

IHP
SG13G2
SG13G2 DC CV PMOS HV

Rev. 1.2 (190924)

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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_S562_3	10	10	3.4	3.4	20. 7	20. 7	0	0	1		Large

W0u3_L10u0_S555_4	300 m	10	102 m	102 m	1.2 8	1.2 8	0	0	1		Narrow
W10u0_L0u35_S561_3	10 m	350	3.4	3.4	20. 7	20. 7	0	0	1		Short
W0u3_L0u35_S565_3	300 m	350	102 m	102 m	1.2 8	1.2 8	0	0	1		Small
W10u0_L0u4_T356_S38 7_1	10	400 m	0	0	0	0	0	0	1		L Scale
W10u0_L3u0_S562_1	10	3	3.4	3.4	20. 7	20. 7	0	0	1		L Scale
W10u0_L5u0_S562_2	10	5	3.4	3.4	20. 7	20. 7	0	0	1		L Scale
W10u0_L0u5_S561_4	10	500 m	3.4	3.4	20. 7	20. 7	0	0	1		L Scale
W05u0_L10u0_S563_1	5	10	1.7	1.7	10. 7	10. 7	0	0	1		W Scale
W0u6_L10u0_S564_5	600 m	10	204 m	204 m	1.8 8	1.8 8	0	0	1		W Scale
W02u0_L10u0_S563_5	2	10	680 m	680 m	4.6 8	4.6 8	0	0	1		W Scale
W0u6_L1u2_S564_4	600 m	1.2	204 m	204 m	1.8 8	1.8 8	0	0	1		LW Scale
W0u3_L0u5_S565_4	300 m	500	102 m	102 m	1.2 8	1.2 8	0	0	1		LW Scale
W0u3_L1u2_S565_5	300 m	1.2	102 m	102 m	1.2 8	1.2 8	0	0	1		LW Scale
W0u6_L0u35_S564_2	600 m	350	204 m	204 m	1.8 8	1.8 8	0	0	1		LW Scale
W0u3_L0u4_T356_S385 M_3	300 m	400	0	0	0	0	0	0	1		LW Scale
W02u0_L1u2_S563_3	2	1.2	680 m	680 m	4.6 8	4.6 8	0	0	1		LW Scale
W0u6_L0u5_S564_3	600 m	500	204 m	204 m	1.8 8	1.8 8	0	0	1		LW Scale
W05u0_L5u0_S562_5	5	5	1.7	1.7	10. 7	10. 7	0	0	1		LW Scale
W02u0_L3u0_S563_4	2	3	680 m	680 m	4.6 8	4.6 8	0	0	1		LW Scale
W10u0_L0u33_S561_2	10	330 m	3.4	3.4	20. 7	20. 7	0	0	1		Additional
W10u0_L0u3_S561_1	10	300	3.4	3.4	20.	20.	0	0	1		Additional

		m			7	7					al
W0u3_L0u3_S565_1	300 m	300 m	102 m	102 m	1.2 8	1.2 8	0	0	1		Addition al
W10u0_L0u4_S387_1	10	400 m	3.4	3.4	20. 7	20. 7	0	0	1		Addition al
W0u6_L0u33_S564_1	600 m	330 m	204 m	204 m	1.8 8	1.8 8	0	0	1		Addition al
W05u0_L0u33_S562_4	5	330 m	1.7	1.7	10. 7	10. 7	0	0	1		Addition al
W0u15_L0u33_S555_5	150 m	330 m	101 m	101 m	1.3 4	1.3 4	0	0	1		Addition al
W02u0_L0u33_S563_2	2	330 m	680 m	680 m	4.6 8	4.6 8	0	0	1		Addition al
W0u3_L0u33_S565_2	300 m	330 m	102 m	102 m	1.2 8	1.2 8	0	0	1		Addition al

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_S351B_5			1	37.5 K		850		B- High, S/D- Low	BD Area
CJBDperim_S351B_6			1	28.6 K		102K		B- High, S/D- Low	BD Perim
Junction Capacitance Bulk - Source									
CJBSarea_S351B_5			1	0		0		B- High, S/D- Low	BS Area
CJBSperim_S351B_6			1	0		0		B- High, S/D-	BS Perim

								Low	
Oxide Capacitance									
Cox_S342K_4	160	250	1					B-High, G-Low	Oxide
Overlap Capacitance									
Cgds1_S351B_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_S351B_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_S351B_10	400	10	40	79.8	79.8	436	436	G-High, S/D-Low, B+Sub-GND	Overlap 1 GDS
Cgdsb2_S351B_10	400	10	40	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 = 400.0n, NF = 1

	Slow			Typic.			Fast		
	Target	Sim.	Error [%]	Target	Sim.	Error [%]	Target	Sim.	Error [%]
VT	-710m	- 706m	0.59	-650m	- 656m	-0.88	-590m	- 594m	-0.67
Ron*W	-	-	-	4.8	4.75	-0.96	-	-	-
Ion/W	-190	-190	0	-235	-236	-0.24	-280	-281	-0.24
log(Ioff/W)	-13.5	-12.9	2.7	-12.5	-12.7	2.21	-11.5	-12.3	2.06

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

	Slow			Typic.			Fast		
	Target	Sim.	Error [%]	Target	Sim.	Error [%]	Target	Sim.	Error [%]
VT	-740m	-739m	0.19	-690m	-688m	0.28	-640m	-637m	0.43
Ion/W	-7.4	-7.37	0.37	-8	-7.98	0.31	-8.6	-8.61	0

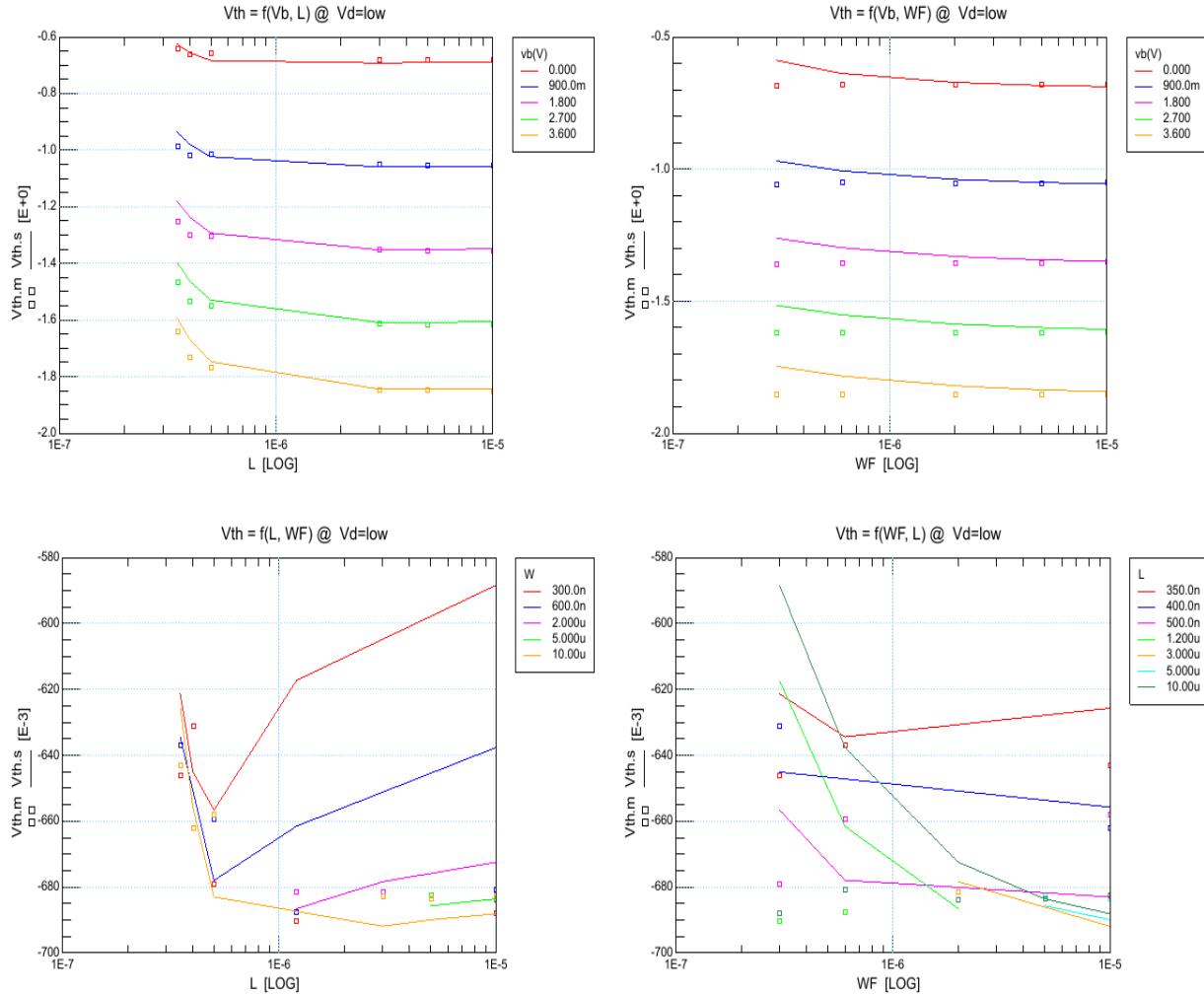
3.1.3 W = 300.0n, L = 400.0n, NF = 1

	Slow			Typic.			Fast		
	Target	Sim.	Error [%]	Target	Sim.	Error [%]	Target	Sim.	Error [%]
VT	-720m	-719m	0	-640m	-645m	-0.79	-560m	-563m	-0.55
Ion/W	-220	-221	-0.32	-265	-264	0.23	-310	-311	-0.43

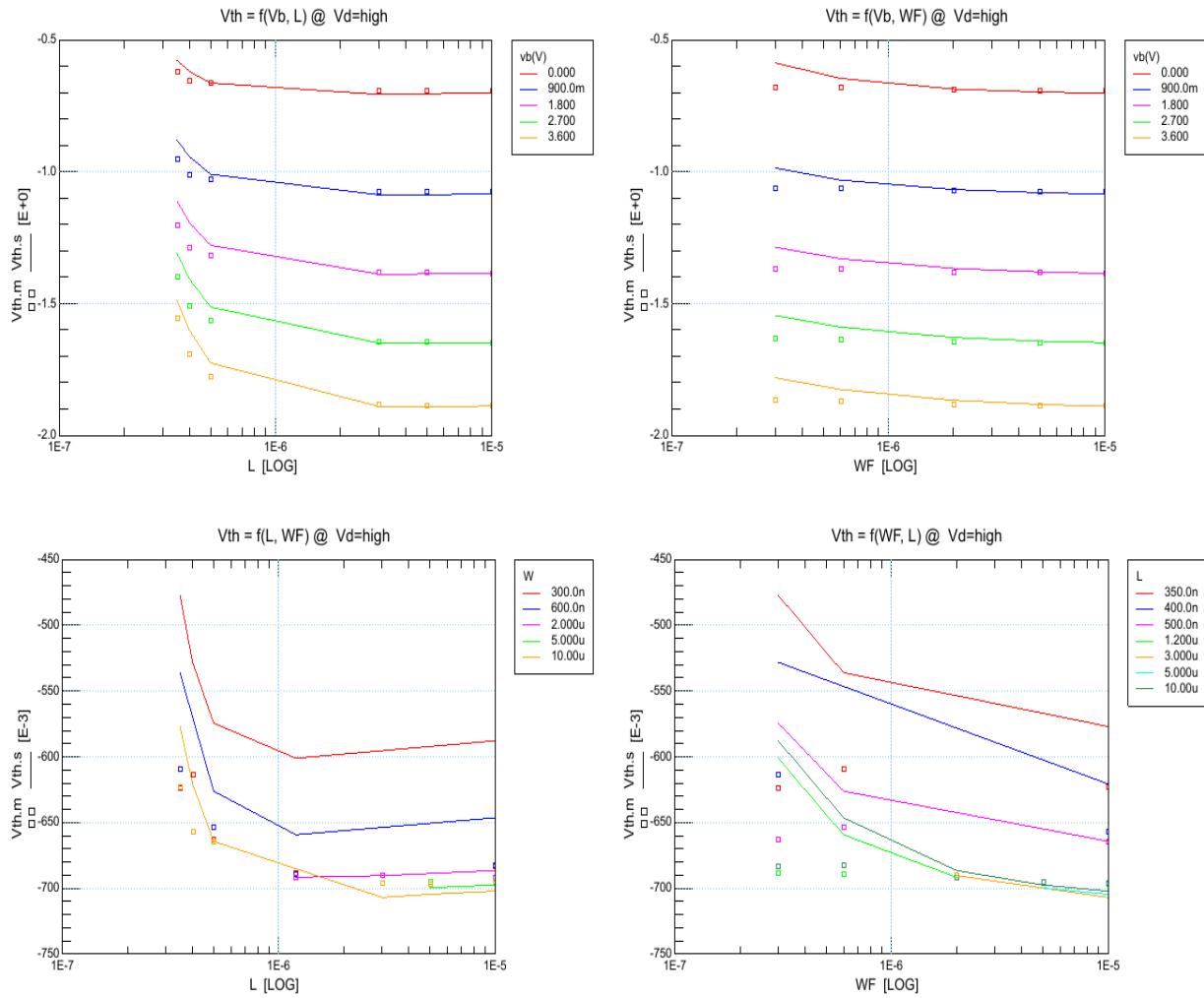
4 DC Transistors

4.1 Summarized Results

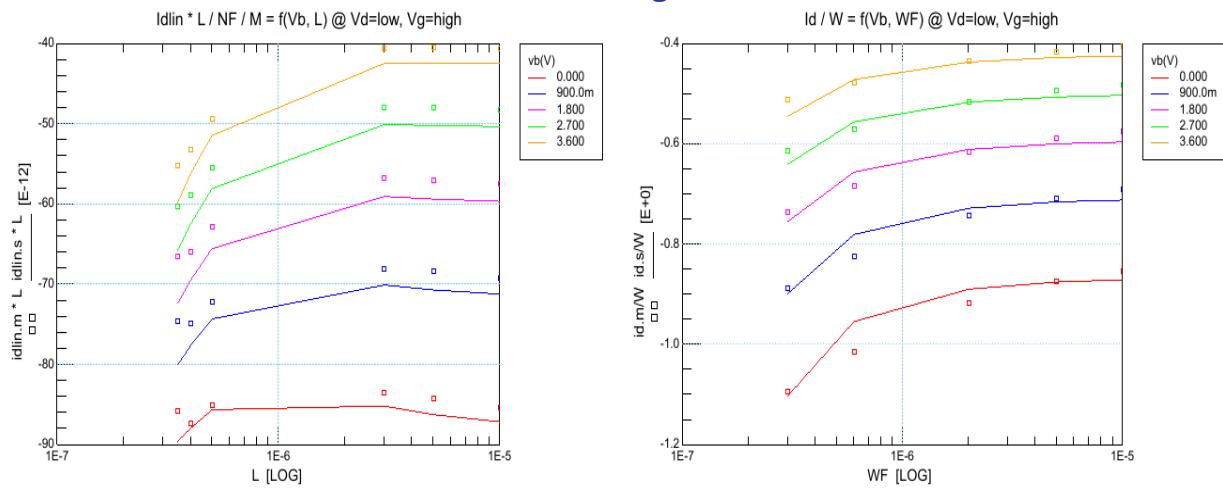
4.1.1 Threshold Voltage Linear Region

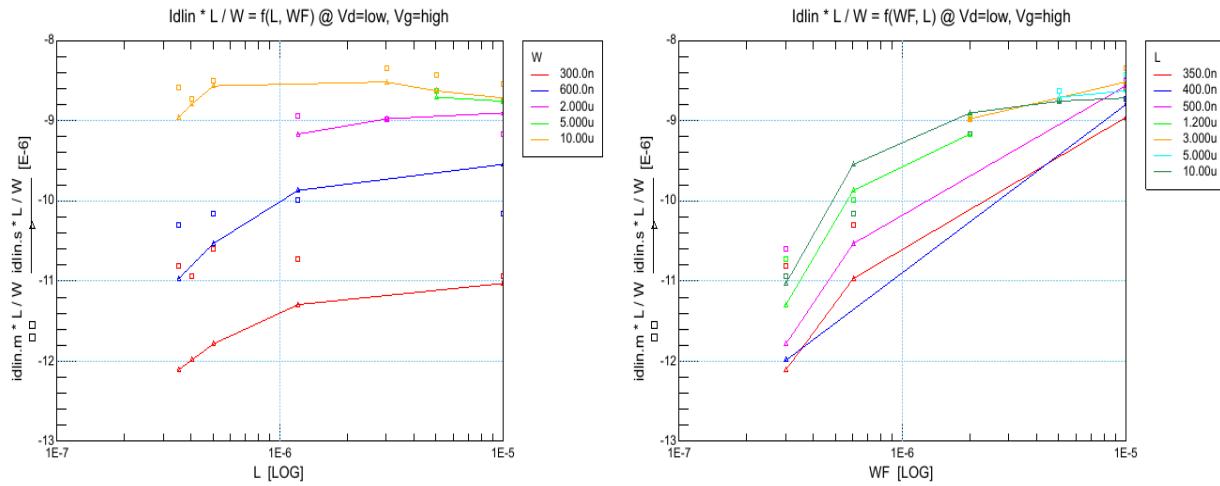


4.1.2 Threshold Voltage in Saturation

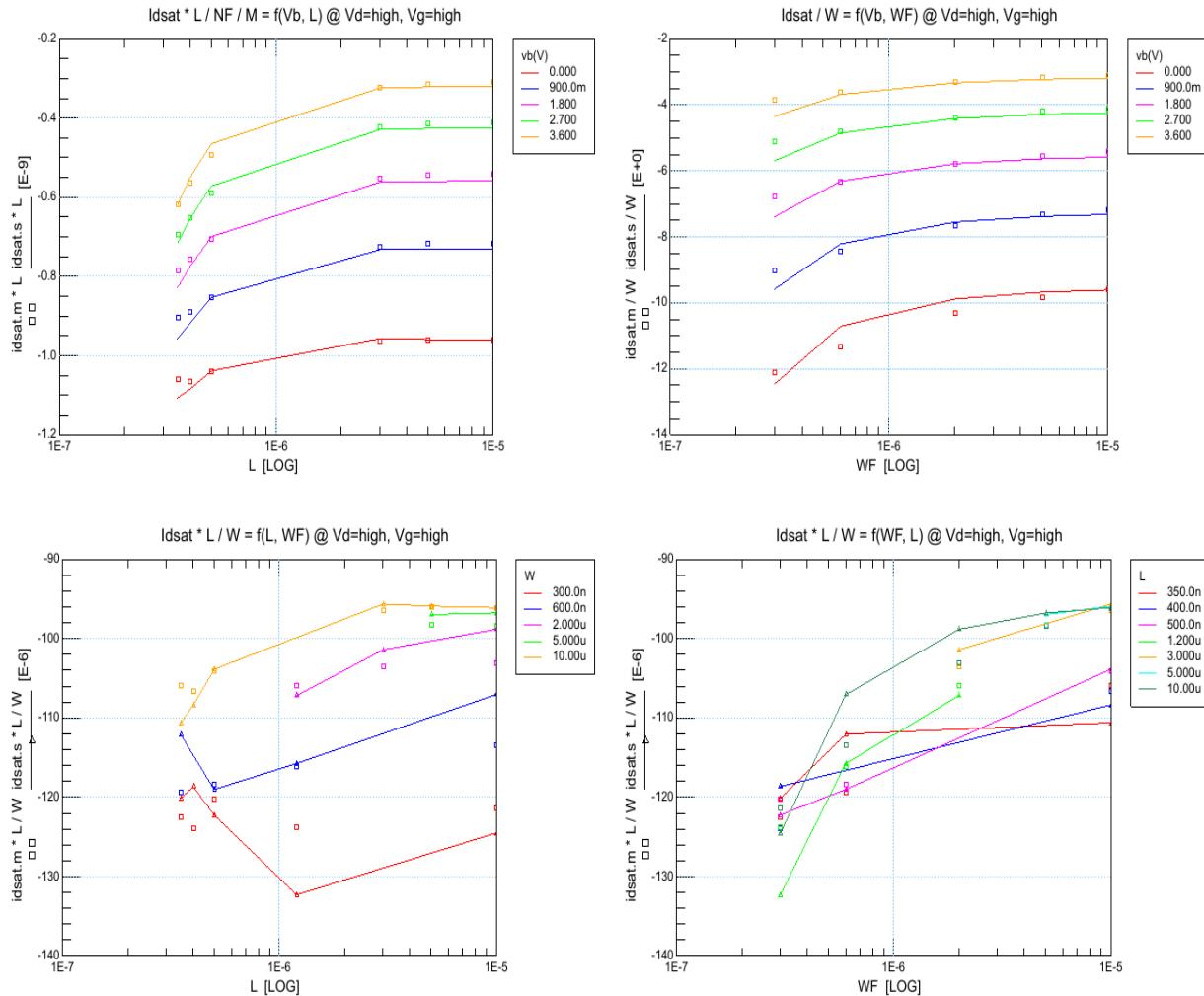


4.1.3 Maximum Drain Current in Linear Region



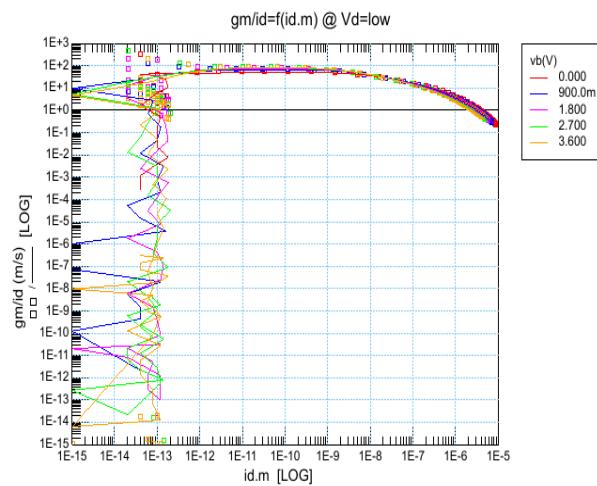
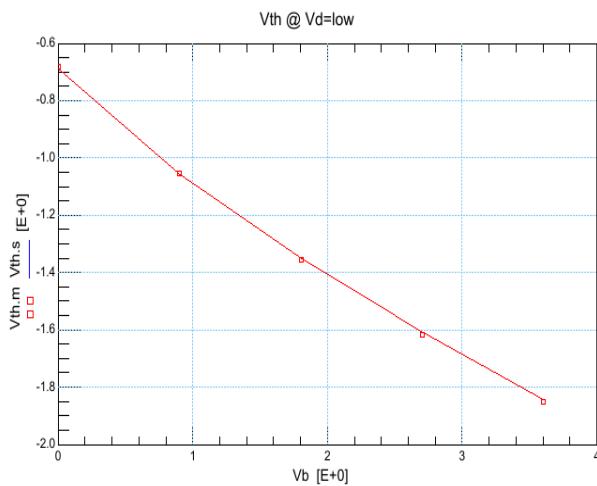
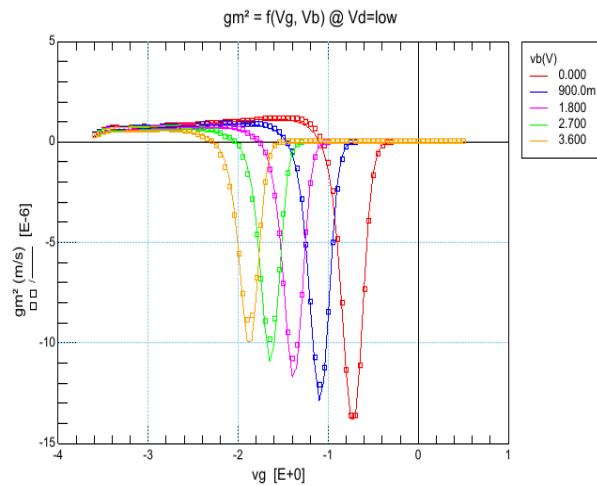
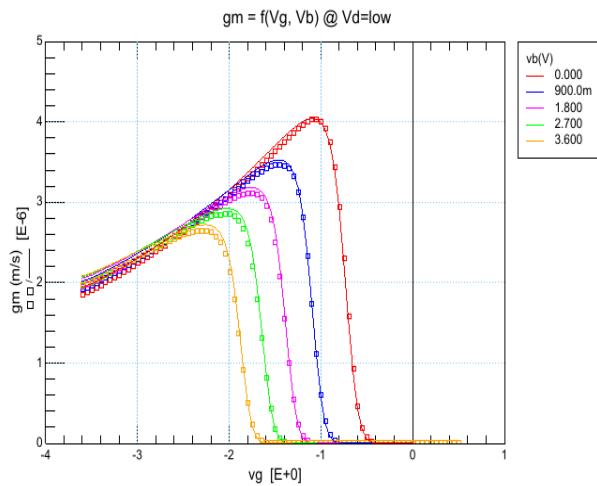
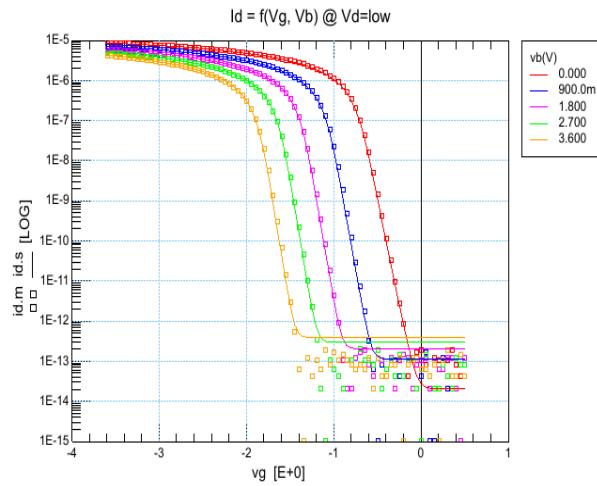
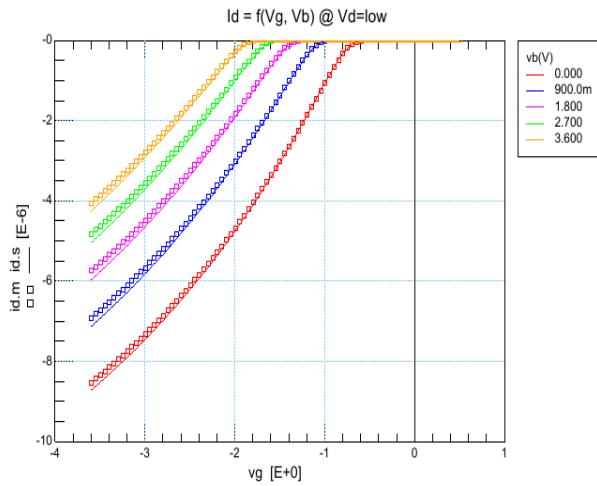


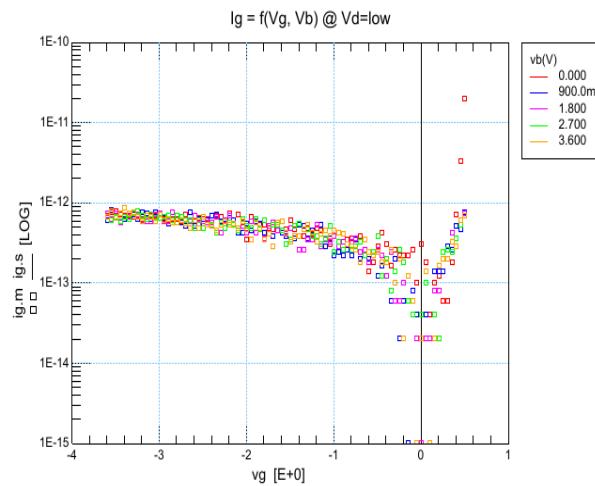
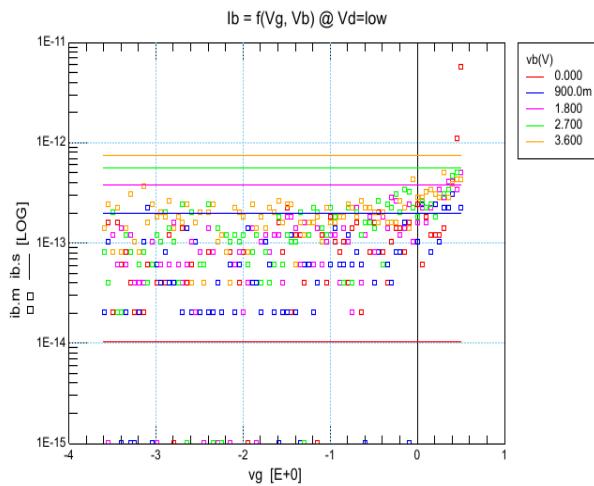
4.1.4 Maximum Drain Current in Saturation Region



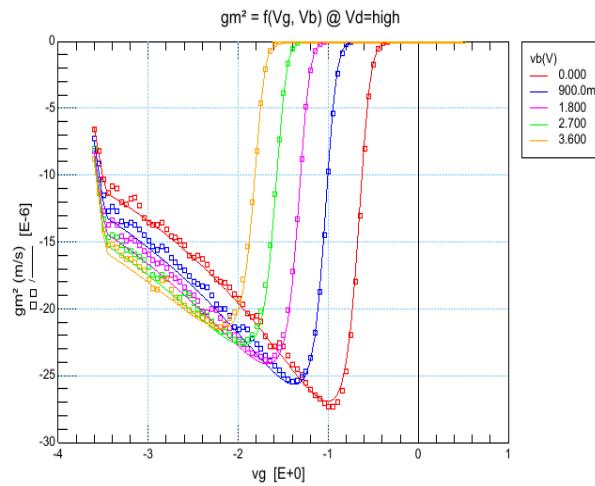
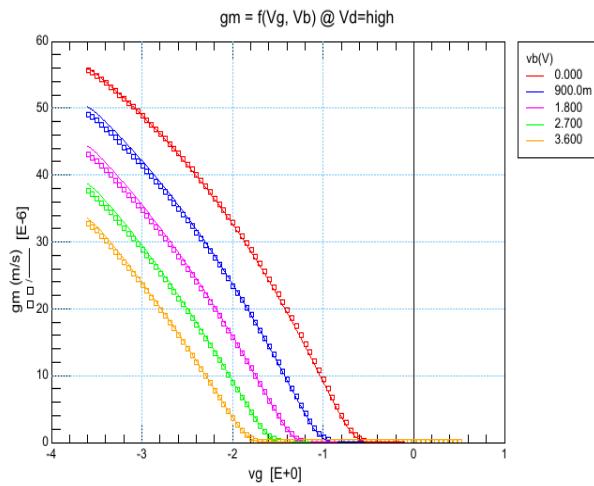
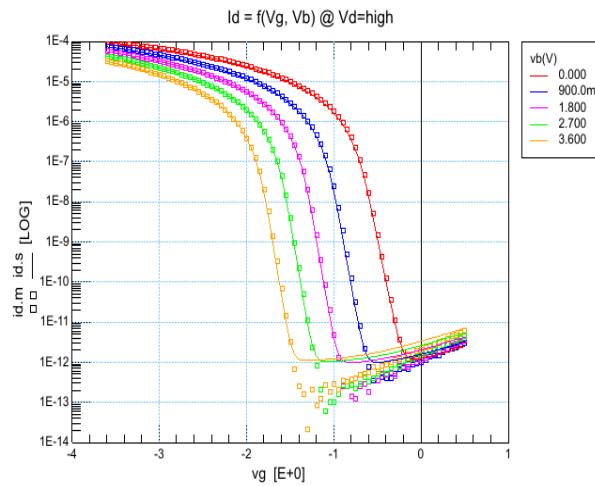
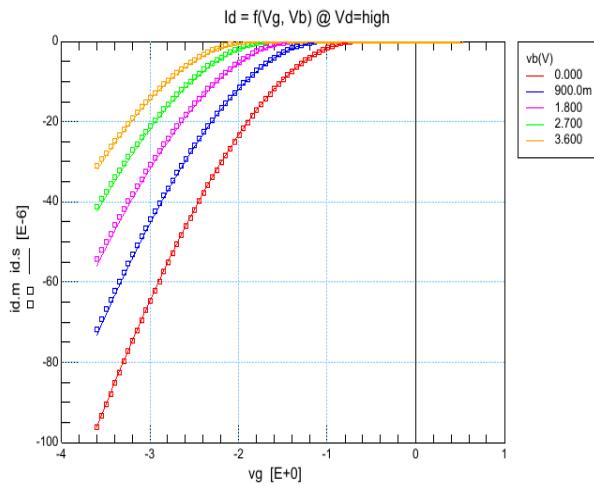
4.2 W10u0_L10u0_S562_3

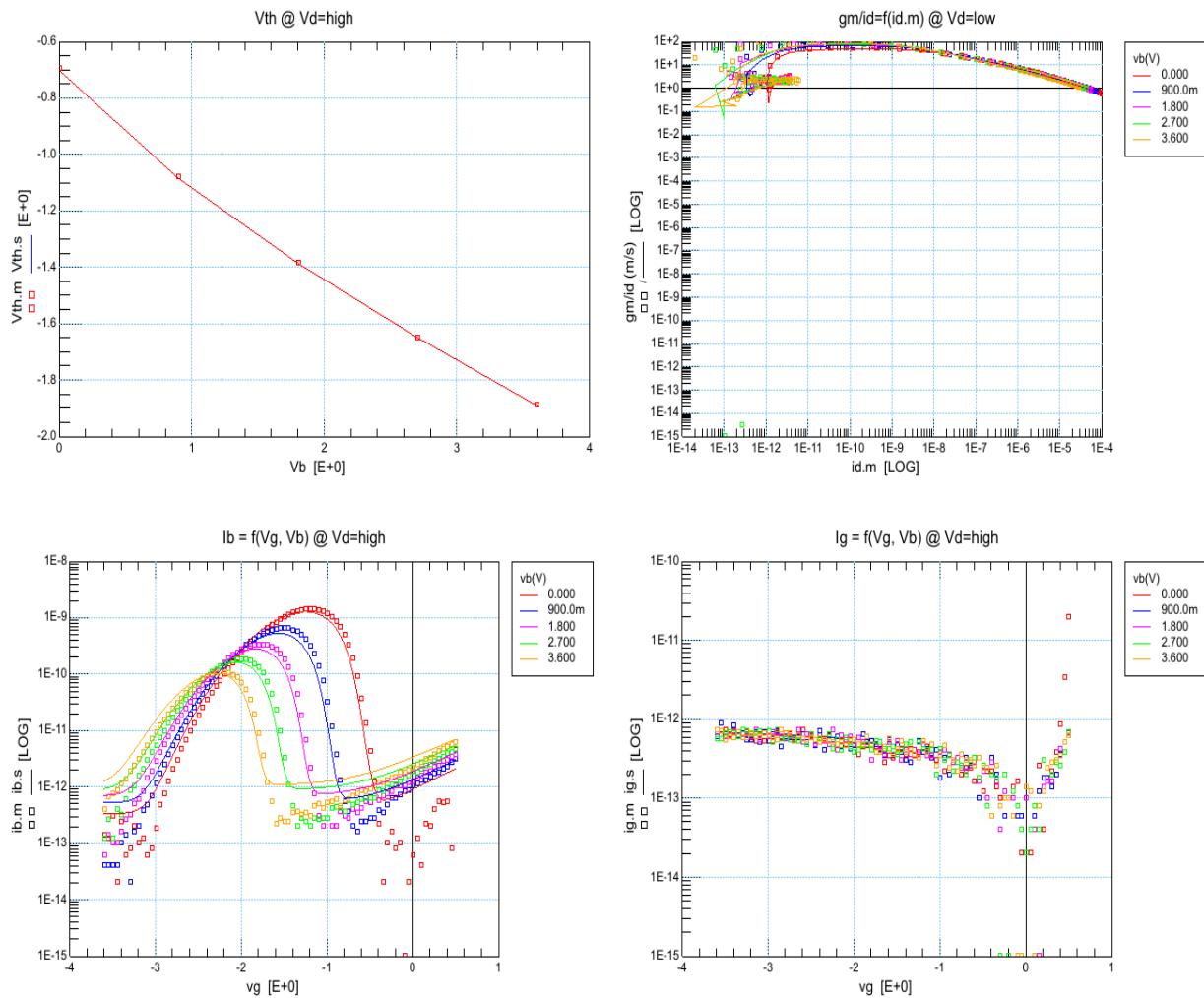
$idvg$, $Vd = -0.1V$, $T = 27^\circ C$



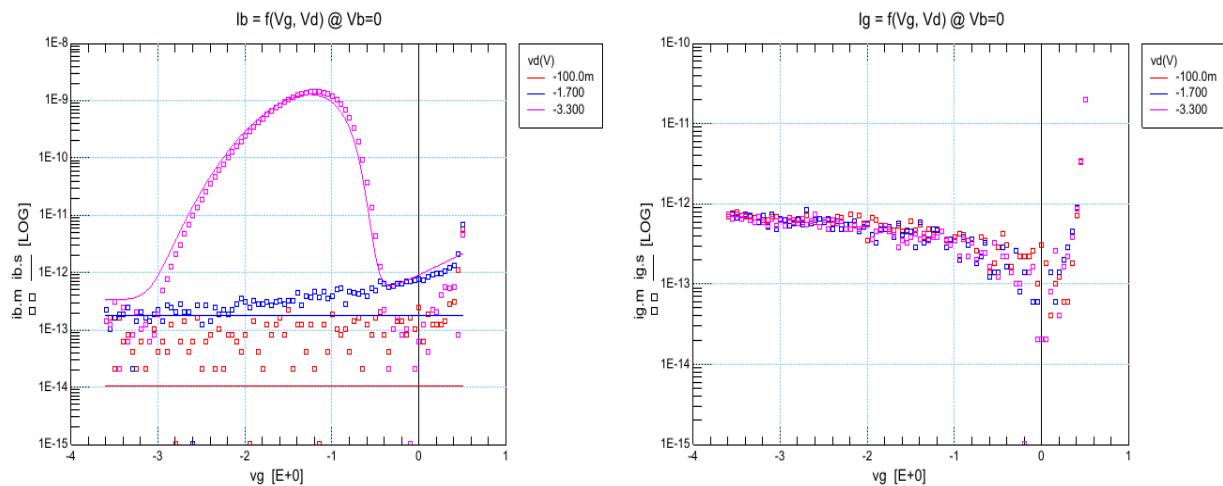


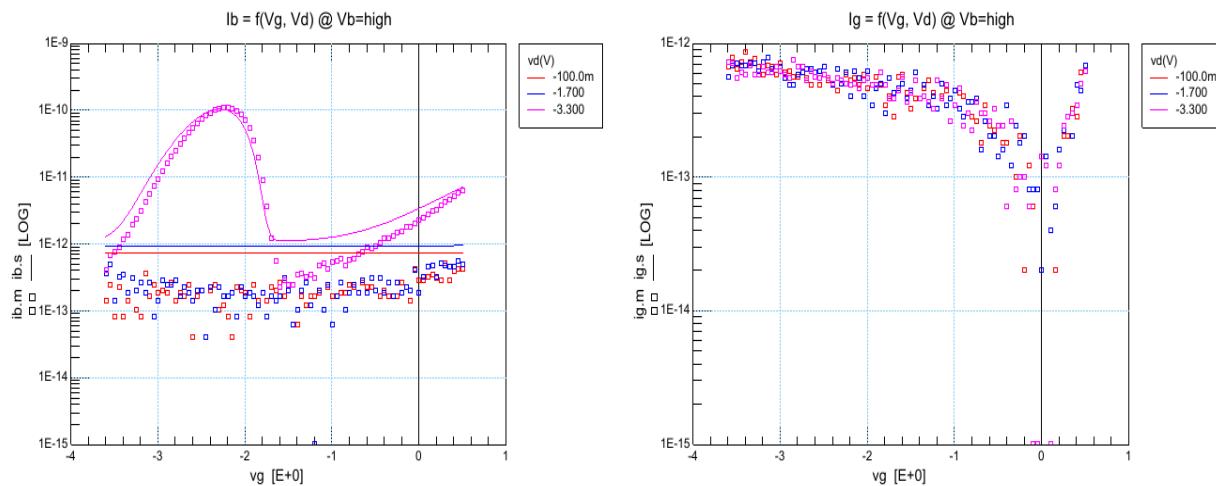
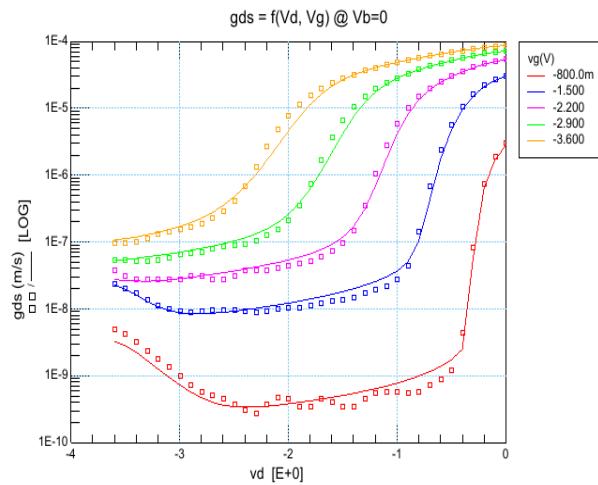
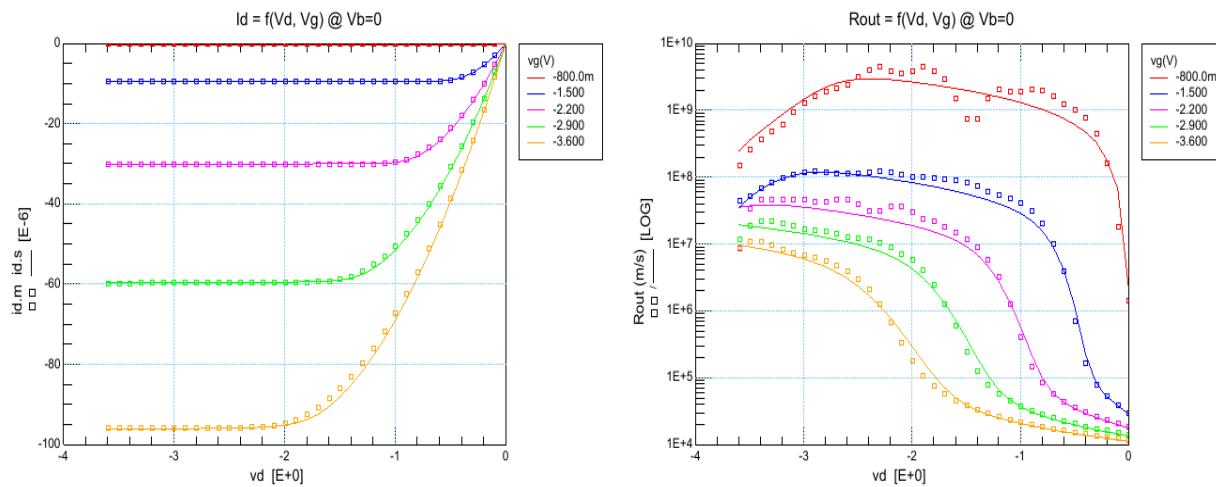
$idvg, Vd = -3.3V, T = 27^\circ\text{C}$

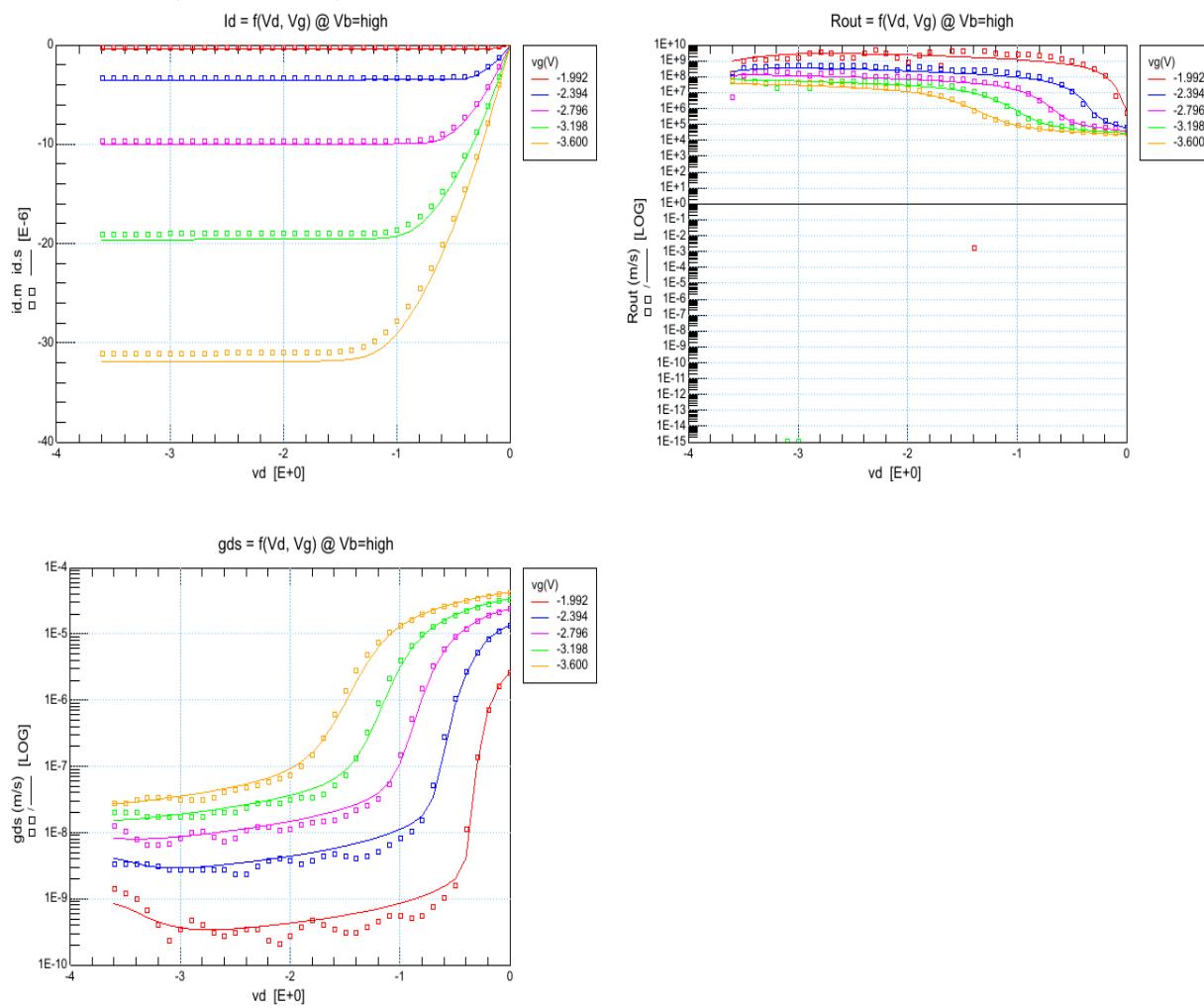
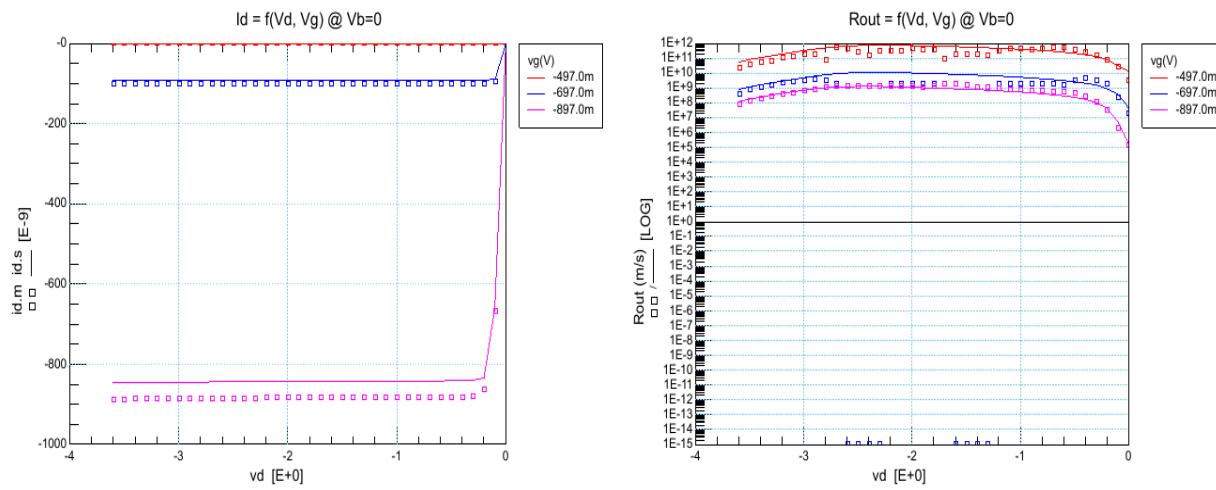


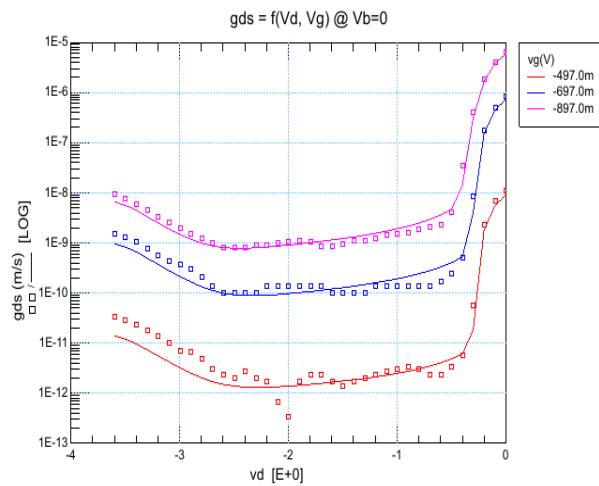


idvg, Ib,Ig, Vb = 0V, T = 27°C

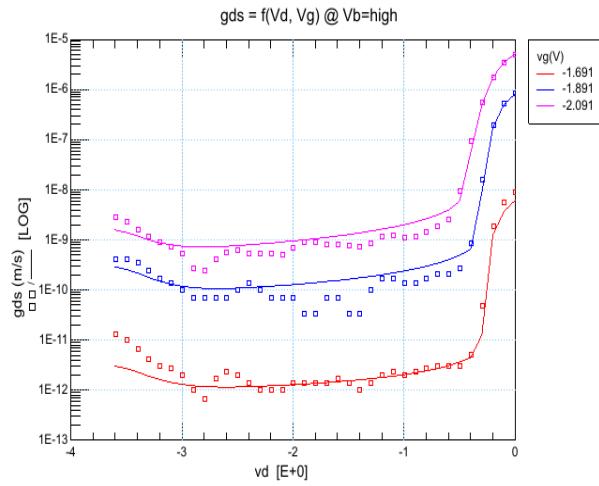
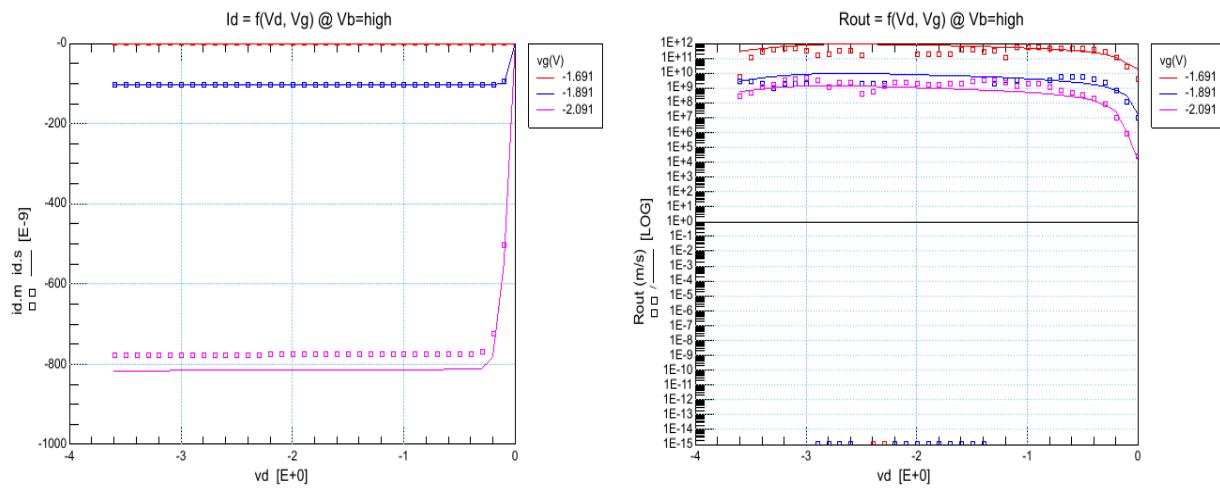


idvg, Ib,Ig, Vb = 3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


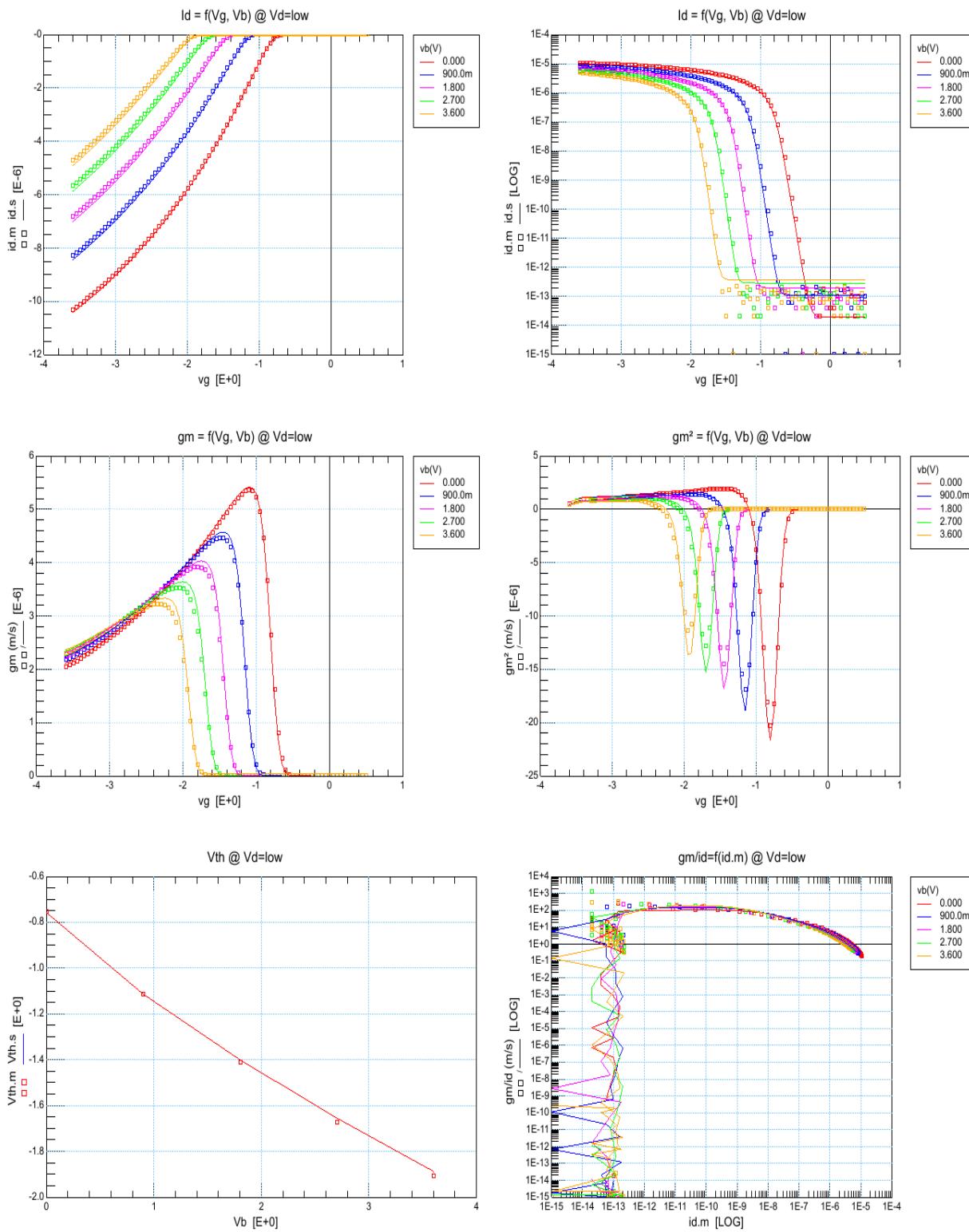
idvd_vbmin, Vb = 3.6V, T = 27°C**idvd_vth, Vb = 0V, T = 27°C**

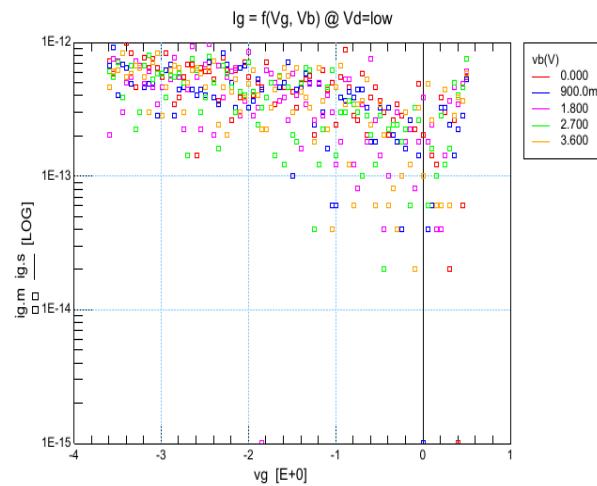
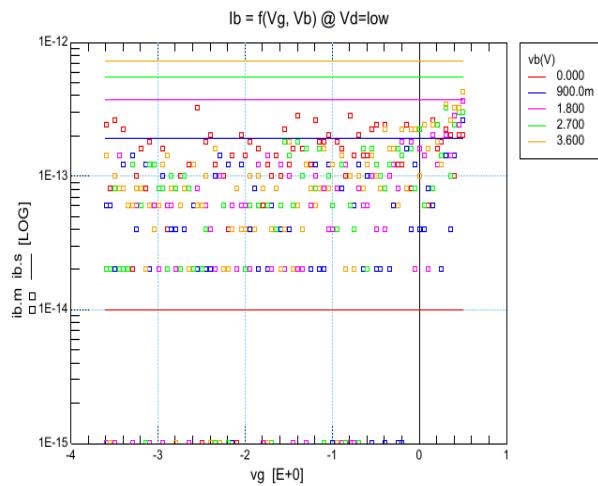


idvd_vth_vbmin, Vb = 3.6V, T = 27°C

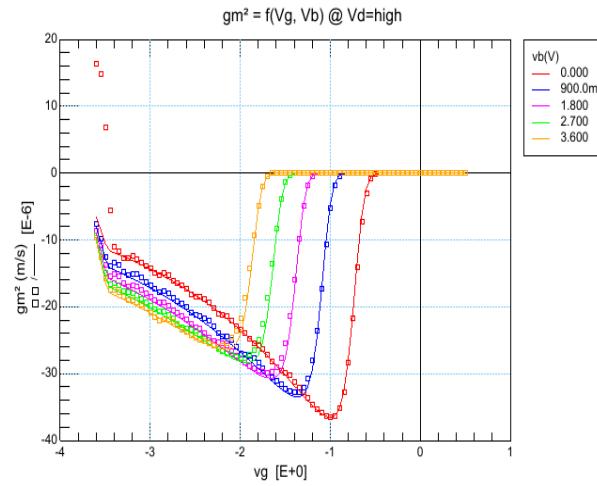
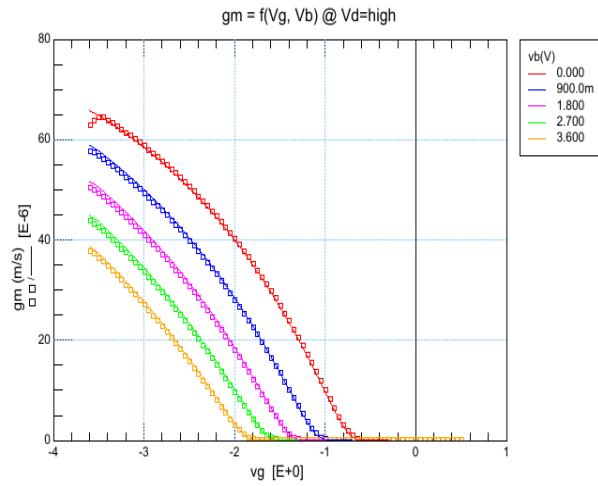
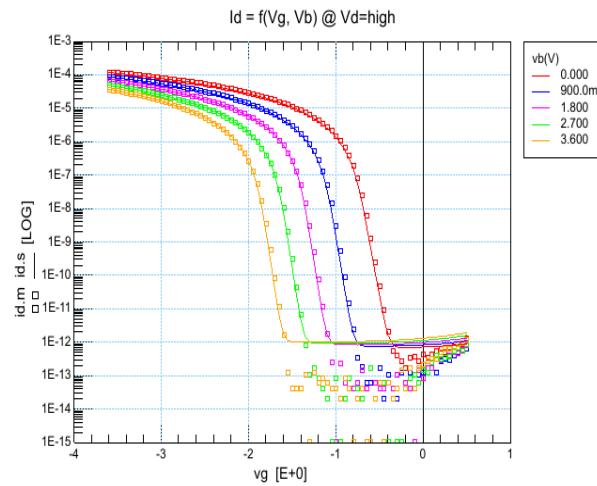
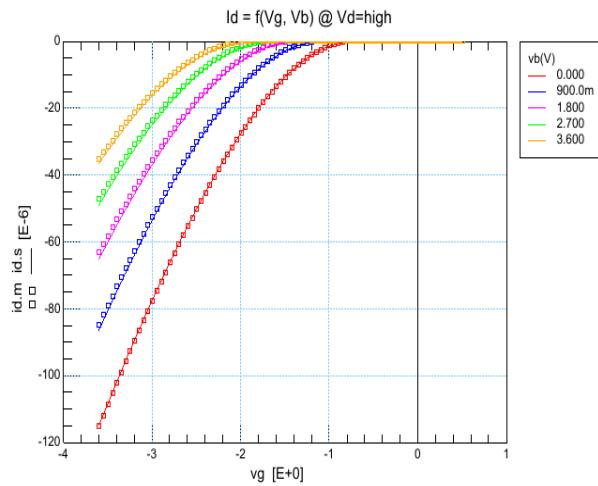


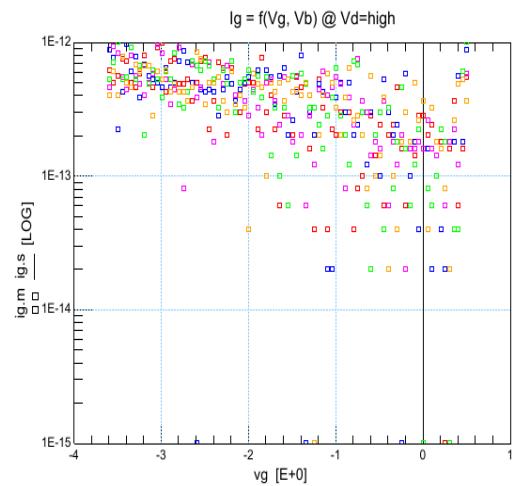
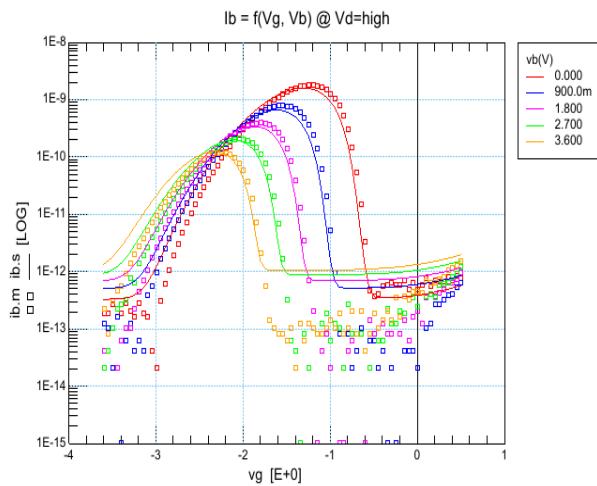
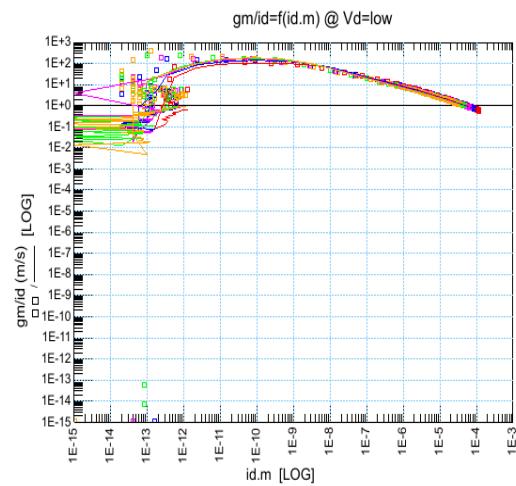
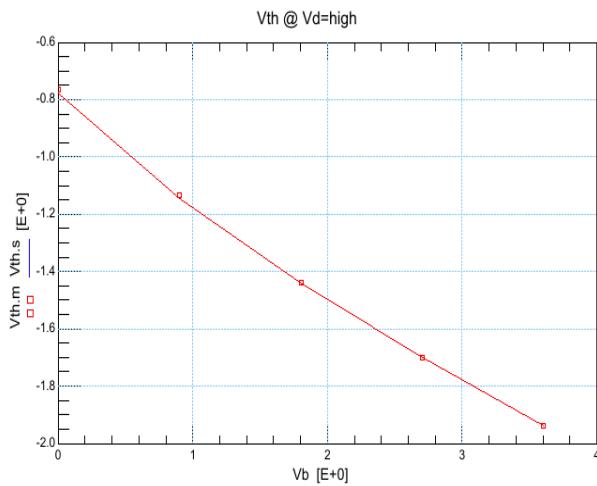
$idvg$, $Vd = -0.1V$, $T = -40^{\circ}C$



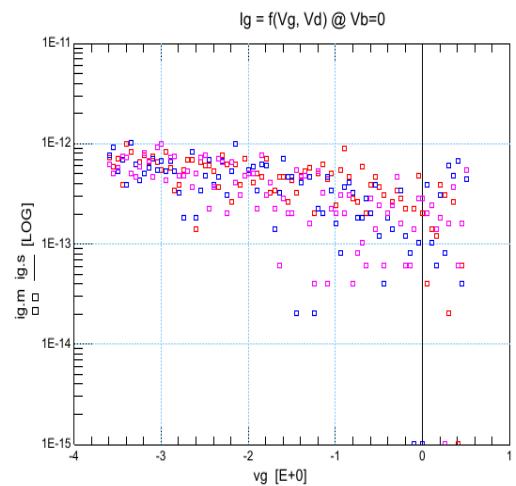
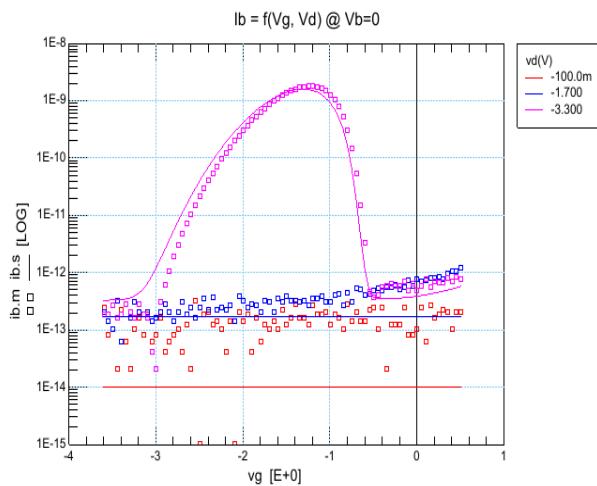


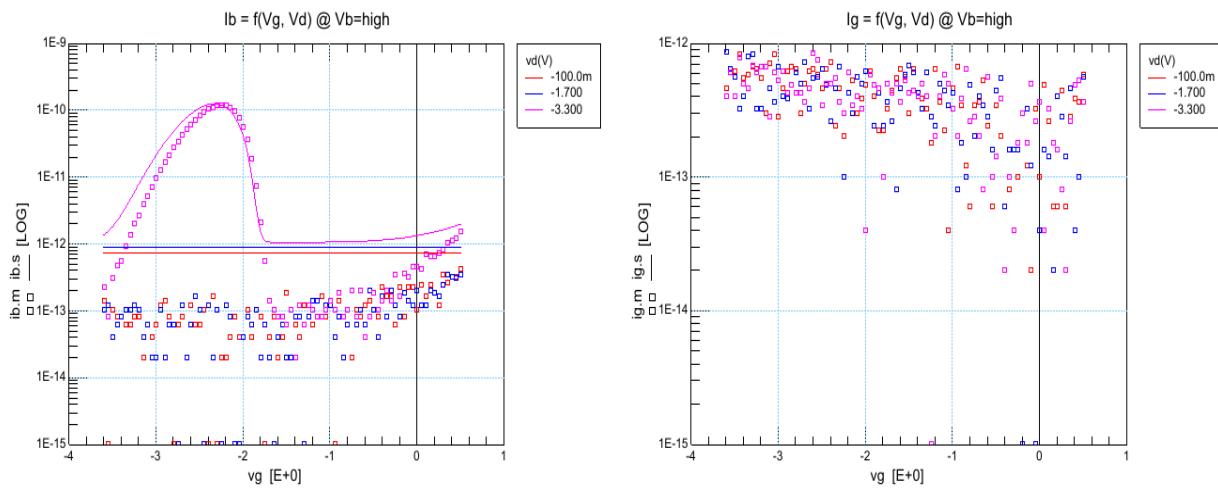
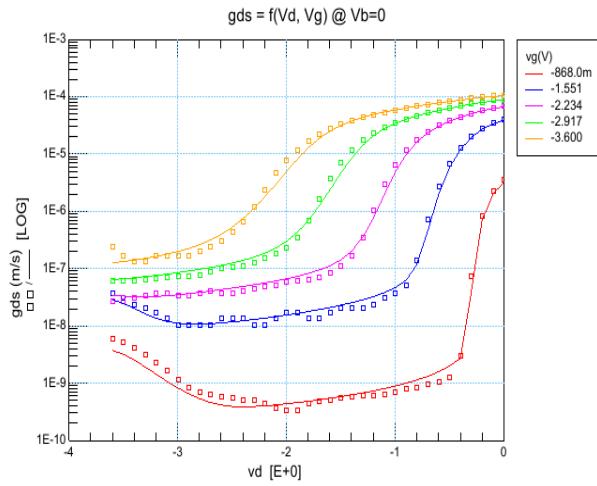
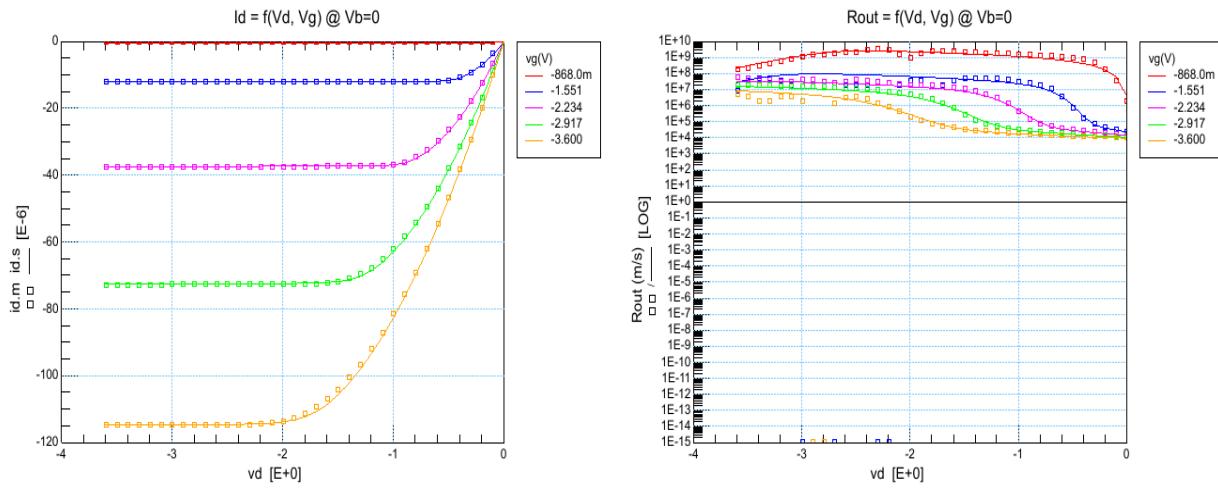
$i_{dvg}, V_d = -3.3V, T = -40^\circ\text{C}$

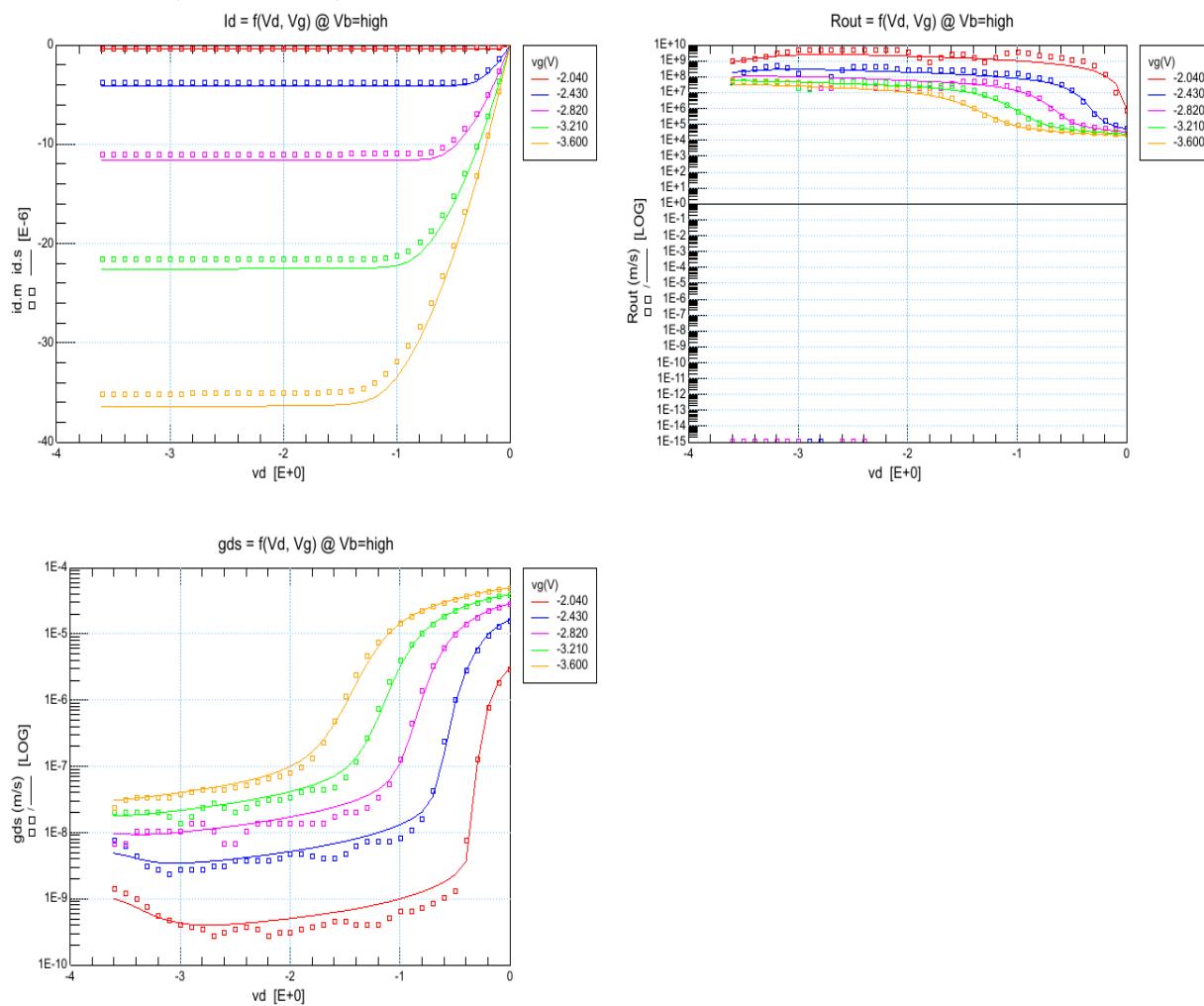
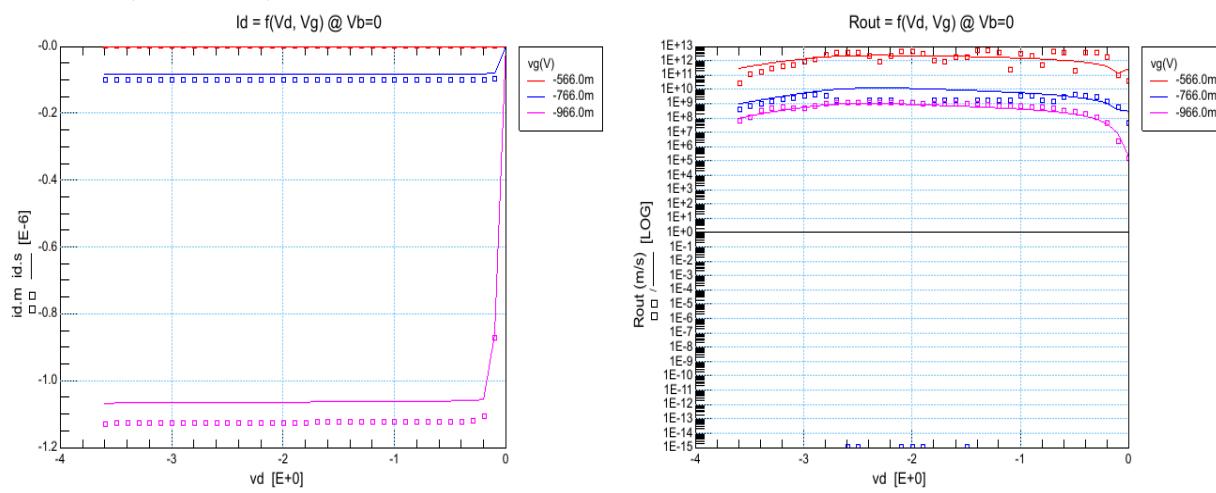


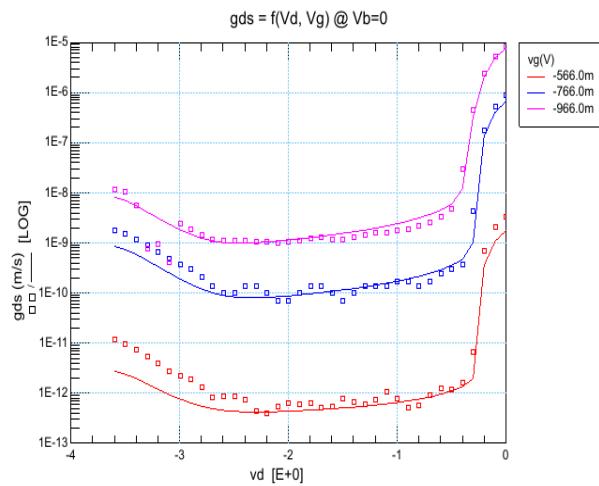


idvg, lb, lg, Vb = 0V, T = -40°C

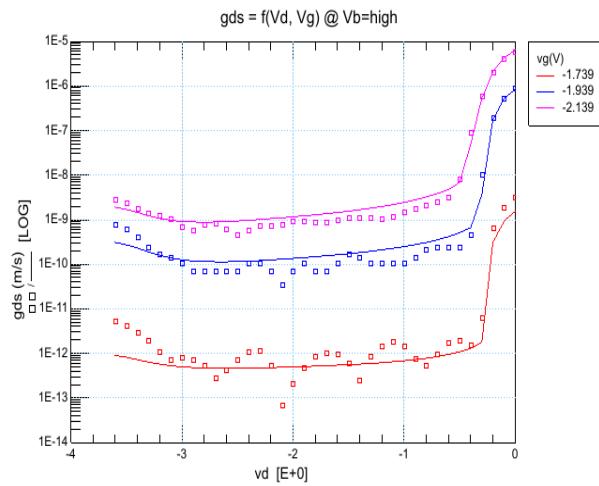
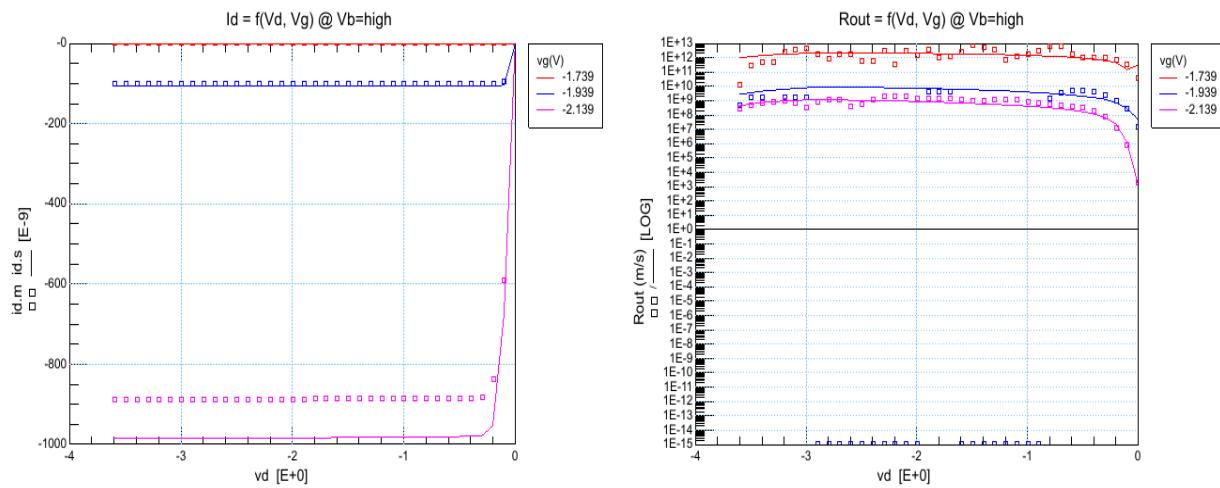


idvg, Ib,Ig, Vb = 3.6V, T = -40°C

idvd, Vb = 0V, T = -40°C


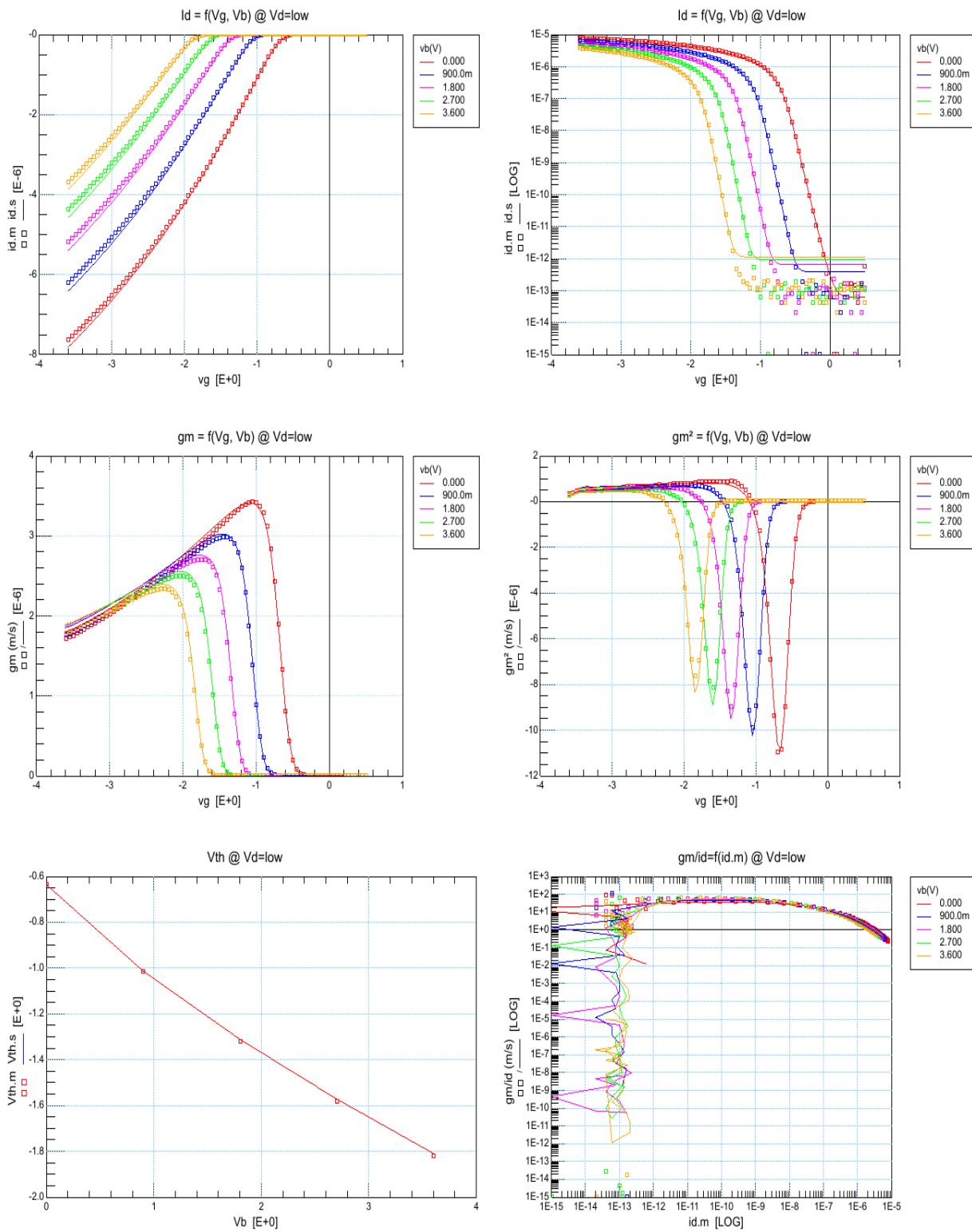
idvd_vbmin, Vb = 3.6V, T = -40°C**idvd_vth, Vb = 0V, T = -40°C**

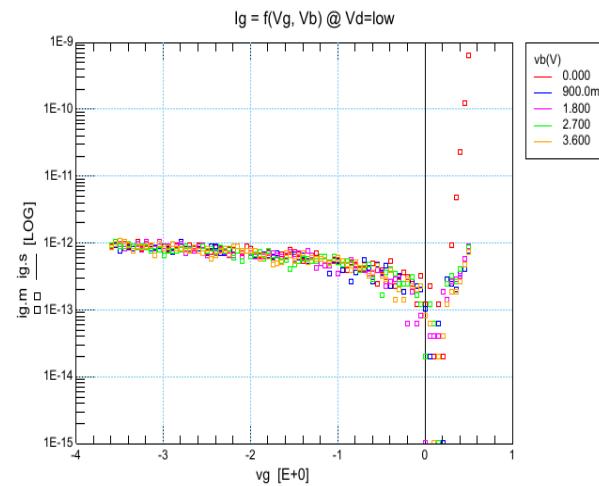
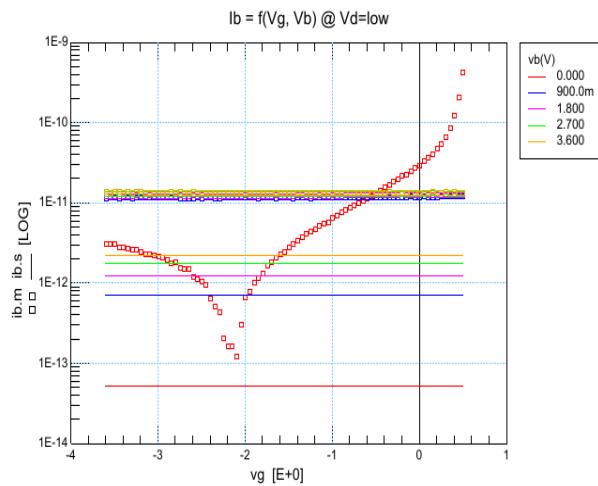


idvd_vth_vbmin, Vb = 3.6V, T = -40°C

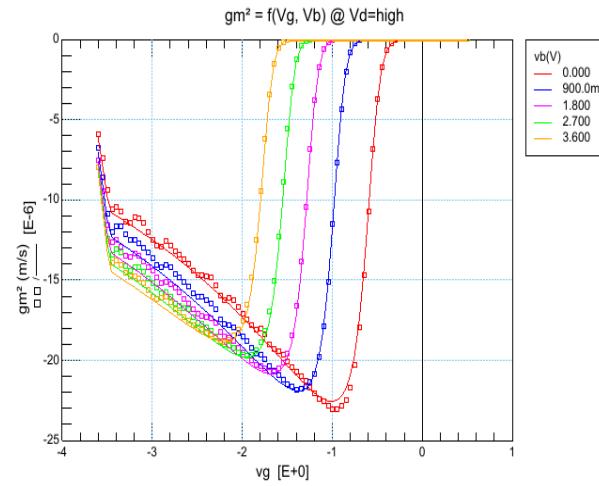
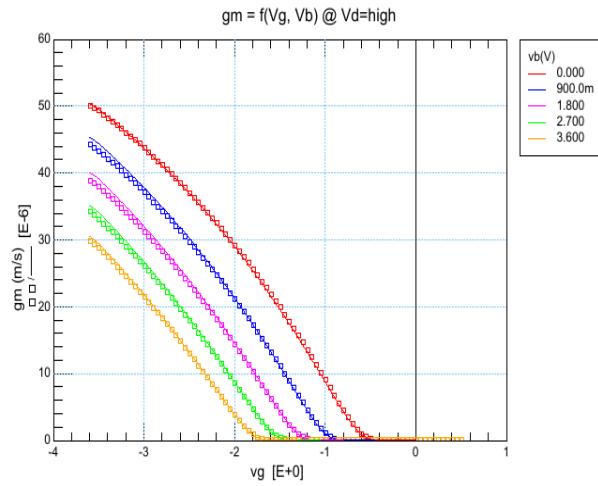
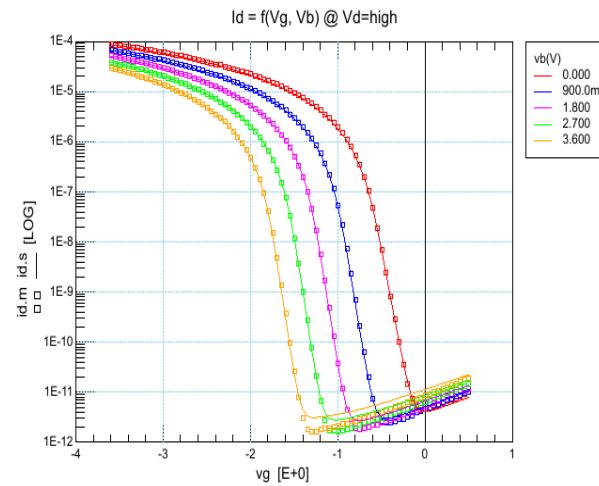
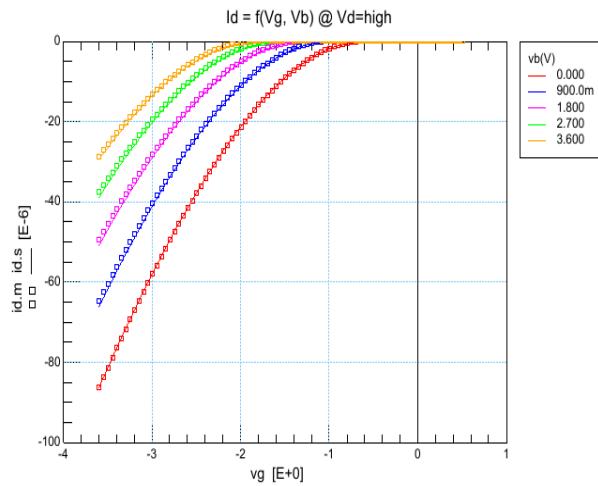


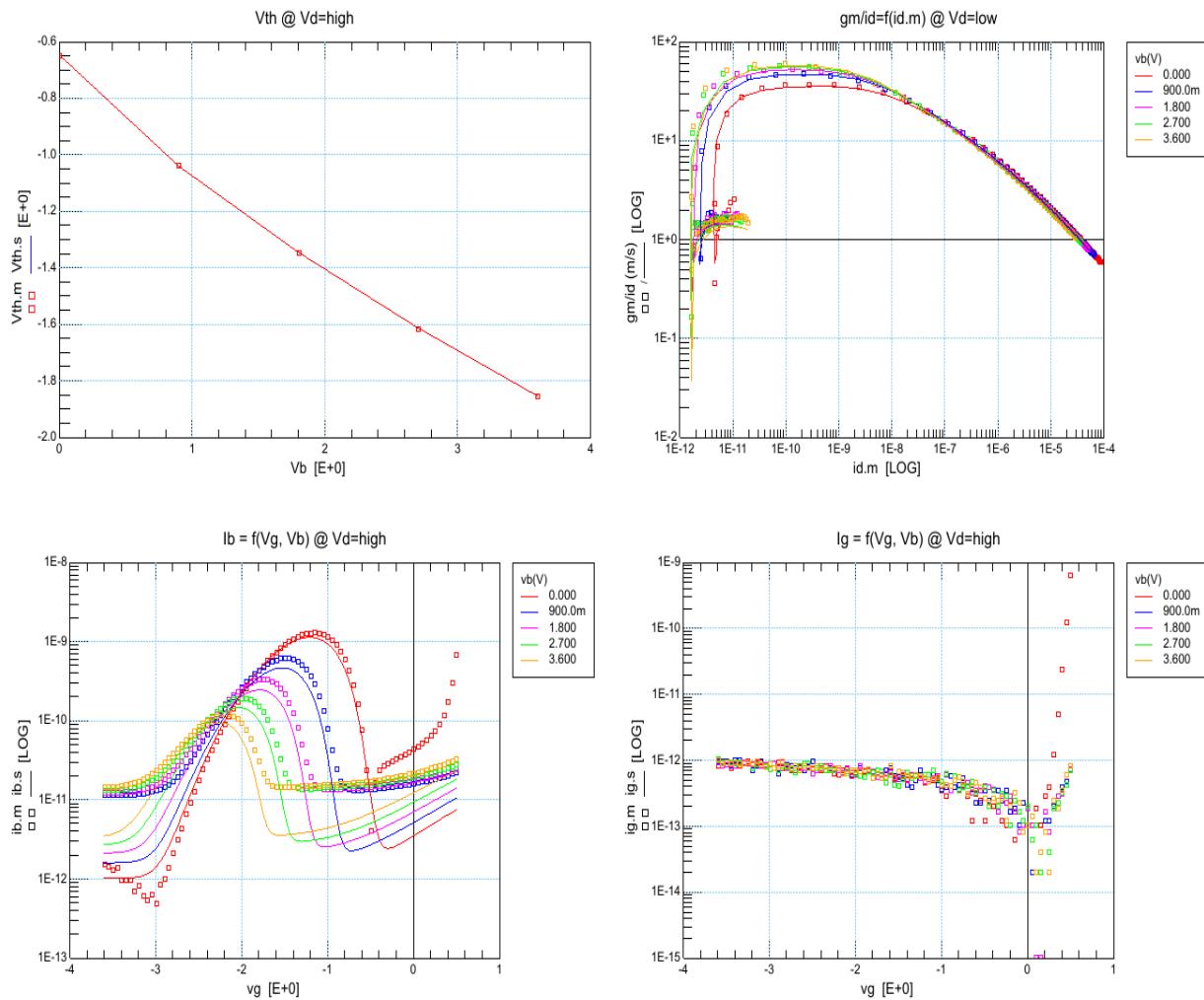
idvg, Vd = -0.1V, T = 70°C



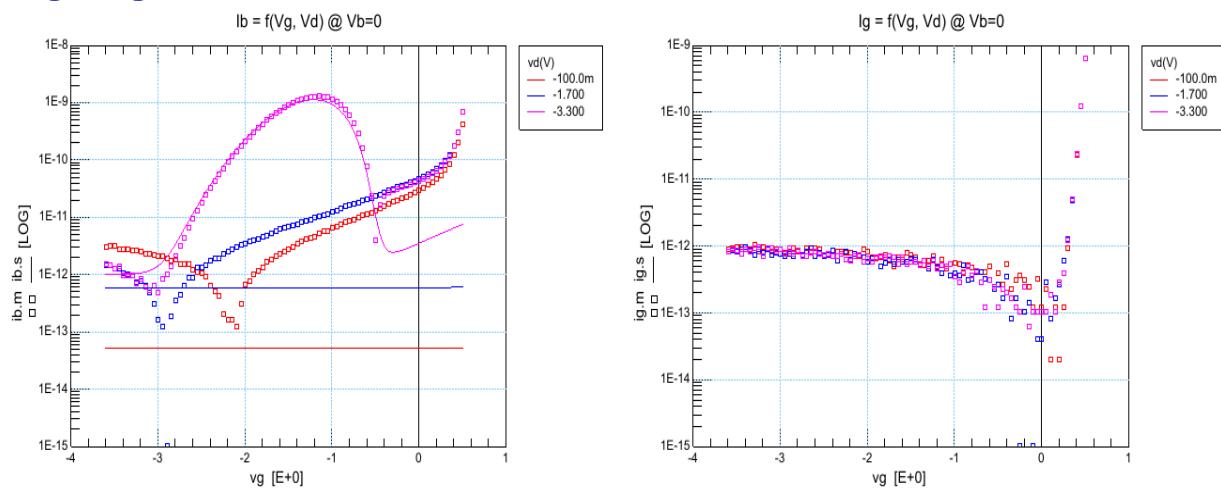


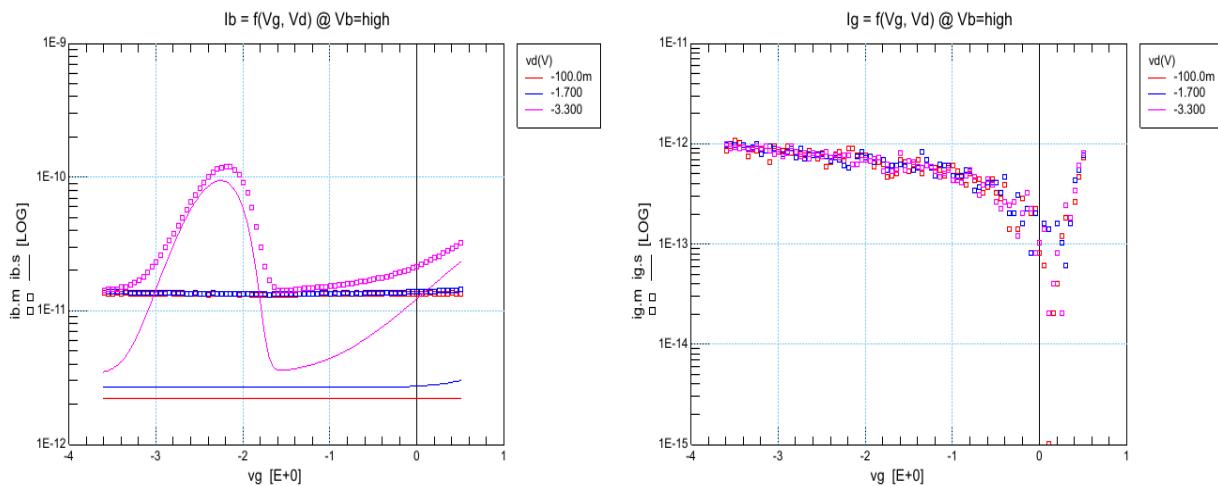
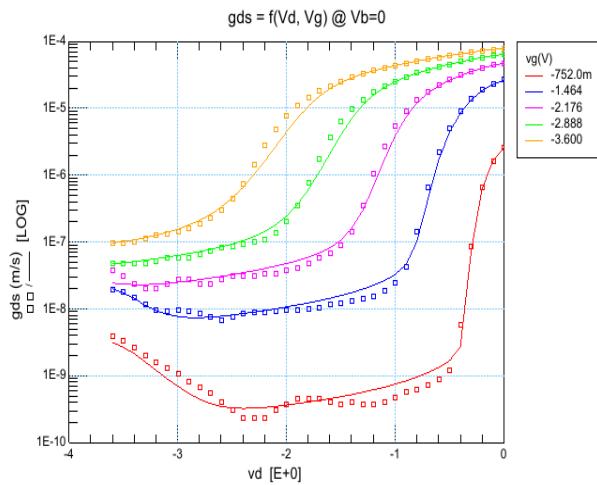
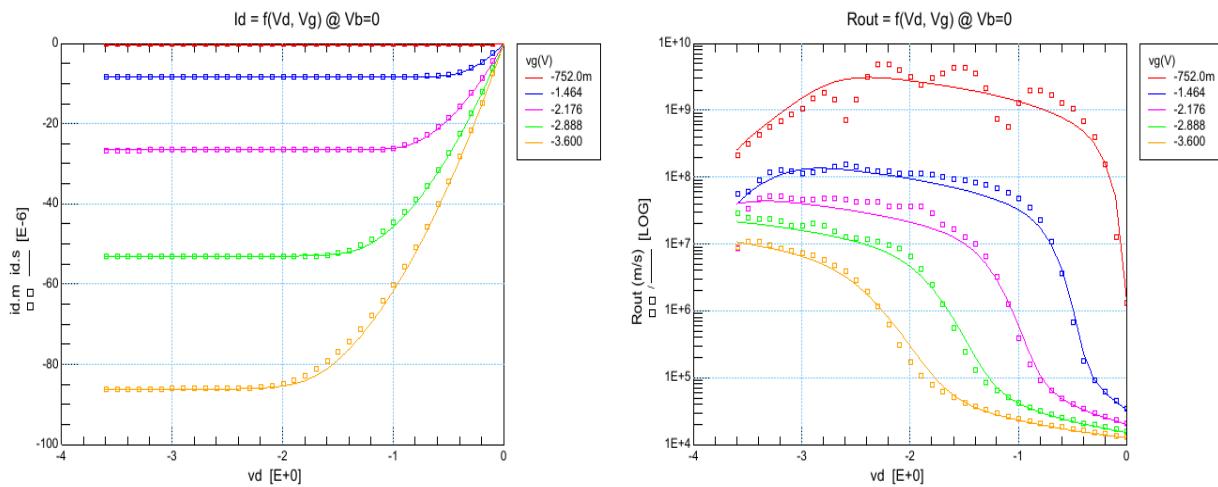
$i_{dvg}, V_d = -3.3V, T = 70^\circ\text{C}$

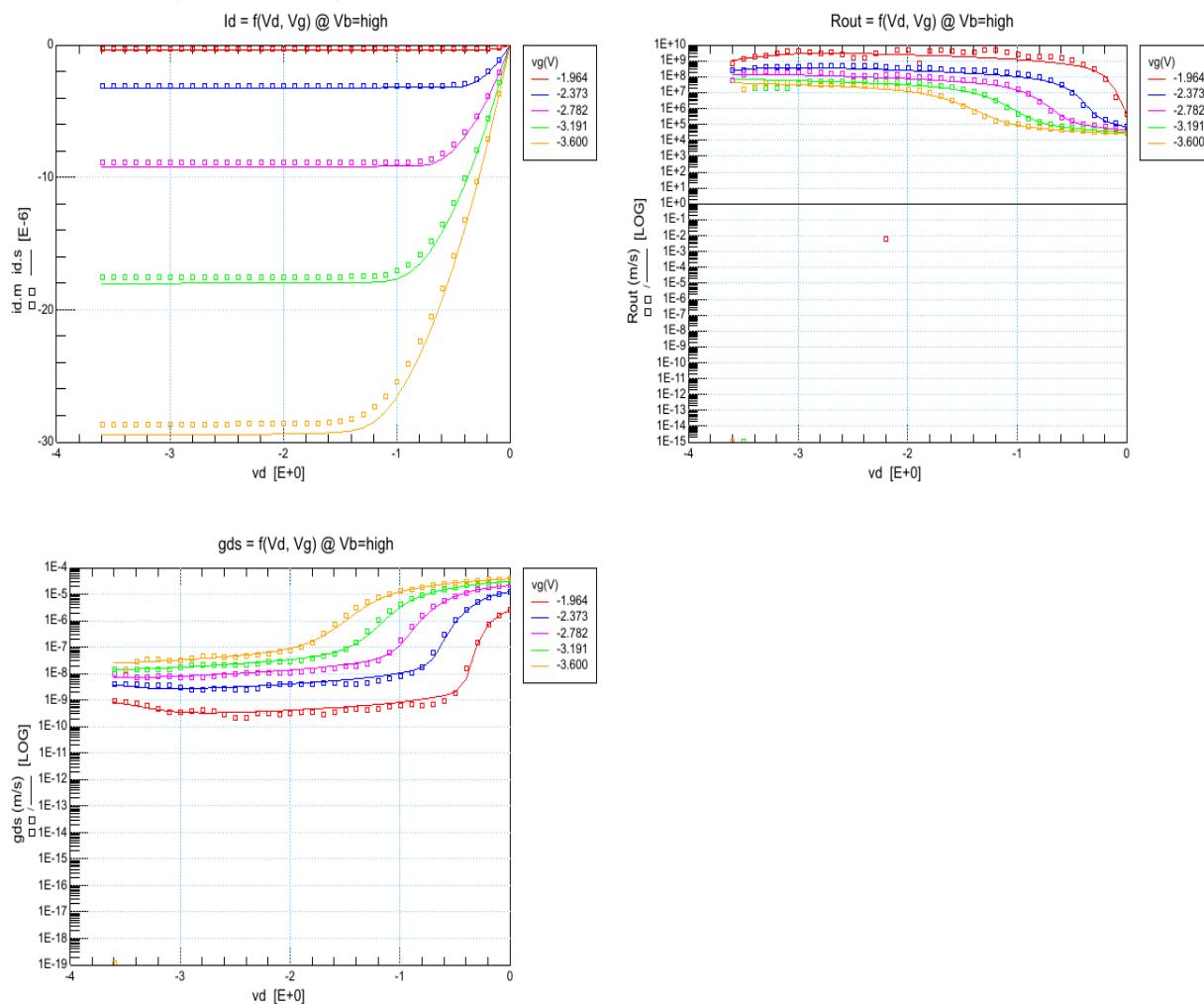
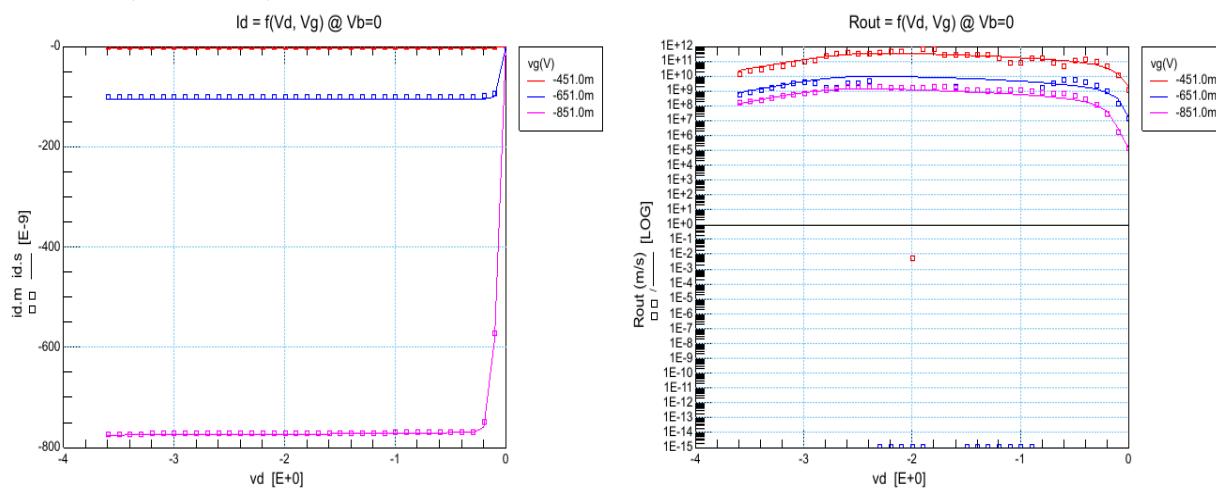


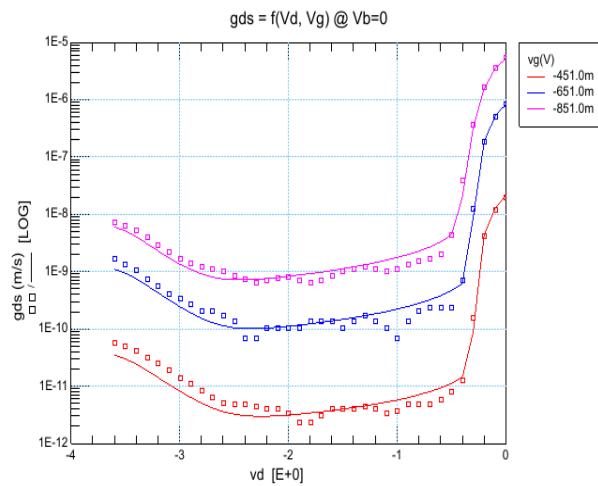


$idvg, Ib, Ig, Vb = 0V, T = 70^\circ C$

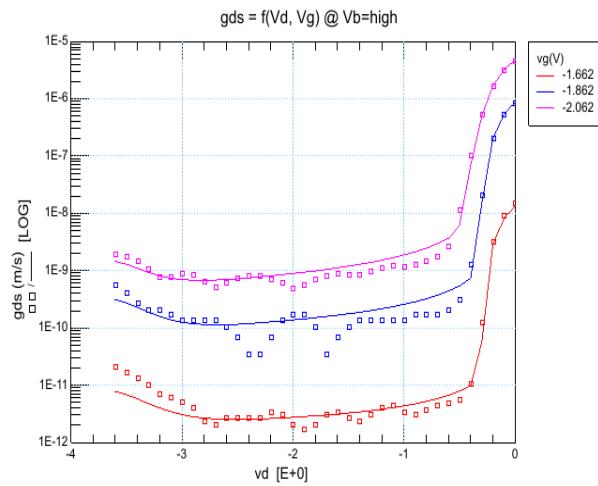
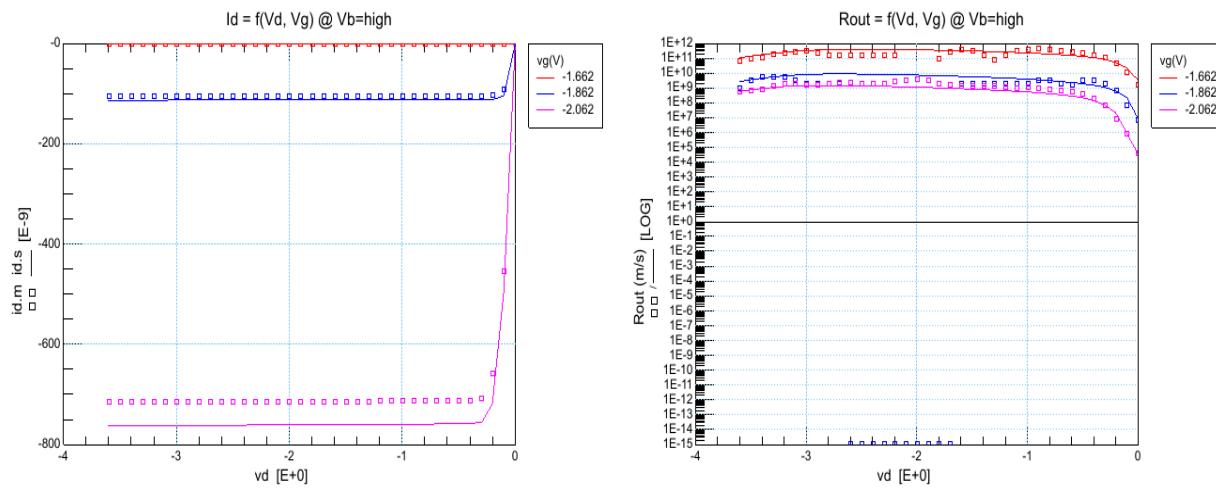


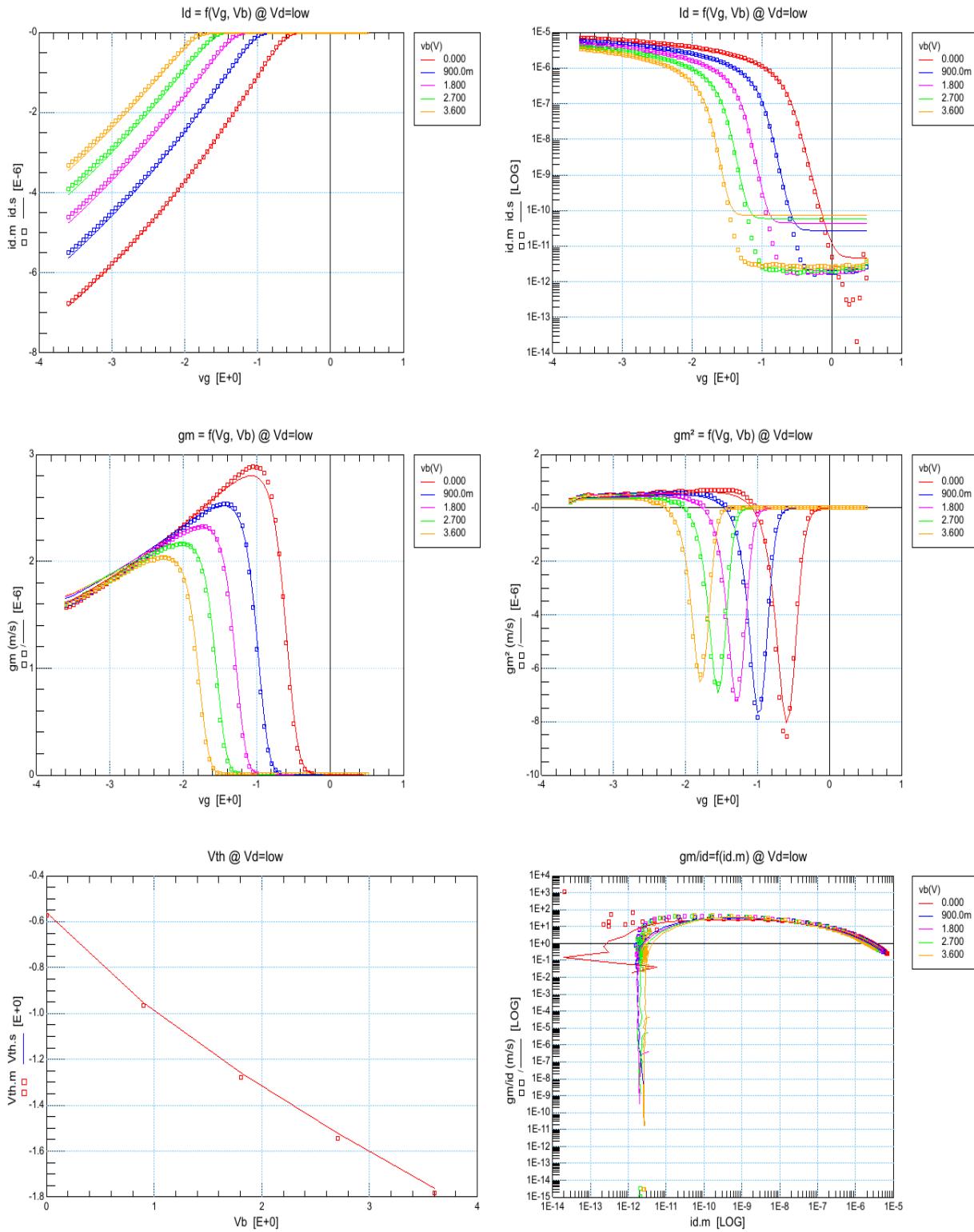
idvg, Ib,Ig, Vb = 3.6V, T = 70°C

idvd, Vb = 0V, T = 70°C


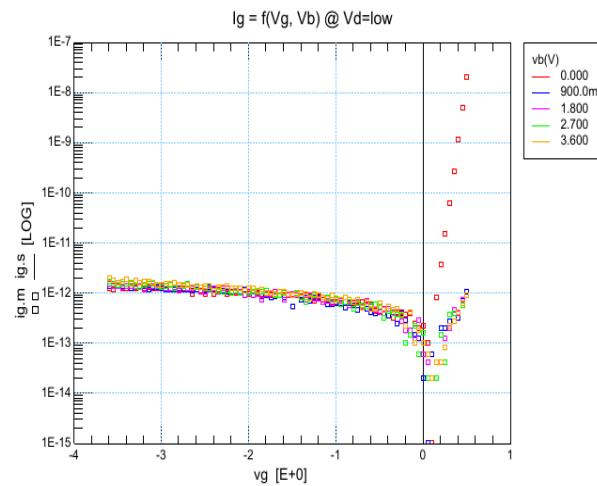
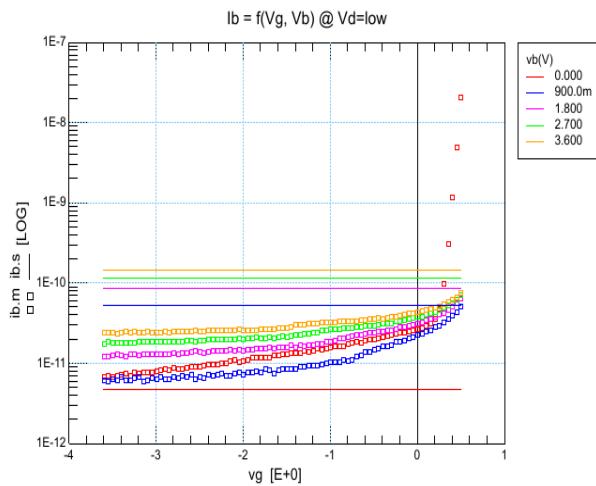
idvd_vbmin, Vb = 3.6V, T = 70°C**idvd_vth, Vb = 0V, T = 70°C**



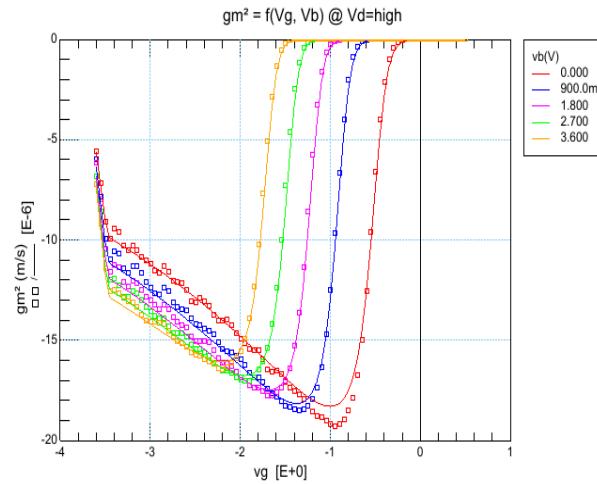
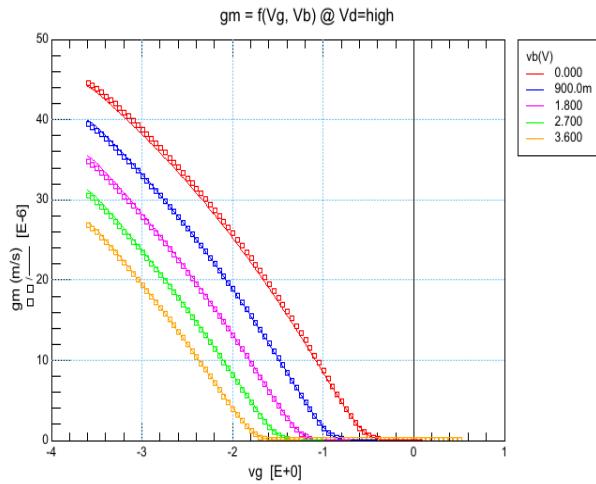
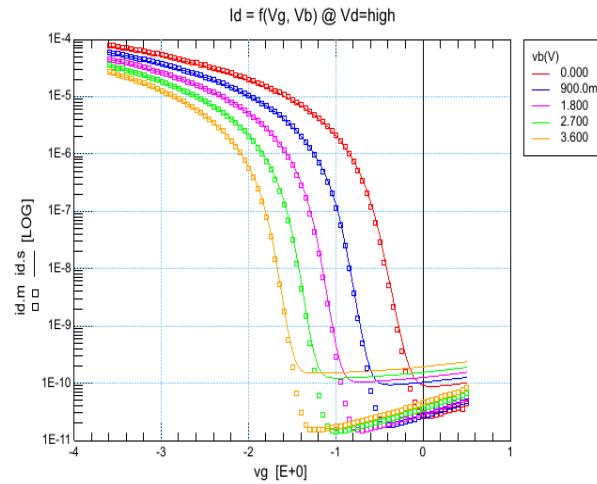
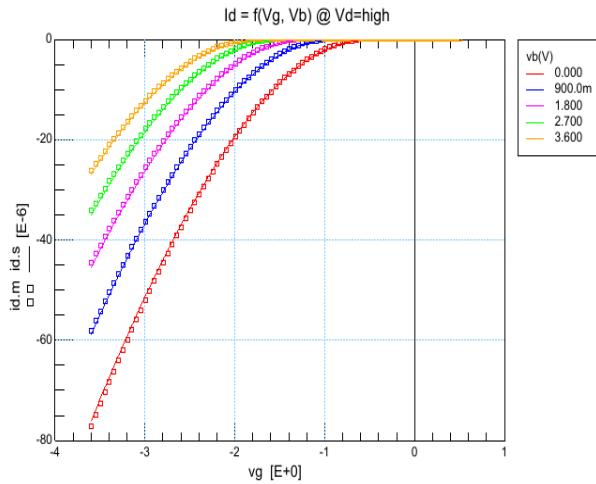
idvd_vth_vbmin, Vb = 3.6V, T = 70°C

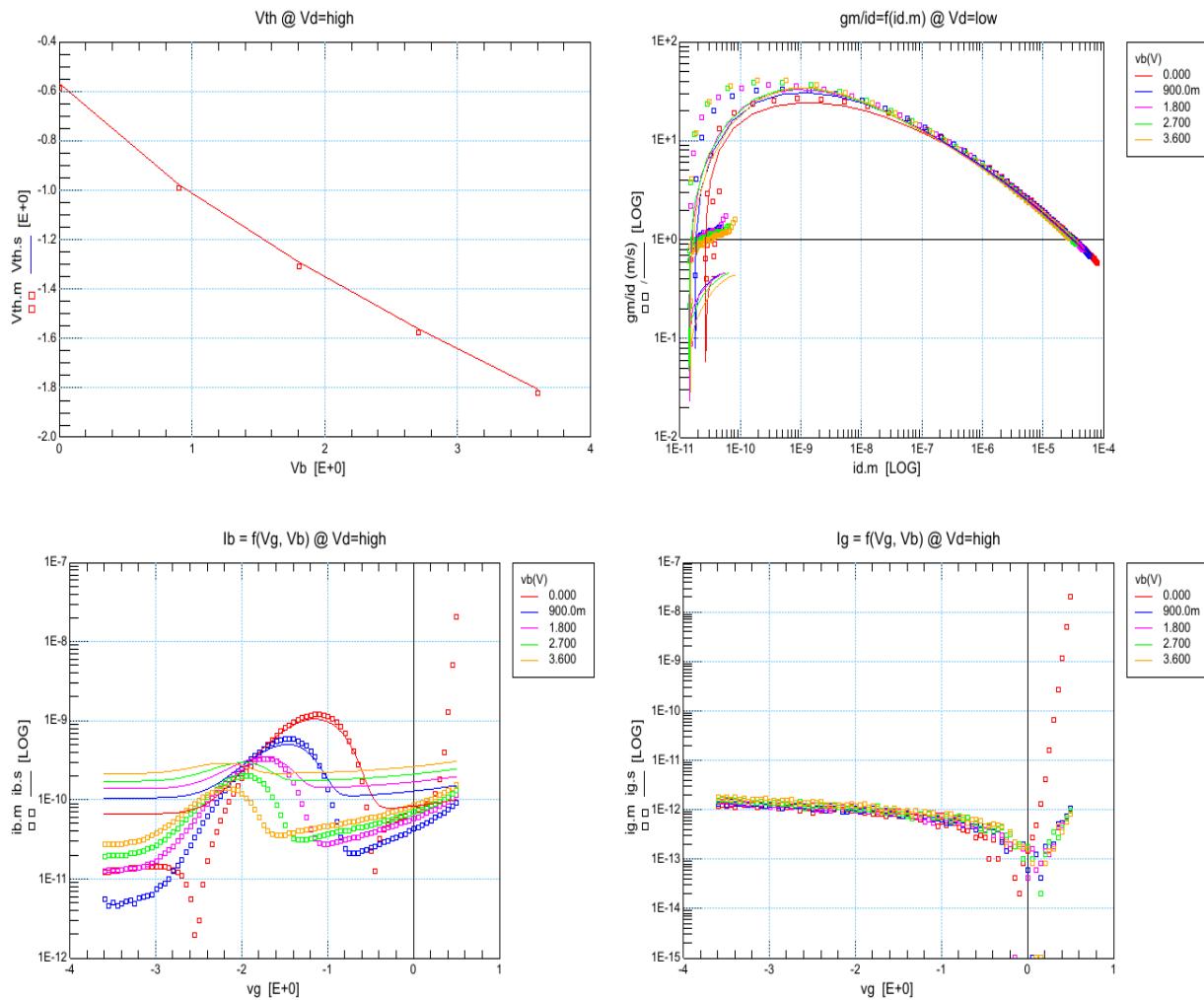


idvg, Vd = -0.1V, T = 125°C


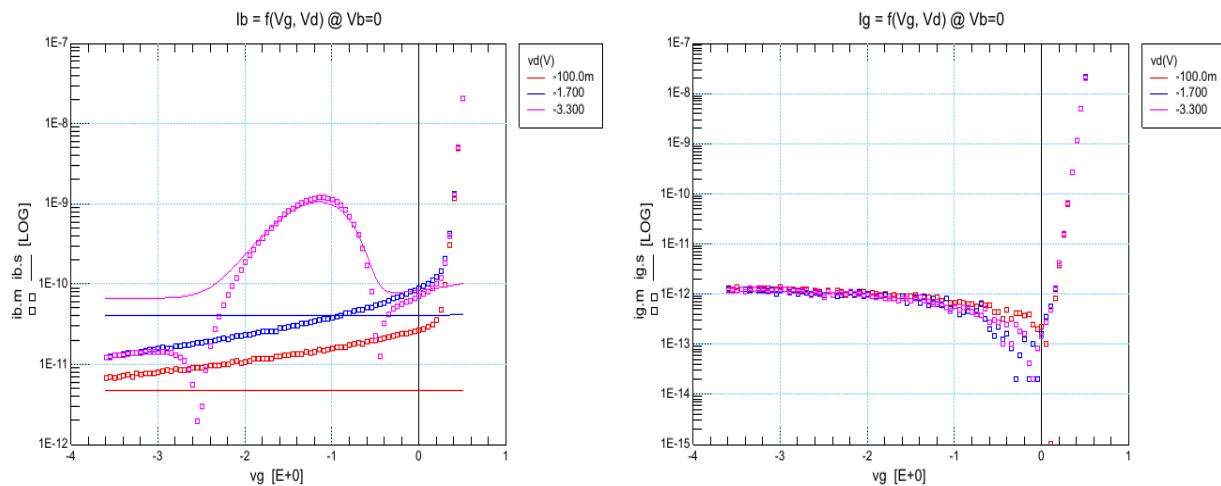


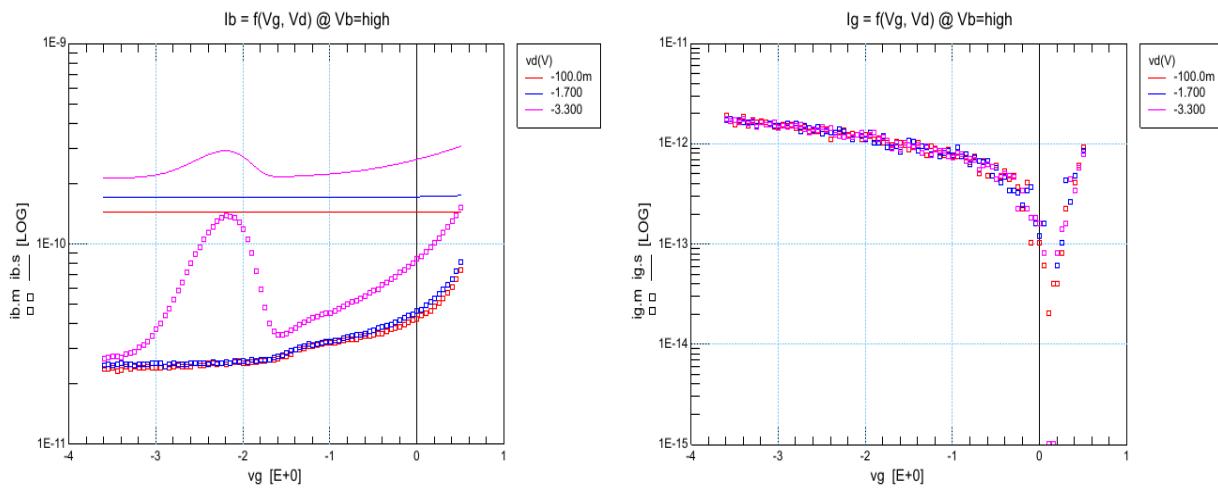
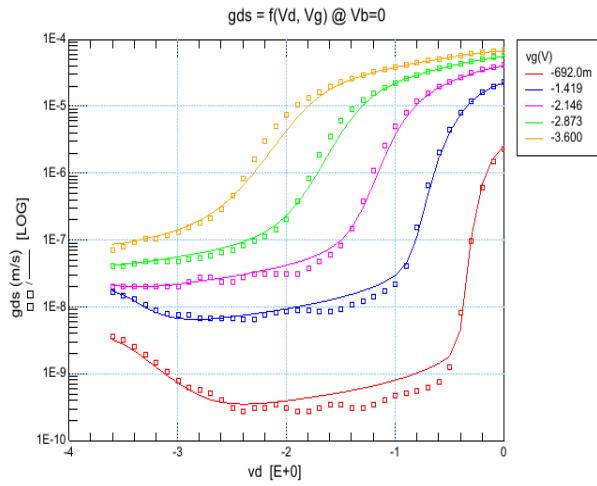
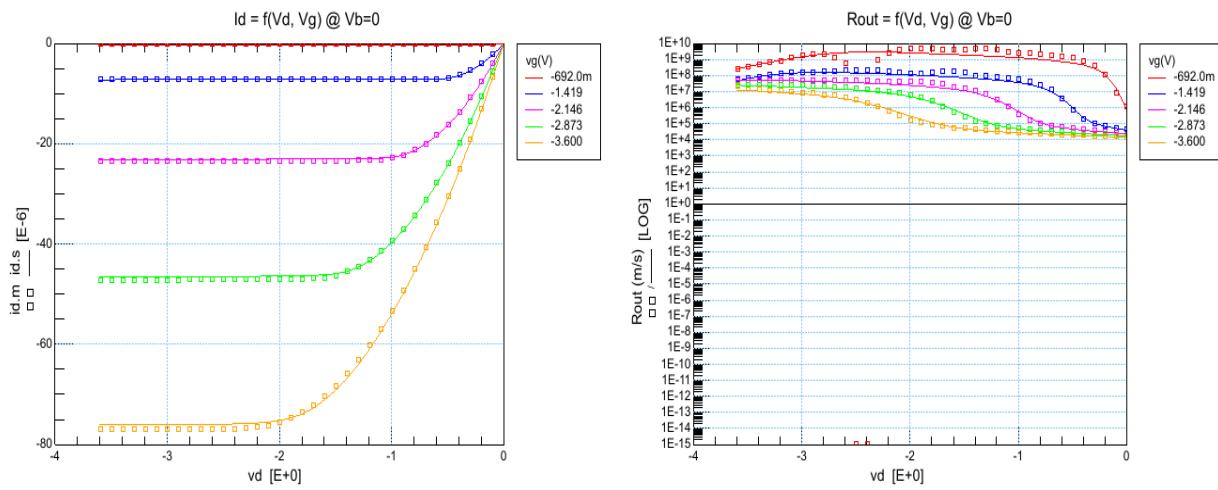
$i_{dvg}, V_d = -3.3V, T = 125^\circ\text{C}$

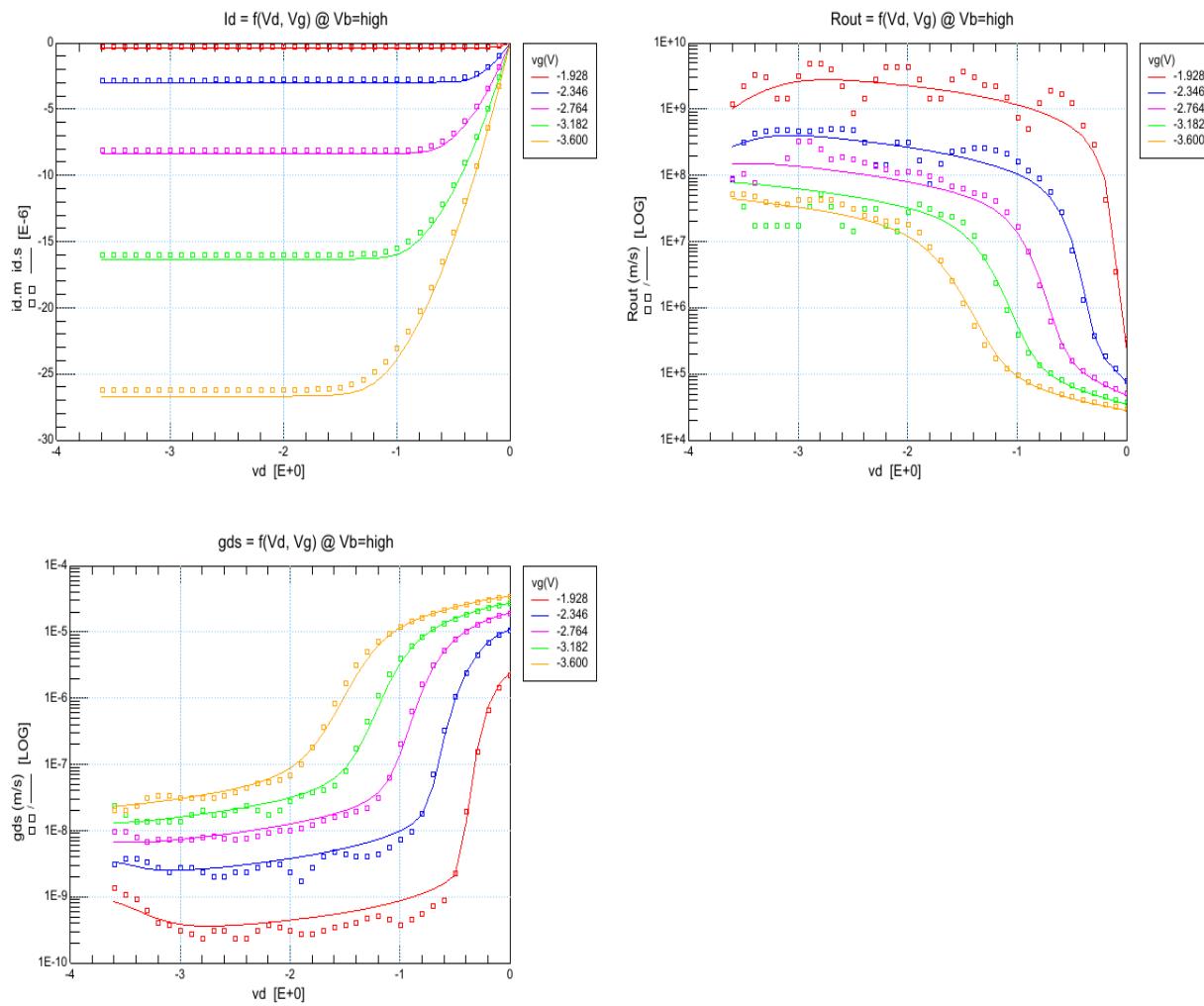
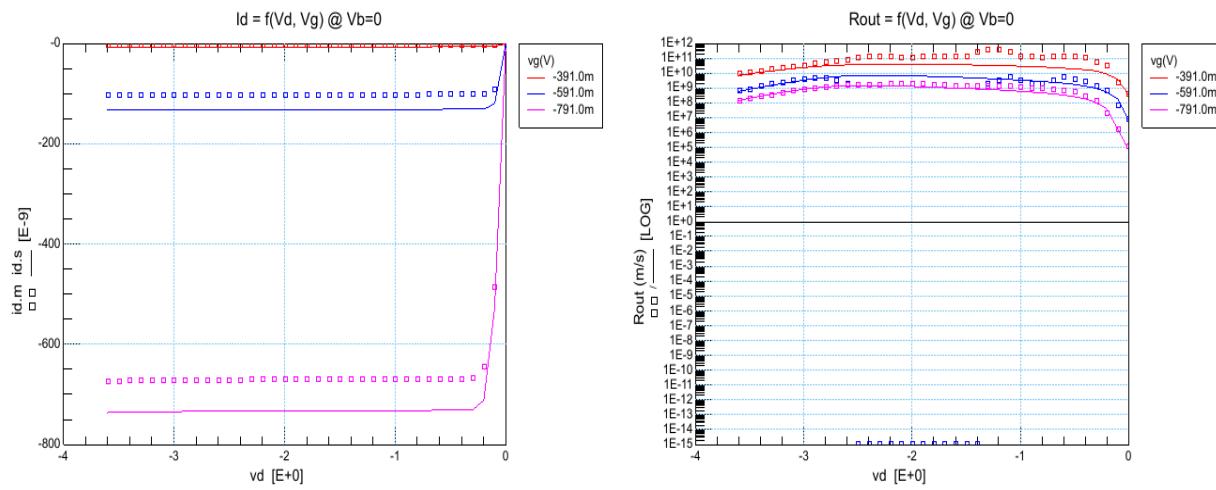


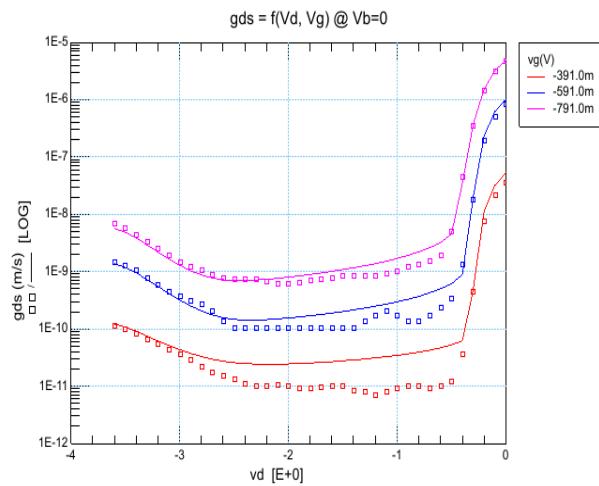


$i_{dvg}, I_b, I_g, V_b = 0V, T = 125^\circ C$

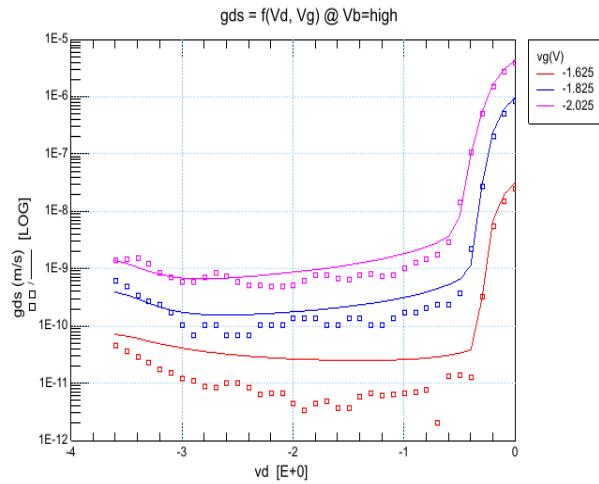
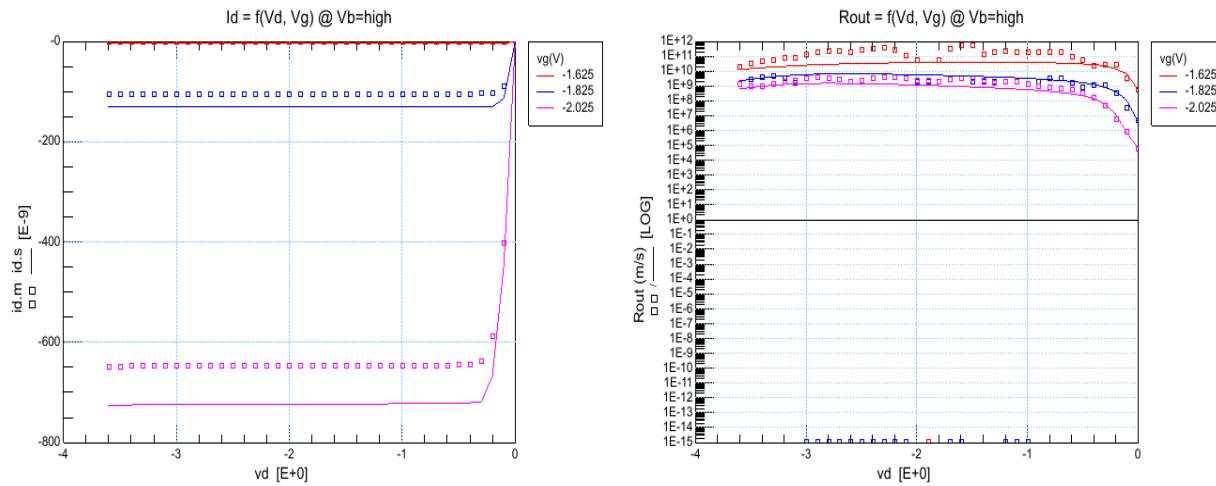


idvg, Ib,Ig, Vb = 3.6V, T = 125°C

idvd, Vb = 0V, T = 125°C


idvd_vbmin, Vb = 3.6V, T = 125°C

idvd_vth, Vb = 0V, T = 125°C


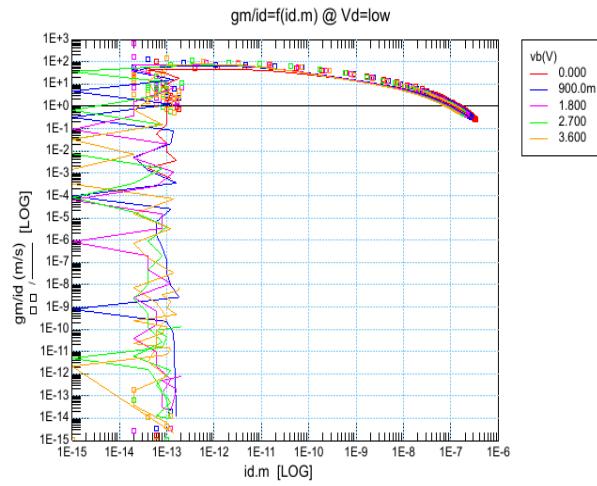
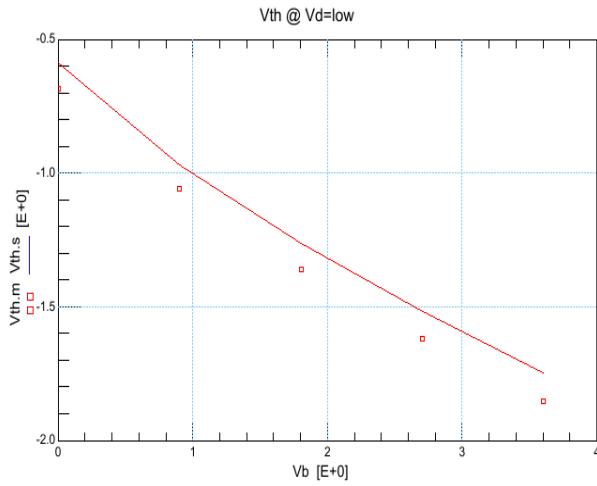
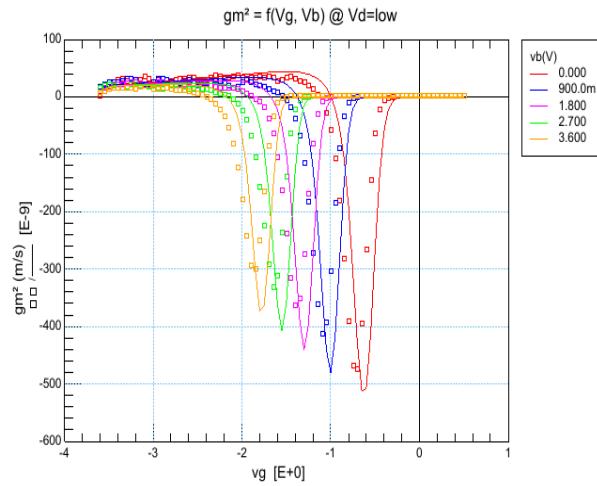
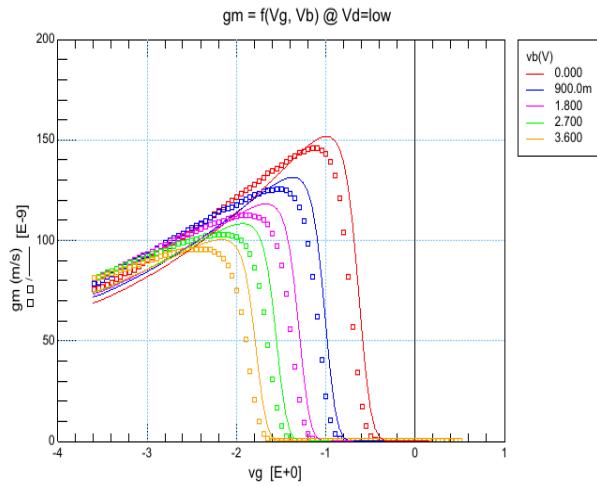
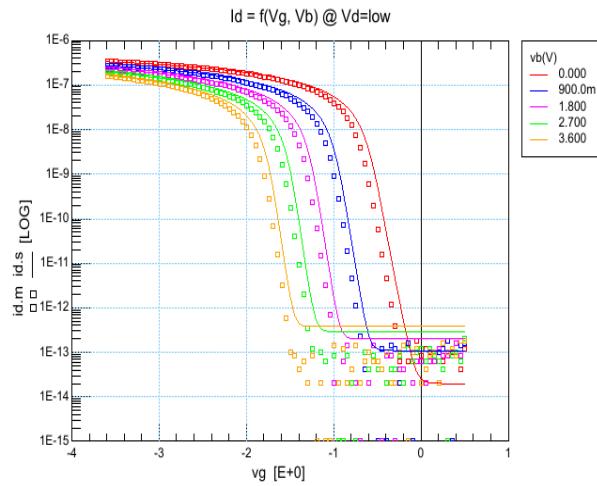
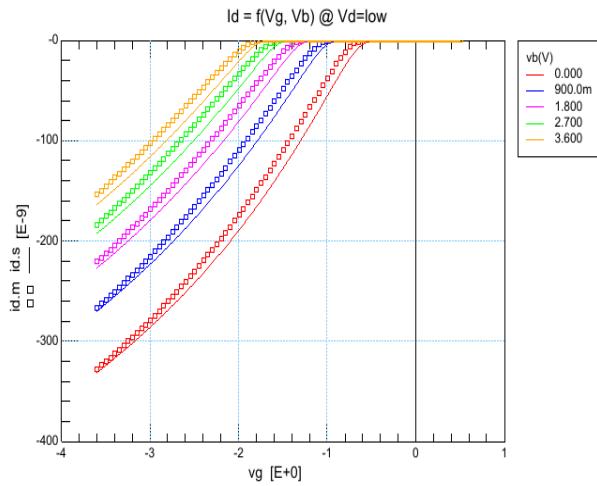


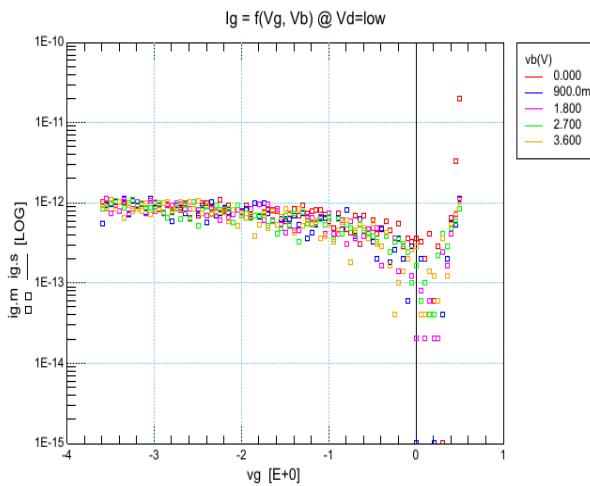
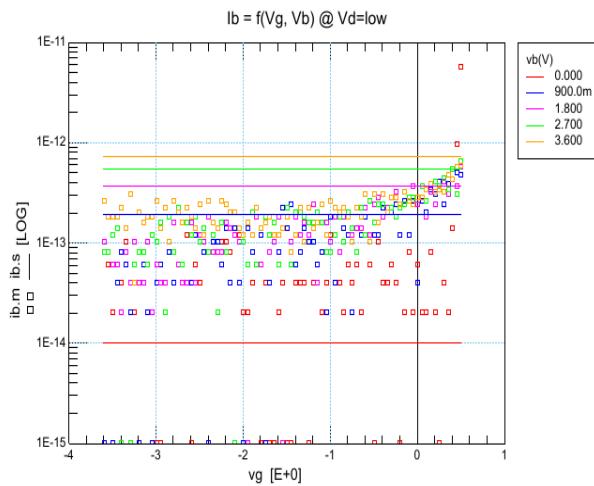
idvd_vth_vbmin, Vb = 3.6V, T = 125°C



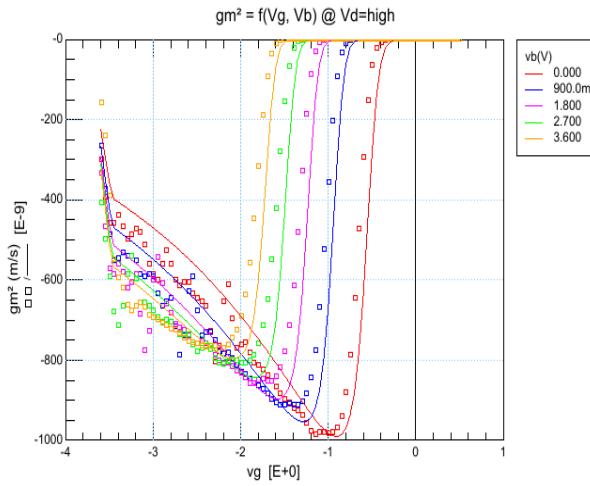
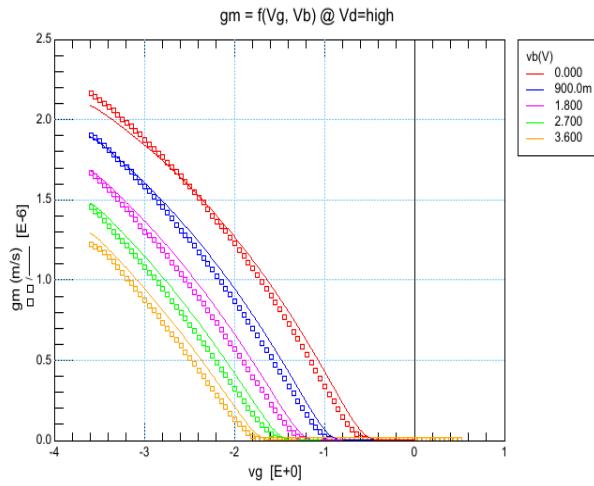
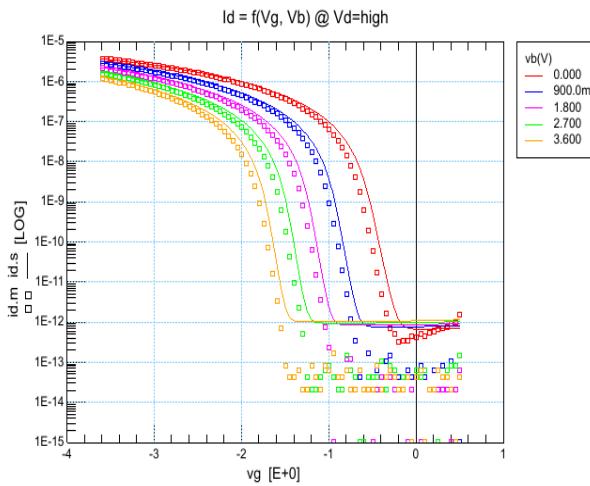
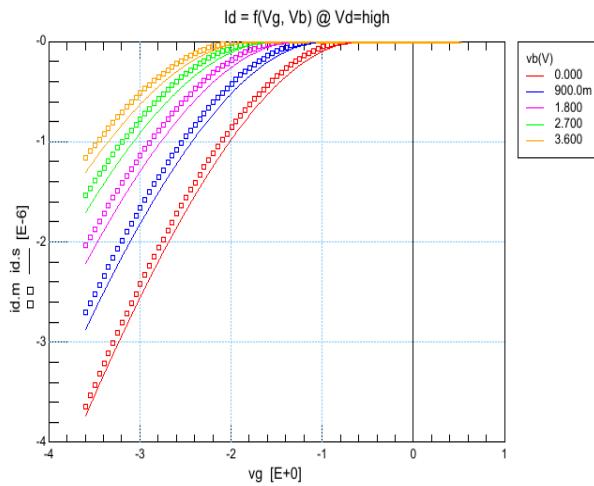
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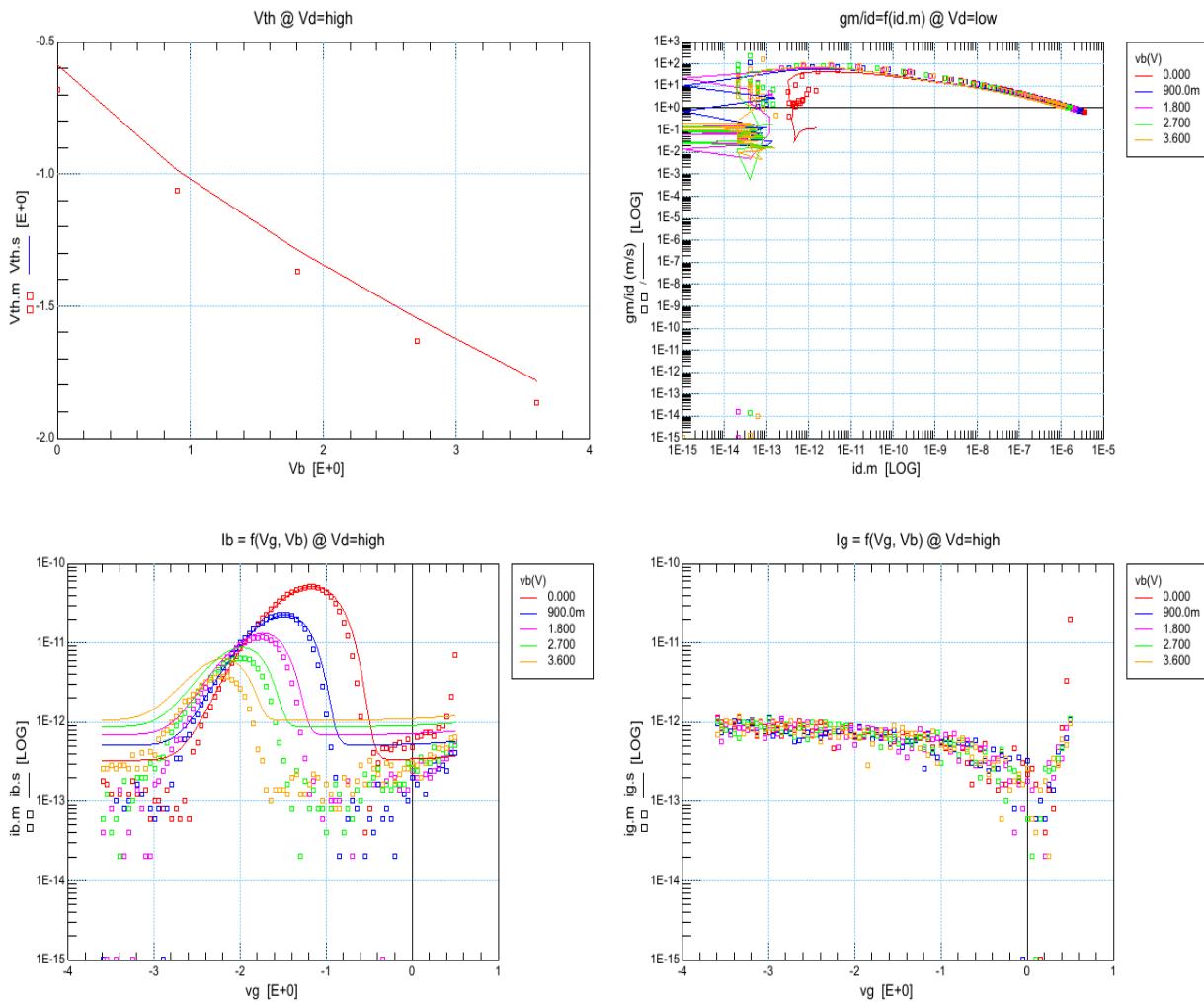
$idv_g, V_d = -0.1V, T = 27^\circ C$



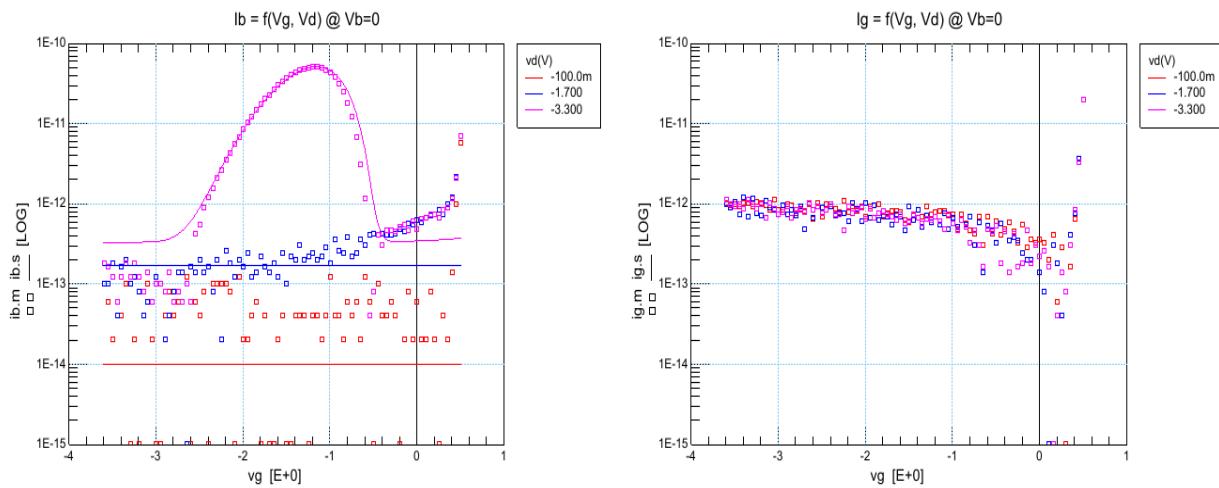


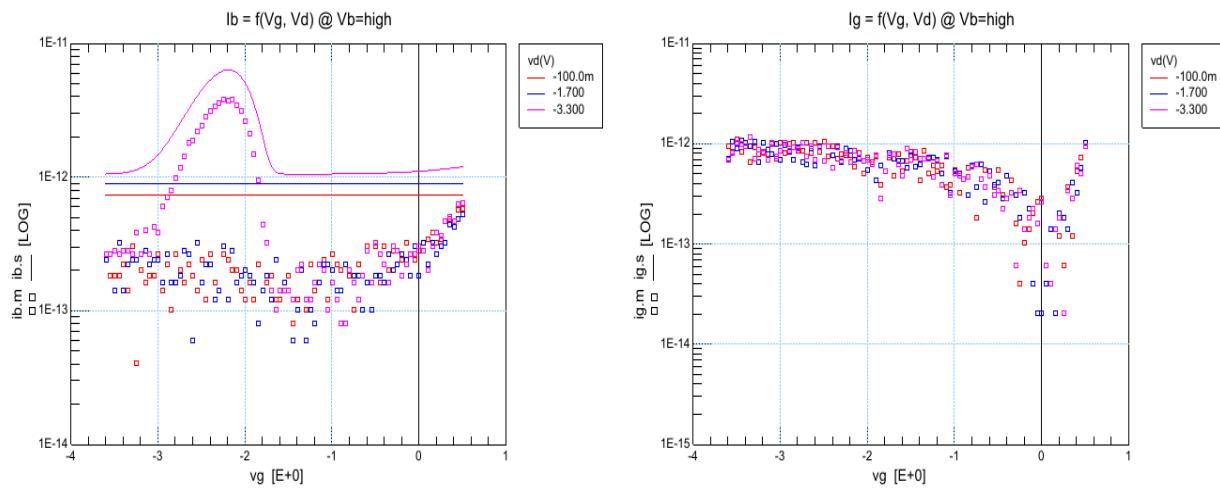
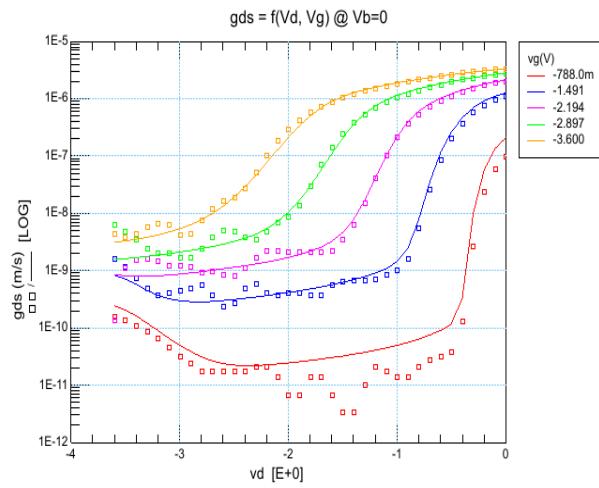
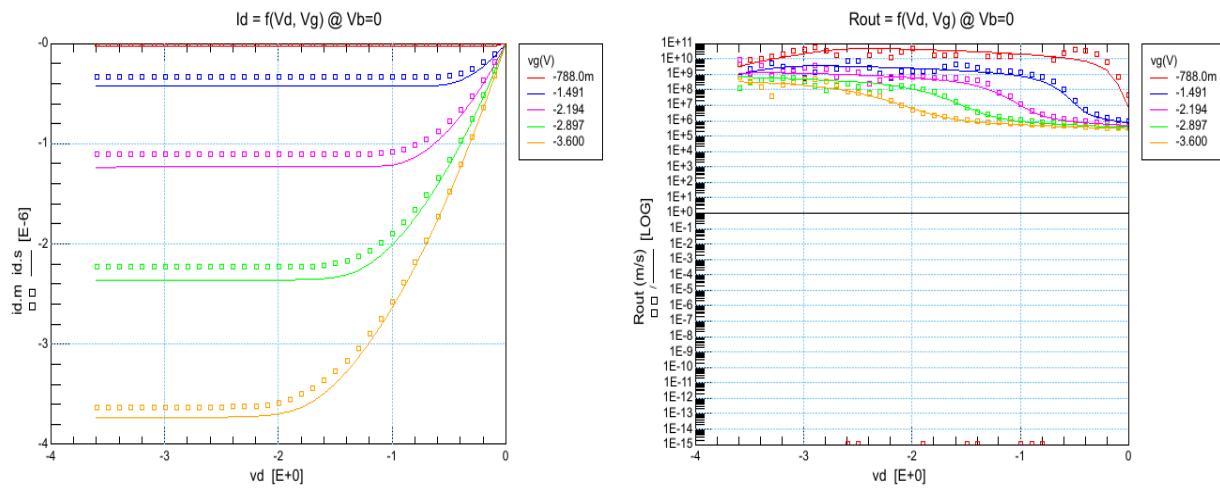
$i_{dvg}, V_d = -3.3V, T = 27^\circ\text{C}$

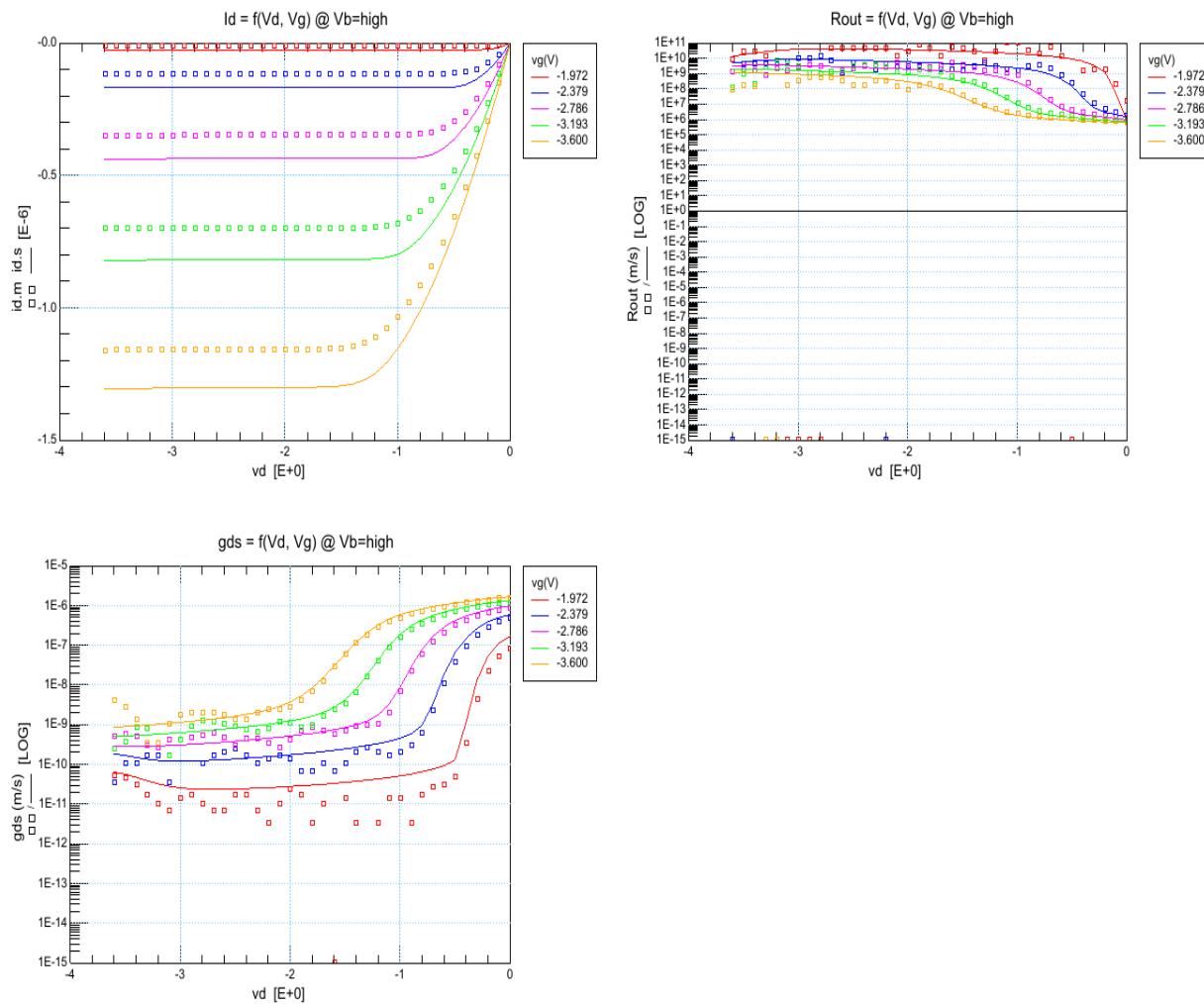
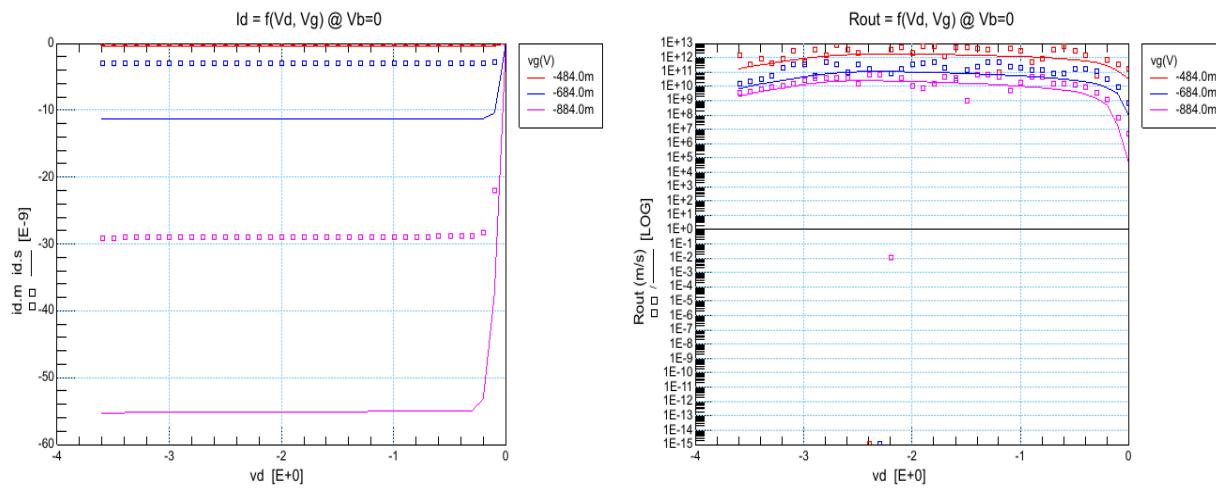


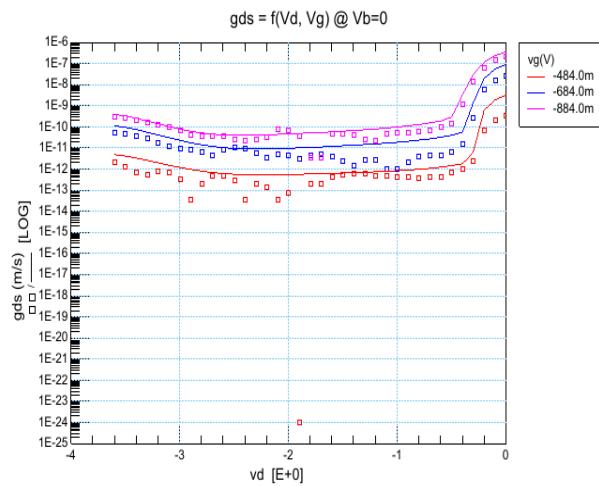


$idvg, I_b, Ig, V_b = 0V, T = 27^\circ C$

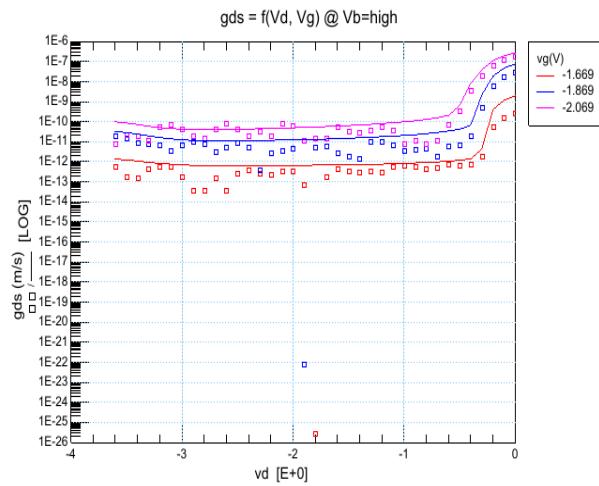
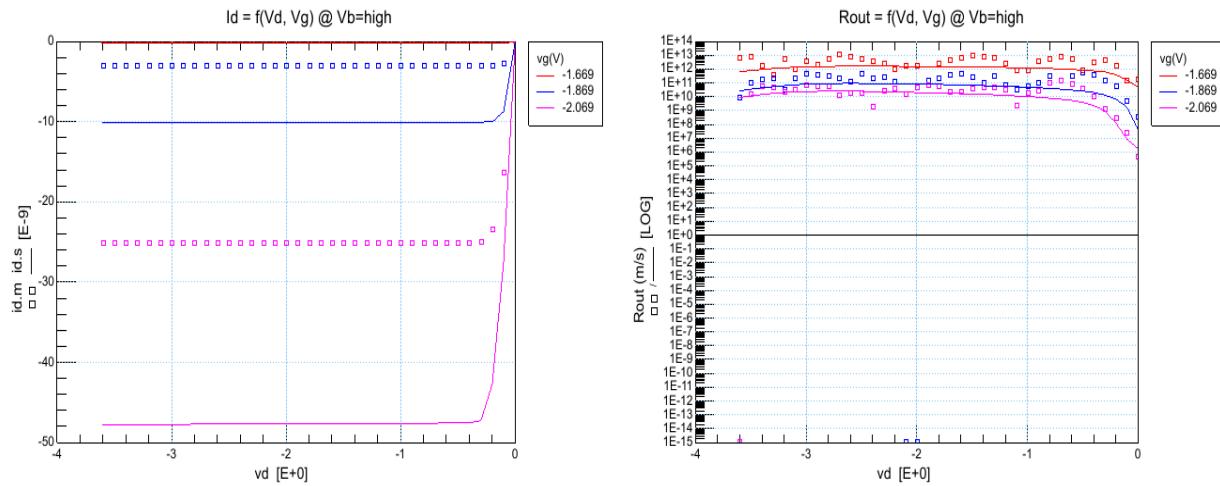


idvg, Ib,Ig, Vb = 3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


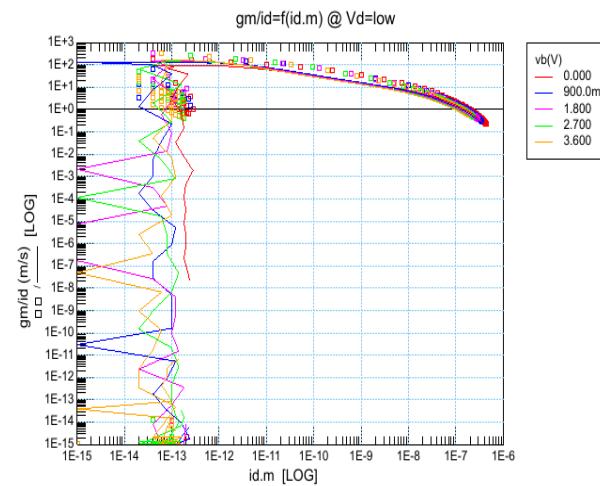
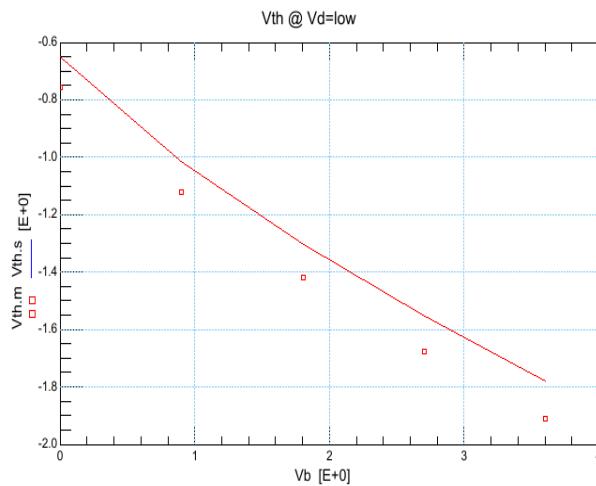
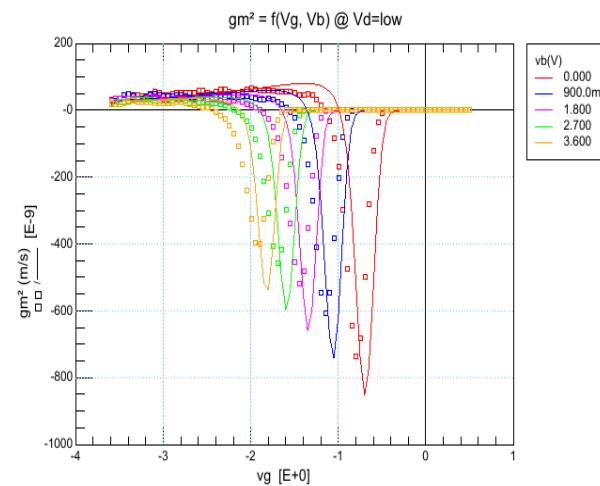
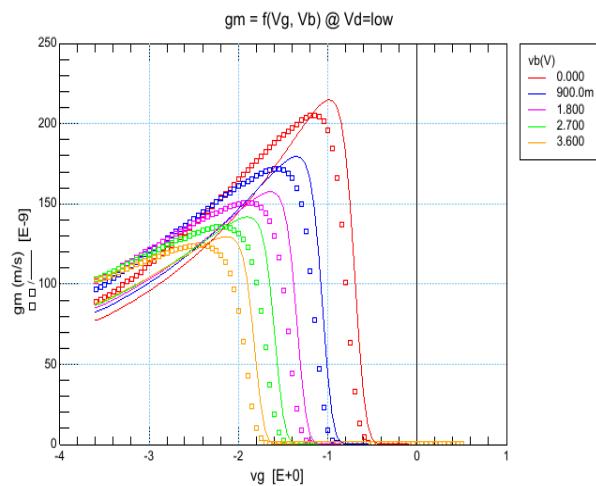
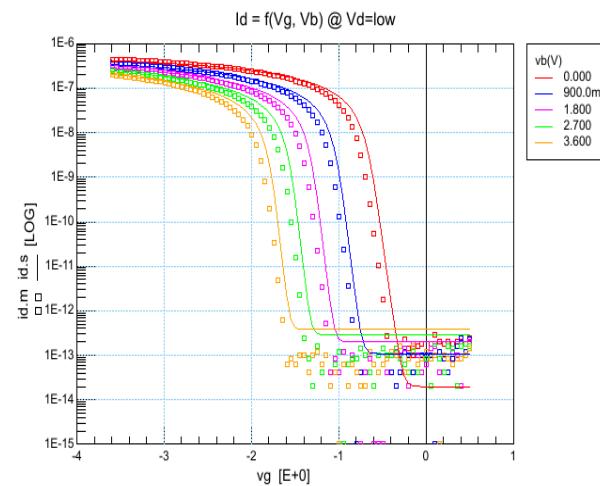
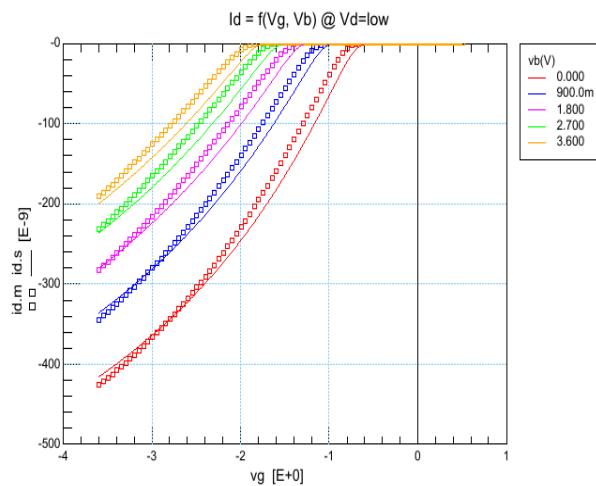
idvd_vbmin, Vb = 3.6V, T = 27°C**idvd_vth, Vb = 0V, T = 27°C**

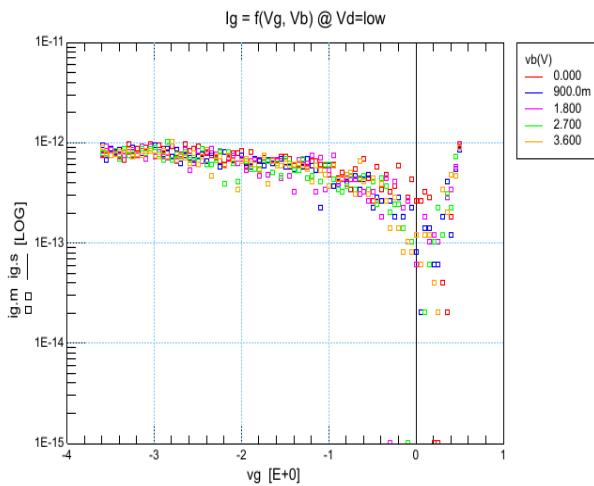
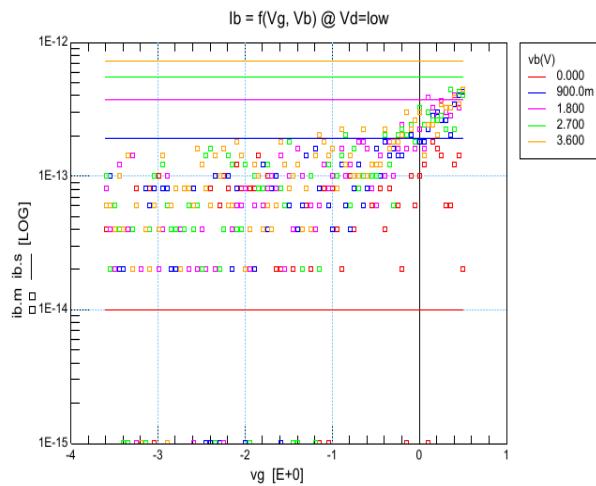


idvd_vth_vbmin, Vb = 3.6V, T = 27°C

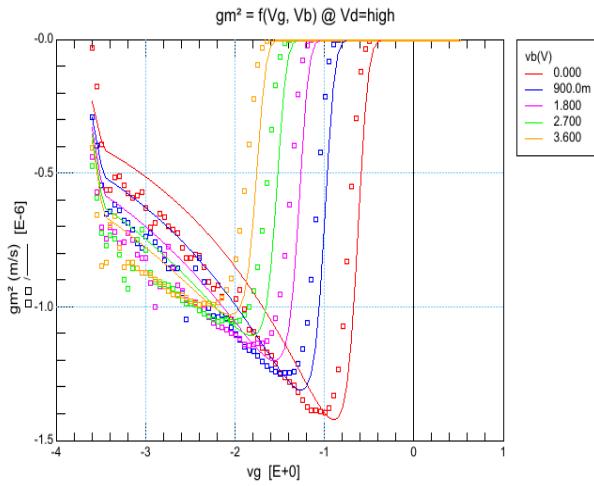
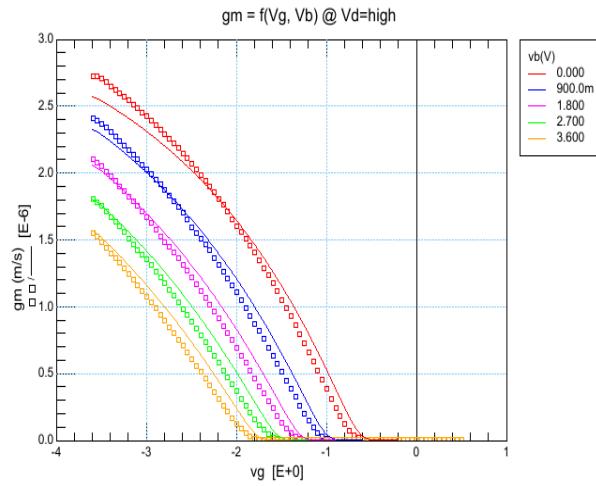
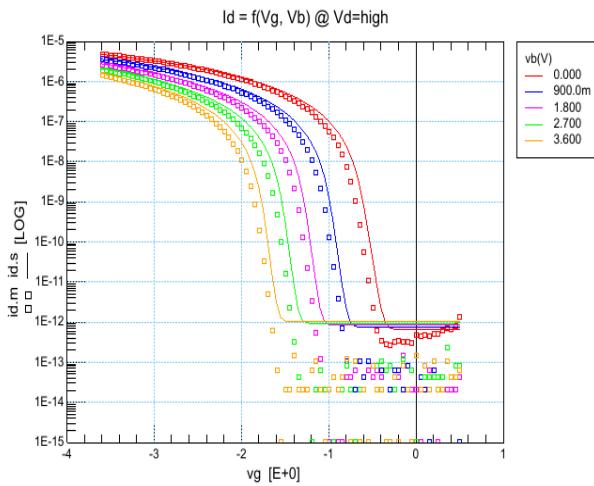
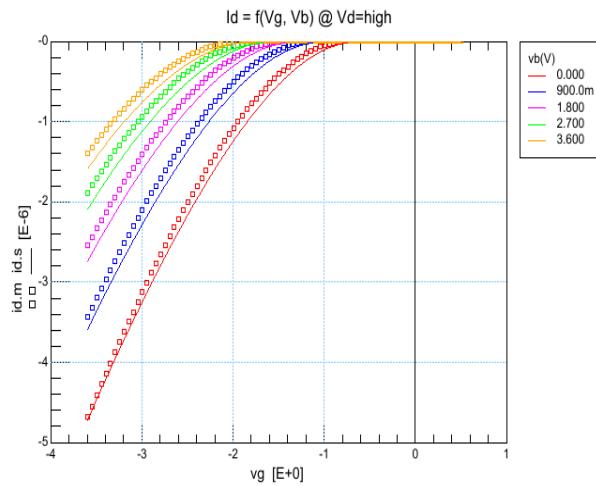


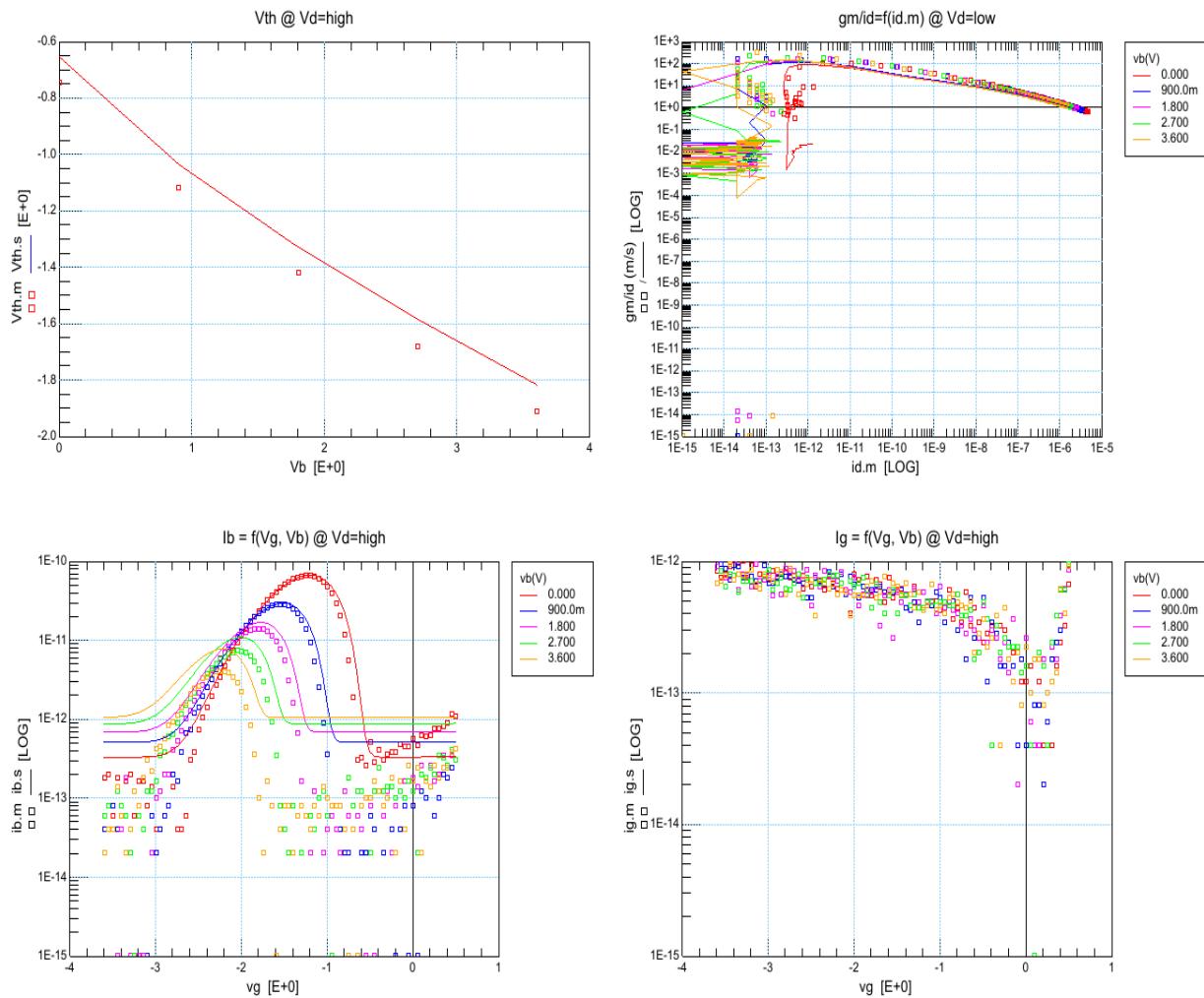
$idvg$, $Vd = -0.1V$, $T = -40^{\circ}C$



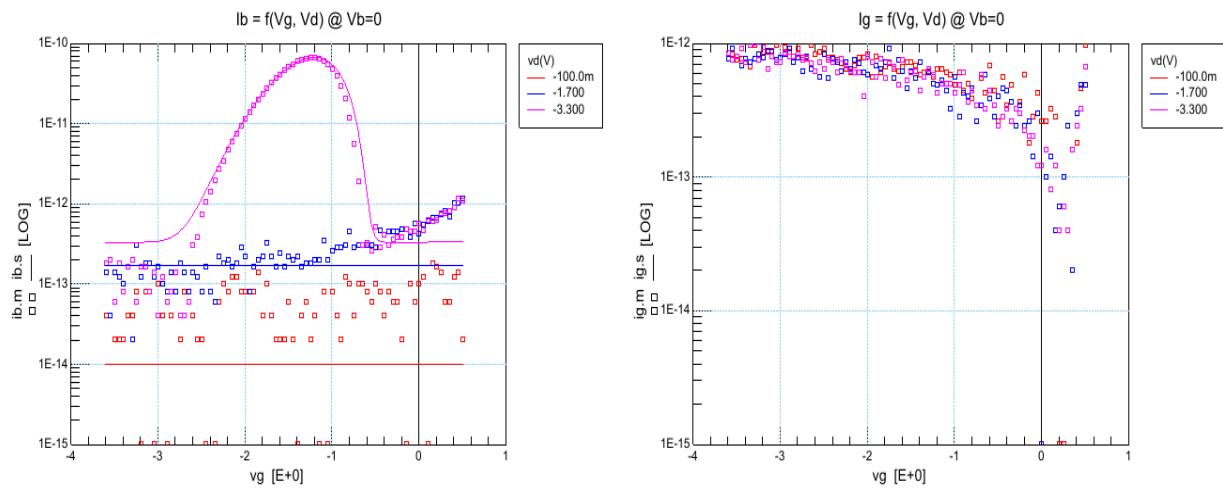


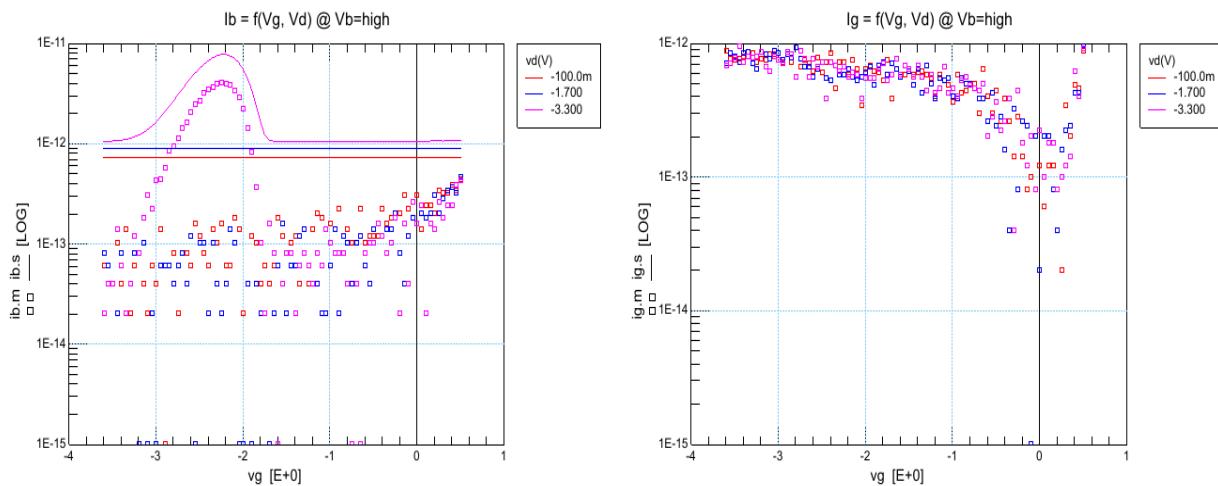
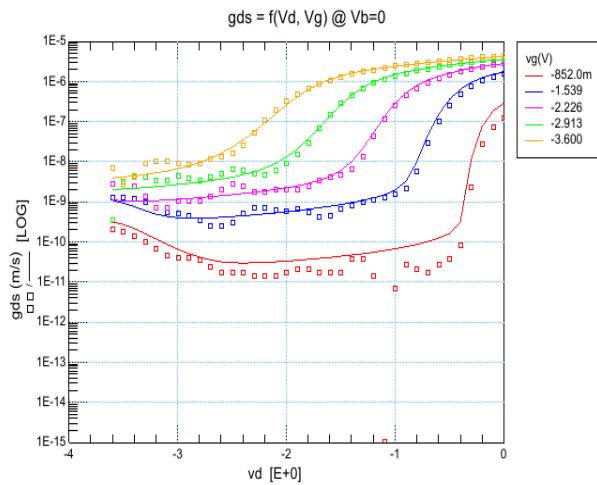
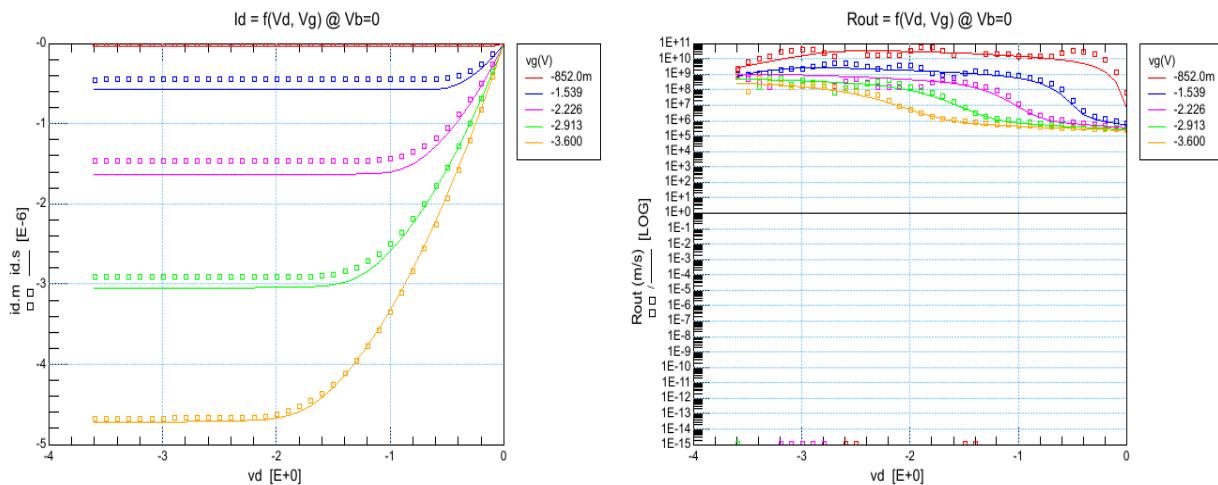
$i_{dvg}, V_d = -3.3V, T = -40^\circ\text{C}$

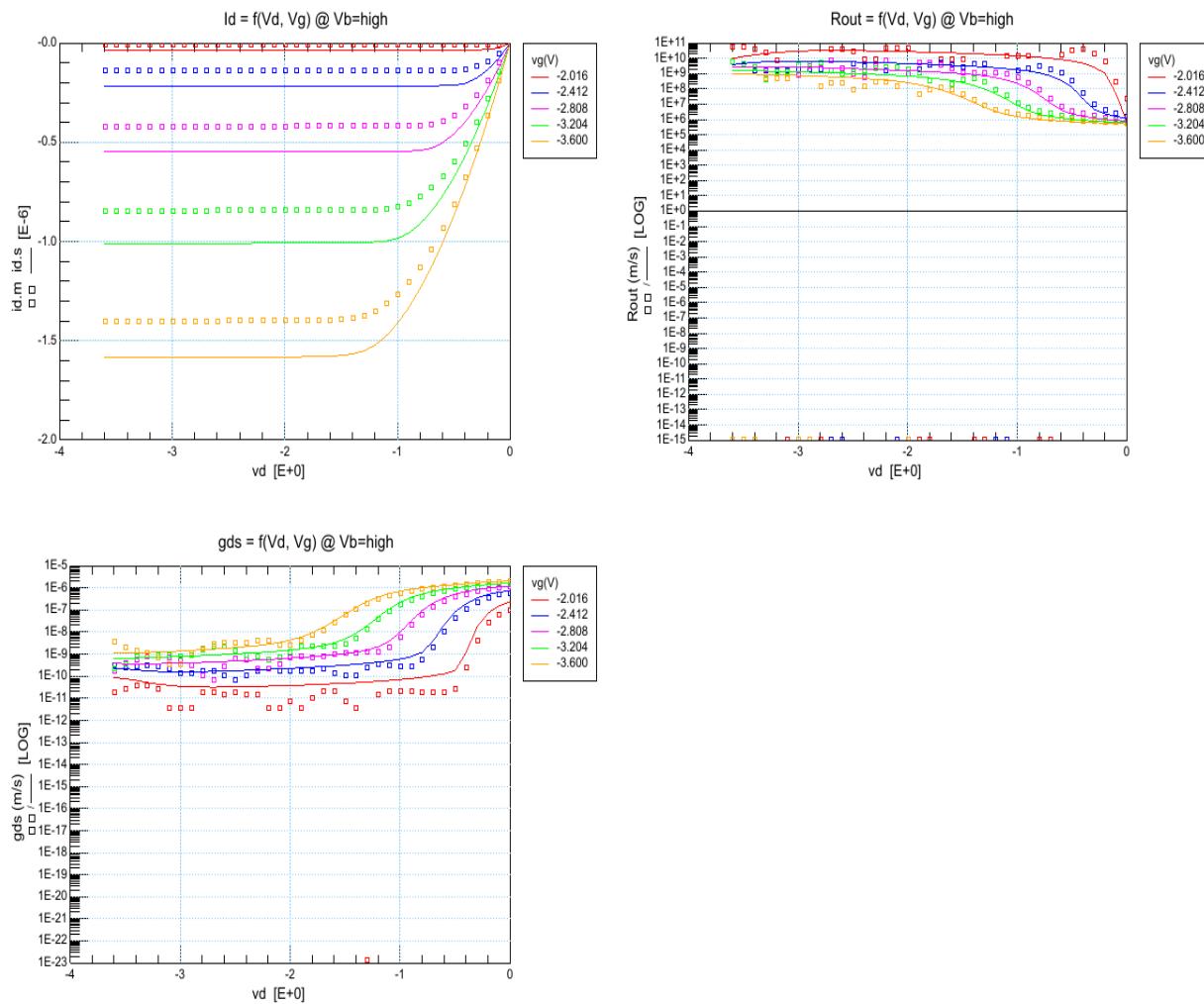
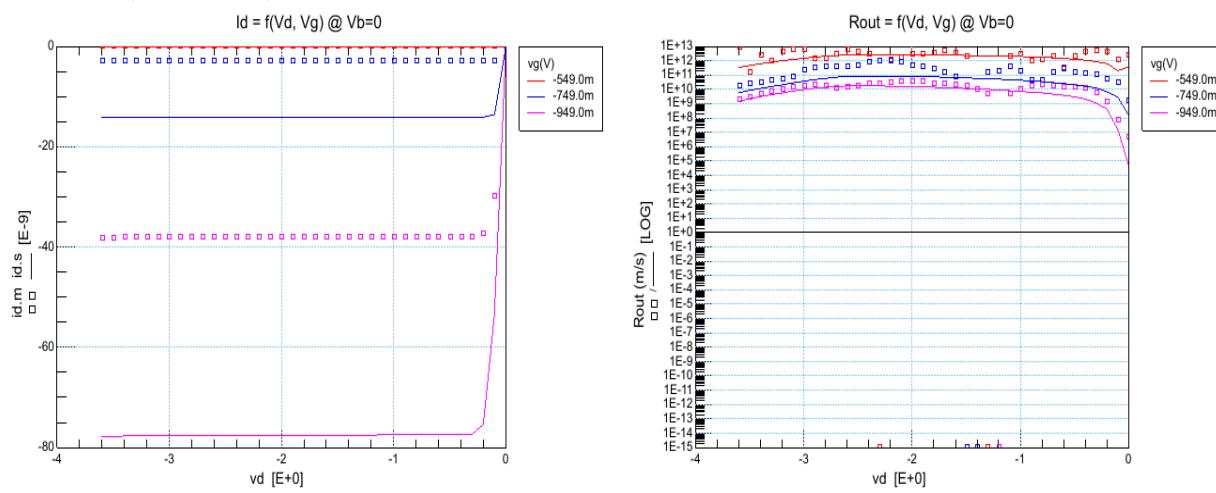


