

IHP
SG13G2
SG13G2 DC CV NMOS HV

Rev. 1.2 (190924)

Date: February 4, 2023

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1 Documentation

1.1 Included Effects in Simulation Model

General	Date, Version	24.09.2019
	Processversion	SG13G2
	Simulator	ADS 2019, Spectre 18.1
	Simulation model	PSP 103.6
	Warning Boundaries	On

Statistic	Corner	x
	Process variations for Monte Carlo Simulation	e
	Mismatch	x
Transistor	DC behavior	x
	Drain diode	x
	Overlap cap.	x
	Junction cap.	x
	1/f Noise	x ₁
	HF / Thermal Noise	-
	Substrate resistance (RF)	x ₂
	Gate resistance (RF)	x ₂
Temperature	-40°C, 25°C, 70°C, 125°C	x

x measured and modelled

x₁ parameters taken from SG13

x₂ measurements are done from a different wafer run than DC model which leads to slight offsets

e estimated and modelled

o not included

- not applicable

1.2 Time range measurement

The verification of the time range measurements is done by the standard IHP verification procedure.

2 Setup

2.1 Measurement Conditions

2.1.1 Measurement Conditions for Transistors

	Sweep	Start[V]	Stop[V]	No. Points	List or f(Vth)
idvg	vg	-500m	3.6	83	
	vb	0	-3.6	5	
	vd	100m	3.3	3	
	vs	0		1	
idvd	vd	0	3.6	37	
	vg	Lin f(Vth)	3.6	5	Ref. Setup: idvg Idref: 100.0n Offset: 100.0m Resolution: 1.000m
	vb	0		1	
	vs	0		1	
idvd_vbmin	vd	0	3.6	37	
	vg	Lin f(Vth)	3.6	5	Ref. Setup: idvg Idref: 100.0n Offset: 100.0m Resolution: 1.000m
	vb	-3.6		1	
	vs	0		1	
idvd_vth	vd	0	3.6	37	
	vg	List f(Vth)		3	Ref. Setup: idvg Idref: 100.0n Offset: -200.0m Resolution: 1.000m Steps: 200.0m 200.0m
	vb	0		1	
	vs	0		1	
idvd_vth_vbmin	vd	0	3.6	37	
	vg	List		3	Ref. Setup: idvg

		f(Vth)			Idref: 100.0n Offset: -200.0m Resolution: 1.000m Steps: 200.0m 200.0m
	vb	-3.6		1	
	vs	0		1	
RF idvg	vg	-500m	3.6	83	
	vd	100m	3.3	3	
RF idvd	vd	0	3.6	37	
	vg	0	3.6	13	
RF sdut	freq	100MEG	47.6G	31	
	vd	0	3.6	13	
	vg	0	3.6	13	

2.1.2 Measurement Conditions for Capacitance

	Sweep	Start[V]	Step[V]	Stop[V]	High Node	Low Node
Junction Bulk-Drain	1 VHI	-5	200m	200m	B	D
Junction Bulk-Source	1 VHI	-1	20m	300m	B	S
Oxide	1 VHI	3.6	-100m	-3.6	B	G
Overlap	1 VHI	-3.6	100m	3.6	G	D

2.2 Devices

2.2.1 Setup of DC Test Devices

Name	W[um]	L[um]	AD[um ²]	AS[um ²]	PD[um]	PS[um]	NRD	NRS	NF	Comment	Size Category
W10u0_L10u0_S557_3	10	10	3.4	3.4	20. 7	20. 7	0	0	1		Large

W0u3_L10u0_S547_4	300 m	10	102 m	102 m	1.2 8	1.2 8	0	0	1		Narrow
W10u0_L0u5_S387_5	10	500 m	3.4	3.4	20. 7	20. 7	0	0	1		Short
W10u0_L0u35_S556_3	10	350 m	3.4	3.4	20. 7	20. 7	0	0	1		Short
W10u0_L0u5_T356_S387 _5	10	500 m	0	0	0	0	0	0	1		Short
W0u3_L0u35_S560_3	300 m	350 m	102 m	102 m	1.2 8	1.2 8	0	0	1		Small
W10u0_L0u5_S556_4	10	500 m	3.4	3.4	20. 7	20. 7	0	0	1		L Scale
W10u0_L3u0_S557_1	10	3	3.4	3.4	20. 7	20. 7	0	0	1		L Scale
W10u0_L5u0_S557_2	10	5	3.4	3.4	20. 7	20. 7	0	0	1		L Scale
W10u0_L1u2_S556_5	10	1.2	3.4	3.4	20. 7	20. 7	0	0	1		L Scale
W05u0_L10u0_S558_1	5	10	1.7	1.7	10. 7	10. 7	0	0	1		W Scale
W02u0_L10u0_S558_5	2	10	680 m	680 m	4.6 8	4.6 8	0	0	1		W Scale
W0u6_L10u0_S559_5	600 m	10	204 m	204 m	1.8 8	1.8 8	0	0	1		W Scale
W02u0_L3u0_S558_4	2	3	680 m	680 m	4.6 8	4.6 8	0	0	1		LW Scale
W0u6_L1u2_S559_4	600 m	1.2	204 m	204 m	1.8 8	1.8 8	0	0	1		LW Scale
W02u0_L1u2_S558_3	2	1.2	680 m	680 m	4.6 8	4.6 8	0	0	1		LW Scale
W05u0_L5u0_S557_5	5	5	1.7	1.7	10. 7	10. 7	0	0	1		LW Scale
W0u3_L1u2_S560_5	300 m	1.2	102 m	102 m	1.2 8	1.2 8	0	0	1		LW Scale
W0u6_L0u35_S559_2	600 m	350 m	204 m	204 m	1.8 8	1.8 8	0	0	1		LW Scale
W0u6_L0u5_S559_3	600 m	500 m	204 m	204 m	1.8 8	1.8 8	0	0	1		LW Scale
W0u3_L0u5_S560_4	300 m	500 m	102 m	102 m	1.2 8	1.2 8	0	0	1		LW Scale
W02u0_L0u33_S558_2	2	330	680	680	4.6	4.6	0	0	1		Additio

		m	m	m	8	8					nal
W10u0_L0u33_S556_2	10	330 m	3.4	3.4	20. 7	20. 7	0	0	1		Additio nal
W10u0_L0u4_T356_S387 _4	10	400 m	0	0	0	0	0	0	1		Additio nal
W0u3_L0u3_S560_1	300 m	300 m	102 m	102 m	1.2 8	1.2 8	0	0	1		Additio nal
W10u0_L0u45_T356_S38 4M_1	10	450 m	0	0	0	0	0	0	1		Additio nal
W0u15_L0u33_S547_5	150 m	330 m	101 m	101 m	1.3 4	1.3 4	0	0	1		Additio nal
W10u0_L0u4_S387_4	10	400 m	3.4	3.4	20. 7	20. 7	0	0	1		Additio nal
W10u0_L0u3_S556_1	10	300 m	3.4	3.4	20. 7	20. 7	0	0	1		Additio nal
W0u3_L0u45_T356_S384 M_3	300 m	450 m	0	0	0	0	0	0	1		Additio nal
W0u3_L0u33_S560_2	300 m	330 m	102 m	102 m	1.2 8	1.2 8	0	0	1		Additio nal
W0u6_L0u33_S559_1	600 m	330 m	204 m	204 m	1.8 8	1.8 8	0	0	1		Additio nal
W05u0_L0u33_S557_4	5	330 m	1.7	1.7	10. 7	10. 7	0	0	1		Additio nal

2.2.2 Setup of CV Test Devices

Name	W[um]	L[um]	NF	AD[um ²]	AS[um ²]	PD[um]	PS[um]	Comment	Size Category
Junction Capacitance Bulk - Drain									
CJBDarea_S350B_5			1	37.5 K		850		B- High, S/D- Low	BD Area
CJBDperim_S350B_6			1	28.6 K		102K		B- High, S/D- Low	BD Perim

Junction Capacitance Bulk - Source									
CJBSarea_S350B_5			1	0		0		B-High, S/D-Low	BS Area
CJBSperim_S350B_6			1	0		0		B-High, S/D-Low	BS Perim
Oxide Capacitance									
Cox_S342K_3	160	250	1					B-High, G-Low	Oxide
Overlap Capacitance									
Cgds1_S350B_9	6K	300 m	600	1.14 K	1.14 K	6.25 K	6.25 K	G-High, S/D-Low, B+Sub-GND	Overlap GDS
Cgdsb1_S350B_9	6K	300 m	600	1.14 K	1.14 K	6.25 K	6.25 K	G-High, S/D+B-Low	Overlap GDSB
Cgds2_S350B_10	400	10	40	79.8	79.8	436	436	G-High, S/D-Low, B+Sub-GND	Overlap 1 GDS
Cgdsb2_S350B_10	400	10	200	79.8	79.8	436	436	G-High, S/D+B-Low	Overlap 1 GDSB

3 Corner Devices

3.1 Target Values vs. Simulated Values

3.1.1 W = 10.00u, L = 450.0n, NF = 1

	Slow			Typic.			Fast		
	Target	Sim.	Error [%]	Target	Sim.	Error [%]	Target	Sim.	Error [%]
VT	770m	770m	0	700m	700m	0	630m	630m	0
Ron*W	-	-	-	1.42	1.42	0	-	-	-
Ion/W	480	482	-0.31	550	550	0	620	622	-0.33
log(Ioff/W)	-14	-12.5	-3.53	-13	-12.4	-2.5	-12	-12.1	1.12

3.1.2 W = 10.00u, L = 10.00u, NF = 1

	Slow			Typic.			Fast		
	Target	Sim.	Error [%]	Target	Sim.	Error [%]	Target	Sim.	Error [%]
VT	730m	730m	0	690m	690m	0	650m	650m	0
Ion/W	33	33.1	-0.22	37	37	0	42	42	0

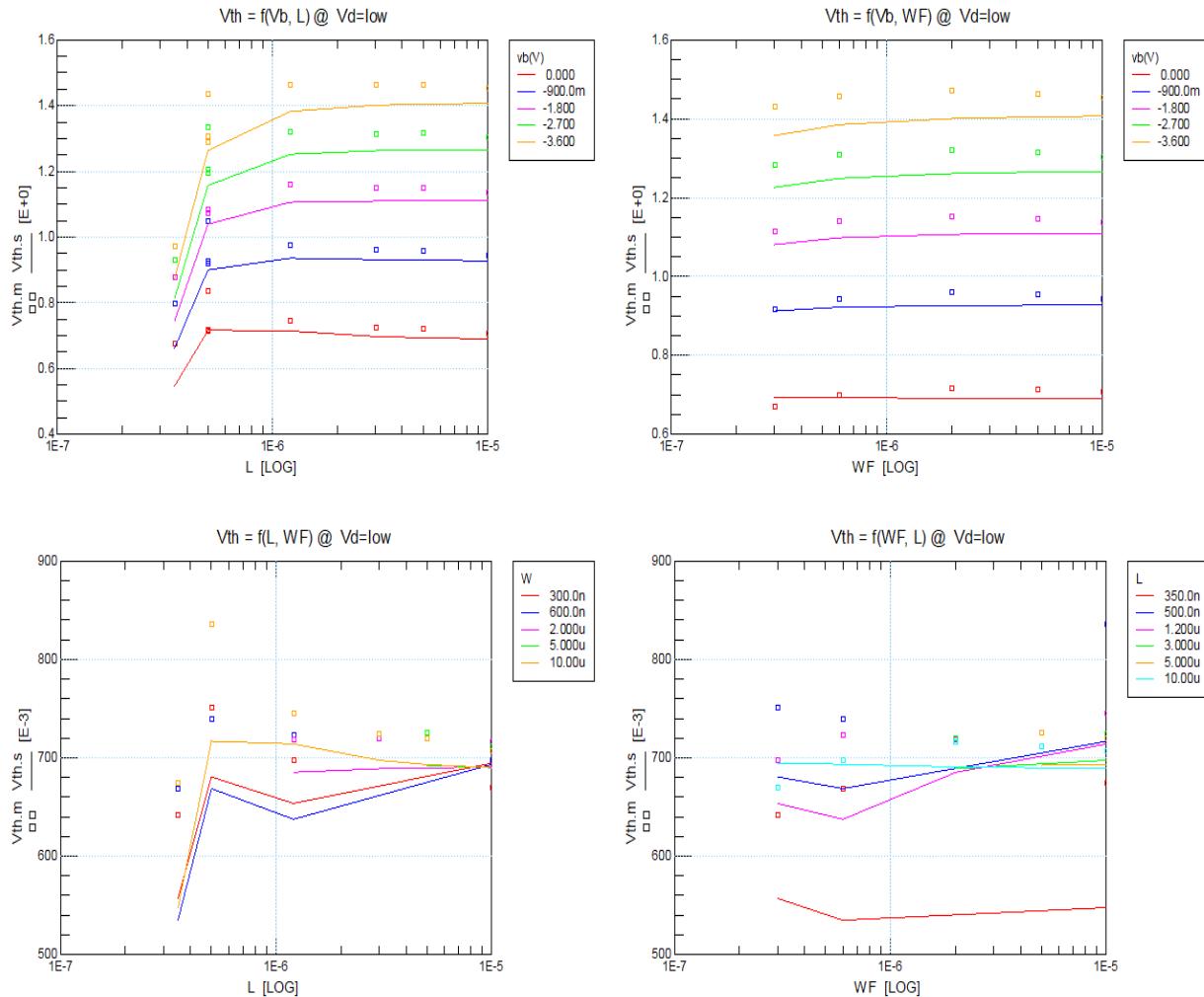
3.1.3 W = 300.0n, L = 450.0n, NF = 1

	Slow			Typic.			Fast		
	Target	Sim.	Error [%]	Target	Sim.	Error [%]	Target	Sim.	Error [%]
VT	750m	750m	0	670m	670m	0	590m	590m	0
Ion/W	490	491	-0.21	580	580	0	670	671	-0.21

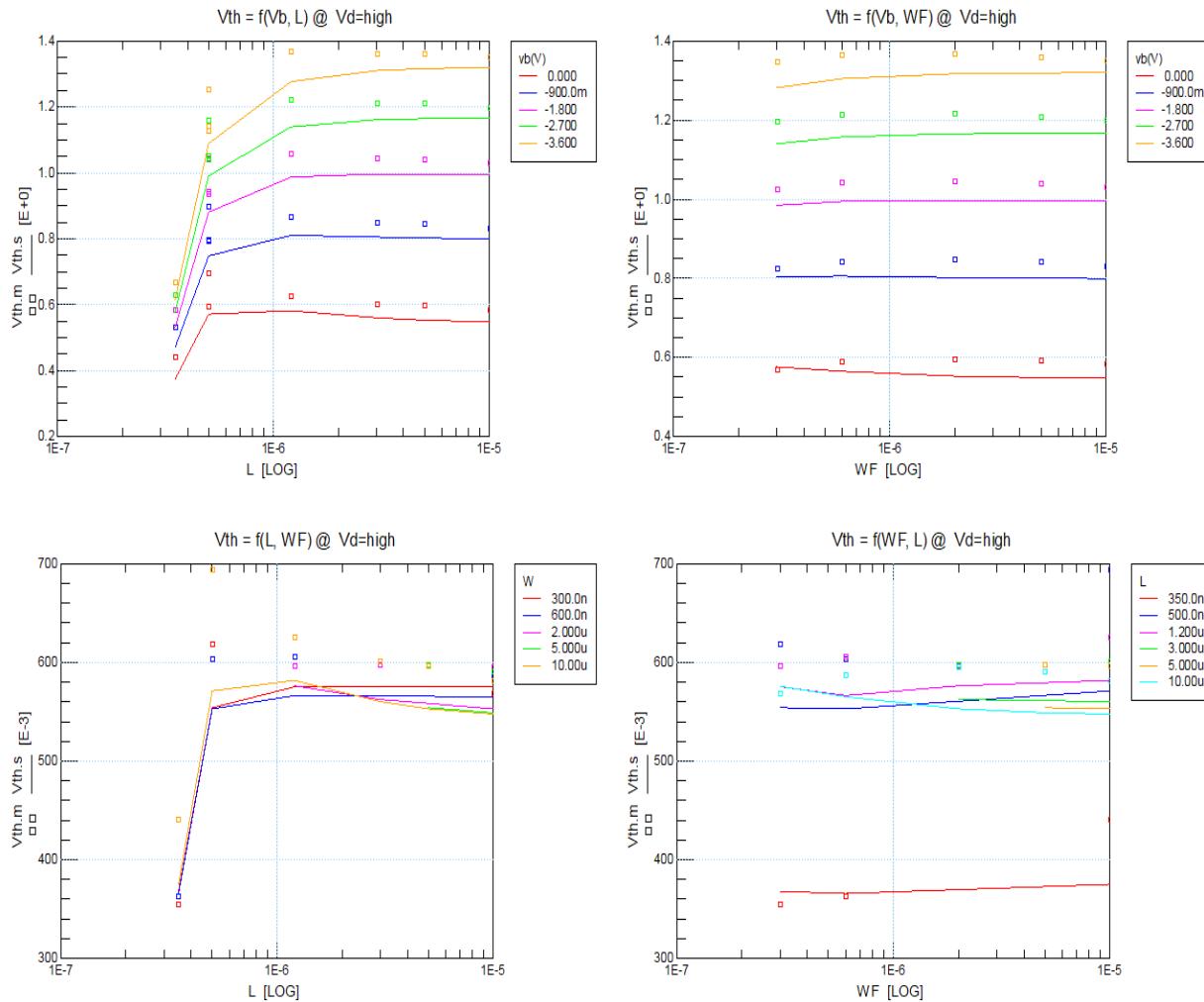
4 DC Transistors

4.1 Summarized Results

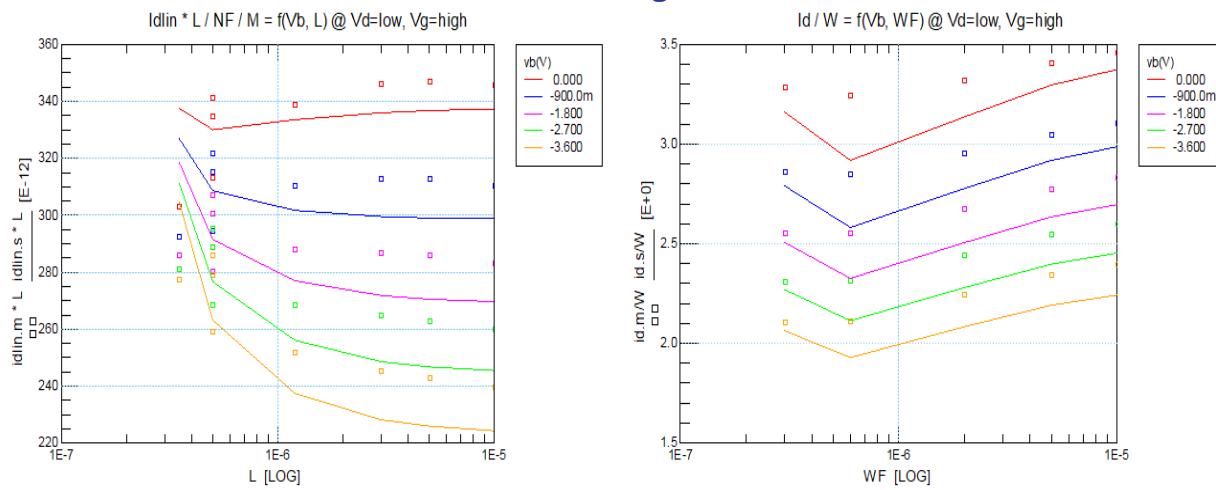
4.1.1 Threshold Voltage Linear Region

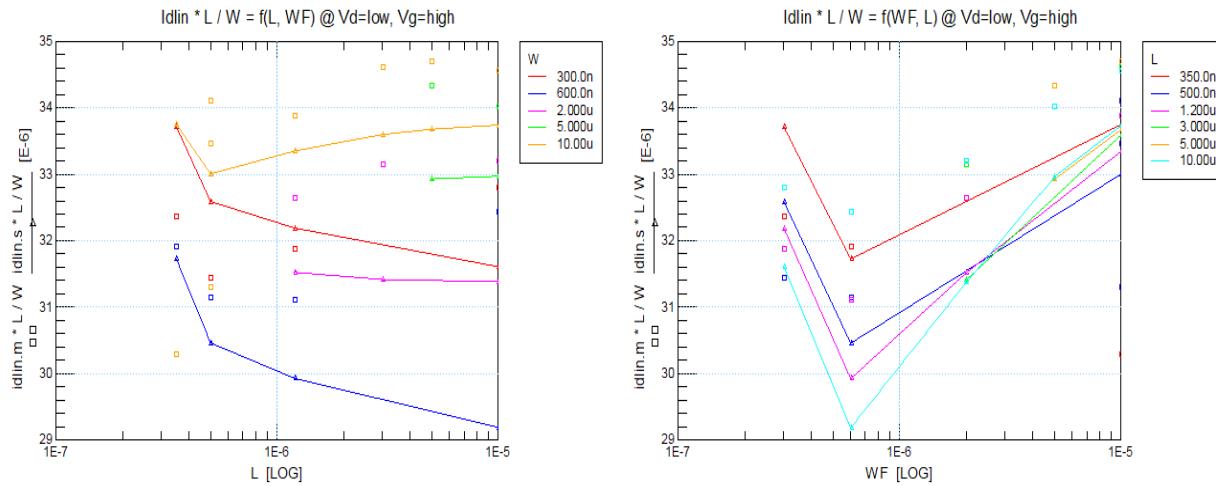


4.1.2 Threshold Voltage in Saturation

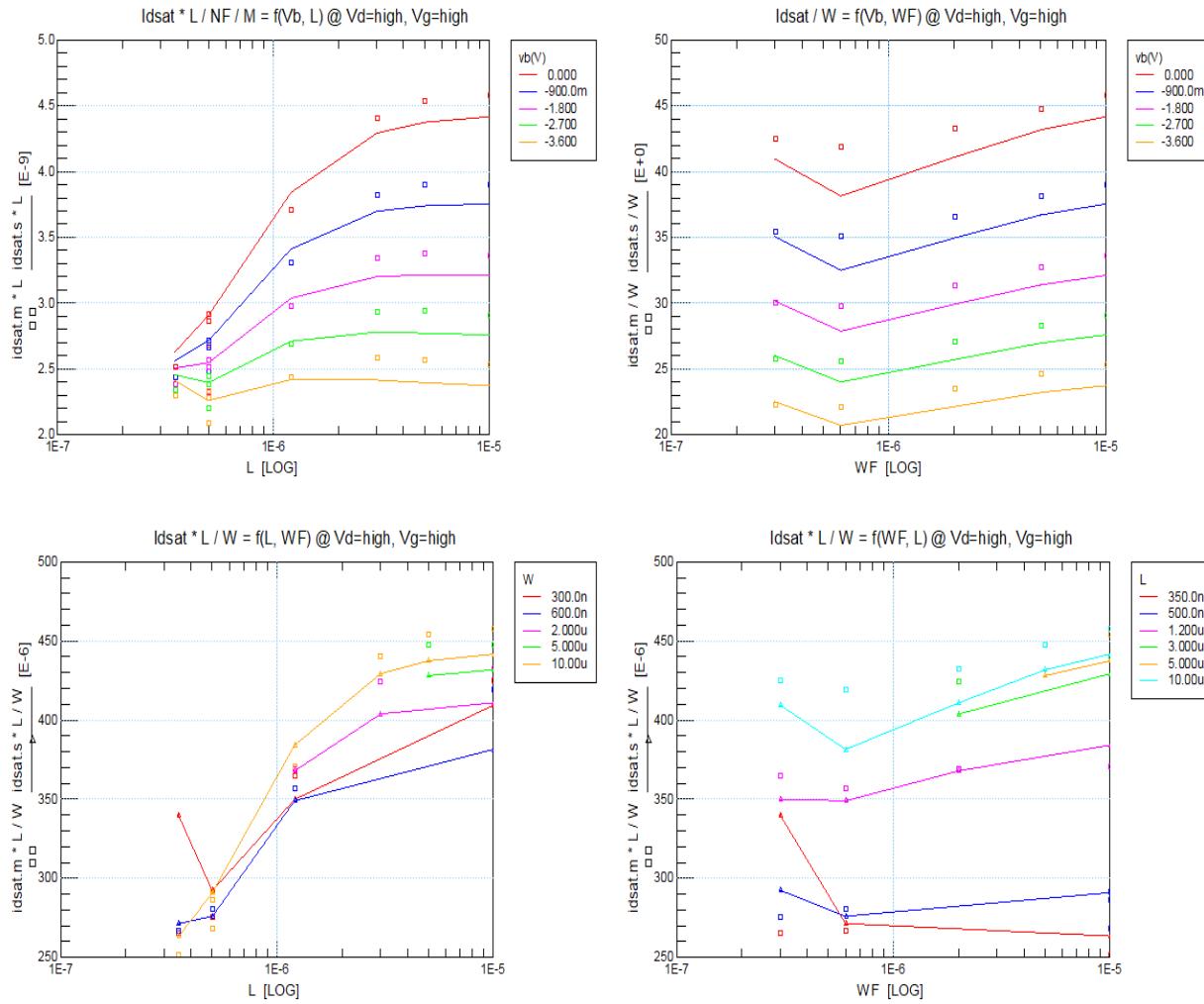


4.1.3 Maximum Drain Current in Linear Region



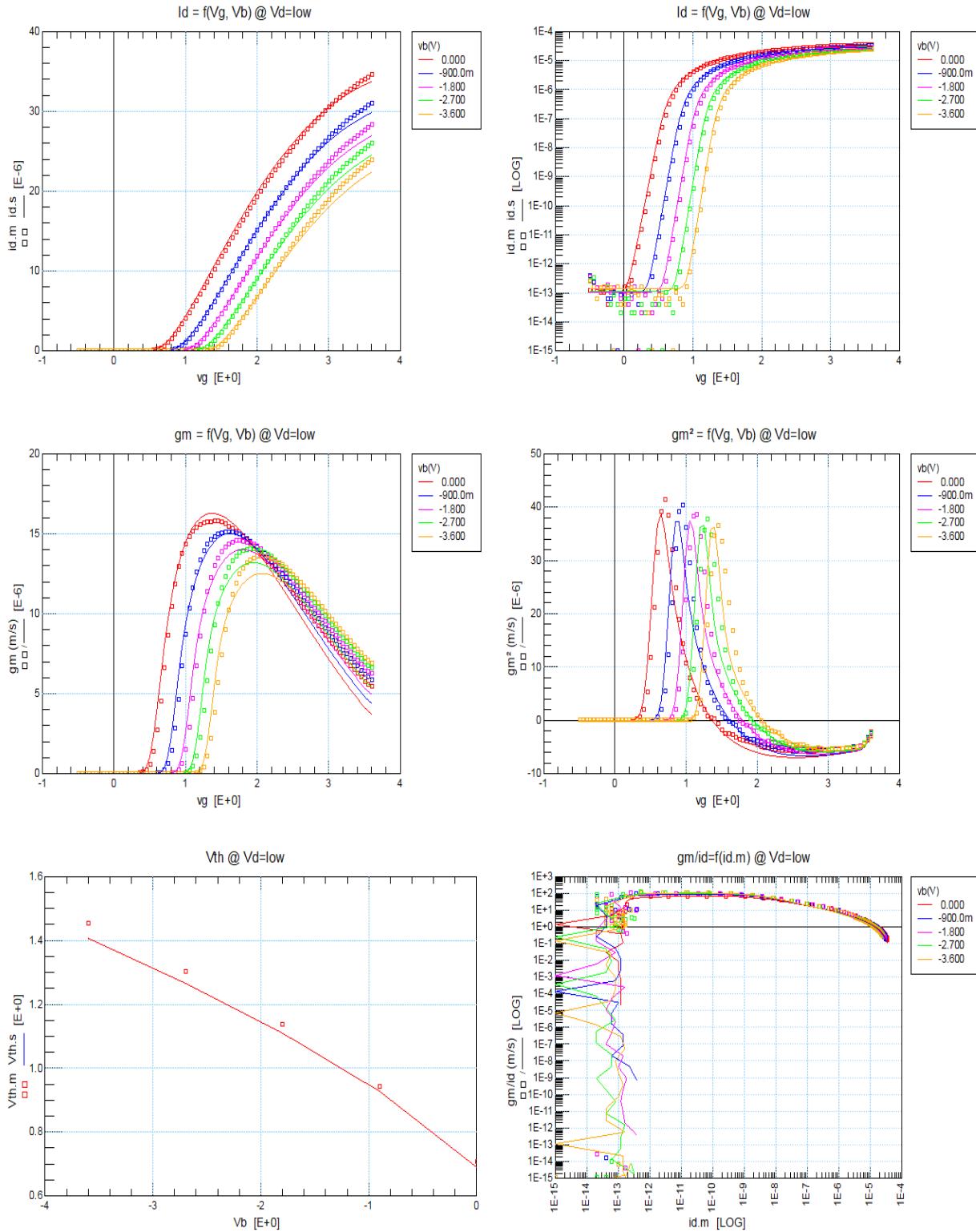


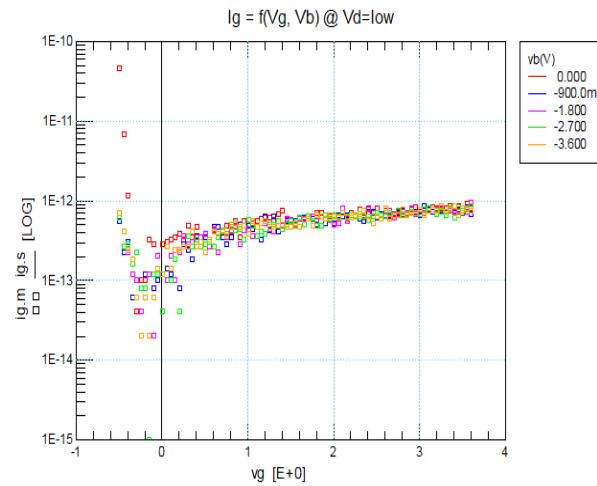
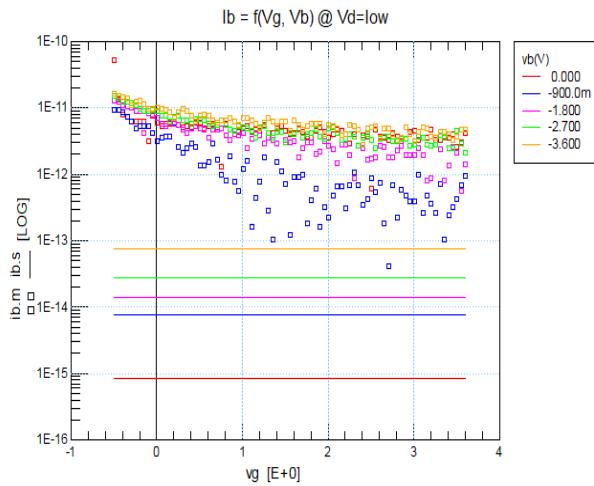
4.1.4 Maximum Drain Current in Saturation Region



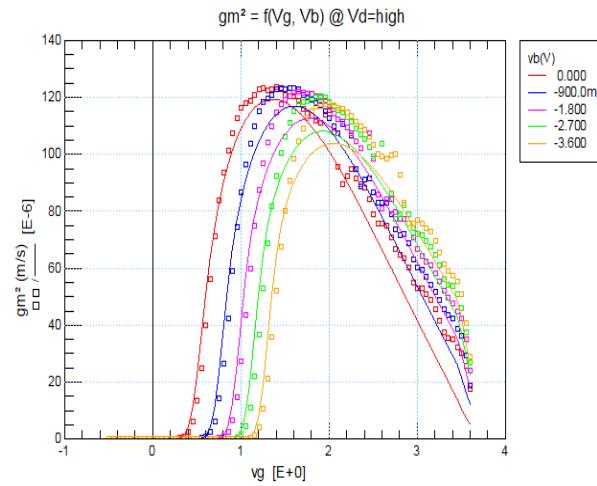
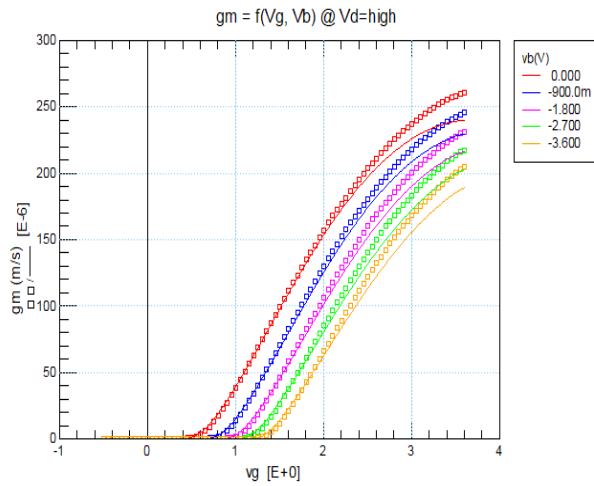
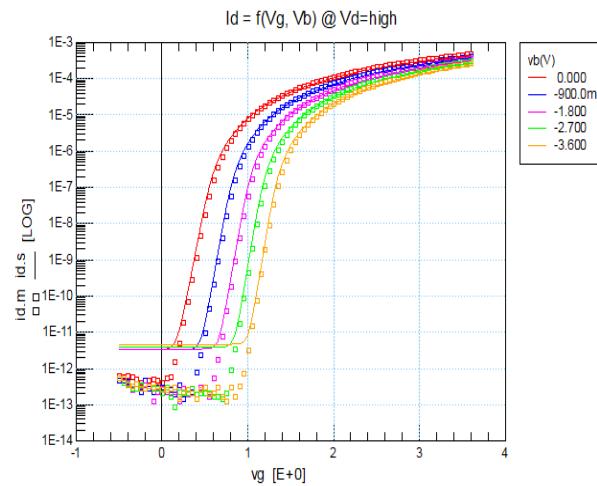
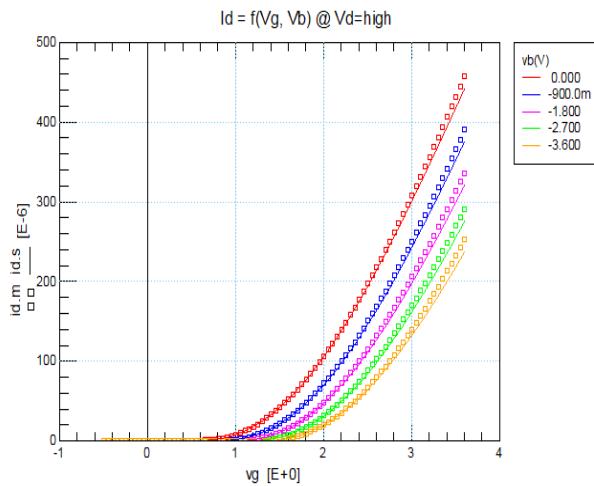
4.2 W10u0_L10u0_S557_3

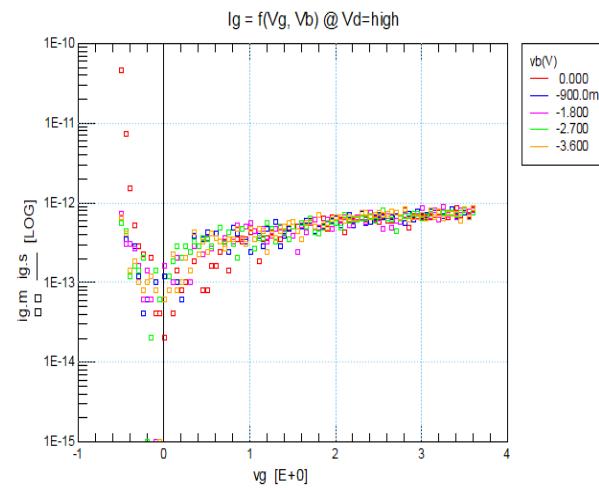
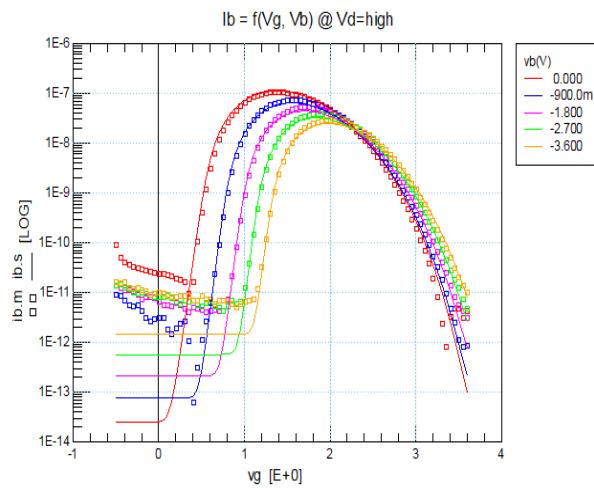
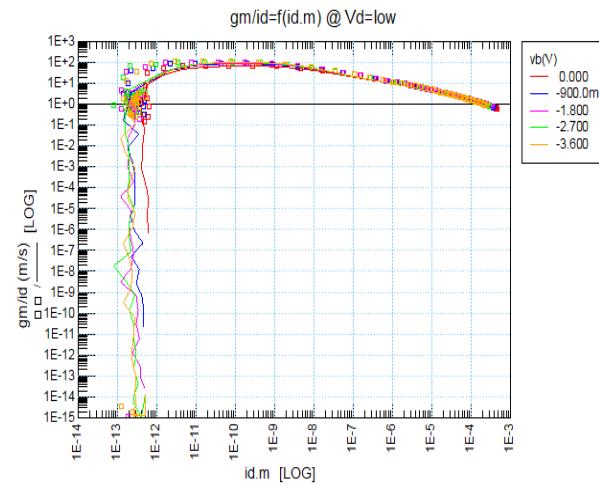
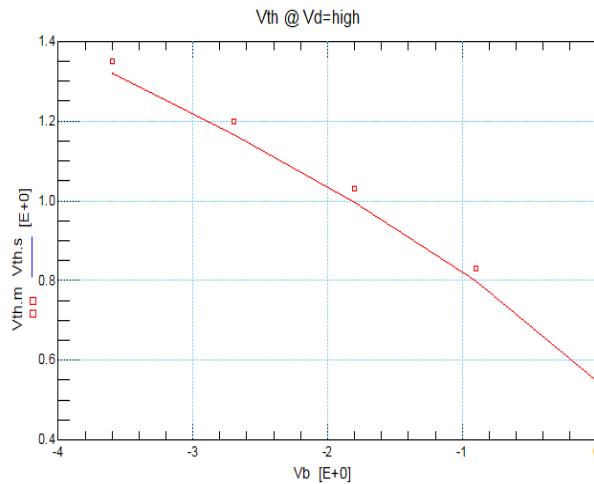
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



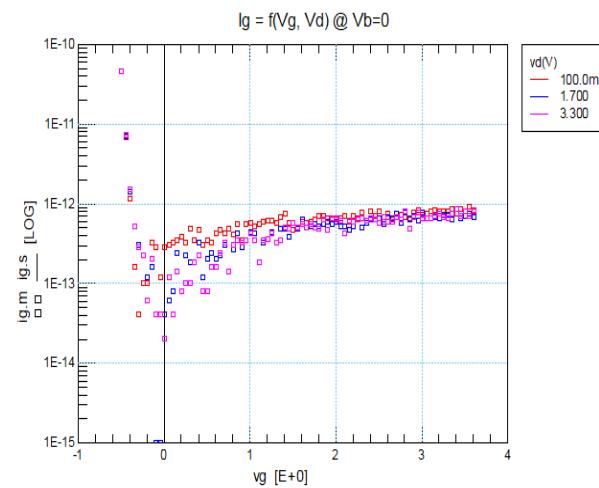
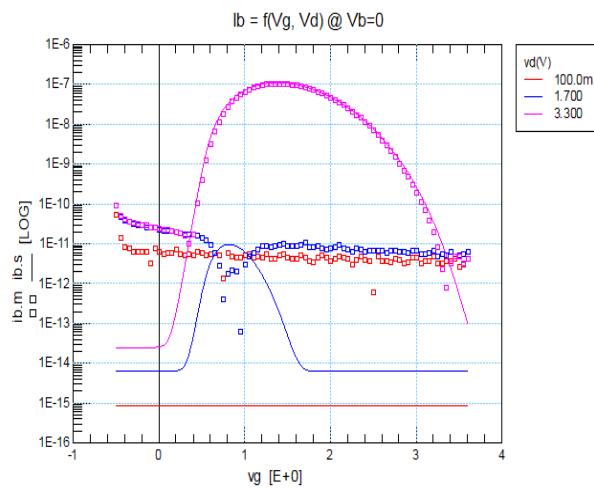


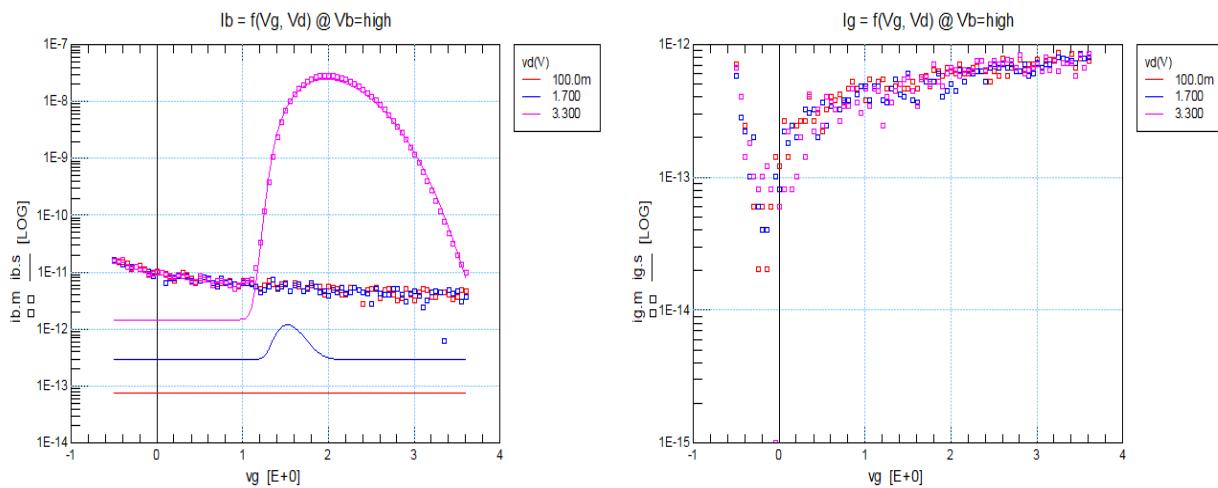
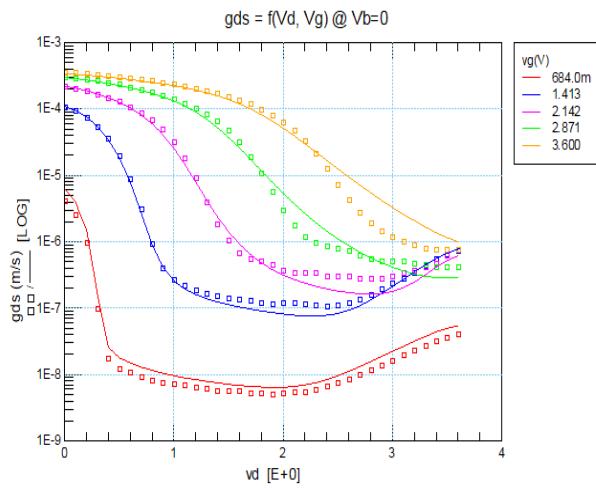
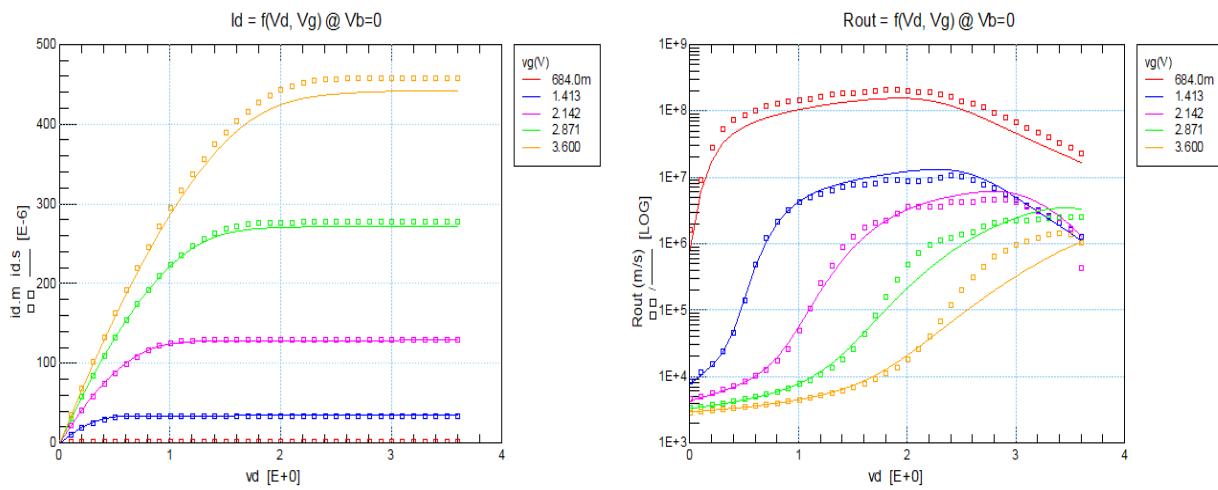
$i_{dvg}, V_d = 3.3V, T = 27^\circ C$

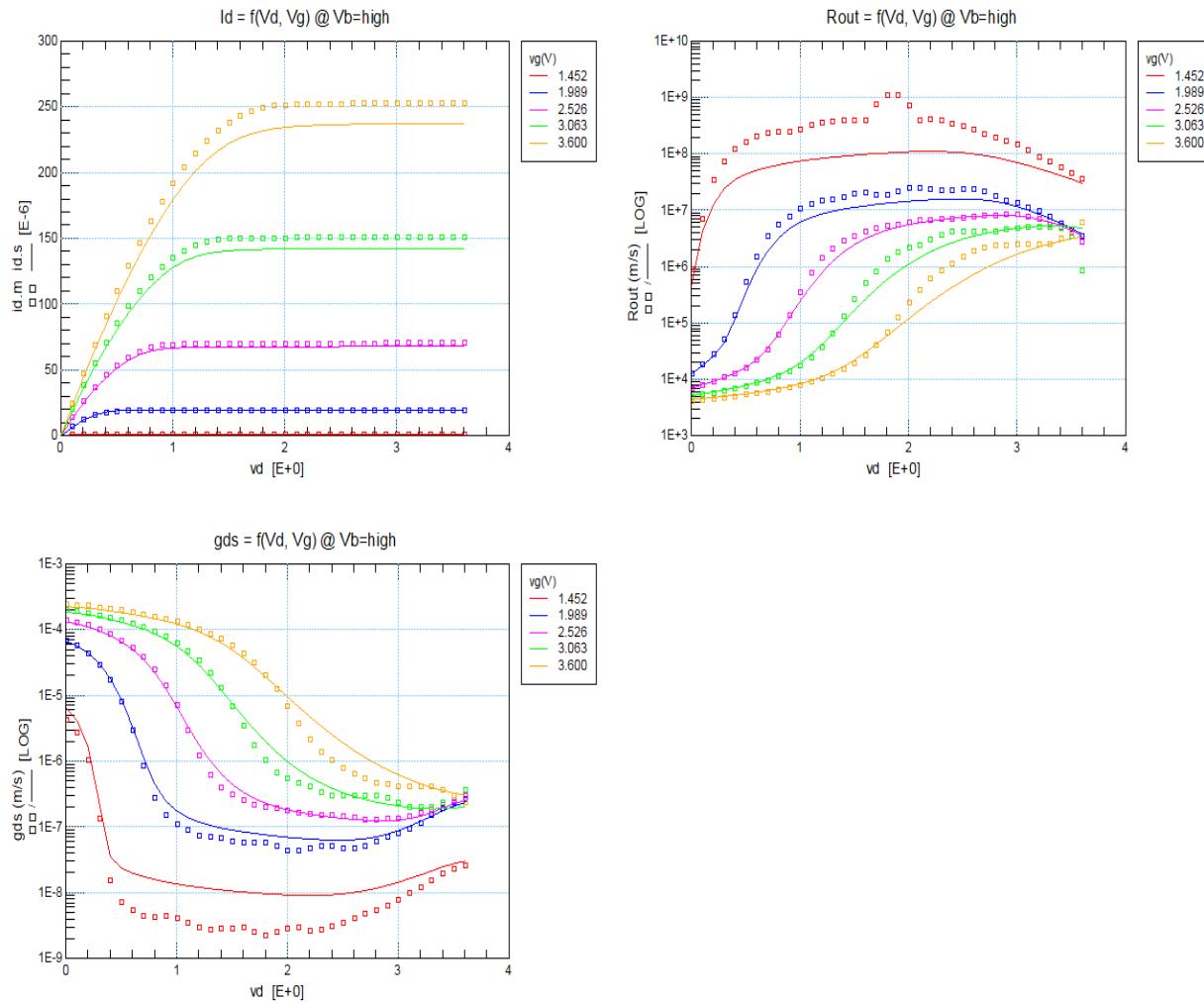
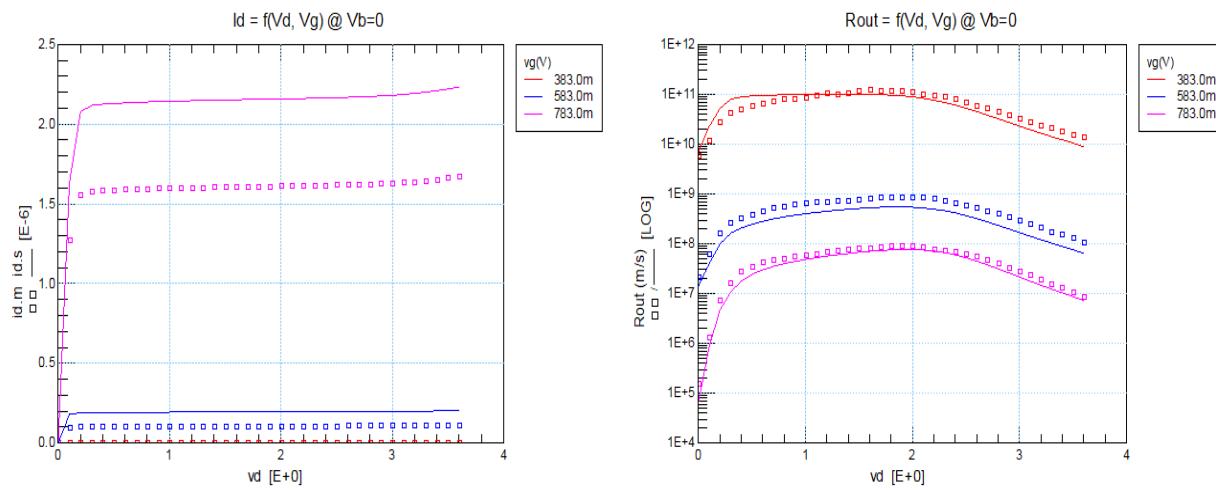


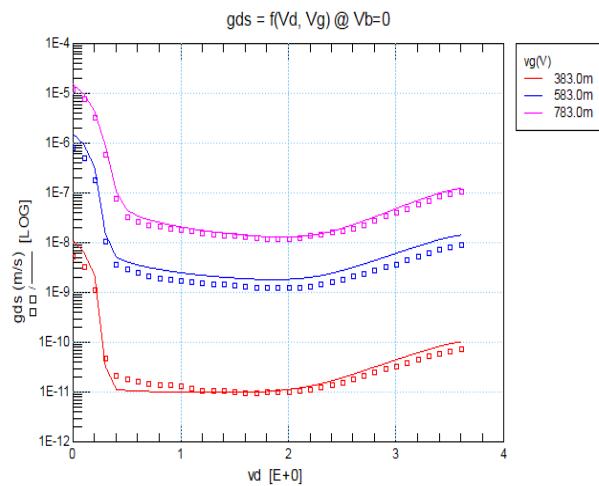


$id_{vg}, I_b, I_g, V_b = 0V, T = 27^\circ C$

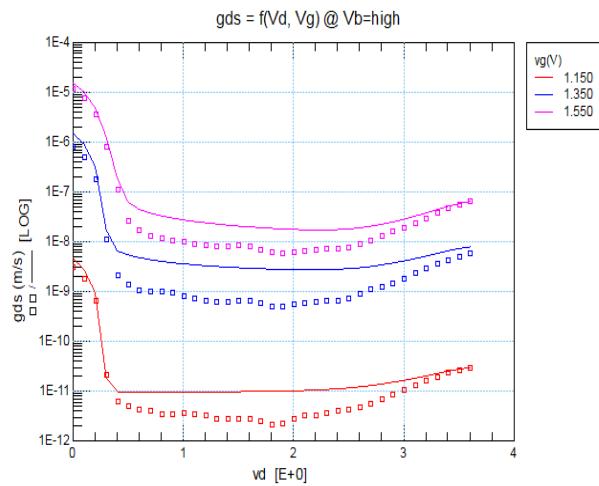
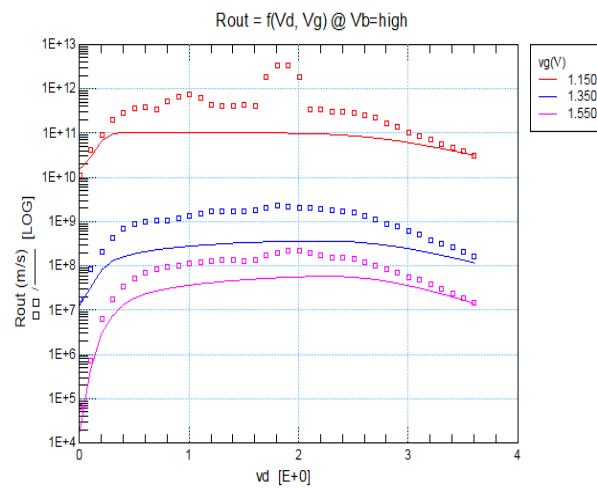
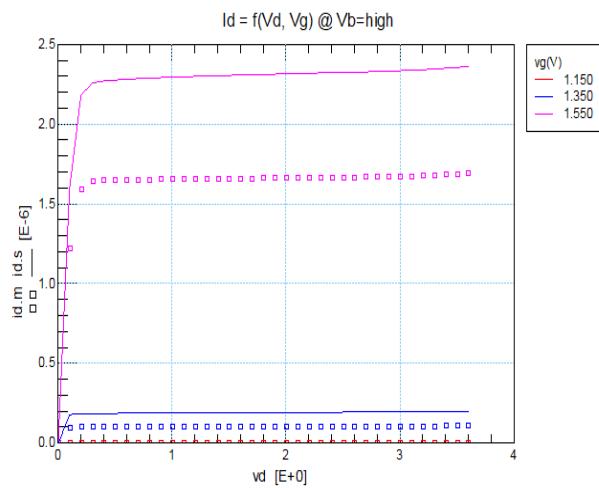


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


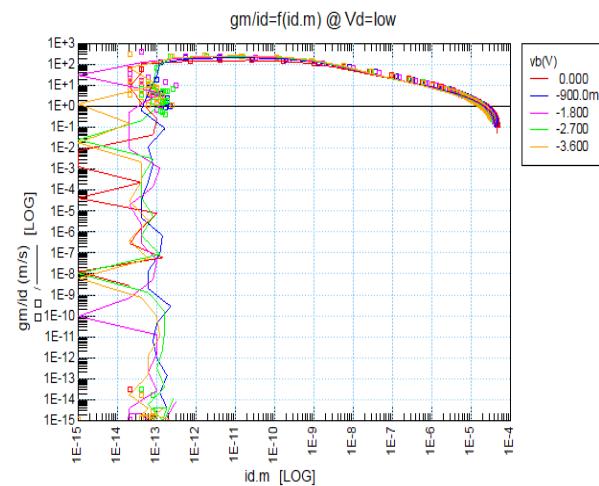
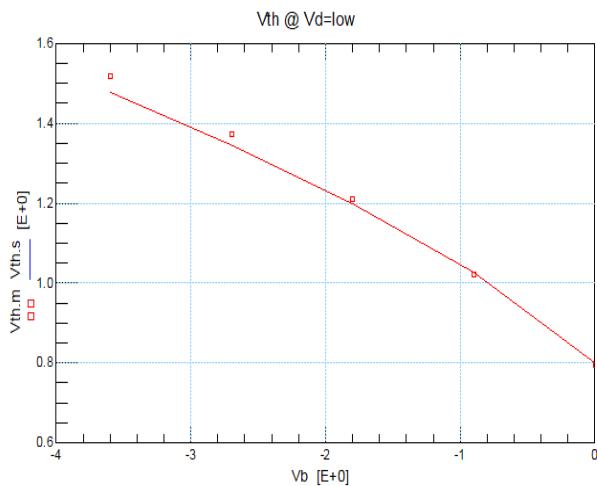
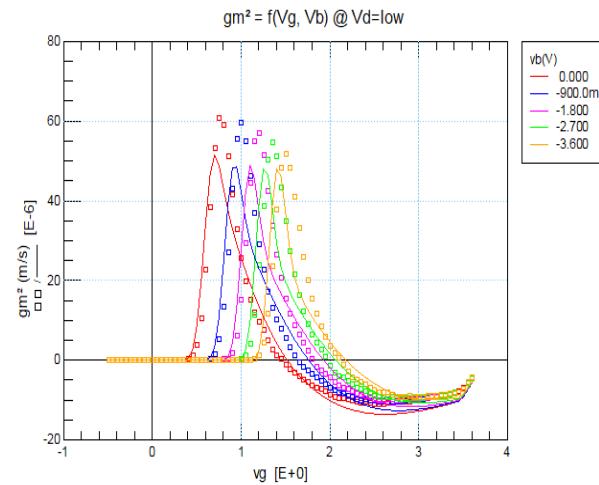
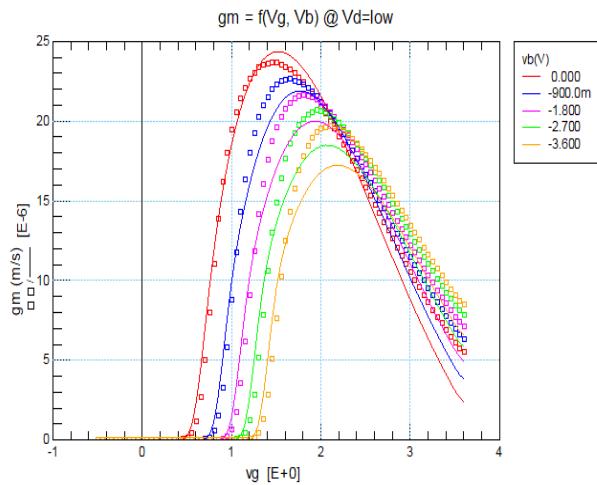
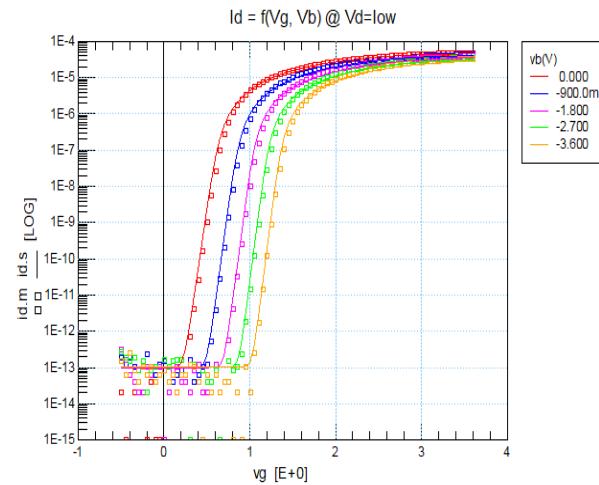
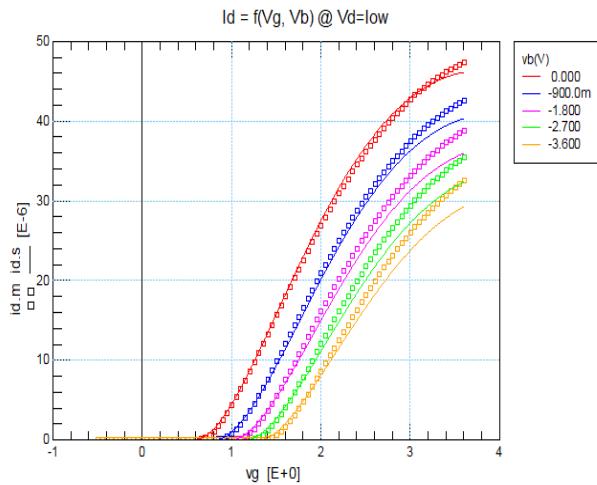
idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


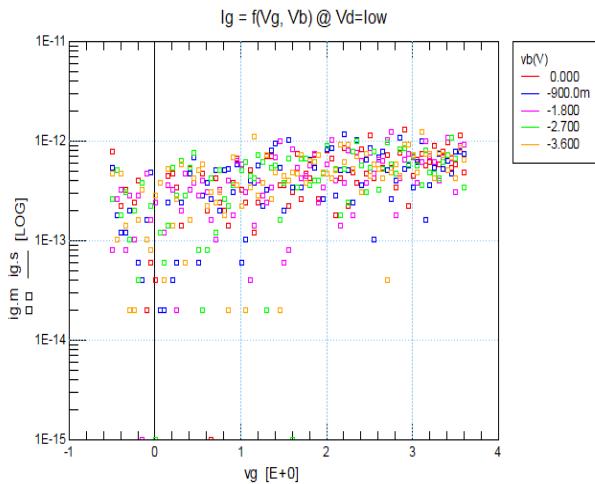
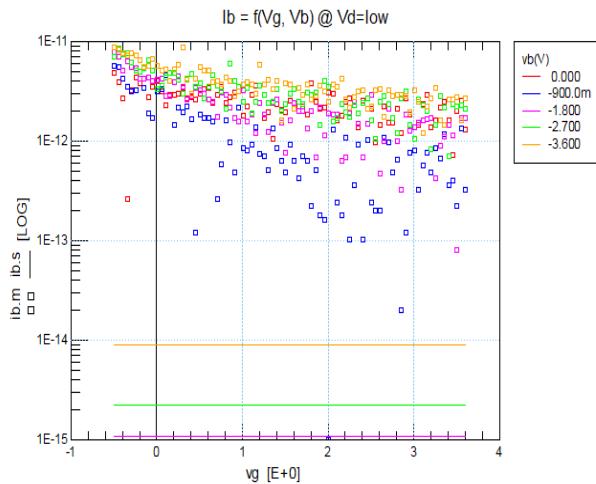


idvd_vth_vbmin, Vb = -3.6V, T = 27°C

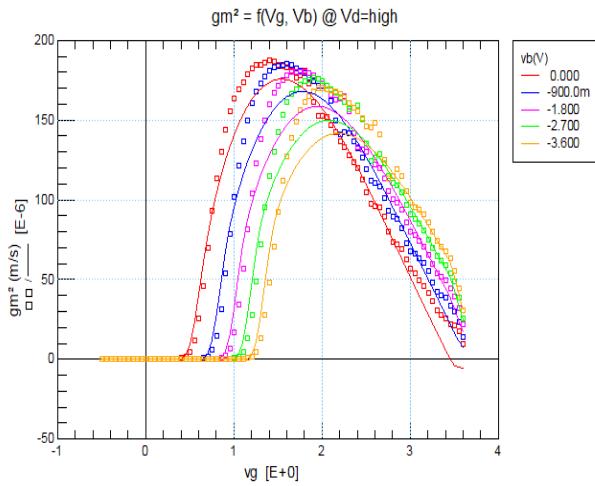
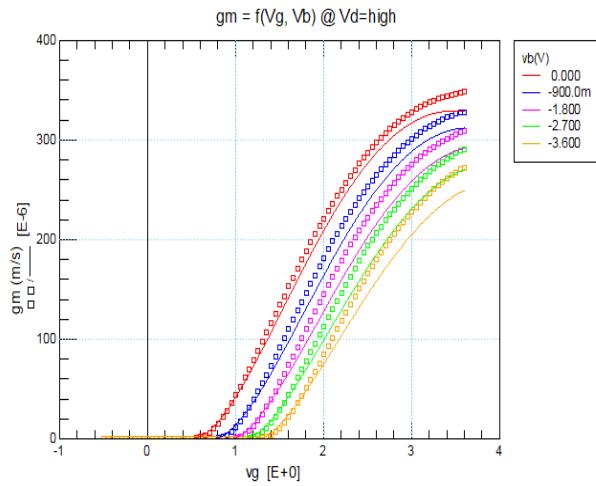
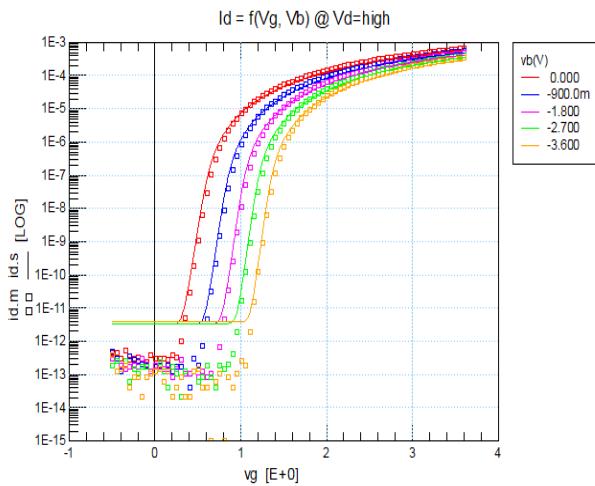
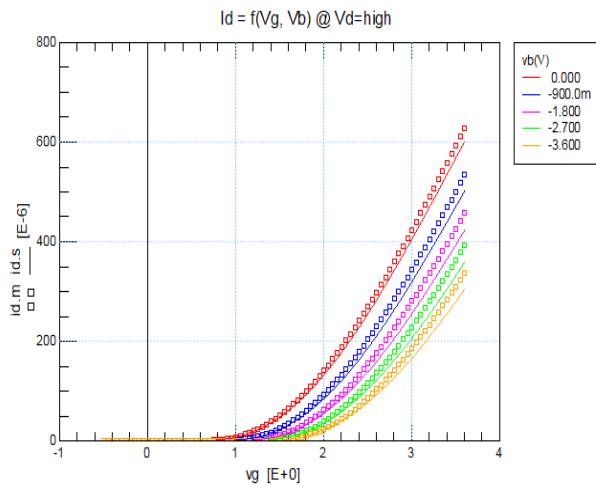


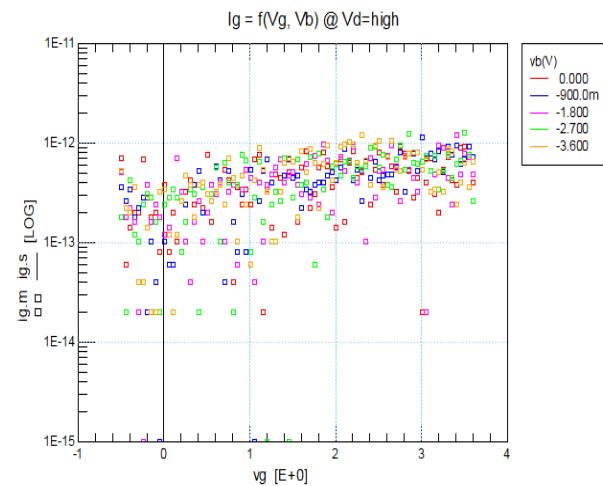
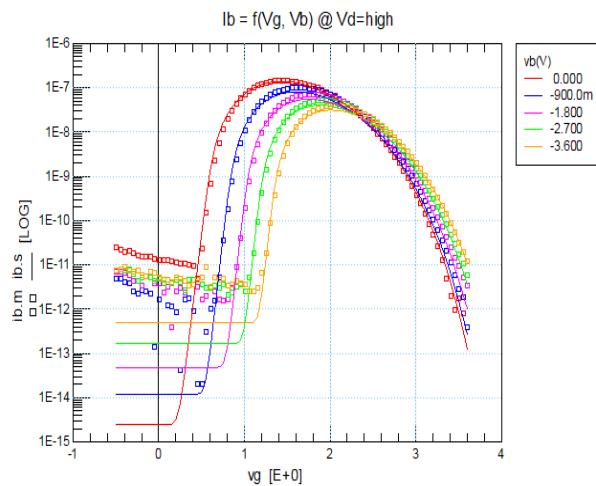
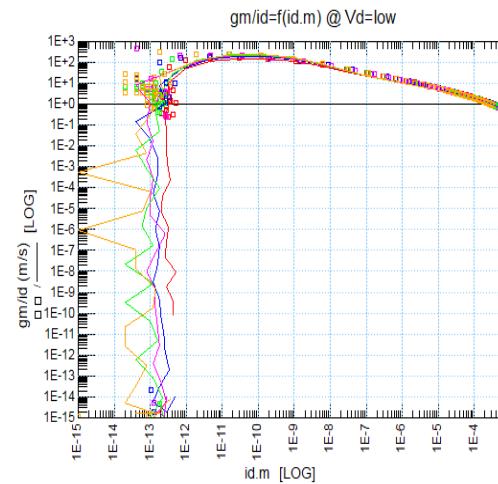
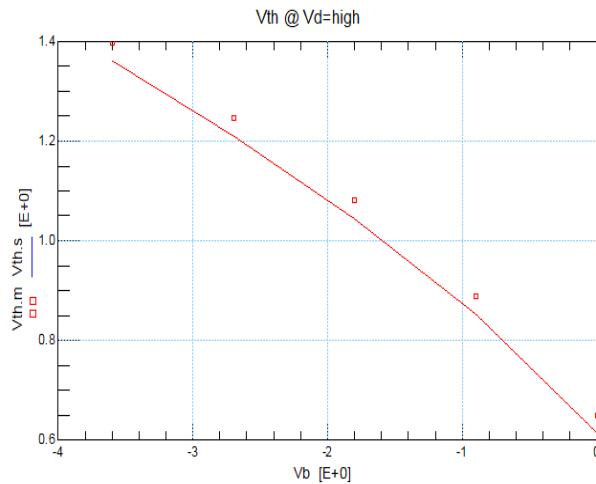
idvg, Vd = 0.1V, T = -40°C



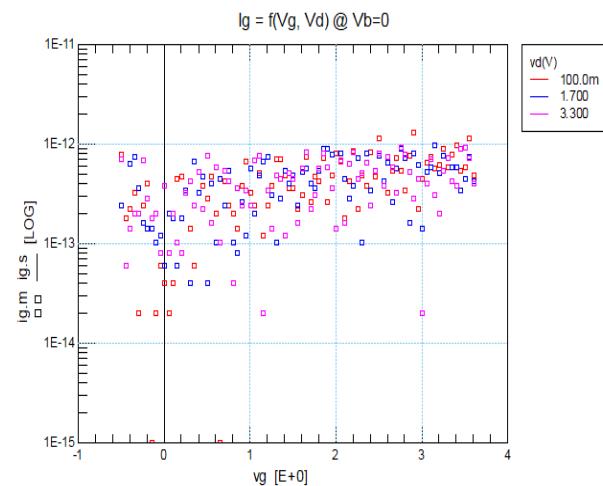
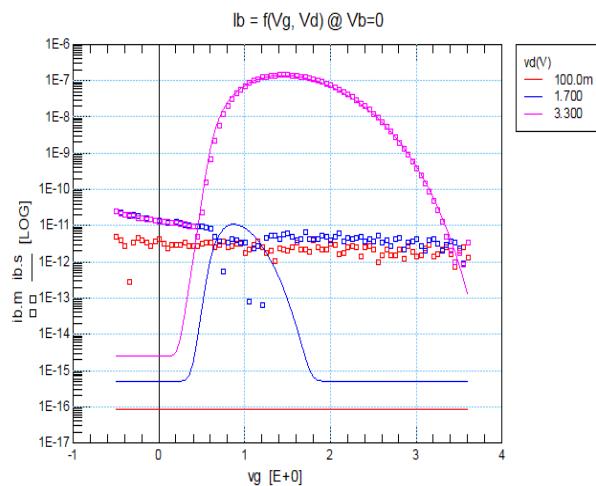


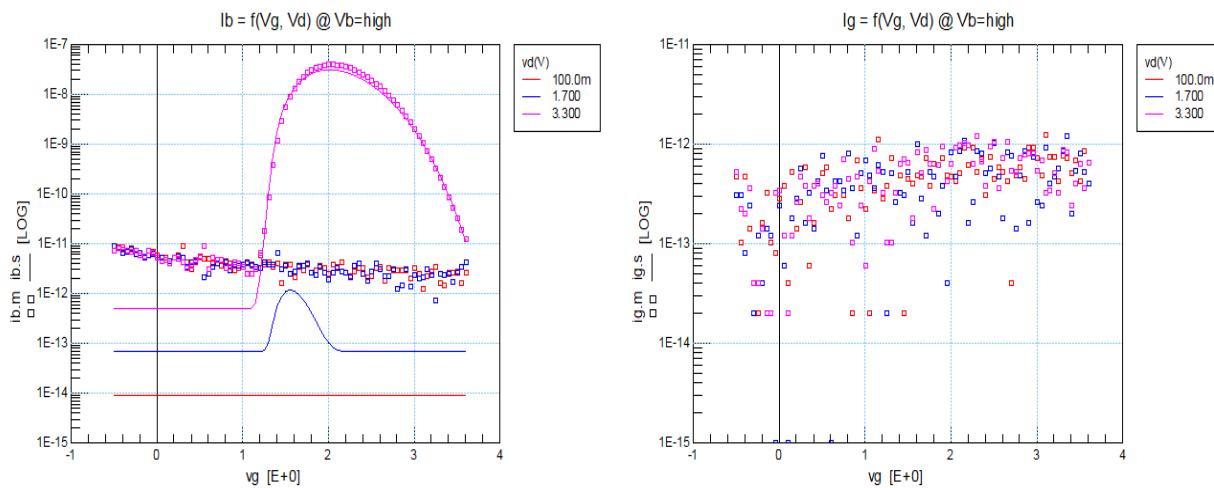
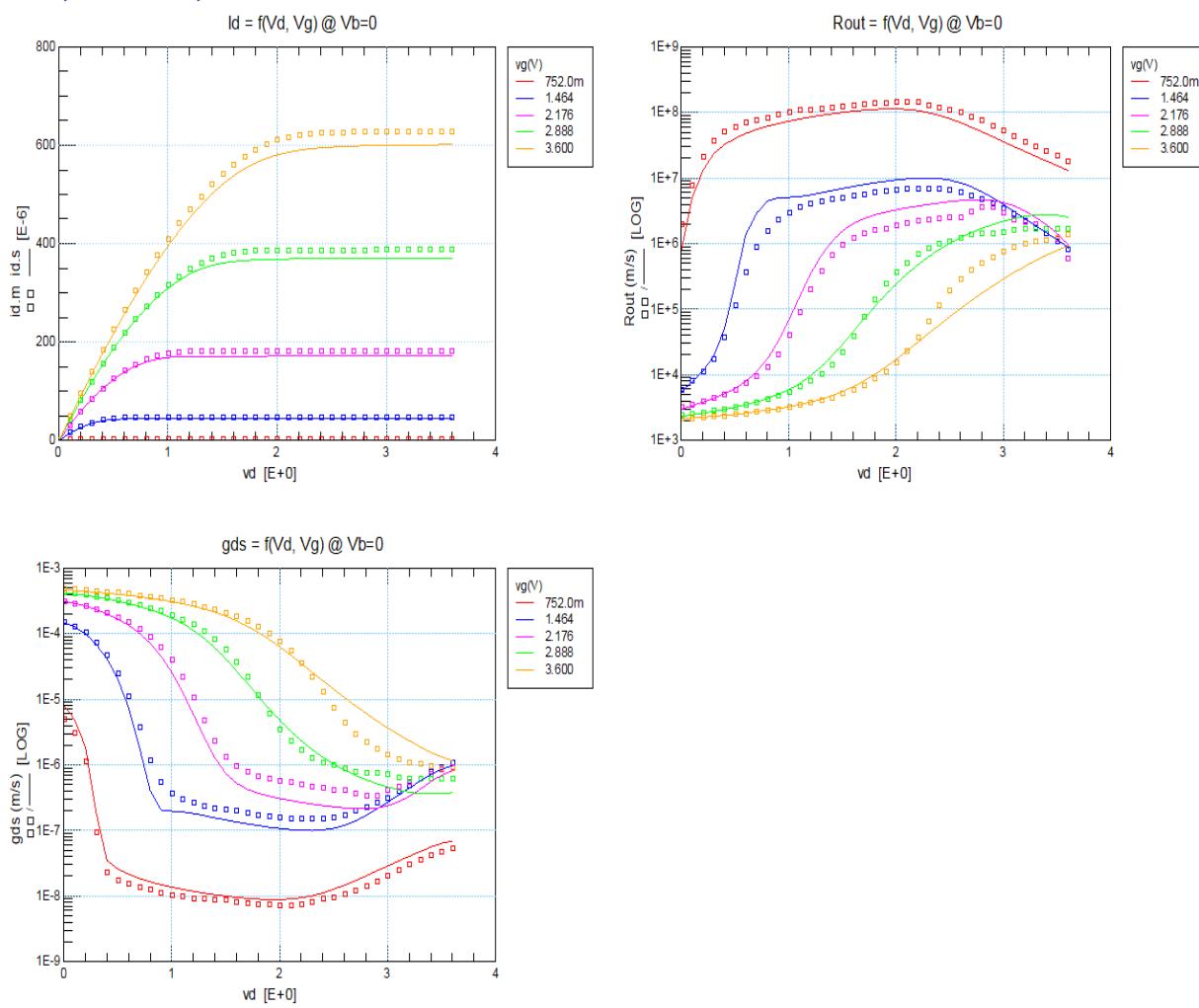
i_{dvg} , $V_d = 3.3V$, $T = -40^\circ C$

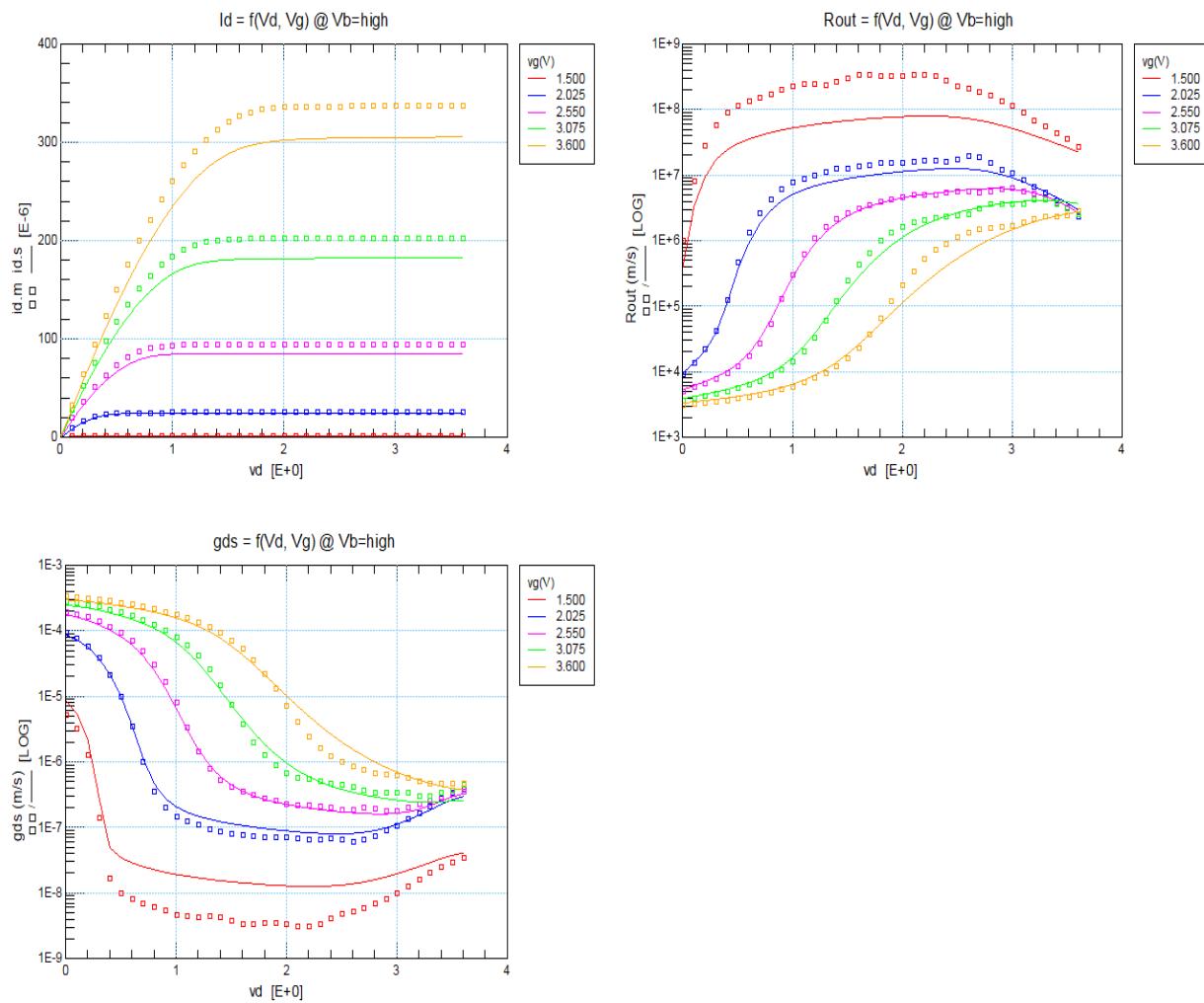
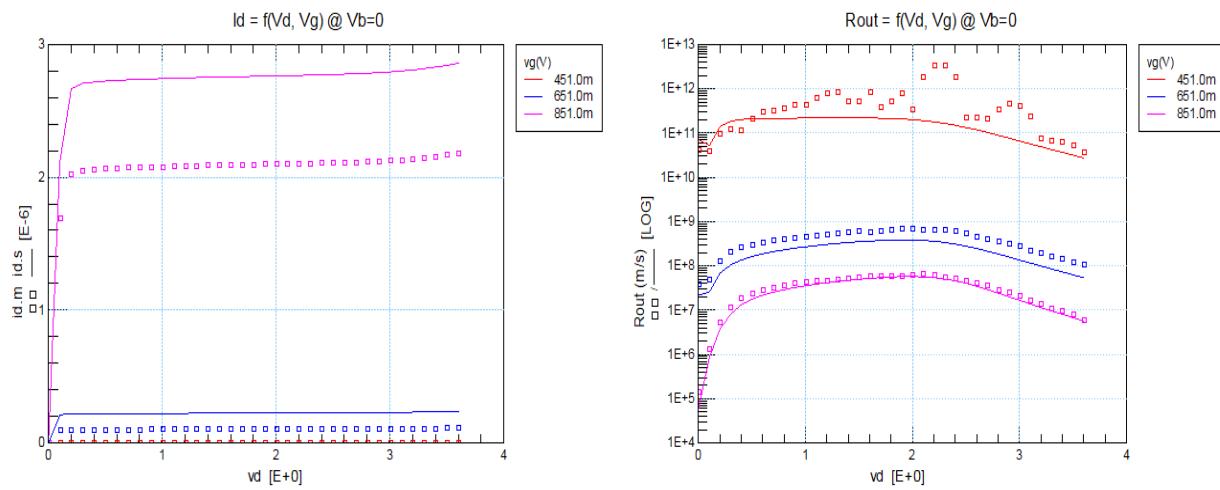


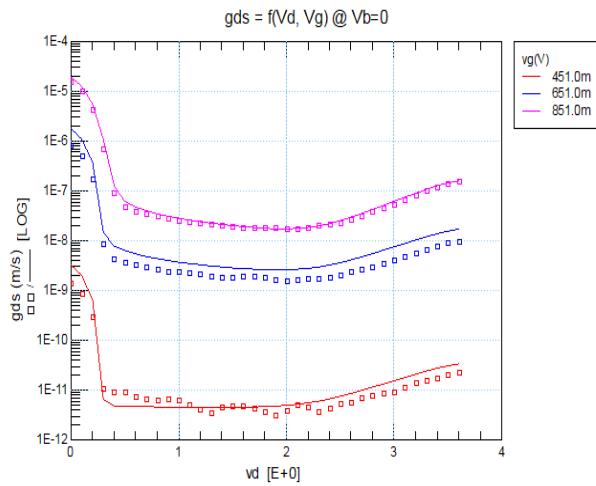


idvg, lb, lg, Vb = 0V, T = -40°C

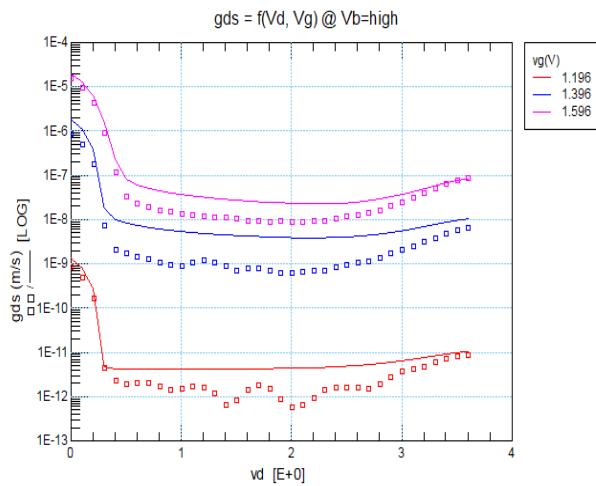
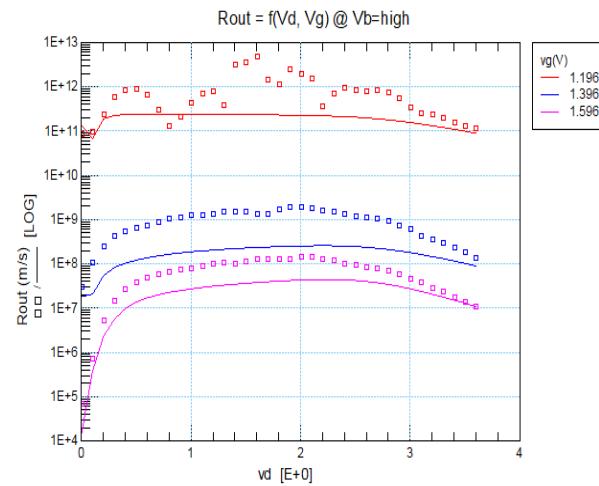
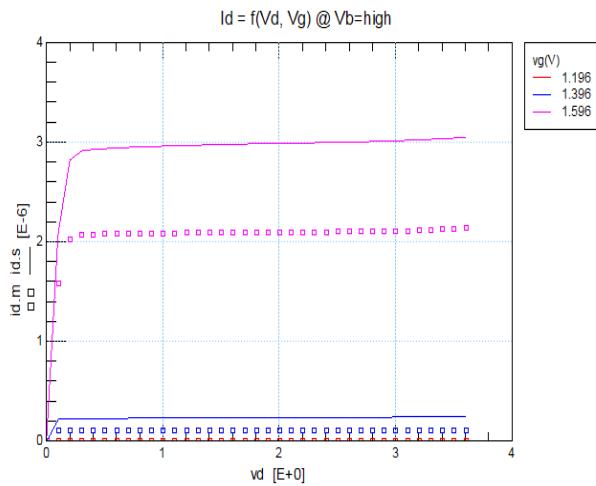


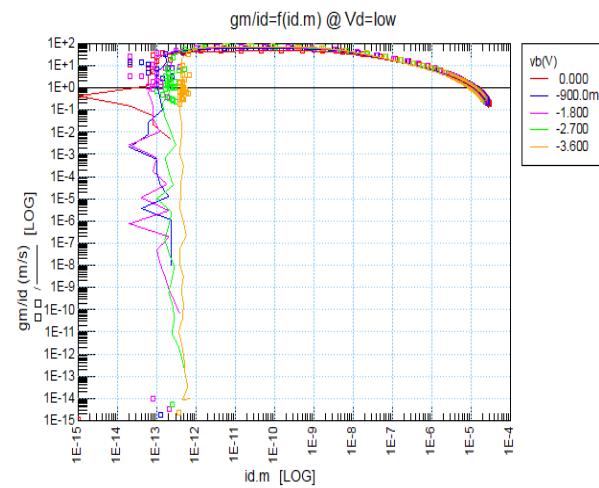
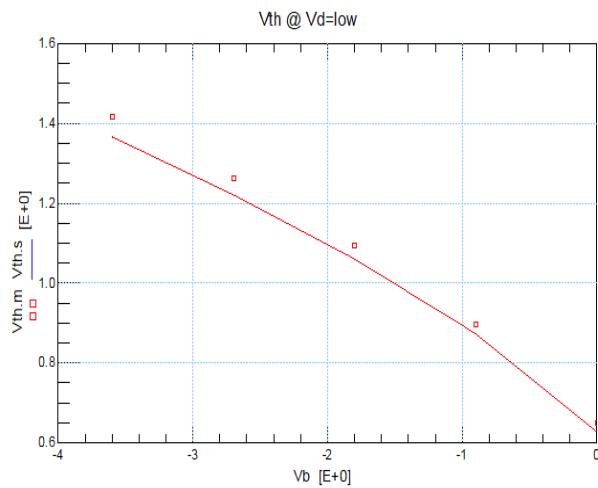
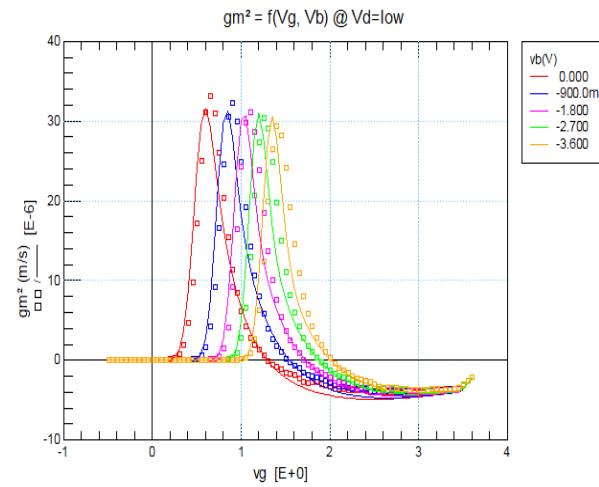
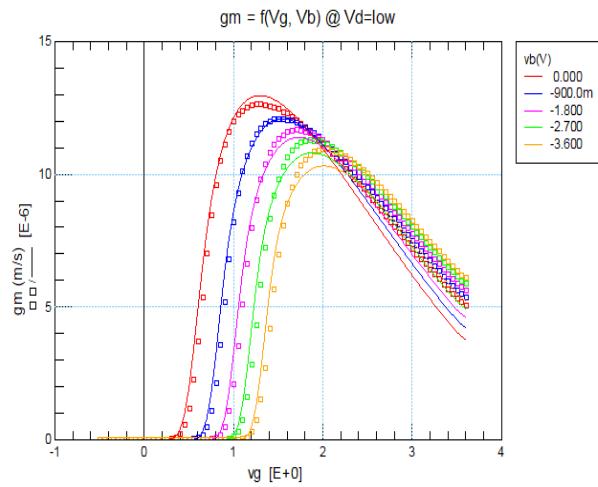
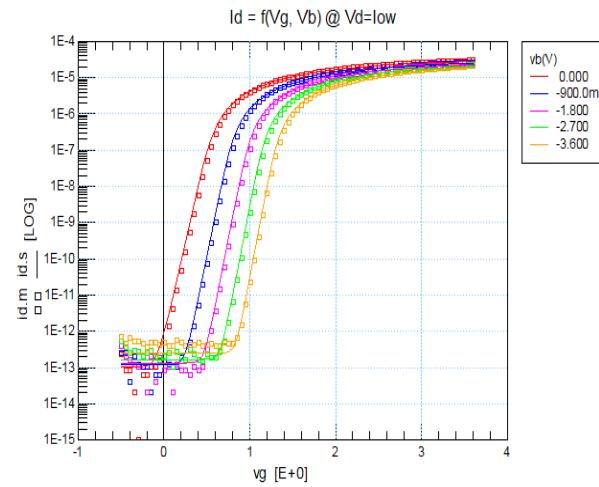
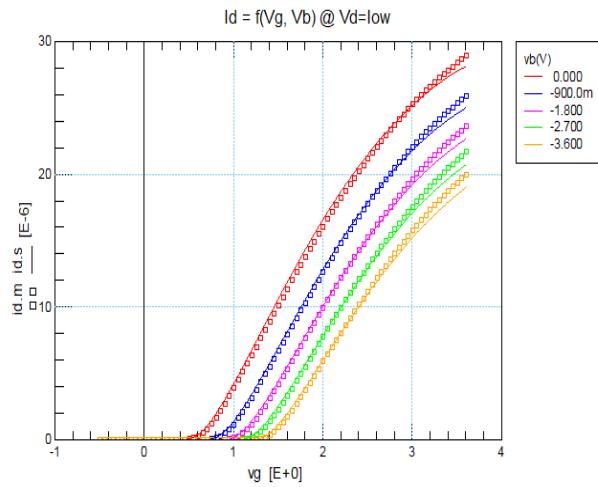
idvg, Ib,Ig, Vb = -3.6V, T = -40°C

idvd, Vb = 0V, T = -40°C


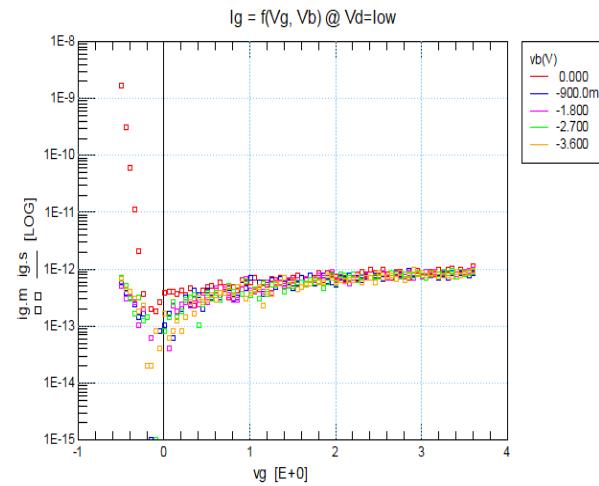
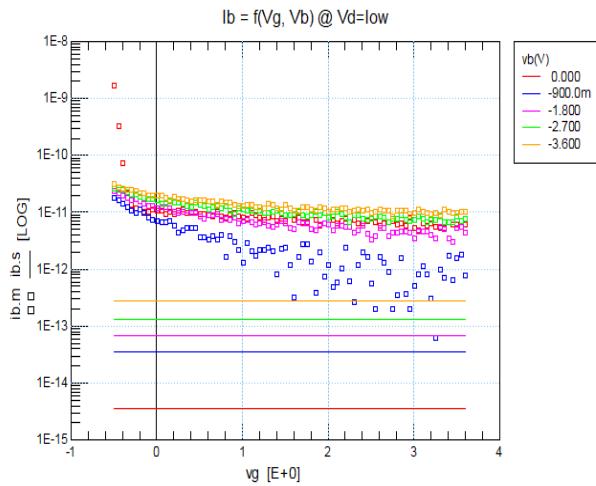
idvd_vbmin, Vb = -3.6V, T = -40°C**idvd_vth, Vb = 0V, T = -40°C**



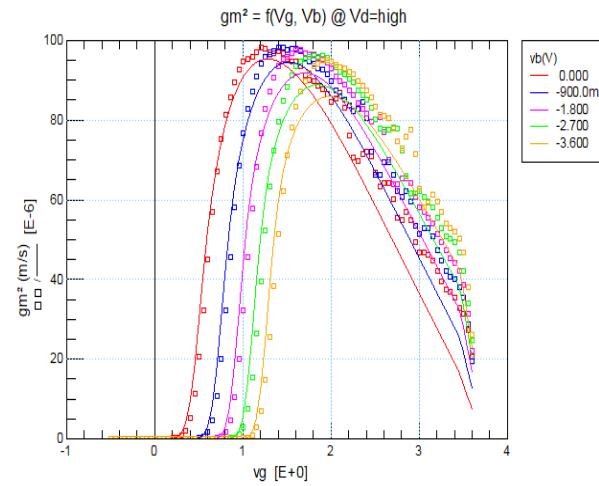
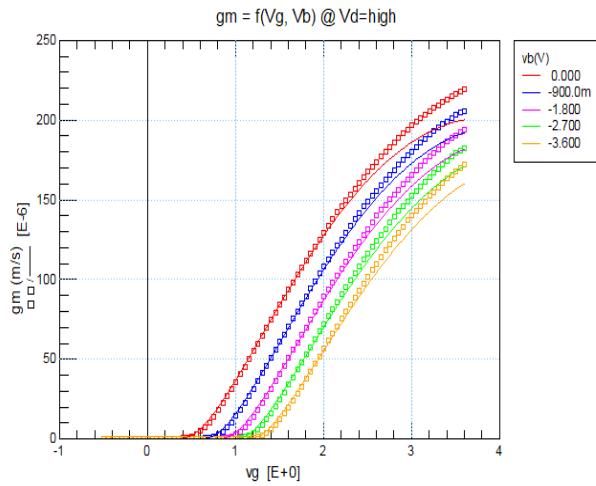
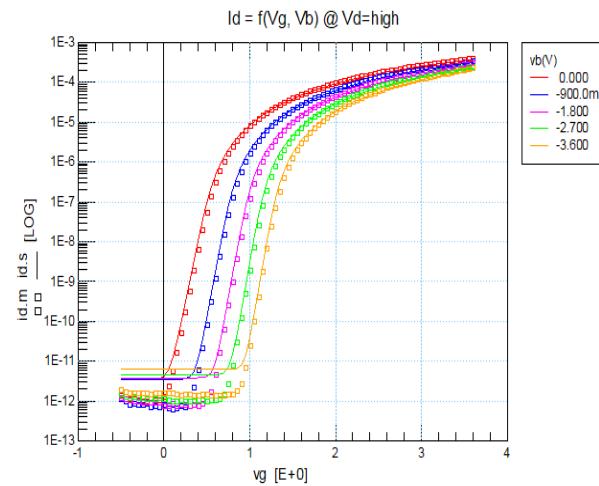
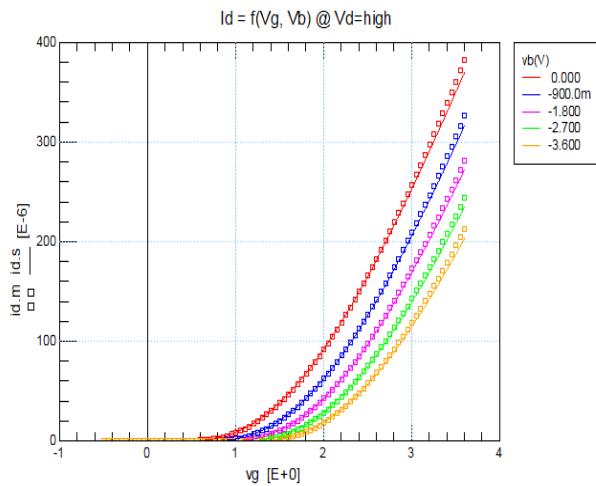
idvd_vth_vbmin, Vb = -3.6V, T = -40°C

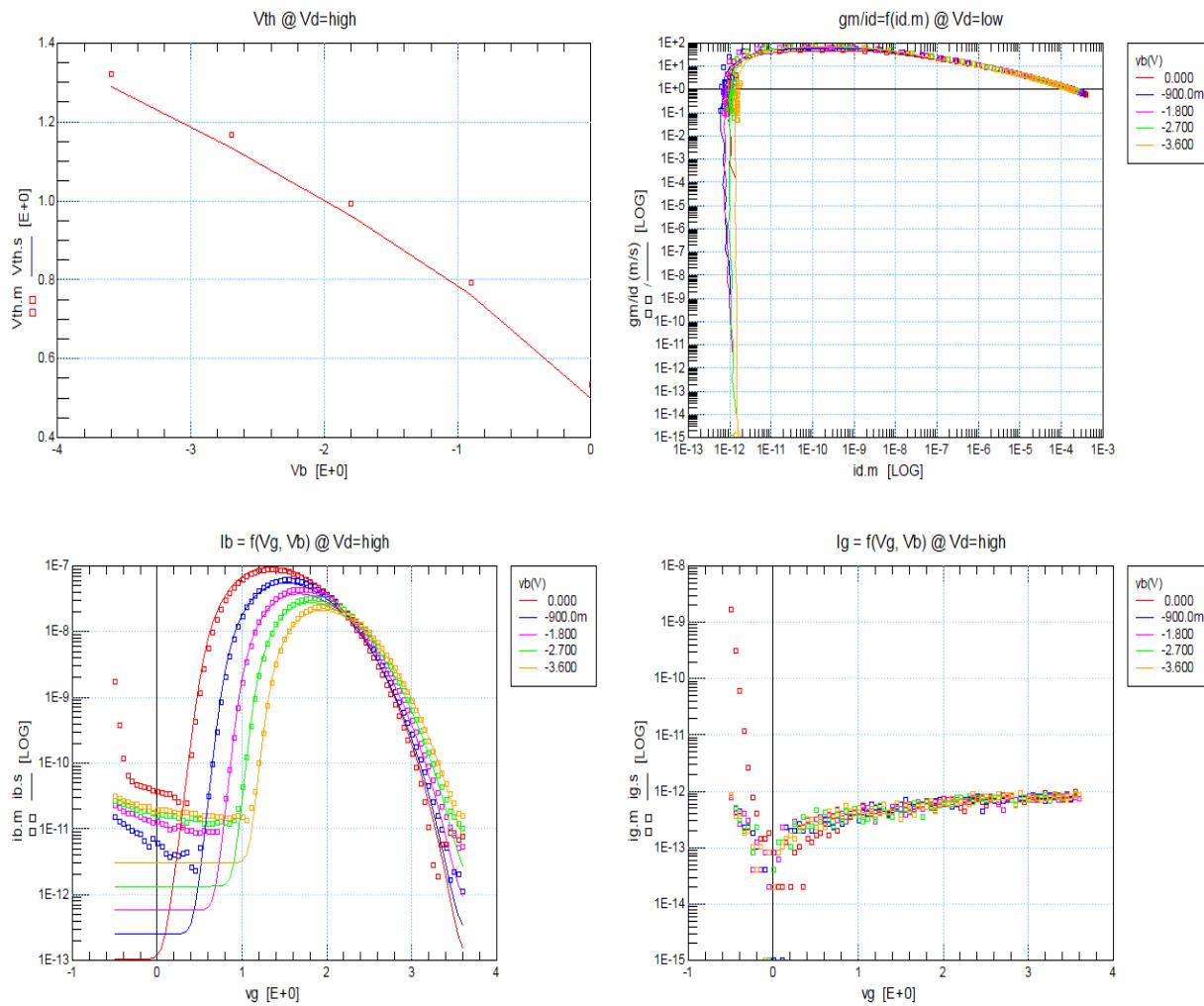


idvg, Vd = 0.1V, T = 70°C


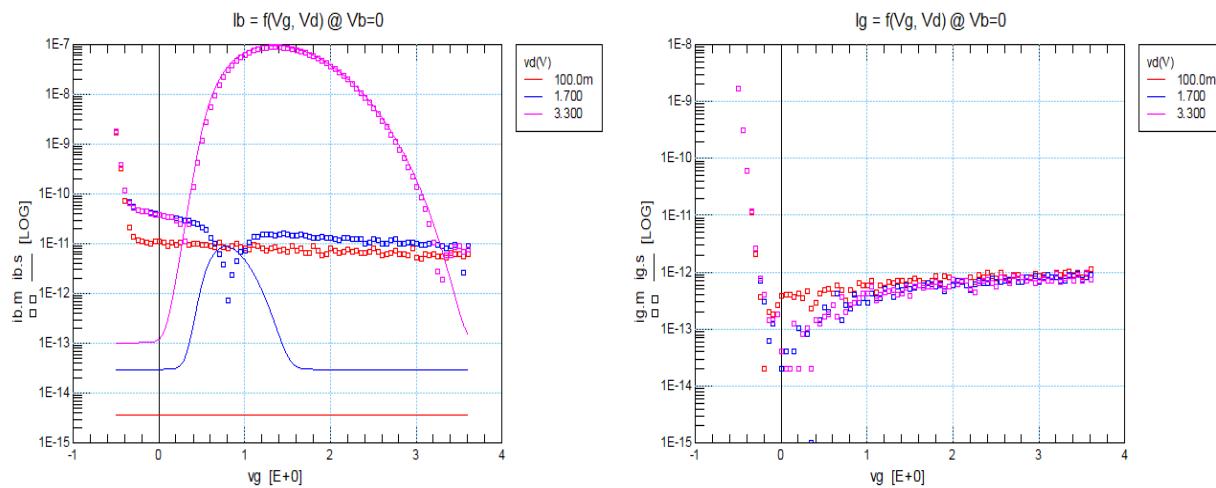


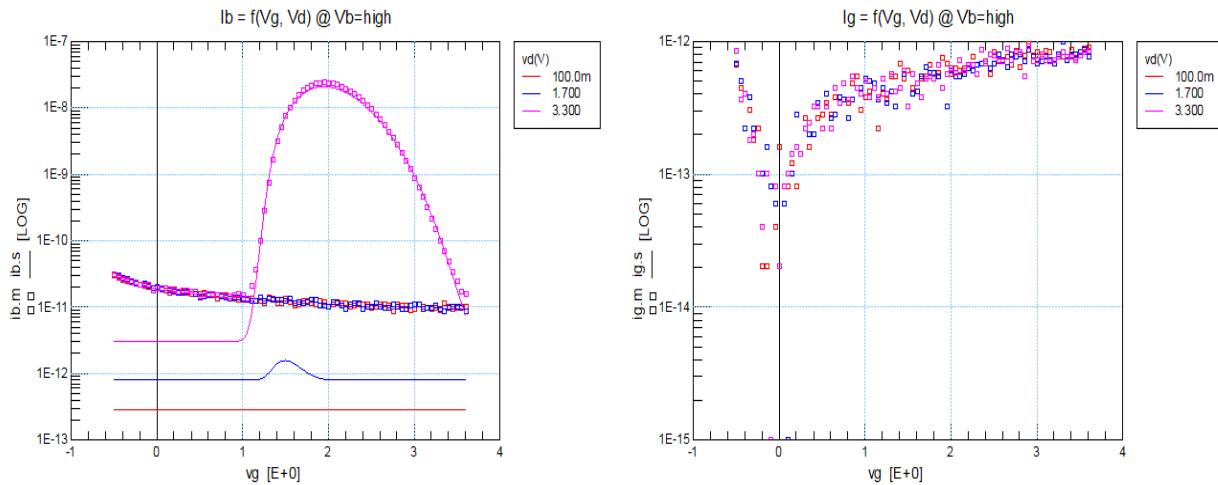
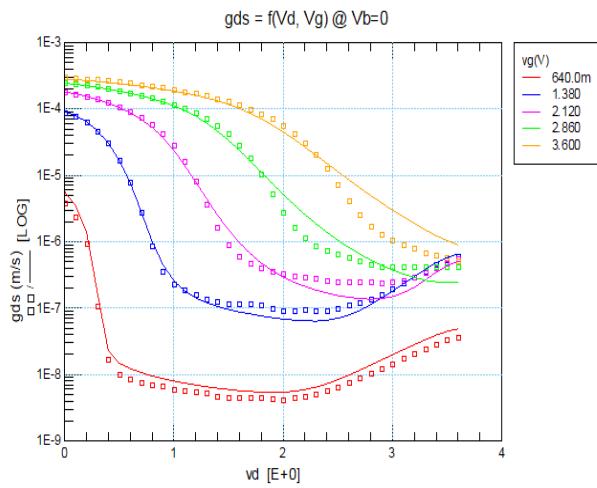
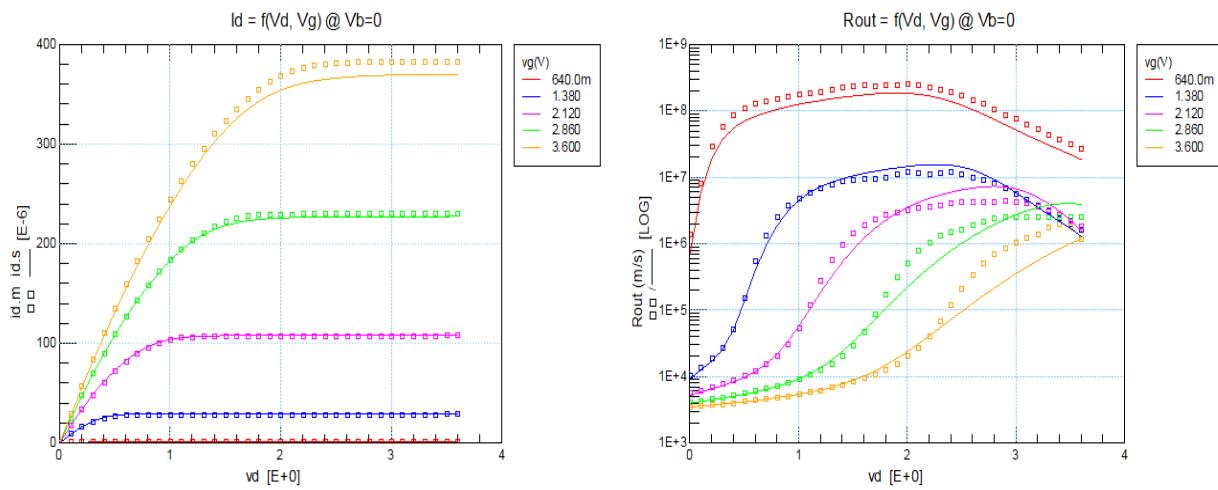
$i_{dvg}, V_d = 3.3V, T = 70^\circ C$

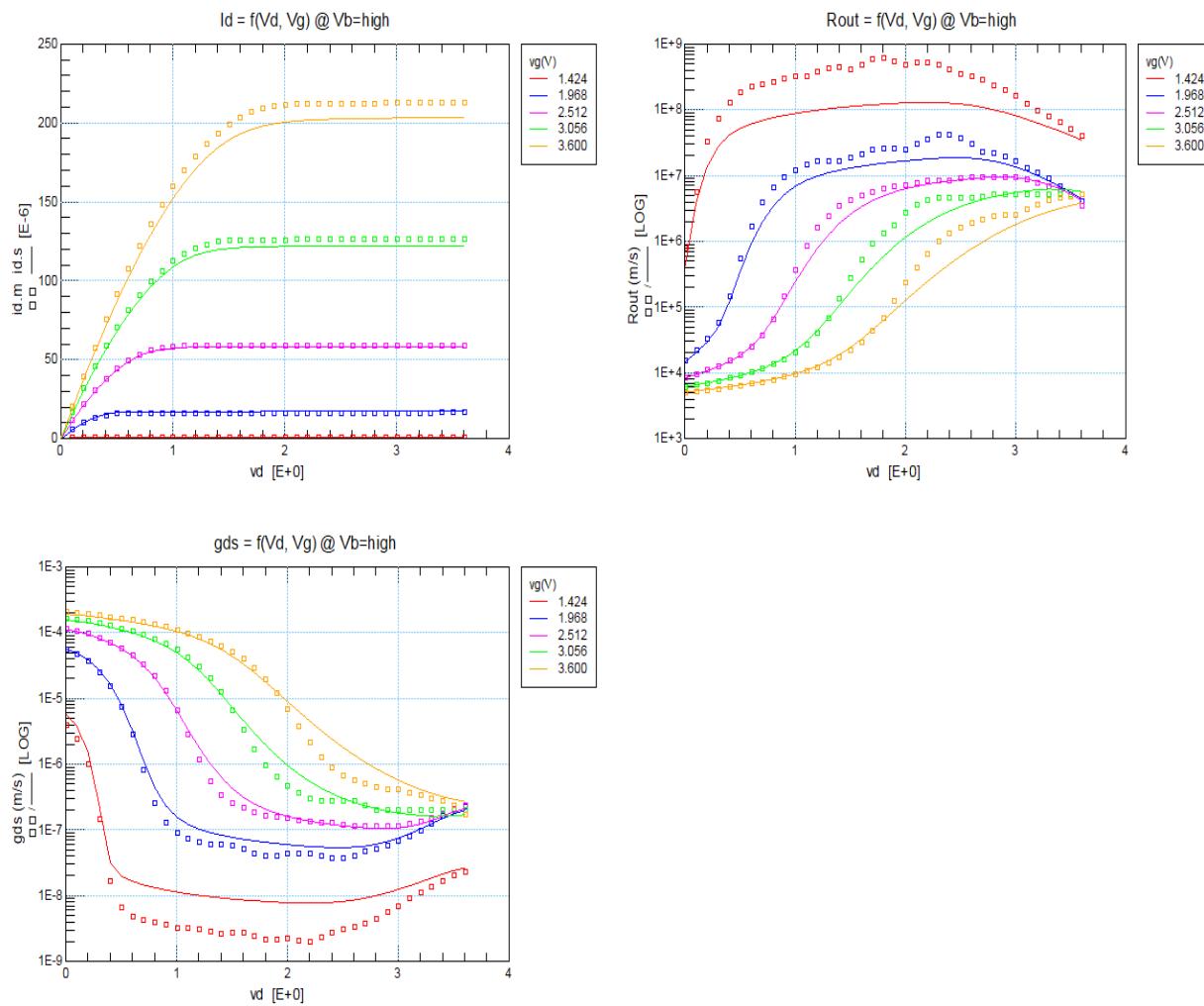
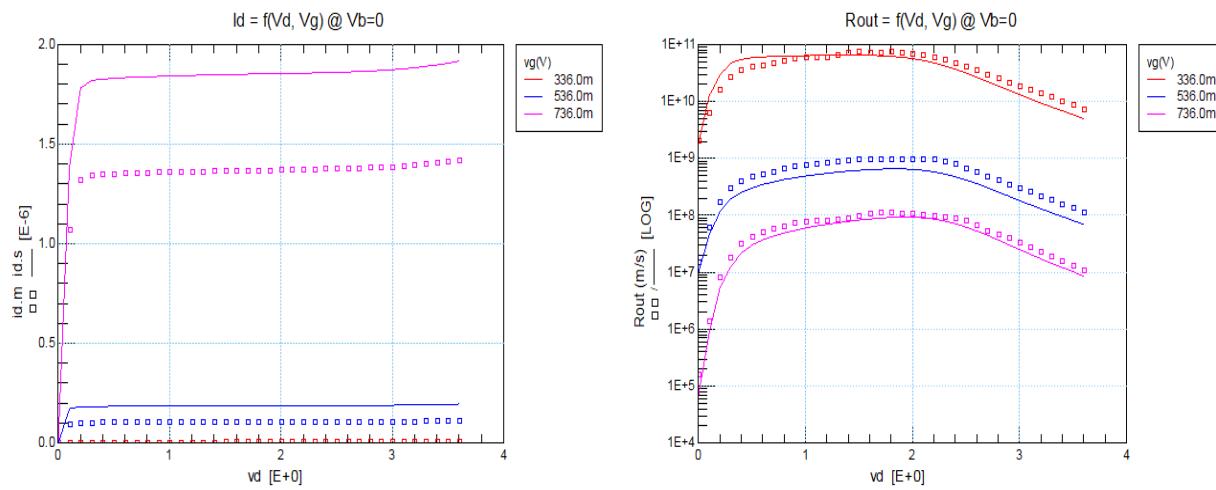


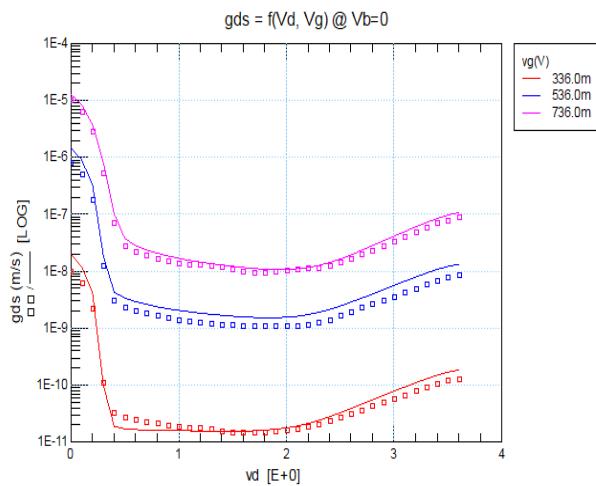


idvg, Ib, Ig, Vb = 0V, T = 70°C

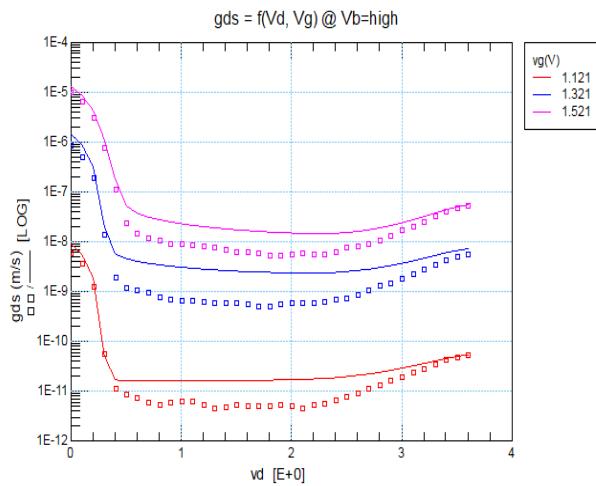
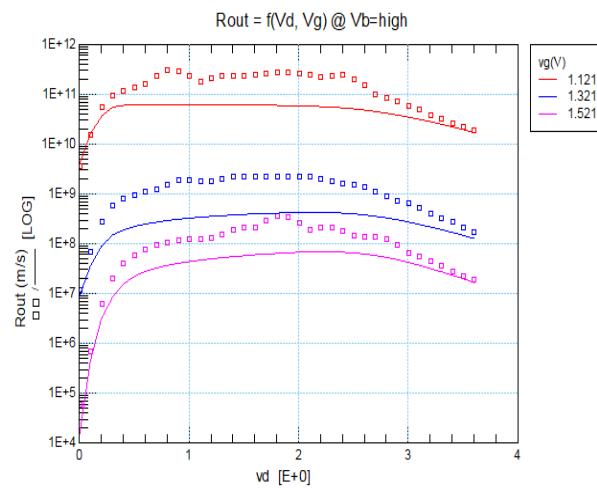
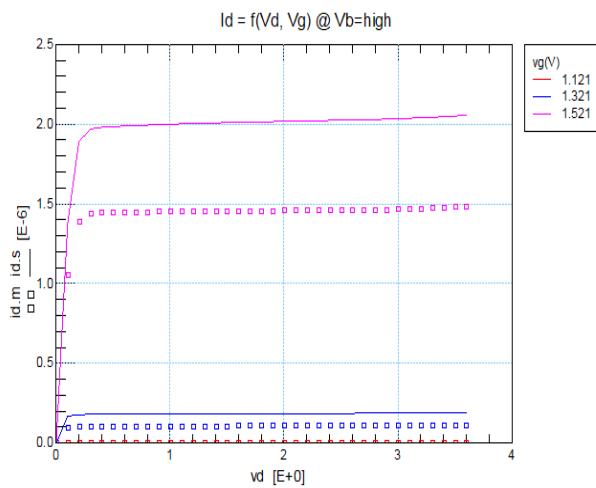


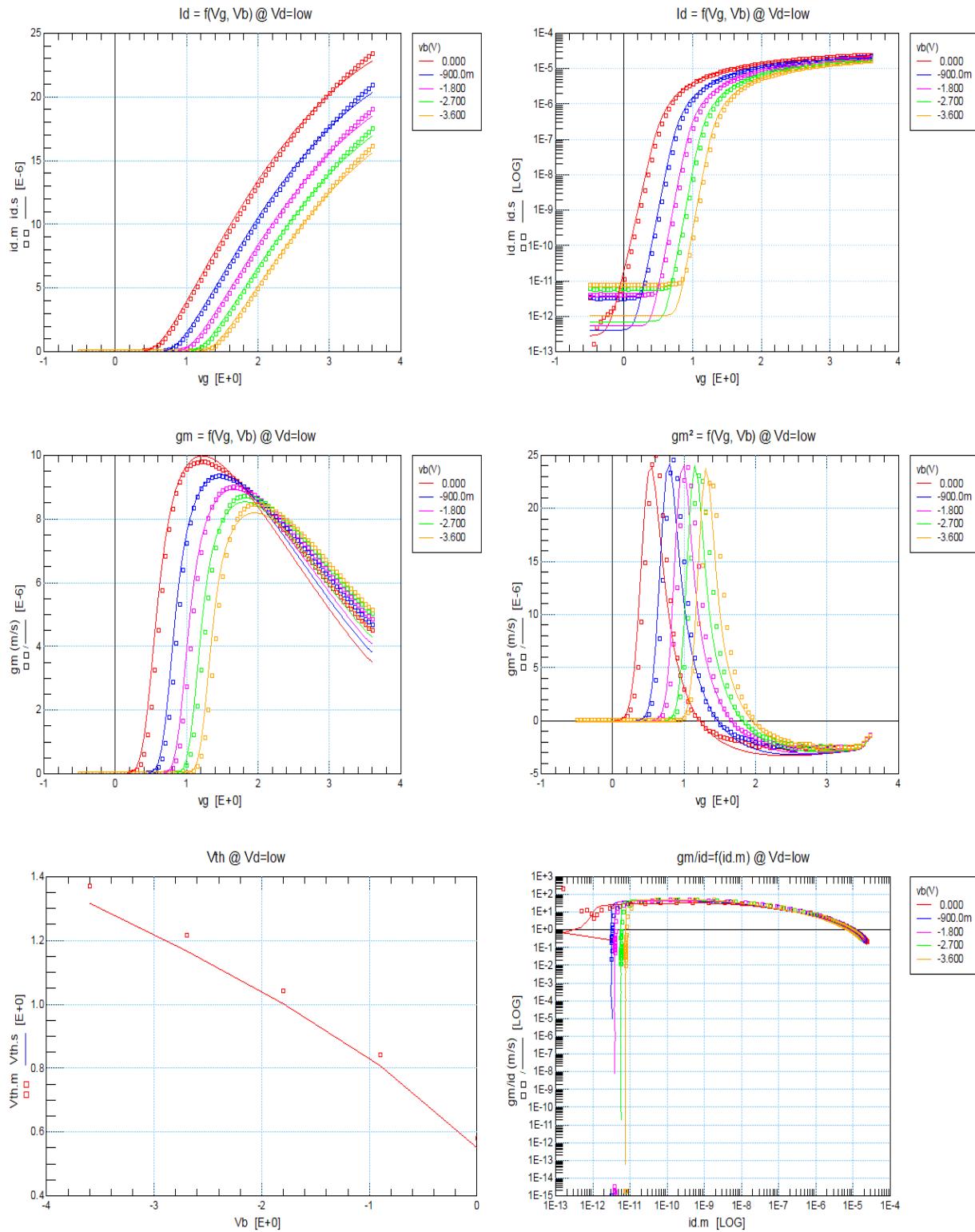
idvg, Ib,Ig, Vb = -3.6V, T = 70°C

idvd, Vb = 0V, T = 70°C


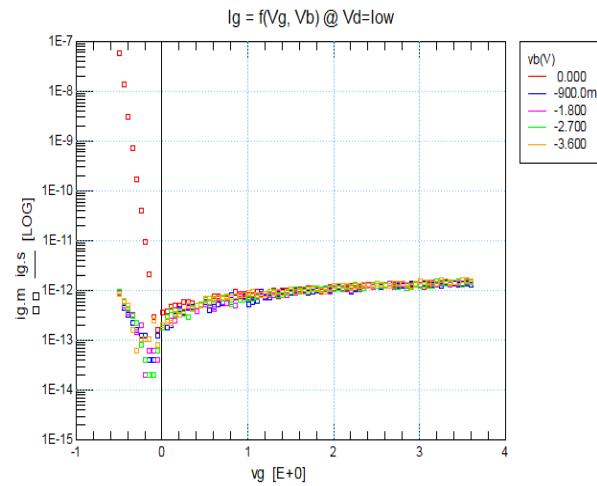
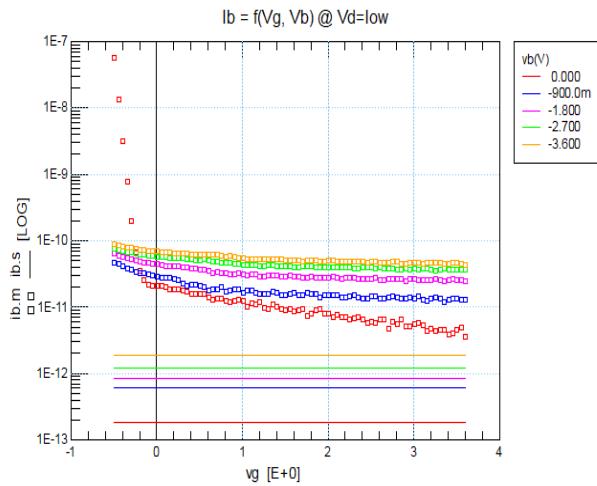
idvd_vbmin, Vb = -3.6V, T = 70°C**idvd_vth, Vb = 0V, T = 70°C**



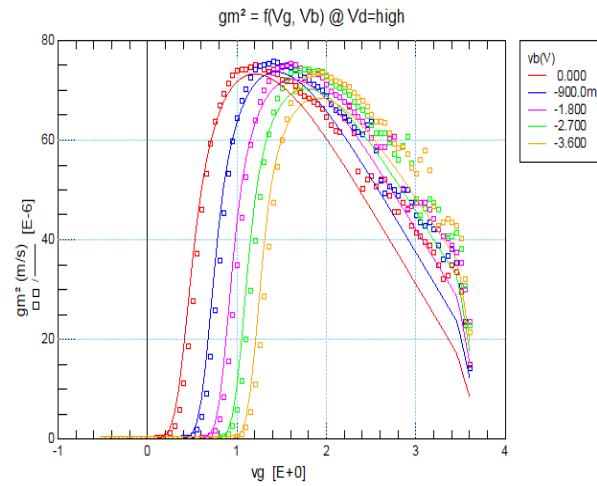
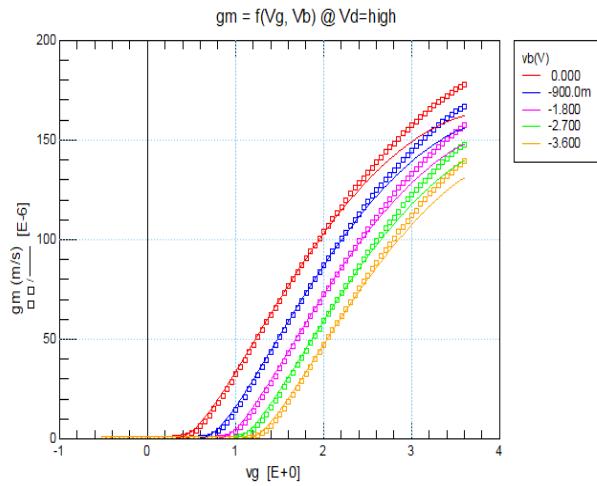
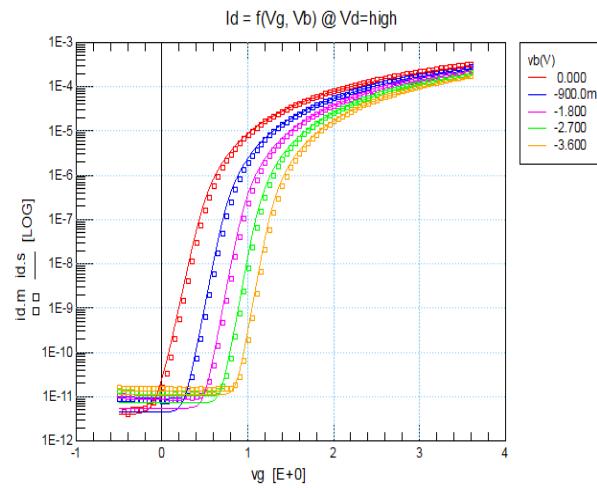
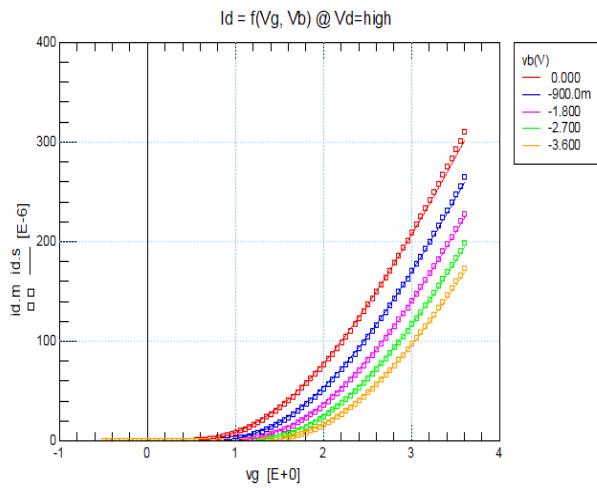
idvd_vth_vbmin, Vb = -3.6V, T = 70°C

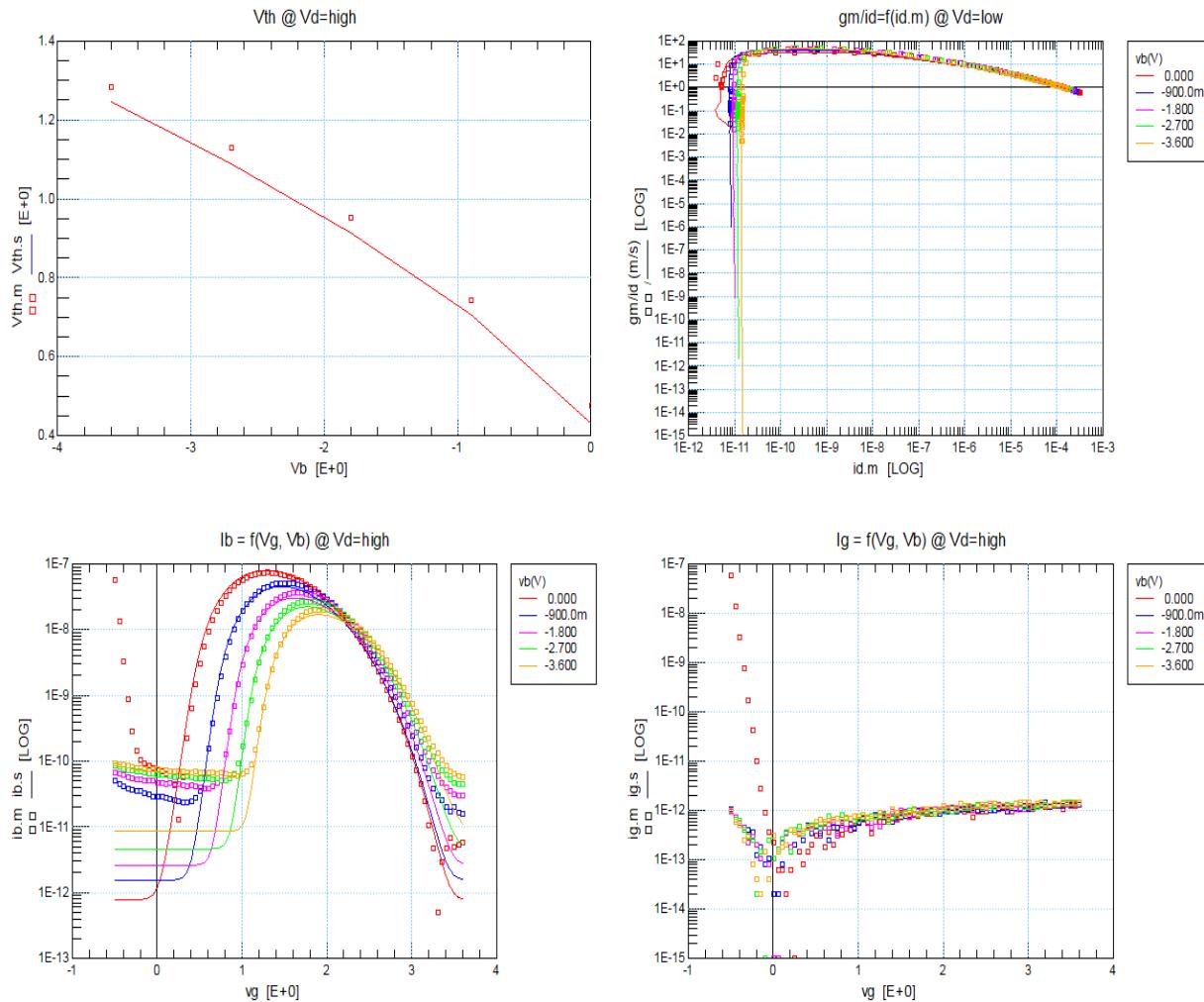


idvg, Vd = 0.1V, T = 125°C


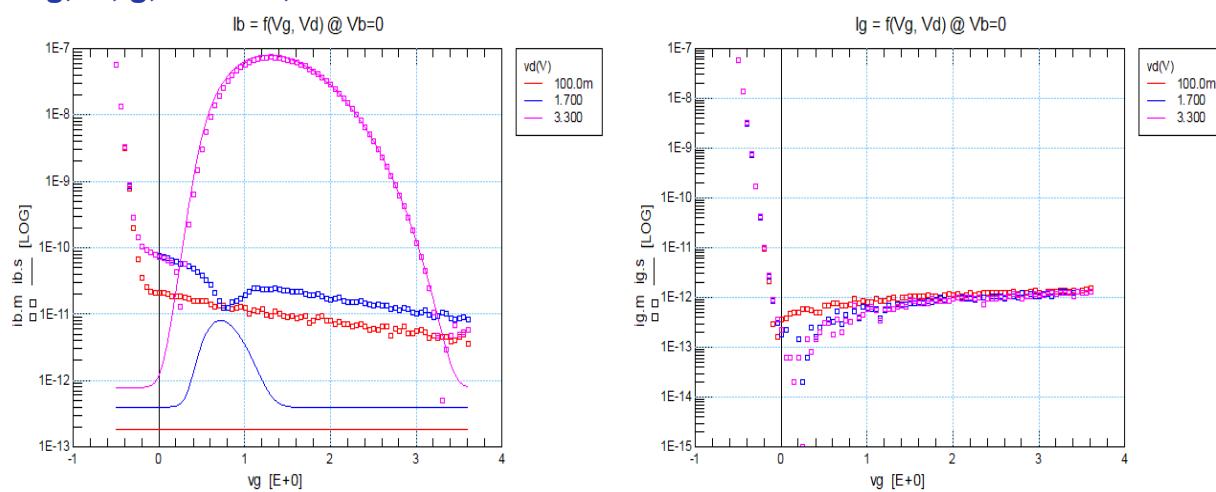


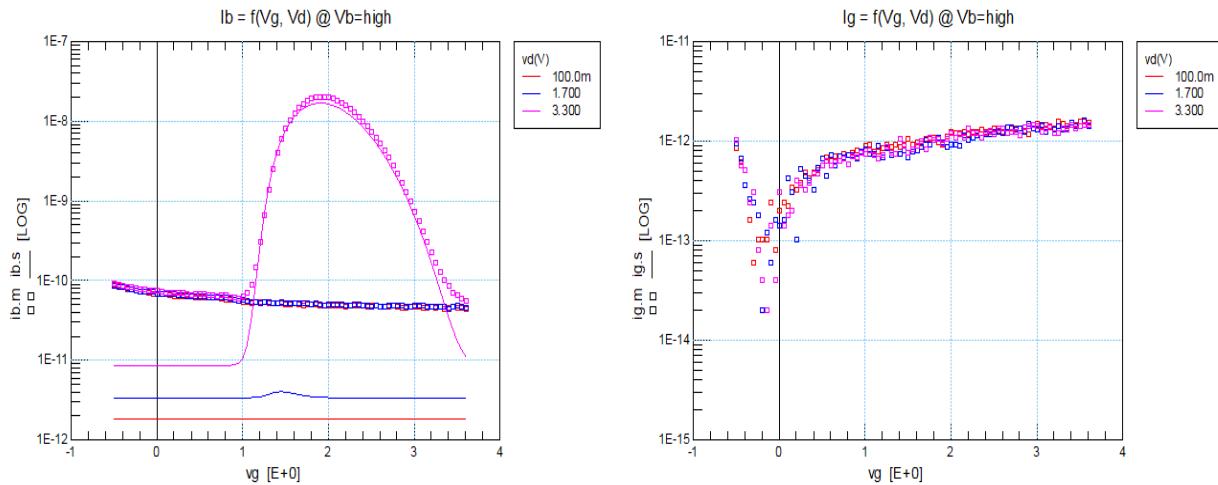
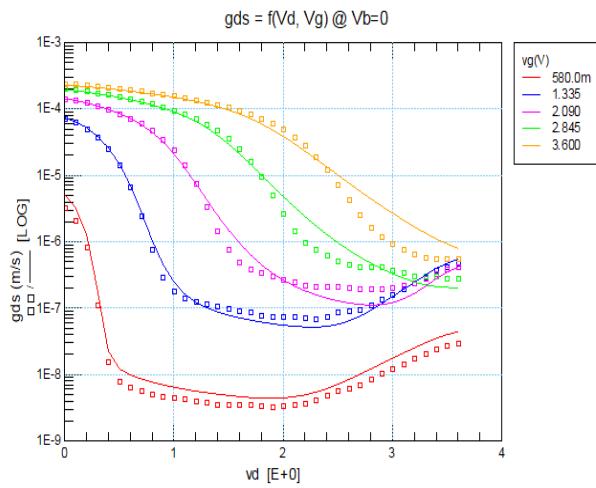
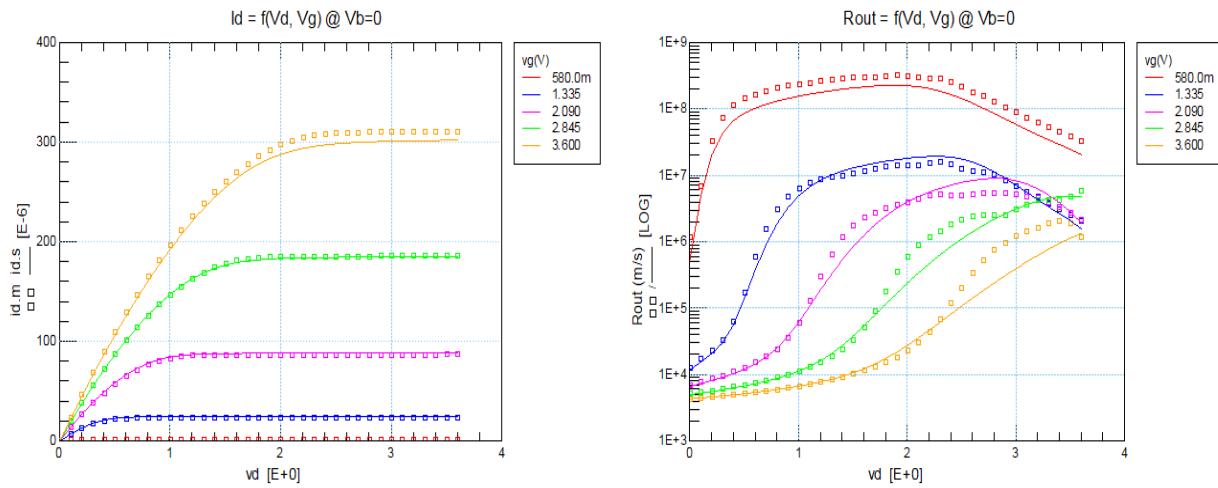
$i_{dvg}, V_d = 3.3V, T = 125^\circ C$

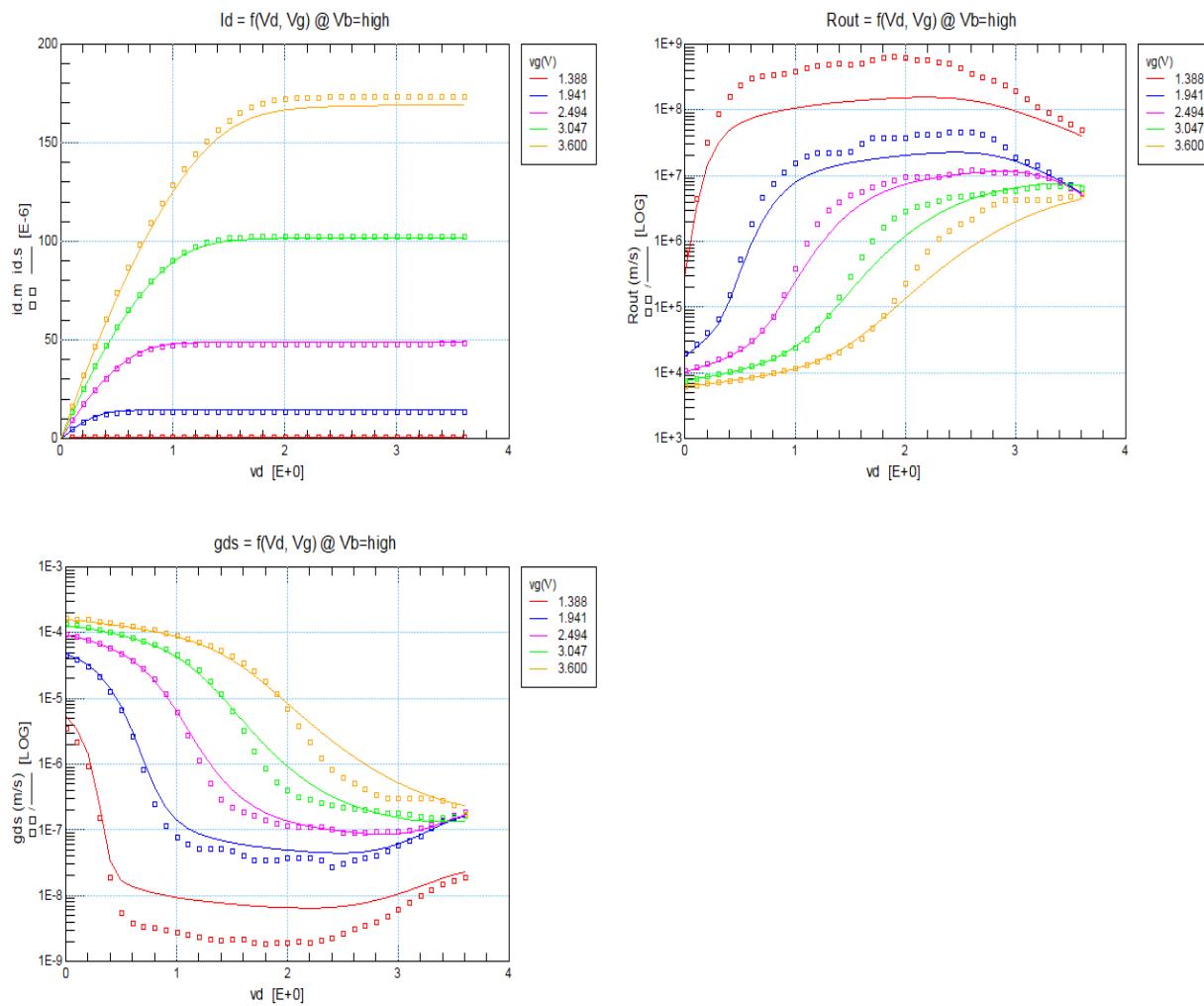
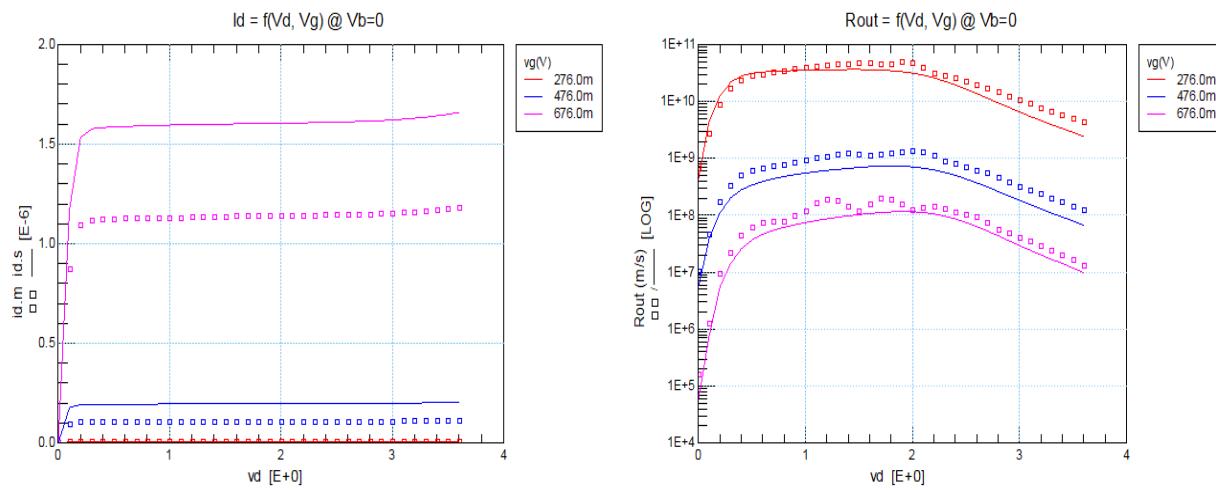


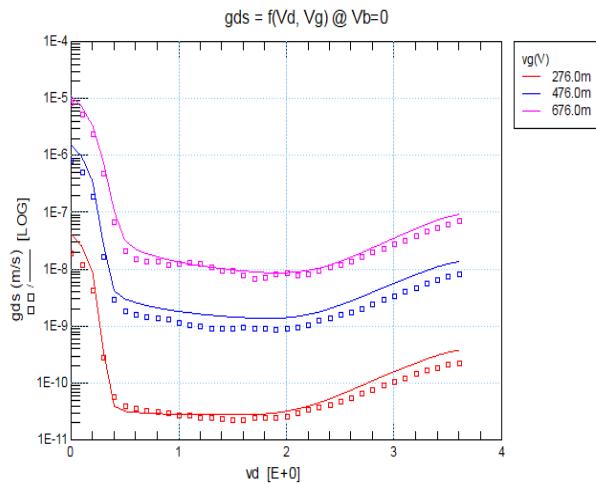


idvg, Ib,Ig, Vb = 0V, T = 125°C

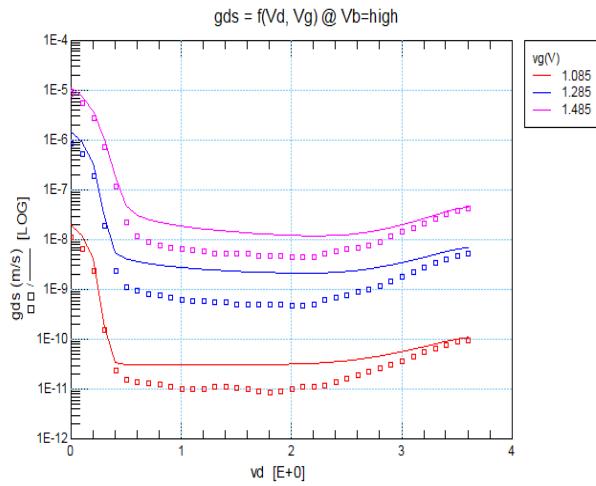
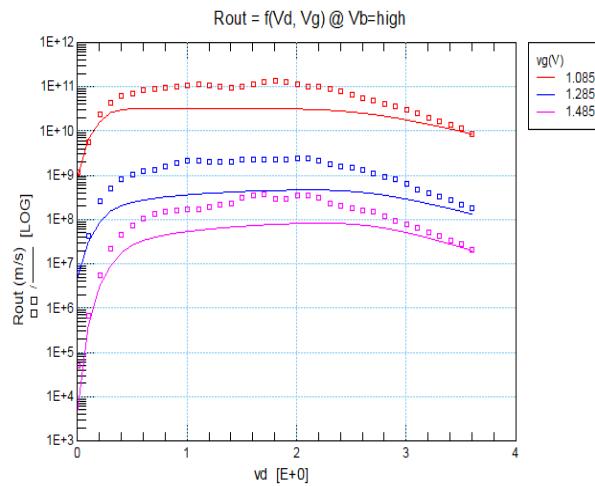
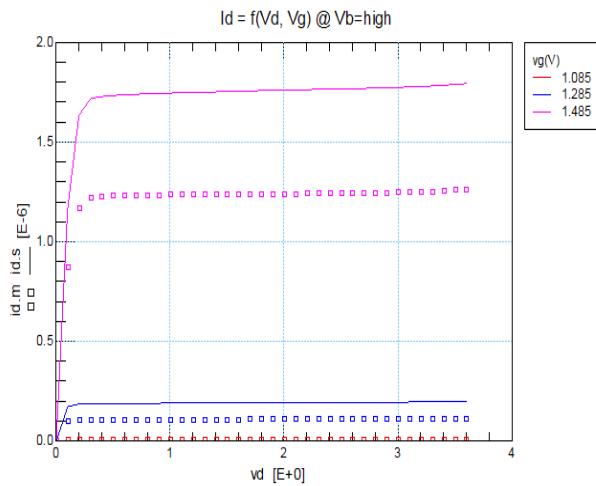


idvg, Ib,Ig, Vb = -3.6V, T = 125°C

idvd, Vb = 0V, T = 125°C


idvd_vbmin, Vb = -3.6V, T = 125°C**idvd_vth, Vb = 0V, T = 125°C**

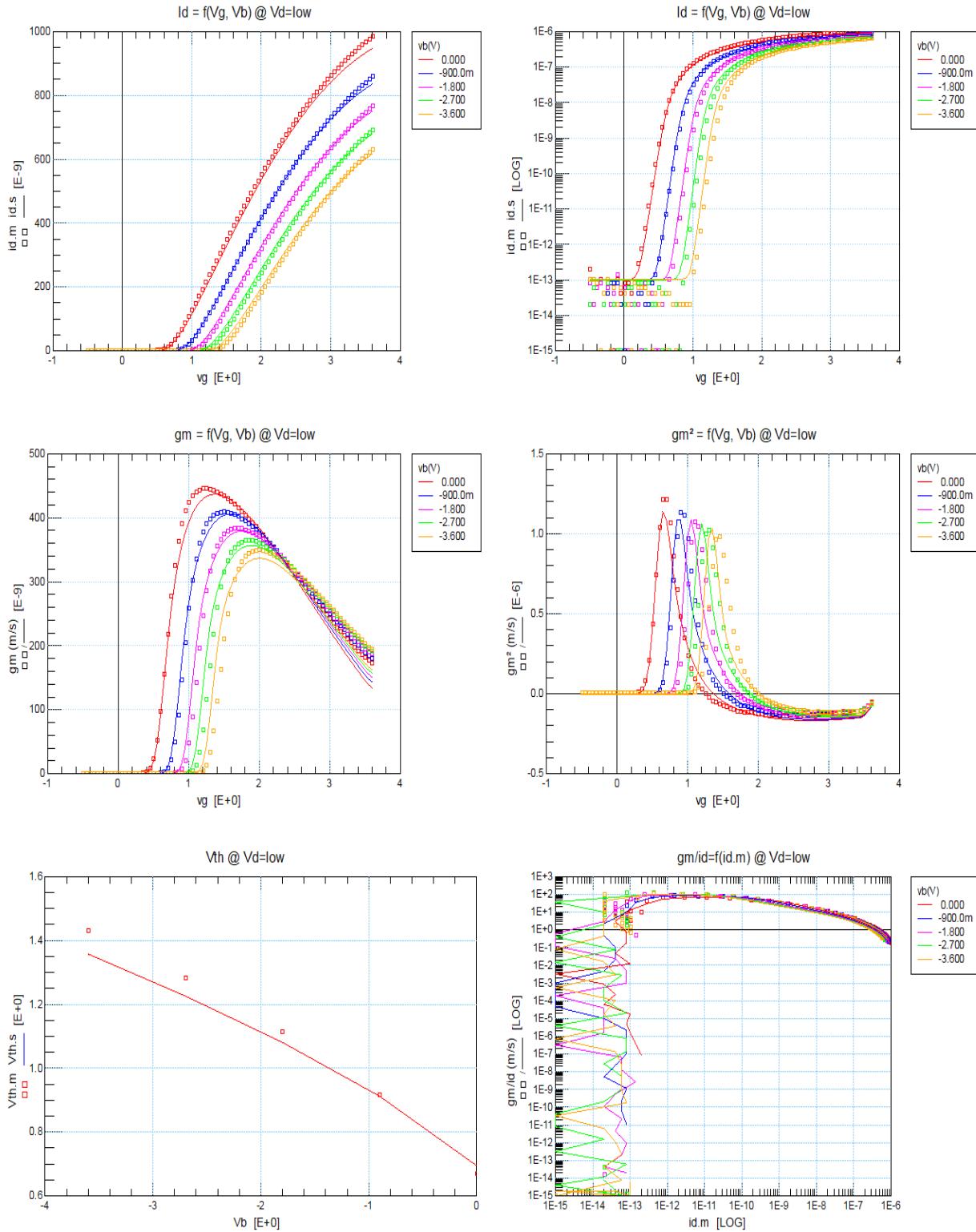


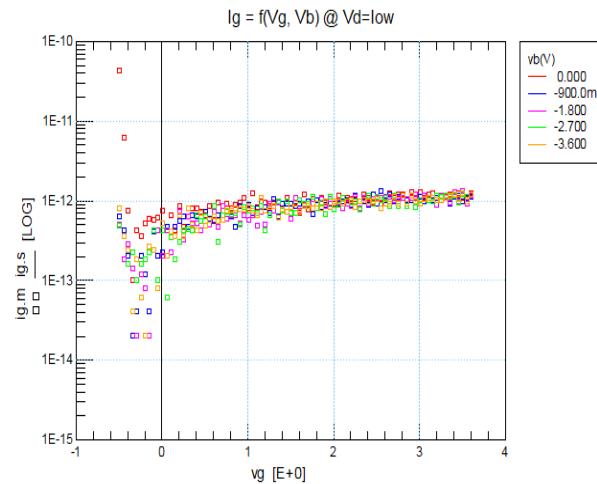
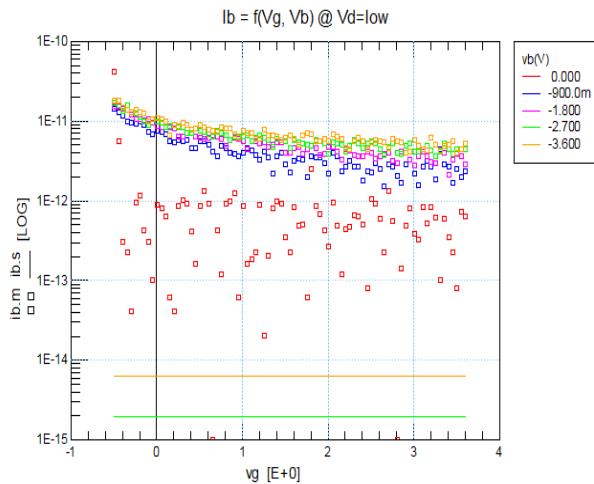
idvd_vth_vbmin, Vb = -3.6V, T = 125°C



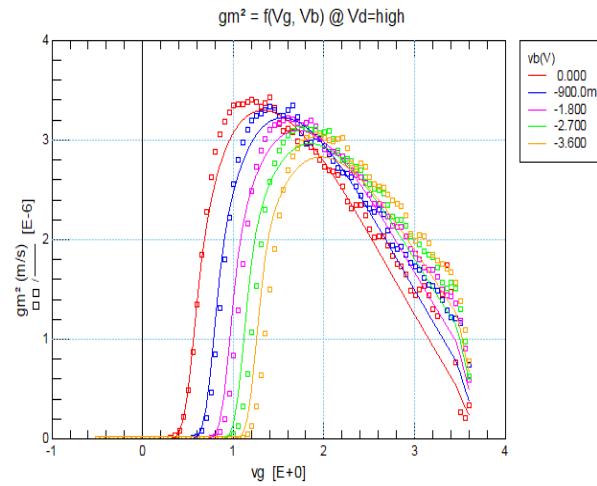
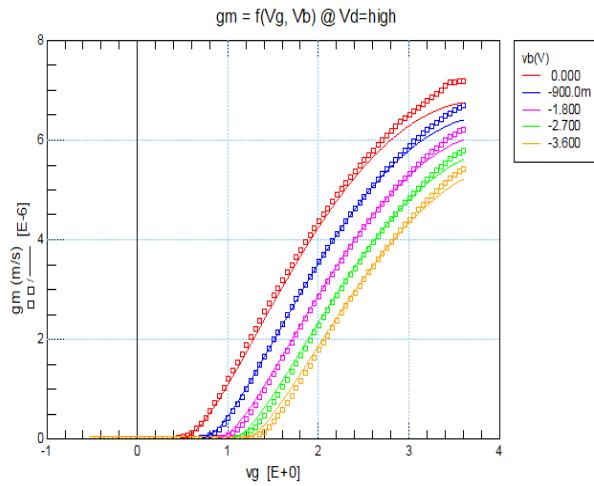
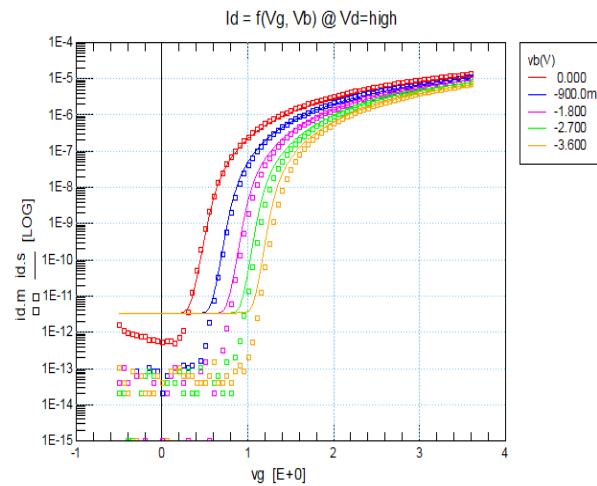
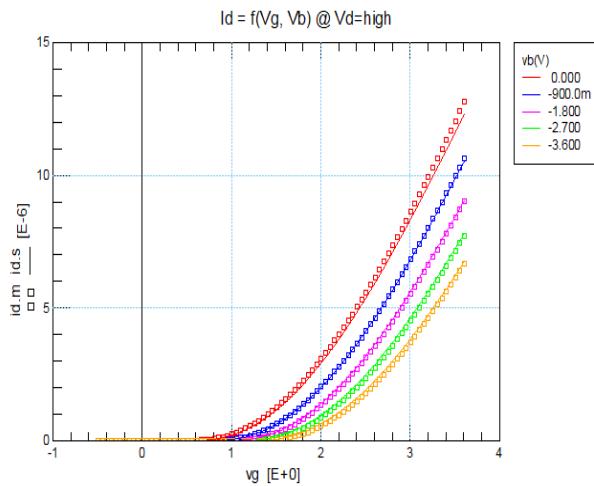
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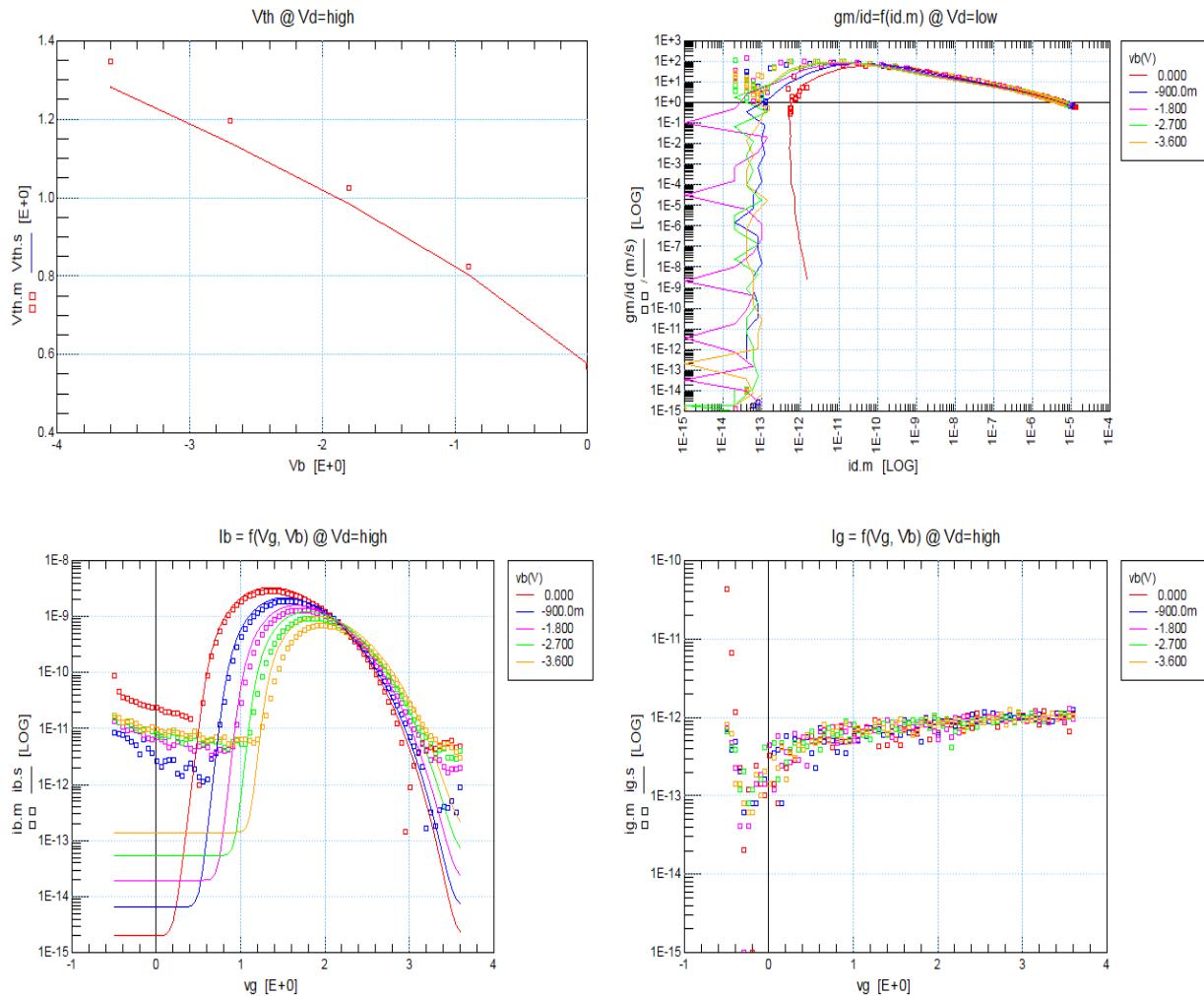
idvg, Vd = 0.1V, T = 27°C



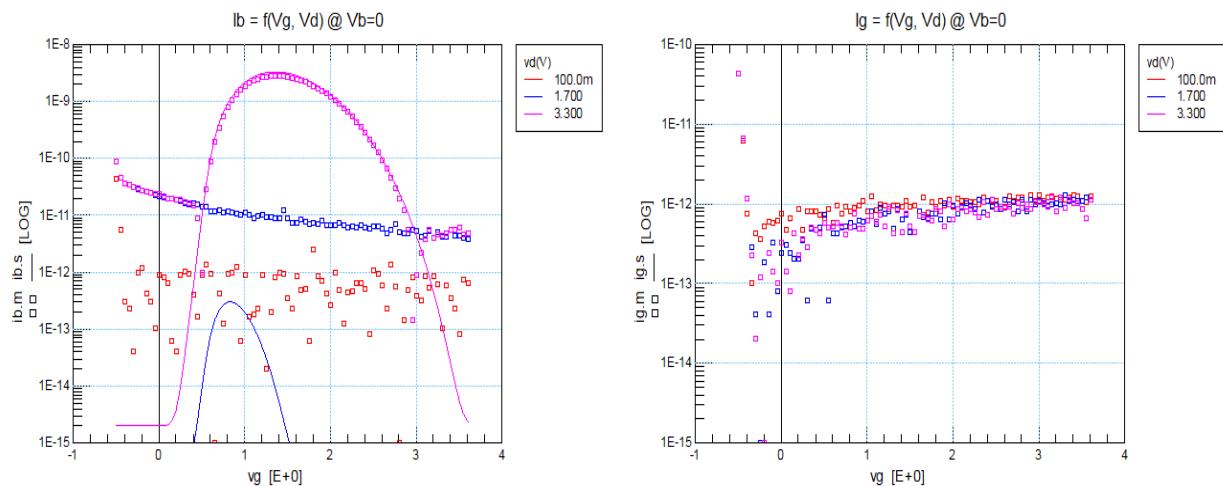


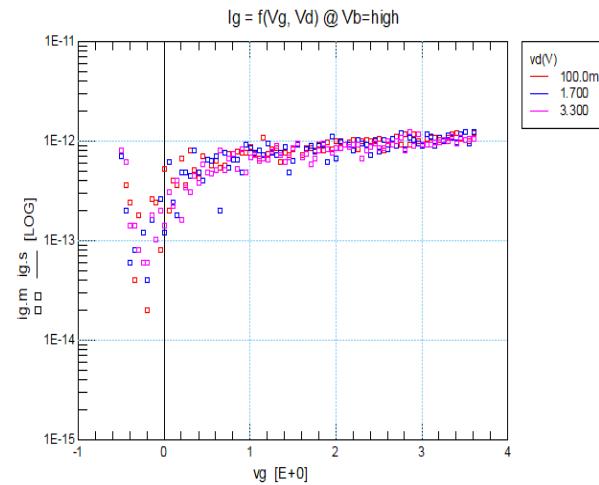
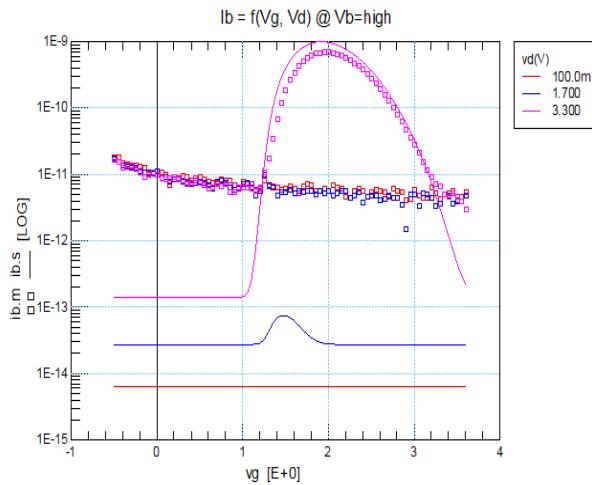
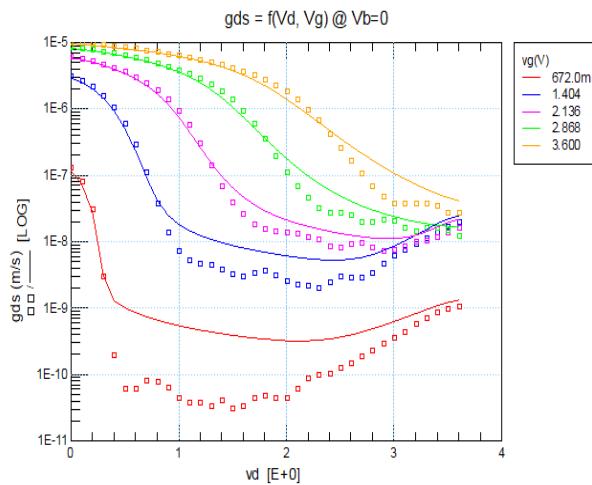
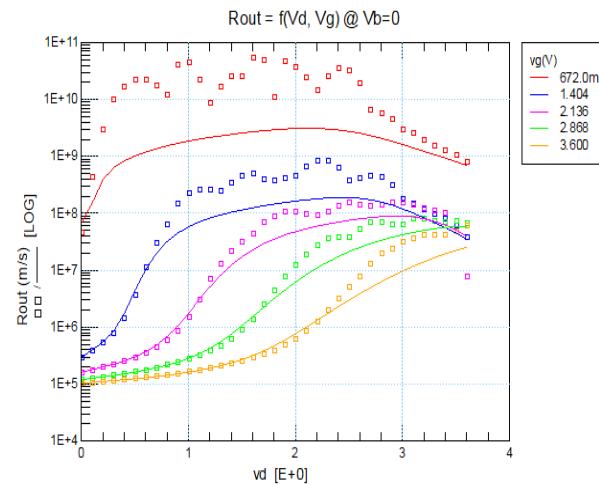
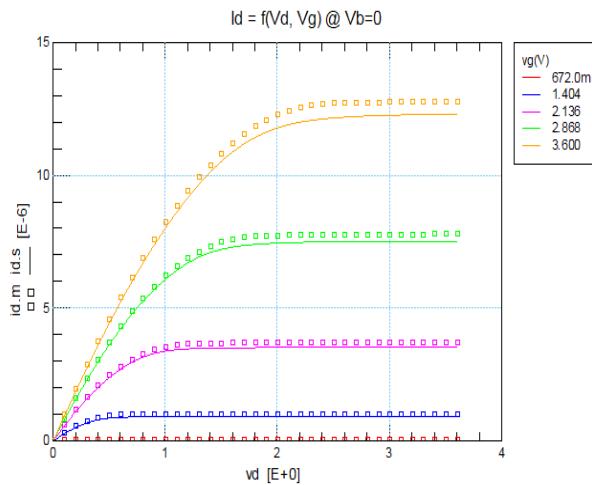
$i_d v_g, V_d = 3.3V, T = 27^\circ C$

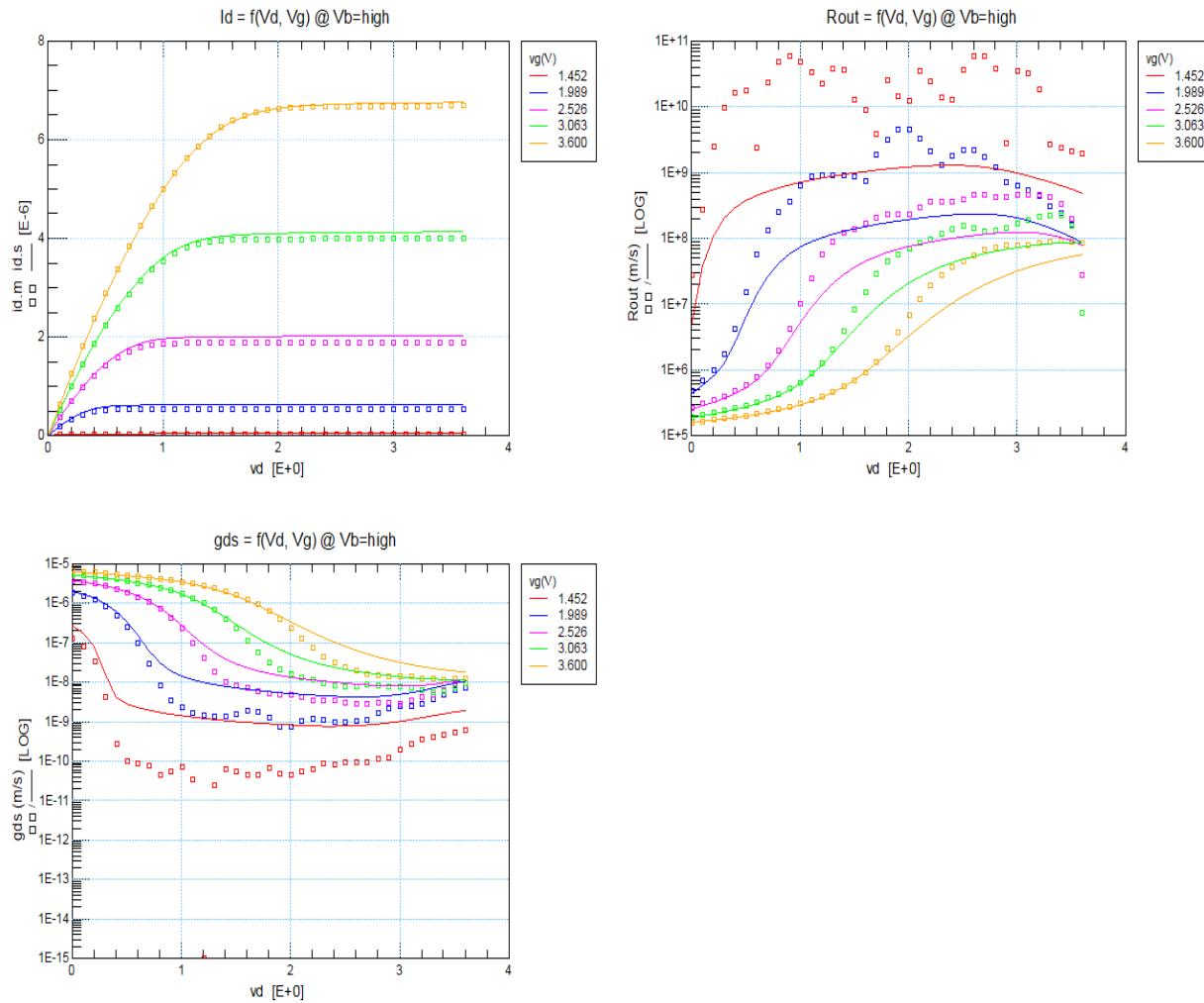
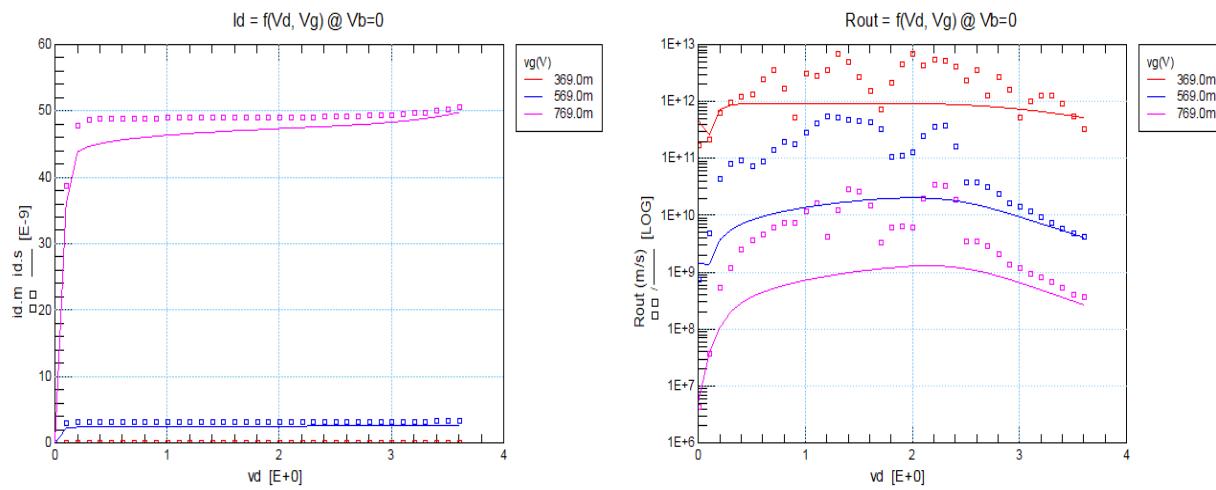


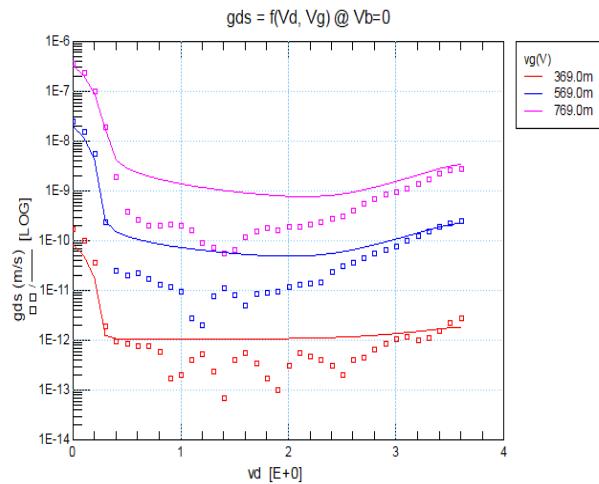


idvg, Ib, Ig, Vb = 0V, T = 27°C

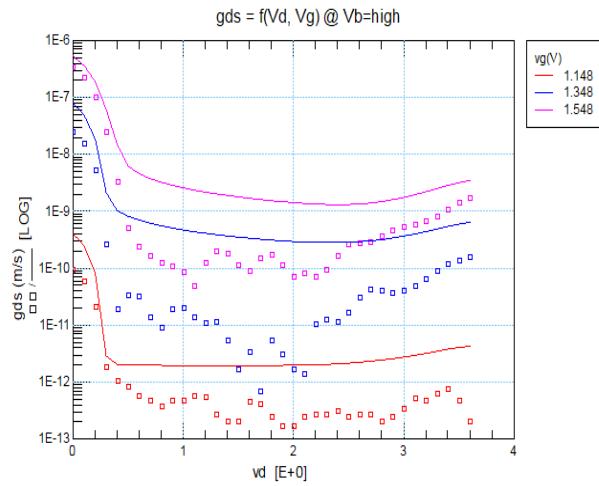
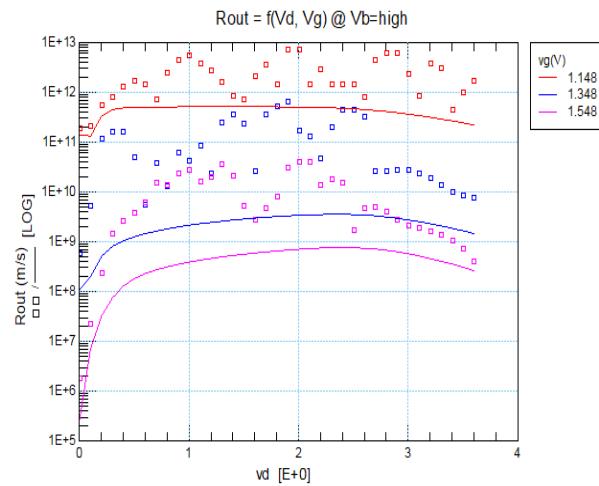
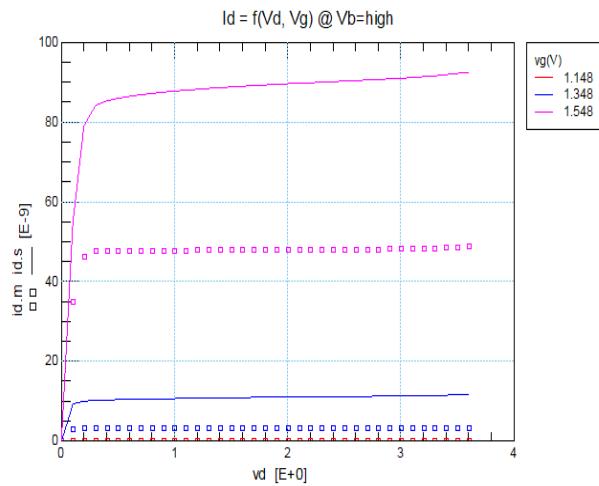


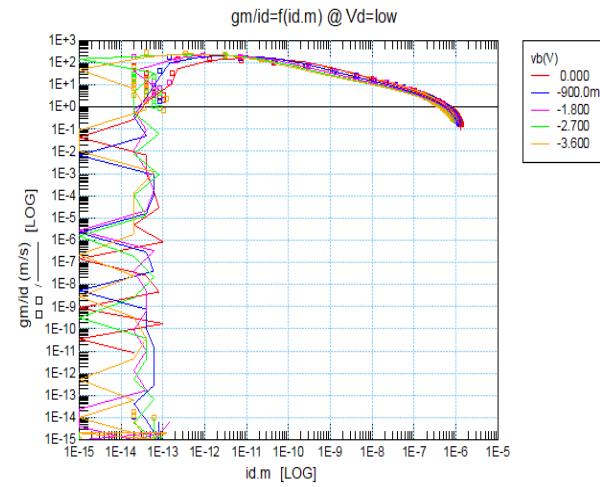
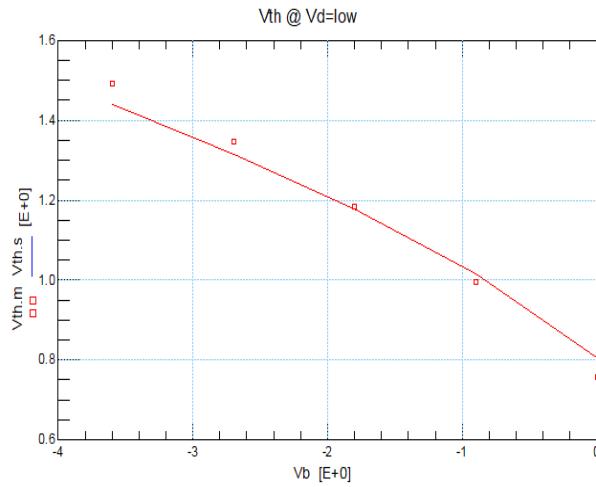
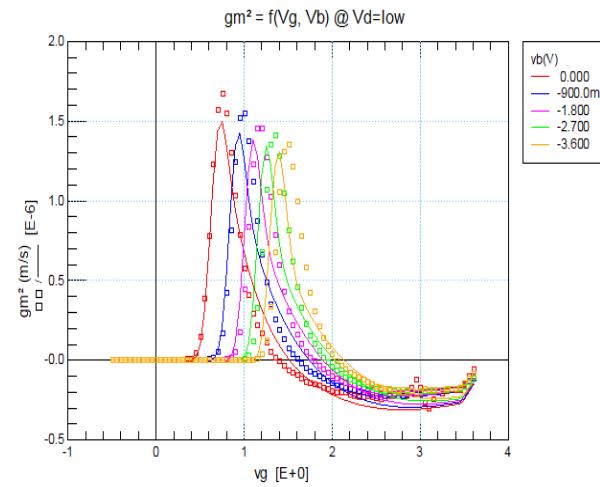
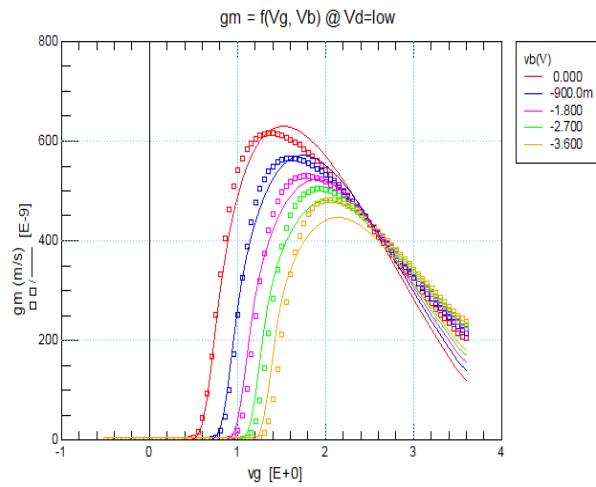
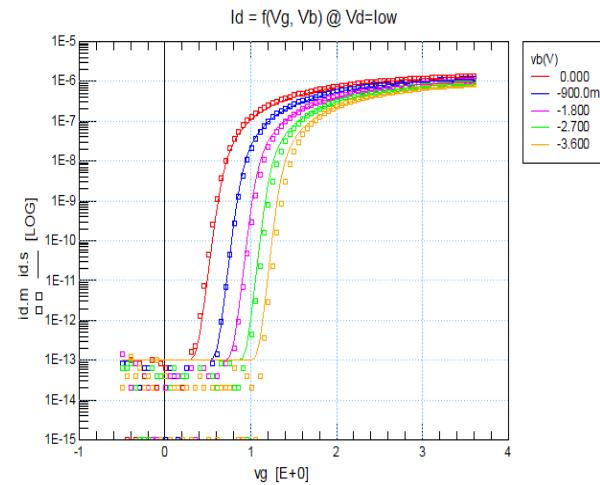
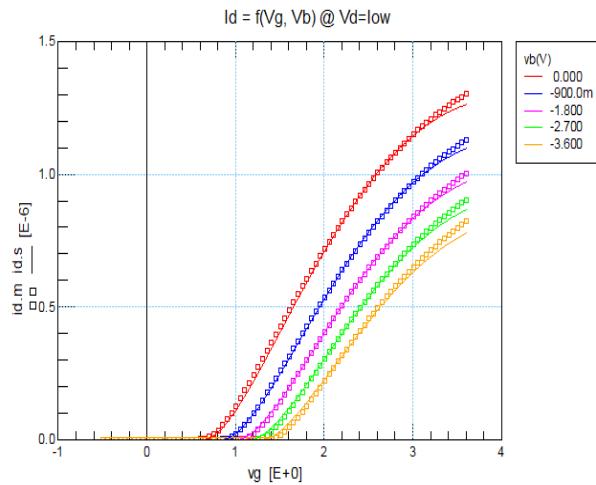
idvg, Ib,Ig, Vb = -3.6V, T = 27°C**idvd, Vb = 0V, T = 27°C**

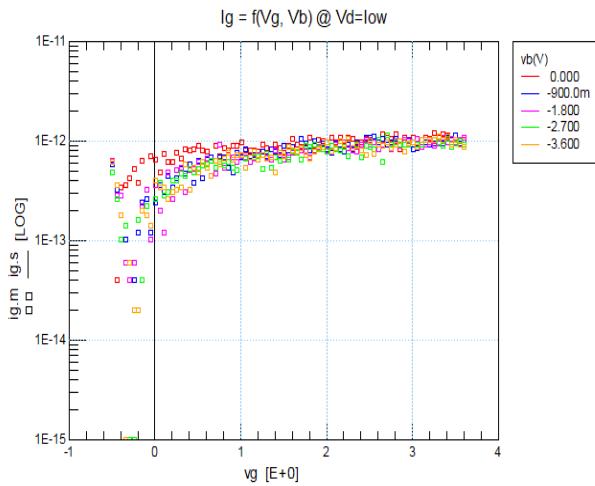
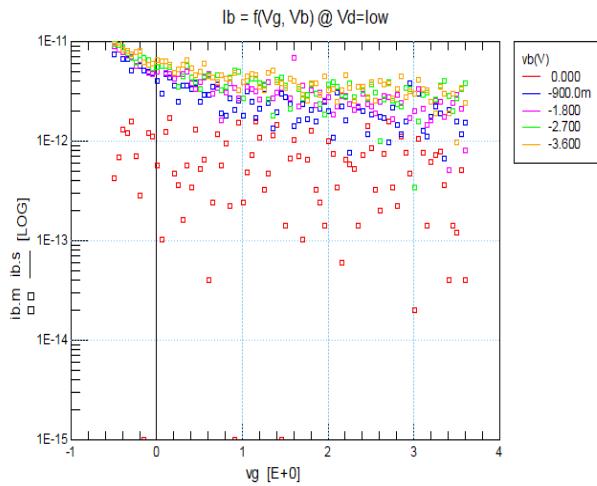
idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C




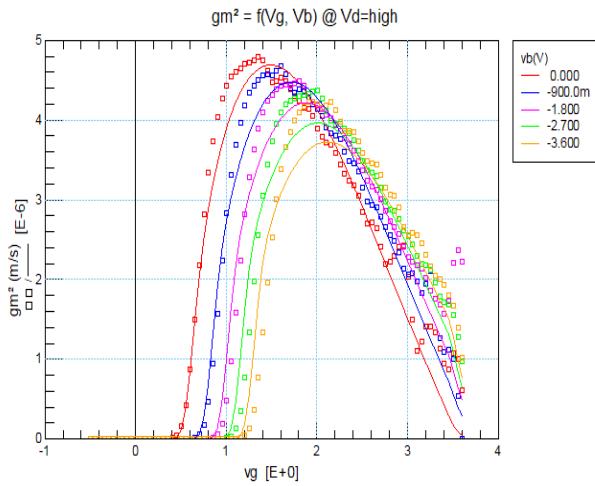
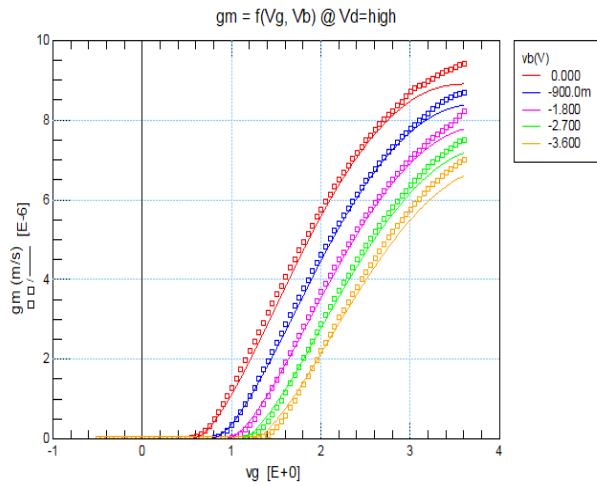
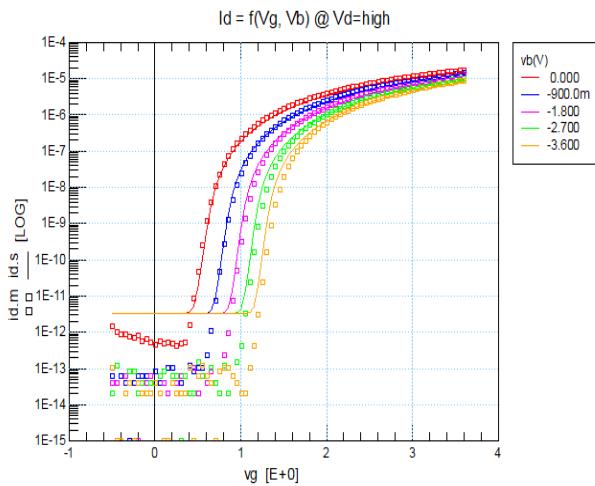
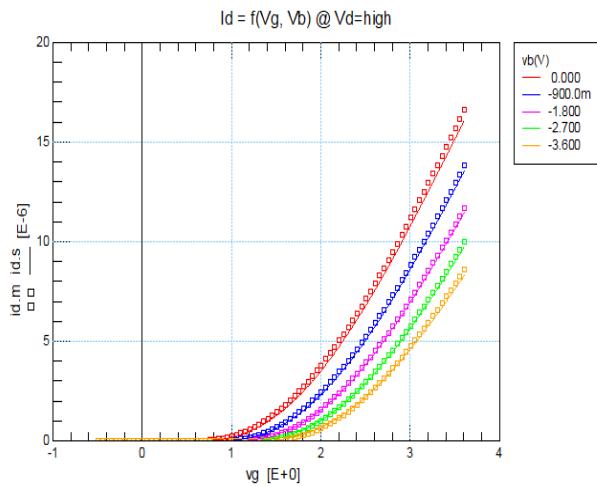
idvd_vth_vbmin, Vb = -3.6V, T = 27°C

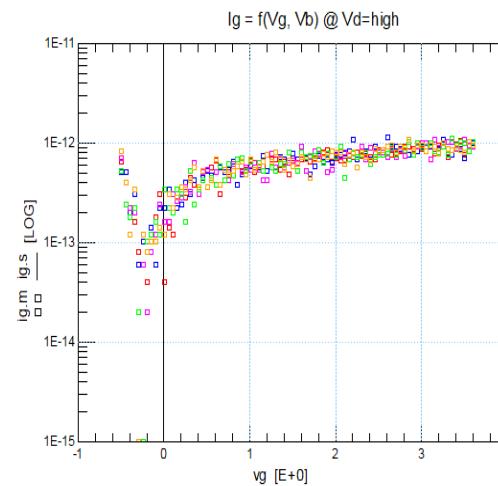
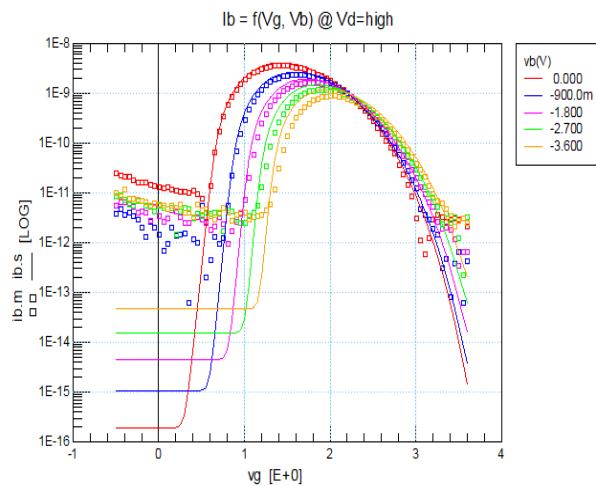
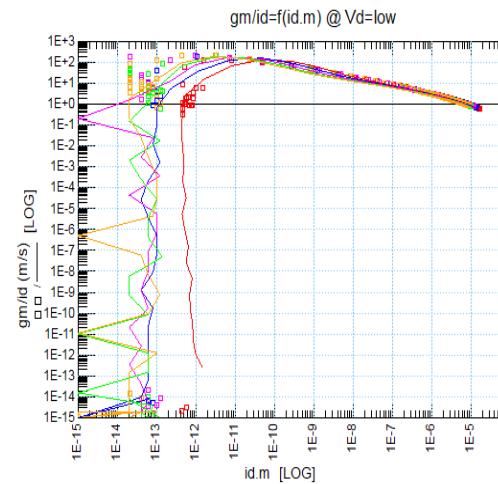
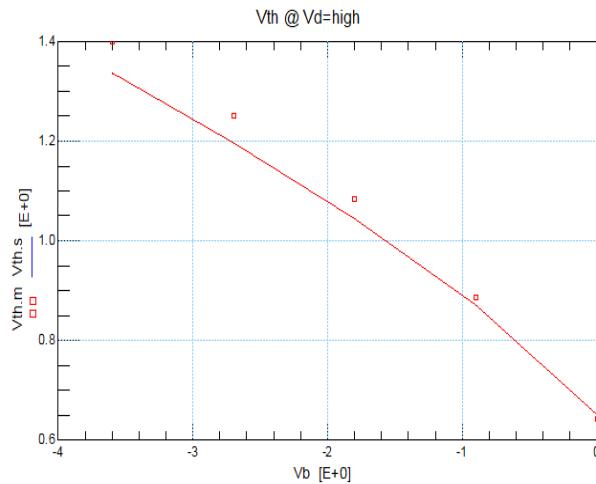


idvg, Vd = 0.1V, T = -40°C


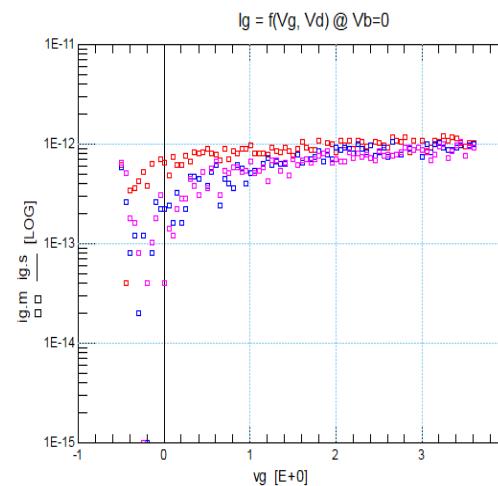
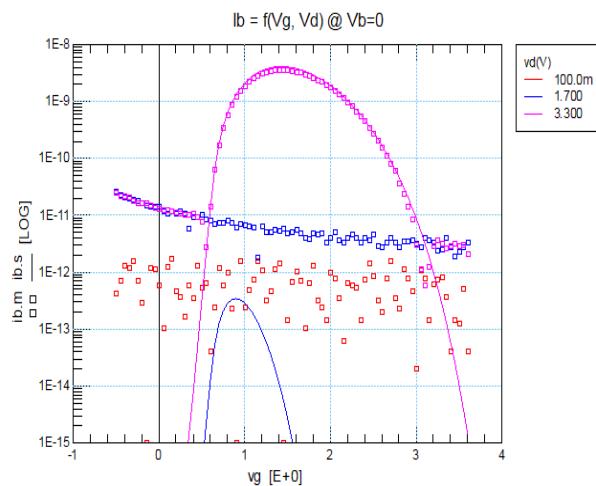


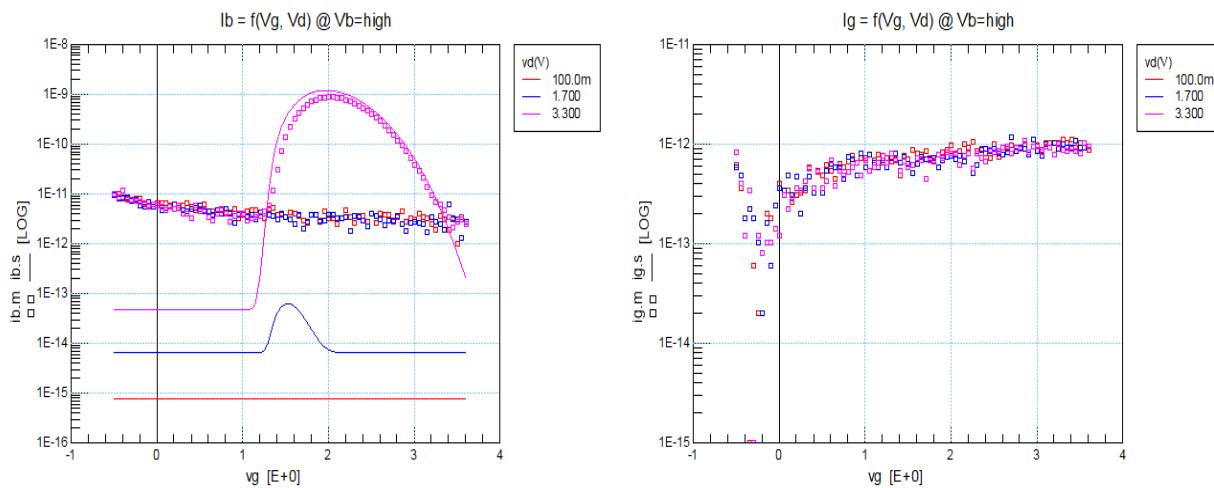
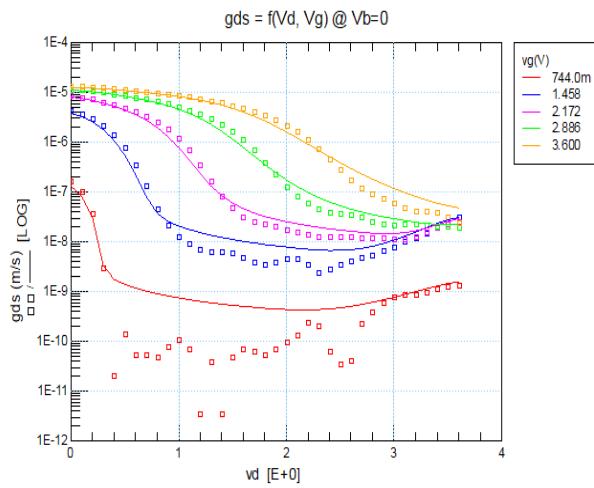
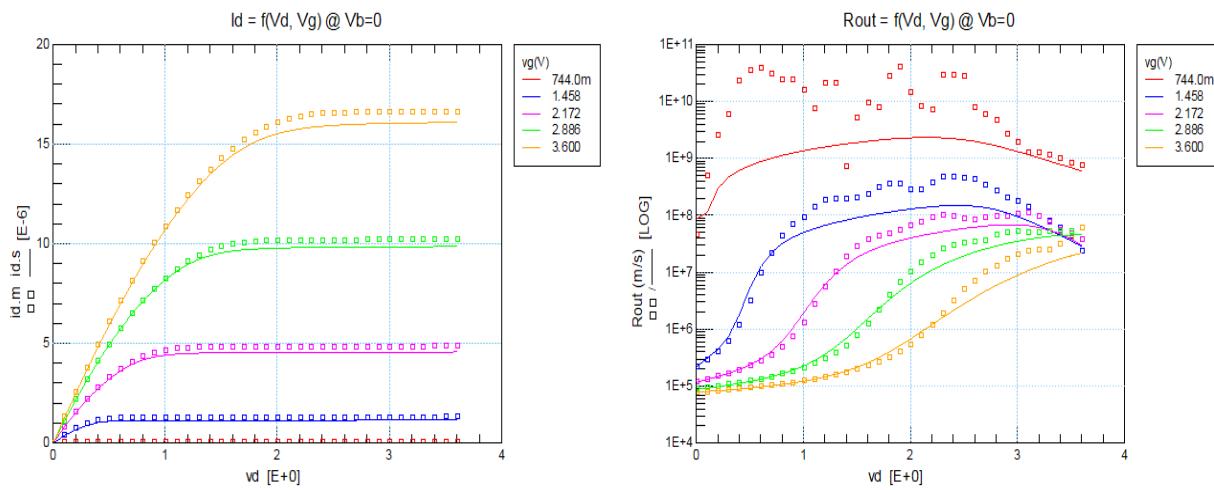
$i_{dvg}, V_d = 3.3V, T = -40^\circ C$

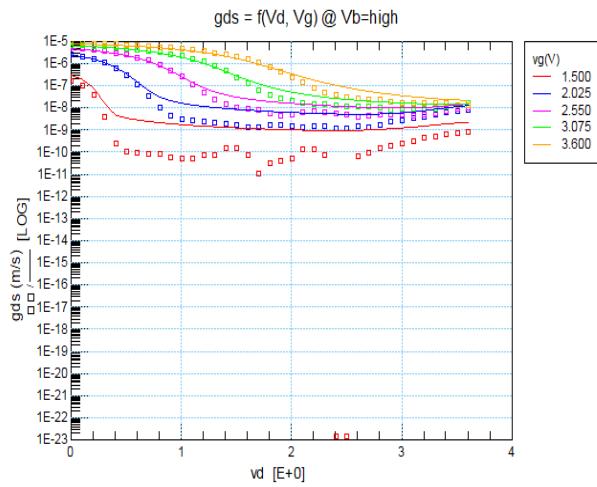
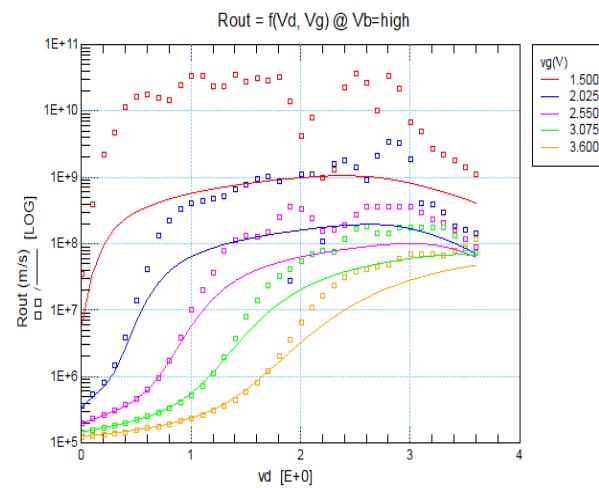
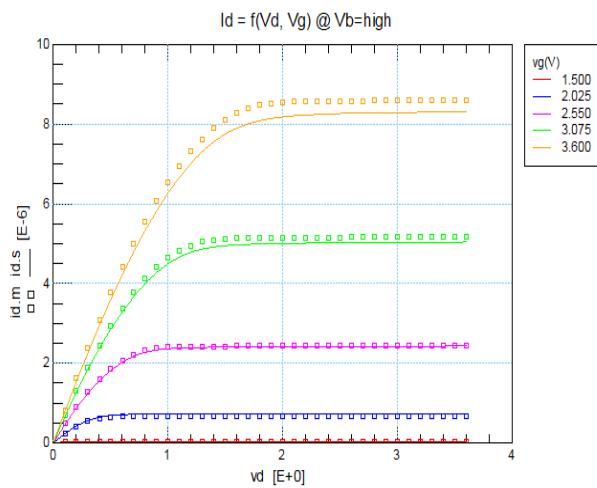
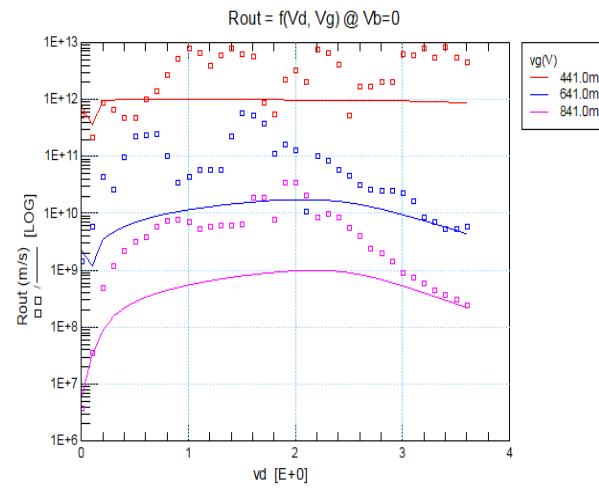
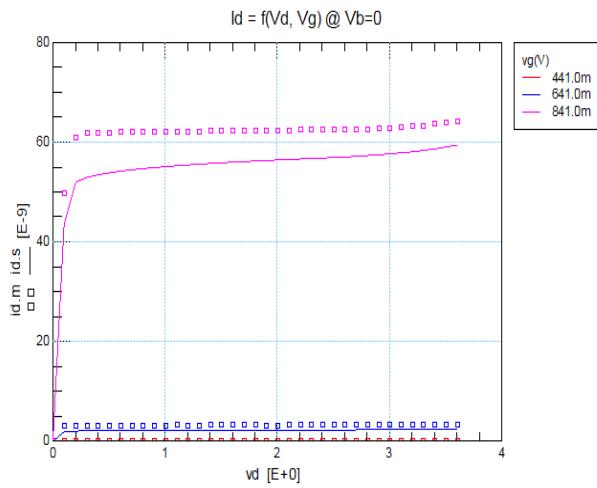


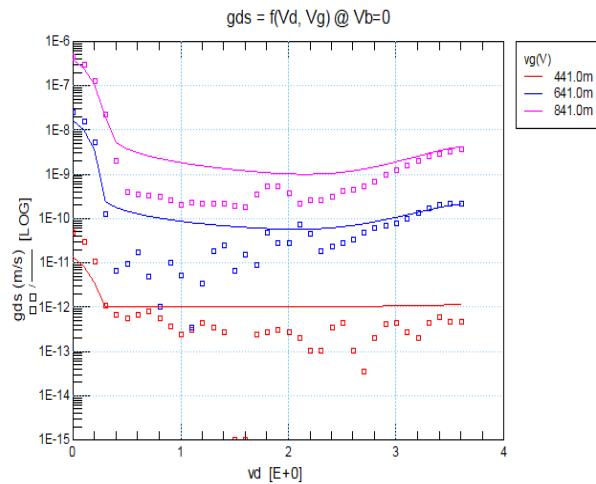


idvg, lb, lg, Vb = 0V, T = -40°C

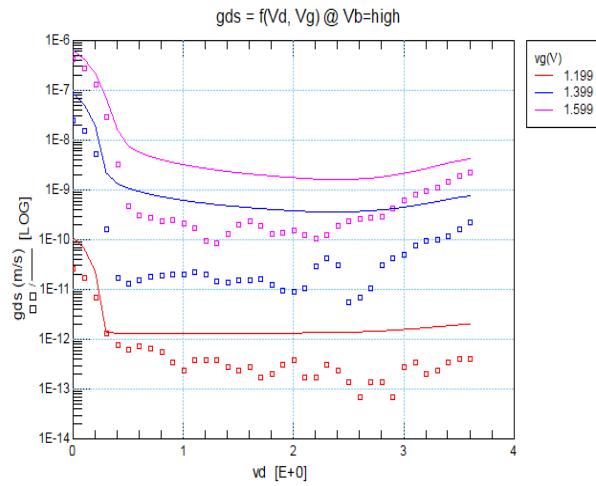
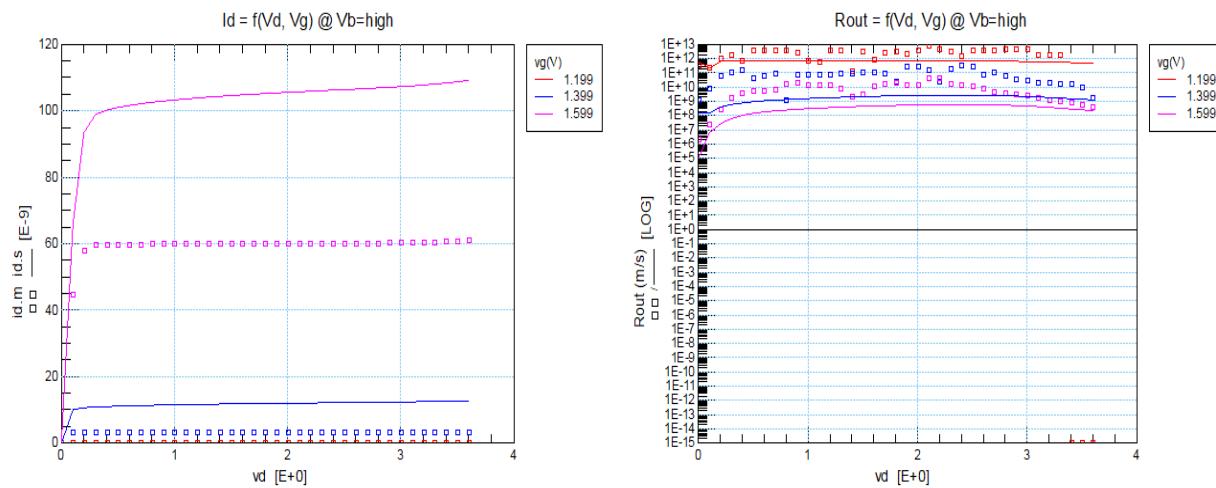


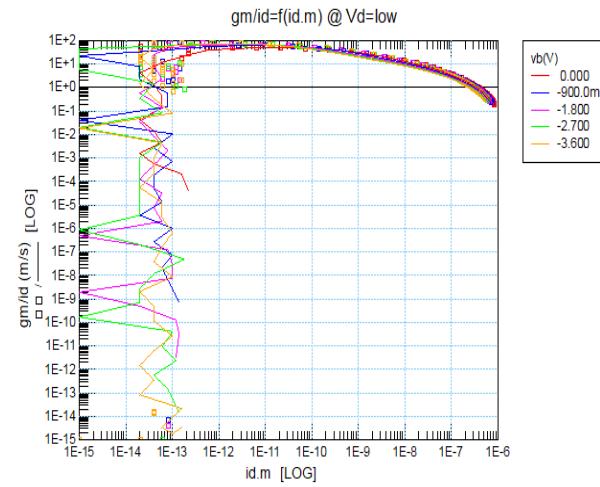
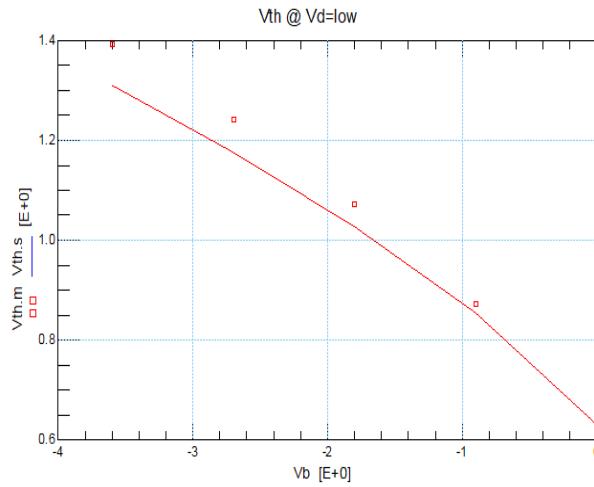
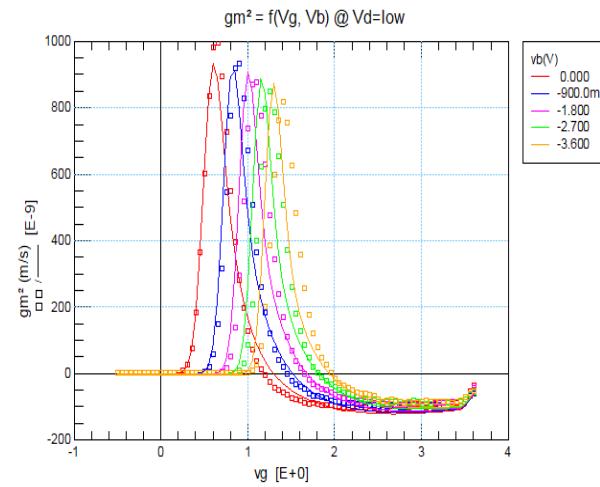
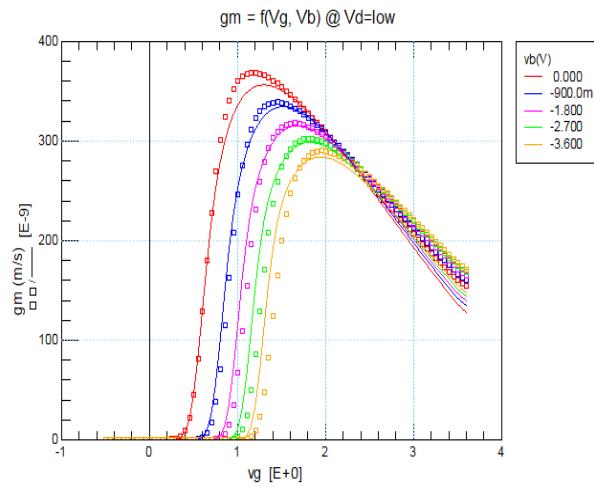
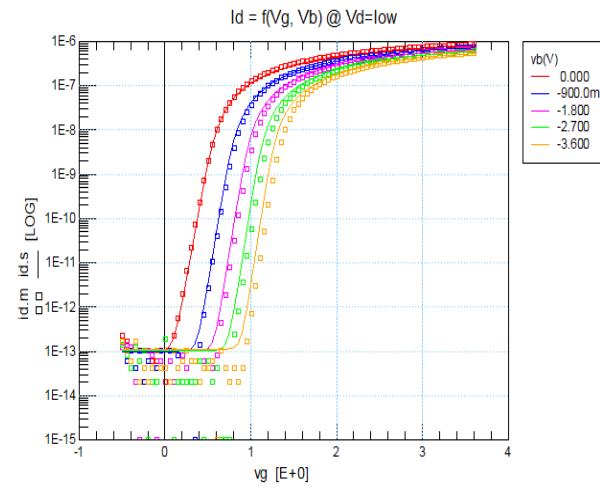
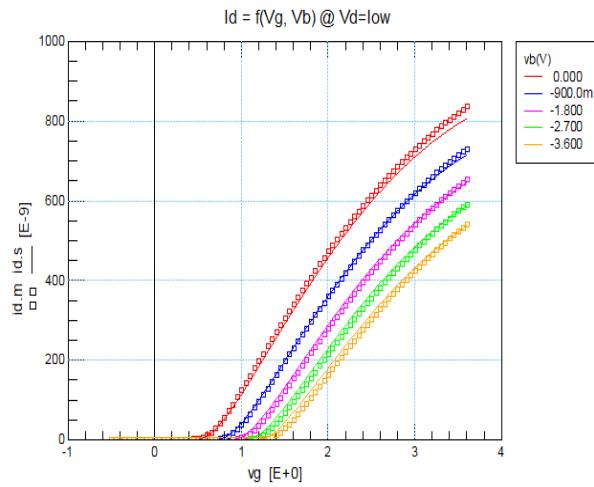
idvg, Ib,Ig, Vb = -3.6V, T = -40°C

idvd, Vb = 0V, T = -40°C


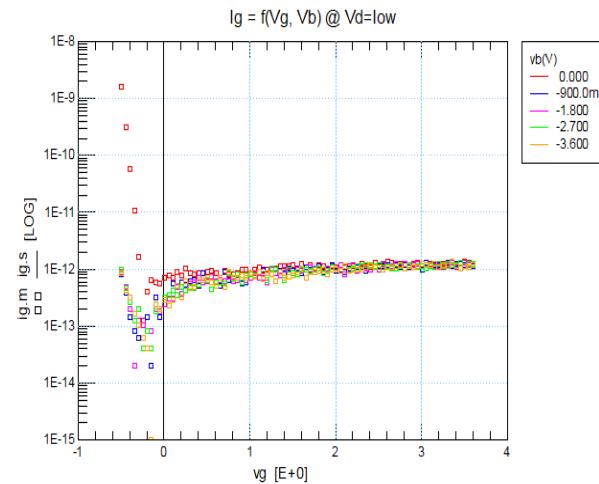
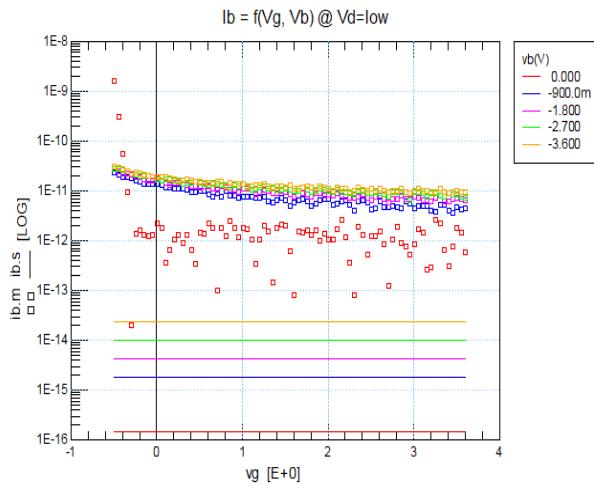
idvd_vbmin, Vb = -3.6V, T = -40°C**idvd_vth, Vb = 0V, T = -40°C**



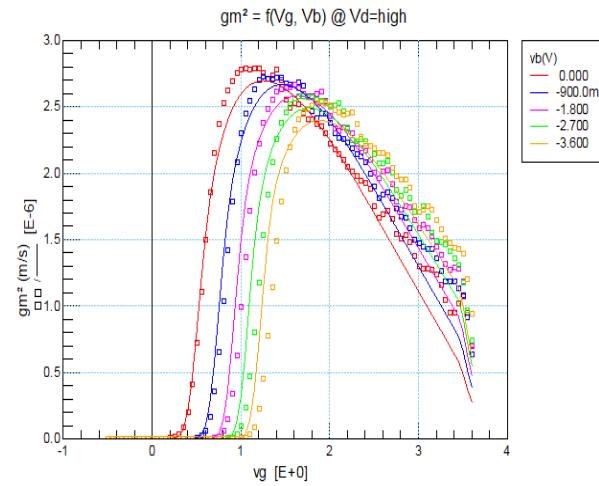
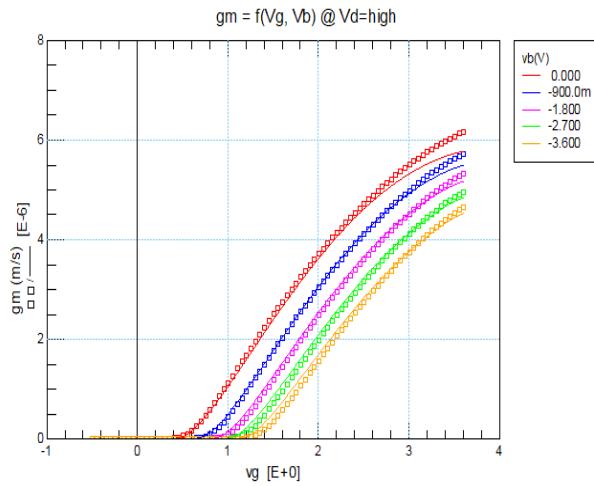
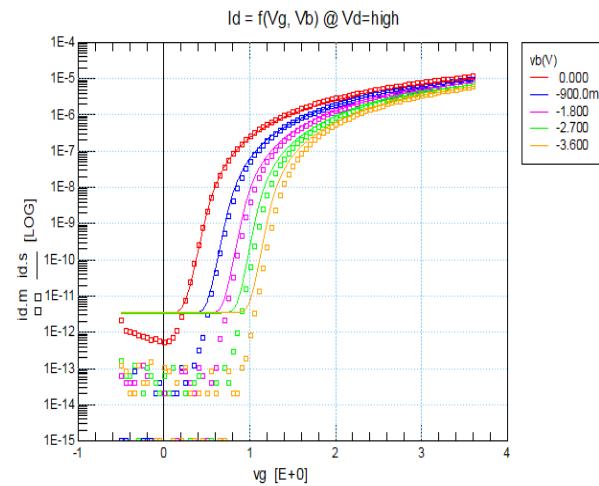
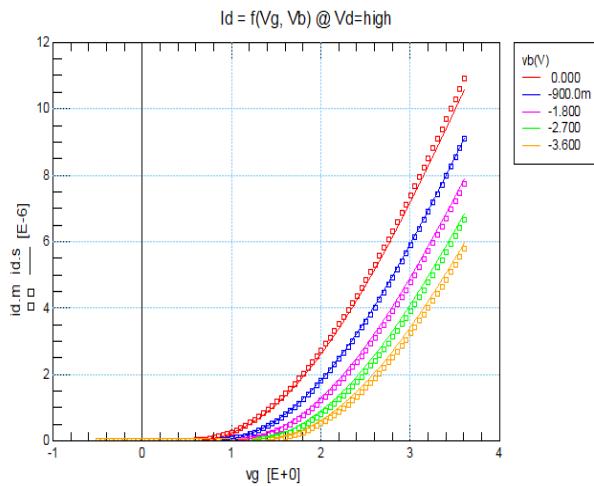
idvd_vth_vbmin, Vb = -3.6V, T = -40°C

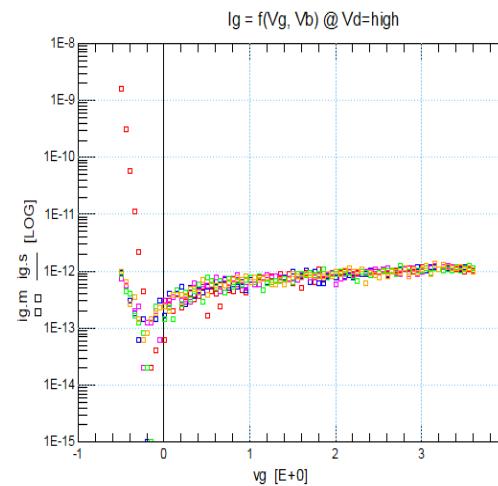
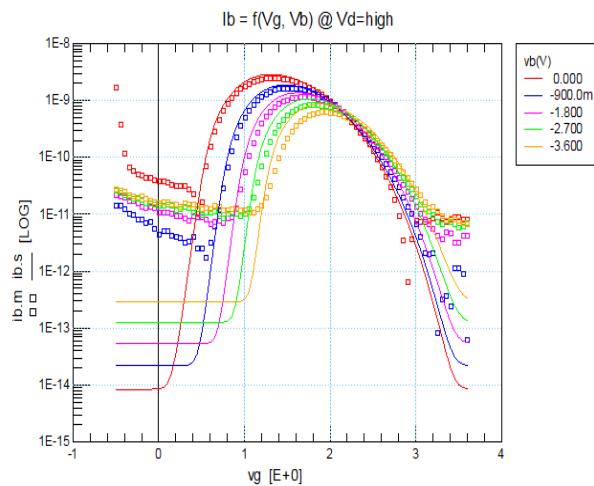
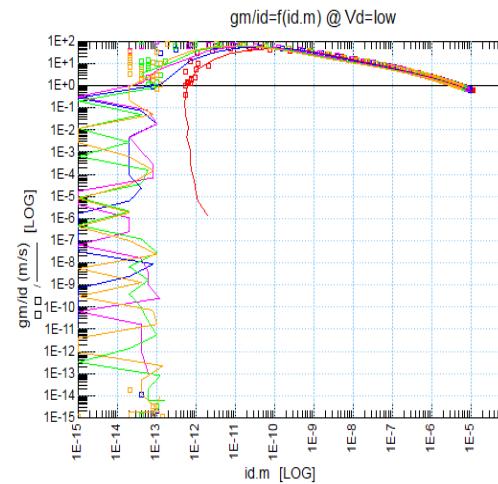
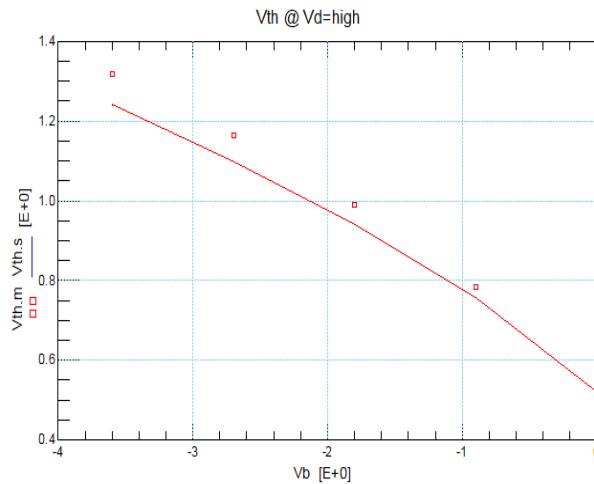


idvg, Vd = 0.1V, T = 70°C


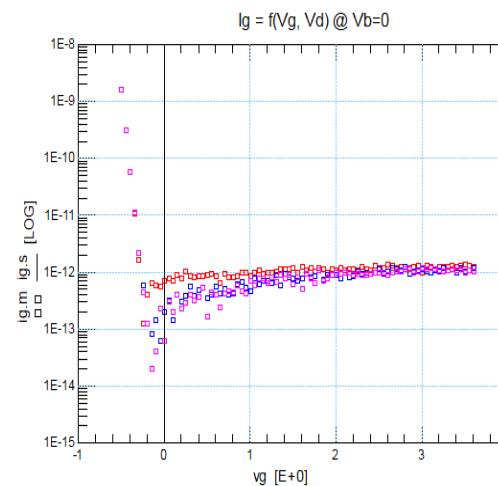
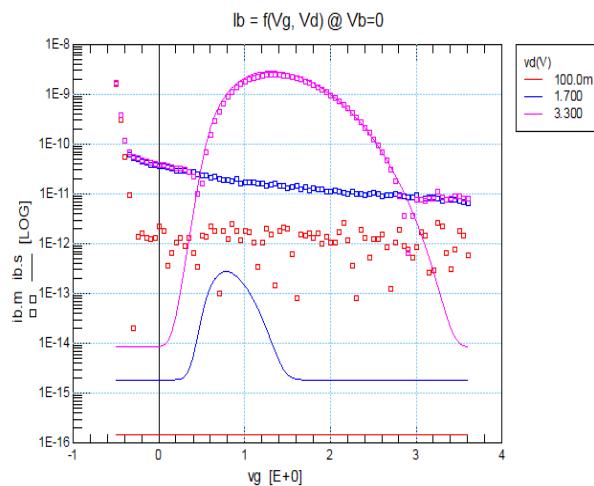


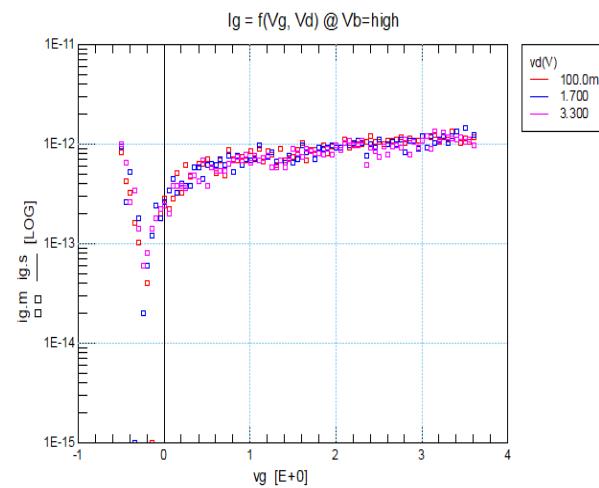
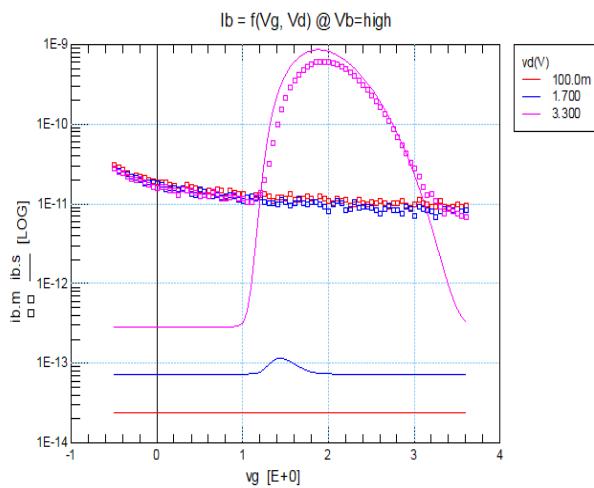
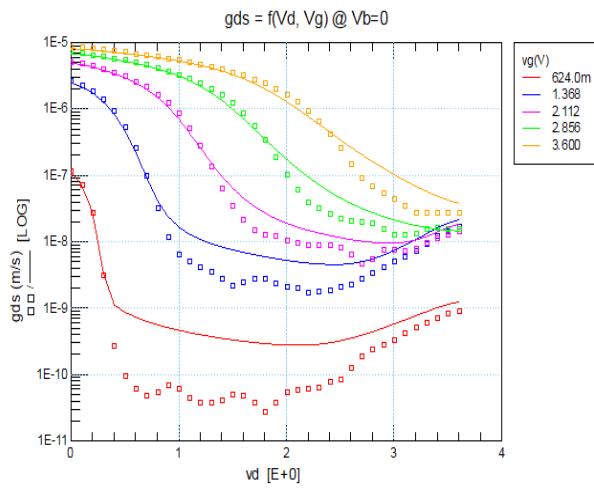
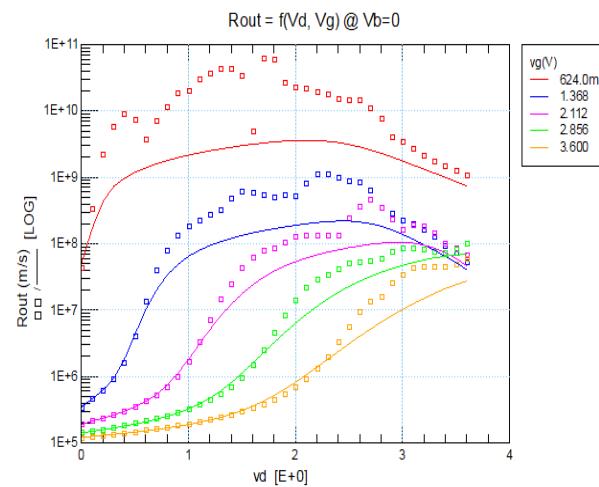
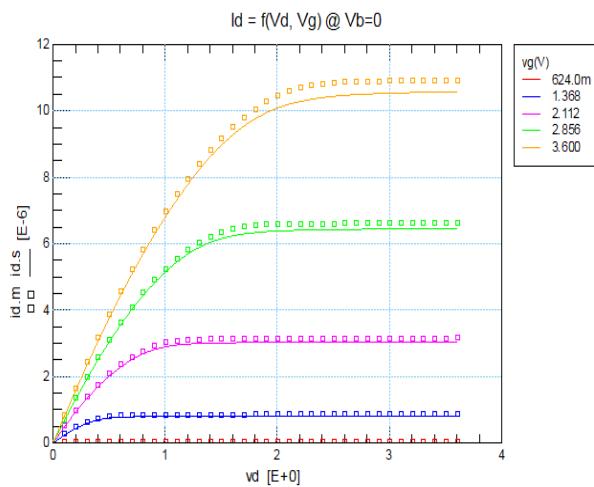
$i_{dvg}, V_d = 3.3V, T = 70^\circ C$

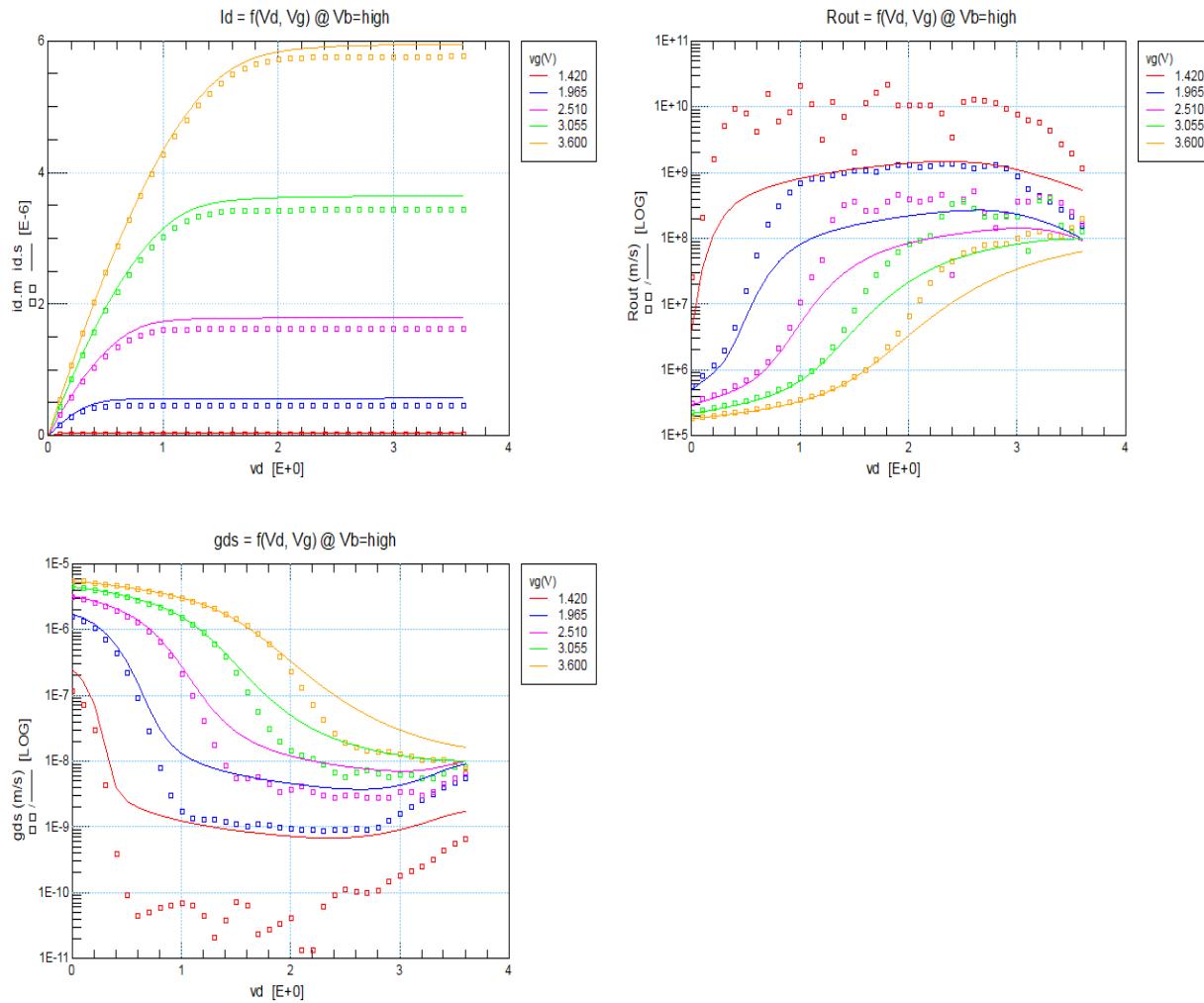
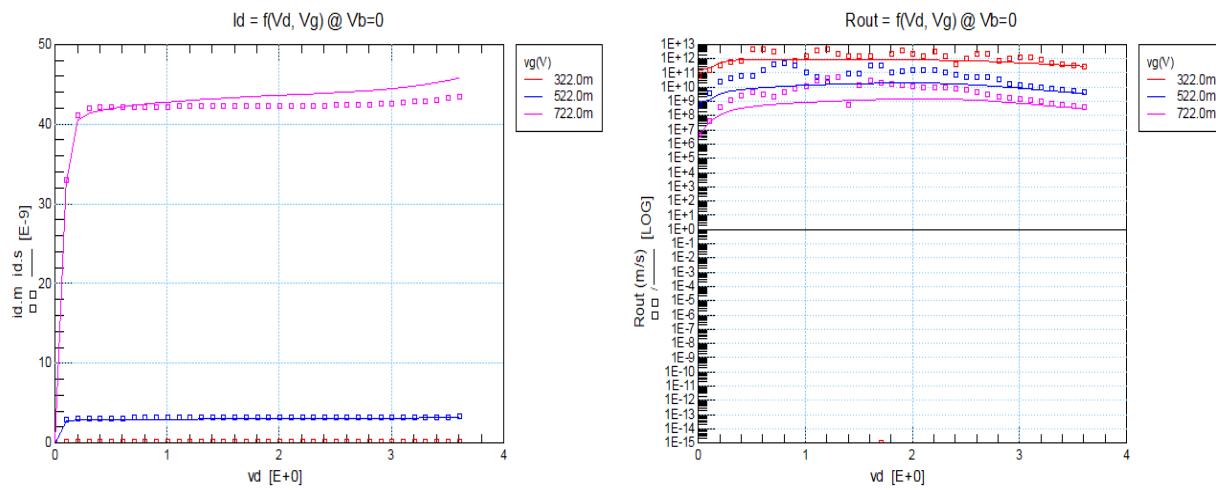


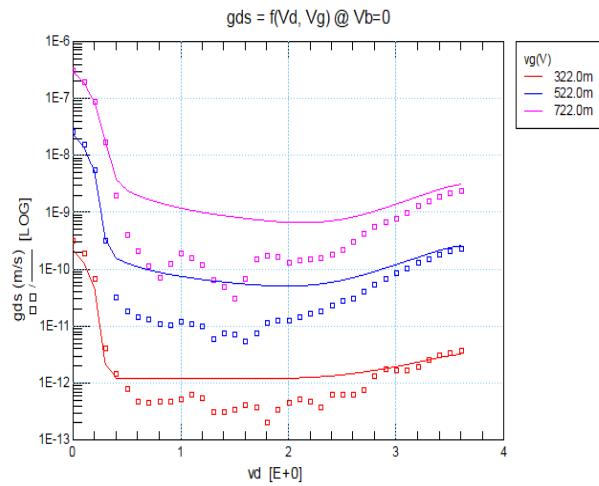


idvg, lb, lg, Vb = 0V, T = 70°C

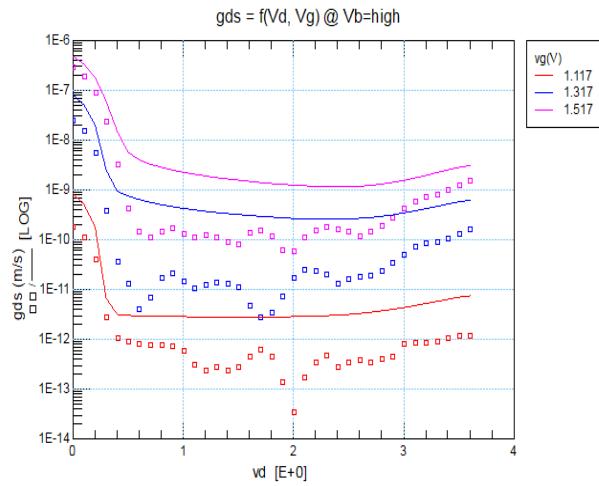
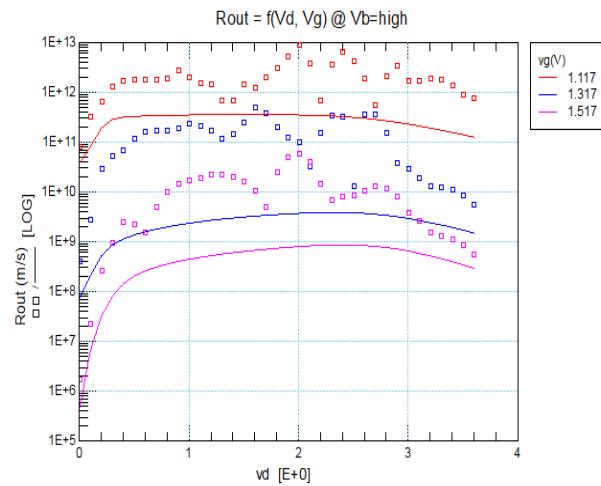
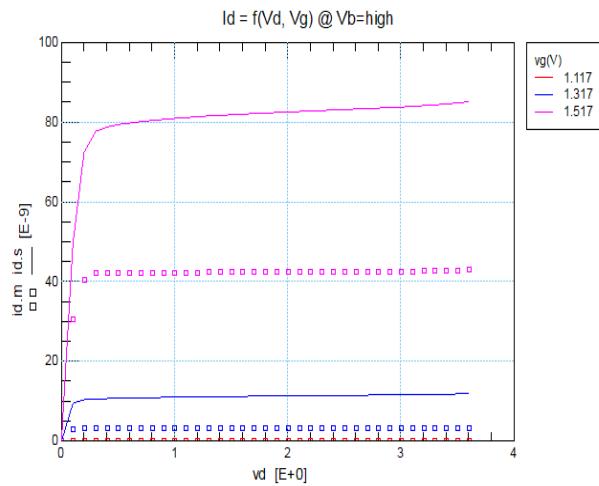


idvg, Ib,Ig, Vb = -3.6V, T = 70°C

idvd, Vb = 0V, T = 70°C


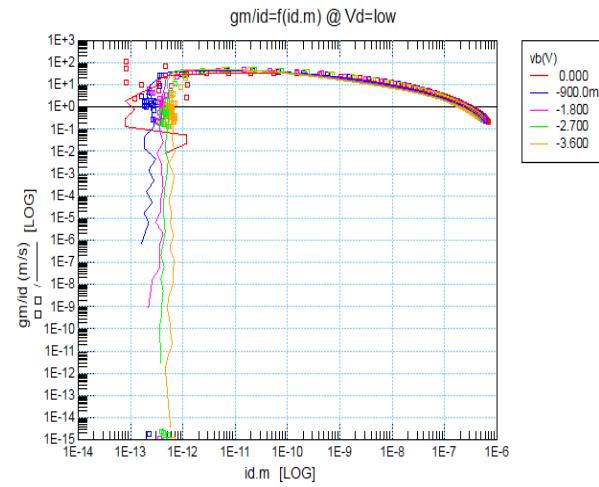
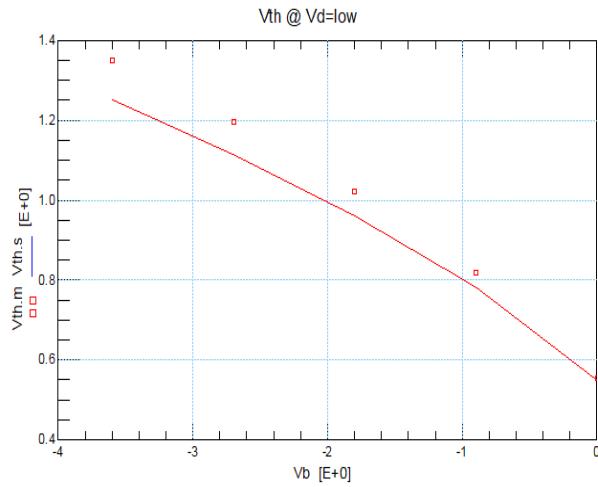
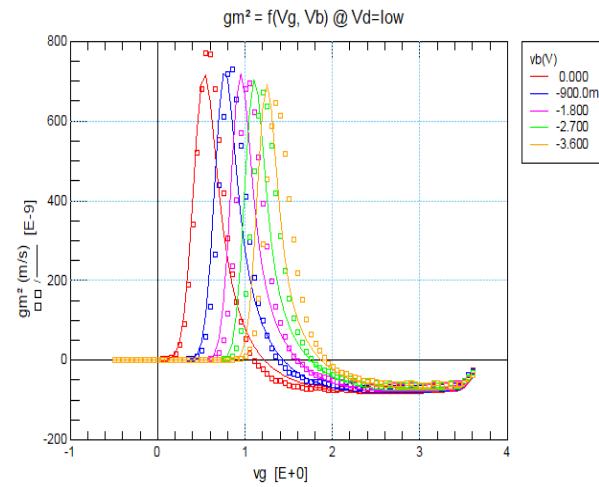
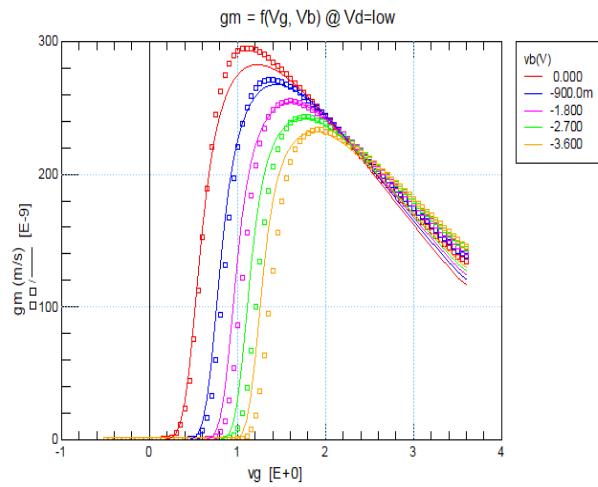
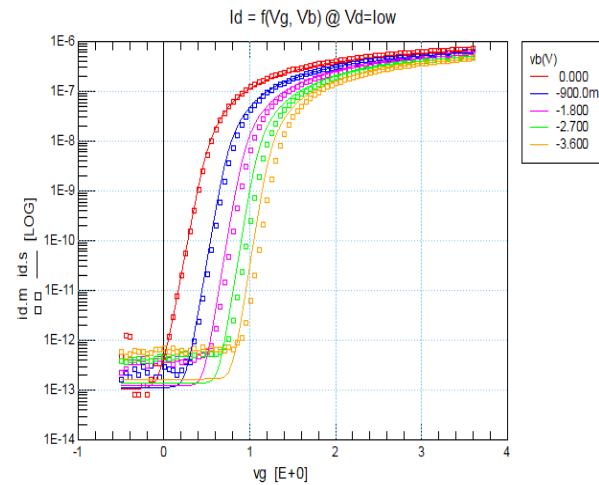
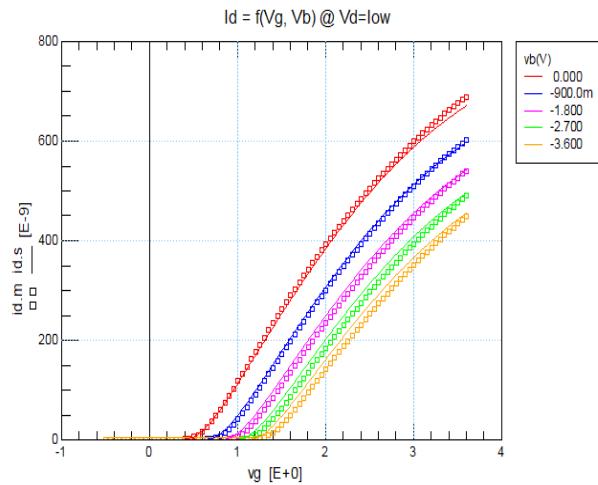
idvd_vbmin, Vb = -3.6V, T = 70°C

idvd_vth, Vb = 0V, T = 70°C


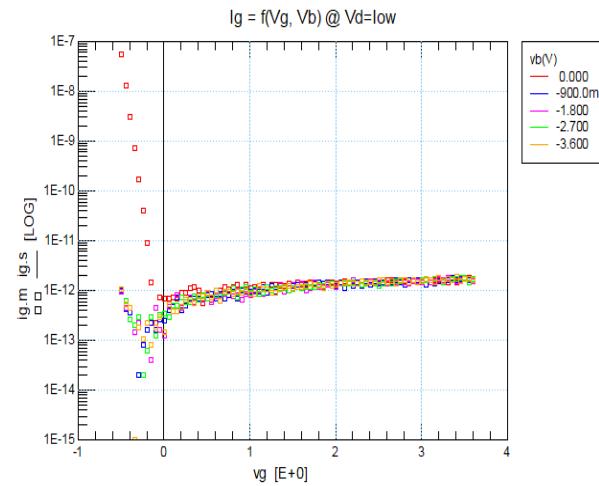
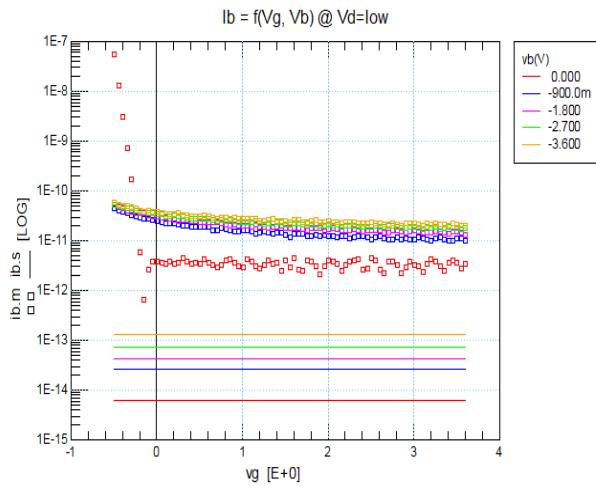


idvd_vth_vbmin, Vb = -3.6V, T = 70°C

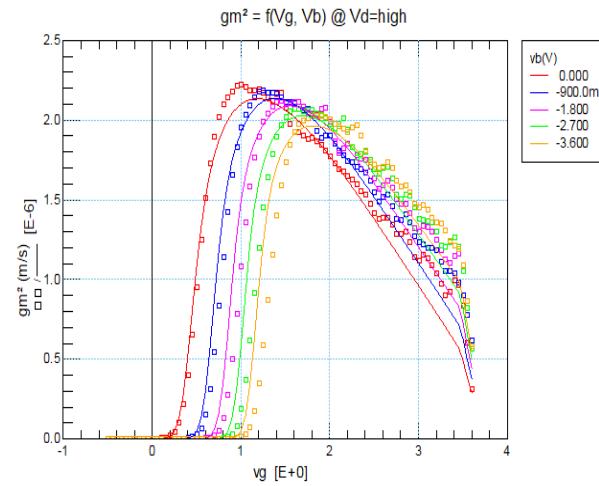
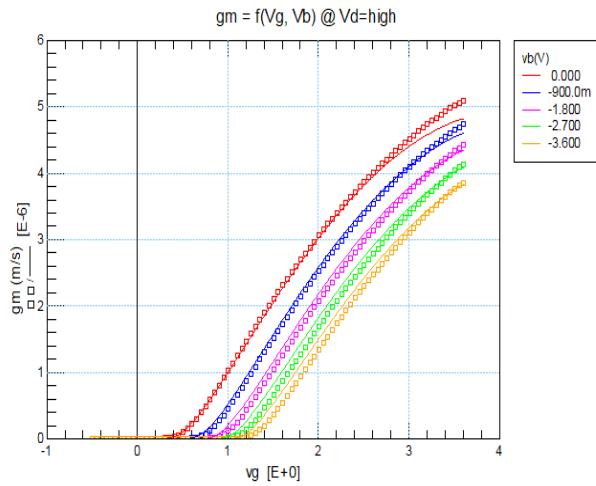
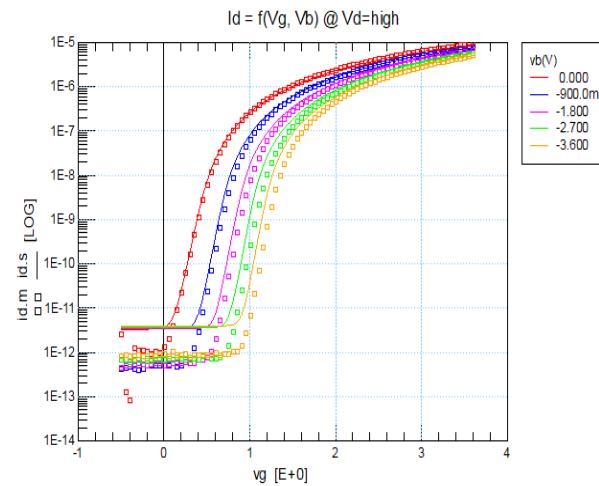
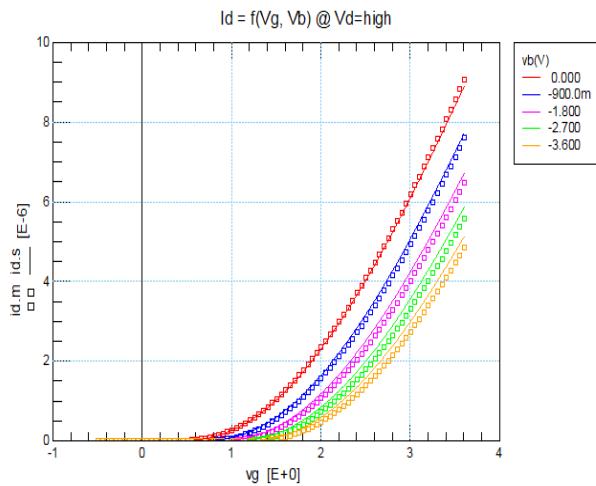