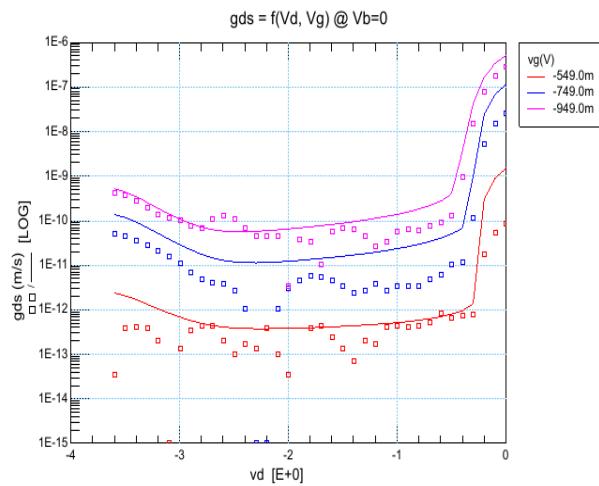


idvg, Ib,Ig, Vb = 0V, T = -40°C

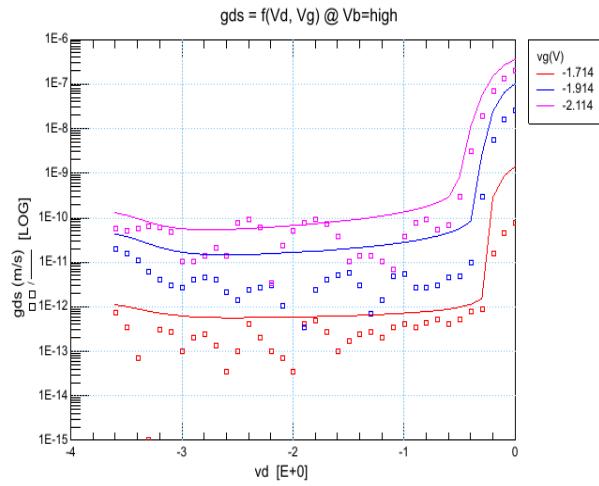
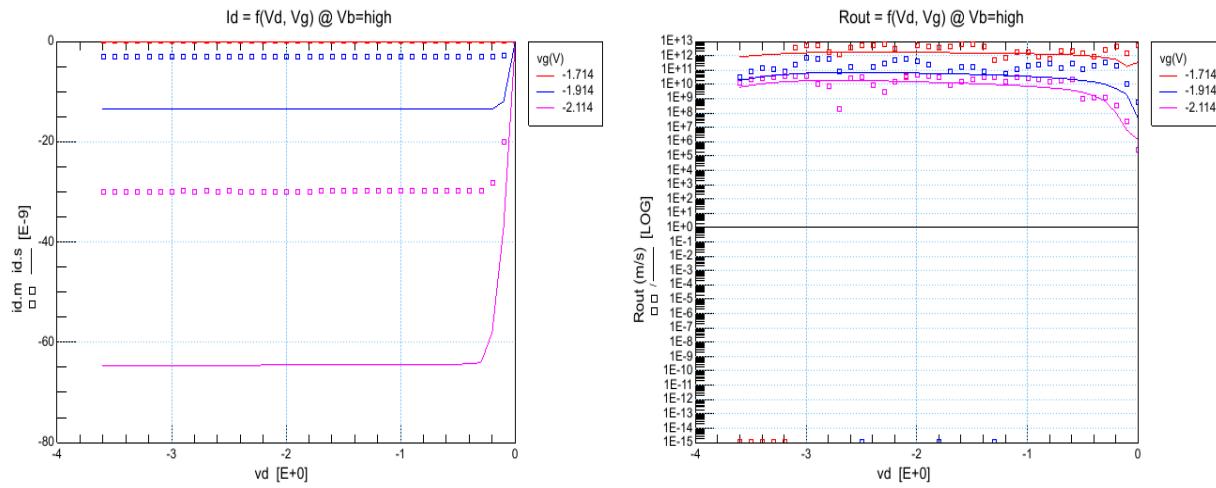


idvg, Ib,Ig, Vb = 3.6V, T = -40°C

idvd, Vb = 0V, T = -40°C


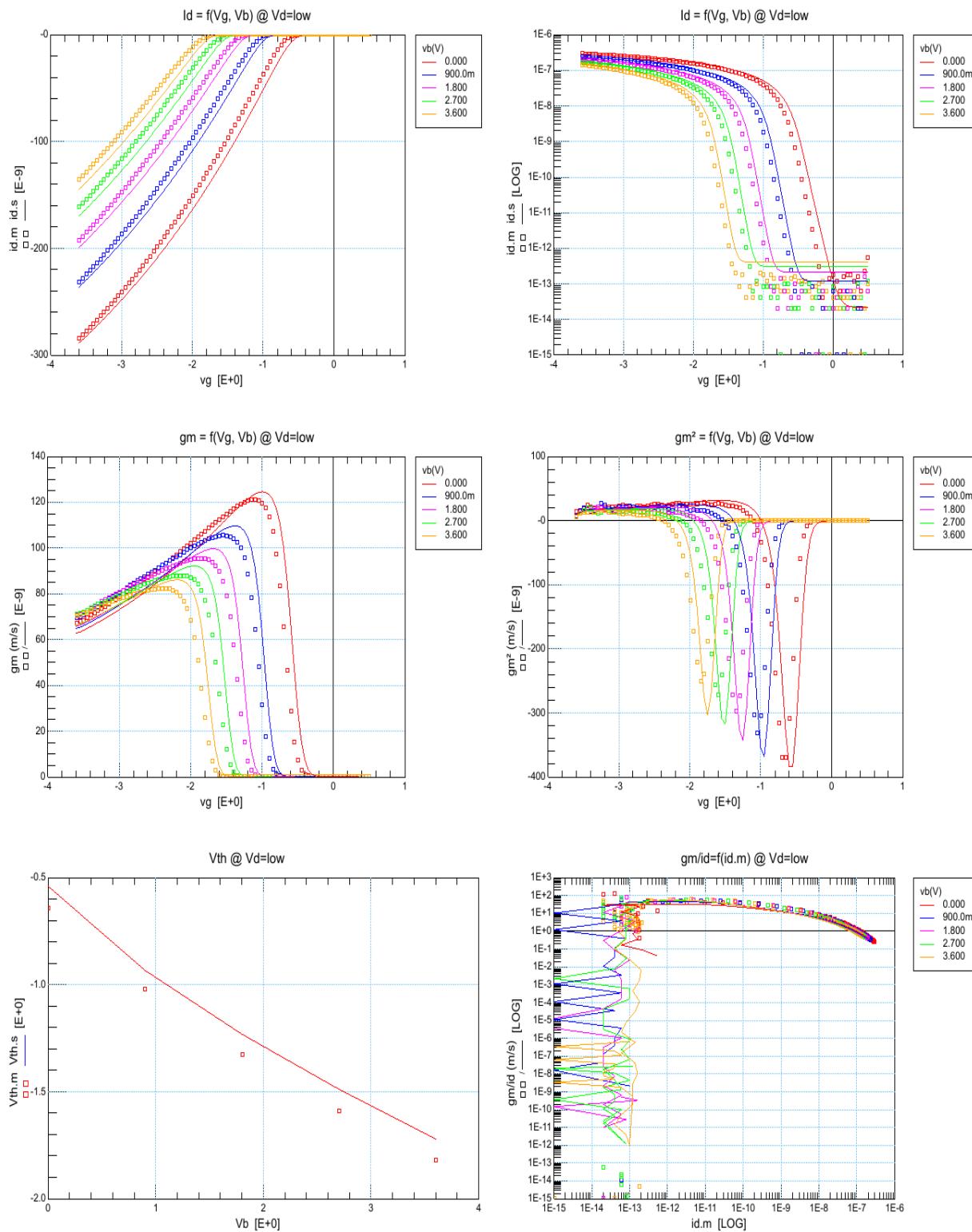
idvd_vbmin, Vb = 3.6V, T = -40°C**idvd_vth, Vb = 0V, T = -40°C**

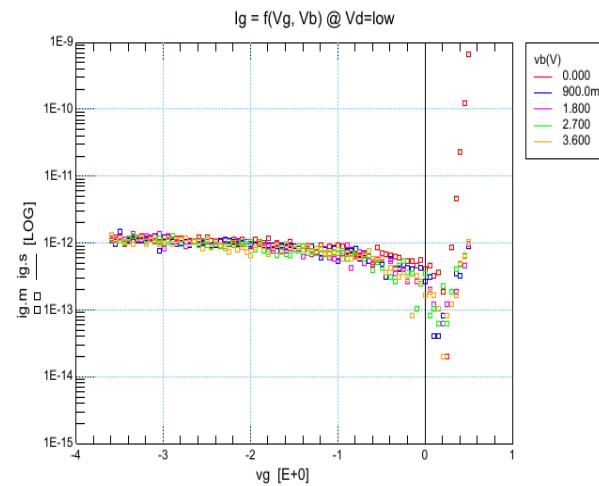
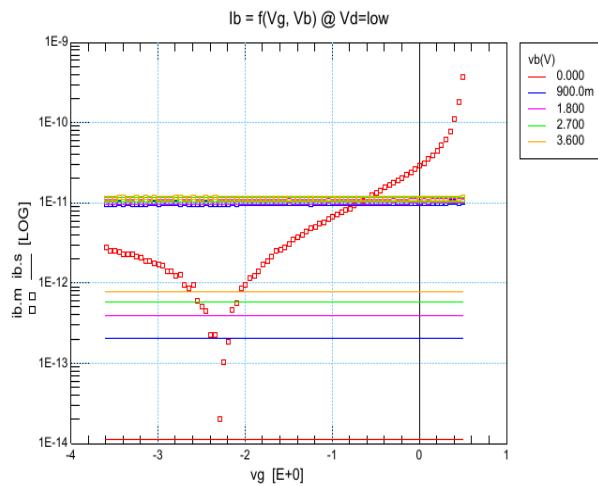


idvd_vth_vbmin, Vb = 3.6V, T = -40°C

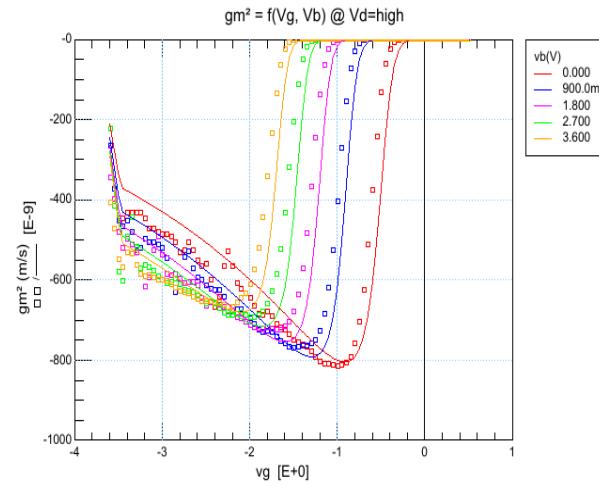
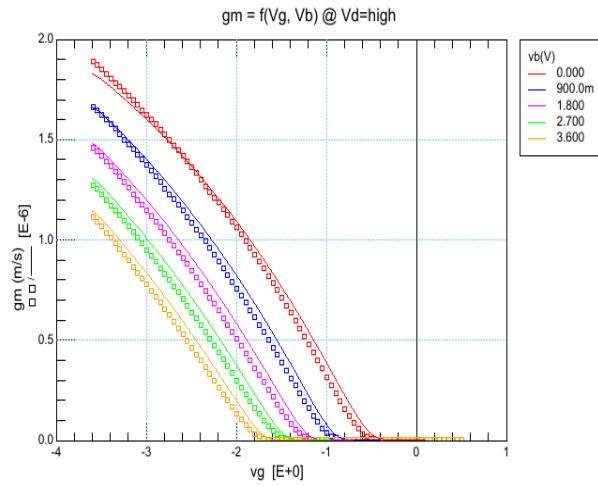
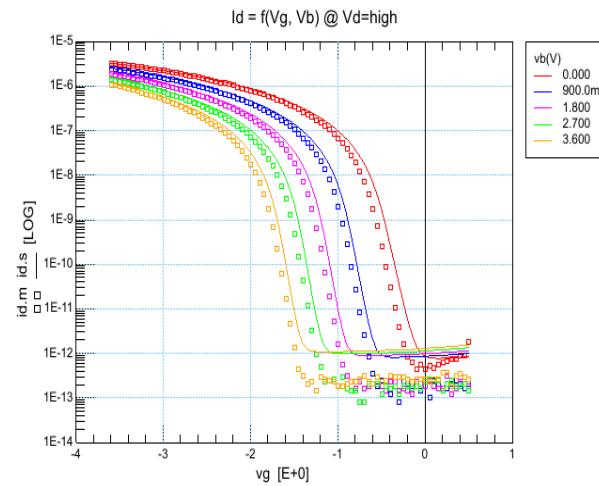
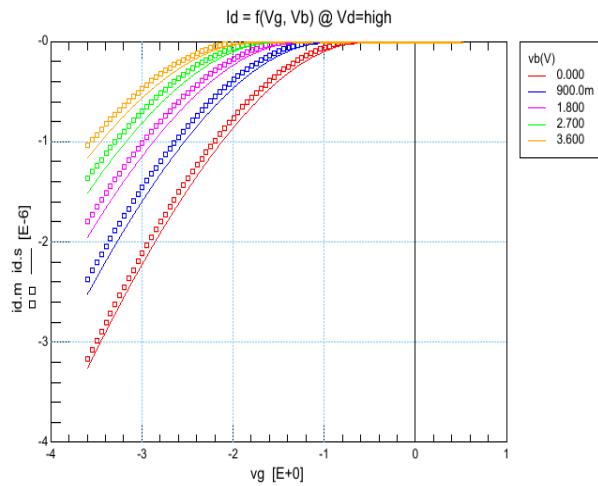


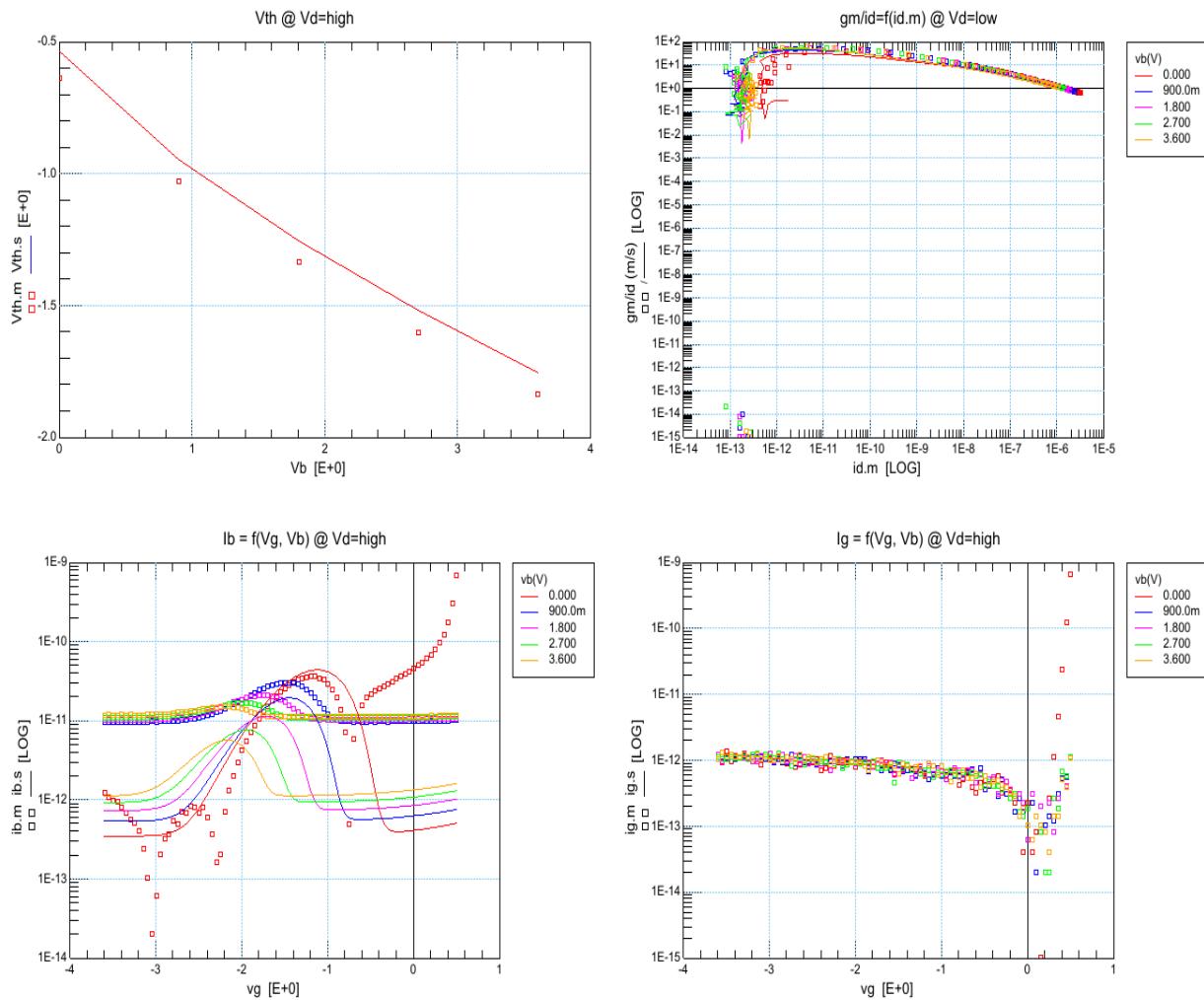
idvg, Vd = -0.1V, T = 70°C



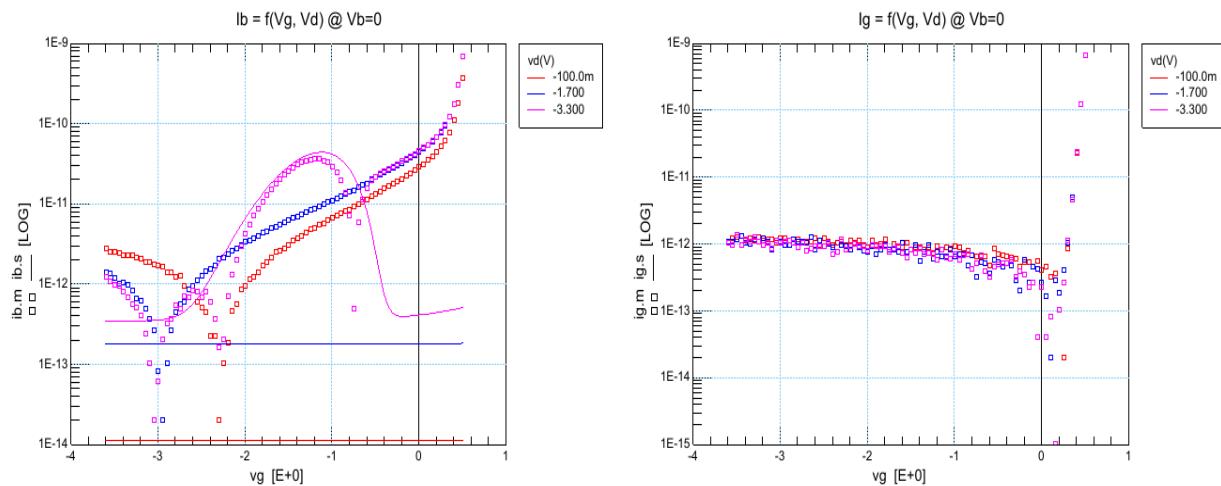


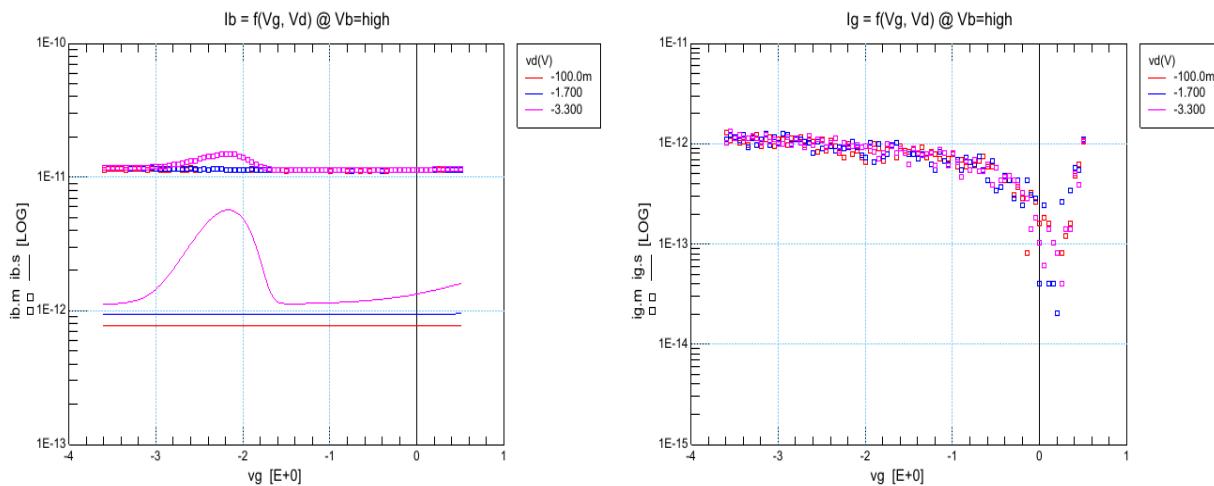
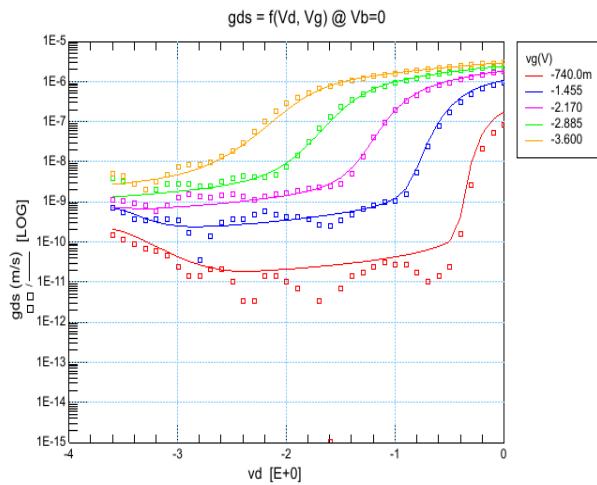
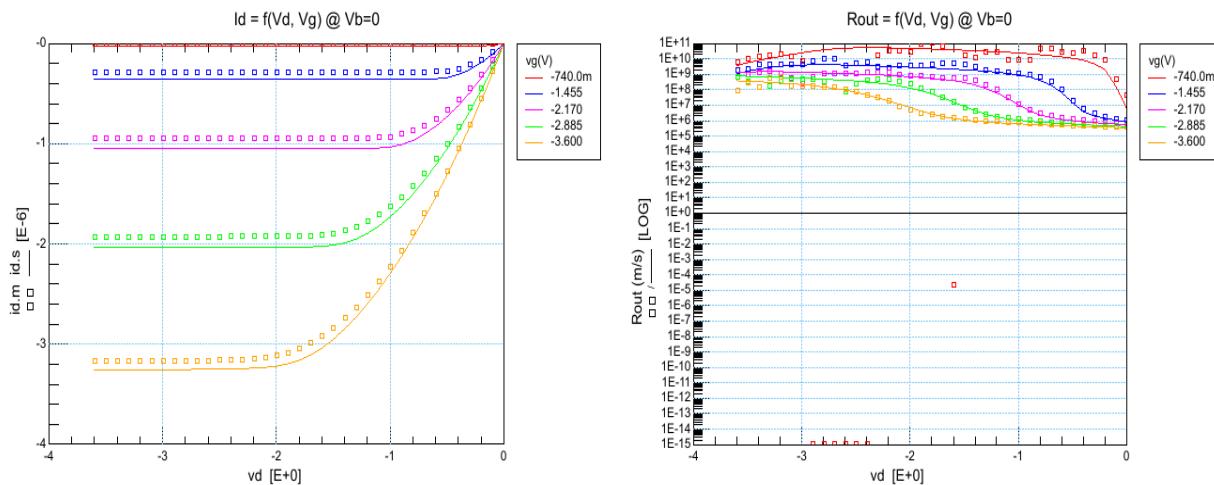
$i_{dvg}, V_d = -3.3V, T = 70^\circ\text{C}$

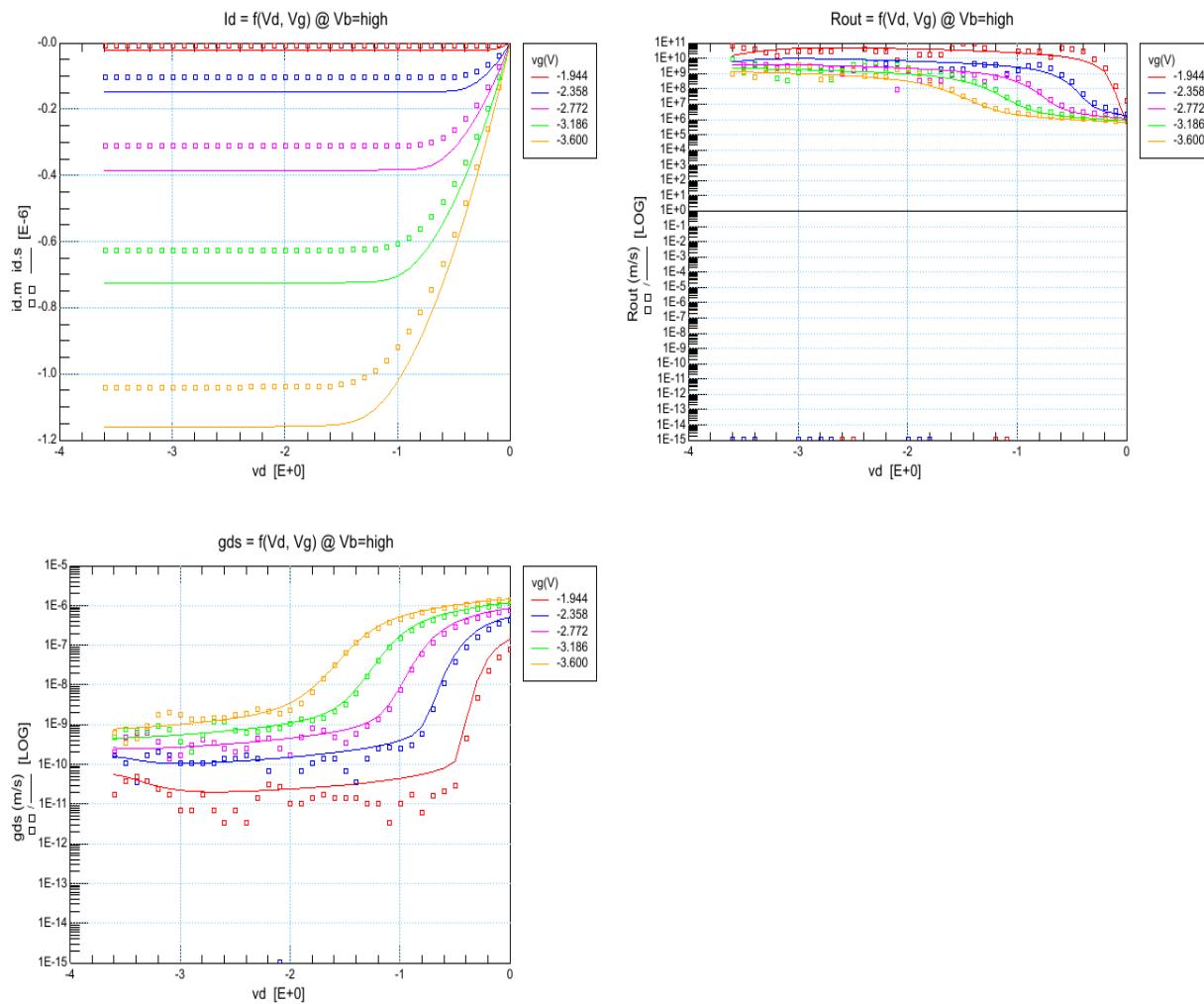
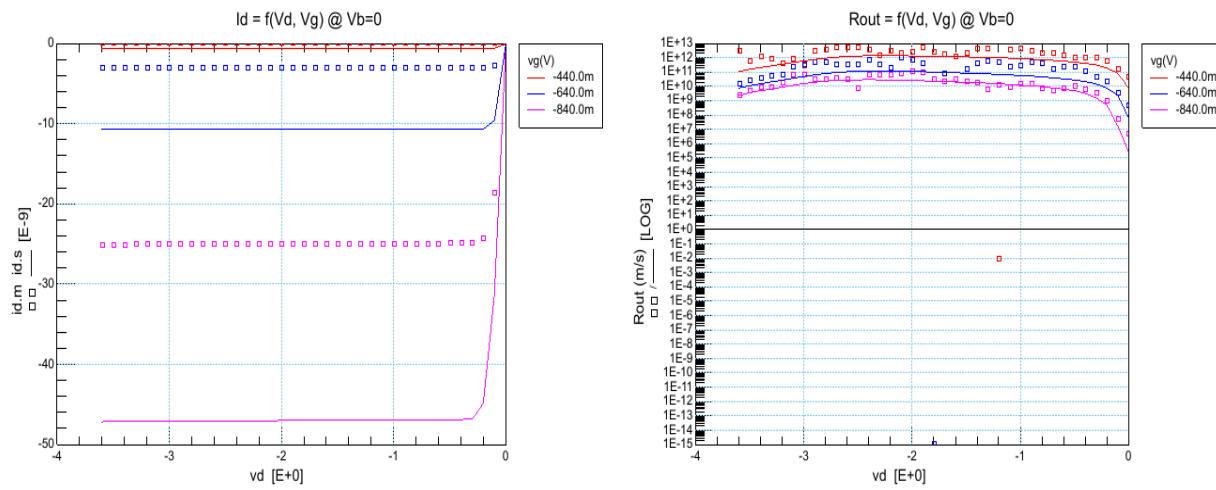


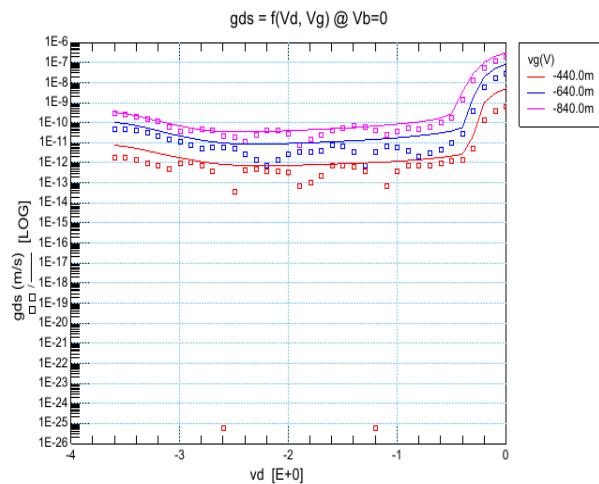


idvg, lb, lg, Vb = 0V, T = 70°C

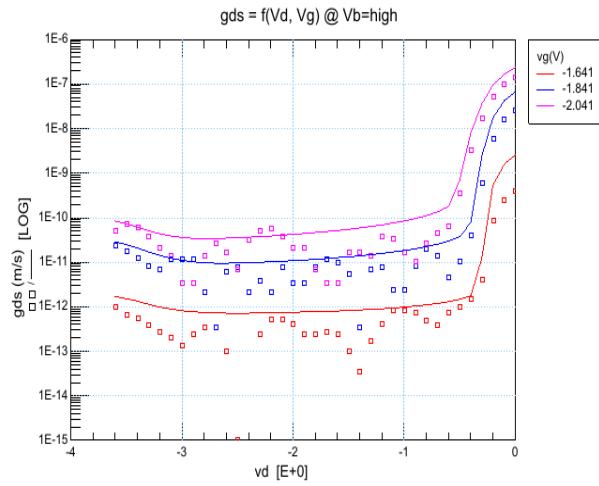
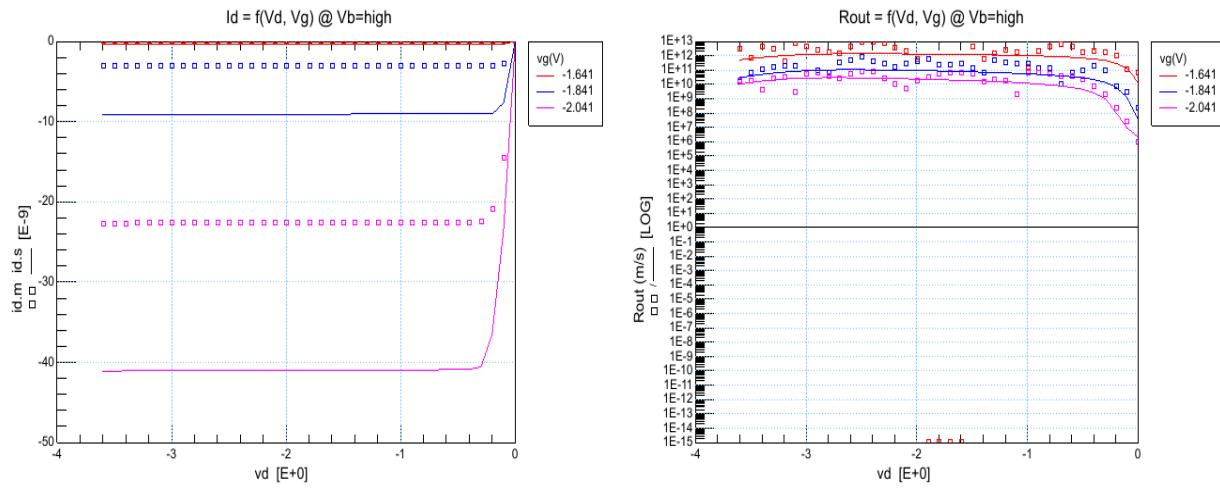


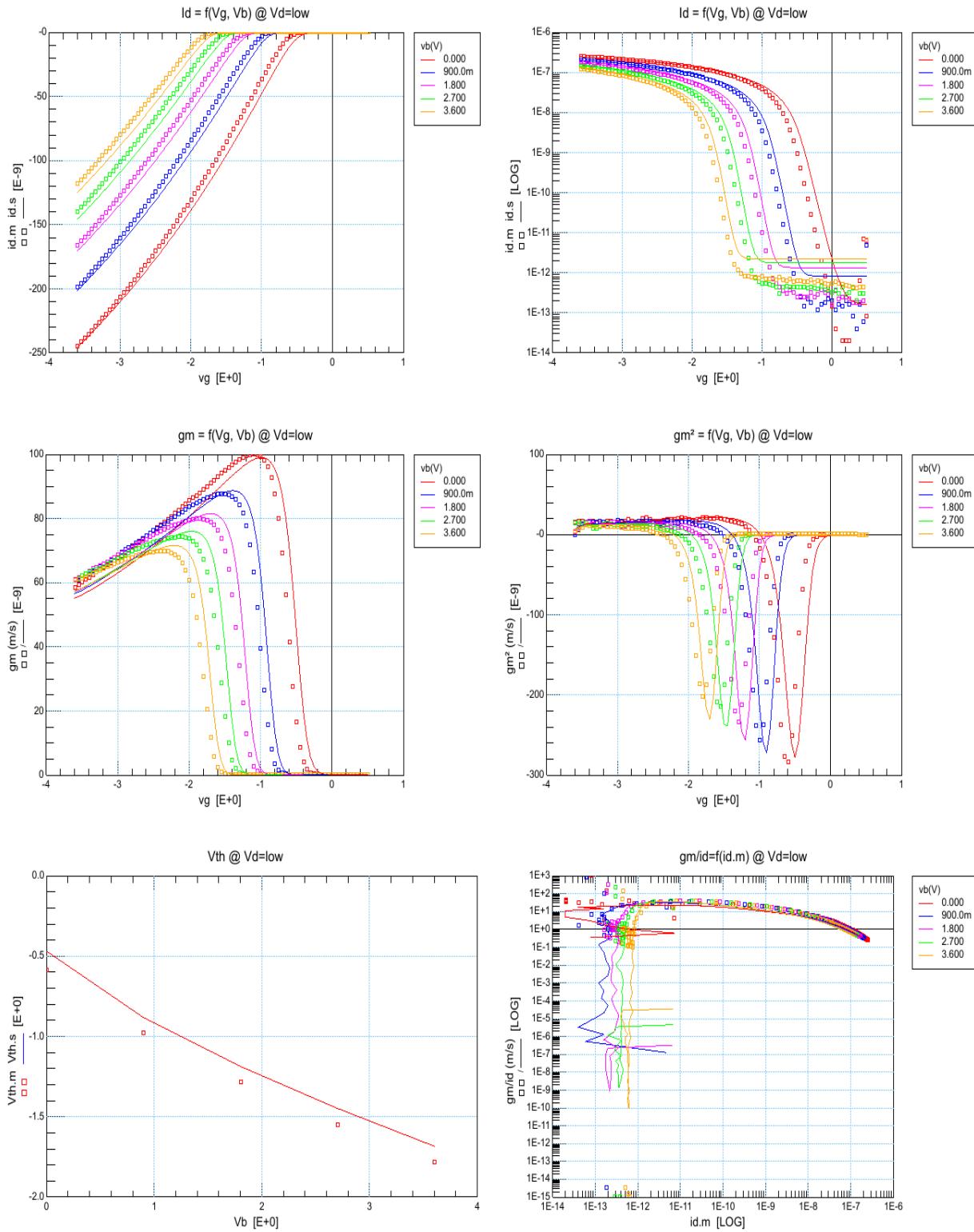
idvg, Ib,Ig, Vb = 3.6V, T = 70°C

idvd, Vb = 0V, T = 70°C


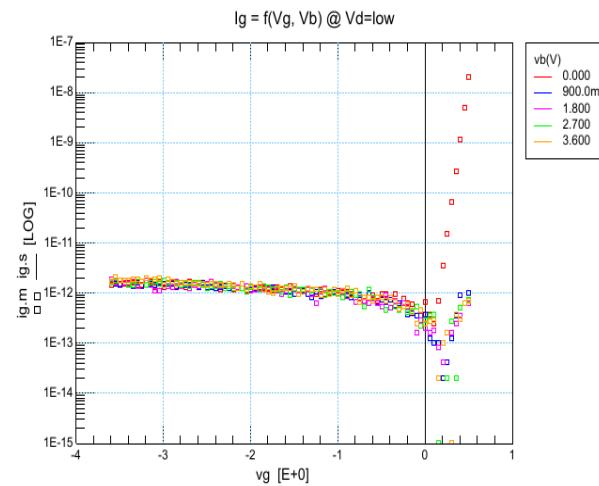
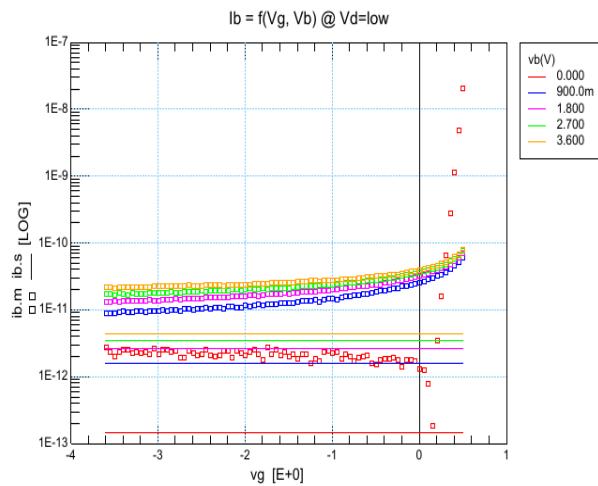
idvd_vbmin, Vb = 3.6V, T = 70°C**idvd_vth, Vb = 0V, T = 70°C**



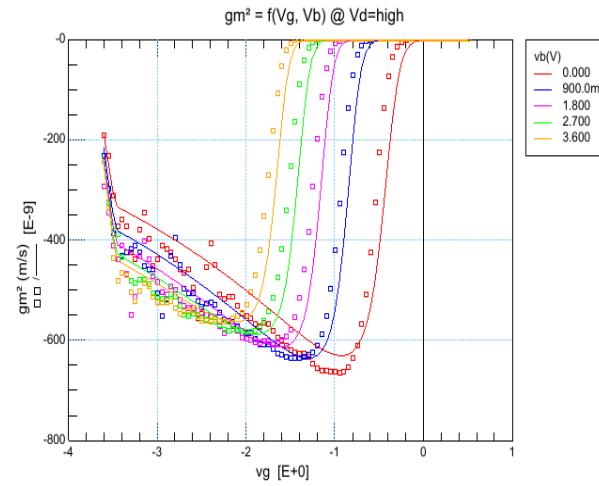
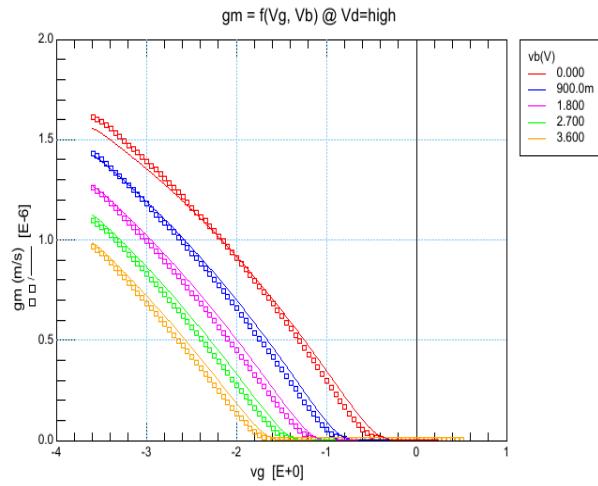
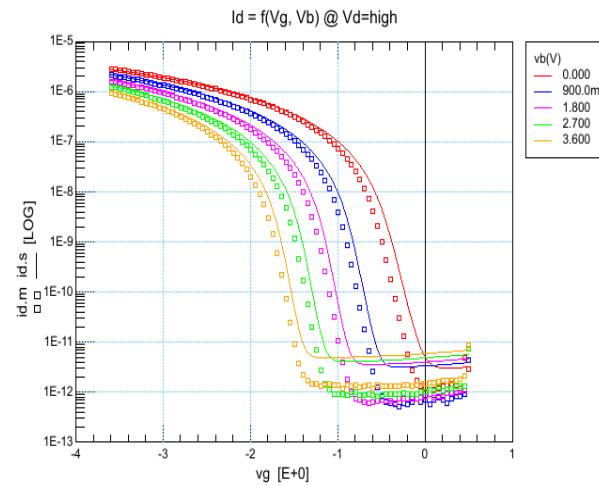
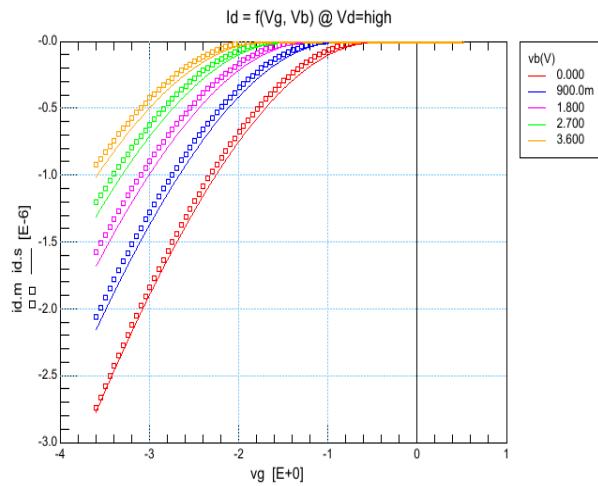
idvd_vth_vbmin, Vb = 3.6V, T = 70°C

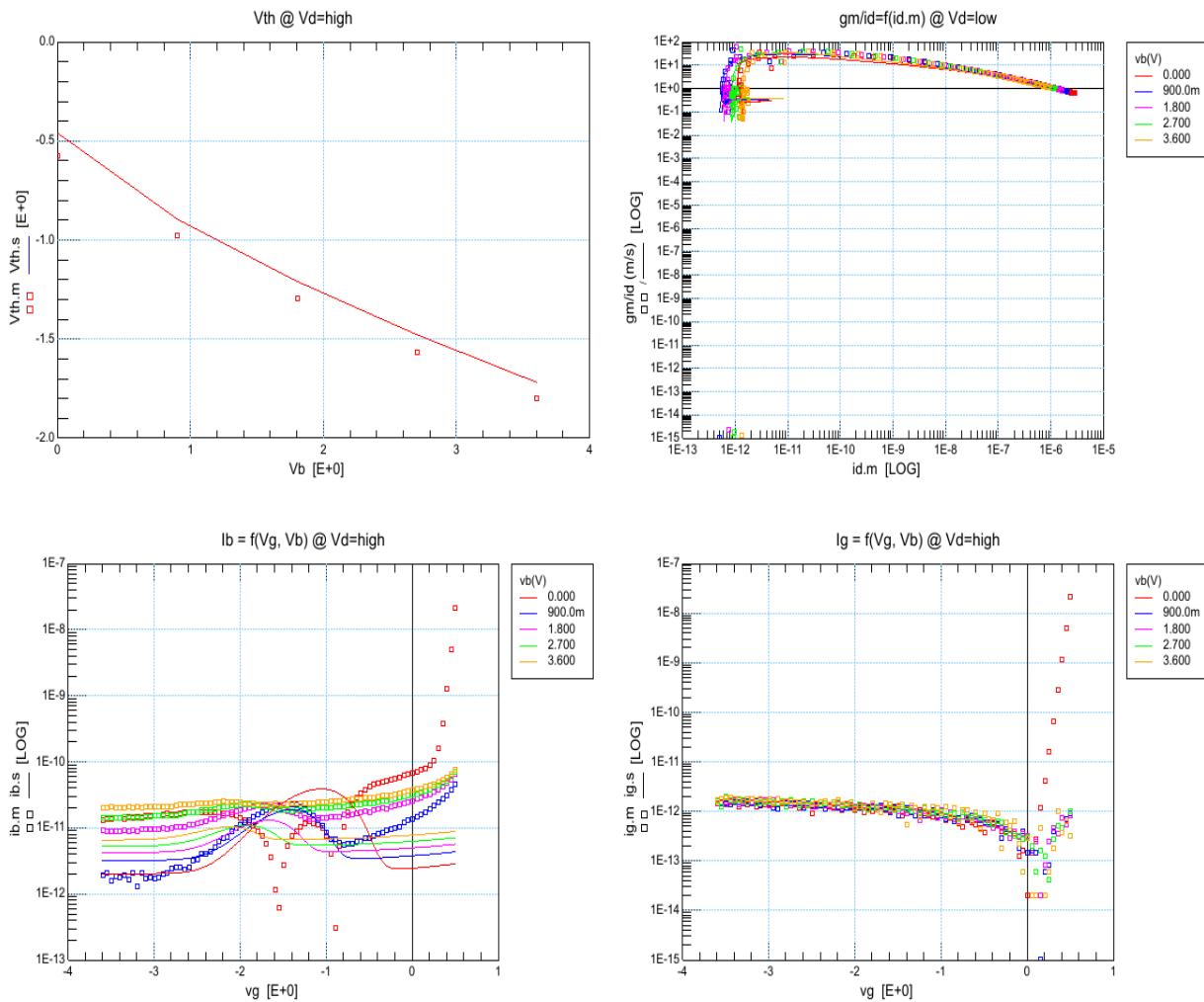


idvg, Vd = -0.1V, T = 125°C


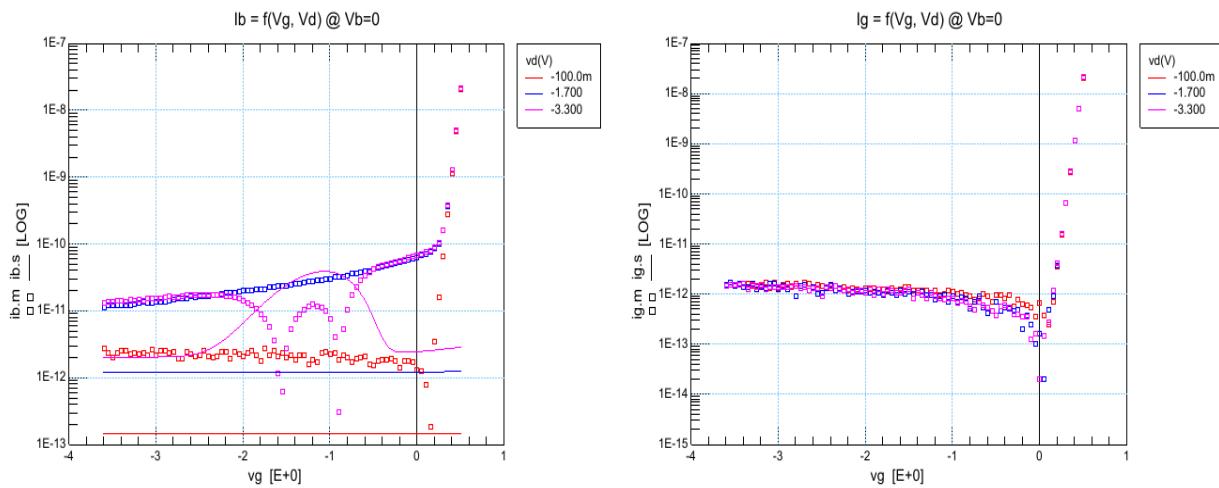


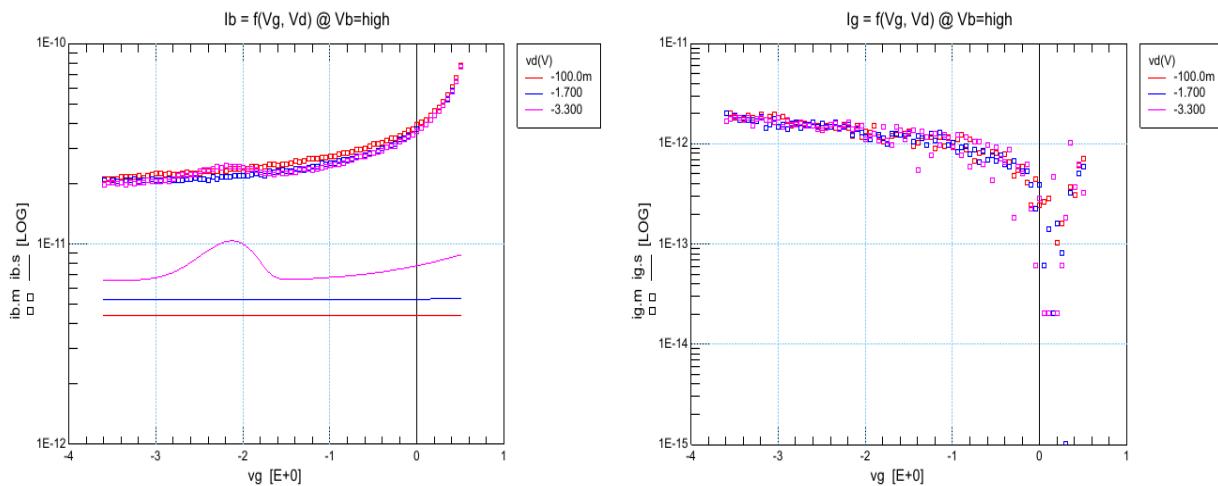
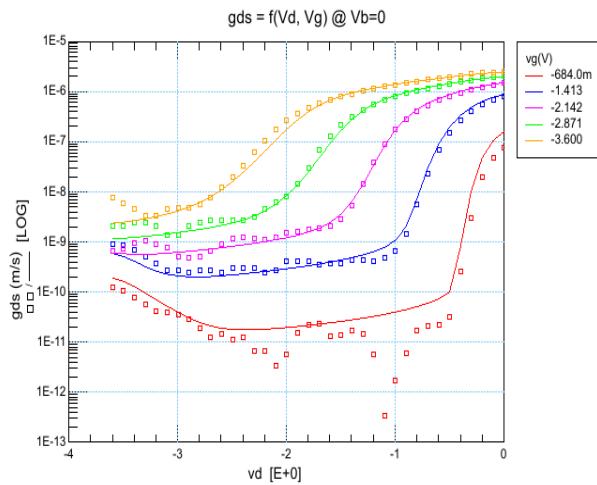
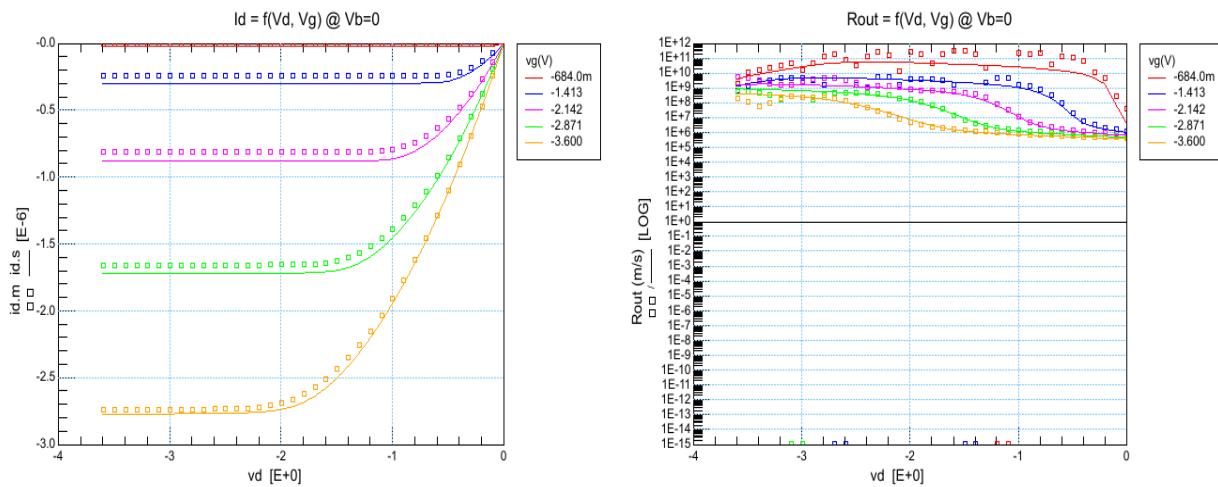
$i_{dvg}, V_d = -3.3V, T = 125^\circ\text{C}$

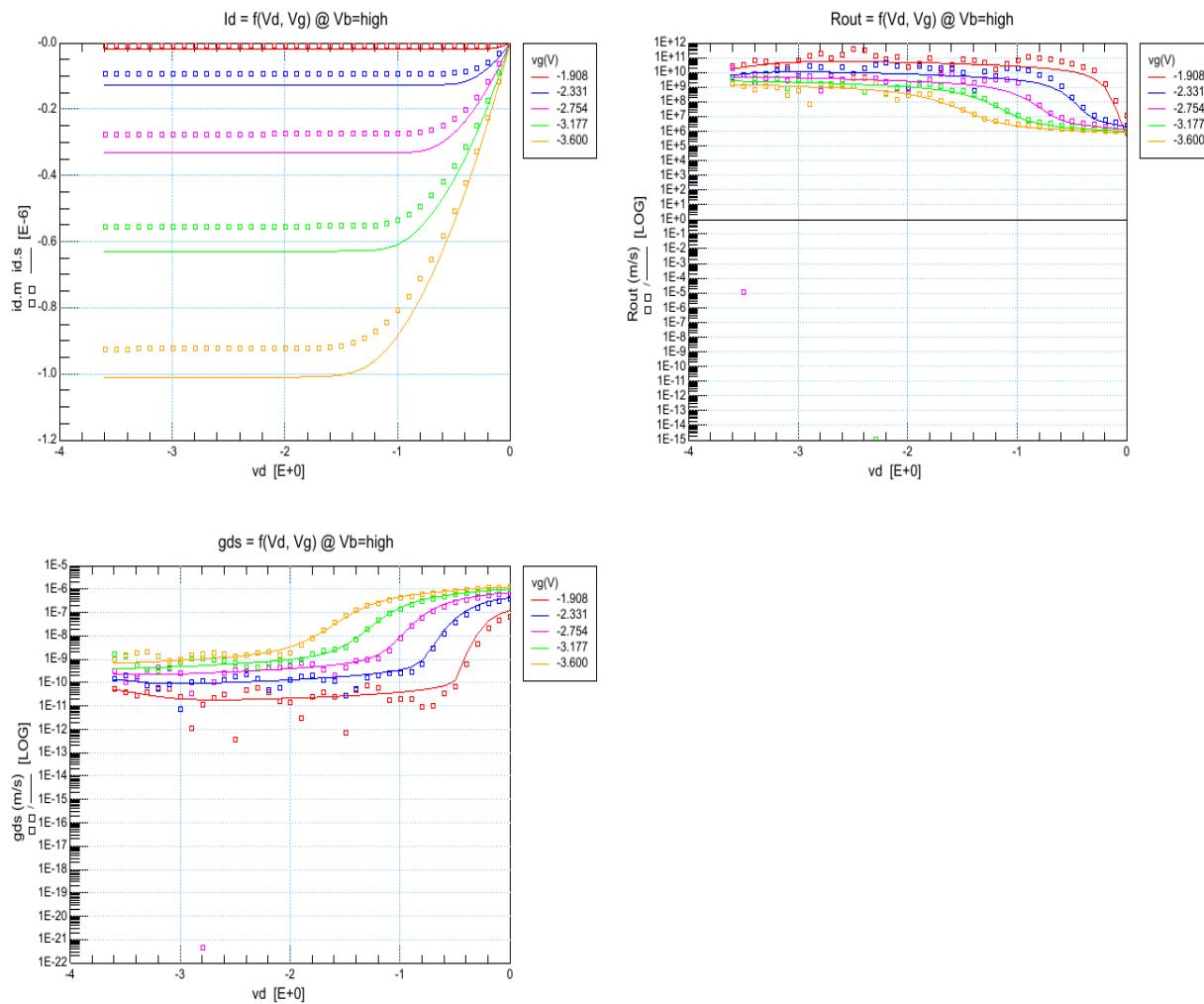
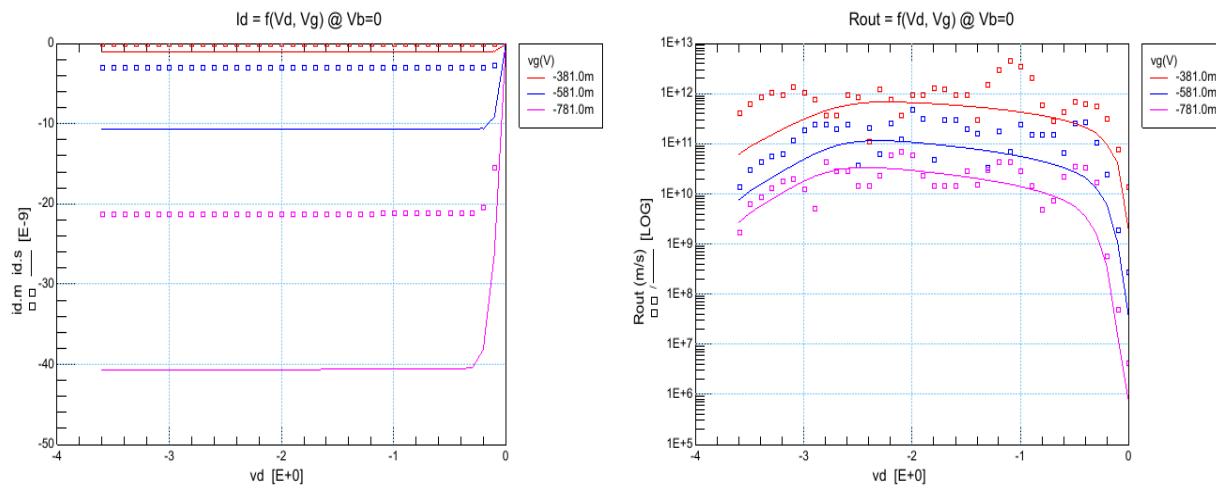


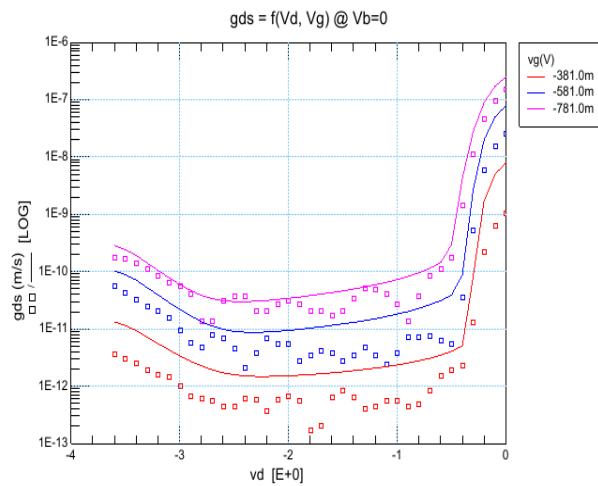


idvg, Ib,Ig, Vb = 0V, T = 125°C

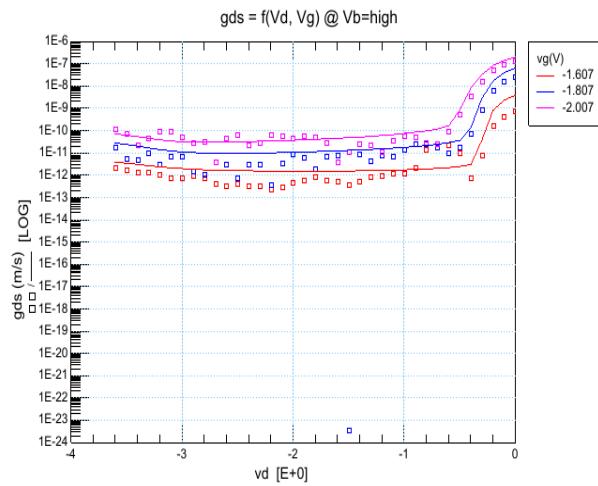
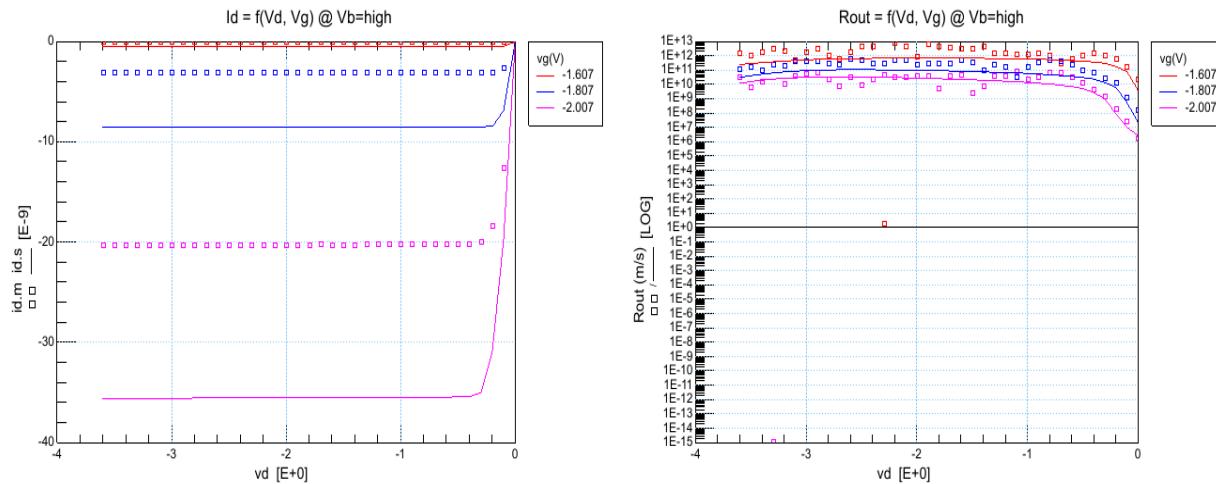


idvg, Ib,Ig, Vb = 3.6V, T = 125°C

idvd, Vb = 0V, T = 125°C


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

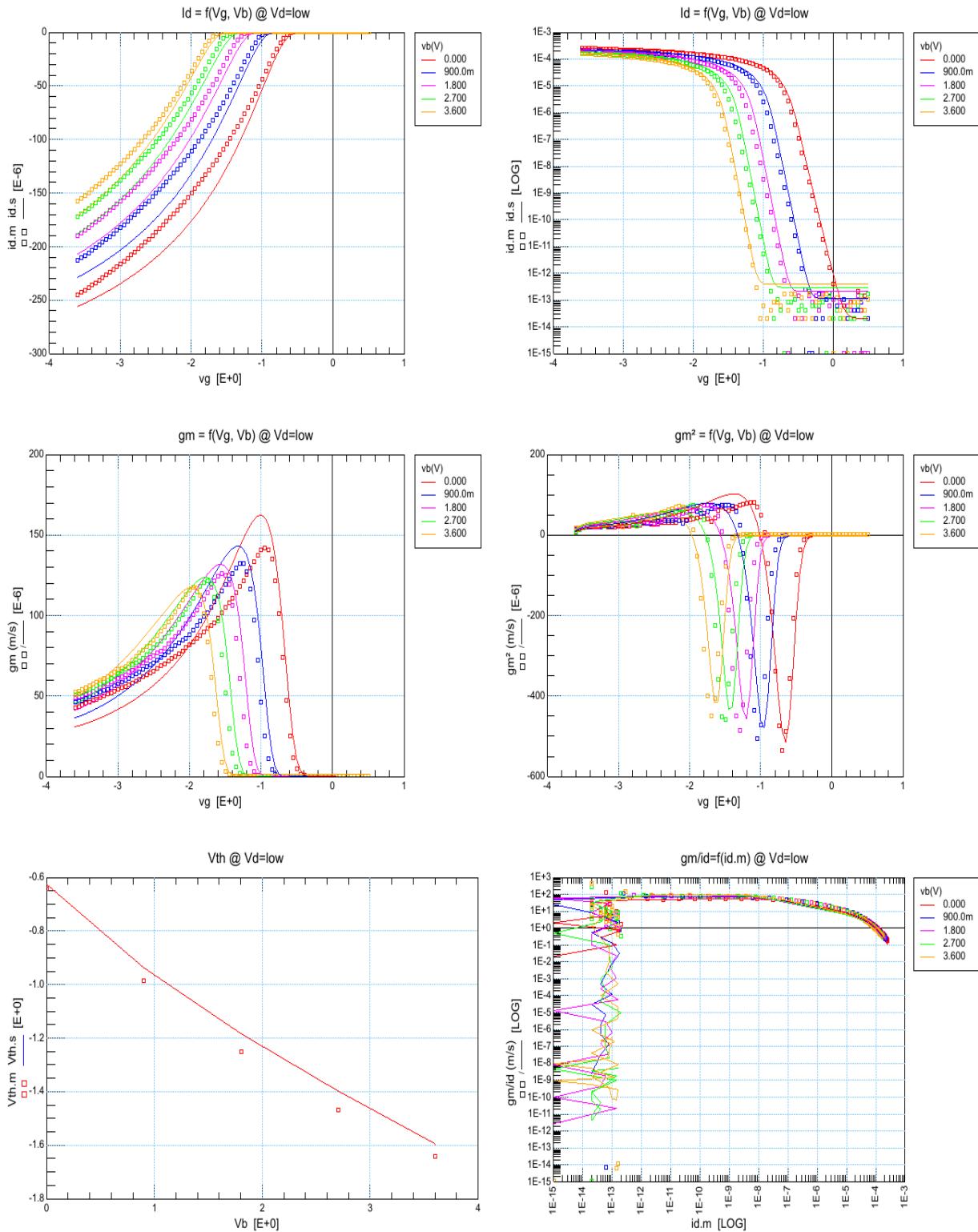


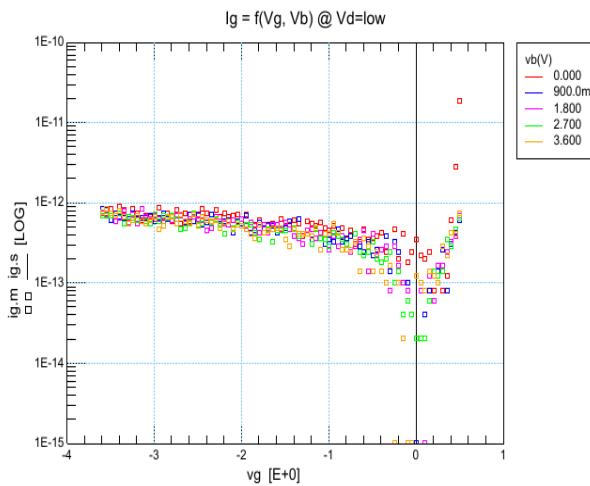
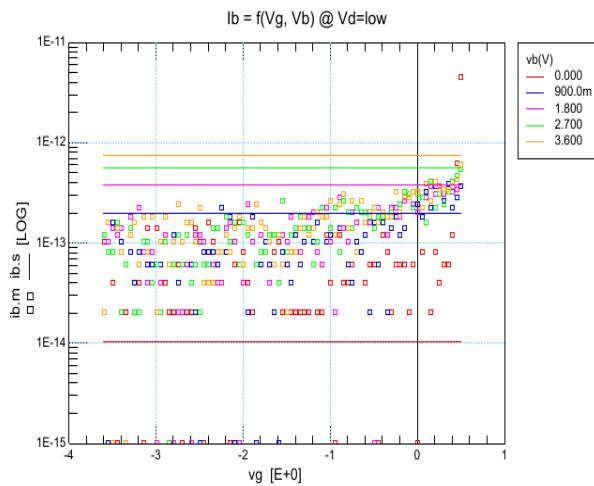
idvd_vth_vbmin, Vb = 3.6V, T = 125°C



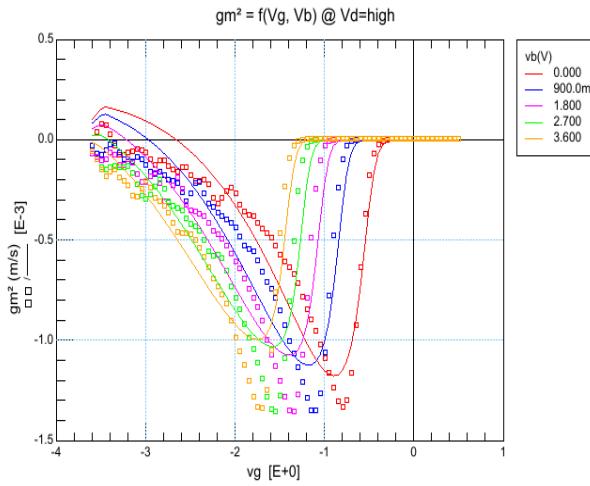
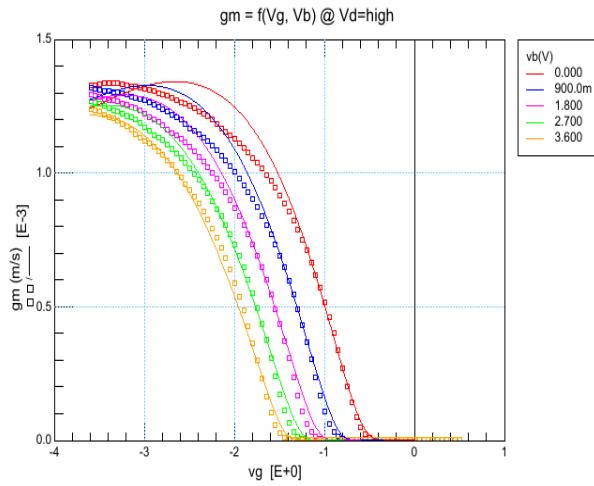
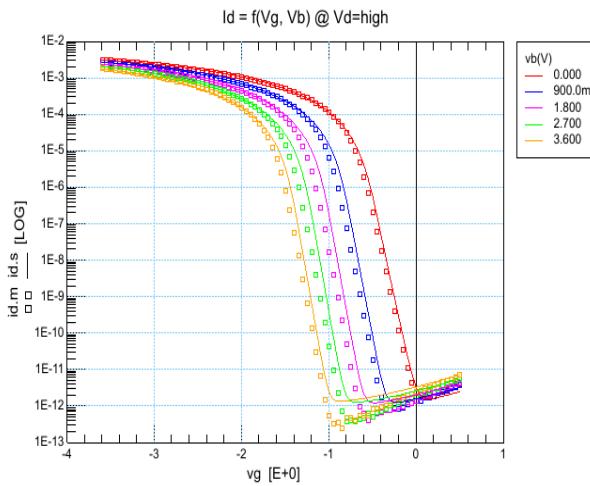
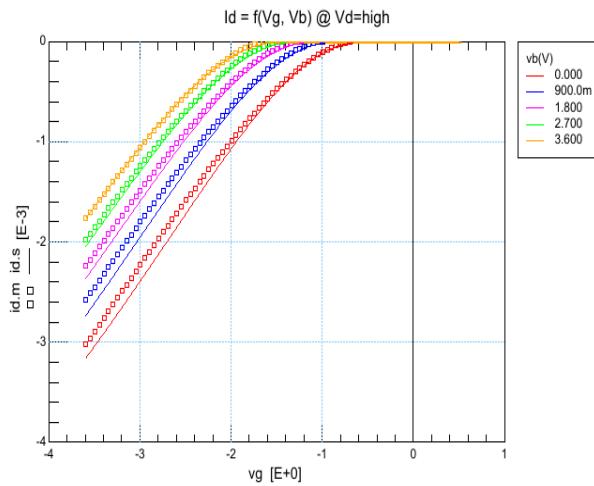
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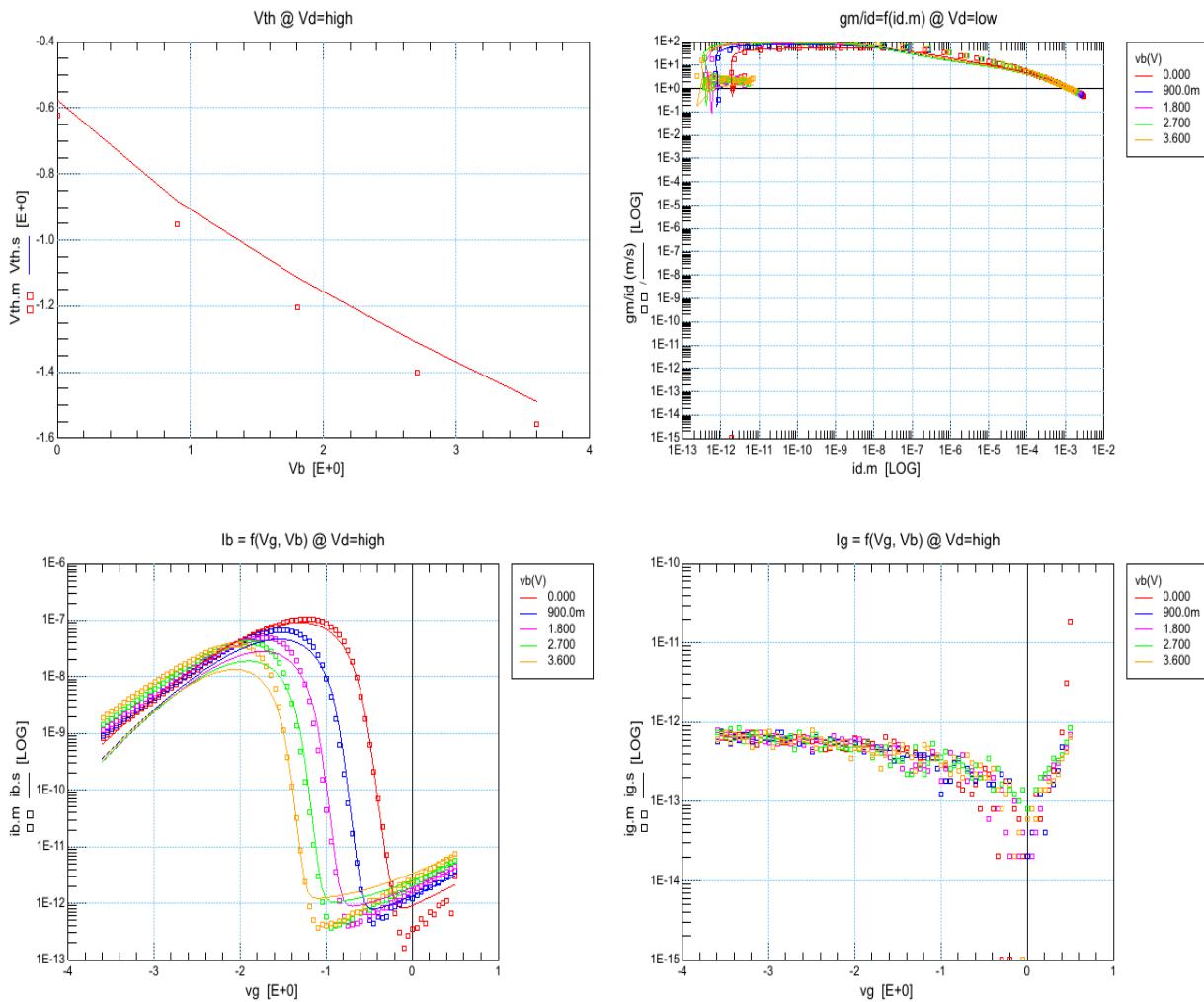
$idv_g, V_d = -0.1V, T = 27^\circ C$



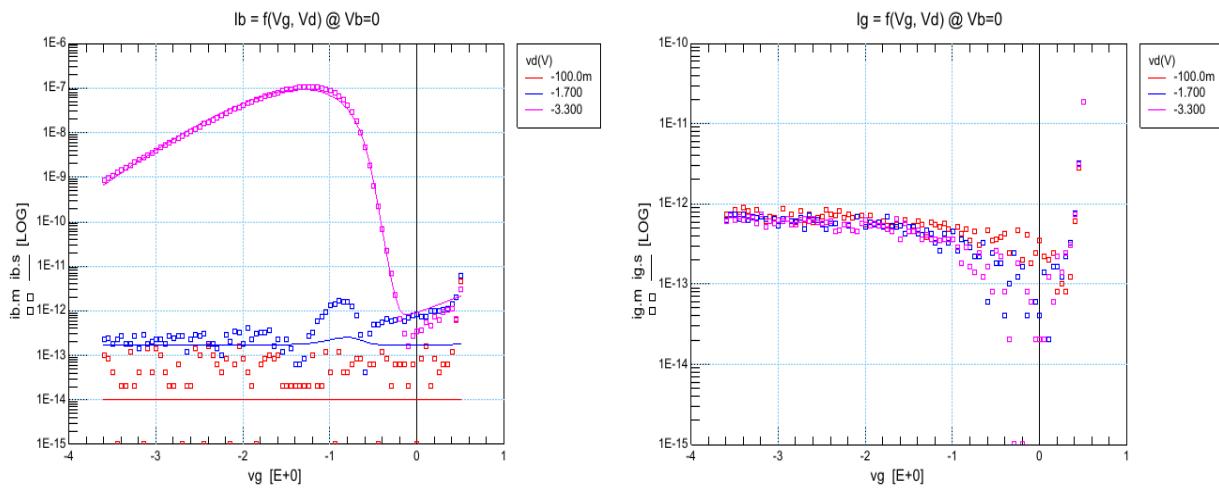


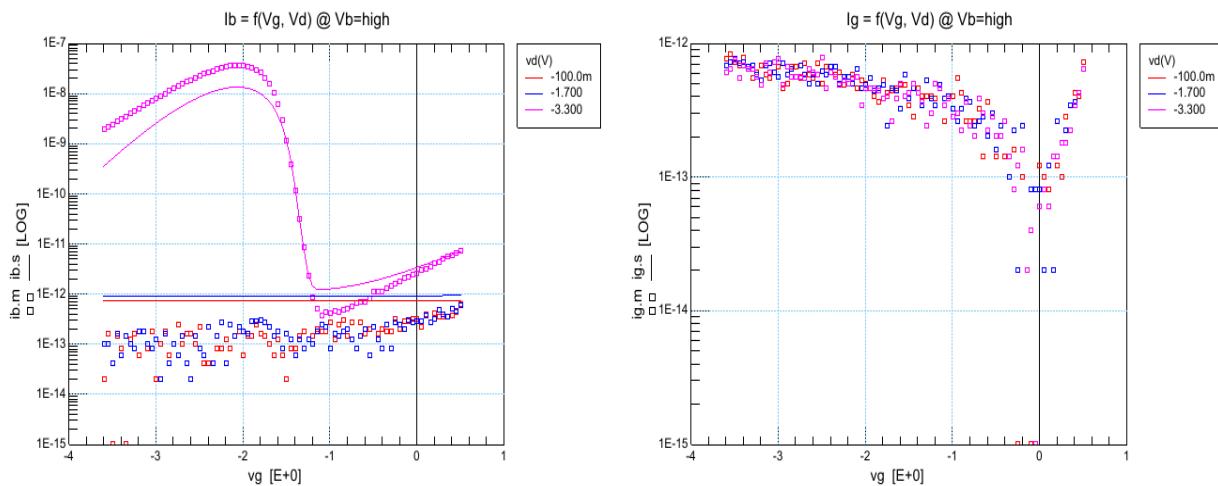
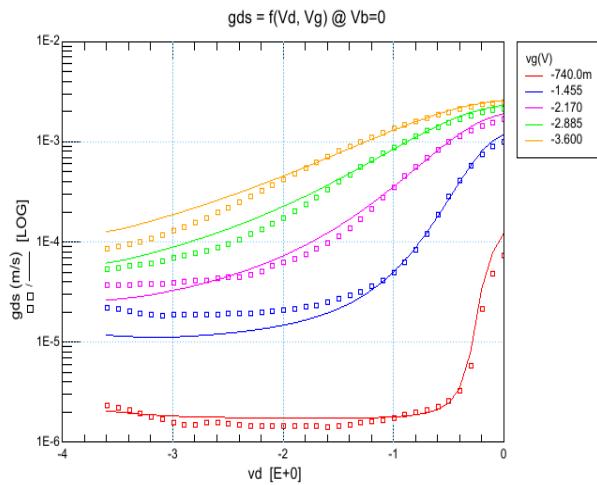
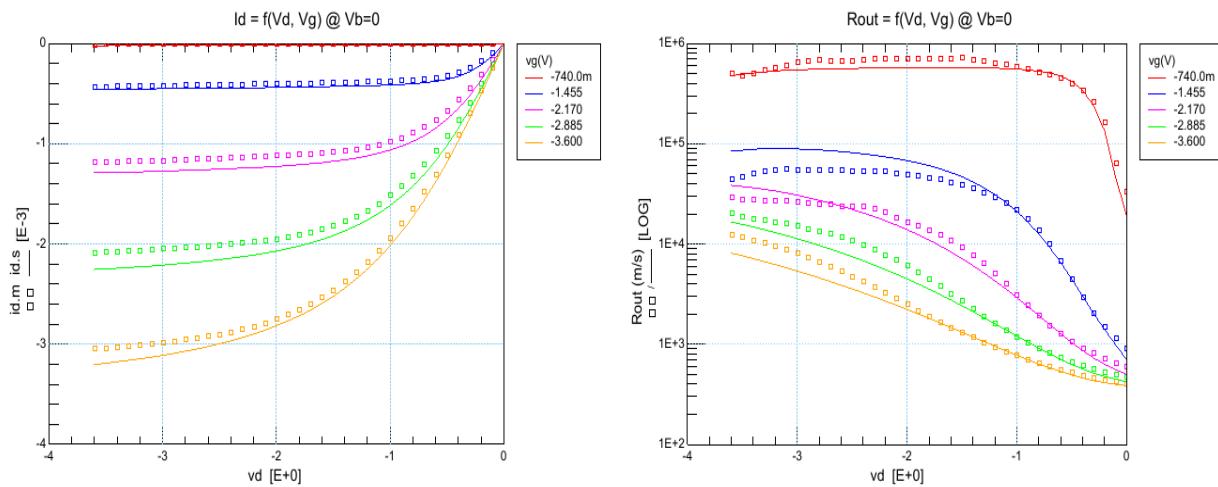
$i_{dvg}, V_d = -3.3V, T = 27^\circ\text{C}$

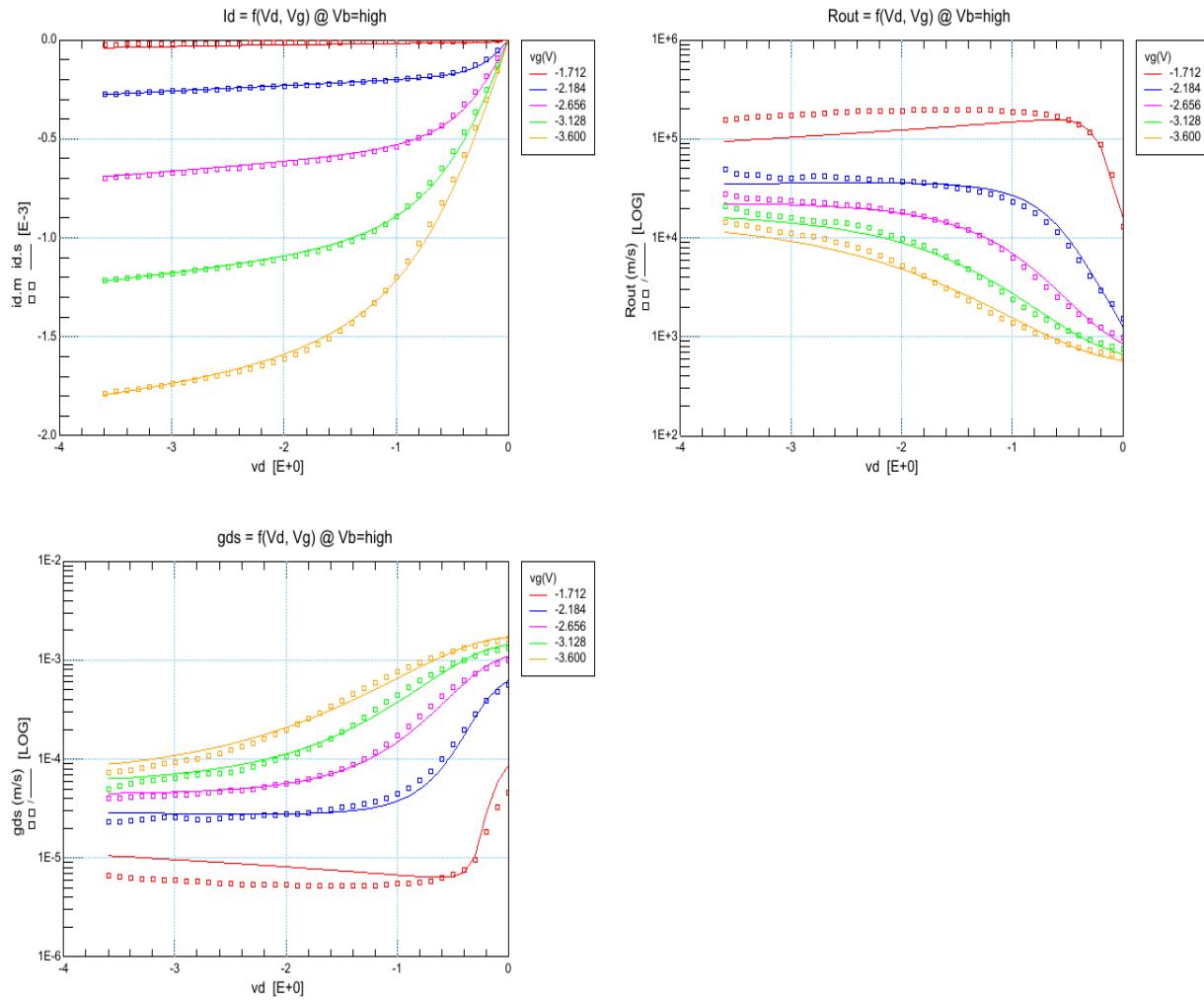
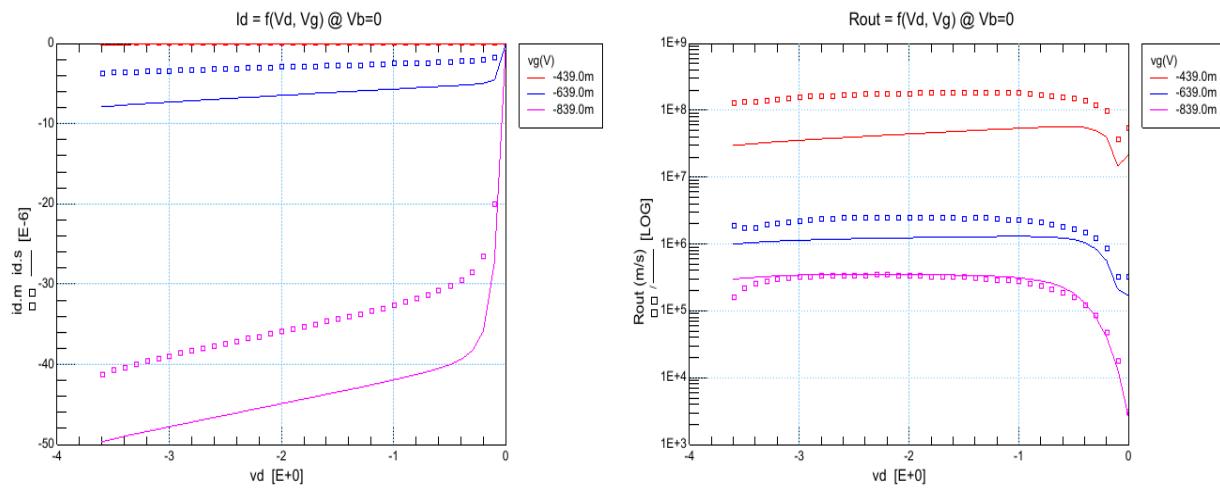


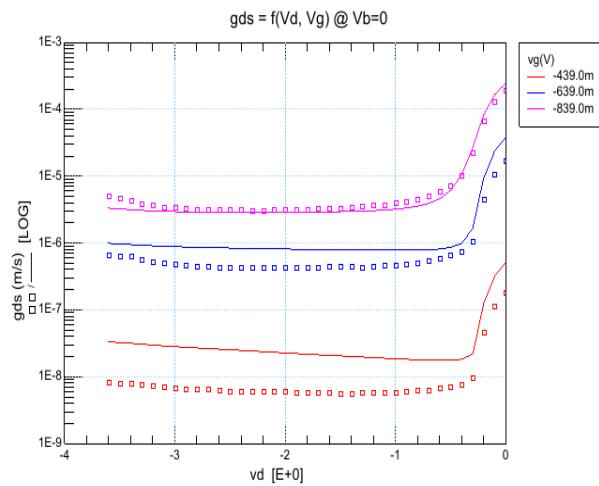


idvg, Ib, Ig, Vb = 0V, T = 27°C

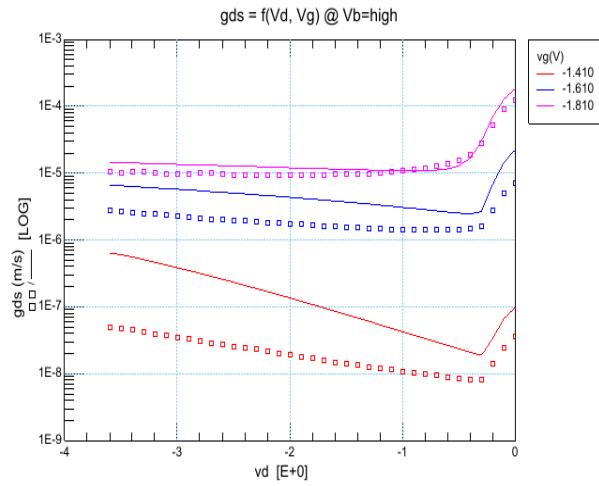
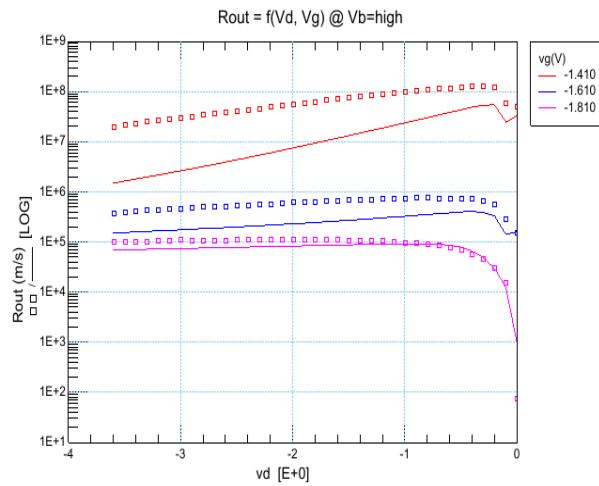
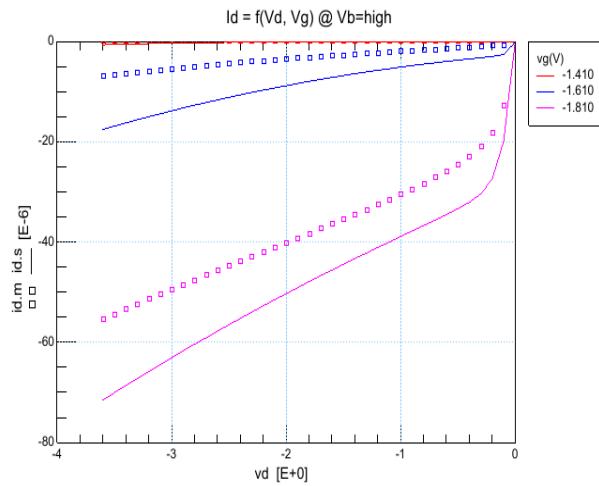


idvg, Ib,Ig, Vb = 3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


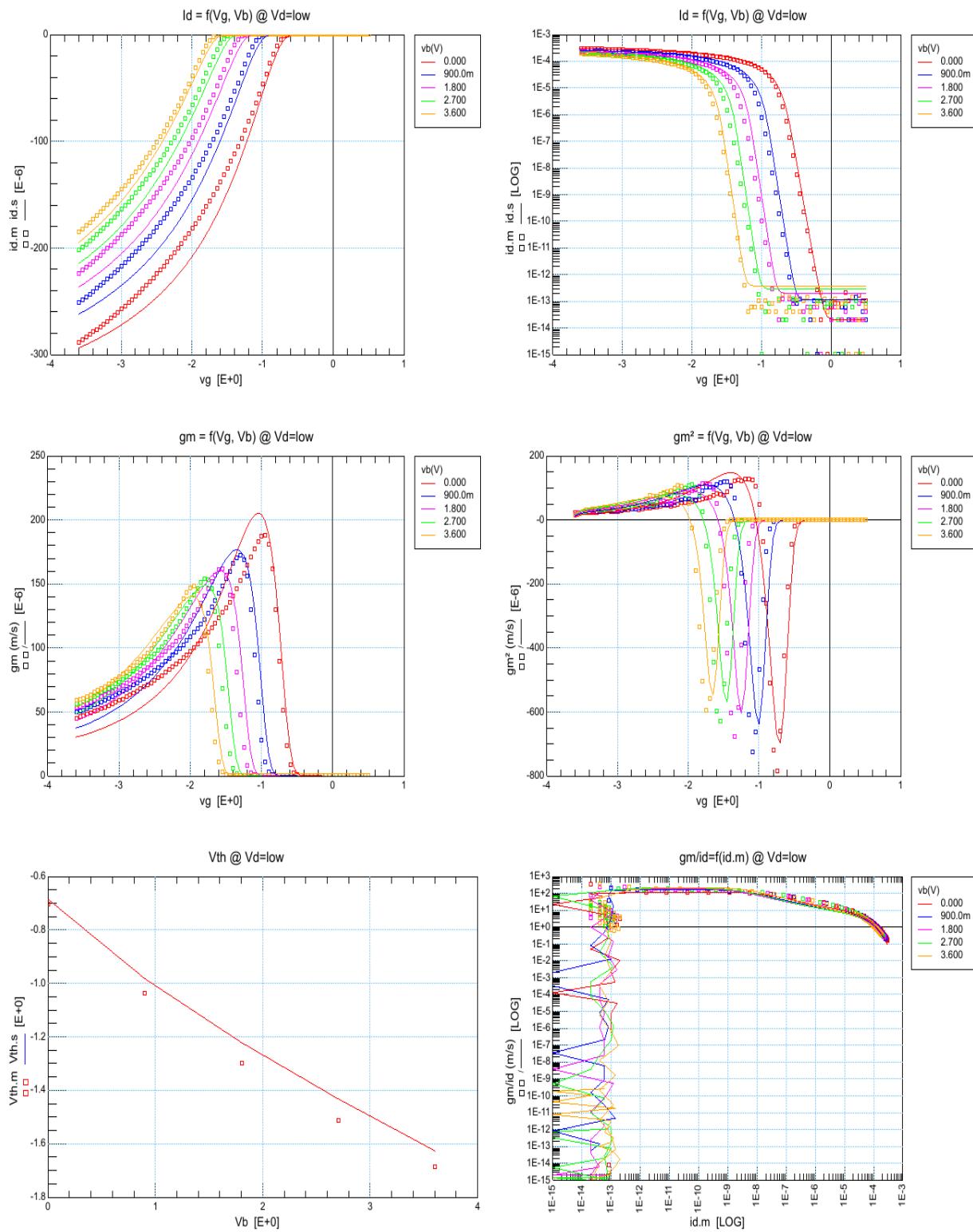
idvd_vbmin, Vb = 3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


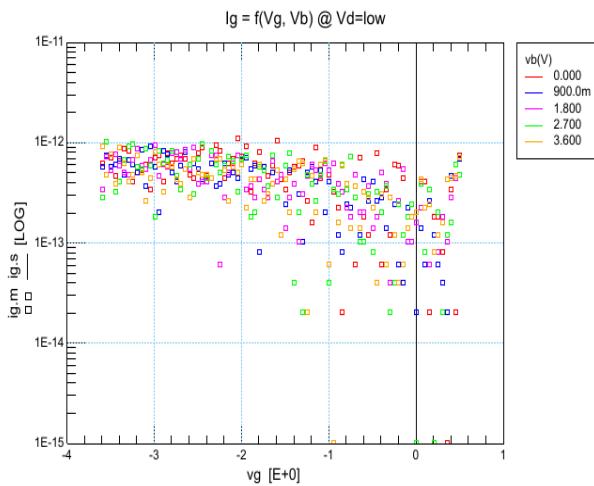
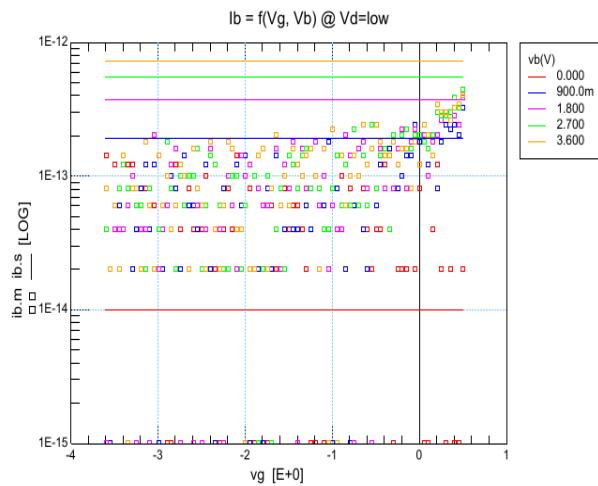


idvd_vth_vbmin, Vb = 3.6V, T = 27°C

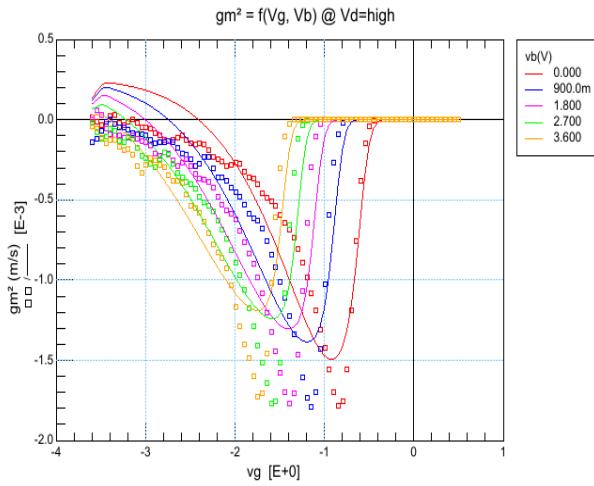
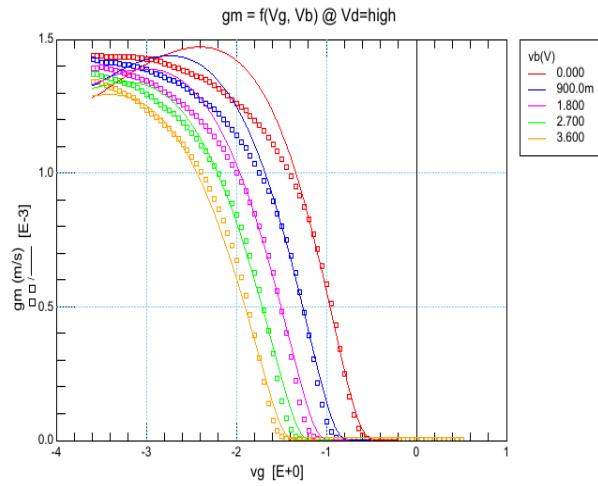
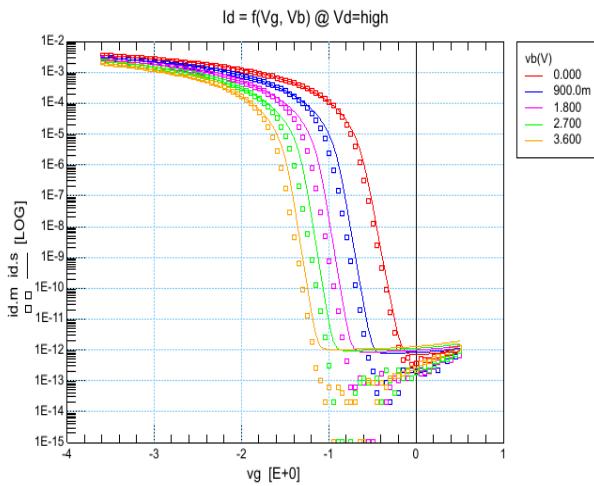
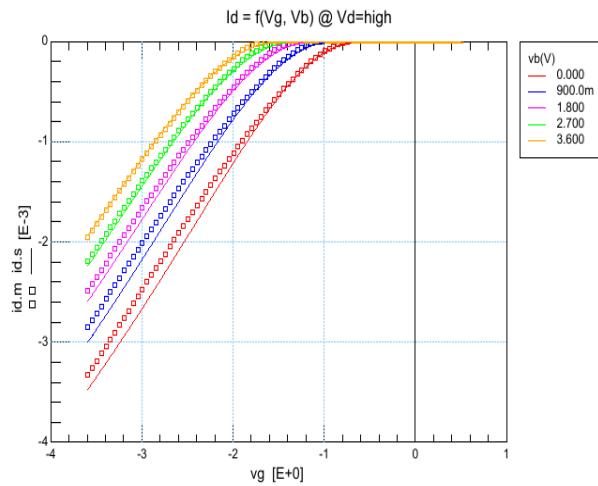


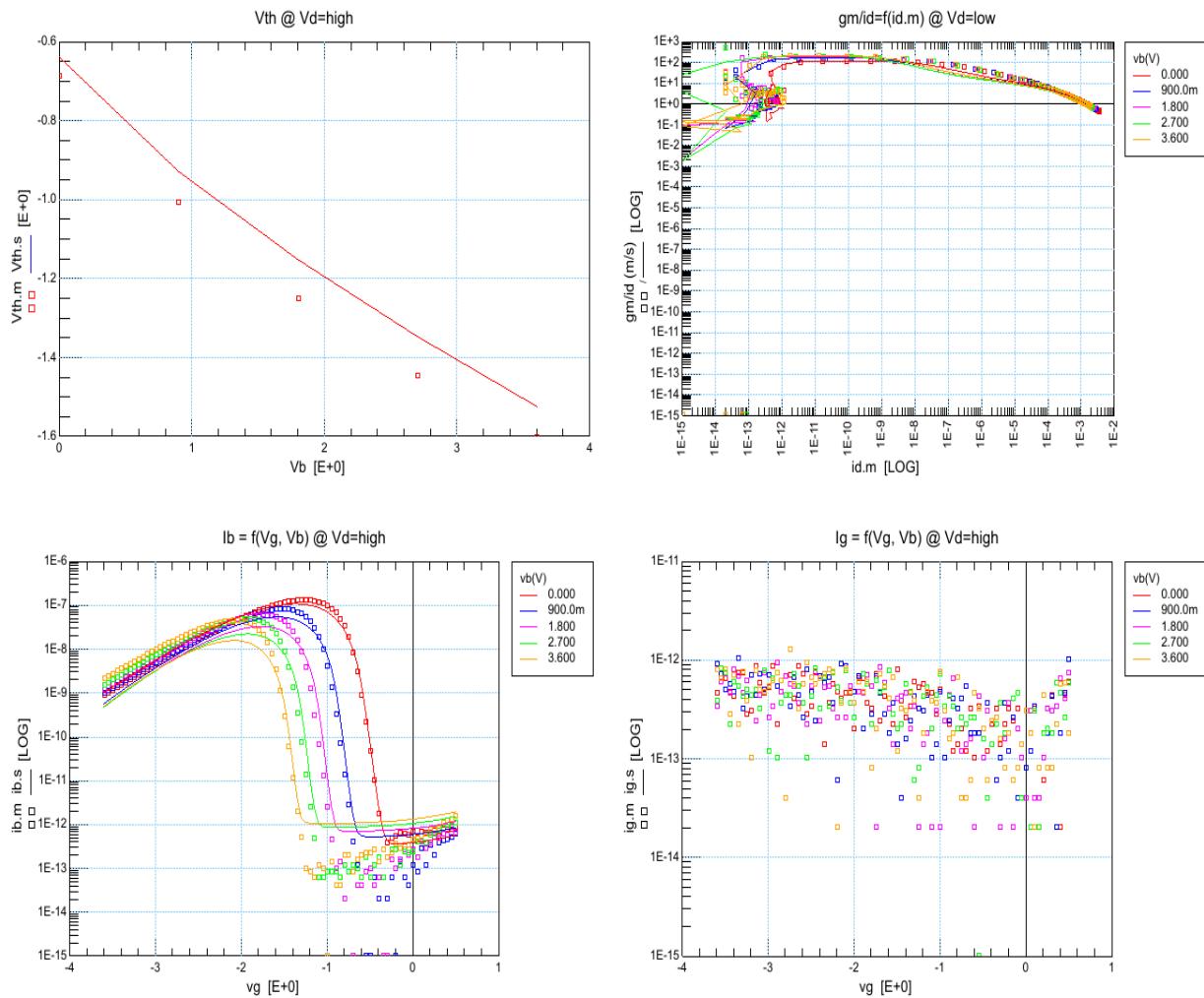
$idvg$, $Vd = -0.1V$, $T = -40^{\circ}C$



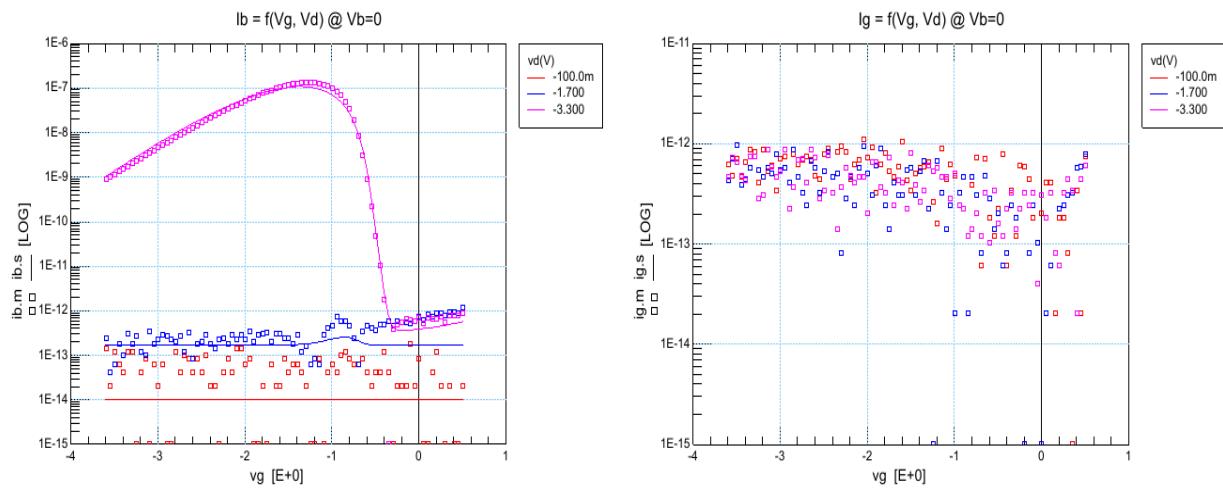


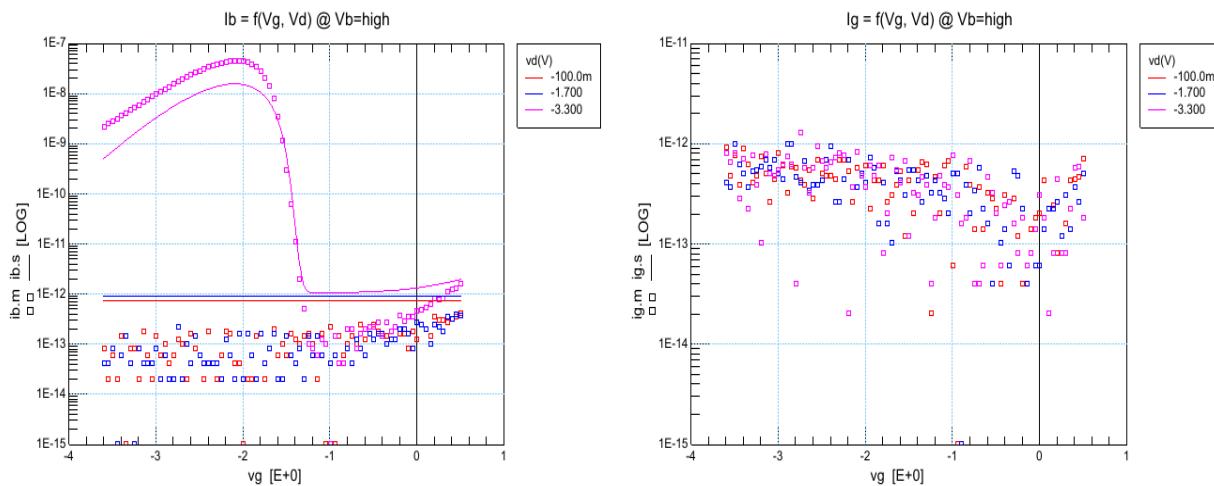
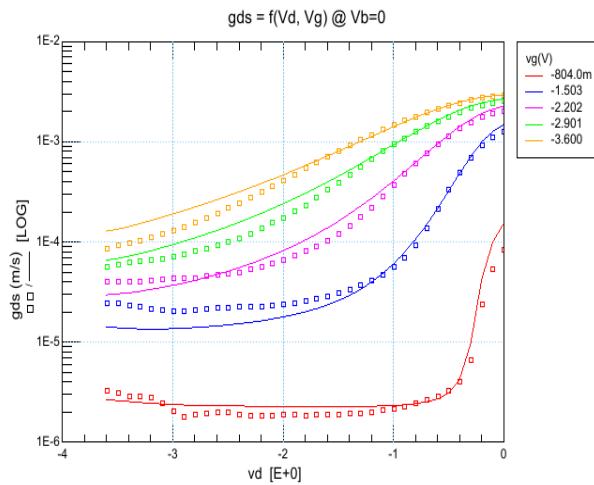
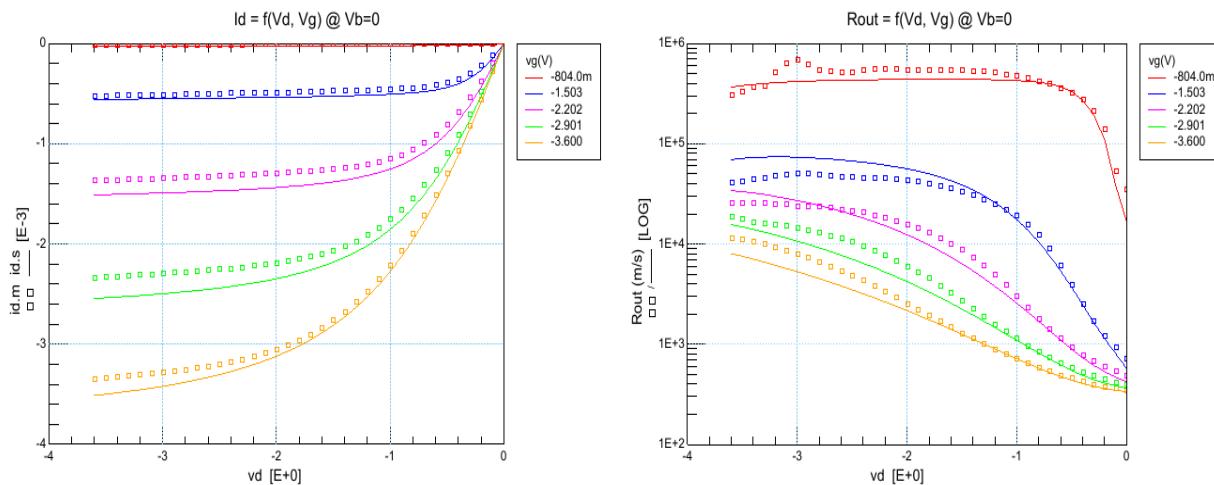
$i_{dvg}, V_d = -3.3V, T = -40^\circ\text{C}$

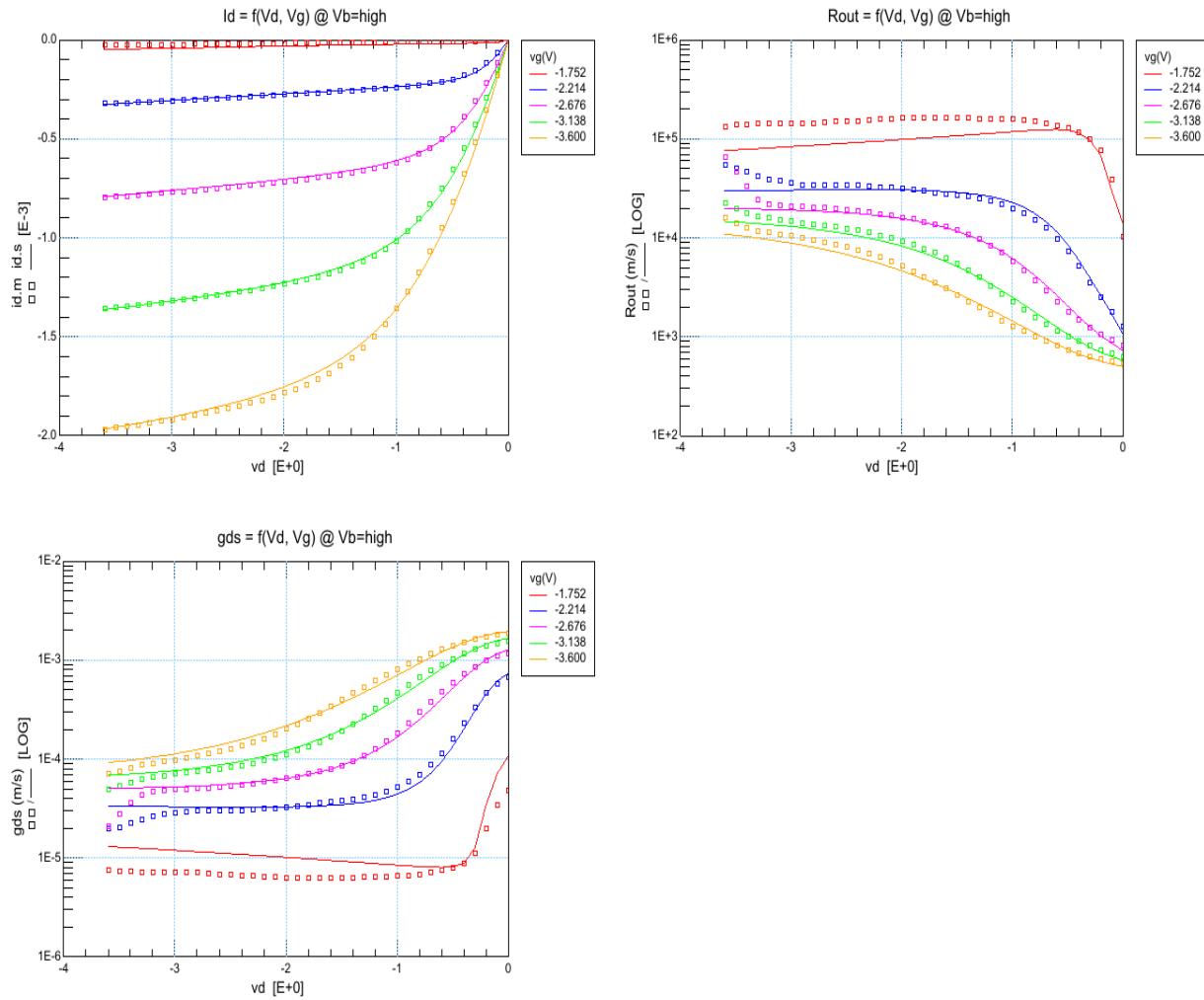
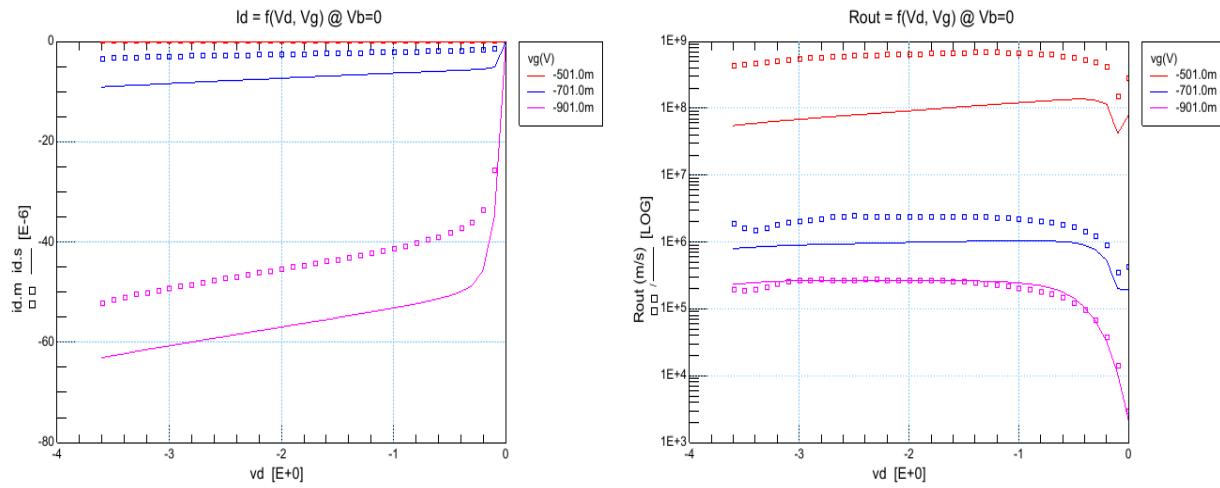


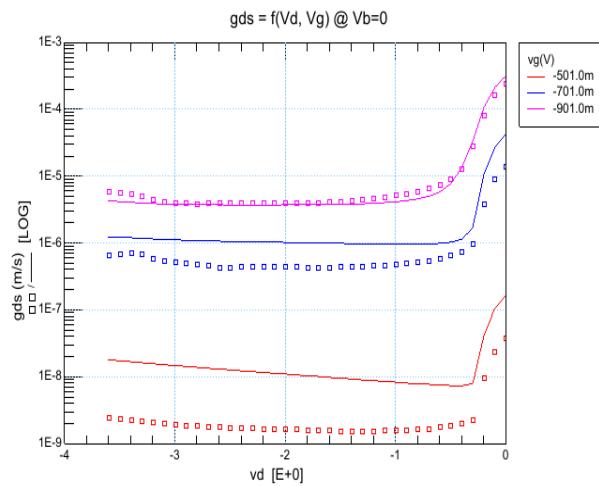


idvg, Ib,Ig, Vb = 0V, T = -40°C

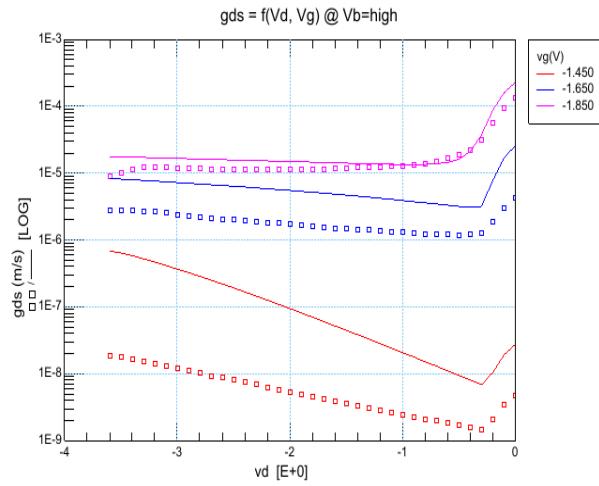
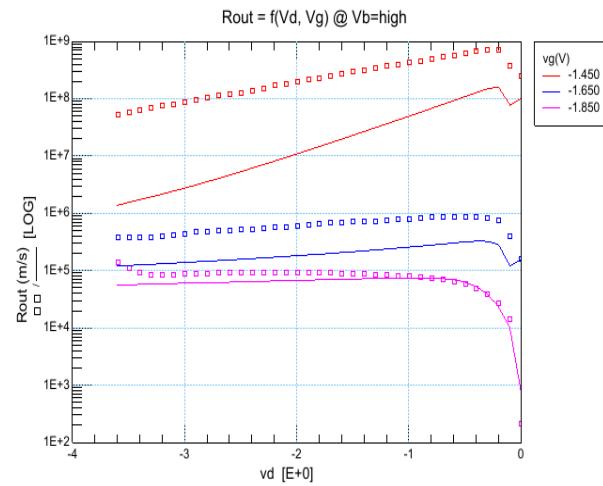
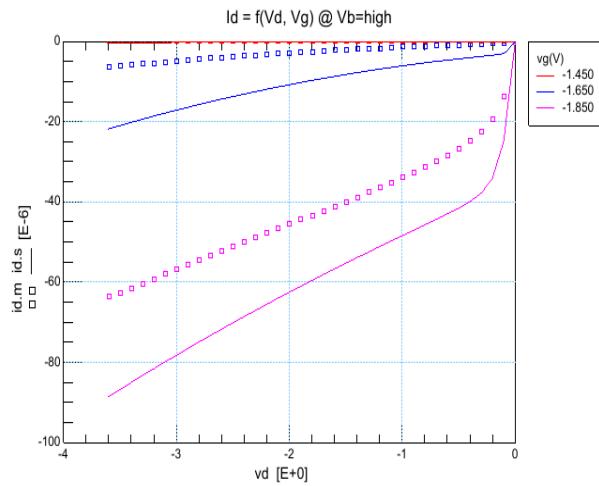


idvg, Ib,Ig, Vb = 3.6V, T = -40°C

idvd, Vb = 0V, T = -40°C


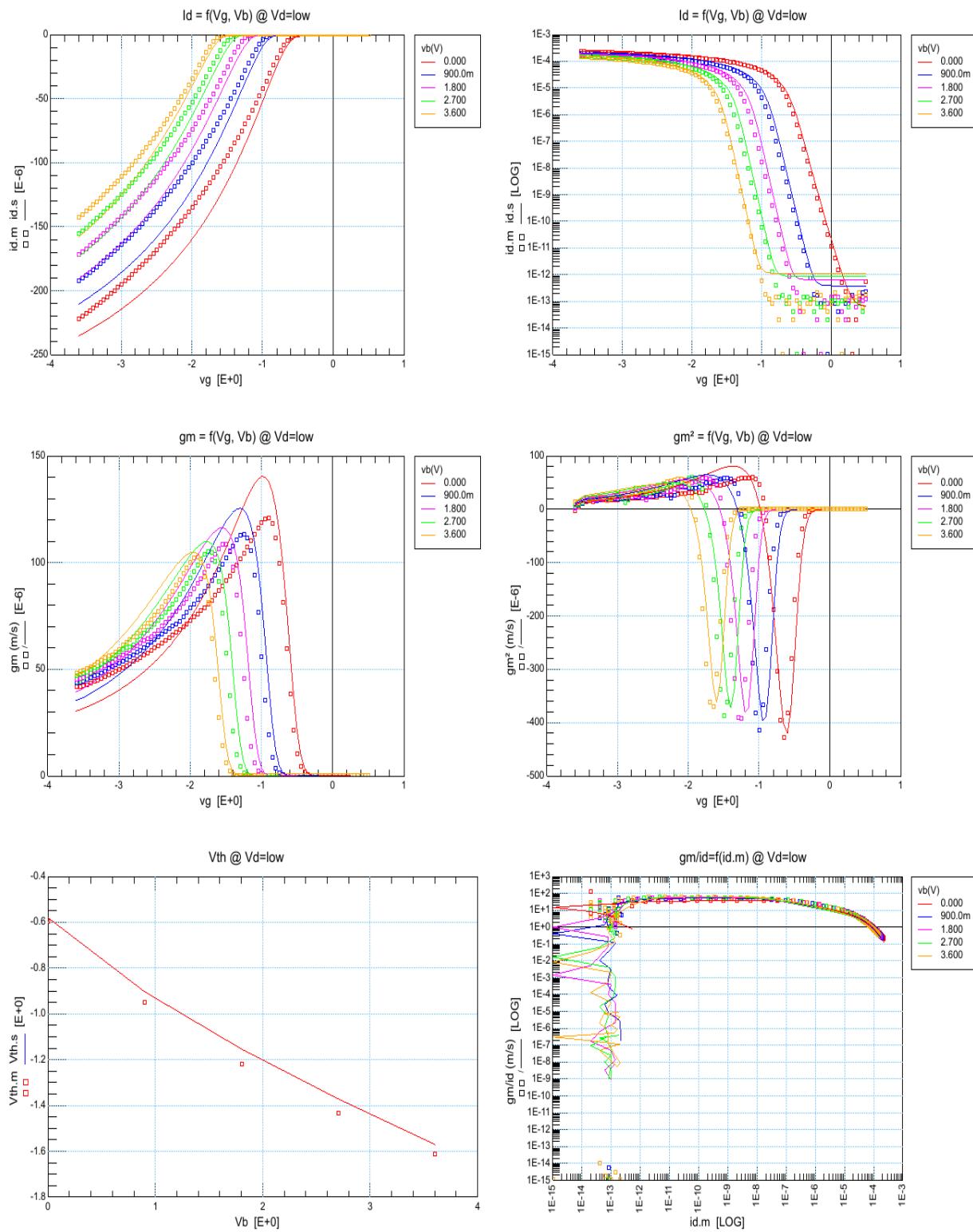
idvd_vbmin, Vb = 3.6V, T = -40°C**idvd_vth, Vb = 0V, T = -40°C**

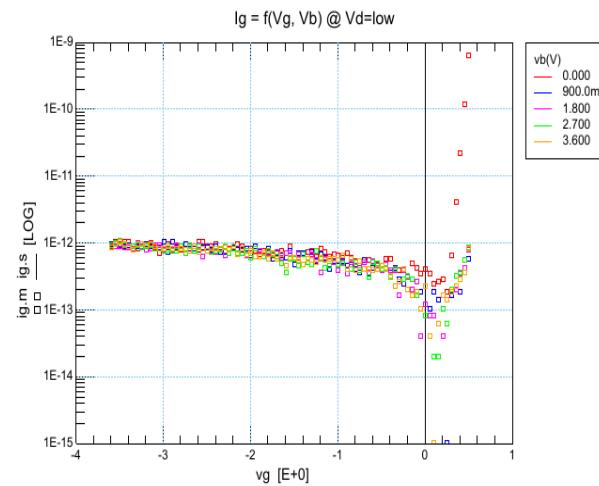
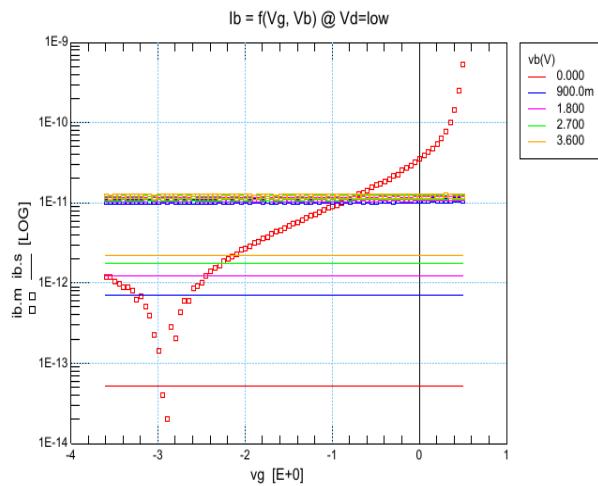


idvd_vth_vbmin, Vb = 3.6V, T = -40°C

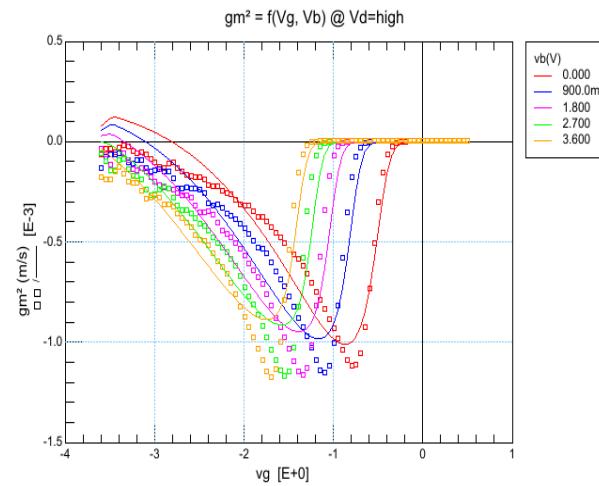
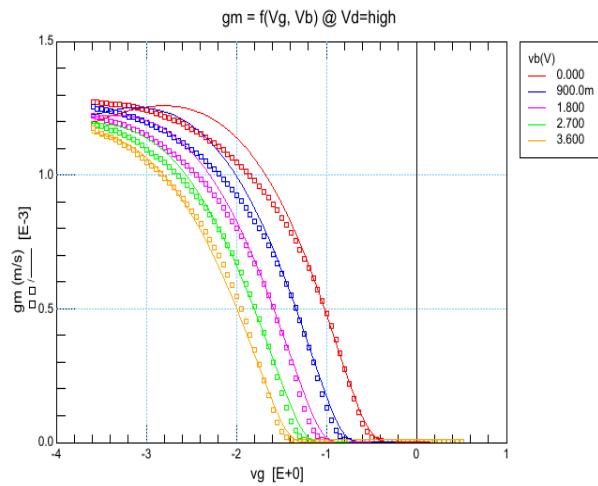
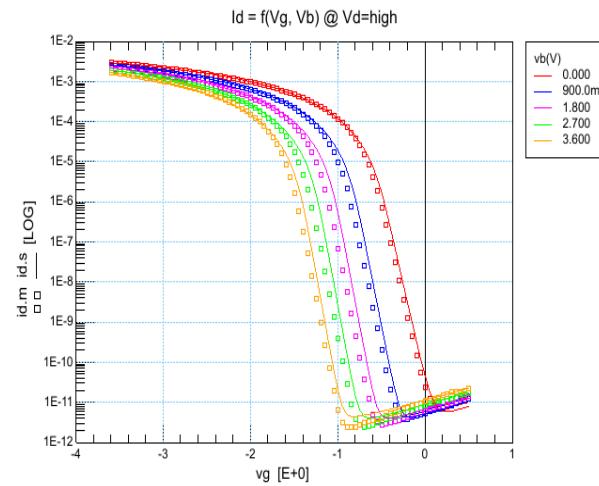
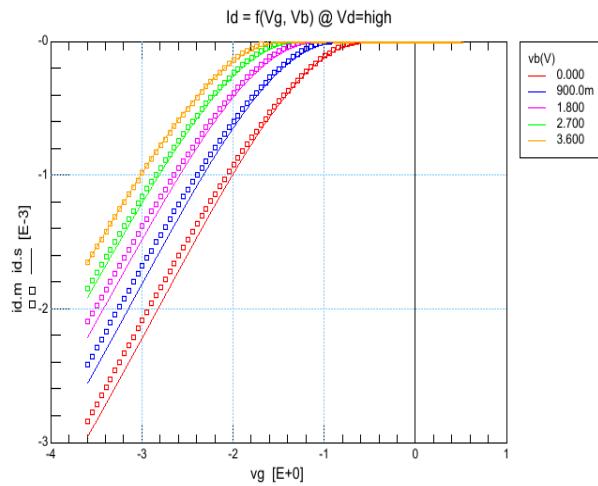


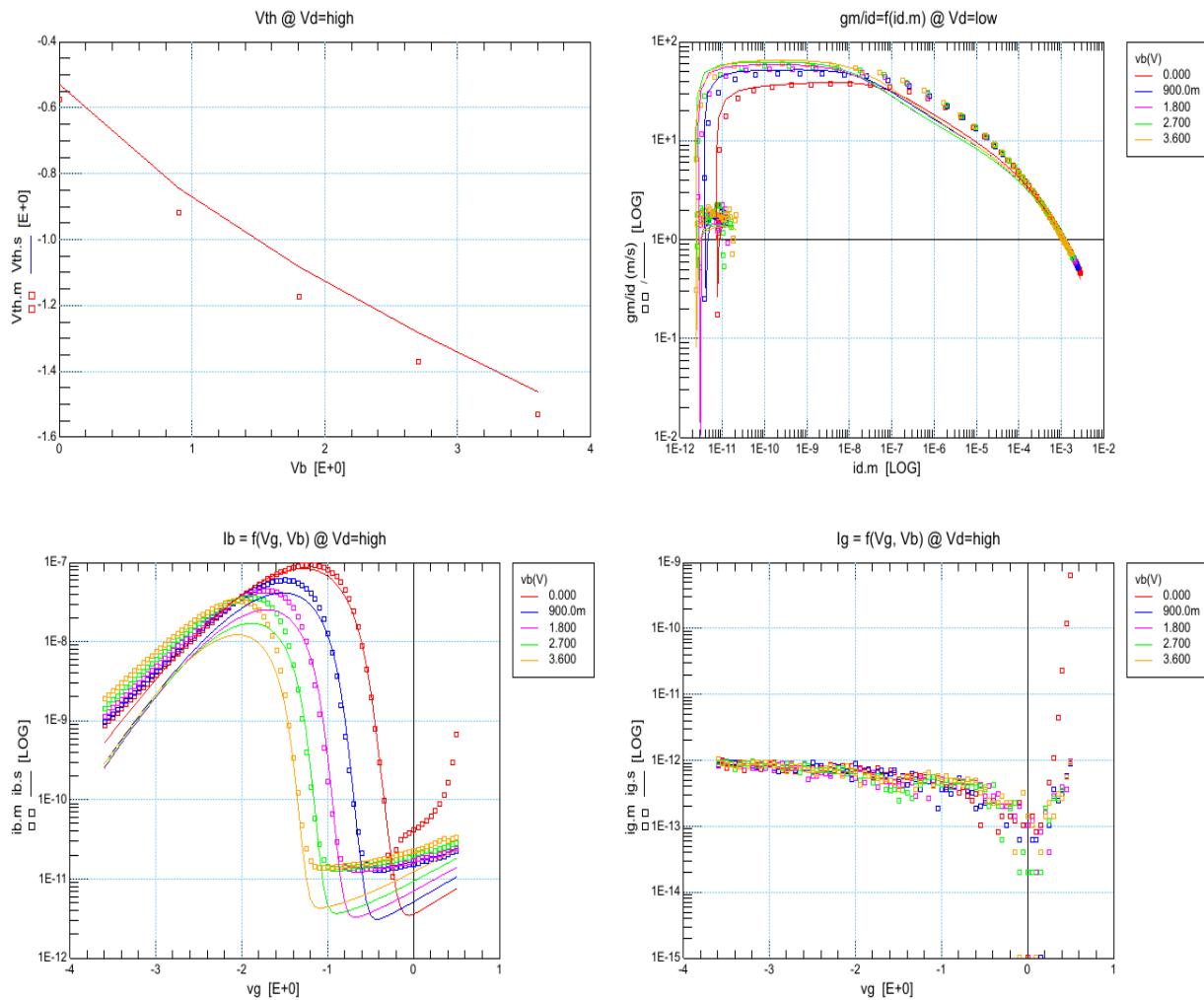
idvg, Vd = -0.1V, T = 70°C



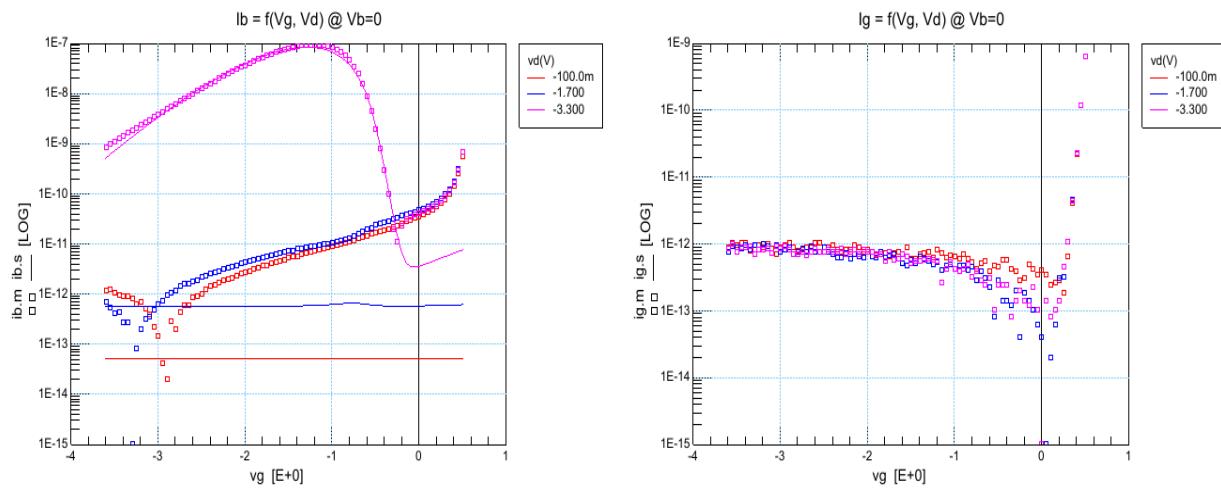


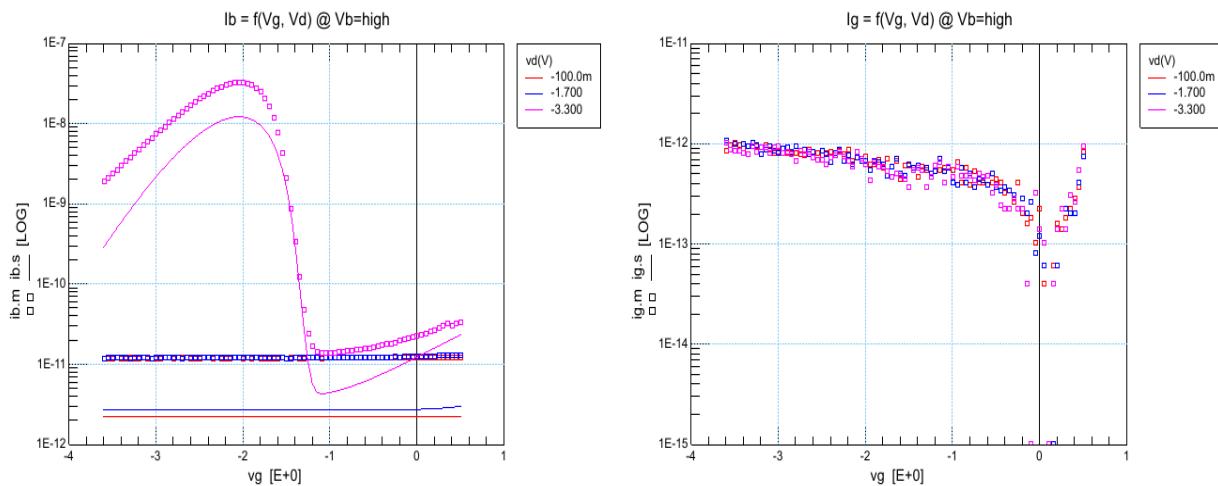
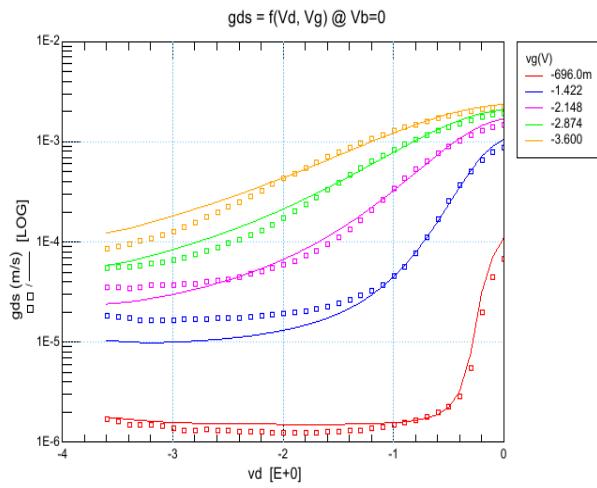
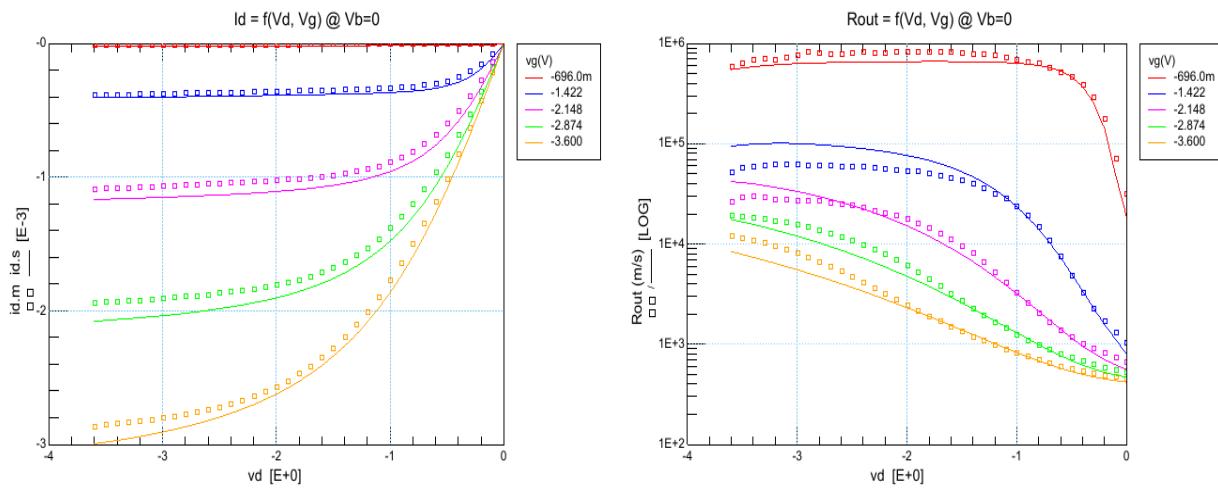
$i_{dvg}, V_d = -3.3V, T = 70^\circ\text{C}$

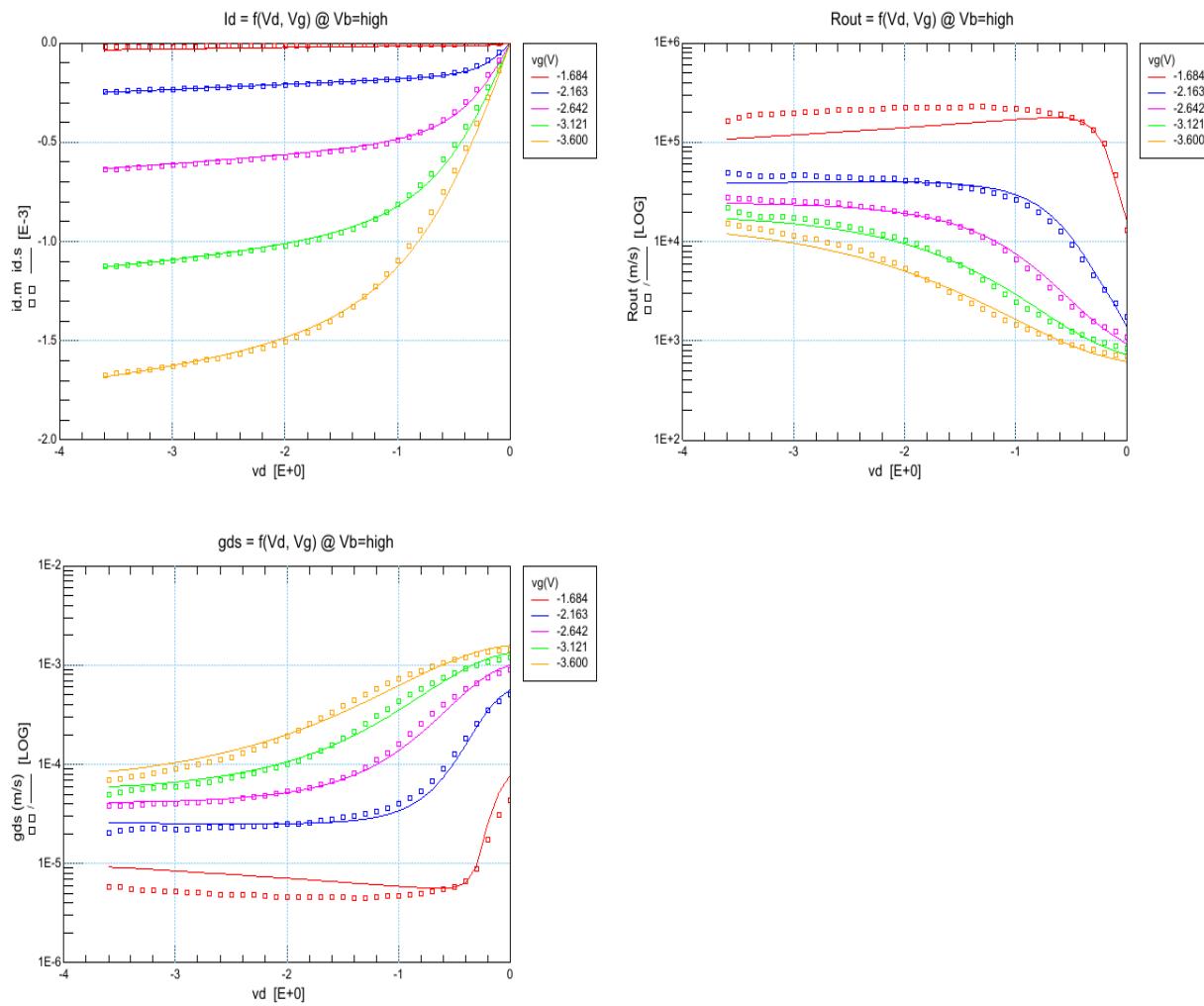
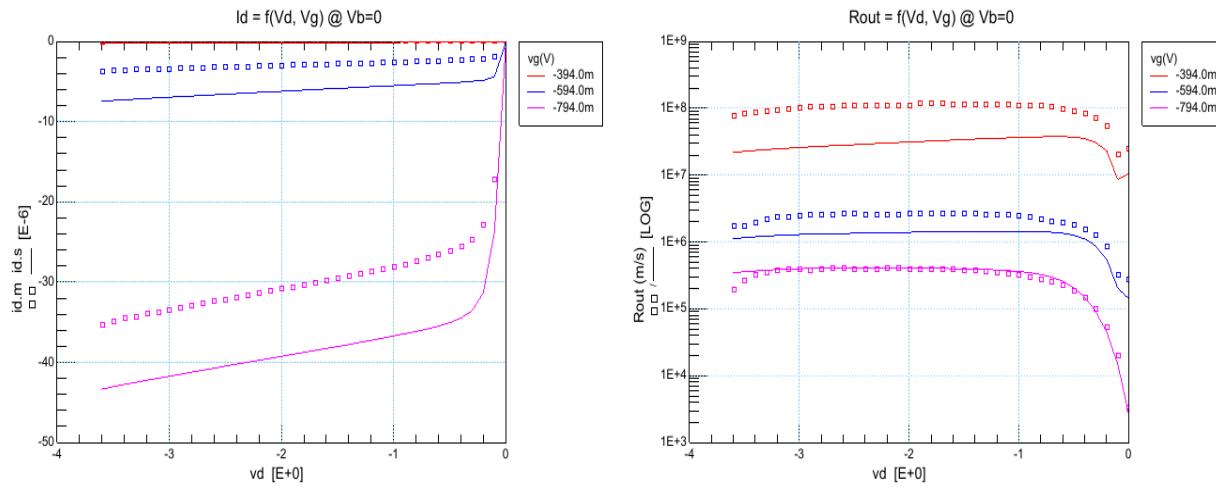


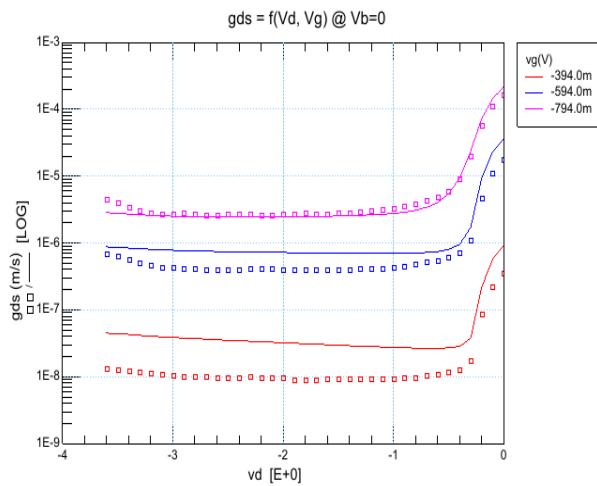


idvg, Ib,Ig, Vb = 0V, T = 70°C

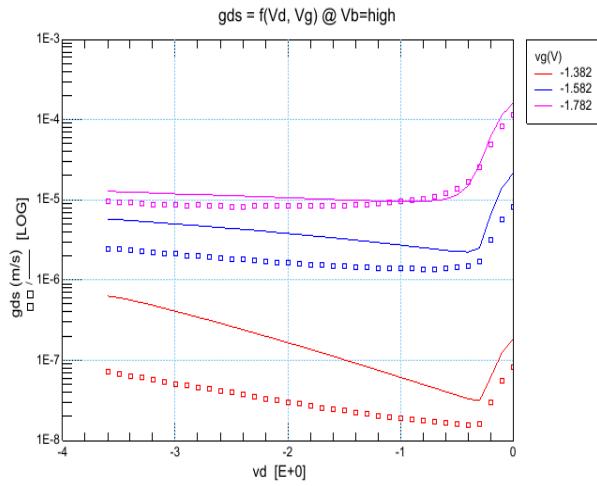
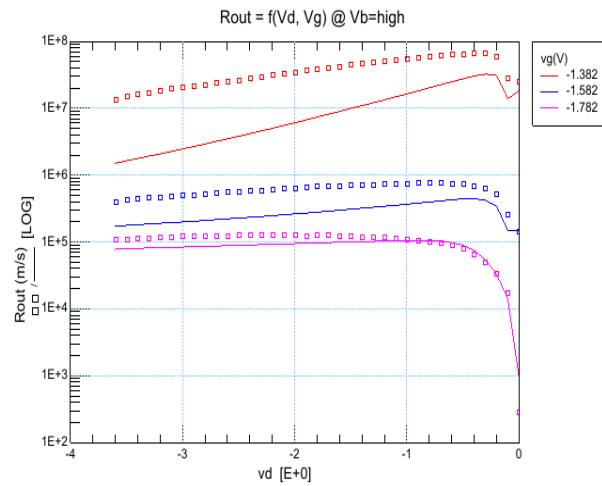
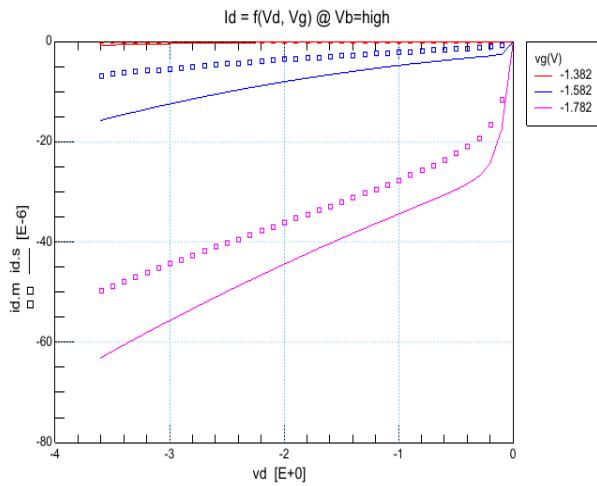


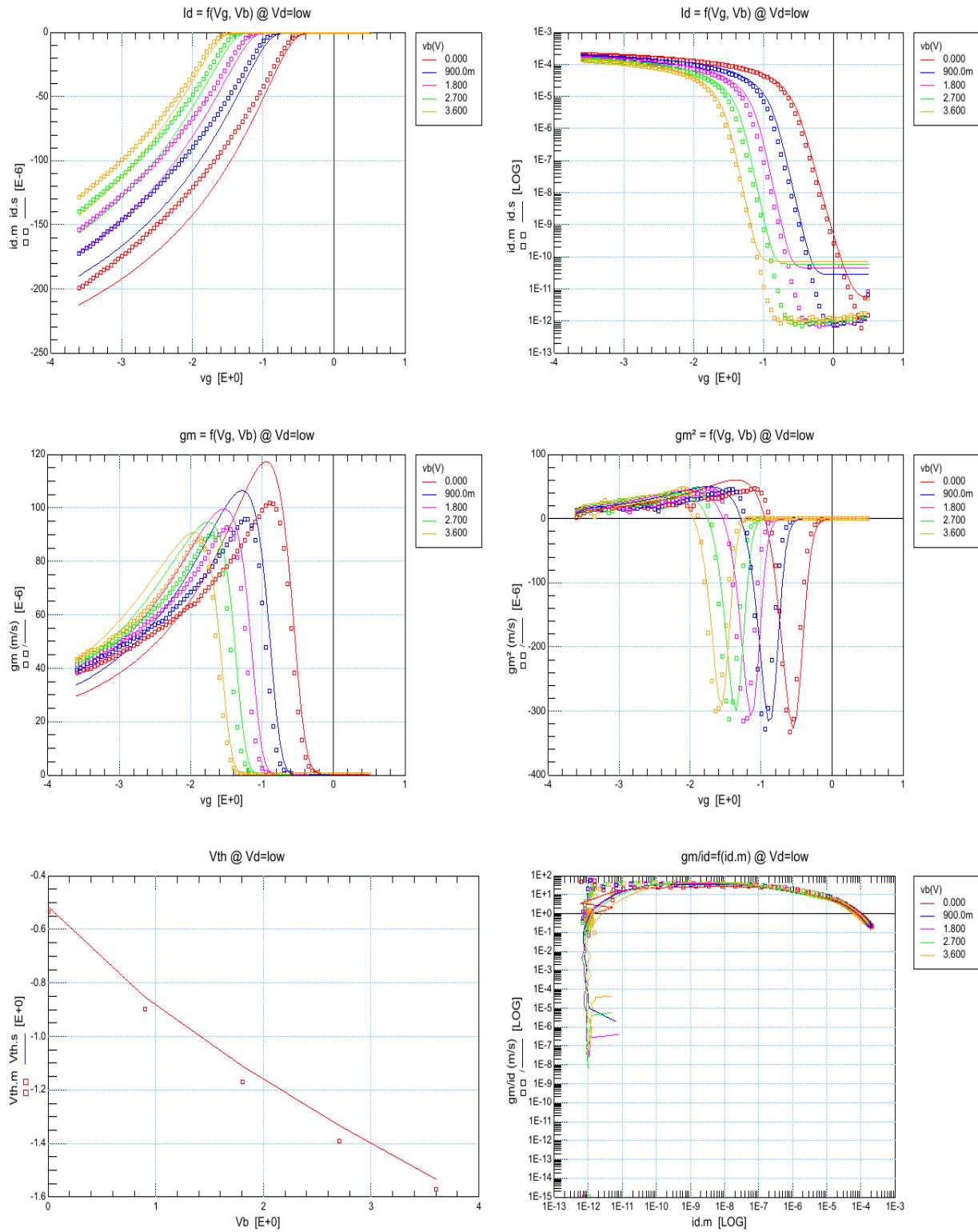
idvg, Ib,Ig, Vb = 3.6V, T = 70°C

idvd, Vb = 0V, T = 70°C


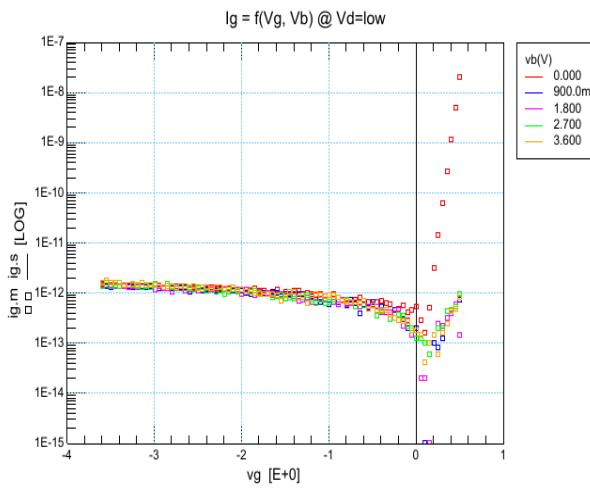
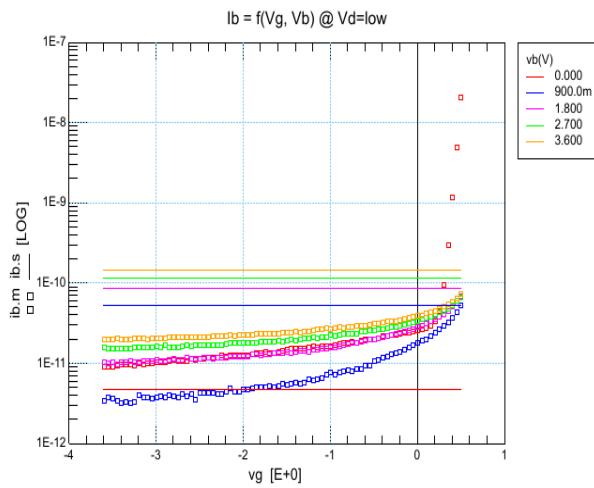
idvd_vbmin, Vb = 3.6V, T = 70°C**idvd_vth, Vb = 0V, T = 70°C**



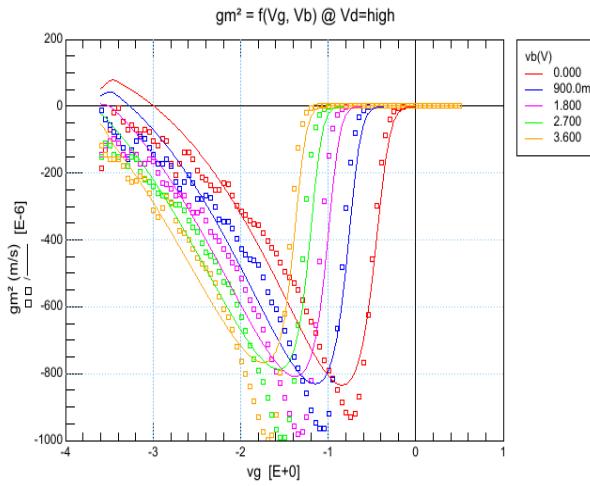
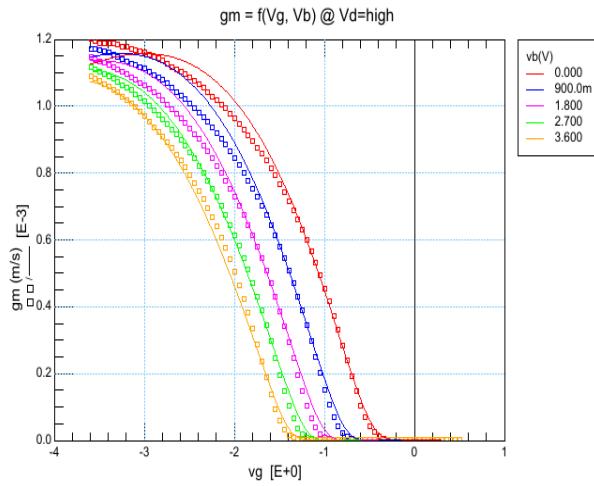
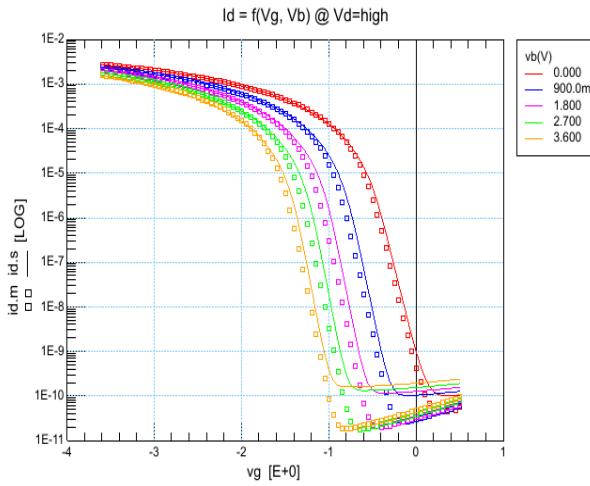
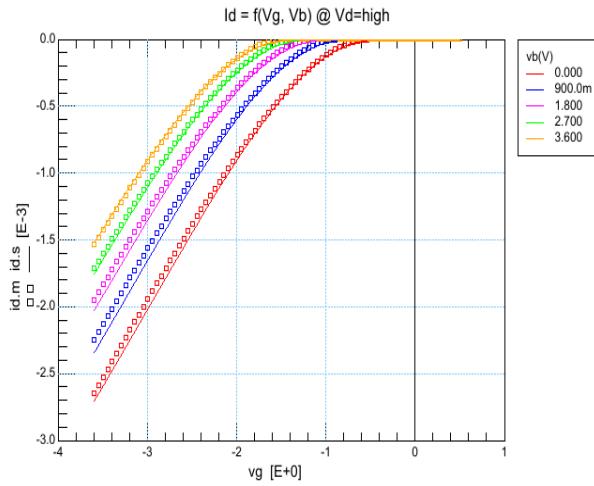
idvd_vth_vbmin, Vb = 3.6V, T = 70°C

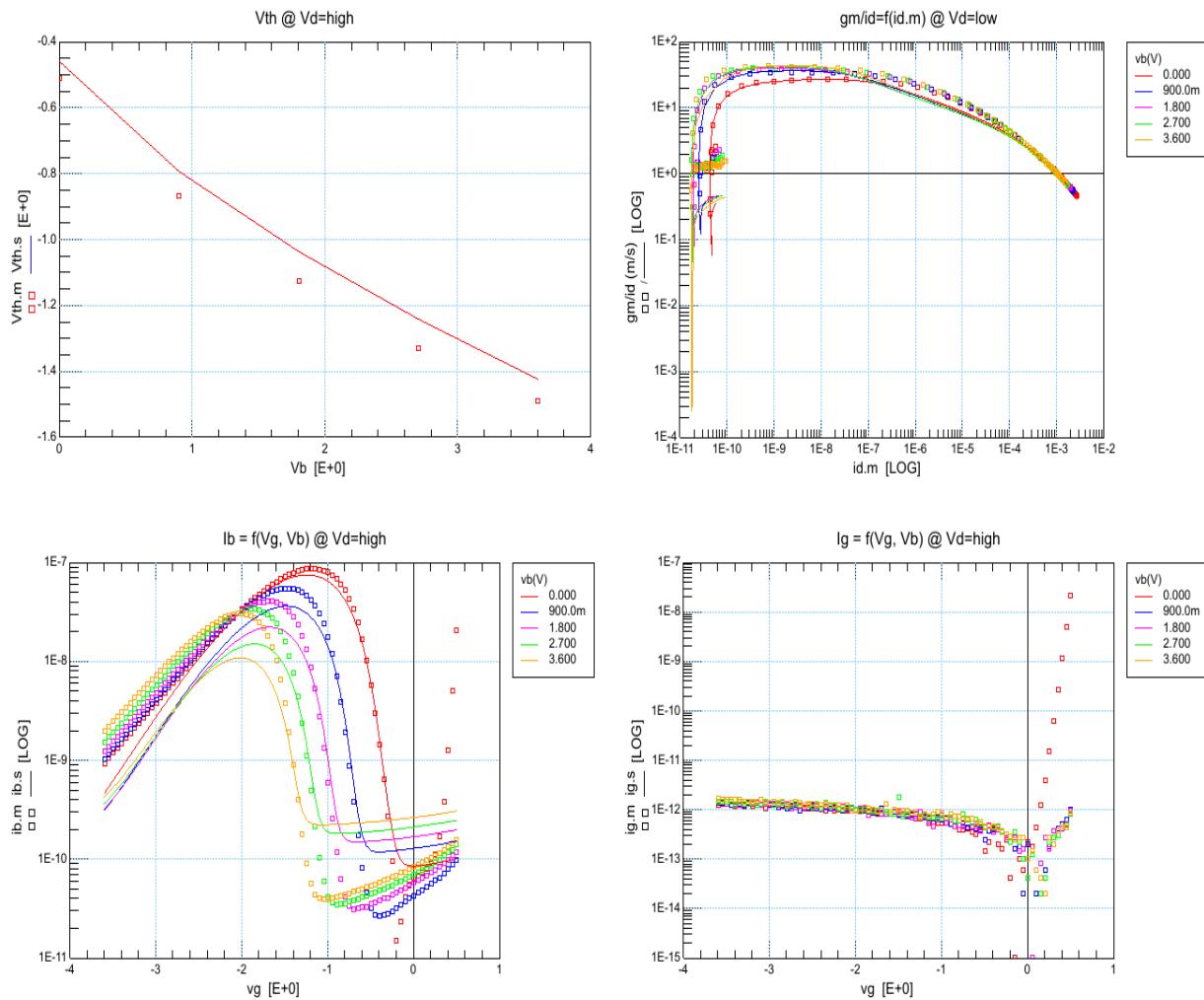


idvg, Vd = -0.1V, T = 125°C


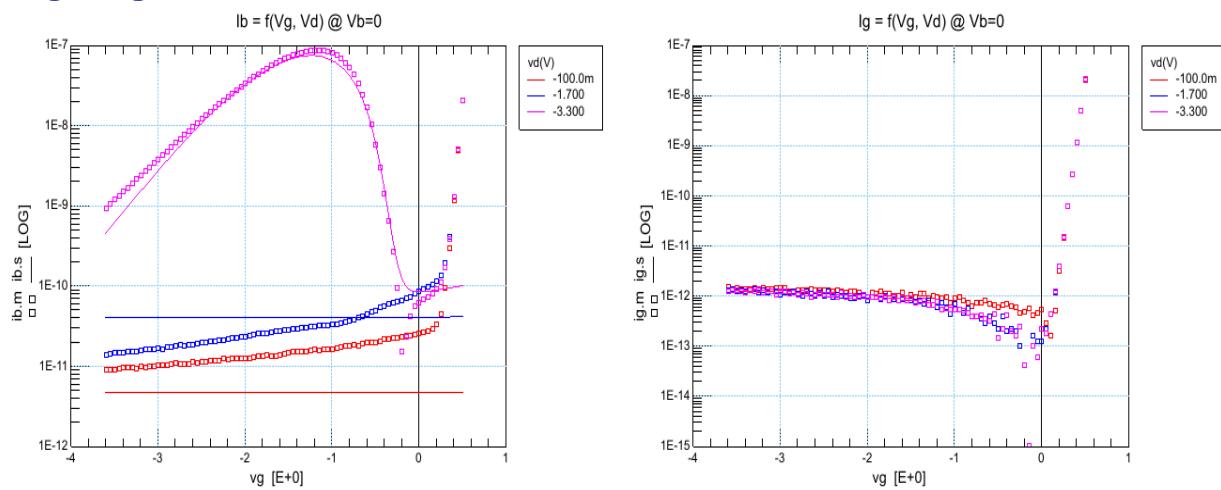


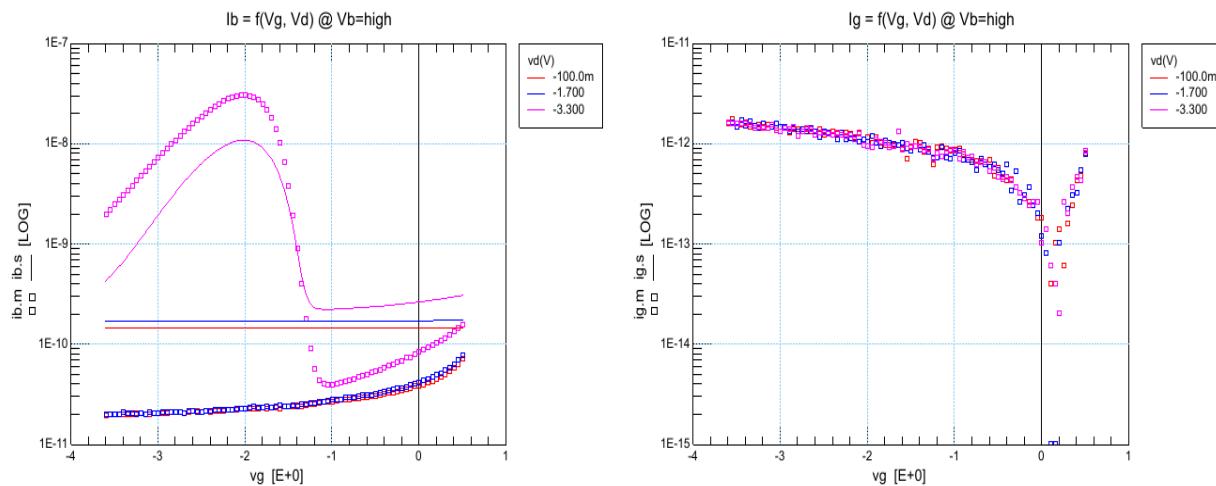
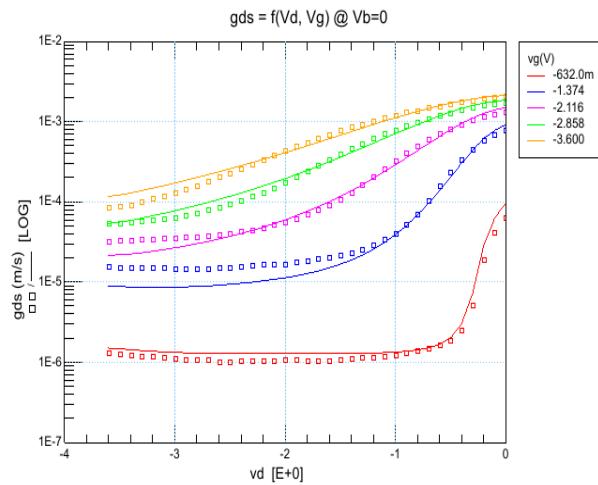
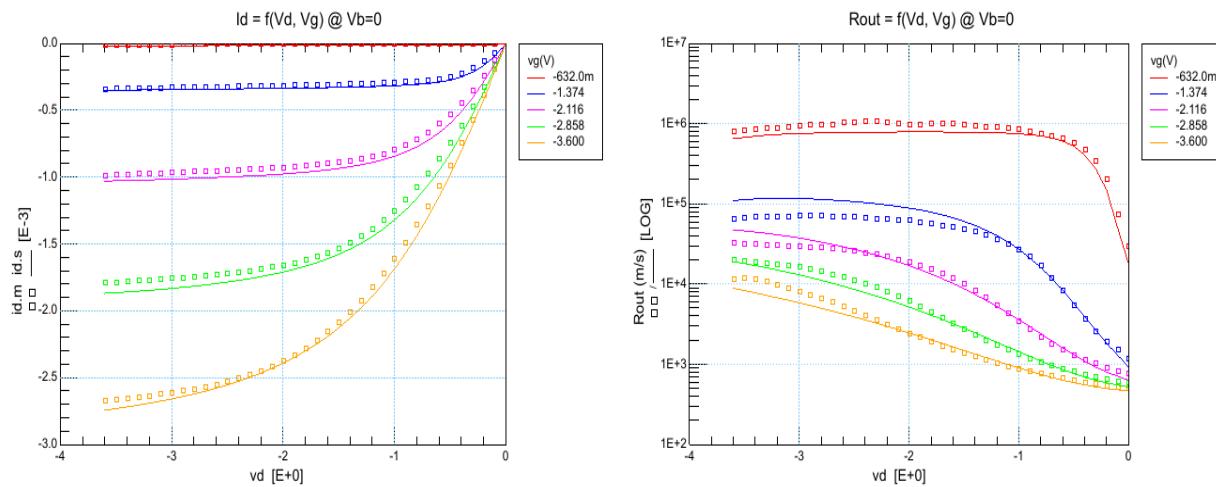
$i_{dvg}, V_d = -3.3V, T = 125^\circ\text{C}$

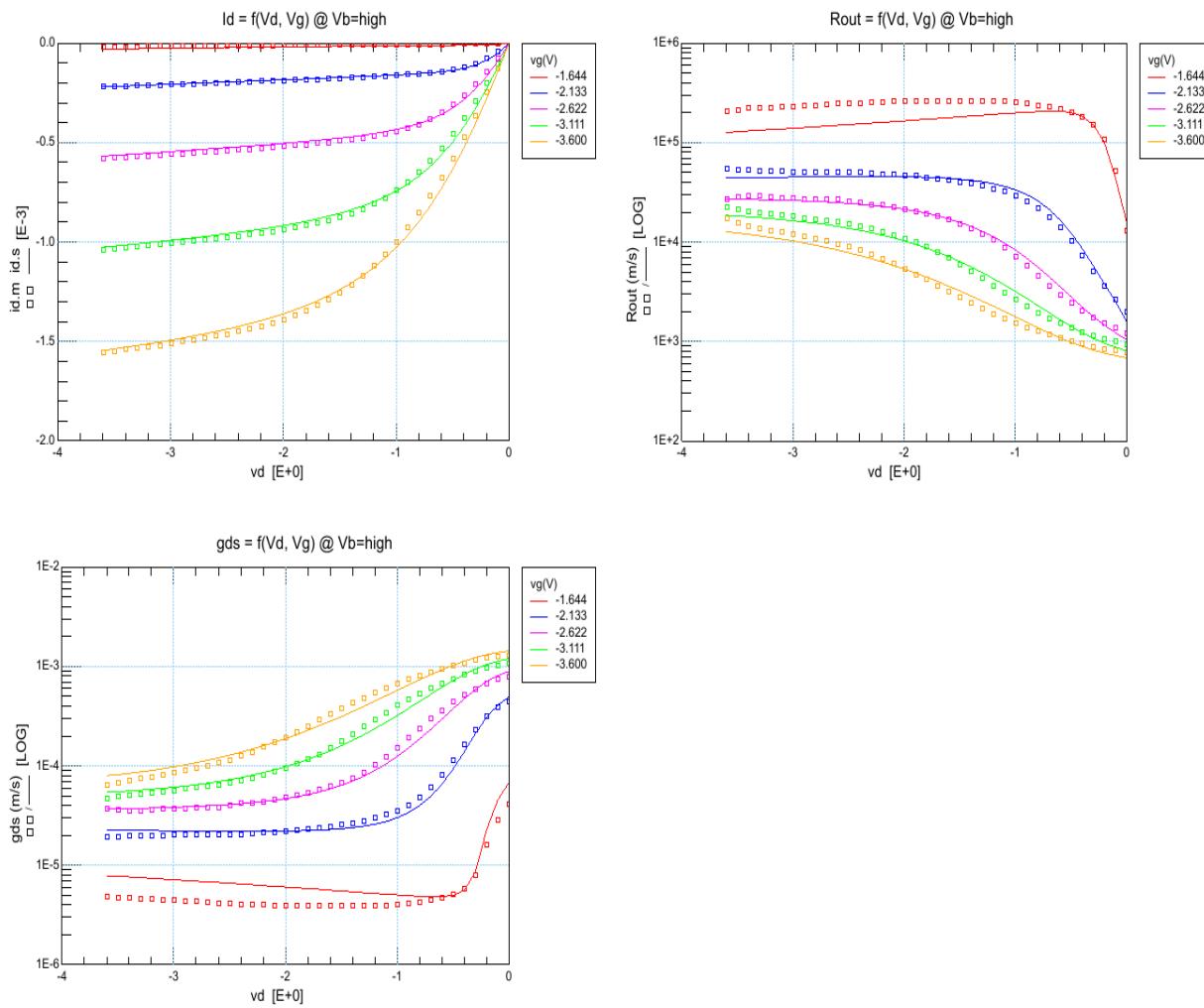
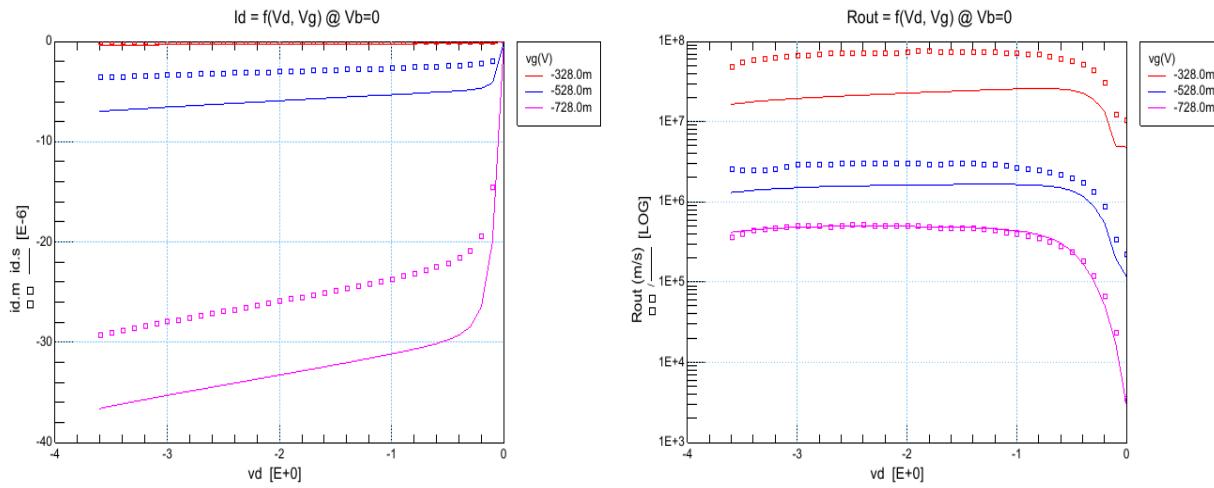


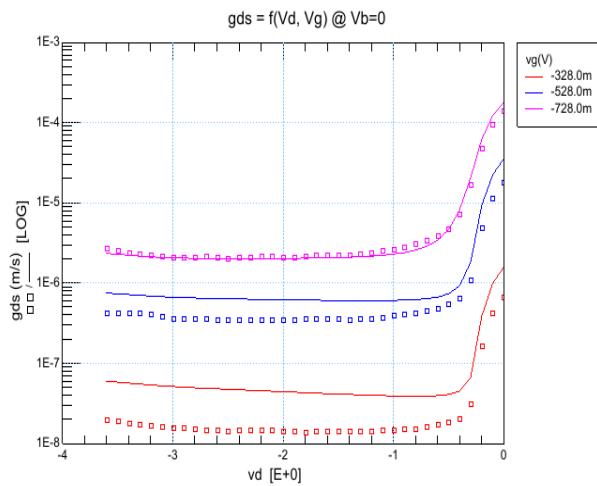


$idvg, Ib, Ig, Vb = 0V, T = 125^{\circ}C$

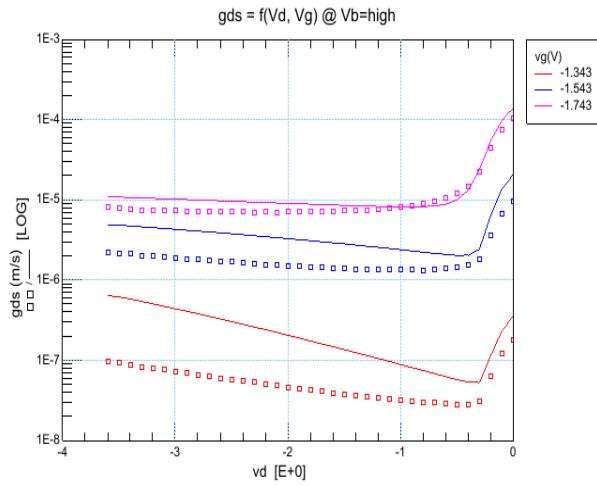
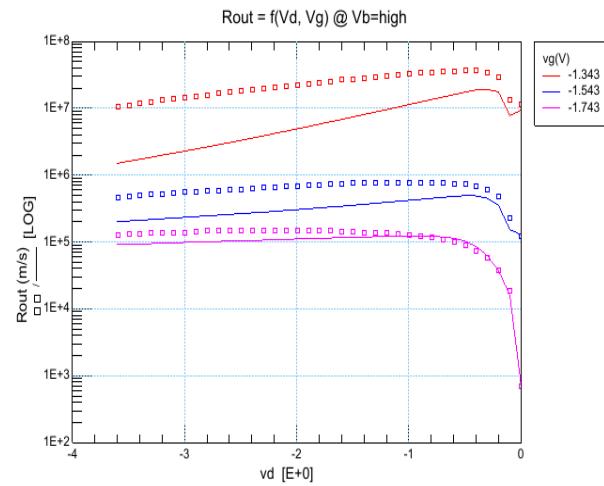
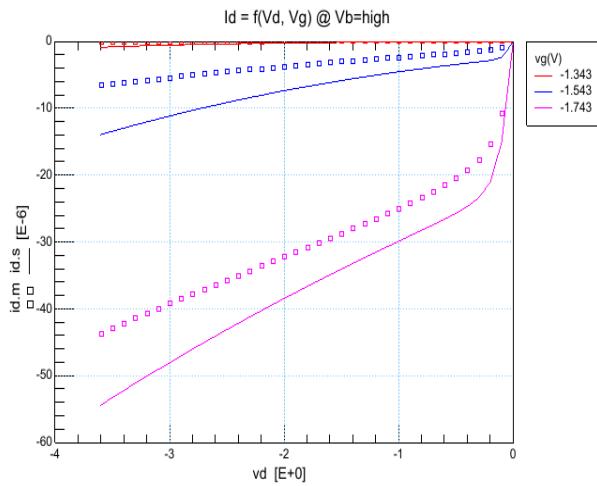


idvg, Ib,Ig, Vb = 3.6V, T = 125°C

idvd, Vb = 0V, T = 125°C


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

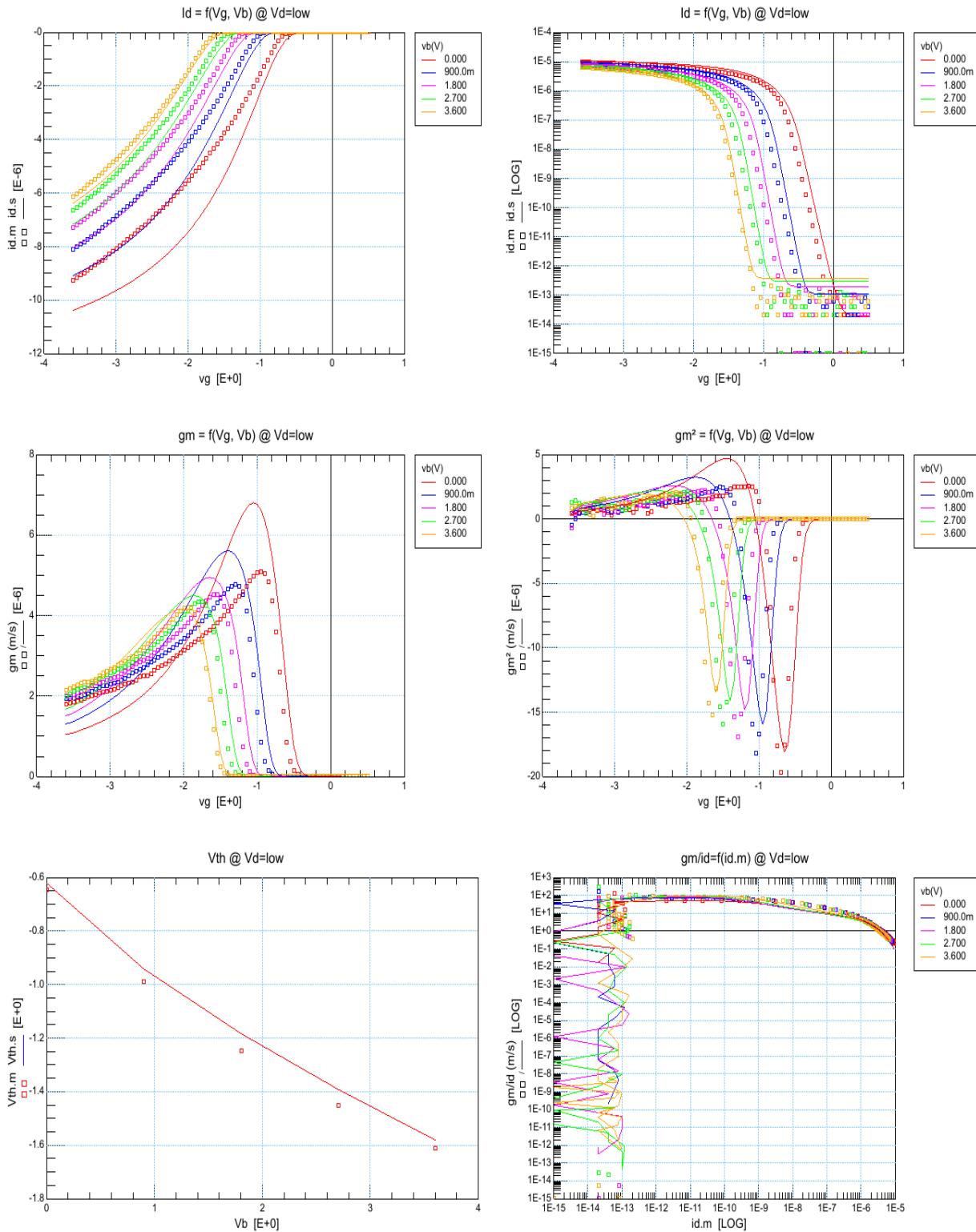


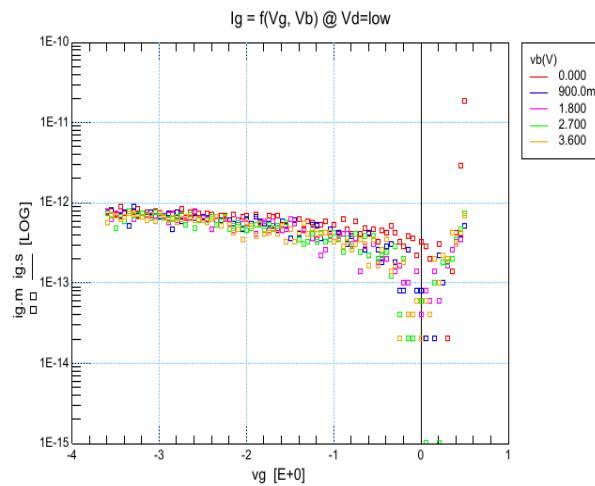
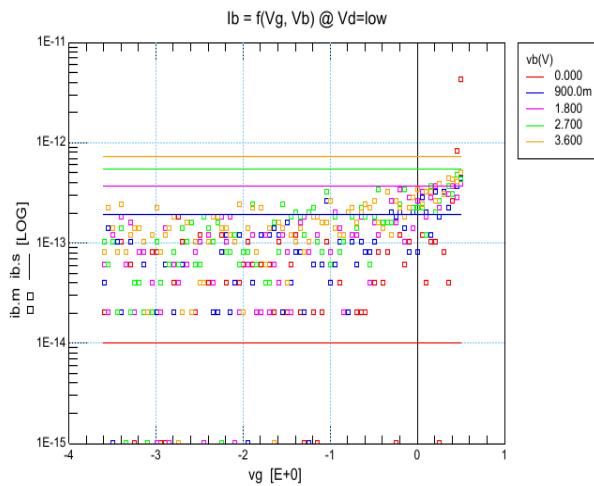
idvd_vth_vbmin, Vb = 3.6V, T = 125°C



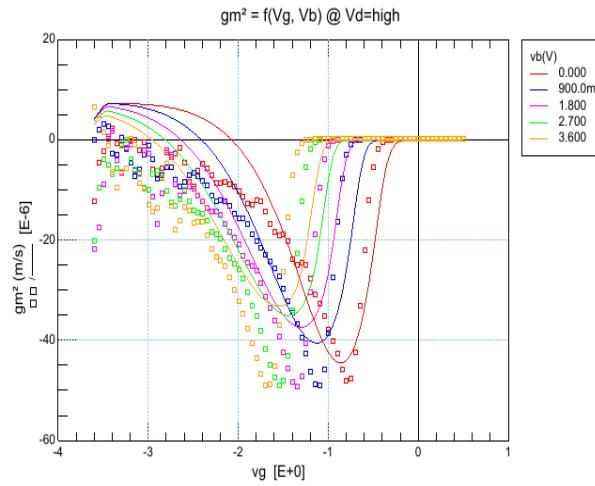
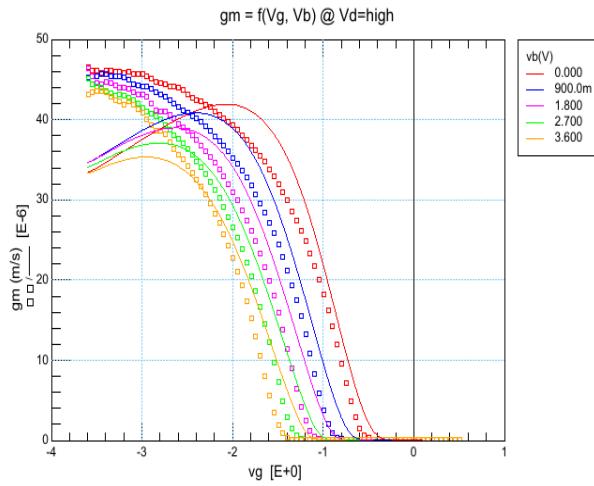
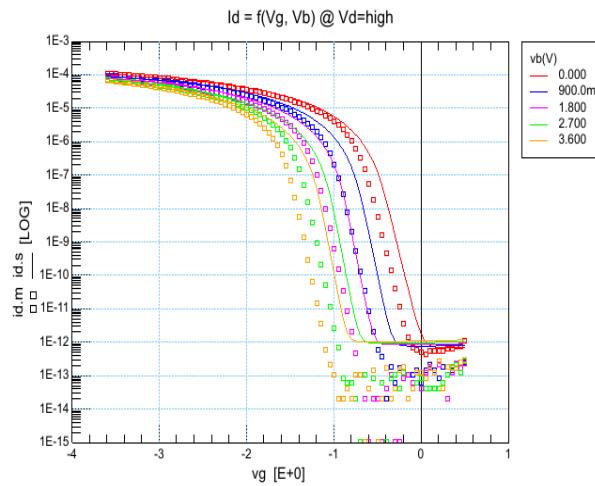
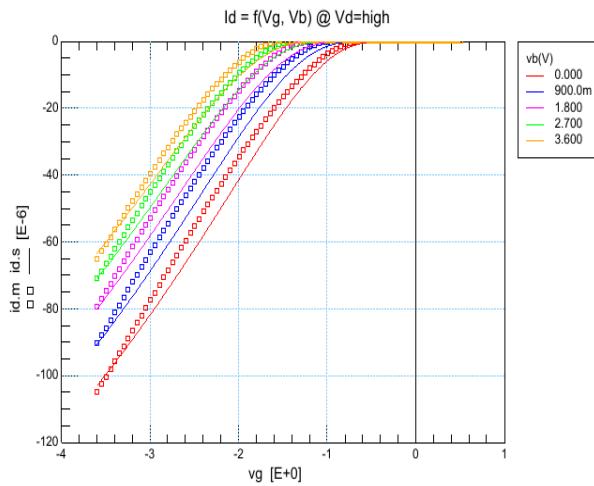
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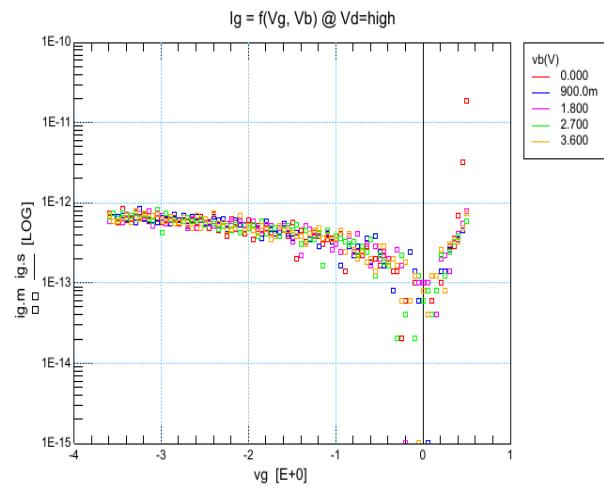
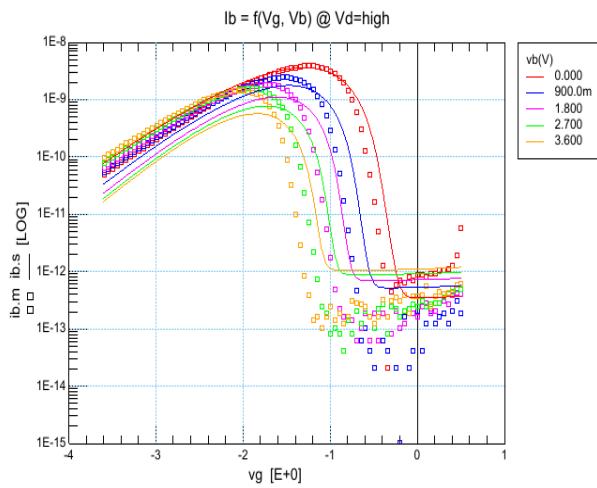
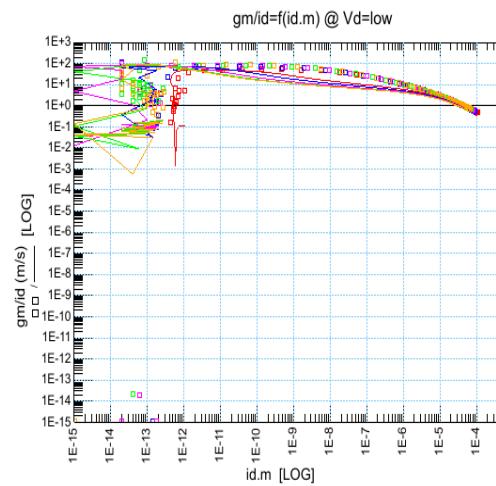
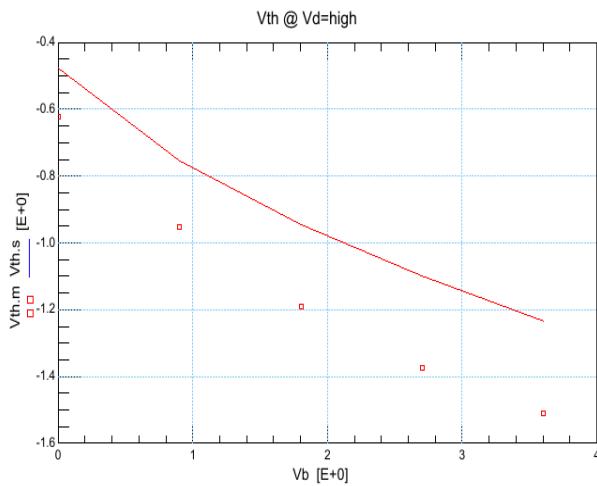
$idvg$, $Vd = -0.1V$, $T = 27^\circ C$



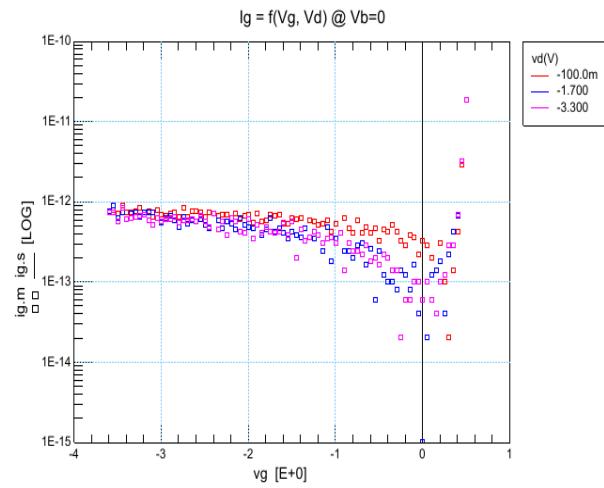
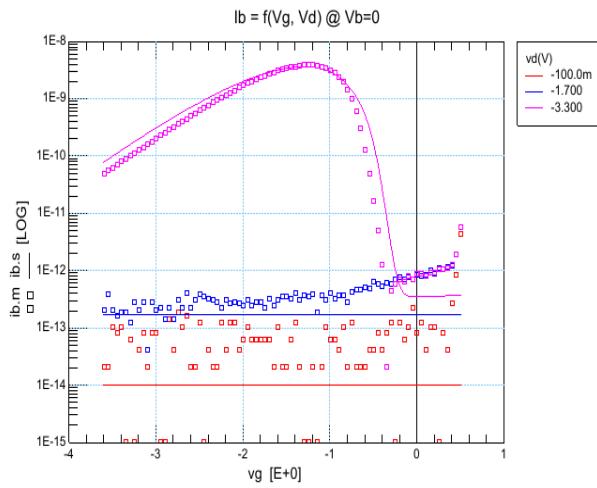


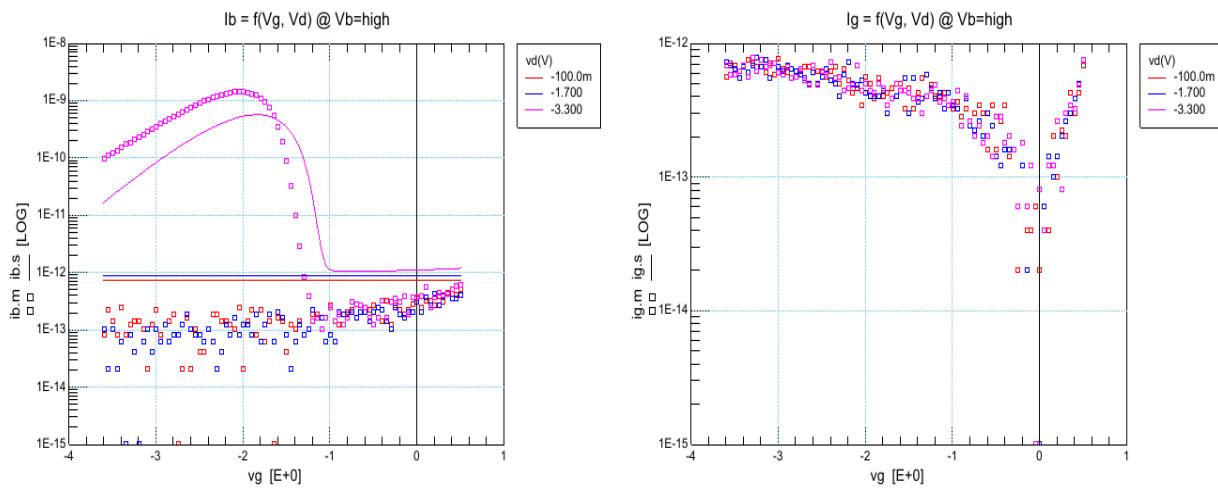
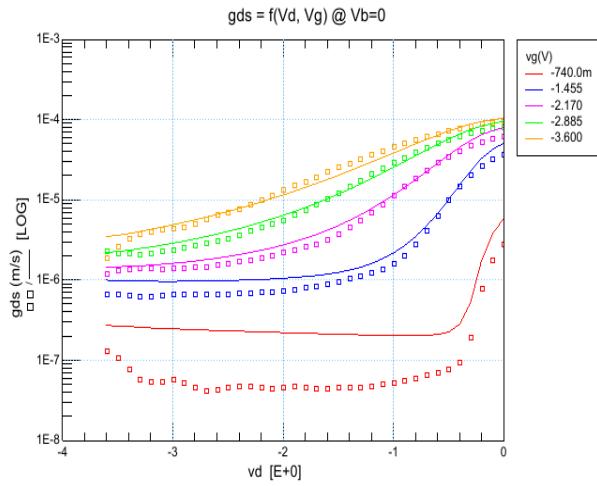
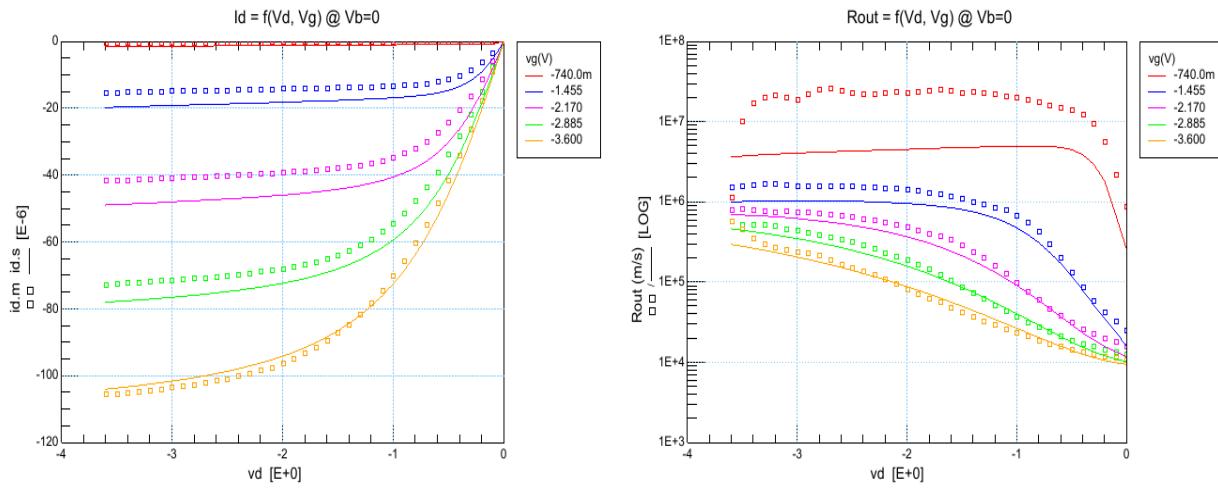
$i_{dvg}, V_d = -3.3V, T = 27^\circ\text{C}$

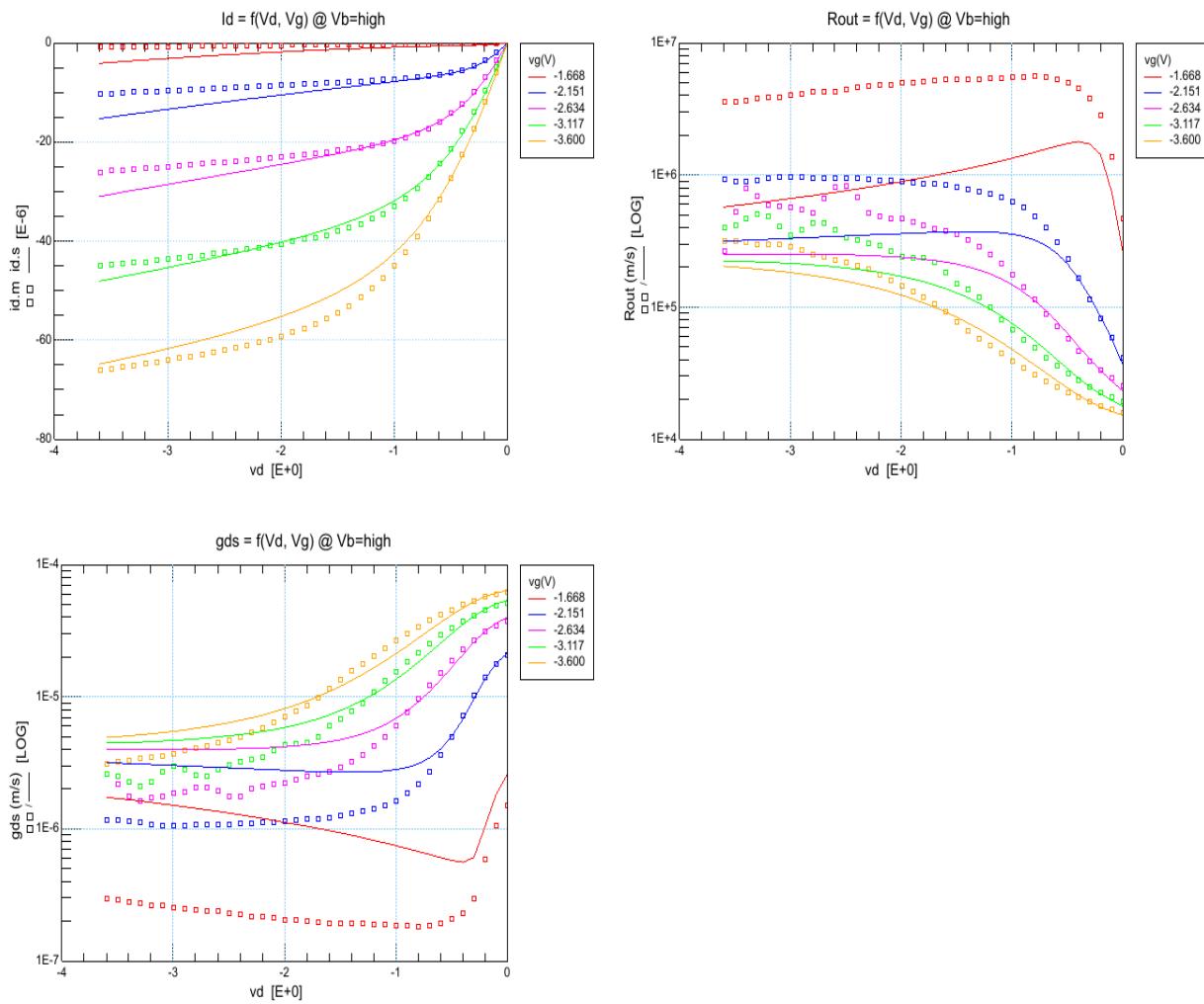
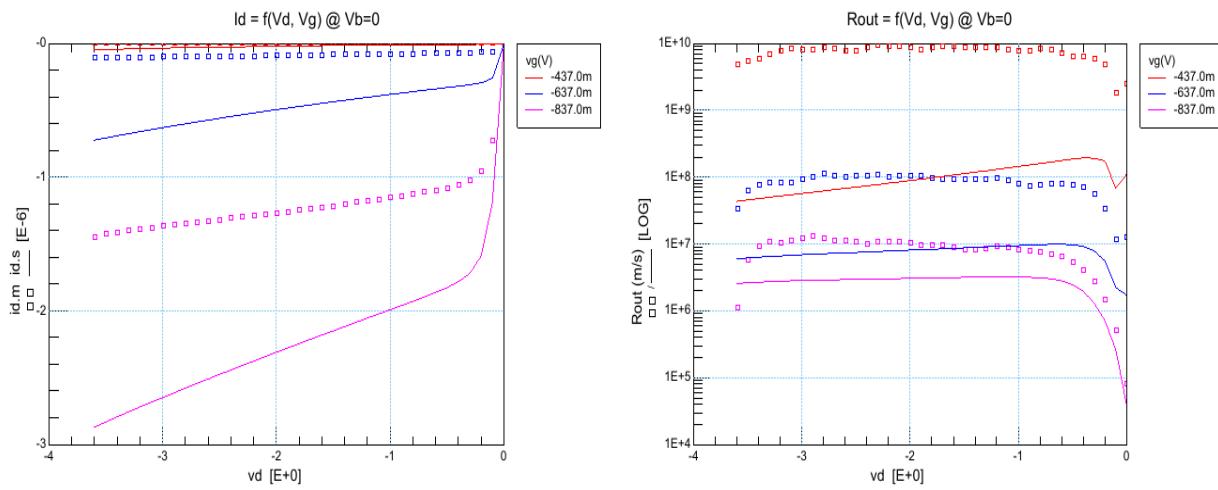


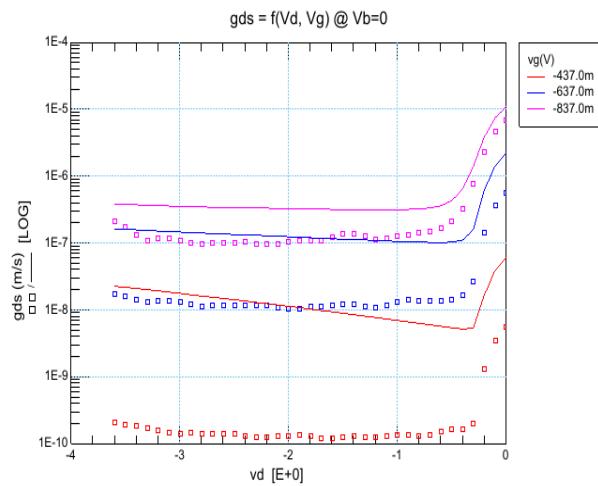


idvg, lb, lg, Vb = 0V, T = 27°C

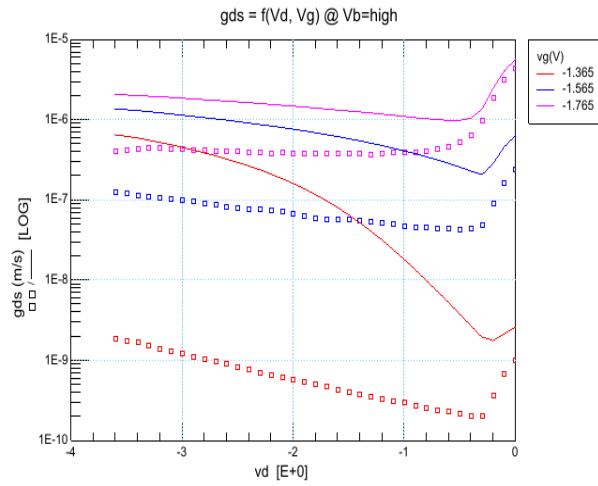
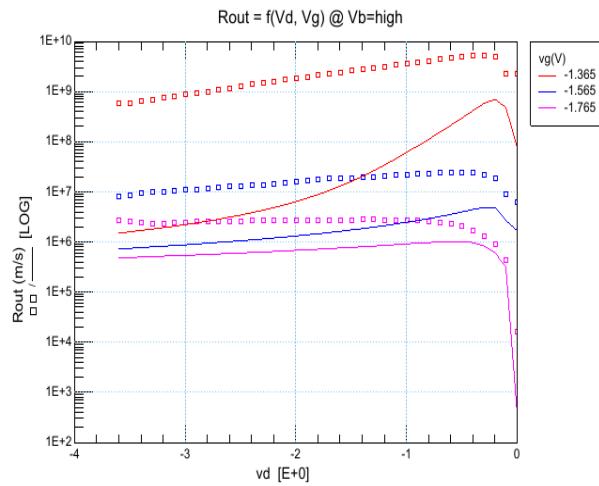
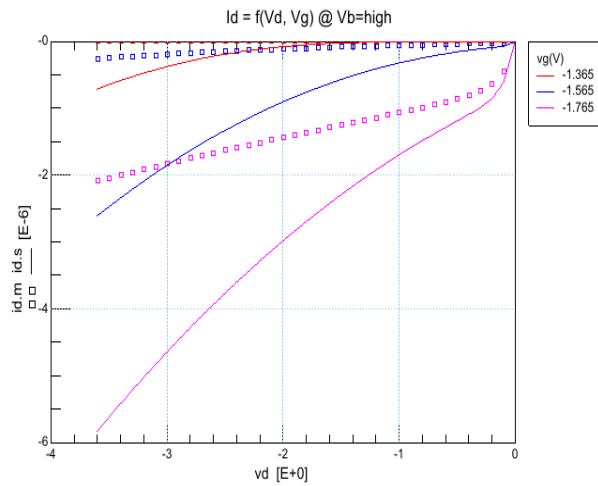


idvg, Ib,Ig, Vb = 3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


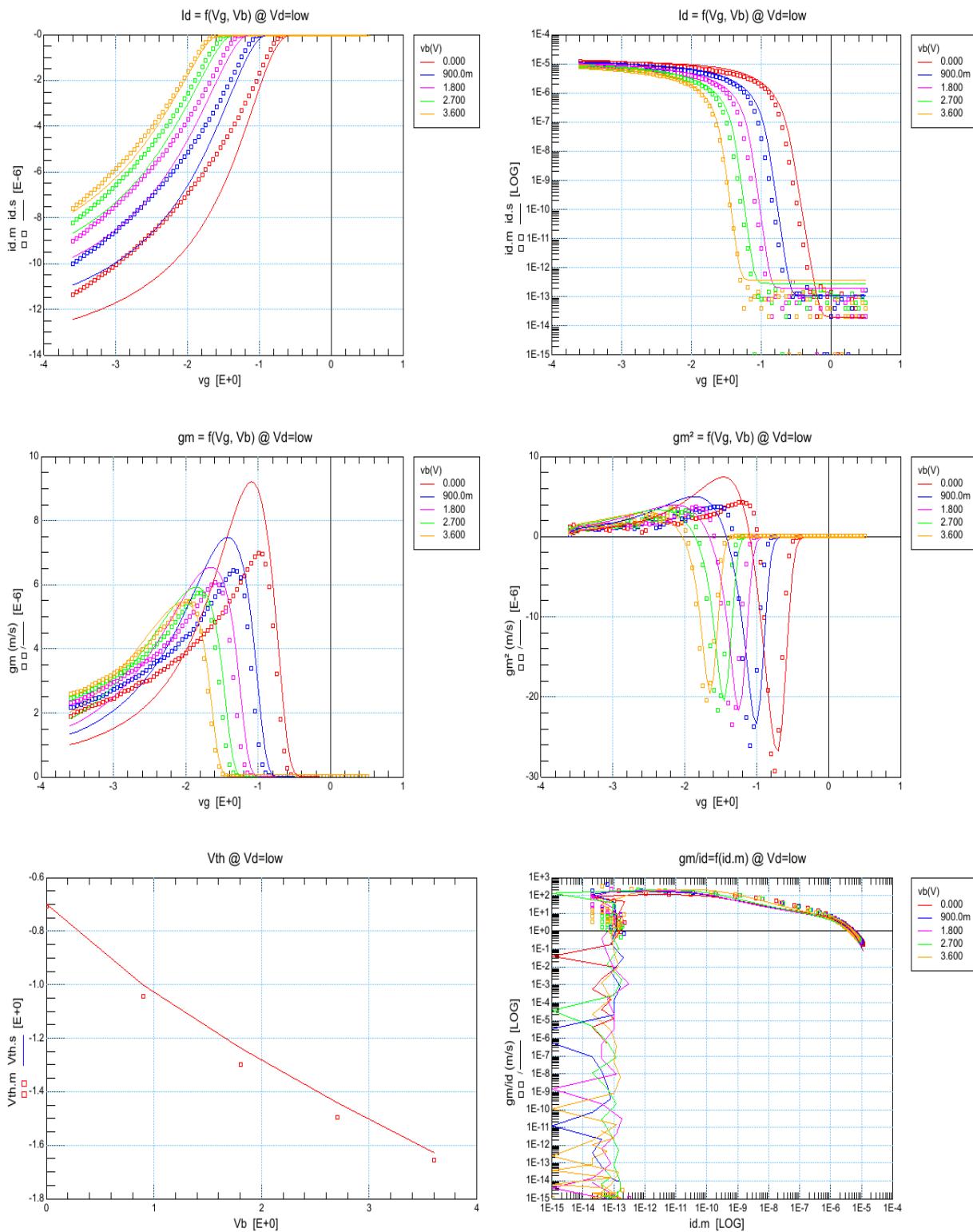
idvd_vbmin, Vb = 3.6V, T = 27°C**idvd_vth, Vb = 0V, T = 27°C**

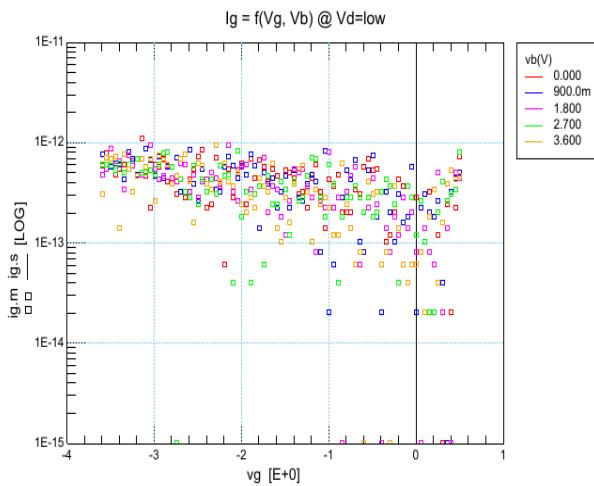
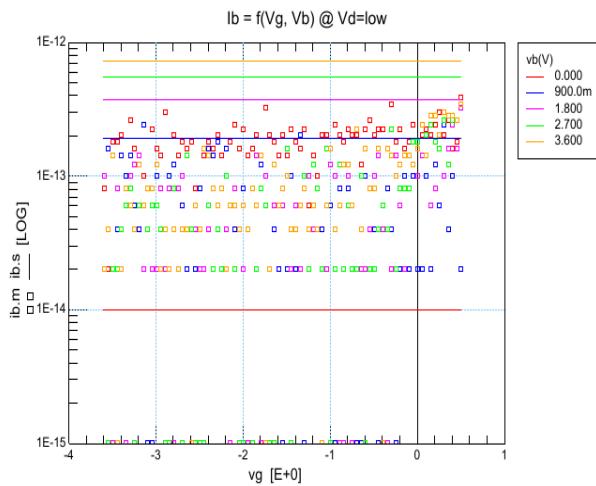


idvd_vth_vbmin, Vb = 3.6V, T = 27°C

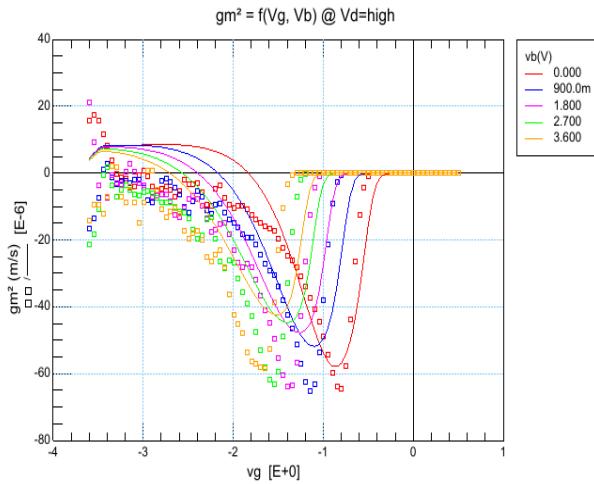
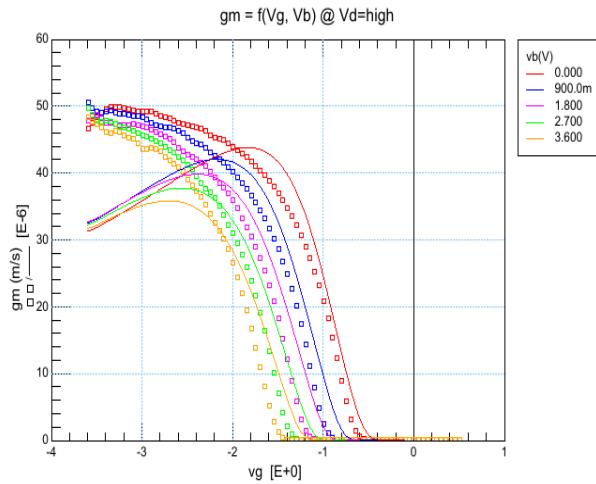
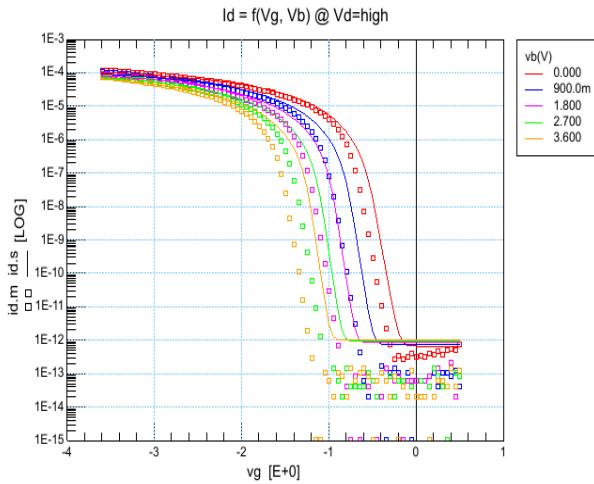
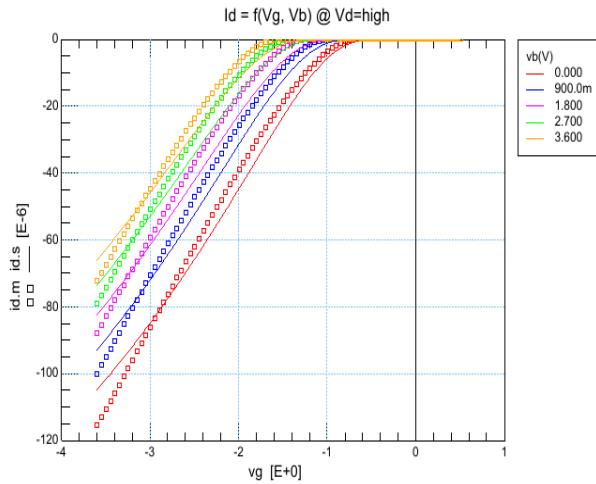


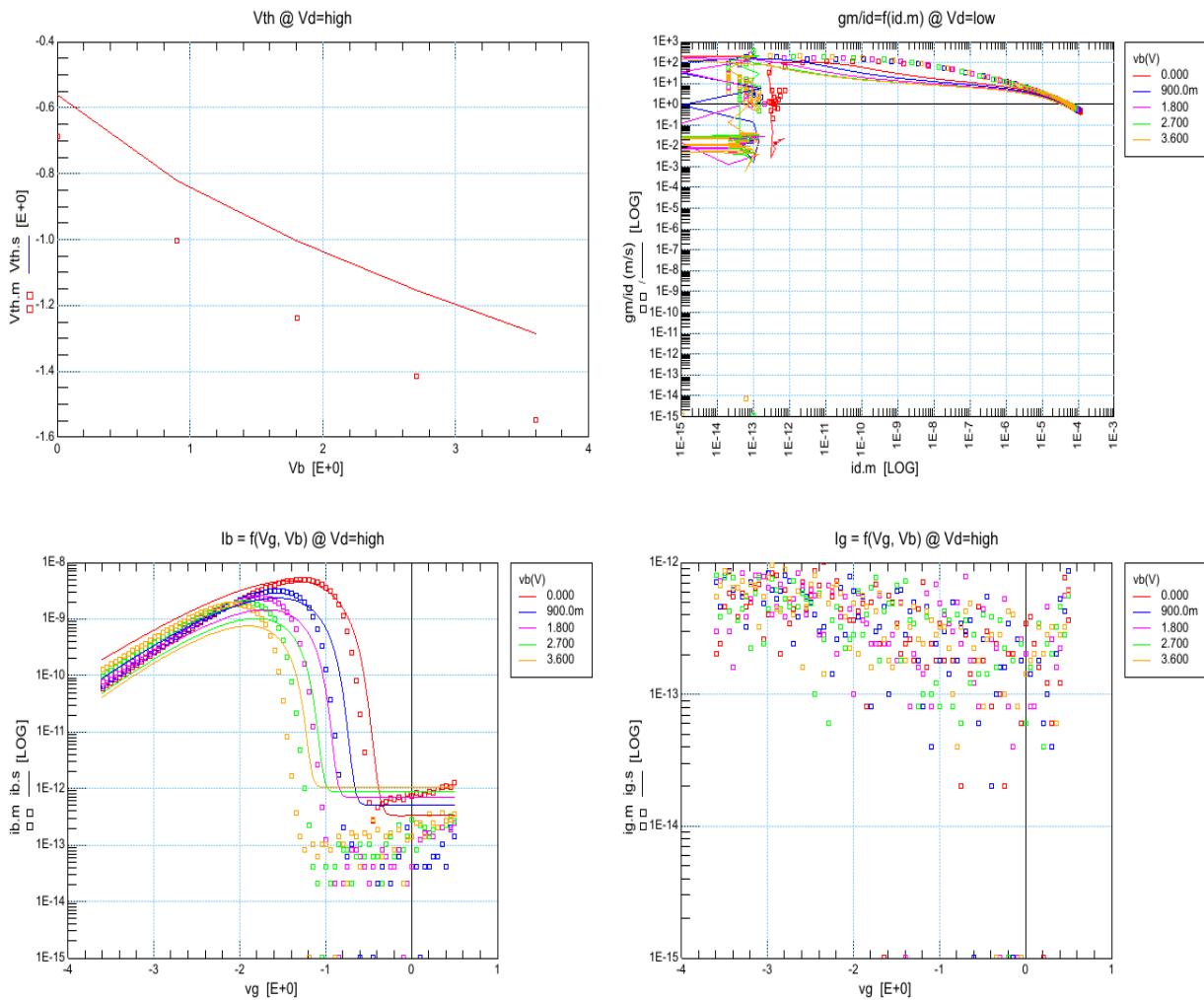
$idvg$, $Vd = -0.1V$, $T = -40^{\circ}C$



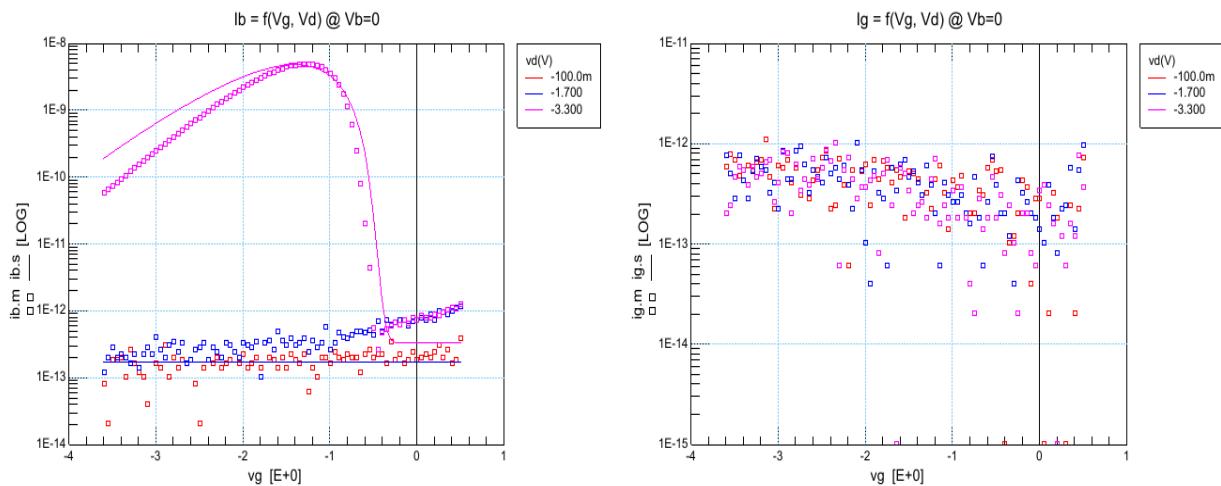


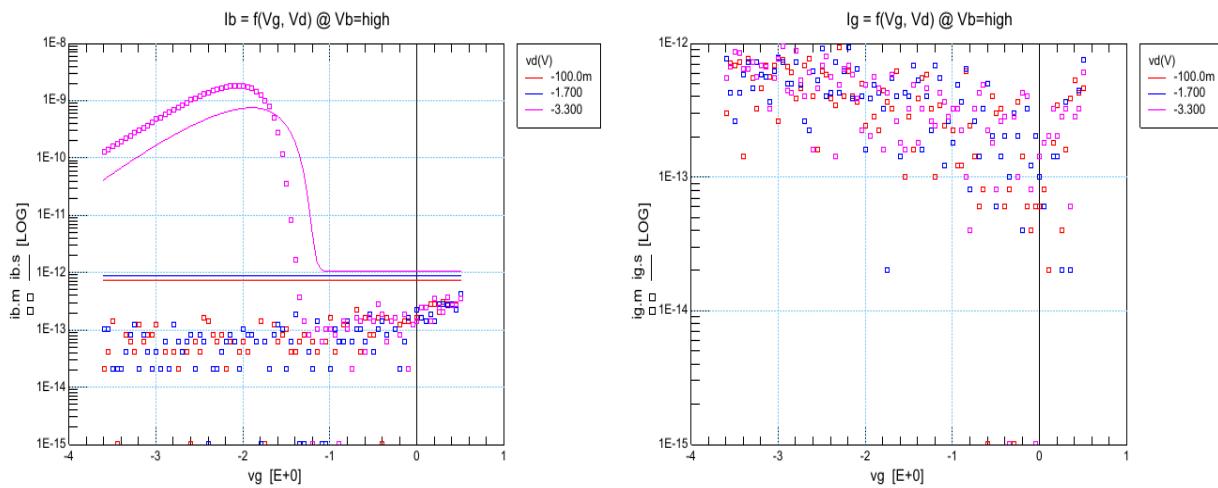
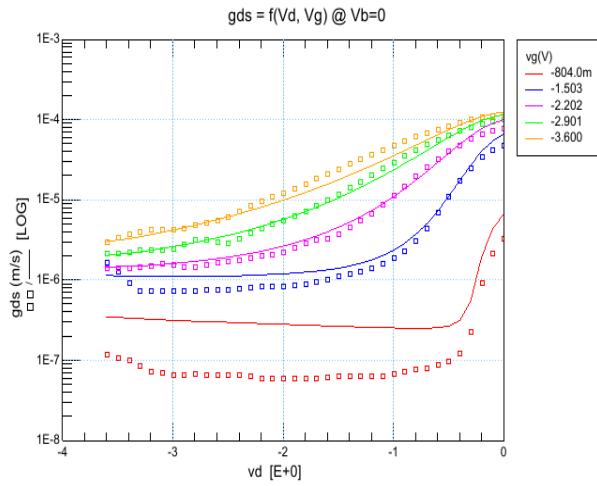
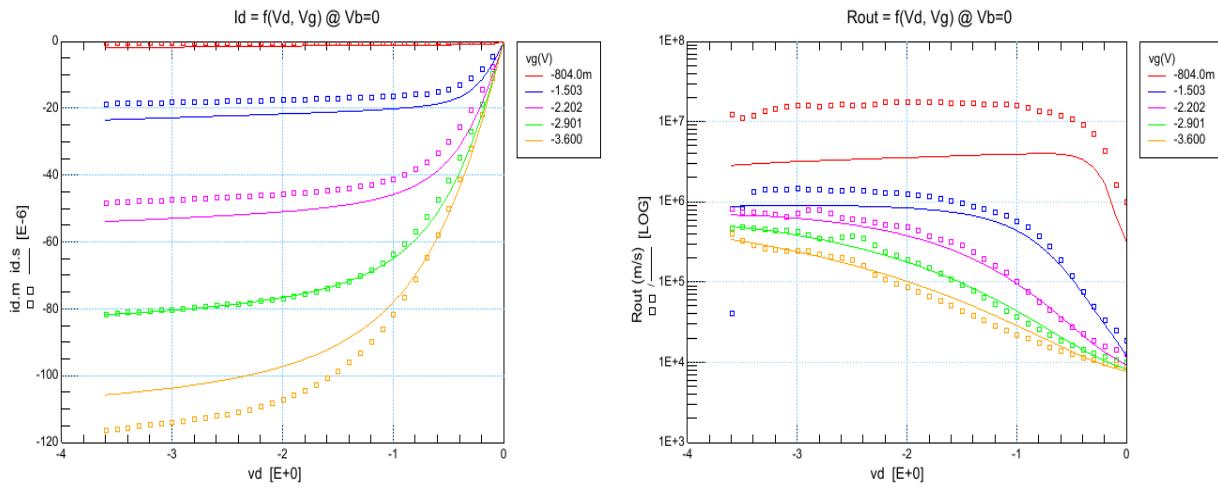
$i_{dvg}, V_d = -3.3V, T = -40^\circ\text{C}$

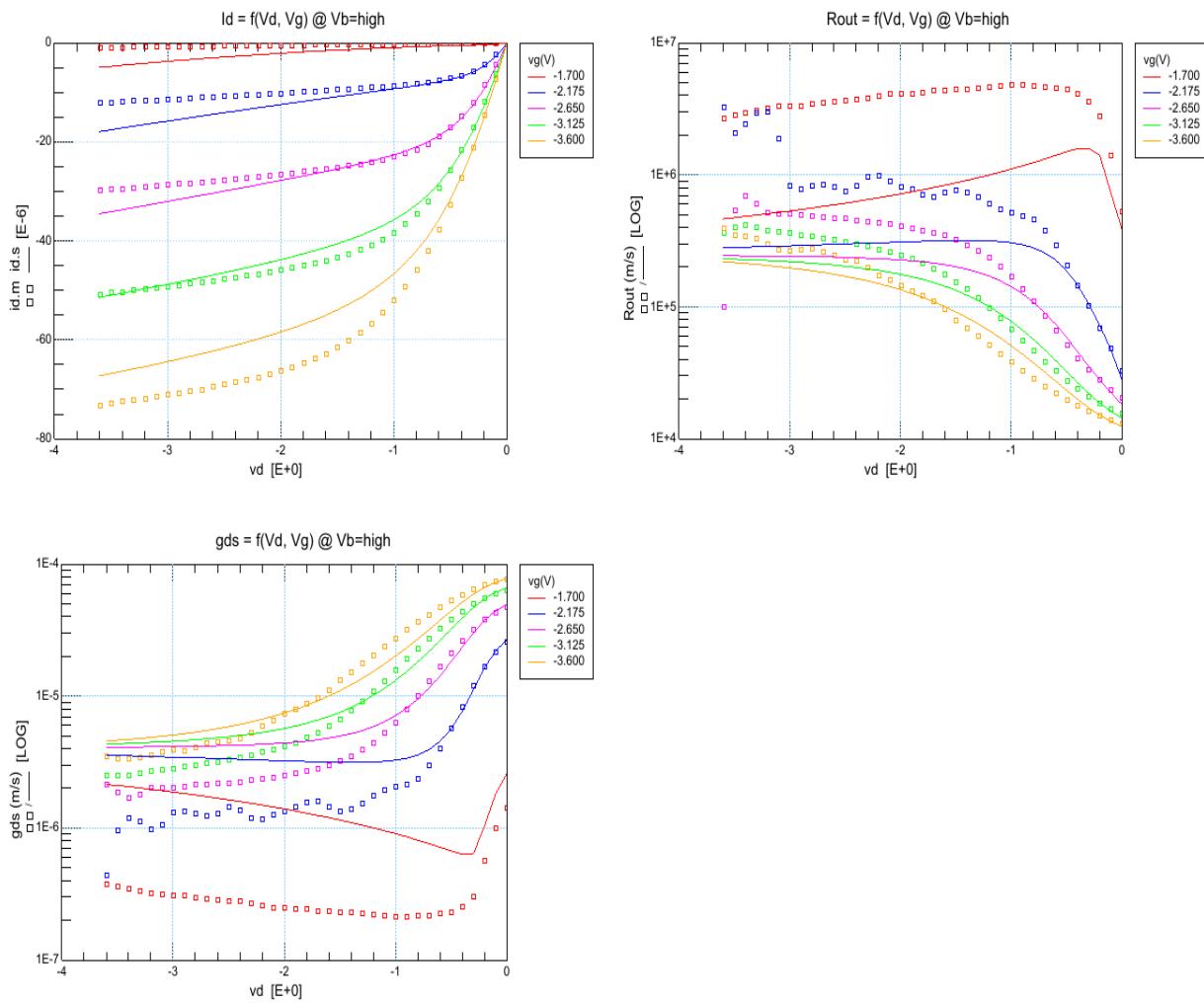
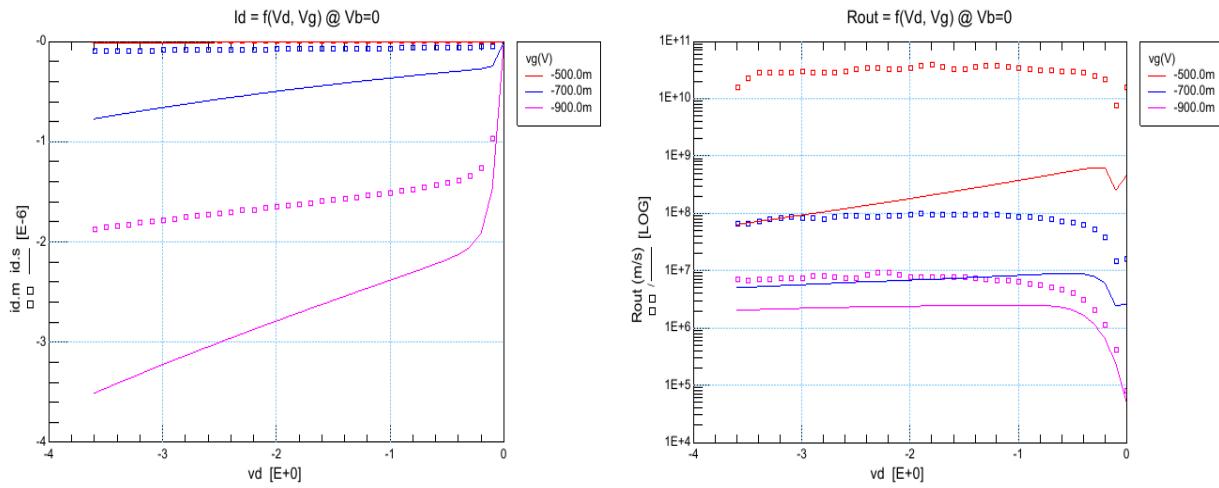


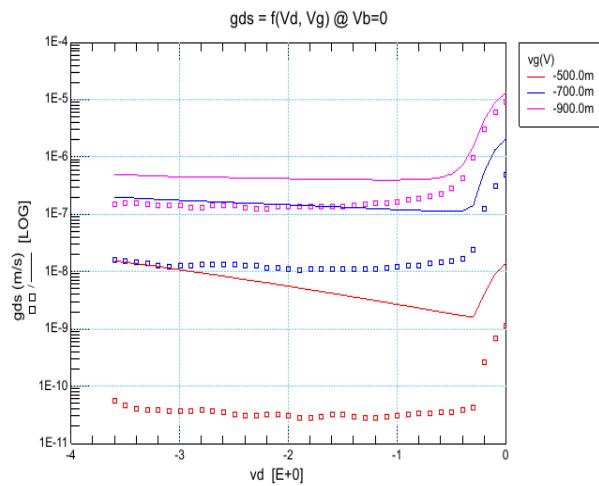


idvg, Ib,Ig, Vb = 0V, T = -40°C

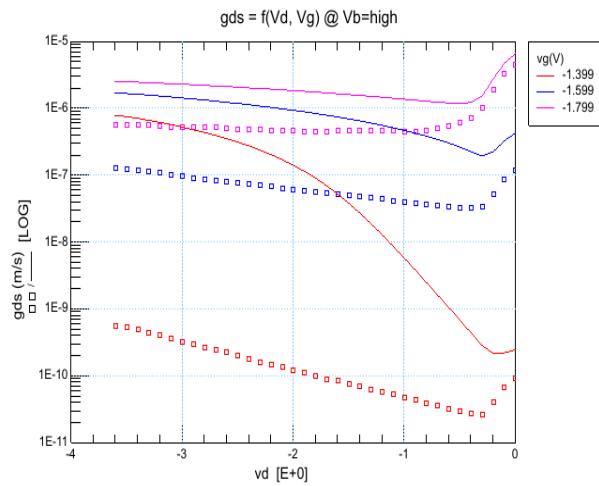
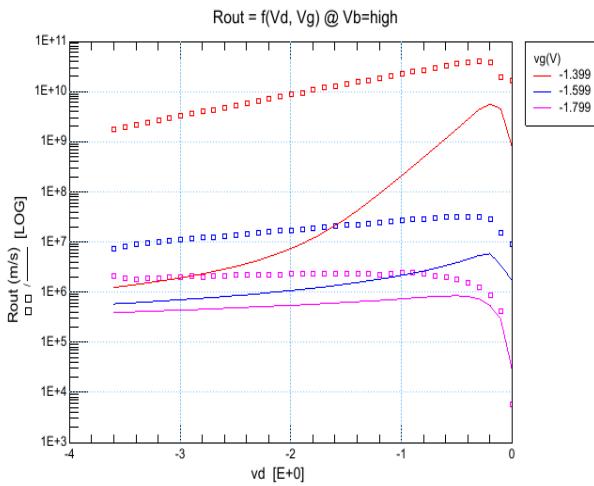
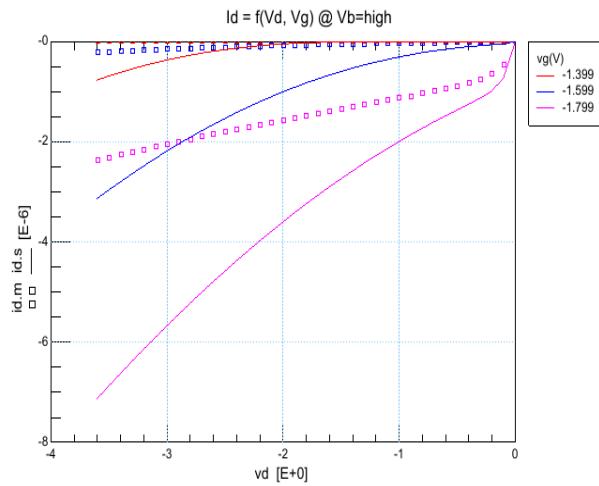


idvg, Ib,Ig, Vb = 3.6V, T = -40°C

idvd, Vb = 0V, T = -40°C


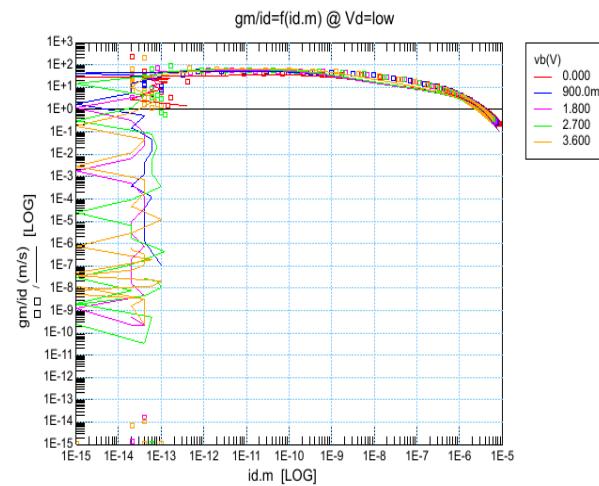
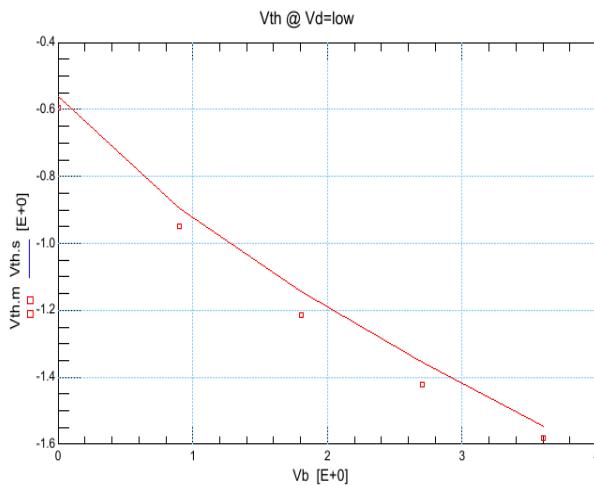
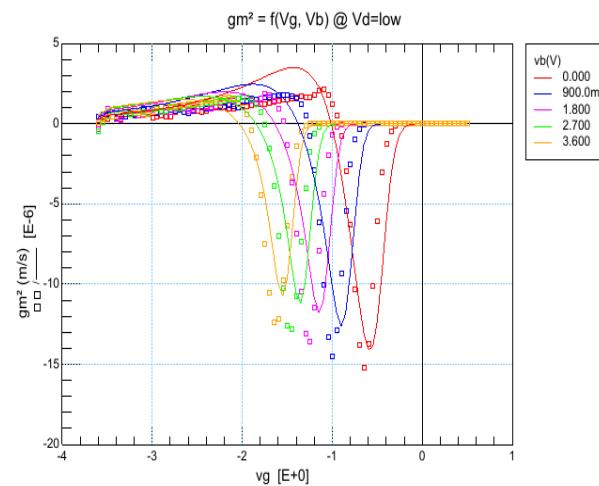
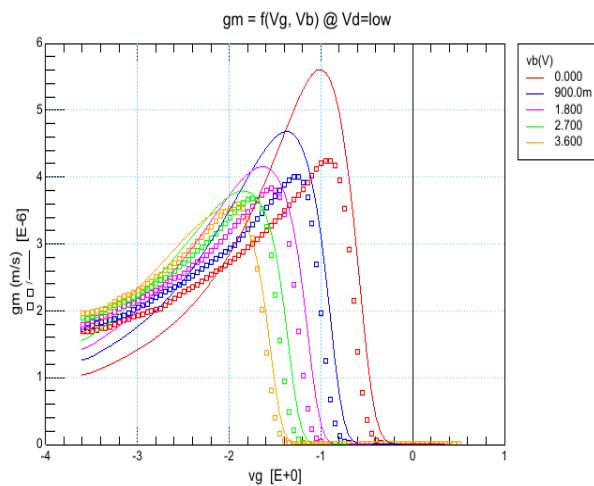
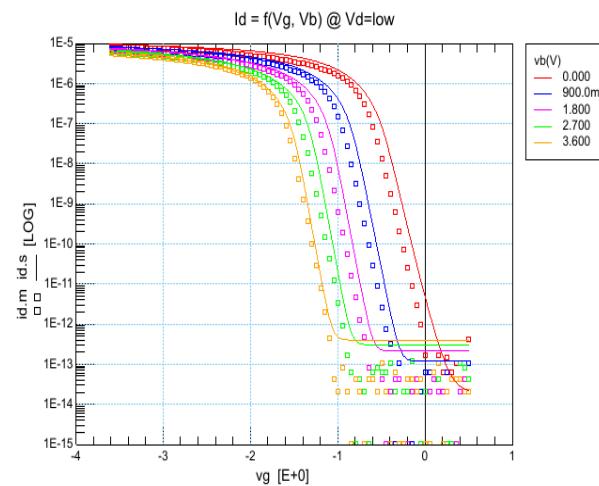
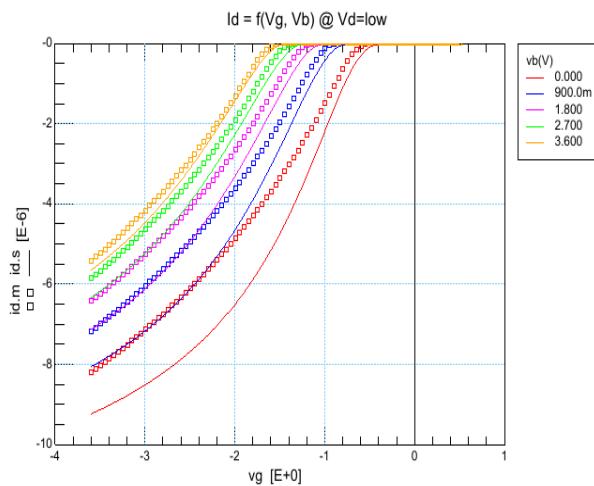
idvd_vbmin, Vb = 3.6V, T = -40°C**idvd_vth, Vb = 0V, T = -40°C**

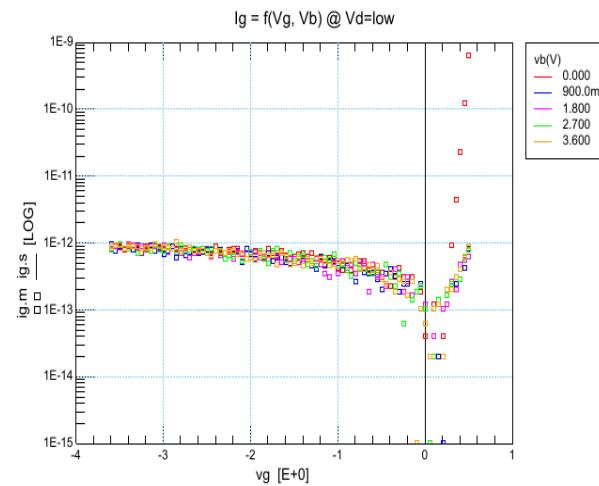
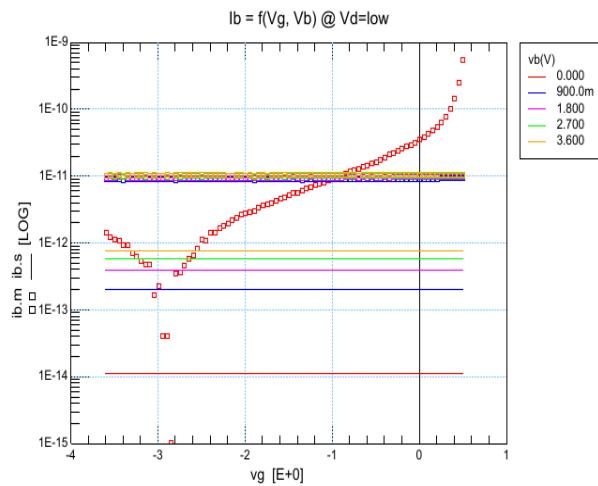


idvd_vth_vbmin, Vb = 3.6V, T = -40°C

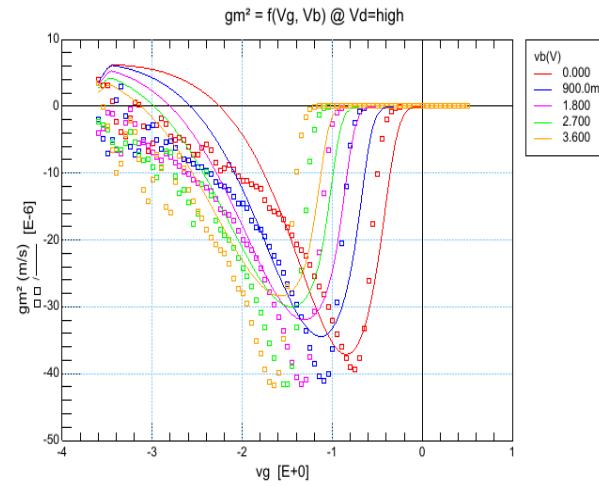
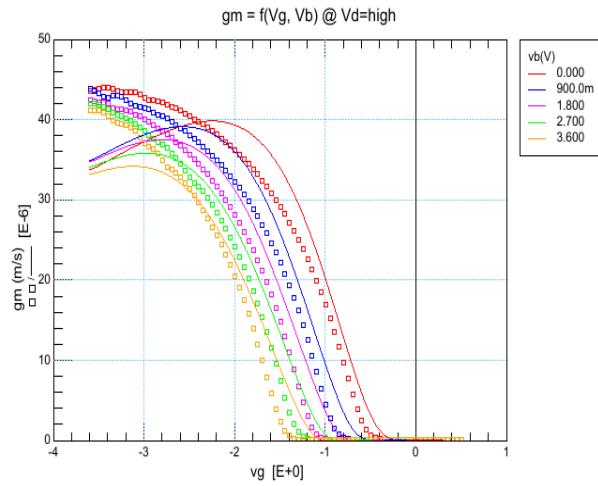
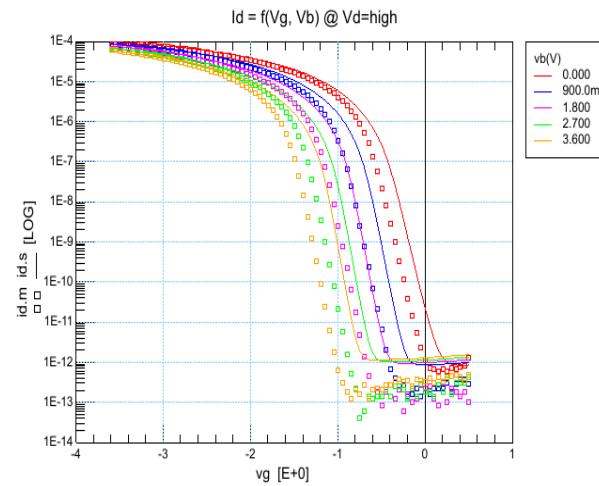
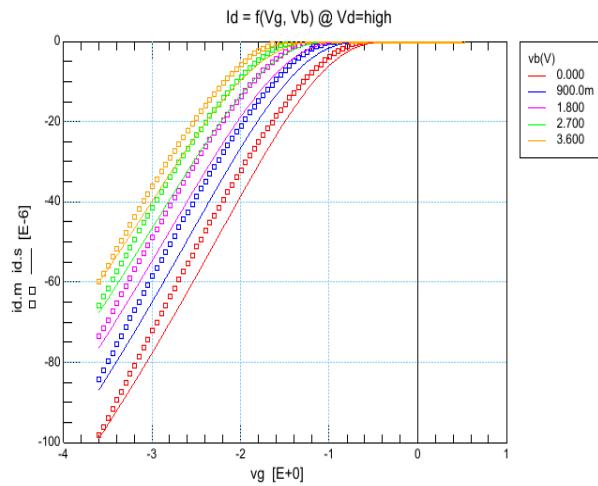


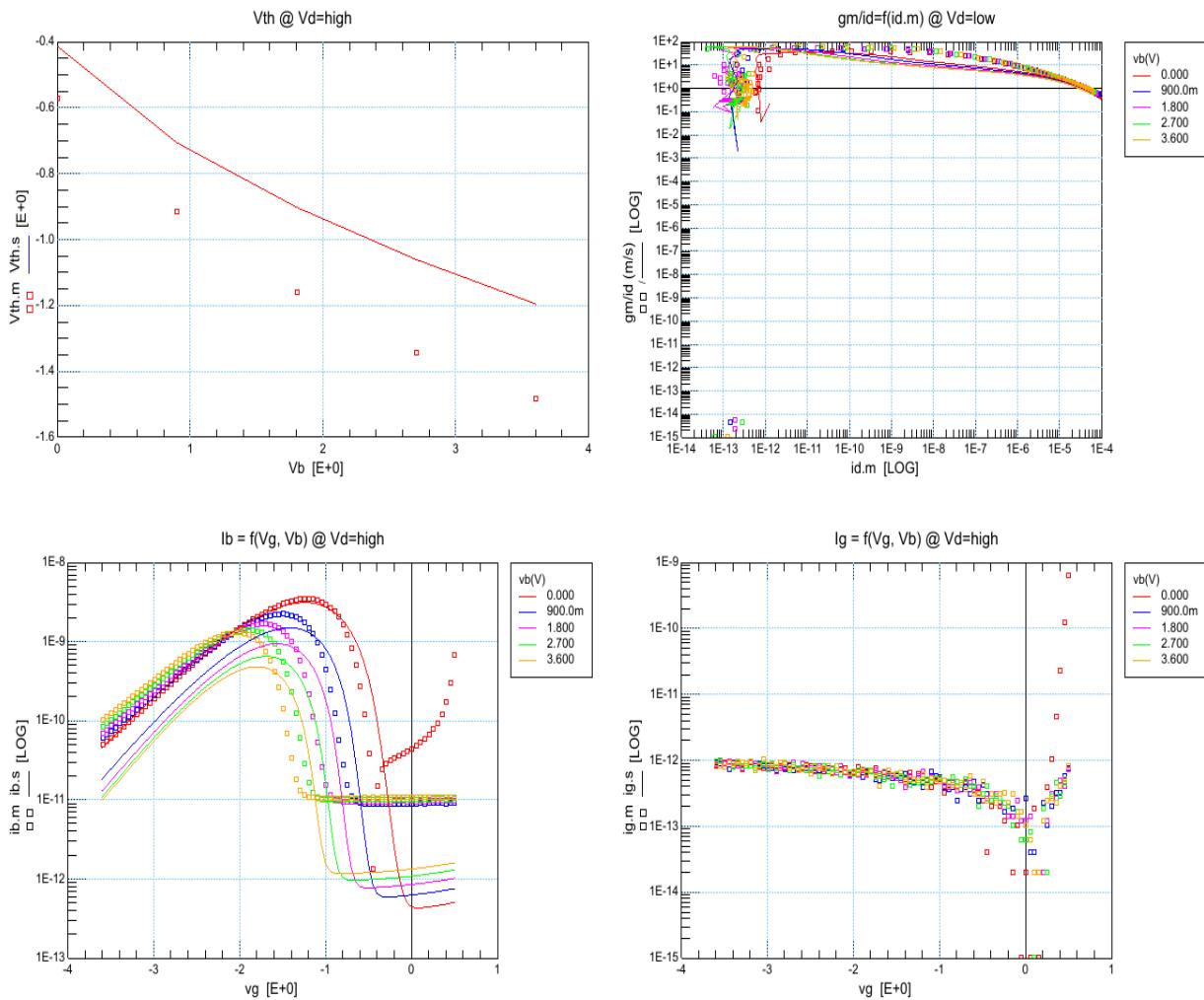
$idvg$, $Vd = -0.1V$, $T = 70^\circ C$



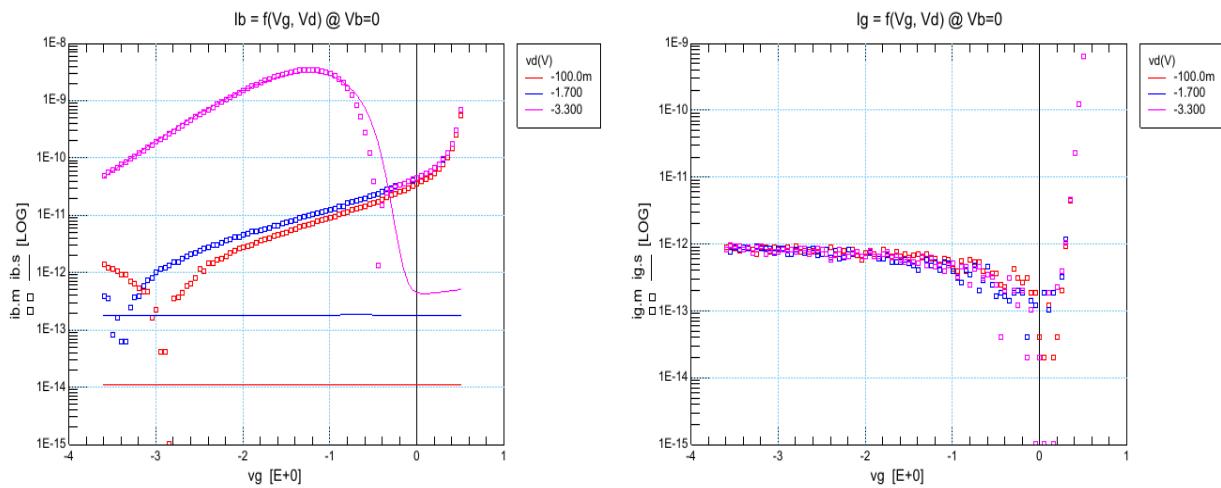


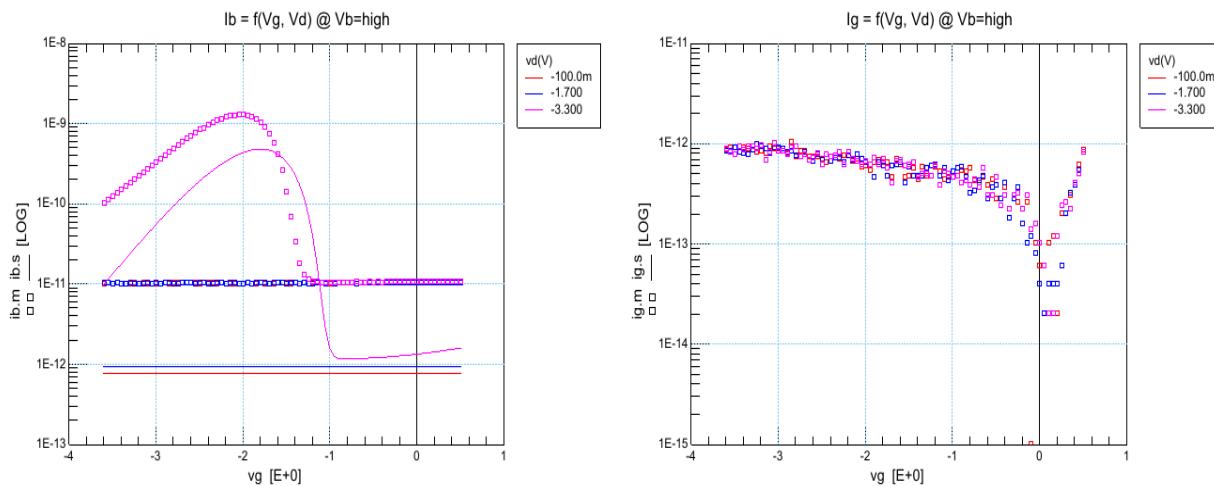
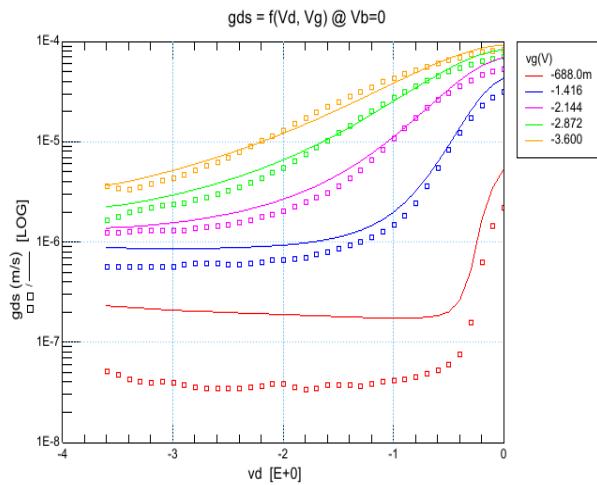
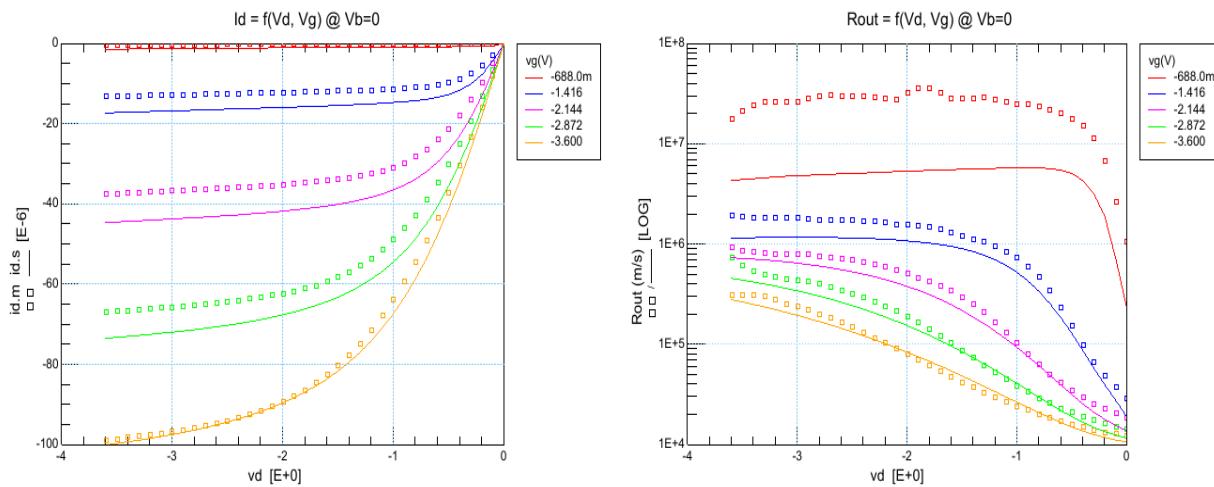
$i_{dvg}, V_d = -3.3V, T = 70^\circ\text{C}$

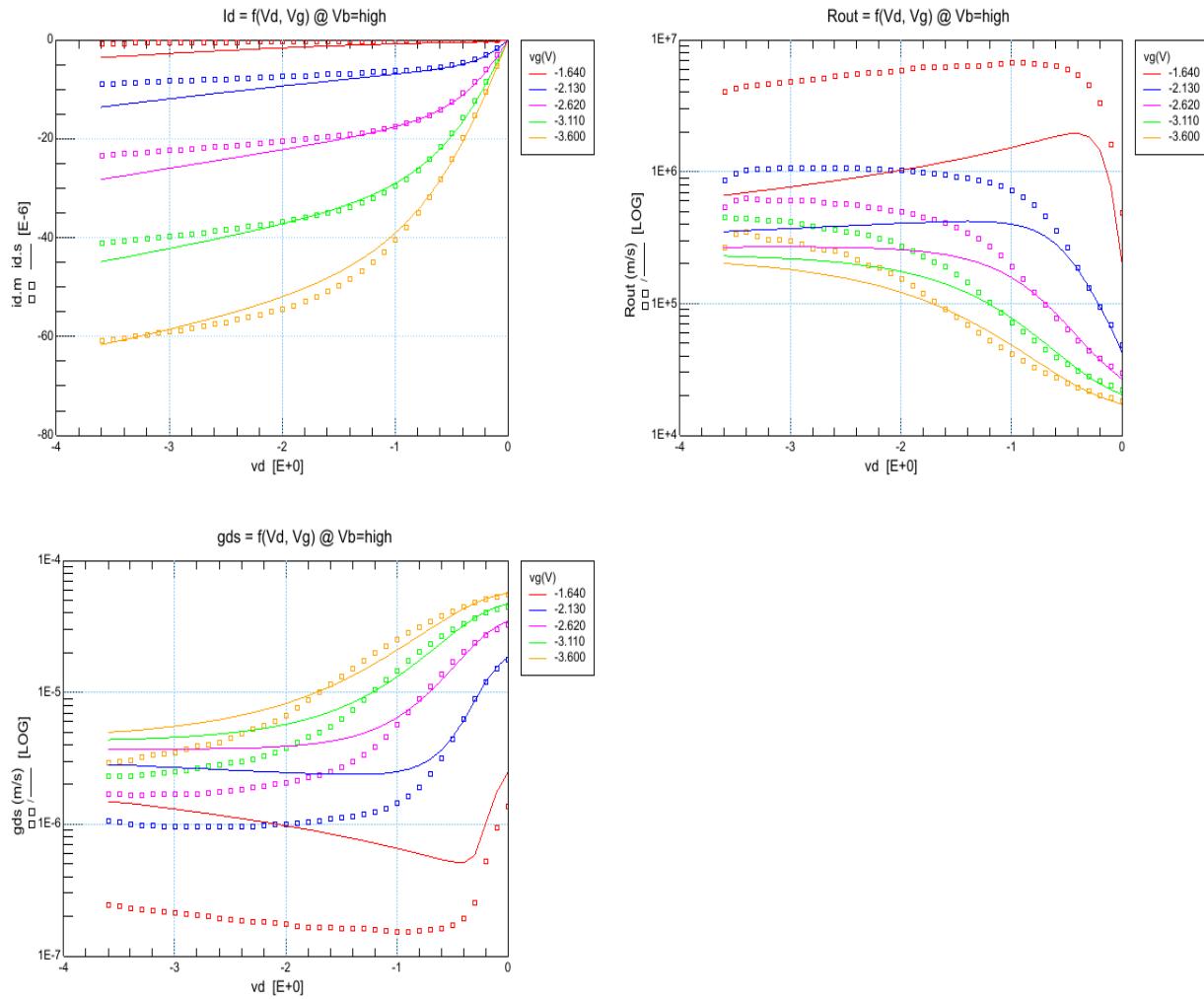
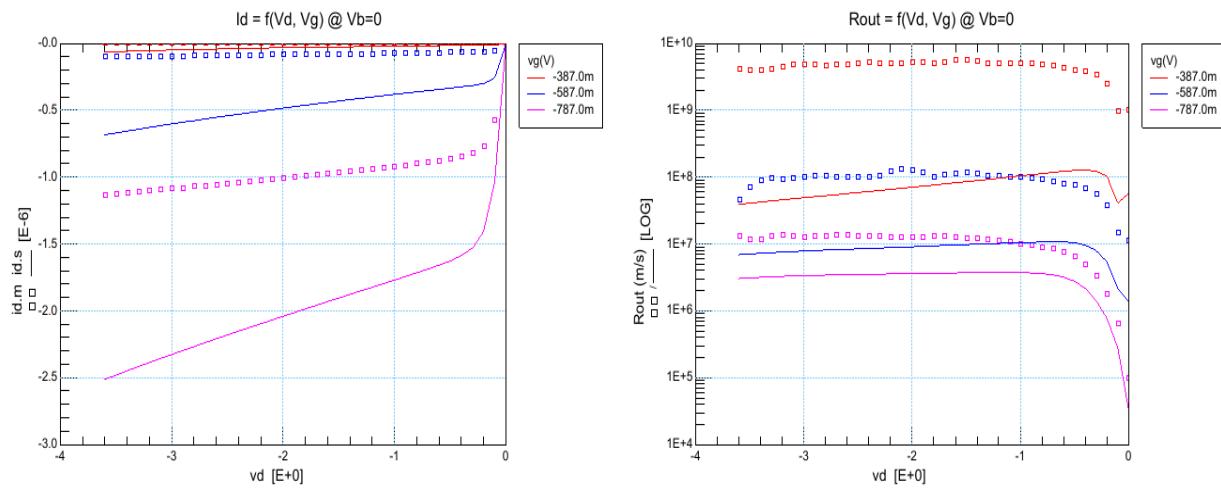


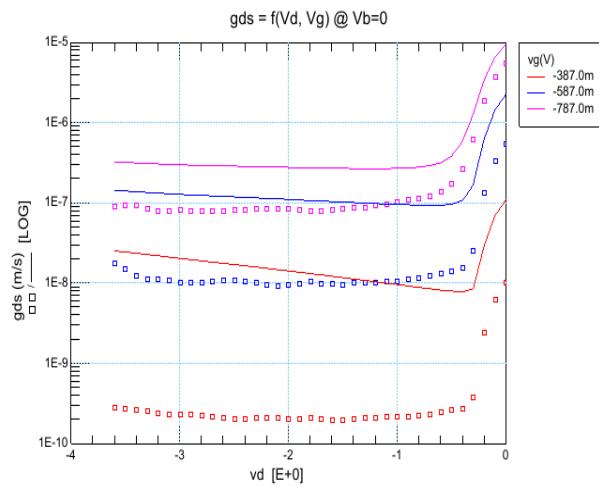


$i_{dvg}, I_b, I_g, V_b = 0V, T = 70^\circ C$

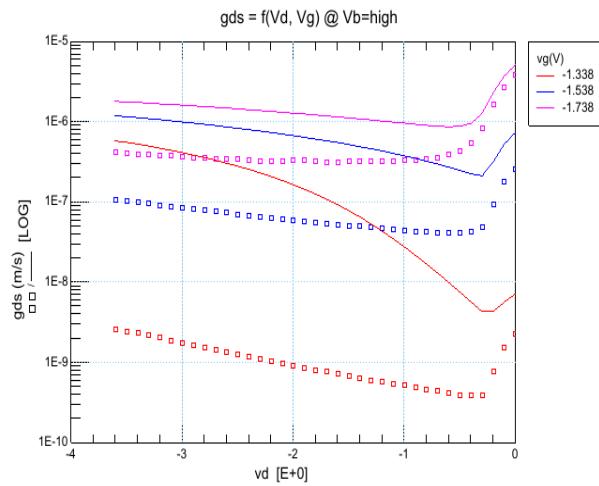
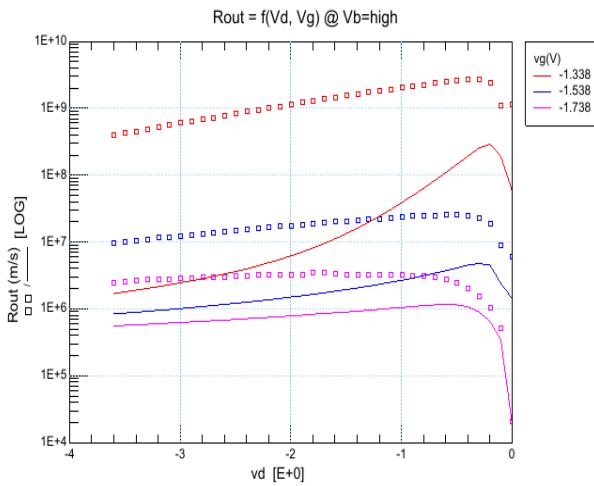
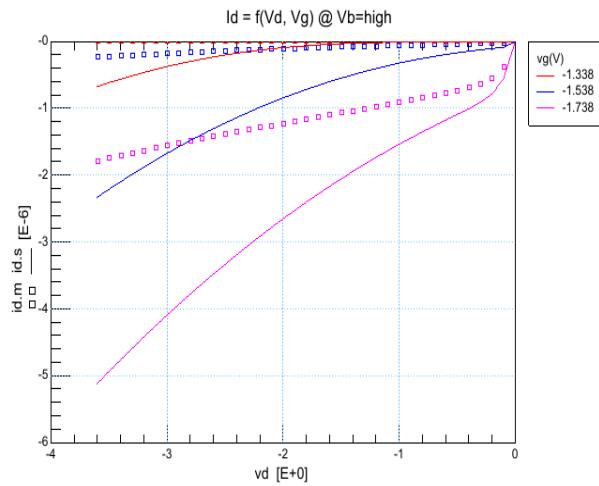


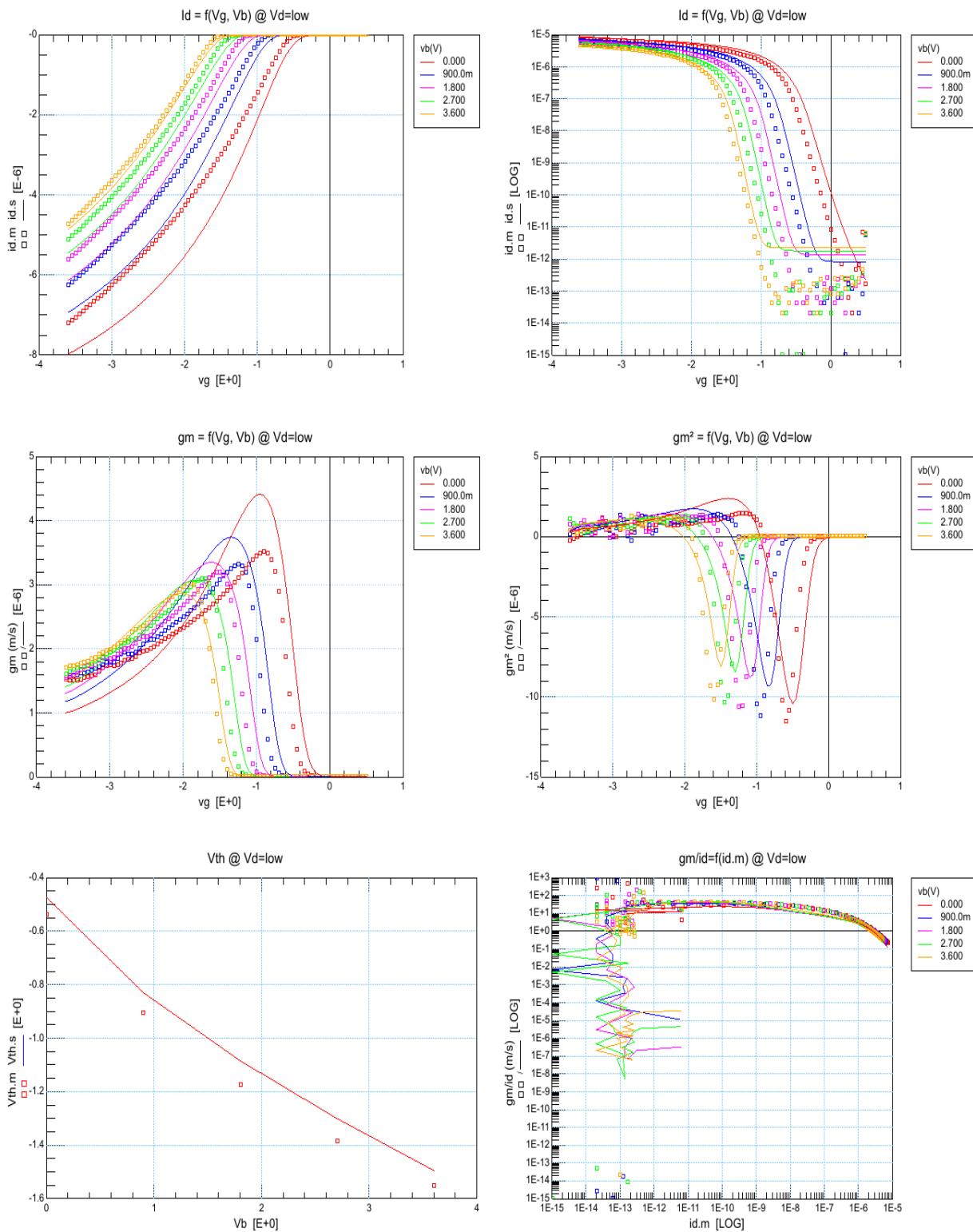
idvg, Ib,Ig, Vb = 3.6V, T = 70°C

idvd, Vb = 0V, T = 70°C


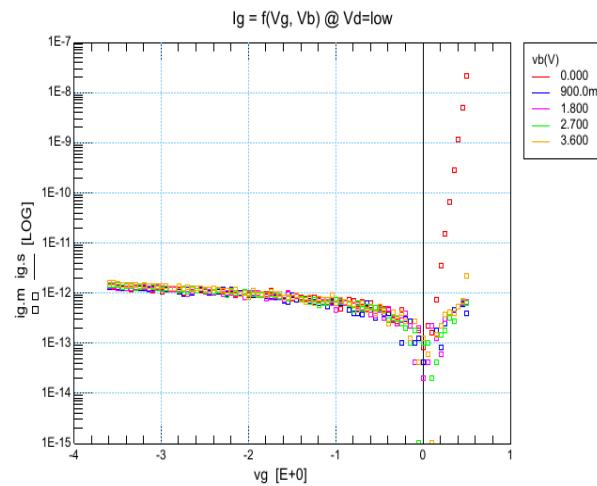
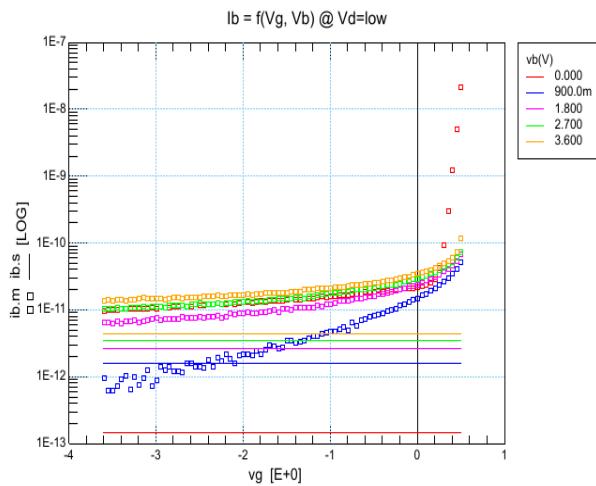
idvd_vbmin, Vb = 3.6V, T = 70°C

idvd_vth, Vb = 0V, T = 70°C




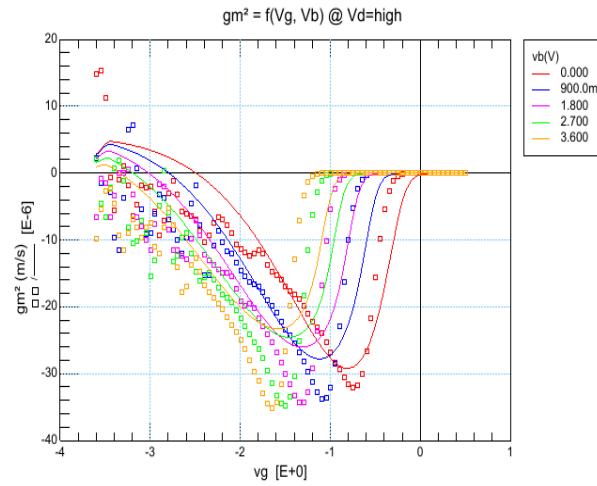
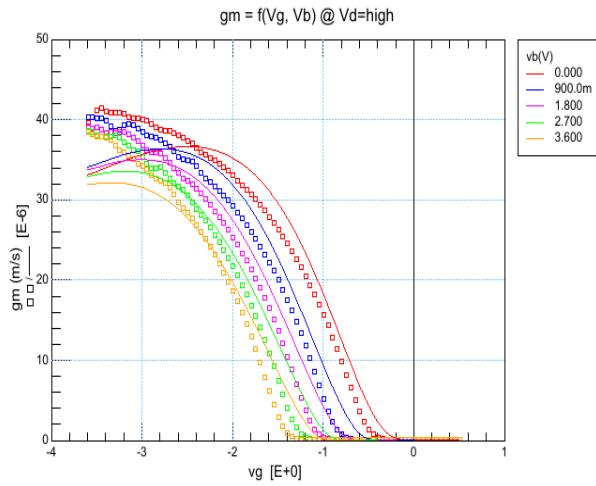
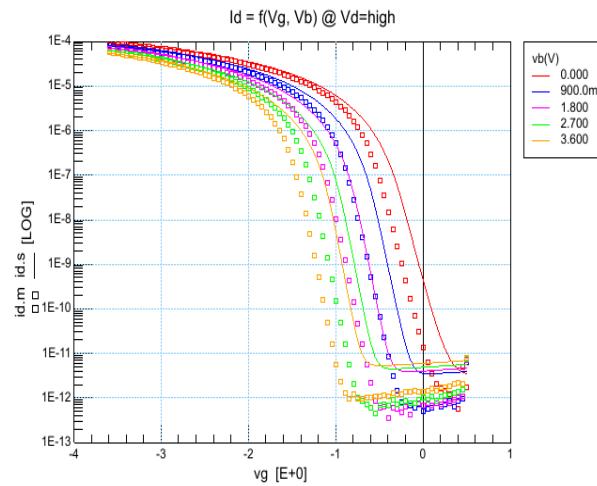
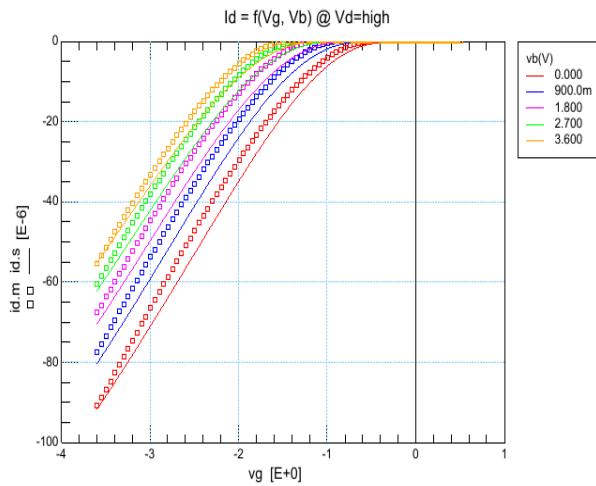
idvd_vth_vbmin, Vb = 3.6V, T = 70°C

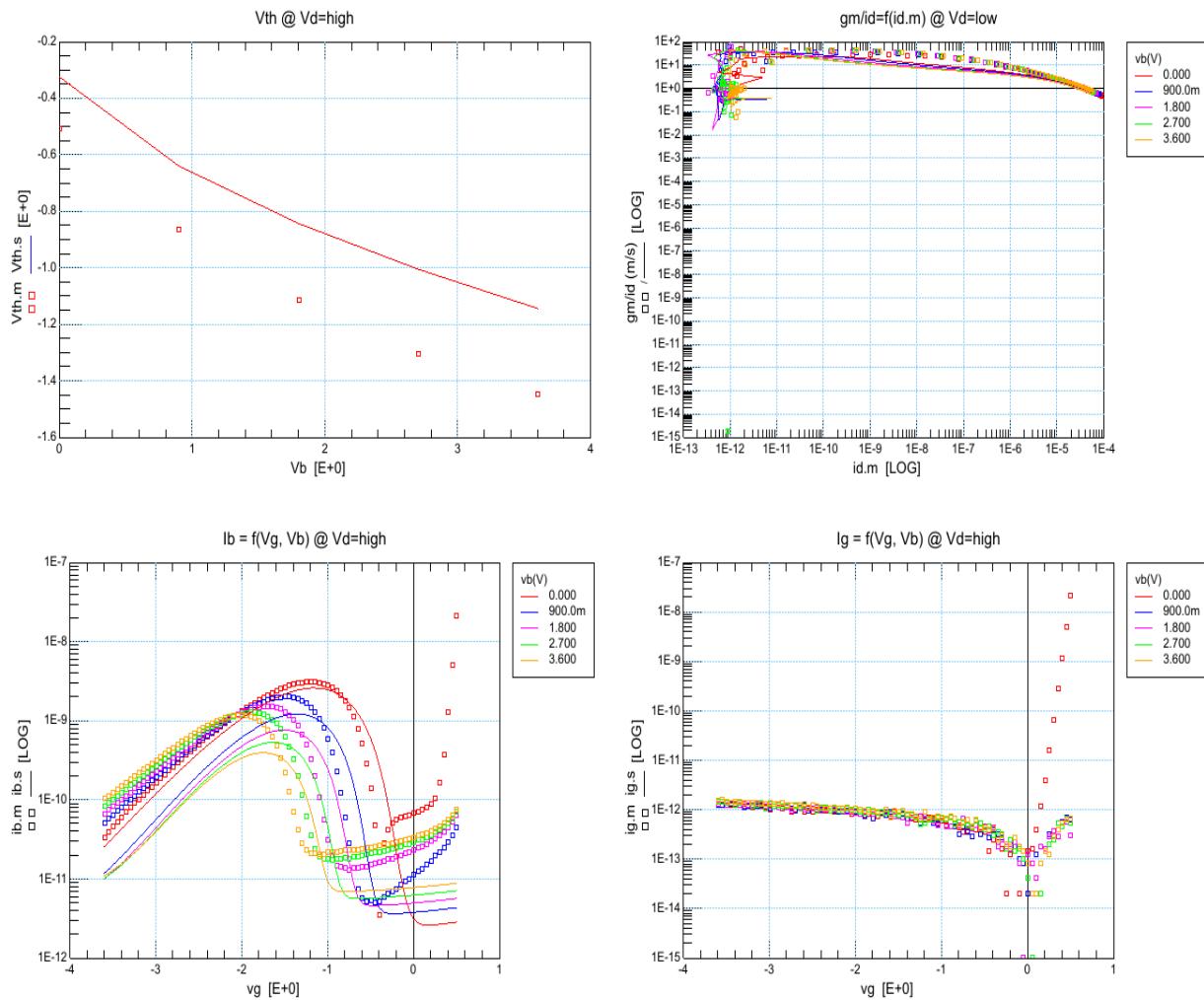


idvg, Vd = -0.1V, T = 125°C


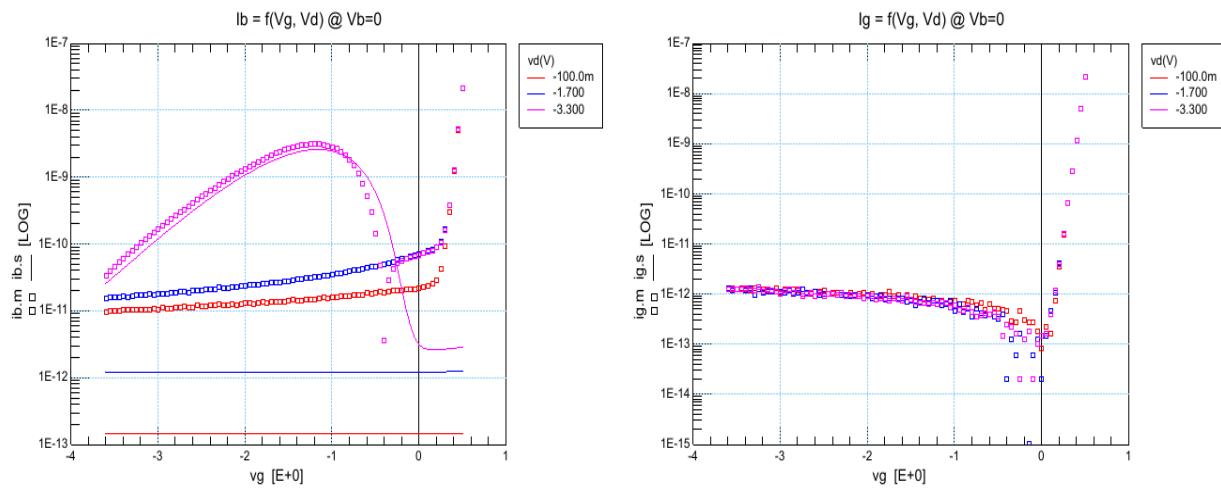


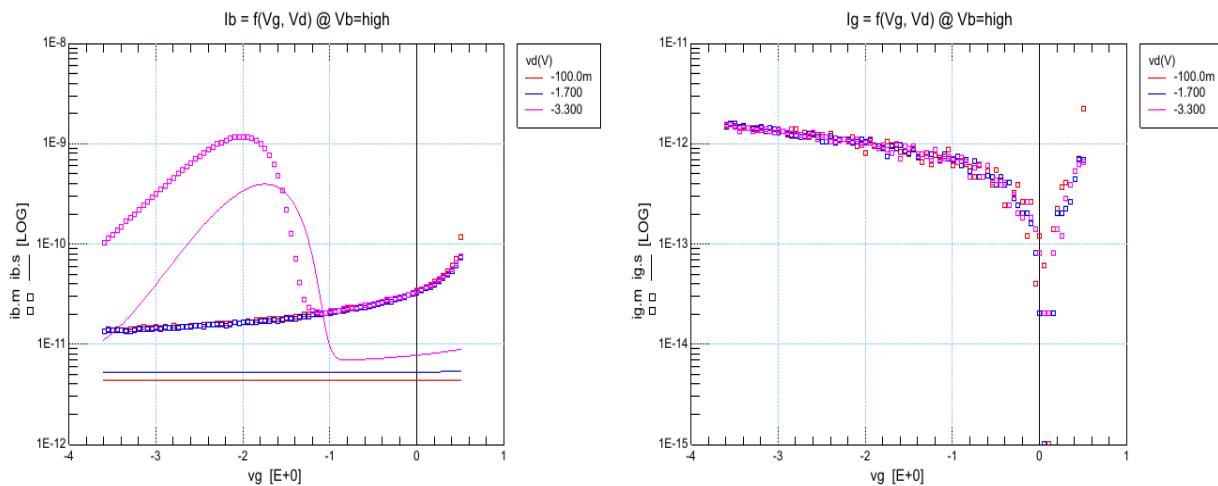
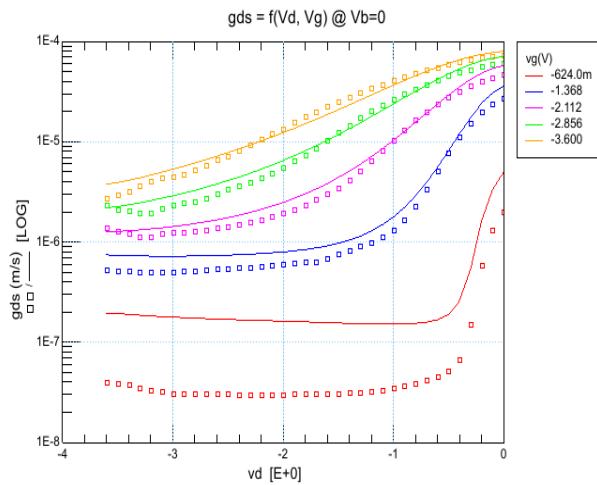
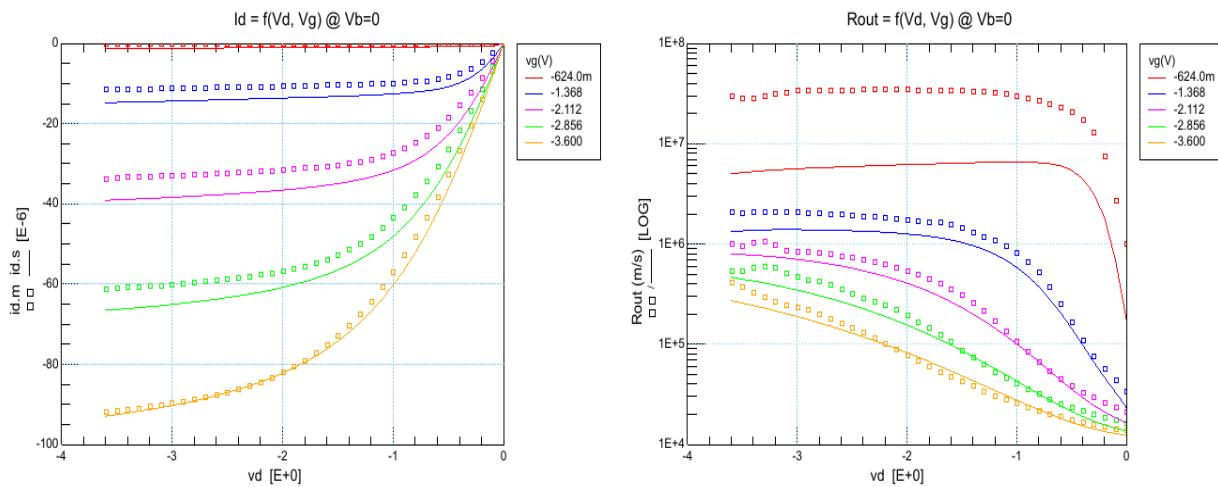
$i_{dvg}, V_d = -3.3V, T = 125^\circ\text{C}$

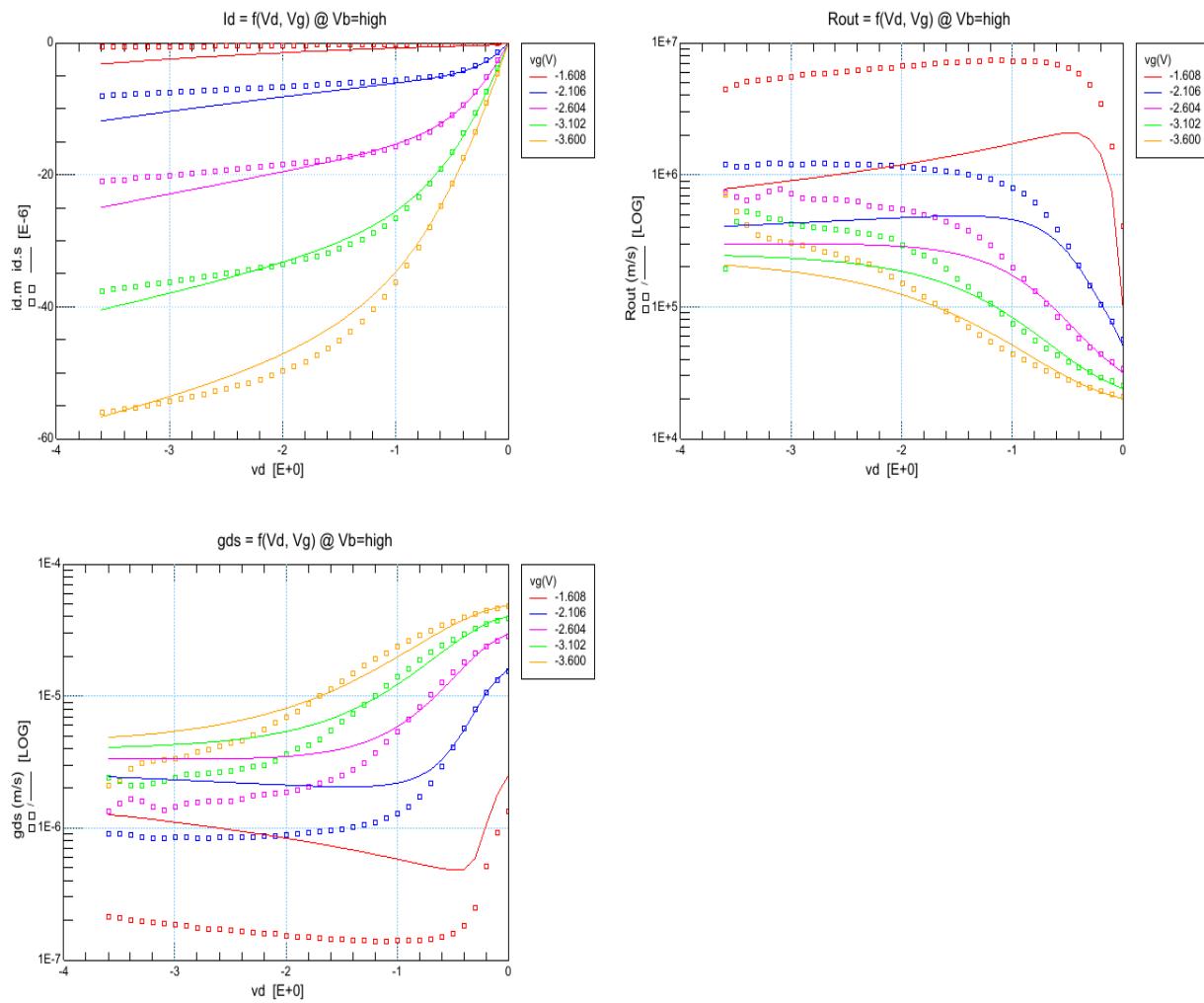
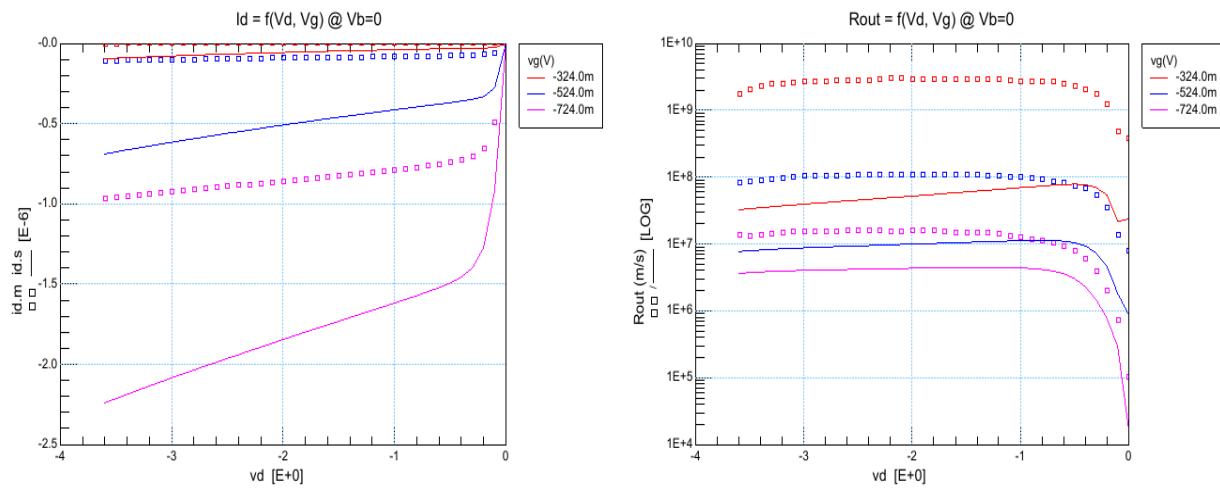


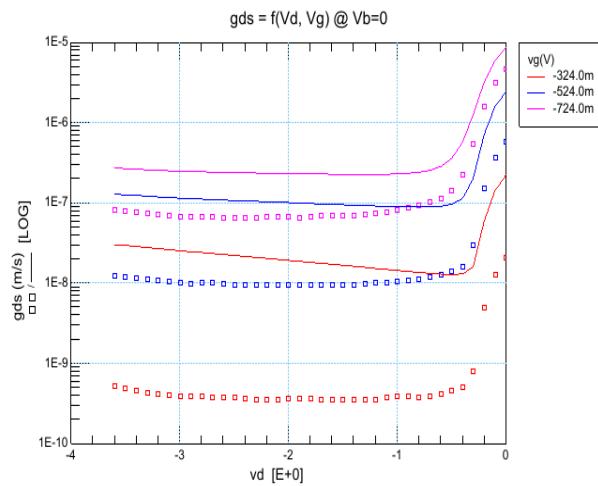


$i_{dvg}, I_b, I_g, V_b = 0V, T = 125^\circ C$

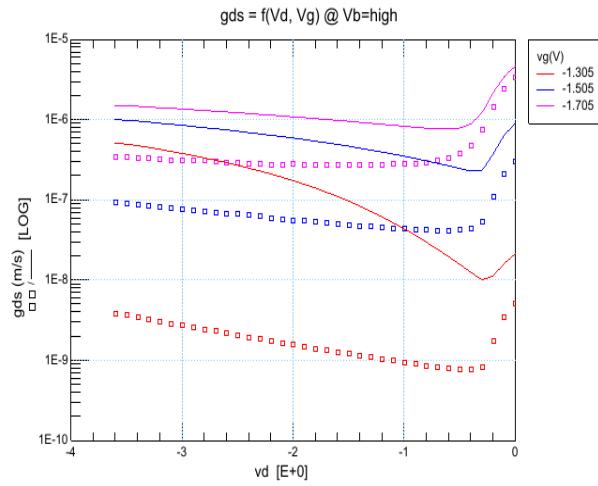
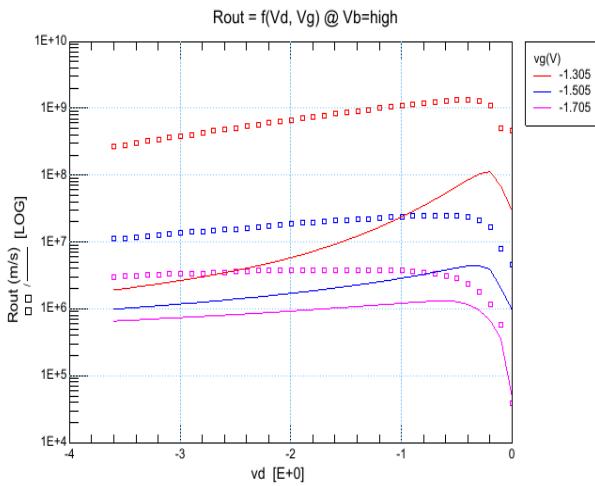
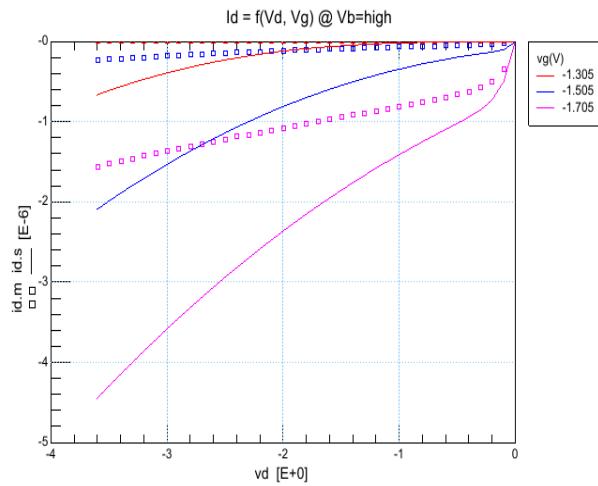


idvg, Ib,Ig, Vb = 3.6V, T = 125°C

idvd, Vb = 0V, T = 125°C


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

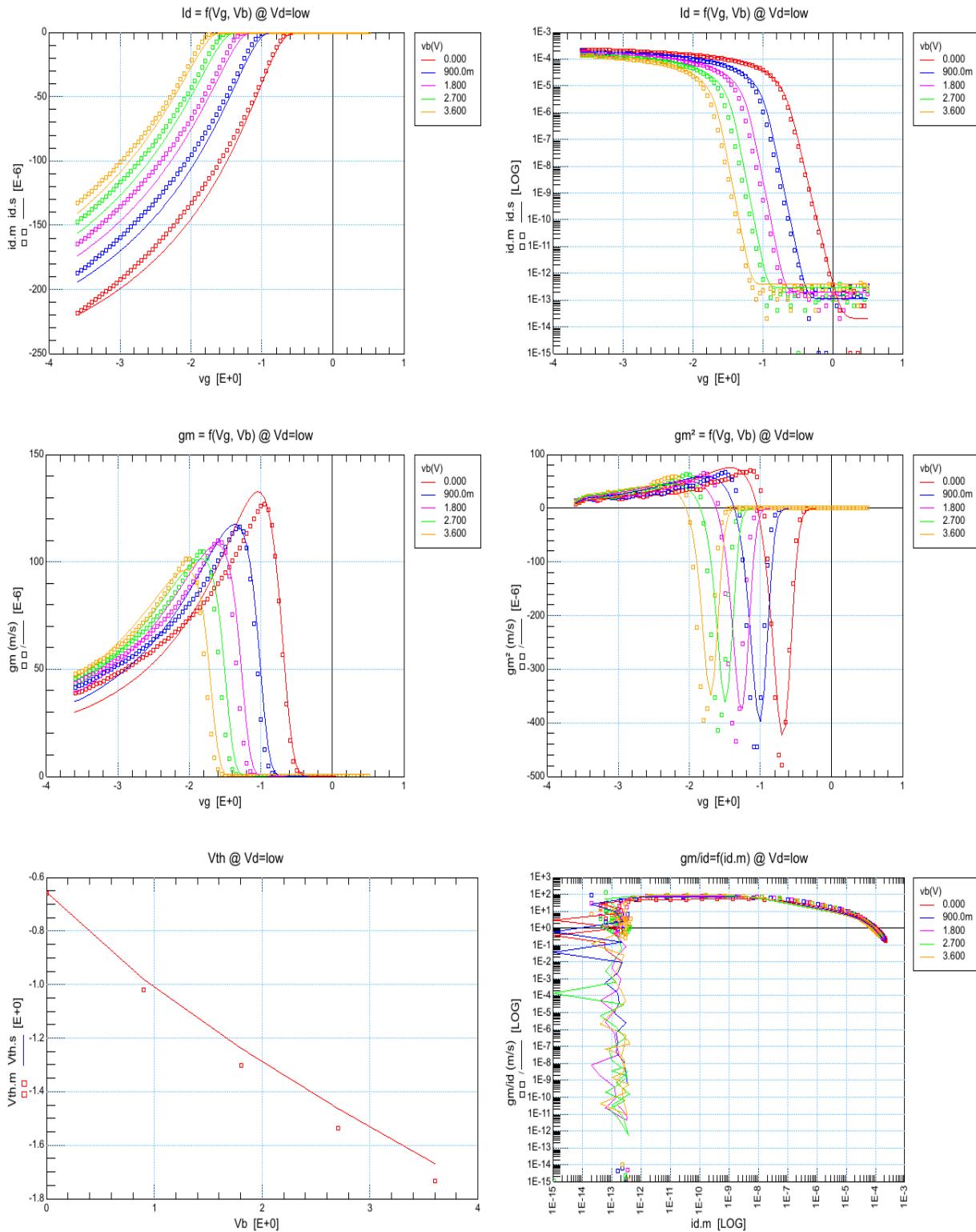


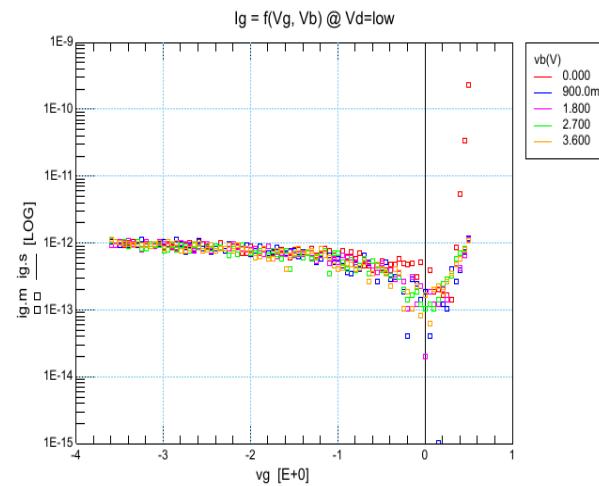
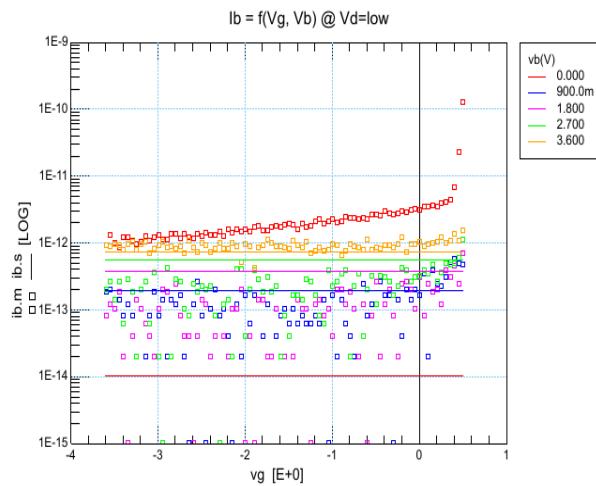
idvd_vth_vbmin, Vb = 3.6V, T = 125°C



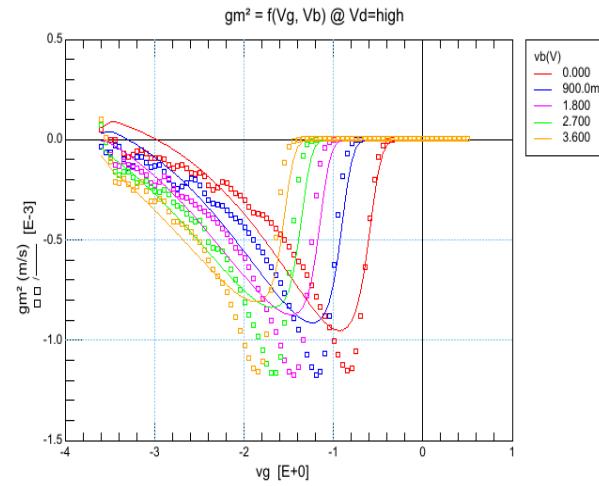
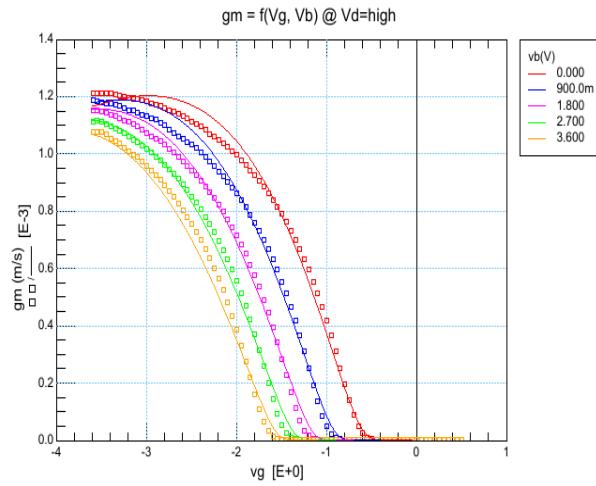
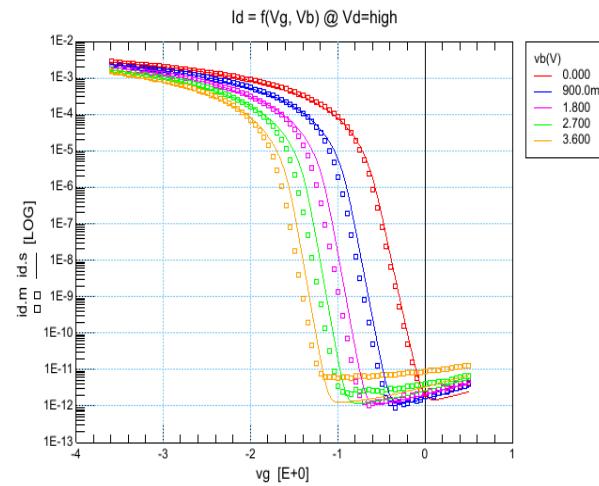
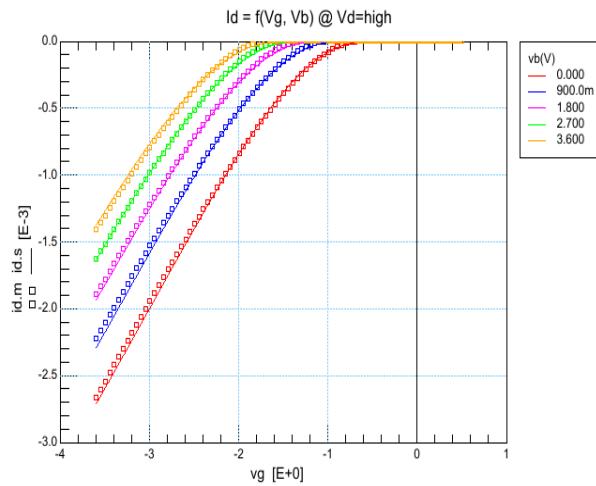
4.6 W10u0_L0u4_T356_S387_1

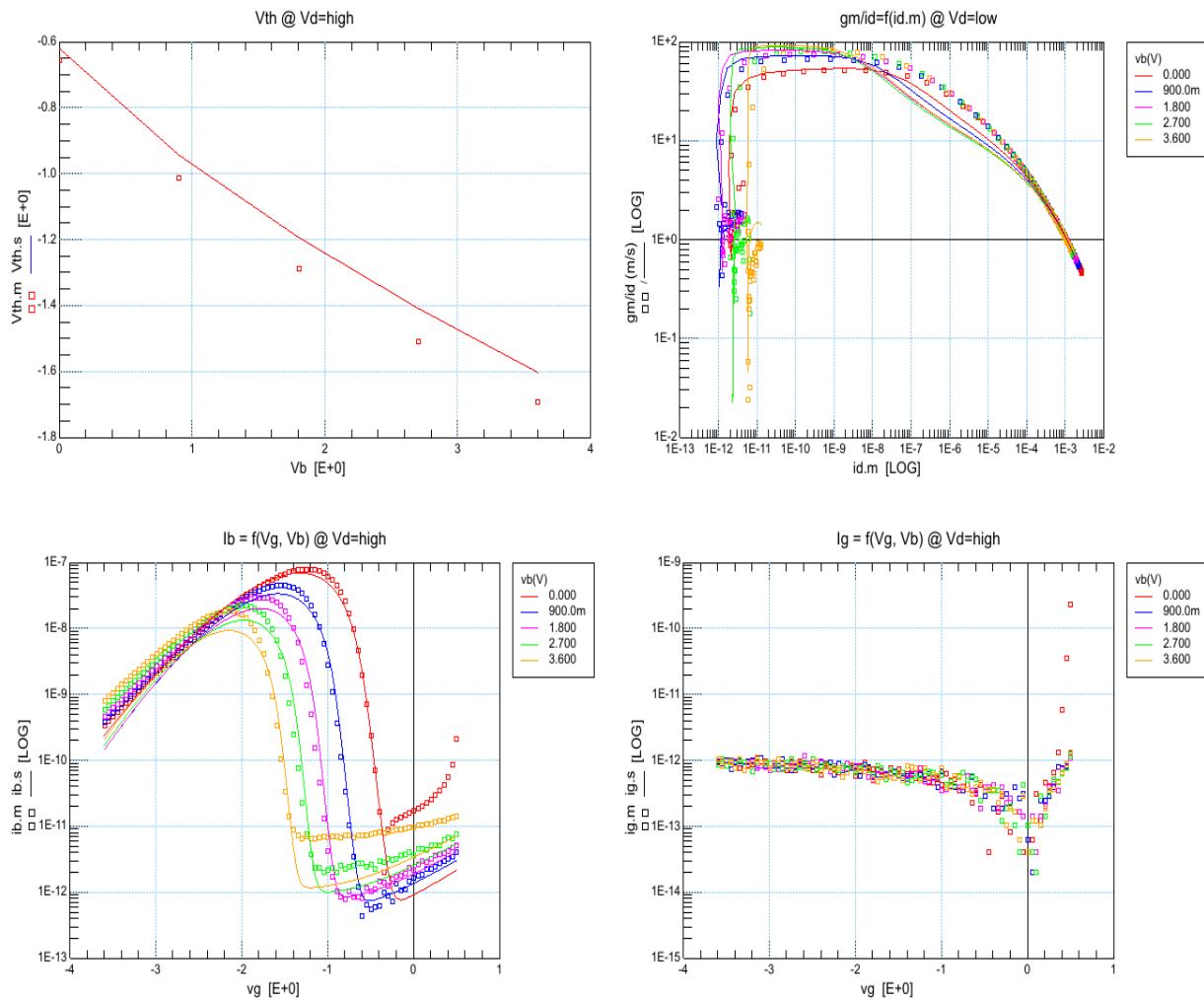
$idvg$, $Vd = -0.1V$, $T = 27^\circ C$



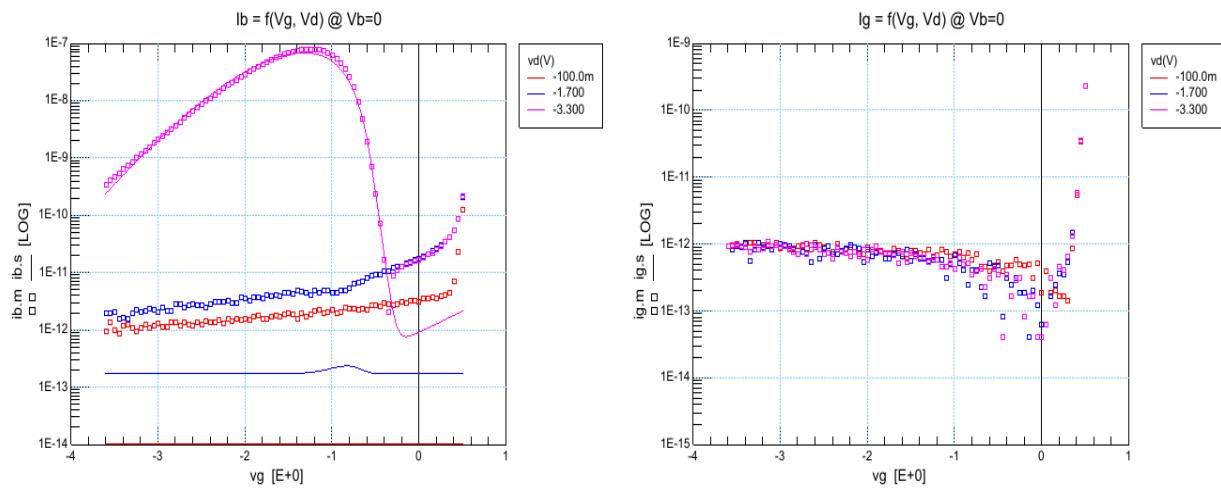


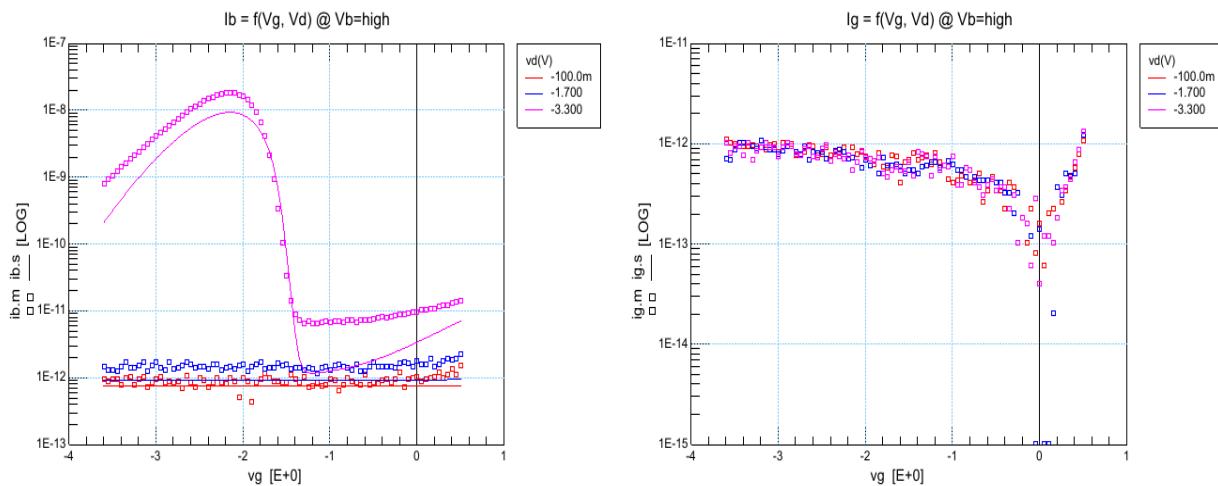
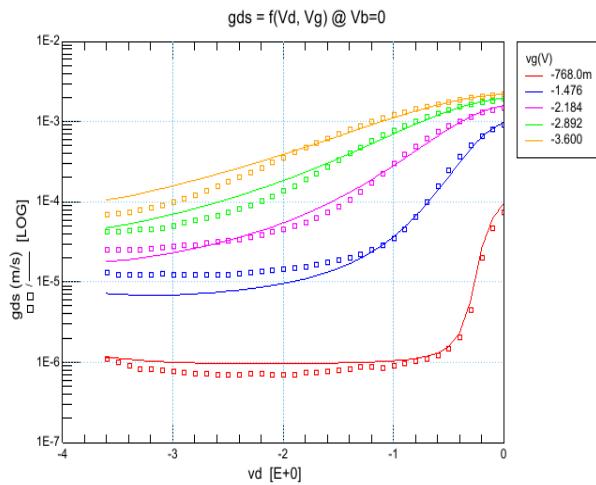
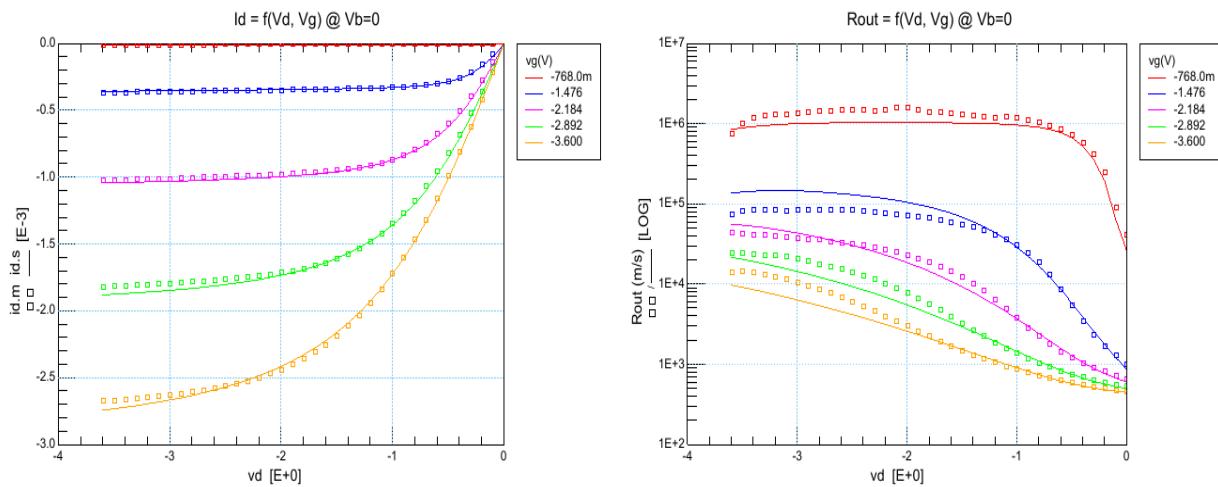
$i_{dvg}, V_d = -3.3V, T = 27^\circ\text{C}$

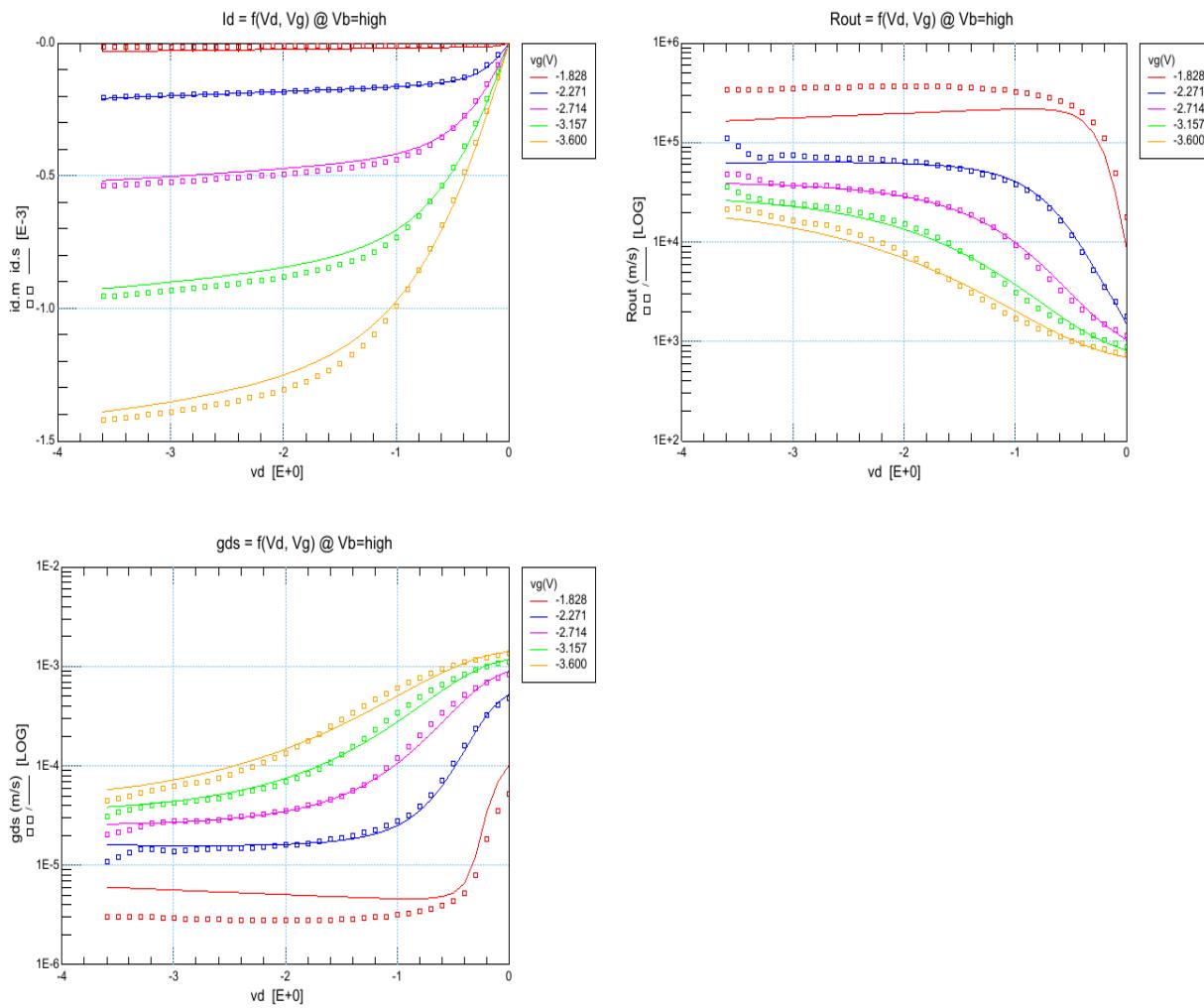
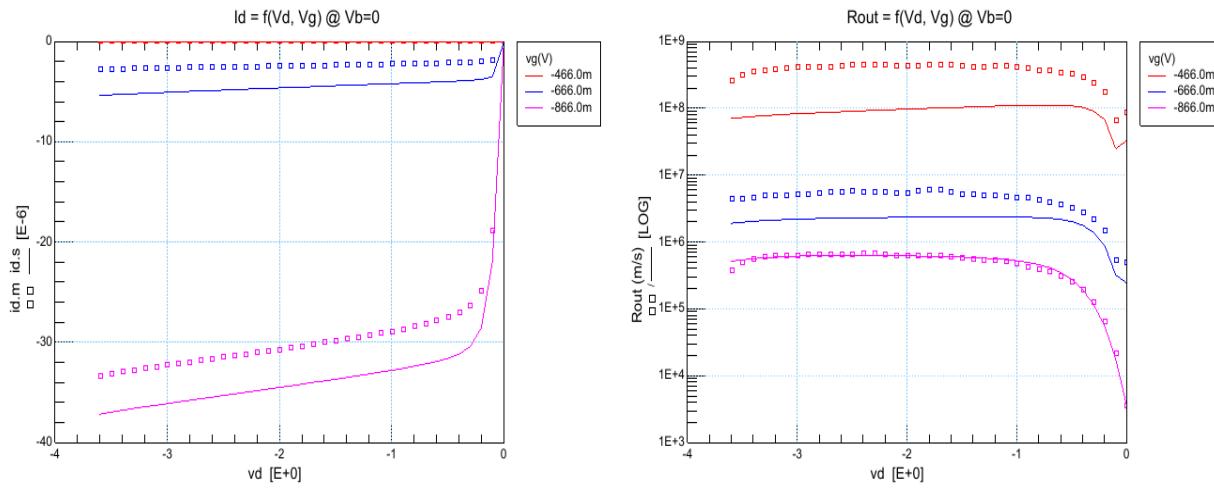


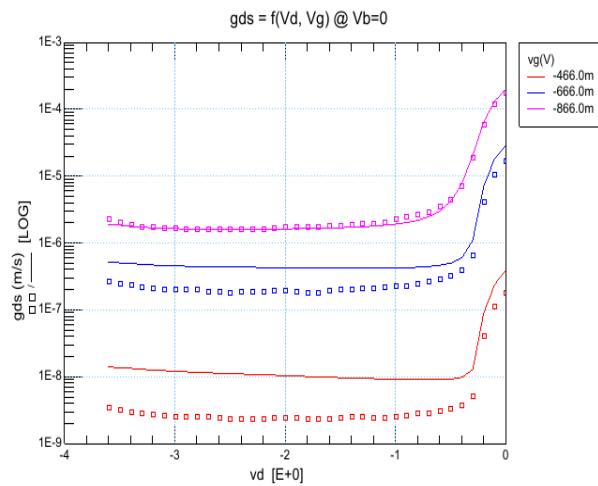


idvg, Ib, Ig, Vb = 0V, T = 27°C

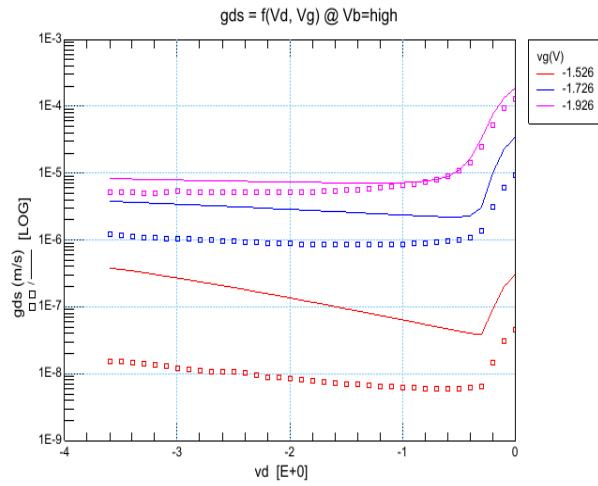
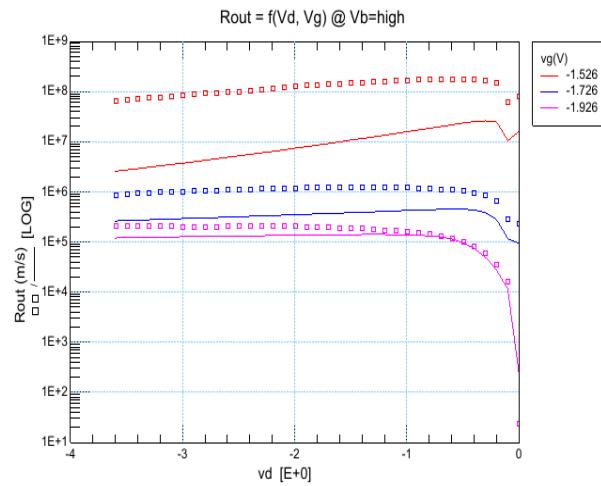
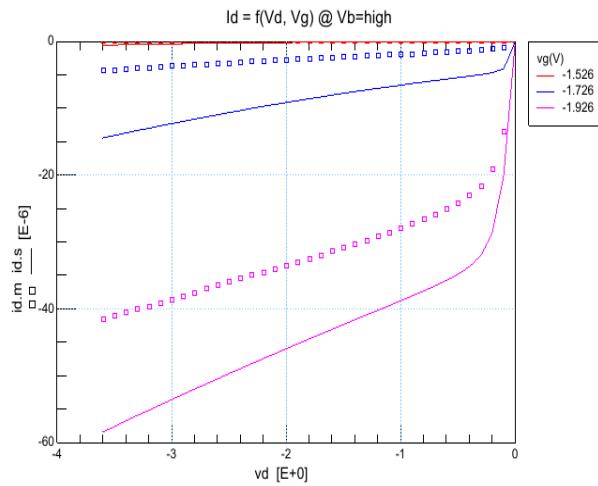


idvg, Ib,Ig, Vb = 3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


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

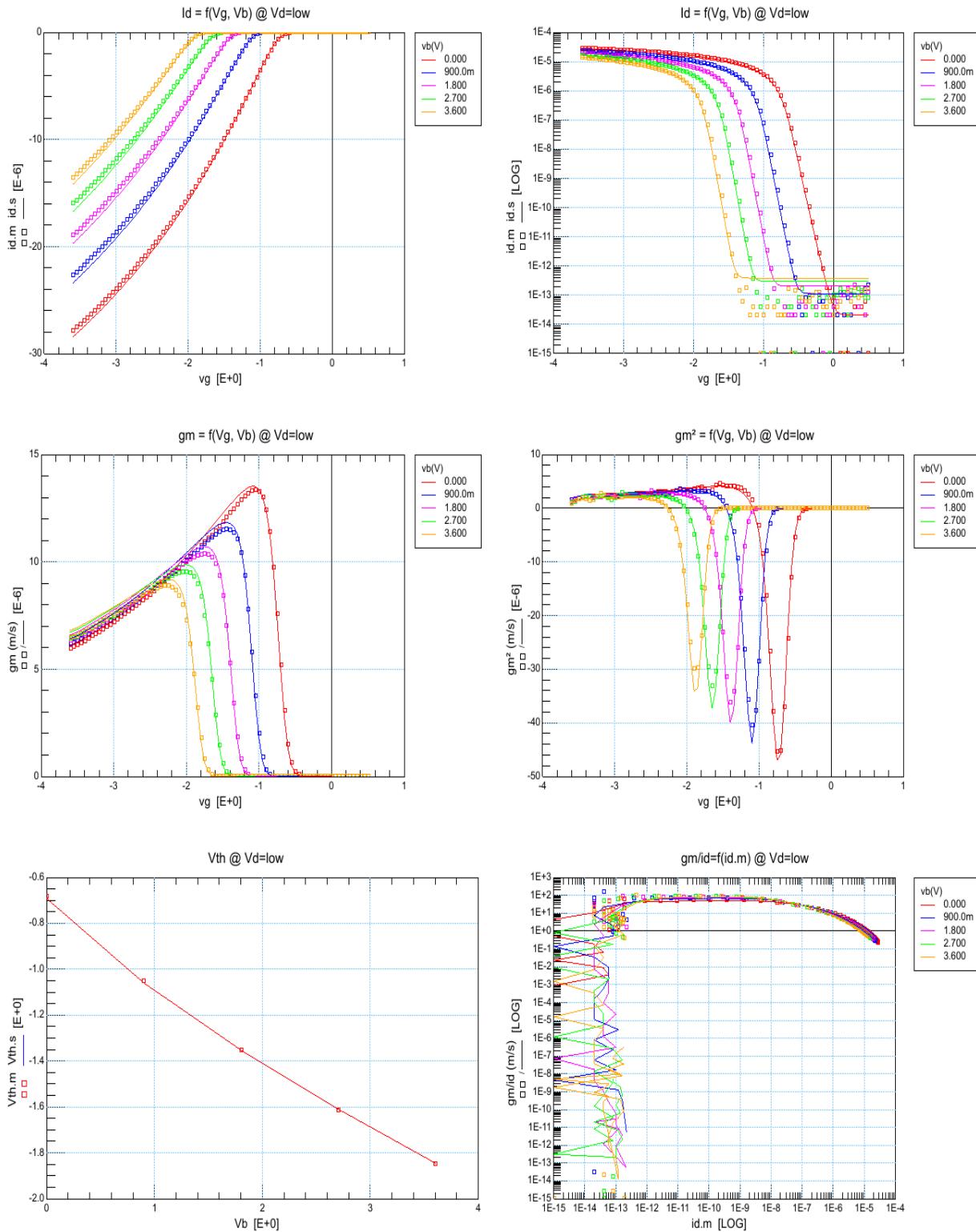


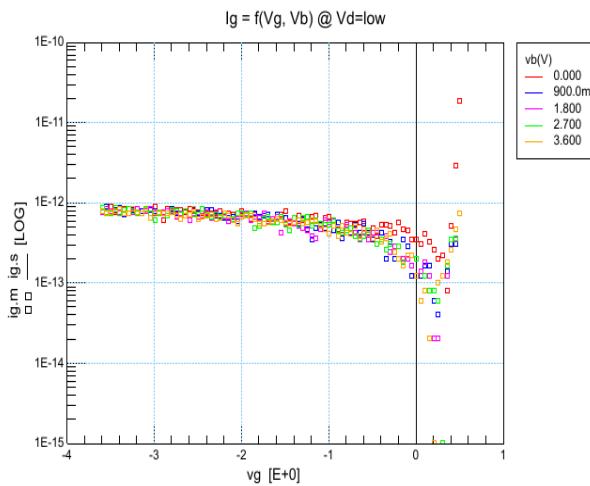
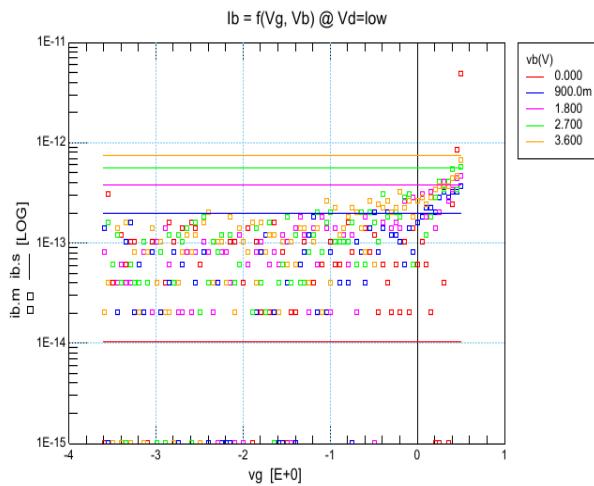
idvd_vth_vbmin, Vb = 3.6V, T = 27°C



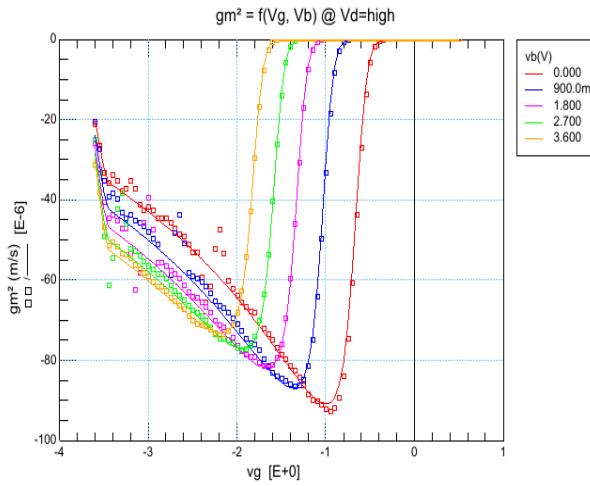
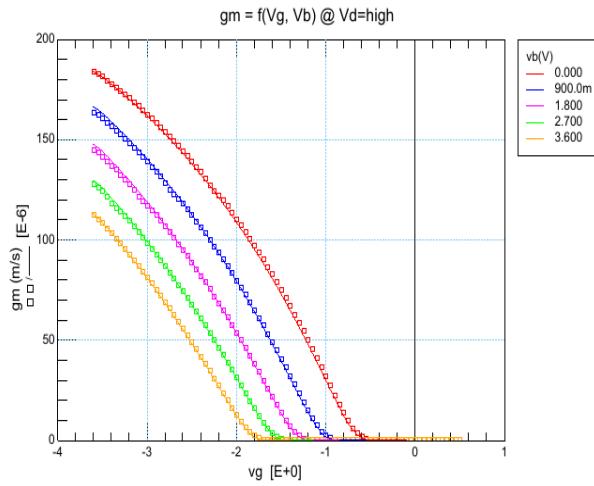
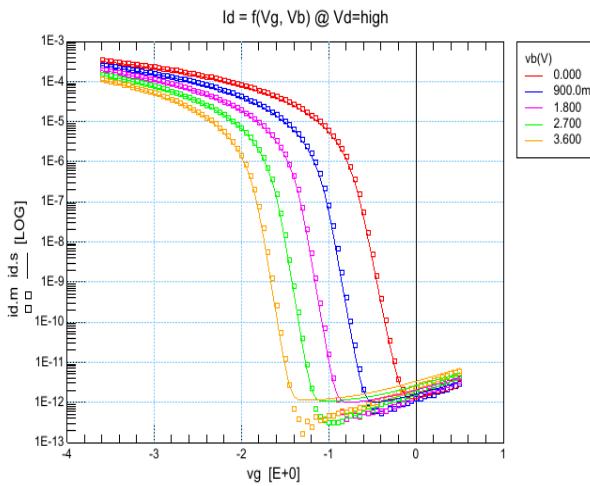
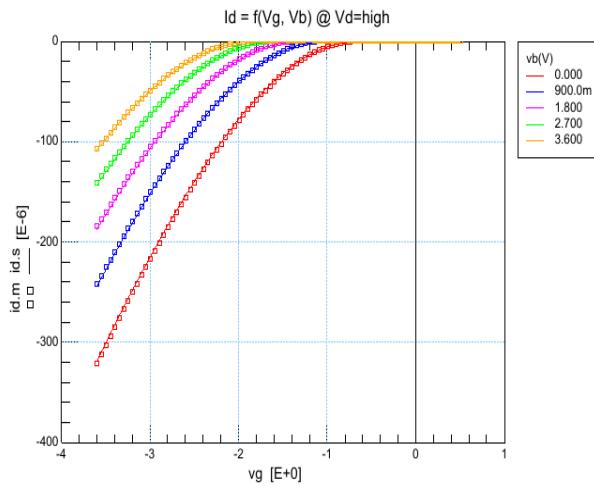
4.7 W10u0_L3u0_S562_1

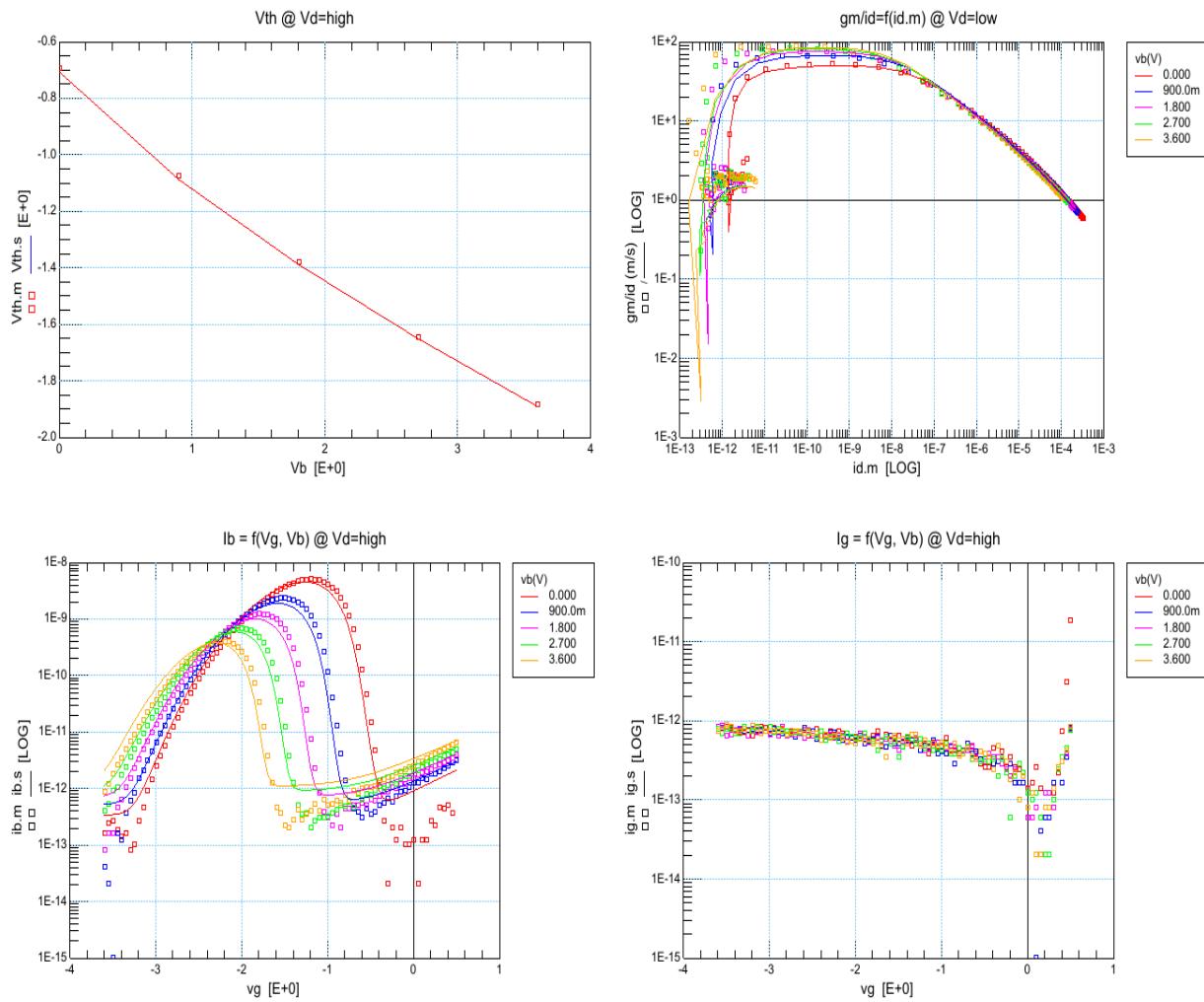
$idvg$, $Vd = -0.1V$, $T = 27^\circ C$



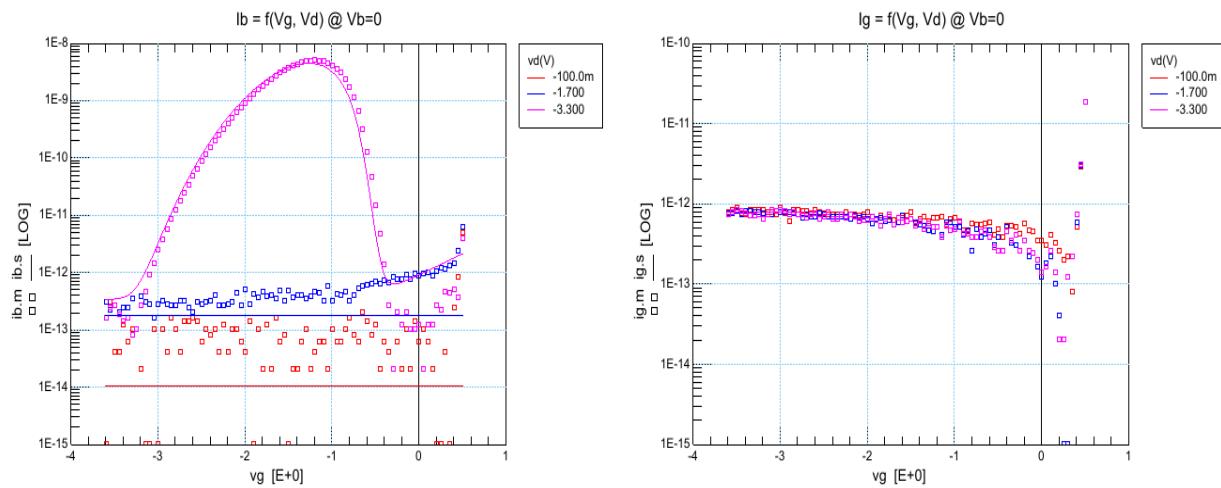


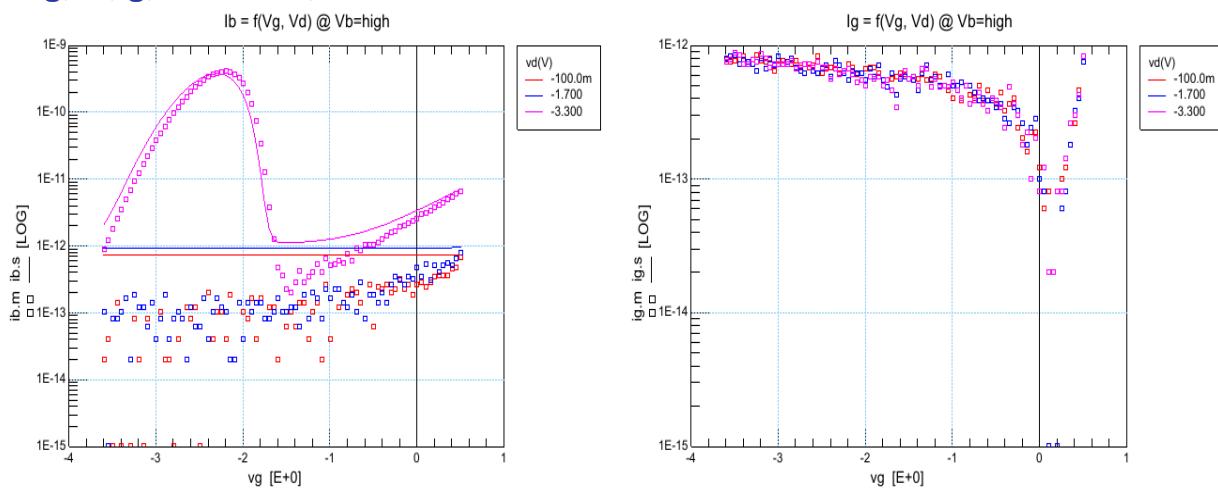
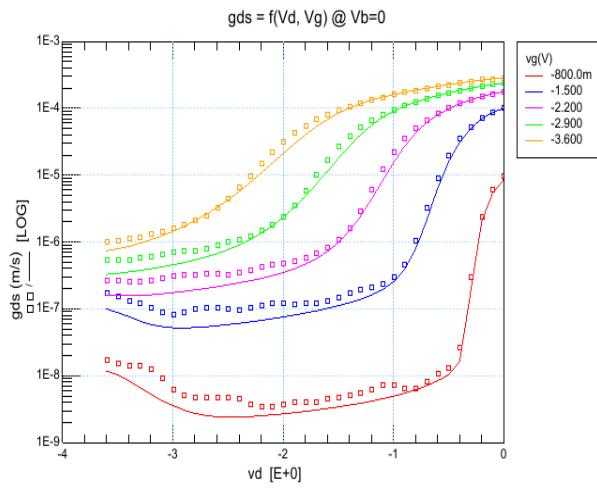
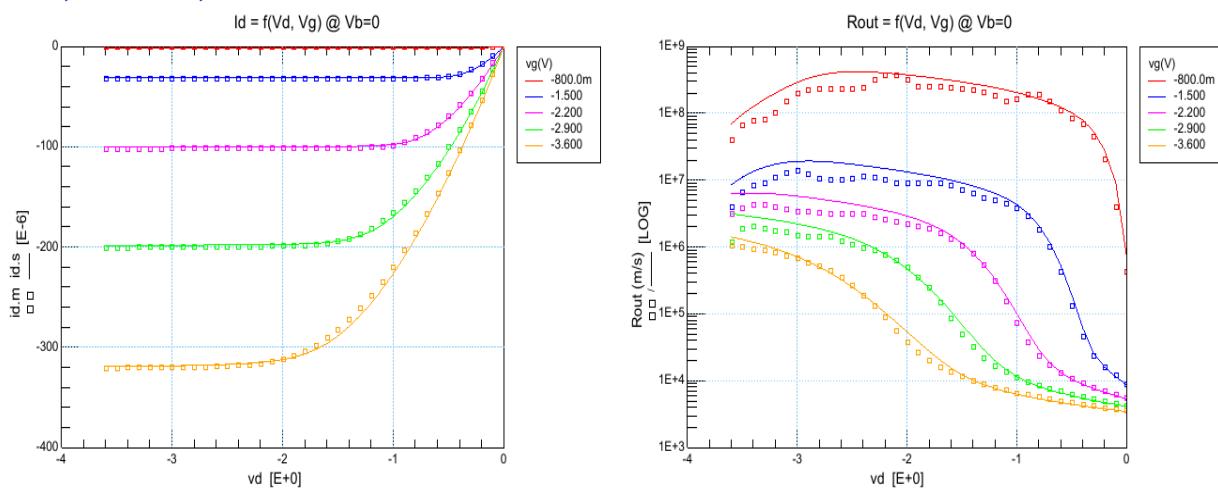
$i_{dvg}, V_d = -3.3V, T = 27^\circ\text{C}$

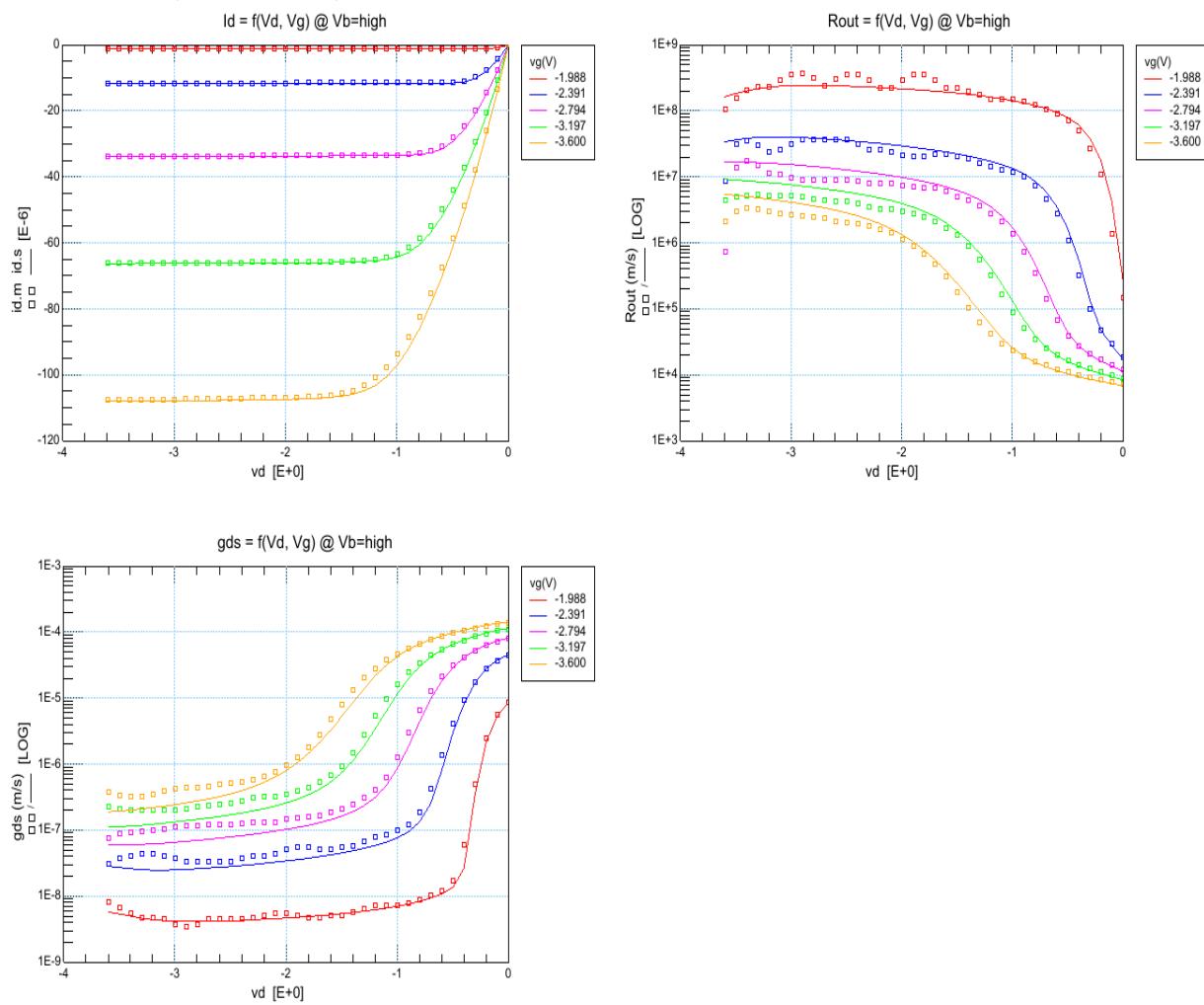
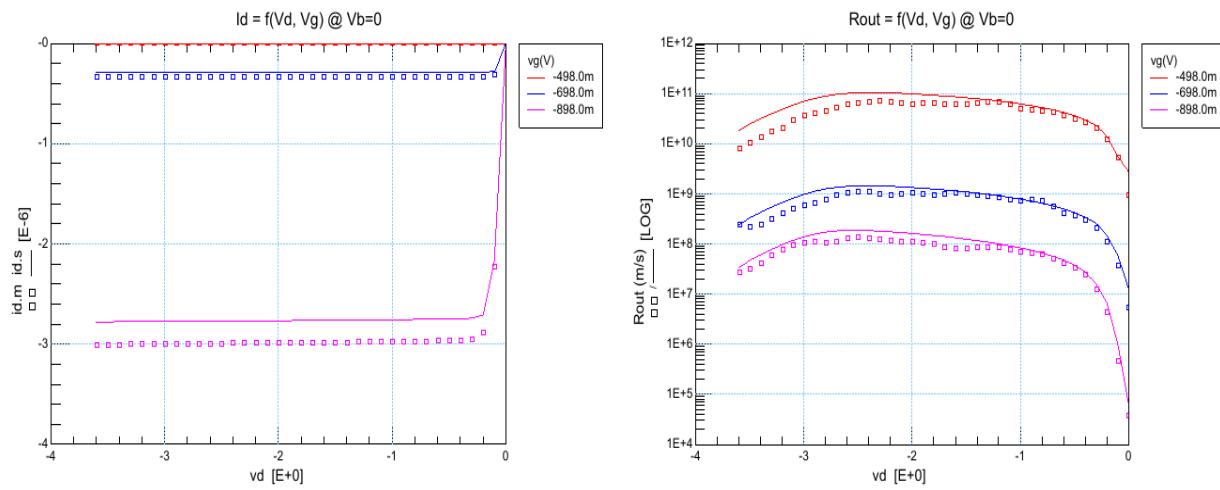


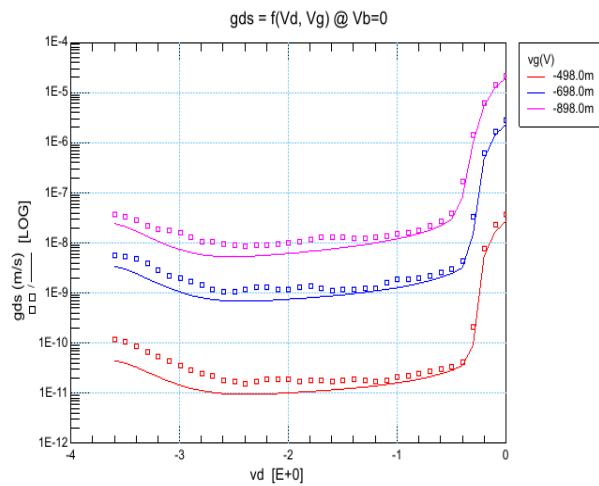


i_{dVg} , I_b , I_g , $V_b = 0V$, $T = 27^\circ C$

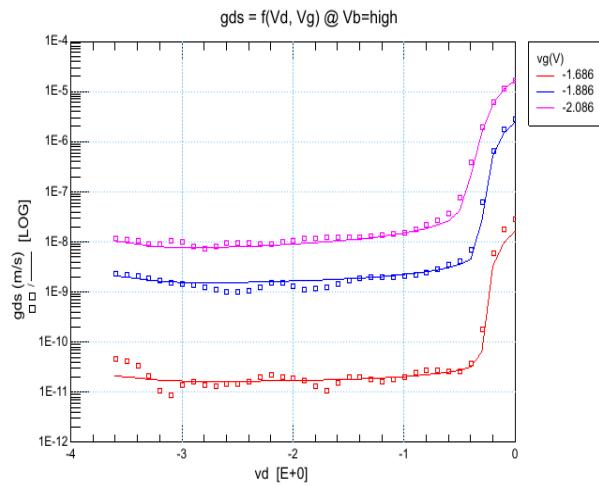
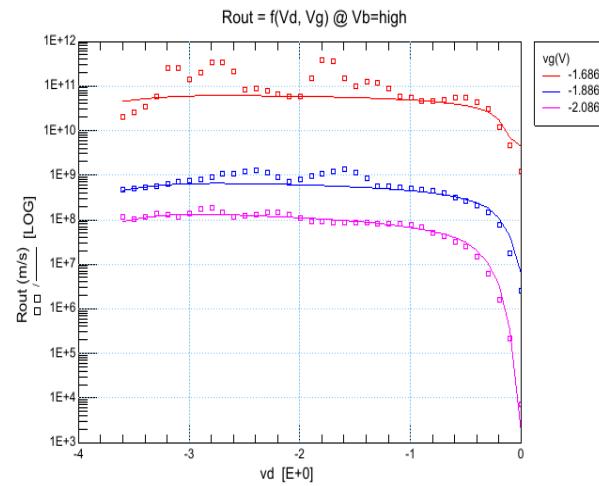
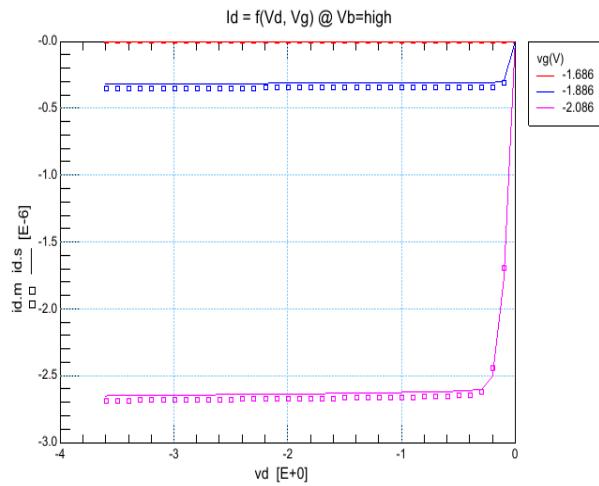


idvg, Ib,Ig, Vb = 3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


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

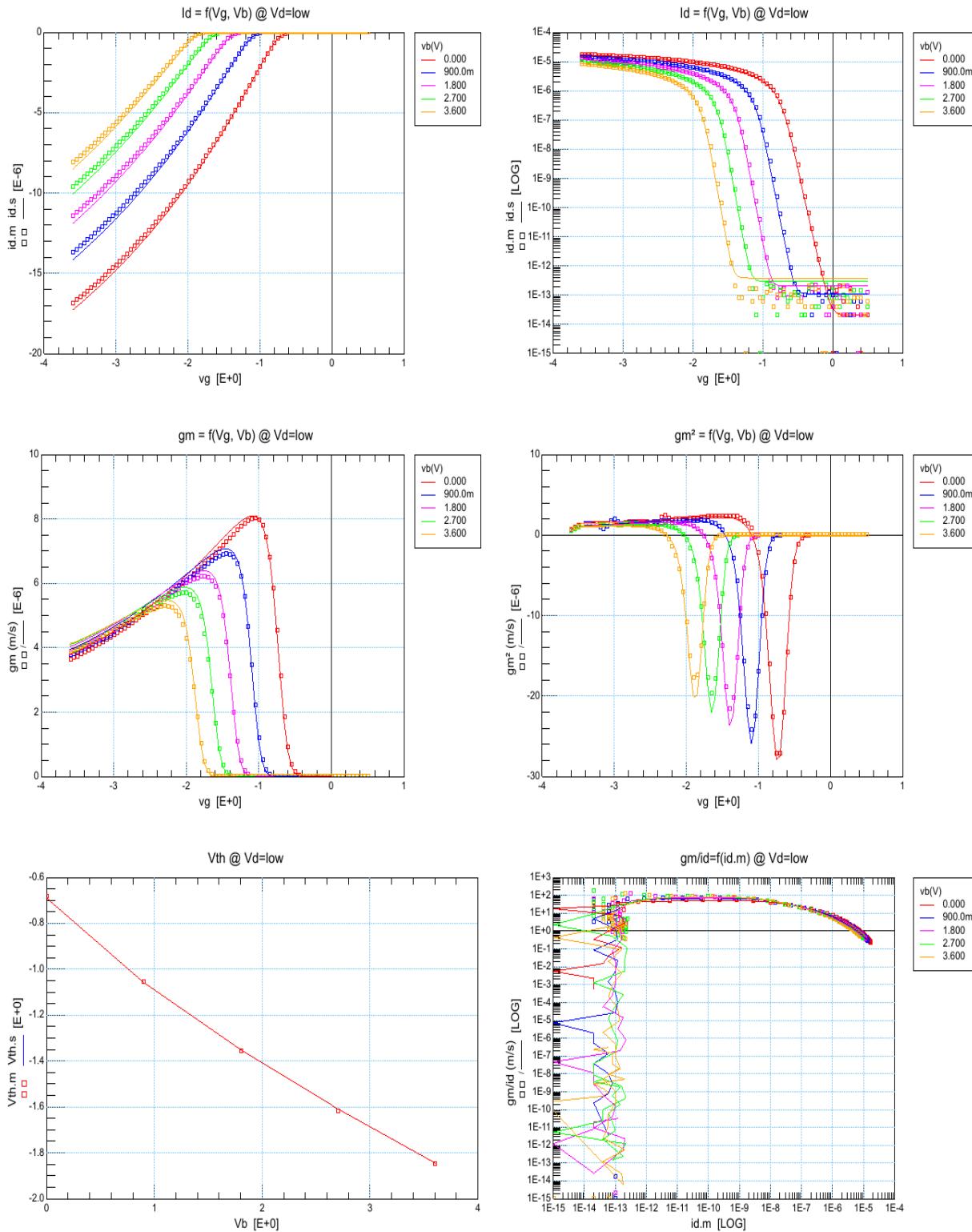


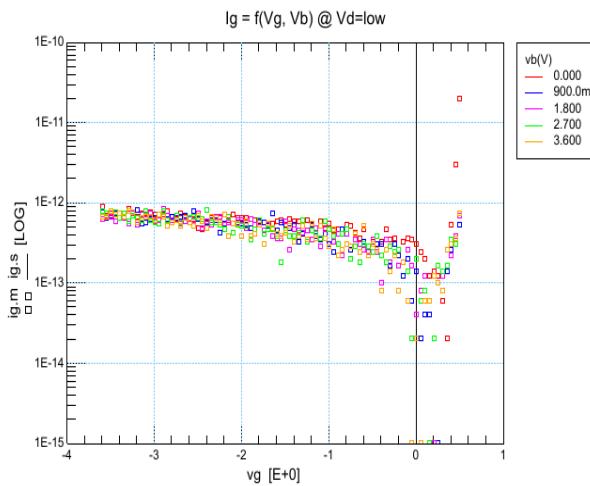
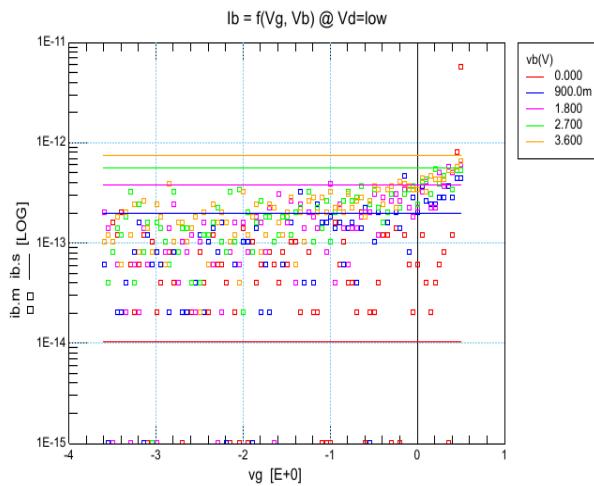
idvd_vth_vbmin, Vb = 3.6V, T = 27°C



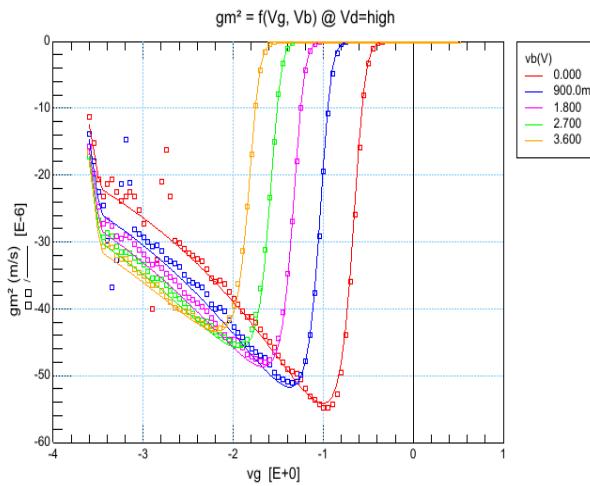
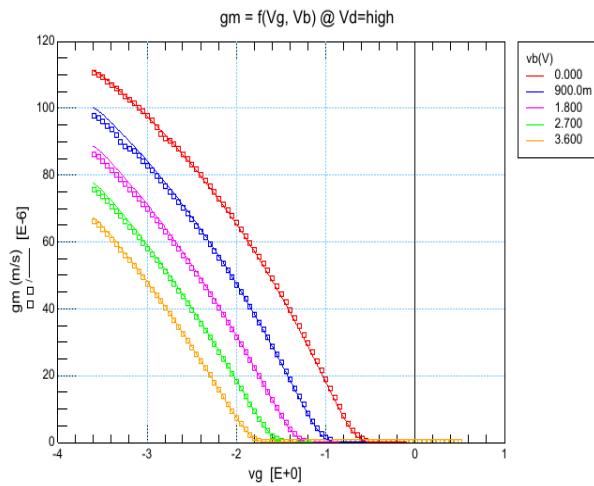
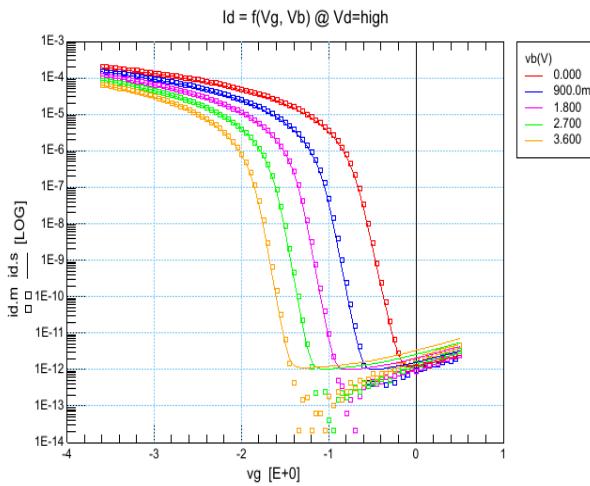
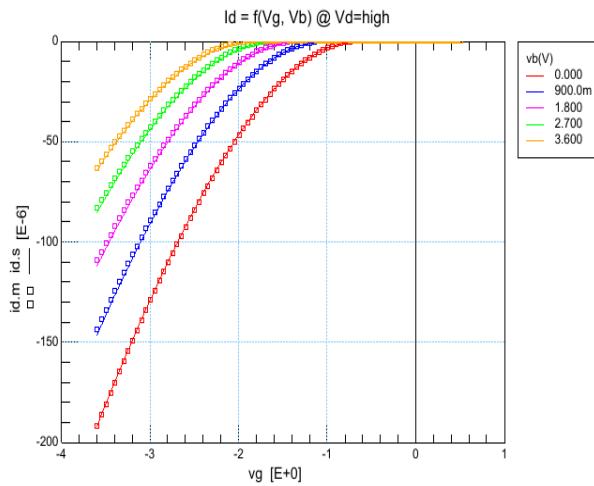
4.8 W10u0_L5u0_S562_2

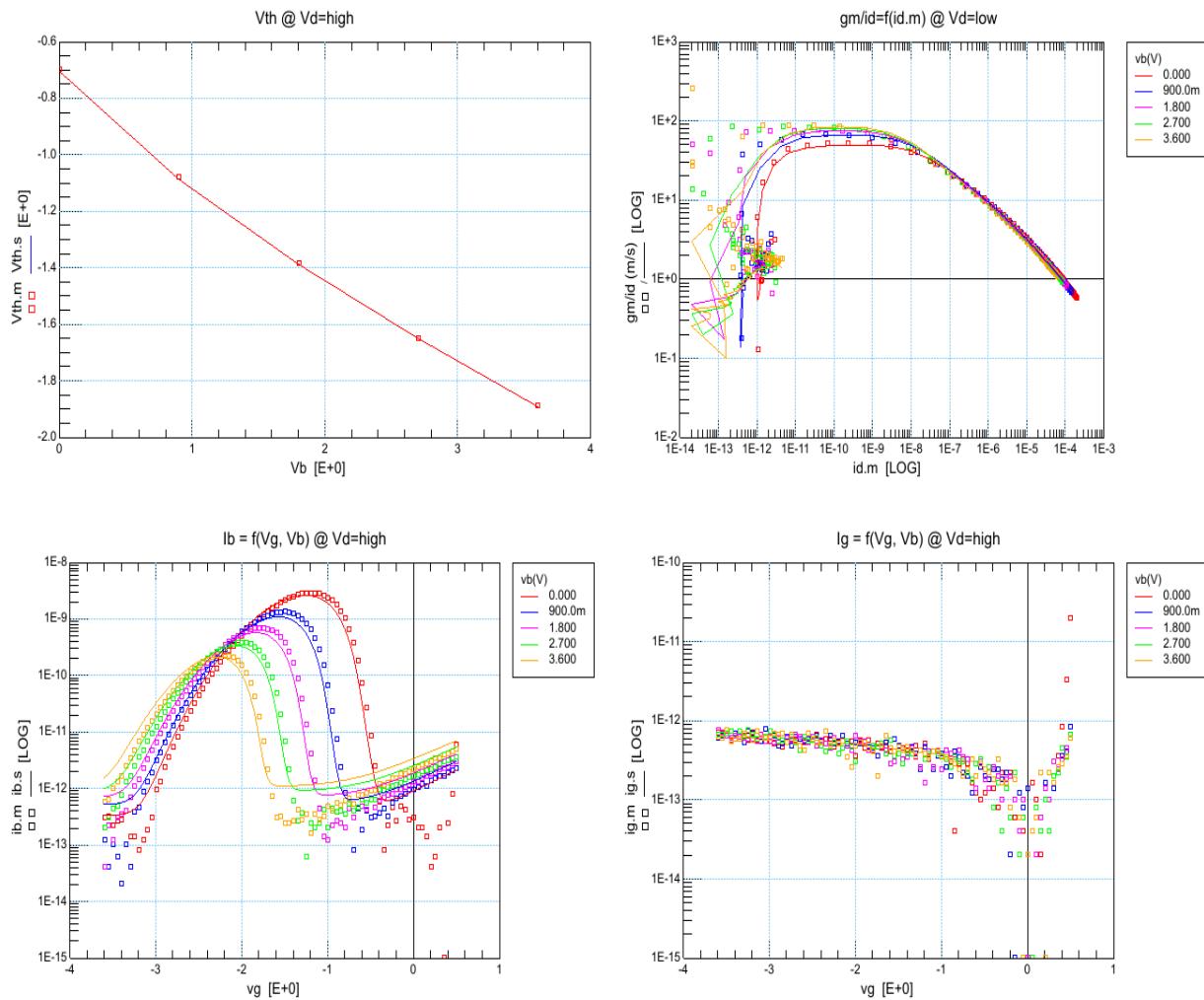
id_{vg} , $V_d = -0.1V$, $T = 27^\circ C$



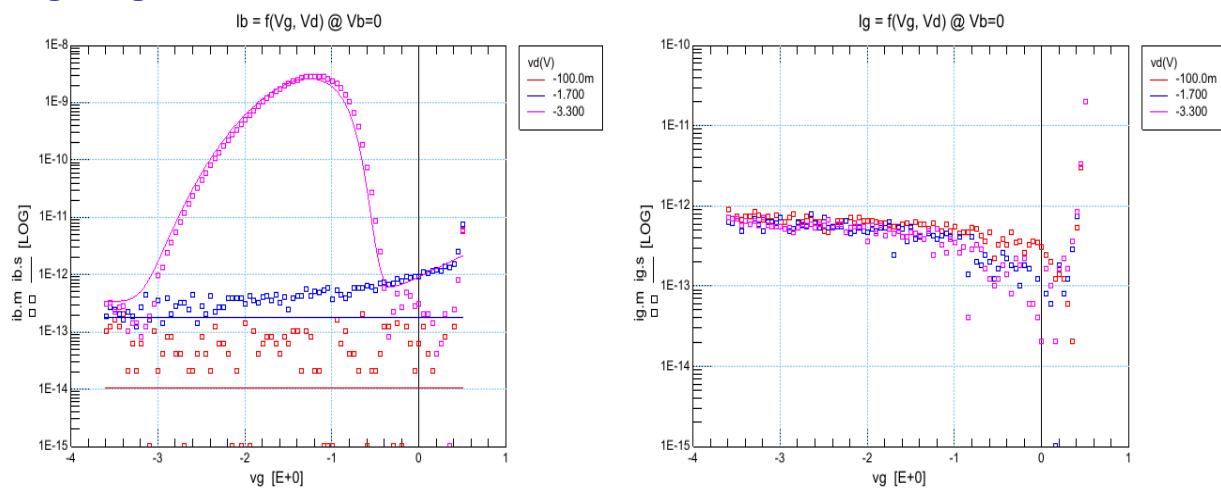


$i_{dvg}, V_d = -3.3V, T = 27^\circ\text{C}$

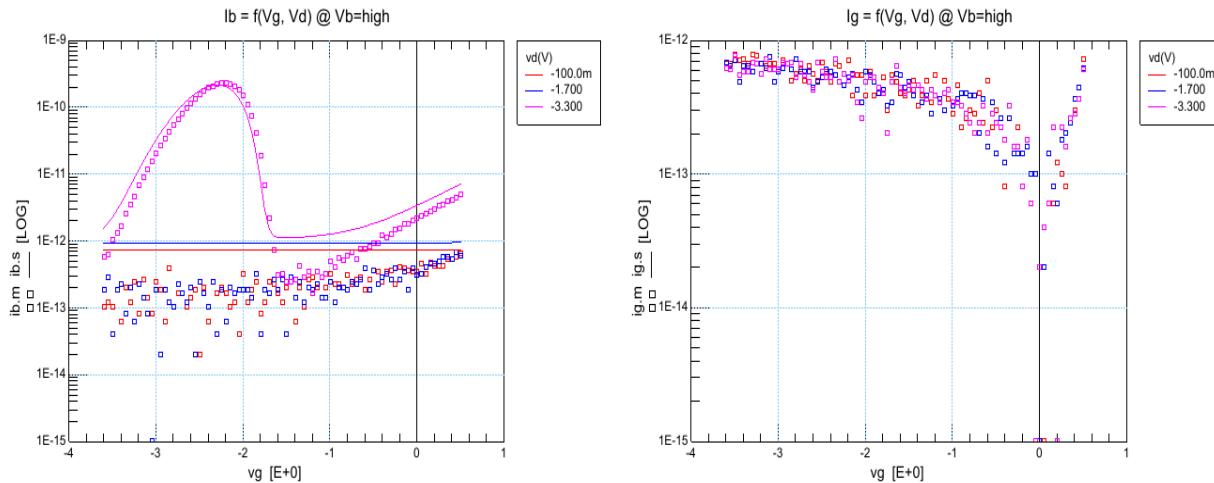




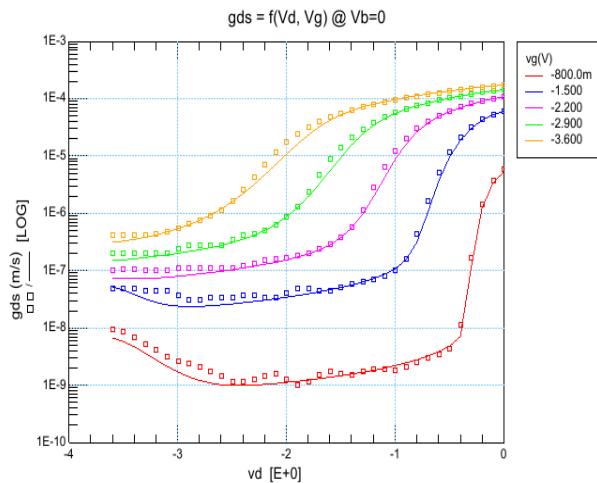
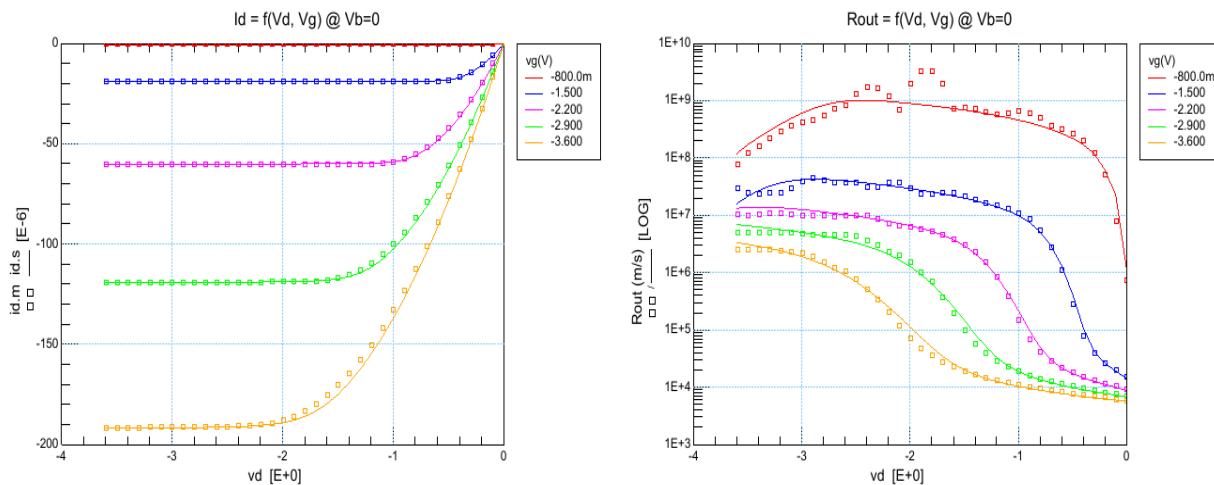
idvg, Ib, Ig, Vb = 0V, T = 27°C

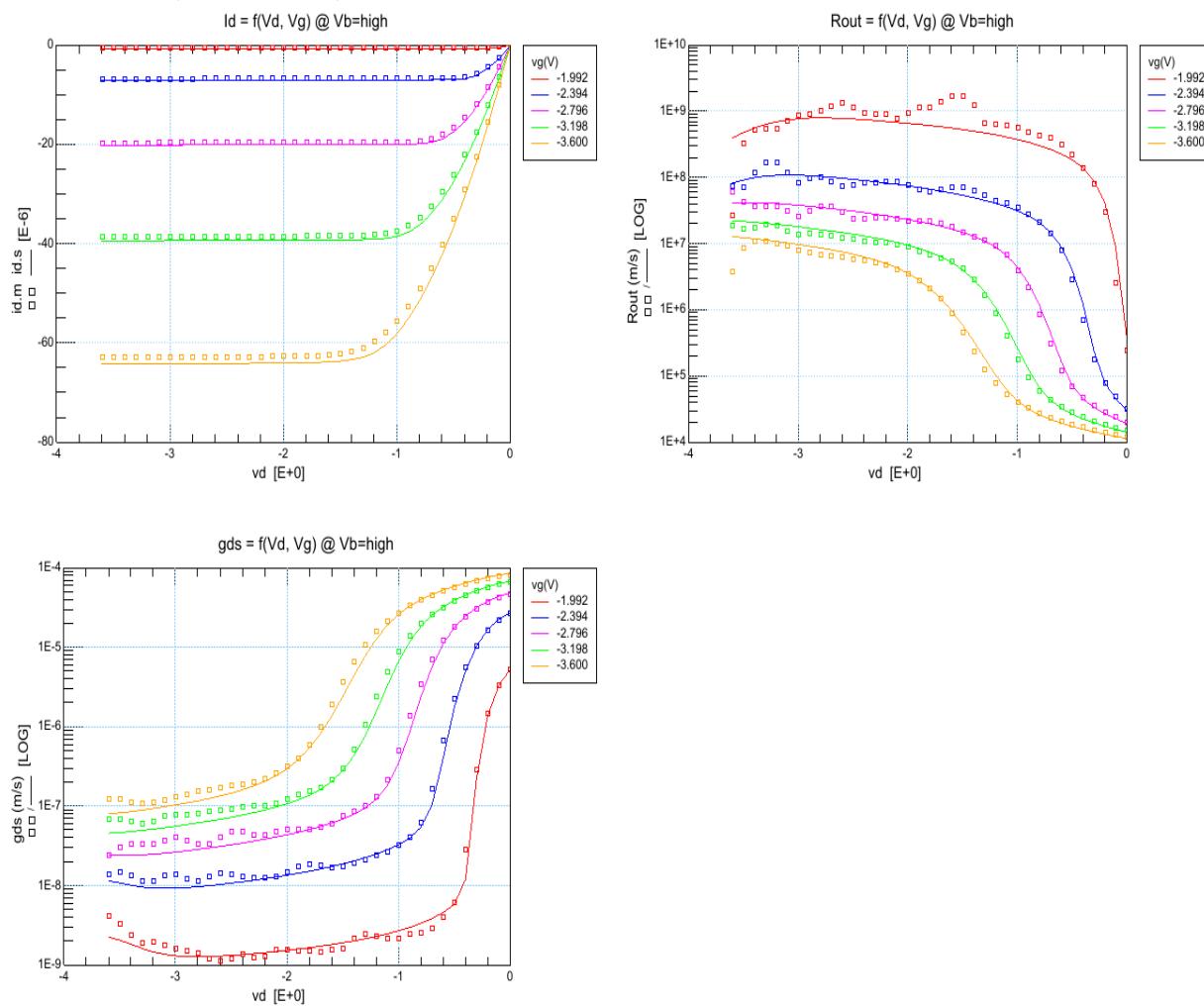
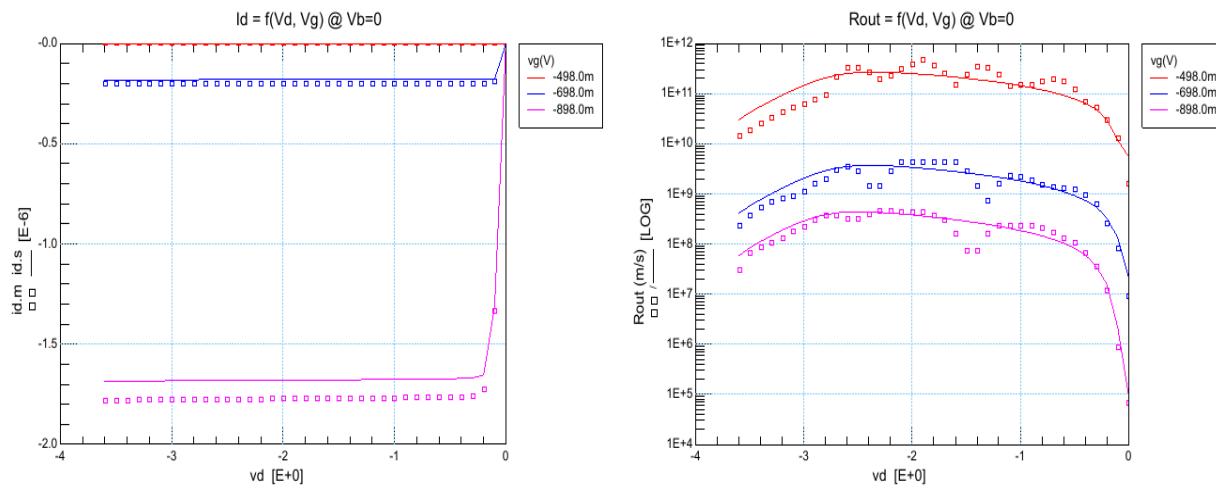


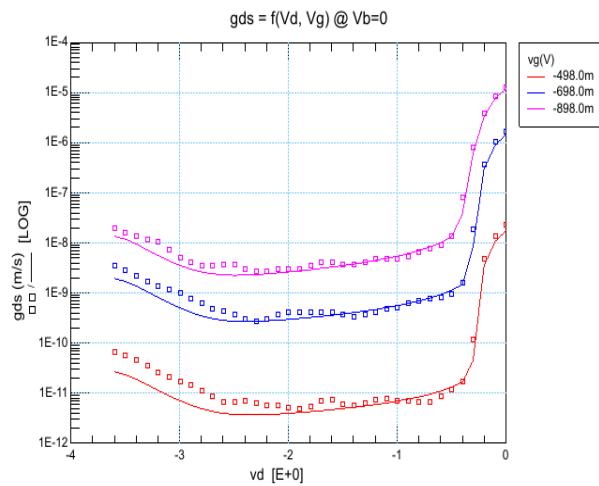
idvg, Ib,Ig, Vb = 3.6V, T = 27°C



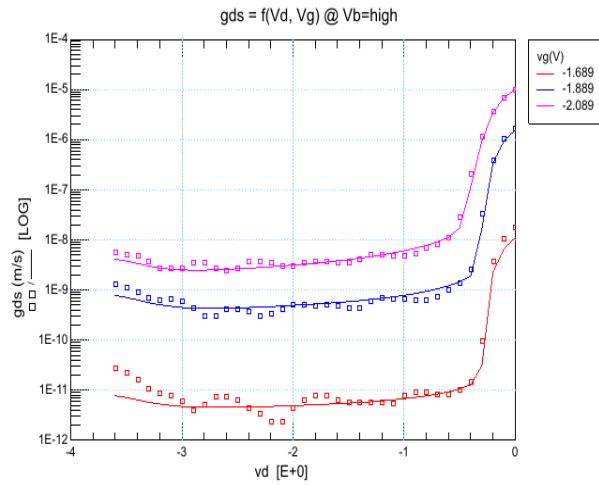
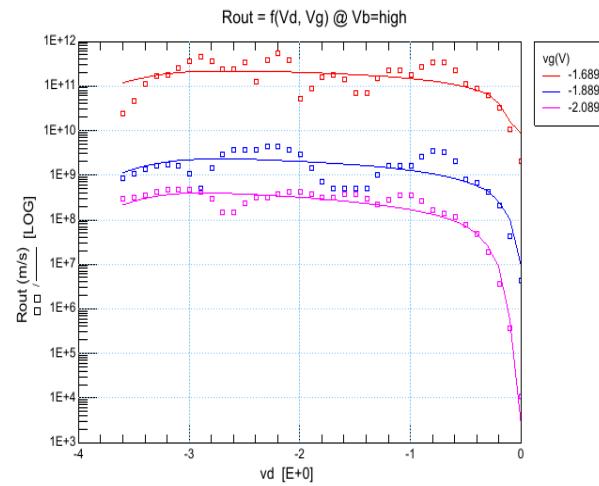
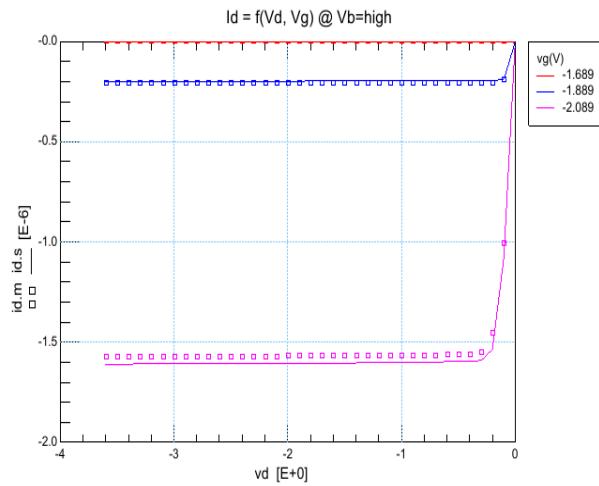
idvd, Vb = 0V, T = 27°C



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

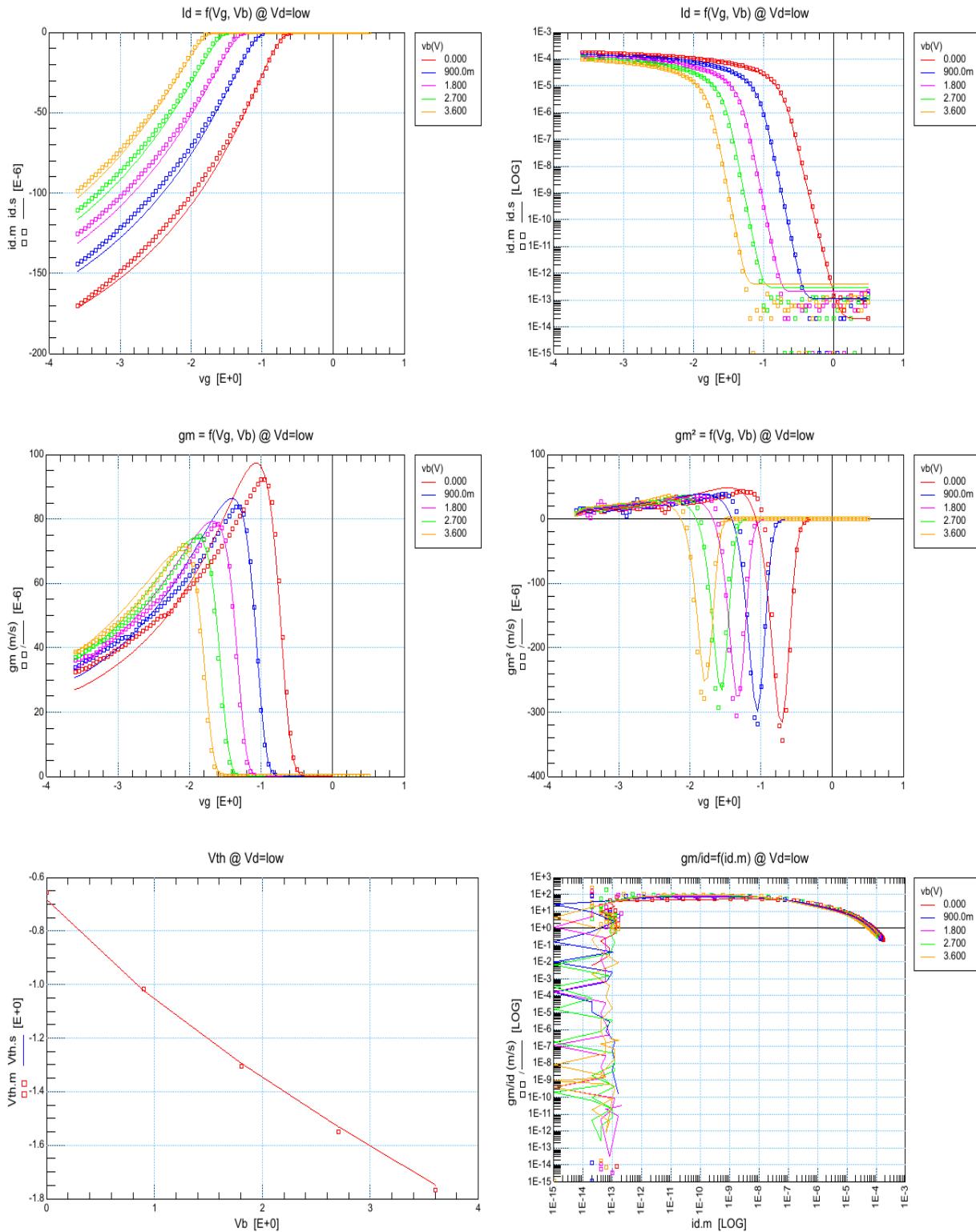


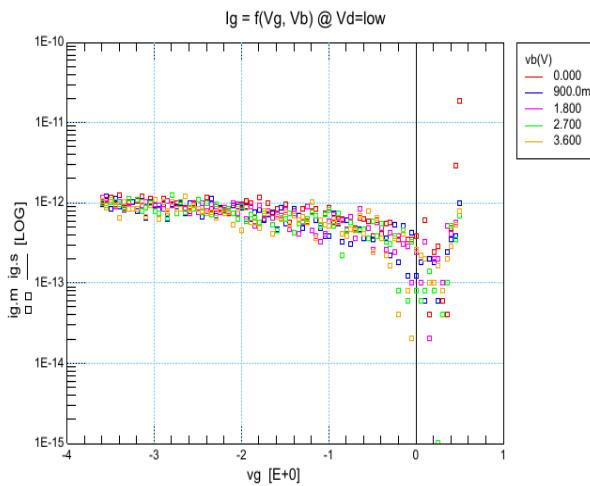
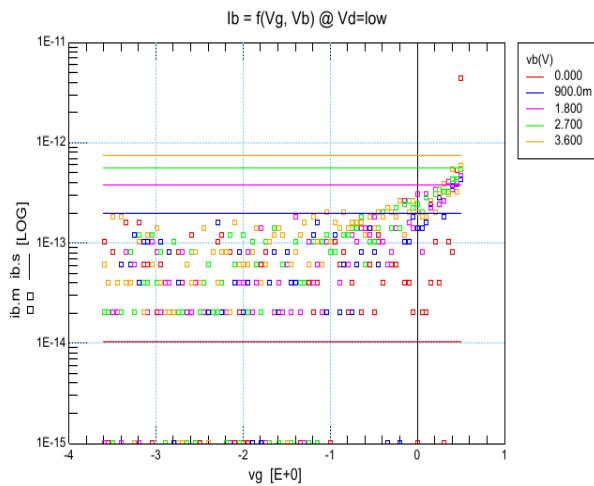
idvd_vth_vbmin, Vb = 3.6V, T = 27°C



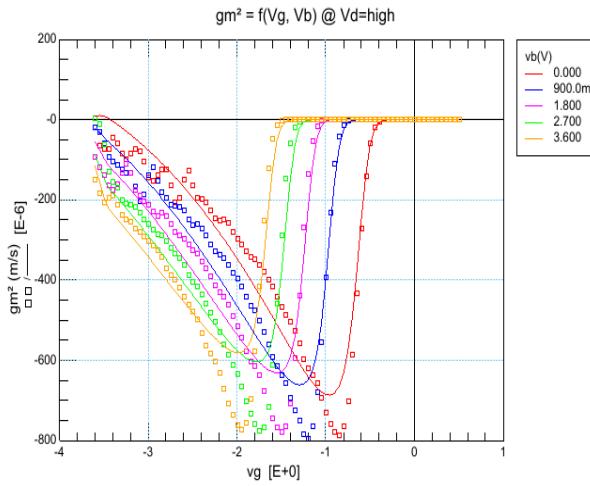
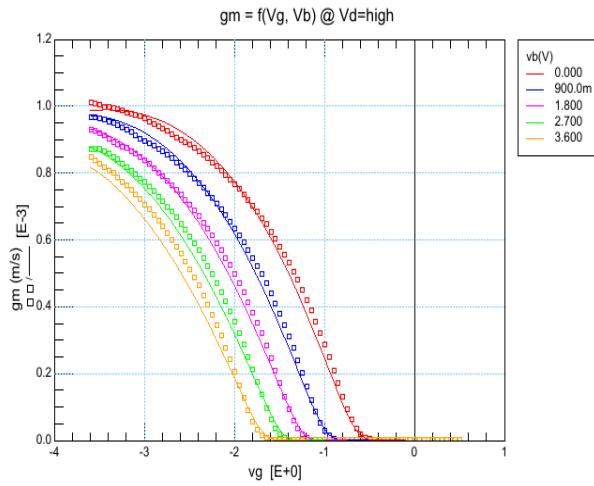
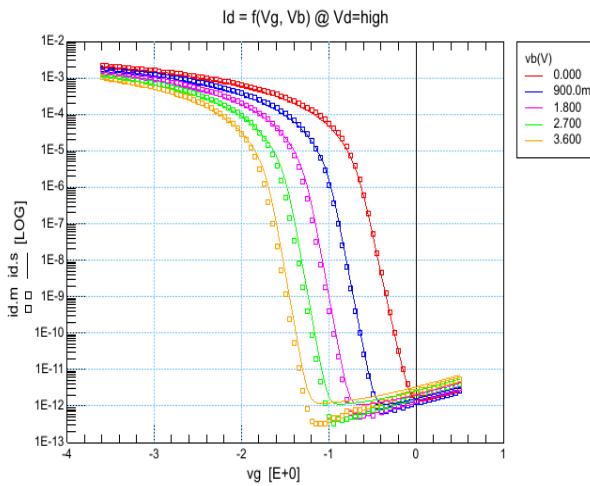
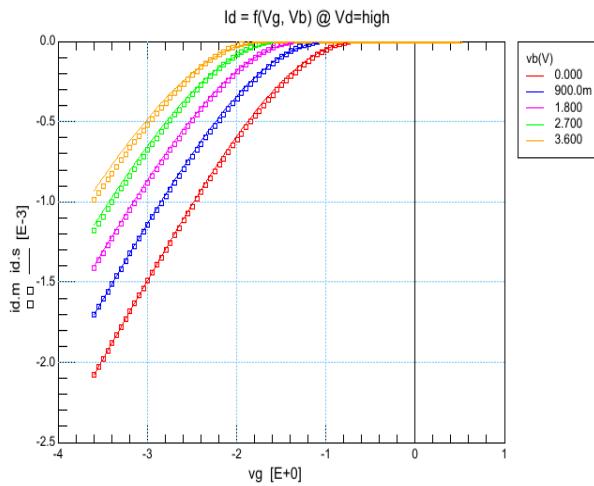
4.9 W10u0_L0u5_S561_4