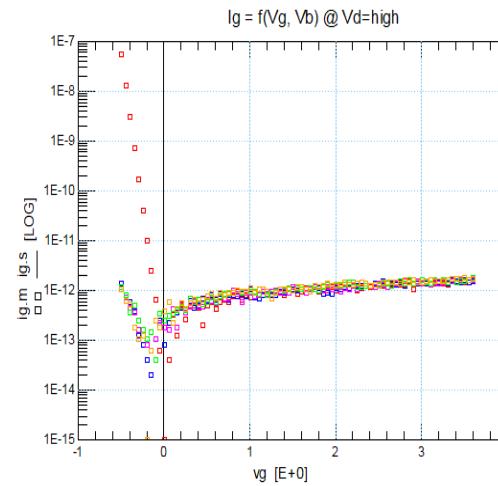
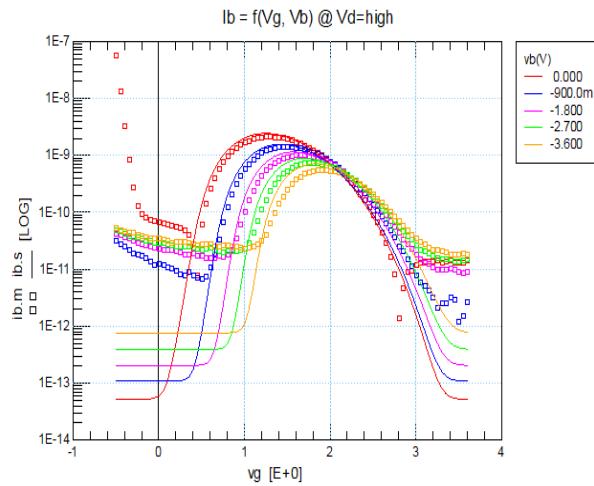
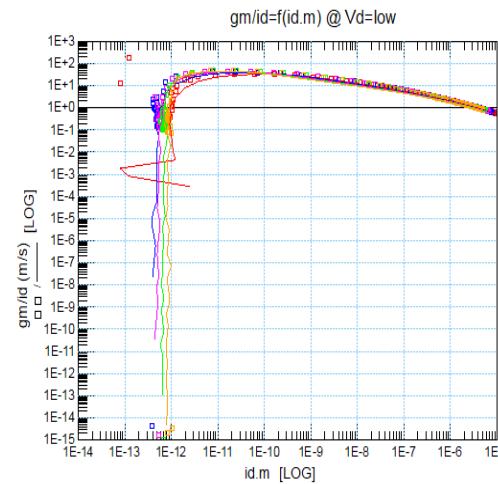
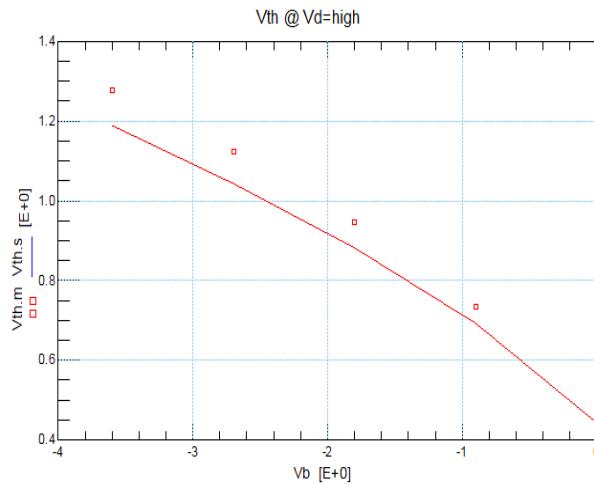
idvg, Vd = 0.1V, T = 125°C



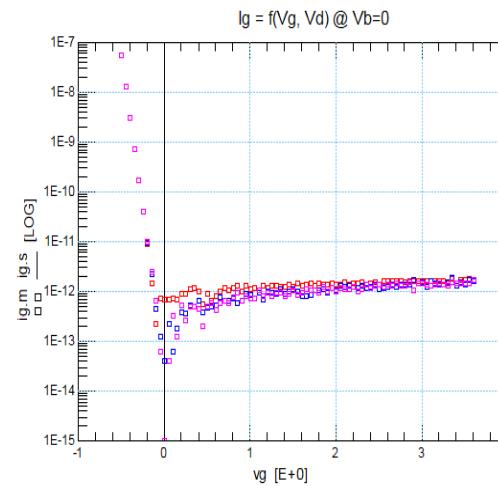
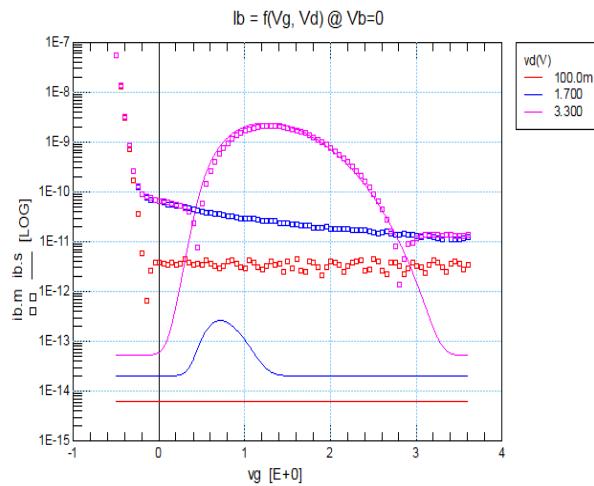


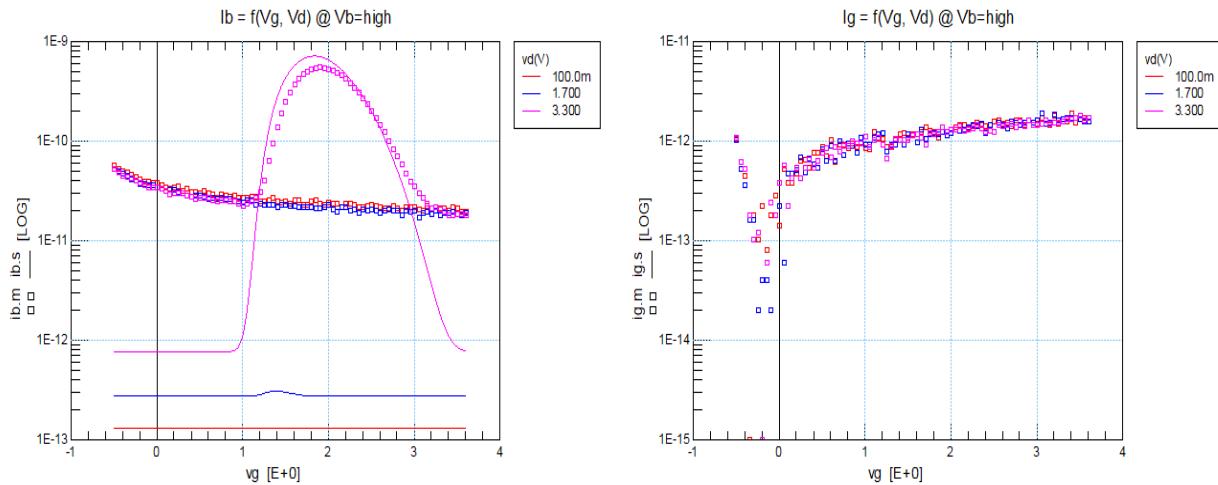
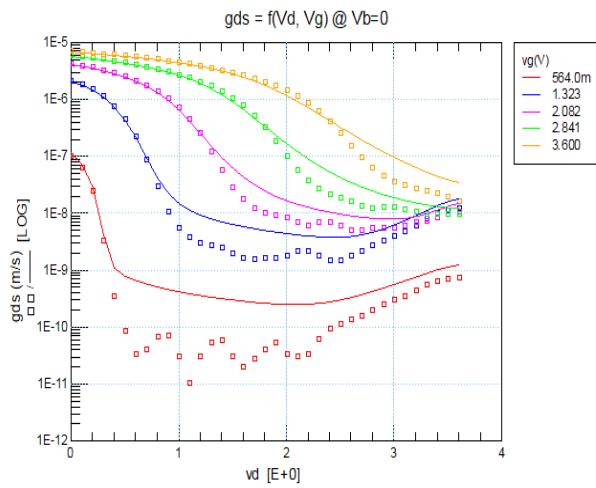
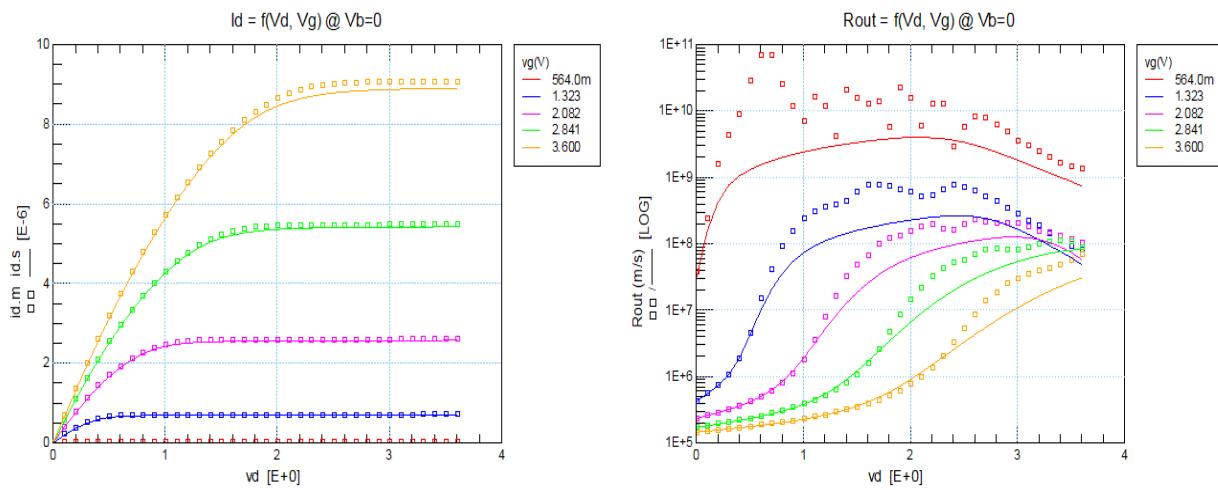
$i_{dvg}, V_d = 3.3V, T = 125^\circ C$

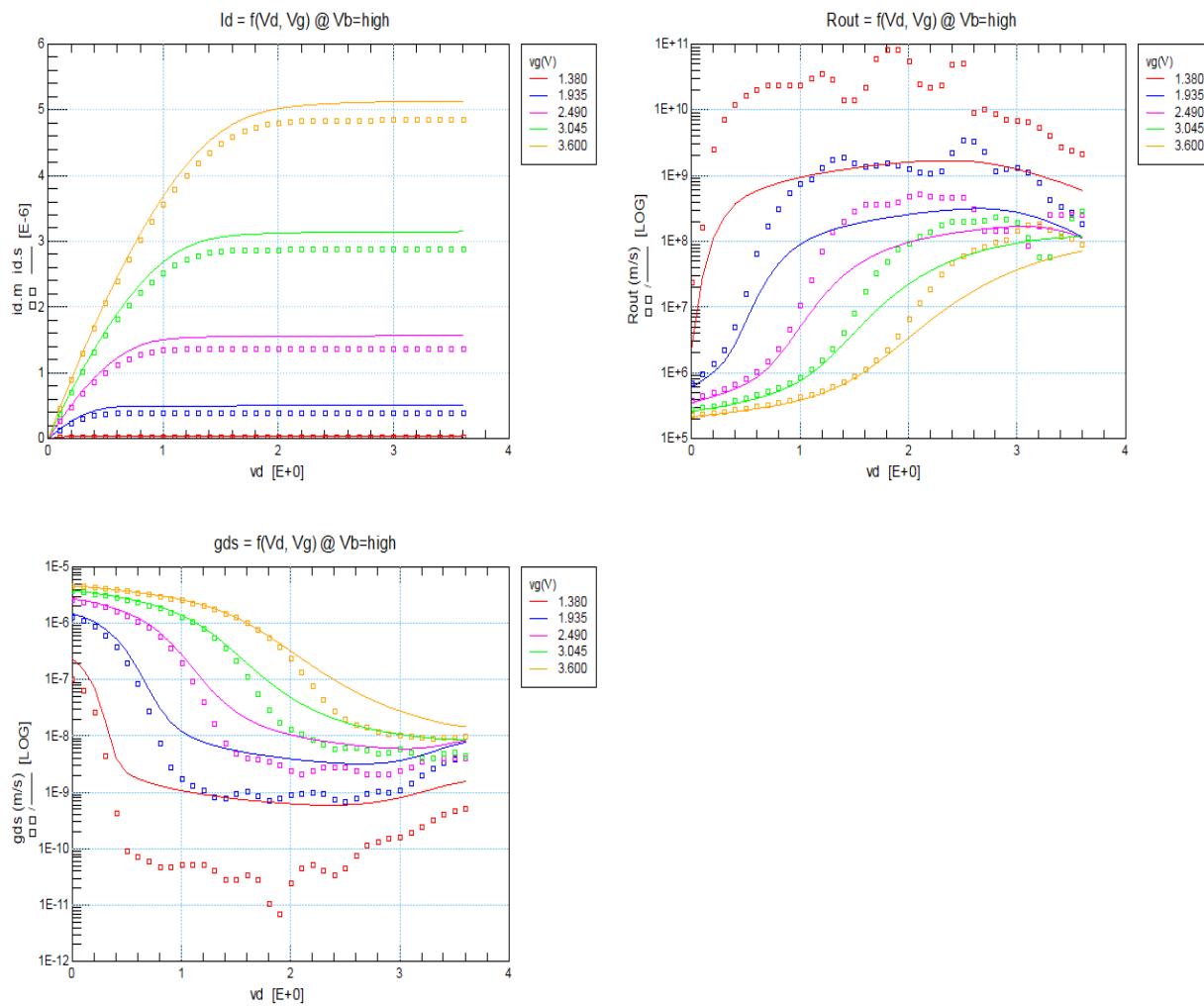
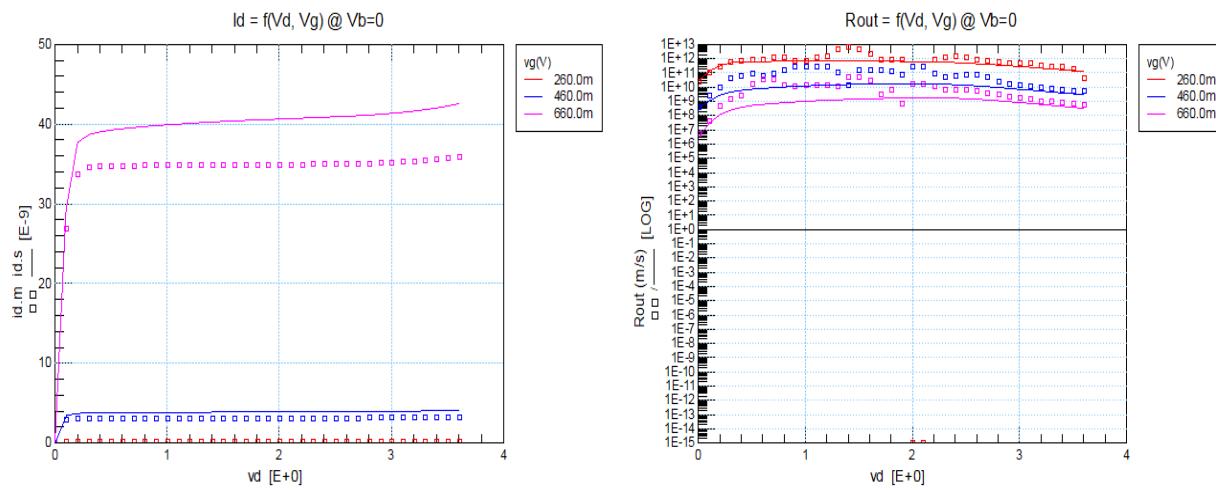


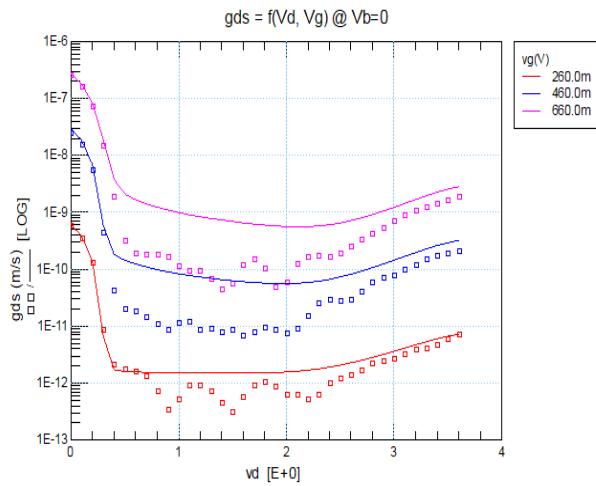


idvg, lb, lg, Vb = 0V, T = 125°C

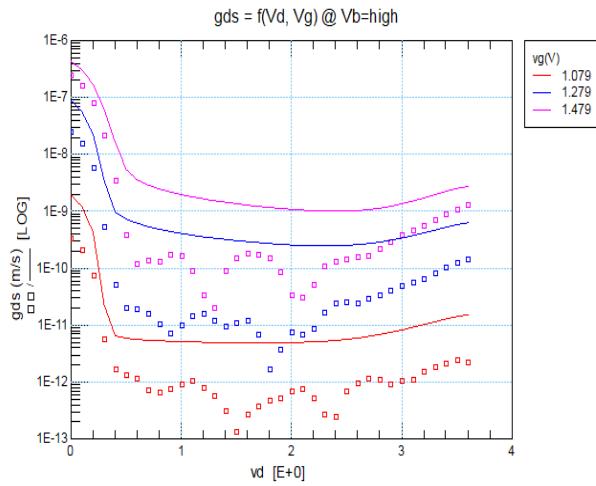
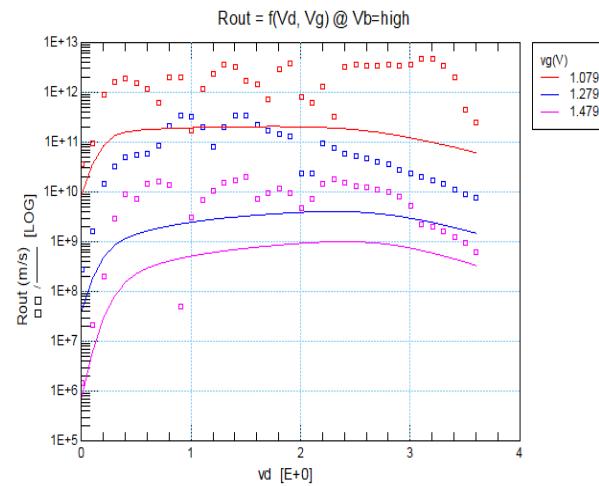
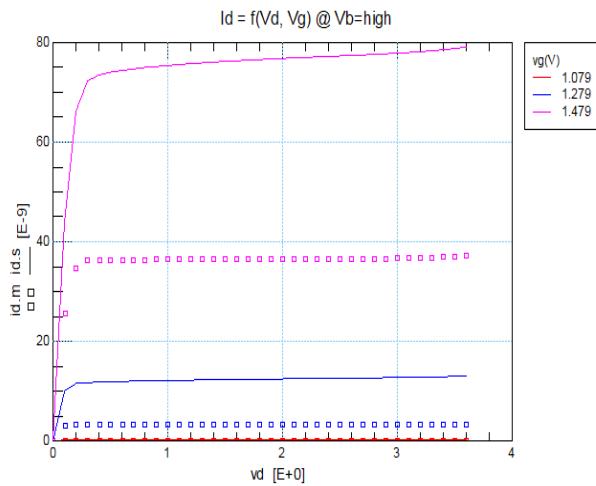


idvg, Ib,Ig, Vb = -3.6V, T = 125°C

idvd, Vb = 0V, T = 125°C


idvd_vbmin, Vb = -3.6V, T = 125°C

idvd_vth, Vb = 0V, T = 125°C


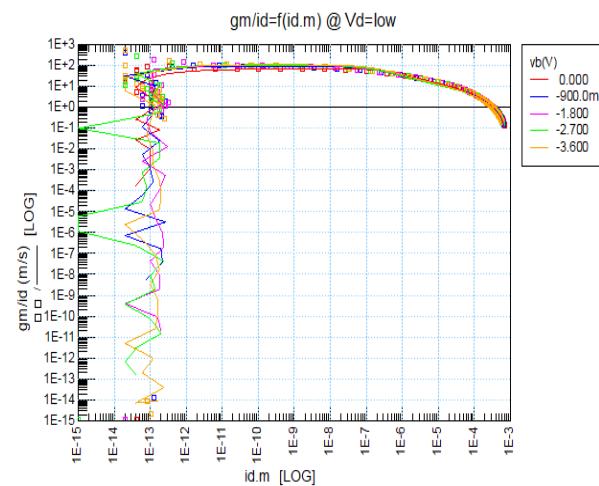
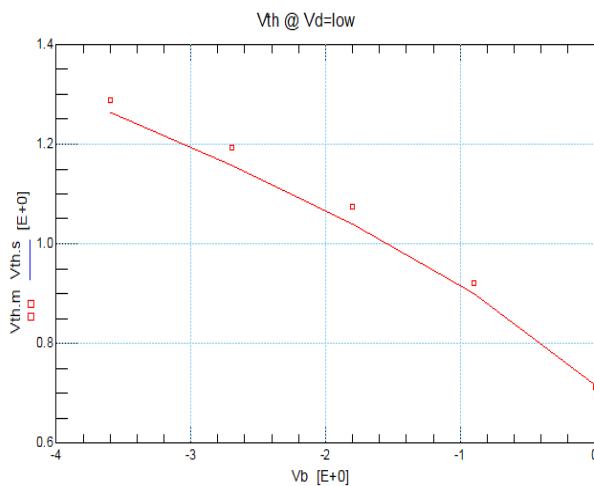
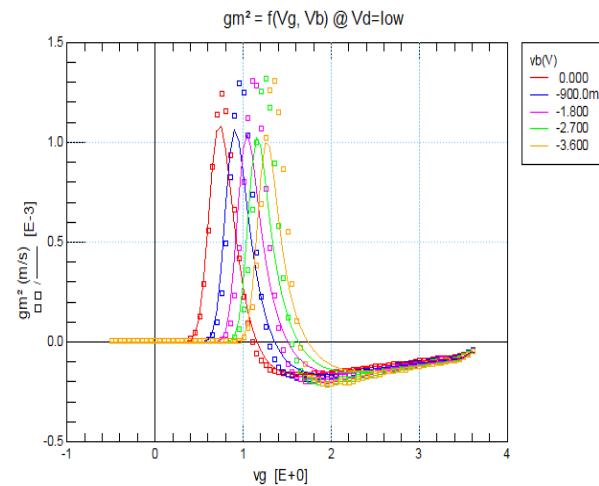
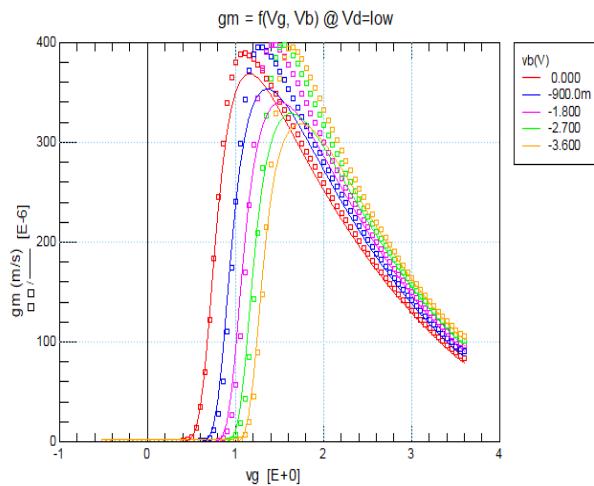
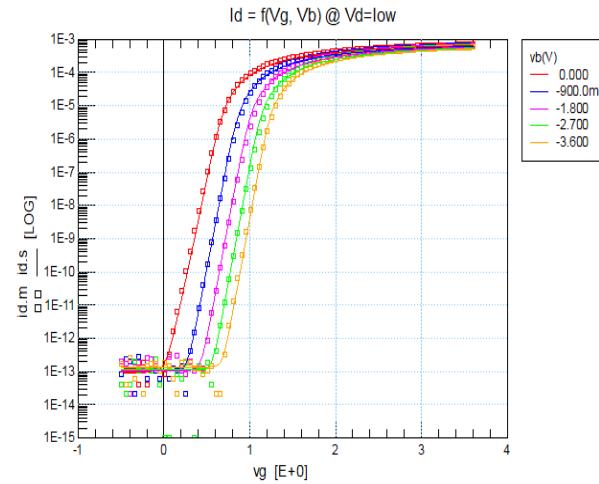
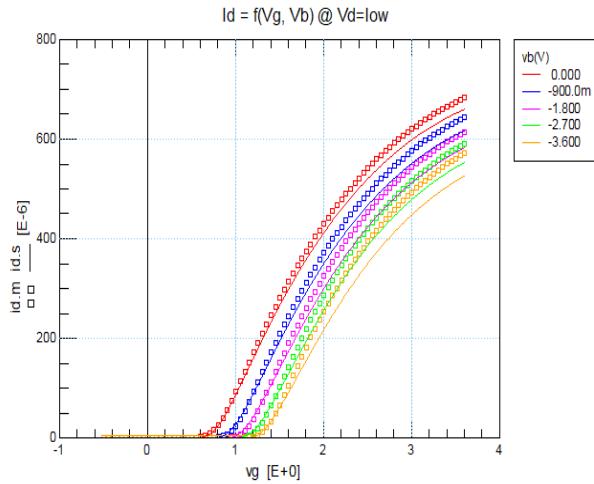


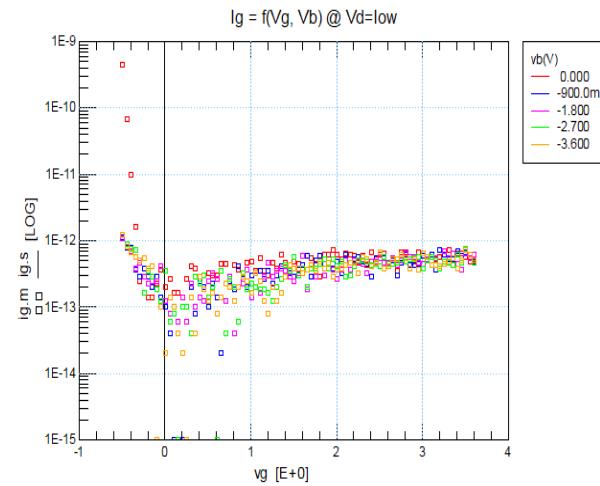
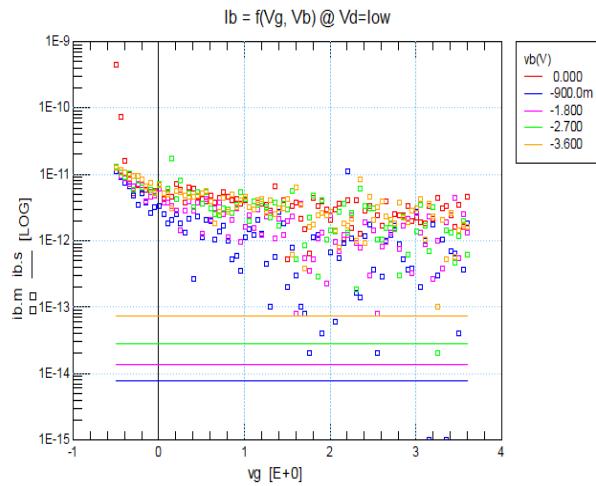
idvd_vth_vbmin, Vb = -3.6V, T = 125°C



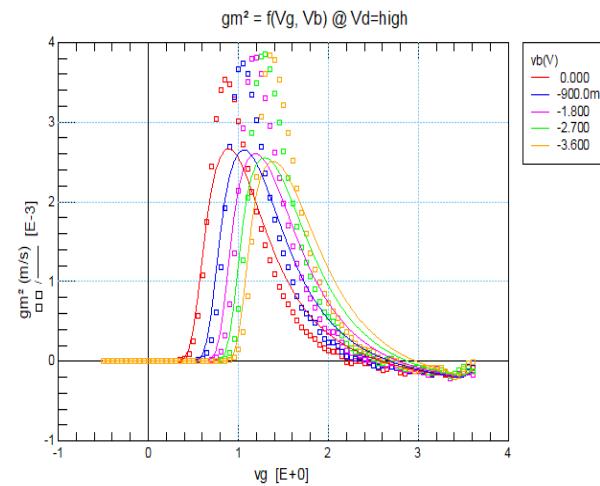
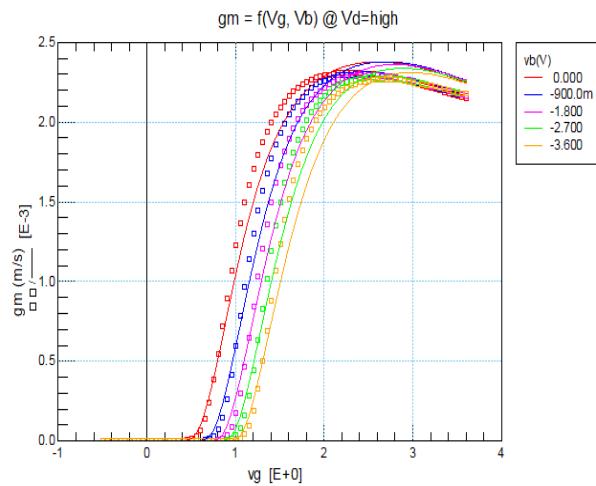
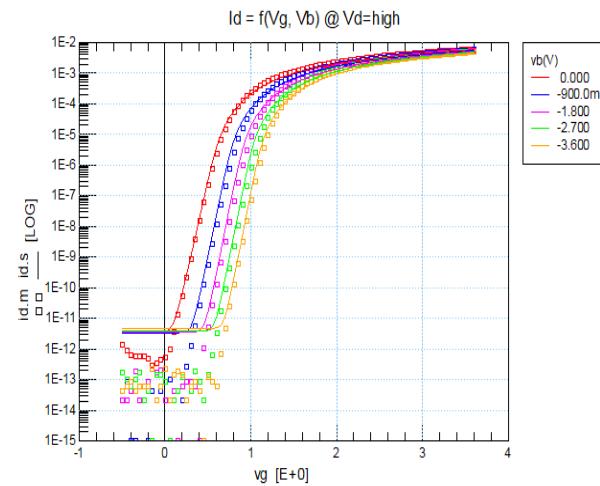
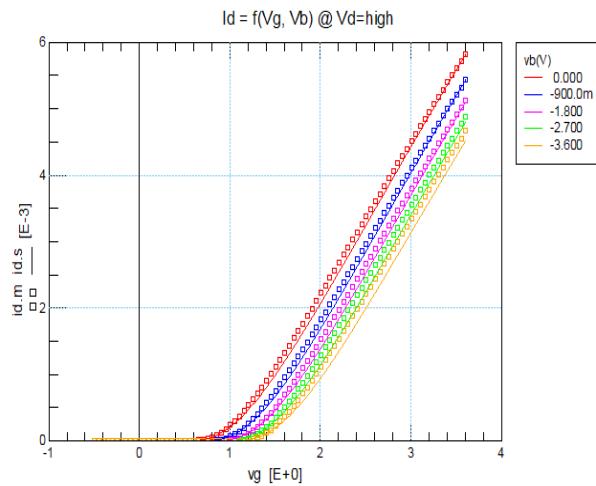
4.4 W10u0_L0u5_S387_5

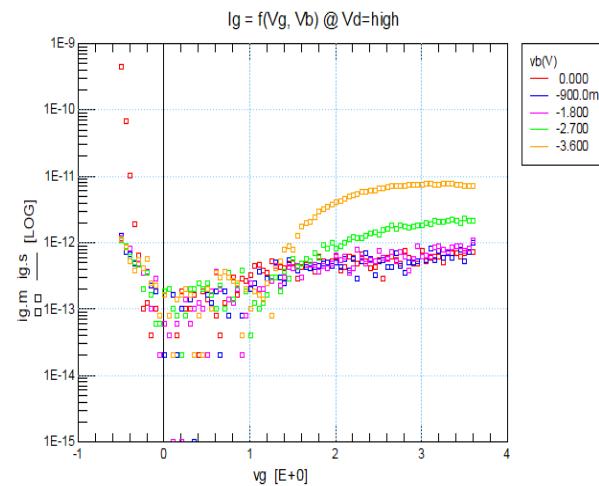
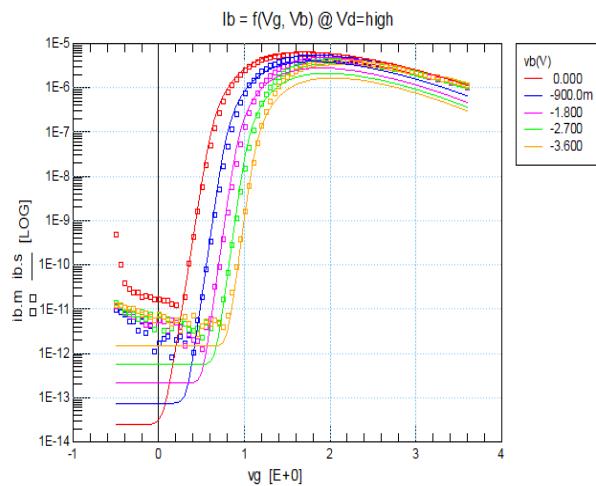
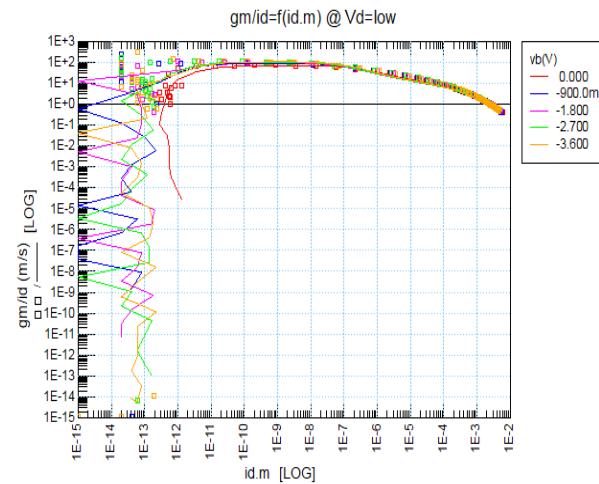
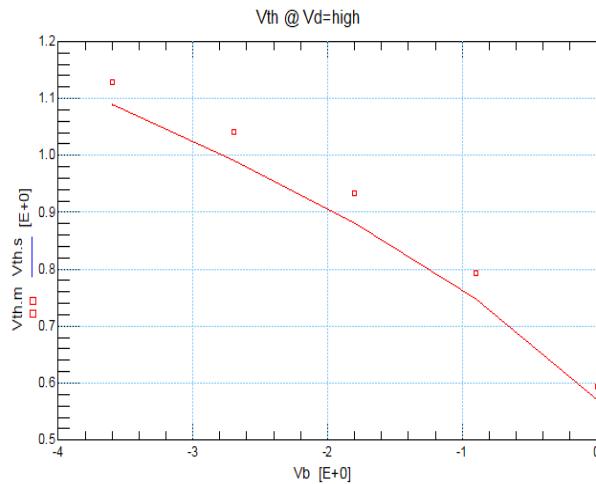
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



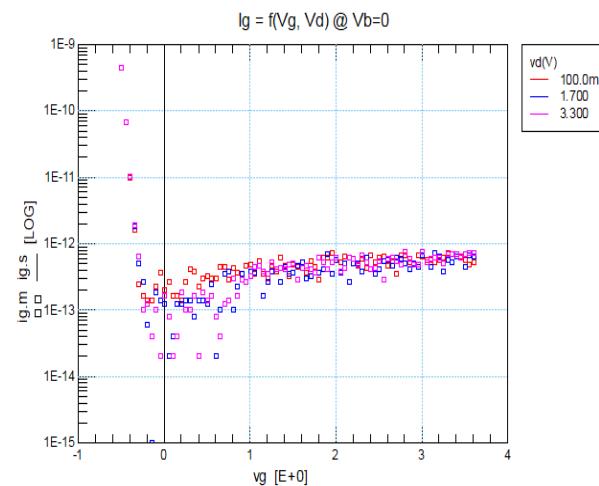
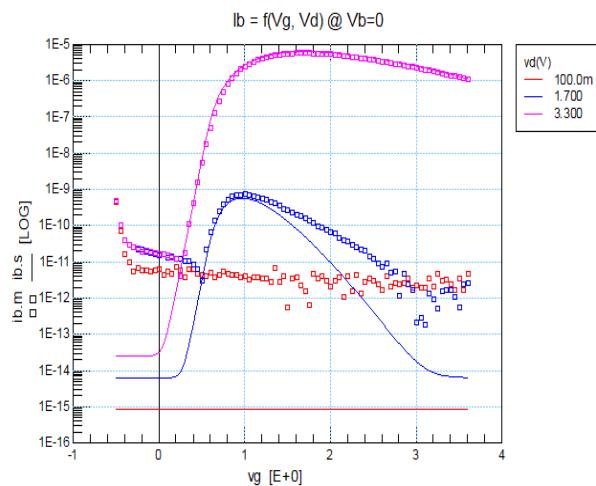


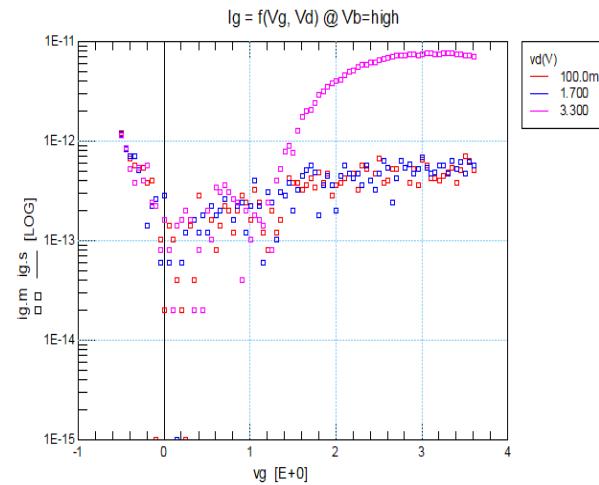
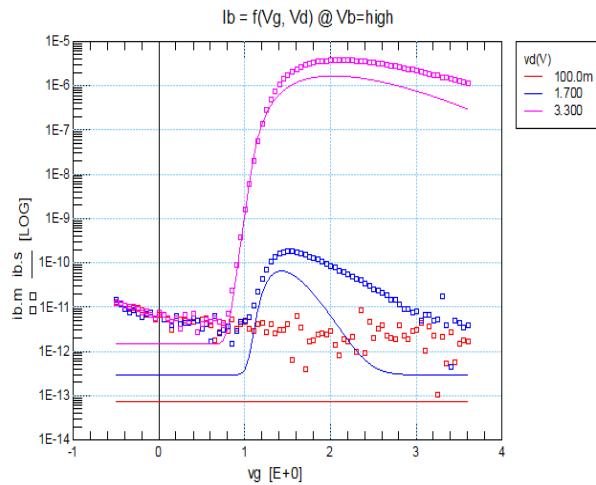
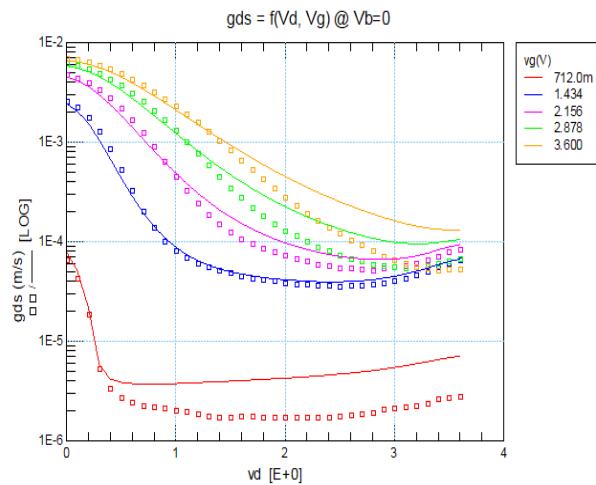
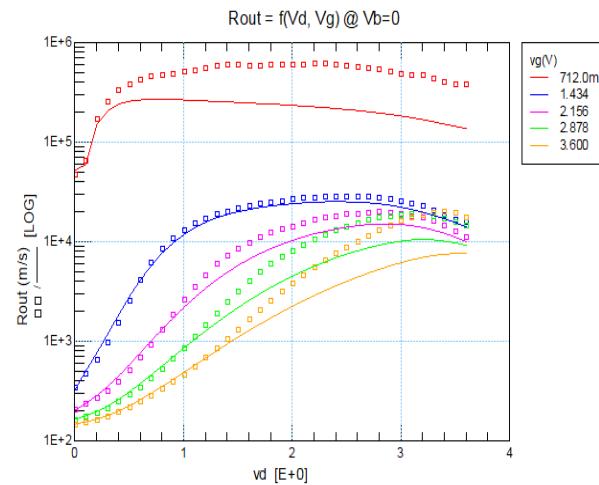
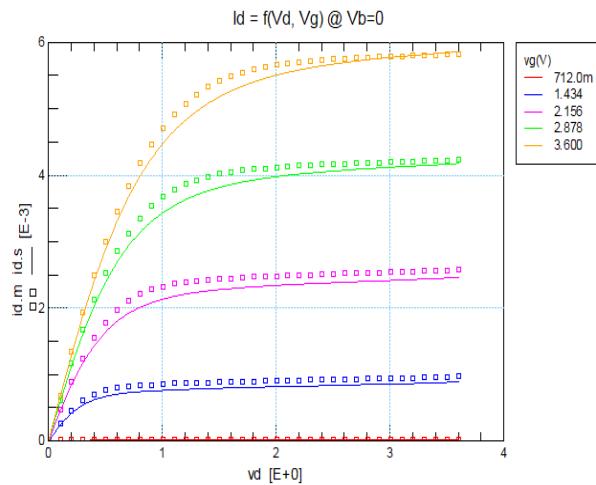
$i_{dvg}, V_d = 3.3V, T = 27^\circ C$

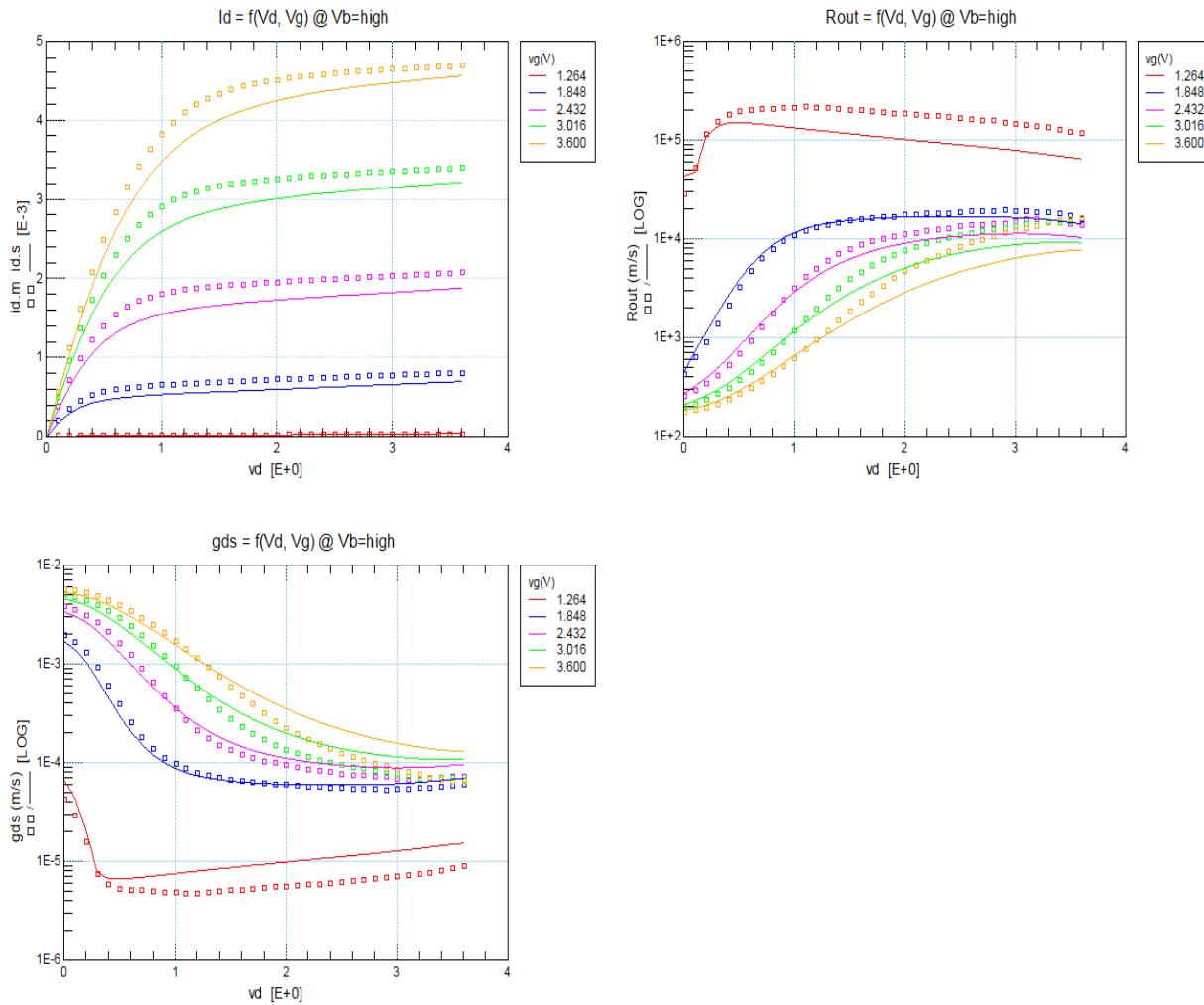
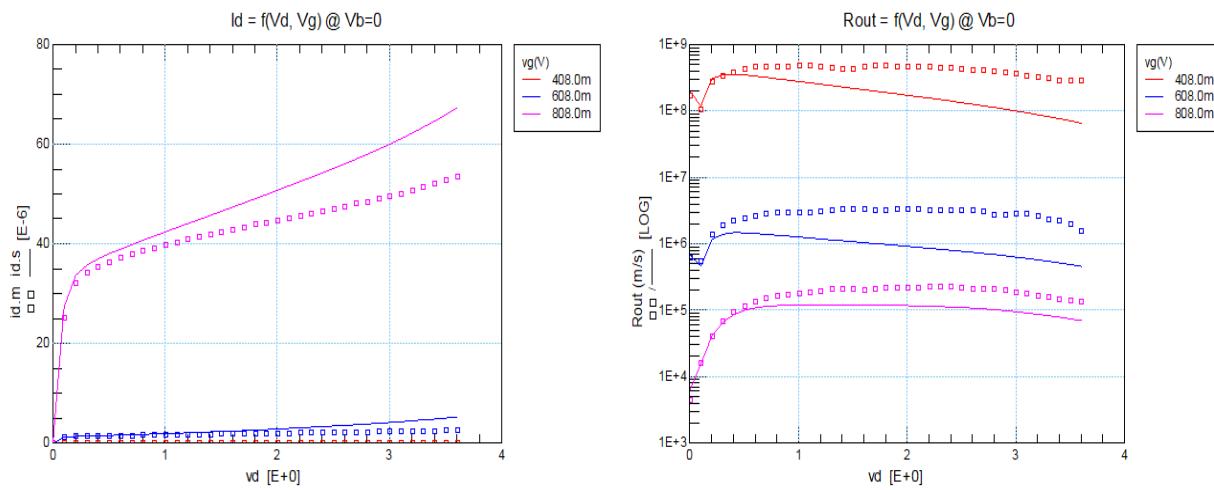


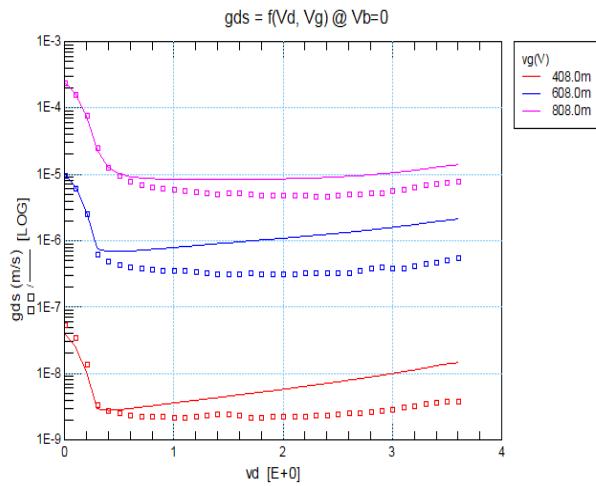


$idvg, I_b, I_g, V_b = 0V, T = 27^\circ C$

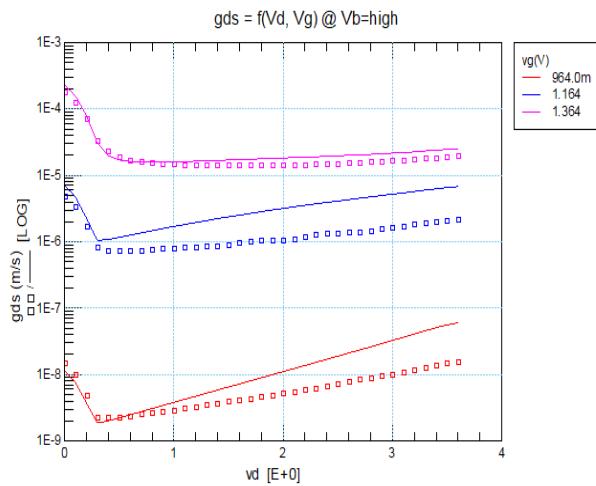
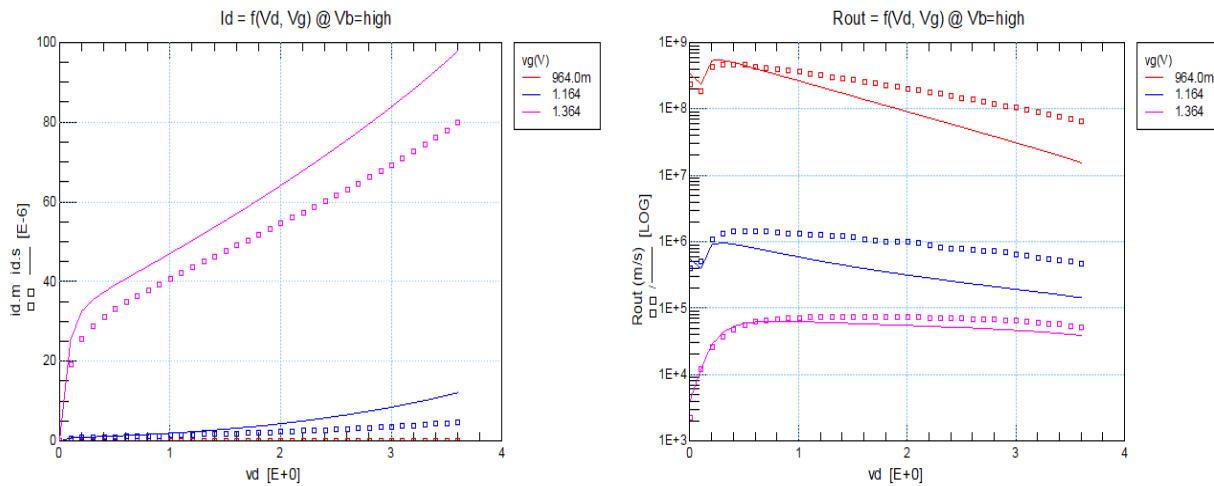


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


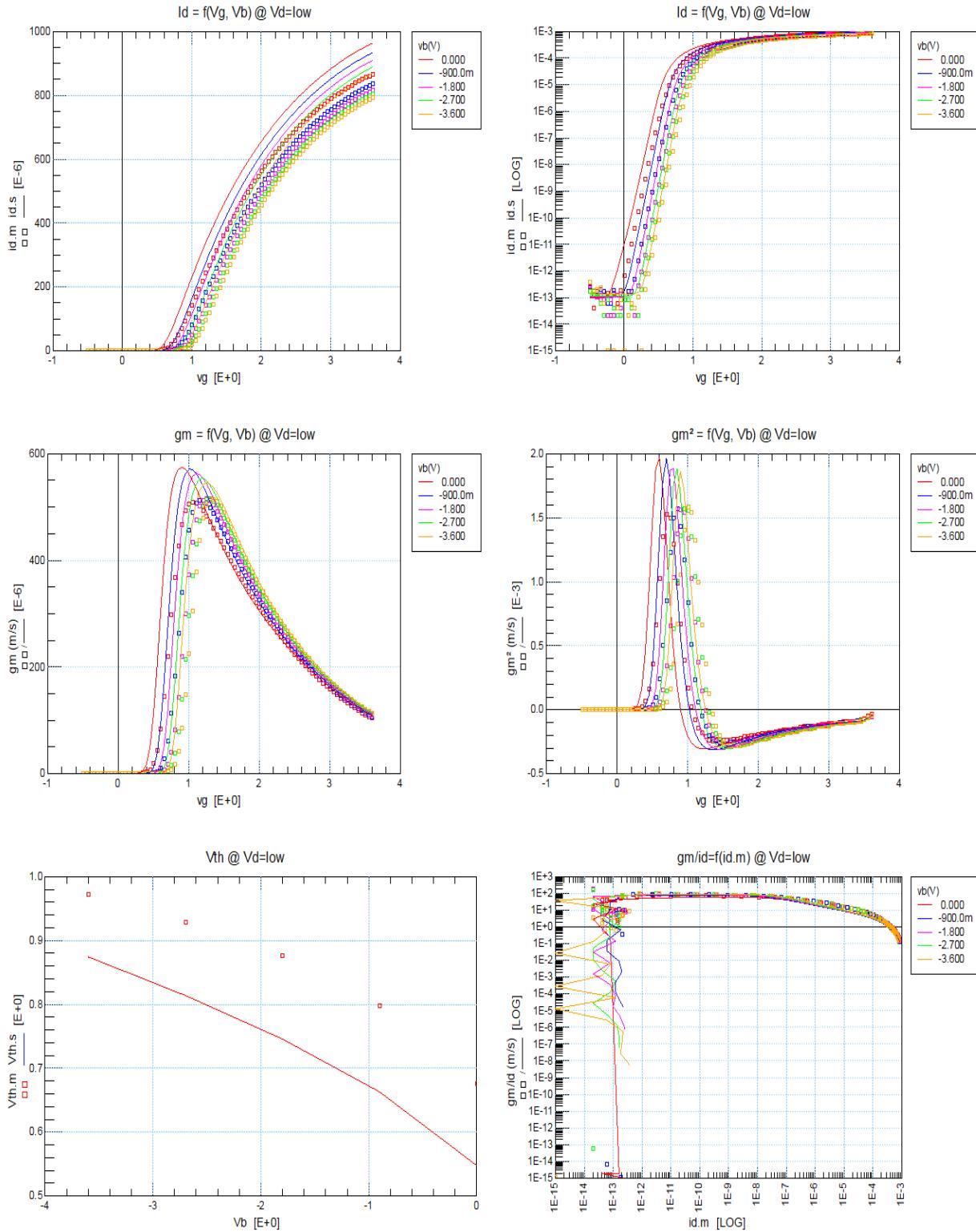


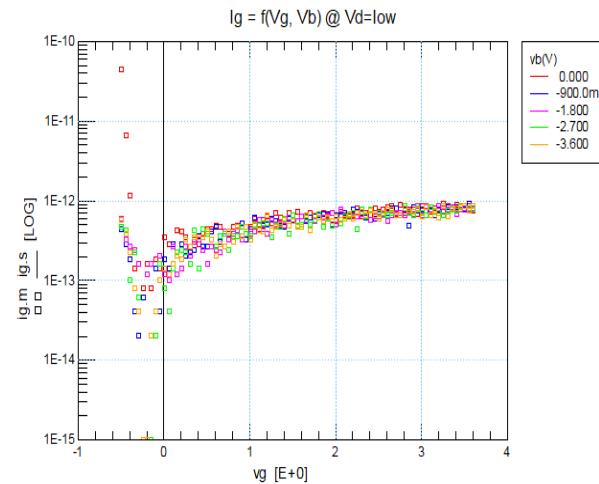
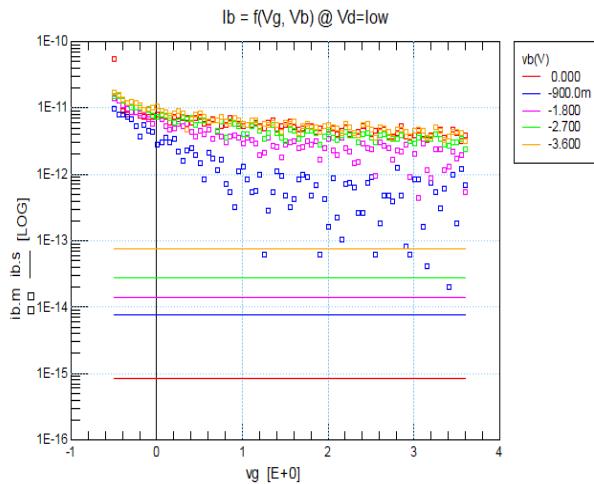
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



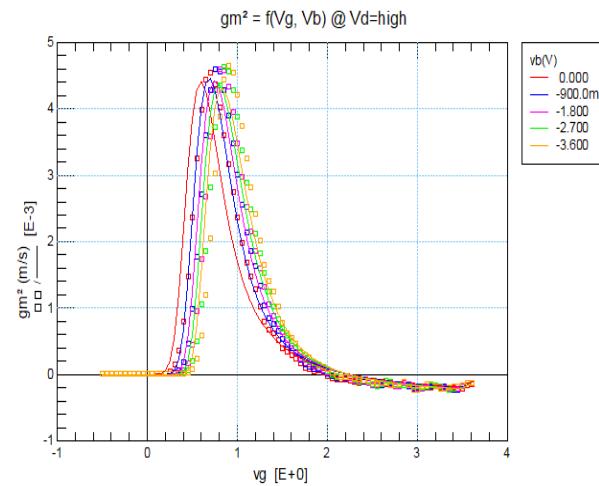
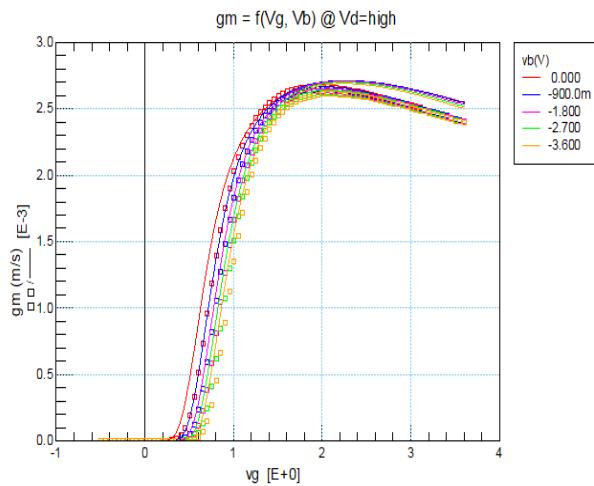
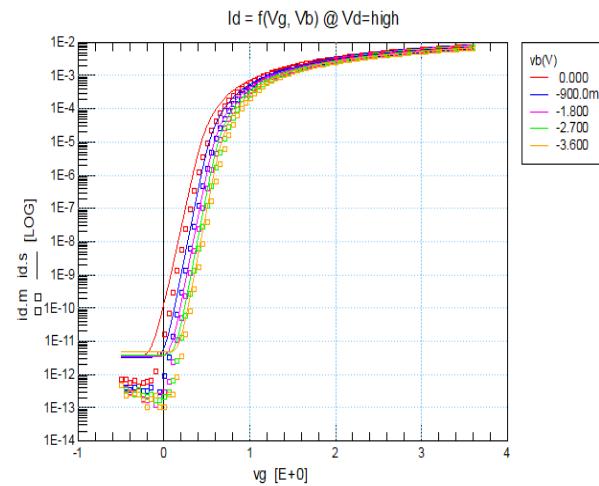
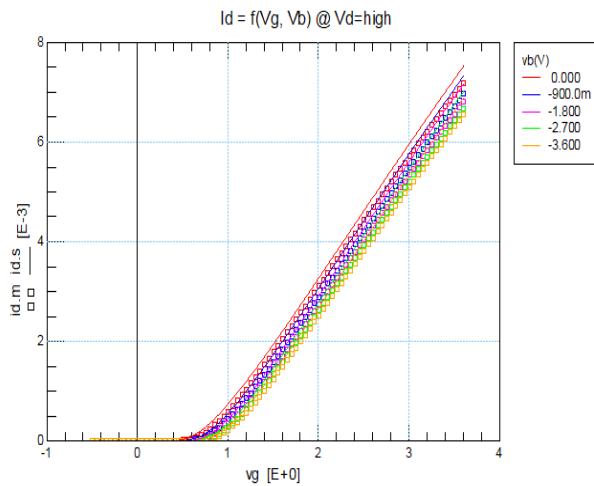
4.5 W10u0_L0u35_S556_3

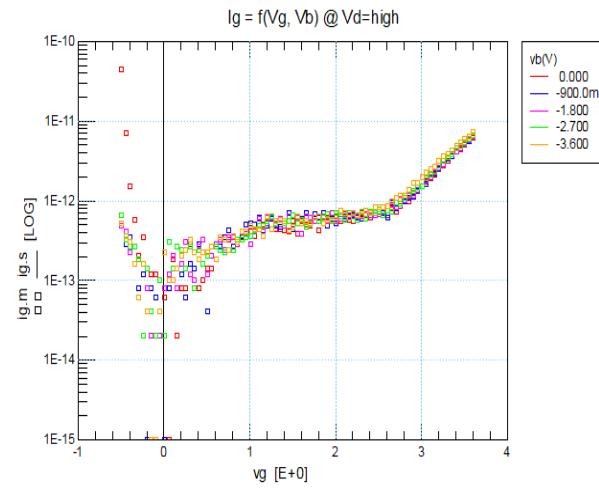
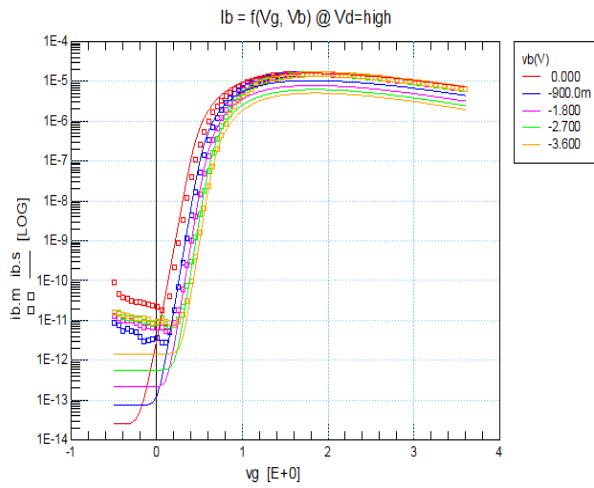
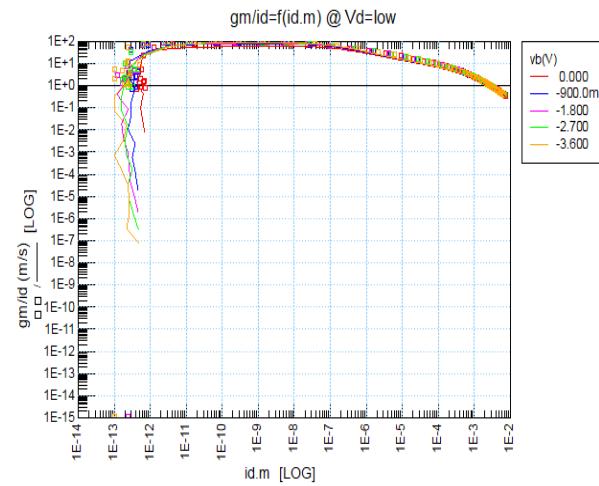
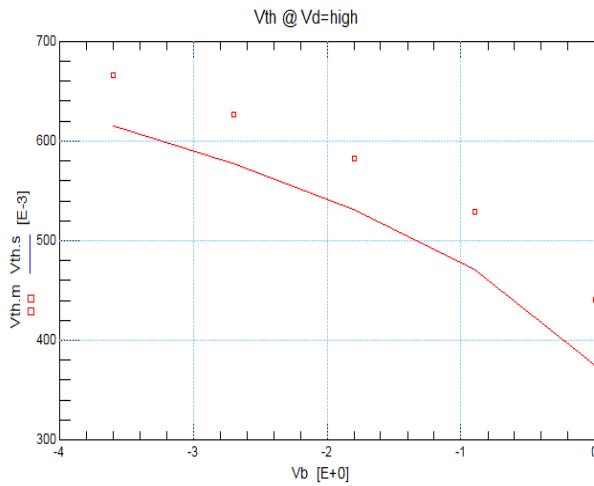
idvg, Vd = 0.1V, T = 27°C



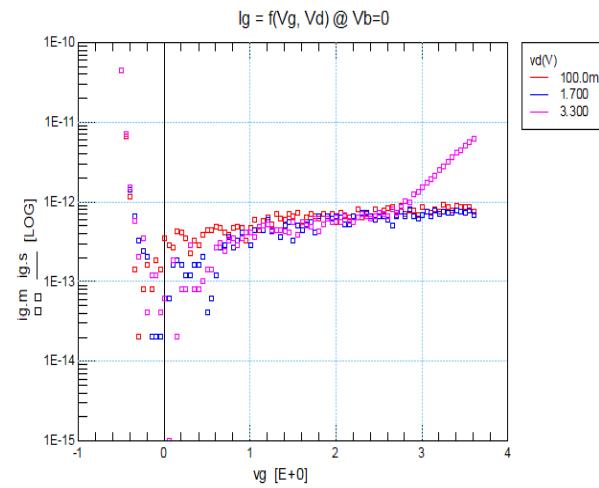
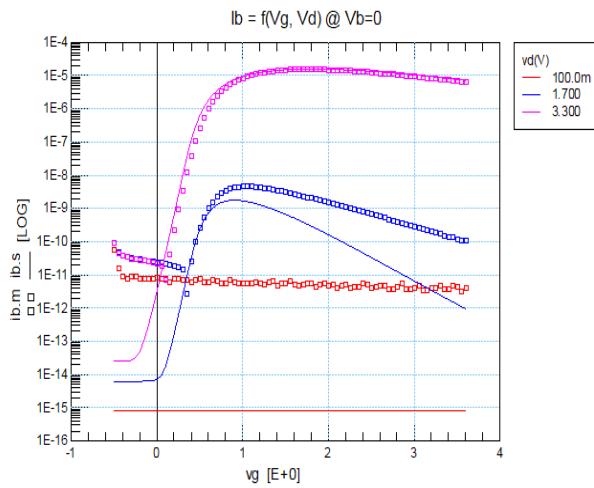


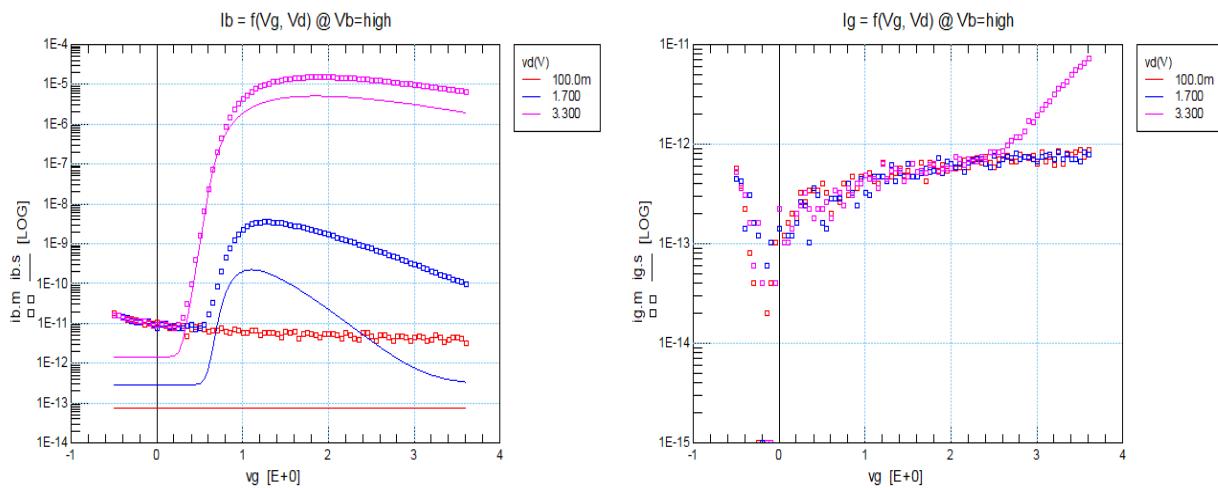
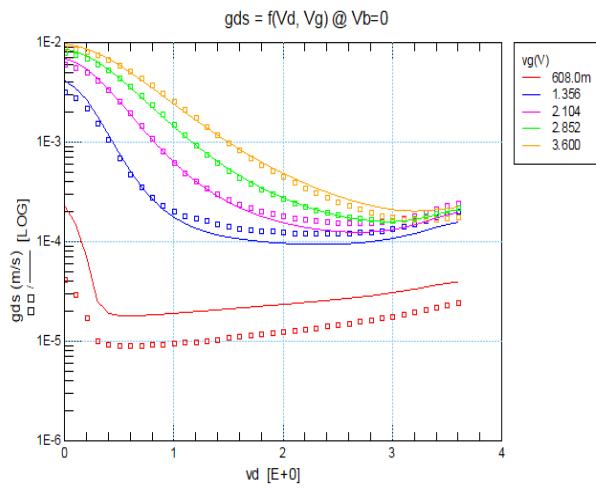
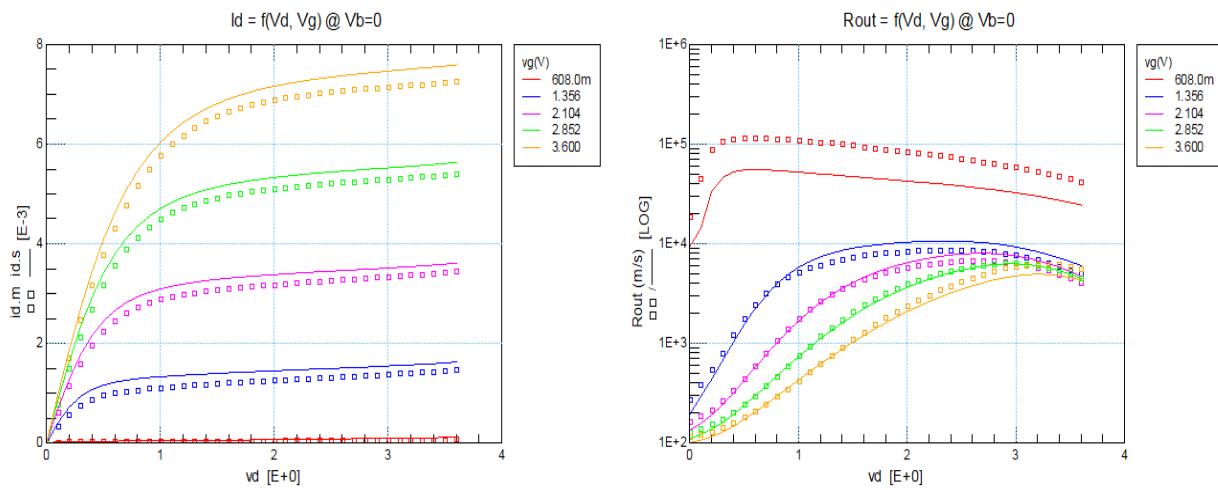
$i_d v_g, V_d = 3.3V, T = 27^\circ C$

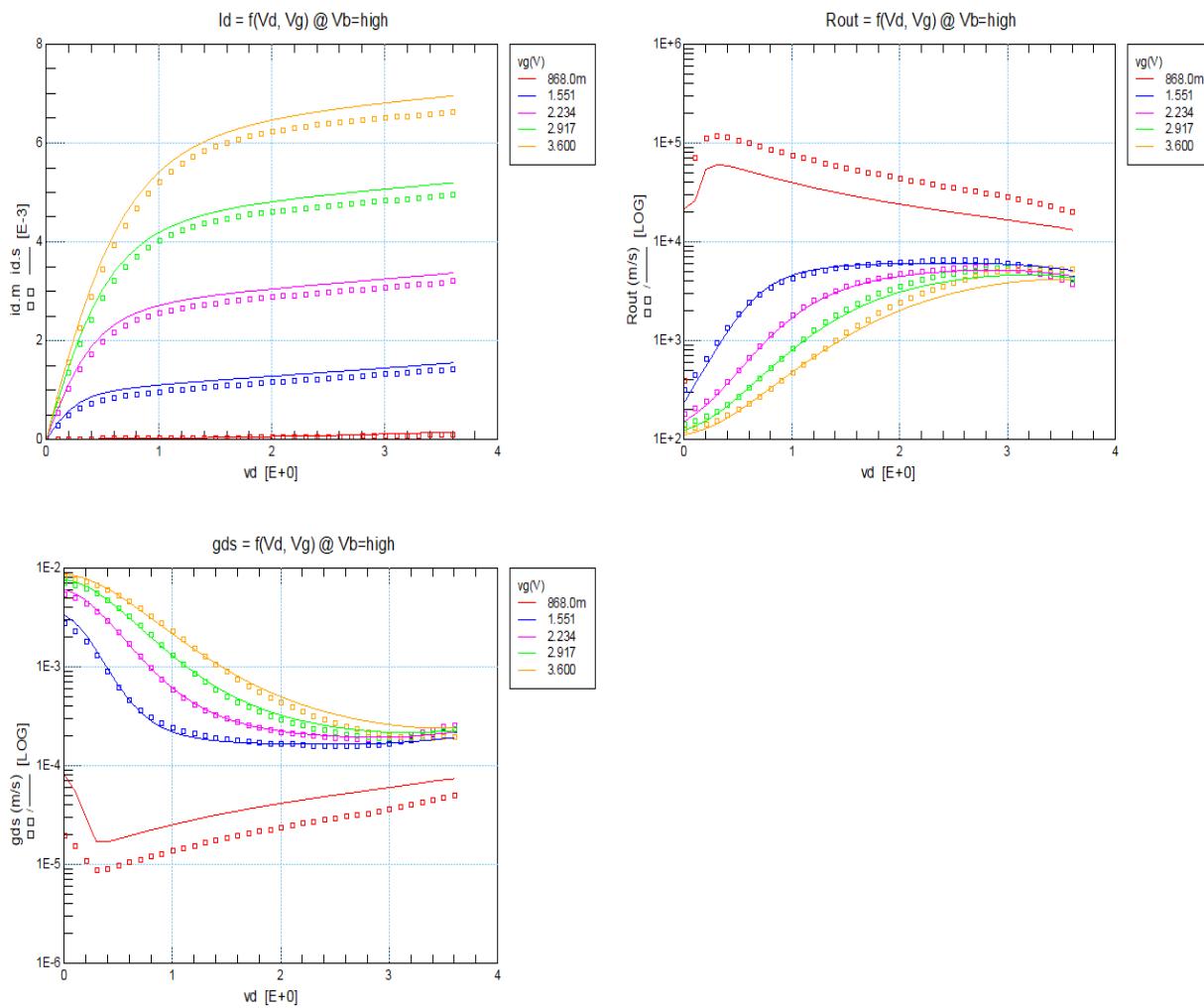
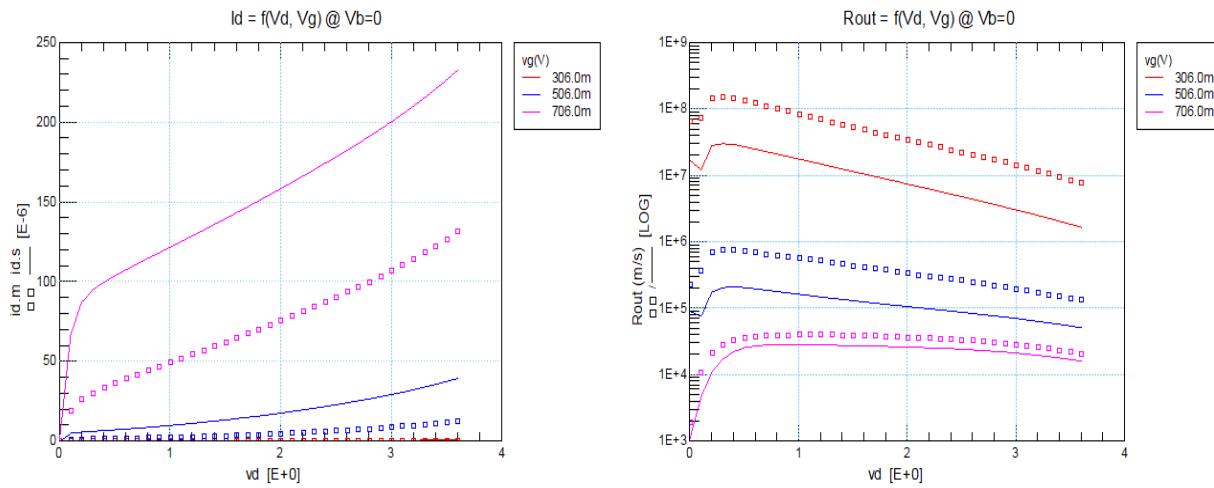


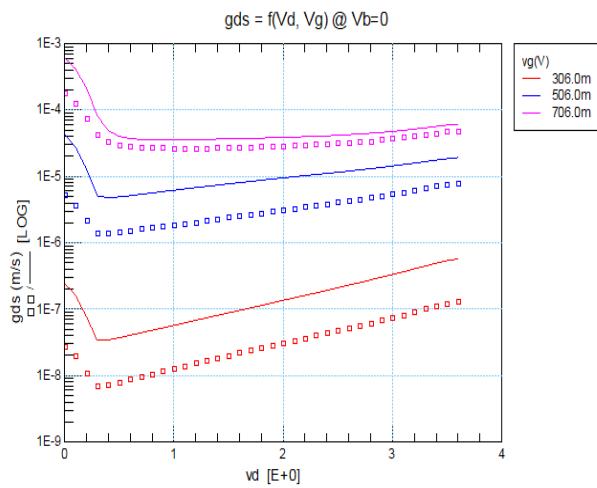


idvg, Ib, Ig, Vb = 0V, T = 27°C

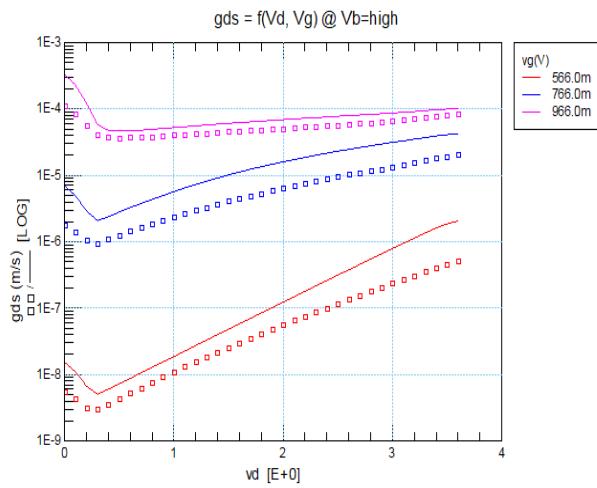
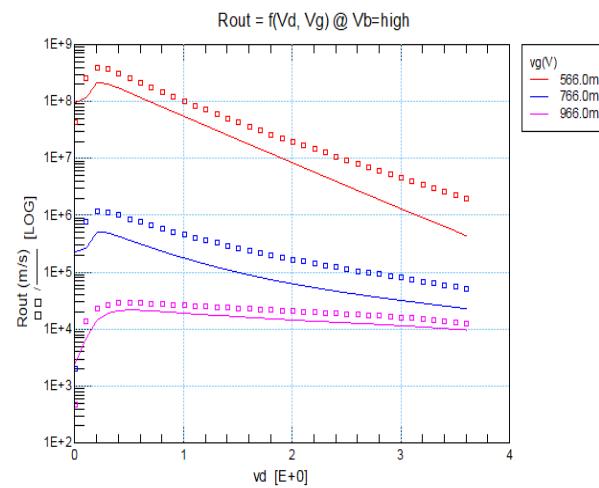
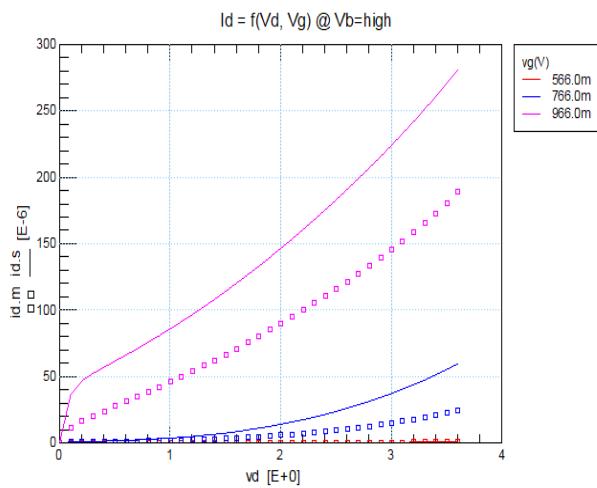


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C**idvd_vth, Vb = 0V, T = 27°C**

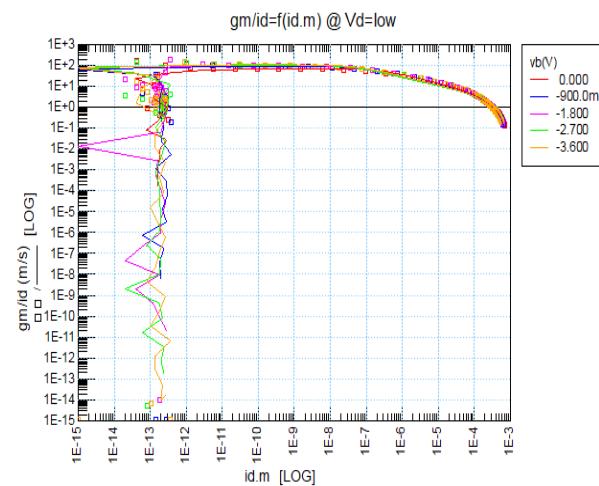
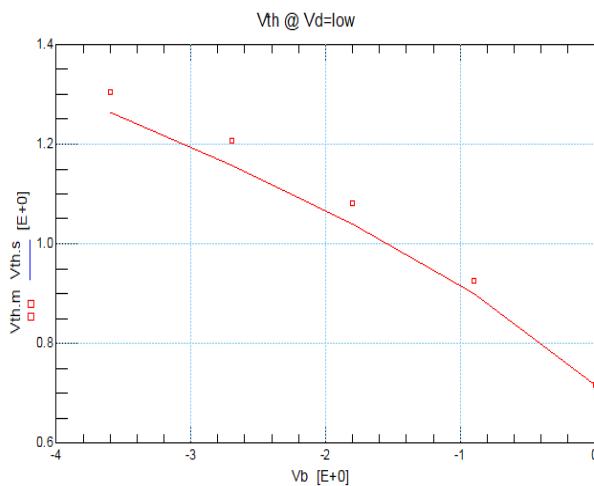
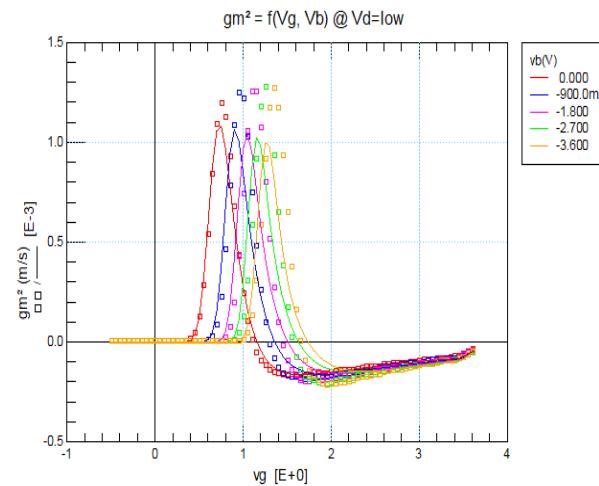
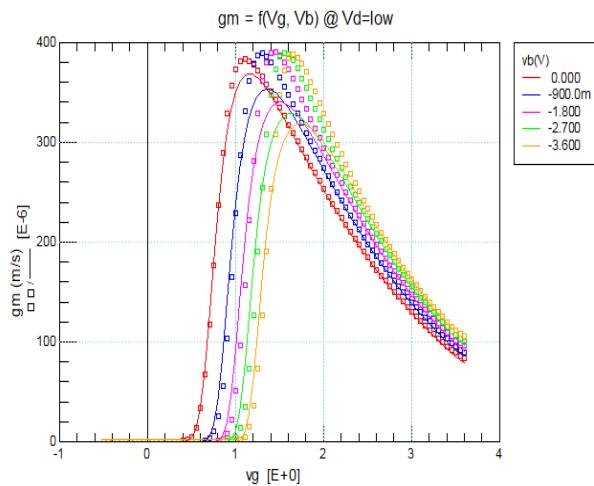
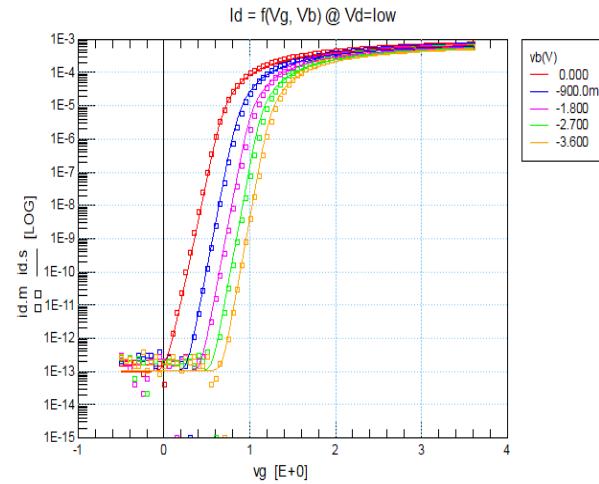
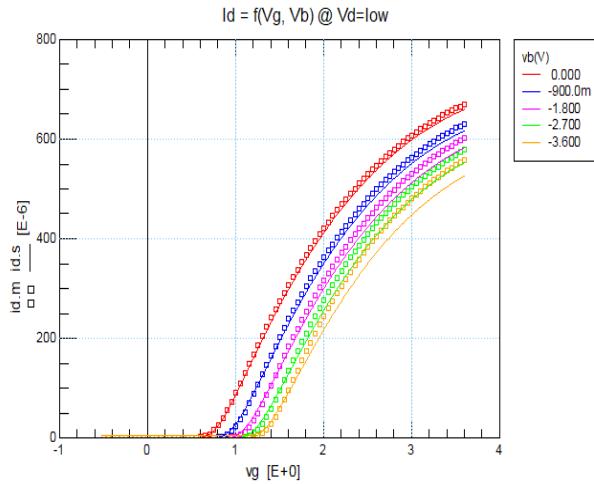


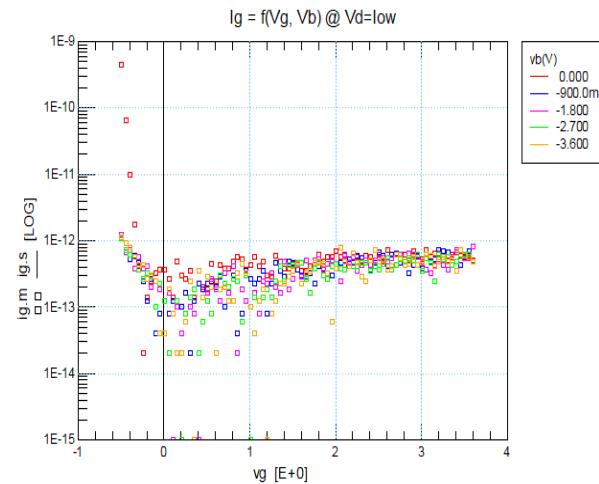
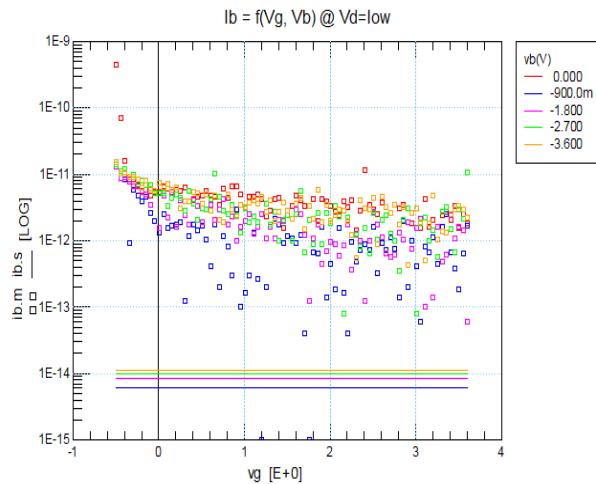
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



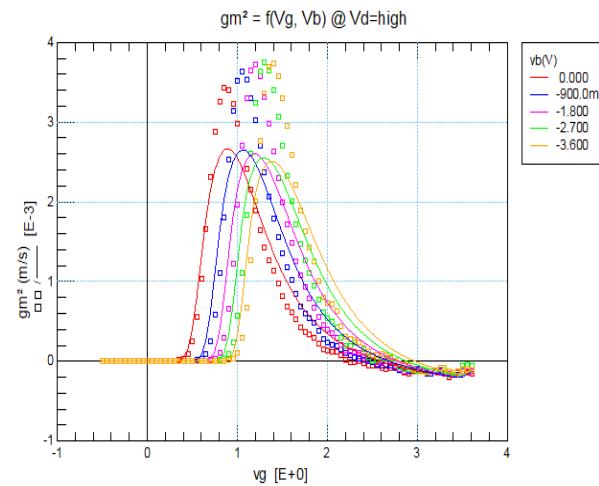
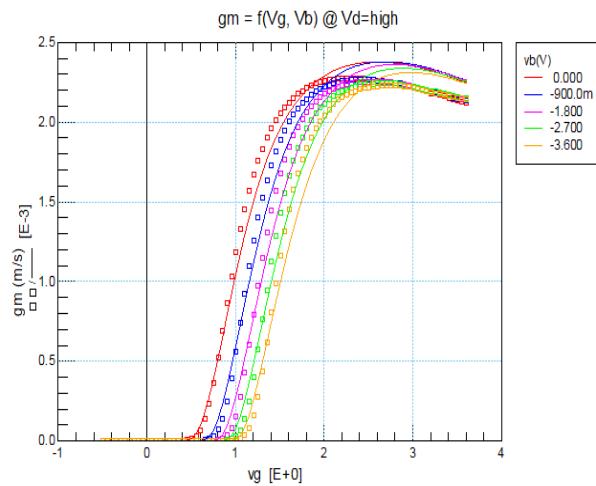
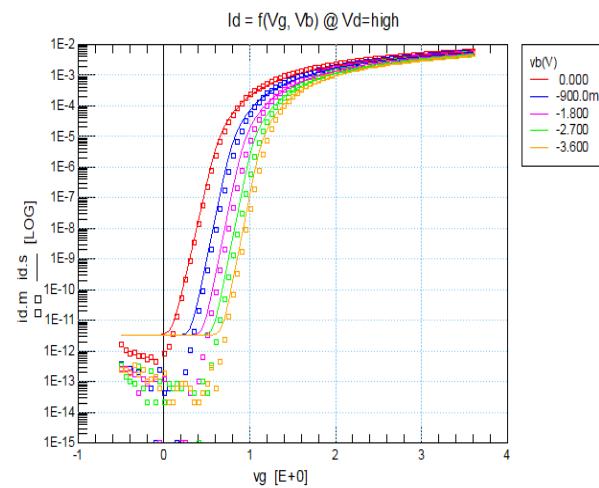
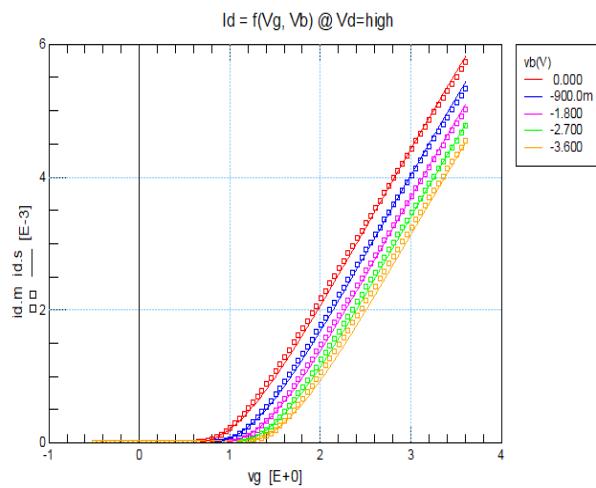
4.6 W10u0_L0u5_T356_S387_5

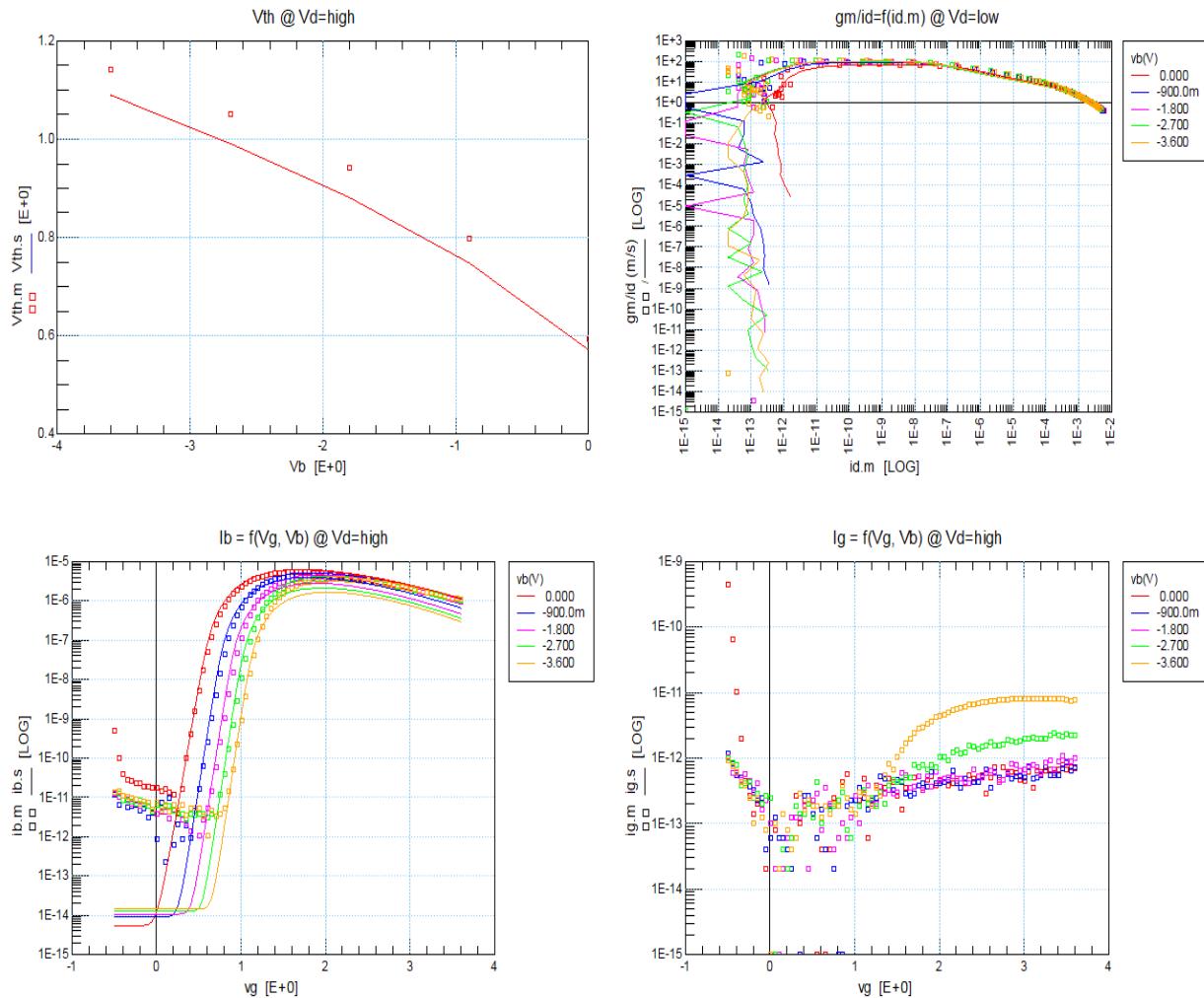
id_{vg} , $V_d = 0.1V$, $T = 27^\circ C$



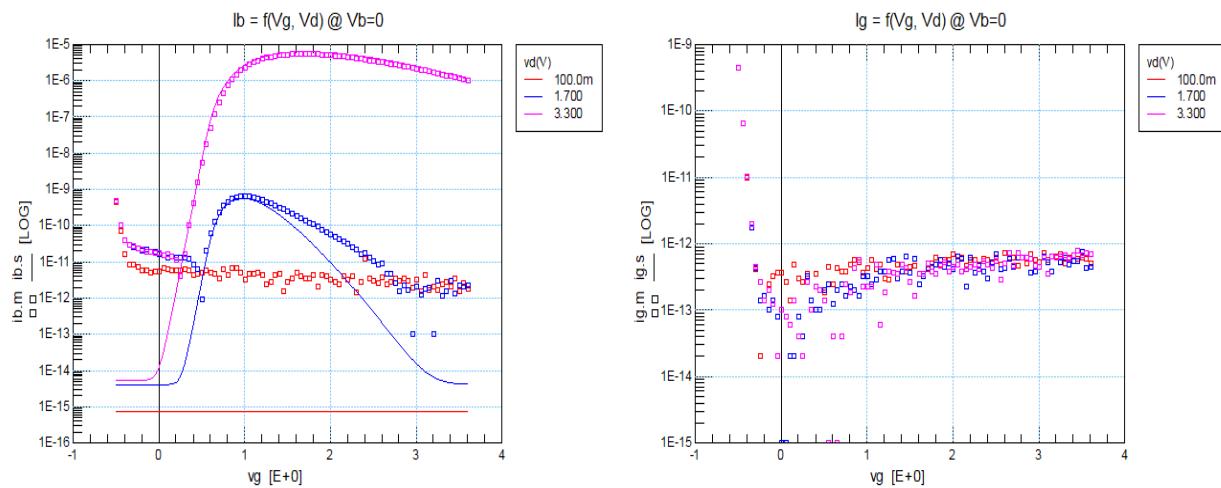


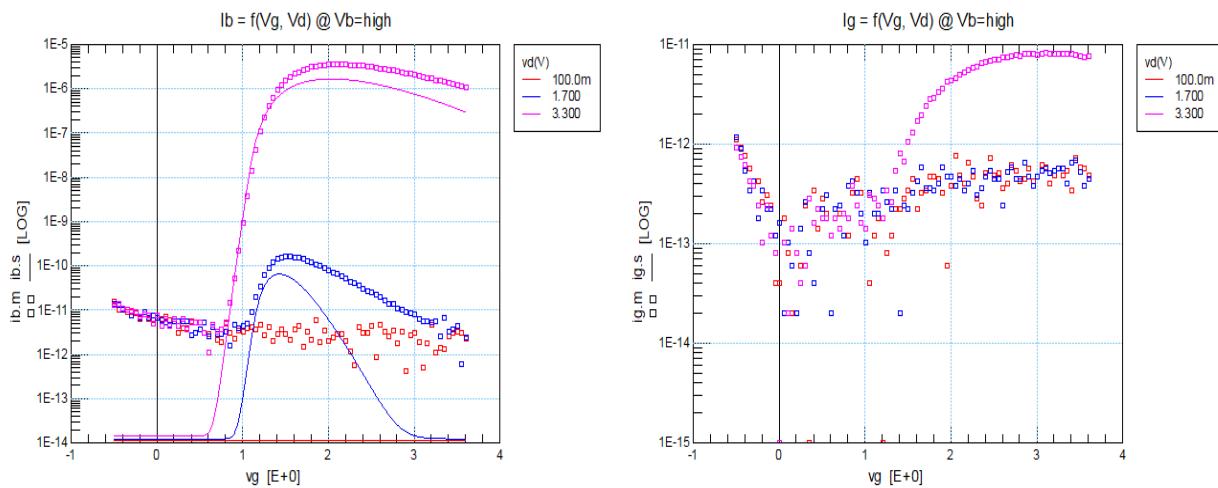
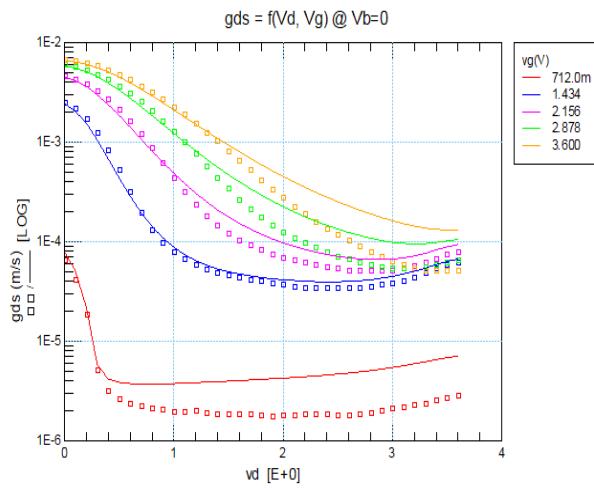
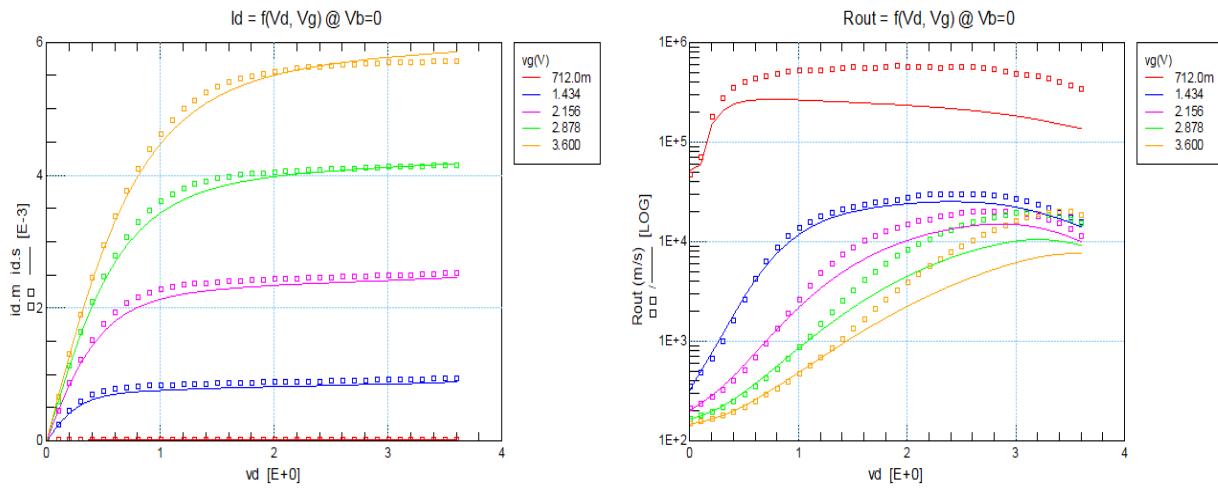
$i_{dvg}, V_d = 3.3V, T = 27^\circ C$

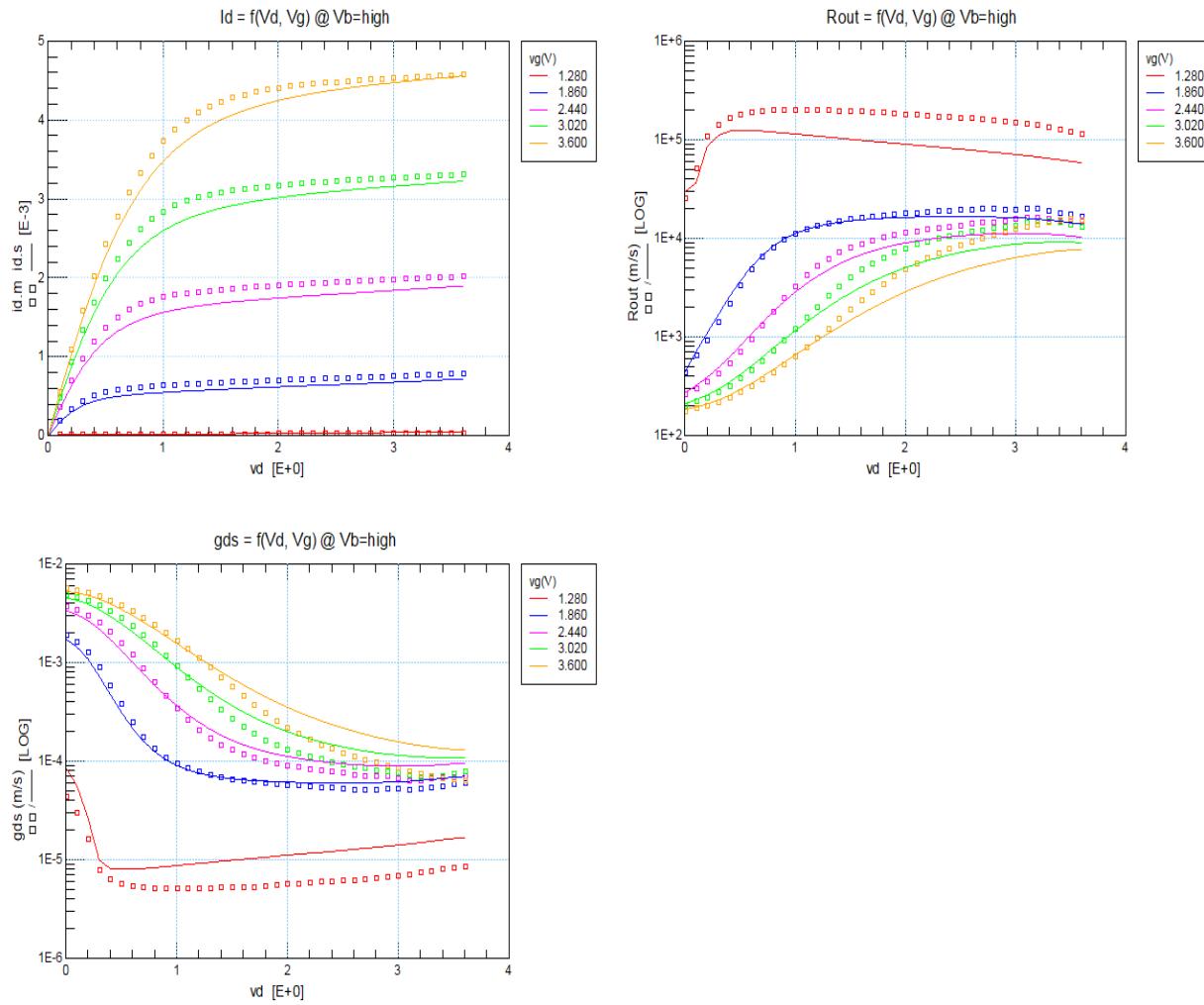
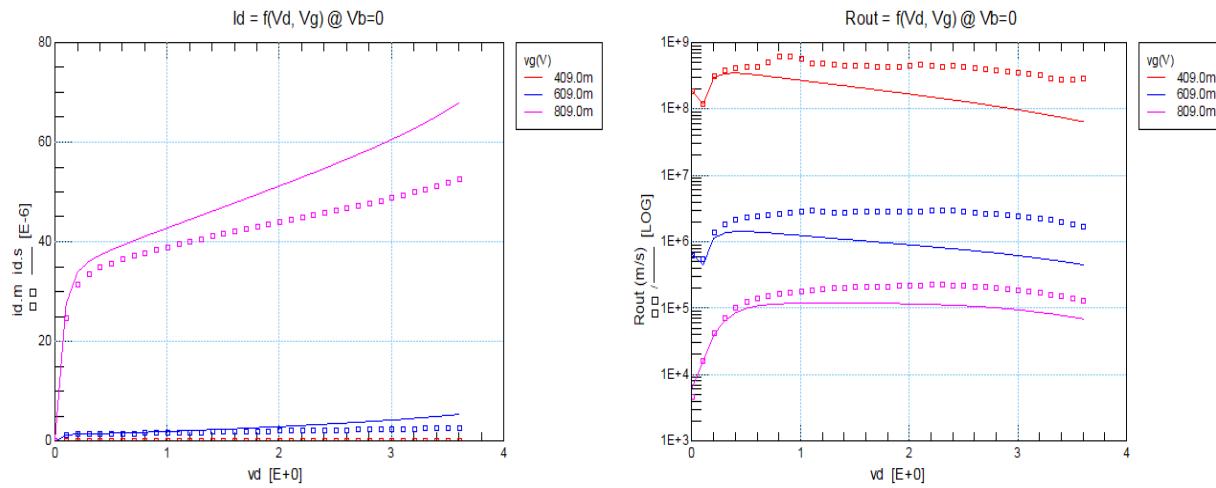


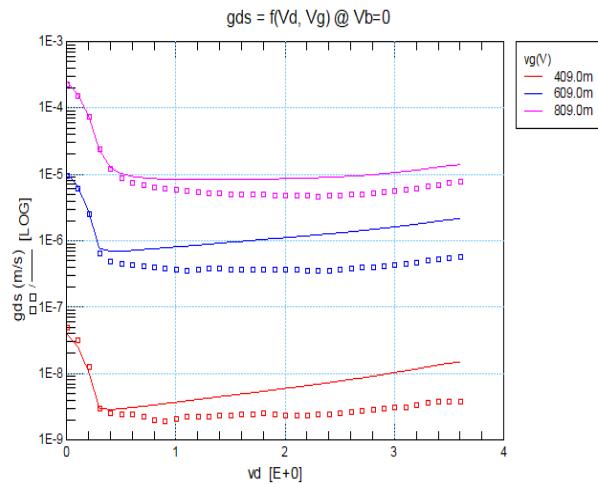


$idvg, Ib, Ig, Vb = 0V, T = 27^\circ C$

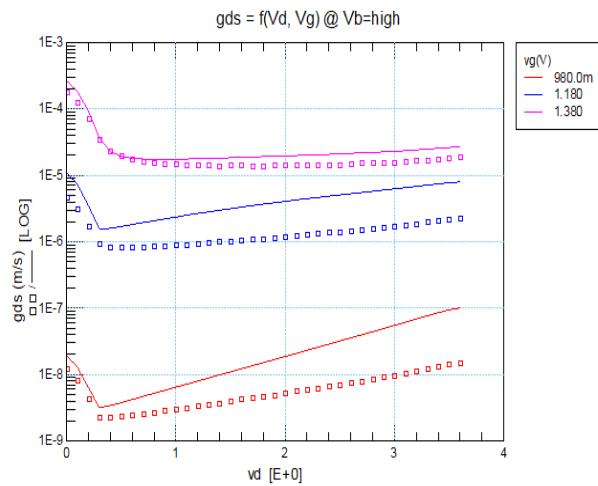
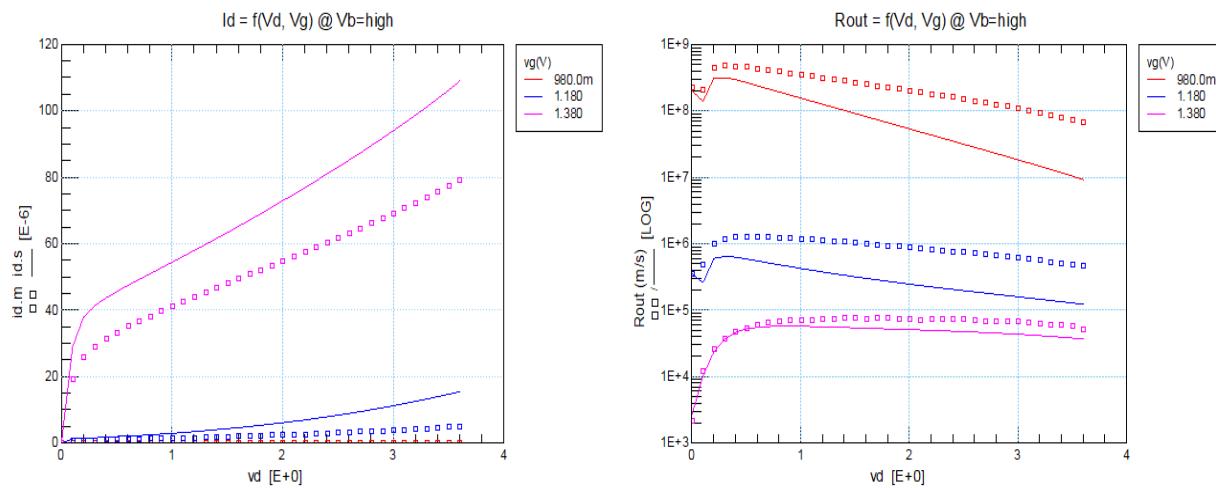


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


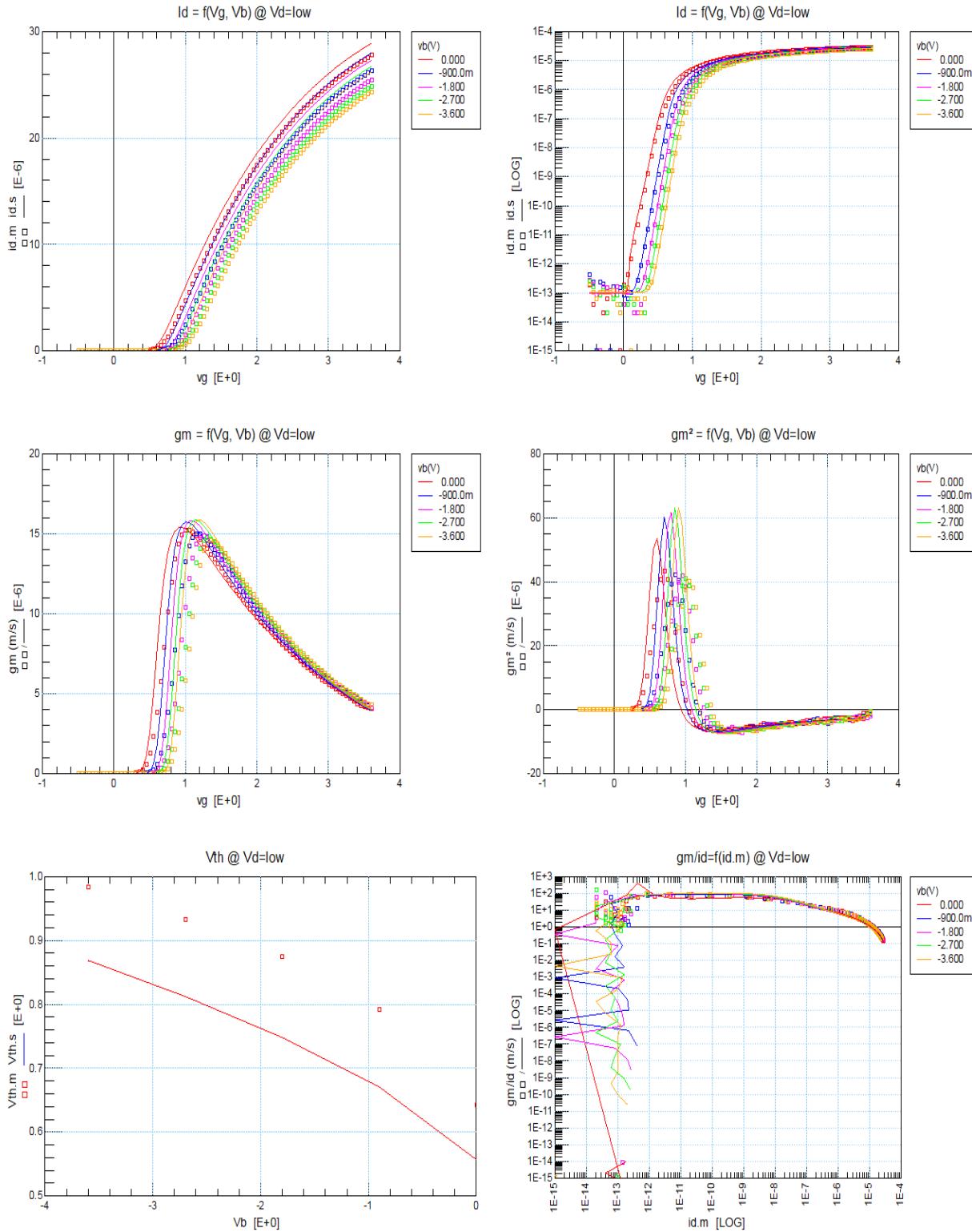


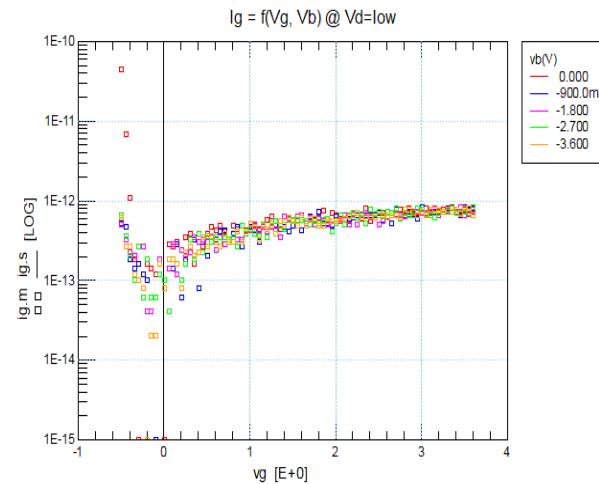
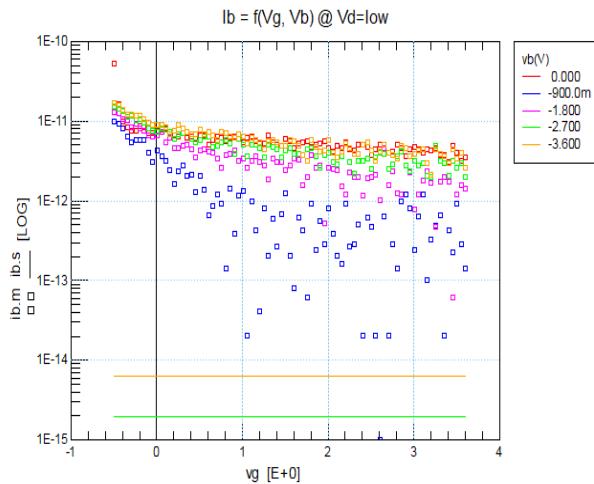
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



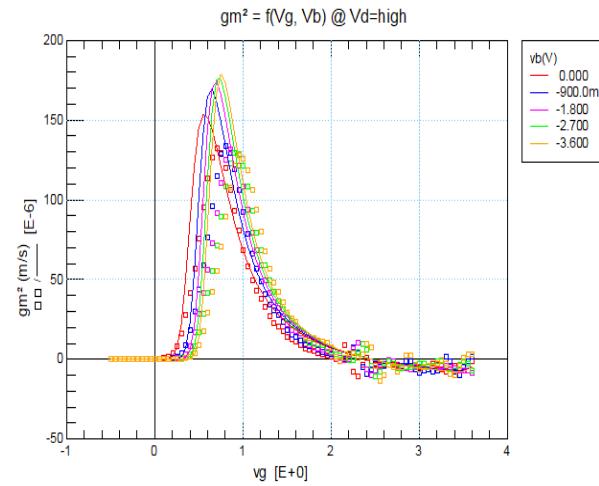
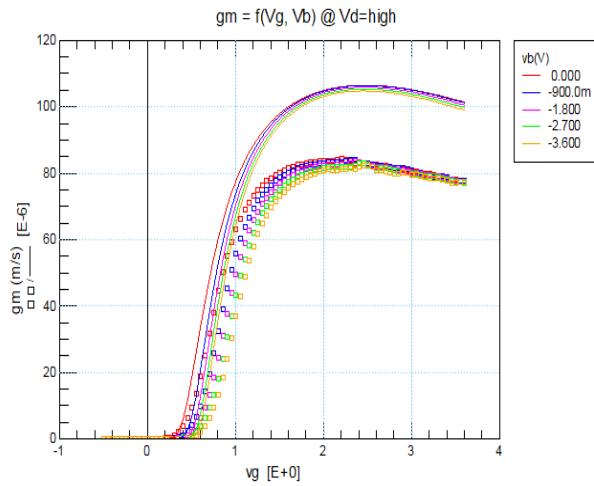
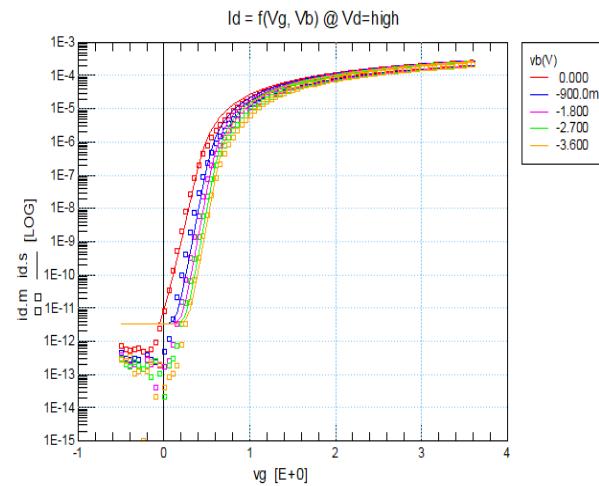
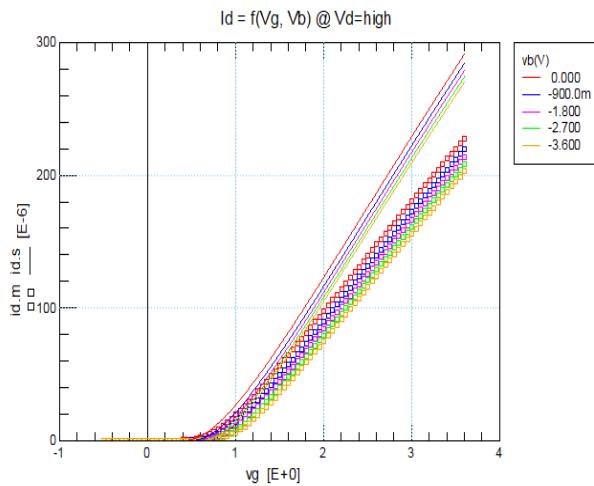
4.7 W0u3_L0u35_S560_3

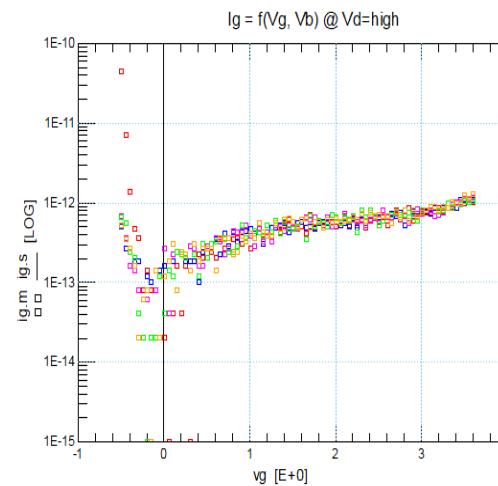
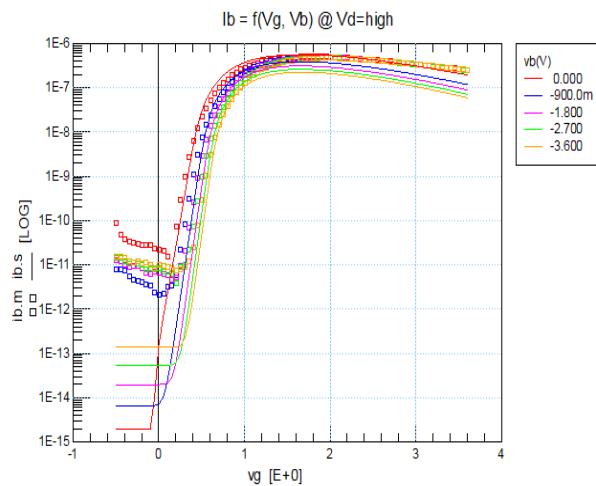
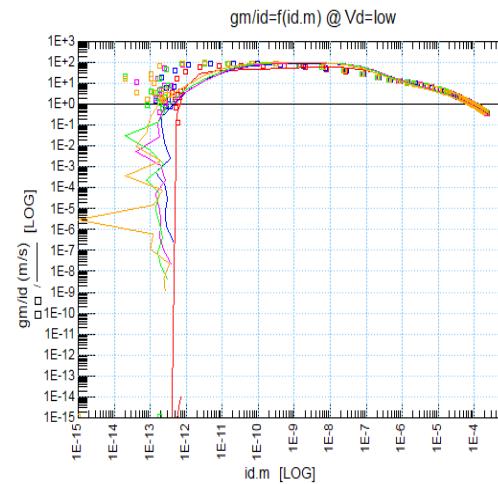
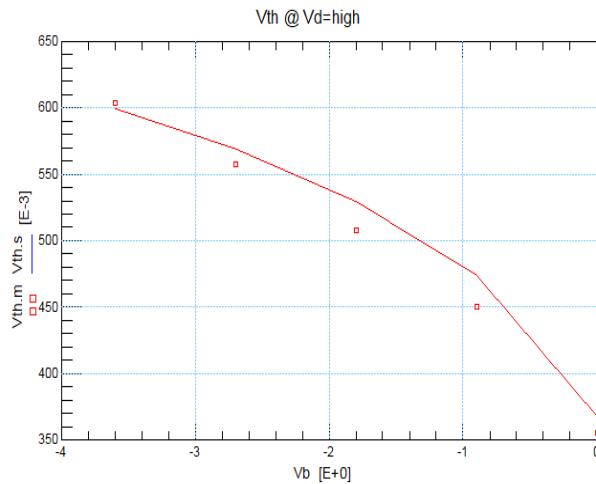
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



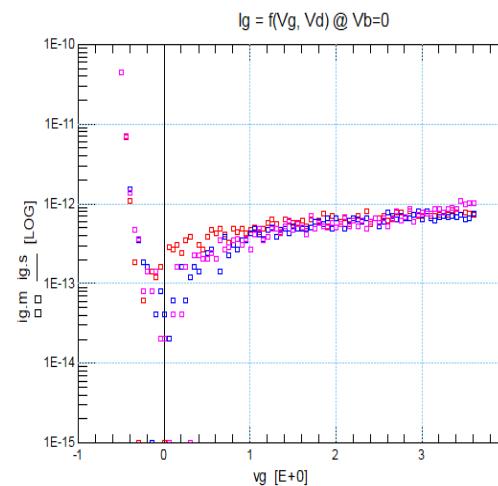
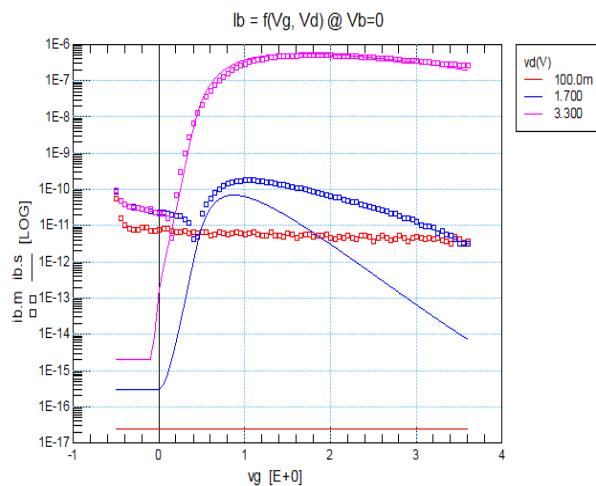


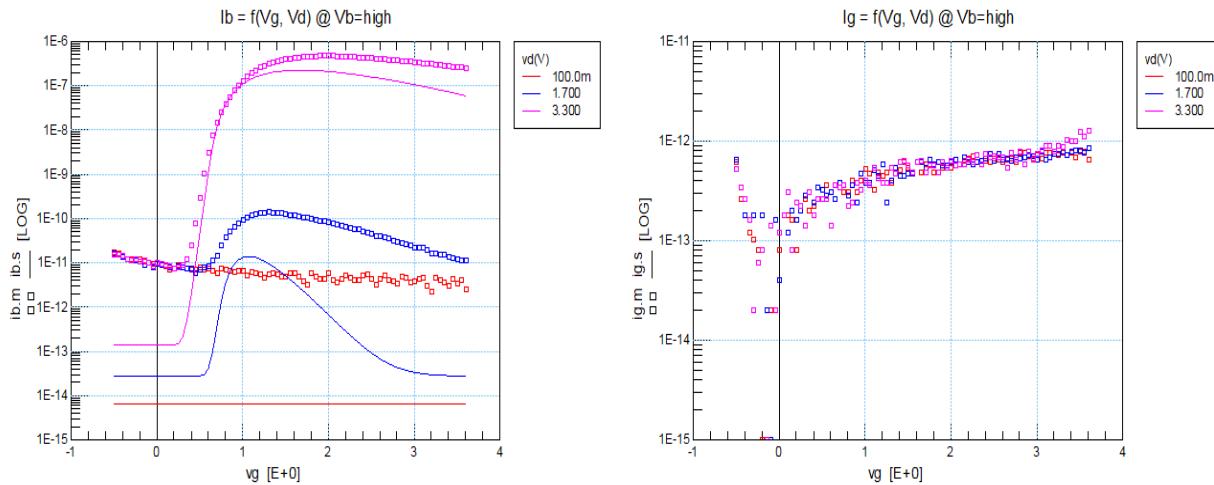
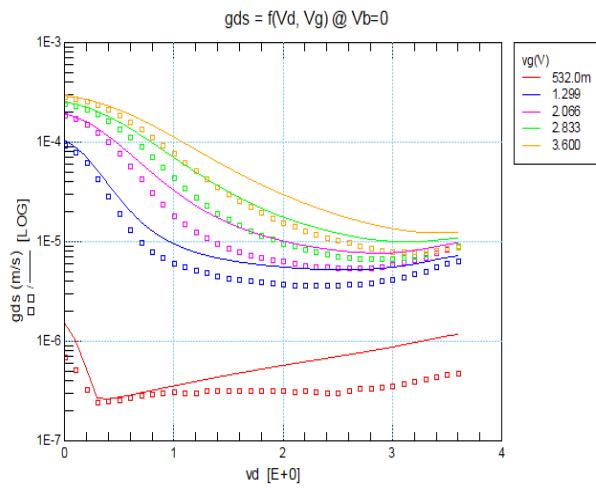
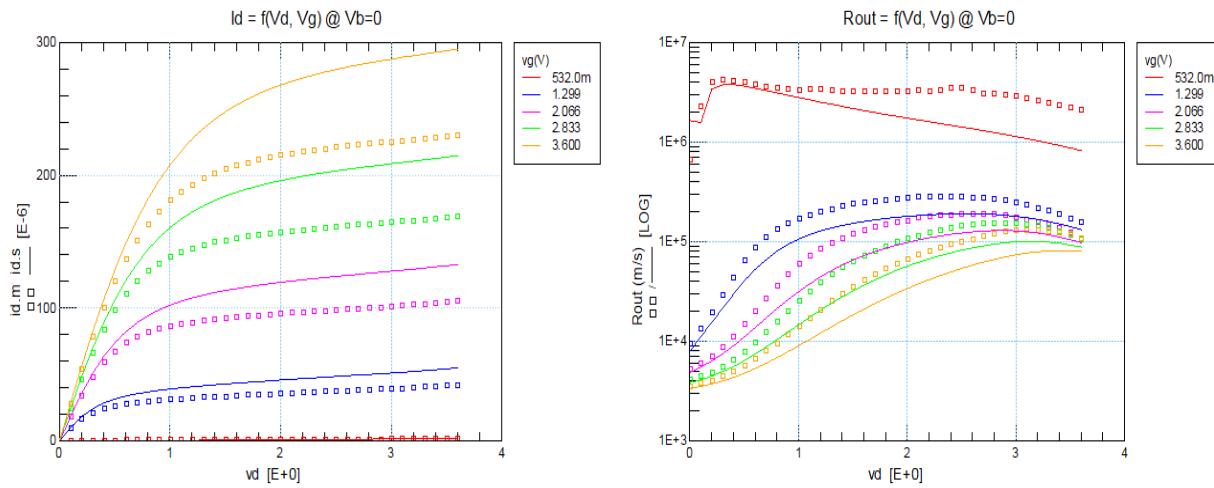
$i_d v_g, V_d = 3.3V, T = 27^\circ C$

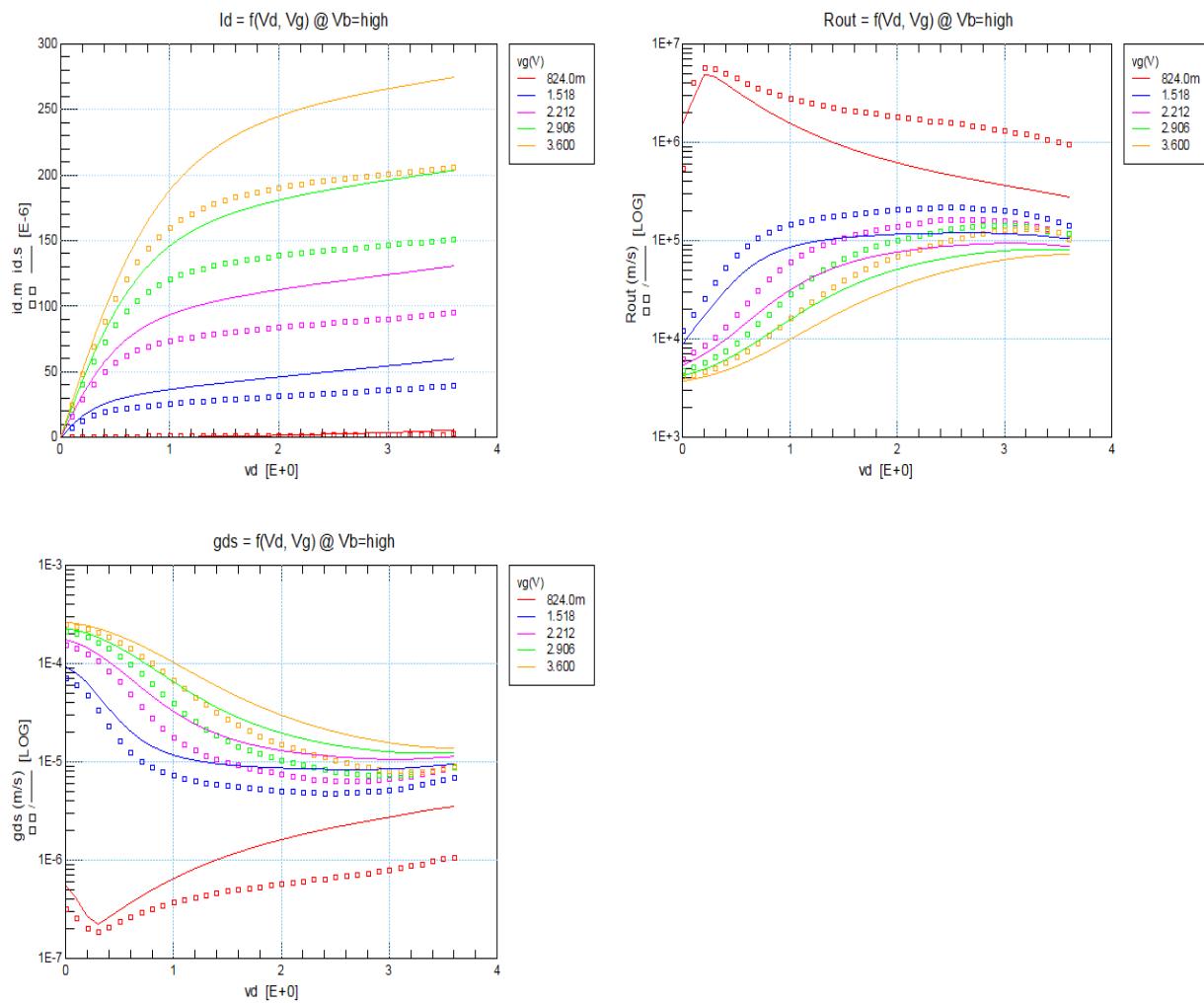
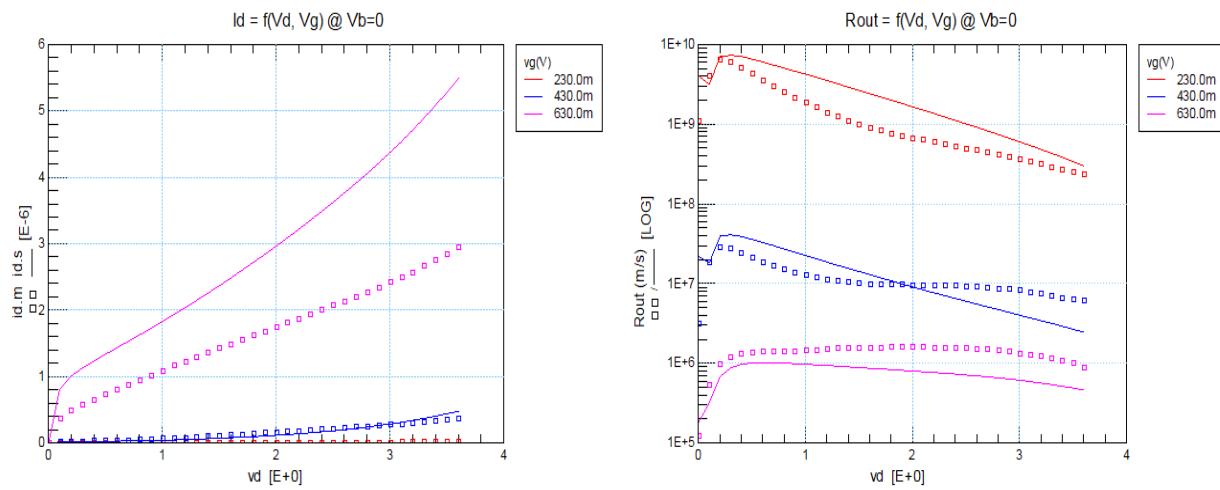


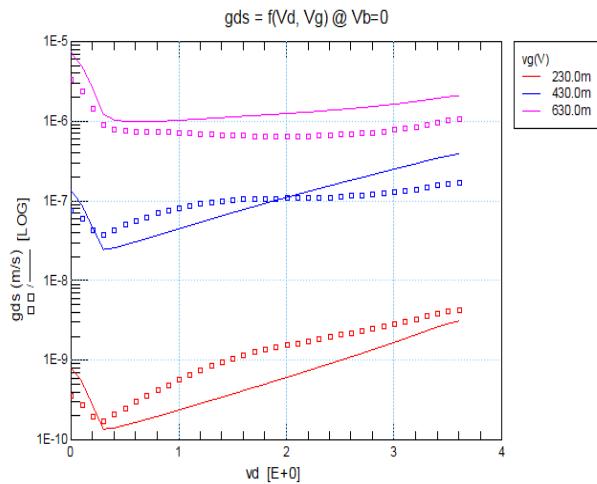


idvg, lb, lg, Vb = 0V, T = 27°C

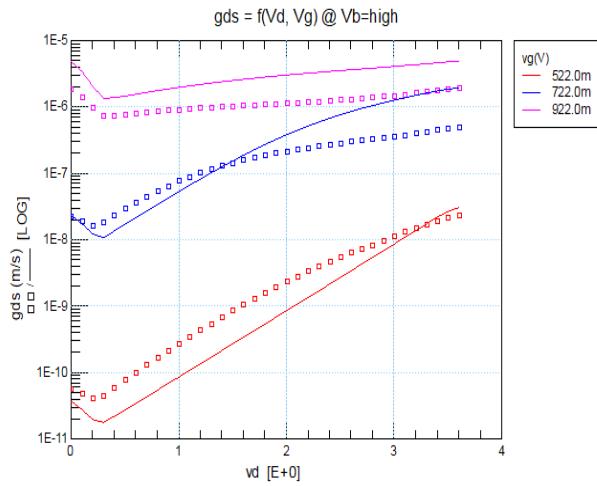
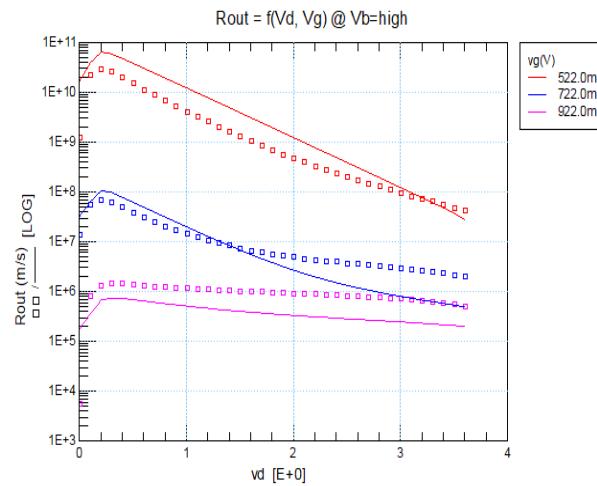
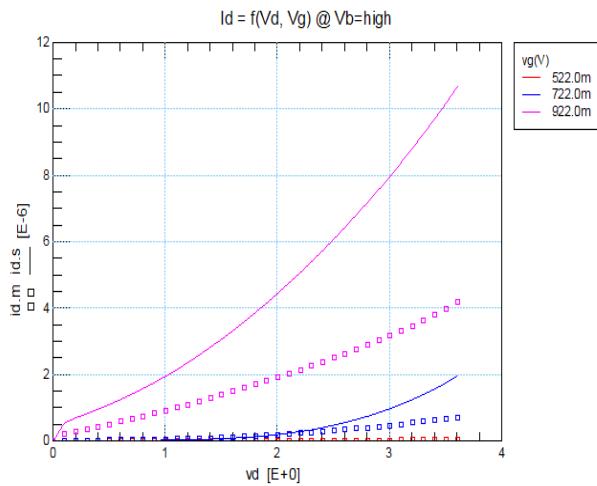


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


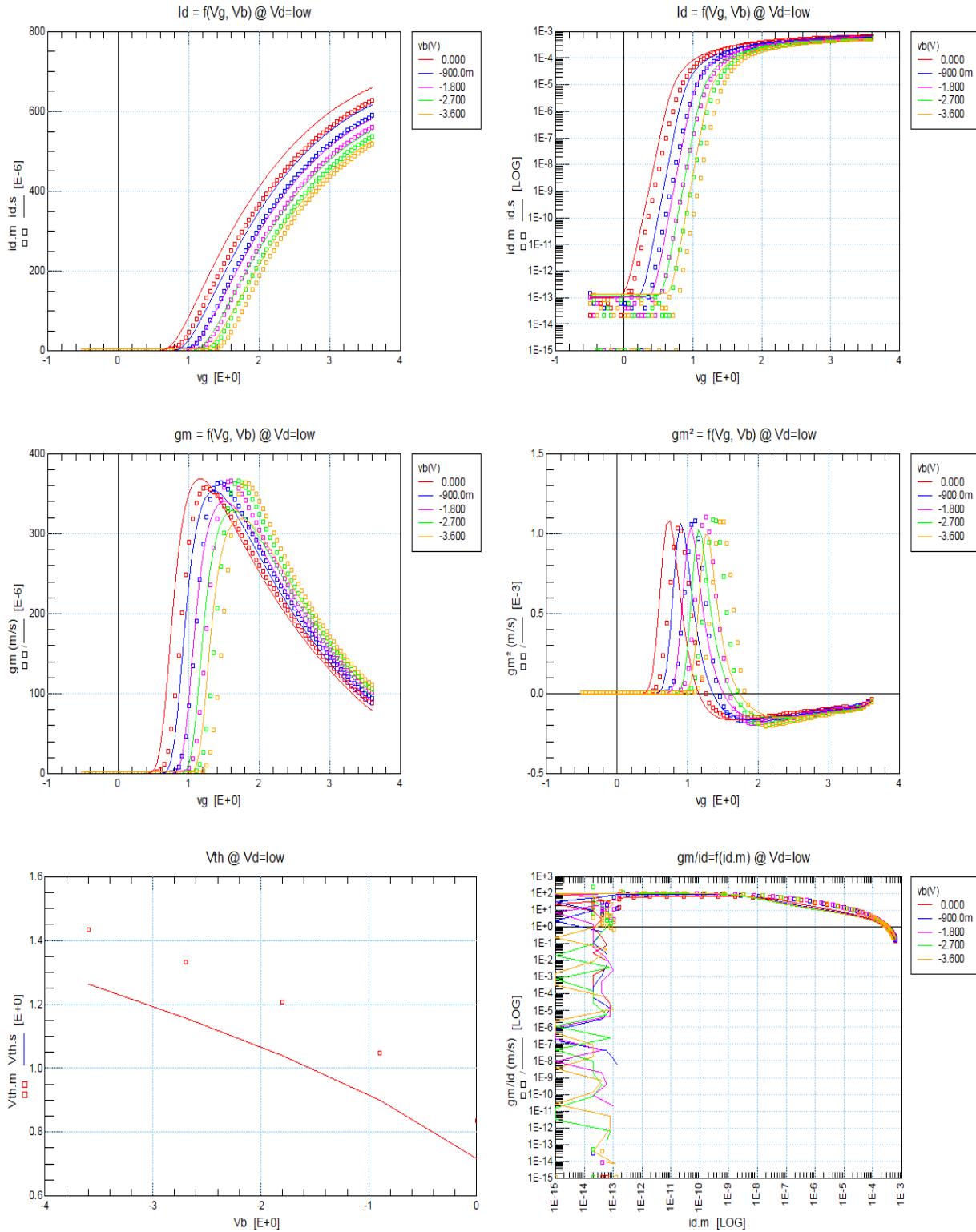


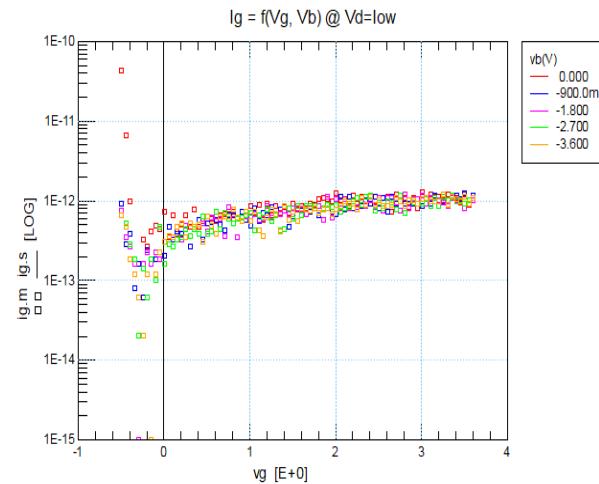
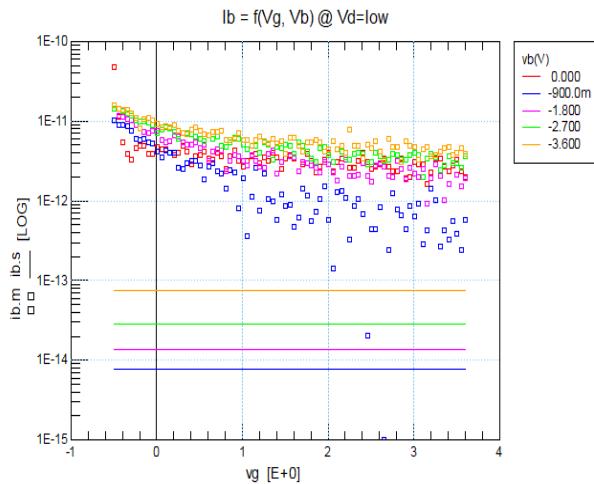
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



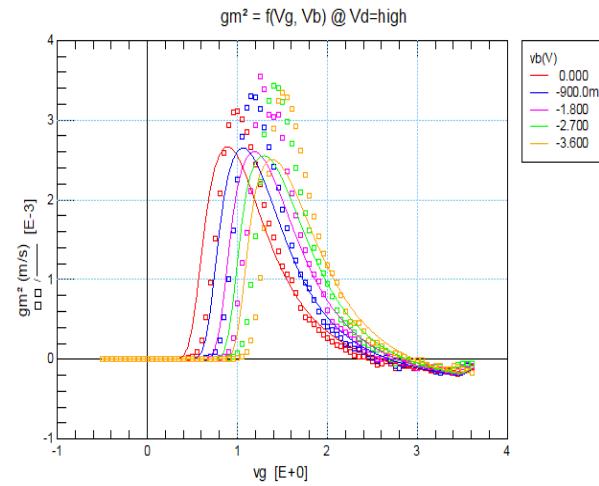
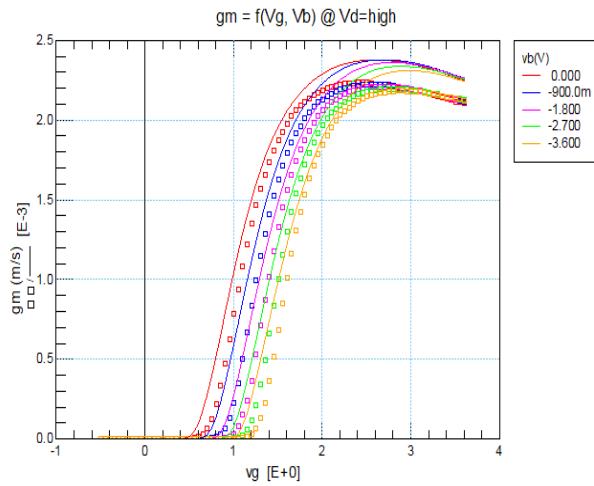
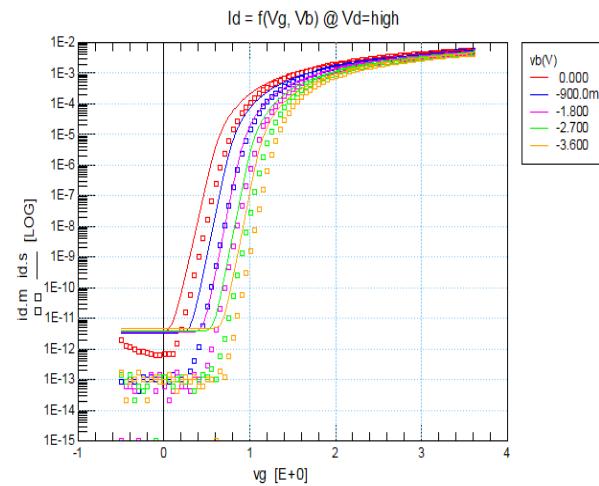
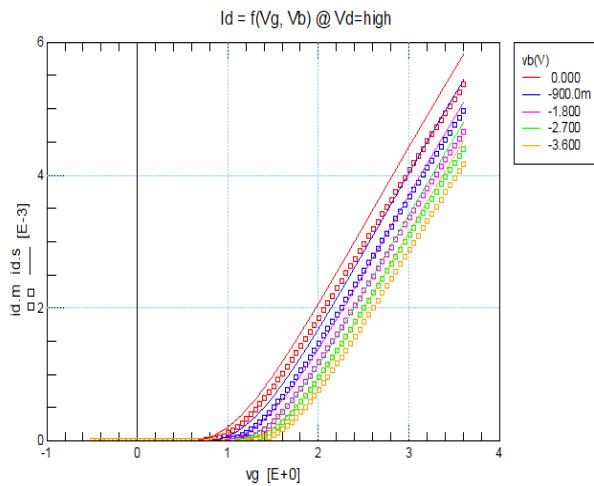
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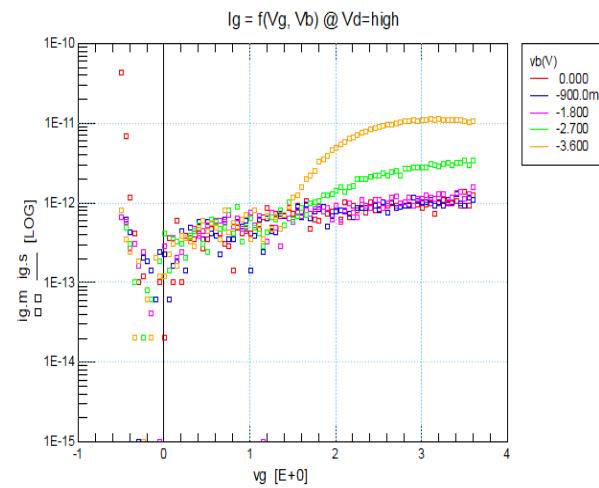
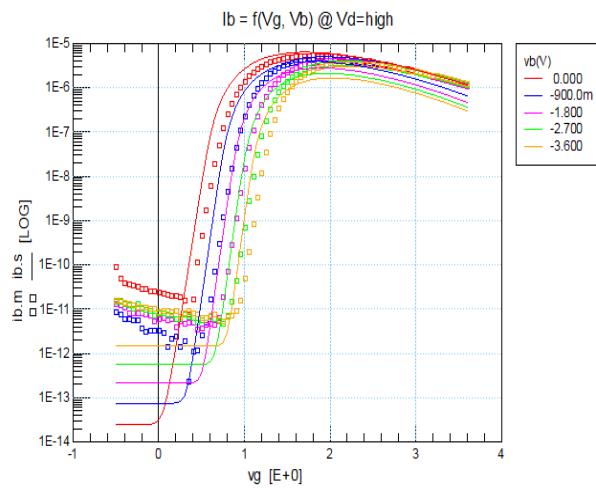
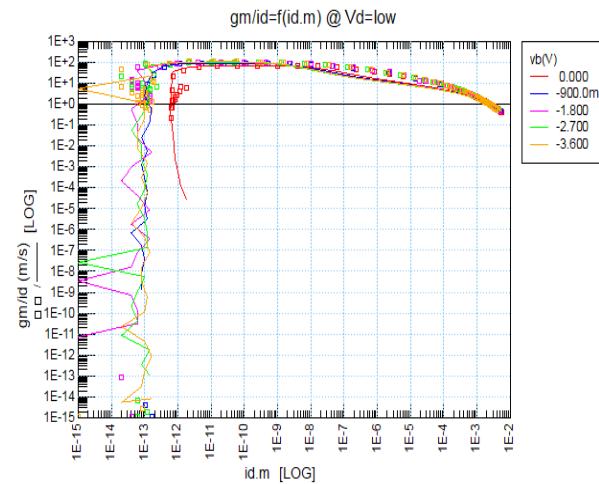
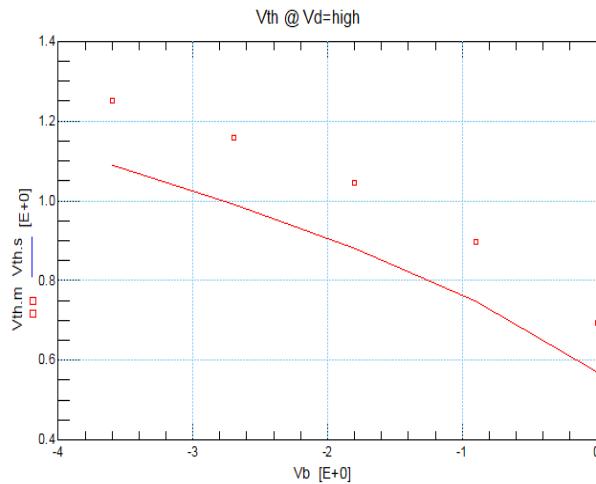
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



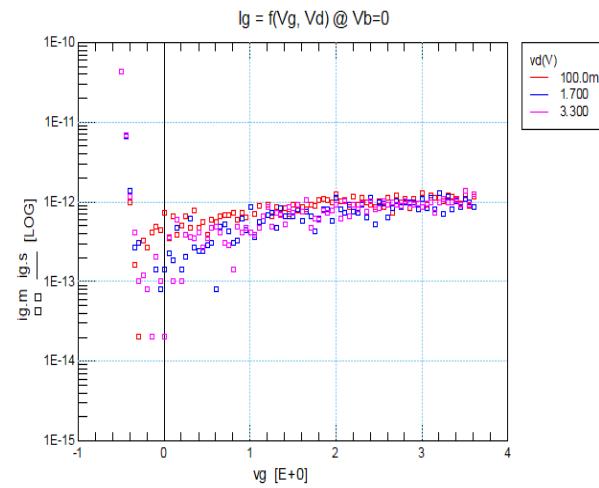
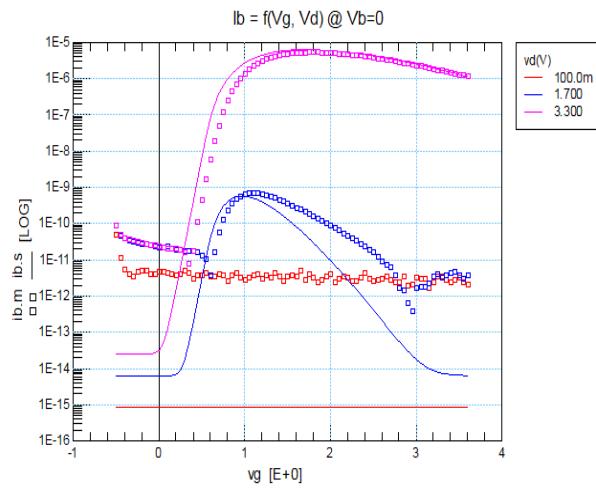


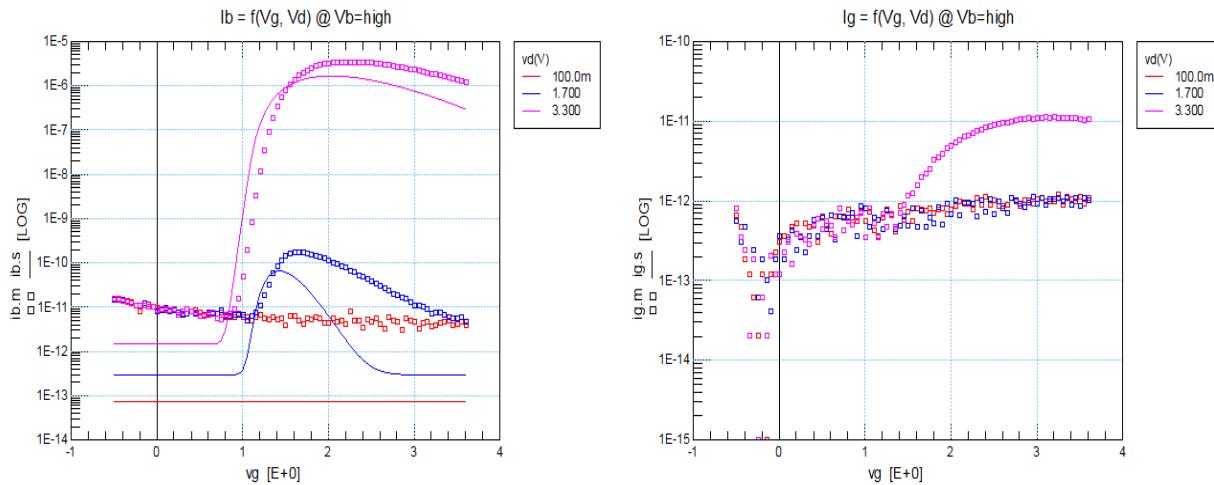
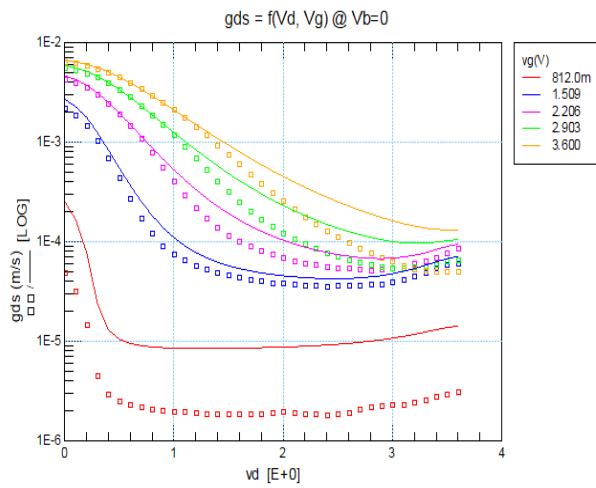
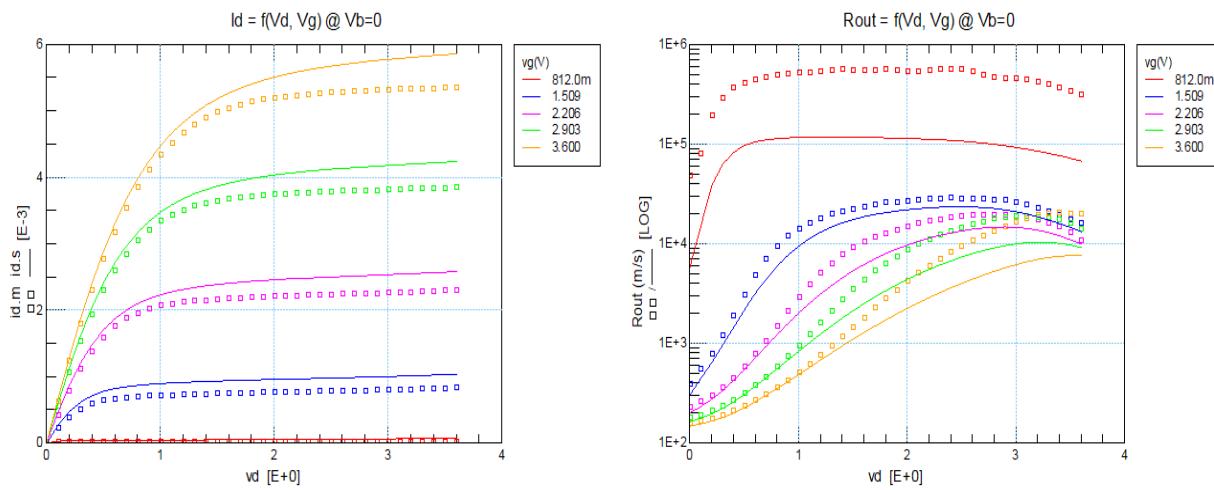
$i_{dvg}, V_d = 3.3V, T = 27^\circ C$

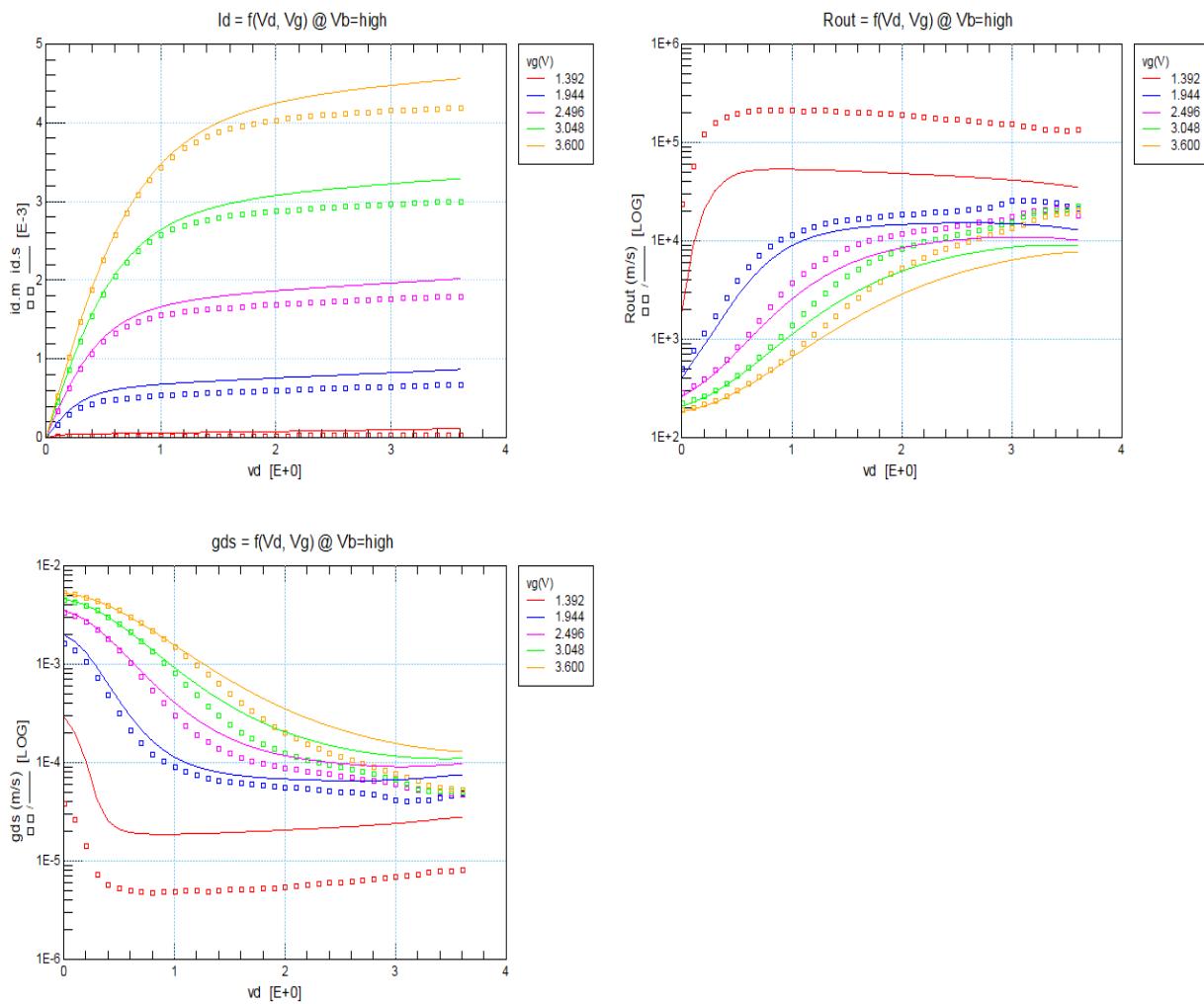
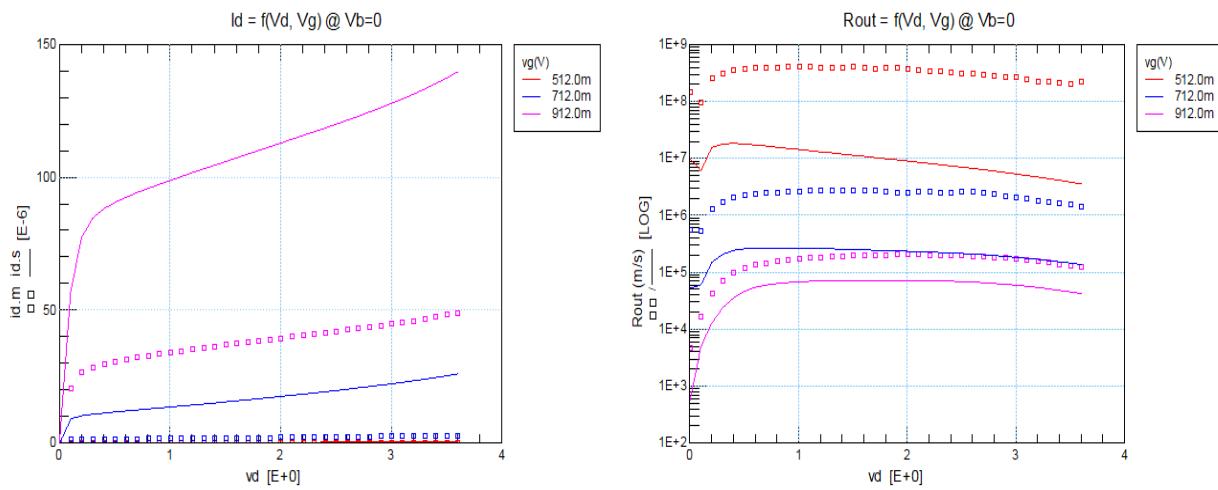


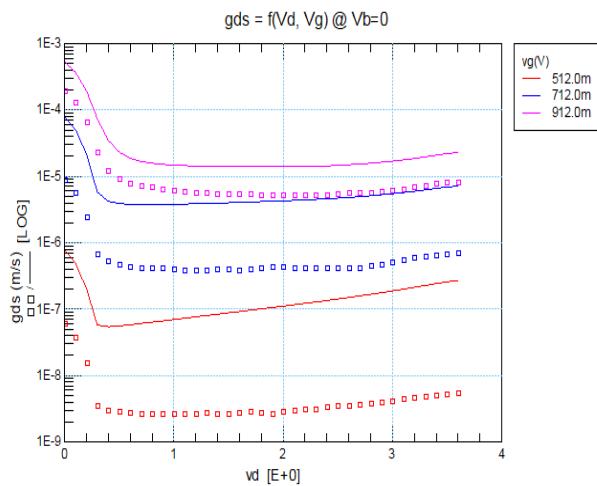


idvg, lb, lg, Vb = 0V, T = 27°C

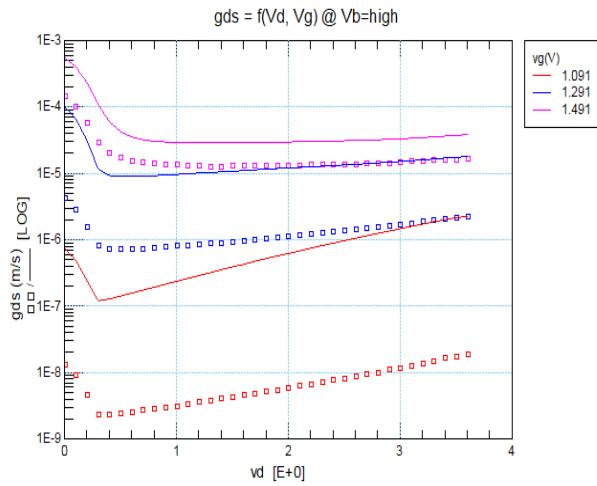
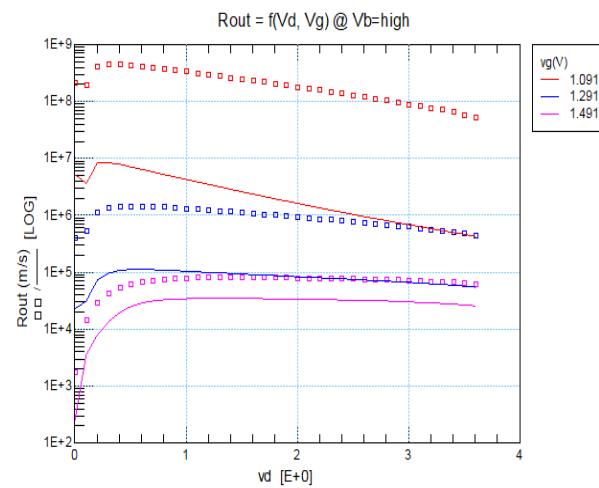
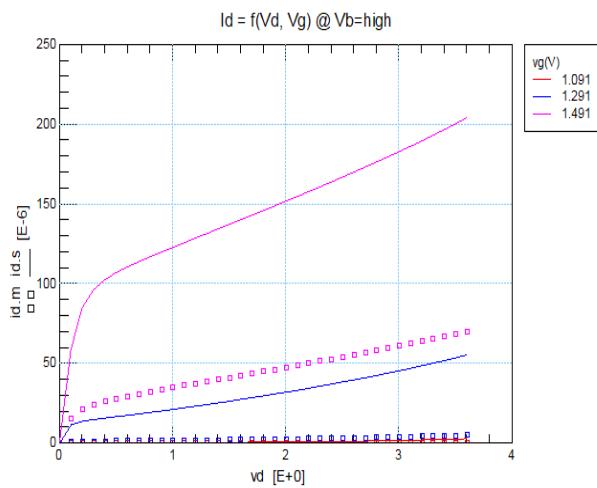


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


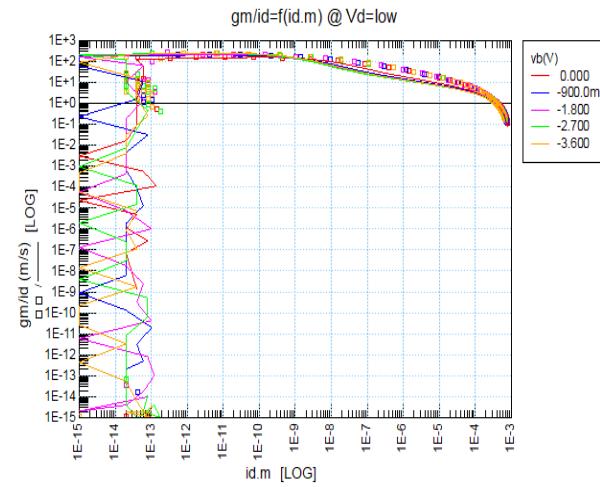
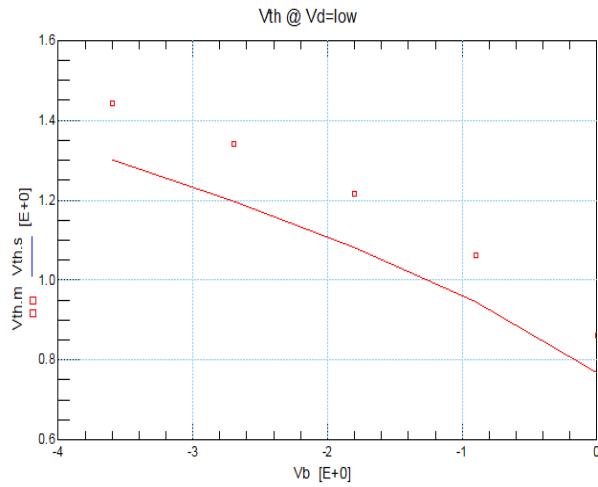
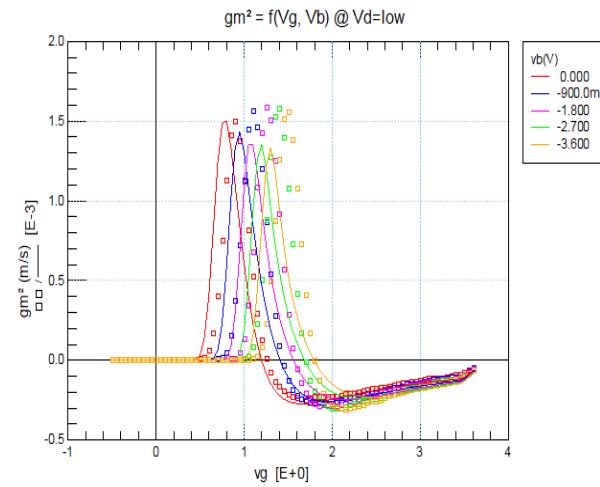
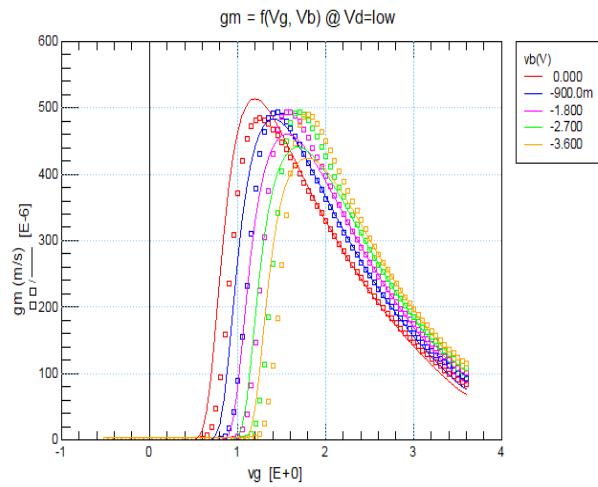
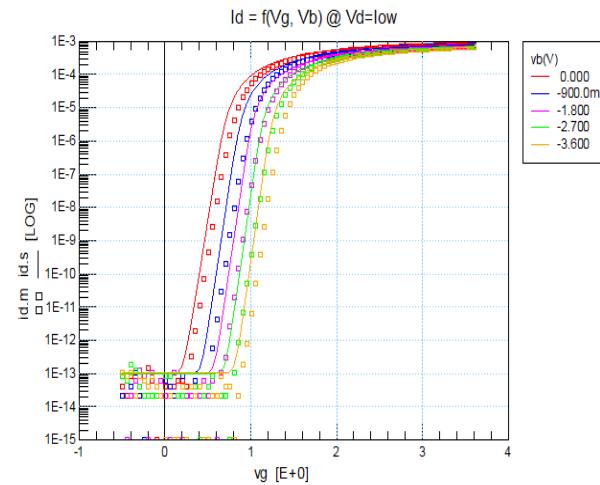
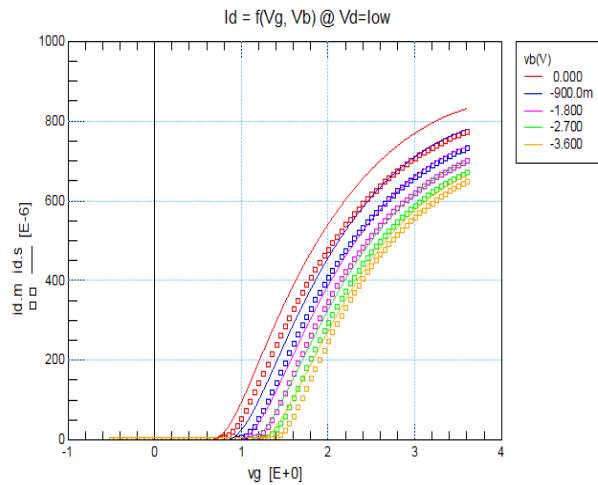
idvd_vbmin, Vb = -3.6V, T = 27°C**idvd_vth, Vb = 0V, T = 27°C**

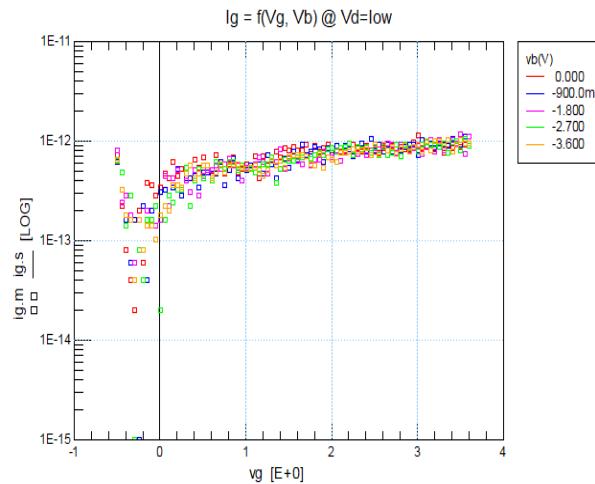
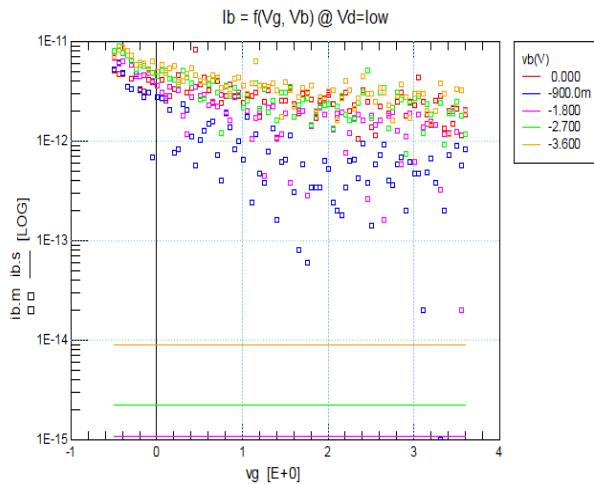


idvd_vth_vbmin, Vb = -3.6V, T = 27°C

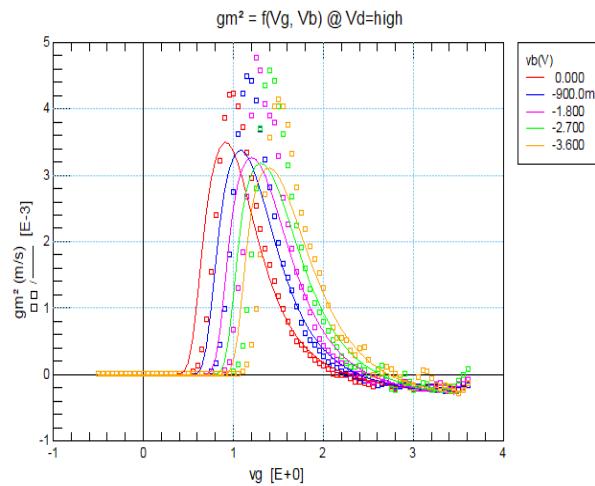
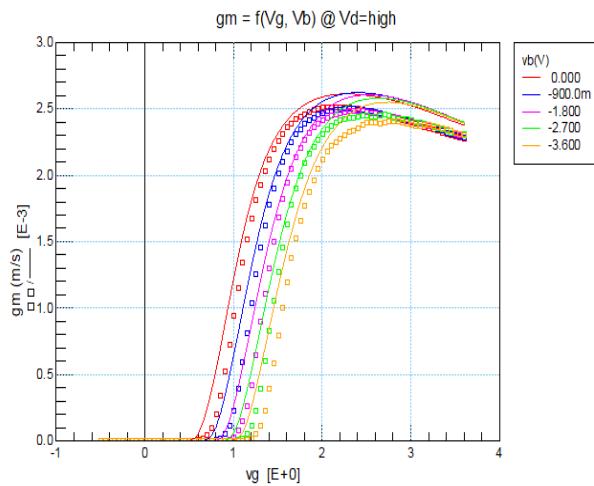
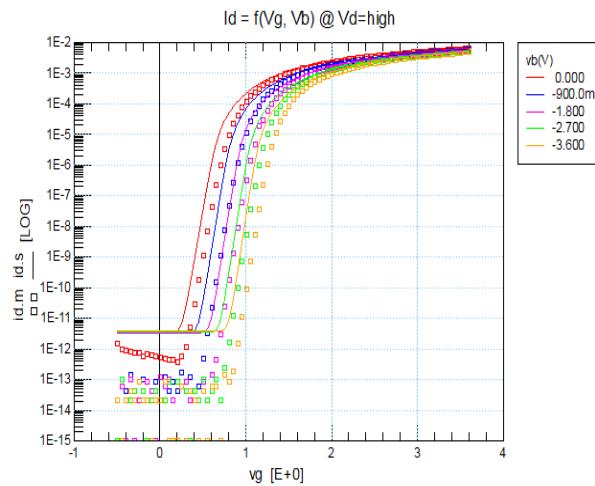
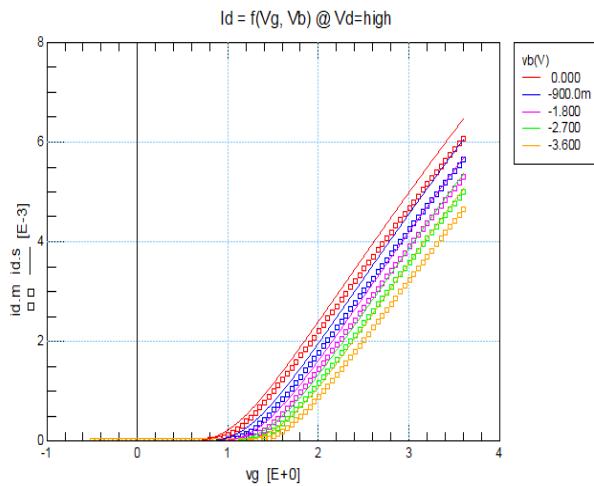


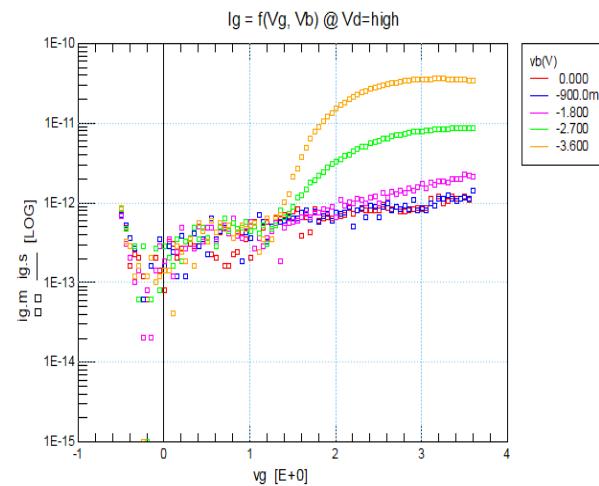
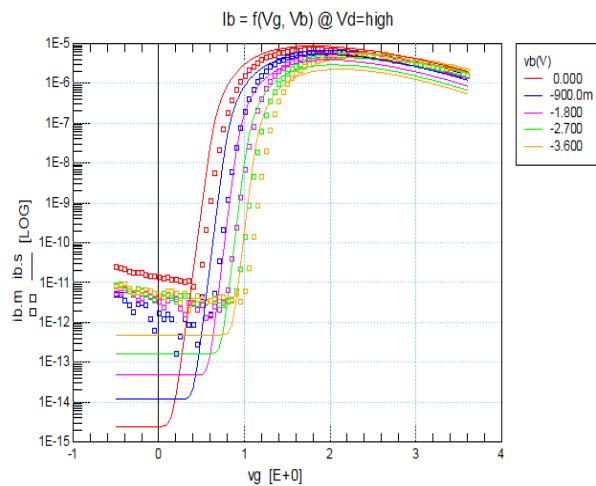
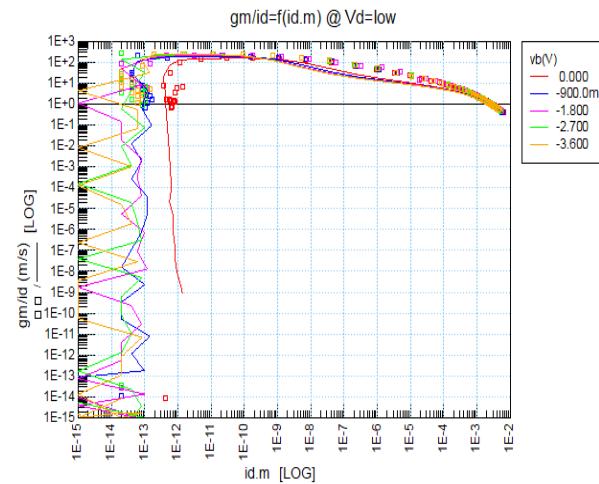
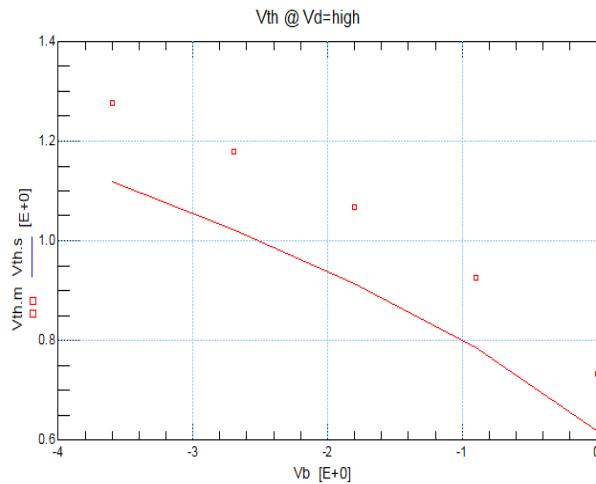
idvg, Vd = 0.1V, T = -40°C



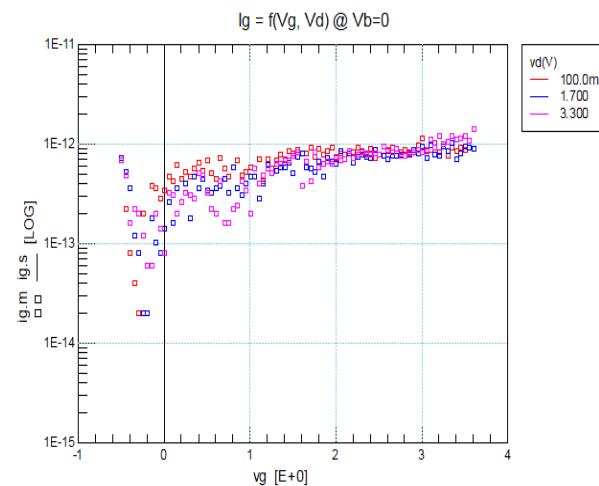
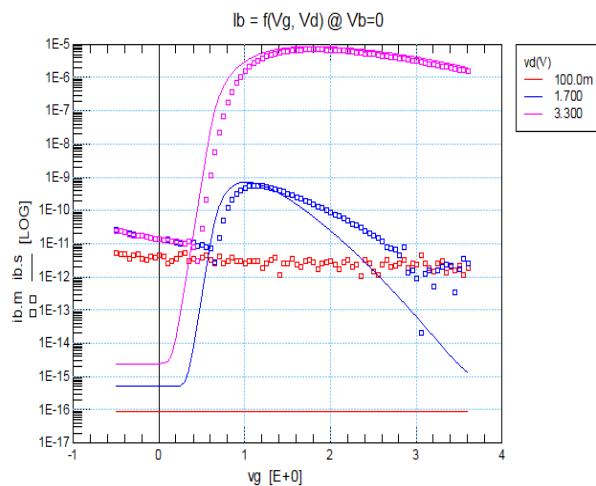


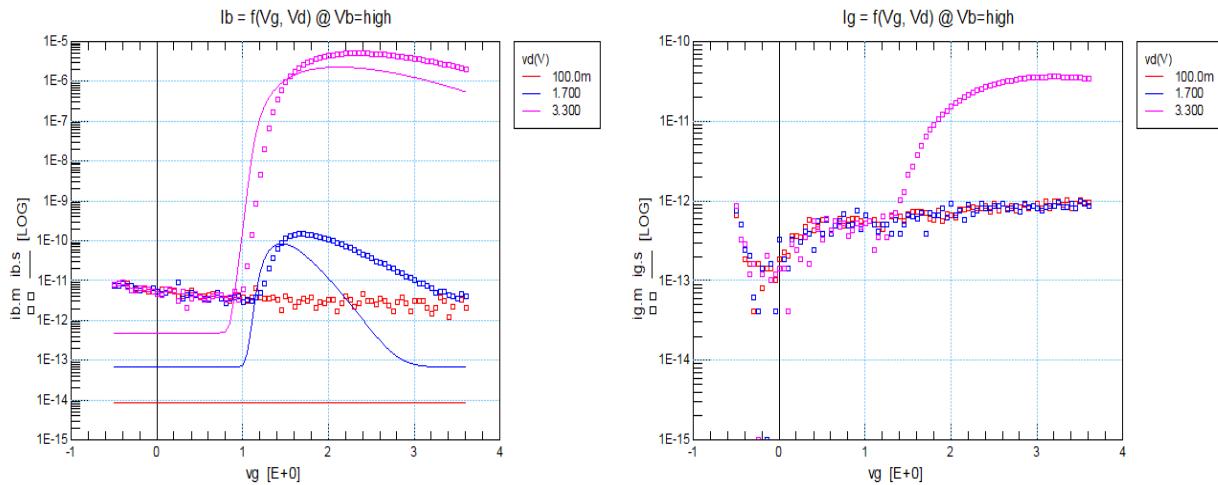
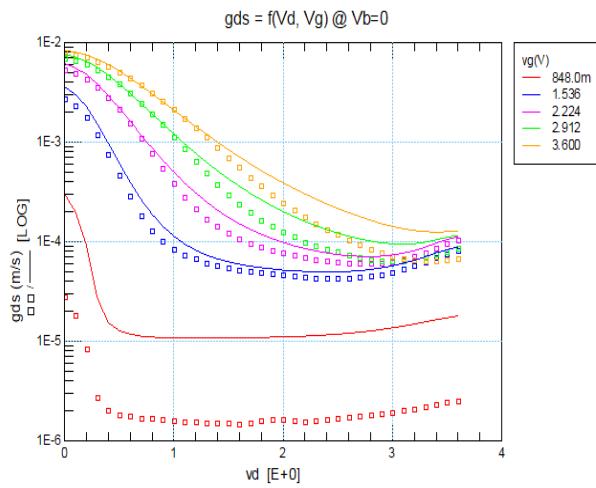
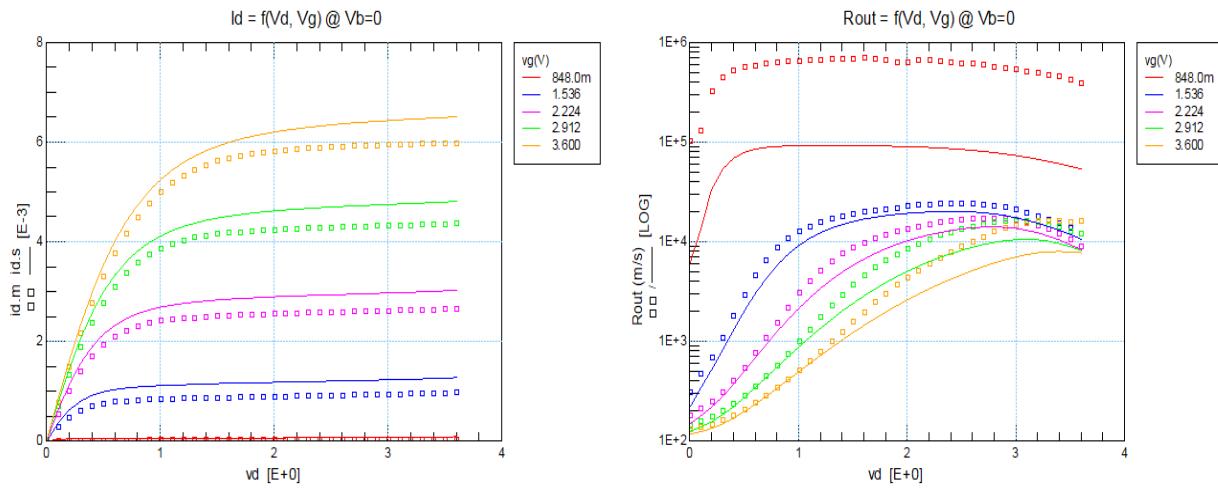
$i_d v_g, V_d = 3.3V, T = -40^\circ C$





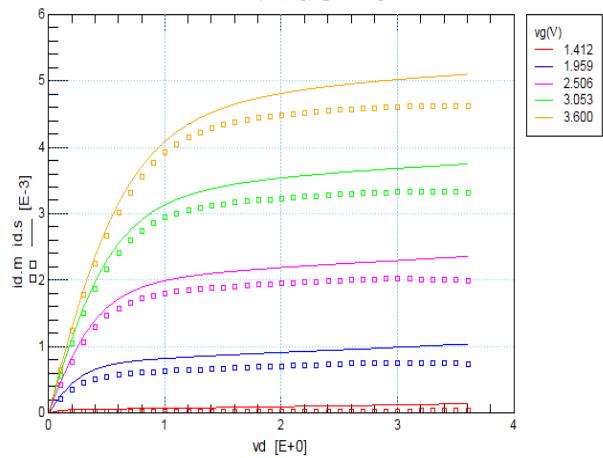
idvg, lb, lg, Vb = 0V, T = -40°C



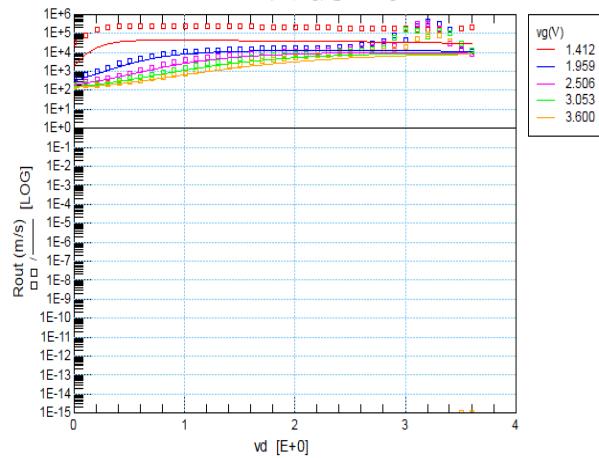
idvg, Ib,Ig, Vb = -3.6V, T = -40°C

idvd, Vb = 0V, T = -40°C


idvd_vbmin, Vb = -3.6V, T = -40°C

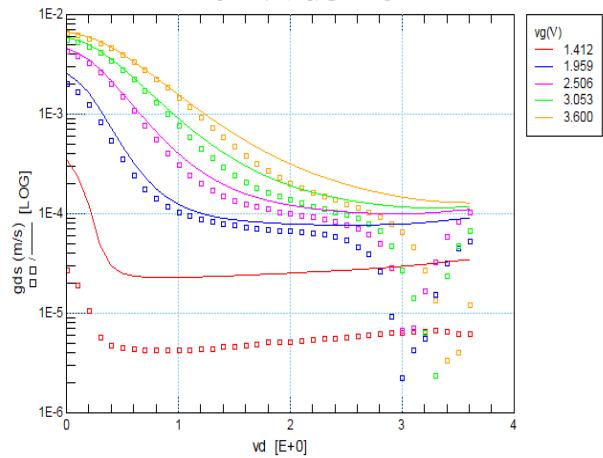
Id = f(Vd, Vg) @ Vb=high



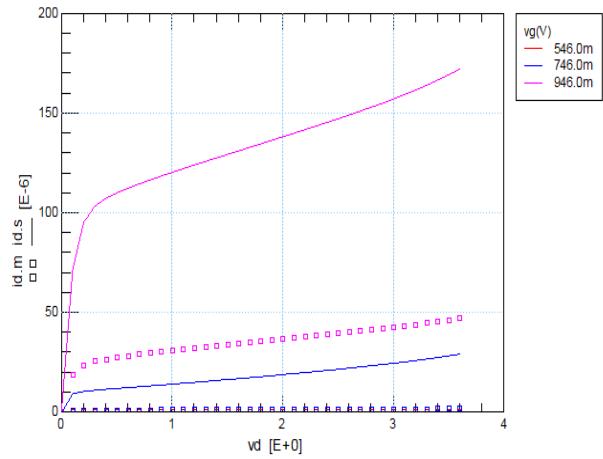
Rout = f(Vd, Vg) @ Vb=high



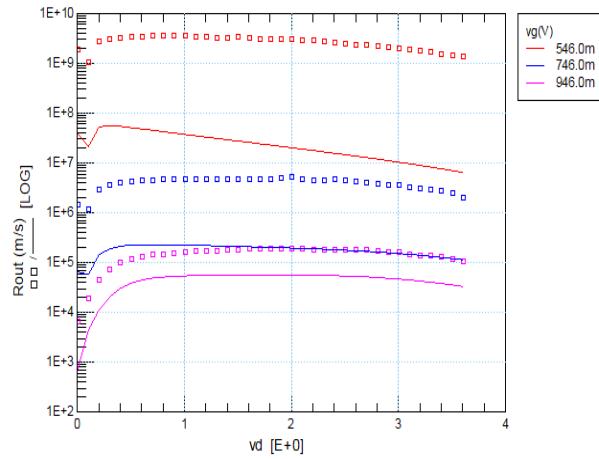
gds = f(Vd, Vg) @ Vb=high

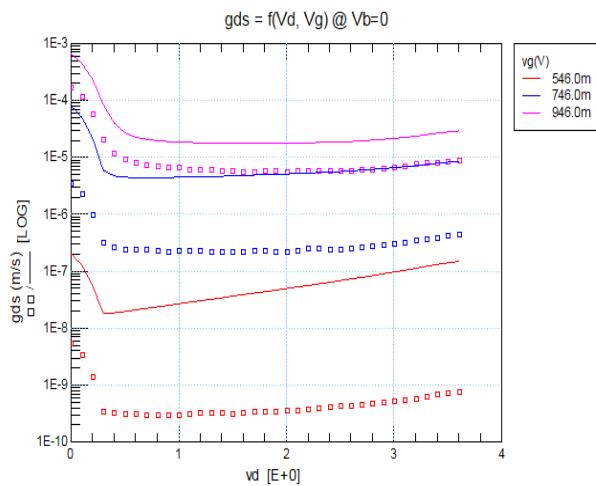
**idvd_vth, Vb = 0V, T = -40°C**

Id = f(Vd, Vg) @ Vb=0

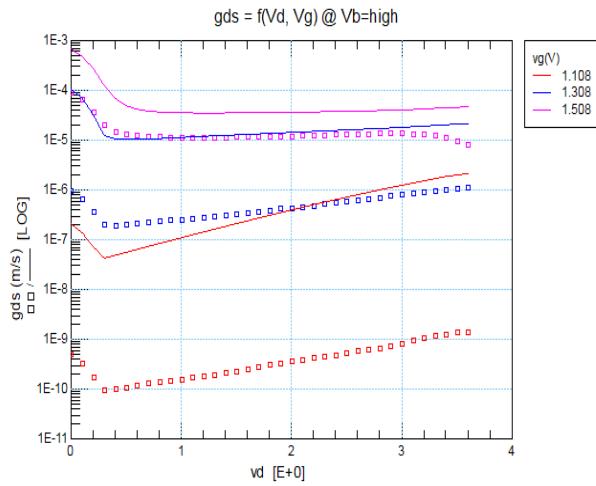
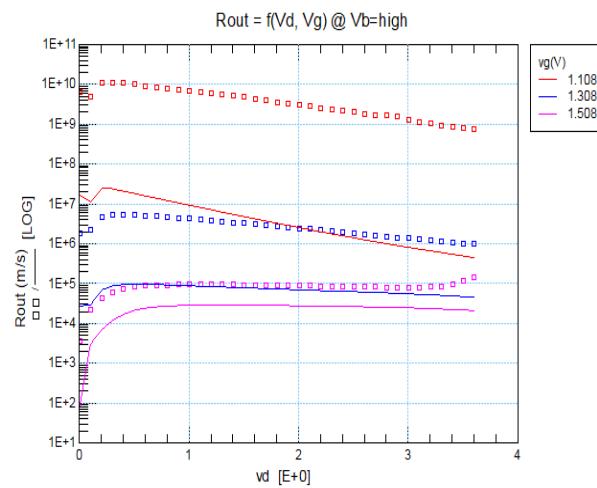
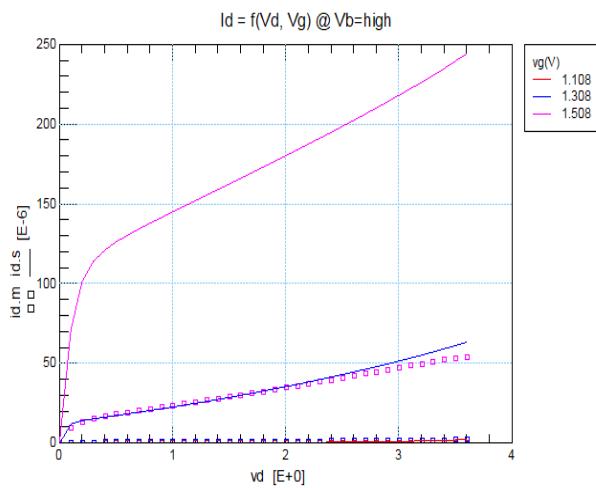


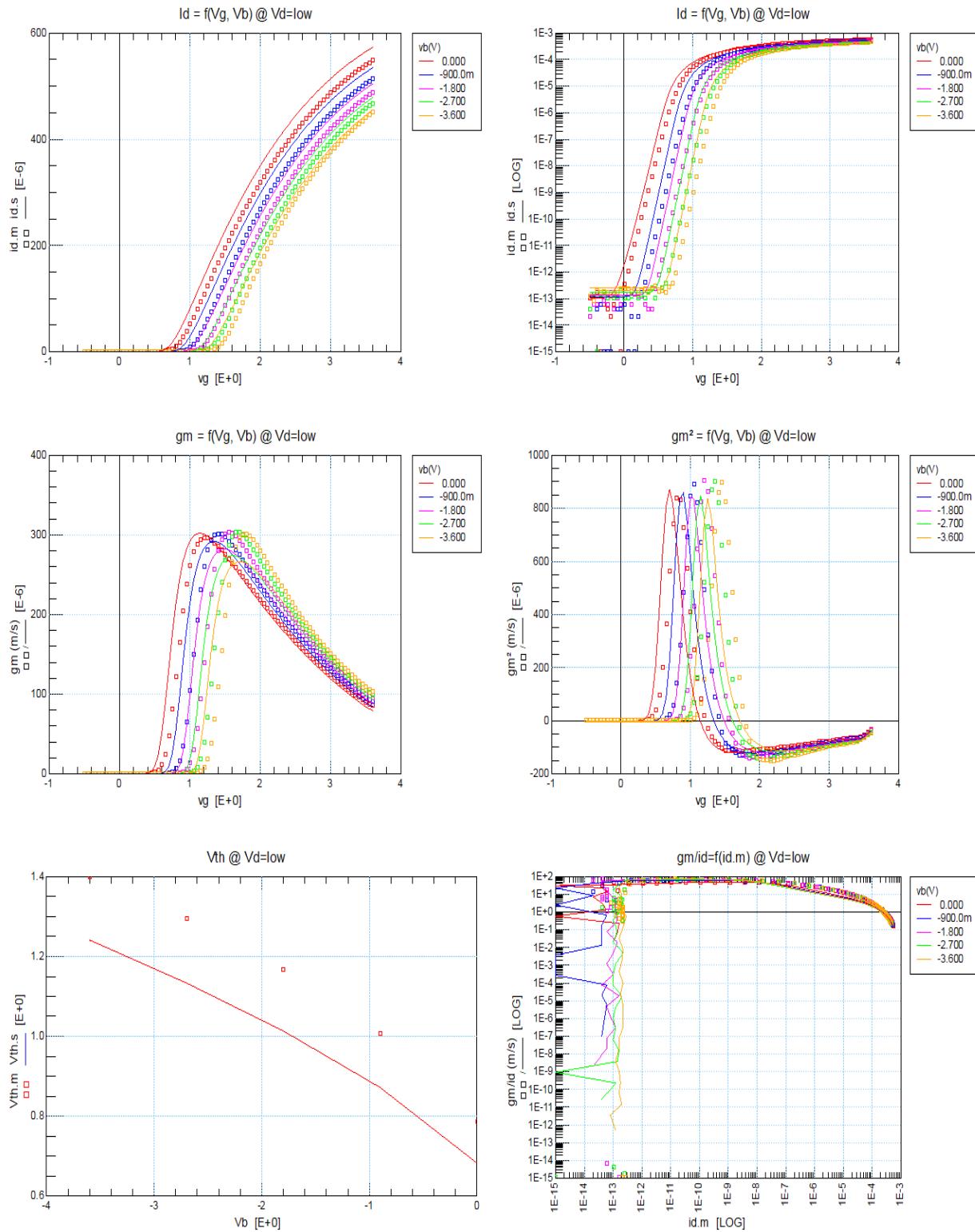
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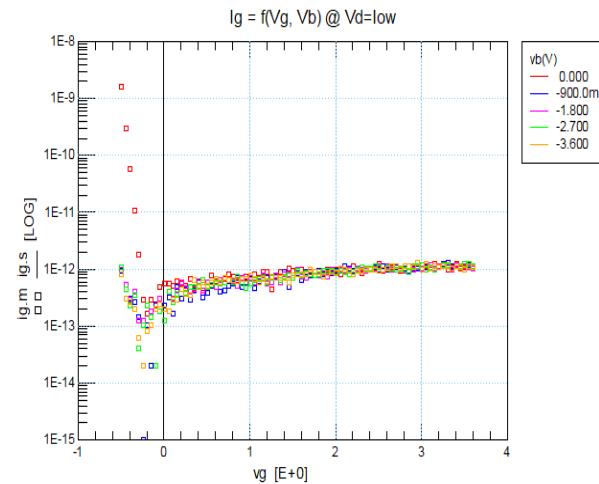
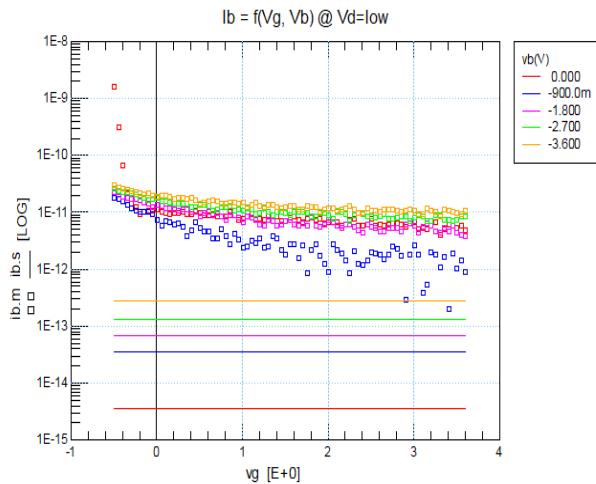




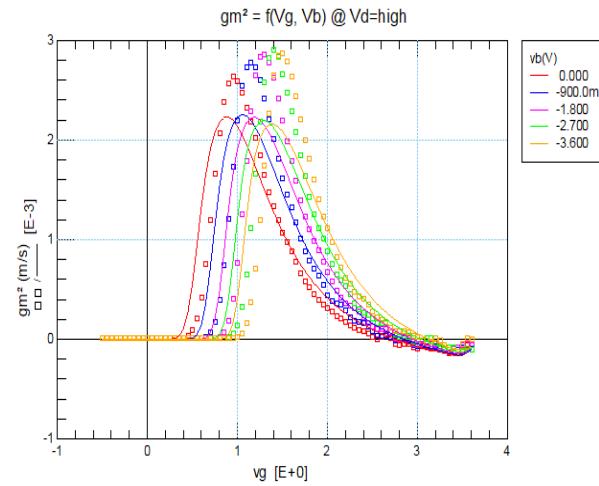
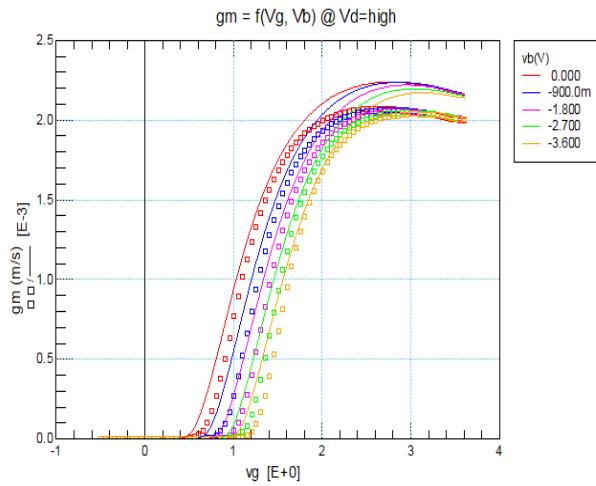
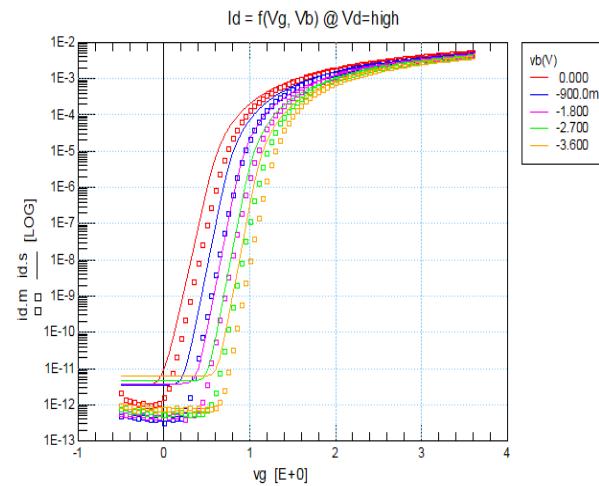
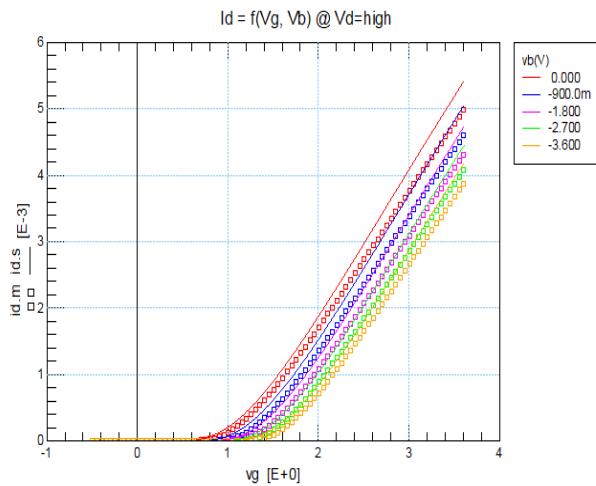
idvd_vth_vbmin, Vb = -3.6V, T = -40°C

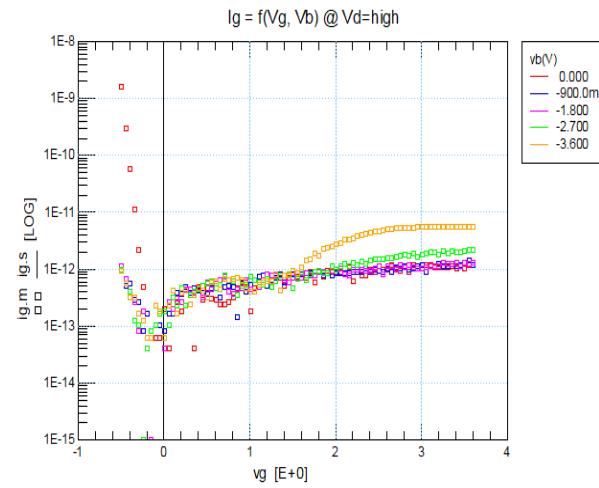
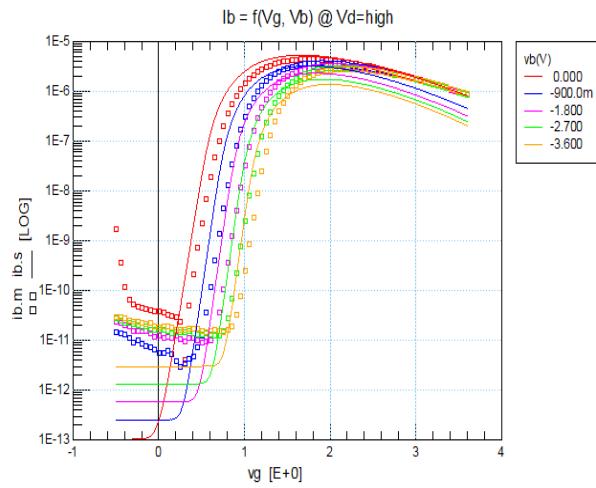
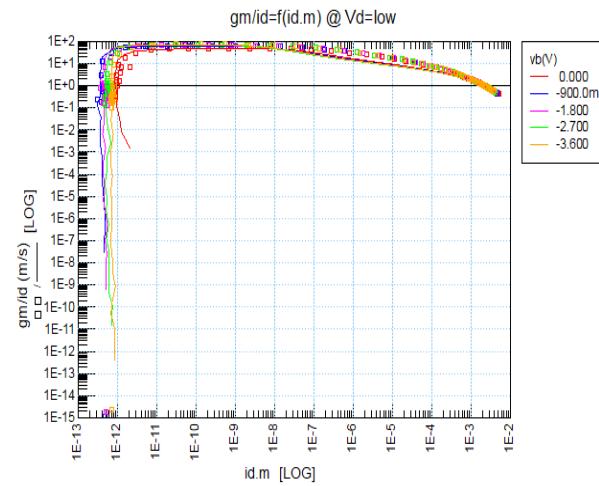
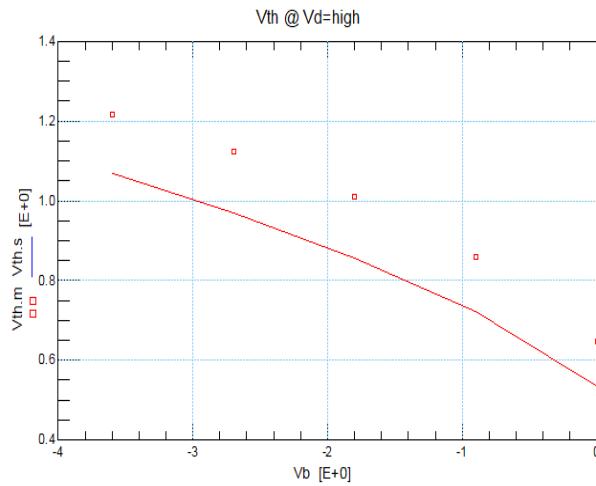


idvg, Vd = 0.1V, T = 70°C


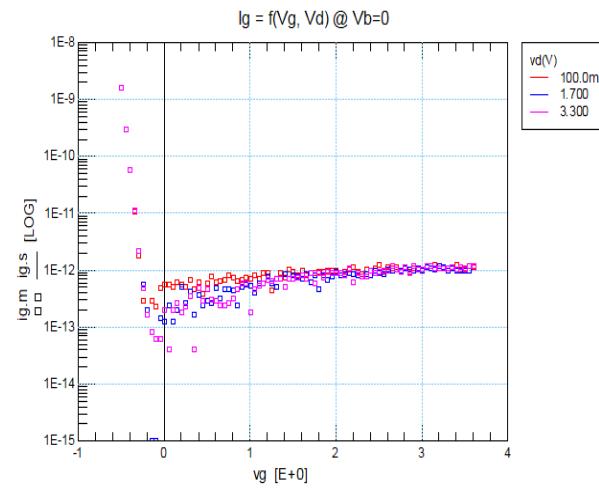
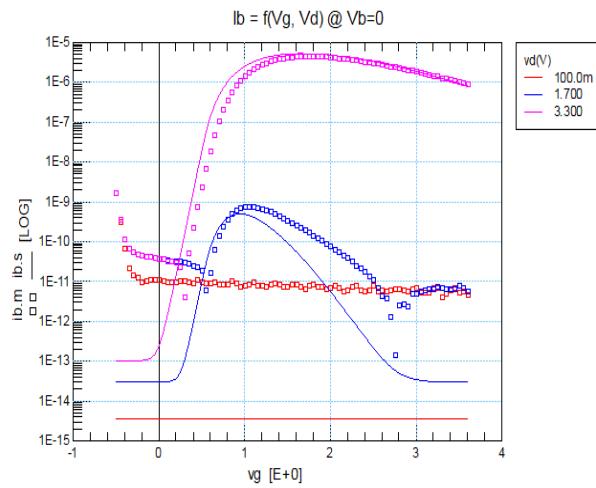


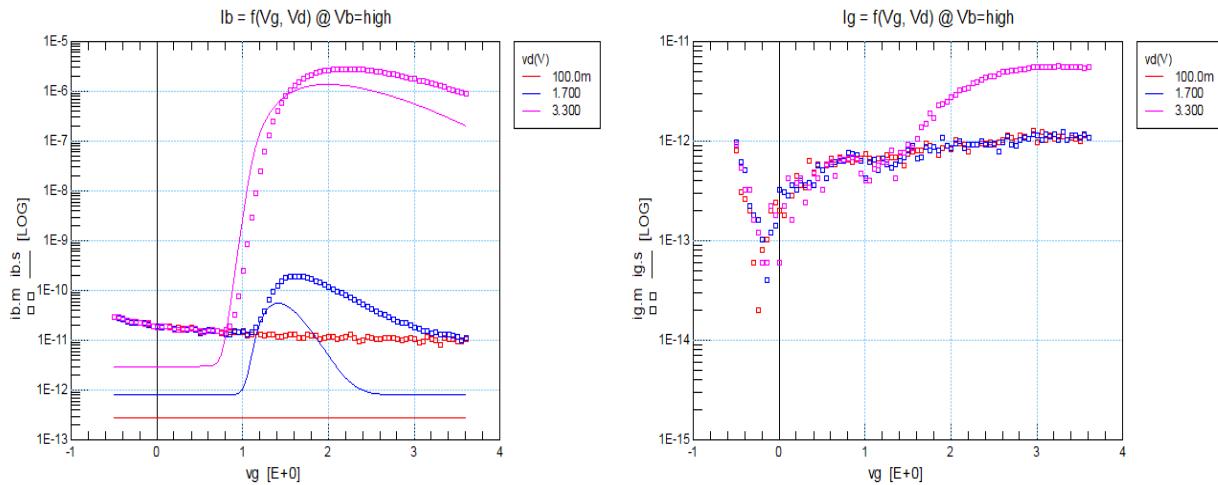
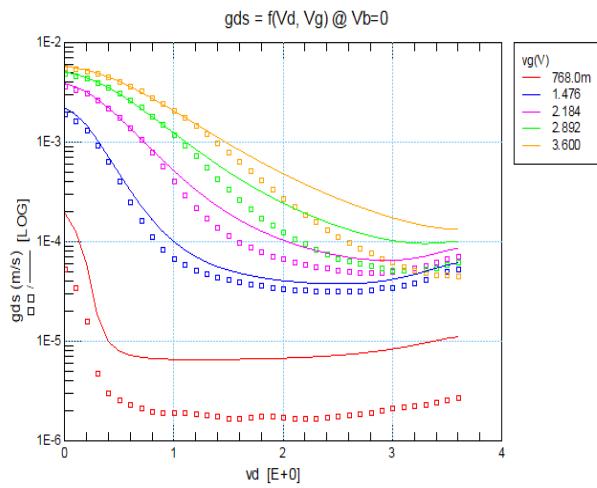
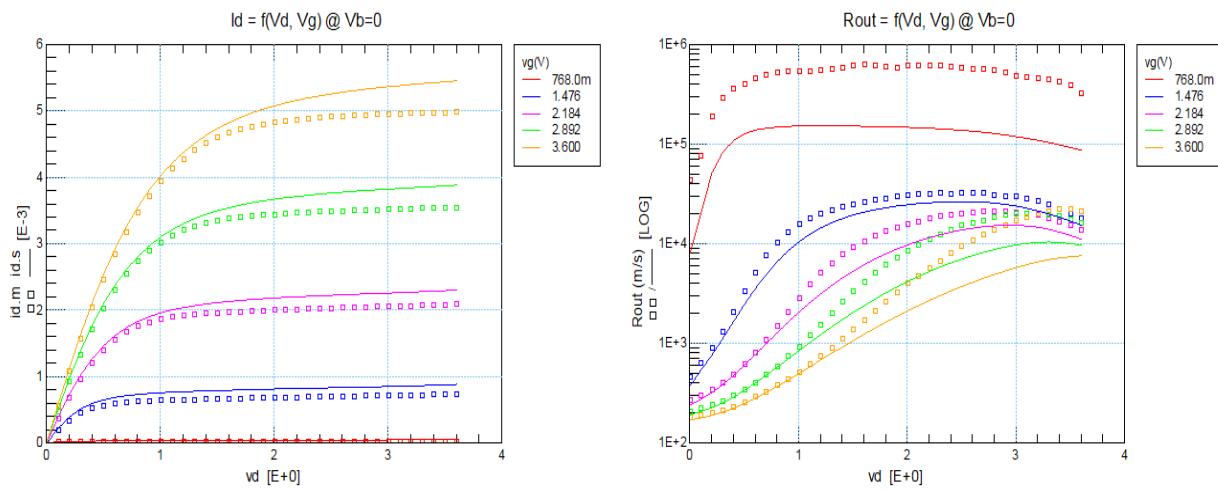
$i_{dvg}, V_d = 3.3V, T = 70^\circ\text{C}$

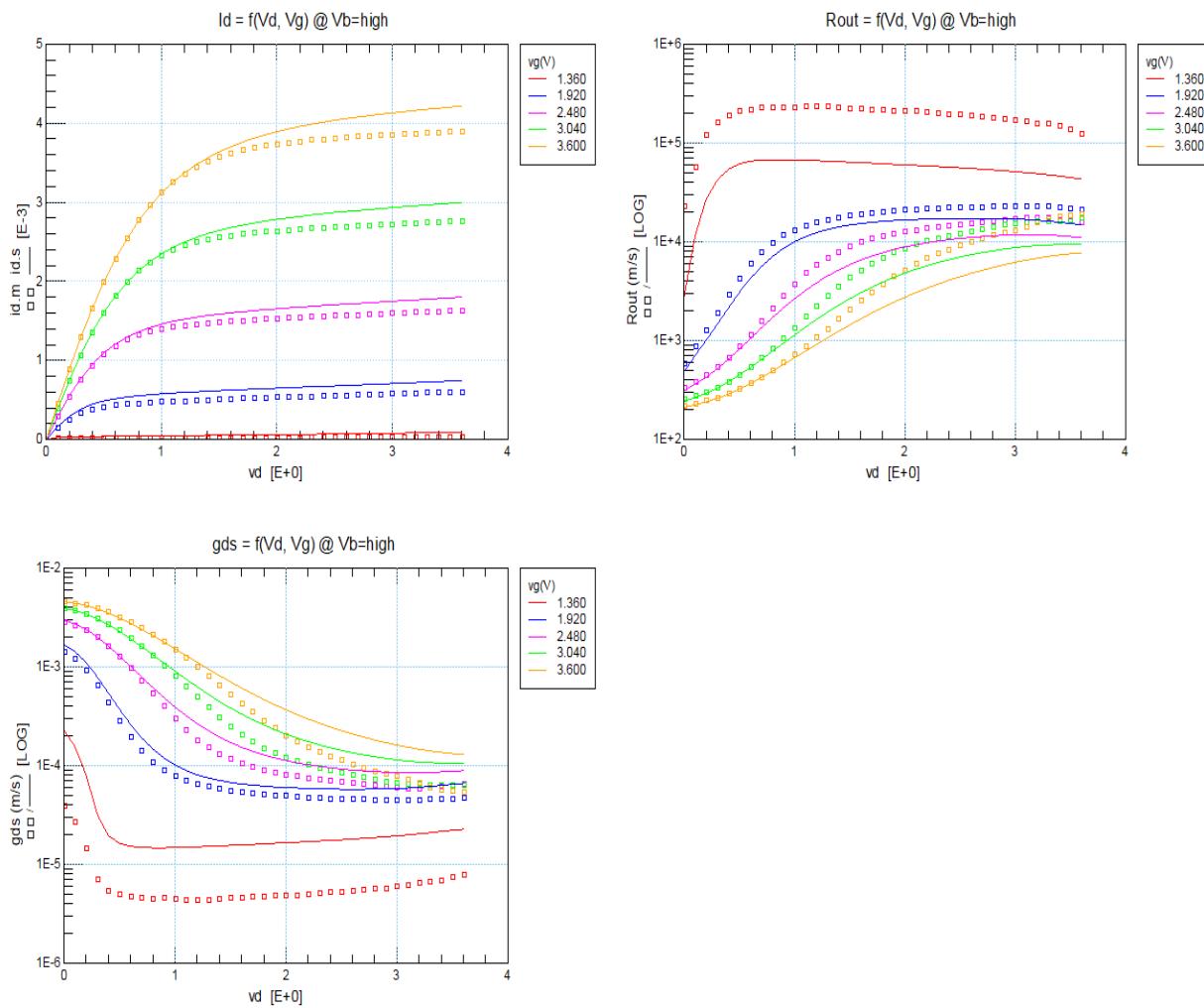
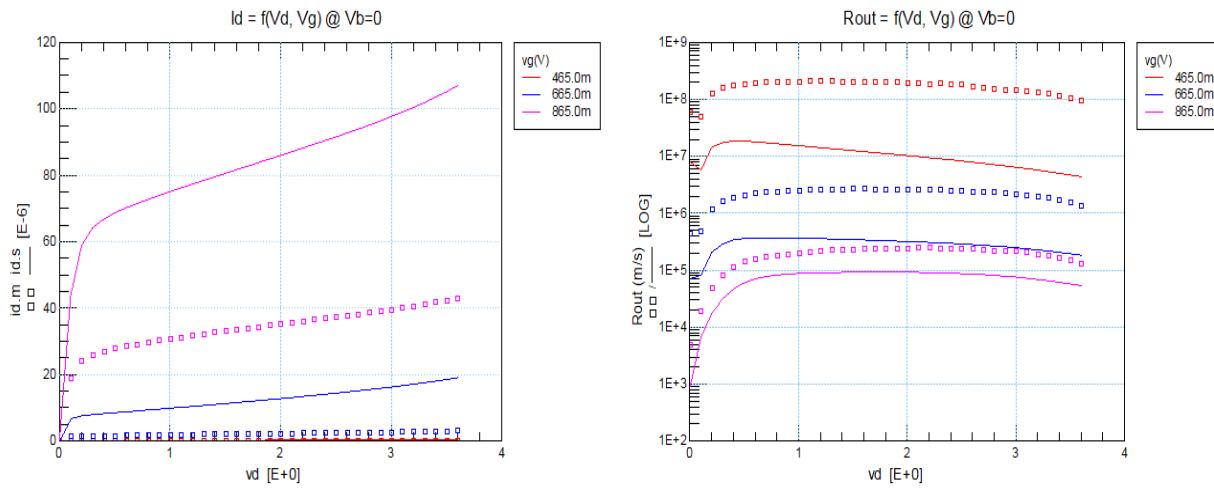


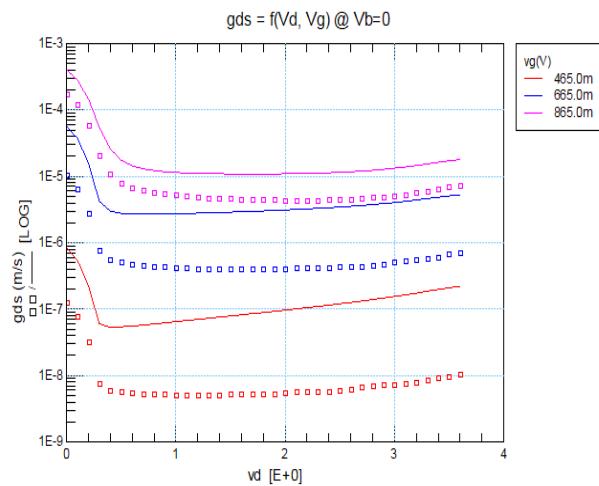


idvg, lb, lg, Vb = 0V, T = 70°C

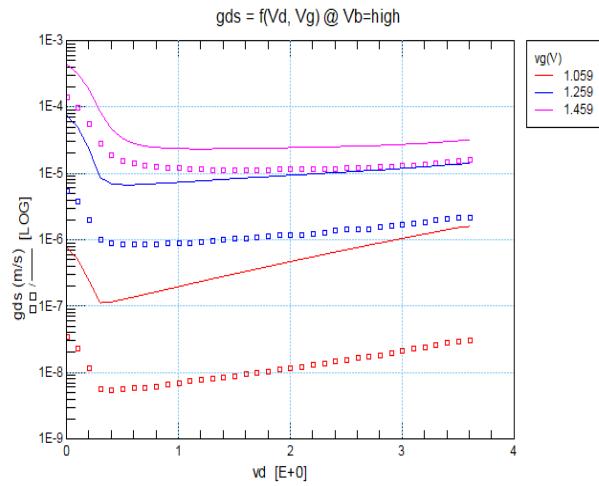
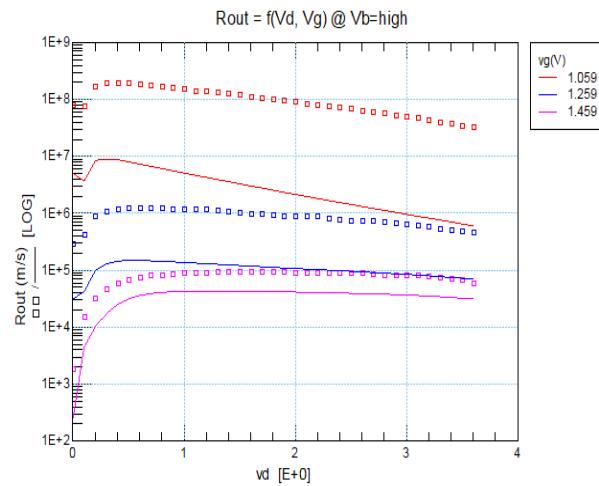
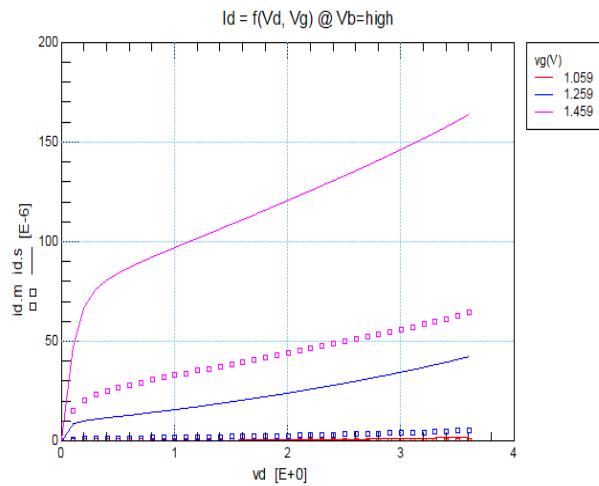


idvg, Ib,Ig, Vb = -3.6V, T = 70°C

idvd, Vb = 0V, T = 70°C


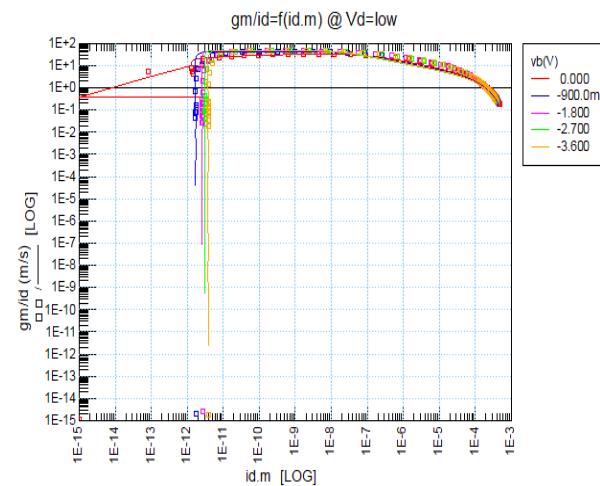
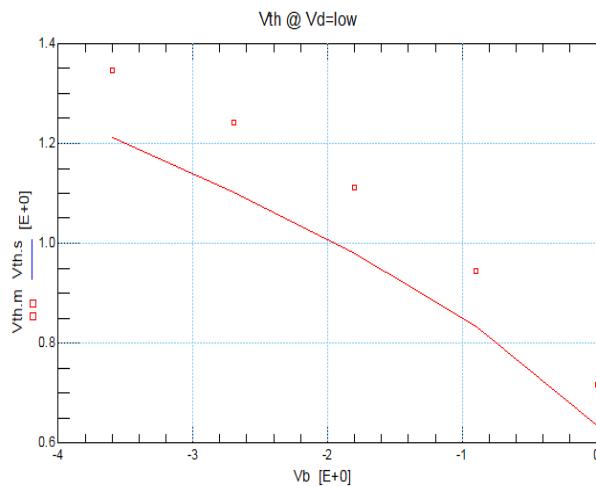
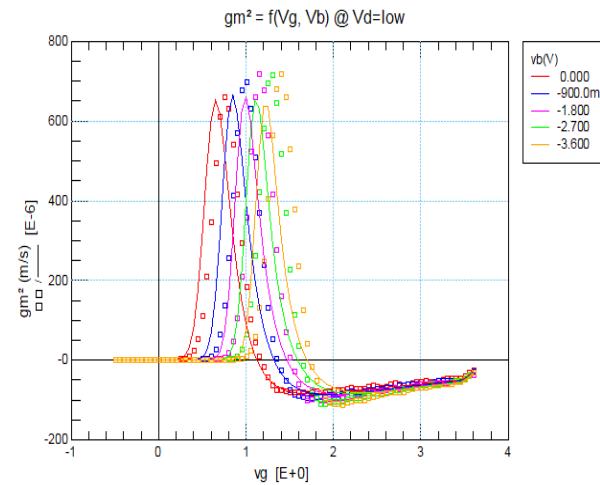
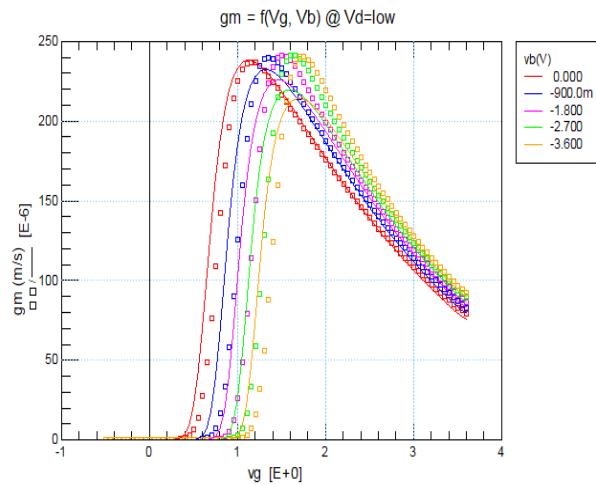
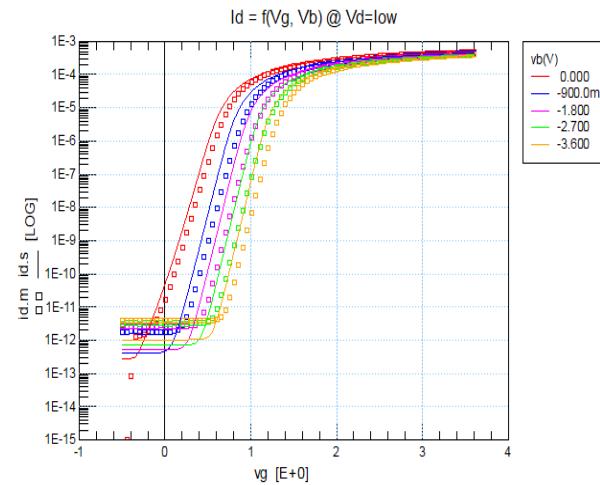
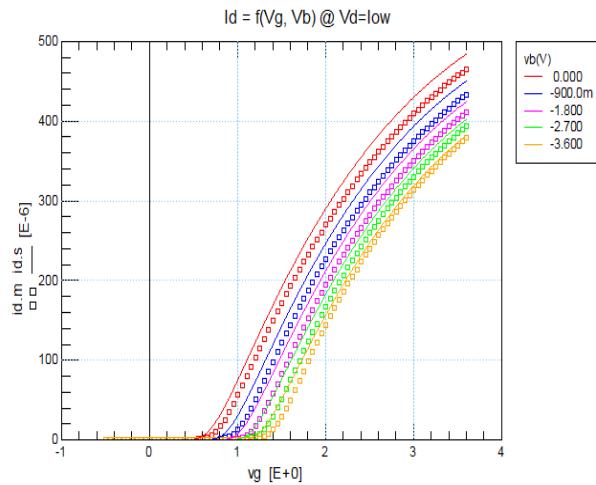
idvd_vbmin, Vb = -3.6V, T = 70°C**idvd_vth, Vb = 0V, T = 70°C**

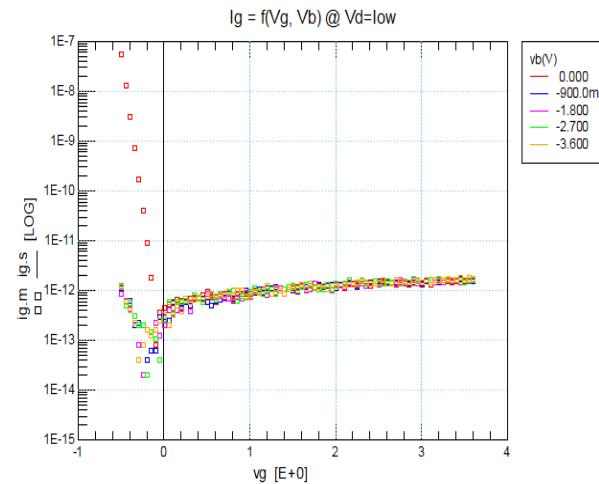
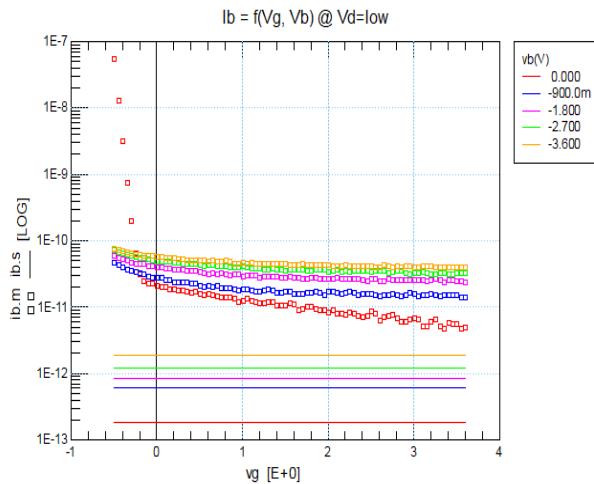


idvd_vth_vbmin, Vb = -3.6V, T = 70°C

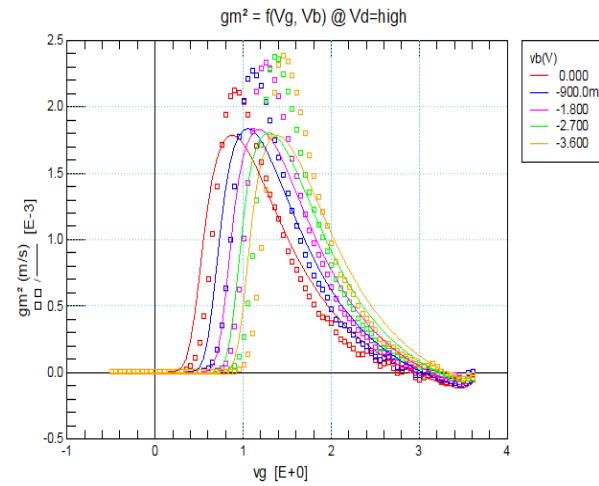
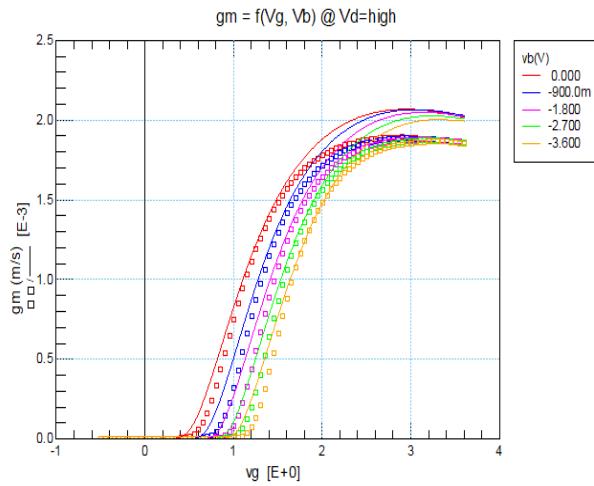
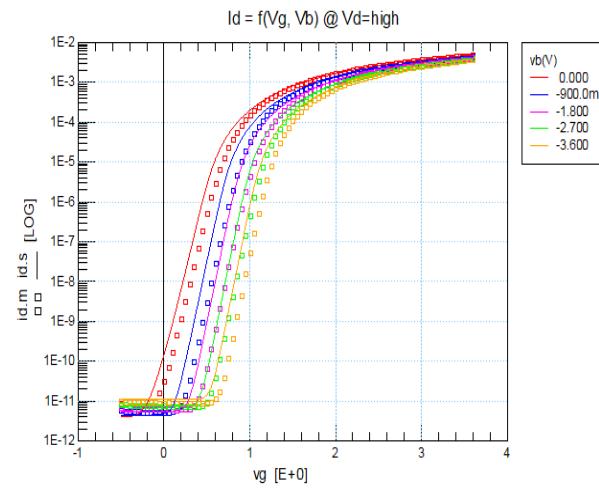
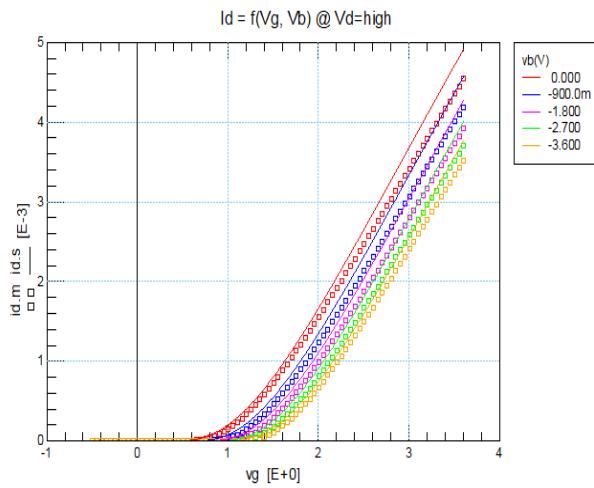


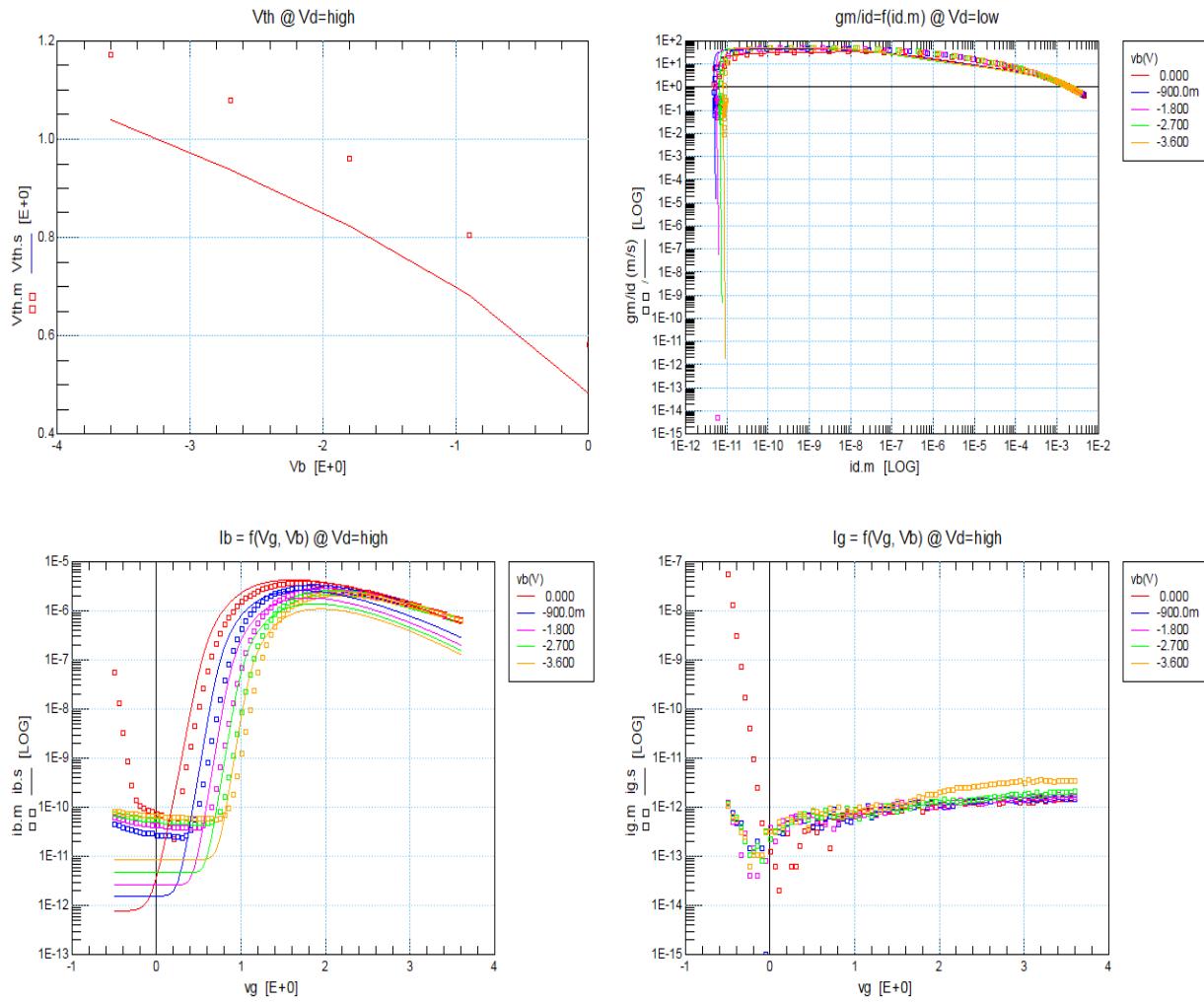
idvg, Vd = 0.1V, T = 125°C



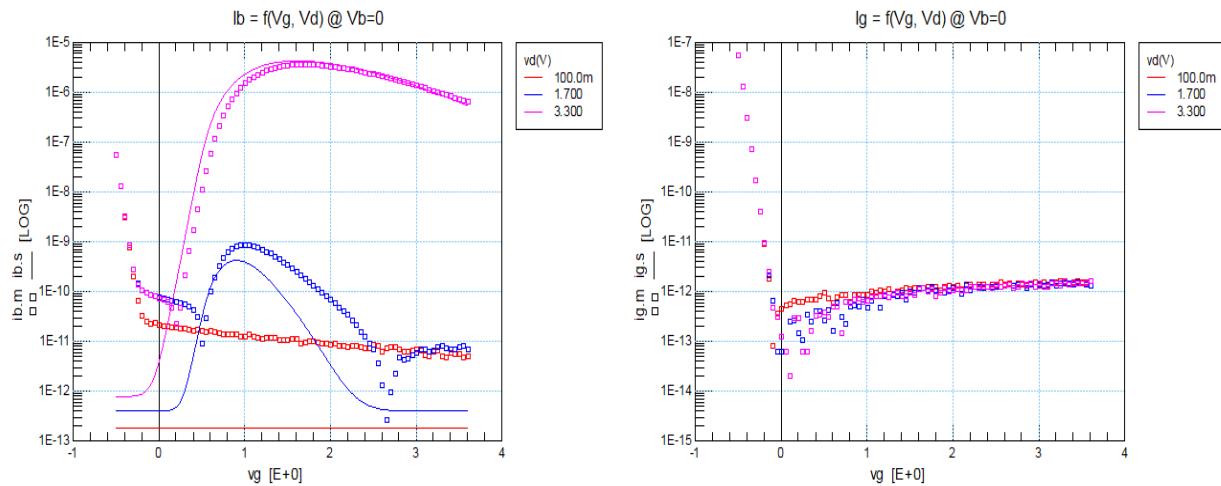


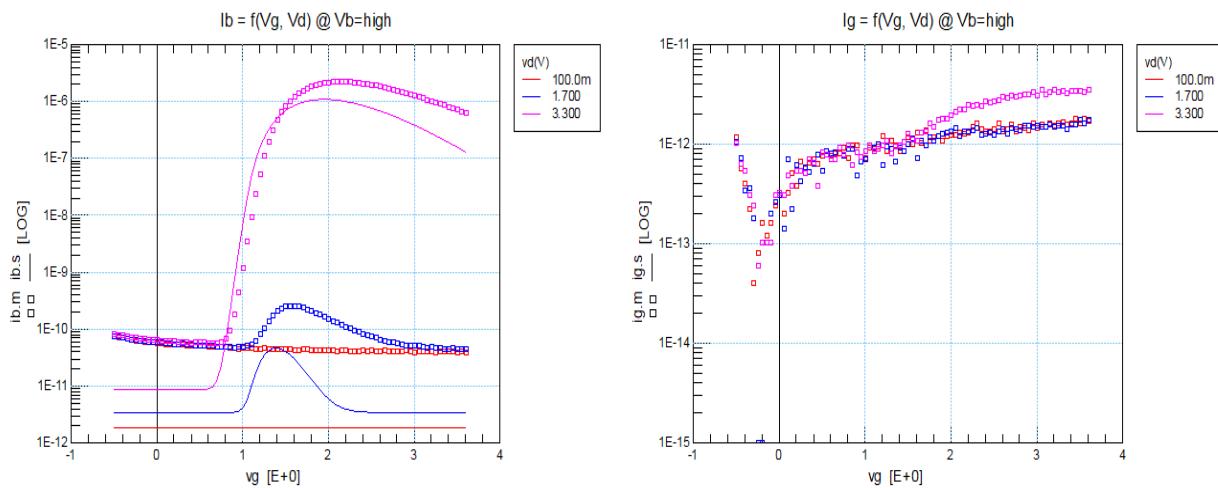
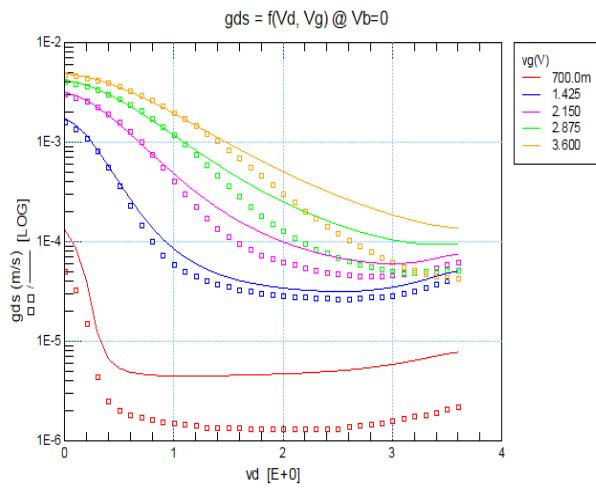
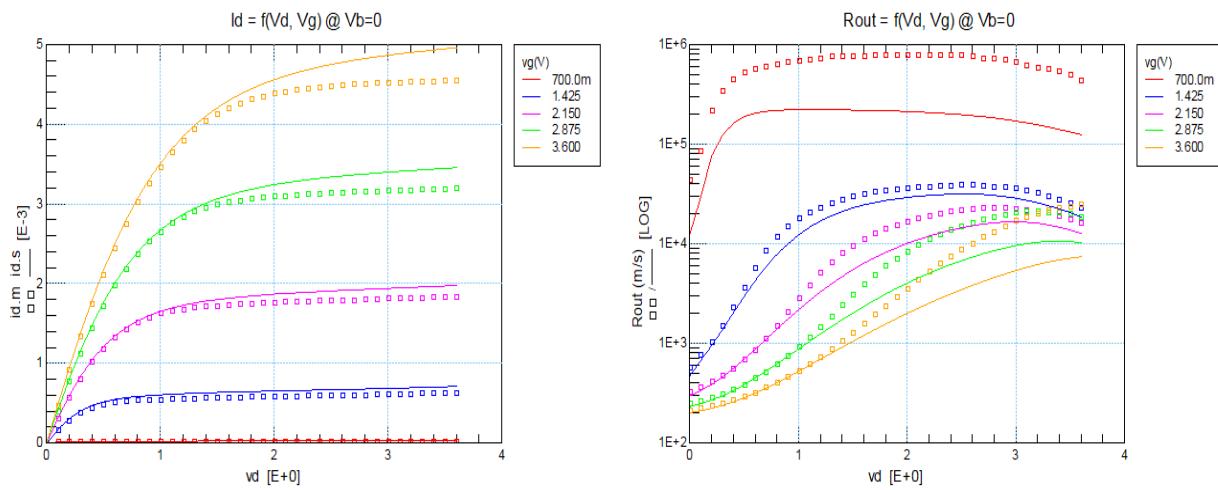
$i_d v_g, V_d = 3.3V, T = 125^\circ C$

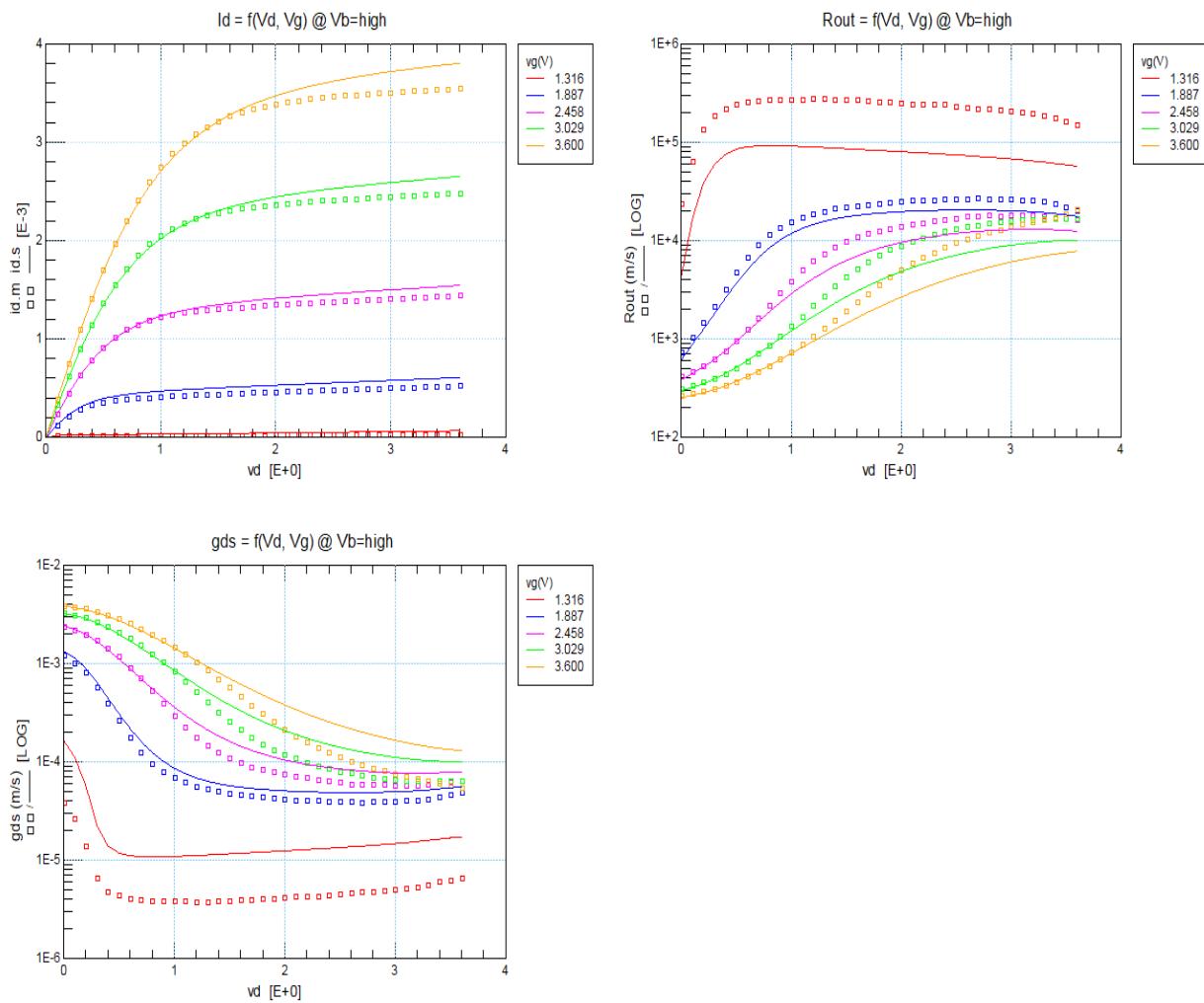
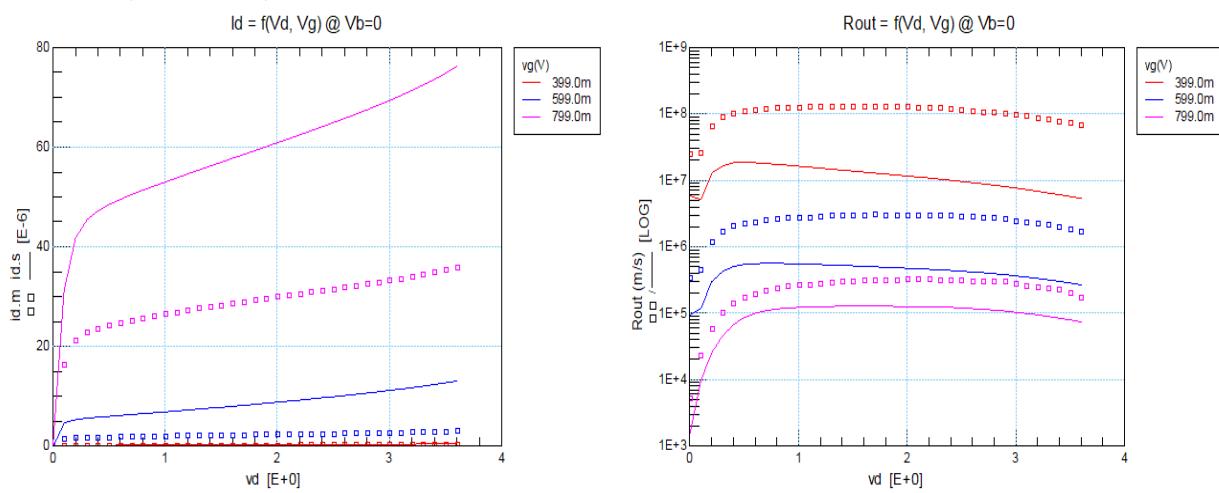


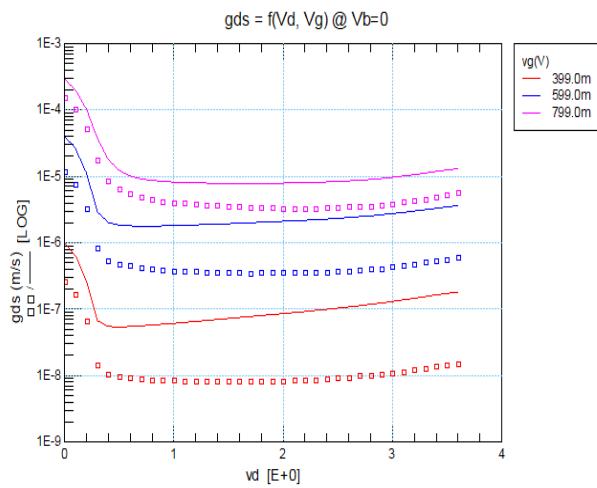


idvg, Ib, Ig, Vb = 0V, T = 125°C

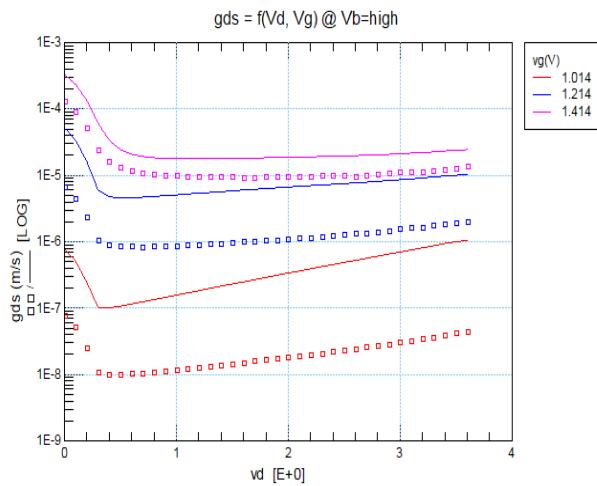
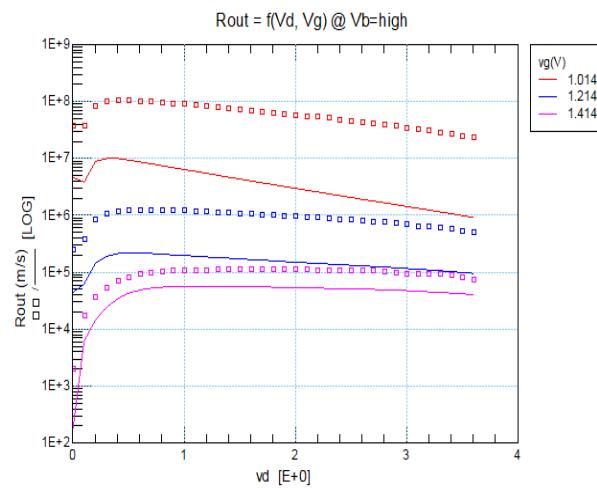
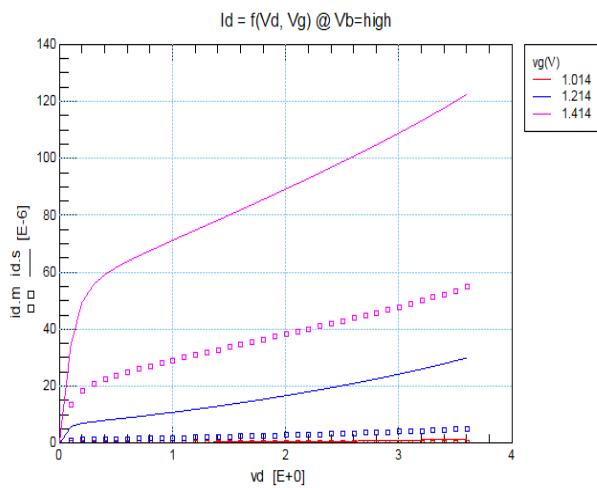


idvg, Ib,Ig, Vb = -3.6V, T = 125°C

idvd, Vb = 0V, T = 125°C


idvd_vbmin, Vb = -3.6V, T = 125°C**idvd_vth, Vb = 0V, T = 125°C**

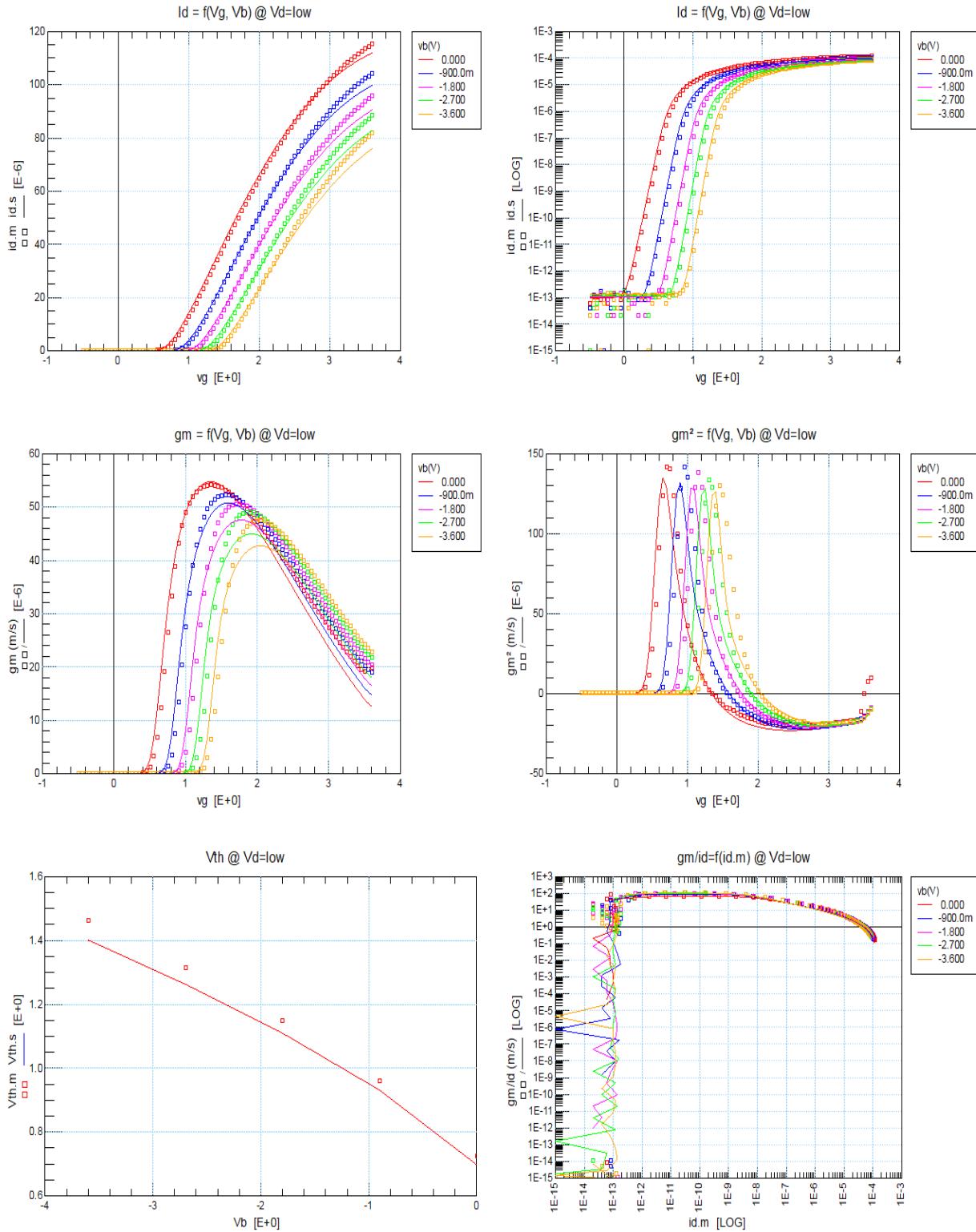


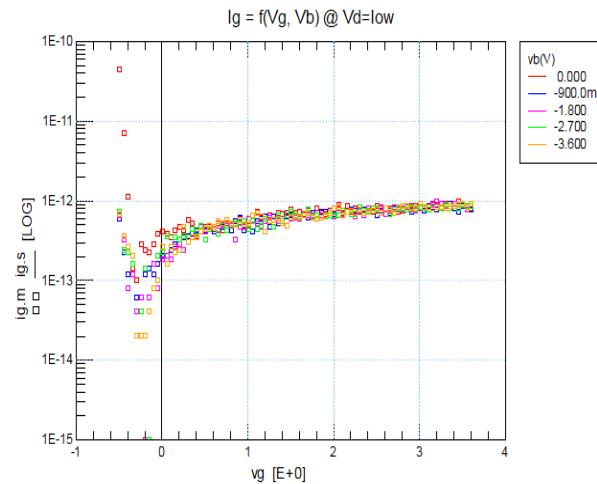
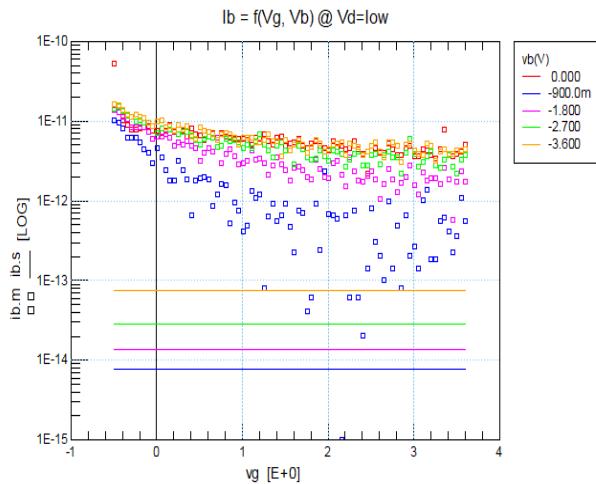
idvd_vth_vbmin, Vb = -3.6V, T = 125°C



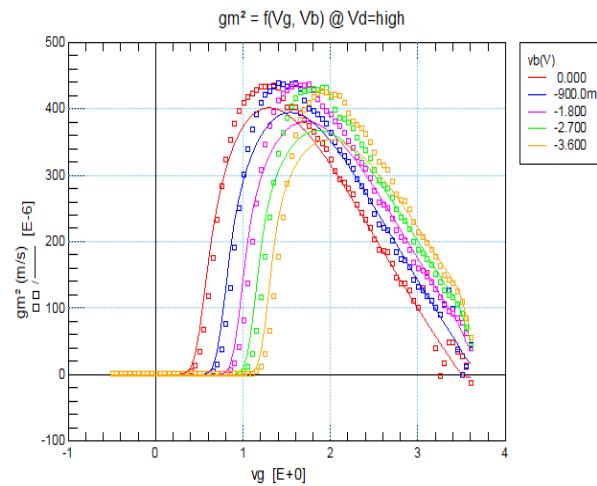
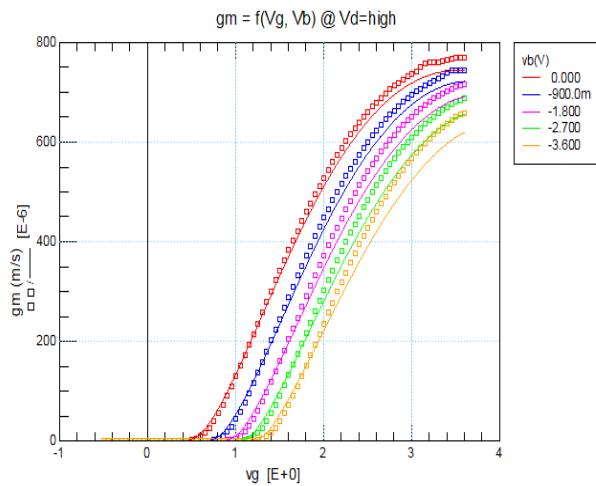
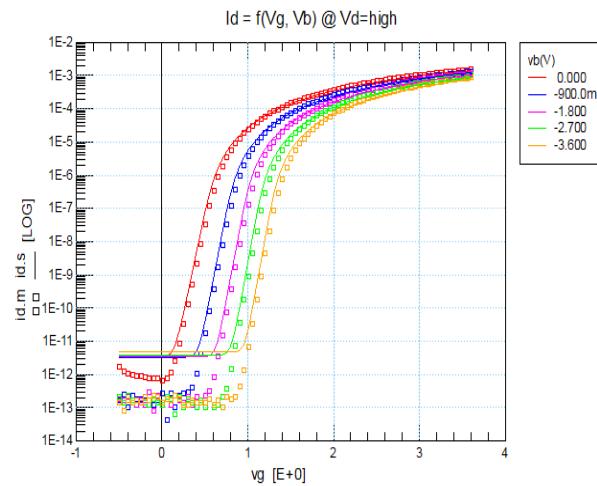
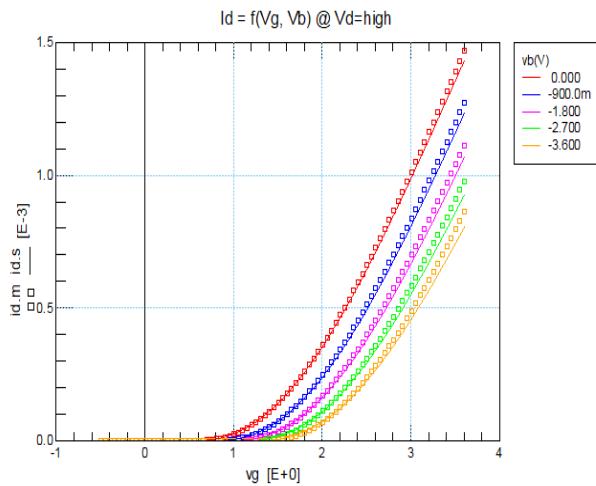
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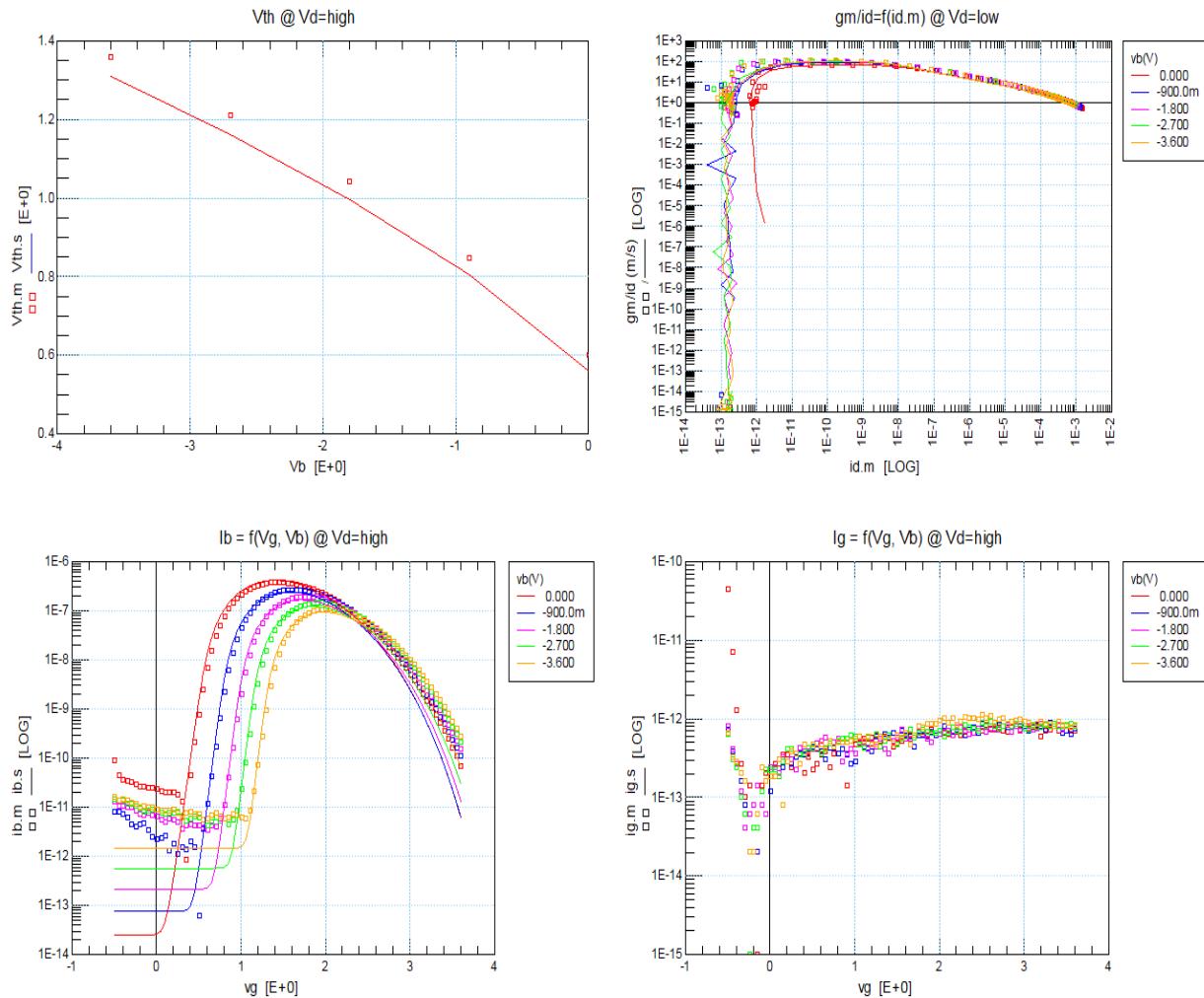
$idvg, Vd = 0.1V, T = 27^\circ C$



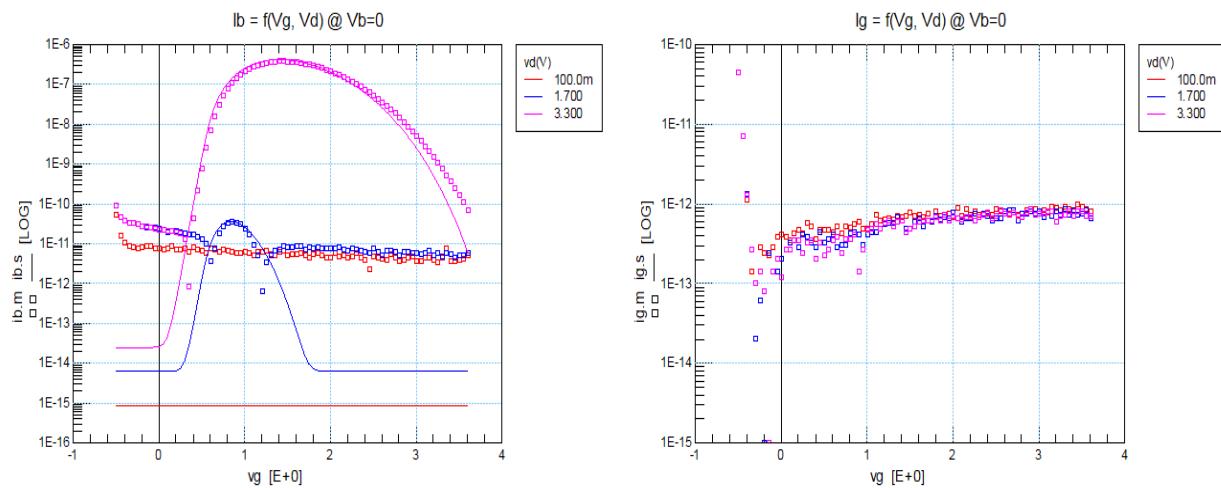


$i_{dvg}, V_d = 3.3V, T = 27^\circ C$

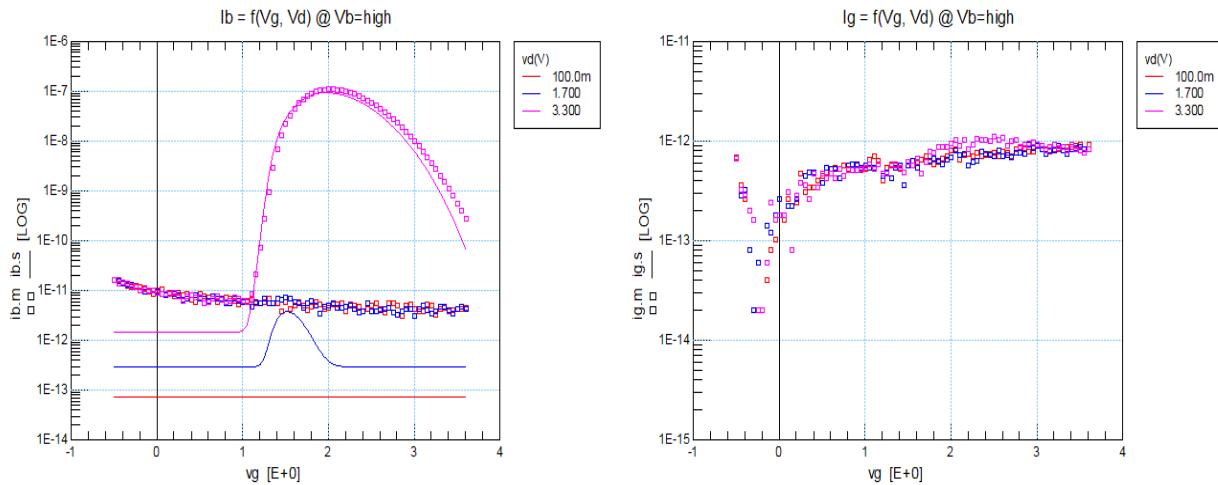




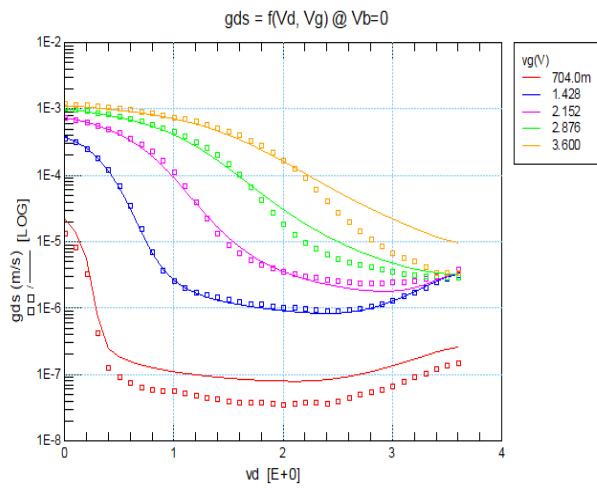
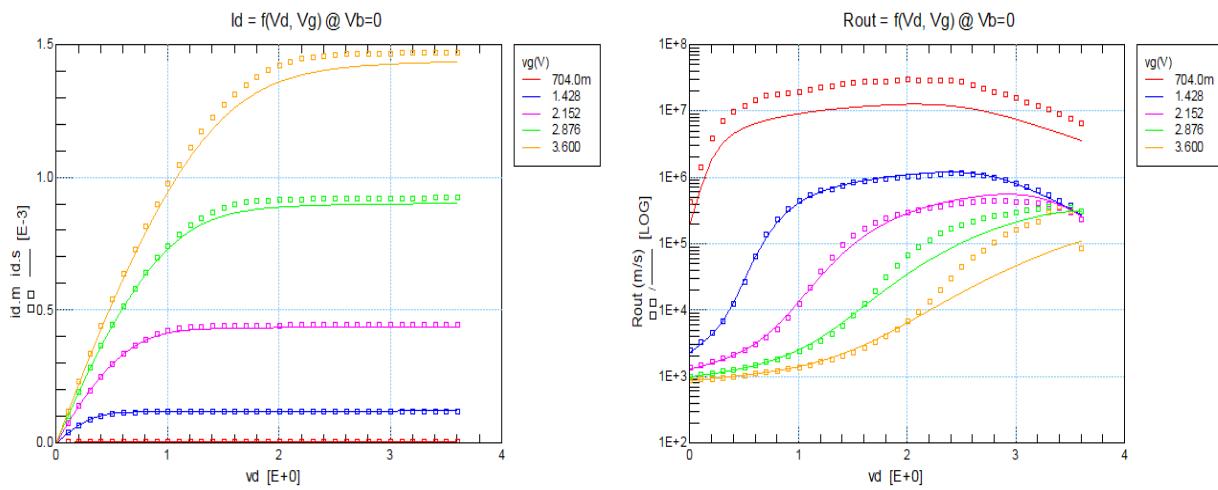
idvg, Ib, Ig, Vb = 0V, T = 27°C

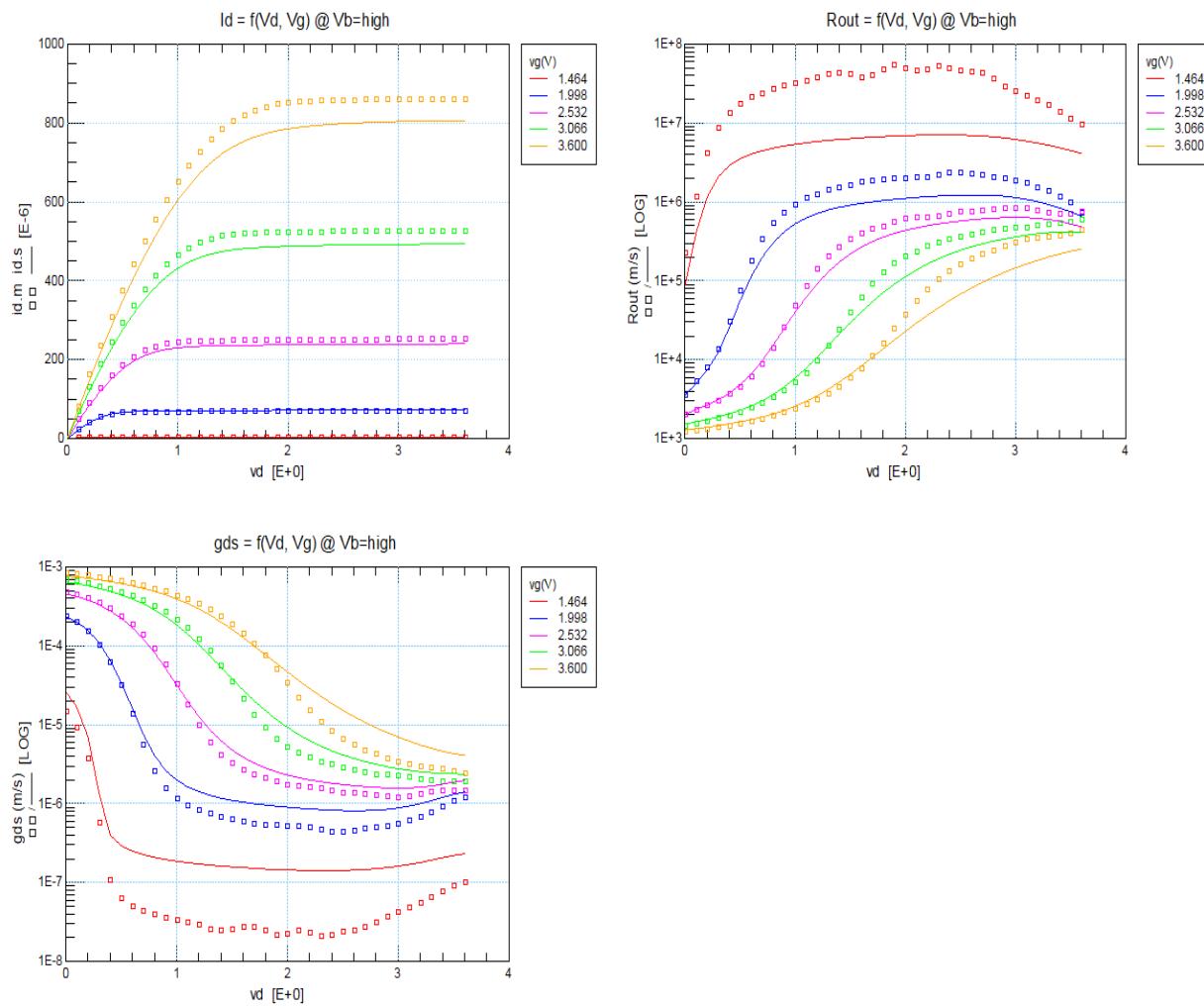
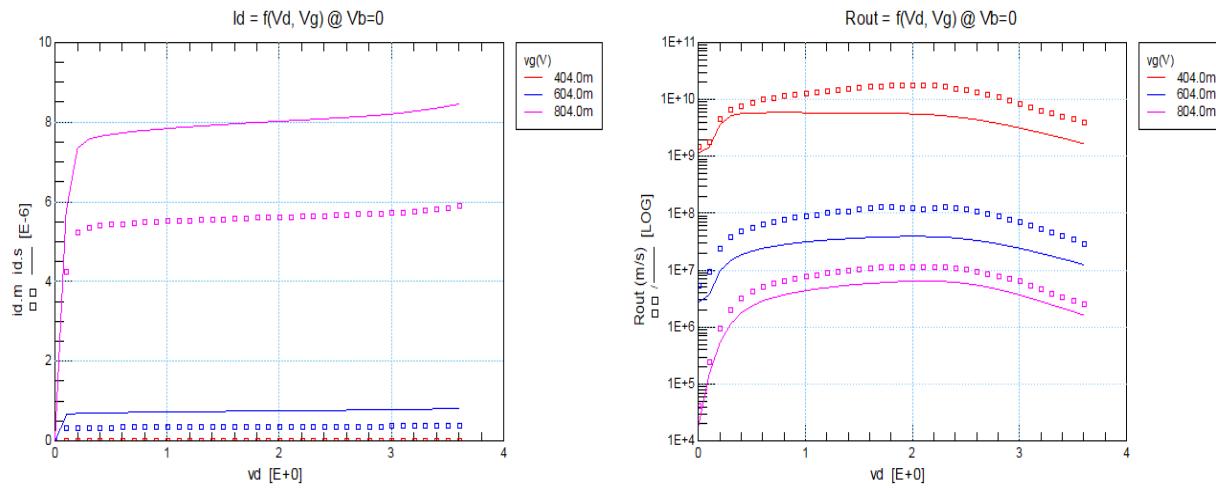


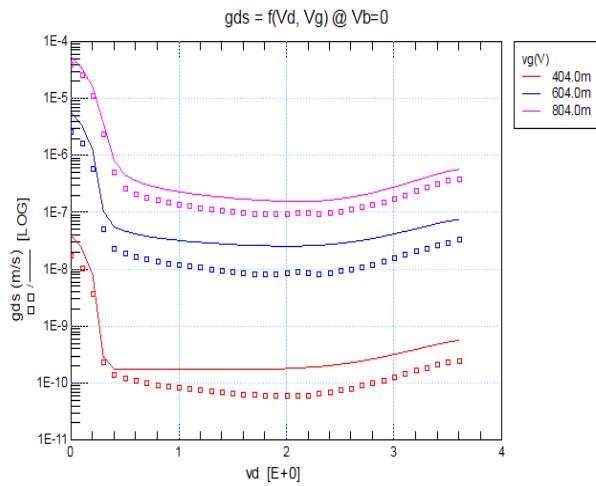
idvg, Ib,Ig, Vb = -3.6V, T = 27°C



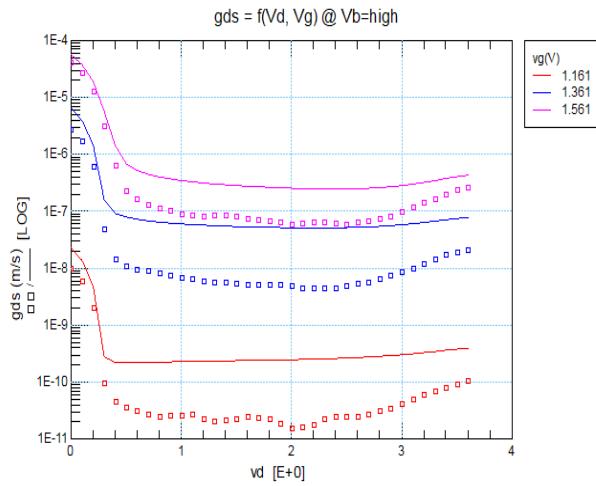
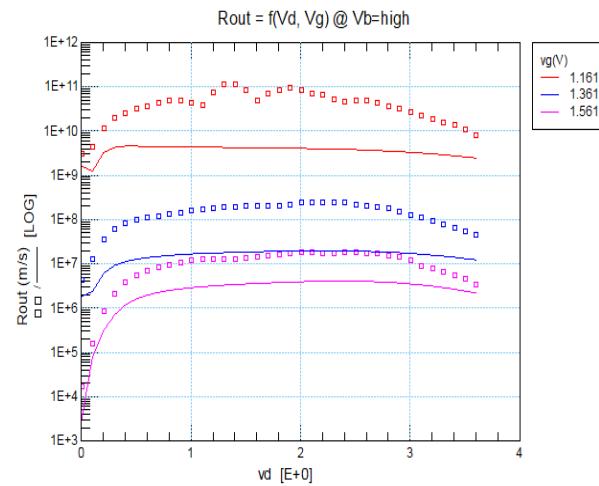
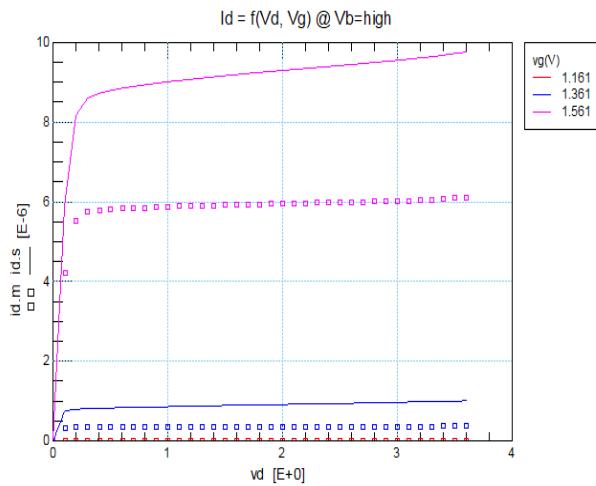
idvd, Vb = 0V, T = 27°C



idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


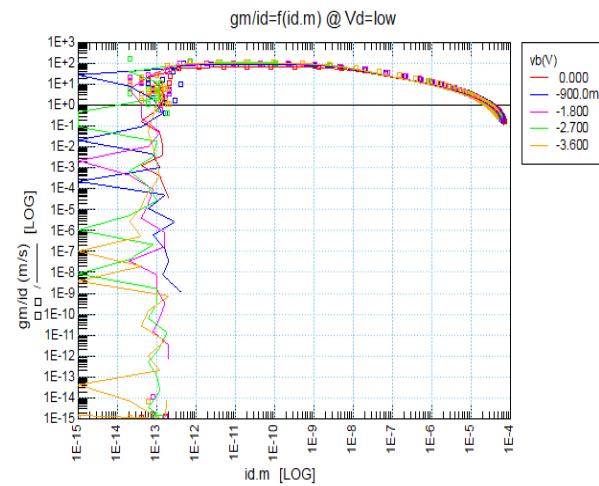
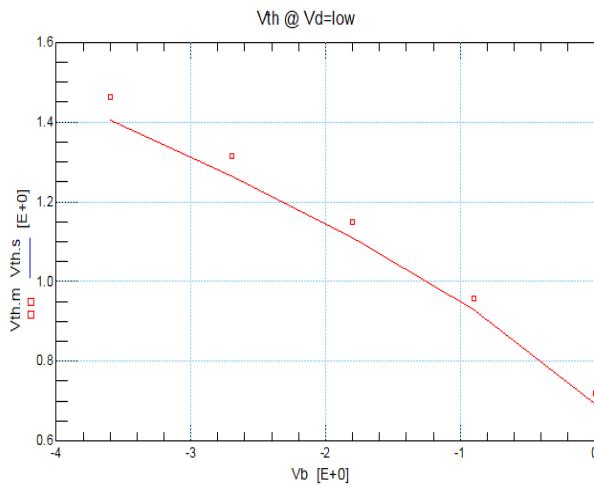
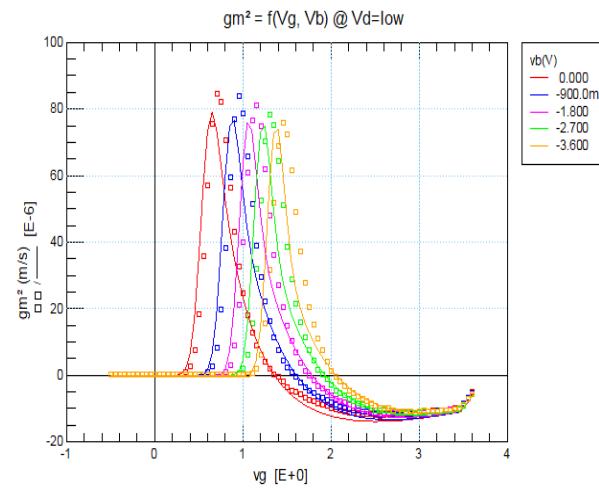
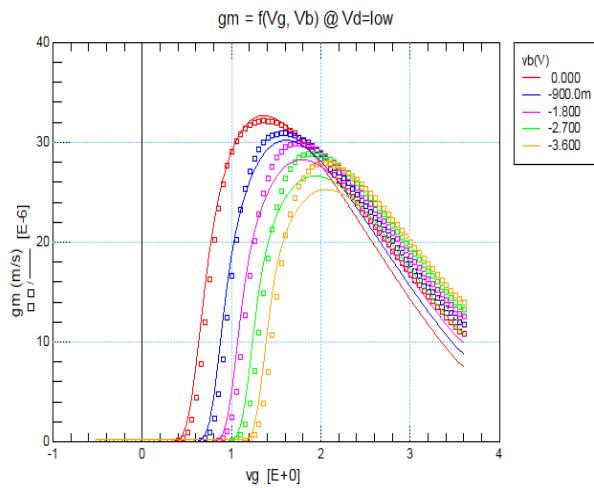
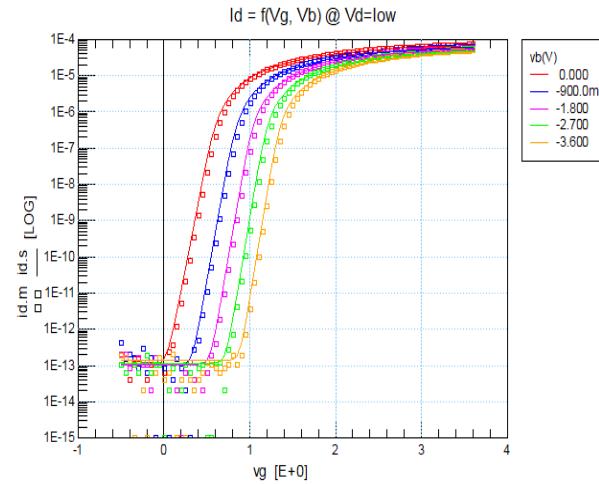
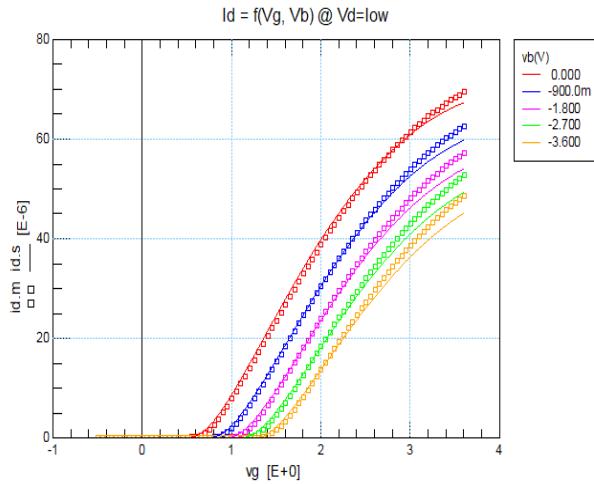


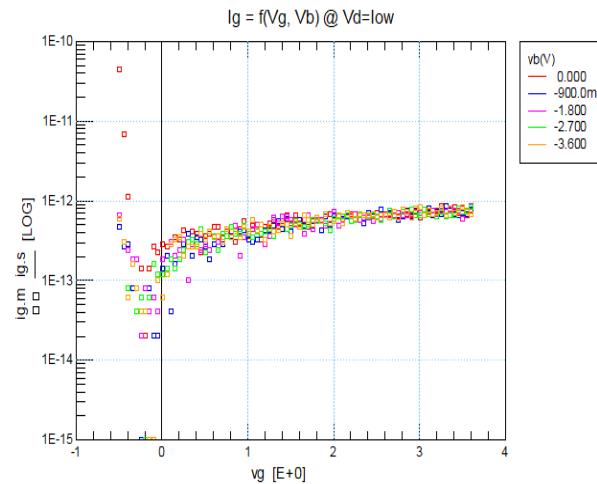
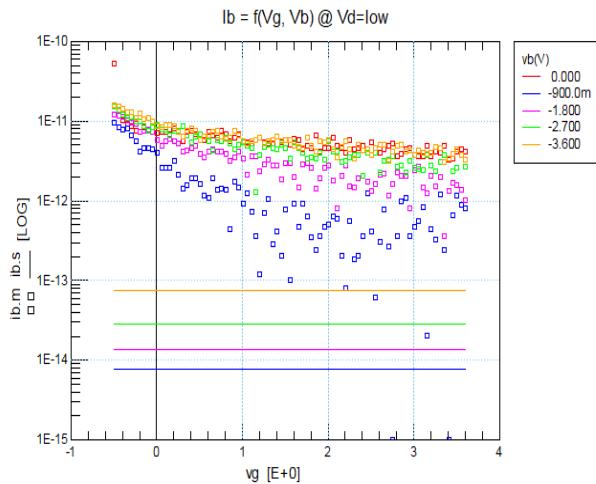
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



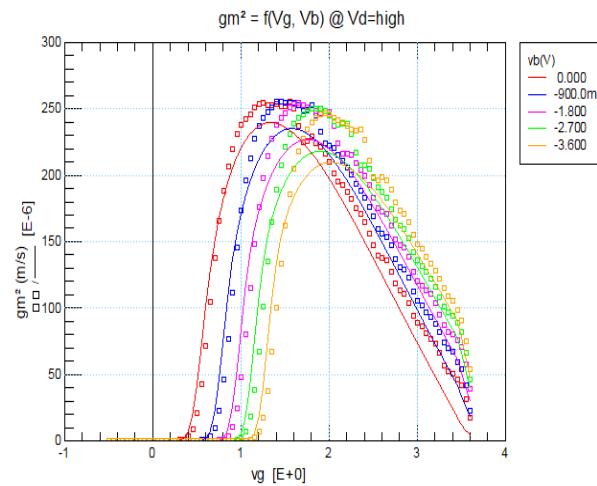
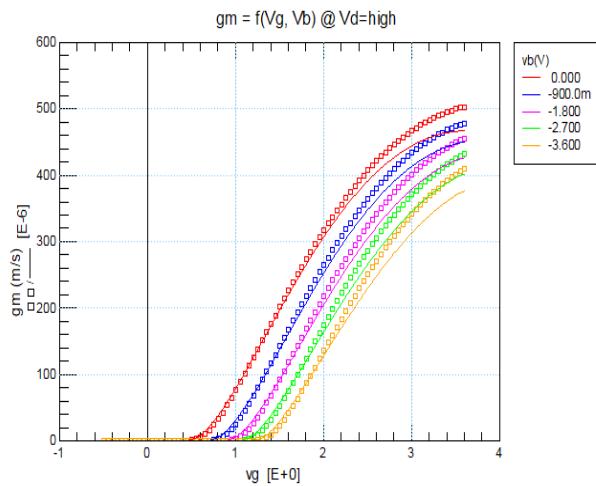
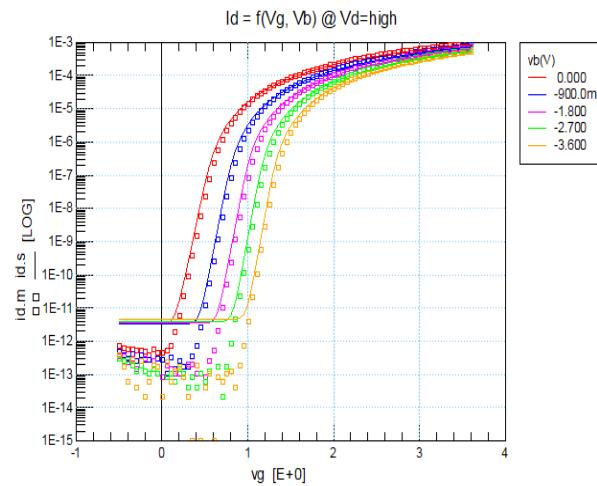
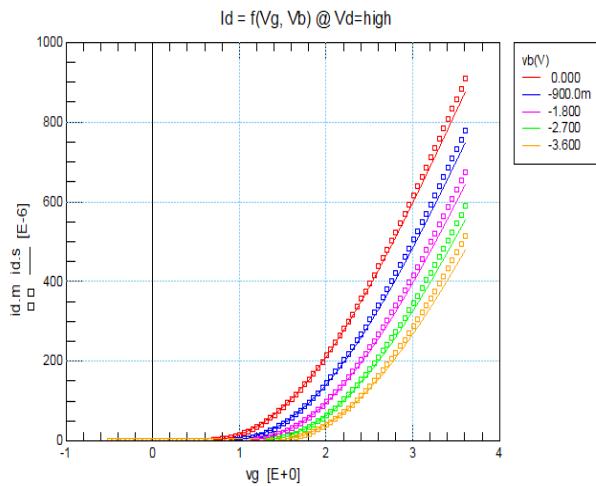
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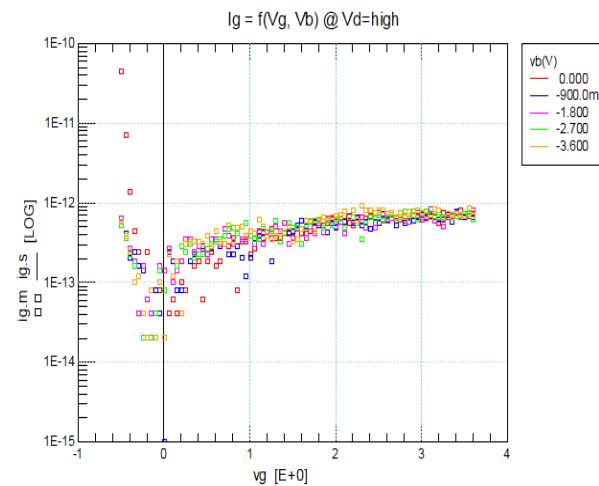
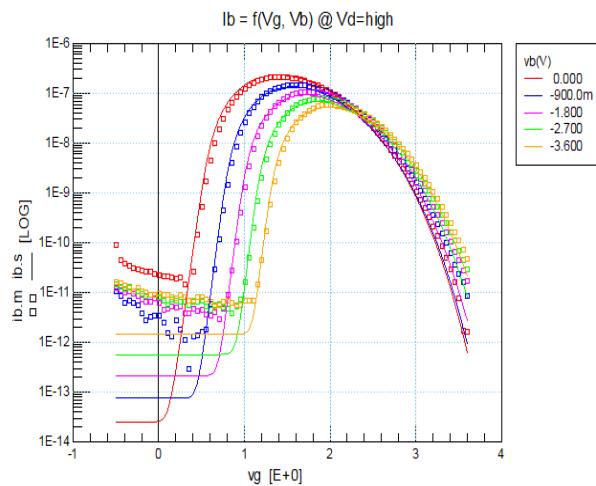
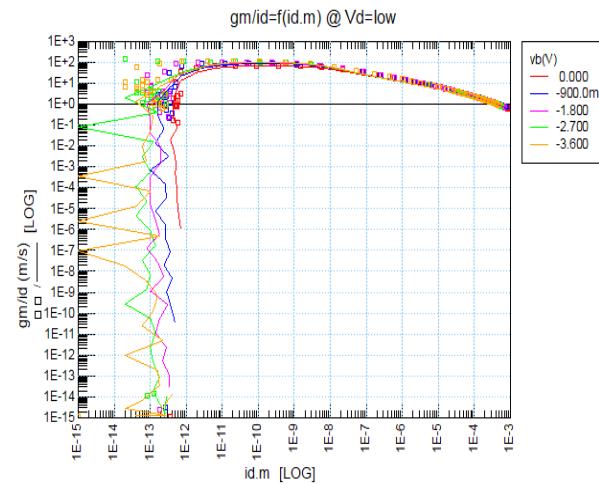
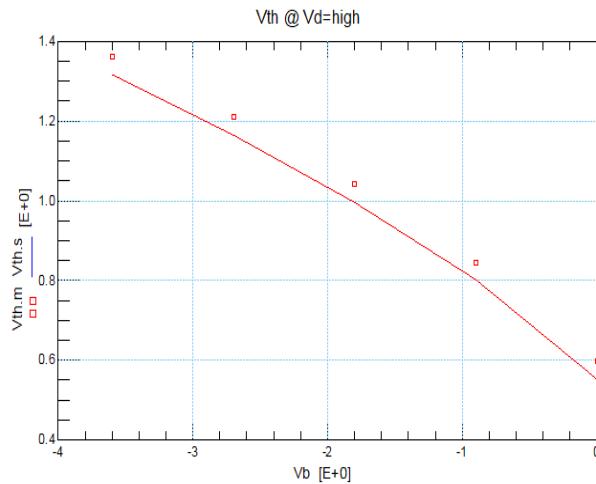
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



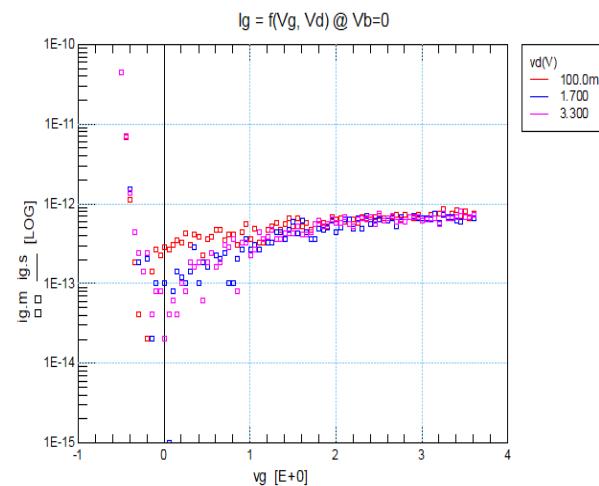
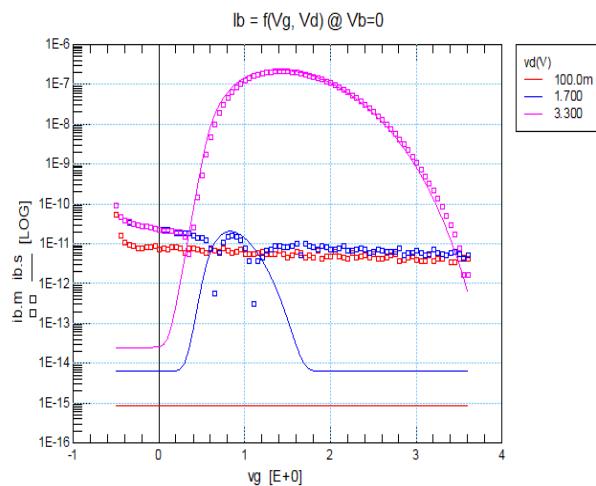


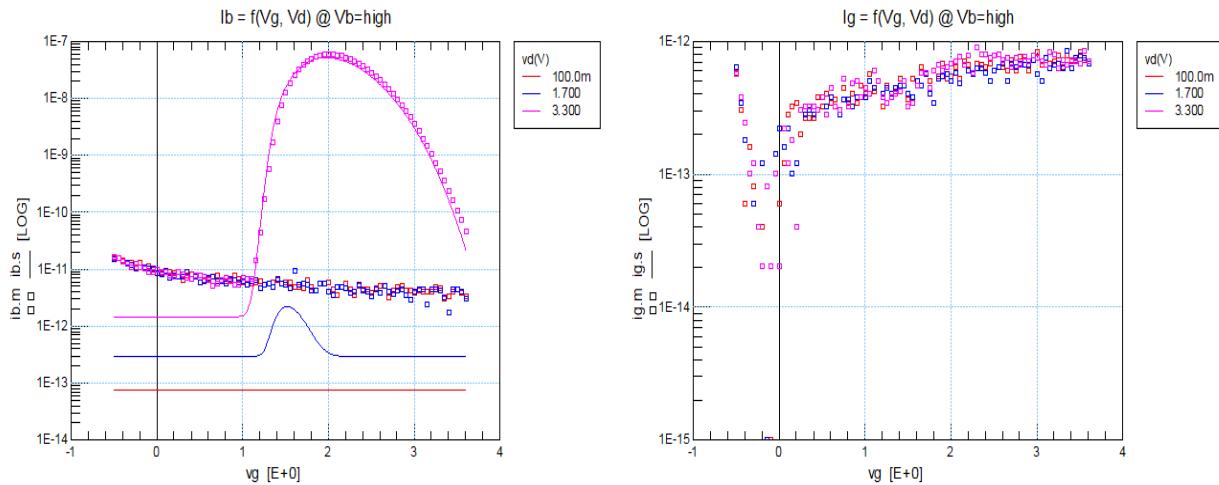
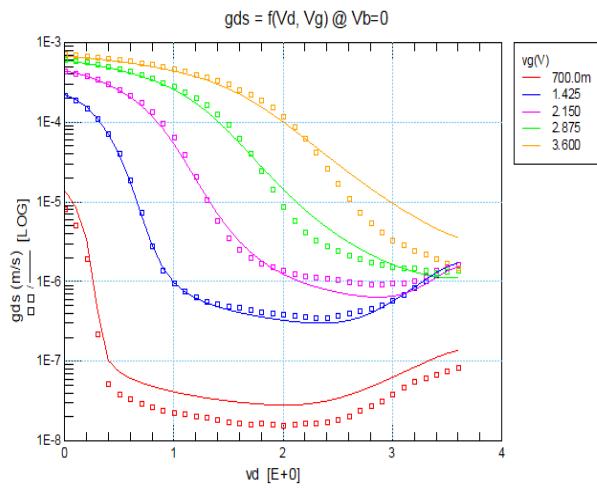
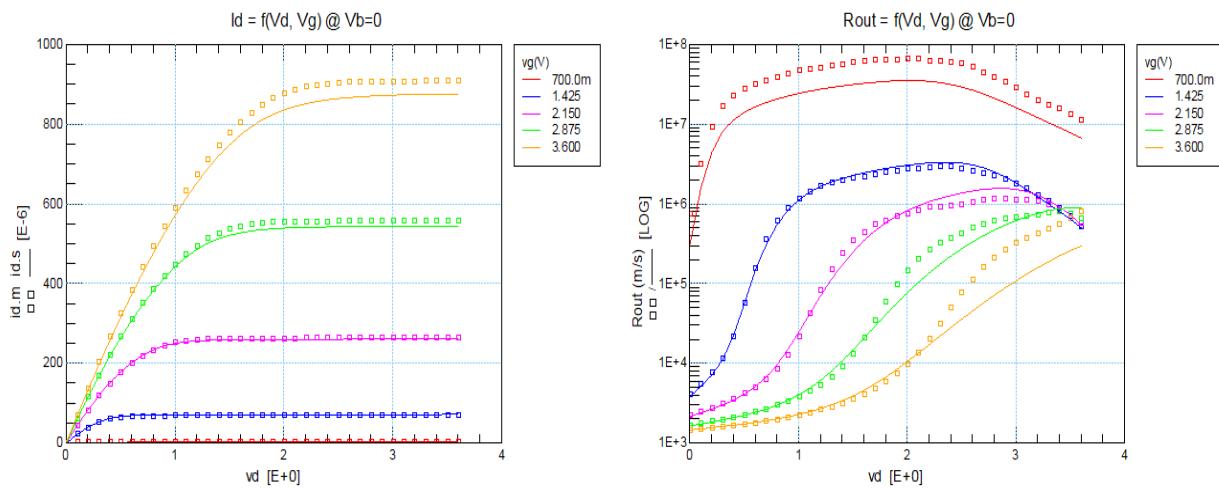
$i_{dvg}, V_d = 3.3V, T = 27^\circ C$

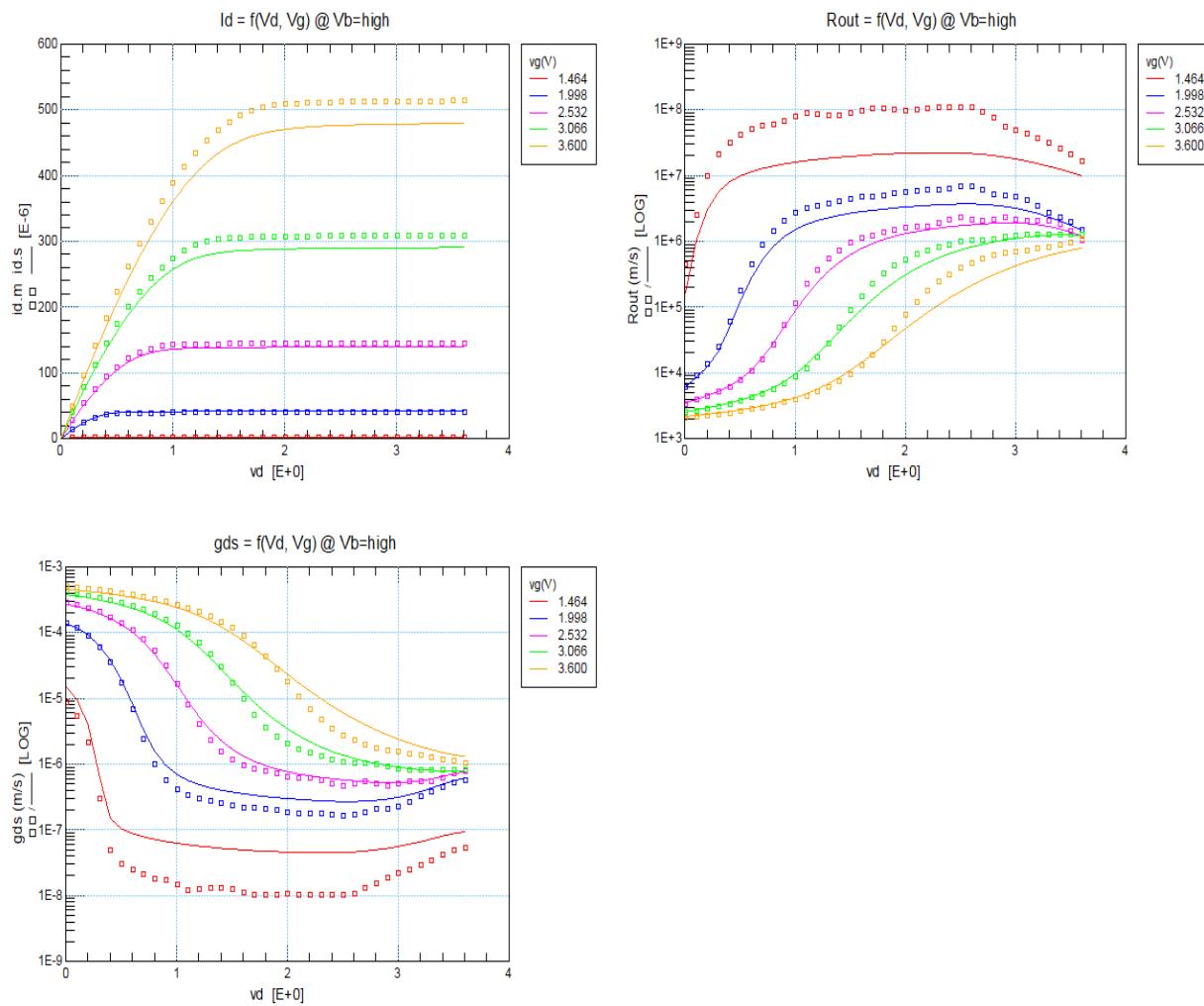
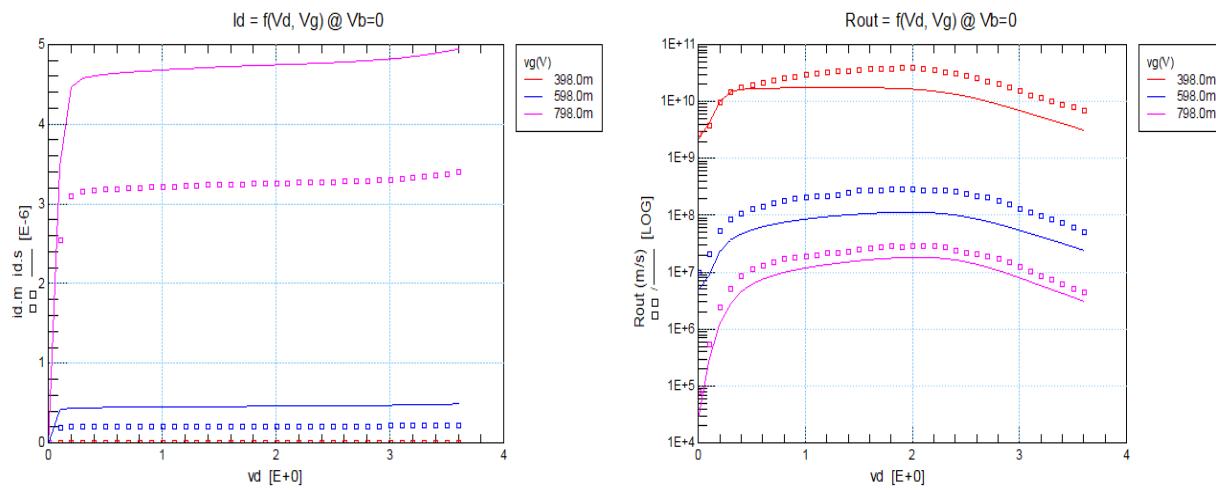


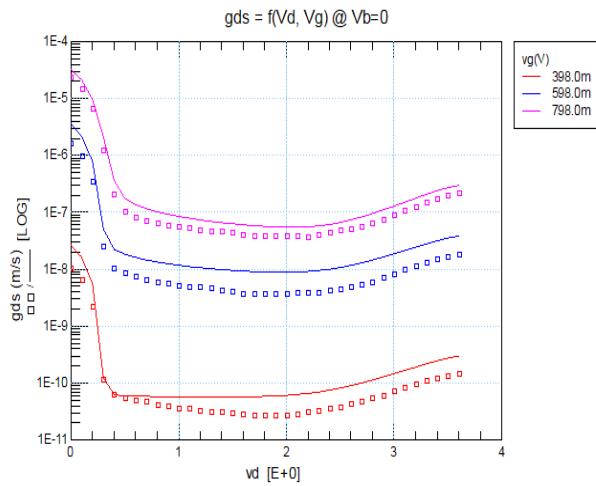


$idvg, Ib, Ig, Vb = 0V, T = 27^\circ C$

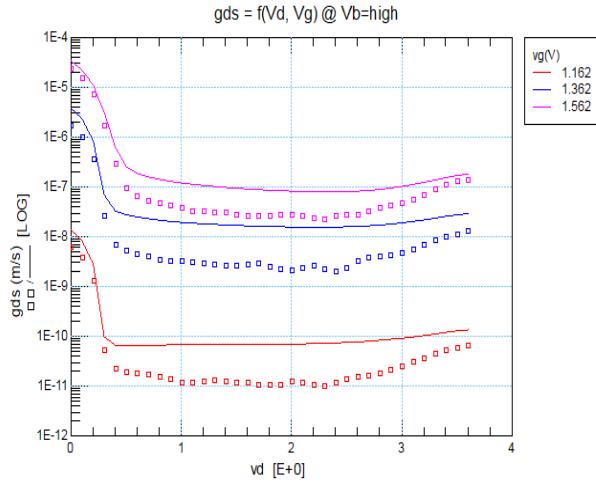
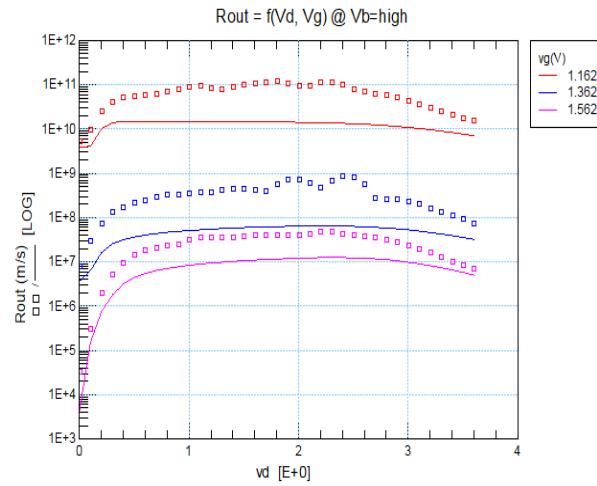
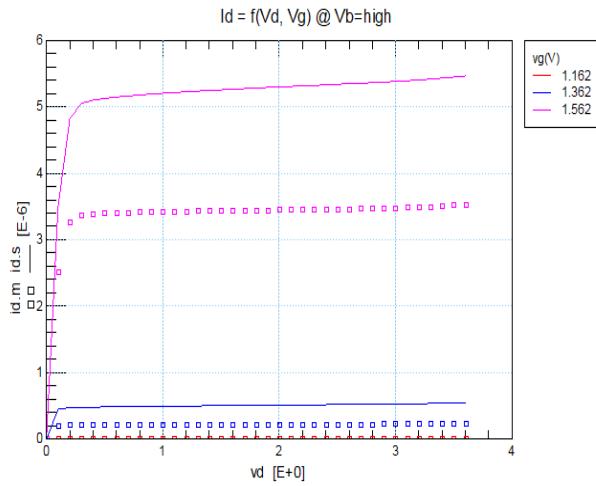


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


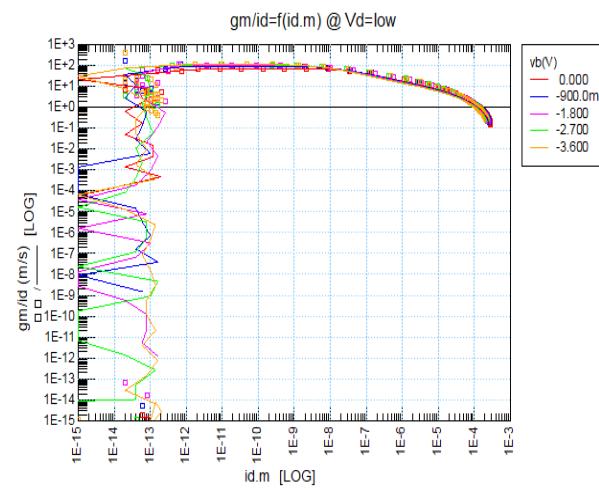
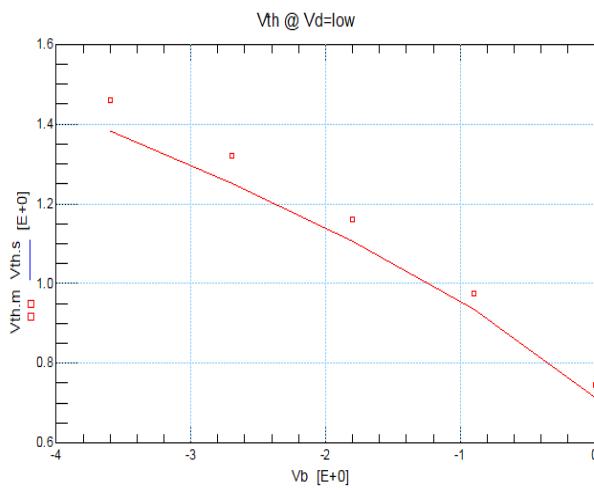
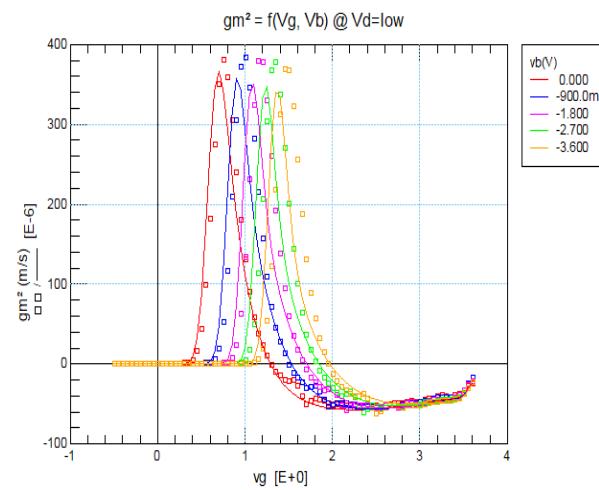
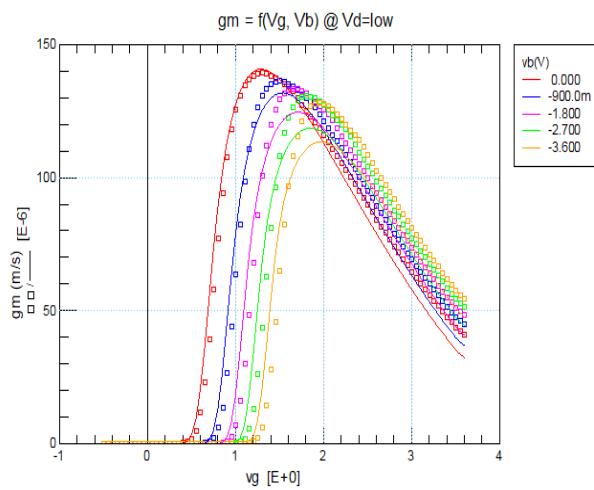
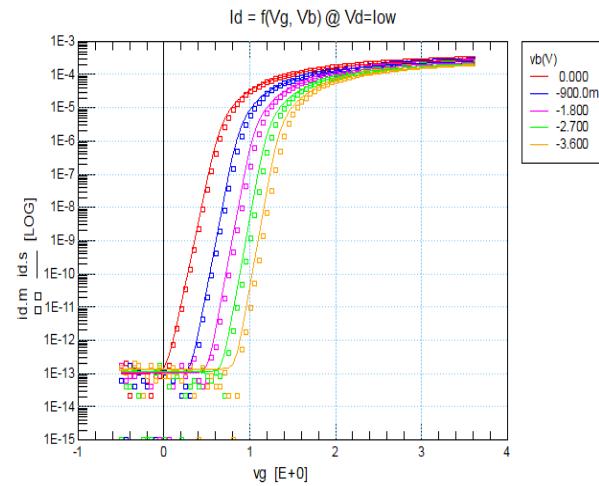
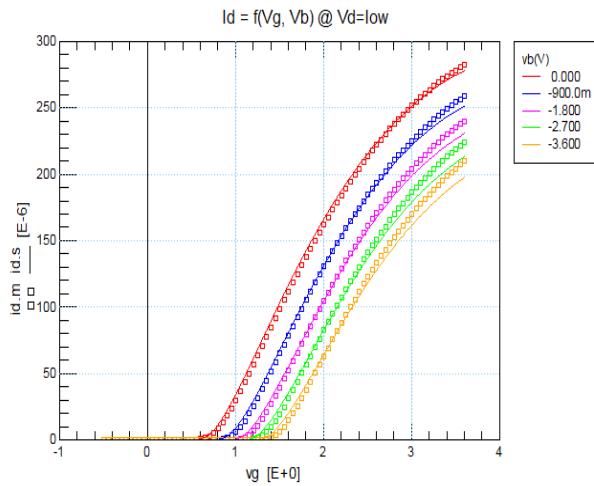


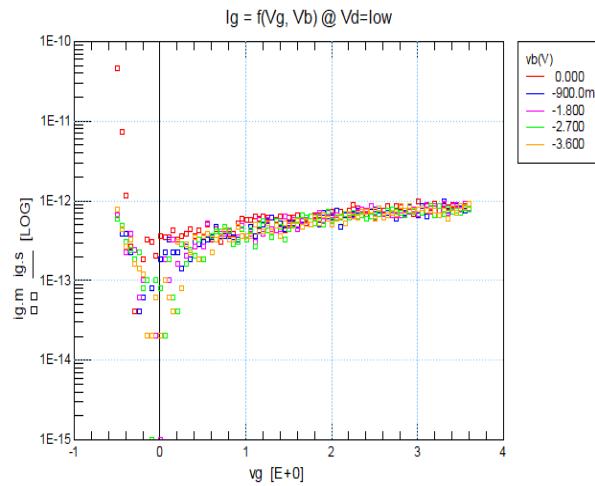
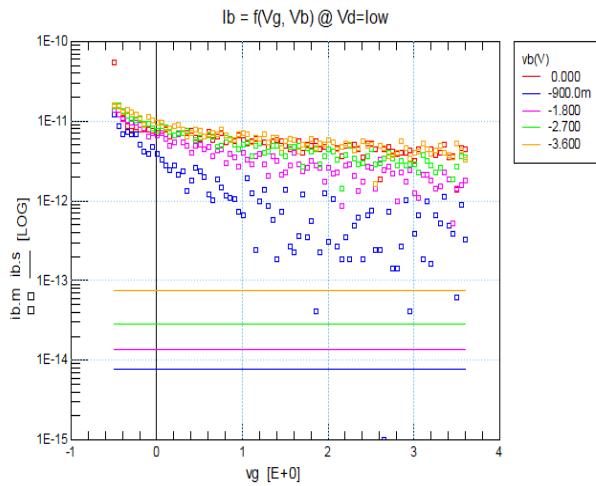
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



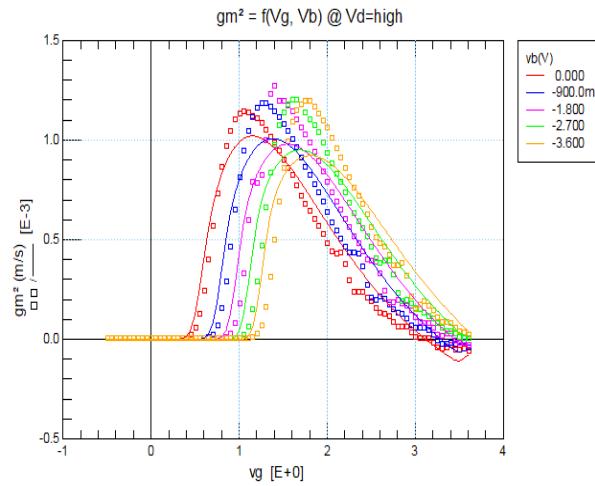
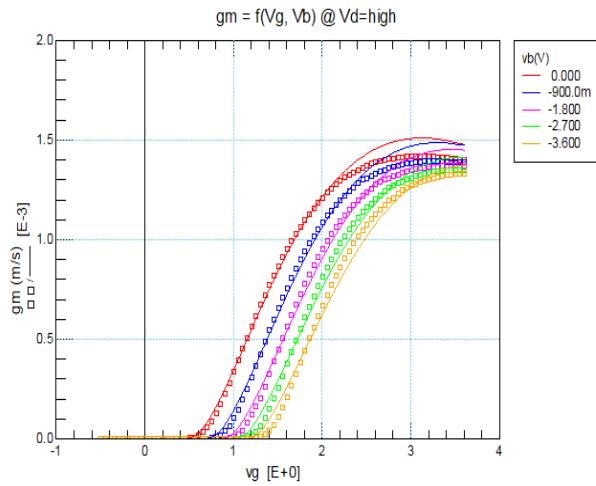
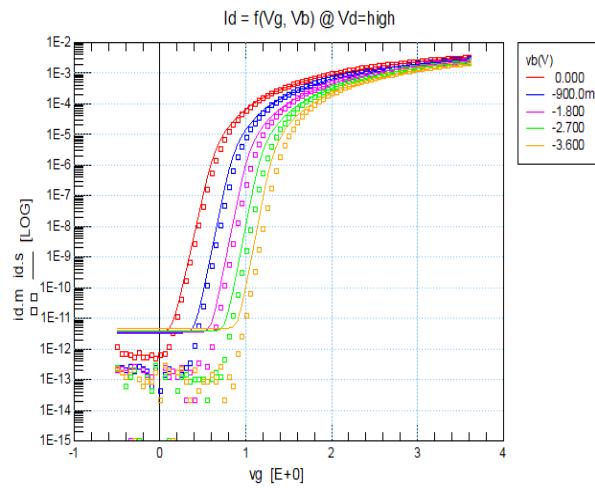
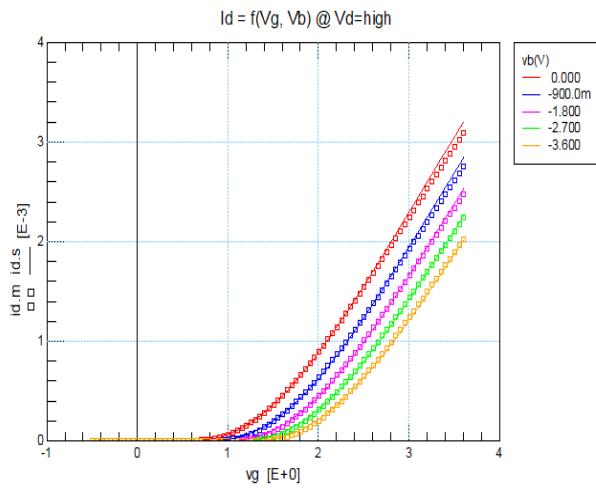
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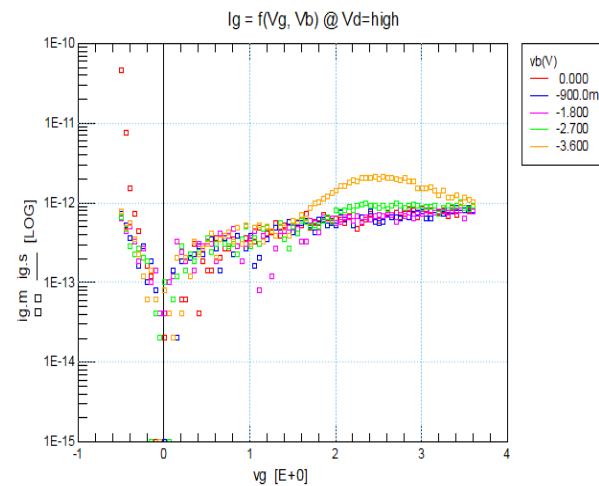
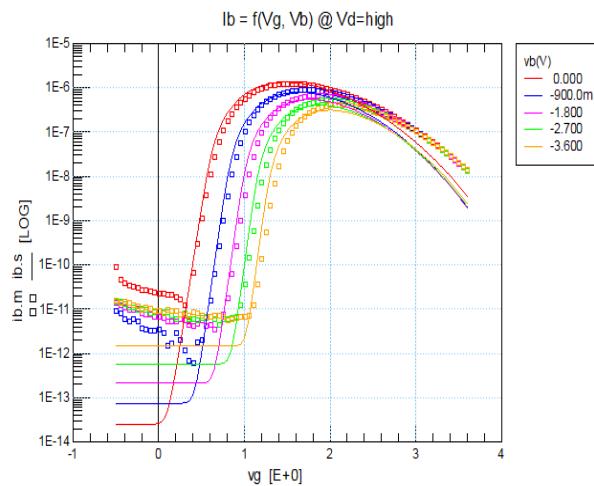
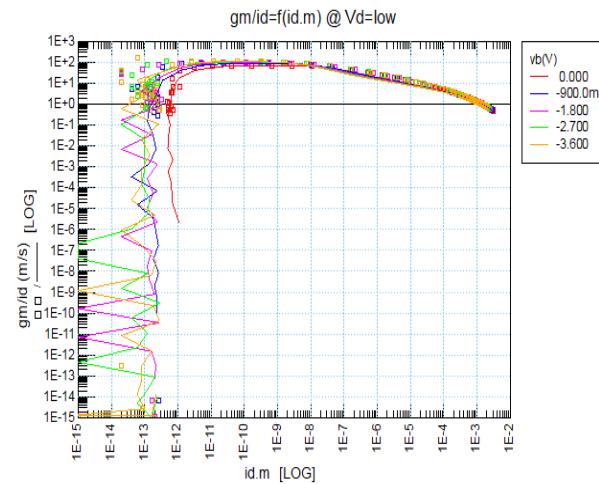
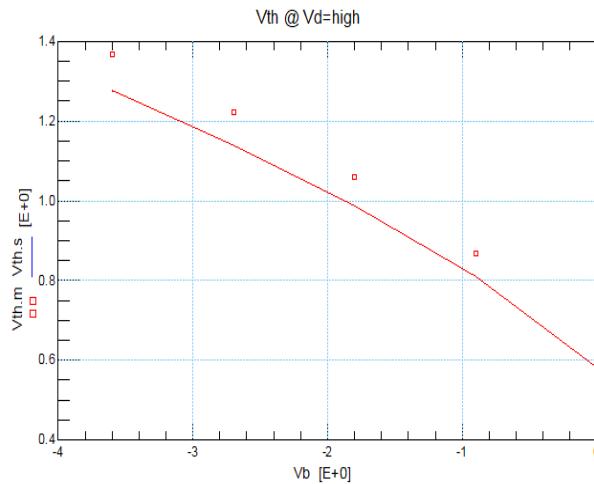
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



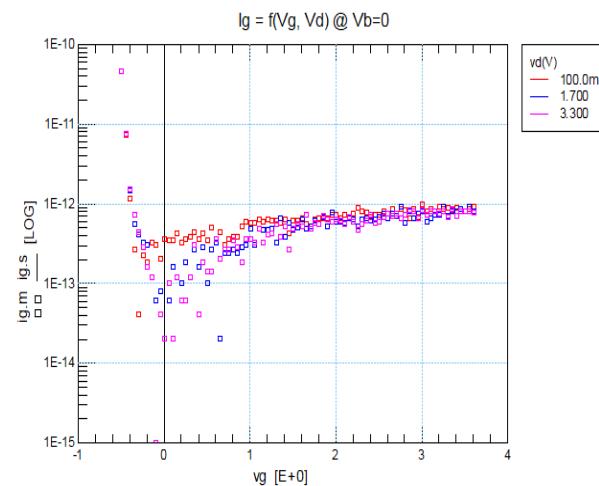
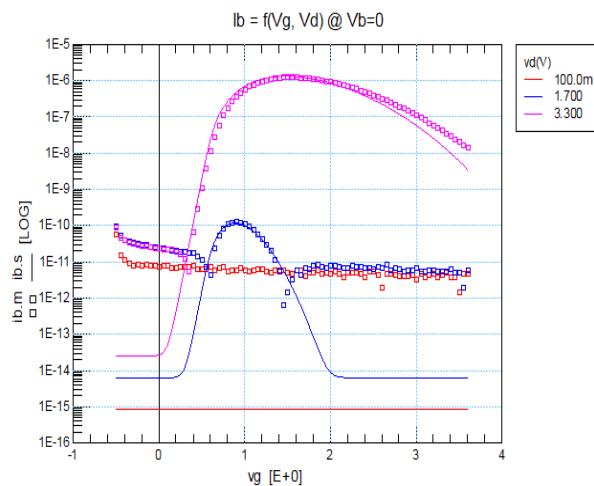


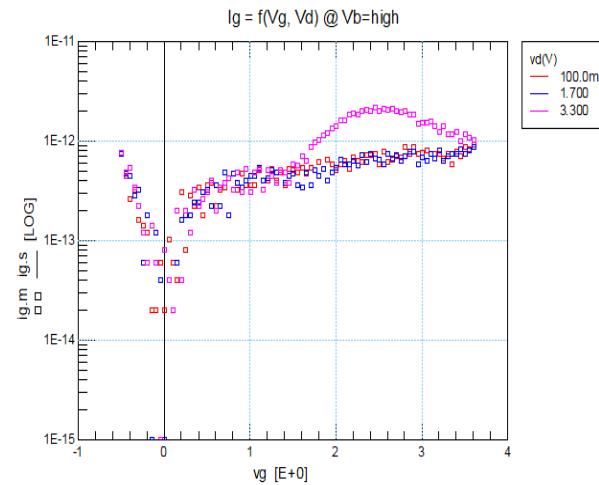
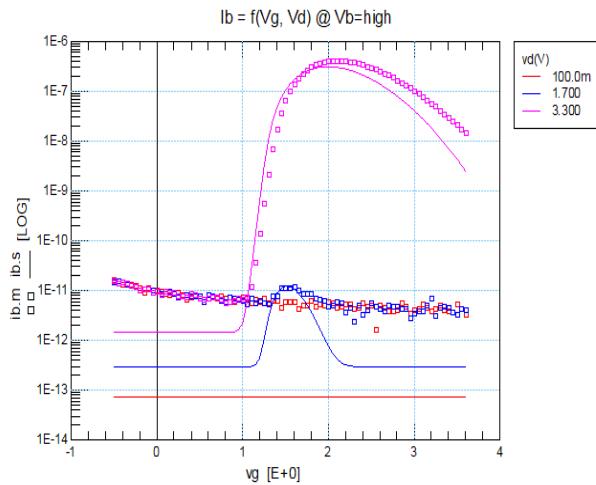
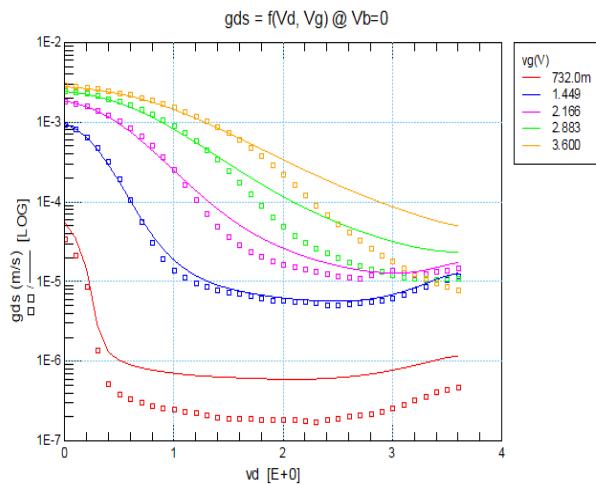
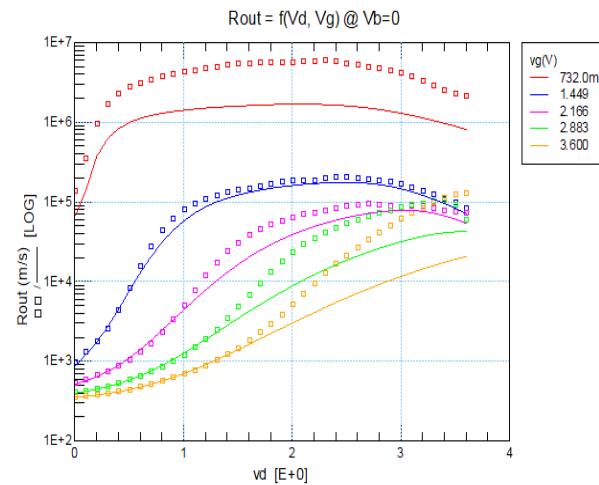
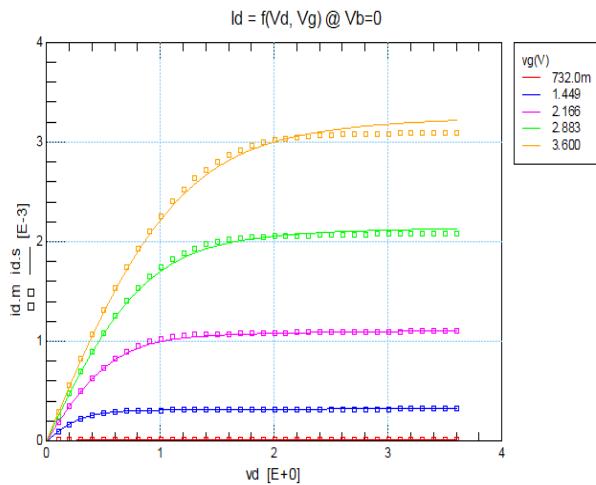
$i_{dvg}, V_d = 3.3V, T = 27^\circ C$

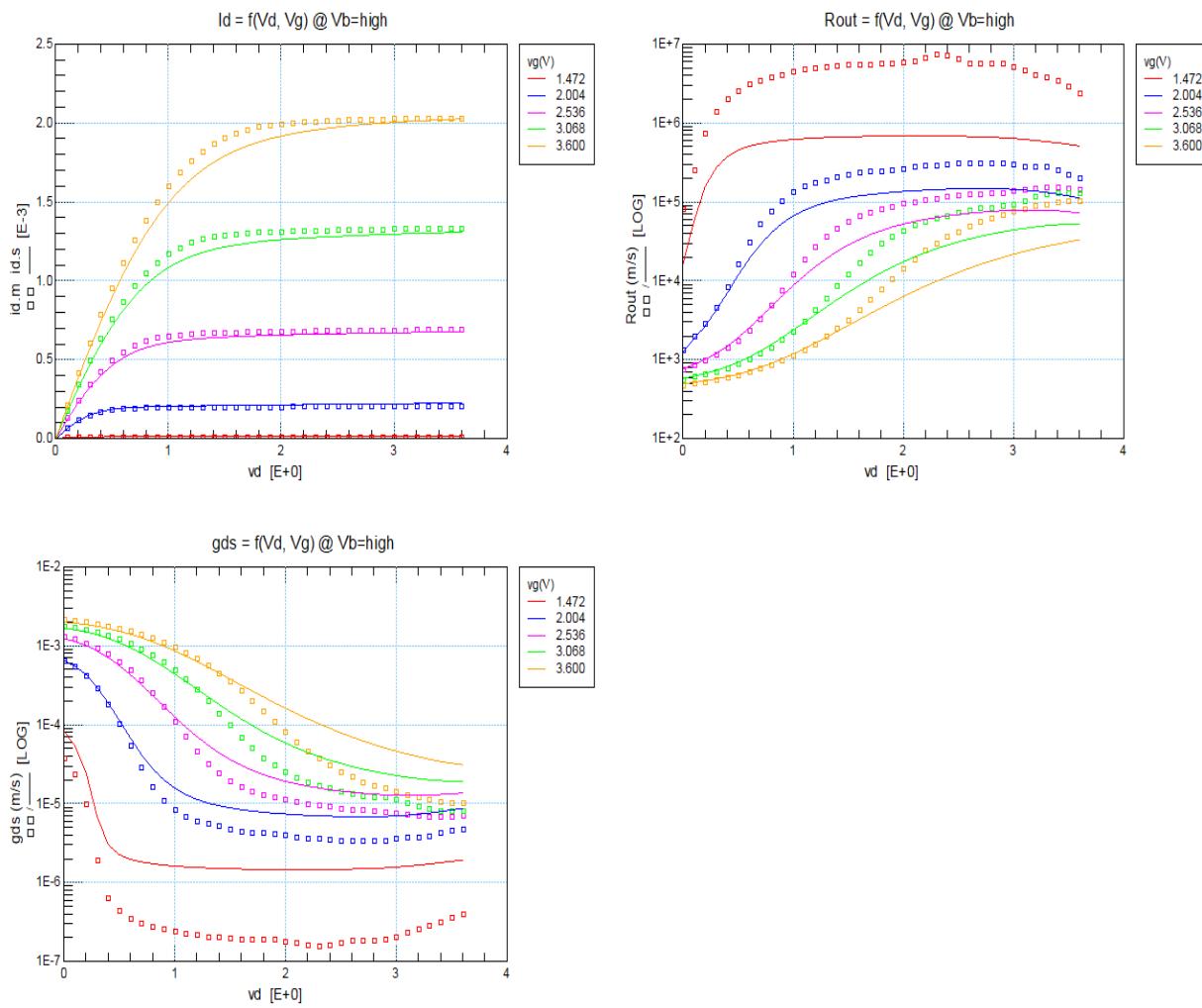
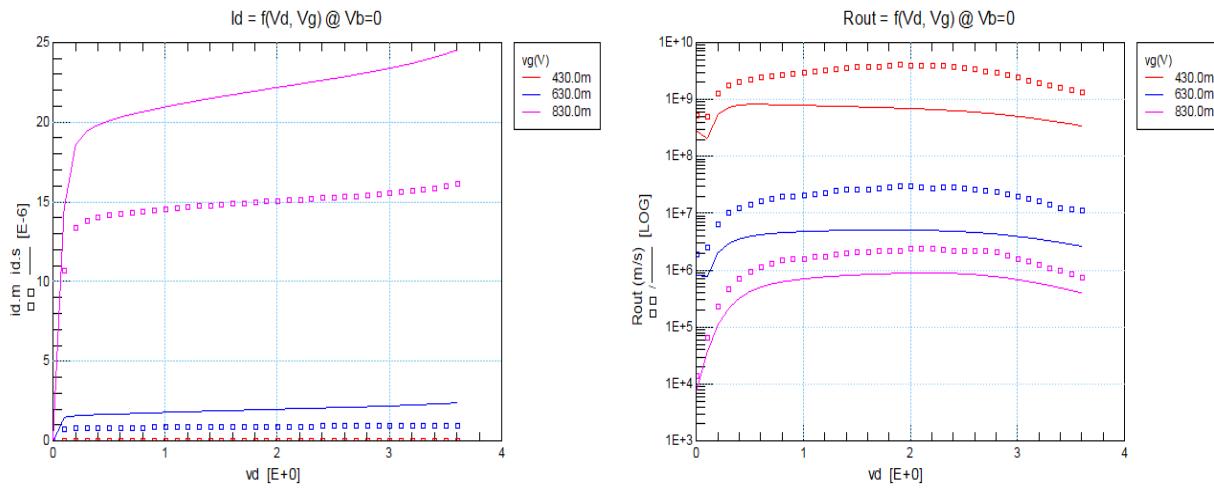


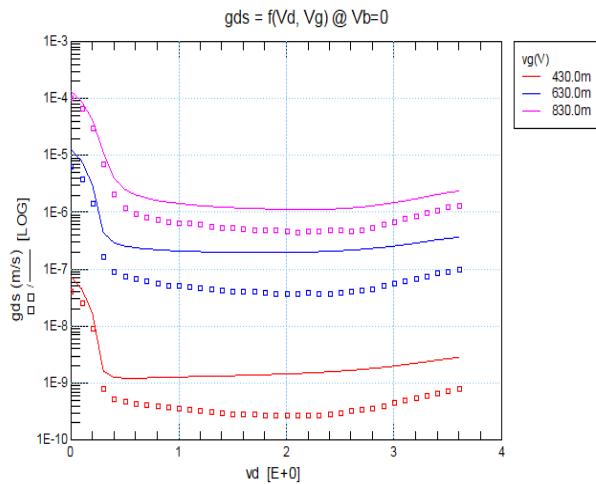


idvg, lb, lg, Vb = 0V, T = 27°C

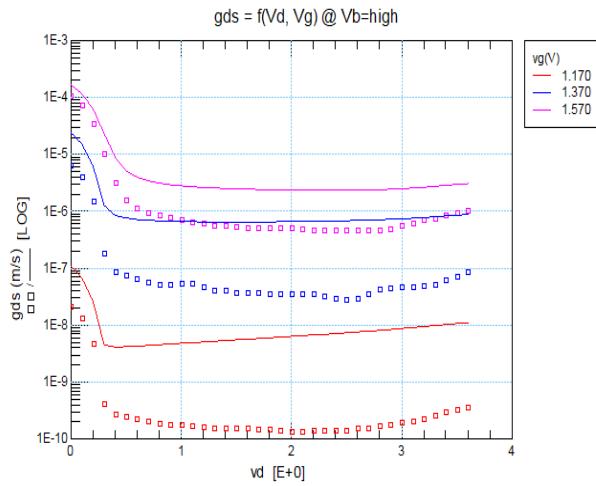
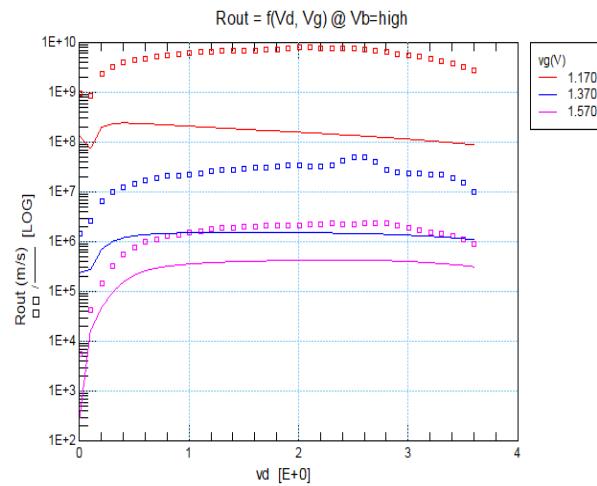
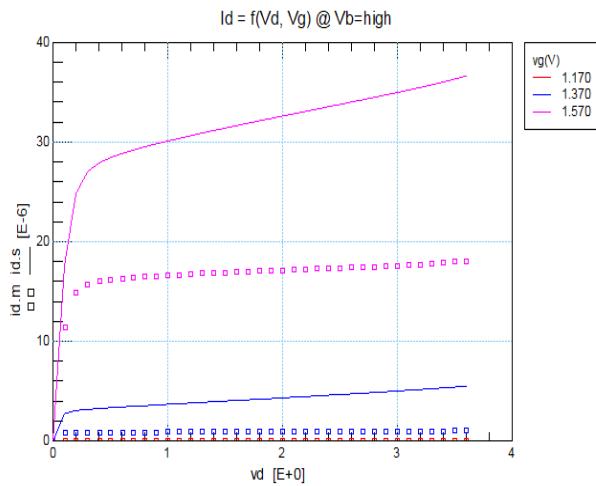


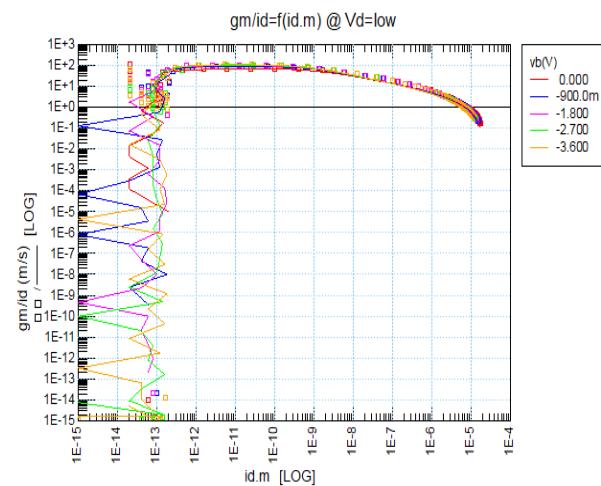
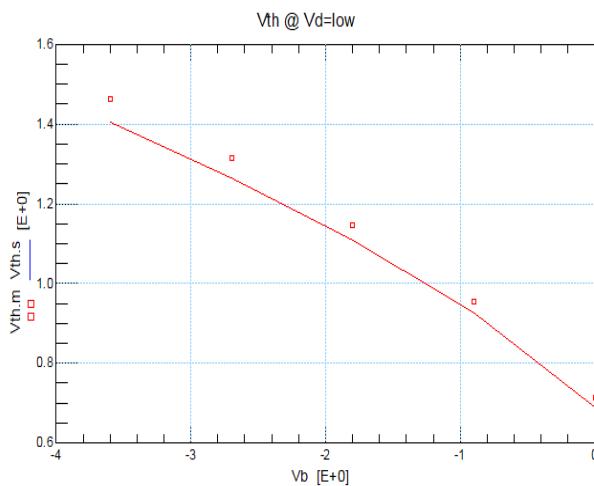
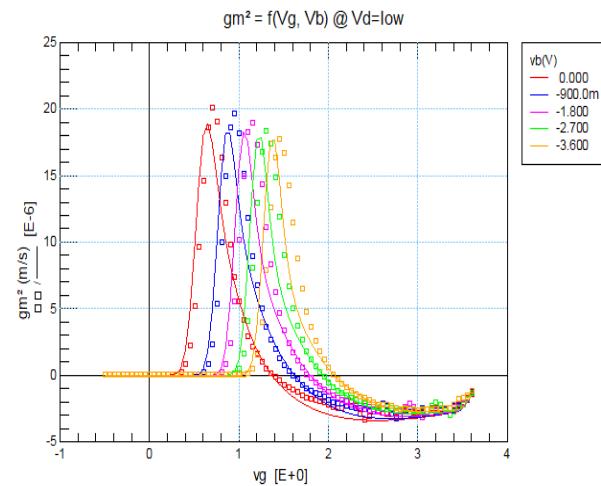
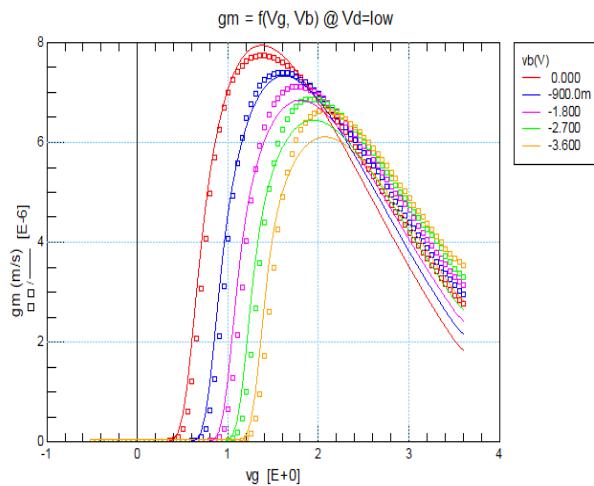
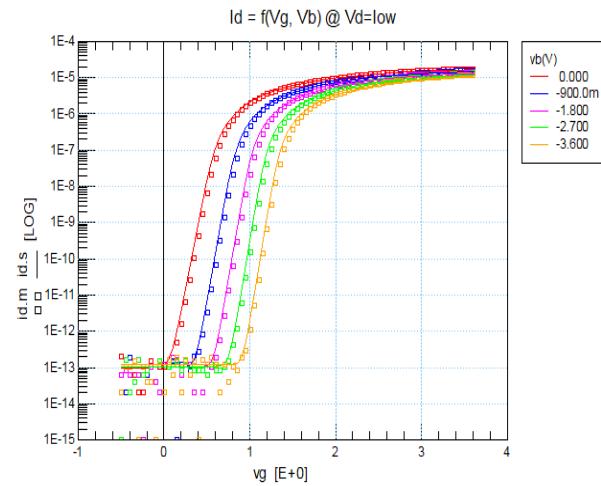
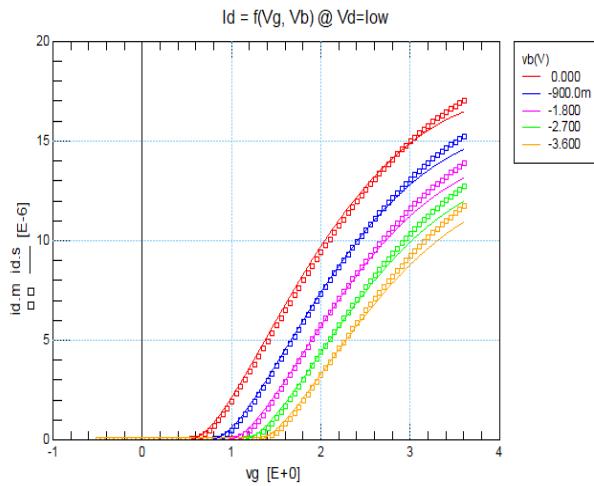
idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


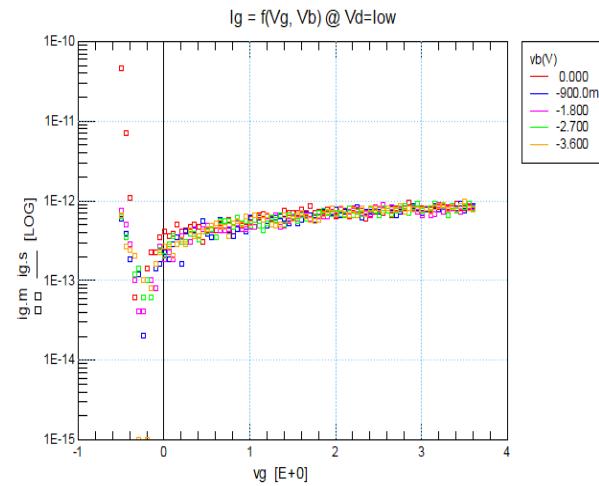
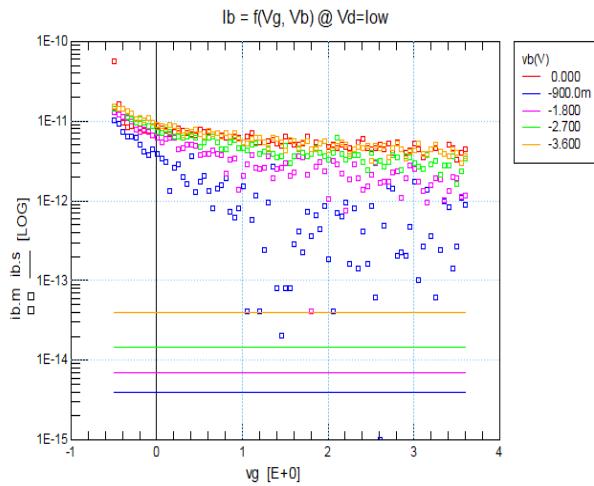
idvd_vbmin, Vb = -3.6V, T = 27°C**idvd_vth, Vb = 0V, T = 27°C**



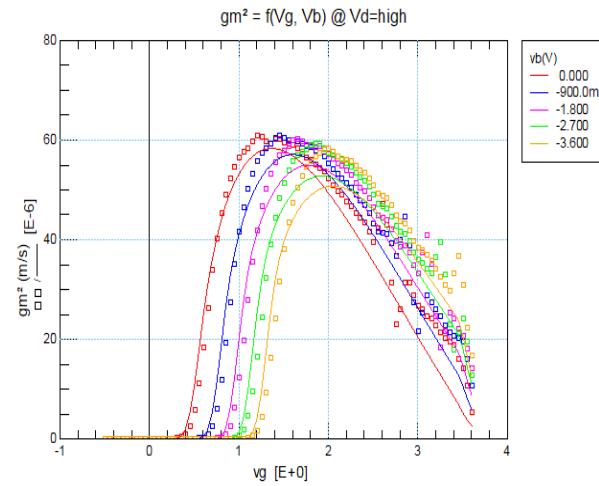
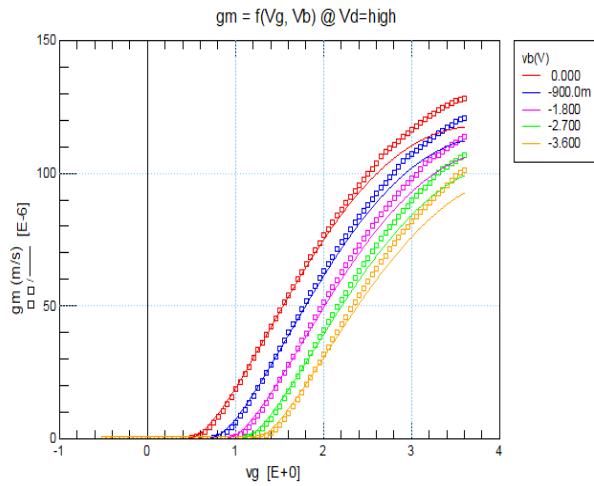
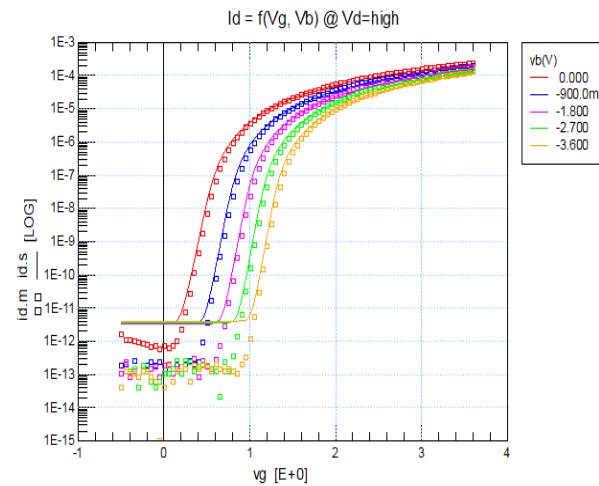
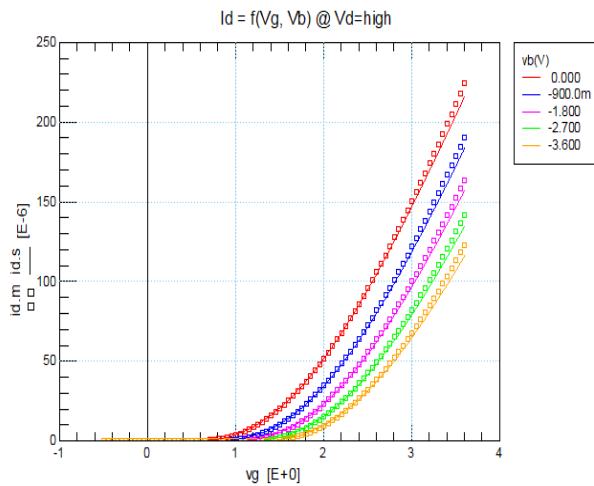
idvd_vth_vbmin, Vb = -3.6V, T = 27°C

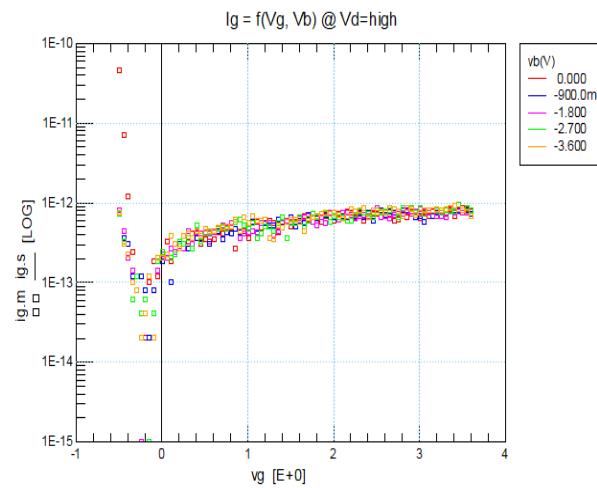
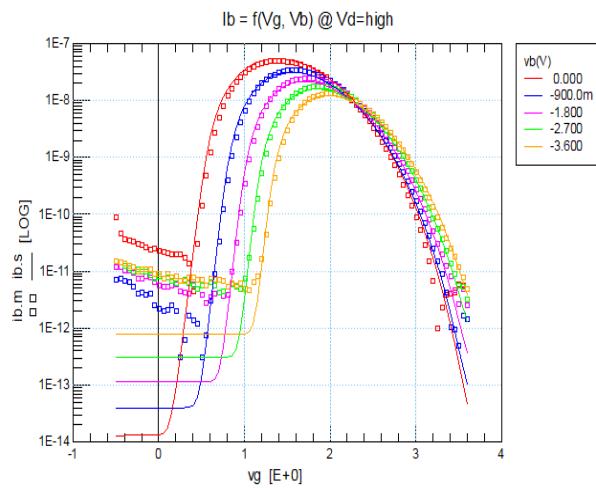
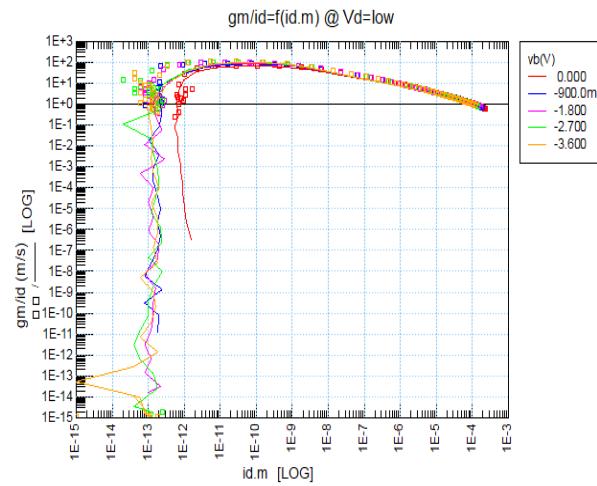
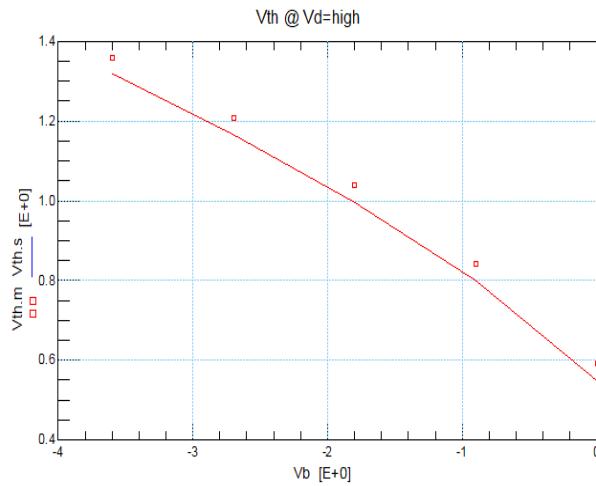


4.12 W05u0_L10u0_S558_1**idvg, Vd = 0.1V, T = 27°C**

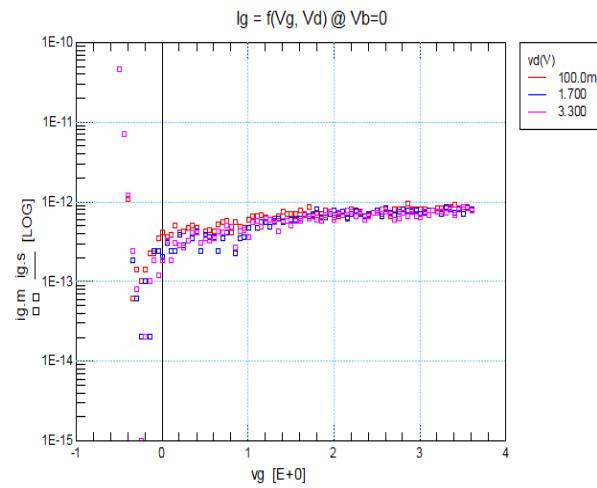
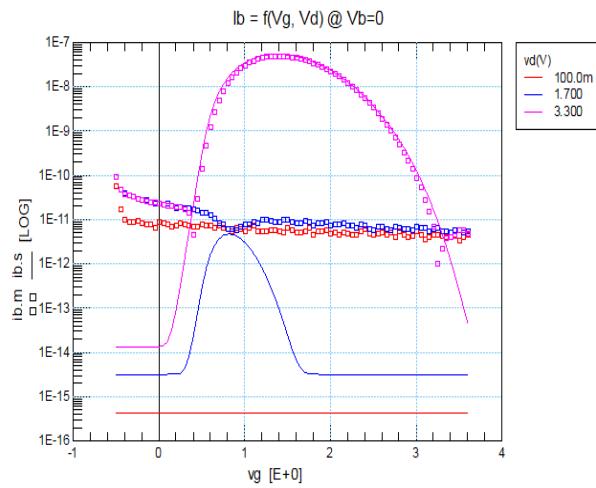


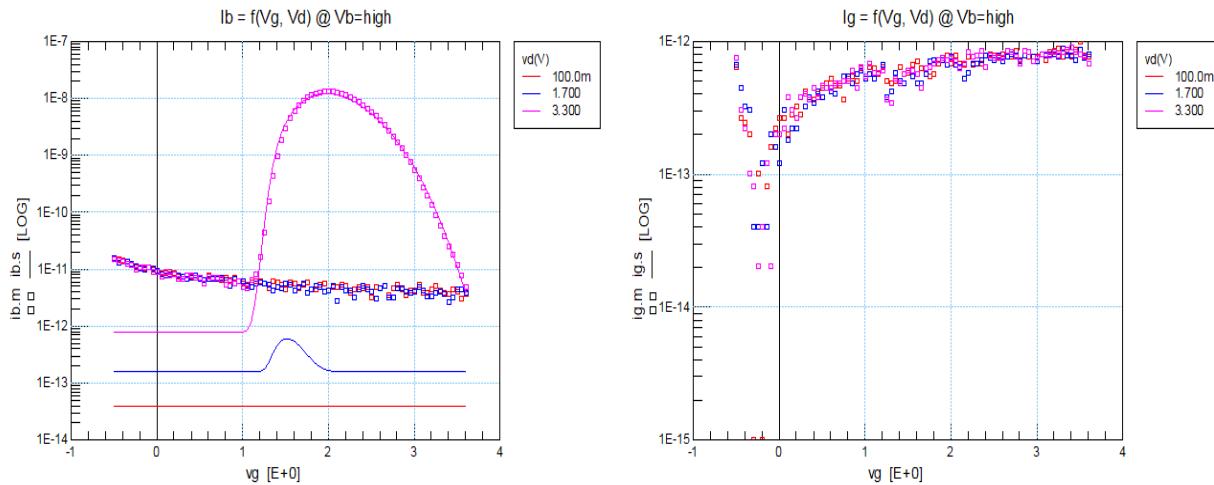
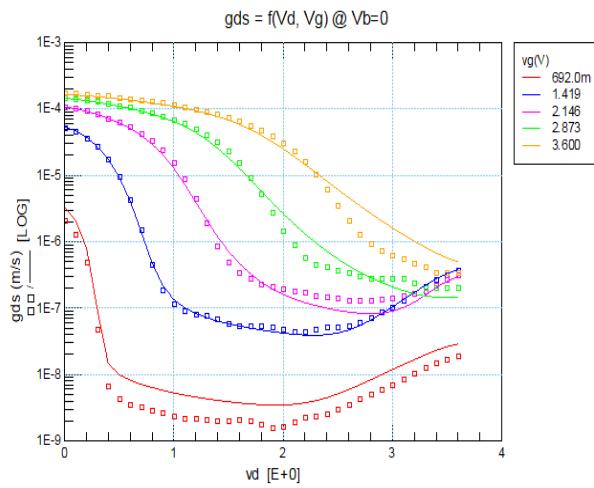
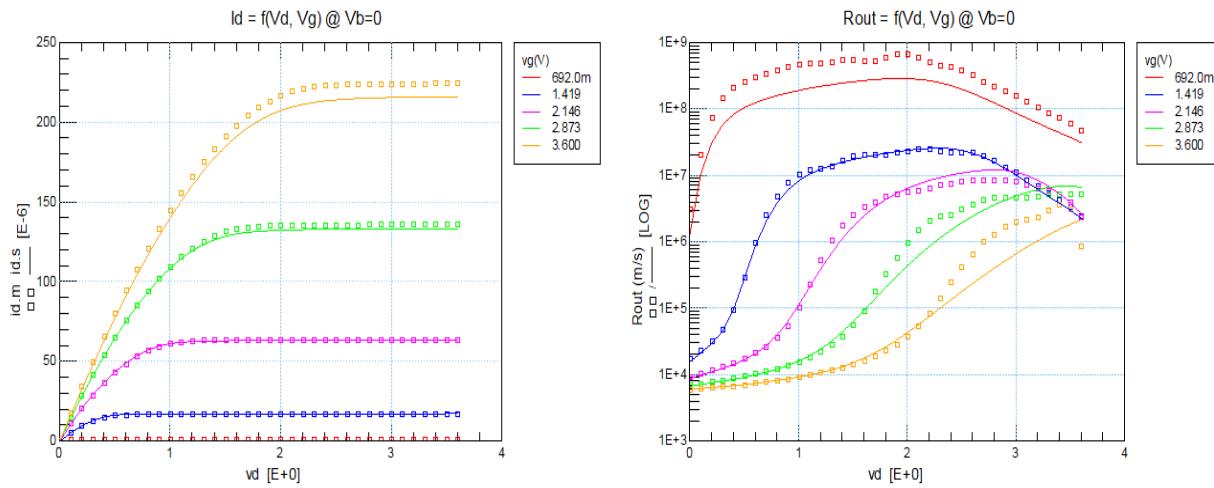
$i_{dvg}, V_d = 3.3V, T = 27^\circ C$

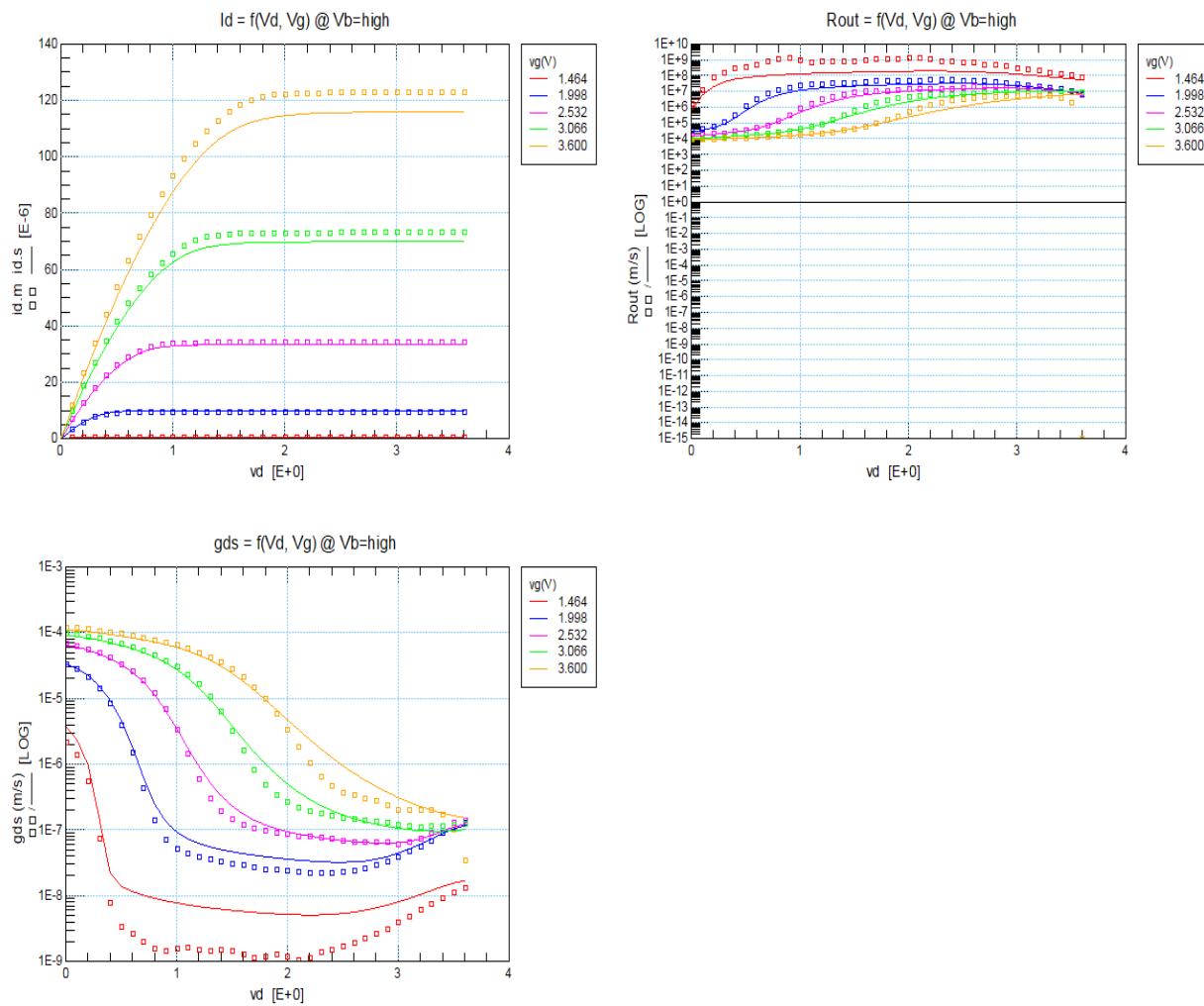
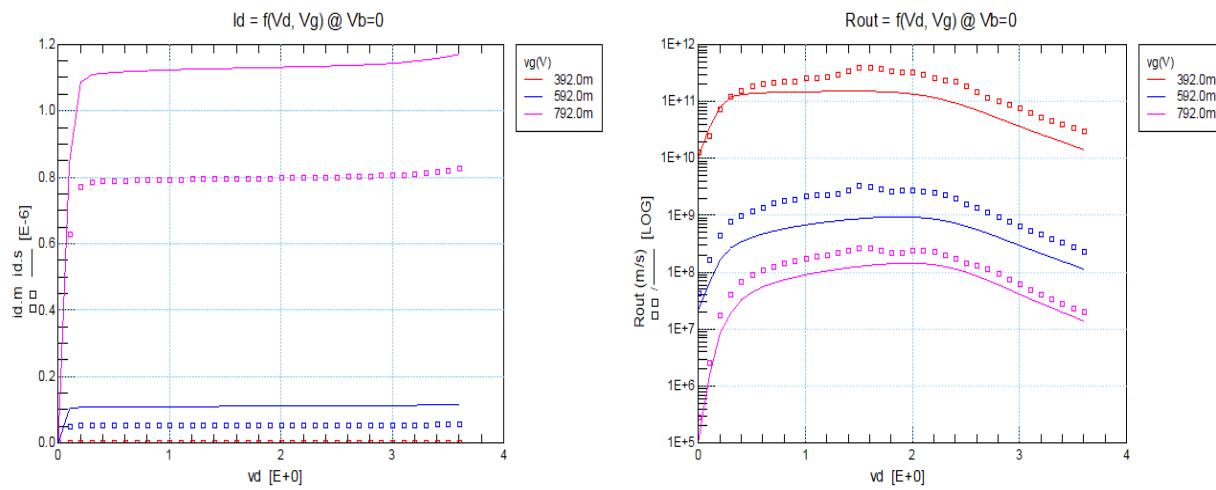


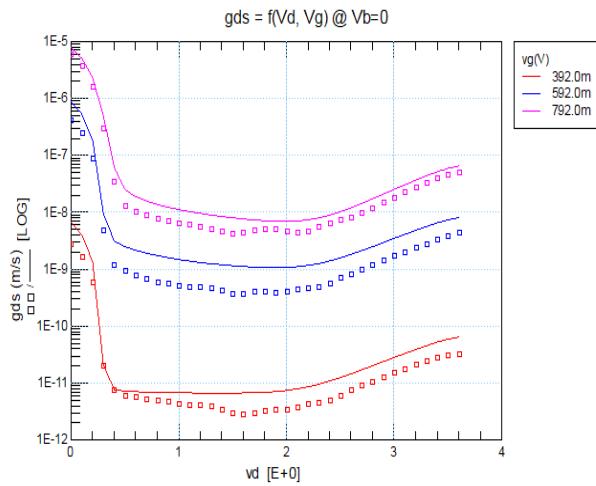


idvg, Ib,Ig, Vb = 0V, T = 27°C

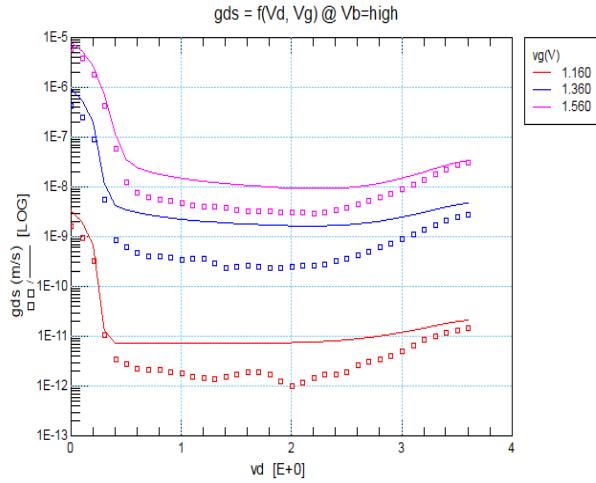
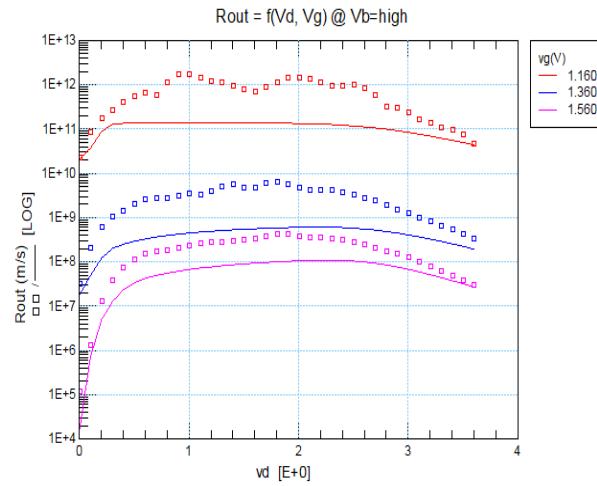
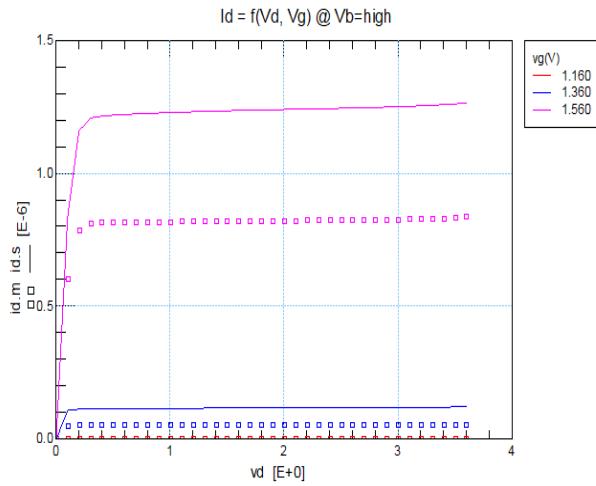


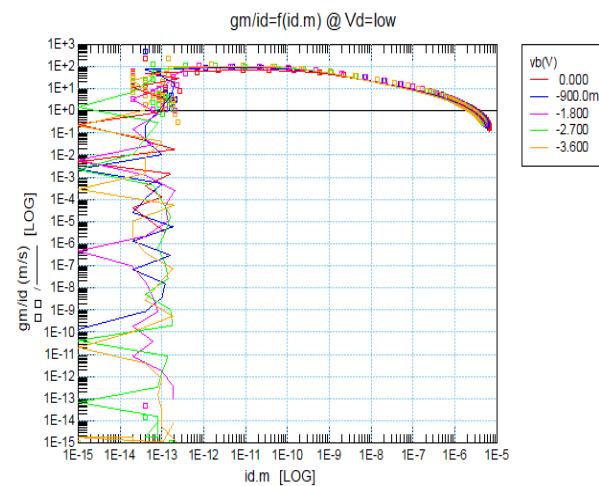
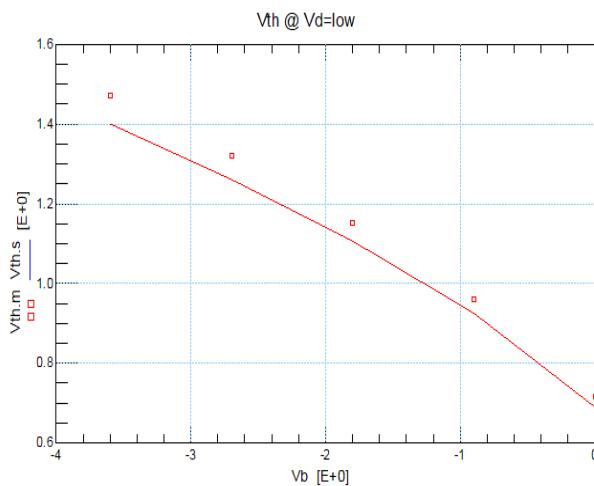
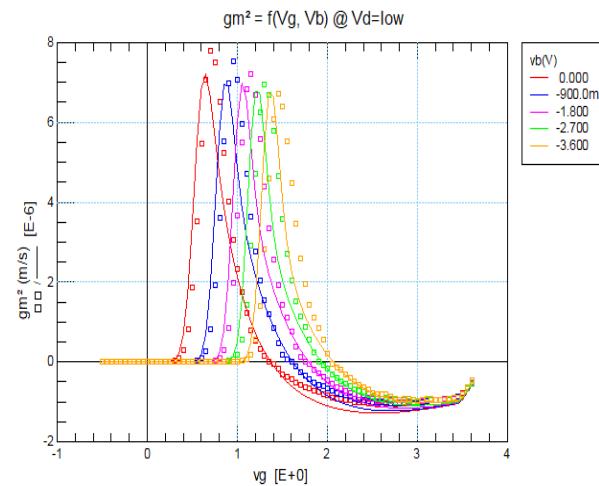
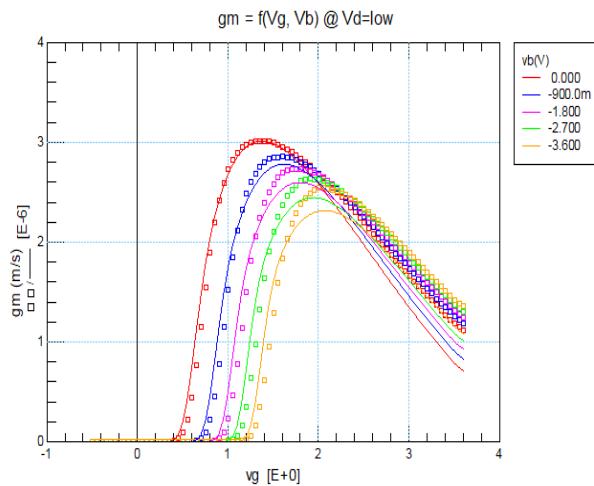
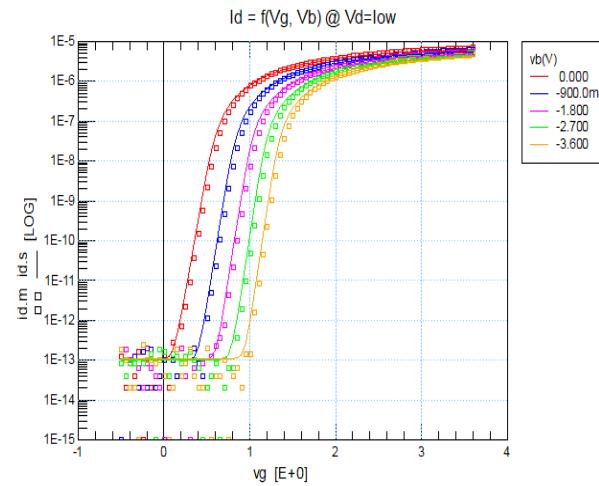
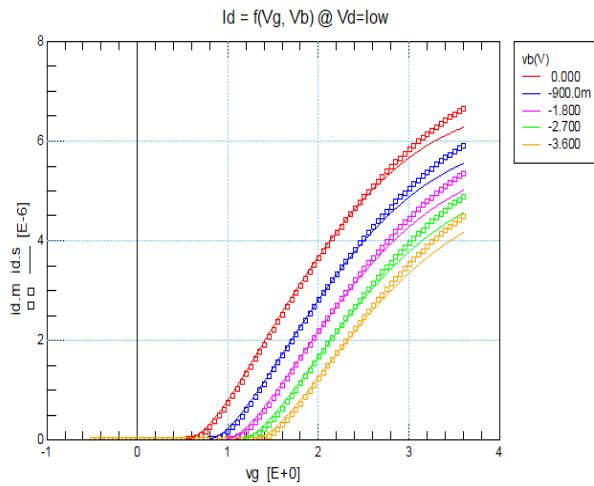
idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


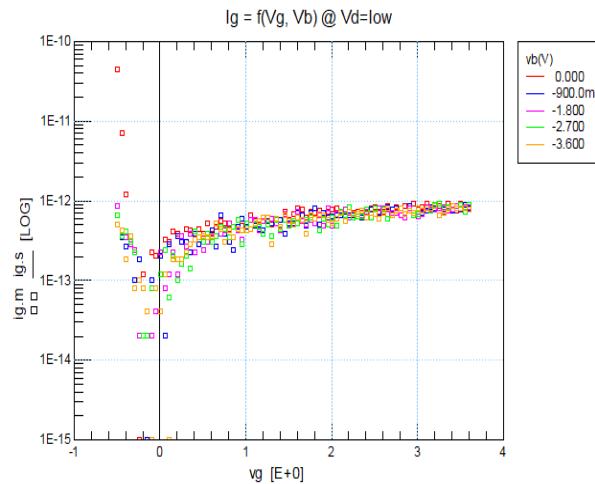
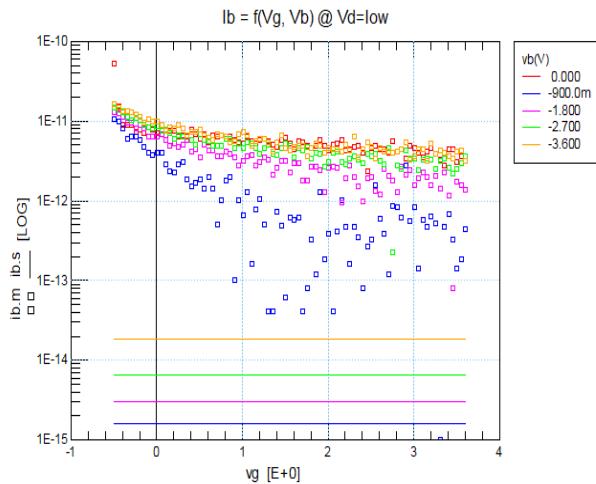
idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C




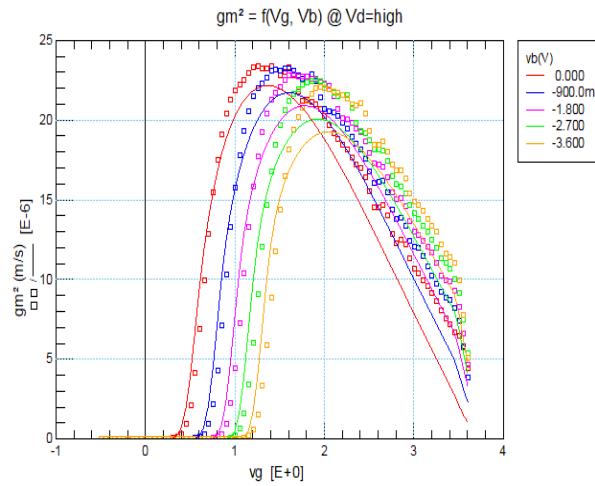
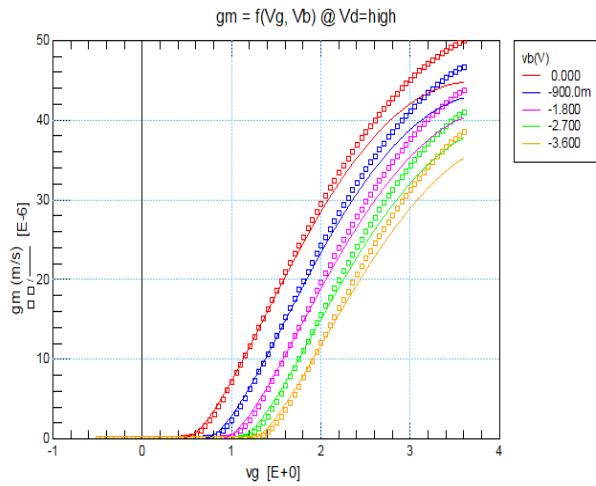
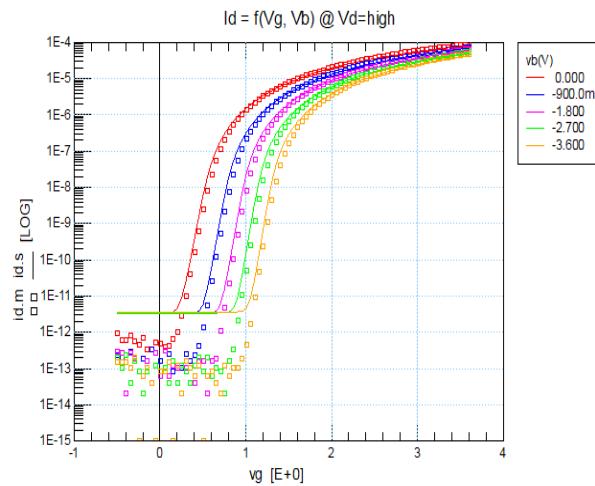
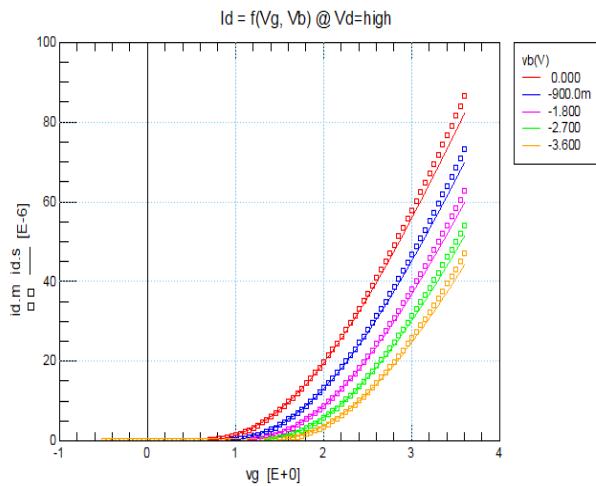
idvd_vth_vbmin, Vb = -3.6V, T = 27°C

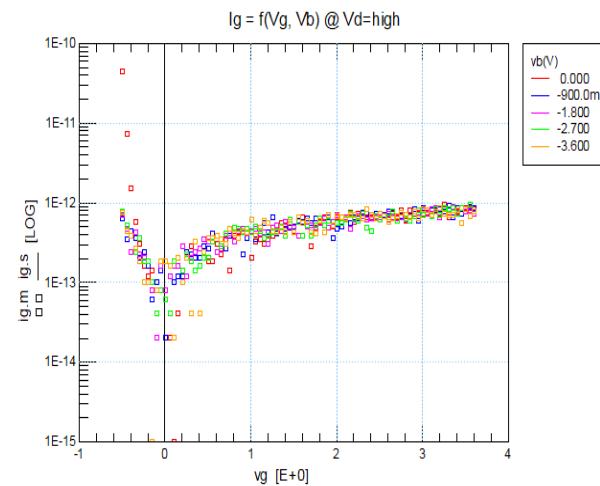
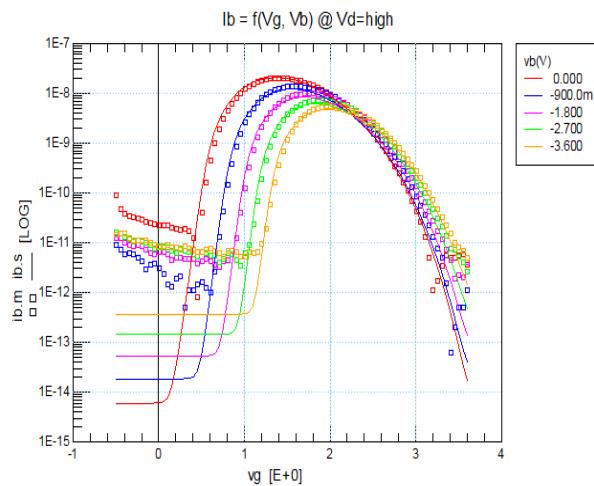
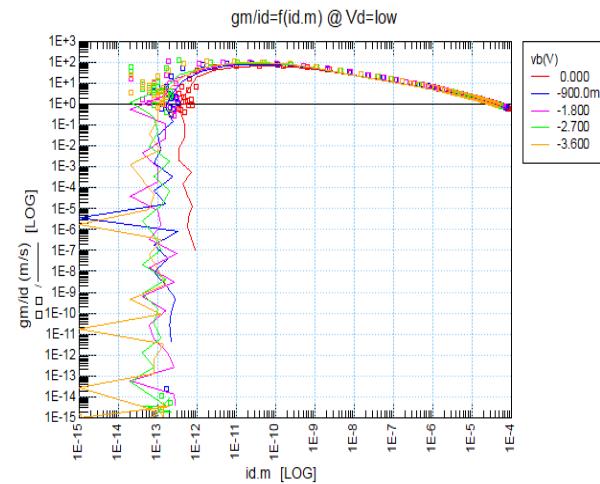
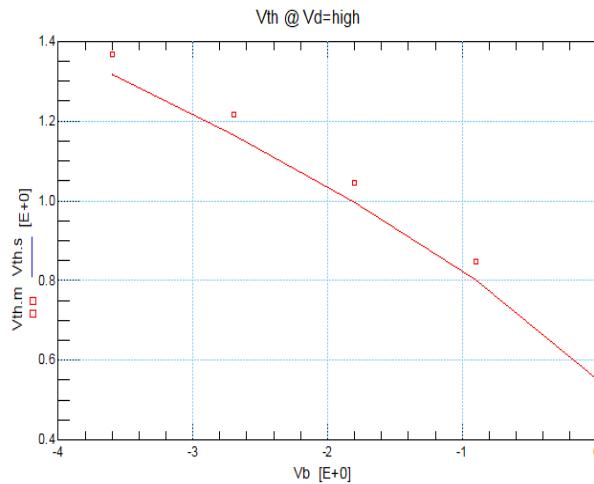


4.13 W02u0_L10u0_S558_5**idvg, Vd = 0.1V, T = 27°C**

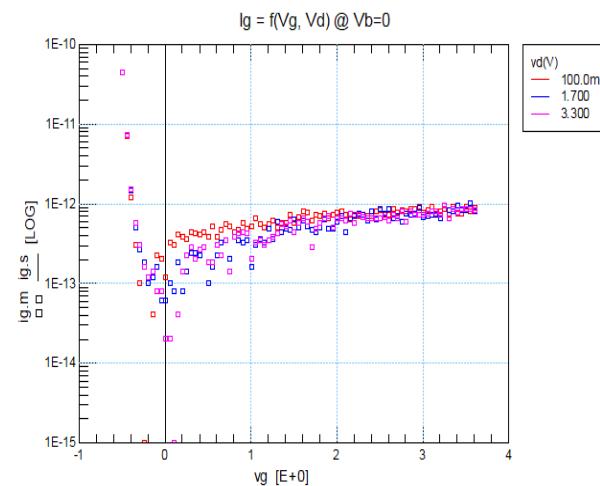
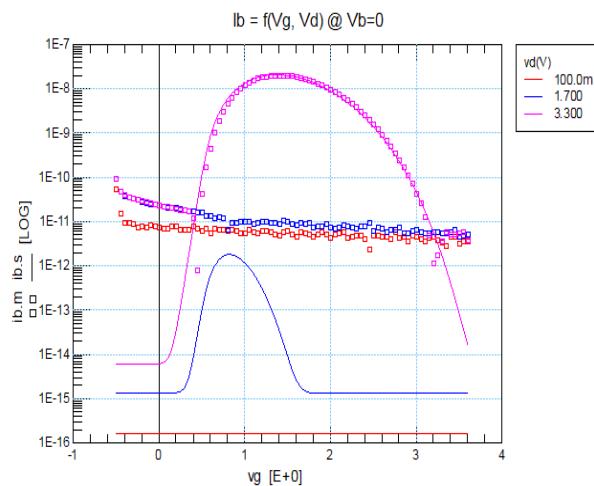


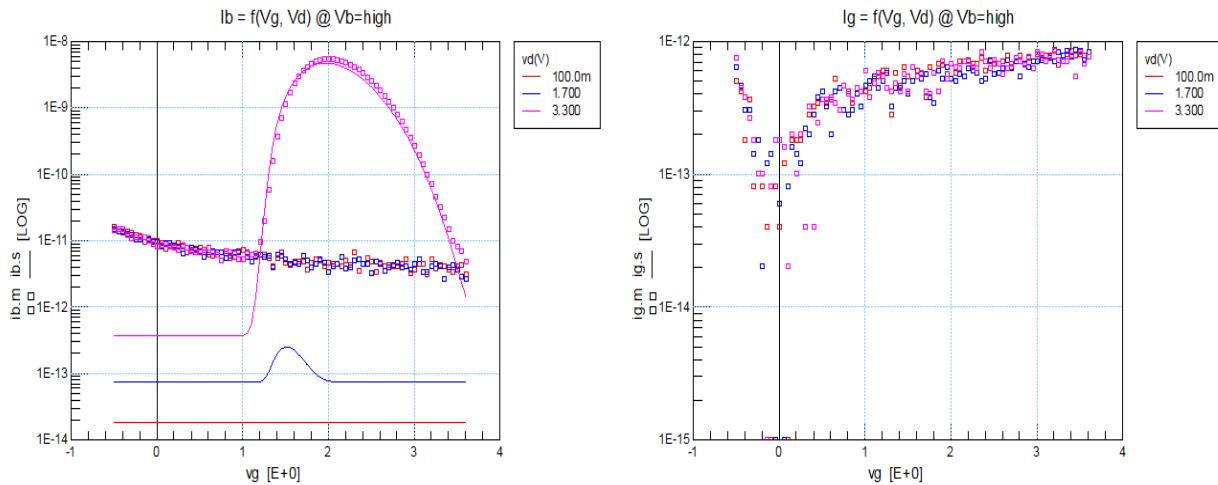
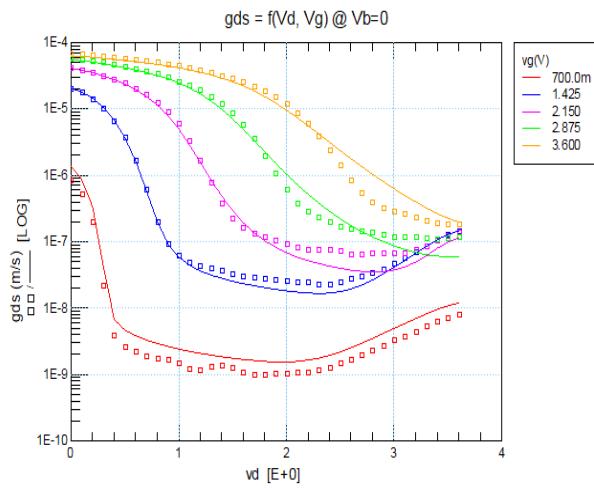
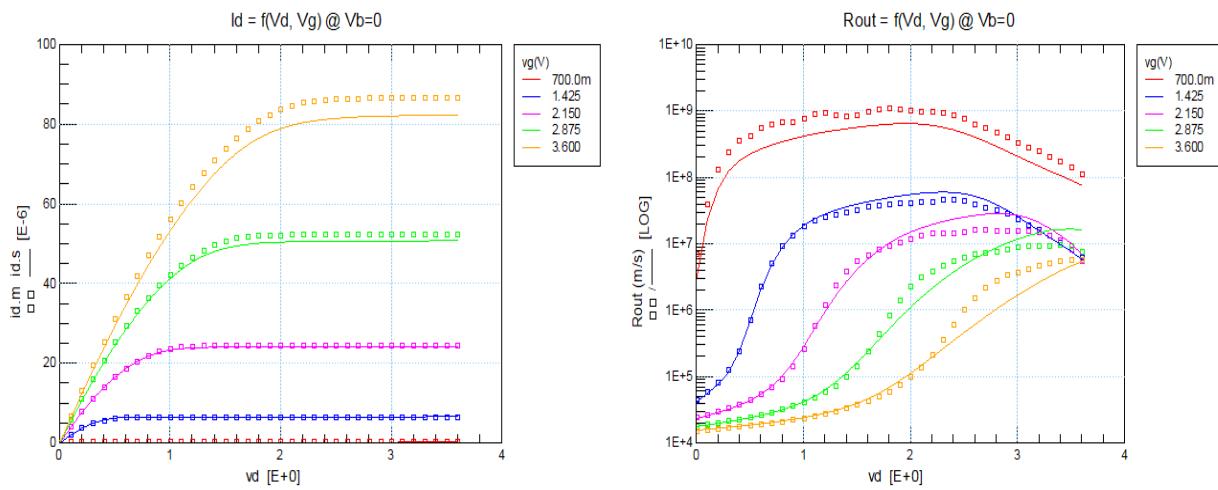
$i_d v_g, V_d = 3.3V, T = 27^\circ C$

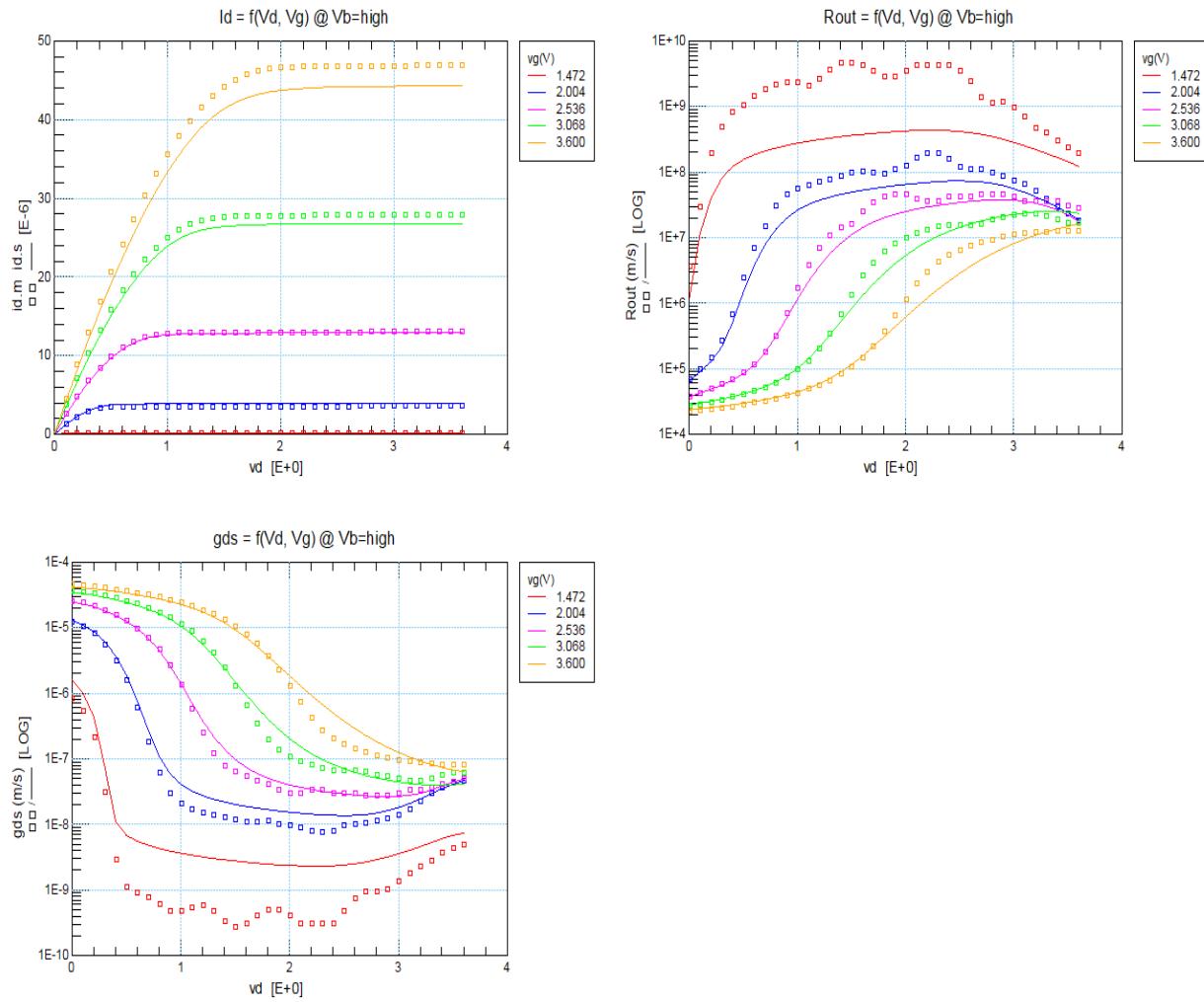
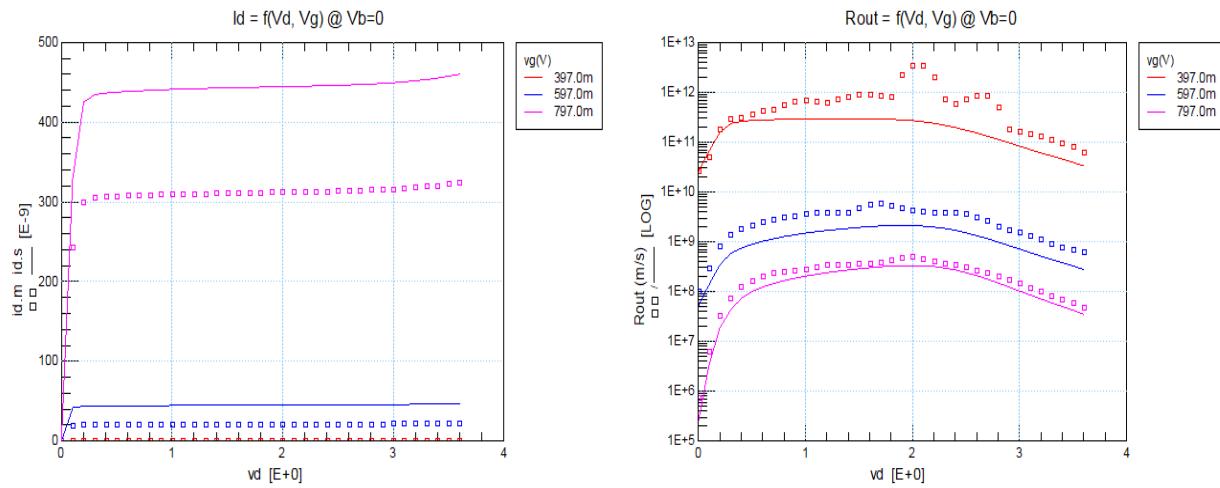


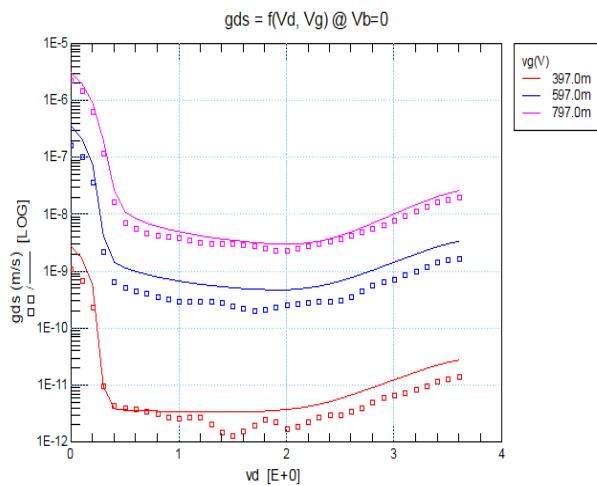


idvg, Ib, Ig, Vb = 0V, T = 27°C

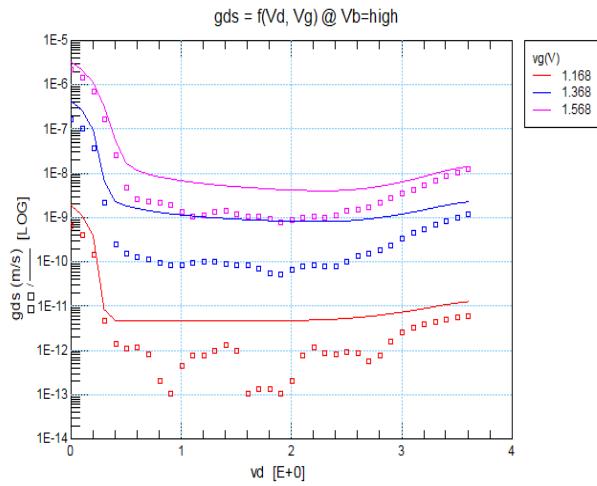
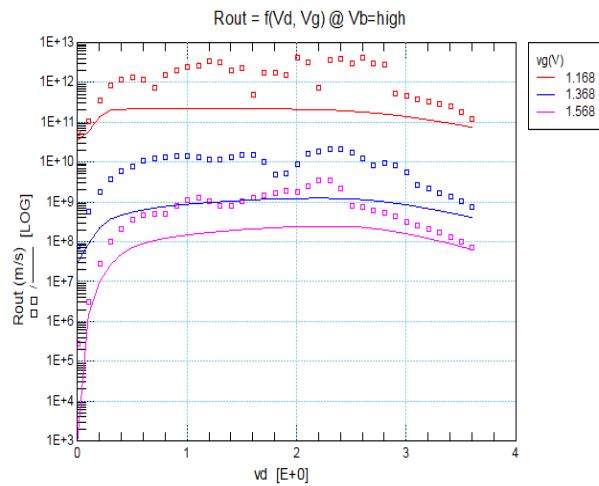
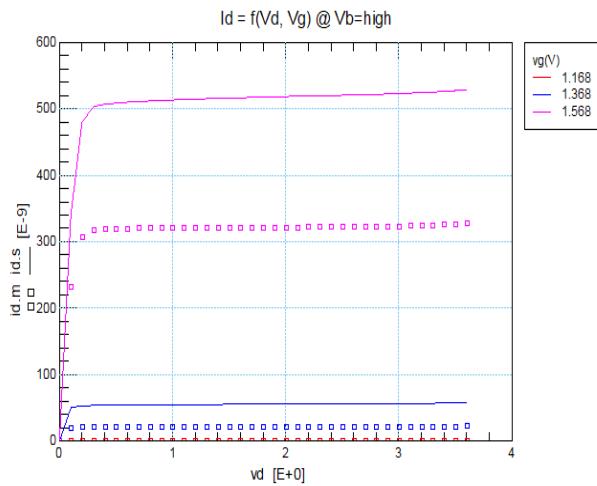


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


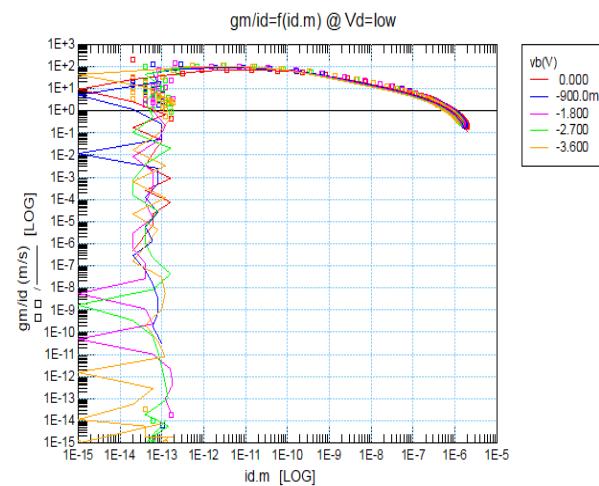
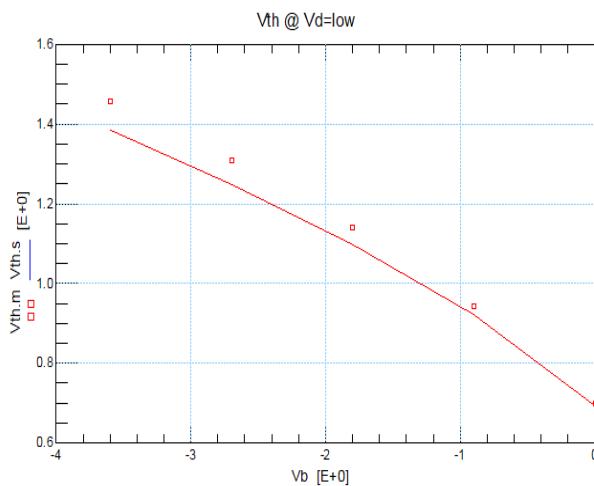
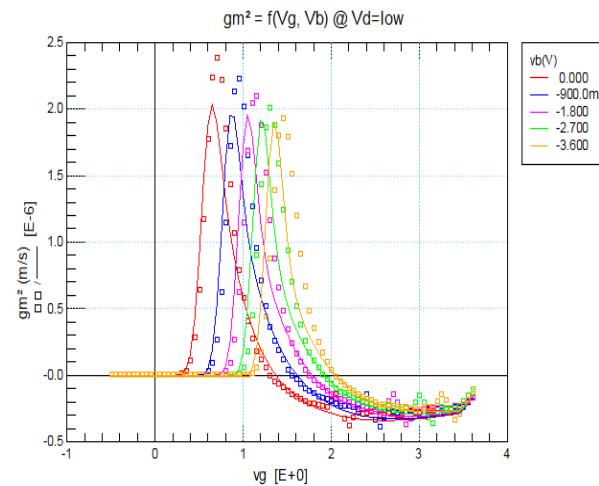
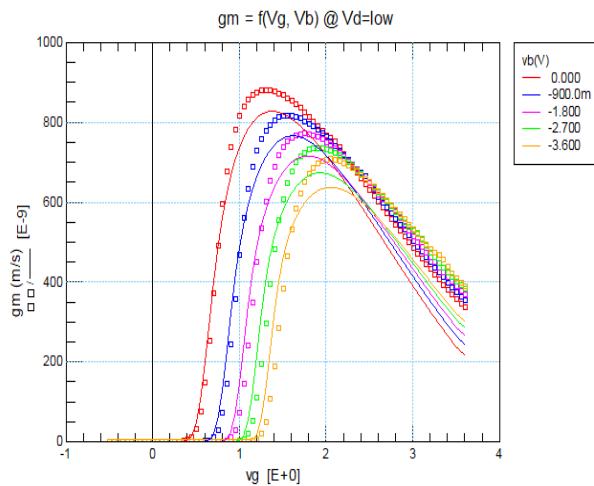
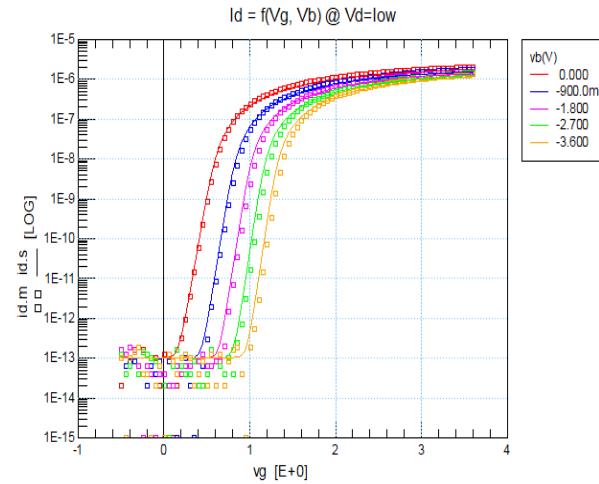
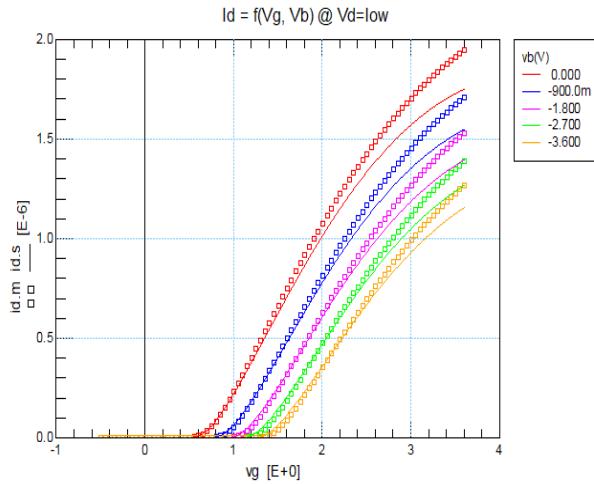


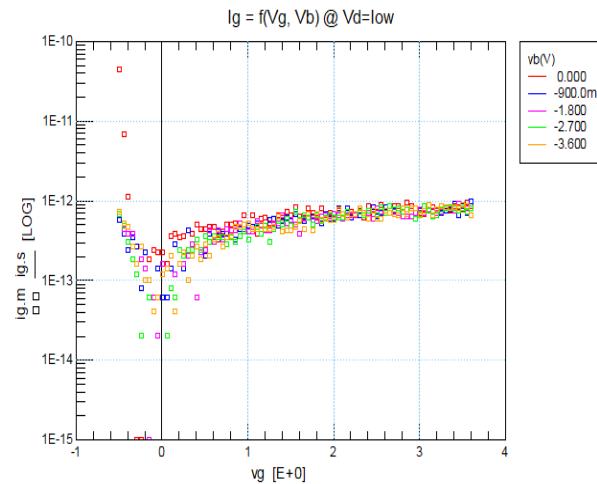
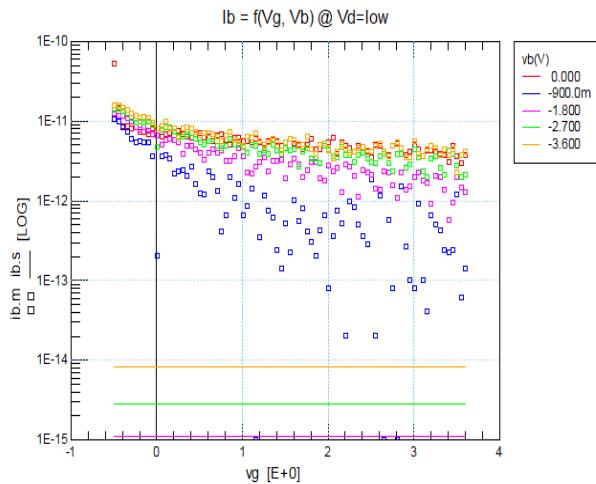
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



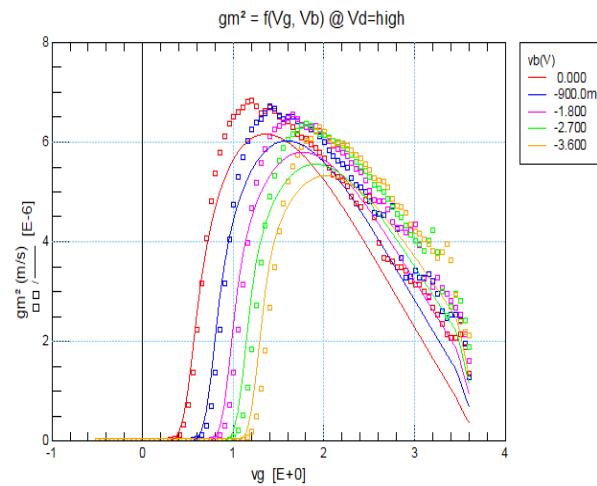
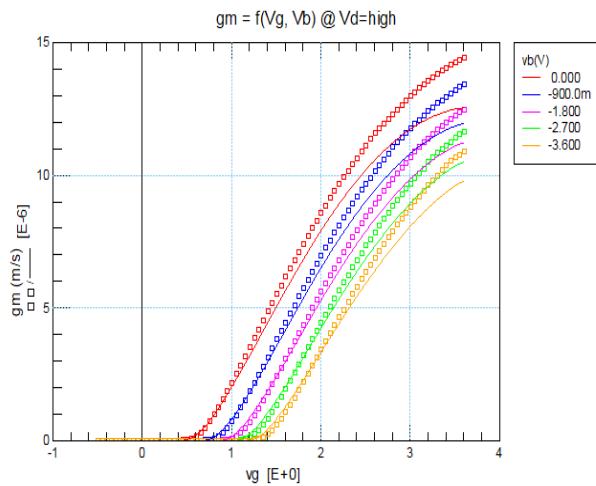
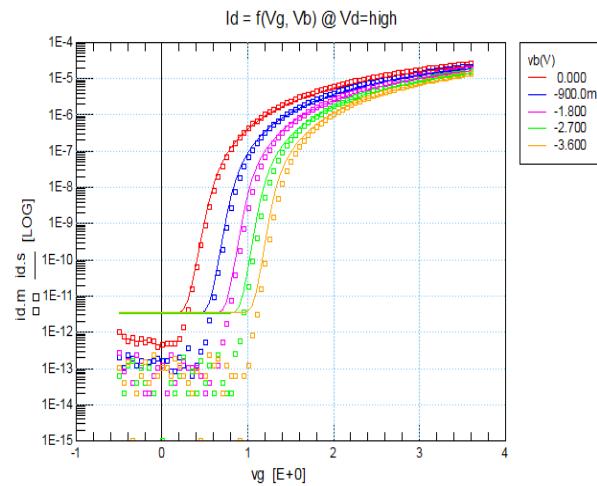
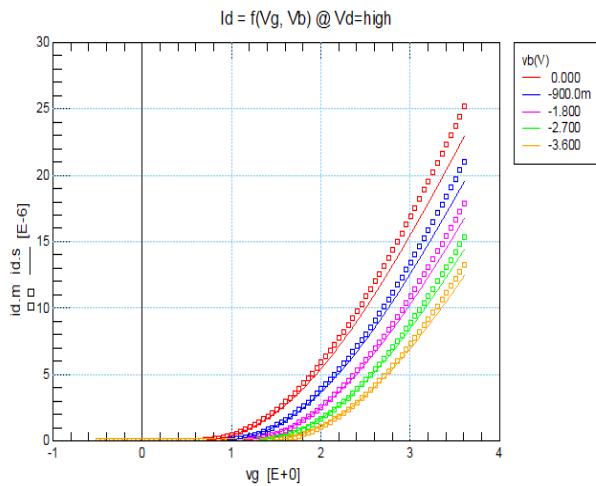
4.14 W0u6_L10u0_S559_5

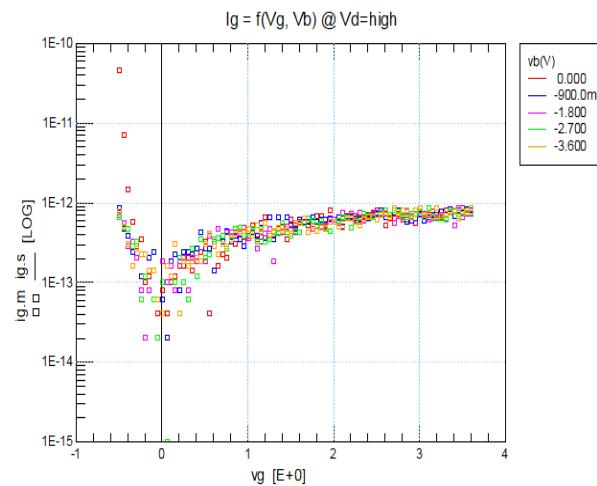
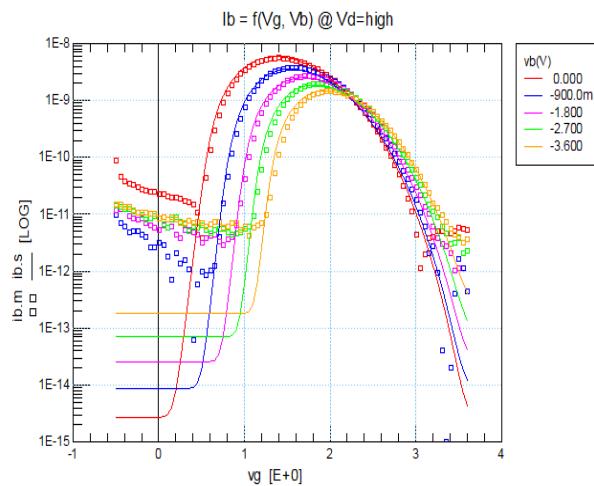
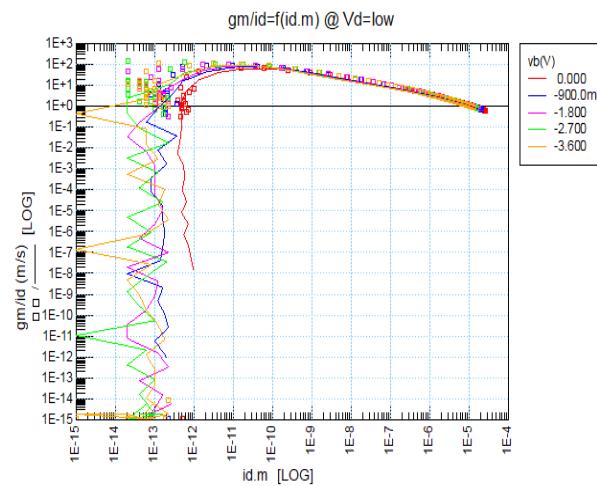
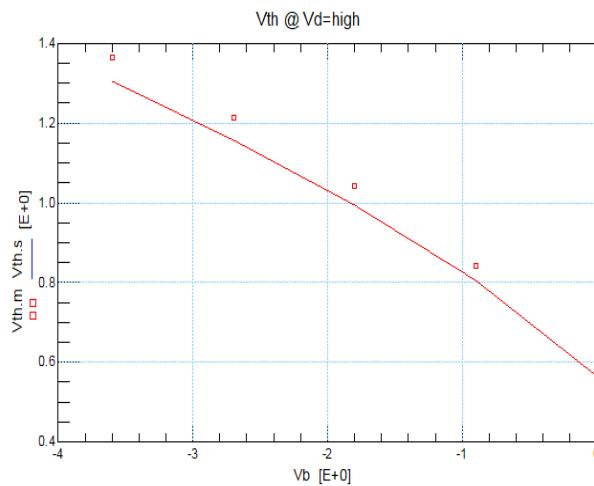
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



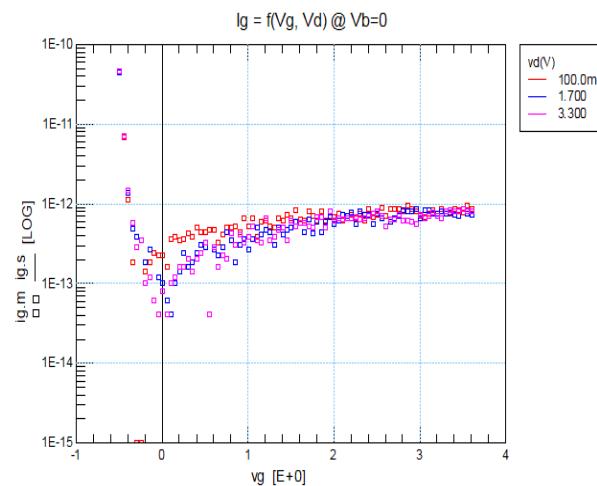
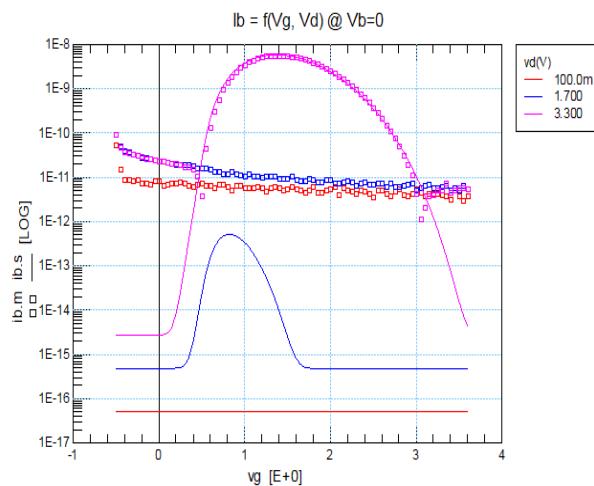


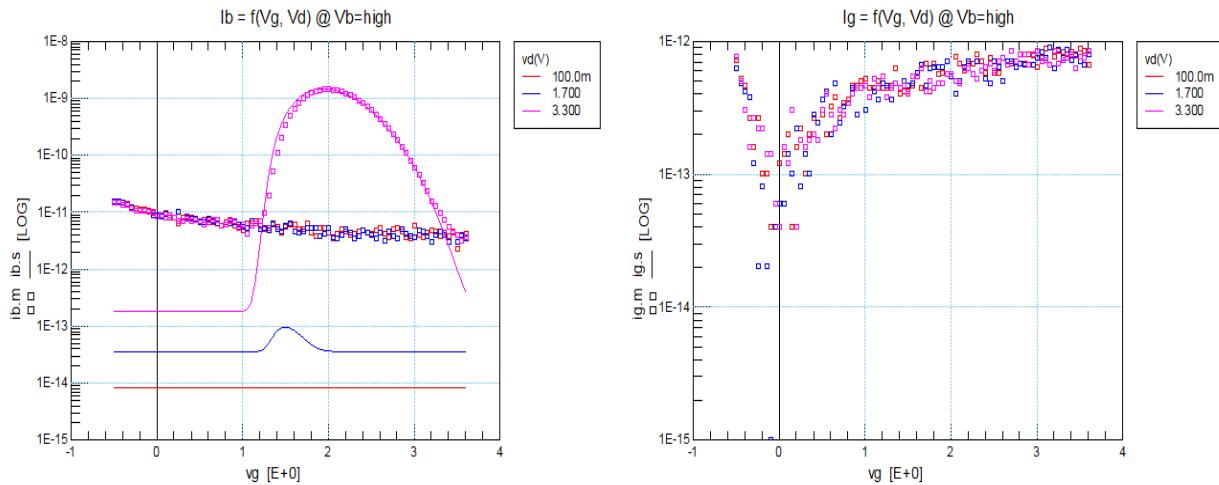
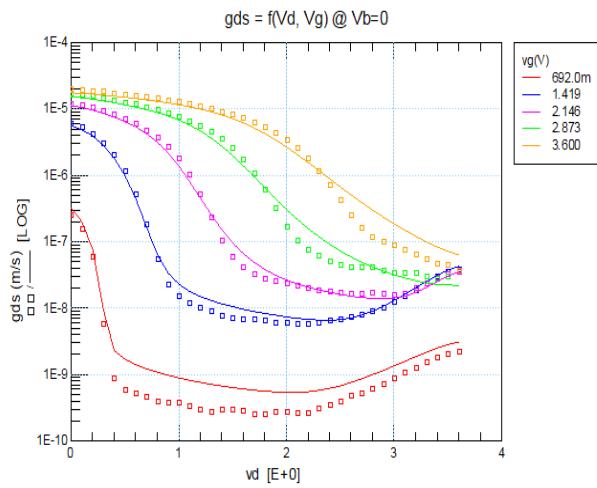
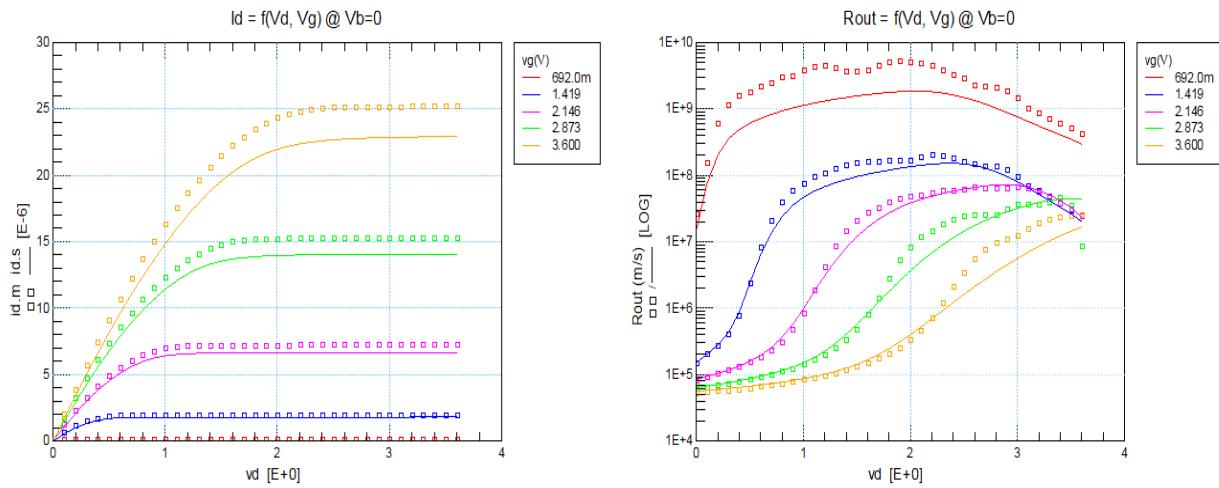
$i_d v_g, V_d = 3.3V, T = 27^\circ C$

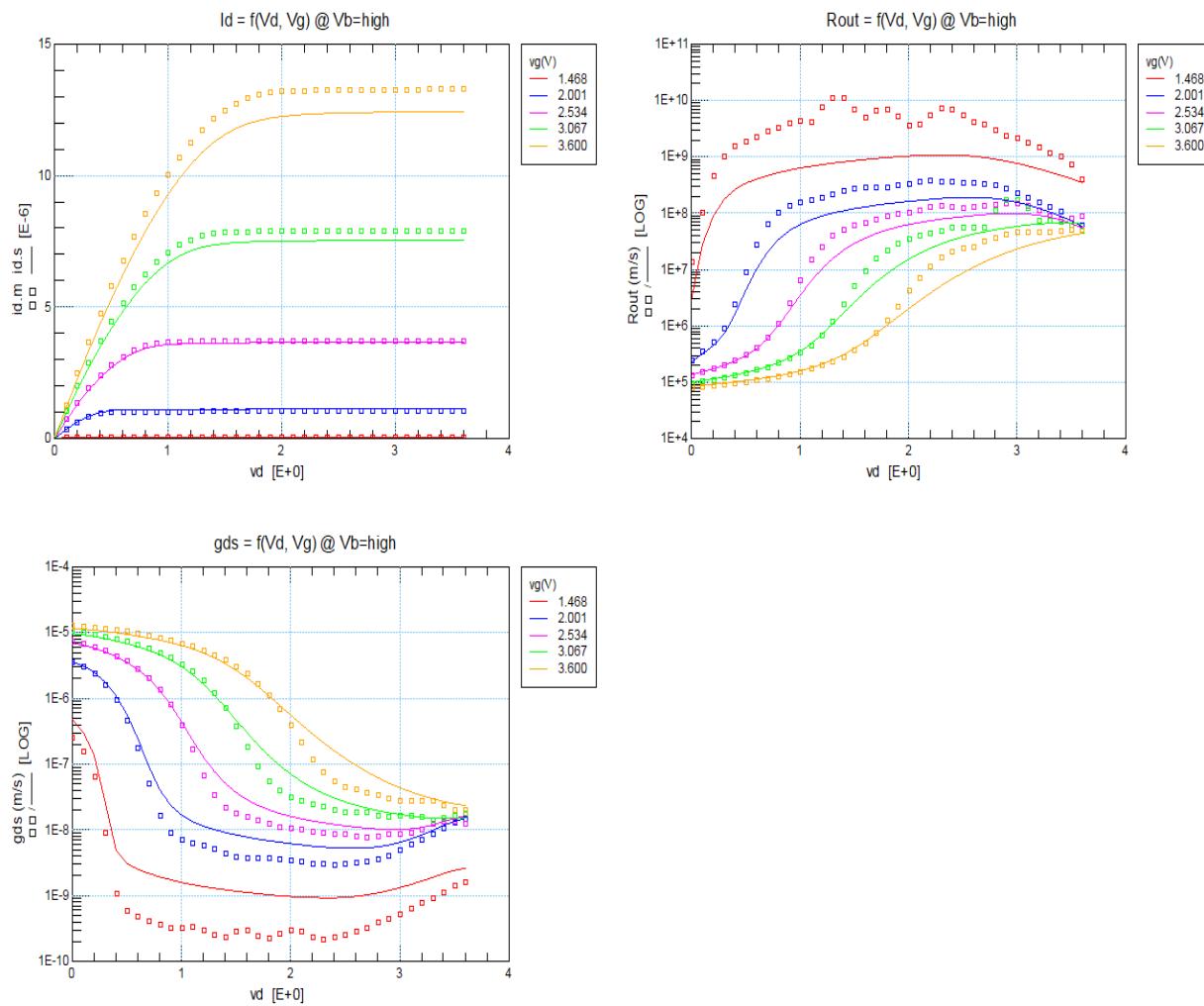
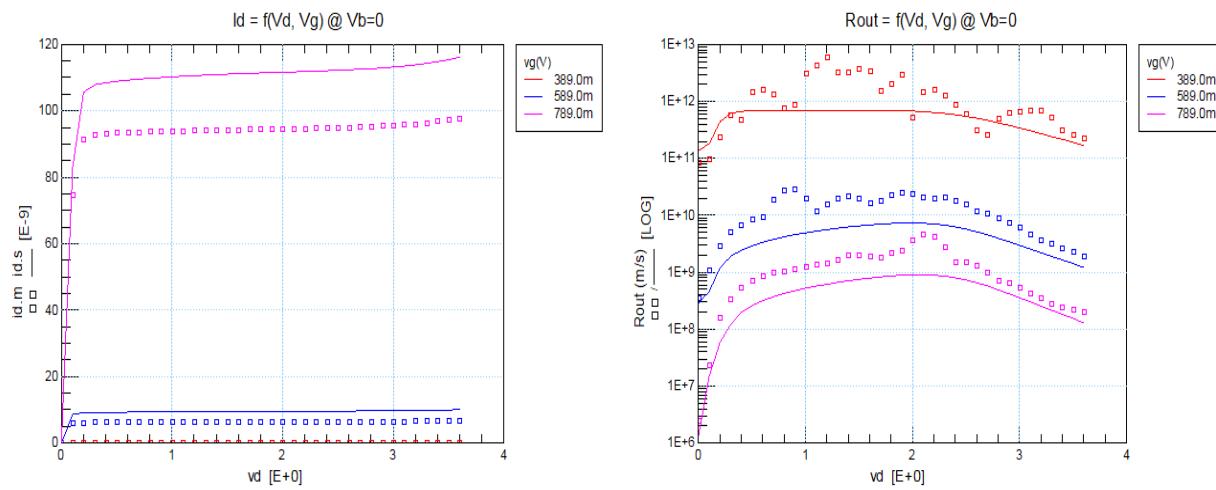


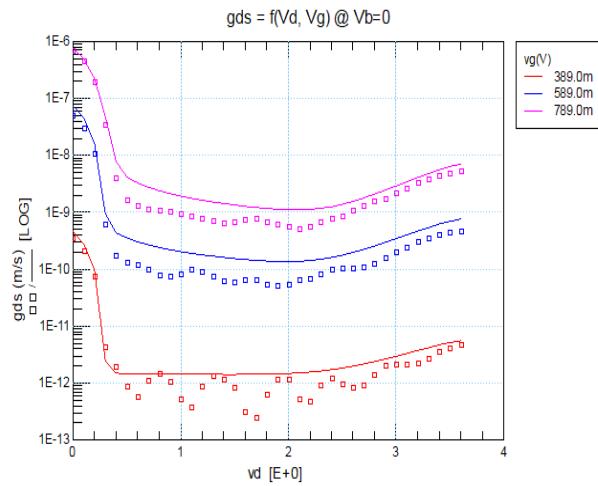


idvg, Ib, Ig, Vb = 0V, T = 27°C

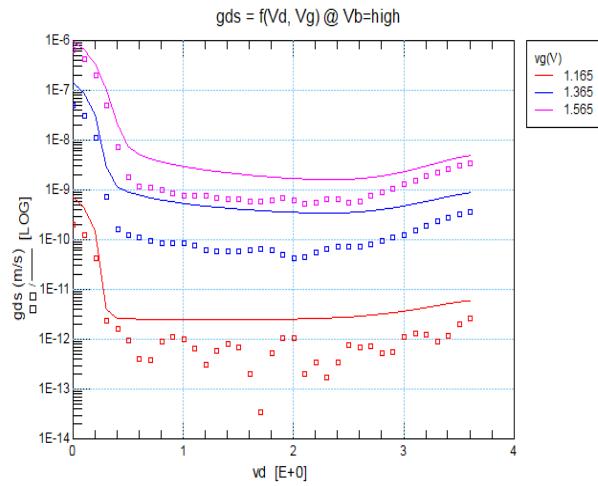
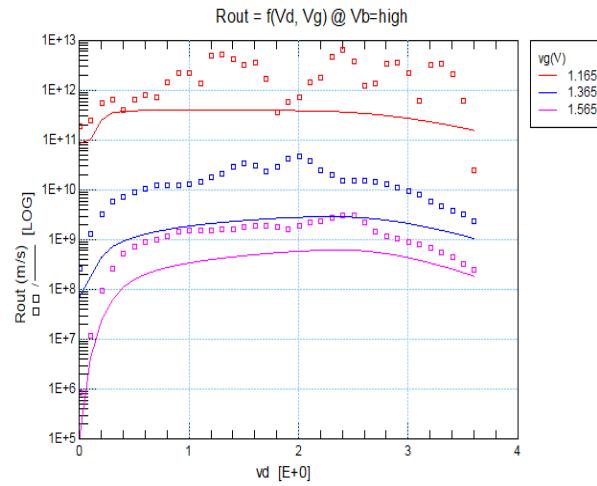
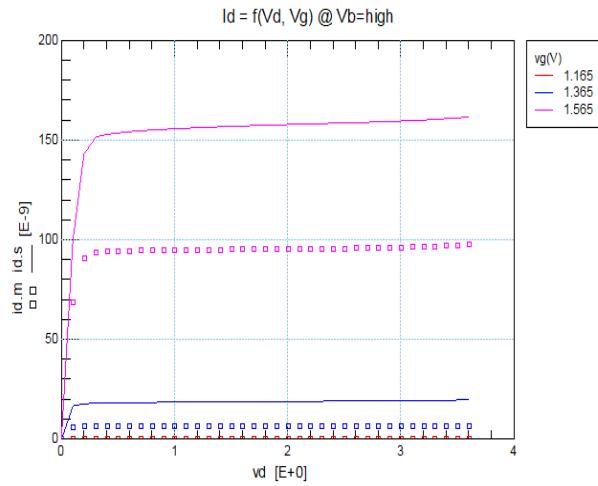


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


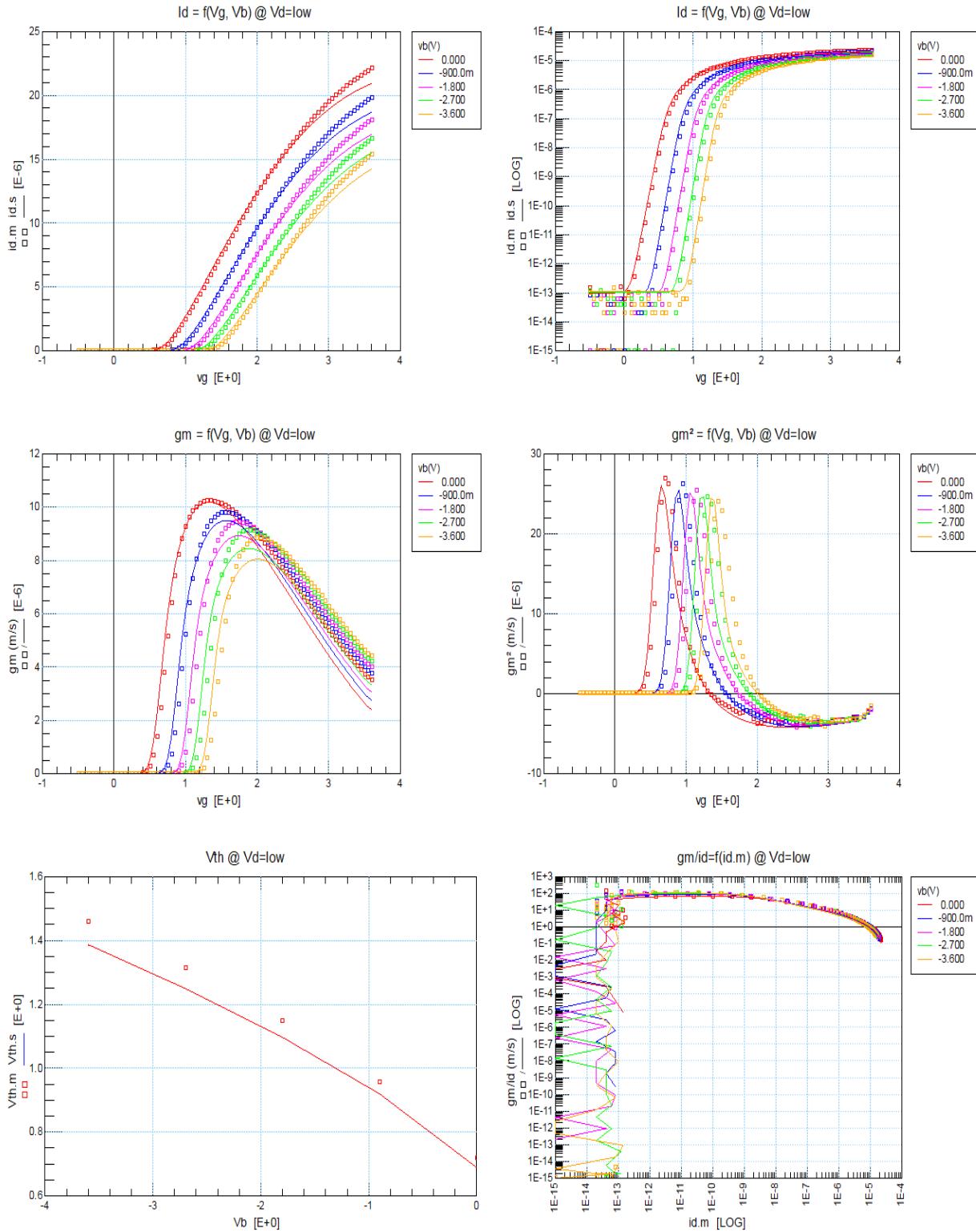


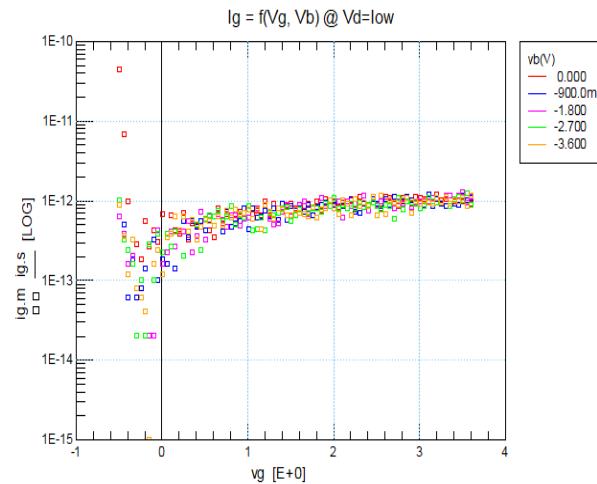
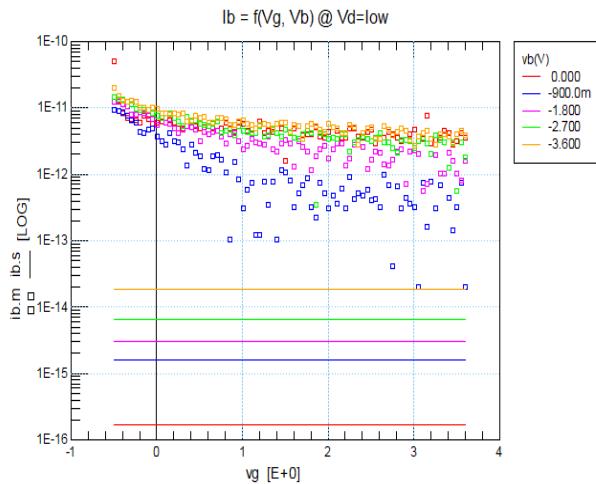
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



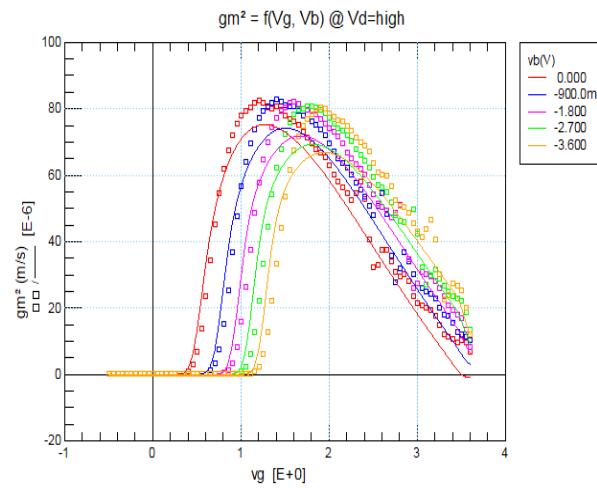
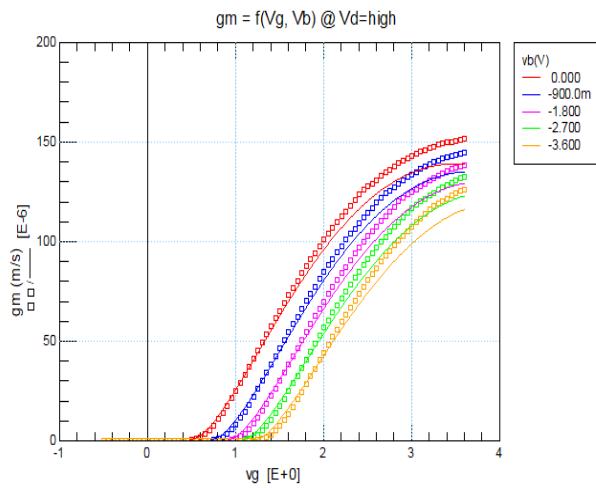
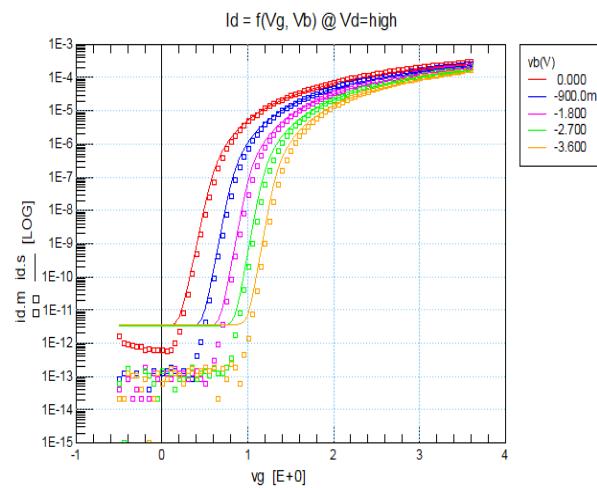
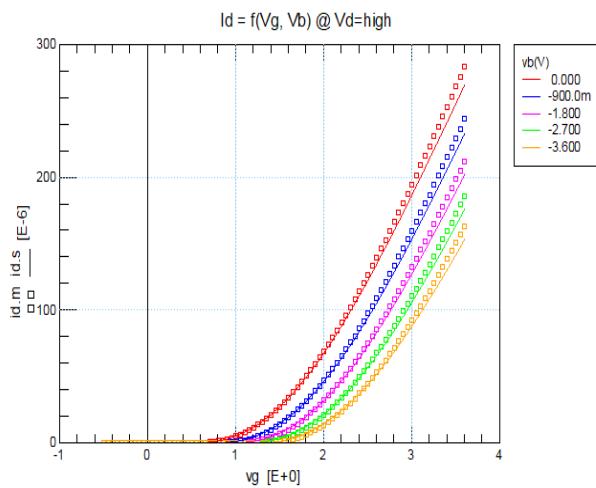
4.15 W02u0_L3u0_S558_4

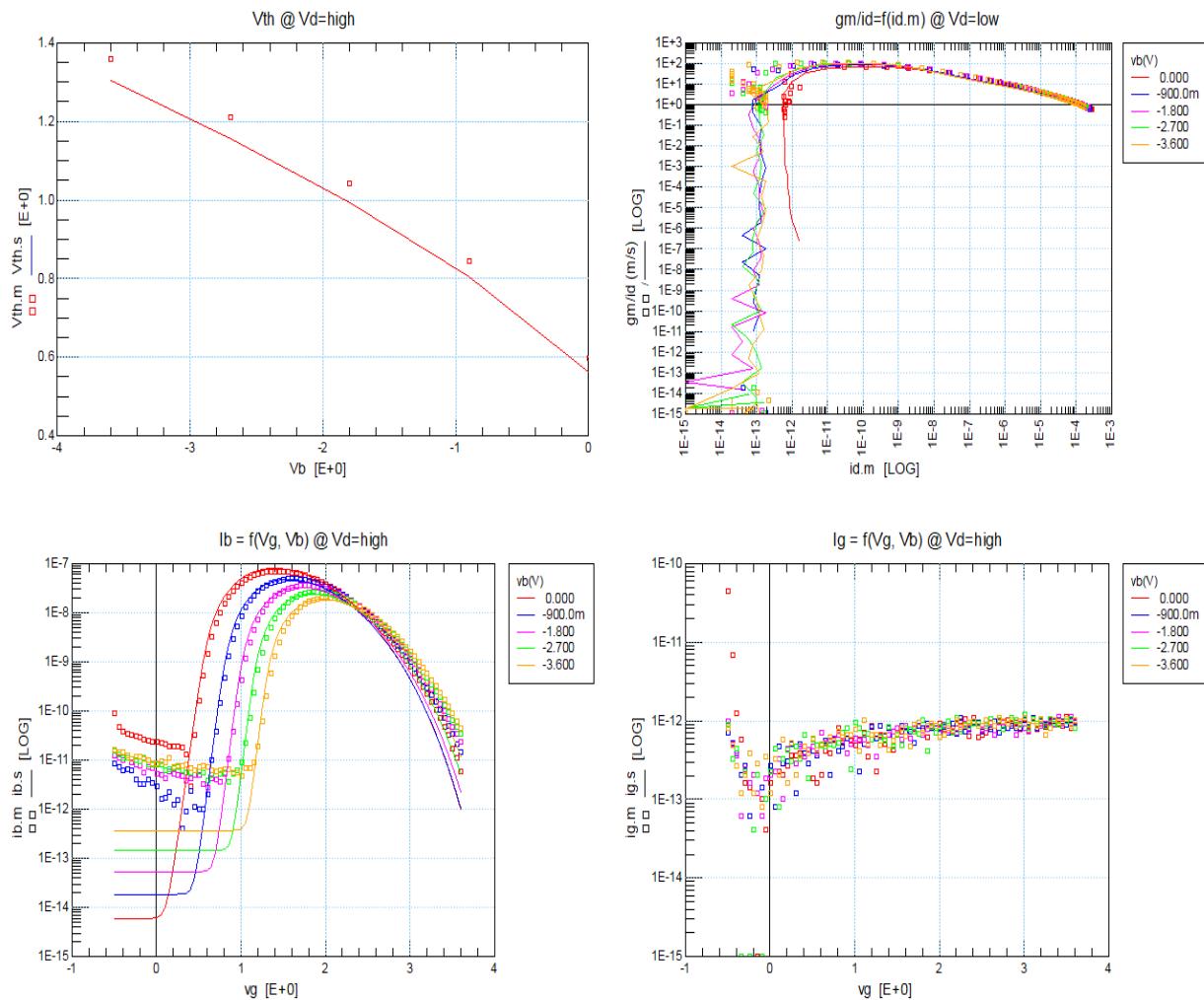
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$

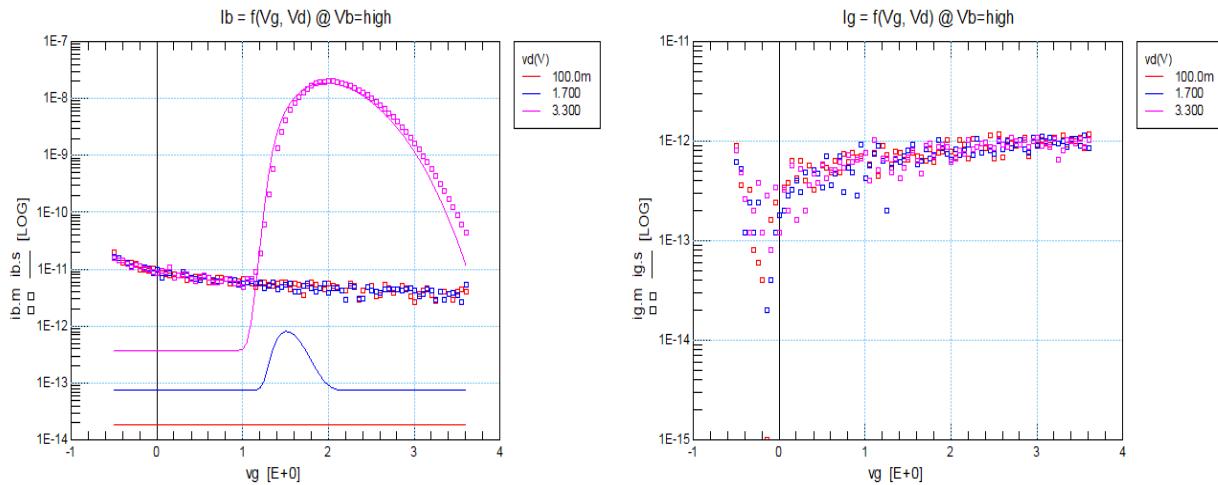
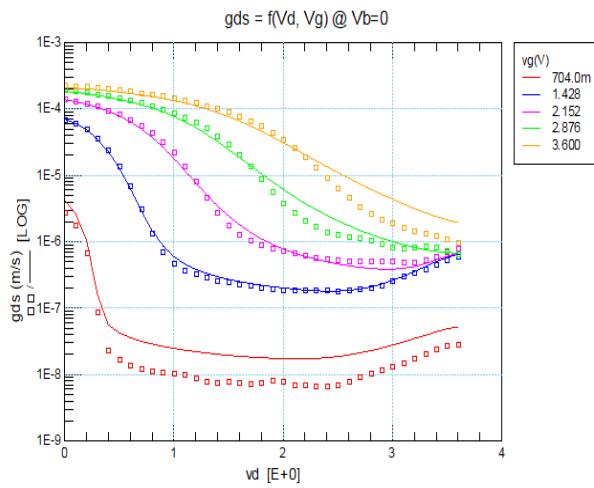
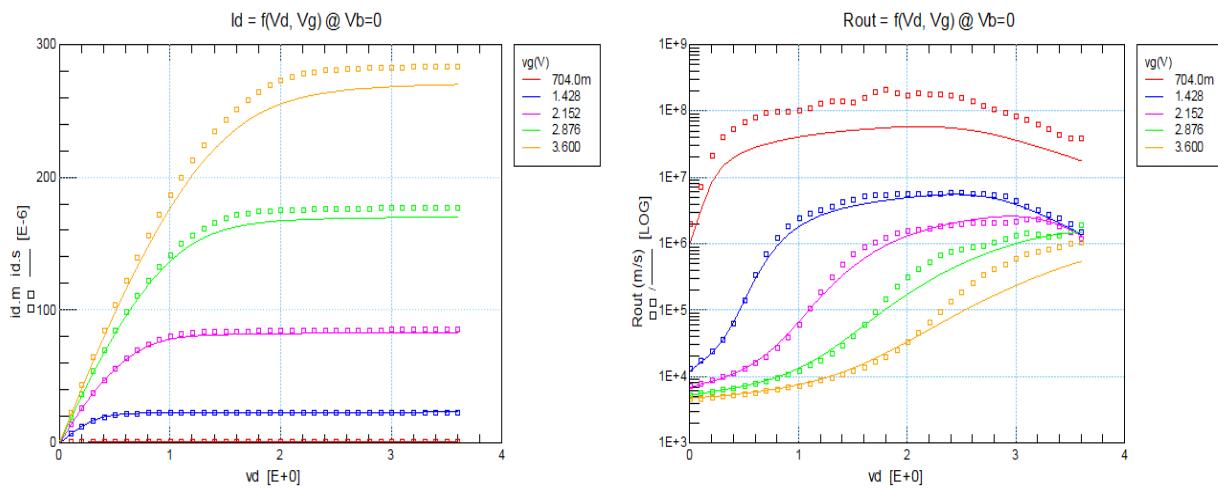


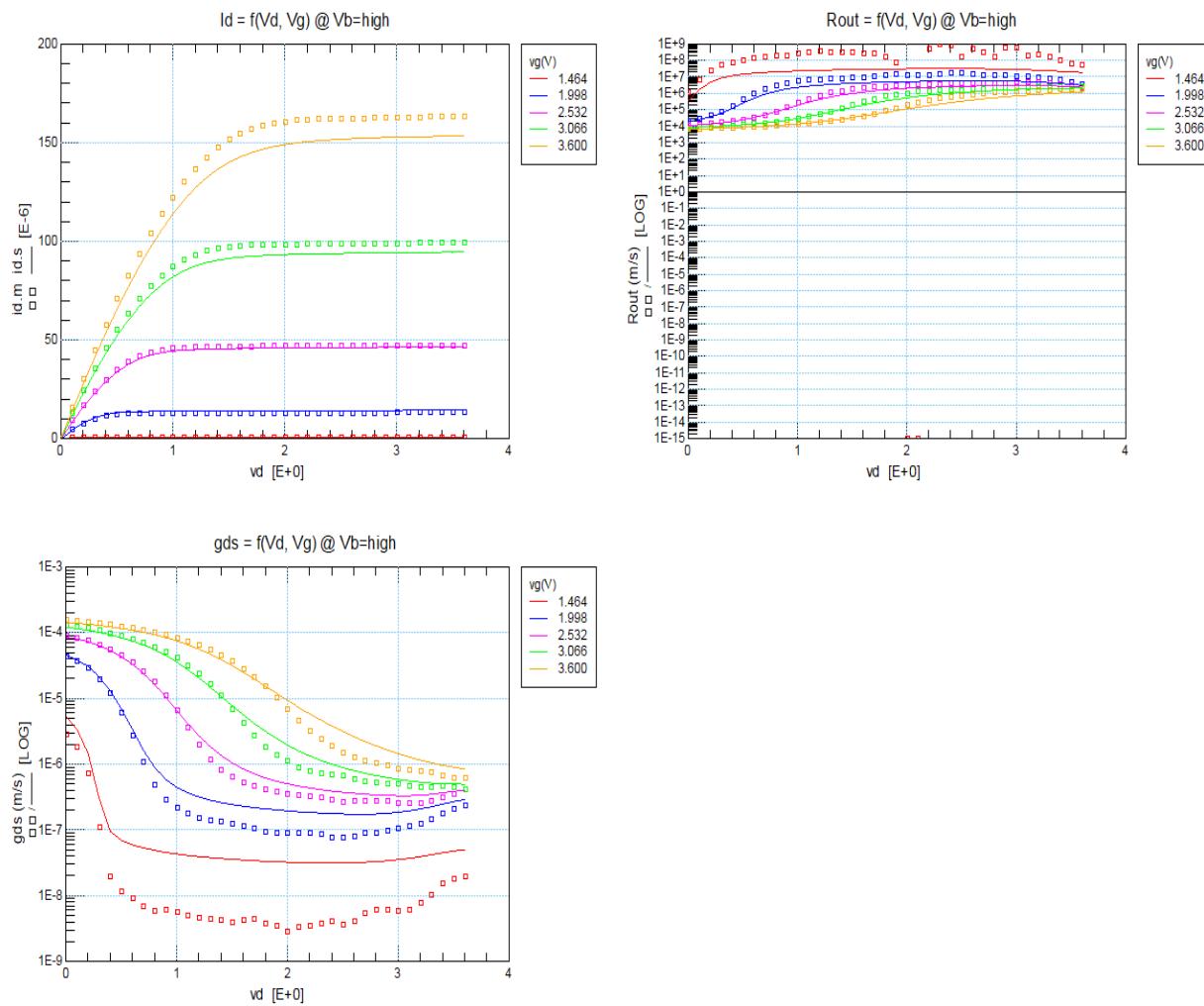
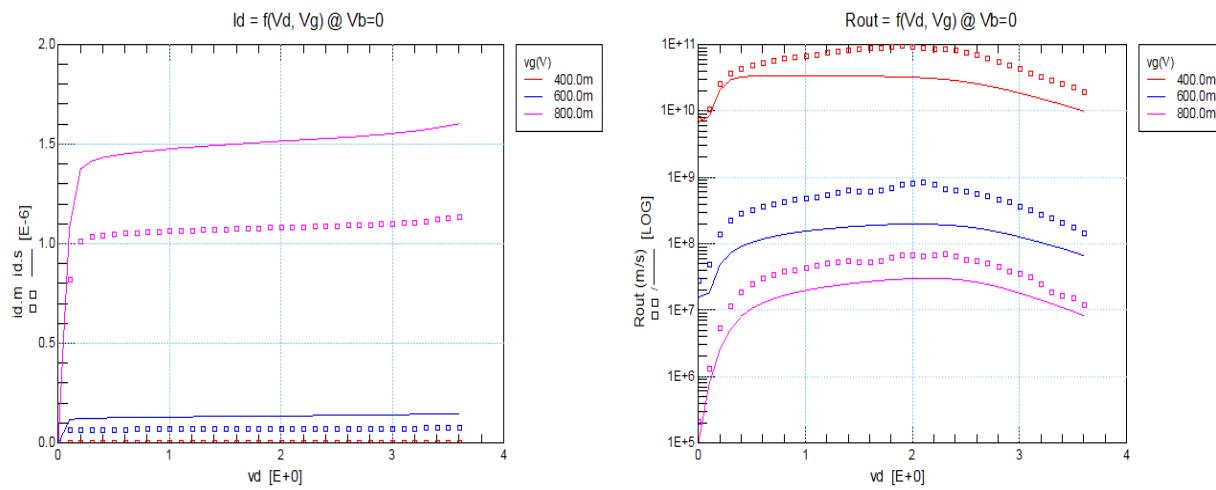


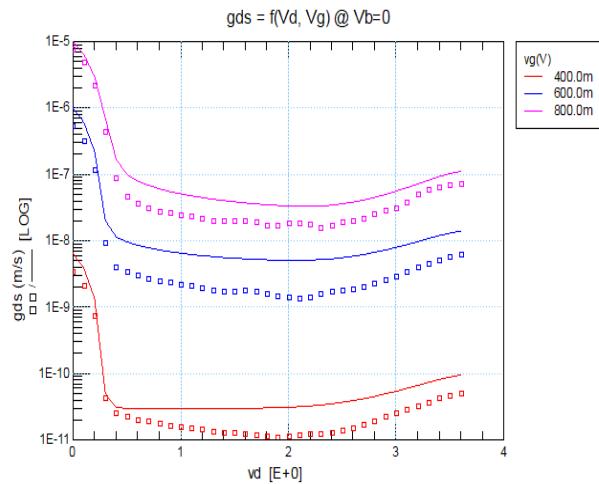
$i_{dvg}, V_d = 3.3V, T = 27^\circ C$



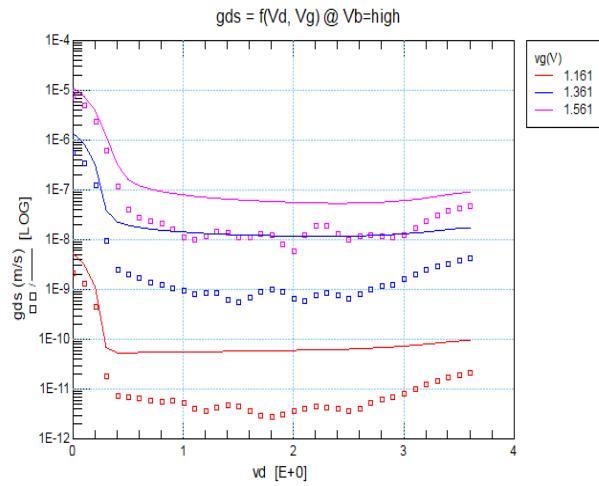
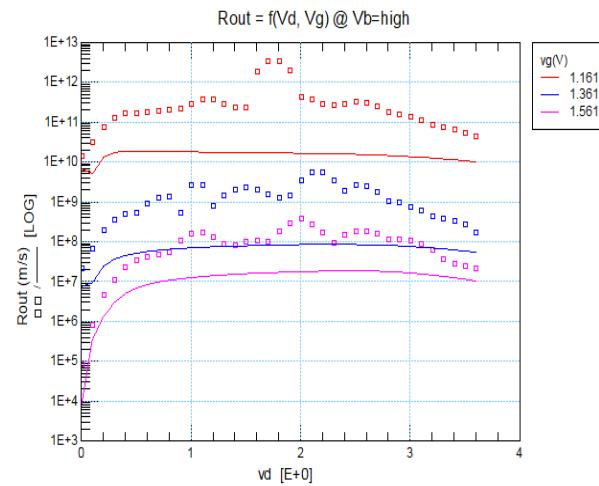
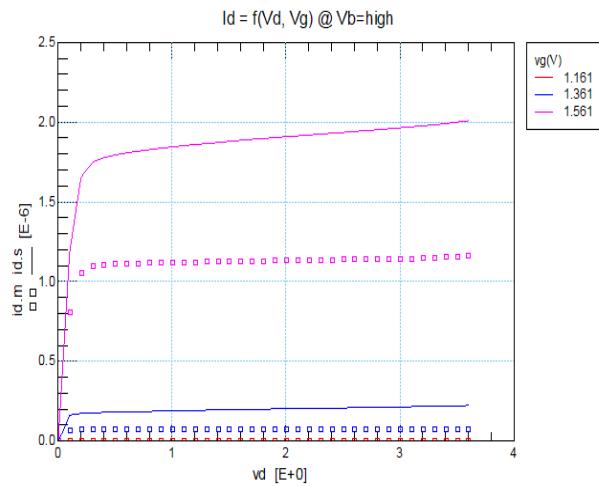


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


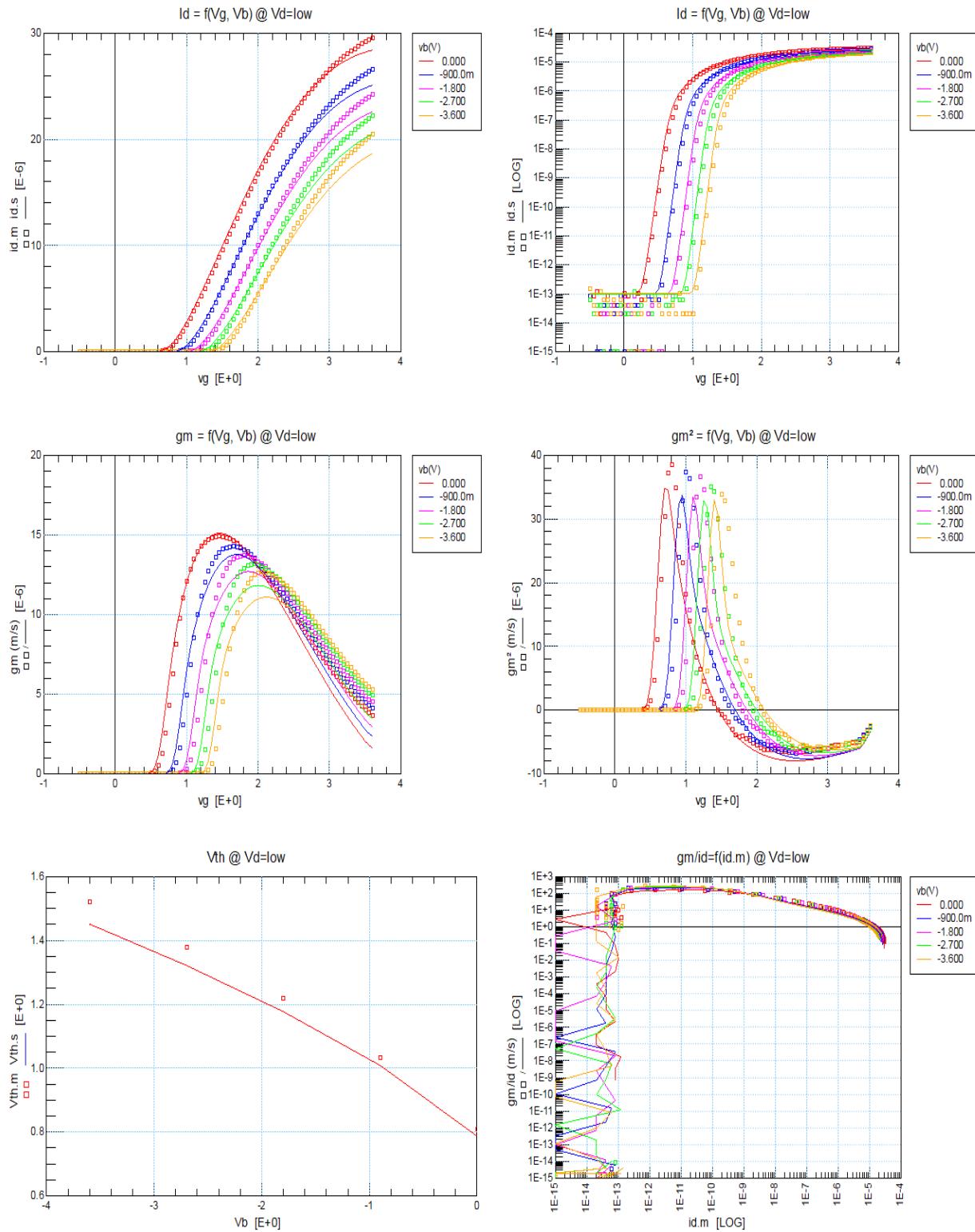
idvd_vbmin, Vb = -3.6V, T = 27°C**idvd_vth, Vb = 0V, T = 27°C**

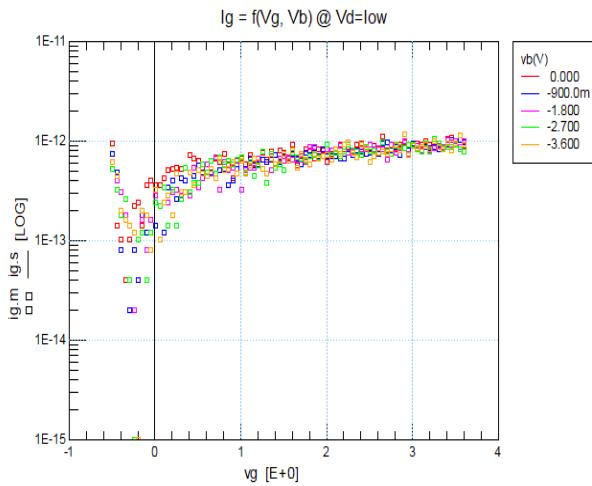
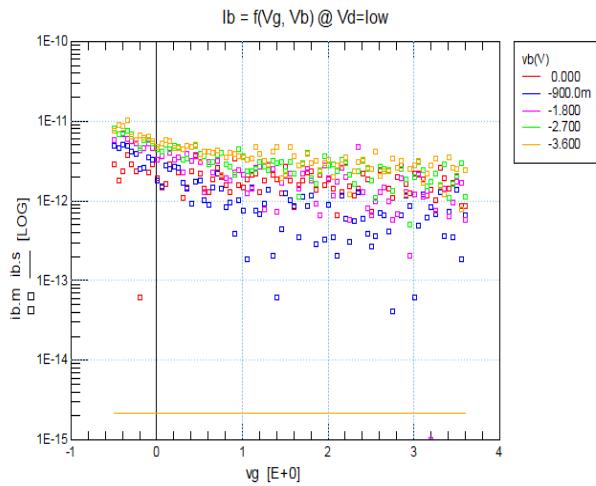


idvd_vth_vbmin, Vb = -3.6V, T = 27°C

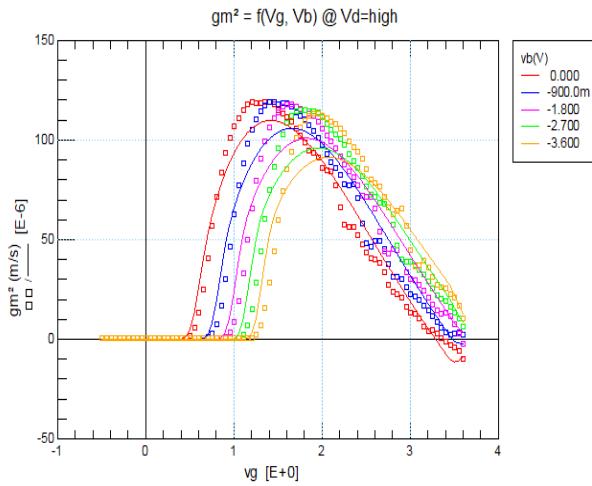
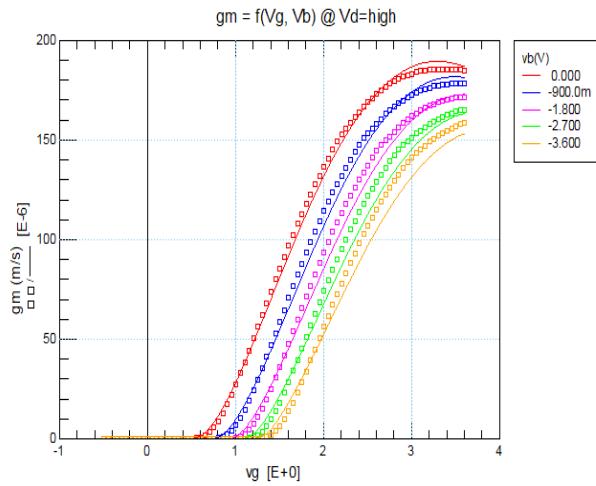
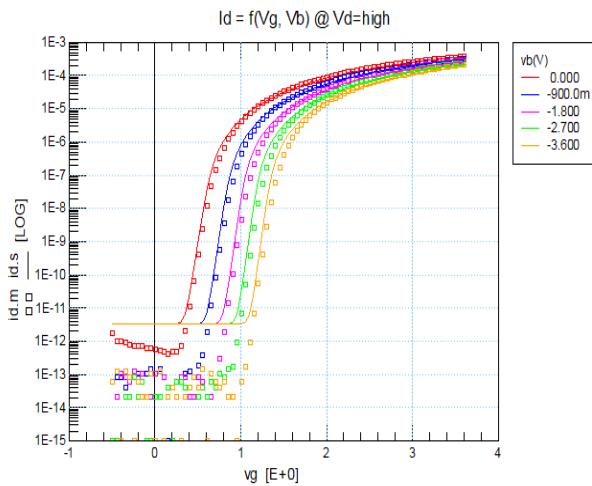
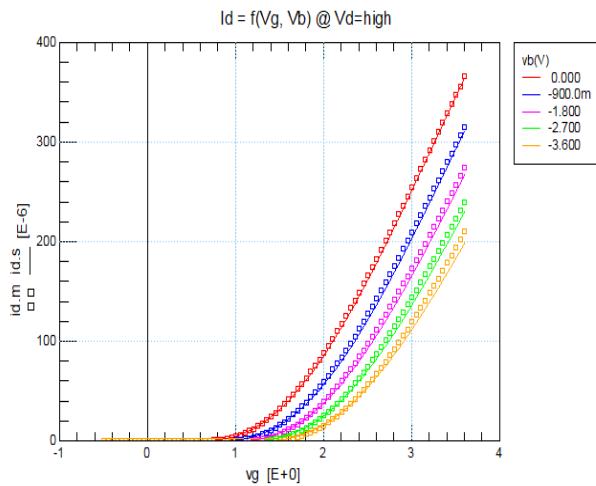


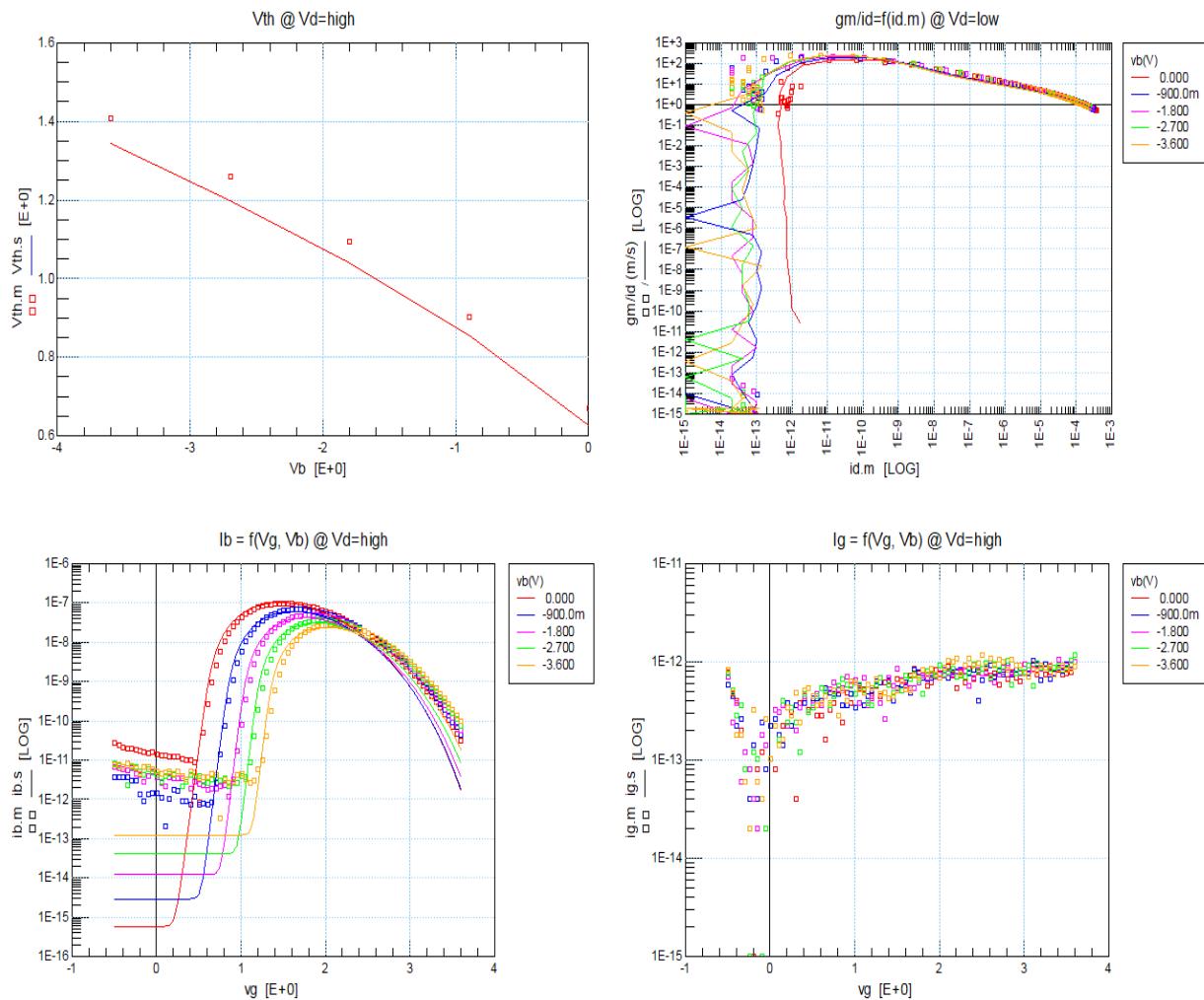
idvg, Vd = 0.1V, T = -40°C



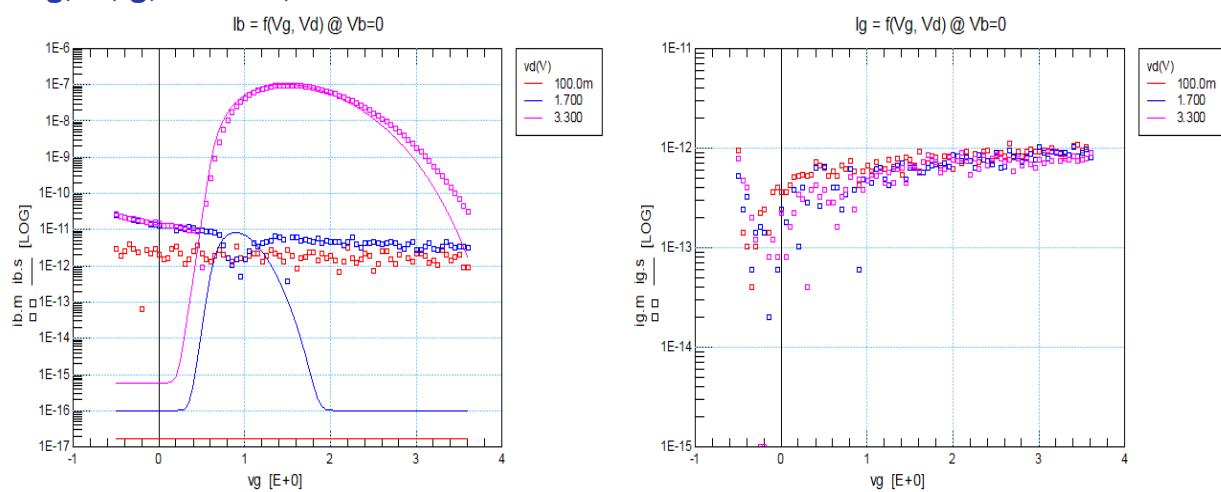


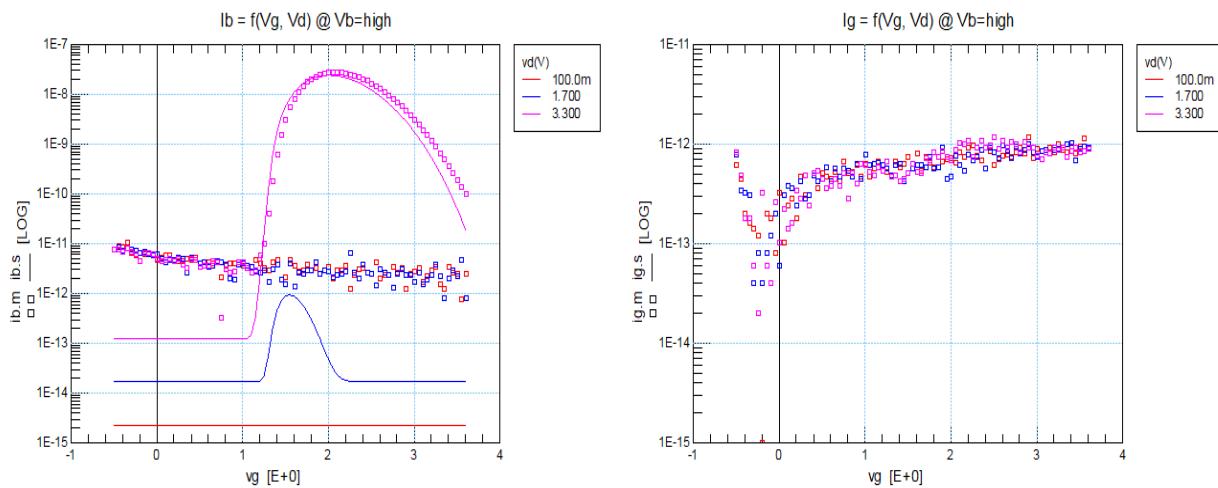
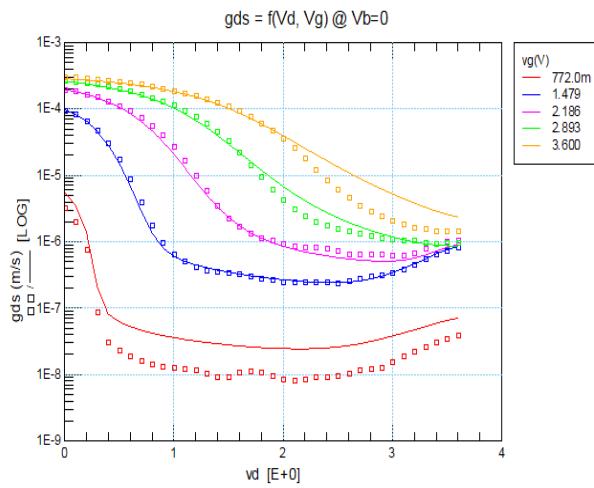
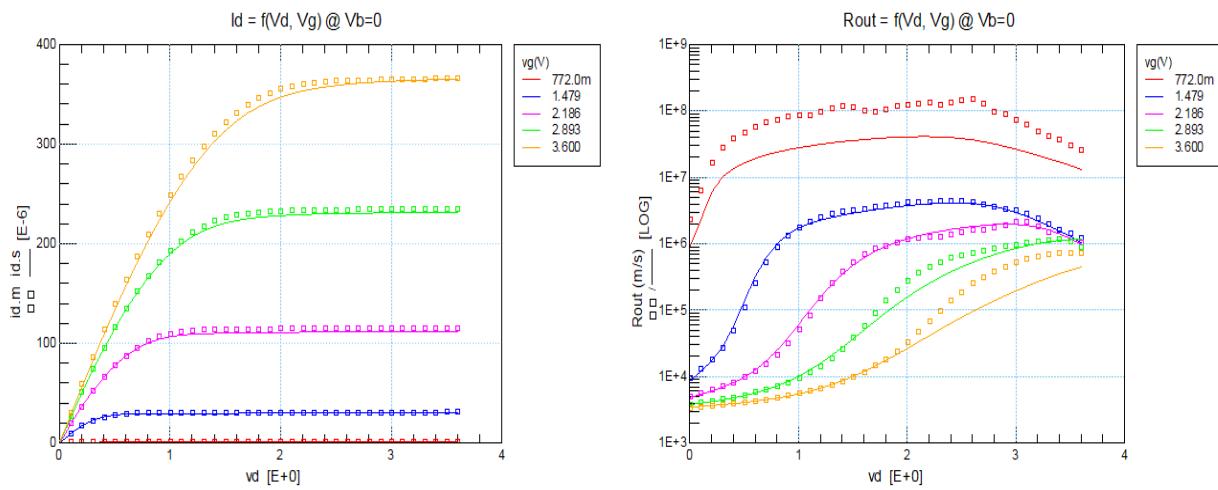
$i_{dvg}, V_d = 3.3V, T = -40^{\circ}C$