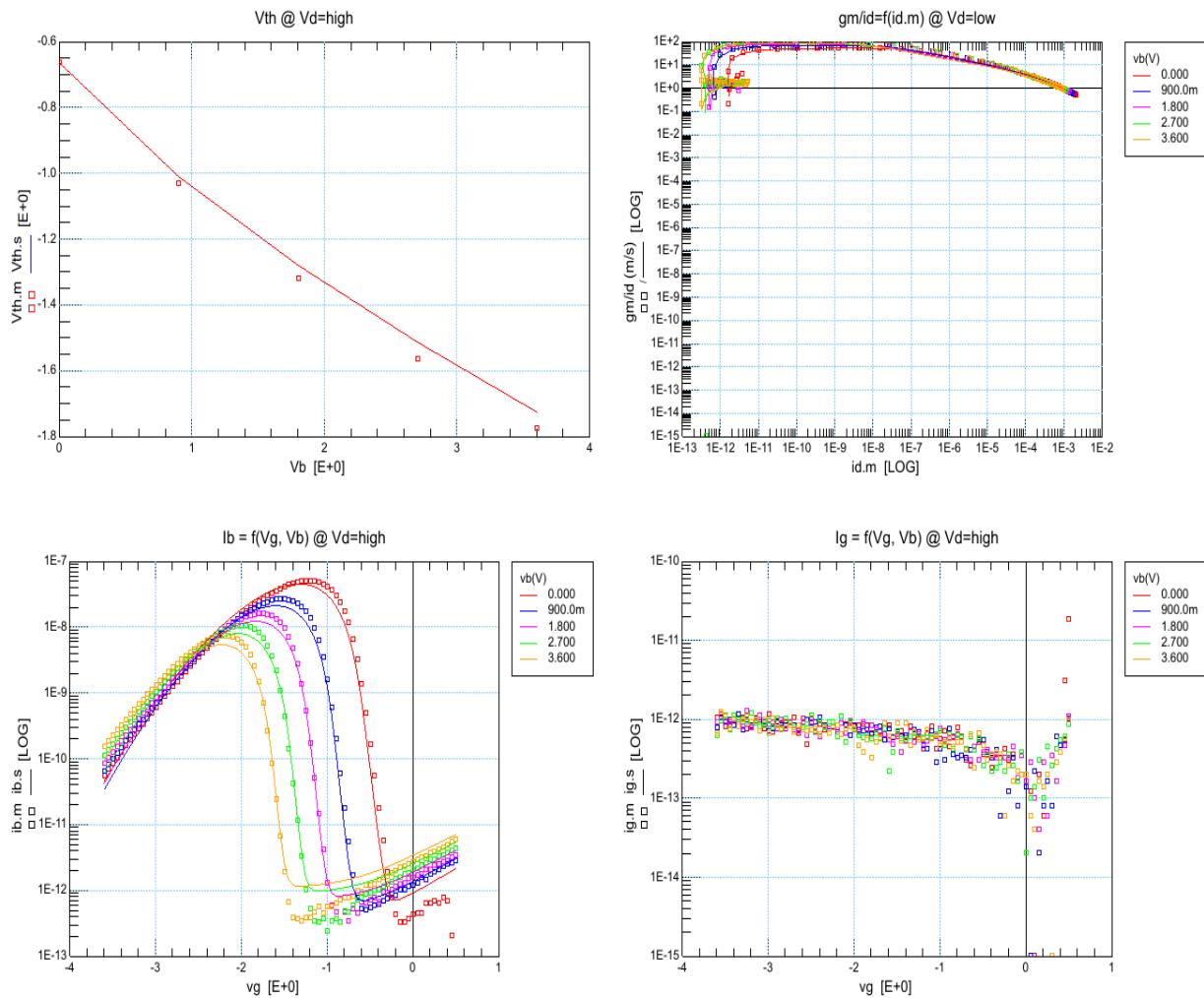
$idv_g, V_d = -0.1V, T = 27^\circ C$



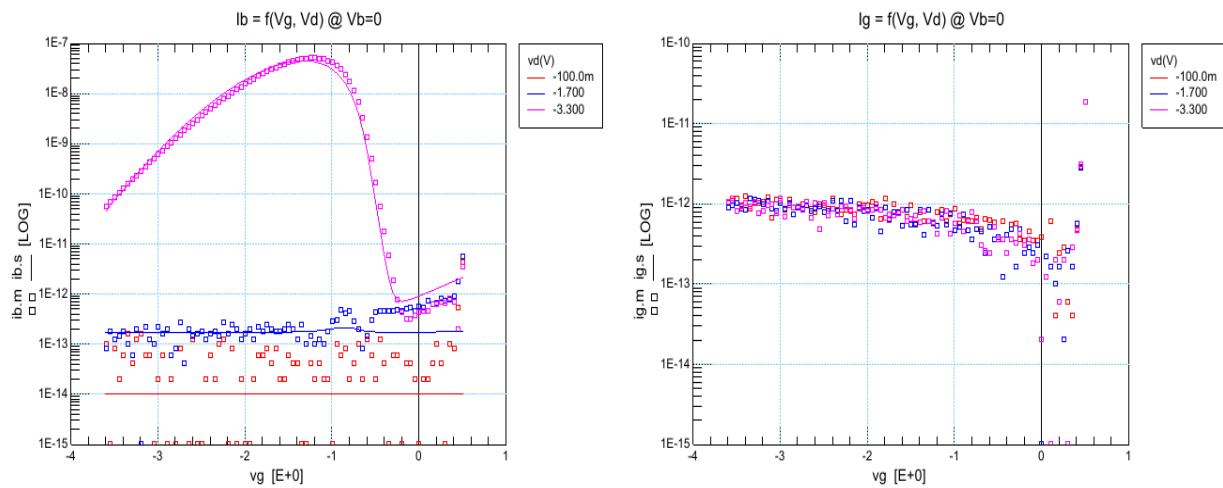


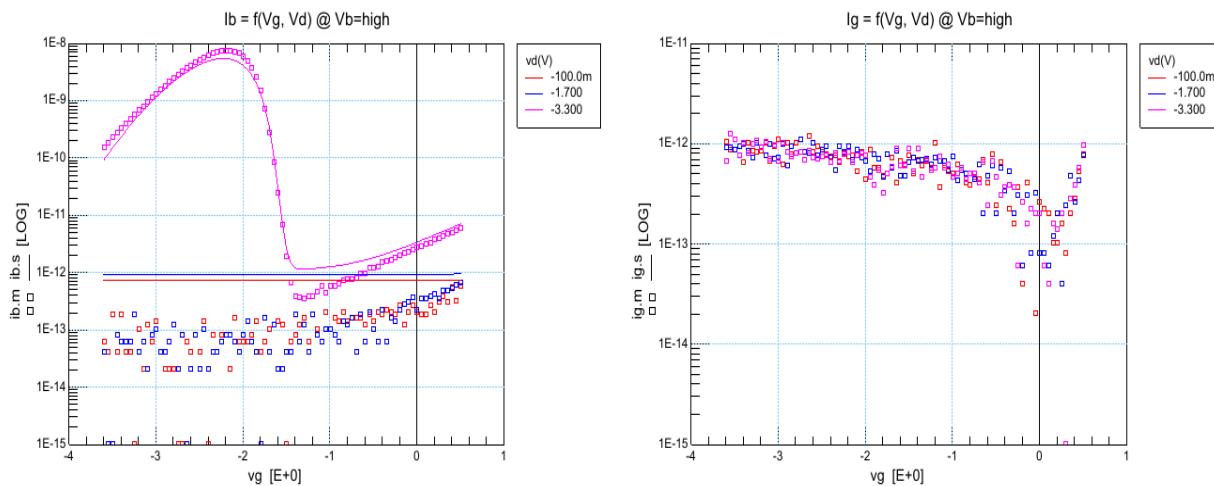
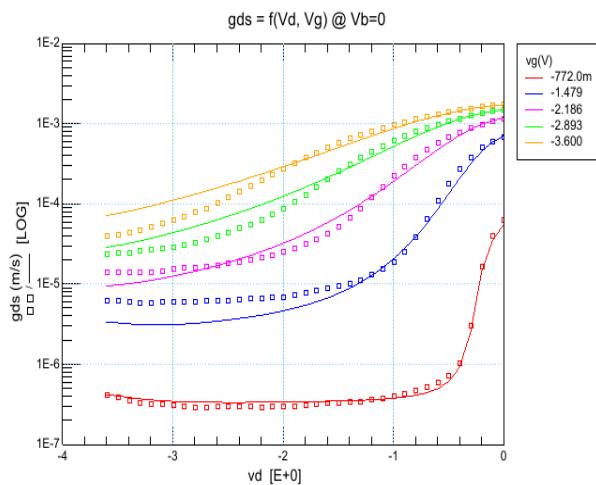
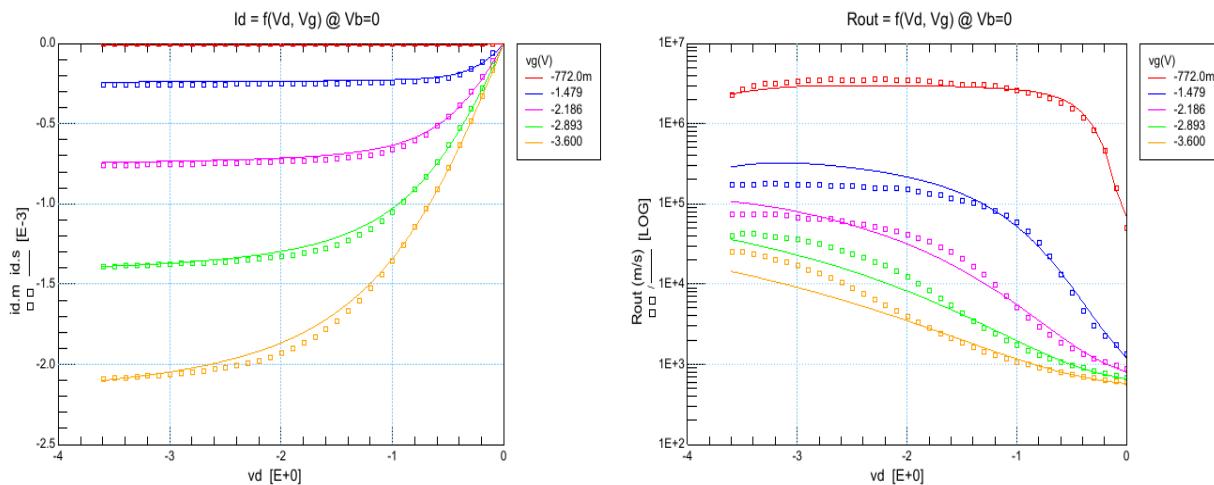
$i_{dvg}, V_d = -3.3V, T = 27^\circ\text{C}$

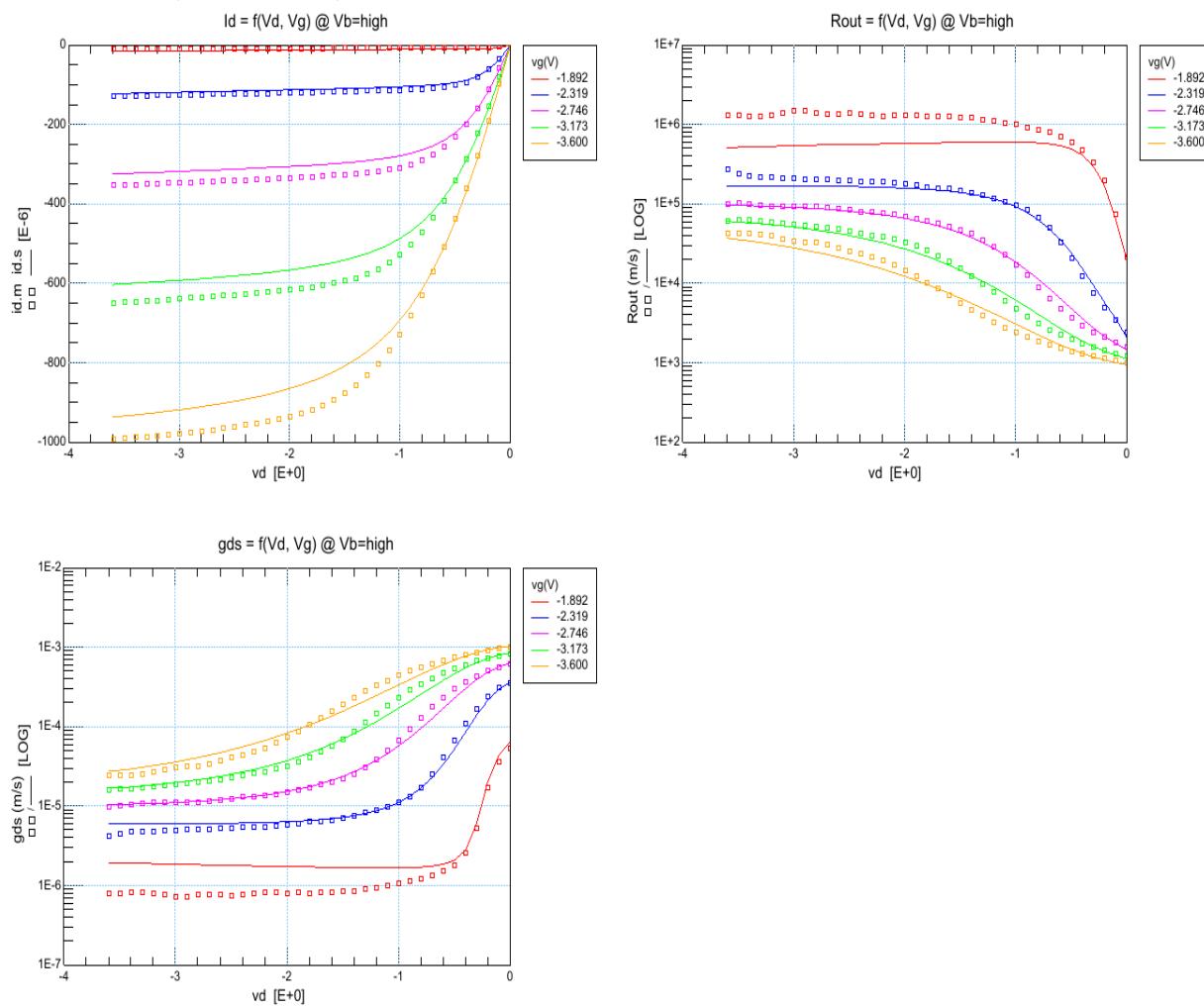
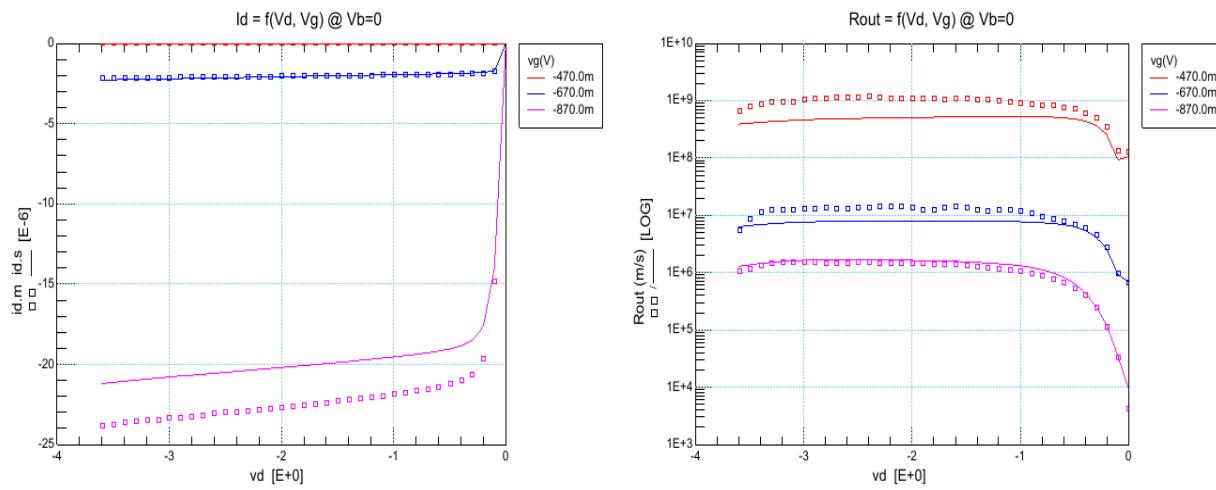


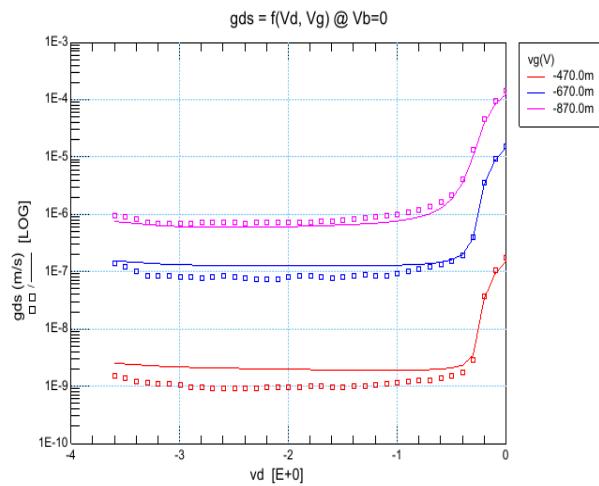


idvg, Ib,Ig, Vb = 0V, T = 27°C

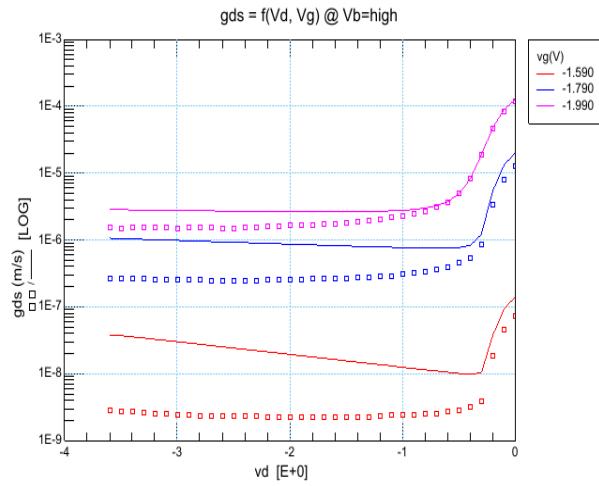
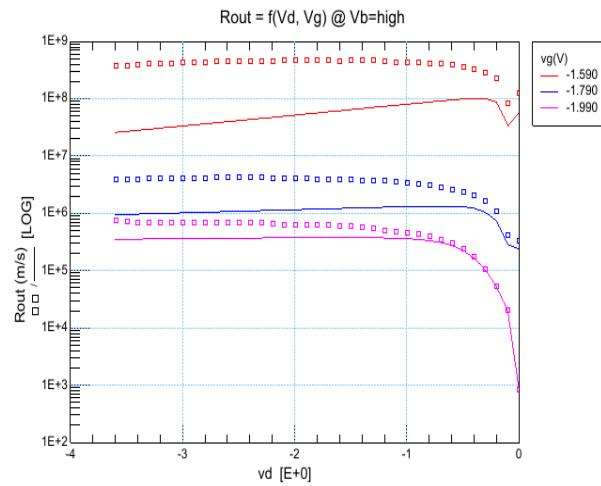
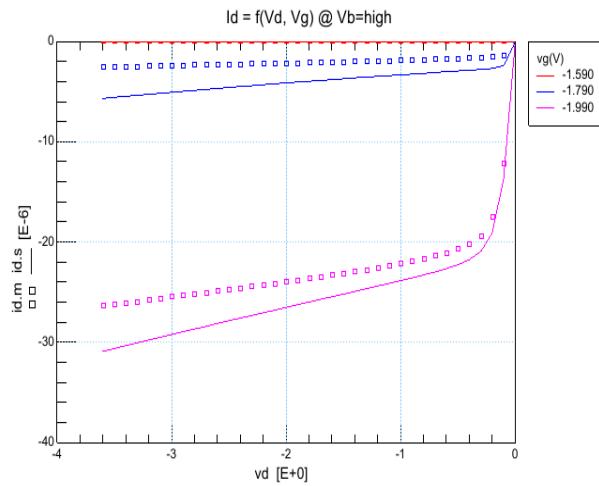


idvg, Ib,Ig, Vb = 3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


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

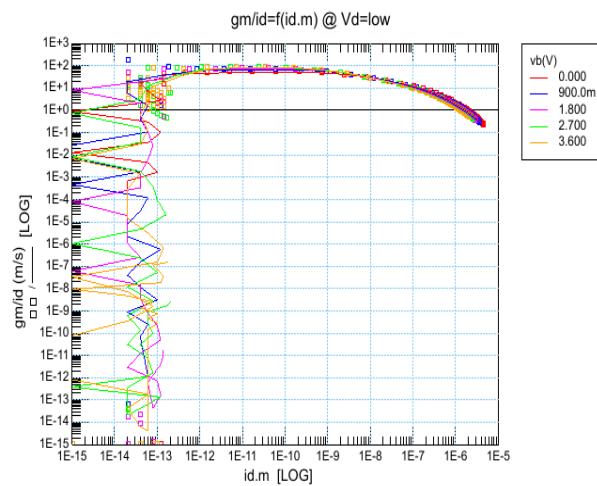
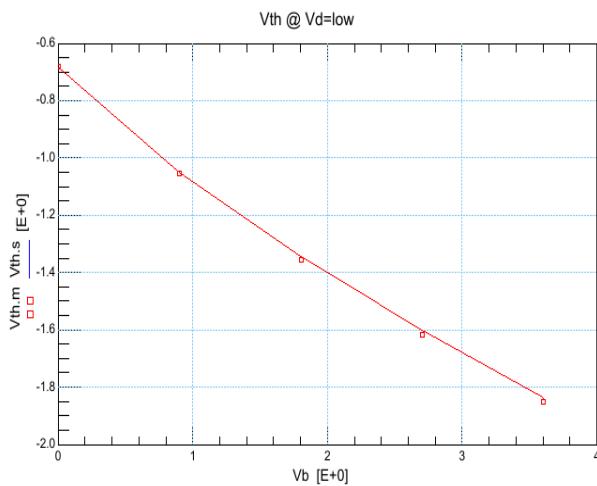
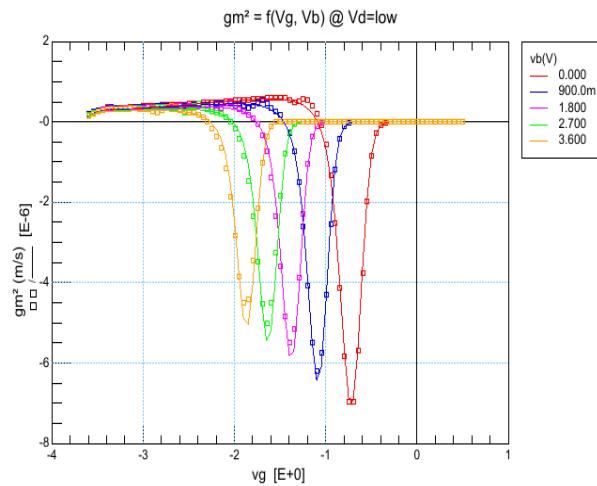
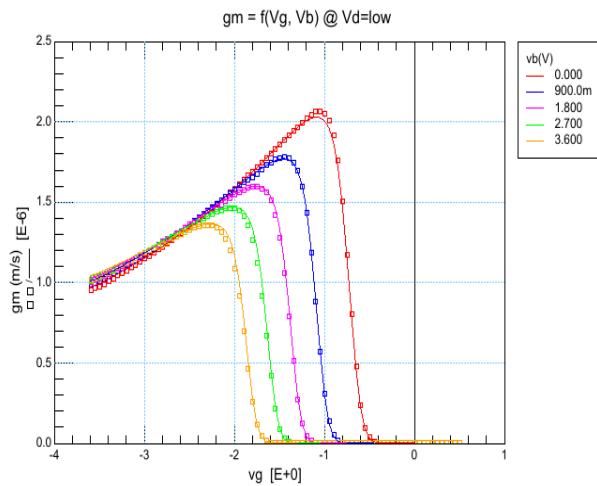
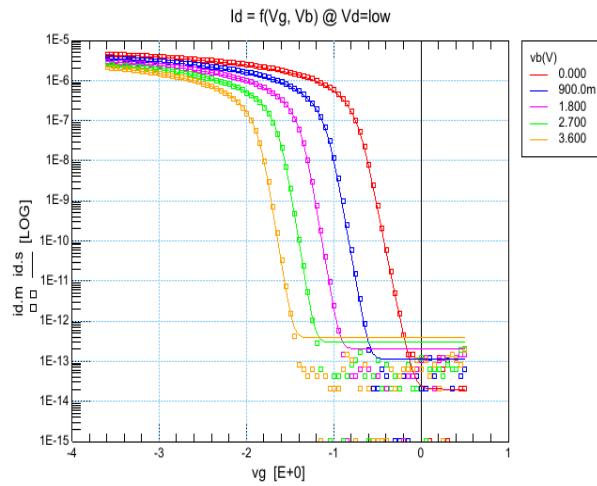
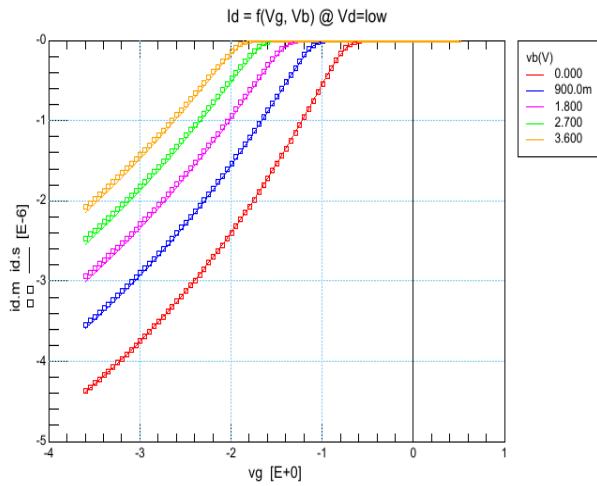


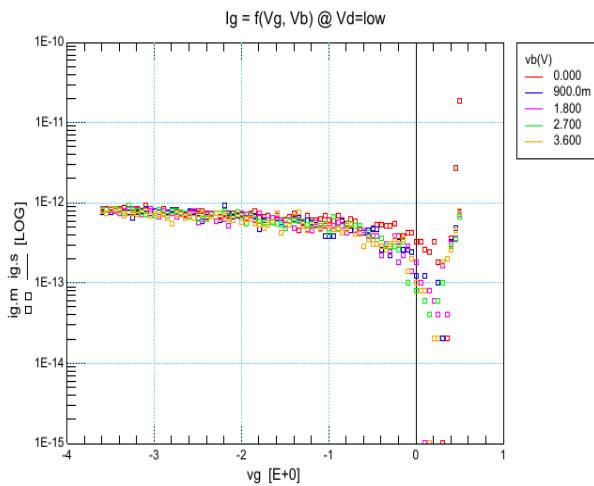
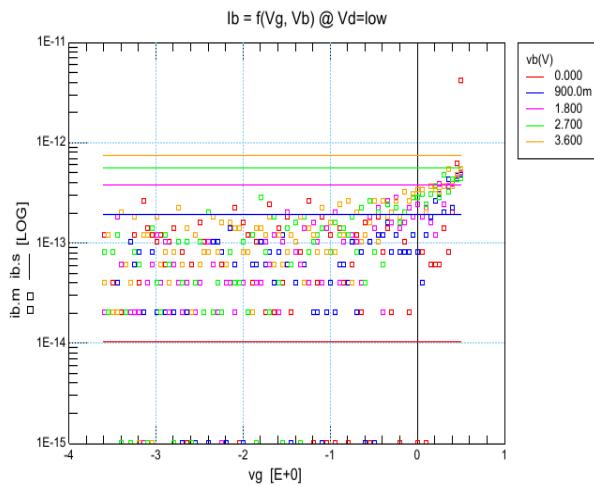
idvd_vth_vbmin, Vb = 3.6V, T = 27°C



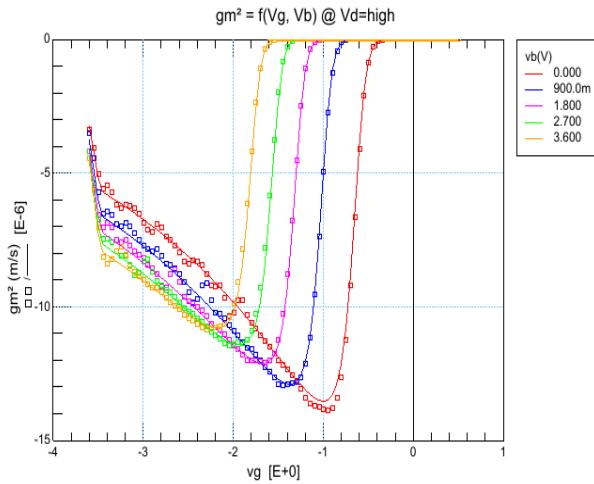
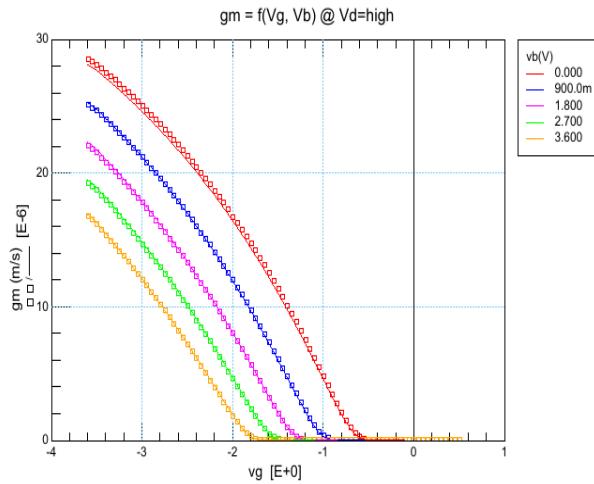
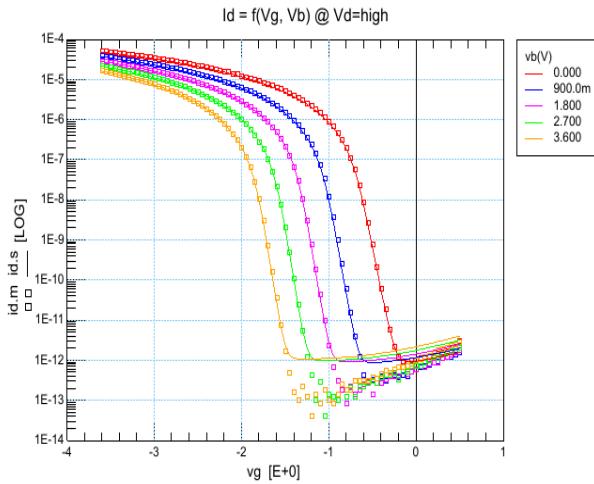
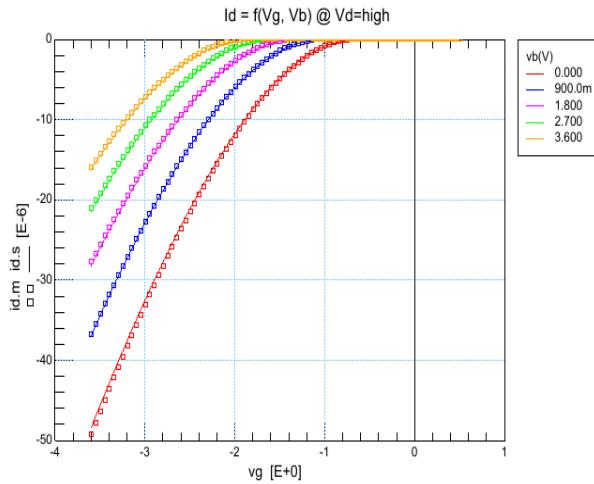
4.10 W05u0_L10u0_S563_1

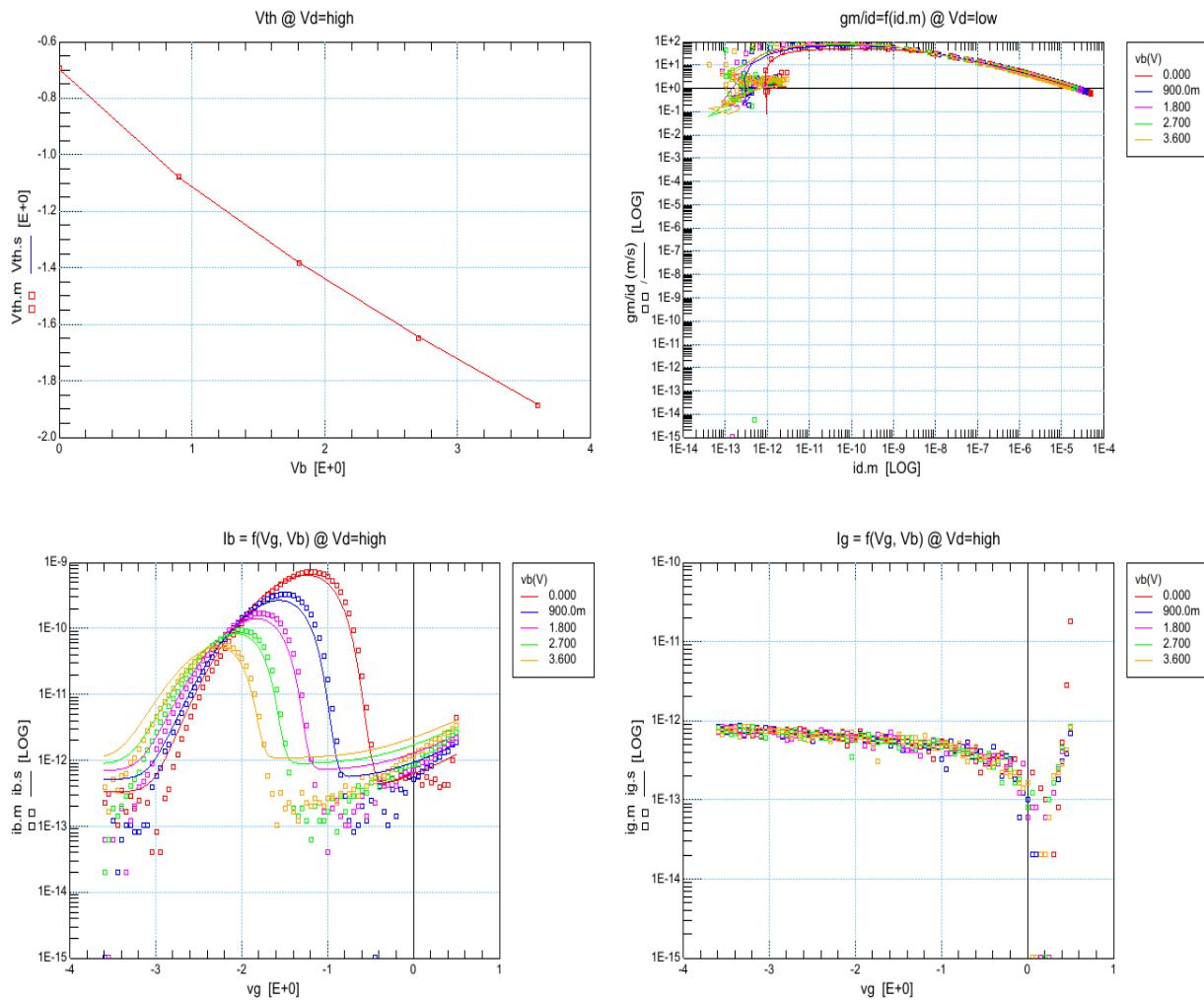
$idvg$, $Vd = -0.1V$, $T = 27^\circ C$



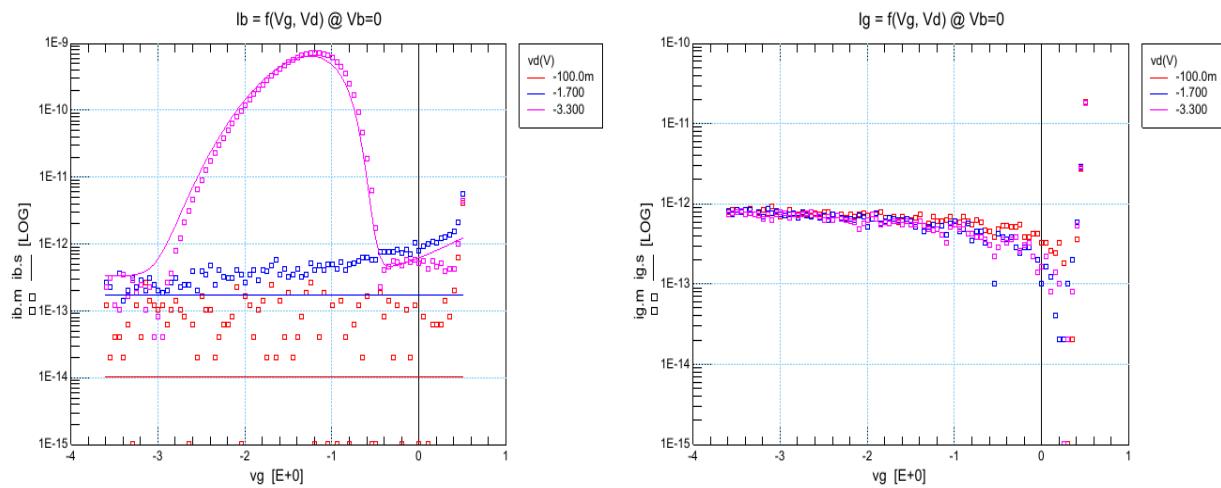


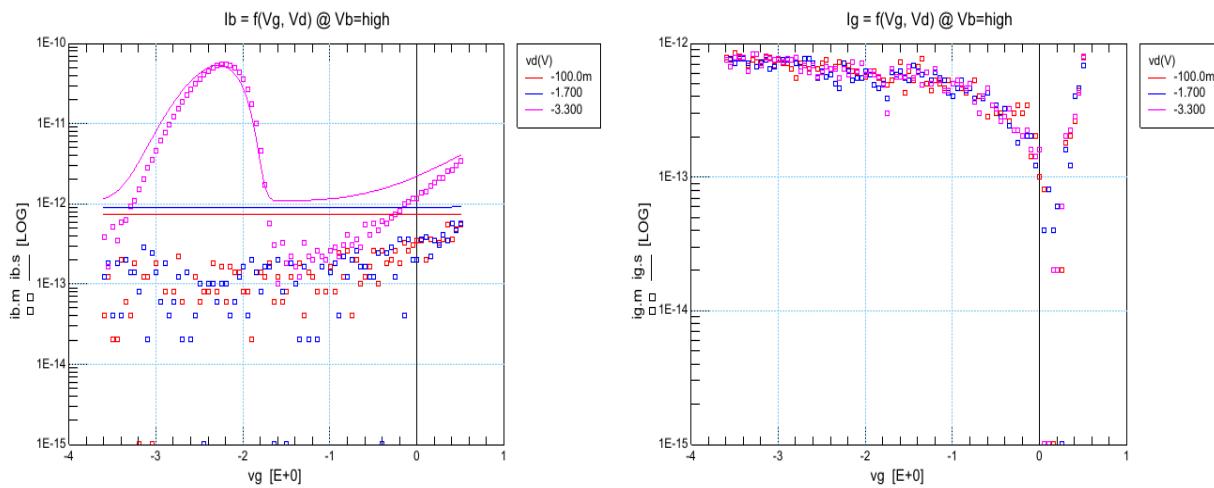
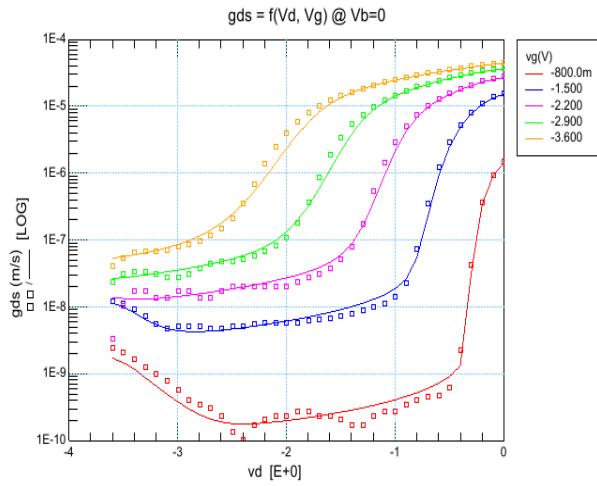
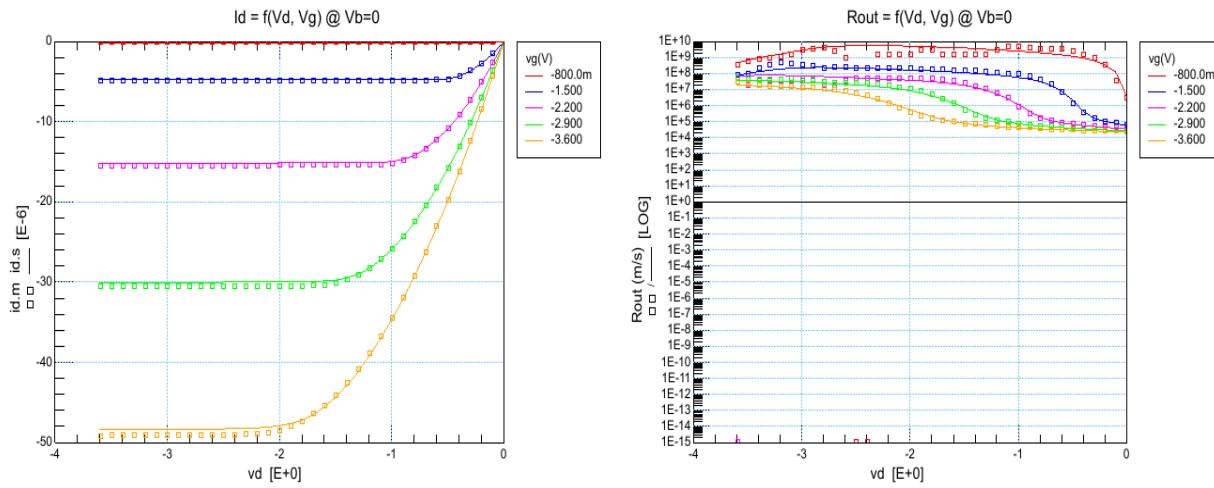
$idvg, Vd = -3.3V, T = 27^\circ C$

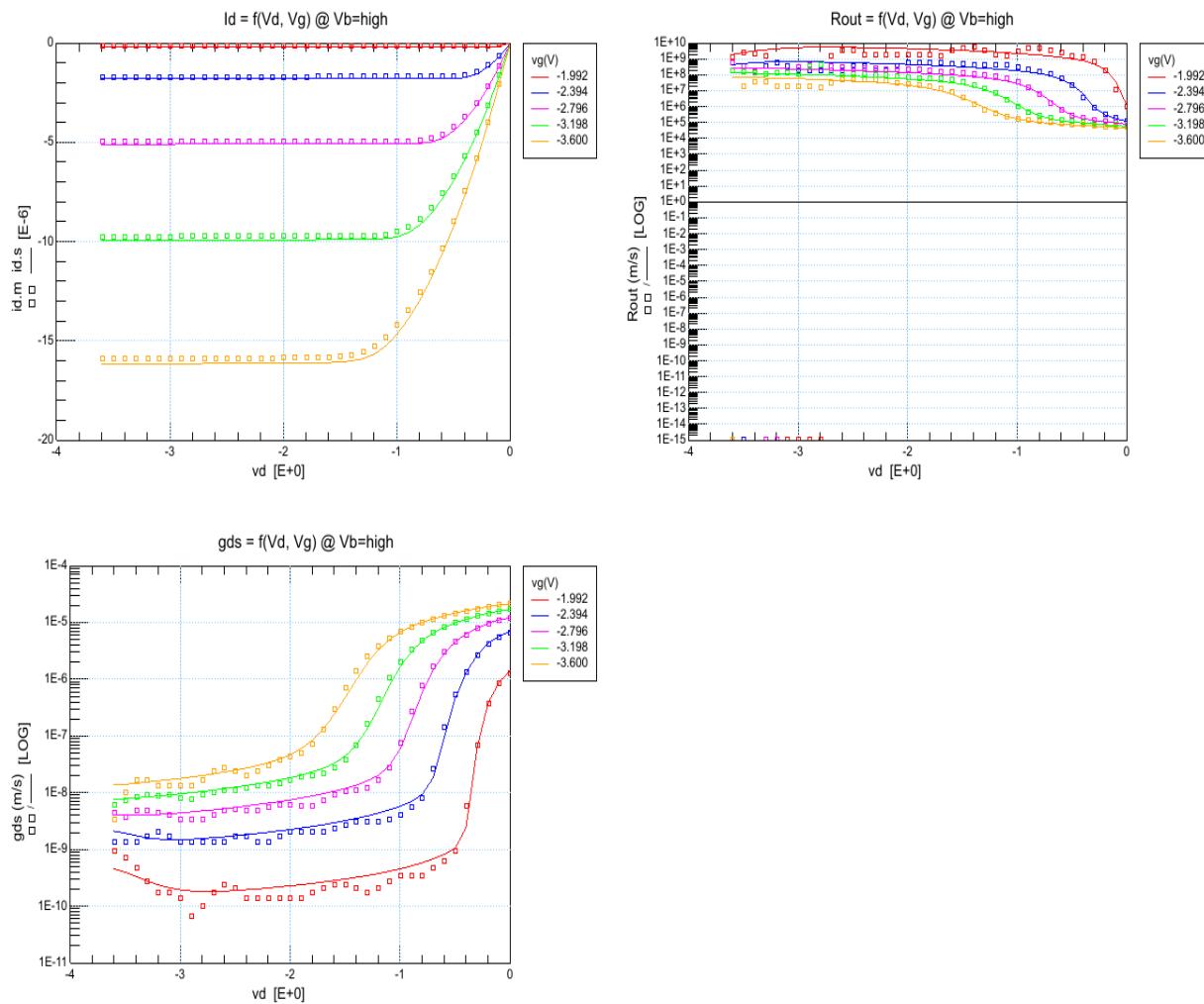
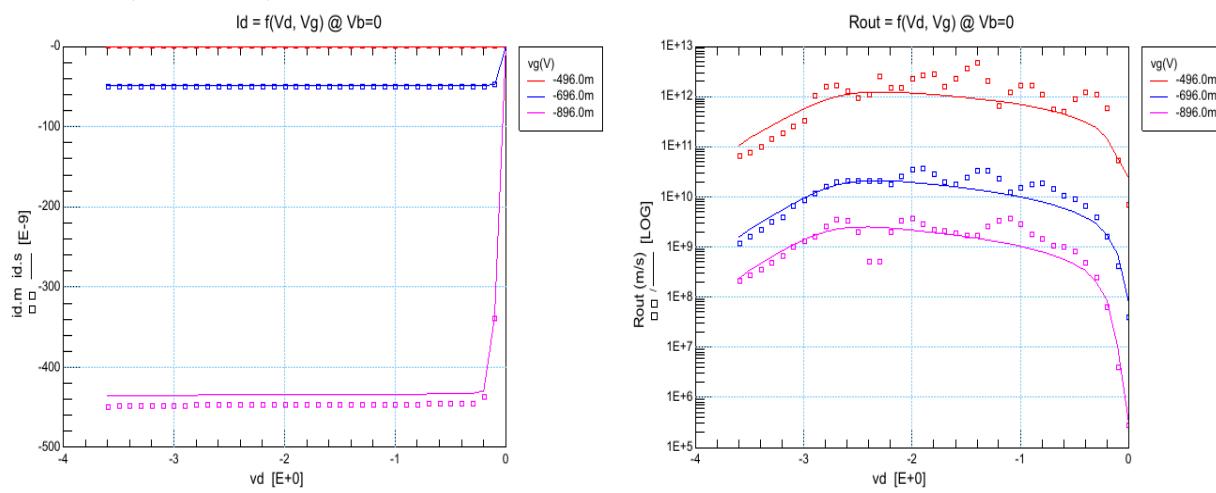


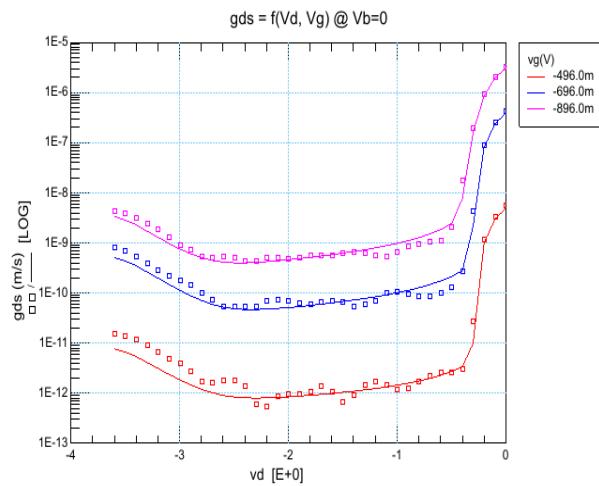


idvg, Ib,Ig, Vb = 0V, T = 27°C

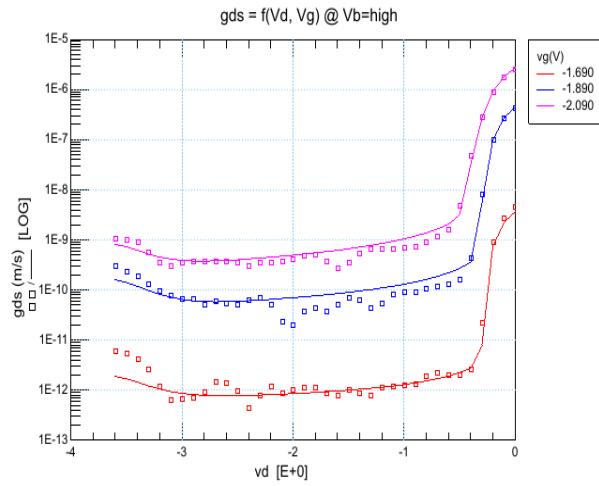
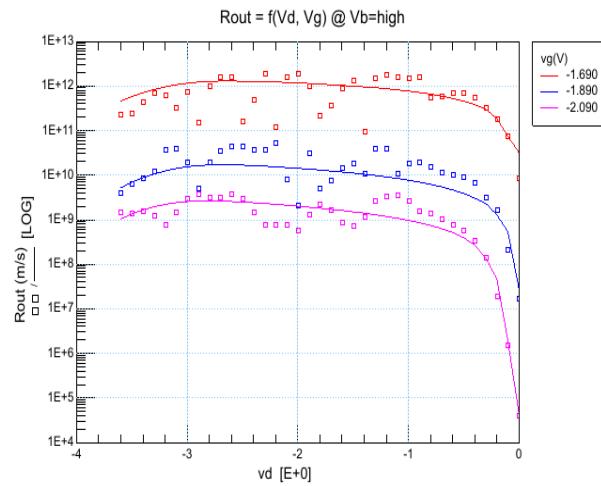
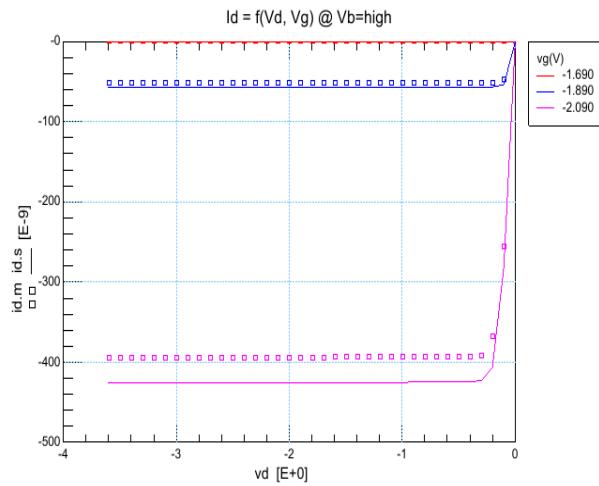


idvg, Ib,Ig, Vb = 3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


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

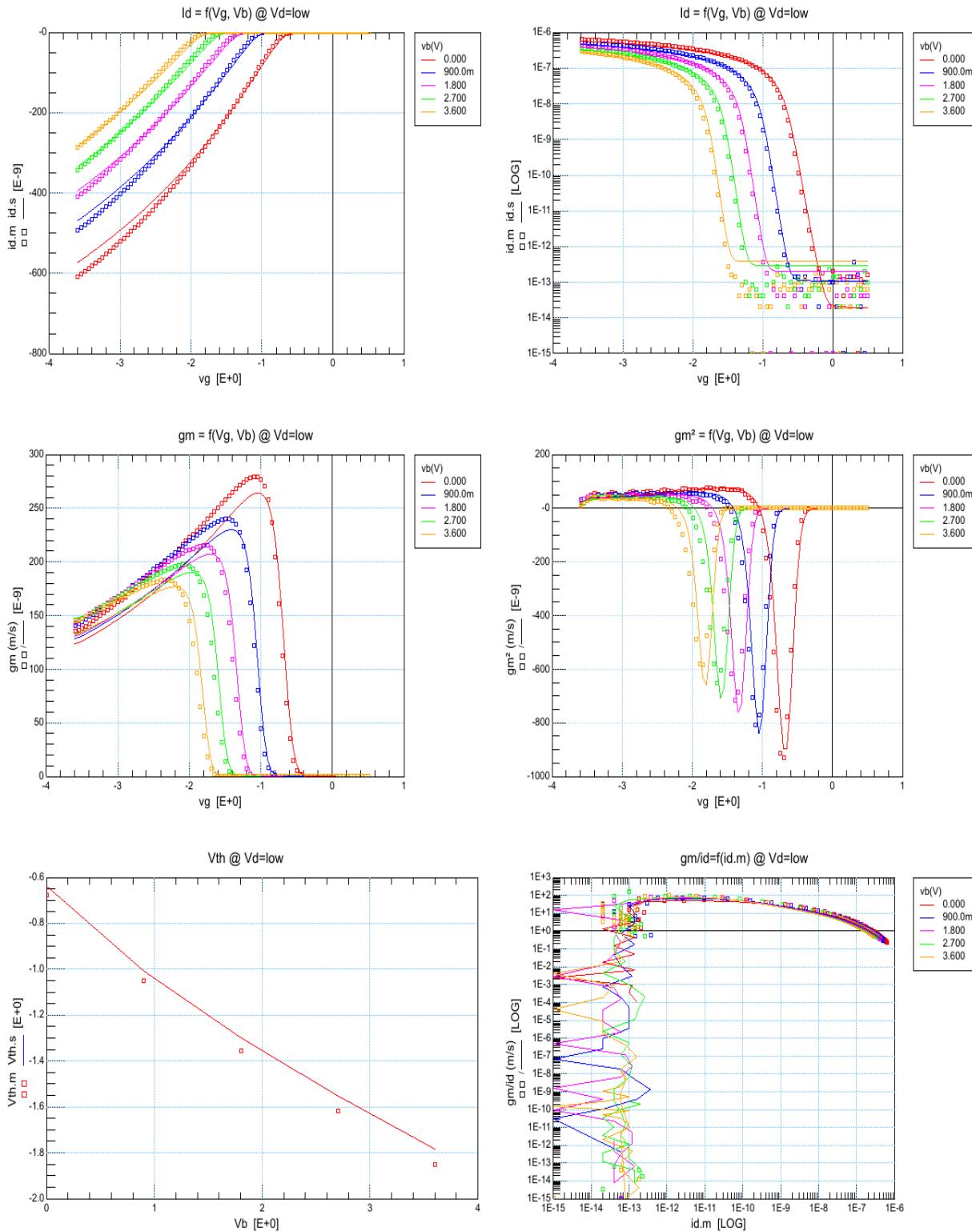


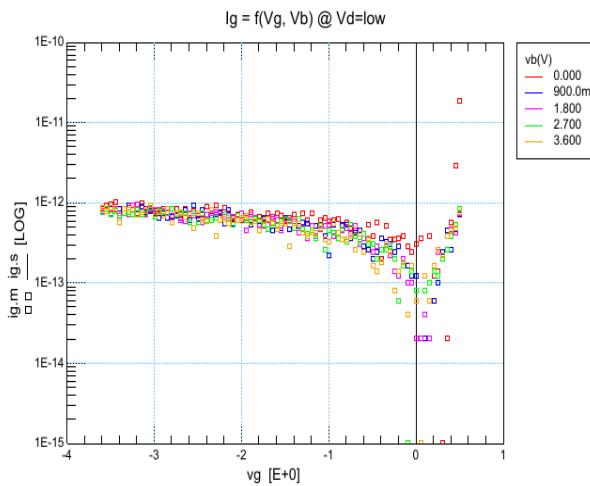
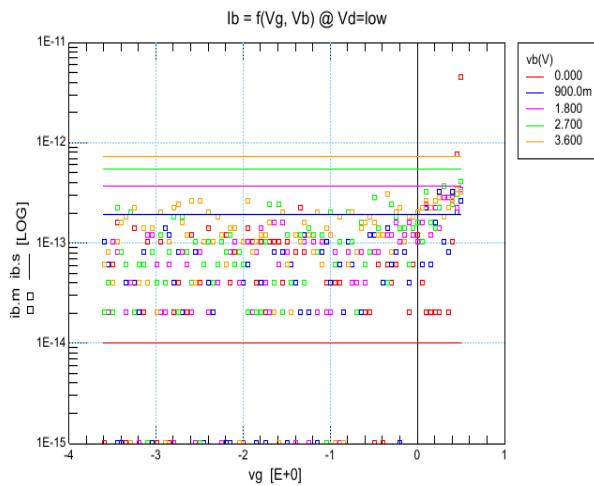
idvd_vth_vbmin, Vb = 3.6V, T = 27°C



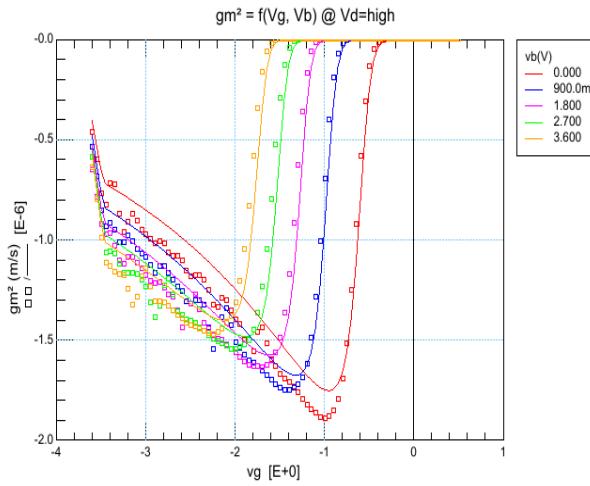
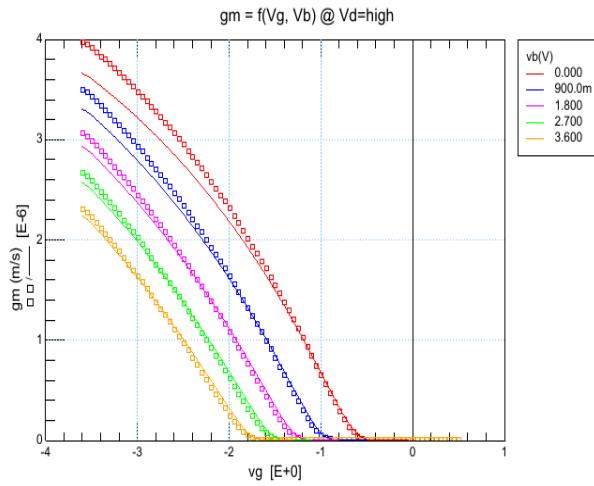
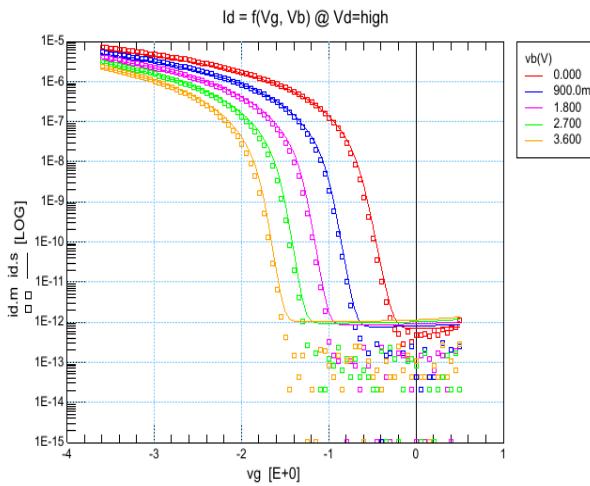
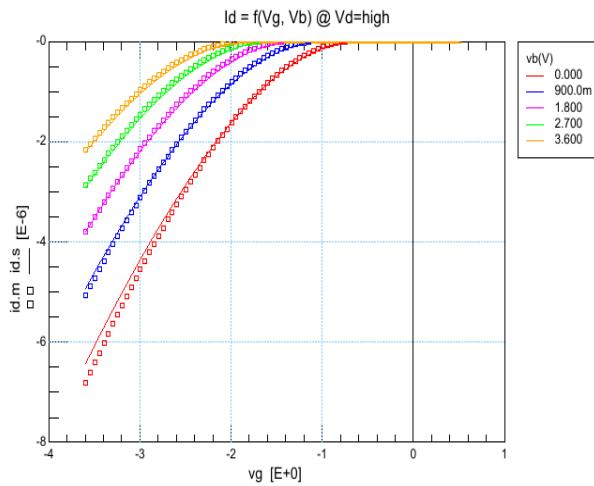
4.11 W0u6_L10u0_S564_5

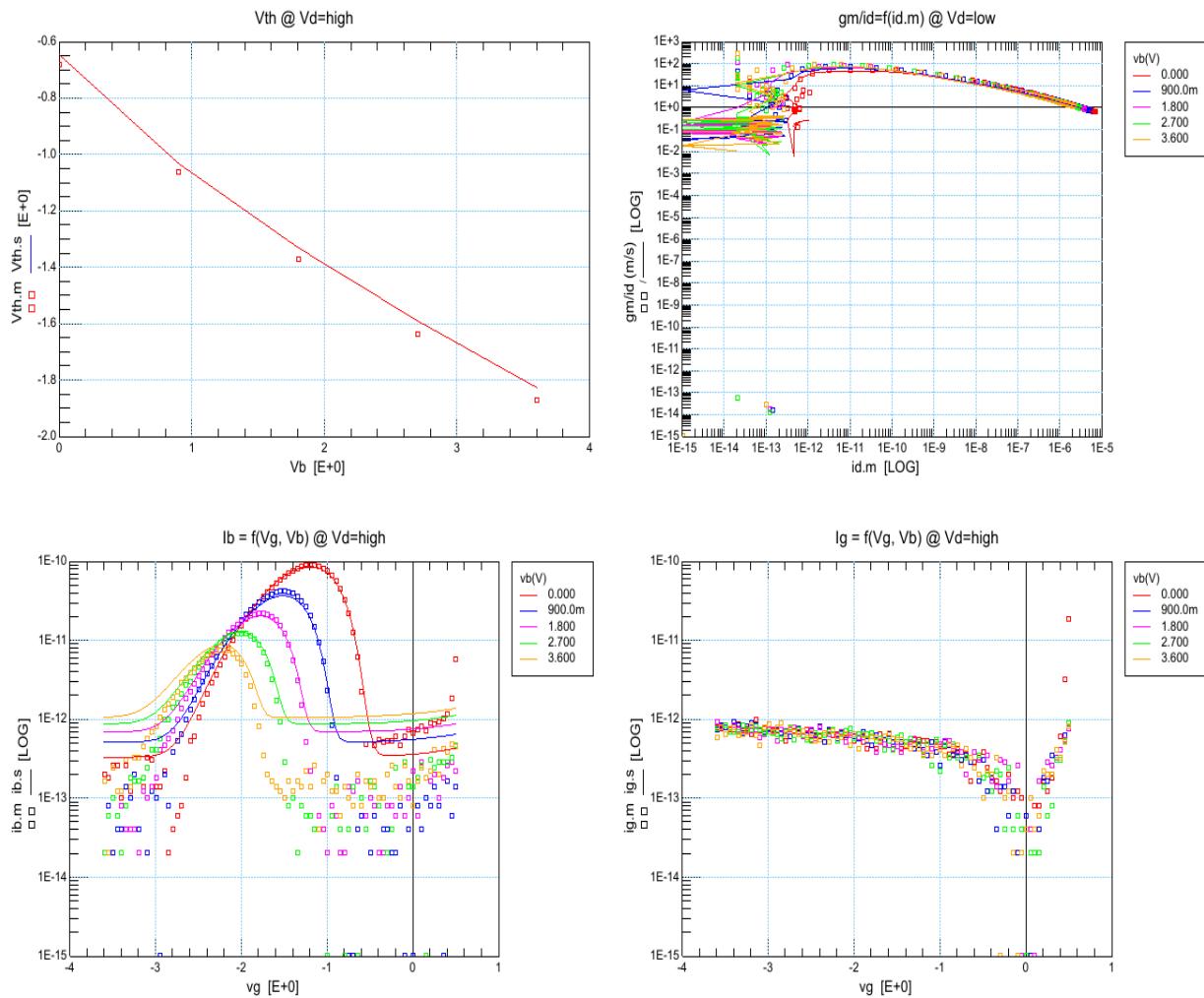
$idv_g, V_d = -0.1V, T = 27^\circ C$



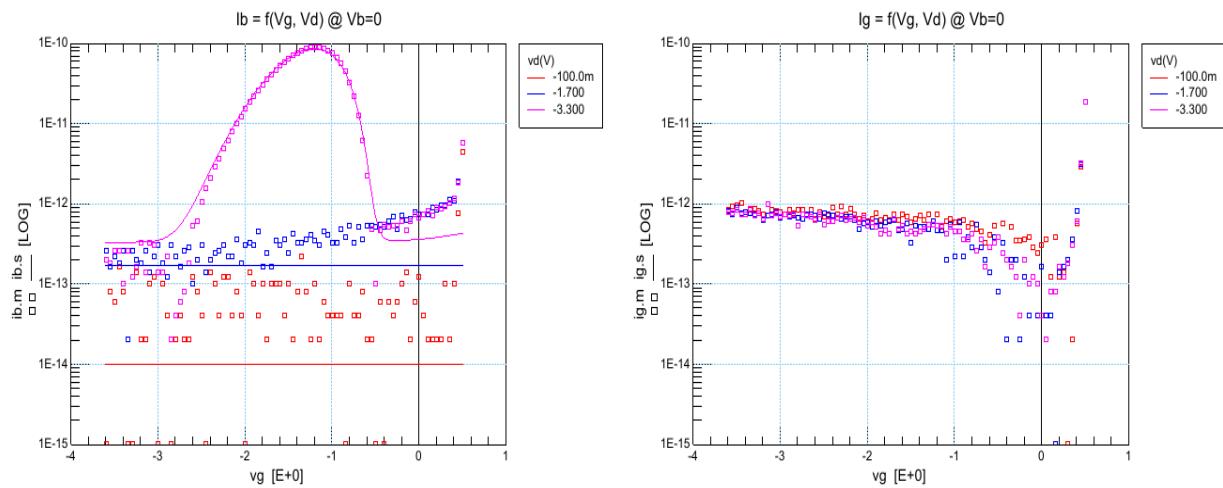


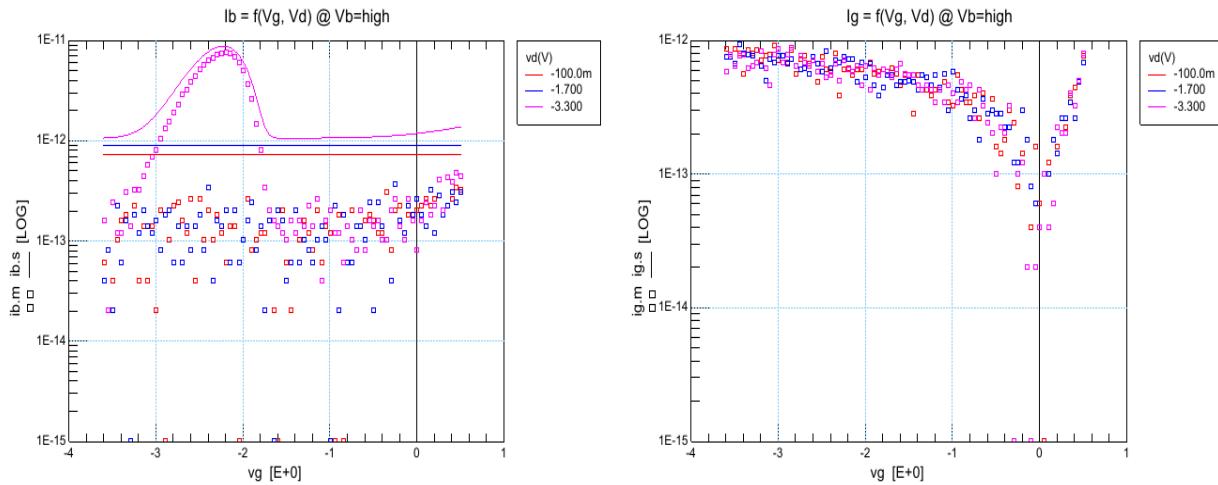
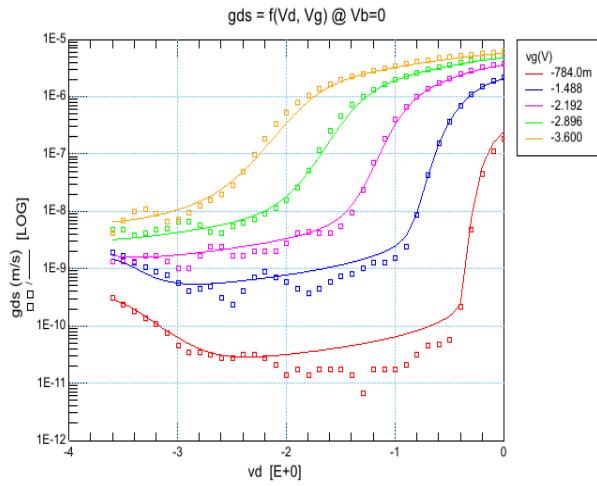
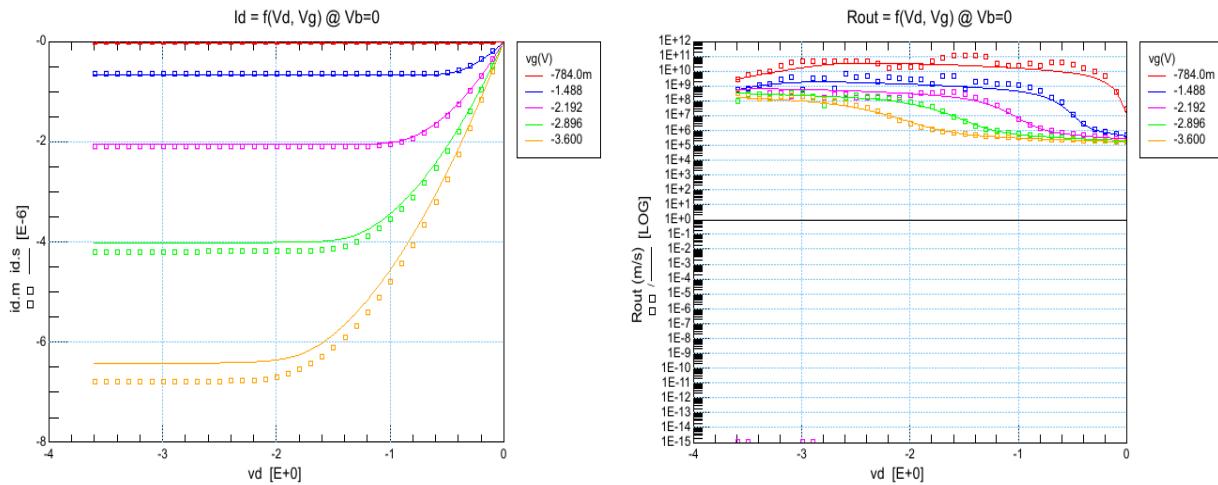
$i_{dvg}, V_d = -3.3V, T = 27^\circ\text{C}$

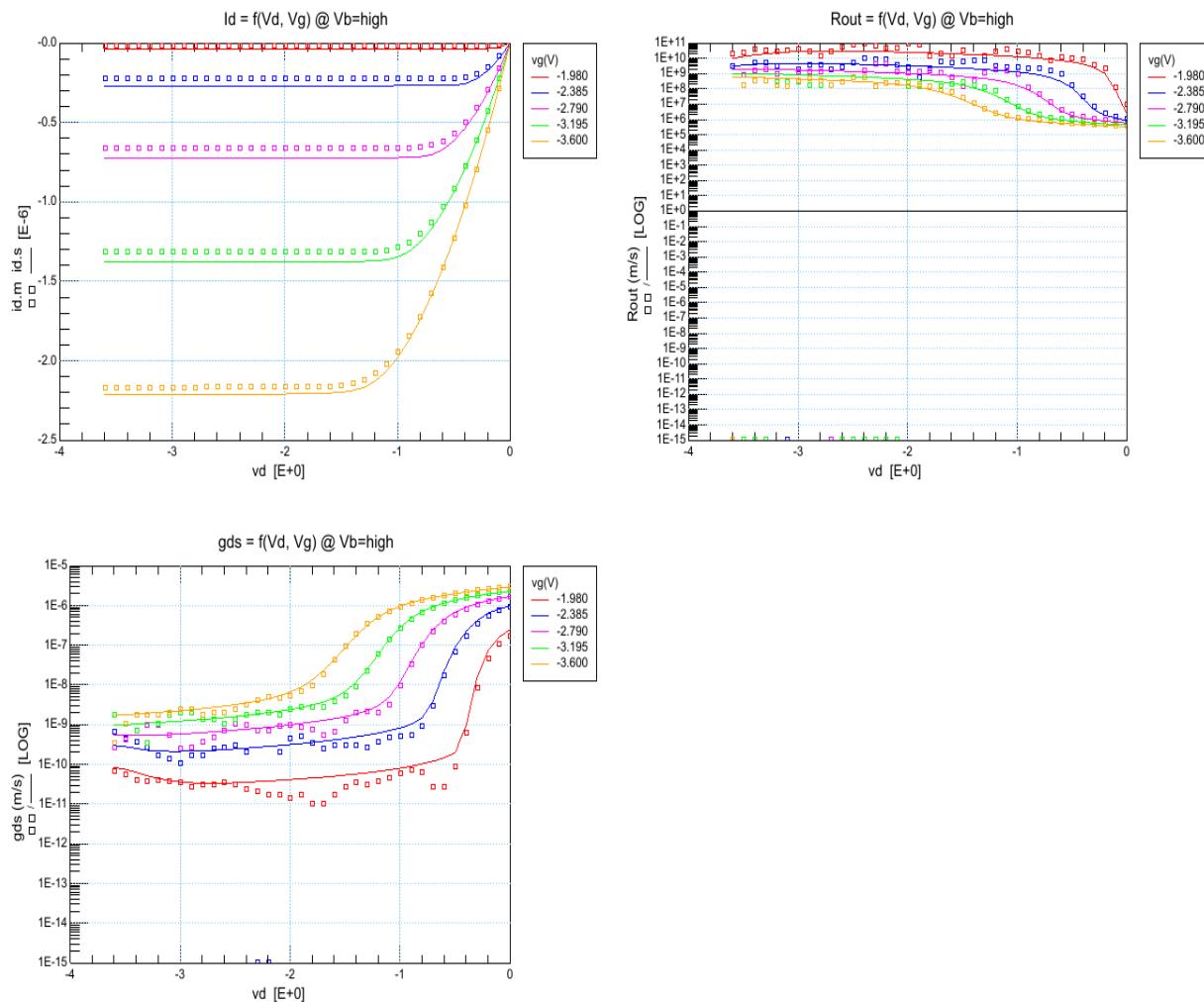
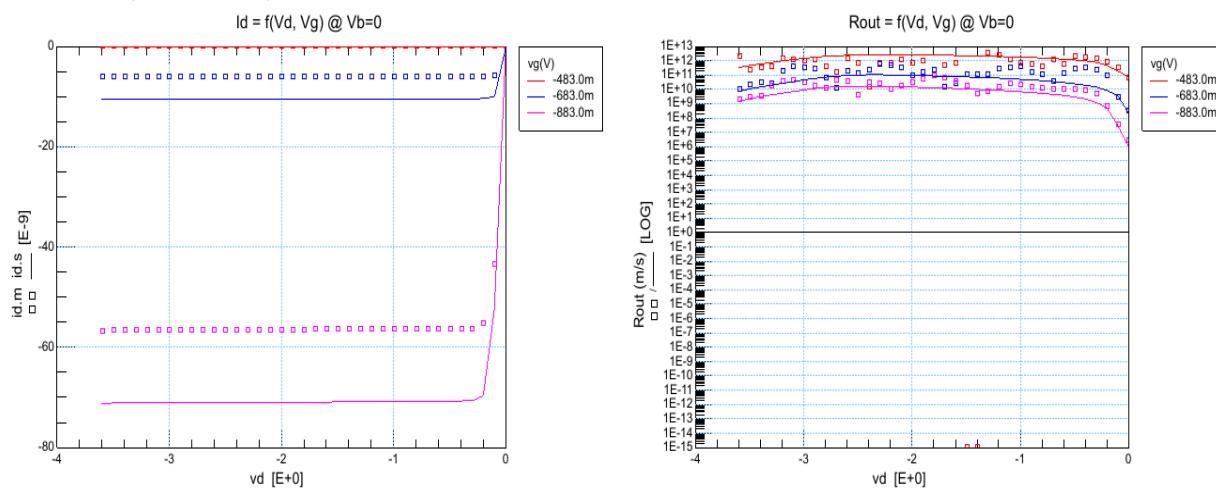


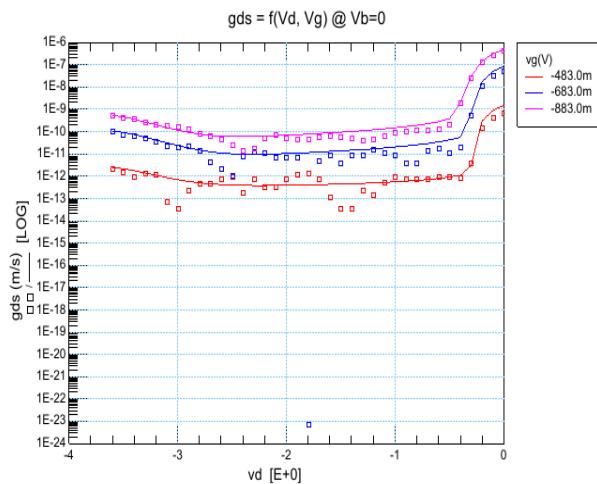


idvg, Ib,Ig, Vb = 0V, T = 27°C

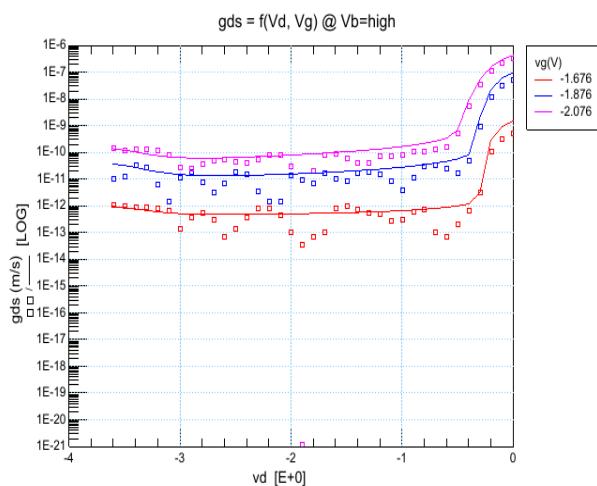
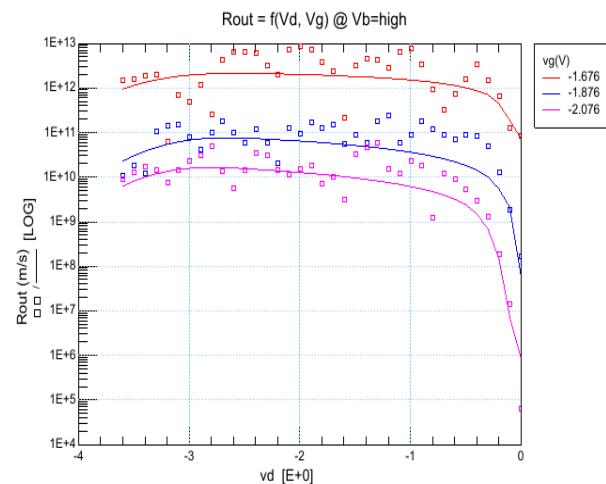
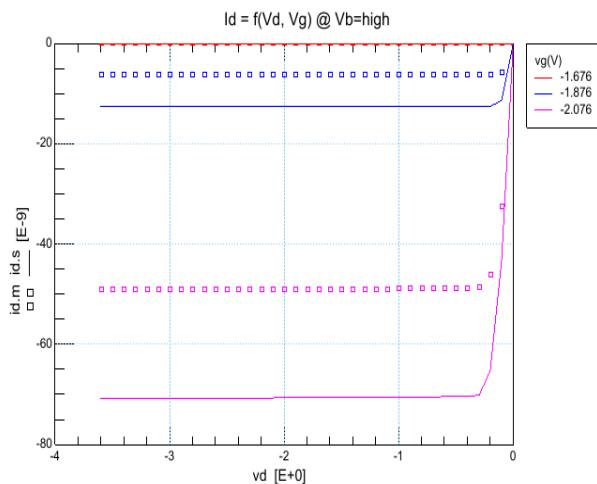


idvg, Ib,Ig, Vb = 3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


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

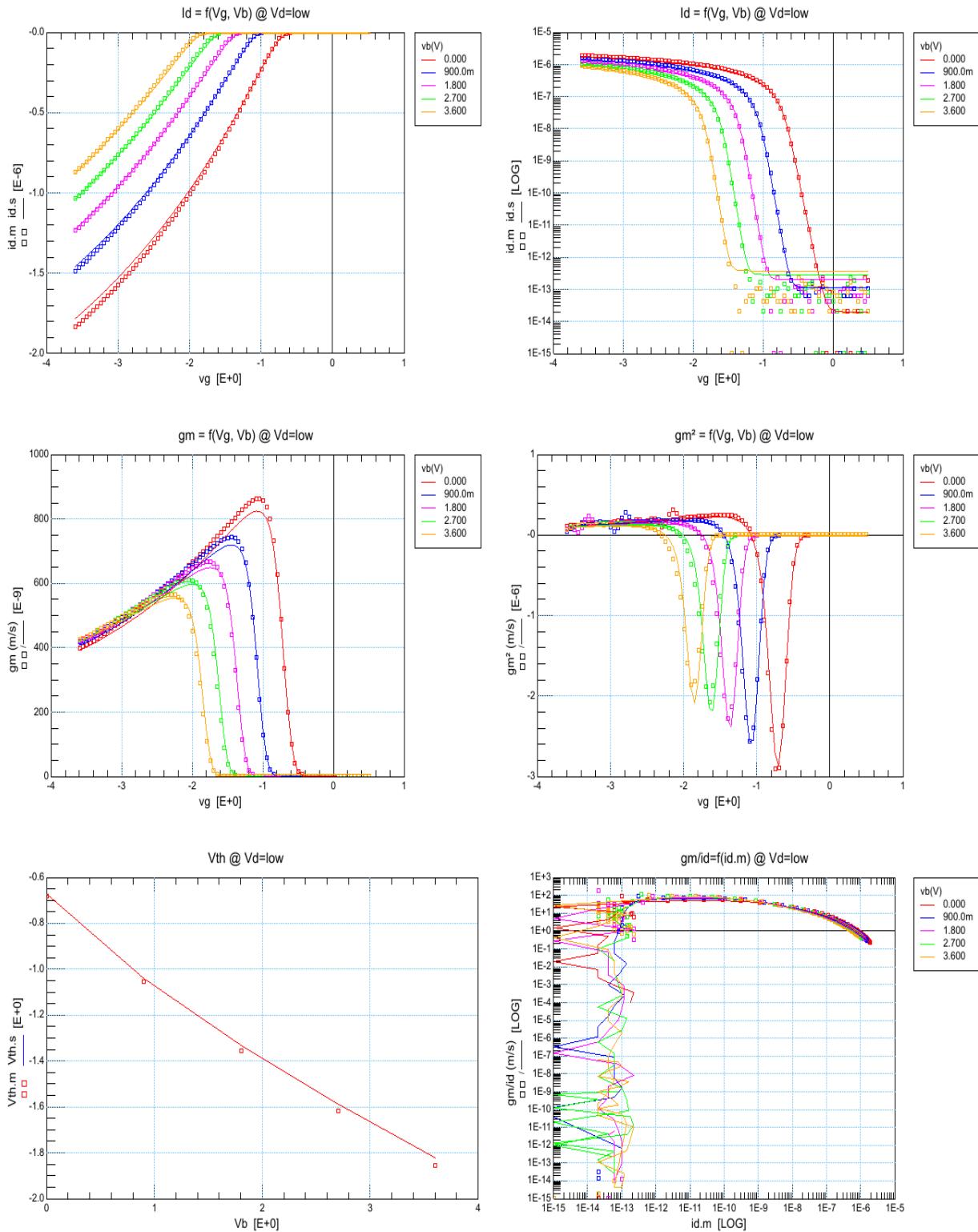


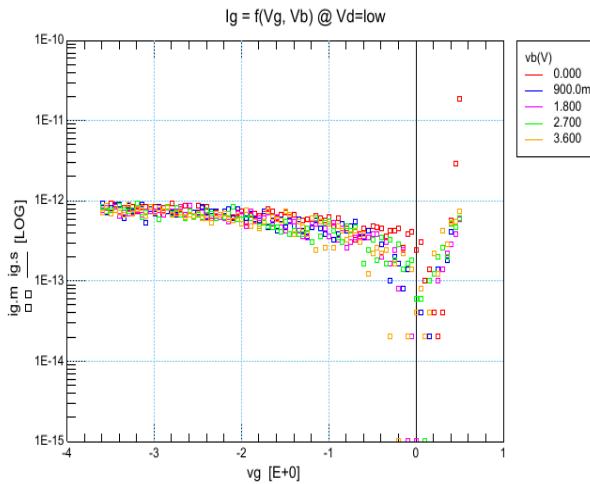
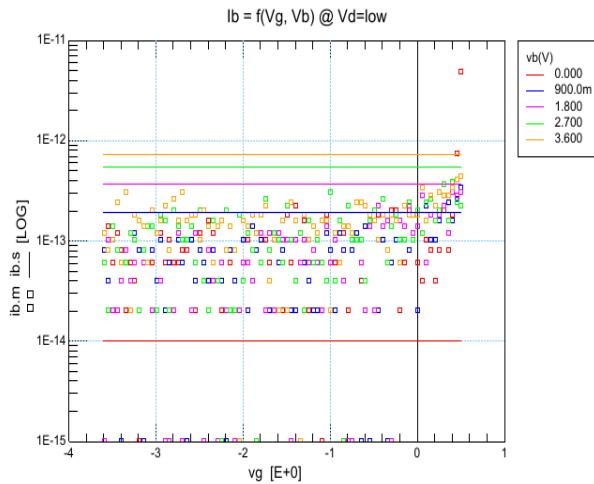
idvd_vth_vbmin, Vb = 3.6V, T = 27°C



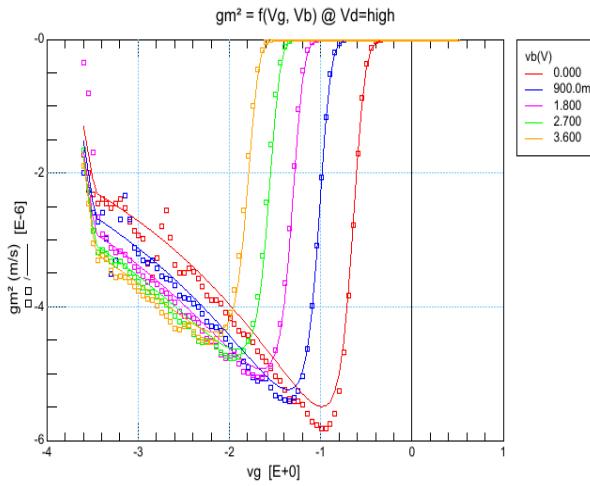
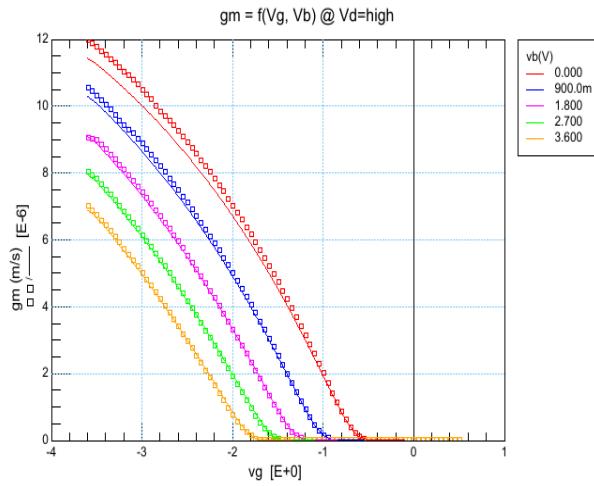
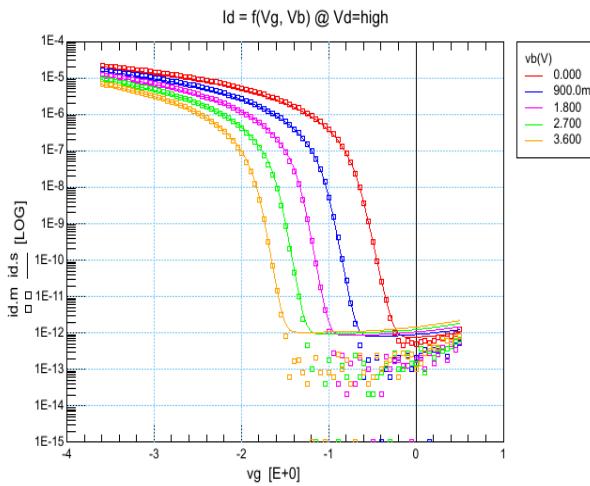
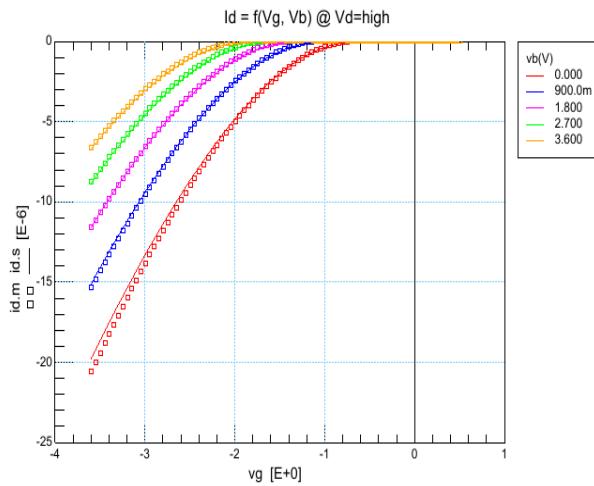
4.12 W02u0_L10u0_S563_5

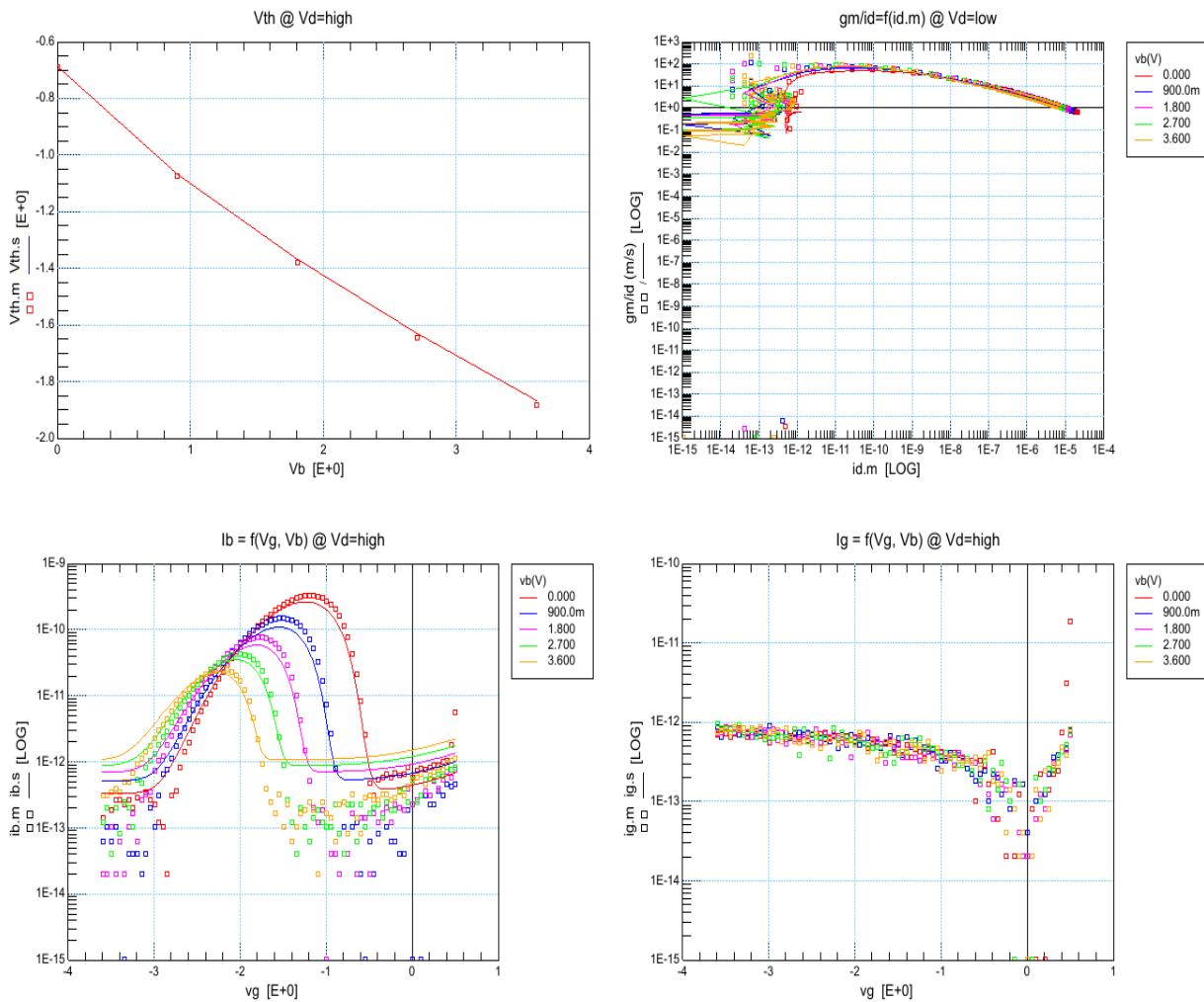
$idvg$, $Vd = -0.1V$, $T = 27^\circ C$



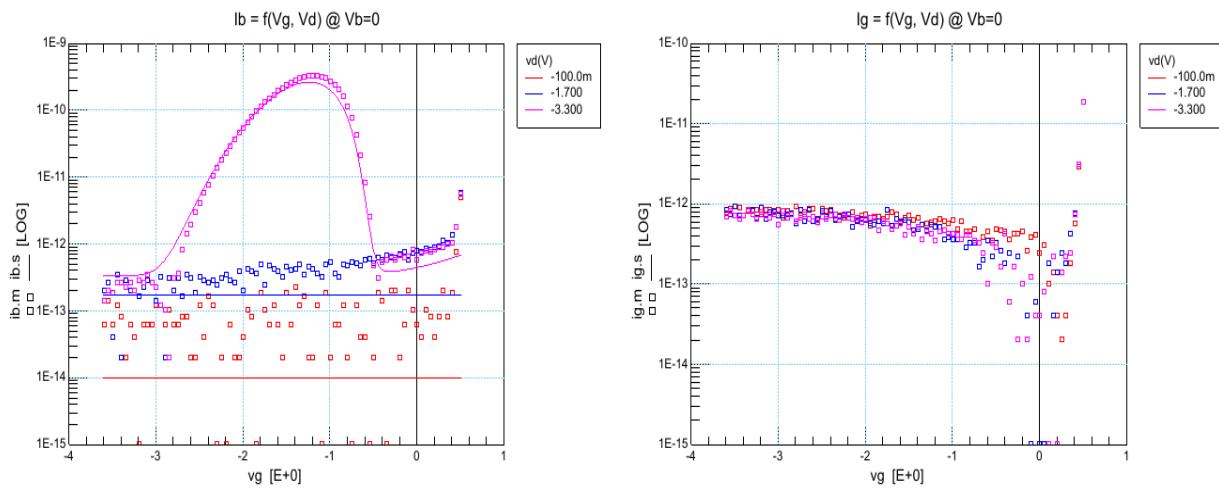


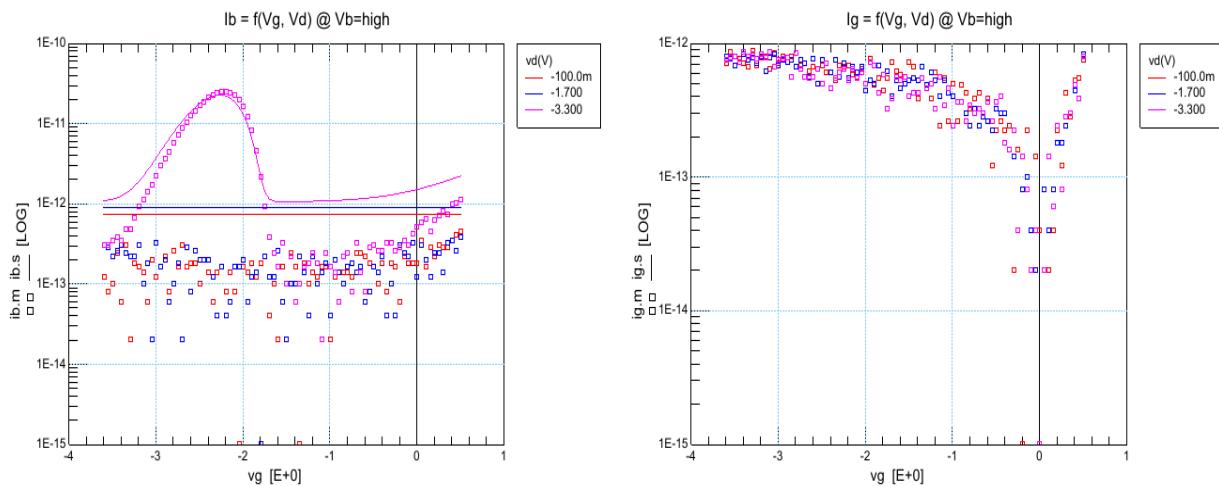
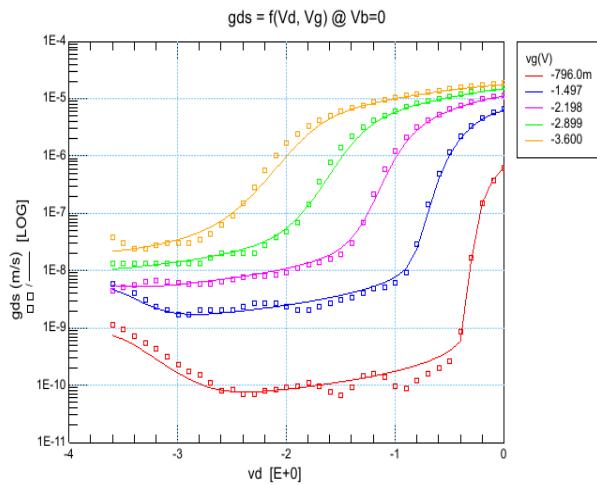
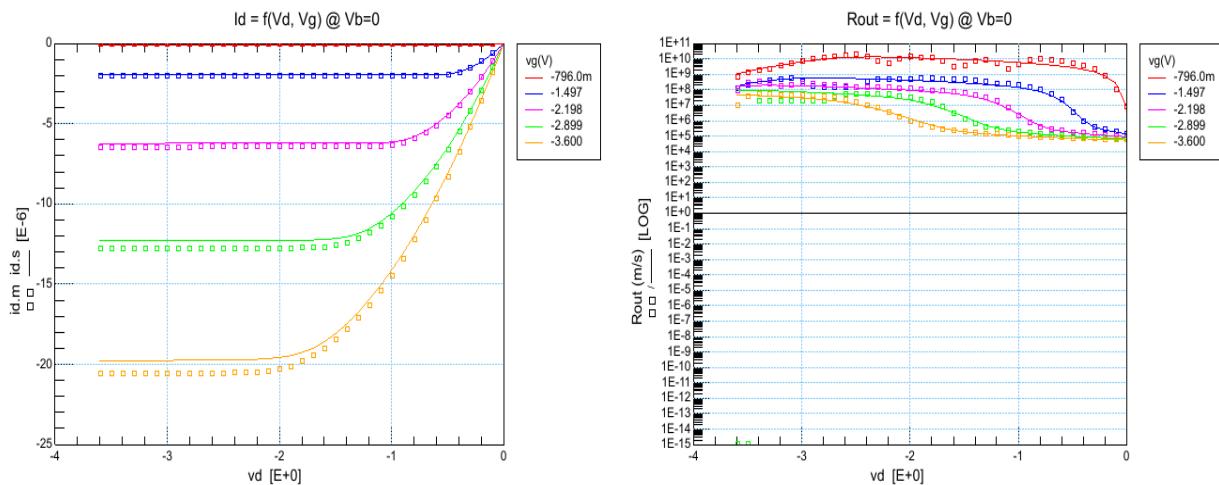
$i_{dvg}, V_d = -3.3V, T = 27^\circ\text{C}$

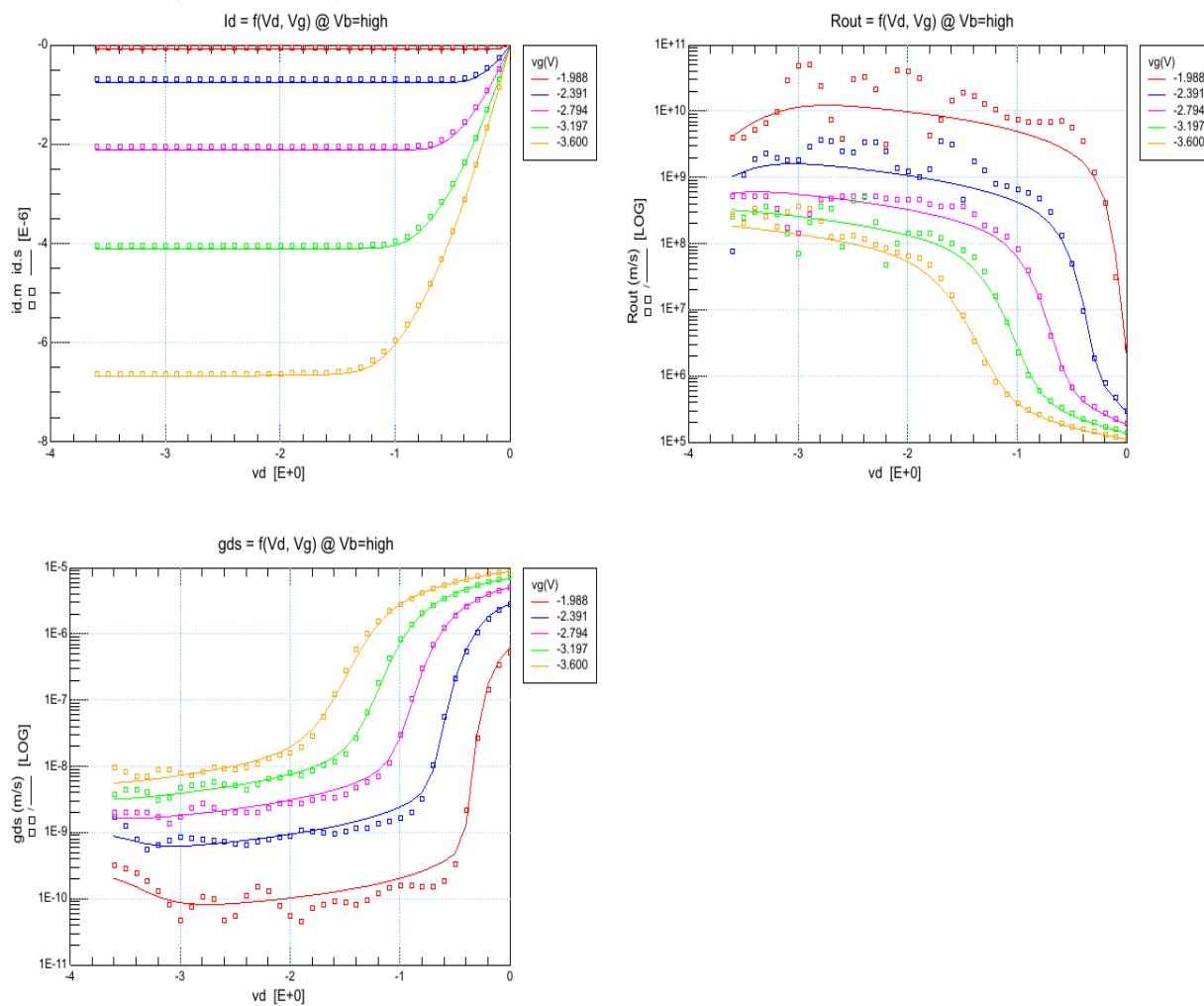
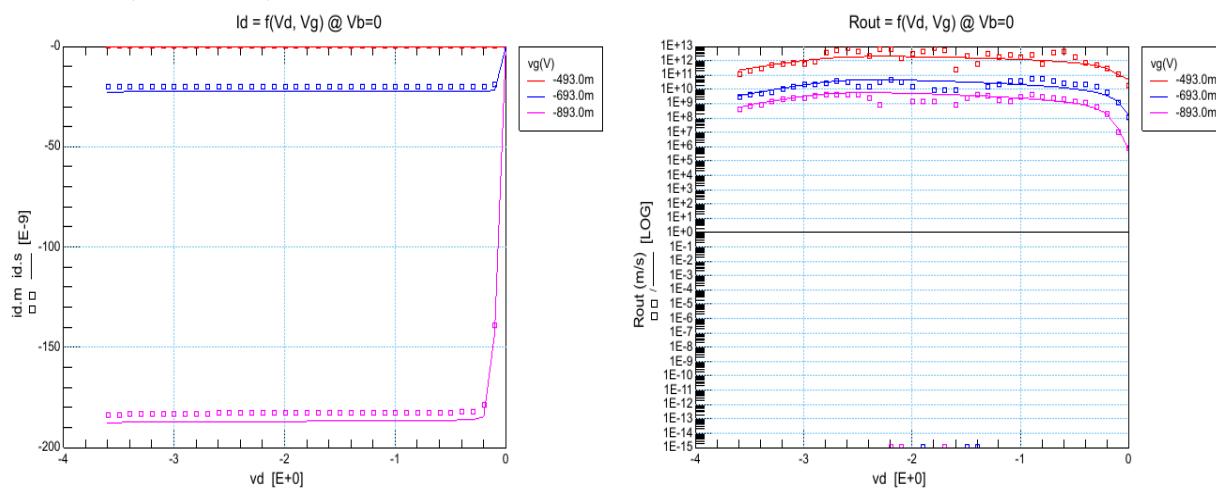


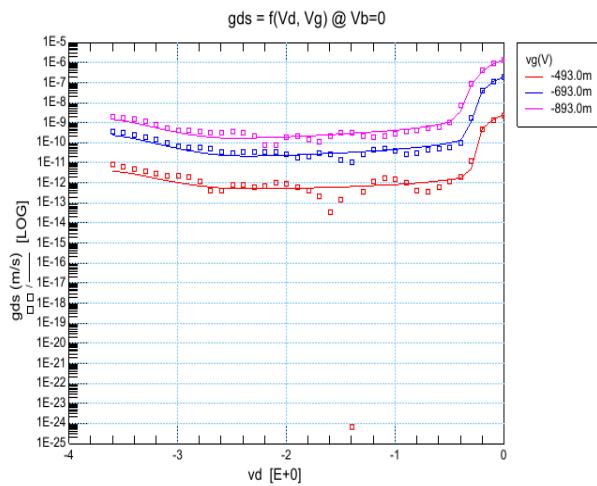


idvg, Ib,Ig, Vb = 0V, T = 27°C

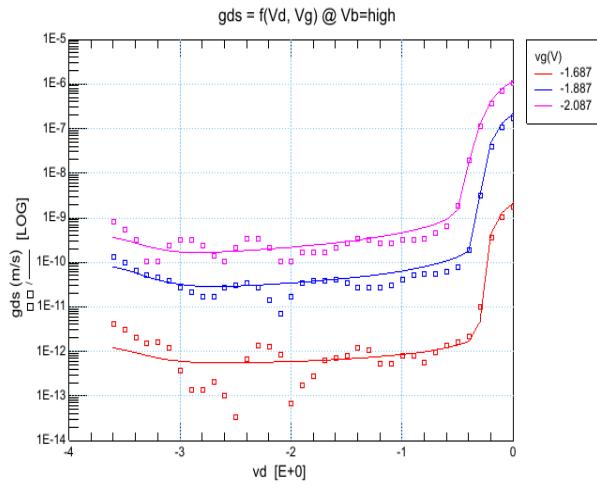
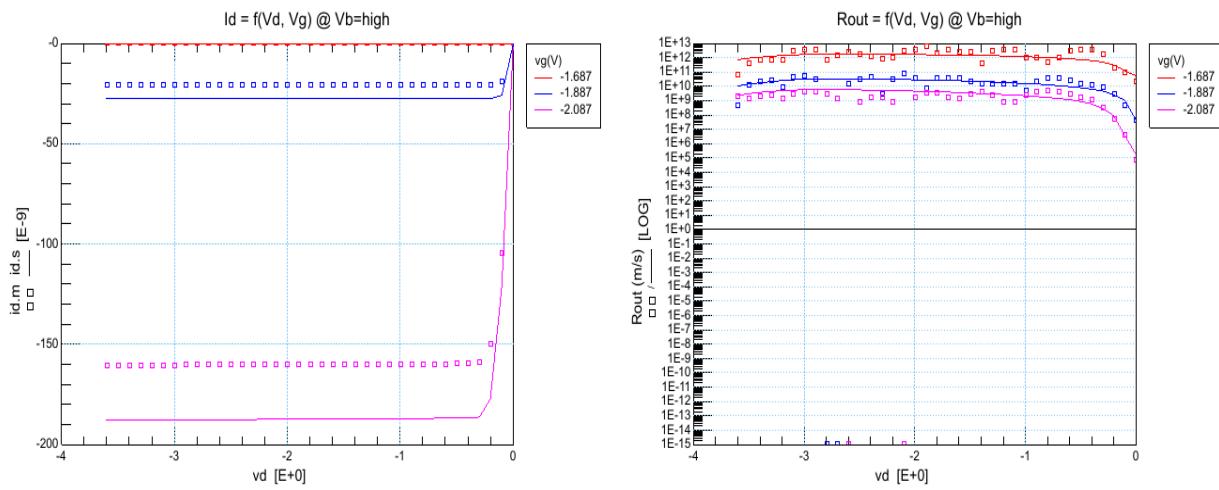


idvg, Ib,Ig, Vb = 3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


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

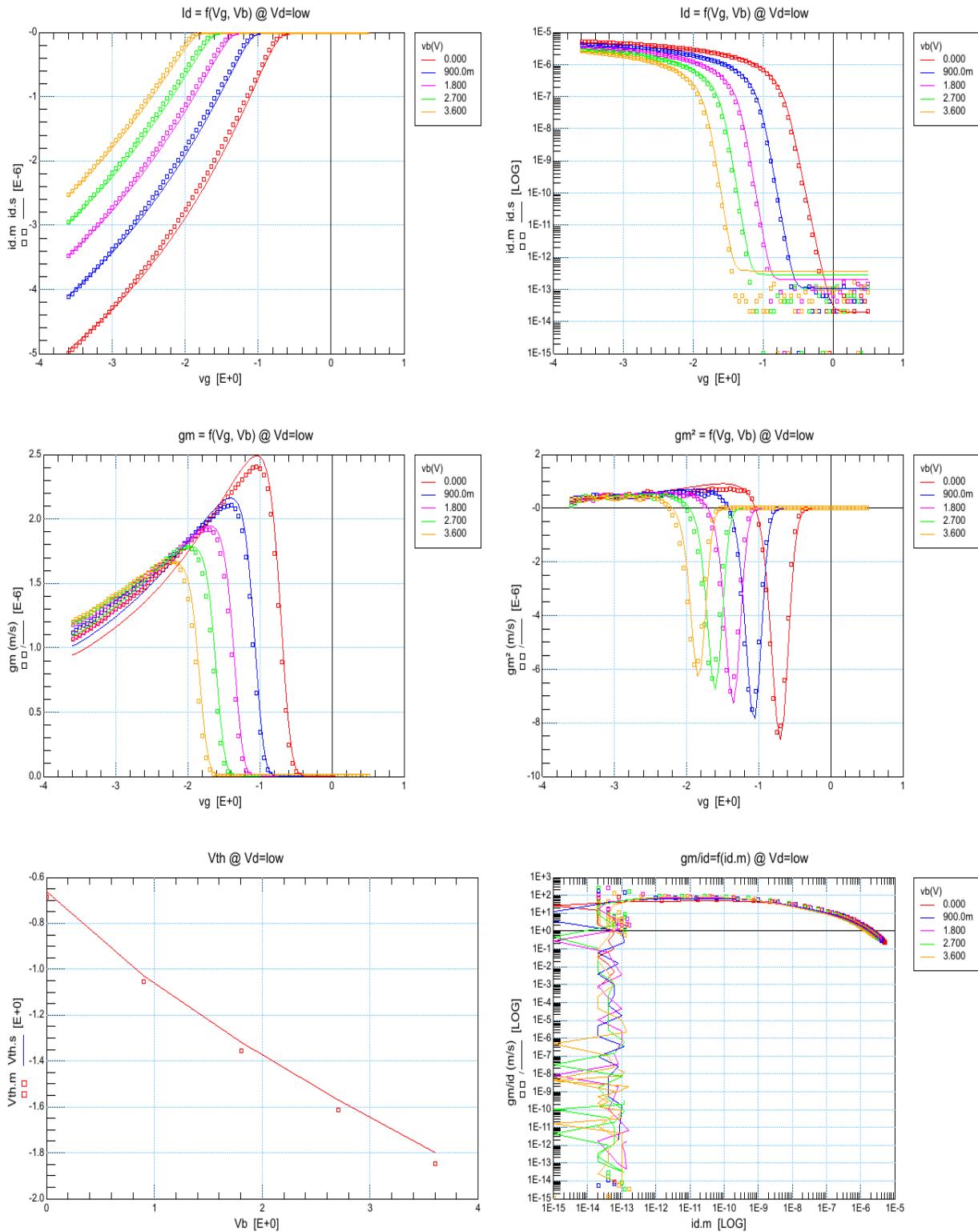


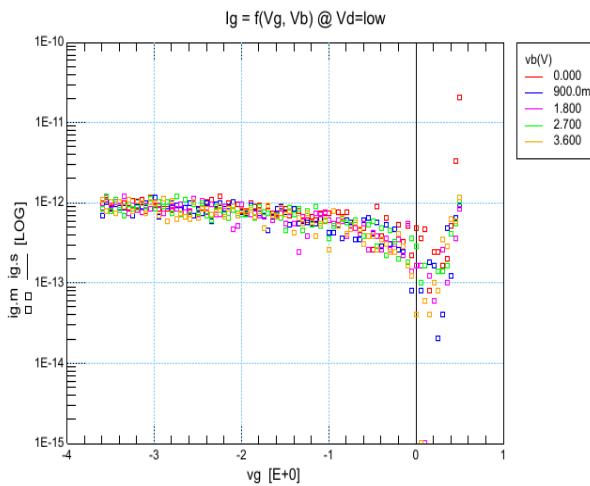
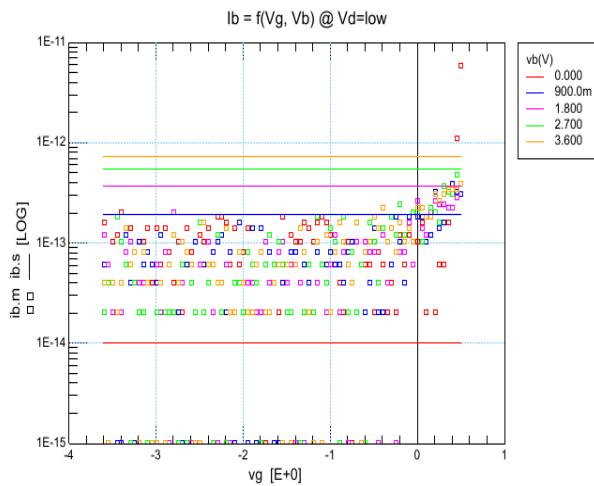
idvd_vth_vbmin, Vb = 3.6V, T = 27°C



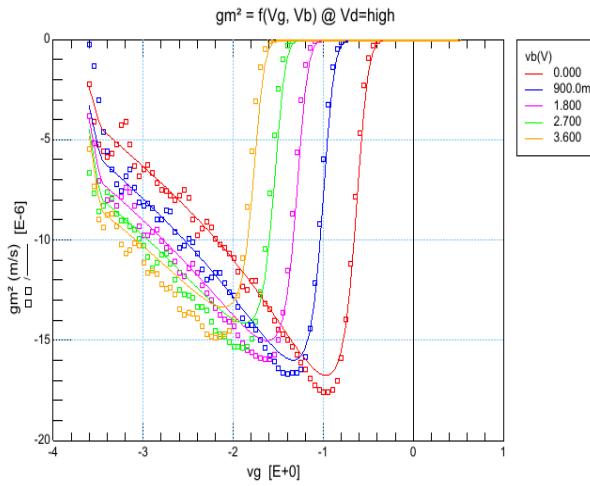
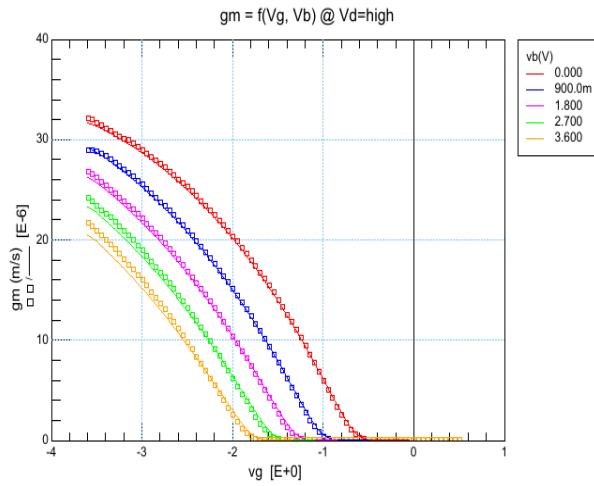
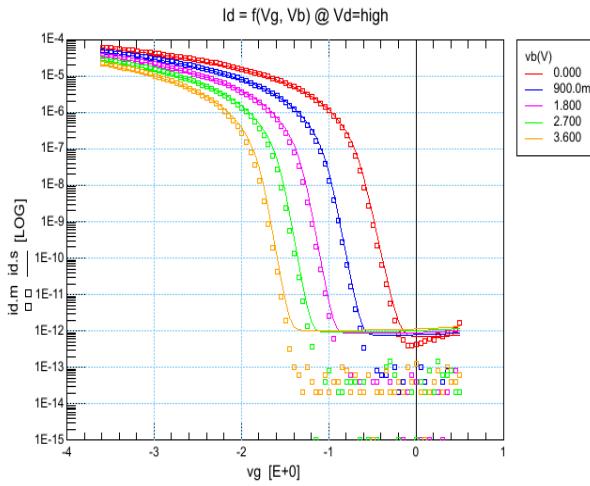
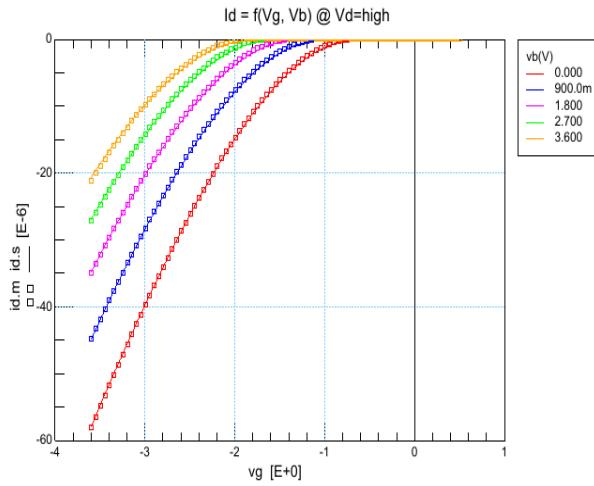
4.13 W0u6_L1u2_S564_4

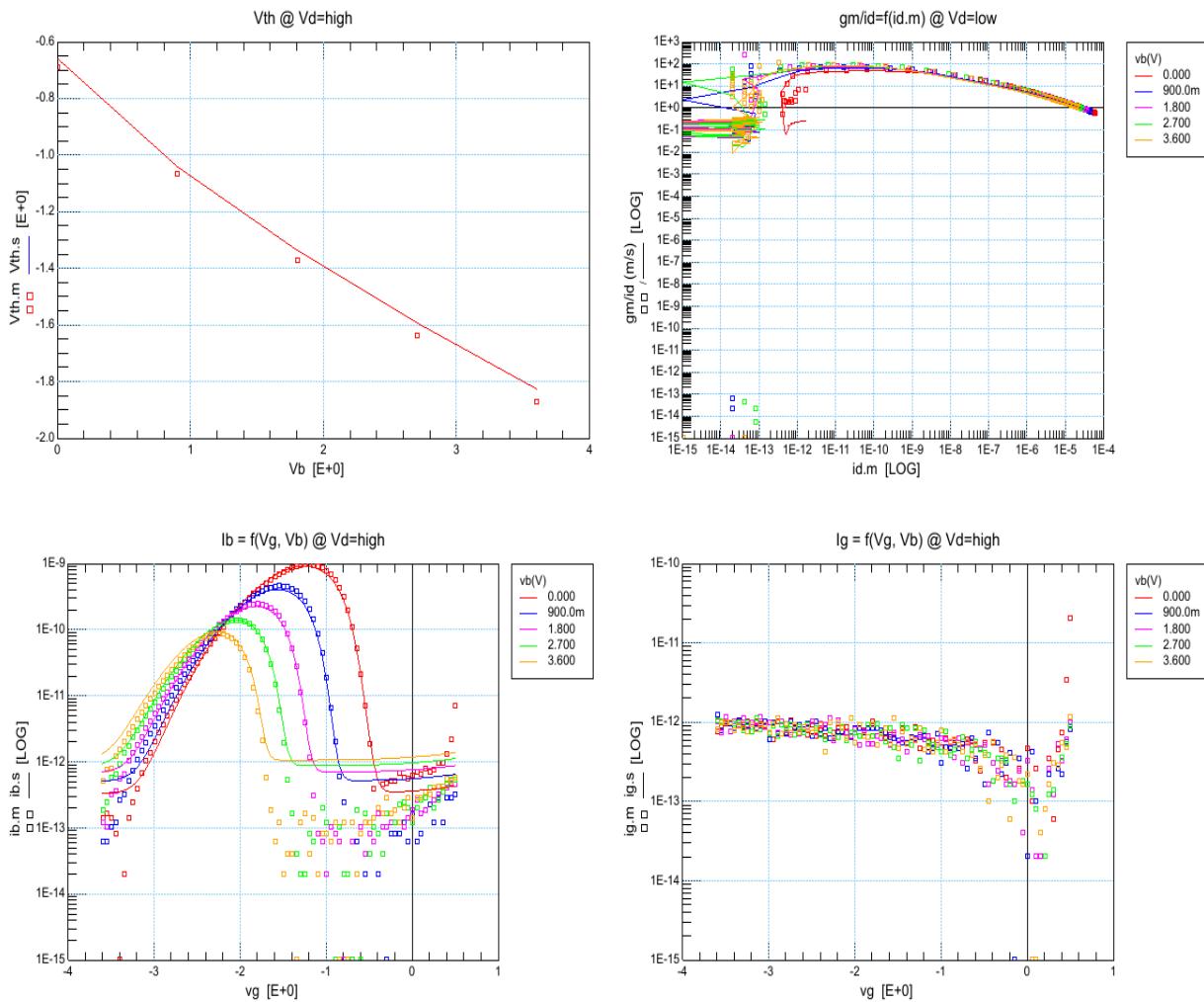
$idvg$, $Vd = -0.1V$, $T = 27^\circ C$



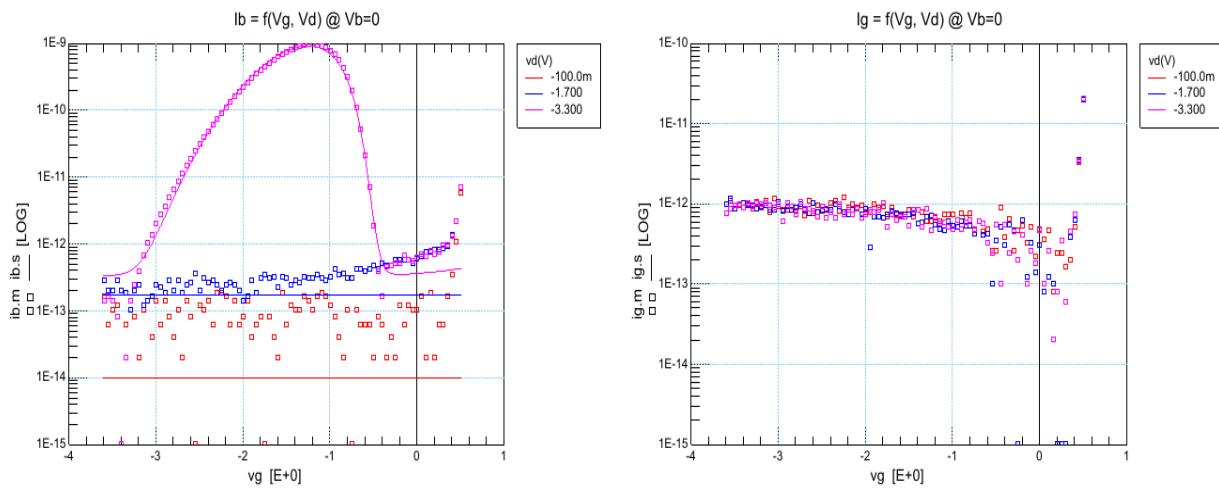


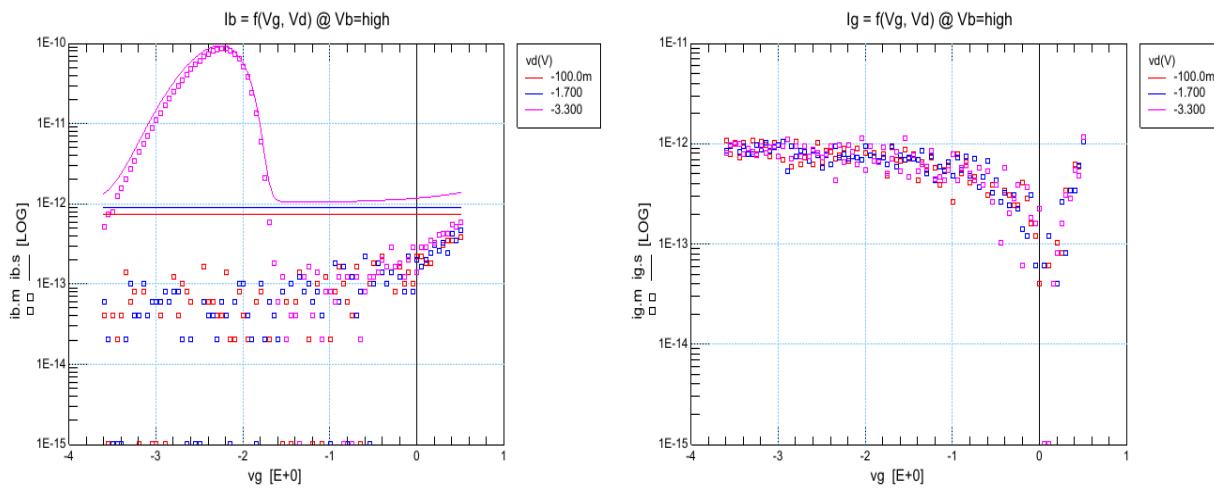
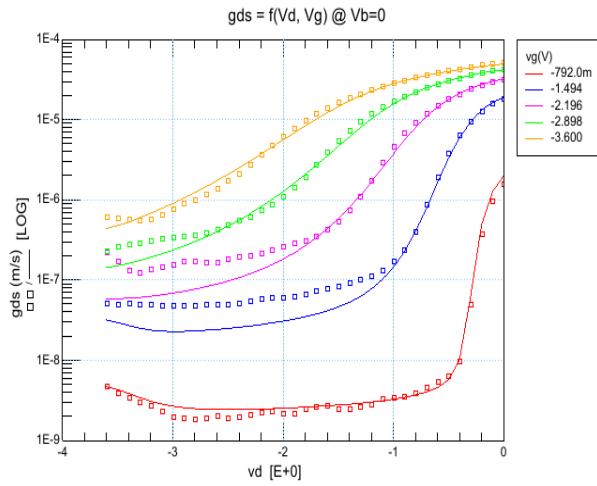
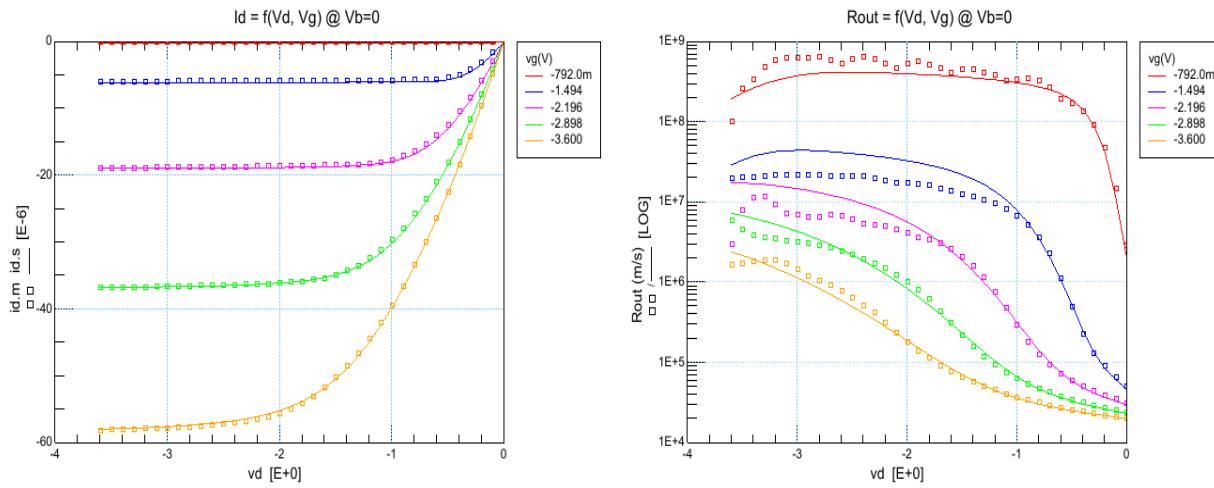
$i_d v_g, V_d = -3.3V, T = 27^\circ\text{C}$

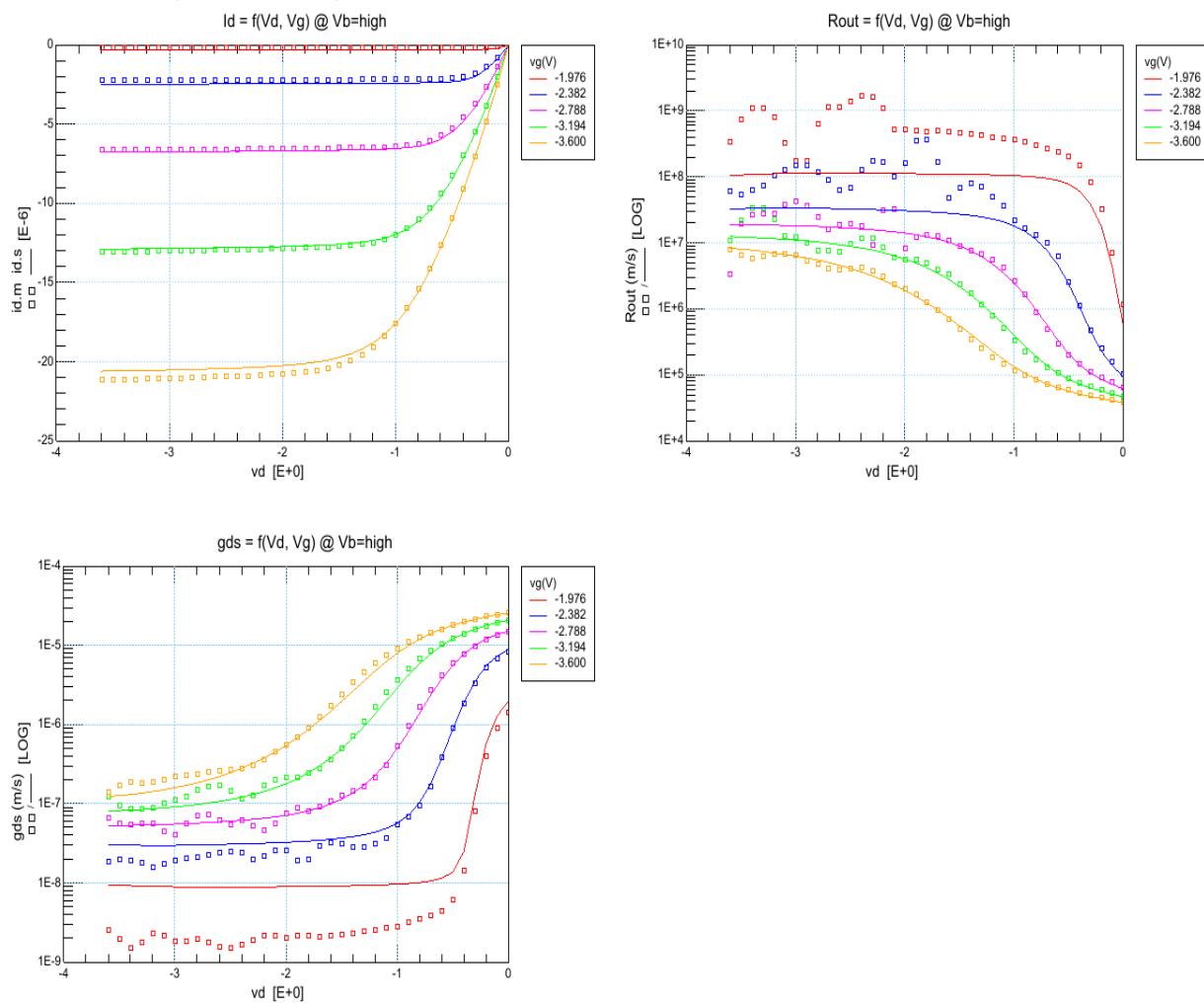
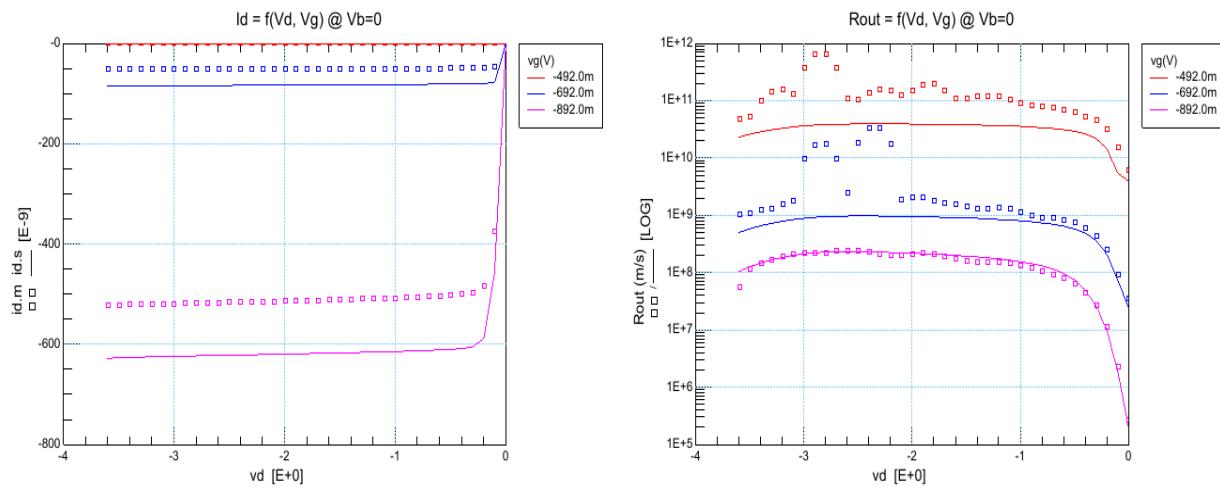


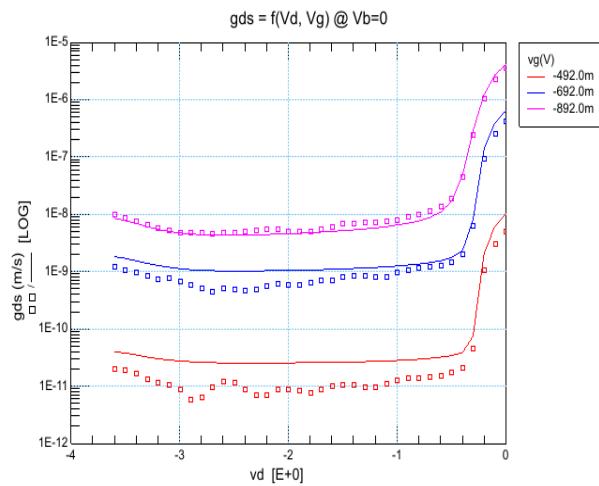


idvg, Ib, Ig, Vb = 0V, T = 27°C

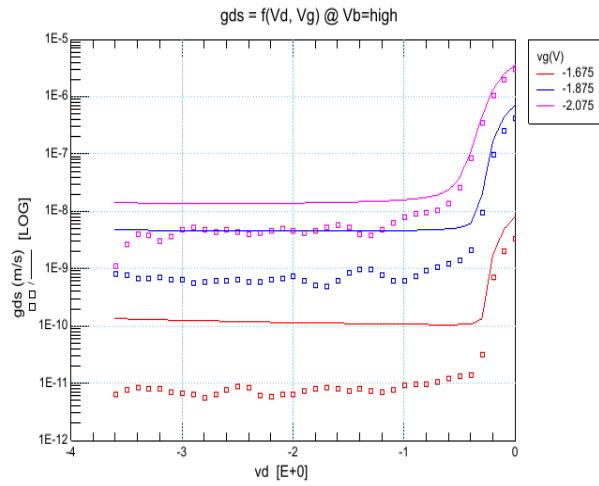
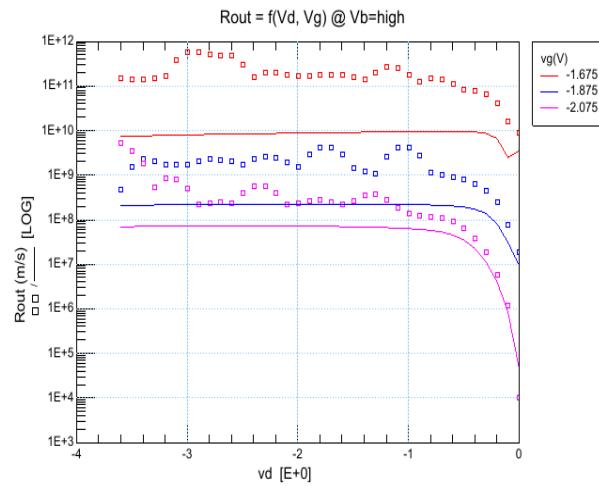
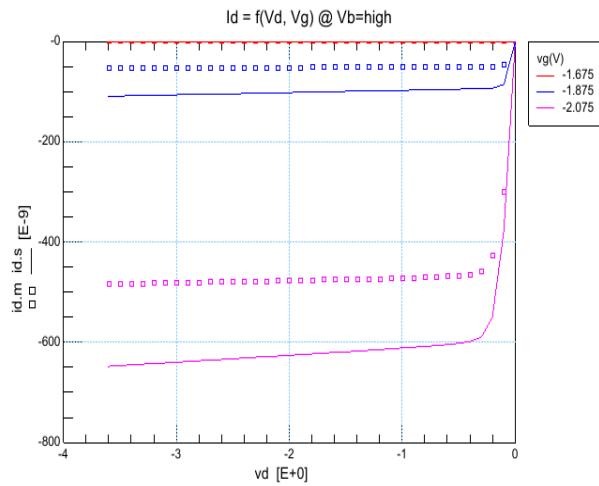


idvg, Ib,Ig, Vb = 3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


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

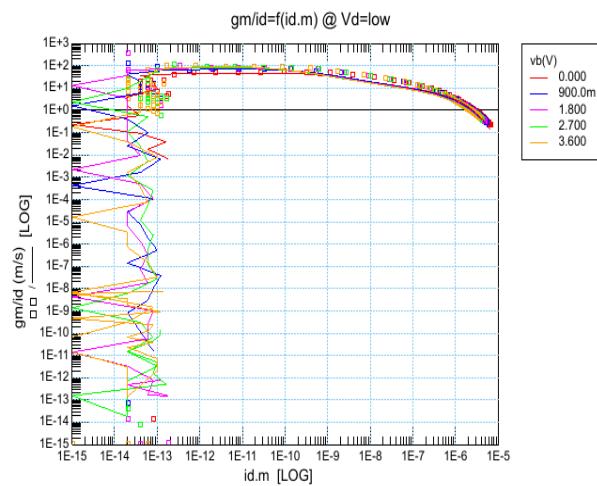
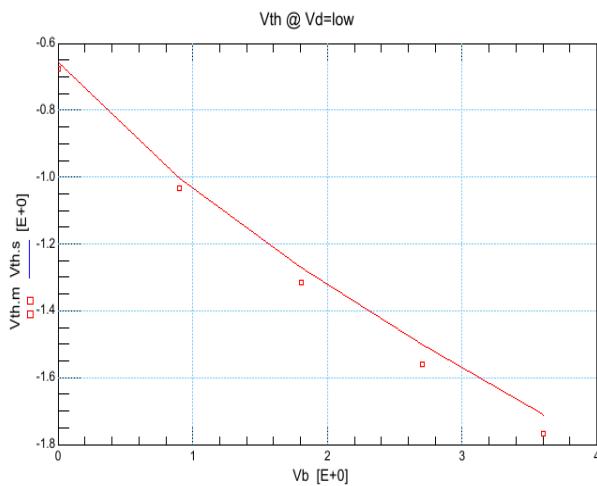
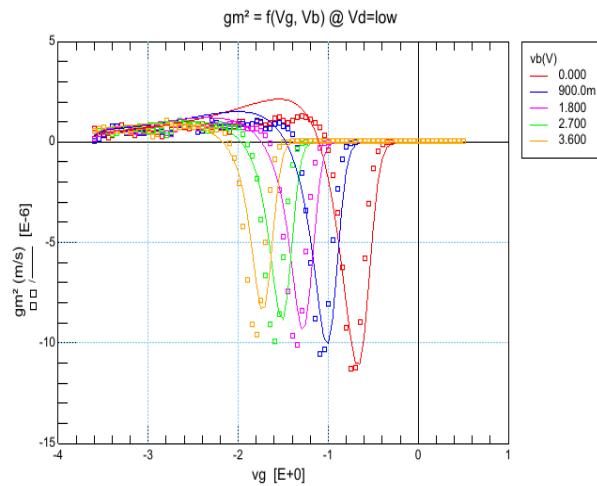
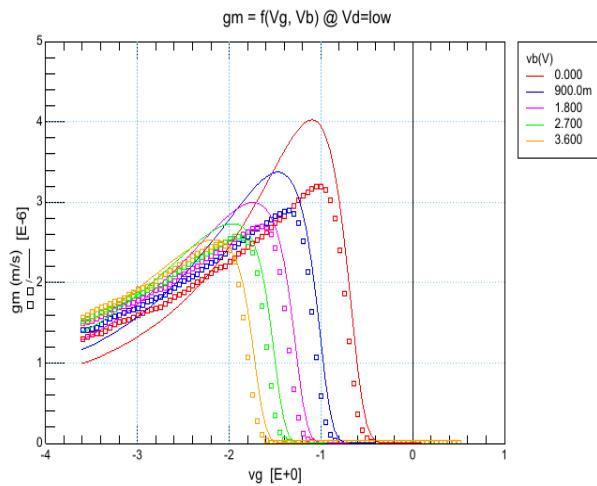
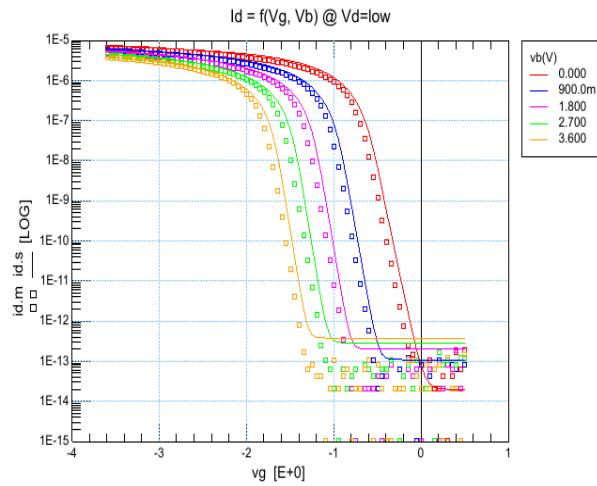
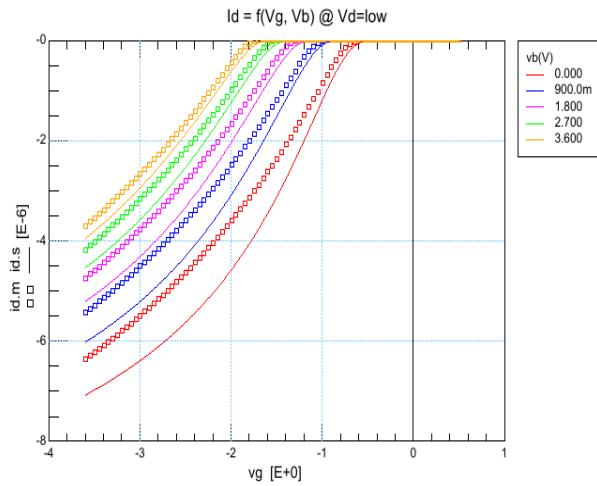


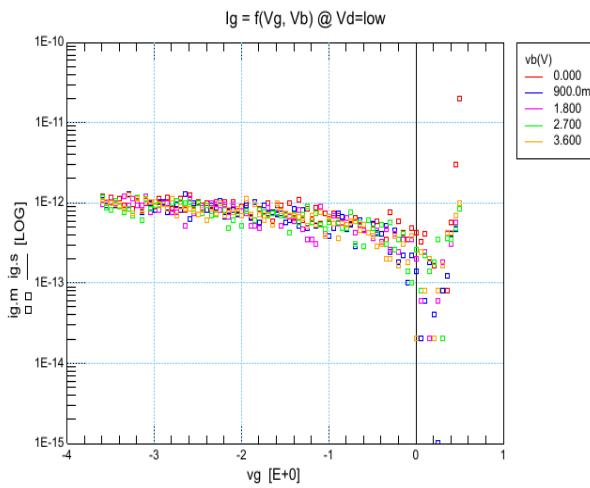
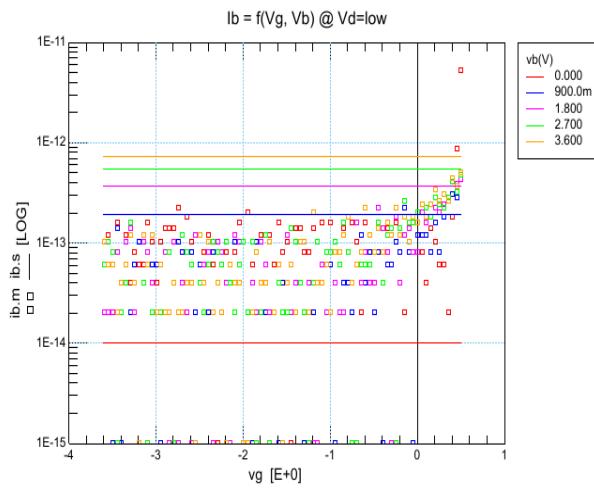
idvd_vth_vbmin, Vb = 3.6V, T = 27°C



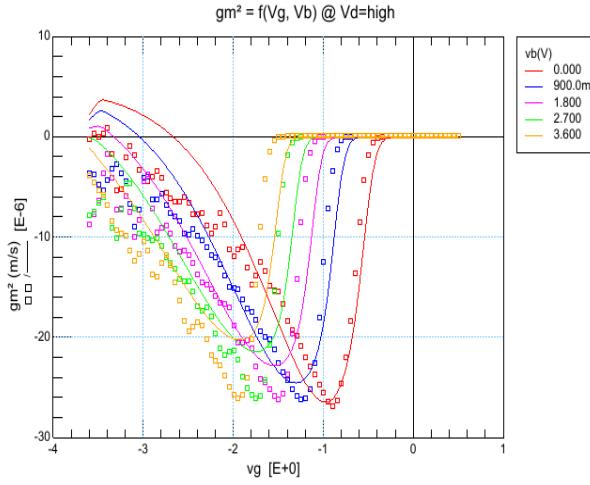
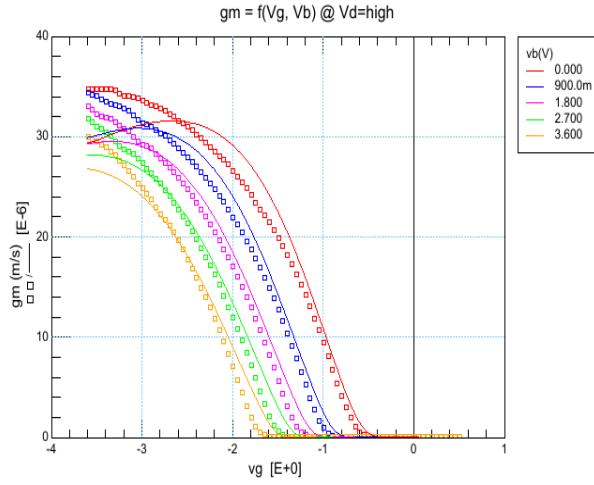
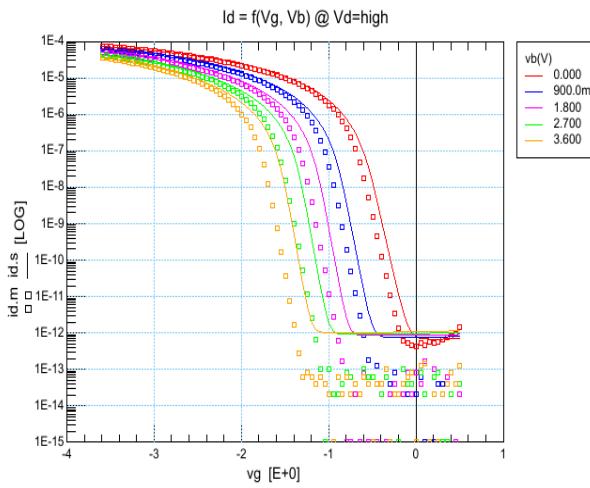
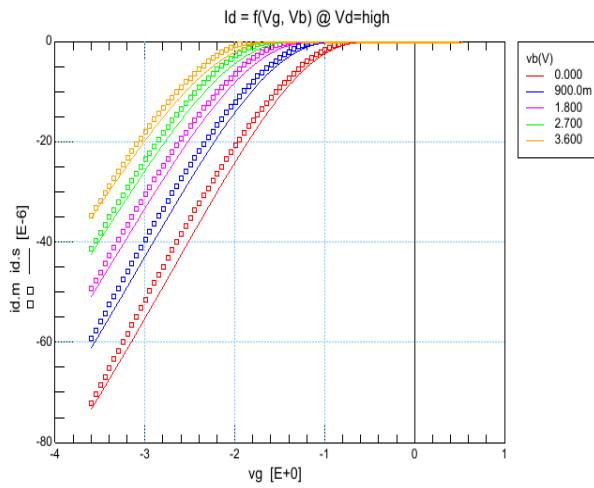
4.14 W0u3_L0u5_S565_4

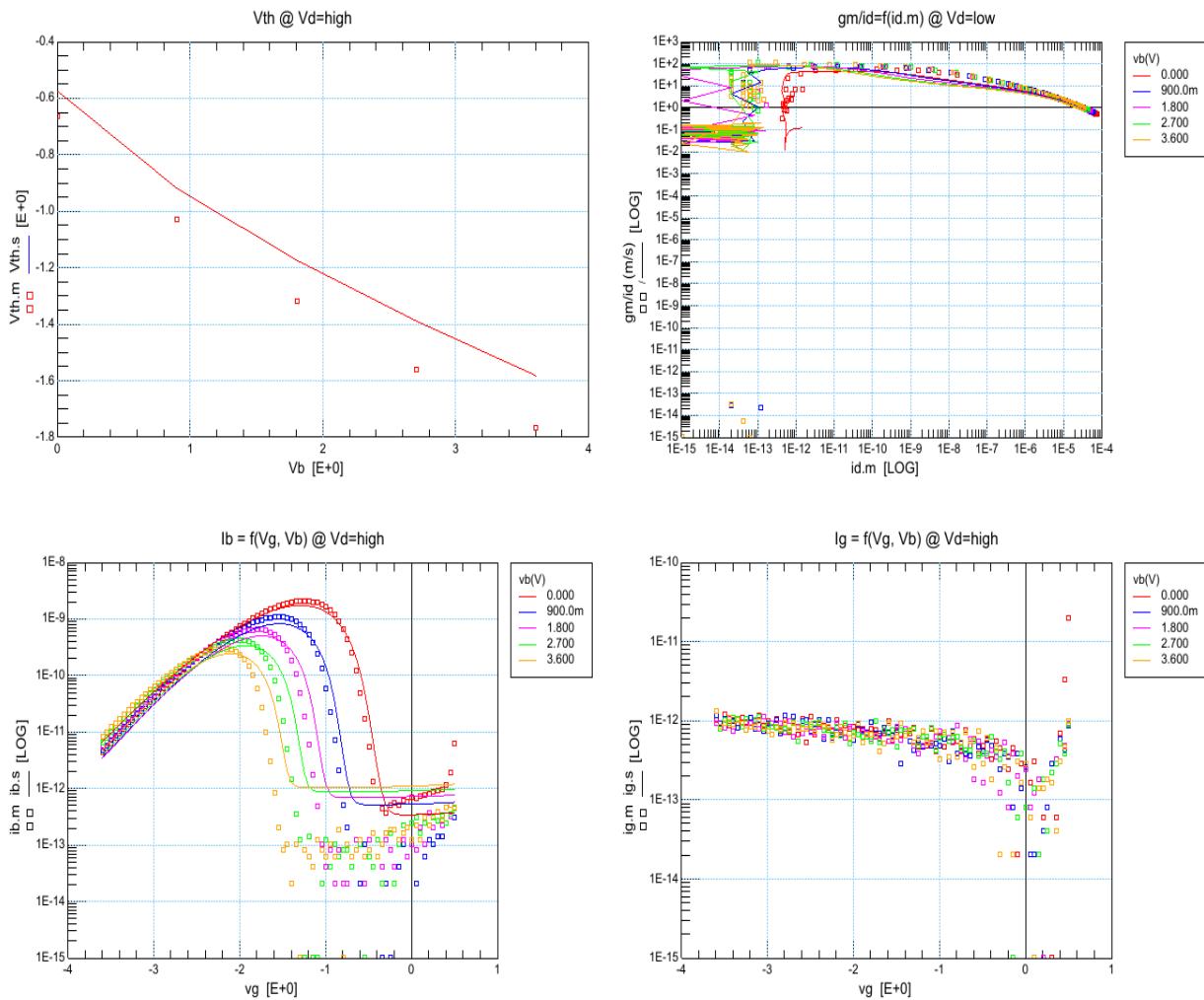
$idv_g, V_d = -0.1V, T = 27^\circ C$



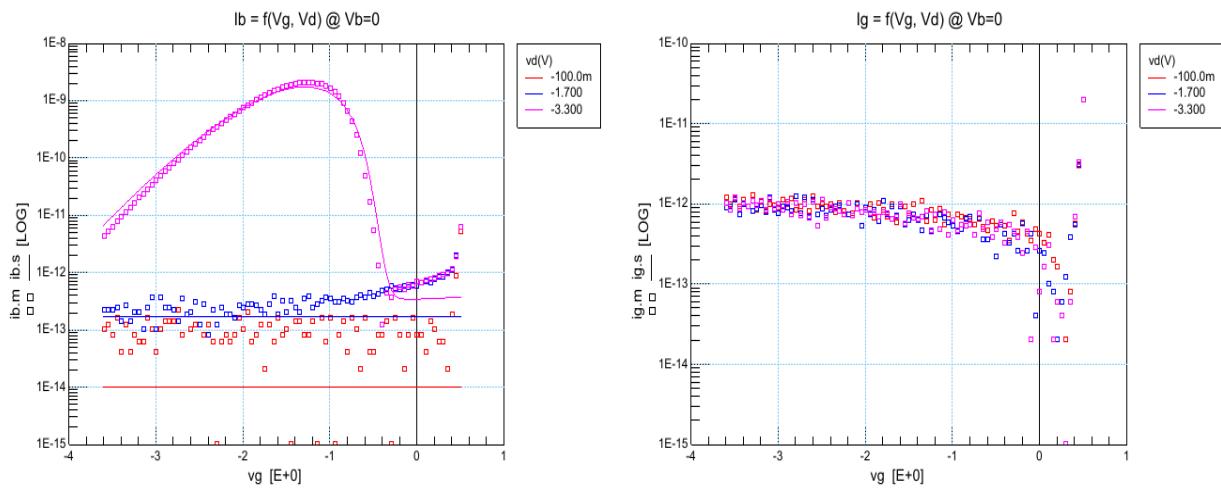


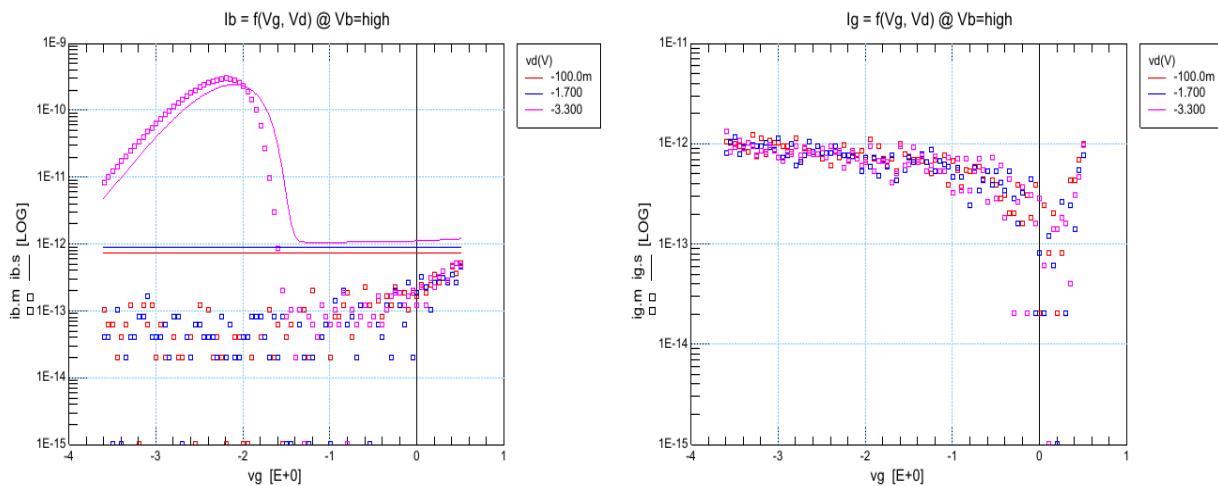
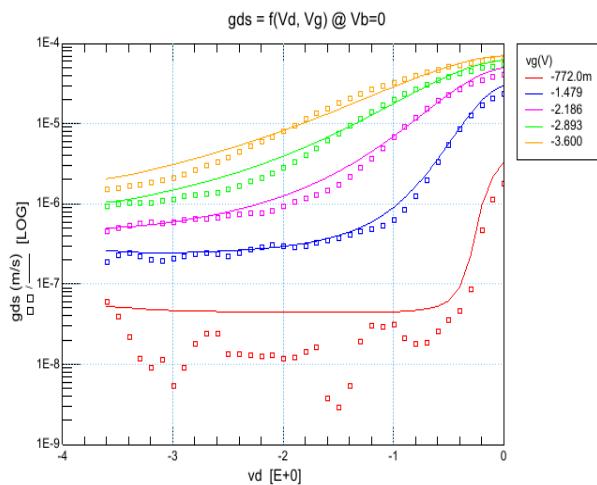
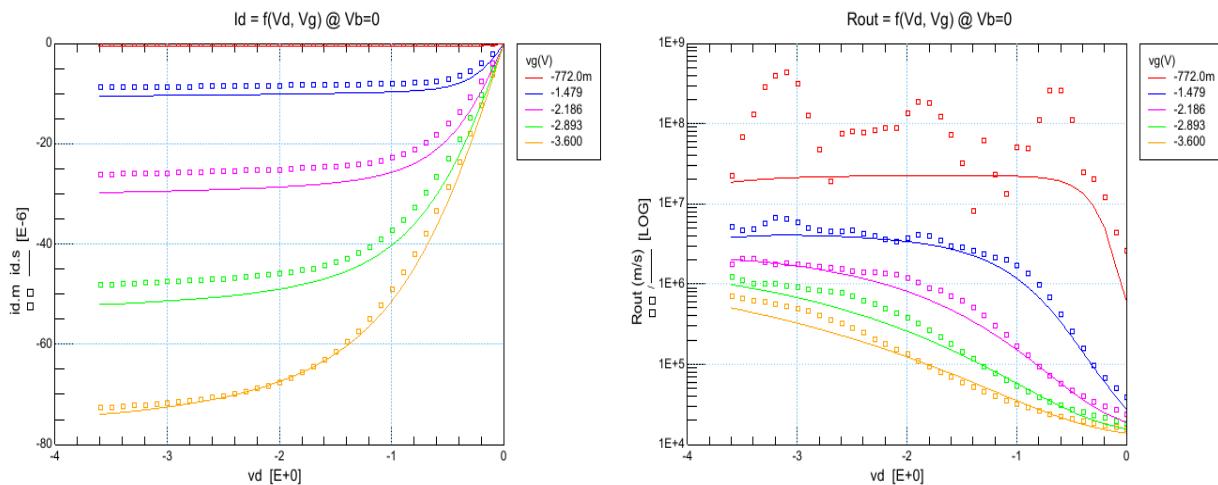
$i_d v_g, V_d = -3.3V, T = 27^\circ\text{C}$

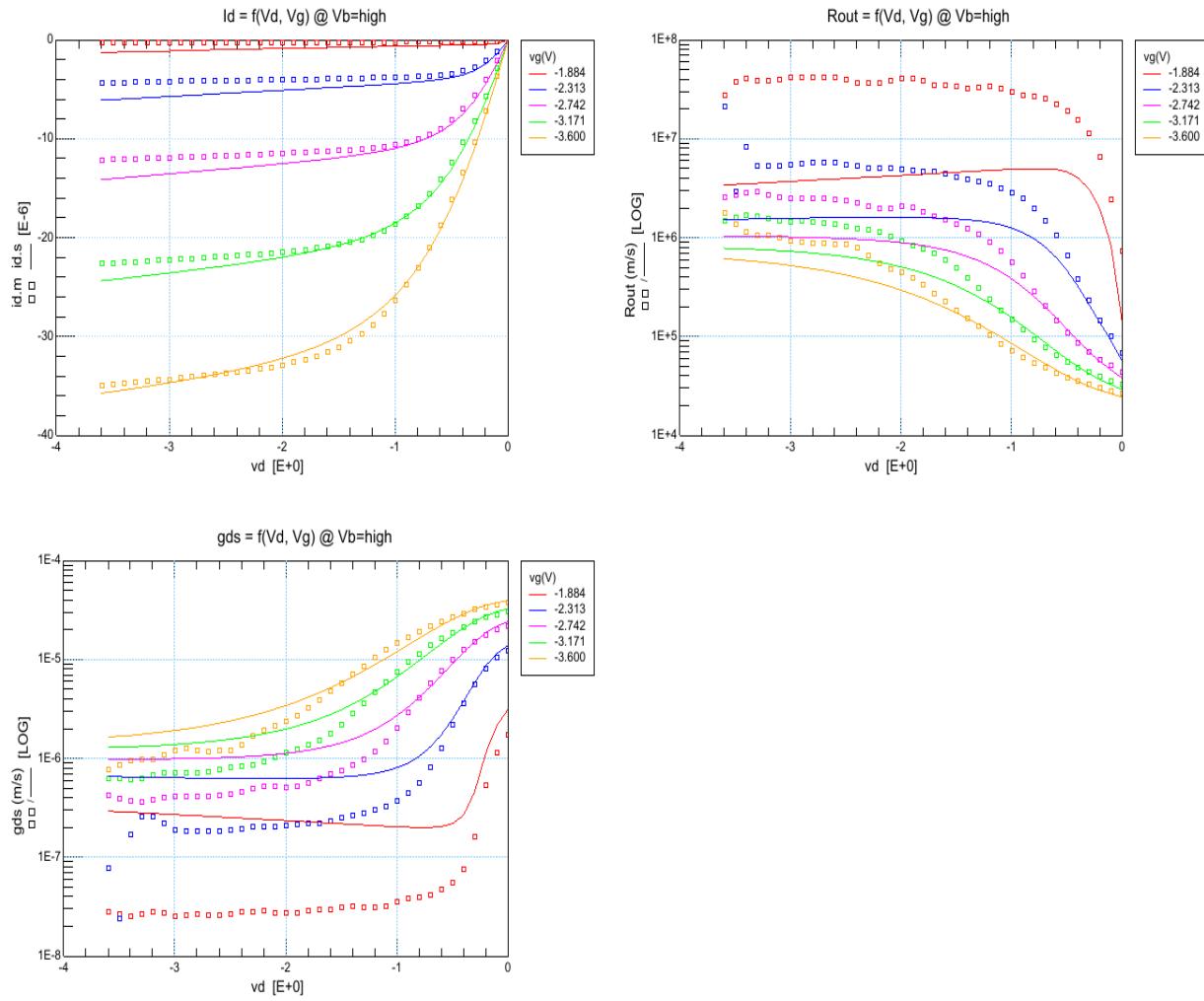
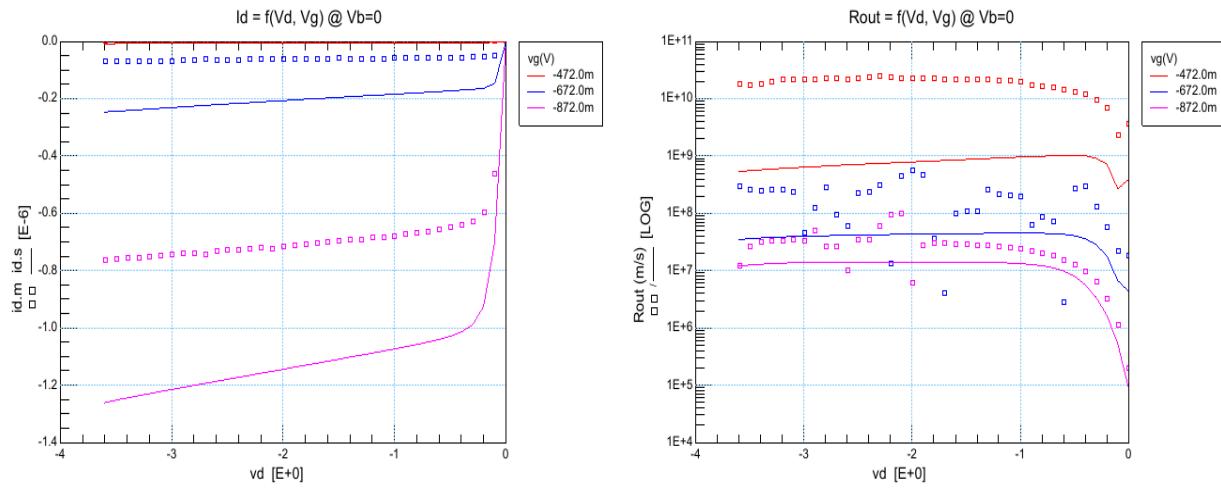


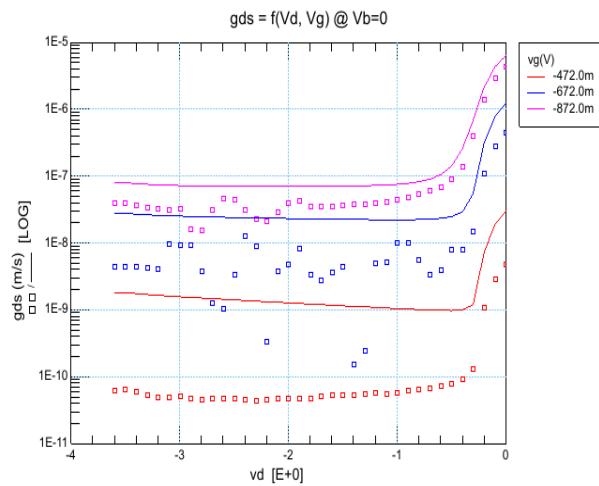


$i_{dvg}, I_b, I_g, V_b = 0V, T = 27^\circ C$

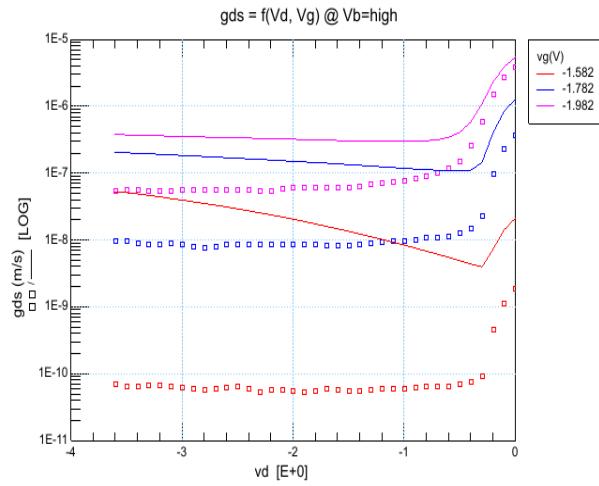
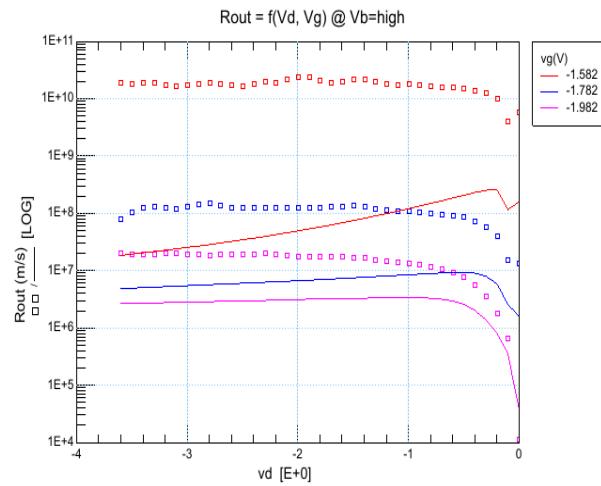
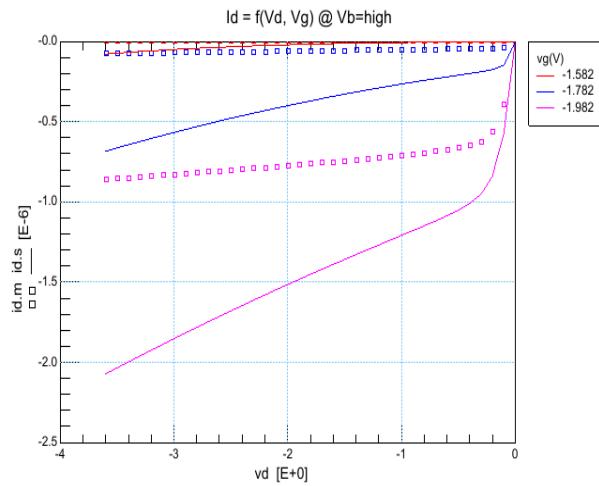


idvg, Ib,Ig, Vb = 3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = 3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


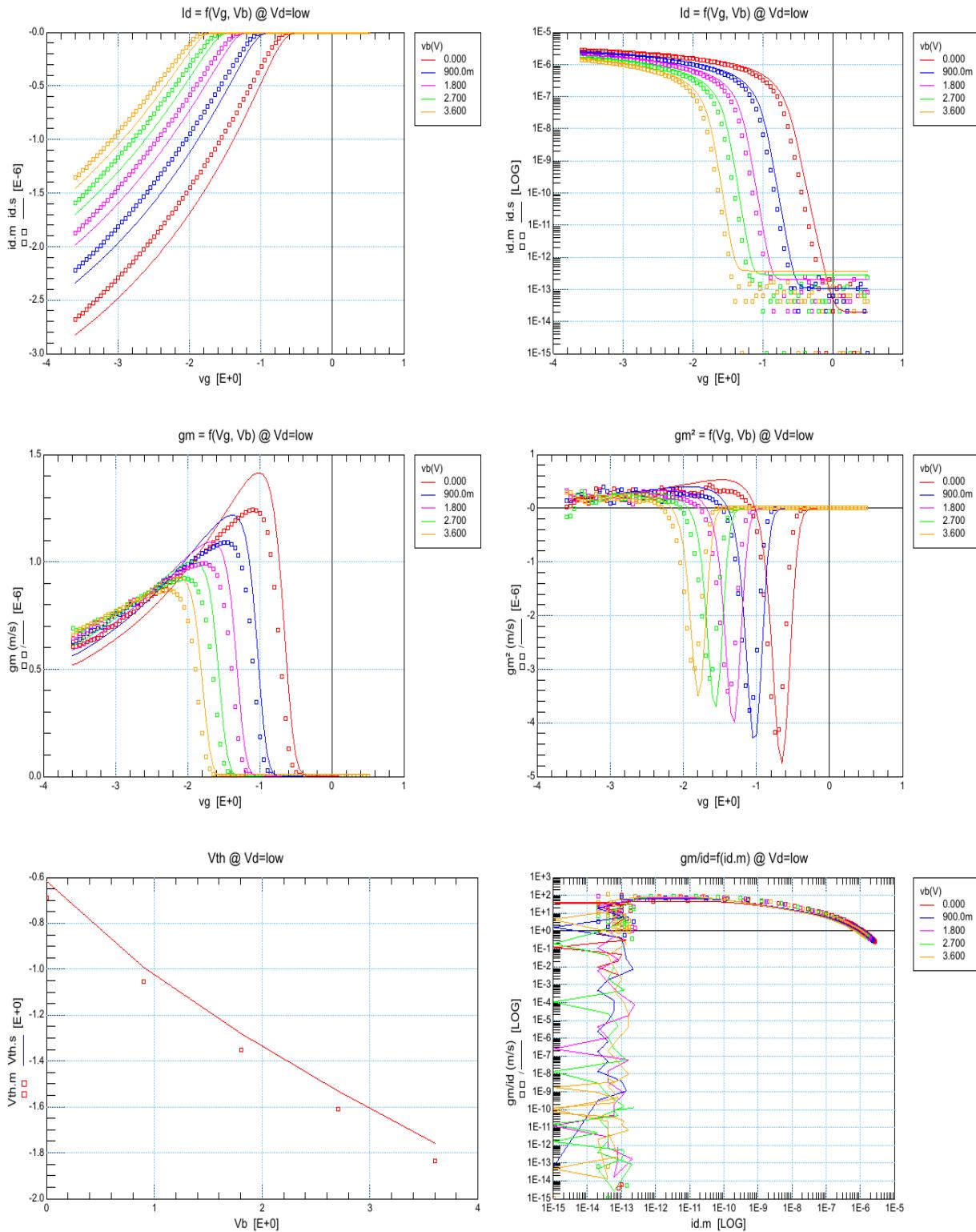


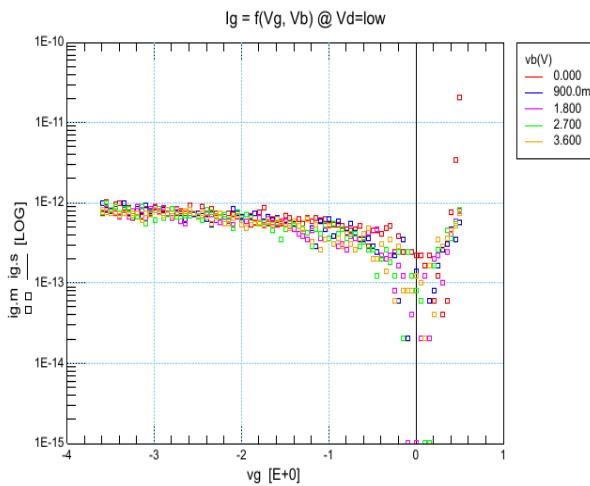
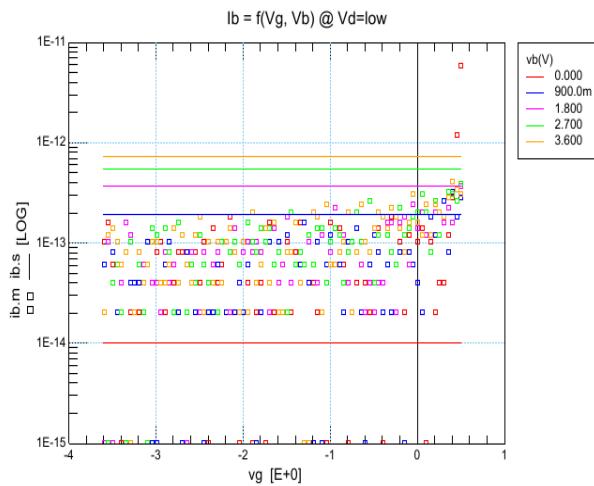
idvd_vth_vbmin, Vb = 3.6V, T = 27°C



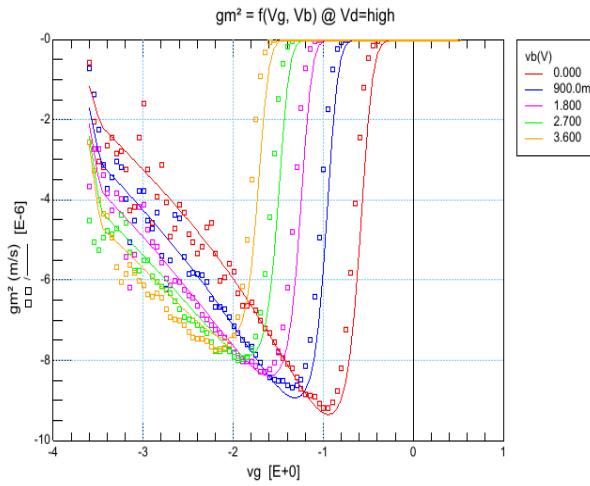
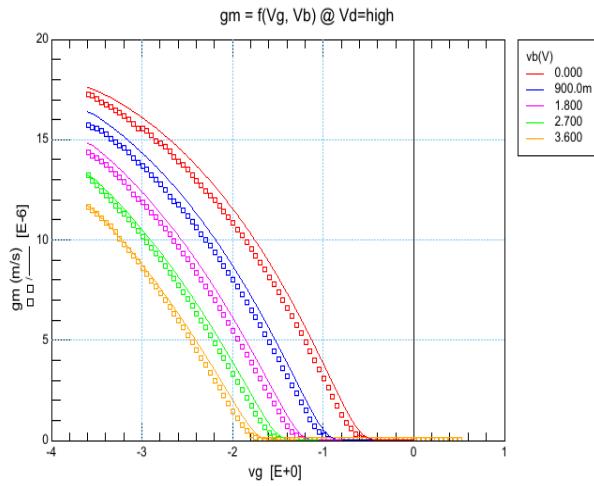
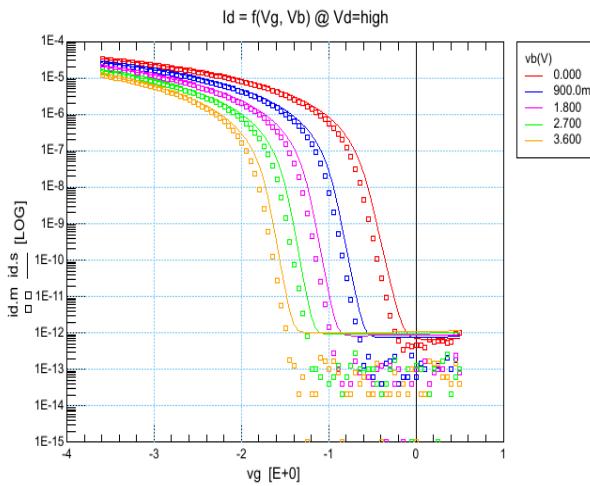
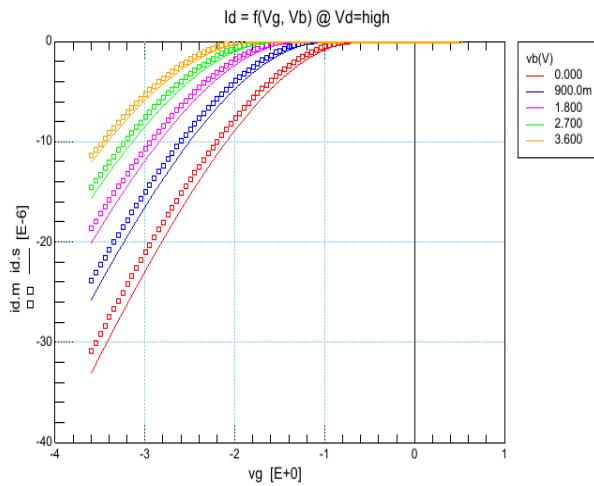
4.15 W0u3_L1u2_S565_5

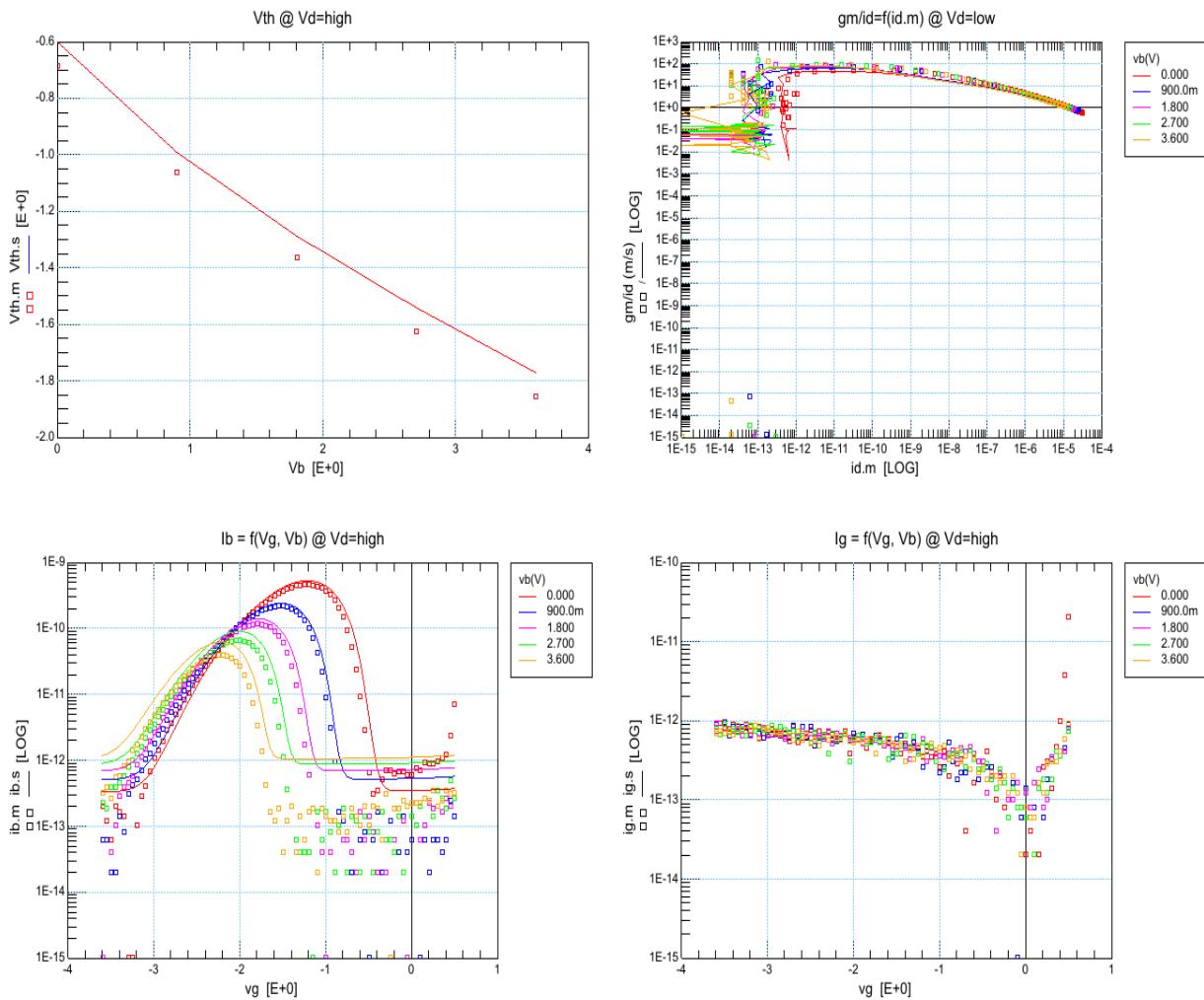
$idvg, Vd = -0.1V, T = 27^\circ C$



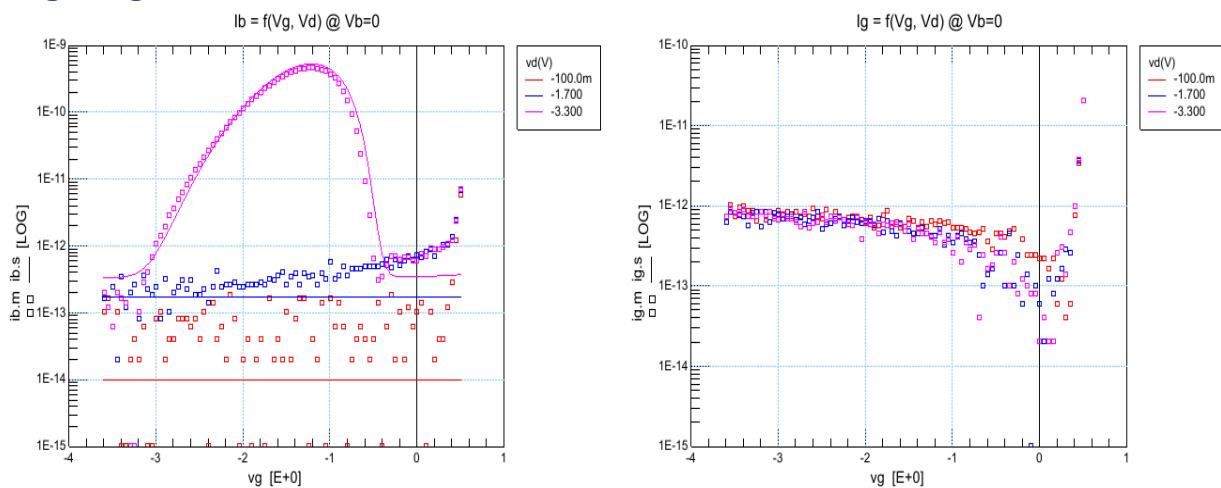


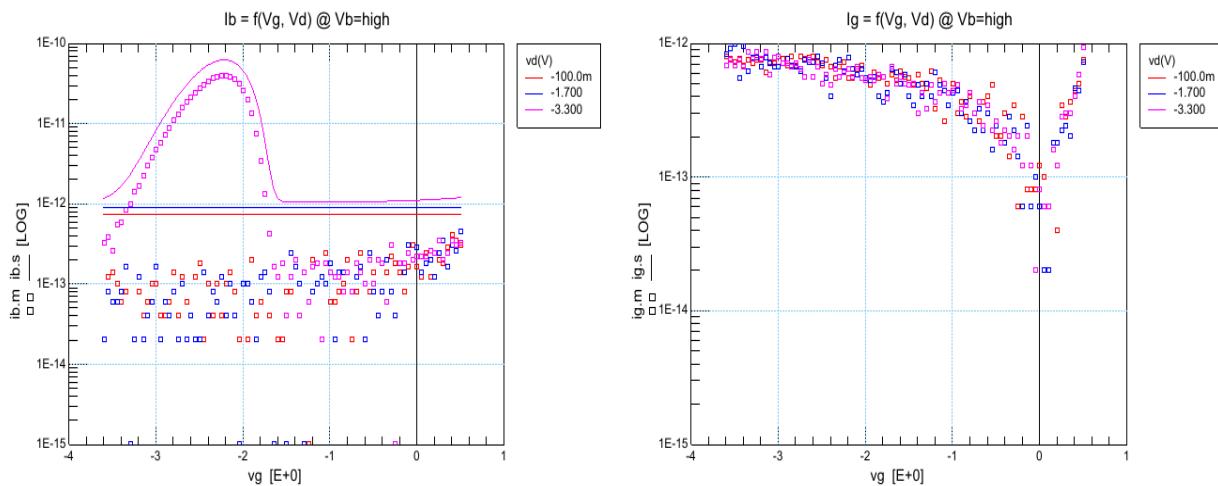
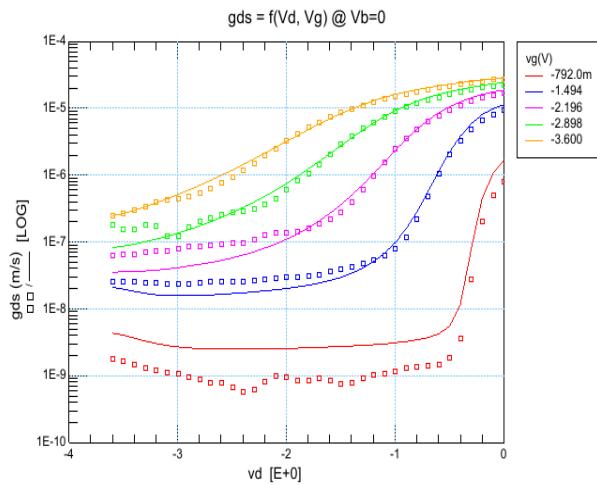
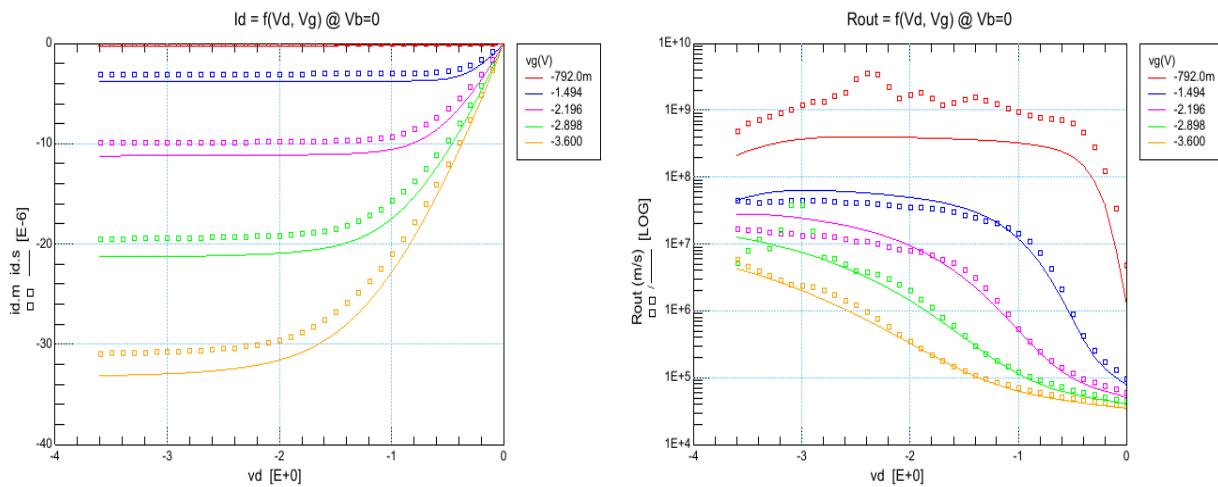
$i_{dvg}, V_d = -3.3V, T = 27^\circ\text{C}$

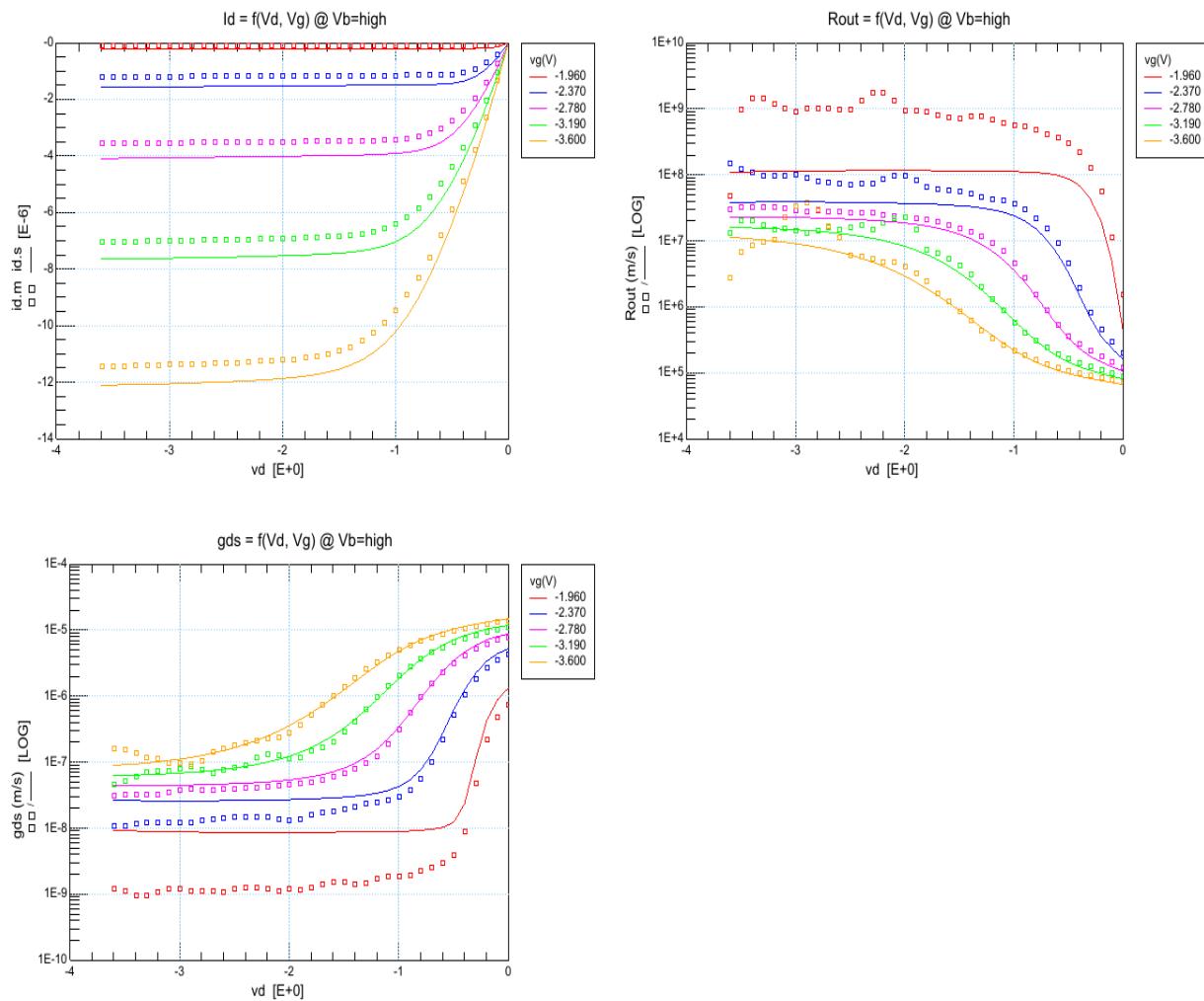
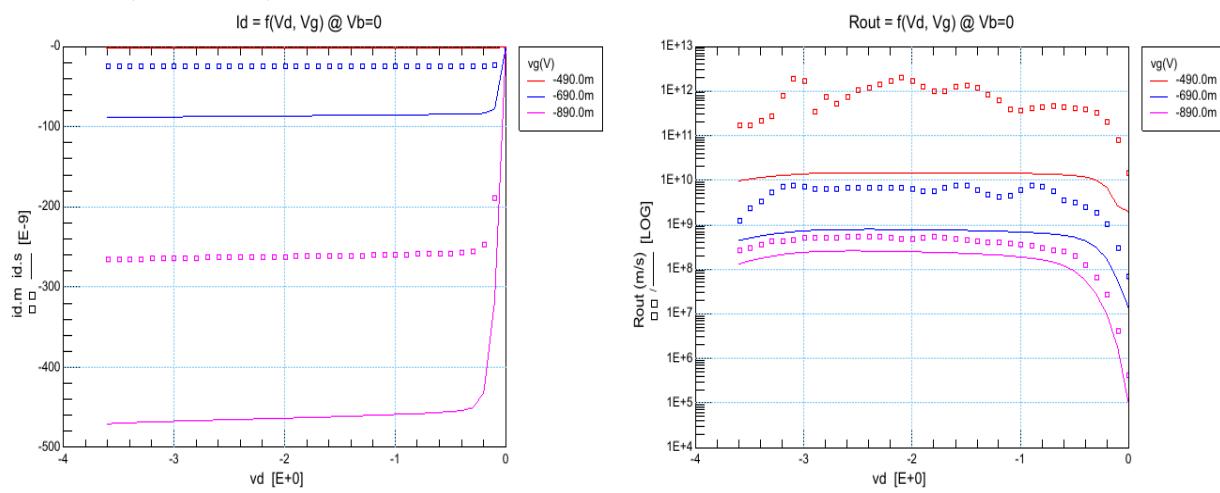


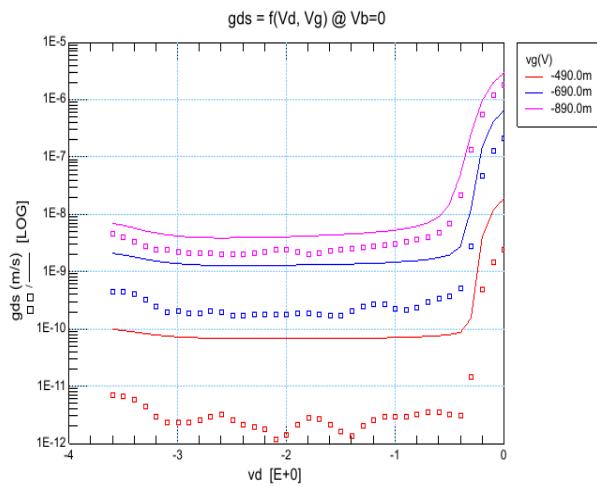


$id_{vg}, Id, Ig, Vb = 0V, T = 27^\circ C$

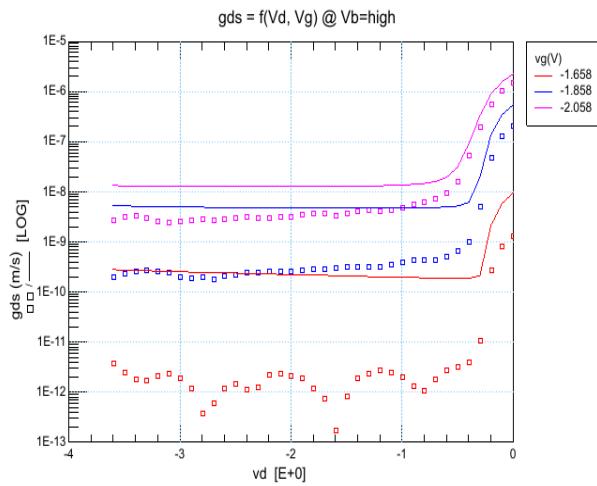
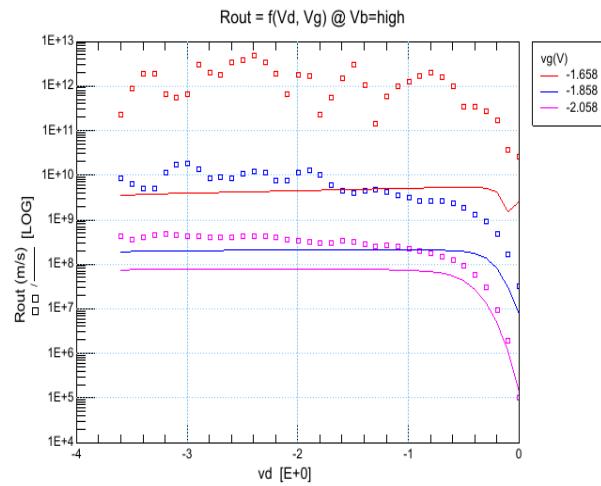
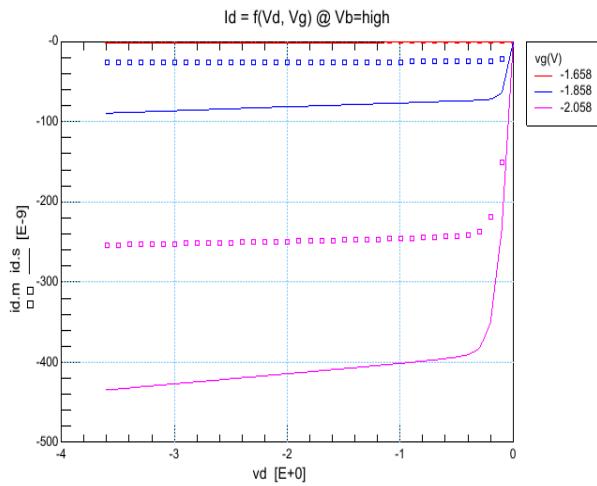


idvg, Ib,Ig, Vb = 3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


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

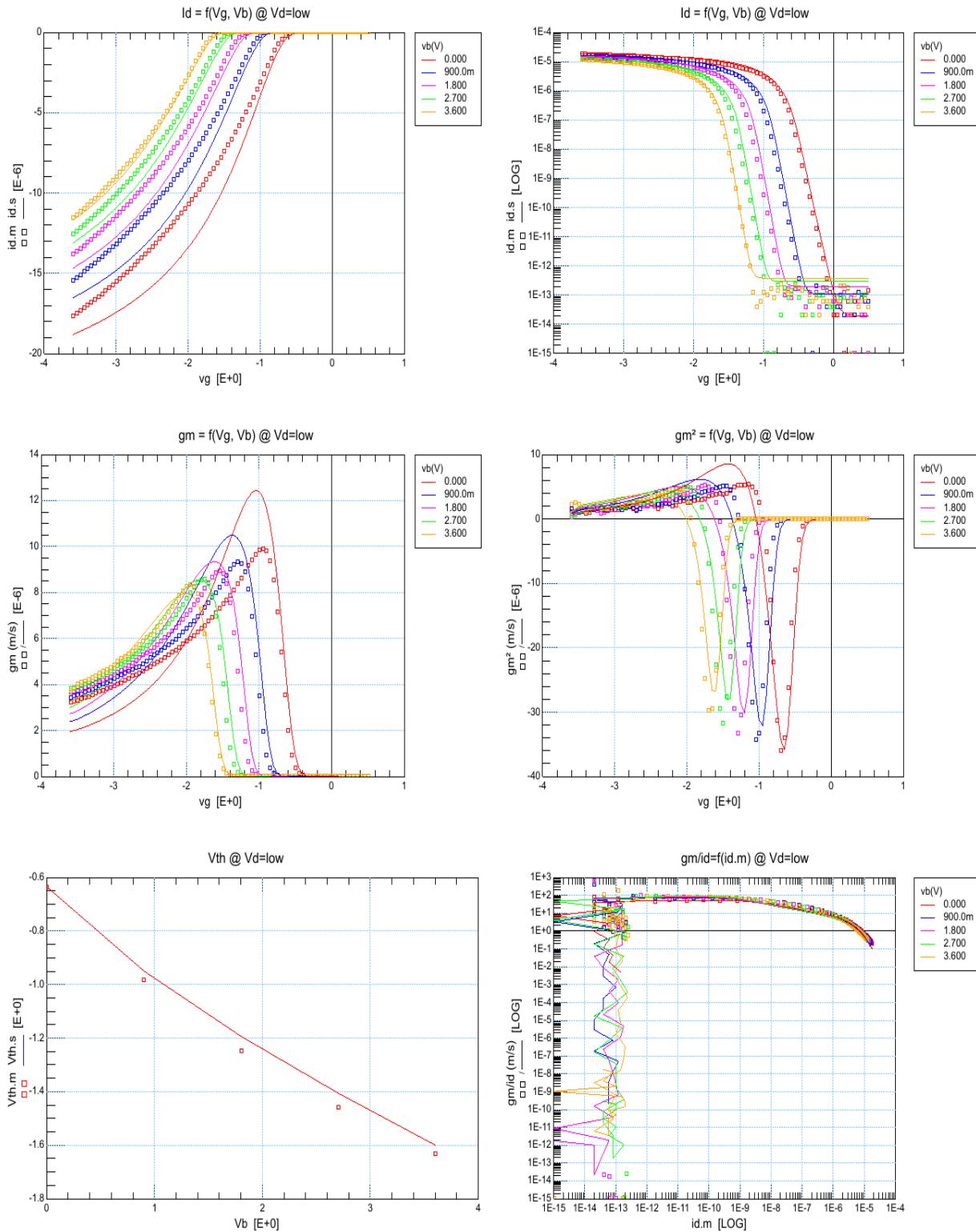


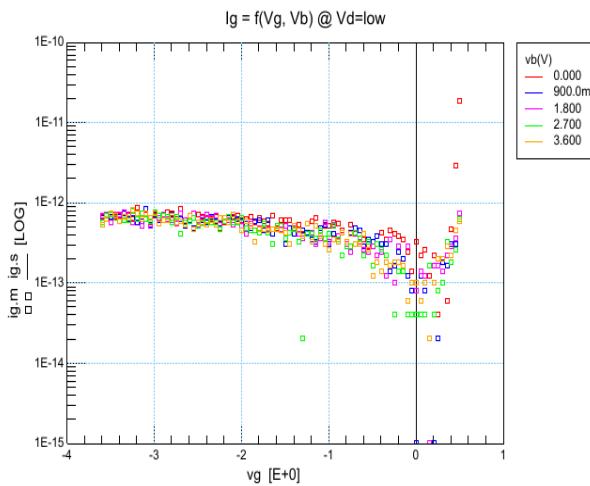
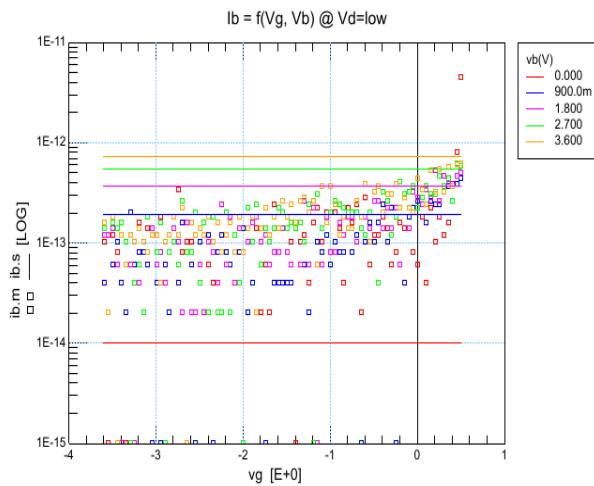
idvd_vth_vbmin, Vb = 3.6V, T = 27°C



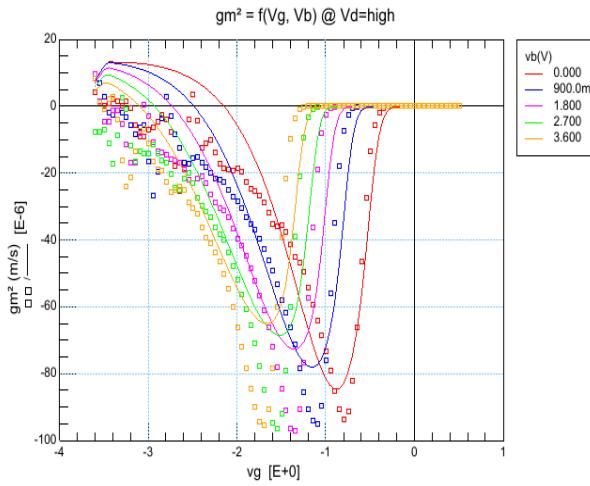
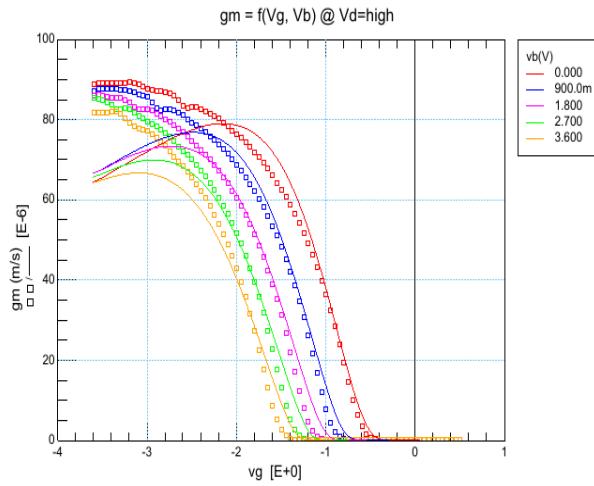
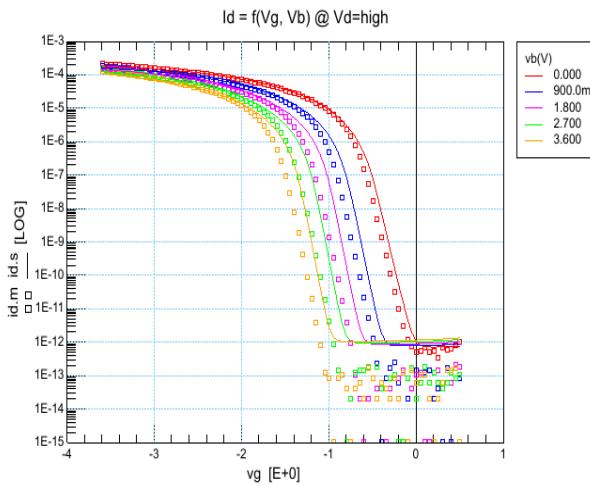
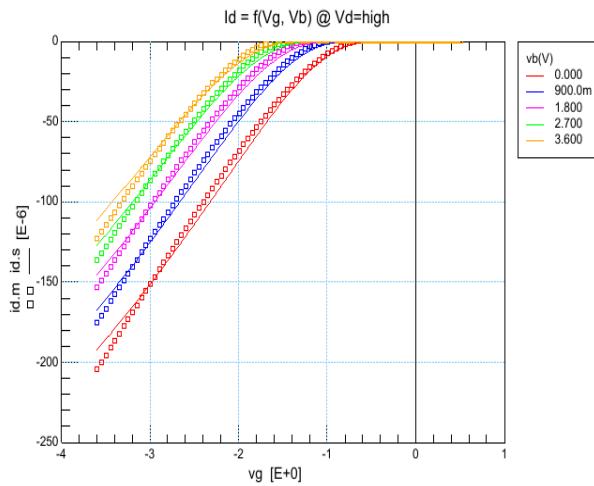
4.16 W0u6_L0u35_S564_2

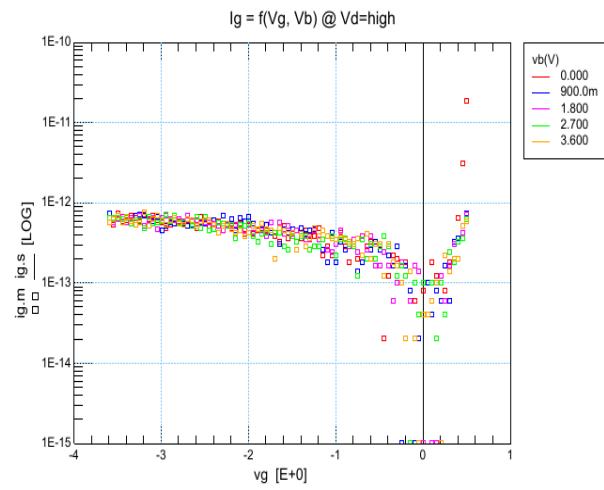
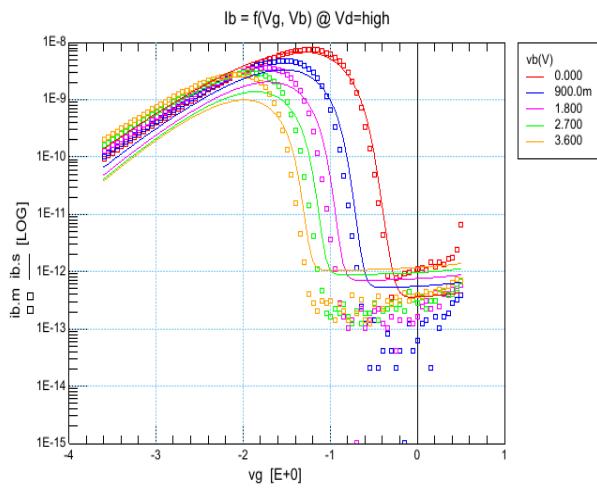
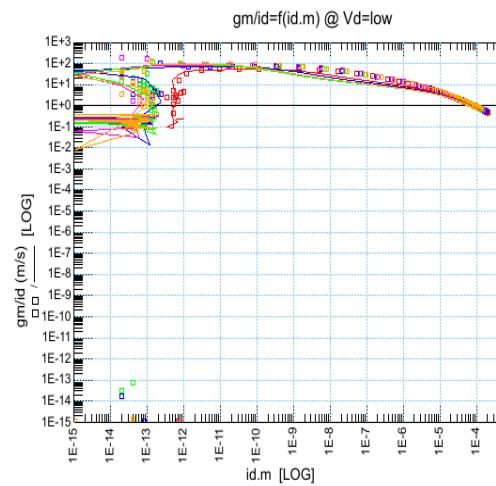
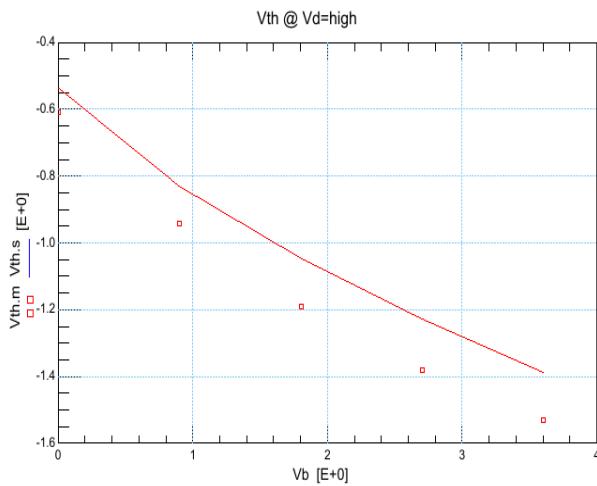
$idvg$, $Vd = -0.1V$, $T = 27^\circ C$



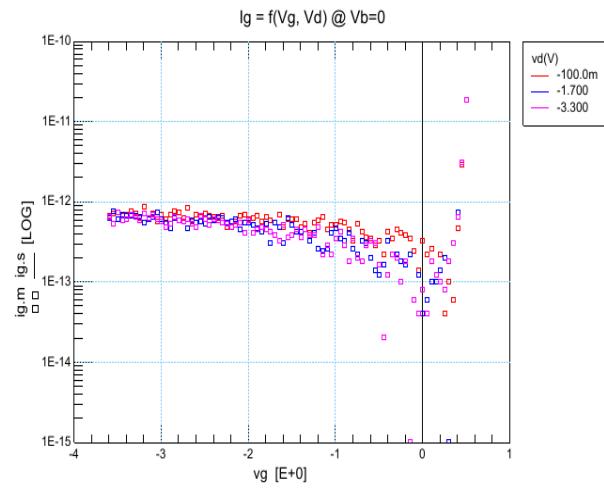
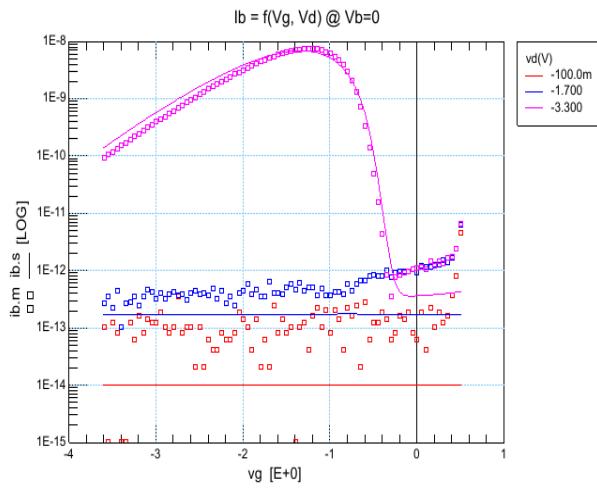


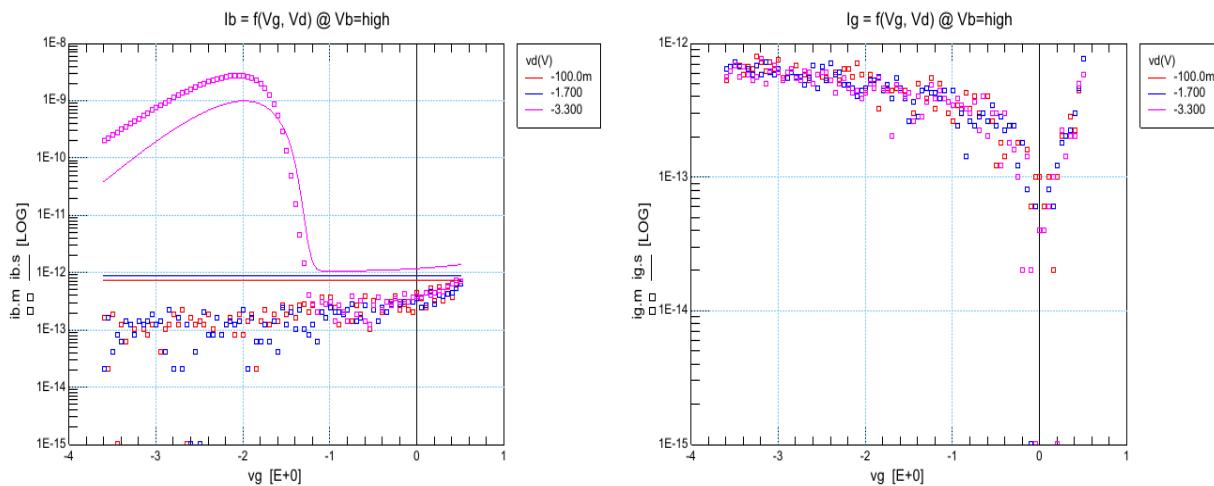
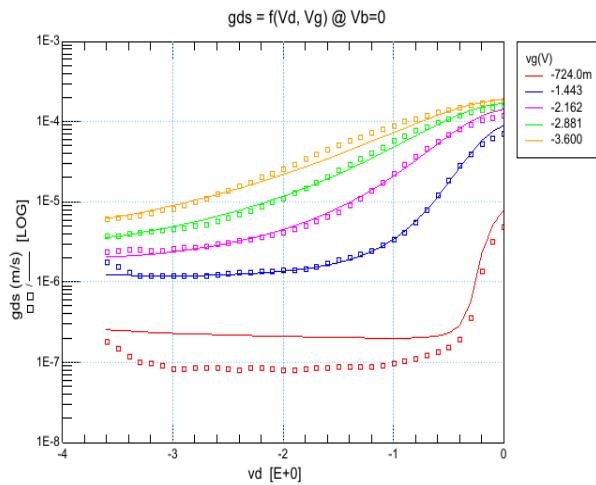
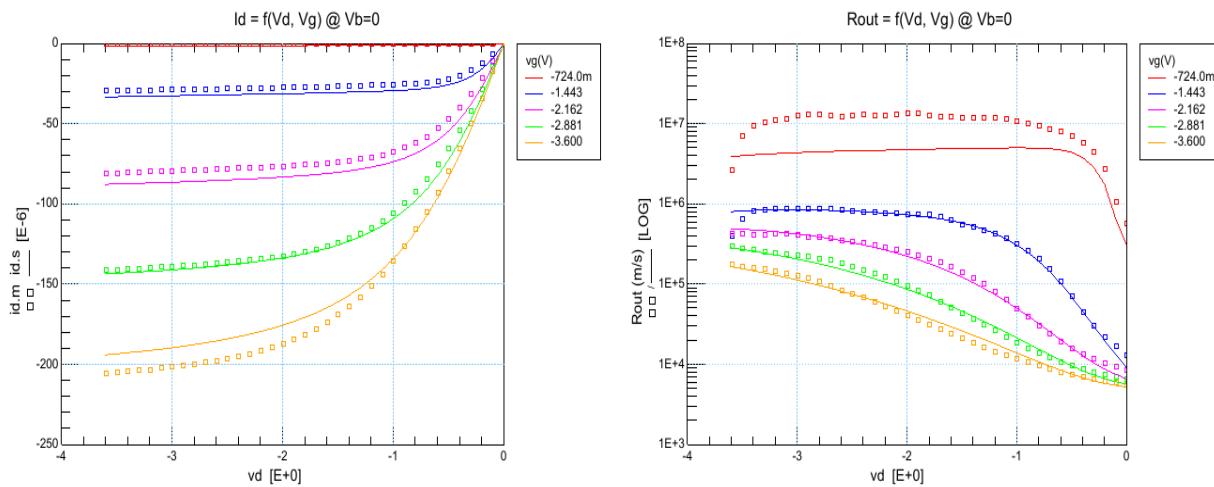
$i_{dvg}, V_d = -3.3V, T = 27^\circ\text{C}$

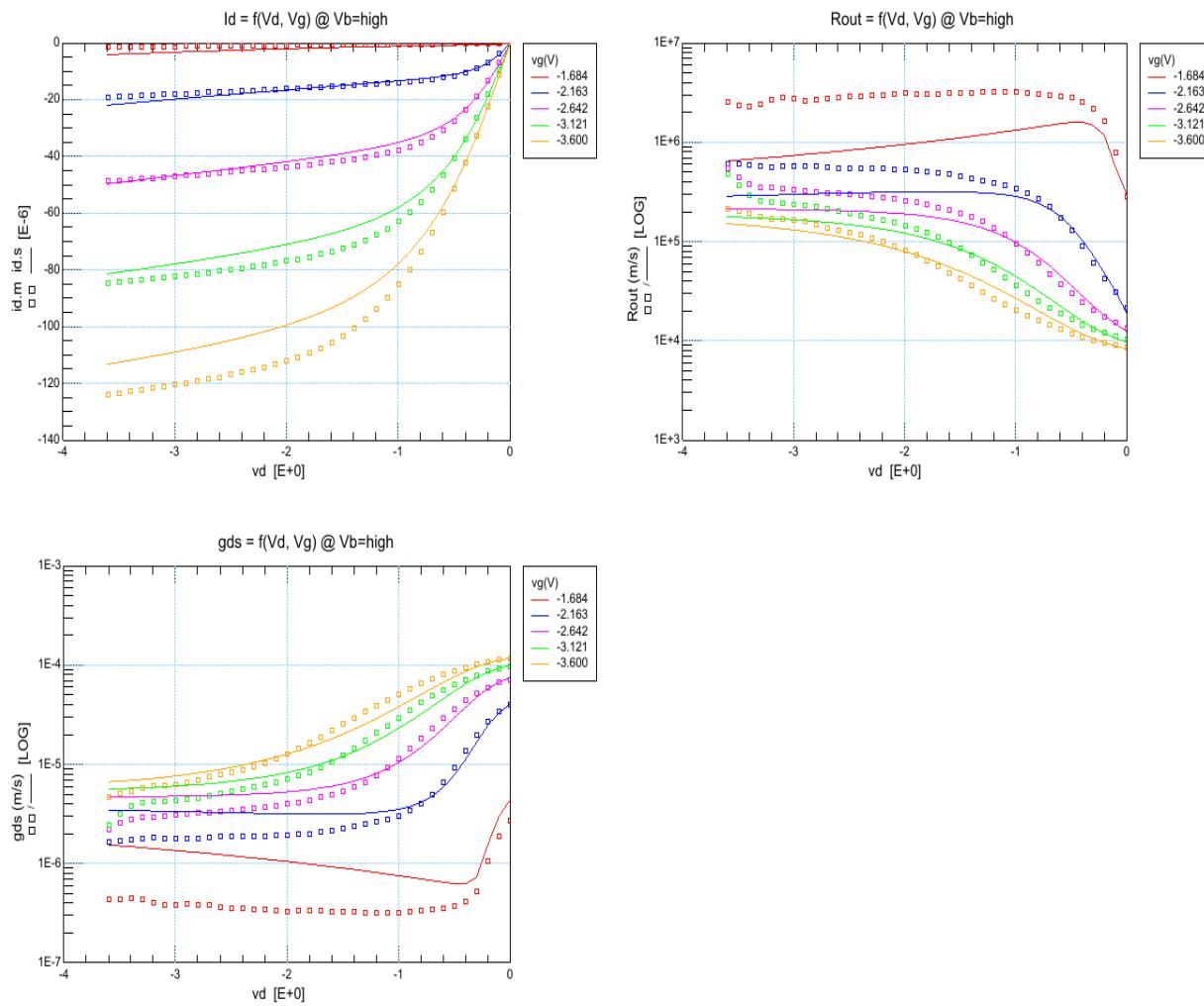
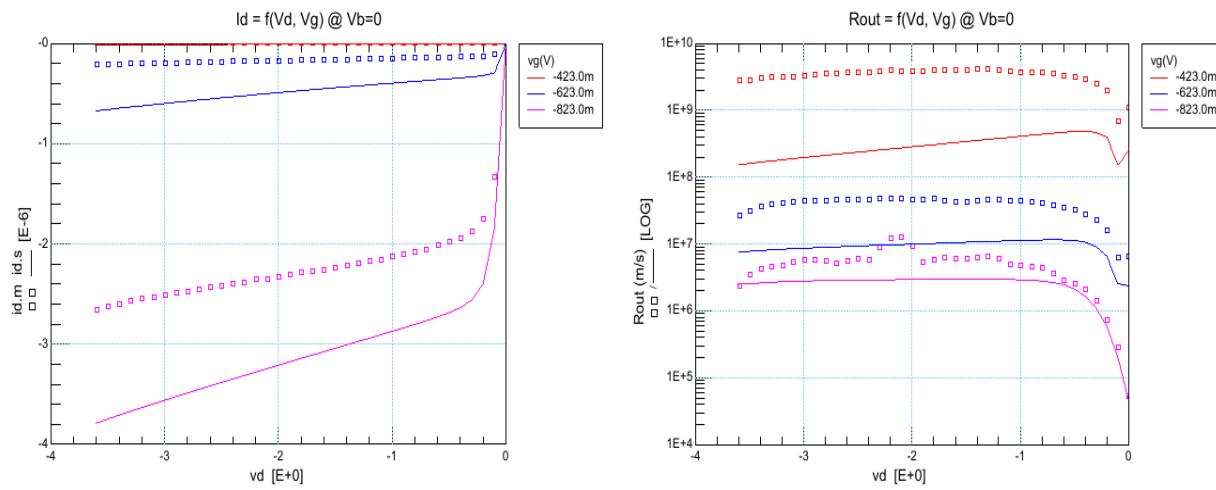


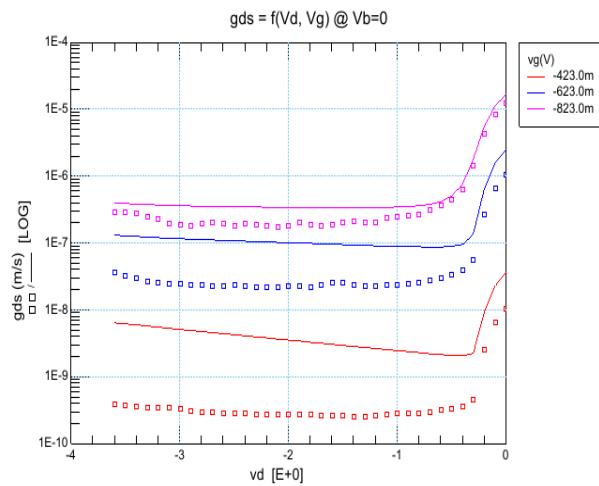


idvg, lb, lg, Vb = 0V, T = 27°C

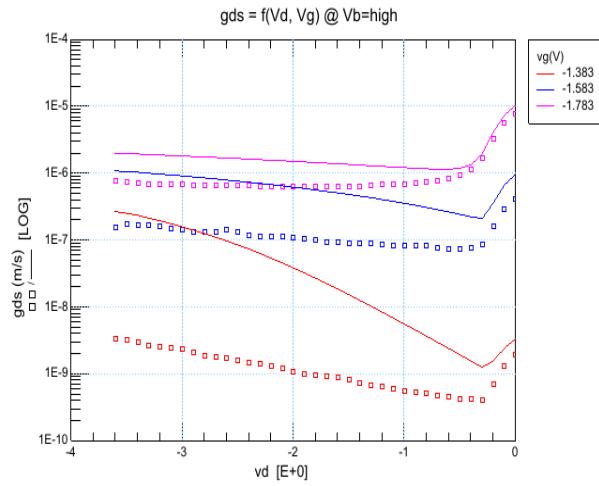
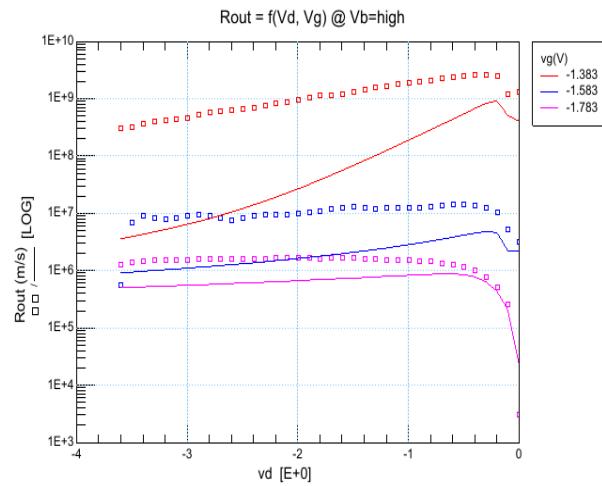
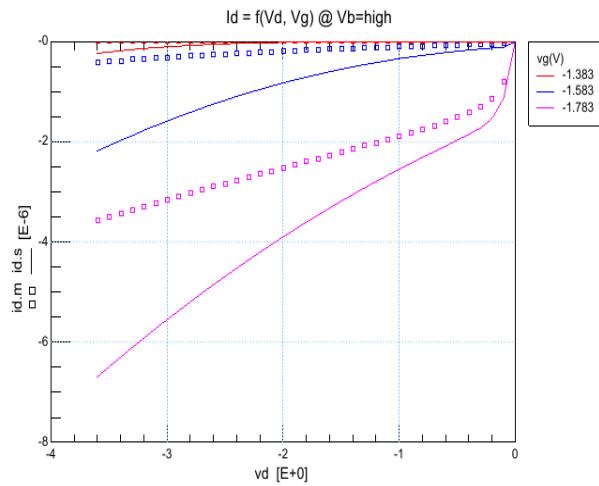


idvg, Ib,Ig, Vb = 3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


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

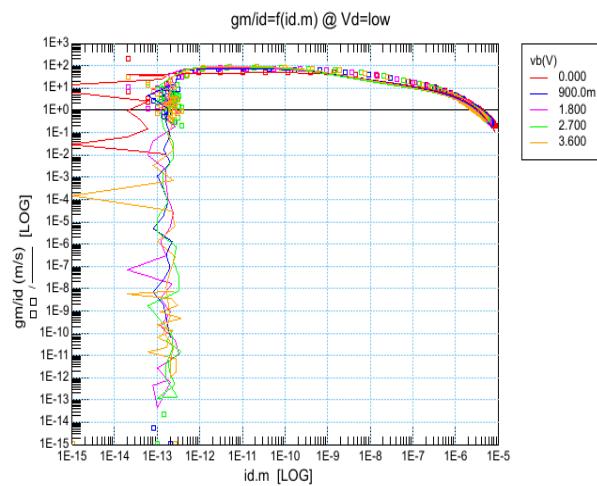
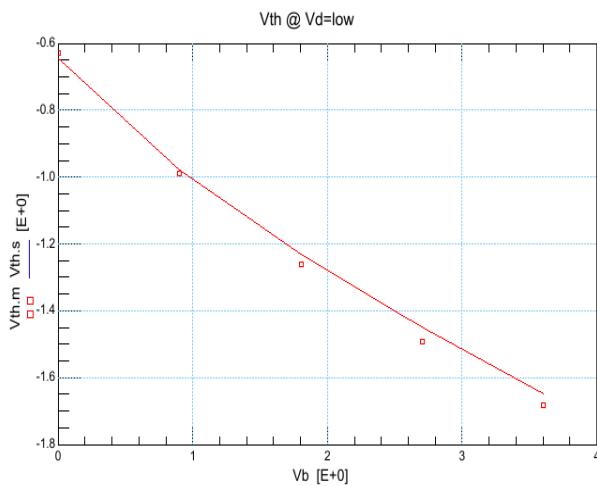
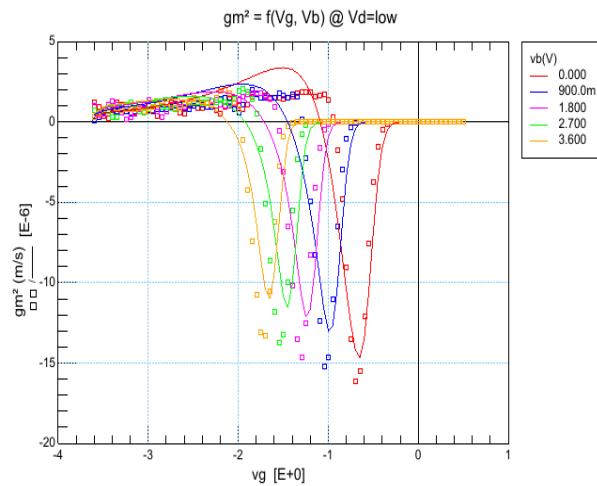
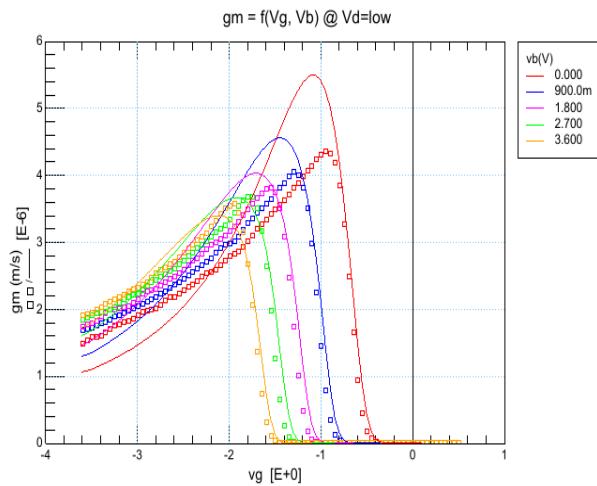
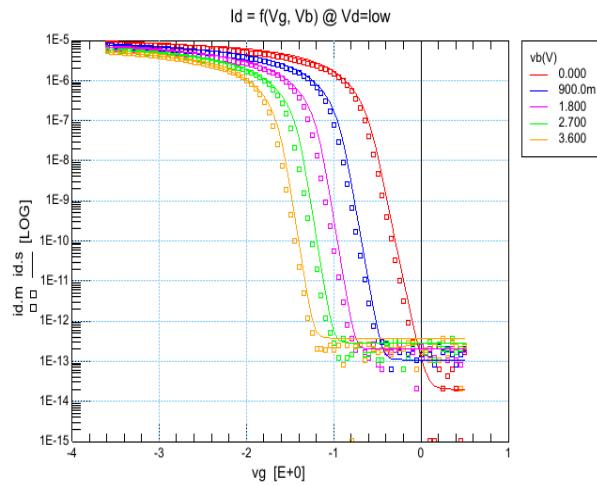
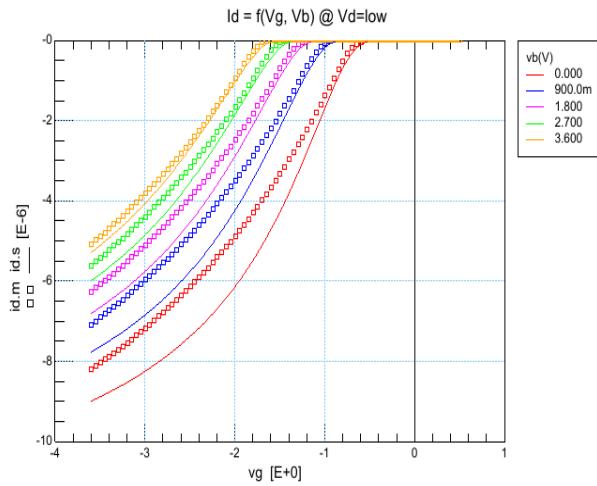


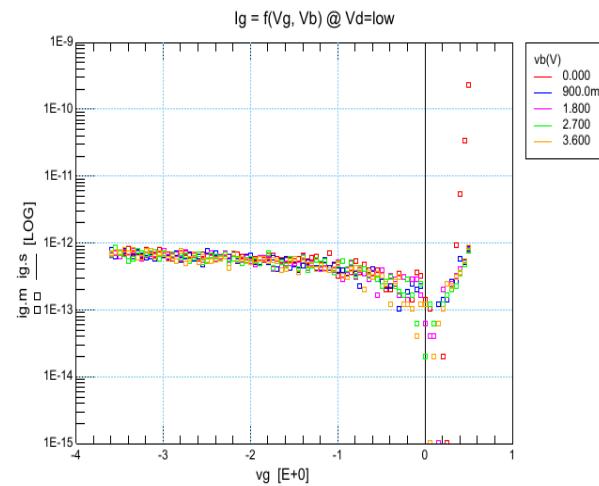
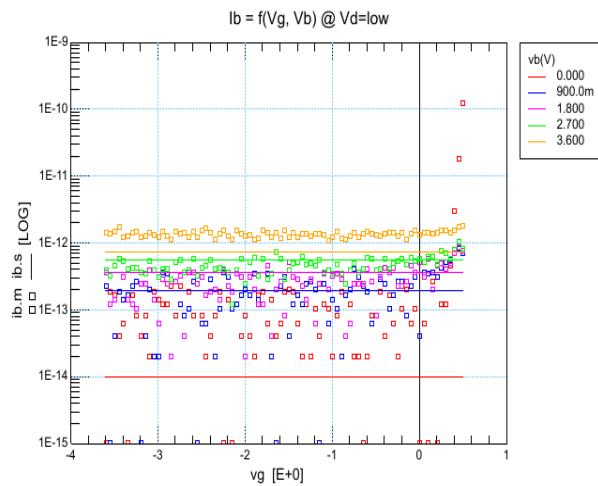
idvd_vth_vbmin, Vb = 3.6V, T = 27°C



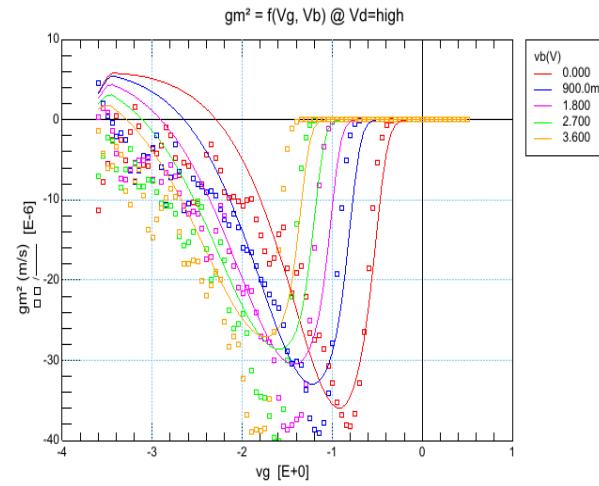
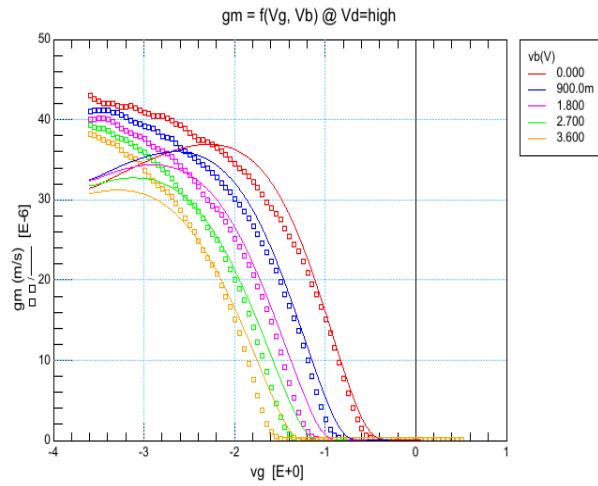
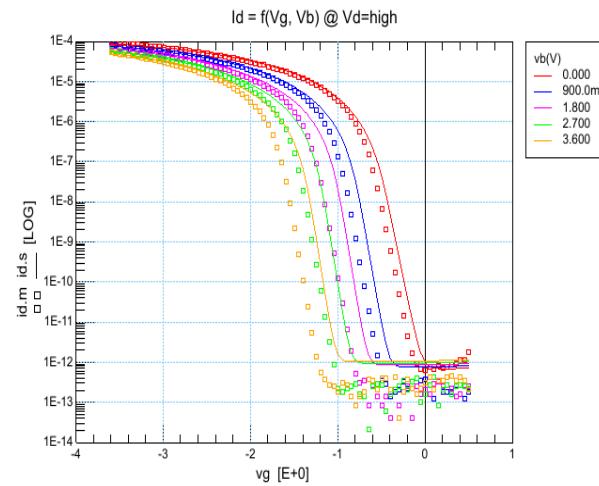
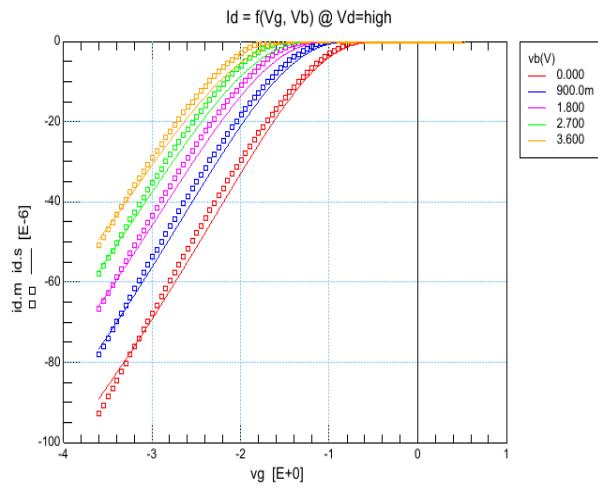
4.17W0u3_L0u4_T356_S385M_3

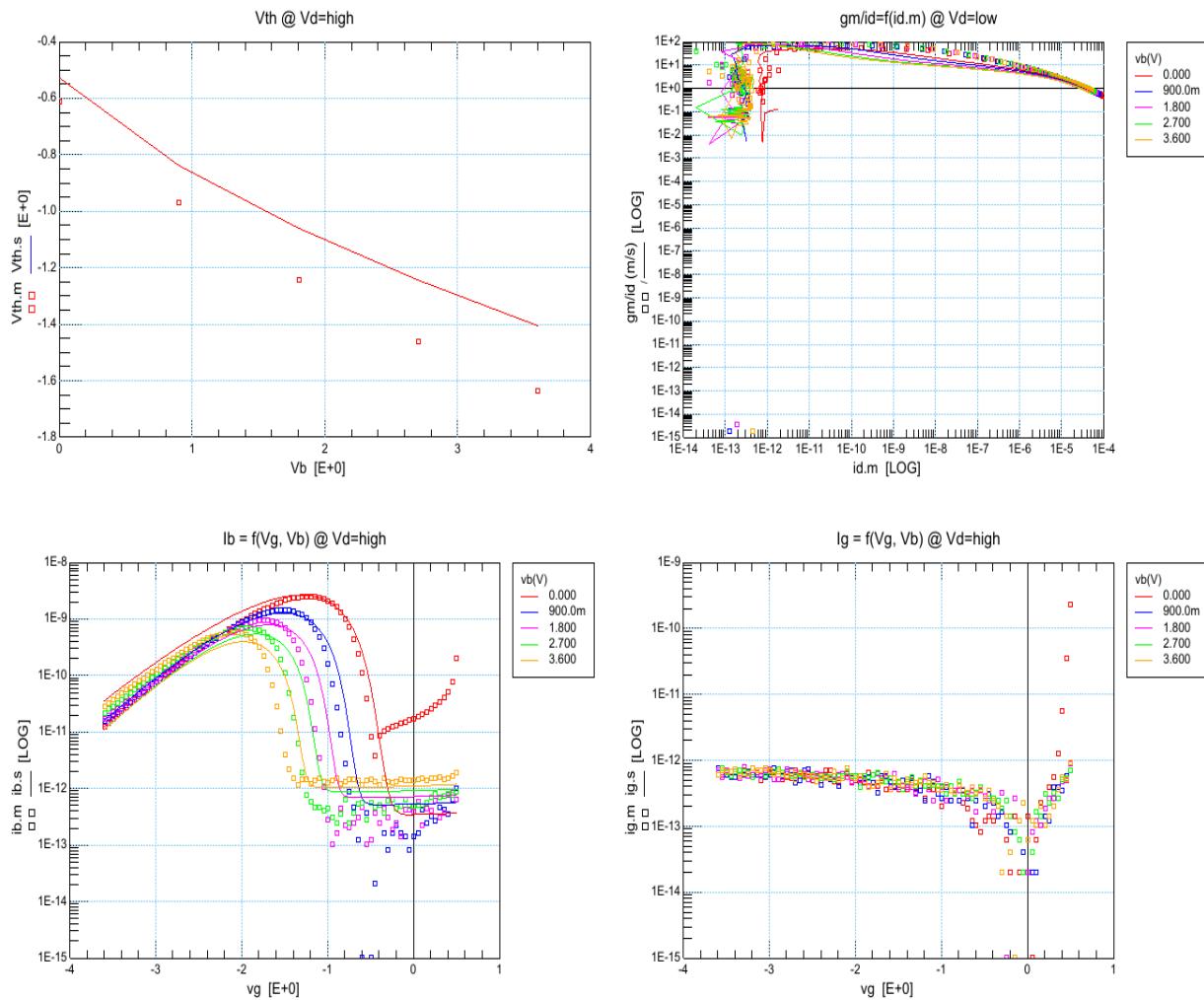
$idvg$, $Vd = -0.1V$, $T = 27^\circ C$



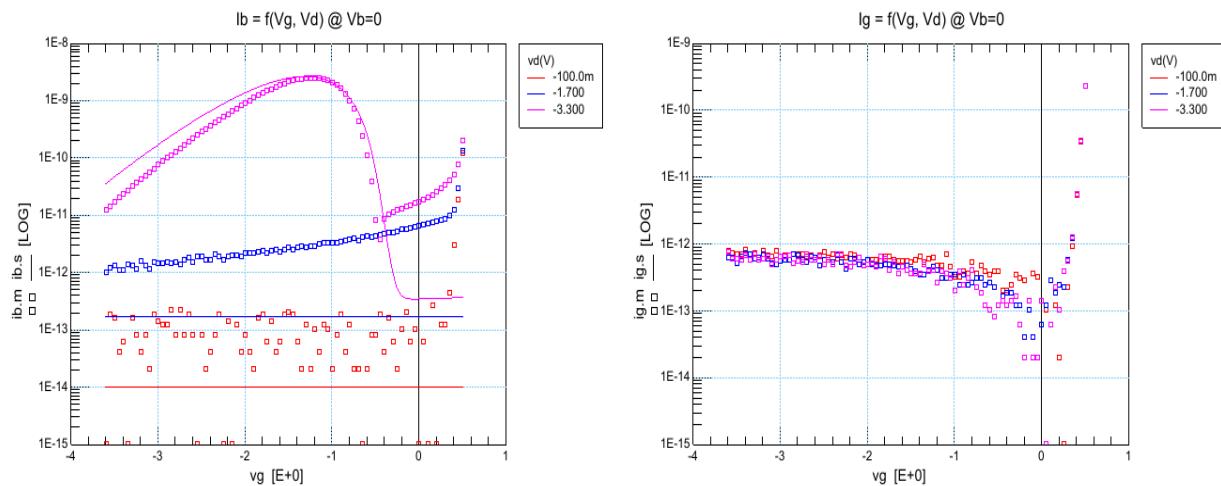


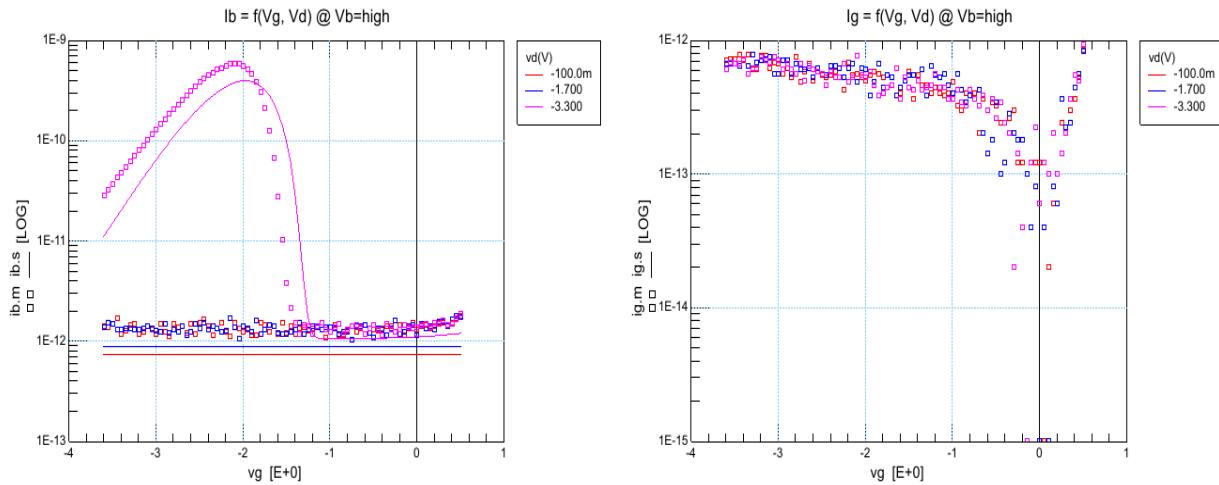
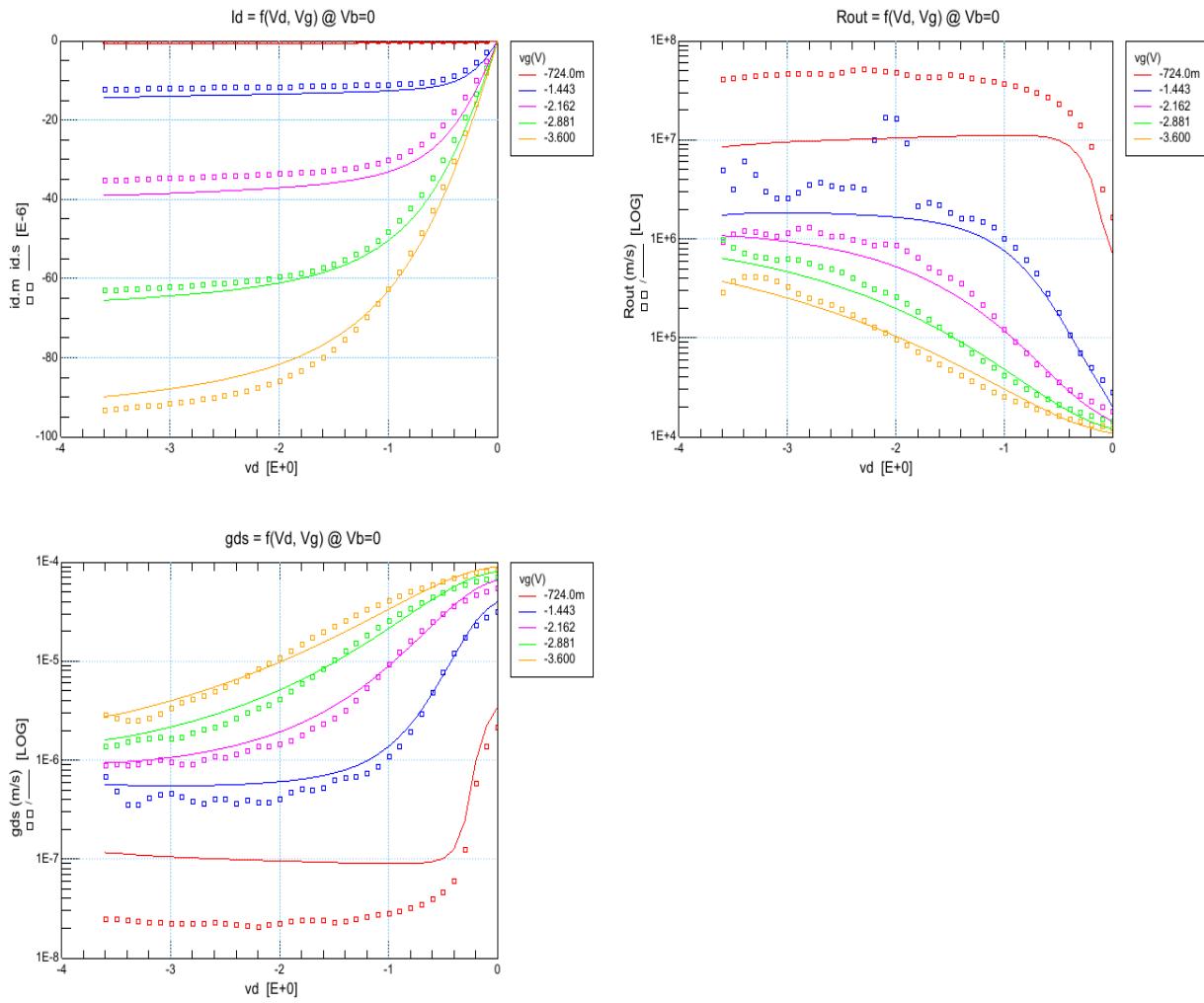
$i_{dvg}, V_d = -3.3V, T = 27^\circ\text{C}$

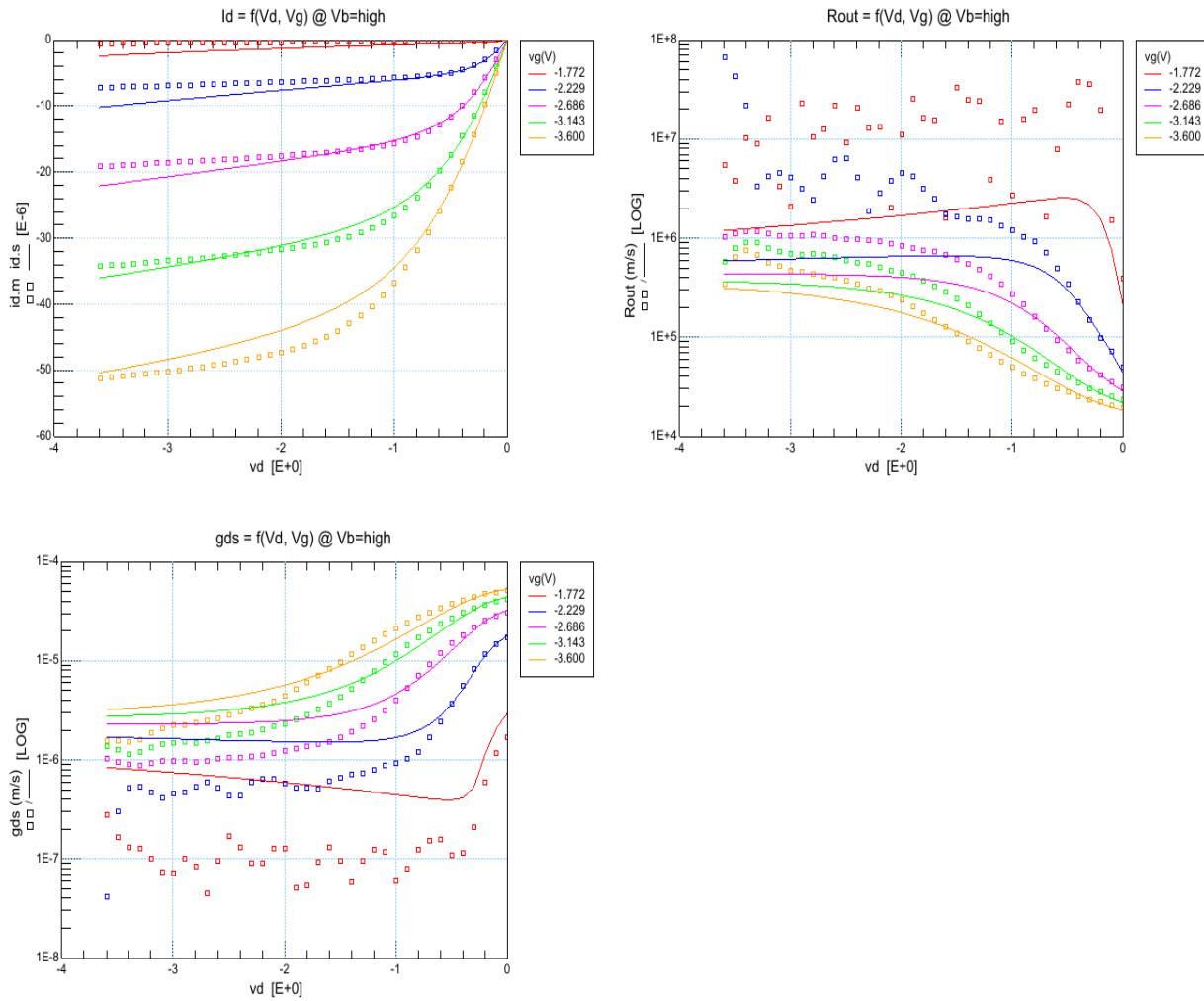
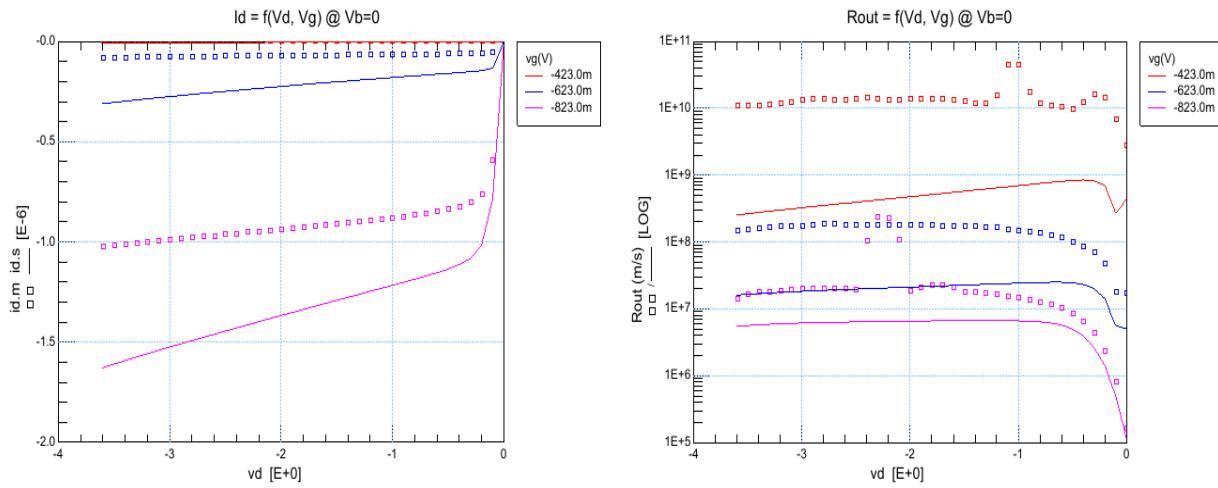


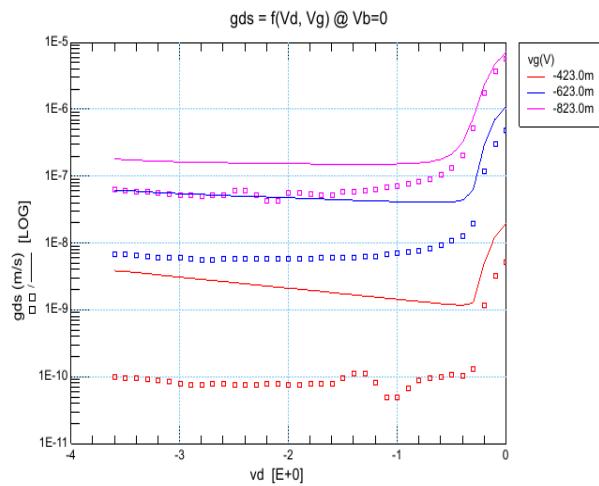


idvg, Ib,Ig, Vb = 0V, T = 27°C

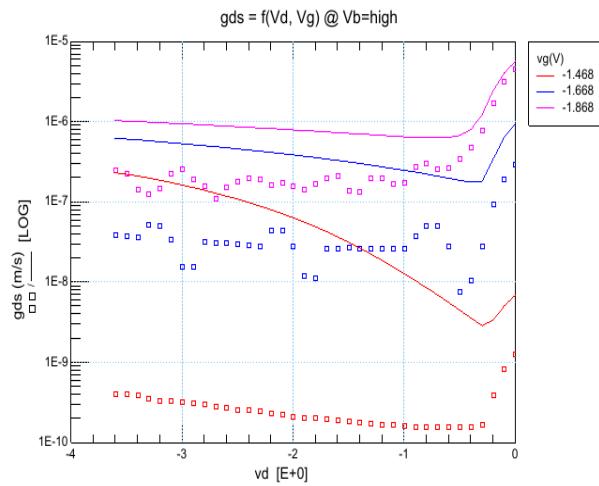
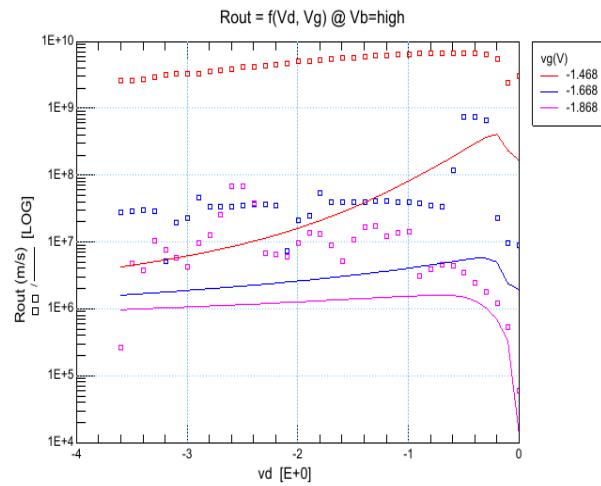
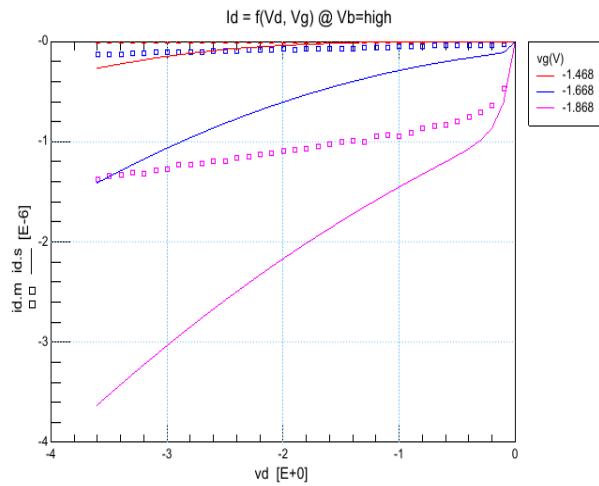


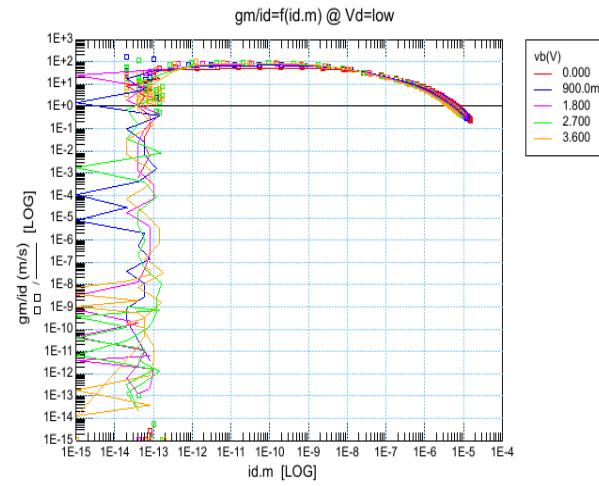
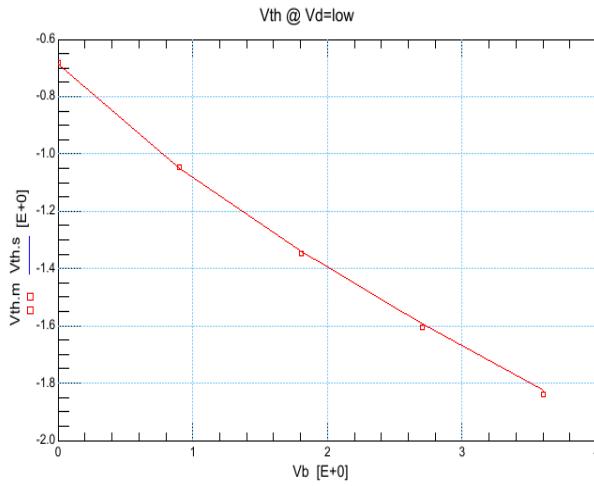
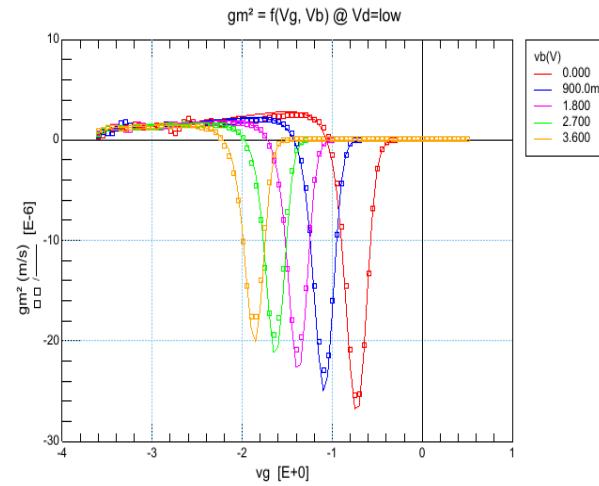
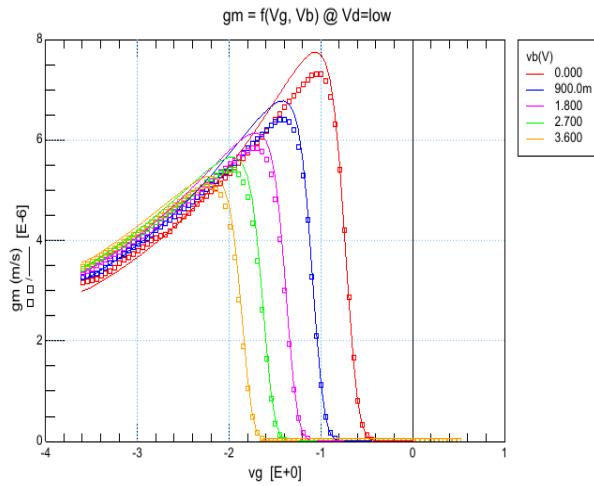
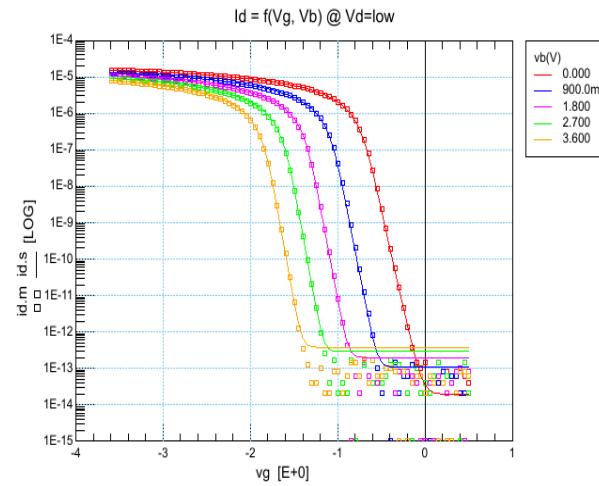
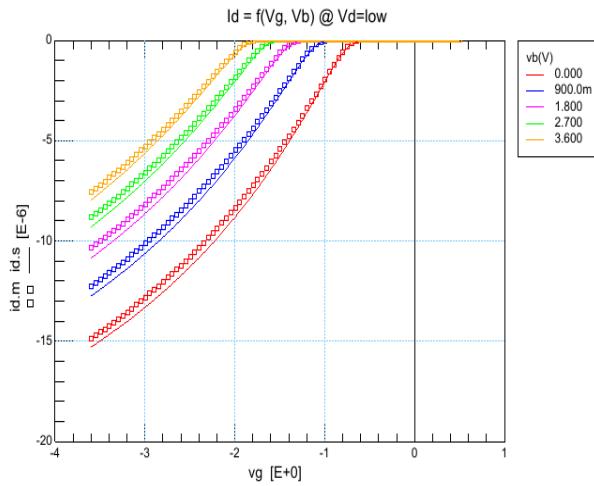
idvg, Ib,Ig, Vb = 3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


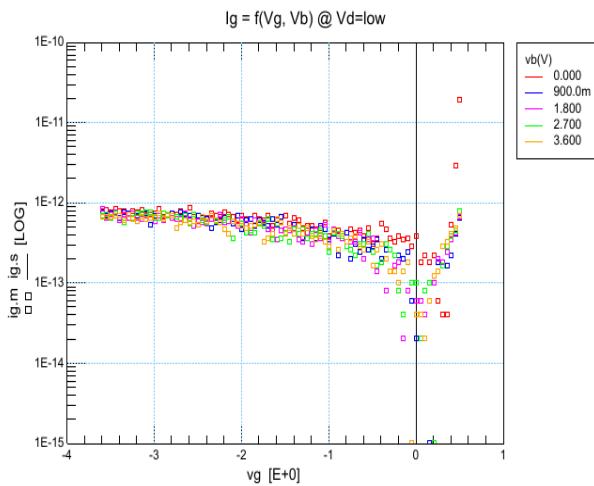
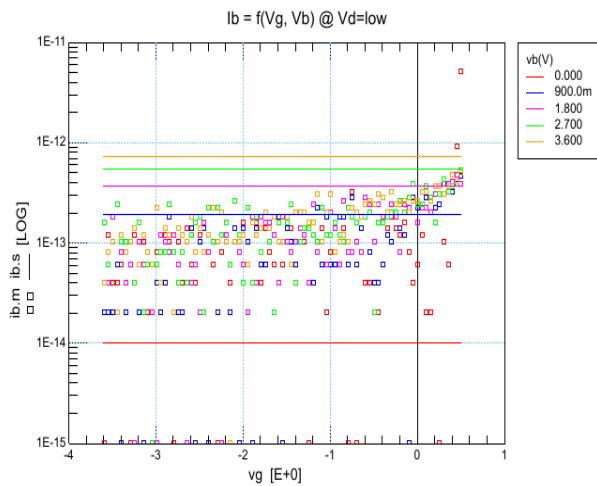
idvd_vbmin, Vb = 3.6V, T = 27°C**idvd_vth, Vb = 0V, T = 27°C**



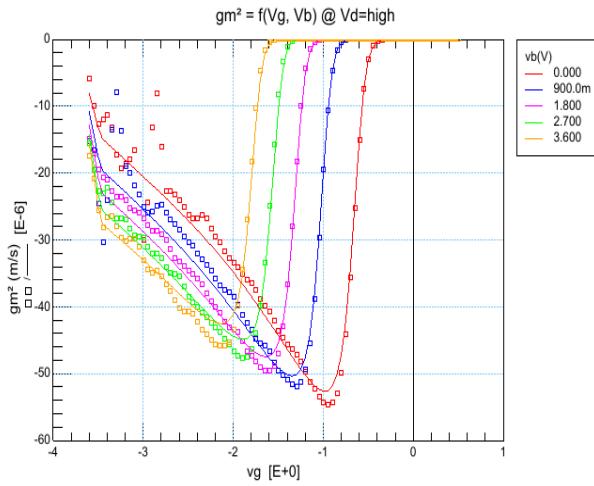
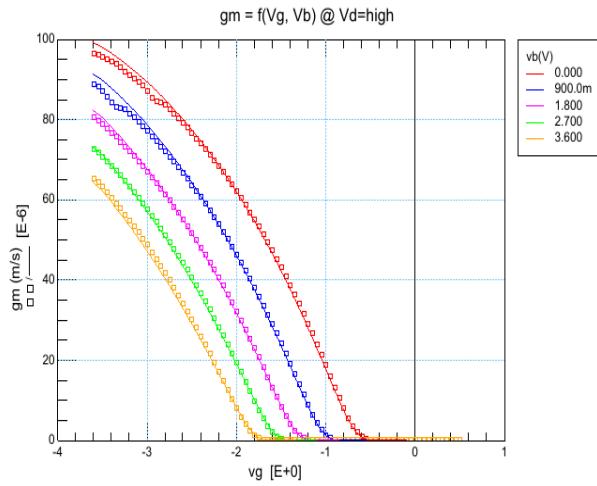
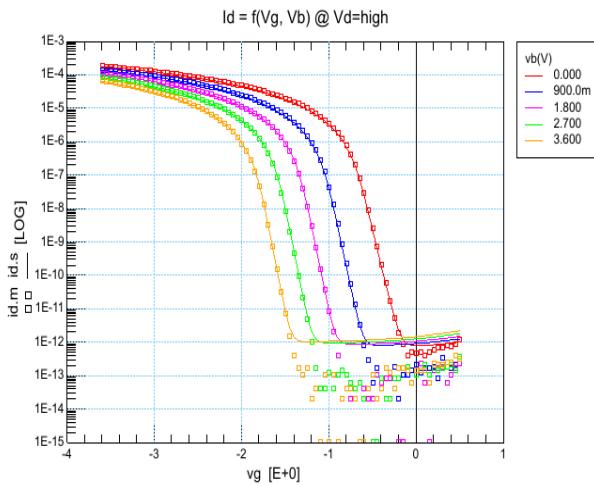
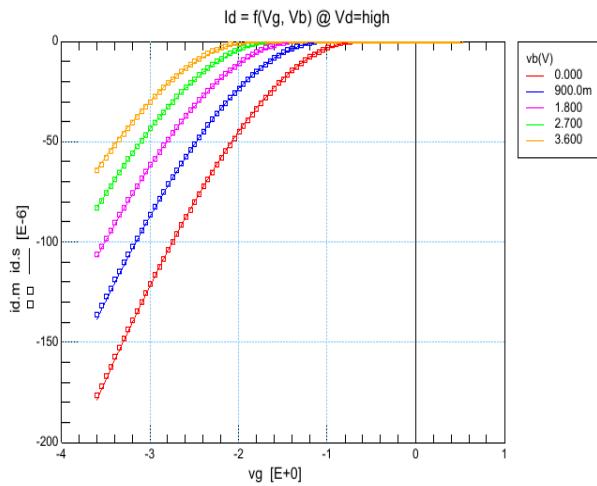
idvd_vth_vbmin, Vb = 3.6V, T = 27°C

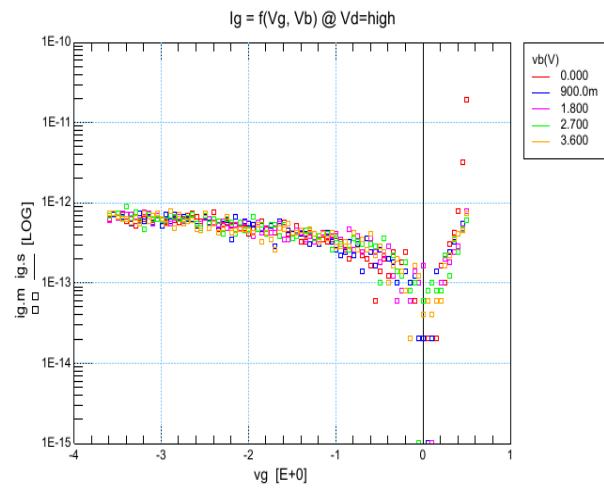
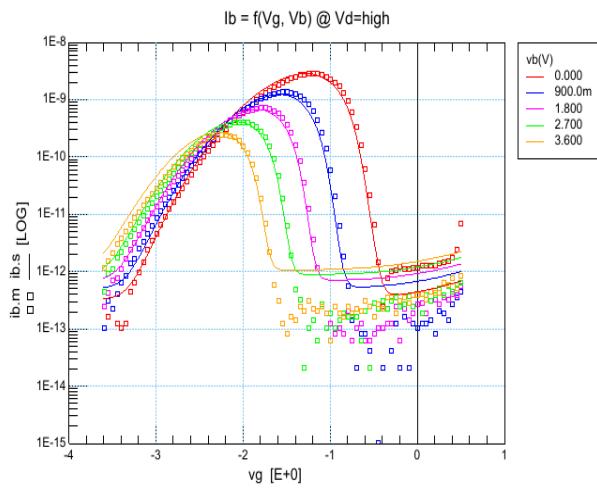
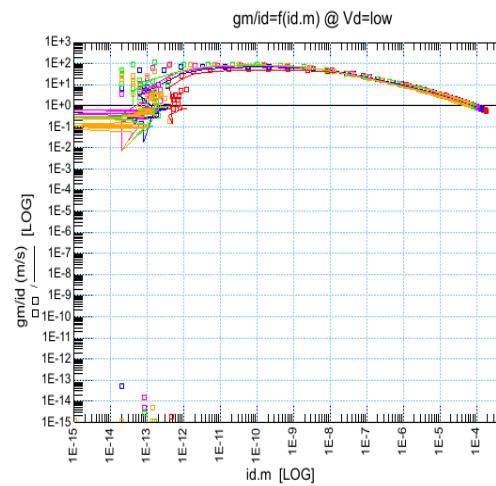
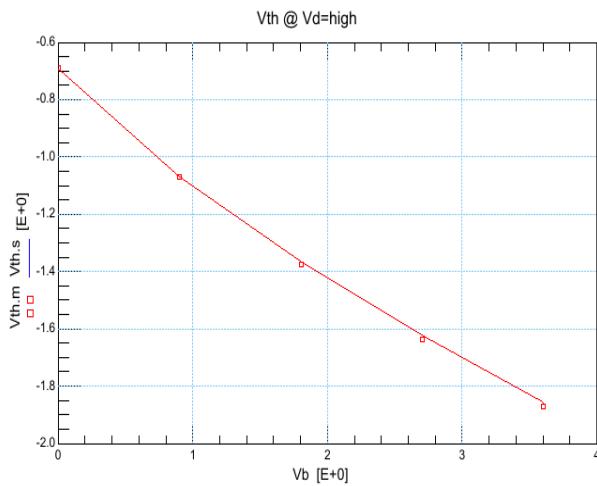


4.18W02u0_L1u2_S563_3**idvg, Vd = -0.1V, T = 27°C**

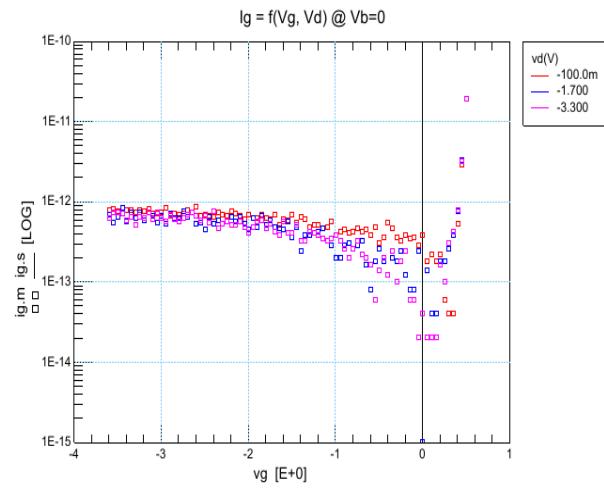
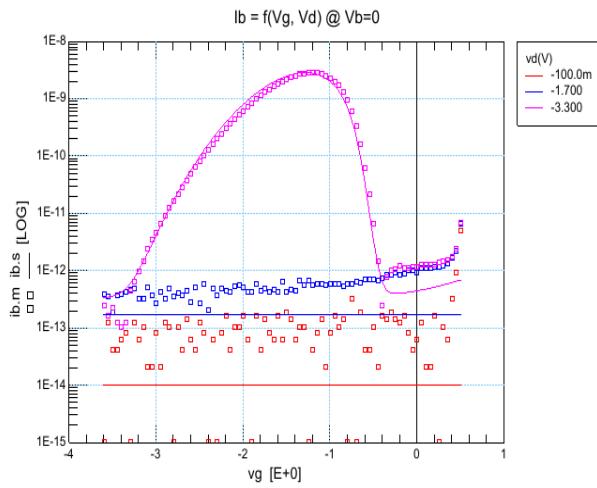


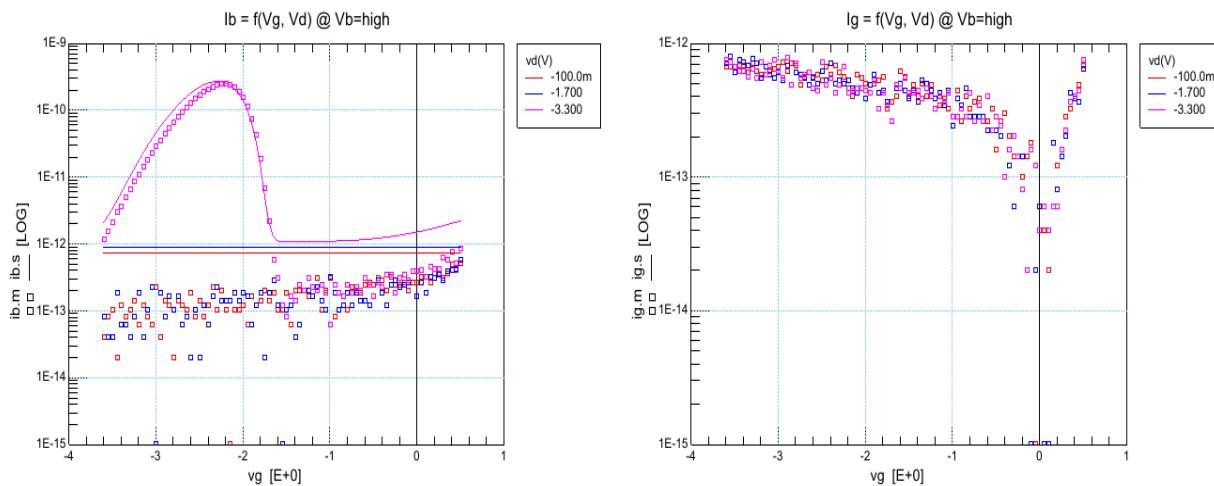
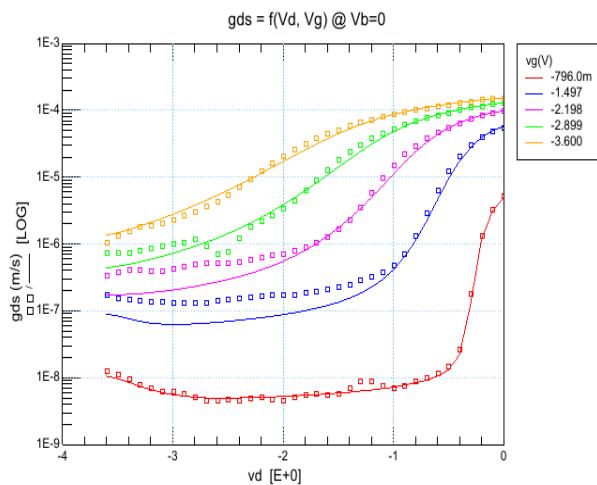
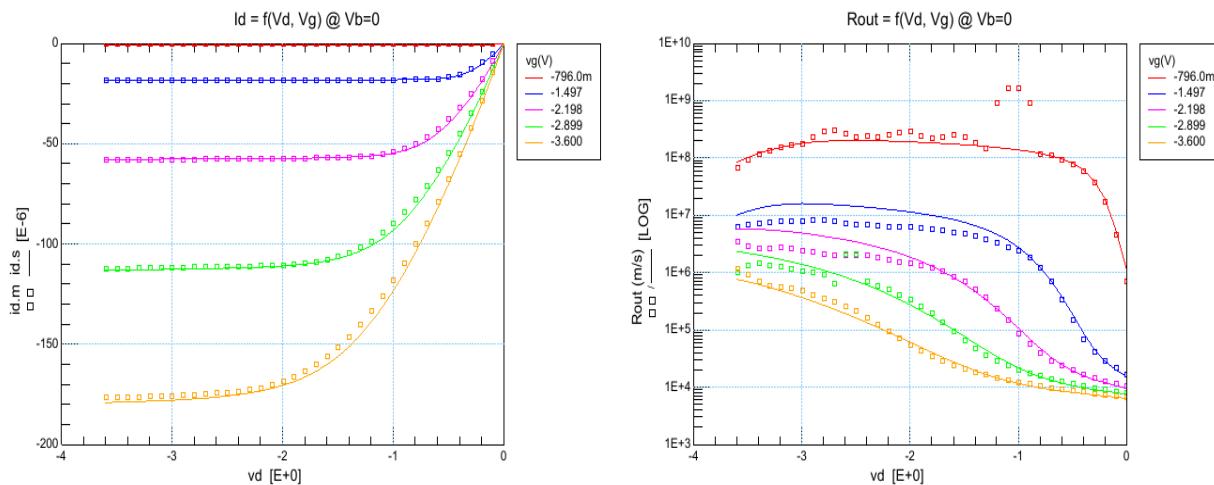
$idvg, Vd = -3.3V, T = 27^\circ C$

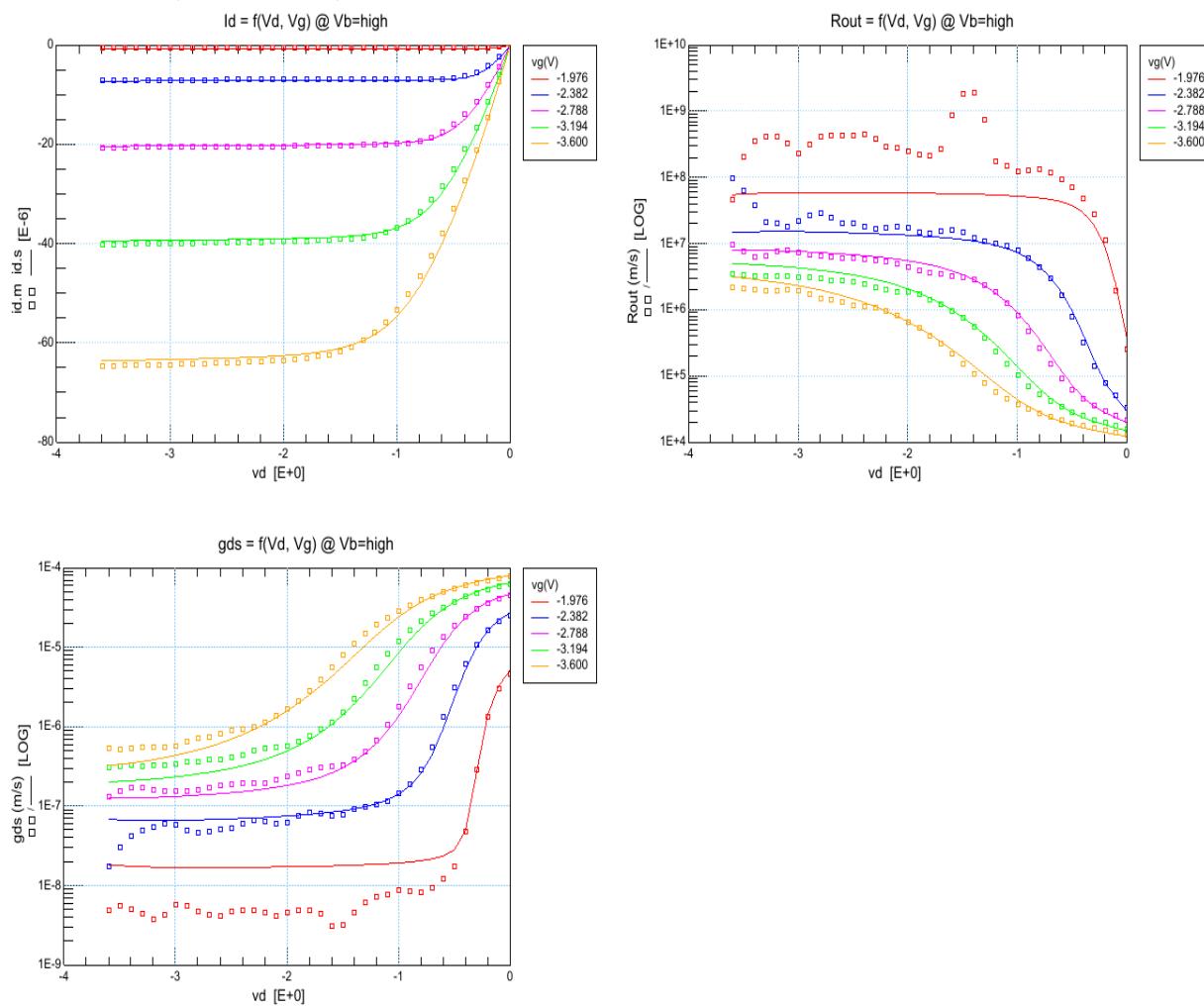
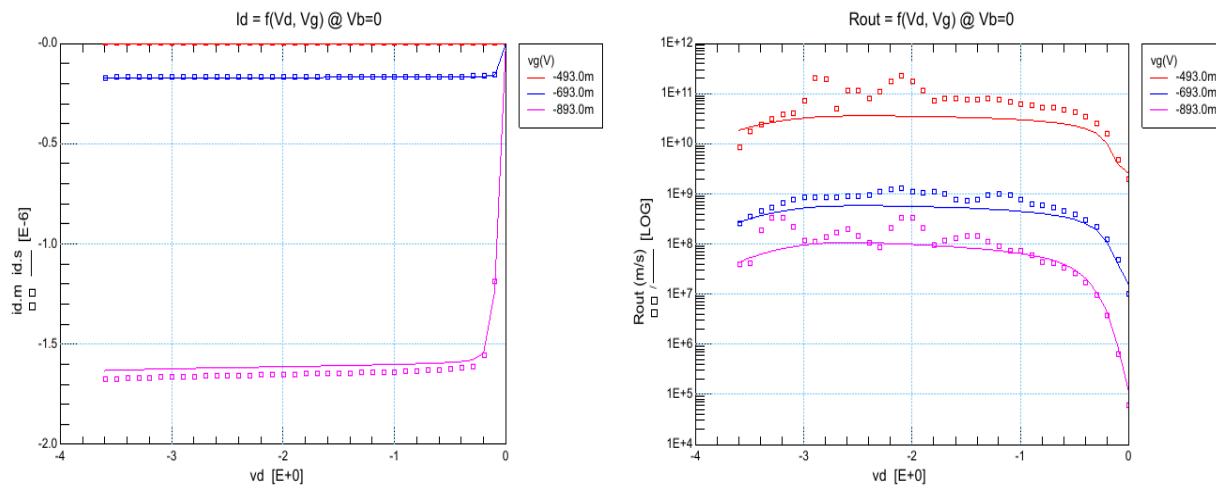


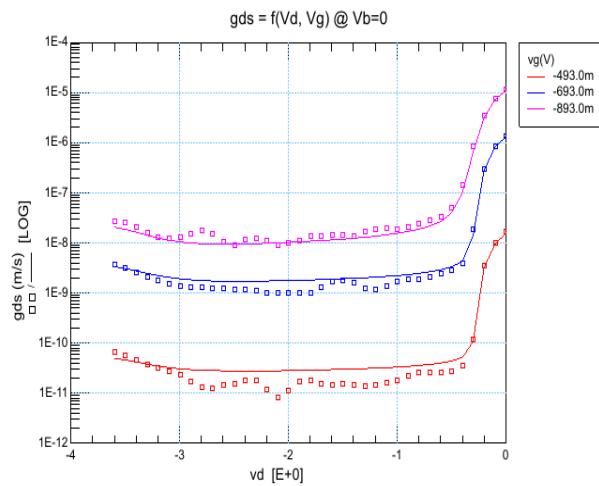


idvg, lb, lg, Vb = 0V, T = 27°C

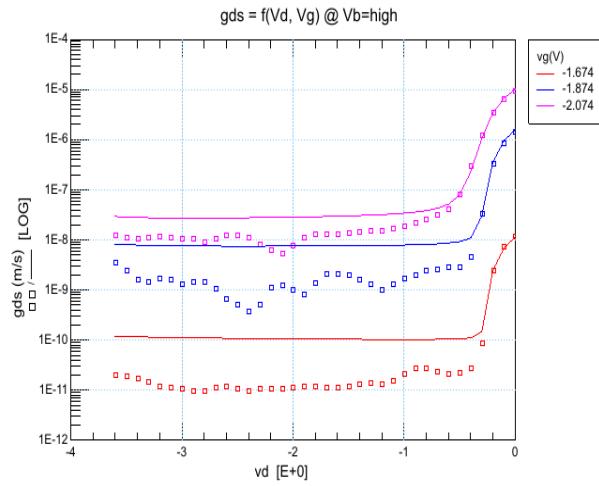
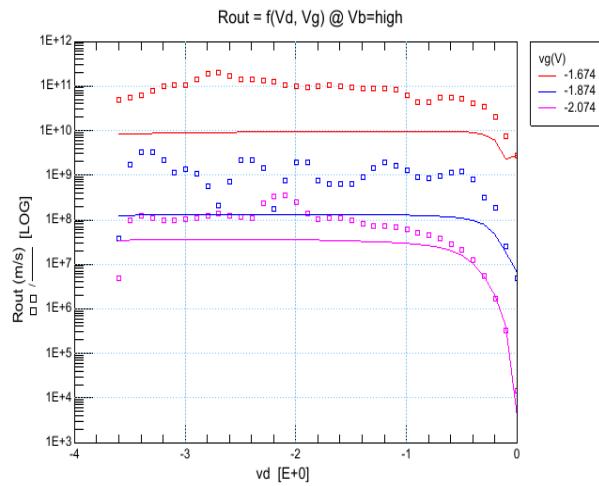
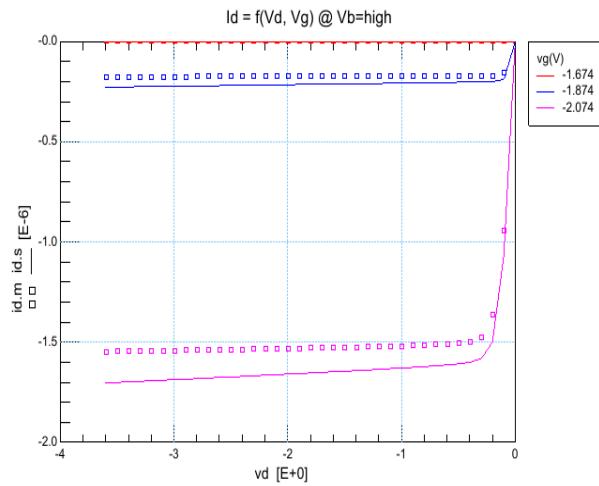


idvg, Ib,Ig, Vb = 3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


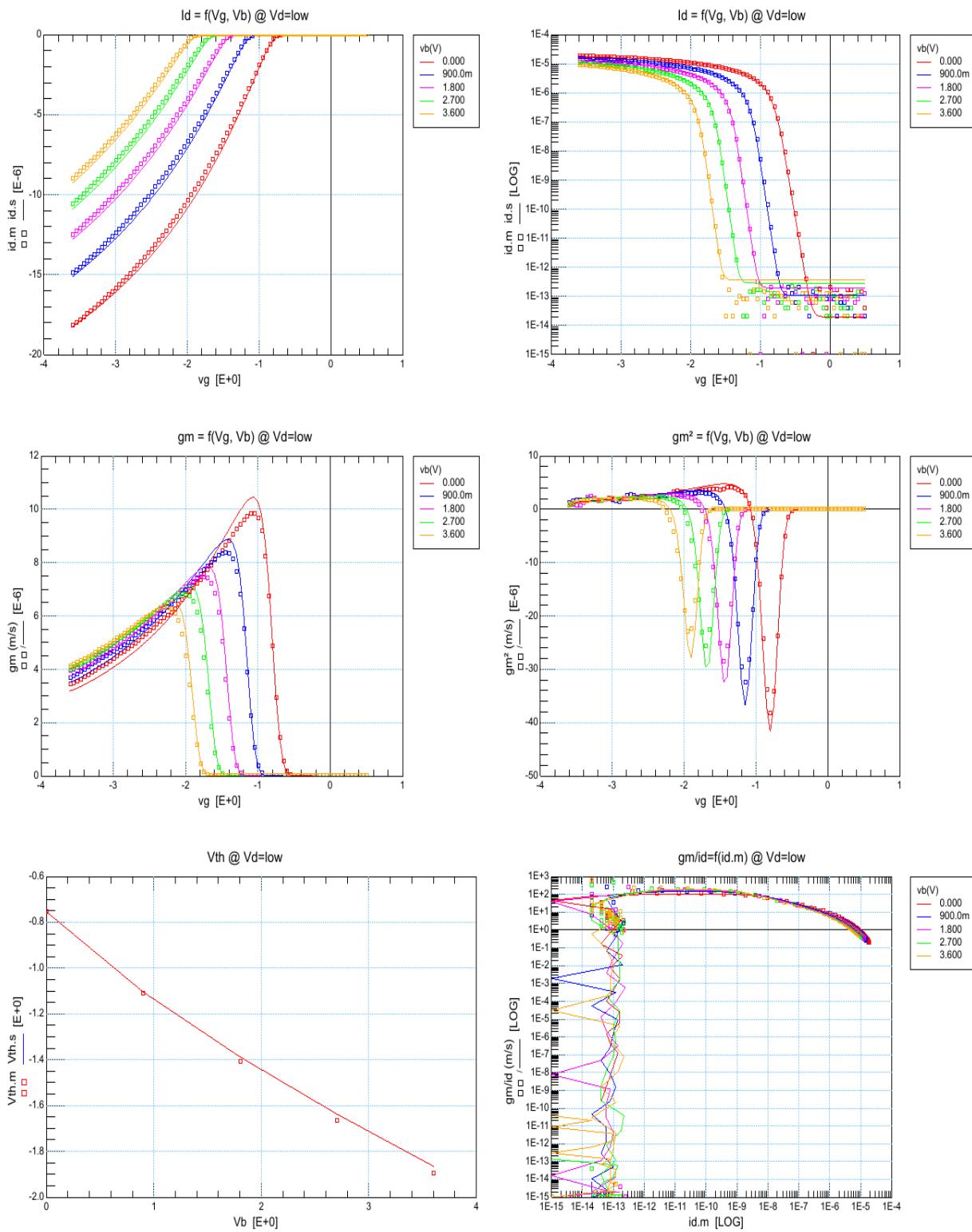
idvd_vbmin, Vb = 3.6V, T = 27°C**idvd_vth, Vb = 0V, T = 27°C**

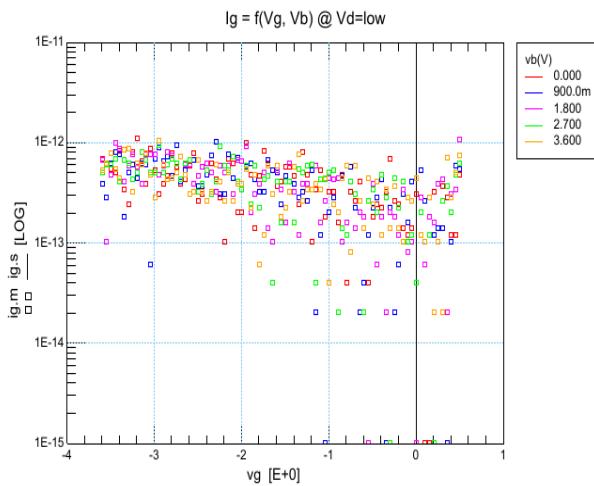
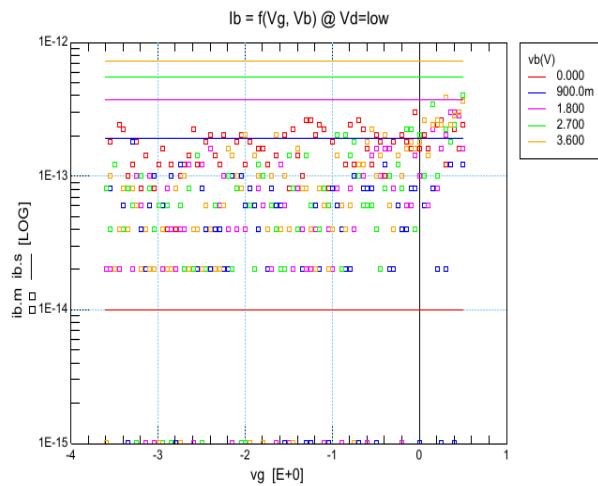


idvd_vth_vbmin, Vb = 3.6V, T = 27°C

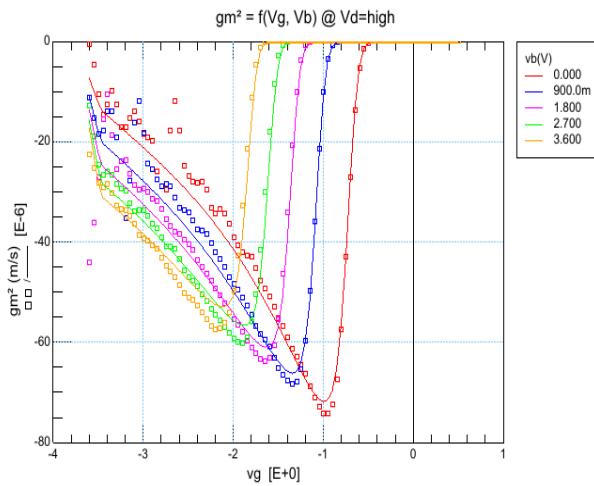
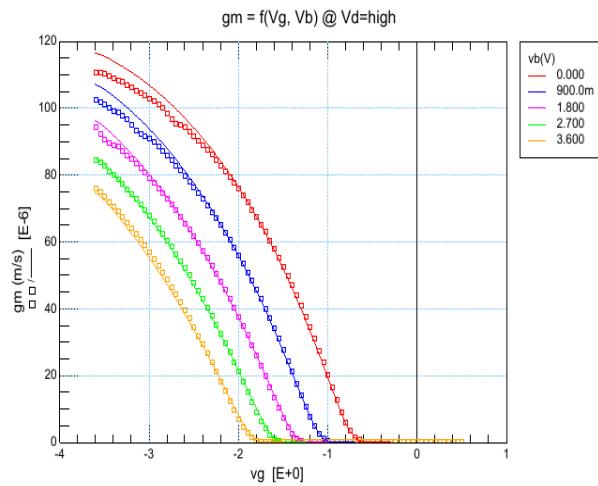
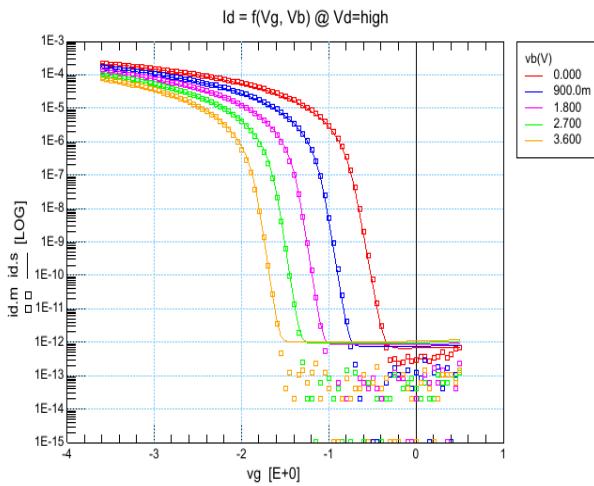
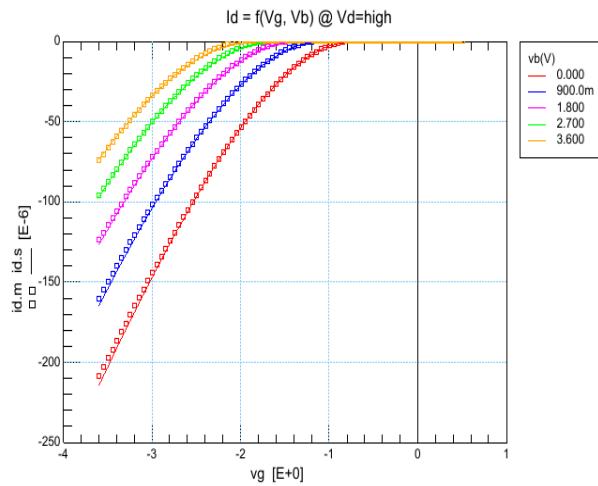


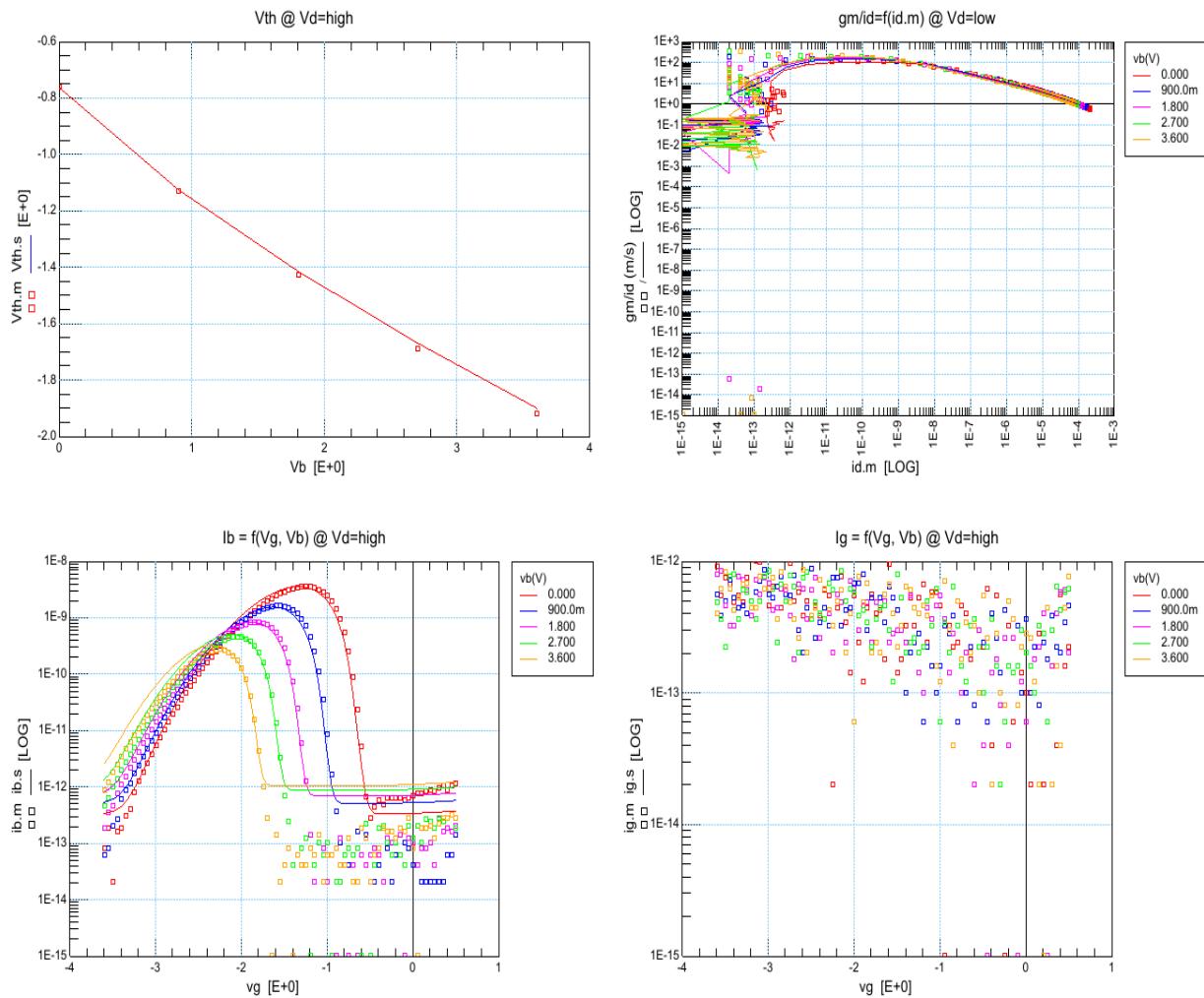
$idvg$, $Vd = -0.1V$, $T = -40^{\circ}C$



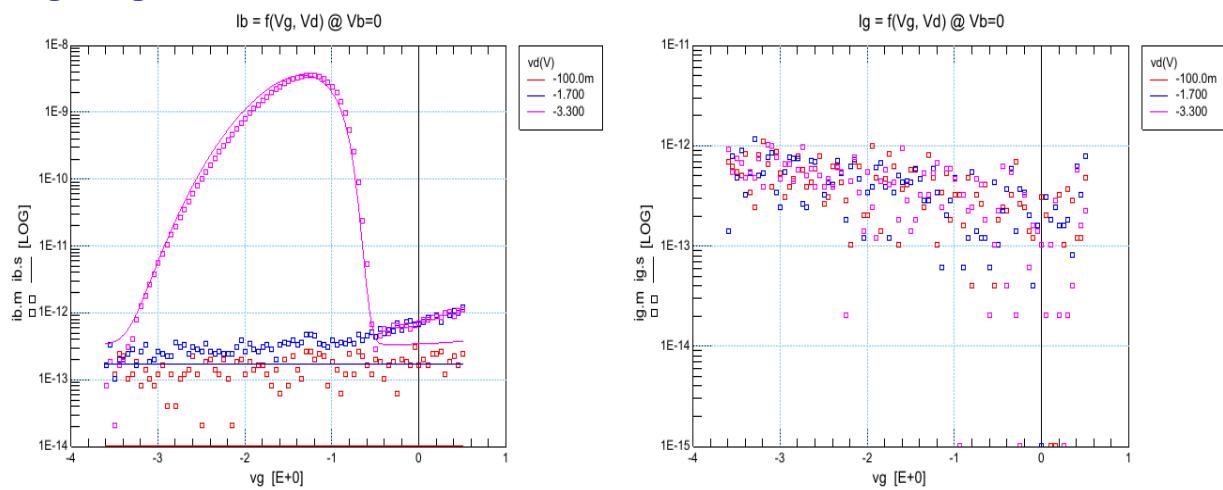


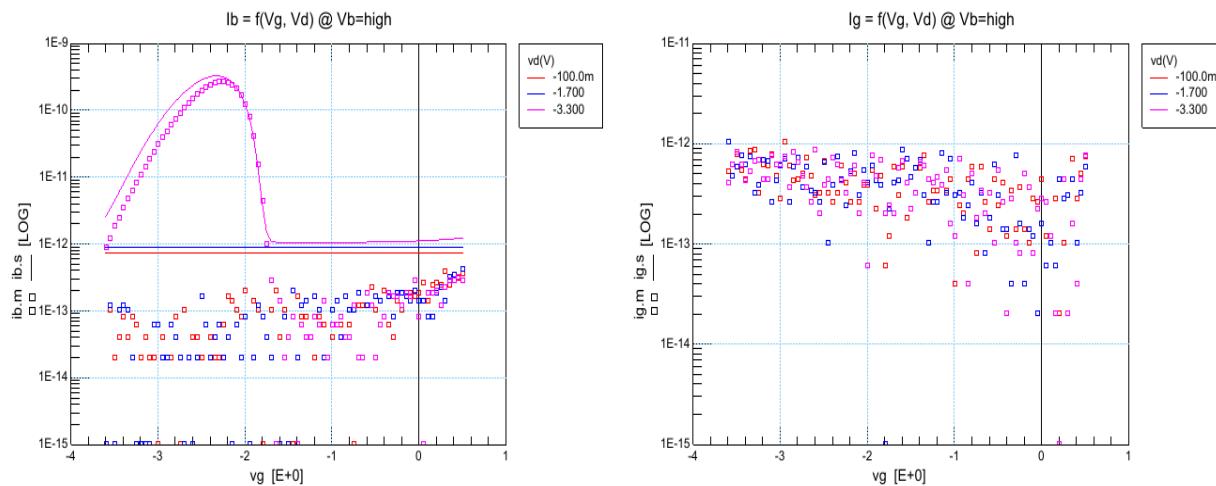
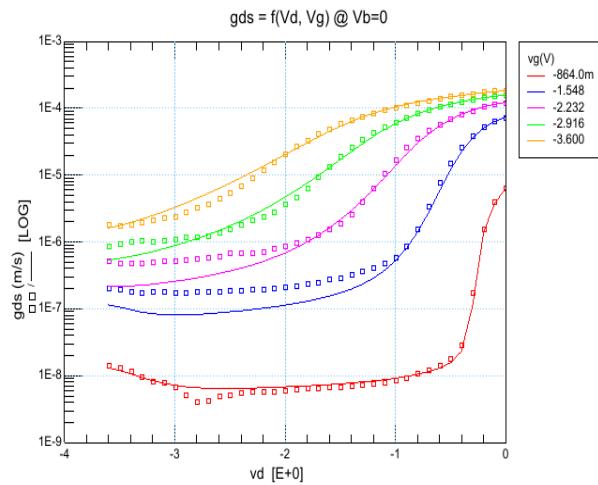
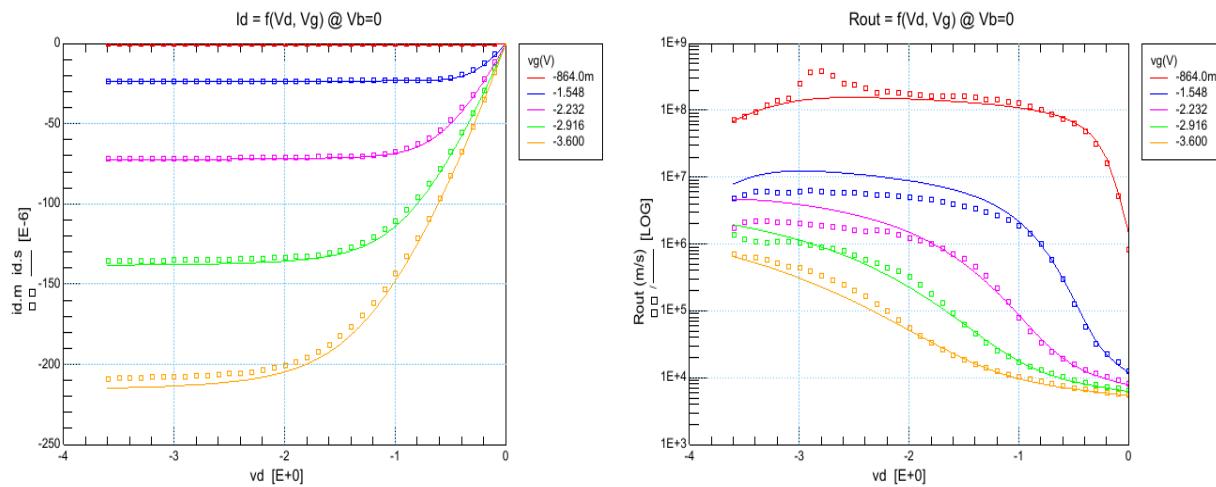
$i_{dvg}, V_d = -3.3V, T = -40^\circ\text{C}$

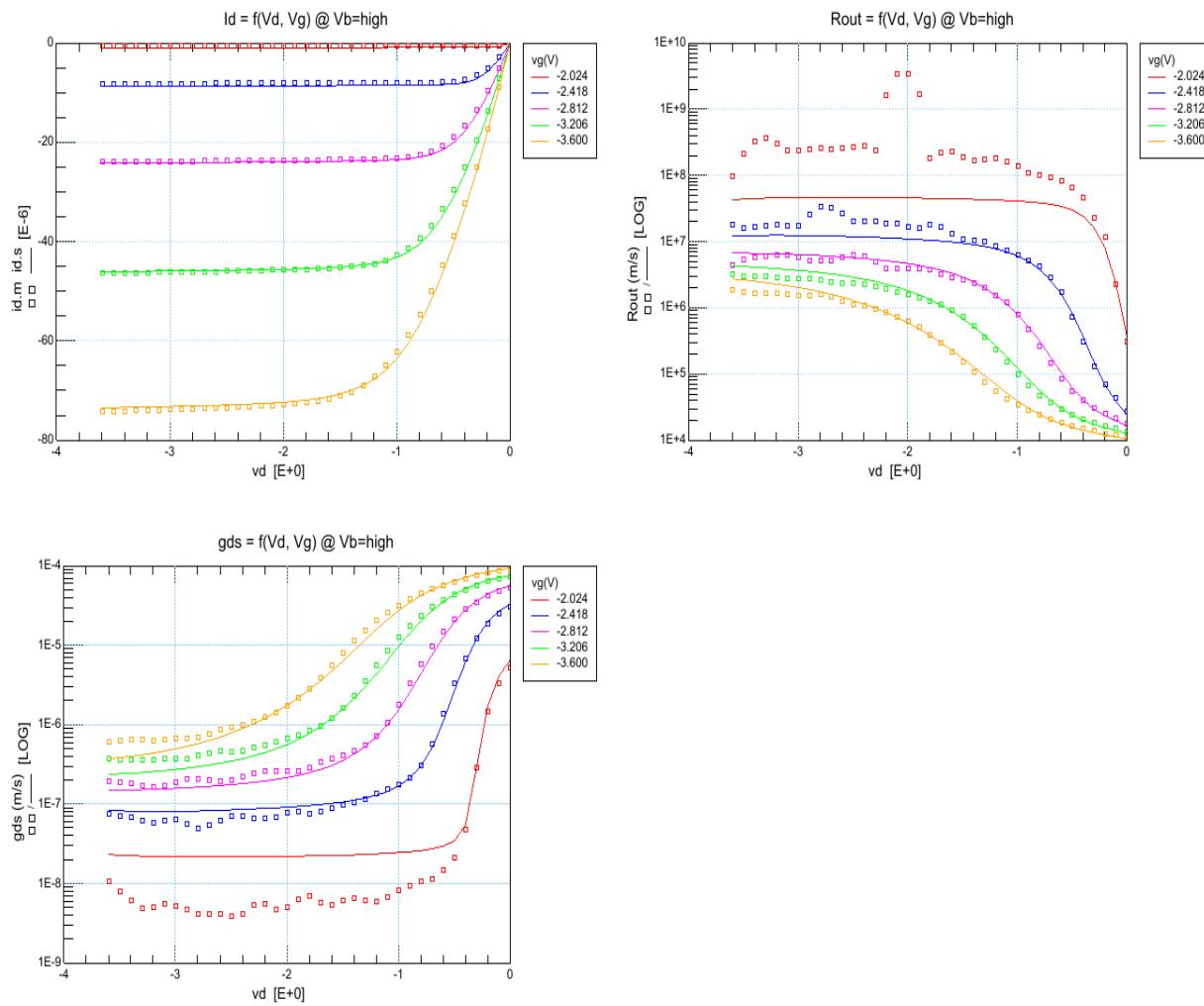
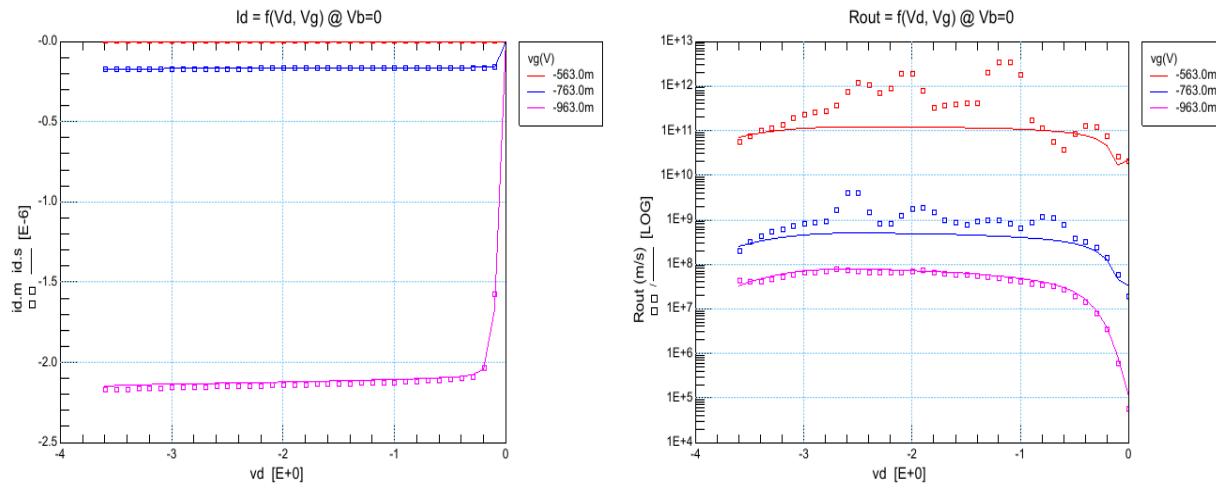


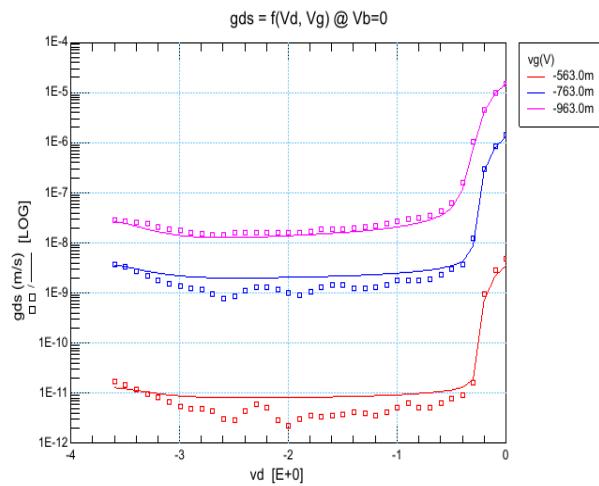


idvg, Ib,Ig, Vb = 0V, T = -40°C

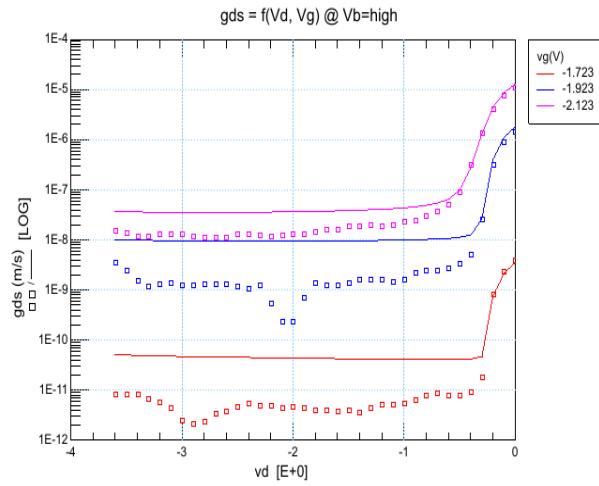
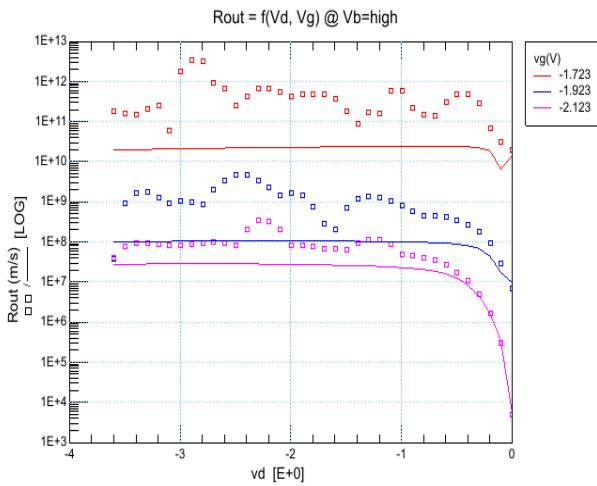
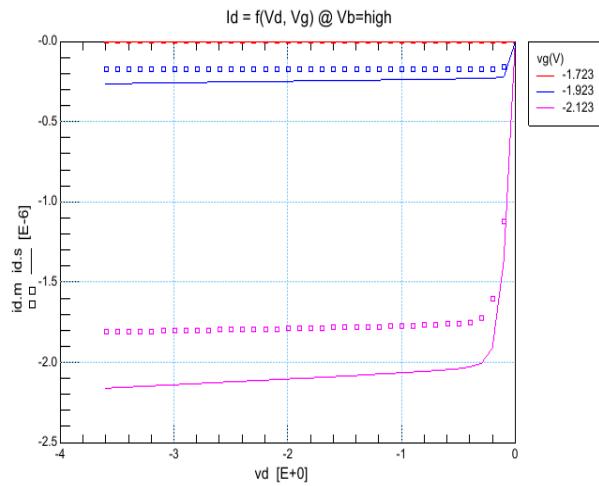


idvg, Ib,Ig, Vb = 3.6V, T = -40°C

idvd, Vb = 0V, T = -40°C


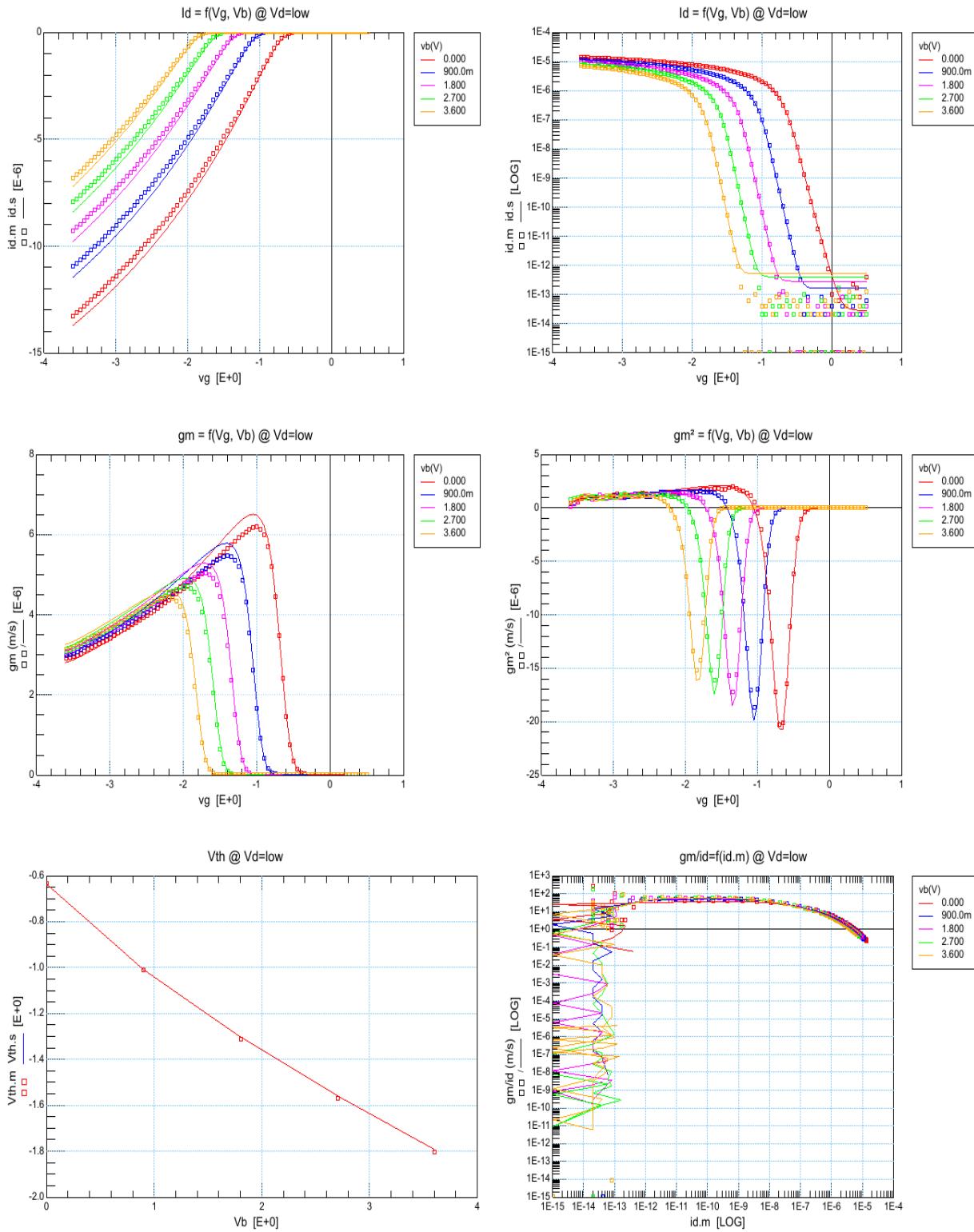
idvd_vbmin, Vb = 3.6V, T = -40°C**idvd_vth, Vb = 0V, T = -40°C**

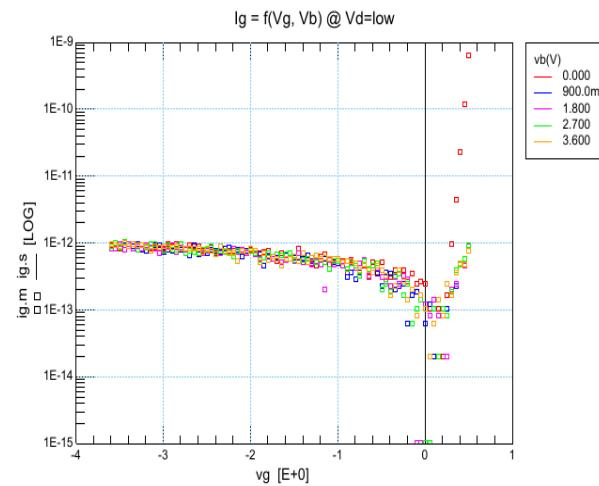
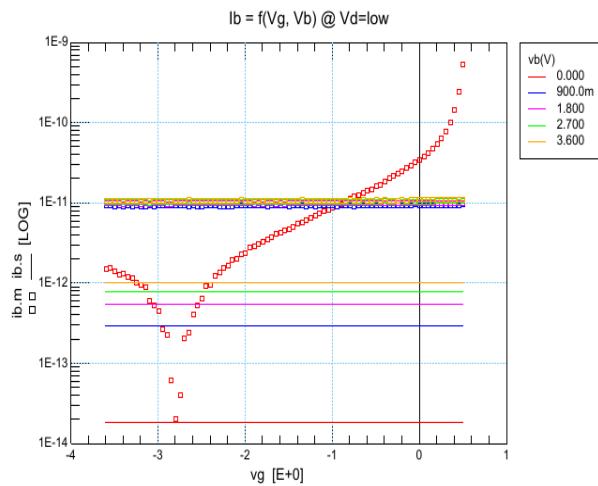


idvd_vth_vbmin, Vb = 3.6V, T = -40°C

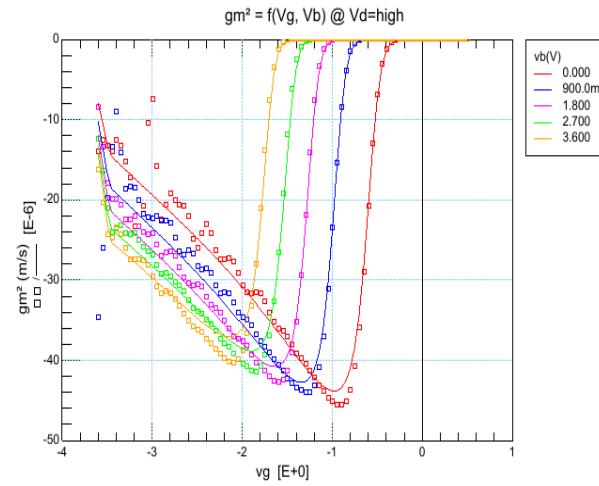
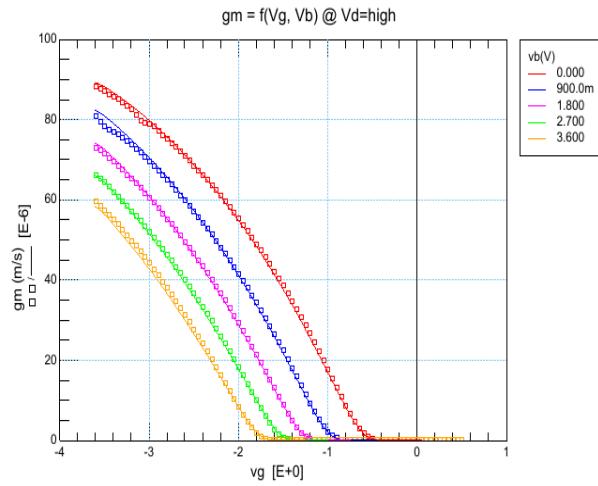
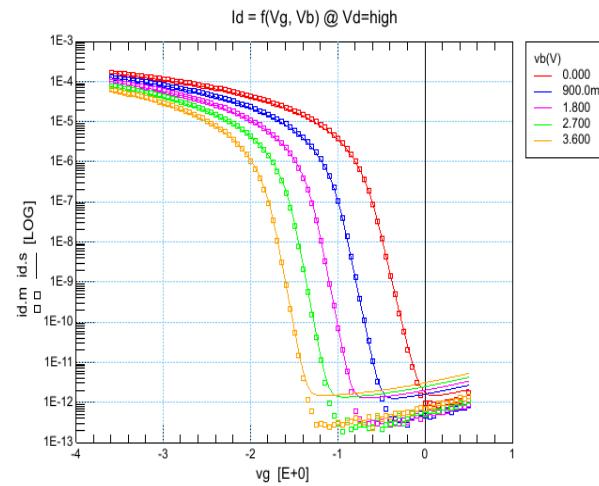
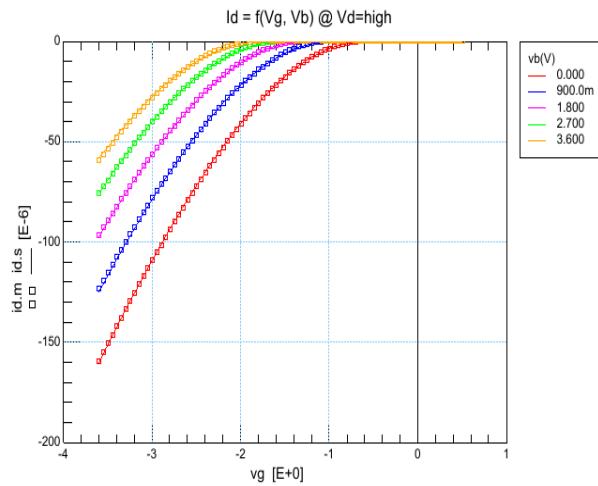


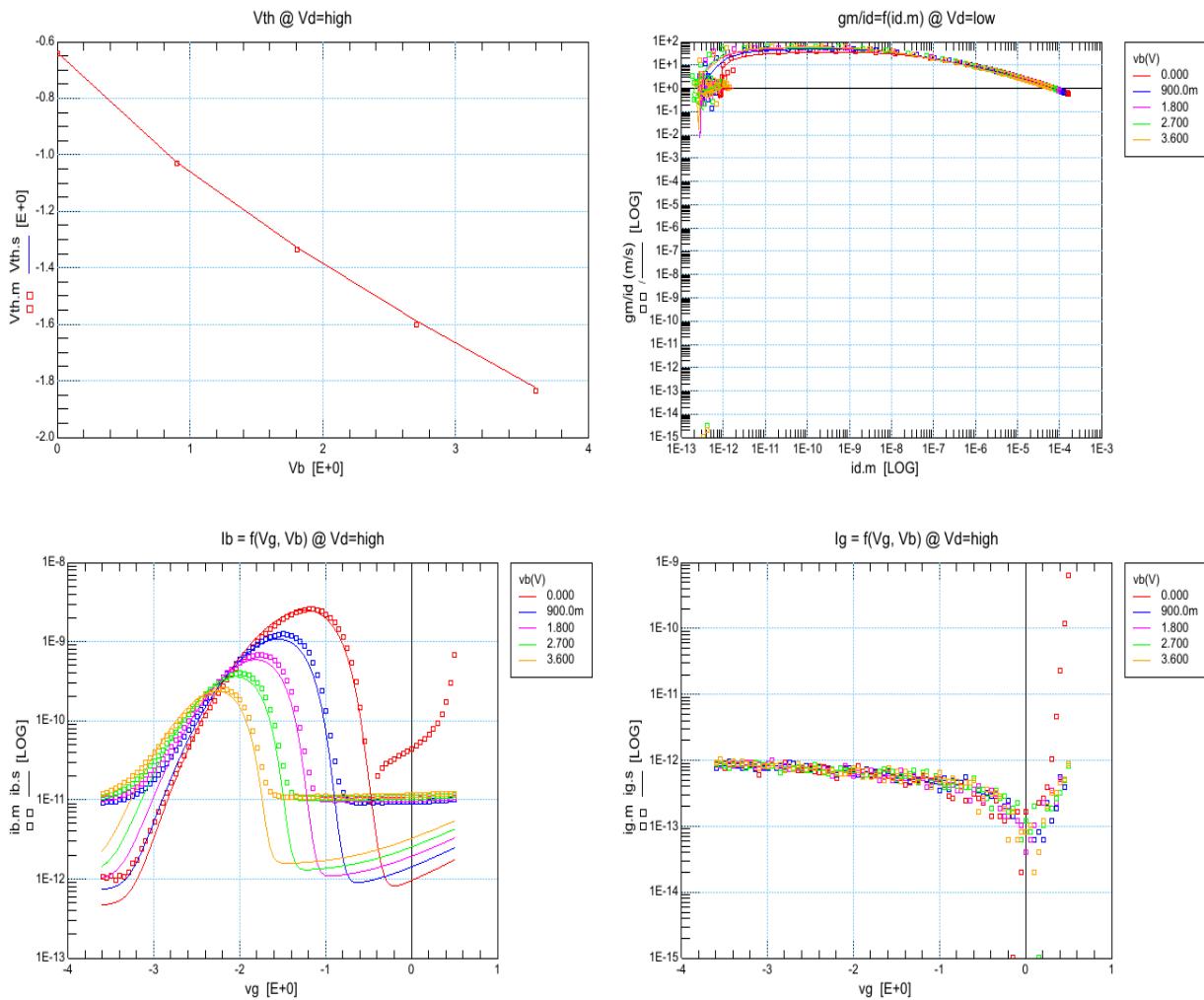
idvg, Vd = -0.1V, T = 70°C



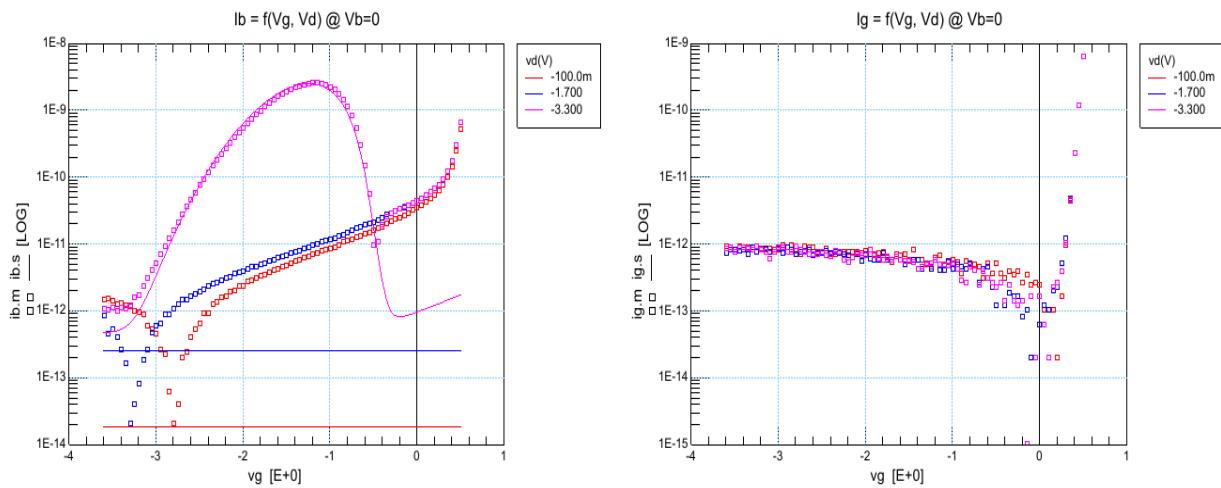


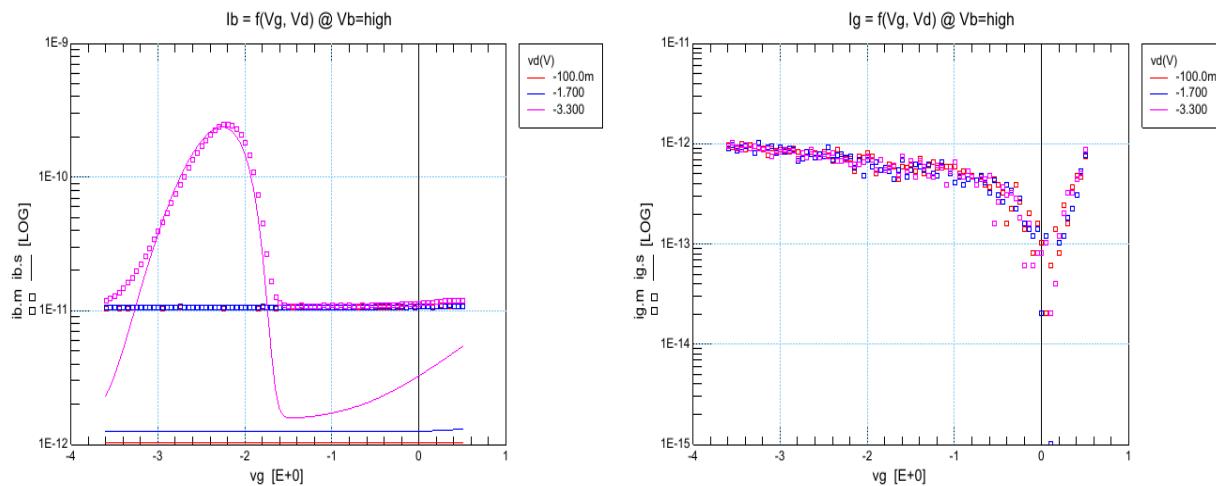
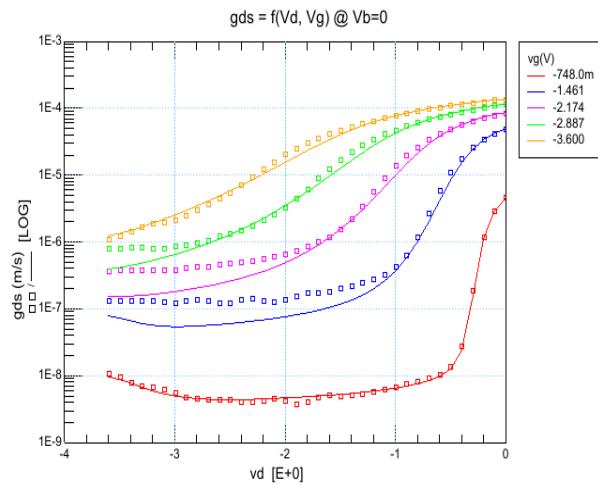
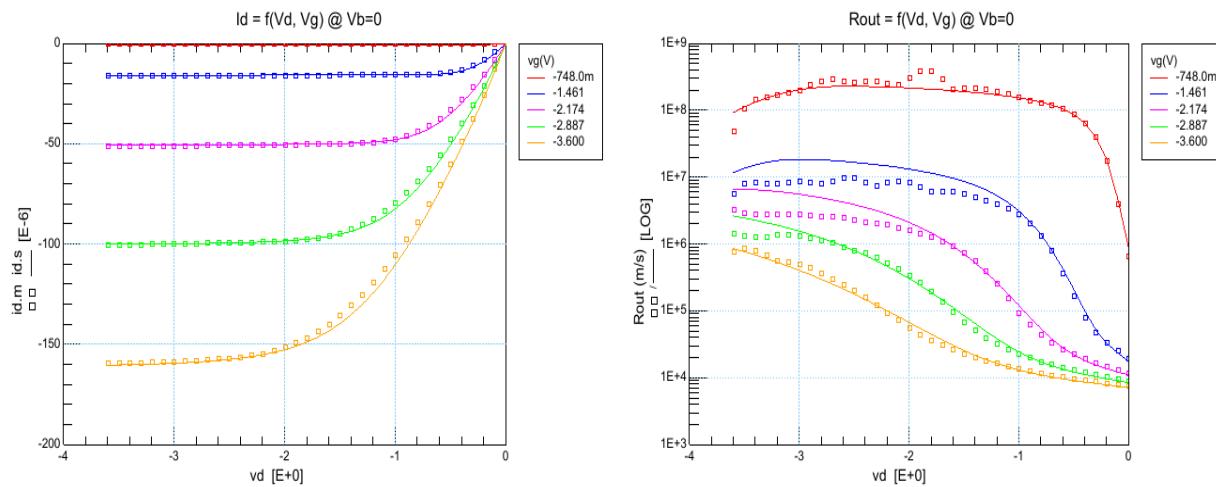
$i_{dvg}, V_d = -3.3V, T = 70^\circ\text{C}$

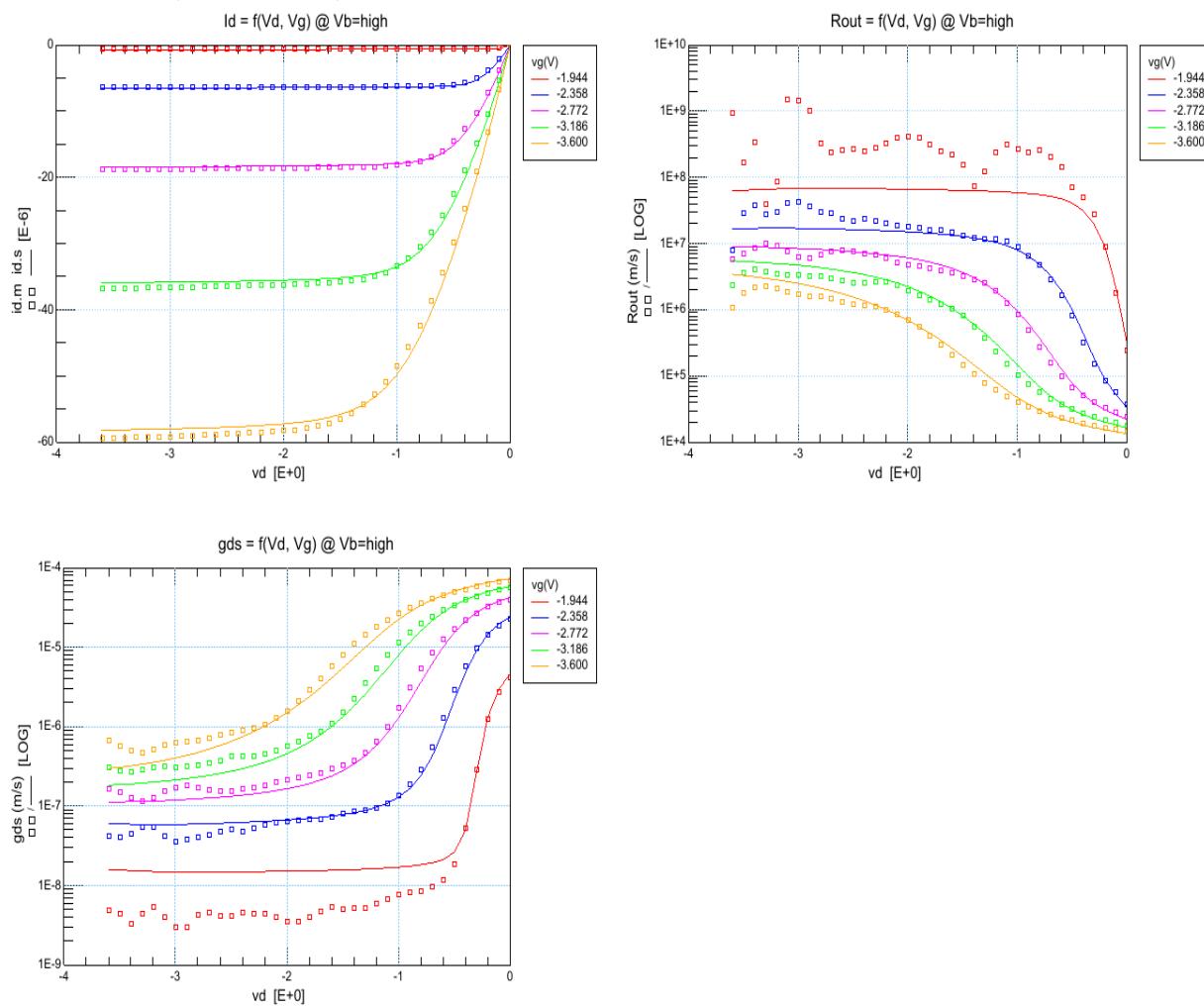
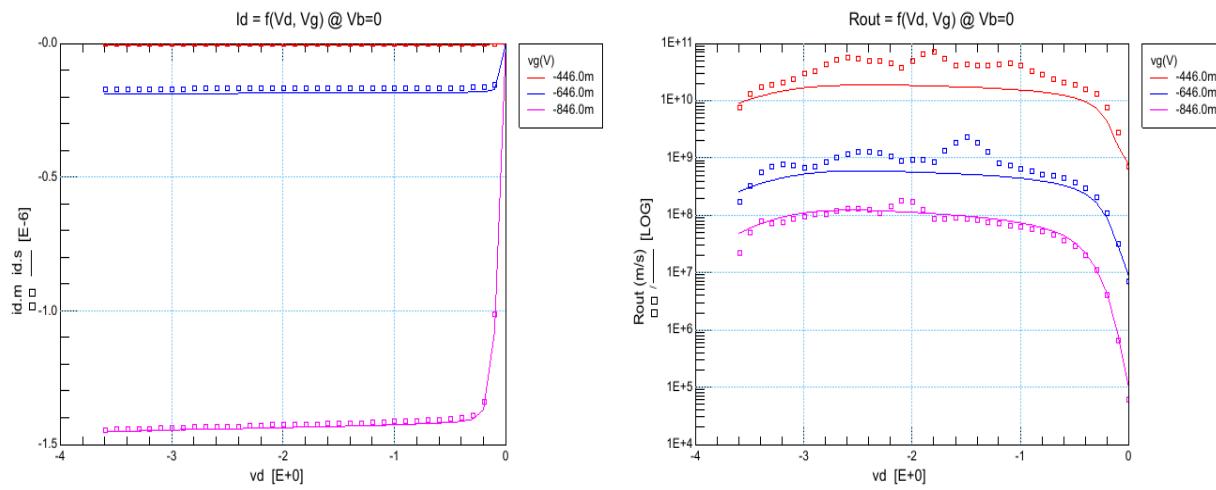


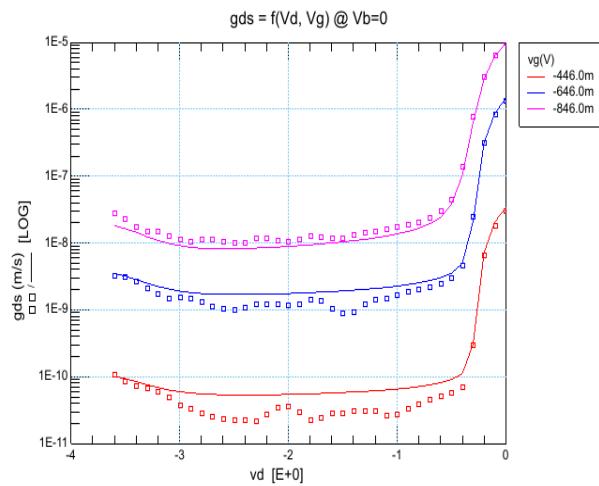


$idvg, Ib, Ig, Vb = 0V, T = 70^\circ C$

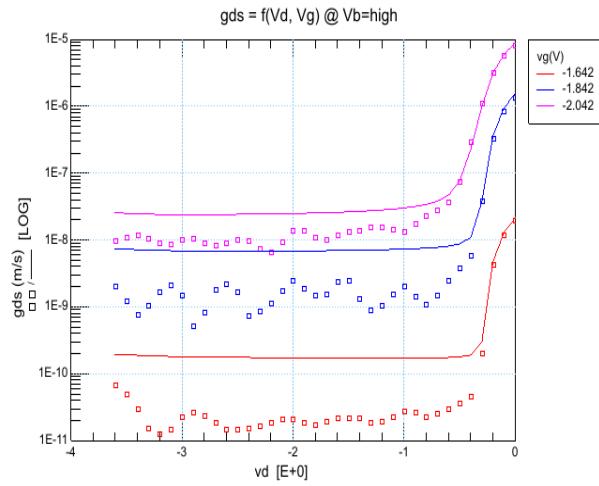
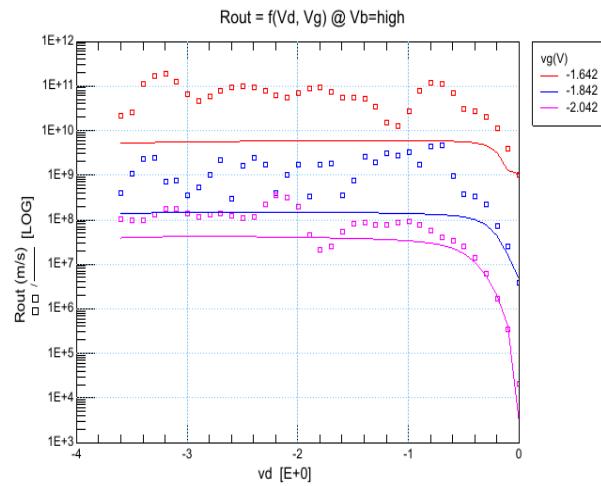
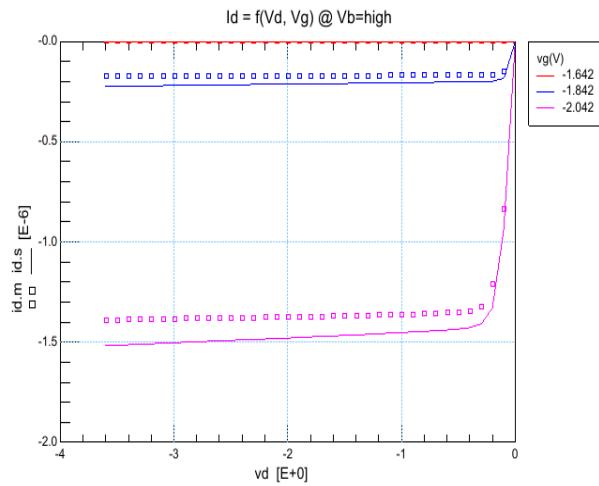


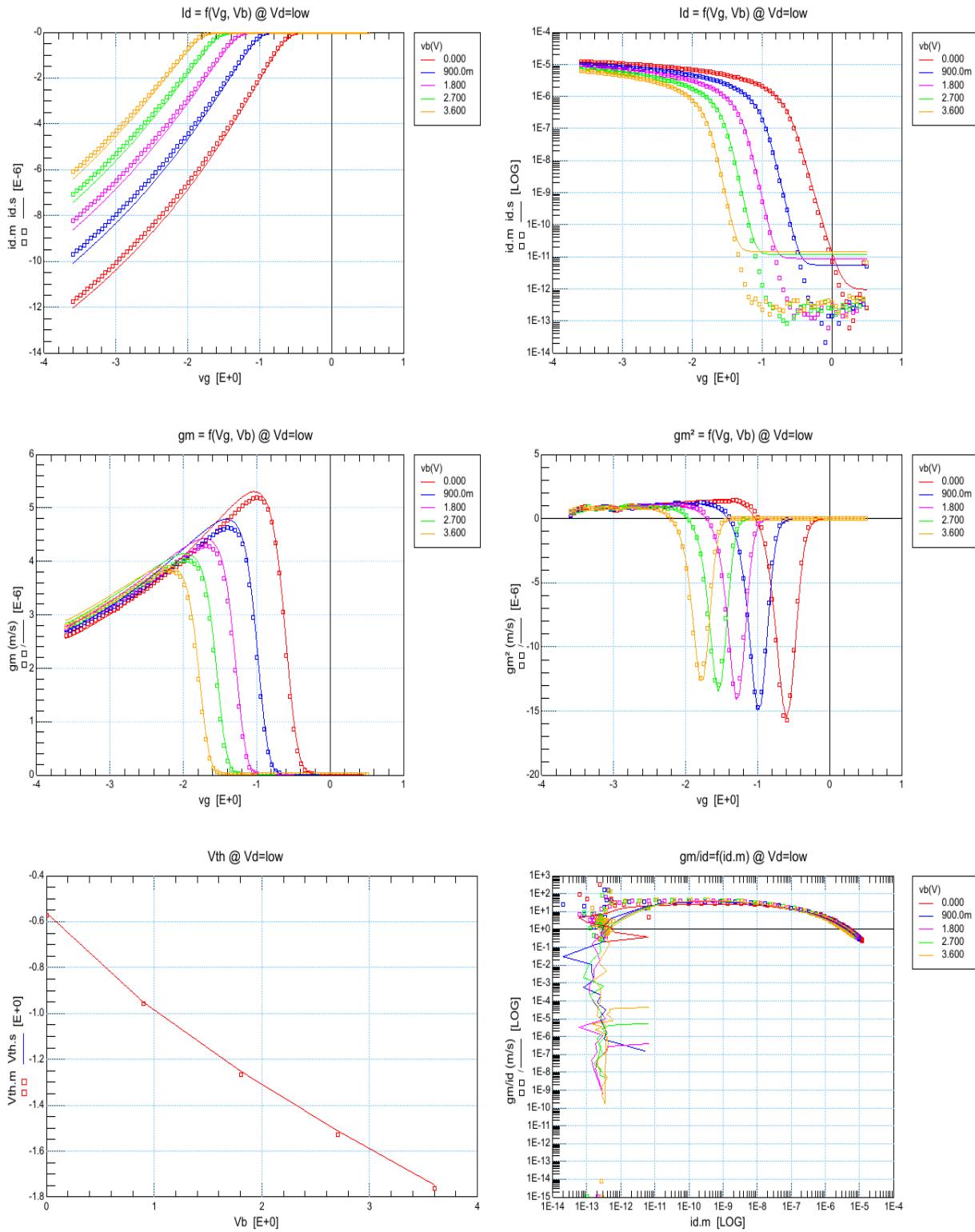
idvg, Ib,Ig, Vb = 3.6V, T = 70°C

idvd, Vb = 0V, T = 70°C


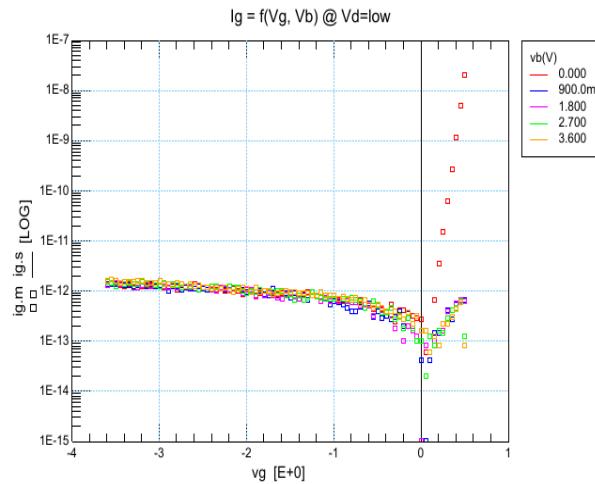
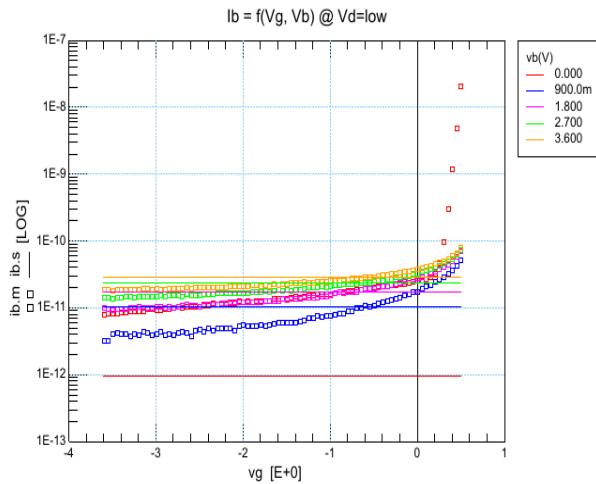
idvd_vbmin, Vb = 3.6V, T = 70°C**idvd_vth, Vb = 0V, T = 70°C**



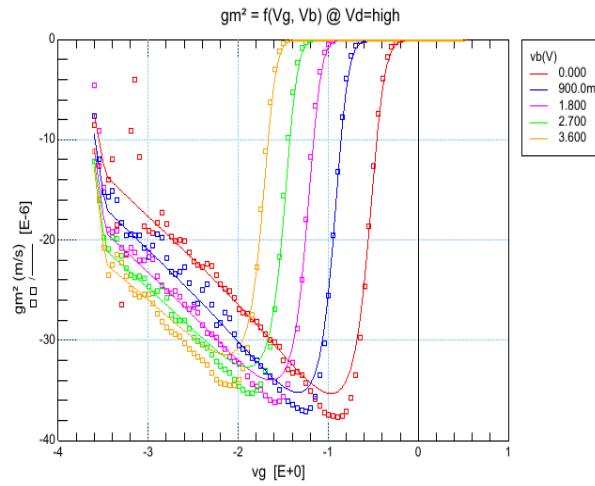
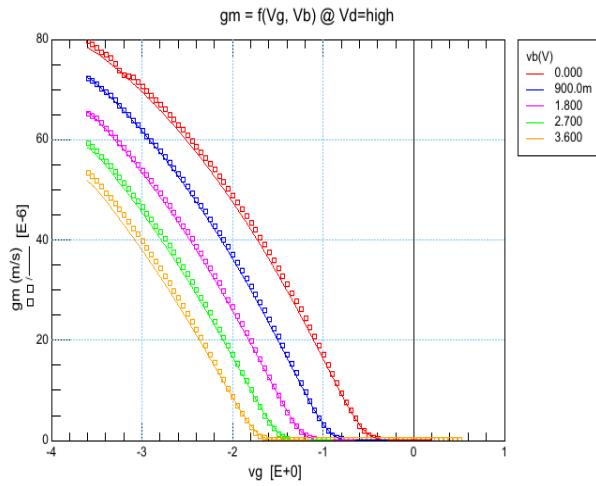
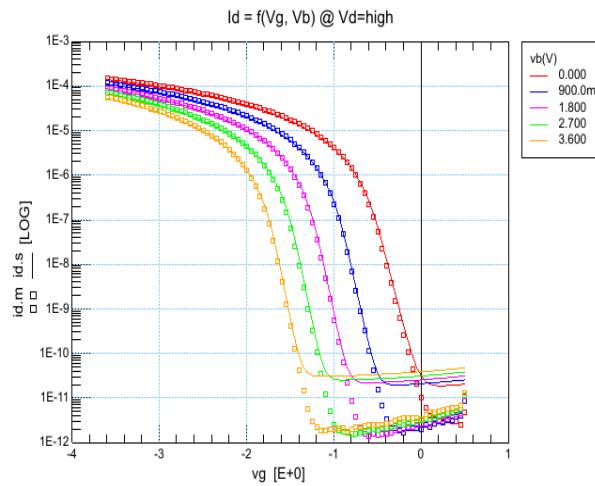
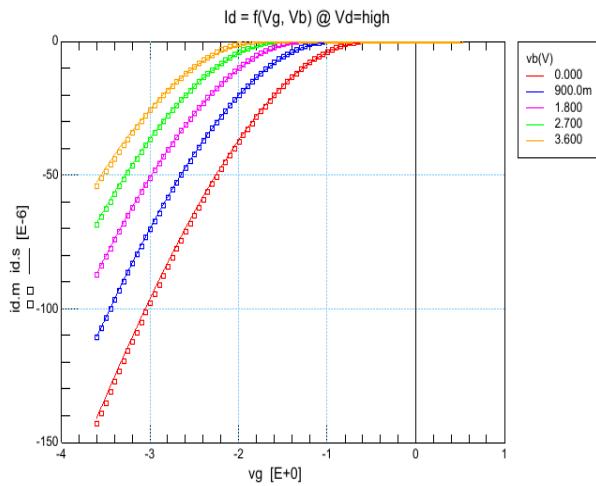
idvd_vth_vbmin, Vb = 3.6V, T = 70°C

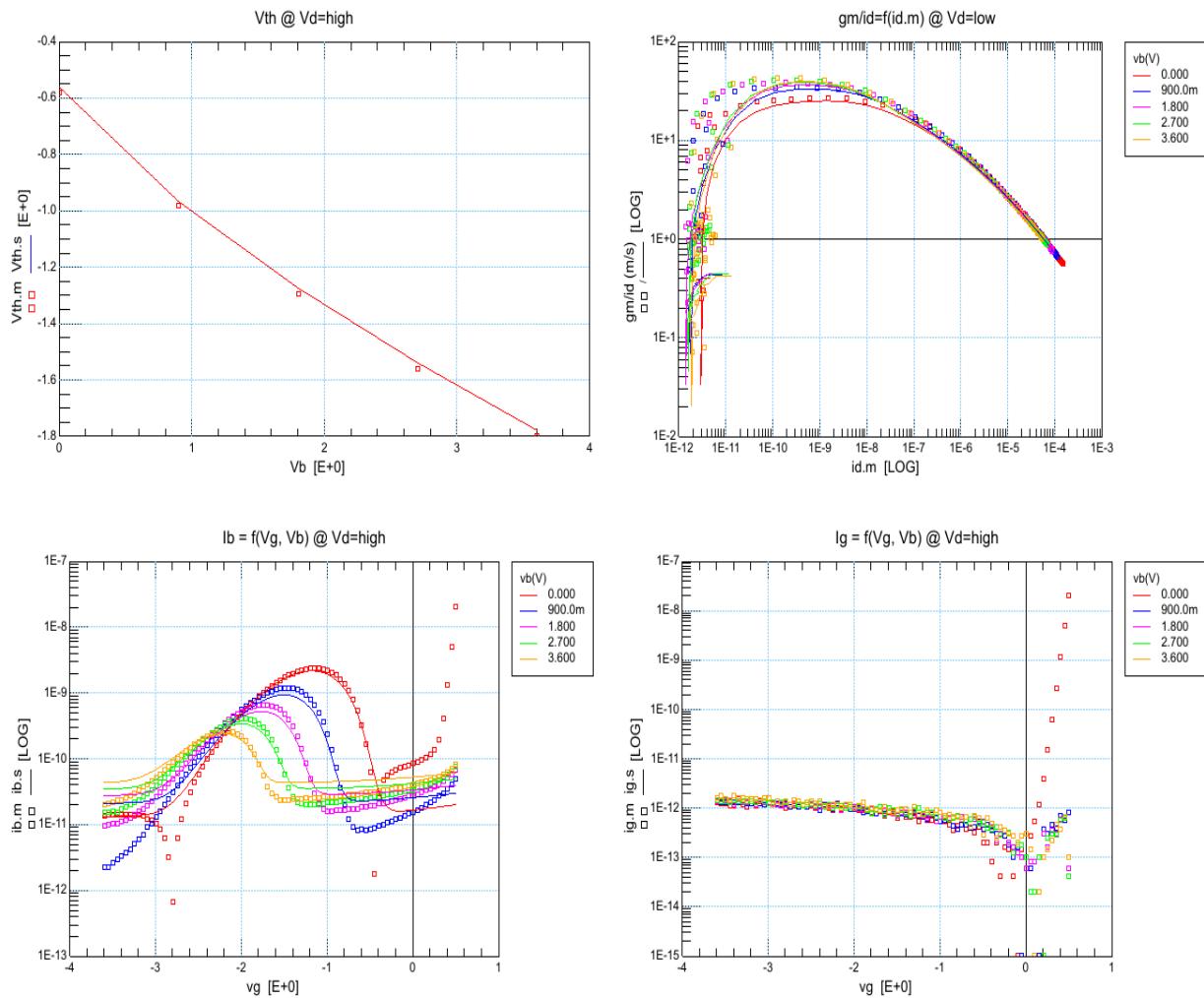


idvg, Vd = -0.1V, T = 125°C


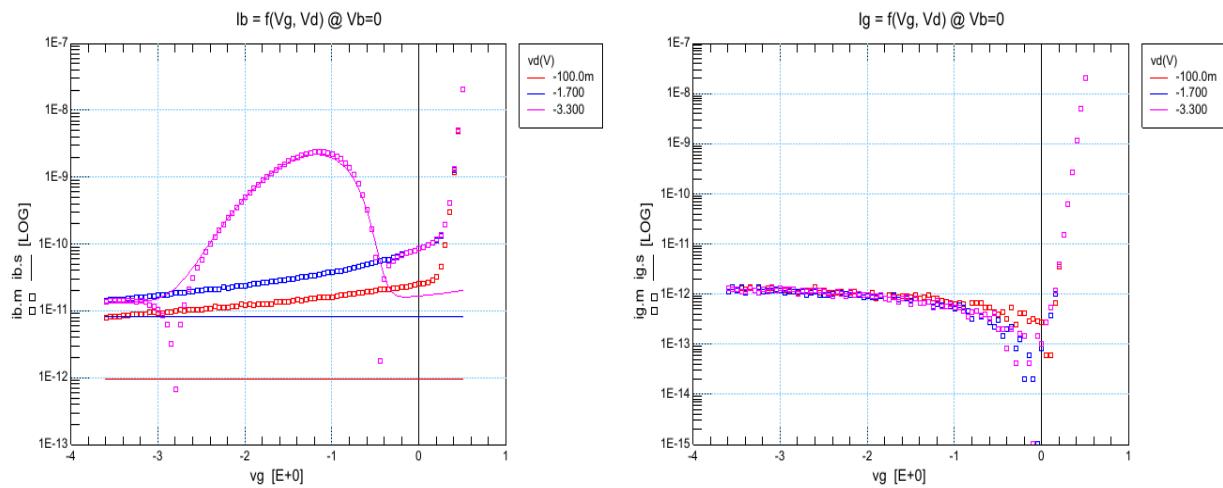


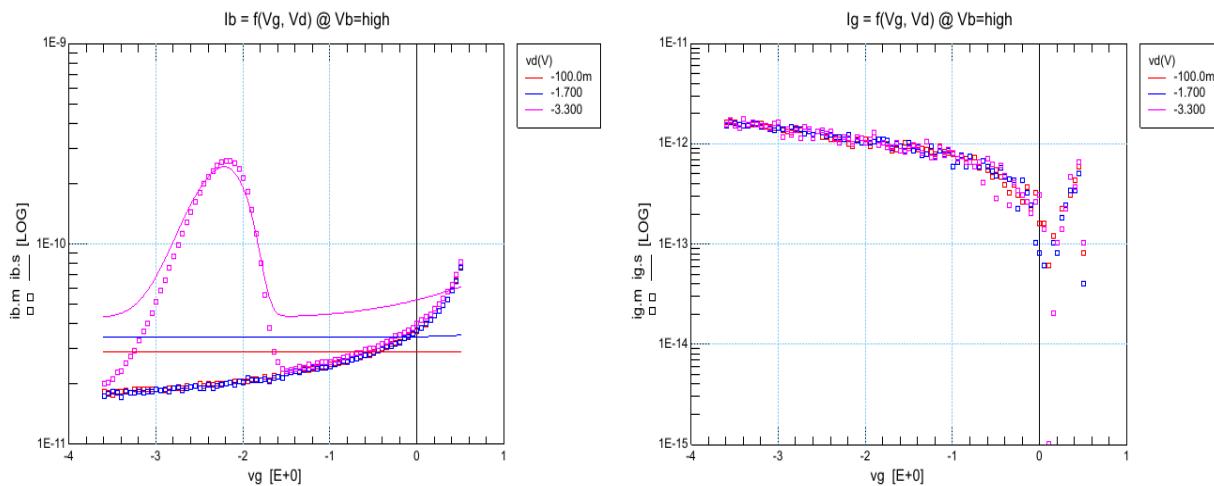
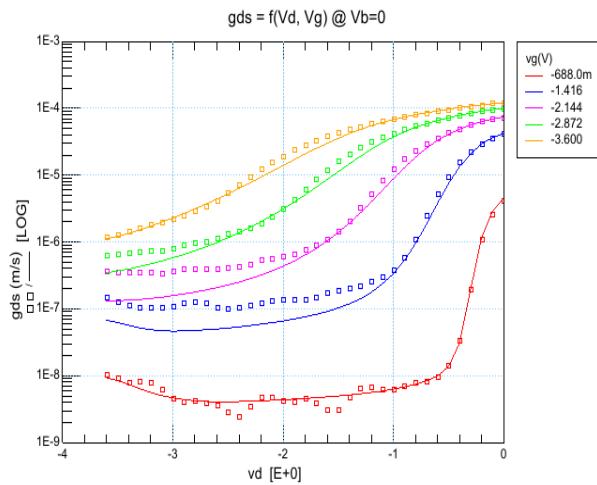
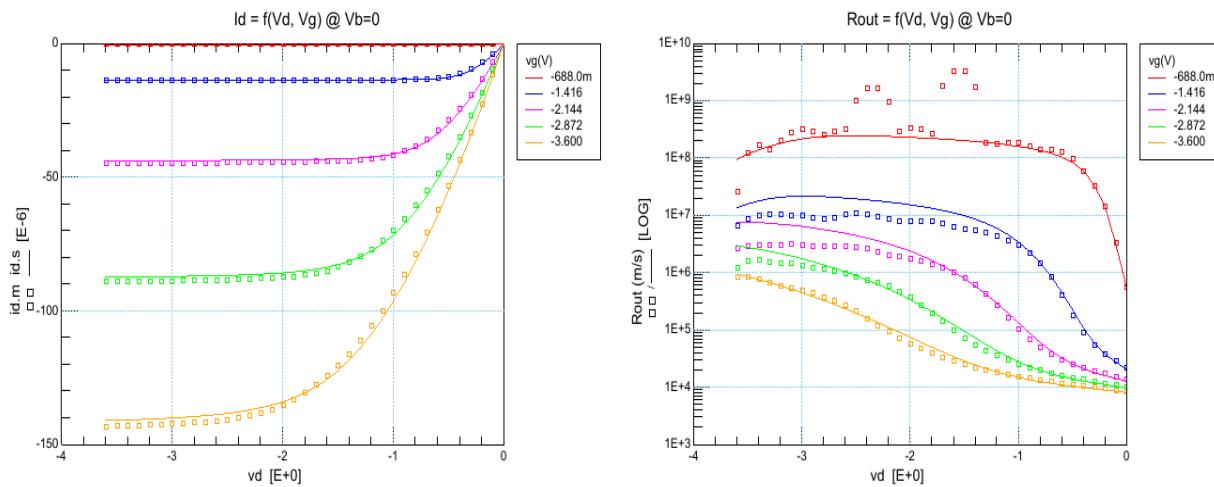
$i_{dvg}, V_d = -3.3V, T = 125^\circ\text{C}$

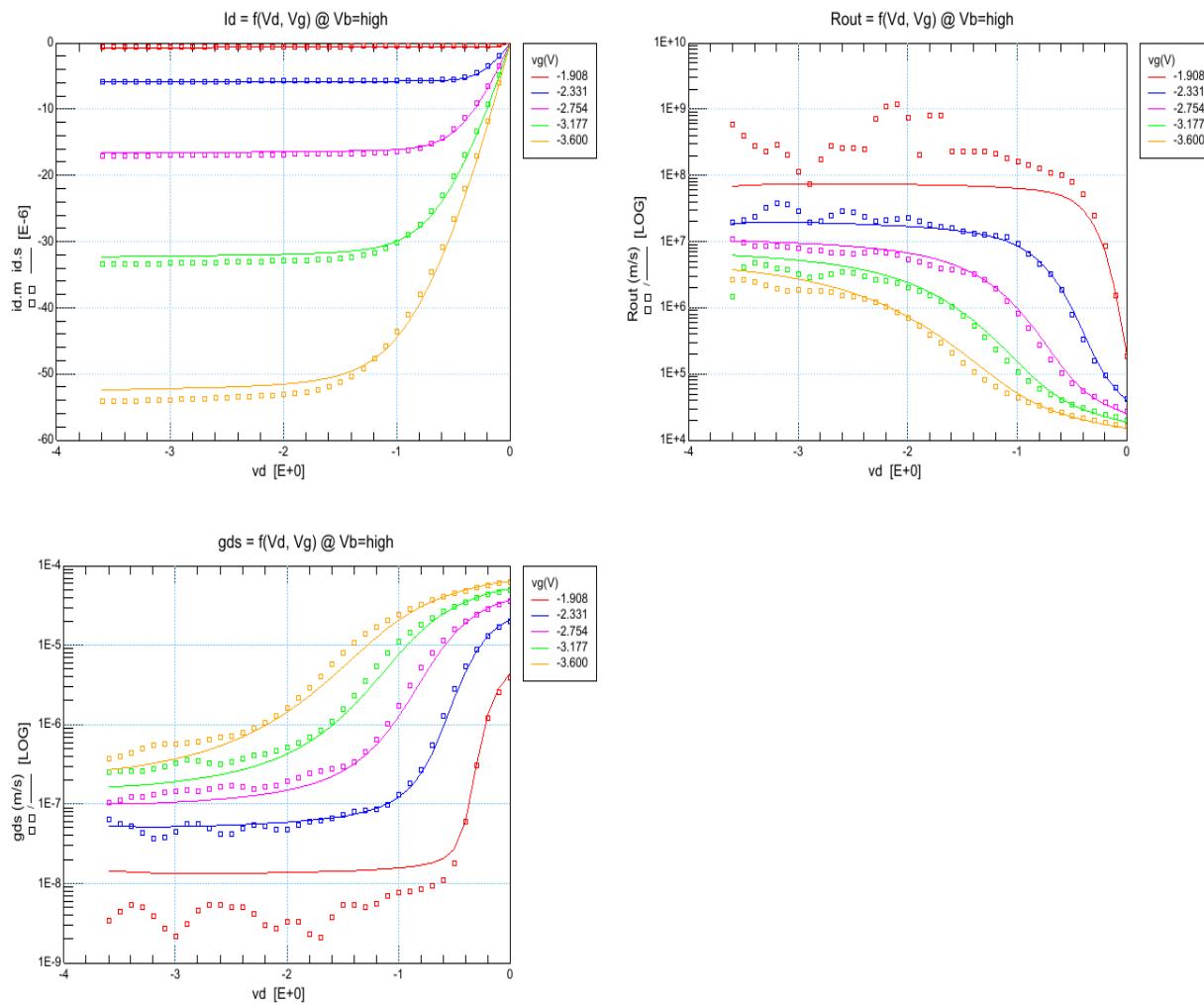
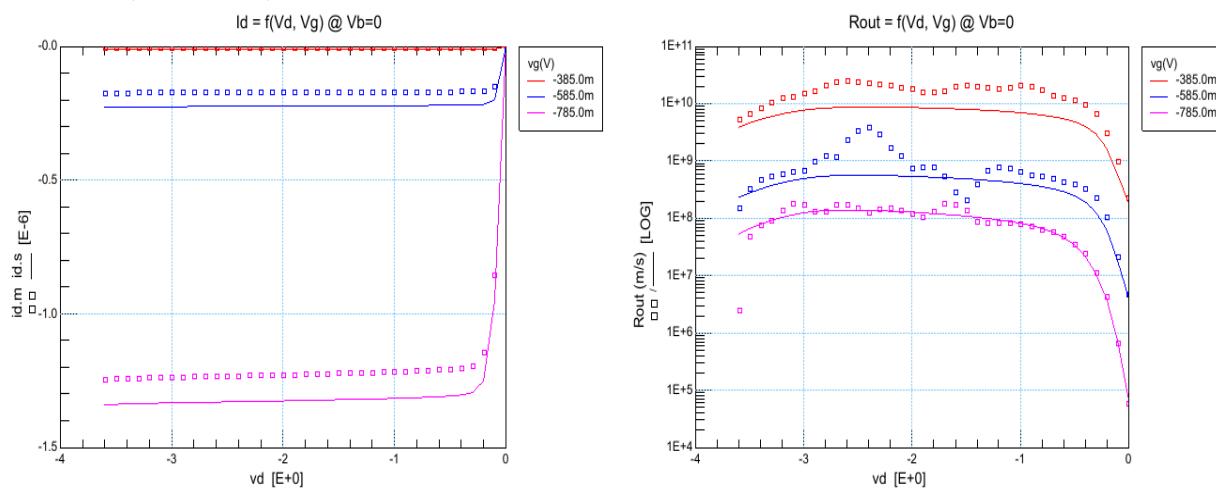


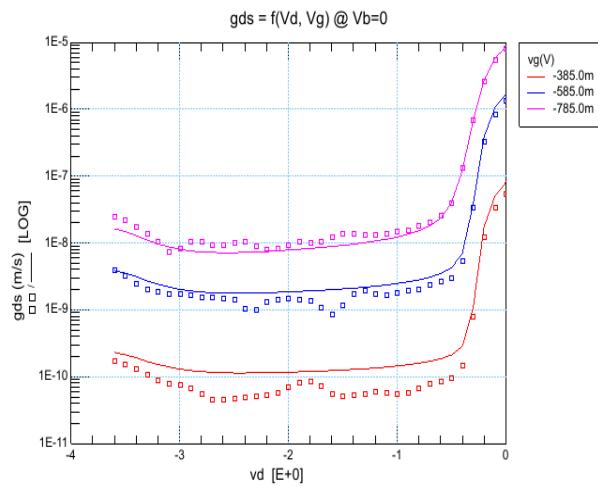


$idv_g, I_b, I_g, V_b = 0V, T = 125^\circ C$

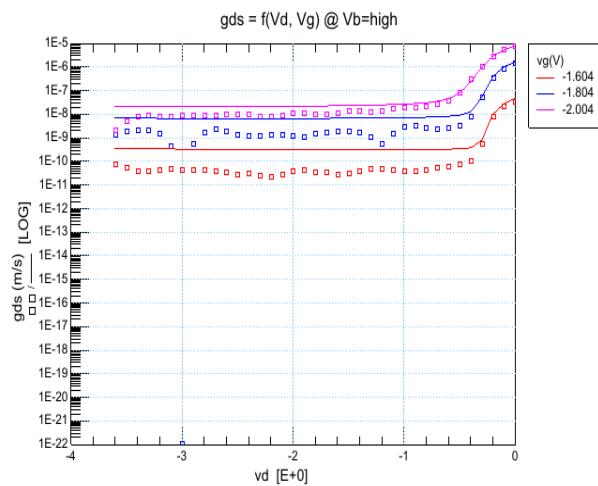
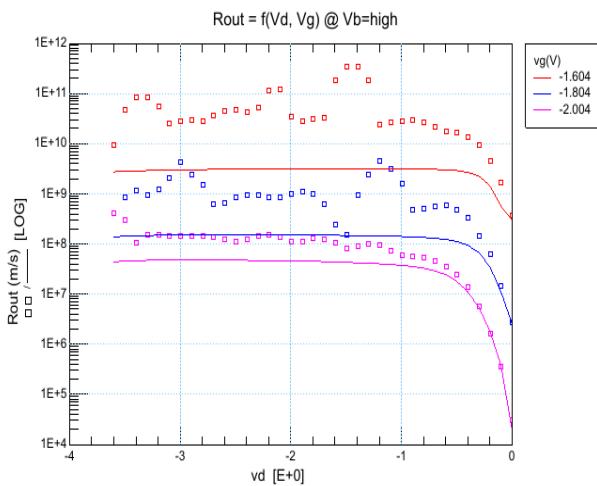
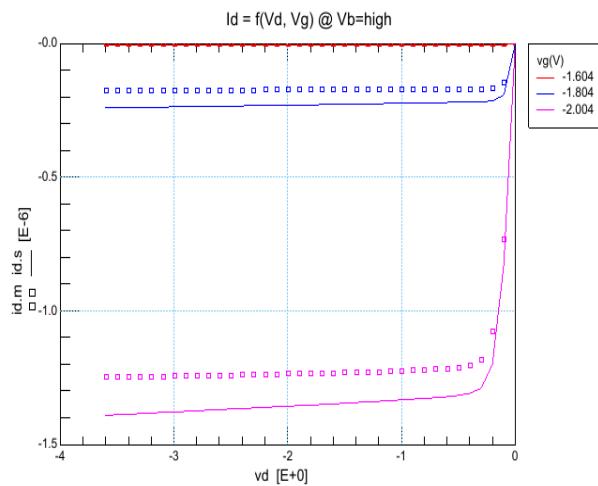


idvg, Ib,Ig, Vb = 3.6V, T = 125°C

idvd, Vb = 0V, T = 125°C


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

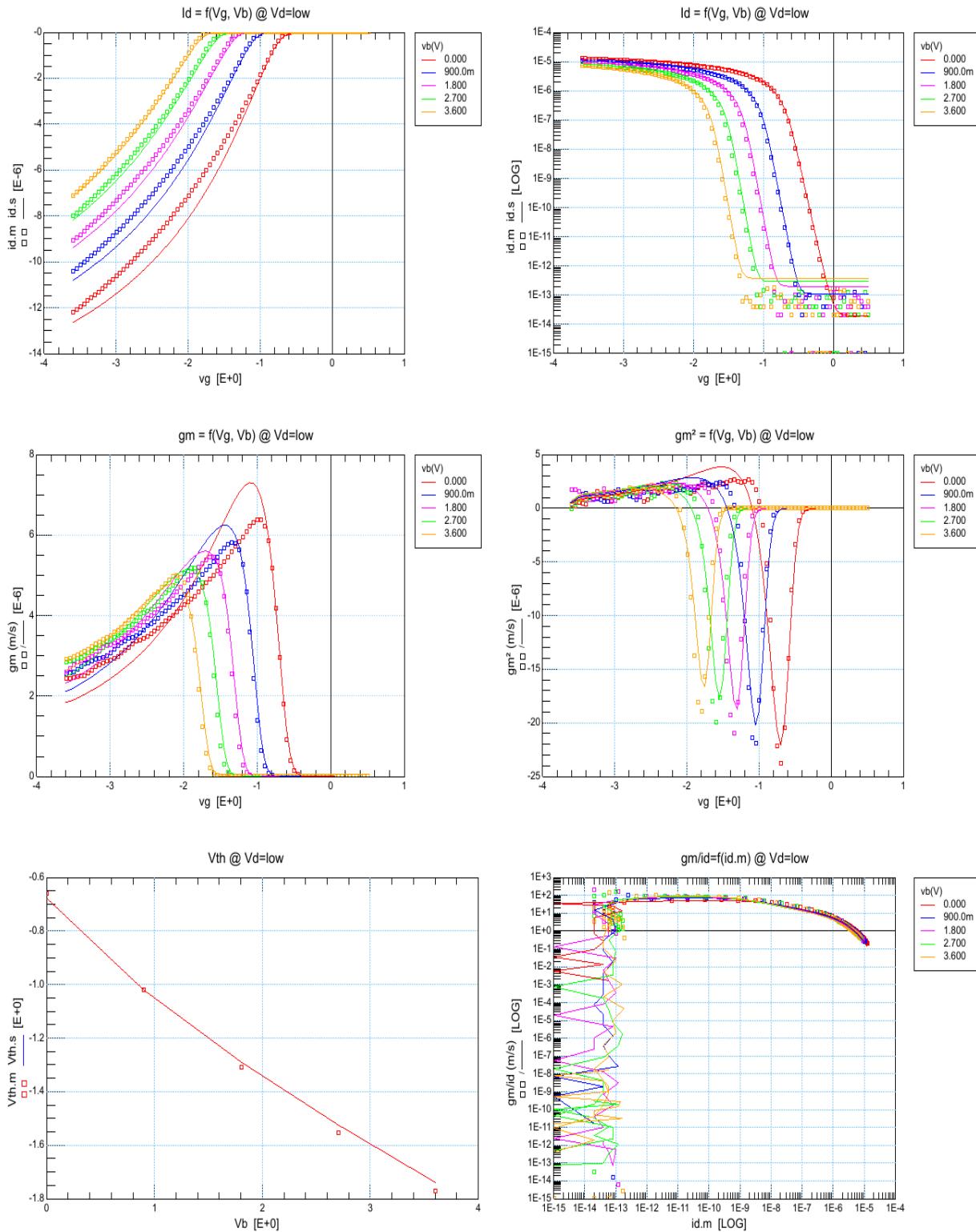


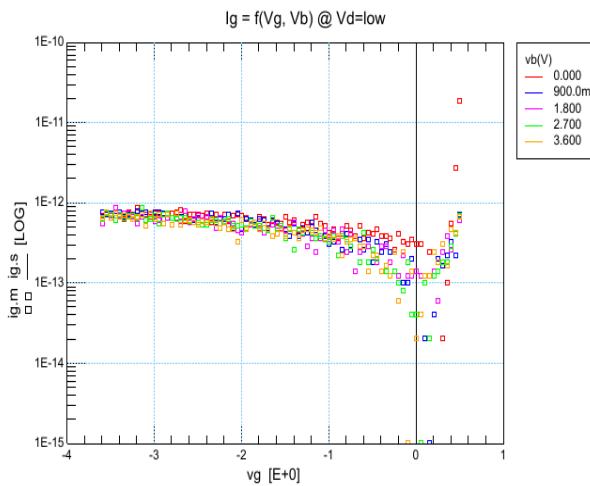
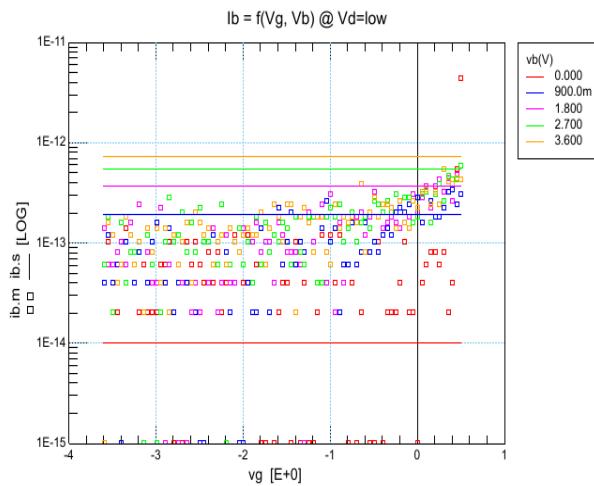
idvd_vth_vbmin, Vb = 3.6V, T = 125°C



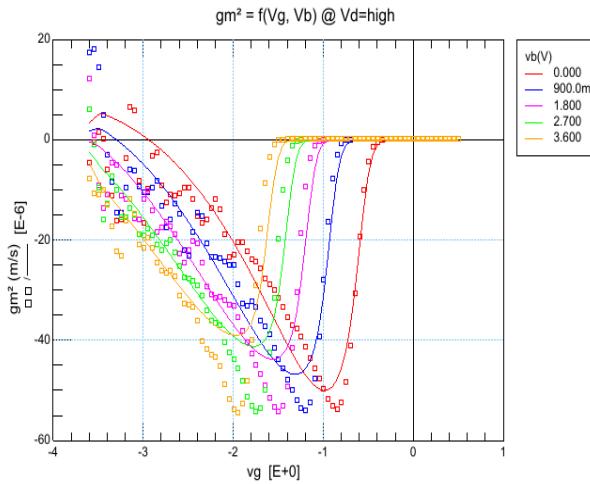
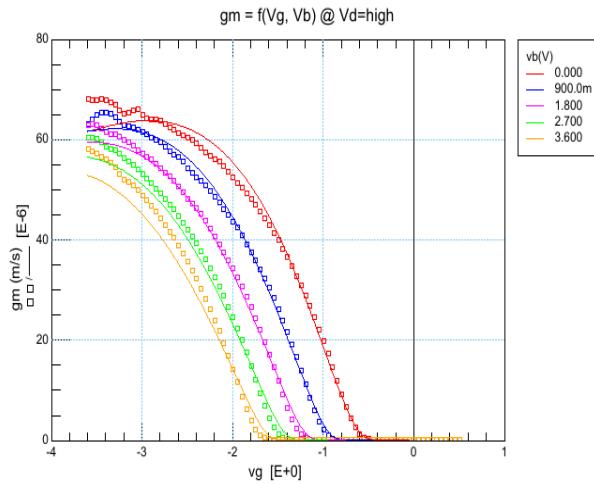
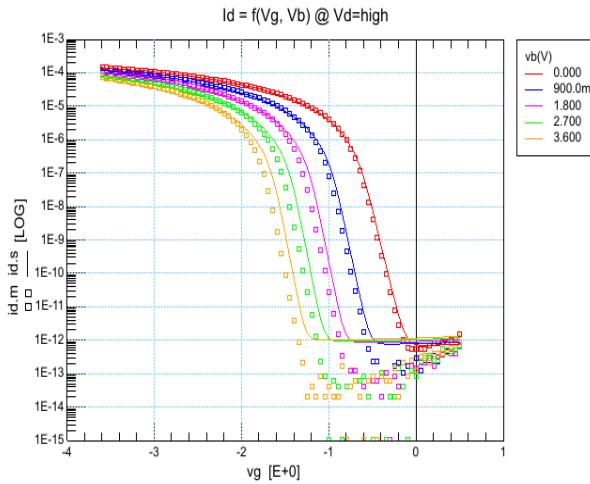
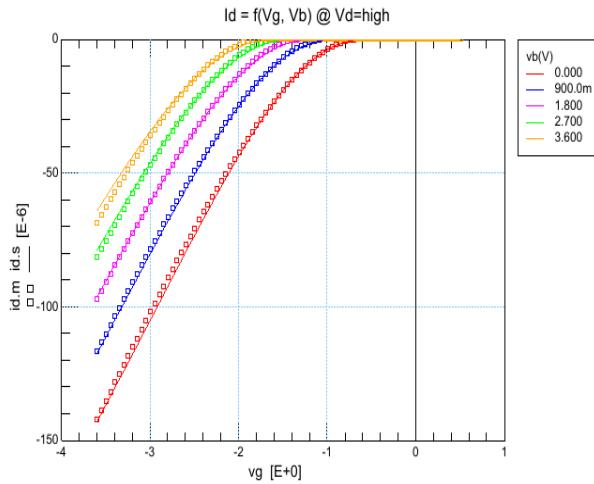
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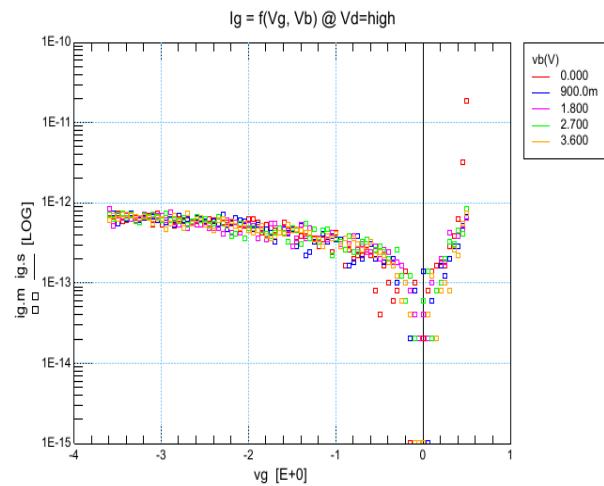
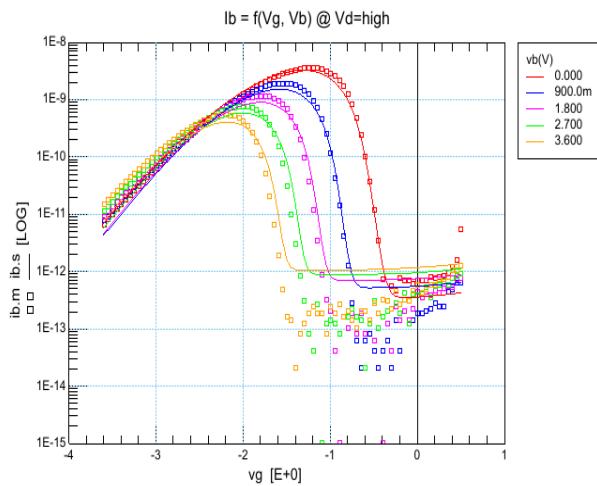
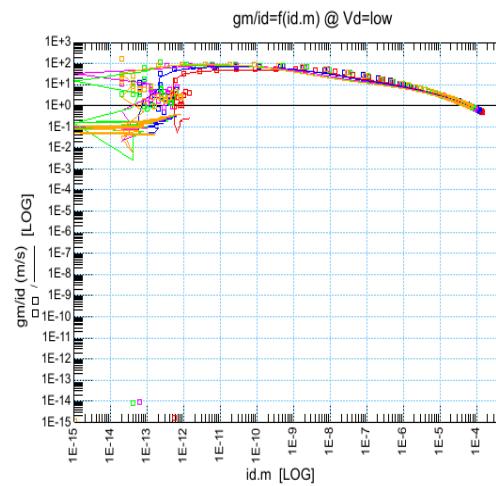
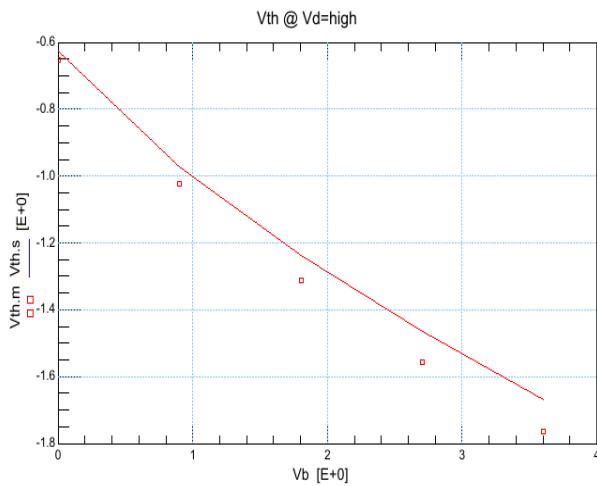
$idv_g, V_d = -0.1V, T = 27^\circ C$



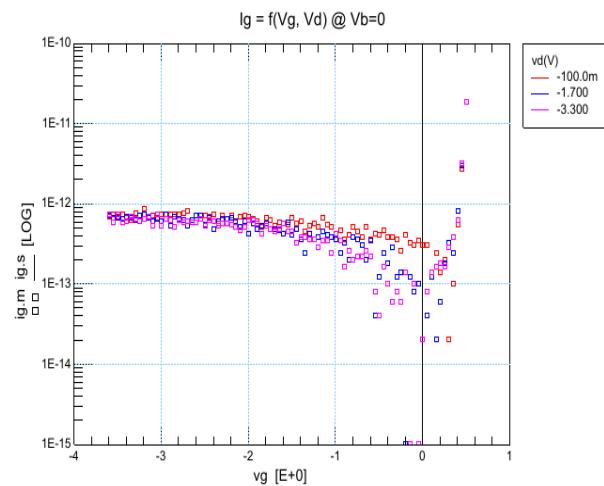
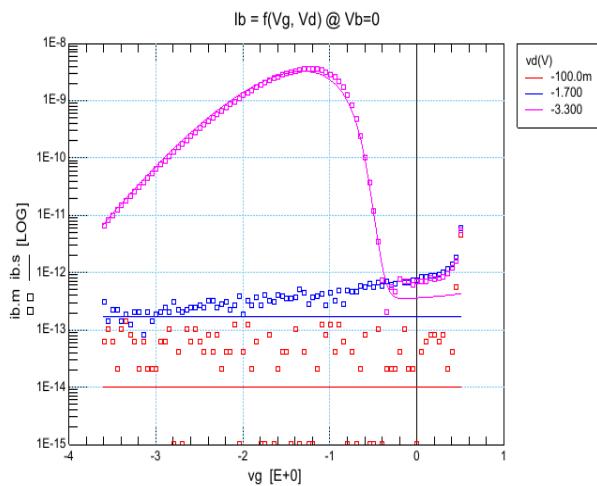


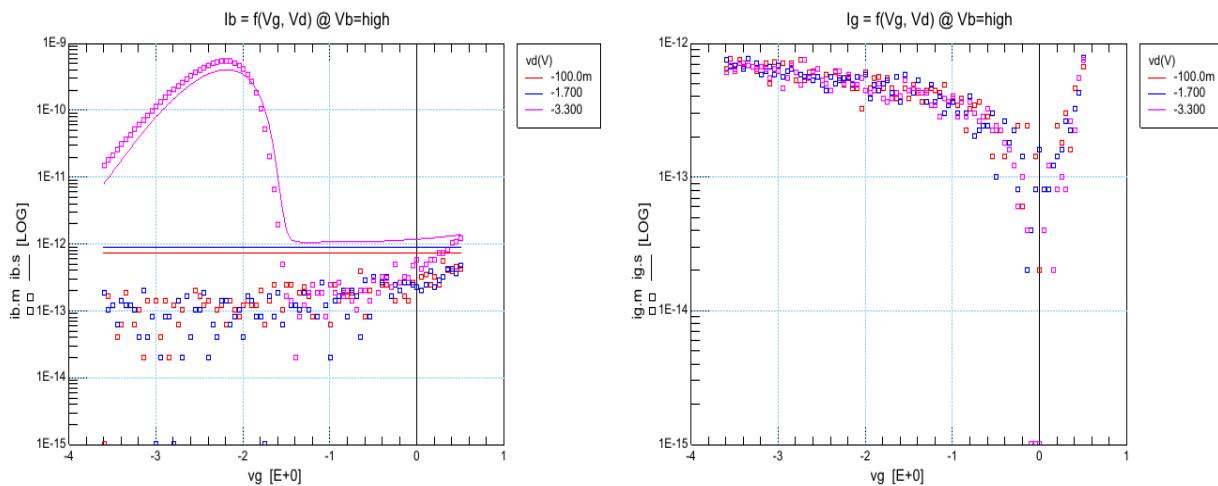
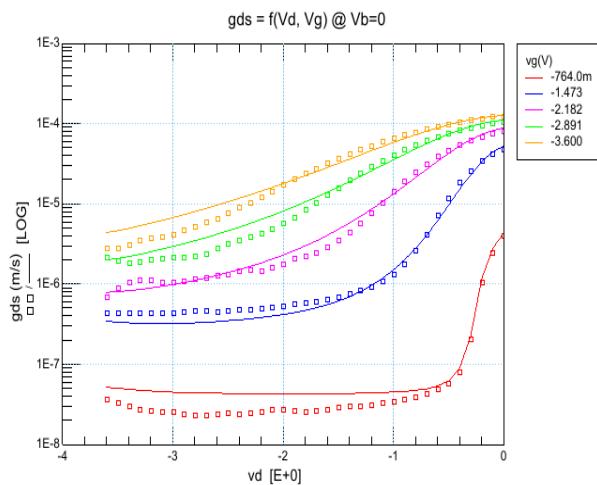
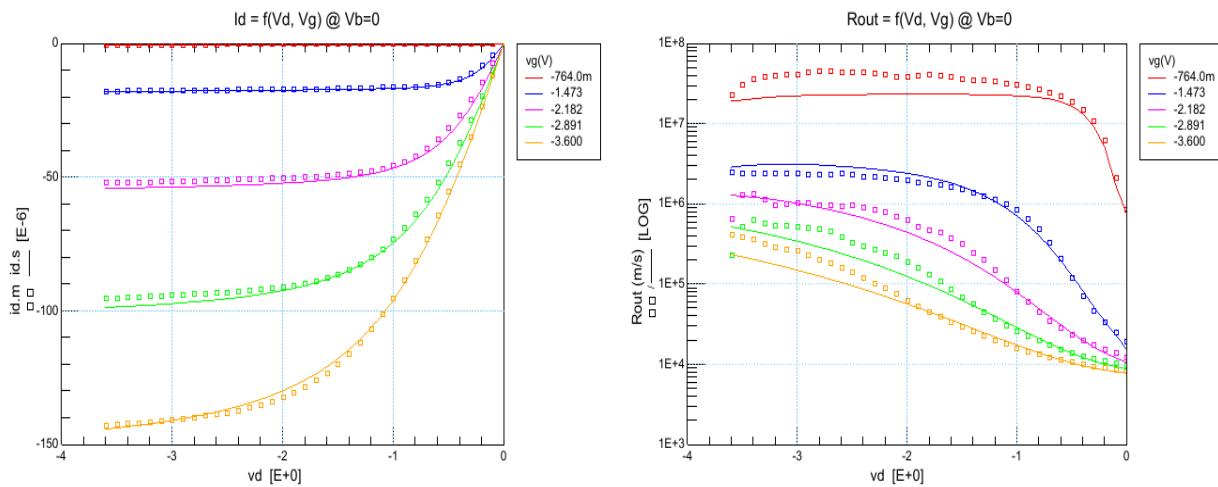
$idvg, Vd = -3.3V, T = 27^\circ C$