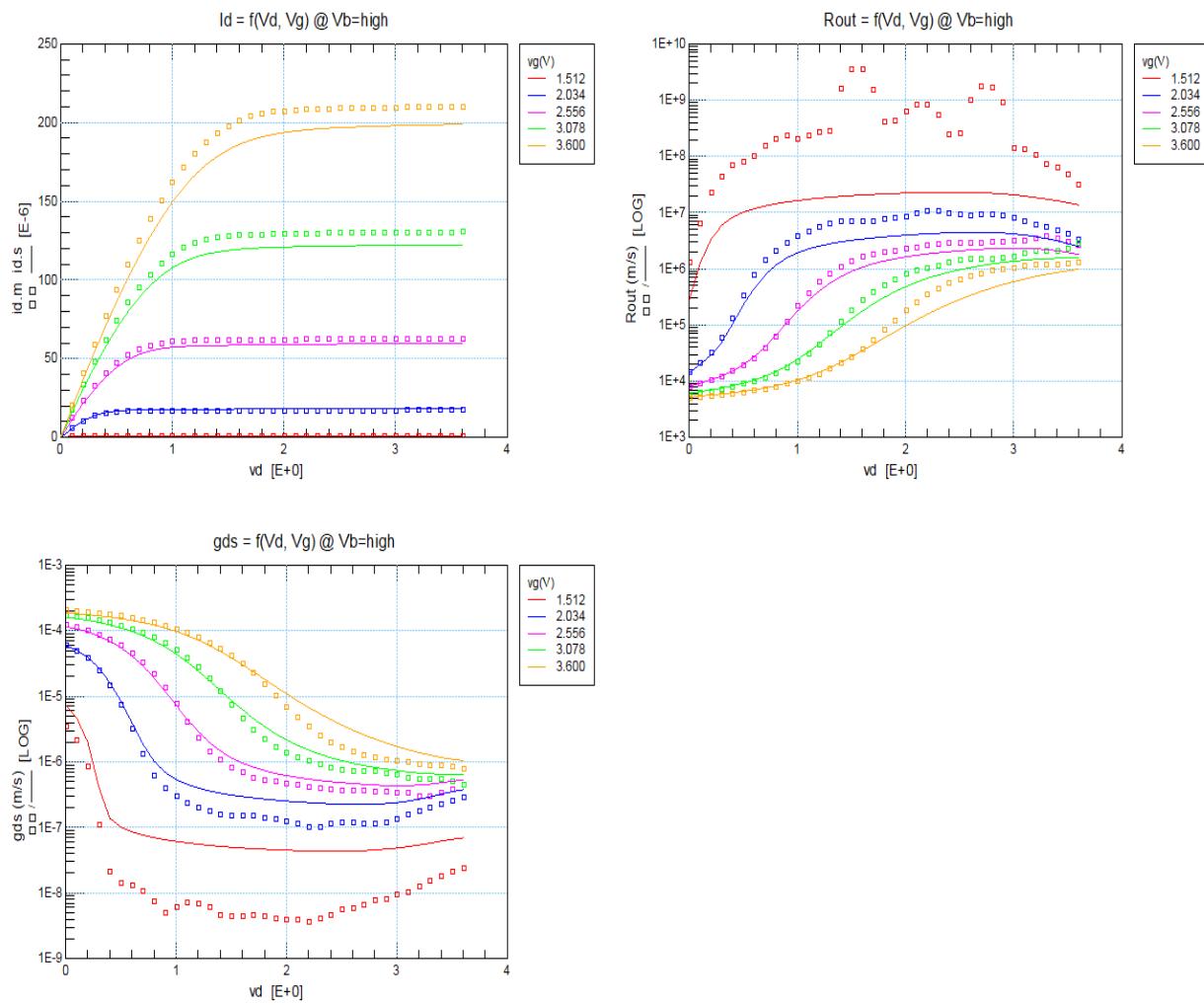
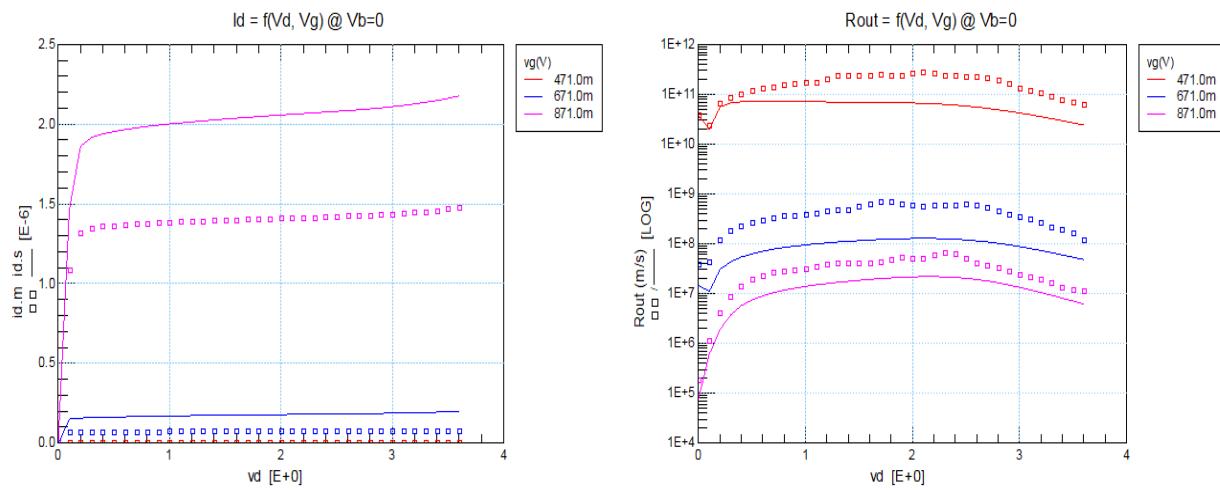


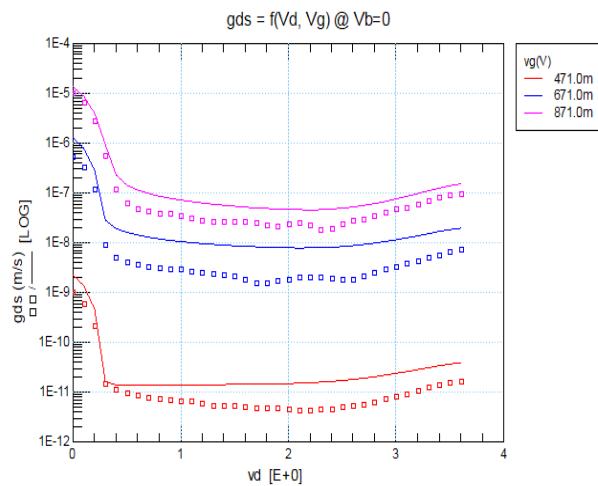


idvg, Ib, Ig, Vb = 0V, T = -40°C

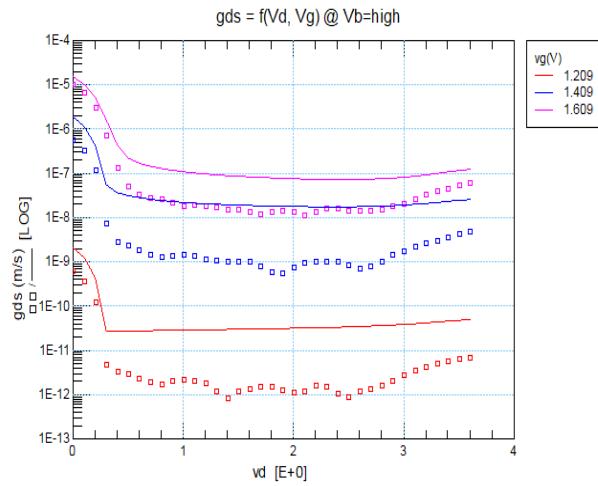
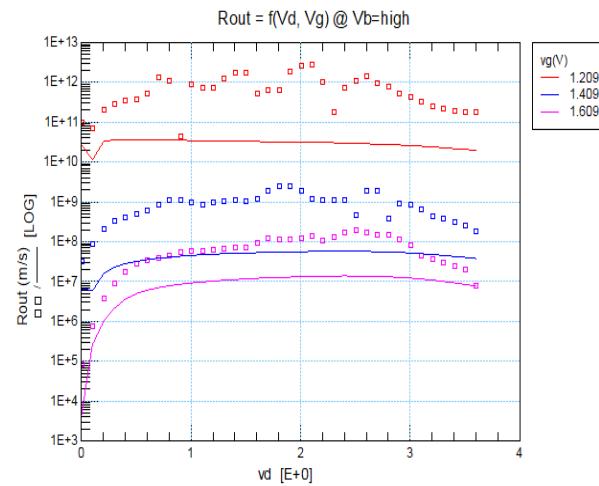
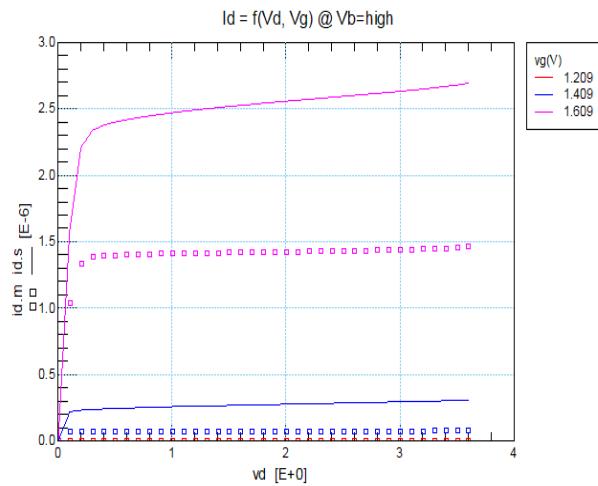


idvg, Ib,Ig, Vb = -3.6V, T = -40°C

idvd, Vb = 0V, T = -40°C


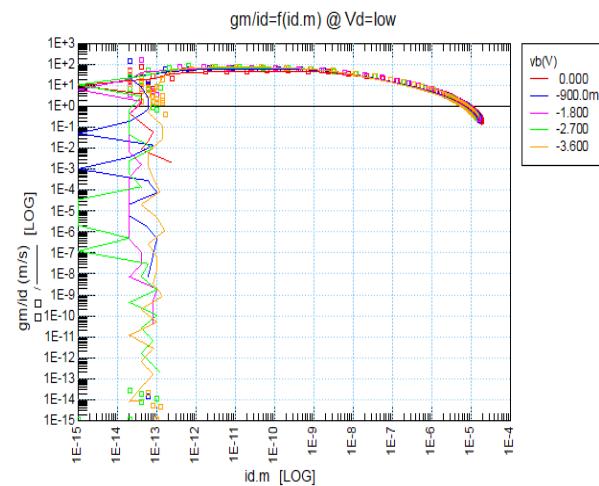
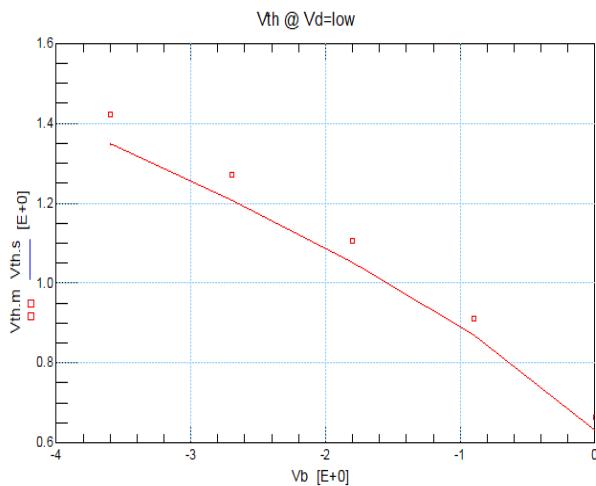
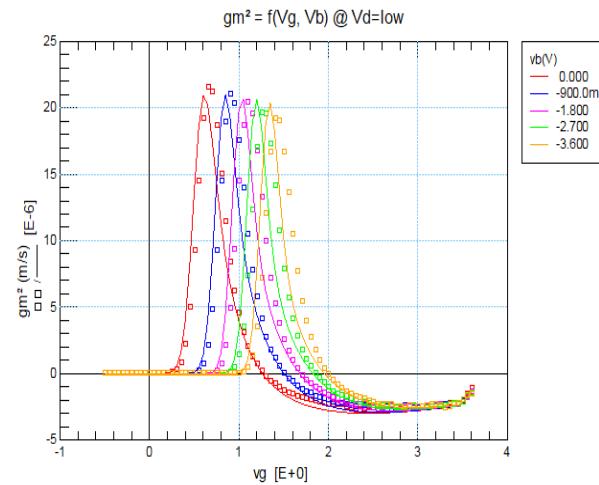
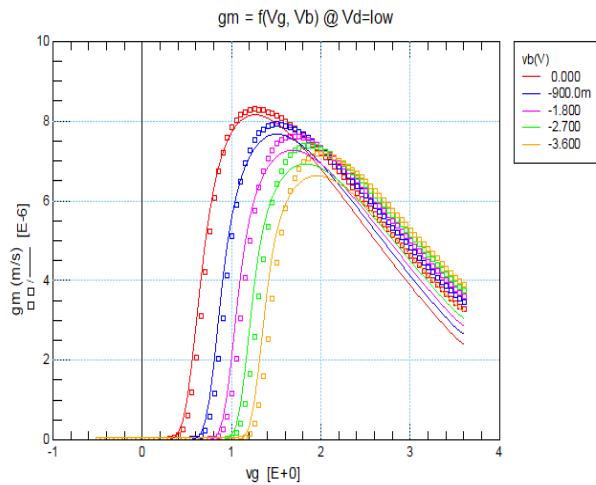
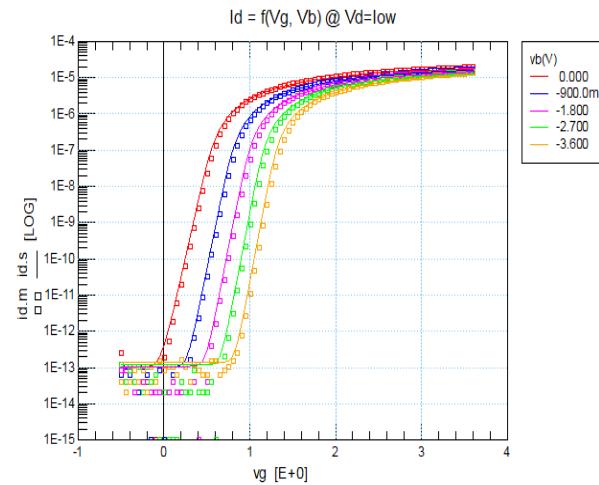
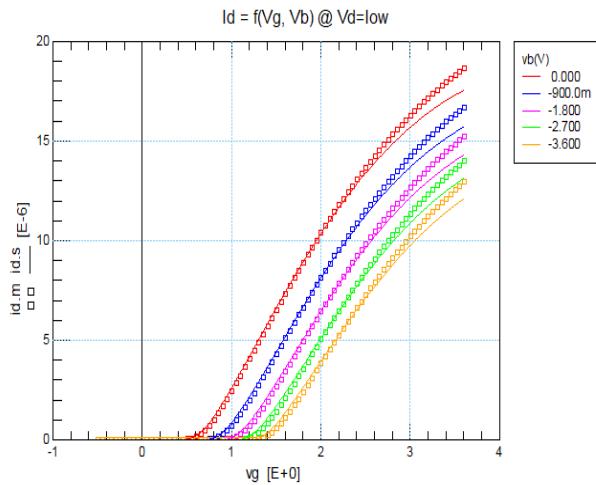
idvd_vbmin, Vb = -3.6V, T = -40°C**idvd_vth, Vb = 0V, T = -40°C**

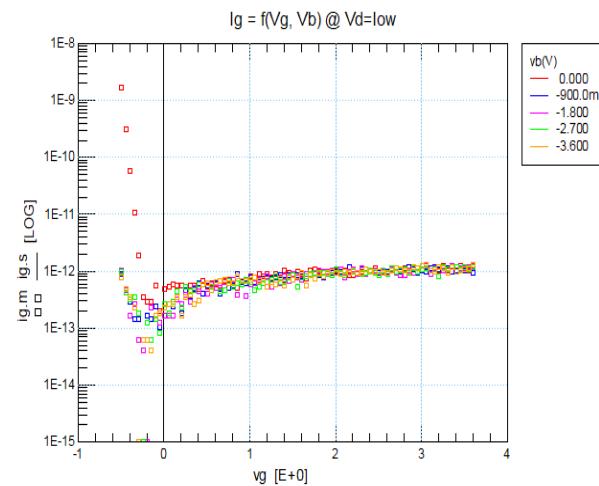
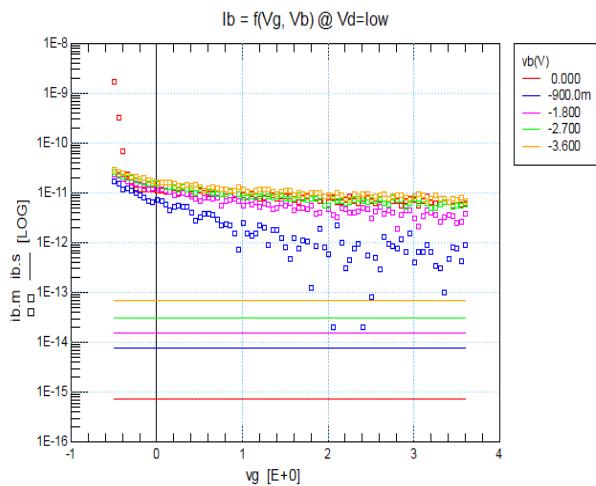


idvd_vth_vbmin, Vb = -3.6V, T = -40°C

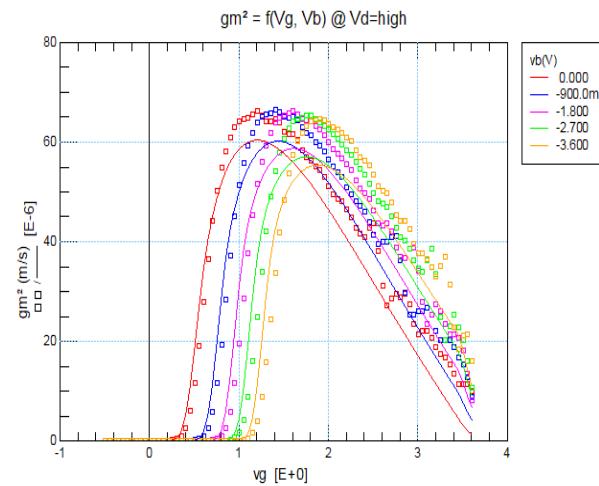
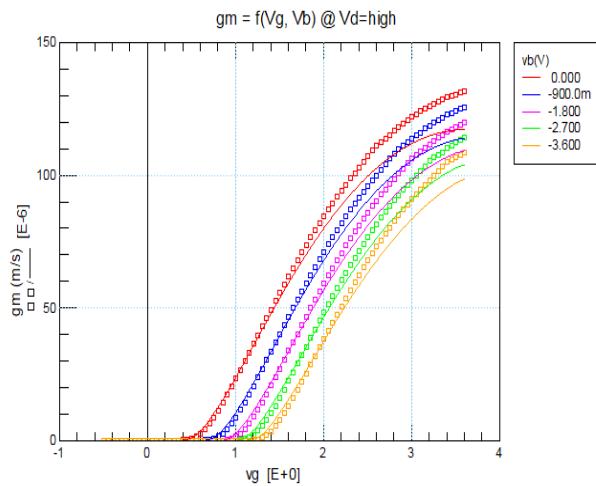
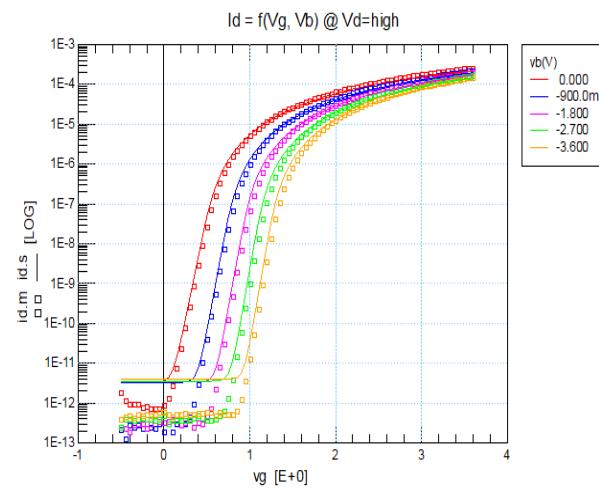
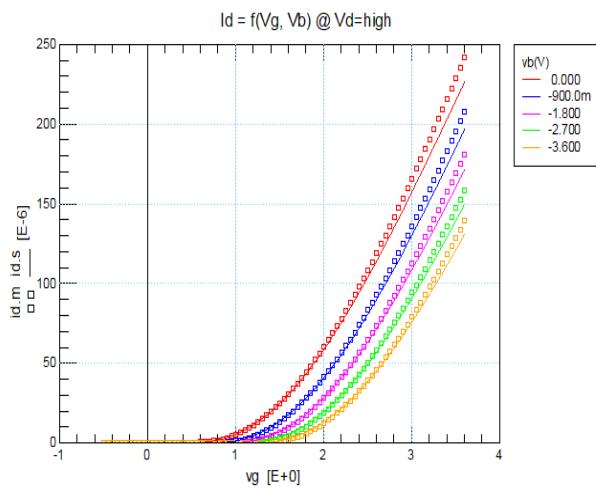


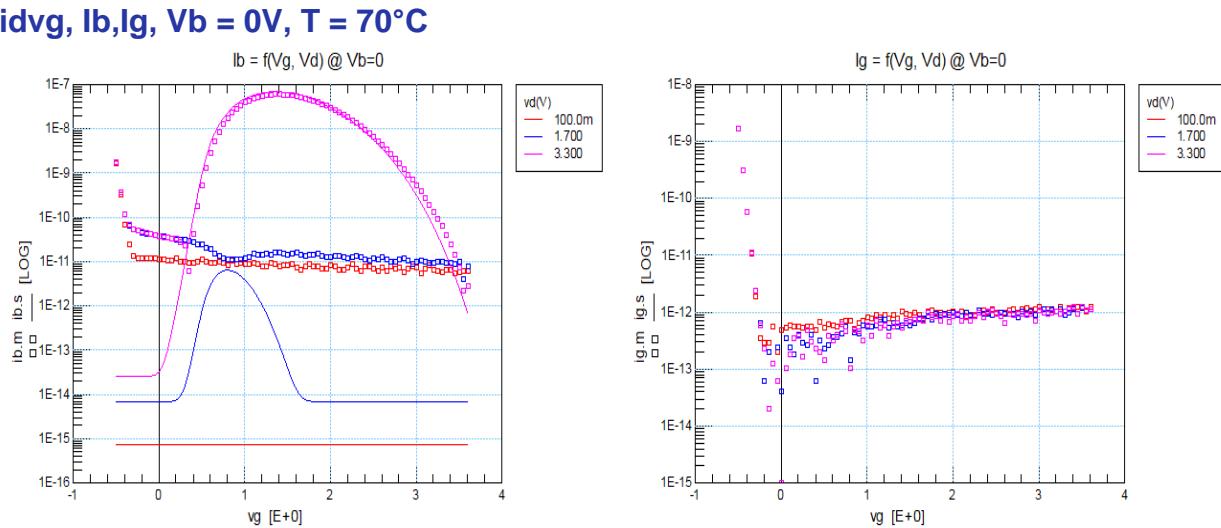
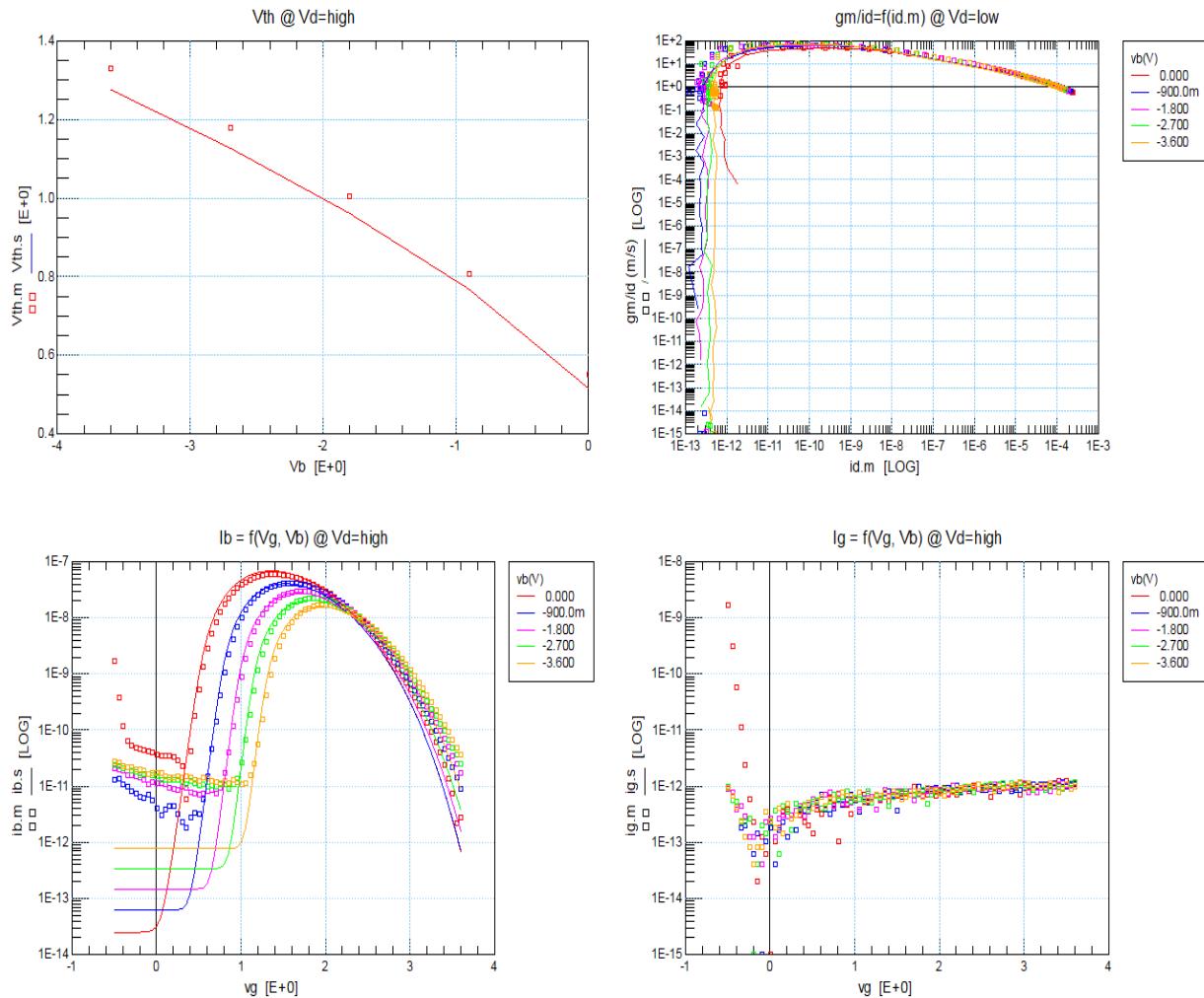
idvg, Vd = 0.1V, T = 70°C

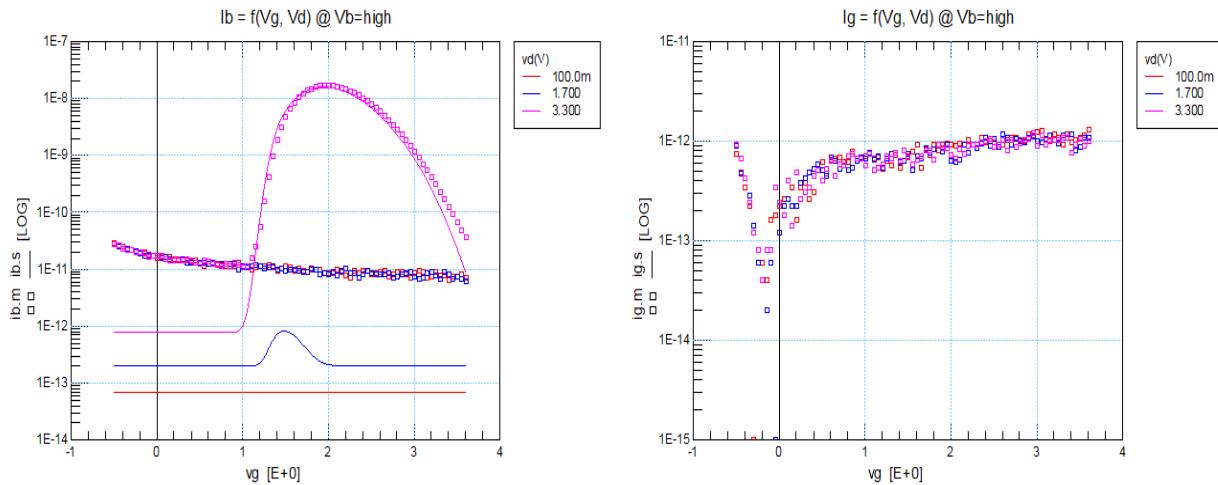
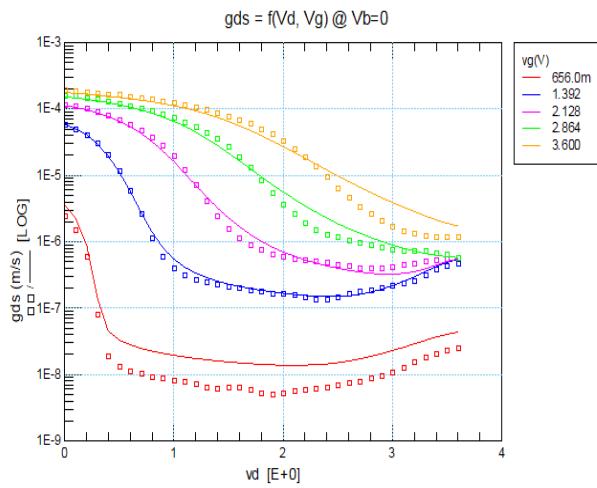
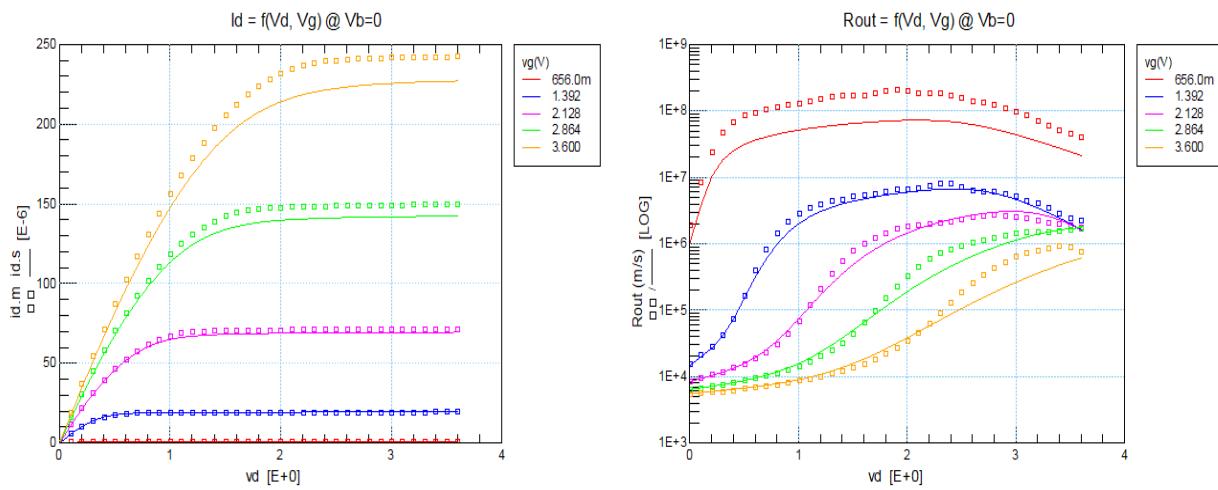


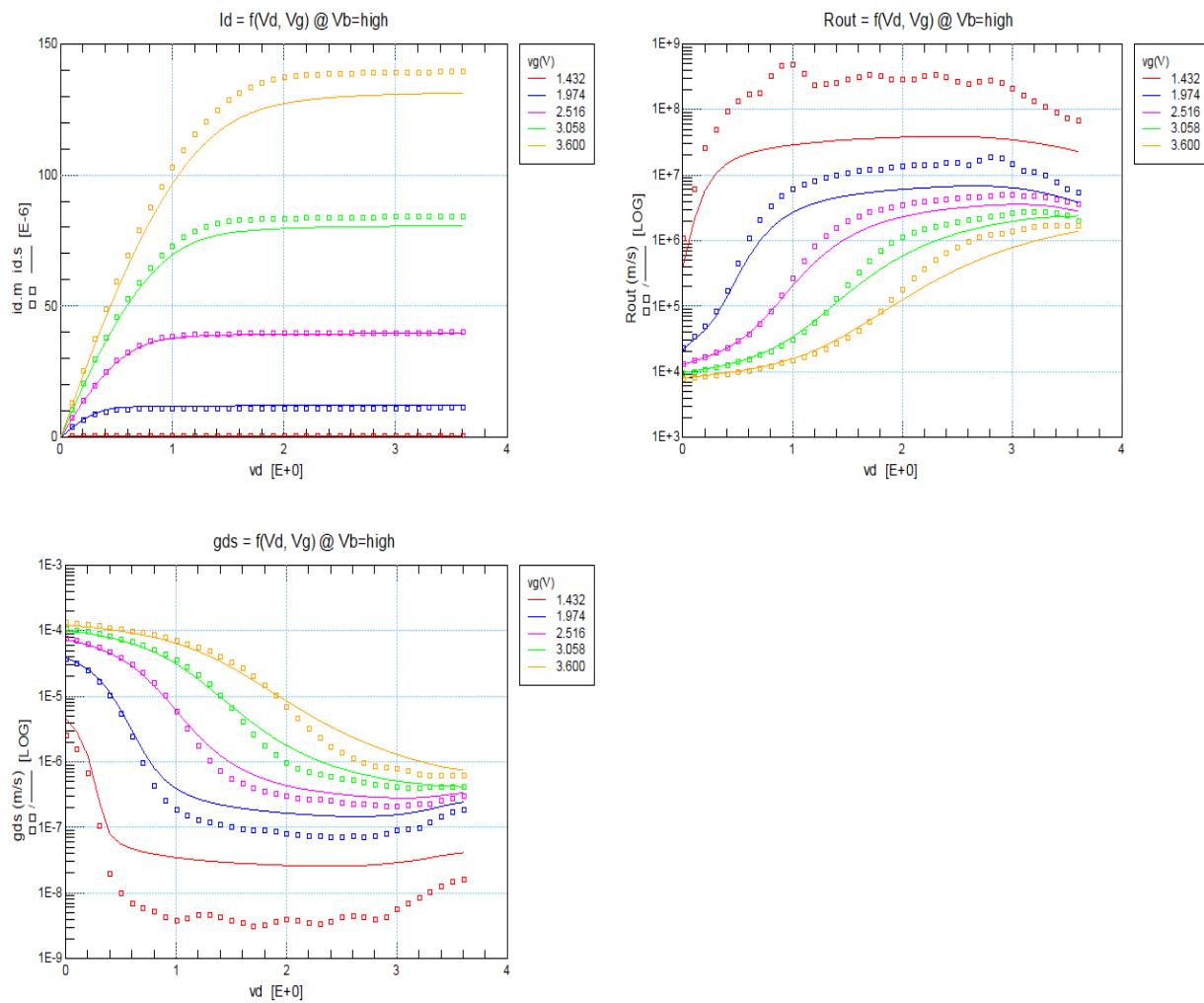
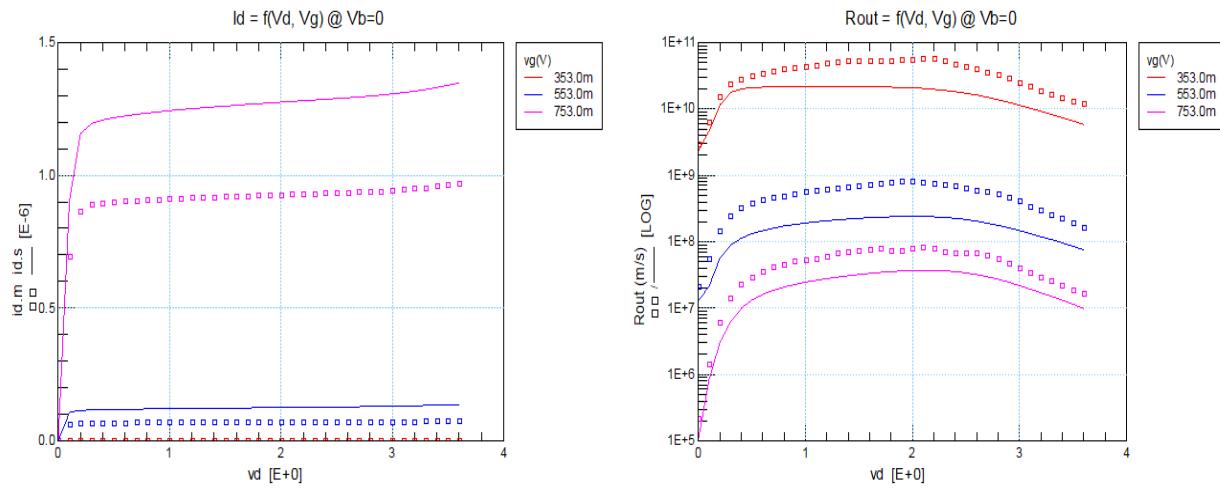


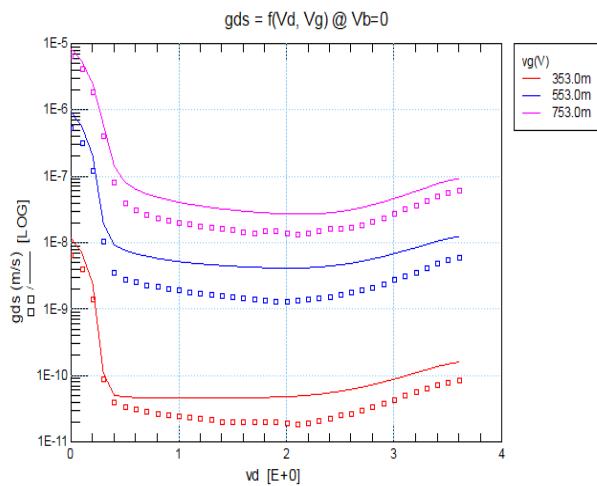
$i_{dvg}, V_d = 3.3V, T = 70^\circ C$



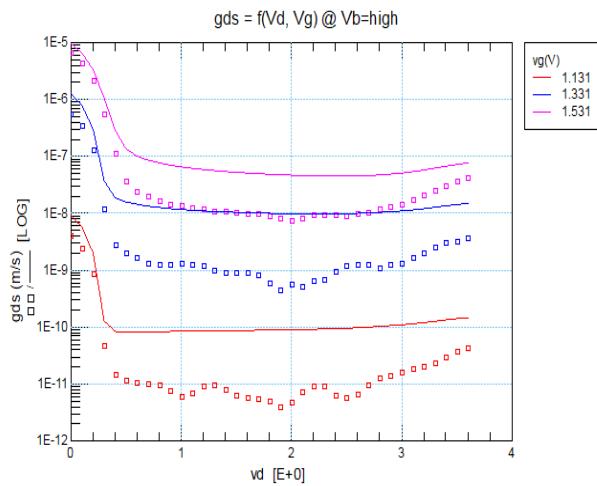
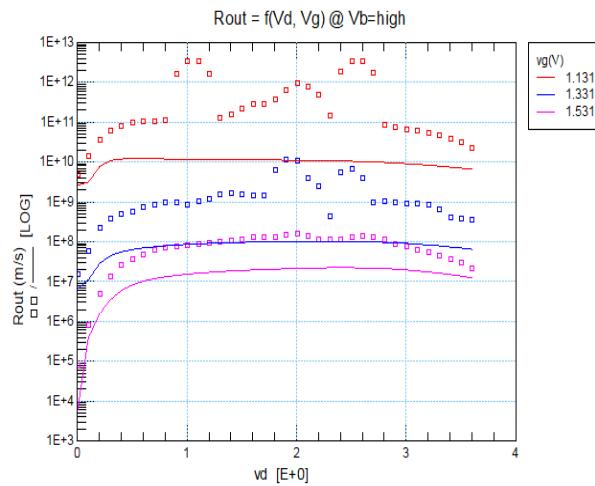
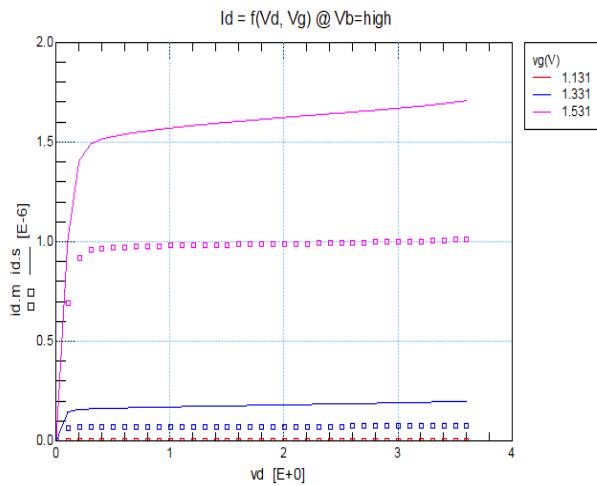


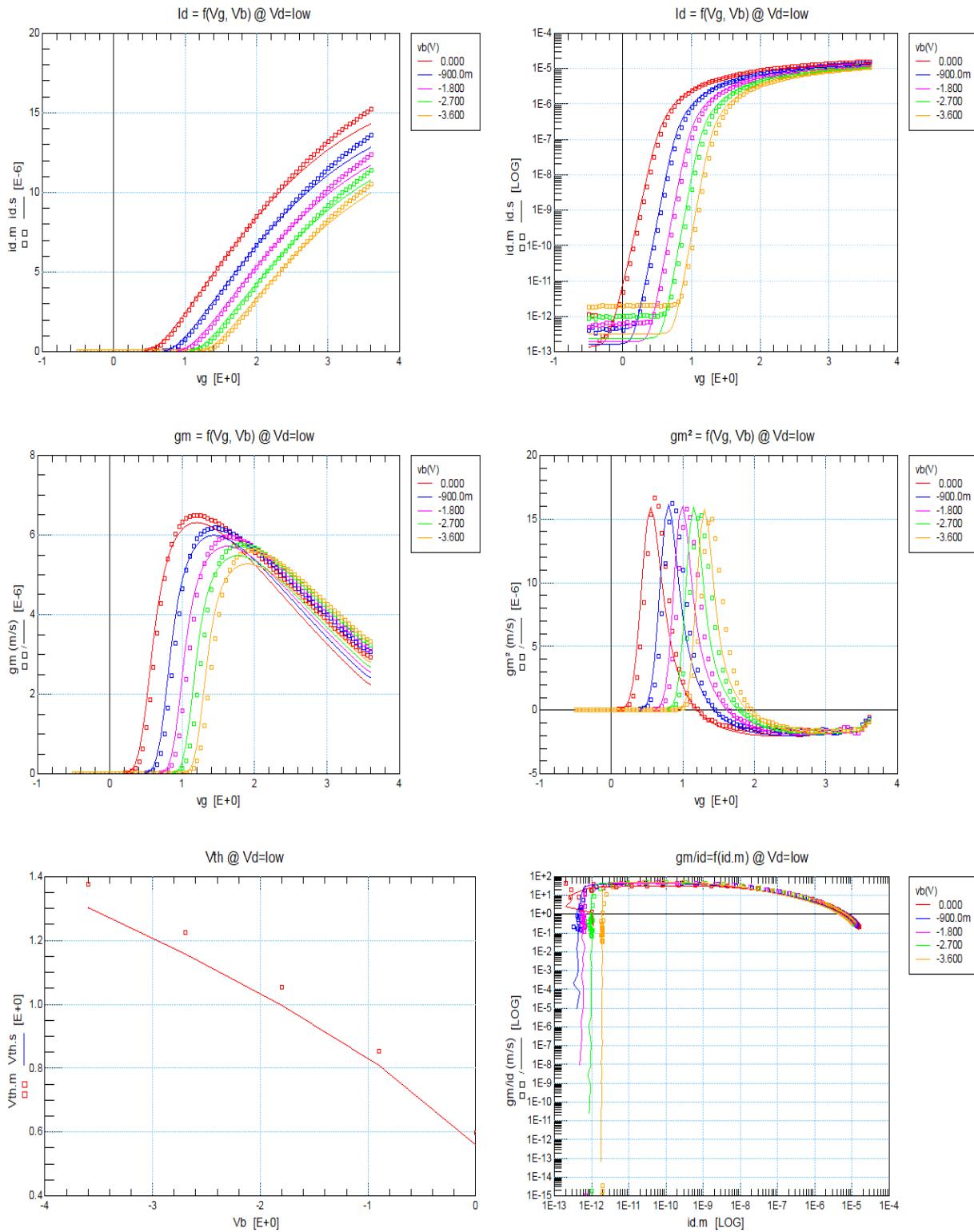
idvg, Ib,Ig, Vb = -3.6V, T = 70°C

idvd, Vb = 0V, T = 70°C


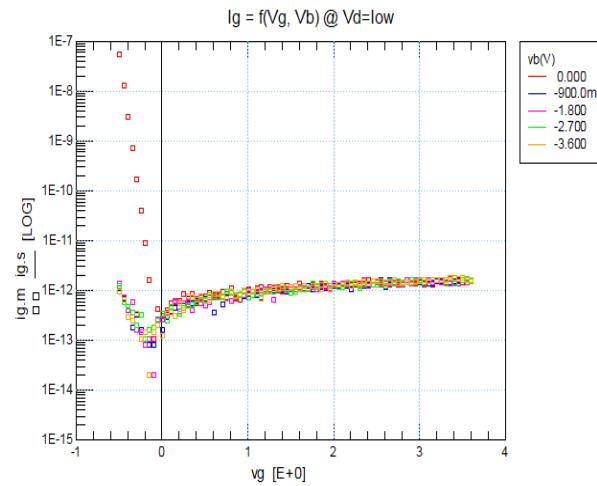
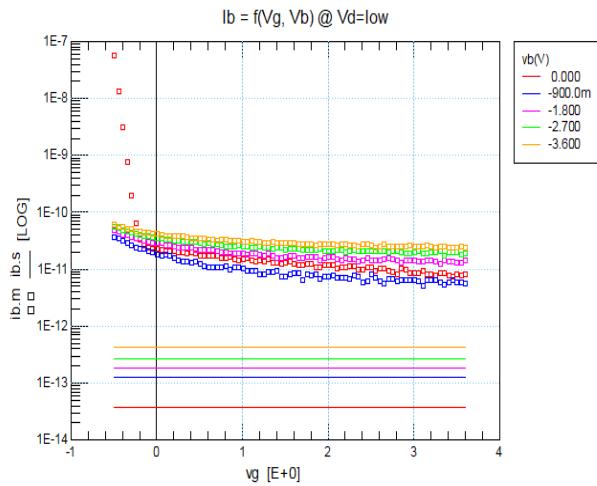
idvd_vbmin, Vb = -3.6V, T = 70°C**idvd_vth, Vb = 0V, T = 70°C**



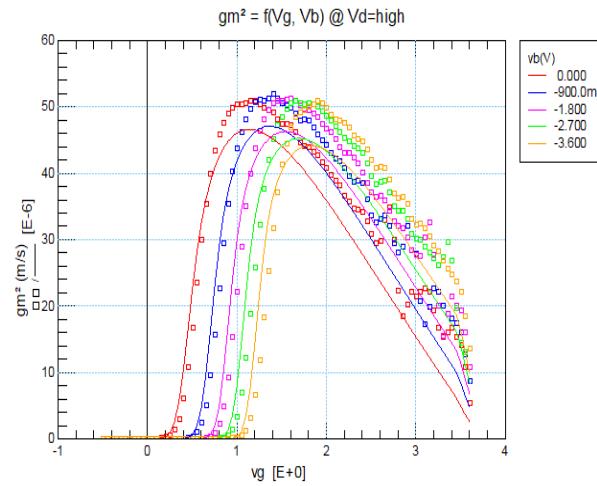
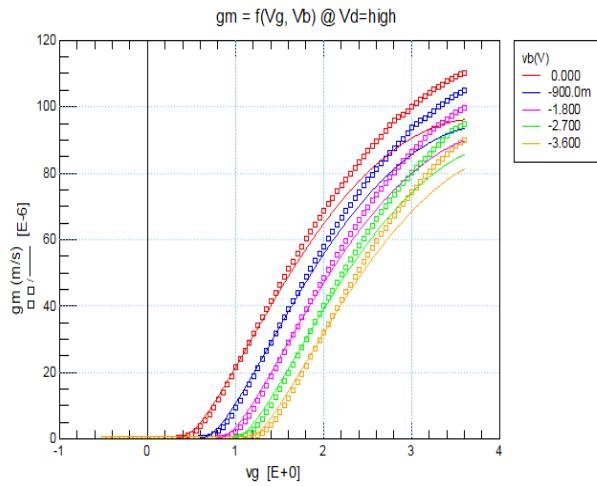
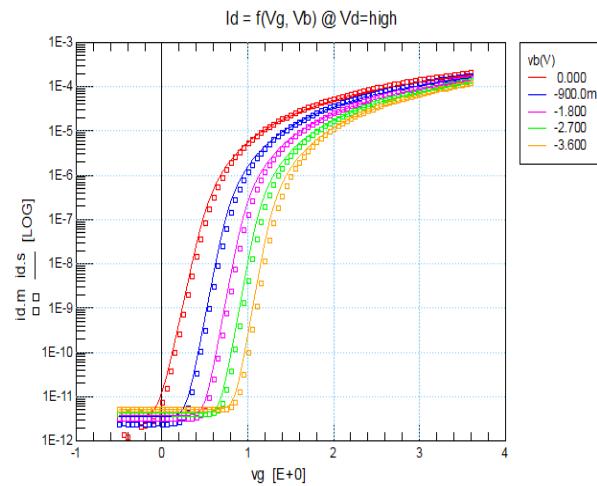
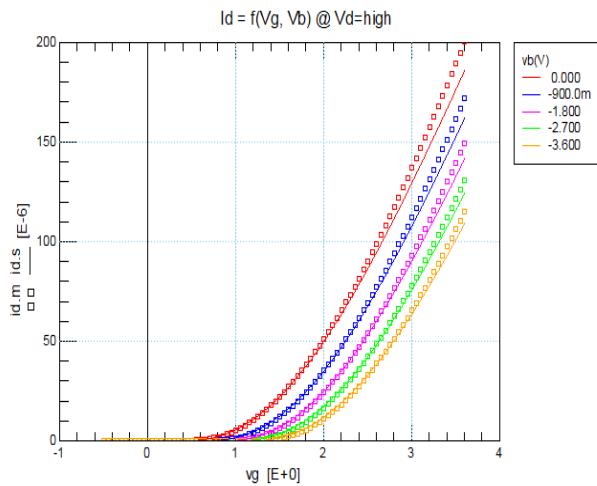
idvd_vth_vbmin, Vb = -3.6V, T = 70°C

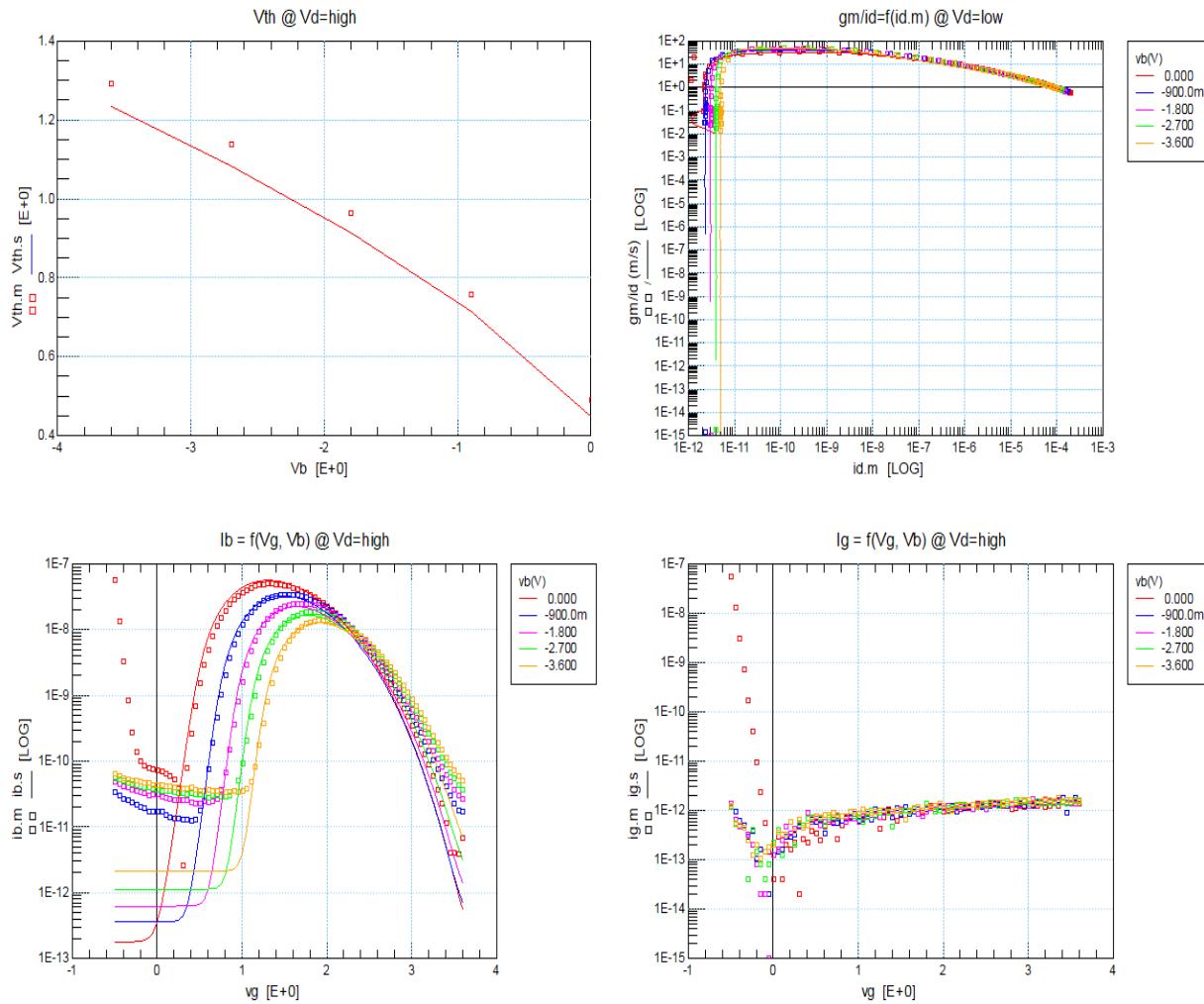


idvg, Vd = 0.1V, T = 125°C


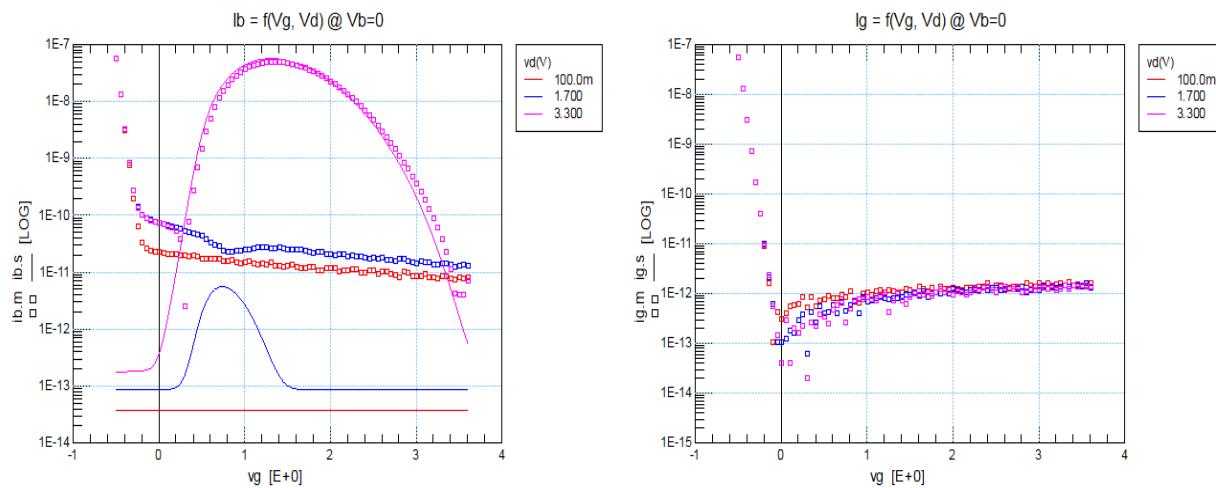


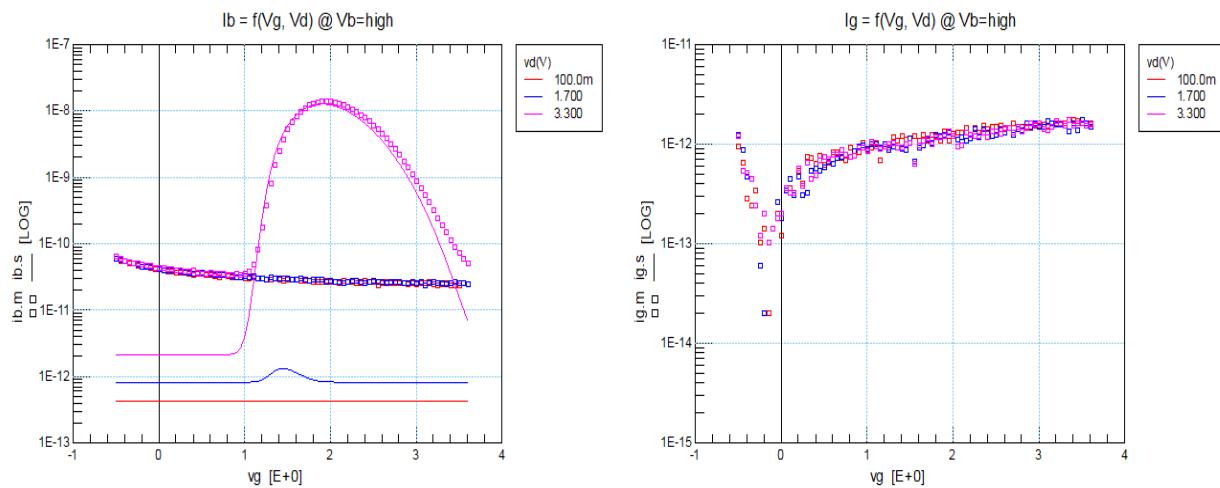
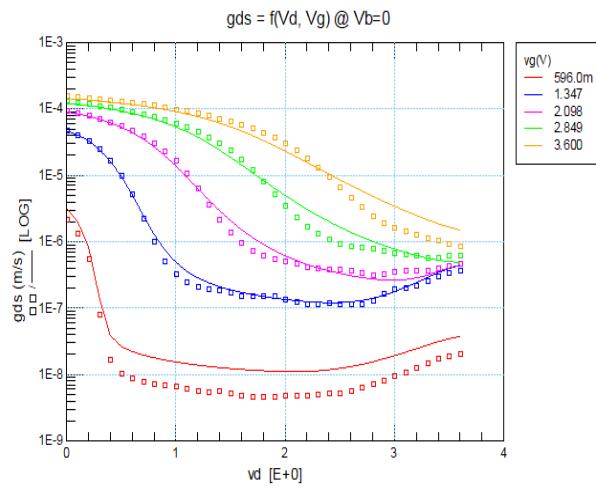
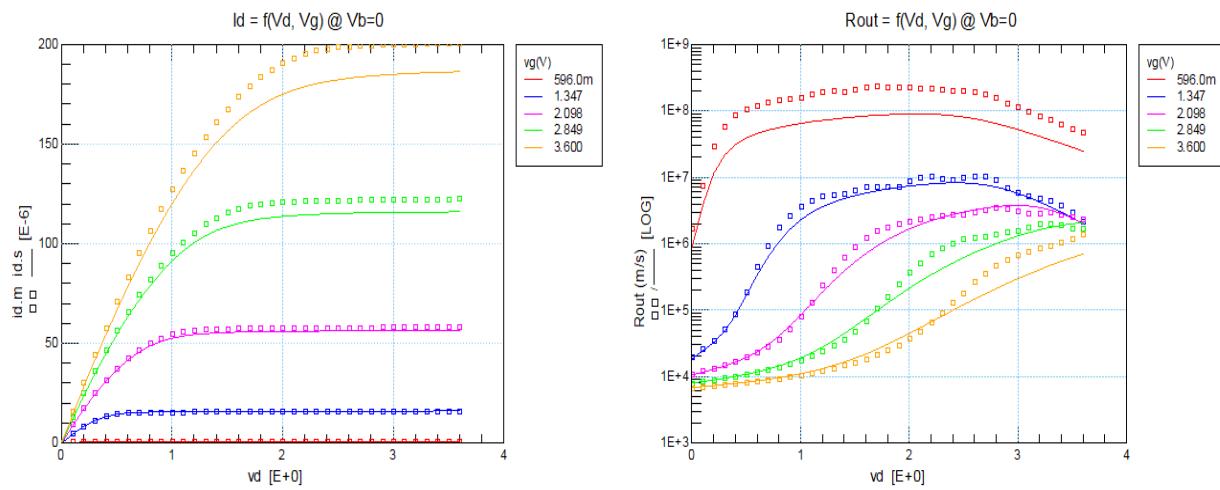
$i_{dvg}, V_d = 3.3V, T = 125^\circ C$

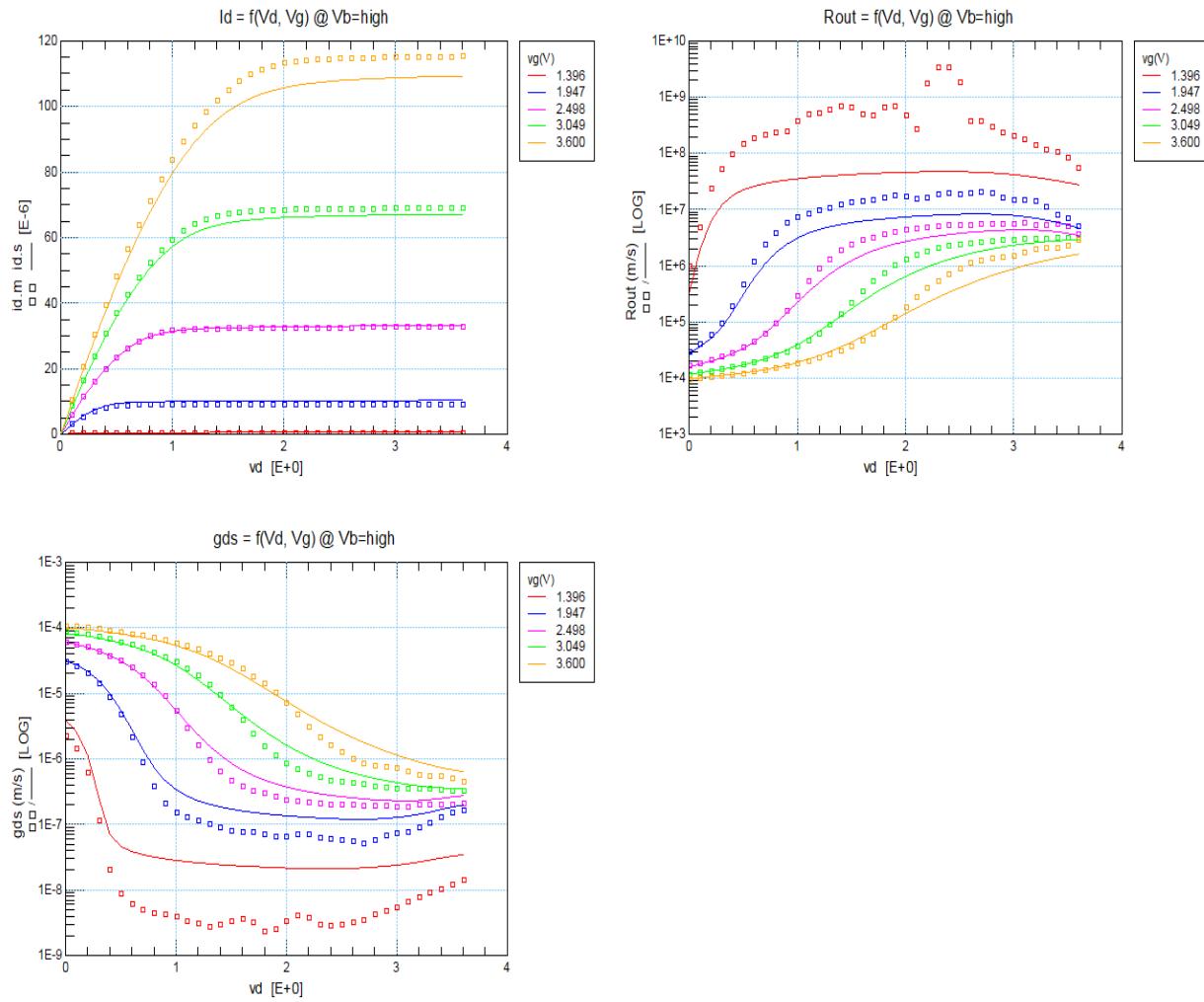
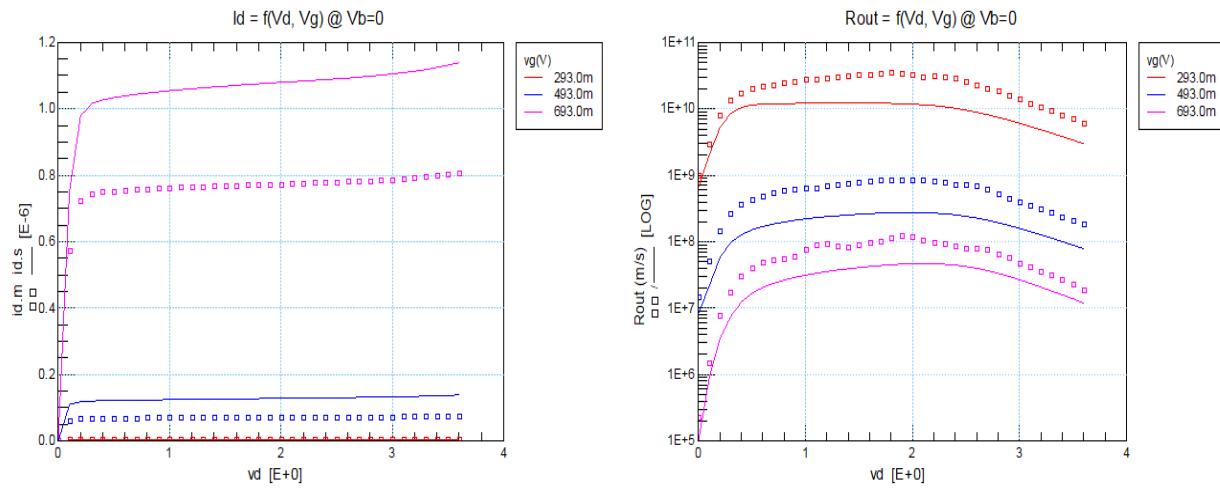


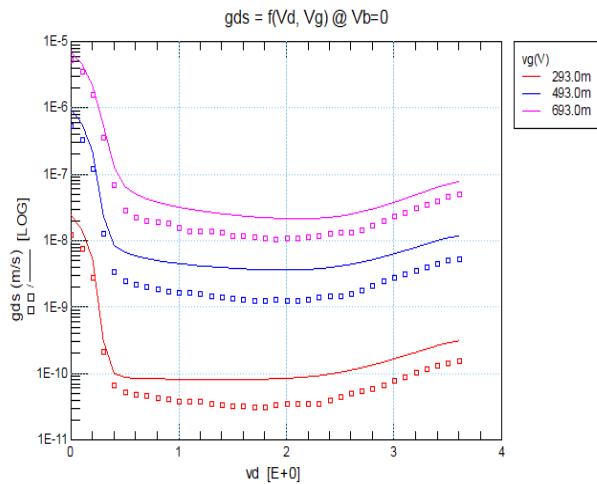


idvg, Ib,Ig, Vb = 0V, T = 125°C

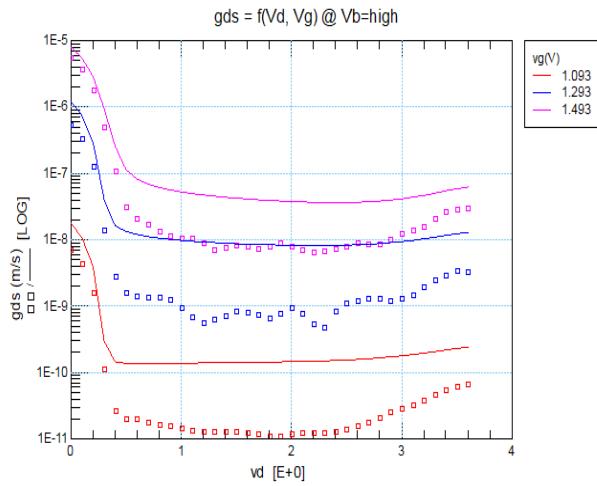
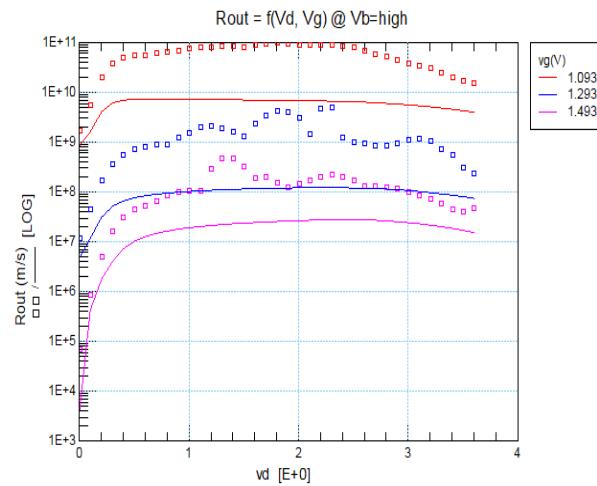
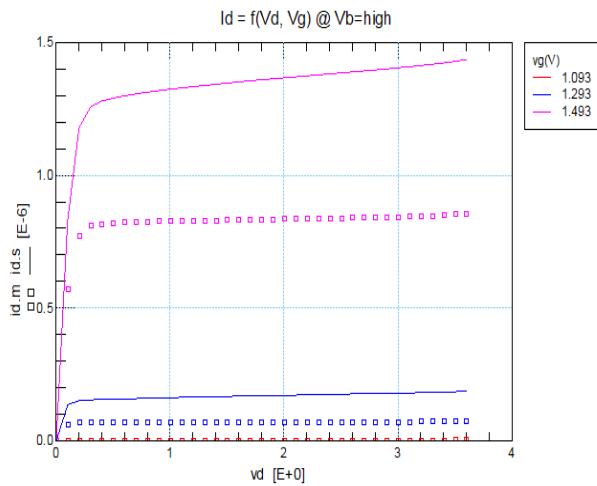


idvg, Ib,Ig, Vb = -3.6V, T = 125°C

idvd, Vb = 0V, T = 125°C


idvd_vbmin, Vb = -3.6V, T = 125°C**idvd_vth, Vb = 0V, T = 125°C**

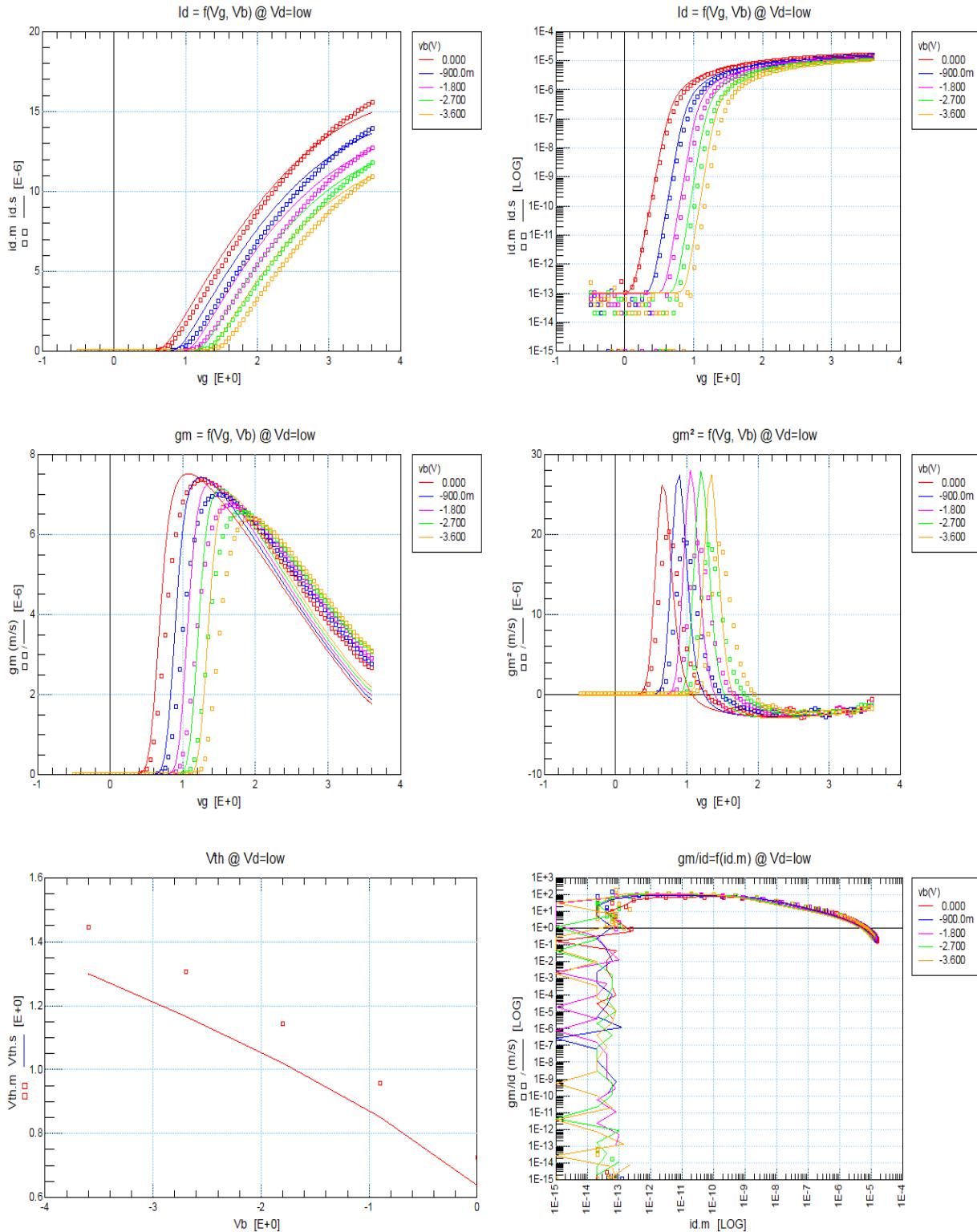


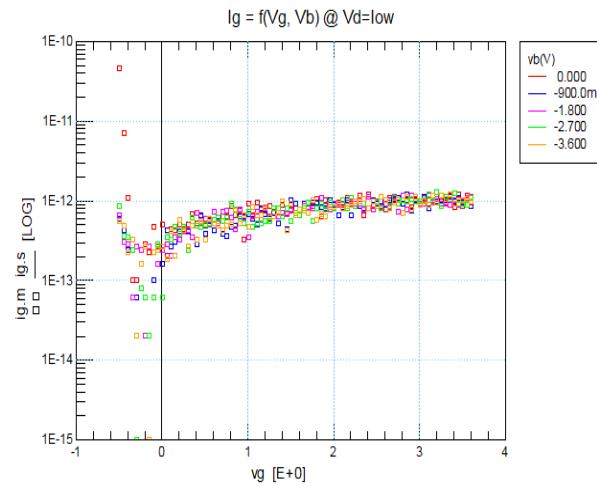
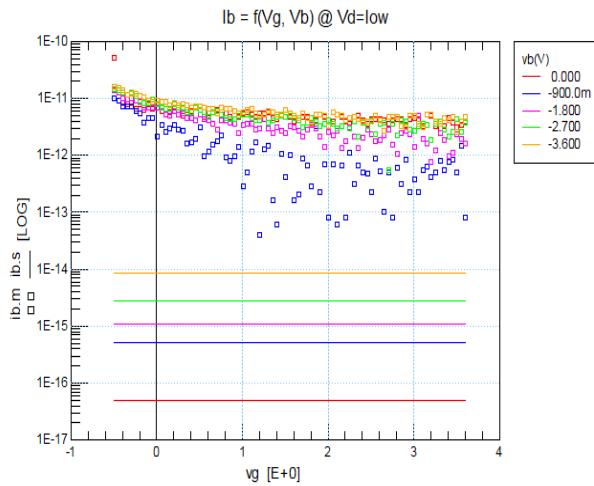
idvd_vth_vbmin, Vb = -3.6V, T = 125°C



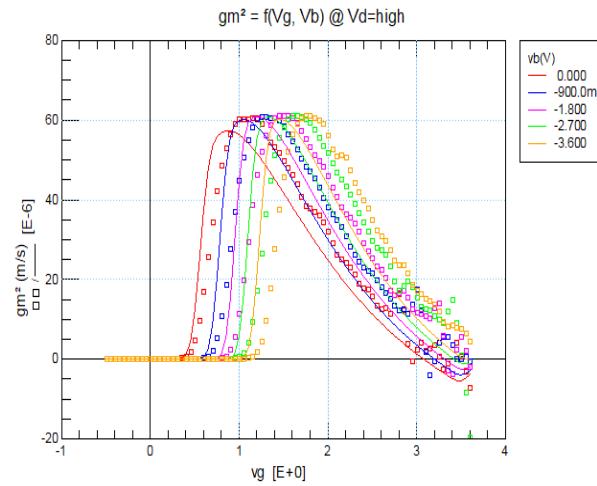
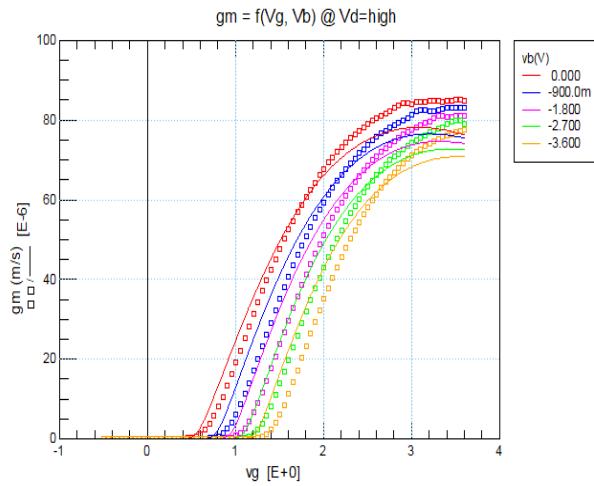
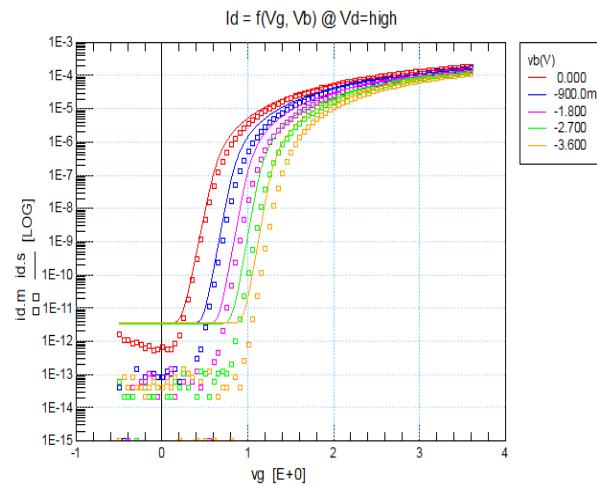
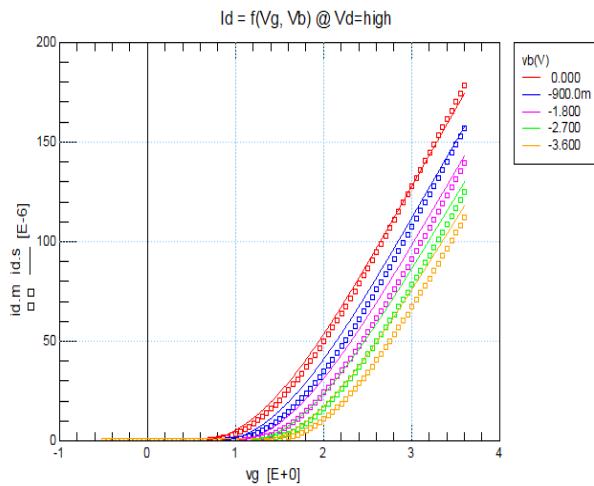
4.16 W0u6_L1u2_S559_4

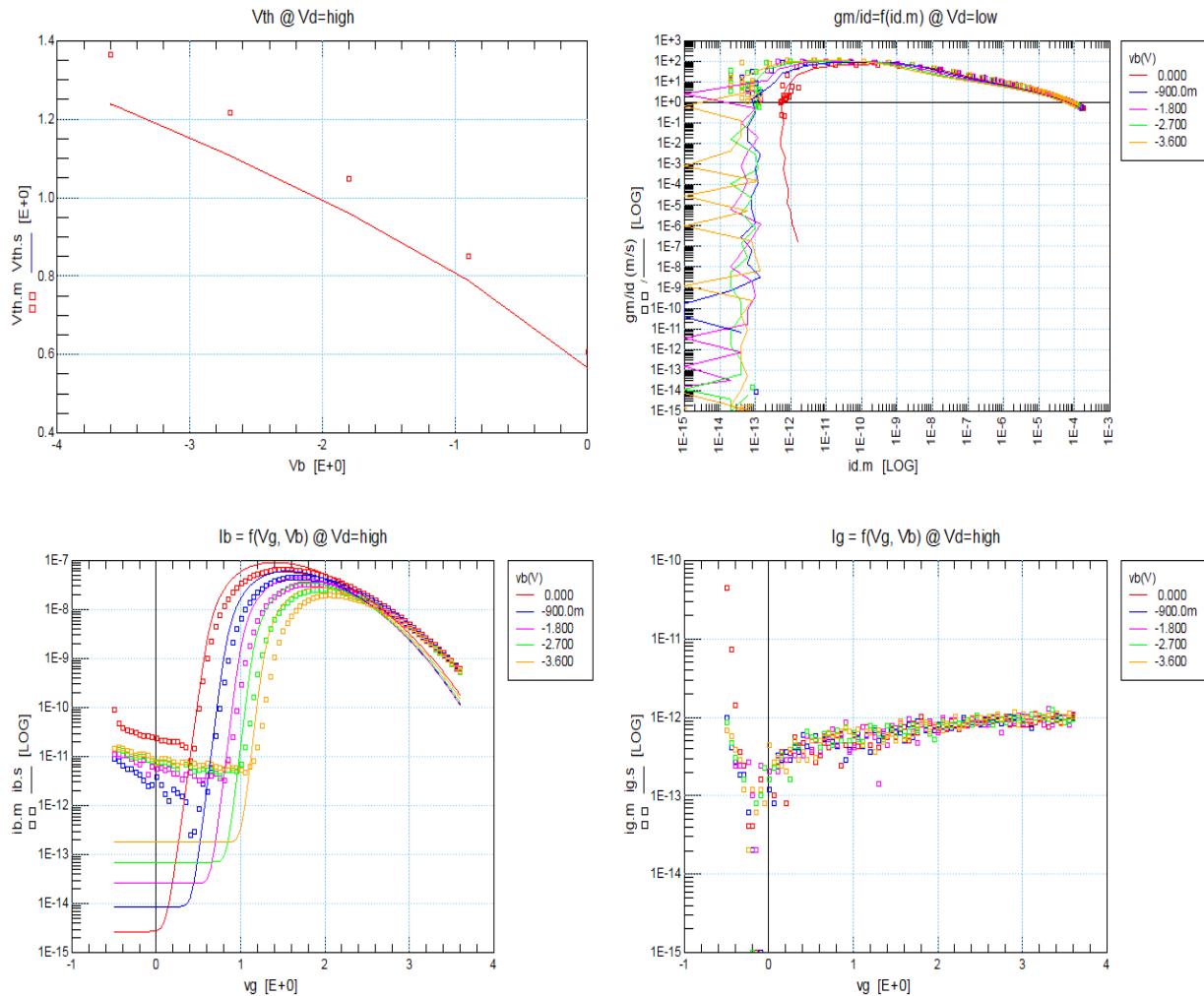
$idvg, Vd = 0.1V, T = 27^\circ C$



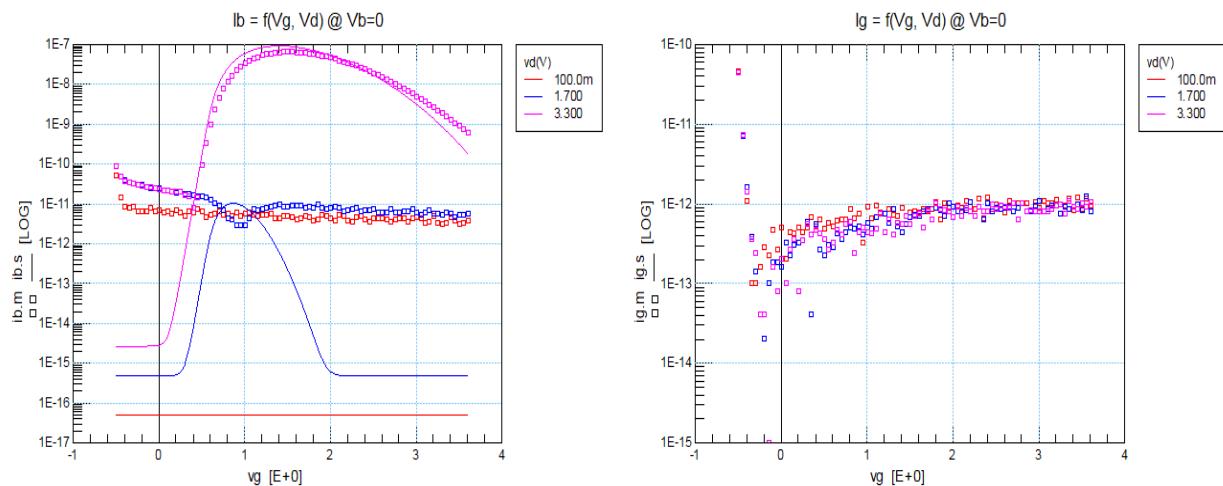


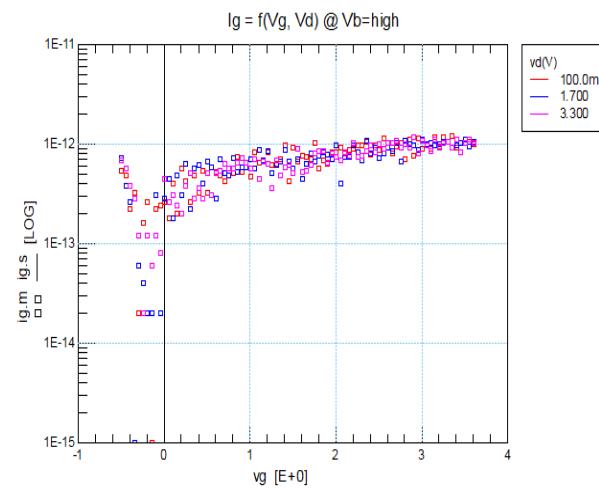
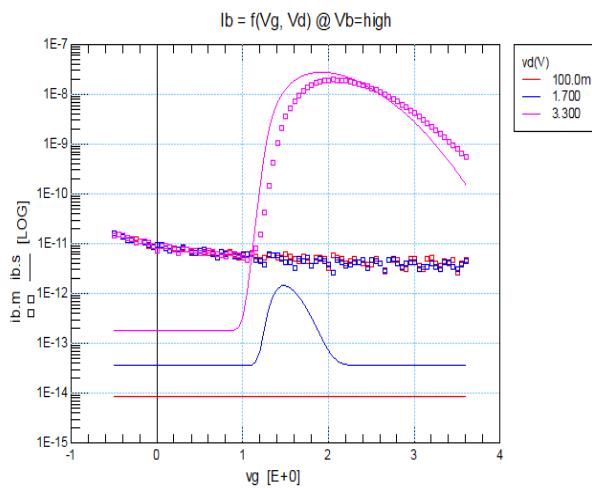
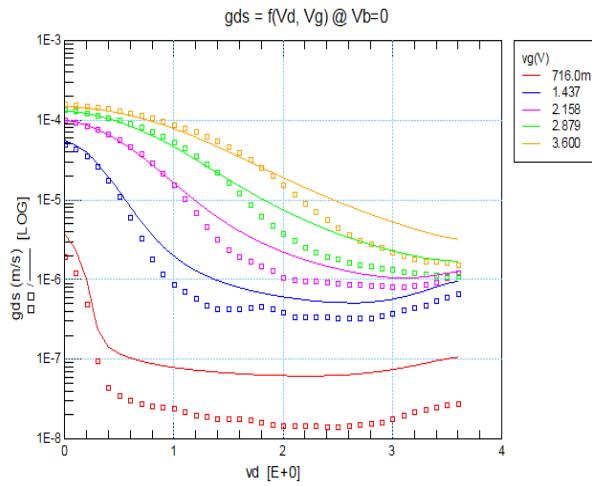
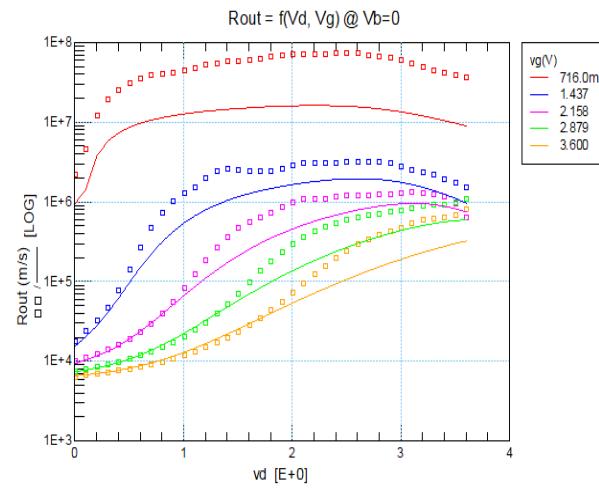
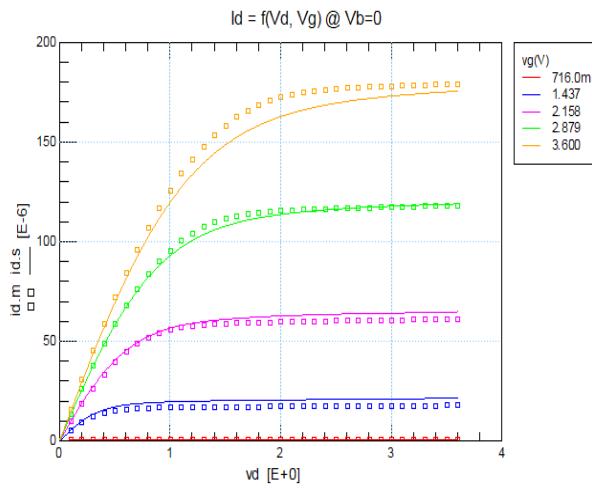
$i_{dvg}, V_d = 3.3V, T = 27^\circ C$

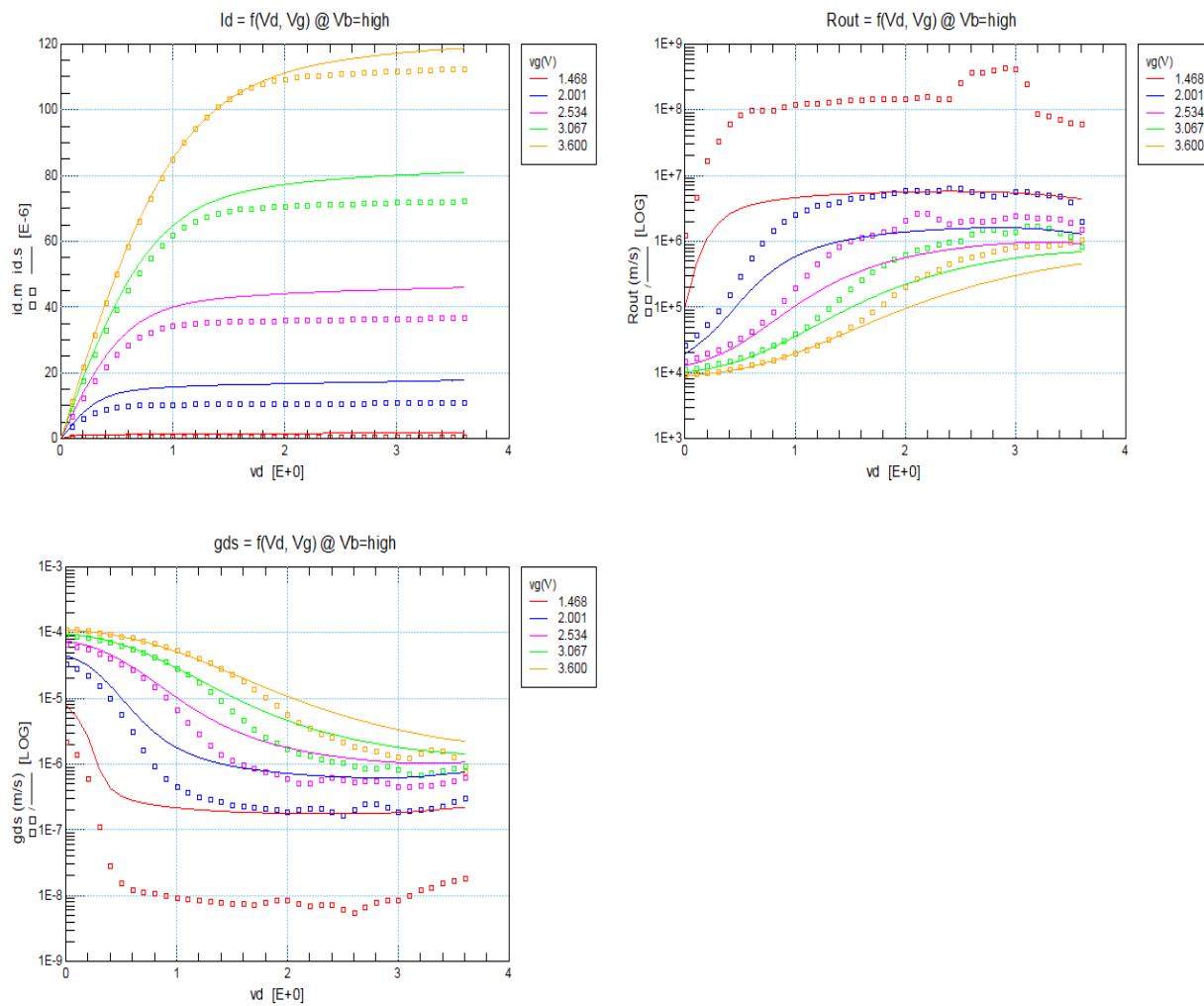
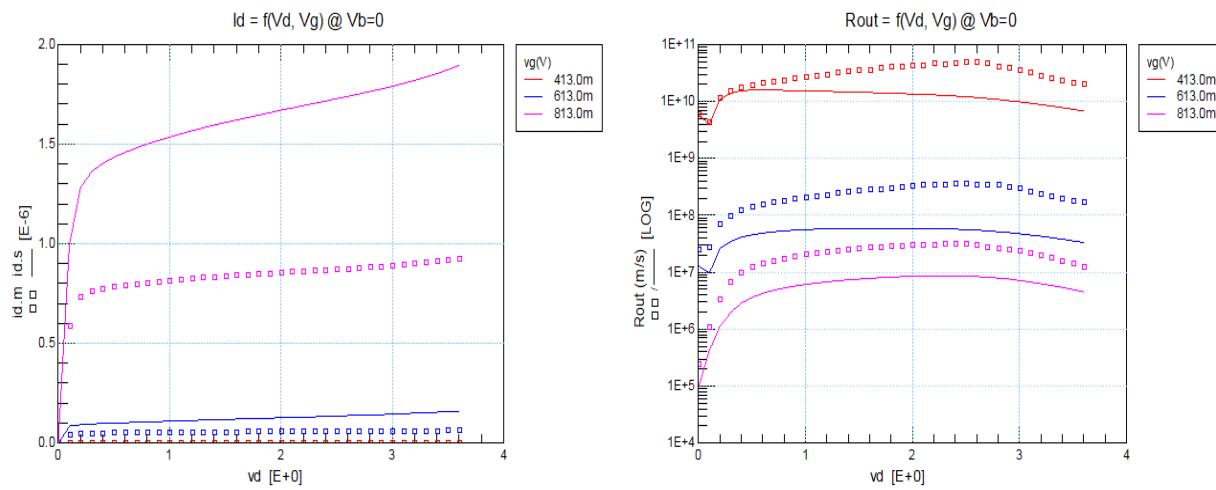


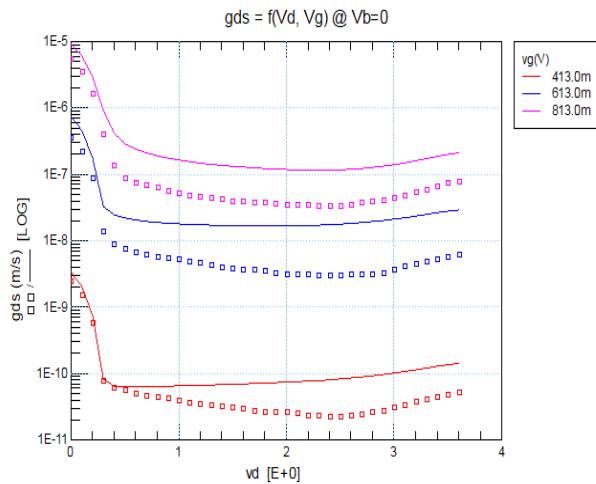


idvg, Ib,Ig, Vb = 0V, T = 27°C

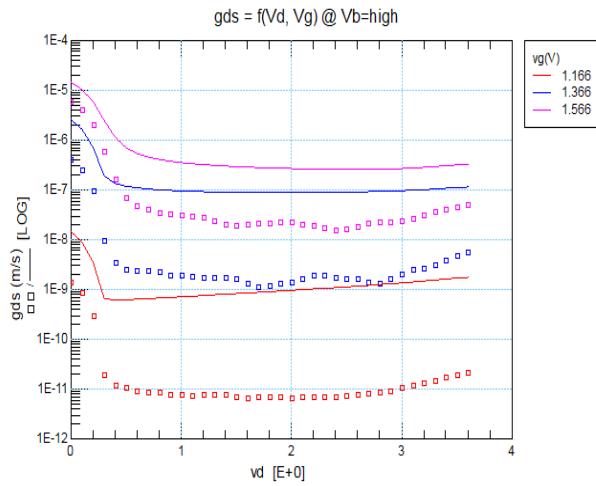
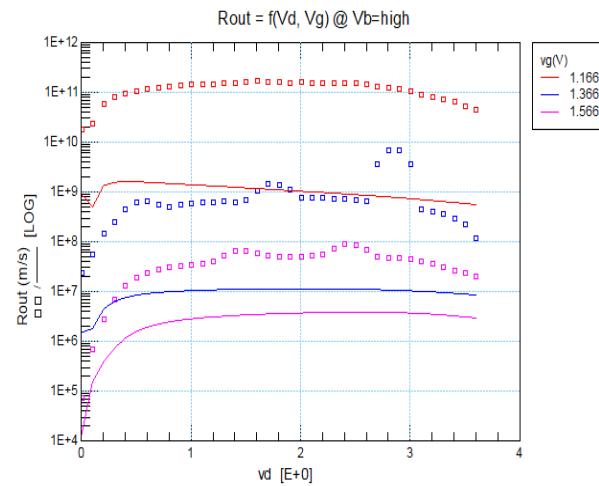
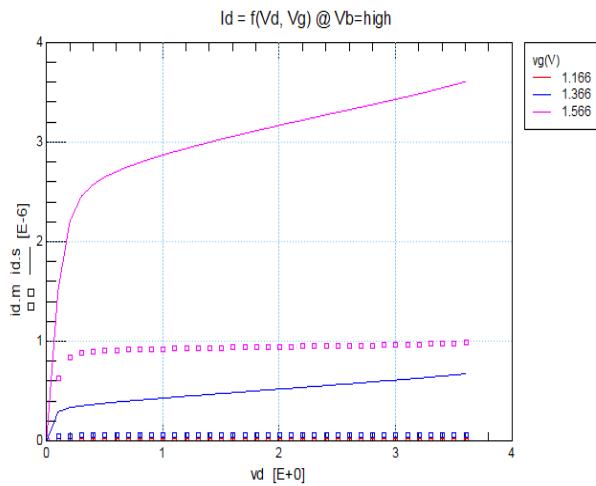


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


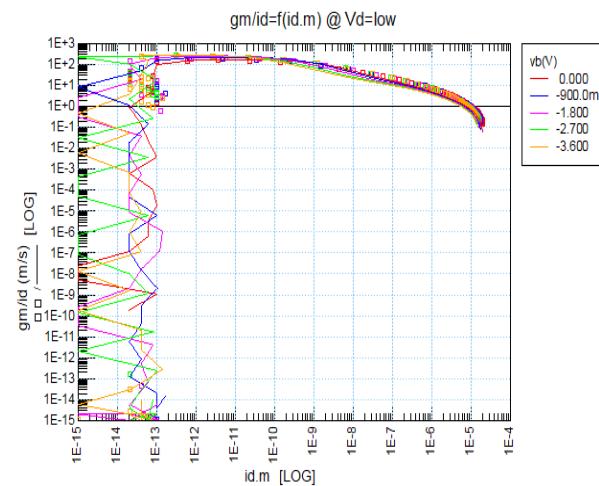
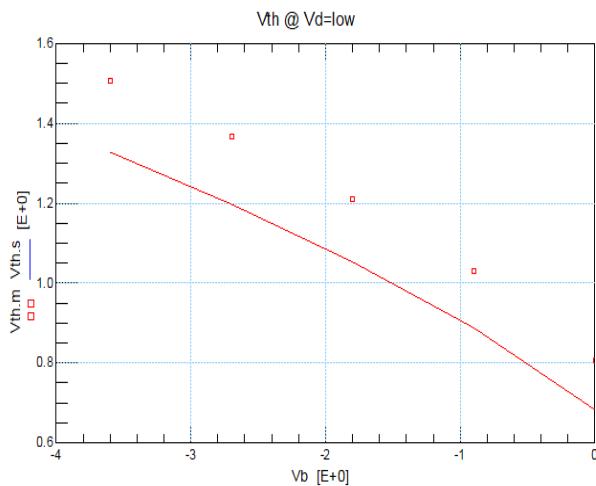
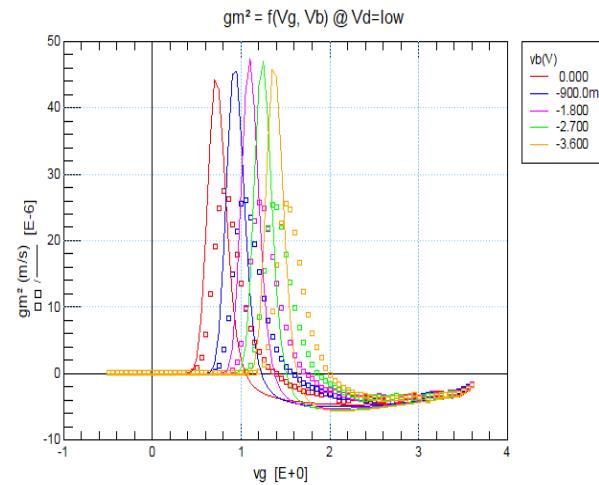
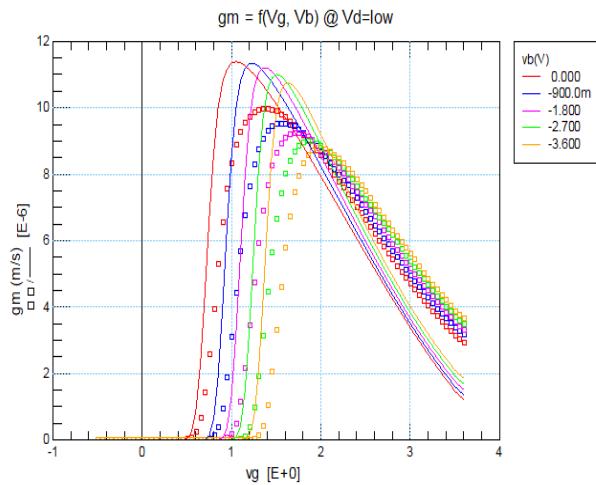
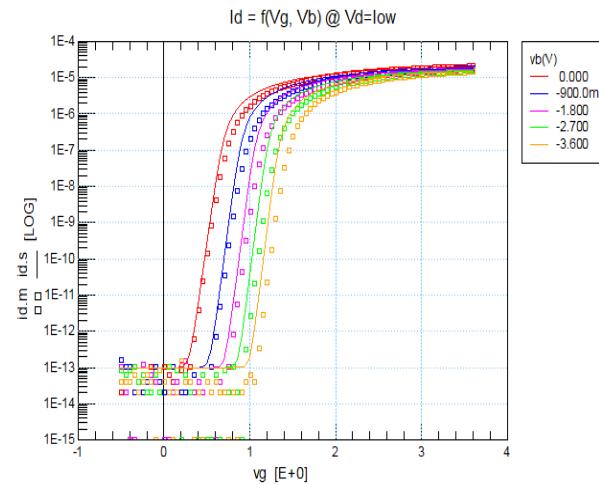
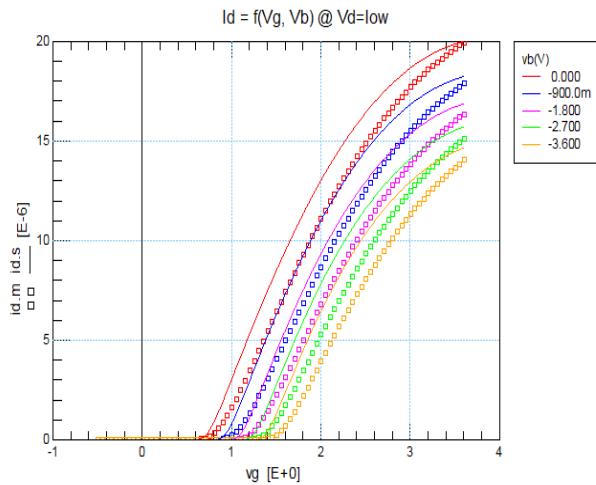
idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


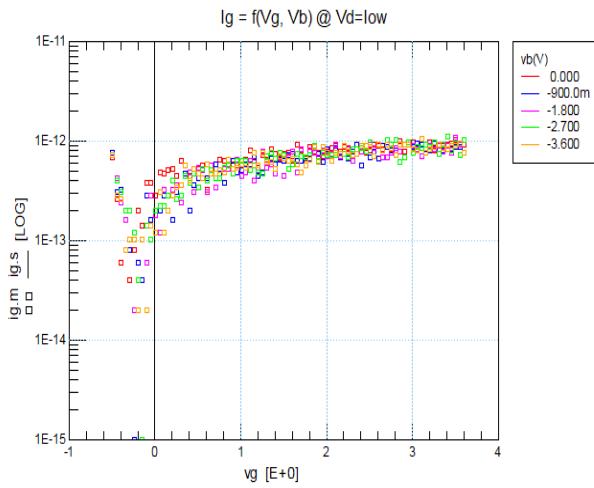
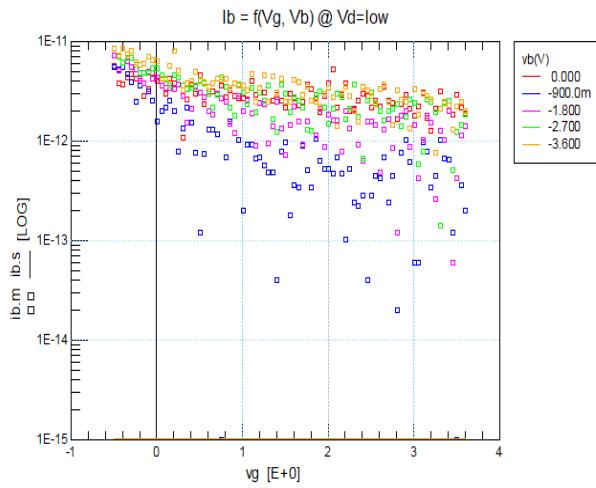


idvd_vth_vbmin, Vb = -3.6V, T = 27°C

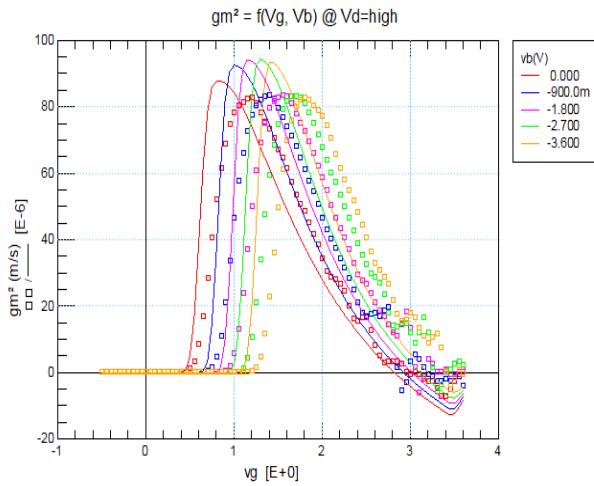
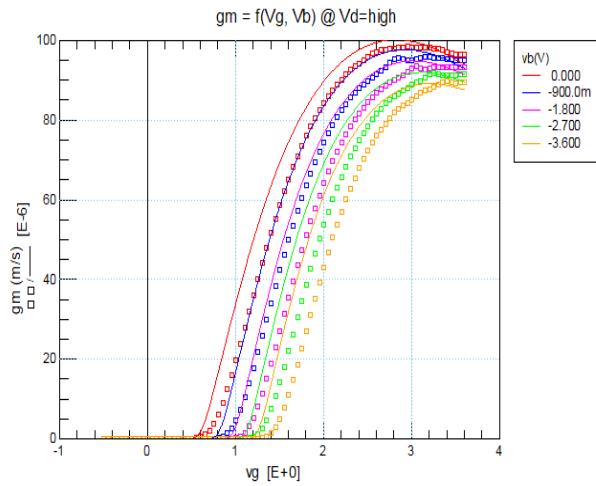
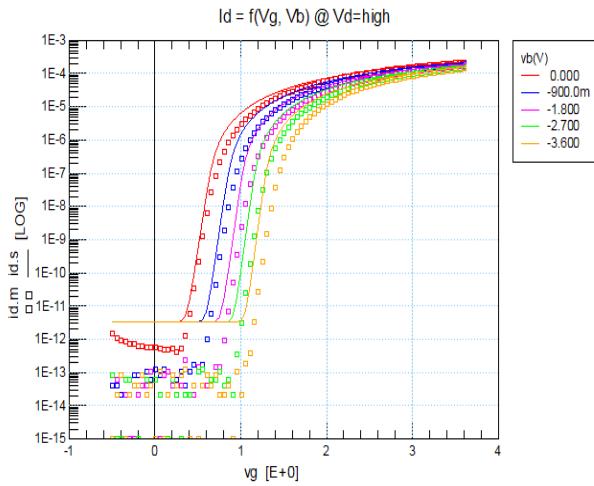
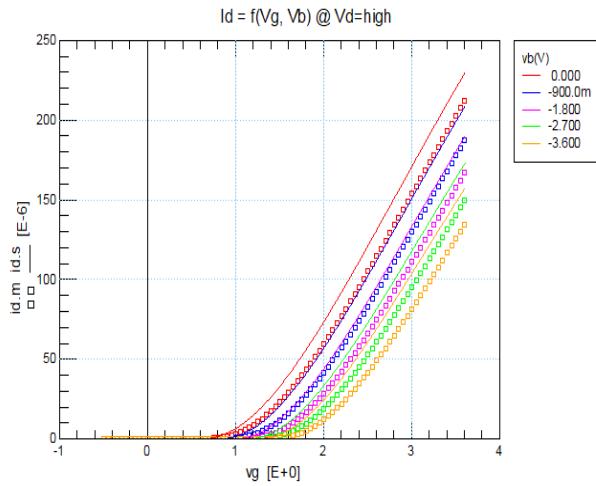


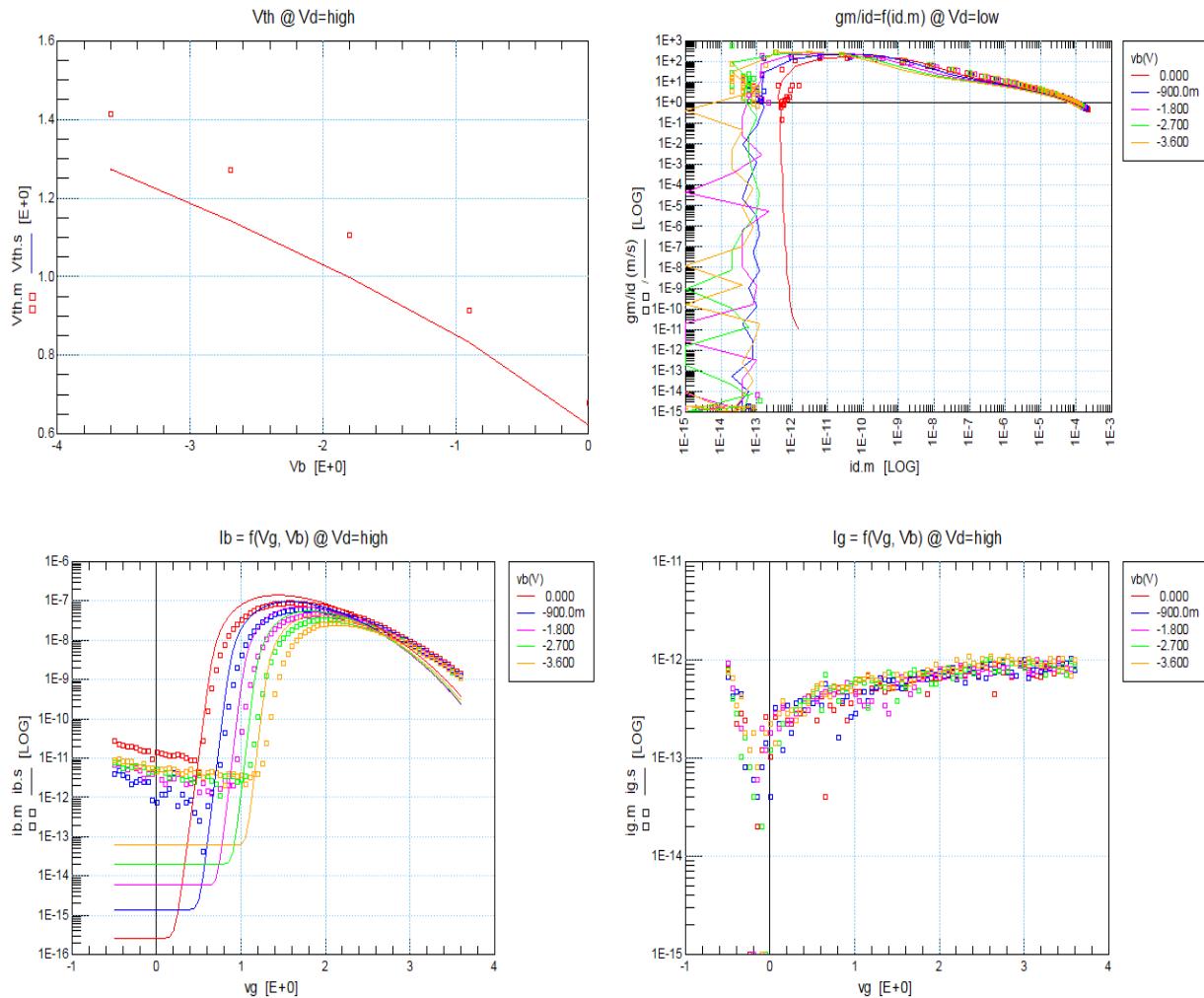
idvg, Vd = 0.1V, T = -40°C



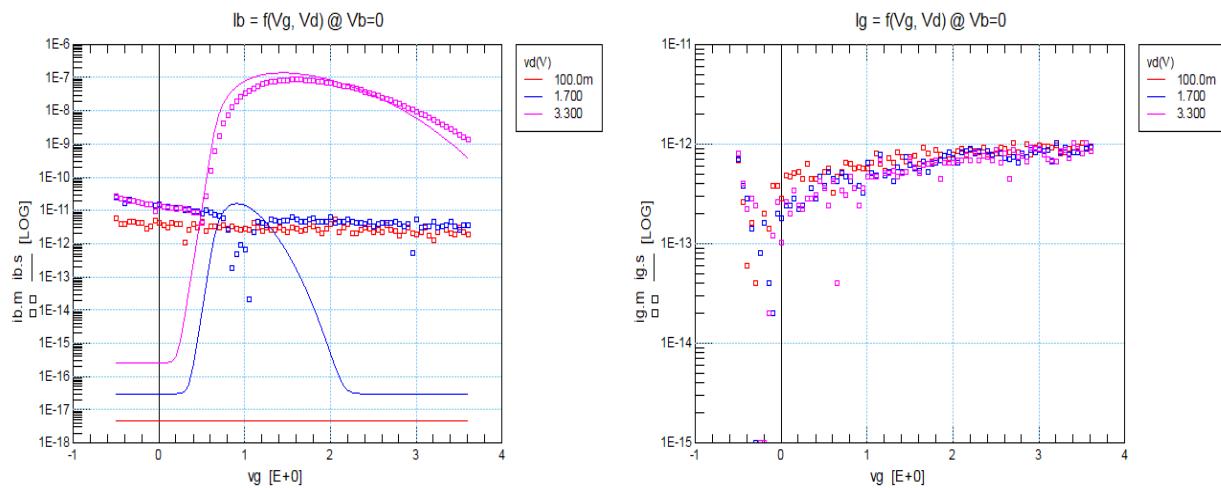


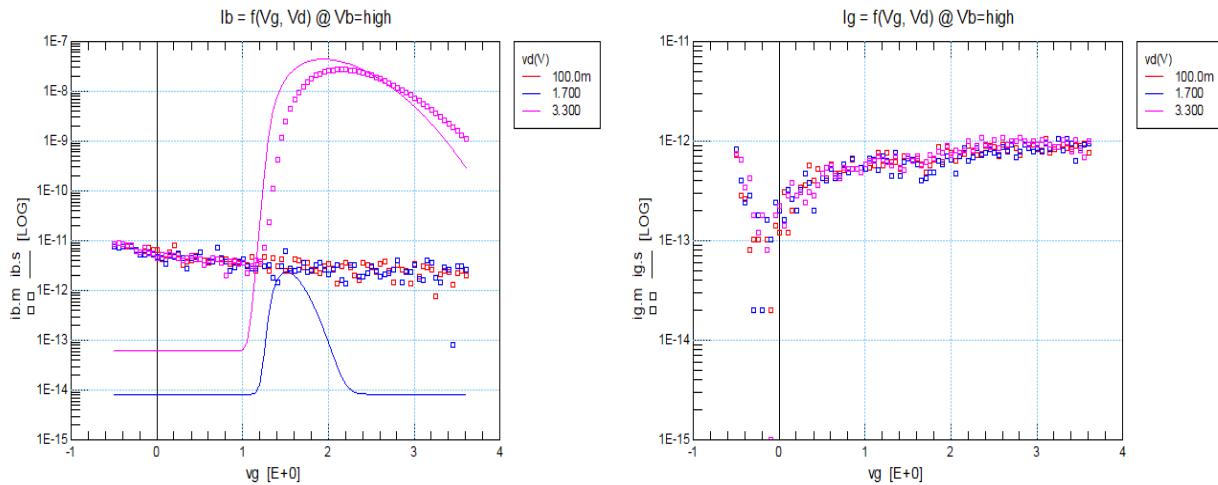
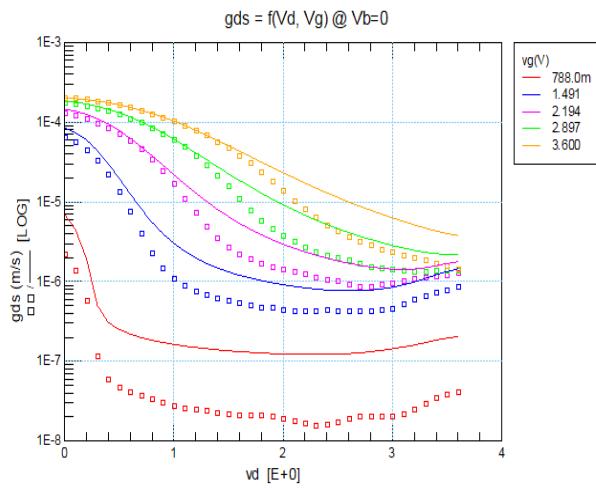
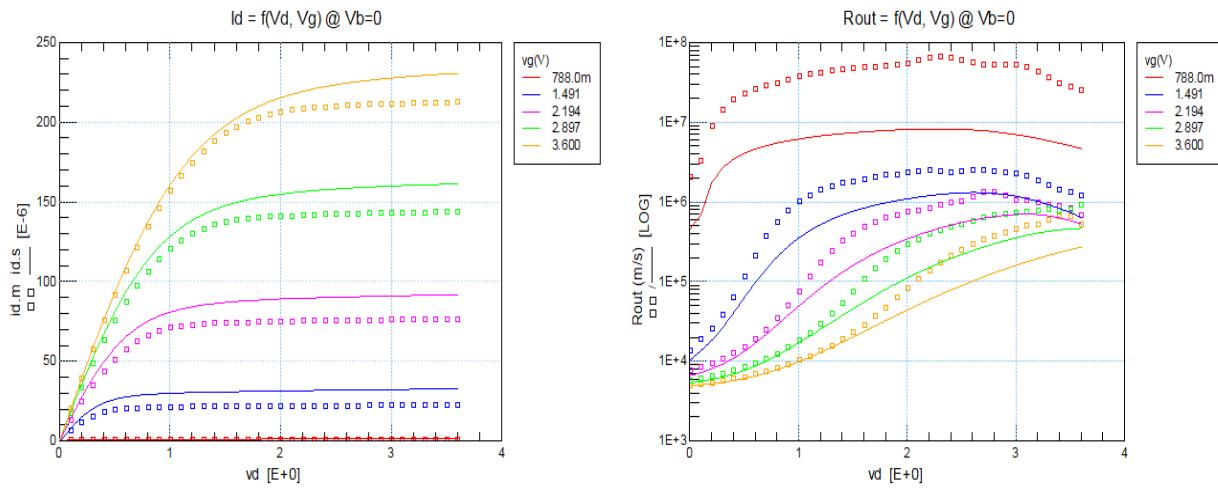
$i_{dvg}, V_d = 3.3V, T = -40^\circ C$

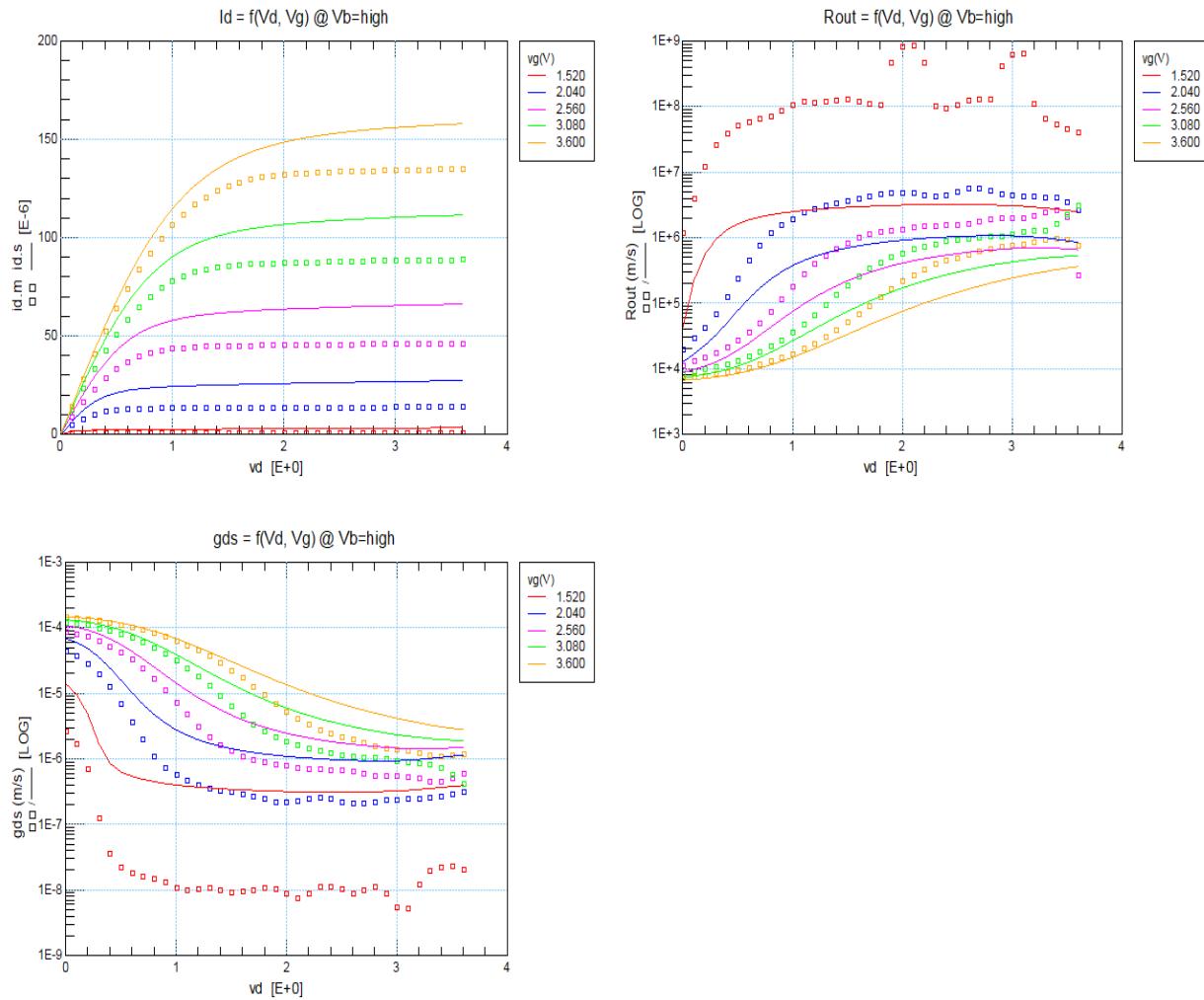
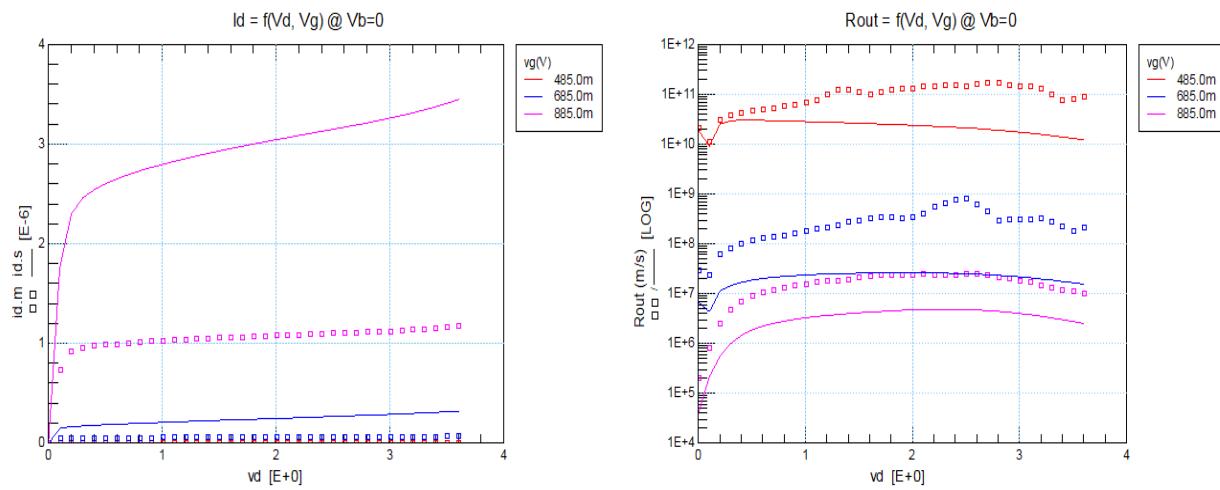


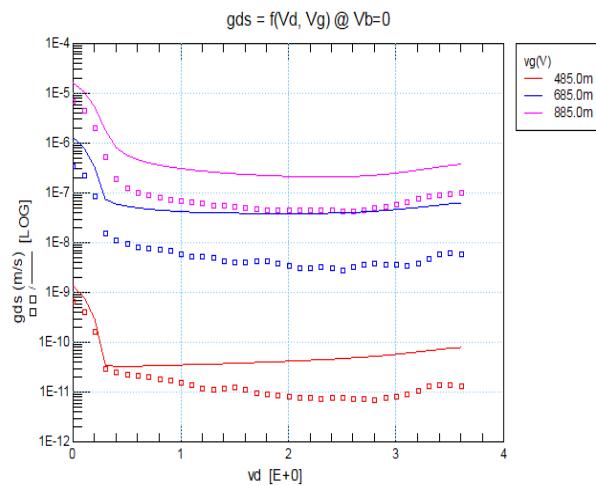


idvg, Ib,Ig, Vb = 0V, T = -40°C

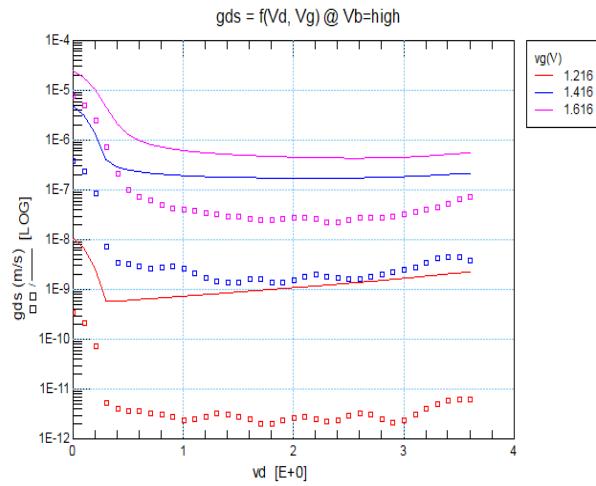
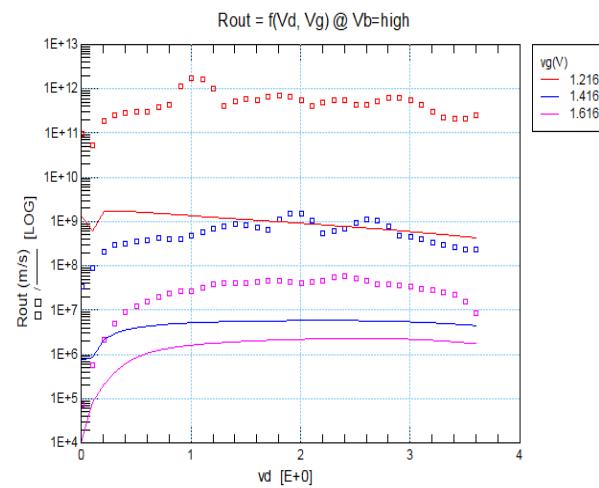
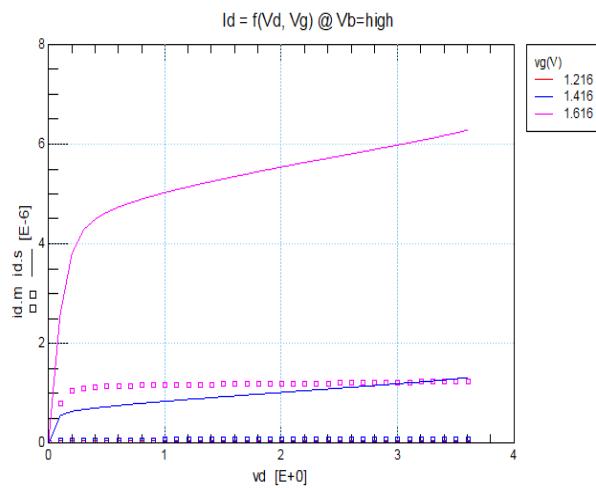


idvg, Ib,Ig, Vb = -3.6V, T = -40°C

idvd, Vb = 0V, T = -40°C


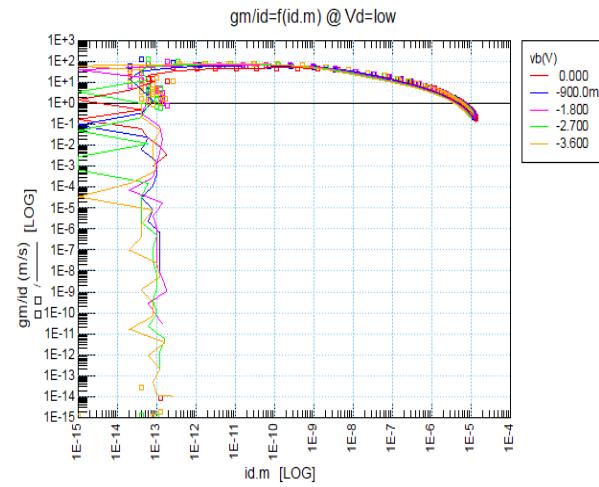
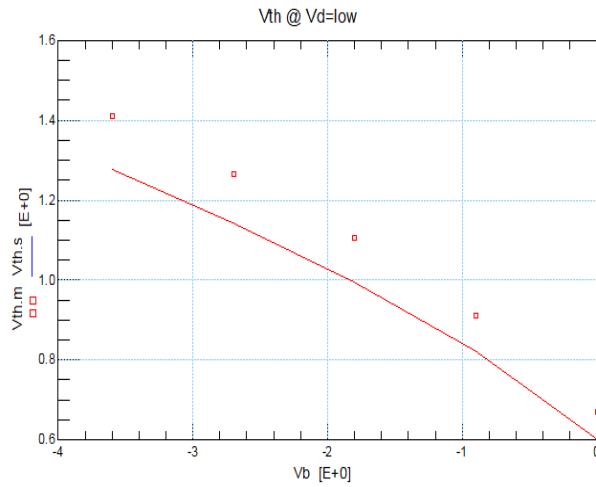
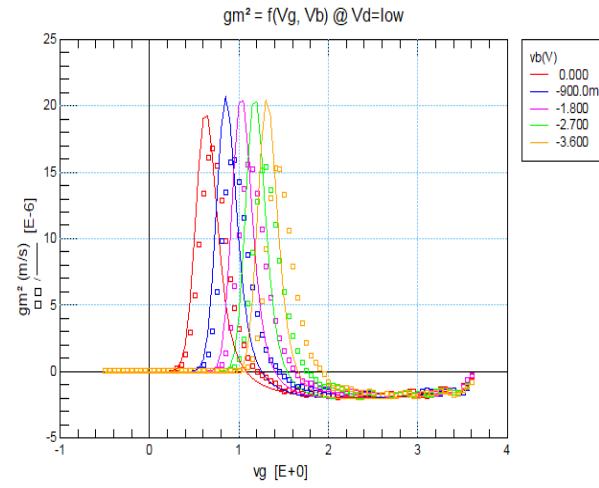
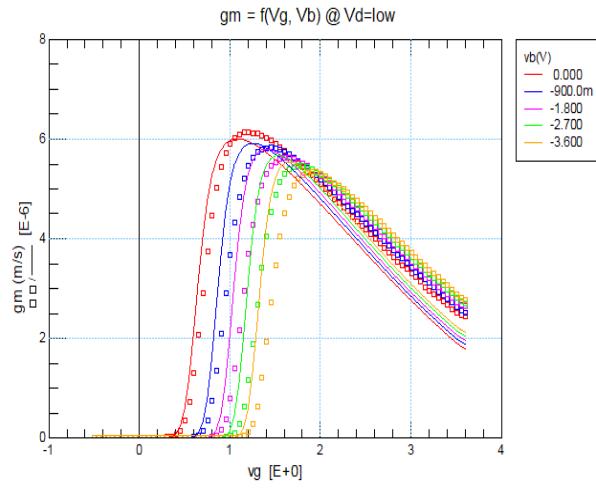
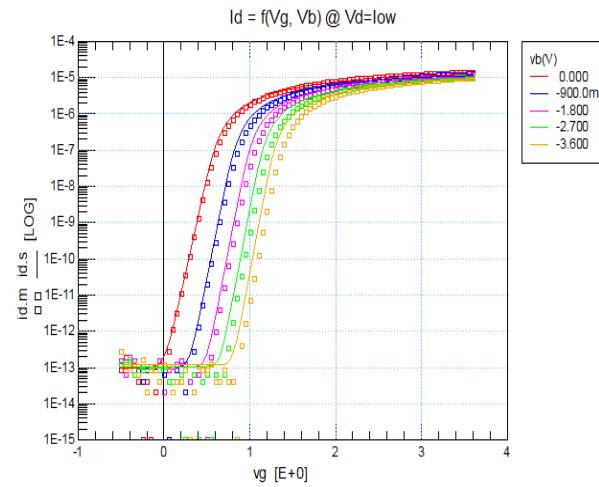
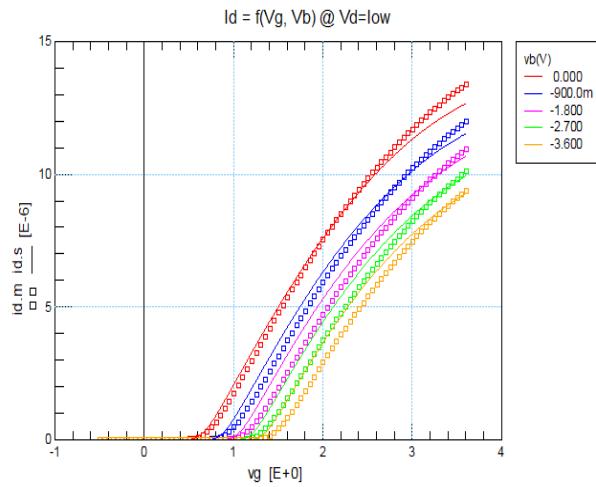
idvd_vbmin, Vb = -3.6V, T = -40°C**idvd_vth, Vb = 0V, T = -40°C**

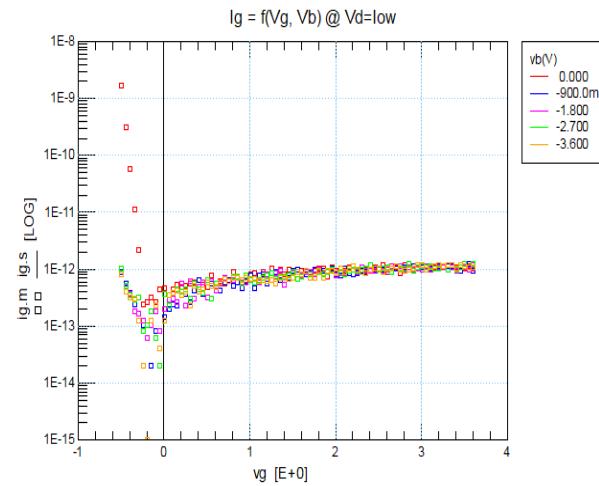
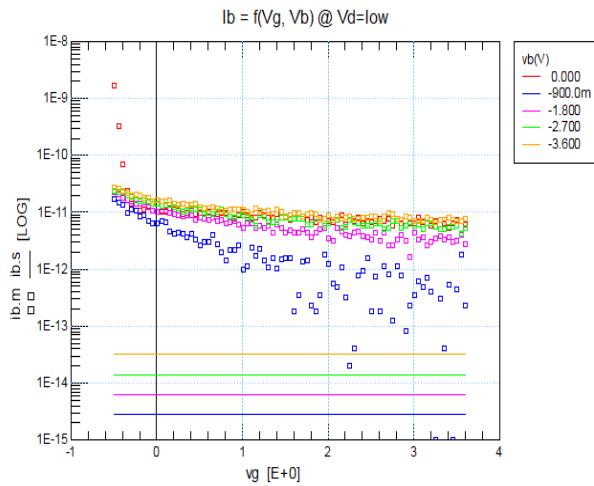


idvd_vth_vbmin, Vb = -3.6V, T = -40°C

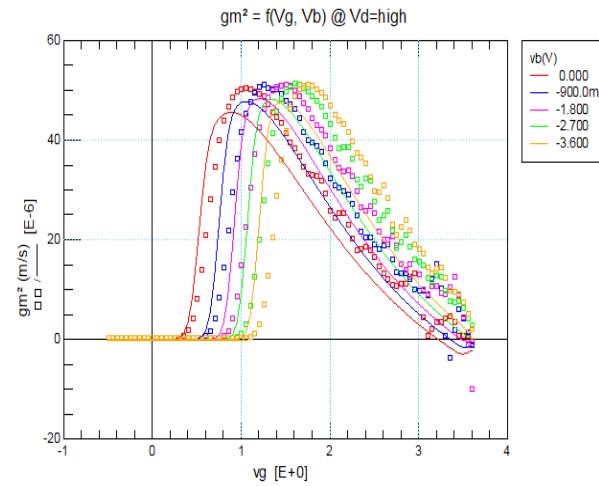
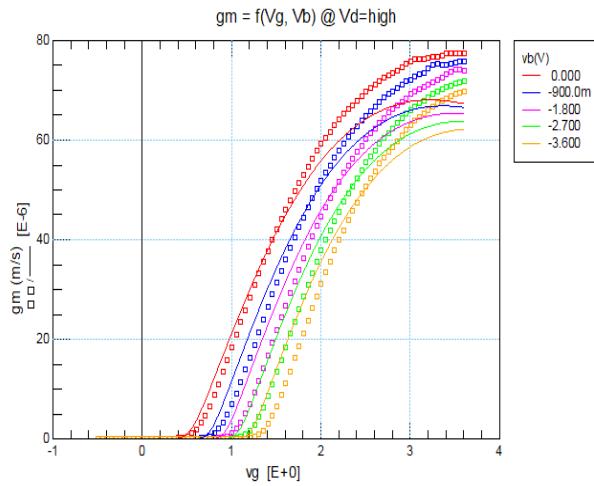
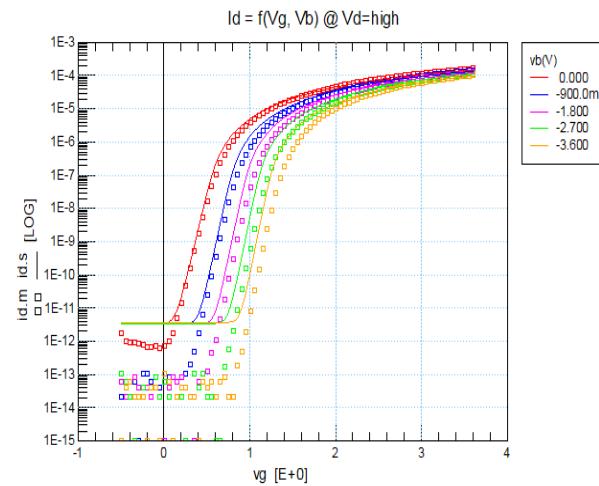
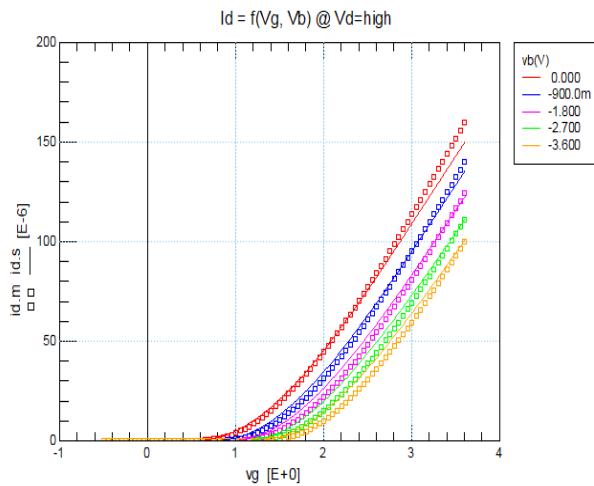


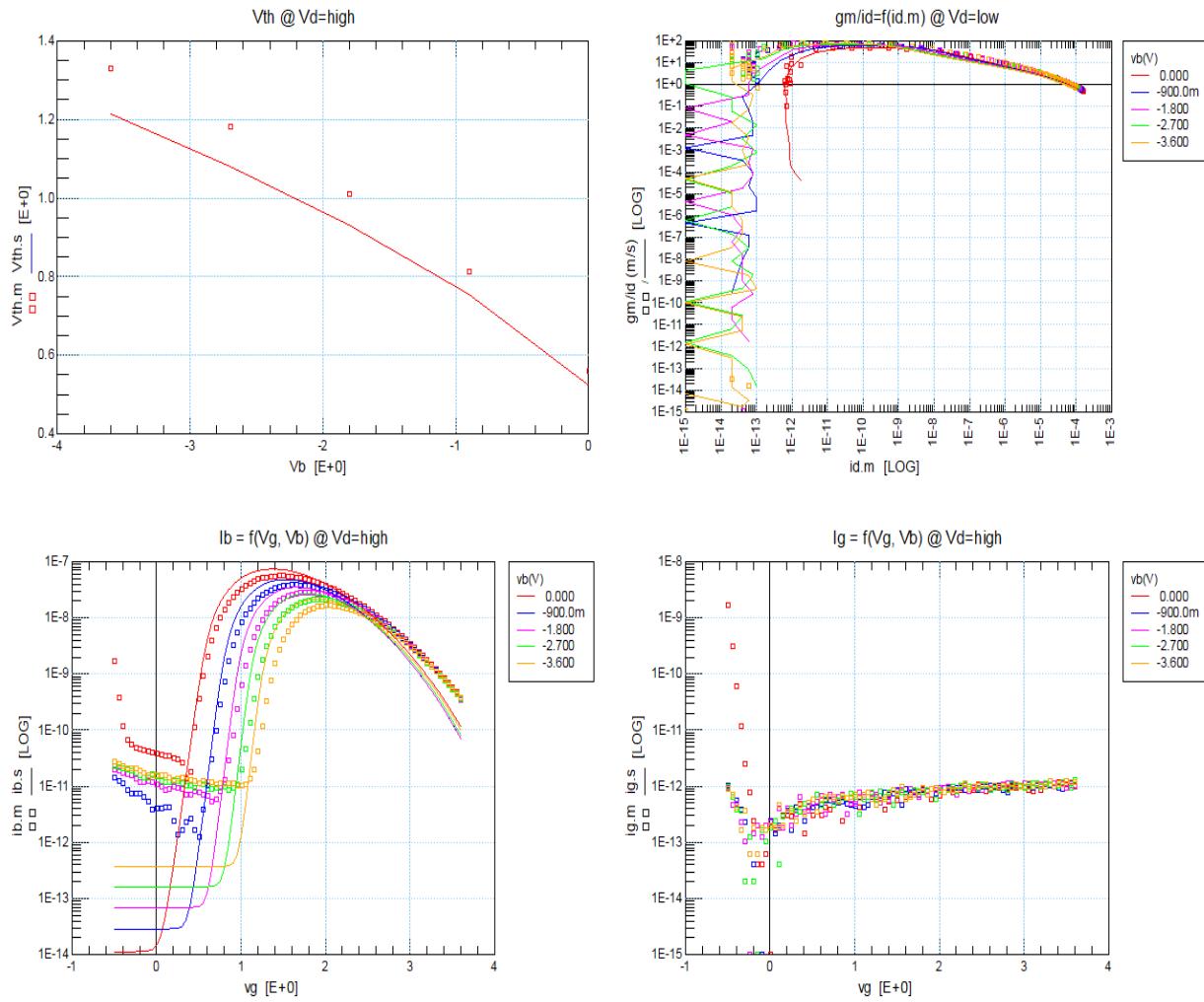
idvg, Vd = 0.1V, T = 70°C



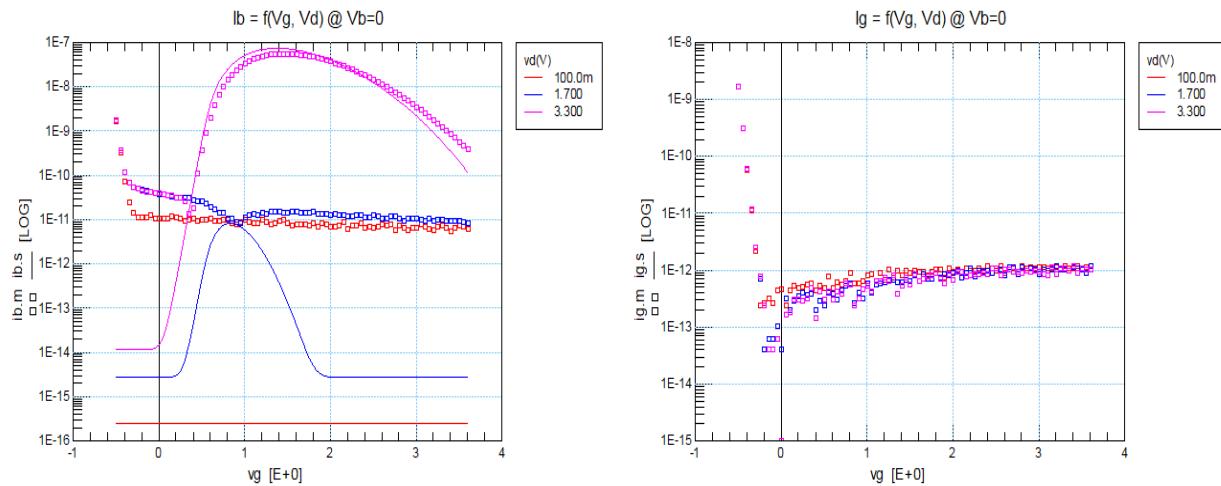


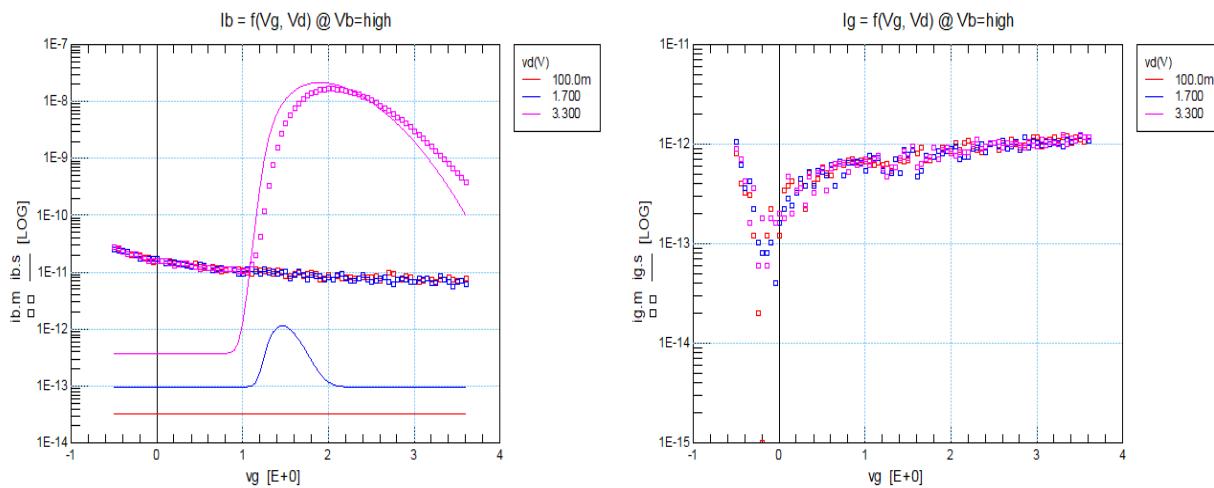
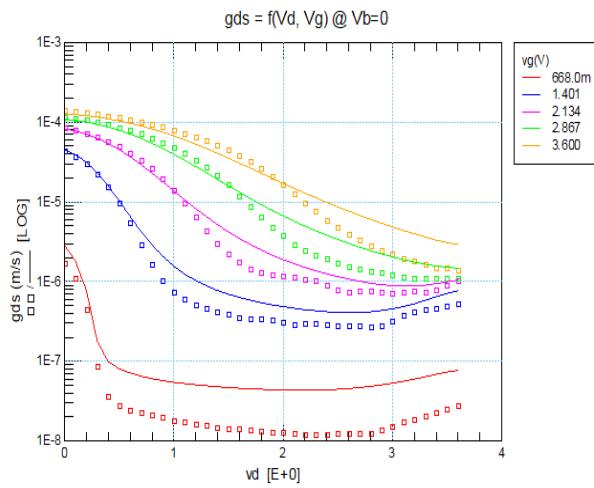
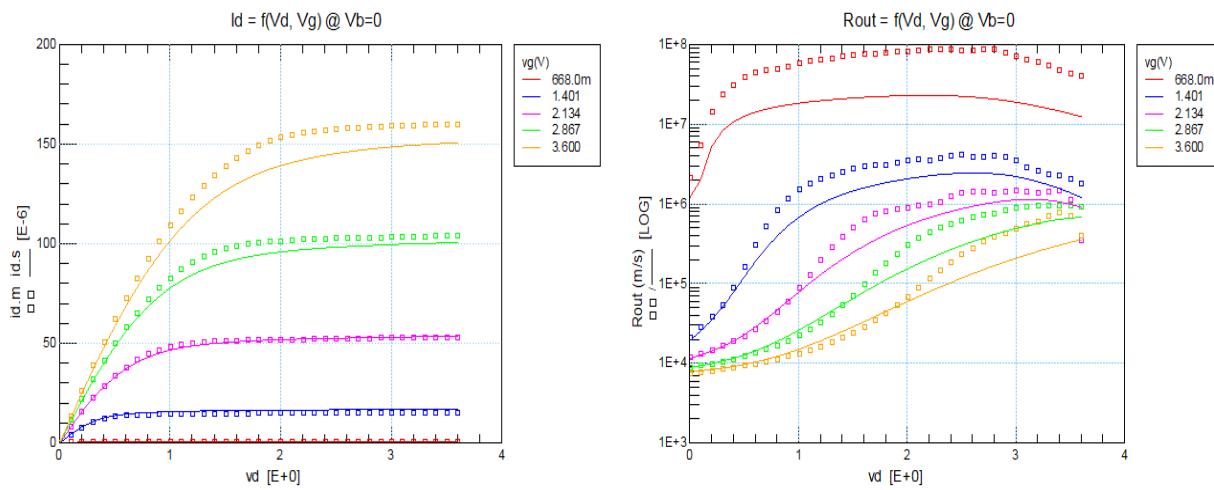
$i_{dvg}, V_d = 3.3V, T = 70^\circ C$

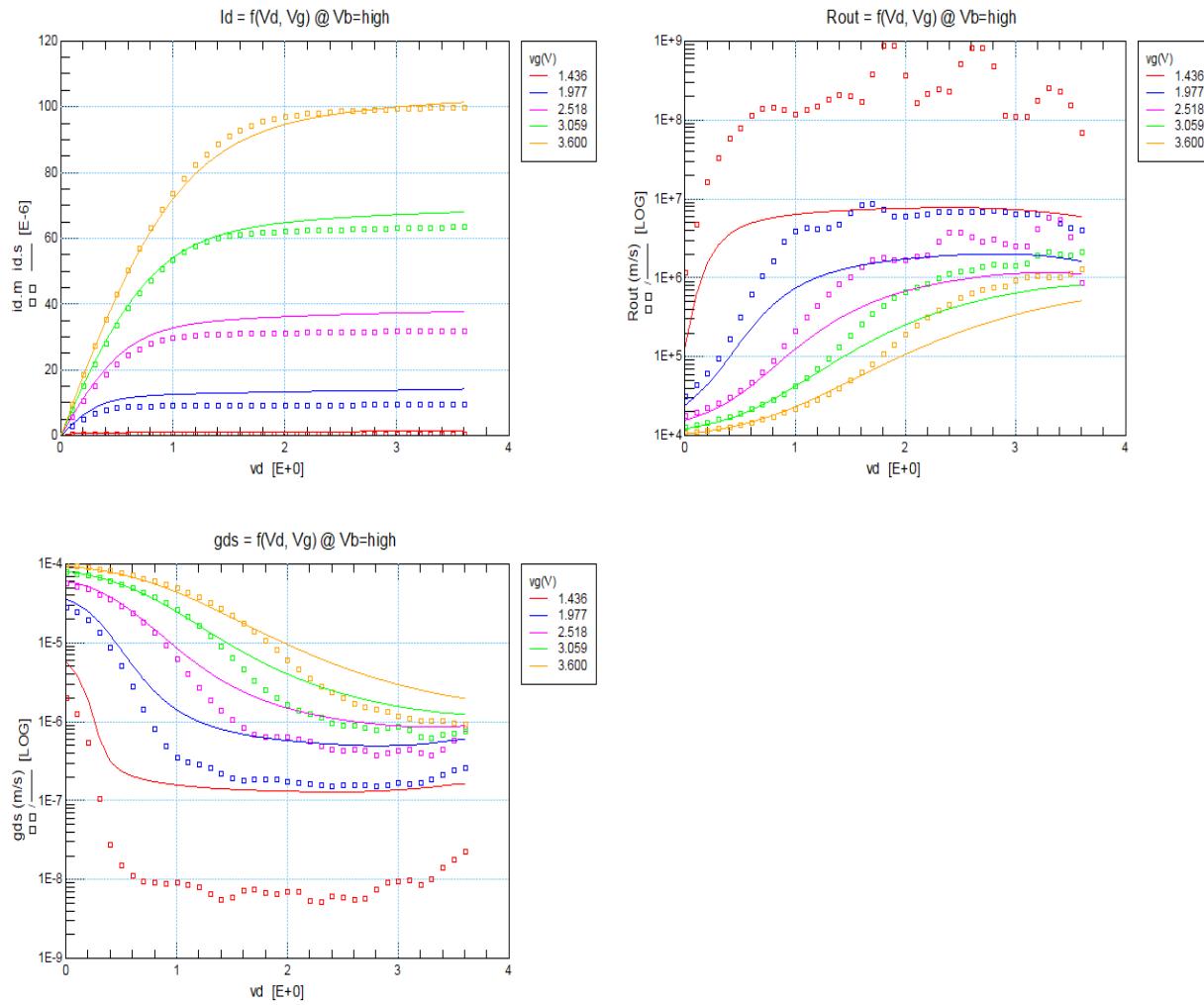
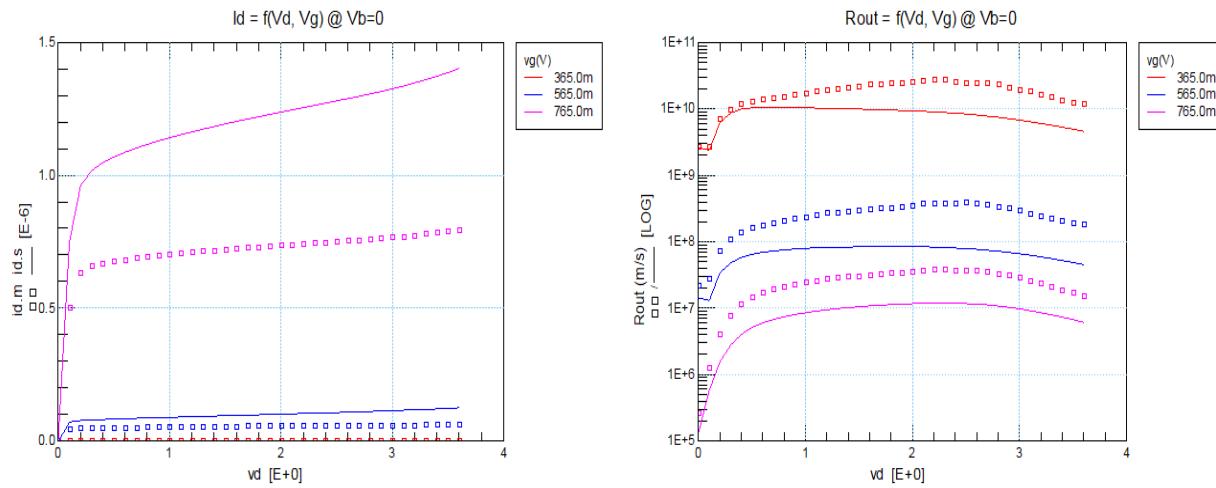


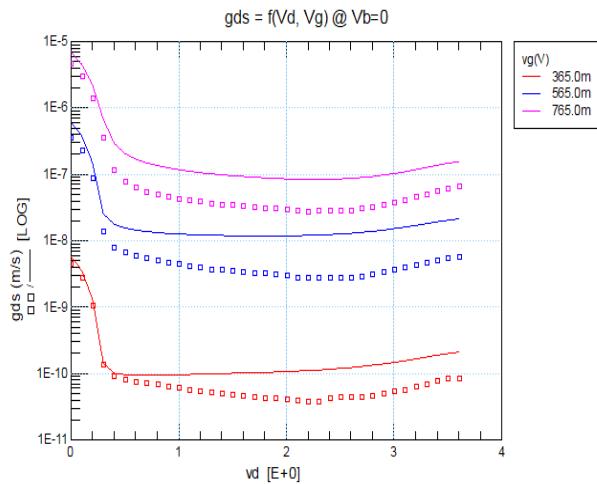


id_{vg} , I_b , I_g , $V_b = 0V$, $T = 70^\circ C$

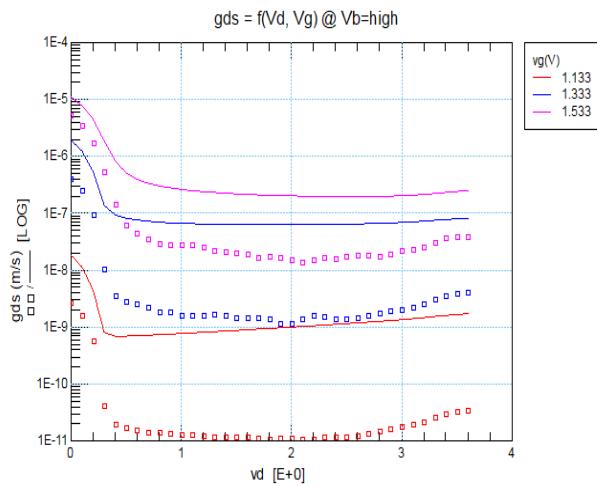
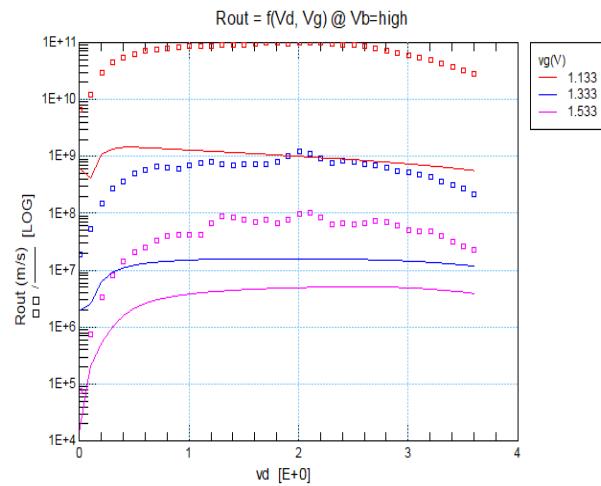
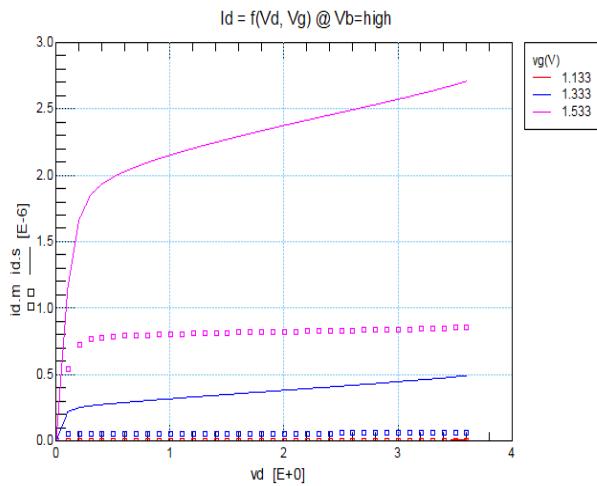


idvg, Ib,Ig, Vb = -3.6V, T = 70°C

idvd, Vb = 0V, T = 70°C


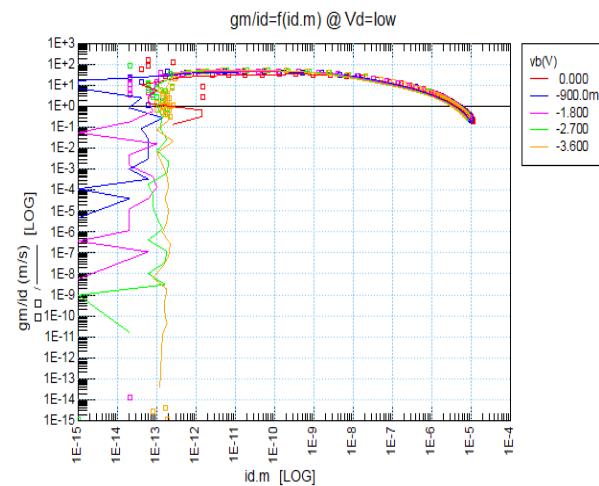
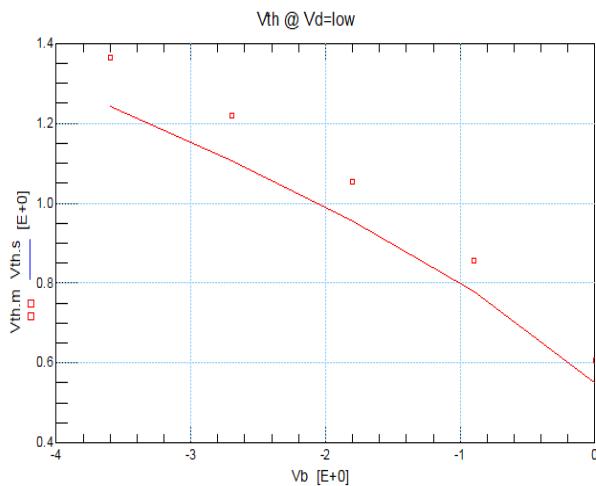
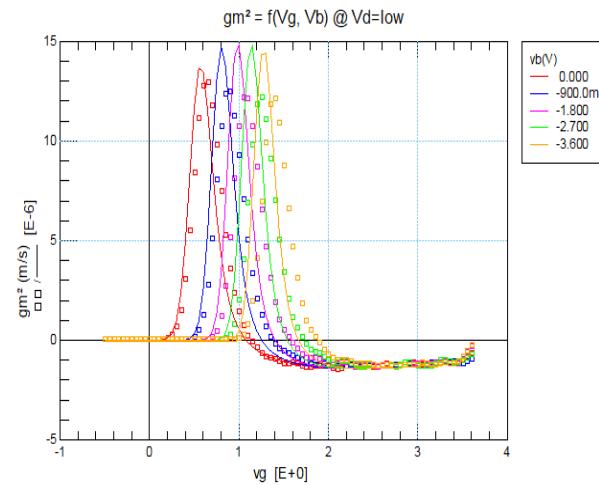
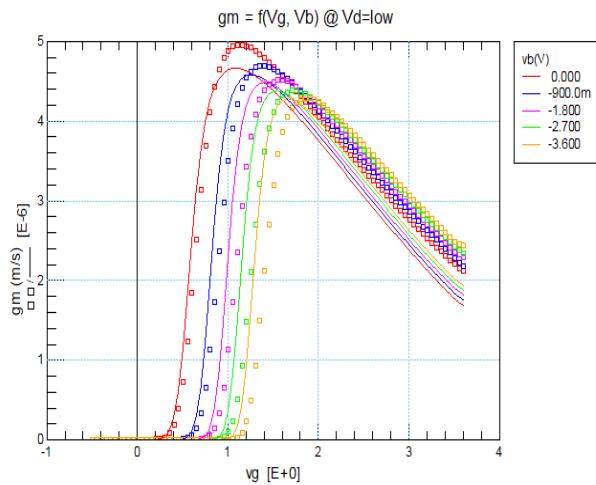
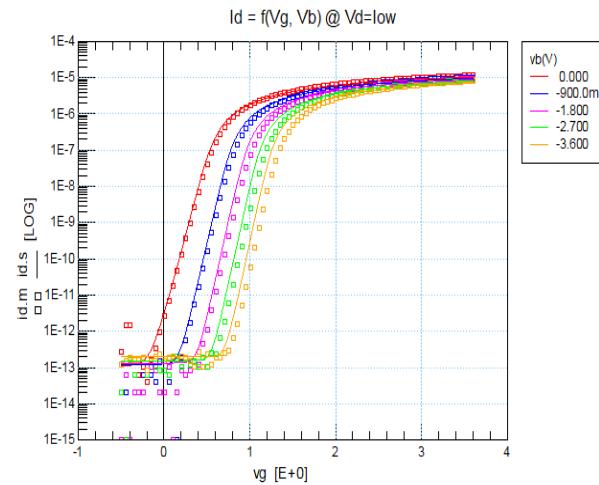
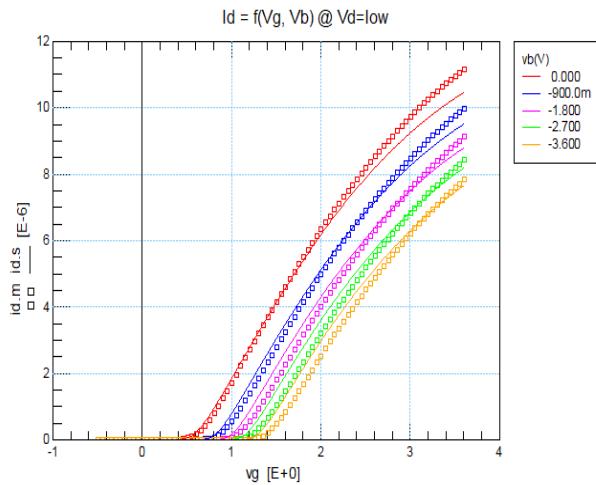
idvd_vbmin, Vb = -3.6V, T = 70°C

idvd_vth, Vb = 0V, T = 70°C


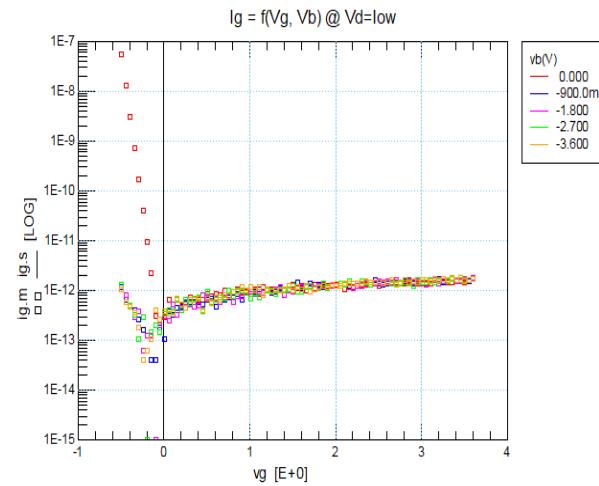
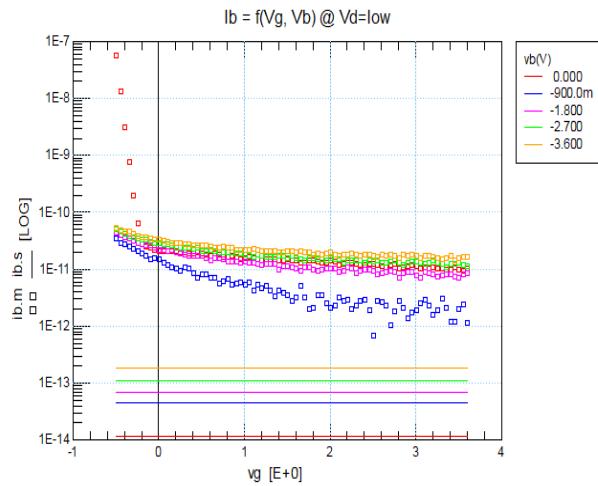


idvd_vth_vbmin, Vb = -3.6V, T = 70°C

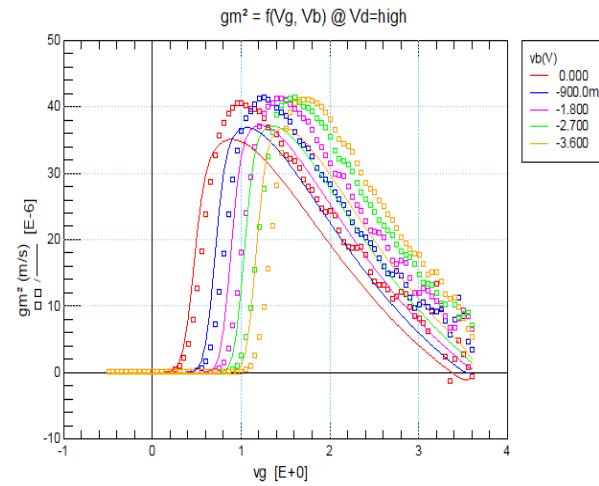
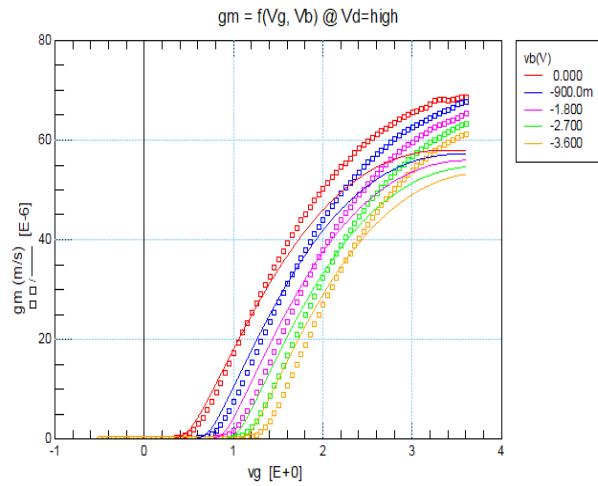
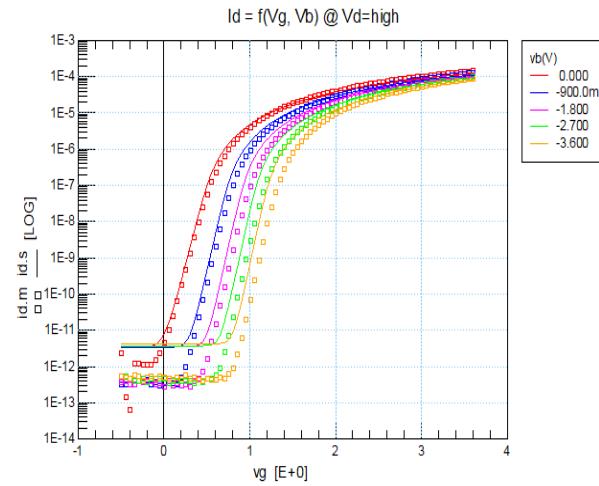
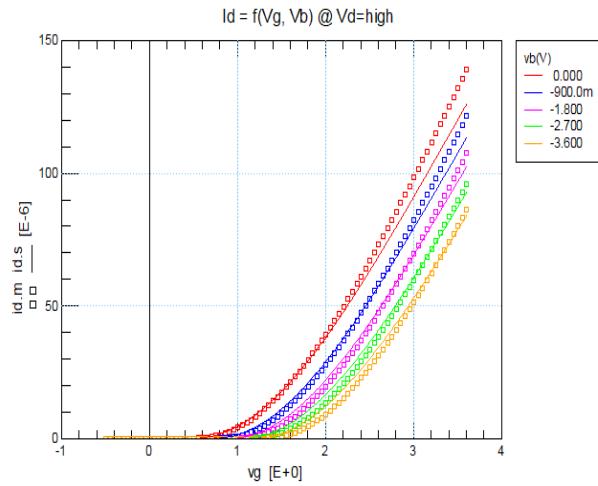


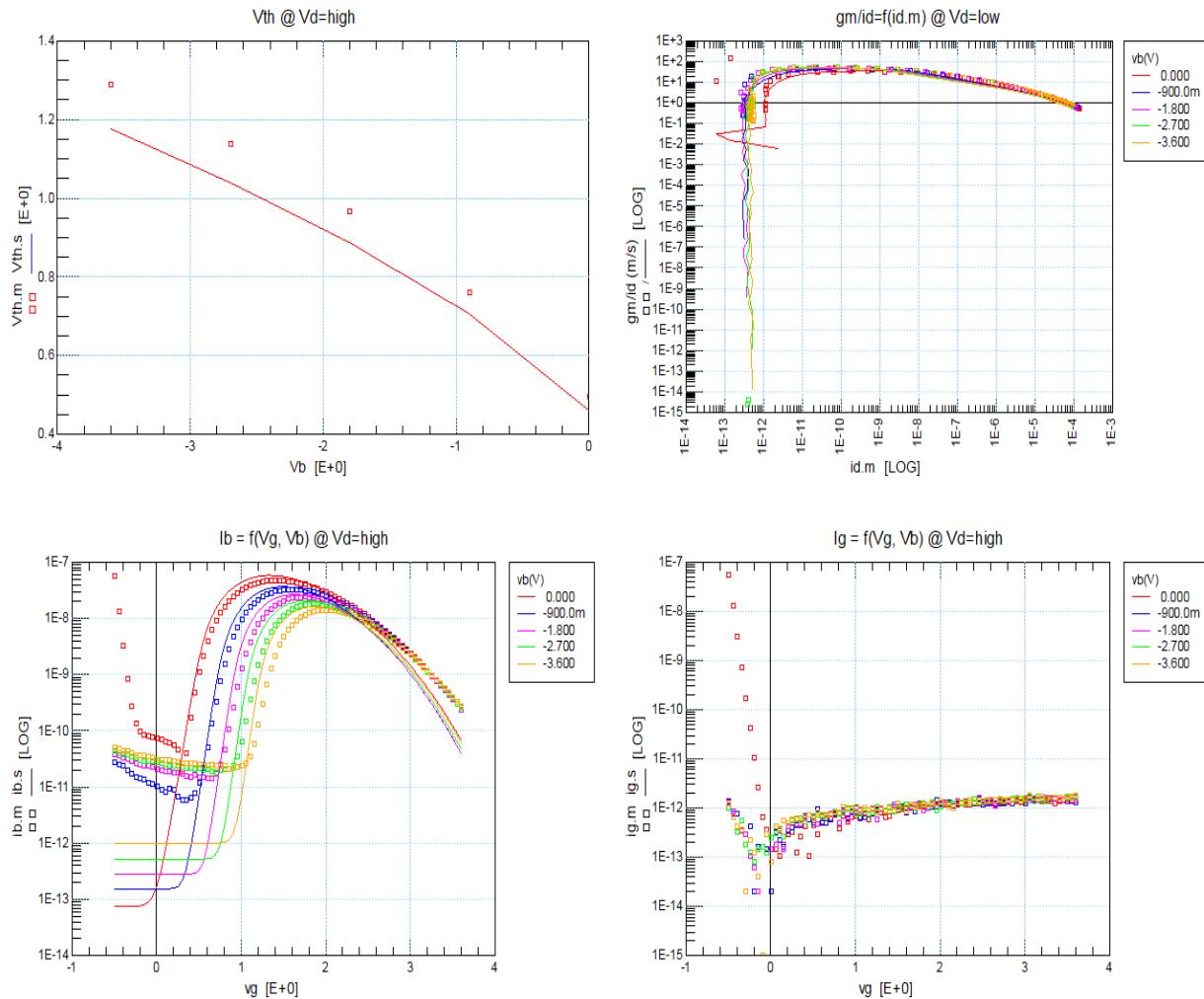
idvg, Vd = 0.1V, T = 125°C



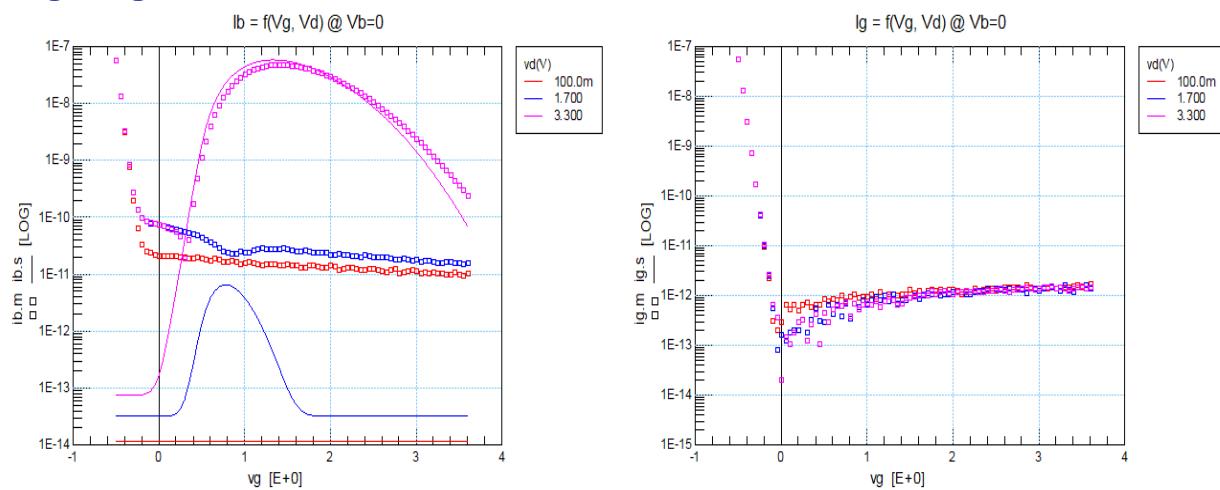


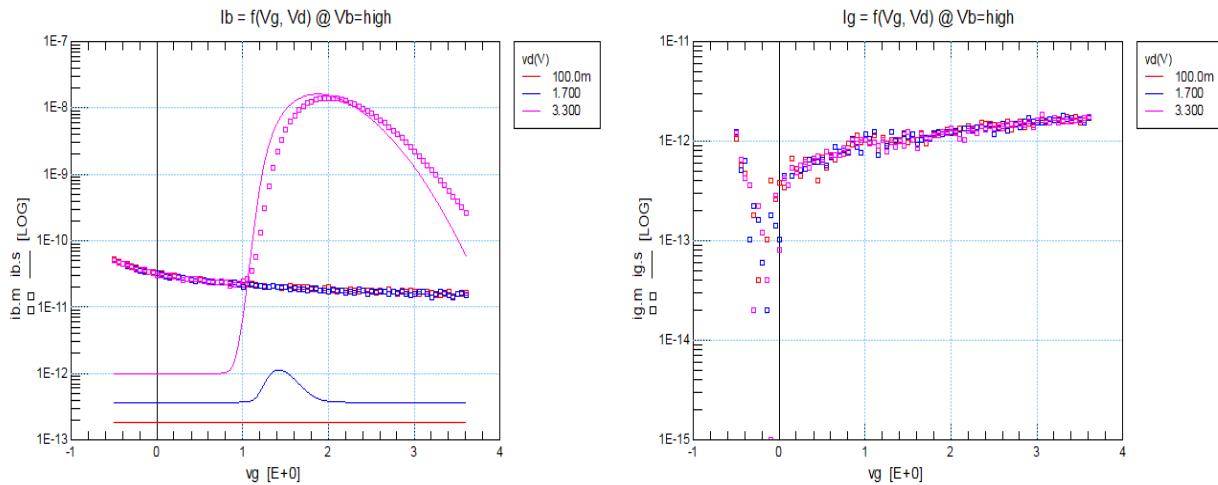
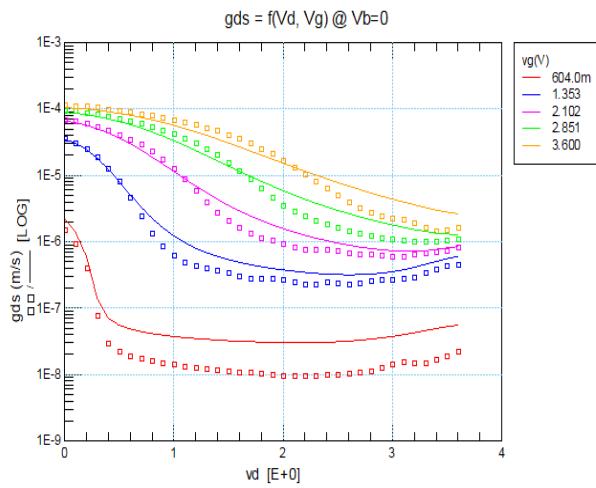
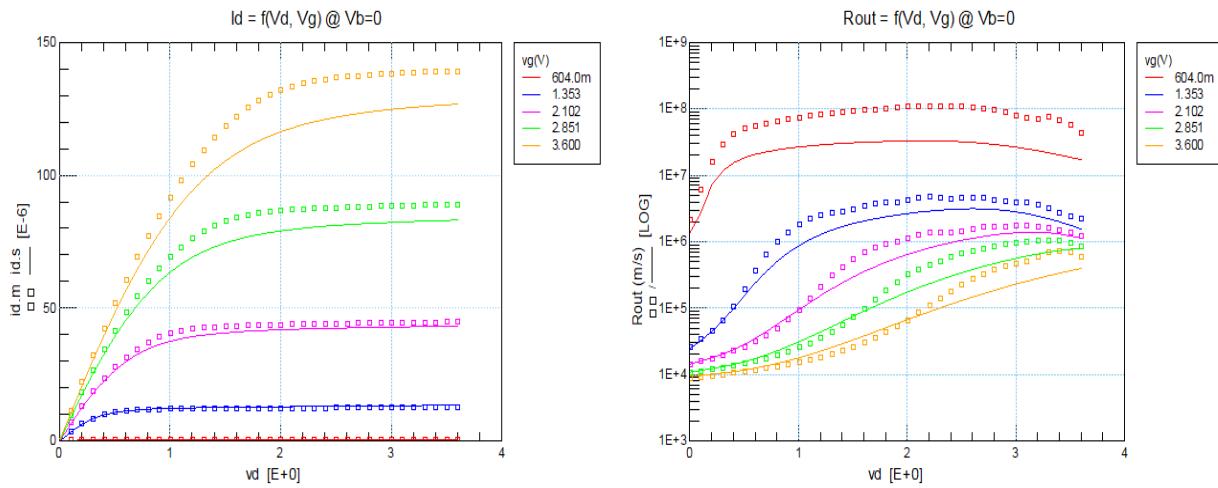
$i_{dvg}, V_d = 3.3V, T = 125^\circ C$

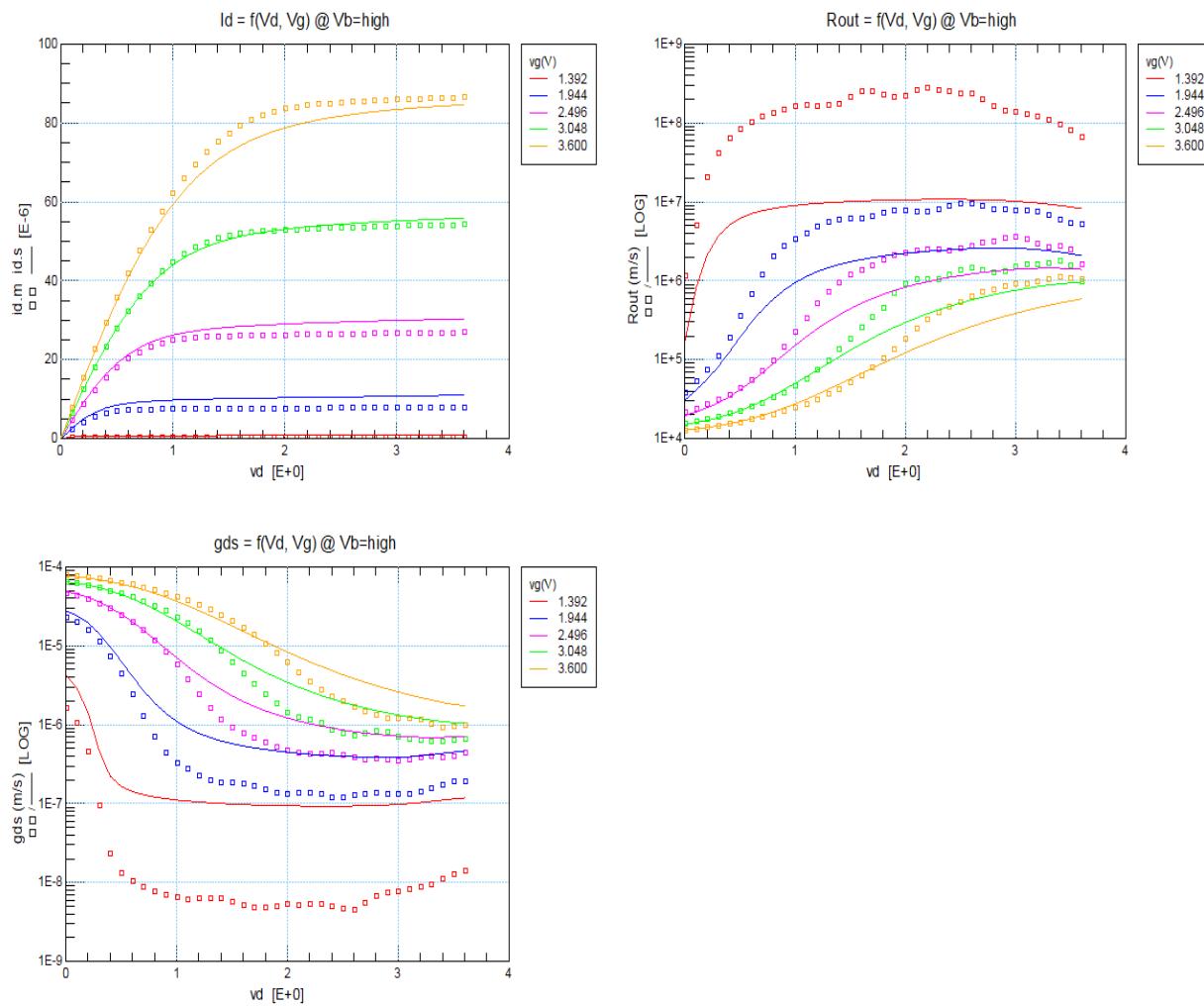
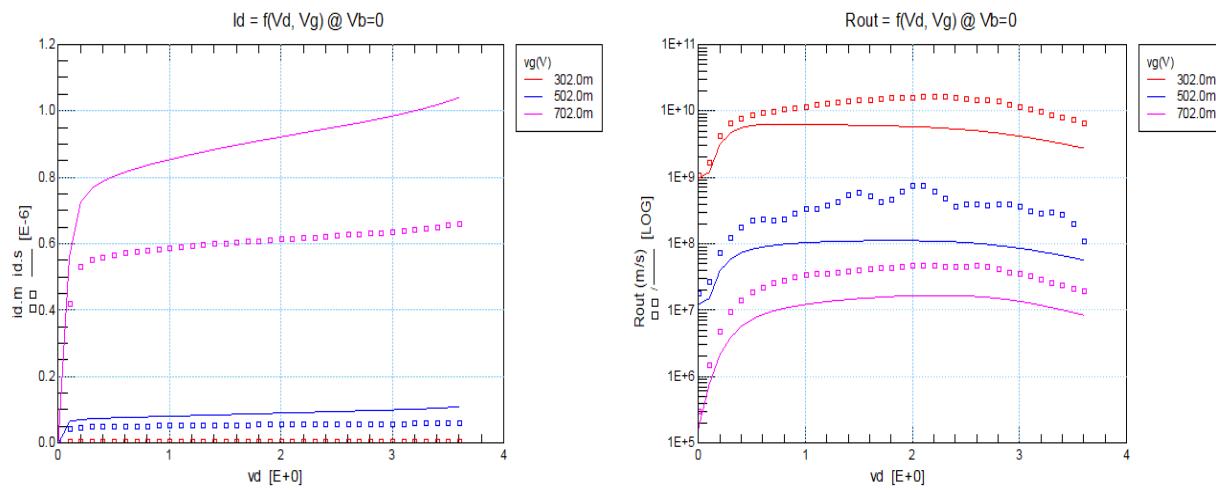


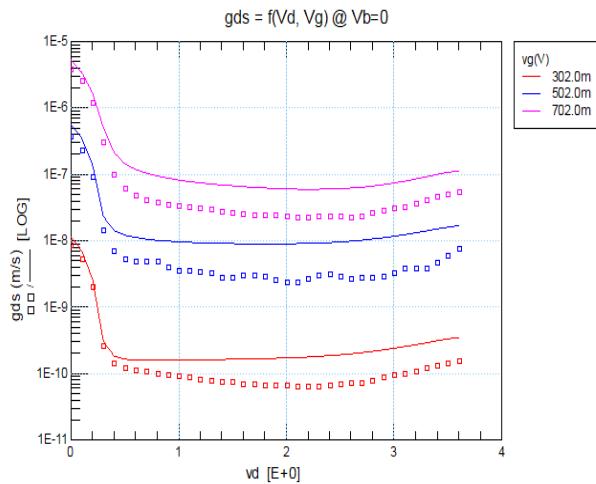


idvg, Ib, Ig, Vb = 0V, T = 125°C

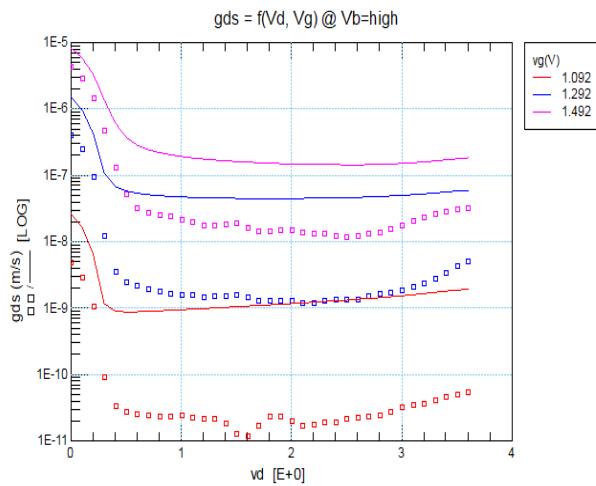
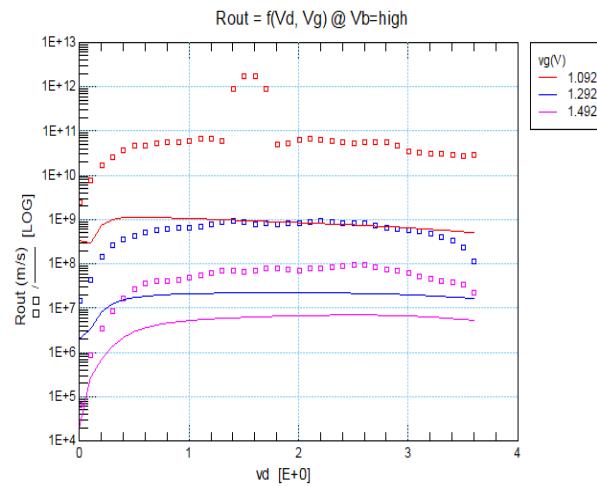
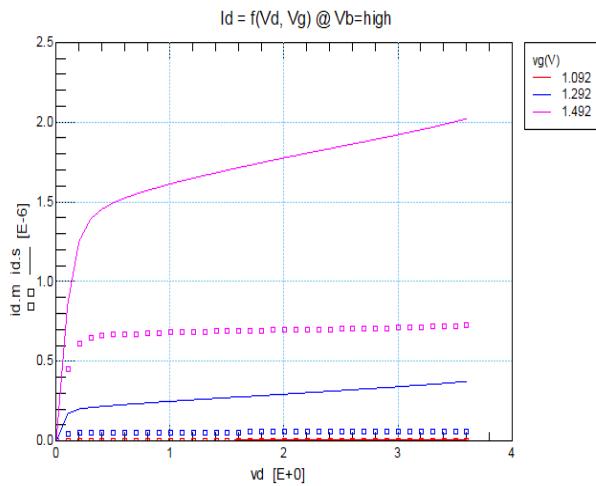


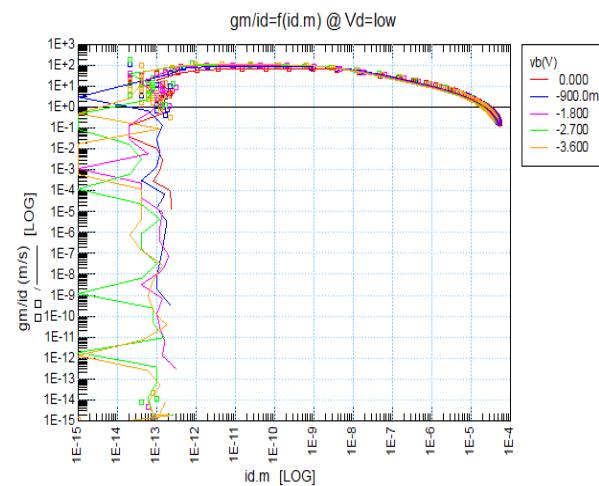
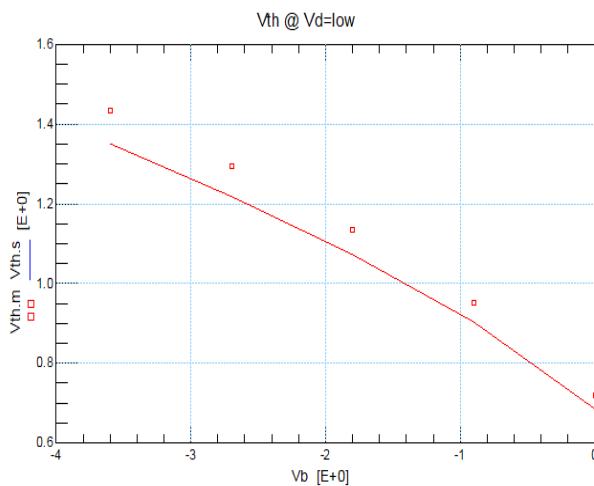
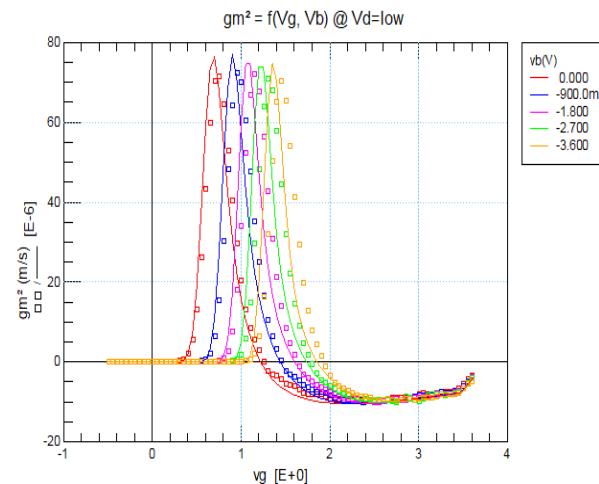
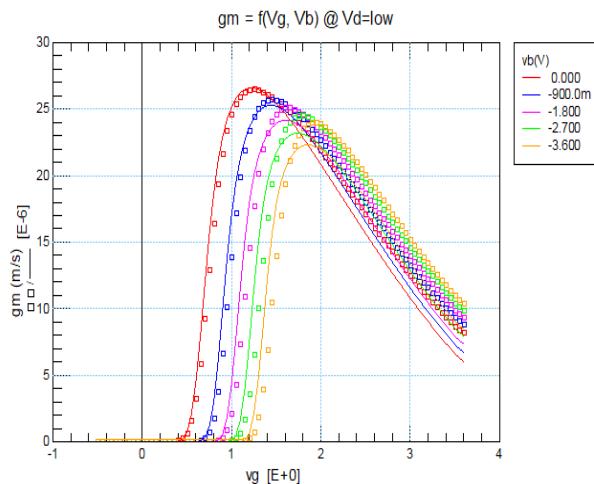
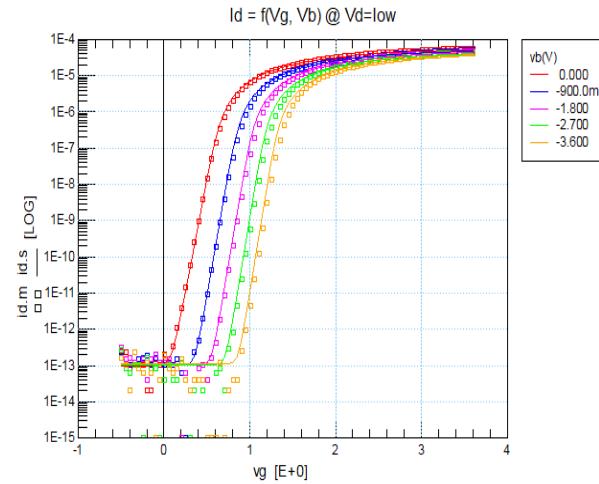
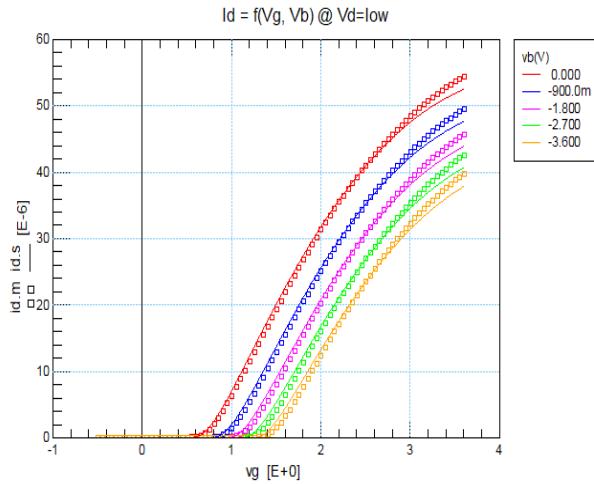
idvg, Ib,Ig, Vb = -3.6V, T = 125°C

idvd, Vb = 0V, T = 125°C


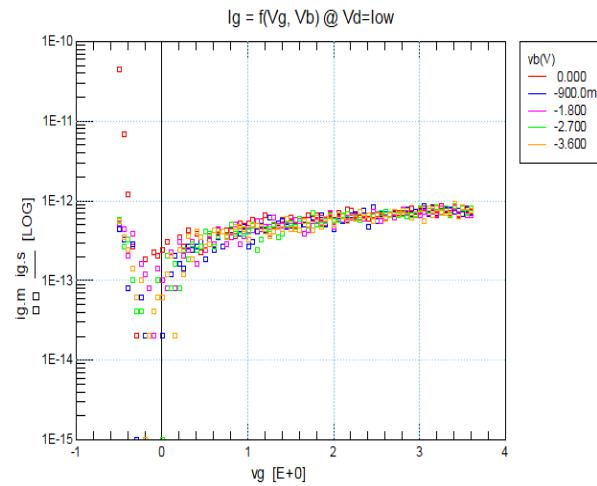
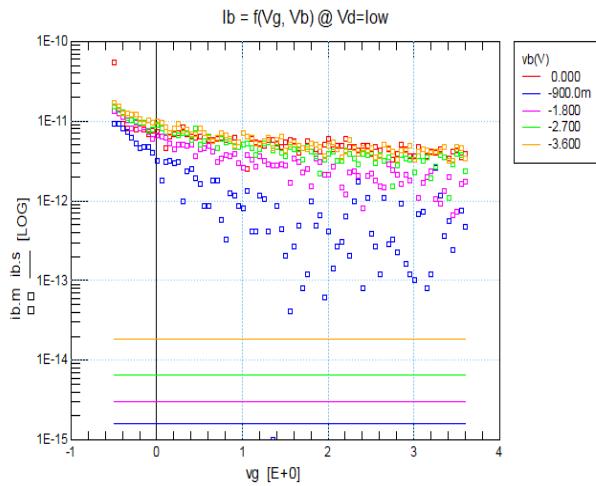
idvd_vbmin, Vb = -3.6V, T = 125°C

idvd_vth, Vb = 0V, T = 125°C




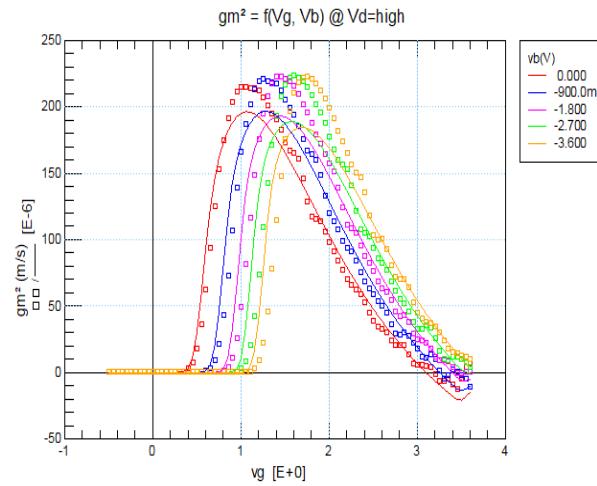
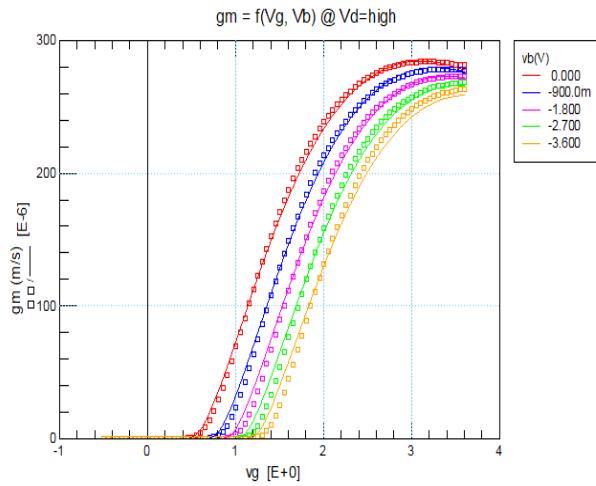
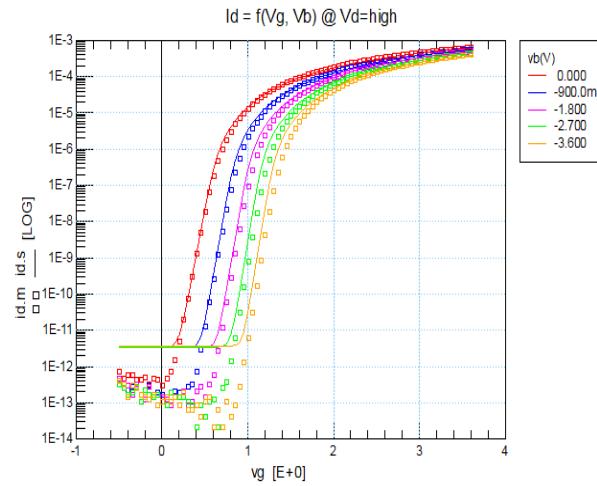
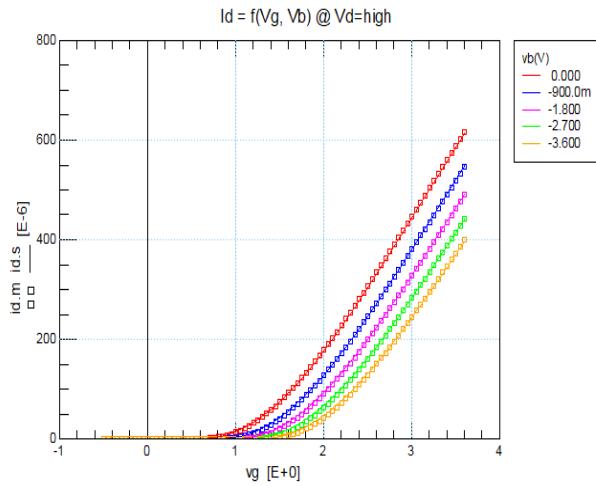
idvd_vth_vbmin, Vb = -3.6V, T = 125°C

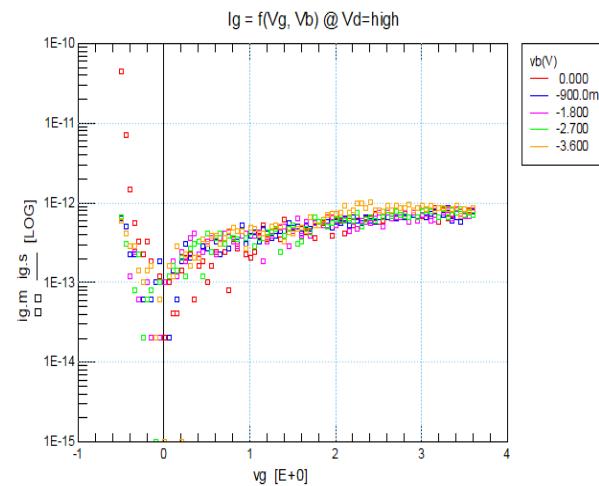
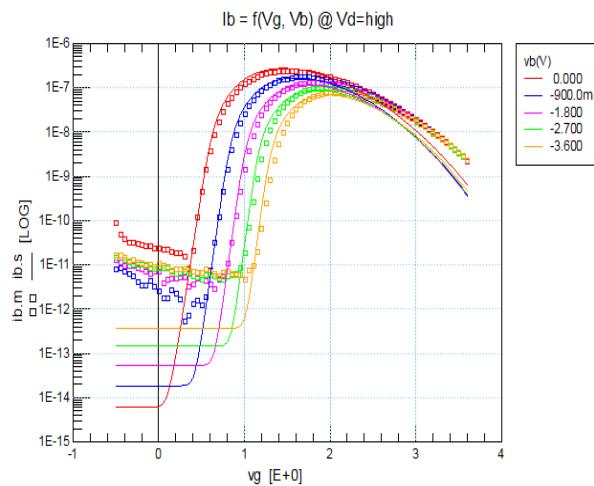
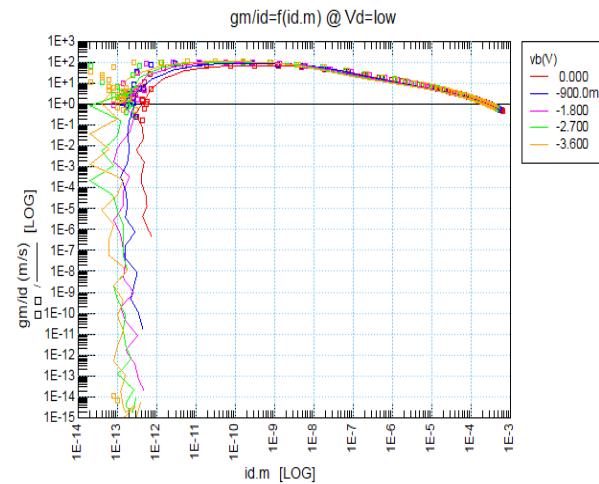
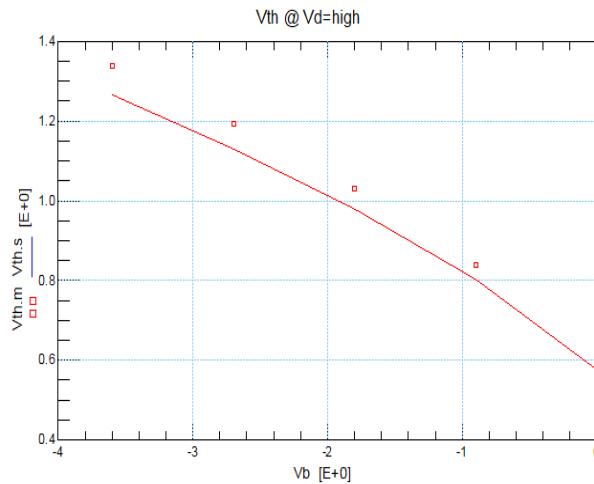


4.17W02u0_L1u2_S558_3**idvg, Vd = 0.1V, T = 27°C**

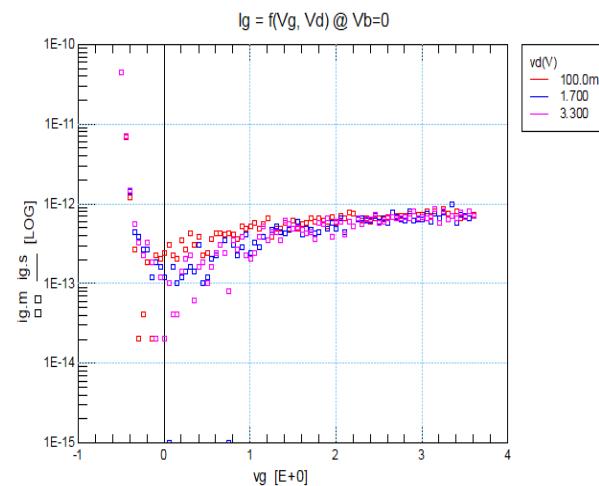
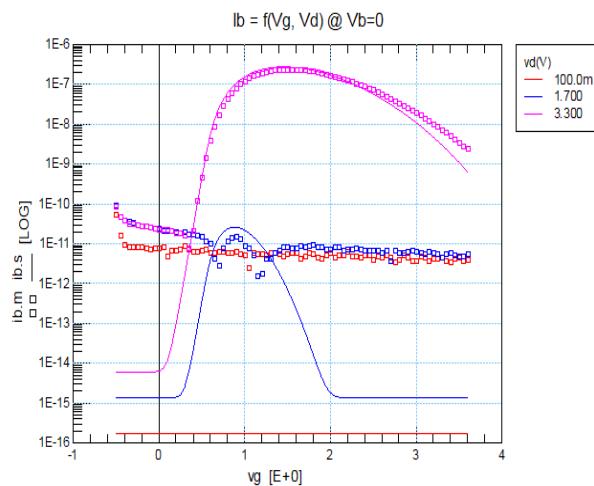


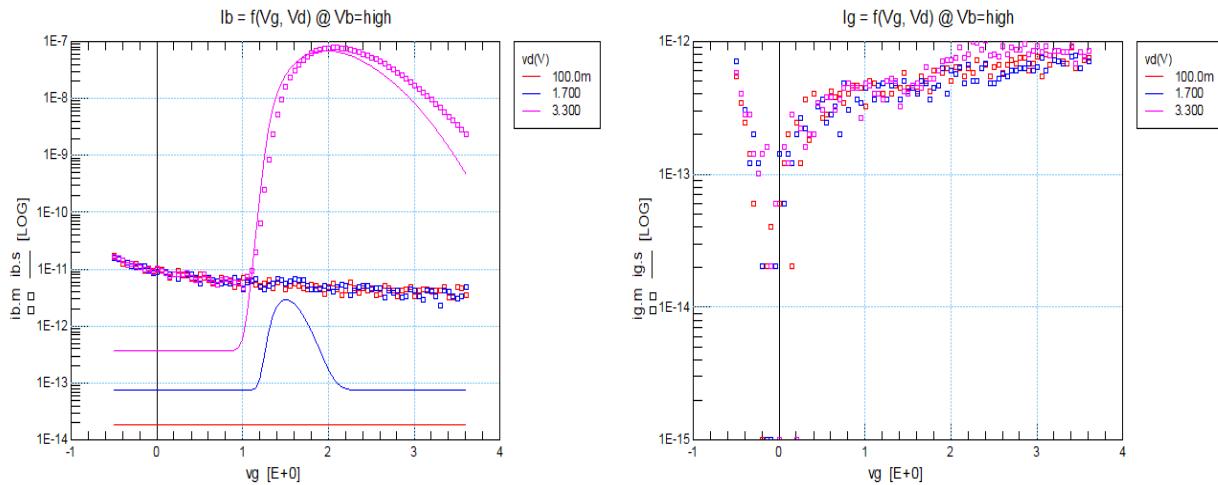
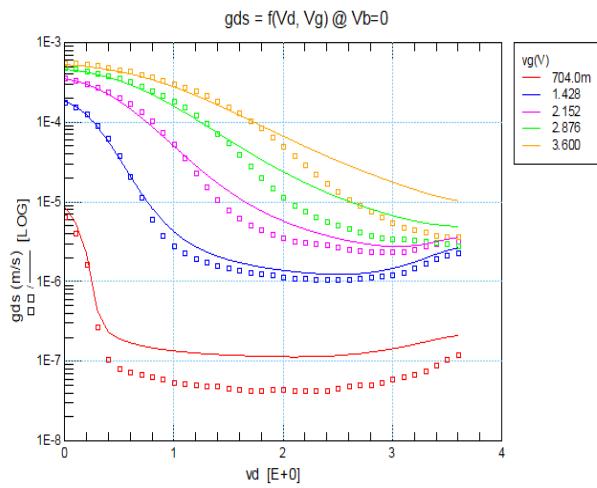
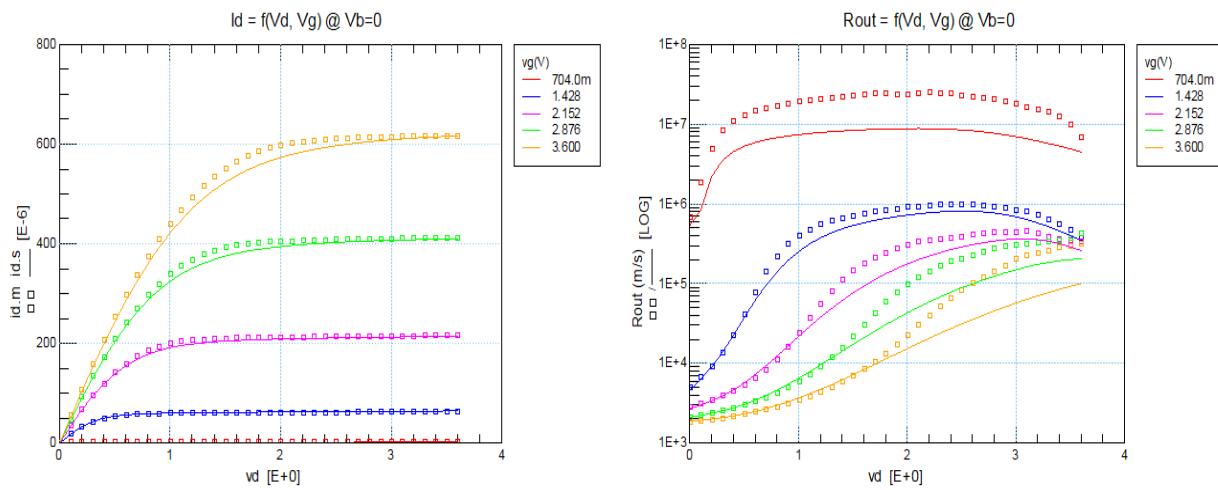
$i_d v_g, V_d = 3.3V, T = 27^\circ C$

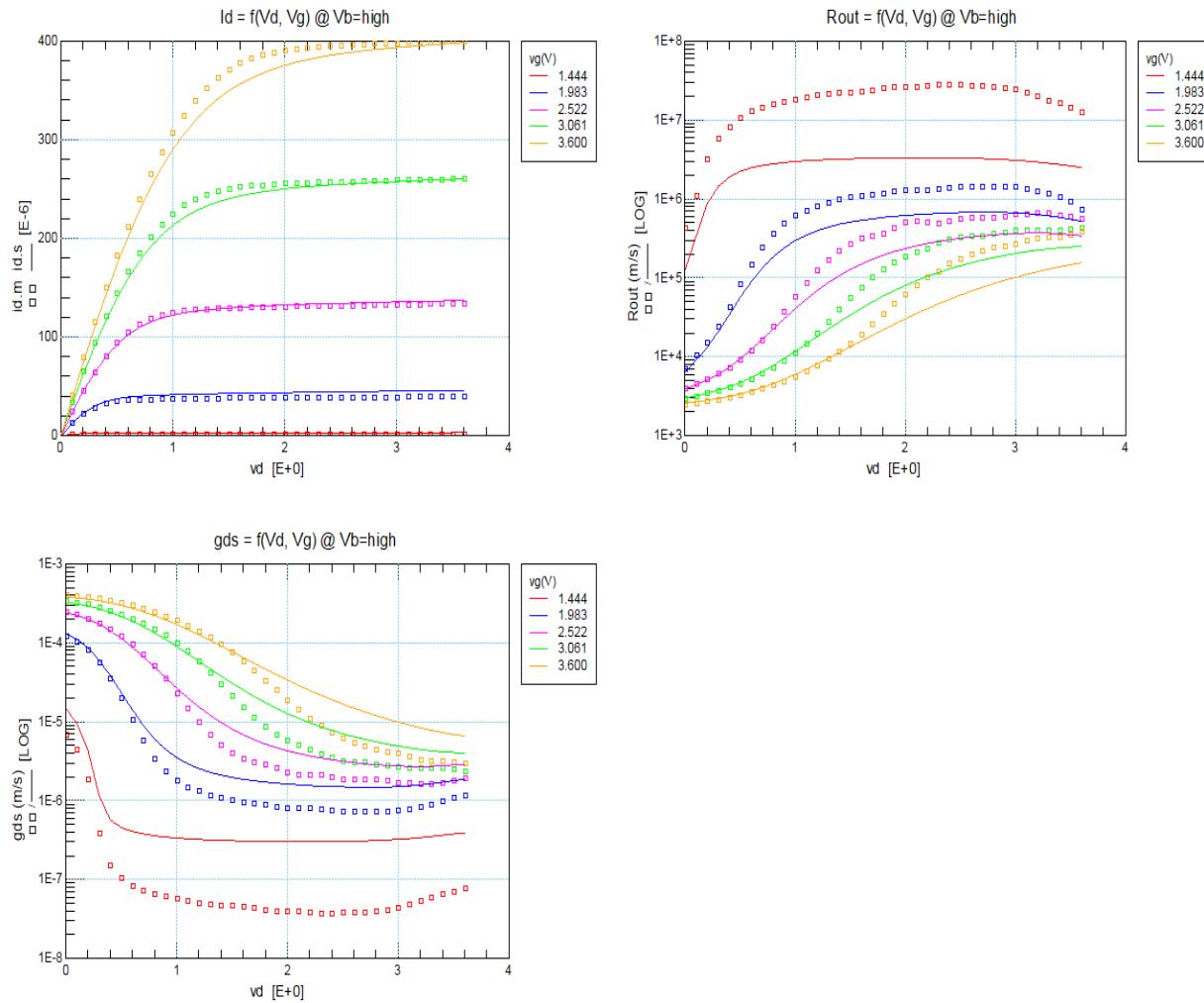
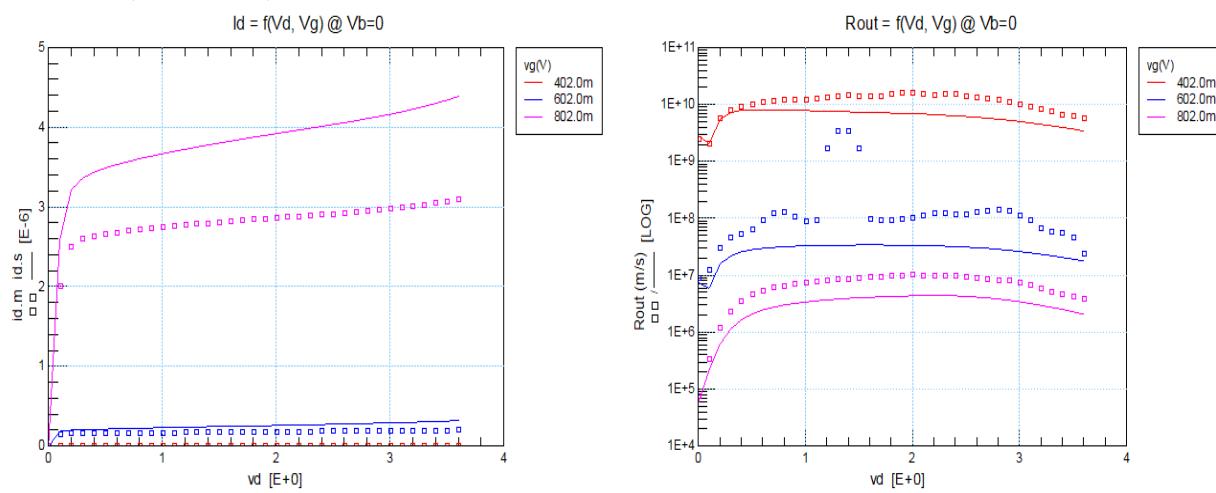


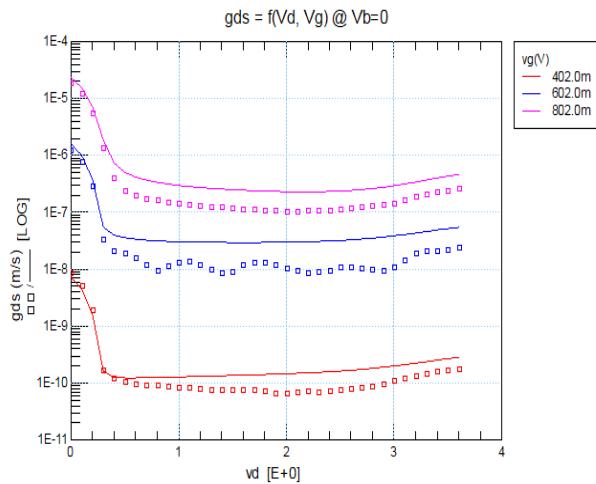


$id_{vg}, I_b, I_g, V_b = 0V, T = 27^\circ C$

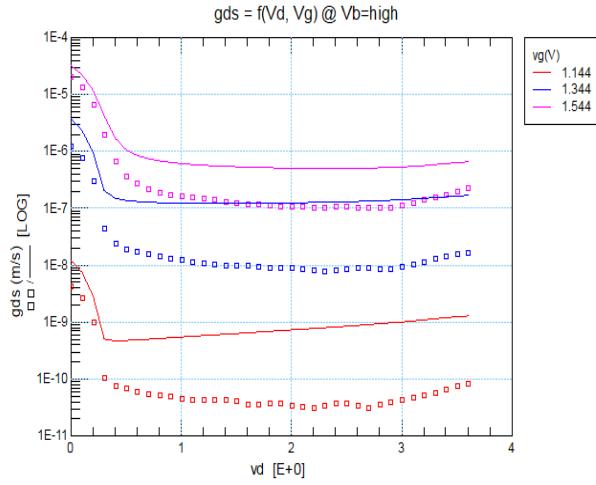
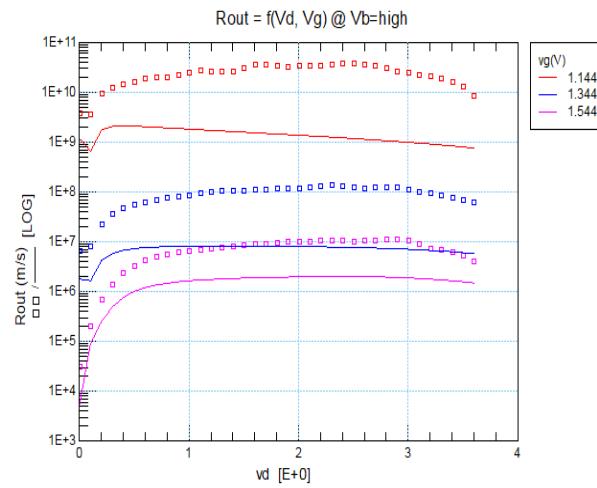
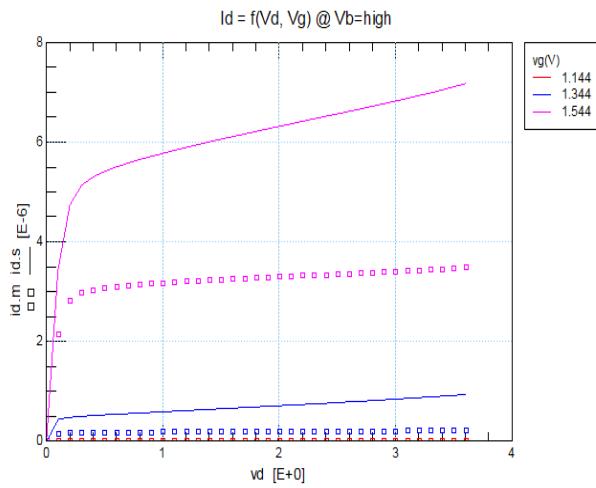


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


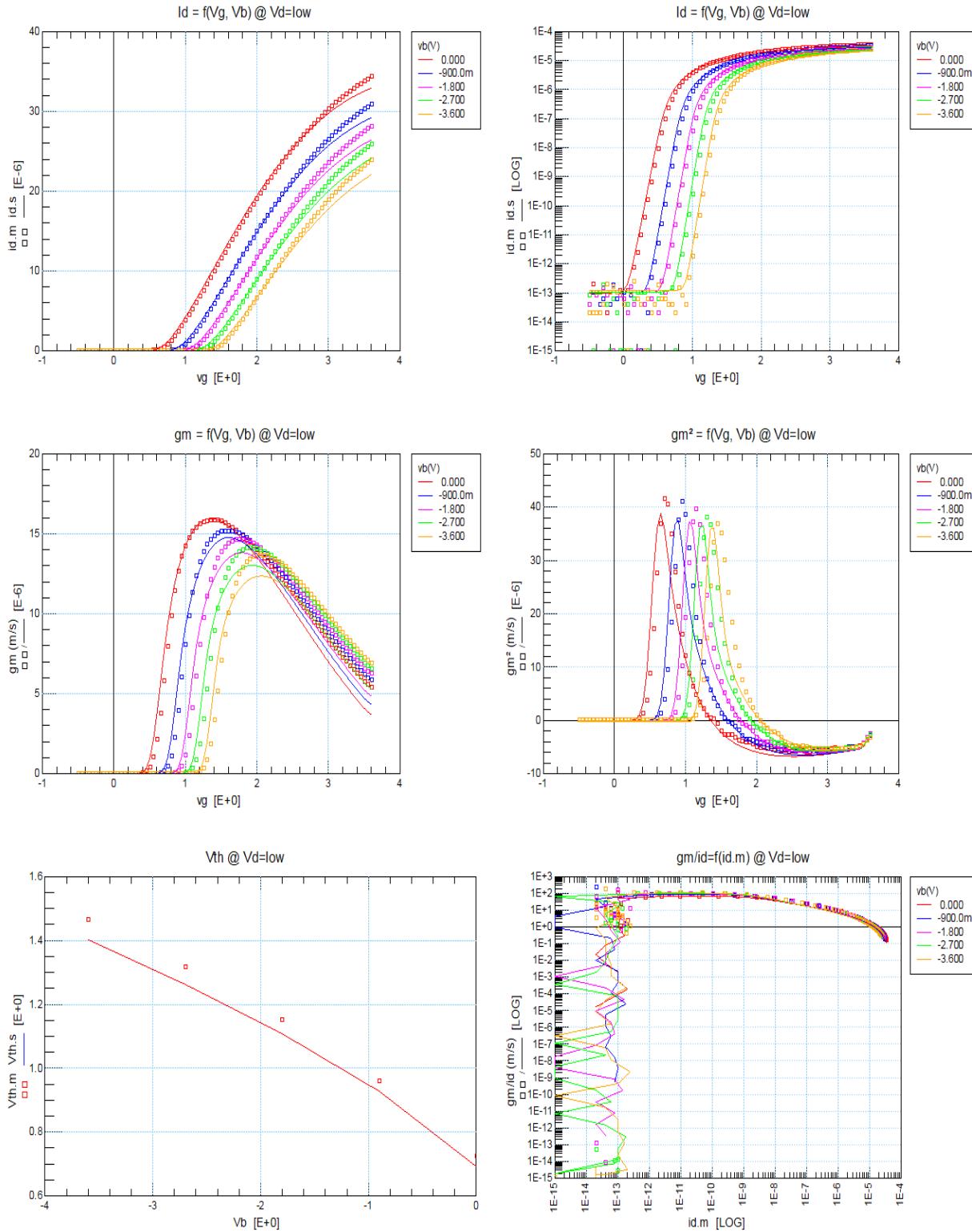


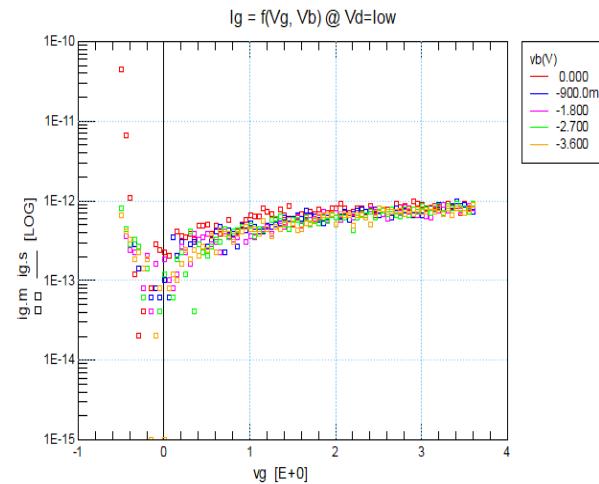
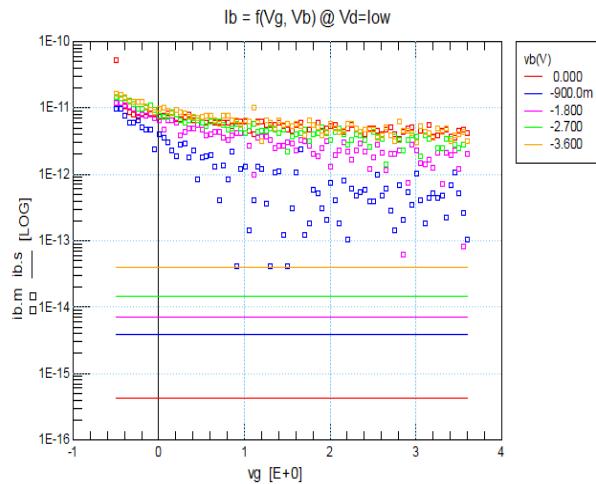
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



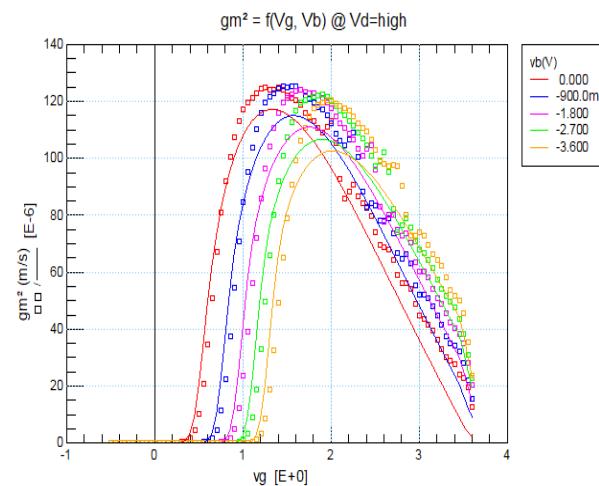
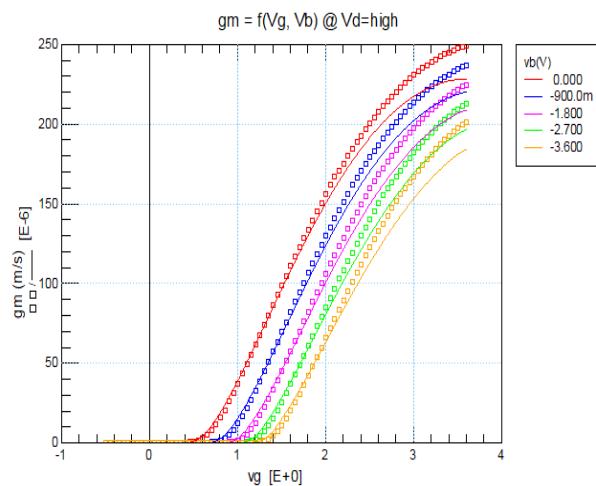
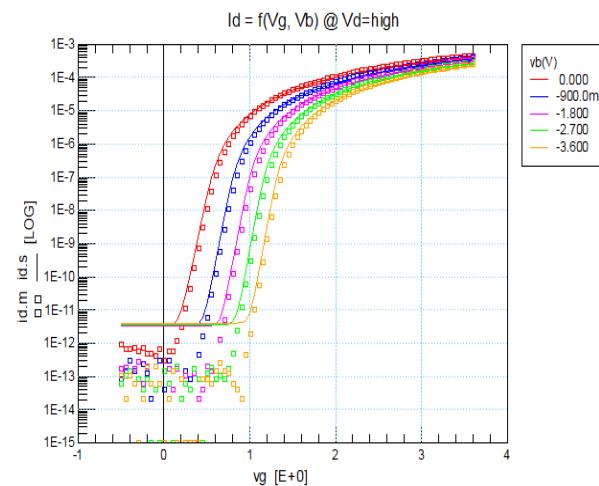
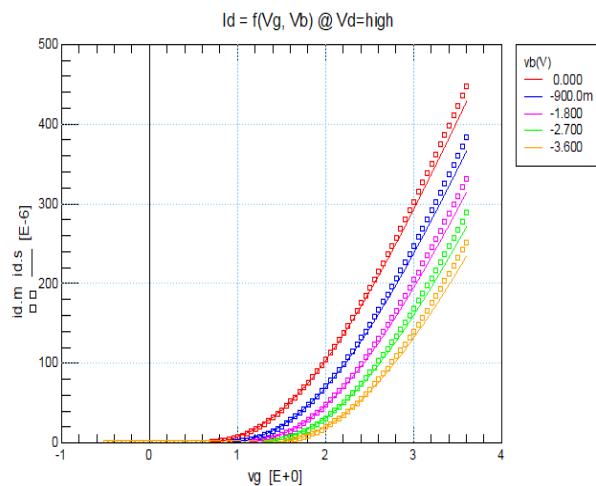
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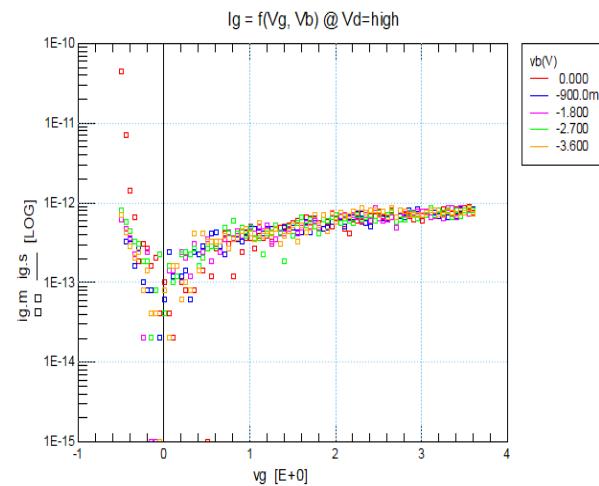
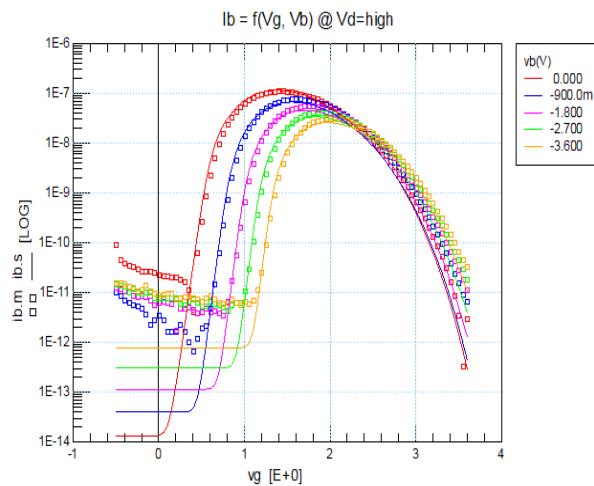
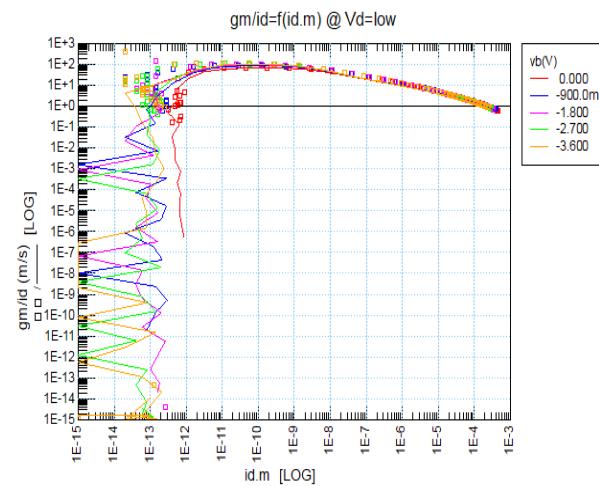
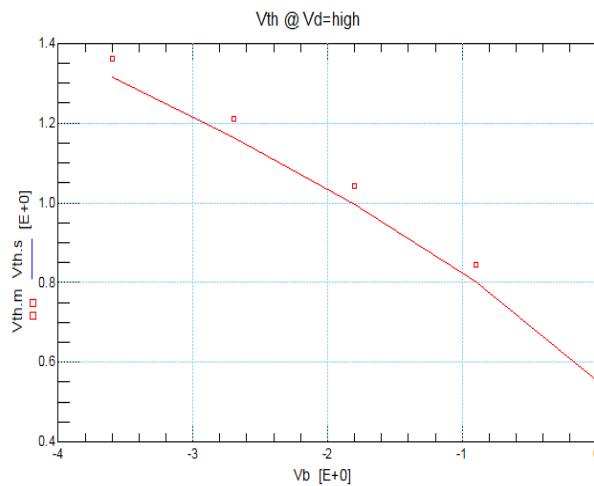
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



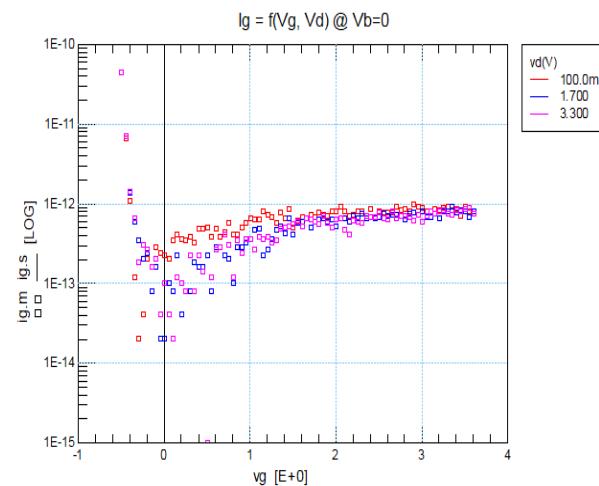
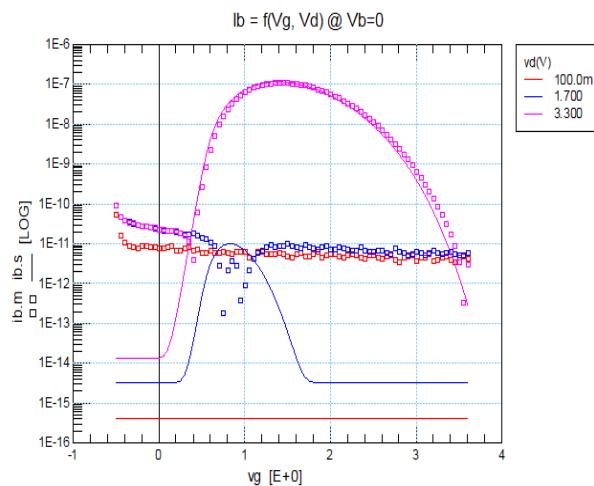