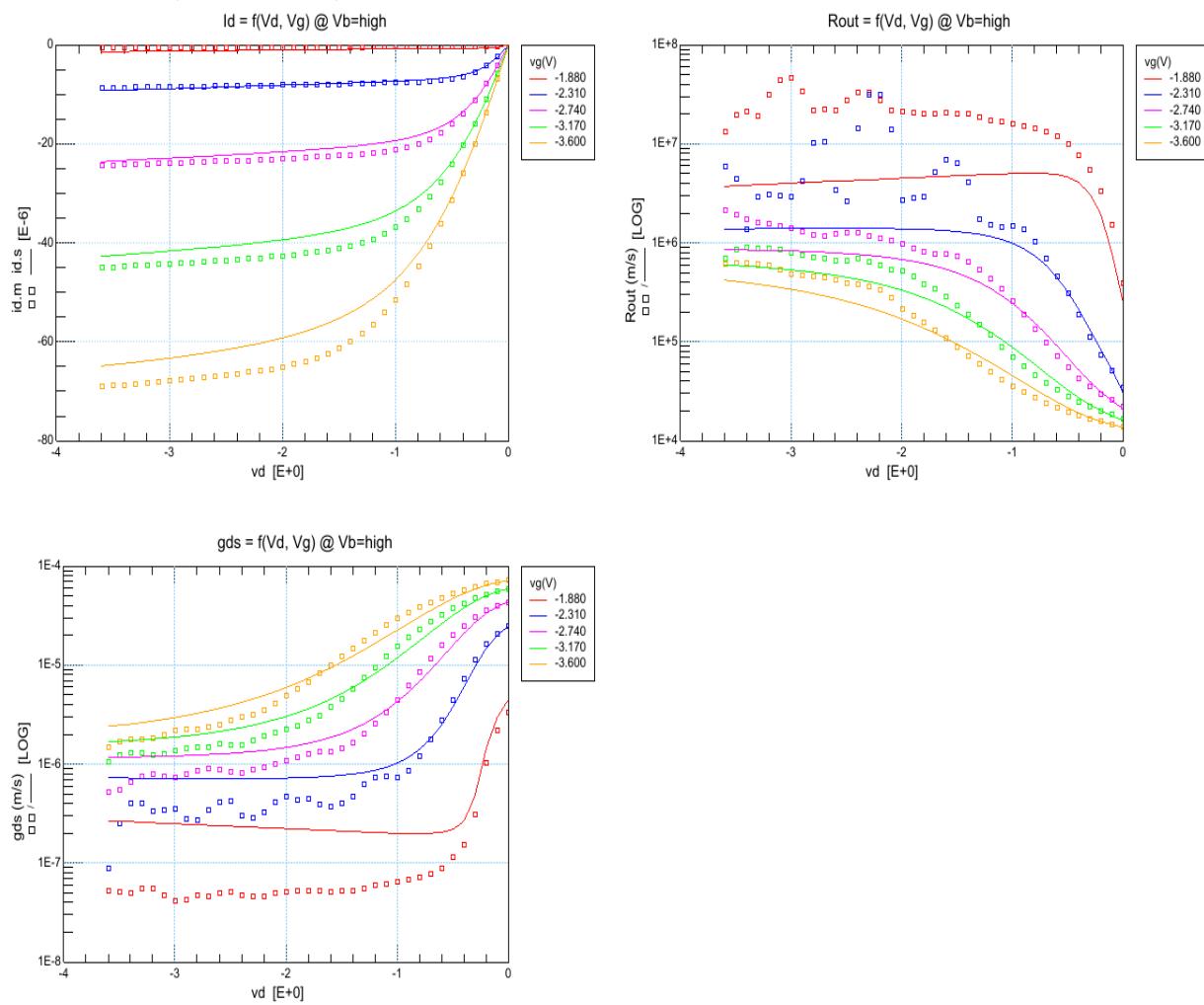
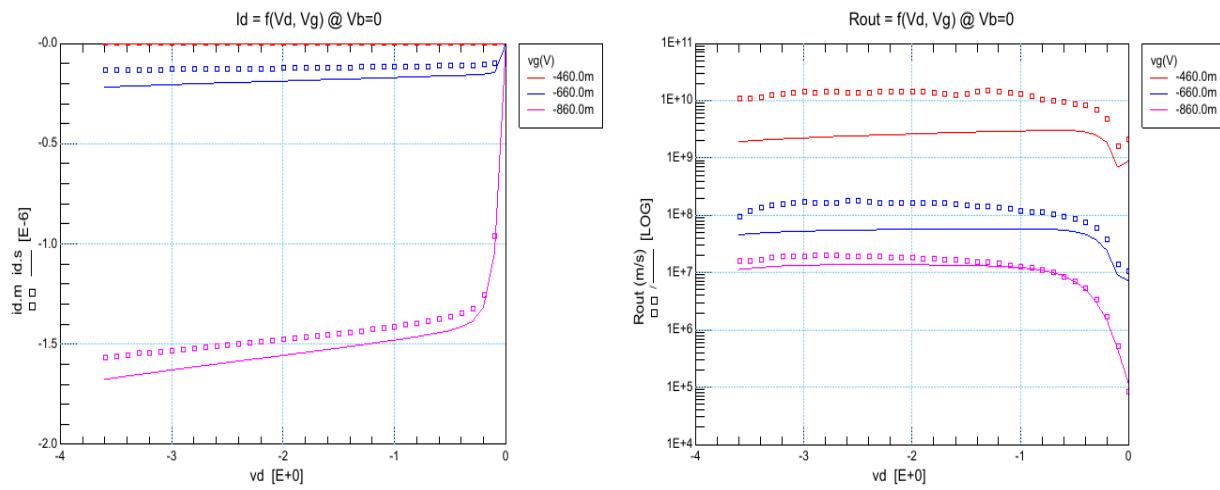


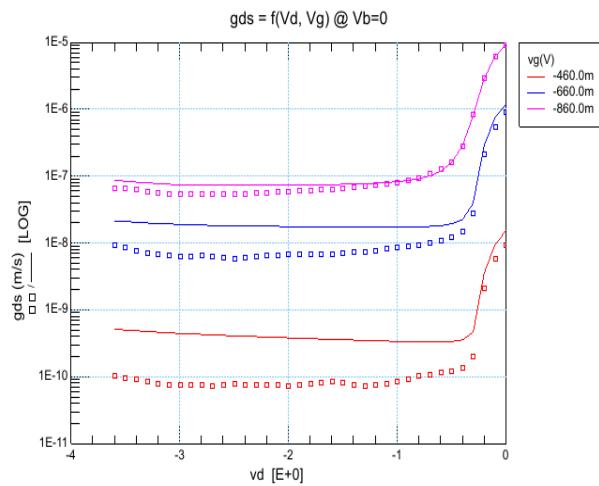


idvg, lb, lg, Vb = 0V, T = 27°C

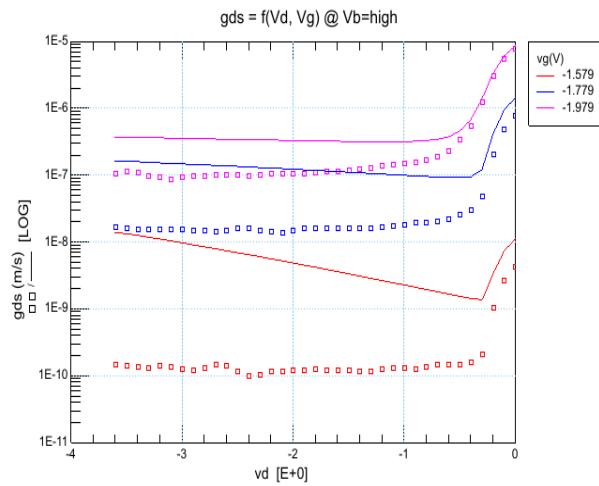
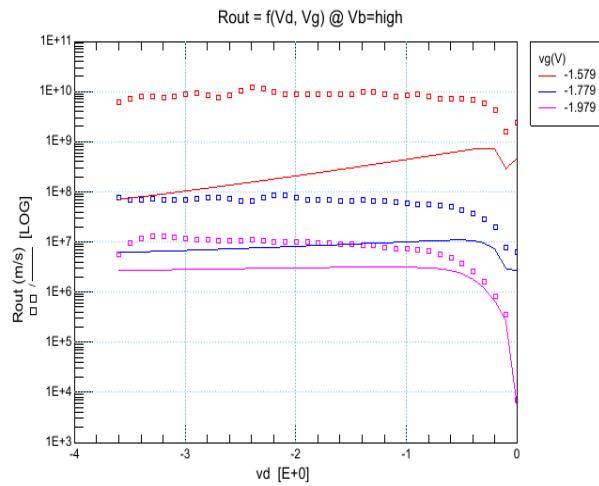
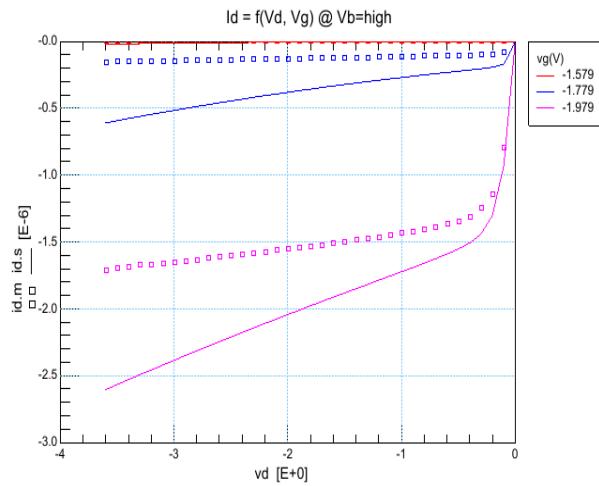


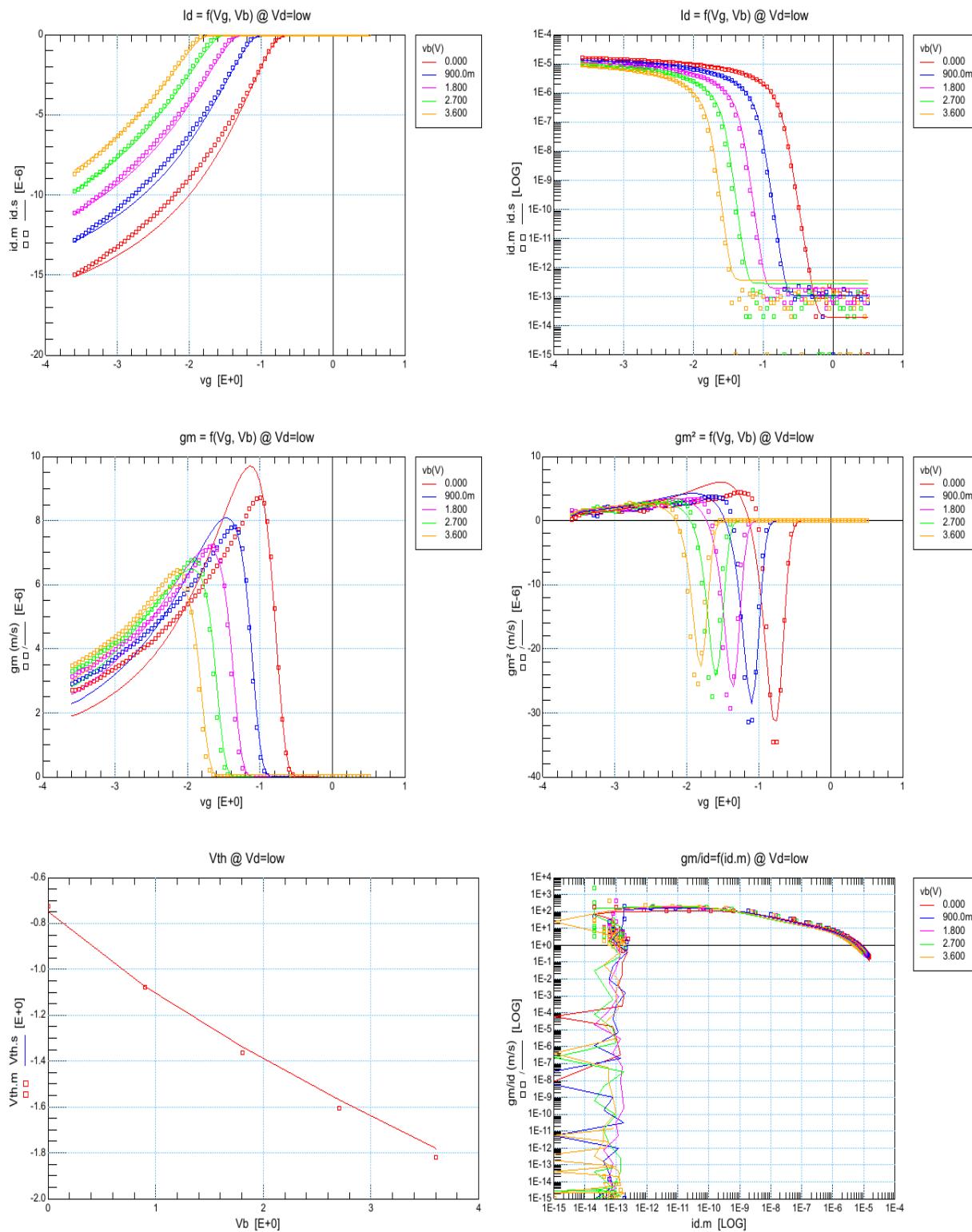
idvg, Ib,Ig, Vb = 3.6V, T = 27°C**idvd, Vb = 0V, T = 27°C**

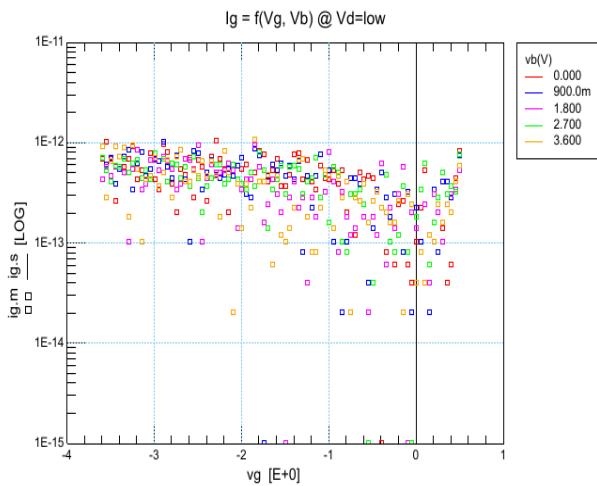
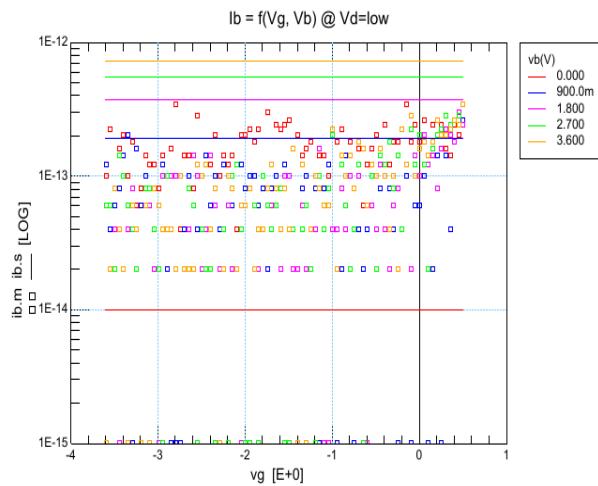
idvd_vbmin, Vb = 3.6V, T = 27°C**idvd_vth, Vb = 0V, T = 27°C**



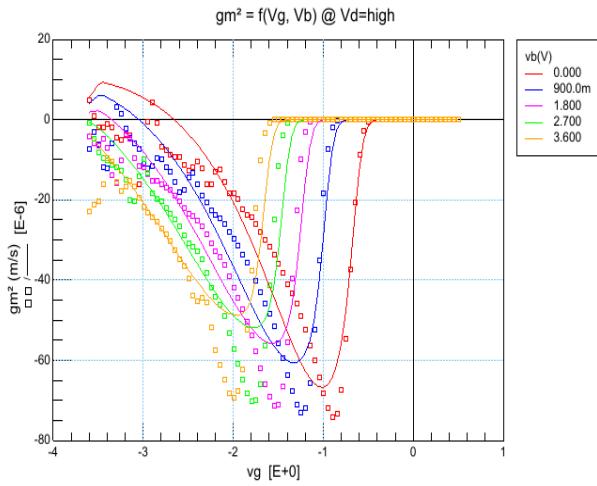
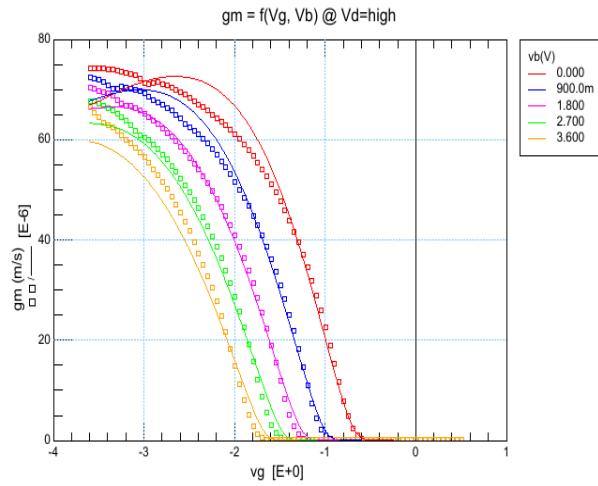
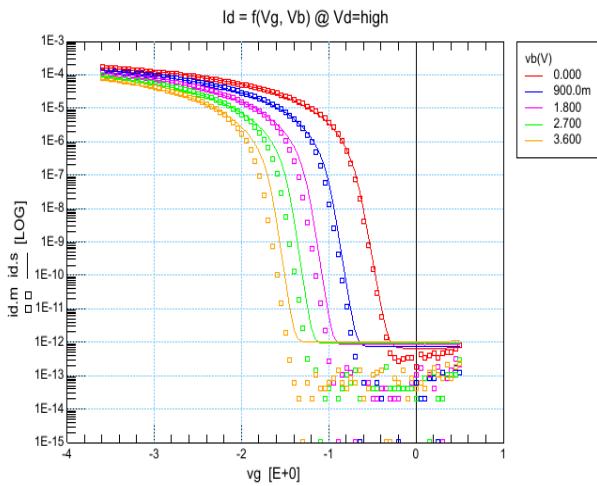
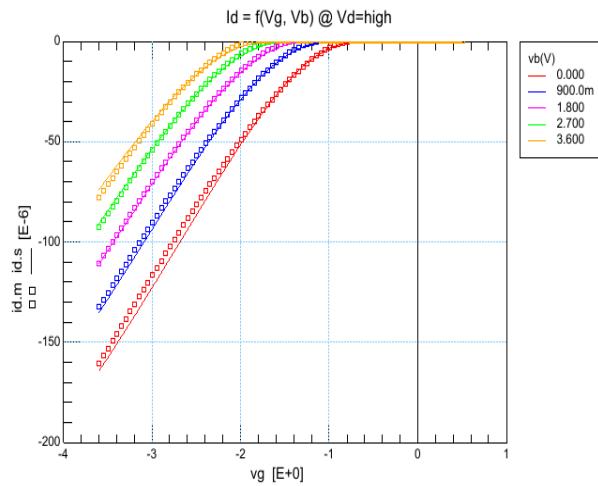
idvd_vth_vbmin, Vb = 3.6V, T = 27°C

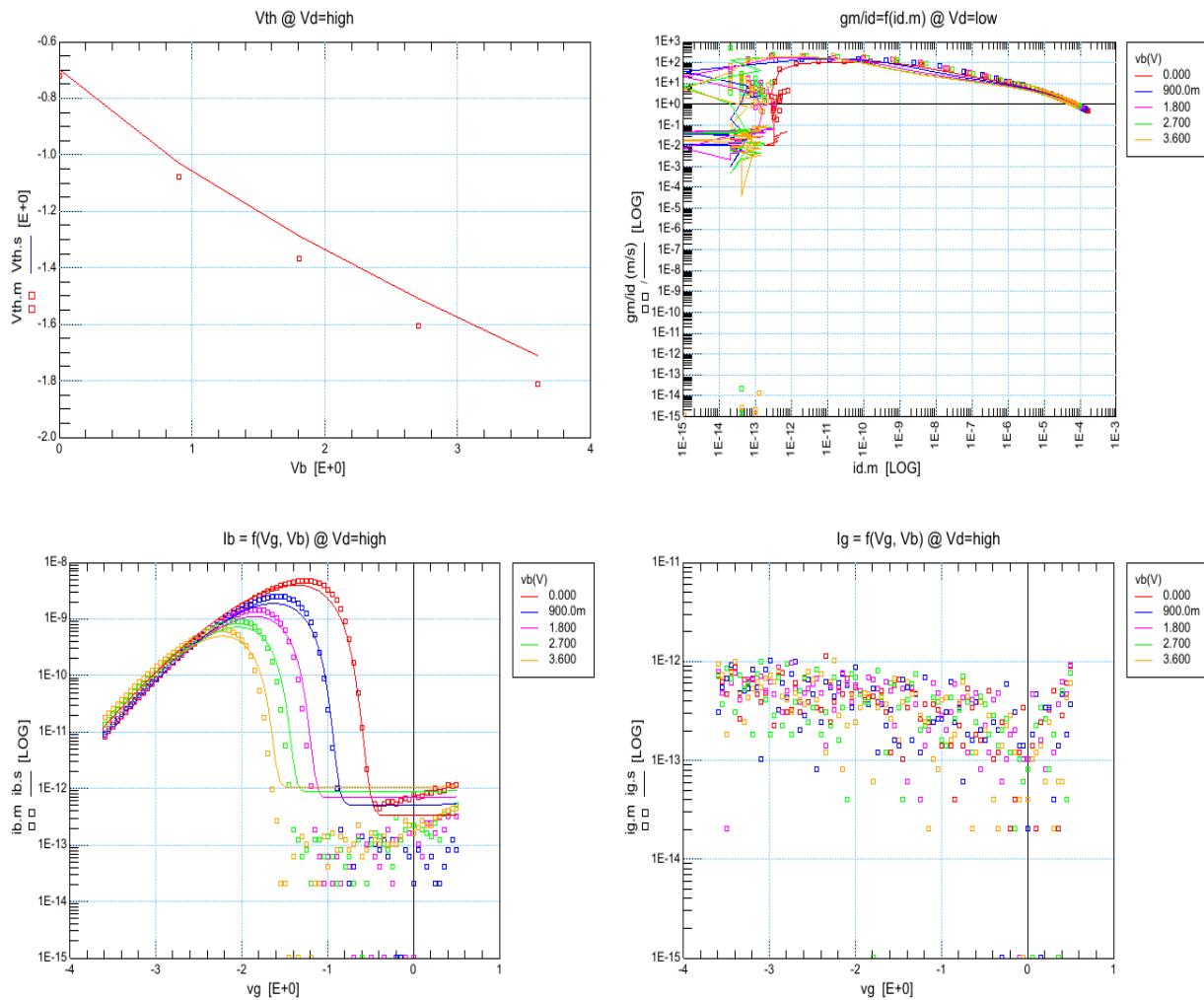


idvg, Vd = -0.1V, T = -40°C


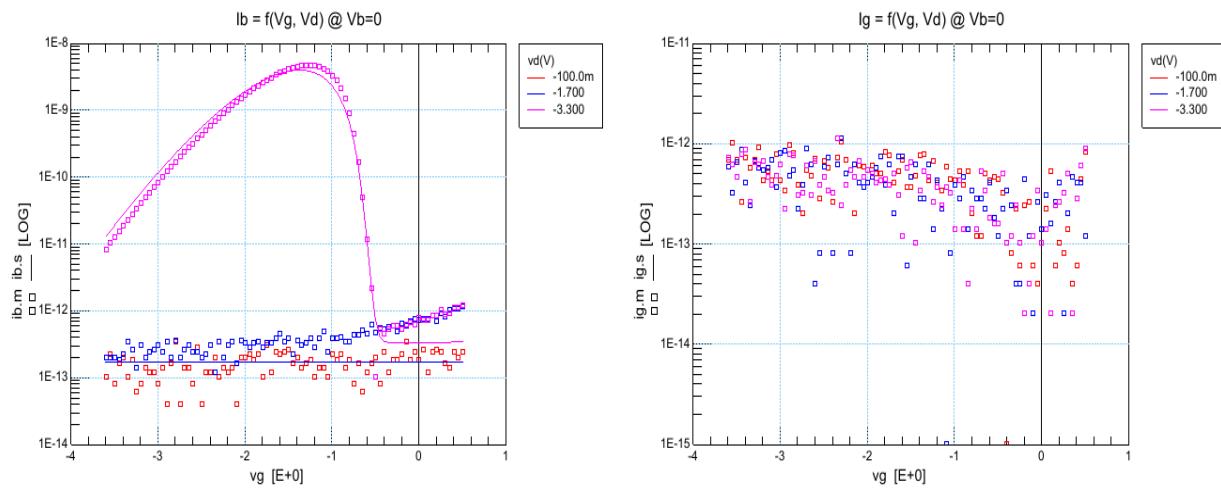


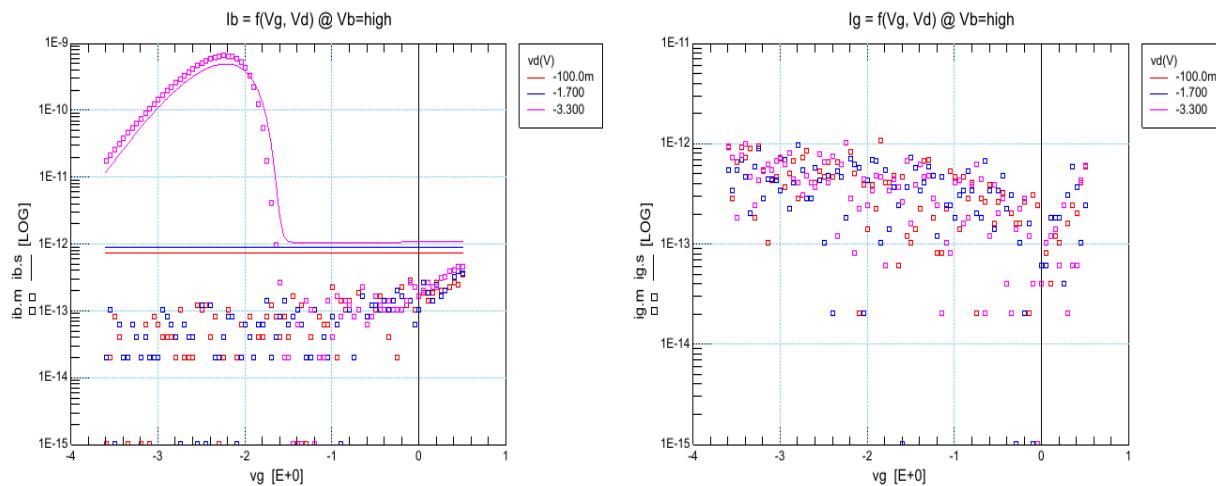
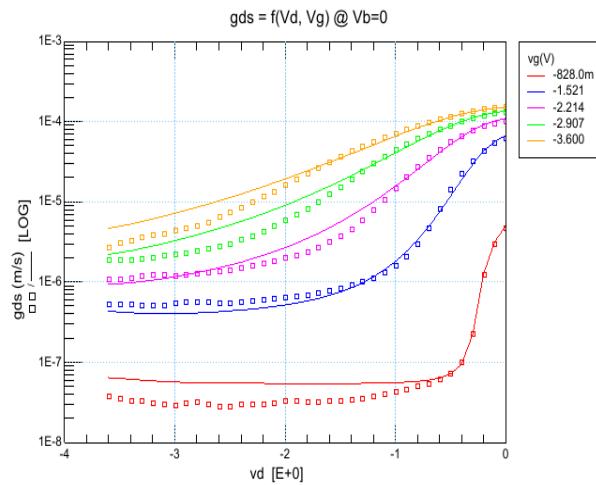
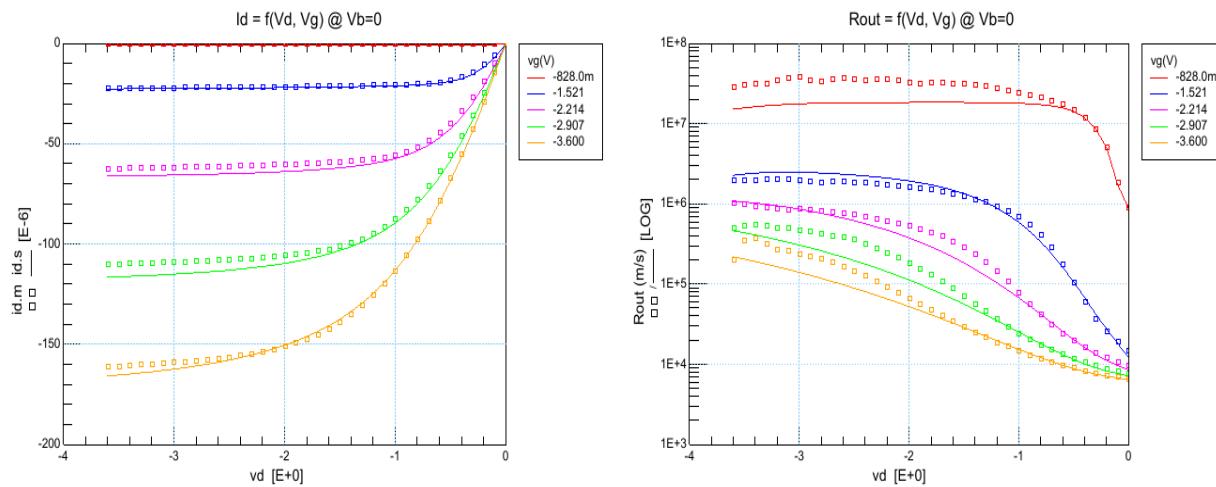
idvg, Vd = -3.3V, T = -40°C

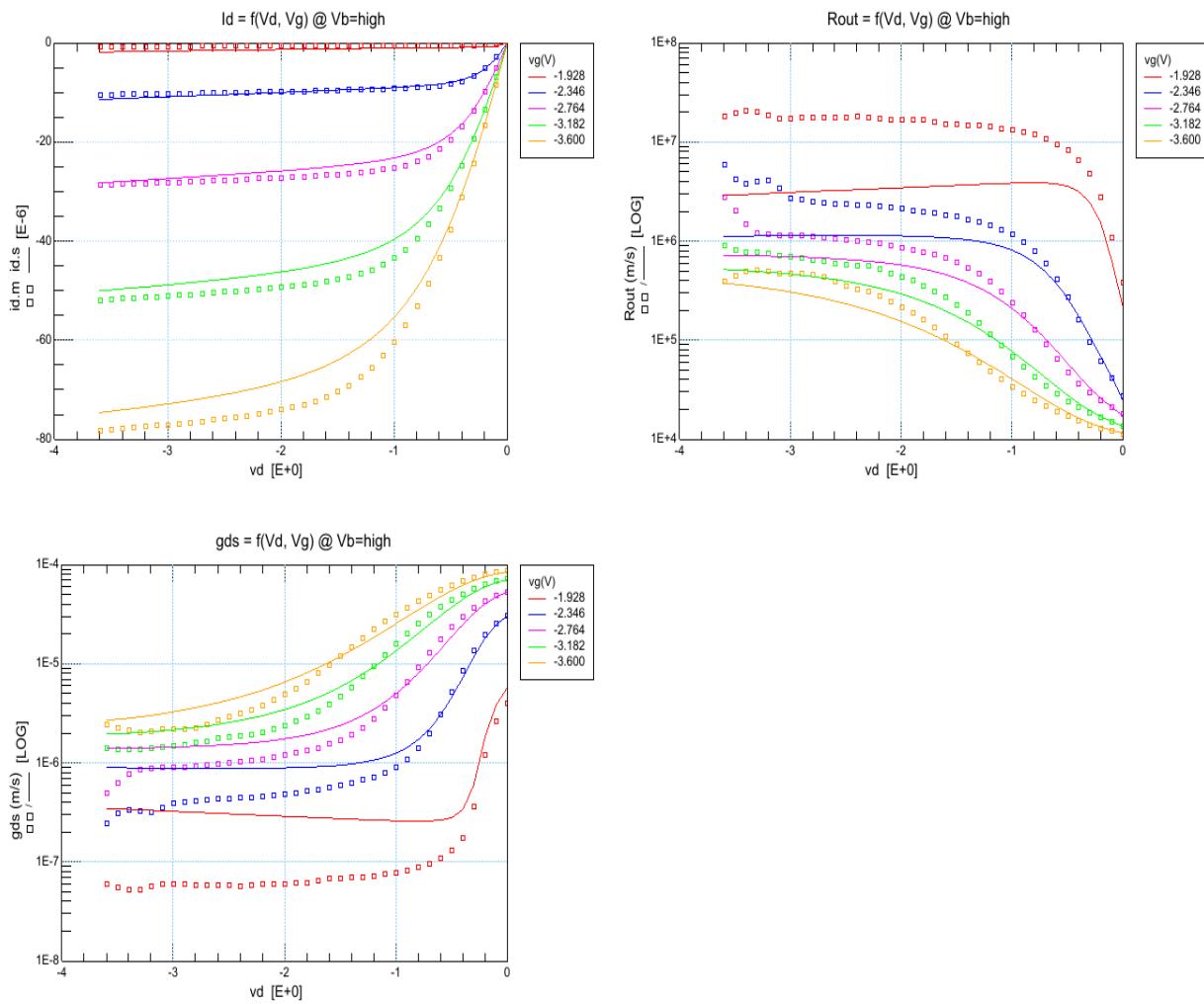
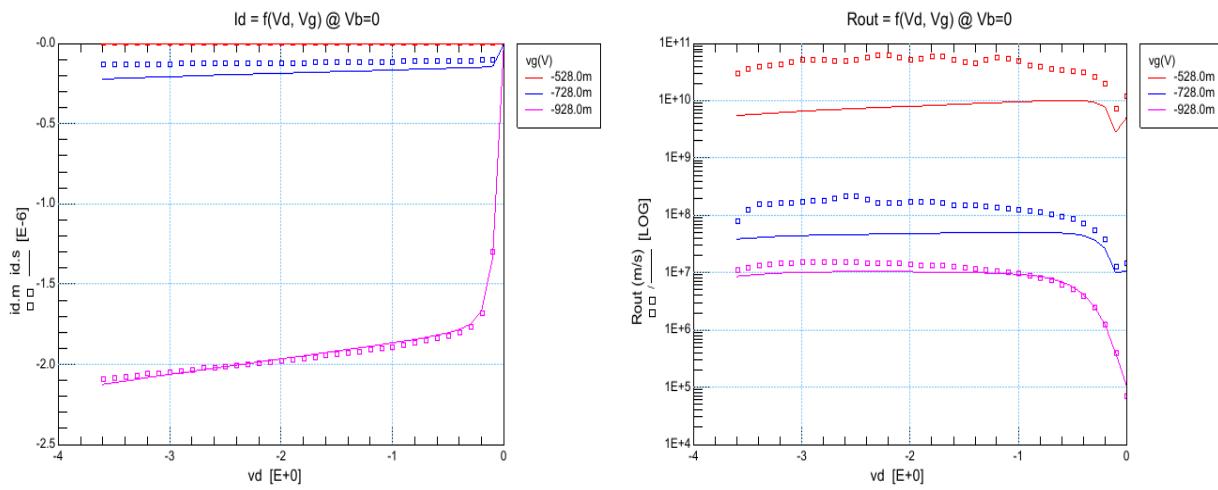


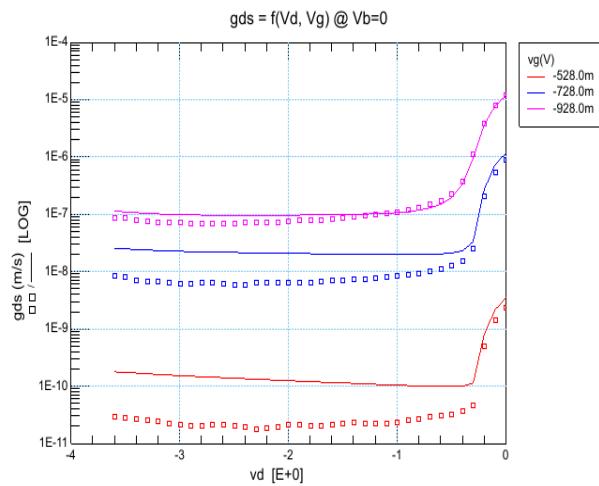


idvg, Ib,Ig, Vb = 0V, T = -40°C

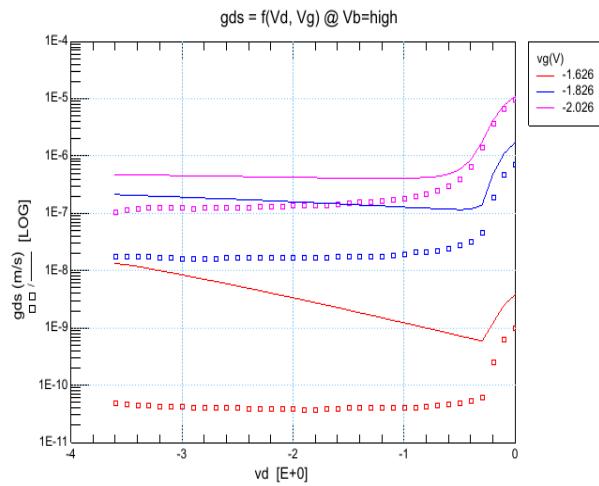
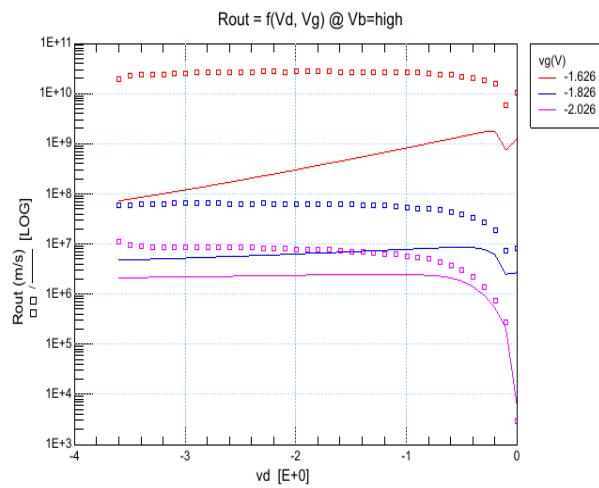
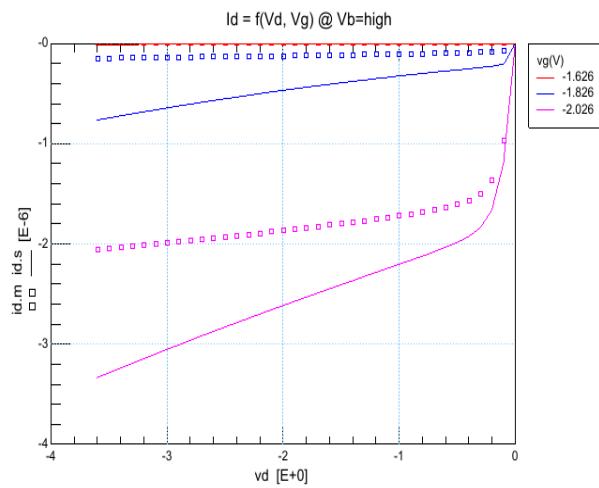


idvg, Ib,Ig, Vb = 3.6V, T = -40°C

idvd, Vb = 0V, T = -40°C


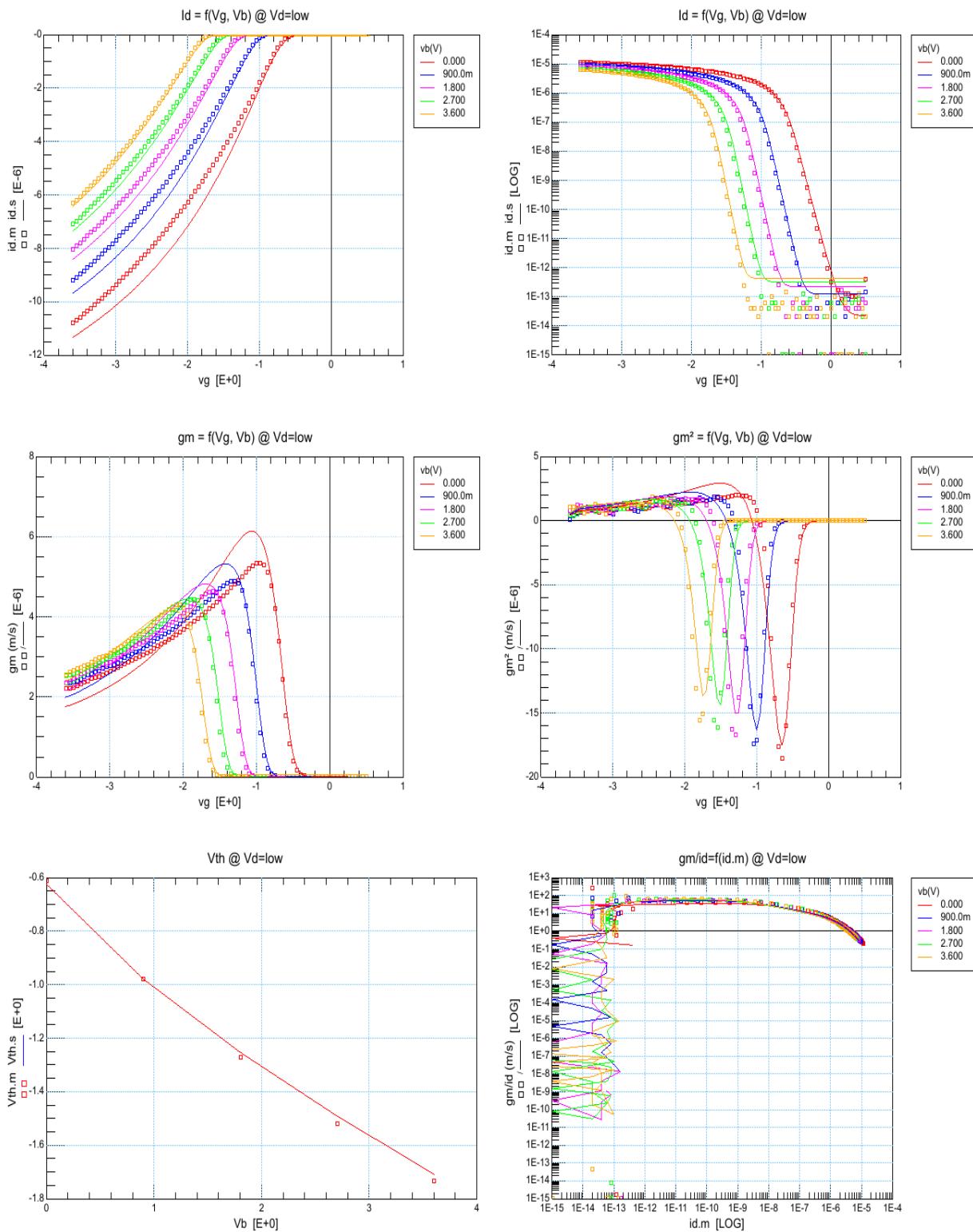
idvd_vbmin, Vb = 3.6V, T = -40°C**idvd_vth, Vb = 0V, T = -40°C**

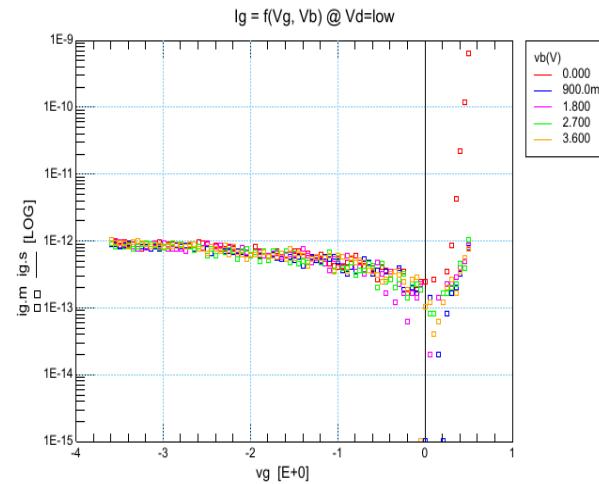
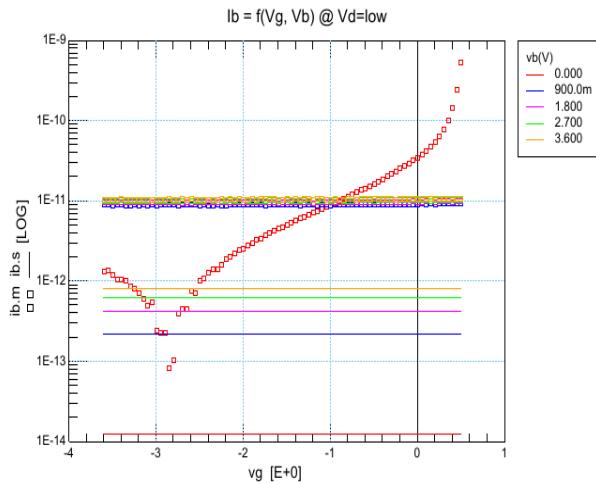


idvd_vth_vbmin, Vb = 3.6V, T = -40°C

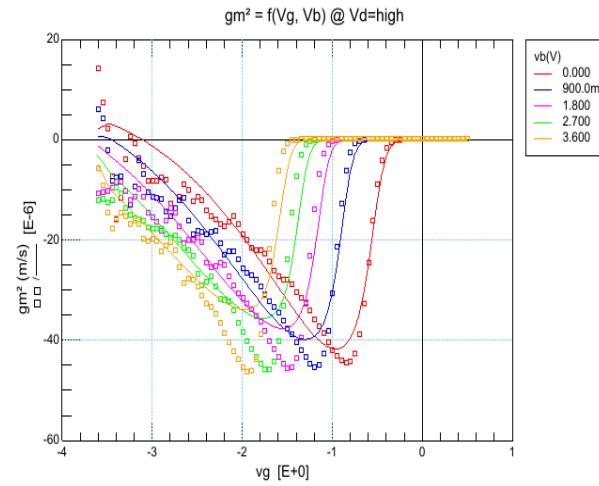
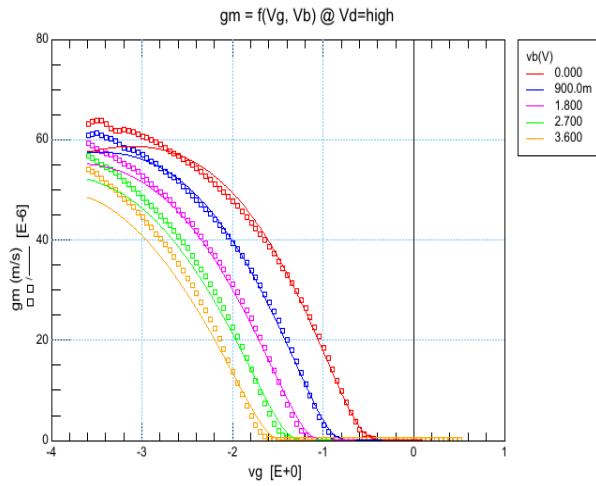
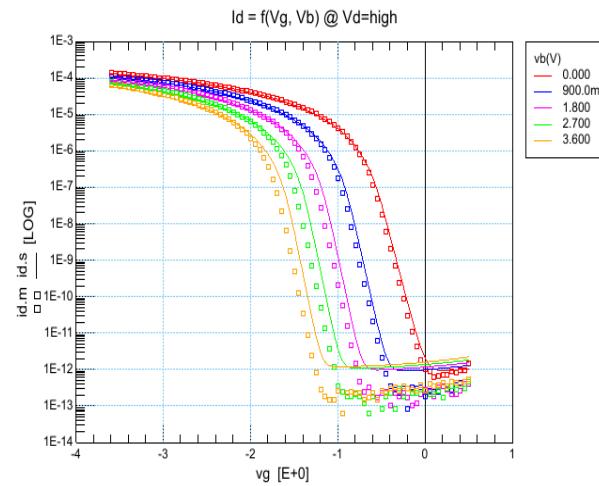
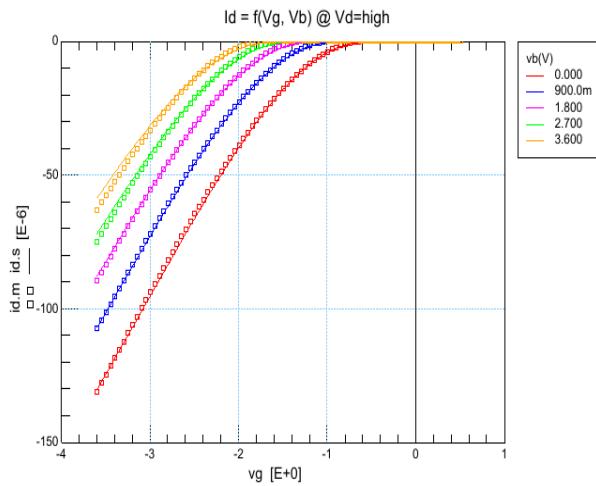


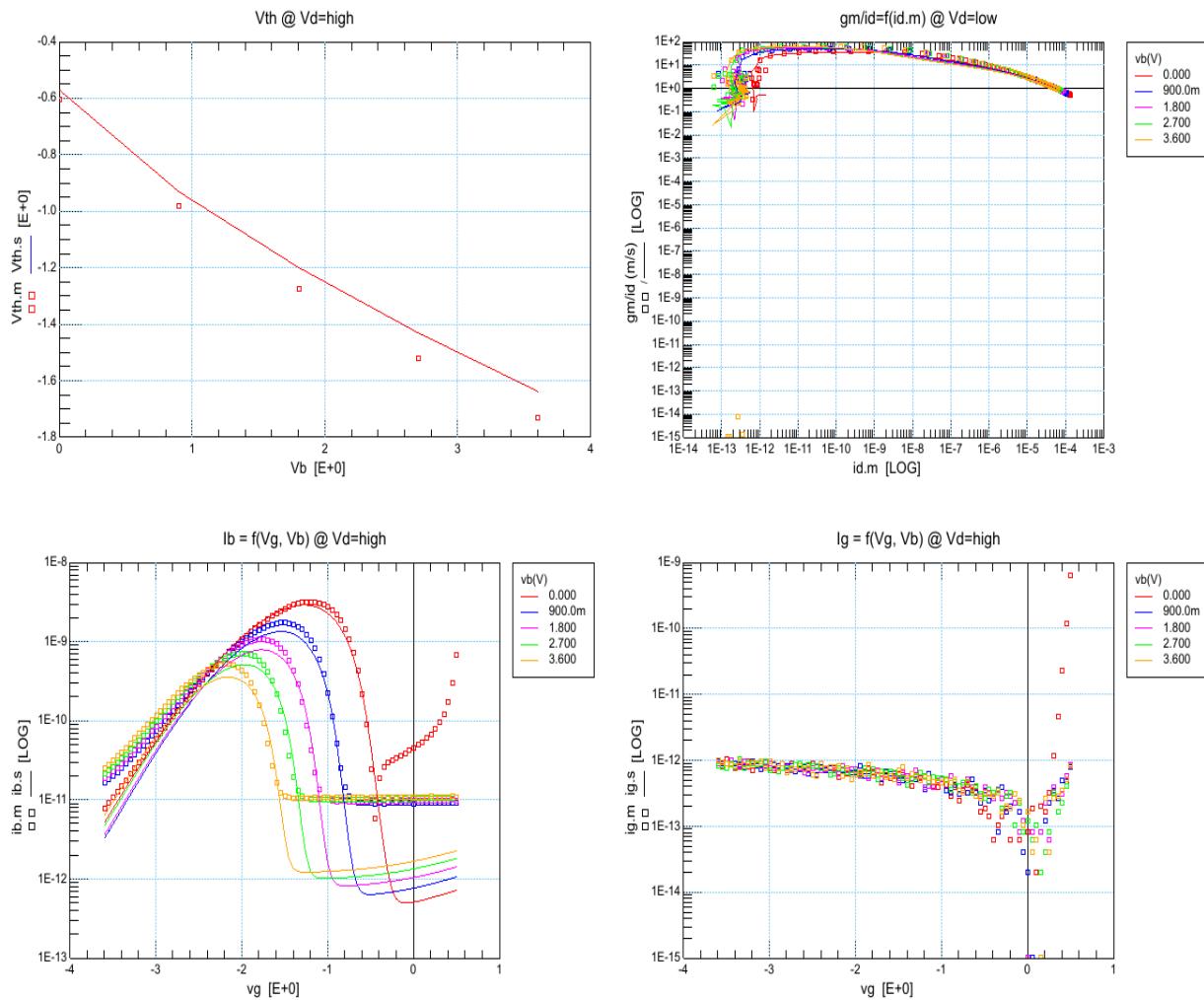
idvg, Vd = -0.1V, T = 70°C



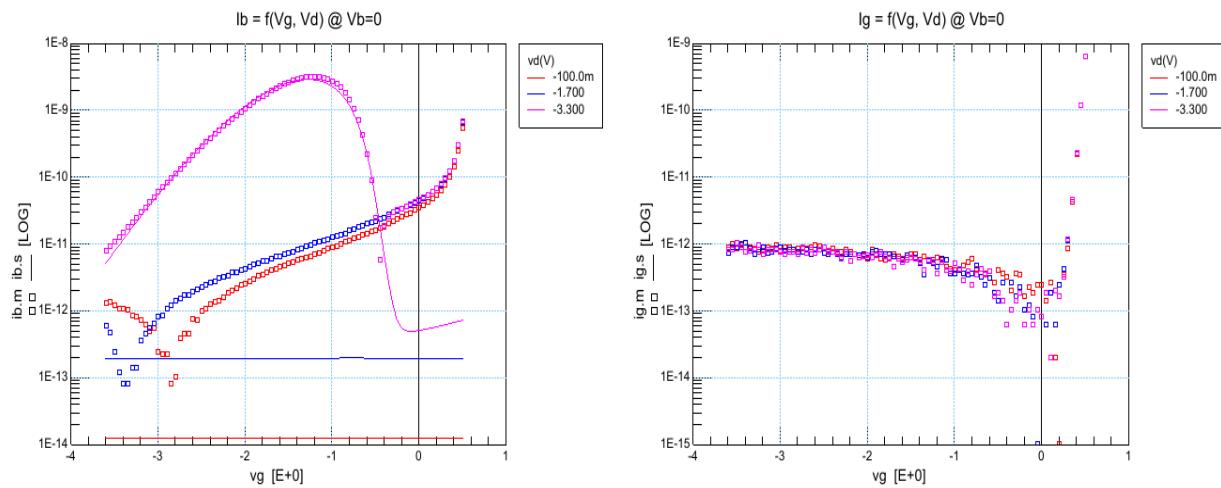


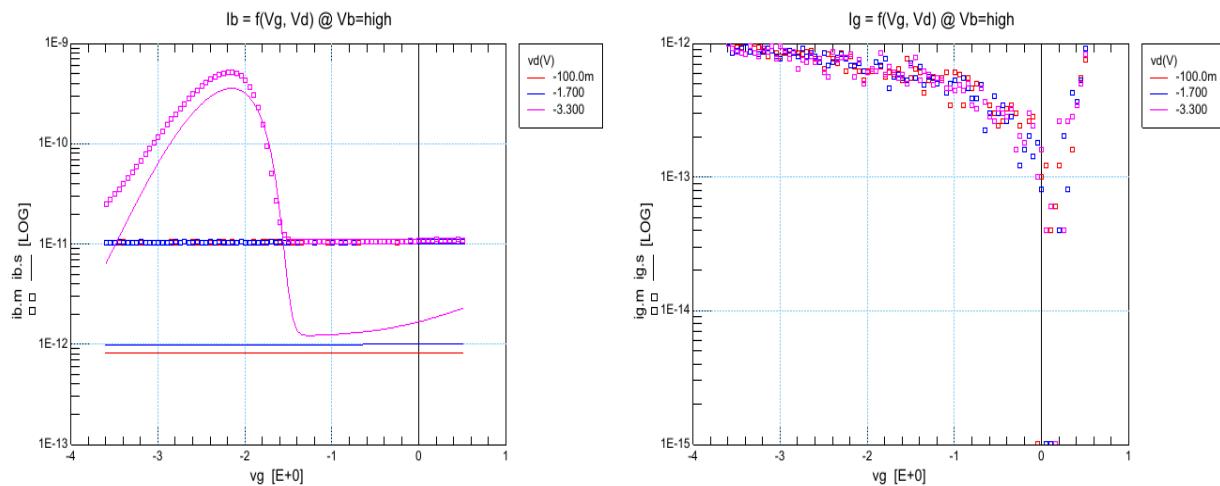
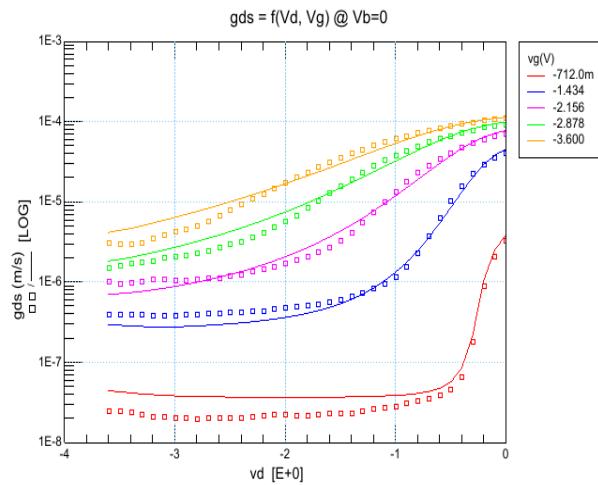
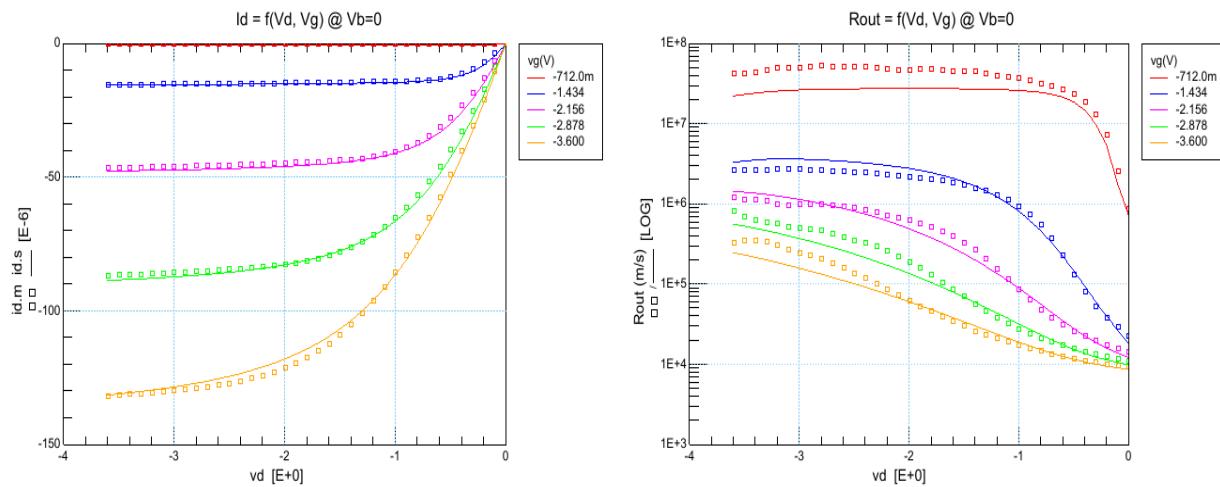
$i_{dvg}, V_d = -3.3V, T = 70^\circ\text{C}$

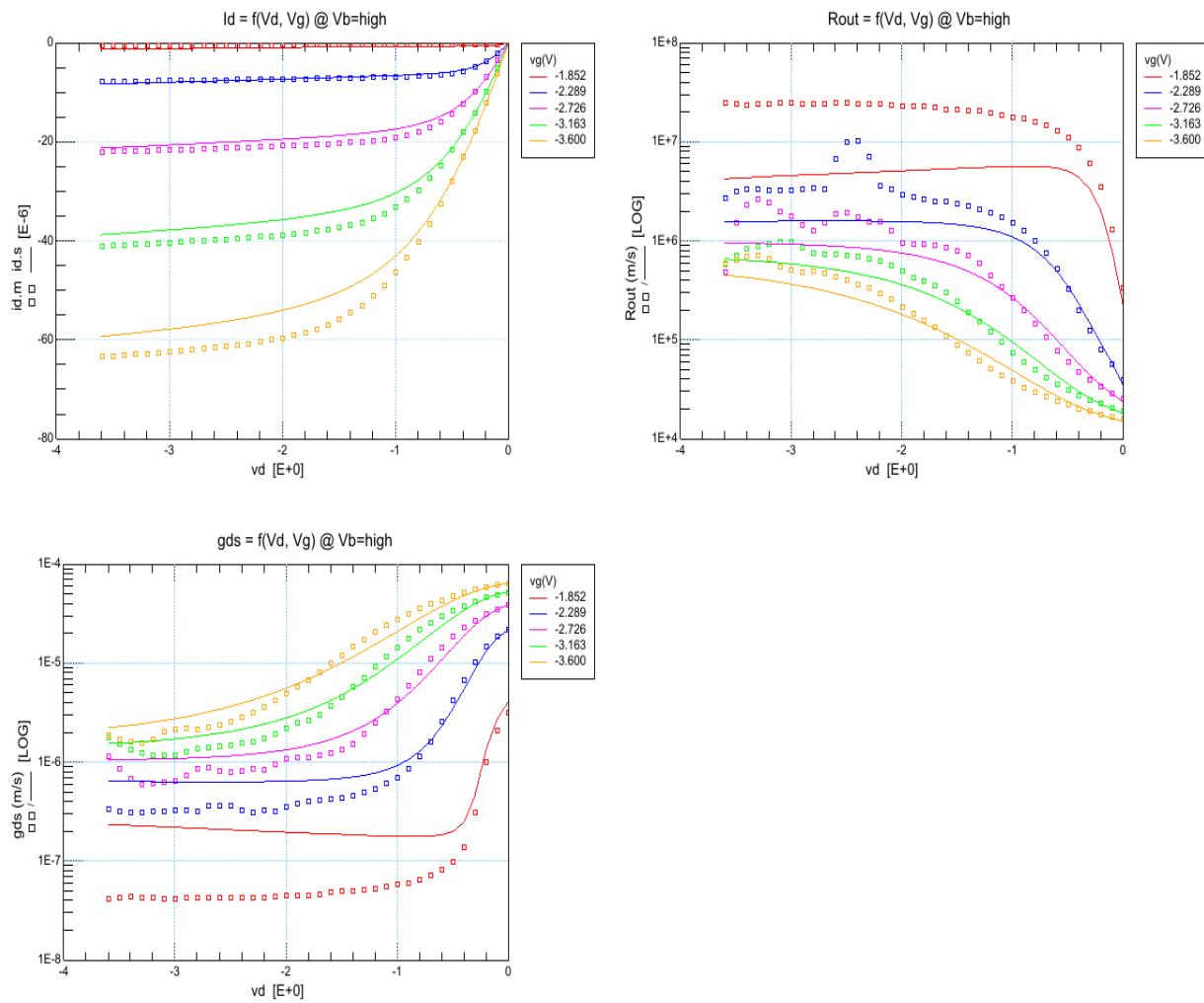
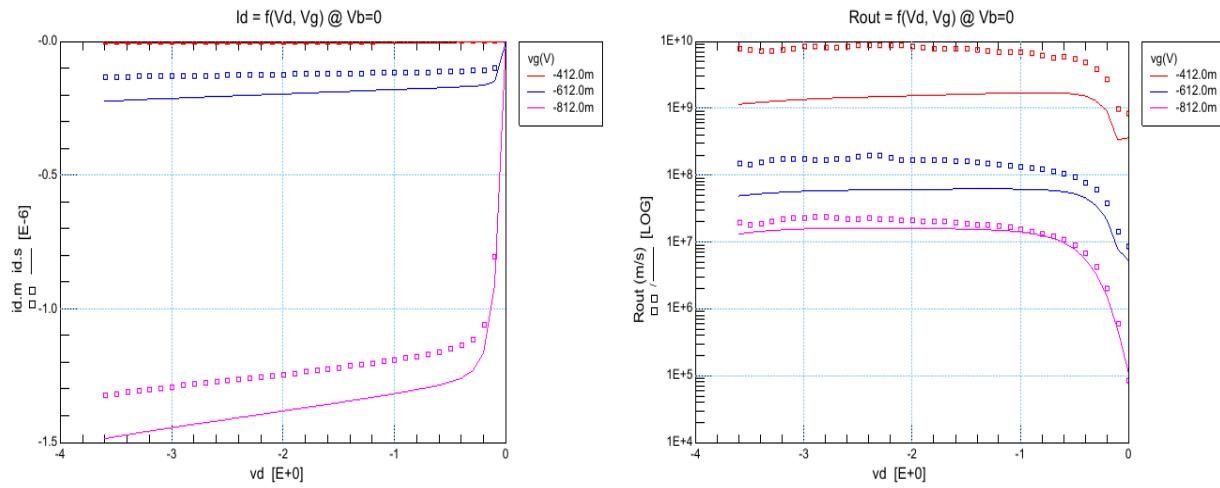


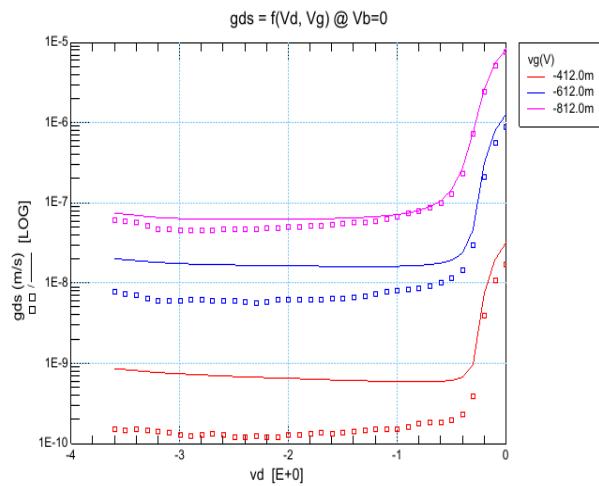


idvg, Ib,Ig, Vb = 0V, T = 70°C

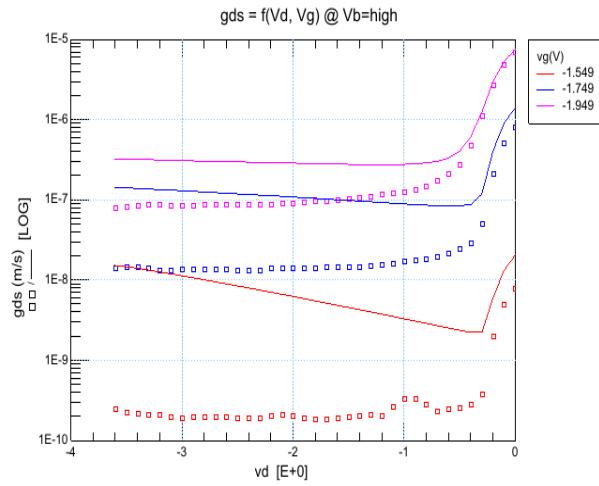
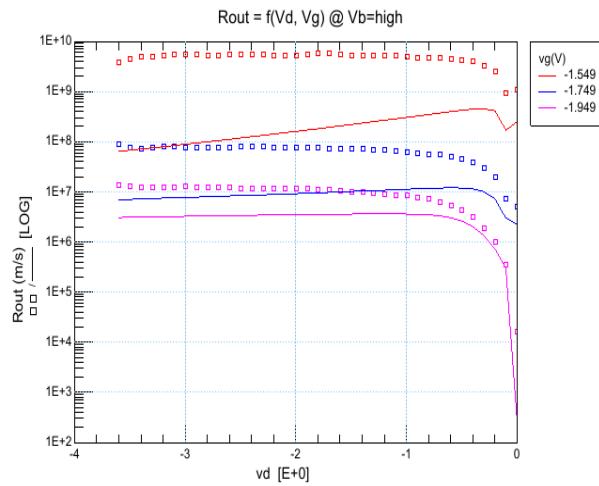
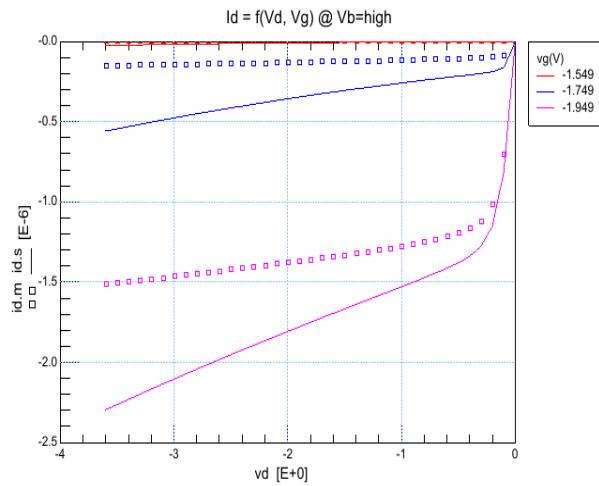


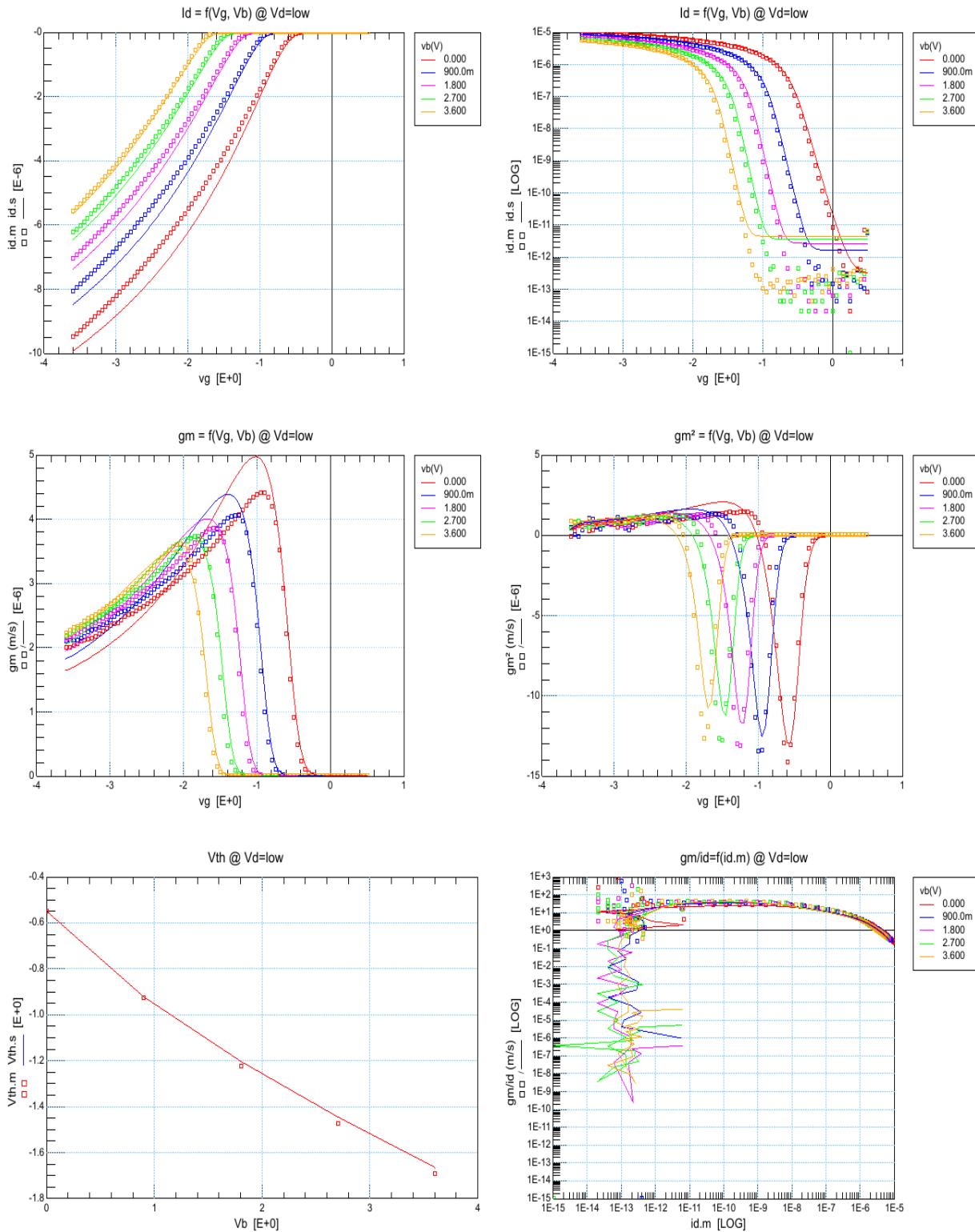
idvg, Ib,Ig, Vb = 3.6V, T = 70°C

idvd, Vb = 0V, T = 70°C


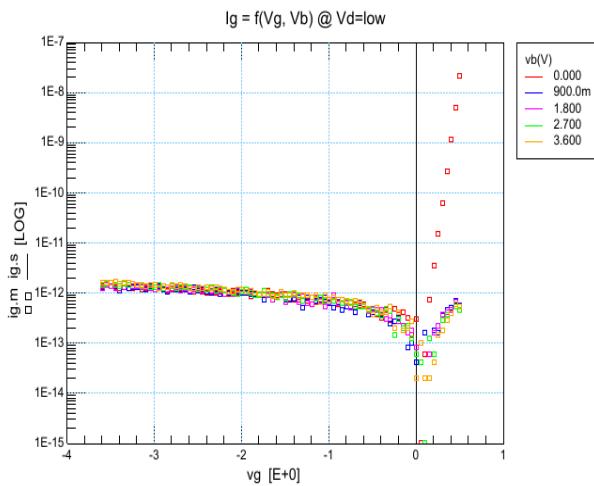
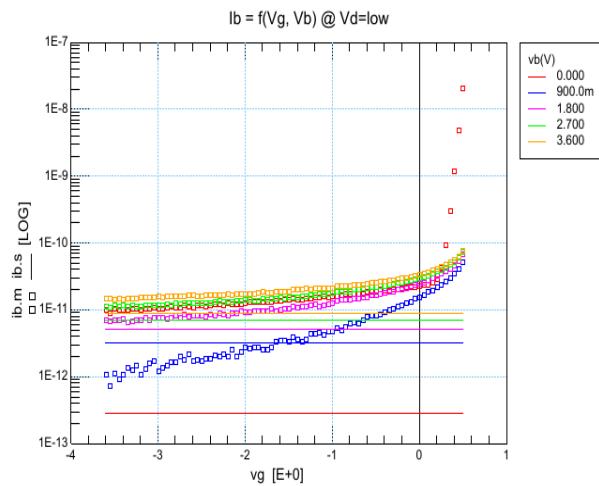
idvd_vbmin, Vb = 3.6V, T = 70°C**idvd_vth, Vb = 0V, T = 70°C**



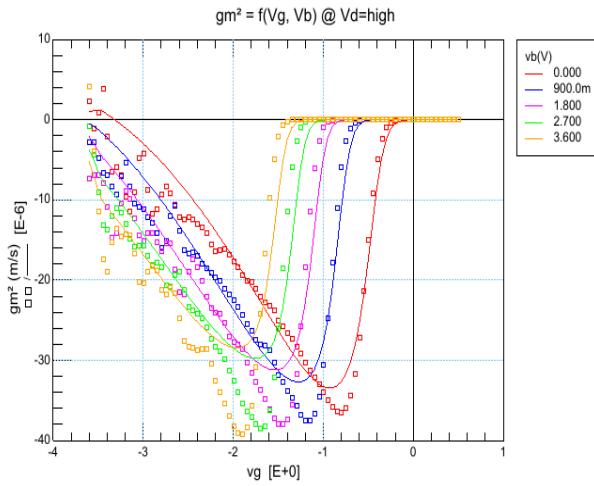
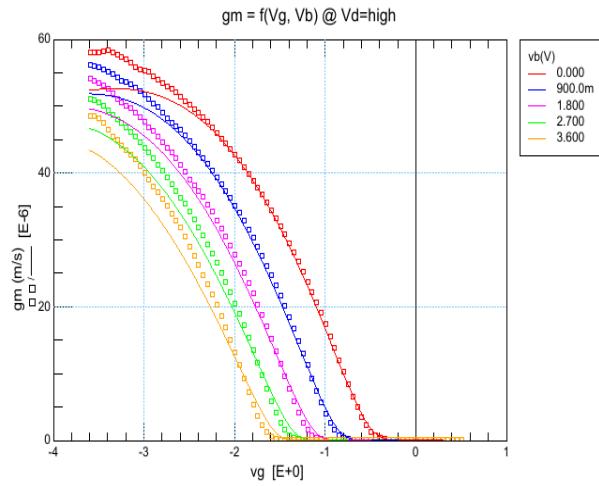
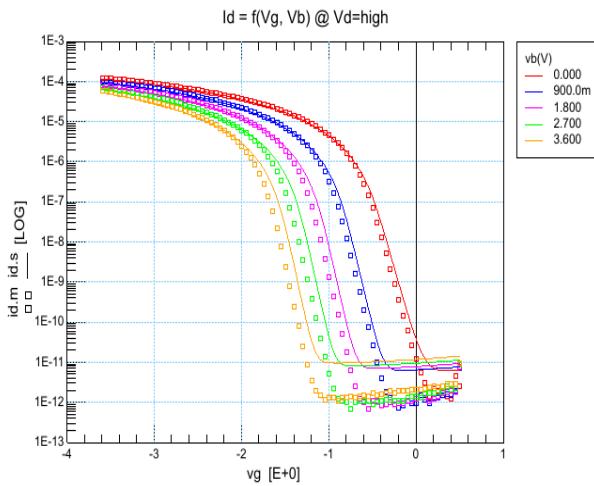
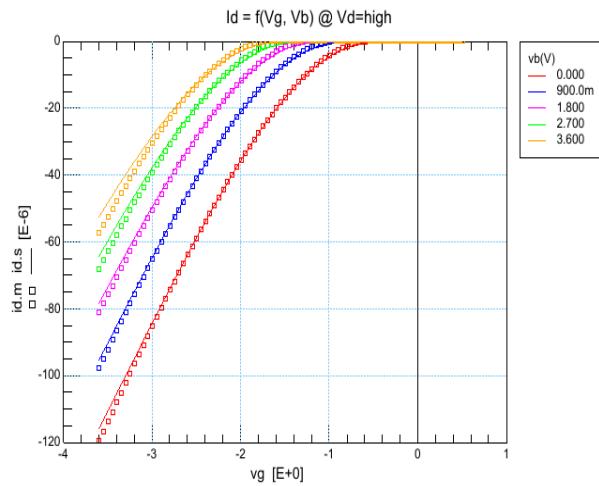
idvd_vth_vbmin, Vb = 3.6V, T = 70°C

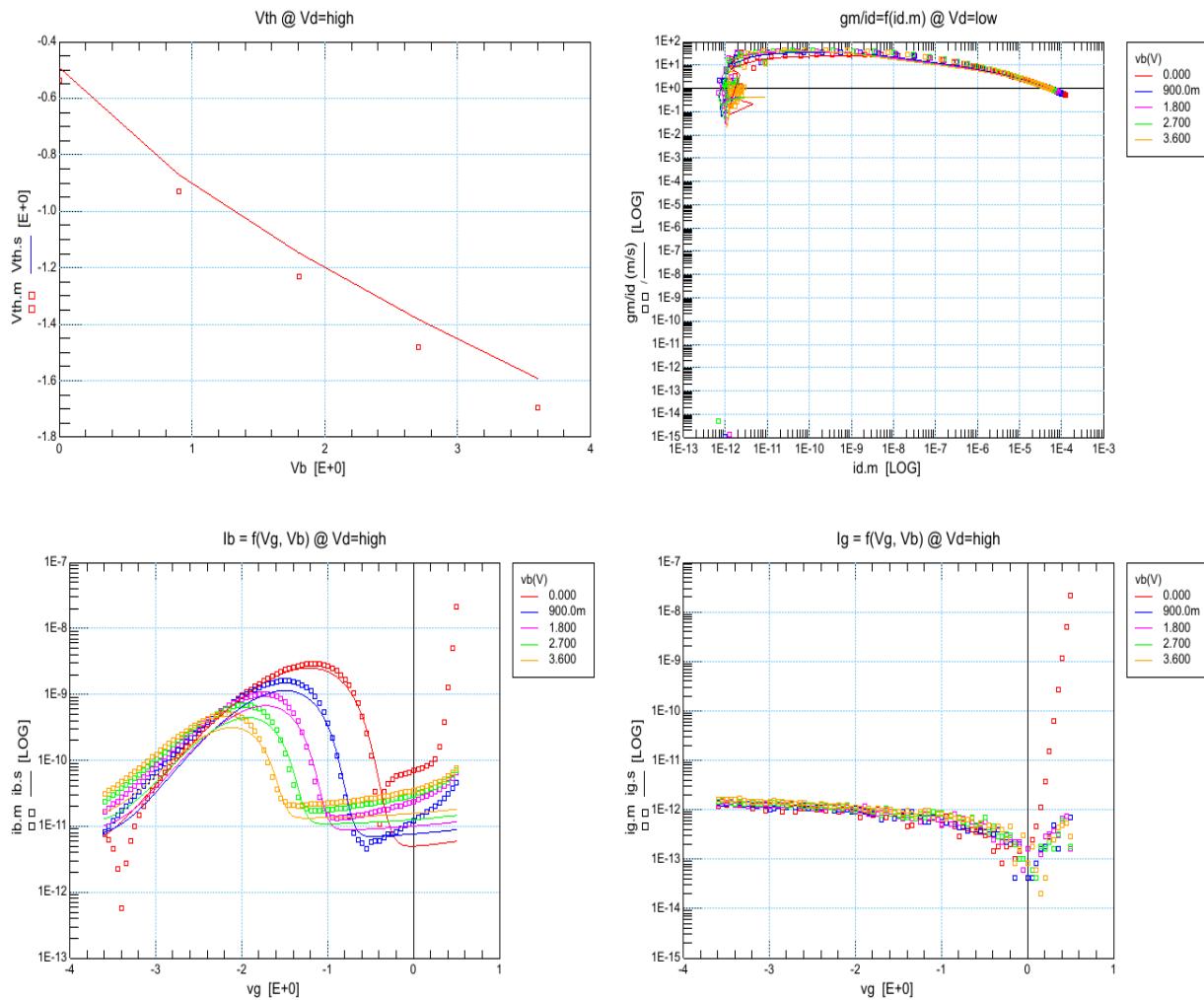


idvg, Vd = -0.1V, T = 125°C


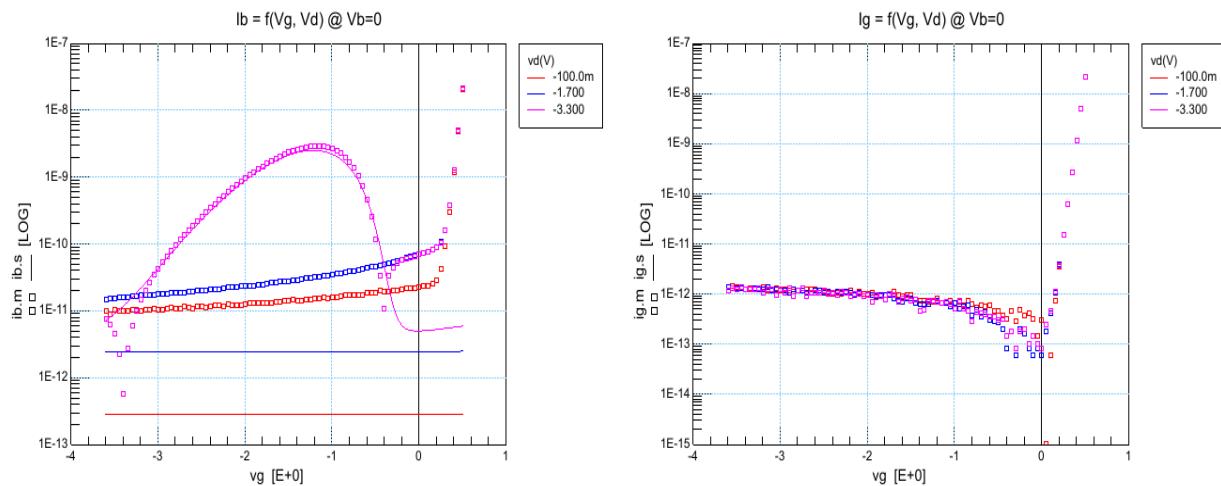


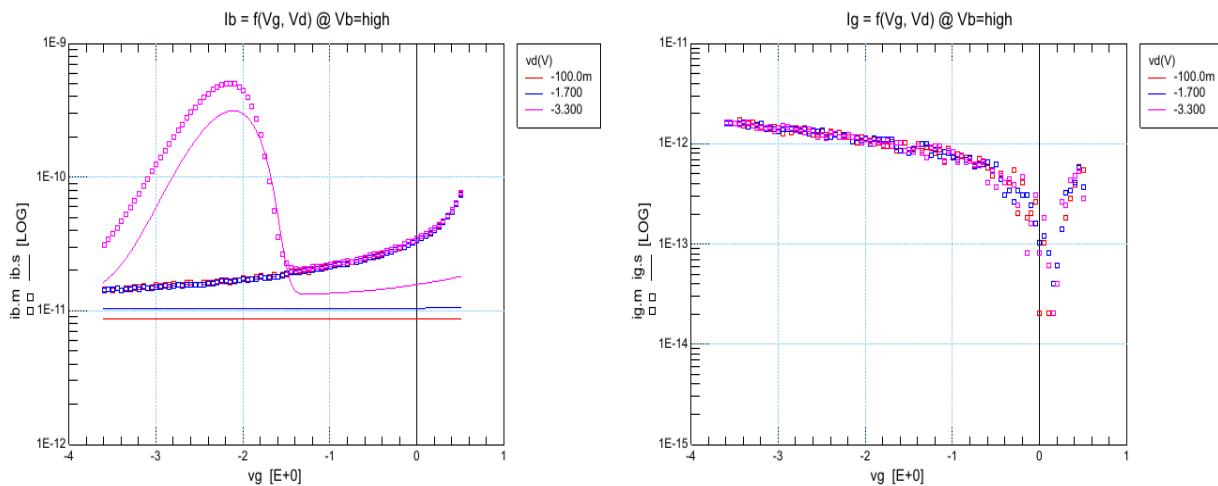
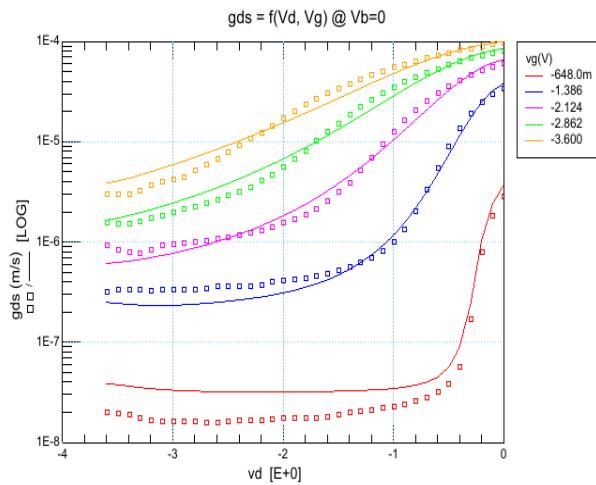
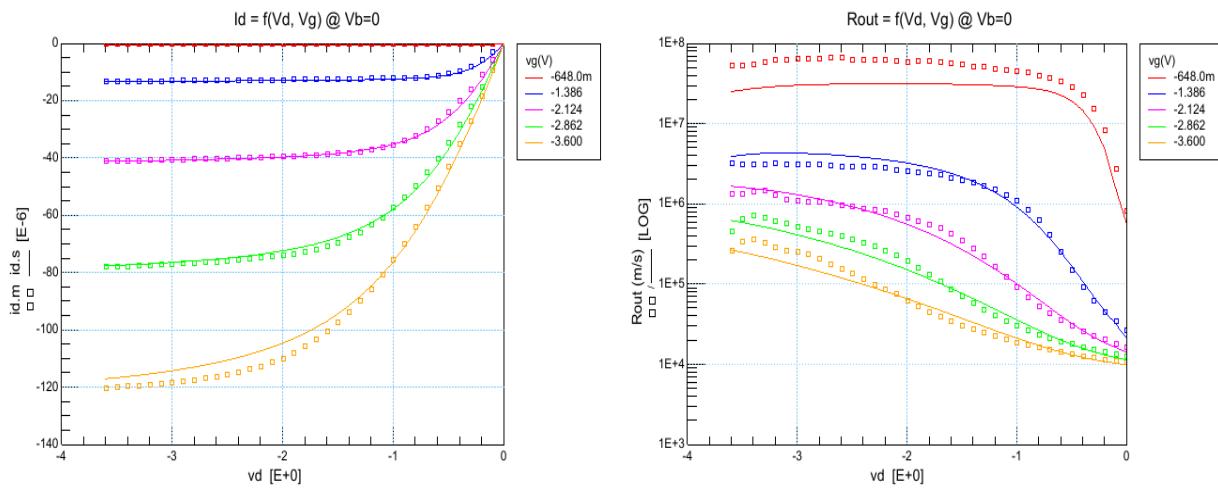
$i_d v_g, V_d = -3.3V, T = 125^\circ\text{C}$

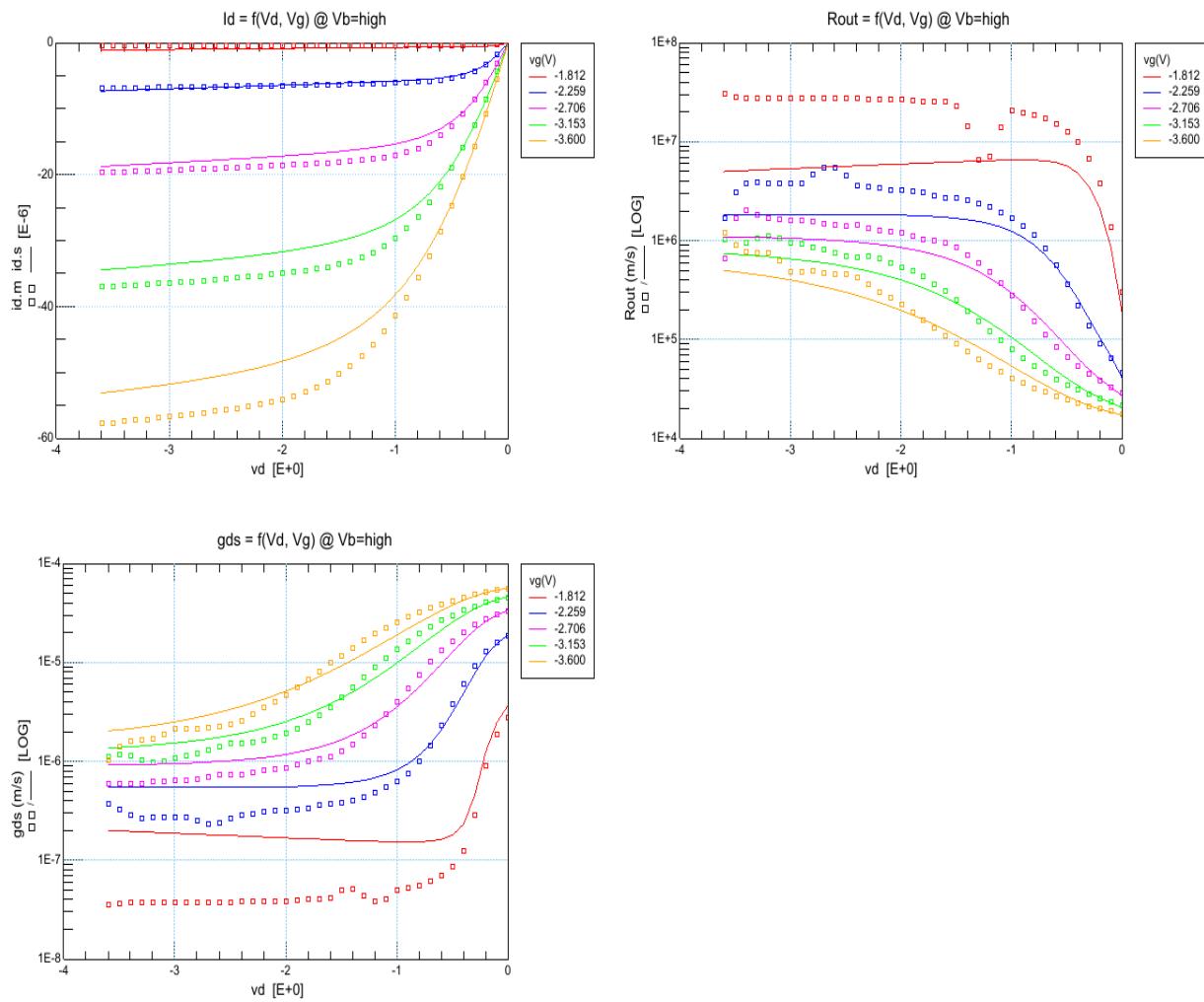
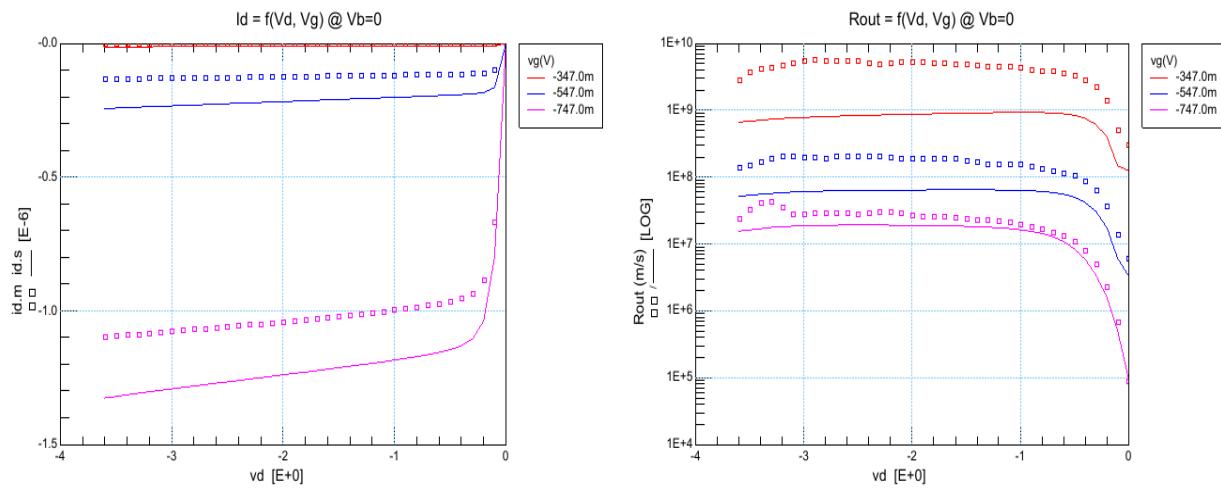


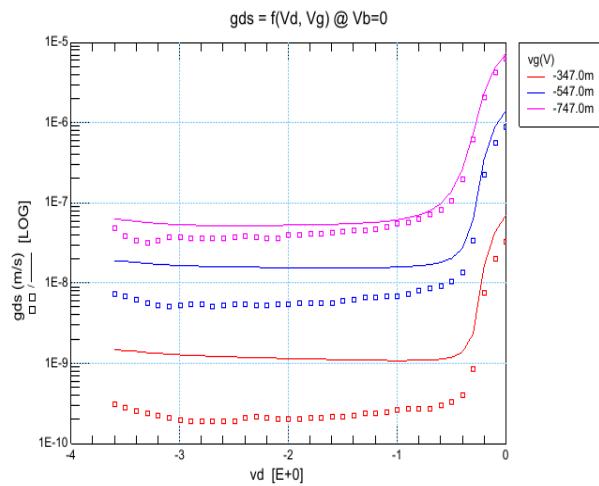


$idvg, Ib, Ig, Vb = 0V, T = 125^{\circ}C$

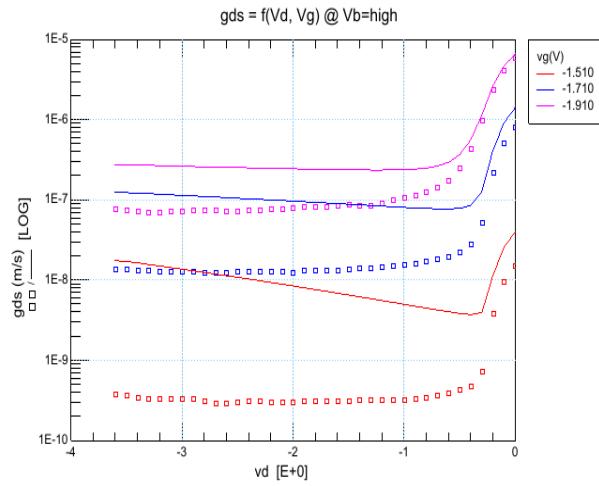
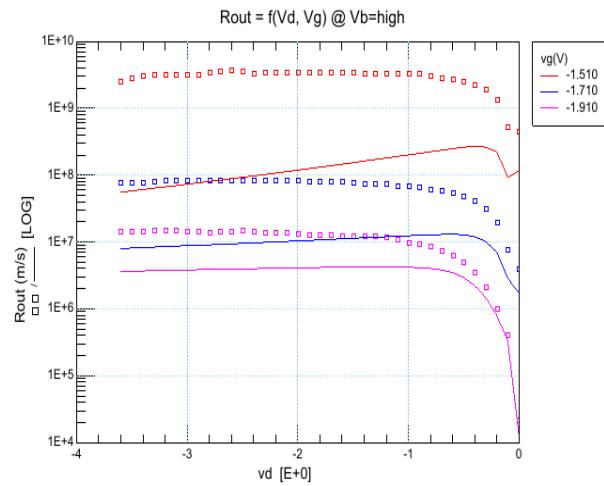
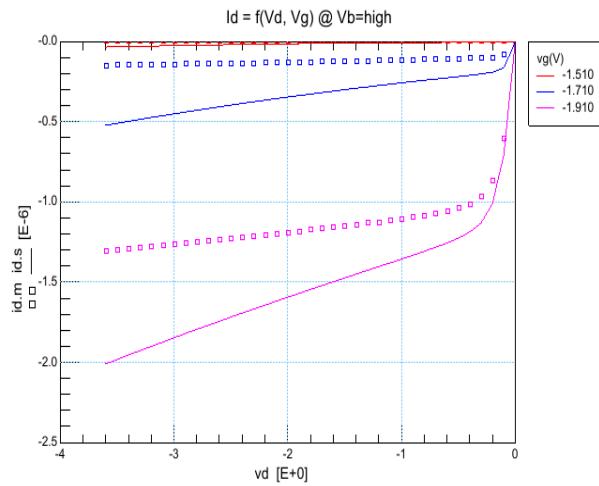


idvg, Ib,Ig, Vb = 3.6V, T = 125°C

idvd, Vb = 0V, T = 125°C


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

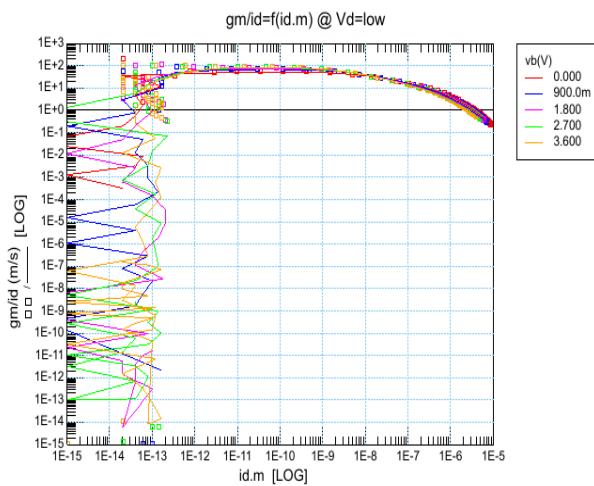
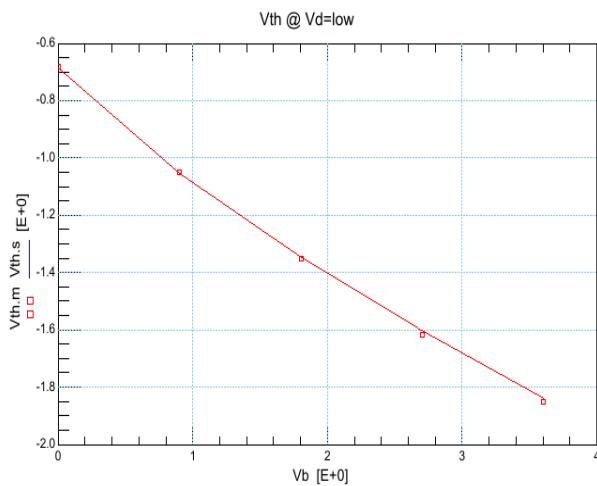
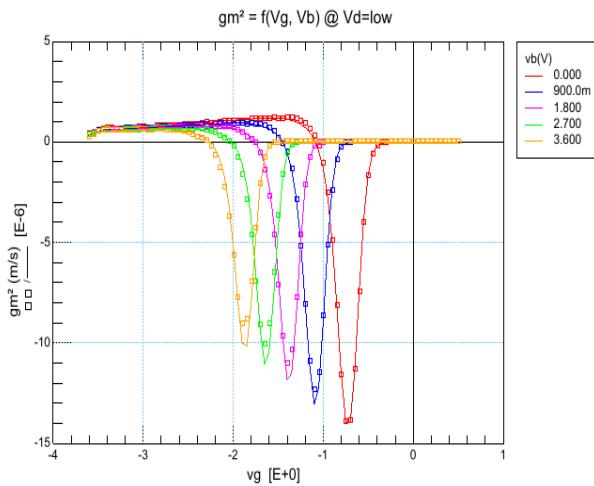
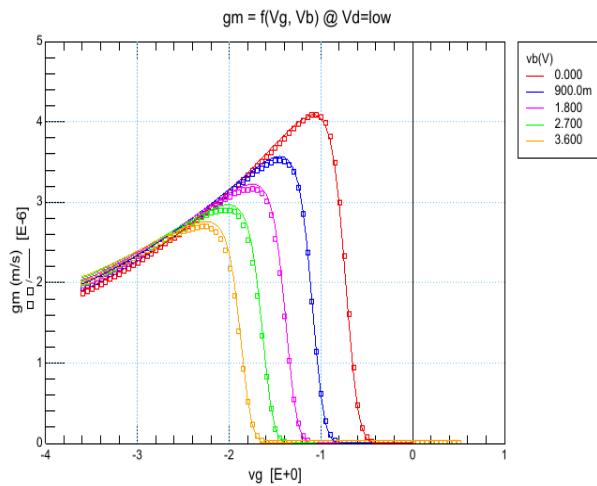
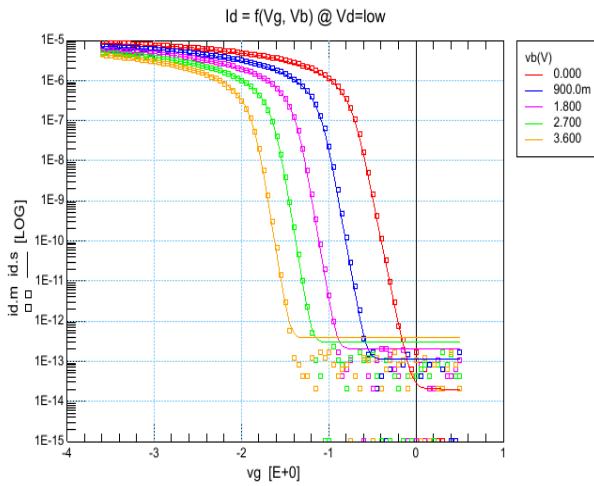
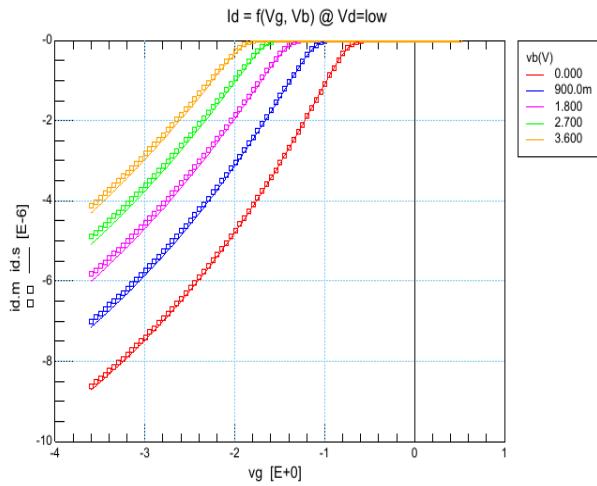


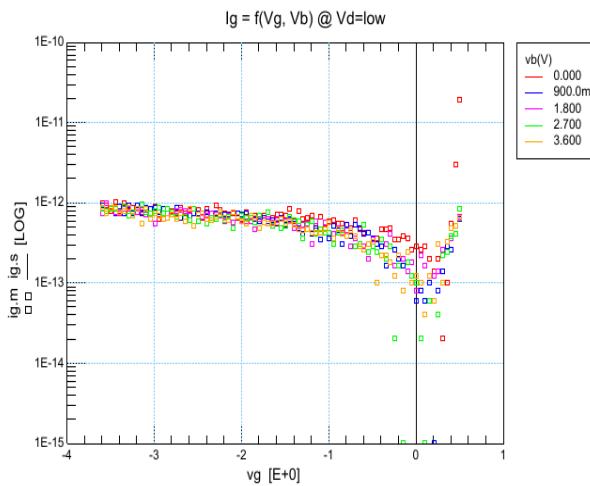
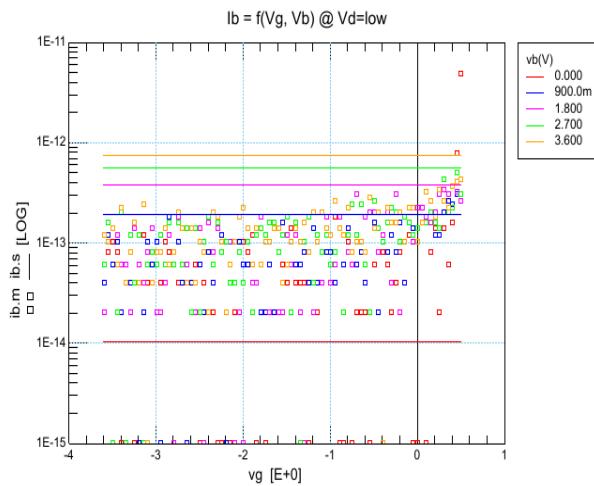
idvd_vth_vbmin, Vb = 3.6V, T = 125°C



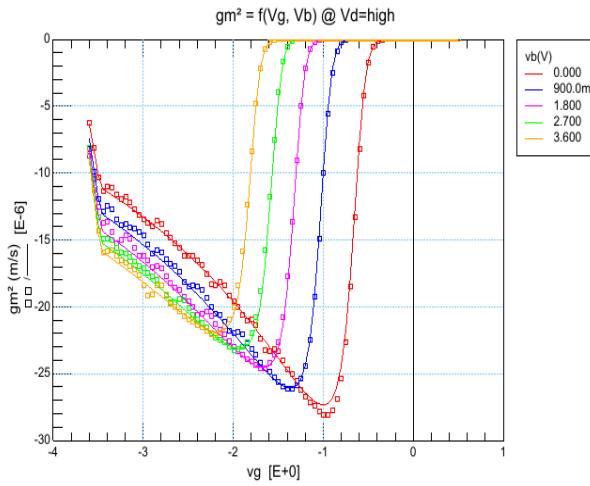
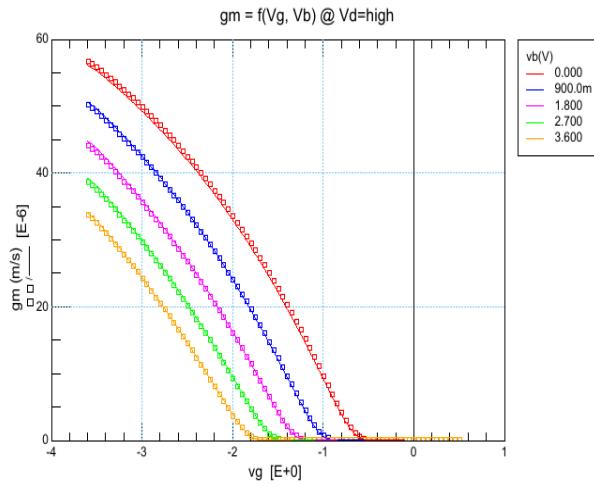
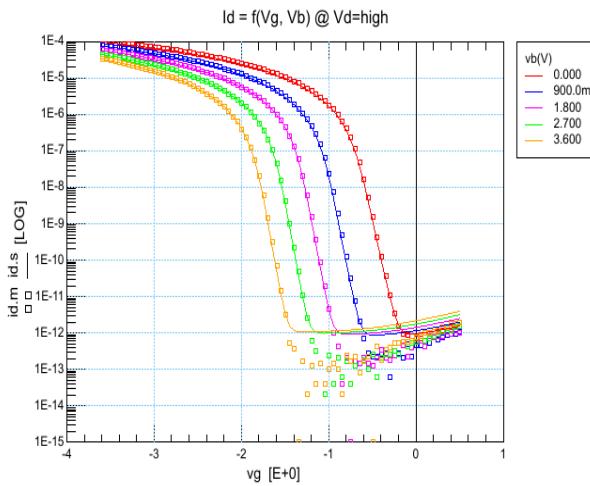
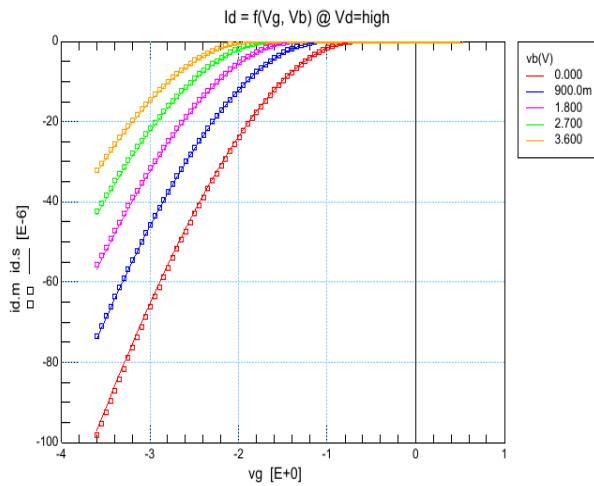
4.20 W05u0_L5u0_S562_5

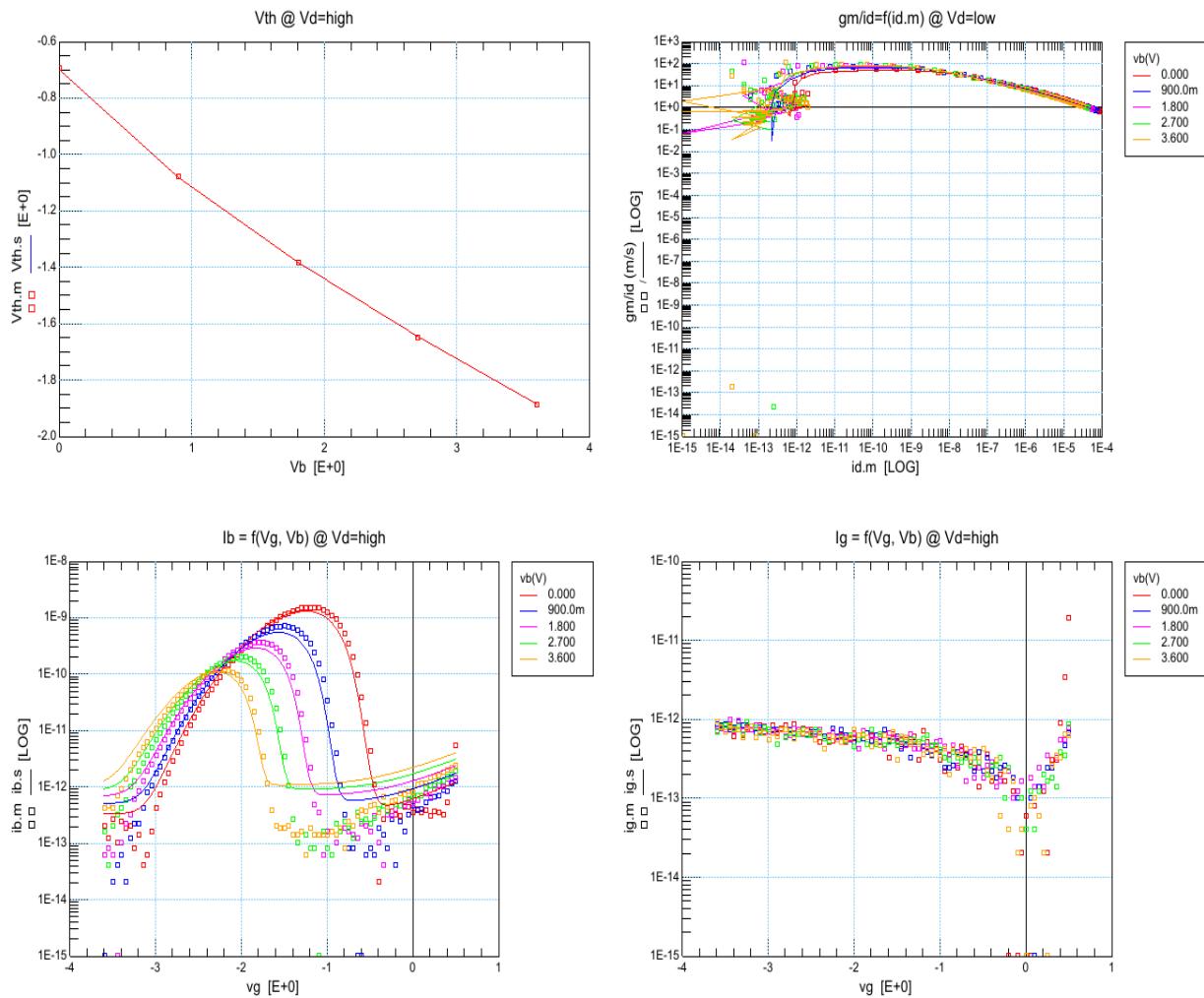
$idvg$, $Vd = -0.1V$, $T = 27^\circ C$



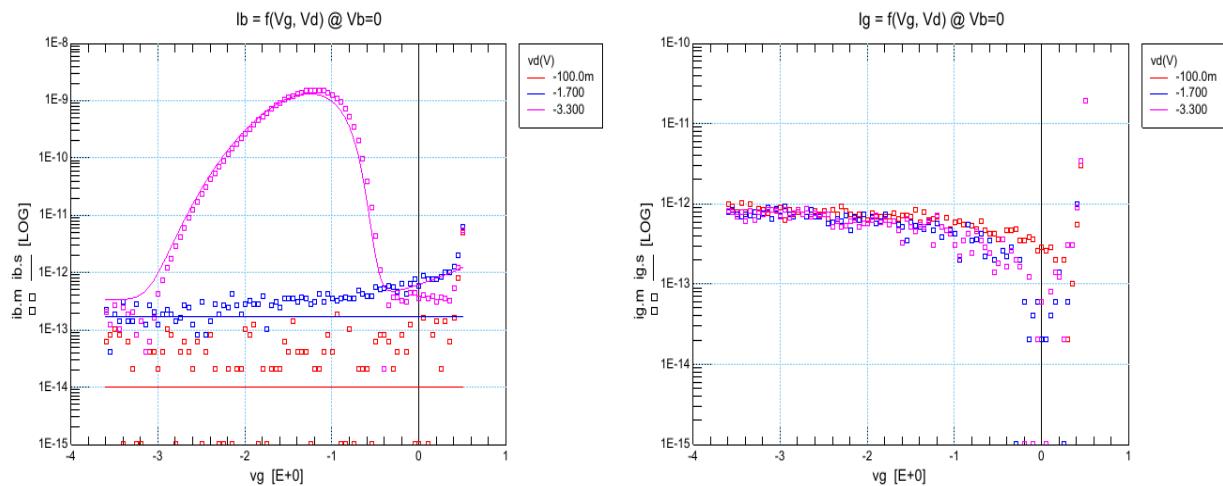


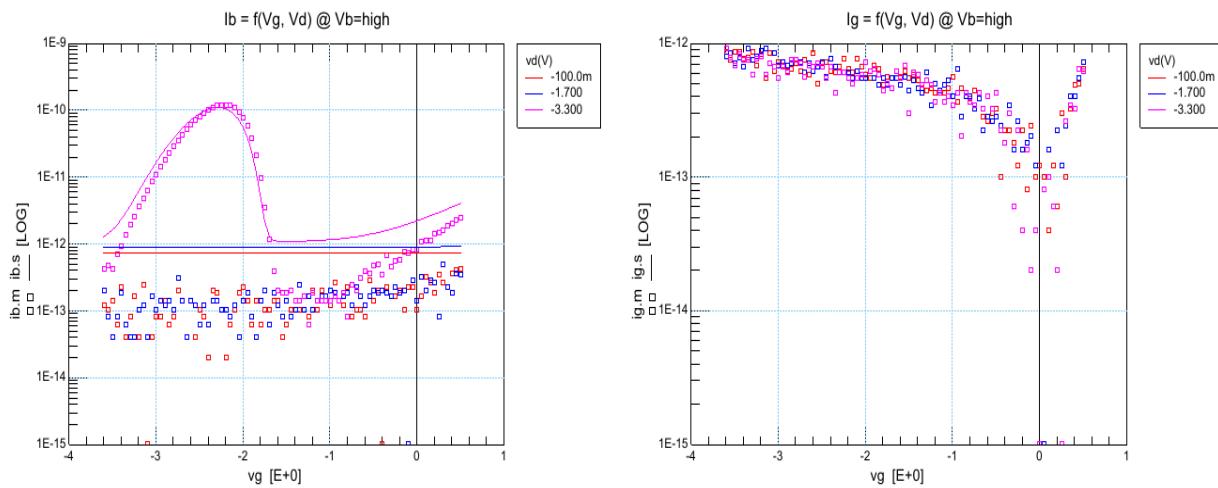
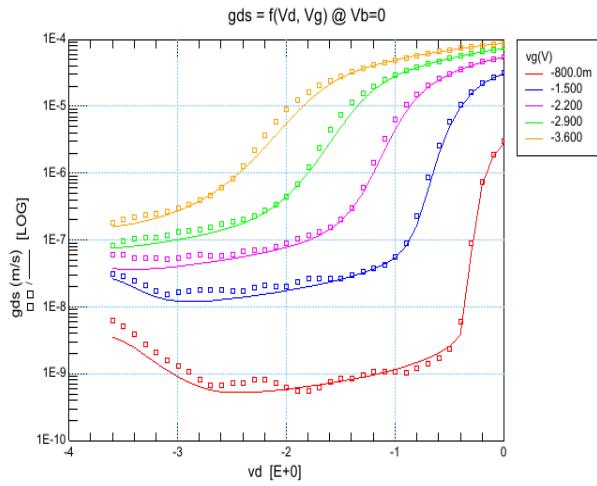
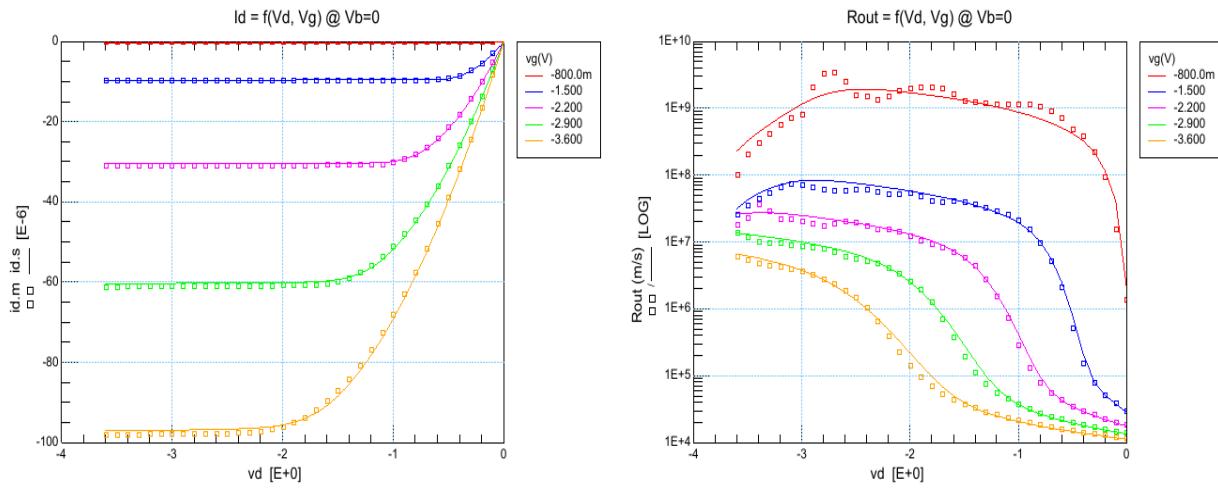
$i_d v_g, V_d = -3.3V, T = 27^\circ\text{C}$

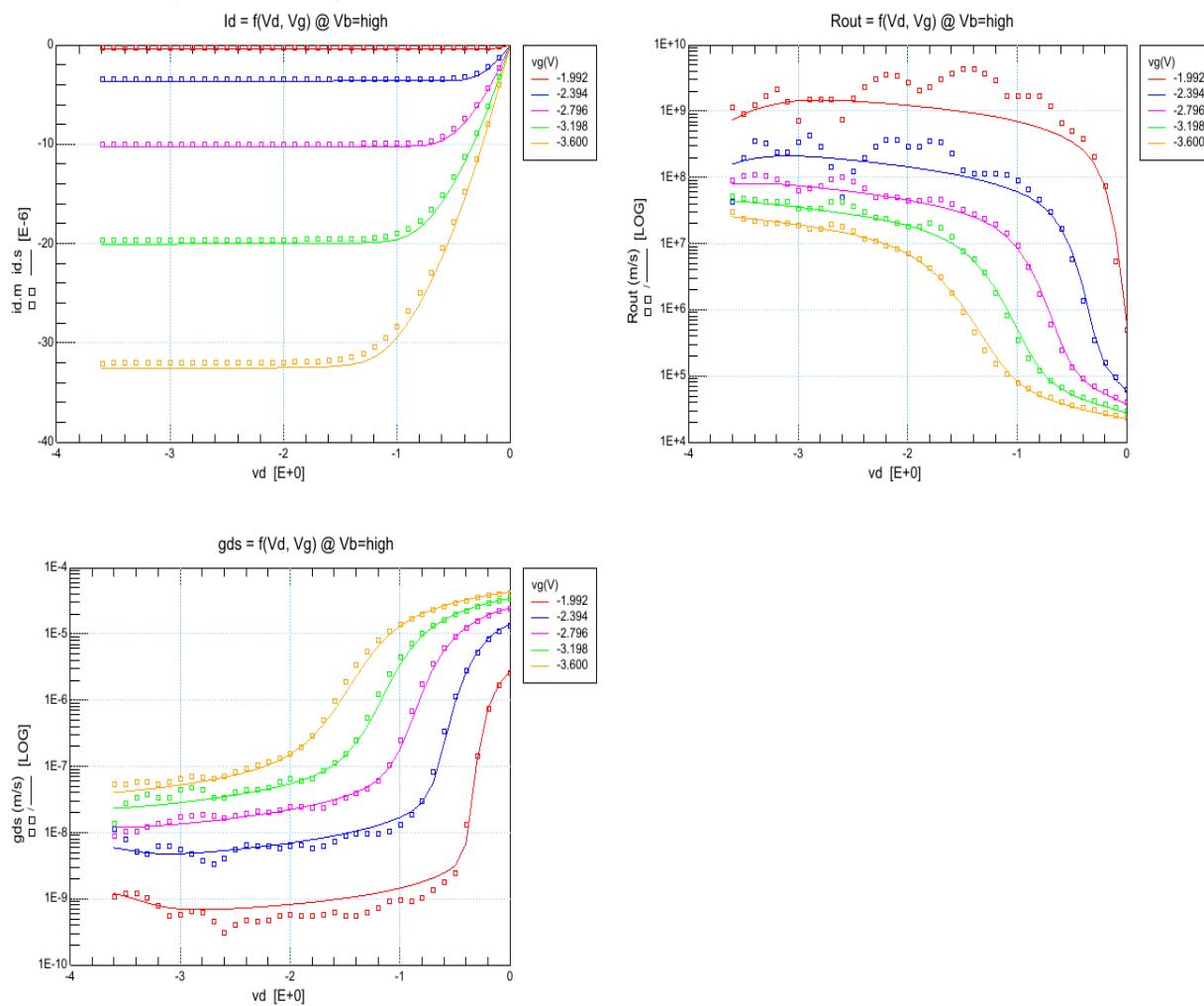
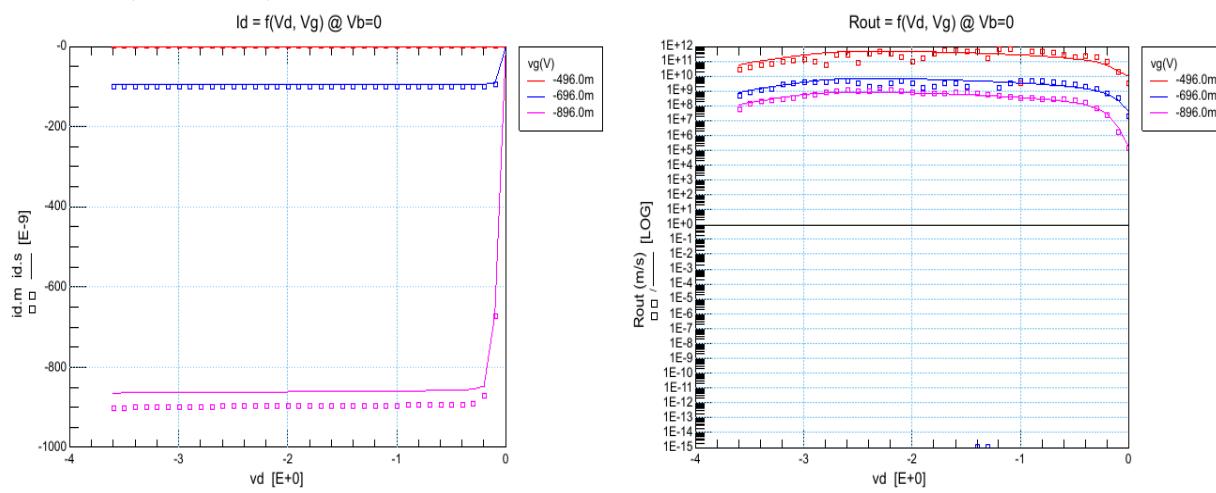


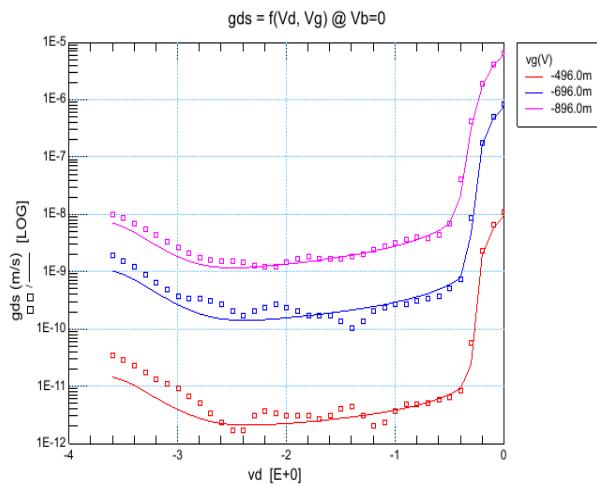


idvg, Ib,Ig, Vb = 0V, T = 27°C

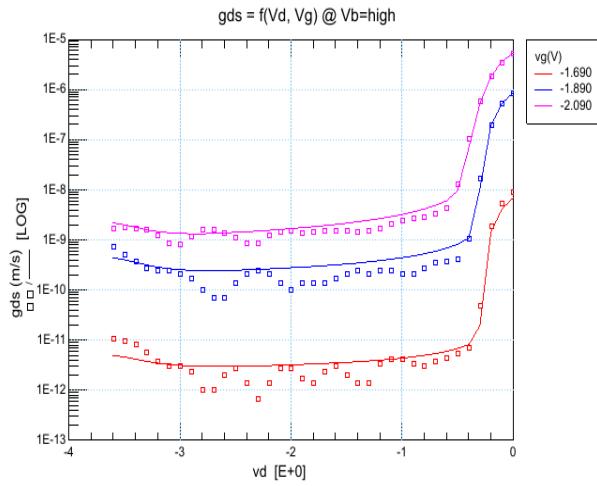
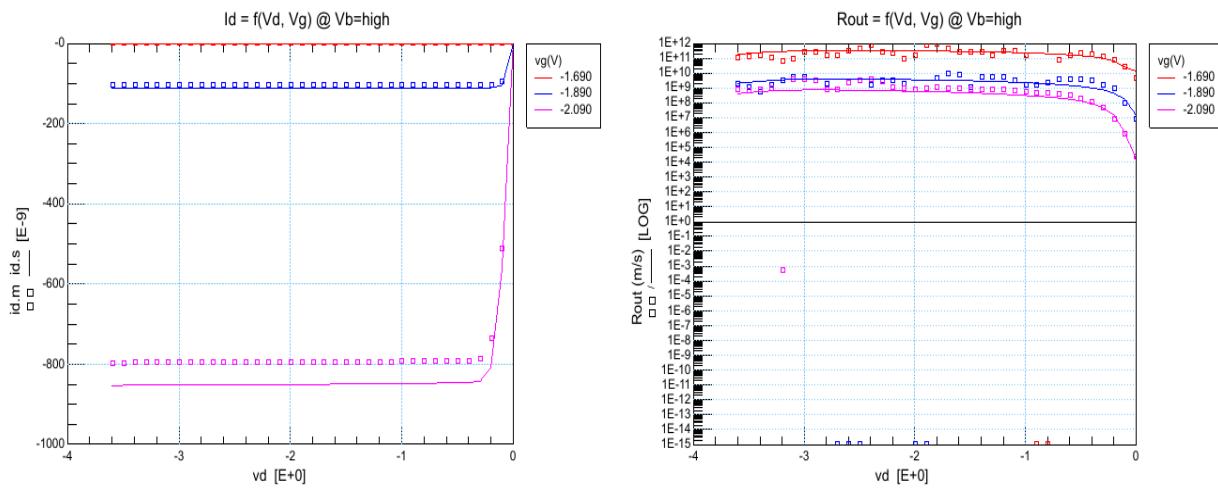


idvg, Ib,Ig, Vb = 3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = 3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


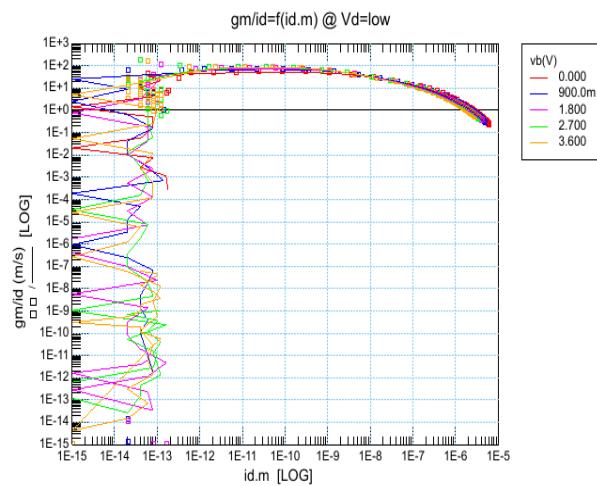
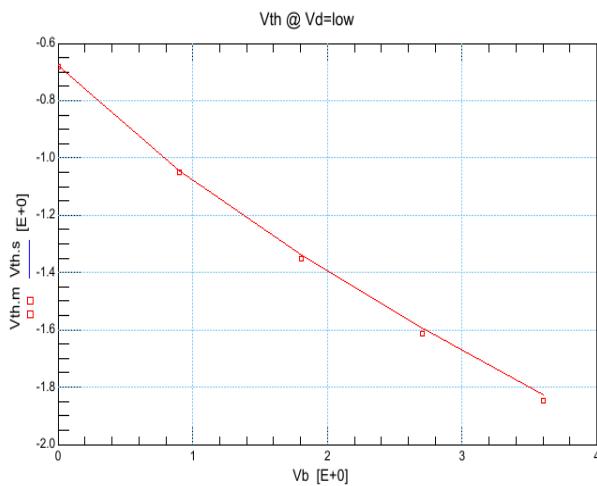
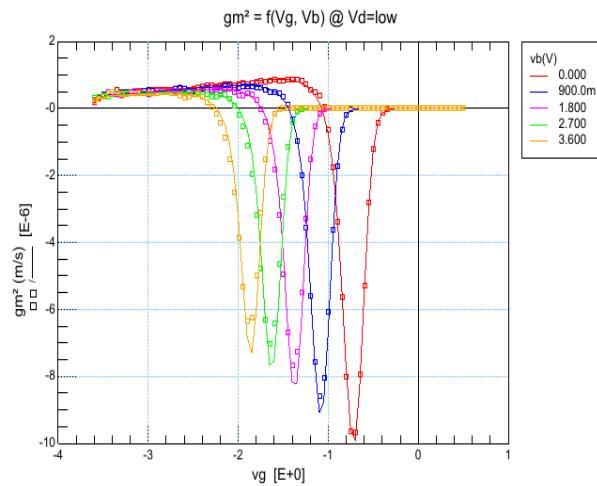
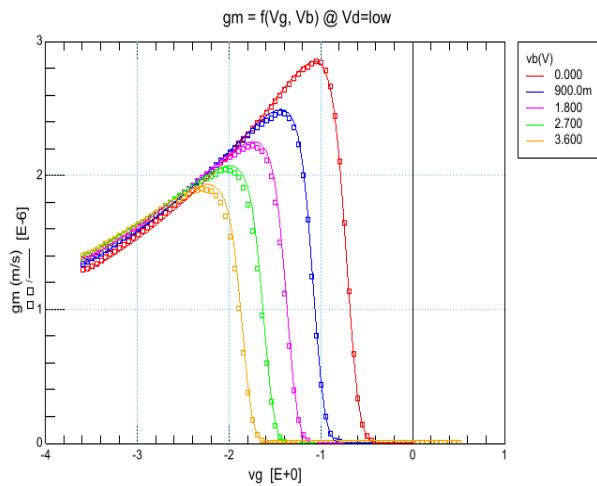
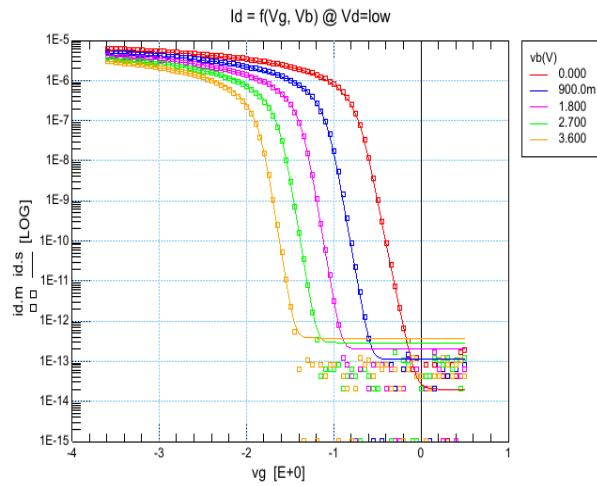
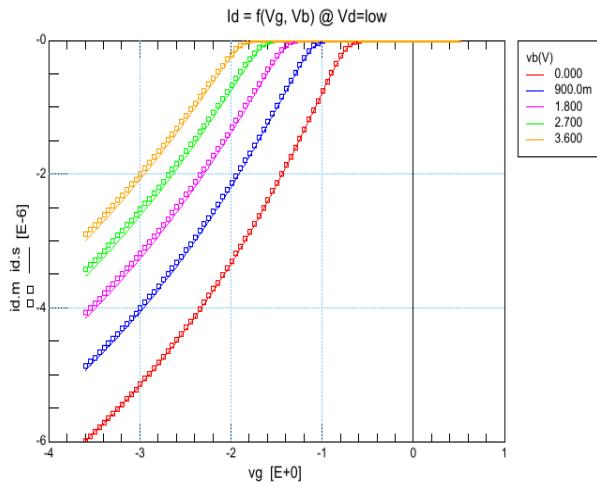


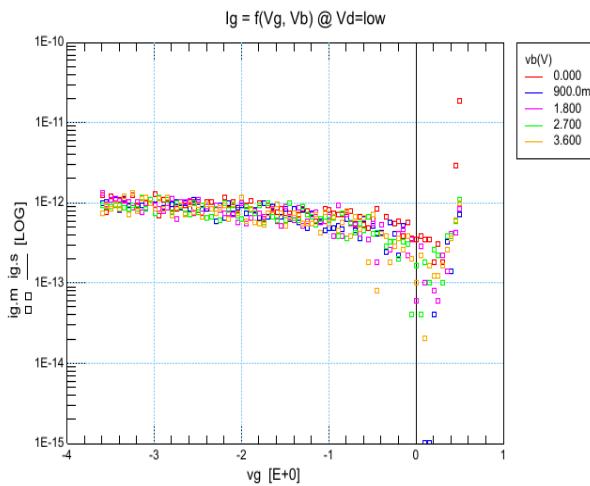
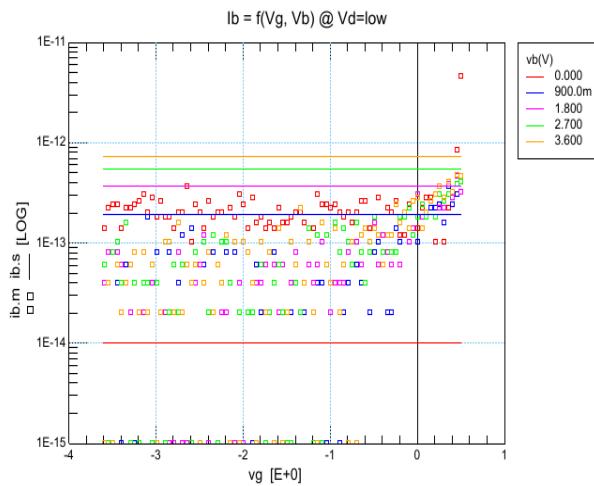
idvd_vth_vbmin, Vb = 3.6V, T = 27°C



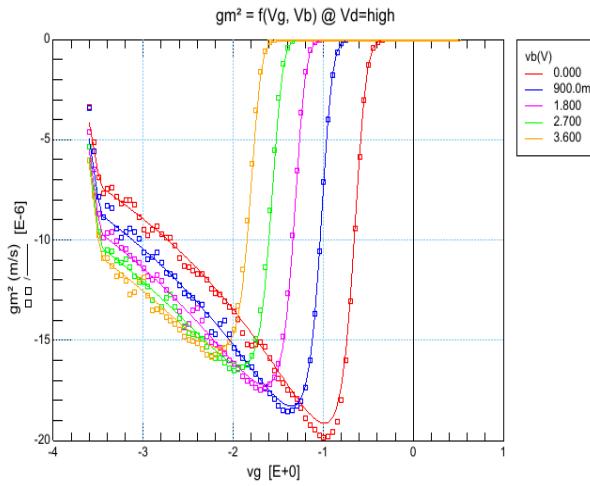
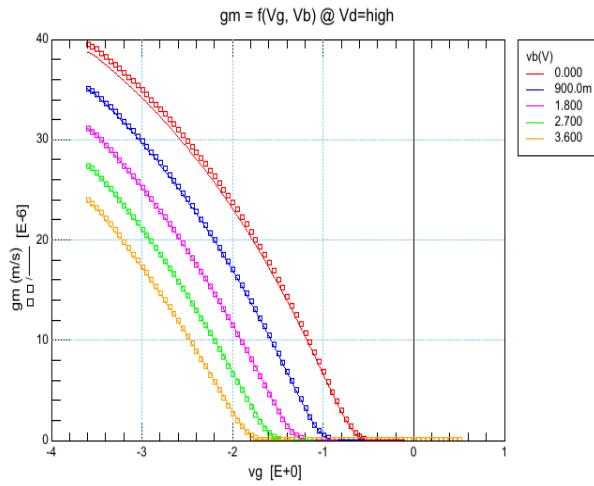
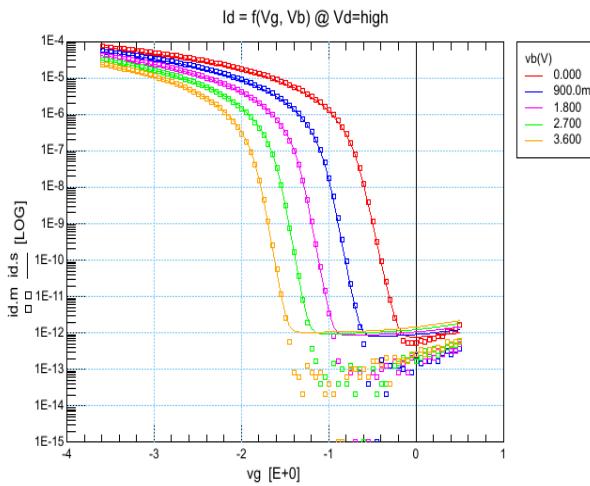
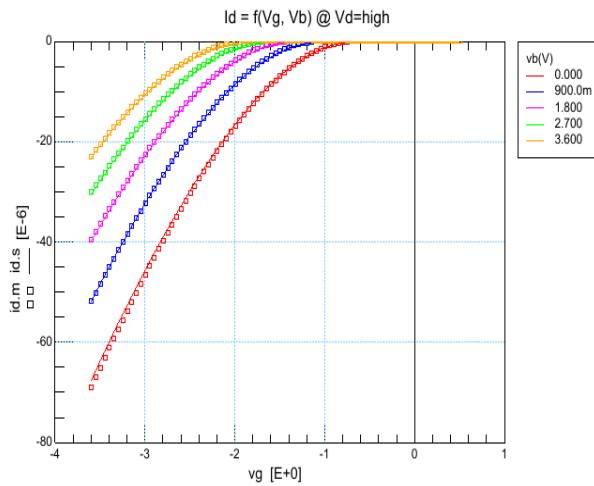
4.21 W02u0_L3u0_S563_4

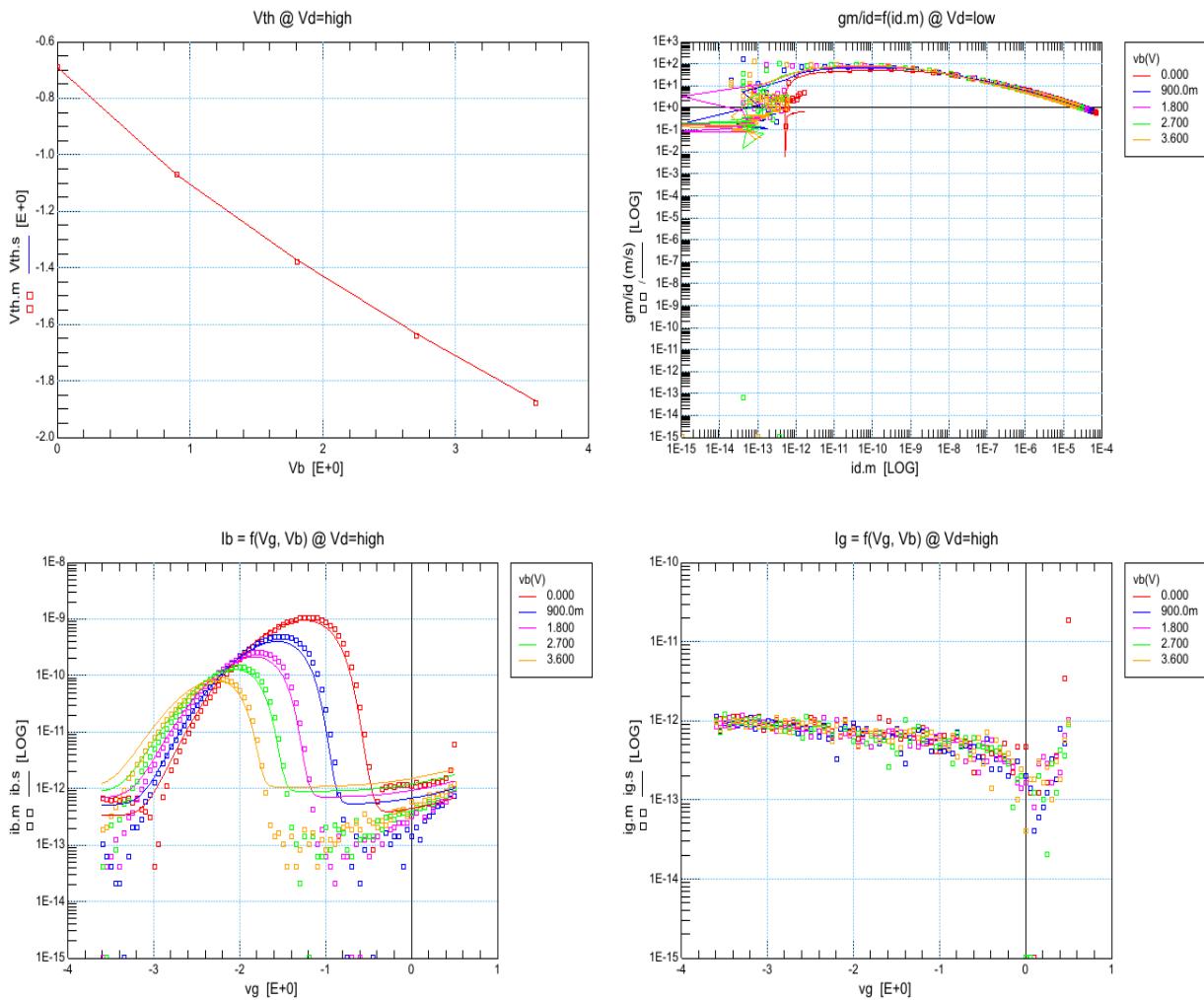
$idvg$, $Vd = -0.1V$, $T = 27^\circ C$



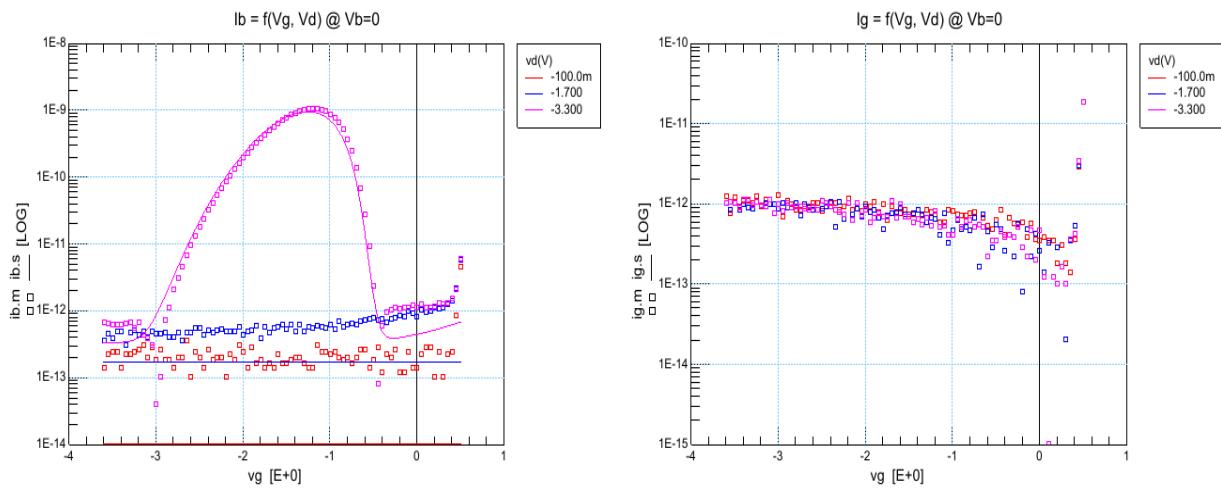


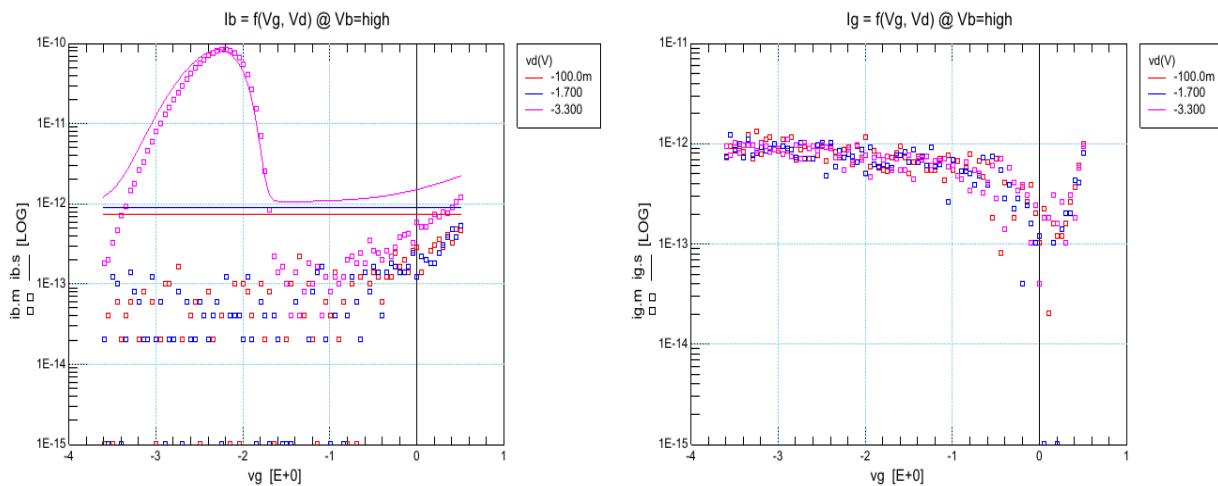
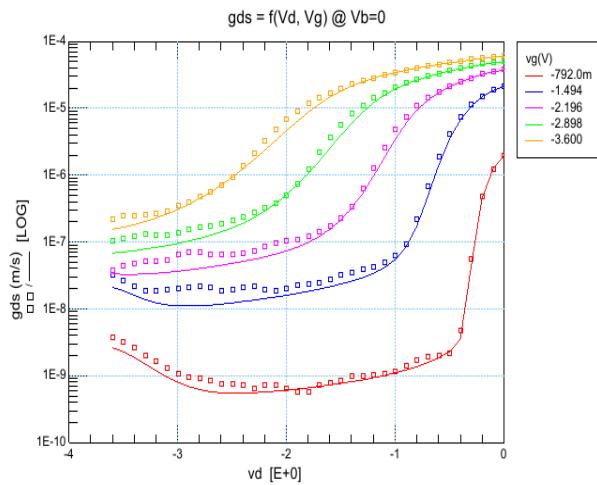
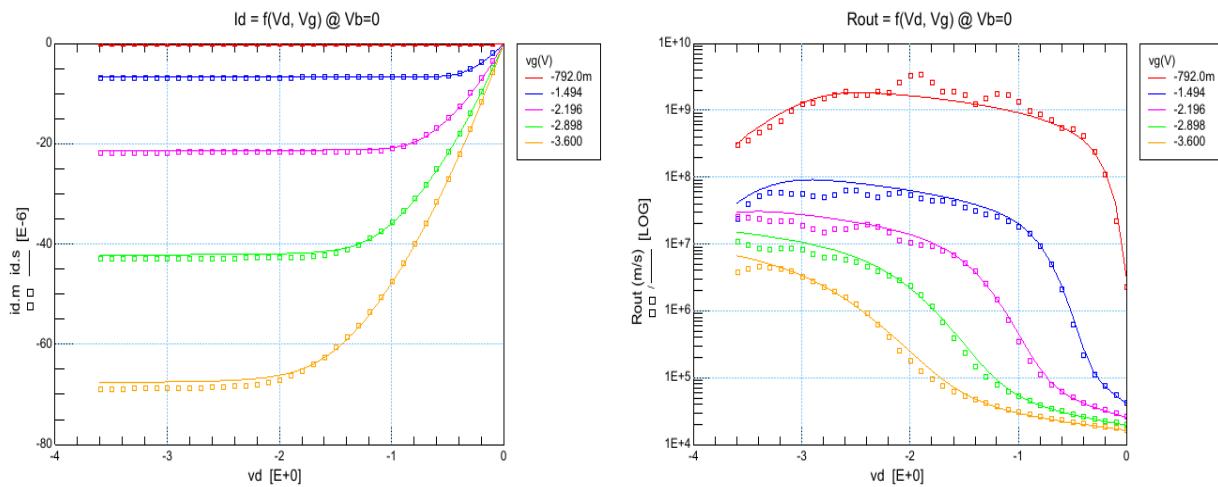
$i_d v_g, V_d = -3.3V, T = 27^\circ\text{C}$

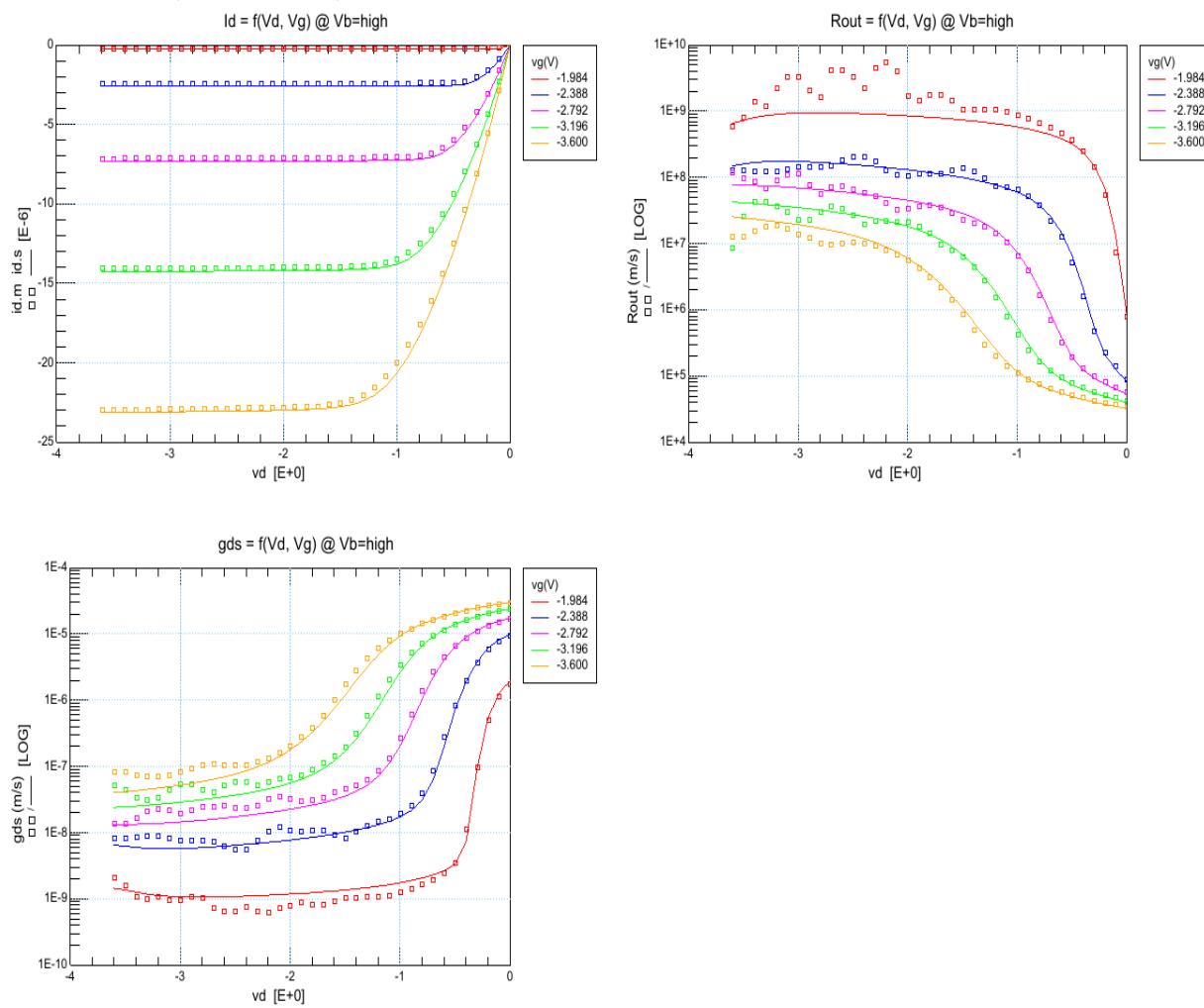
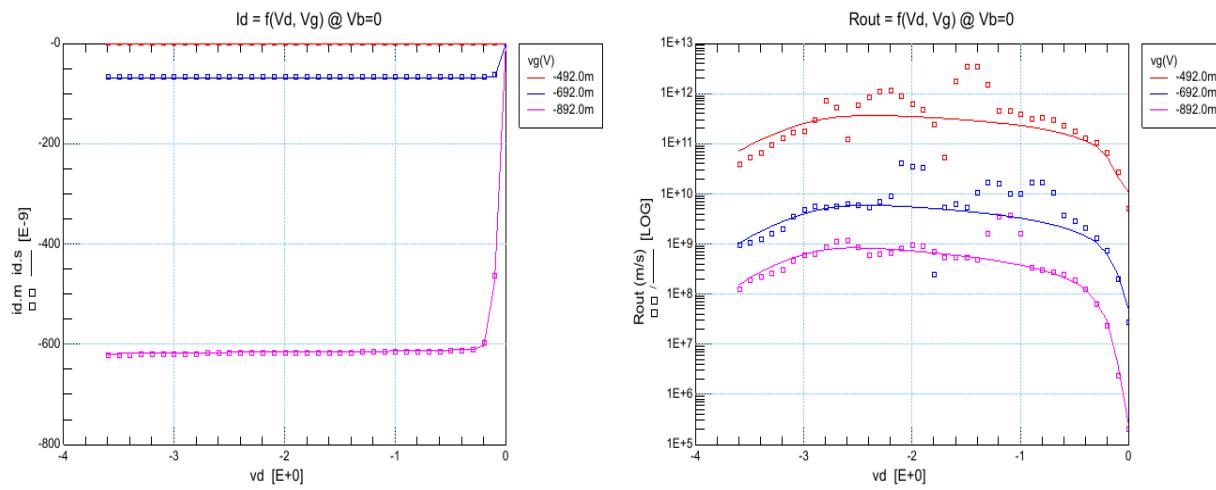


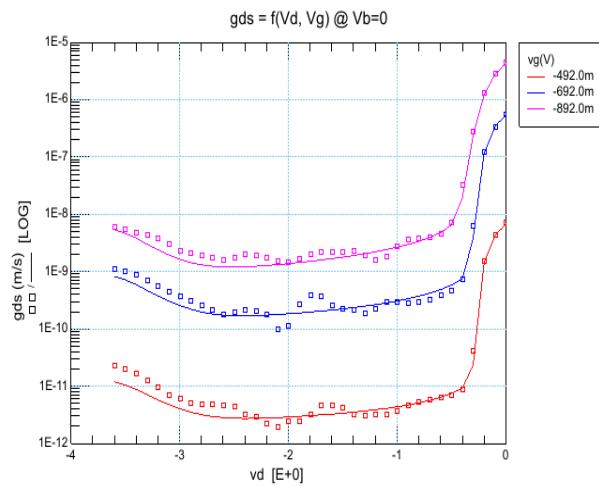


i_{dVg} , I_b , I_g , $V_b = 0V$, $T = 27^\circ C$

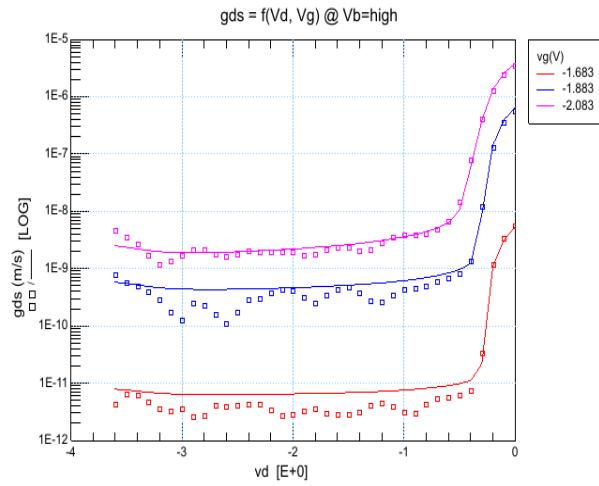
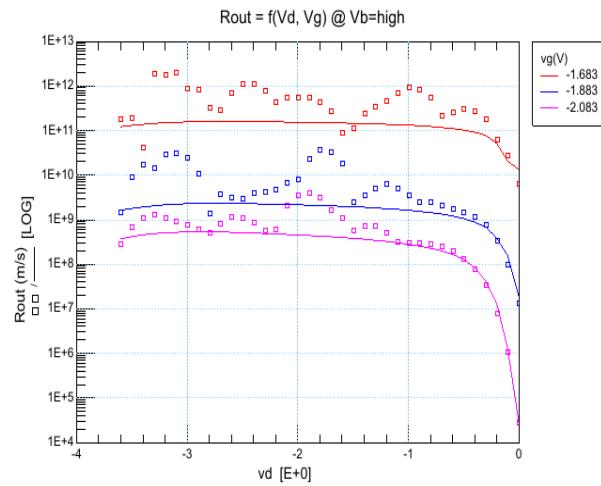
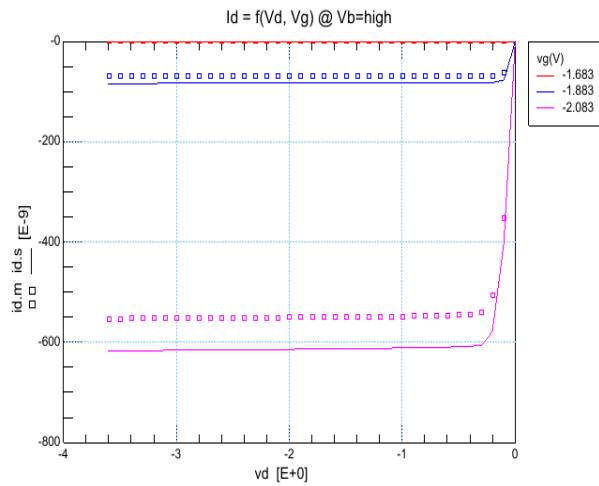


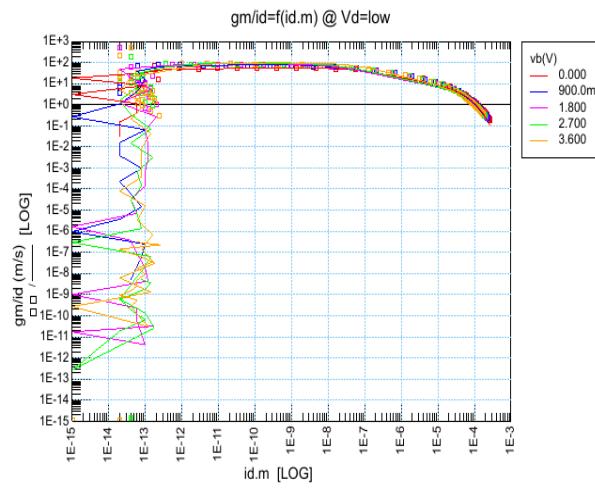
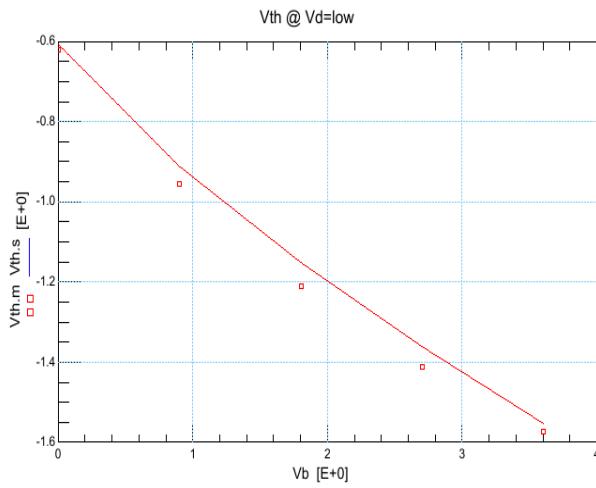
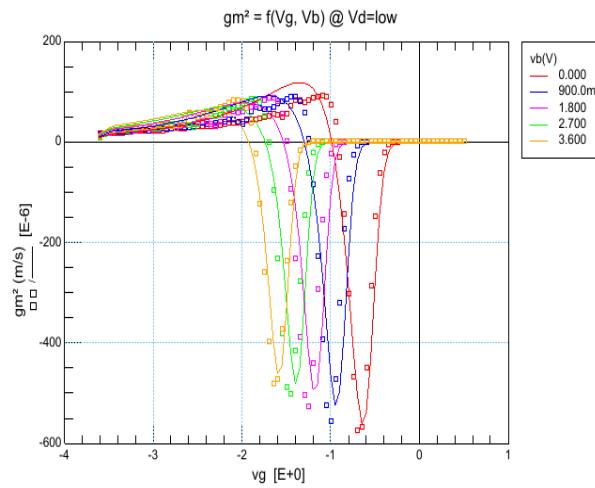
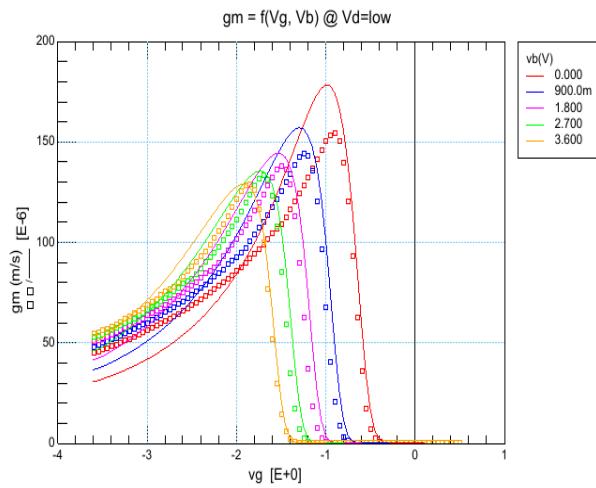
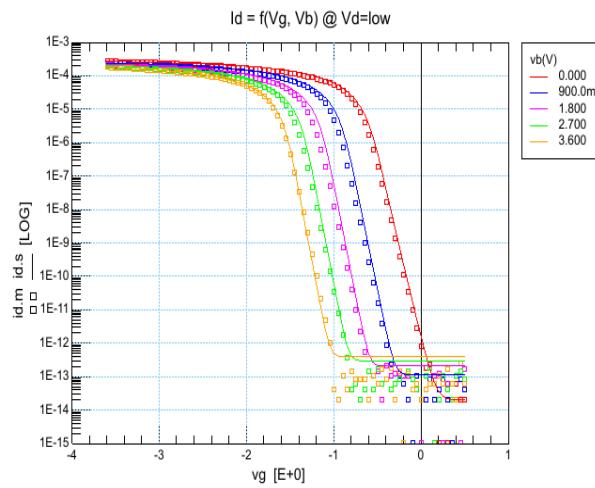
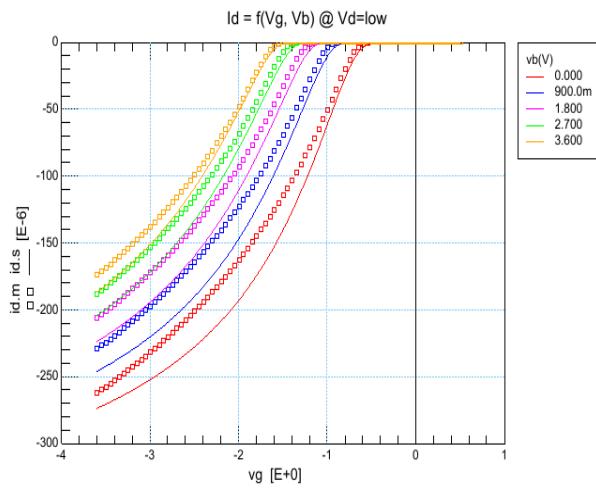
idvg, Ib,Ig, Vb = 3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


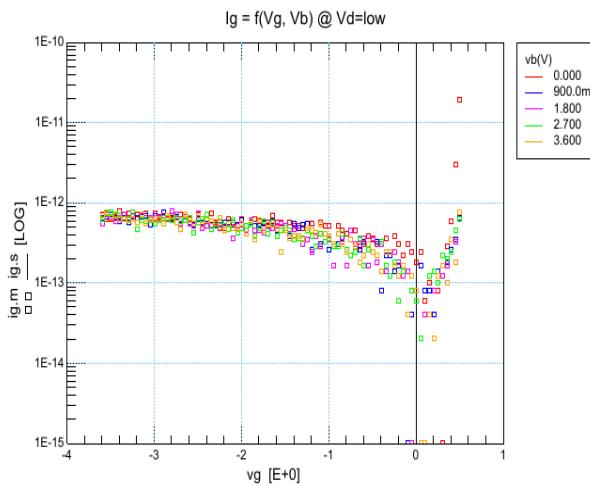
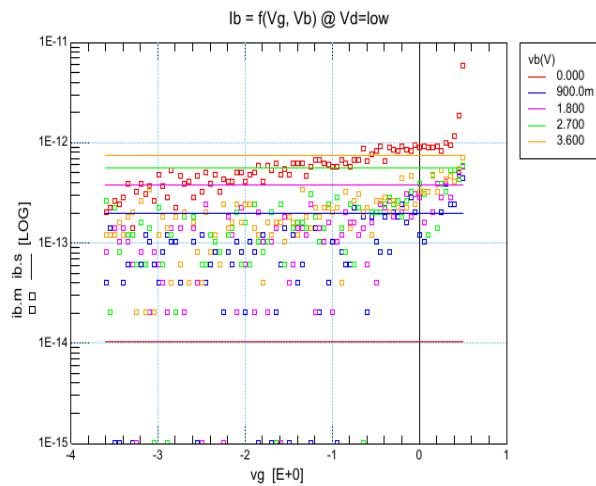
idvd_vbmin, Vb = 3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C




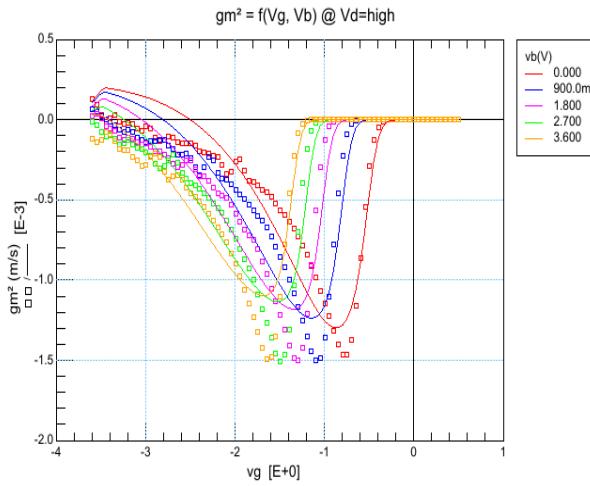
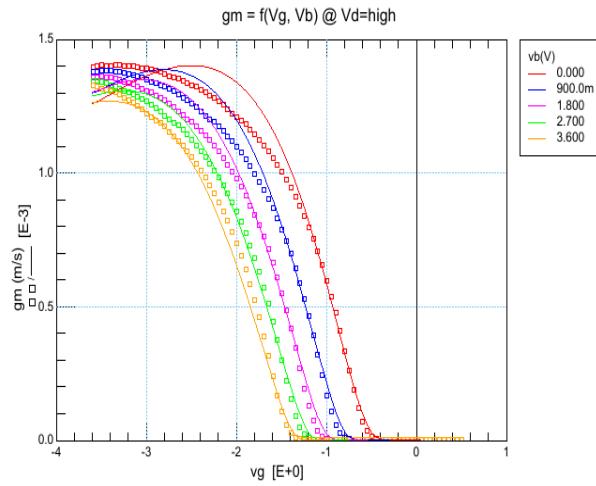
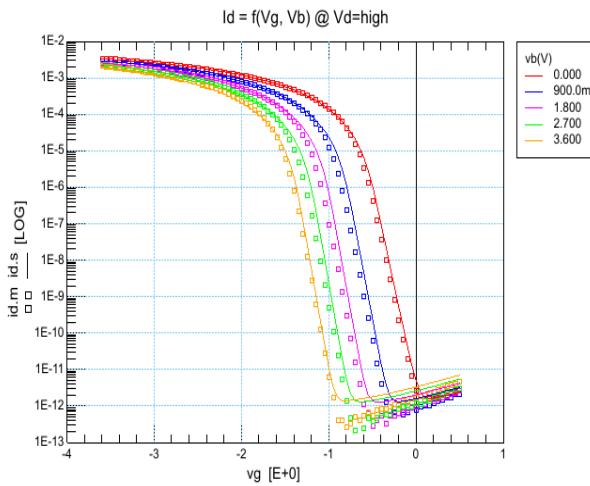
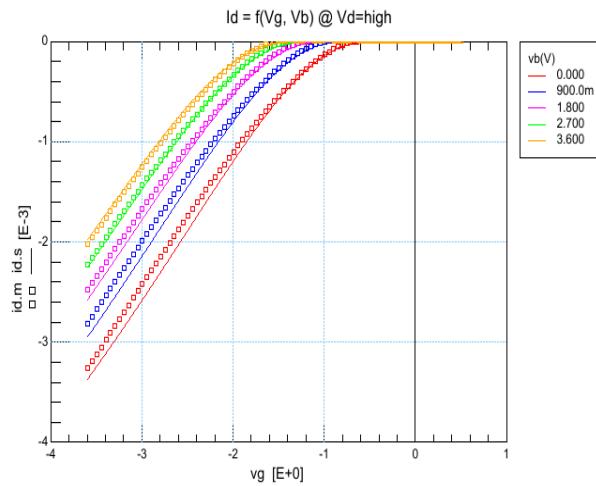
idvd_vth_vbmin, Vb = 3.6V, T = 27°C

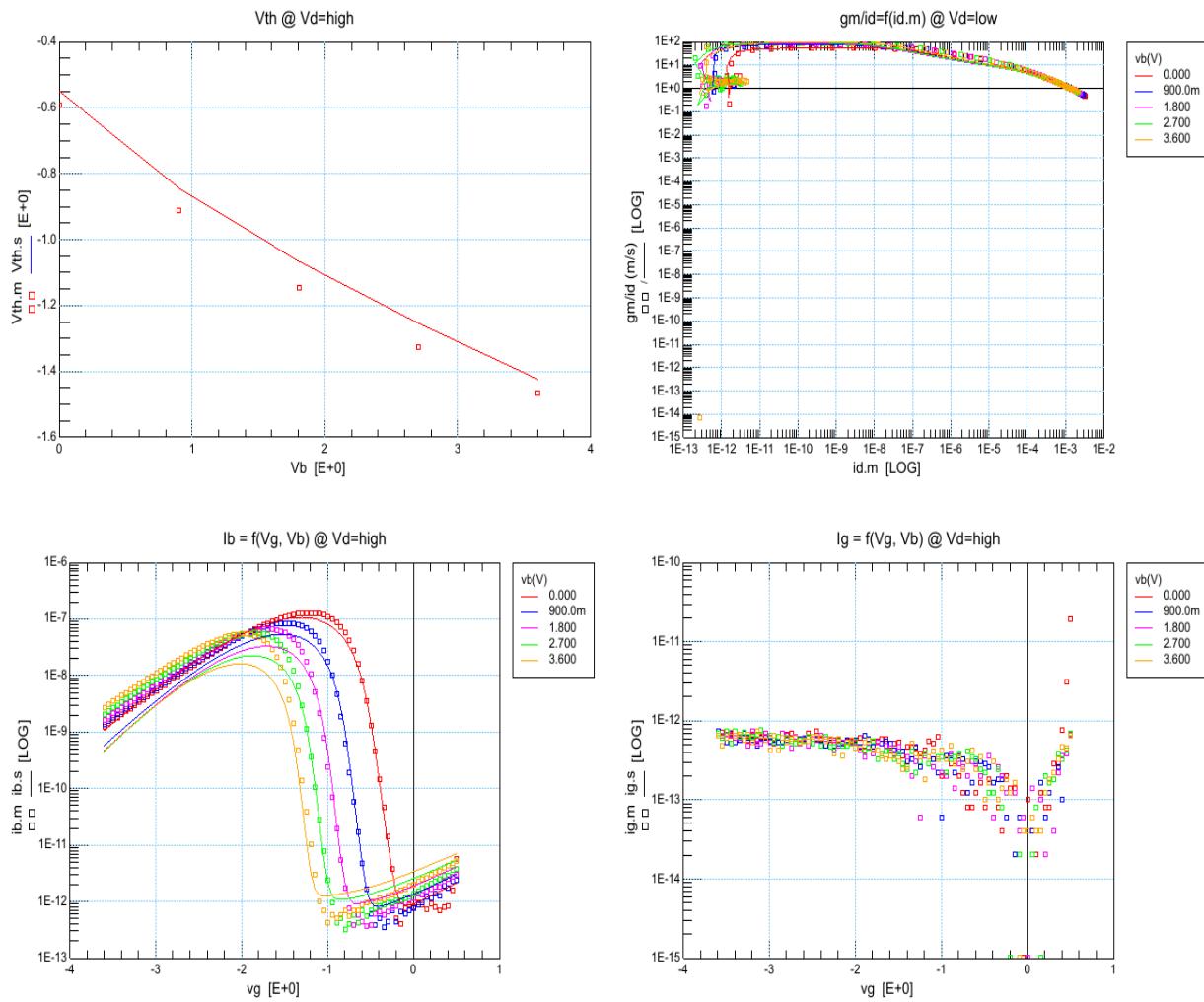


4.22 W10u0_L0u33_S561_2**idvg, Vd = -0.1V, T = 27°C**

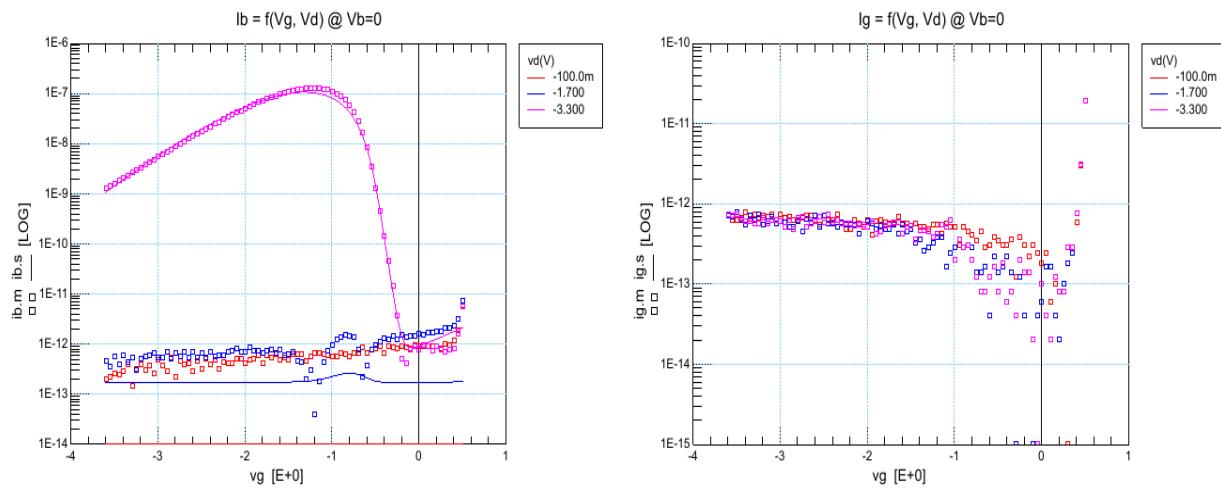


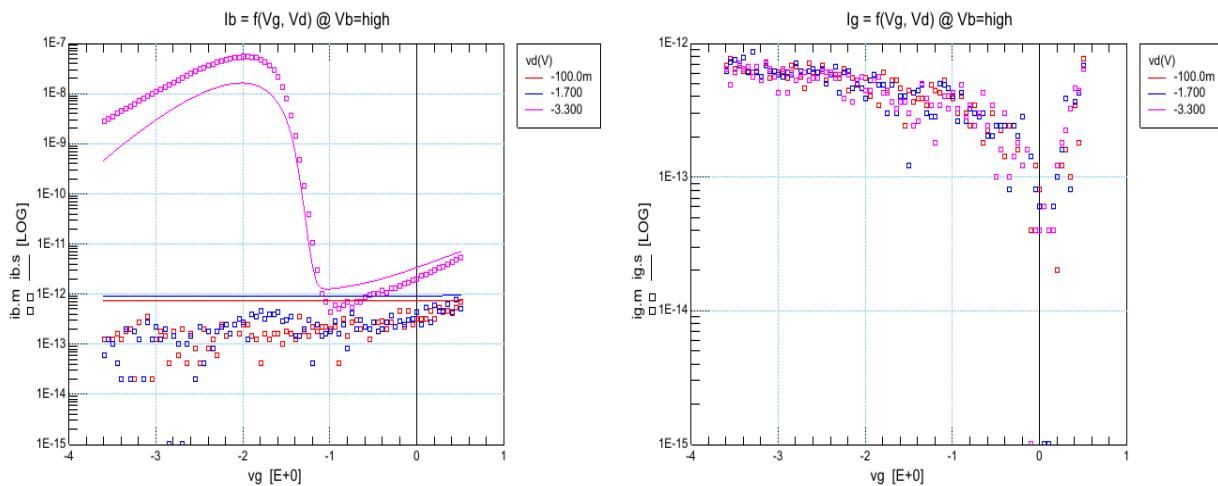
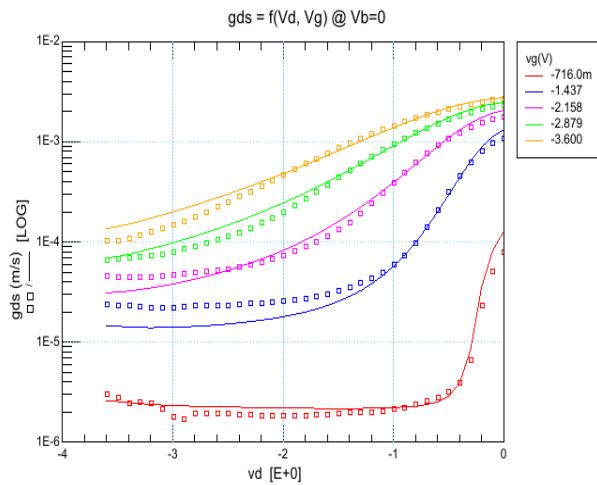
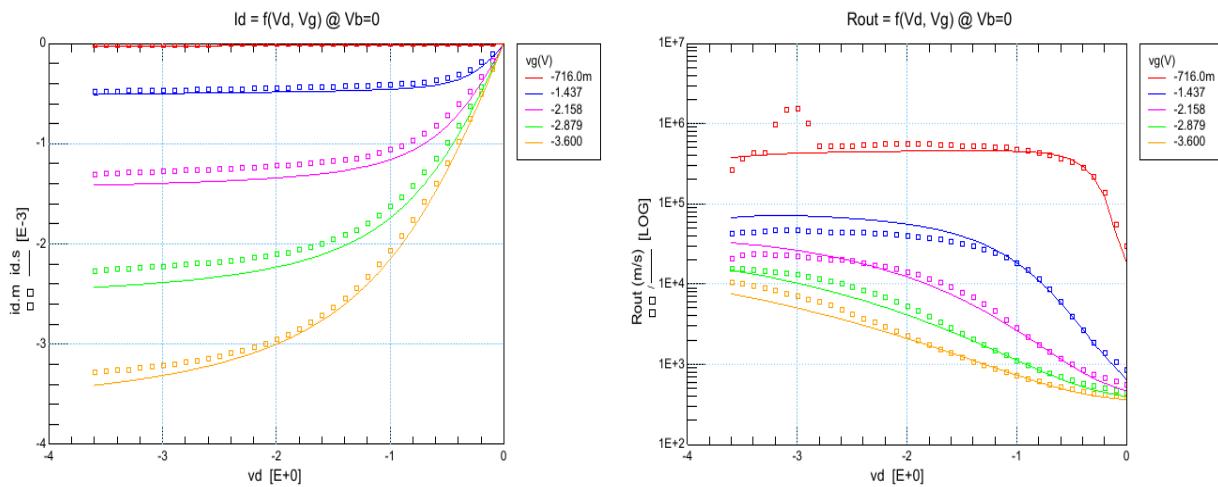
$i_d v_g, V_d = -3.3V, T = 27^\circ\text{C}$

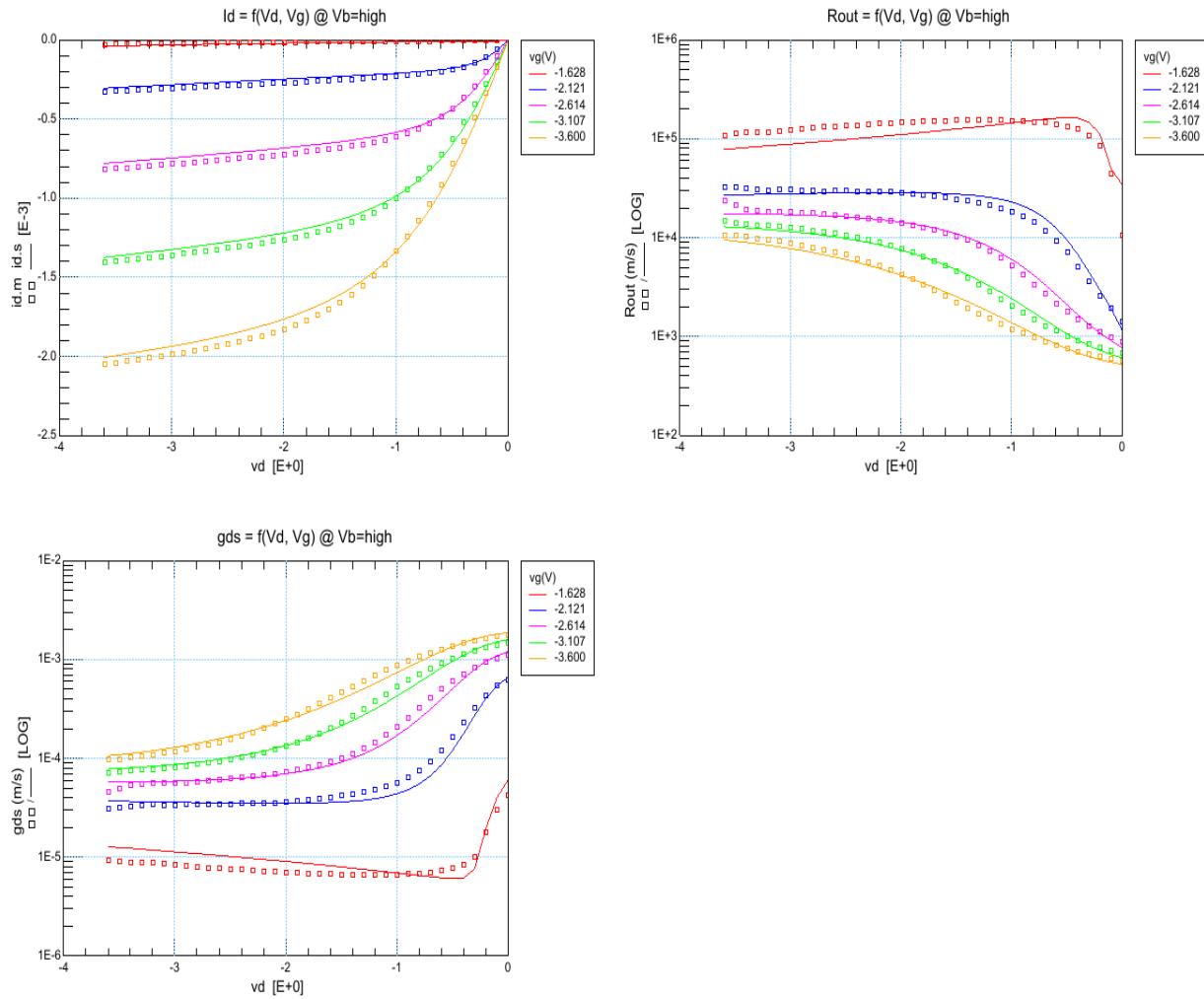
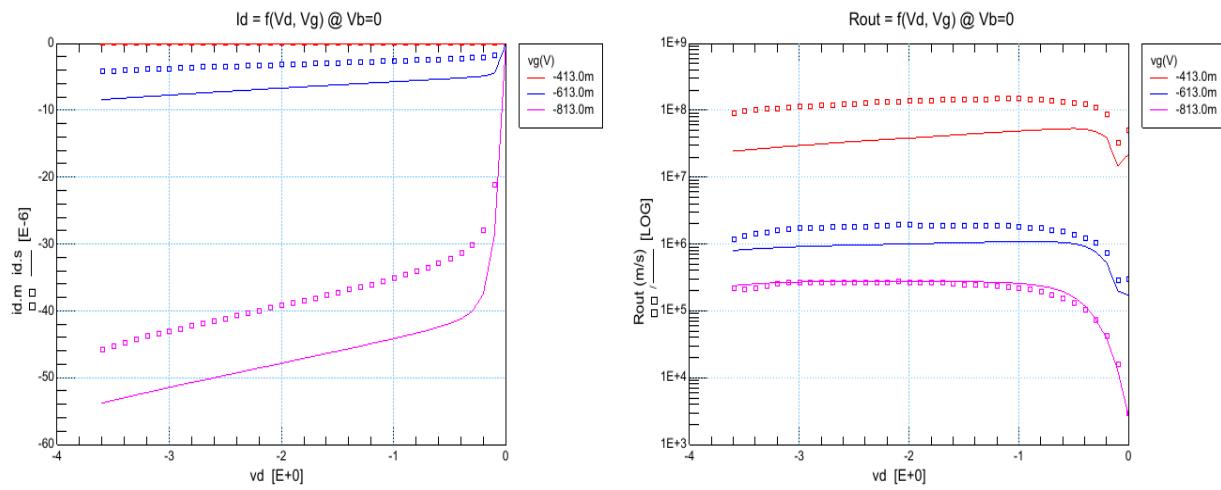


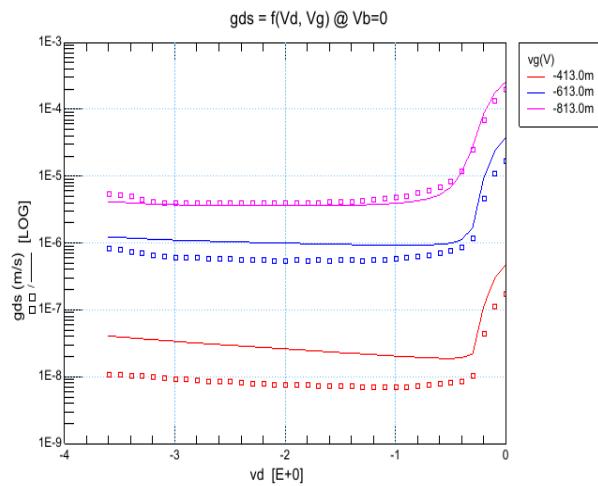


idvg, Ib,Ig, Vb = 0V, T = 27°C

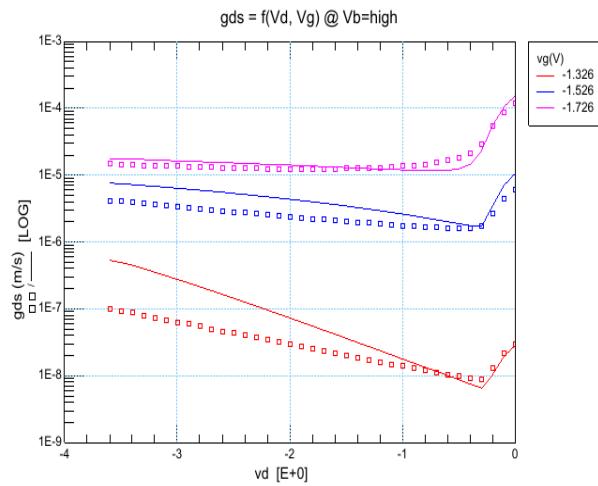
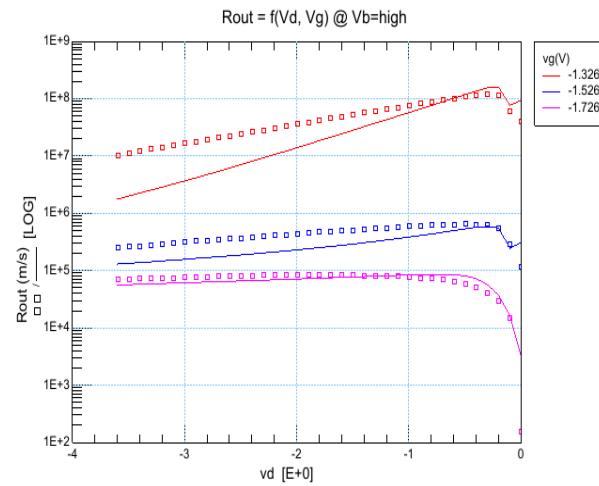
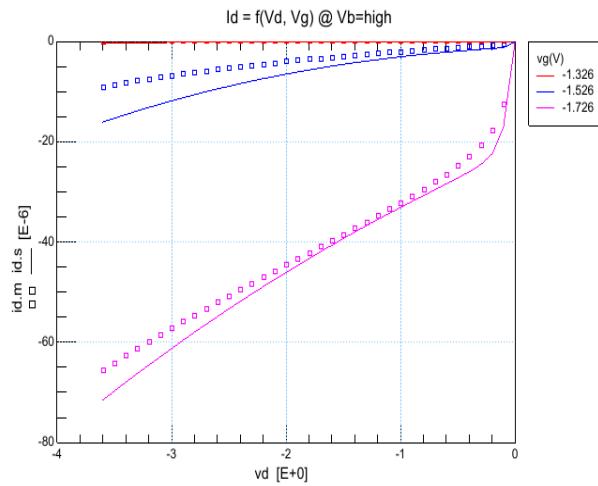


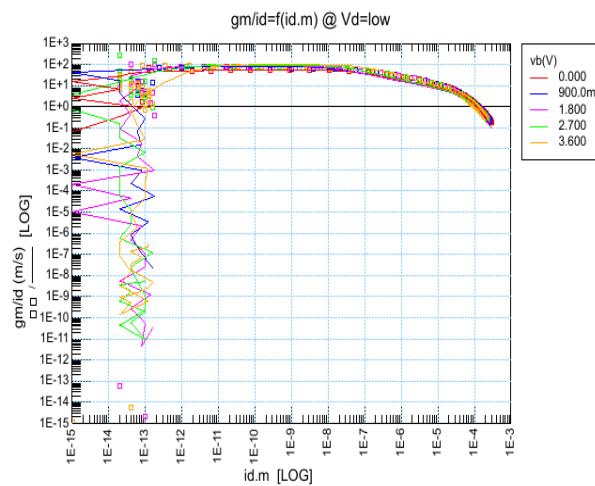
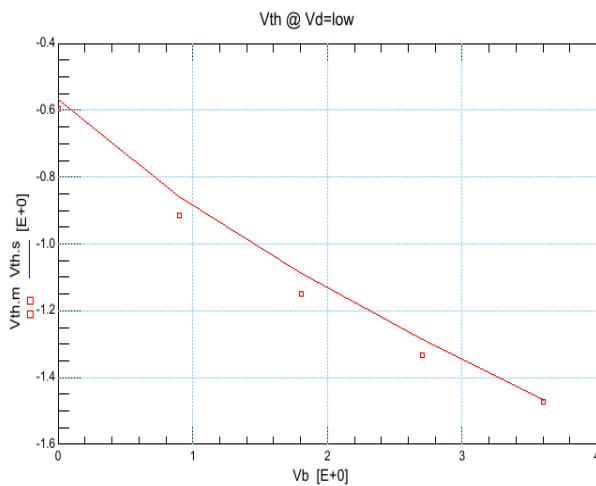
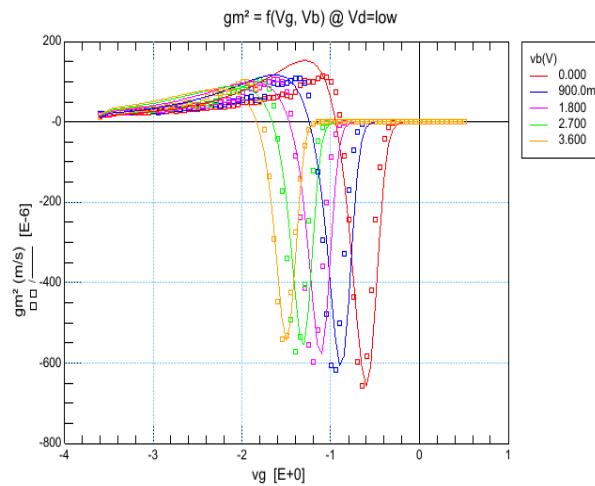
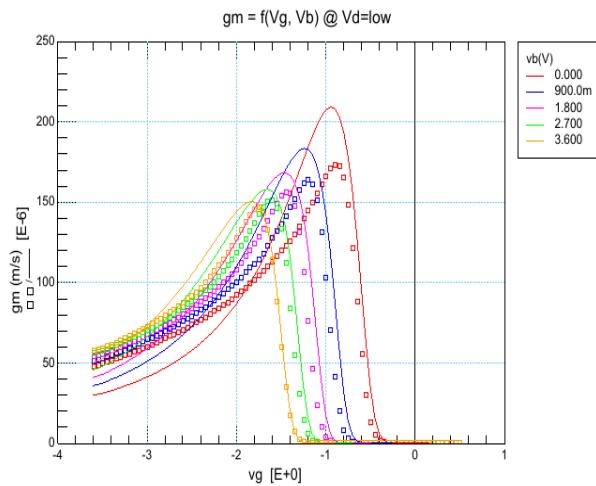
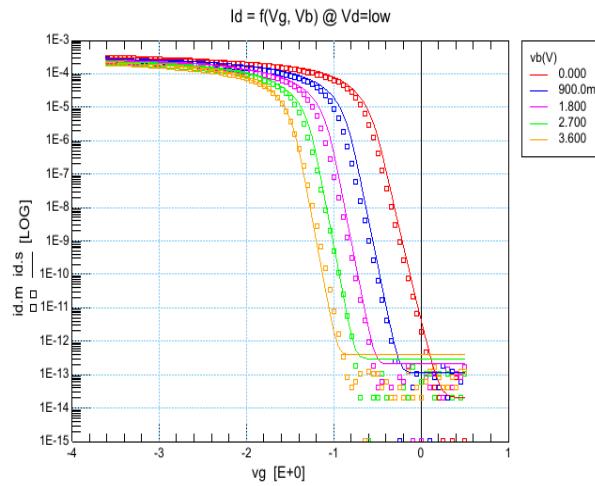
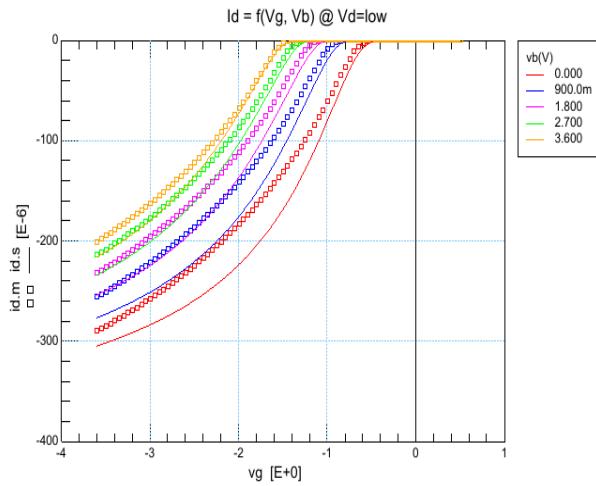
idvg, Ib,Ig, Vb = 3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


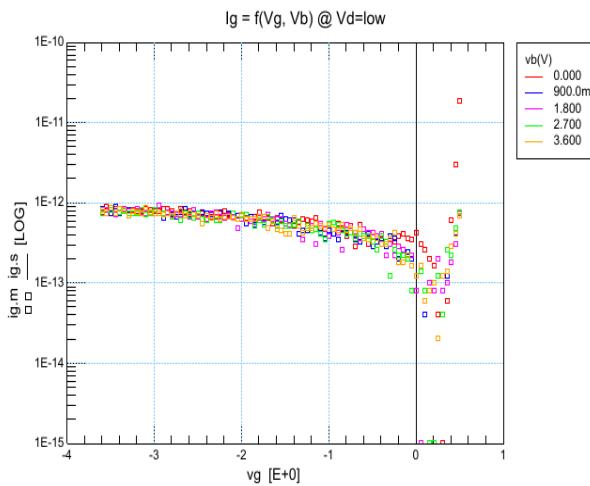
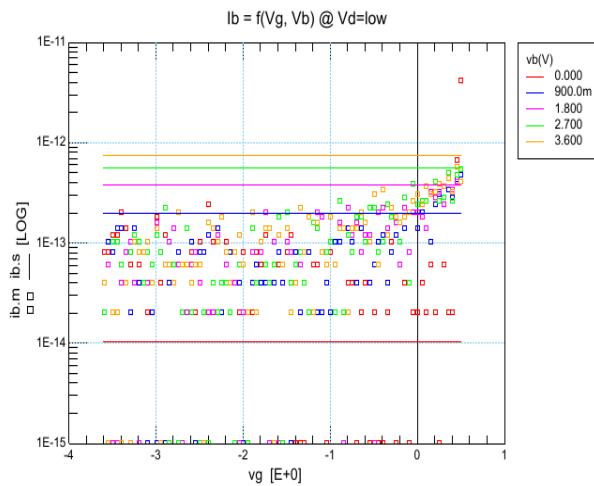
idvd_vbmin, Vb = 3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C