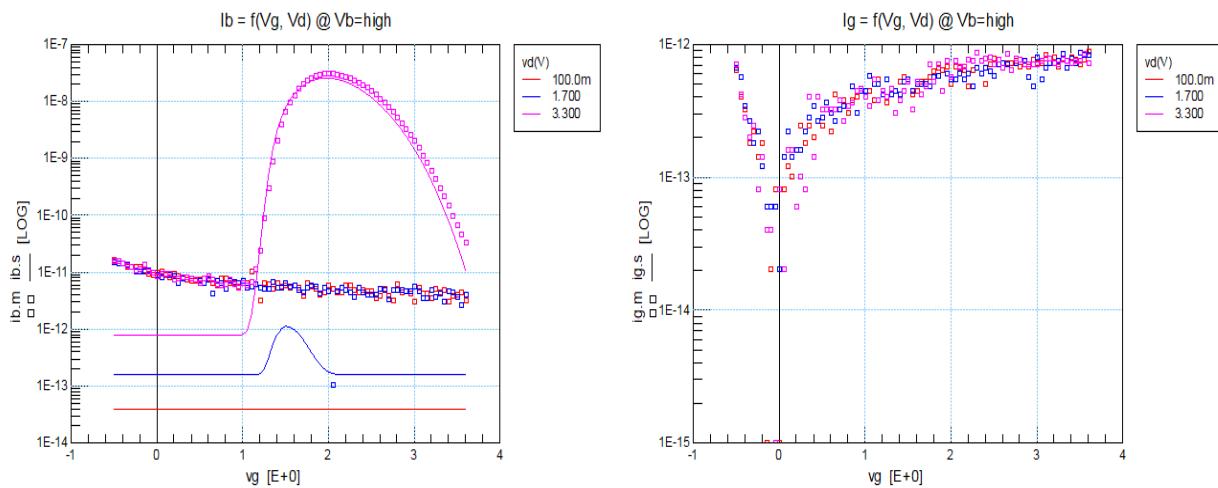
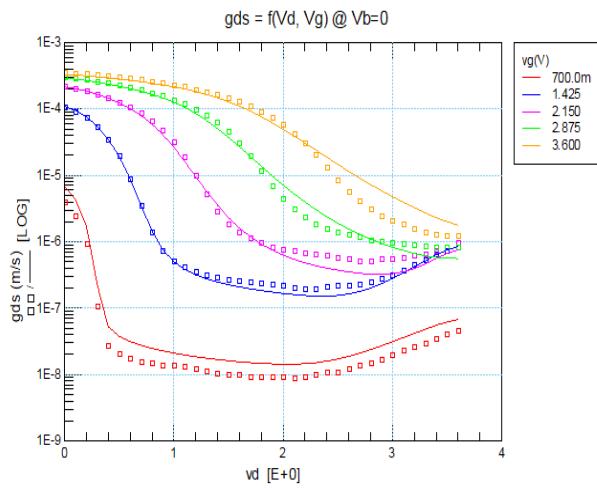
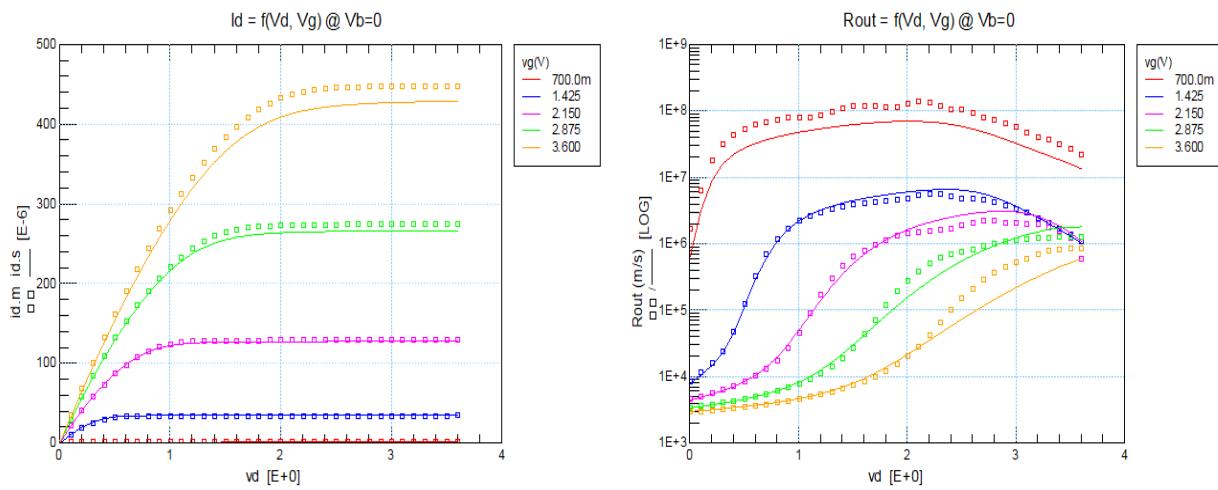
$i_d v_g, V_d = 3.3V, T = 27^\circ C$

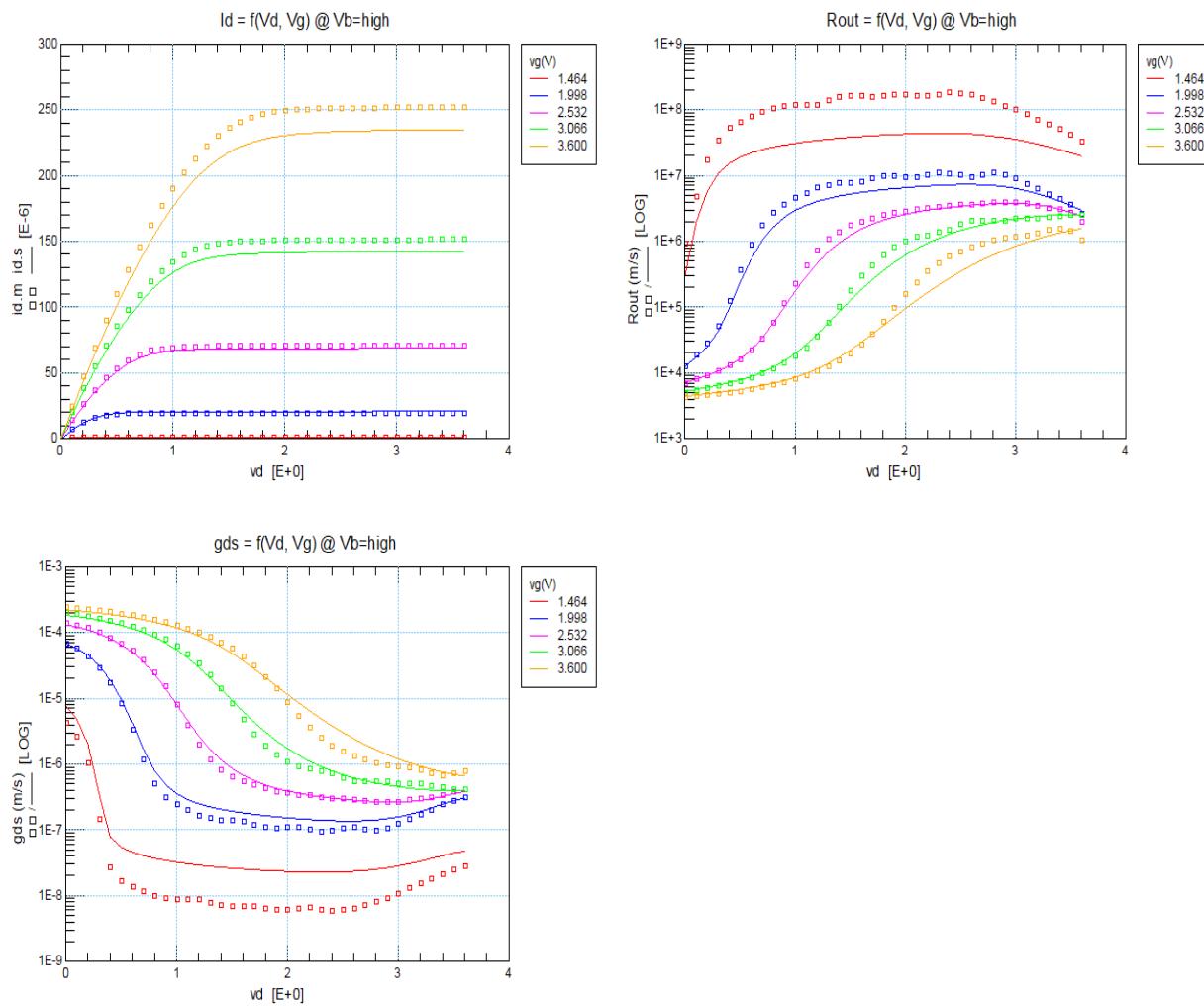
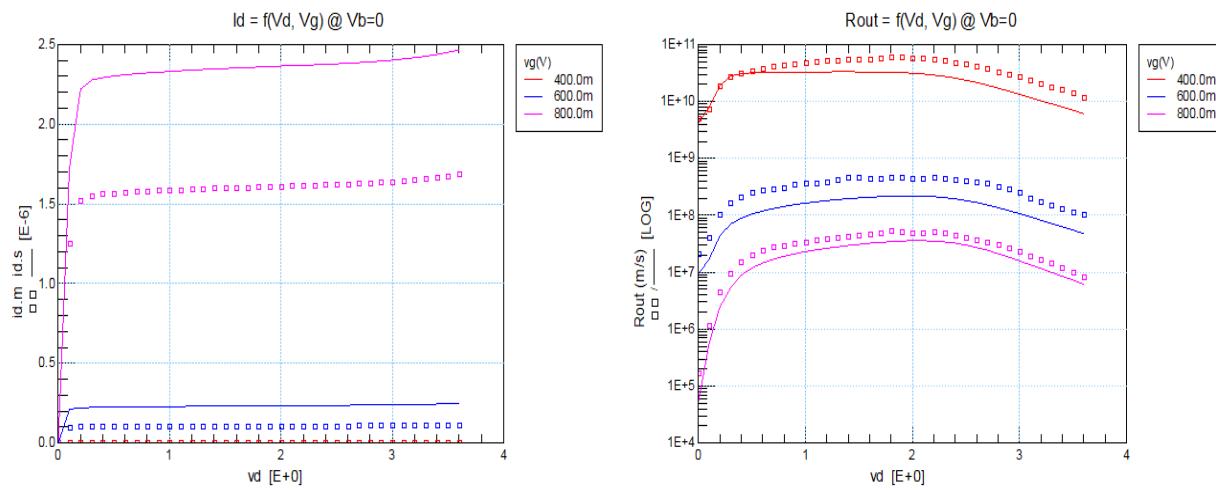


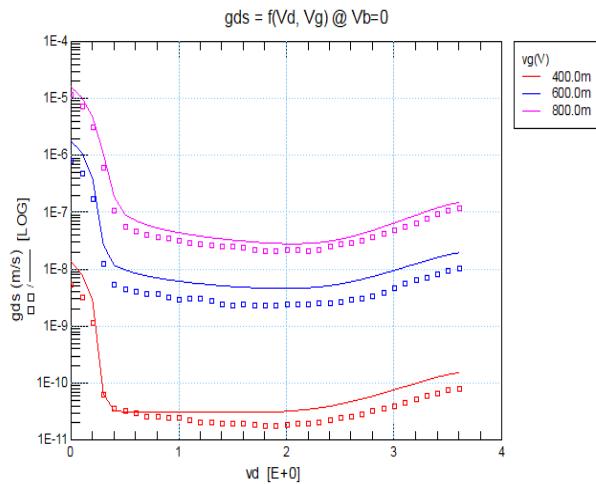


idvg, lb, lg, Vb = 0V, T = 27°C

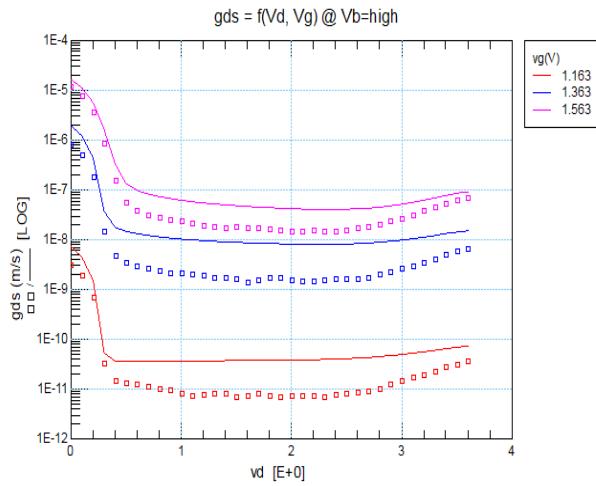
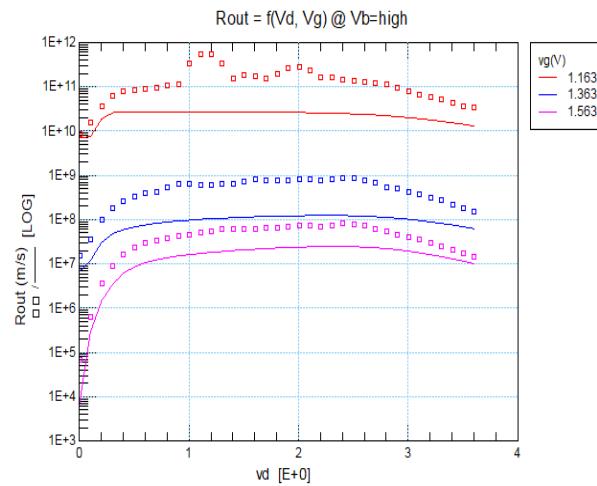
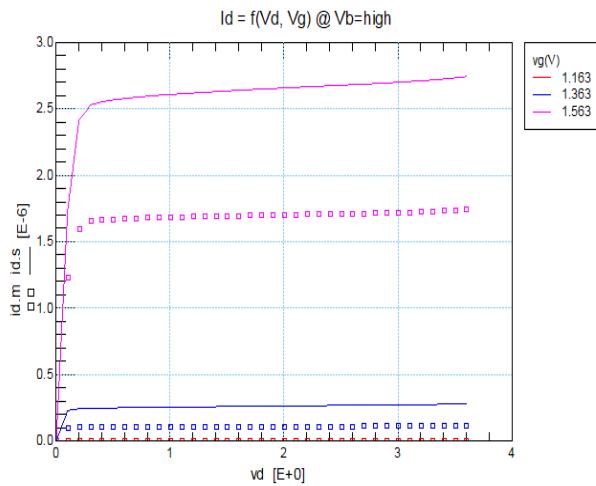


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


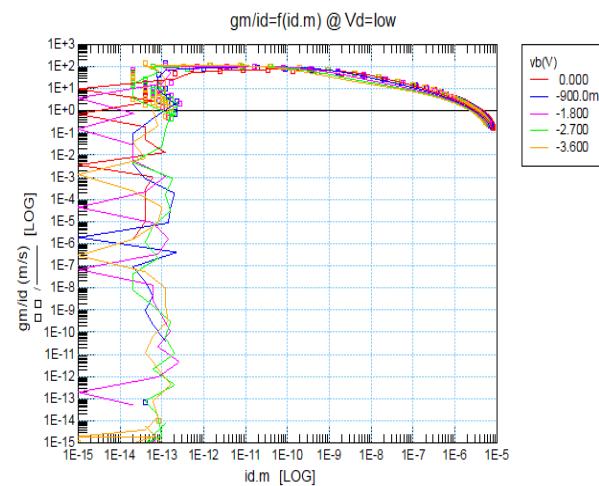
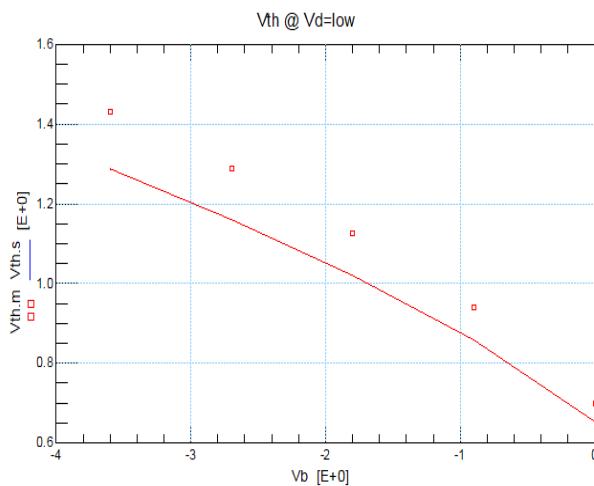
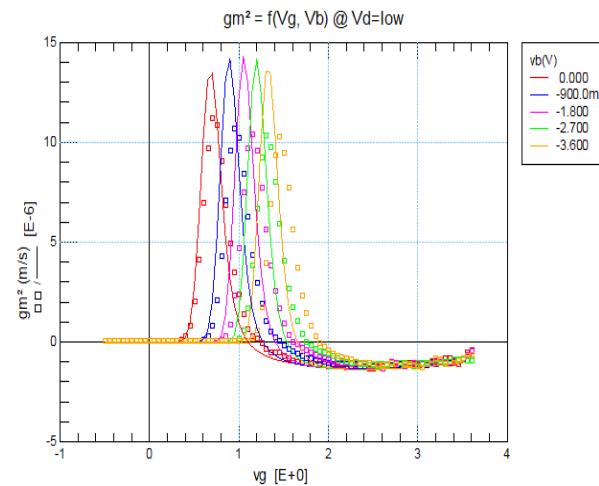
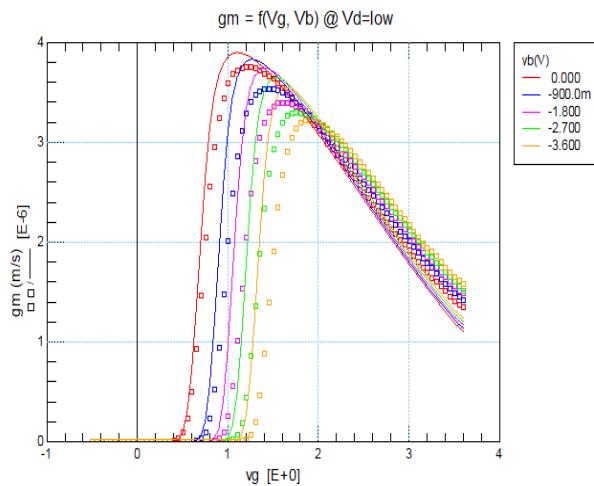
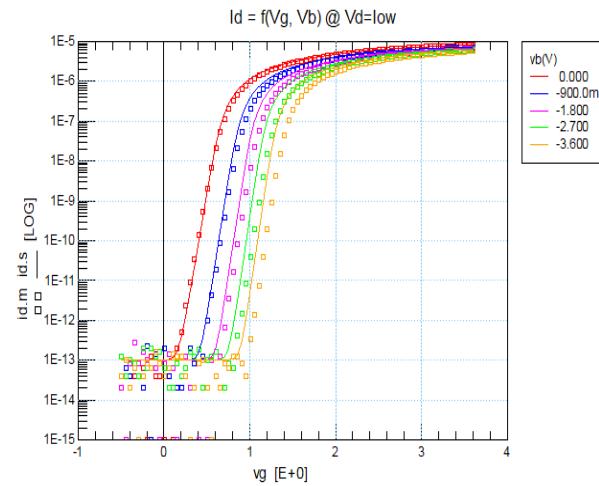
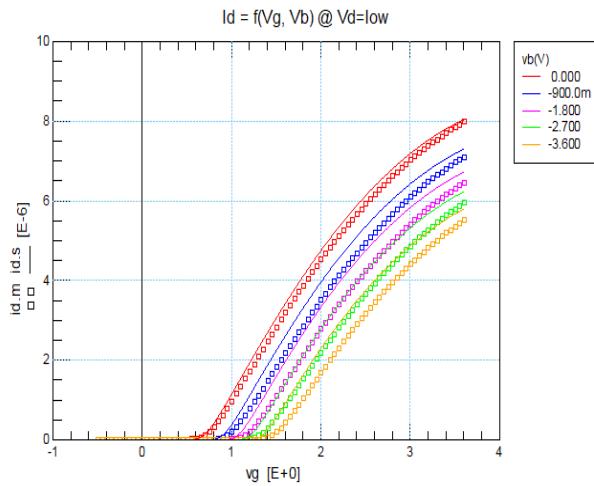


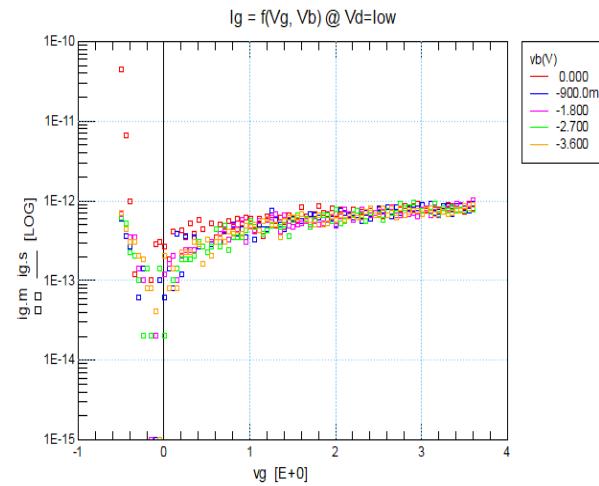
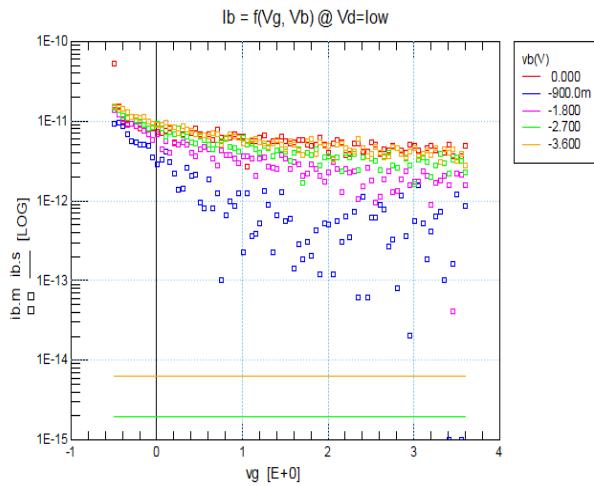
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



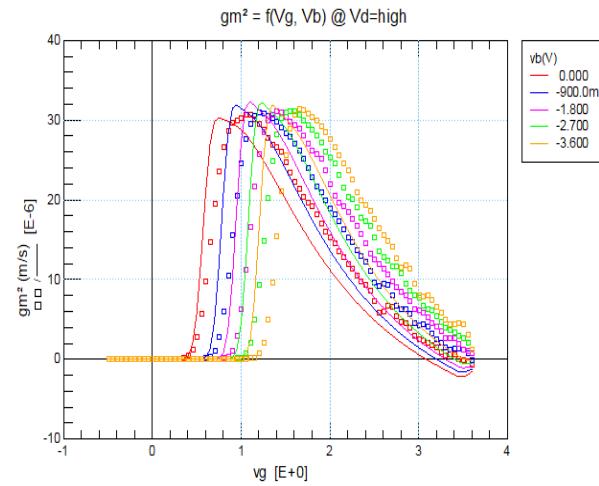
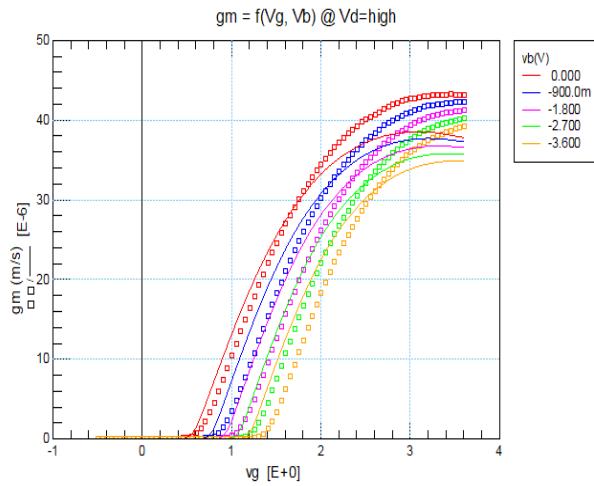
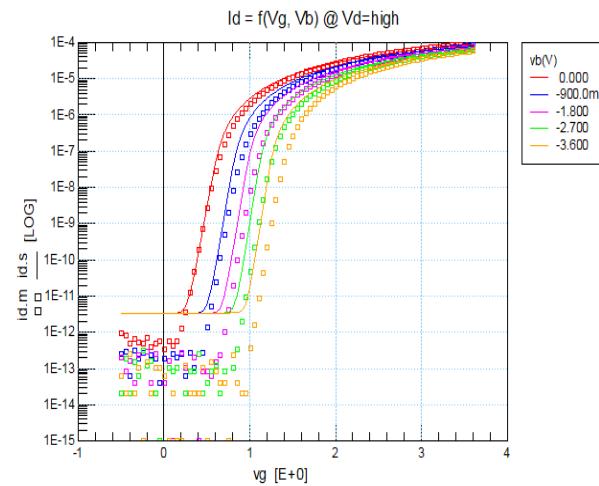
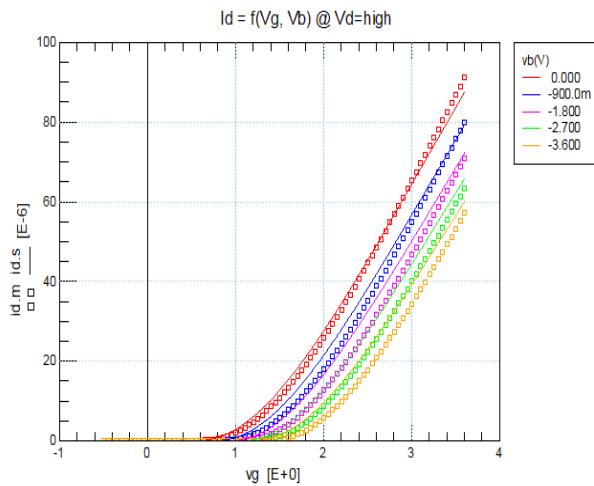
4.19 W0u3_L1u2_S560_5

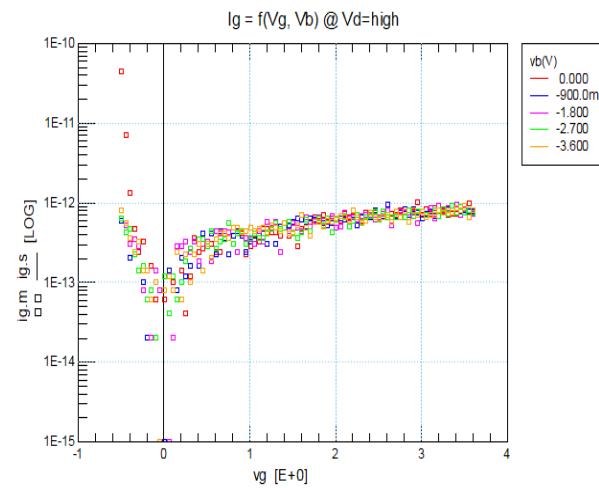
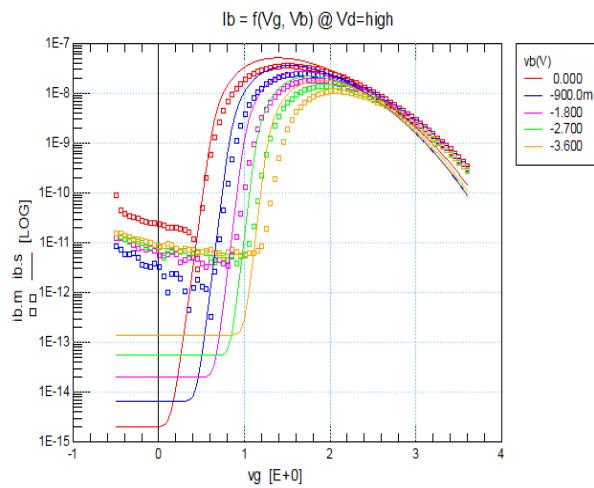
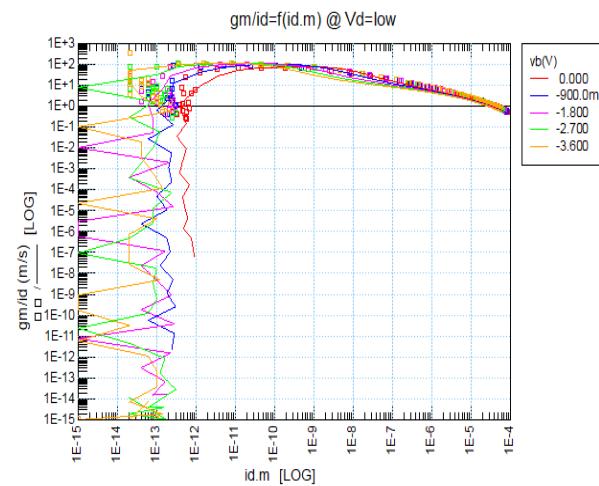
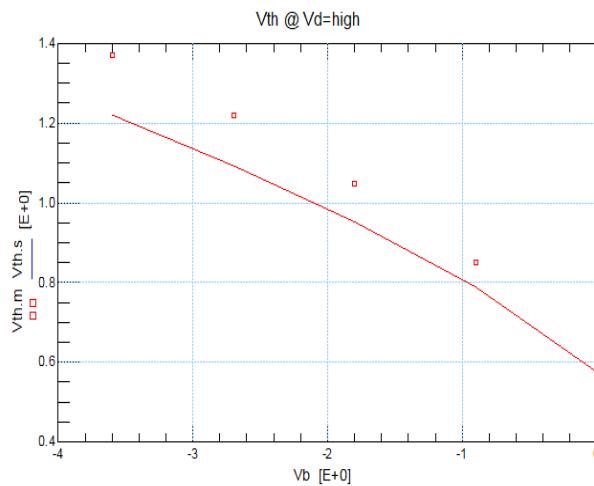
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



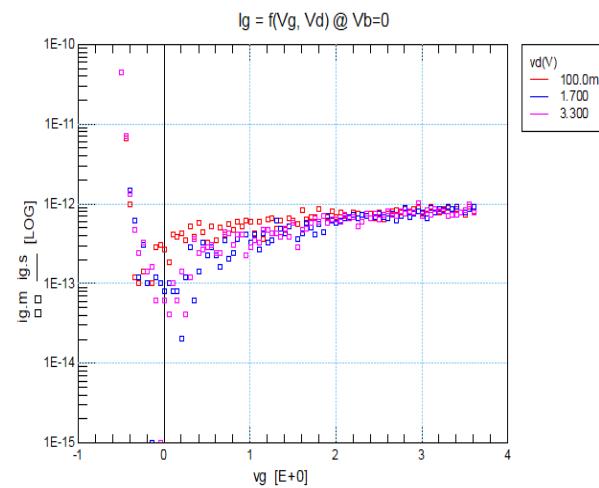
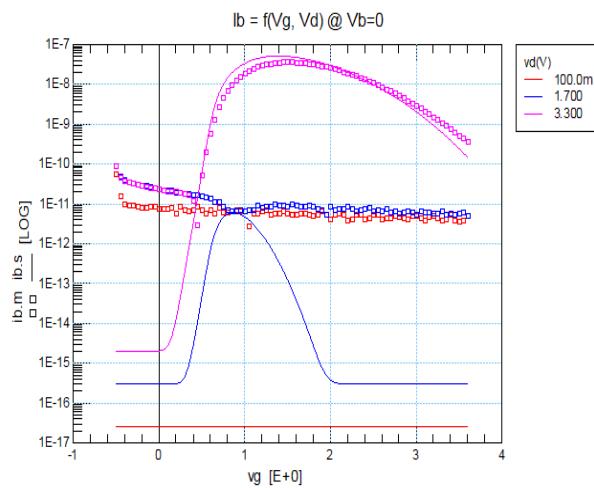


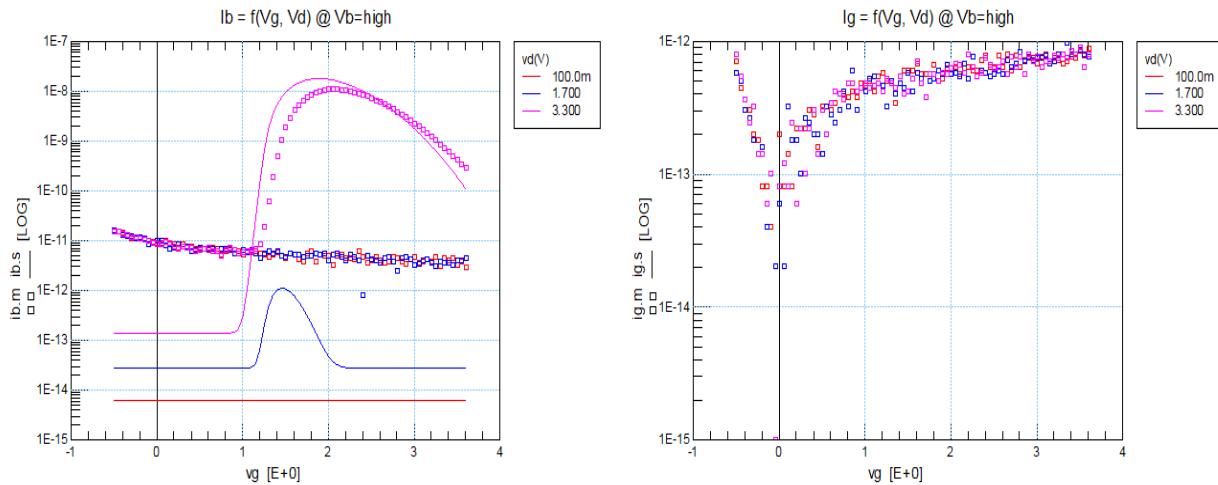
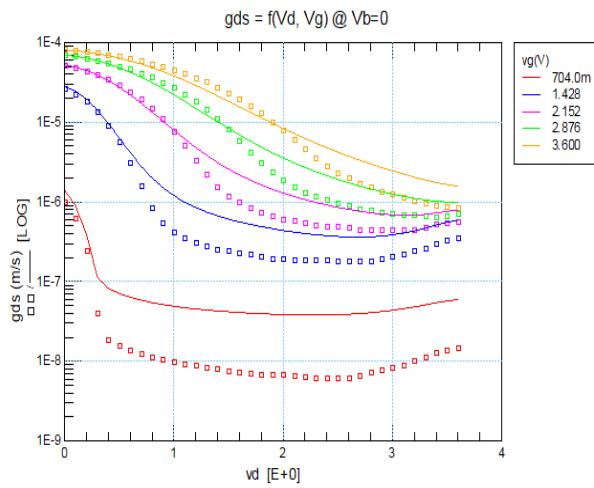
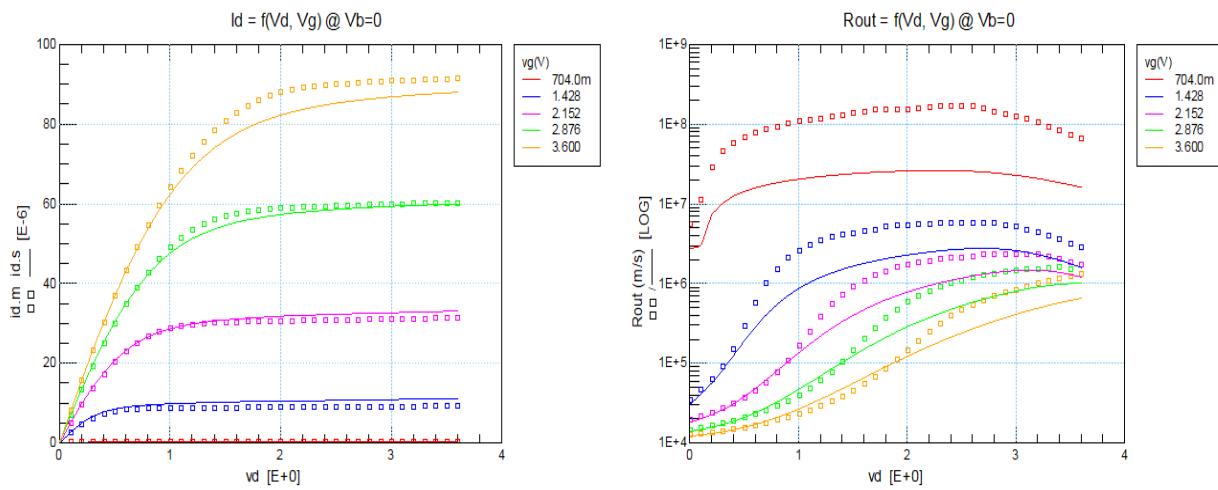
$i_{dvg}, V_d = 3.3V, T = 27^\circ C$

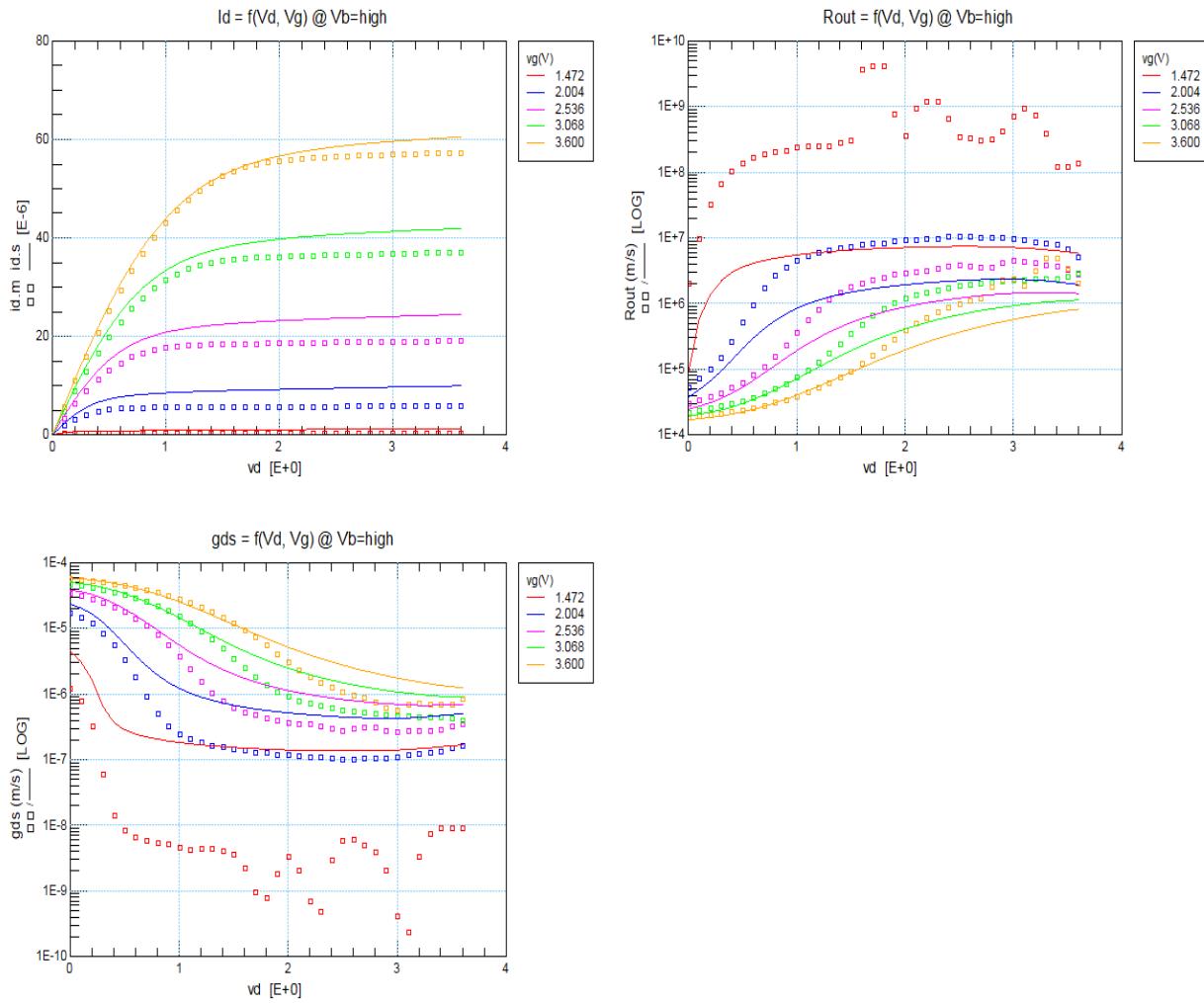
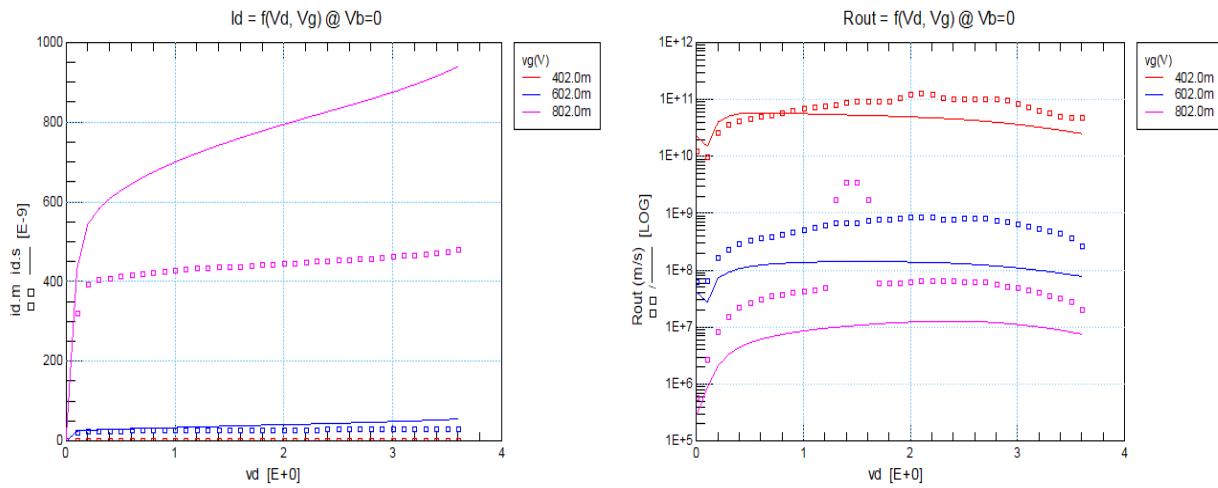


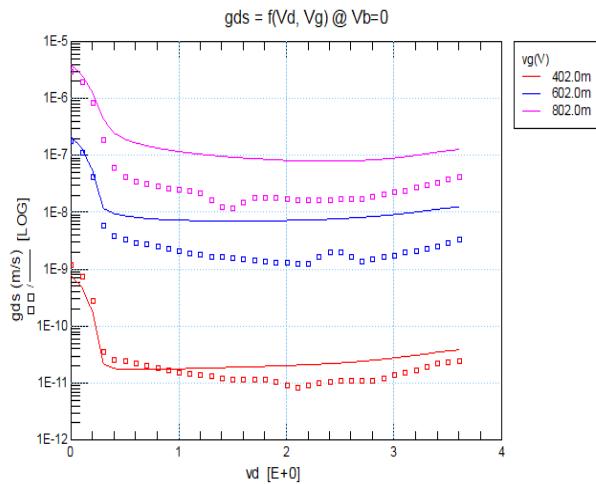


$idvg, Ib, Ig, Vb = 0V, T = 27^\circ C$

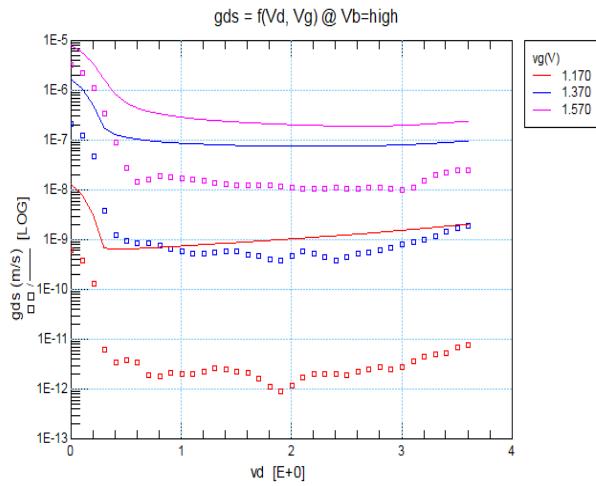
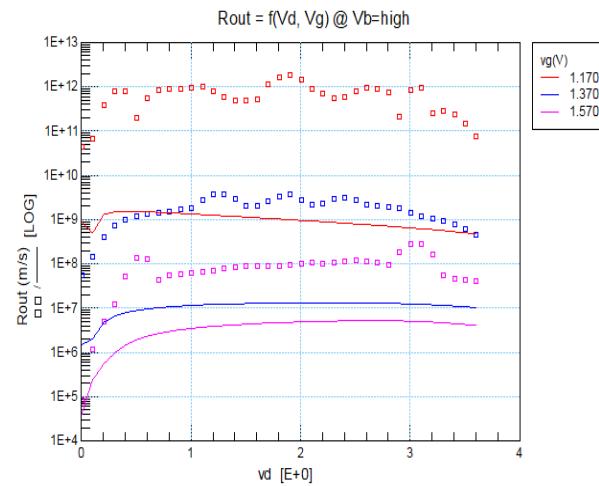
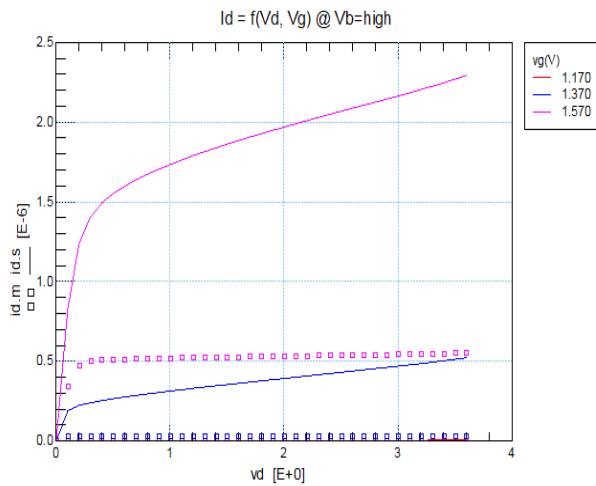


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C**idvd_vth, Vb = 0V, T = 27°C**

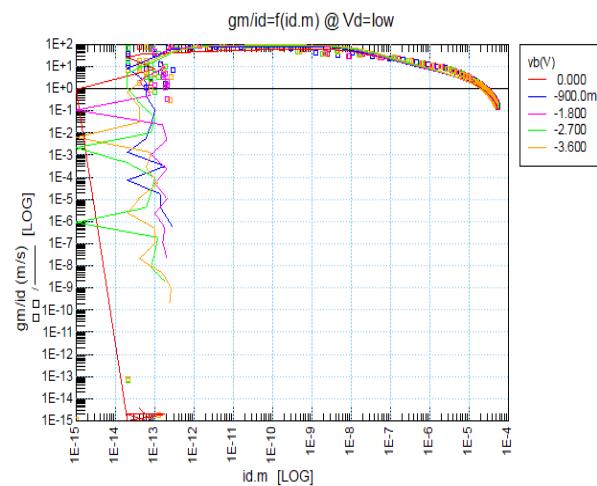
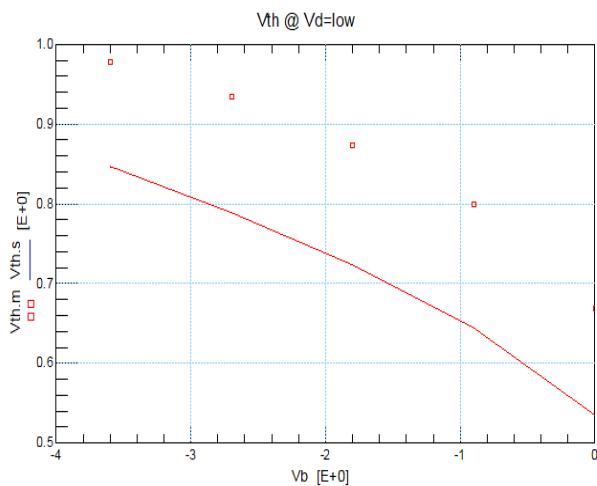
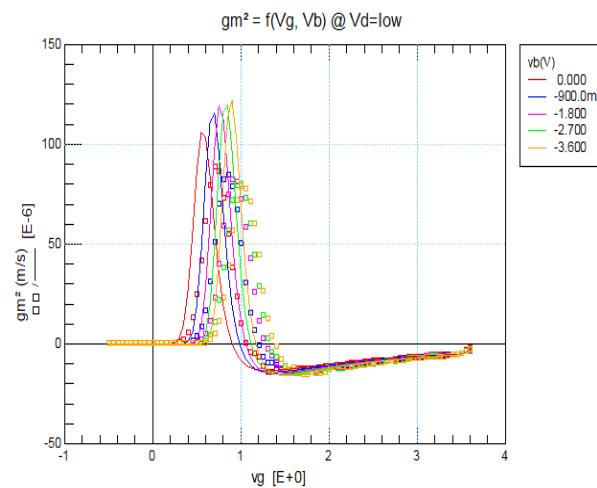
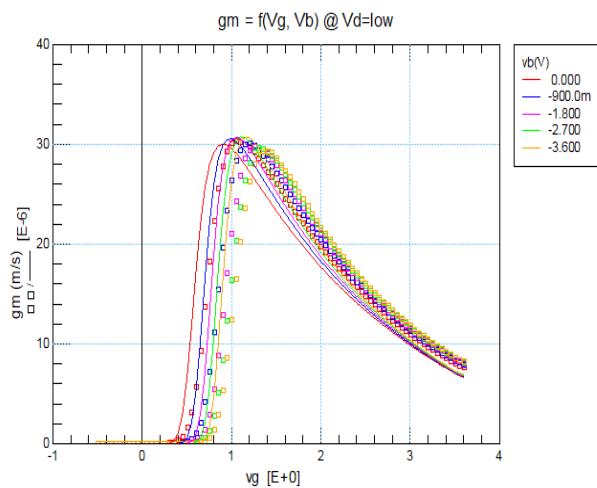
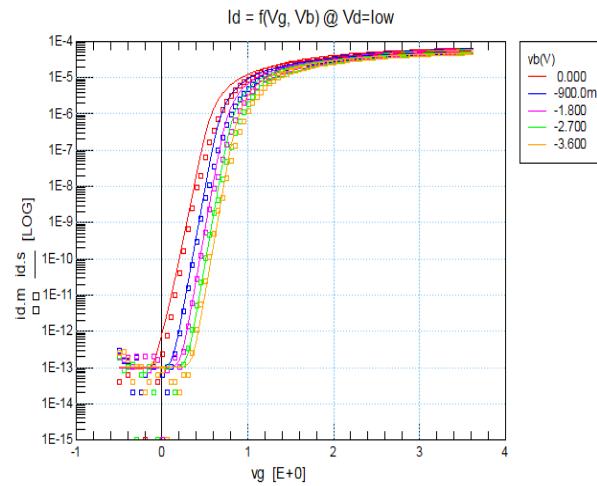
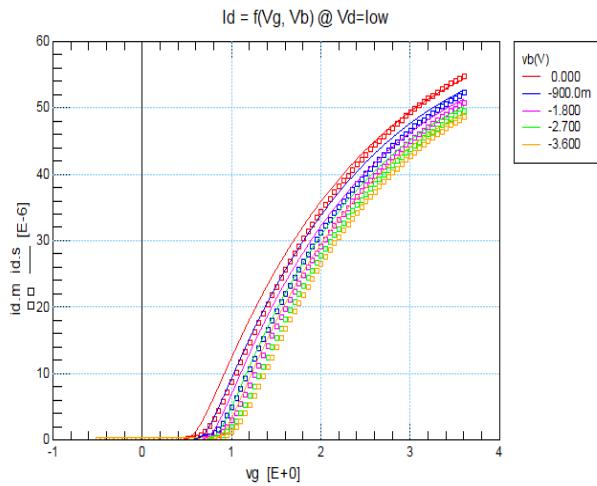


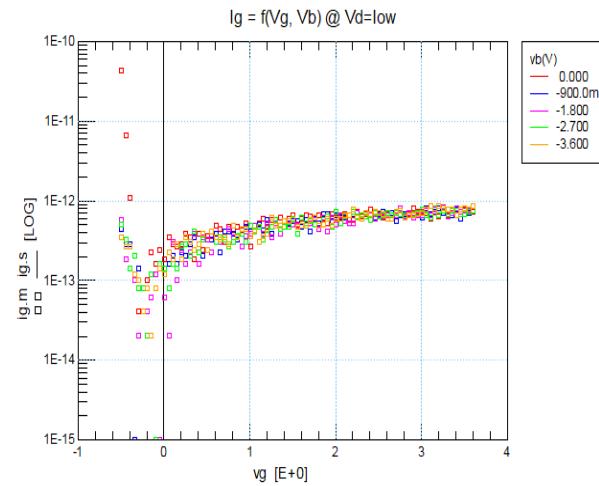
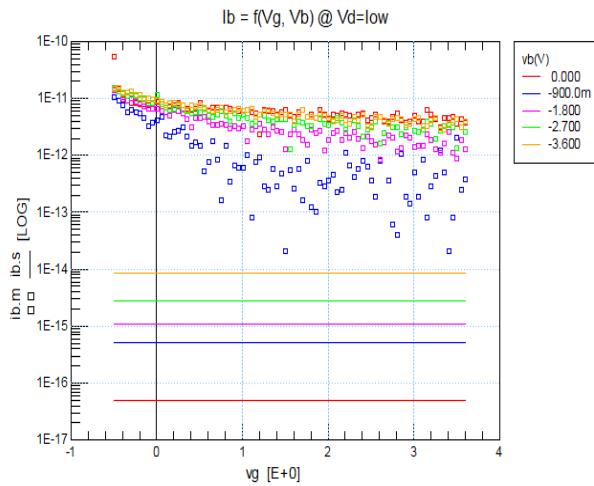
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



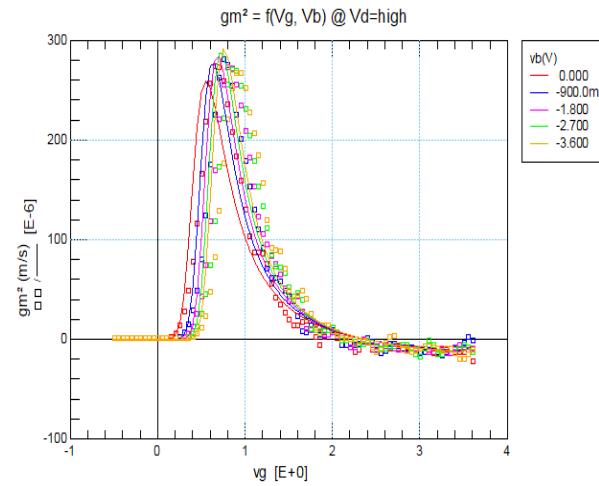
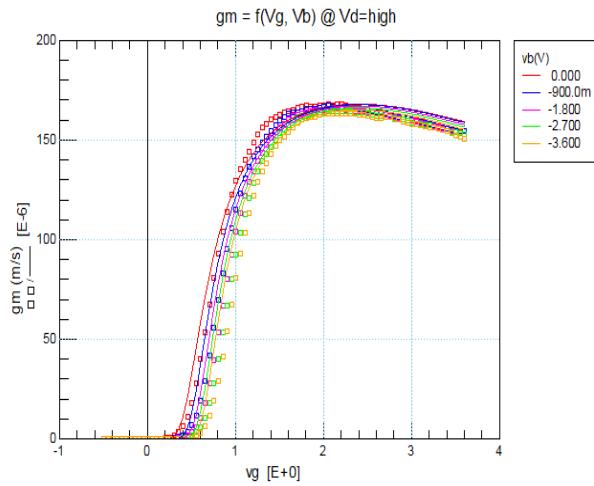
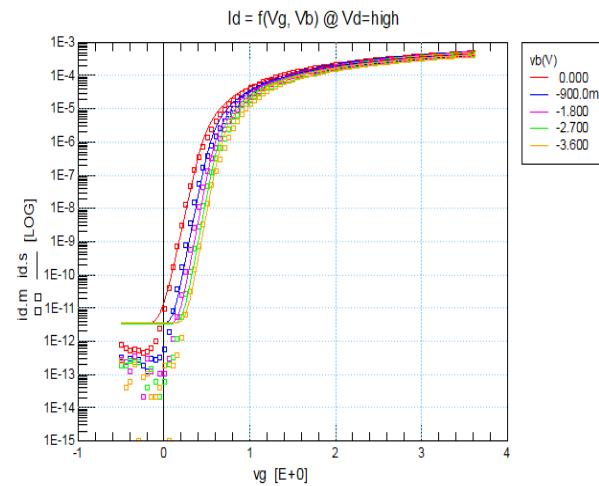
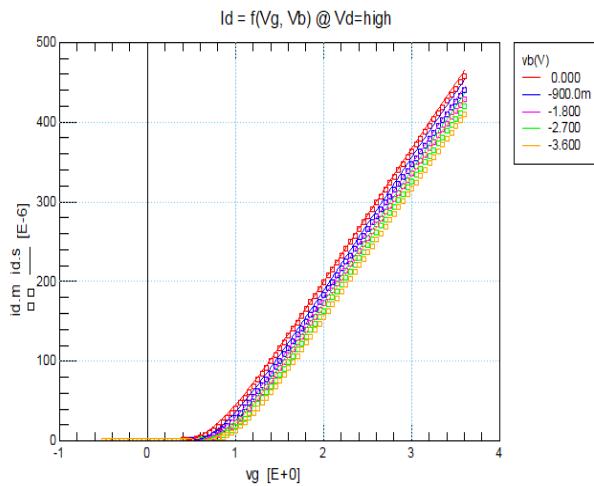
4.20 W0u6_L0u35_S559_2

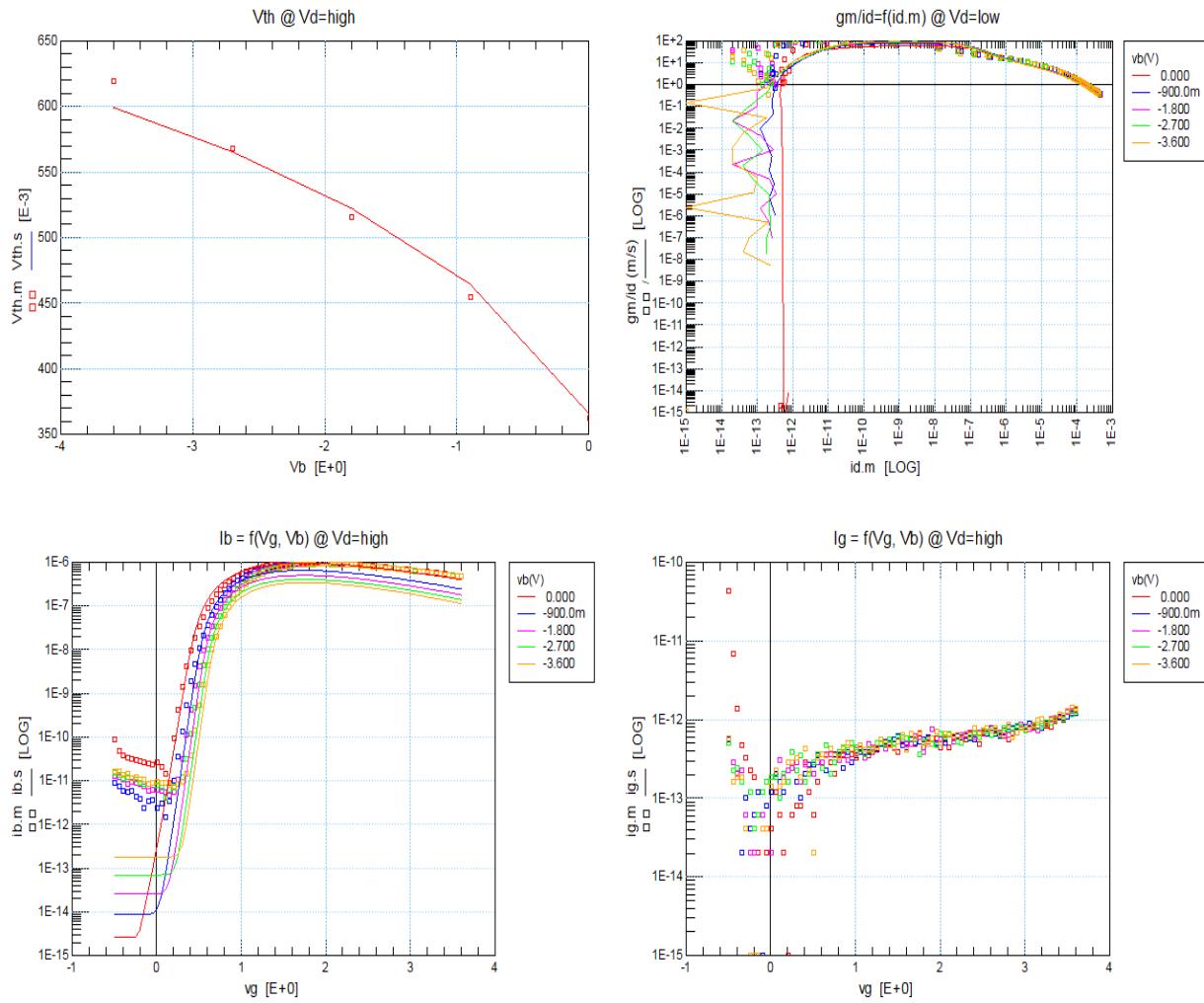
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



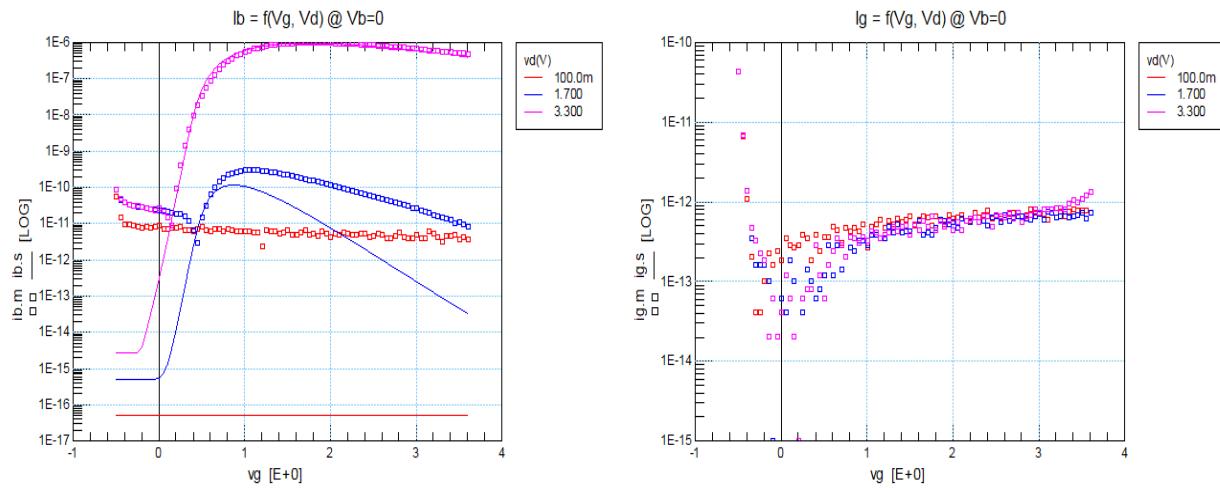


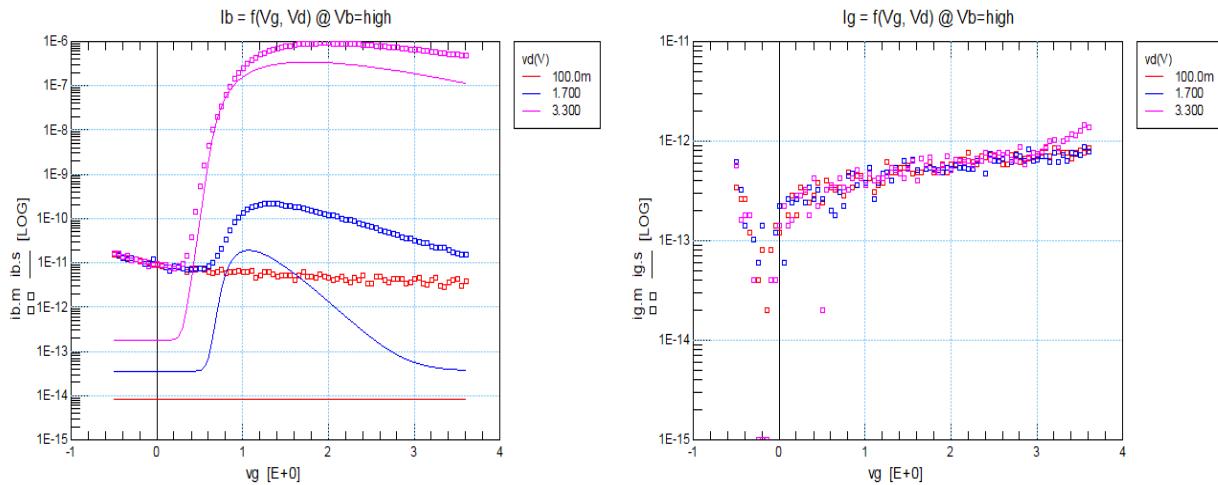
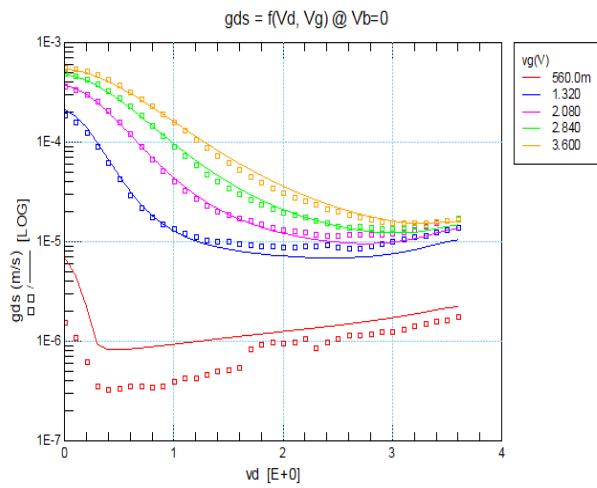
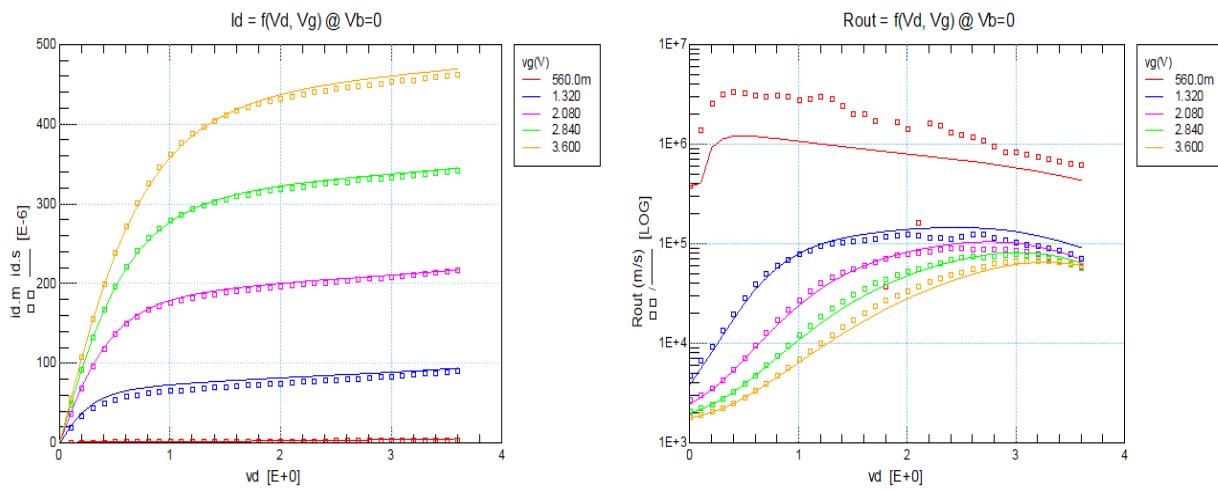
$i_{dvg}, V_d = 3.3V, T = 27^\circ C$

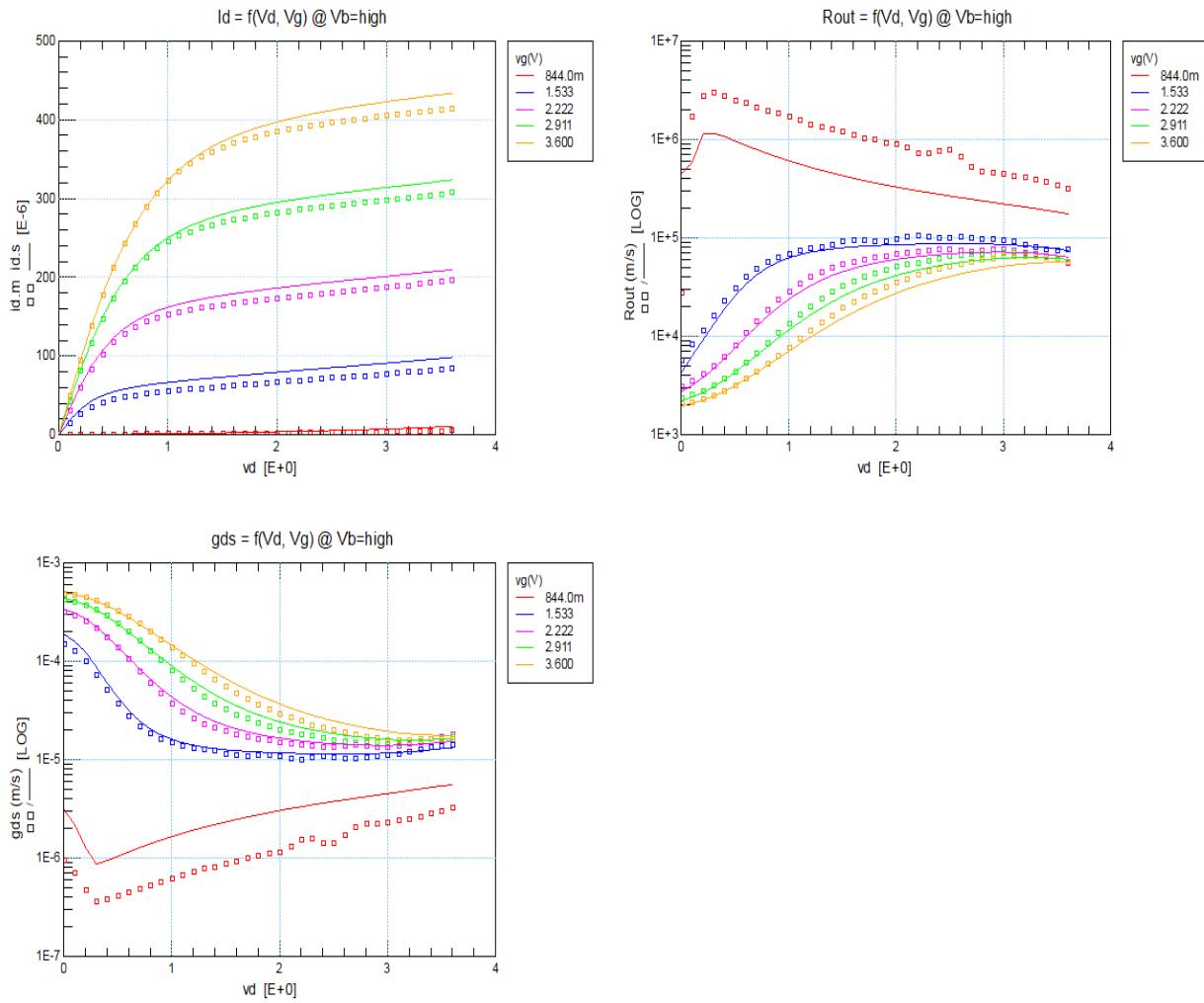
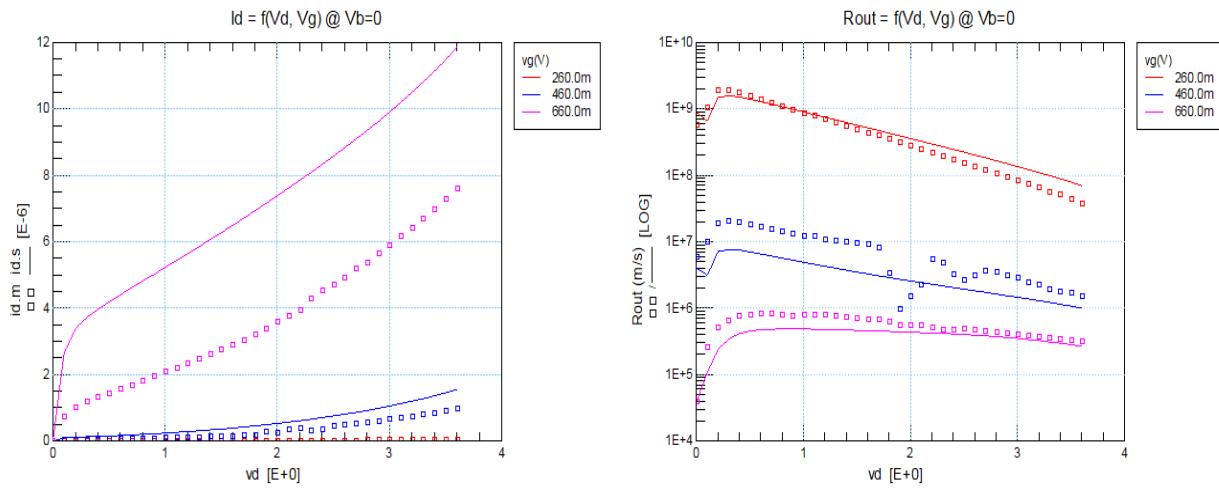


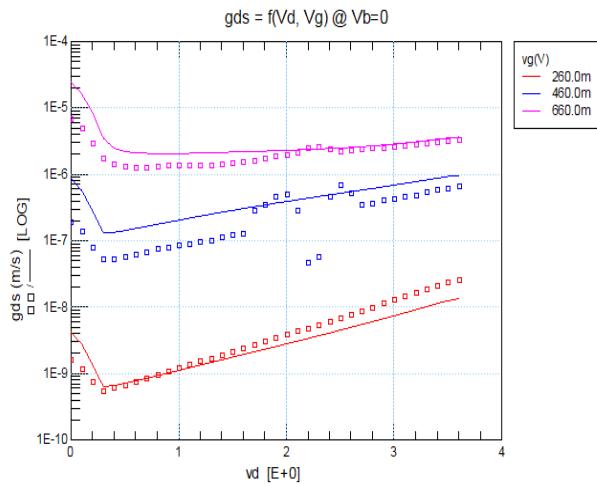


idvg, Ib,Ig, Vb = 0V, T = 27°C

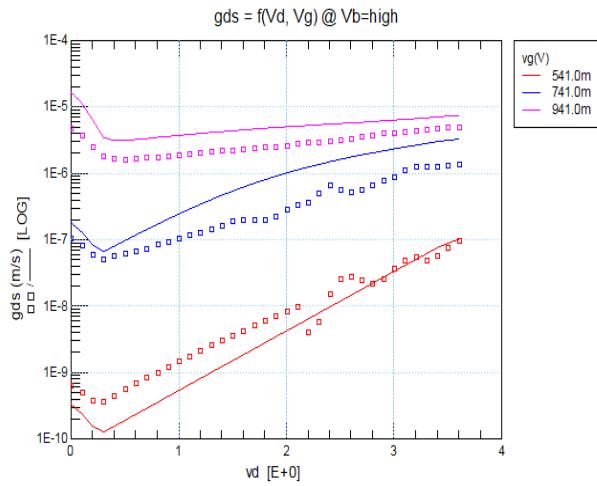
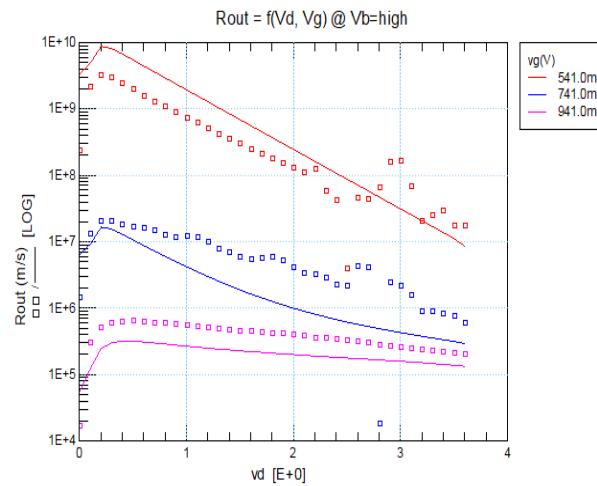
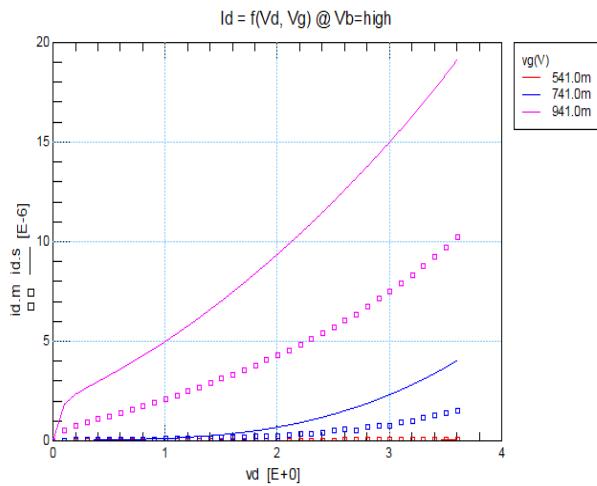


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C**idvd_vth, Vb = 0V, T = 27°C**

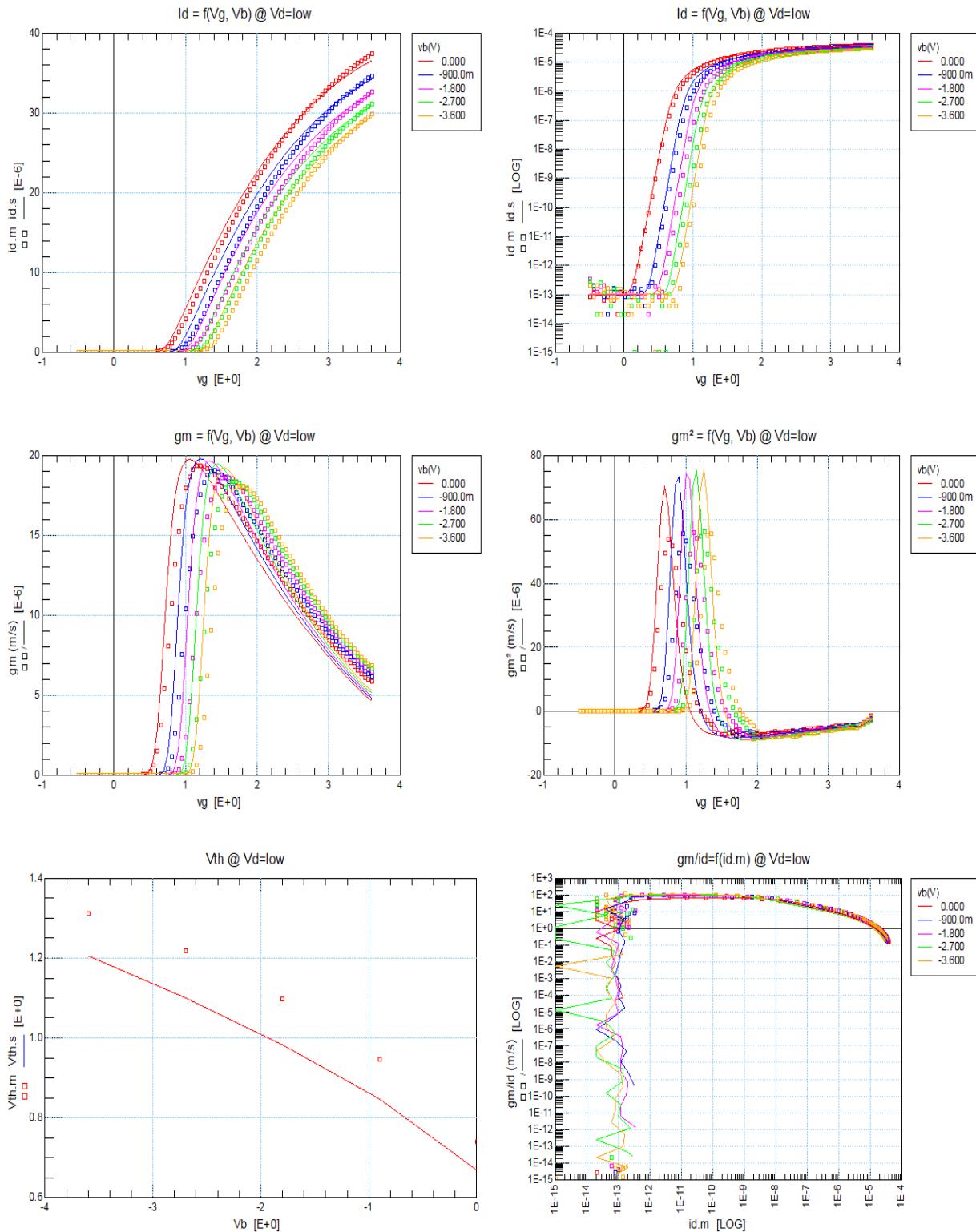


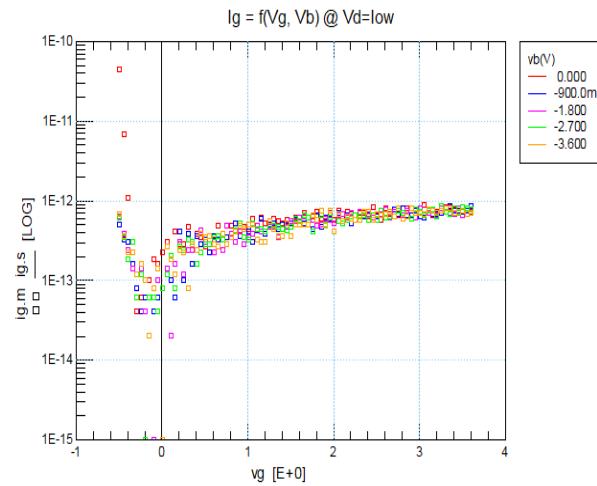
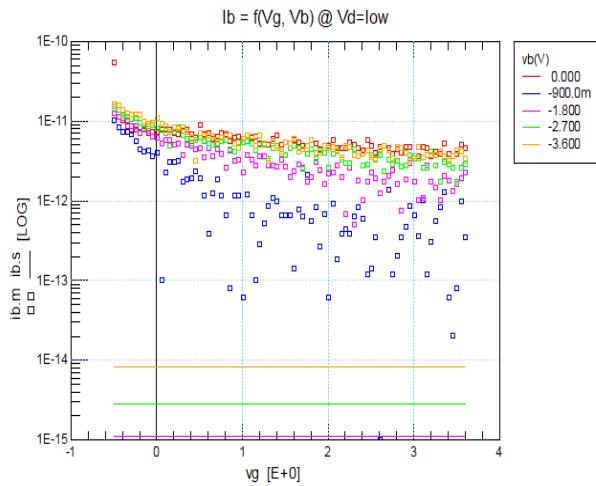
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



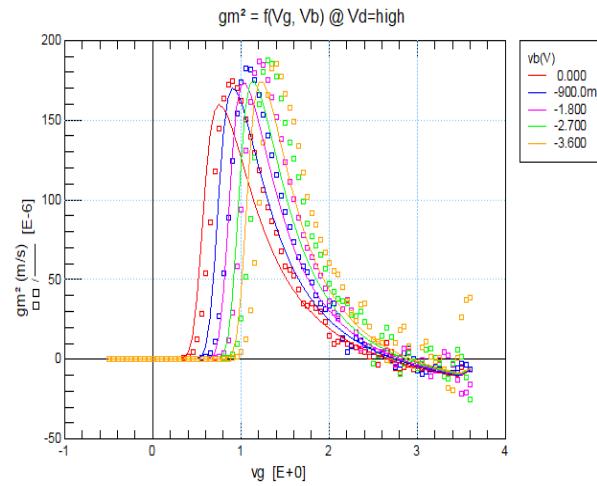
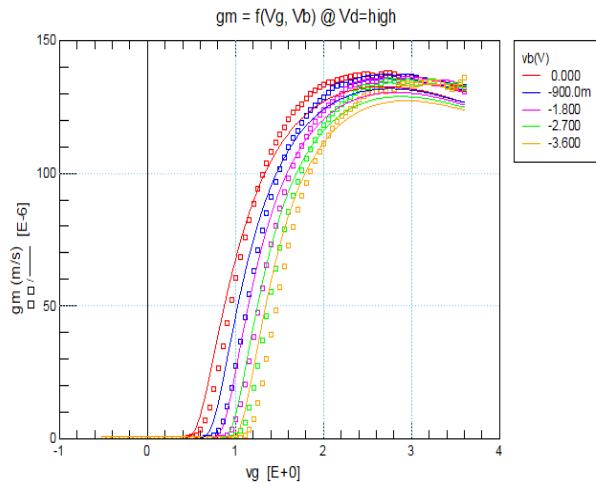
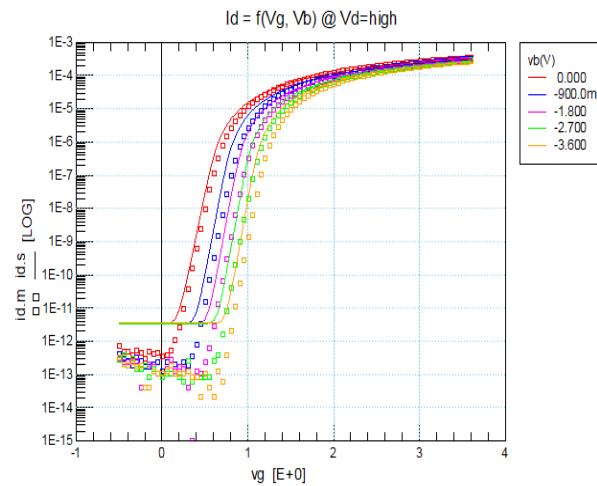
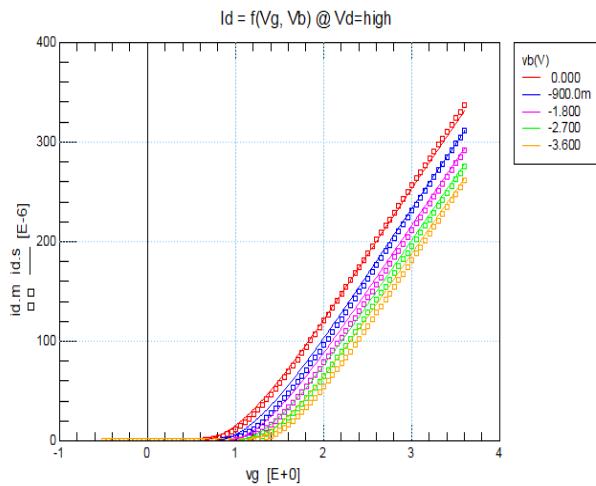
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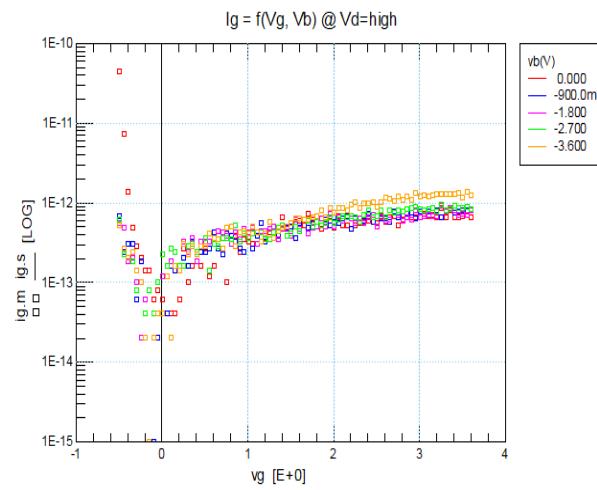
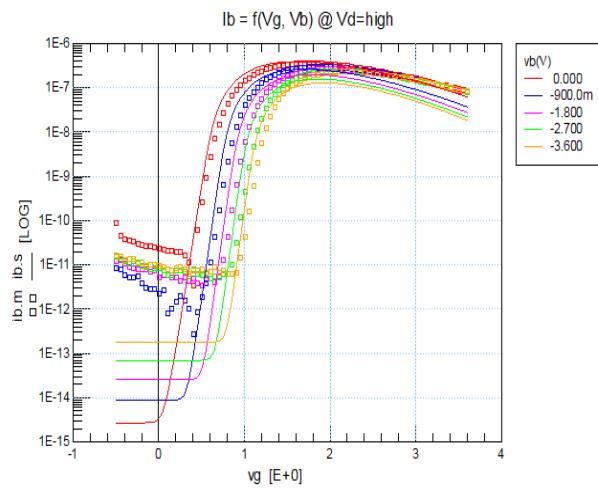
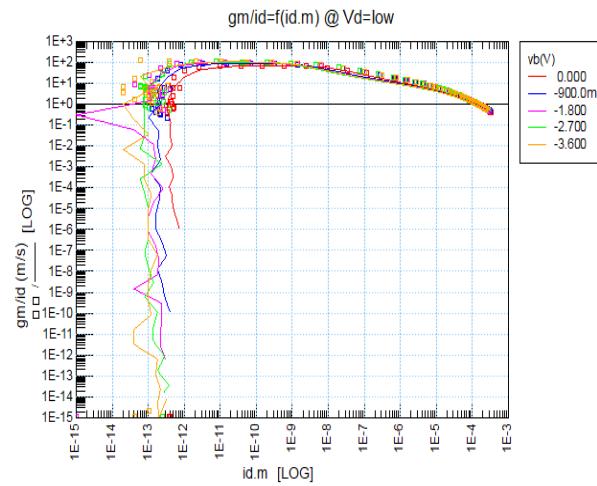
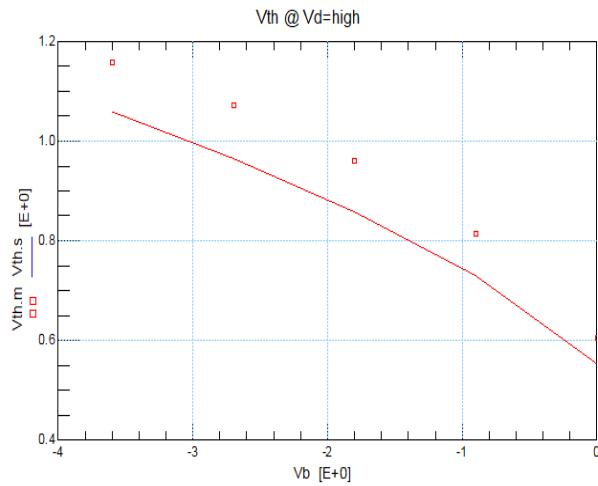
$idv_g, V_d = 0.1V, T = 27^\circ C$



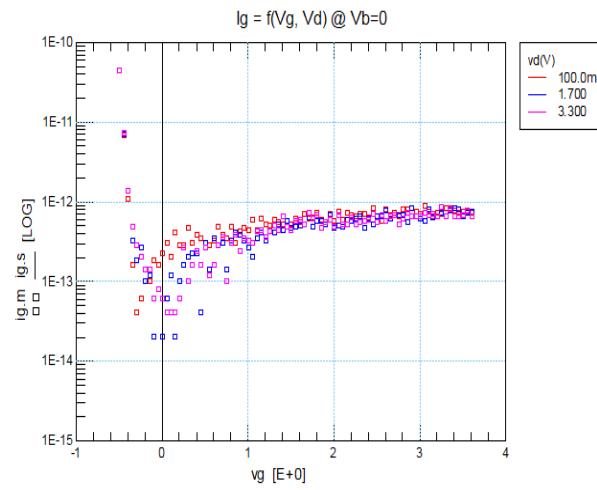
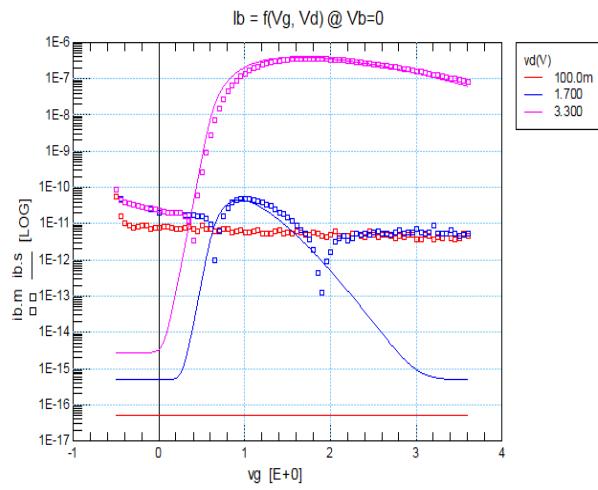


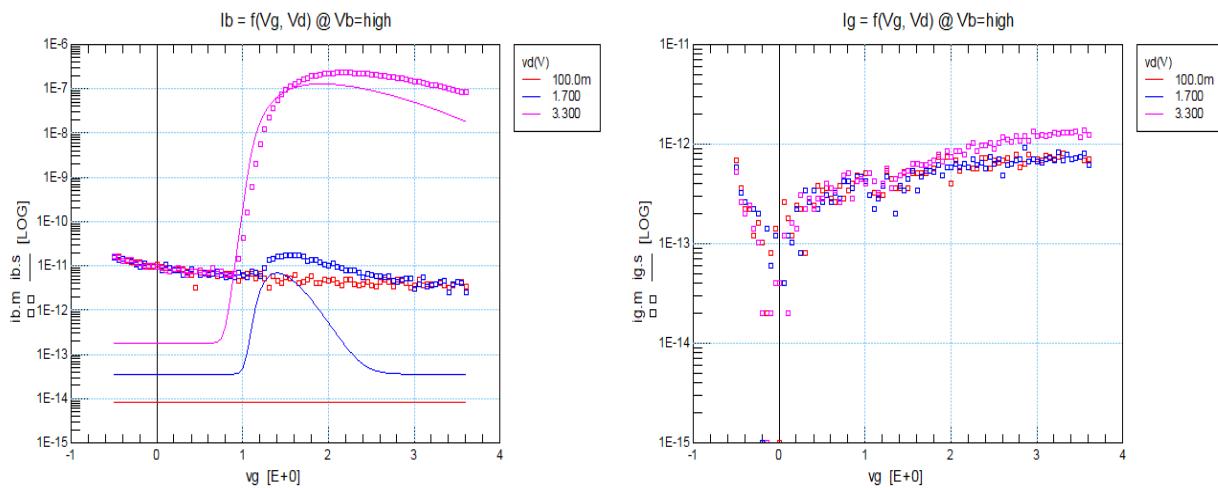
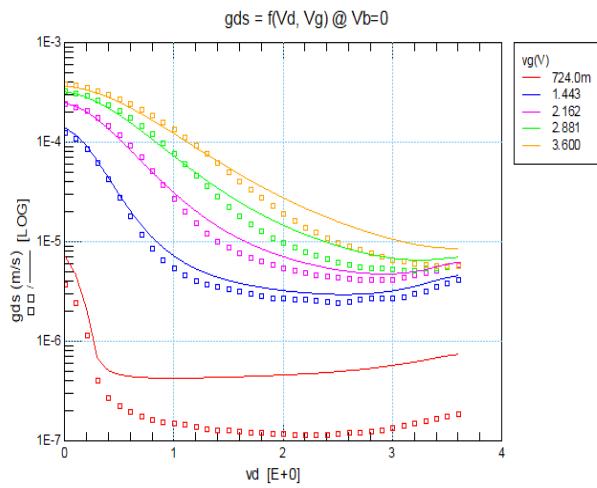
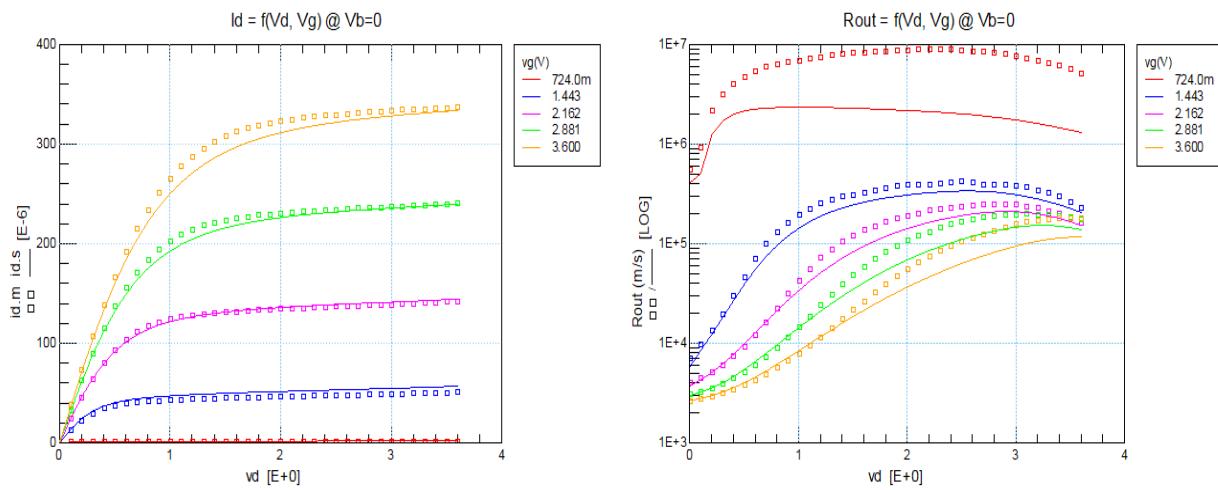
$i_{dvg}, V_d = 3.3V, T = 27^\circ C$

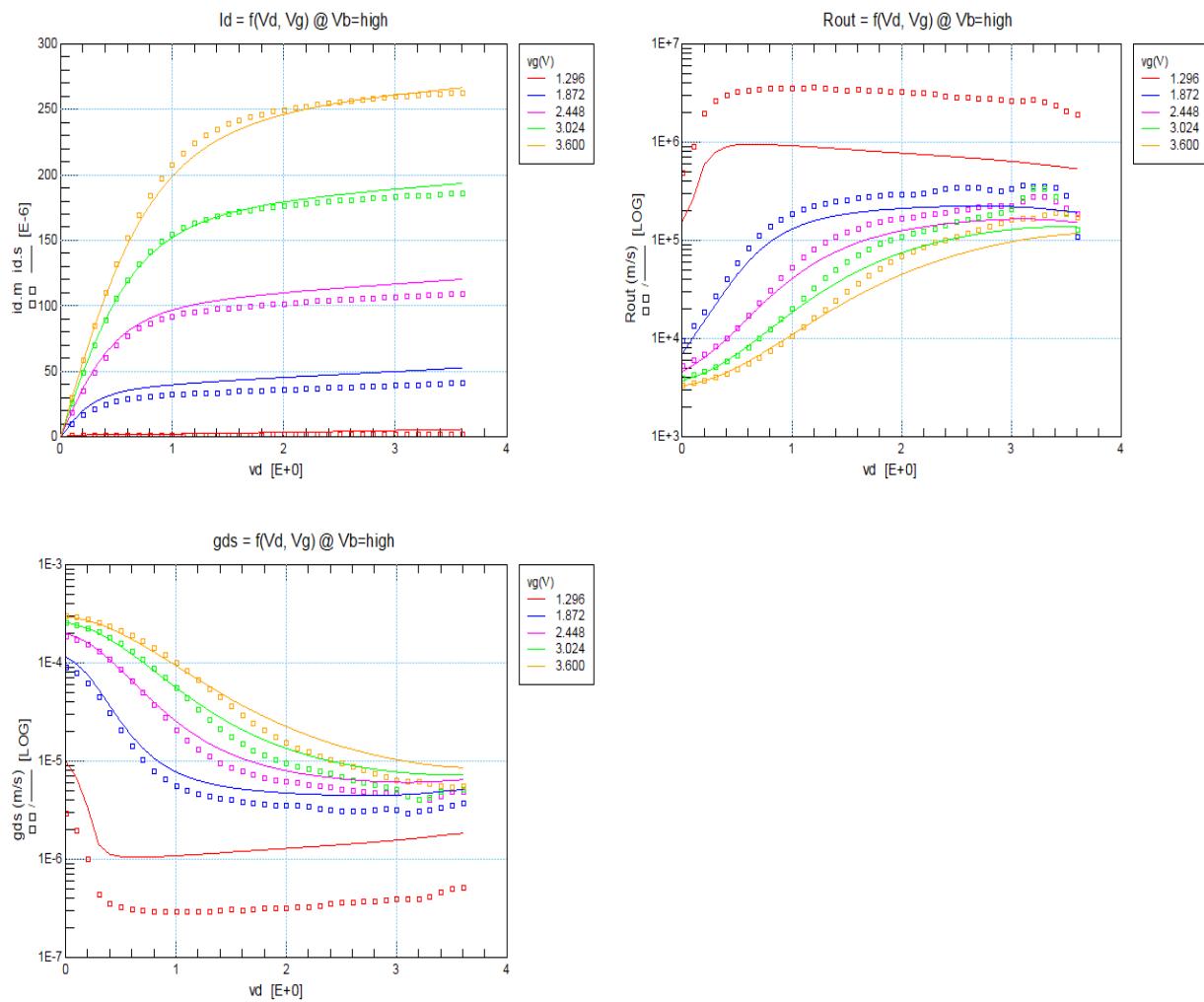
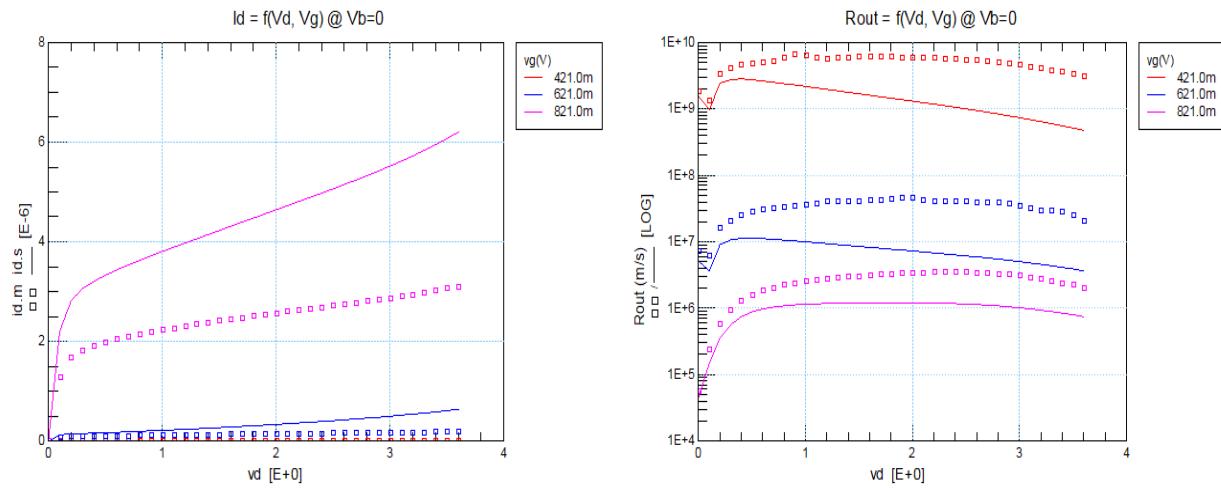


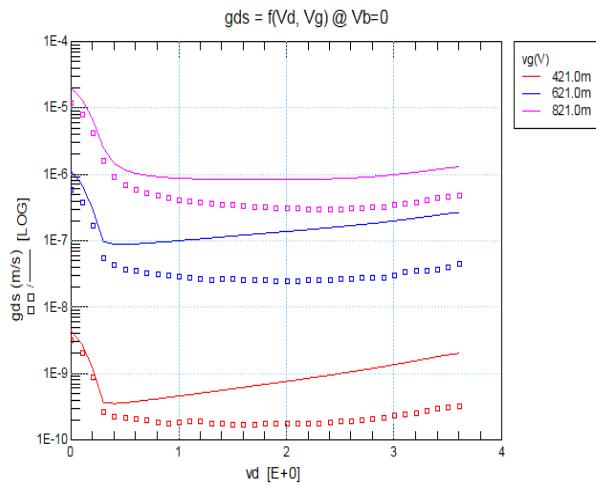


$idvg, I_b, I_g, V_b = 0V, T = 27^\circ C$

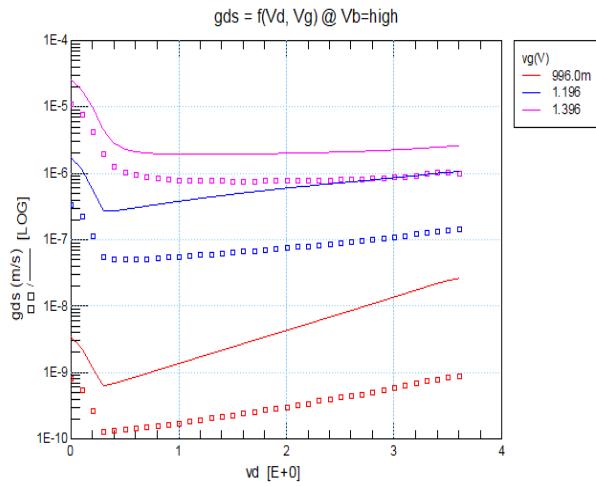
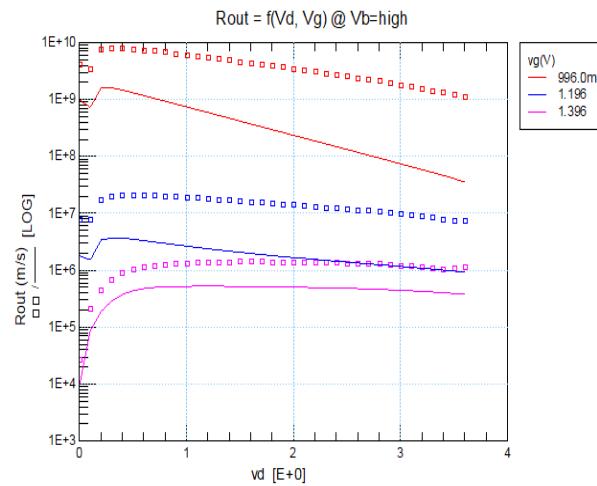
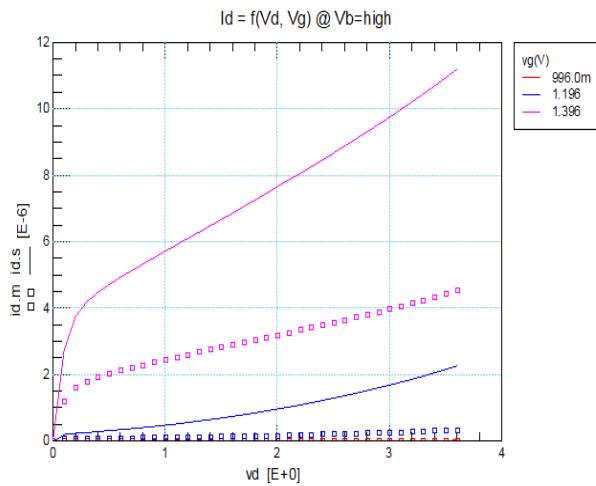


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C**idvd_vth, Vb = 0V, T = 27°C**

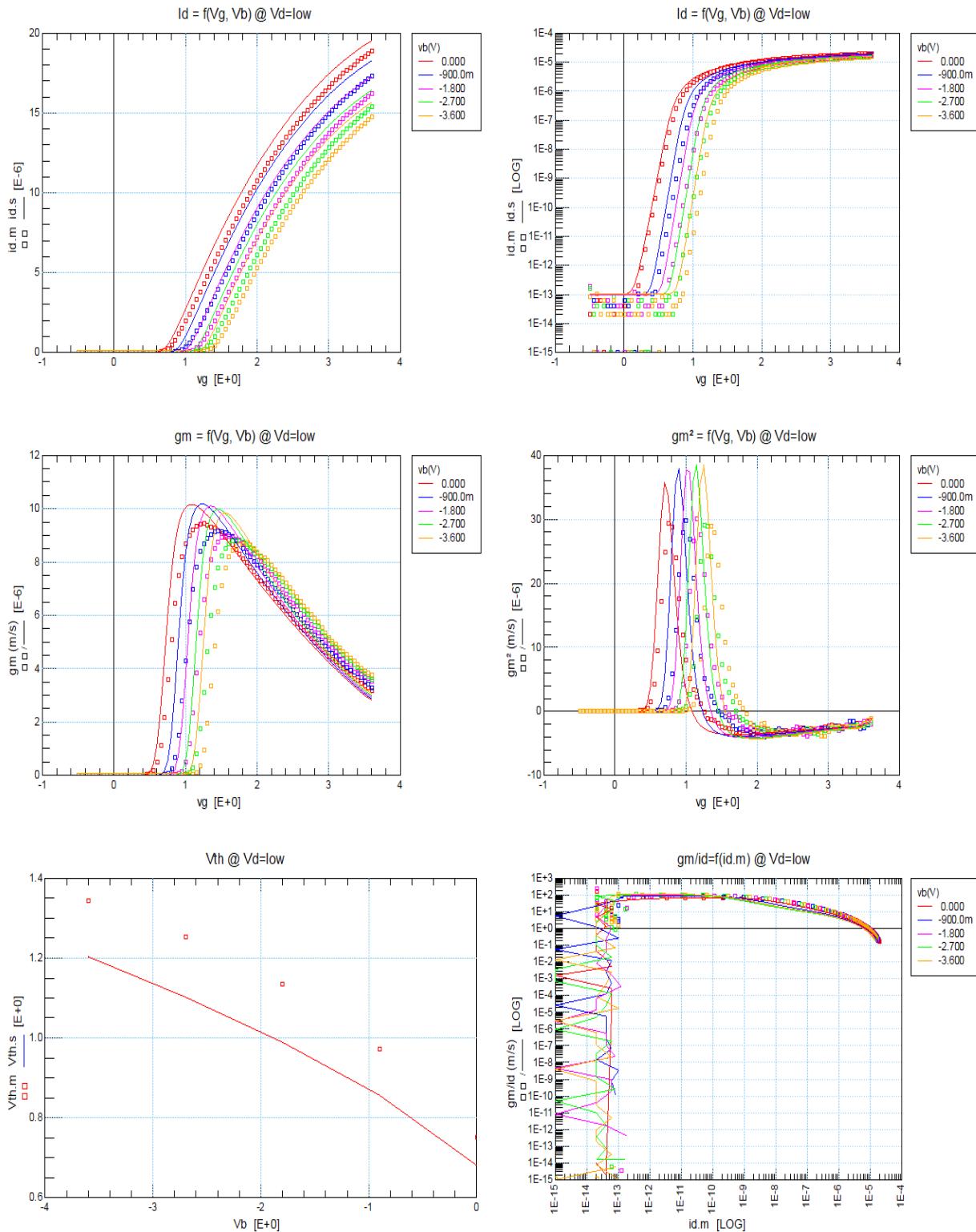


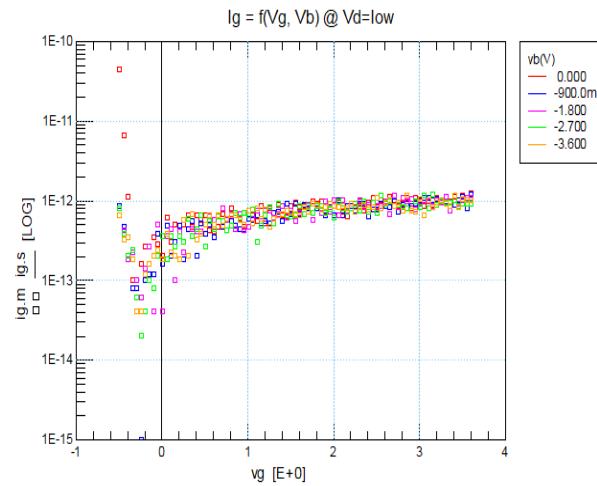
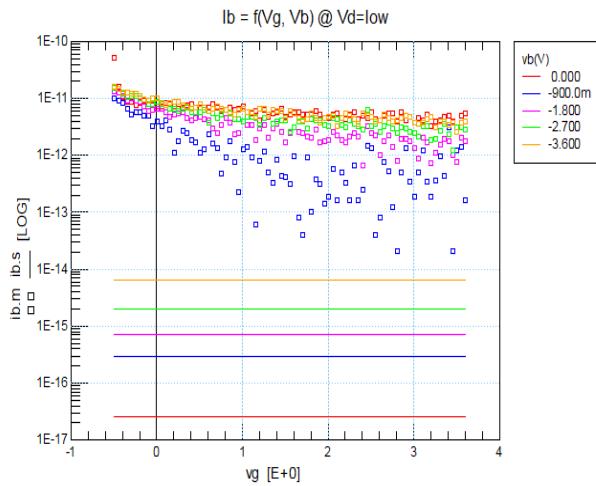
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



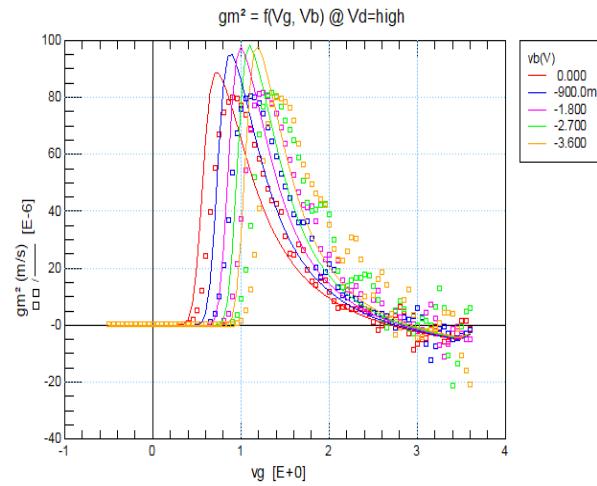
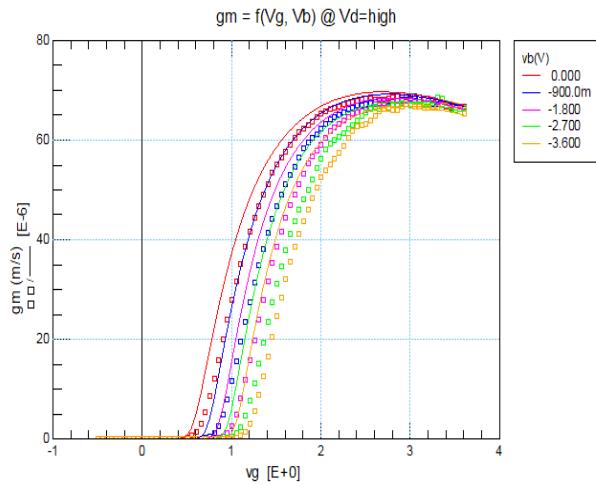
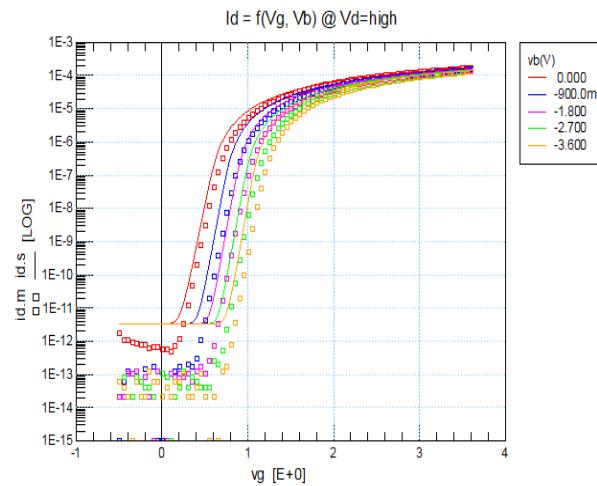
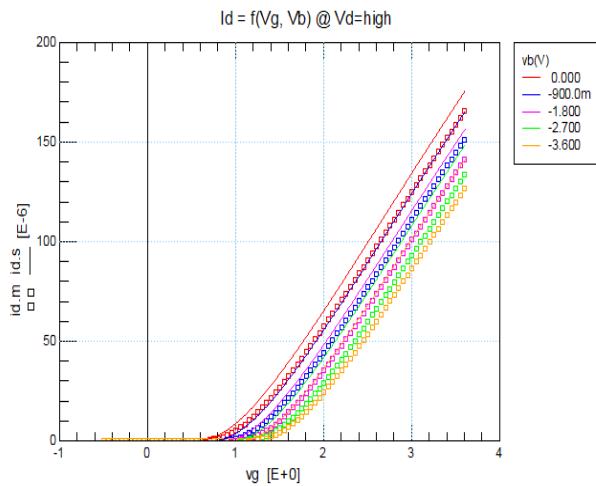
4.22 W0u3_L0u5_S560_4

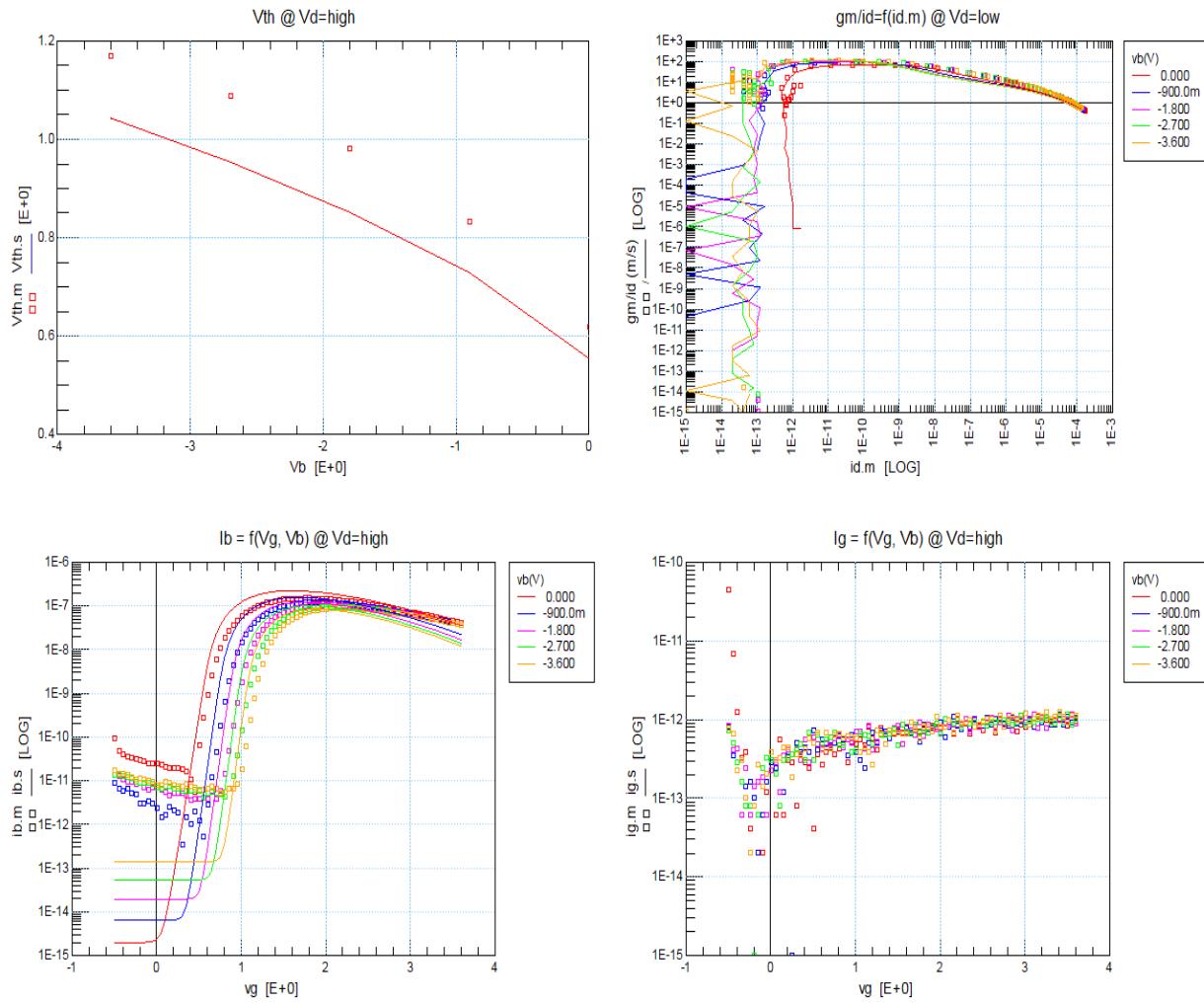
$idv_g, V_d = 0.1V, T = 27^\circ C$



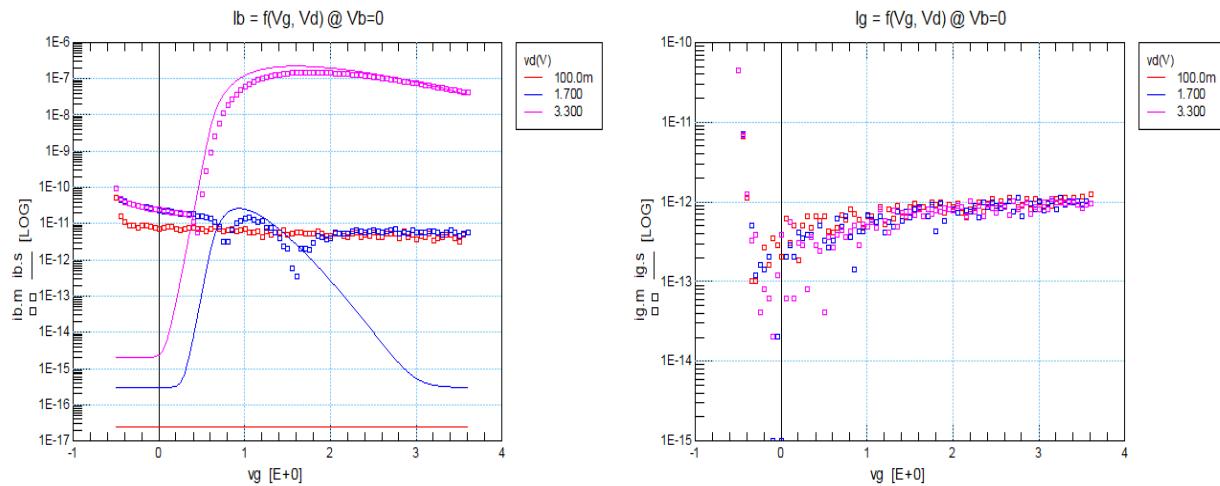


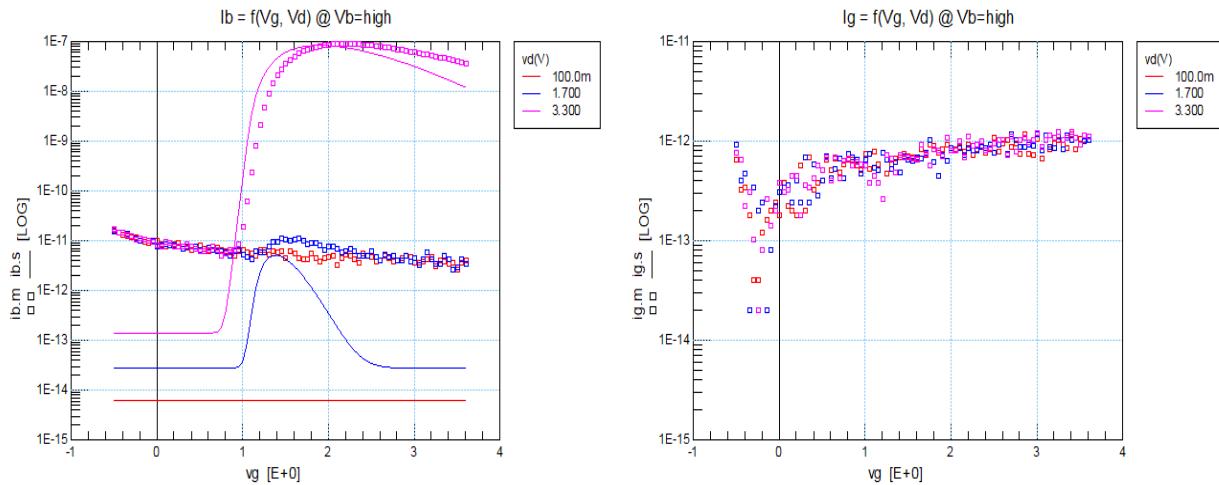
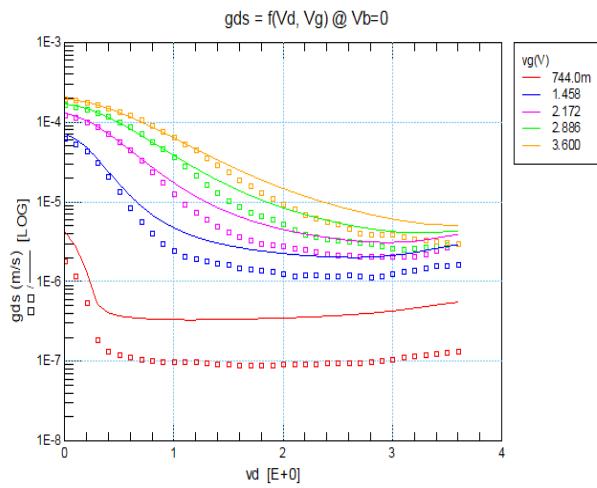
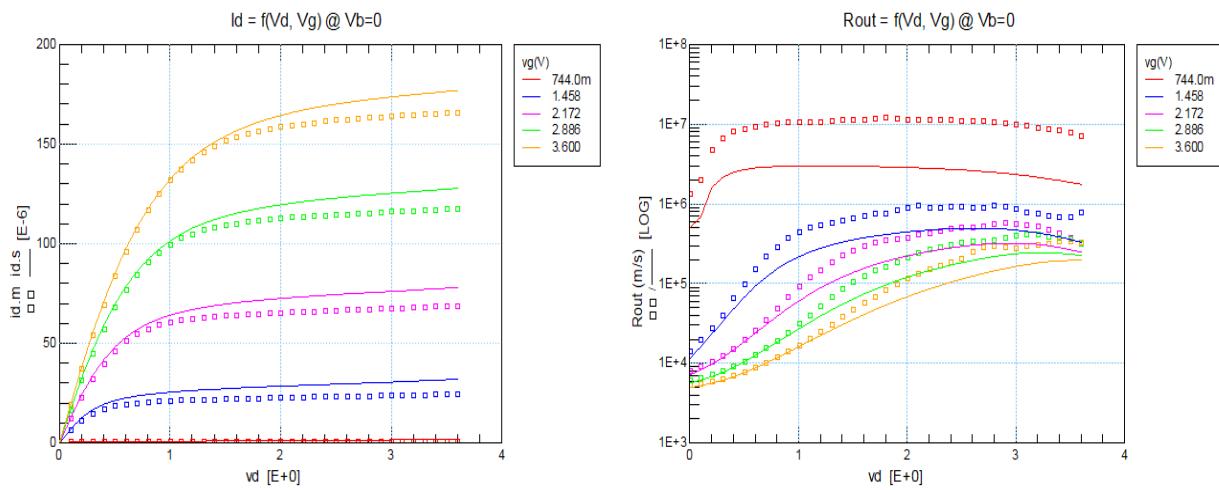
$i_d v_g, V_d = 3.3V, T = 27^\circ C$

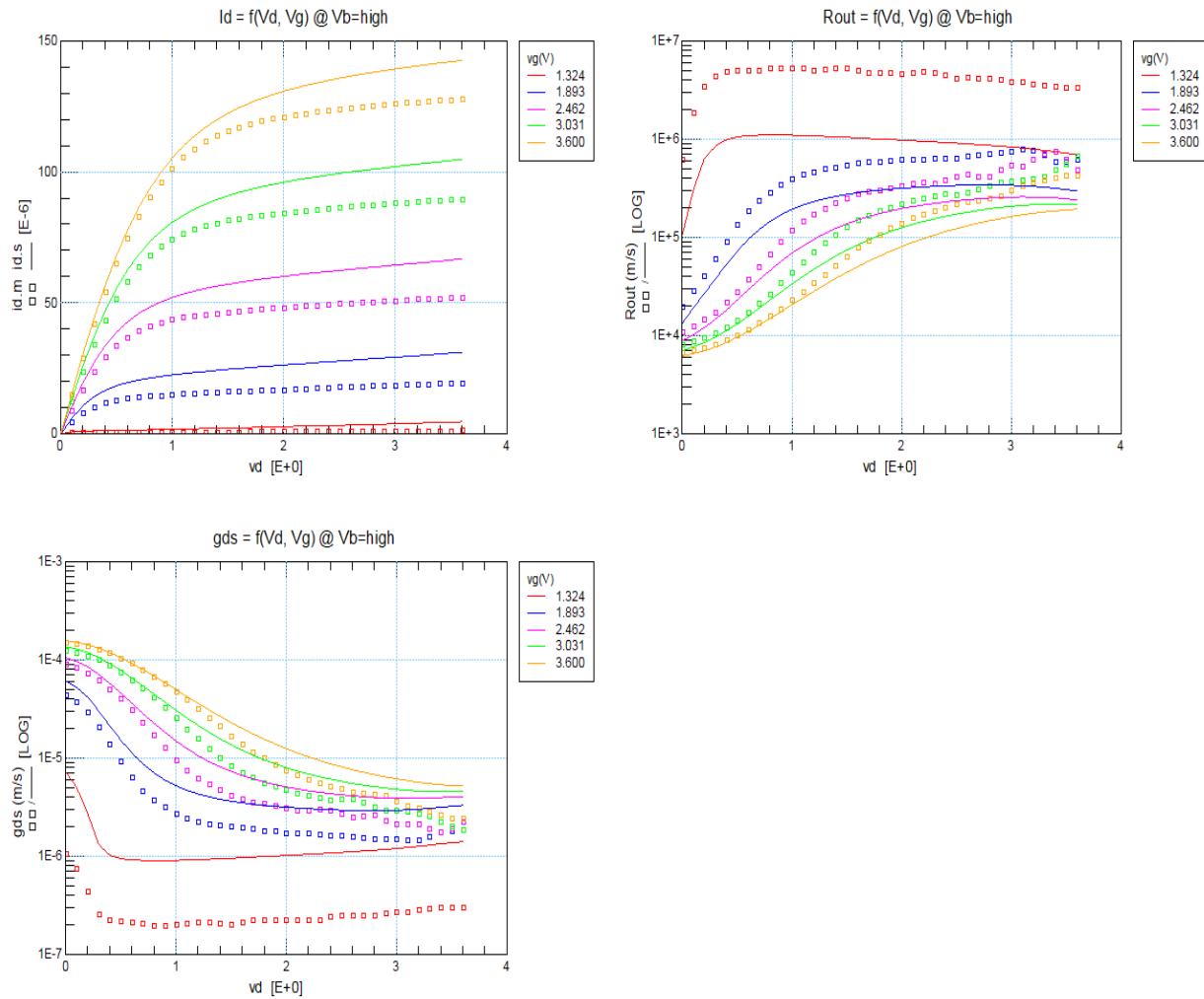
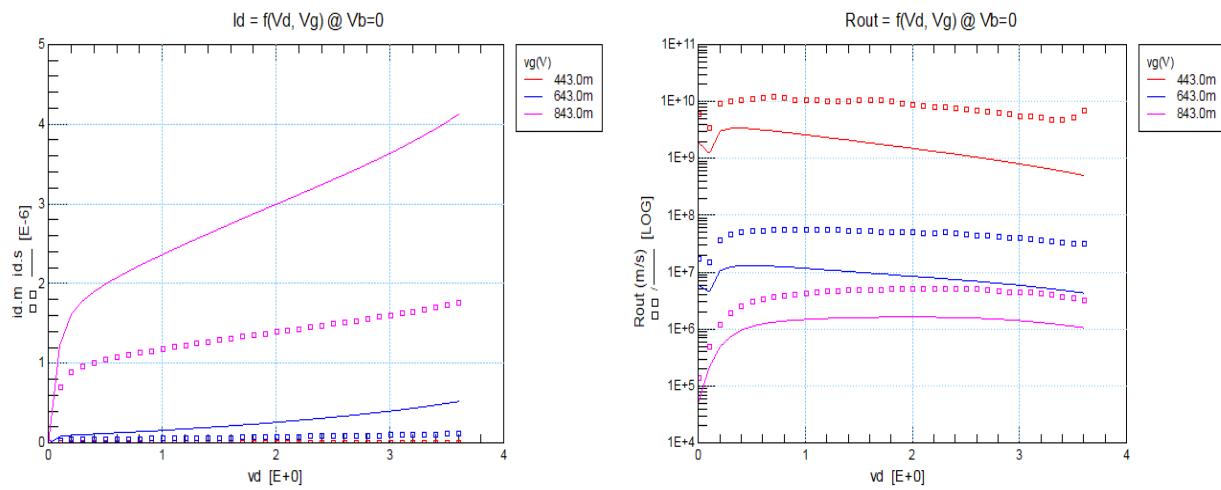


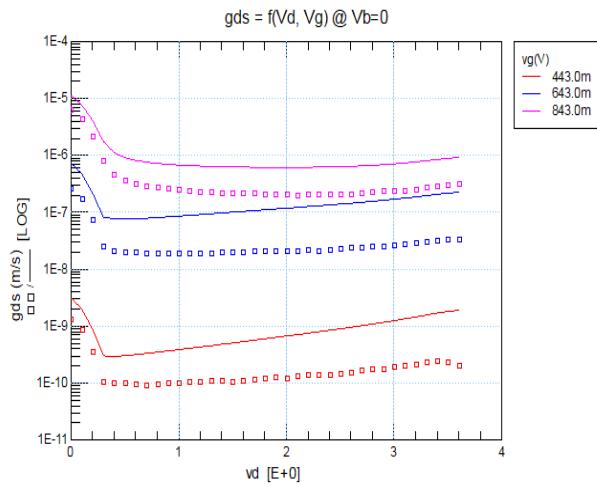


idvg, Ib,Ig, Vb = 0V, T = 27°C

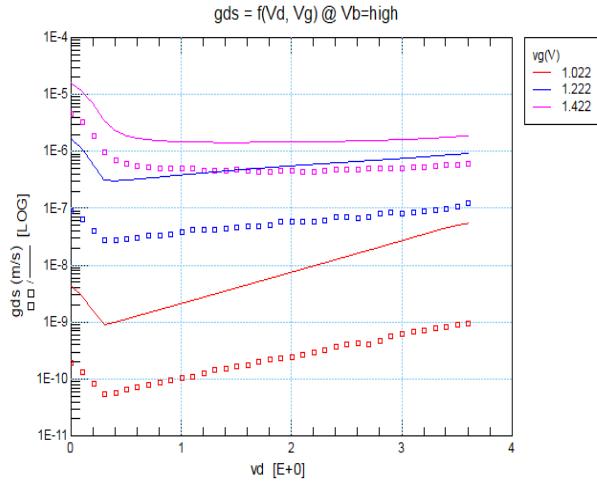
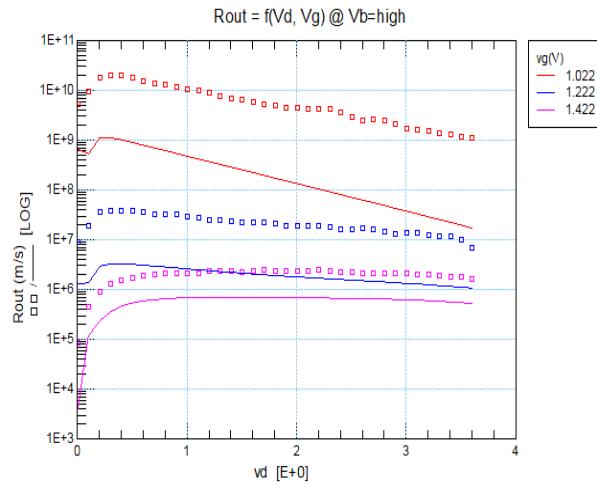
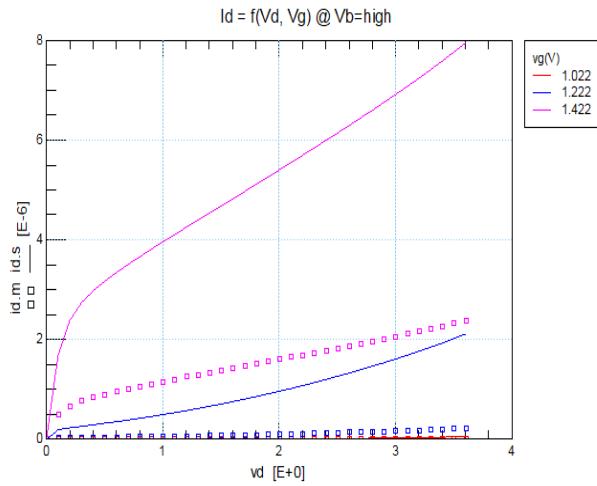


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


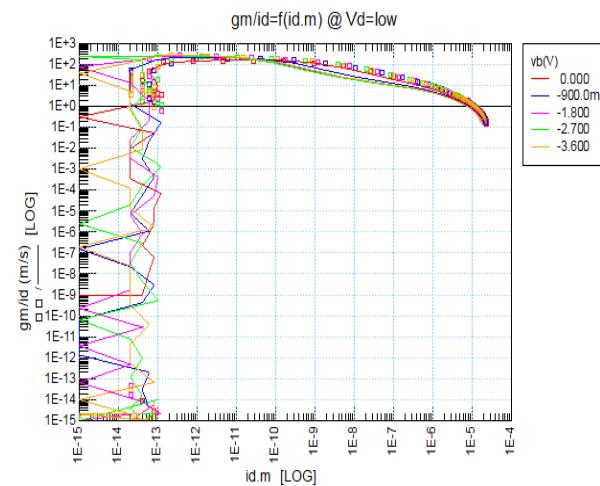
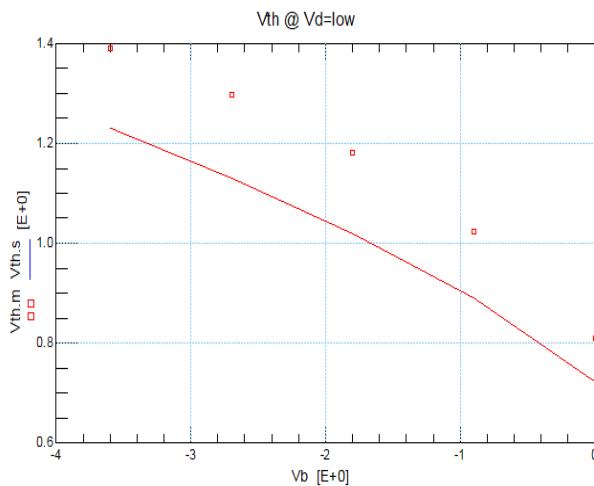
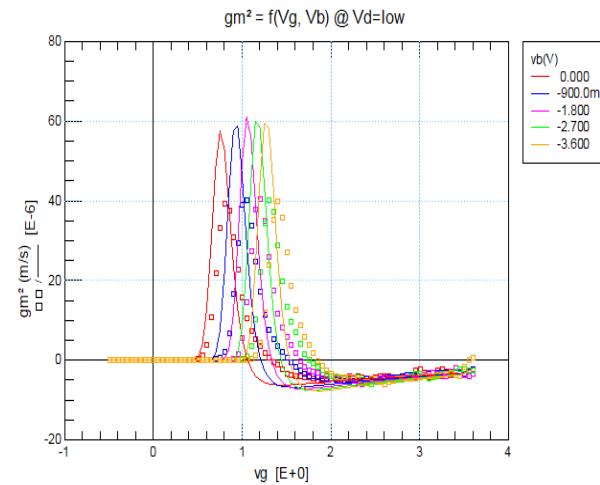
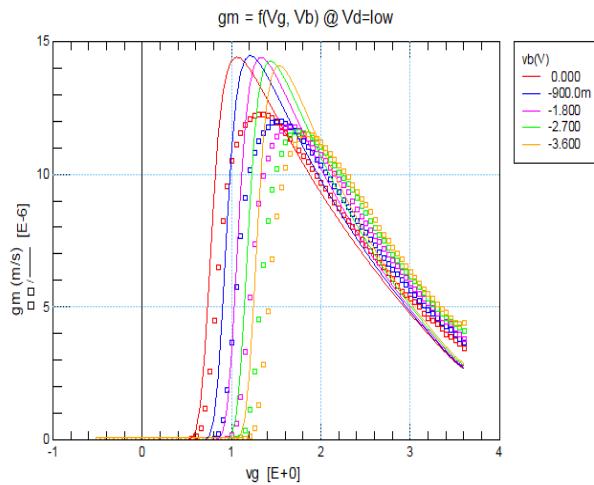
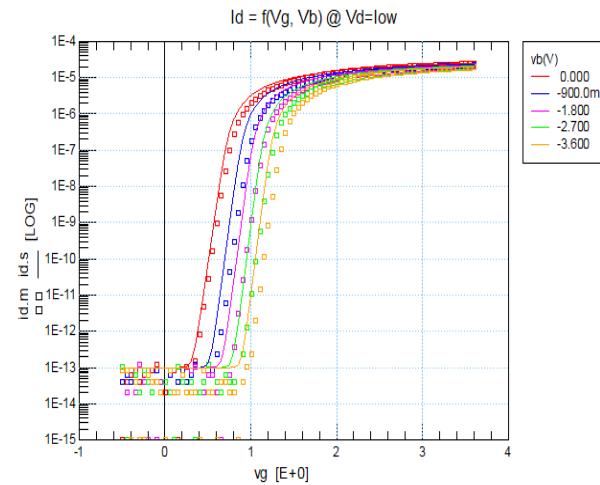
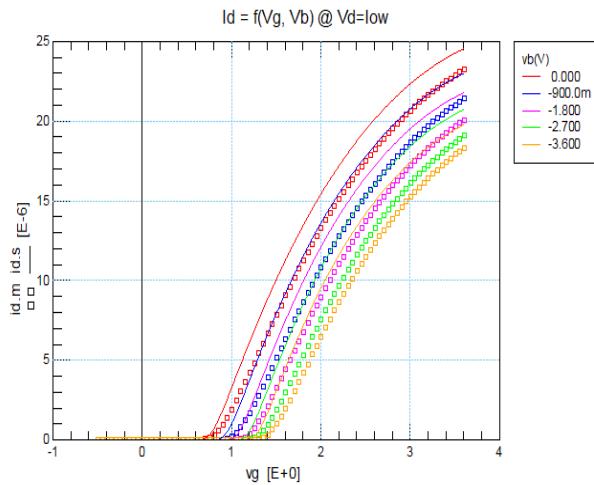
idvd_vbmin, Vb = -3.6V, T = 27°C**idvd_vth, Vb = 0V, T = 27°C**

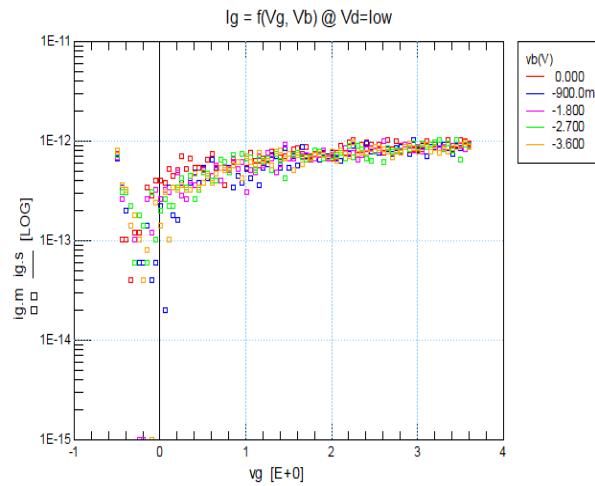
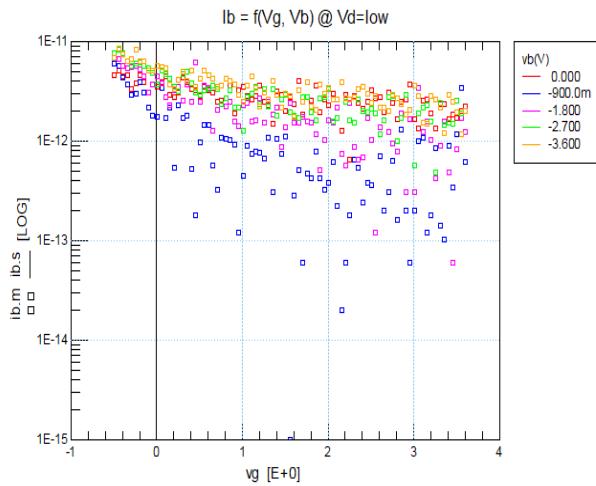


idvd_vth_vbmin, Vb = -3.6V, T = 27°C

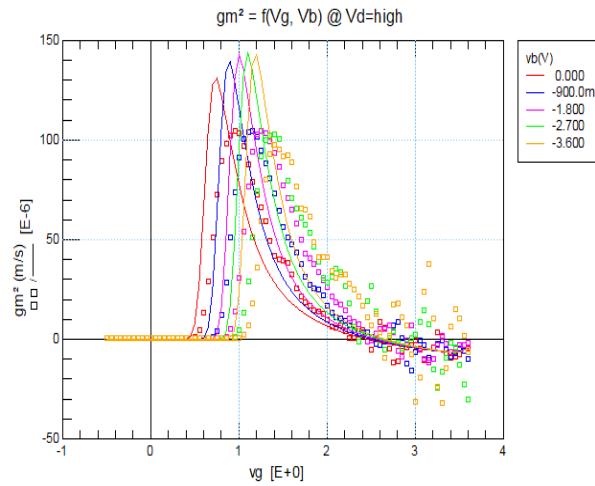
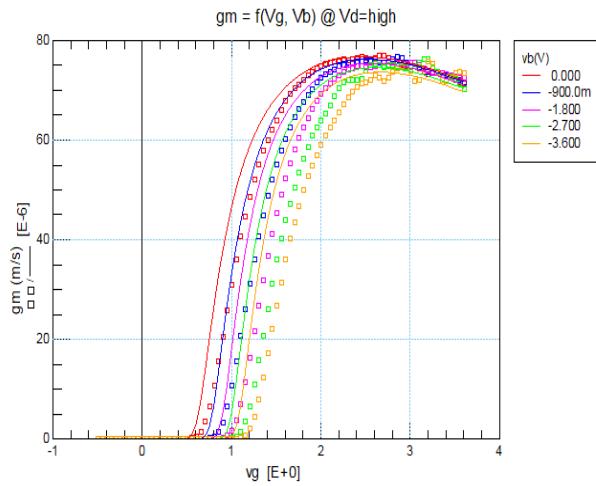
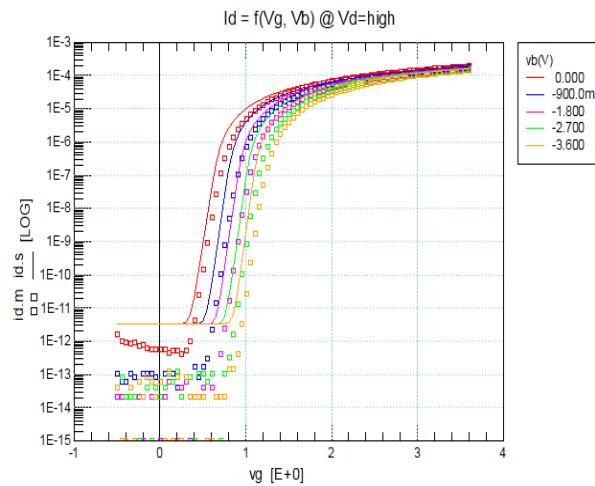
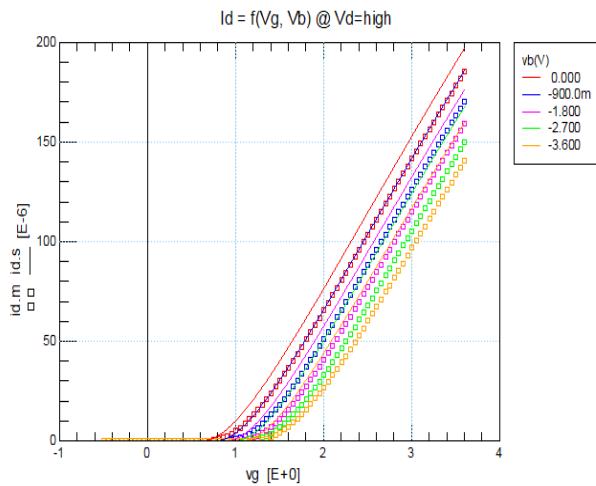


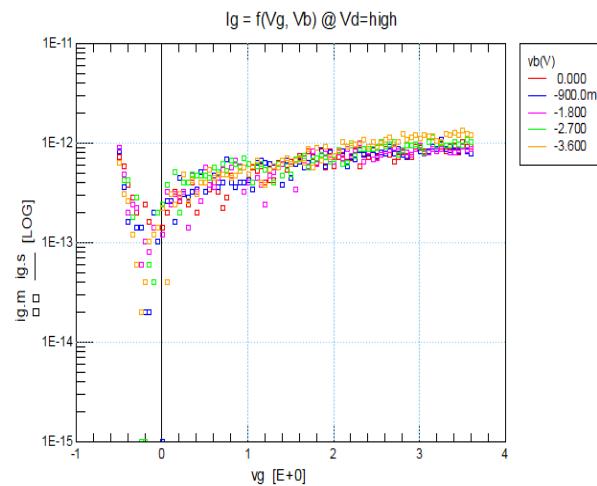
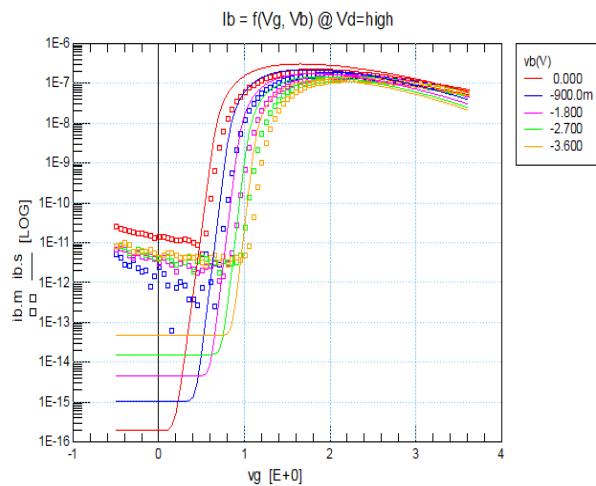
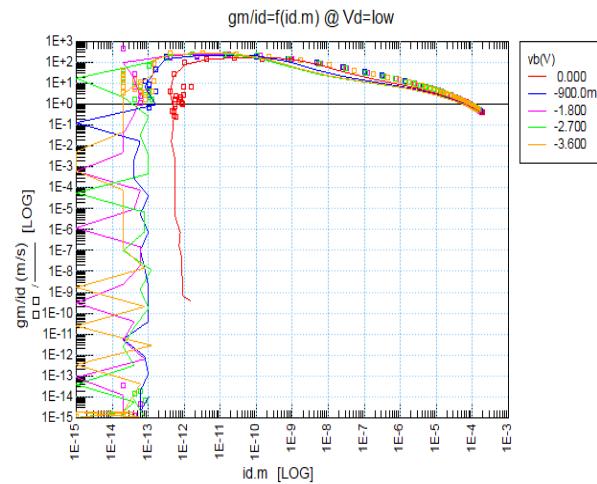
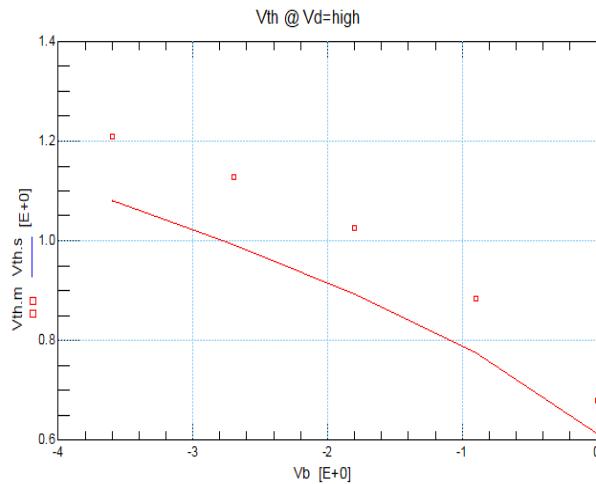
idvg, Vd = 0.1V, T = -40°C



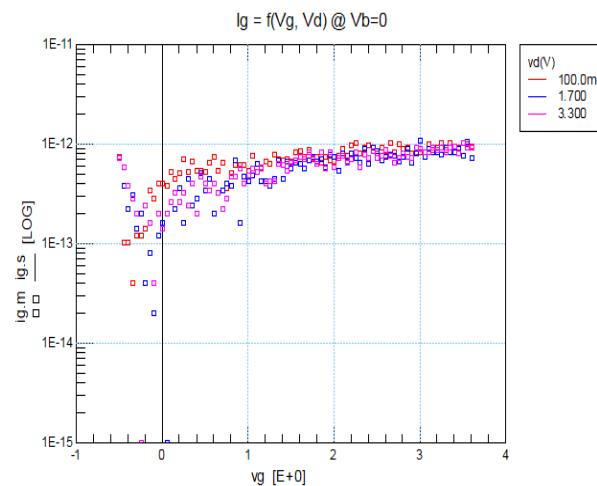
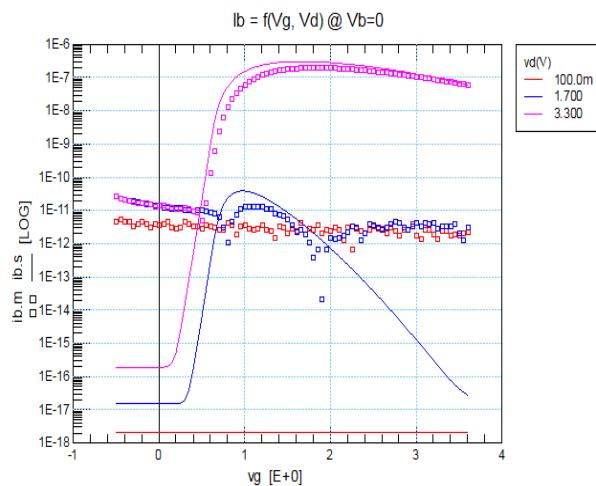


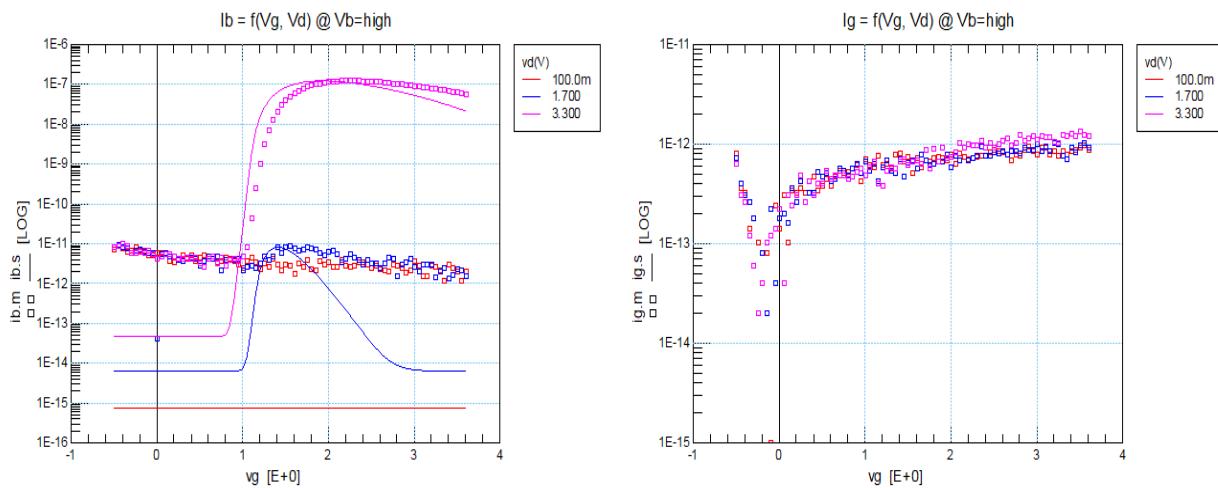
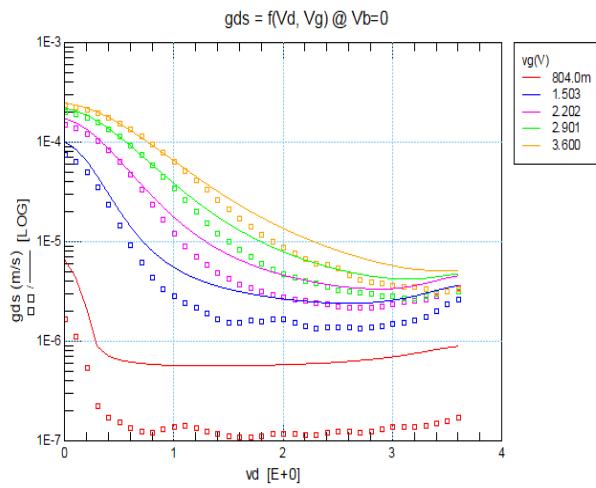
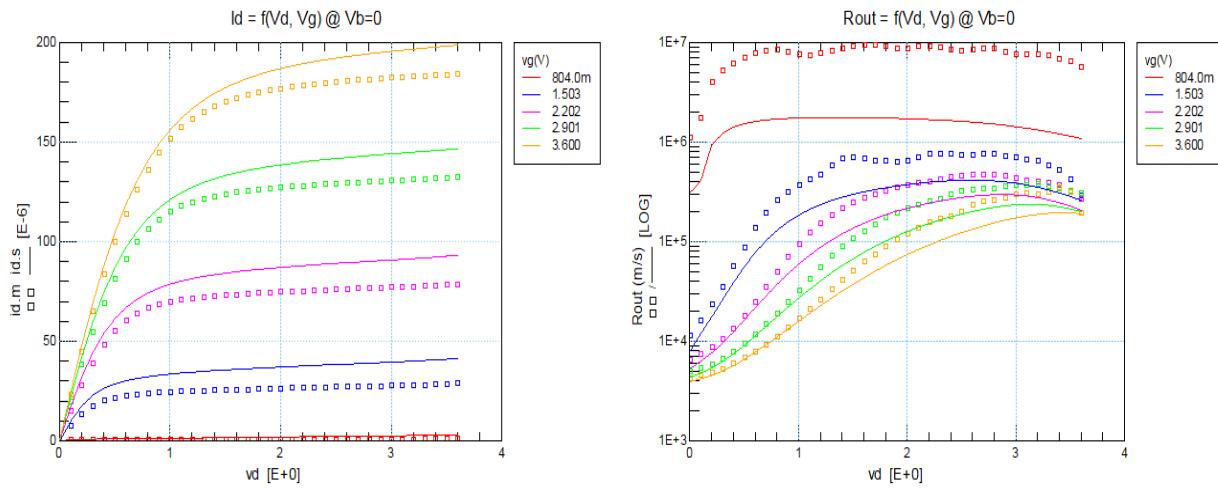
$i_d v_g, V_d = 3.3V, T = -40^\circ C$

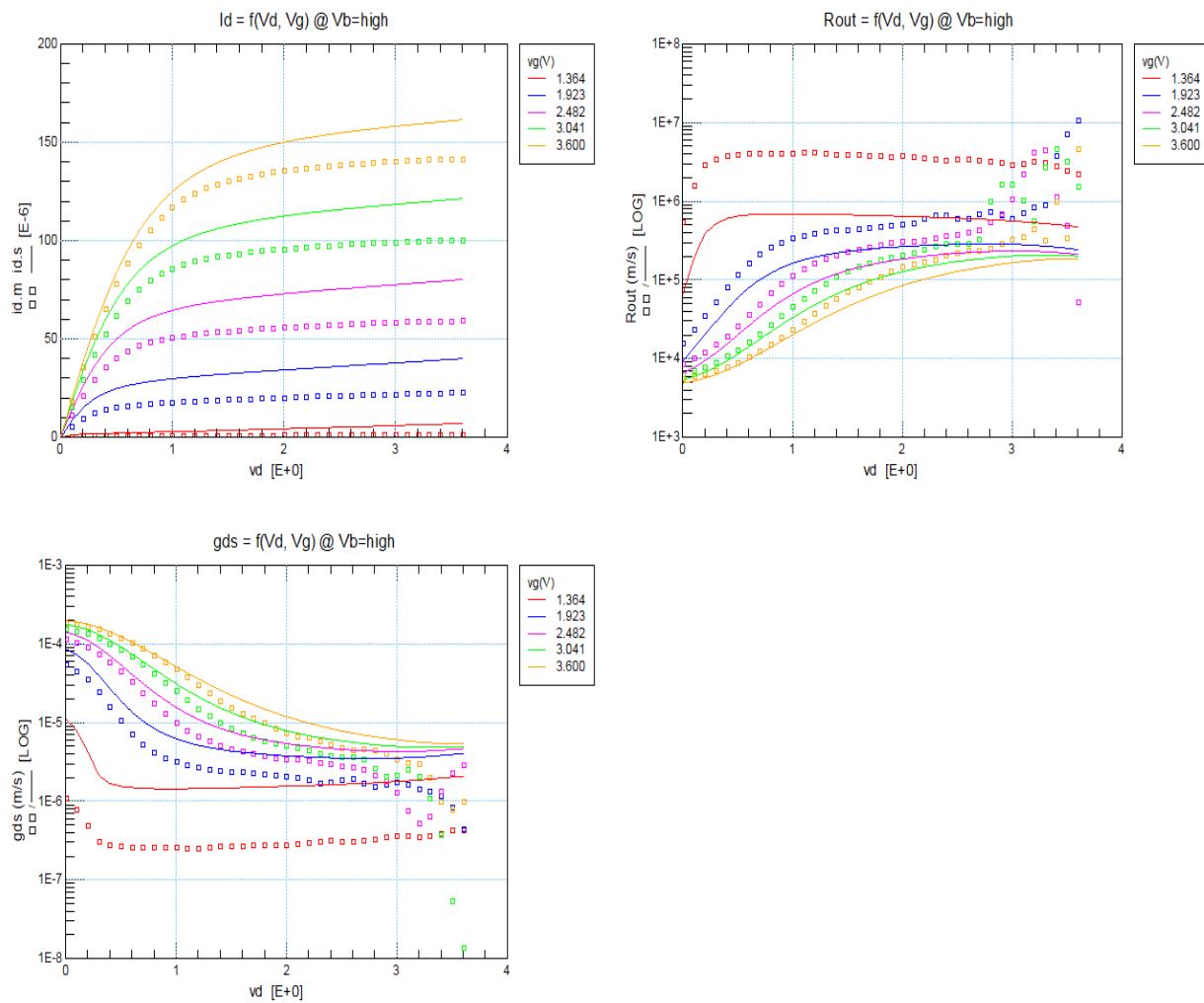
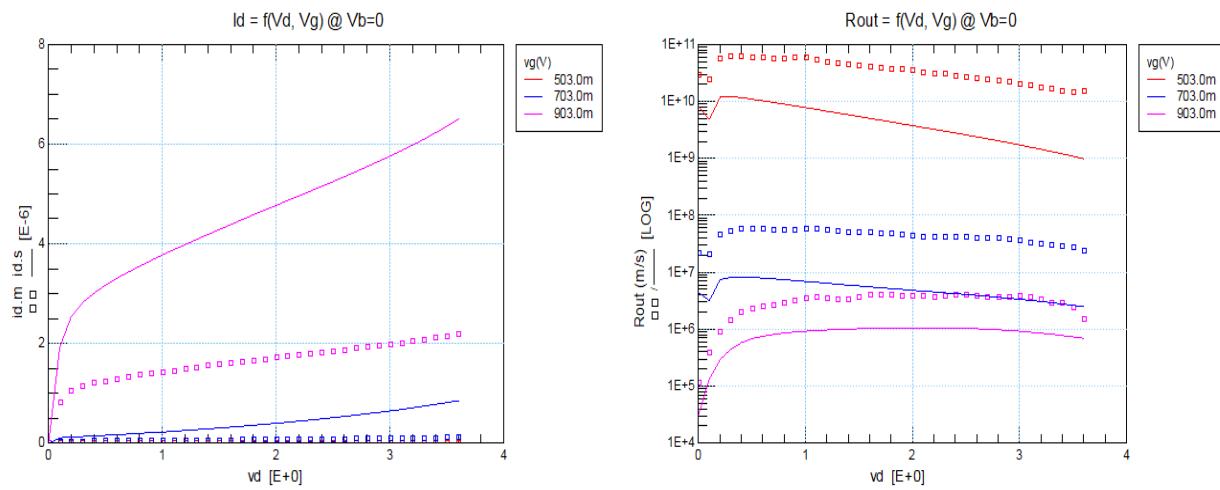


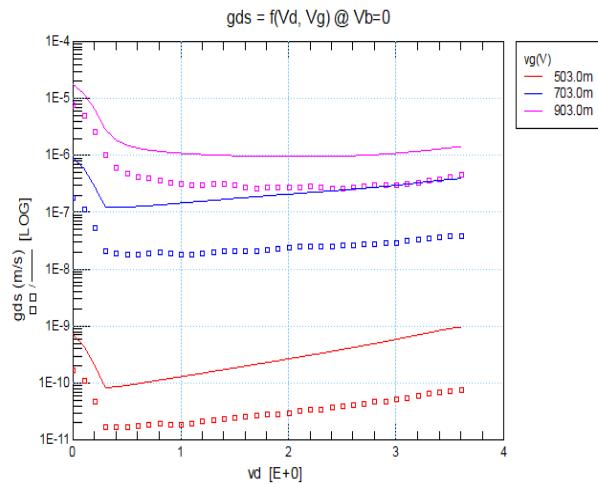


idvg, lb, lg, Vb = 0V, T = -40°C

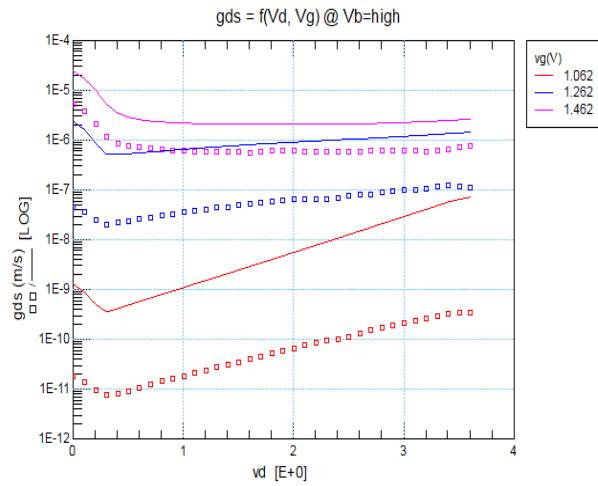
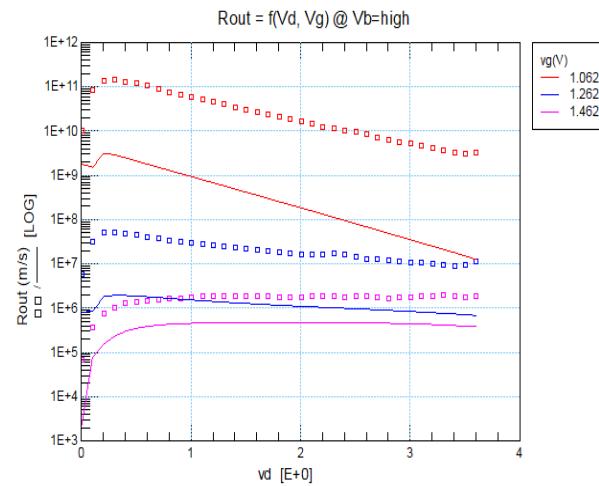
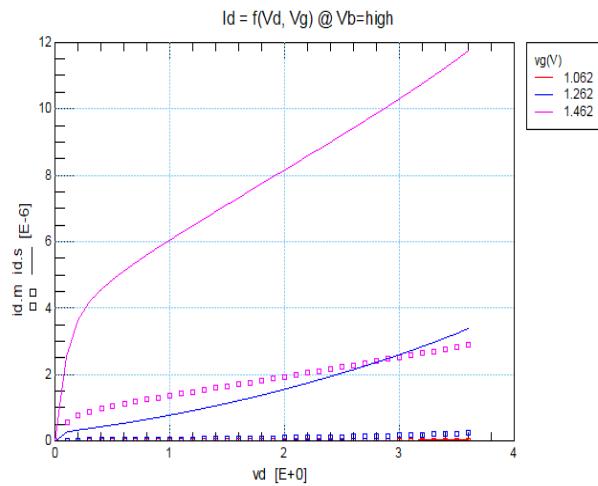


idvg, Ib,Ig, Vb = -3.6V, T = -40°C

idvd, Vb = 0V, T = -40°C


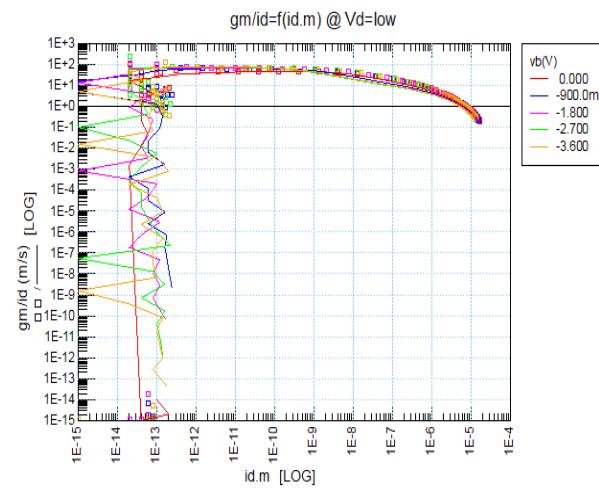
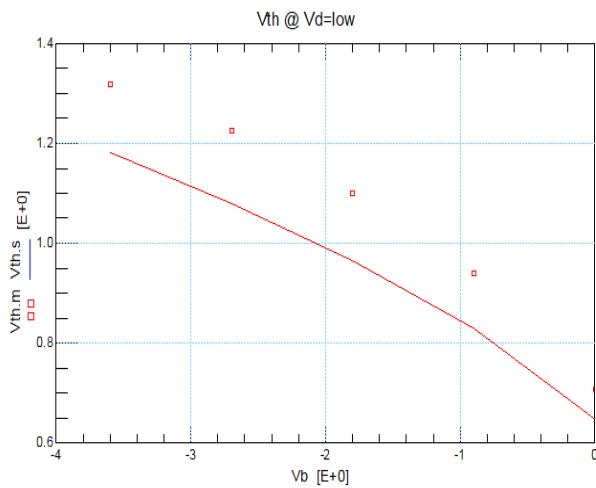
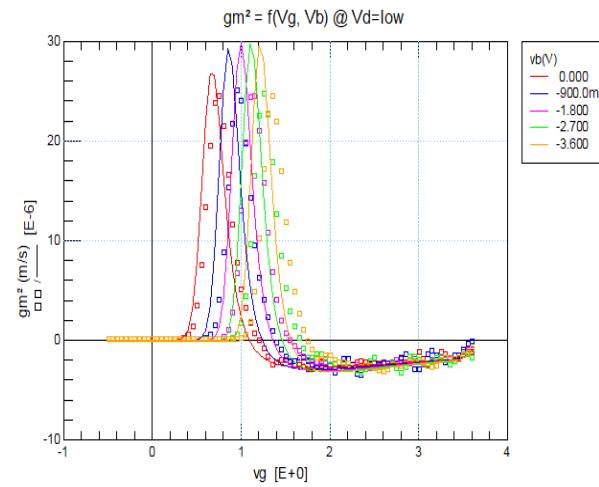
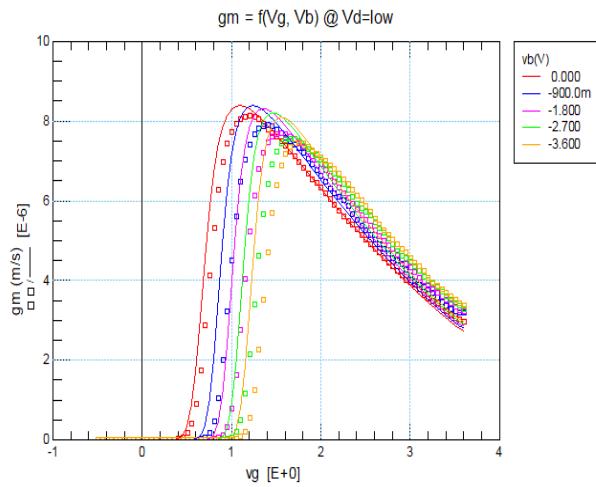
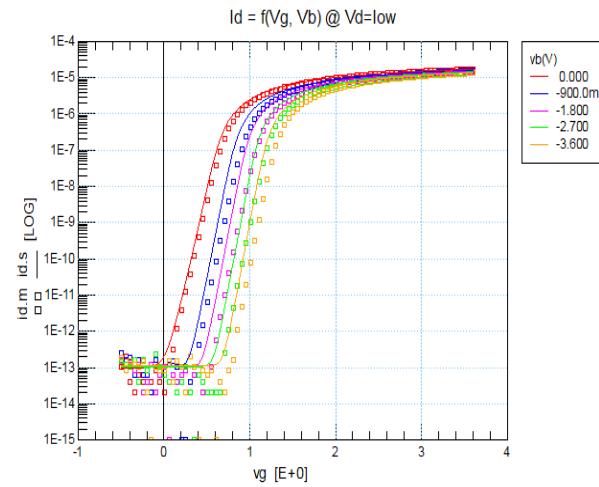
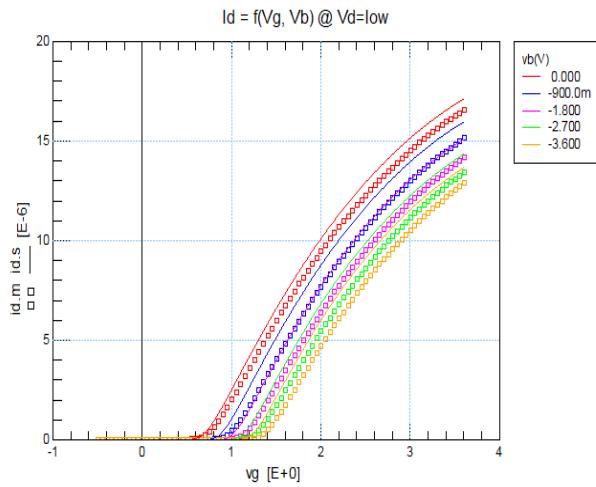
idvd_vbmin, Vb = -3.6V, T = -40°C**idvd_vth, Vb = 0V, T = -40°C**

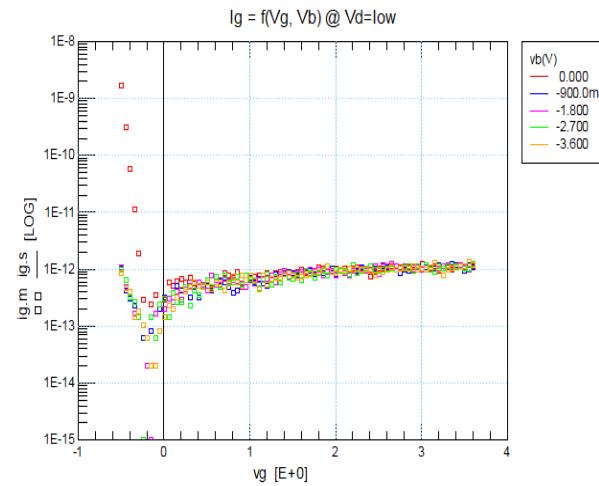
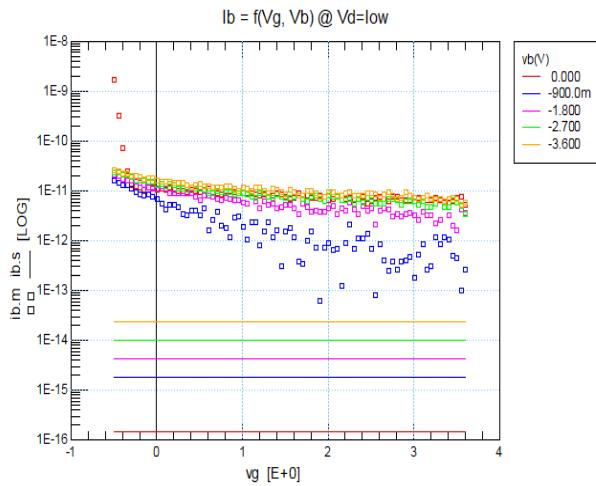


idvd_vth_vbmin, Vb = -3.6V, T = -40°C

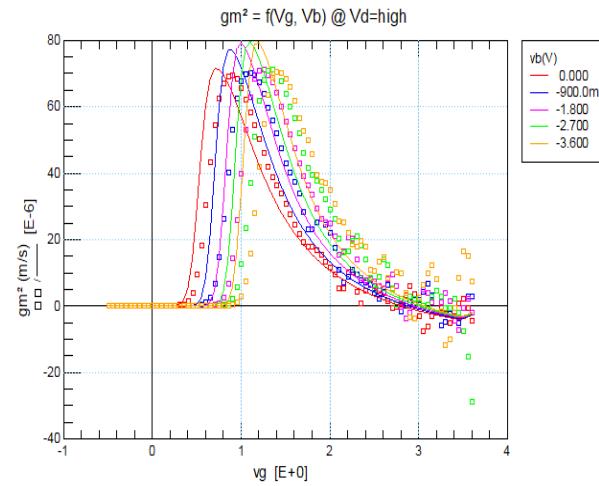
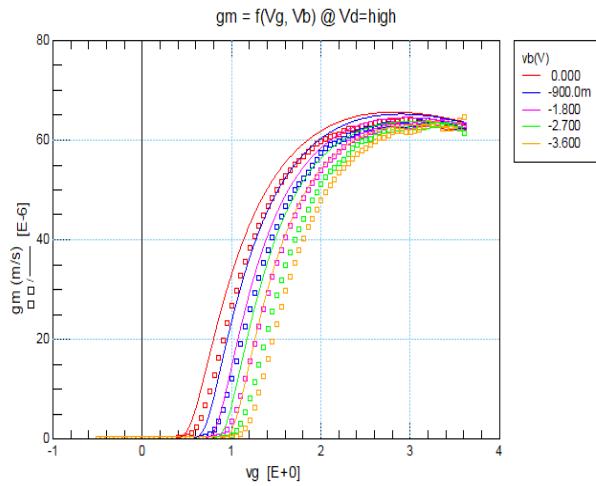
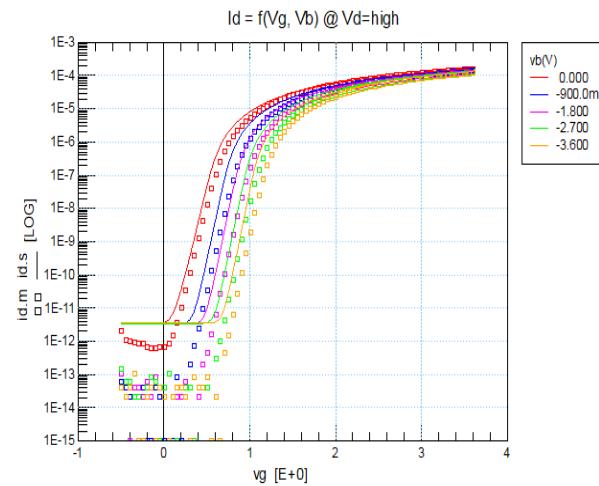
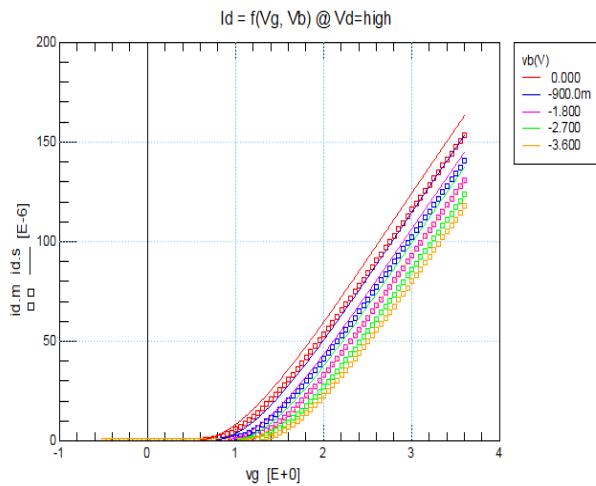


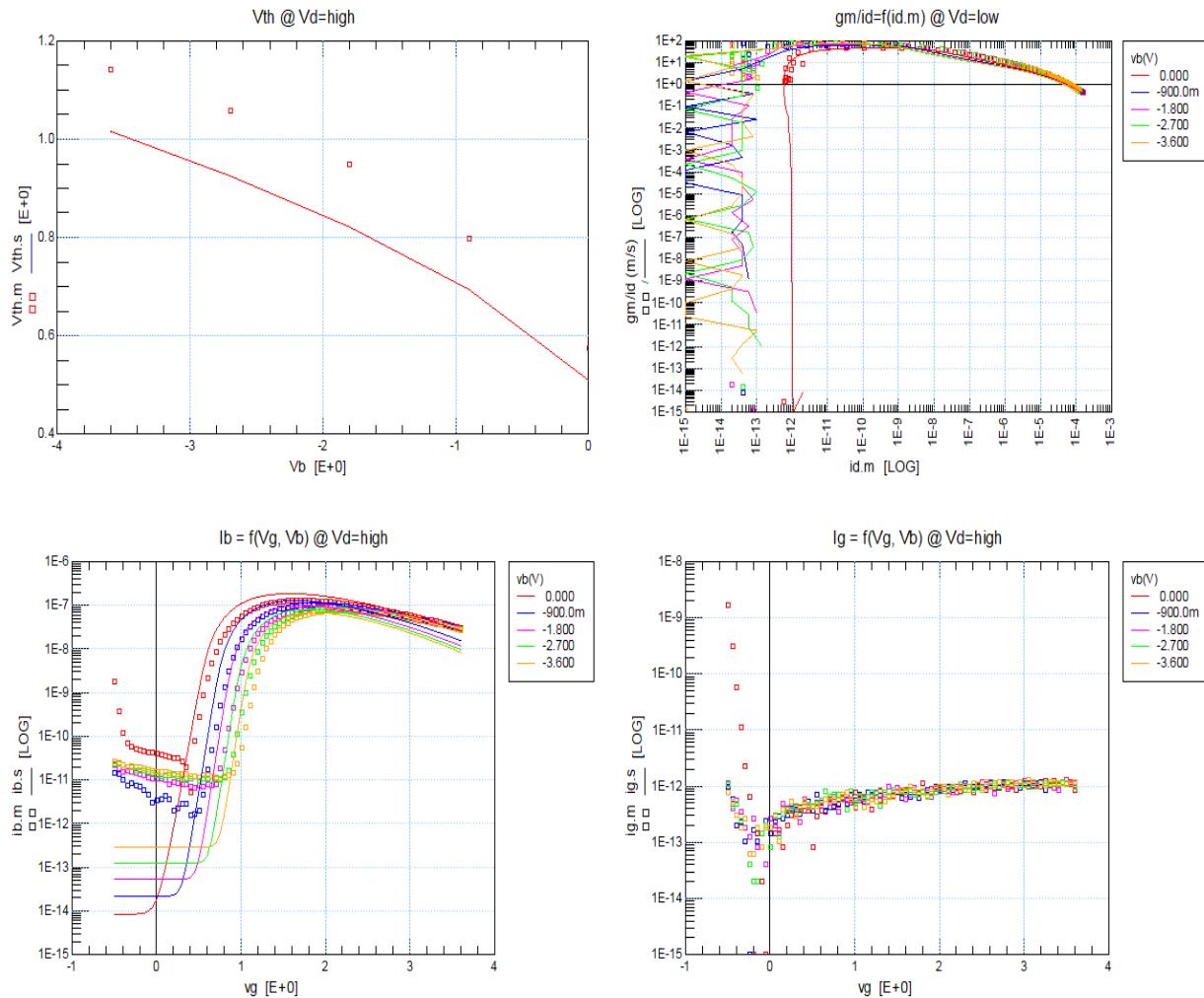
idvg, Vd = 0.1V, T = 70°C



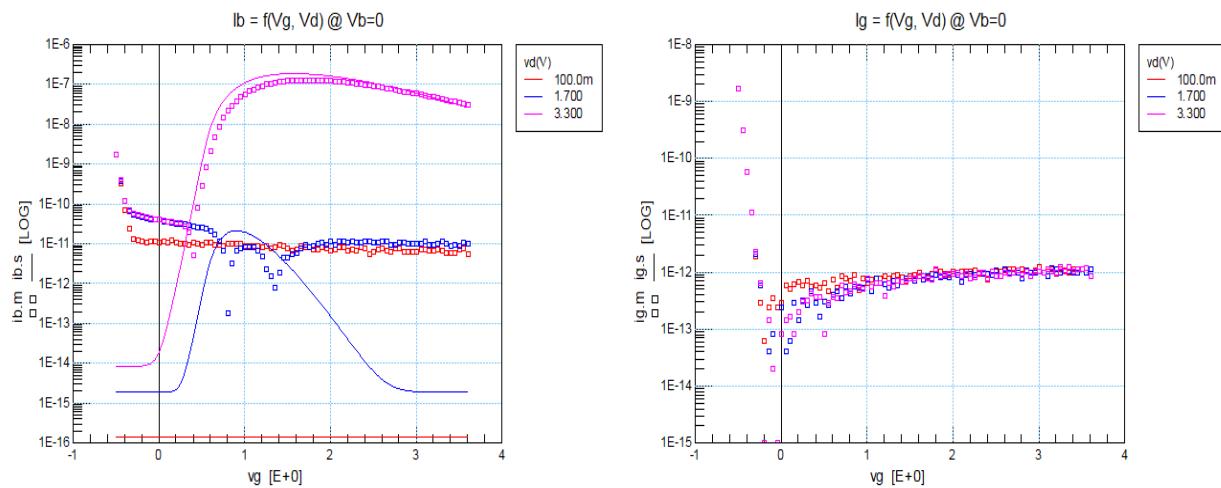


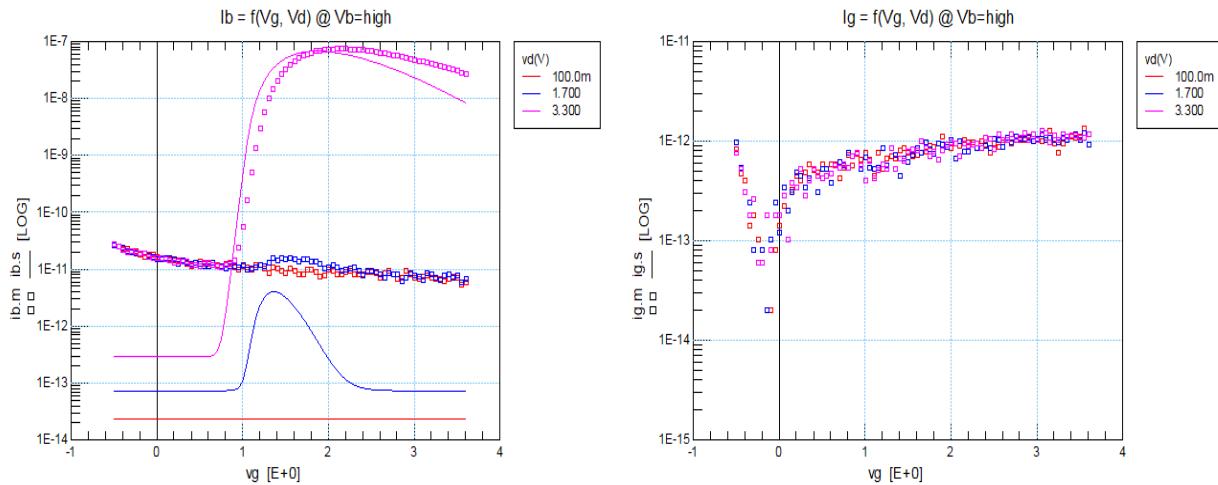
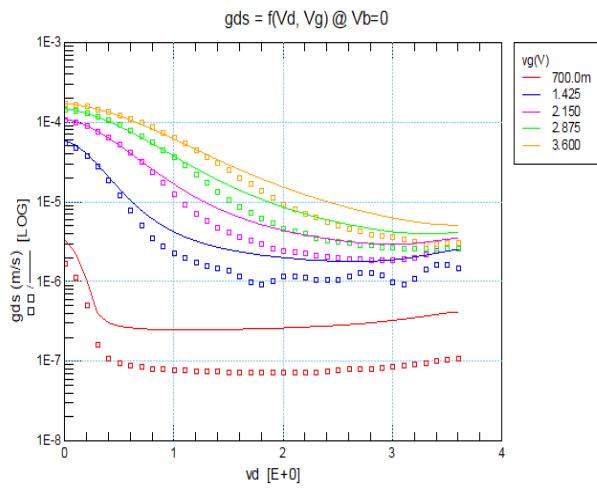
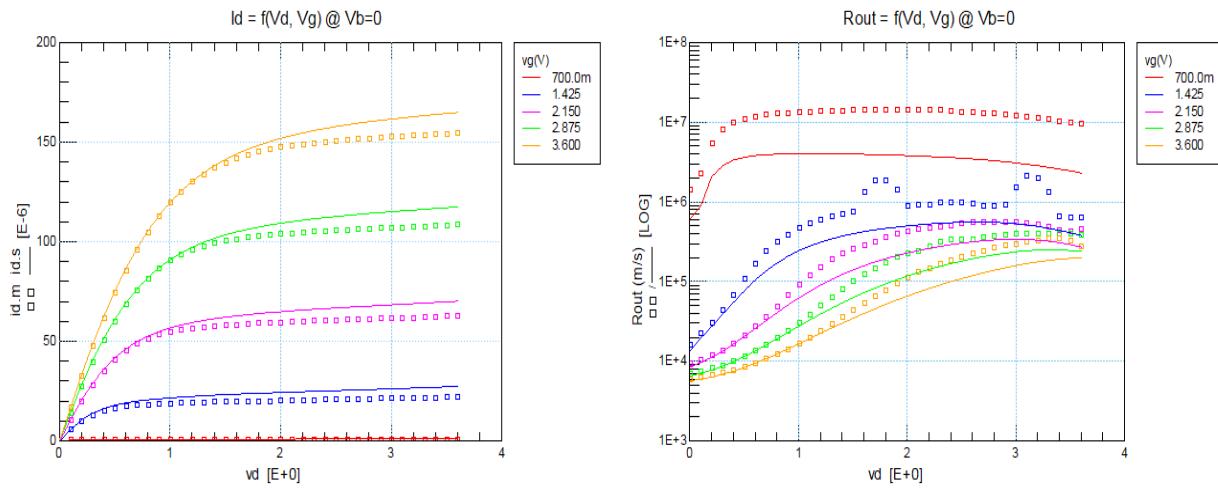
$i_{dvg}, V_d = 3.3V, T = 70^\circ C$

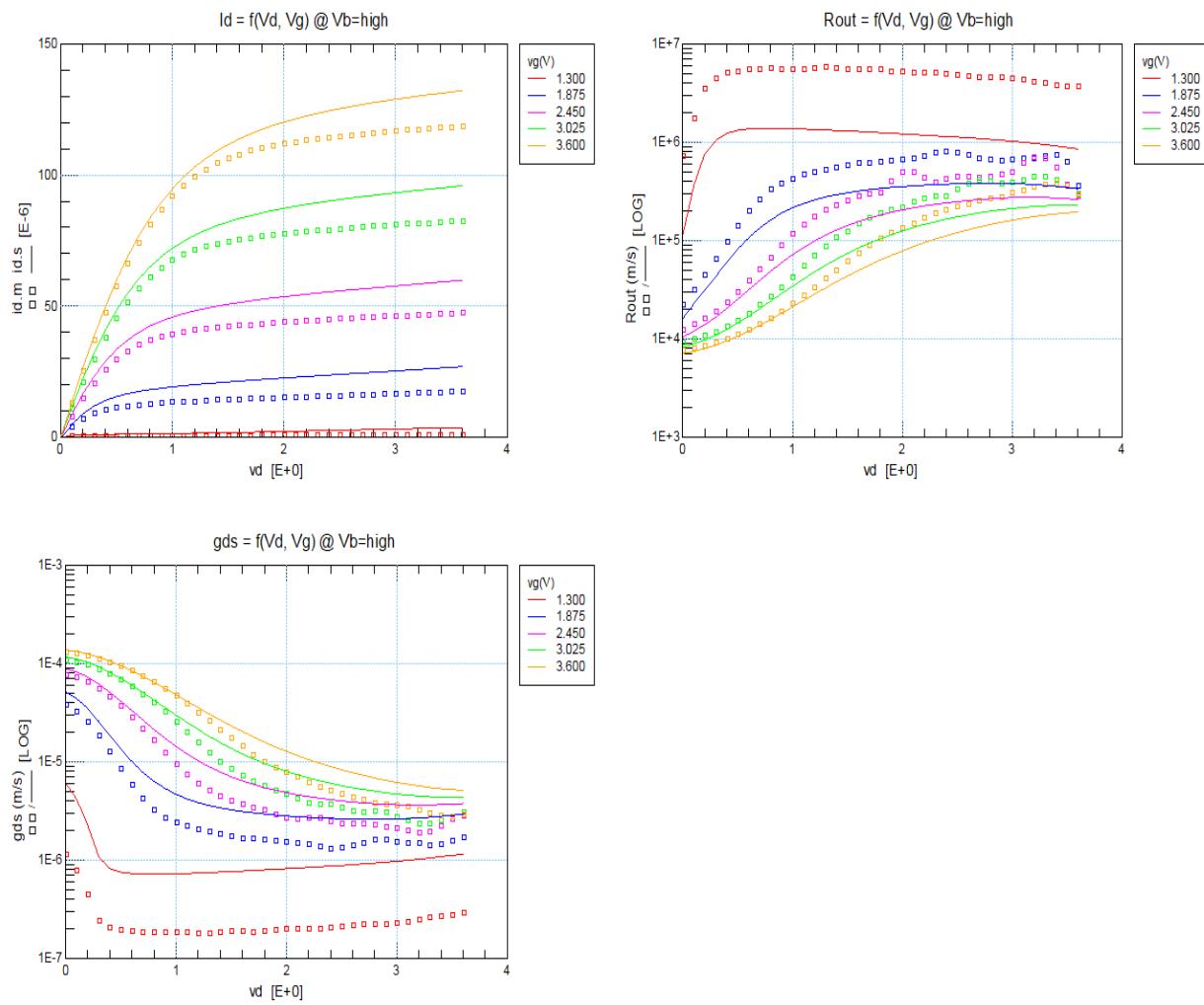
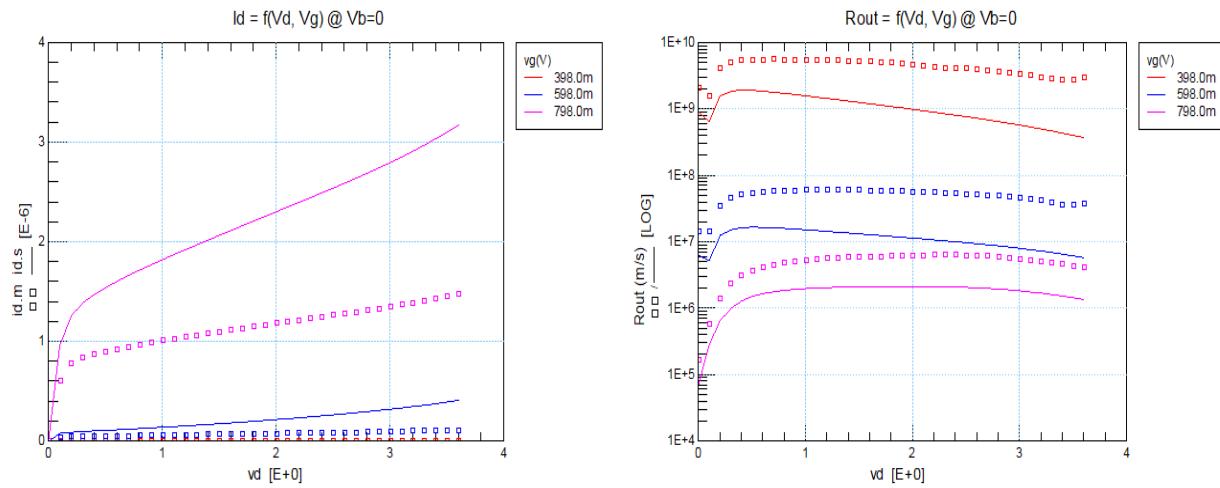


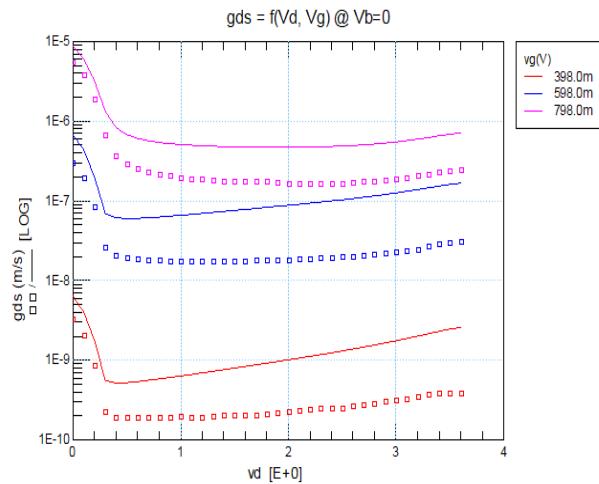


idvg, lb, lg, Vb = 0V, T = 70°C

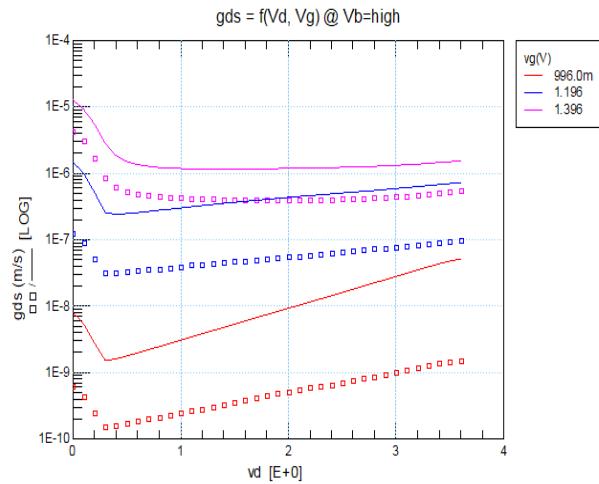
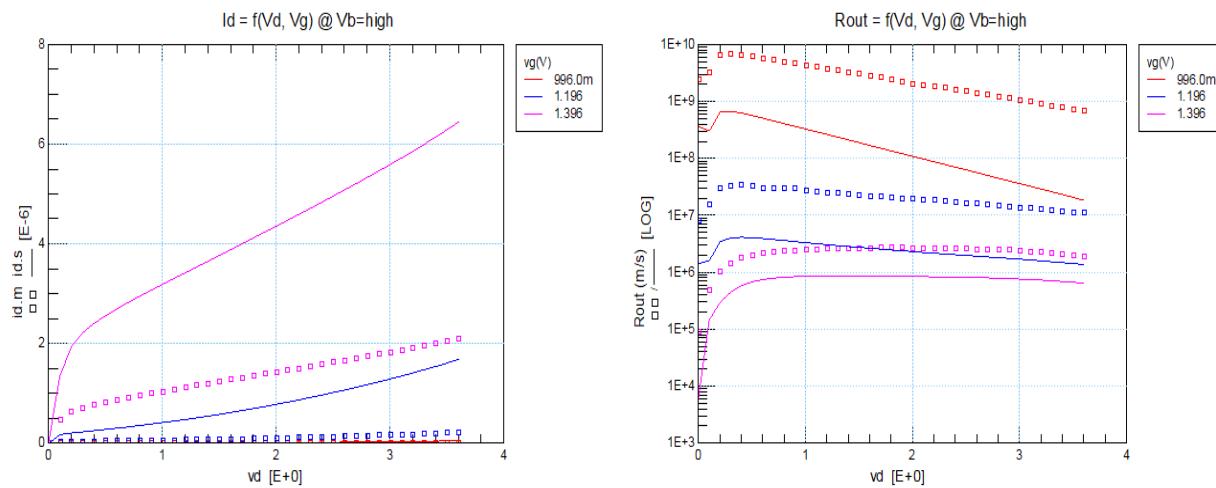


idvg, Ib,Ig, Vb = -3.6V, T = 70°C

idvd, Vb = 0V, T = 70°C


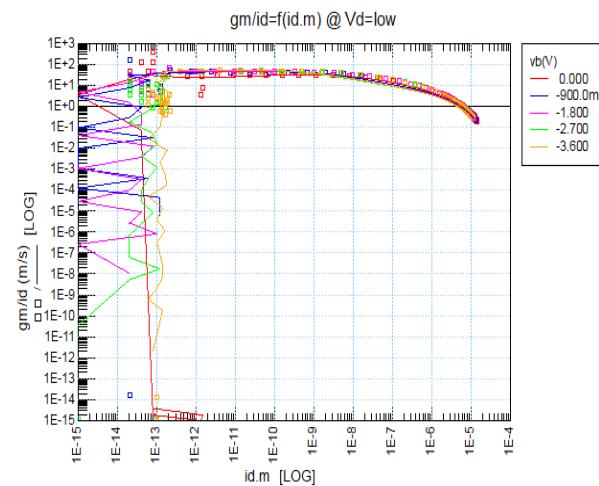
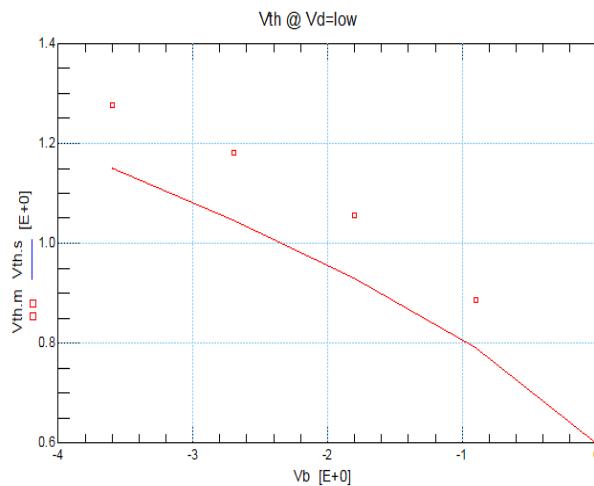
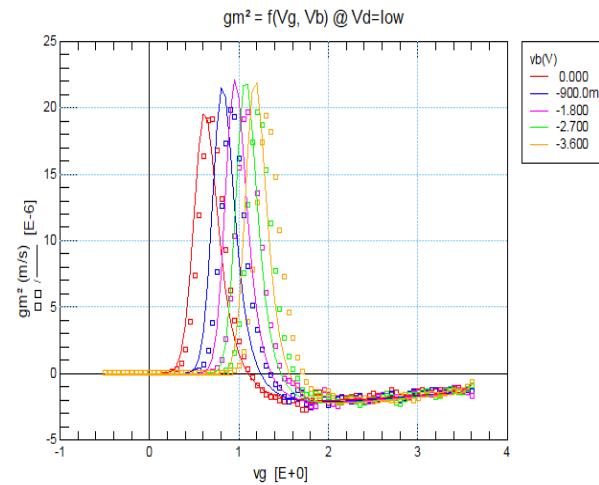
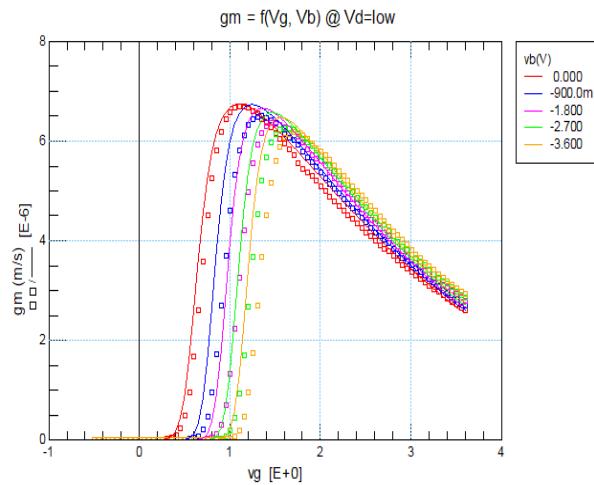
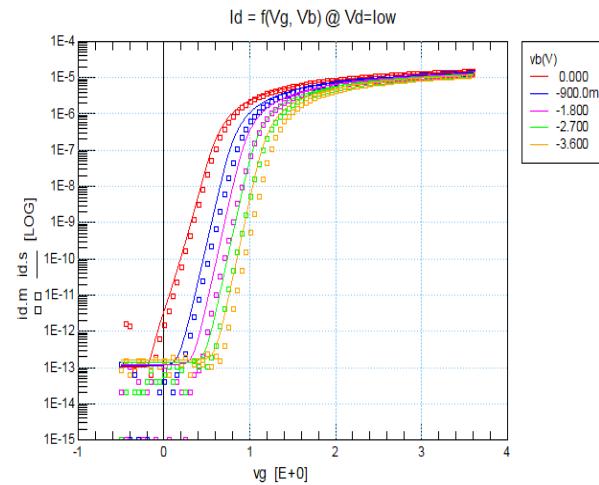
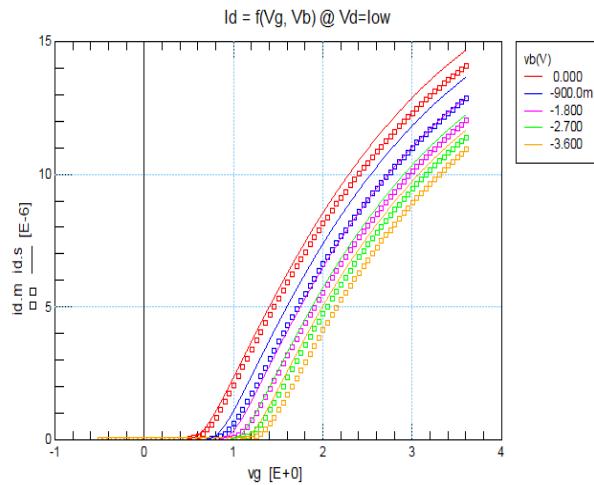
idvd_vbmin, Vb = -3.6V, T = 70°C**idvd_vth, Vb = 0V, T = 70°C**

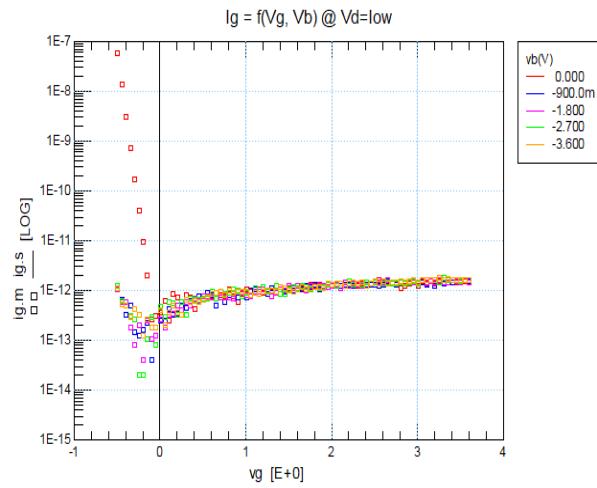
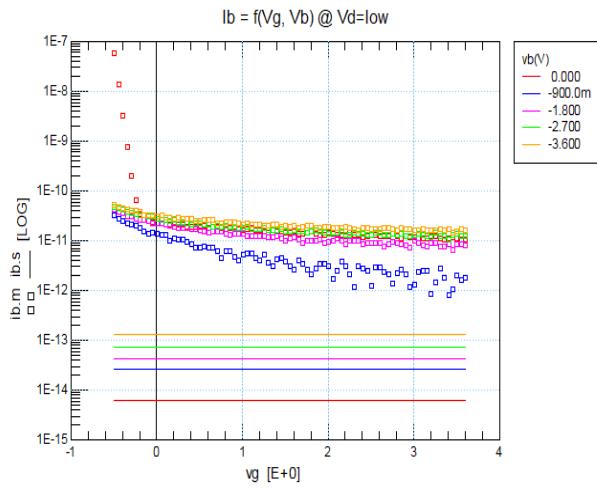


idvd_vth_vbmin, Vb = -3.6V, T = 70°C

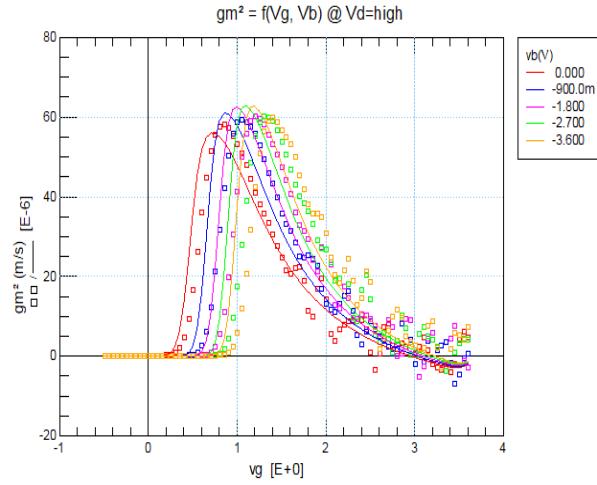
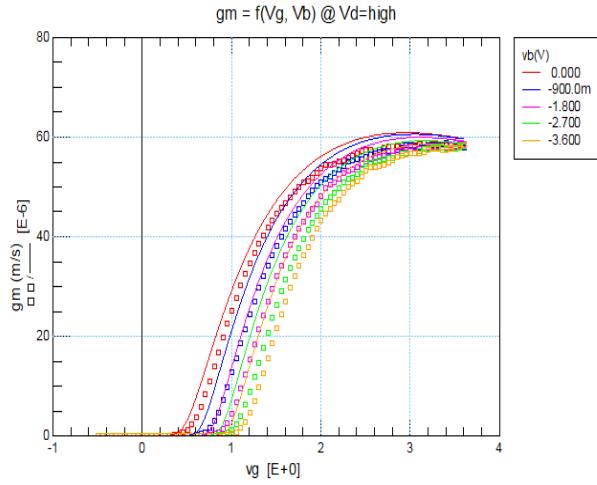
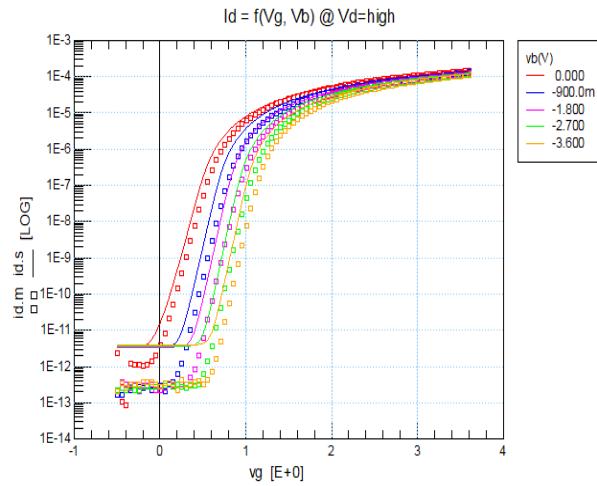
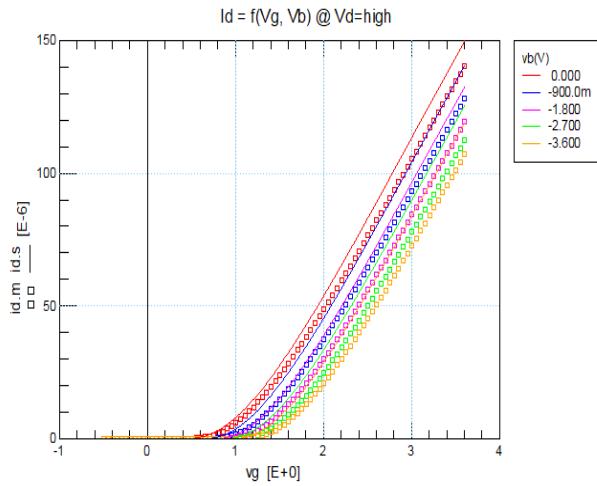


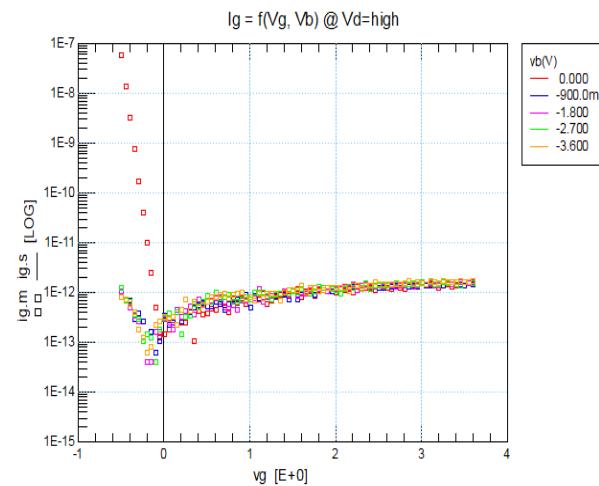
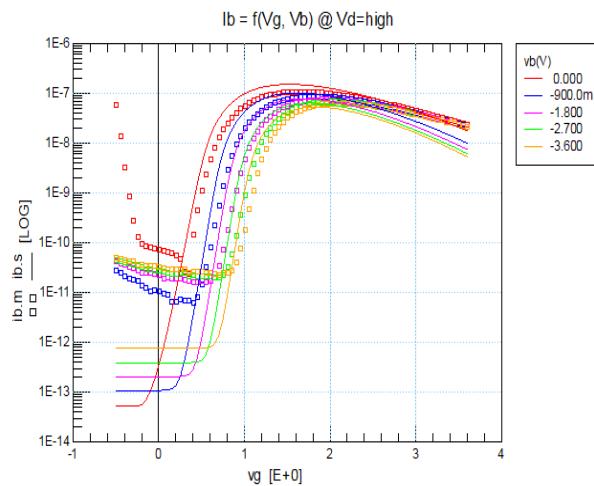
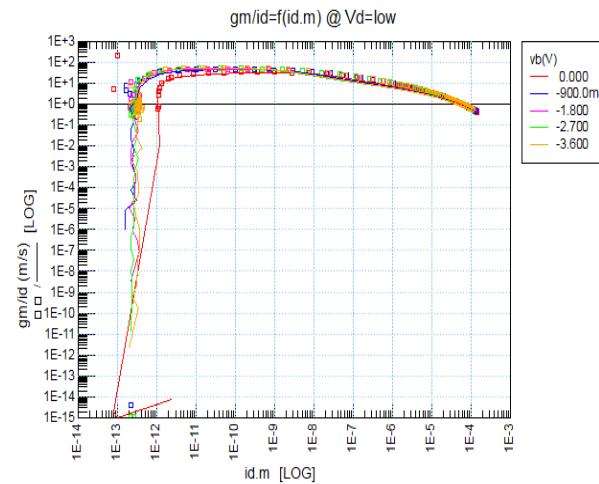
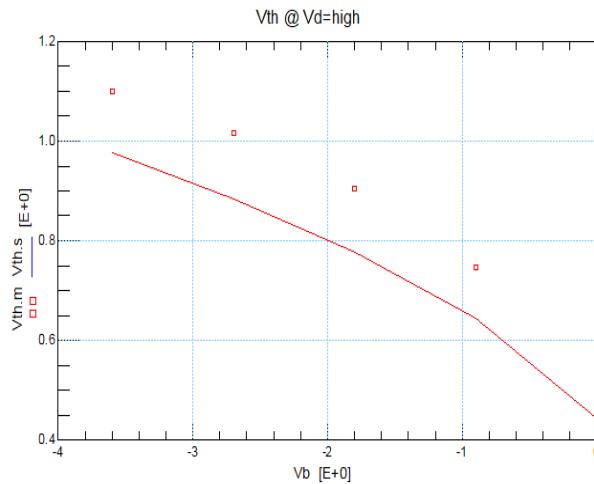
idvg, Vd = 0.1V, T = 125°C



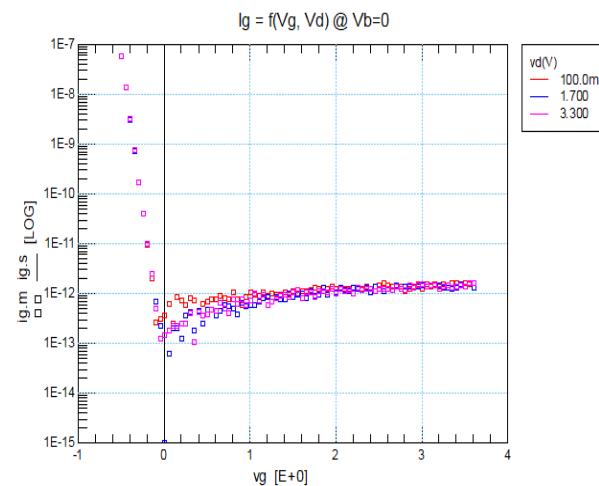
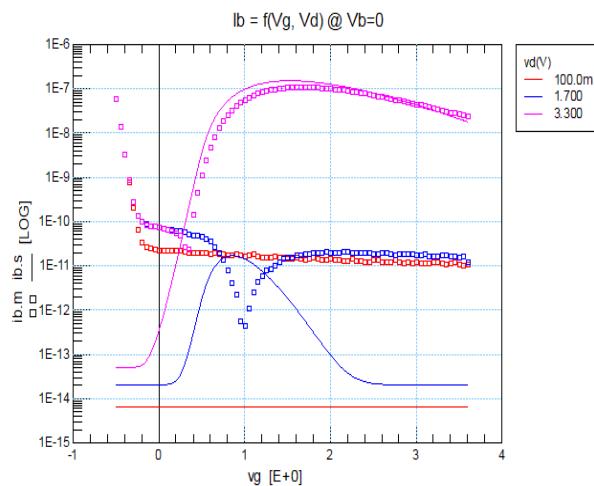


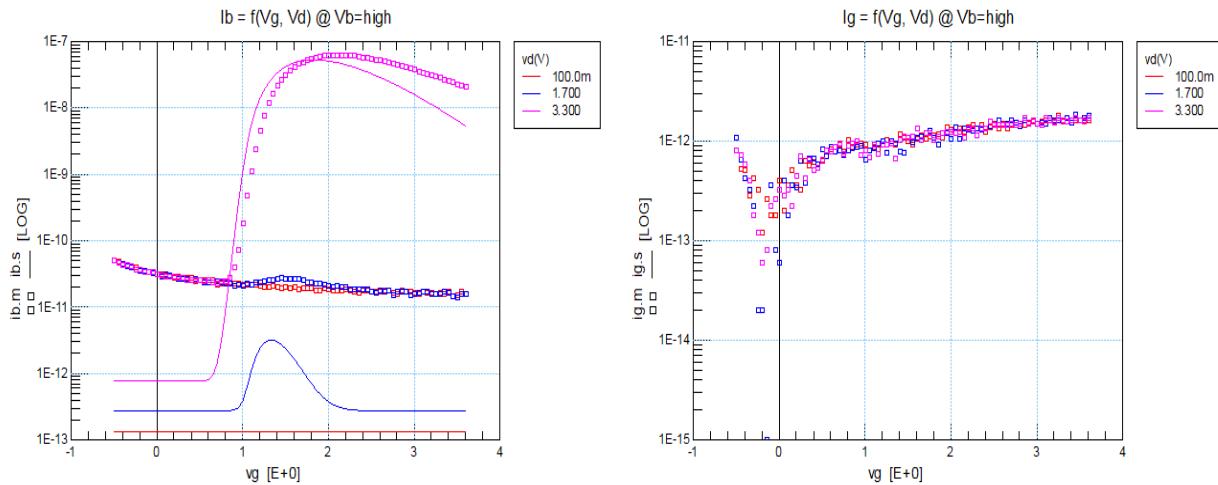
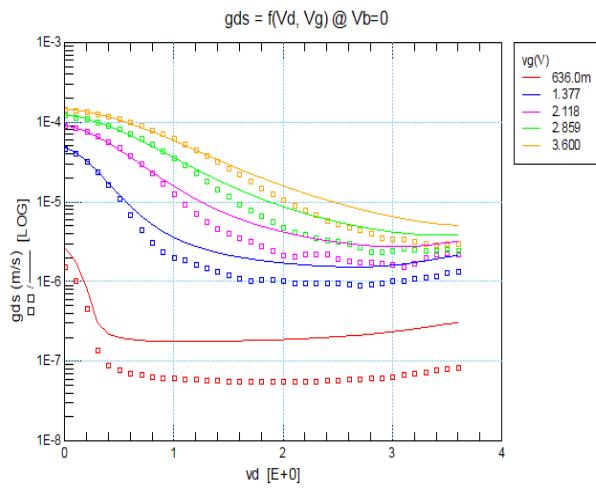
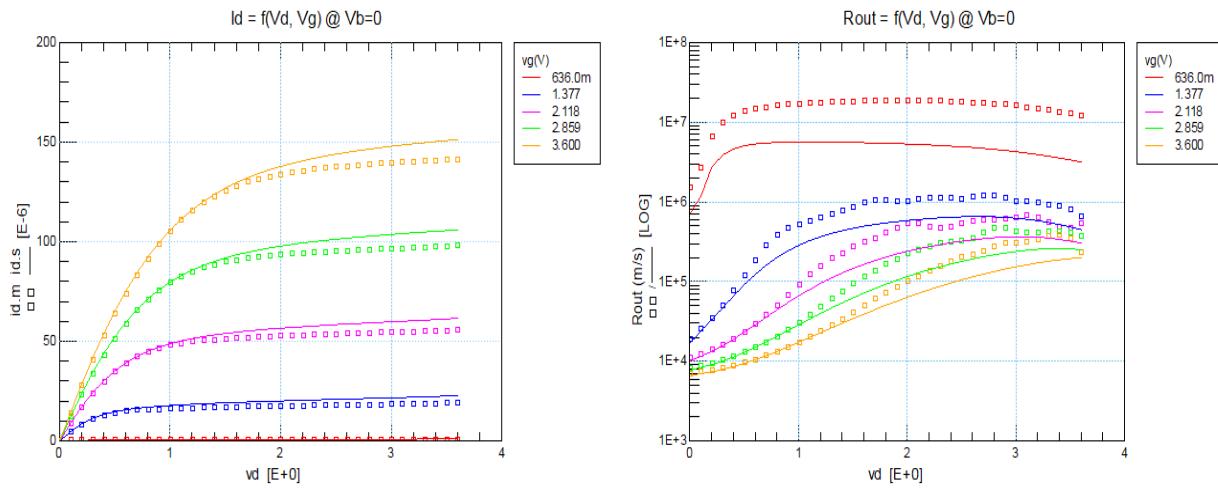
$i_{dvg}, V_d = 3.3V, T = 125^\circ C$

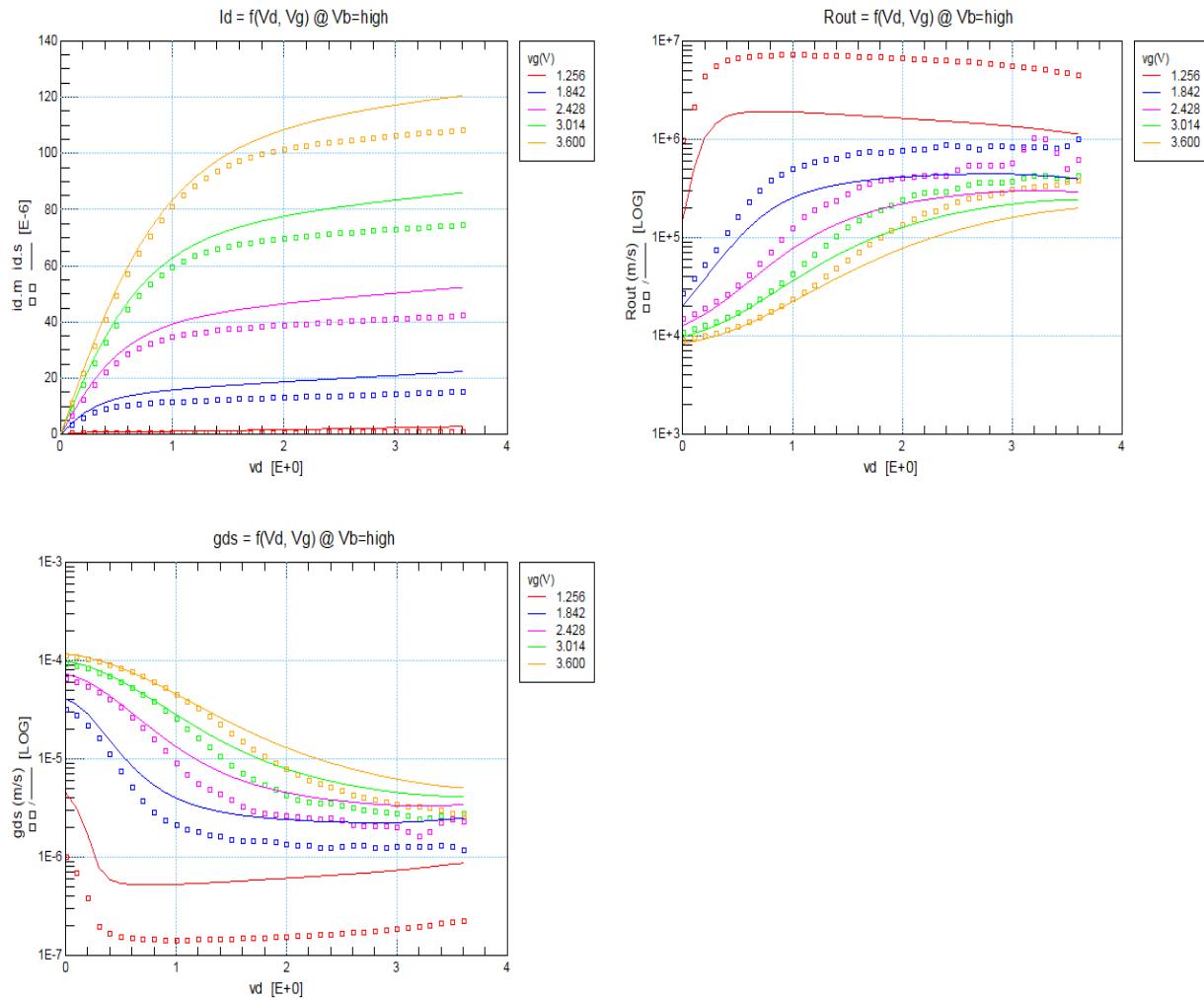
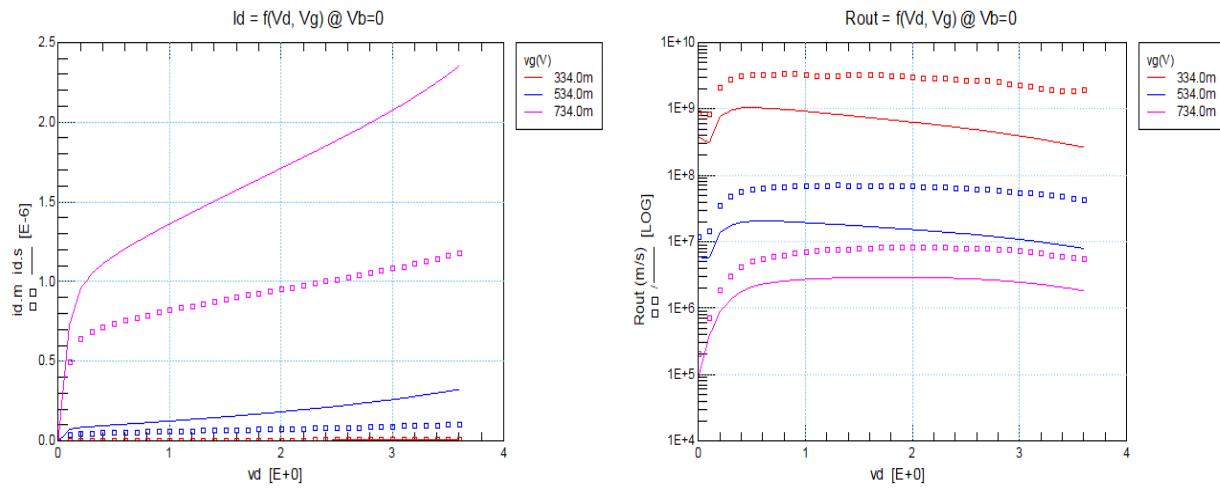


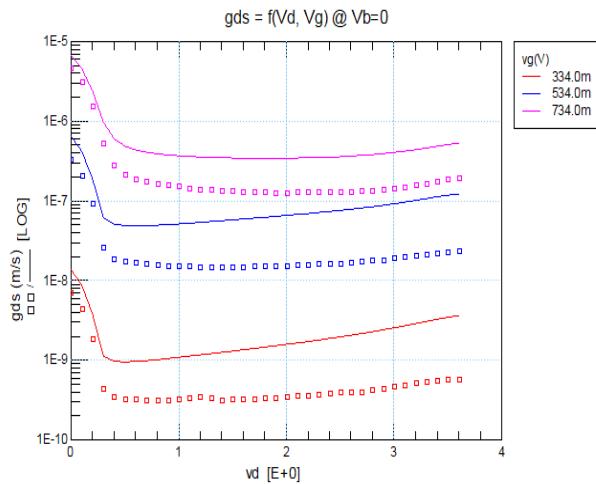


idvg, lb, lg, Vb = 0V, T = 125°C

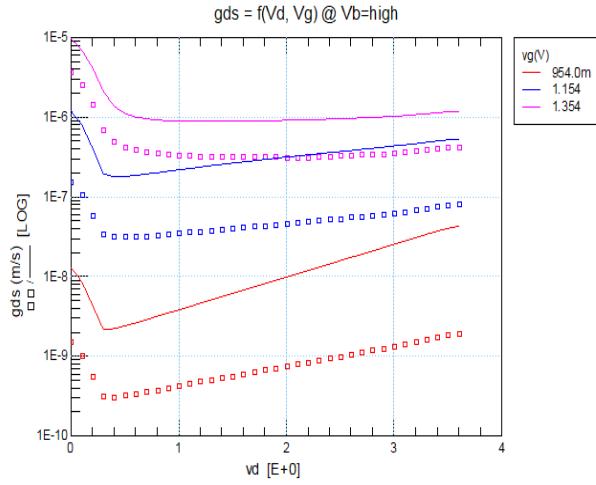
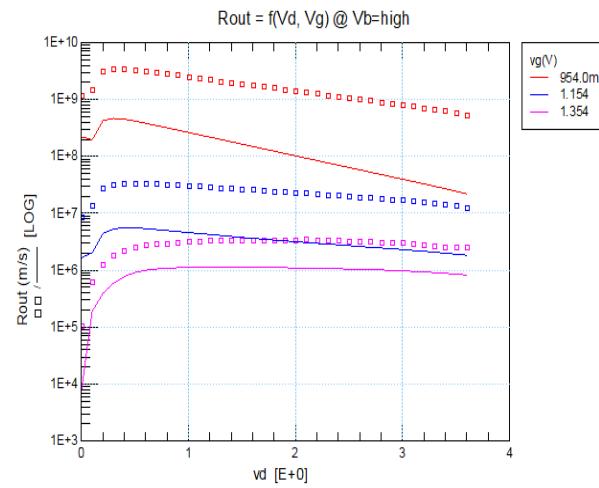
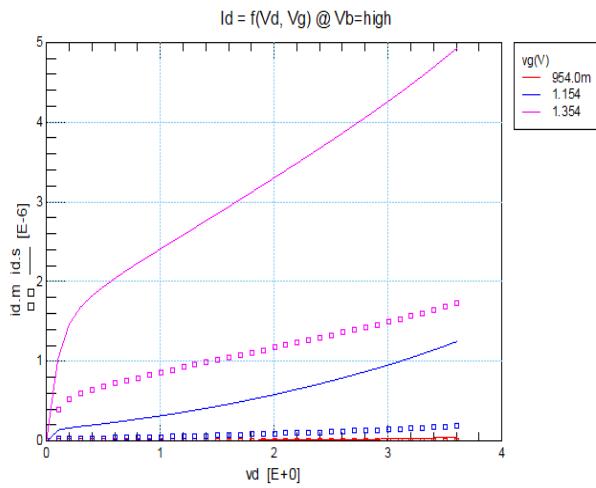


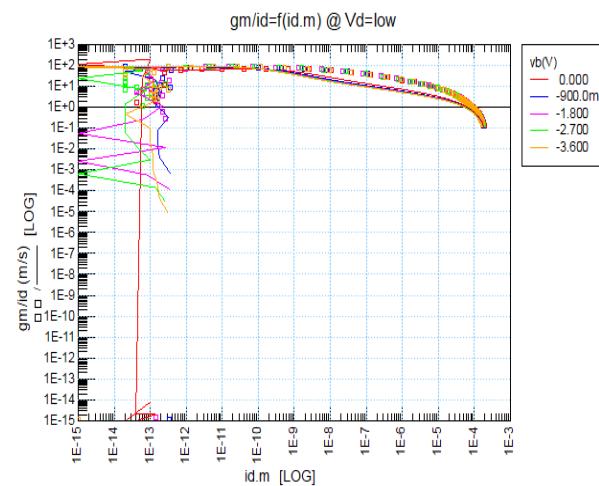
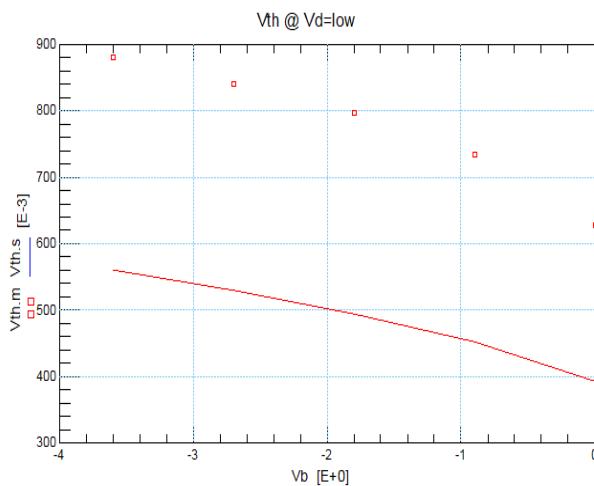
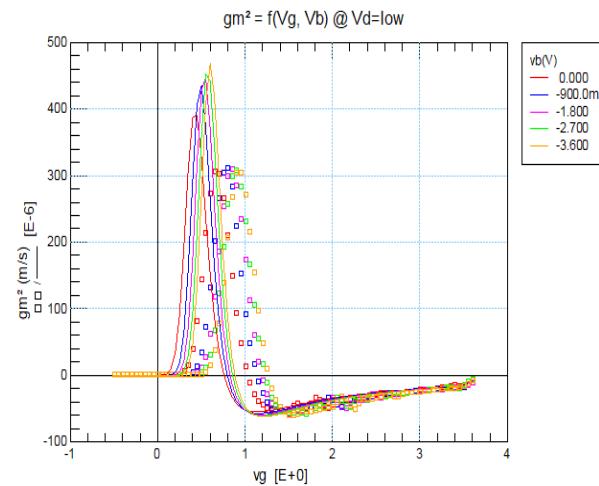
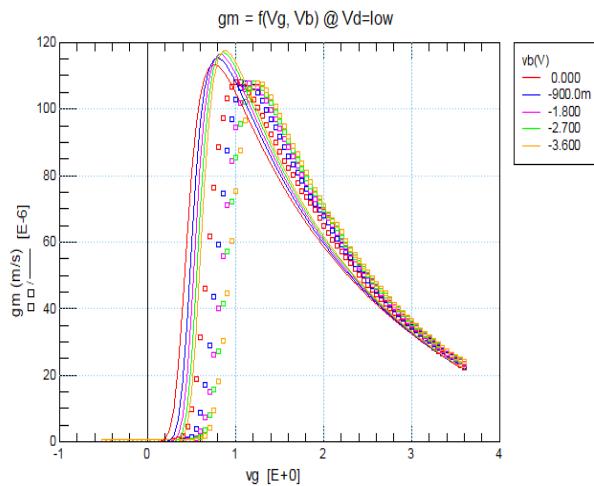
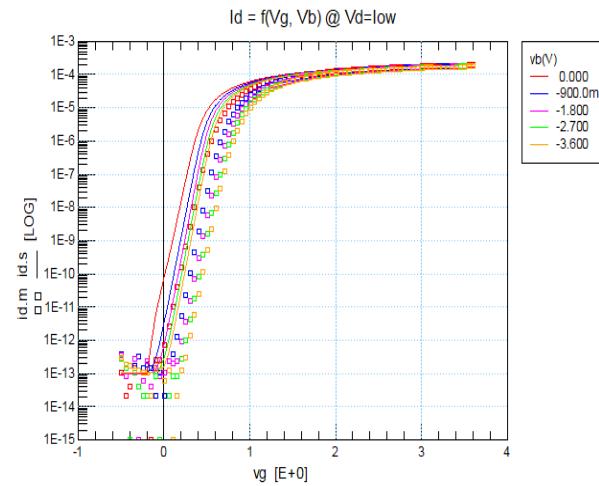
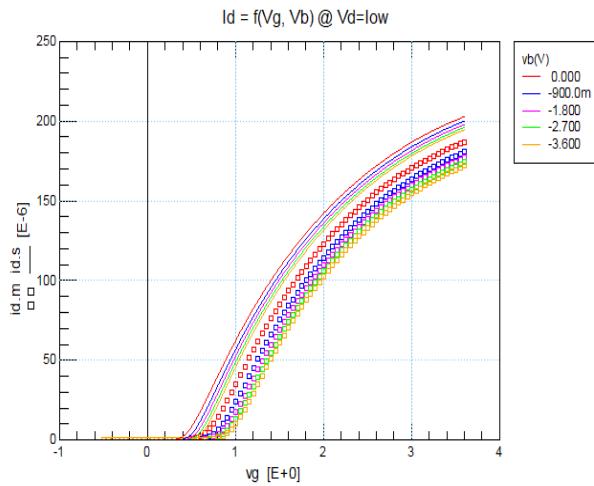
idvg, Ib,Ig, Vb = -3.6V, T = 125°C

idvd, Vb = 0V, T = 125°C


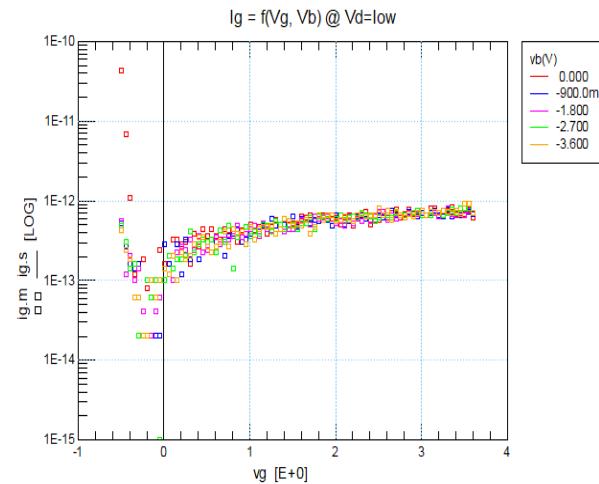
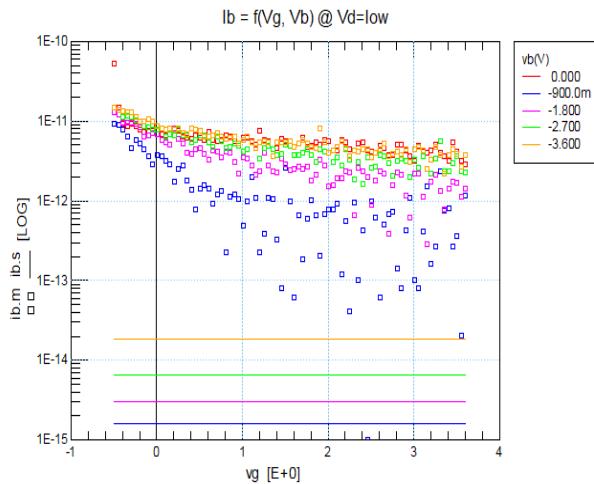
idvd_vbmin, Vb = -3.6V, T = 125°C**idvd_vth, Vb = 0V, T = 125°C**



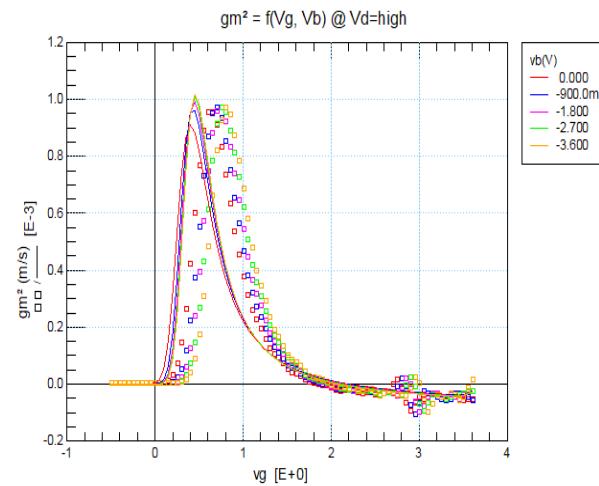
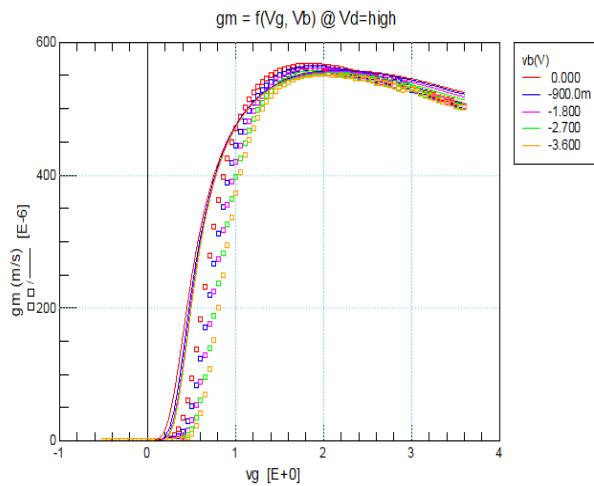
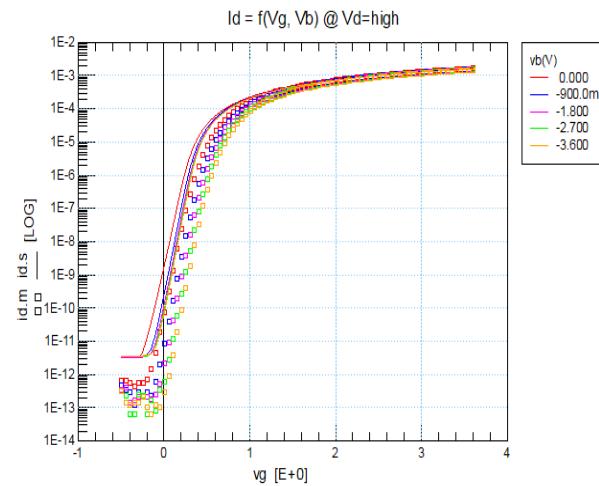
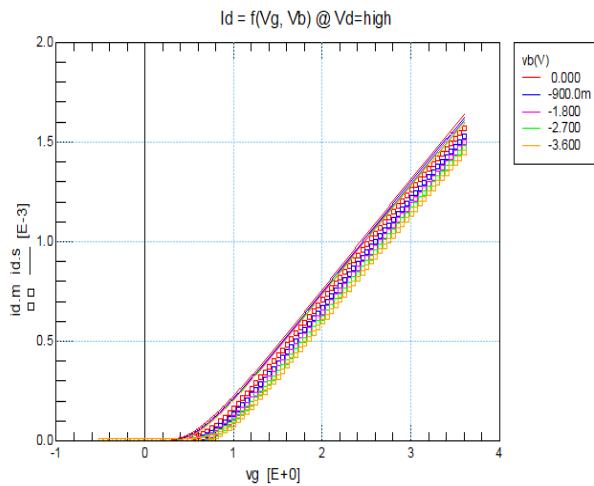
idvd_vth_vbmin, Vb = -3.6V, T = 125°C

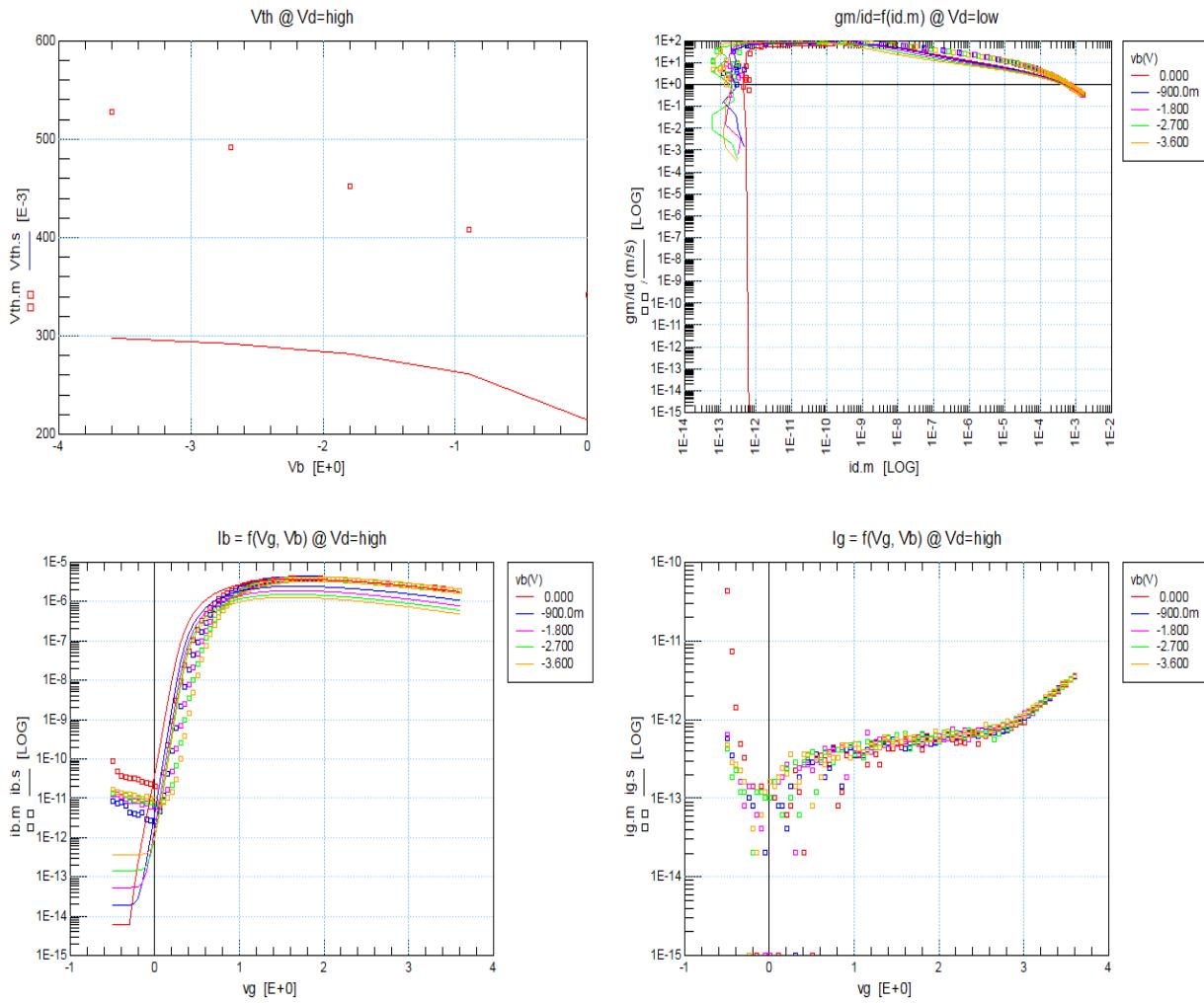


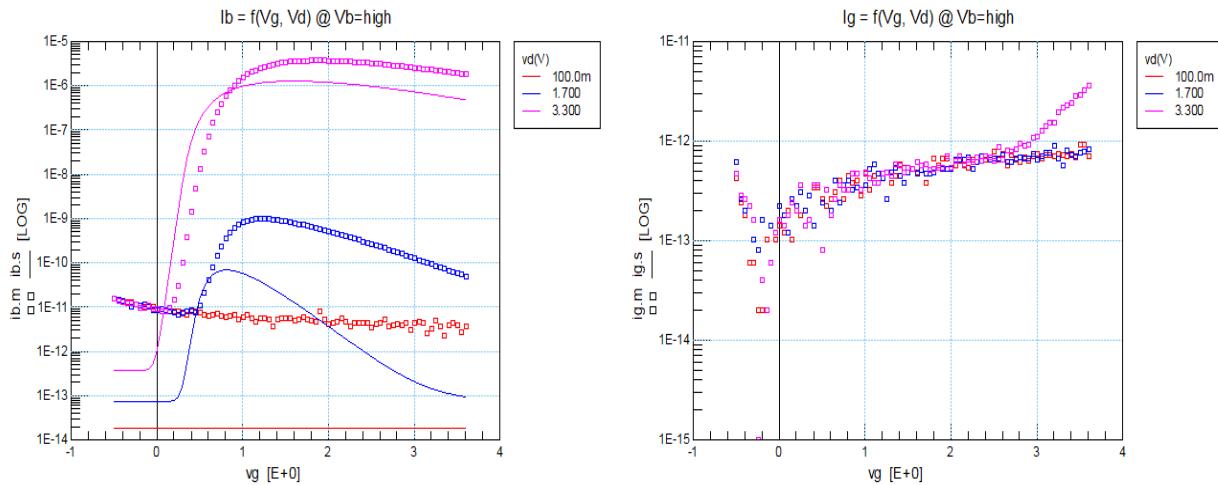
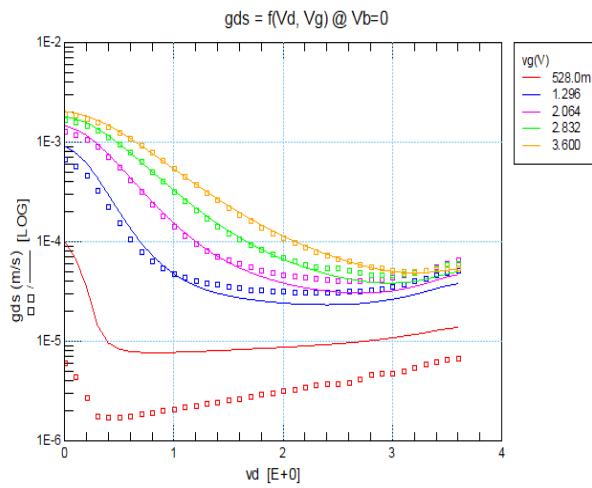
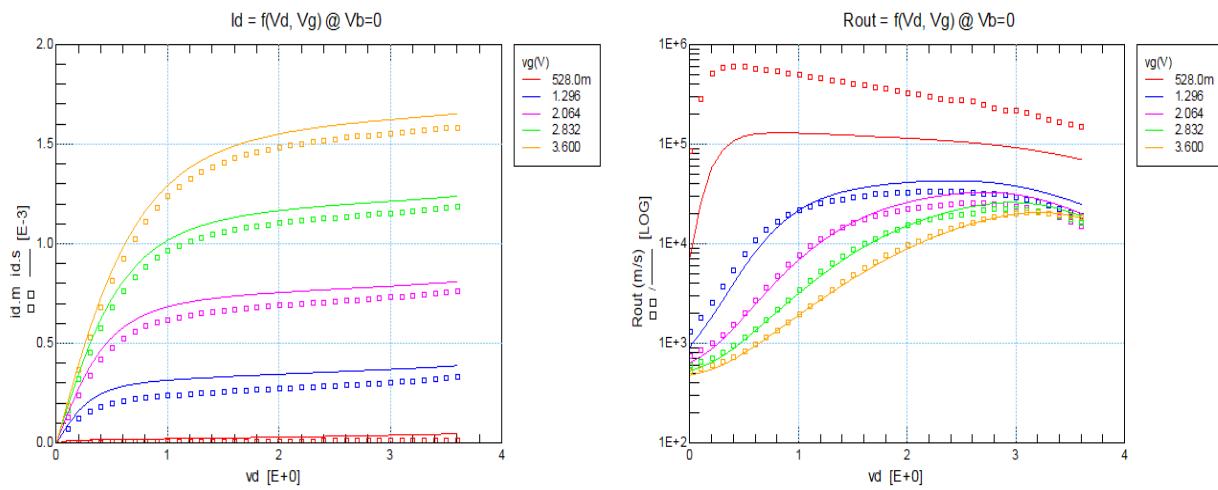
4.23 W02u0_L0u33_S558_2**idvg, Vd = 0.1V, T = 27°C**