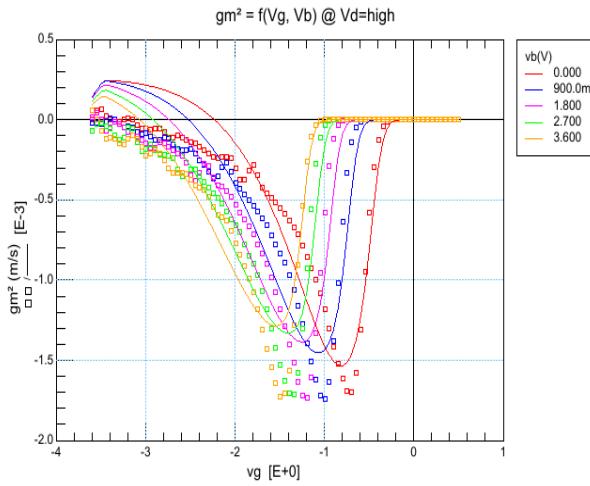
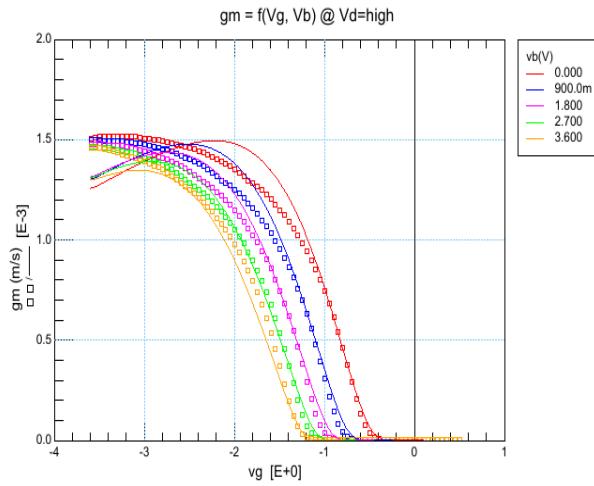
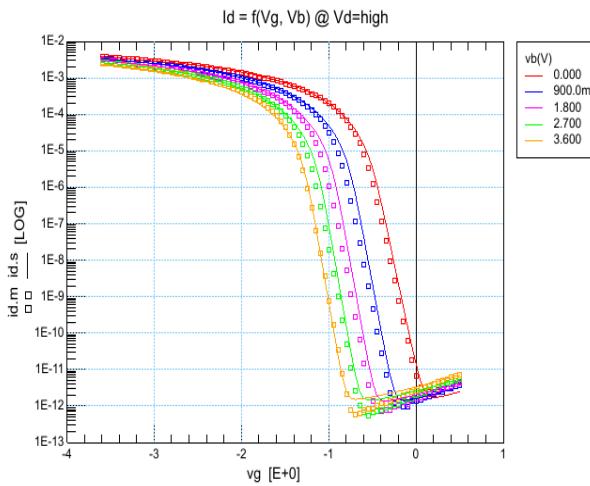
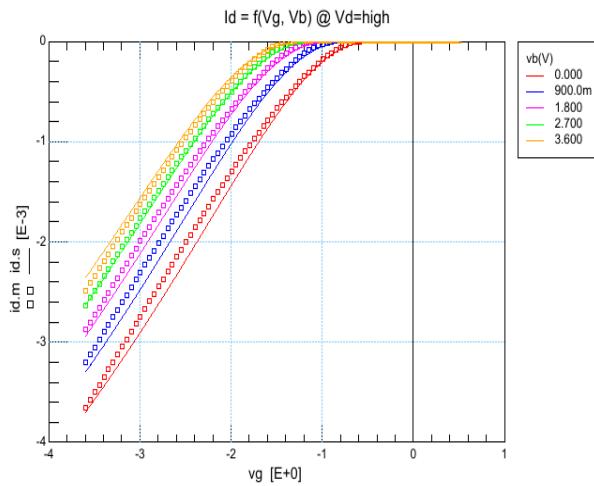
idvd_vth_vbmin, Vb = 3.6V, T = 27°C

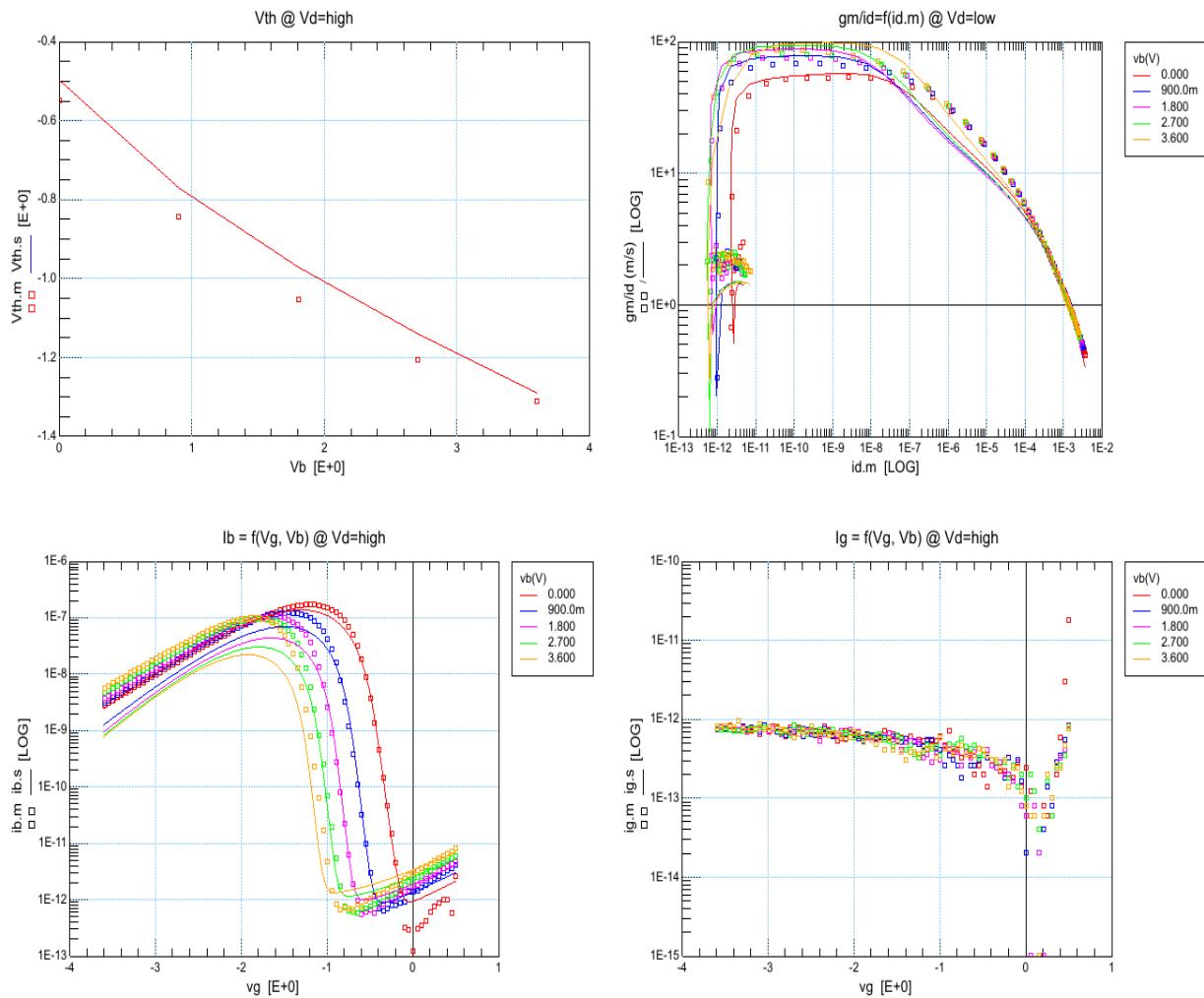


4.23W10u0_L0u3_S561_1**idvg, Vd = -0.1V, T = 27°C**

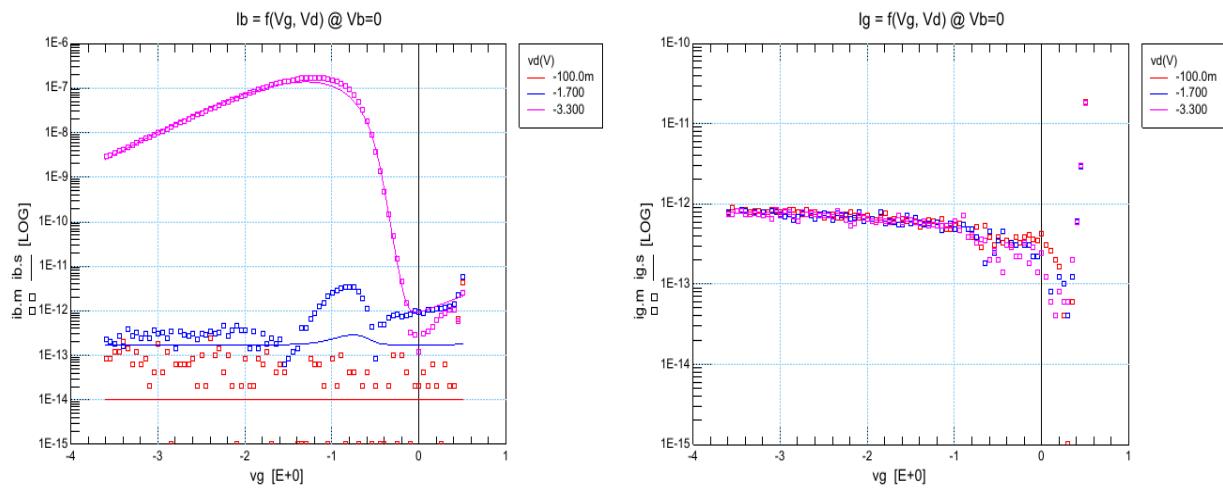


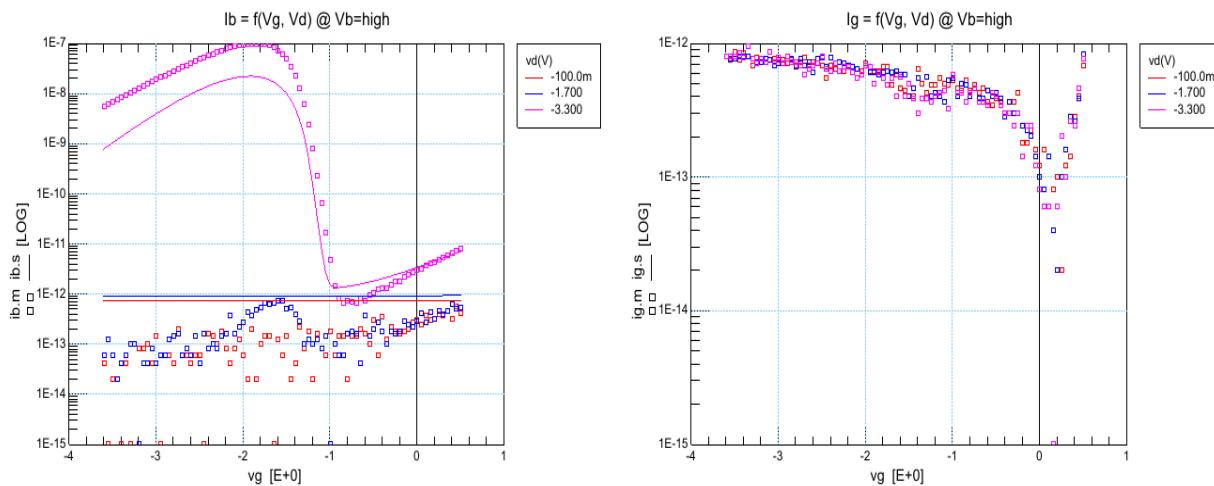
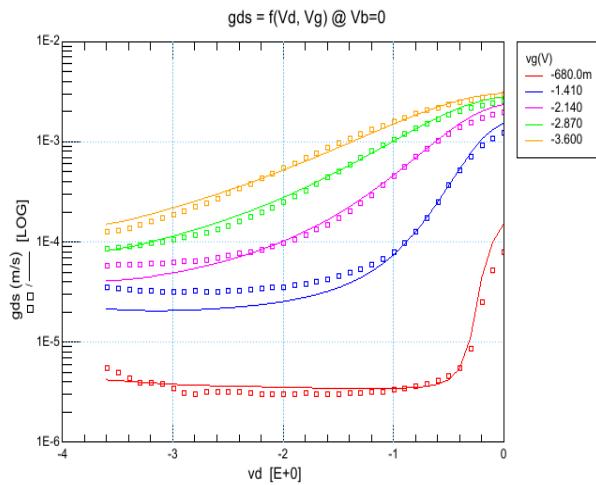
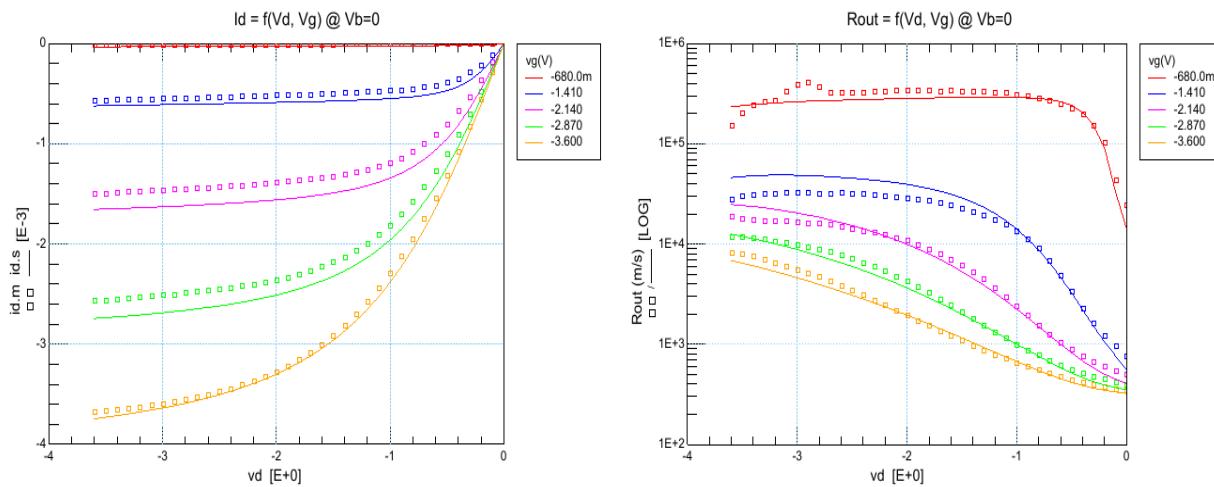
$i_{dvg}, V_d = -3.3V, T = 27^\circ\text{C}$

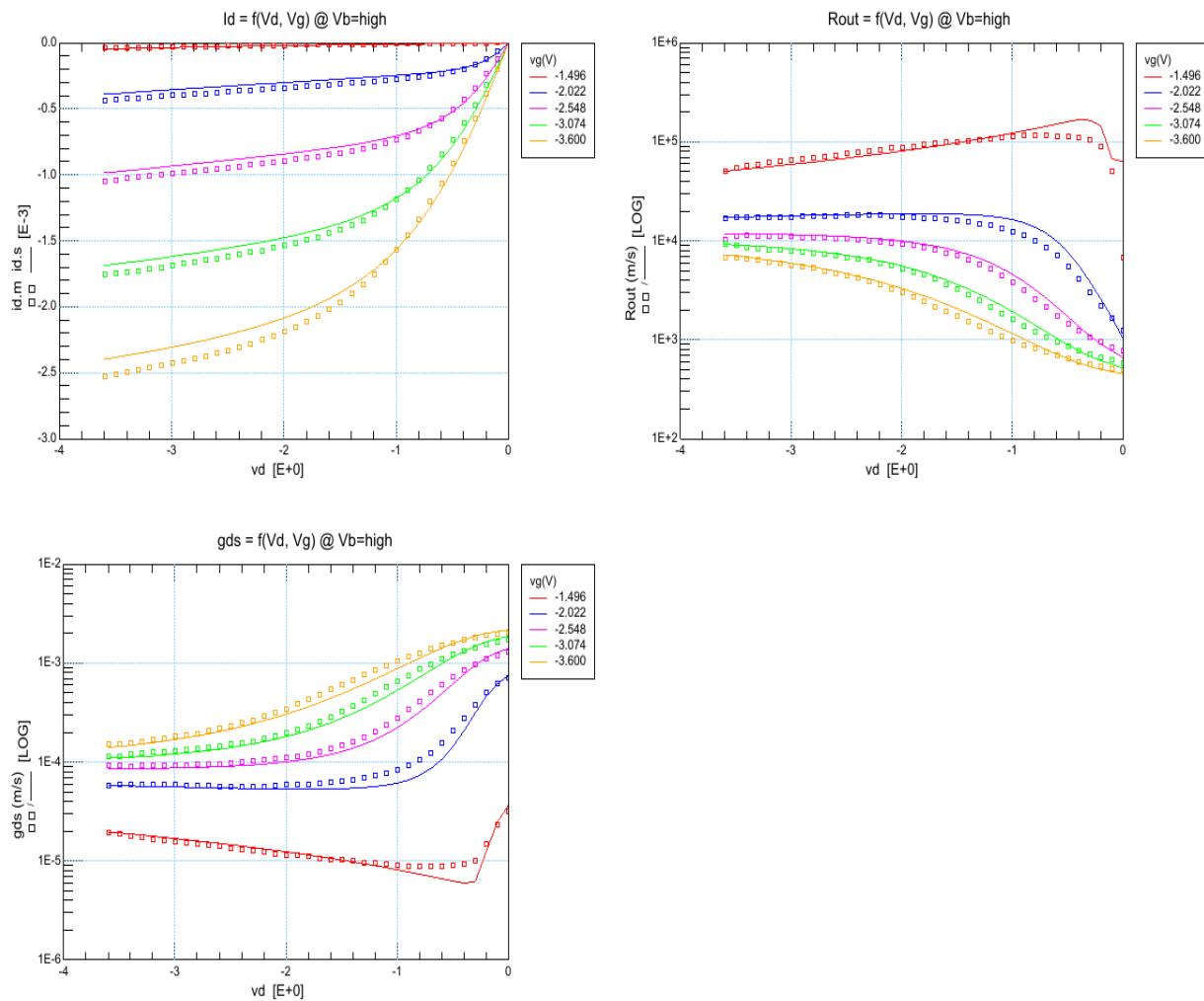
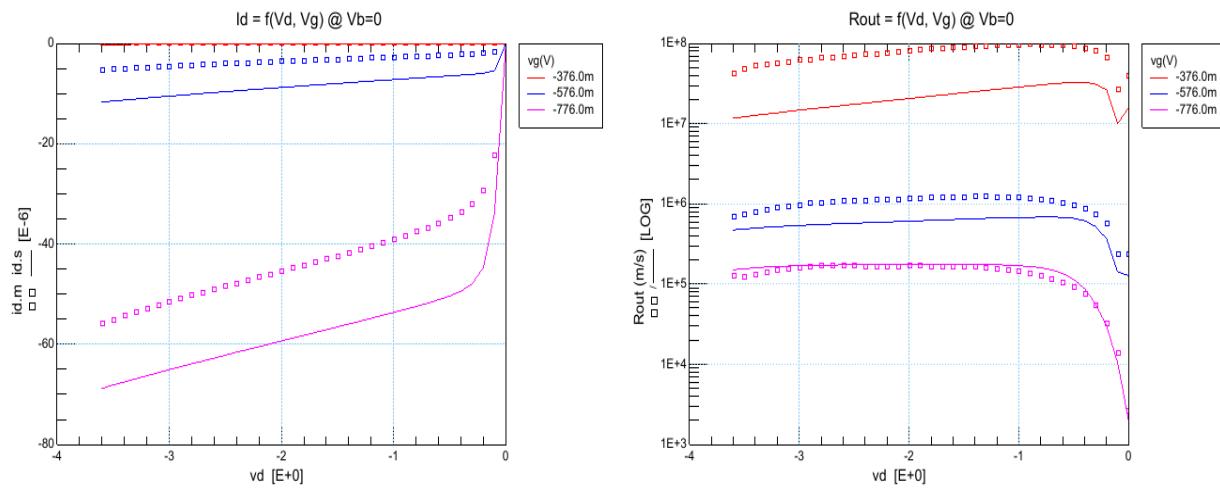


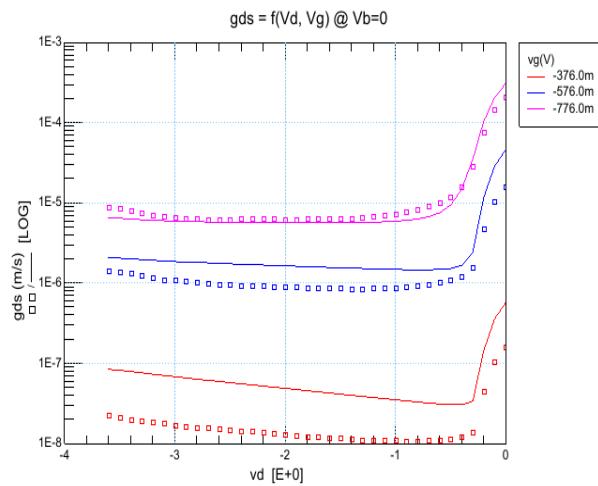


idvg, Ib, Ig, Vb = 0V, T = 27°C

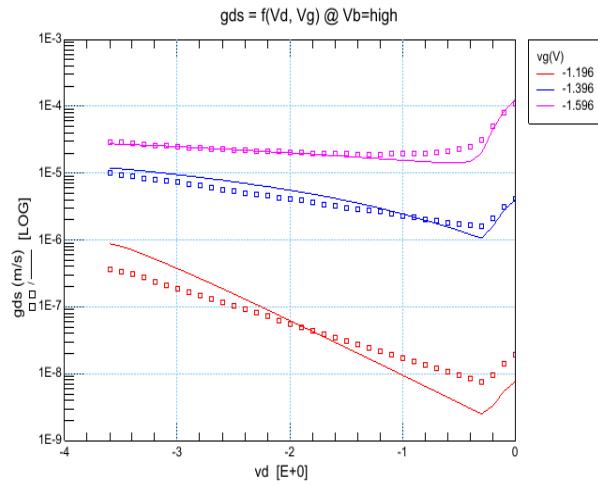
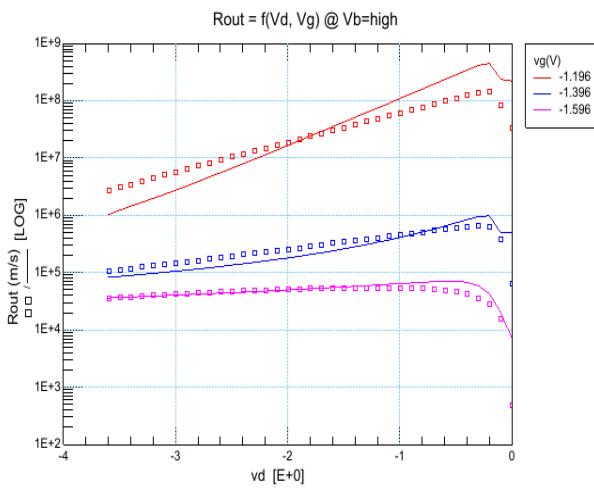
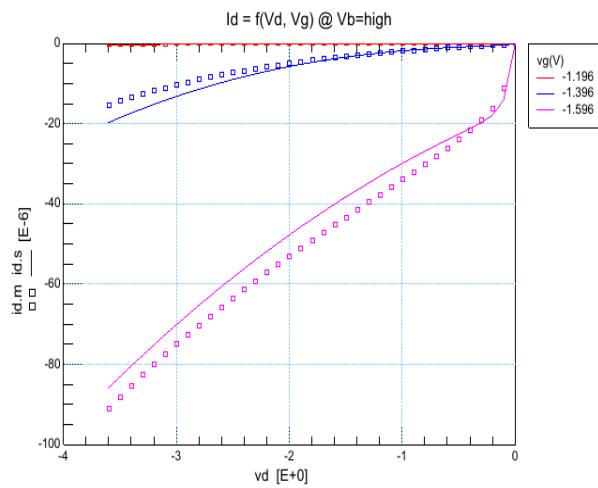


idvg, Ib,Ig, Vb = 3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = 3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


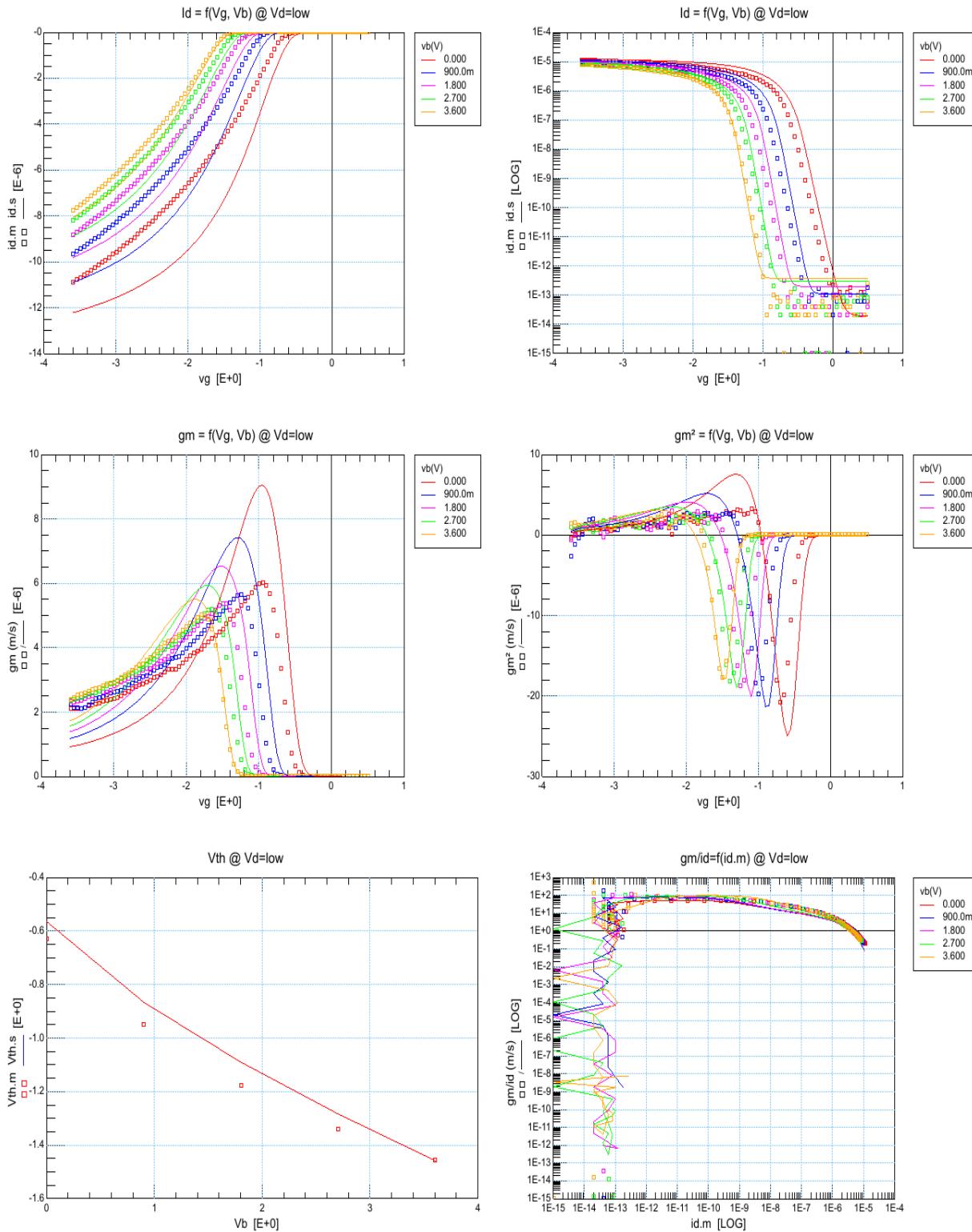


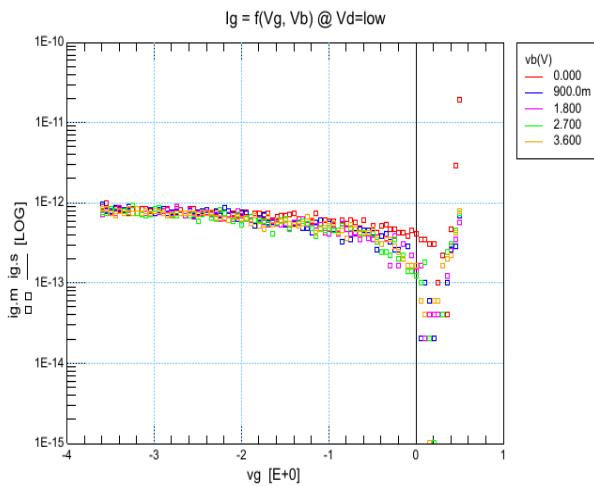
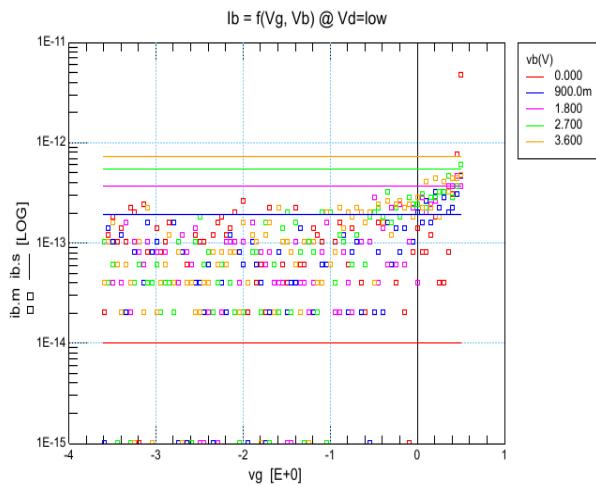
idvd_vth_vbmin, Vb = 3.6V, T = 27°C



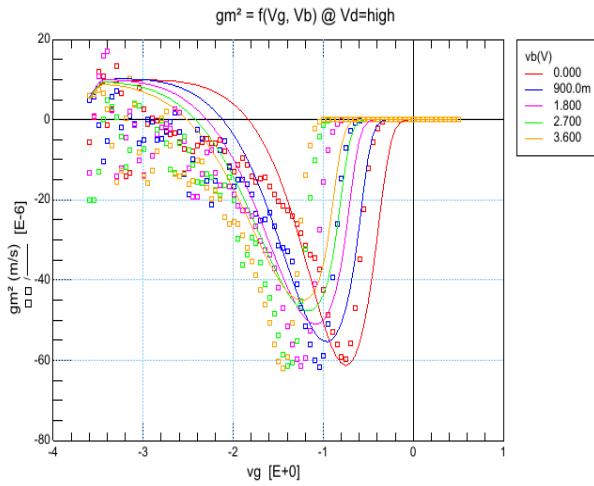
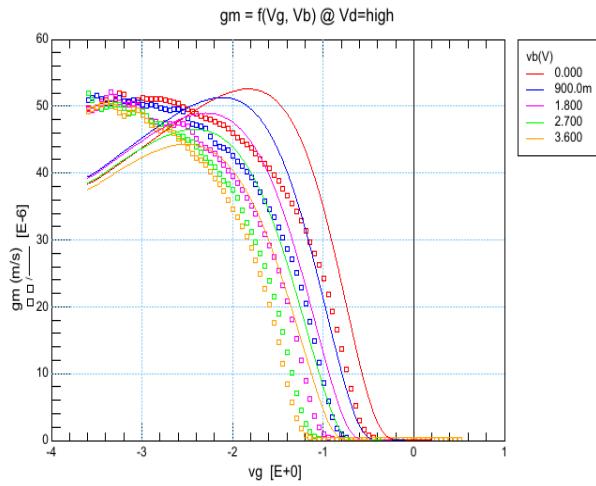
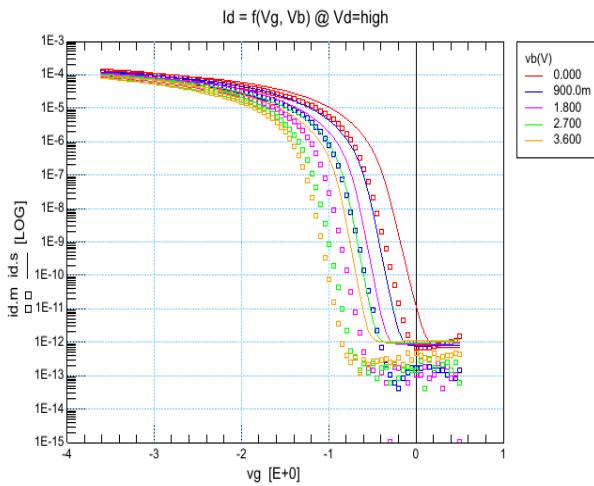
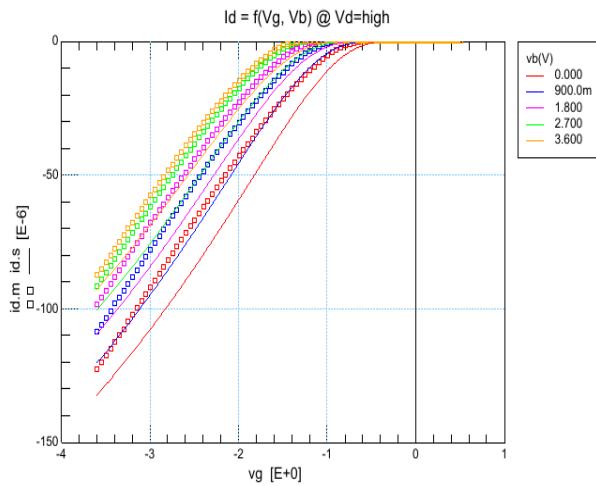
4.24 W0u3_L0u3_S565_1

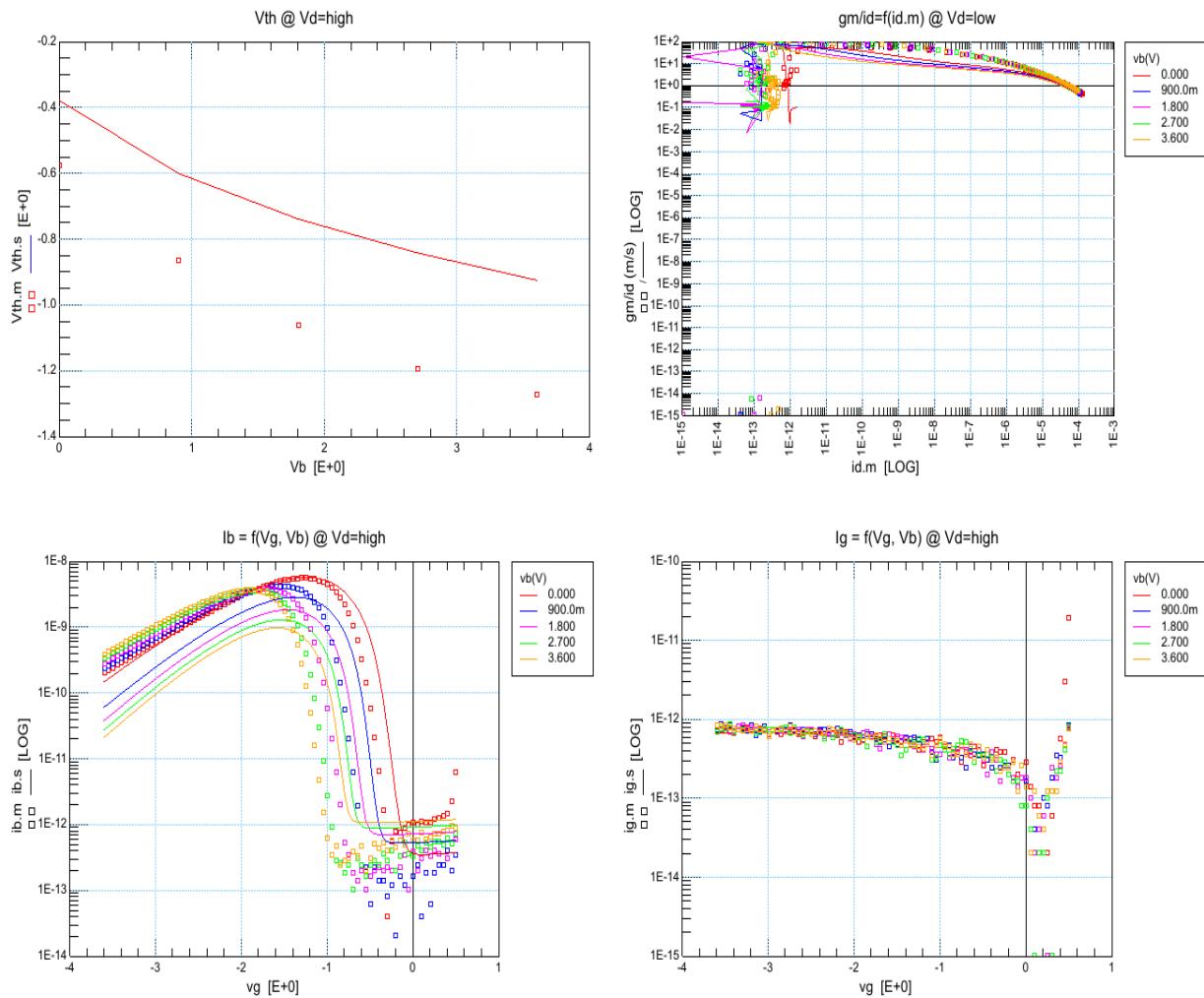
$idv_g, V_d = -0.1V, T = 27^\circ C$



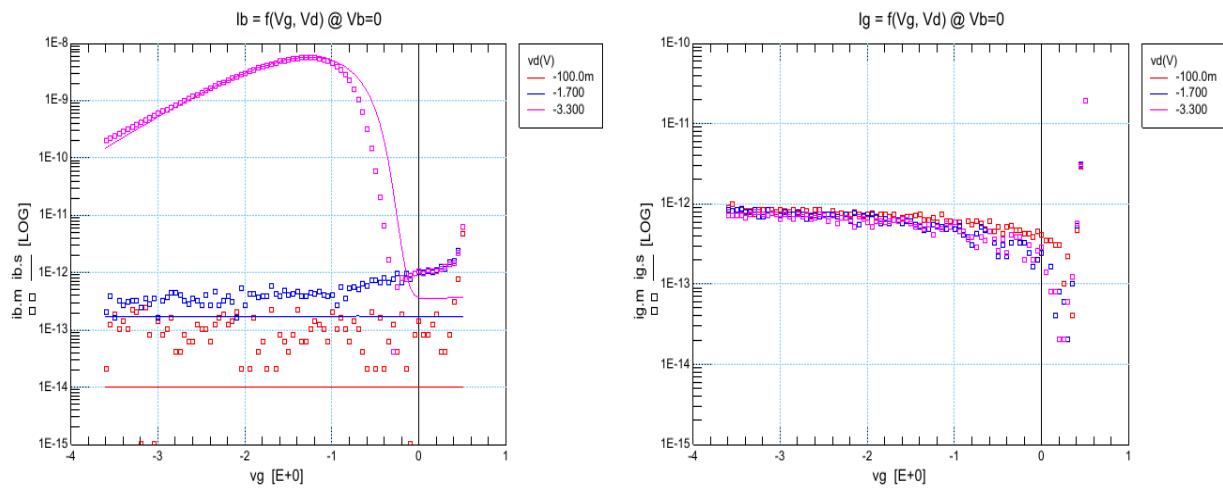


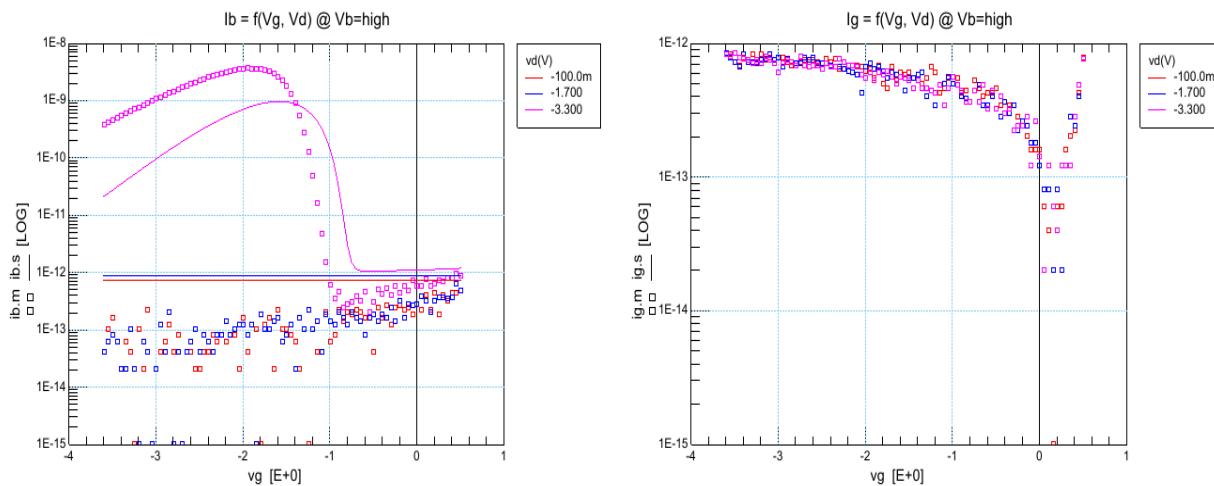
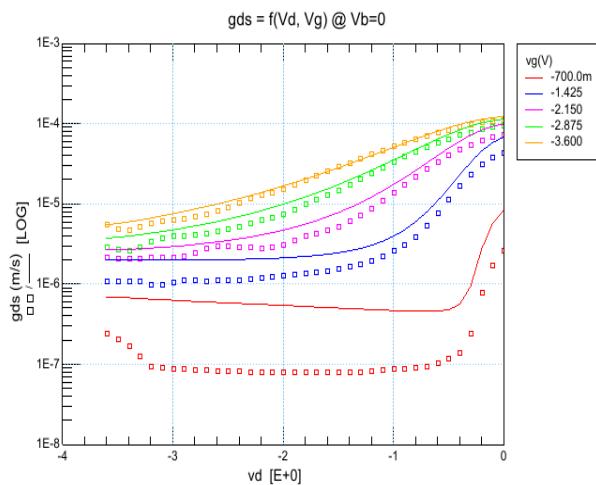
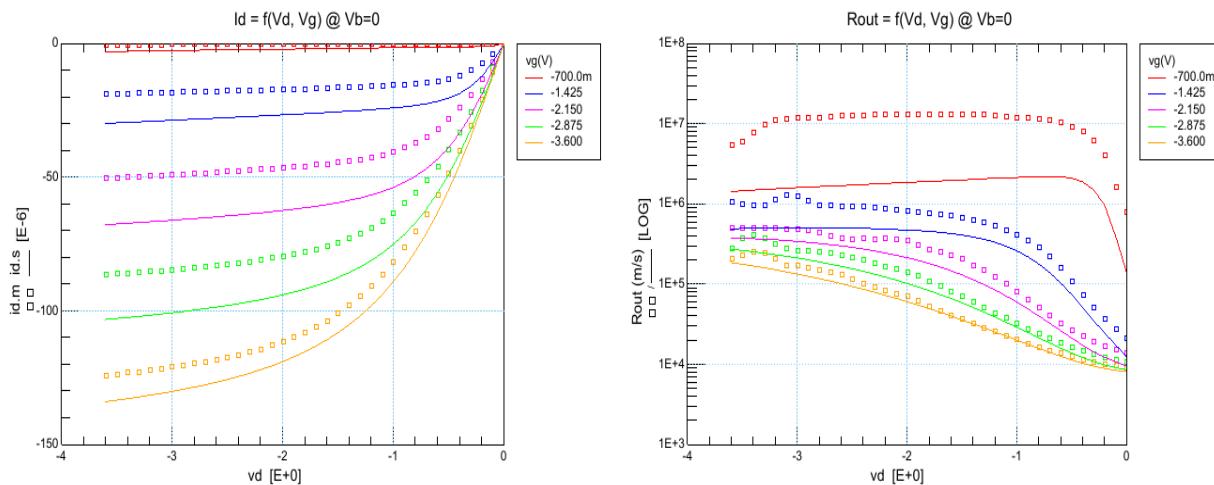
$i_{dvg}, V_d = -3.3V, T = 27^\circ\text{C}$

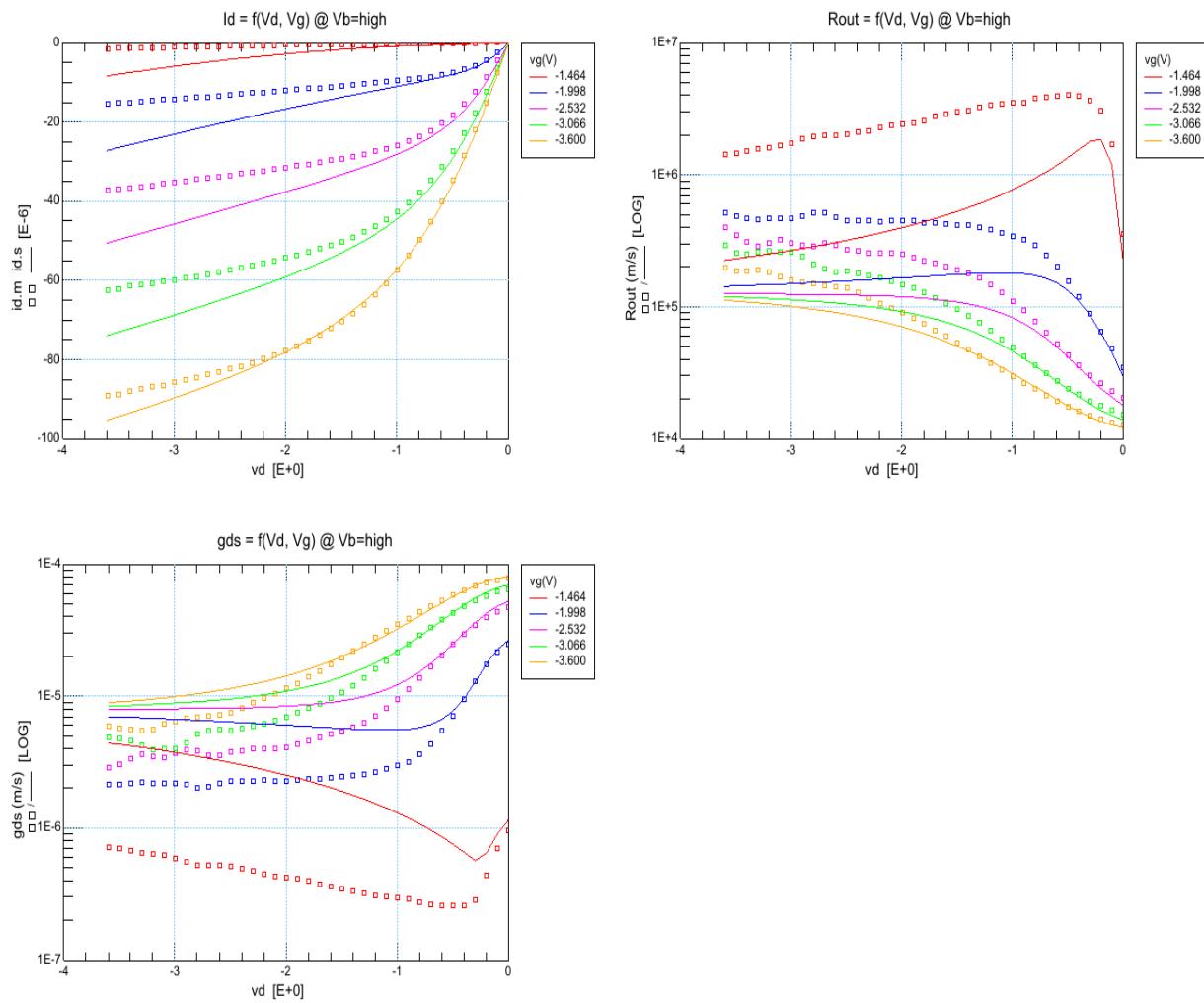
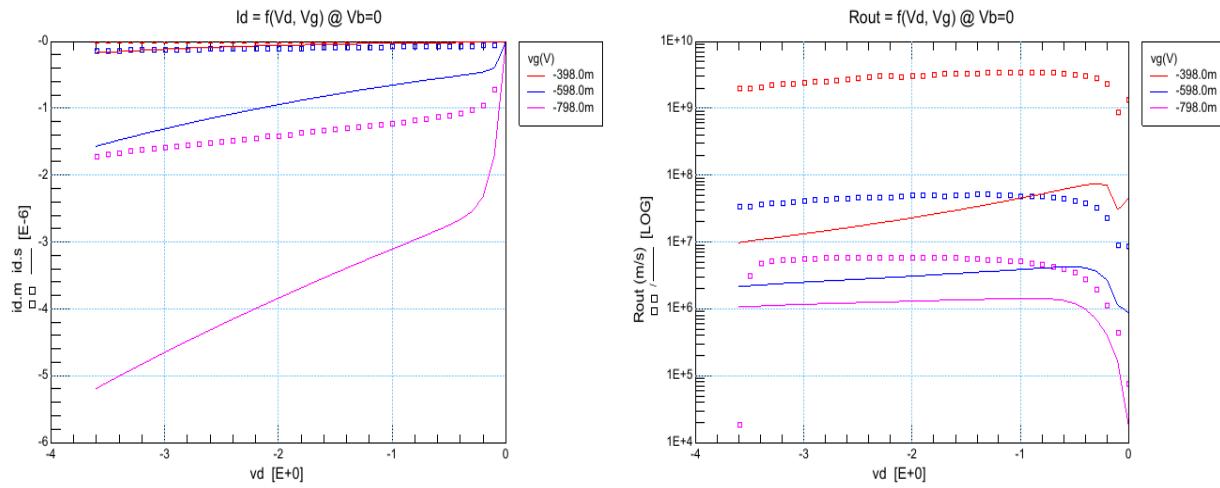


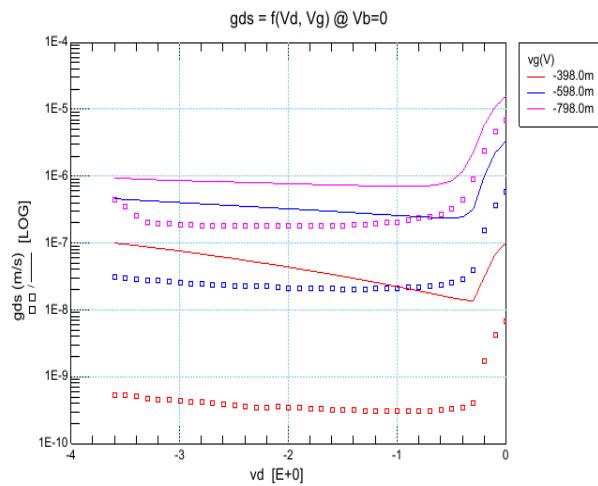


$i_{dvg}, I_b, I_g, V_b = 0V, T = 27^\circ C$

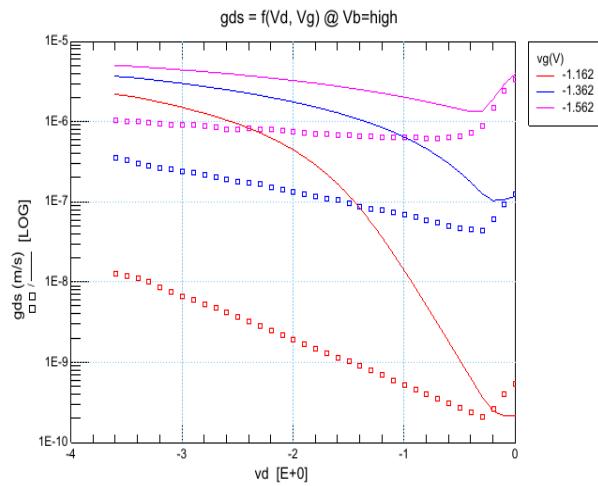
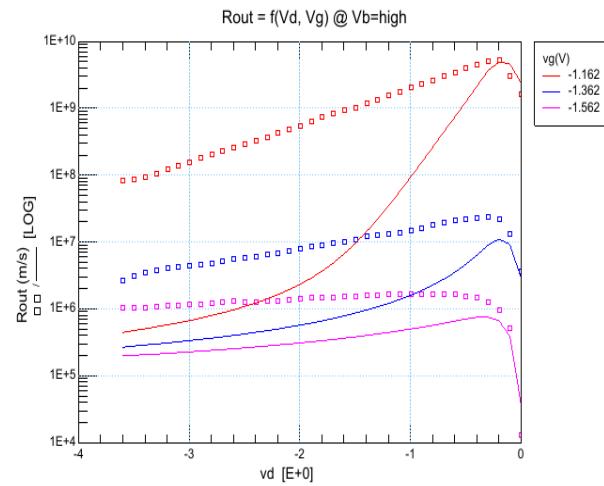
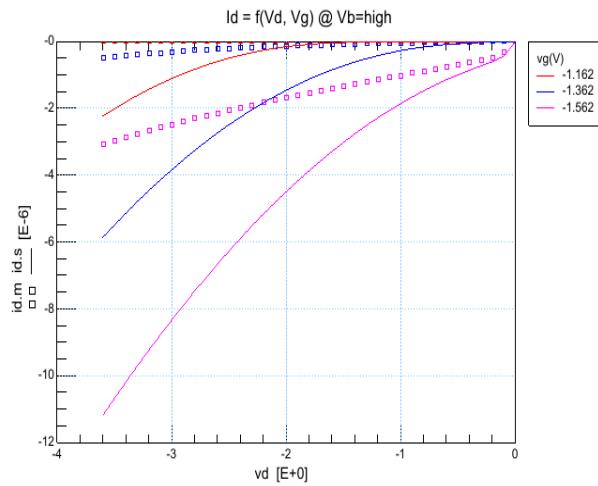


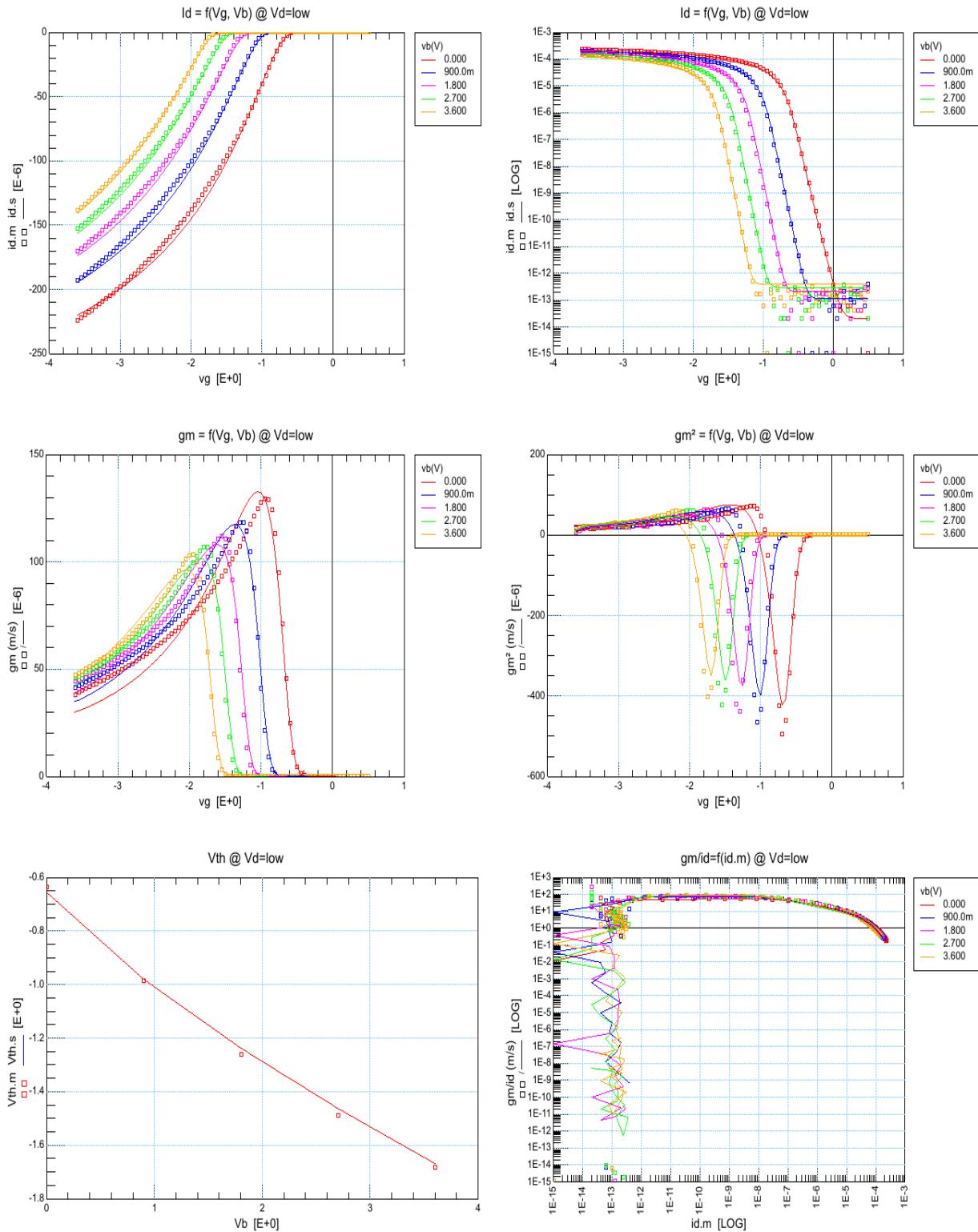
idvg, Ib,Ig, Vb = 3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


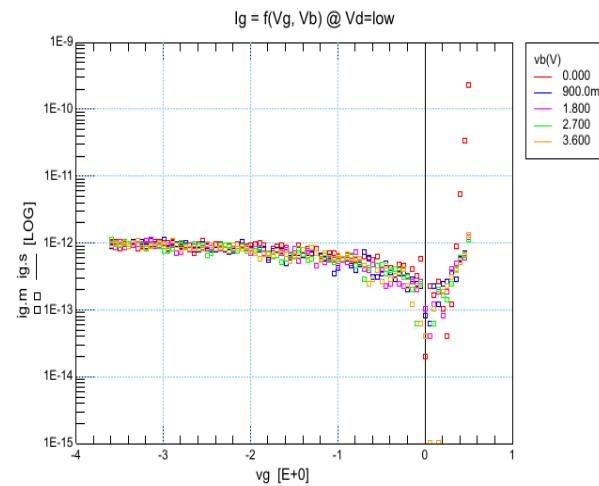
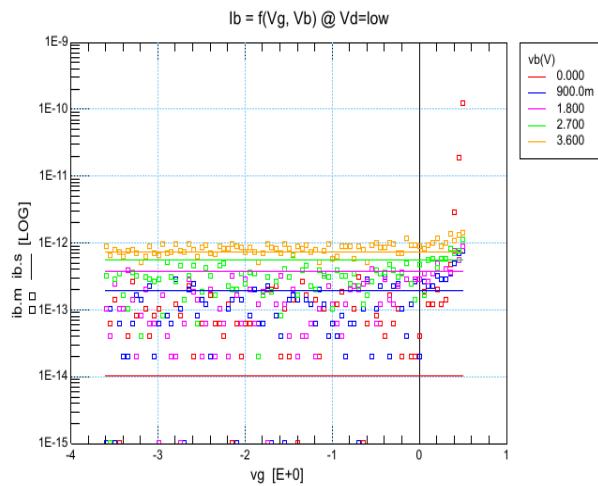
idvd_vbmin, Vb = 3.6V, T = 27°C**idvd_vth, Vb = 0V, T = 27°C**



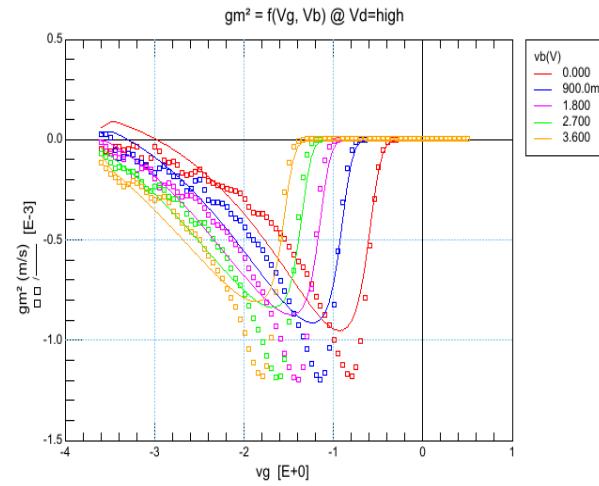
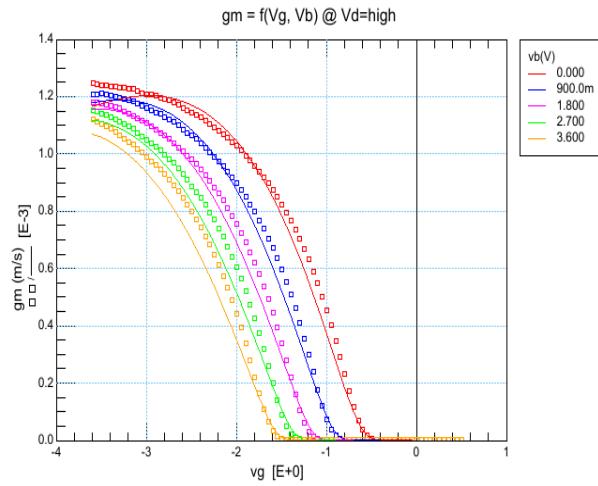
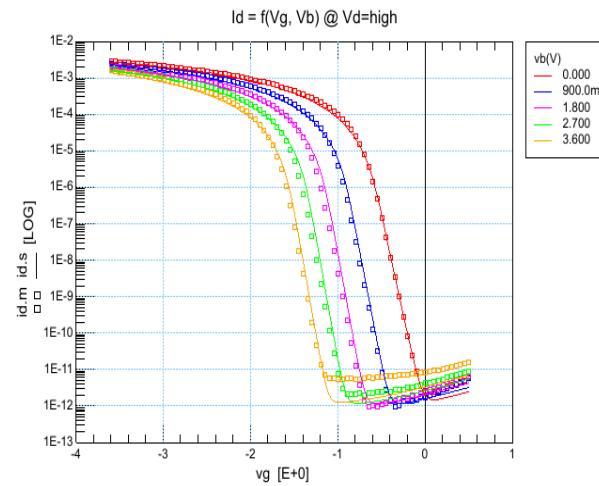
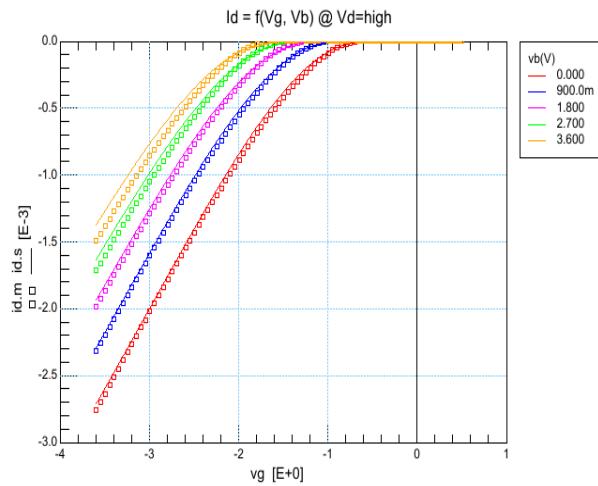
idvd_vth_vbmin, Vb = 3.6V, T = 27°C

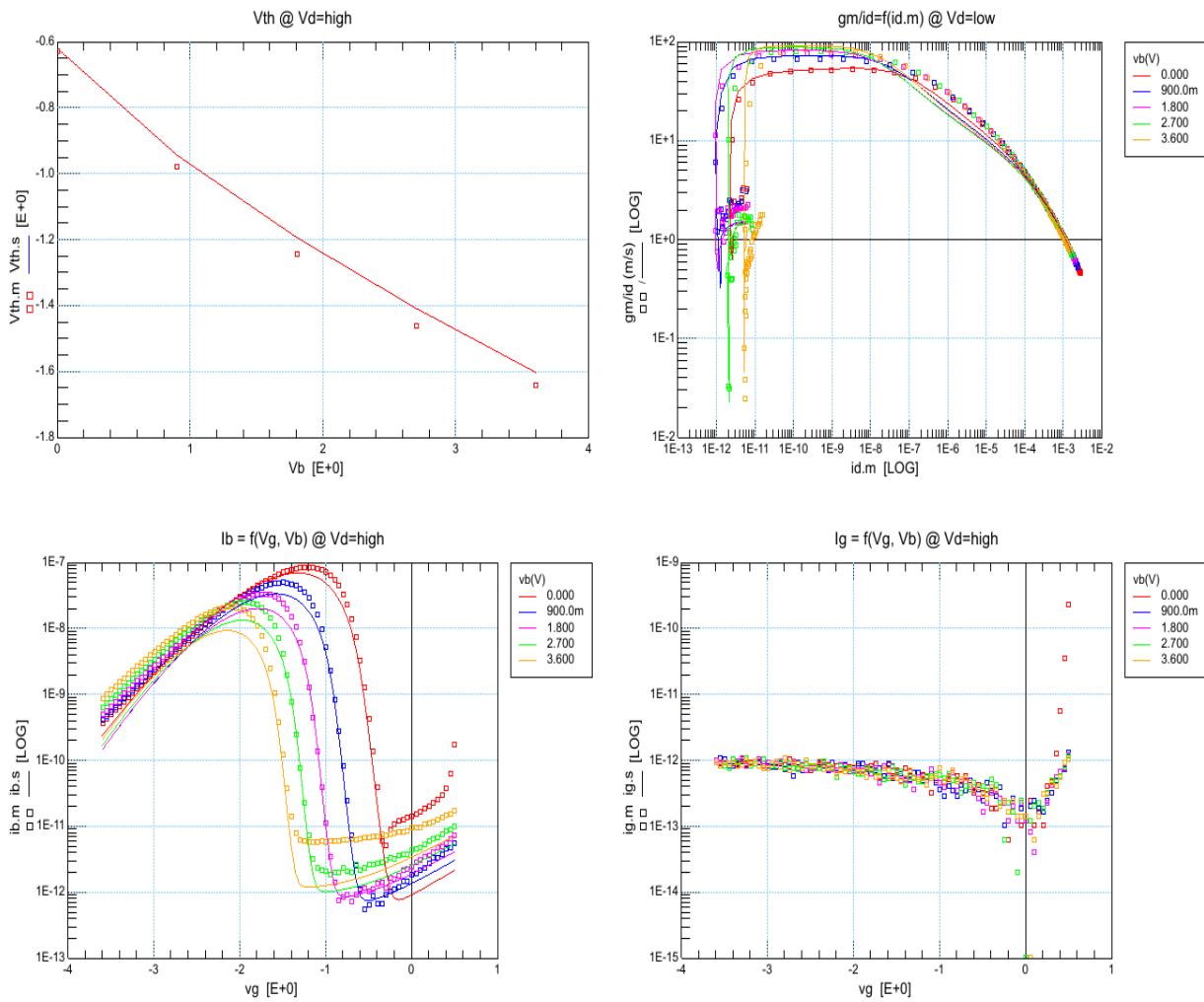


4.25 W10u0_L0u4_S387_1**idvg, Vd = -0.1V, T = 27°C**

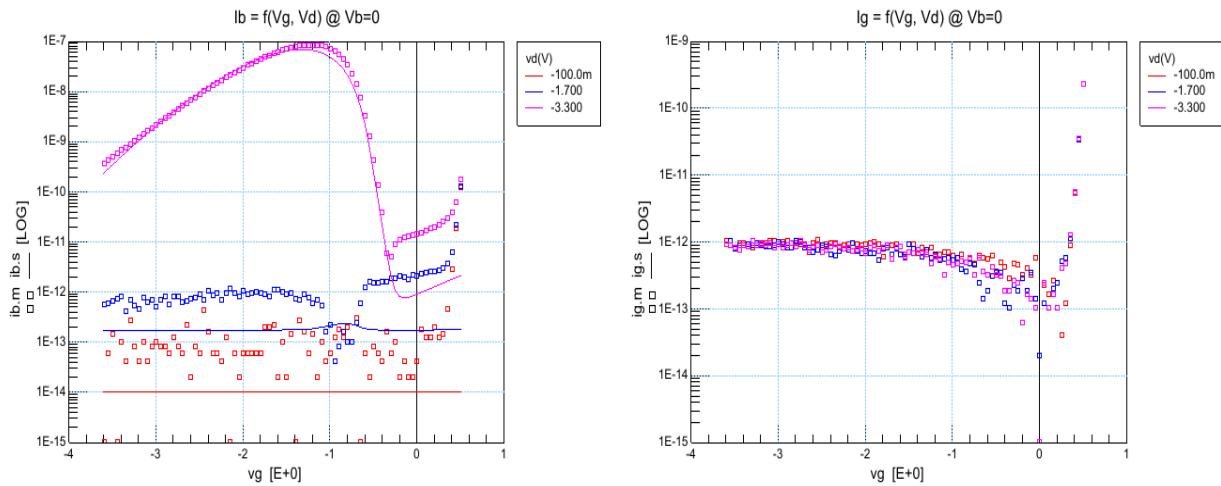


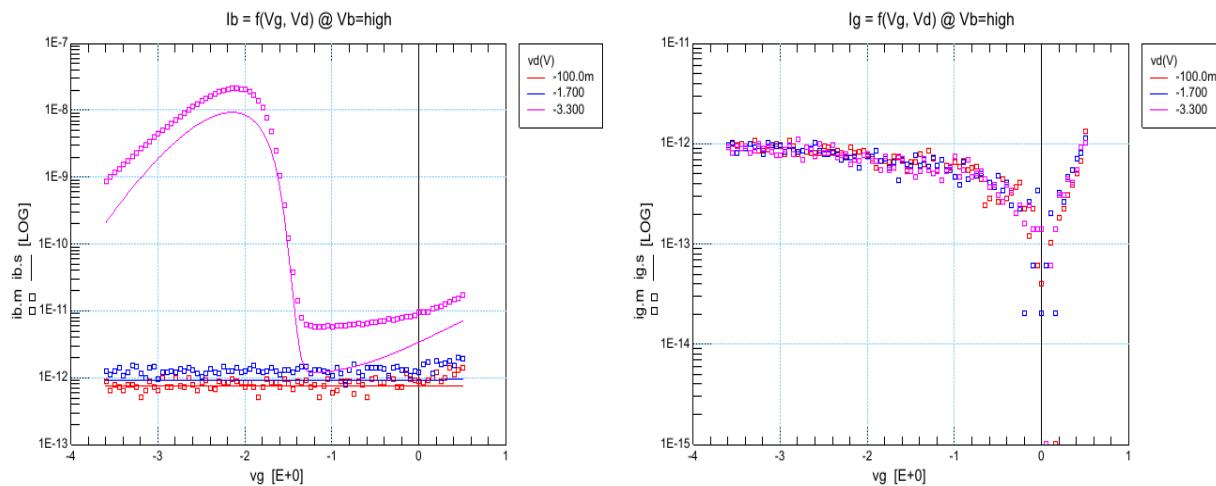
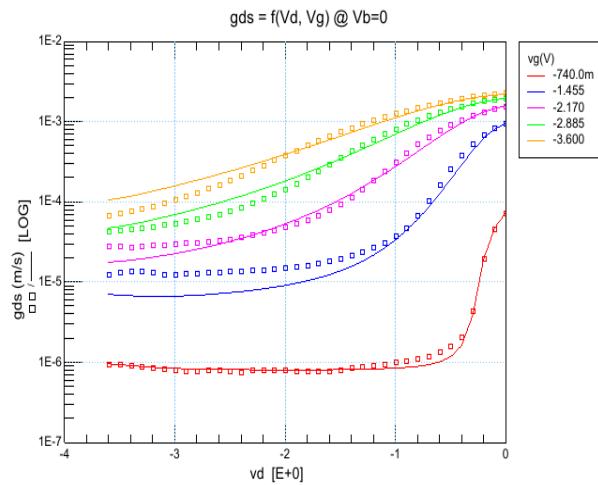
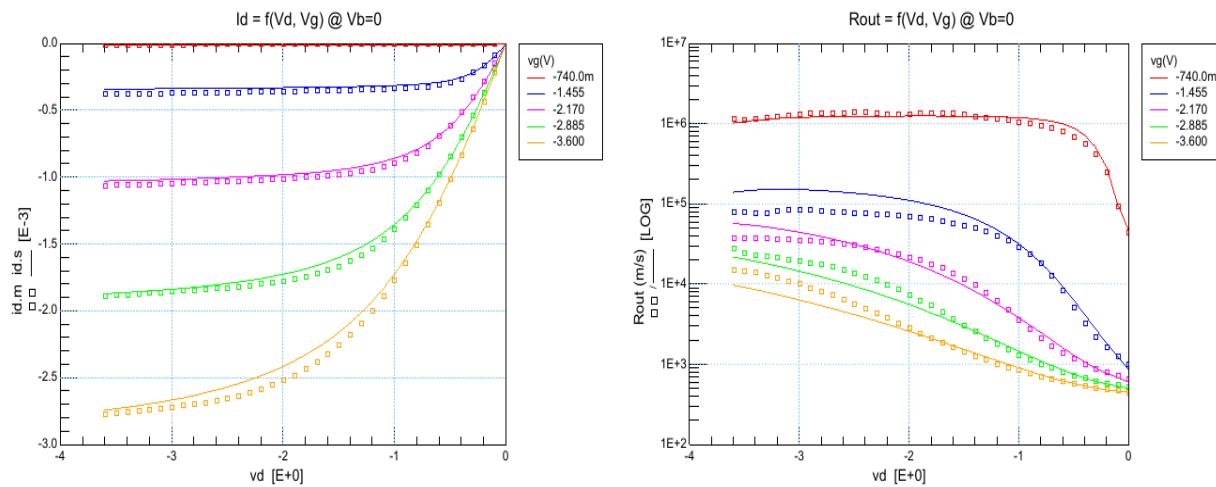
$i_{dvg}, V_d = -3.3V, T = 27^\circ\text{C}$

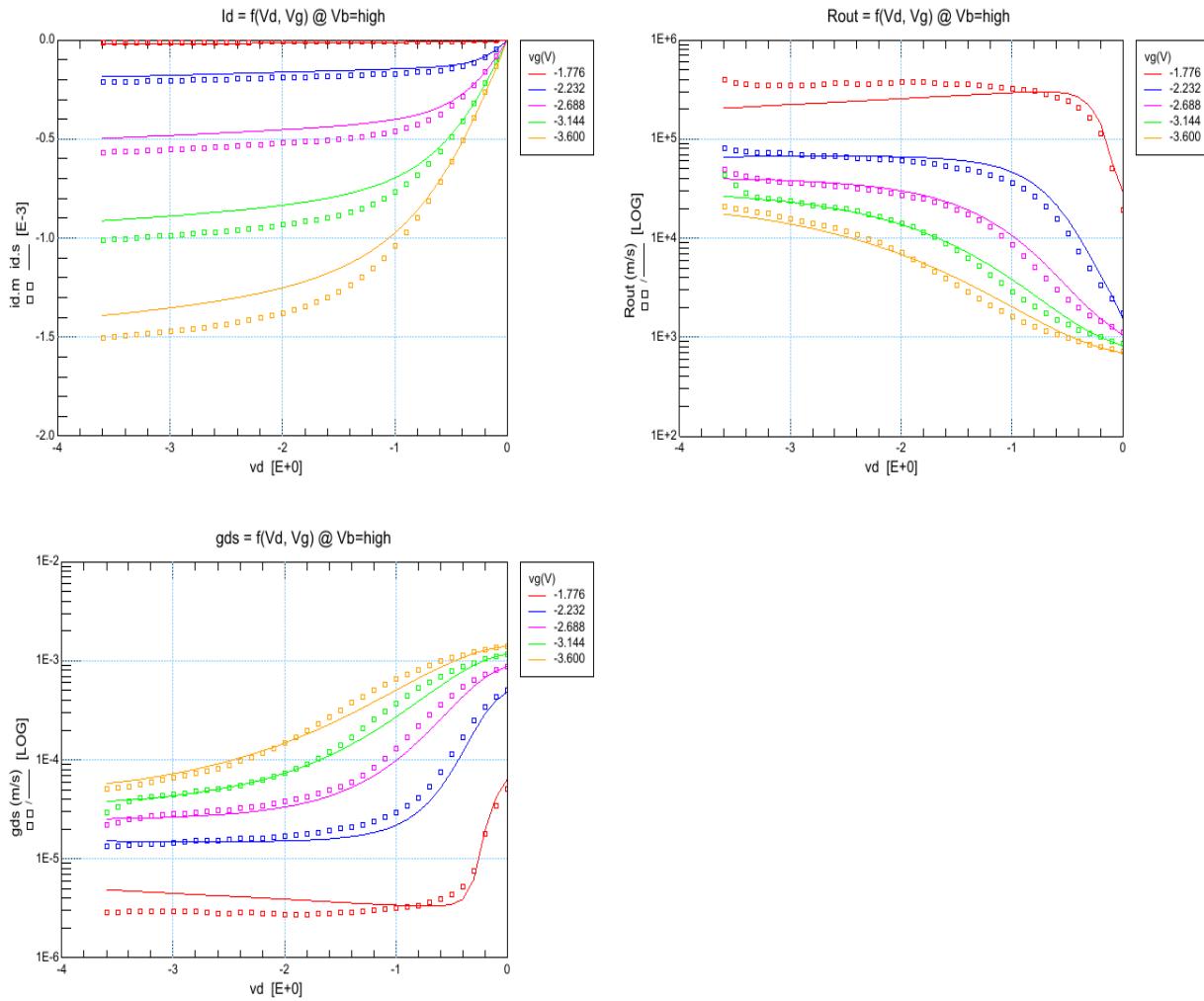
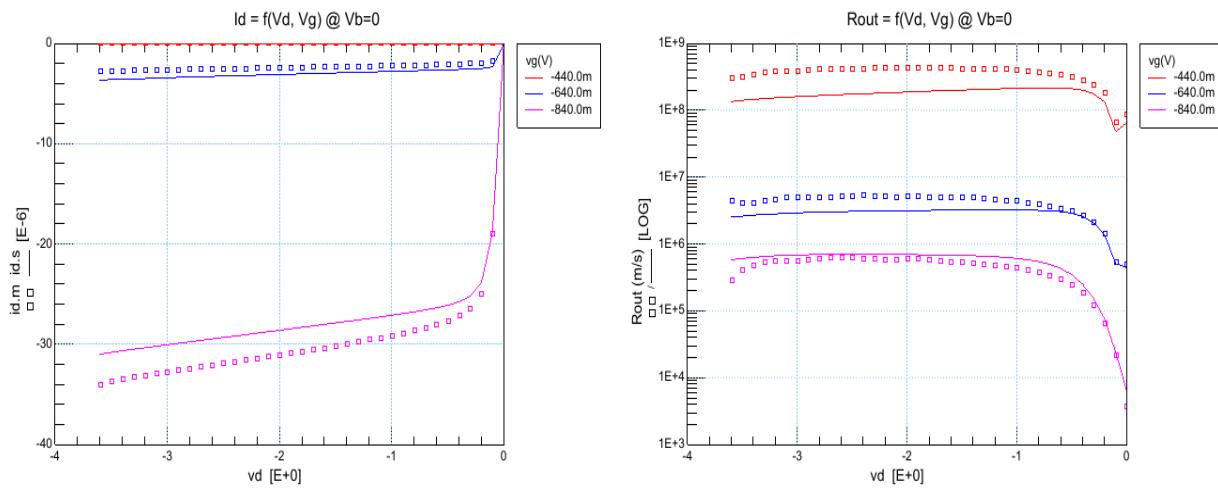


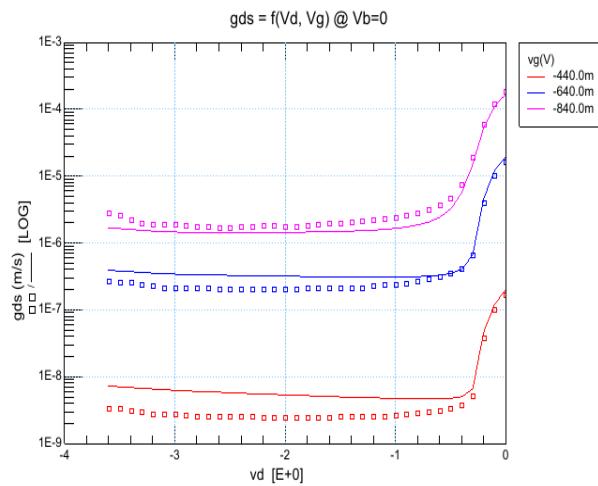


$idvg, I_b, Ig, V_b = 0V, T = 27^\circ C$

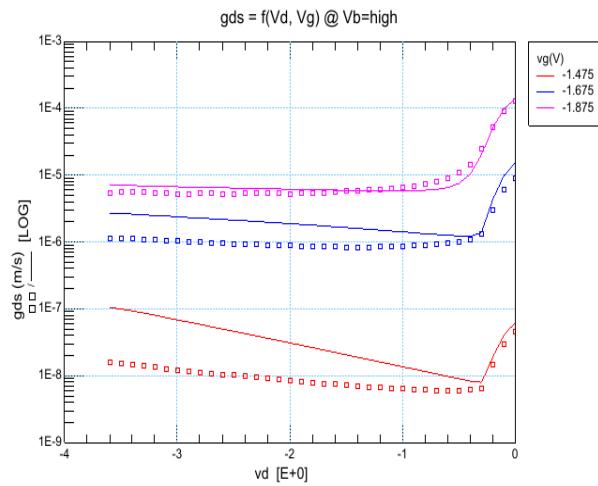
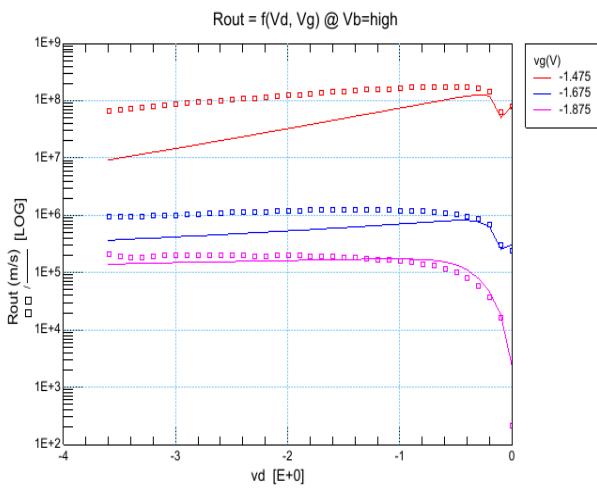
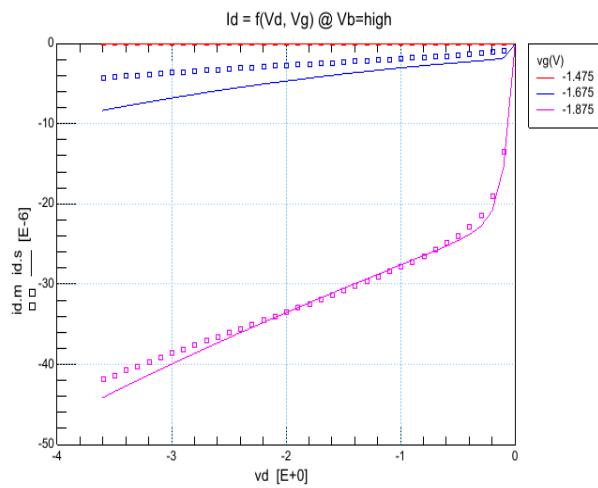


idvg, Ib,Ig, Vb = 3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = 3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


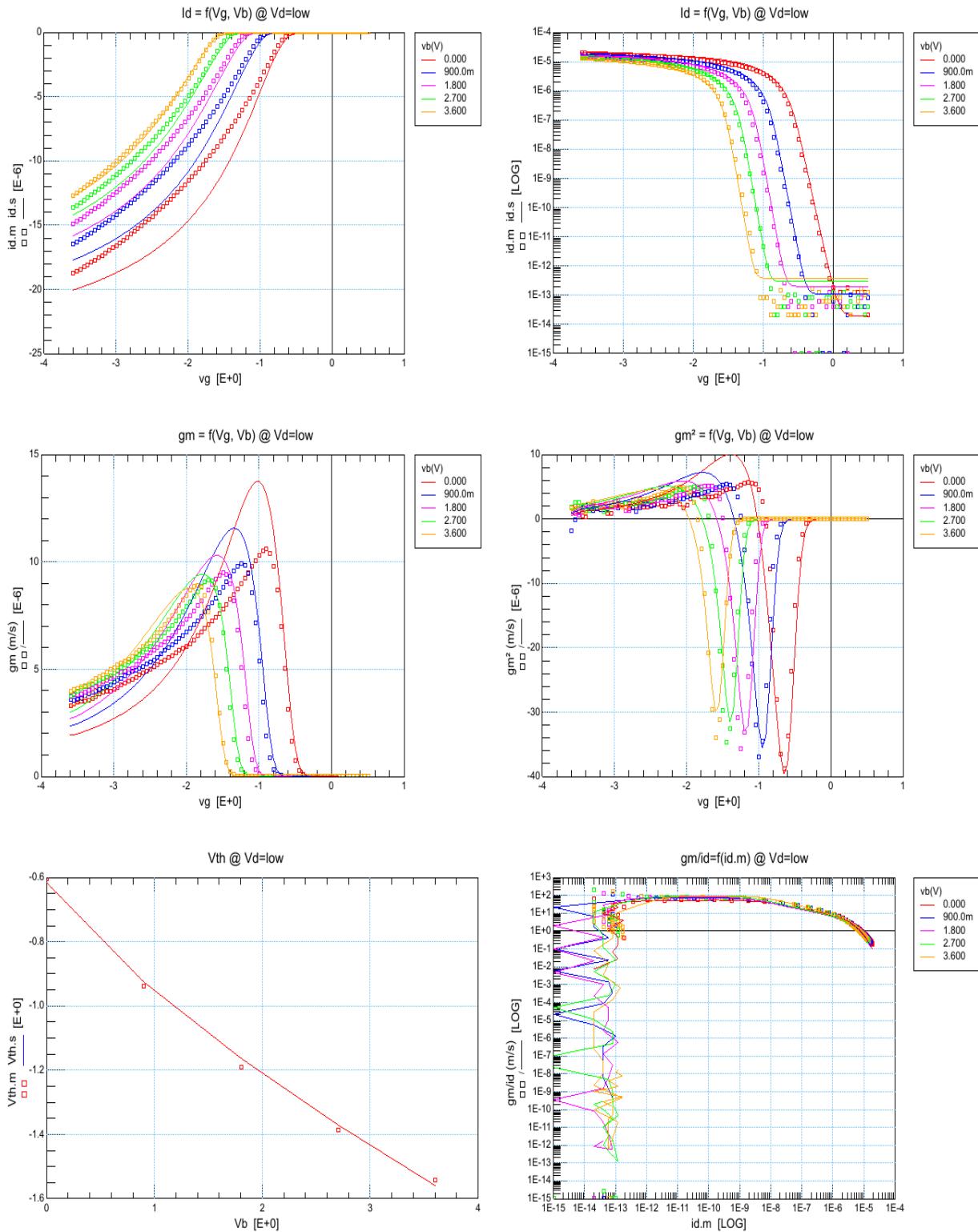


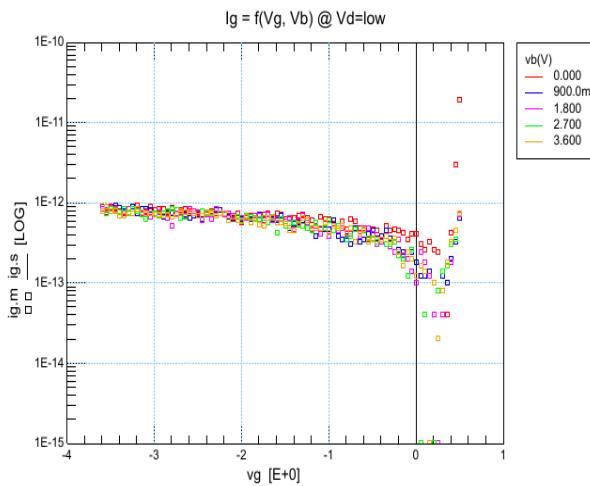
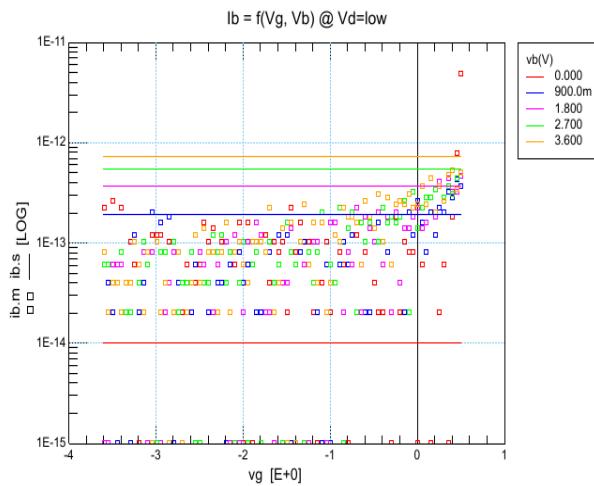
idvd_vth_vbmin, Vb = 3.6V, T = 27°C



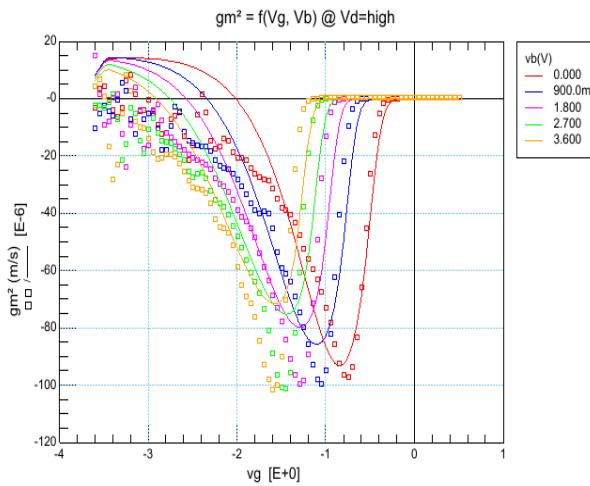
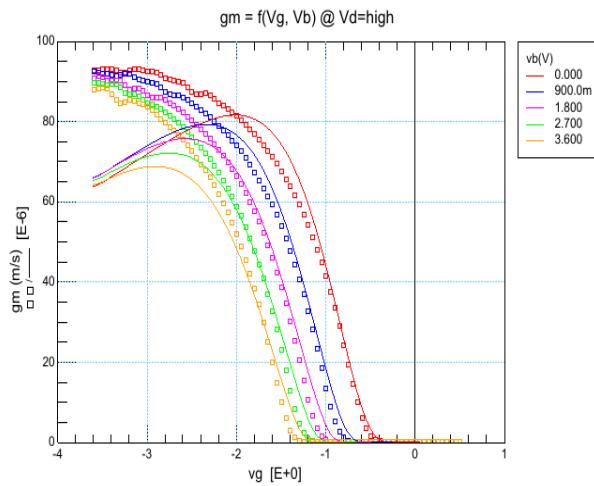
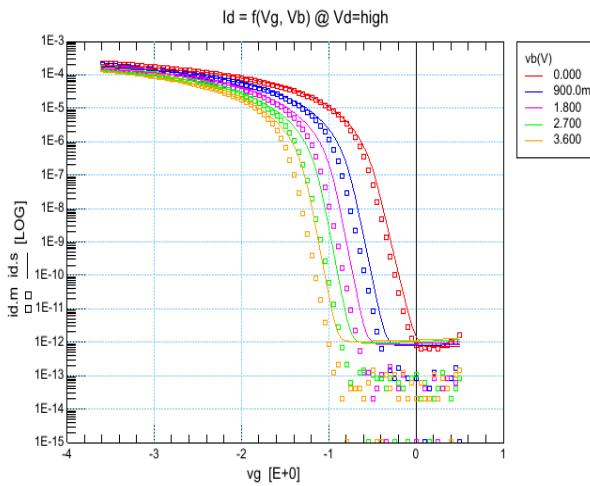
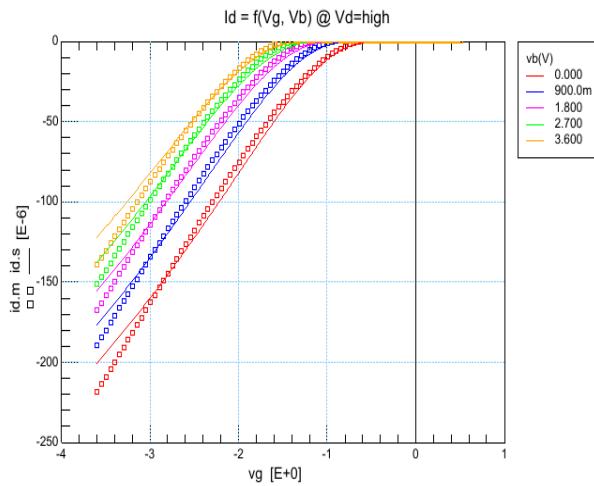
4.26 W0u6_L0u33_S564_1

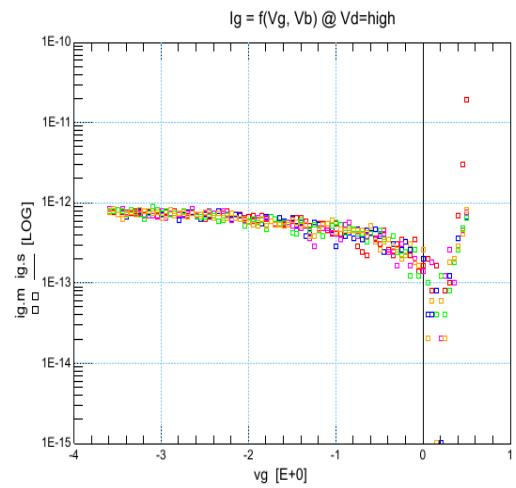
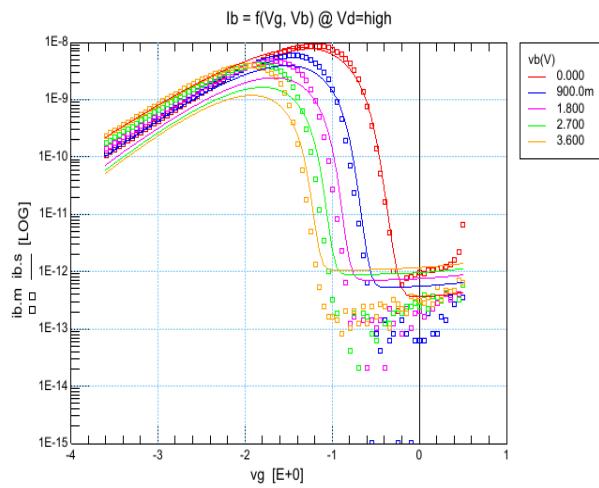
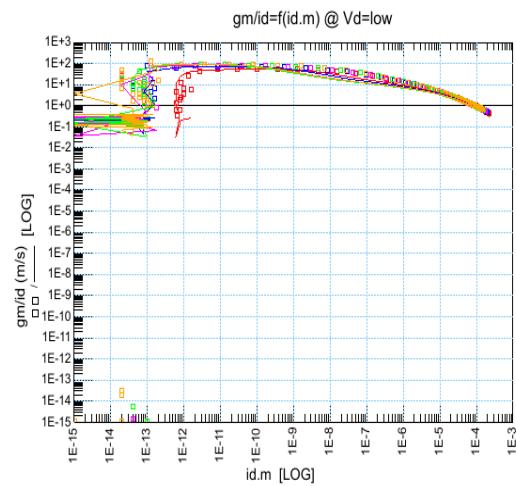
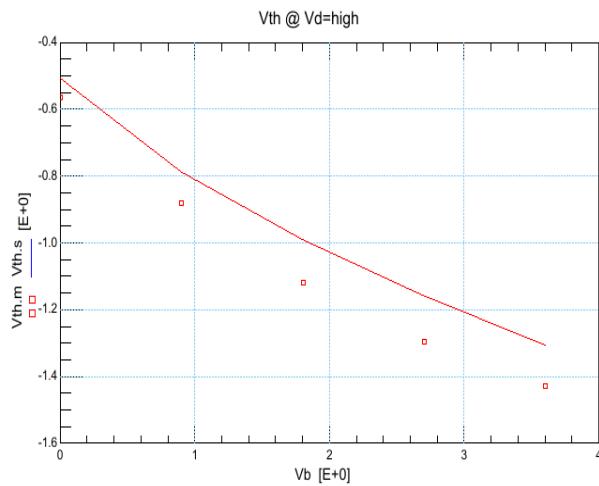
$idv_g, V_d = -0.1V, T = 27^\circ C$



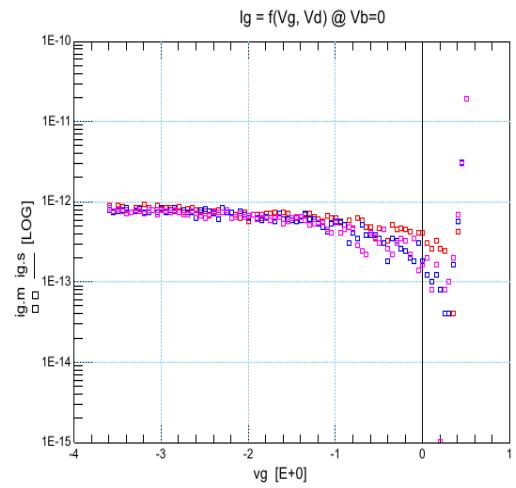
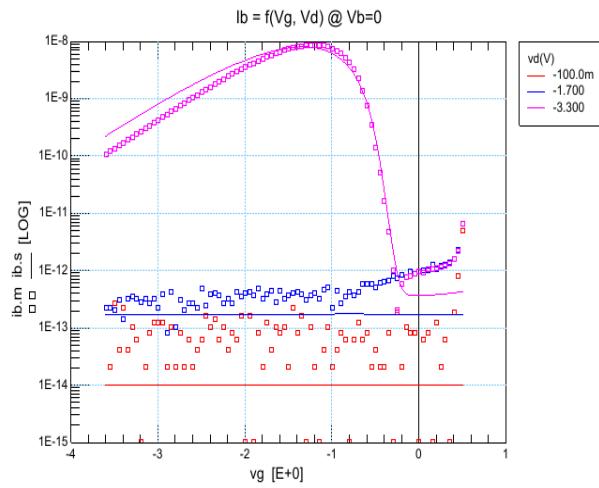


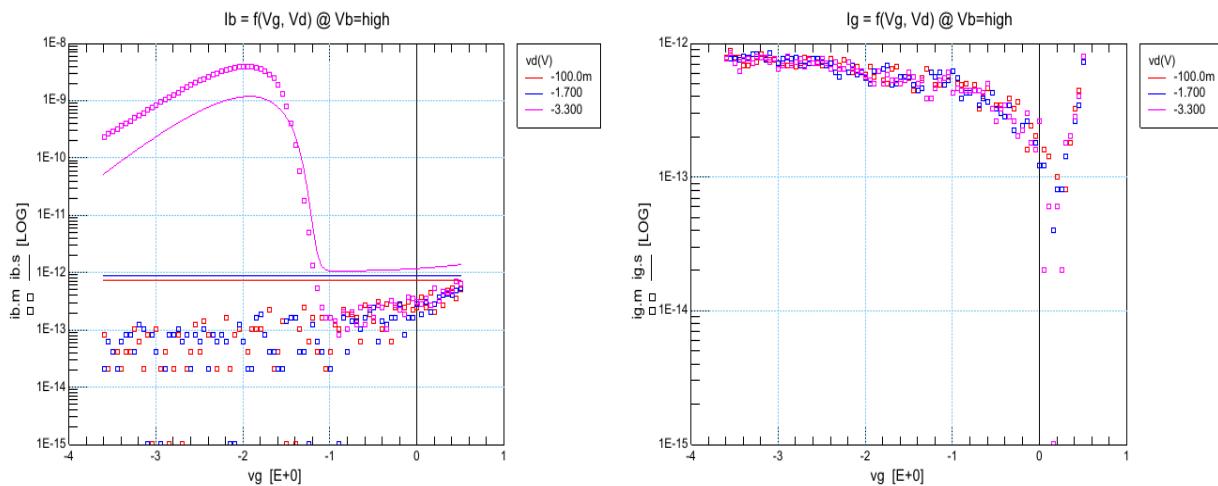
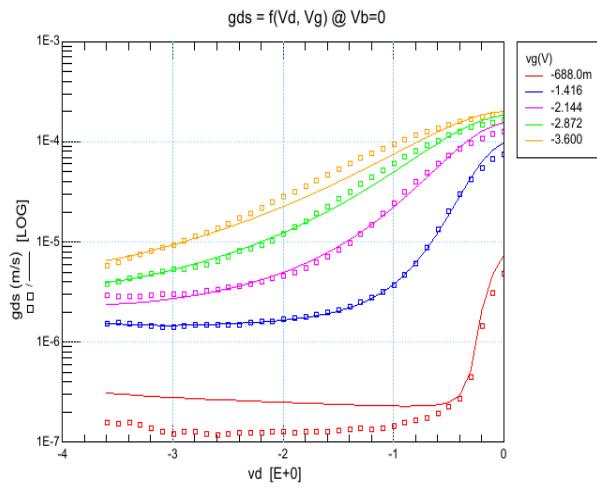
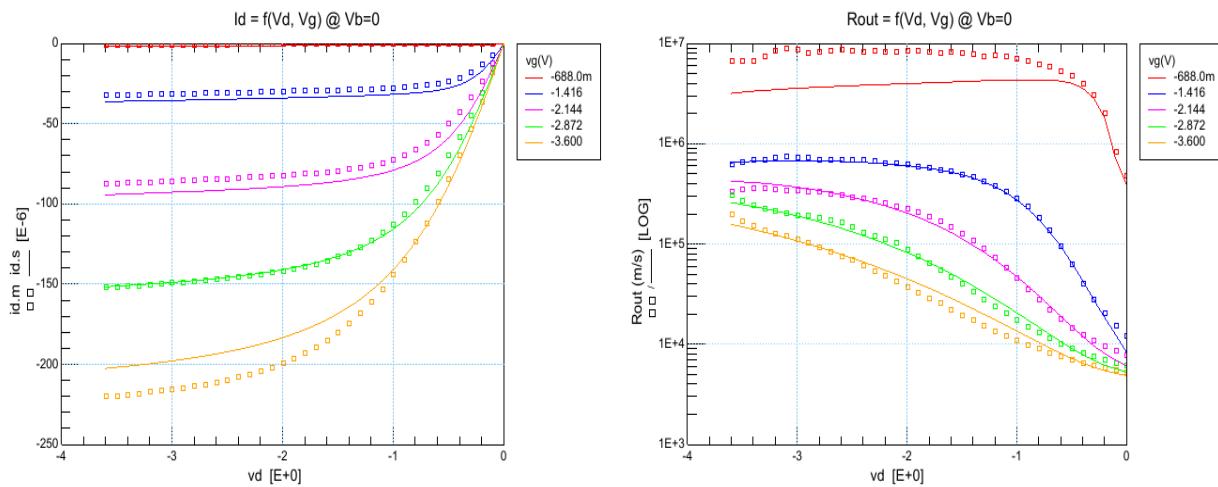
$i_{dvg}, V_d = -3.3V, T = 27^\circ\text{C}$

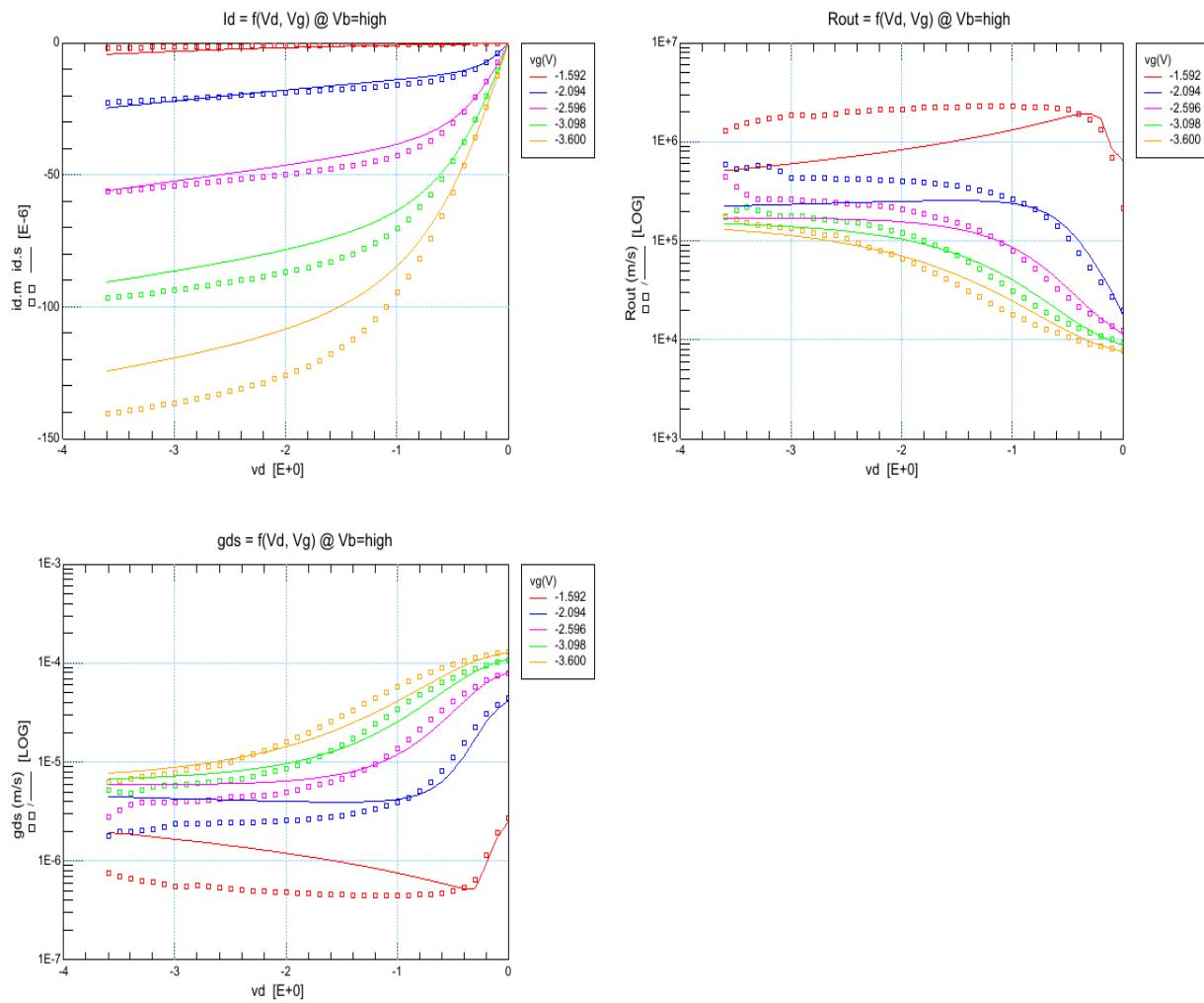
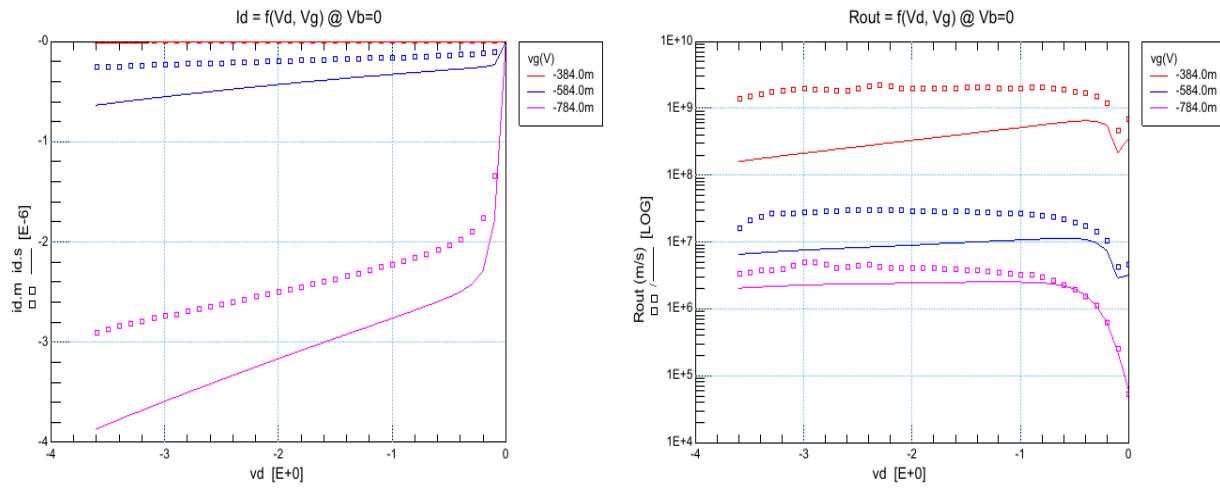


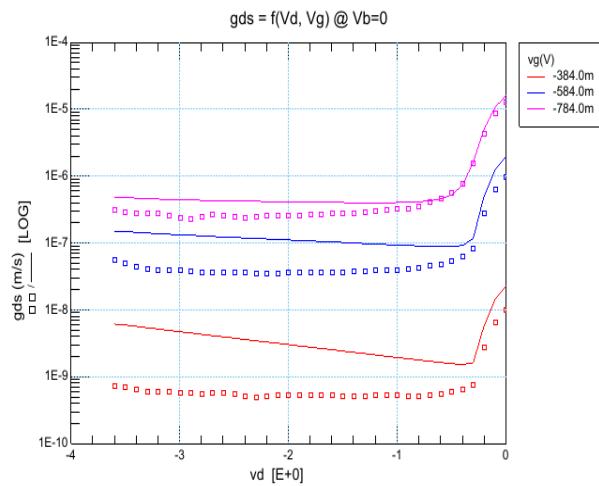


idvg, lb, lg, Vb = 0V, T = 27°C

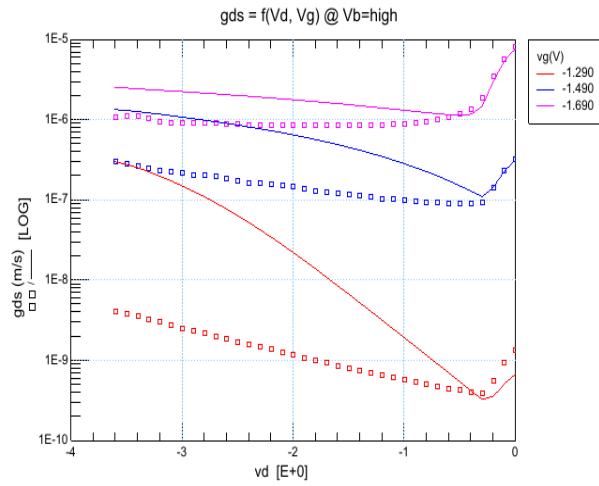
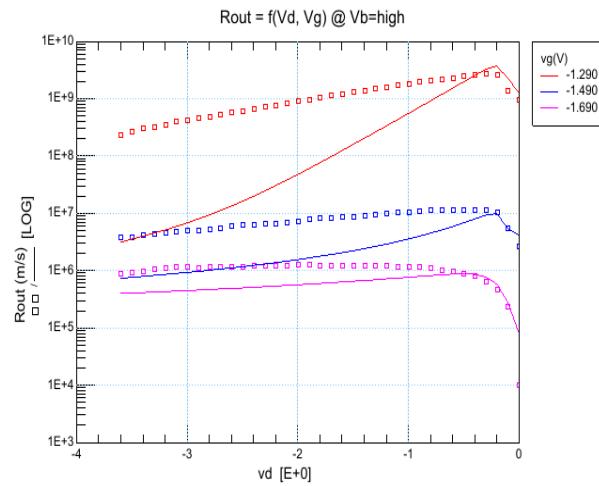
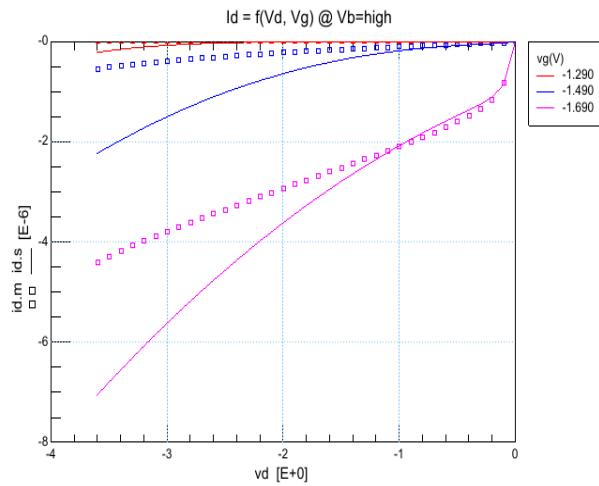


idvg, Ib,Ig, Vb = 3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


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

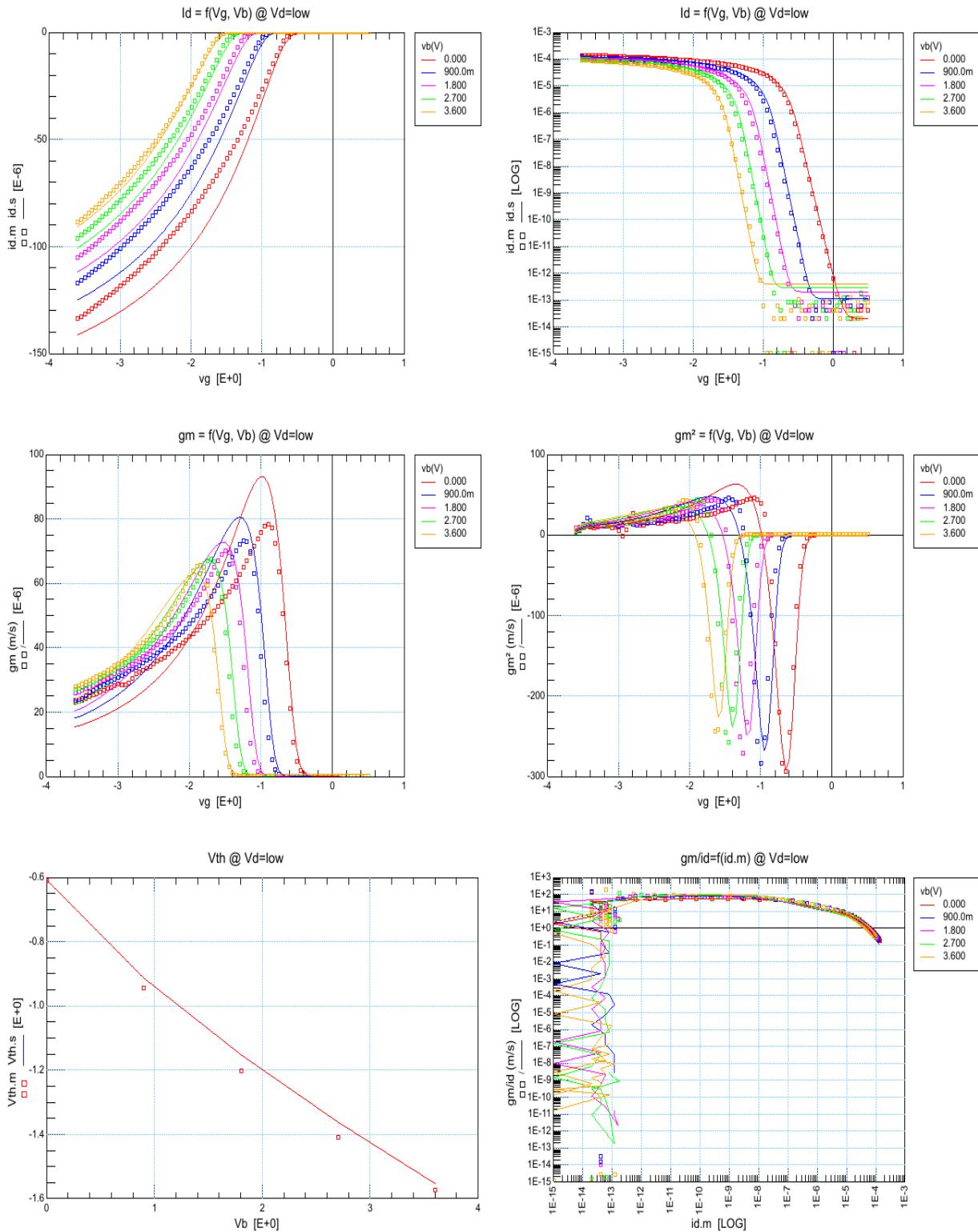


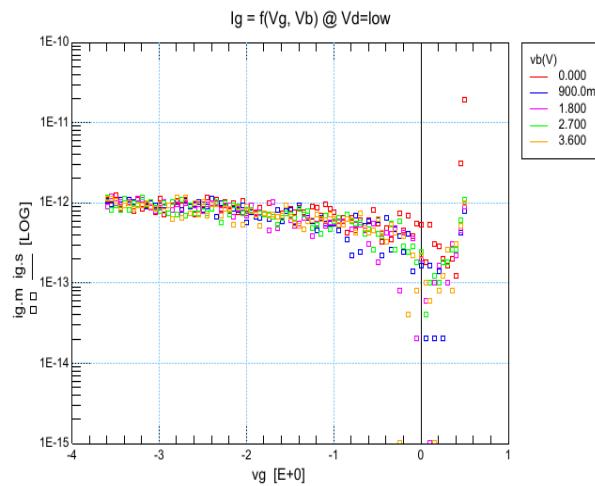
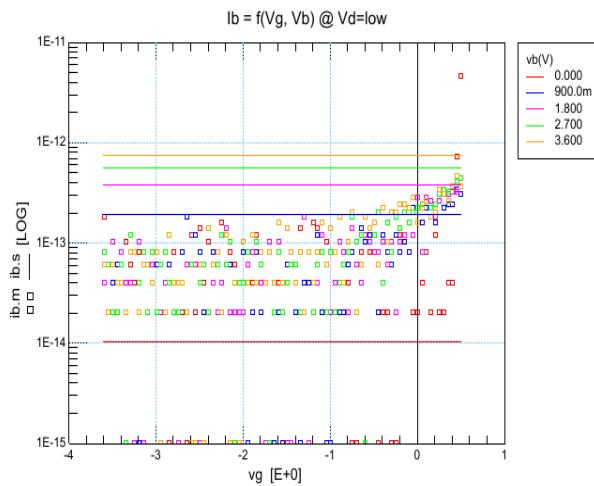
idvd_vth_vbmin, Vb = 3.6V, T = 27°C



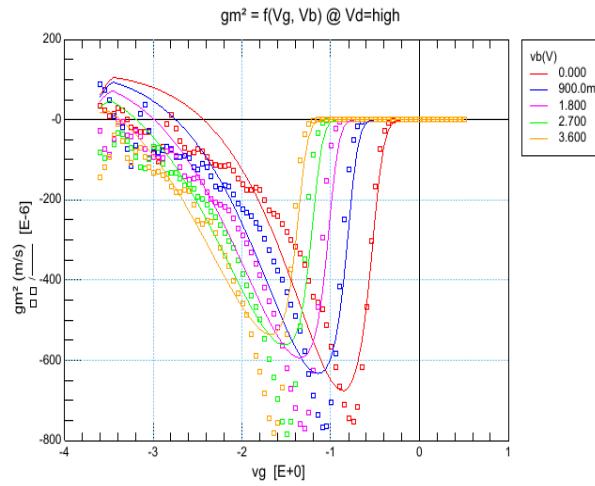
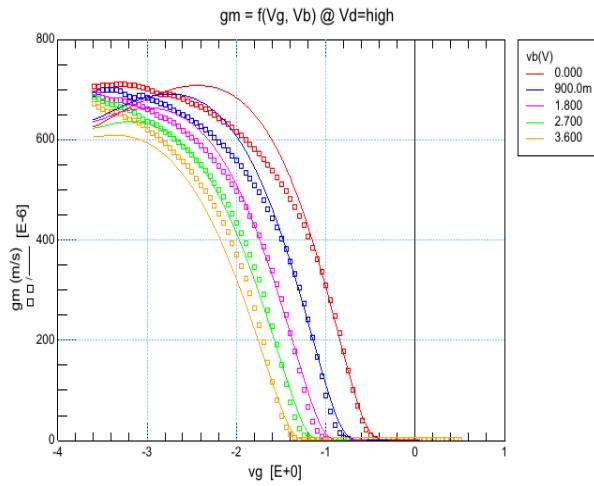
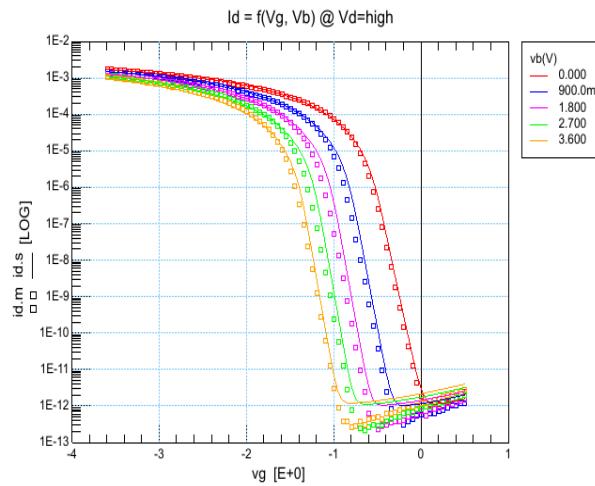
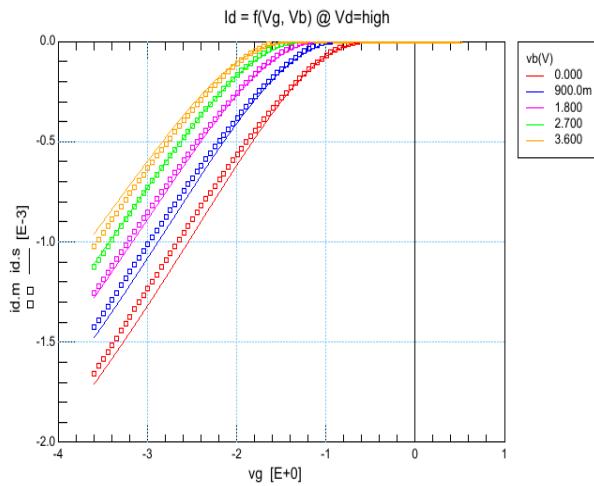
4.27W05u0_L0u33_S562_4

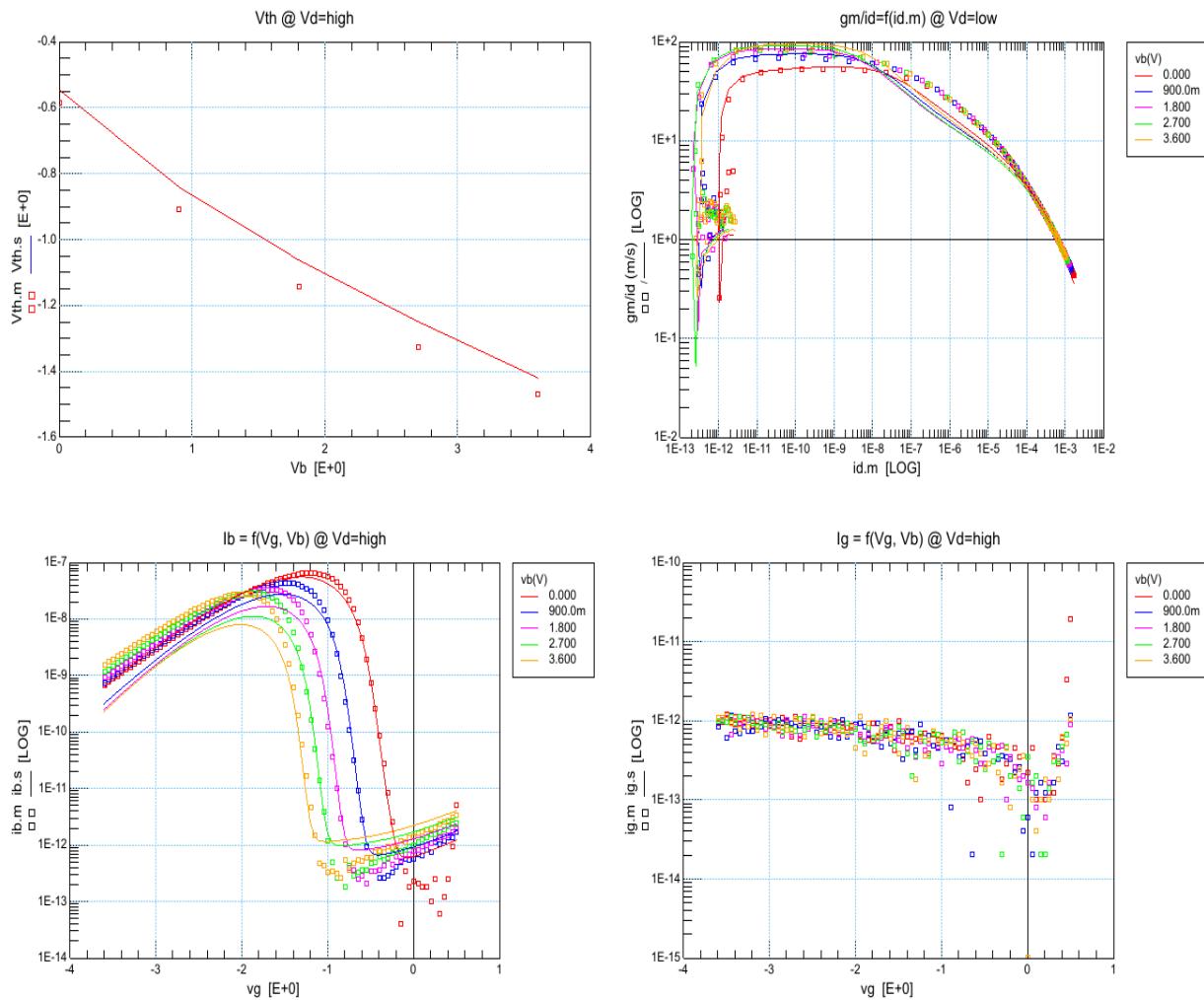
$idv_g, V_d = -0.1V, T = 27^\circ C$



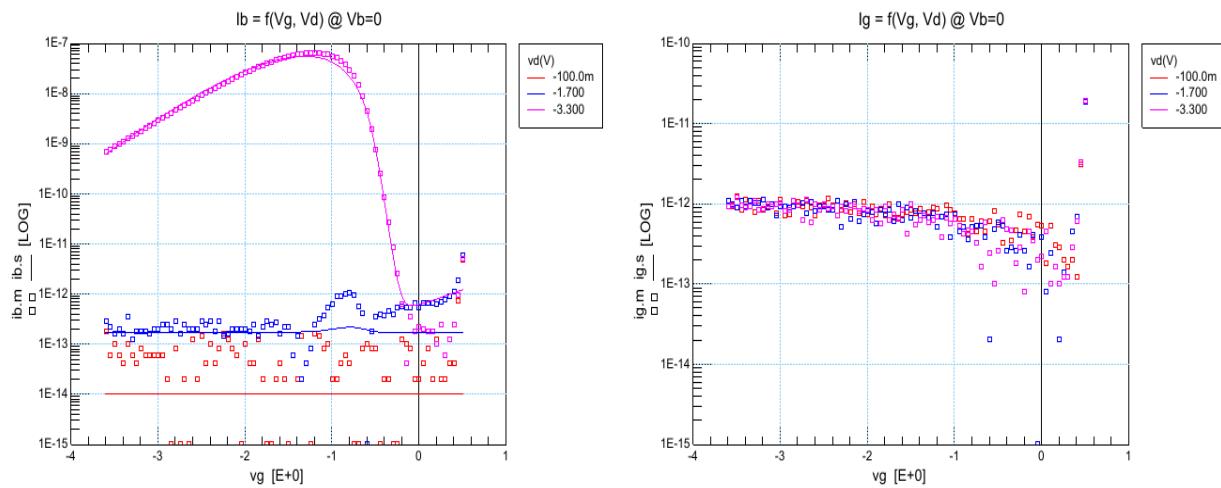


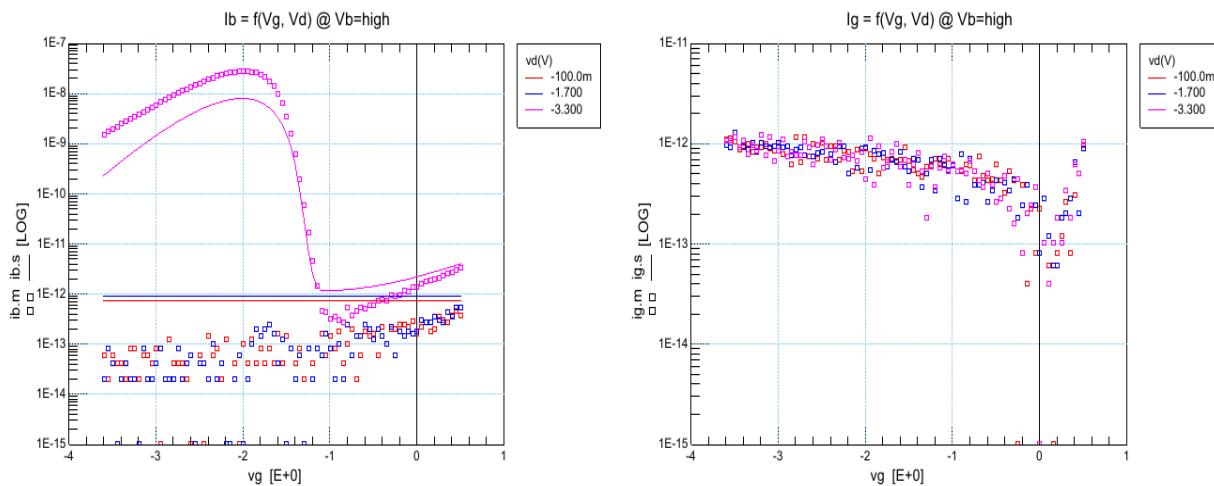
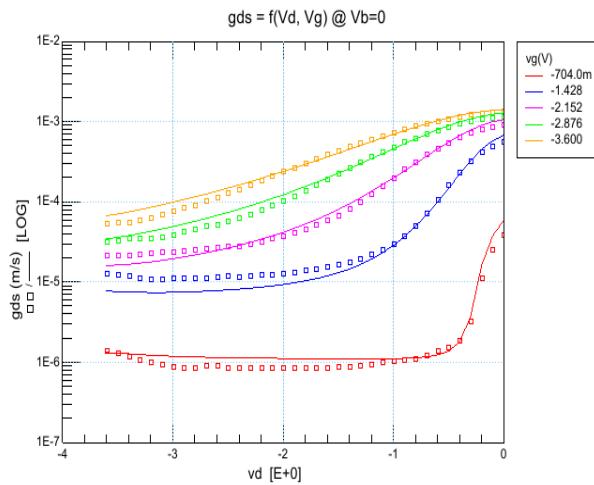
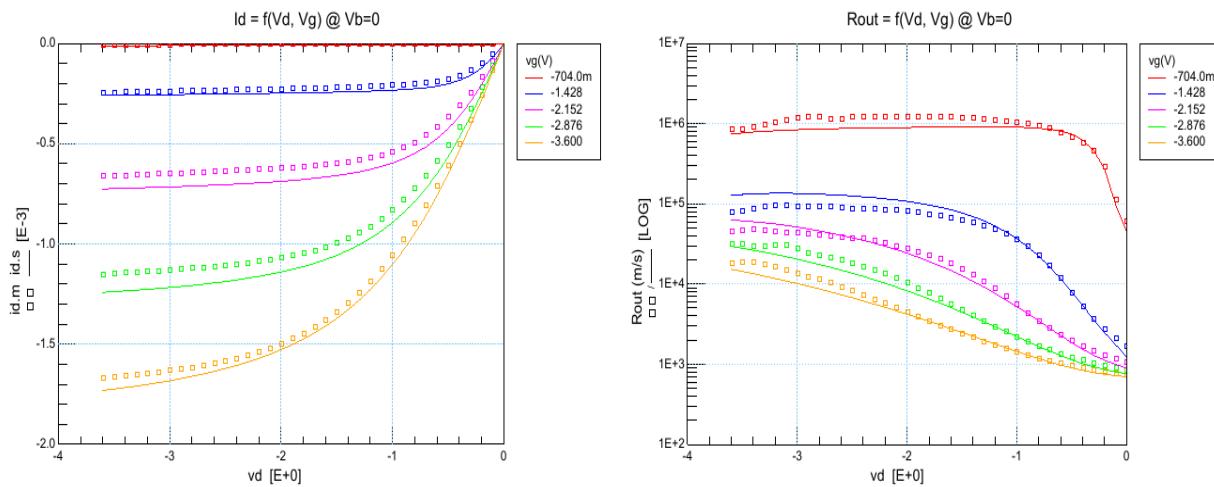
$i_{dvg}, V_d = -3.3V, T = 27^\circ\text{C}$

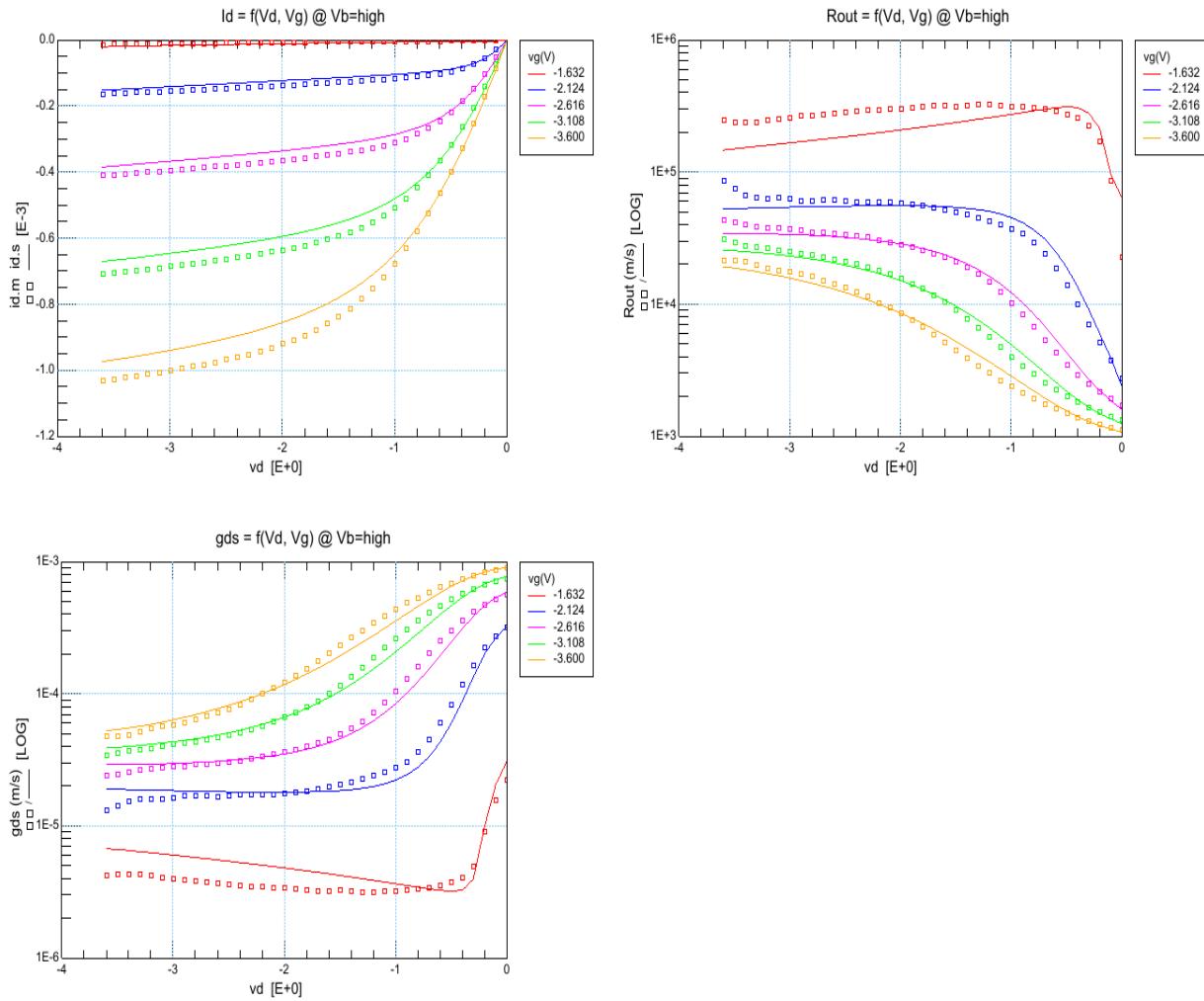
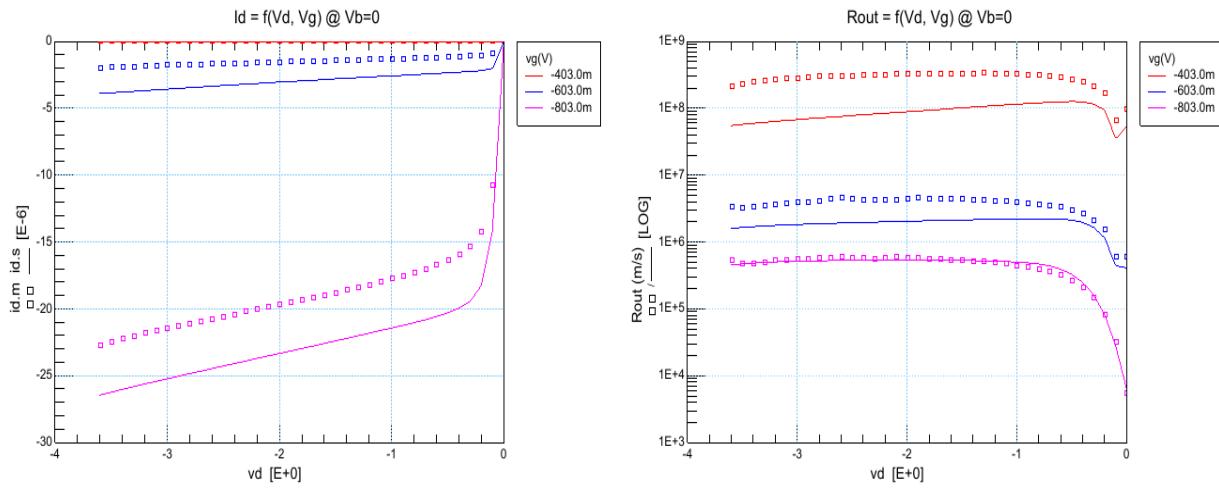


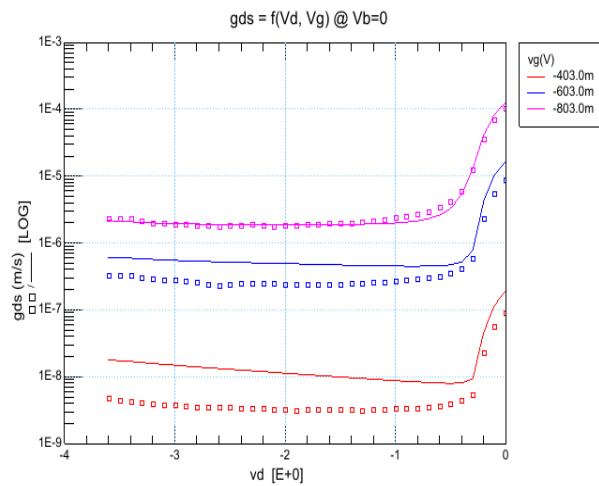


$idvg, I_b, Ig, V_b = 0V, T = 27^\circ C$

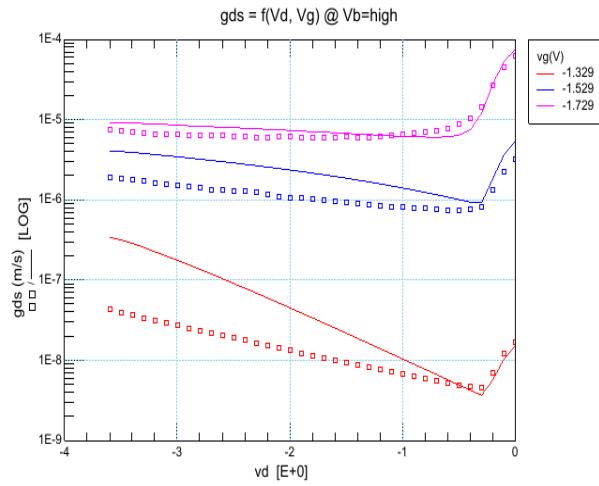
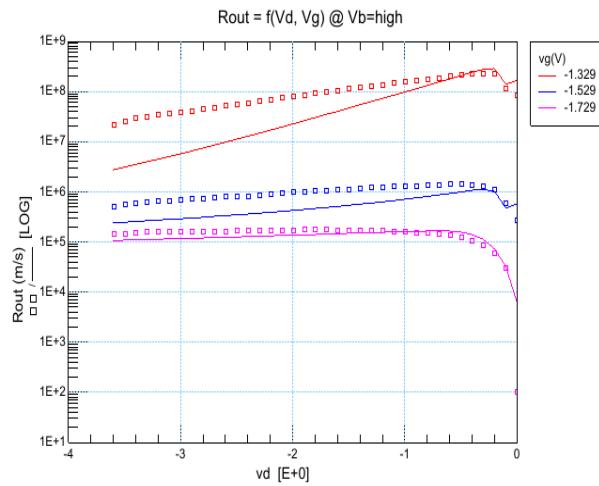
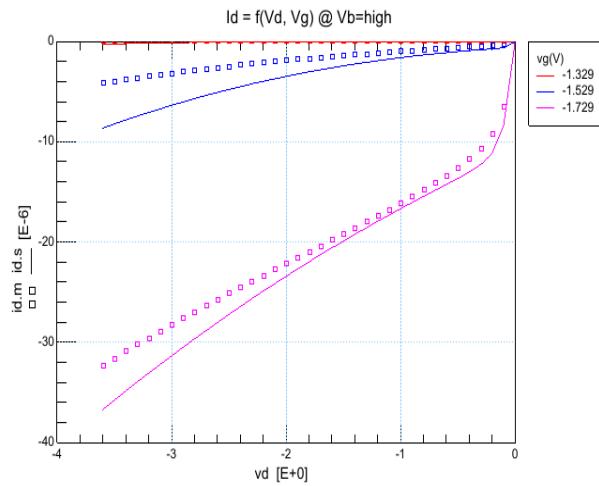


idvg, Ib,Ig, Vb = 3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


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

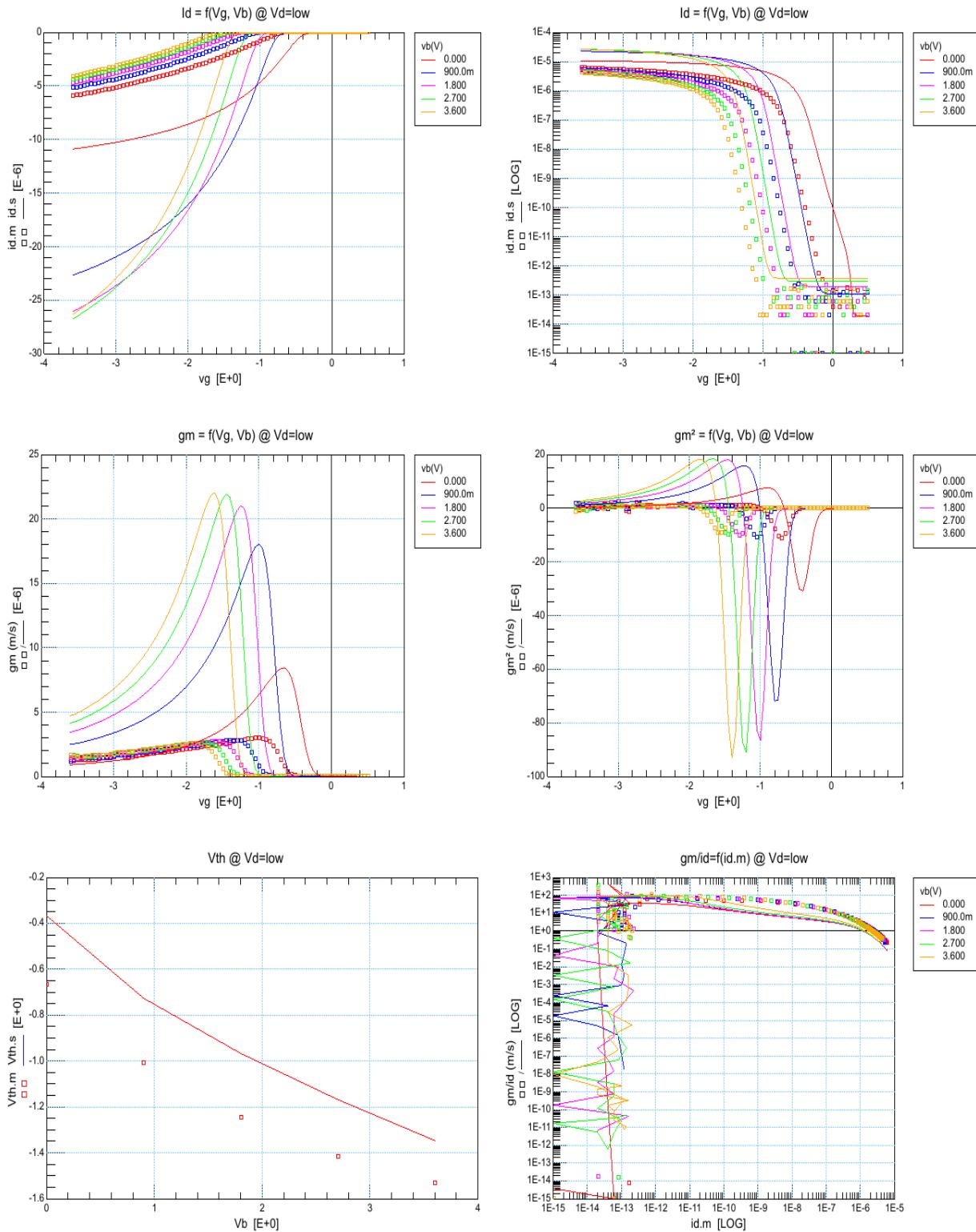


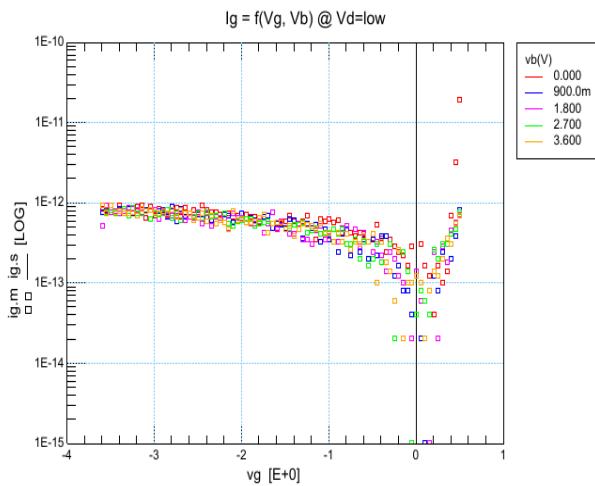
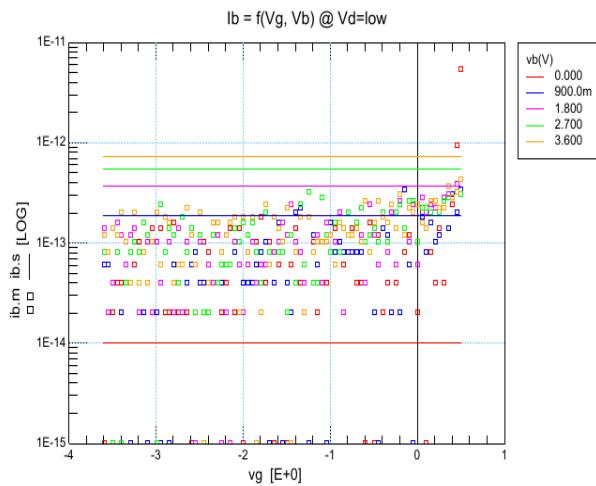
idvd_vth_vbmin, Vb = 3.6V, T = 27°C



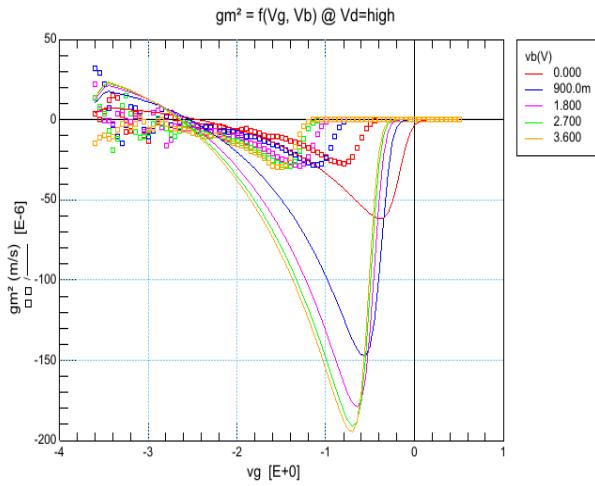
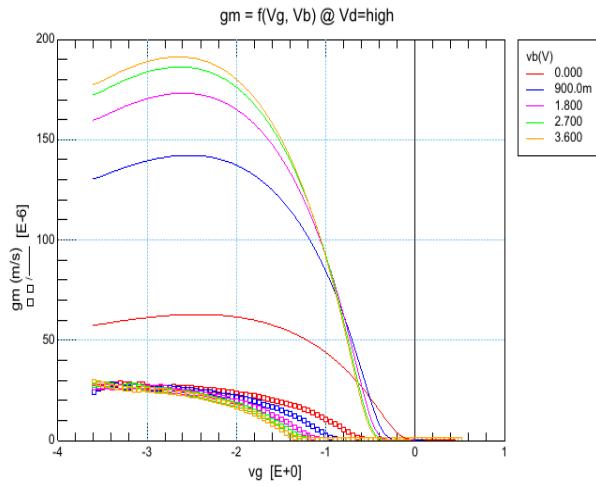
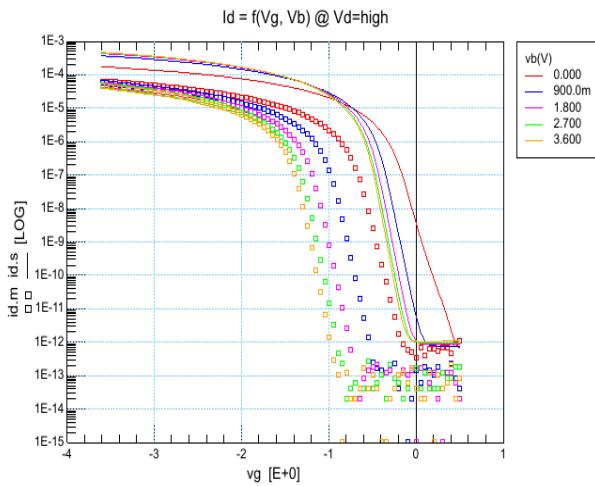
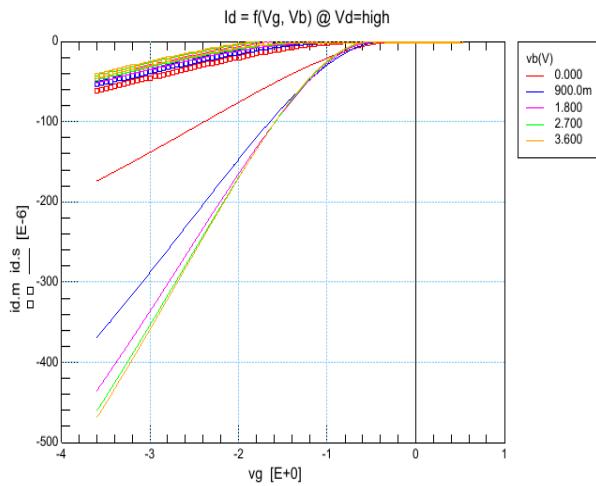
4.28 W0u15_L0u33_S555_5

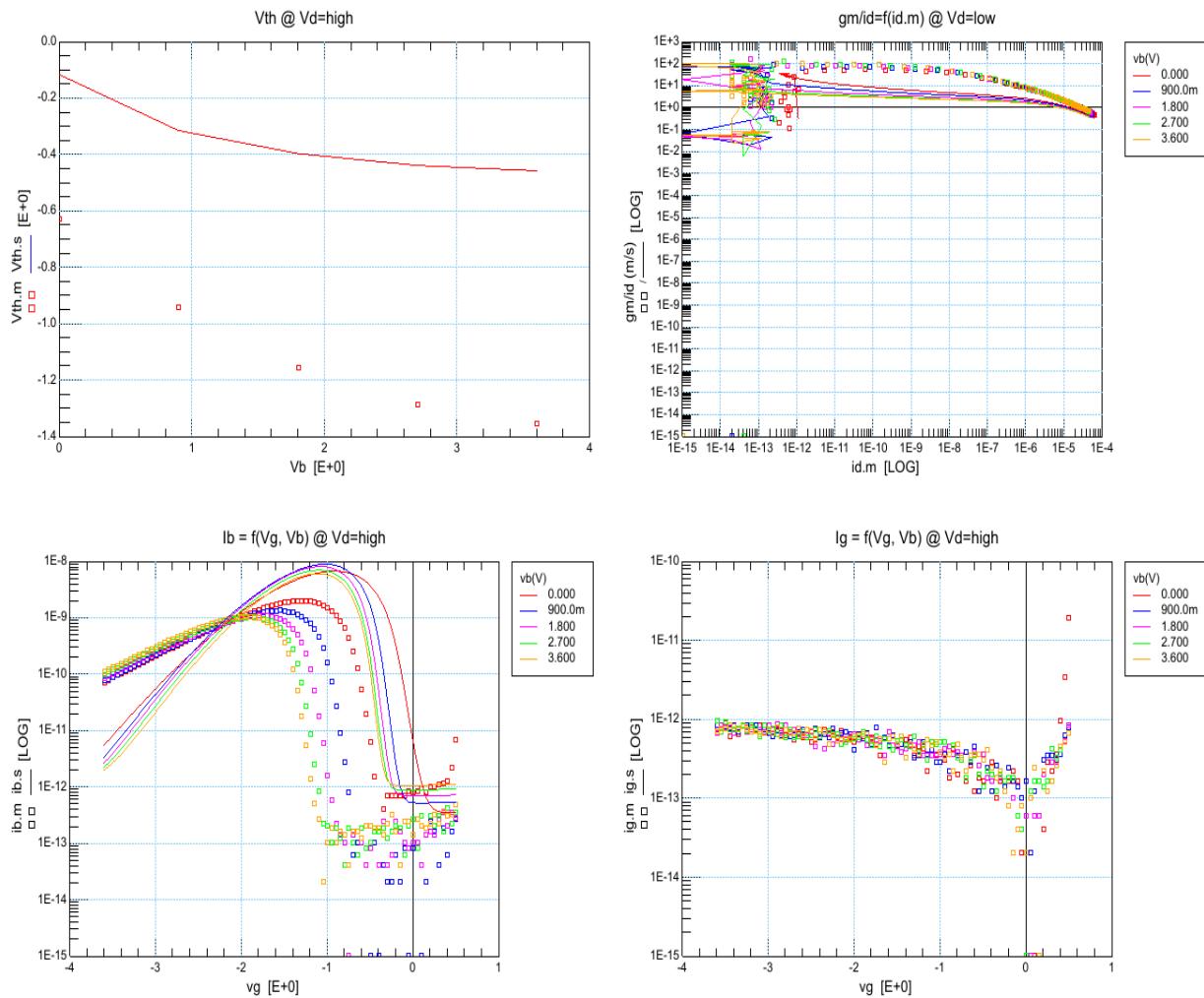
$idvg$, $Vd = -0.1V$, $T = 27^\circ C$



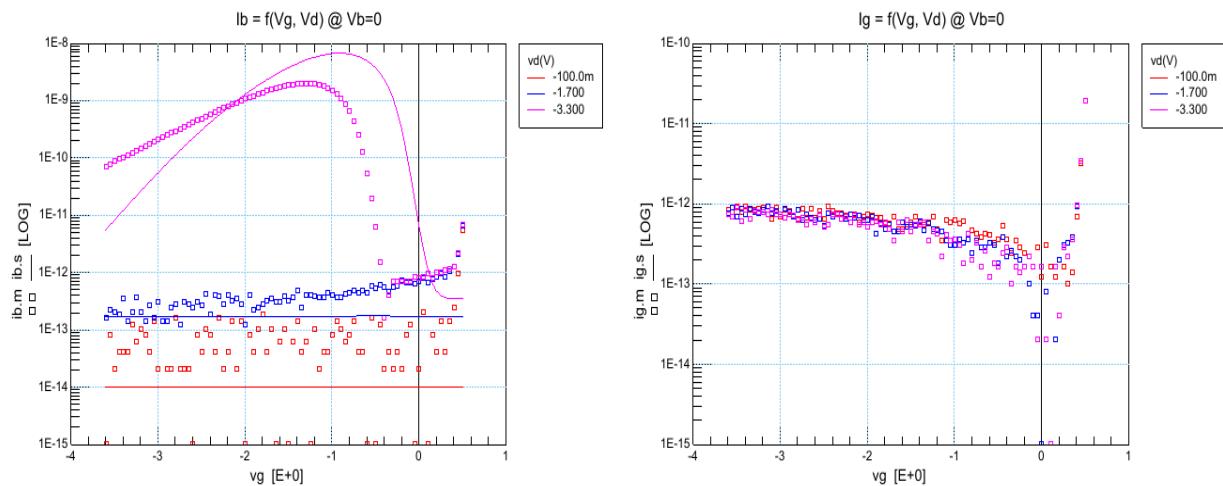


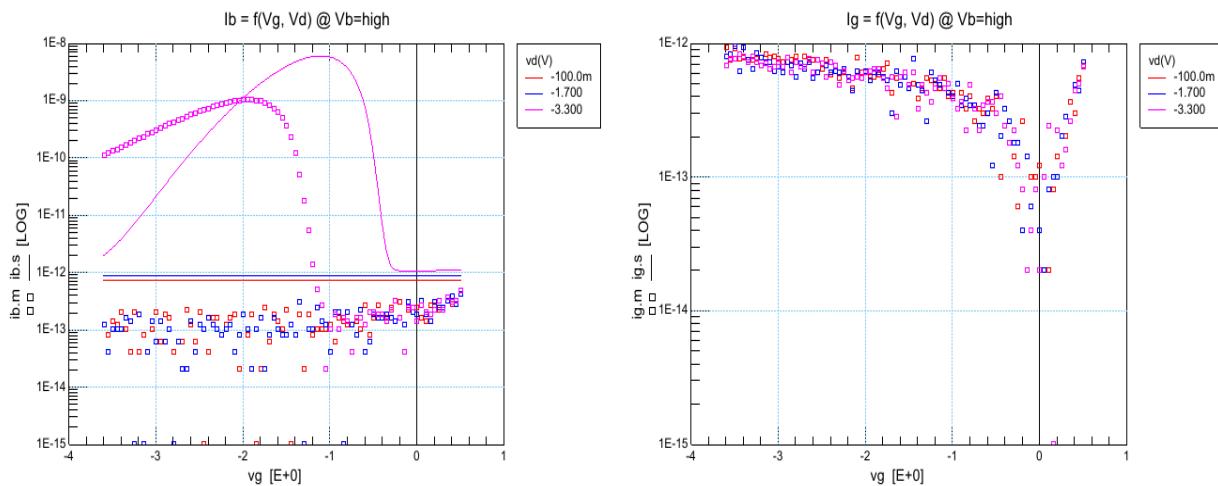
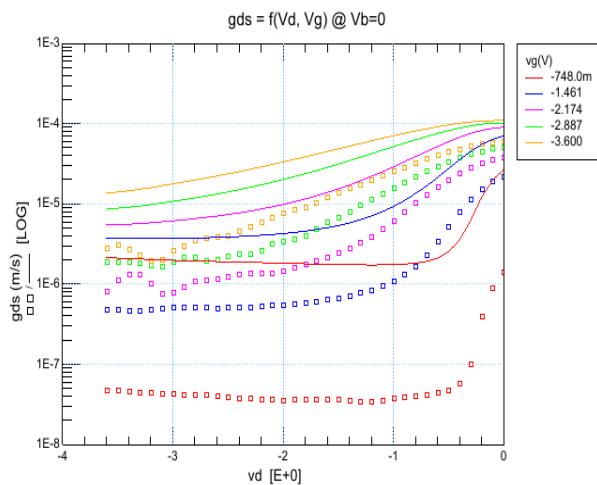
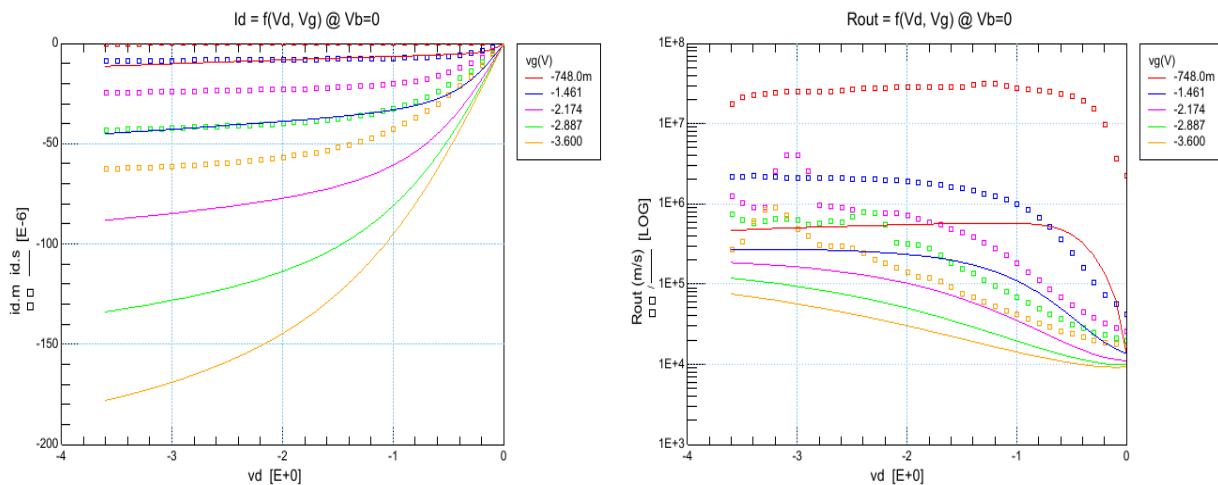
$i_{dvg}, V_d = -3.3V, T = 27^\circ\text{C}$

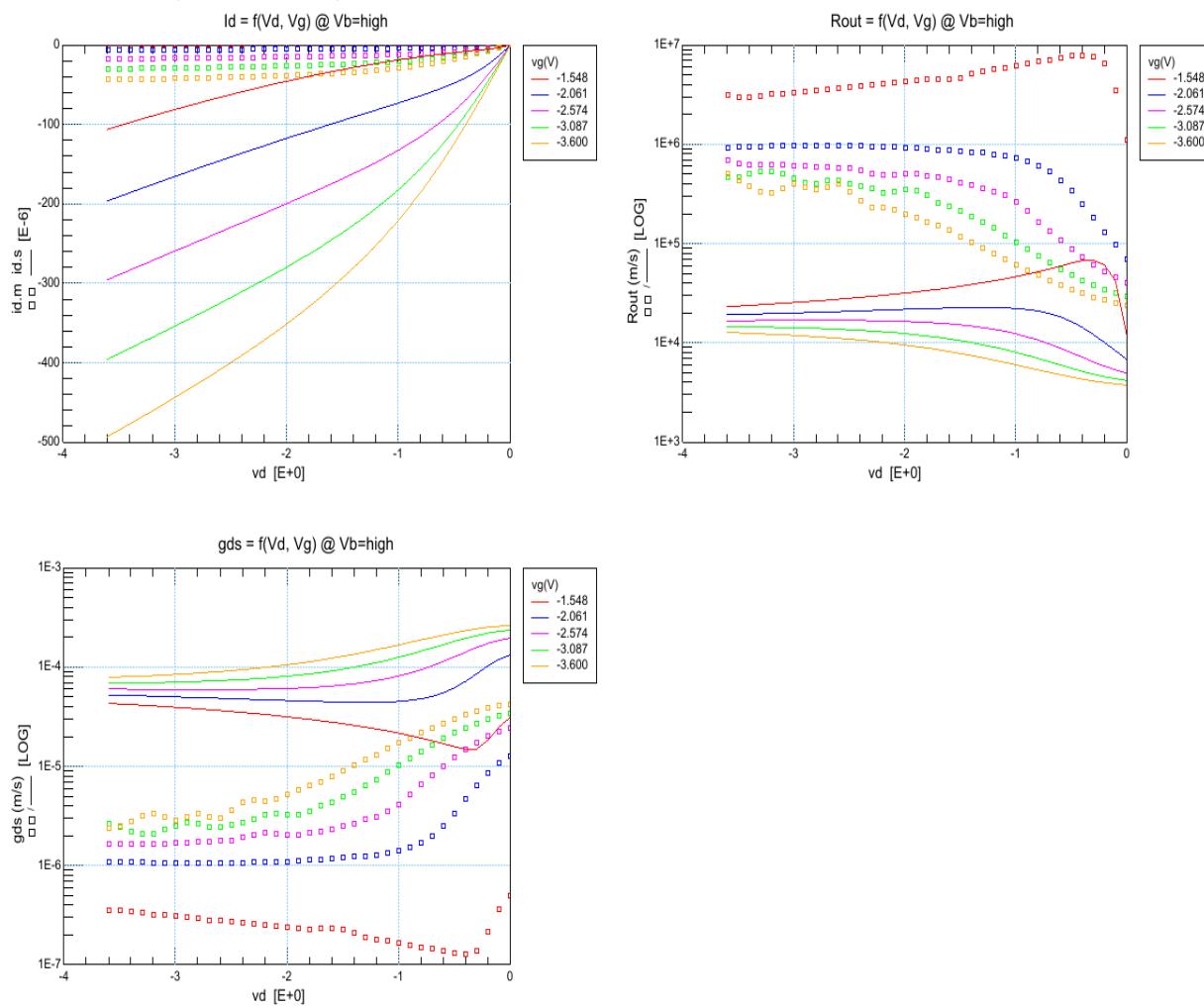
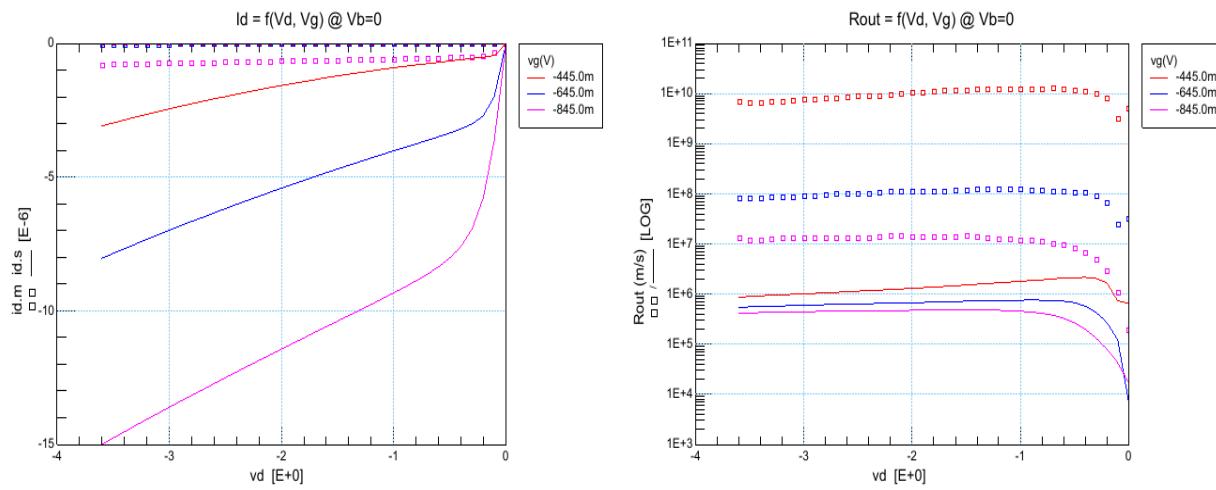


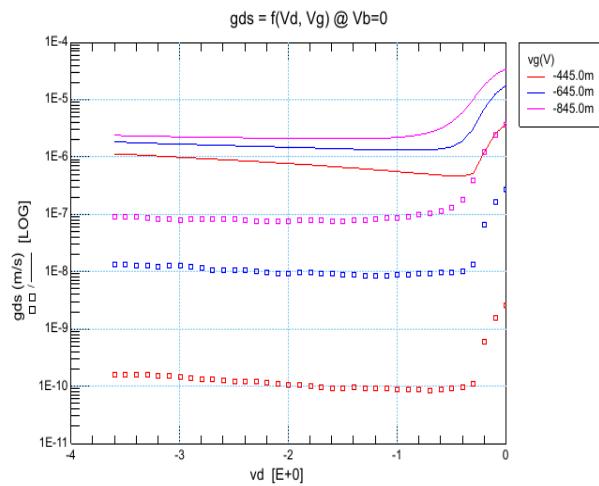


idvg, Ib,Ig, Vb = 0V, T = 27°C

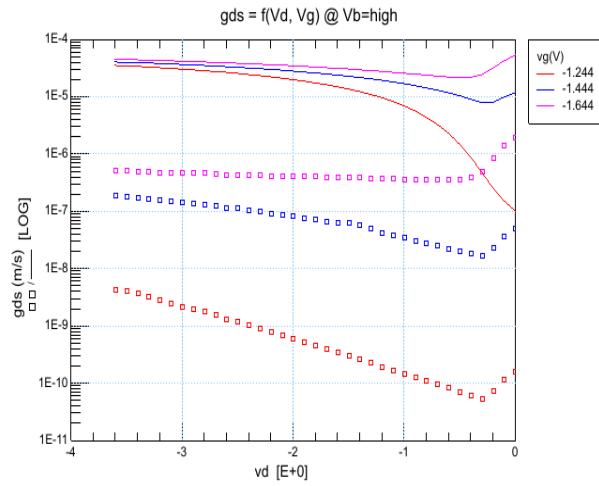
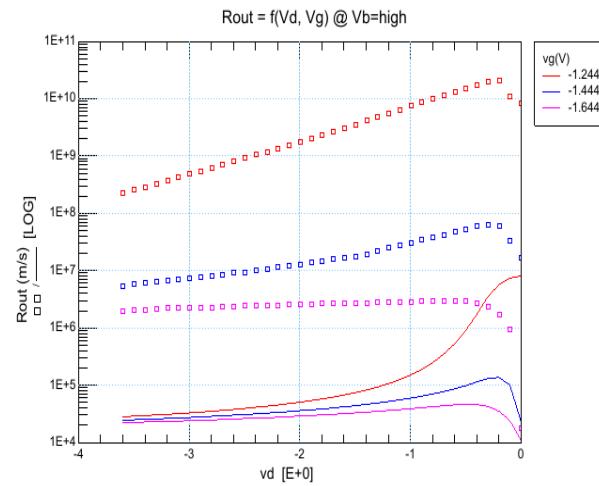
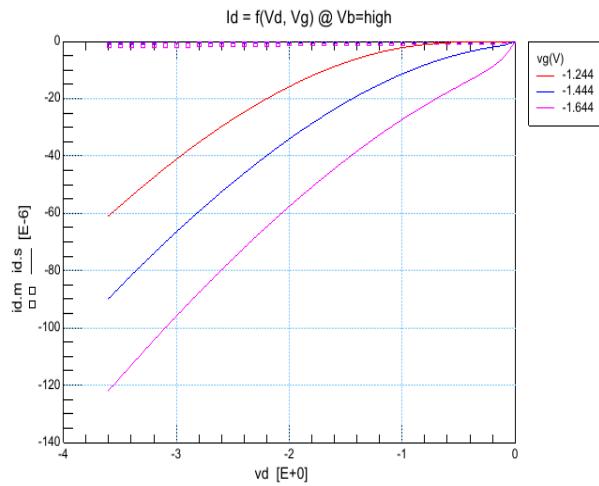


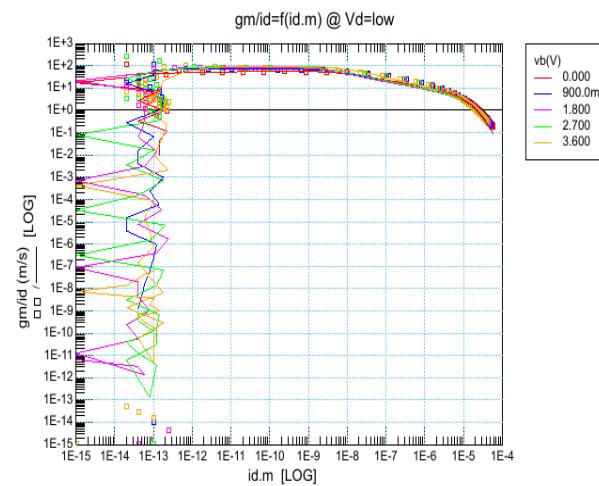
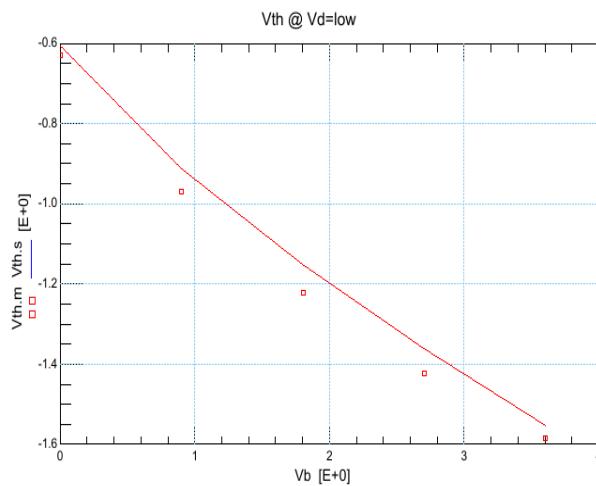
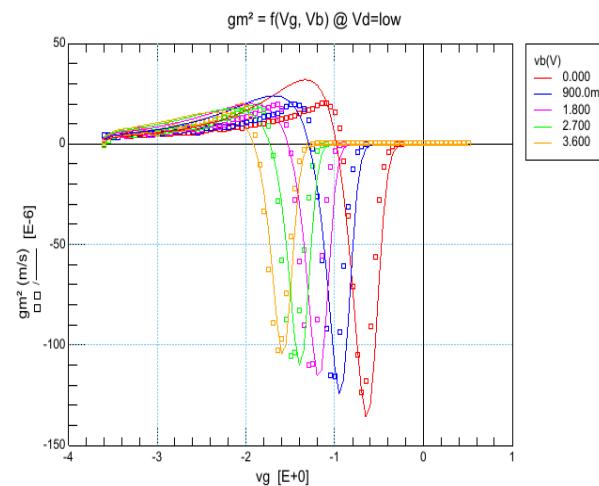
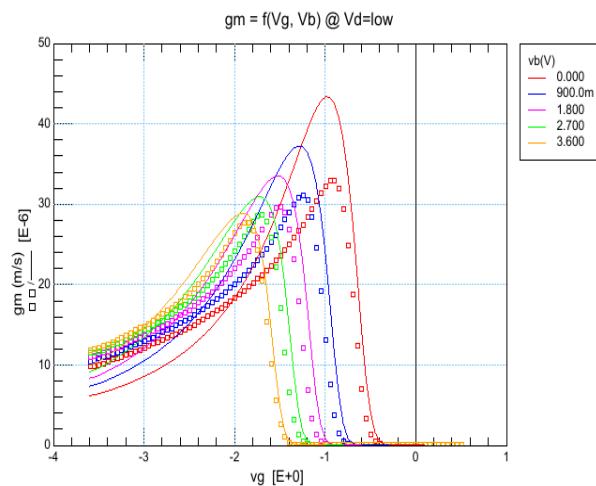
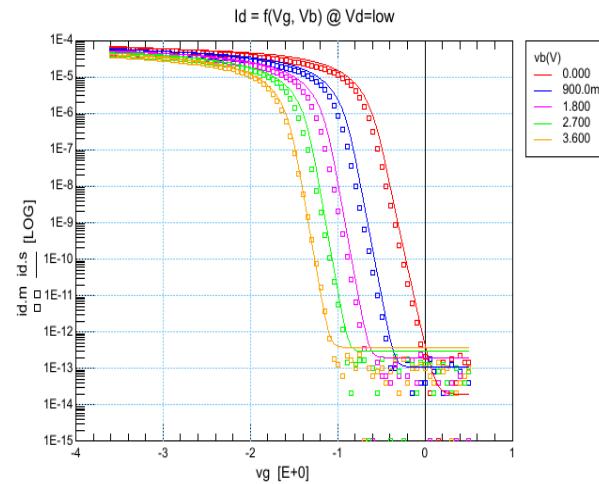
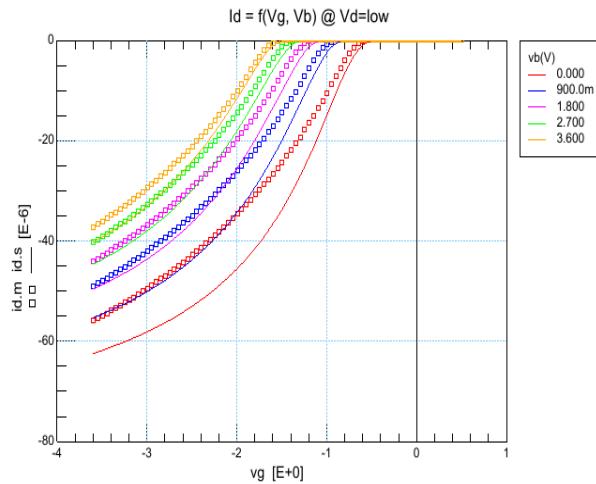
idvg, Ib,Ig, Vb = 3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


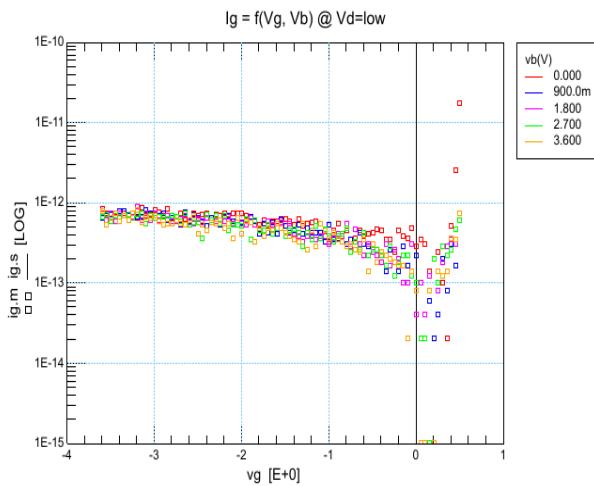
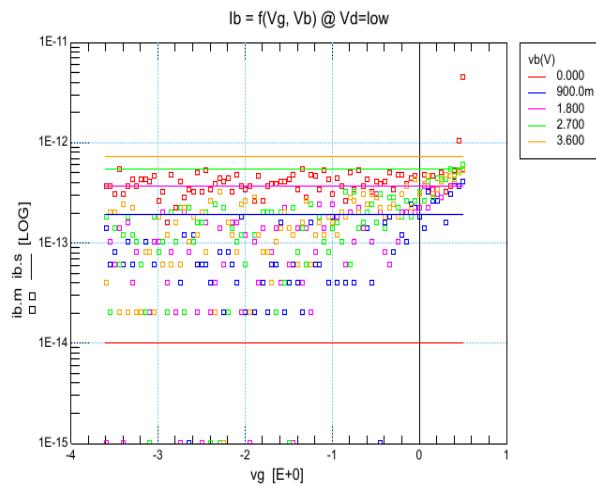
idvd_vbmin, Vb = 3.6V, T = 27°C**idvd_vth, Vb = 0V, T = 27°C**



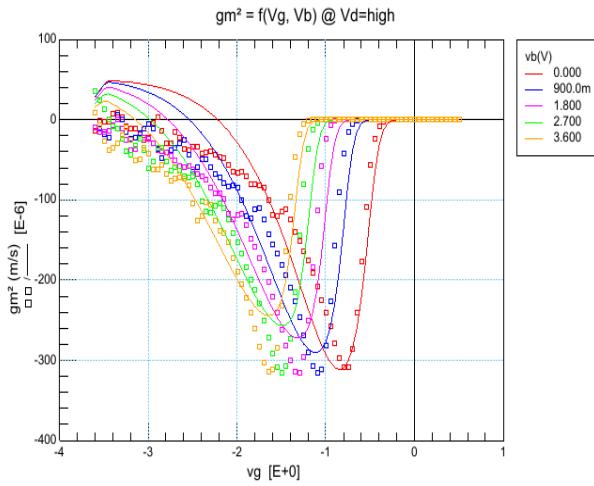
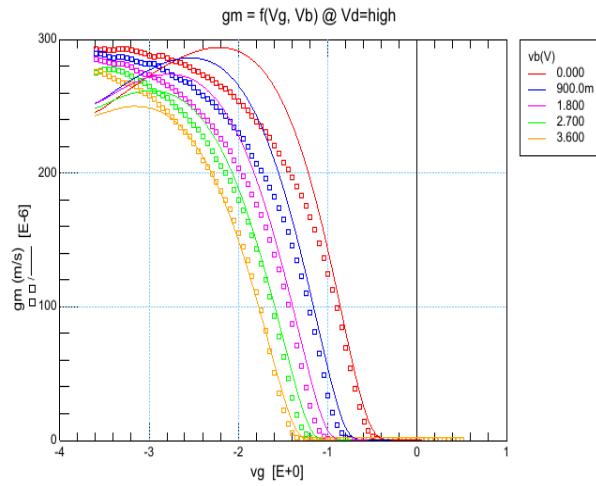
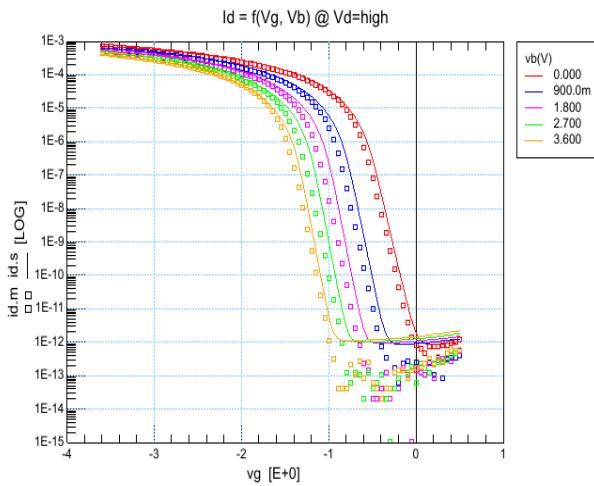
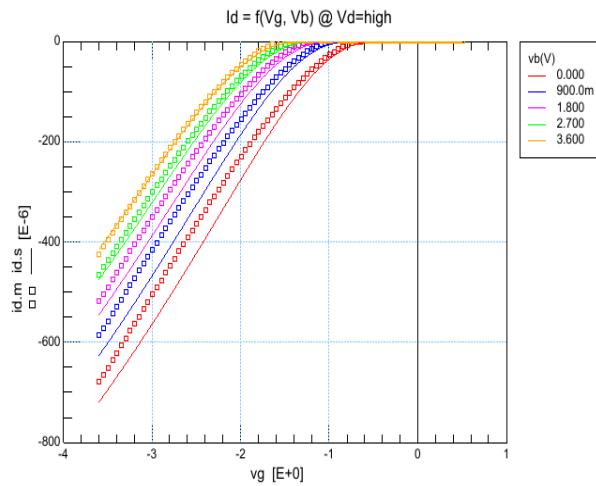
idvd_vth_vbmin, Vb = 3.6V, T = 27°C

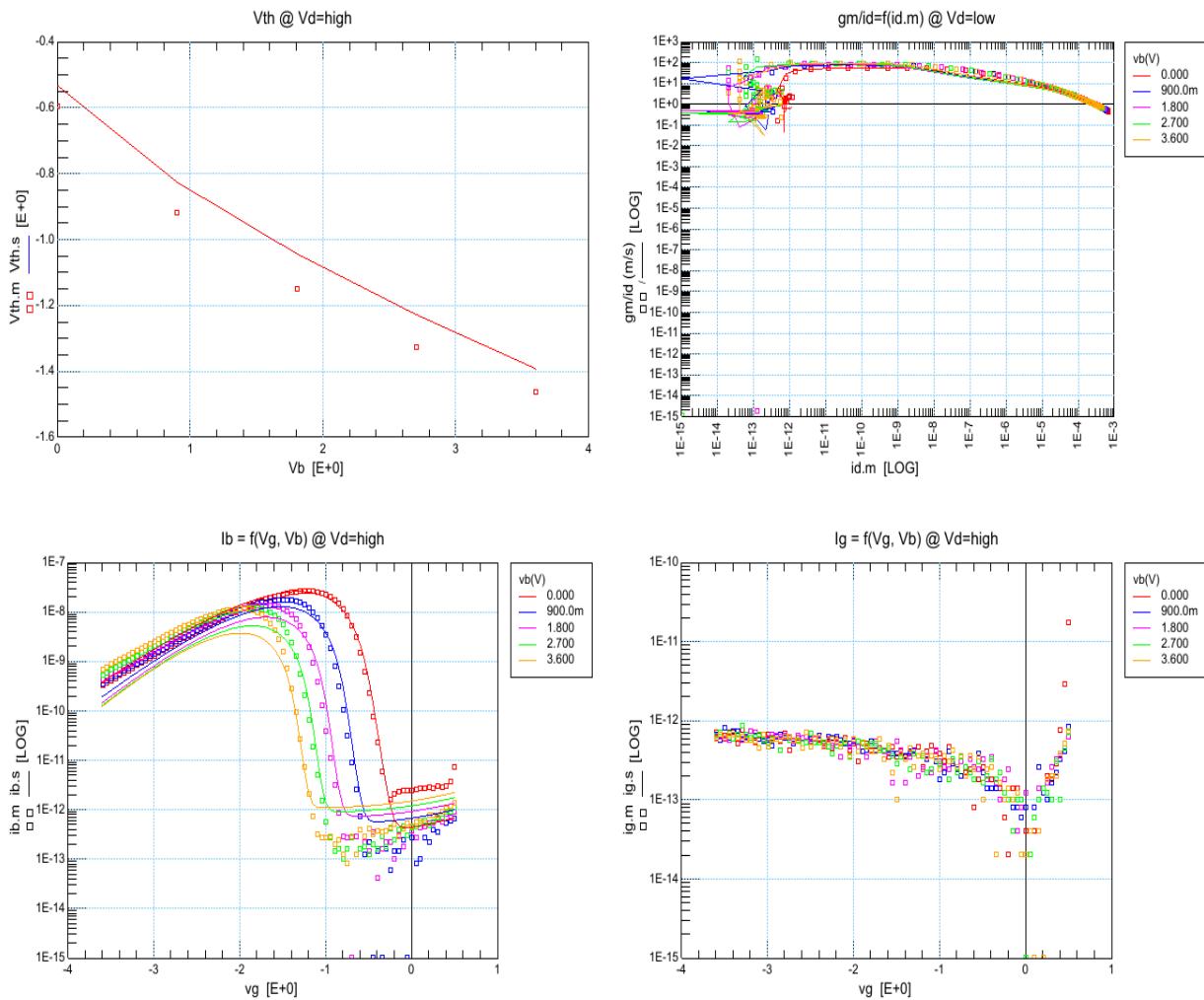


4.29 W02u0_L0u33_S563_2**idvg, Vd = -0.1V, T = 27°C**

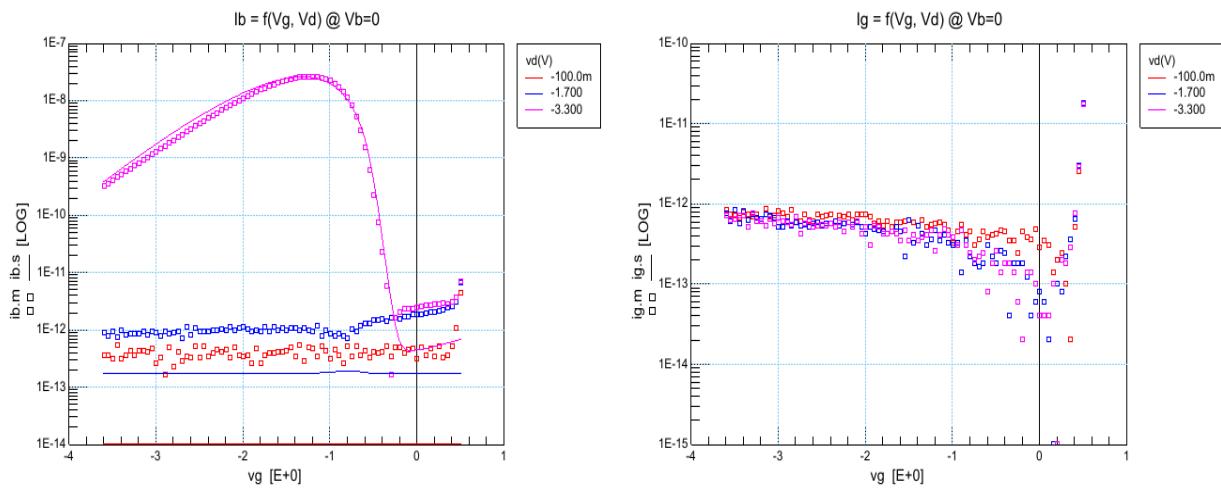


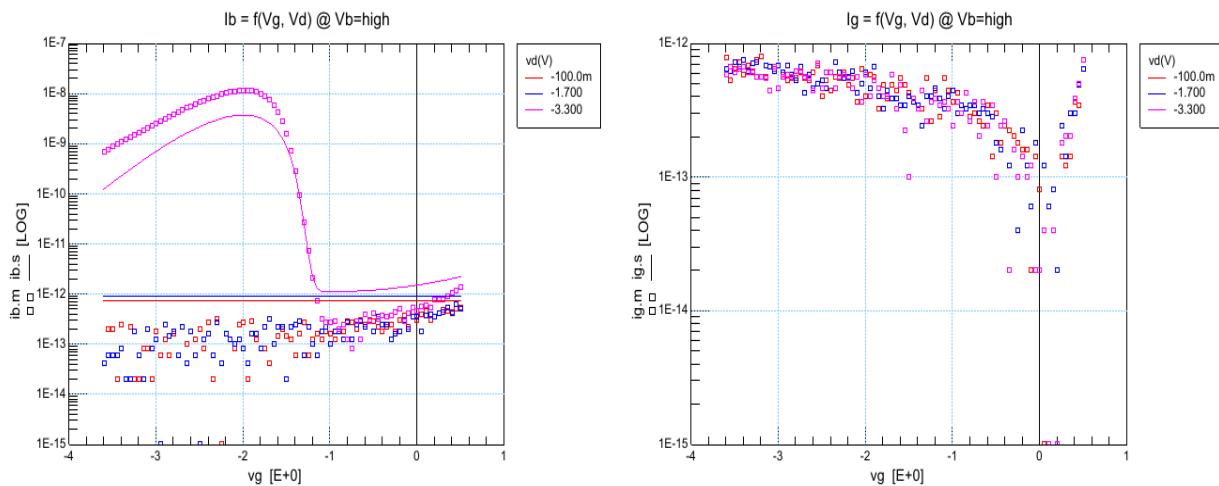
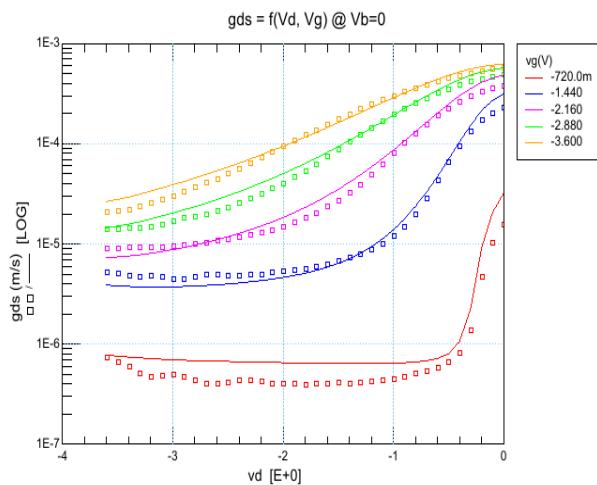
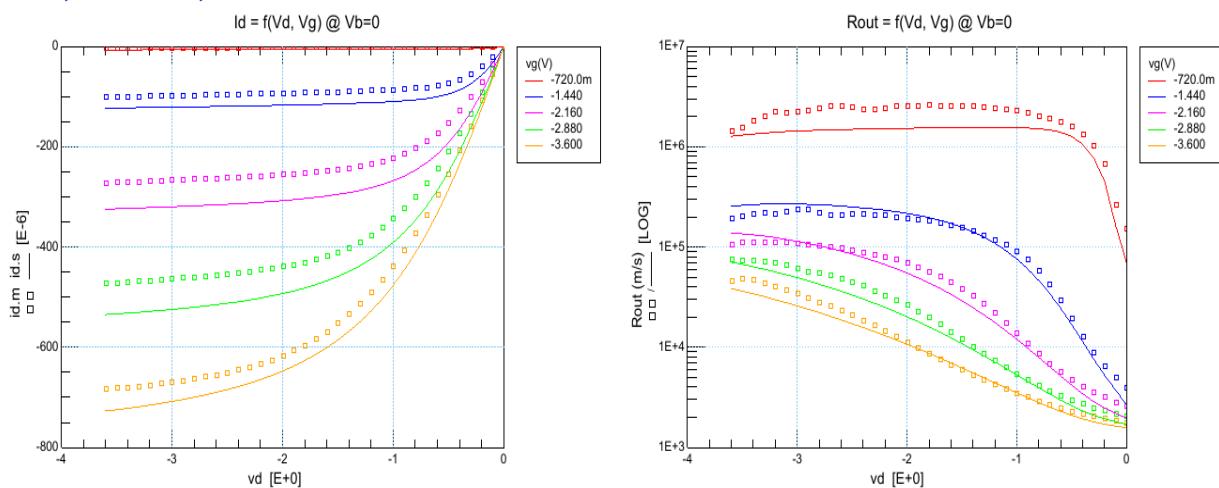
$i_{dvg}, V_d = -3.3V, T = 27^\circ\text{C}$

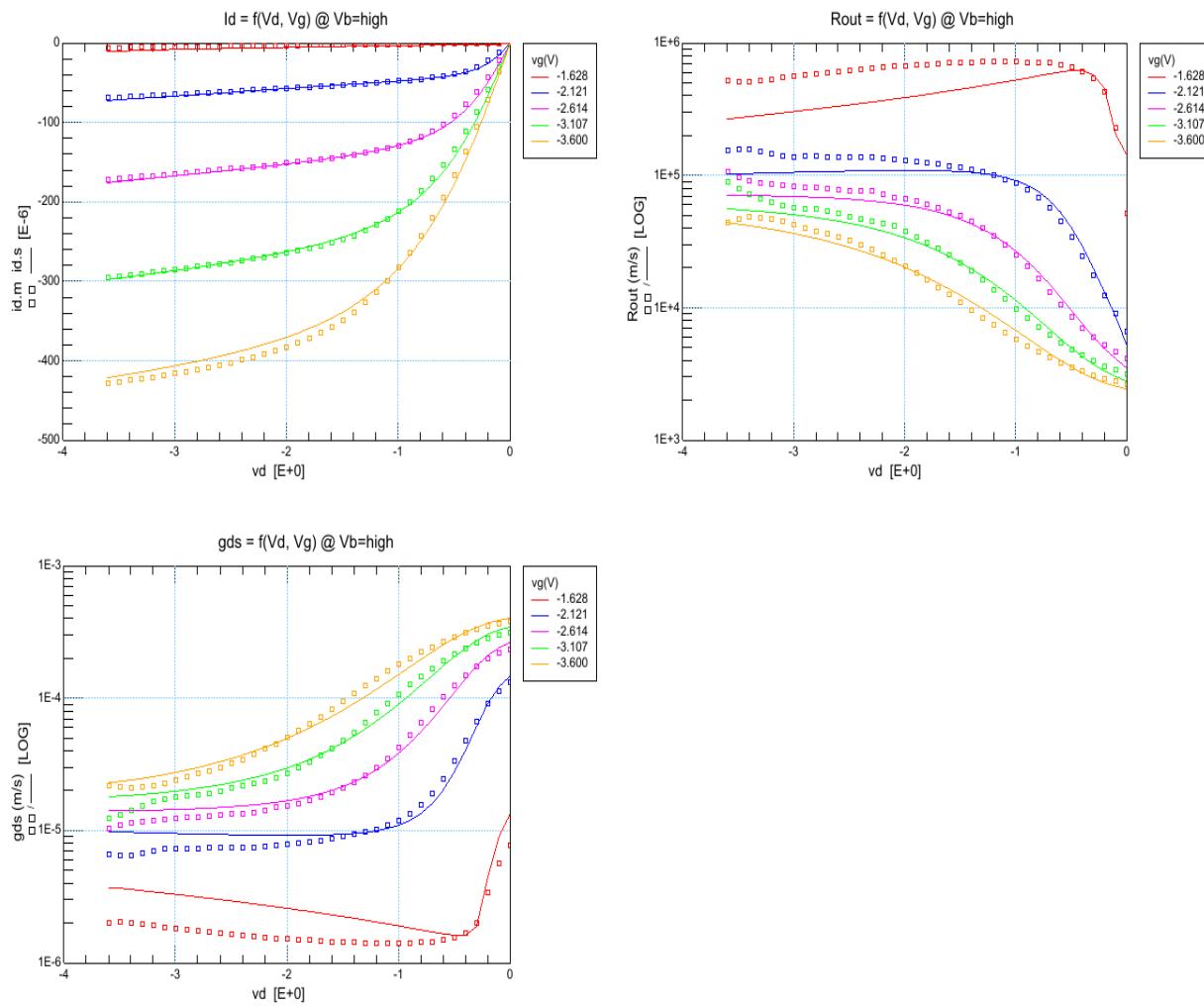
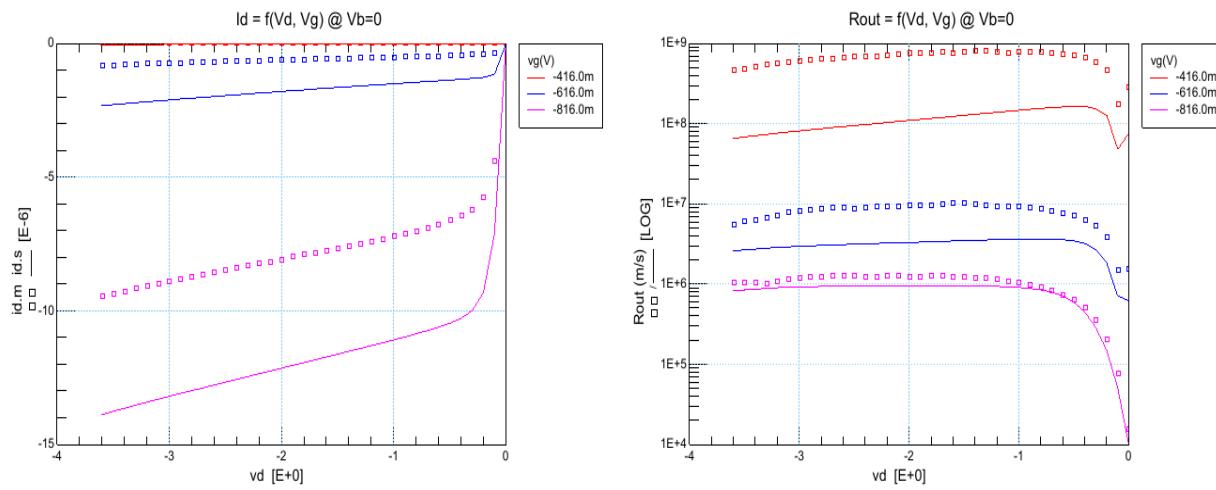