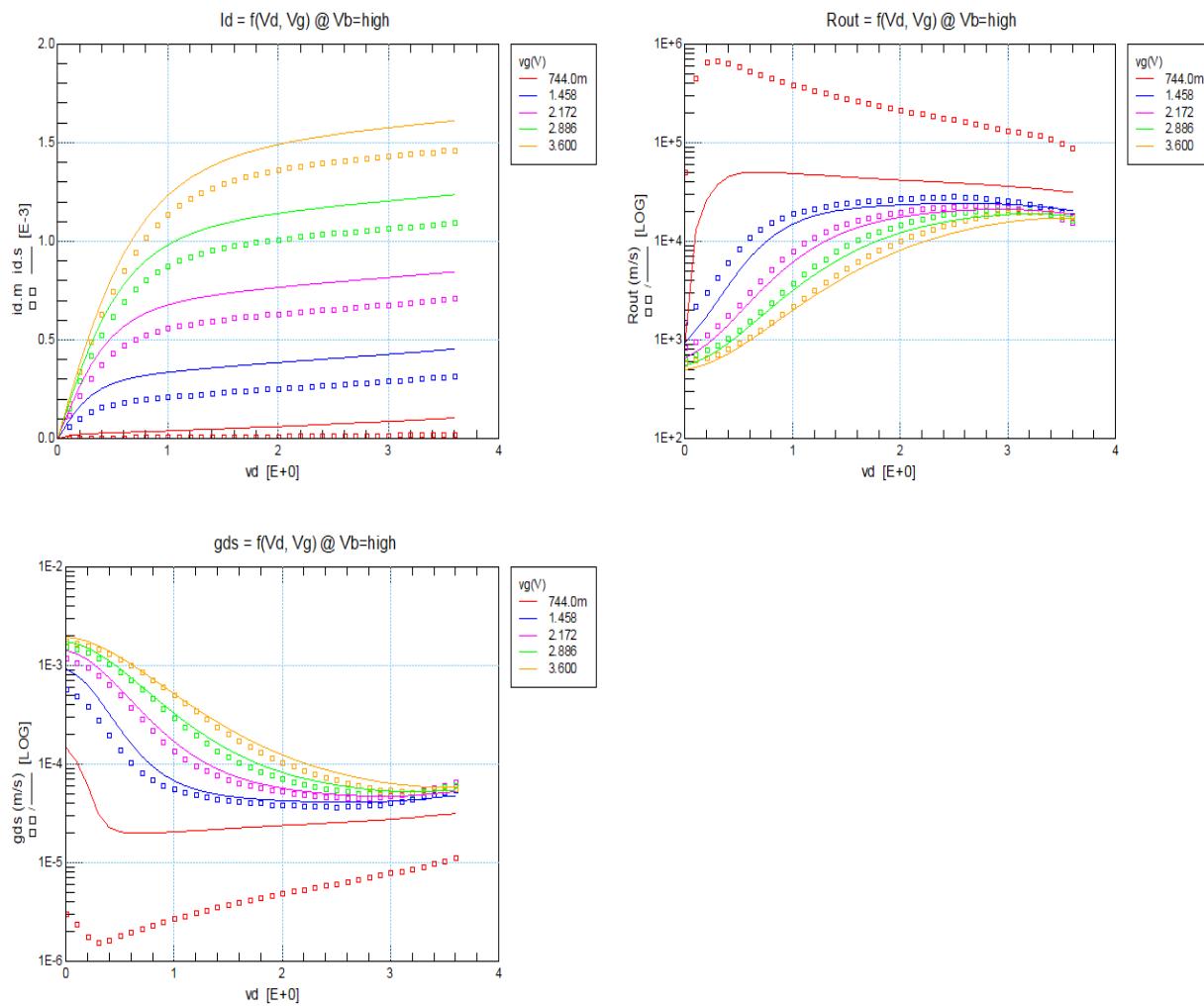
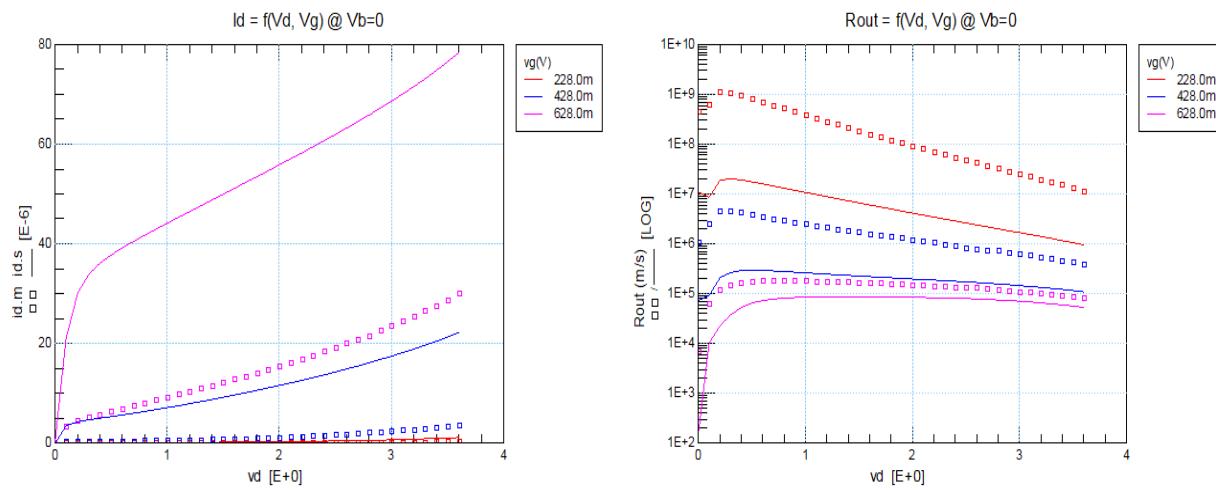


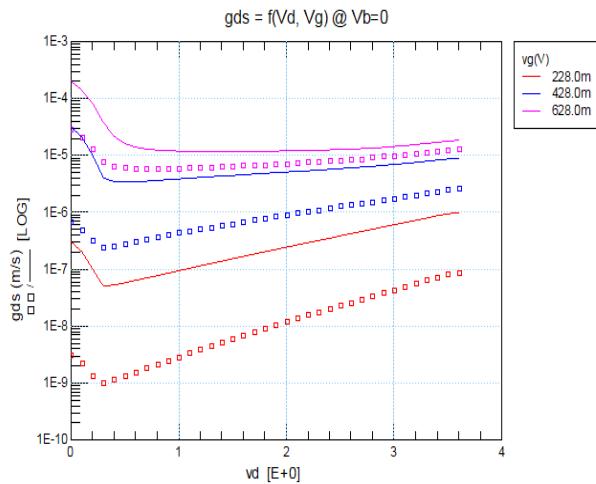
$i_{dvg}, V_d = 3.3V, T = 27^\circ C$



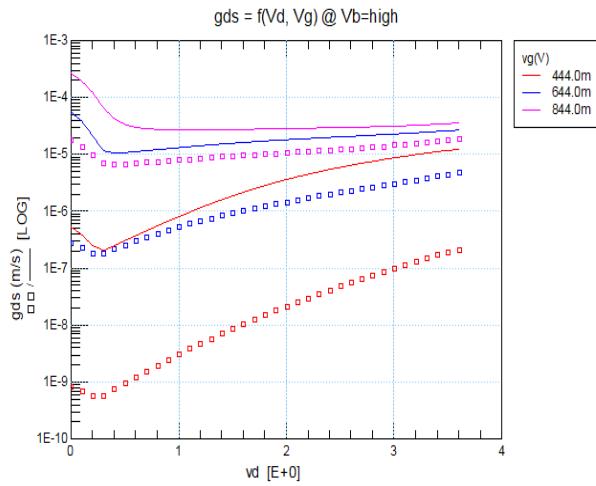
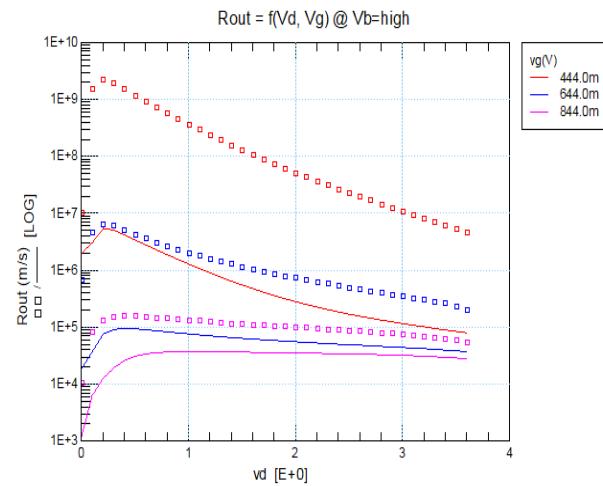
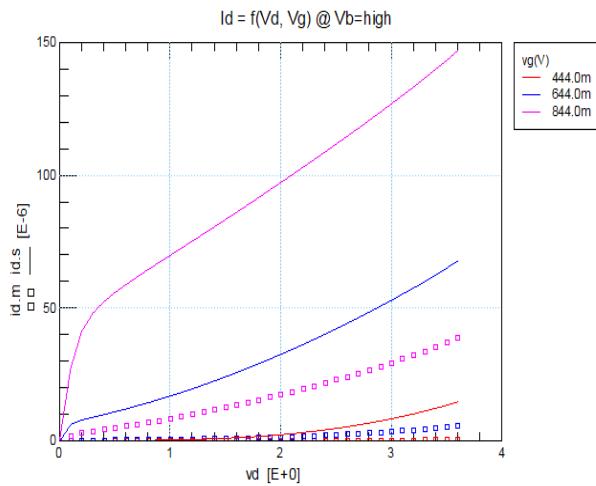


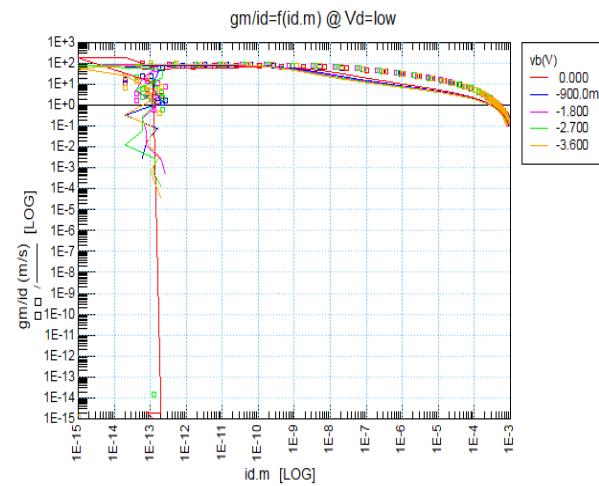
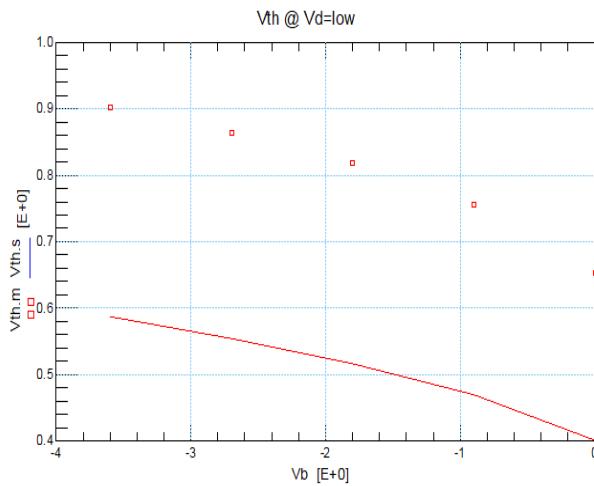
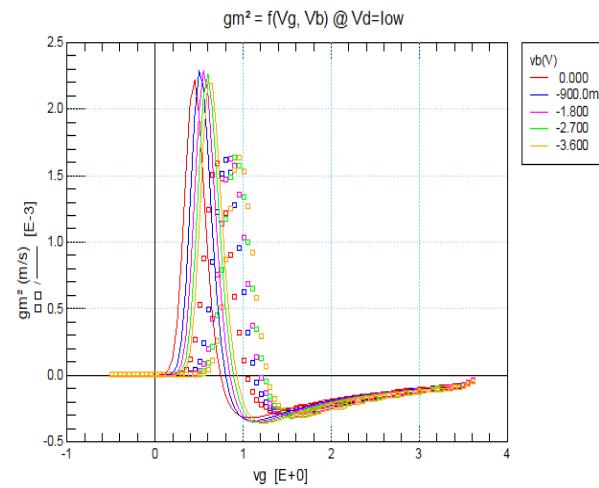
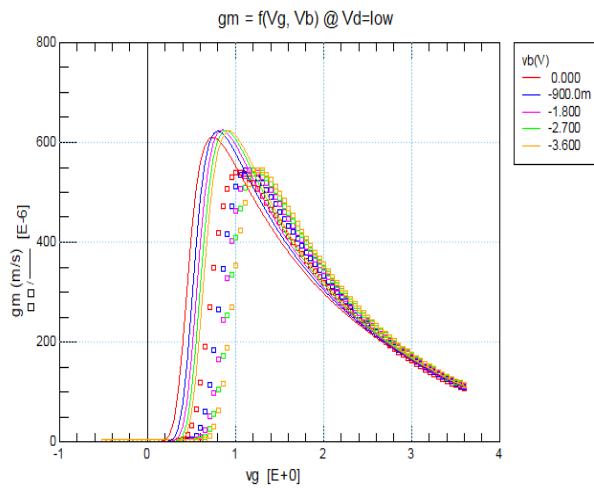
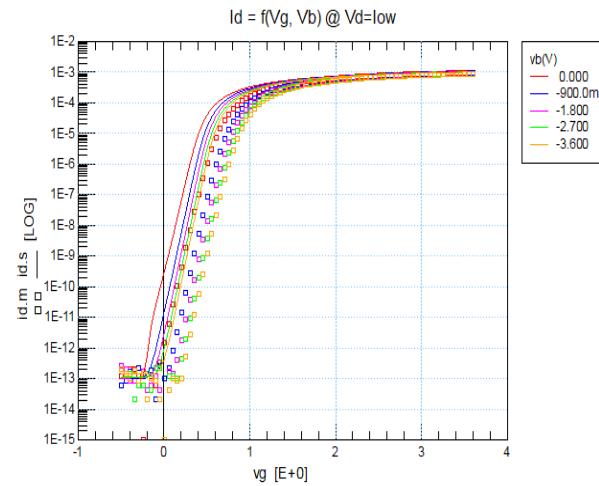
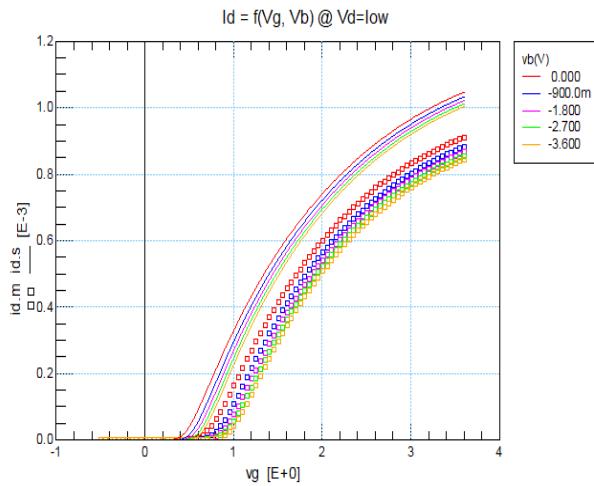
idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


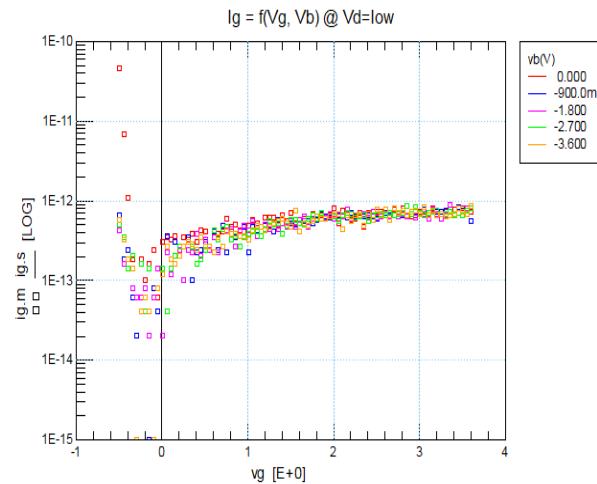
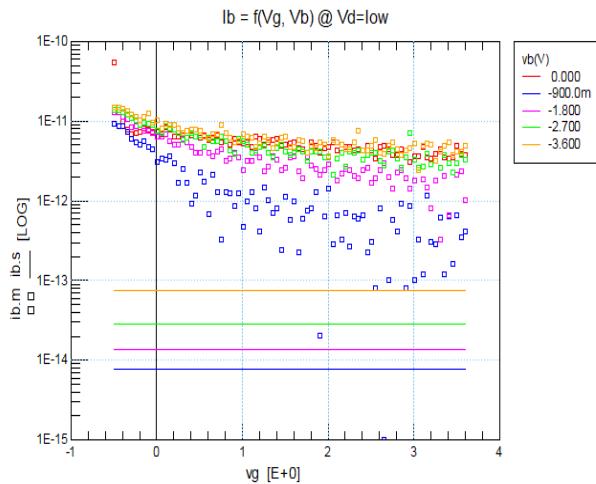
idvd_vbmin, Vb = -3.6V, T = 27°C**idvd_vth, Vb = 0V, T = 27°C**



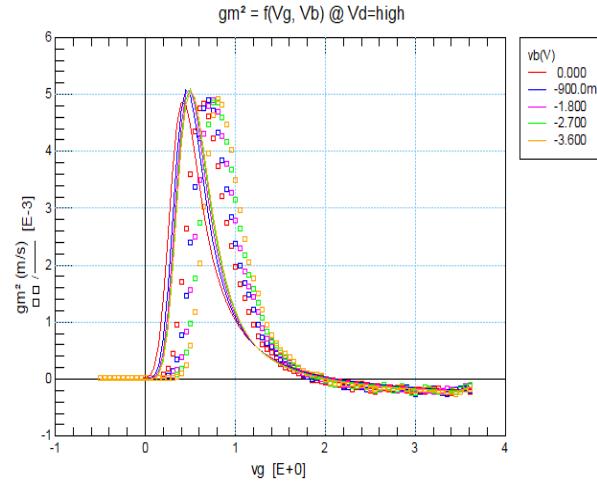
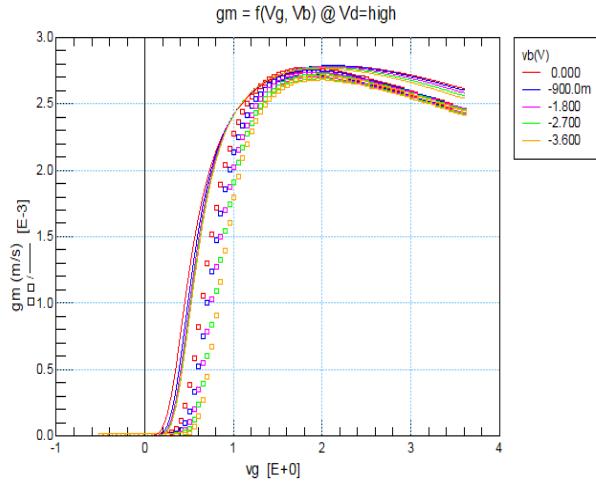
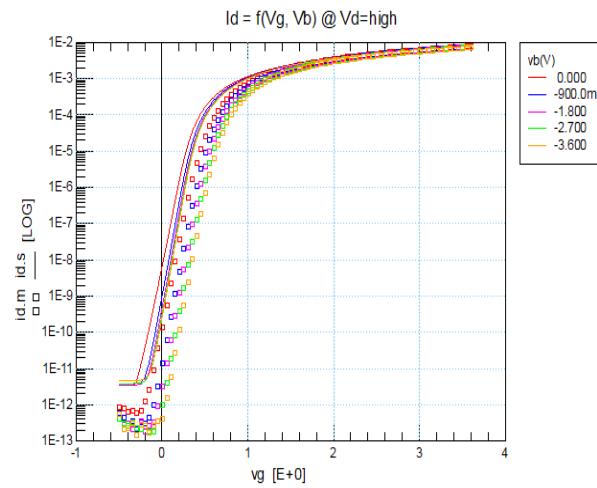
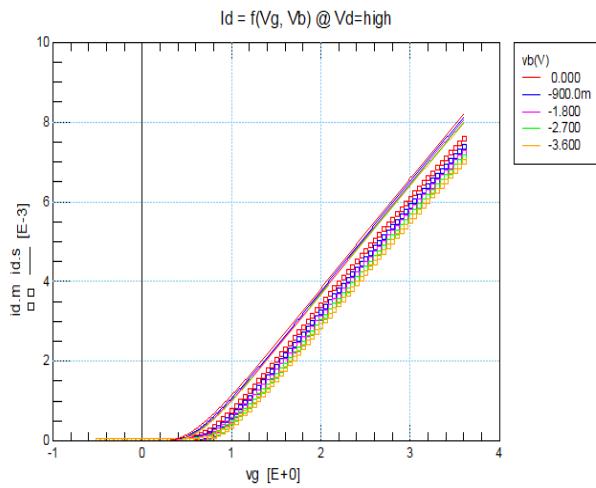
idvd_vth_vbmin, Vb = -3.6V, T = 27°C

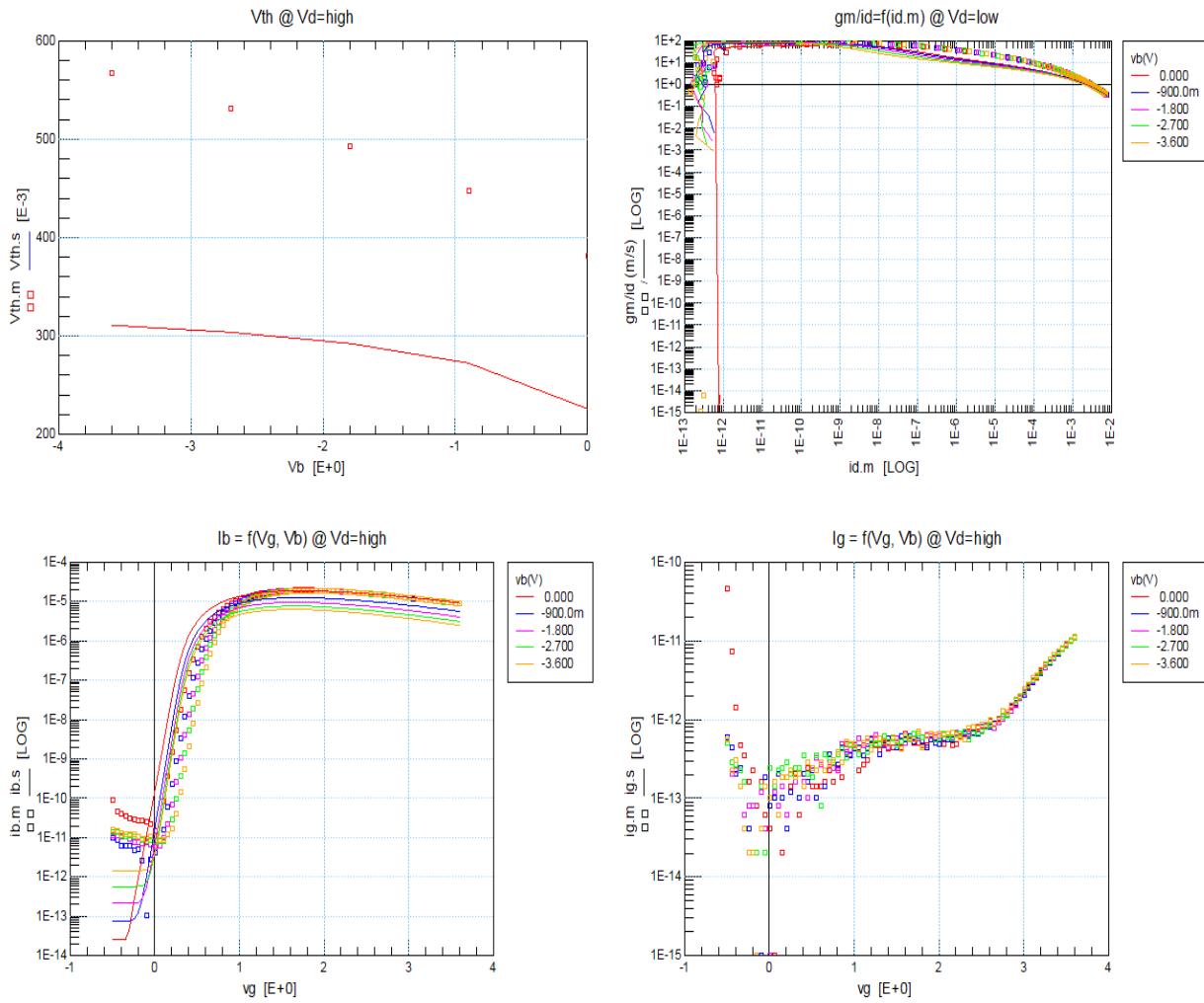


4.24 W10u0_L0u33_S556_2**idvg, Vd = 0.1V, T = 27°C**

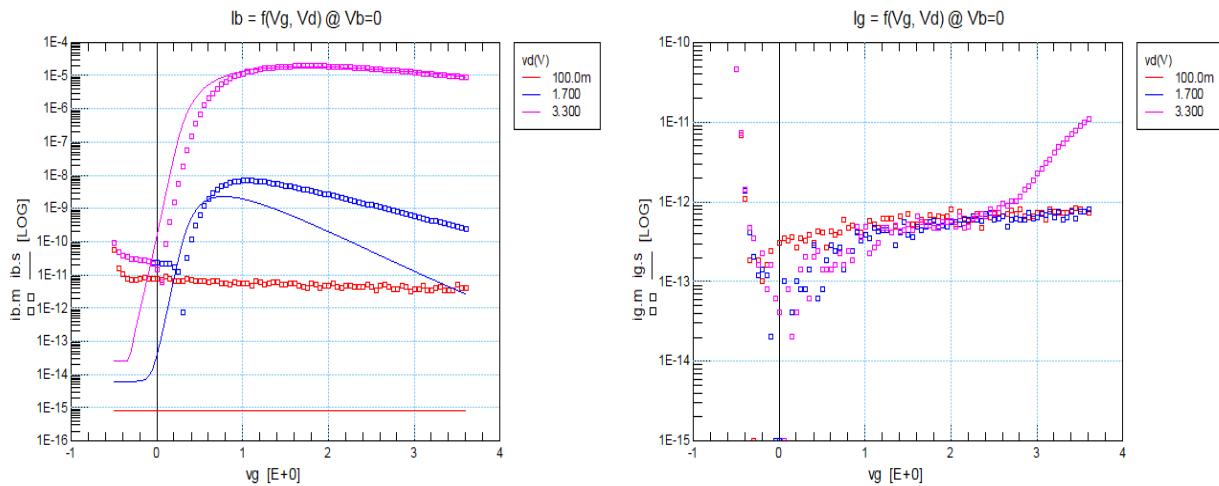


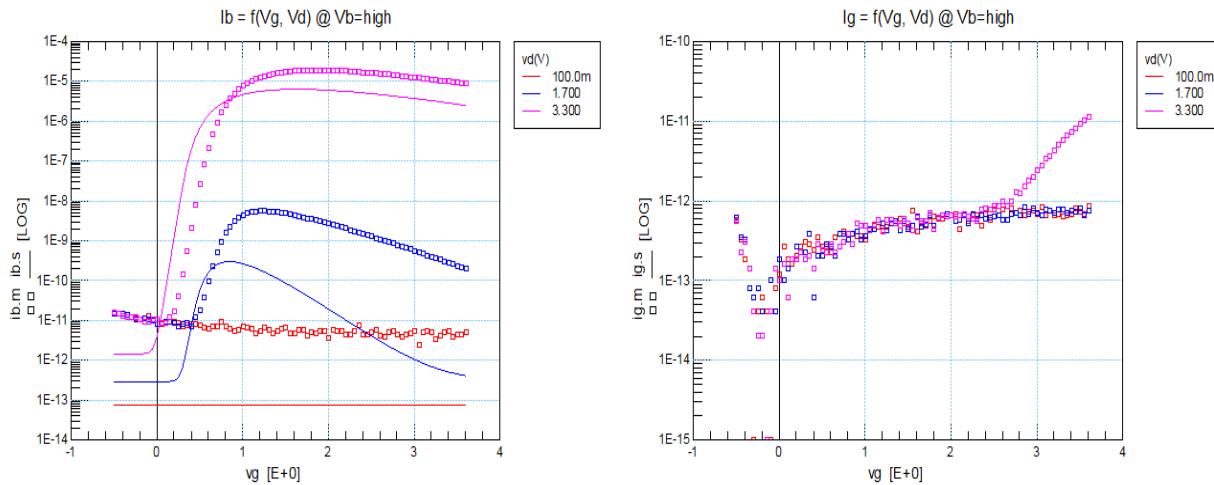
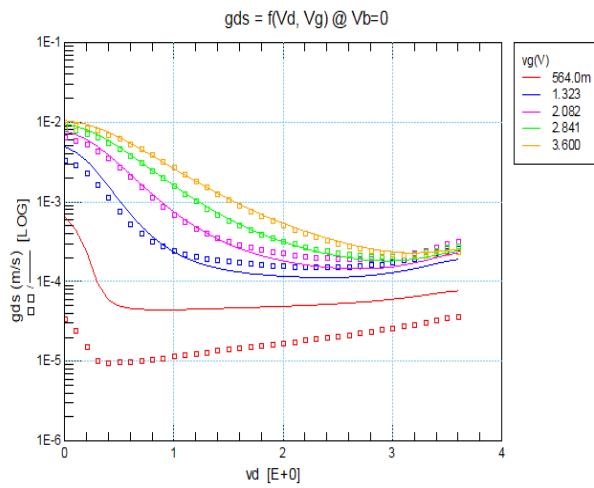
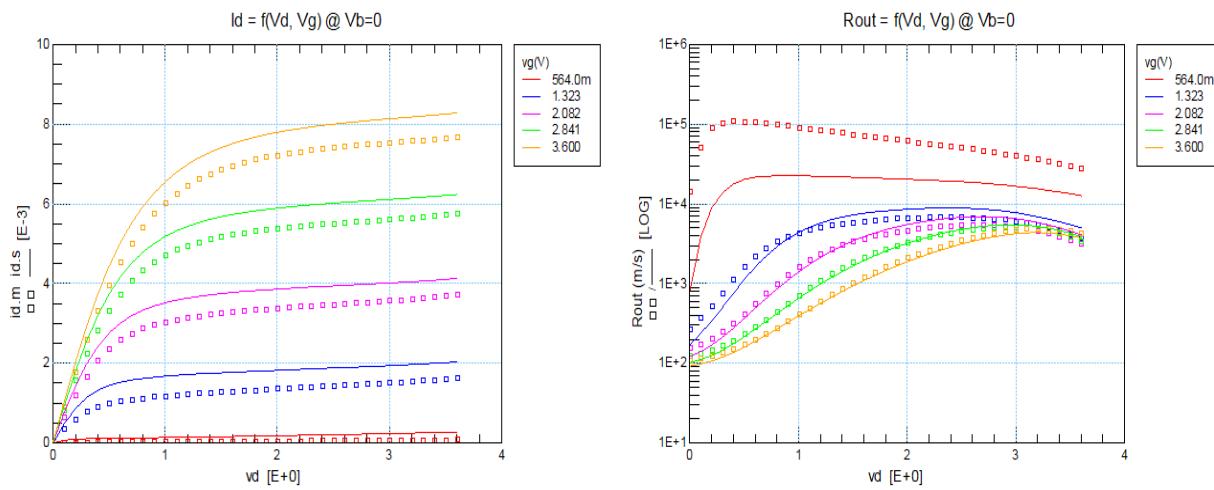
$i_d v_g, V_d = 3.3V, T = 27^\circ C$

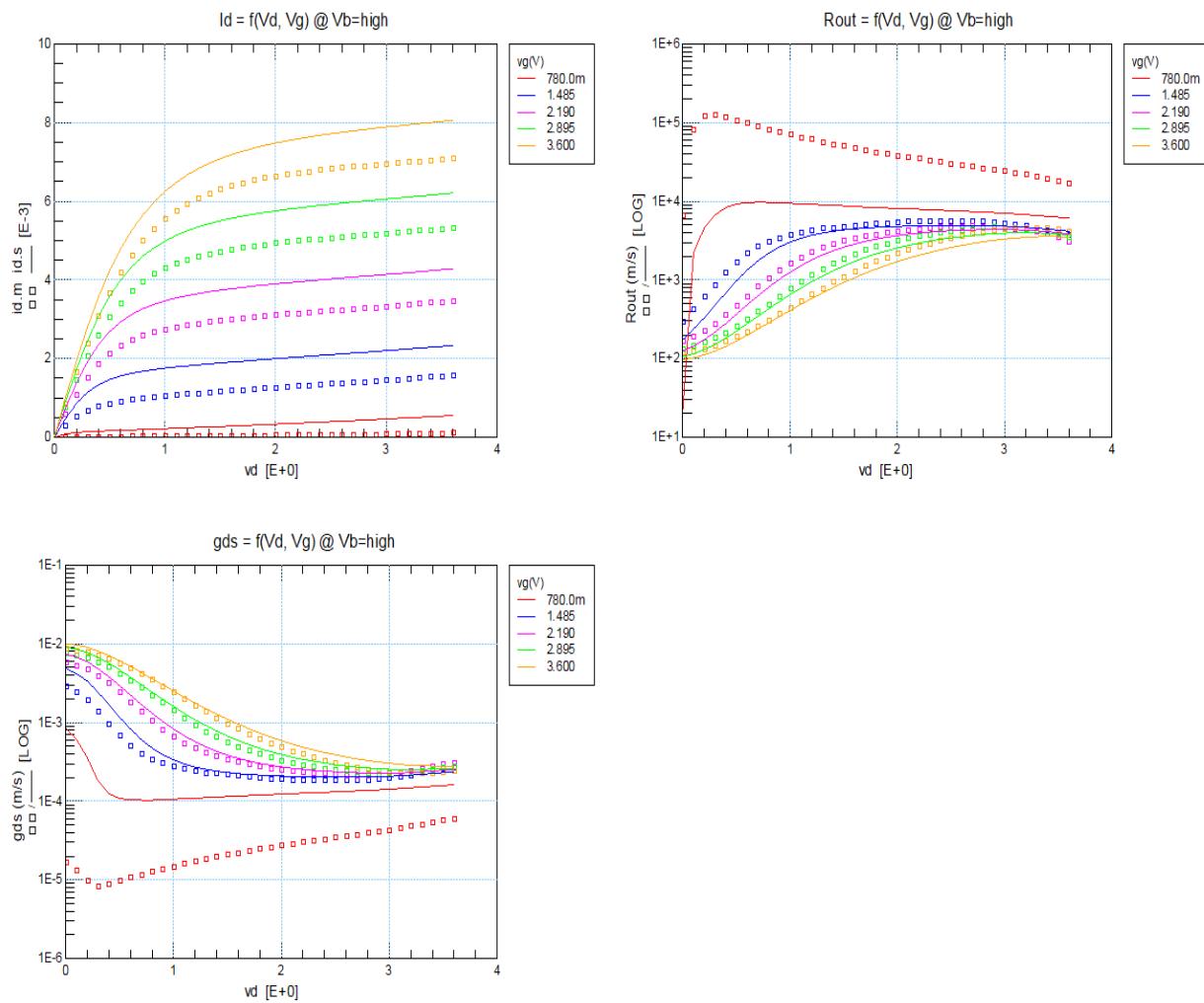
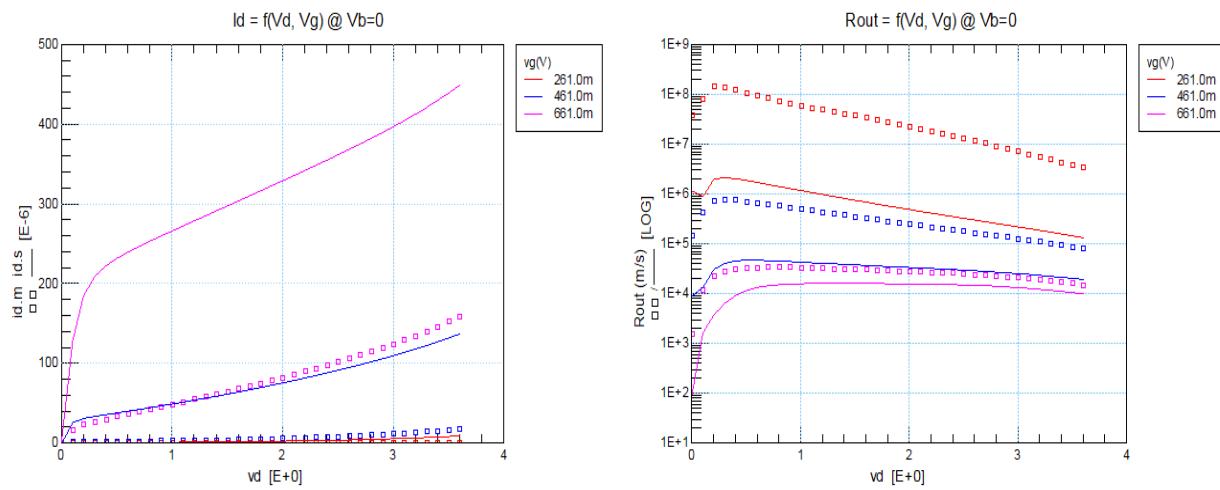


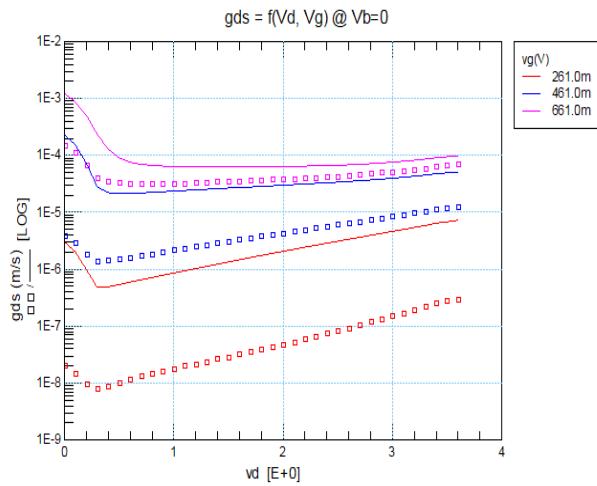


idvg, Ib,Ig, Vb = 0V, T = 27°C

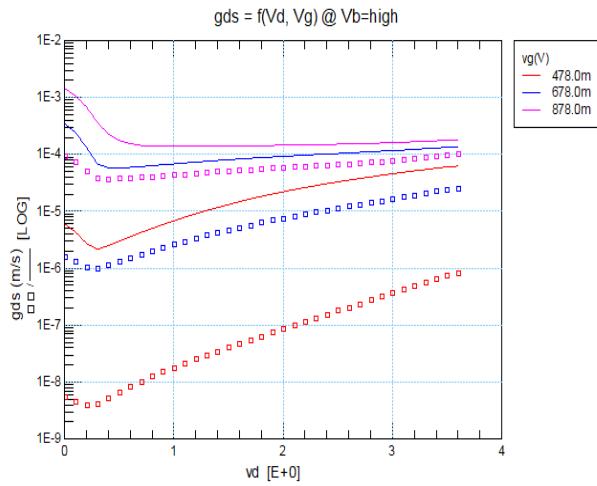
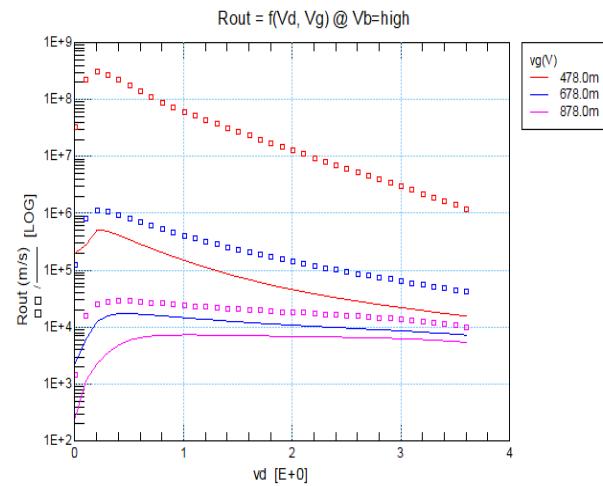
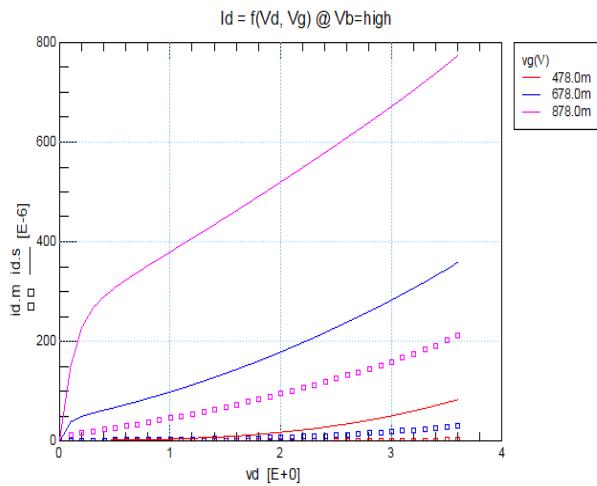


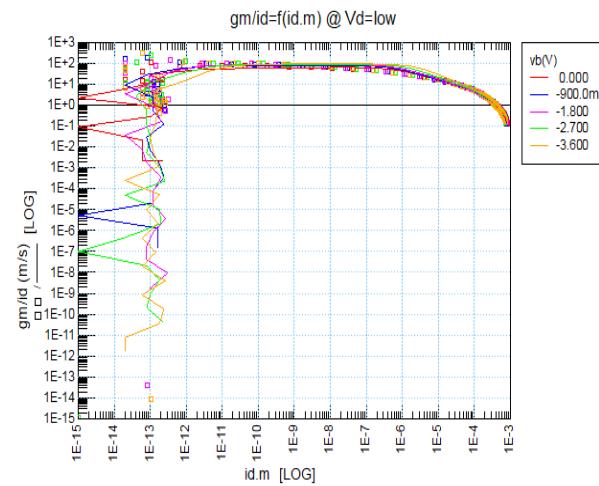
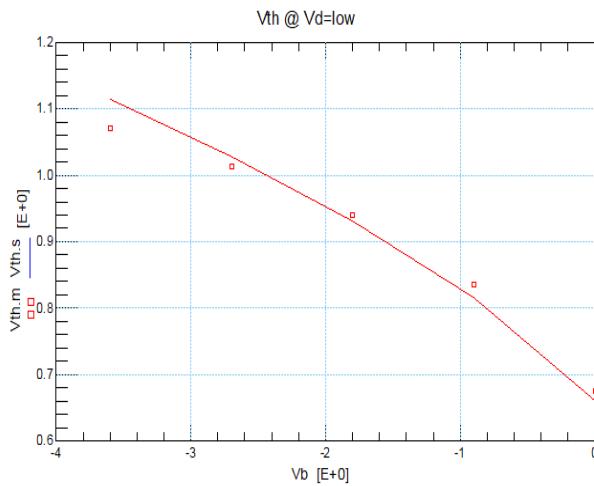
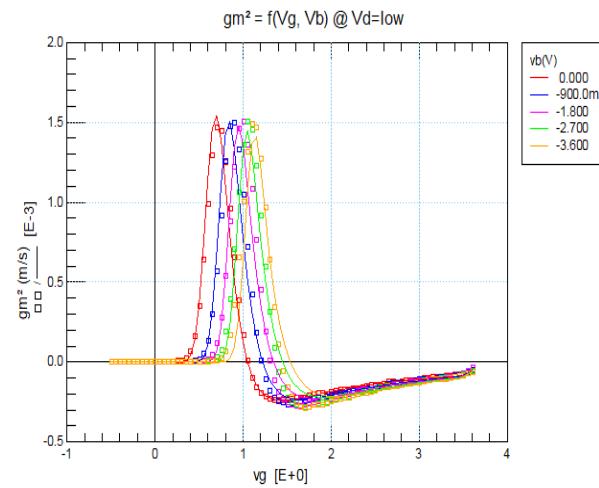
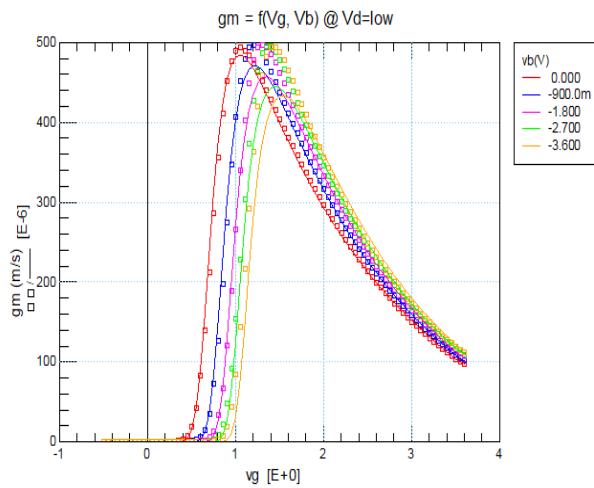
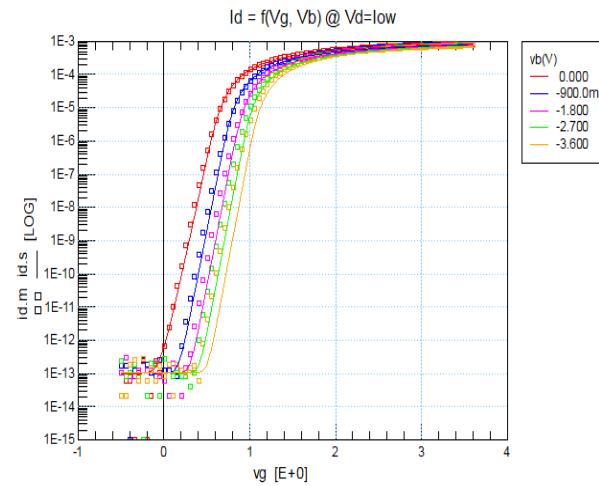
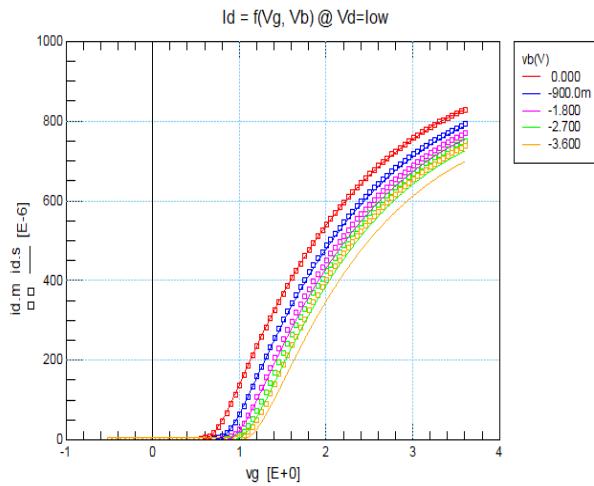
idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


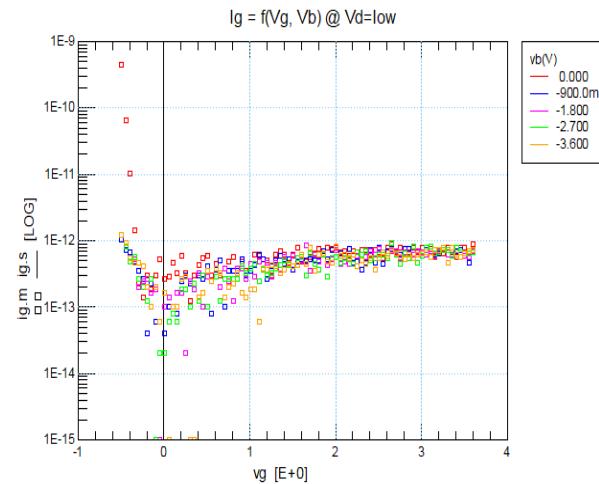
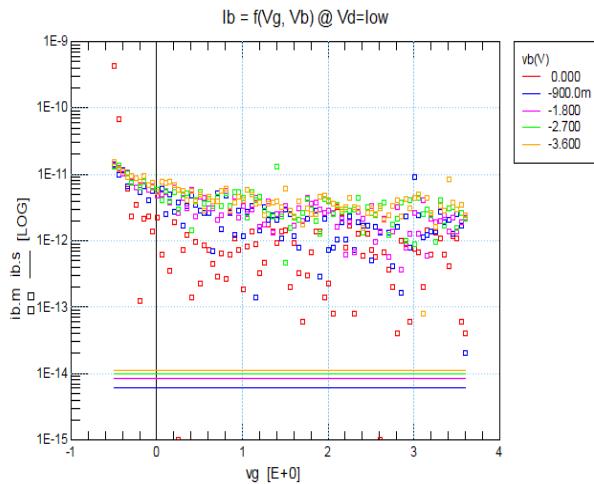
idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C




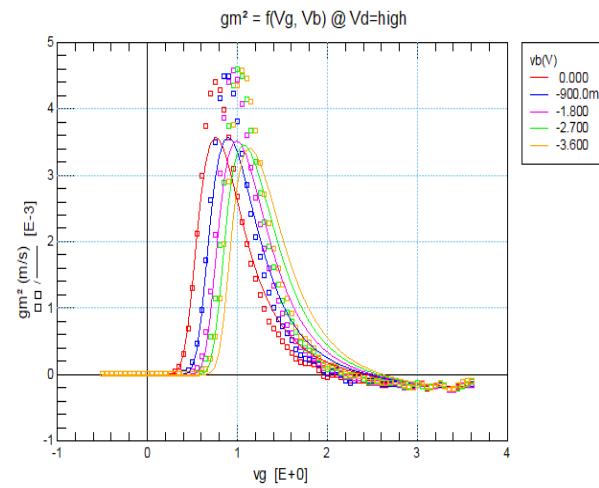
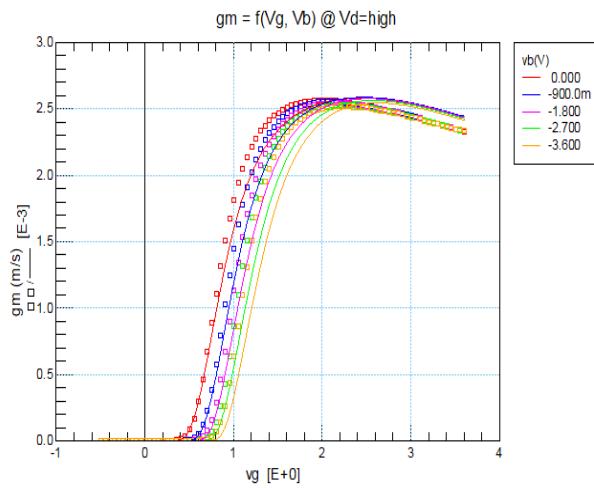
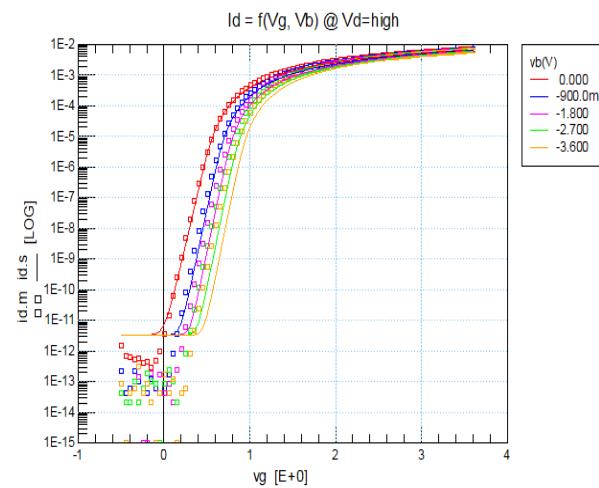
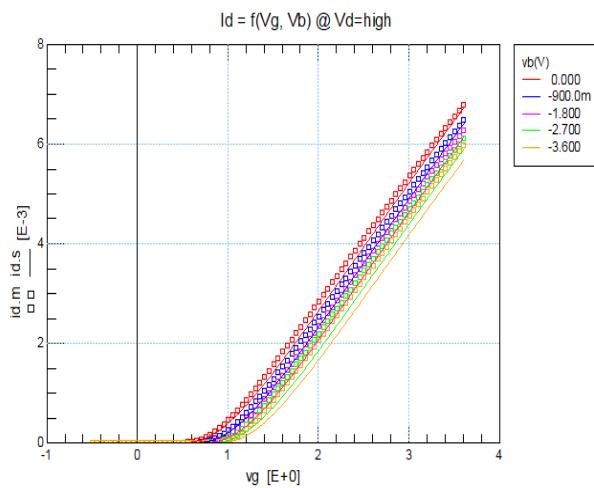
idvd_vth_vbmin, Vb = -3.6V, T = 27°C

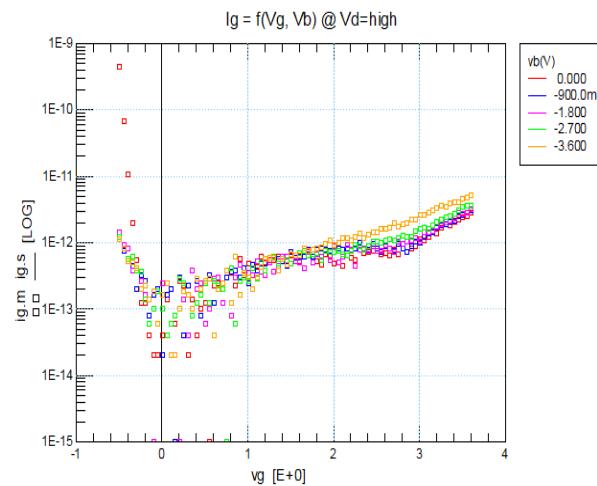
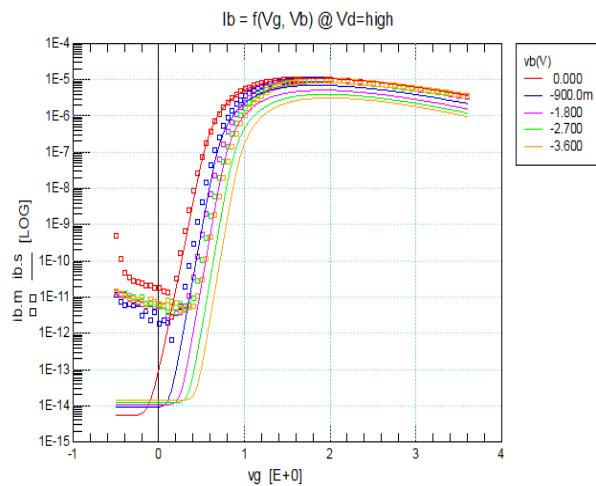
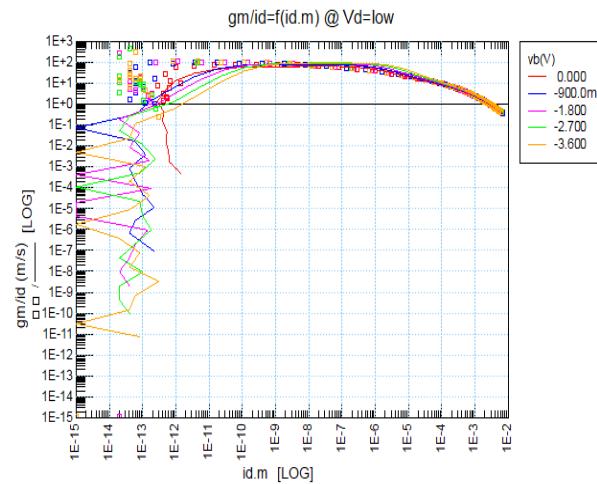
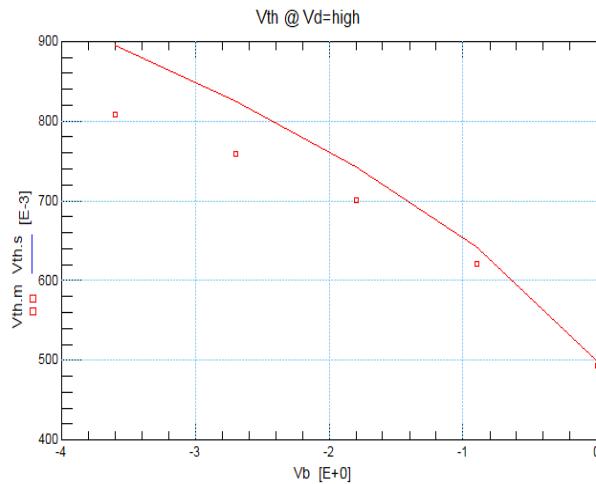


4.25 W10u0_L0u4_T356_S387_4**idvg, Vd = 0.1V, T = 27°C**

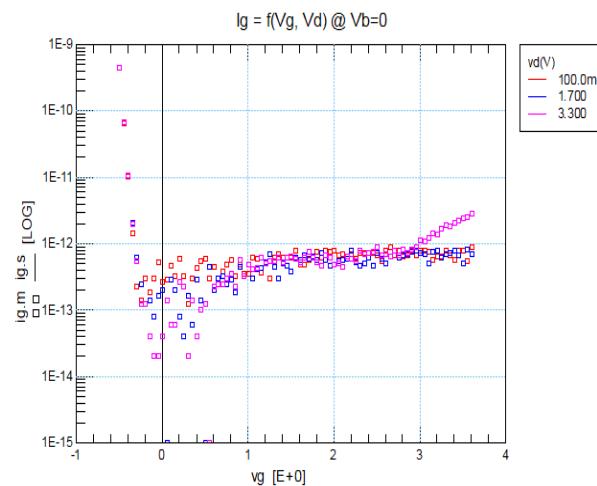
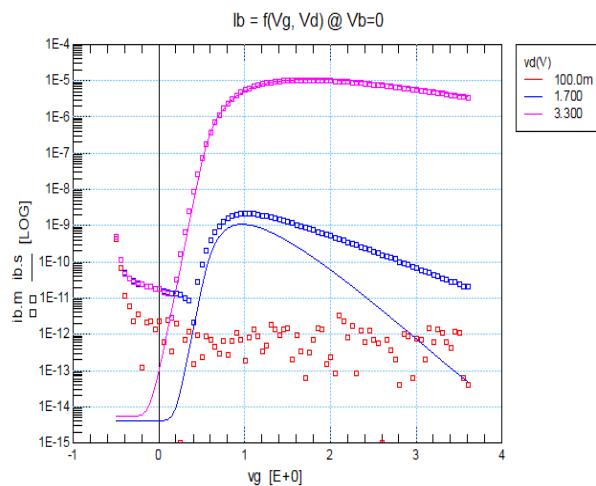


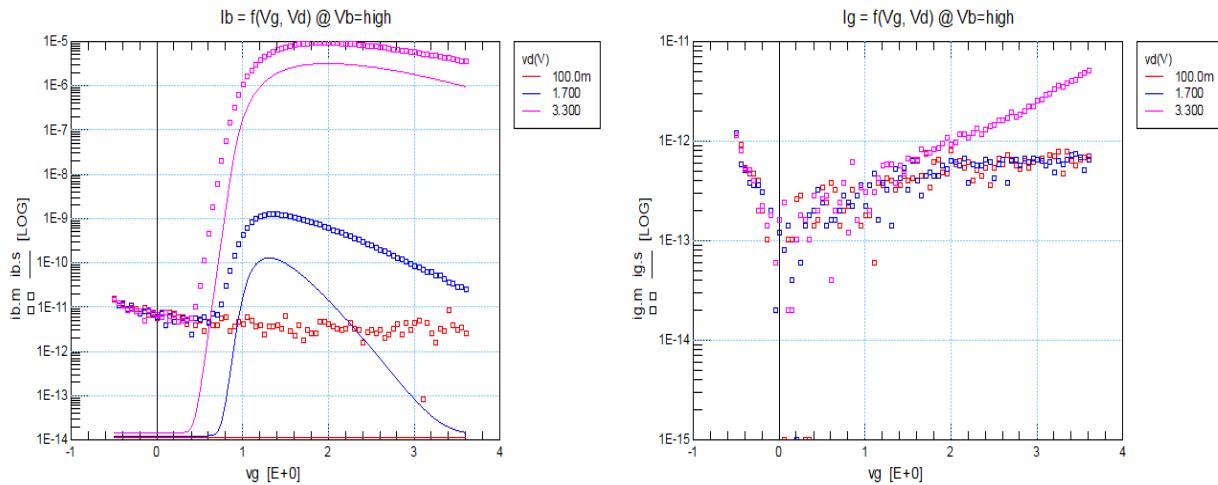
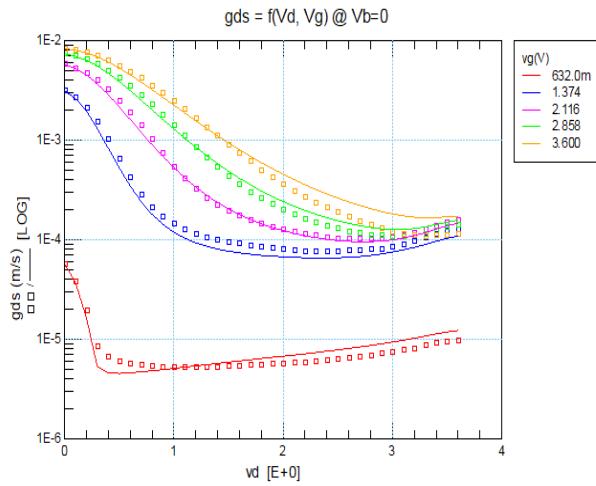
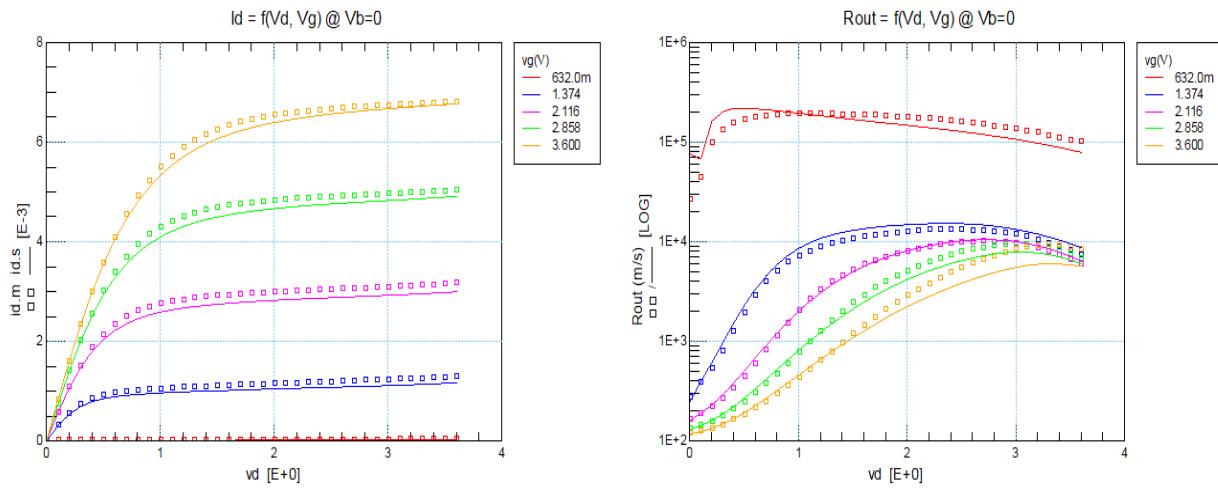
$i_{dvg}, V_d = 3.3V, T = 27^\circ C$

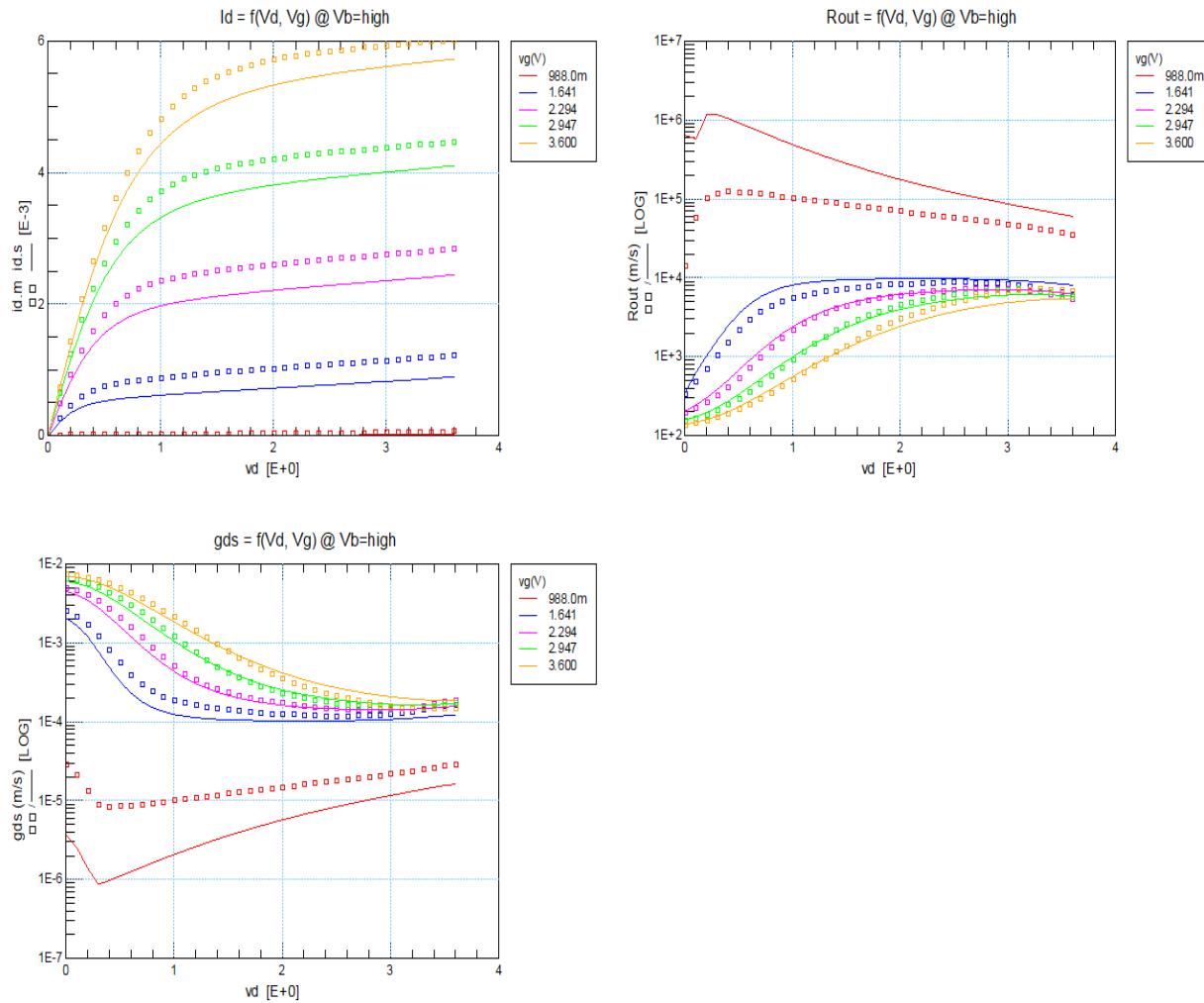
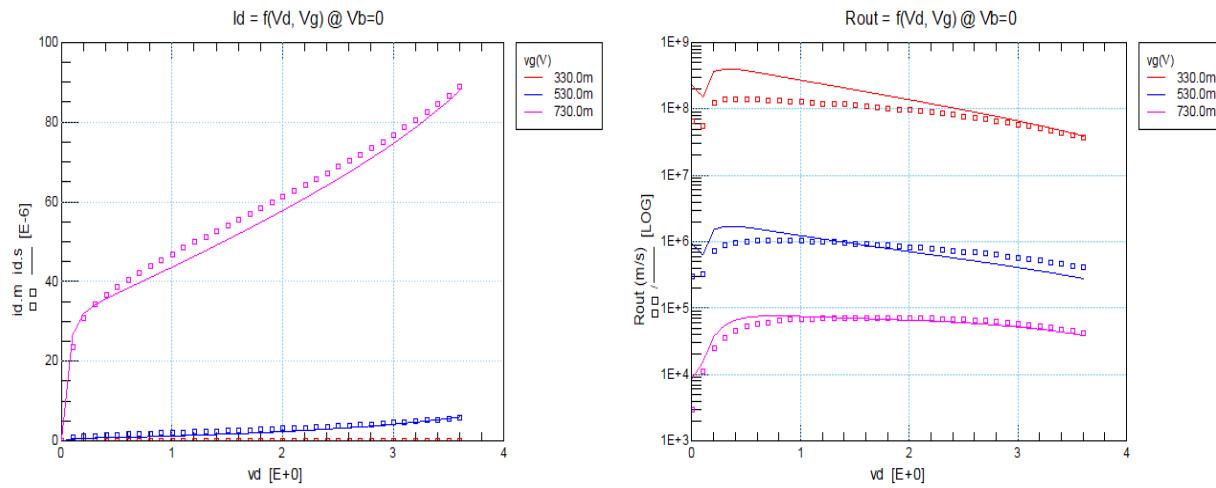


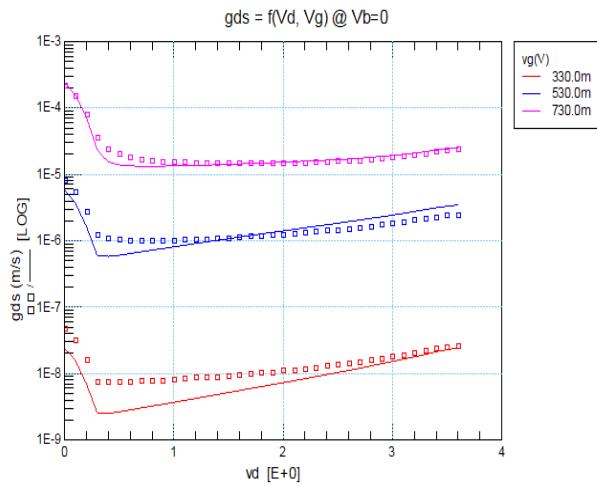


idvg, Ib, Ig, Vb = 0V, T = 27°C

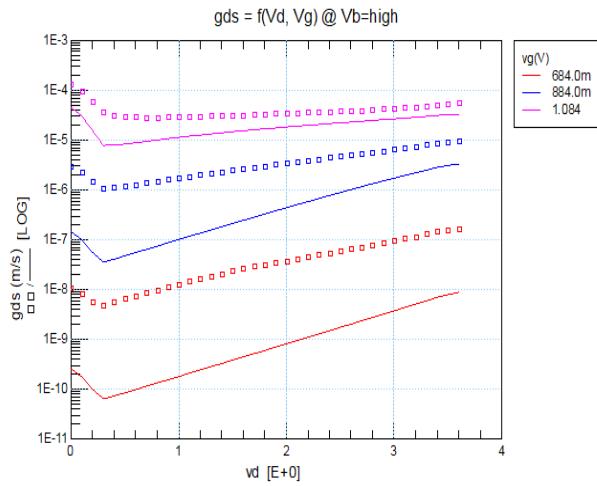
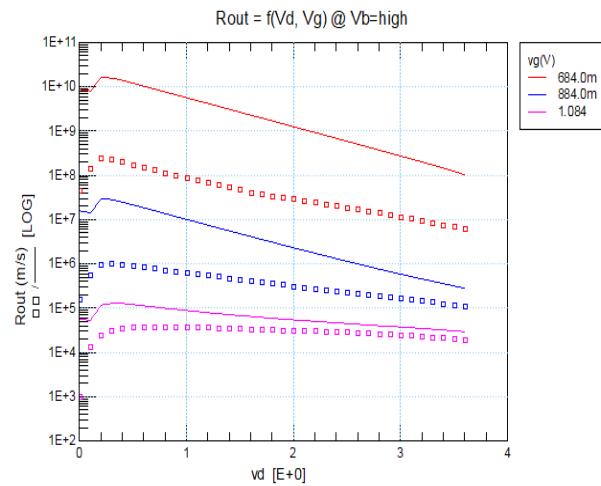
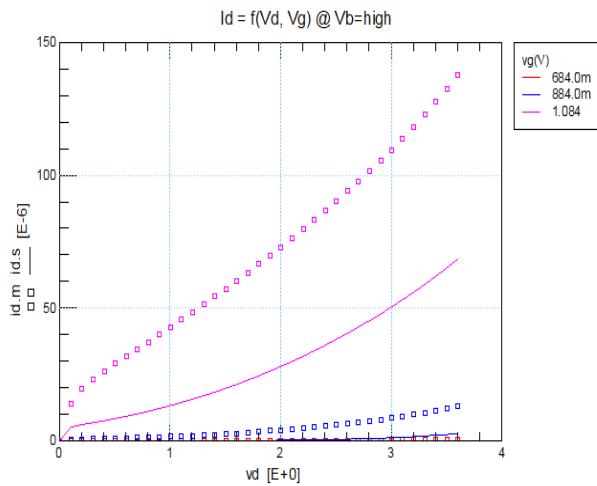


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C**idvd_vth, Vb = 0V, T = 27°C**

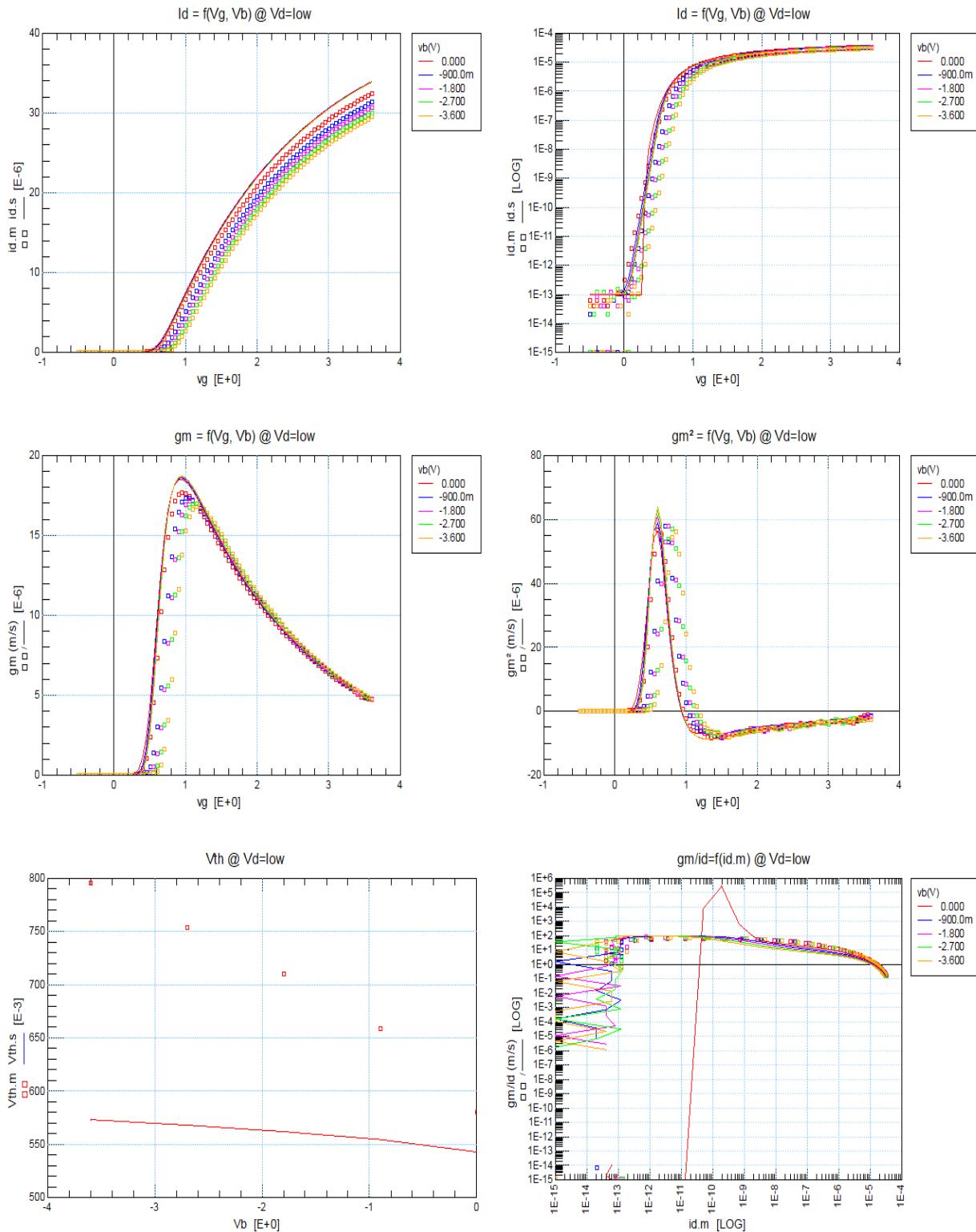


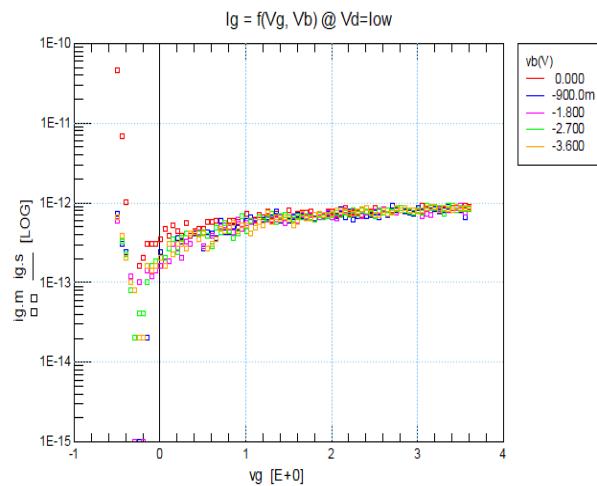
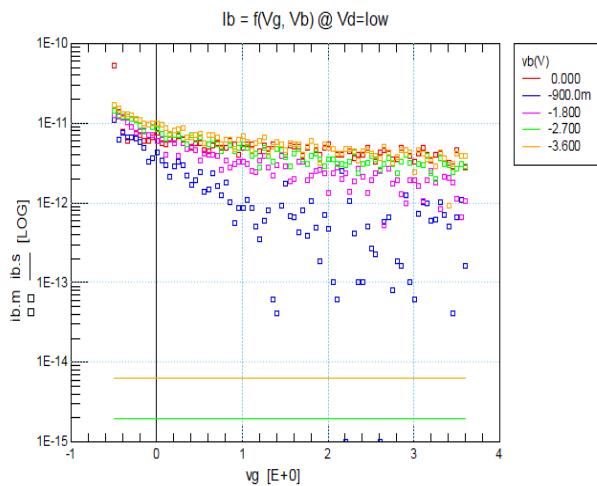
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



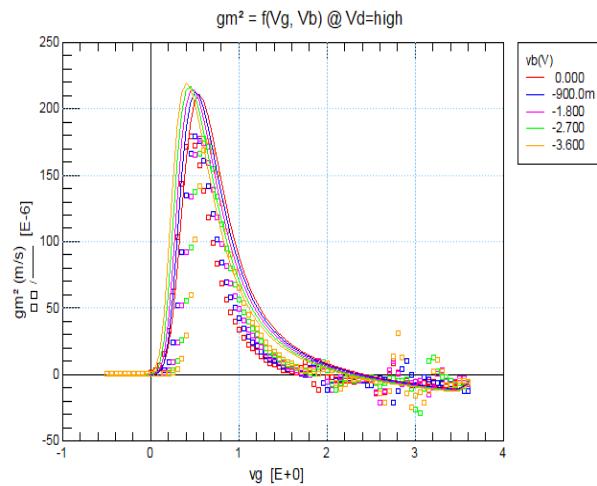
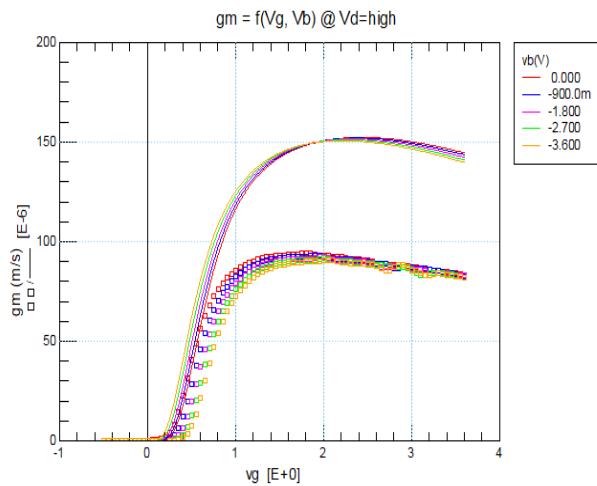
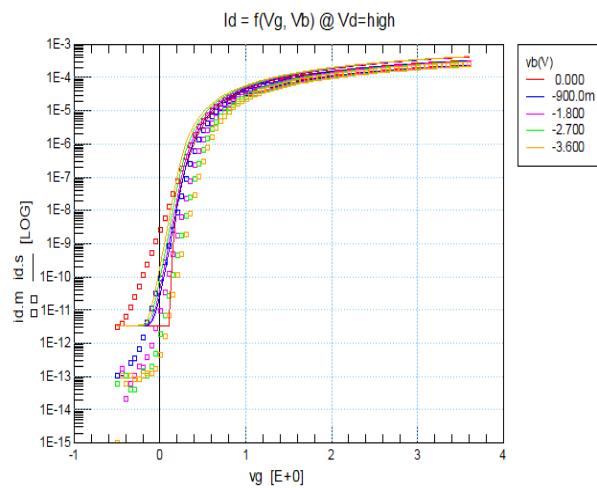
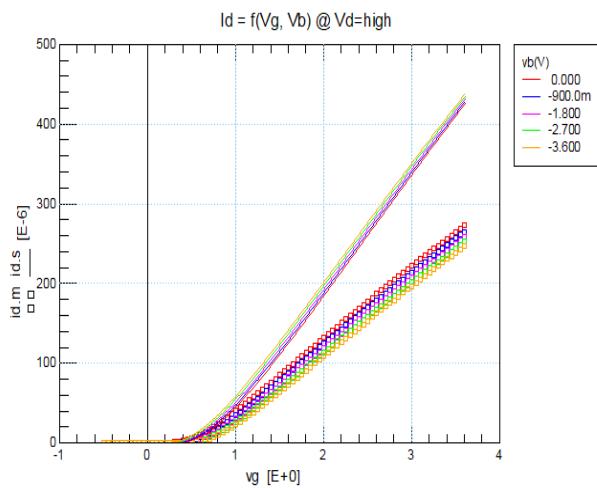
4.26 W0u3_L0u3_S560_1

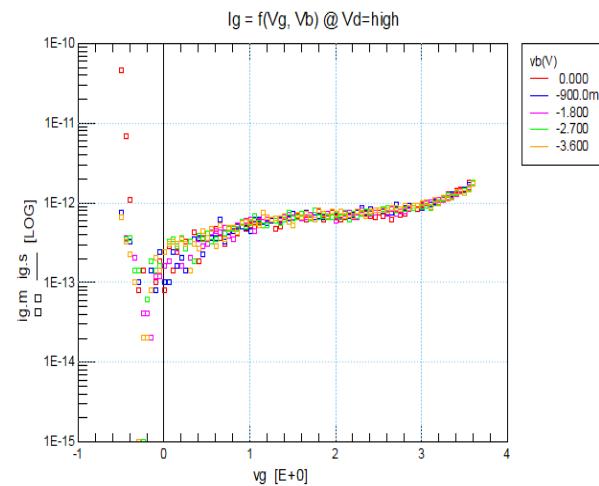
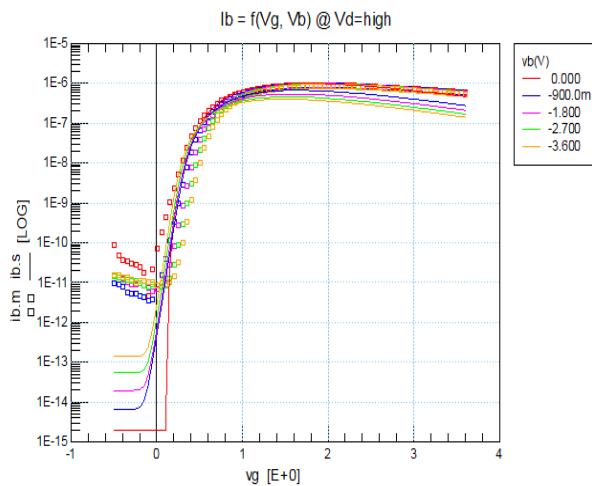
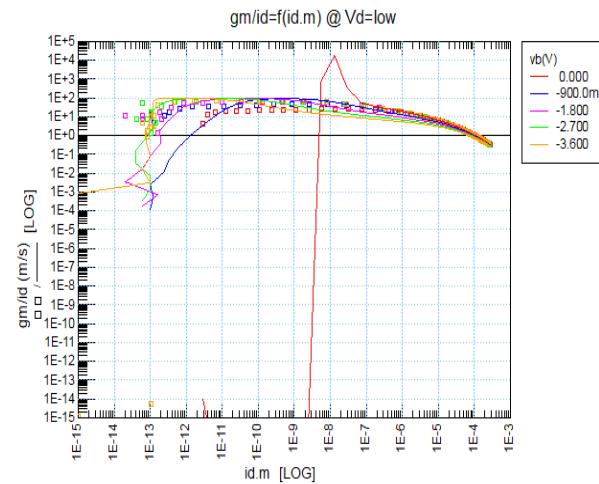
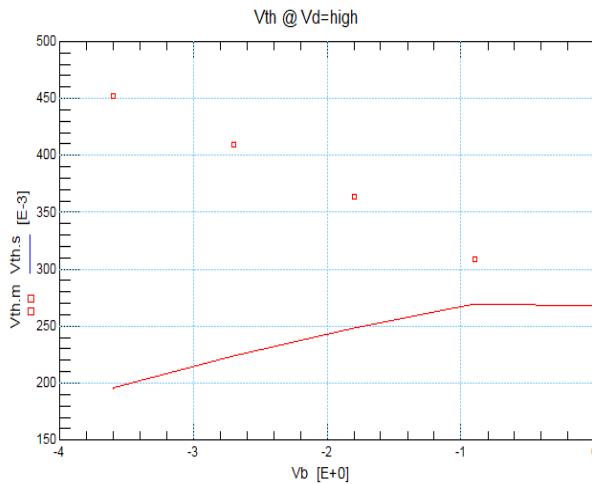
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



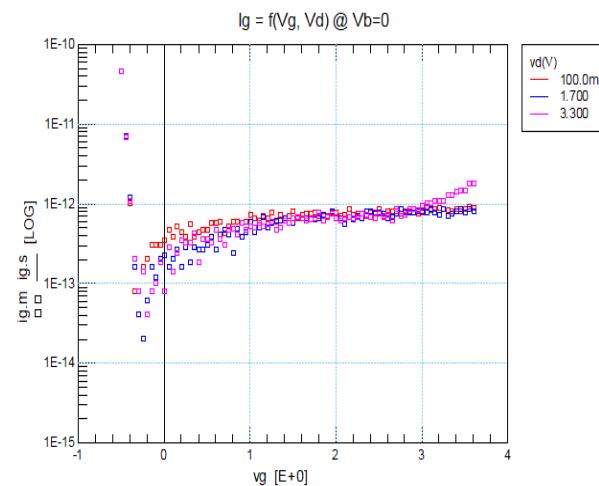
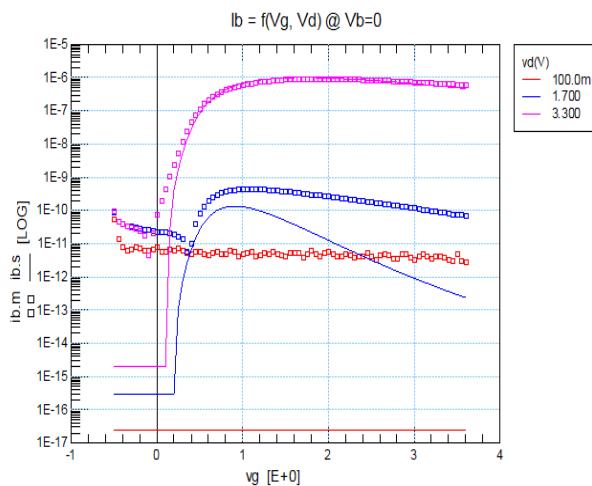


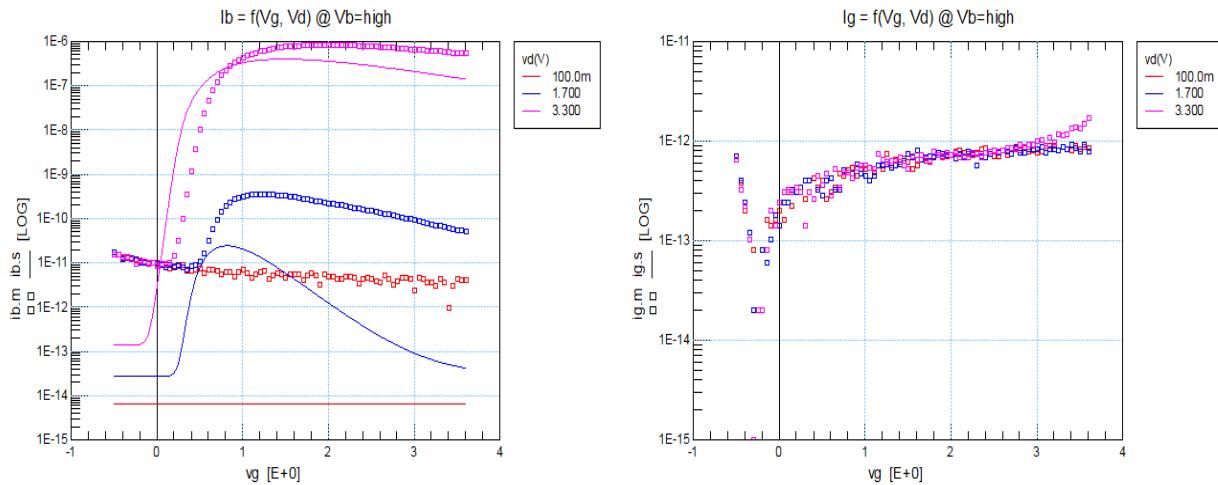
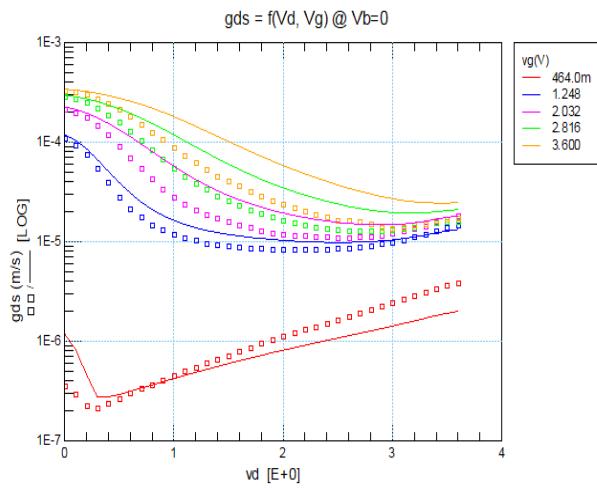
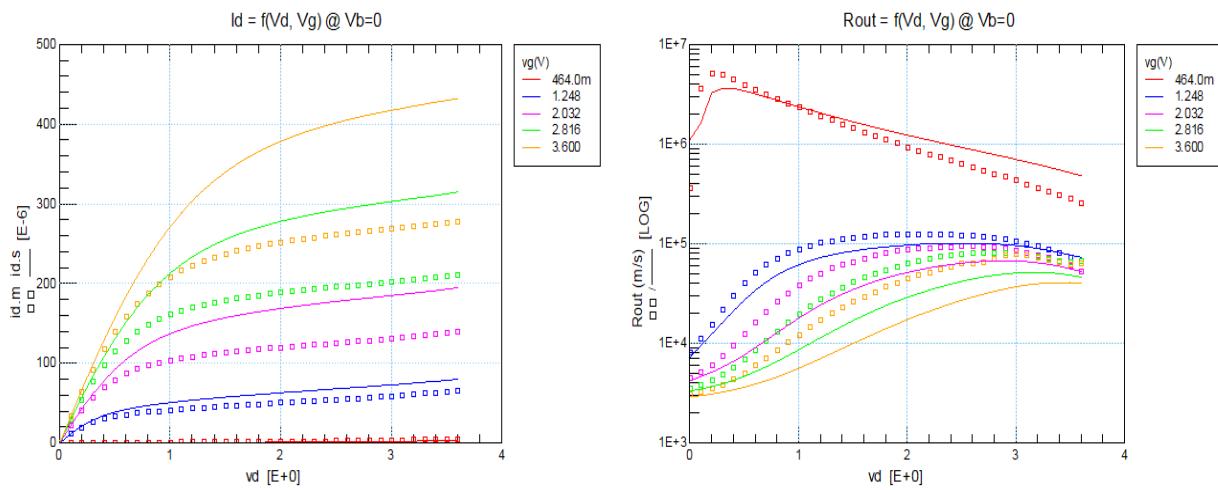
$i_{dvg}, V_d = 3.3V, T = 27^\circ C$

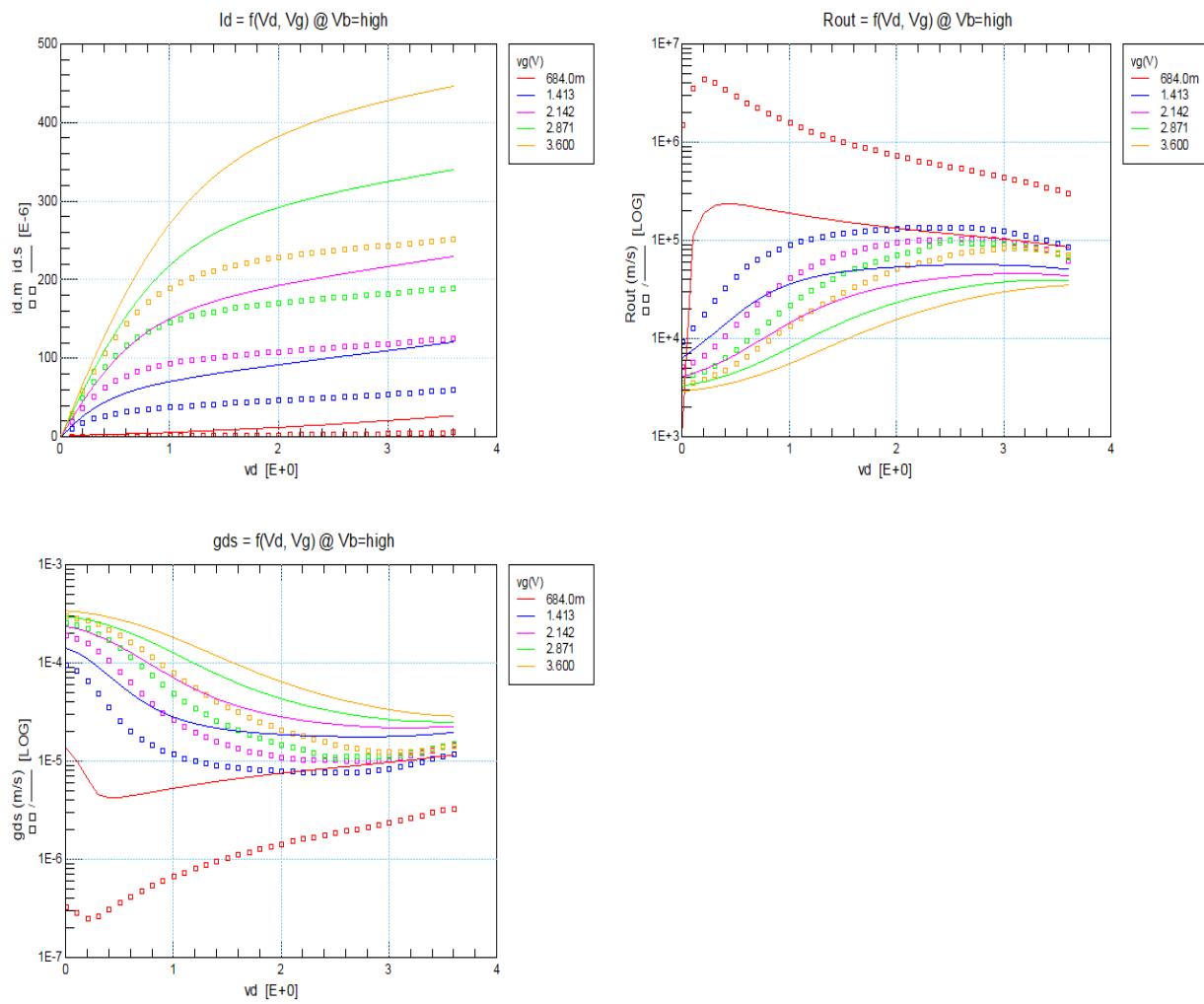
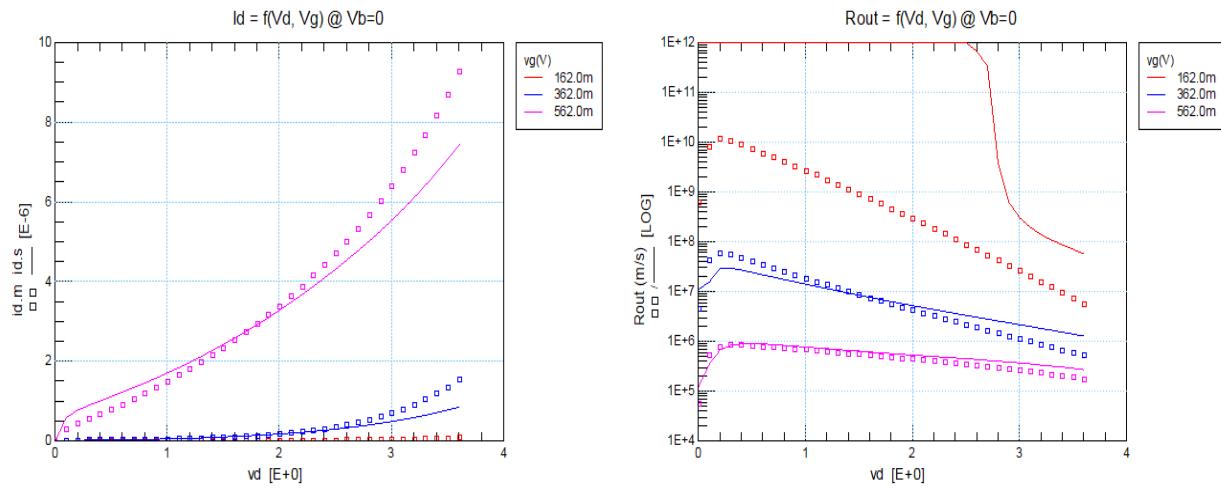


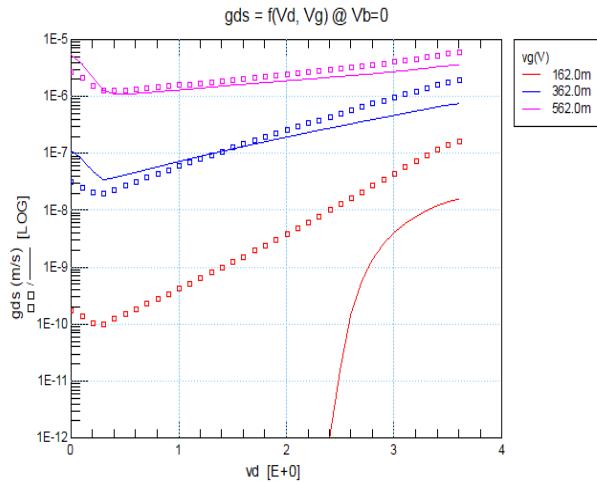


idvg, lb, lg, Vb = 0V, T = 27°C

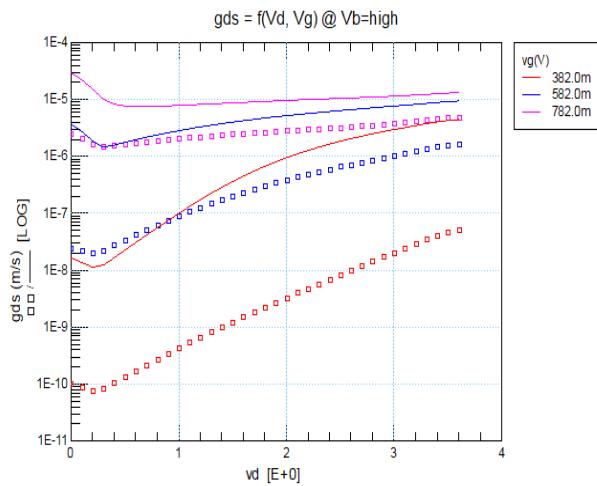
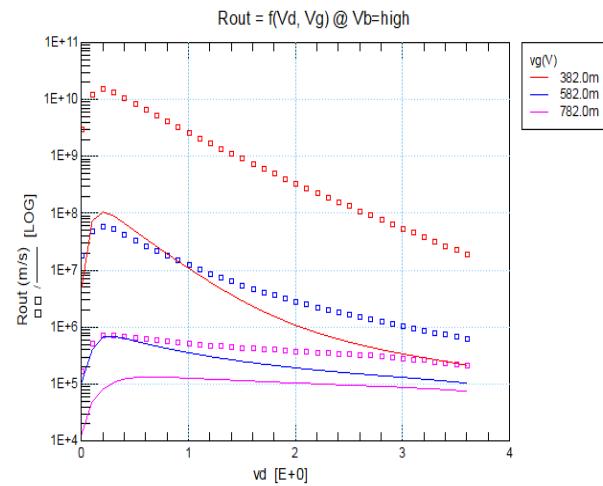
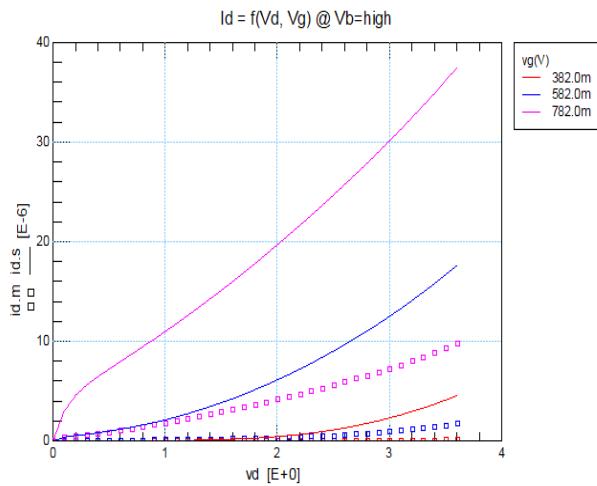


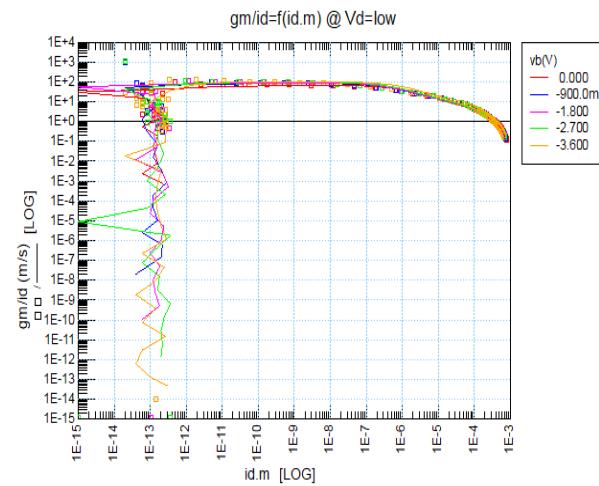
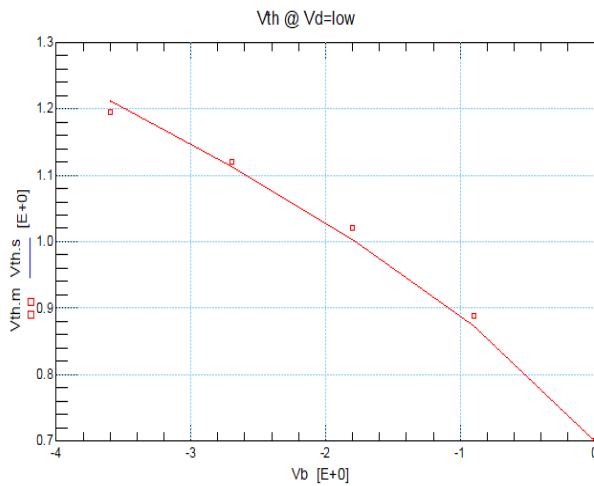
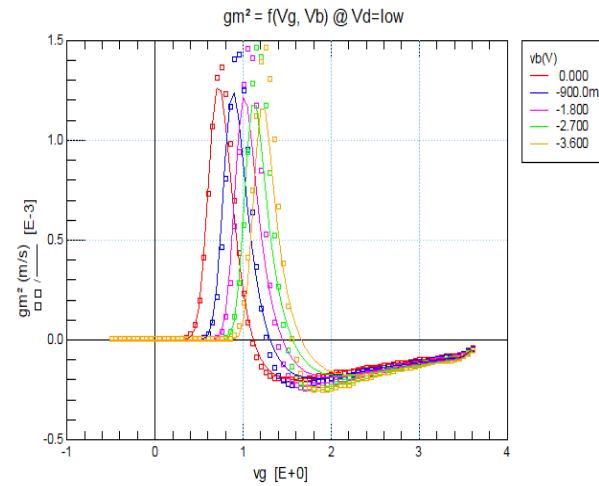
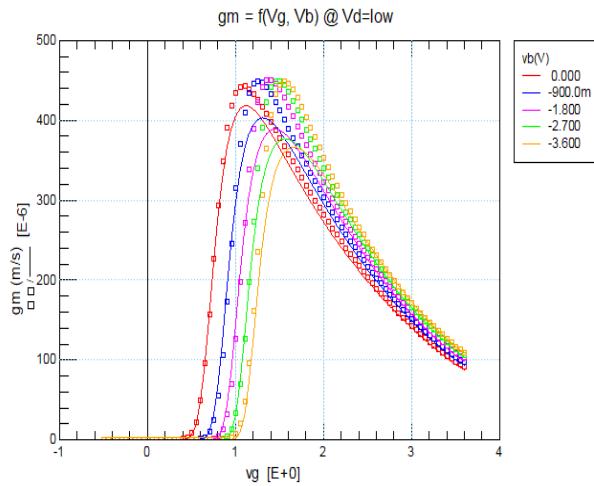
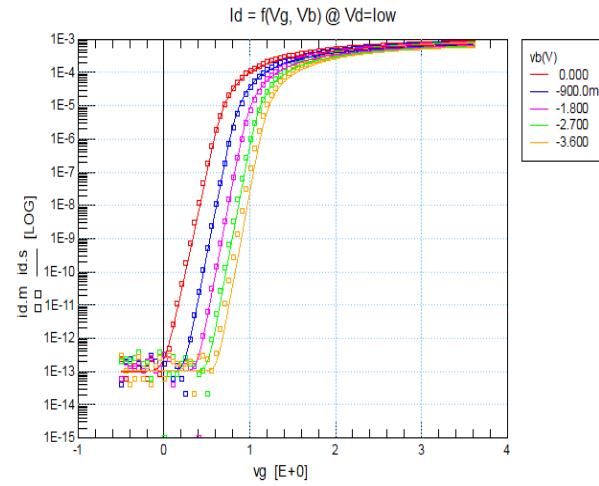
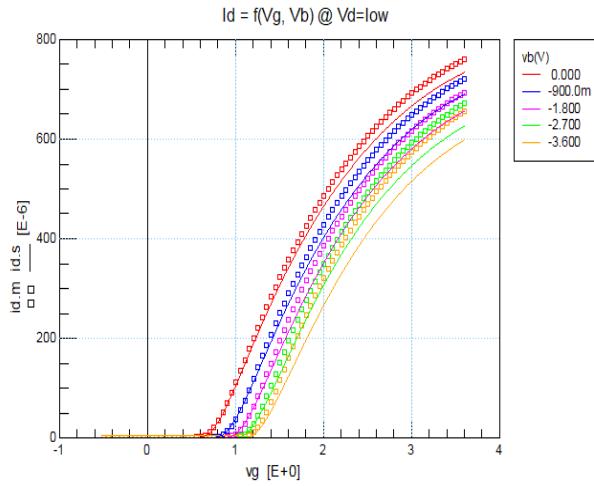
idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


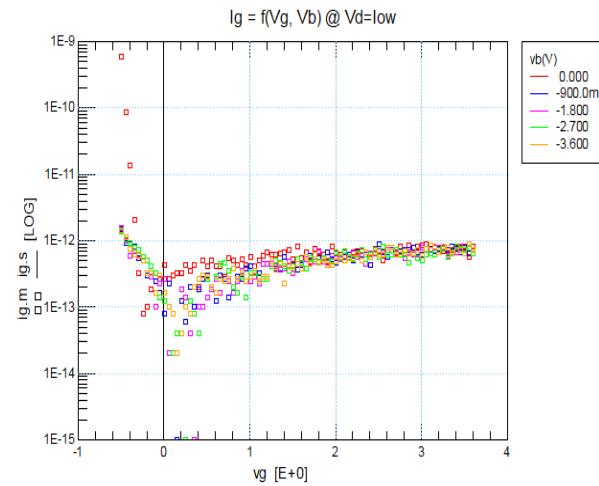
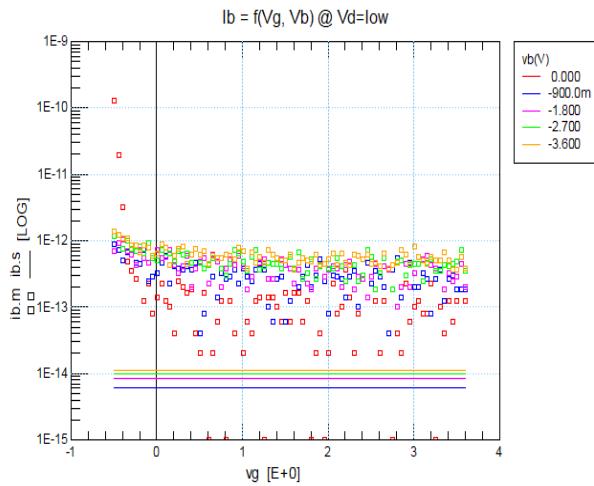
idvd_vbmin, Vb = -3.6V, T = 27°C**idvd_vth, Vb = 0V, T = 27°C**



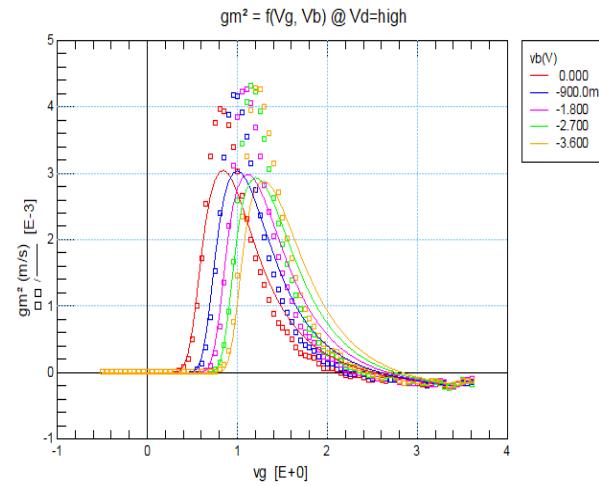
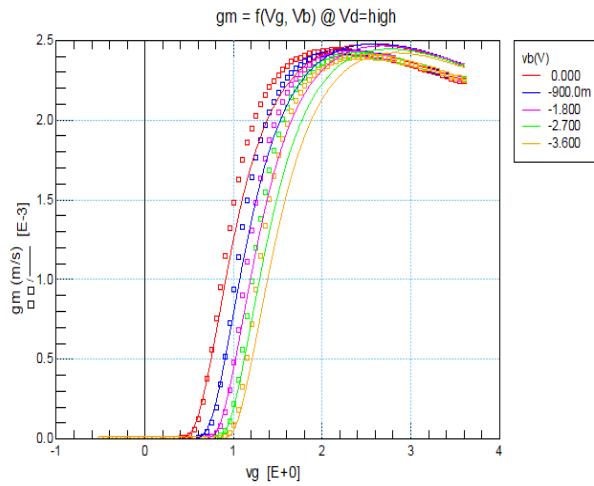
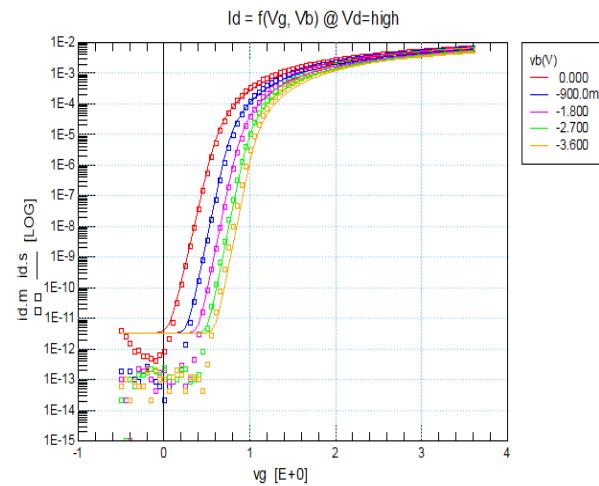
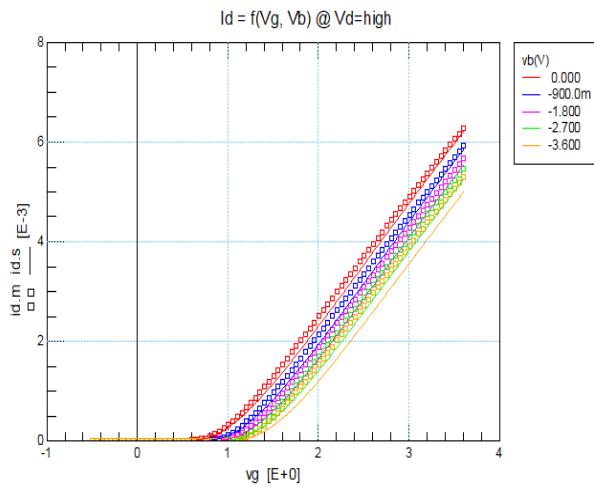
idvd_vth_vbmin, Vb = -3.6V, T = 27°C

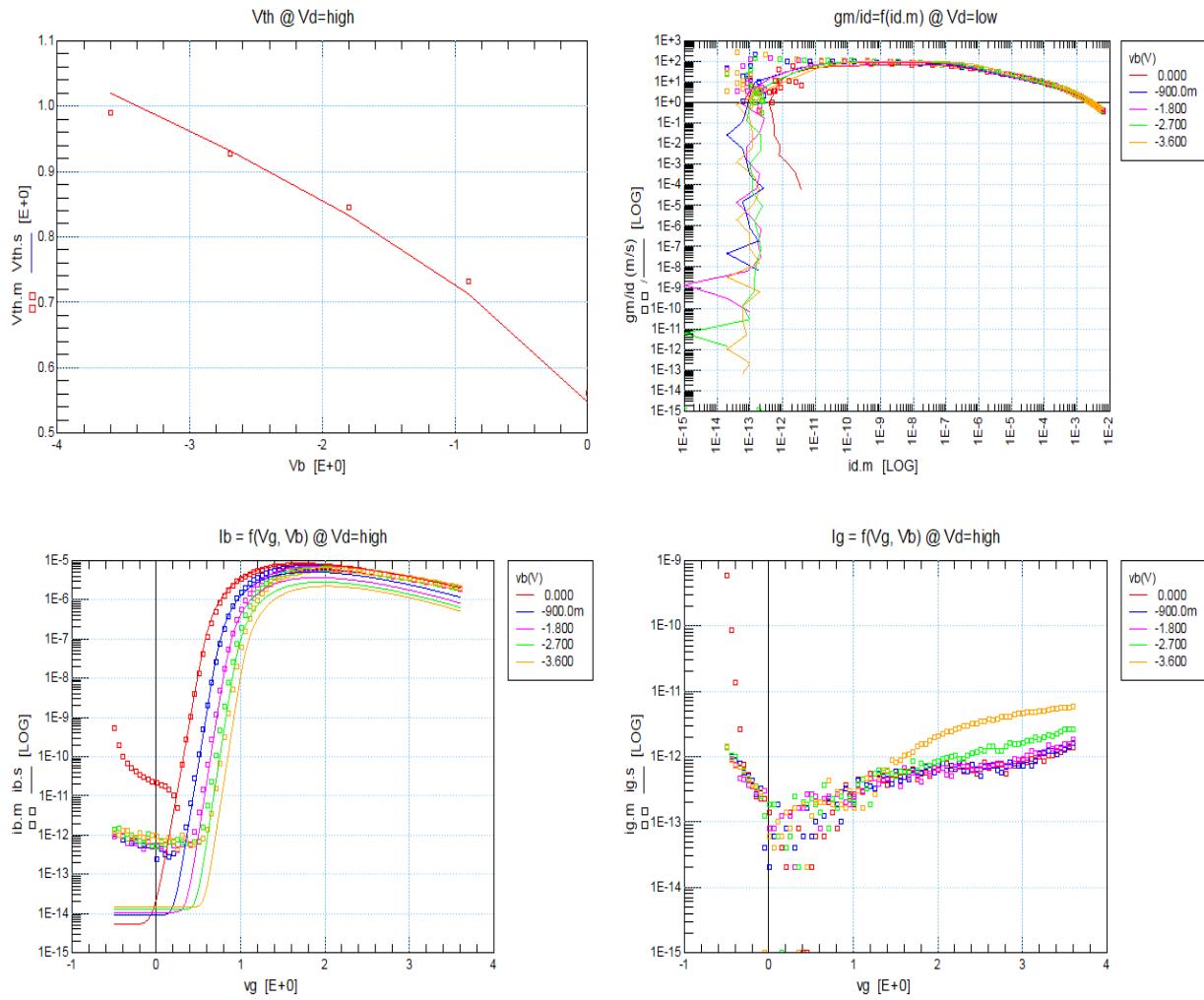


4.27W10u0_L0u45_T356_S384M_1**idvg, Vd = 0.1V, T = 27°C**

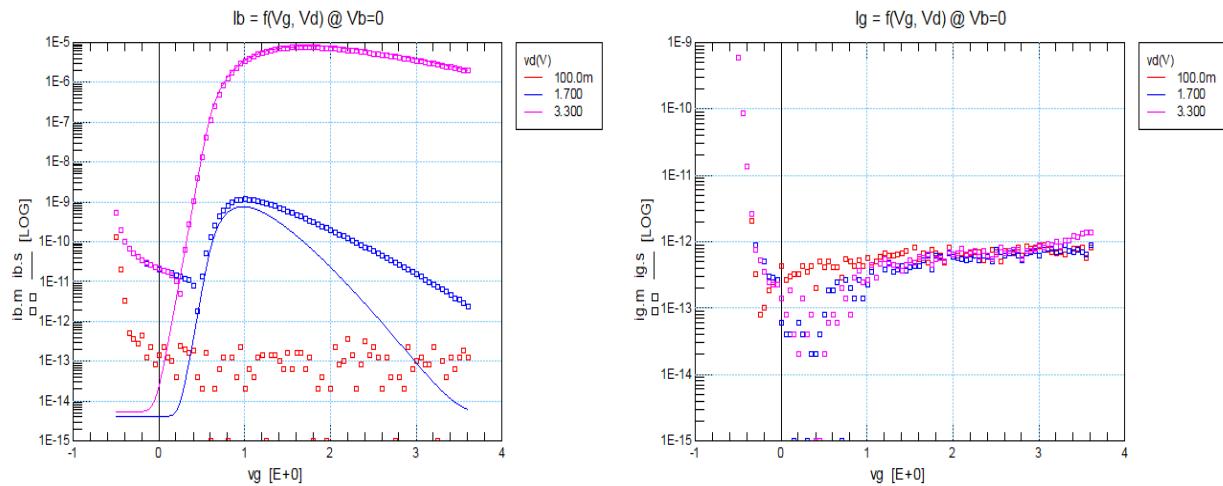


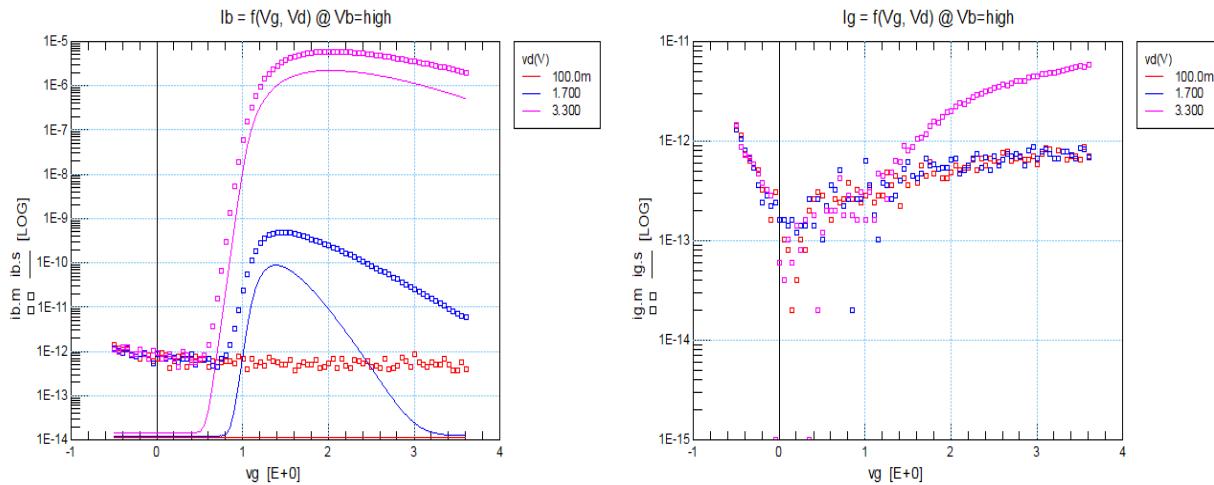
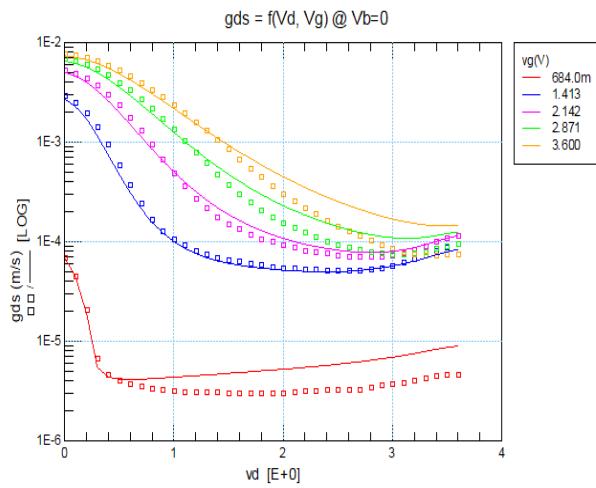
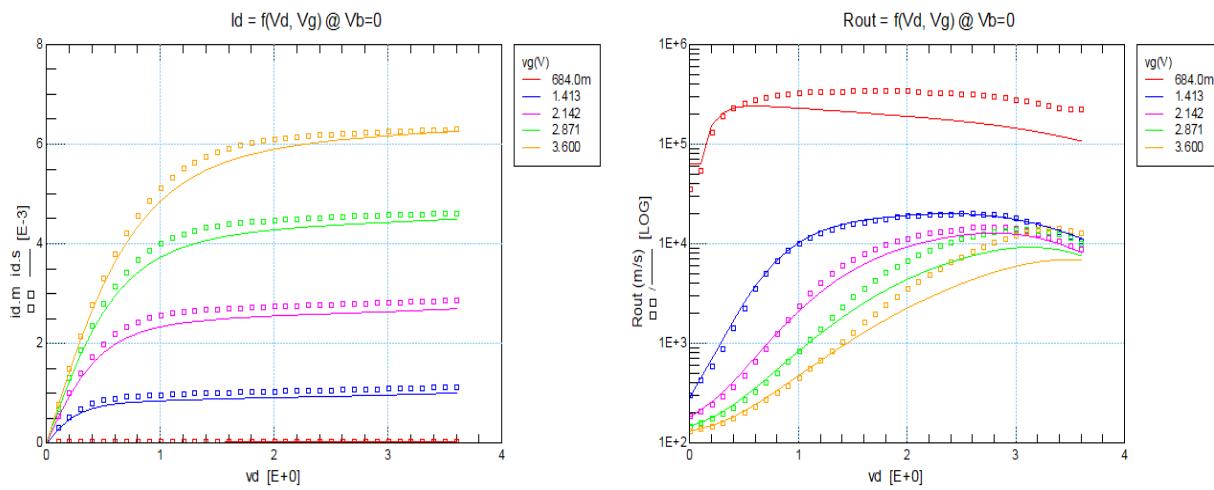
$i_{dvg}, V_d = 3.3V, T = 27^\circ C$

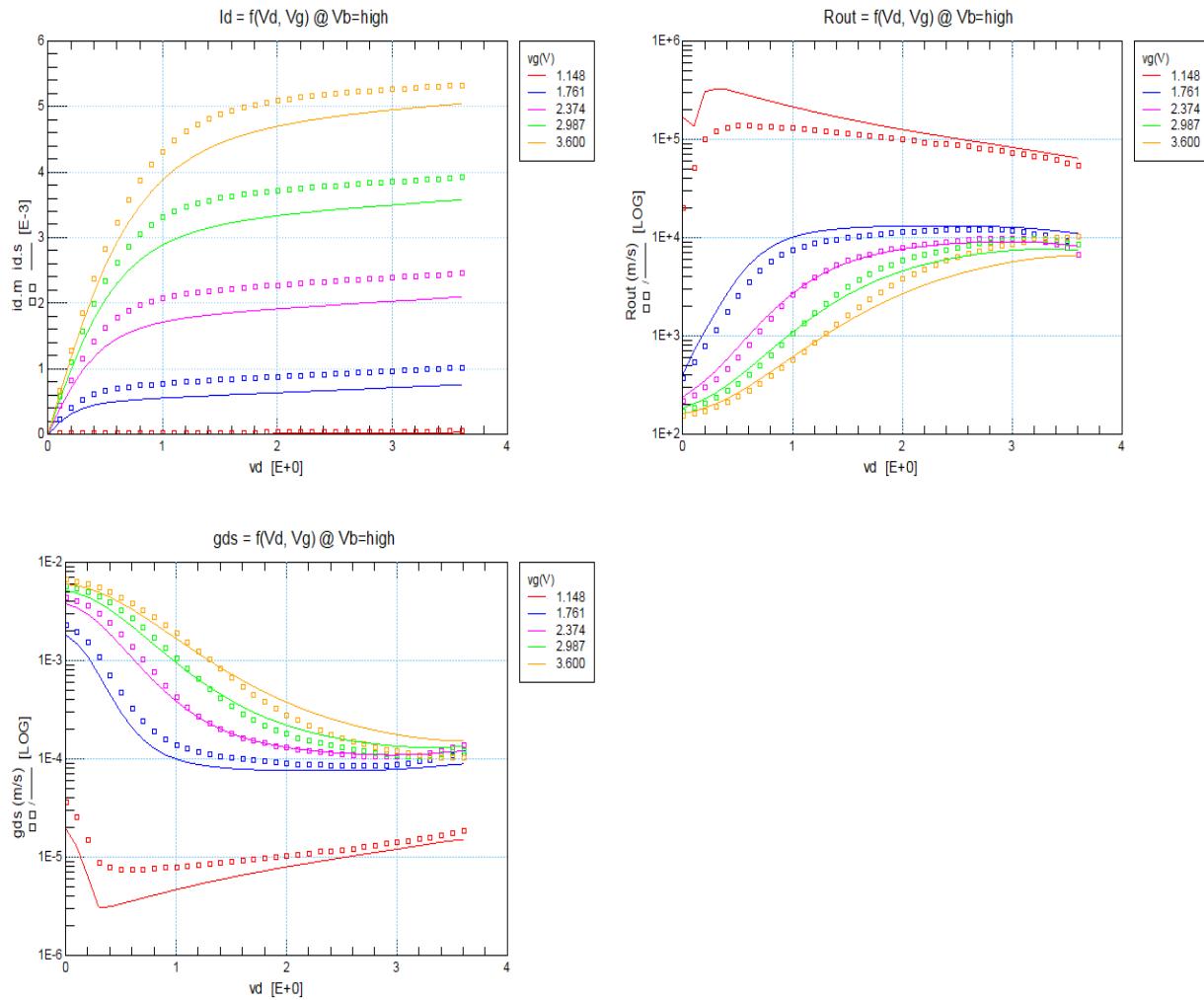
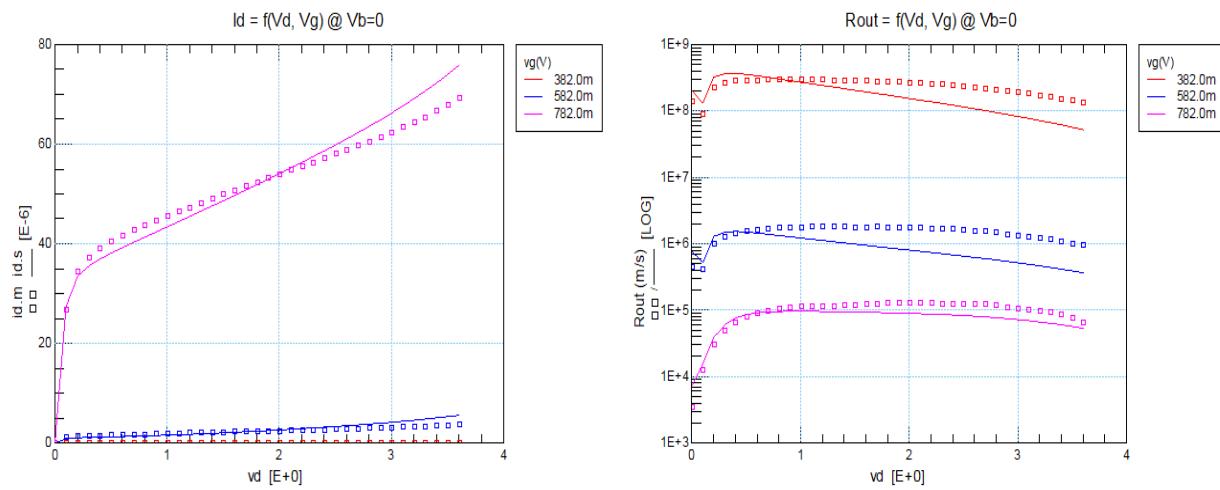


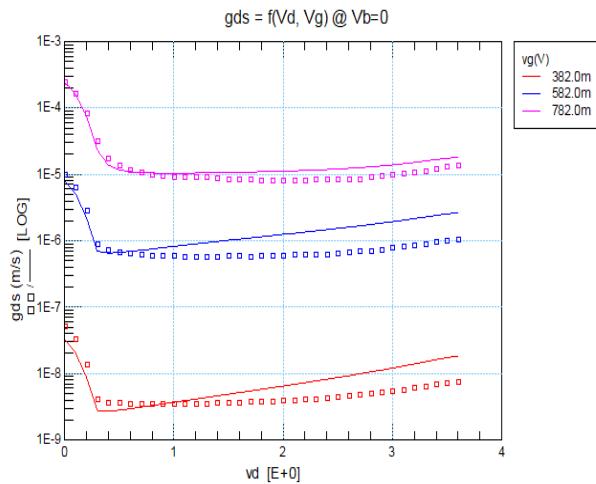


idvg, Ib, Ig, Vb = 0V, T = 27°C

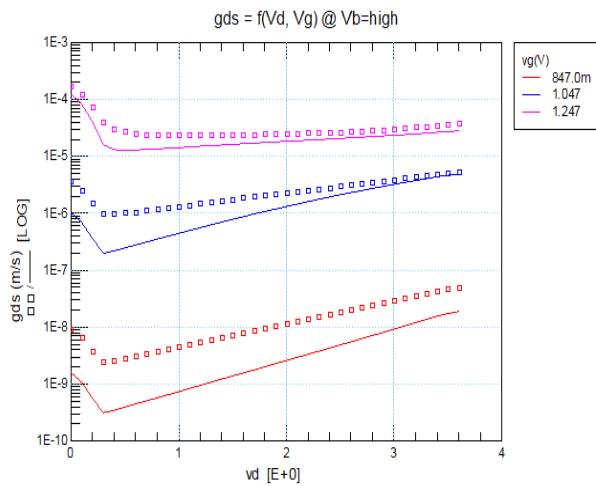
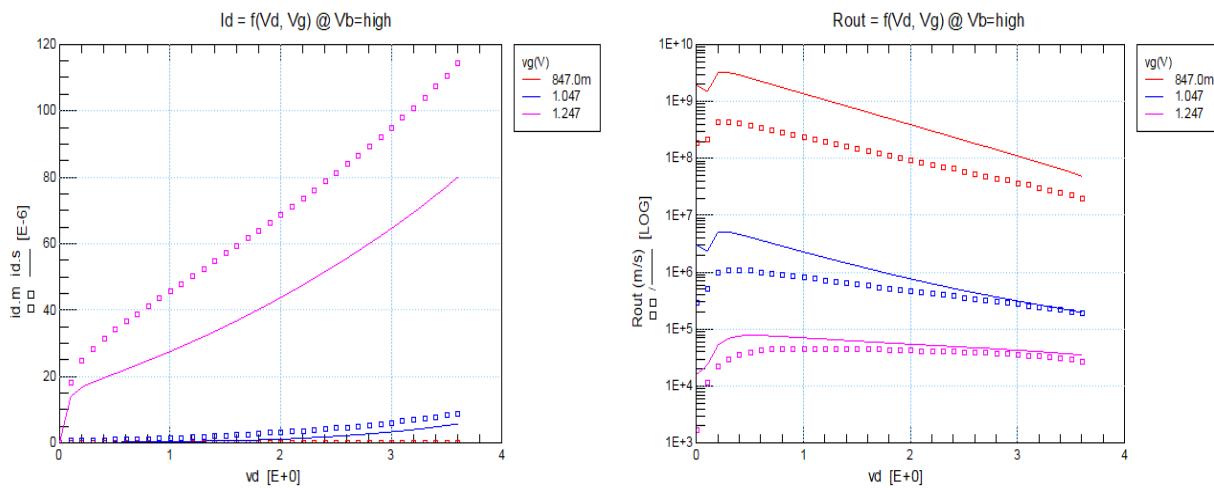


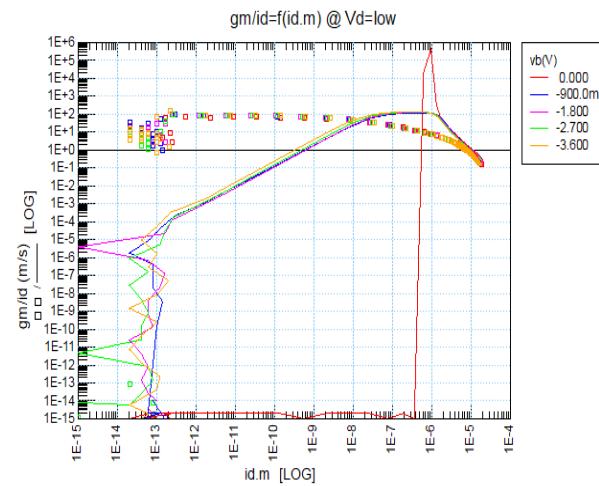
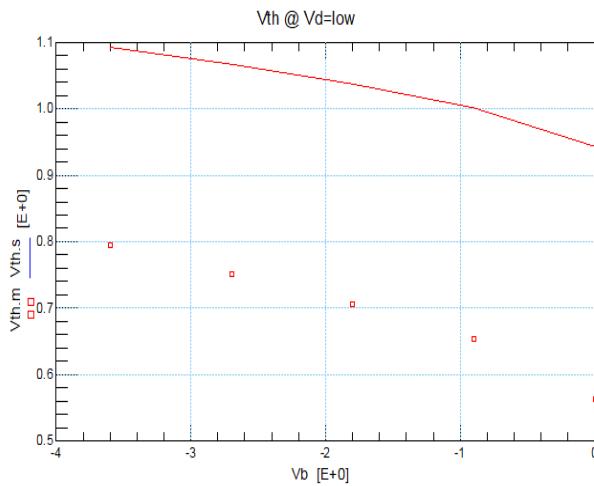
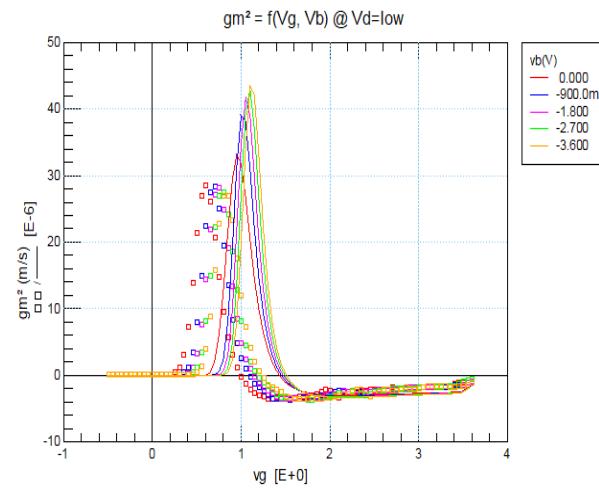
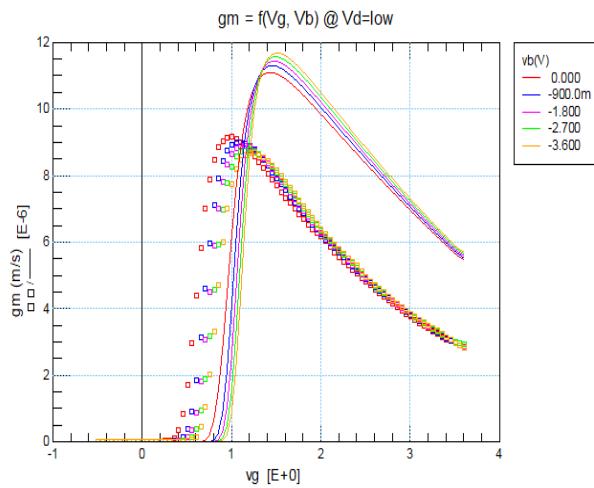
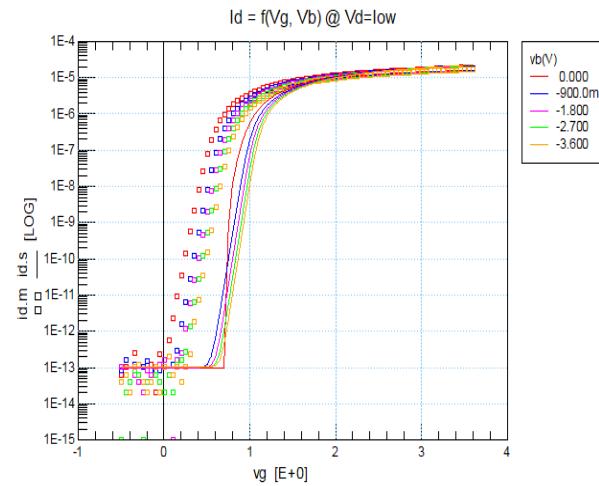
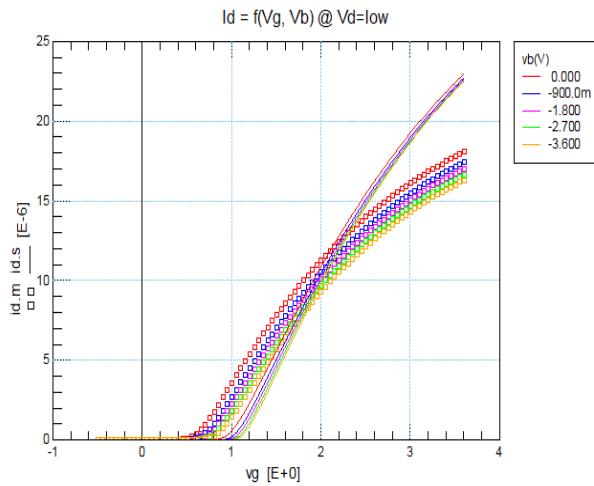
idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


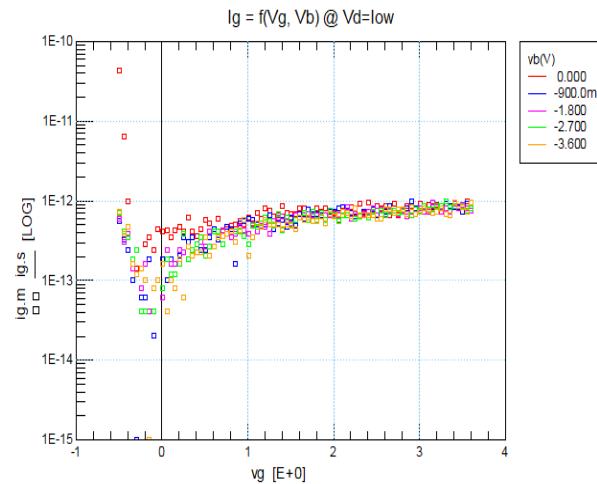
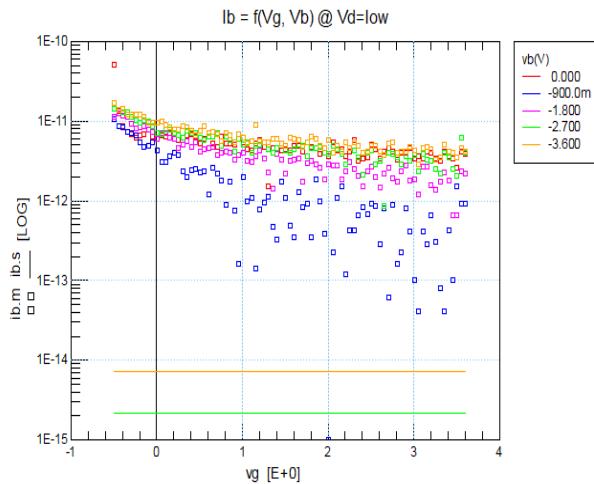
idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C




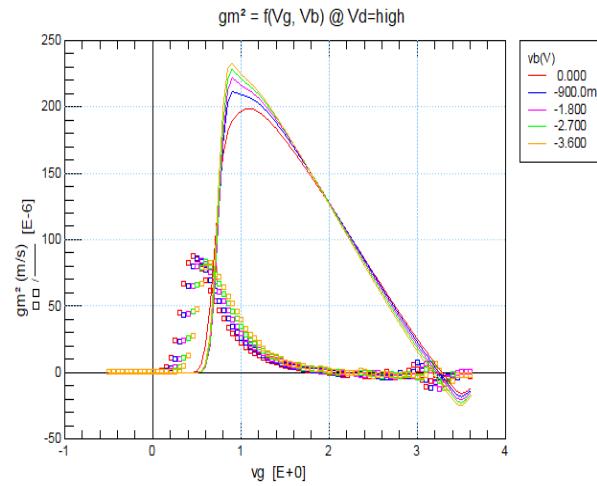
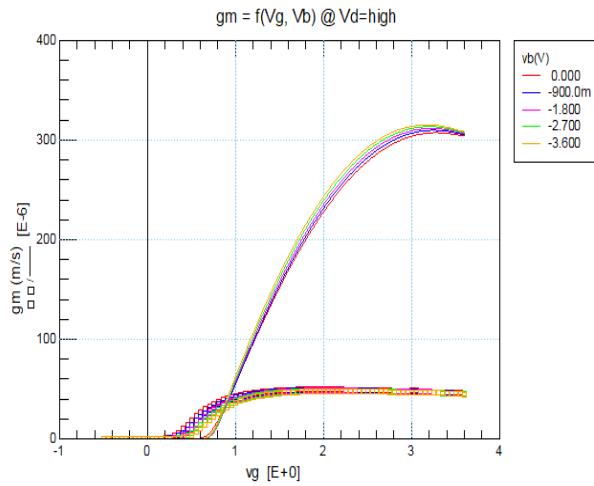
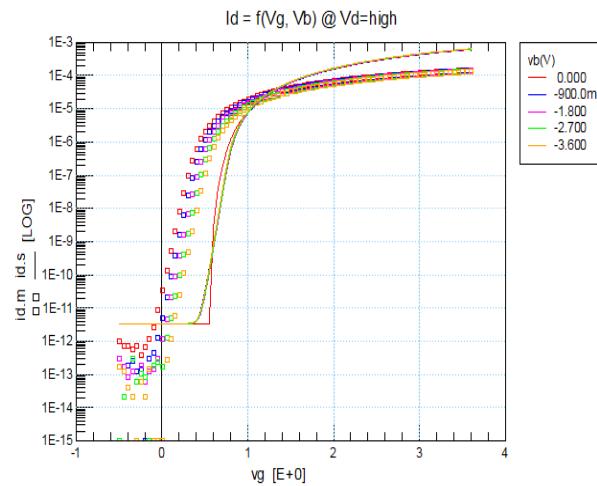
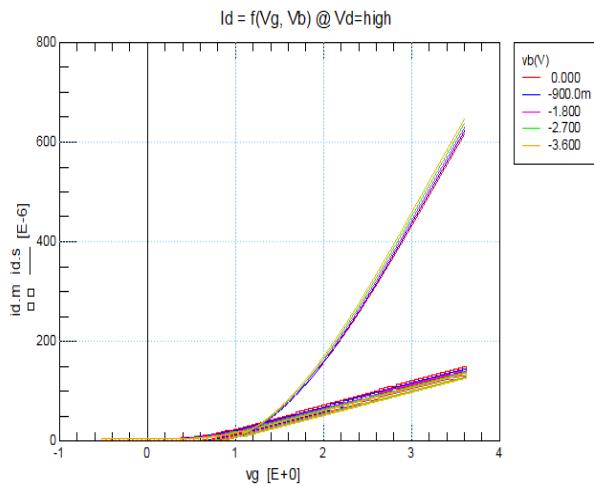
idvd_vth_vbmin, Vb = -3.6V, T = 27°C

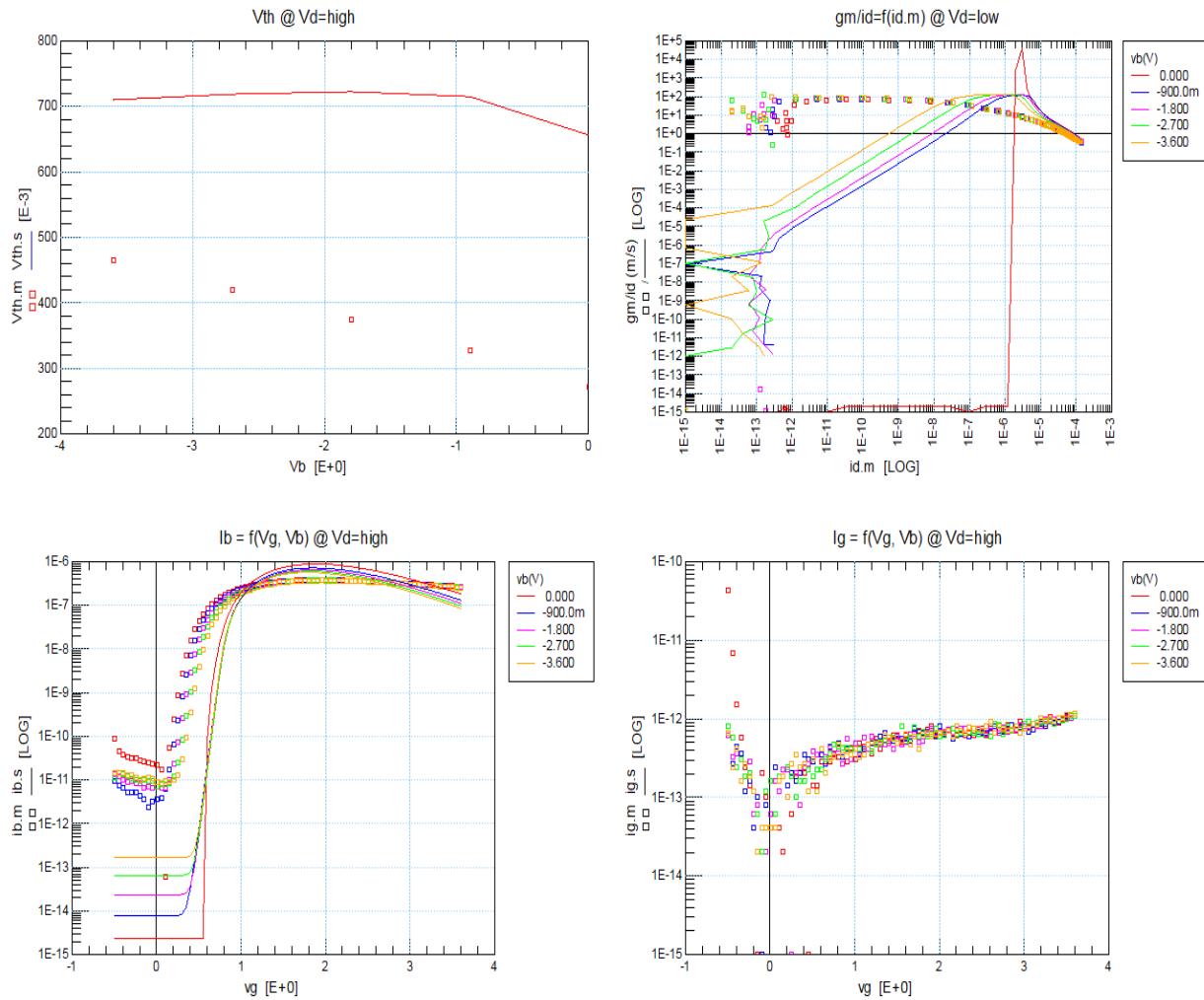


4.28 W0u15_L0u33_S547_5**idvg, Vd = 0.1V, T = 27°C**

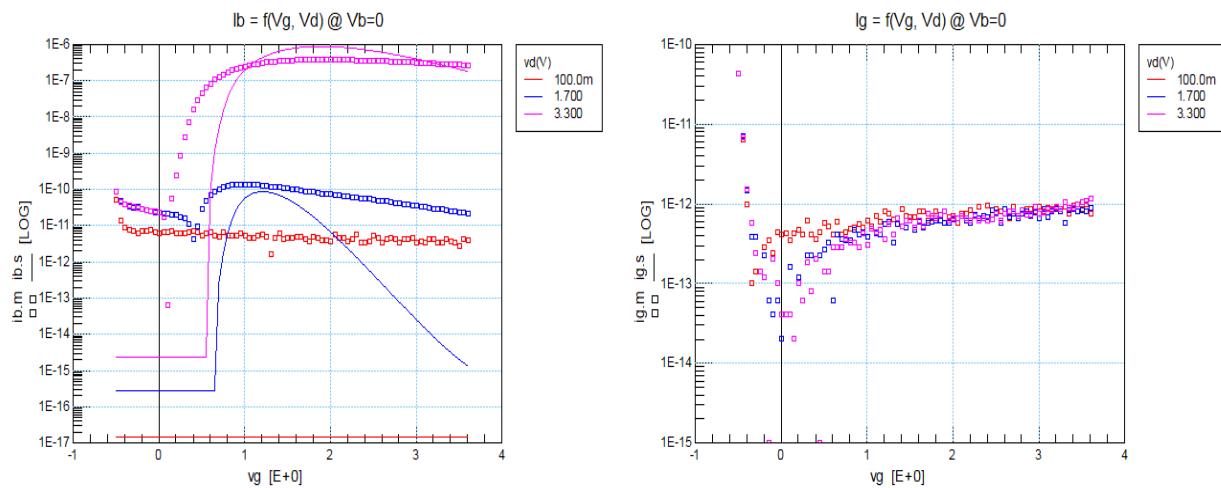


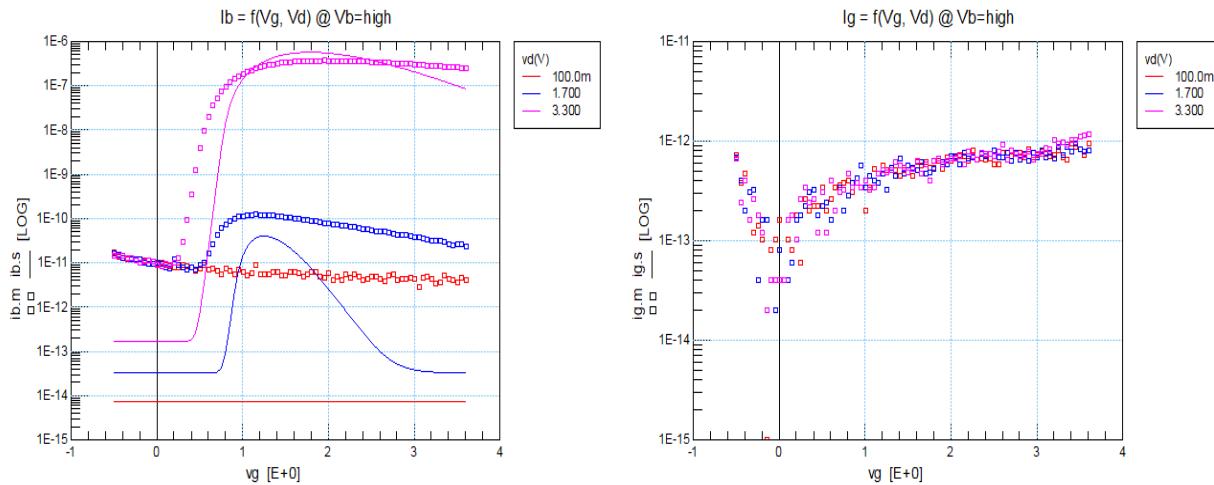
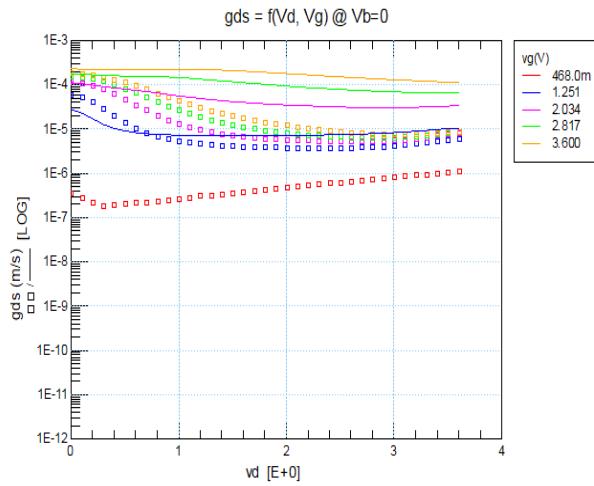
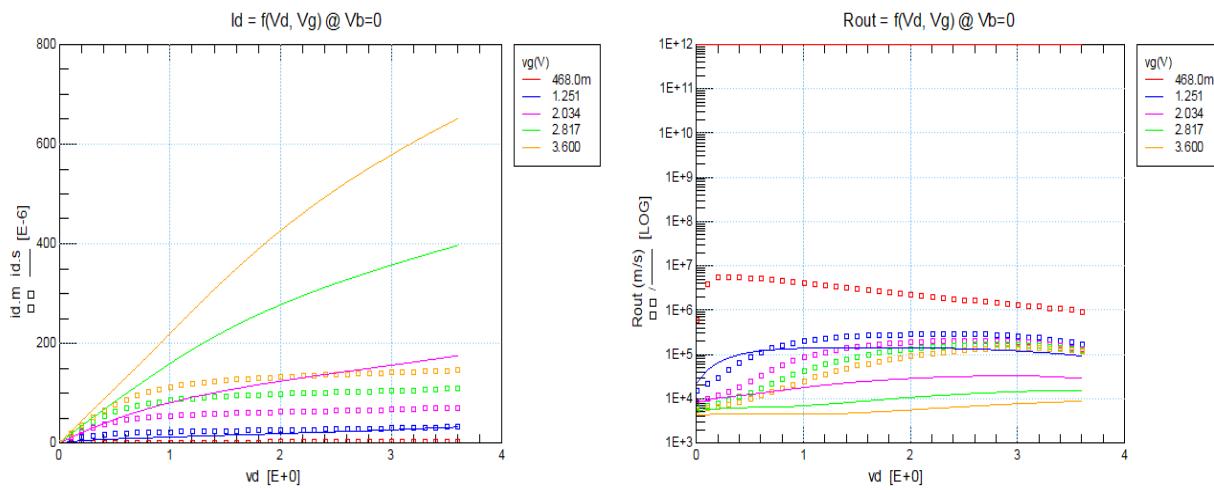
$i_{dvg}, V_d = 3.3V, T = 27^\circ C$

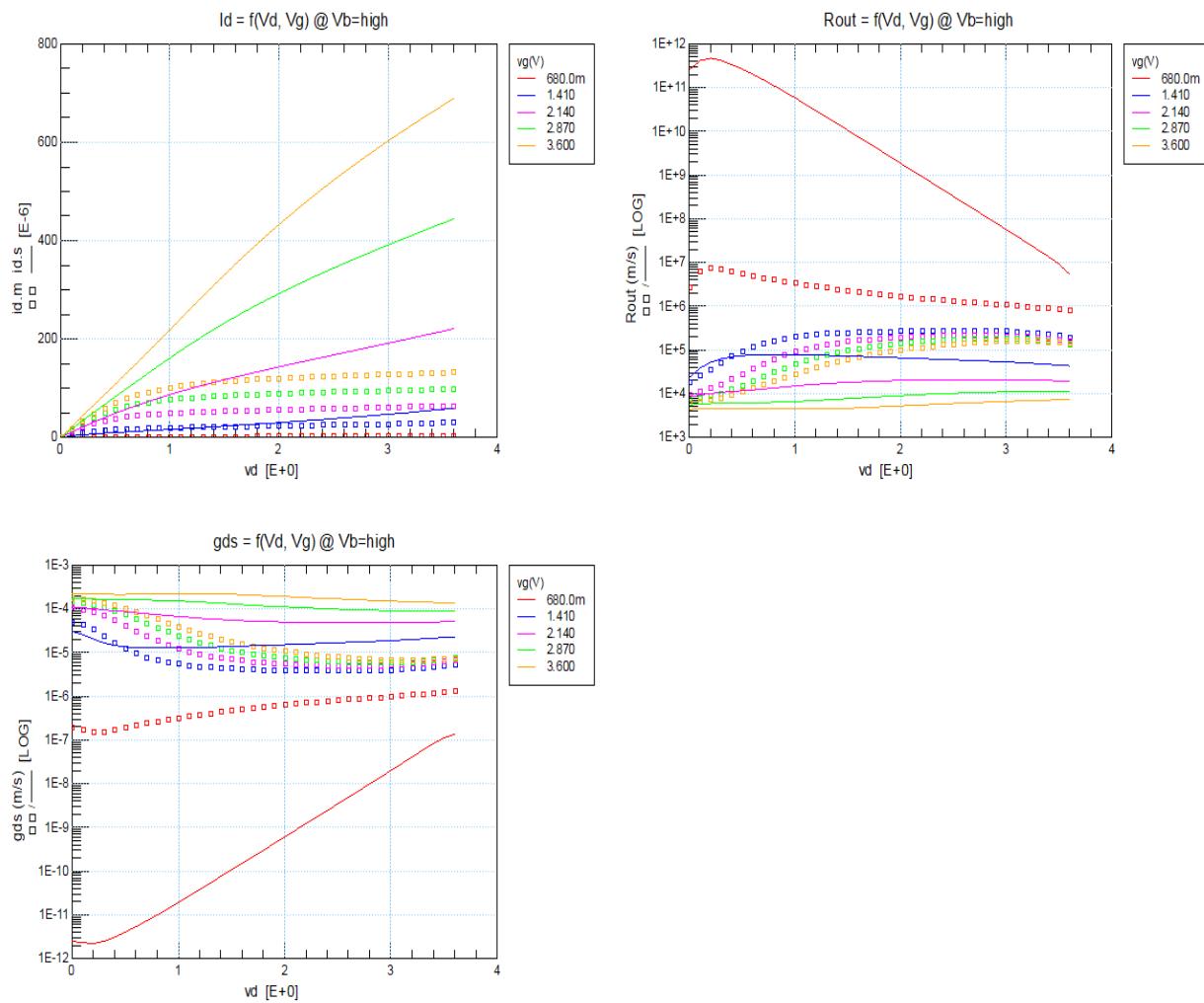
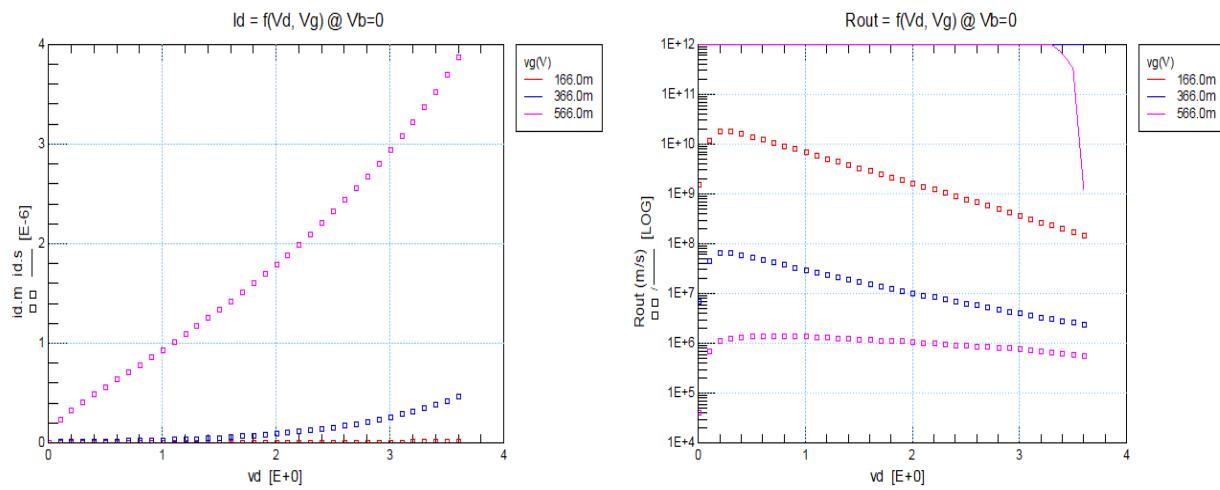


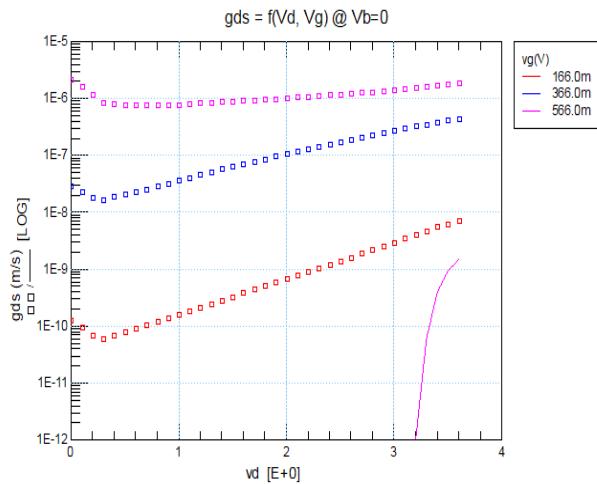


$id_{vg}, I_b, Ig, V_b = 0V, T = 27^\circ C$

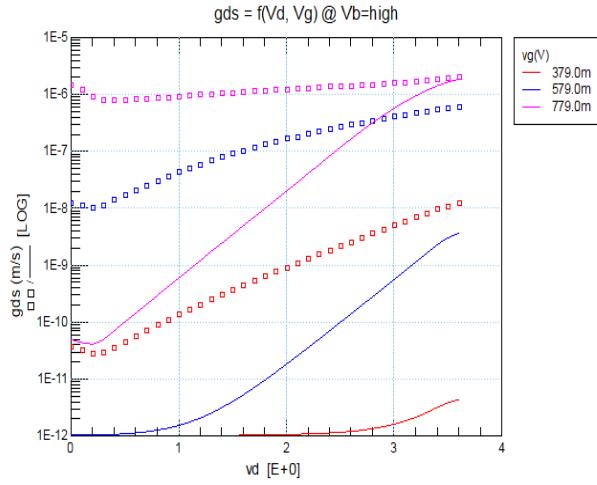
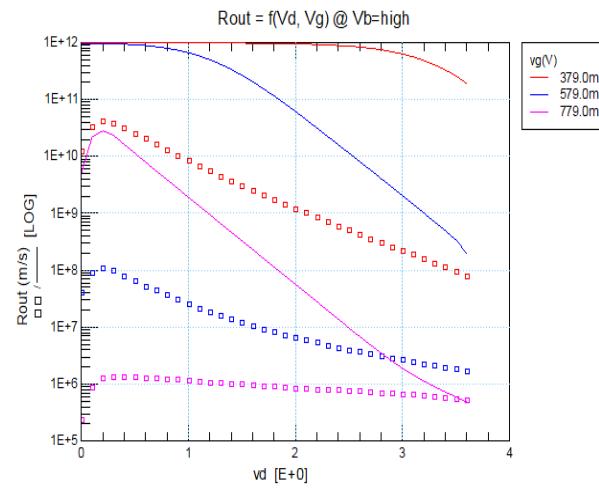
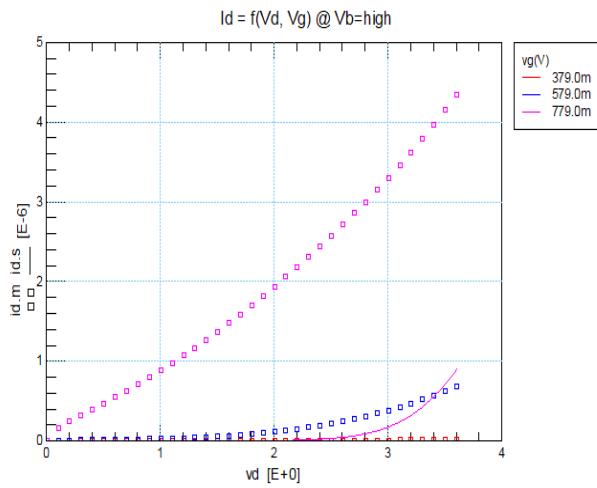


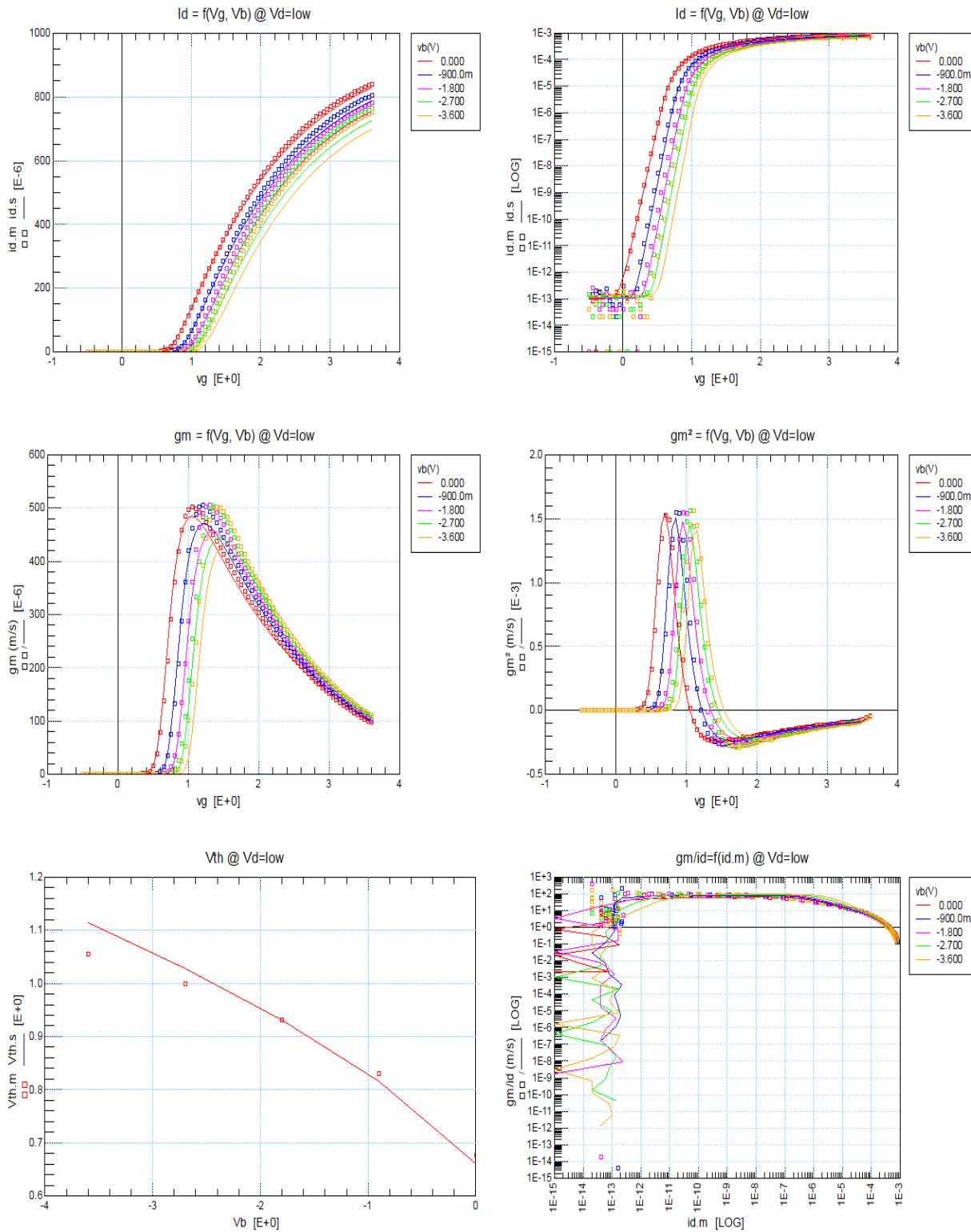
idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


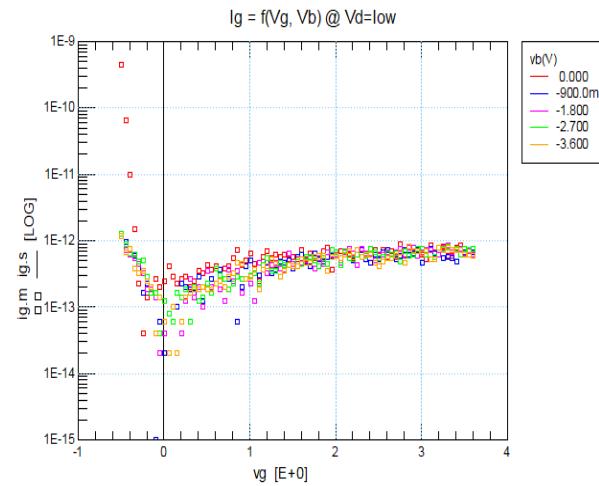
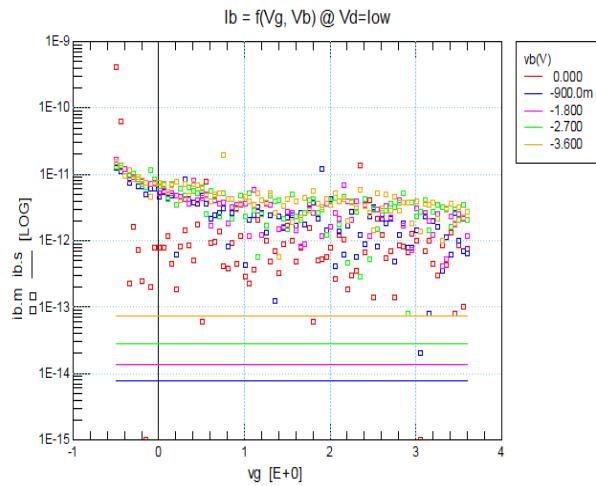
idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C




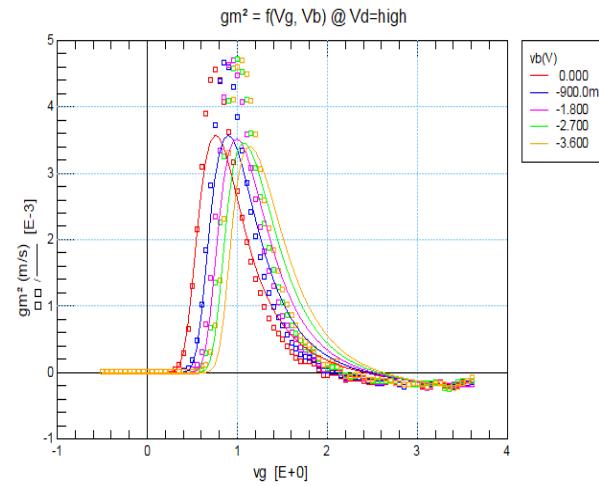
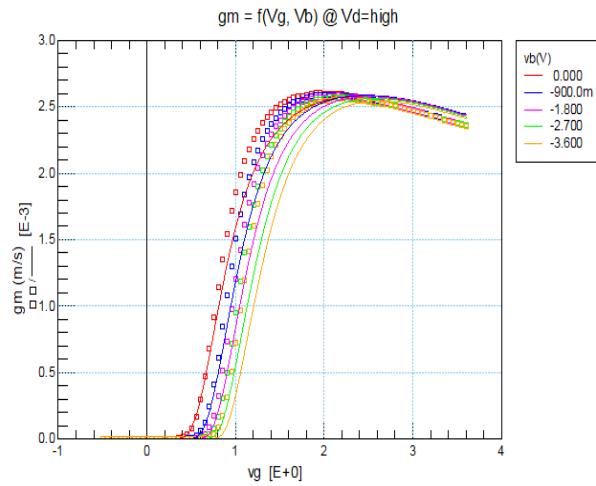
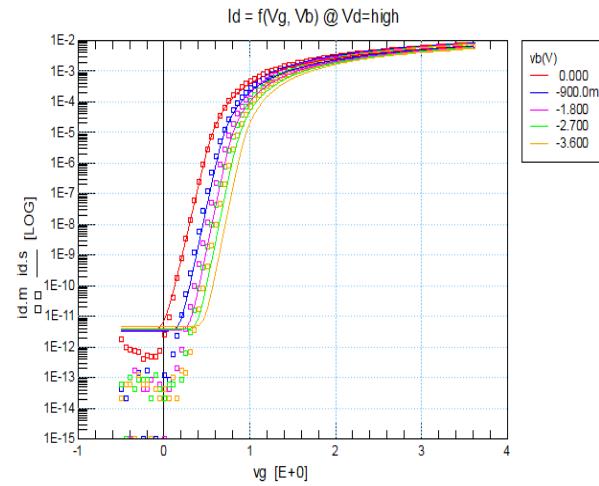
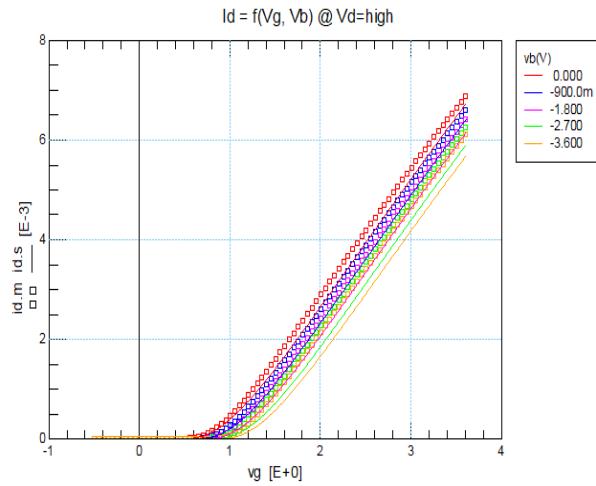
idvd_vth_vbmin, Vb = -3.6V, T = 27°C

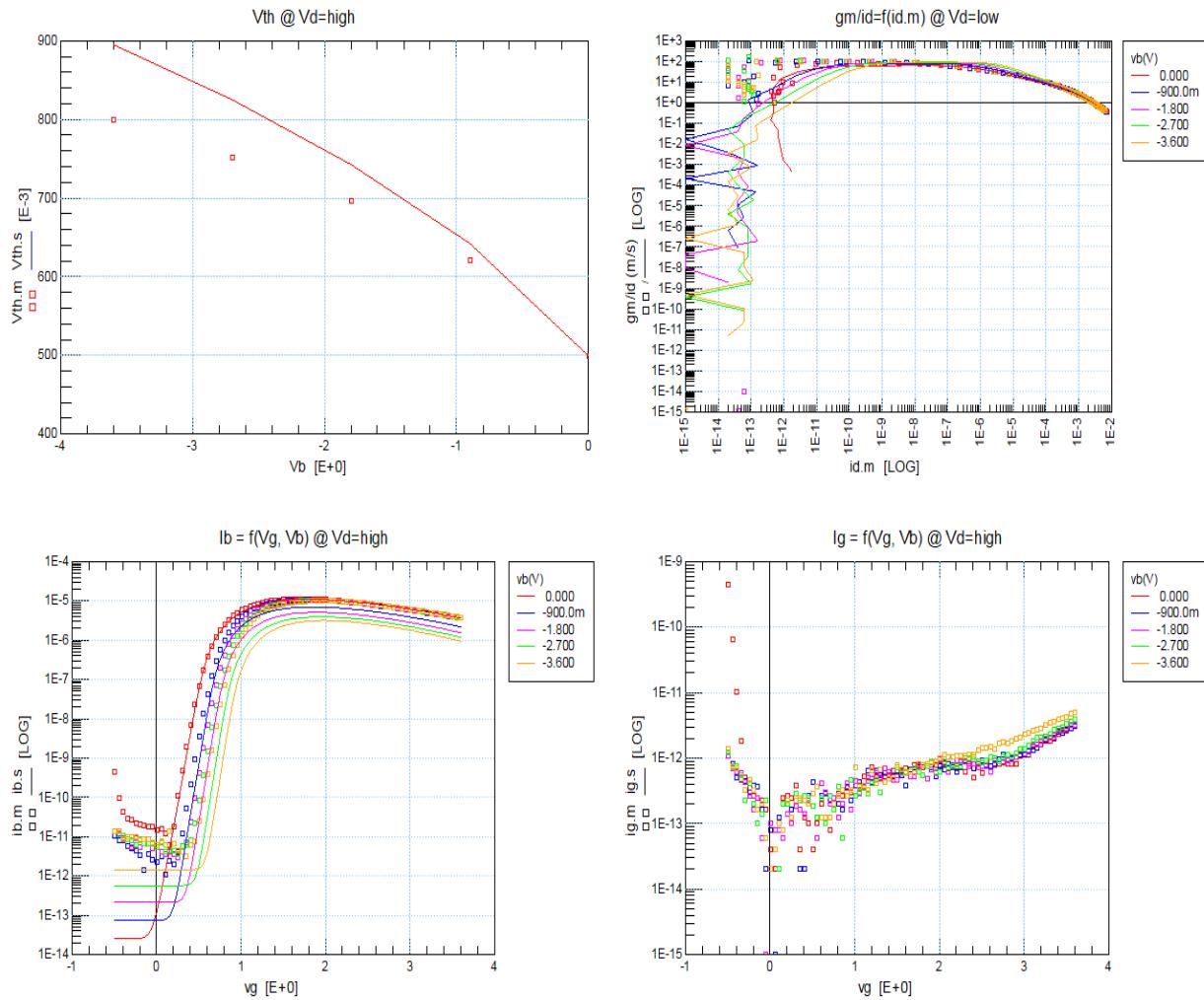


4.29 W10u0_L0u4_S387_4**idvg, Vd = 0.1V, T = 27°C**

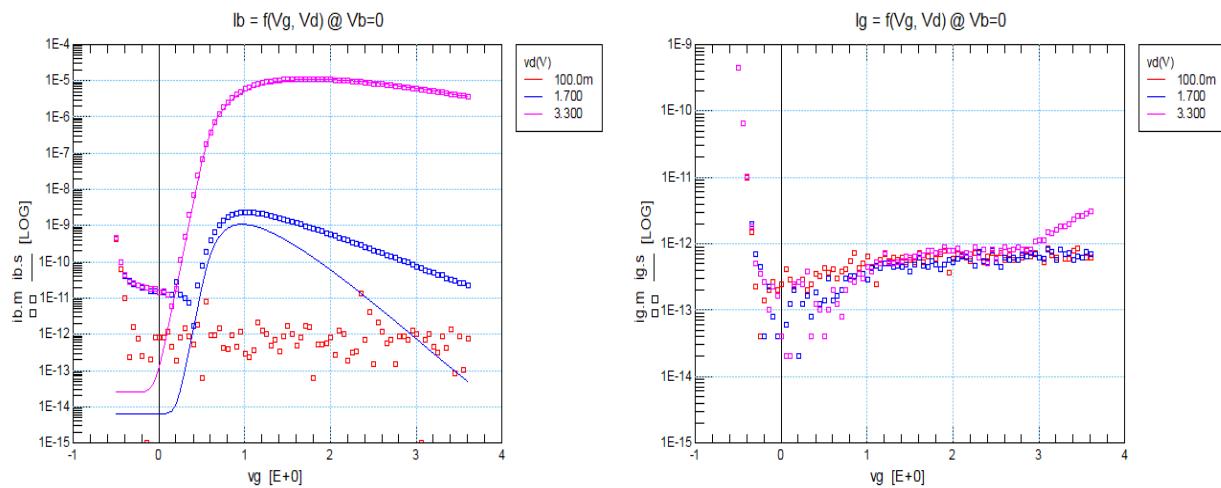


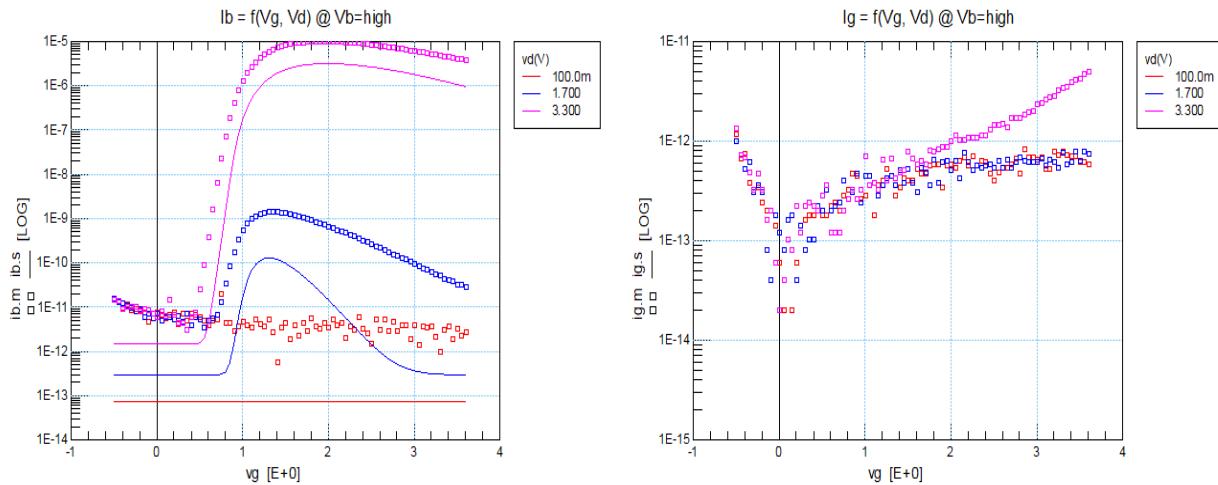
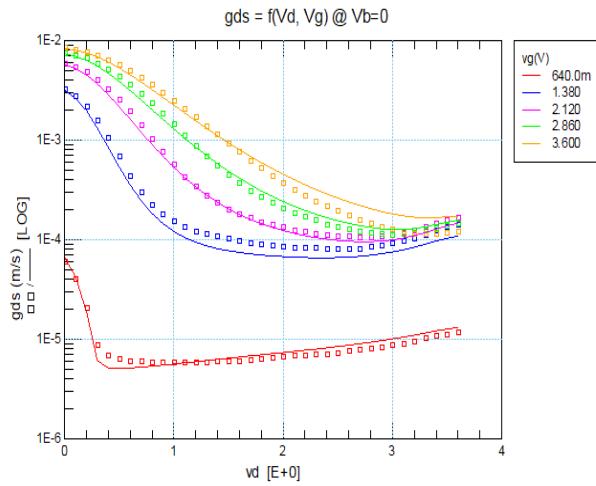
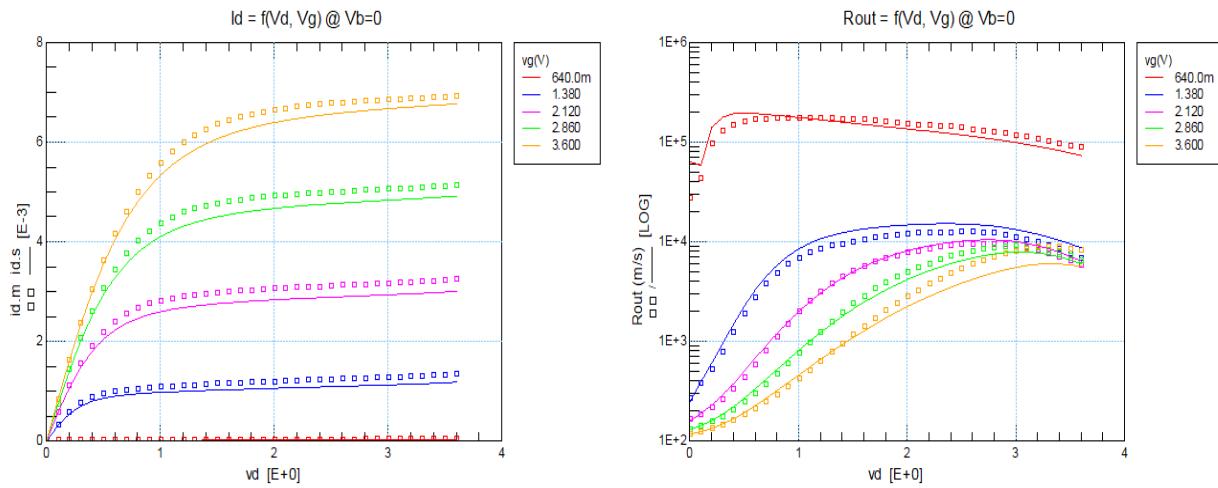
$i_{dvg}, V_d = 3.3V, T = 27^\circ C$

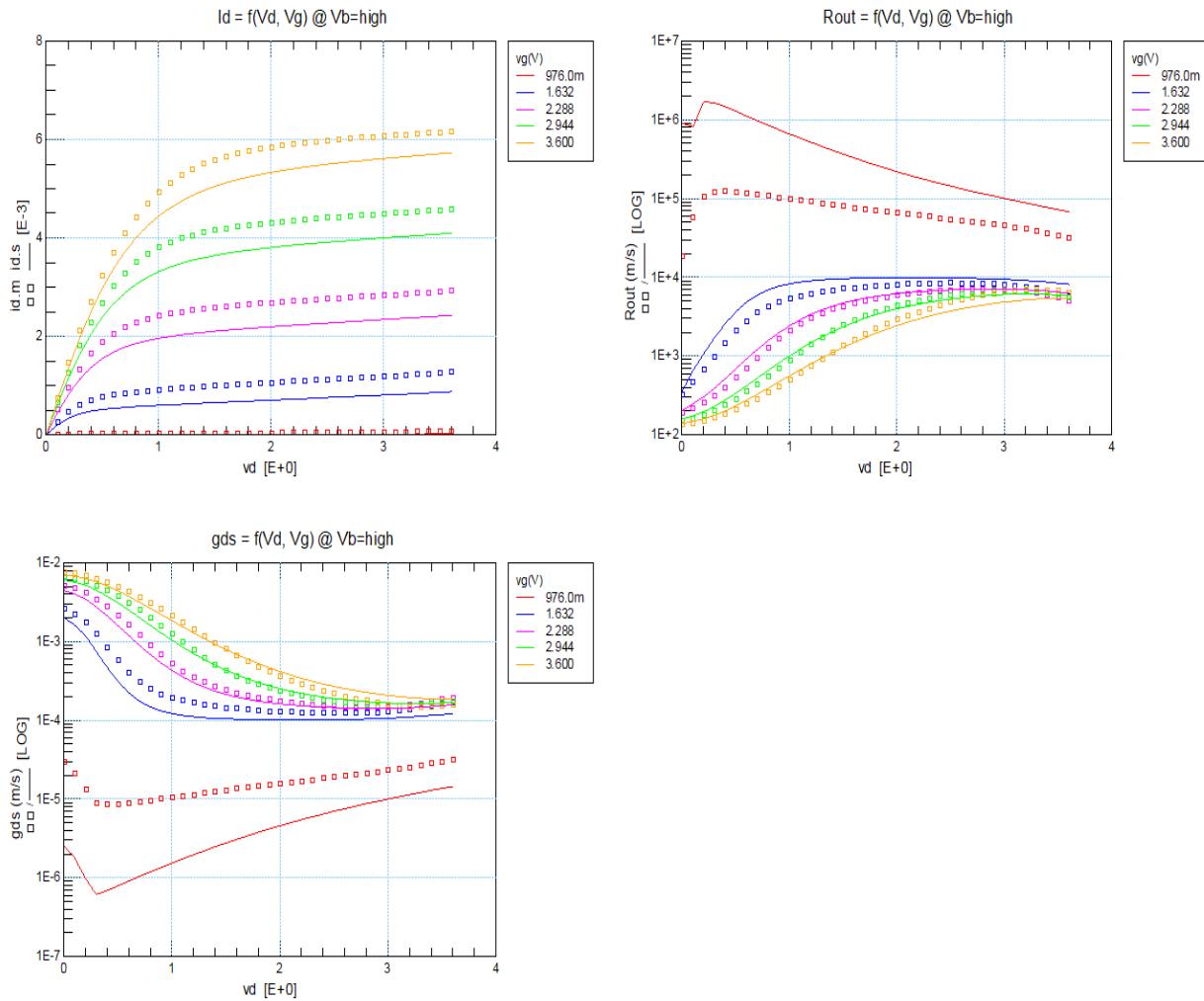
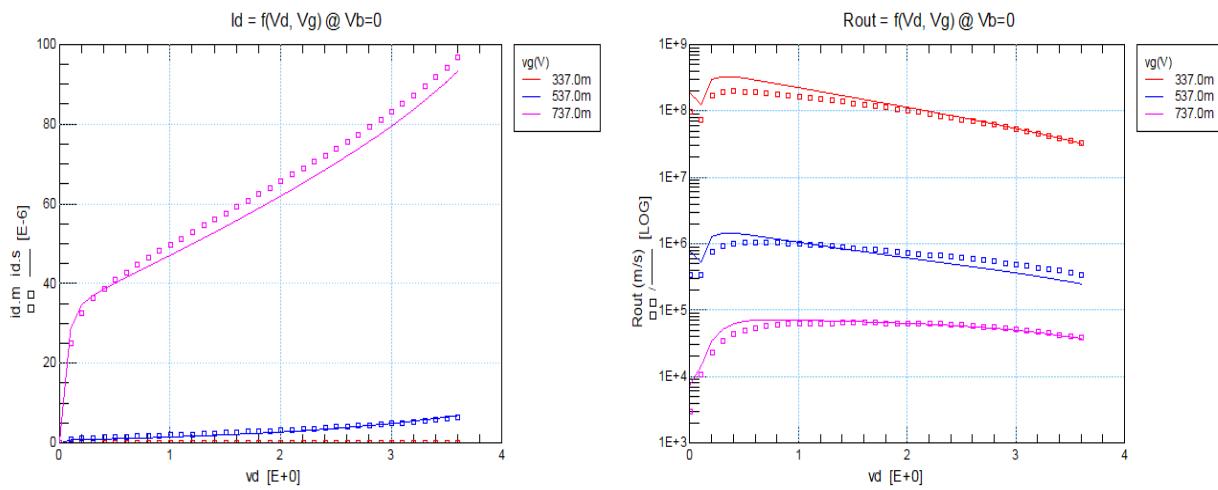


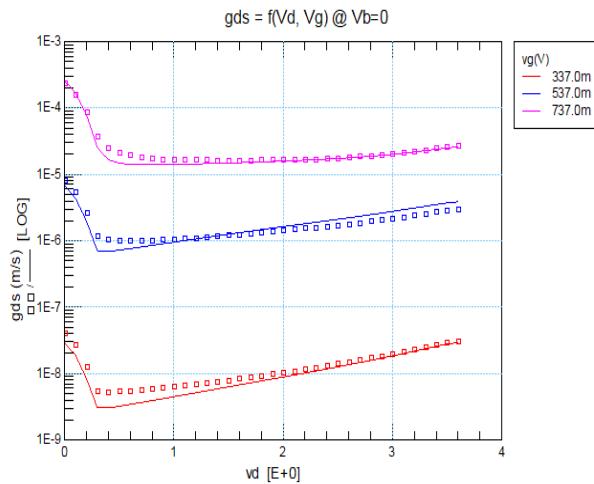


id_{vg} , I_b , I_g , $V_b = 0V$, $T = 27^\circ C$

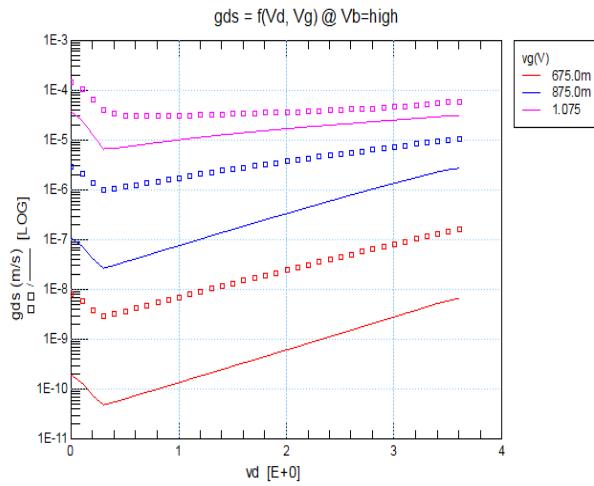
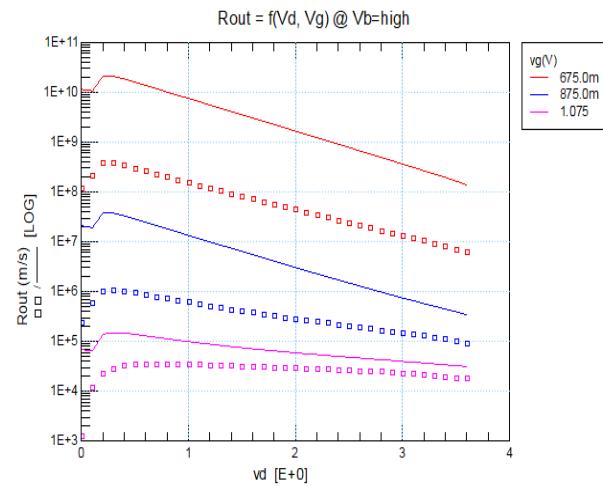
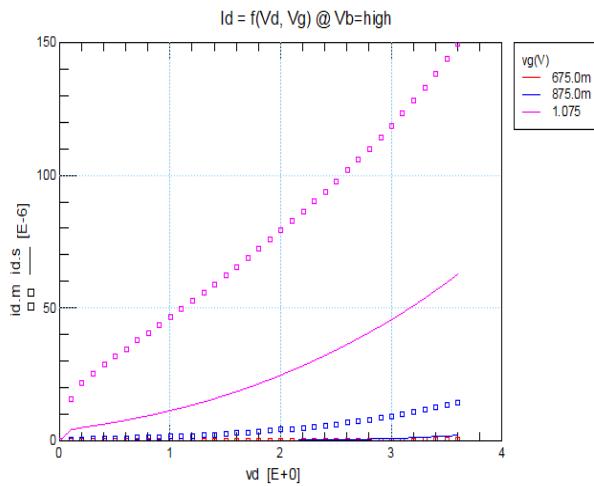


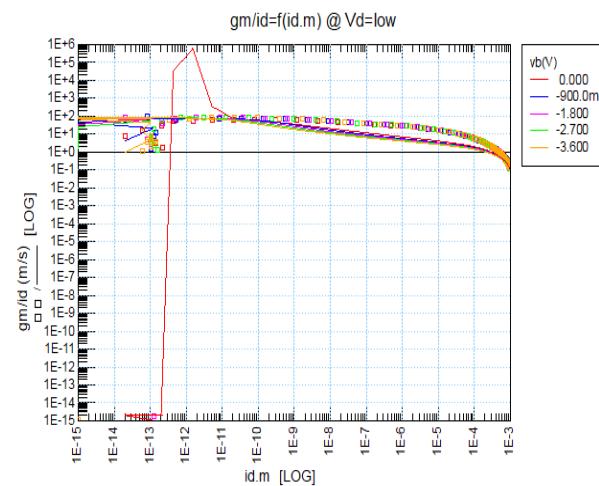
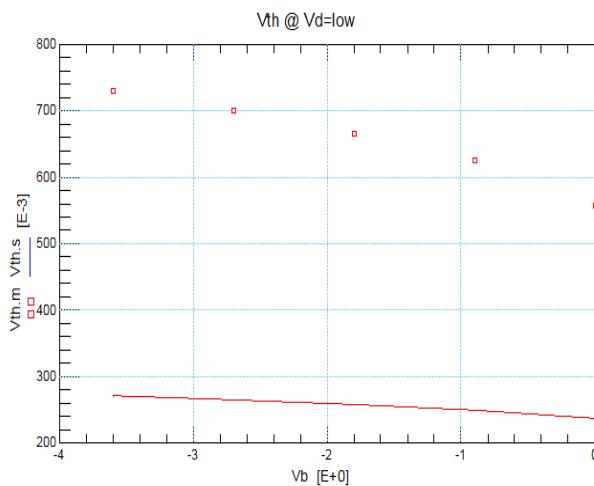
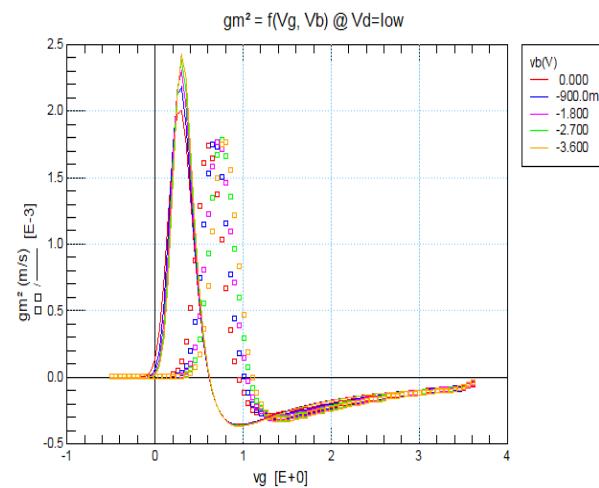
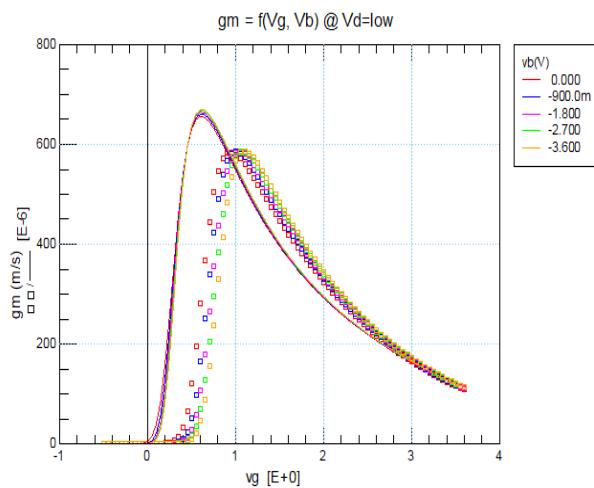
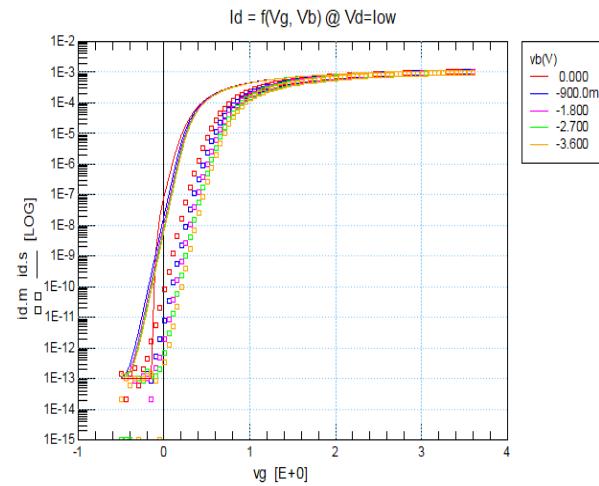
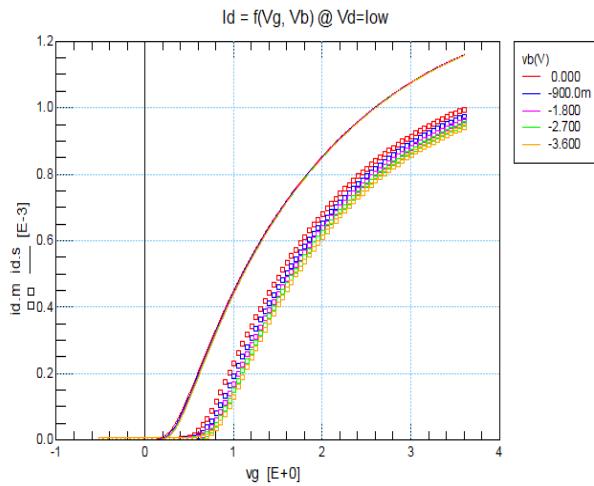
idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


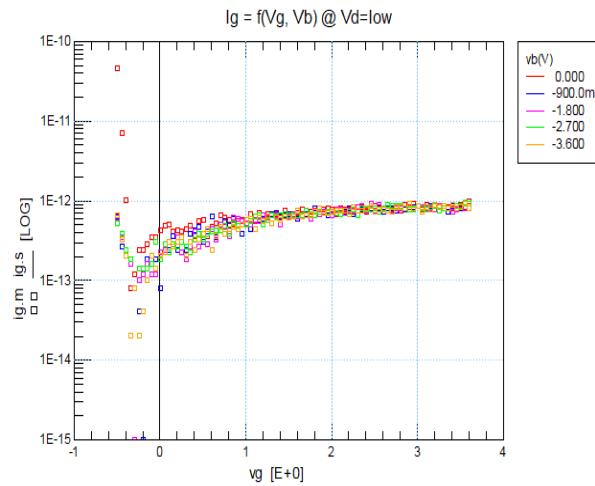
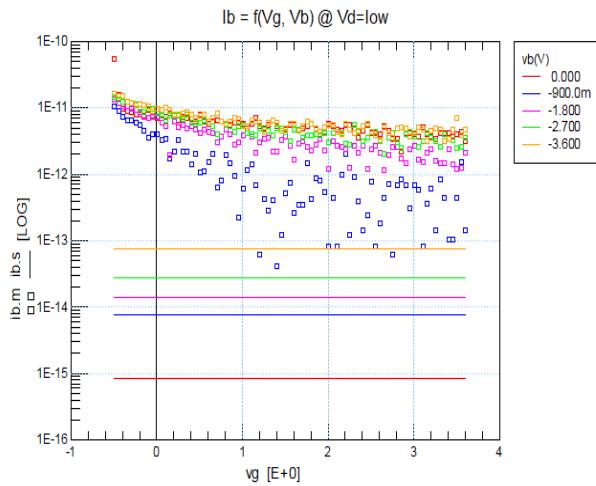
idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C




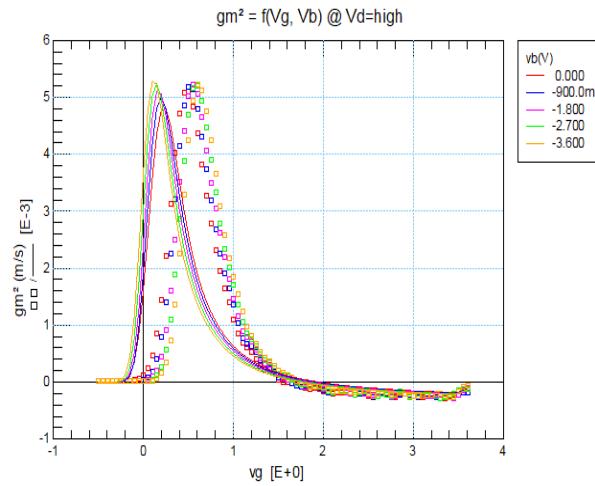
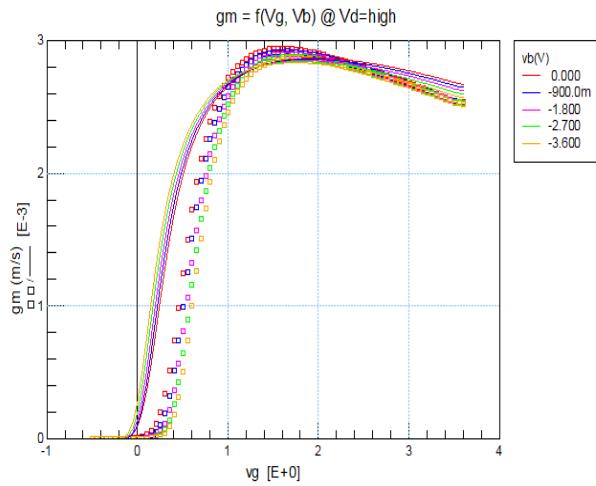
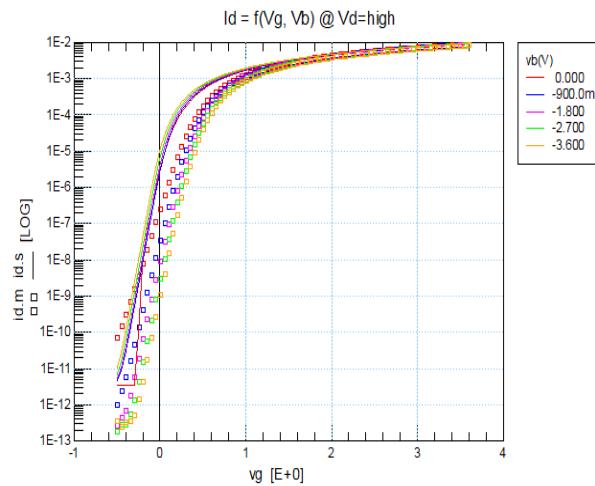
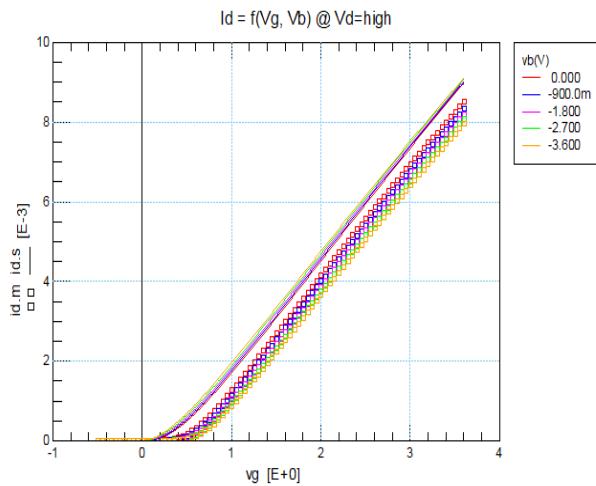
idvd_vth_vbmin, Vb = -3.6V, T = 27°C

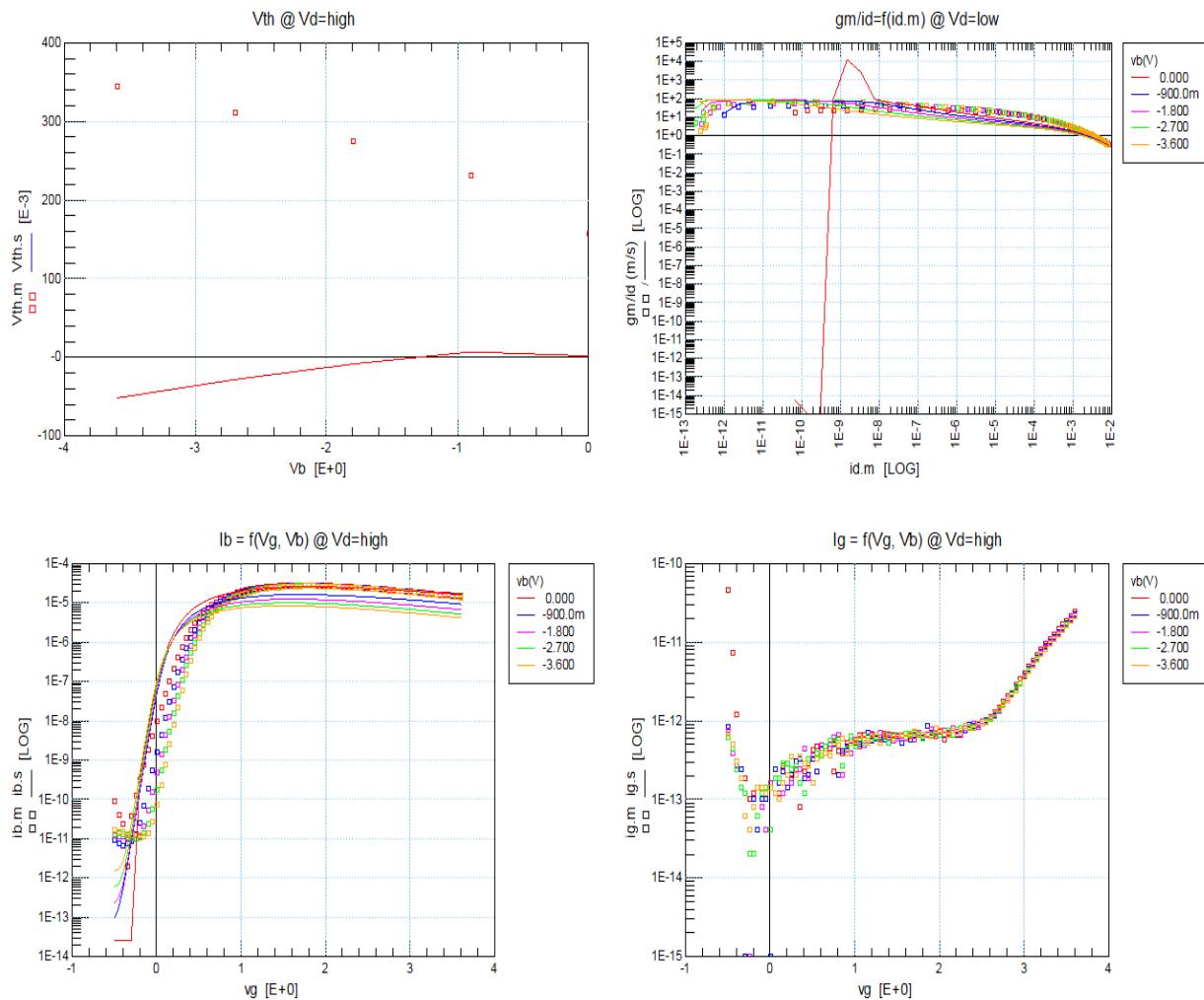


4.30W10u0_L0u3_S556_1**idvg, Vd = 0.1V, T = 27°C**

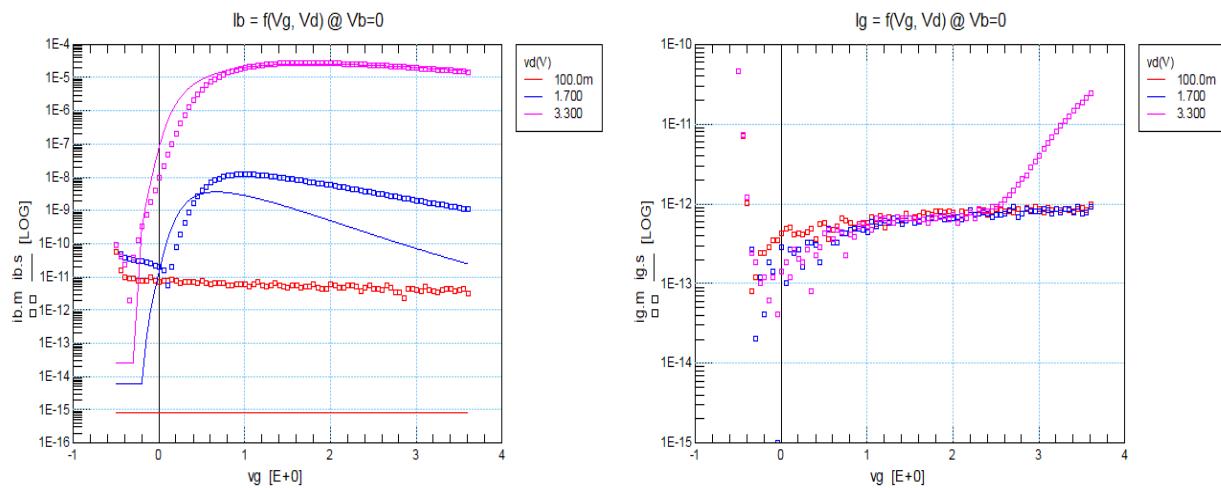


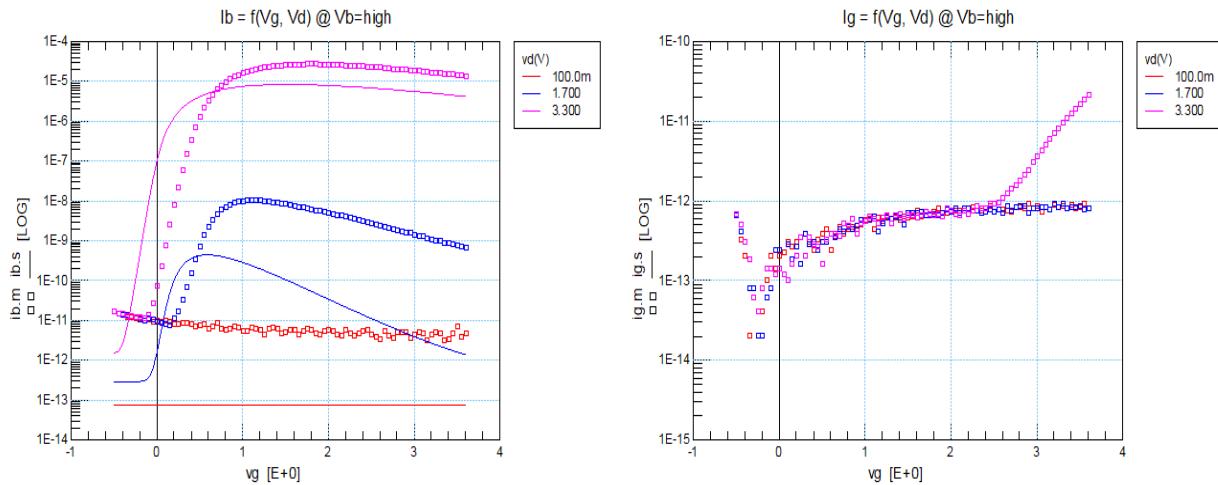
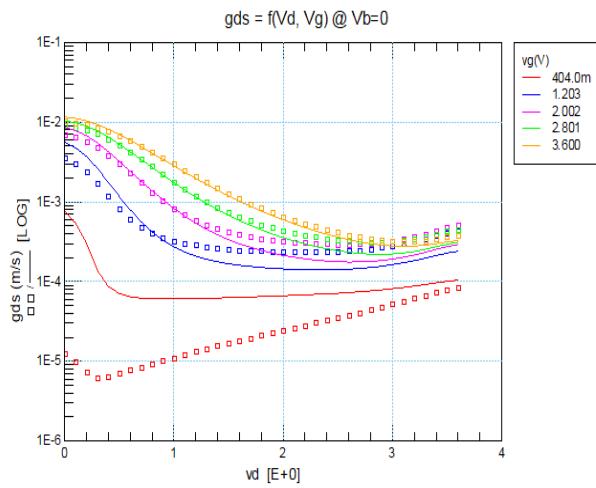
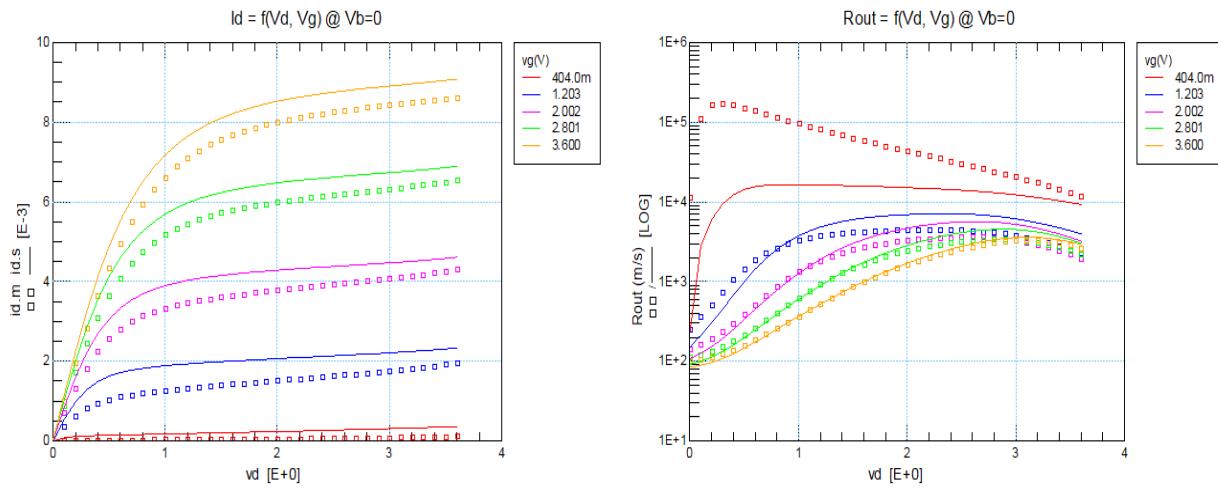
$i_d v_g, V_d = 3.3V, T = 27^\circ C$

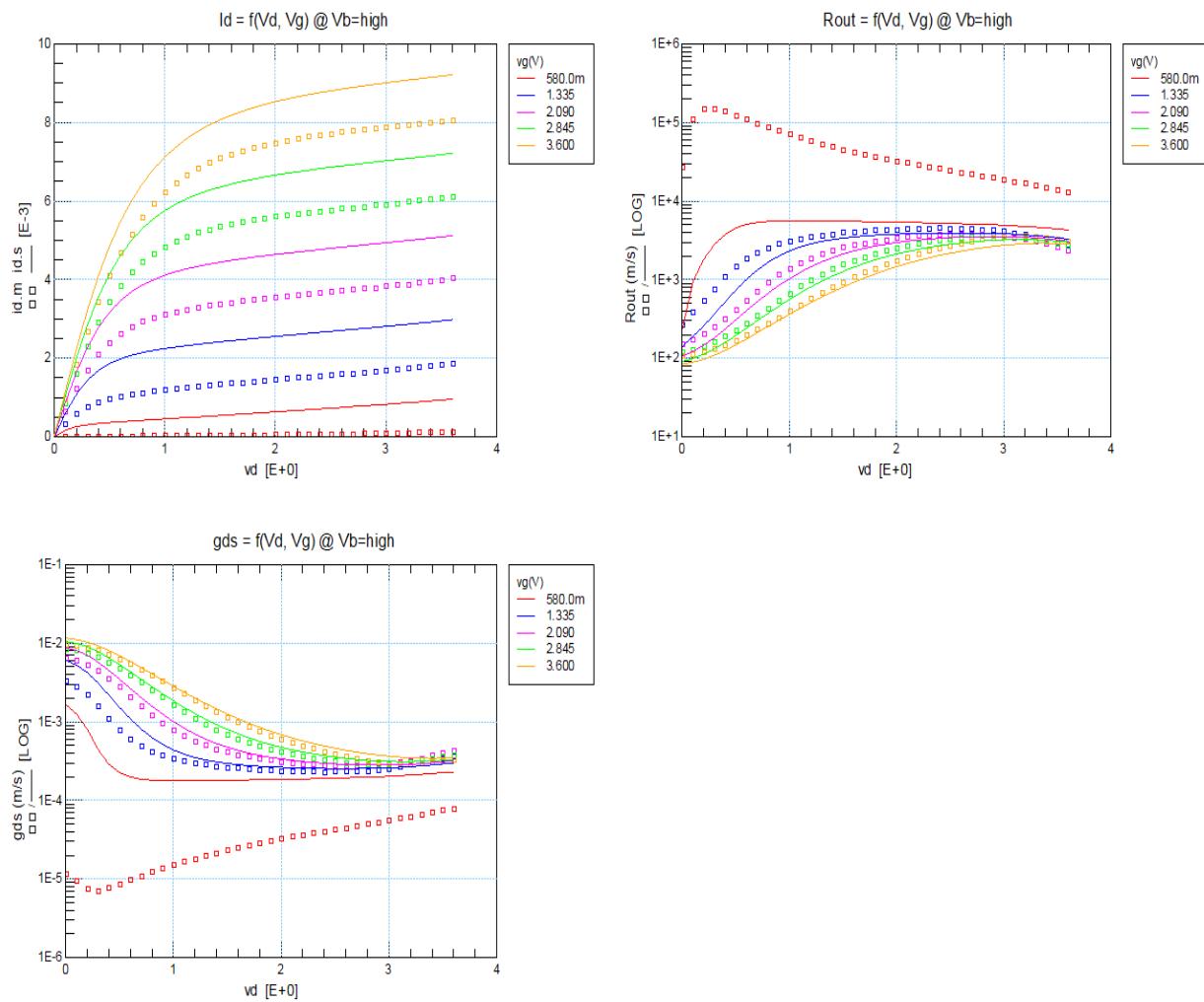
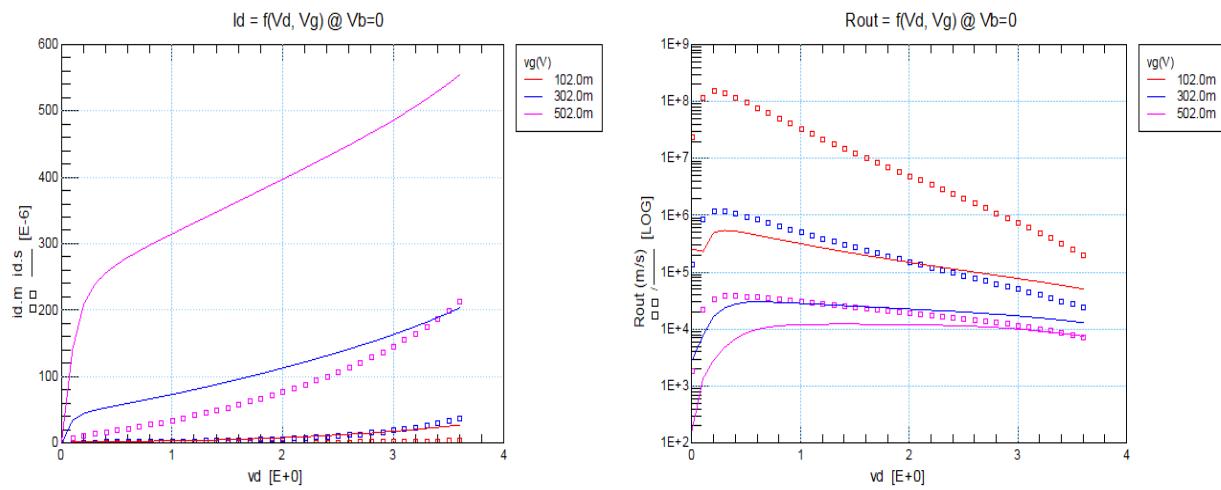


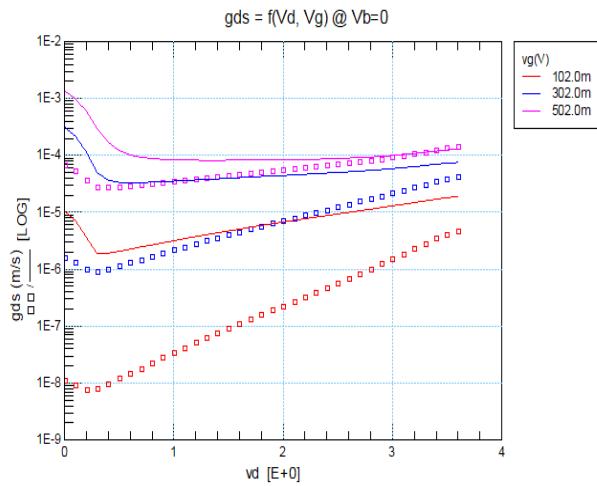


id_{vg} , I_b , I_g , $V_b = 0V$, $T = 27^\circ C$

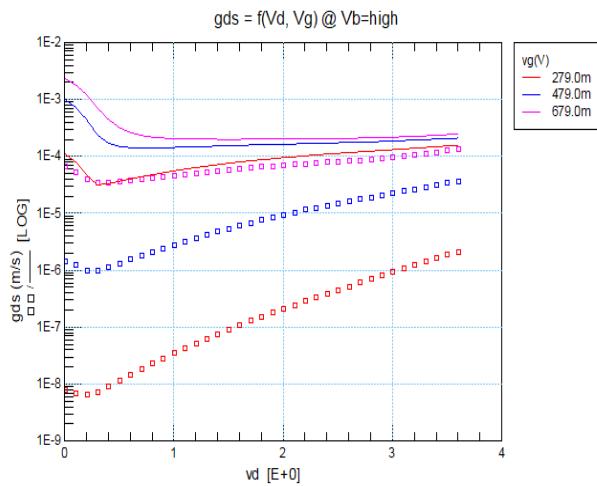
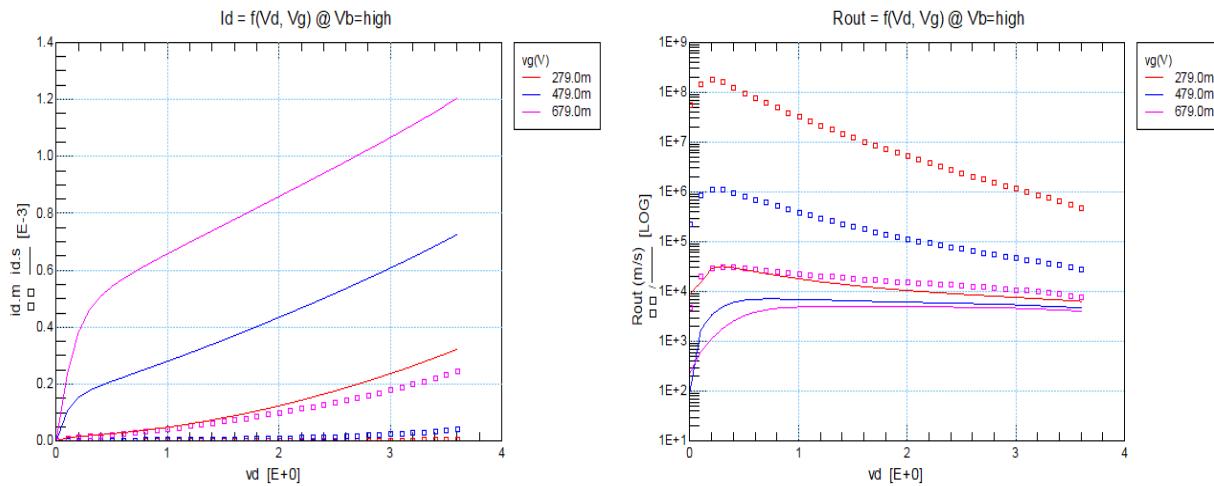


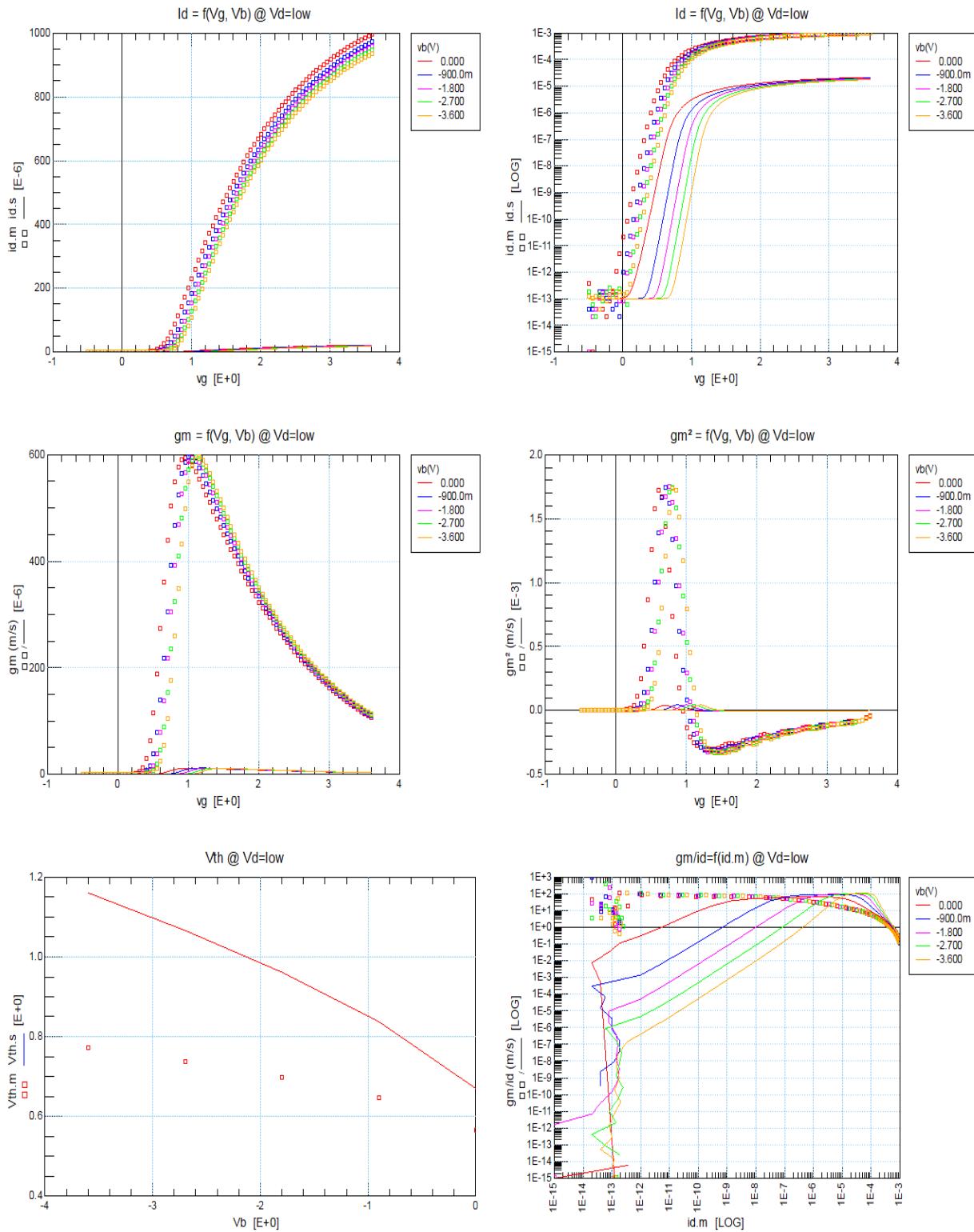
idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


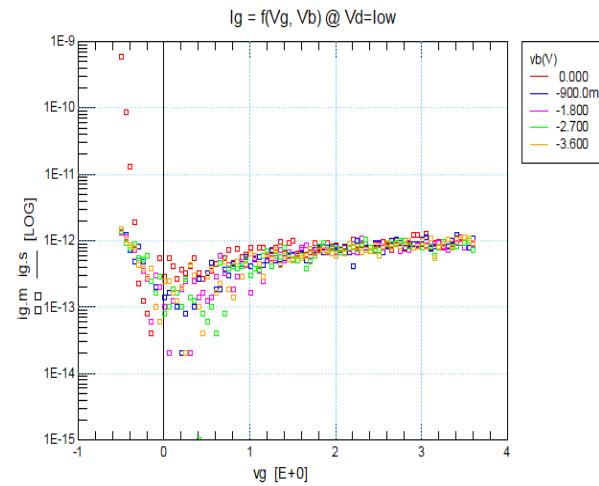
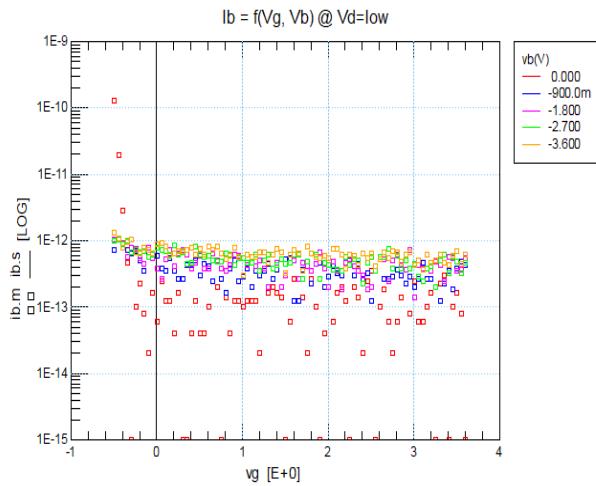
idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C




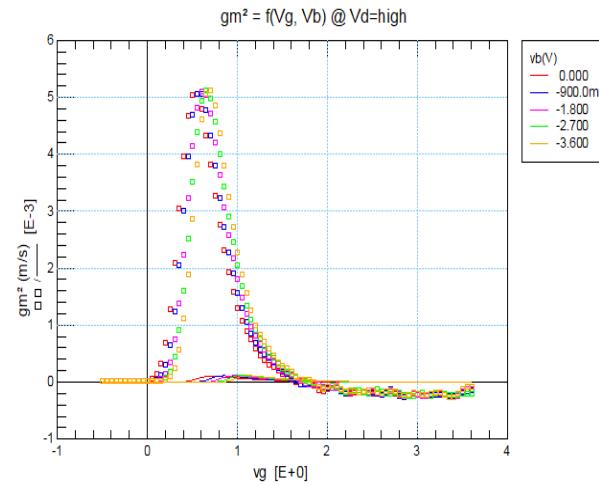
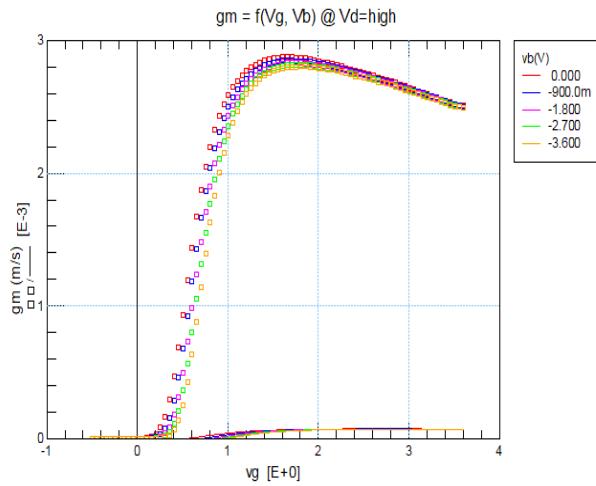
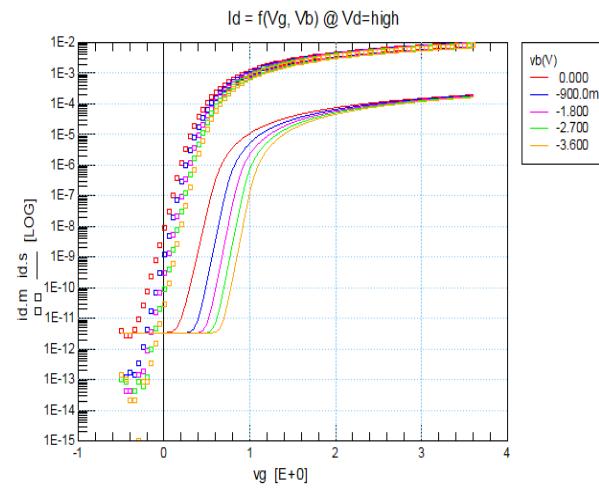
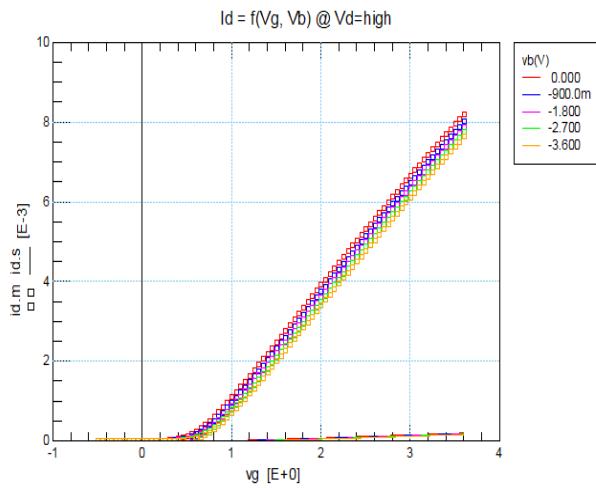
idvd_vth_vbmin, Vb = -3.6V, T = 27°C

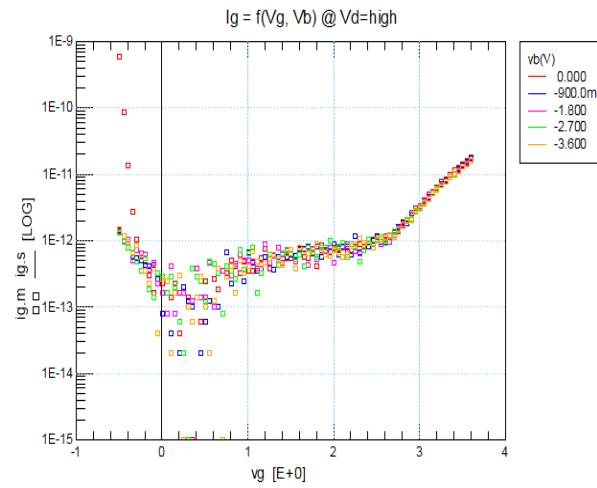
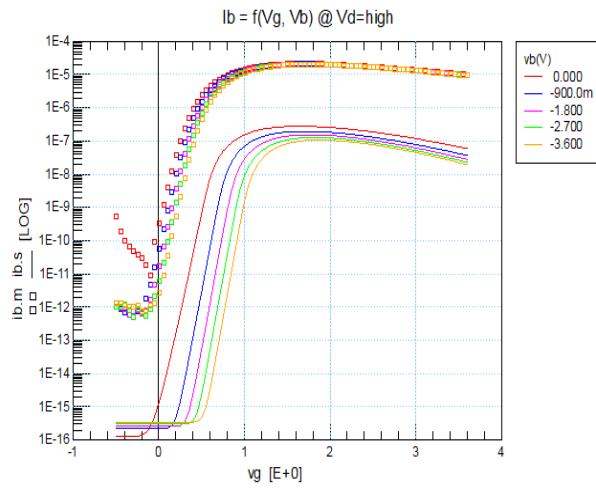
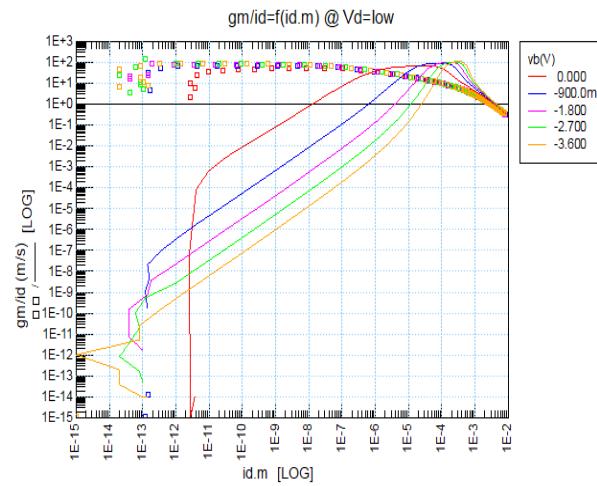
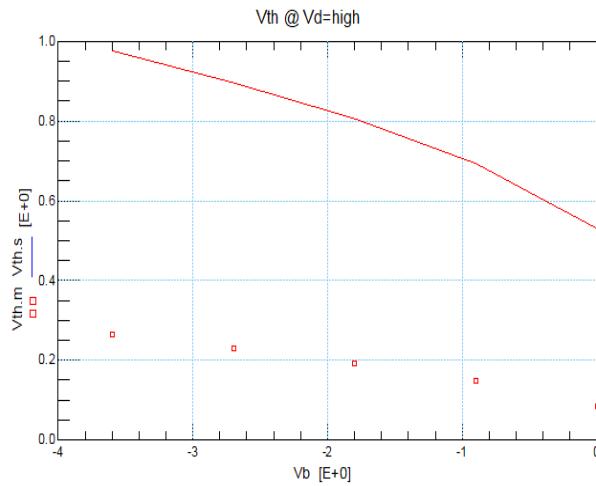


4.31 W0u3_L0u45_T356_S384M_3**idvg, Vd = 0.1V, T = 27°C**

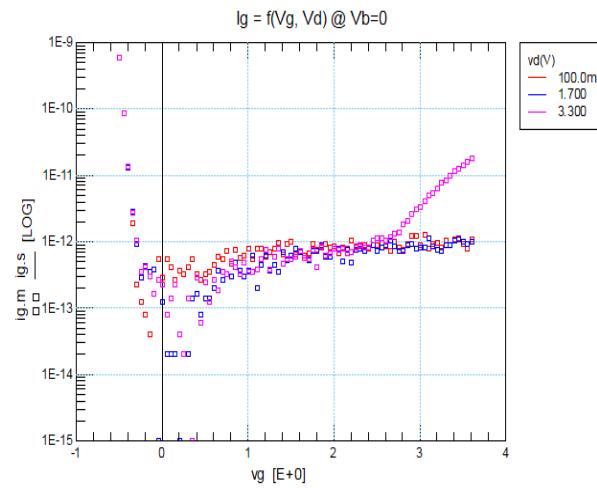
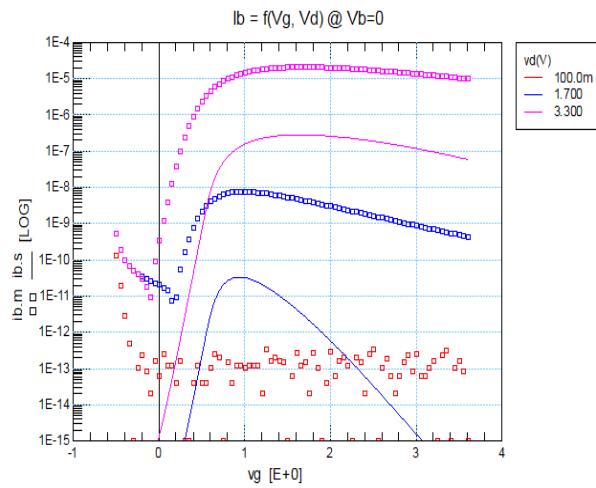


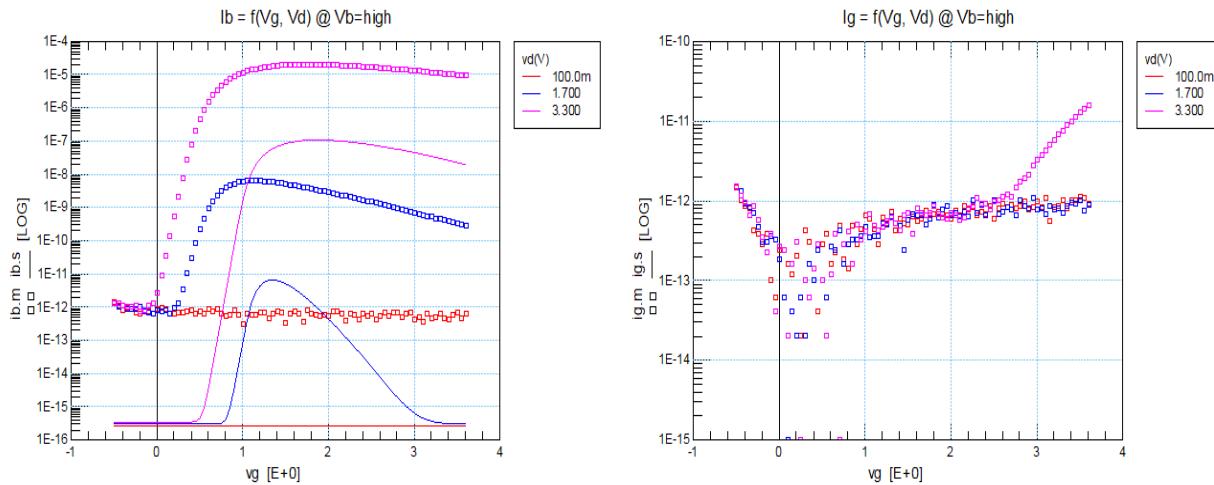
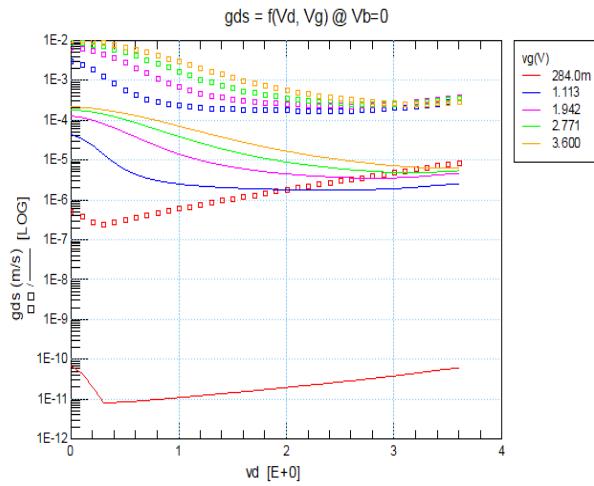
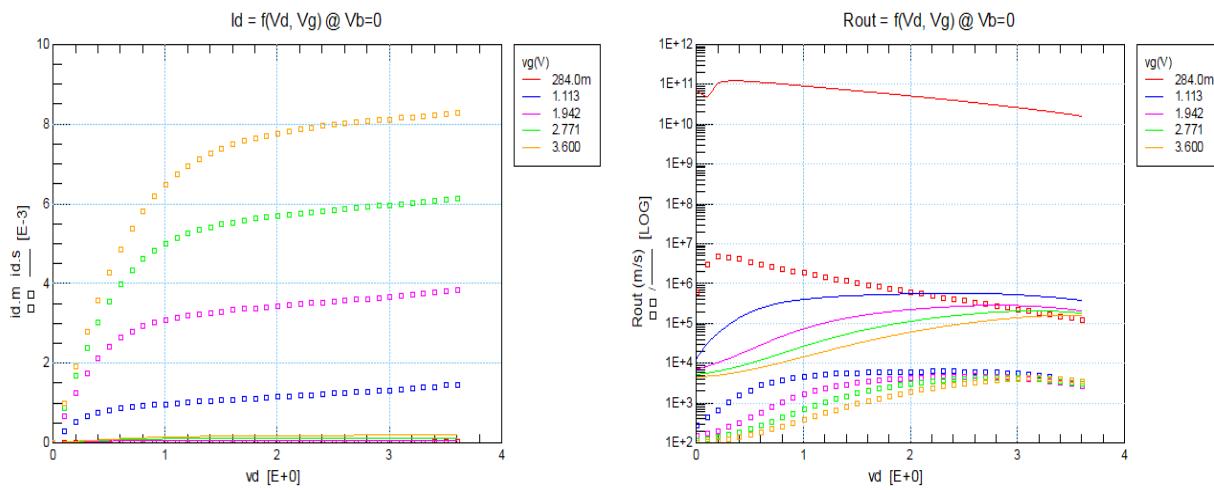
$i_{dvg}, V_d = 3.3V, T = 27^\circ C$

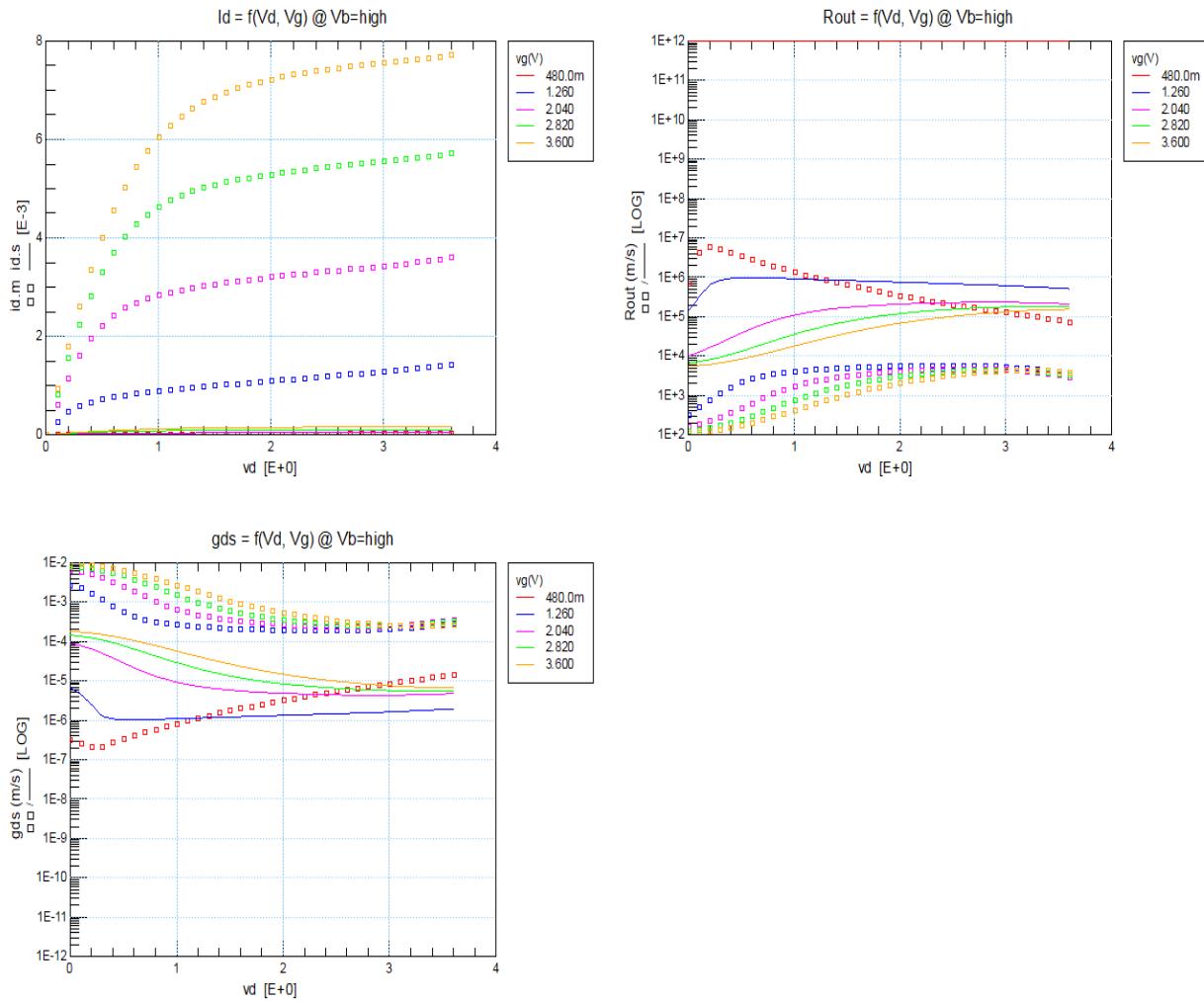
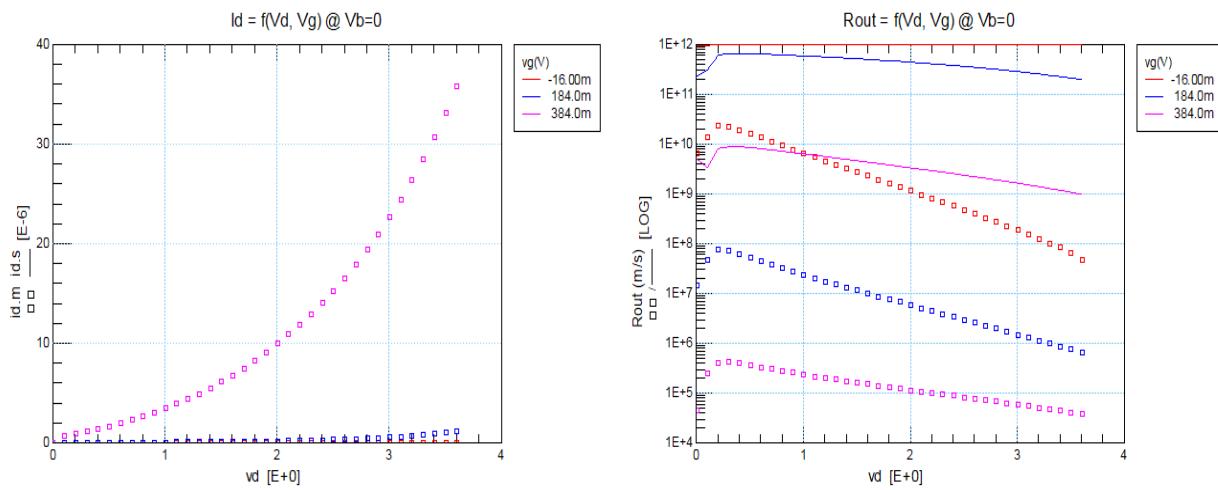


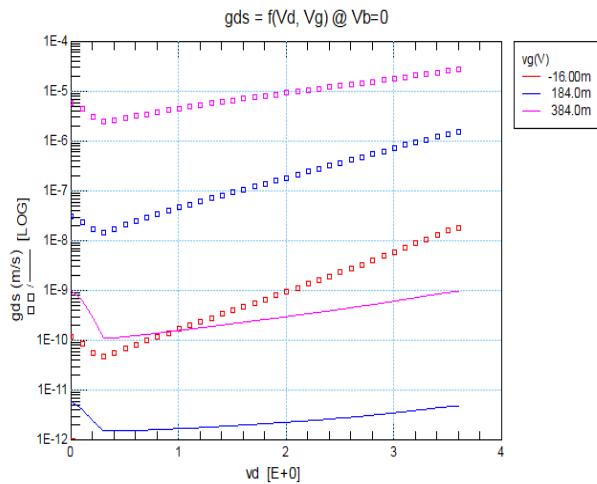


idvg, lb, lg, Vb = 0V, T = 27°C

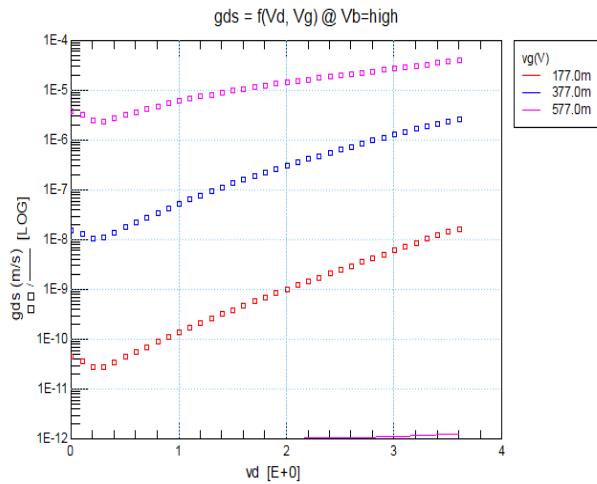
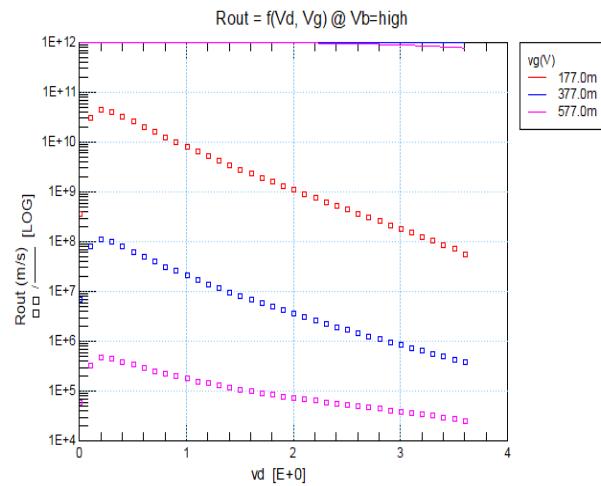
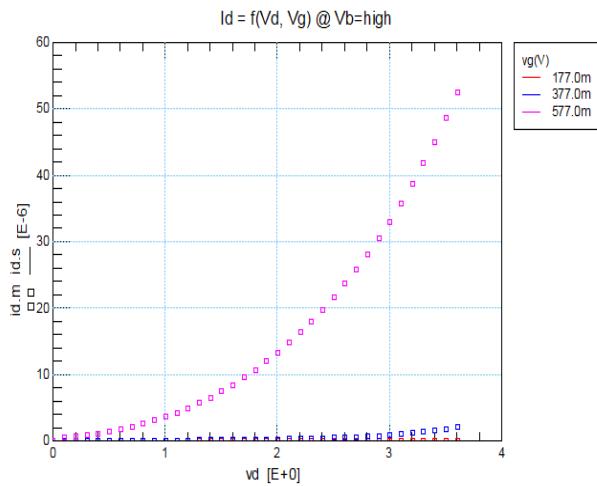


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


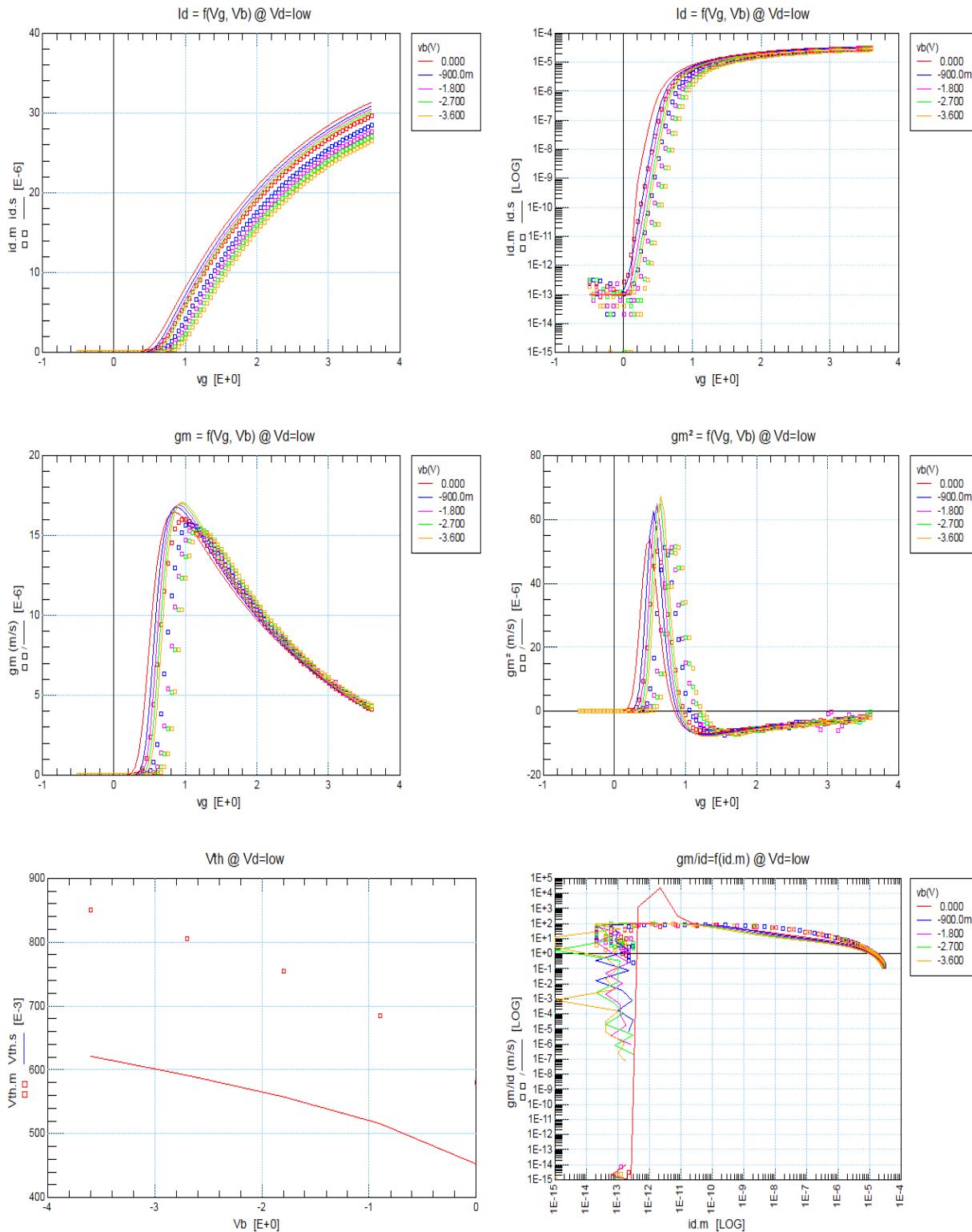


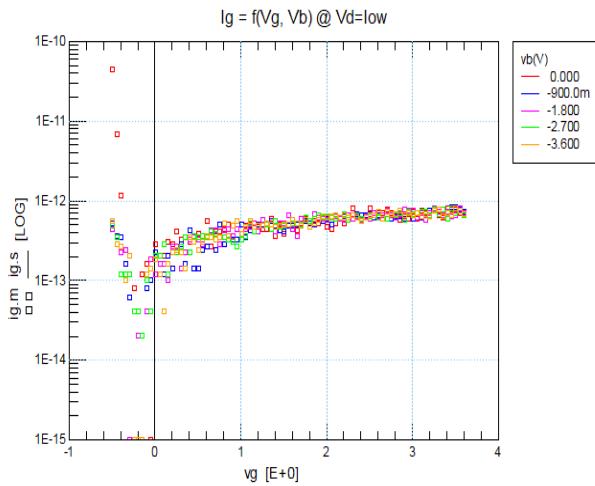
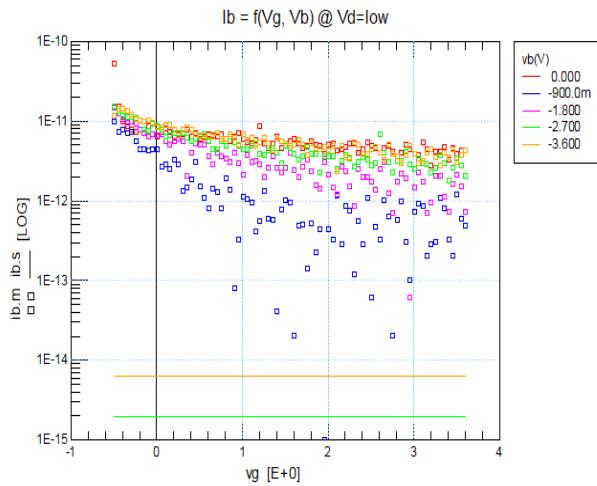
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



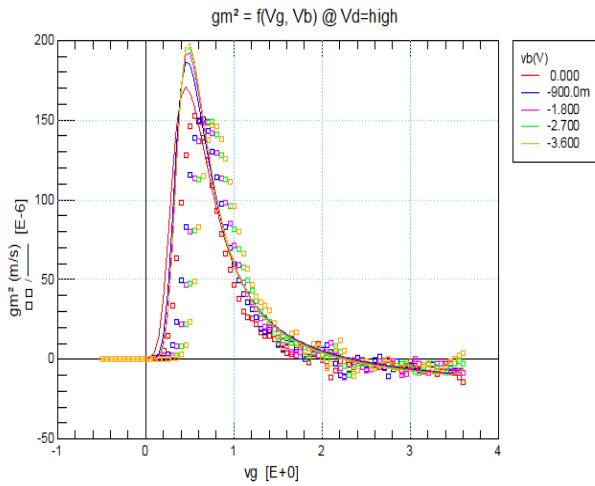
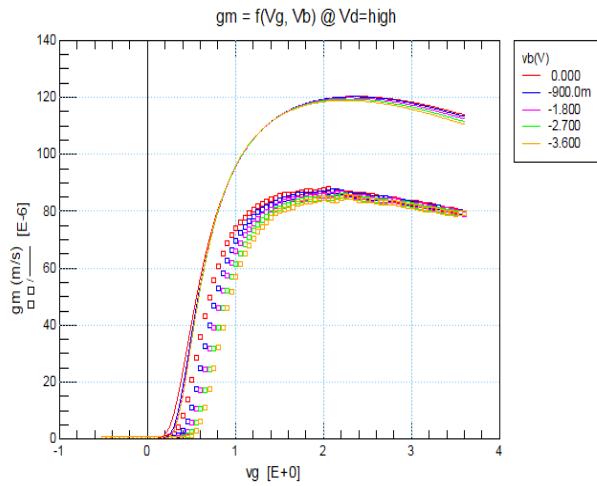
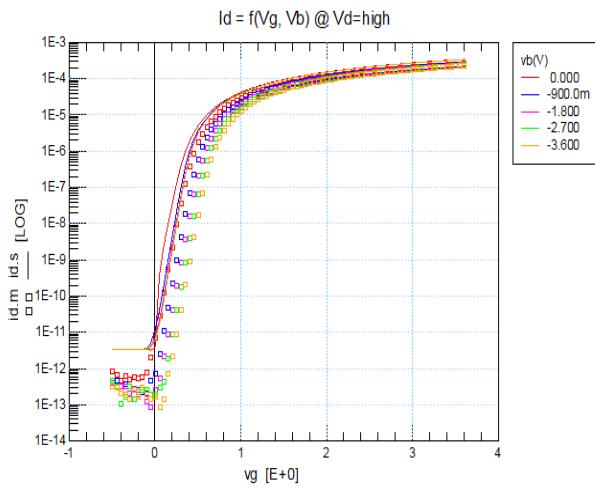
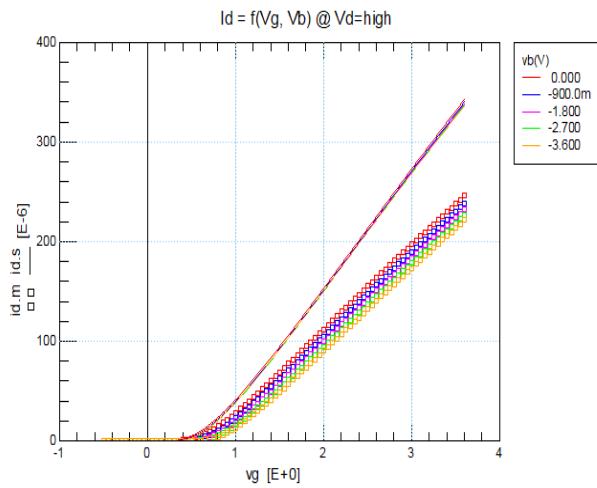
4.32 W0u3_L0u33_S560_2

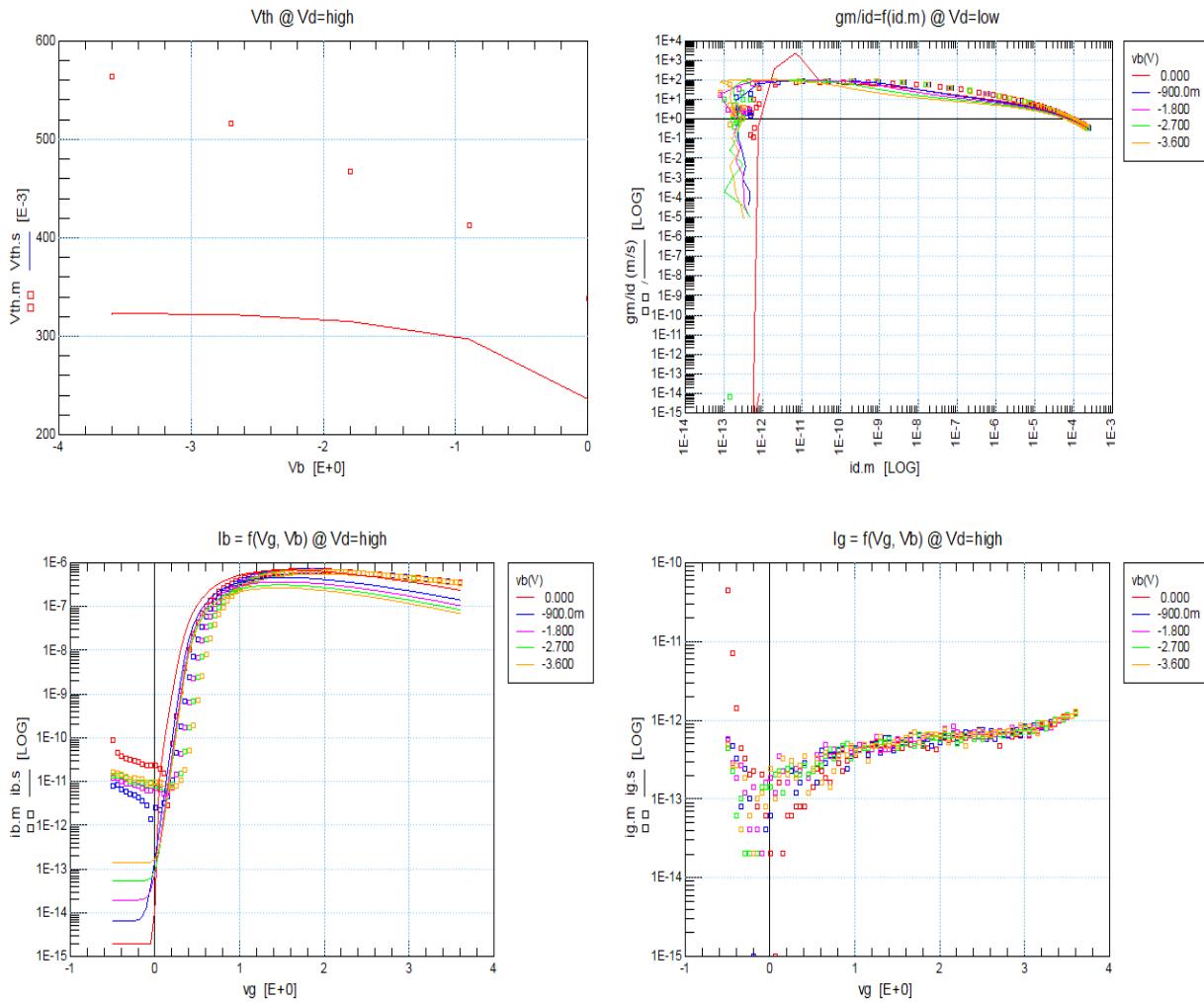
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



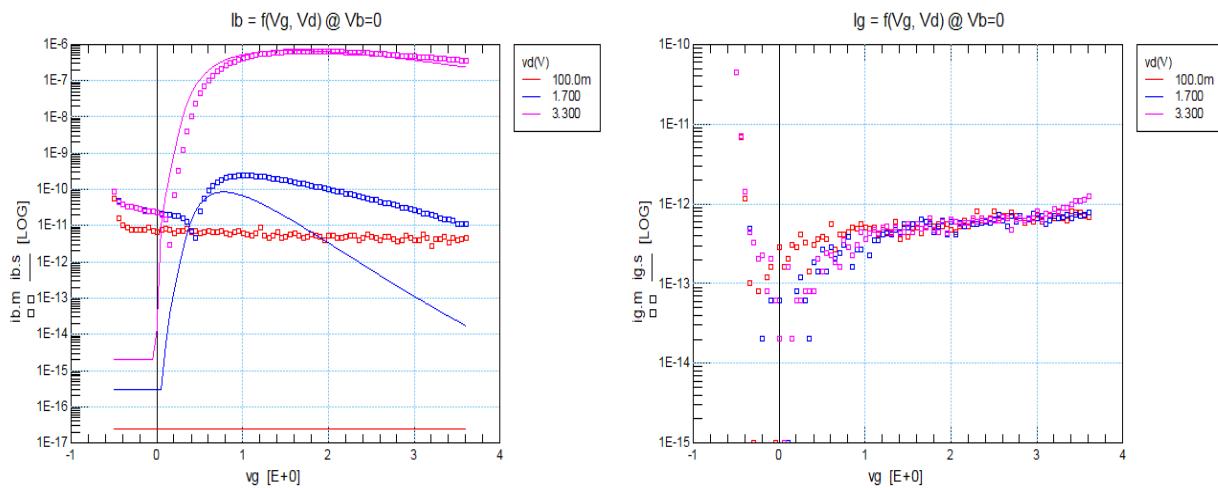


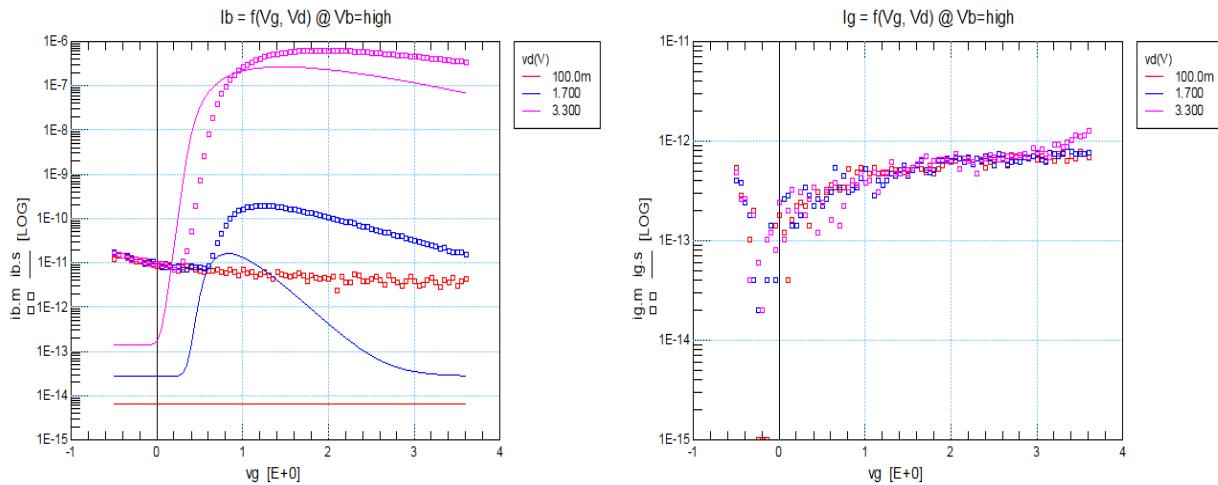
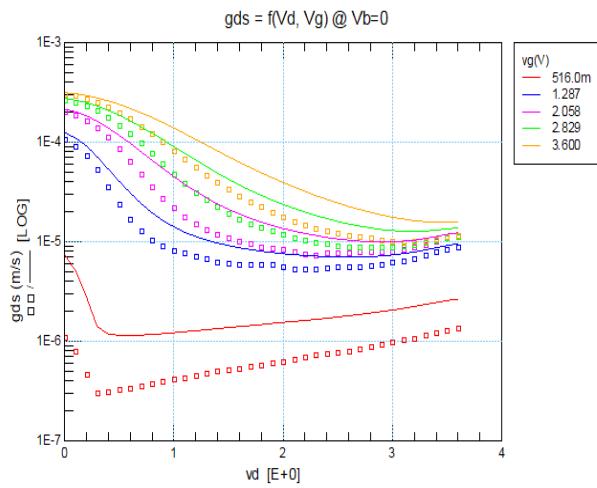
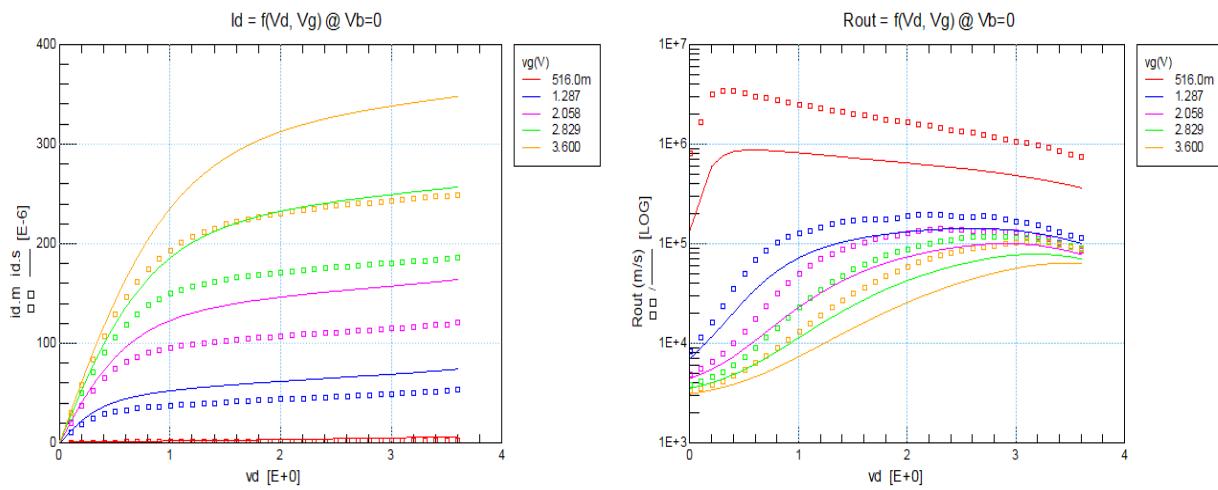
$i_d v_g, V_d = 3.3V, T = 27^\circ\text{C}$

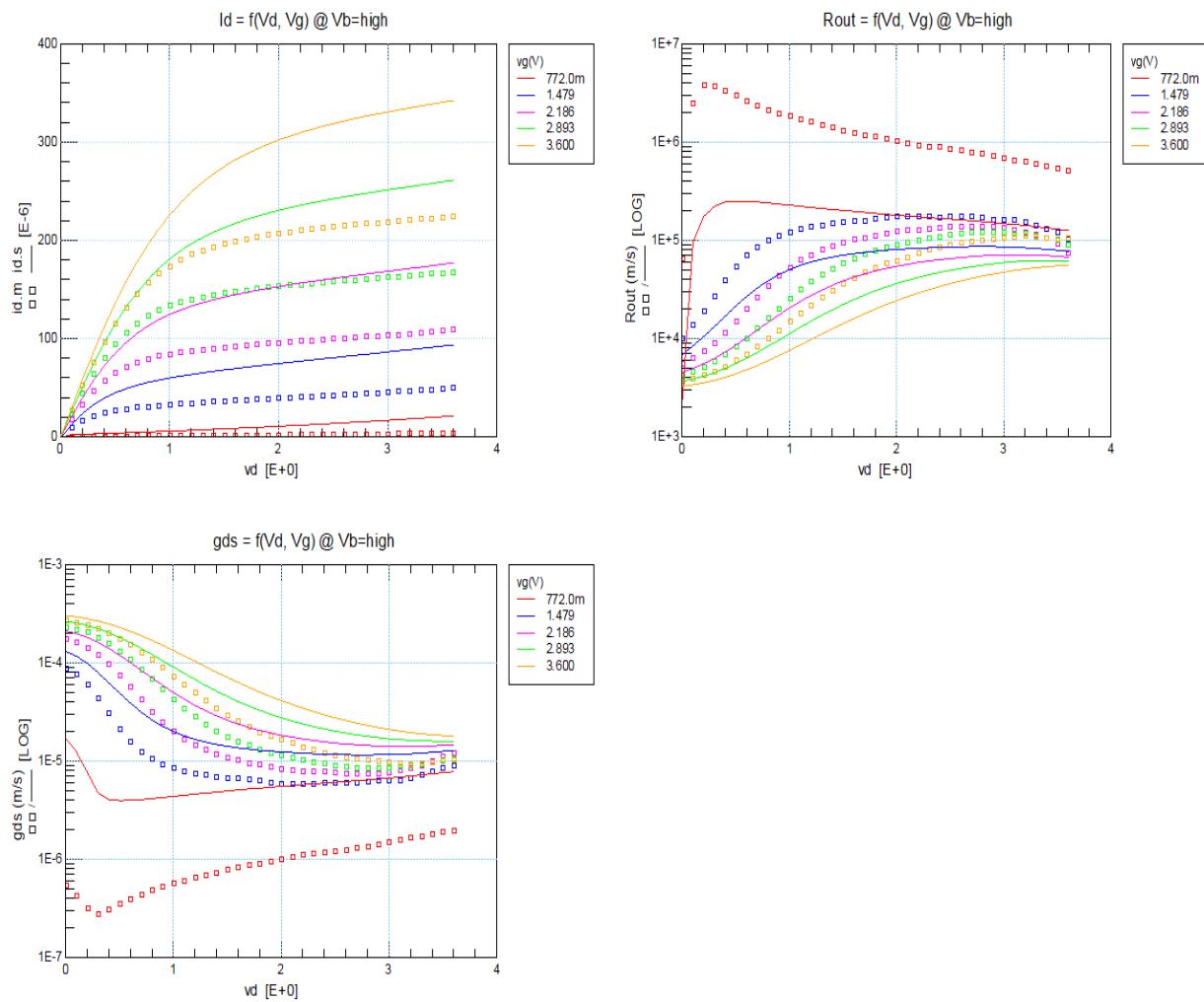
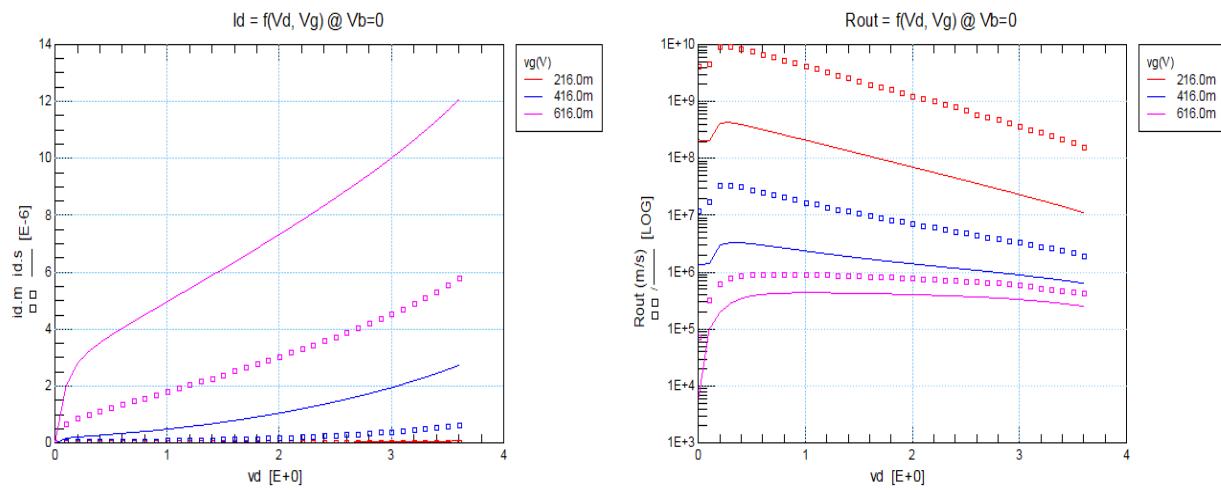


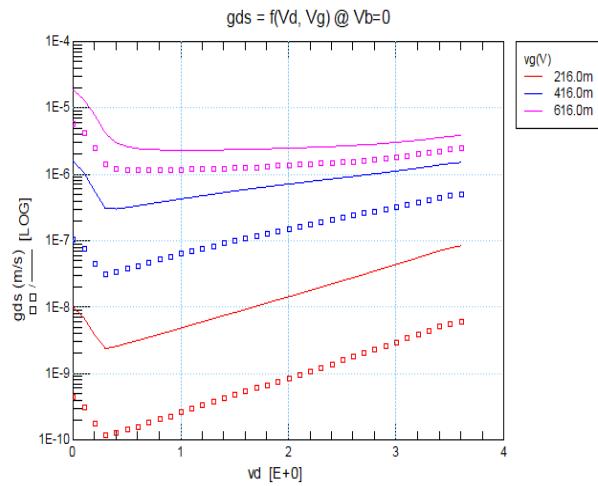


id_{vg} , Ib , Ig , $Vb = 0V$, $T = 27^\circ C$

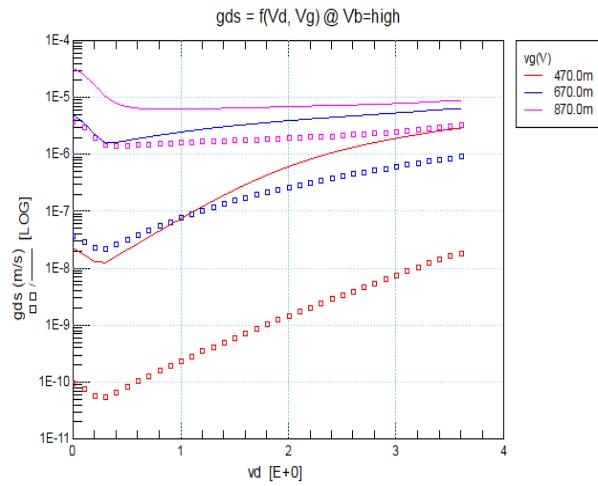
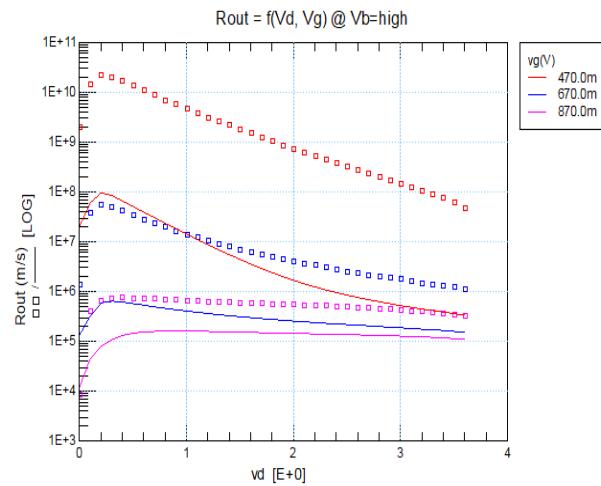
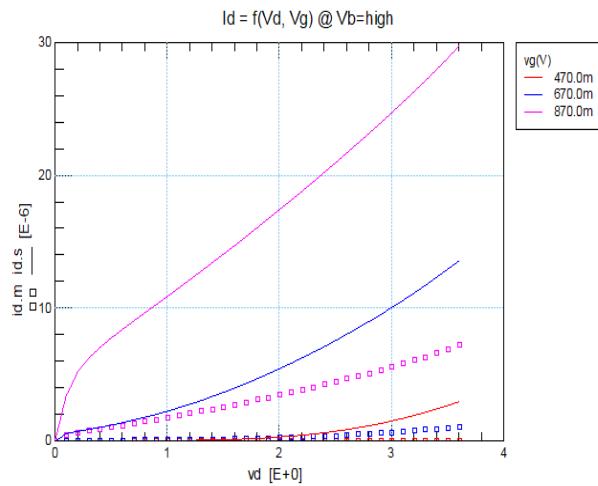


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C**idvd_vth, Vb = 0V, T = 27°C**

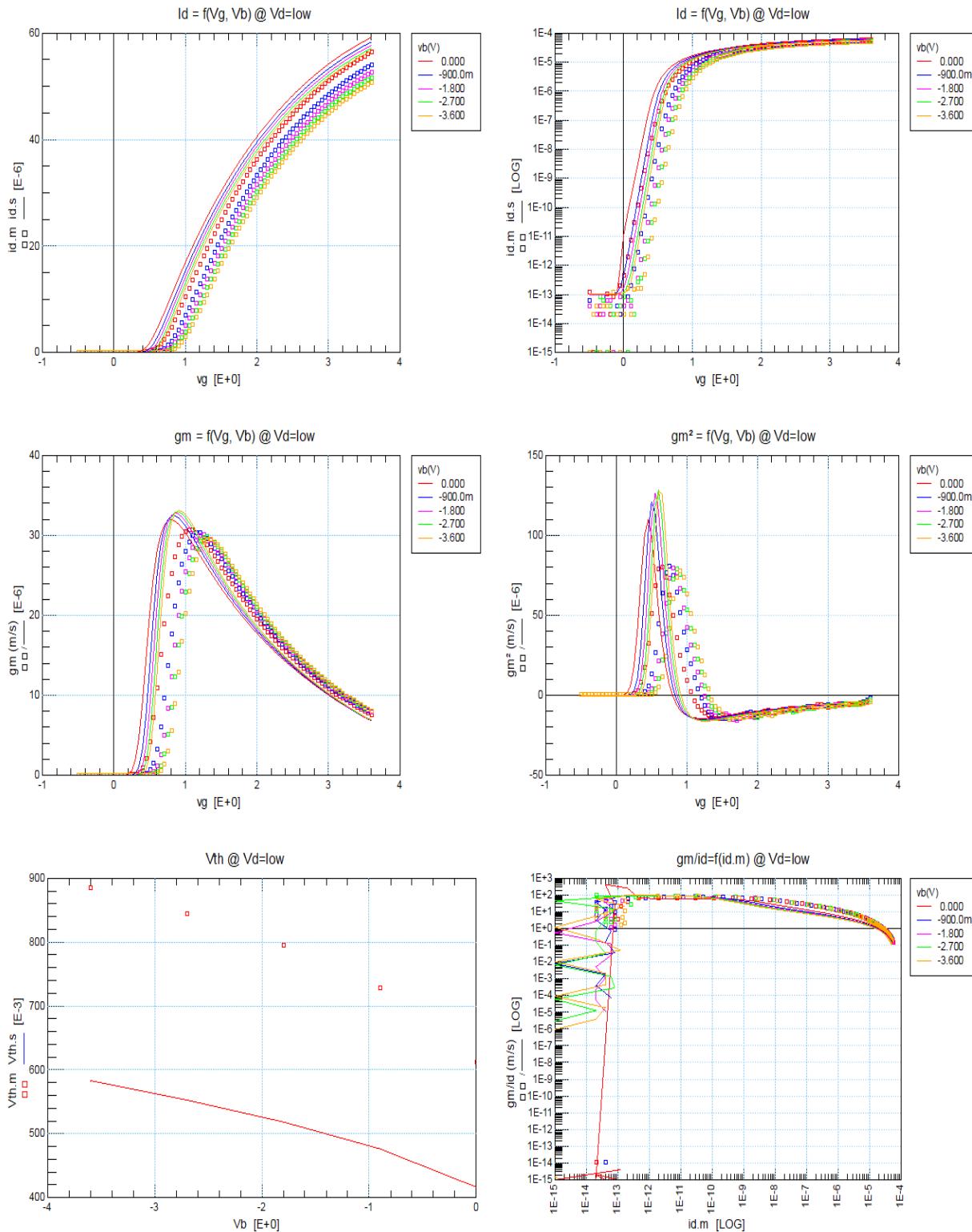


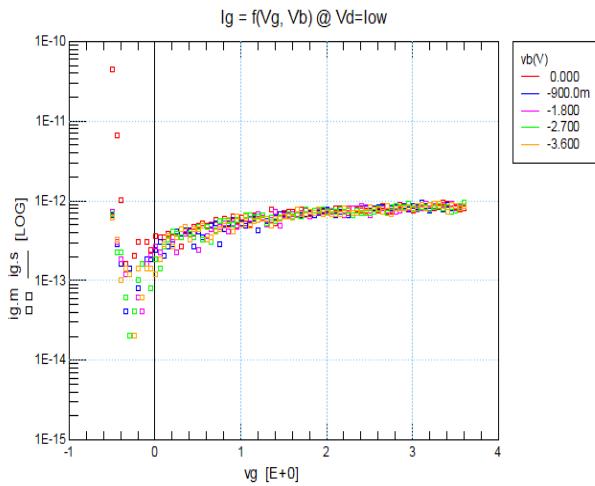
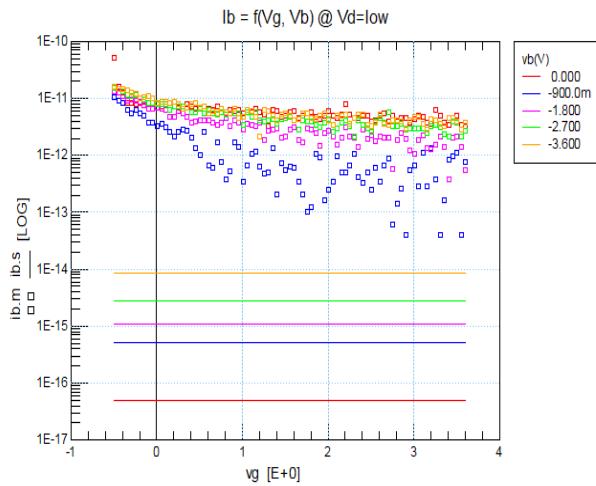
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



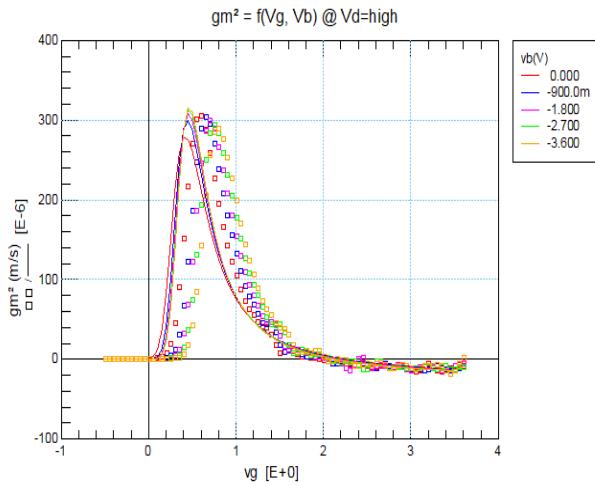
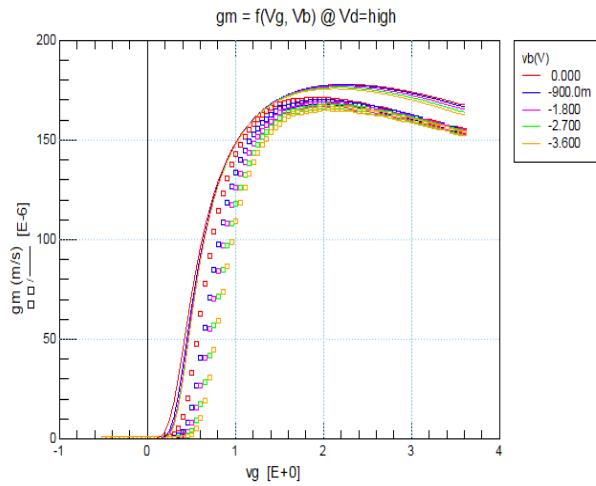
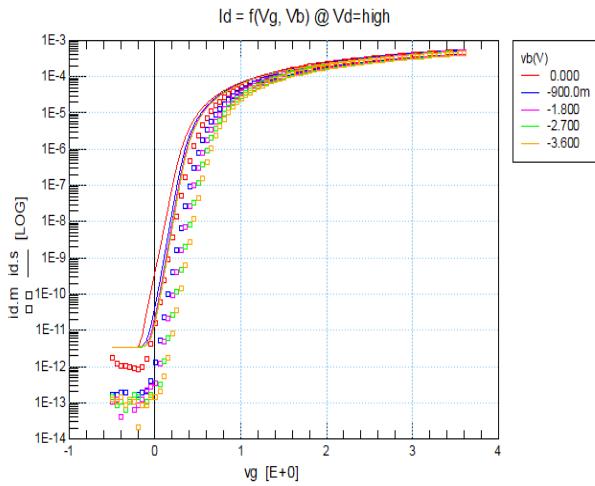
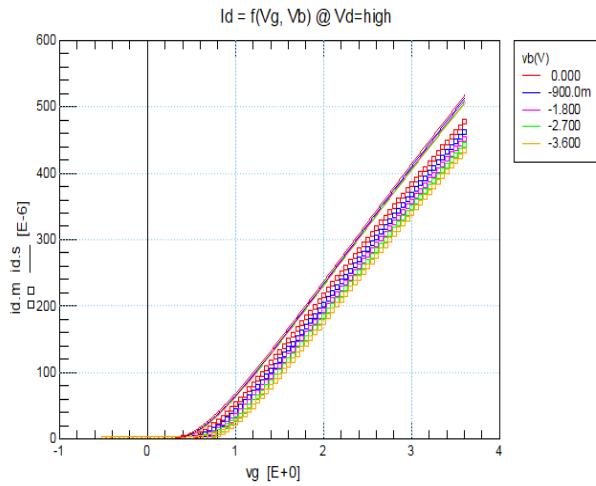
4.33 W0u6_L0u33_S559_1

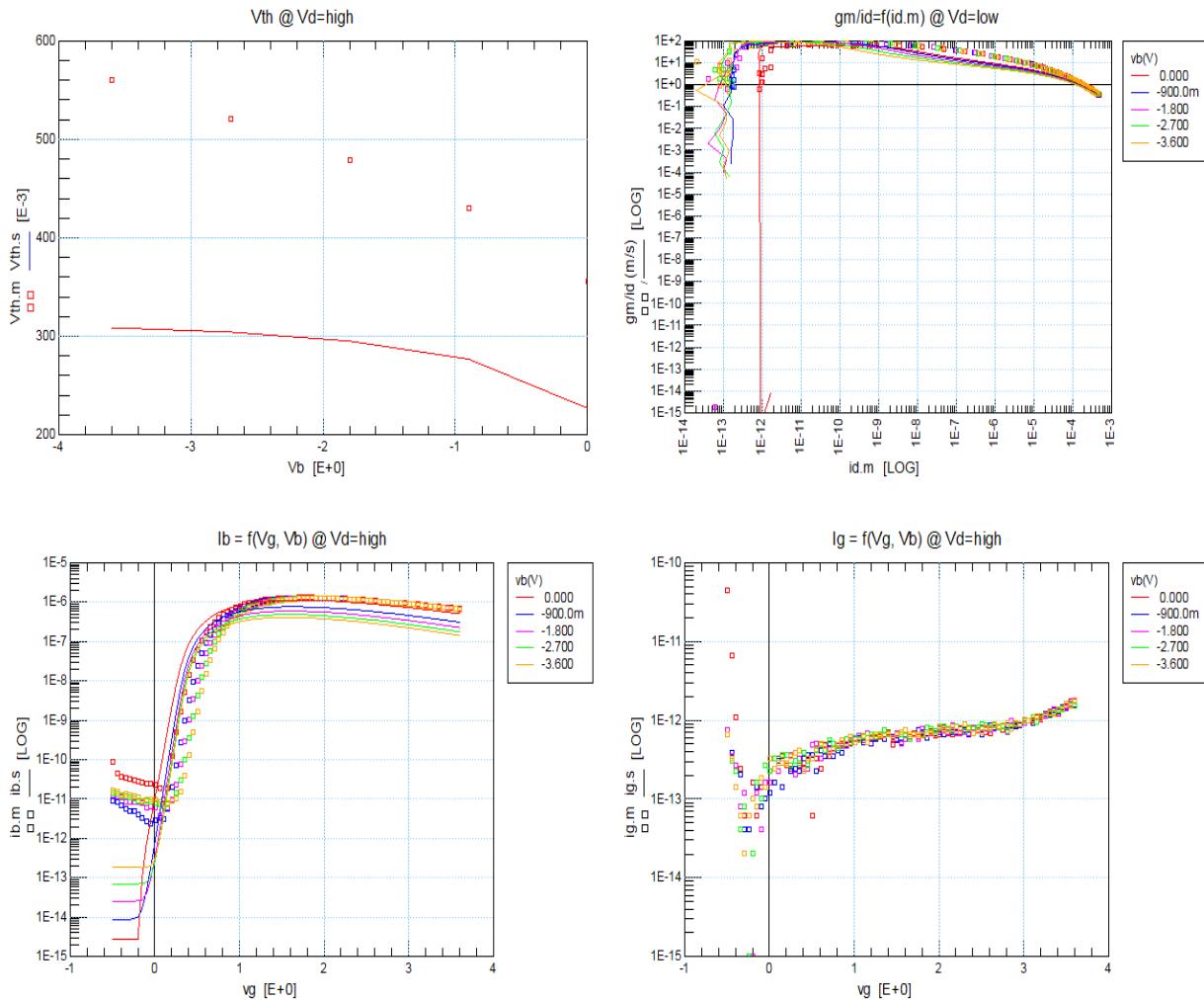
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



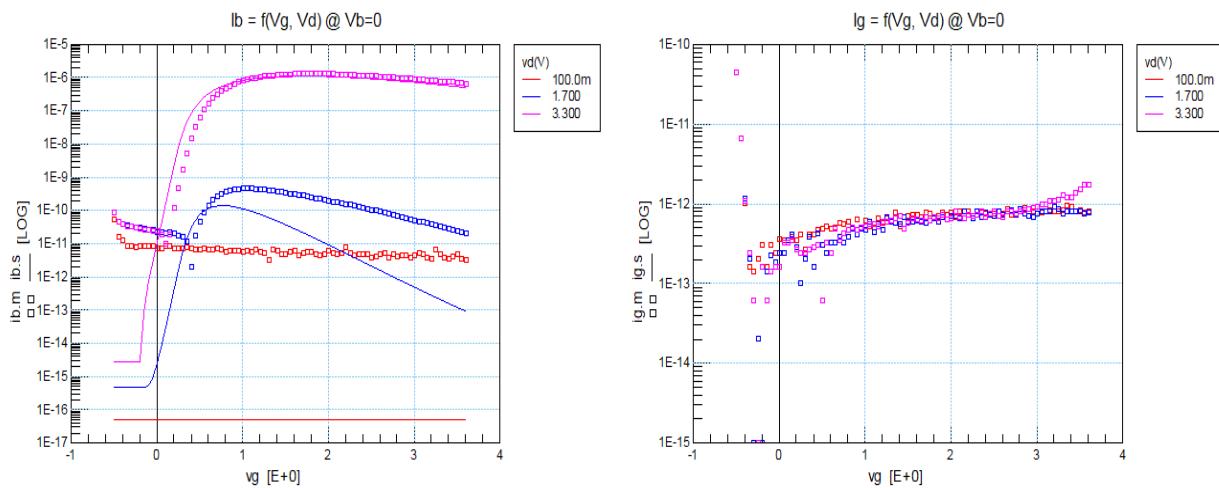


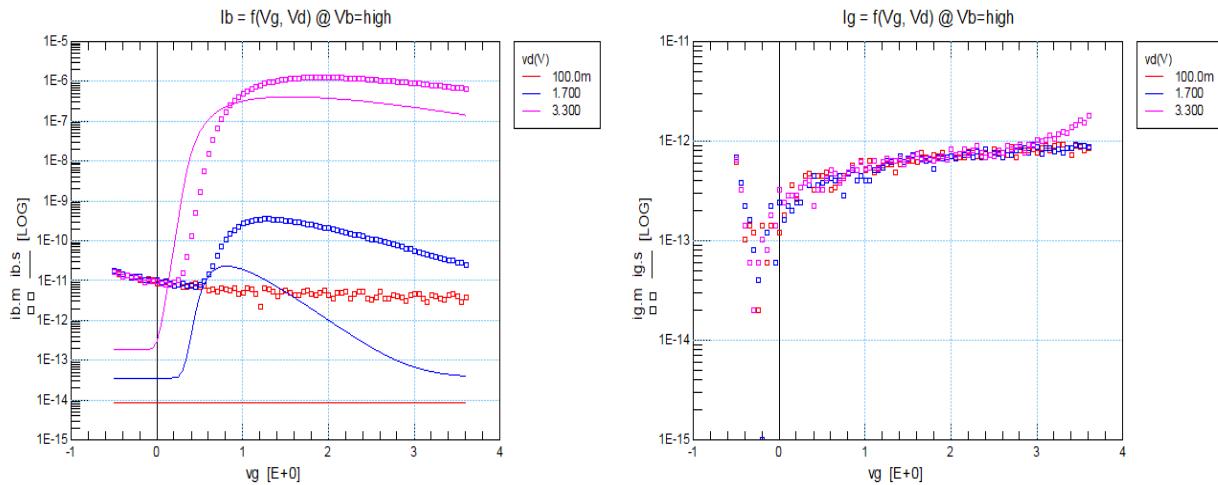
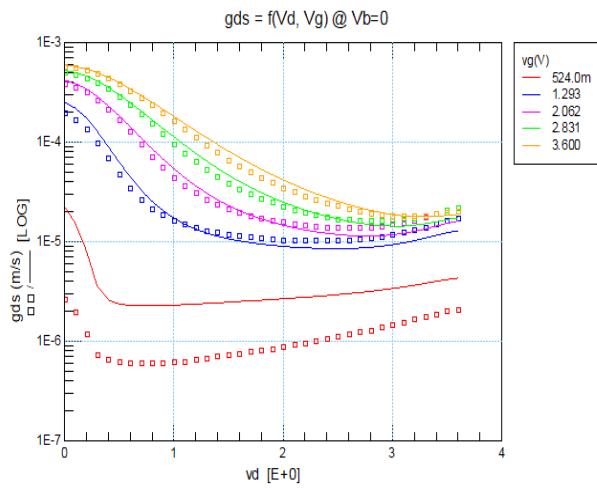
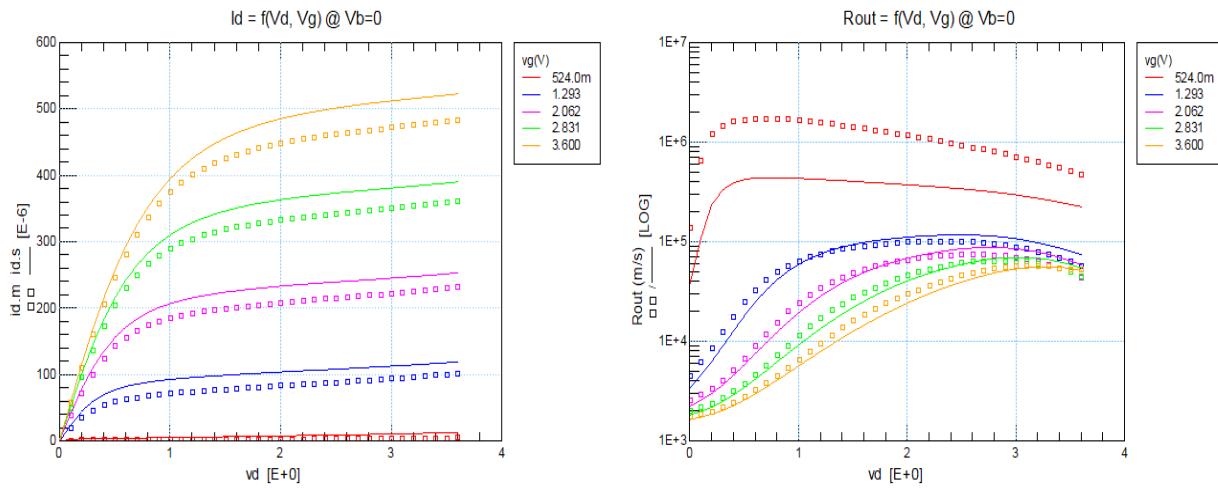
$i_{dvg}, V_d = 3.3V, T = 27^\circ C$

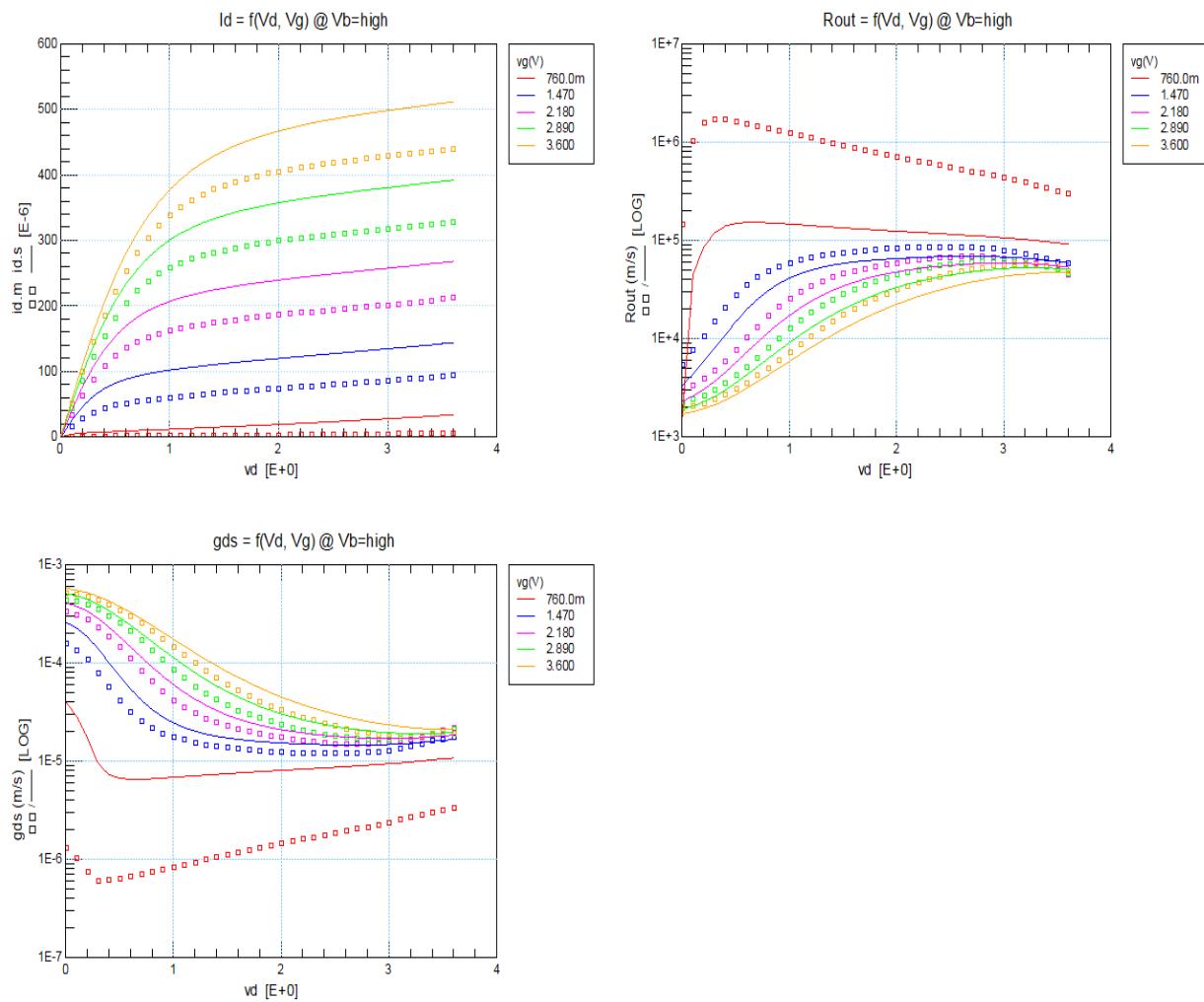
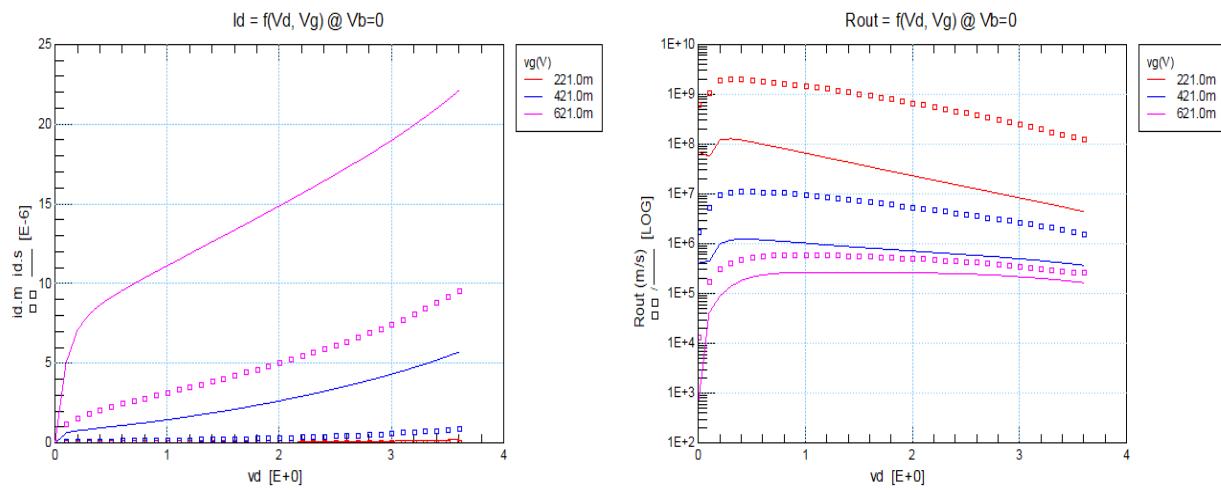


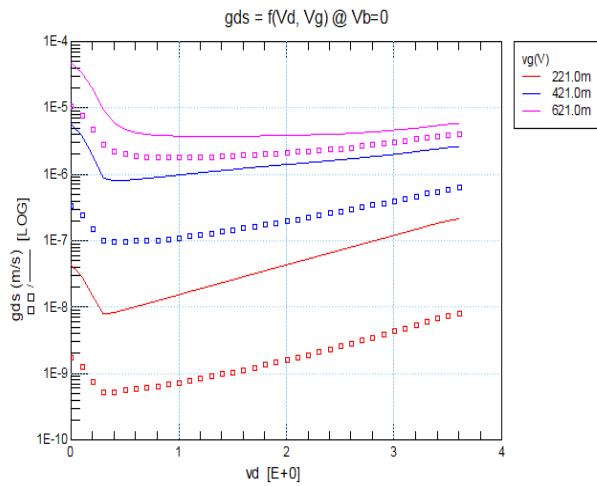


$i_{dvg}, I_b, I_g, V_b = 0V, T = 27^\circ C$

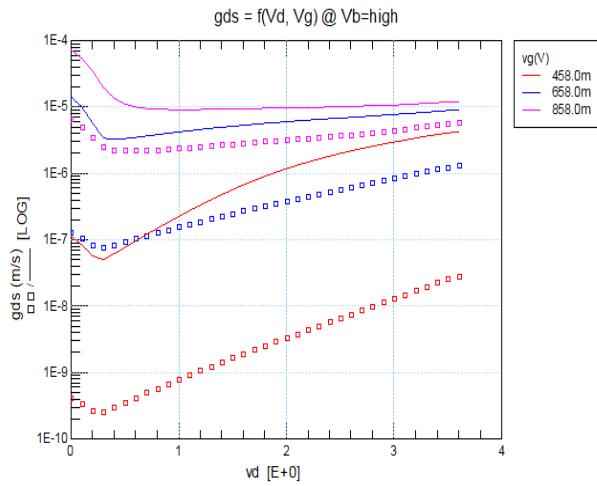
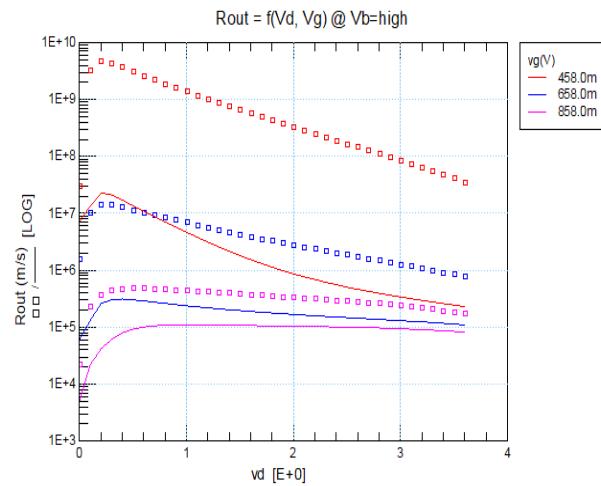
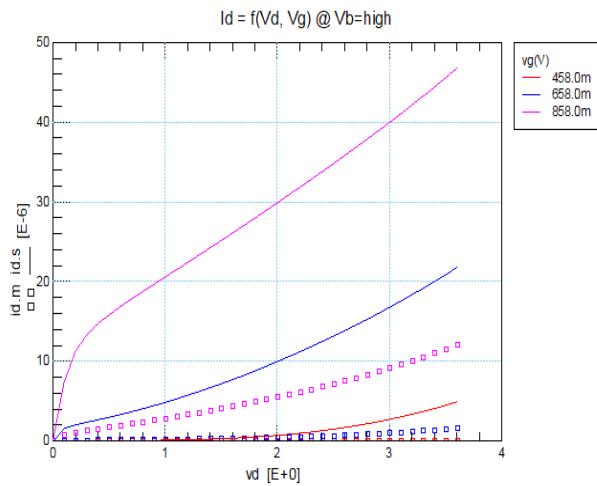


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C**idvd_vth, Vb = 0V, T = 27°C**

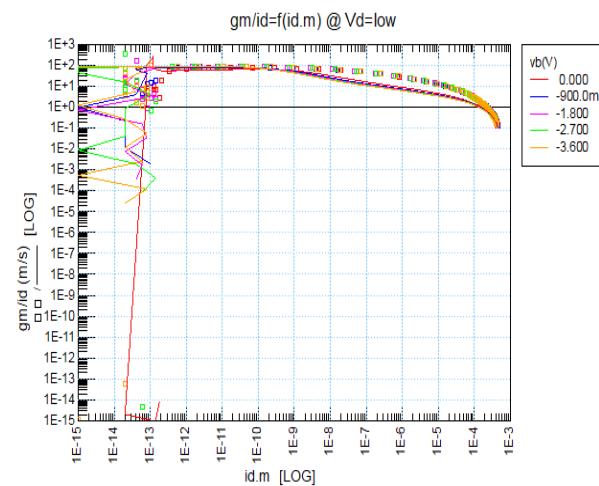
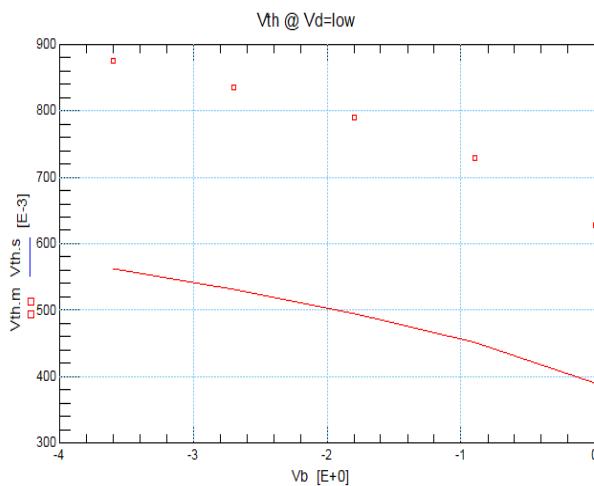
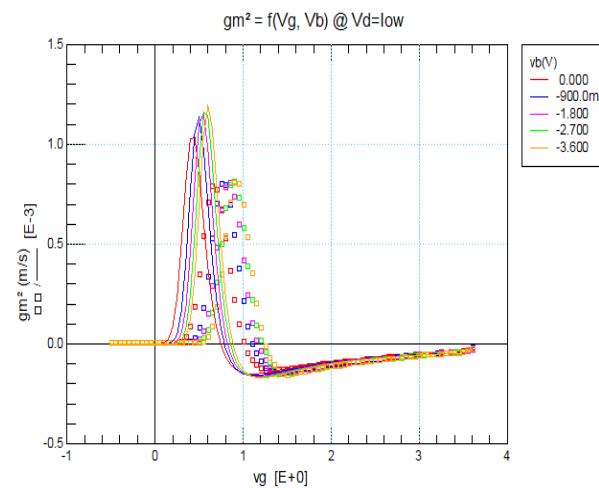
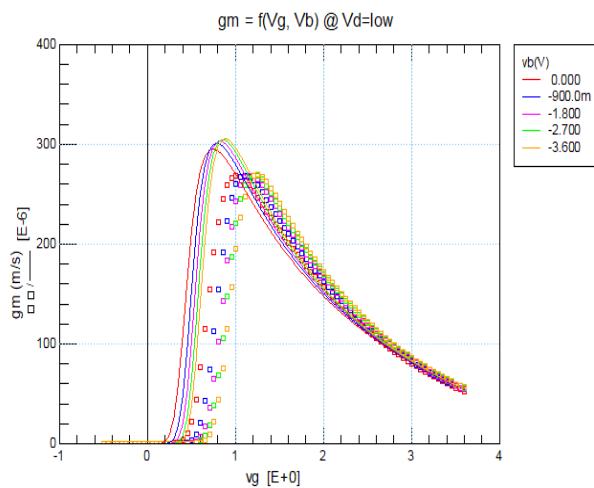
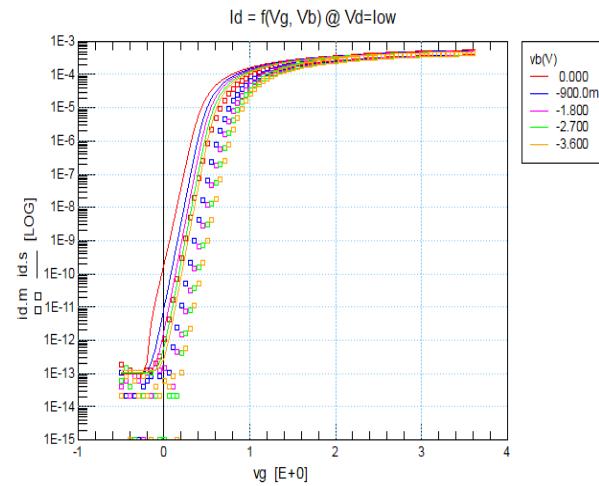
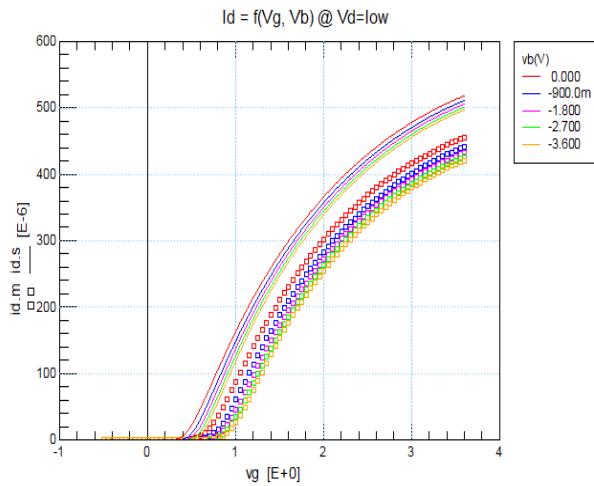


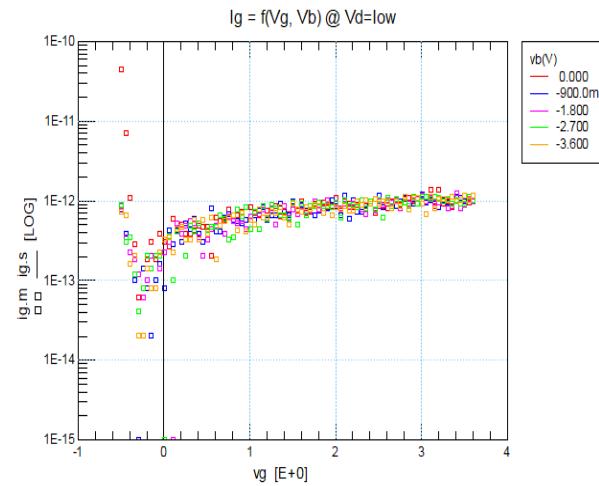
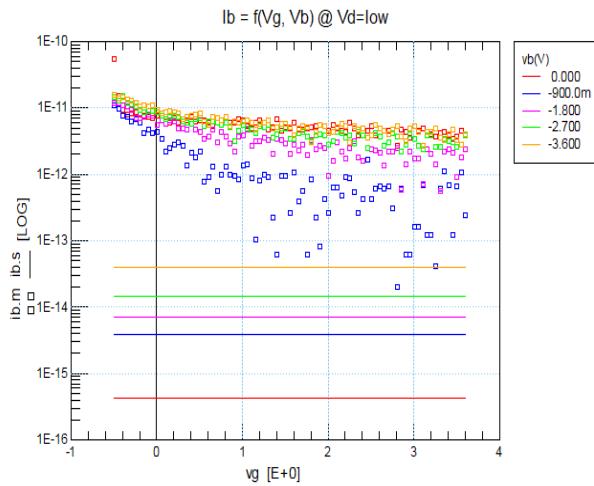
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



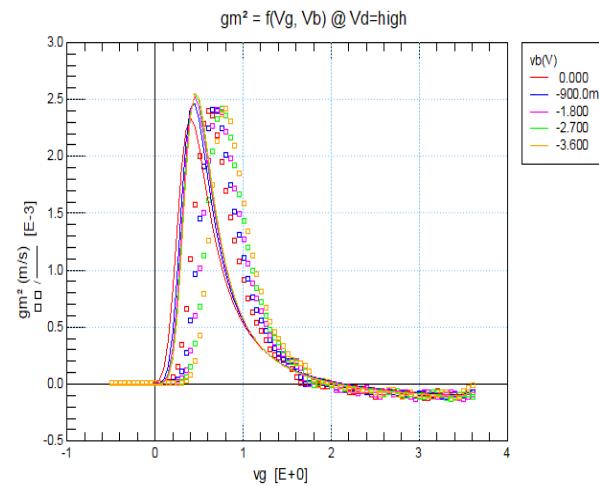
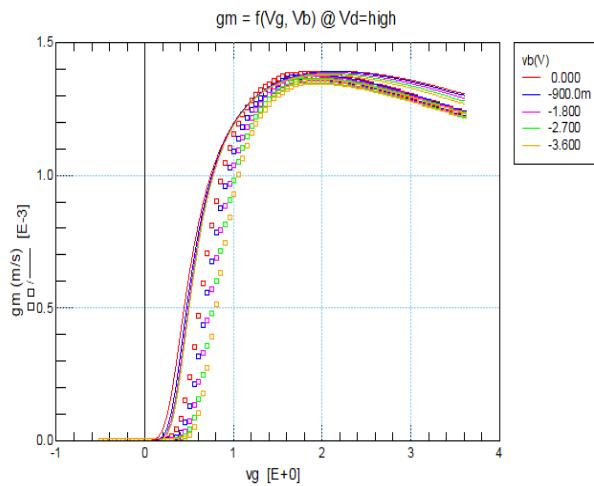
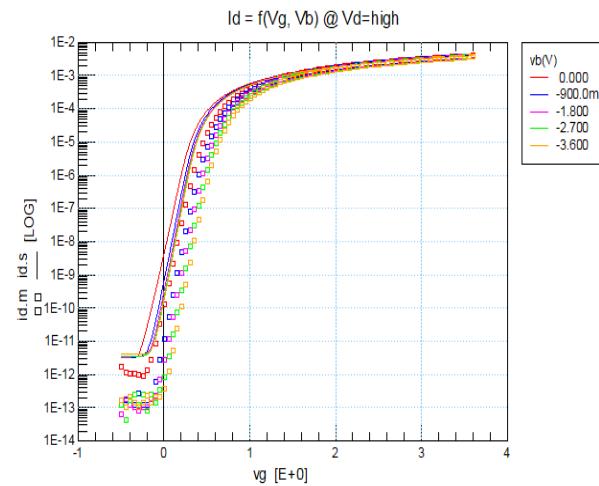
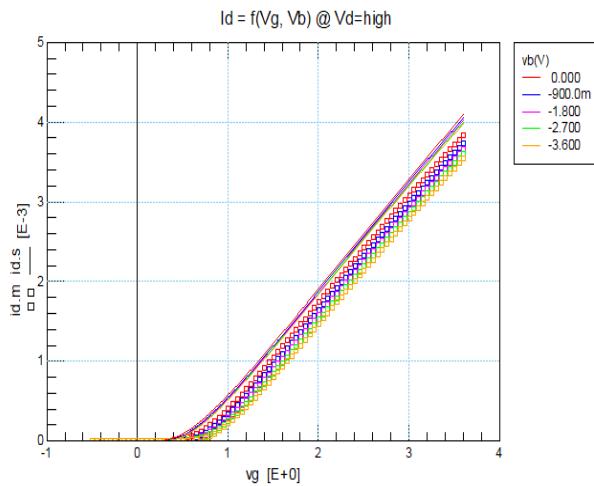
4.34 W05u0_L0u33_S557_4

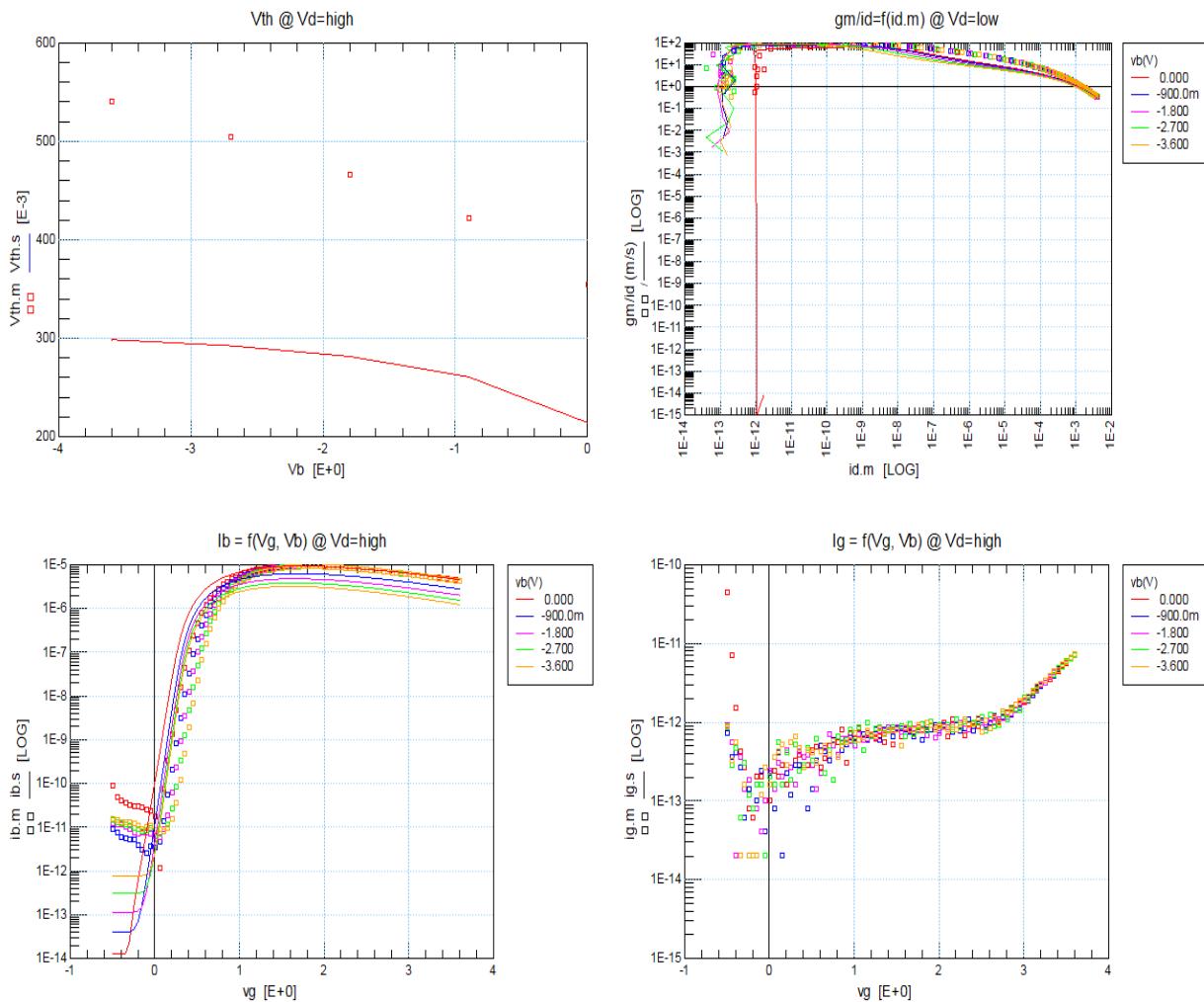
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



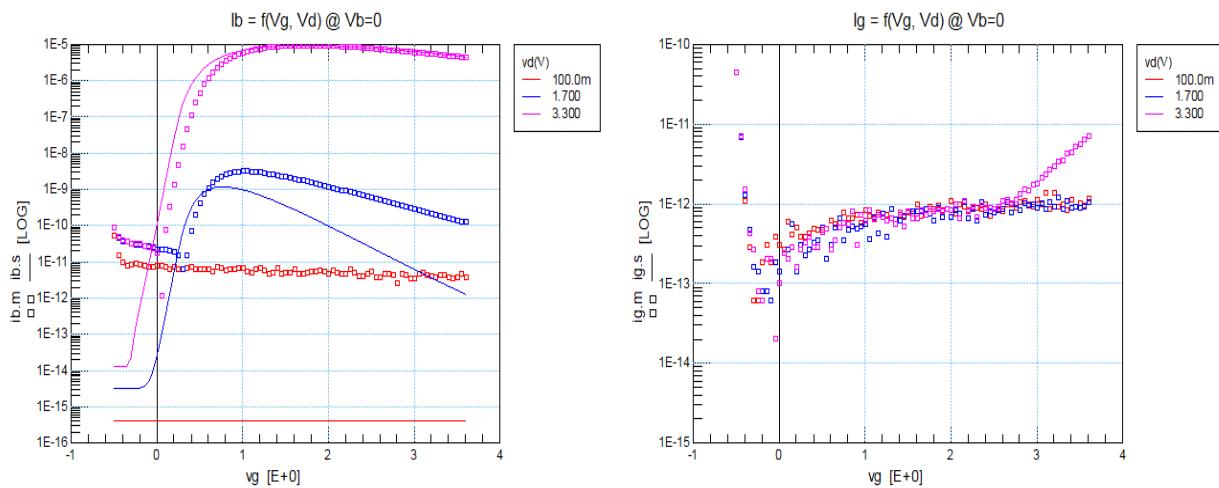


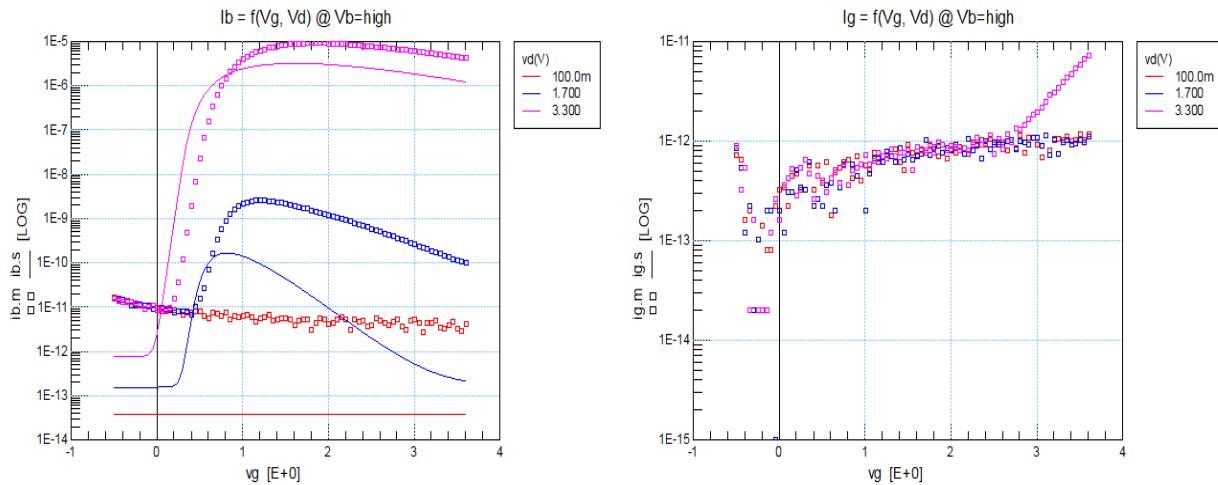
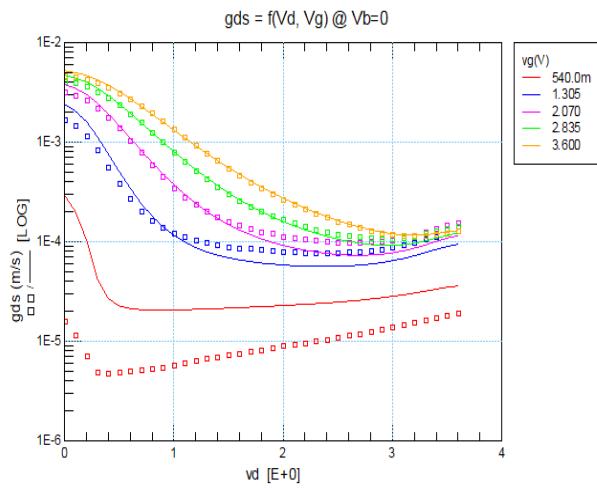
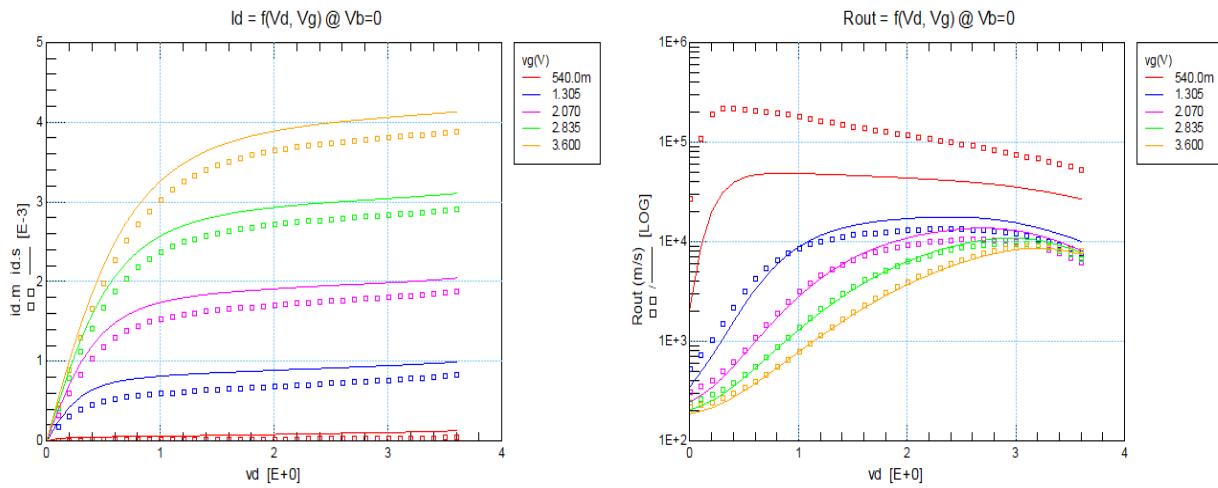
$i_d v_g, V_d = 3.3V, T = 27^\circ C$

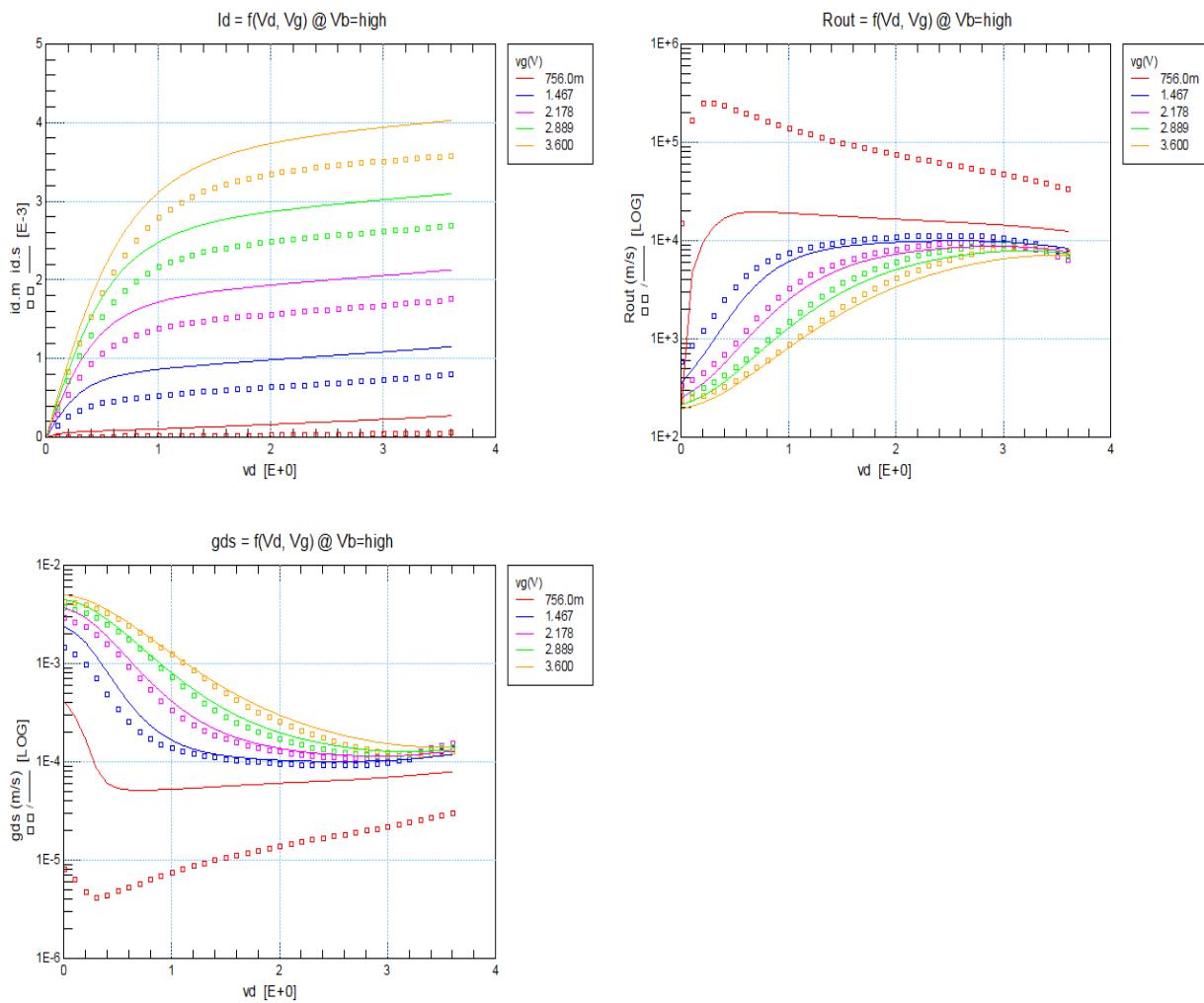
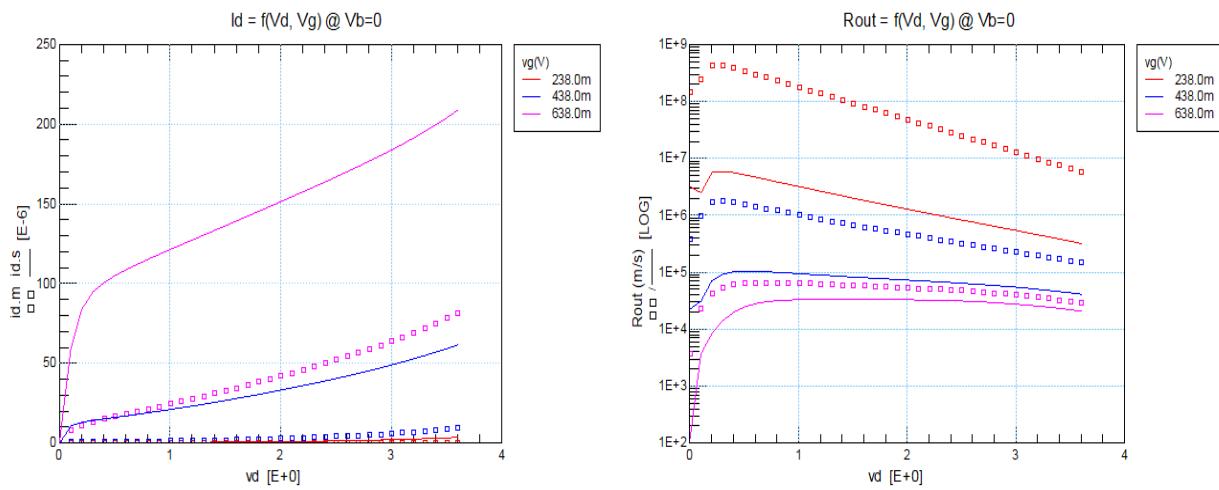


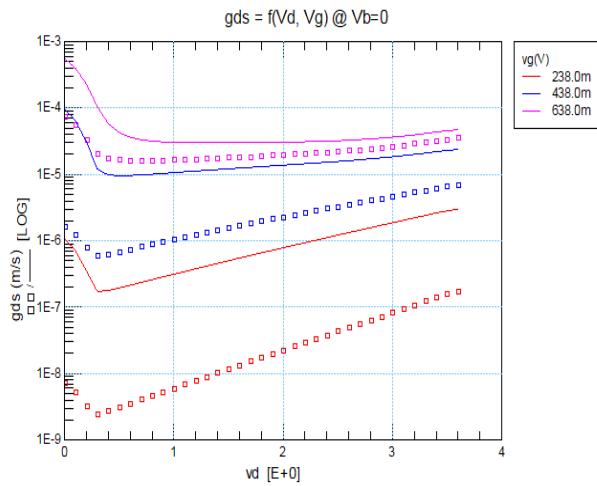


idvg, lb, lg, Vb = 0V, T = 27°C

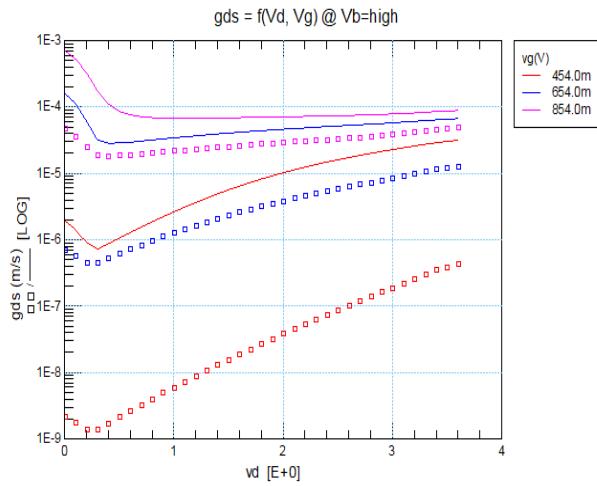
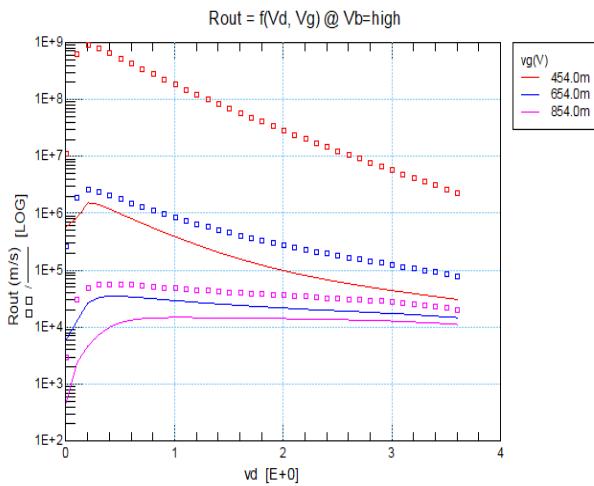
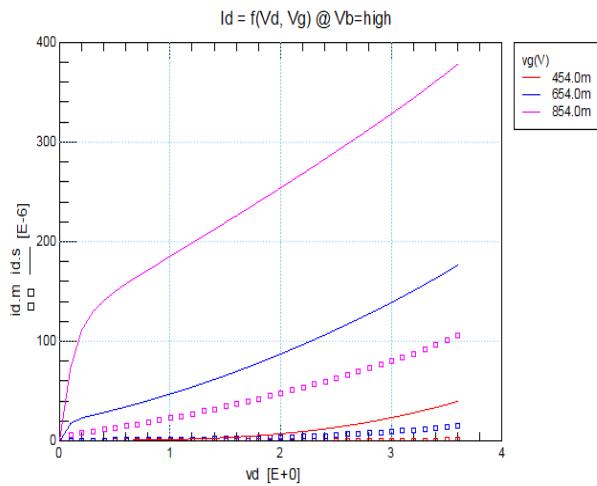


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C**idvd_vth, Vb = 0V, T = 27°C**



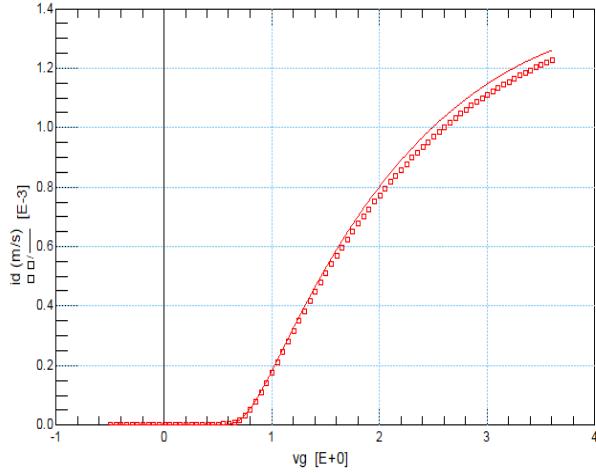
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



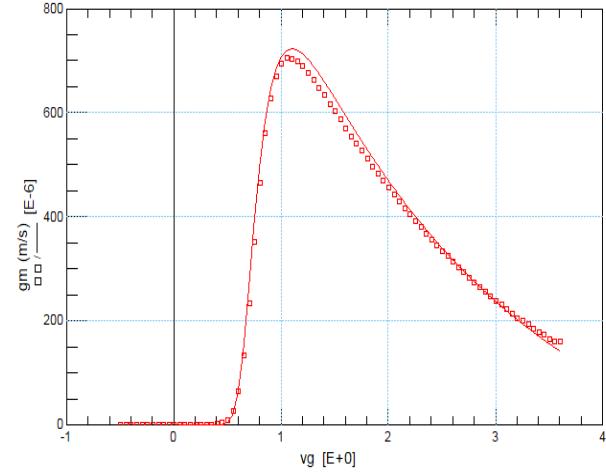
5 RF Transistors

5.1 NF04_WF05u0_L_0u5_post_90

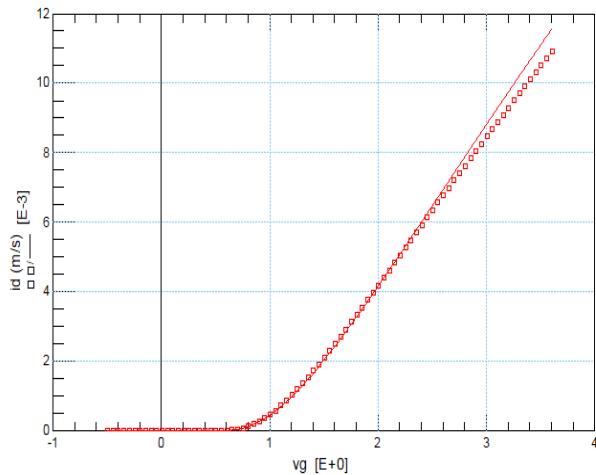
$IdVg$, $T = 27^\circ\text{C}$



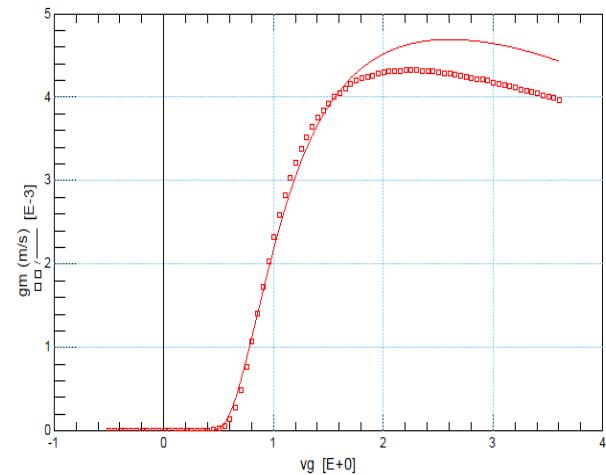
$Id = f(Vg) @ Vd = 0.1\text{V}$



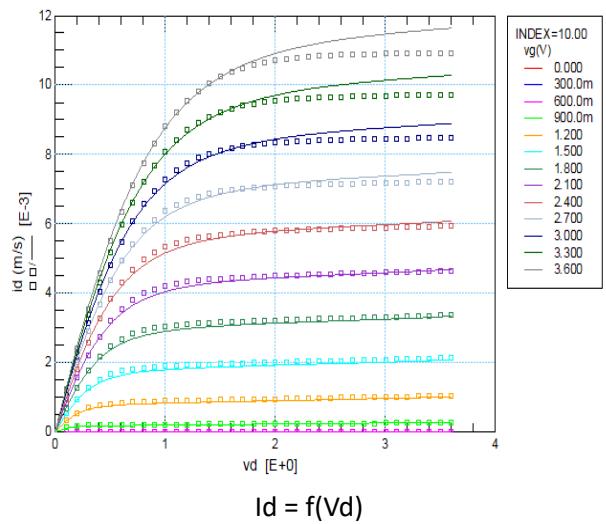
$gm = f(Vg) @ Vd = 0.1\text{V}$



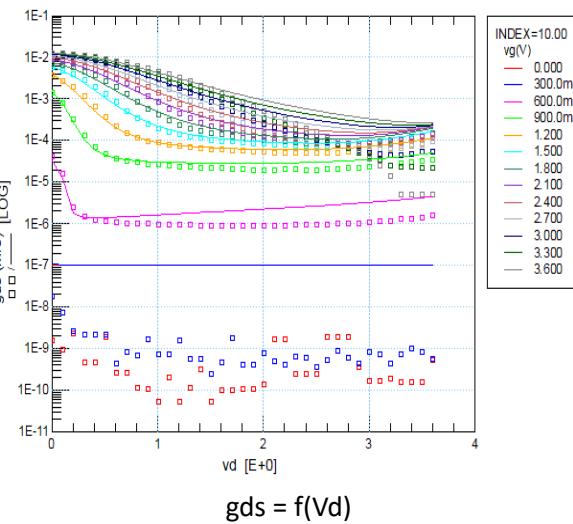
$Id = f(Vg) @ Vd = 3.3\text{V}$



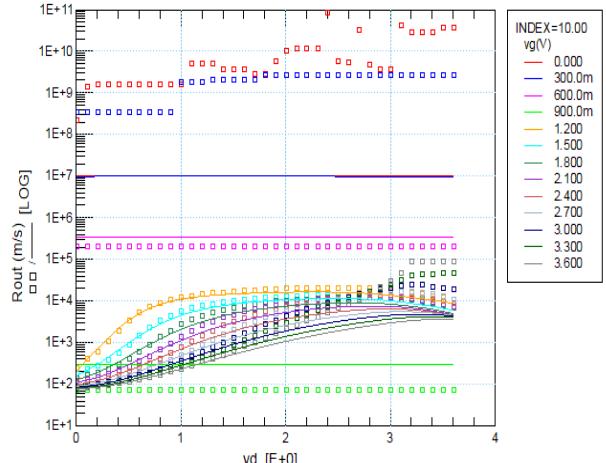
$gm = f(Vg) @ Vd = 3.3\text{V}$

IdVd, T = 27°C


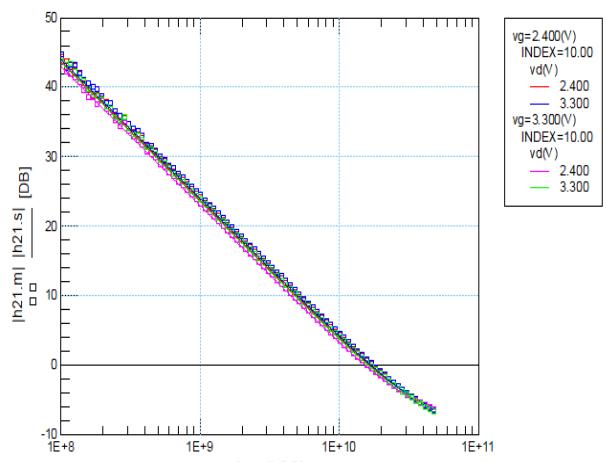
$$Id = f(Vd)$$



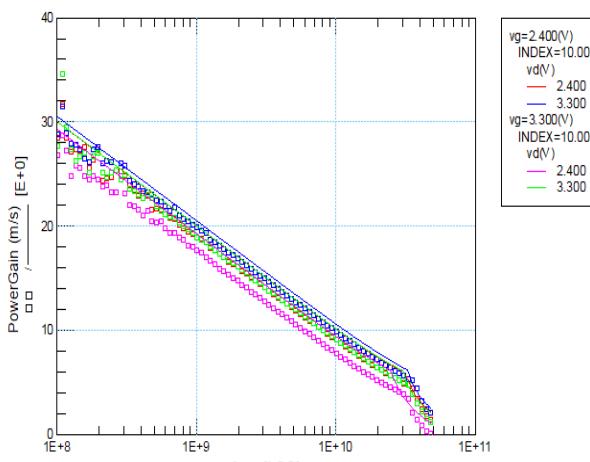
$$gds = f(Vd)$$



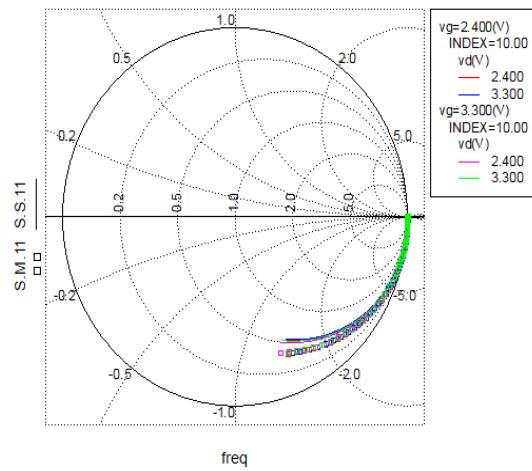
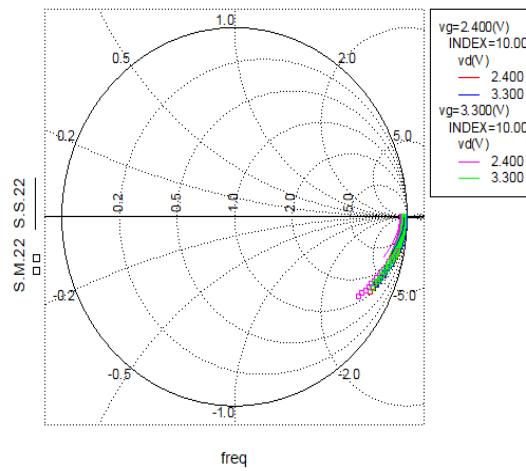
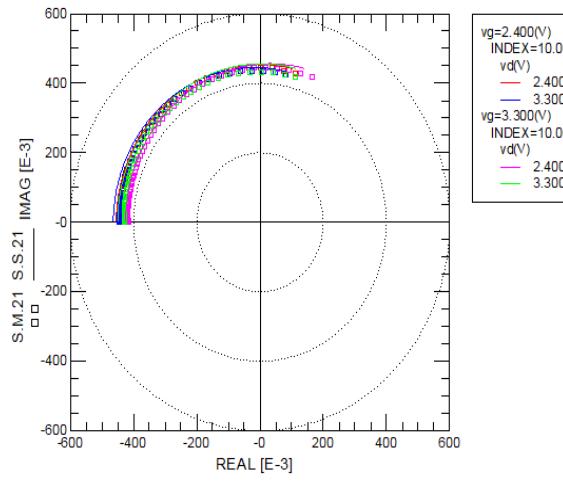
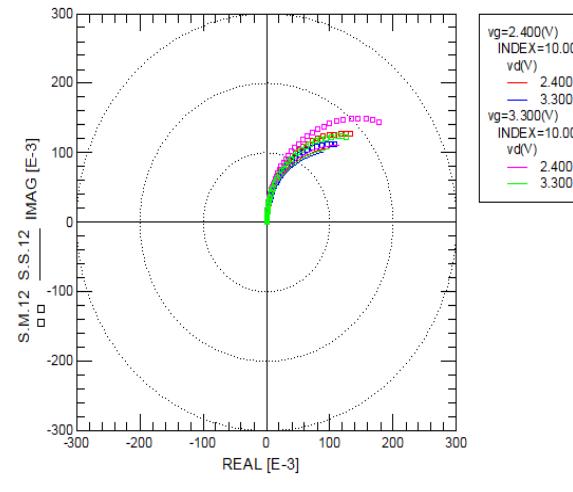
$$Rout = f(Vd)$$

S-Parameter, T = 27°C


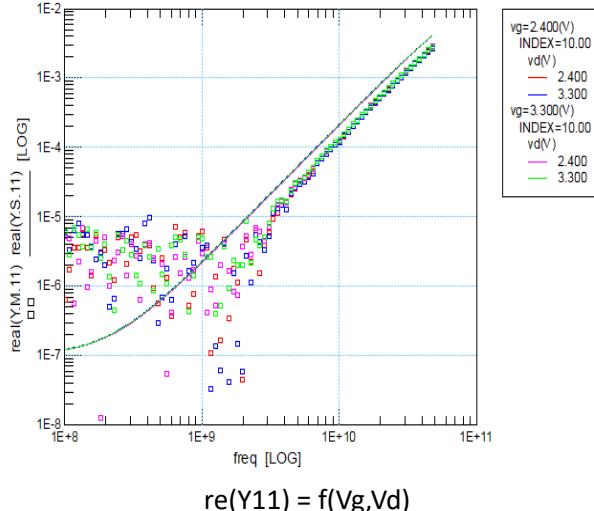
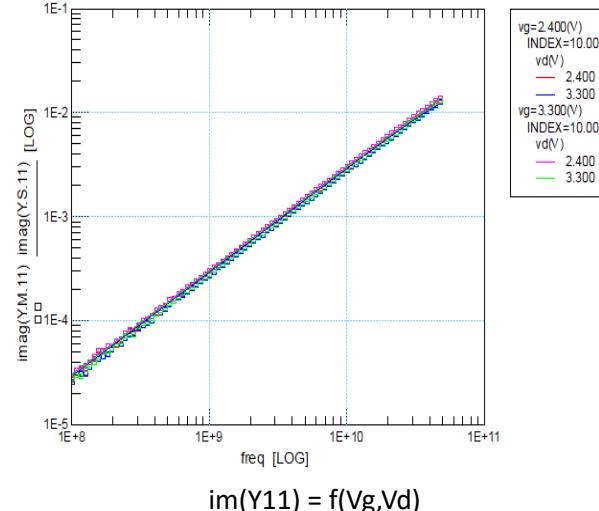
$$|h21| = f(Vg, Vd)$$

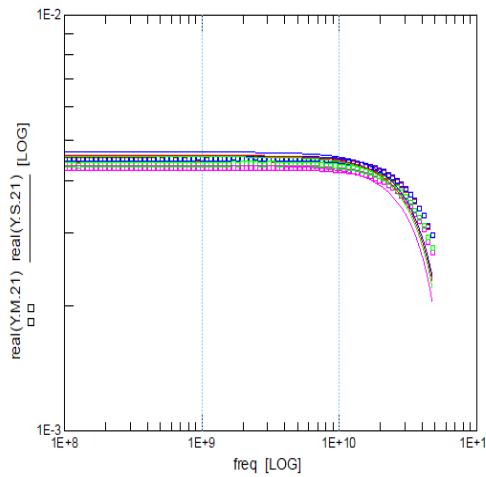
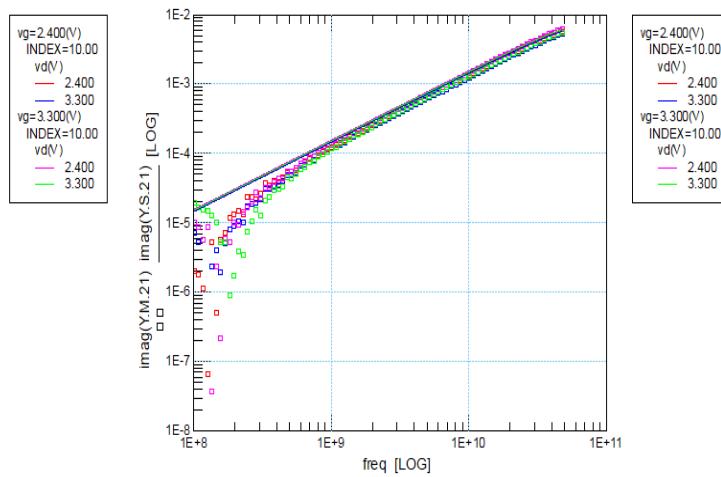
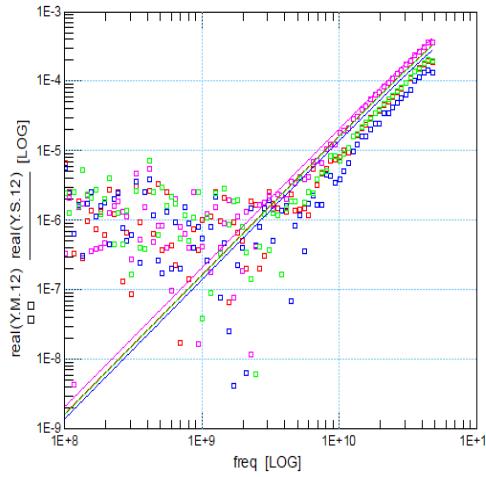
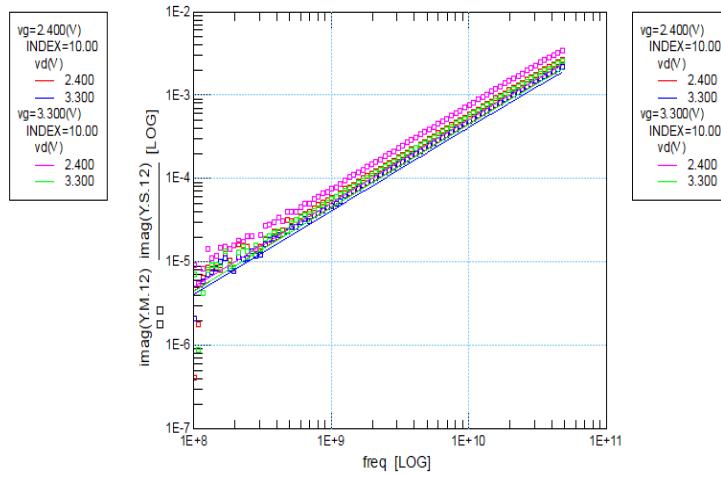
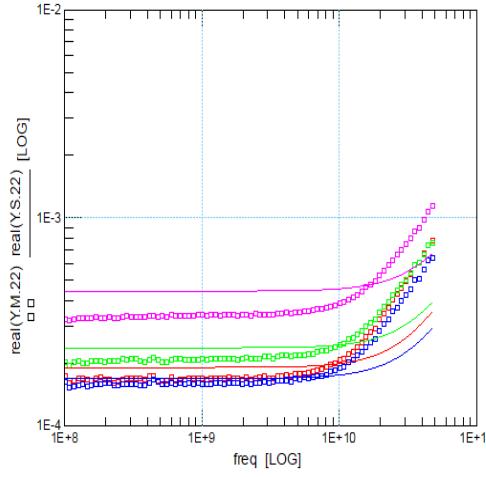
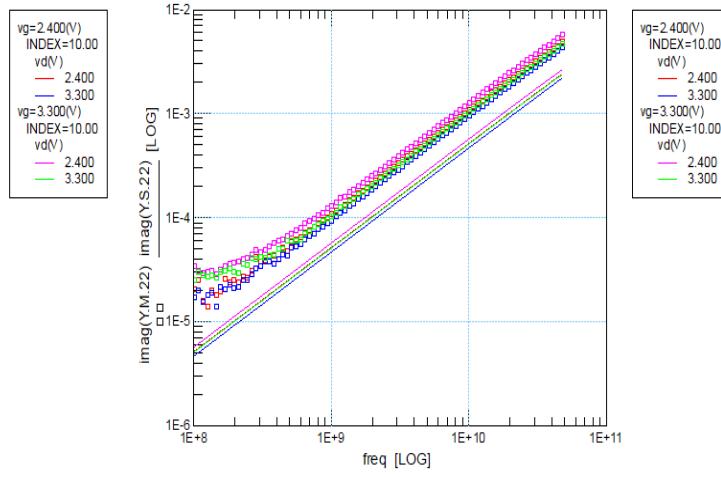


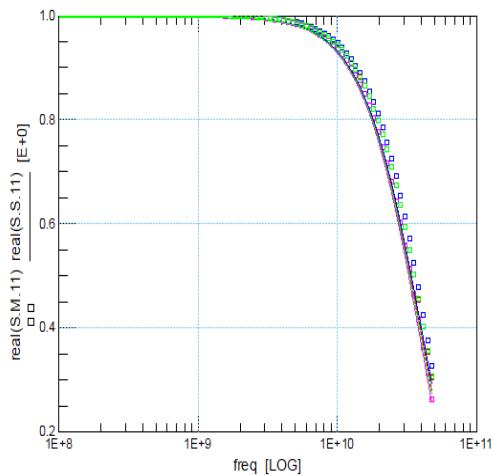
$$MSG/MAG = f(Vg, Vd)$$

 $S_{11} = f(V_g, V_d)$  $S_{22} = f(V_g, V_d)$  $S_{21} = f(V_g, V_d)$  $S_{12} = f(V_g, V_d)$

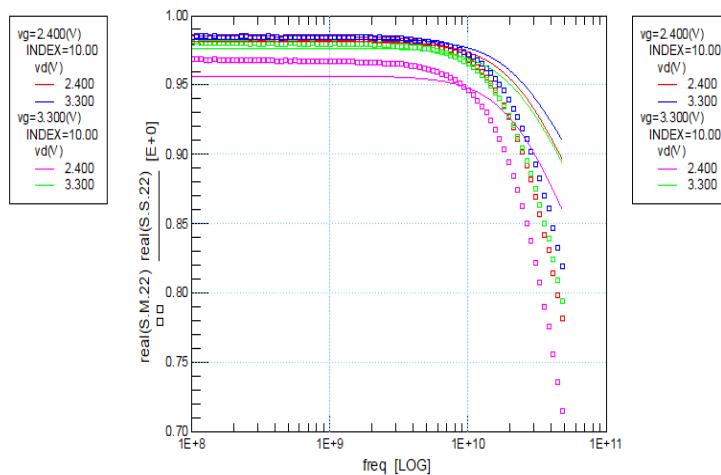
Y-Parameter, $T = 27^\circ\text{C}$

 $\text{re}(Y_{11}) = f(V_g, V_d)$  $\text{im}(Y_{11}) = f(V_g, V_d)$

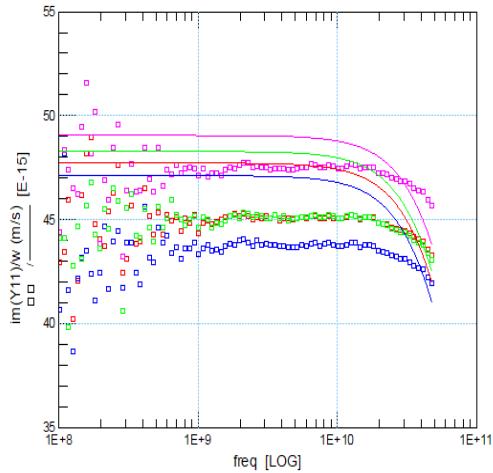
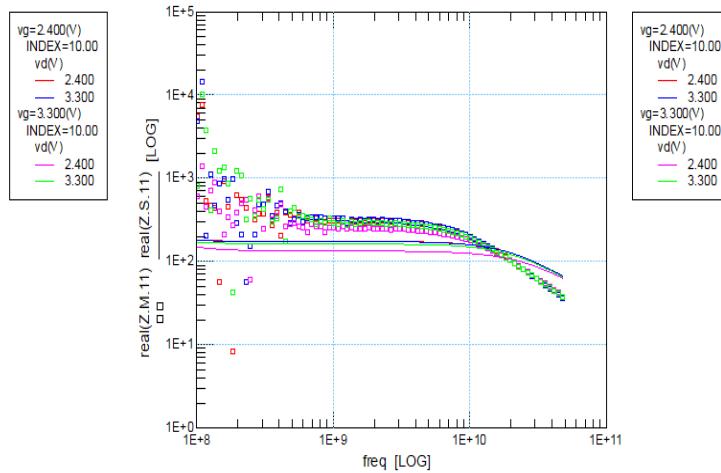
 $\text{re}(Y_{21}) = f(Vg, Vd)$  $\text{im}(Y_{21}) = f(Vg, Vd)$  $\text{re}(Y_{12}) = f(Vg, Vd)$  $\text{im}(Y_{12}) = f(Vg, Vd)$  $\text{re}(Y_{22}) = f(Vg, Vd)$  $\text{im}(Y_{22}) = f(Vg, Vd)$

Verify Plots, $T = 27^\circ\text{C}$ 

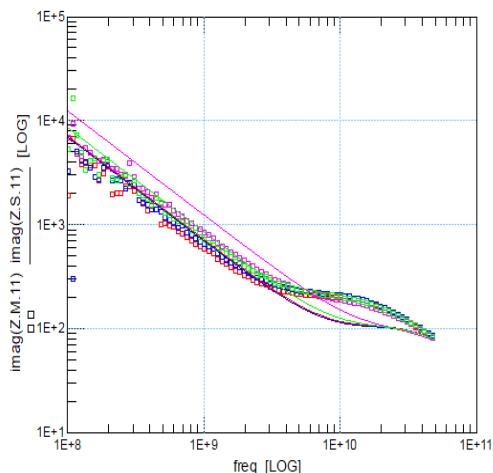
real(S11) = f(Vg,Vd)



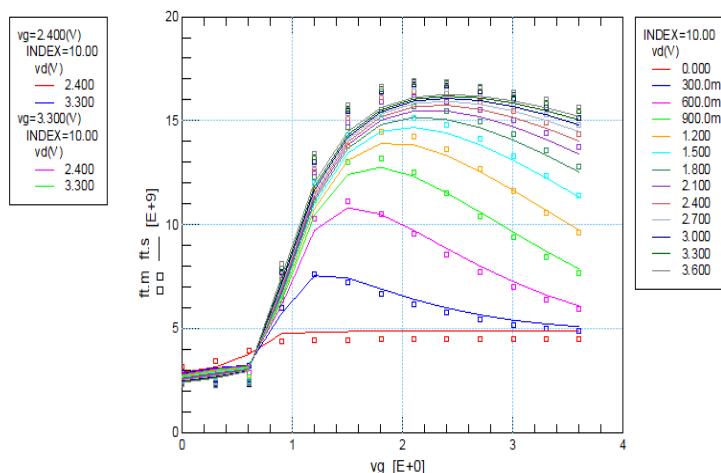
real(S22) = f(Vg,Vd)

im(Y11) divided by ω 

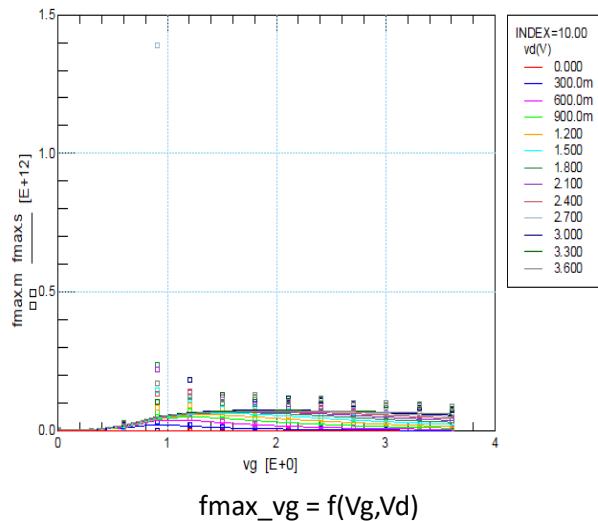
real(Z11) = f(Vg,Vd)



imag(Z11) = f(Vg,Vd)

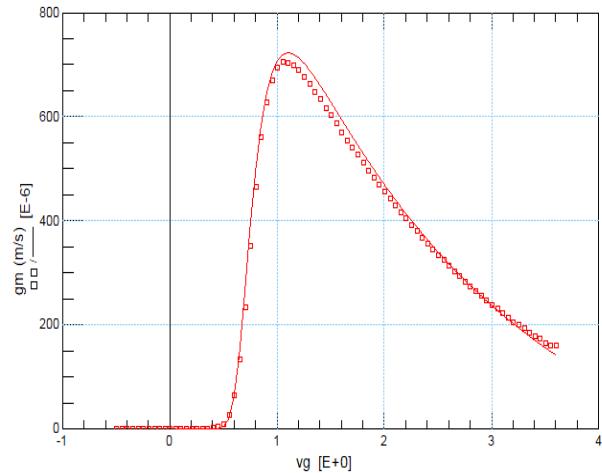
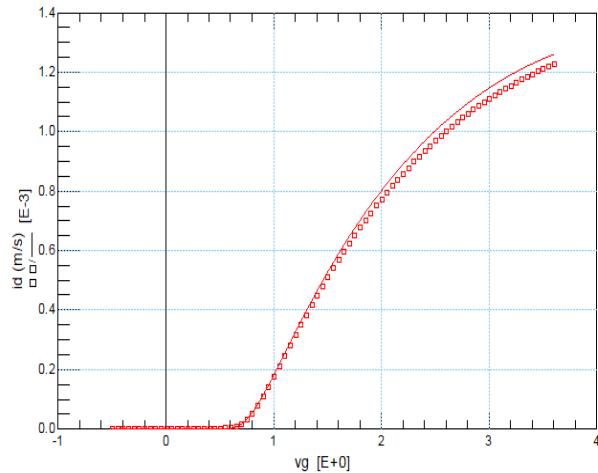


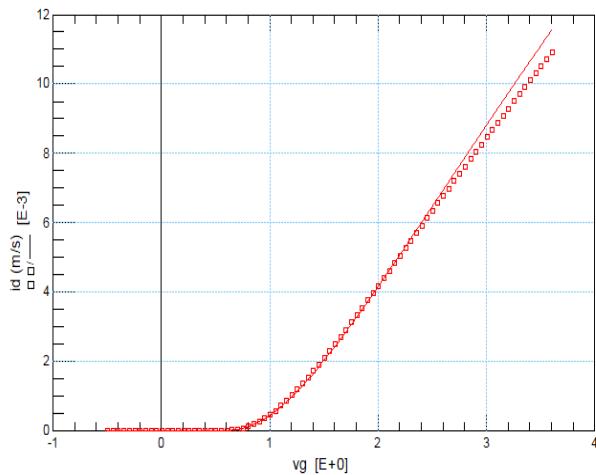
fT_vg = f(Vg,Vd)



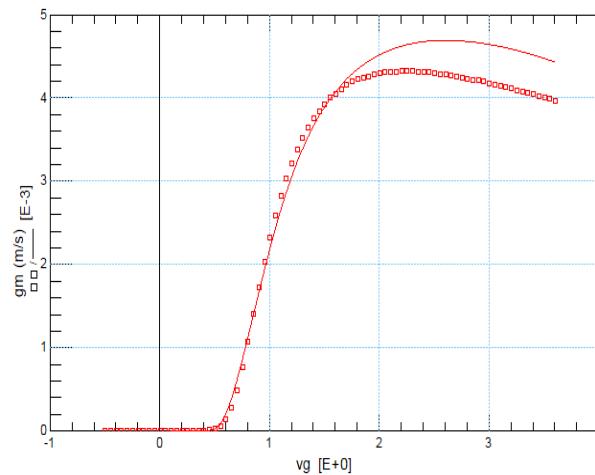
5.2 NF04_WF05u0_L_0u5_S453A_90

I_d vs V_g , $T = 27^\circ C$



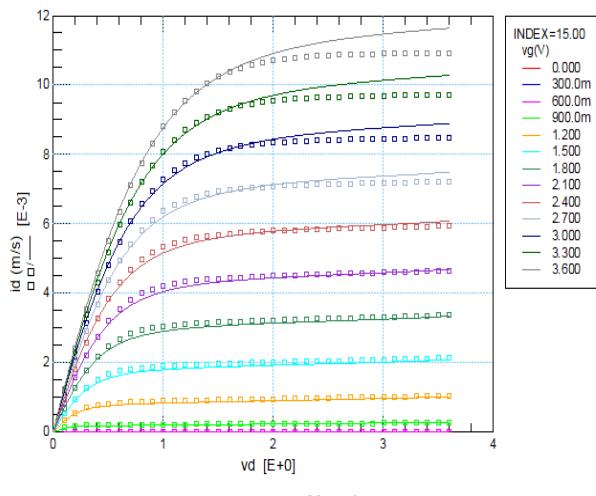


$$Id = f(Vg) @ Vd = 3.3V$$

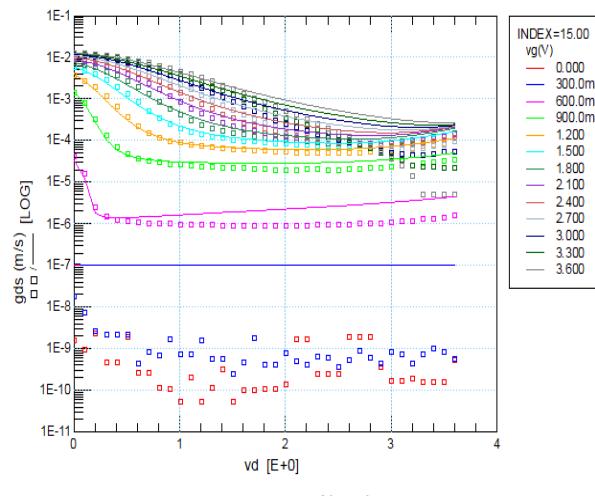


$$gm = f(Vg) @ Vd = 3.3V$$

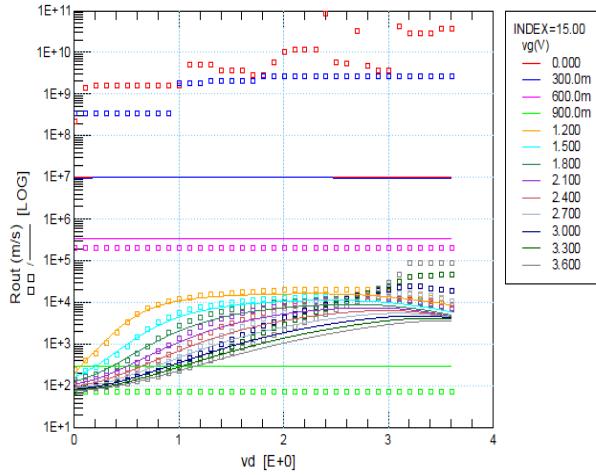
IdVd, T = 27°C



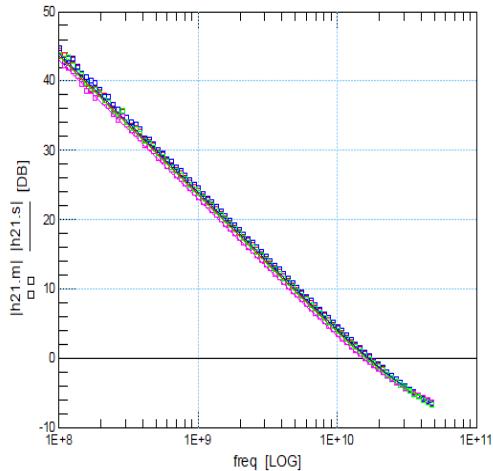
$$Id = f(Vd)$$



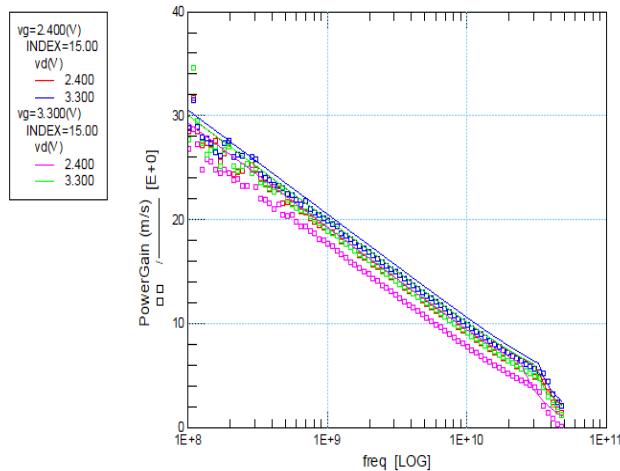
$$gds = f(Vd)$$



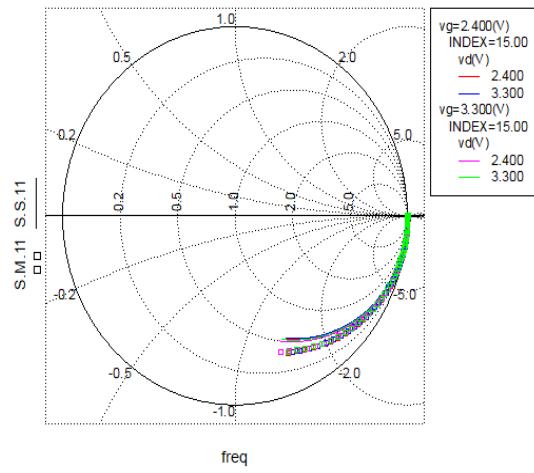
$$Rout = f(Vd)$$

S-Parameter, T = 27°C

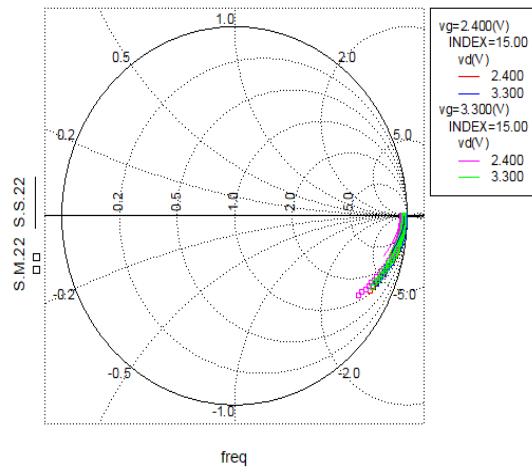
$$|h_{21}| = f(V_g, V_d)$$



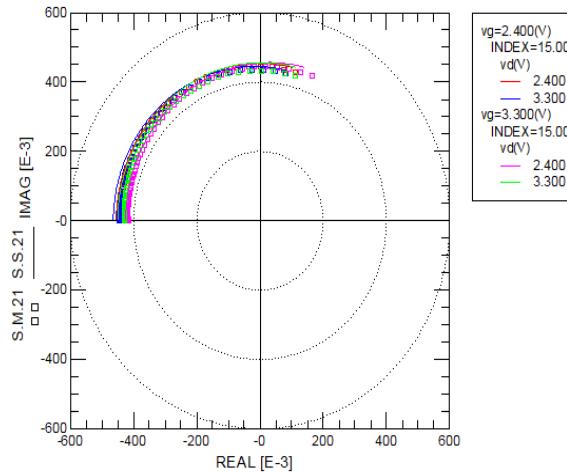
$$MSG/MAG = f(V_g, V_d)$$



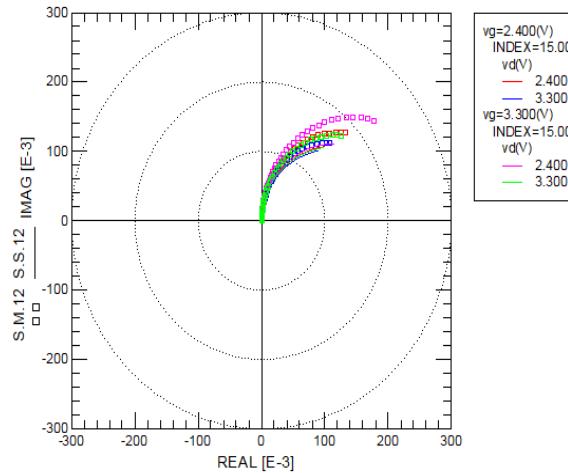
$$S_{11} = f(V_g, V_d)$$



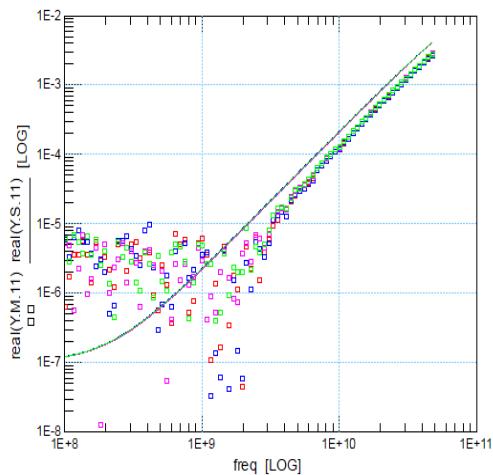
$$S_{22} = f(V_g, V_d)$$



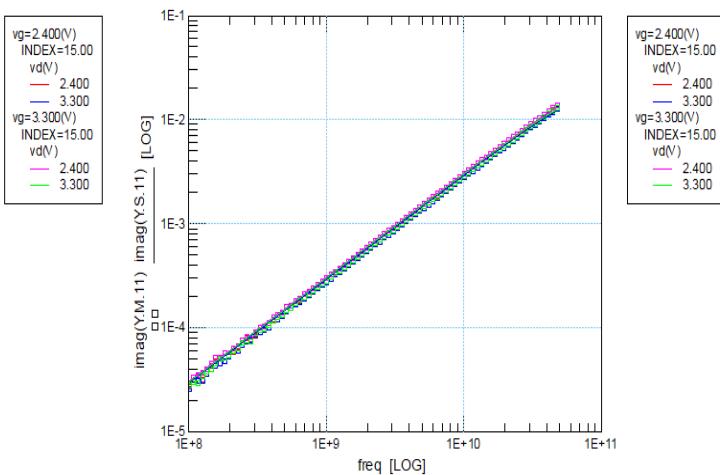
$$S_{21} = f(V_g, V_d)$$



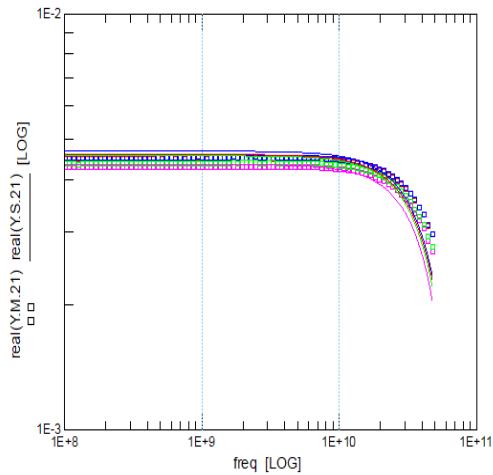
Y-Parameter, T = 27°C



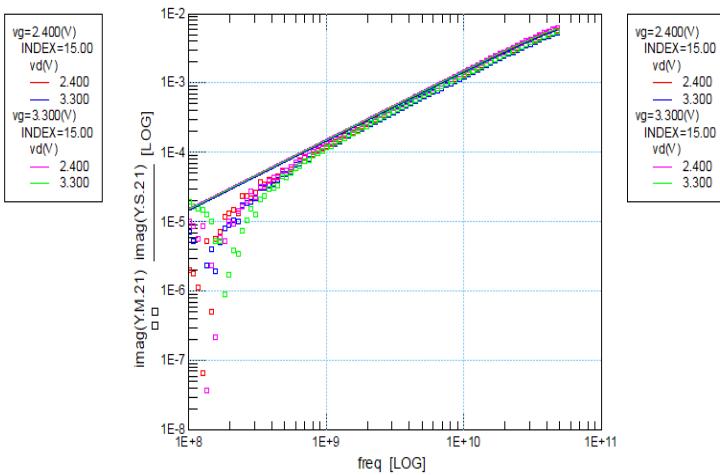
$$\text{re}(Y_{11}) = f(V_g, V_d)$$



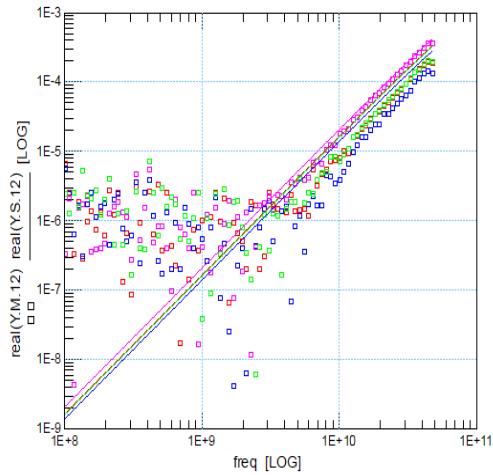
$$\text{im}(Y_{11}) = f(V_g, V_d)$$



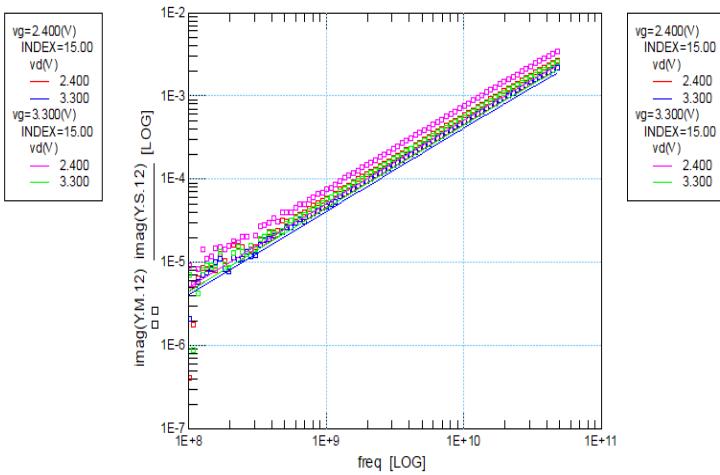
$$\text{re}(Y_{21}) = f(V_g, V_d)$$



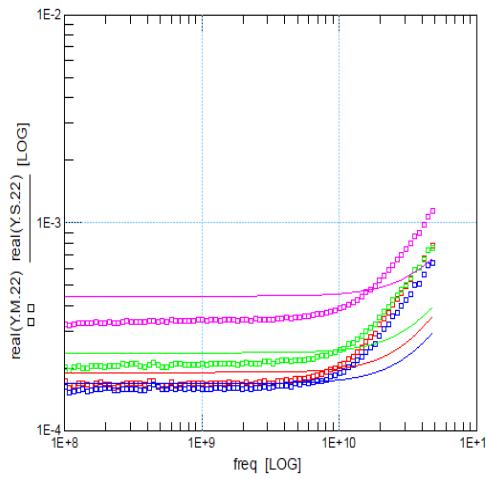
$$\text{im}(Y_{21}) = f(V_g, V_d)$$



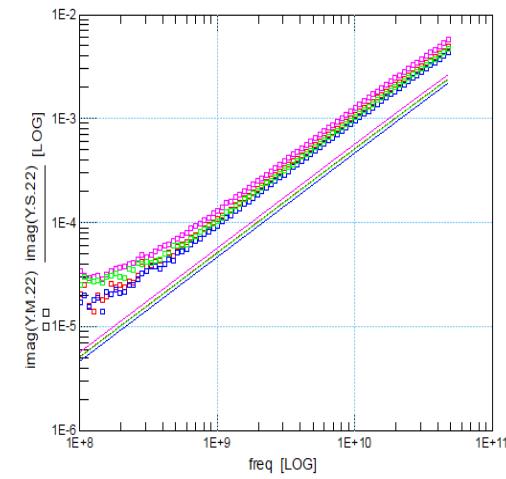
$$\text{re}(Y_{12}) = f(V_g, V_d)$$



$$\text{im}(Y_{12}) = f(V_g, V_d)$$

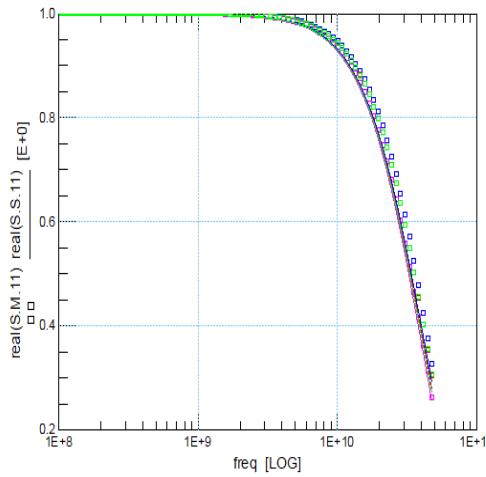


$$\text{re}(Y22) = f(Vg, Vd)$$

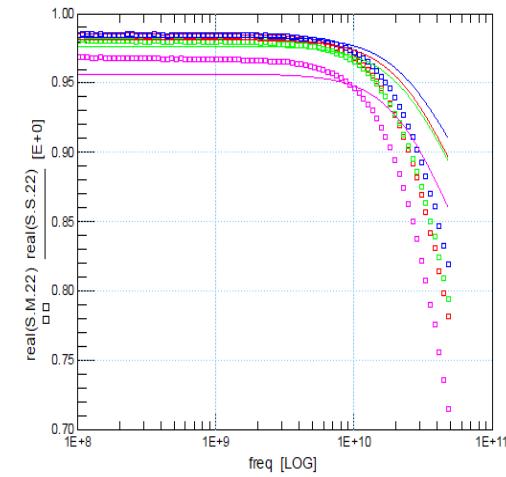


$$\text{im}(Y22) = f(Vg, Vd)$$

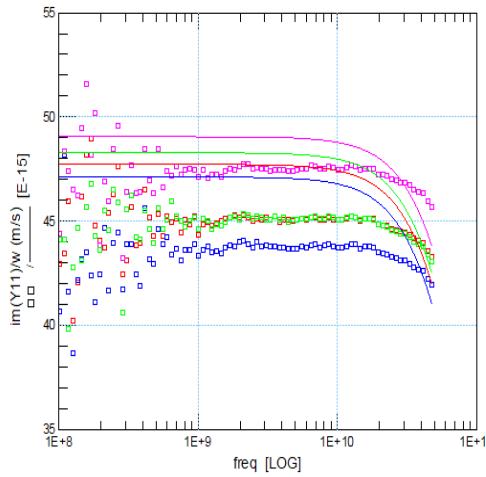
Verify Plots, T = 27°C



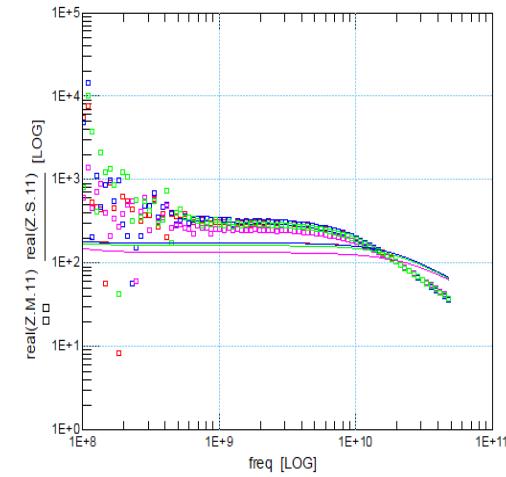
$$\text{re}(S11) = f(Vg, Vd)$$



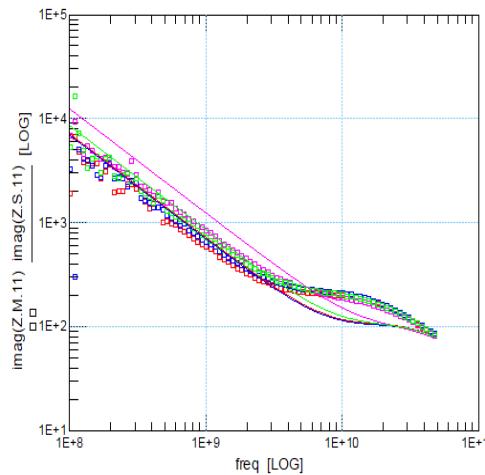
$$\text{re}(S22) = f(Vg, Vd)$$



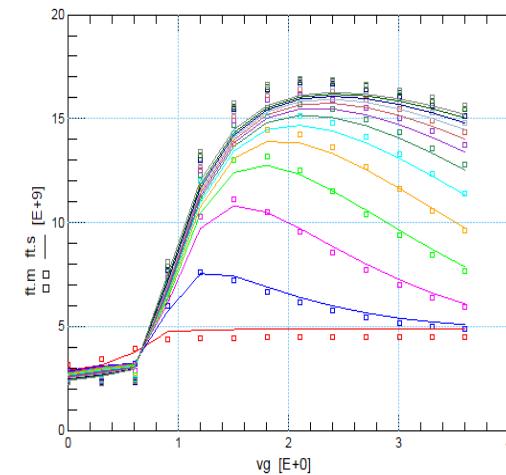
$$\text{im}(Y11) \text{ divided by } \omega$$



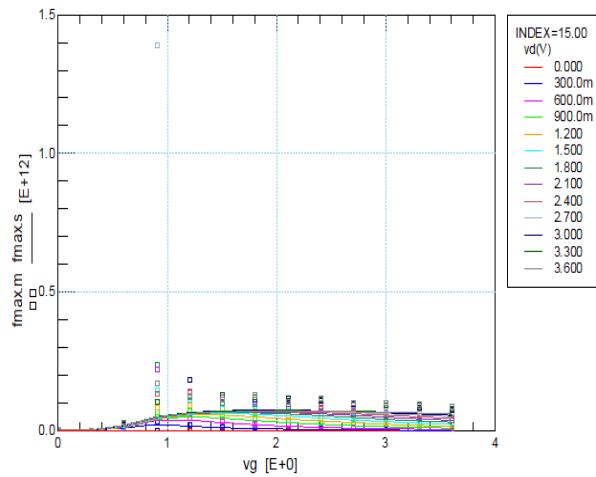
$$\text{re}(Z11) = f(Vg, Vd)$$



$$\text{im}(Z_{11}) = f(V_g, V_d)$$



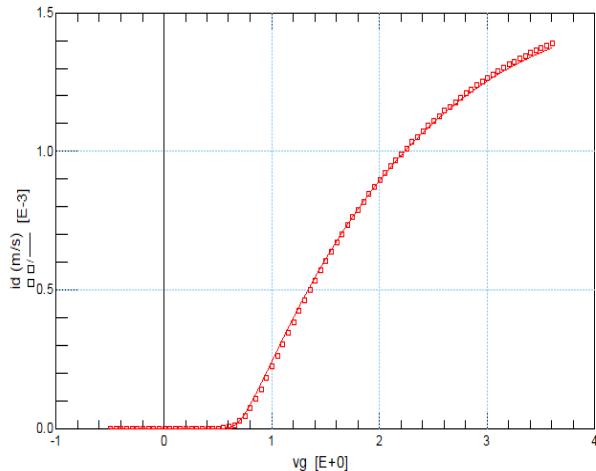
$$f_{T,Vg} = f(V_g, V_d)$$



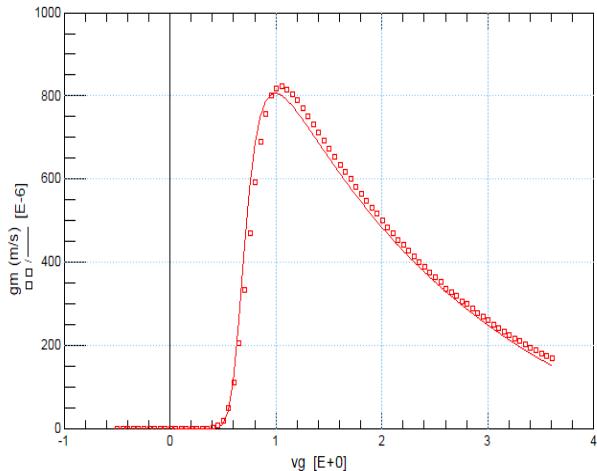
$$f_{max,Vg} = f(V_g, V_d)$$

5.3 NF08_WF02u5_L_0u45_S453A_A1

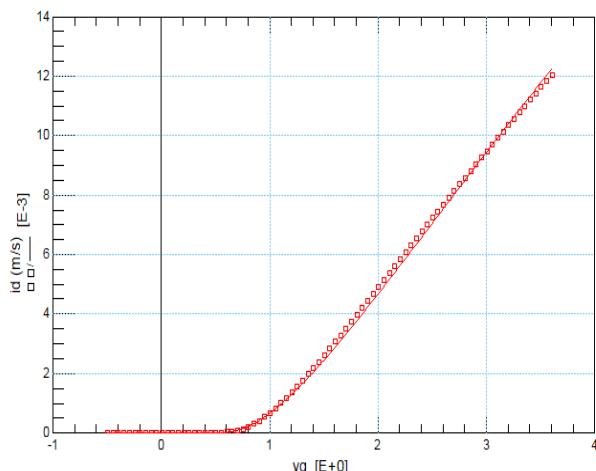
$IdVg$, $T = 27^\circ C$



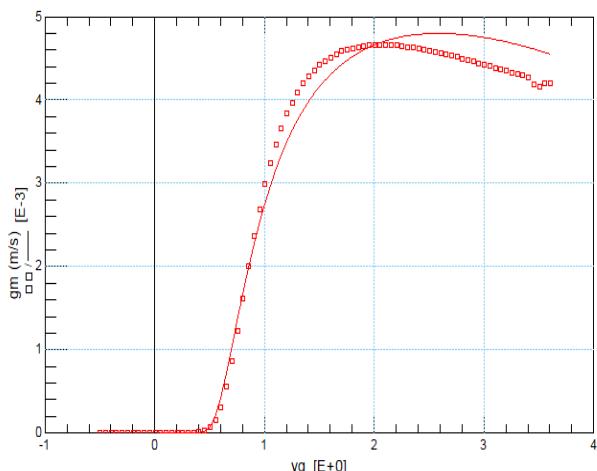
$Id = f(Vg) @ Vd = 0.1V$



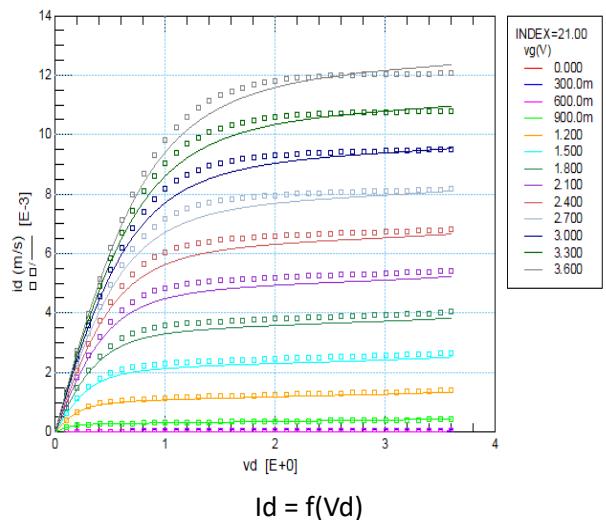
$gm = f(Vg) @ Vd = 0.1V$



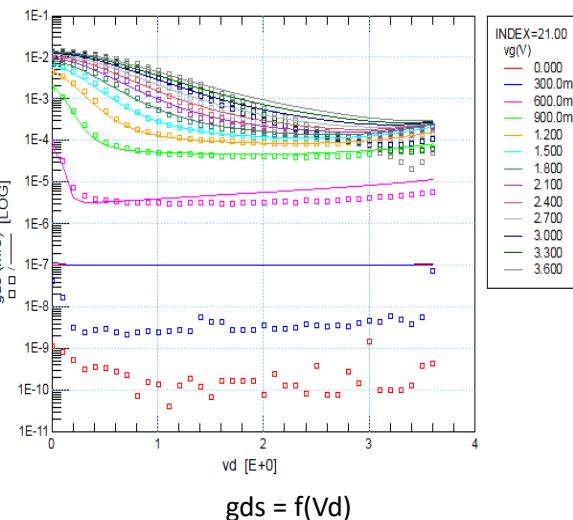
$Id = f(Vg) @ Vd = 3.3V$



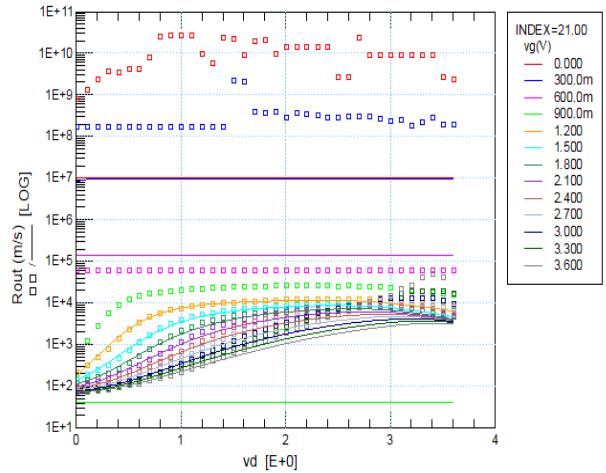
$gm = f(Vg) @ Vd = 3.3V$

IdVd, T = 27°C

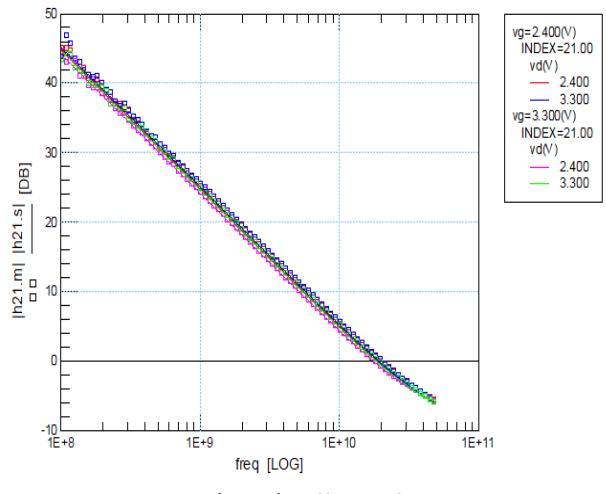
$$Id = f(Vd)$$



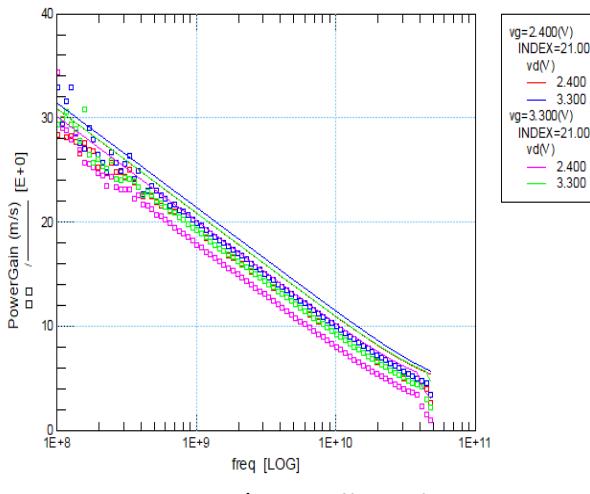
$$gds = f(Vd)$$



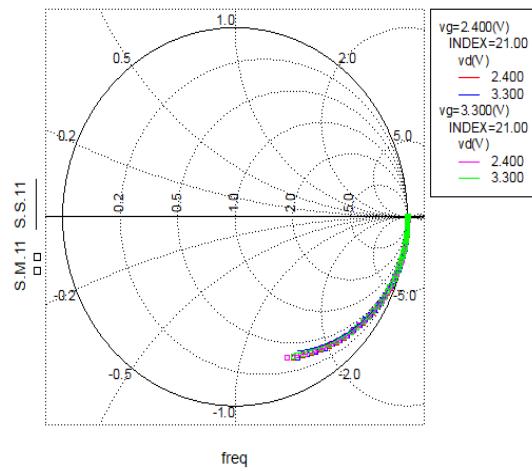
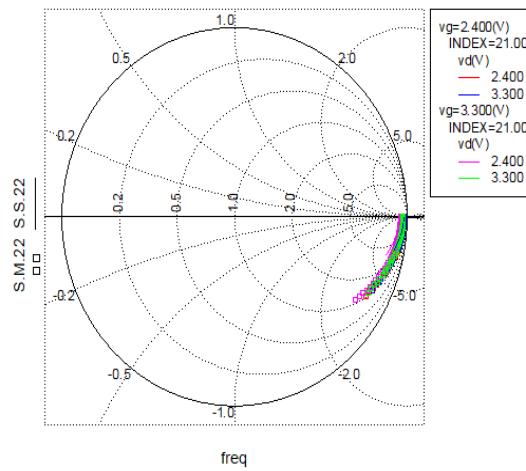
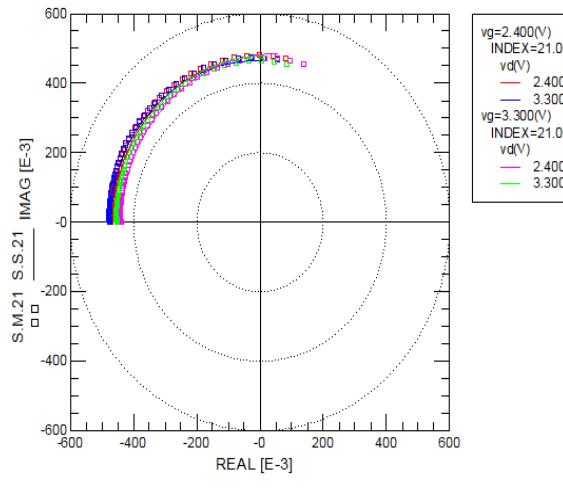
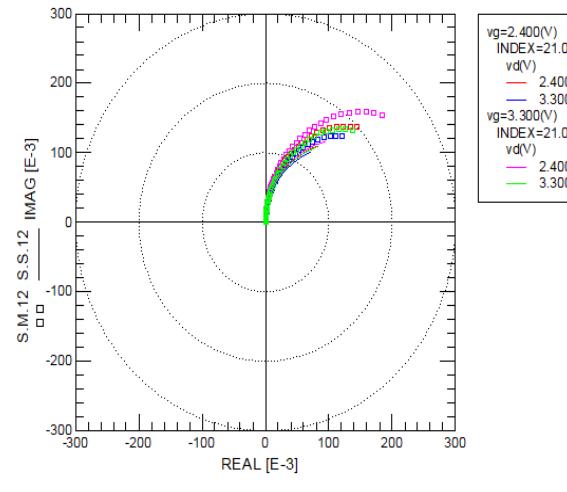
$$Rout = f(Vd)$$

S-Parameter, T = 27°C

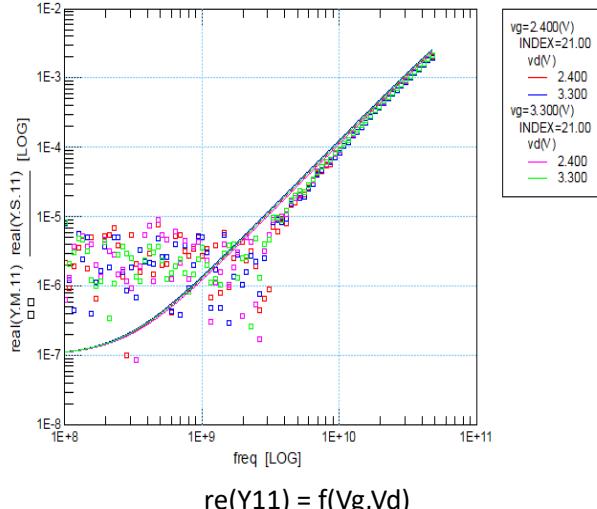
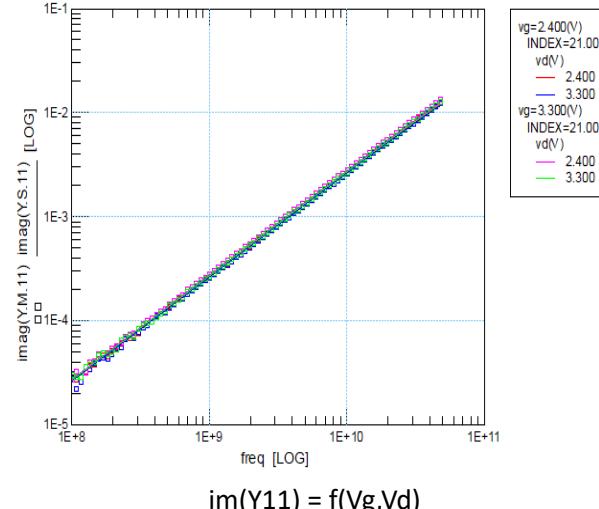
$$|h21| = f(Vg, Vd)$$

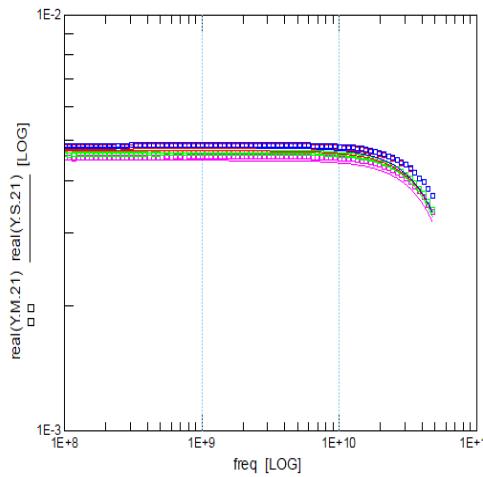


$$MSG/MAG = f(Vg, Vd)$$

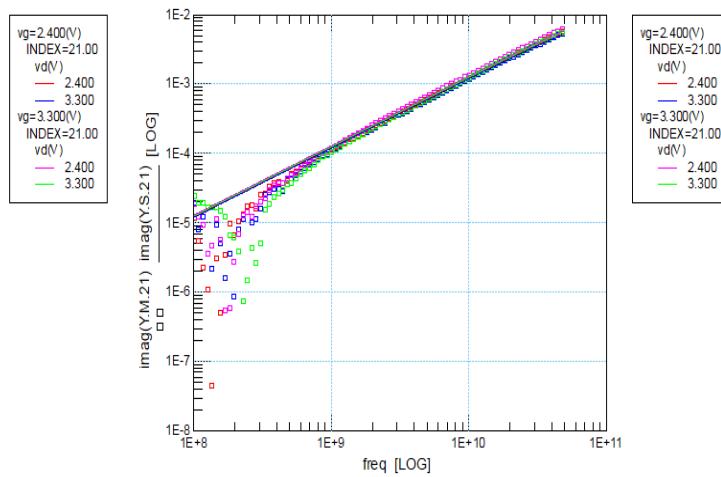
 $S_{11} = f(V_g, V_d)$  $S_{22} = f(V_g, V_d)$  $S_{21} = f(V_g, V_d)$  $S_{12} = f(V_g, V_d)$

Y-Parameter, $T = 27^\circ\text{C}$

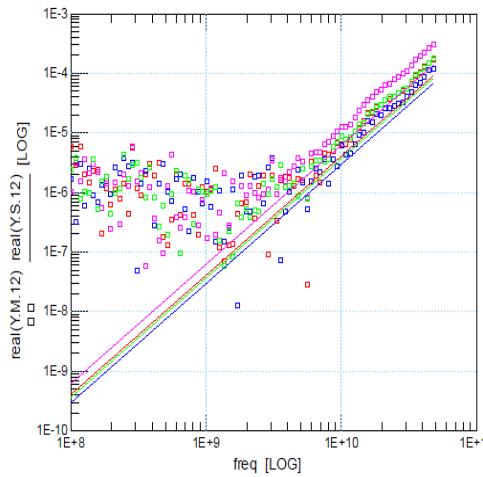
 $\text{re}(Y_{11}) = f(V_g, V_d)$  $\text{im}(Y_{11}) = f(V_g, V_d)$



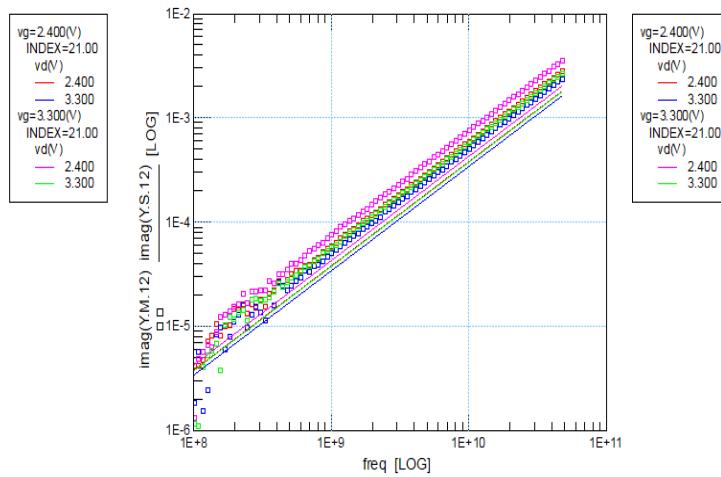
re(Y21) = f(Vg, Vd)



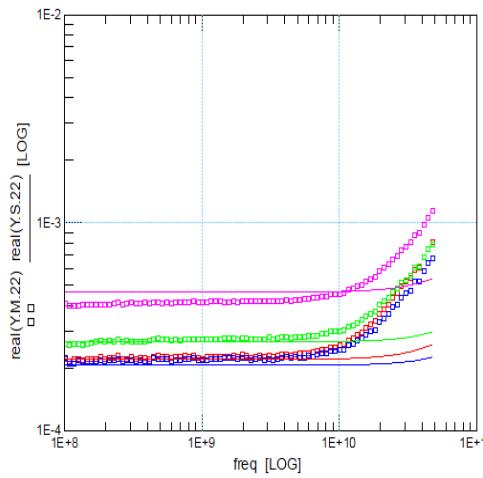
im(Y21) = f(Vg, Vd)



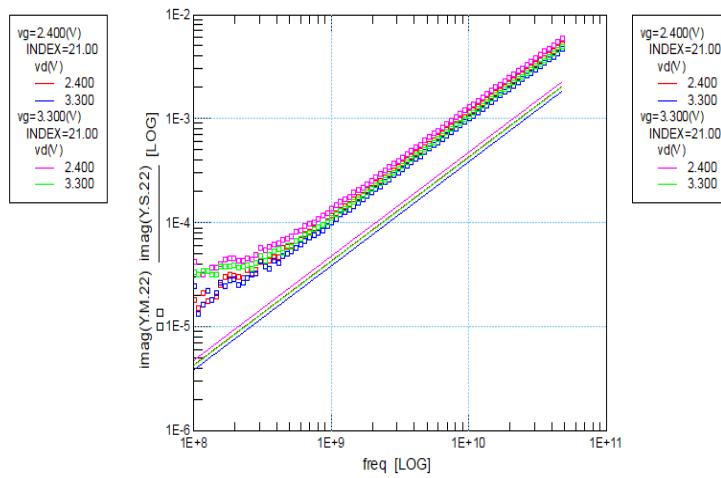
re(Y12) = f(Vg, Vd)



im(Y12) = f(Vg, Vd)

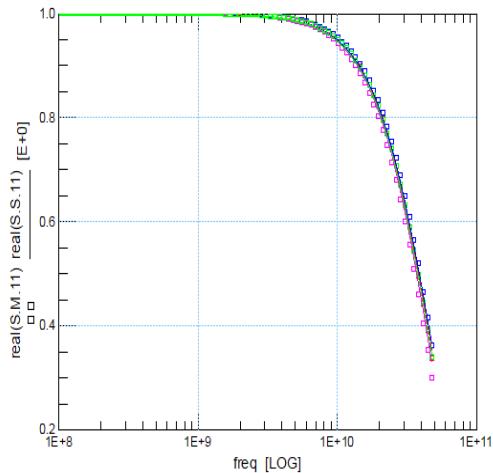


re(Y22) = f(Vg, Vd)

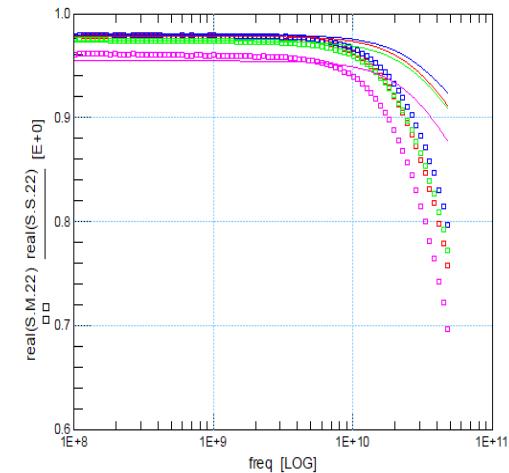


im(Y22) = f(Vg, Vd)

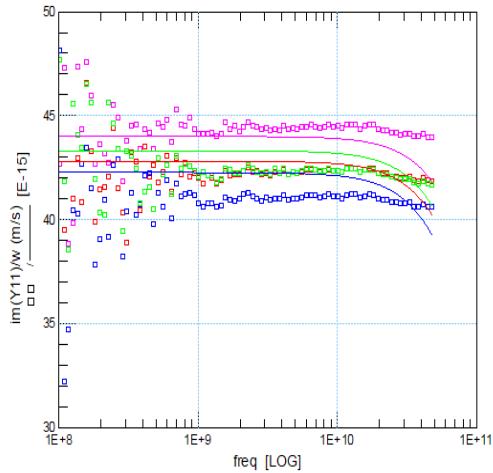
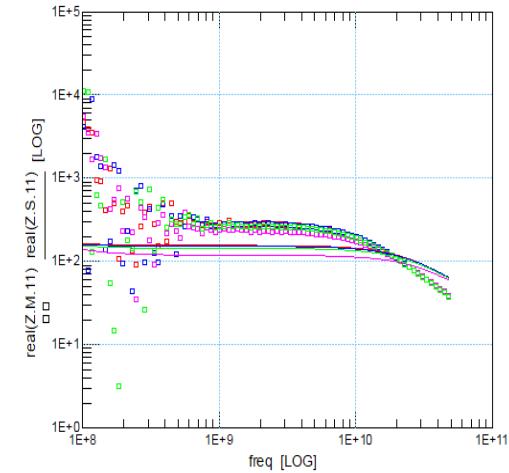
Verify Plots, T = 27°C



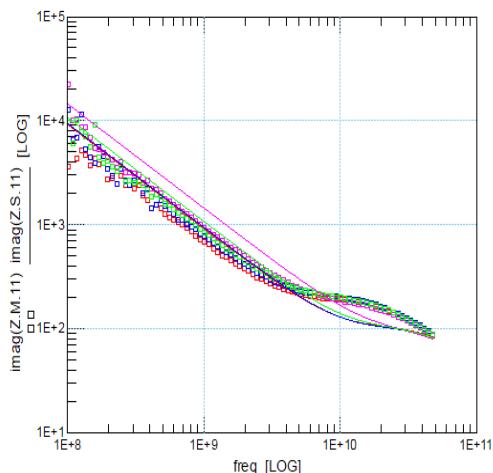
re(S11) = f(Vg, Vd)



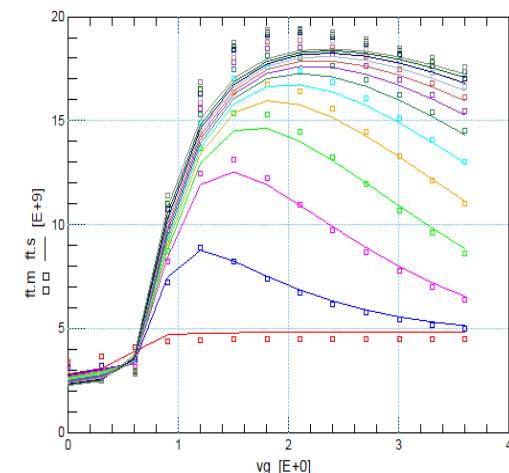
re(S22) = f(Vg, Vd)

im(Y11) divided by ω 

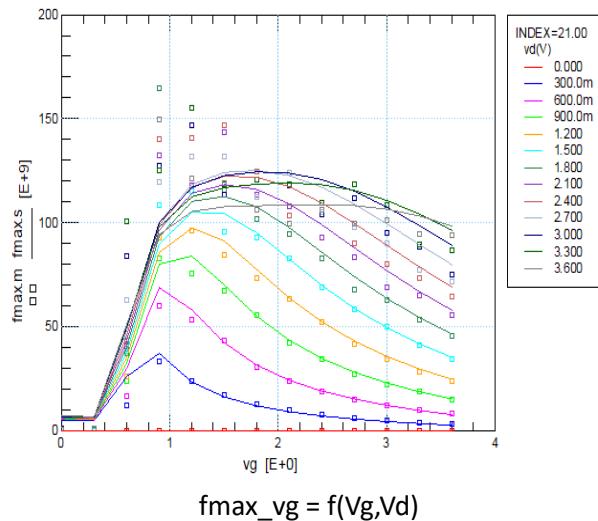
re(Z11) = f(Vg, Vd)



im(Z11) = f(Vg, Vd)

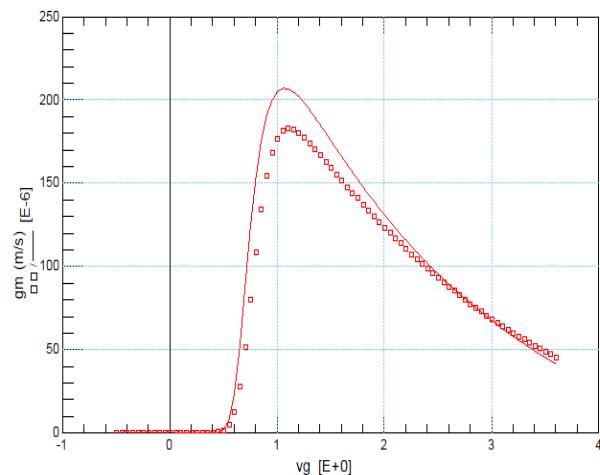
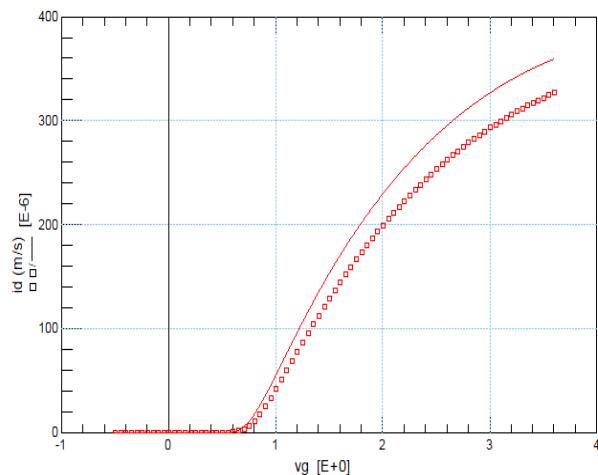


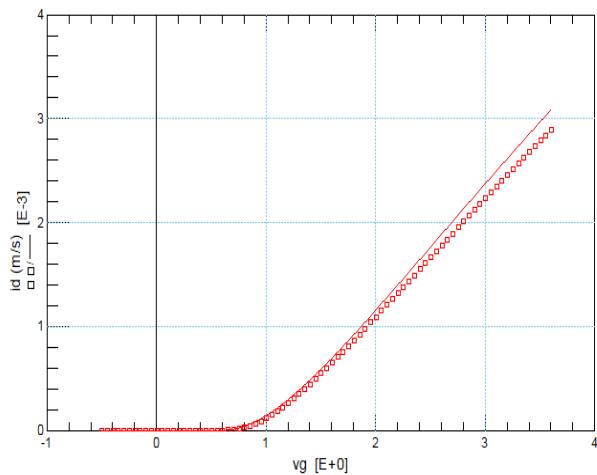
fT_vg = f(Vg, Vd)



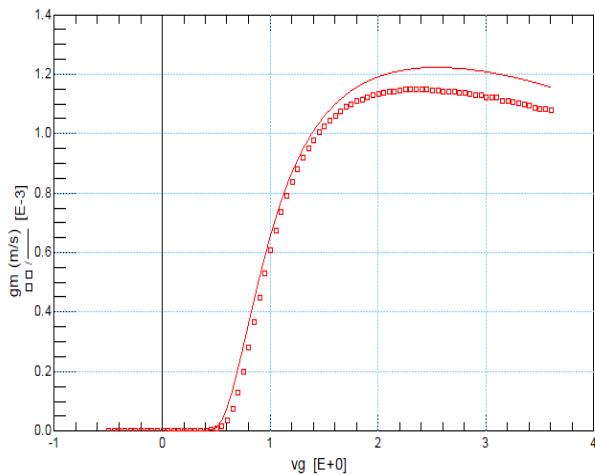
5.4 NF01_WF05u0_L_0u45_S453A_C1

I_d vs V_g , $T = 27^\circ C$



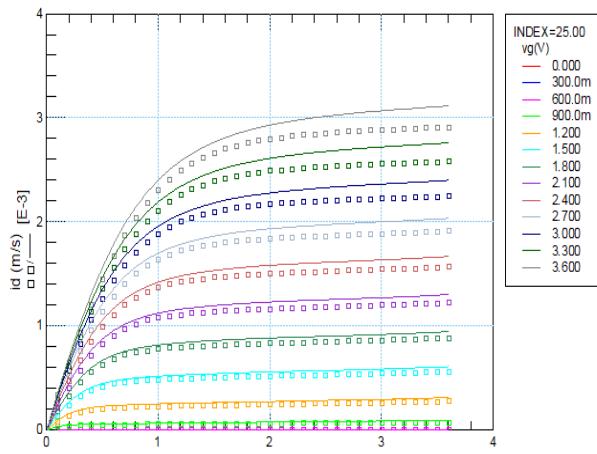


$$Id = f(Vg) @ Vd = 3.3V$$

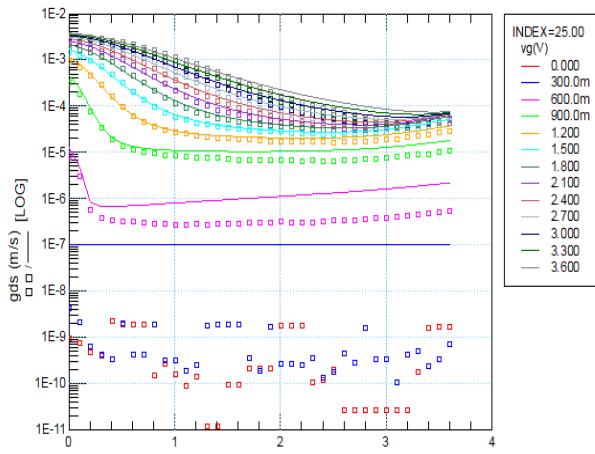


$$gm = f(Vg) @ Vd = 3.3V$$

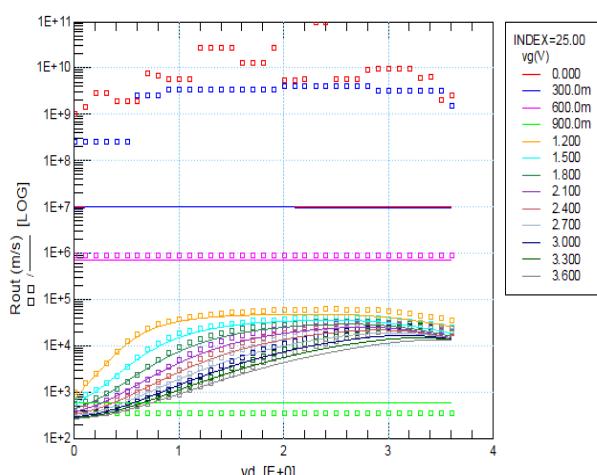
IdVd, T = 27°C



$$Id = f(Vd)$$

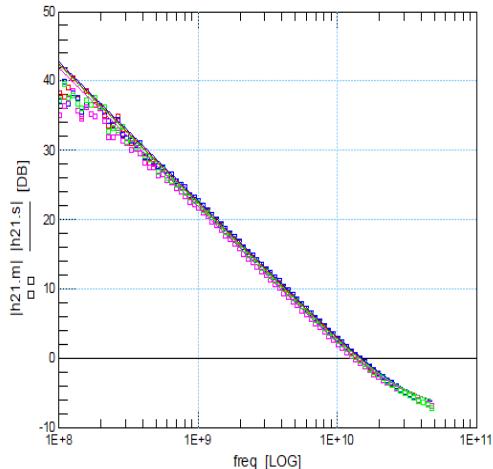


$$gds = f(Vd)$$

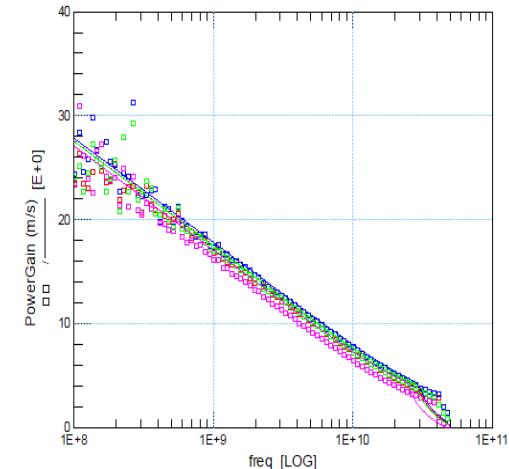


$$Rout = f(Vd)$$

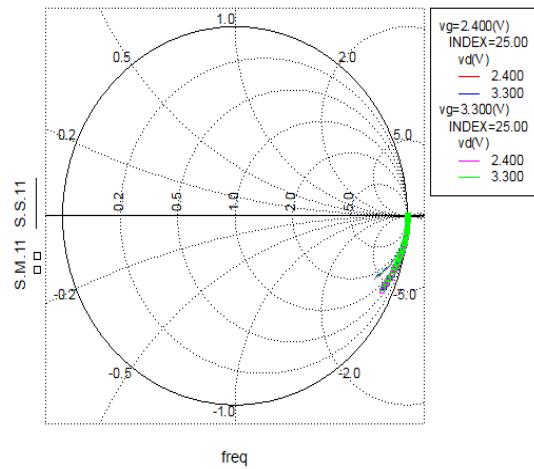
S-Parameter, T = 27°C



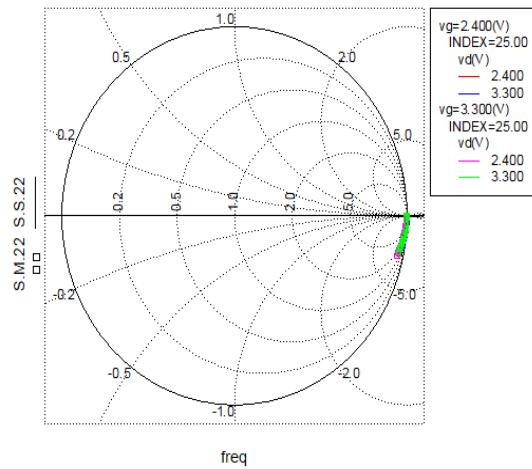
$$|h21| = f(Vg, Vd)$$



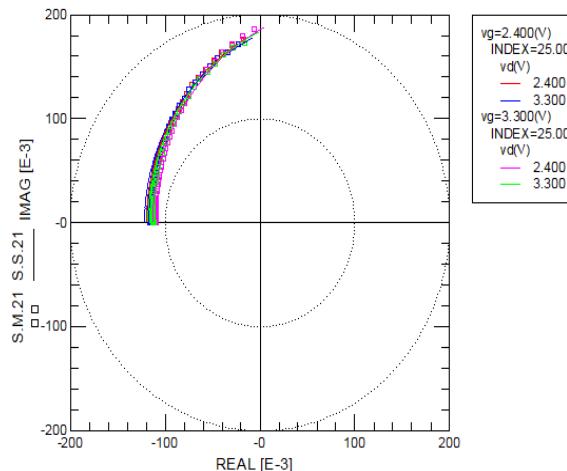
$$MSG/MAG = f(Vg, Vd)$$



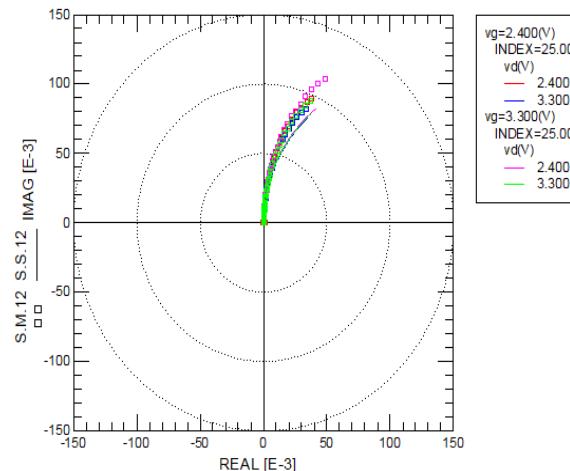
$$S11 = f(Vg, Vd)$$



$$S22 = f(Vg, Vd)$$

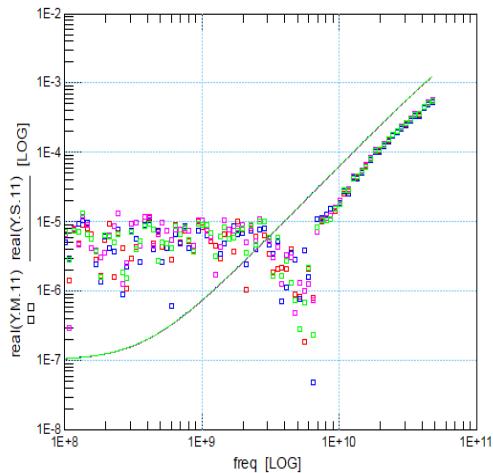


$$S21 = f(Vg, Vd)$$

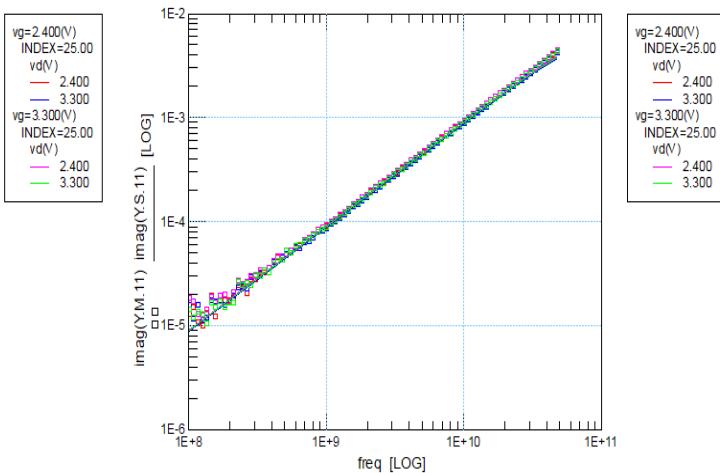


$$S12 = f(Vg, Vd)$$

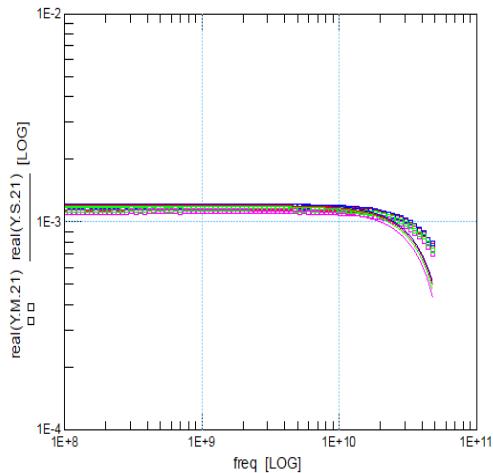
Y-Parameter, T = 27°C



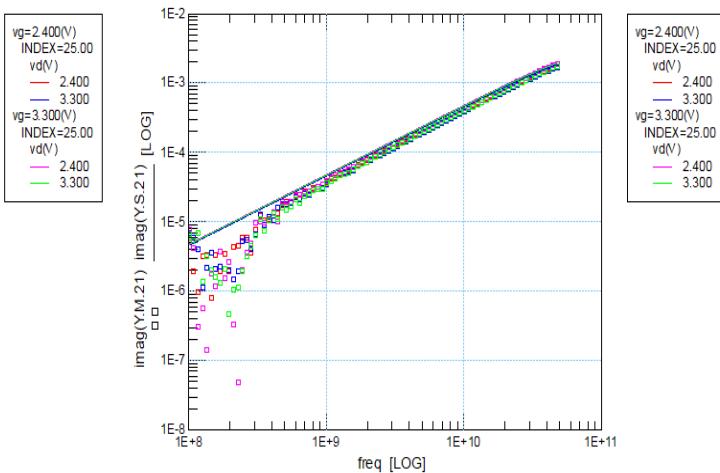
$$\text{re}(Y_{11}) = f(V_g, V_d)$$



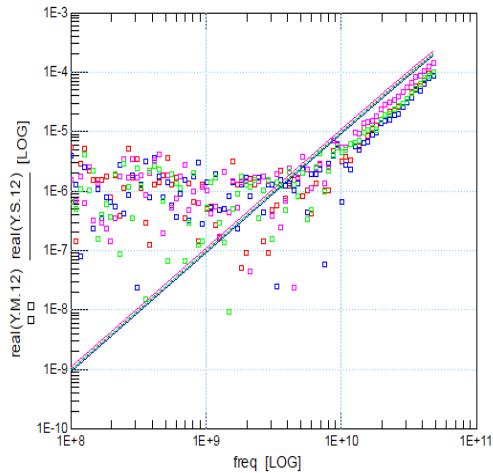
$$\text{im}(Y_{11}) = f(V_g, V_d)$$



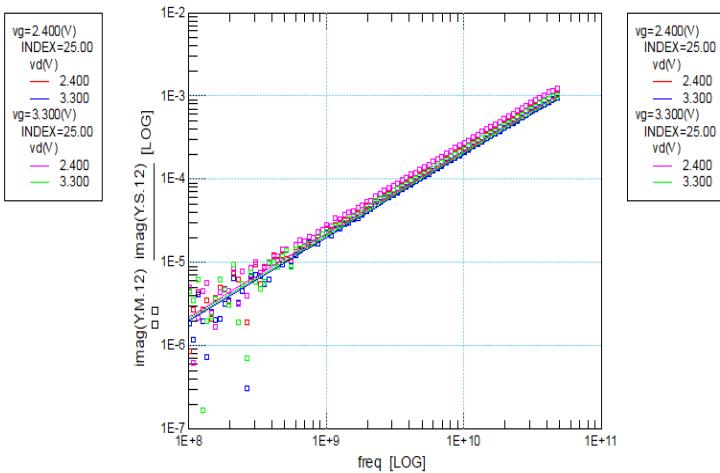
$$\text{re}(Y_{21}) = f(V_g, V_d)$$



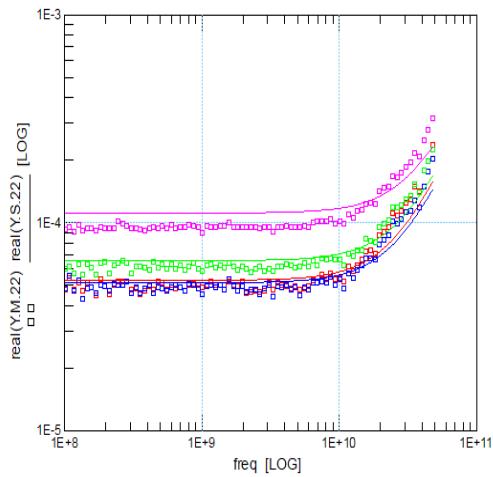
$$\text{im}(Y_{21}) = f(V_g, V_d)$$



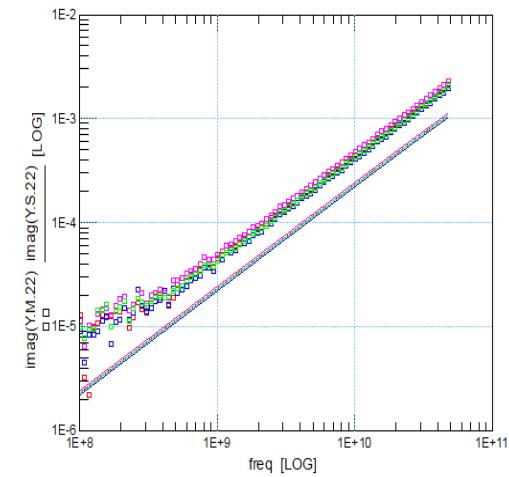
$$\text{re}(Y_{12}) = f(V_g, V_d)$$



$$\text{im}(Y_{12}) = f(V_g, V_d)$$

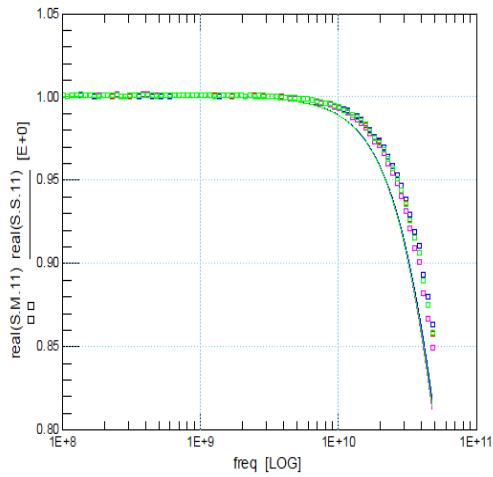


$$\text{re}(Y22) = f(Vg, Vd)$$

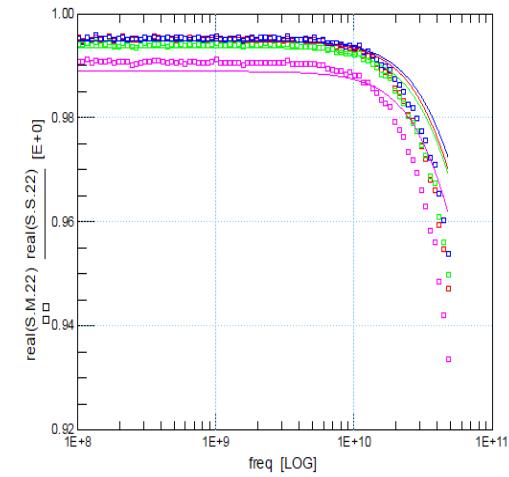


$$\text{im}(Y22) = f(Vg, Vd)$$

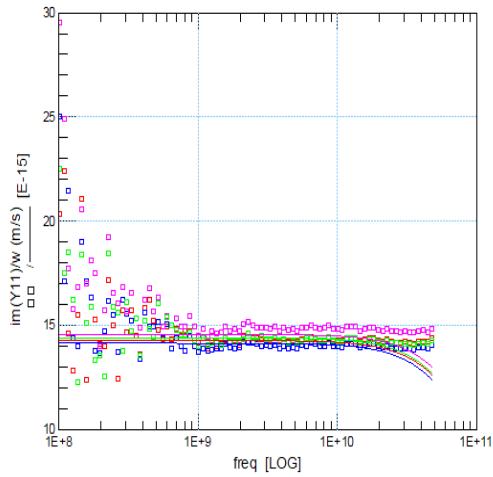
Verify Plots, T = 27°C



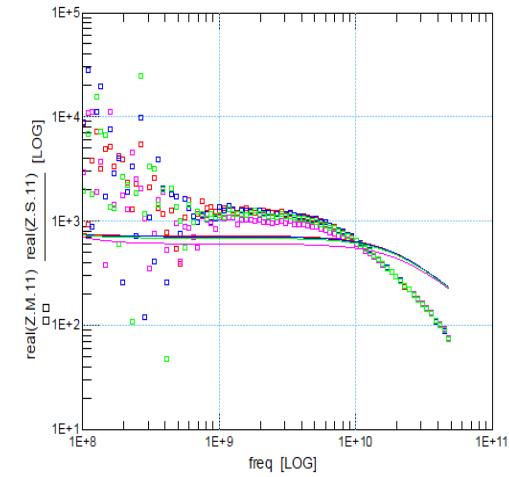
$$\text{re}(S11) = f(Vg, Vd)$$



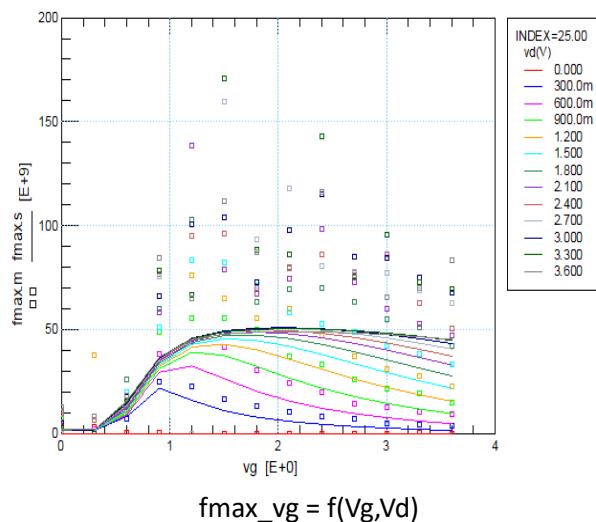
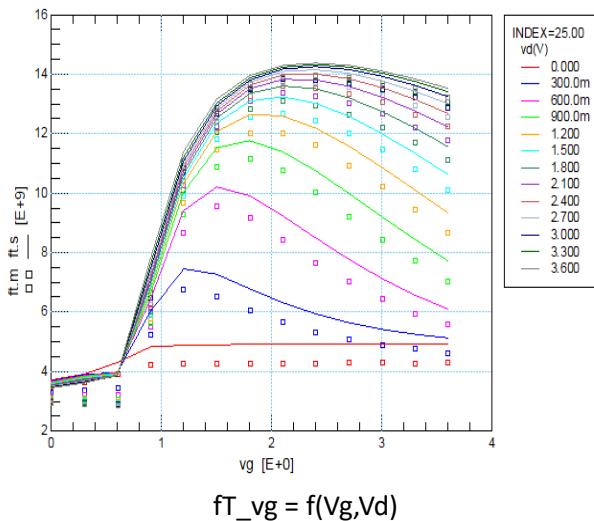
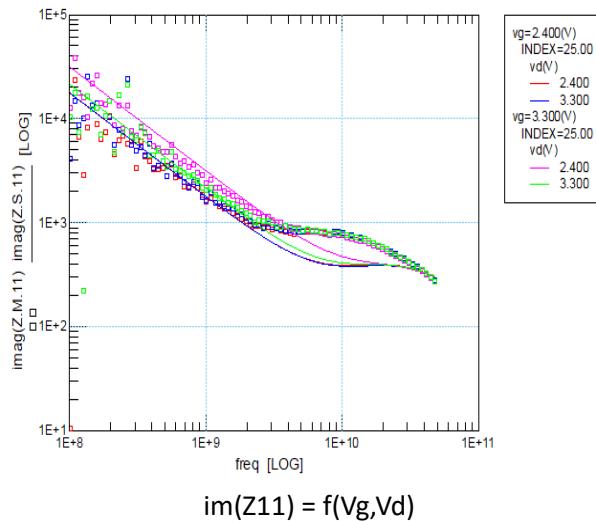
$$\text{re}(S22) = f(Vg, Vd)$$



$$\text{im}(Y11) \text{ divided by } \omega$$

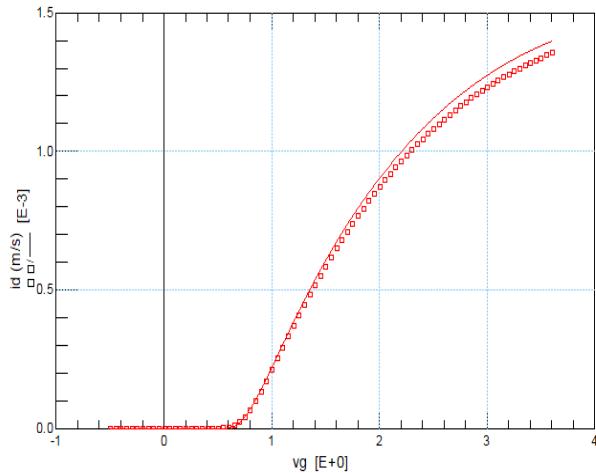


$$\text{re}(Z11) = f(Vg, Vd)$$

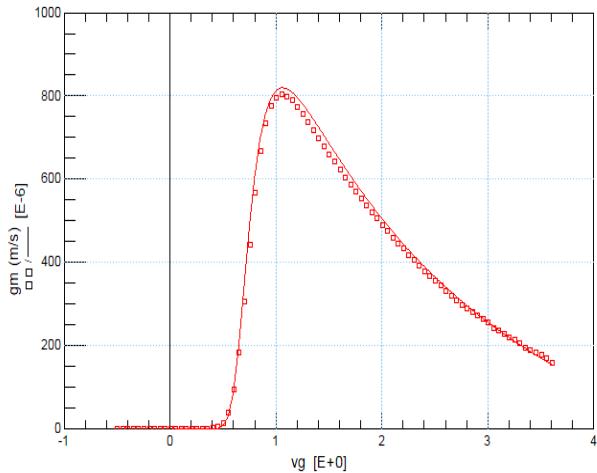


5.5 NF04_WF05u0_L_0u45_S453A_83

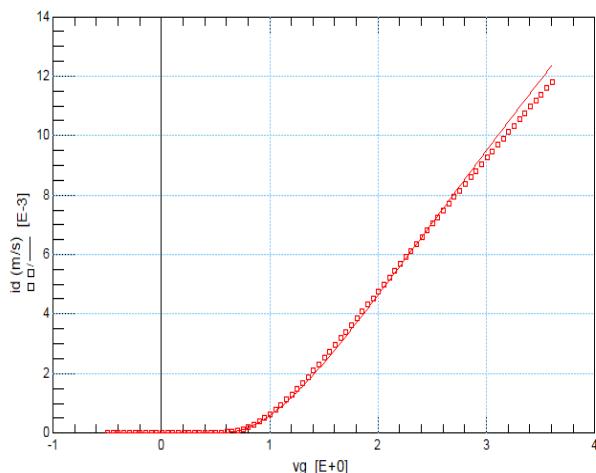
$IdVg$, $T = 27^\circ\text{C}$



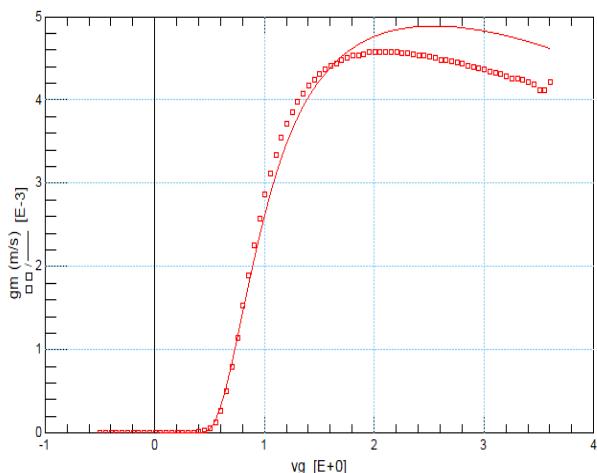
$Id = f(Vg)$ @ $Vd = 0.1\text{V}$



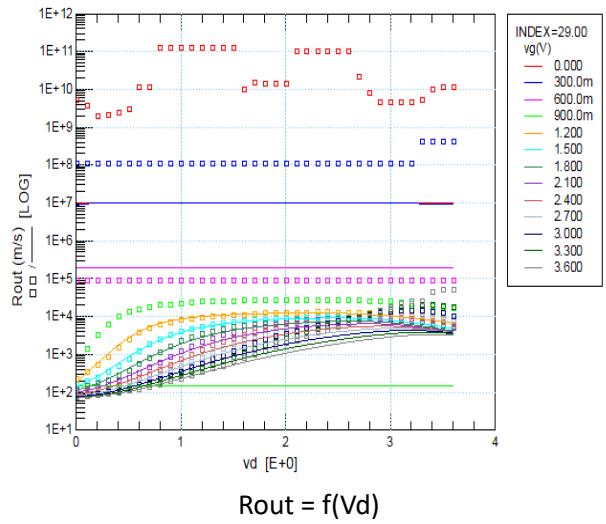
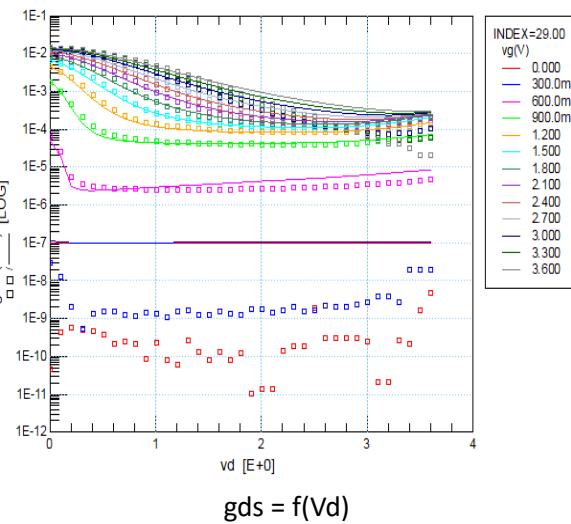
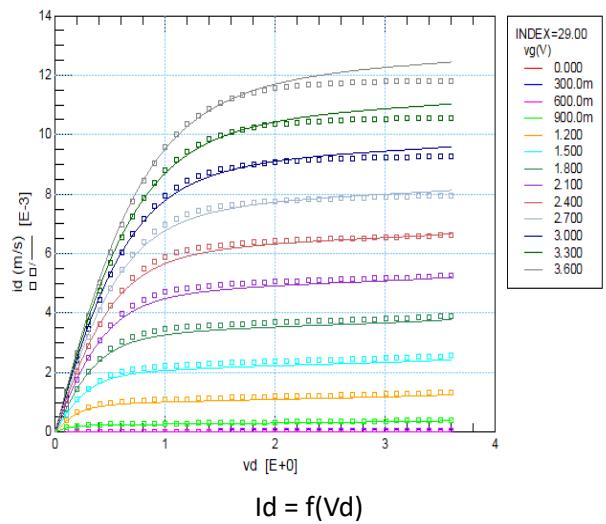
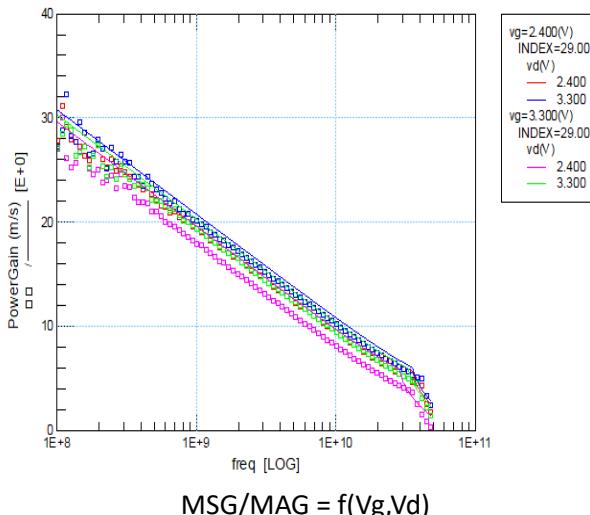
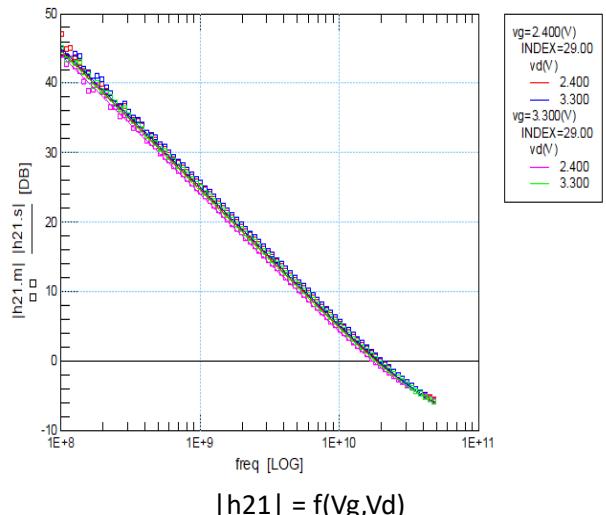
$gm = f(Vg)$ @ $Vd = 0.1\text{V}$

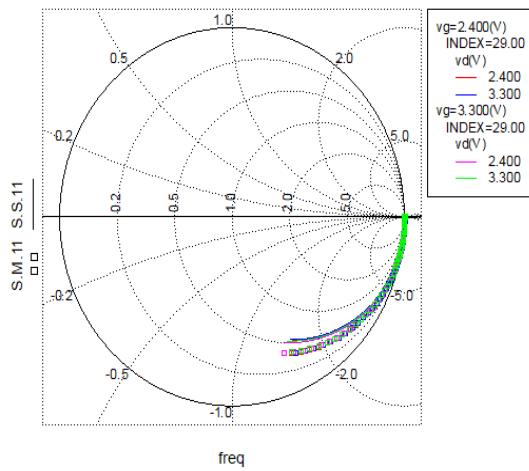
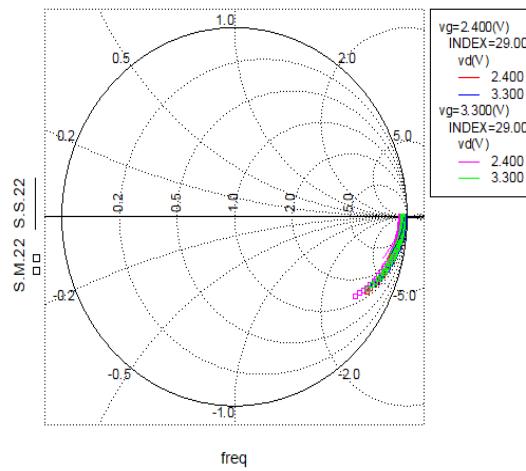
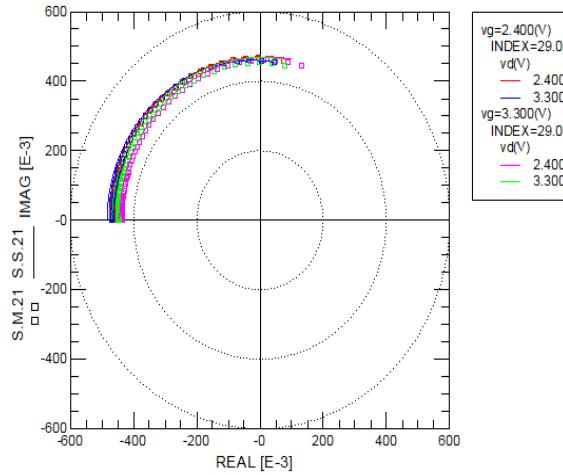
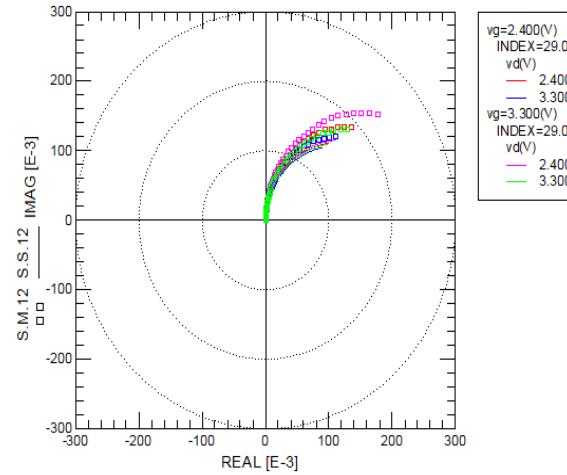


$Id = f(Vg)$ @ $Vd = 3.3\text{V}$

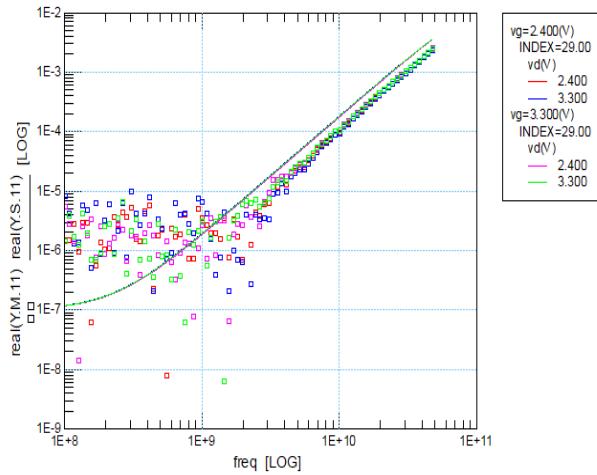
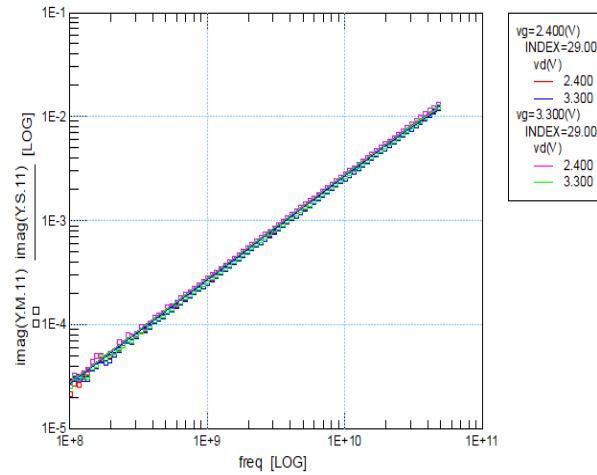


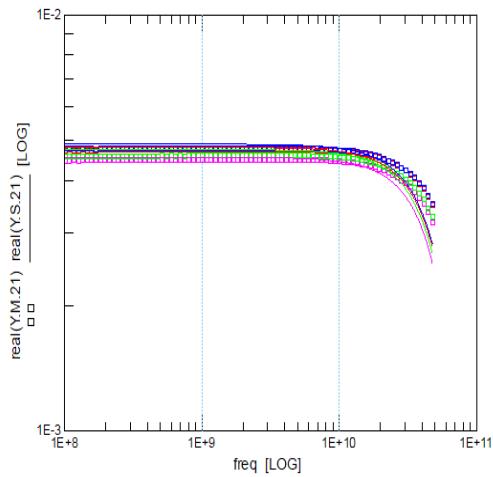
$gm = f(Vg)$ @ $Vd = 3.3\text{V}$

IdVd, T = 27°C**S-Parameter, T = 27°C**

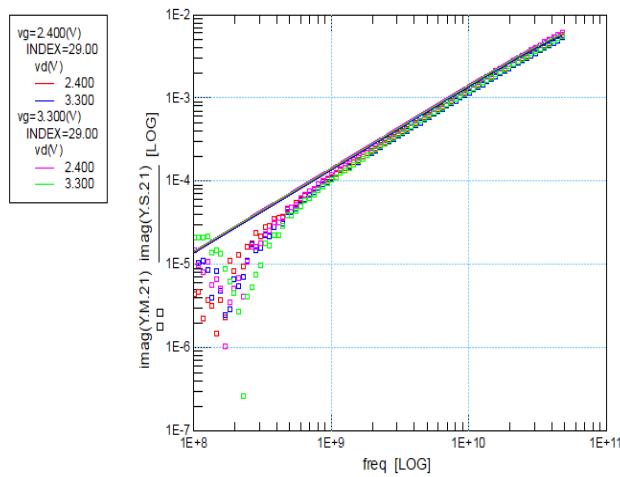
 $S_{11} = f(V_g, V_d)$  $S_{22} = f(V_g, V_d)$  $S_{21} = f(V_g, V_d)$  $S_{12} = f(V_g, V_d)$

Y-Parameter, T = 27°C

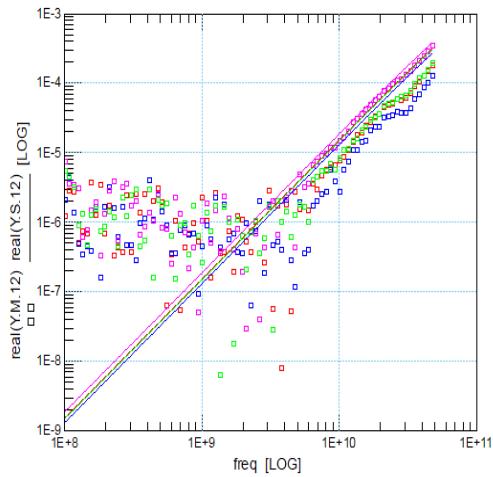
 $\text{re}(Y_{11}) = f(V_g, V_d)$  $\text{im}(Y_{11}) = f(V_g, V_d)$



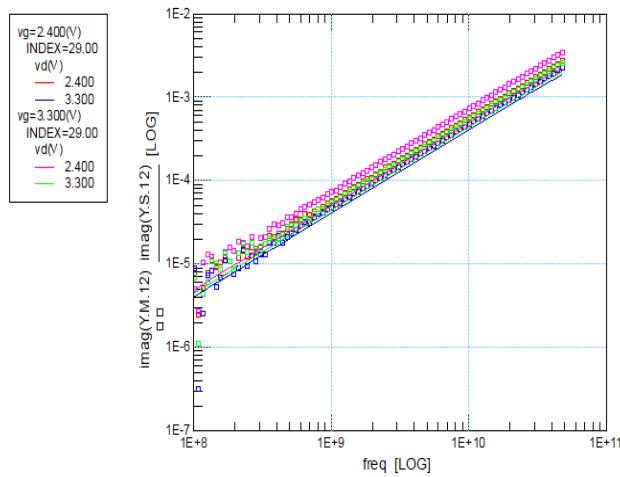
re(Y21) = f(Vg,Vd)



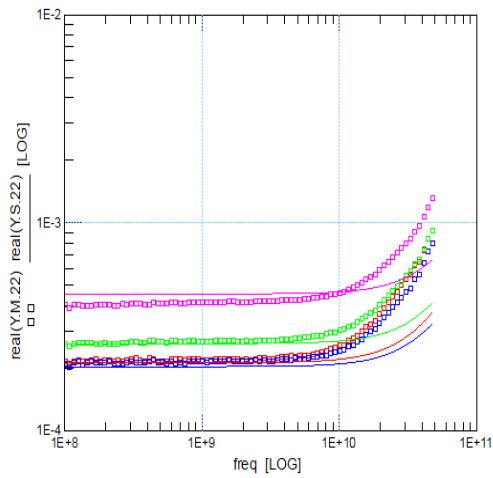
im(Y21) = f(Vg,Vd)



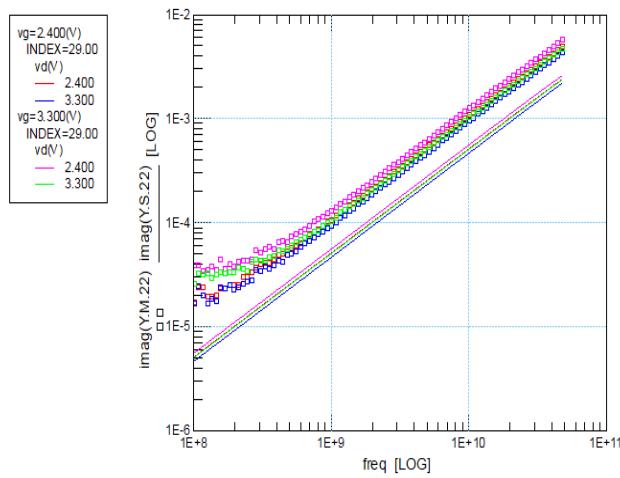
re(Y12) = f(Vg,Vd)



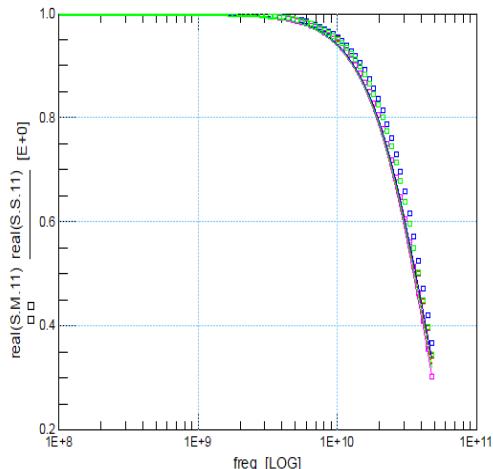
im(Y12) = f(Vg,Vd)



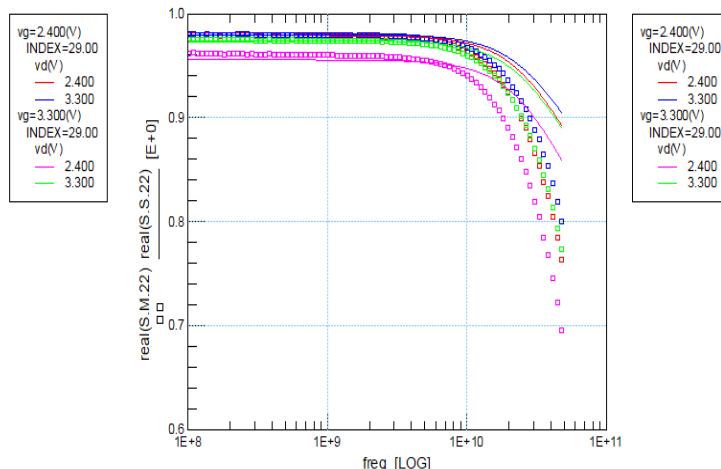
re(Y22) = f(Vg,Vd)



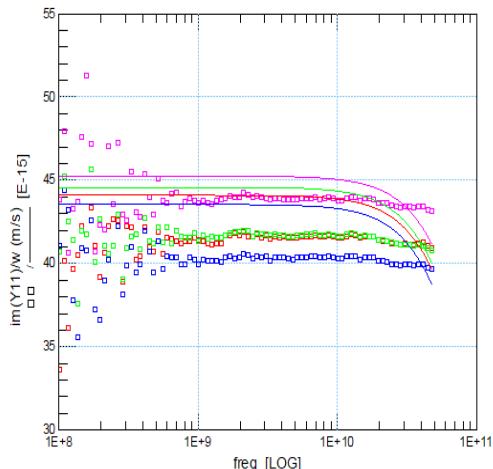
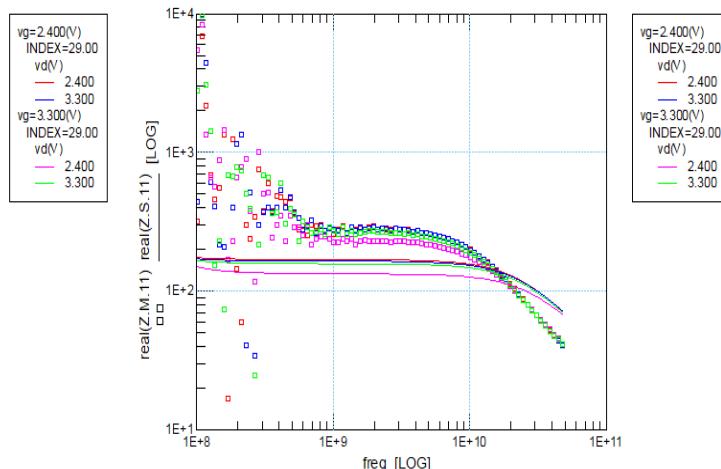
im(Y22) = f(Vg,Vd)

Verify Plots, $T = 27^\circ\text{C}$ 

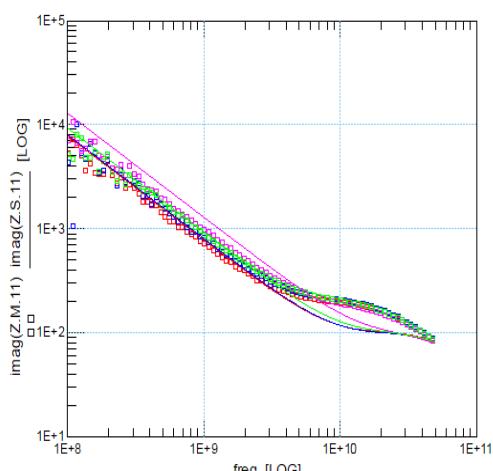
real(S11) = f(Vg,Vd)



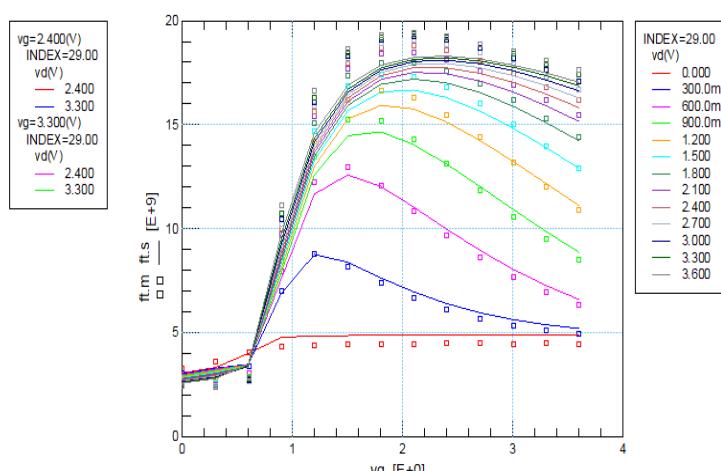
real(S22) = f(Vg,Vd)

im(Y11) divided by ω 

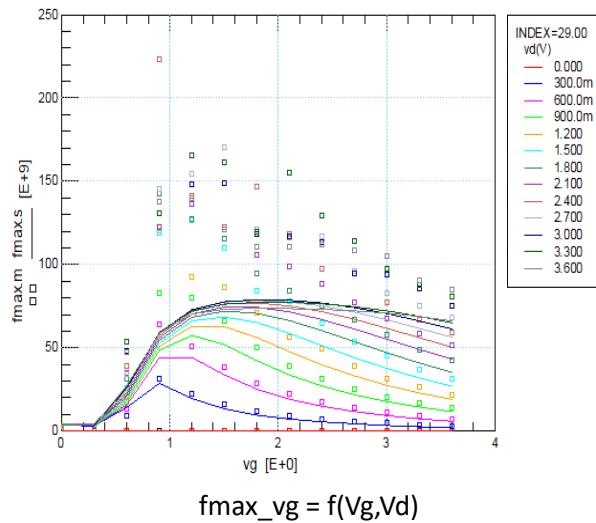
real(Z11) = f(Vg,Vd)



imag(Z11) = f(Vg,Vd)

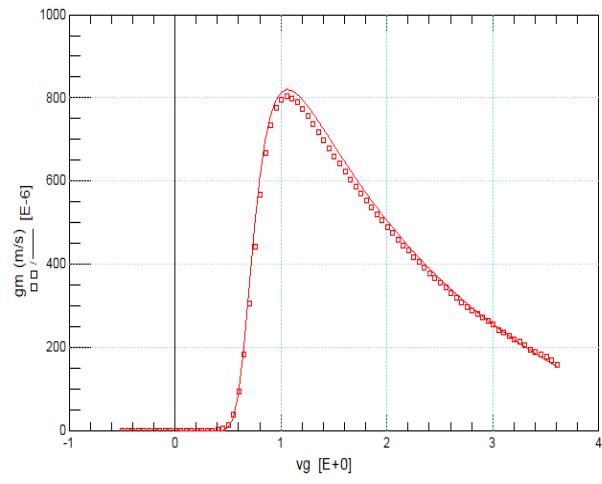
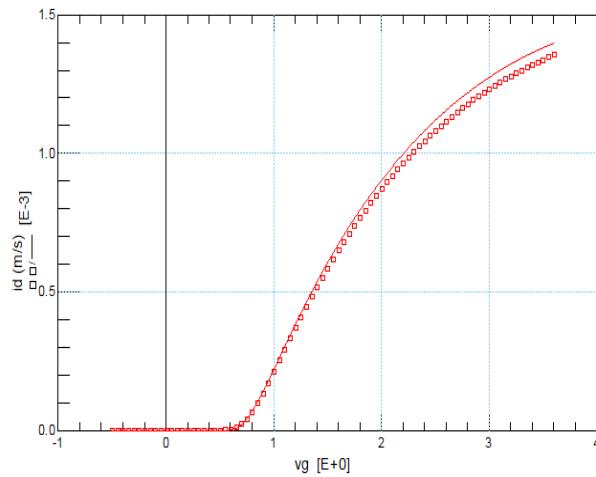


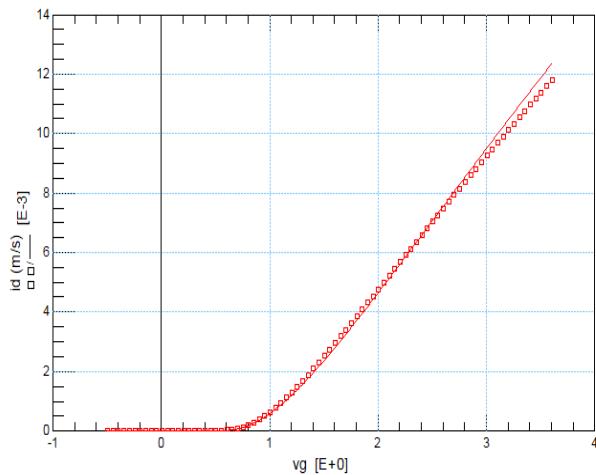
fT_vg = f(Vg,Vd)



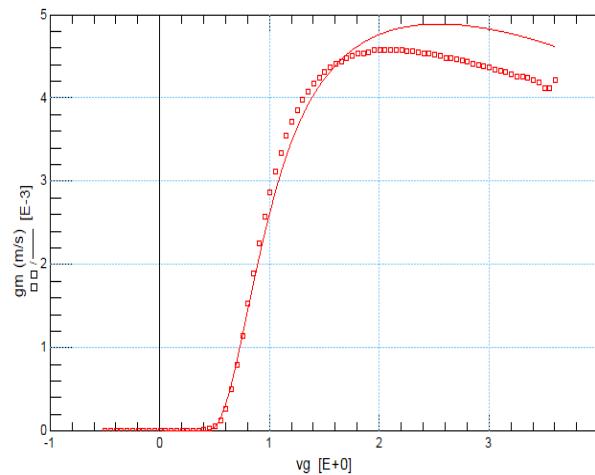
5.6 NF04_WF05u0_L_0u45_post_83

I_d Vg, $T = 27^\circ\text{C}$



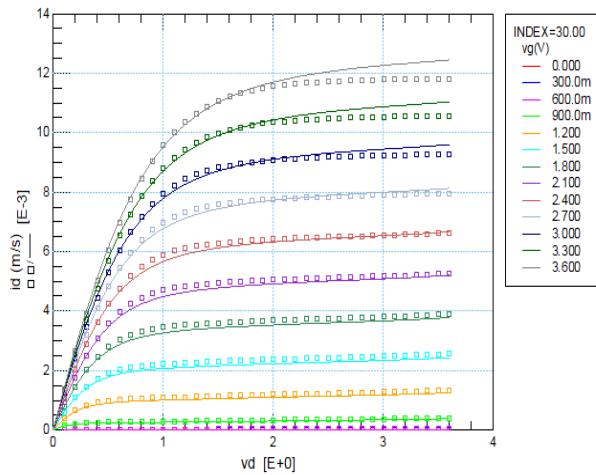


$$Id = f(Vg) @ Vd = 3.3V$$

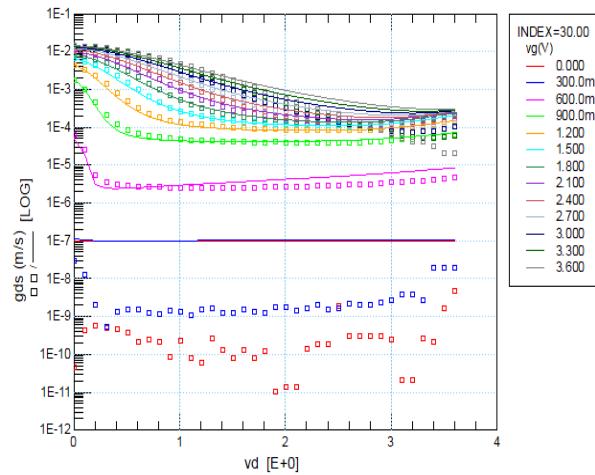


$$gm = f(Vg) @ Vd = 3.3V$$

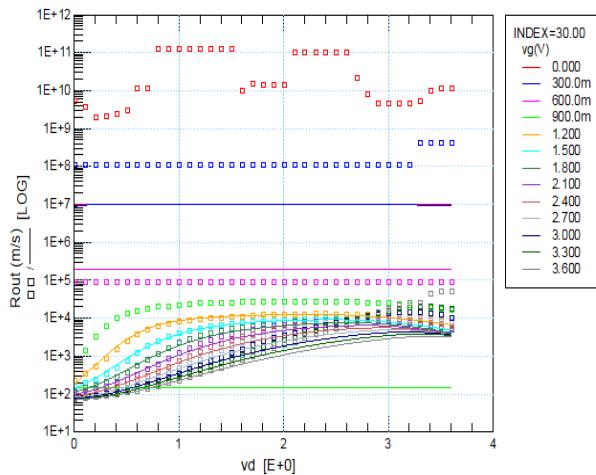
IdVd, T = 27°C



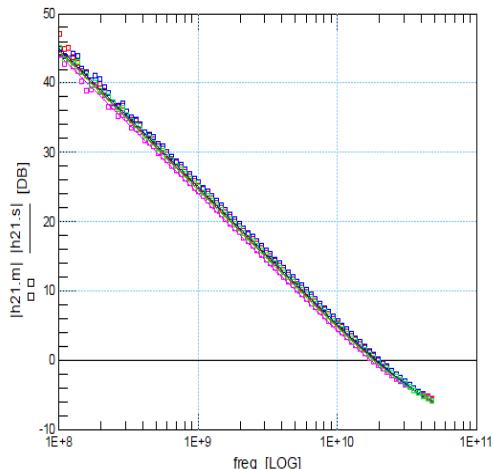
$$Id = f(Vd)$$



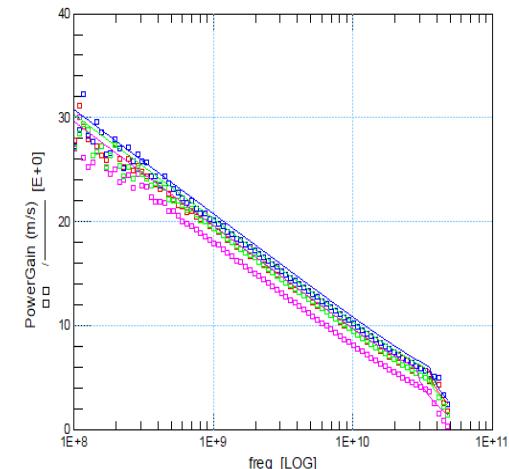
$$gds = f(Vd)$$



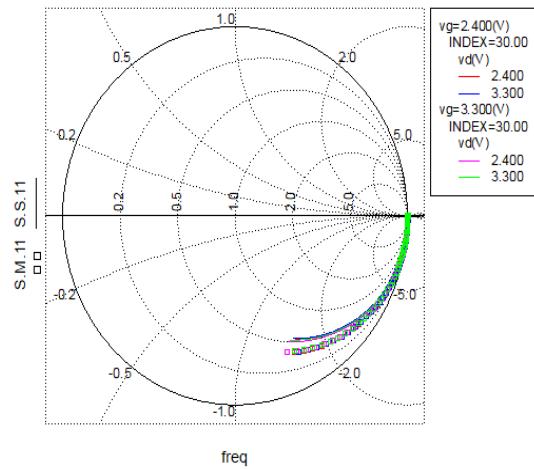
$$Rout = f(Vd)$$

S-Parameter, T = 27°C

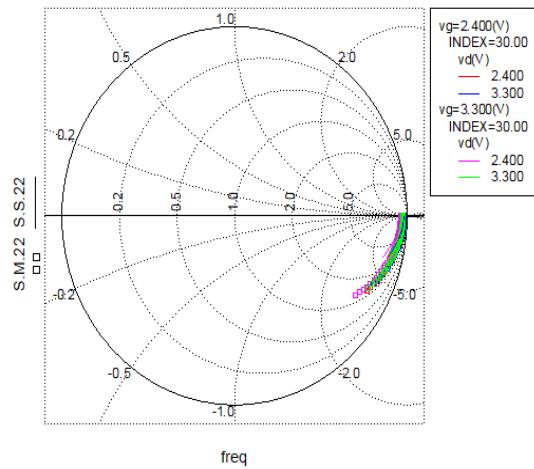
$$|h21| = f(Vg, Vd)$$



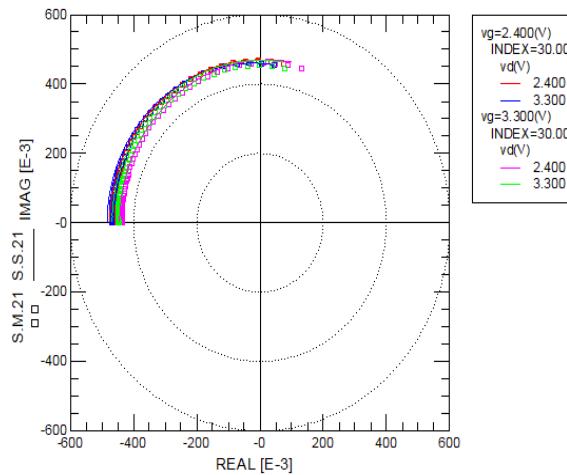
$$MSG/MAG = f(Vg, Vd)$$



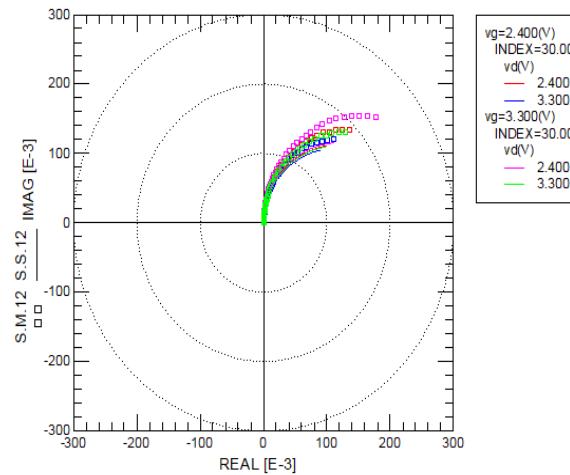
$$S11 = f(Vg, Vd)$$



$$S22 = f(Vg, Vd)$$

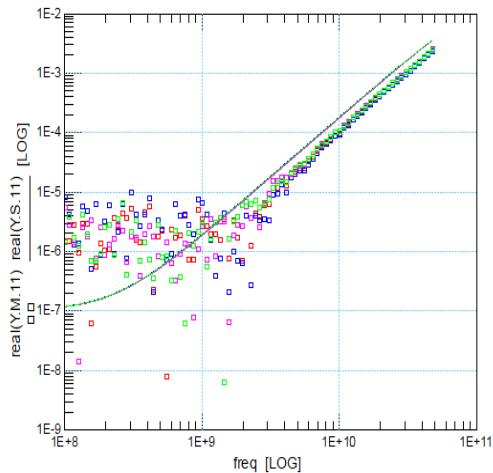


$$S21 = f(Vg, Vd)$$

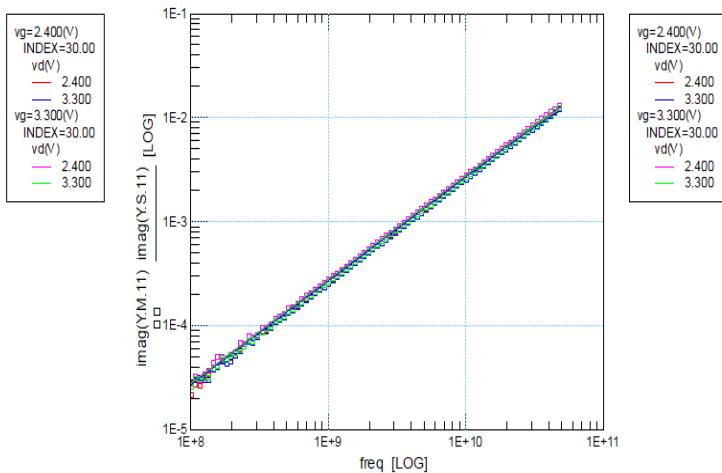


$$S12 = f(Vg, Vd)$$

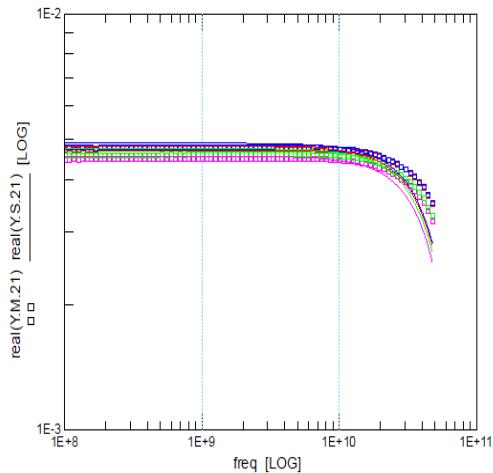
Y-Parameter, T = 27°C



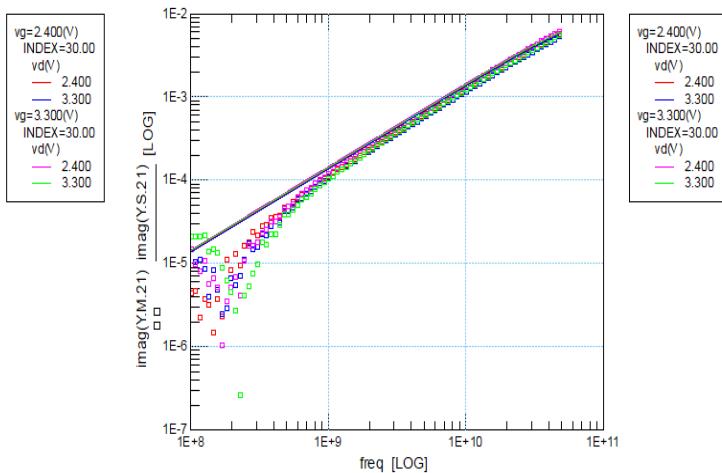
$$\text{re}(Y_{11}) = f(V_g, V_d)$$



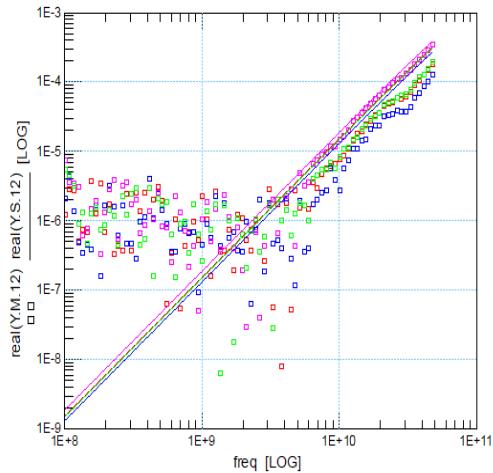
$$\text{im}(Y_{11}) = f(V_g, V_d)$$



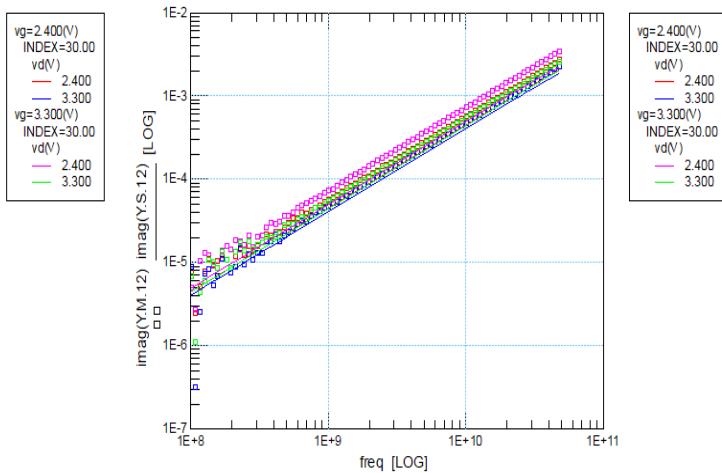
$$\text{re}(Y_{21}) = f(V_g, V_d)$$



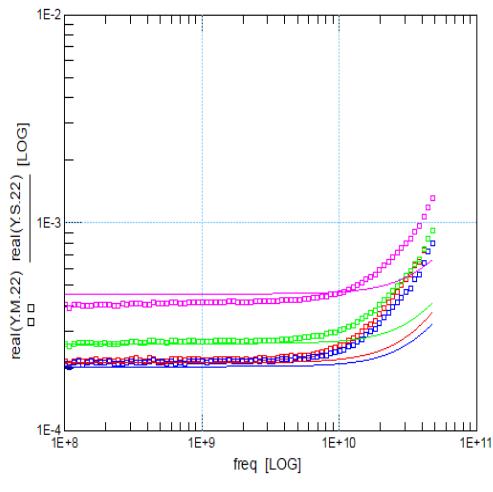
$$\text{im}(Y_{21}) = f(V_g, V_d)$$



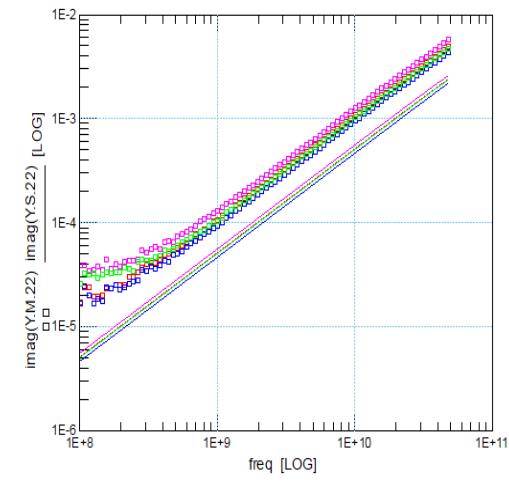
$$\text{re}(Y_{12}) = f(V_g, V_d)$$



$$\text{im}(Y_{12}) = f(V_g, V_d)$$

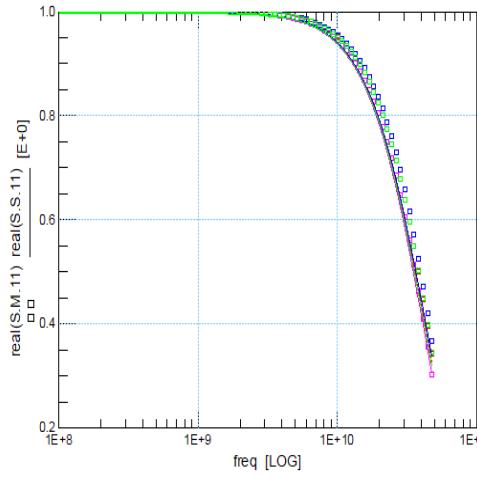


re(Y22) = f(Vg, Vd)

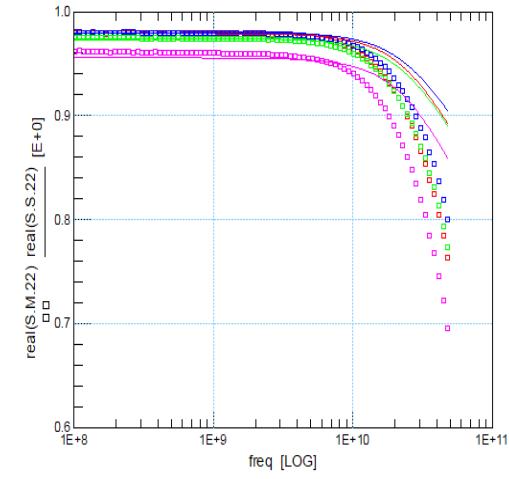


im(Y22) = f(Vg, Vd)

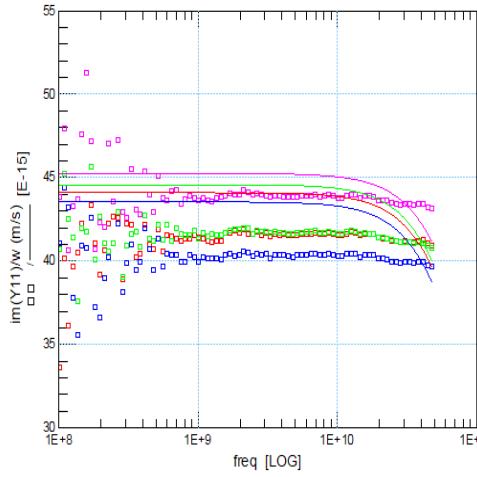
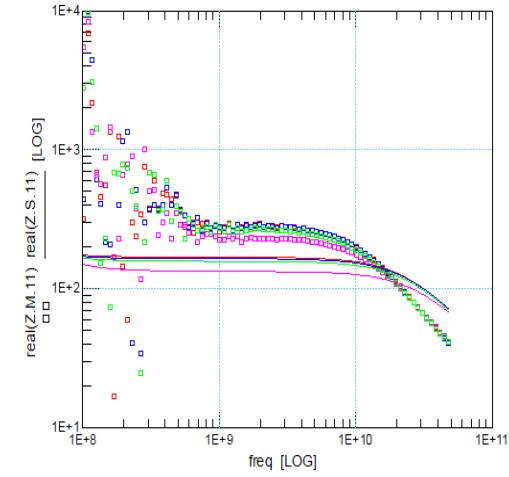
Verify Plots, T = 27°C



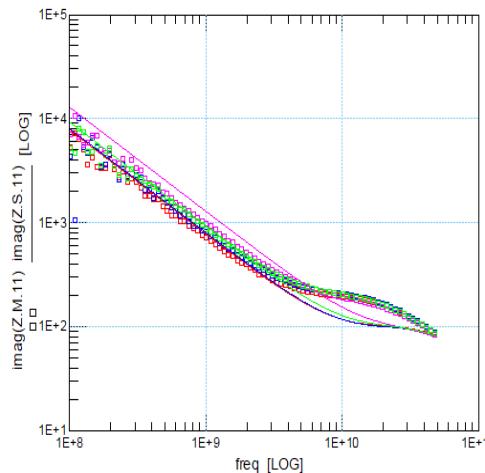
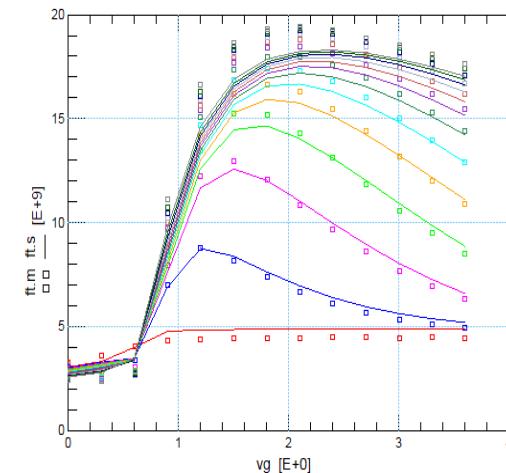
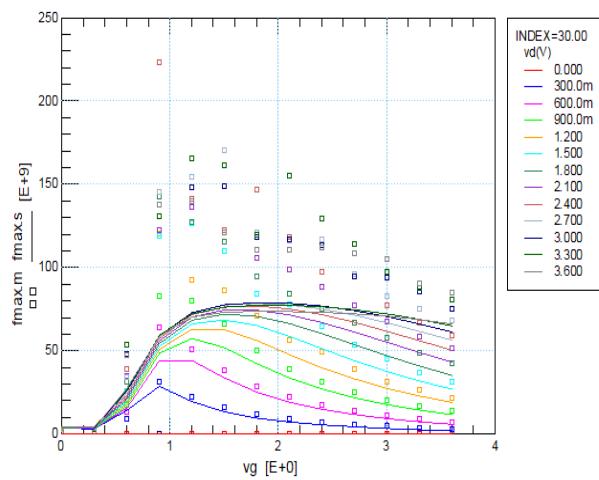
re(S11) = f(Vg, Vd)



re(S22) = f(Vg, Vd)

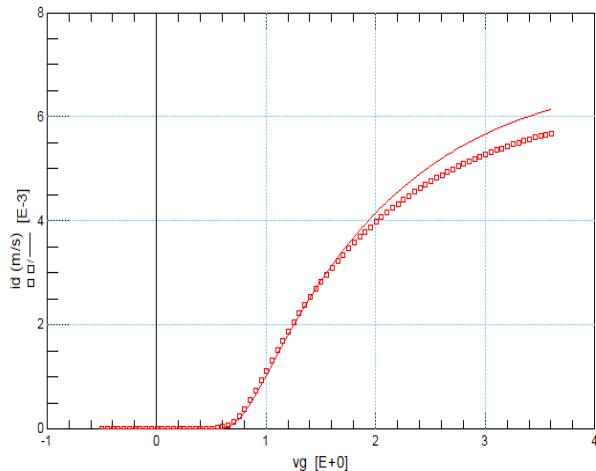
im(Y11) divided by ω 

re(Z11) = f(Vg, Vd)

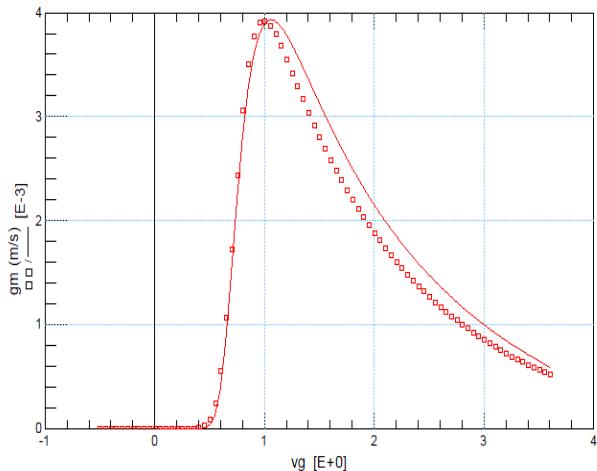
 $\text{im}(Z_{11}) = f(V_g, V_d)$  $fT_{vg} = f(V_g, V_d)$  $f_{\text{max}}_{vg} = f(V_g, V_d)$

5.7 NF10_WF10u0_L_0u45_S453A_80

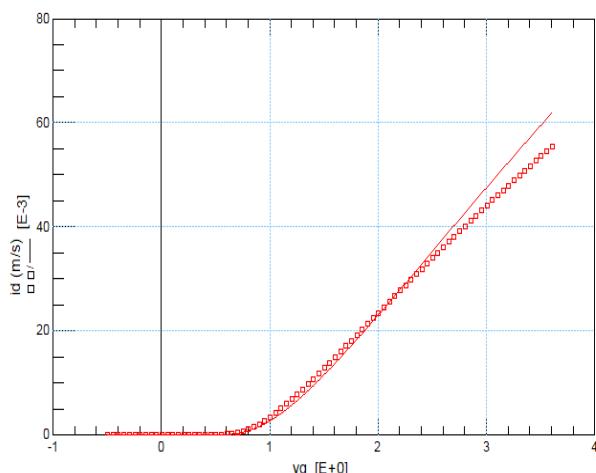
$IdVg$, $T = 27^\circ\text{C}$



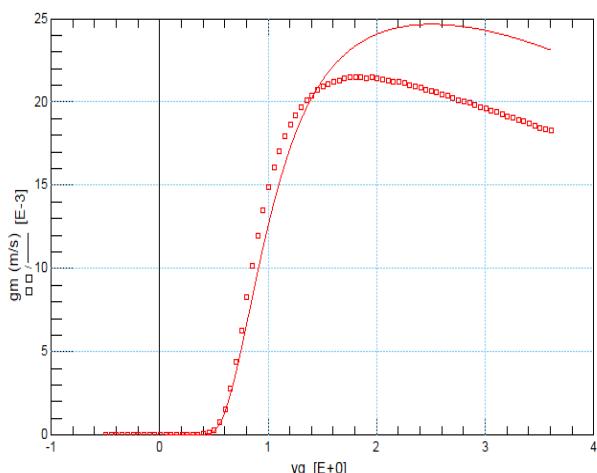
$Id = f(Vg)$ @ $Vd = 0.1\text{V}$



$gm = f(Vg)$ @ $Vd = 0.1\text{V}$

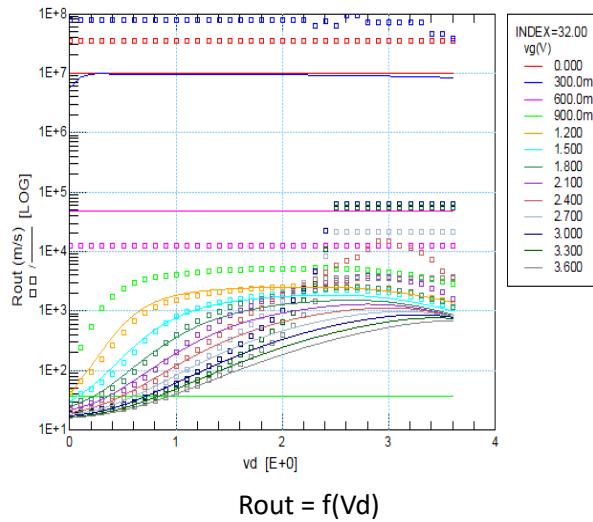
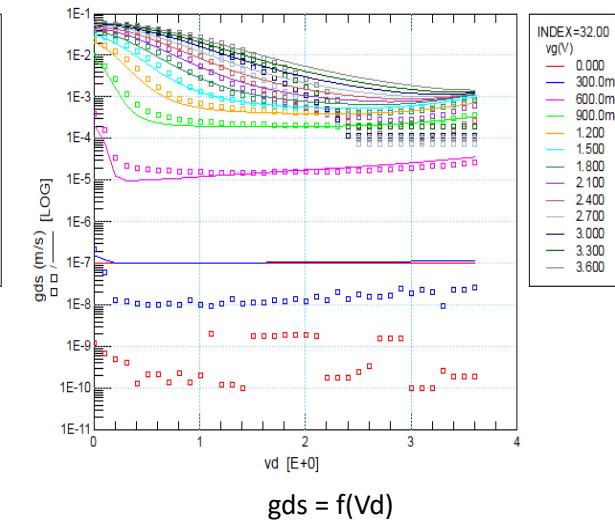
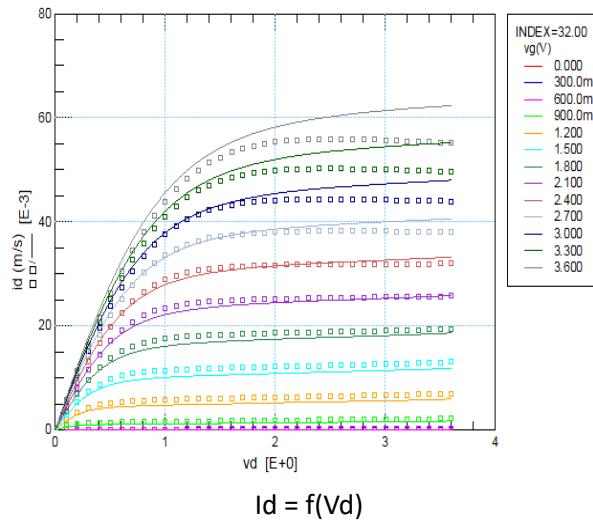


$Id = f(Vg)$ @ $Vd = 3.3\text{V}$

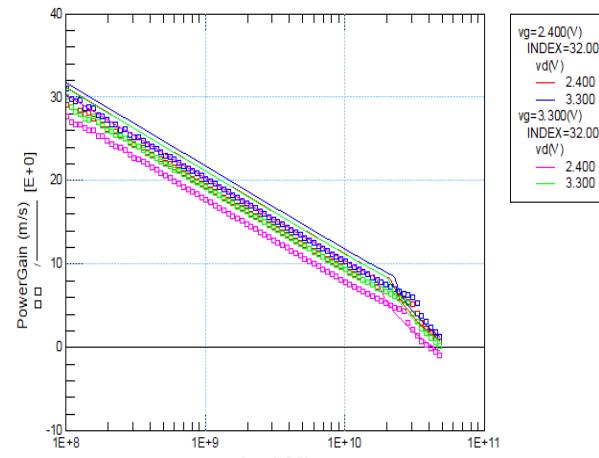
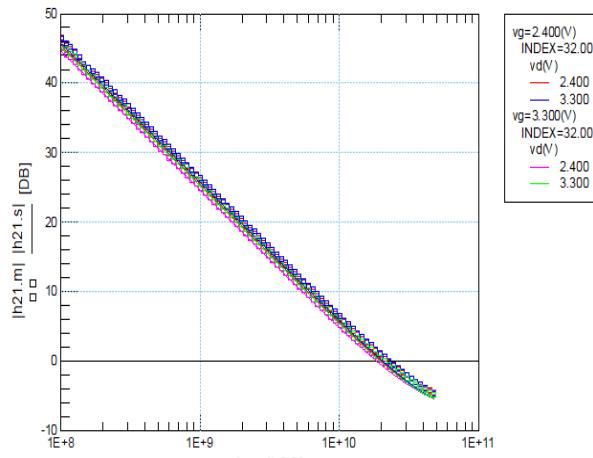


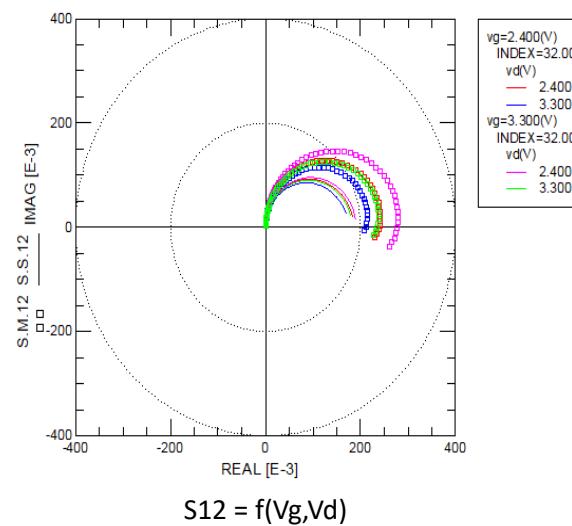
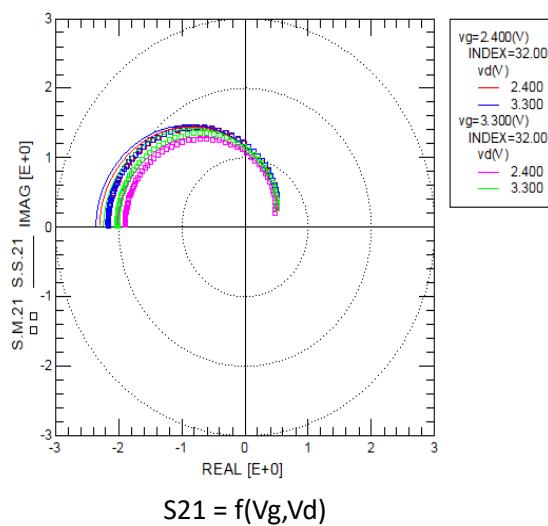
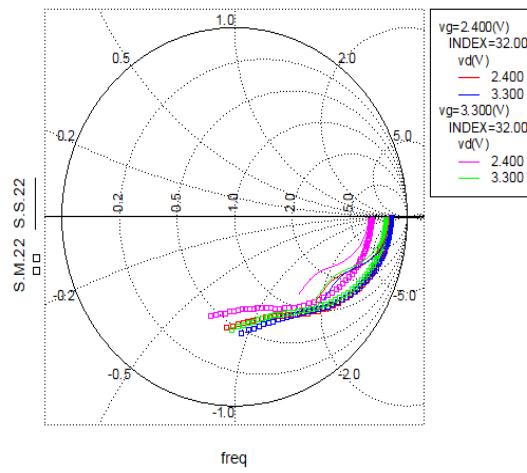
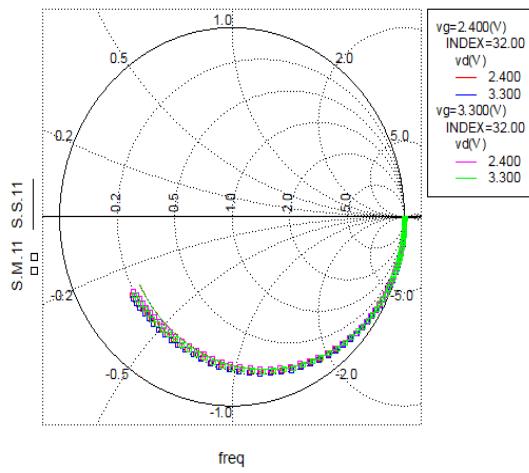
$gm = f(Vg)$ @ $Vd = 3.3\text{V}$

$IdVd$, $T = 27^\circ\text{C}$

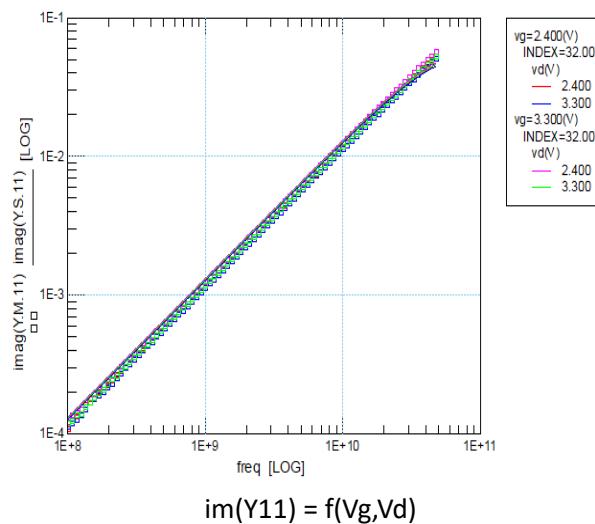
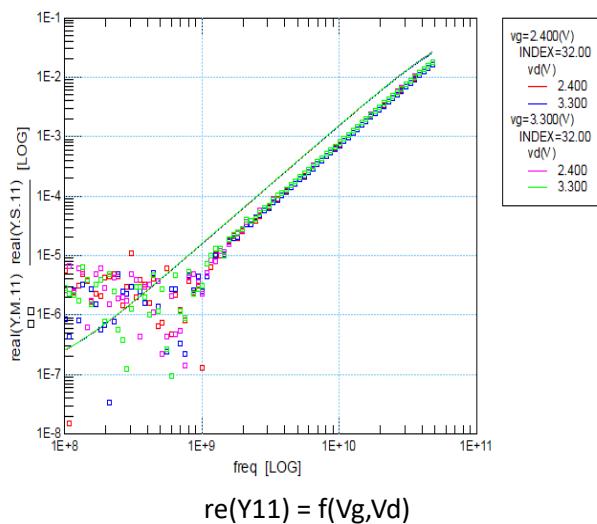


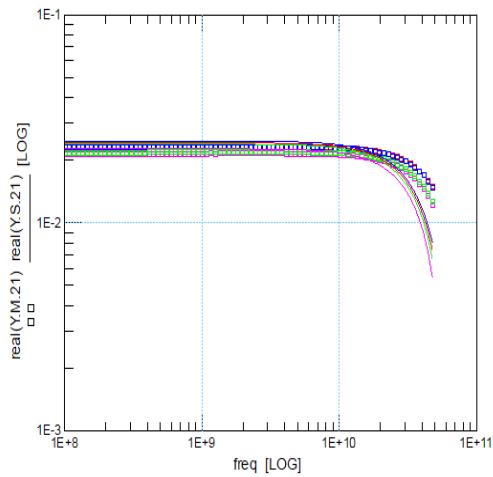
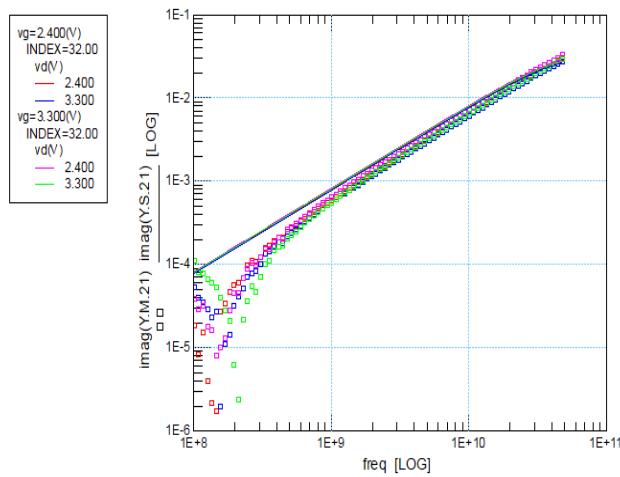
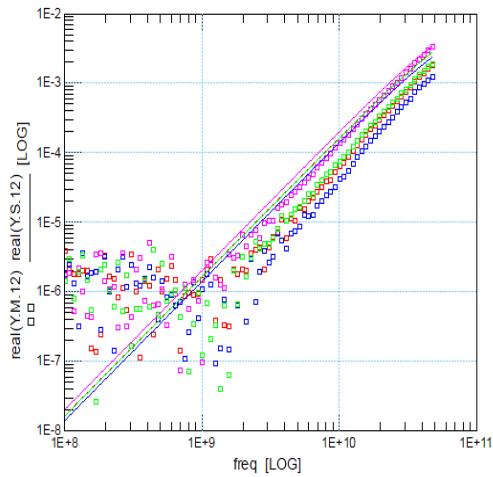
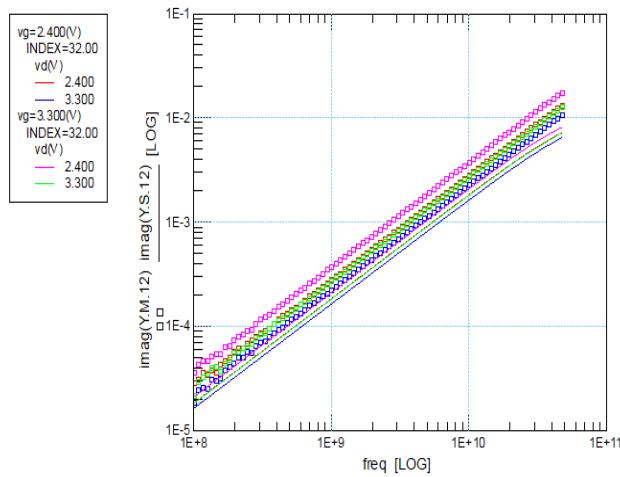
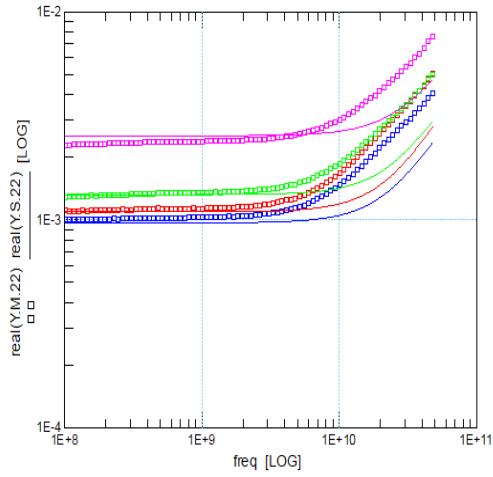
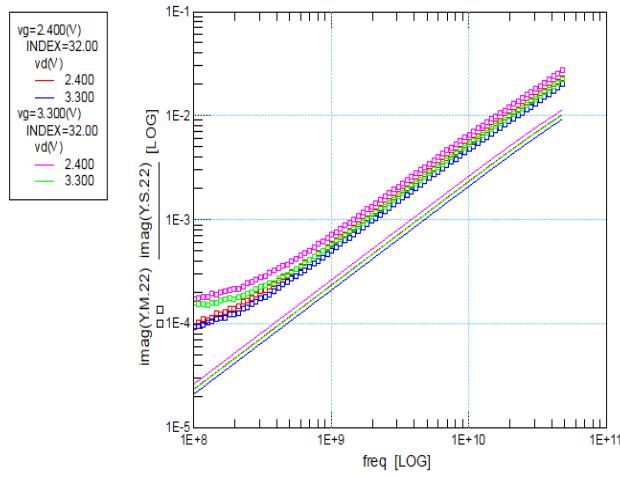
S-Parameter, $T = 27^\circ\text{C}$

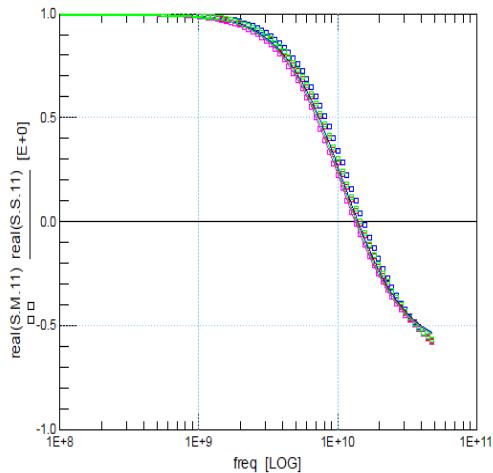




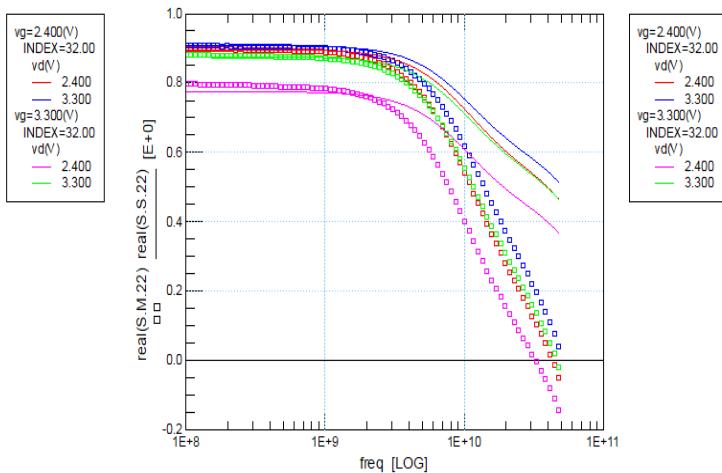
Y-Parameter, T = 27°C



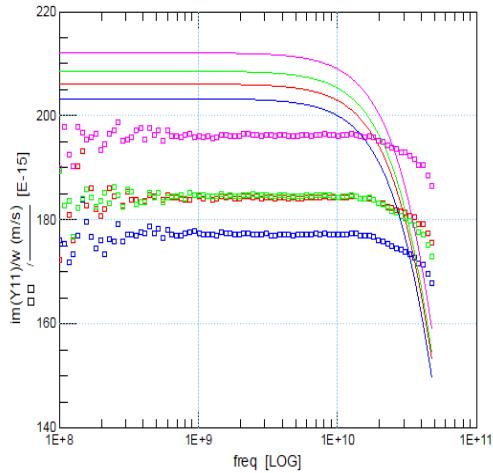
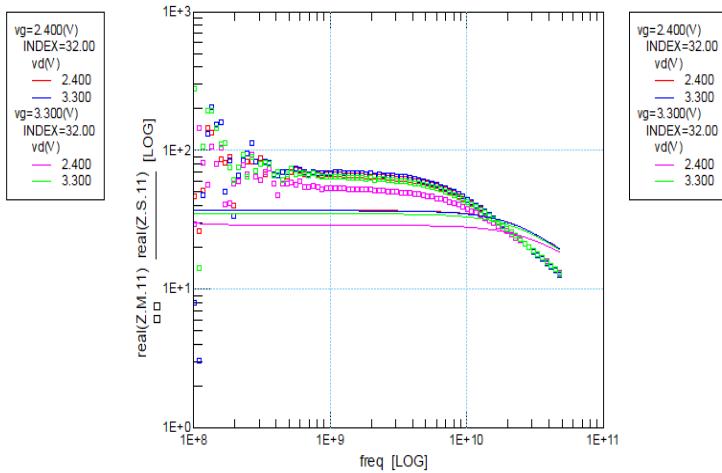
 $\text{re}(Y_{21}) = f(V_g, V_d)$  $\text{im}(Y_{21}) = f(V_g, V_d)$  $\text{re}(Y_{12}) = f(V_g, V_d)$  $\text{im}(Y_{12}) = f(V_g, V_d)$  $\text{re}(Y_{22}) = f(V_g, V_d)$  $\text{im}(Y_{22}) = f(V_g, V_d)$

Verify Plots, $T = 27^\circ\text{C}$ 

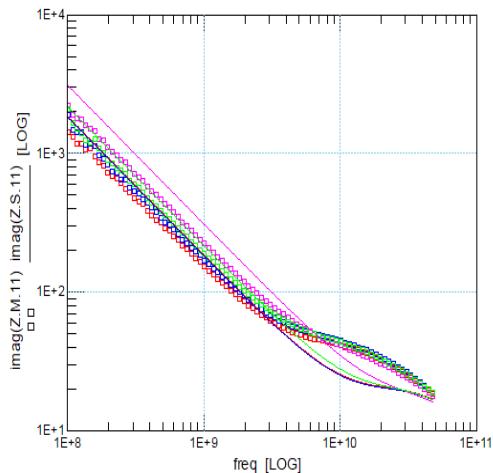
re(S11) = f(Vg, Vd)



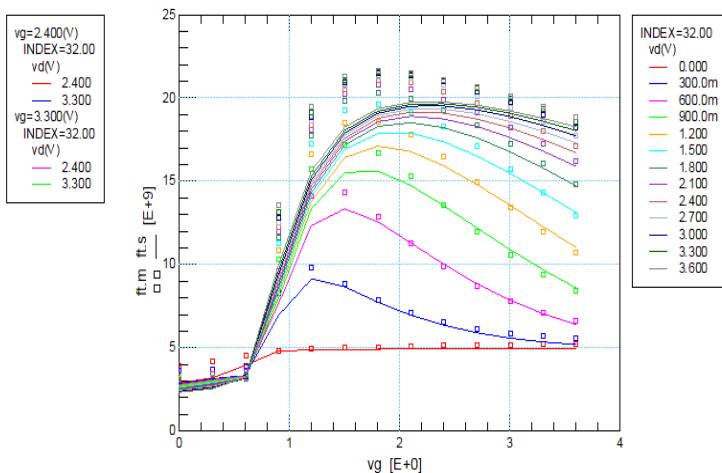
re(S22) = f(Vg, Vd)

im(Y11) divided by ω 

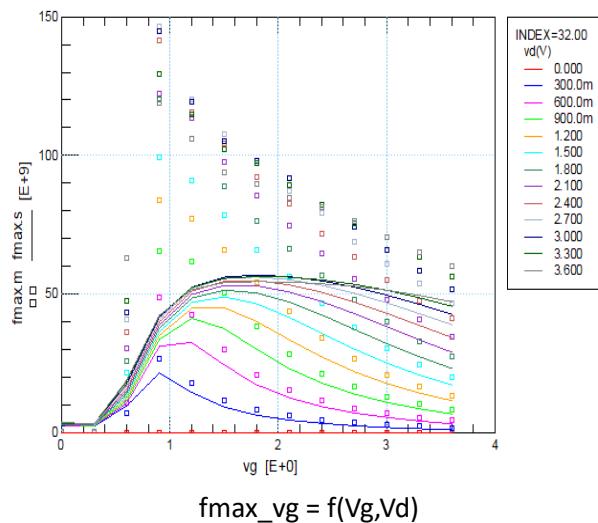
re(Z11) = f(Vg, Vd)



im(Z11) = f(Vg, Vd)

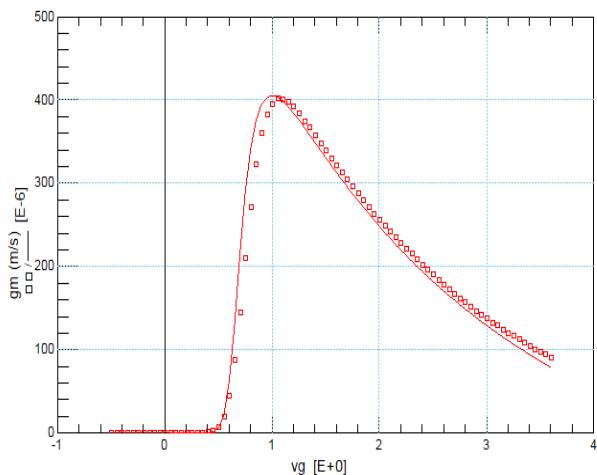
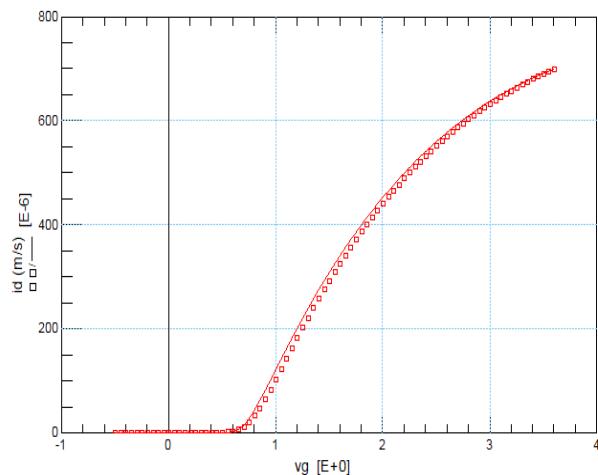


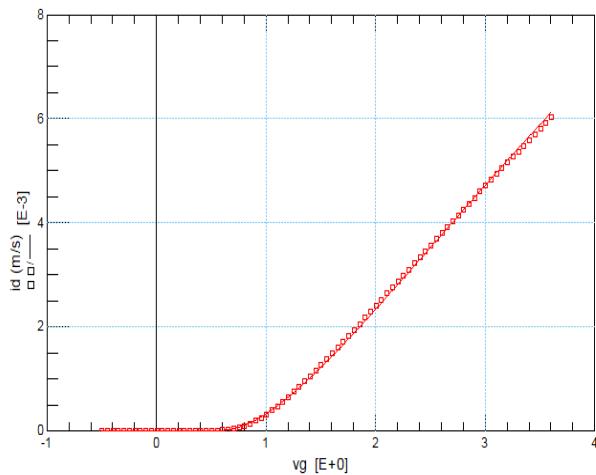
fT_vg = f(Vg, Vd)



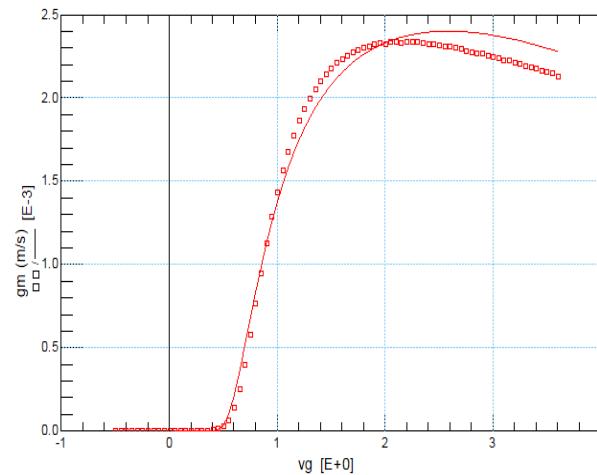
5.8 NF04_WF02u5_L_0u45_S453A_91

I_d vs V_g , $T = 27^\circ C$



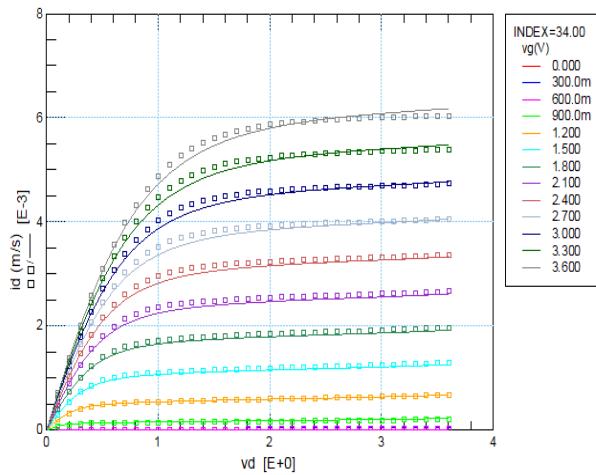


$$Id = f(Vg) @ Vd = 3.3V$$

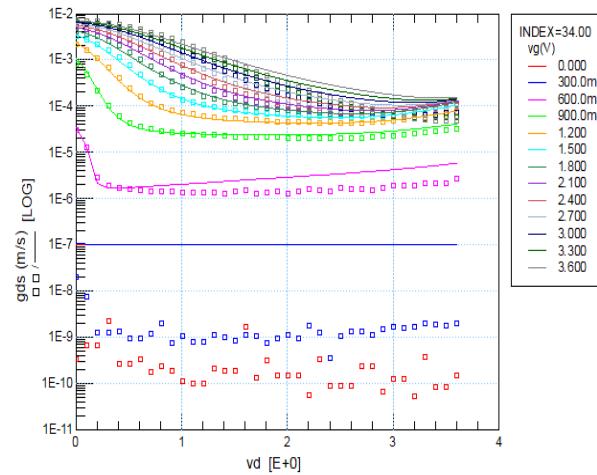


$$gm = f(Vg) @ Vd = 3.3V$$

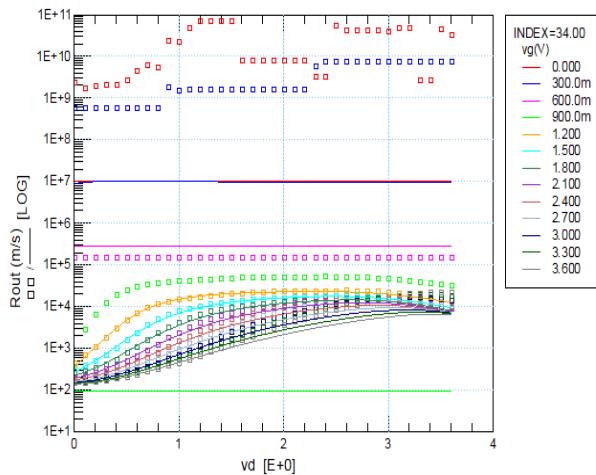
IdVd, T = 27°C



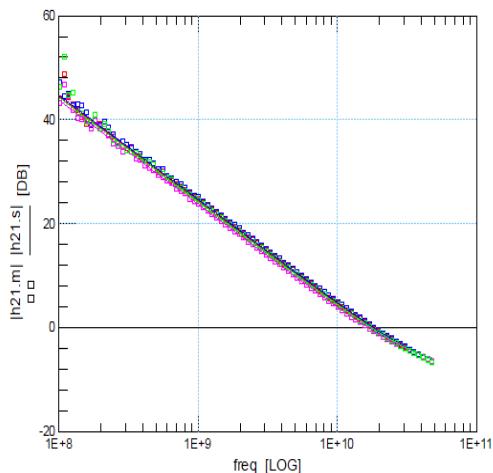
$$Id = f(Vd)$$



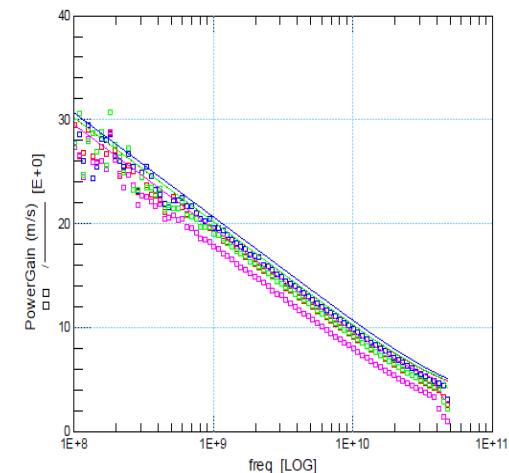
$$gds = f(Vd)$$



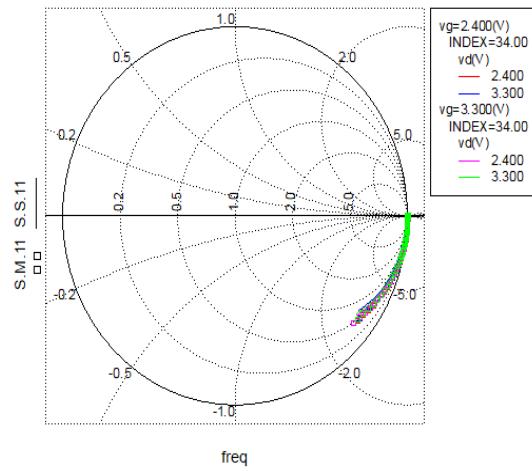
$$Rout = f(Vd)$$

S-Parameter, T = 27°C

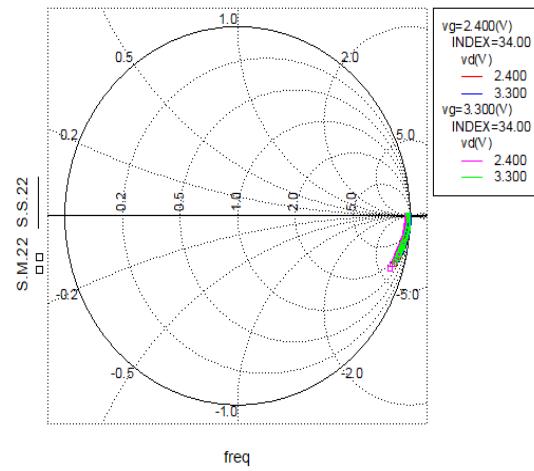
$$|h_{21}| = f(V_g, V_d)$$



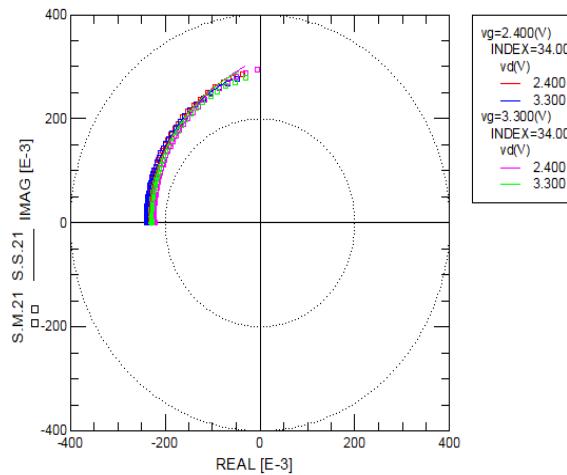
$$MSG/MAG = f(V_g, V_d)$$



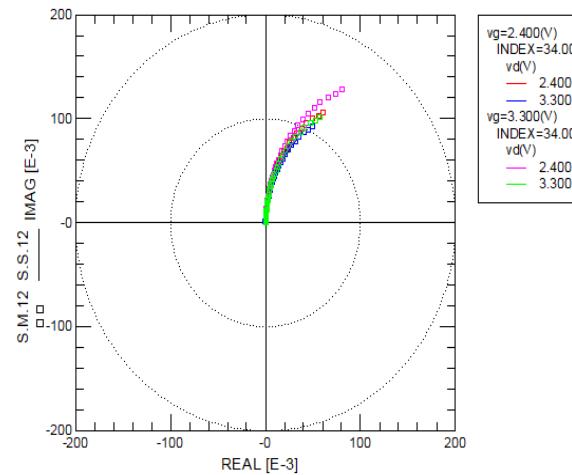
$$S_{11} = f(V_g, V_d)$$



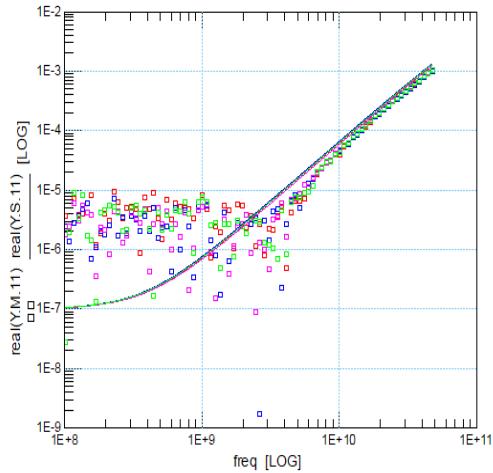
$$S_{22} = f(V_g, V_d)$$



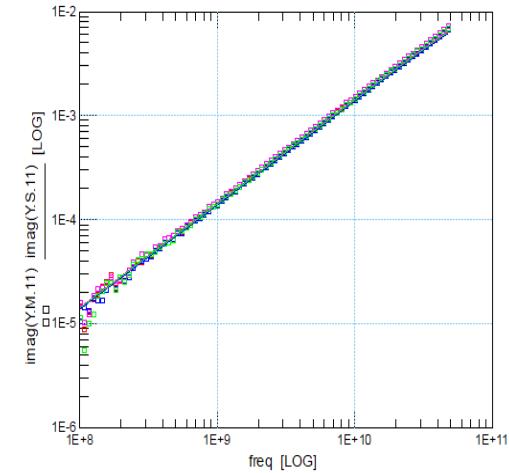
$$S_{21} = f(V_g, V_d)$$



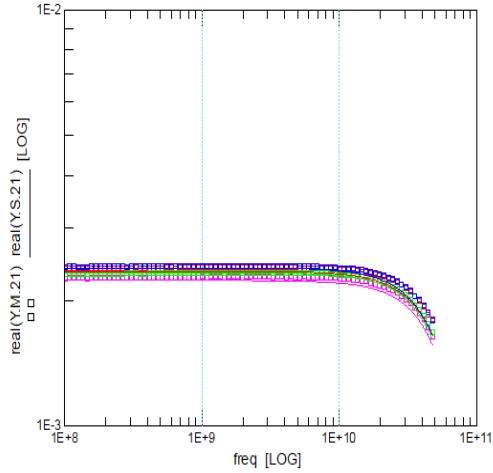
Y-Parameter, T = 27°C



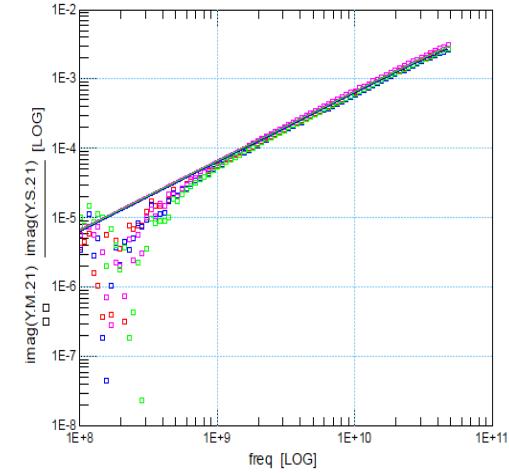
$$\text{re}(Y_{11}) = f(Vg, Vd)$$



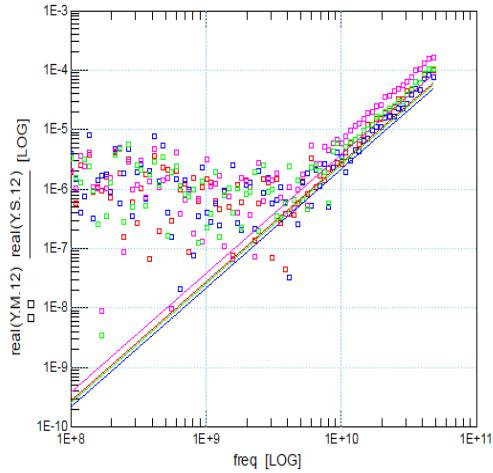
$$\text{im}(Y_{11}) = f(Vg, Vd)$$



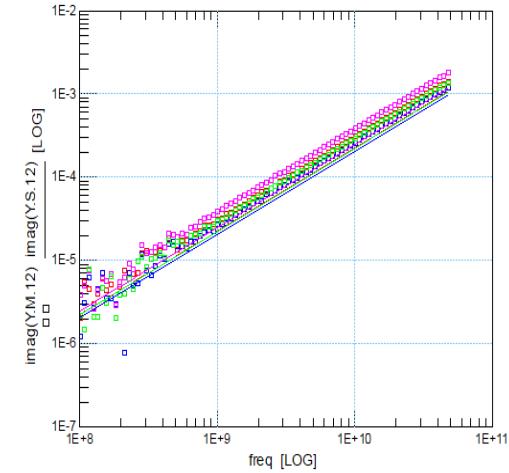
$$\text{re}(Y_{21}) = f(Vg, Vd)$$



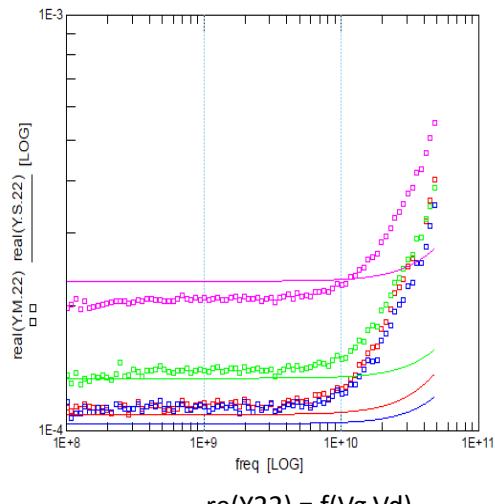
$$\text{im}(Y_{21}) = f(Vg, Vd)$$



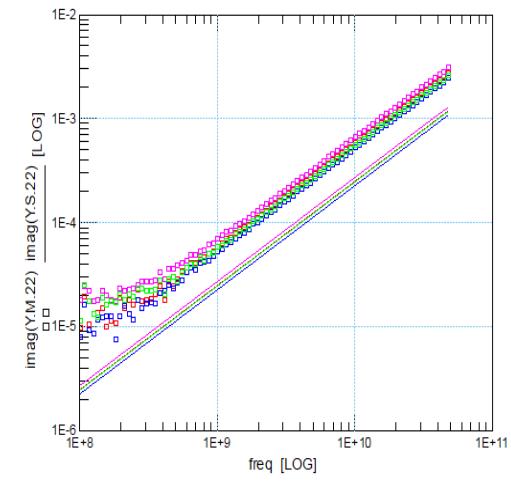
$$\text{re}(Y_{12}) = f(Vg, Vd)$$



$$\text{im}(Y_{12}) = f(Vg, Vd)$$

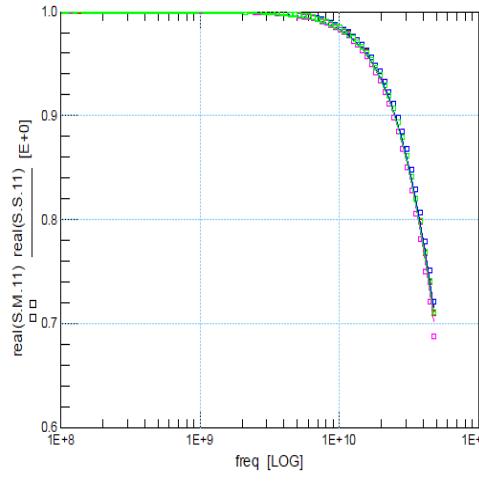


$$\text{re}(Y22) = f(Vg, Vd)$$

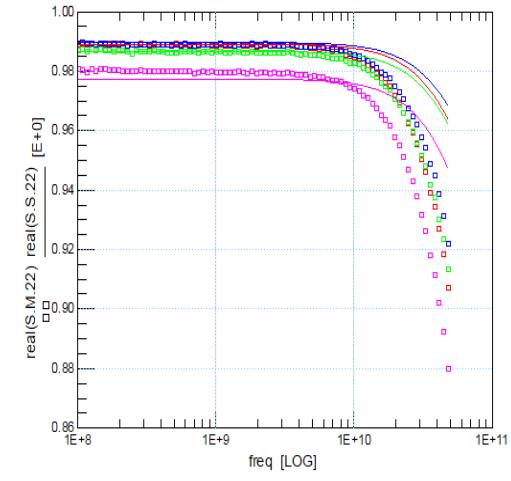


$$\text{im}(Y22) = f(Vg, Vd)$$

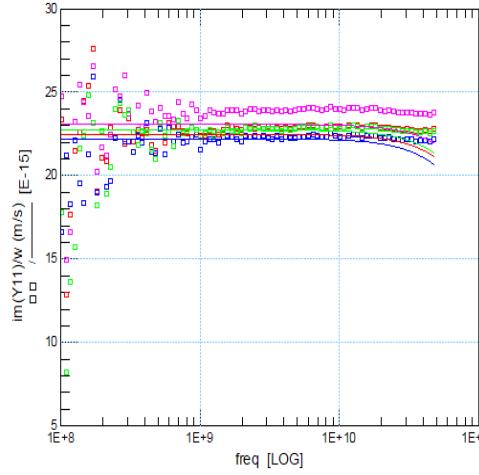
Verify Plots, T = 27°C



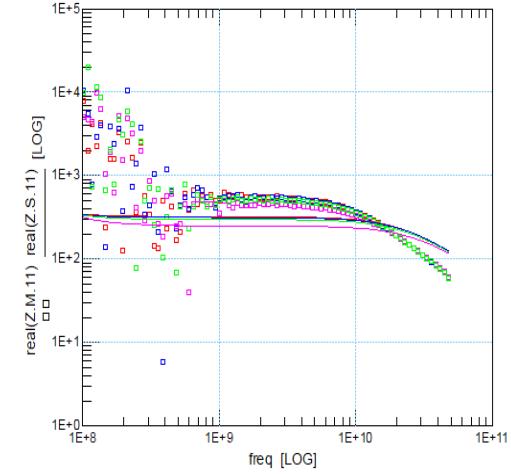
$$\text{re}(S11) = f(Vg, Vd)$$



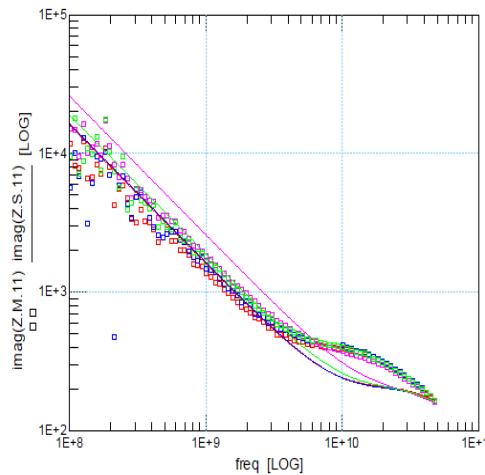
$$\text{re}(S22) = f(Vg, Vd)$$



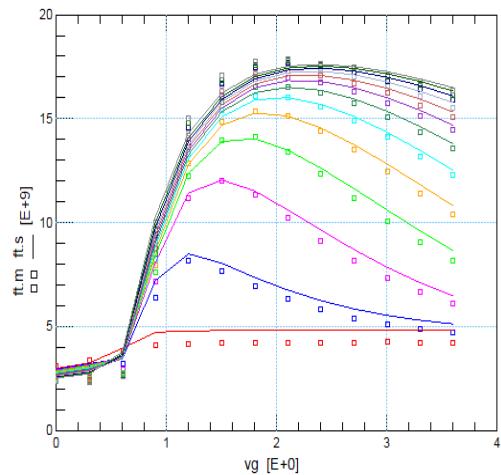
$$\text{im}(Y11) \text{ divided by } \omega$$



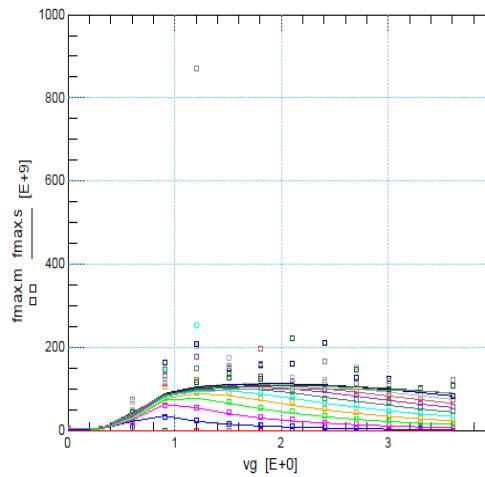
$$\text{re}(Z11) = f(Vg, Vd)$$

 $\text{im}(Z_{11}) = f(V_g, V_d)$

$V_g = 2.400(V)$
 $\text{INDEX} = 34.00$
 $V_d(V)$
— 2.400
— 3.300
 $V_g = 3.300(V)$
 $\text{INDEX} = 34.00$
 $V_d(V)$
— 2.400
— 3.300

 $fT_{vg} = f(V_g, V_d)$

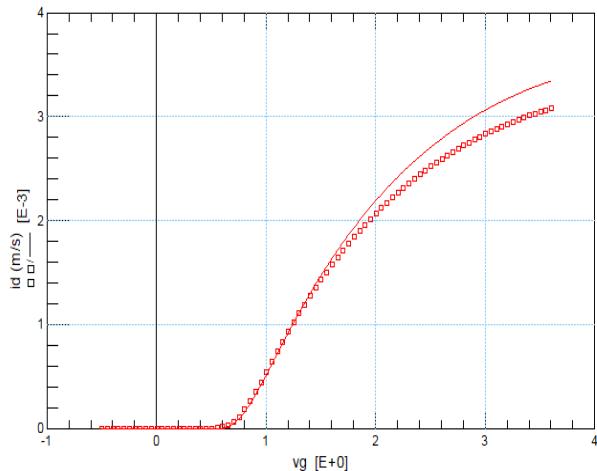
$\text{INDEX} = 34.00$
 $V_d(V)$
— 0.000
— 300.0m
— 600.0m
— 900.0m
— 1.200
— 1.500
— 1.800
— 2.100
— 2.400
— 2.700
— 3.000
— 3.300
— 3.600

 $f_{\text{max}}_{vg} = f(V_g, V_d)$

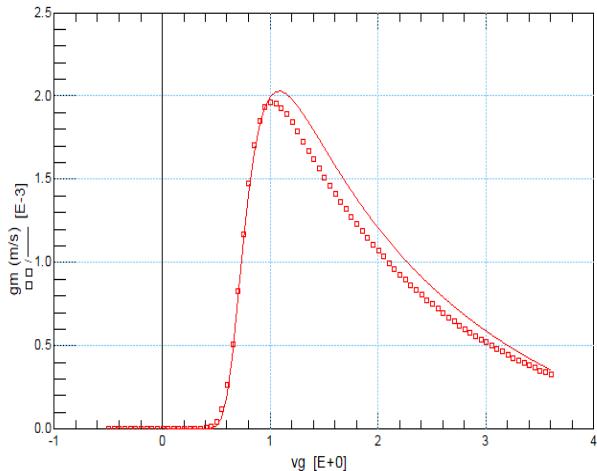
$\text{INDEX} = 34.00$
 $V_d(V)$
— 0.000
— 300.0m
— 600.0m
— 900.0m
— 1.200
— 1.500
— 1.800
— 2.100
— 2.400
— 2.700
— 3.000
— 3.300
— 3.600

5.9 NF05_WF10u0_L_0u45_S453A_A4

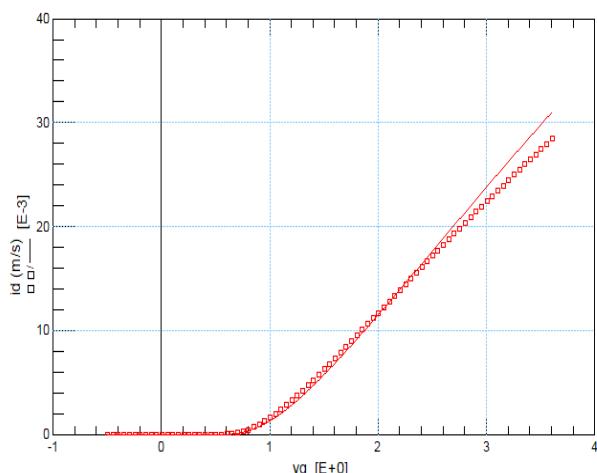
$IdVg$, $T = 27^\circ\text{C}$



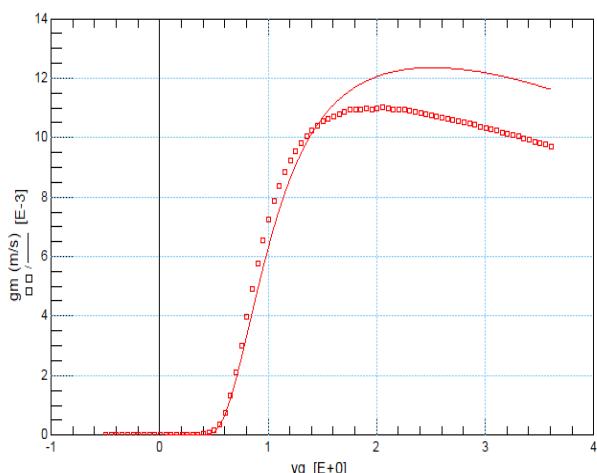
$Id = f(Vg) @ Vd = 0.1\text{V}$



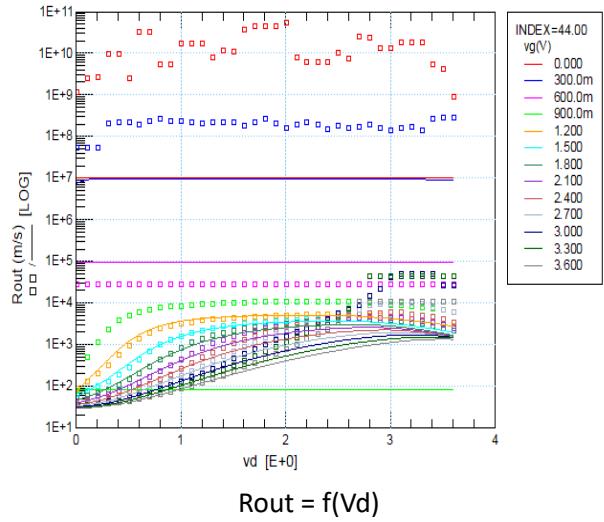
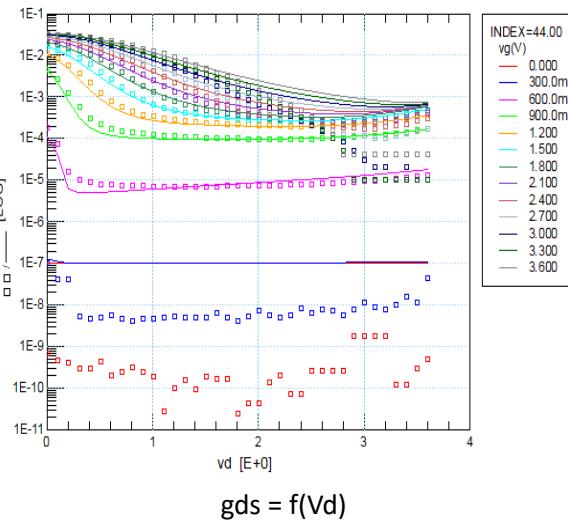
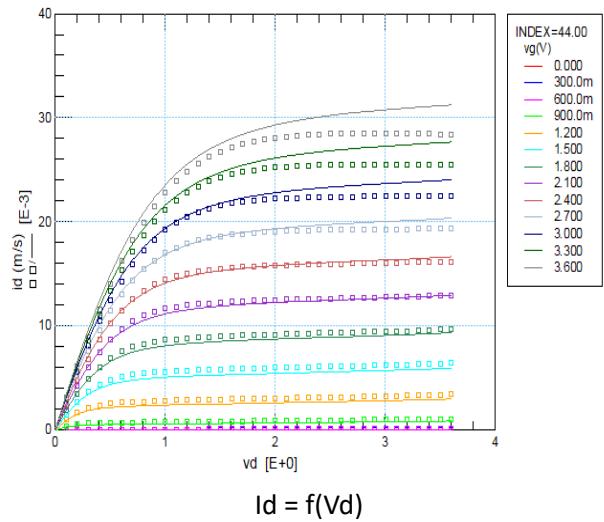
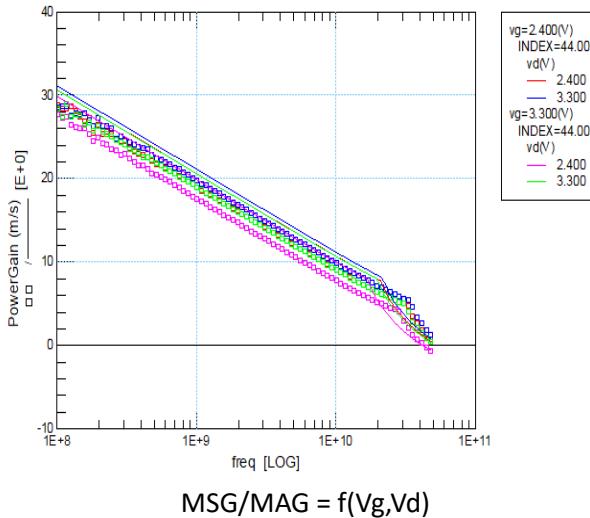
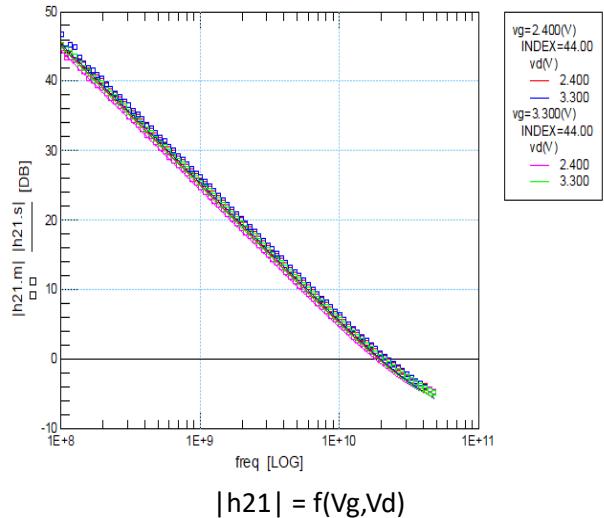
$gm = f(Vg) @ Vd = 0.1\text{V}$

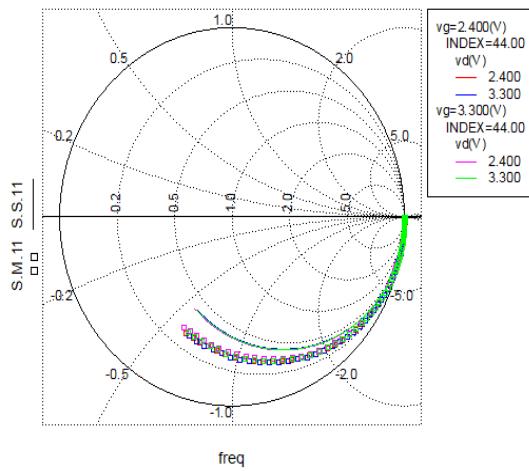
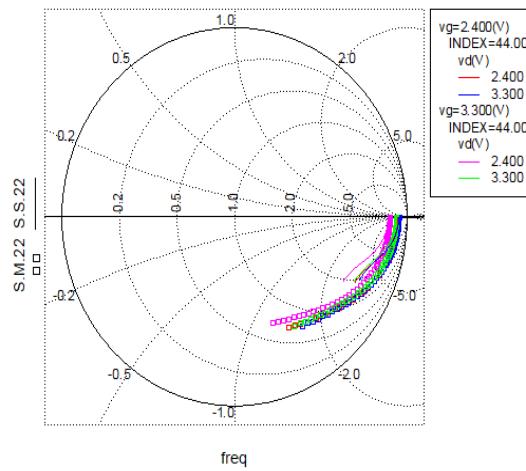
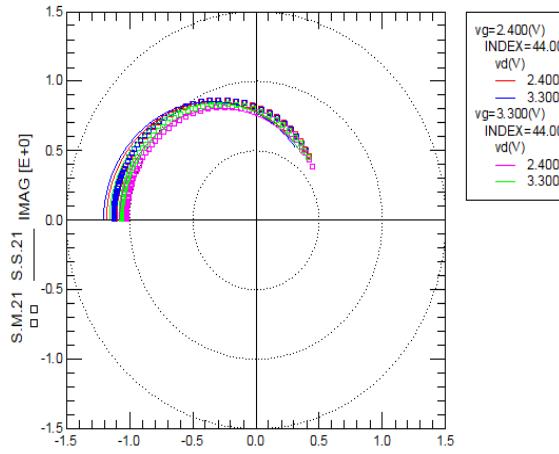
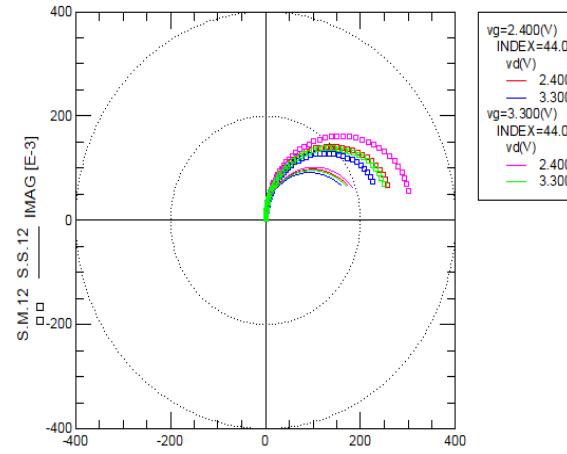


$Id = f(Vg) @ Vd = 3.3\text{V}$

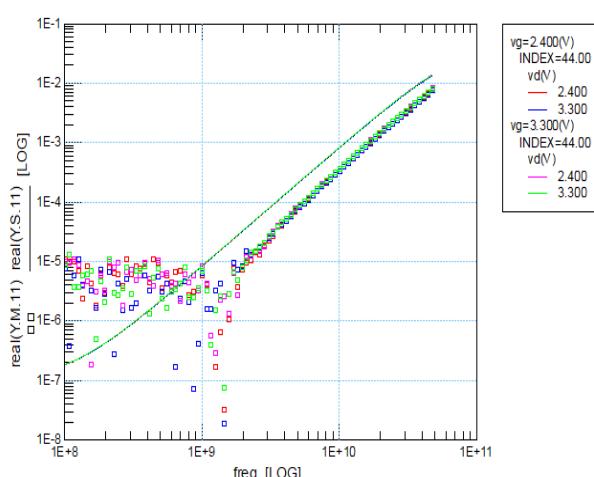
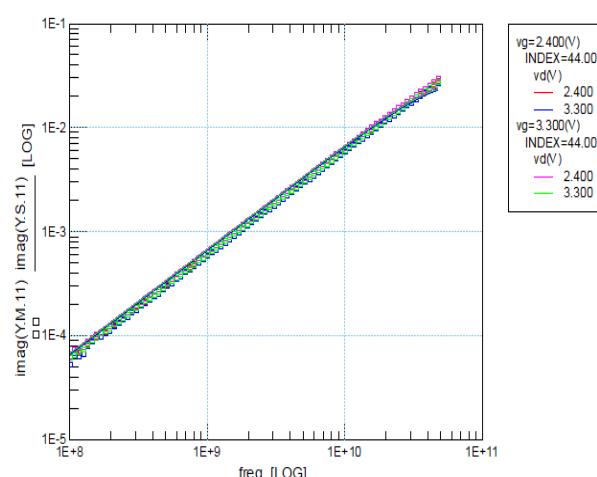


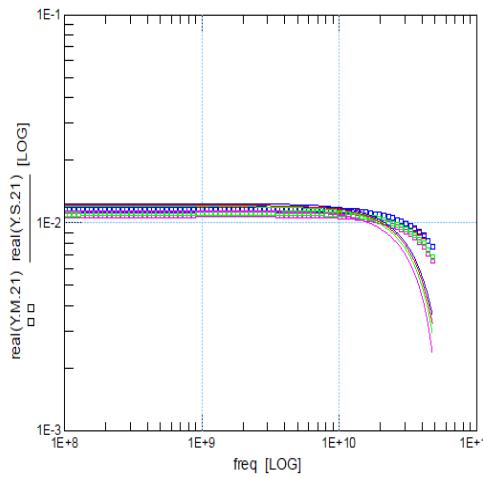
$gm = f(Vg) @ Vd = 3.3\text{V}$

IdVd, T = 27°C**S-Parameter, T = 27°C**

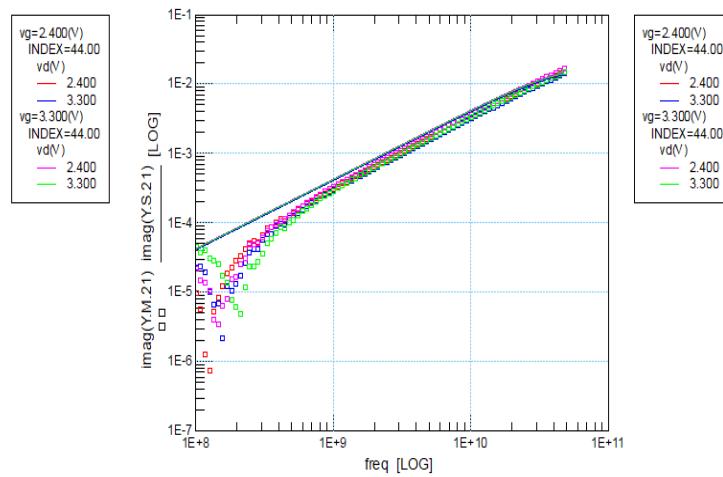
 $S_{11} = f(Vg, Vd)$  $S_{22} = f(Vg, Vd)$  $S_{21} = f(Vg, Vd)$  $S_{12} = f(Vg, Vd)$

Y-Parameter, $T = 27^\circ\text{C}$

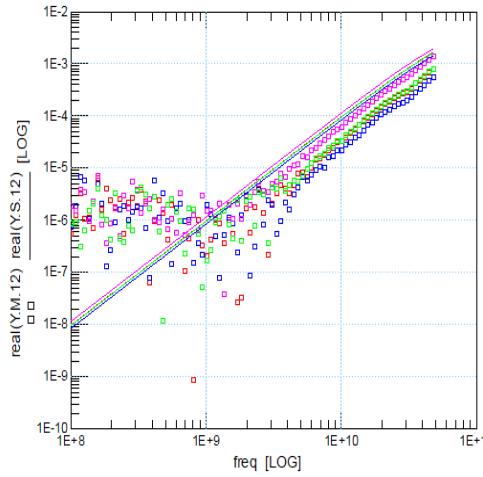
 $\text{re}(Y_{11}) = f(Vg, Vd)$  $\text{im}(Y_{11}) = f(Vg, Vd)$



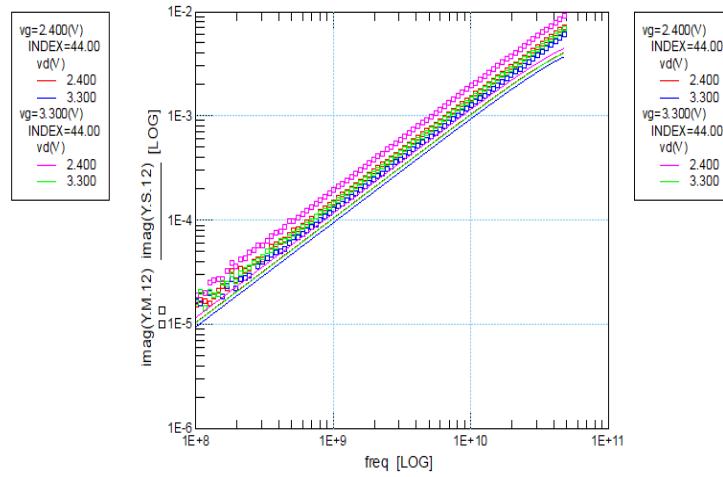
re(Y21) = f(Vg,Vd)



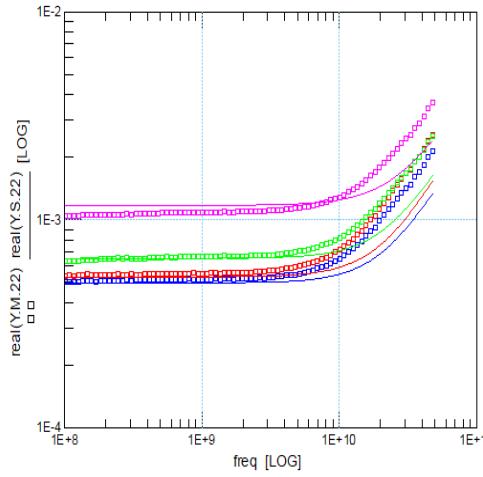
im(Y21) = f(Vg,Vd)



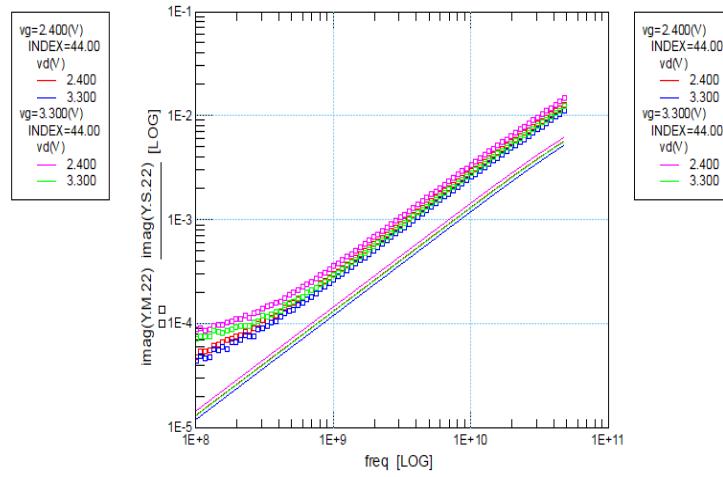
re(Y12) = f(Vg,Vd)



im(Y12) = f(Vg,Vd)

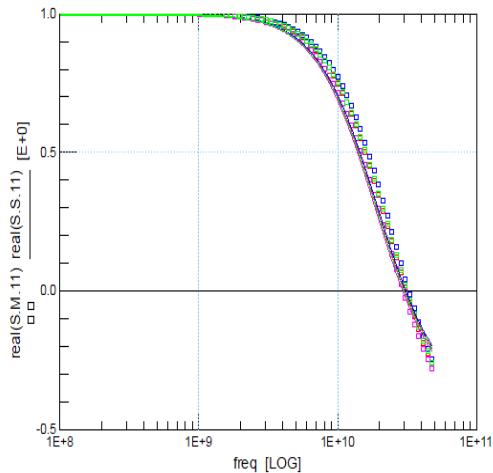


re(Y22) = f(Vg,Vd)

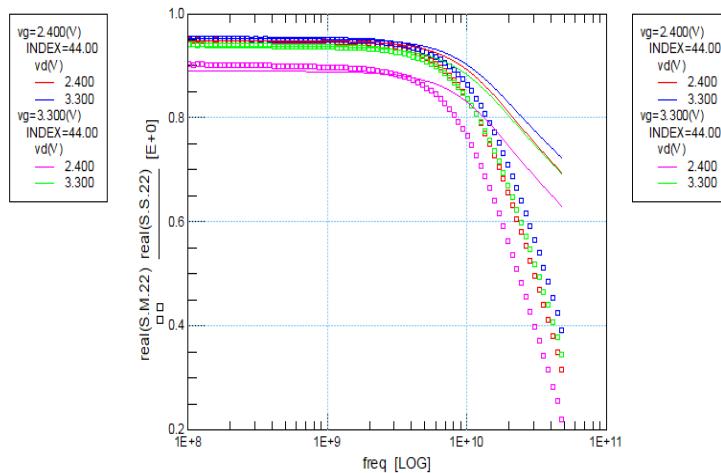


im(Y22) = f(Vg,Vd)

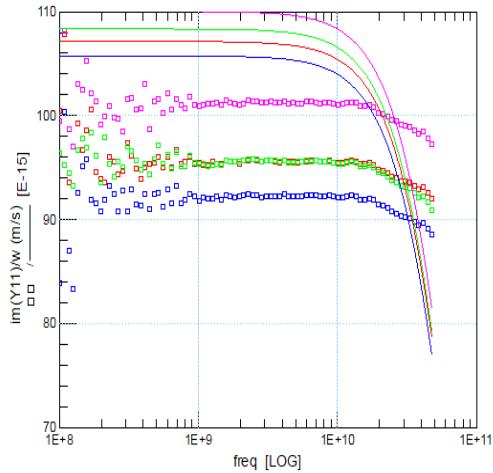
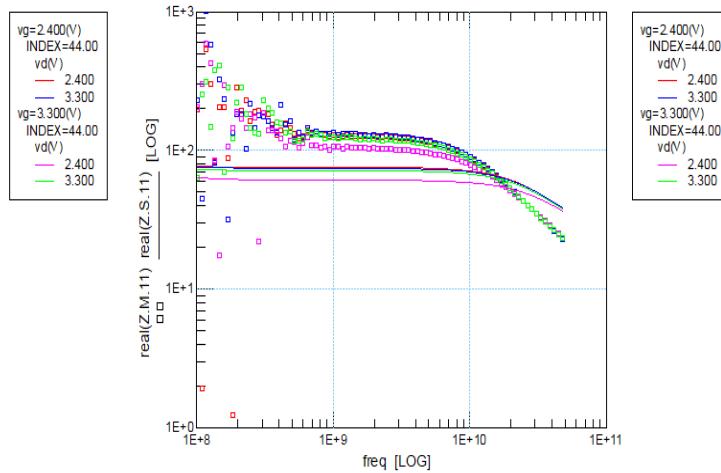
Verify Plots, T = 27°C



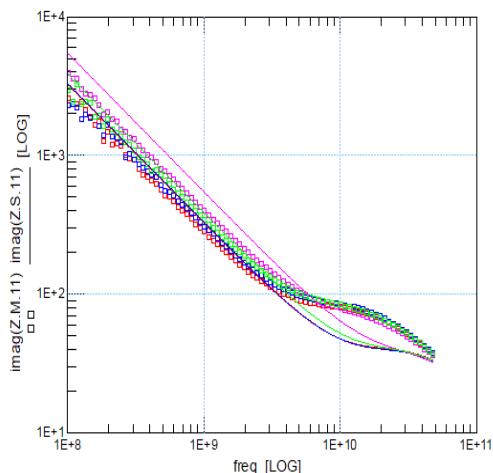
re(S11) = f(Vg, Vd)



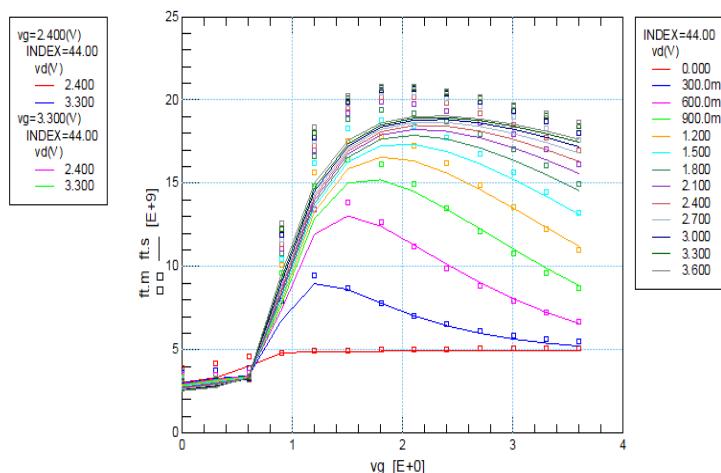
re(S22) = f(Vg, Vd)

im(Y11) divided by ω 

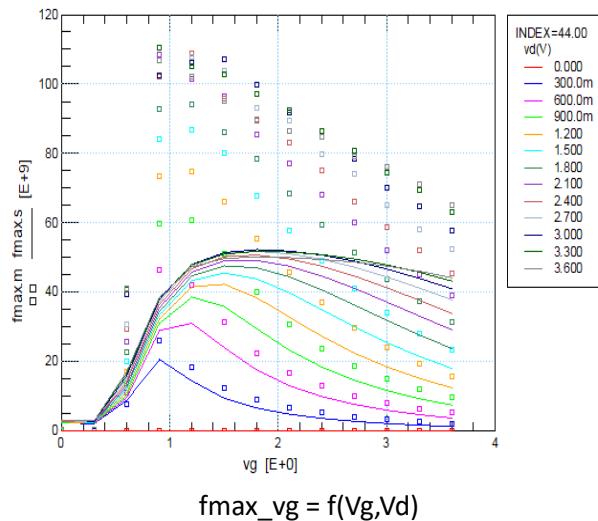
re(Z11) = f(Vg, Vd)



im(Z11) = f(Vg, Vd)

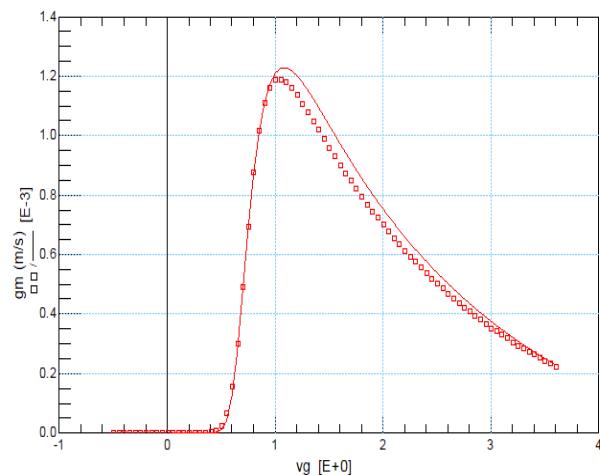
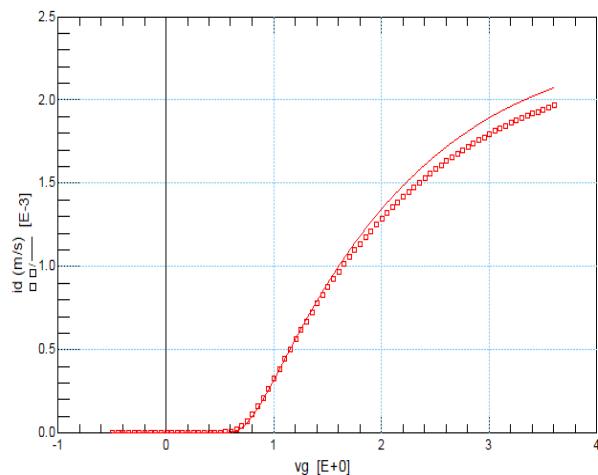


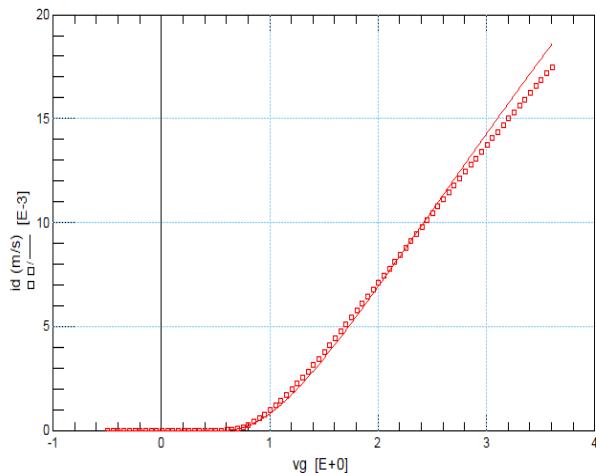
fT_vg = f(Vg, Vd)



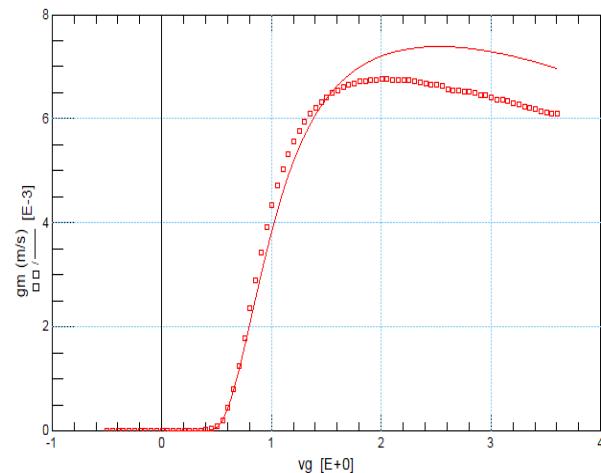
5.10NF04_WF07u5_L_0u45_S453A_94

I_d vs V_g , $T = 27^\circ\text{C}$



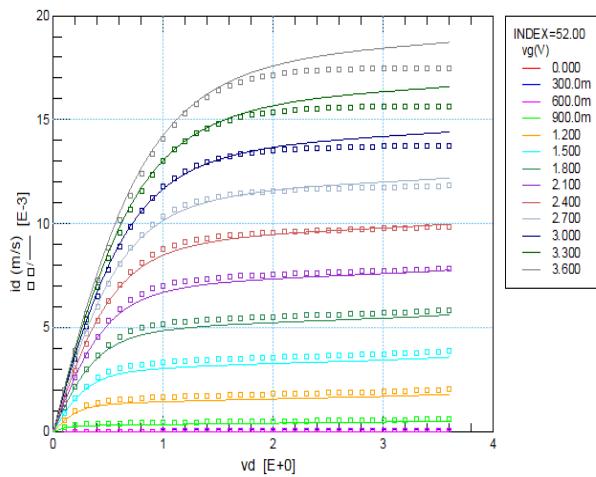


$$Id = f(Vg) @ Vd = 3.3V$$

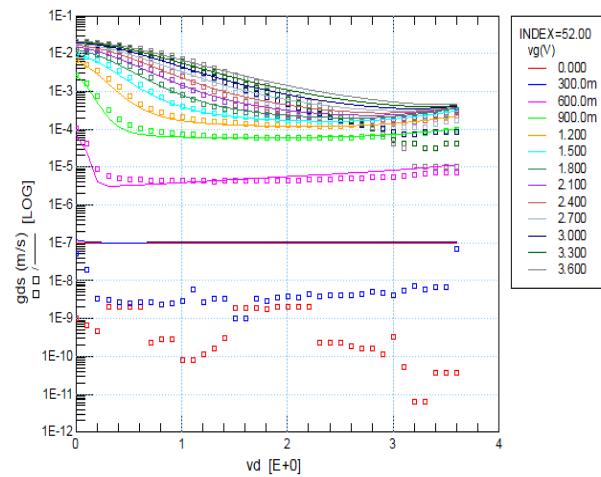


$$gm = f(Vg) @ Vd = 3.3V$$

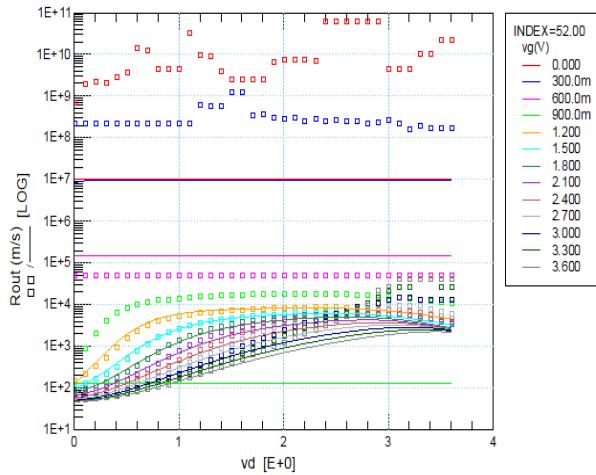
IdVd, T = 27°C



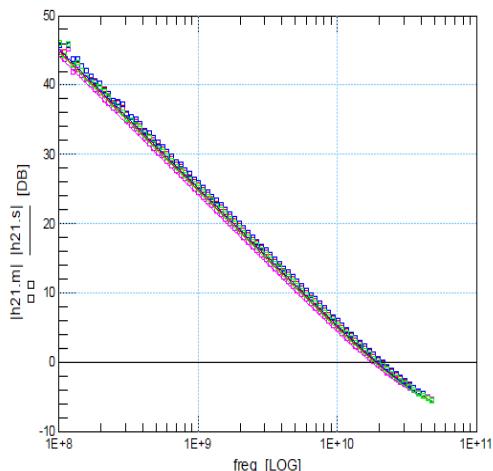
$$Id = f(Vd)$$



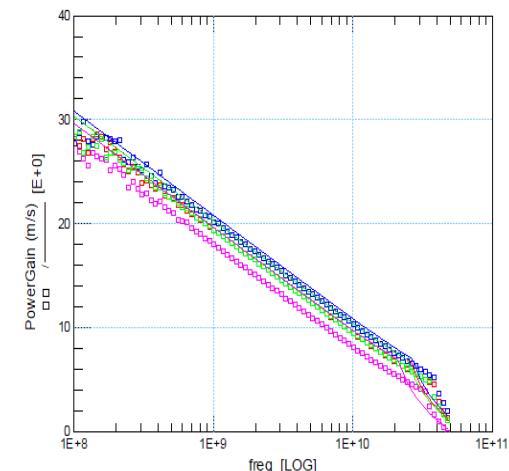
$$gds = f(Vd)$$



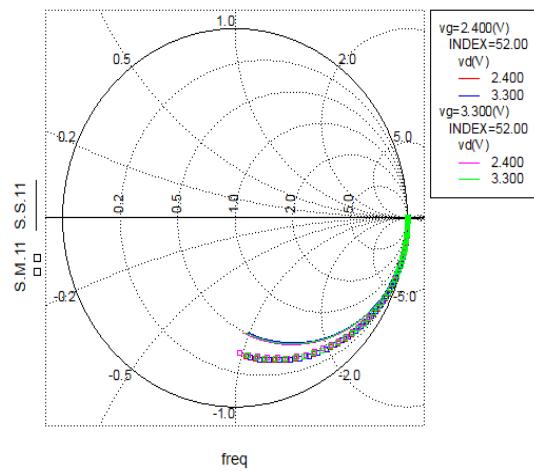
$$Rout = f(Vd)$$

S-Parameter, T = 27°C

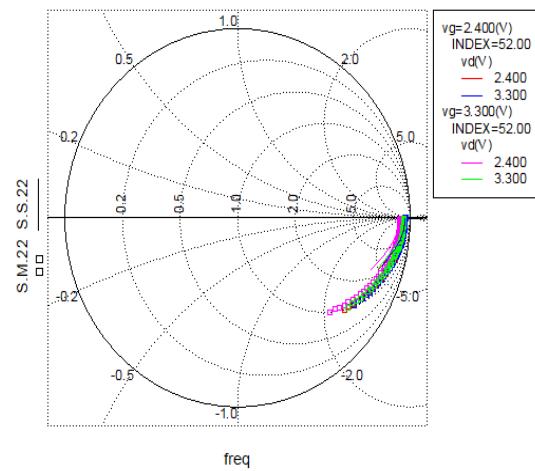
$$|h_{21}| = f(Vg, Vd)$$



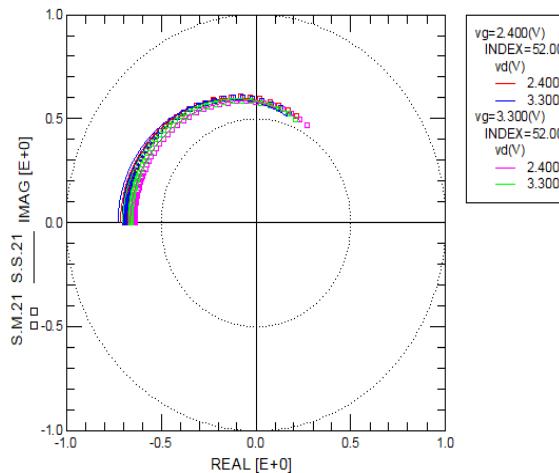
$$MSG/MAG = f(Vg, Vd)$$



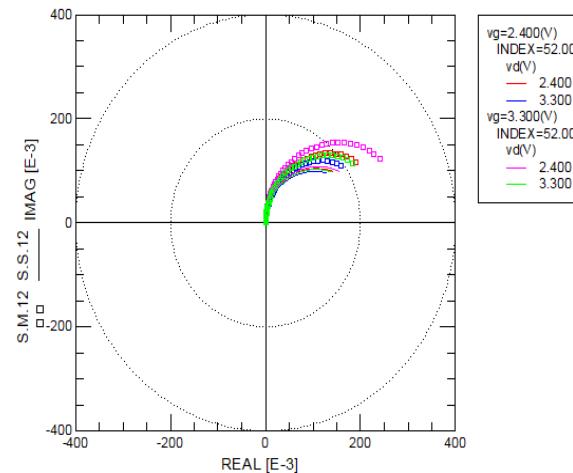
$$S_{11} = f(Vg, Vd)$$



$$S_{22} = f(Vg, Vd)$$

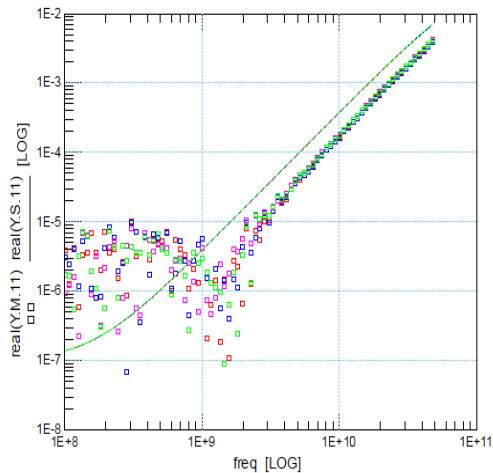


$$S_{21} = f(Vg, Vd)$$

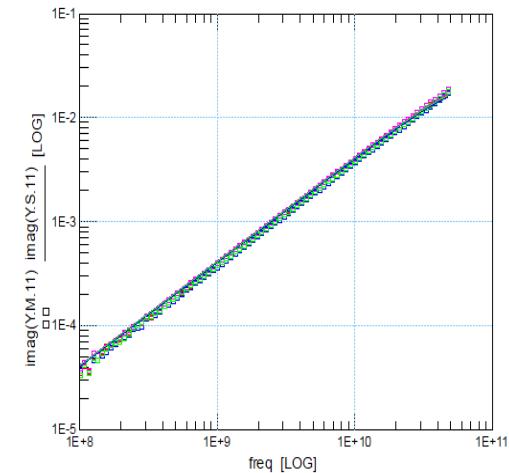


$$S_{12} = f(Vg, Vd)$$

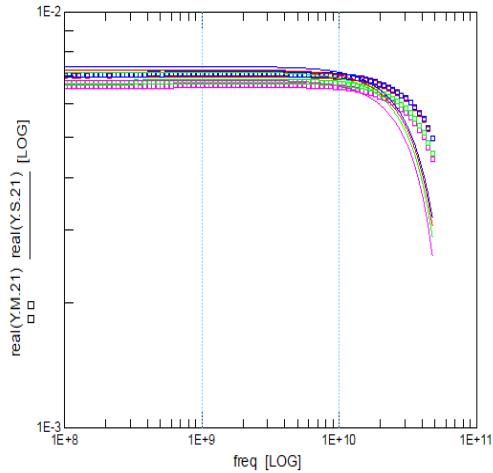
Y-Parameter, T = 27°C



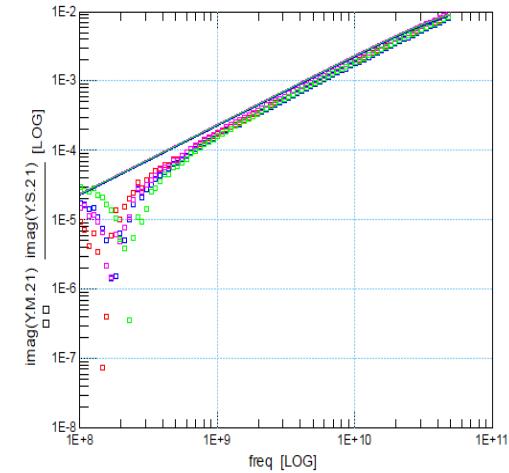
$$\text{re}(Y_{11}) = f(V_g, V_d)$$



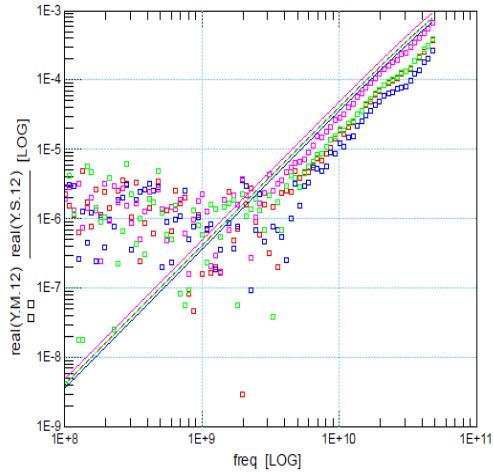
$$\text{im}(Y_{11}) = f(V_g, V_d)$$



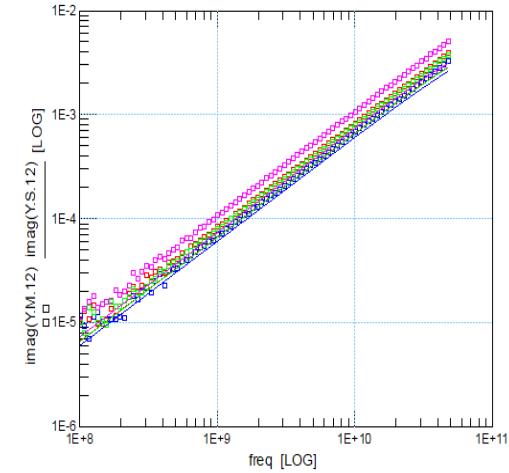
$$\text{re}(Y_{21}) = f(V_g, V_d)$$



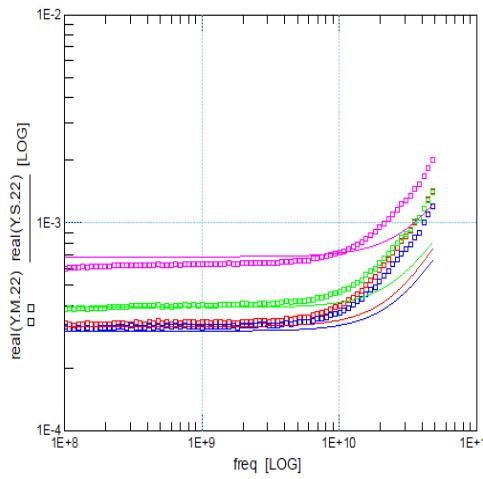
$$\text{im}(Y_{21}) = f(V_g, V_d)$$



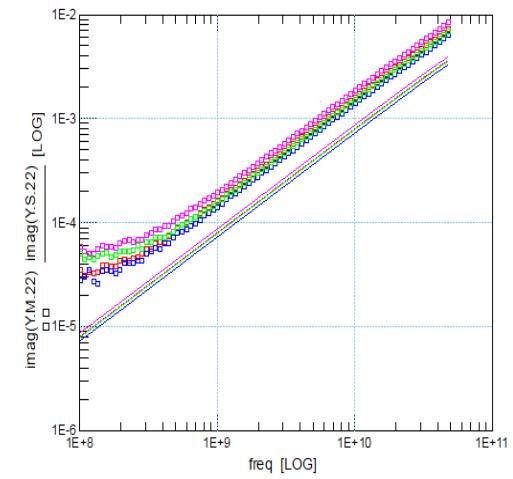
$$\text{re}(Y_{12}) = f(V_g, V_d)$$



$$\text{im}(Y_{12}) = f(V_g, V_d)$$

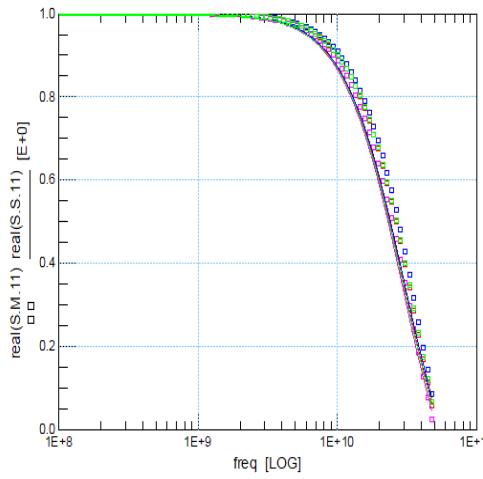


re(Y22) = f(Vg, Vd)

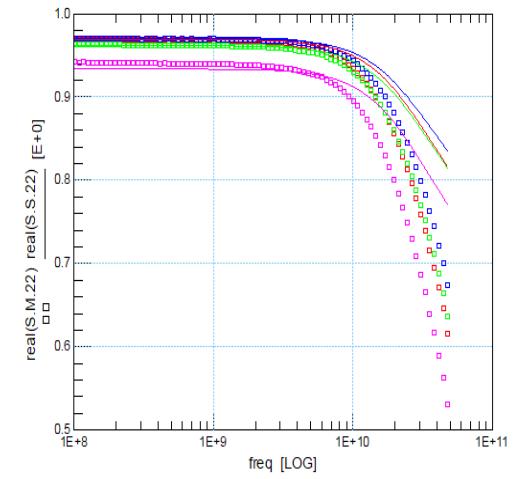


im(Y22) = f(Vg, Vd)

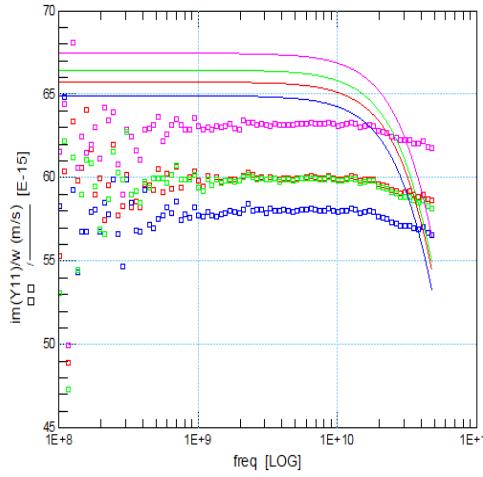
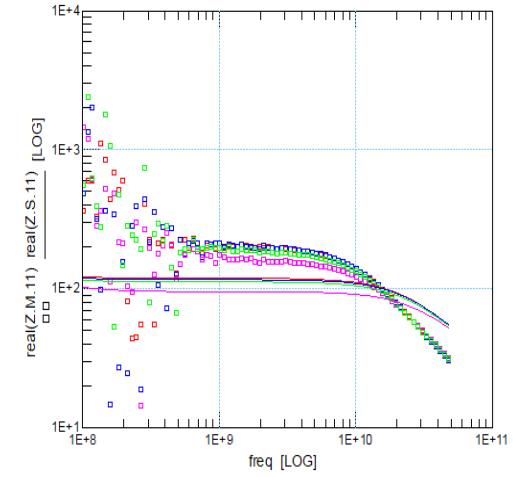
Verify Plots, T = 27°C



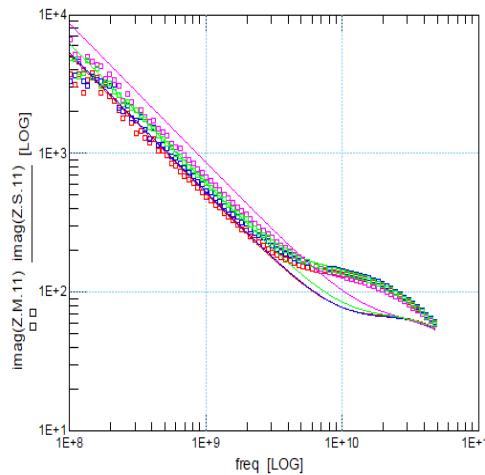
re(S11) = f(Vg, Vd)



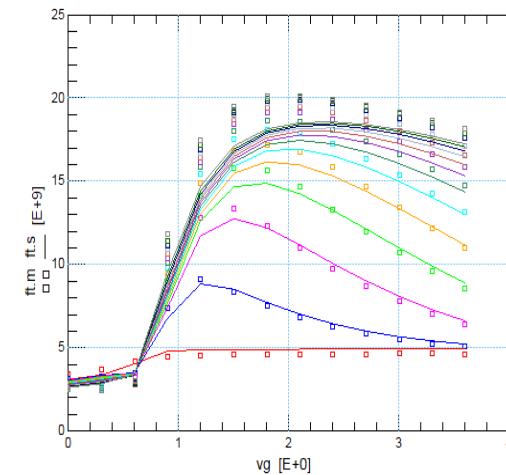
re(S22) = f(Vg, Vd)

im(Y11) divided by ω 

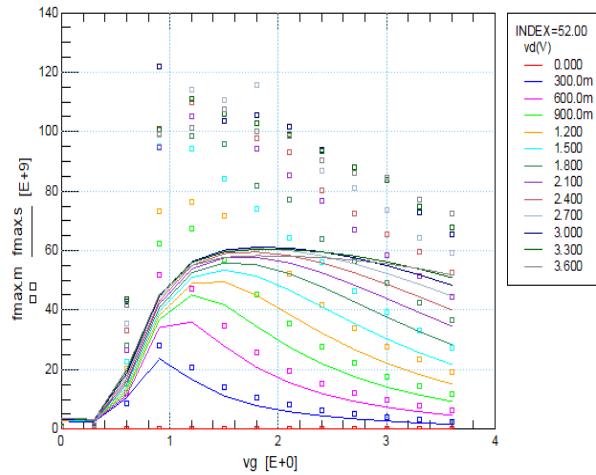
re(Z11) = f(Vg, Vd)



$$\text{im}(Z_{11}) = f(V_g, V_d)$$



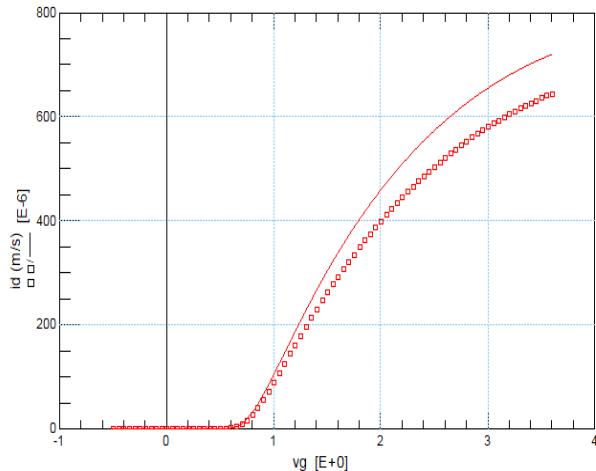
$$fT_{vg} = f(V_g, V_d)$$



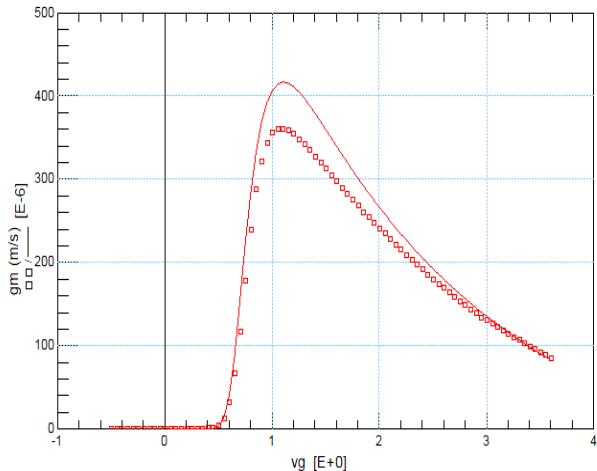
$$f_{\max,vg} = f(V_g, V_d)$$

5.11 NF01_WF10u0_L_0u45_S453A_B1

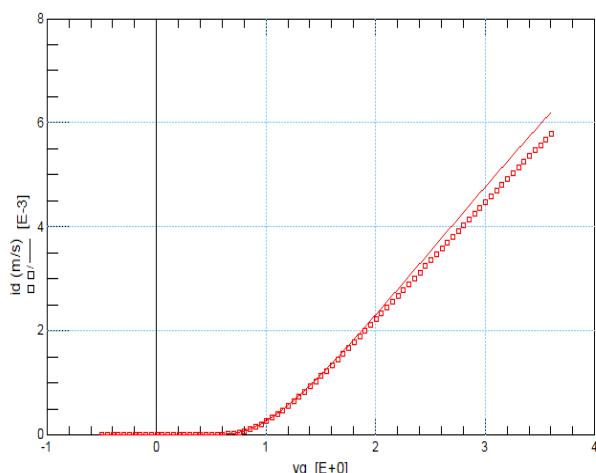
$IdVg$, $T = 27^\circ\text{C}$



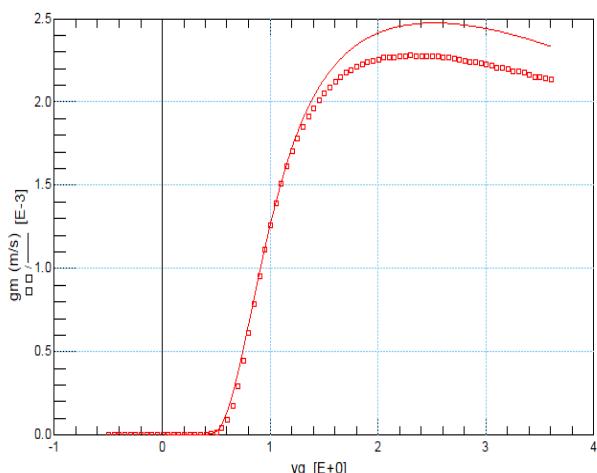
$Id = f(Vg) @ Vd = 0.1\text{V}$



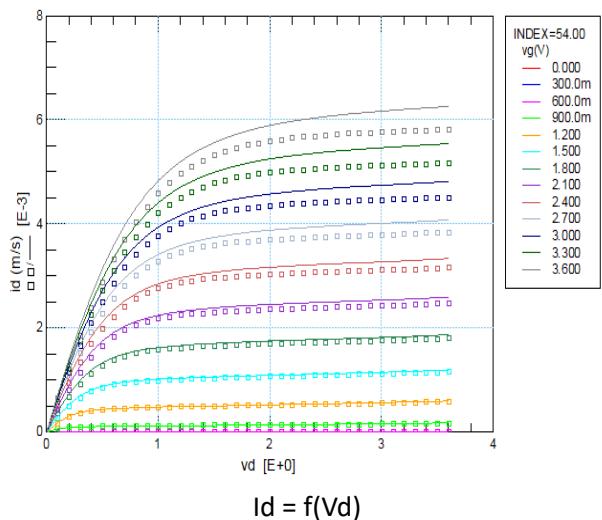
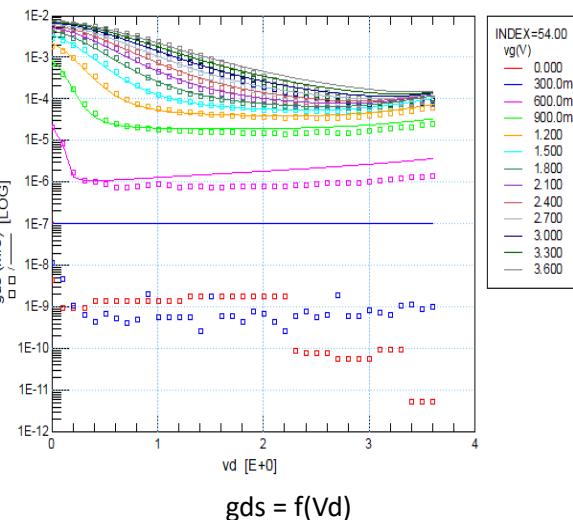
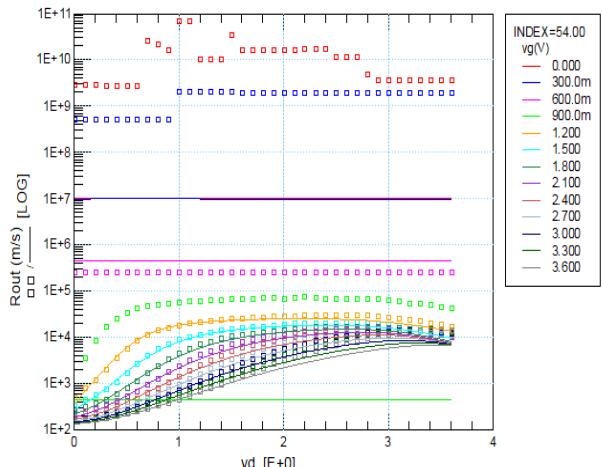
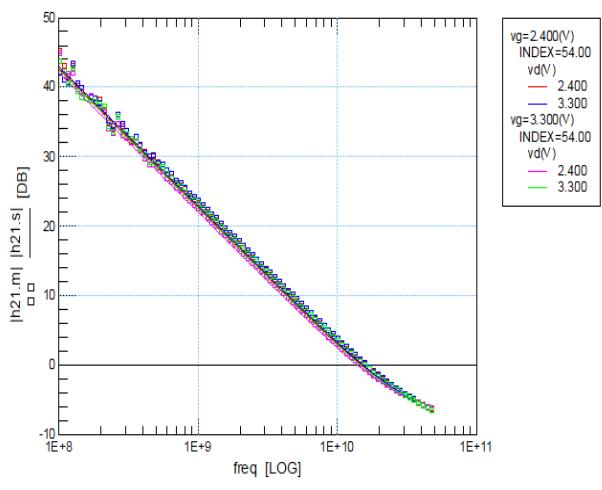
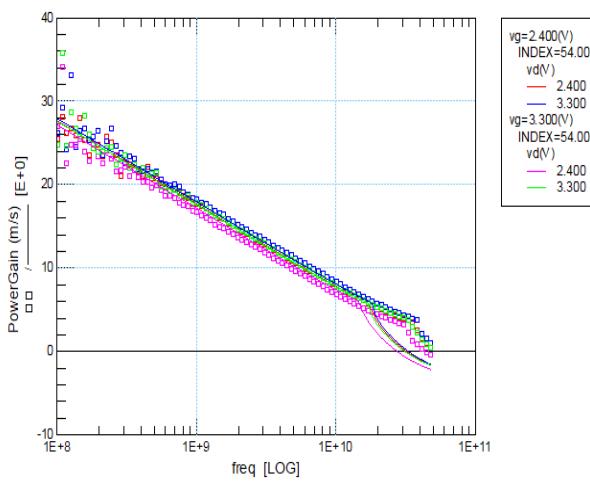
$gm = f(Vg) @ Vd = 0.1\text{V}$

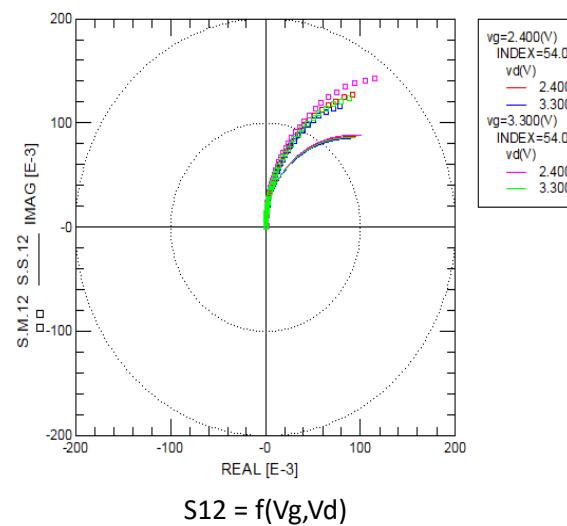
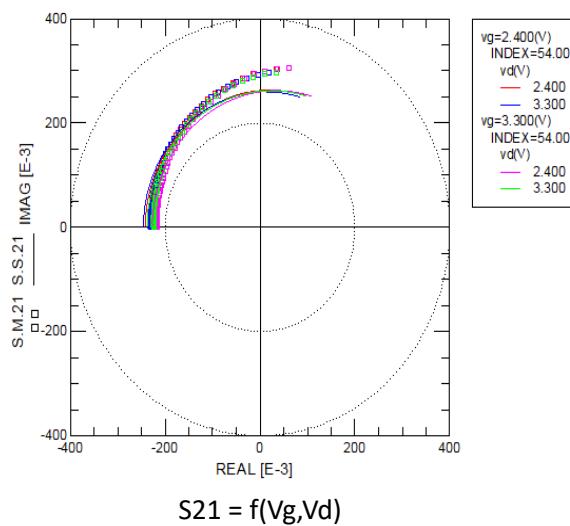
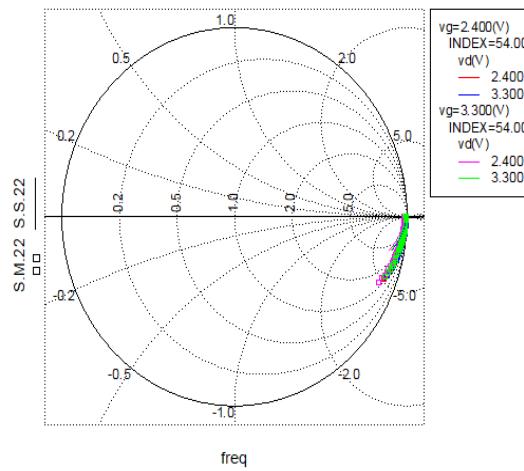
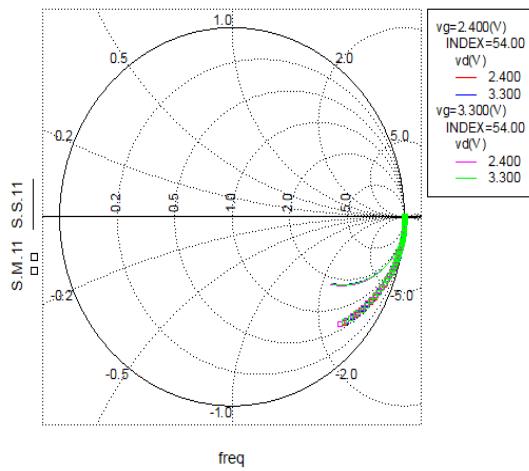


$Id = f(Vg) @ Vd = 3.3\text{V}$

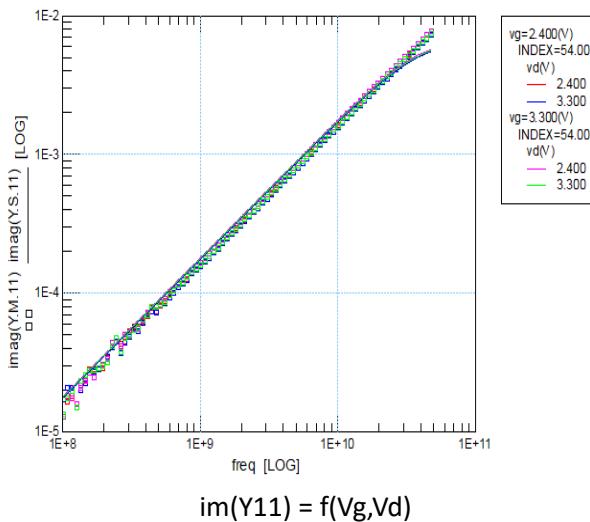
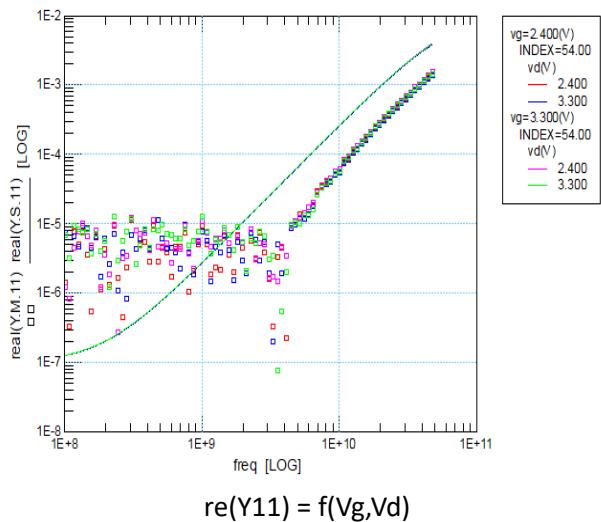


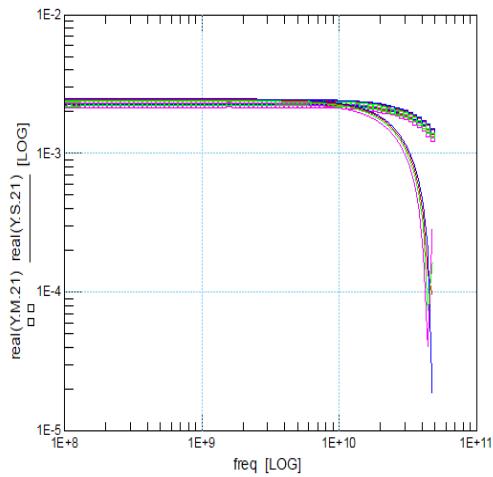
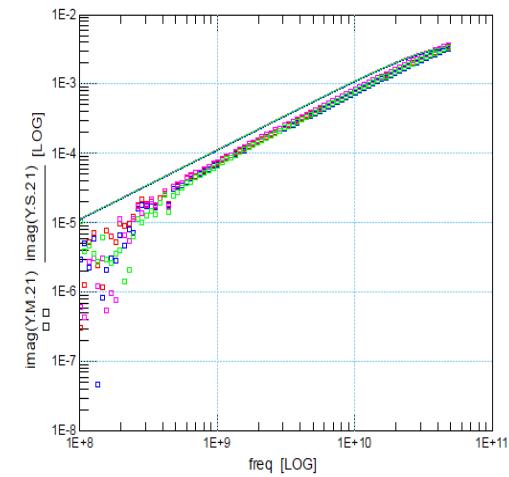
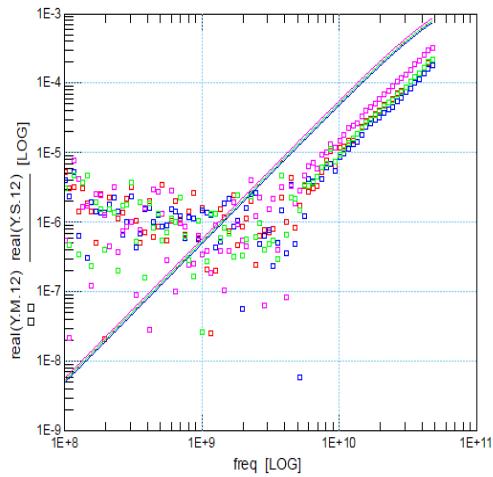
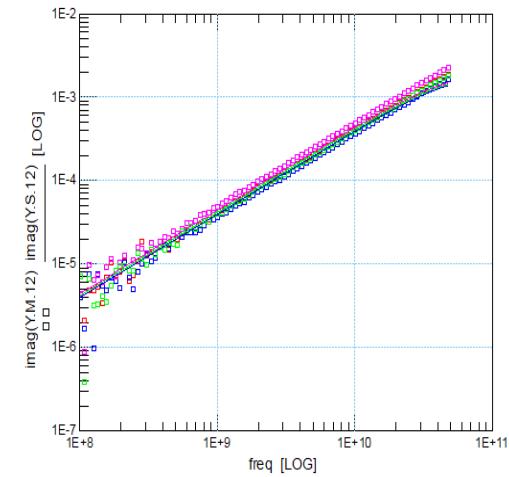
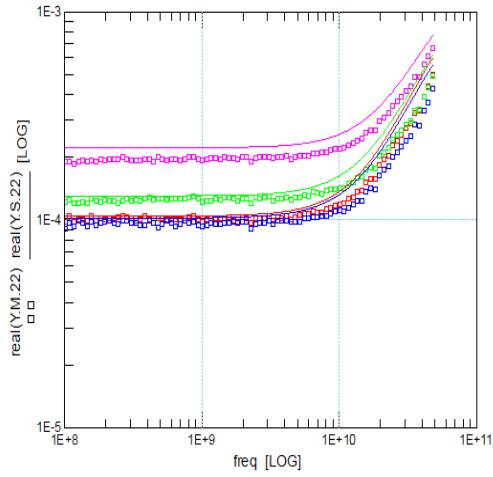
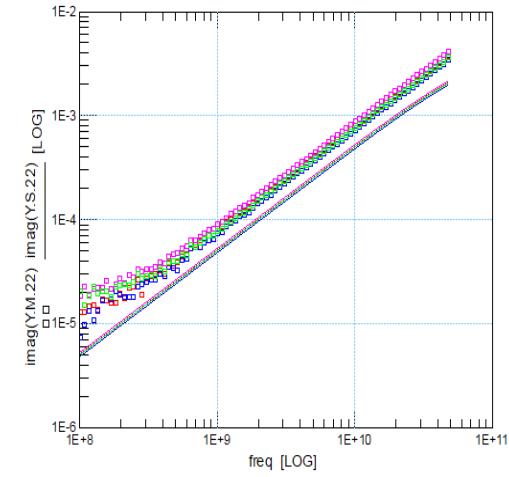
$gm = f(Vg) @ Vd = 3.3\text{V}$

IdVd, T = 27°C
 $Id = f(Vd)$  $gds = f(Vd)$  $Rout = f(Vd)$
S-Parameter, T = 27°C
 $|h21| = f(Vg, Vd)$  $MSG/MAG = f(Vg, Vd)$

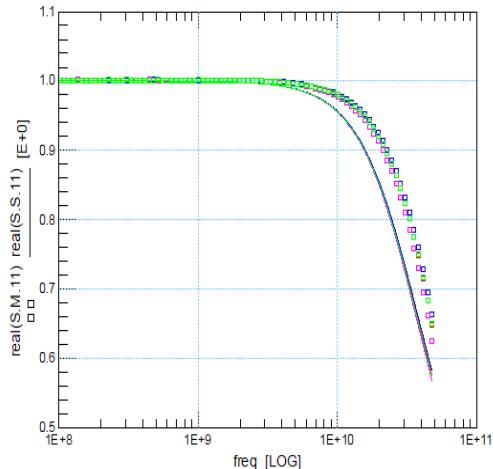


Y-Parameter, T = 27°C

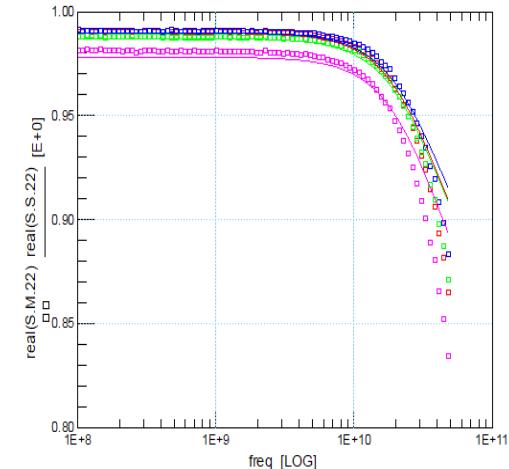


re(Y₂₁) = f(V_g,V_d)im(Y₂₁) = f(V_g,V_d)re(Y₁₂) = f(V_g,V_d)im(Y₁₂) = f(V_g,V_d)re(Y₂₂) = f(V_g,V_d)im(Y₂₂) = f(V_g,V_d)

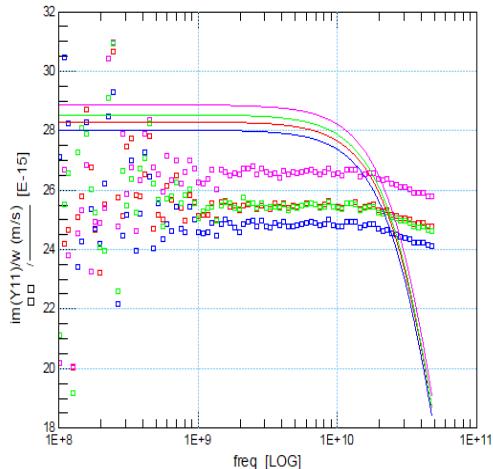
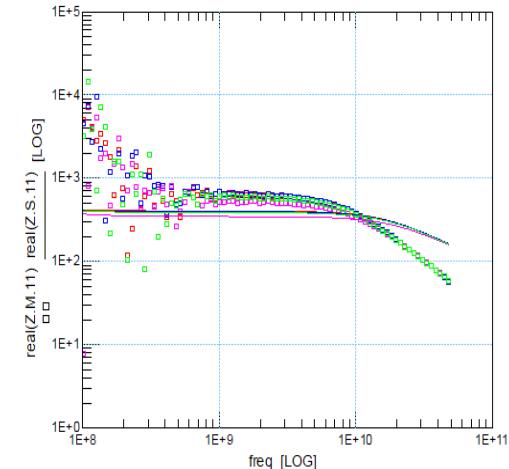
Verify Plots, T = 27°C



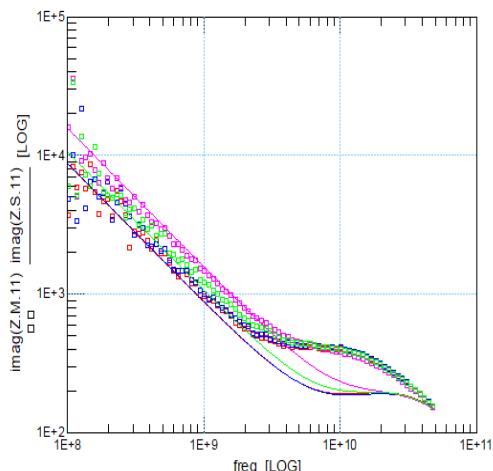
real(S11) = f(Vg,Vd)



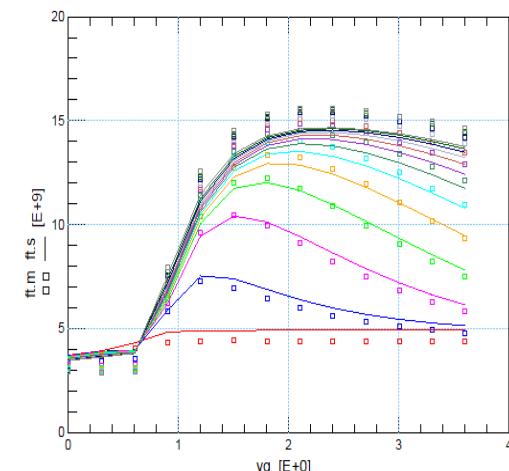
real(S22) = f(Vg,Vd)

im(Y11) divided by ω 

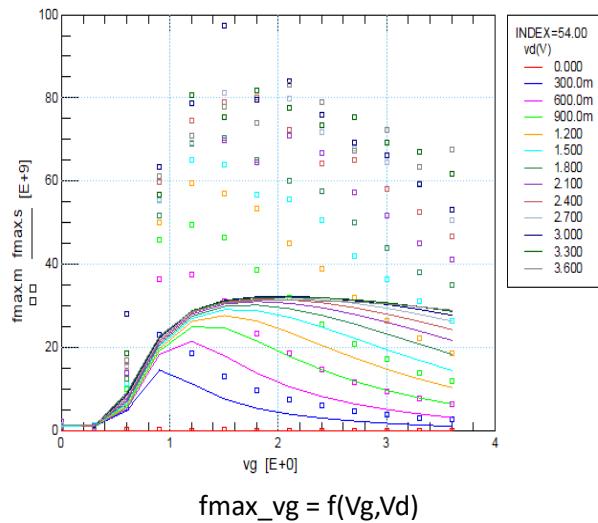
real(Z11) = f(Vg,Vd)



im(Z11) = f(Vg,Vd)

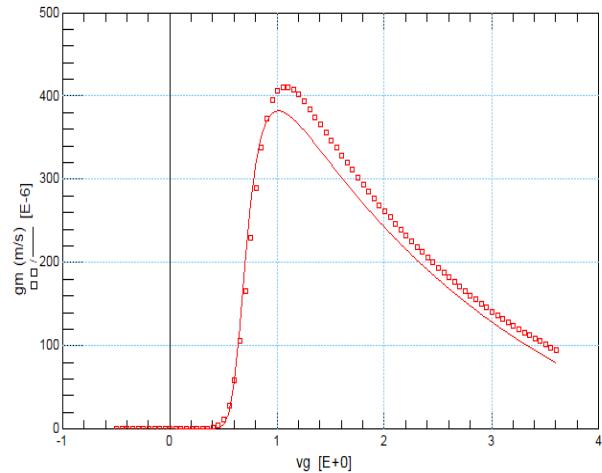
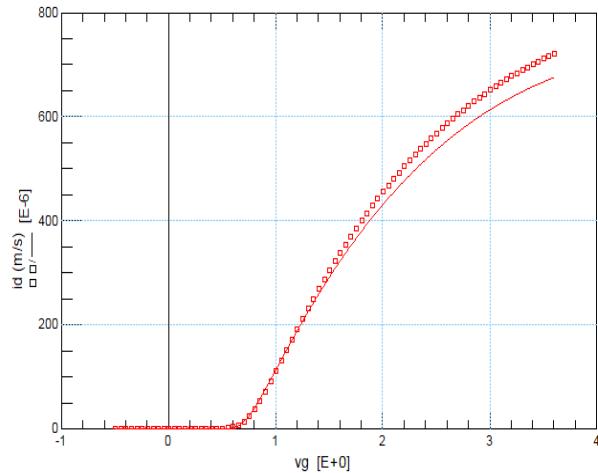


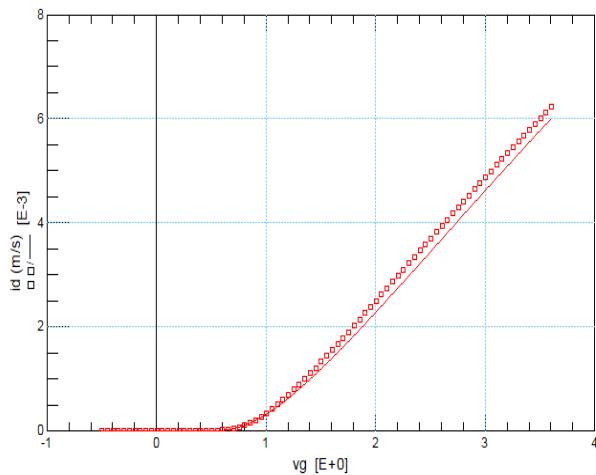
fT_vg = f(Vg,Vd)



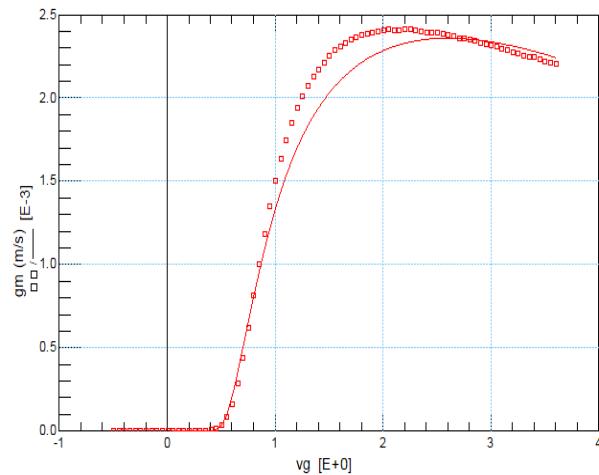
5.12 NF10_WF01u0_L_0u45_S453A_B4

$I_d V_g, T = 27^\circ C$



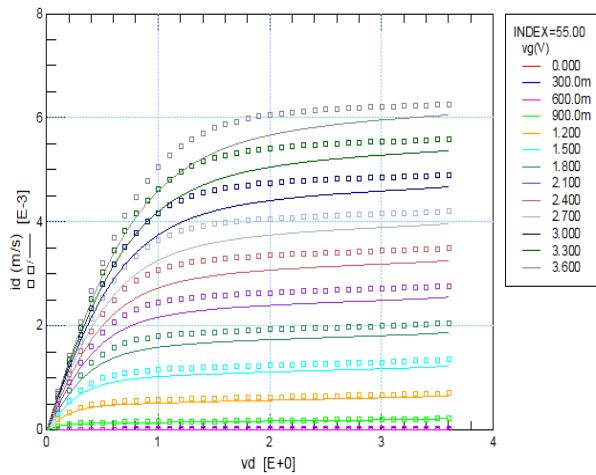


$$Id = f(Vg) @ Vd = 3.3V$$

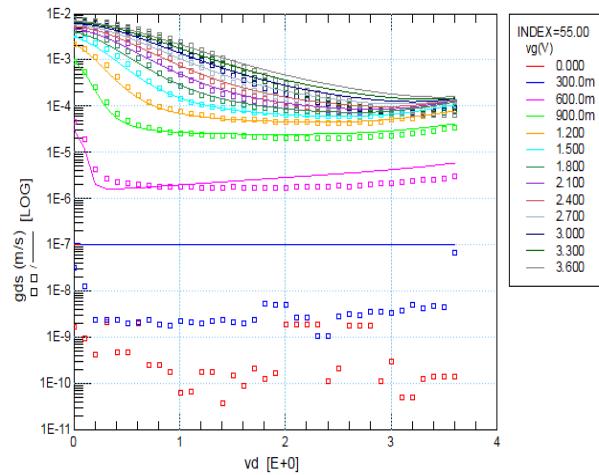


$$gm = f(Vg) @ Vd = 3.3V$$

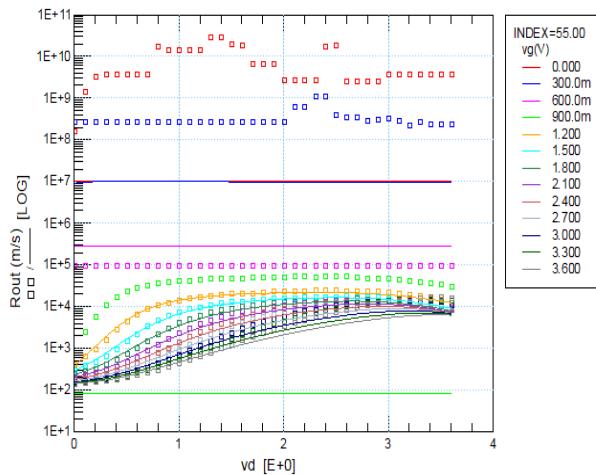
IdVd, T = 27°C



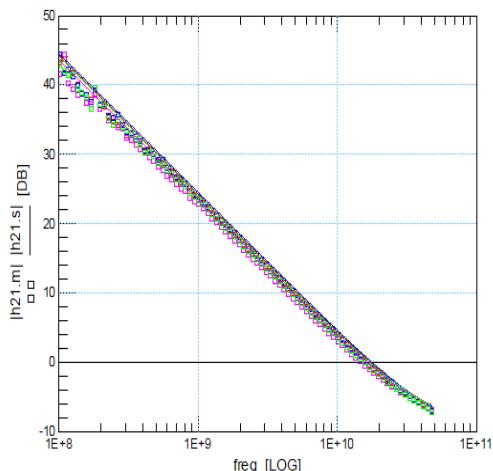
$$Id = f(Vd)$$



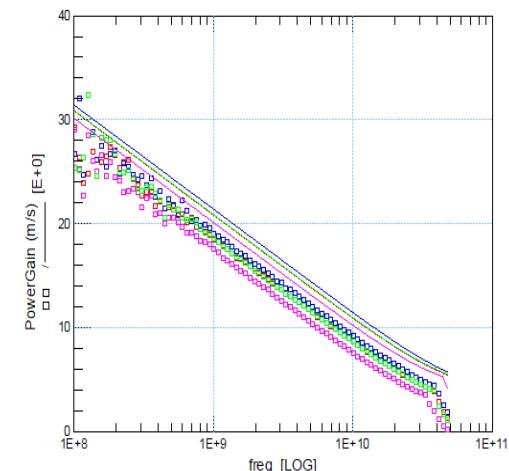
$$gds = f(Vd)$$



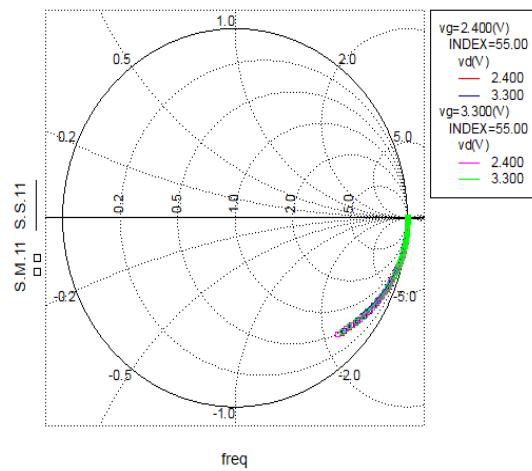
$$Rout = f(Vd)$$

S-Parameter, T = 27°C

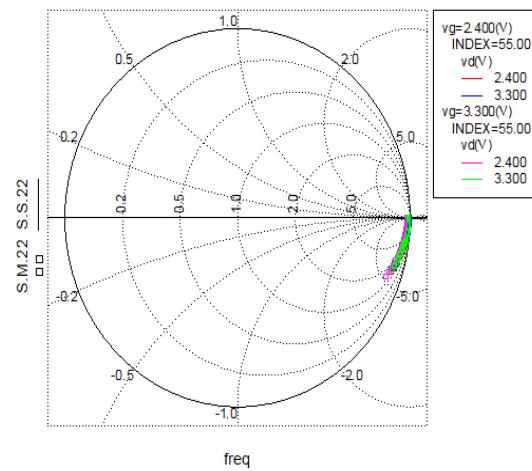
$$|h_{21}| = f(V_g, V_d)$$



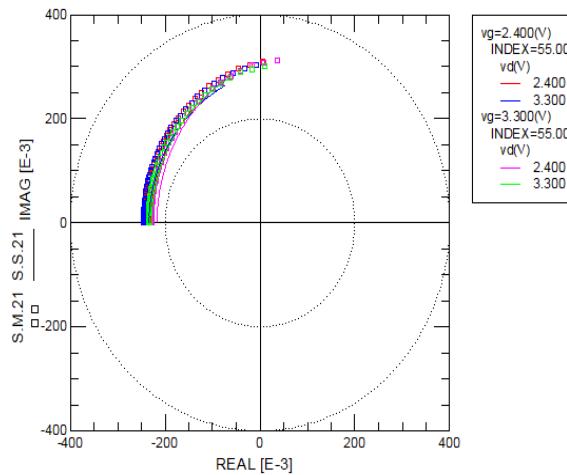
$$\text{MSG/MAG} = f(V_g, V_d)$$



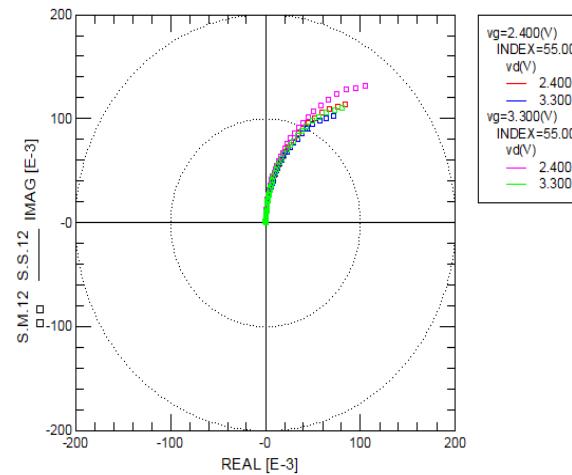
$$S_{11} = f(V_g, V_d)$$



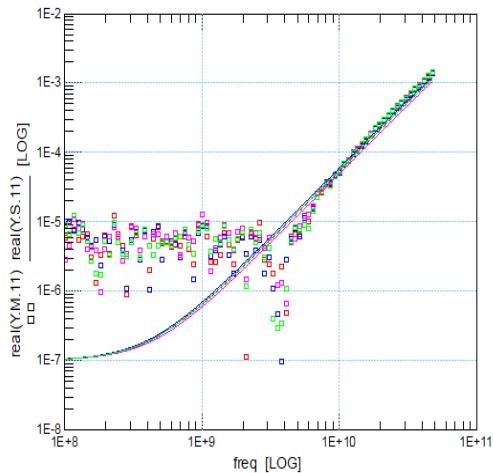
$$S_{22} = f(V_g, V_d)$$



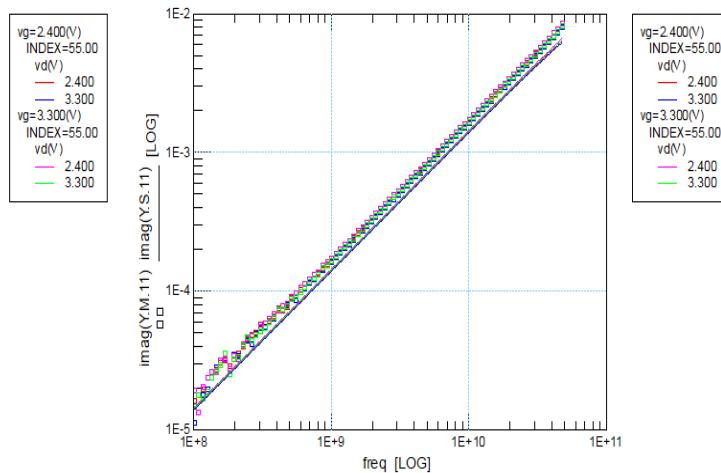
$$S_{21} = f(V_g, V_d)$$



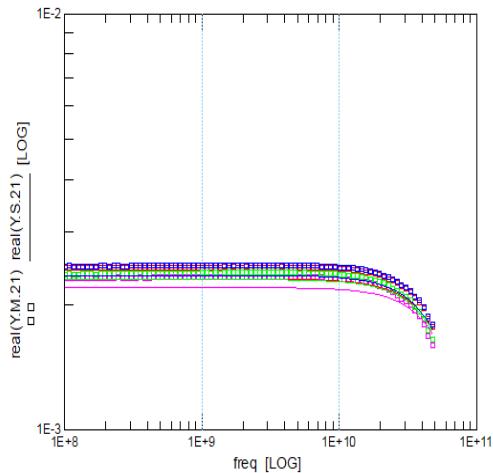
$$S_{12} = f(V_g, V_d)$$

Y-Parameter, T = 27°C

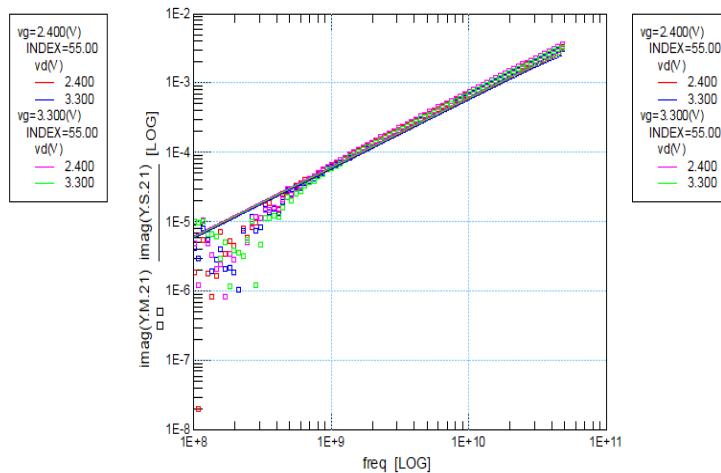
$$\text{re}(Y_{11}) = f(V_g, V_d)$$



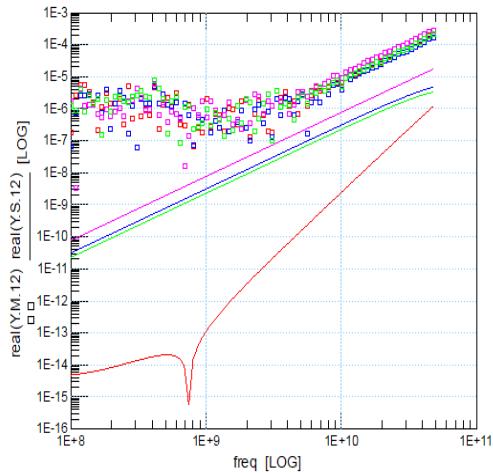
$$\text{im}(Y_{11}) = f(V_g, V_d)$$



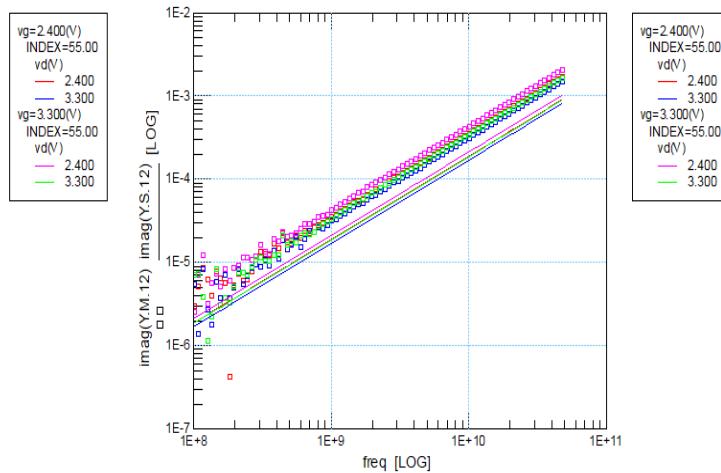
$$\text{re}(Y_{21}) = f(V_g, V_d)$$



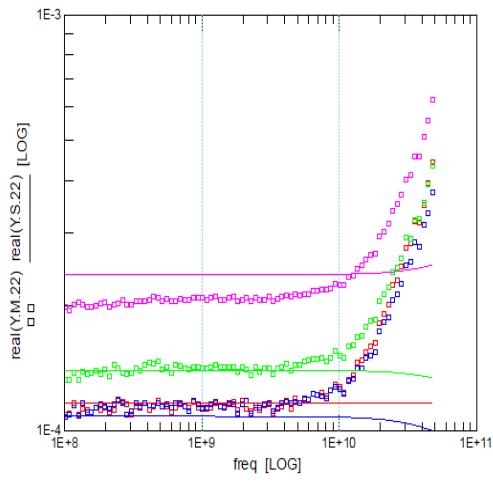
$$\text{im}(Y_{21}) = f(V_g, V_d)$$



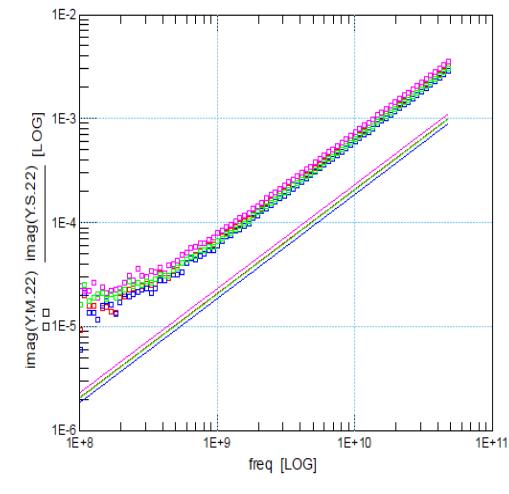
$$\text{re}(Y_{12}) = f(V_g, V_d)$$



$$\text{im}(Y_{12}) = f(V_g, V_d)$$

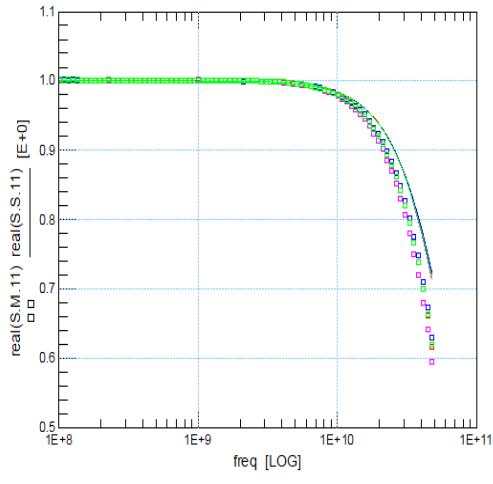


re(Y22) = f(Vg, Vd)

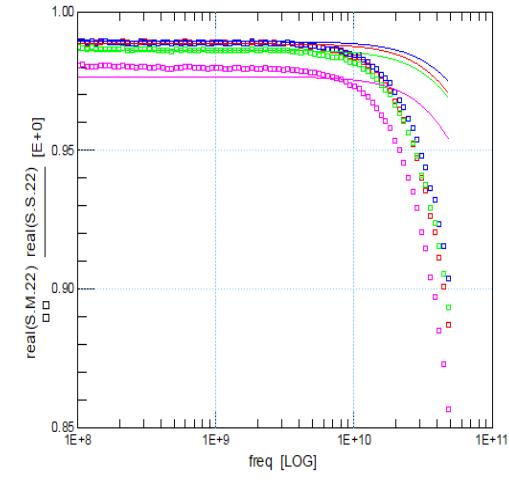


im(Y22) = f(Vg, Vd)

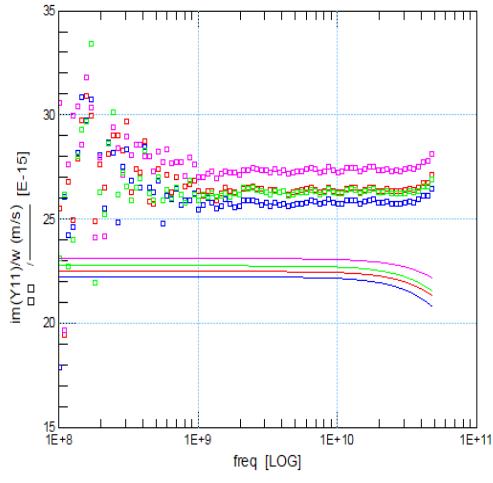
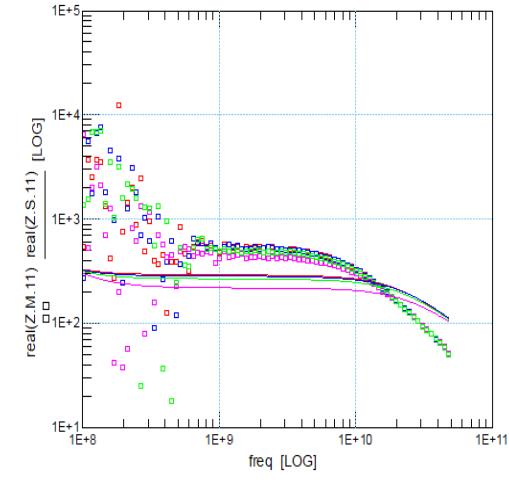
Verify Plots, T = 27°C



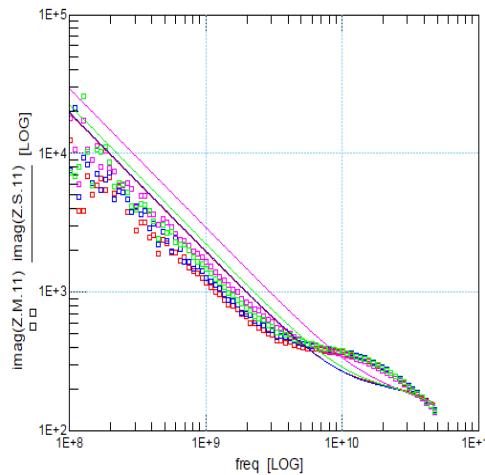
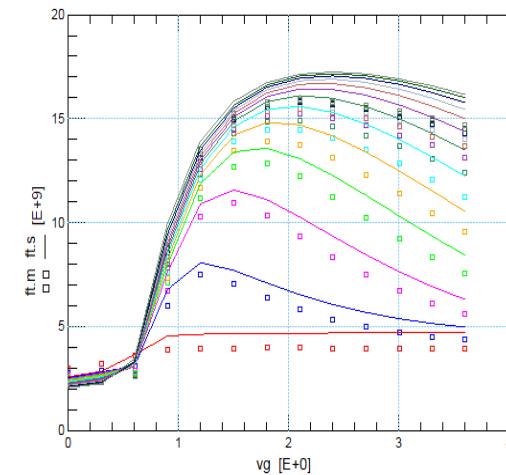
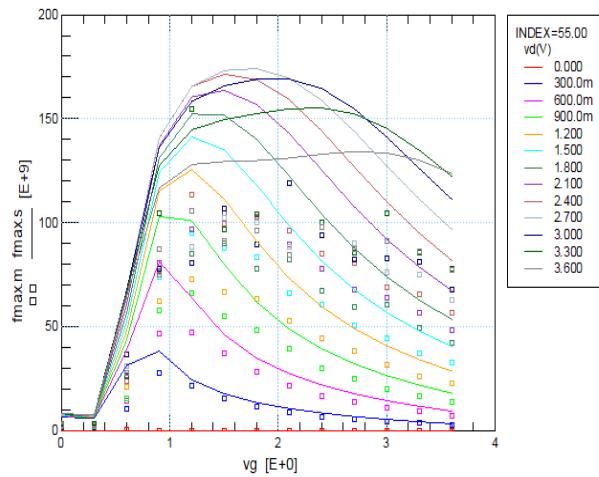
re(S11) = f(Vg, Vd)



re(S22) = f(Vg, Vd)

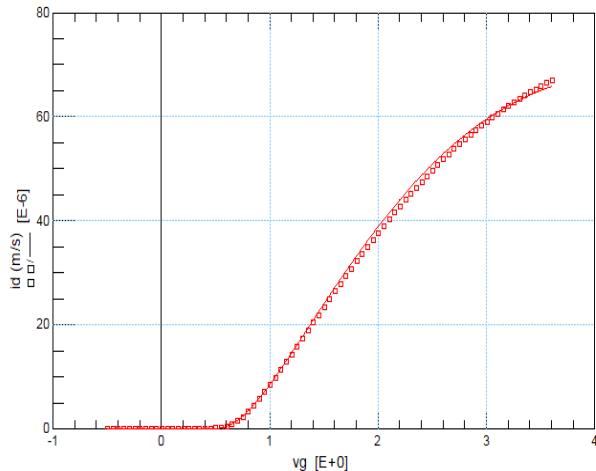
im(Y11) divided by ω 

re(Z11) = f(Vg, Vd)

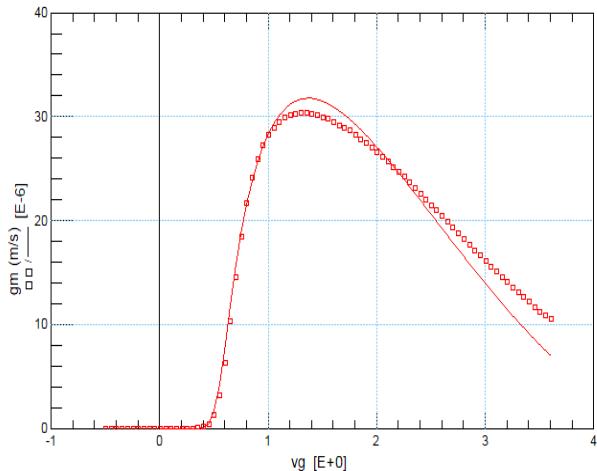
 $\text{im}(Z_{11}) = f(V_g, V_d)$  $fT_{vg} = f(V_g, V_d)$  $f_{\max,vg} = f(V_g, V_d)$

5.13NF04_WF05u0_L_10u0_S453A_14

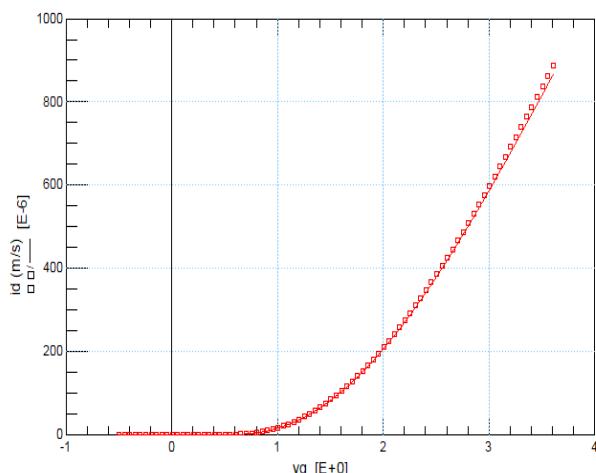
$IdVg$, $T = 27^\circ\text{C}$



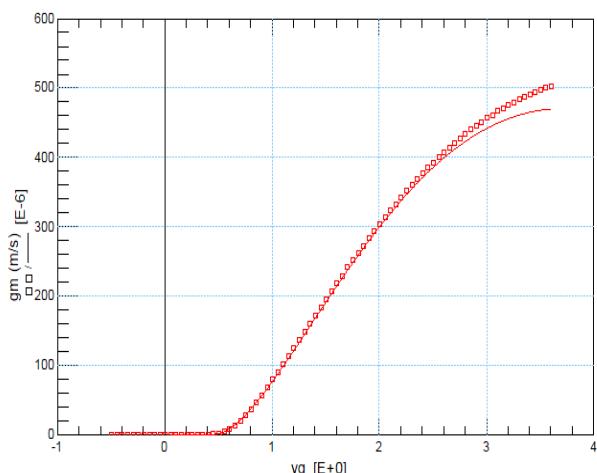
$$Id = f(Vg) \text{ @ } Vd = 0.1\text{V}$$



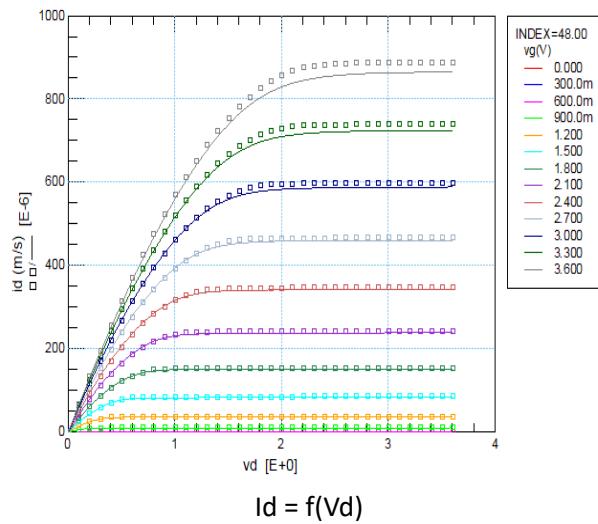
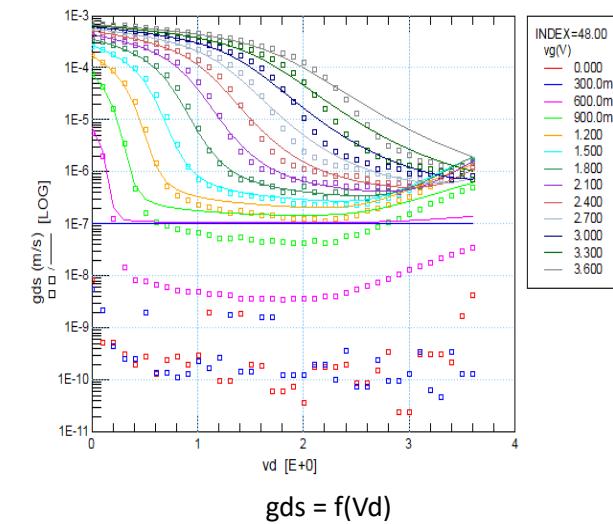
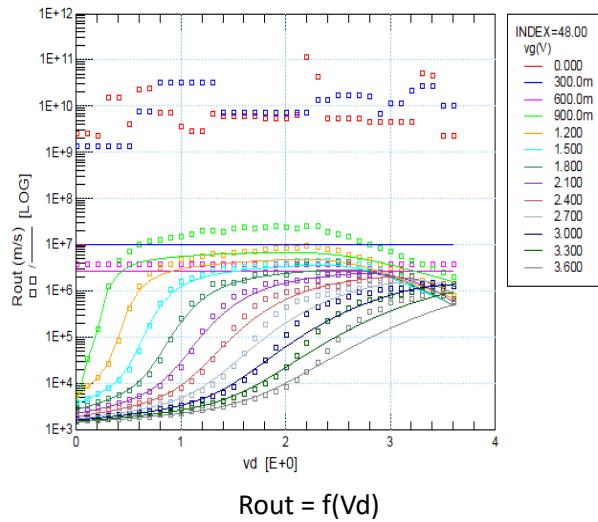
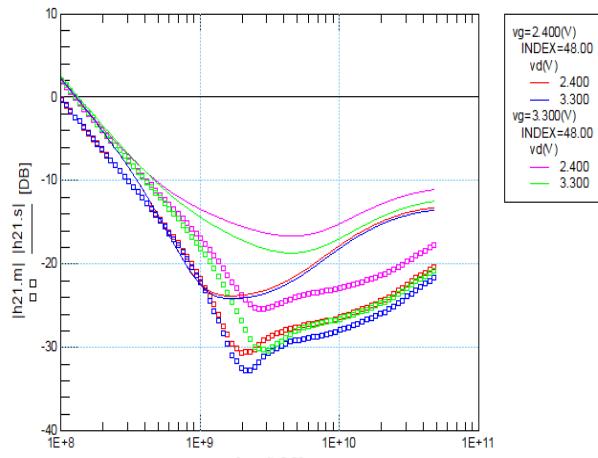
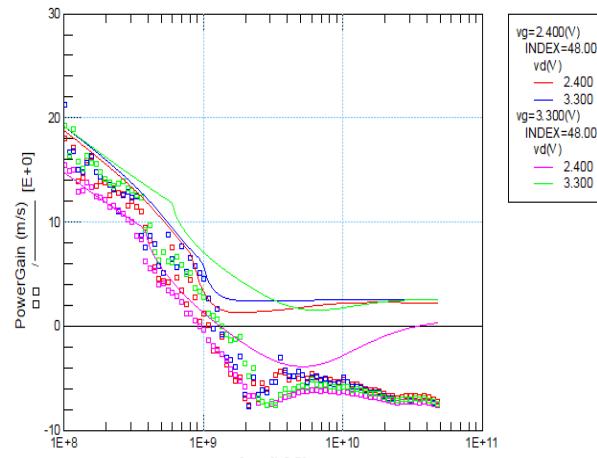
$$gm = f(Vg) \text{ @ } Vd = 0.1\text{V}$$

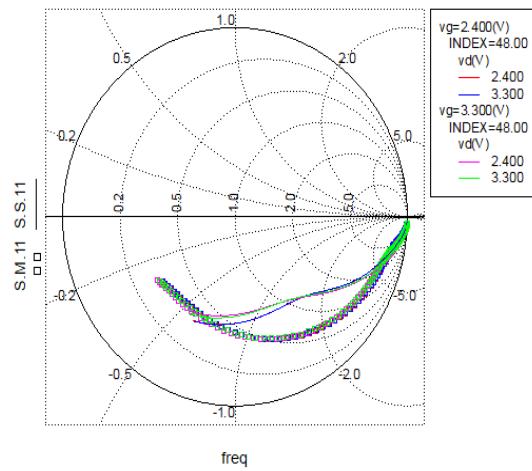
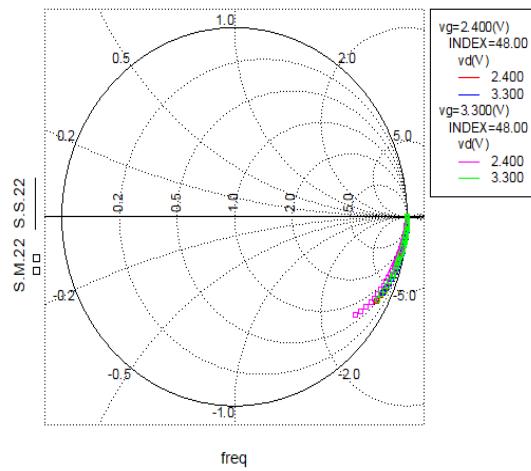
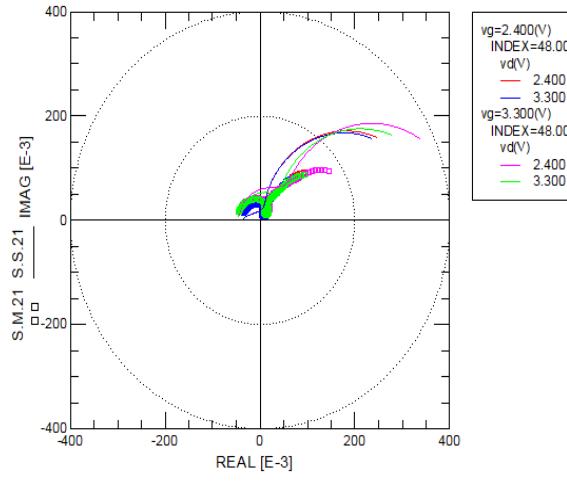
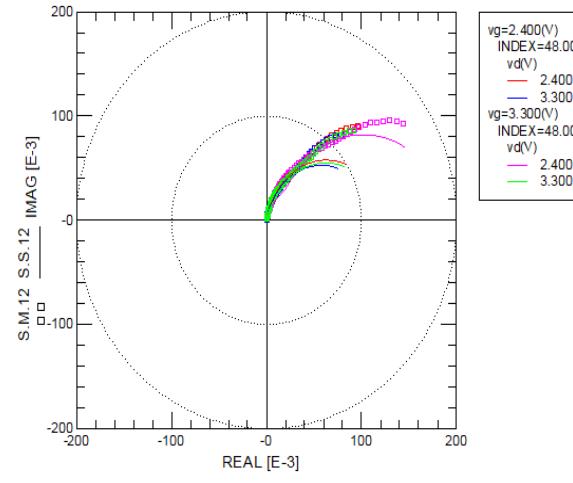


$$Id = f(Vg) \text{ @ } Vd = 3.3\text{V}$$

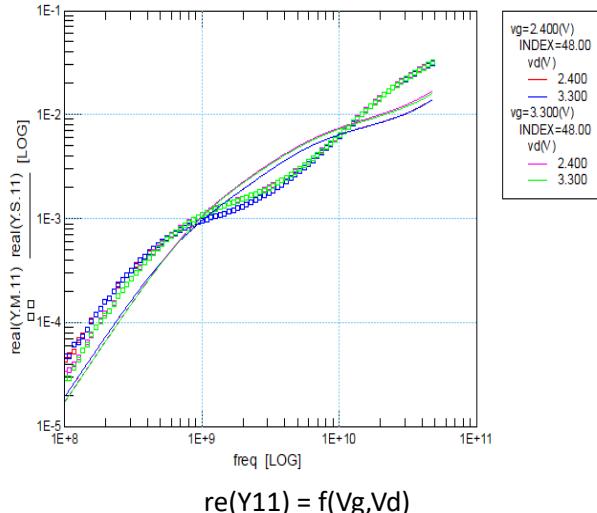
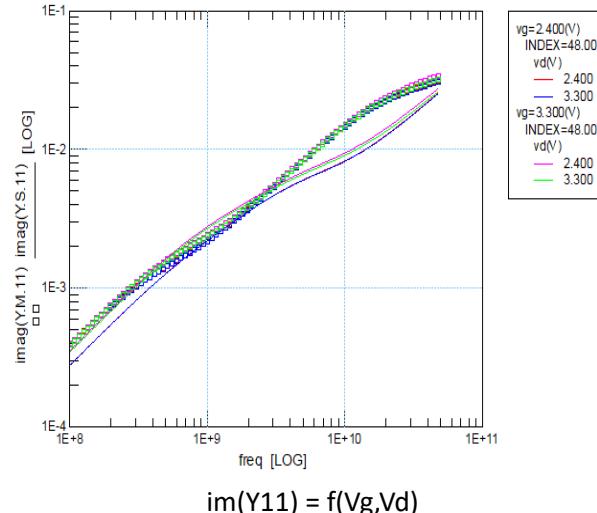


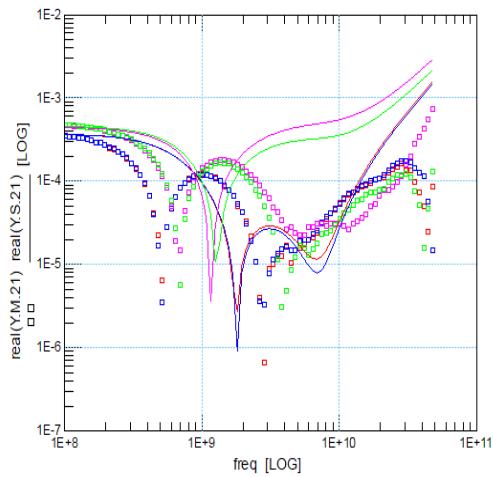
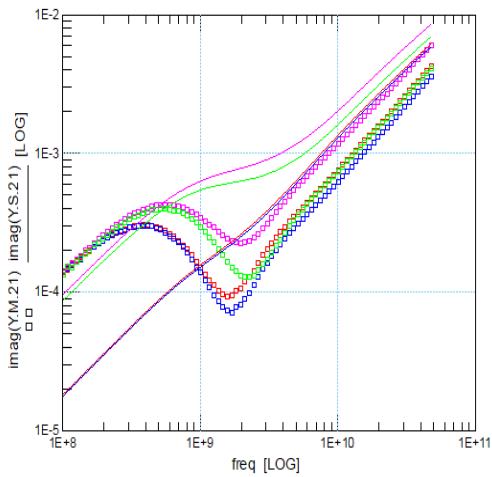
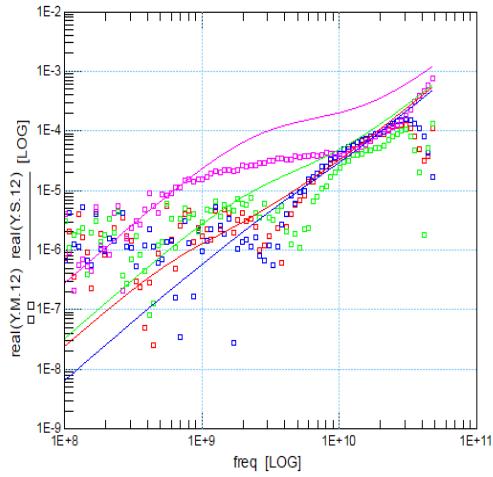
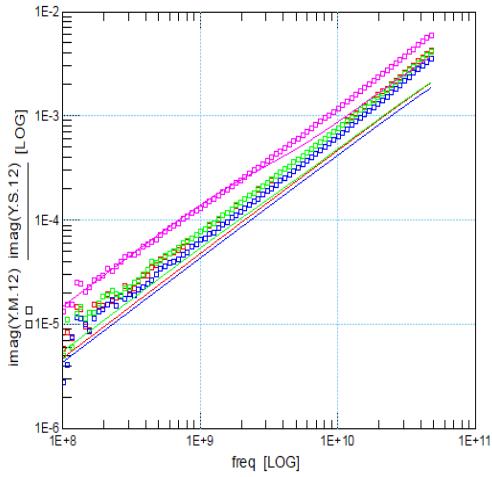
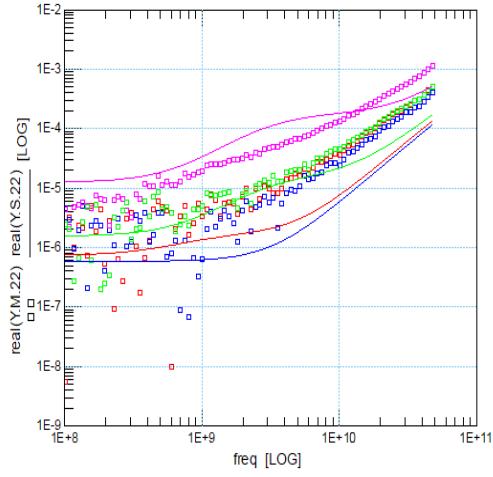
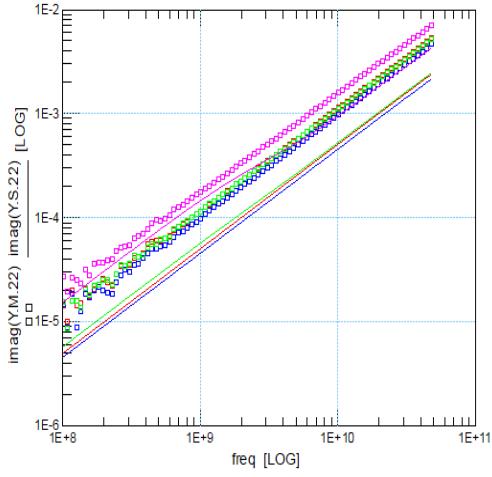
$$gm = f(Vg) \text{ @ } Vd = 3.3\text{V}$$

IdVd, T = 27°C $Id = f(Vd)$  $gds = f(Vd)$  $Rout = f(Vd)$ **S-Parameter, T = 27°C** $|h21| = f(Vg, Vd)$  $MSG/MAG = f(Vg, Vd)$

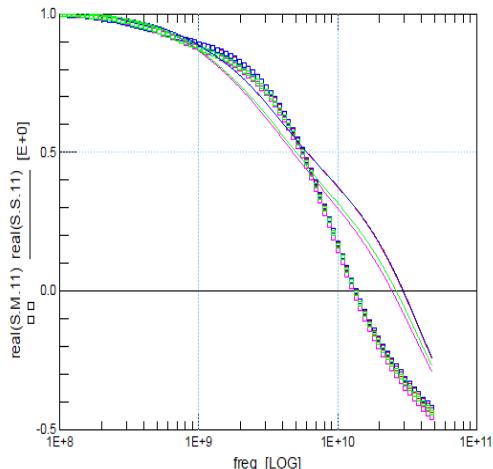
 $S_{11} = f(V_g, V_d)$  $S_{22} = f(V_g, V_d)$  $S_{21} = f(V_g, V_d)$  $S_{12} = f(V_g, V_d)$

Y-Parameter, $T = 27^\circ\text{C}$

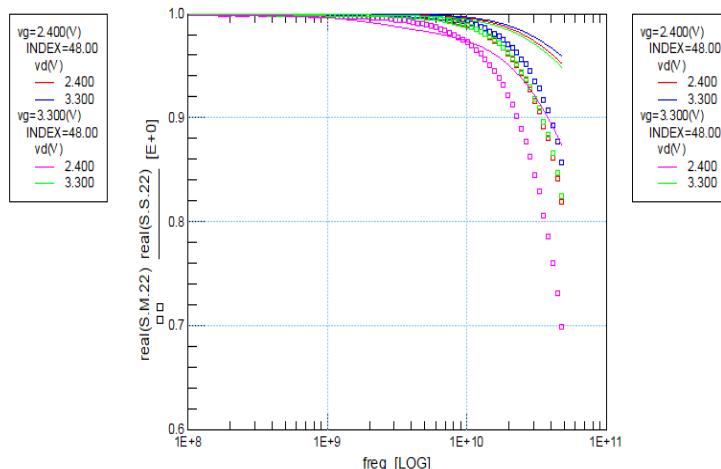
 $\text{re}(Y_{11}) = f(V_g, V_d)$  $\text{im}(Y_{11}) = f(V_g, V_d)$

re(Y₂₁) = f(V_g,V_d)im(Y₂₁) = f(V_g,V_d)re(Y₁₂) = f(V_g,V_d)im(Y₁₂) = f(V_g,V_d)re(Y₂₂) = f(V_g,V_d)im(Y₂₂) = f(V_g,V_d)

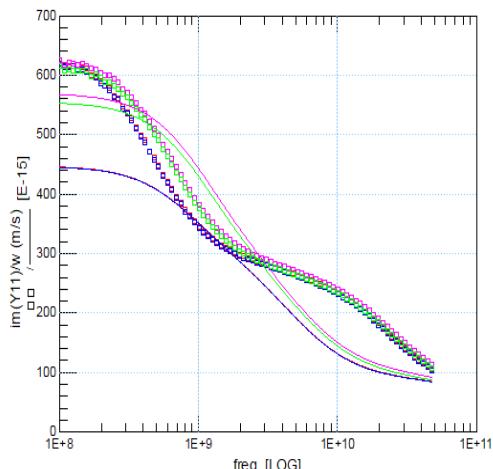
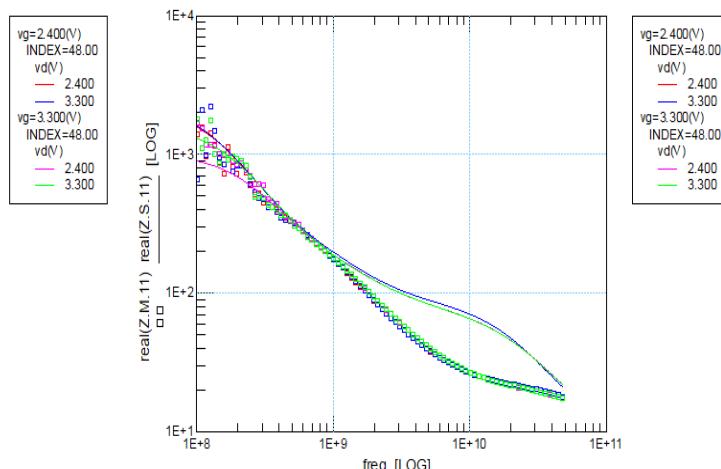
Verify Plots, T = 27°C



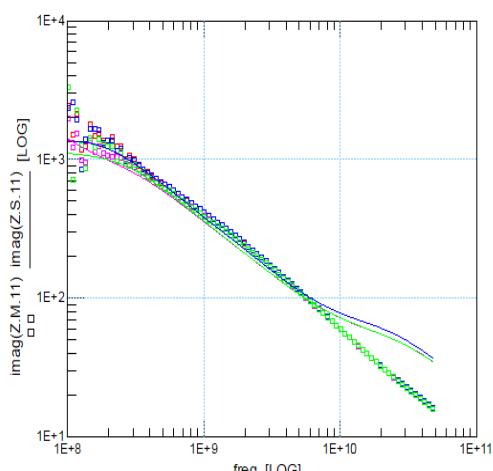
re(S11) = f(Vg, Vd)



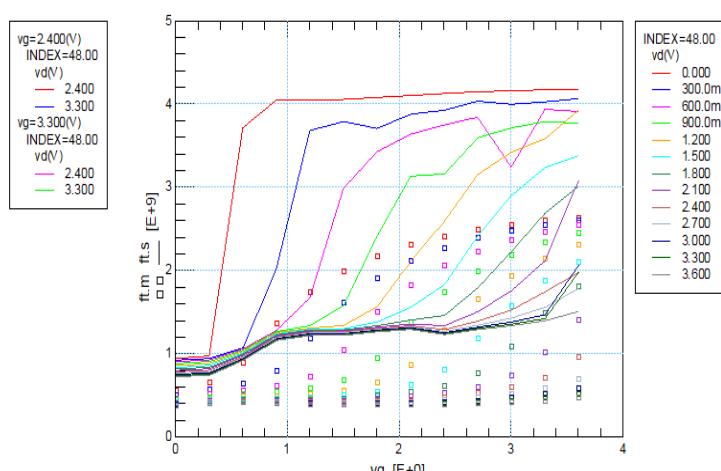
re(S22) = f(Vg, Vd)

im(Y11) divided by ω 

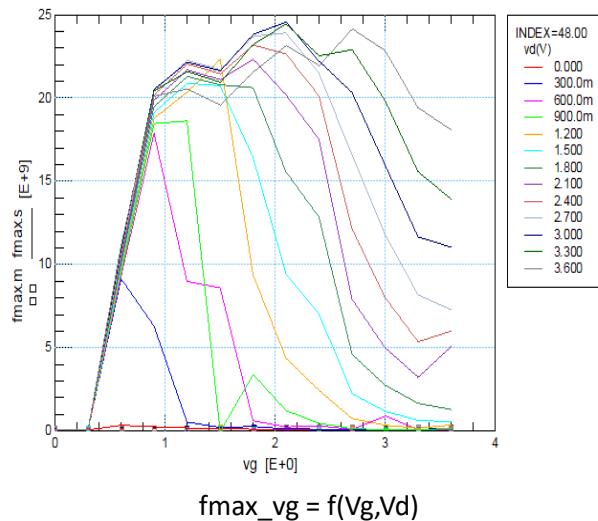
re(Z11) = f(Vg, Vd)



im(Z11) = f(Vg, Vd)

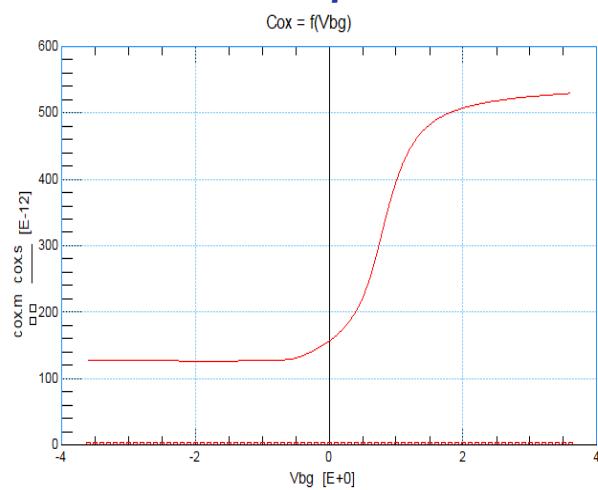


fT_vg = f(Vg, Vd)

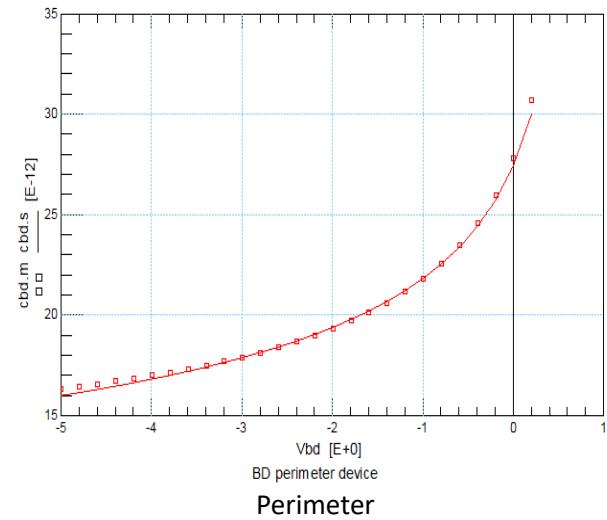
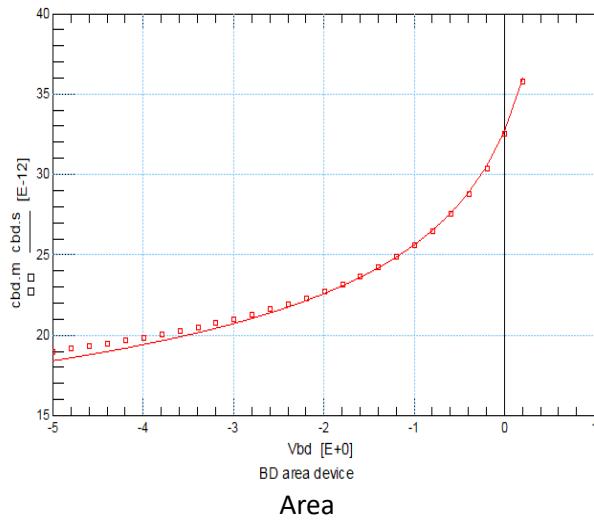


6 Capacitances

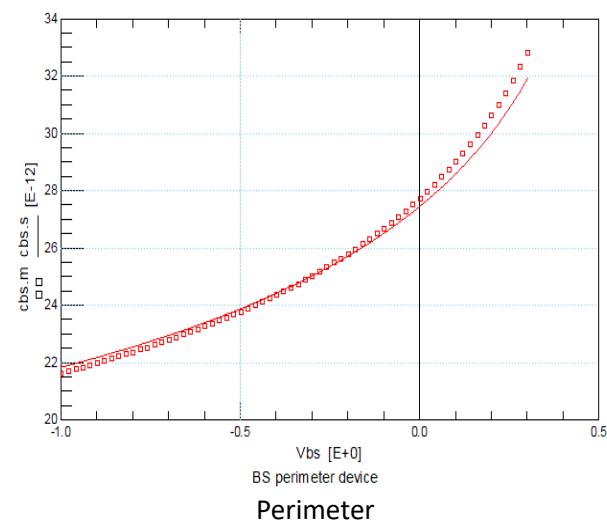
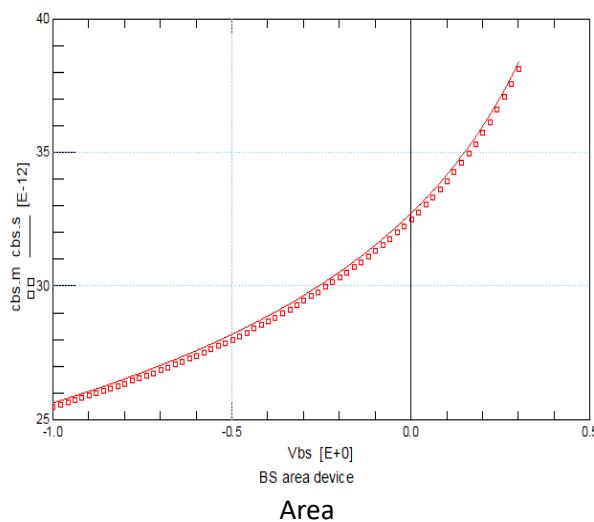
6.1 Gate Oxide Capacitance



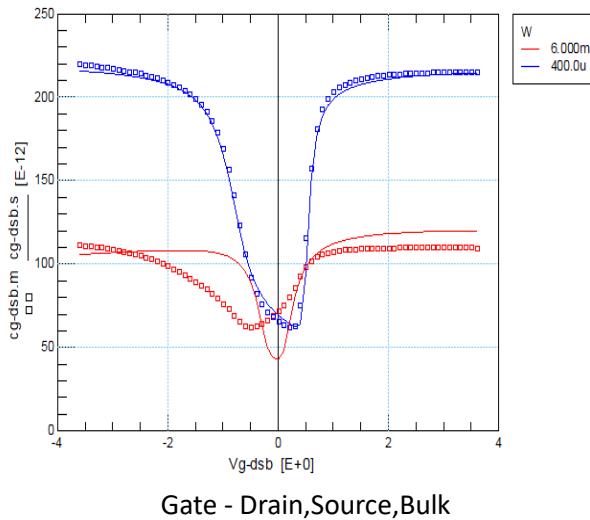
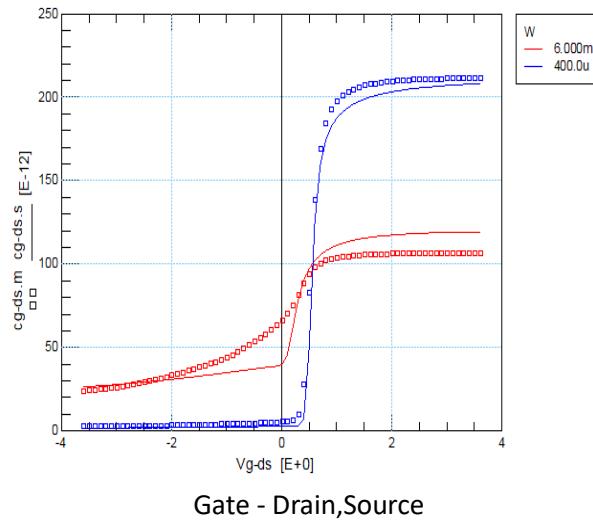
6.2 Junction Capacitance Bulk - Drain



6.3 Junction Capacitance Bulk - Source

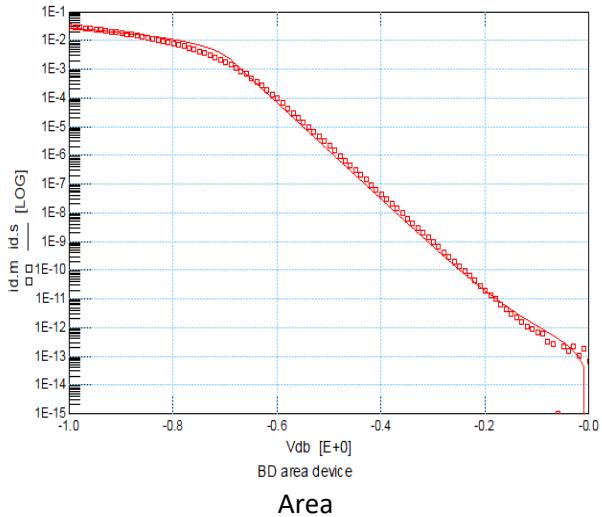
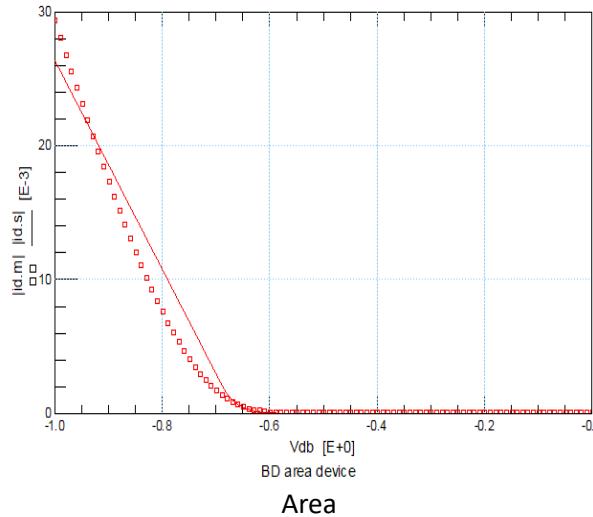


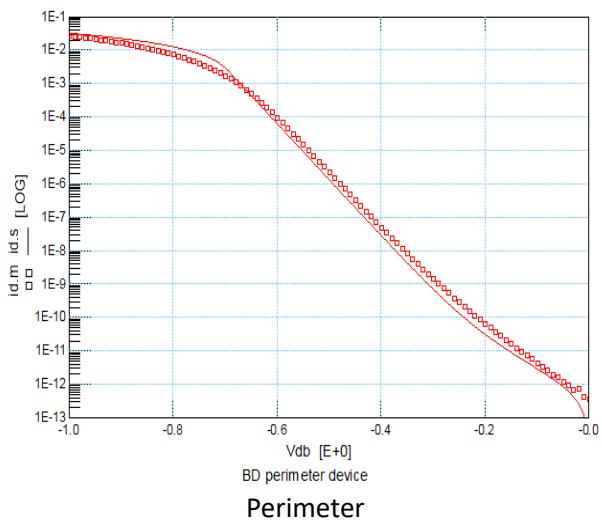
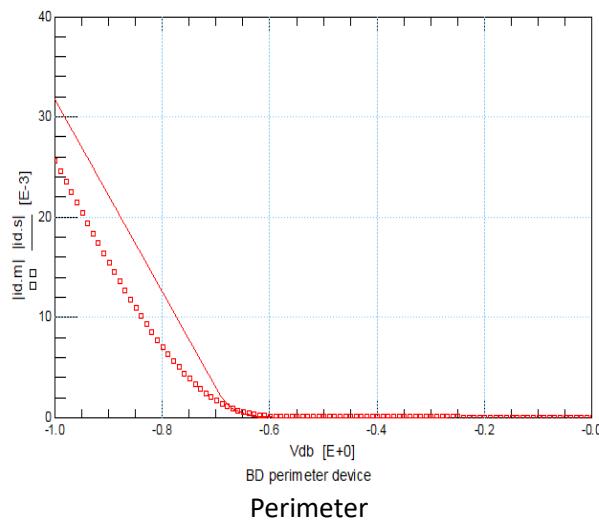
6.4 Overlap Capacitance



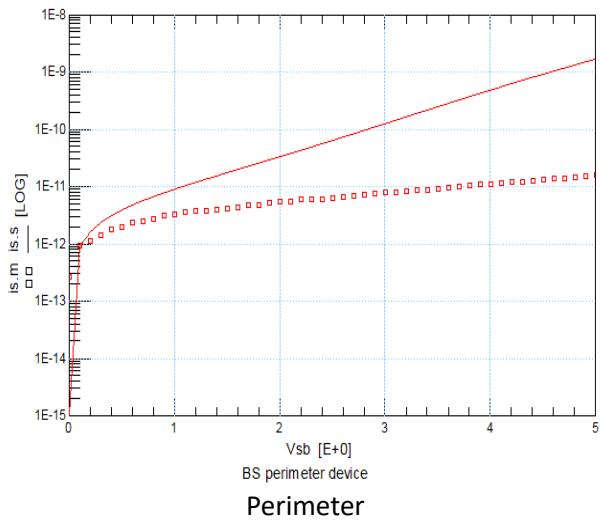
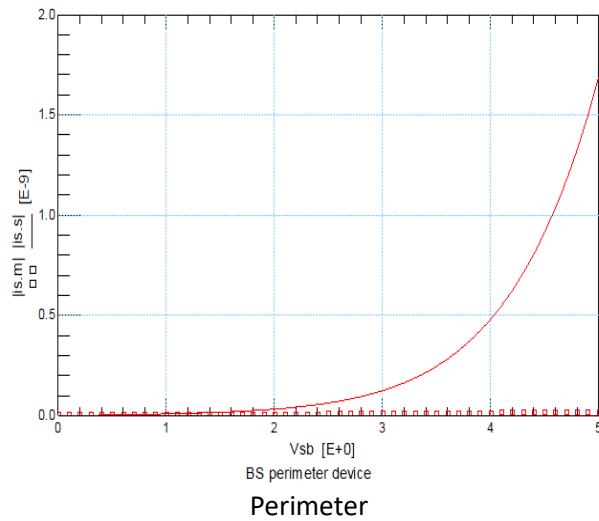
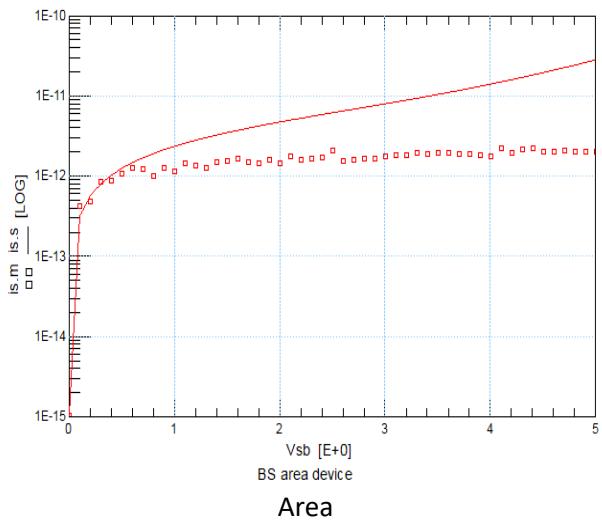
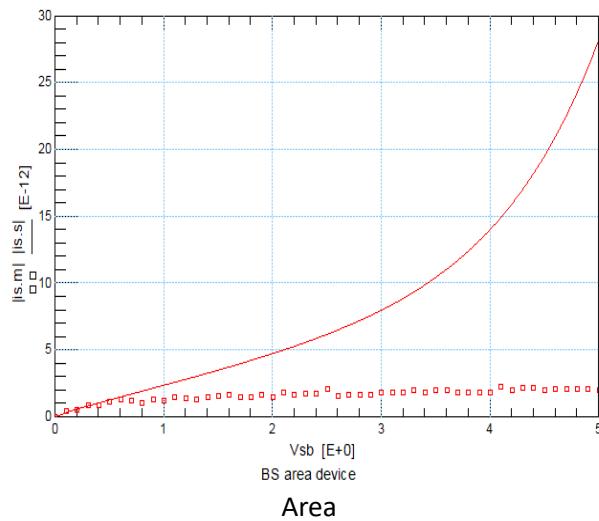
7 Diodes

7.1 Diode Bulk - Drain





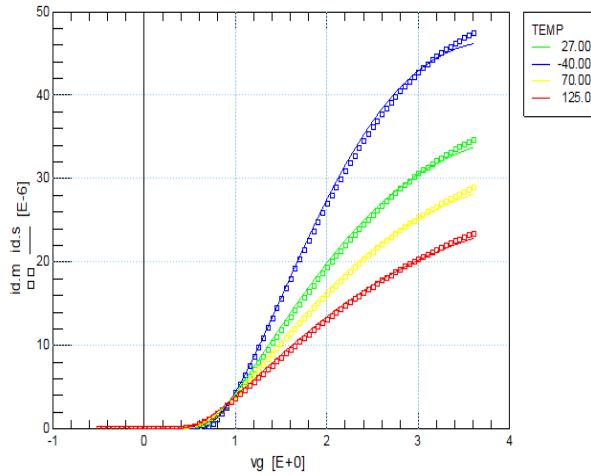
7.2 Diode Bulk - Source



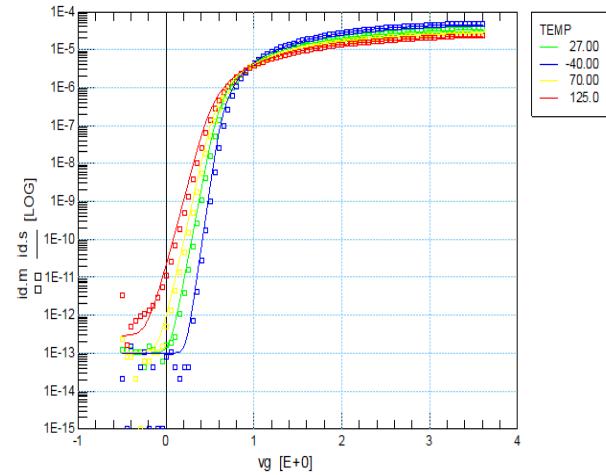
8 Temperature Measurement

8.1 Transistors

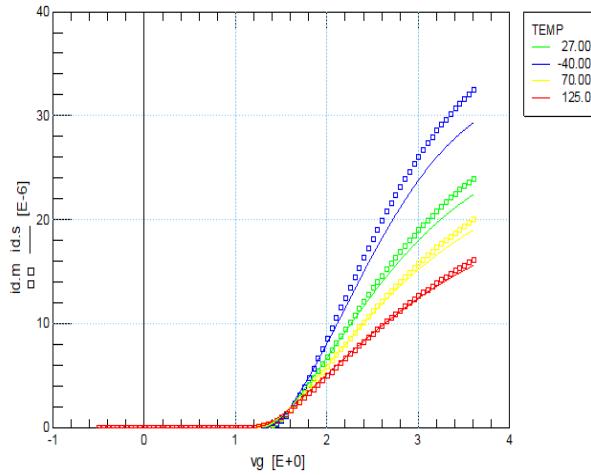
8.1.1 W10u0_L10u0_S557_3



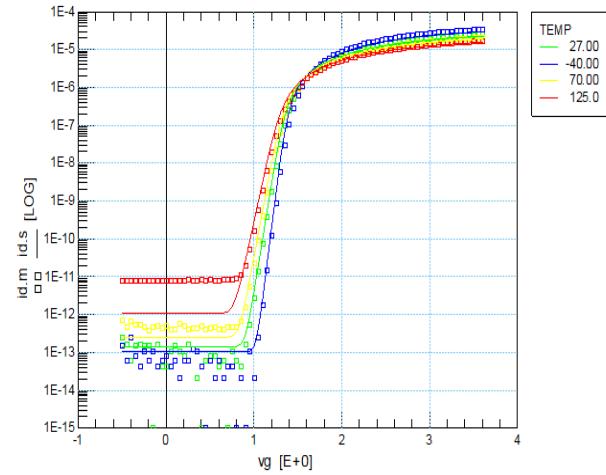
$Id = f(vg, T)$ @ low Vds , $Vbs = 0$



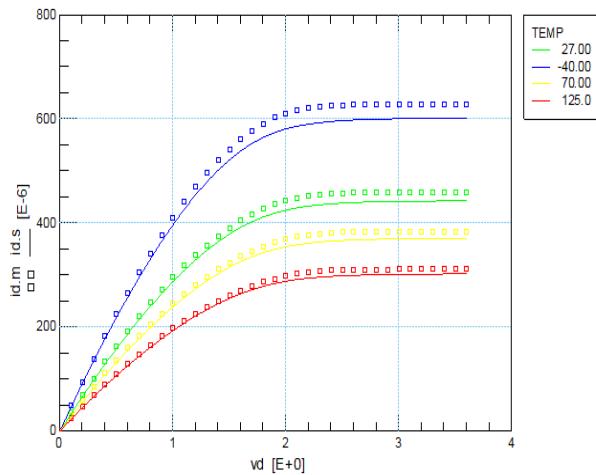
$\log(Id) = f(vg, T)$ @ low Vds , $Vbs = 0$



$Id = f(vg, T)$ @ low Vds , $Vbs = \text{max}$

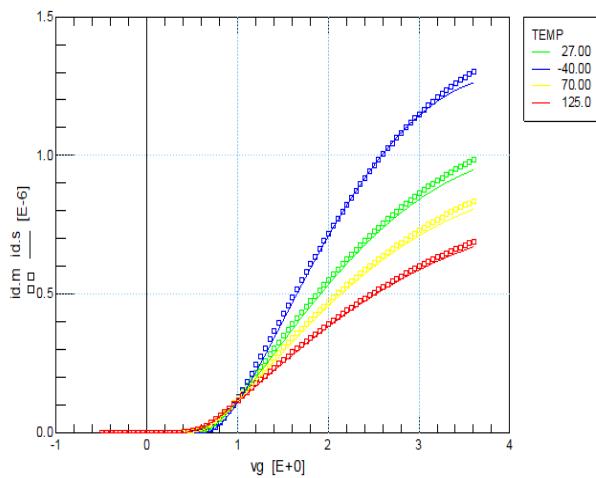


$\log(Id) = f(vg, T)$ @ low Vds , $Vbs = \text{max}$

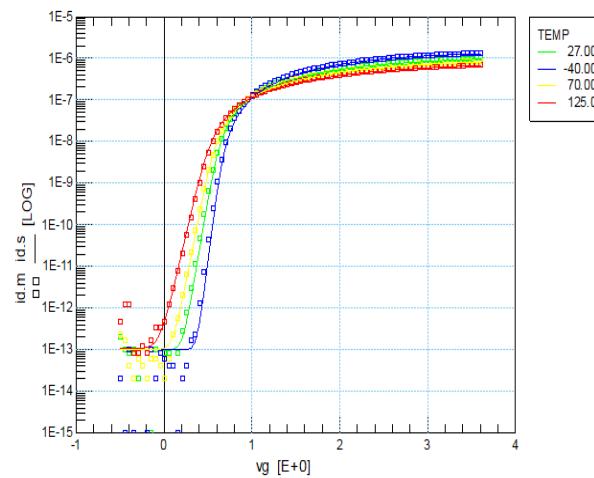


$$Id = f(Vd, Vg, T) @ Vbs = 0$$

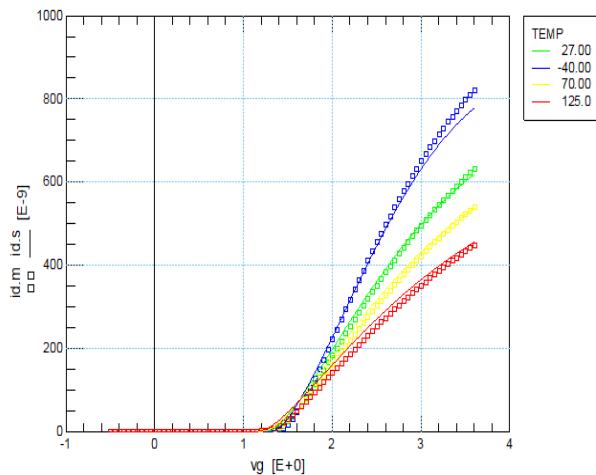
8.1.2 W0u3_L10u0_S547_4



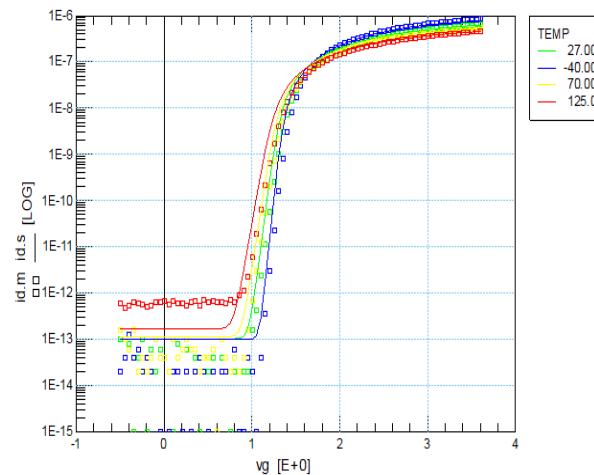
$$Id = f(vg, T) @ \text{low } Vds, Vbs = 0$$



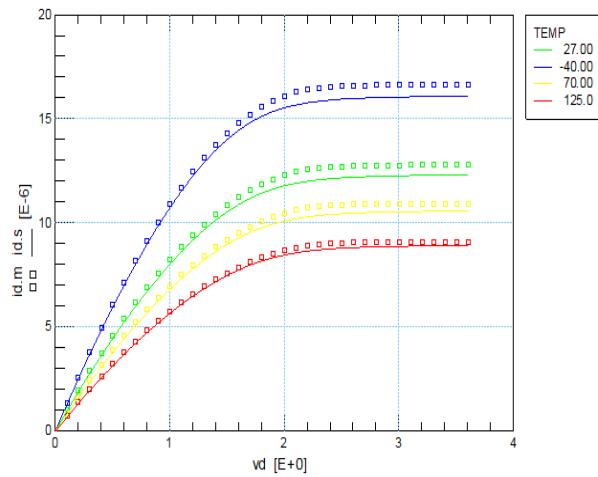
$$\log(Id) = f(vg, T) @ \text{low } Vds, Vbs = 0$$



$$Id = f(vg, T) @ \text{low } Vds, Vbs = \text{max}$$

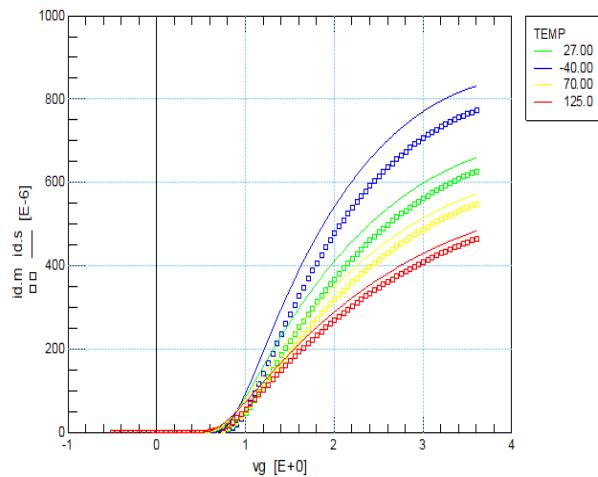


$$\log(Id) = f(vg, T) @ \text{low } Vds, Vbs = \text{max}$$

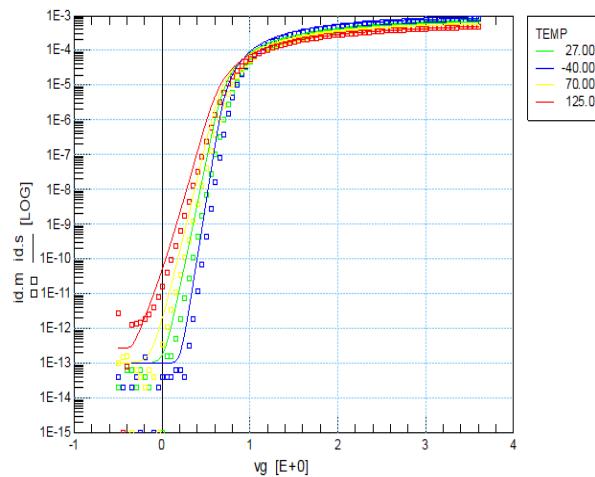


$$Id = f(Vd, Vg, T) @ Vbs = 0$$

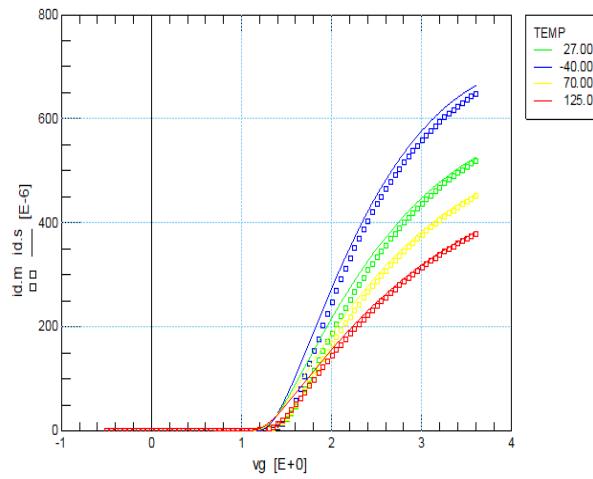
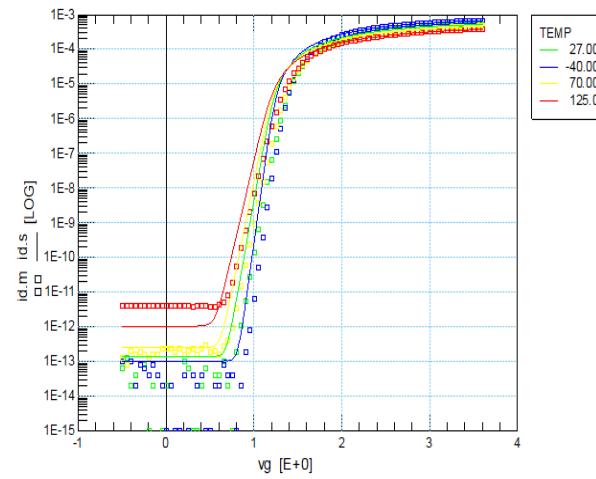
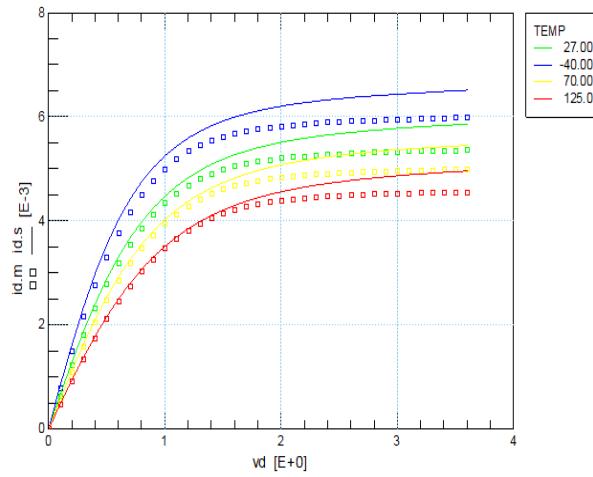
8.1.3 W10u0_L0u5_S556_4



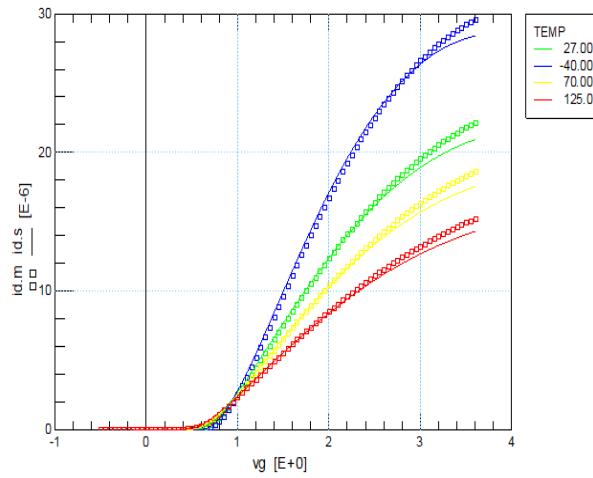
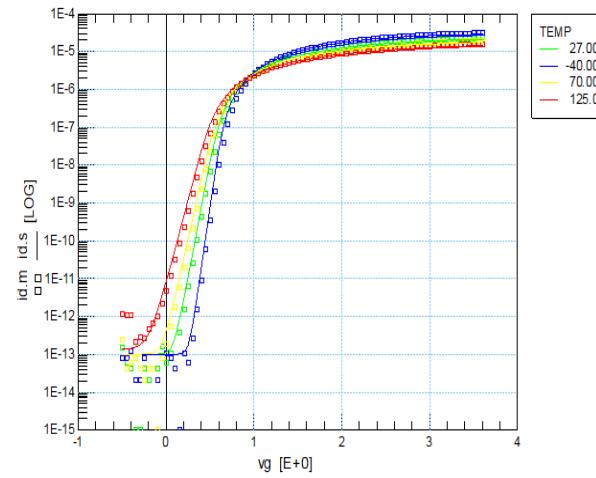
$$Id = f(Vg, T) @ \text{low } Vds, Vbs = 0$$

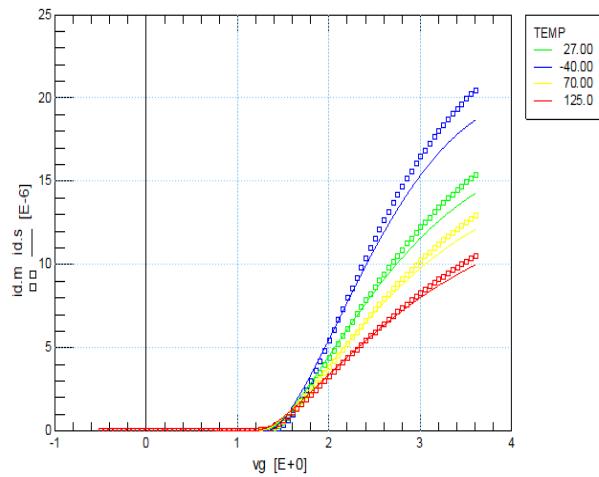
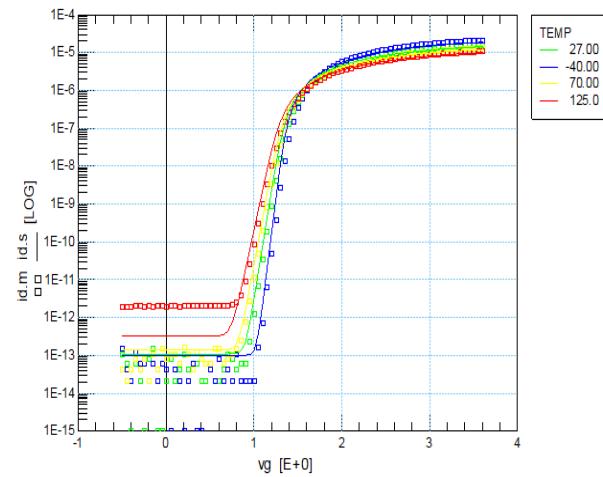
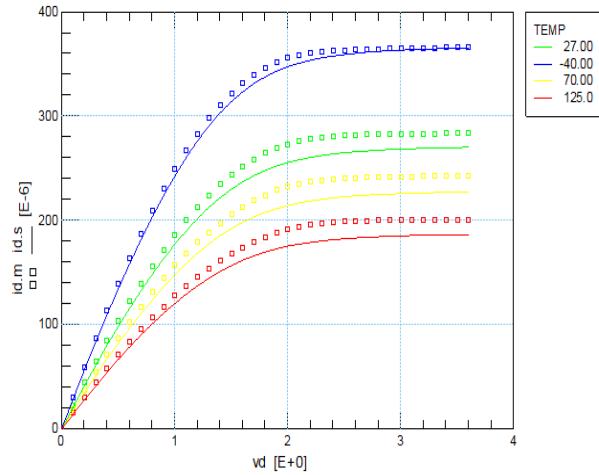


$$\log(Id) = f(Vg, T) @ \text{low } Vds, Vbs = 0$$

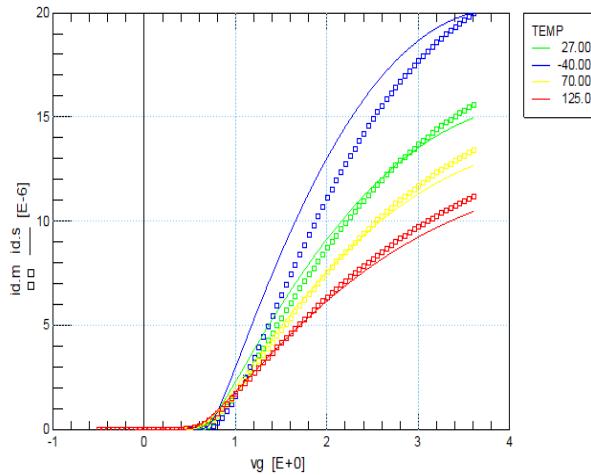
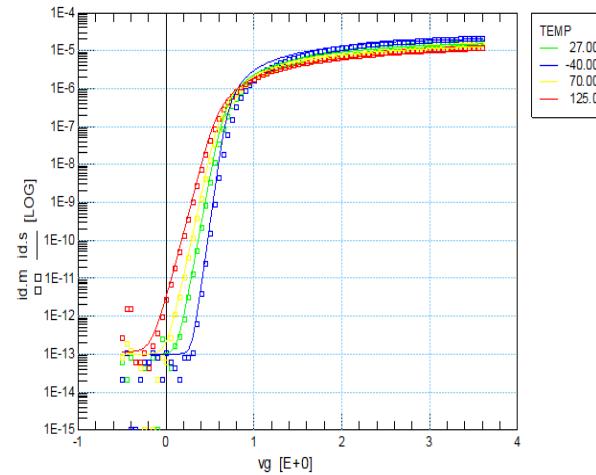
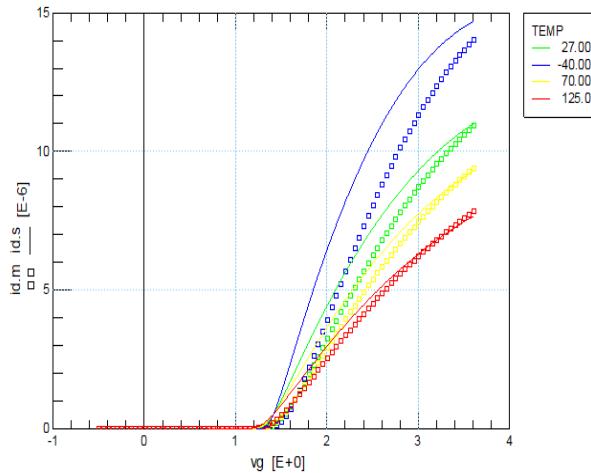
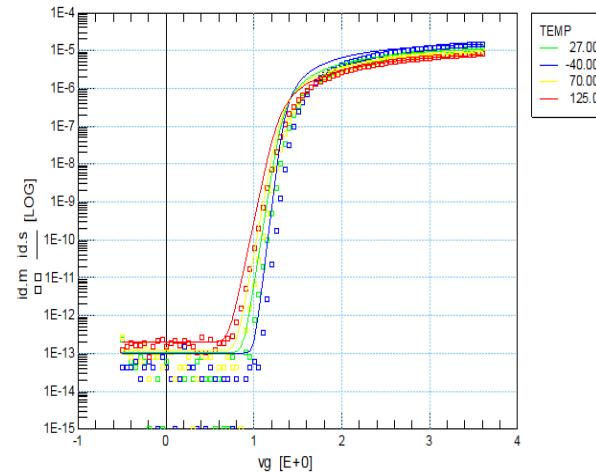
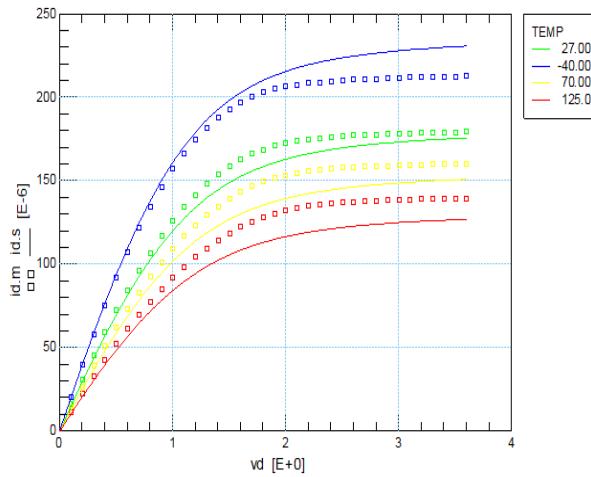
 $Id = f(V_g, T) @ \text{low } V_{ds}, V_{bs} = \text{max}$  $\log(Id) = f(V_g, T) @ \text{low } V_{ds}, V_{bs} = \text{max}$  $Id = f(V_d, V_g, T) @ V_{bs} = 0$

8.1.4 W02u0_L3u0_S558_4

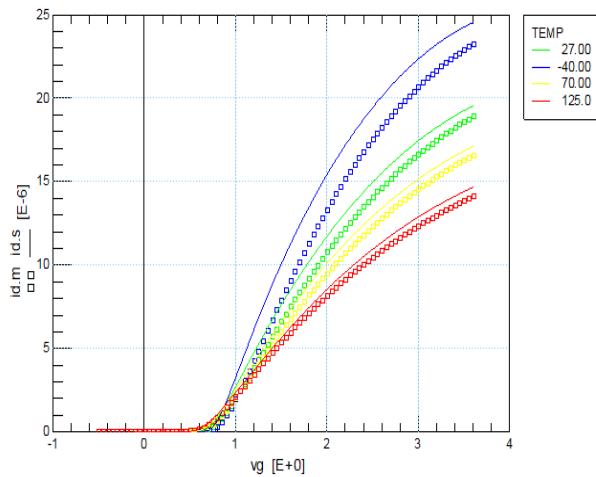
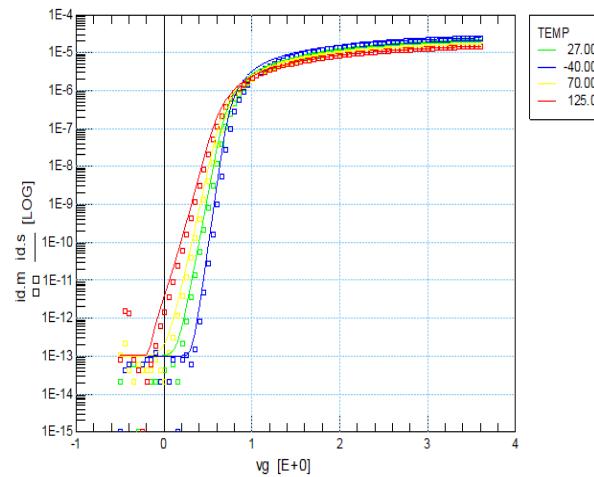
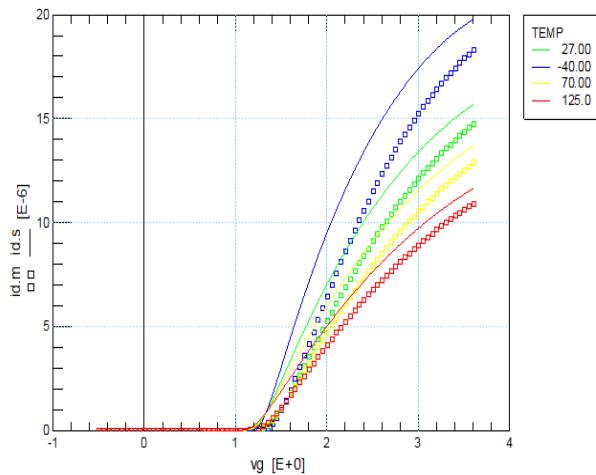
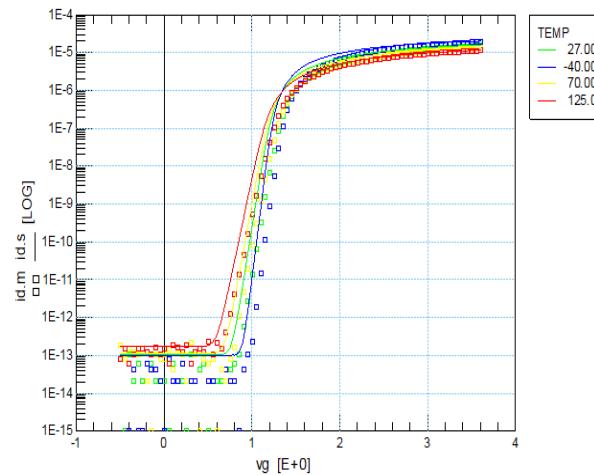
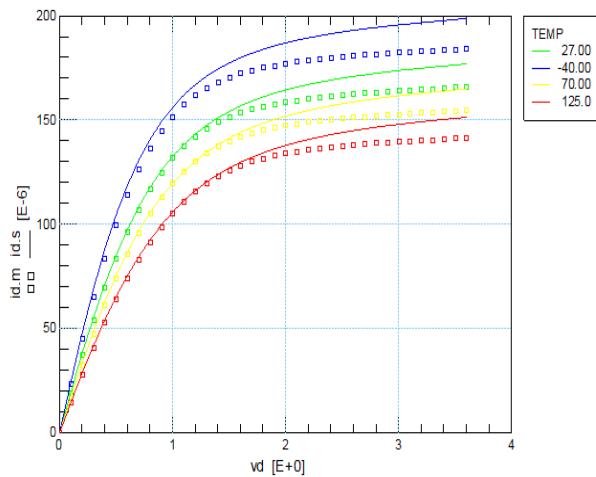
 $Id = f(V_g, T) @ \text{low } V_{ds}, V_{bs} = 0$  $\log(Id) = f(V_g, T) @ \text{low } V_{ds}, V_{bs} = 0$

 $Id = f(vg, T) @ \text{low } V_{ds}, V_{bs} = \text{max}$  $\log(Id) = f(vg, T) @ \text{low } V_{ds}, V_{bs} = \text{max}$  $Id = f(Vd, Vg, T) @ V_{bs} = 0$

8.1.5 W0u6_L1u2_S559_4

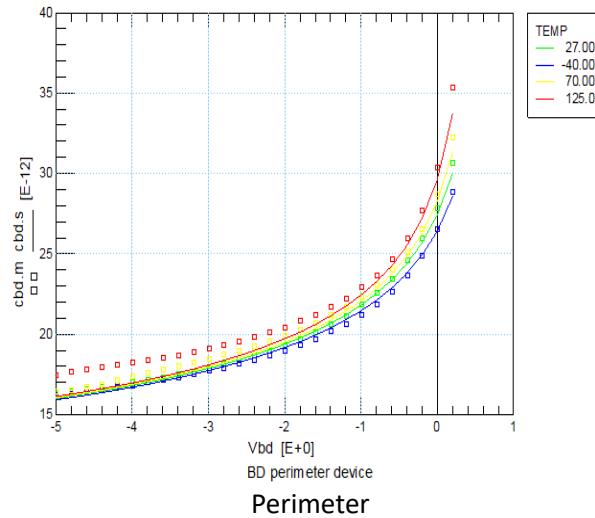
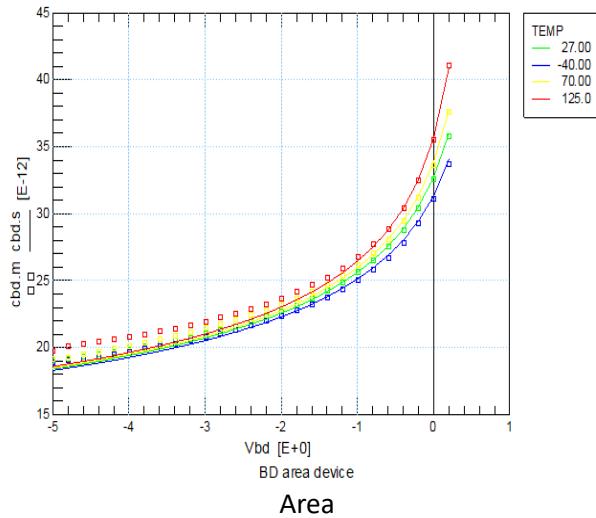
 $Id = f(vg, T) @ \text{low } Vds, Vbs = 0$  $\log(Id) = f(vg, T) @ \text{low } Vds, Vbs = 0$  $Id = f(vg, T) @ \text{low } Vds, Vbs = \text{max}$  $\log(Id) = f(vg, T) @ \text{low } Vds, Vbs = \text{max}$  $Id = f(Vd, Vg, T) @ Vbs = 0$

8.1.6 W0u3_L0u5_S560_4

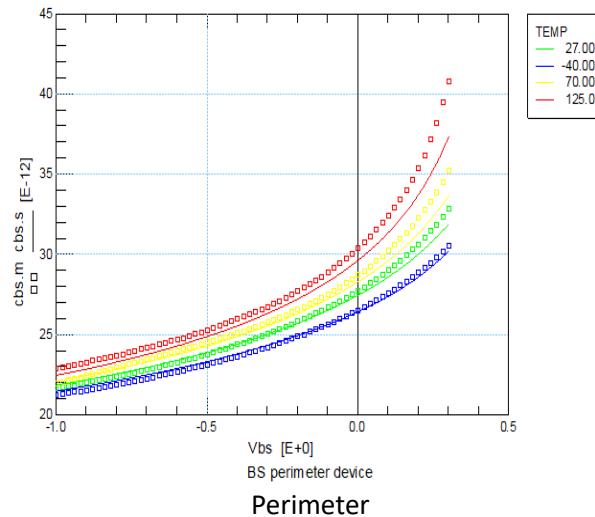
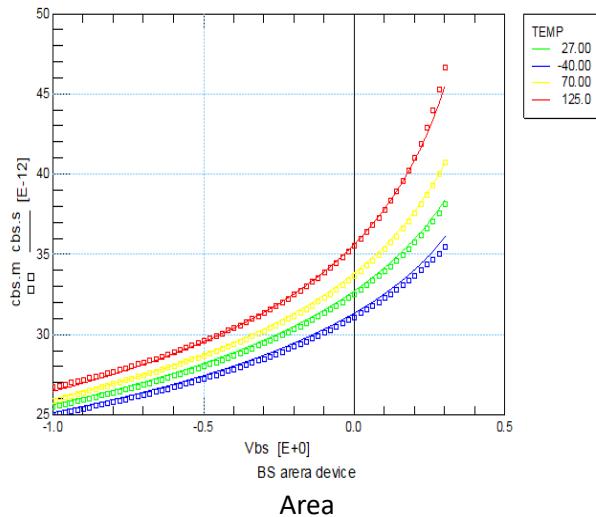
 $Id = f(vg, T) @ \text{low } V_{ds}, V_{bs} = 0$  $\log(Id) = f(vg, T) @ \text{low } V_{ds}, V_{bs} = 0$  $Id = f(vg, T) @ \text{low } V_{ds}, V_{bs} = \text{max}$  $\log(Id) = f(vg, T) @ \text{low } V_{ds}, V_{bs} = \text{max}$  $Id = f(Vd, Vg, T) @ V_{bs} = 0$

8.2 Junction Capacitance

8.2.1 Bulk - Drain

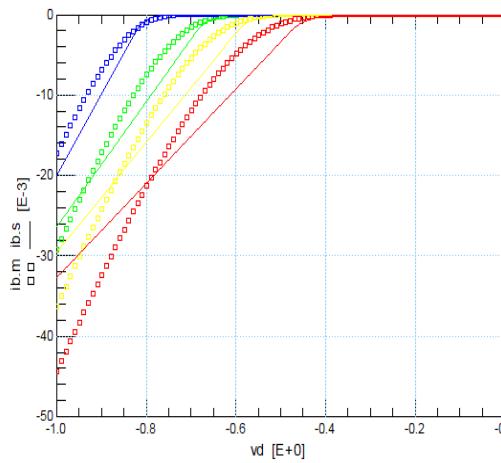


8.2.2 Bulk - Source

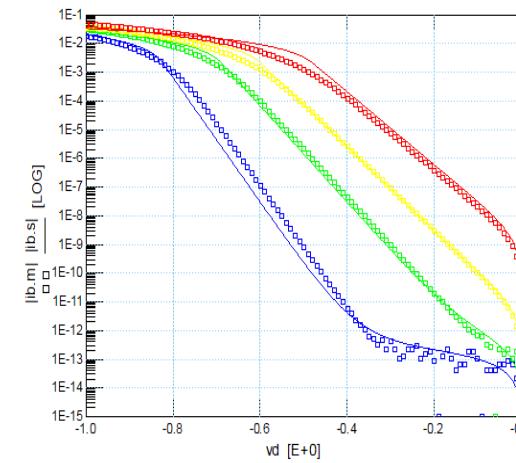


8.3 Parasitic Diodes

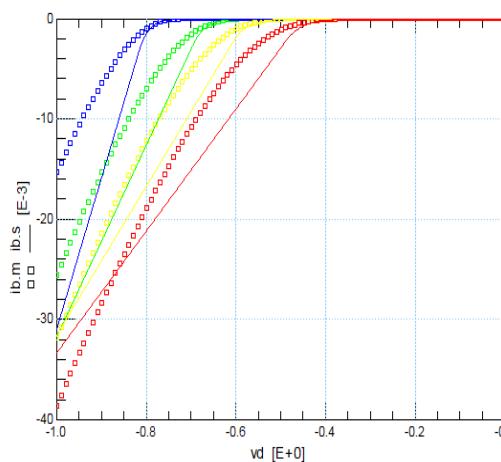
8.3.1 Bulk - Drain



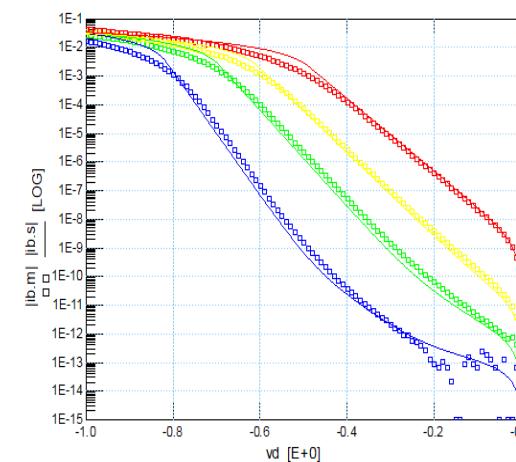
Area



Area

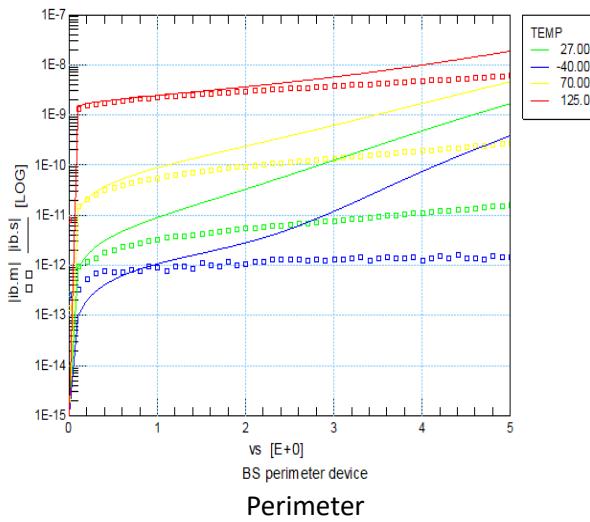
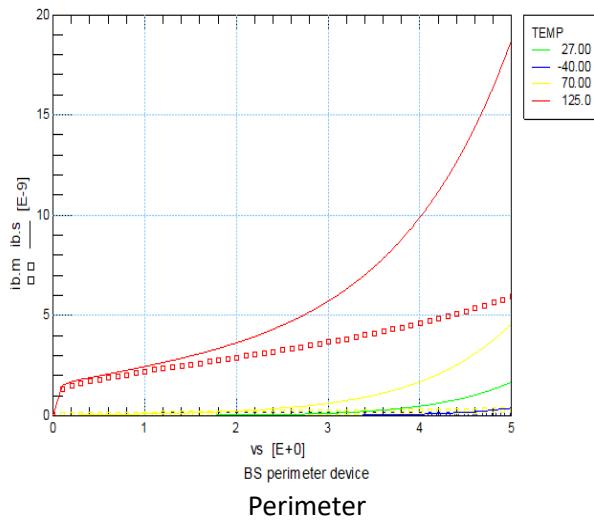
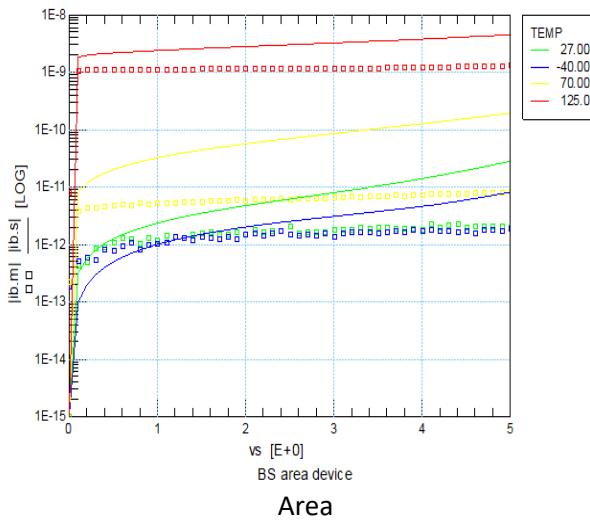
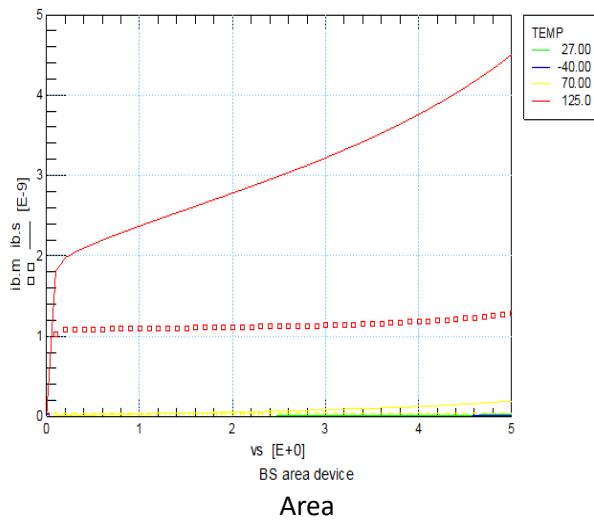


Perimeter



Perimeter

8.3.2 Bulk - Source



9 Flicker Noise

Flicker noise model parameters are taken from the SG13 simulation models.

9.1 *Measurement Conditions*

Not defined as no flicker noise measurements are yet done on SG13G2 devices.

9.2 *Devices*

Not defined as no flicker noise measurements are yet done on SG13G2 devices.

10 Change History

Revision	Device	Changes
190606	All	Initial version
190730	All	Adjust temperature and RF behavior
190924	Summarized Results	Legend added