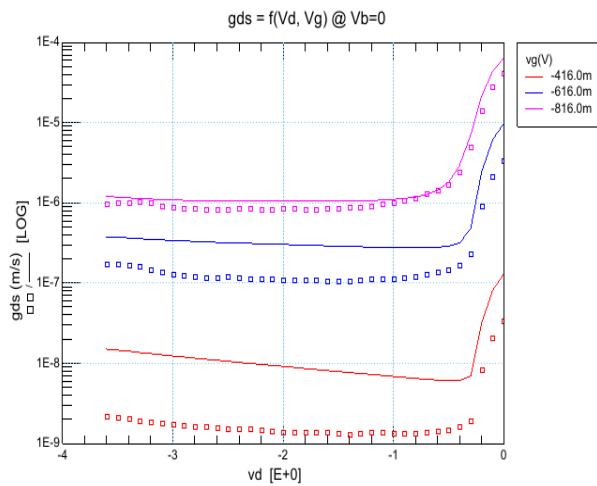


$idvg, I_b, I_g, V_b = 0V, T = 27^\circ C$

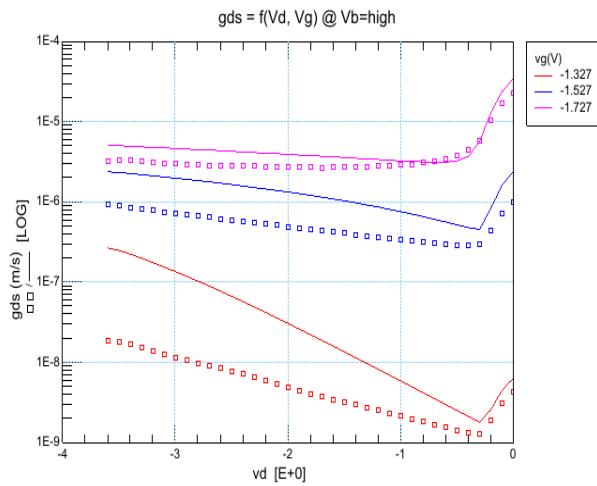
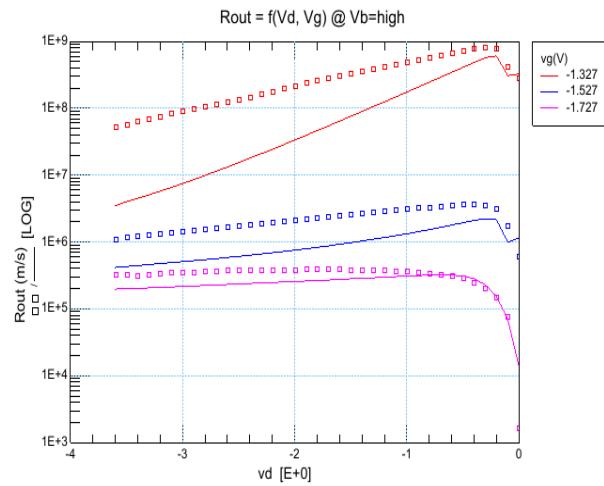
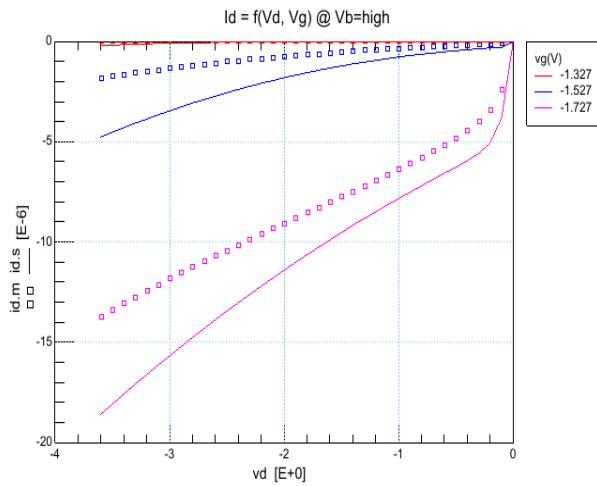


idvg, Ib,Ig, Vb = 3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


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

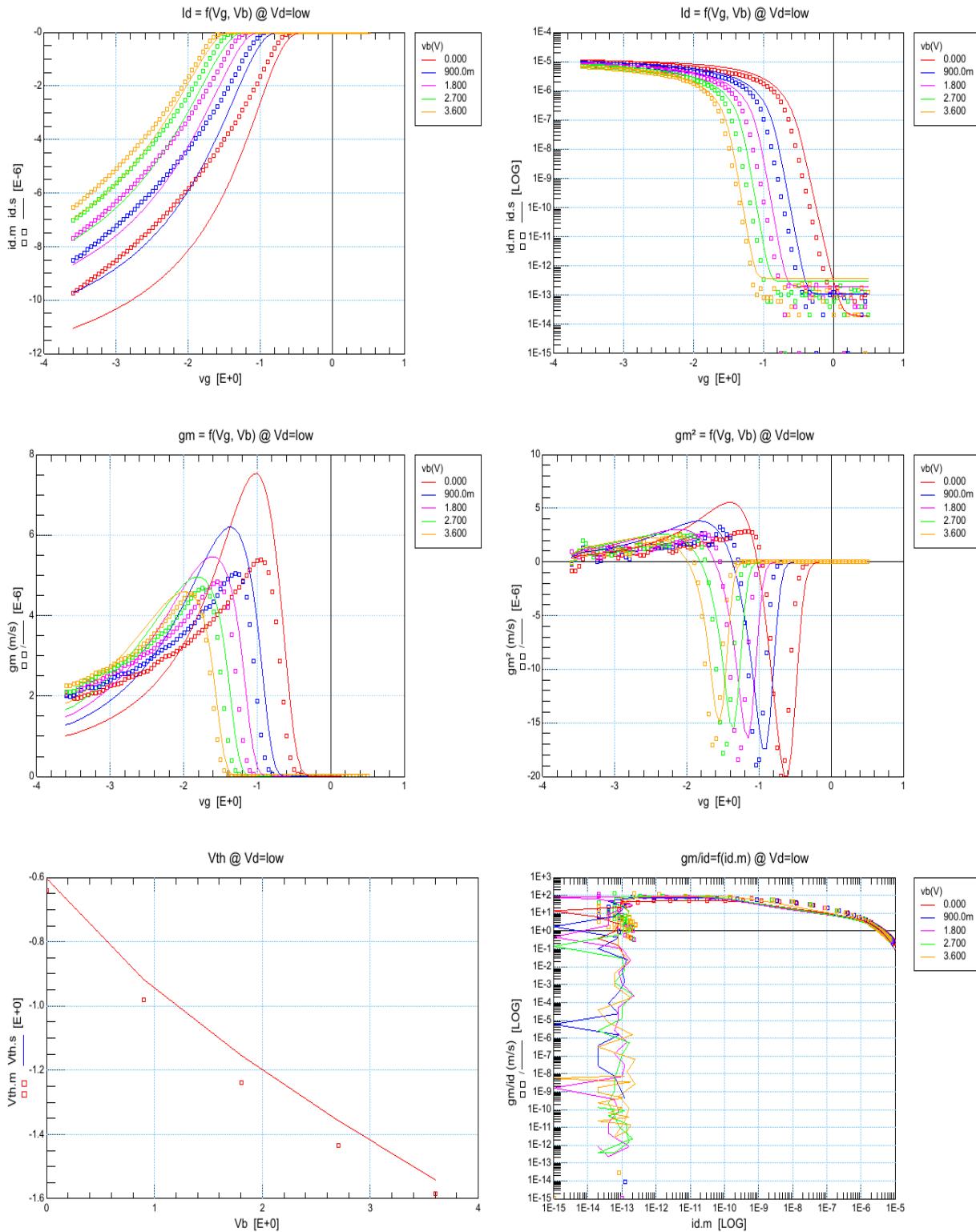


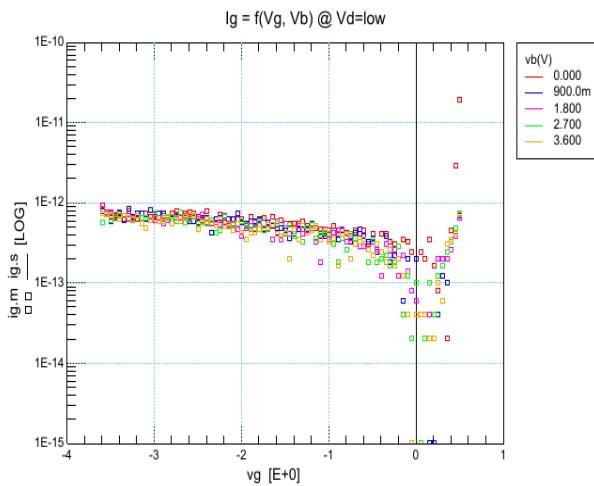
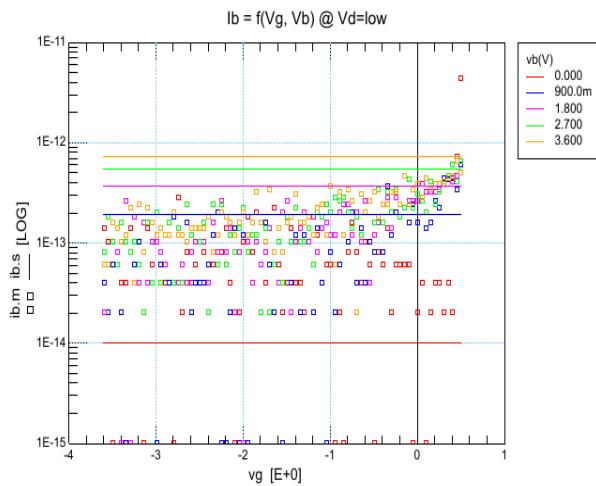
idvd_vth_vbmin, Vb = 3.6V, T = 27°C



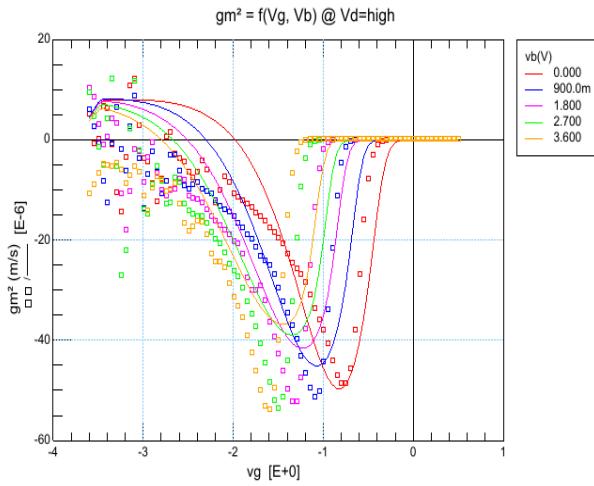
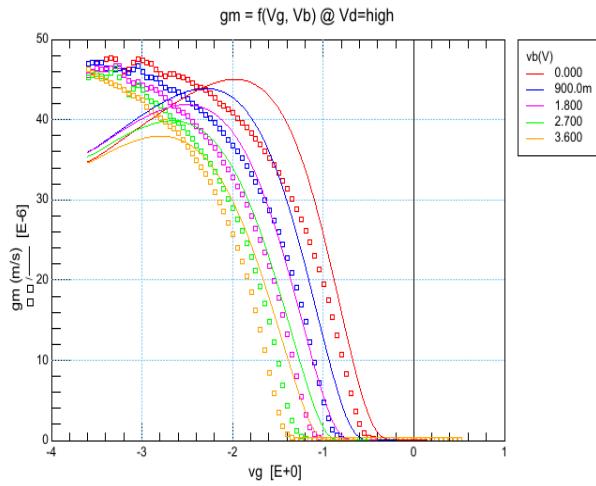
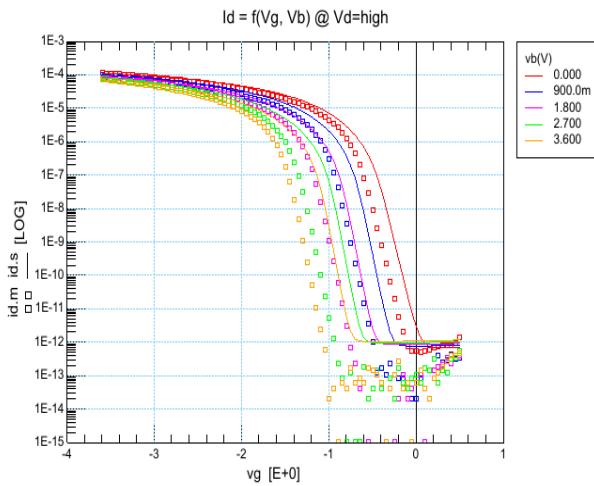
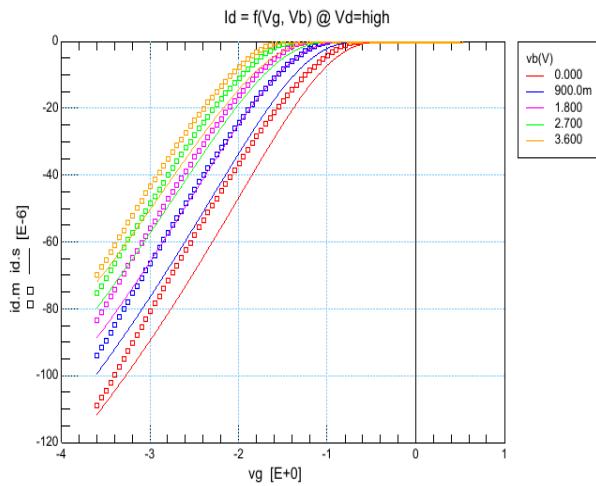
4.30 W0u3_L0u33_S565_2

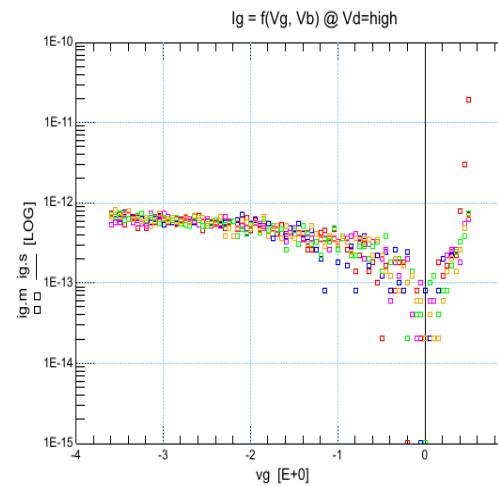
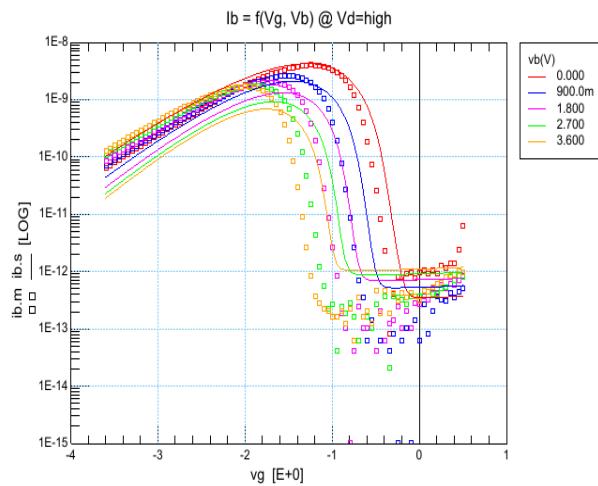
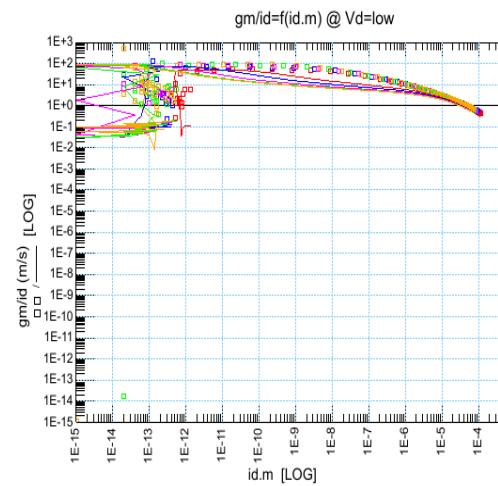
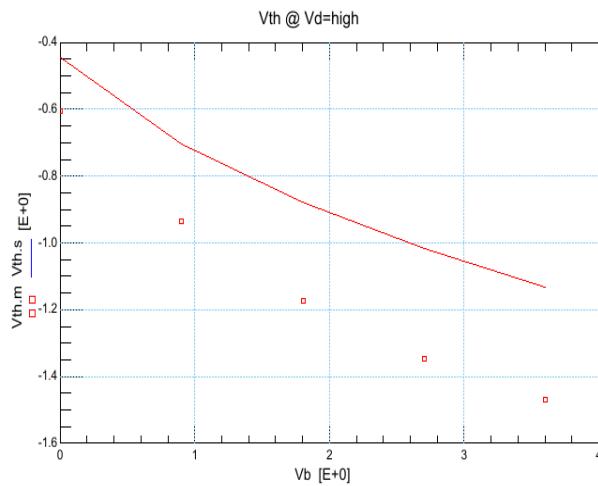
$idvg$, $Vd = -0.1V$, $T = 27^\circ C$



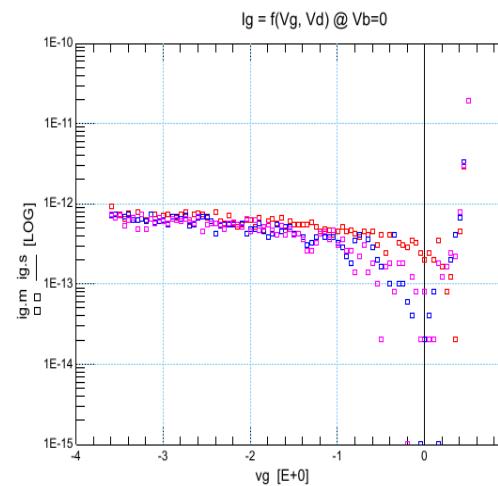
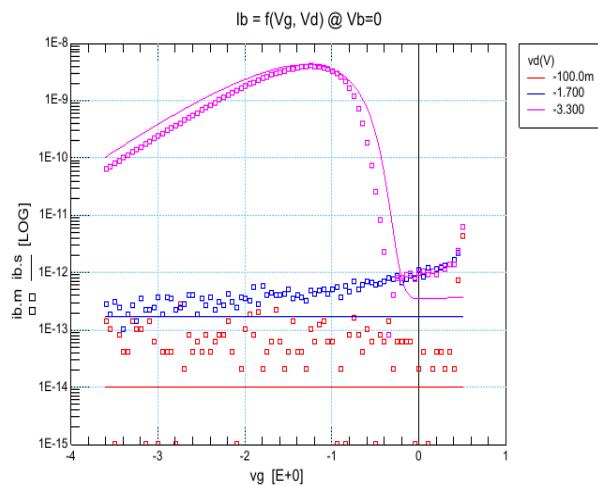


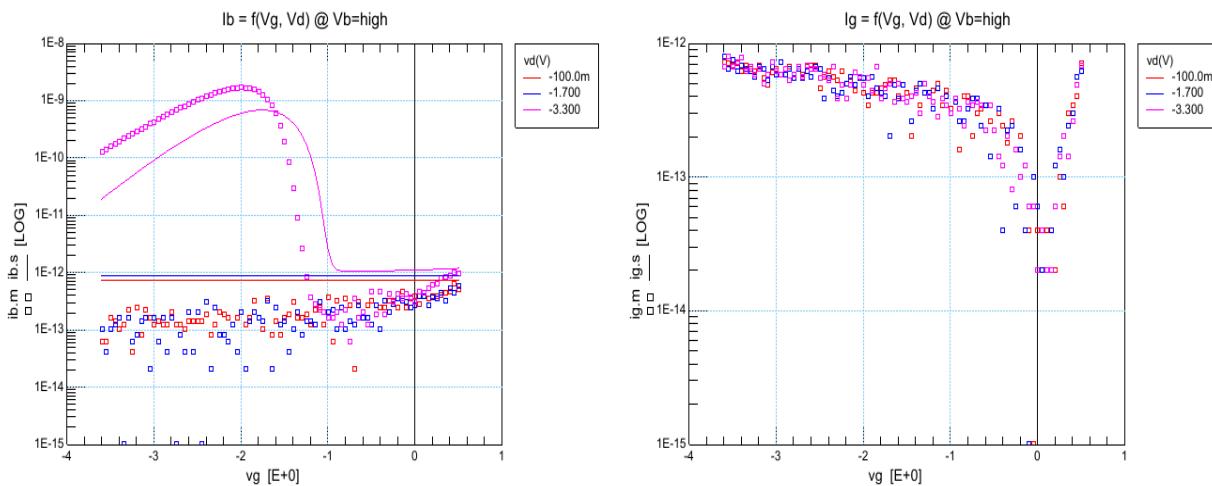
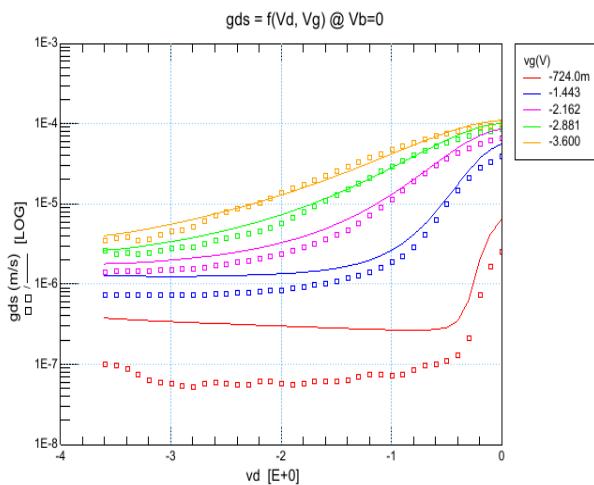
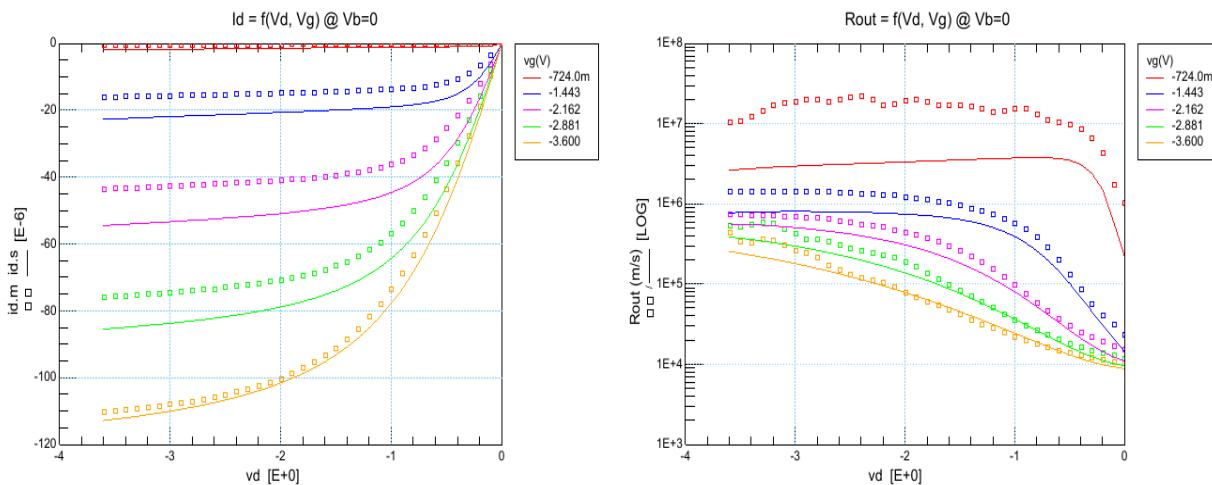
$i_d v_g, V_d = -3.3V, T = 27^\circ\text{C}$

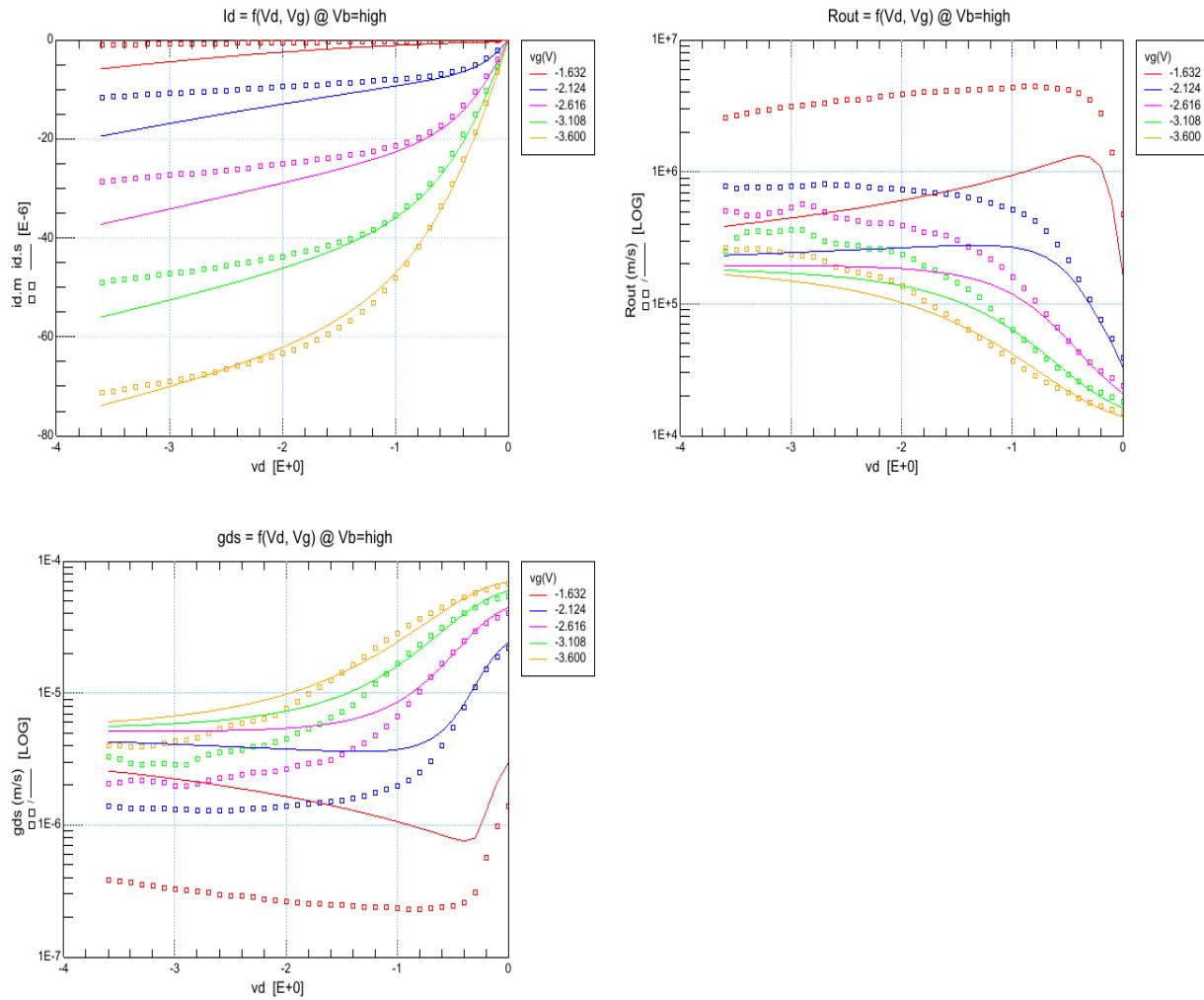
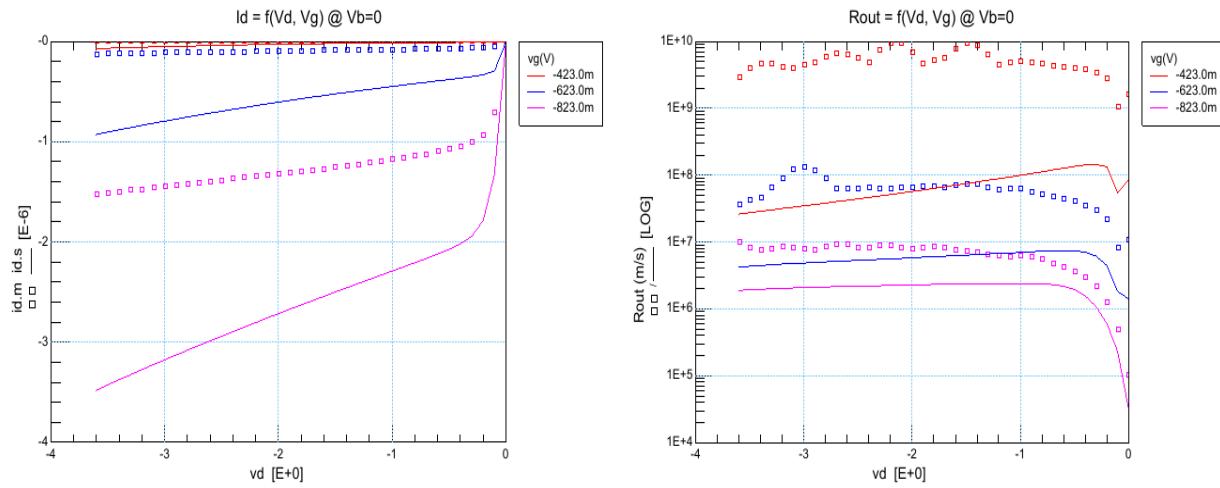


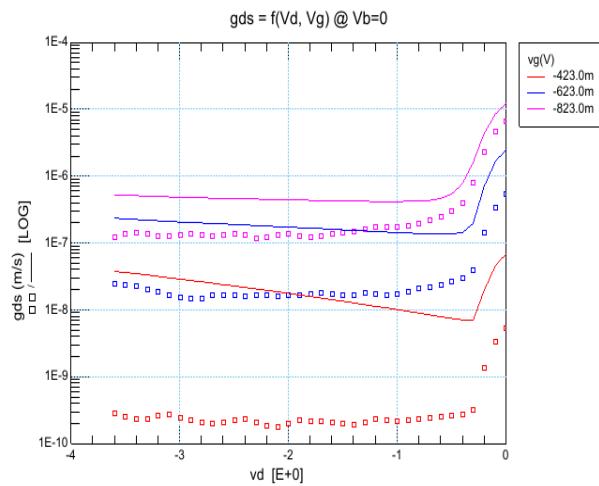


idvg, lb, lg, Vb = 0V, T = 27°C

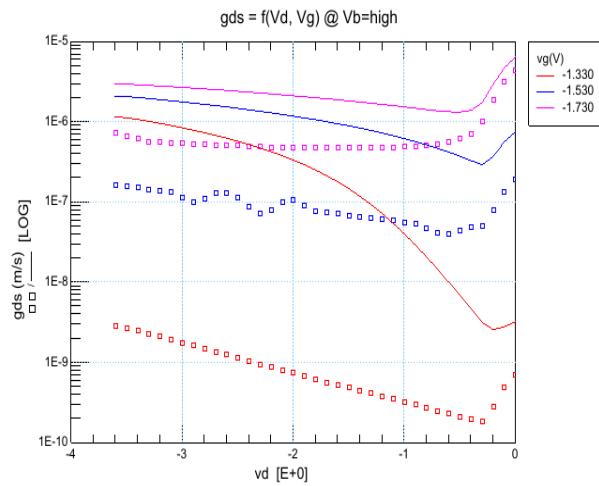
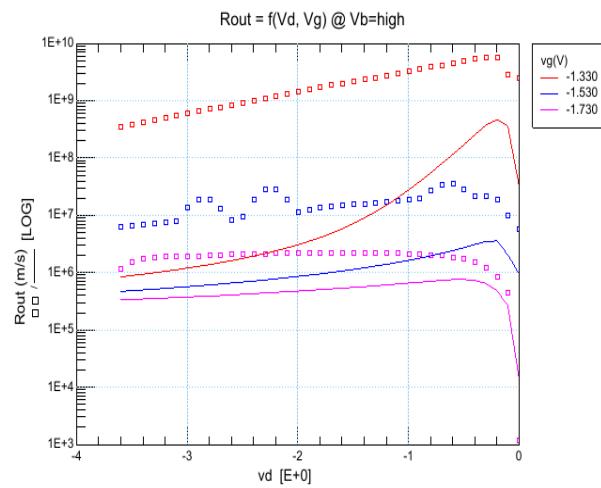
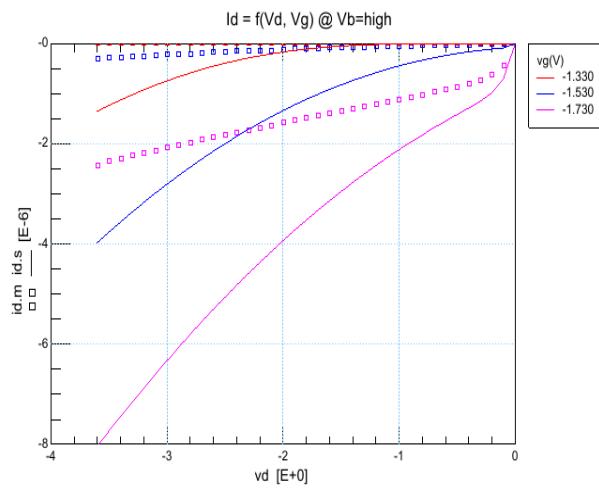


idvg, Ib,Ig, Vb = 3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


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



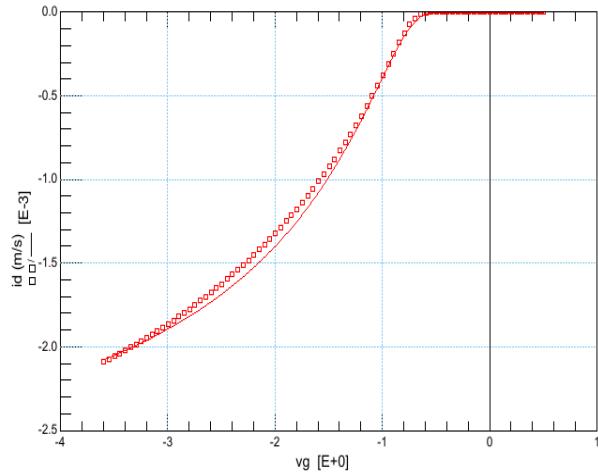
idvd_vth_vbmin, Vb = 3.6V, T = 27°C



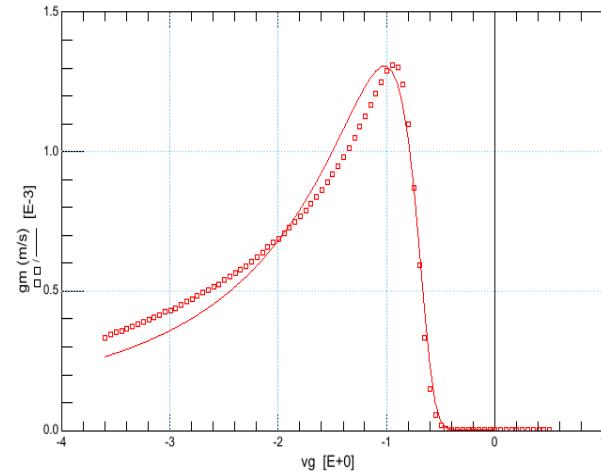
5 RF Transistors

5.1 NF10_WF10u0_L0u4_S453A_C4

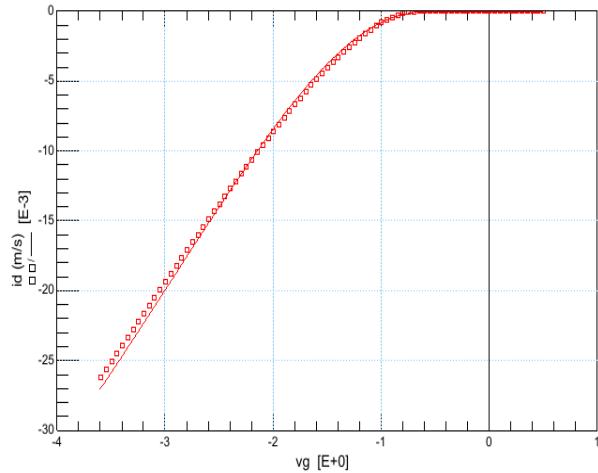
$IdVg$, $T = 27^\circ\text{C}$



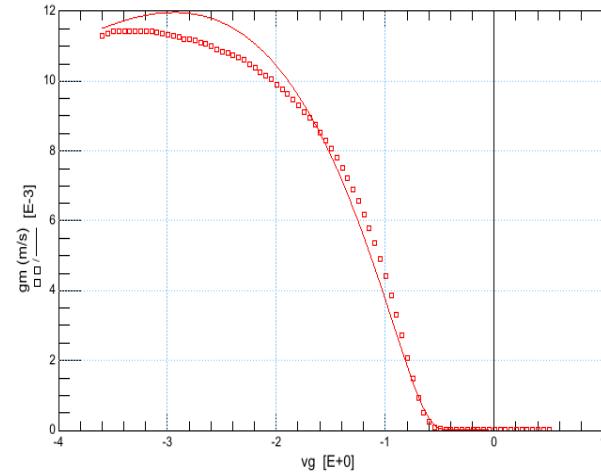
$$Id = f(Vg) @ Vd = -0.1V$$



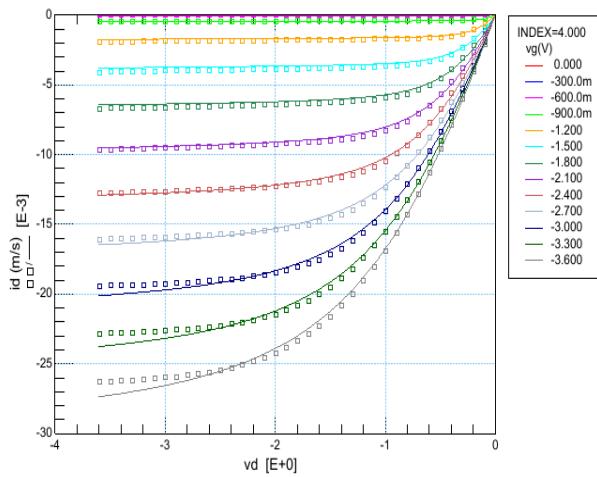
$$gm = f(Vg) @ Vd = -0.1V$$



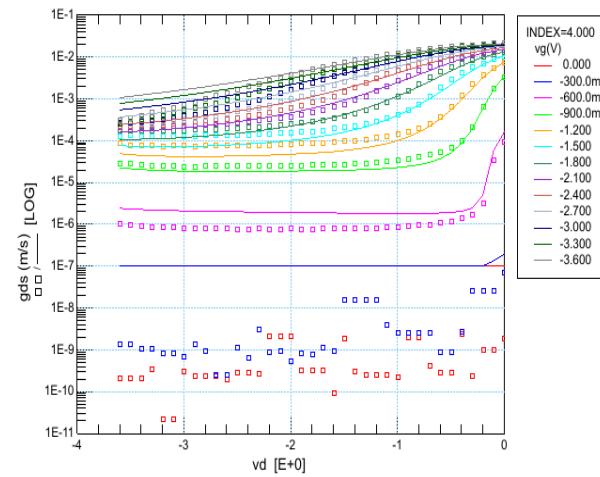
$$Id = f(Vg) @ Vd = -3.3V$$



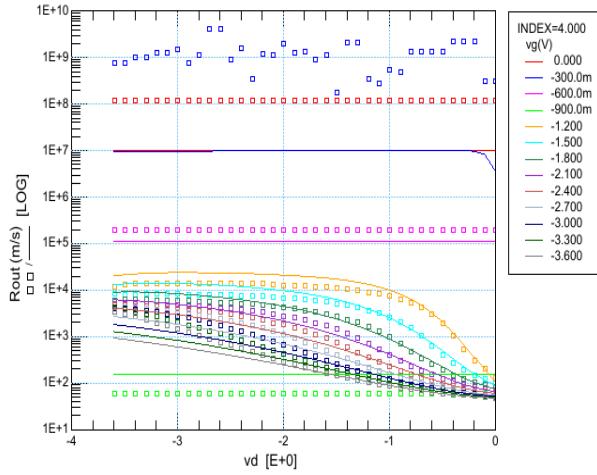
$$gm = f(Vg) @ Vd = -3.3V$$

IdVd, T = 27°C


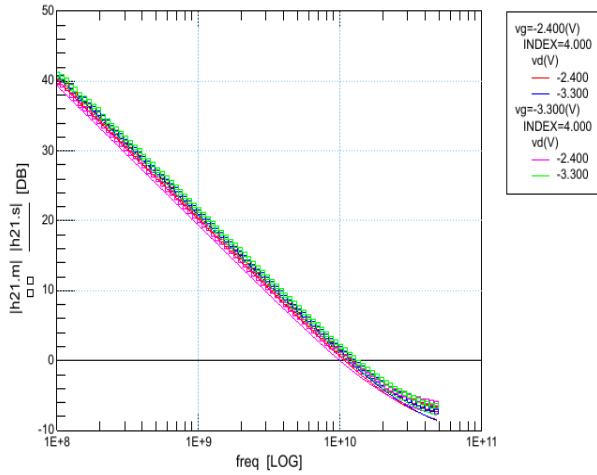
$$Id = f(Vd)$$



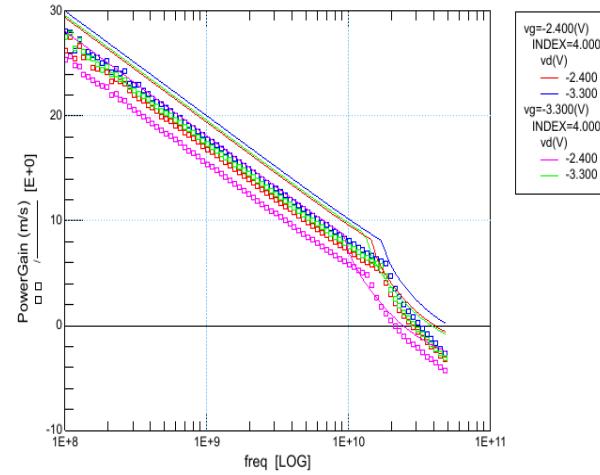
$$gds = f(Vd)$$



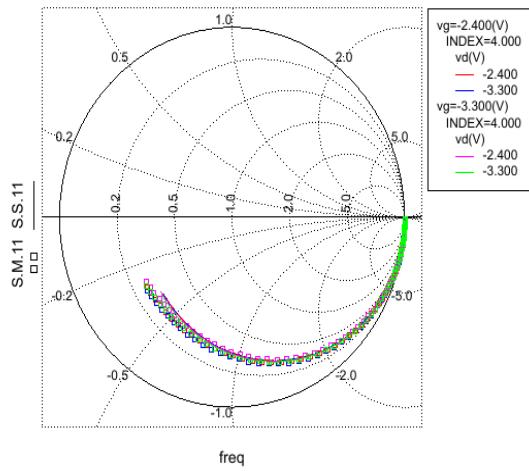
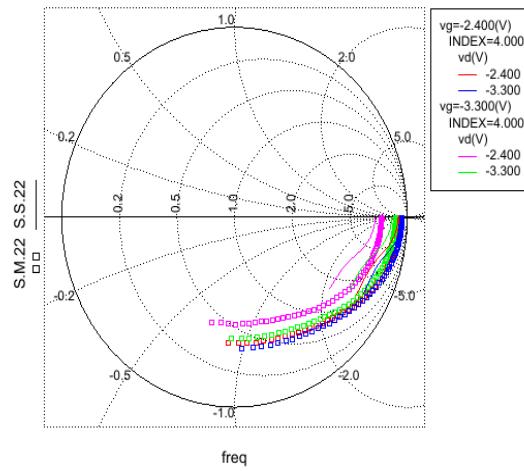
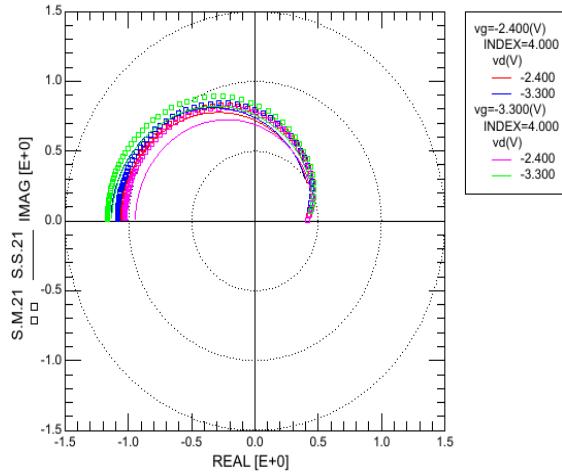
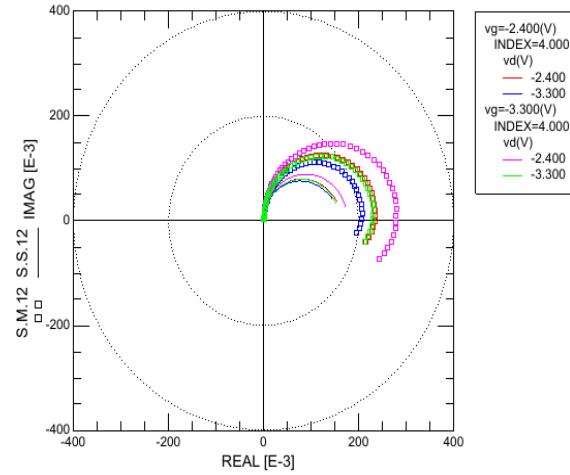
$$Rout = f(Vd)$$

S-Parameter, T = 27°C


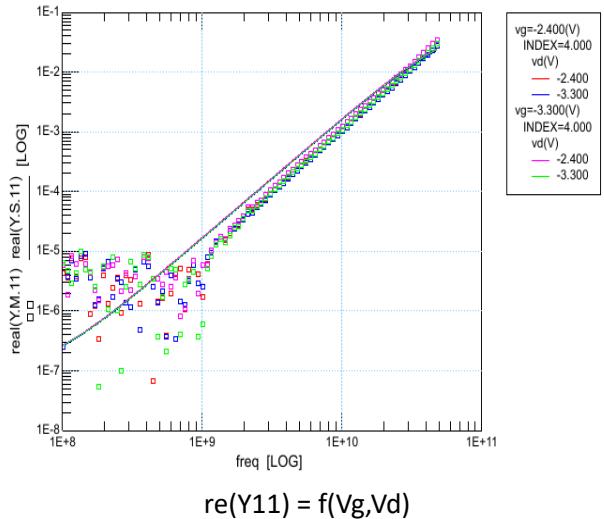
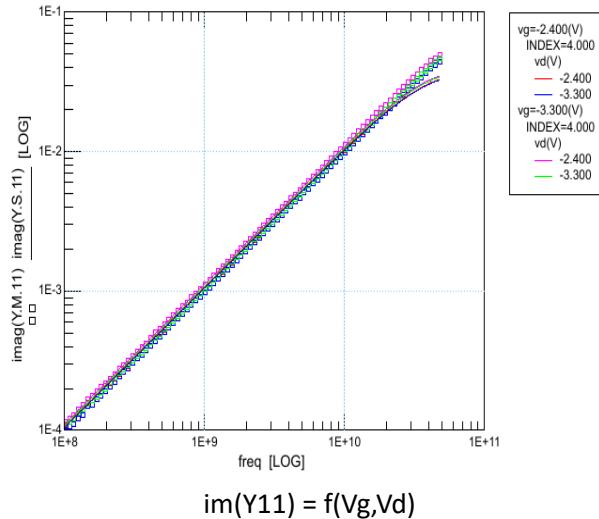
$$|h21| = f(Vg, Vd)$$

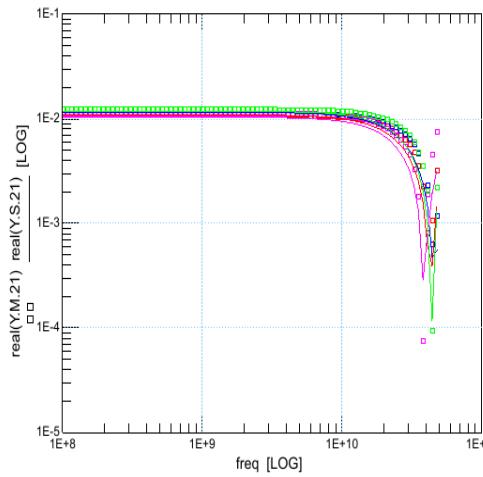


$$MSG/MAG = f(Vg, Vd)$$

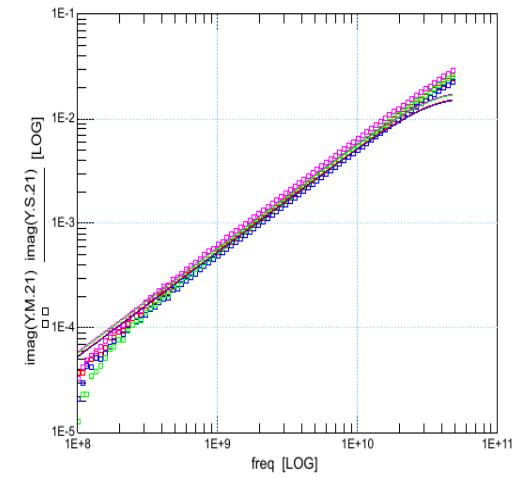
 $S_{11} = f(V_g, V_d)$  $S_{22} = f(V_g, V_d)$  $S_{21} = f(V_g, V_d)$  $S_{12} = f(V_g, V_d)$

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

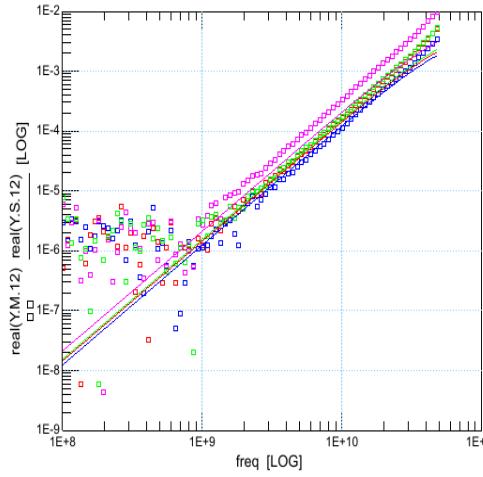
 $\text{re}(Y_{11}) = f(V_g, V_d)$  $\text{im}(Y_{11}) = f(V_g, V_d)$



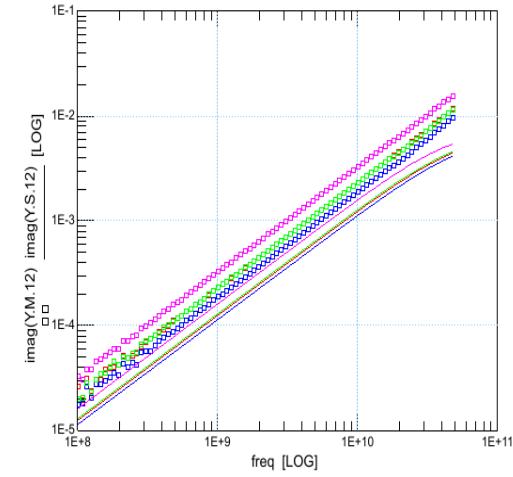
re(Y21) = f(Vg,Vd)



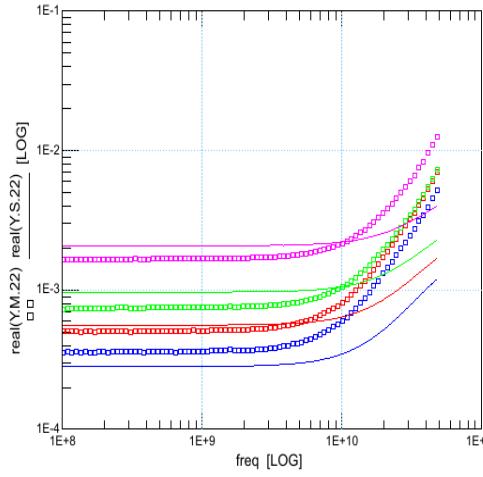
im(Y21) = f(Vg,Vd)



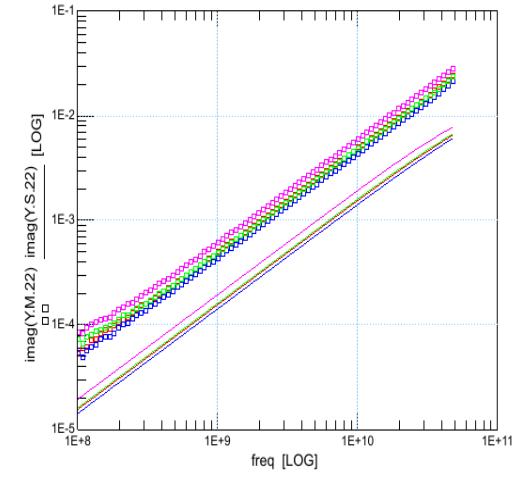
re(Y12) = f(Vg,Vd)



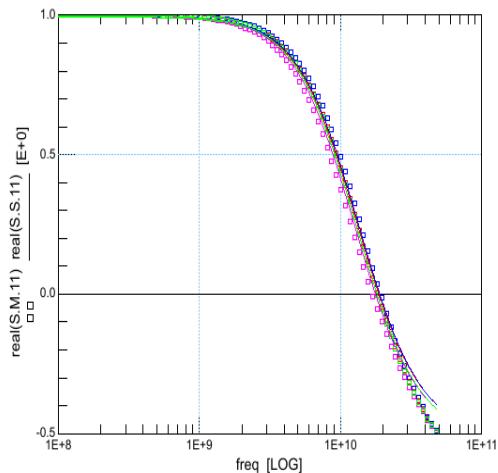
im(Y12) = f(Vg,Vd)



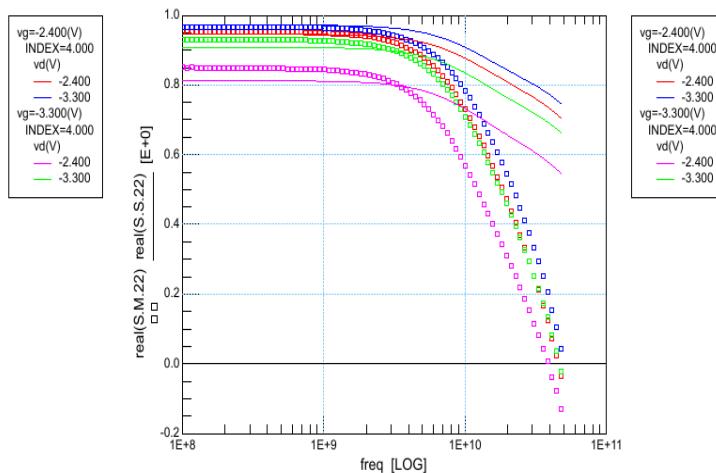
re(Y22) = f(Vg,Vd)



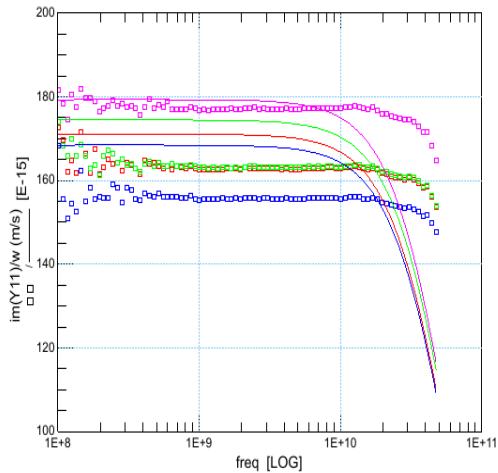
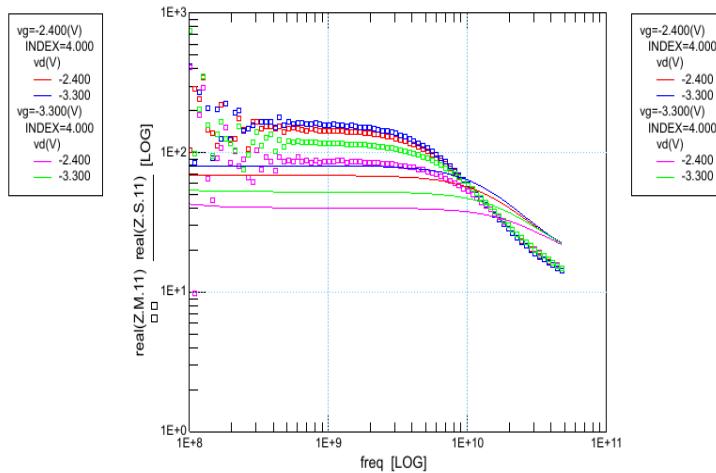
im(Y22) = f(Vg,Vd)

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

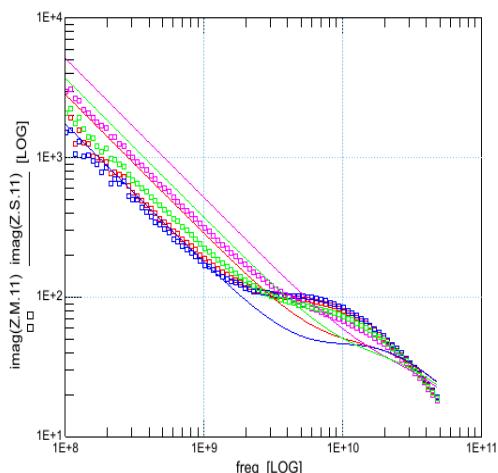
re(S11) = f(Vg, Vd)



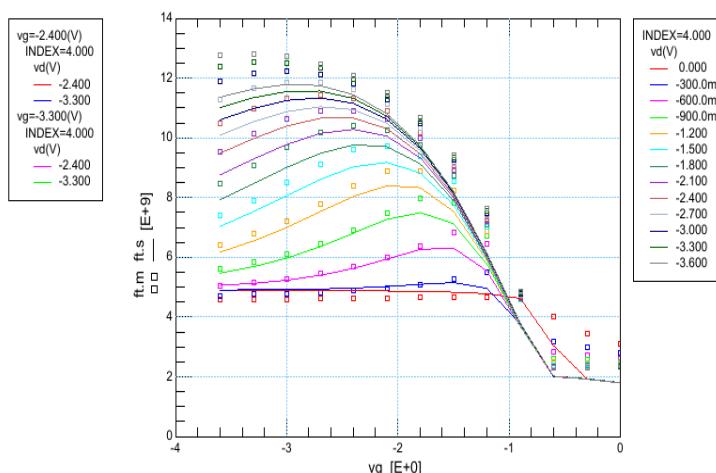
re(S22) = f(Vg, Vd)

im(Y11) divided by ω 

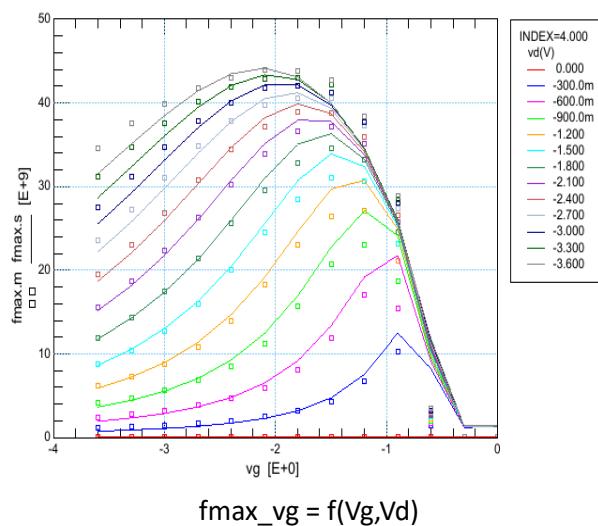
re(Z11) = f(Vg, Vd)



im(Z11) = f(Vg, Vd)

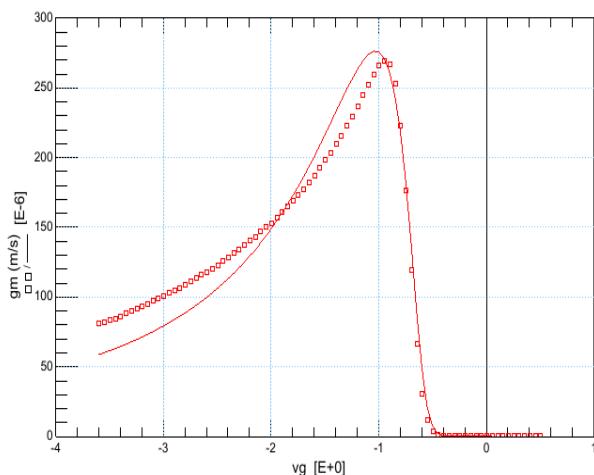
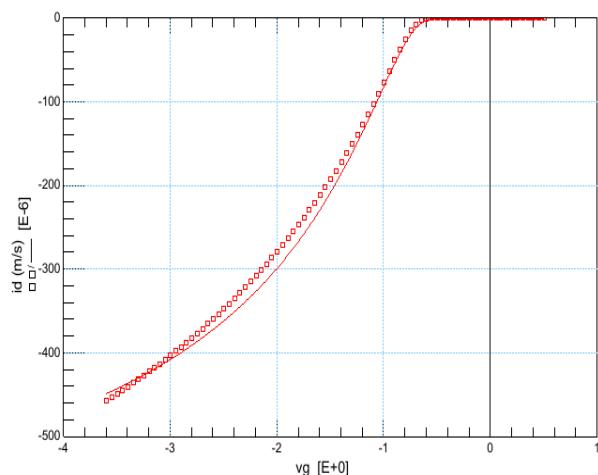


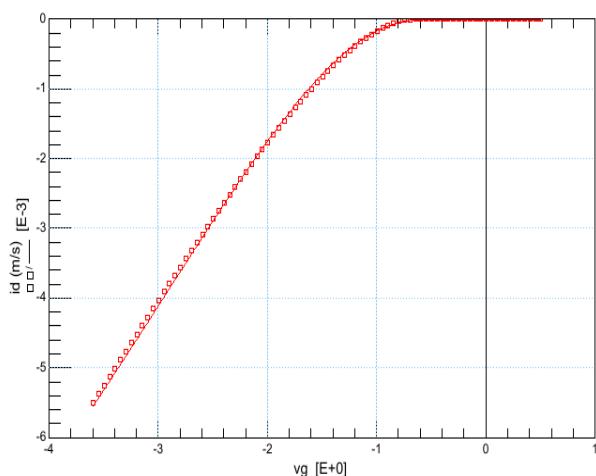
fT_vg = f(Vg, Vd)



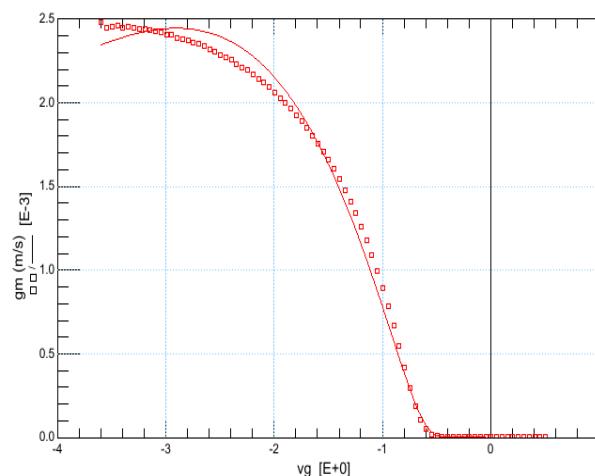
5.2 NF04_WF05u0_L0u4_S453A_C5

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



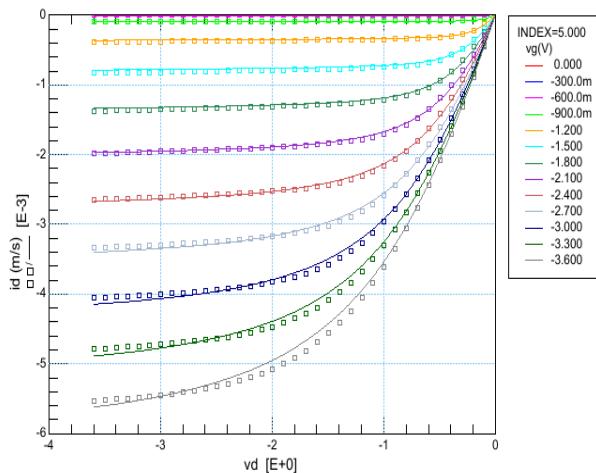


$$Id = f(Vg) @ Vd = -3.3V$$

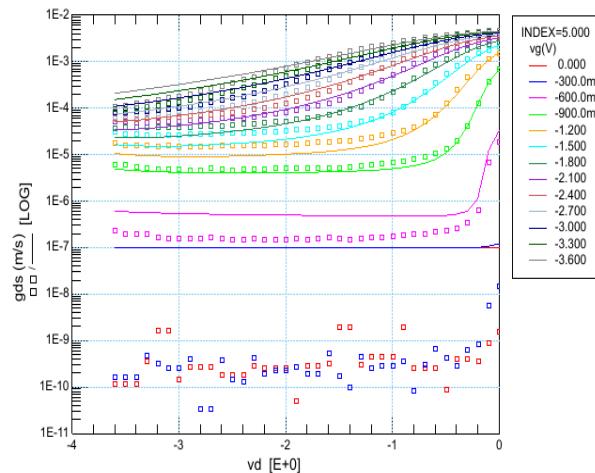


$$gm = f(Vg) @ Vd = -3.3V$$

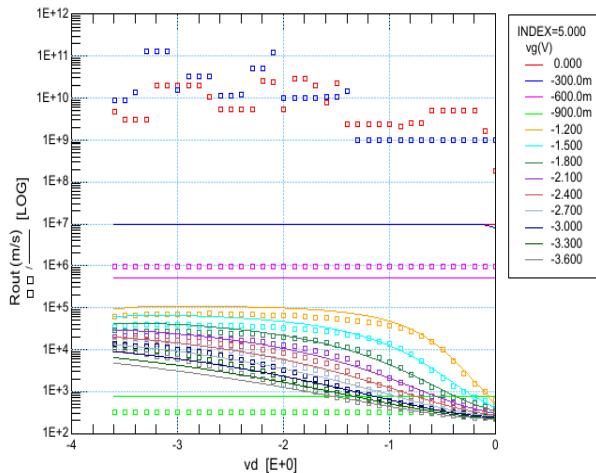
IdVd, T = 27°C



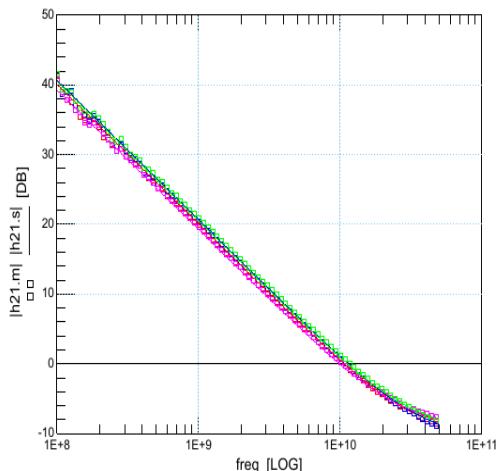
$$Id = f(Vd)$$



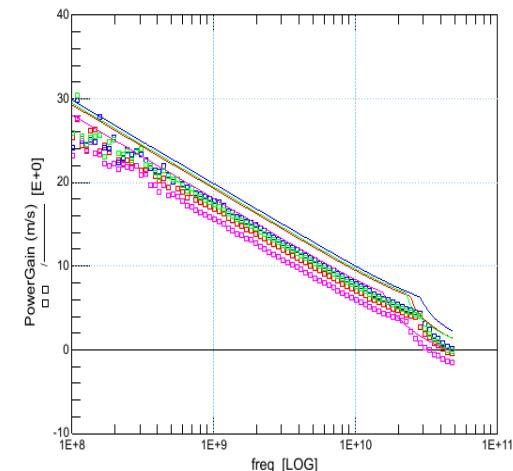
$$gds = f(Vd)$$



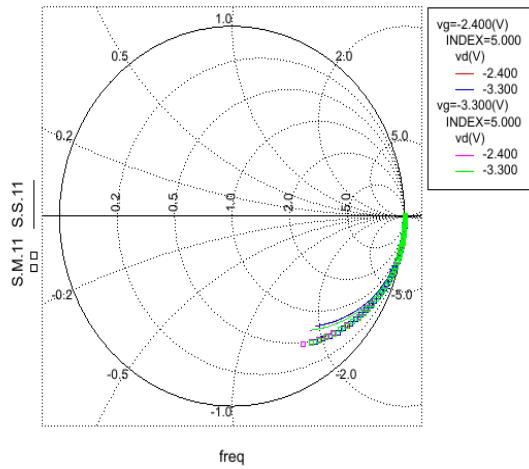
$$Rout = f(Vd)$$

S-Parameter, T = 27°C

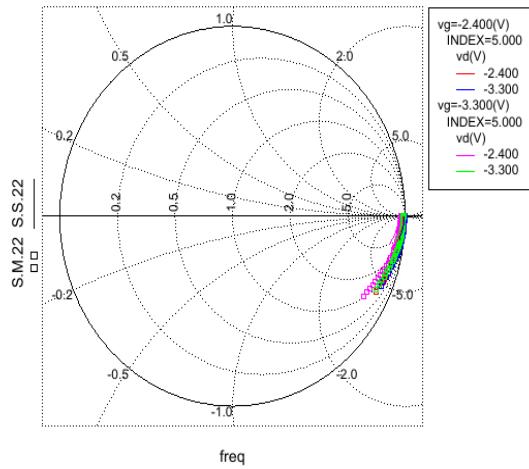
$$|h21| = f(Vg, Vd)$$



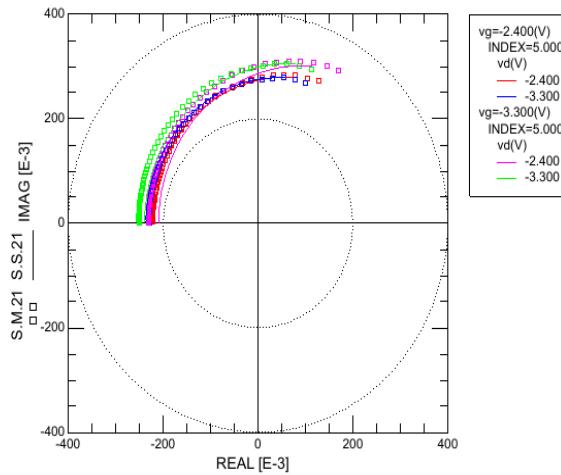
$$MSG/MAG = f(Vg, Vd)$$



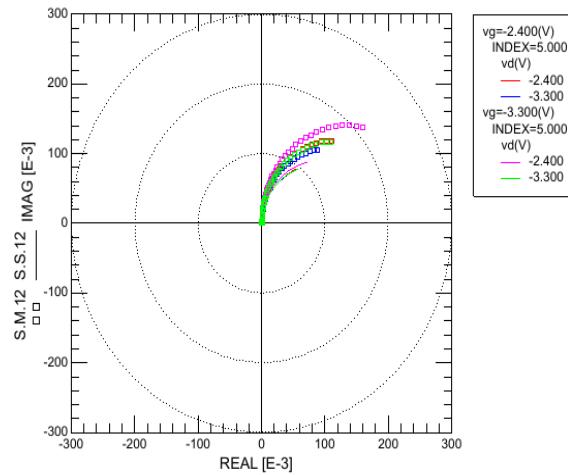
$$S11 = f(Vg, Vd)$$



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

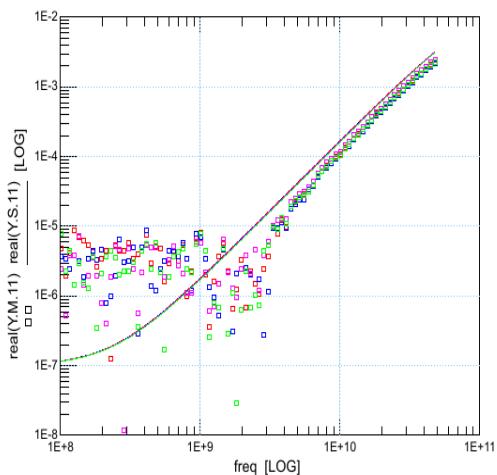


$$S21 = f(Vg, Vd)$$

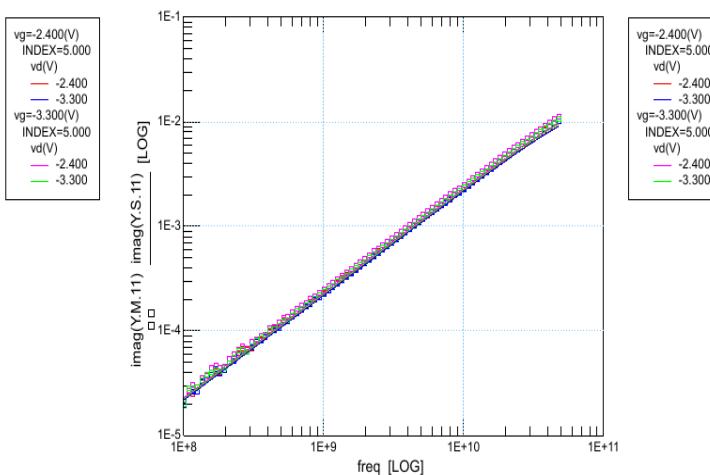


$$S12 = f(Vg, Vd)$$

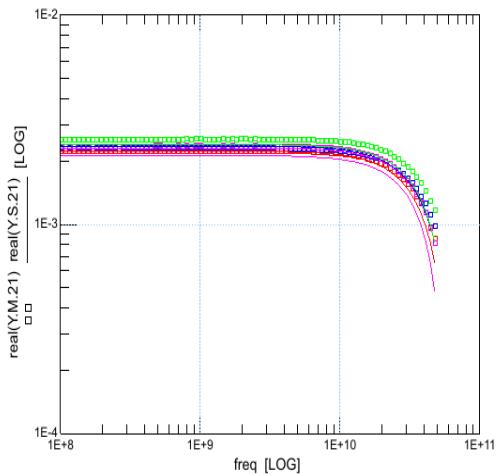
Y-Parameter, T = 27°C



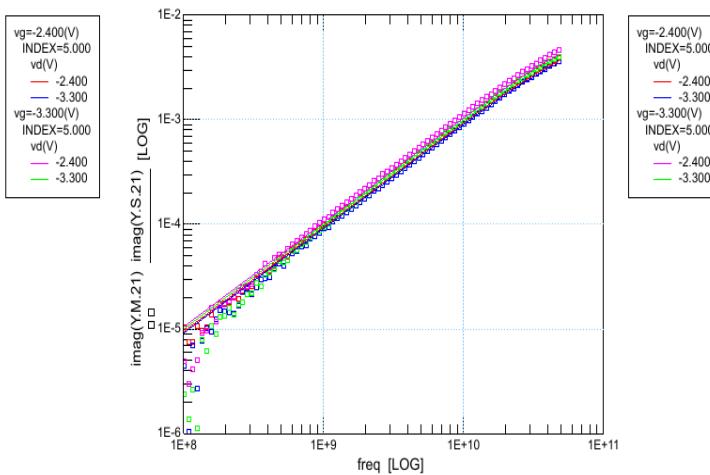
$$\text{re}(Y_{11}) = f(V_g, V_d)$$



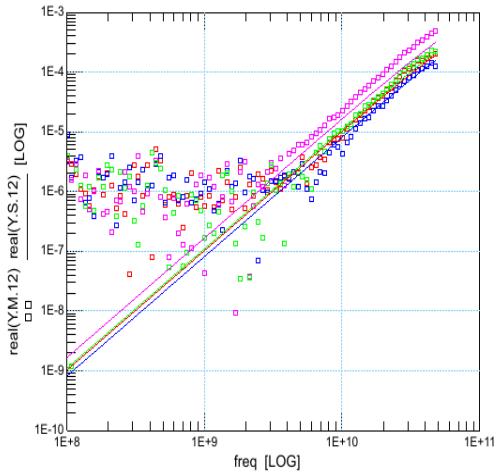
$$\text{im}(Y_{11}) = f(V_g, V_d)$$



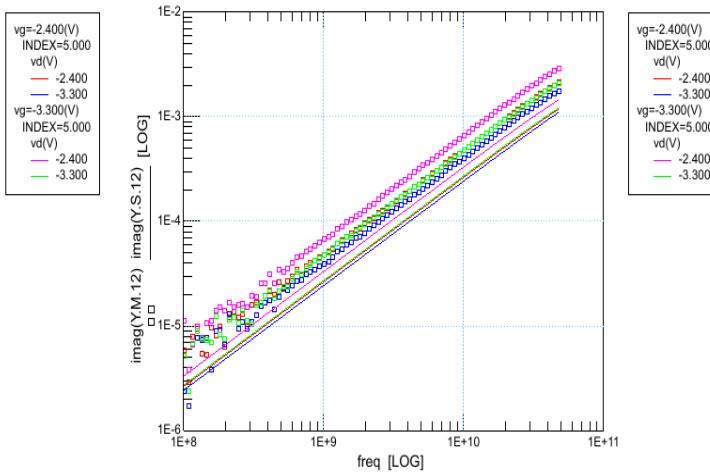
$$\text{re}(Y_{21}) = f(V_g, V_d)$$



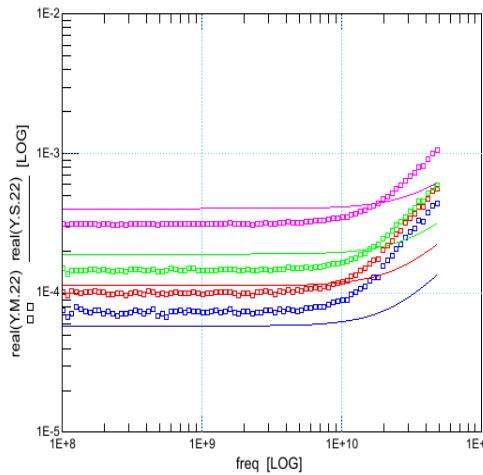
$$\text{im}(Y_{21}) = f(V_g, V_d)$$



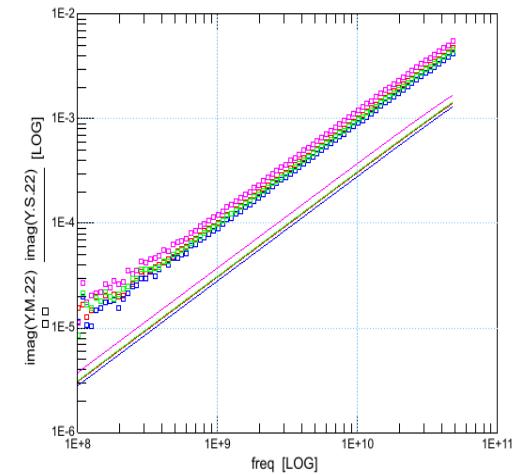
$$\text{re}(Y_{12}) = f(V_g, V_d)$$



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

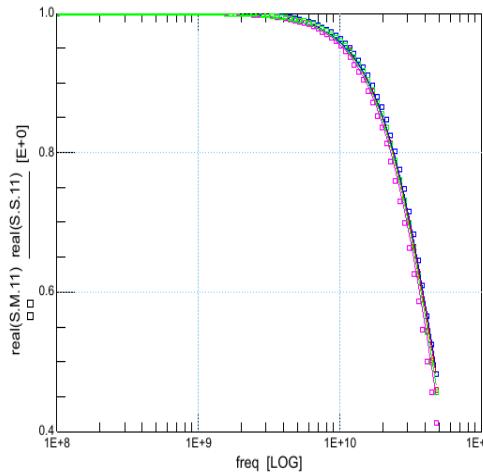


$$\text{real}(Y_{22}) = f(V_g, V_d)$$

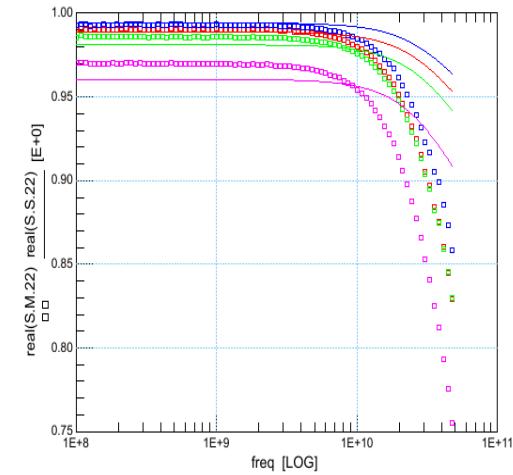


$$\text{imag}(Y_{22}) = f(V_g, V_d)$$

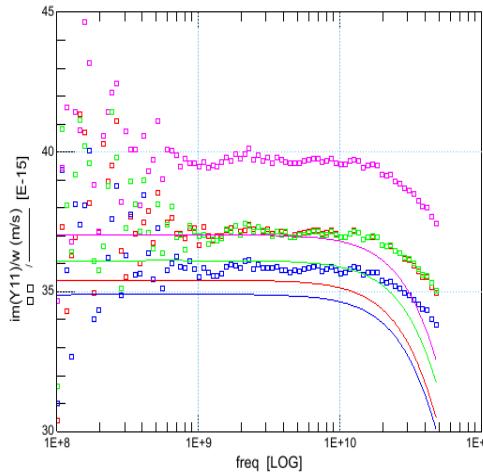
Verify Plots, $T = 27^\circ\text{C}$



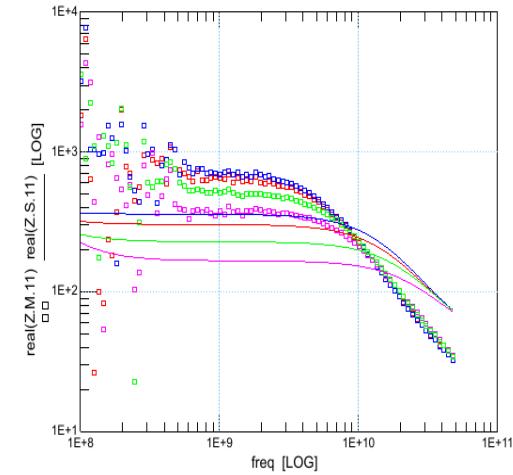
$$\text{real}(S_{11}) = f(V_g, V_d)$$



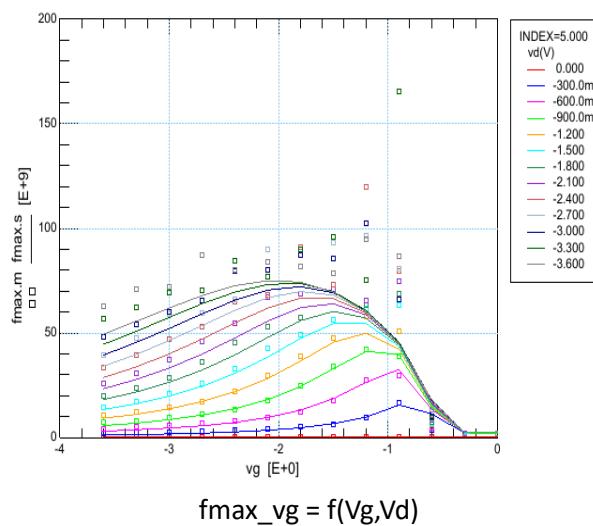
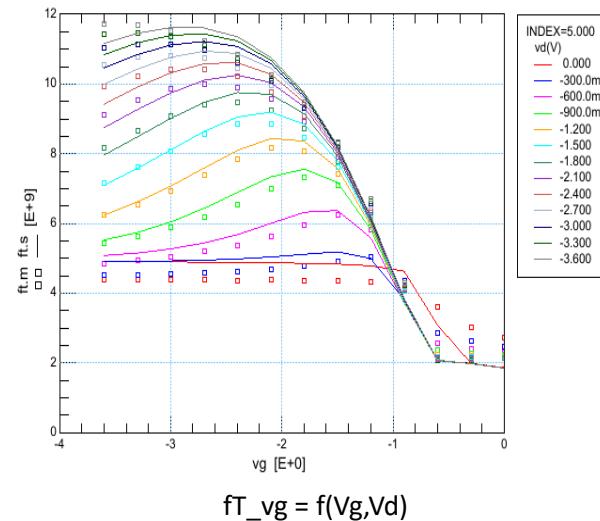
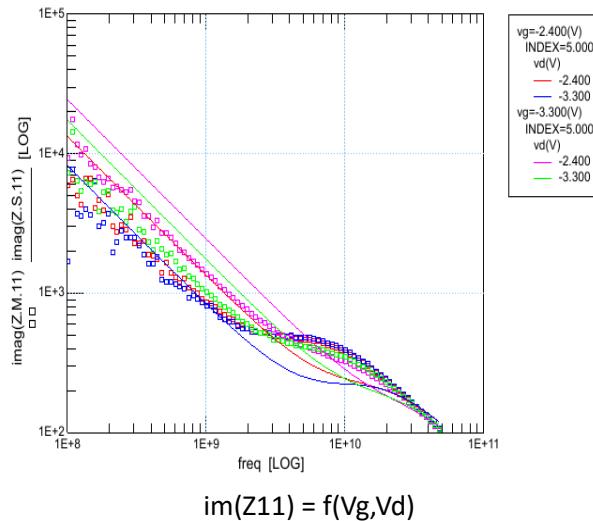
$$\text{real}(S_{22}) = f(V_g, V_d)$$



$$\text{im}(Y_{11}) \text{ divided by } \omega$$

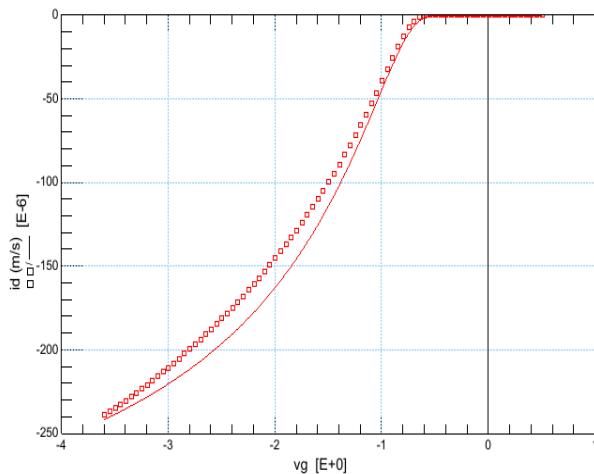


$$\text{real}(Z_{11}) = f(V_g, V_d)$$

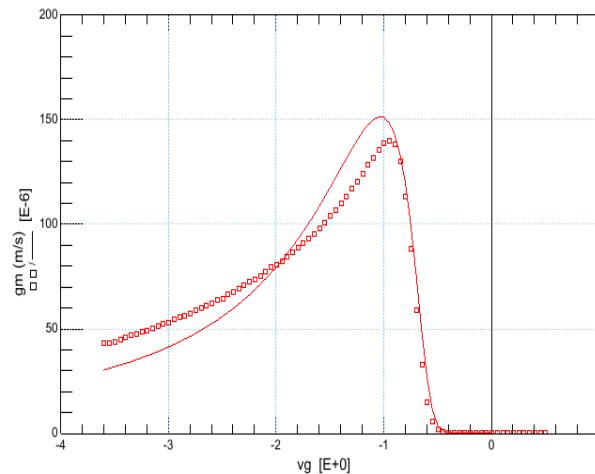


5.3 NF04_WF02u5_L0u4_S453A_D1

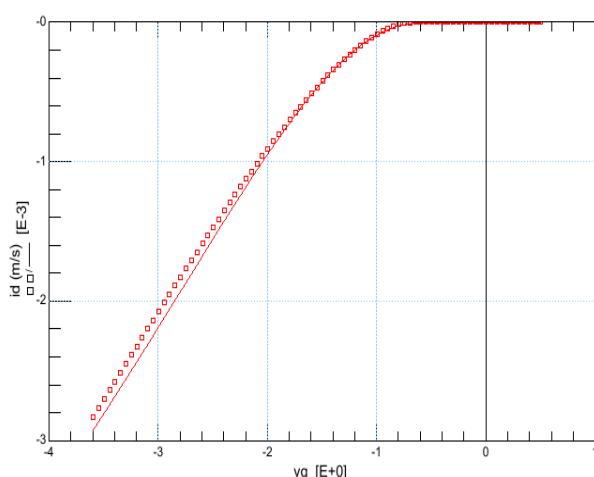
$IdVg$, $T = 27^\circ\text{C}$



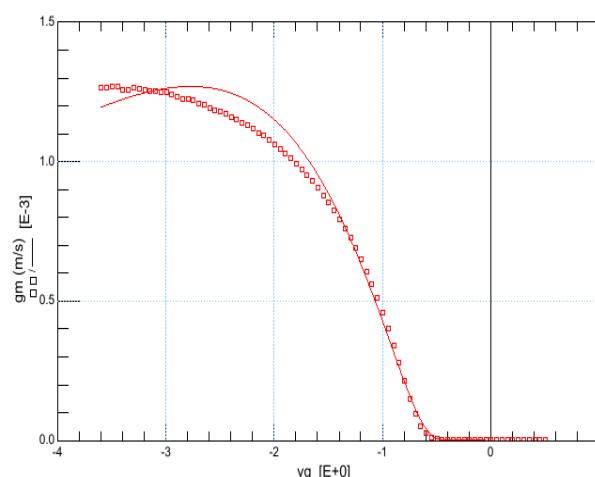
$Id = f(Vg)$ @ $Vd = -0.1\text{V}$



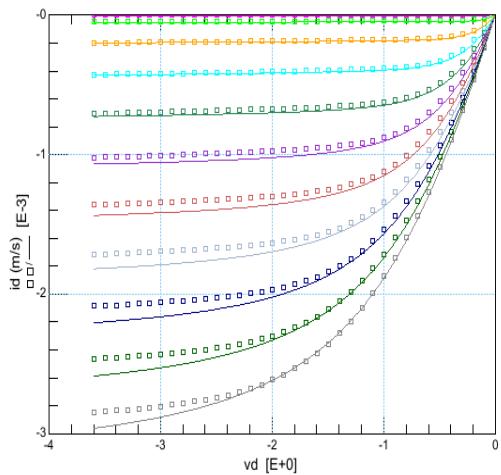
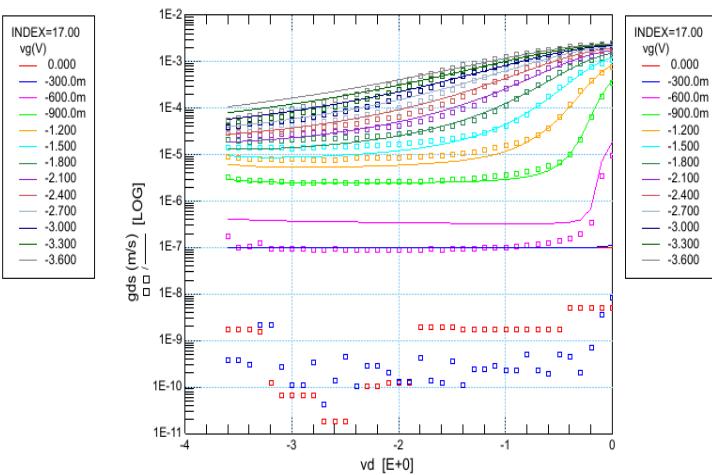
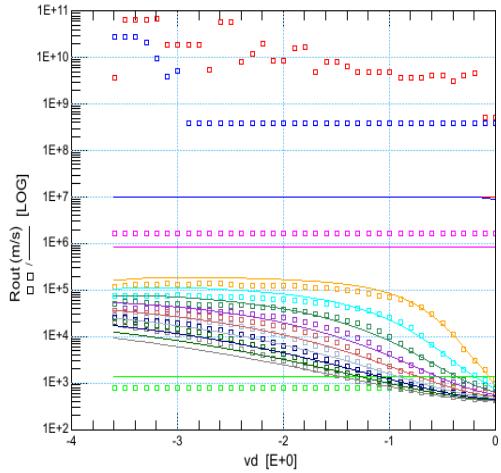
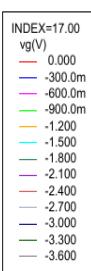
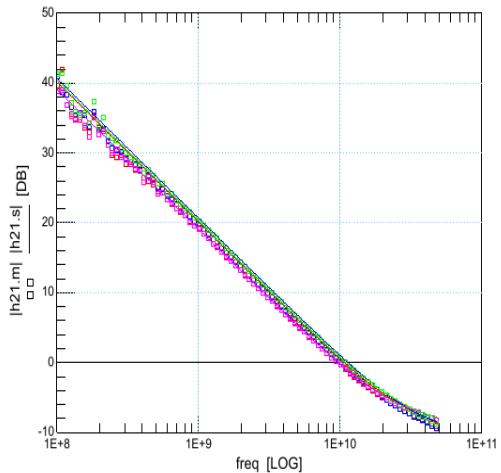
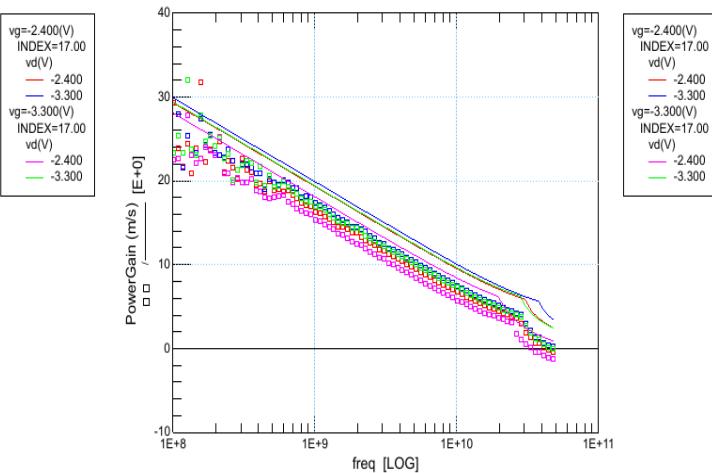
$gm = f(Vg)$ @ $Vd = -0.1\text{V}$

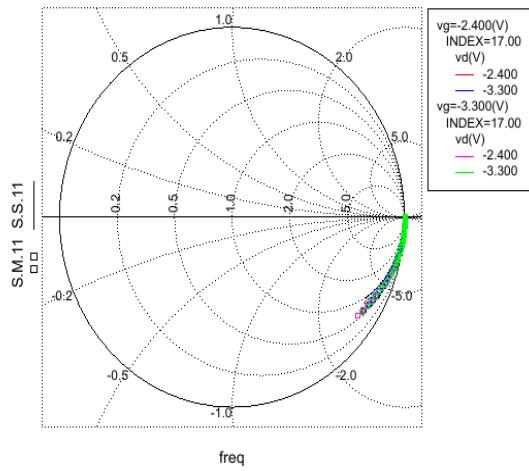
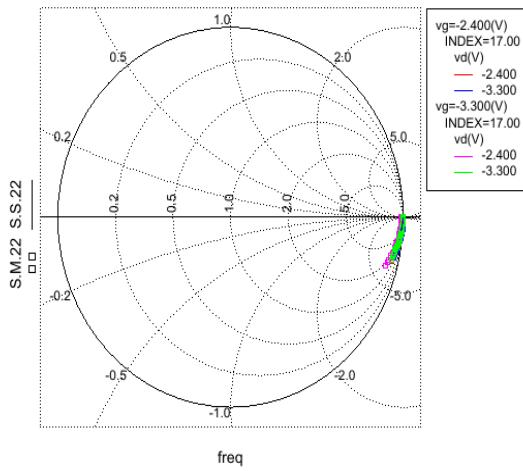
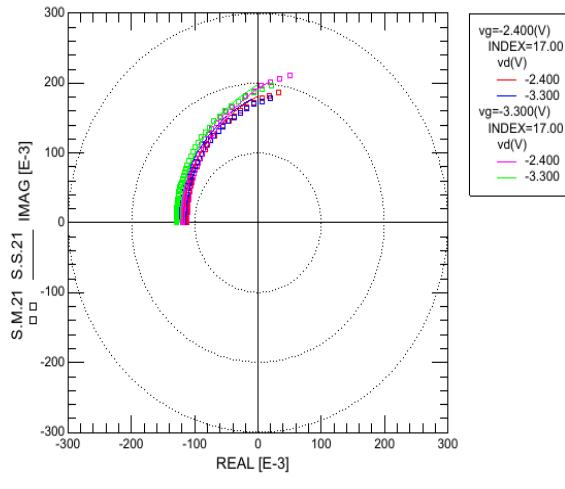
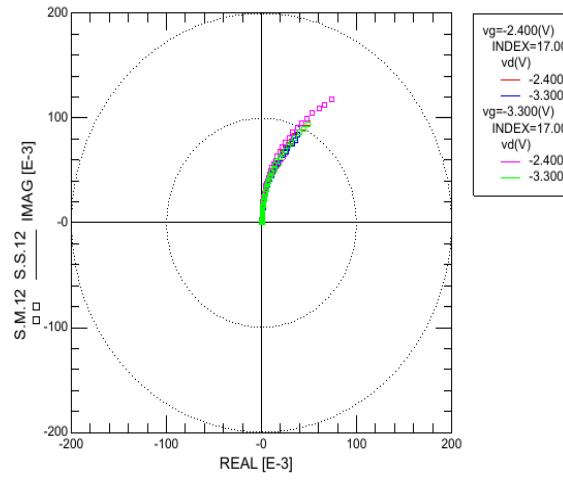


$Id = f(Vg)$ @ $Vd = -3.3\text{V}$

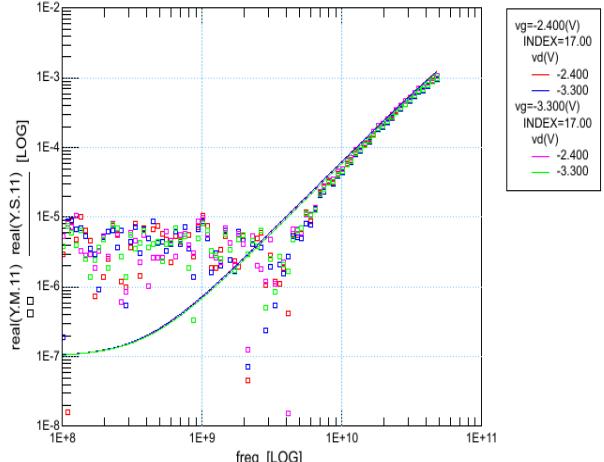
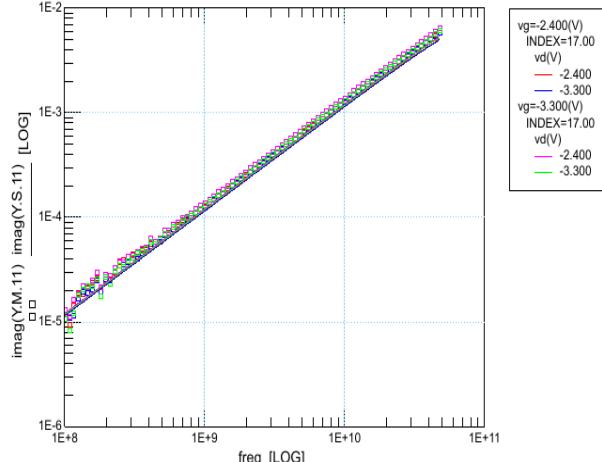


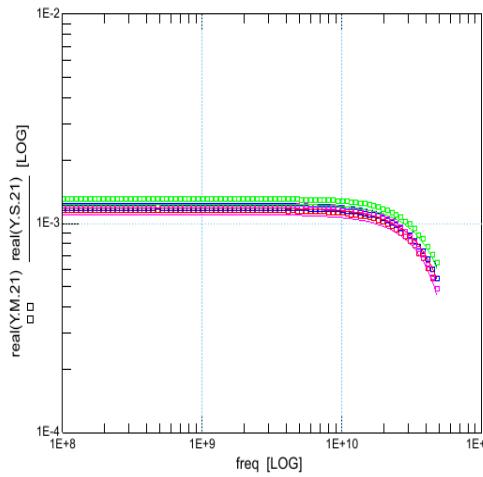
$gm = f(Vg)$ @ $Vd = -3.3\text{V}$

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

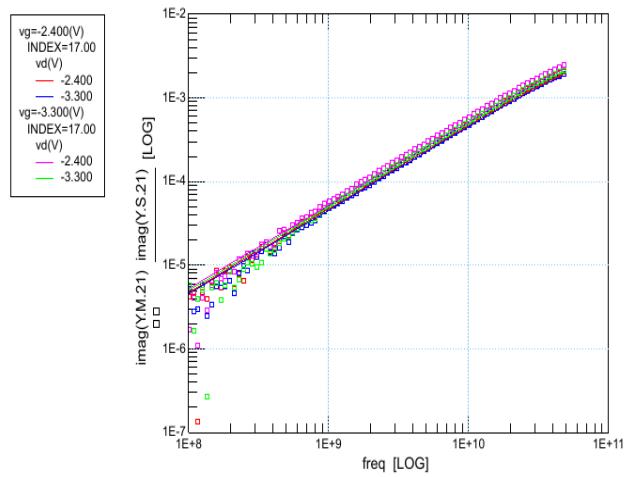
 $S_{11} = f(Vg, Vd)$  $S_{22} = f(Vg, Vd)$  $S_{21} = f(Vg, Vd)$  $S_{12} = f(Vg, Vd)$

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

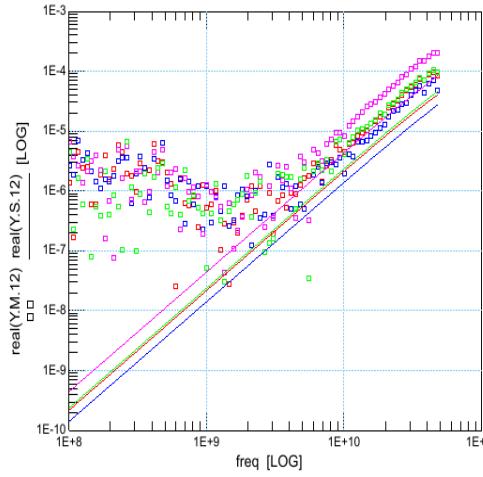
 $\text{re}(Y_{11}) = f(Vg, Vd)$  $\text{im}(Y_{11}) = f(Vg, Vd)$



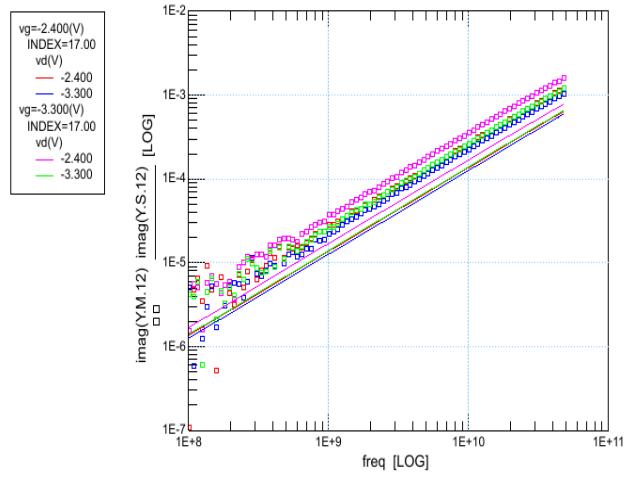
re(Y21) = f(Vg,Vd)



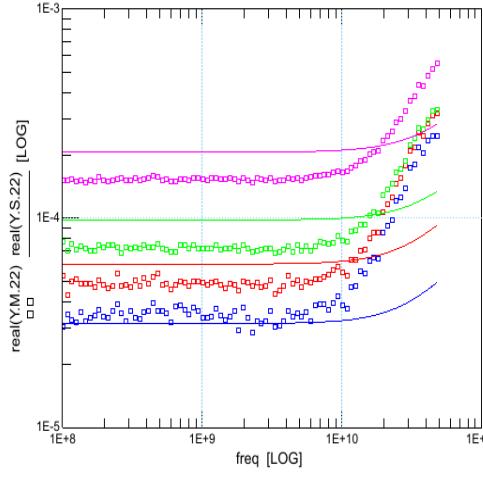
im(Y21) = f(Vg,Vd)



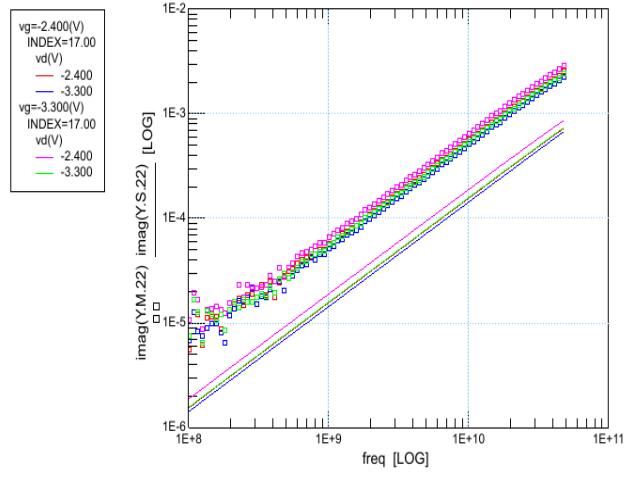
re(Y12) = f(Vg,Vd)



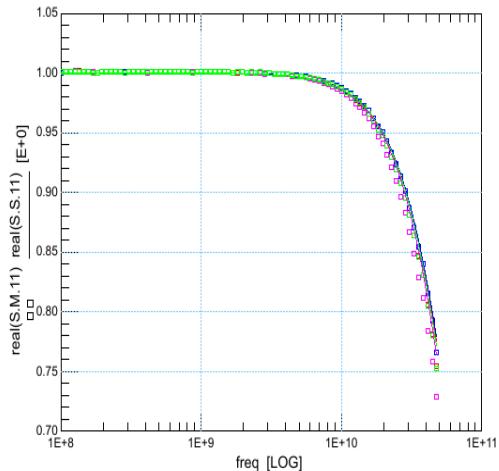
im(Y12) = f(Vg,Vd)



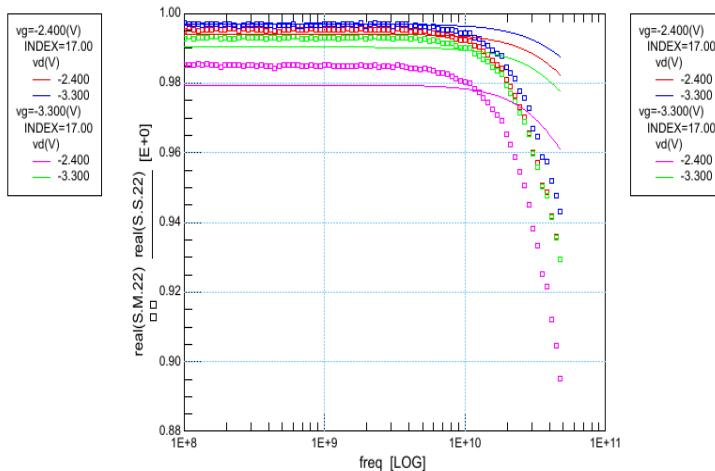
re(Y22) = f(Vg,Vd)



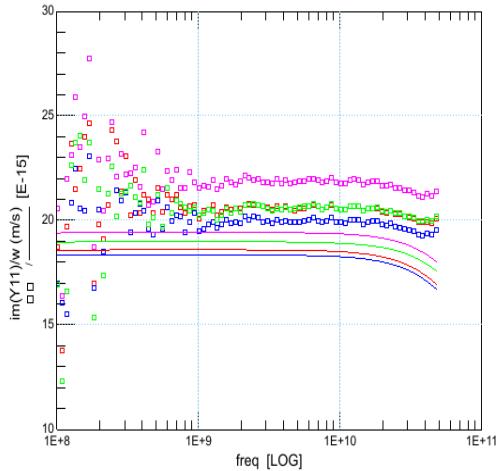
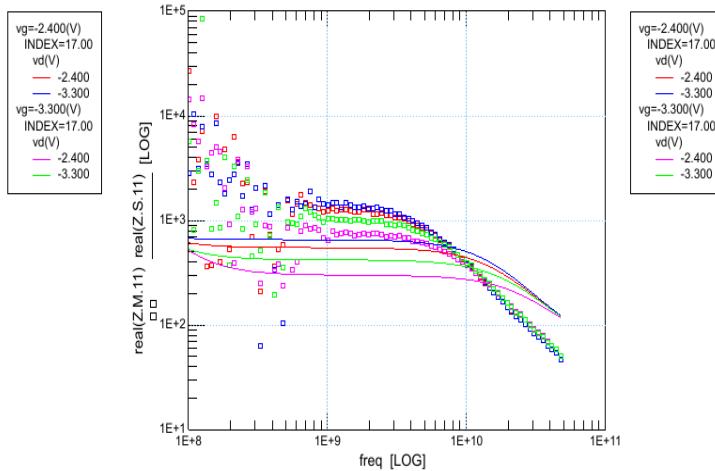
im(Y22) = f(Vg,Vd)

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

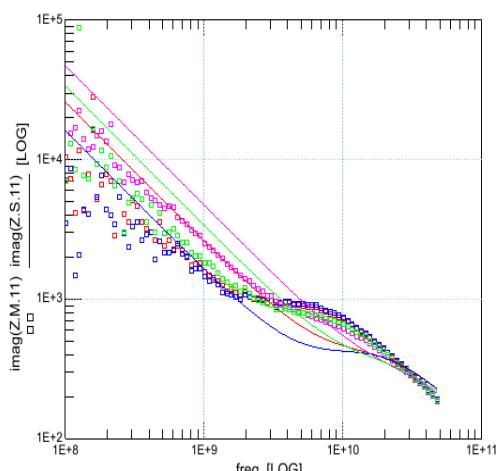
real(S11) = f(Vg,Vd)



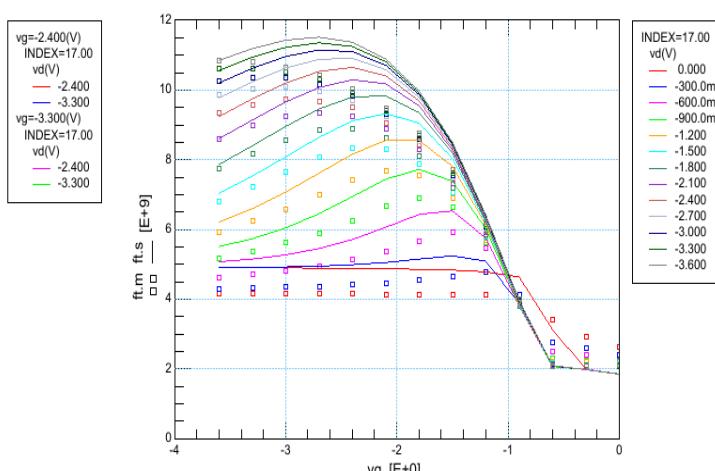
real(S22) = f(Vg,Vd)

im(Y11) divided by ω 

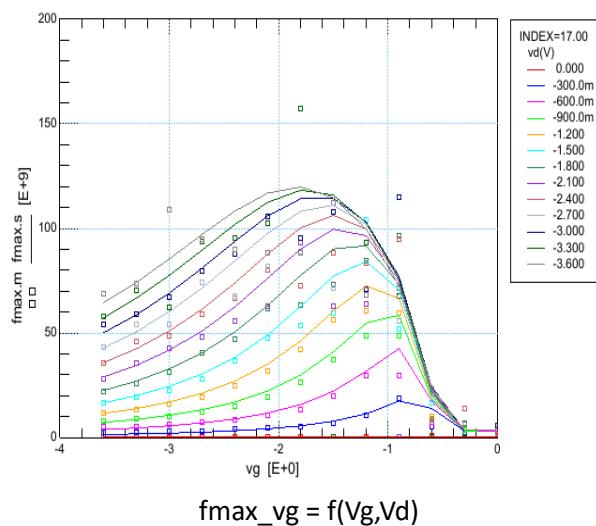
real(Z11) = f(Vg,Vd)



im(Z11) = f(Vg,Vd)



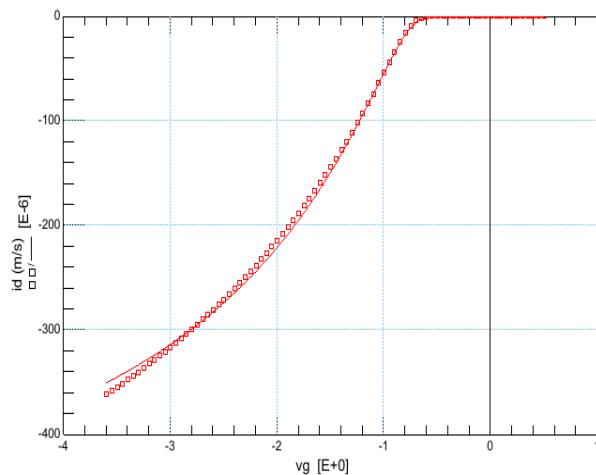
fT_vg = f(Vg,Vd)



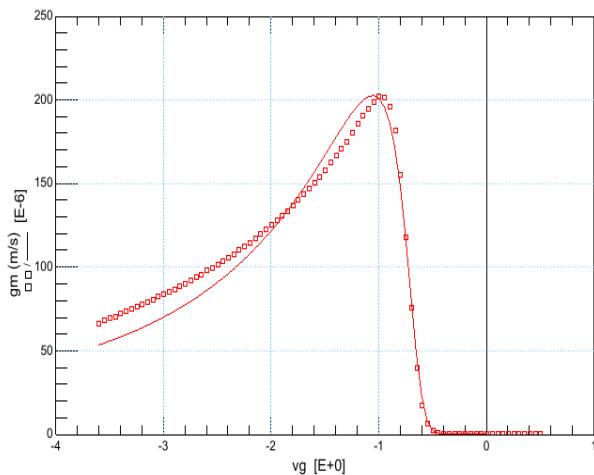
$$f_{max_vg} = f(V_g, V_d)$$

5.4 NF04_WF05u0_L0u5_post_D0

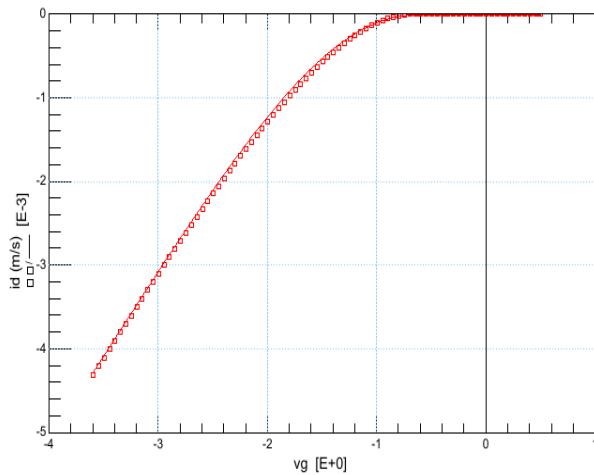
I_d vs V_g , $T = 27^\circ\text{C}$



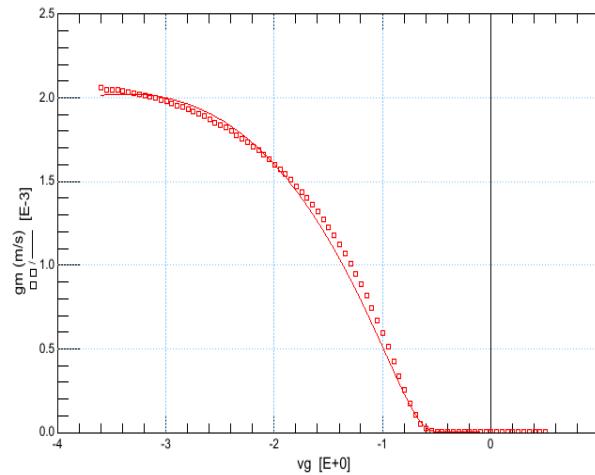
$$I_d = f(V_g) @ V_d = -0.1\text{V}$$



$$g_m = f(V_g) @ V_d = -0.1\text{V}$$

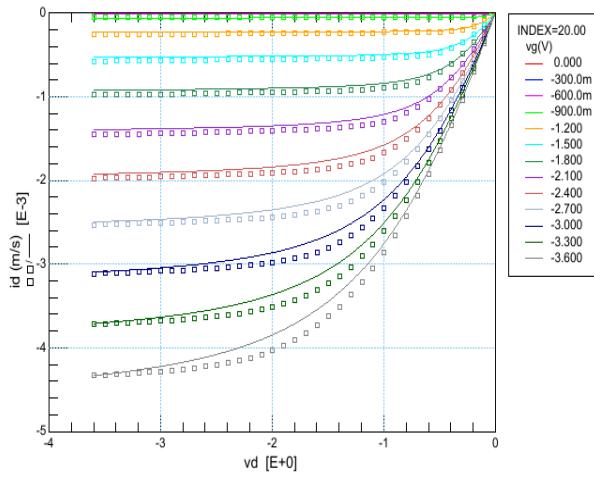


$$Id = f(Vg) @ Vd = -3.3V$$

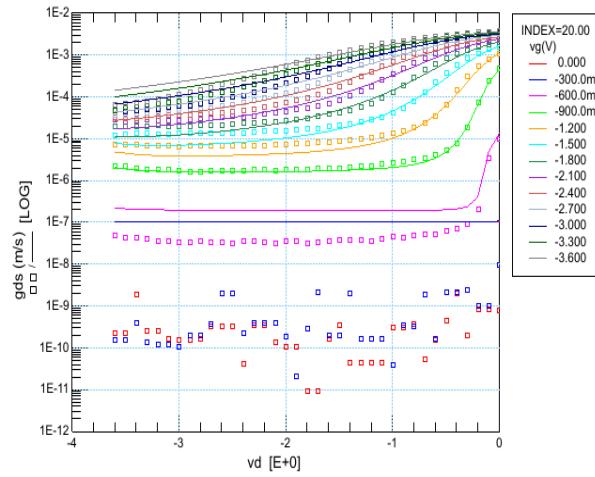


$$gm = f(Vg) @ Vd = -3.3V$$

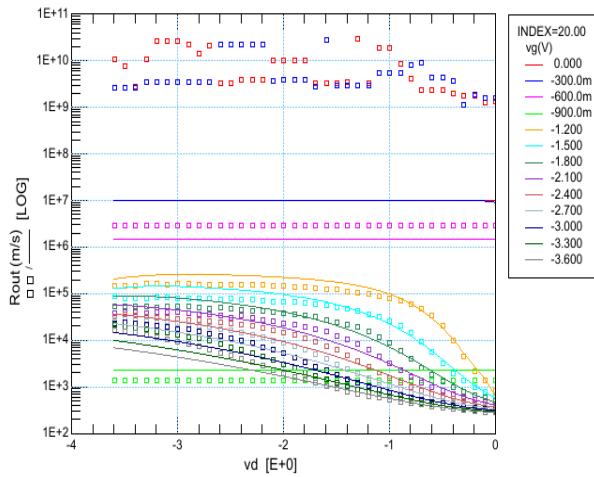
IdVd, T = 27°C



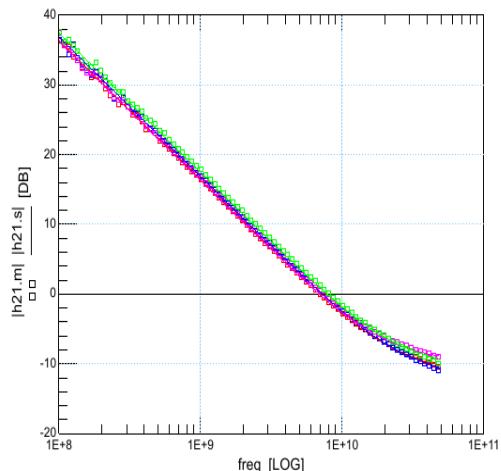
$$Id = f(Vd)$$



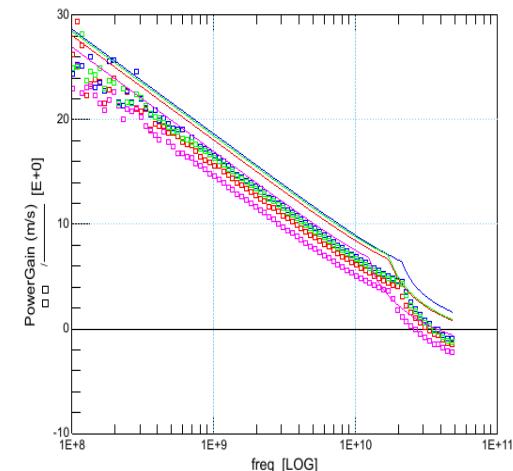
$$gds = f(Vd)$$



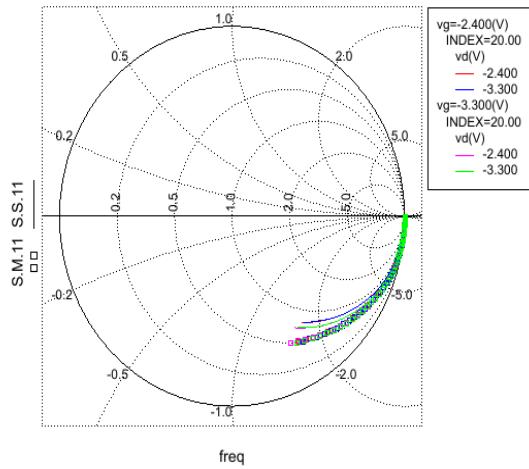
$$Rout = f(Vd)$$

S-Parameter, T = 27°C

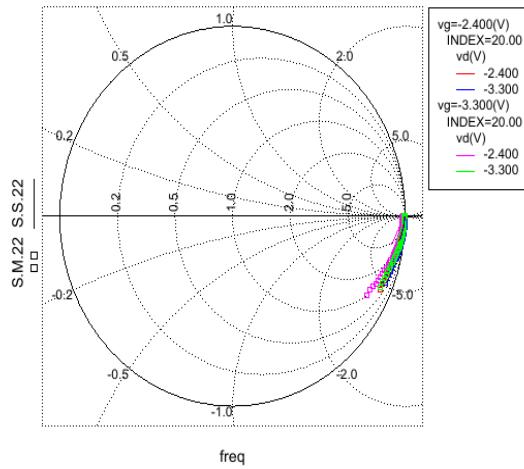
$$|h_{21}| = f(V_g, V_d)$$



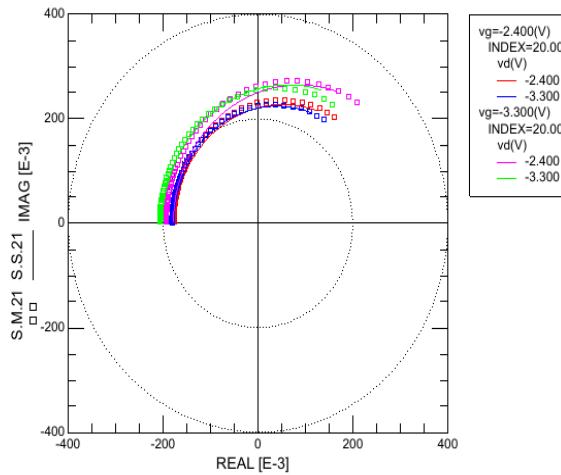
$$\text{MSG/MAG} = f(V_g, V_d)$$



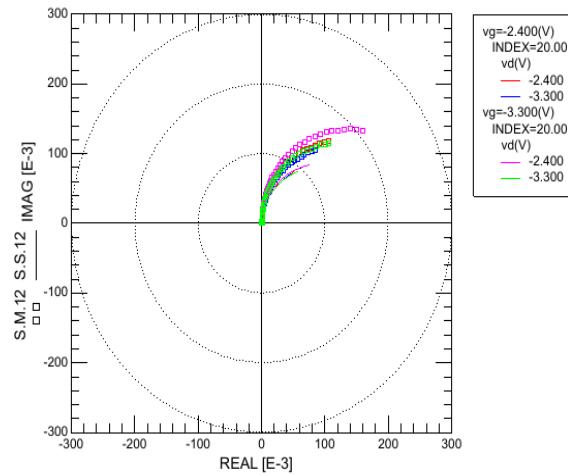
$$S_{11} = f(V_g, V_d)$$



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

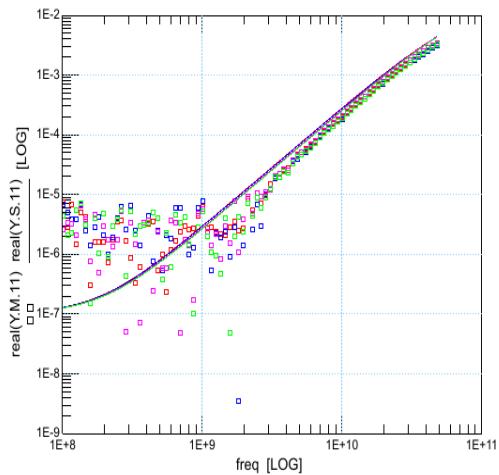


$$S_{21} = f(V_g, V_d)$$

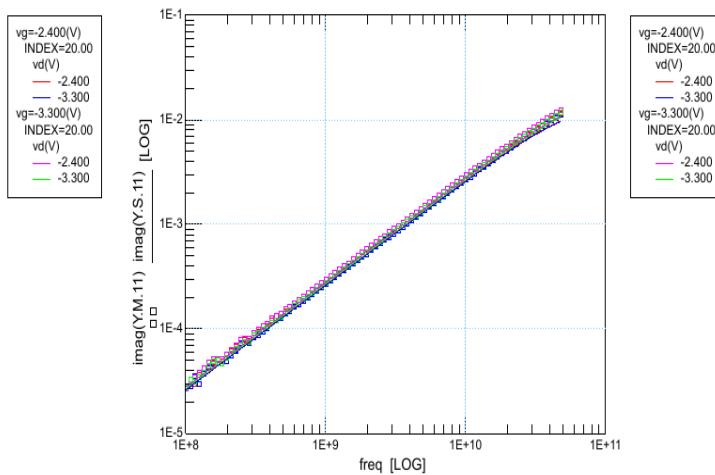


$$S_{12} = f(V_g, V_d)$$

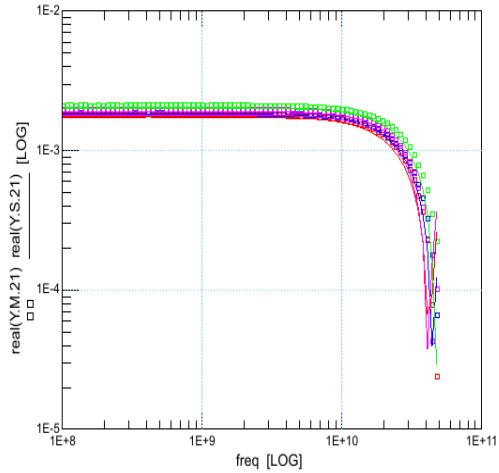
Y-Parameter, T = 27°C



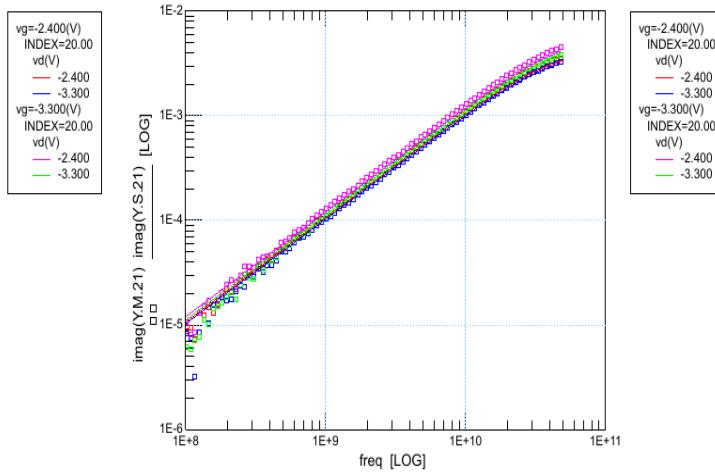
$$\text{re}(Y11) = f(Vg, Vd)$$



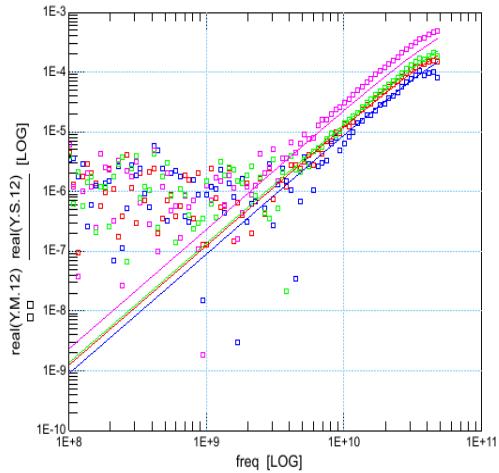
$$\text{im}(Y11) = f(Vg, Vd)$$



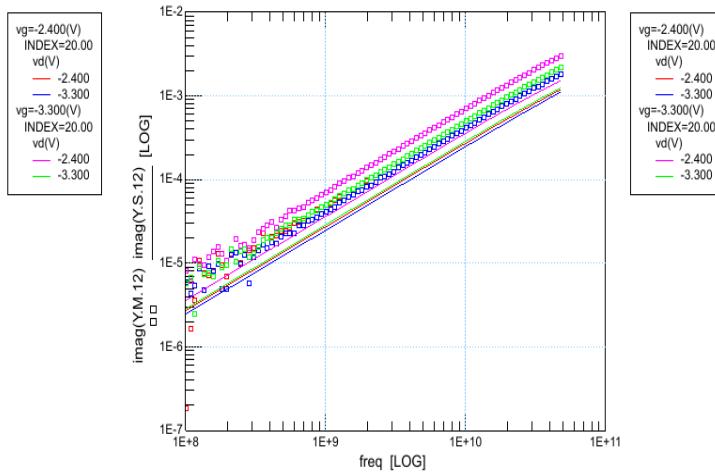
$$\text{re}(Y21) = f(Vg, Vd)$$



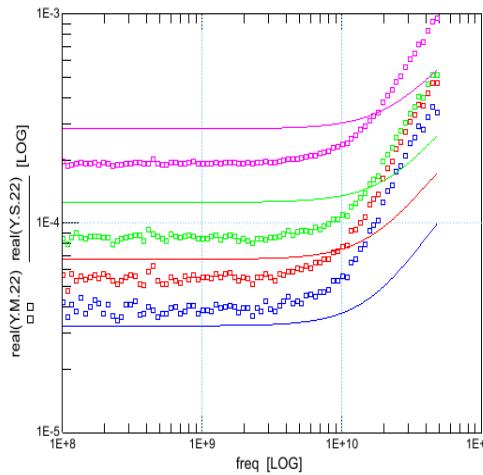
$$\text{im}(Y21) = f(Vg, Vd)$$



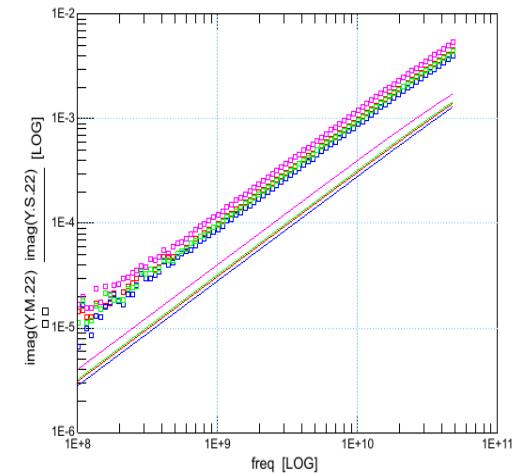
$$\text{re}(Y12) = f(Vg, Vd)$$



$$\text{im}(Y12) = f(Vg, Vd)$$

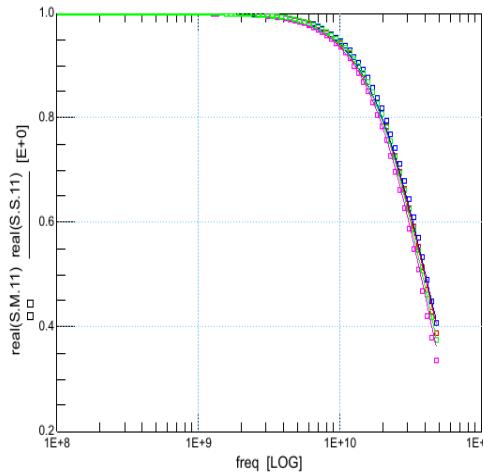


$$\text{re}(Y_{22}) = f(V_g, V_d)$$

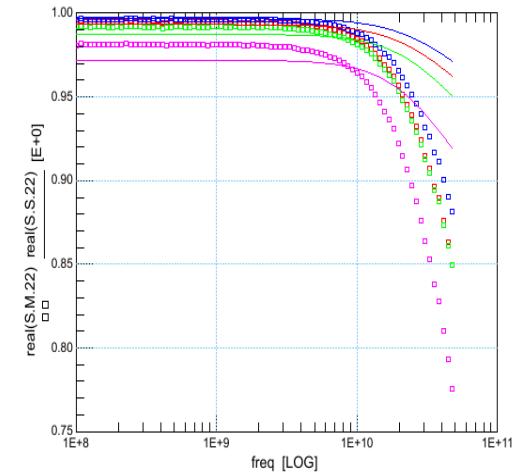


$$\text{im}(Y_{22}) = f(V_g, V_d)$$

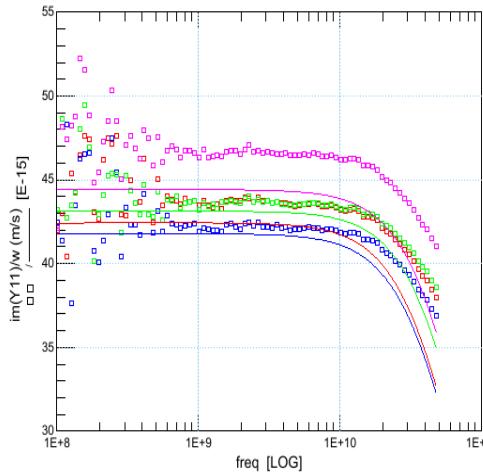
Verify Plots, $T = 27^\circ\text{C}$



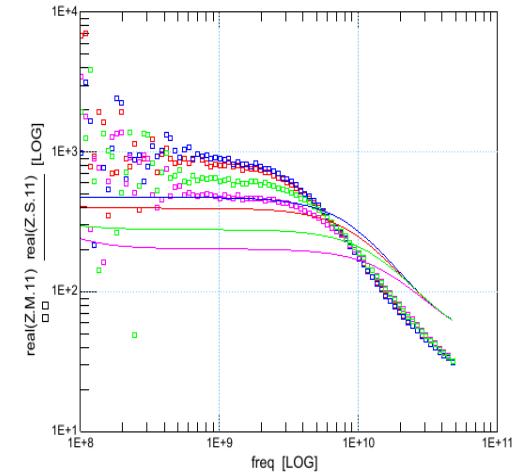
$$\text{re}(S_{11}) = f(V_g, V_d)$$



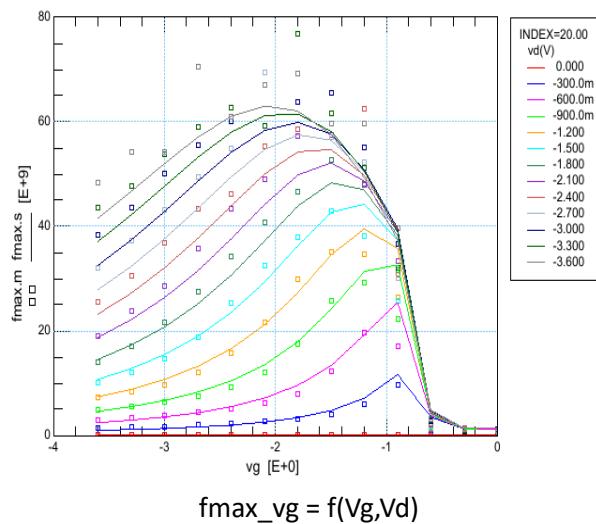
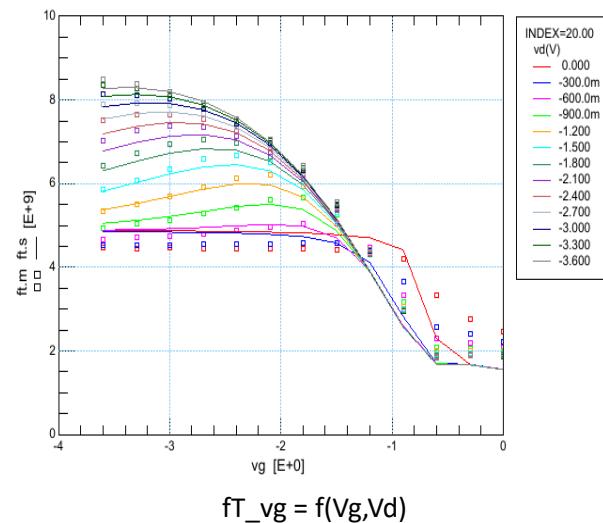
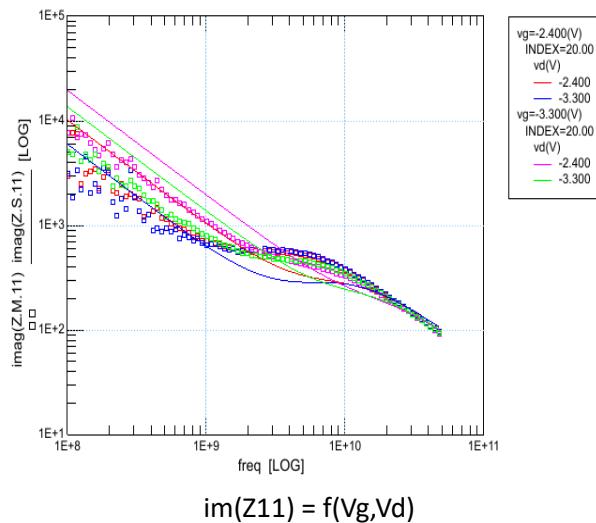
$$\text{re}(S_{22}) = f(V_g, V_d)$$

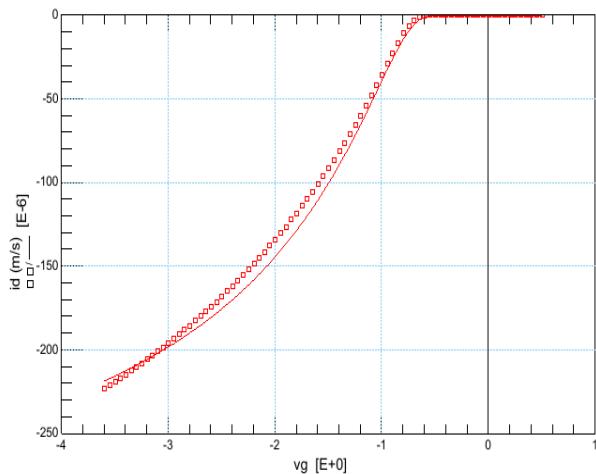


$$\text{im}(Y_{11}) \text{ divided by } \omega$$

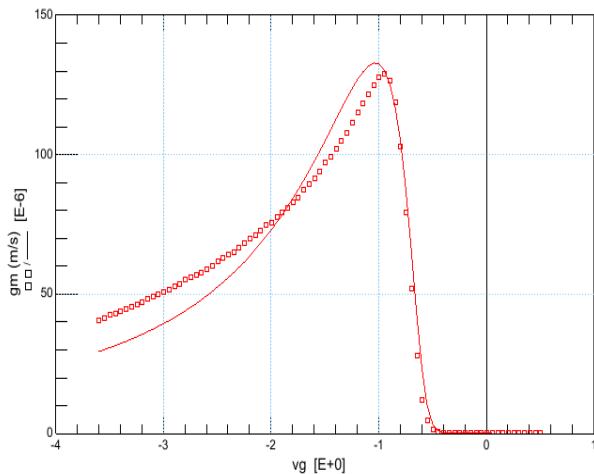


$$\text{re}(Z_{11}) = f(V_g, V_d)$$

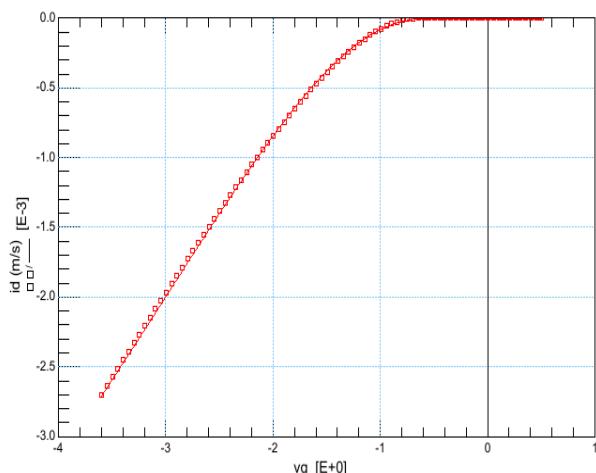


5.5 NF01_WF10u0_L0u4_S453A_D5**IdVg, T = 27°C**

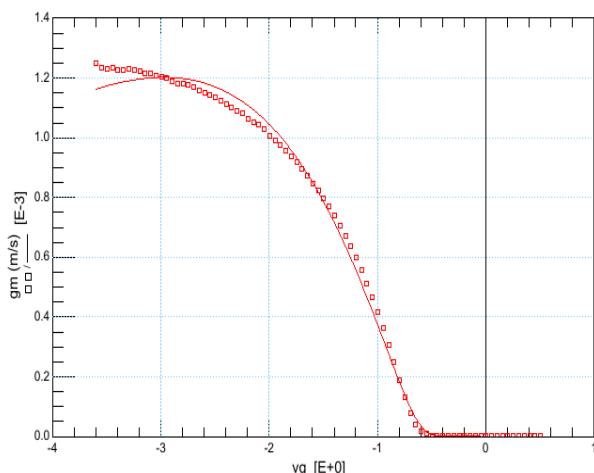
$$Id = f(Vg) \text{ @ } Vd = -0.1V$$



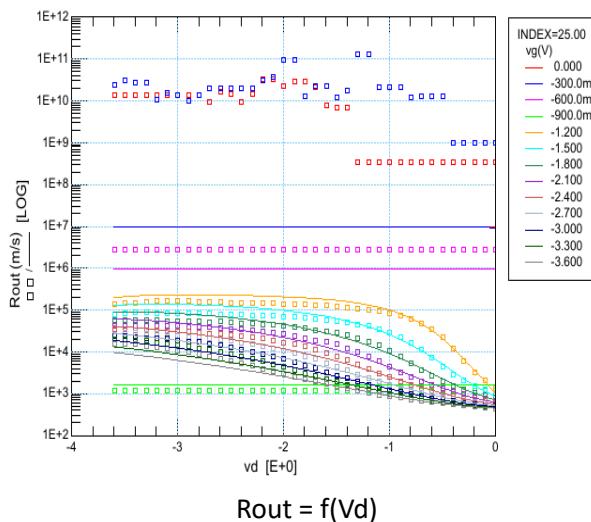
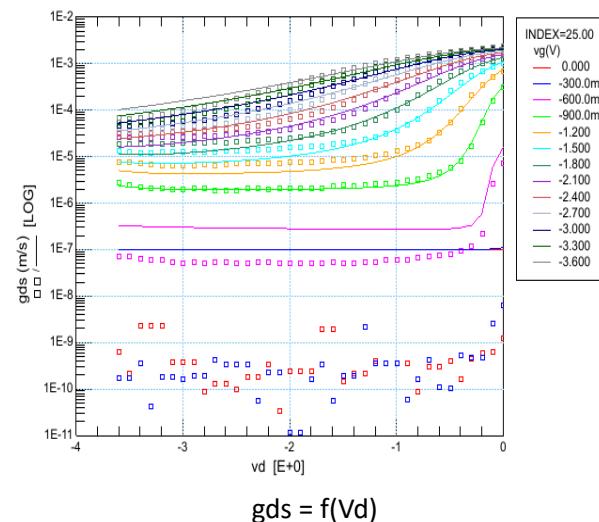
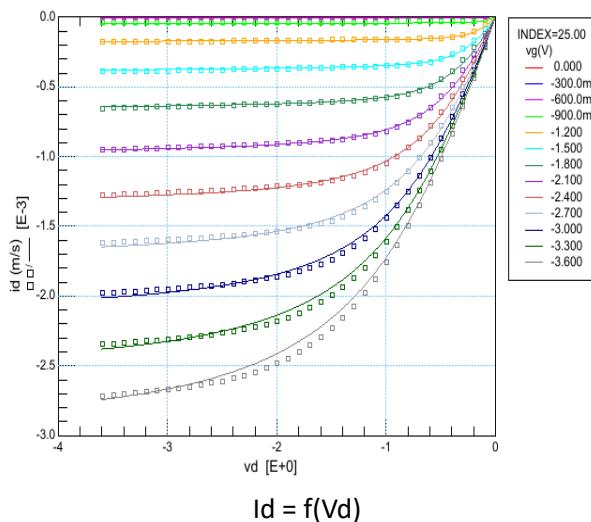
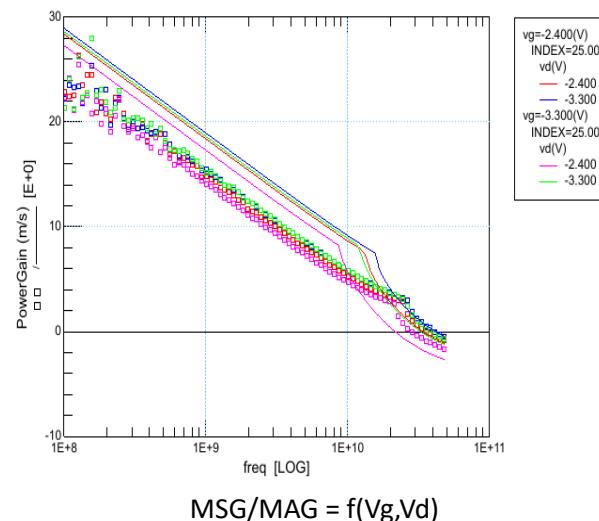
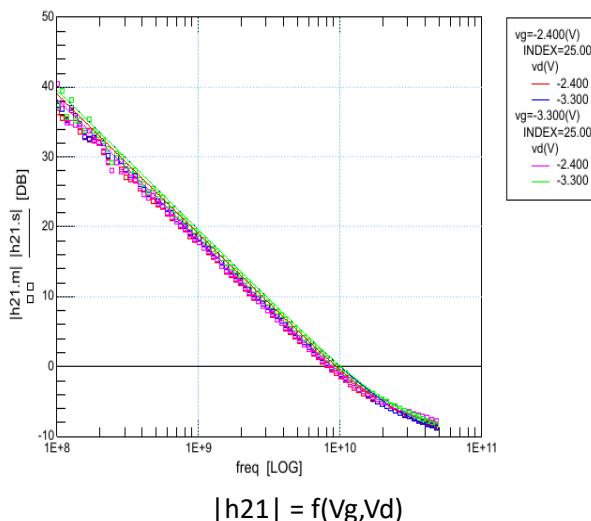
$$gm = f(Vg) \text{ @ } Vd = -0.1V$$

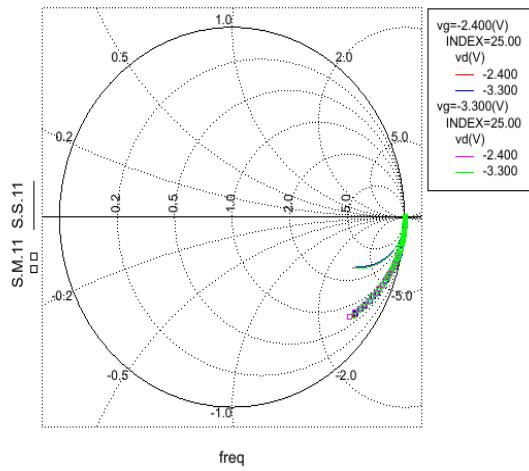
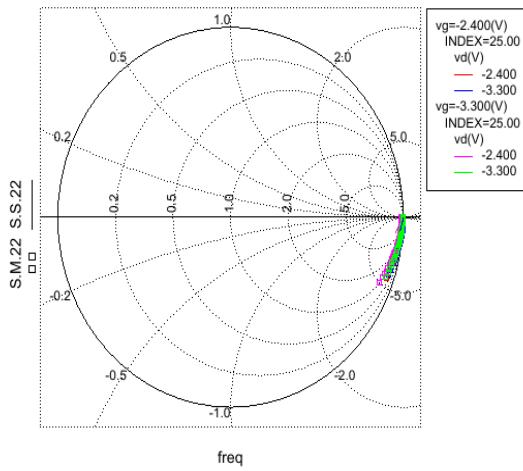
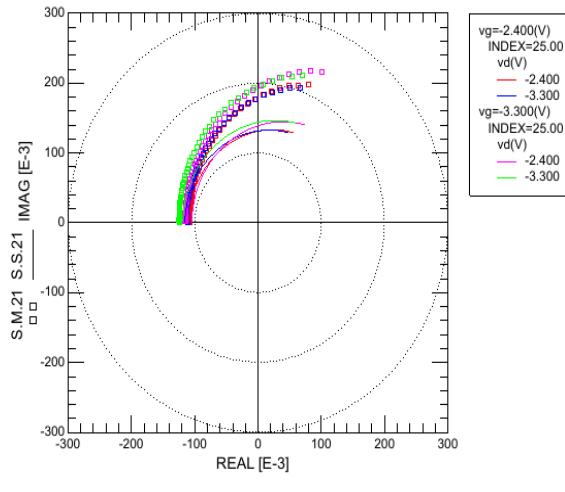
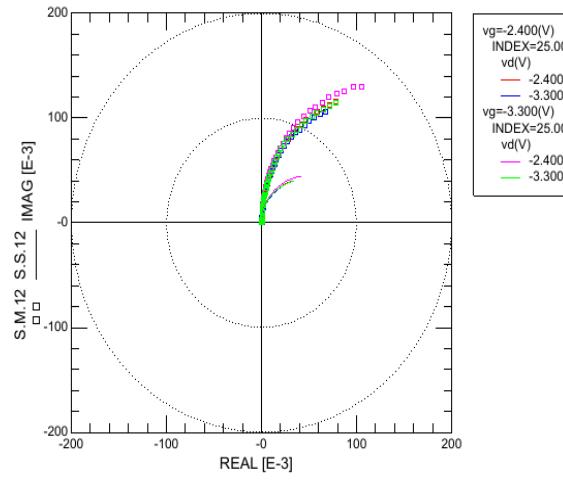


$$Id = f(Vg) \text{ @ } Vd = -3.3V$$

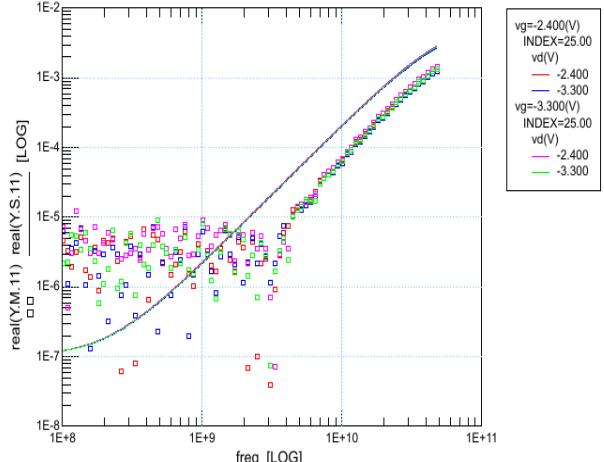
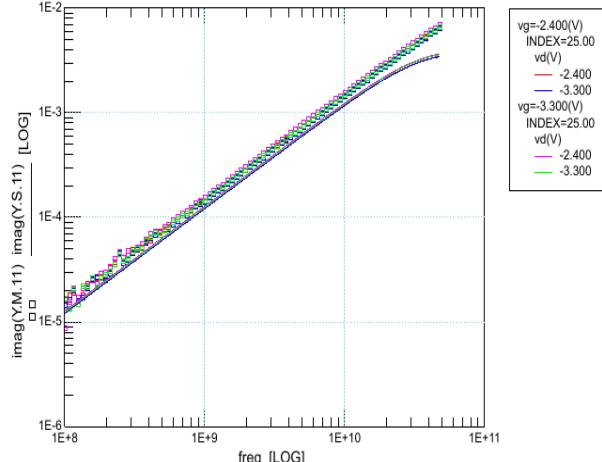


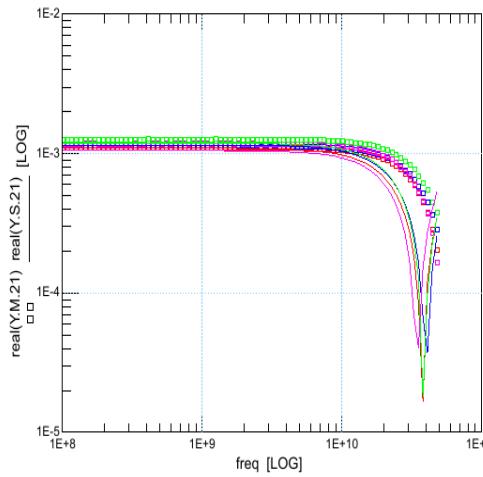
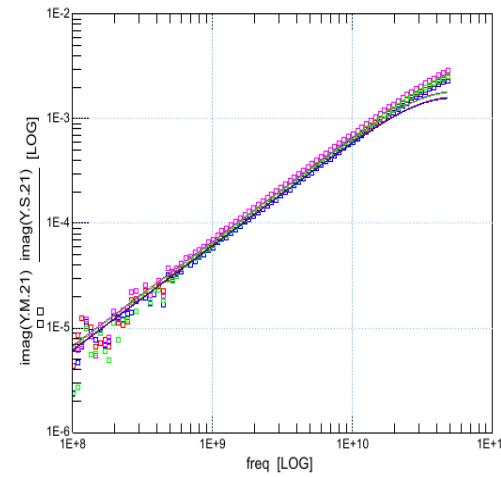
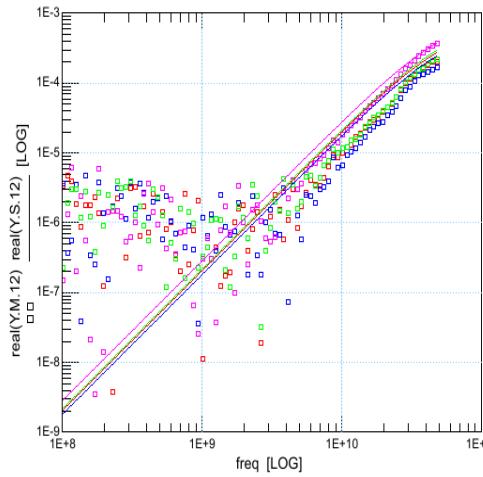
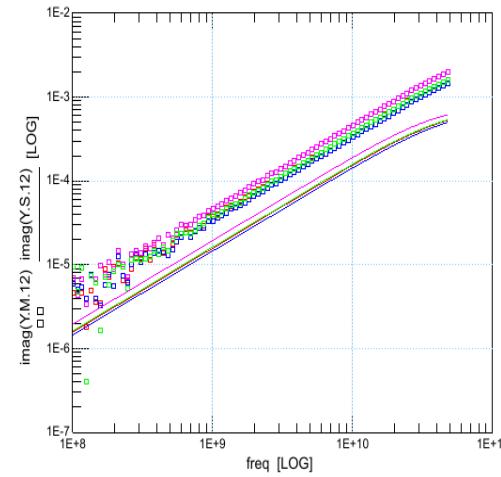
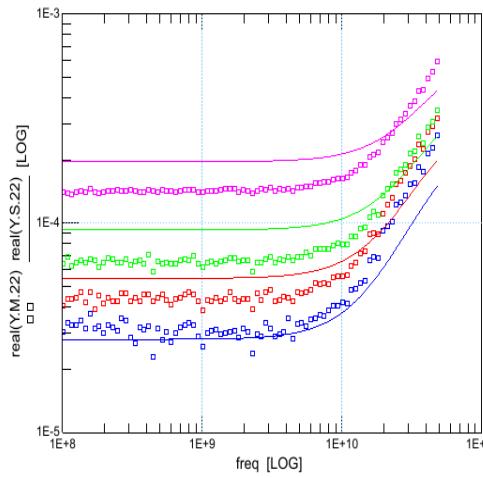
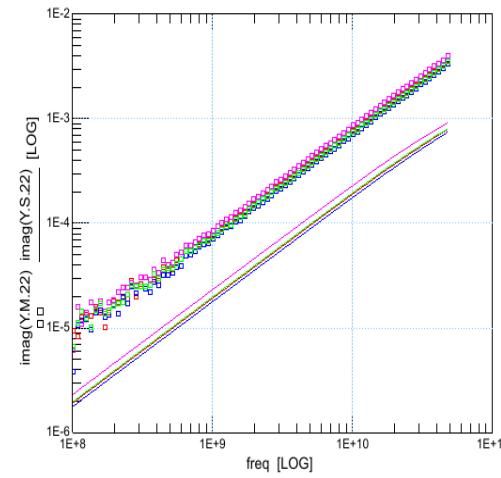
$$gm = f(Vg) \text{ @ } Vd = -3.3V$$

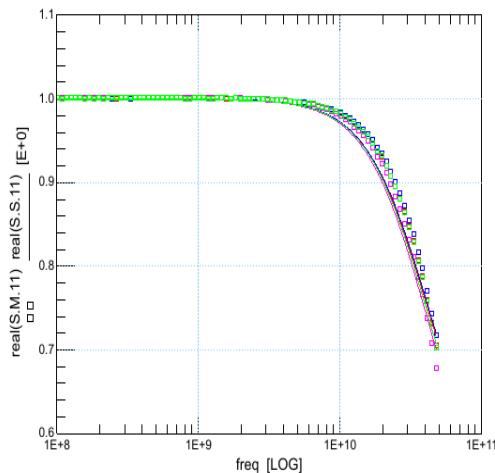
IdVd, T = 27°C

S-Parameter, T = 27°C


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

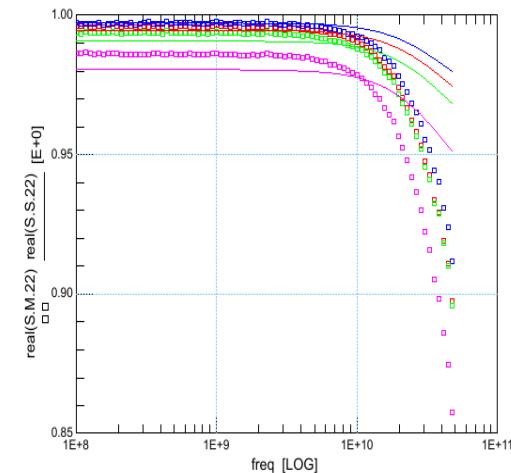
Y-Parameter, $T = 27^\circ\text{C}$

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

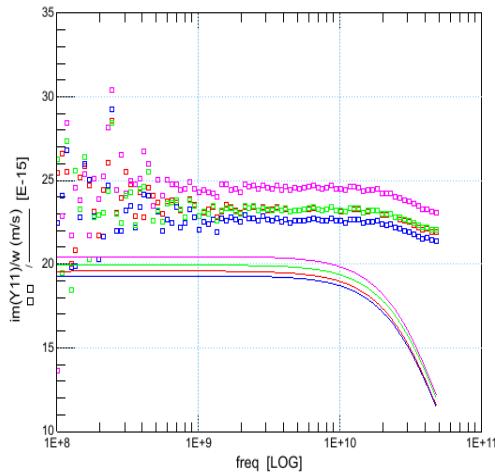
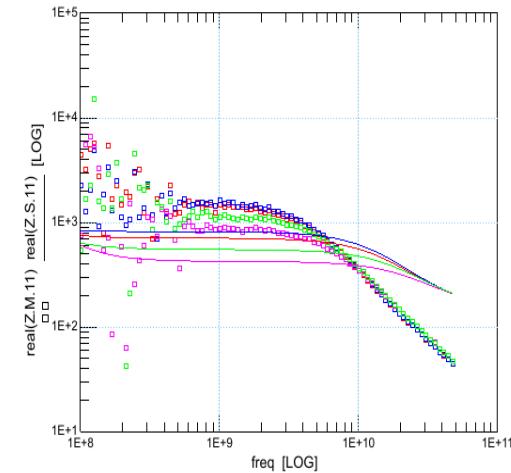
re(γ_{21}) = f(Vg,Vd)im(γ_{21}) = f(Vg,Vd)re(γ_{12}) = f(Vg,Vd)im(γ_{12}) = f(Vg,Vd)re(γ_{22}) = f(Vg,Vd)im(γ_{22}) = f(Vg,Vd)

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

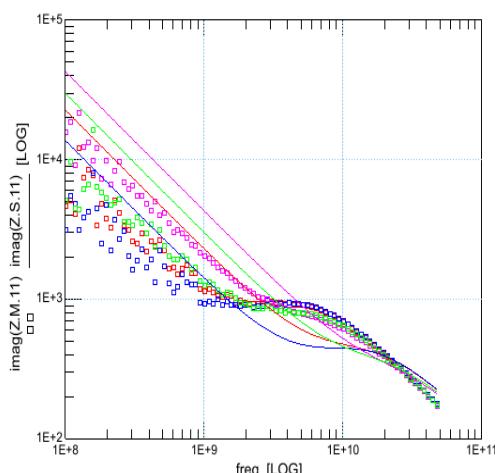
re(S11) = f(Vg, Vd)



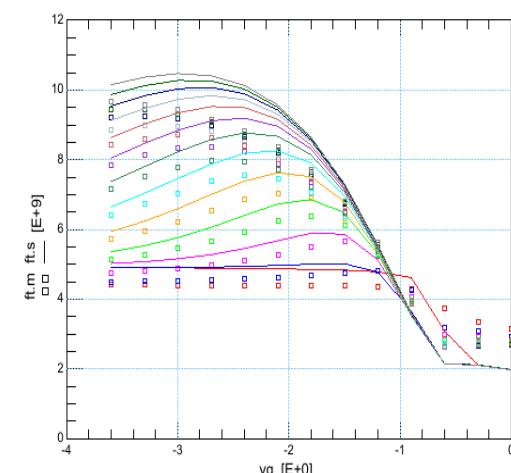
re(S22) = f(Vg, Vd)

im(Y11) divided by ω 

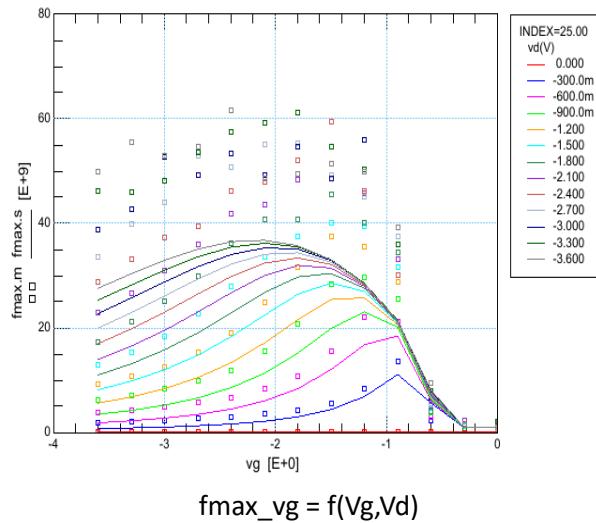
re(Z11) = f(Vg, Vd)



im(Z11) = f(Vg, Vd)

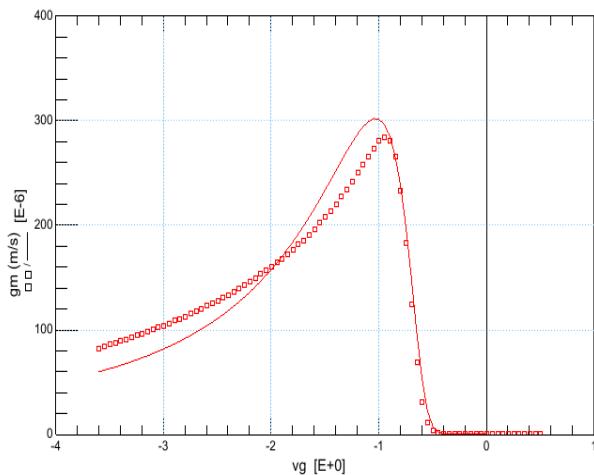
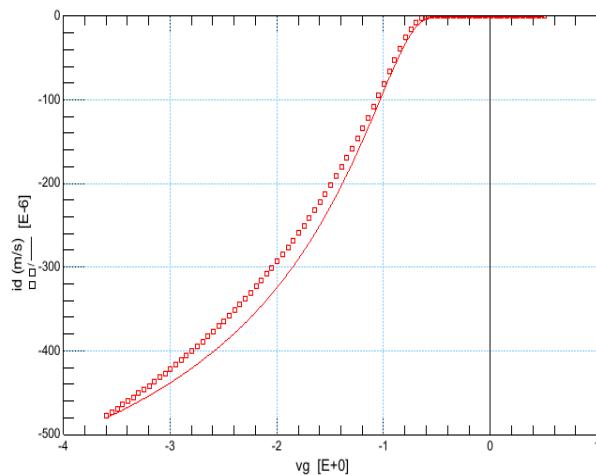


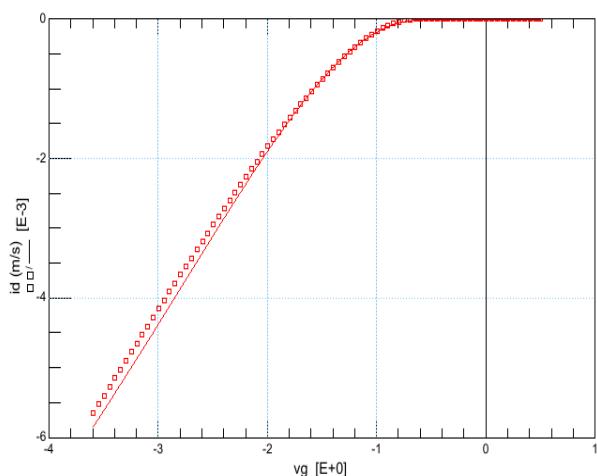
fT_vg = f(Vg, Vd)



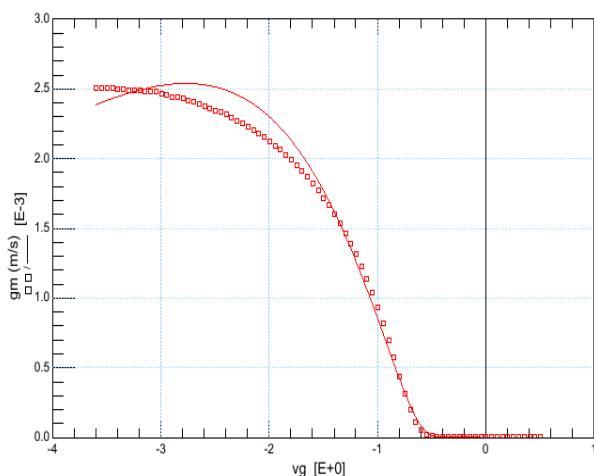
5.6 NF08_WF02u5_L0u4_S453A_D3

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



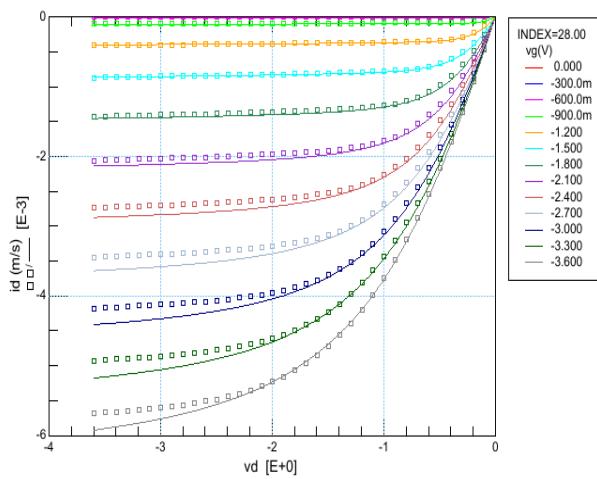


Id = f(Vg) @ Vd = -3.3V

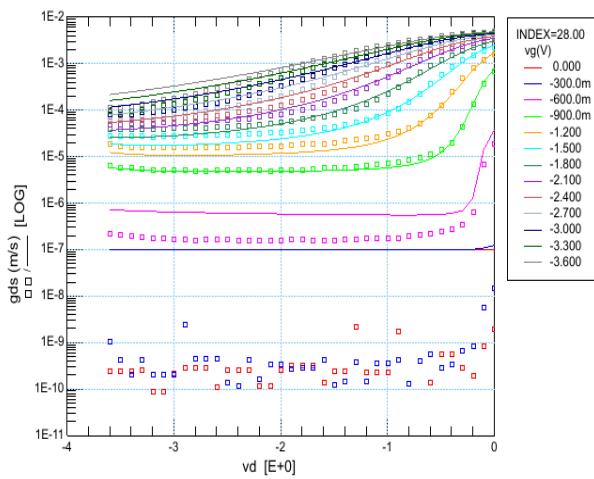


gm = f(Vg) @ Vd = -3.3V

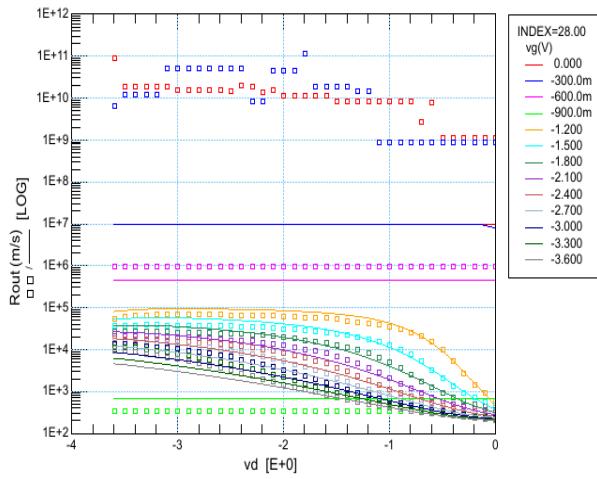
IdVd, T = 27°C



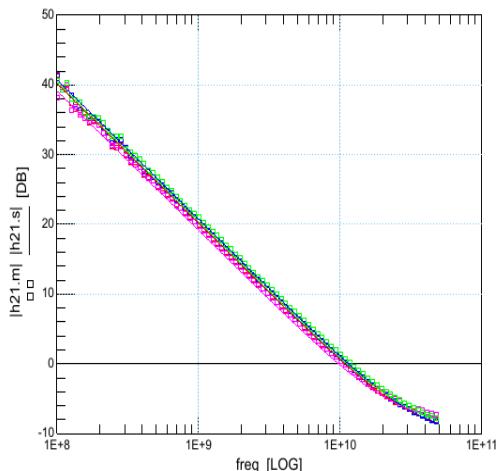
Id = f(Vd)



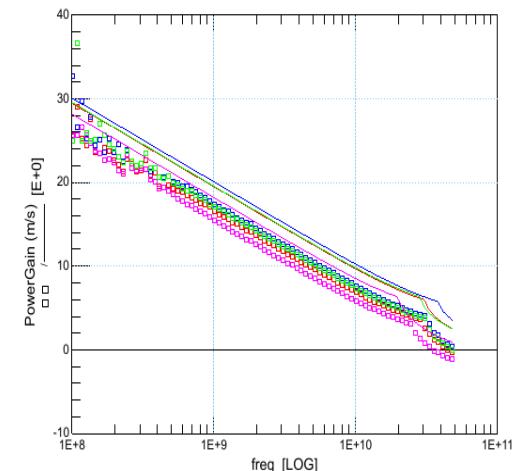
gds = f(Vd)



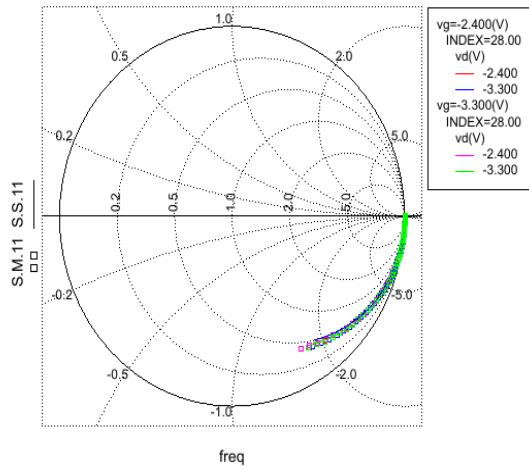
Rout = f(Vd)

S-Parameter, T = 27°C

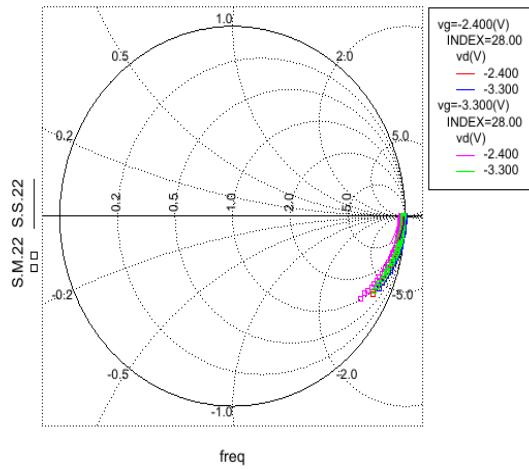
$$|h21| = f(Vg, Vd)$$



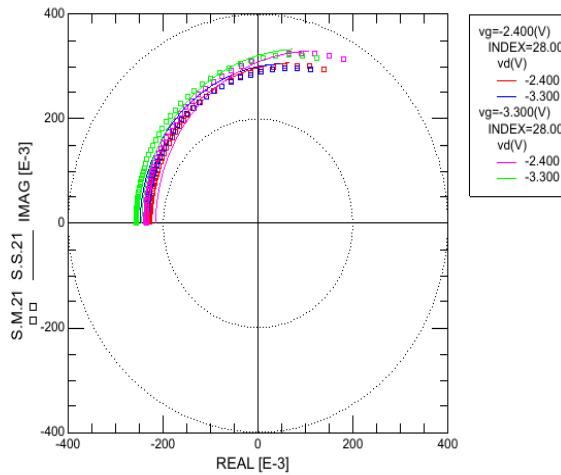
$$MSG/MAG = f(Vg, Vd)$$



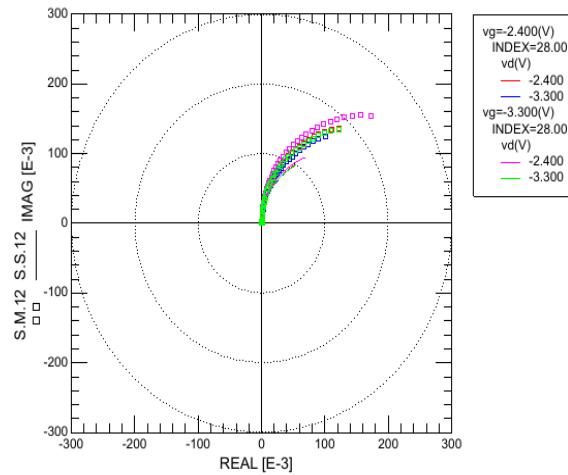
$$S11 = f(Vg, Vd)$$



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

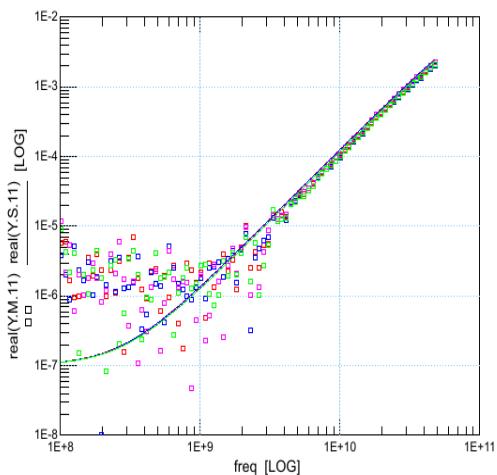


$$S21 = f(Vg, Vd)$$

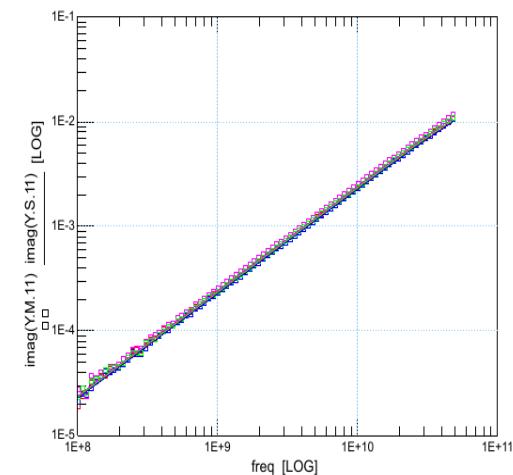


$$S12 = f(Vg, Vd)$$

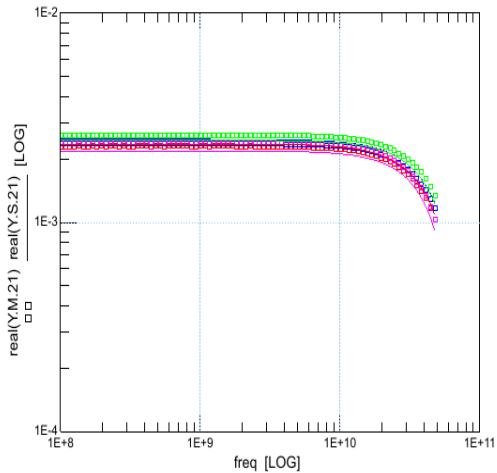
Y-Parameter, T = 27°C



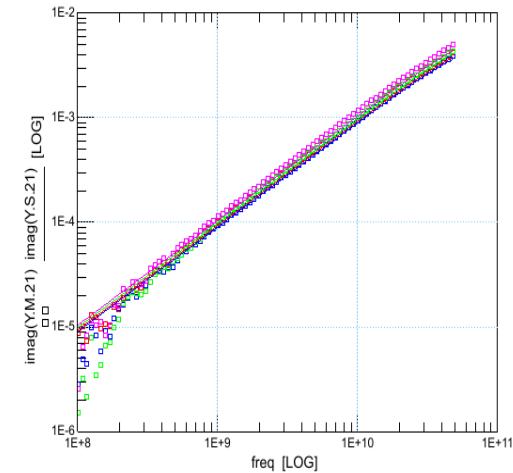
$$\text{re}(Y_{11}) = f(V_g, V_d)$$



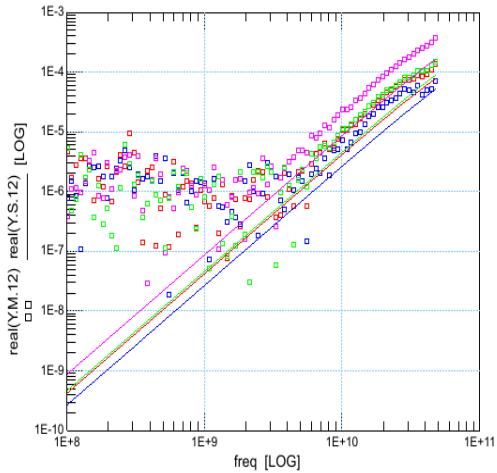
$$\text{im}(Y_{11}) = f(V_g, V_d)$$



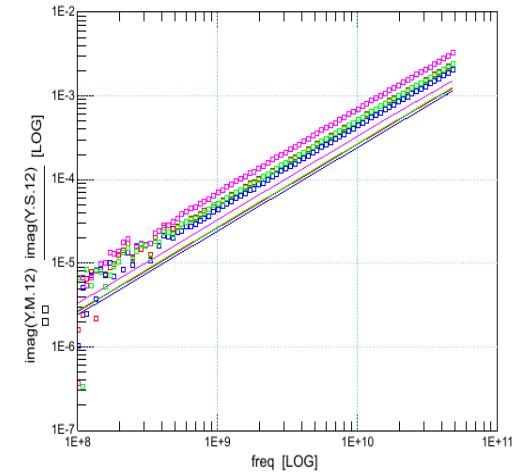
$$\text{re}(Y_{21}) = f(V_g, V_d)$$



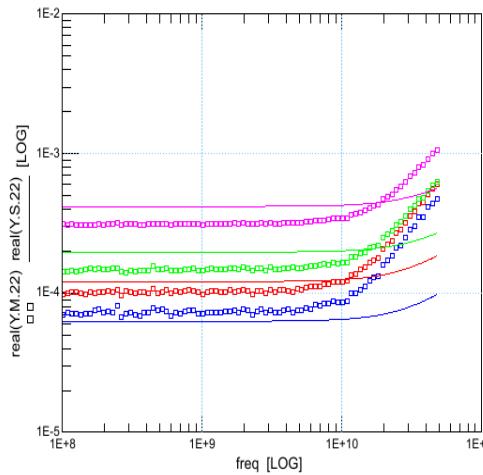
$$\text{im}(Y_{21}) = f(V_g, V_d)$$



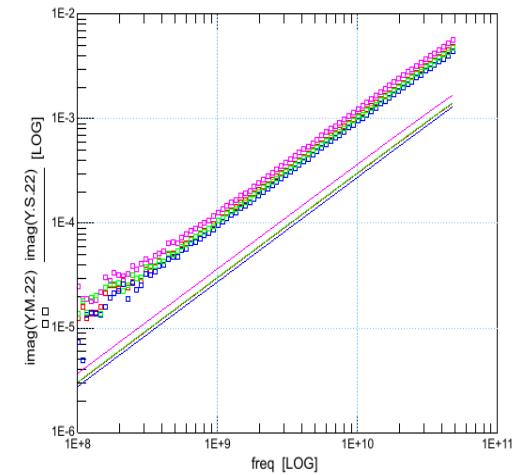
$$\text{re}(Y_{12}) = f(V_g, V_d)$$



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

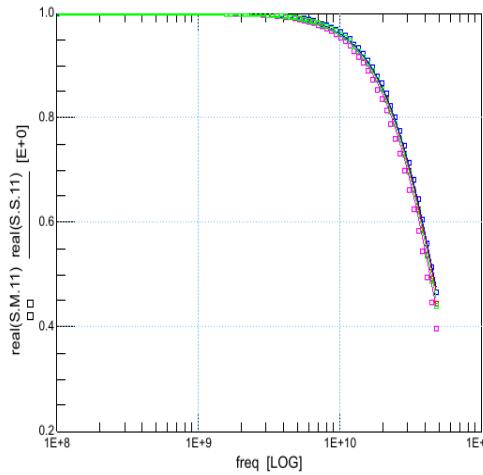


$$\text{re}(Y22) = f(Vg, Vd)$$

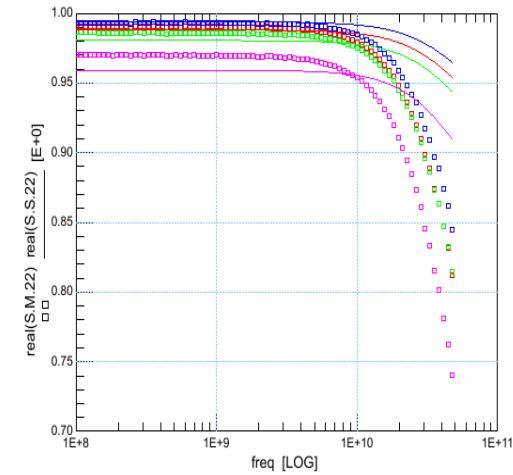


$$\text{im}(Y22) = f(Vg, Vd)$$

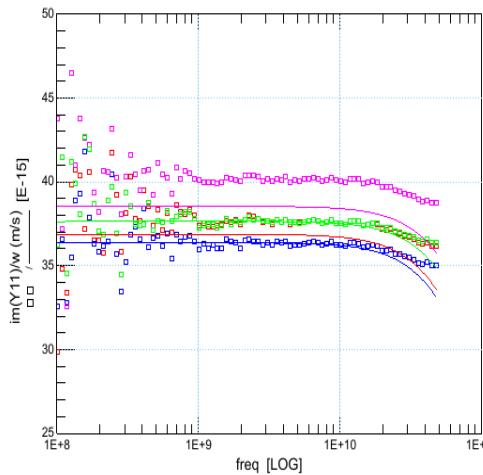
Verify Plots, T = 27°C



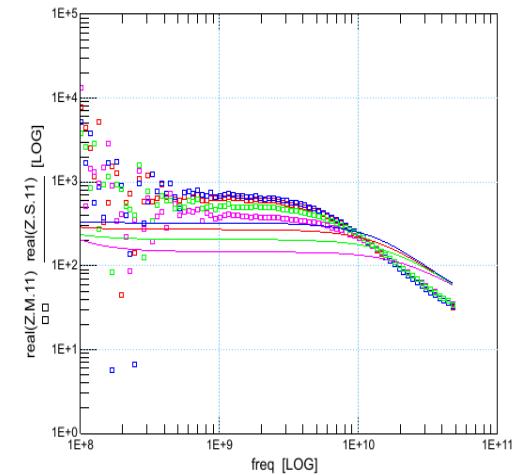
$$\text{re}(S11) = f(Vg, Vd)$$



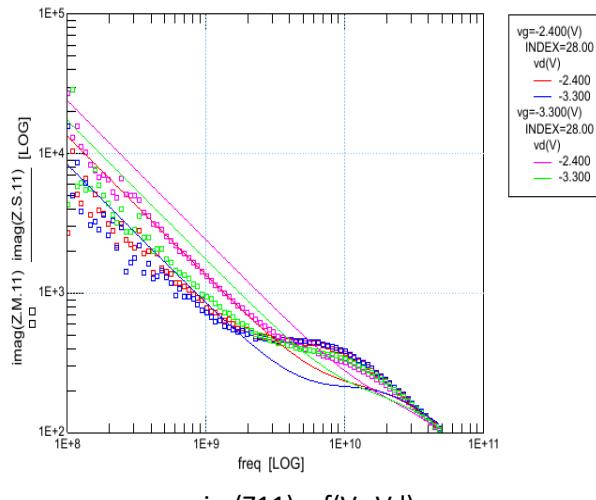
$$\text{re}(S22) = f(Vg, Vd)$$



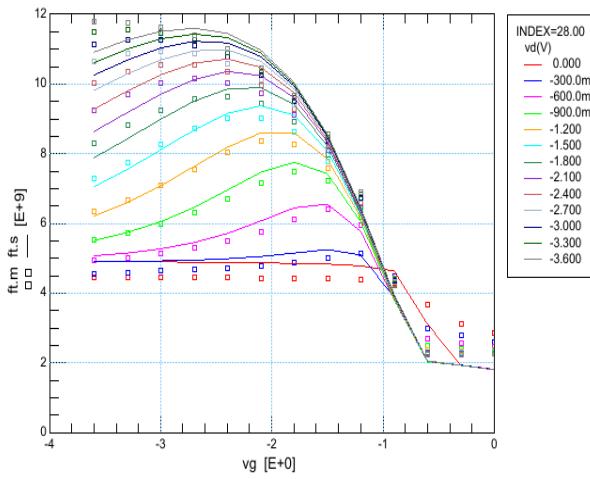
$$\text{im}(Y11) \text{ divided by } \omega$$



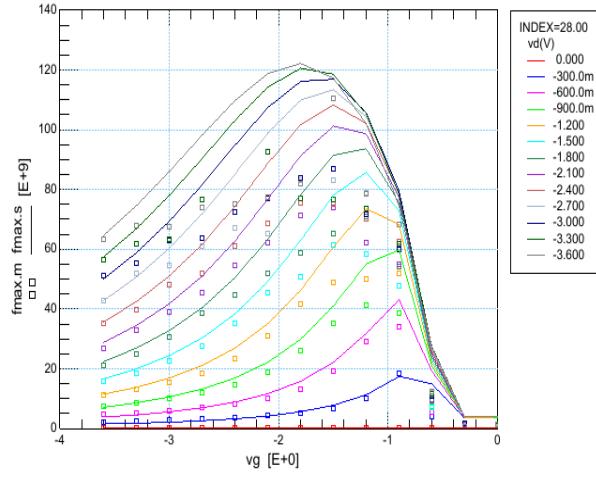
$$\text{re}(Z11) = f(Vg, Vd)$$



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



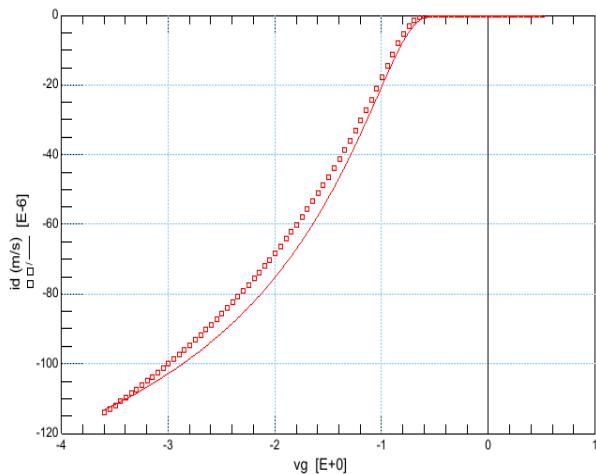
$$f_{T,vg} = f(V_g, V_d)$$



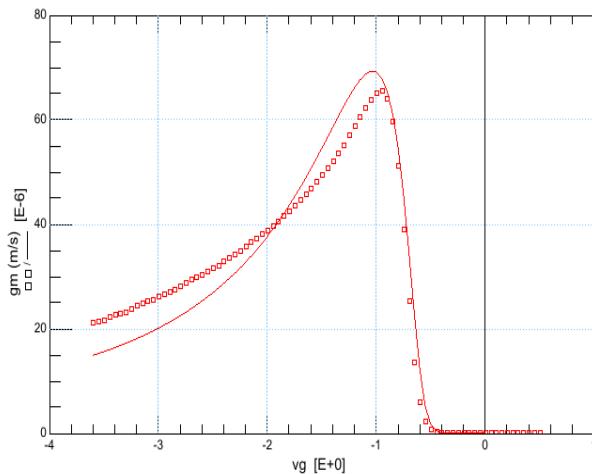
$$f_{\text{max},vg} = f(V_g, V_d)$$

5.7 NF01_WF05u0_L0u4_S453A_E1

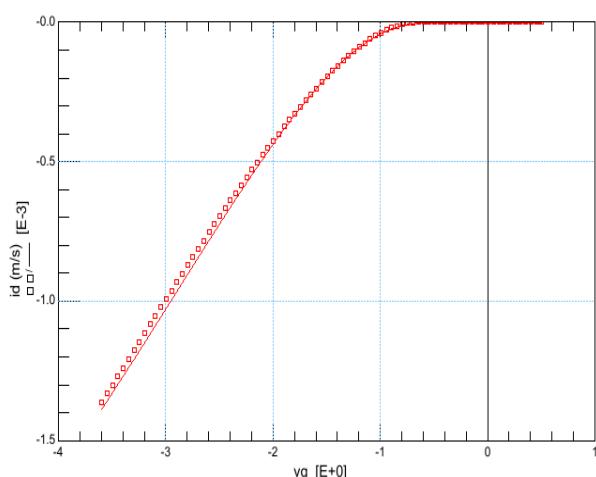
Id , $T = 27^\circ\text{C}$



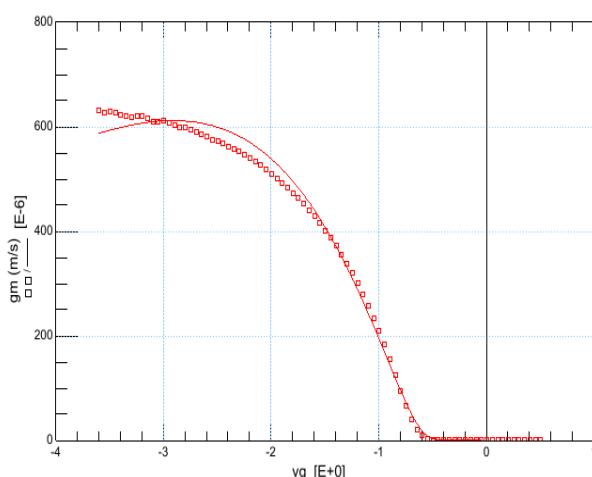
$Id = f(Vg)$ @ $Vd = -0.1\text{V}$



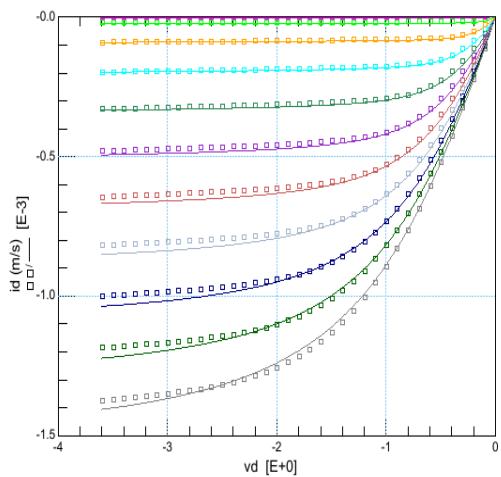
$gm = f(Vg)$ @ $Vd = -0.1\text{V}$



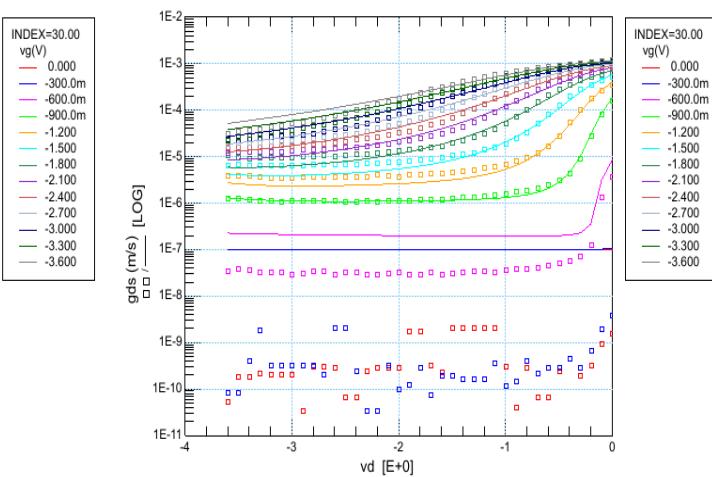
$Id = f(Vg)$ @ $Vd = -3.3\text{V}$



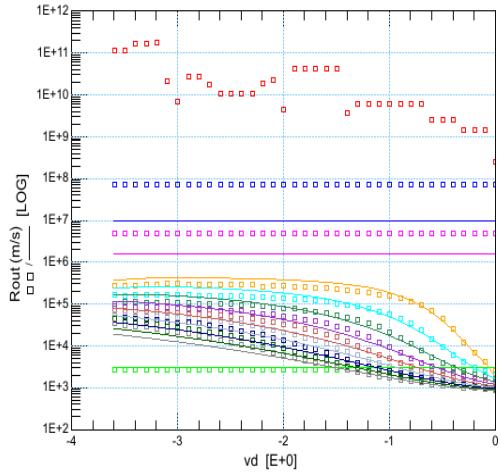
$gm = f(Vg)$ @ $Vd = -3.3\text{V}$

IdVd, T = 27°C

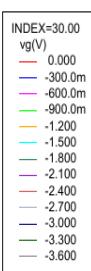
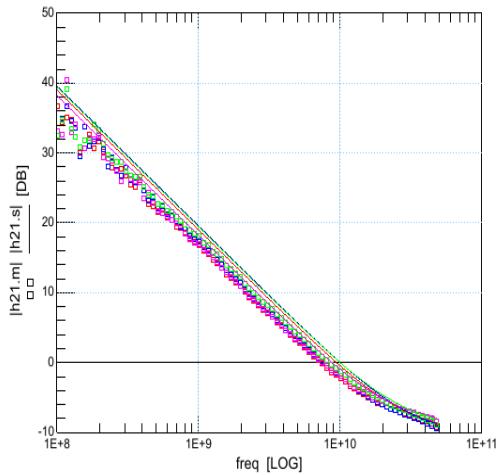
Id = f(Vd)



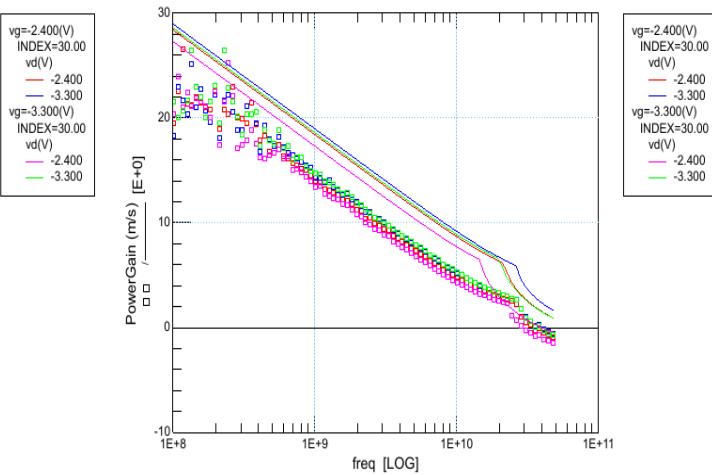
gds = f(Vd)



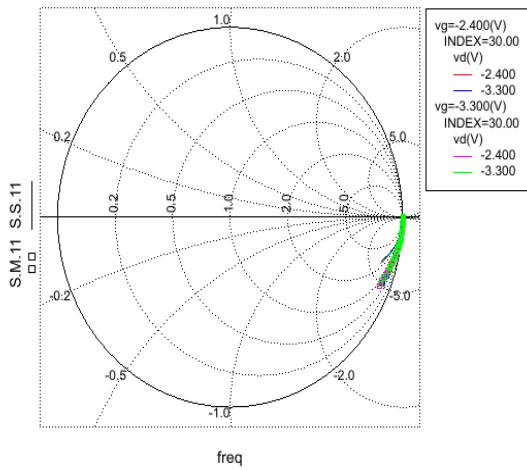
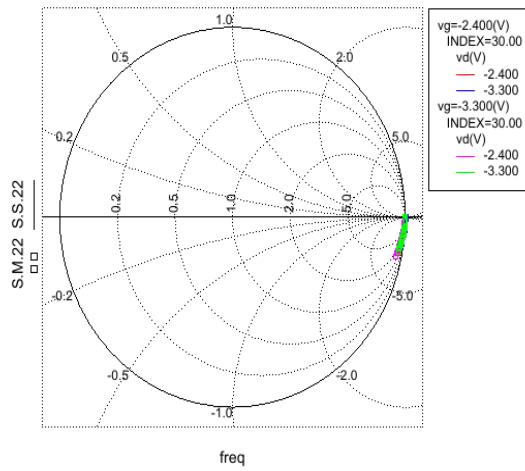
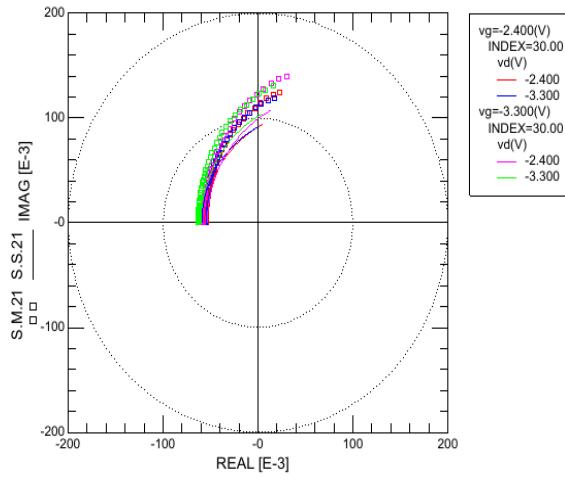
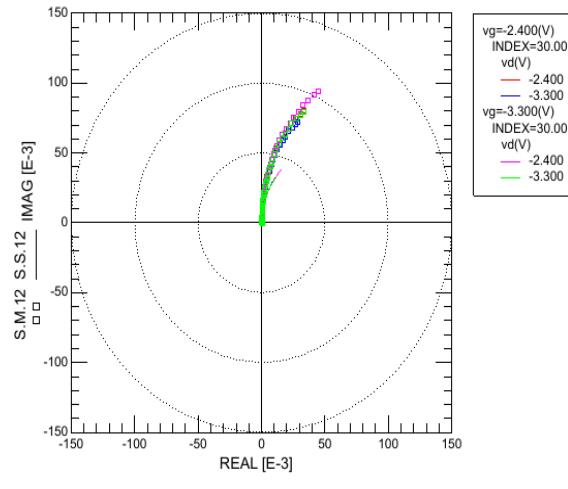
Rout = f(Vd)

**S-Parameter, T = 27°C**

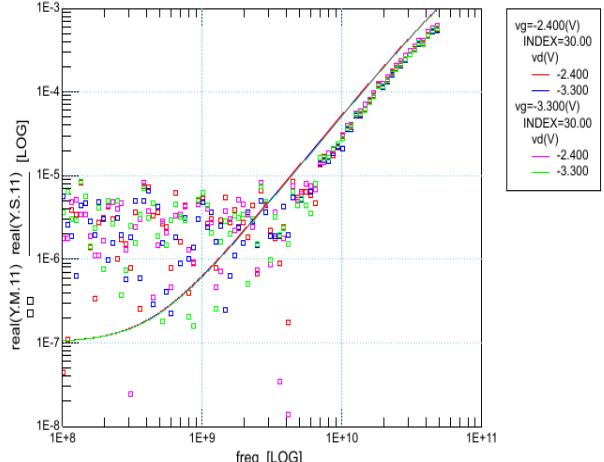
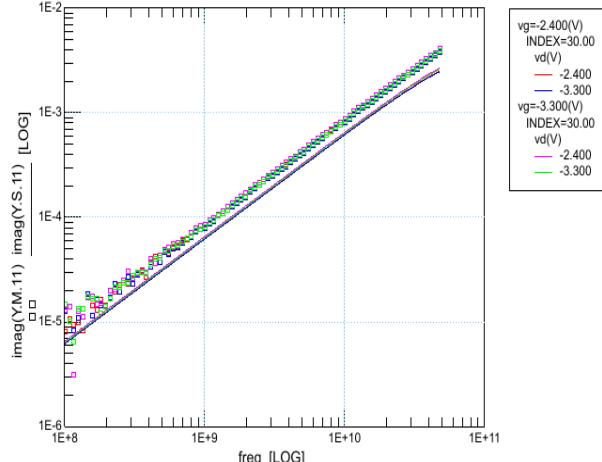
|h21| = f(Vg,Vd)

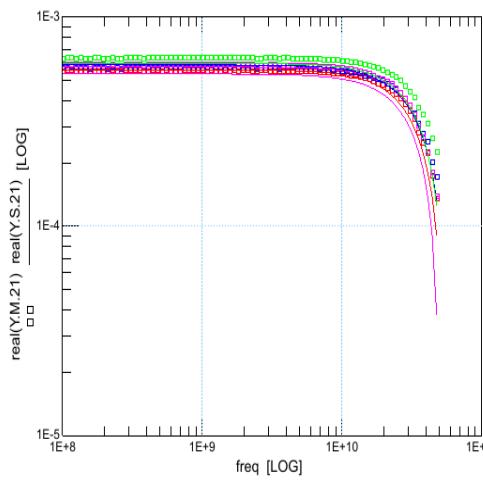
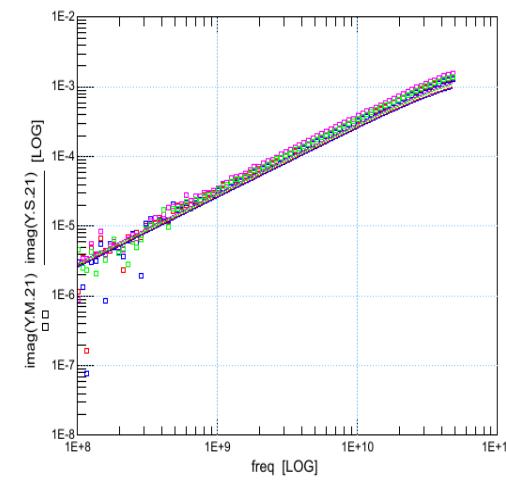
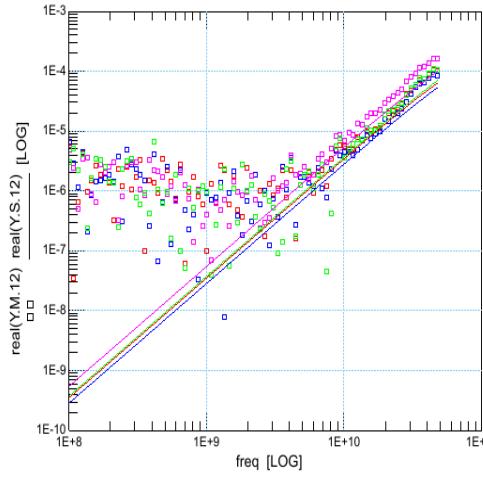
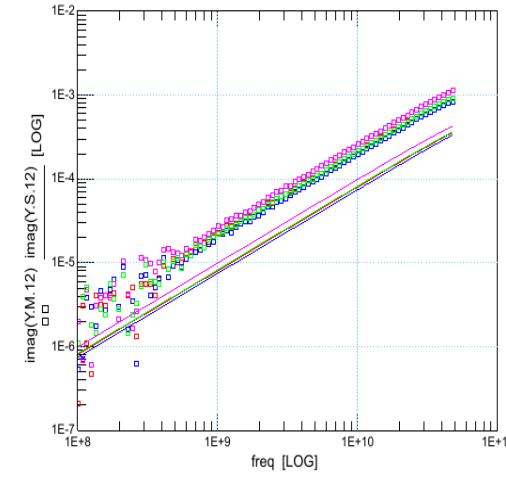
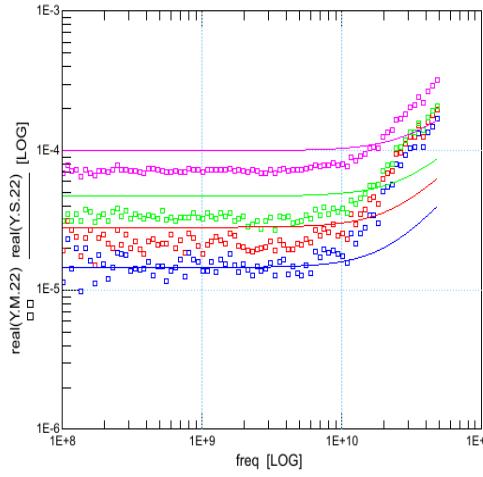
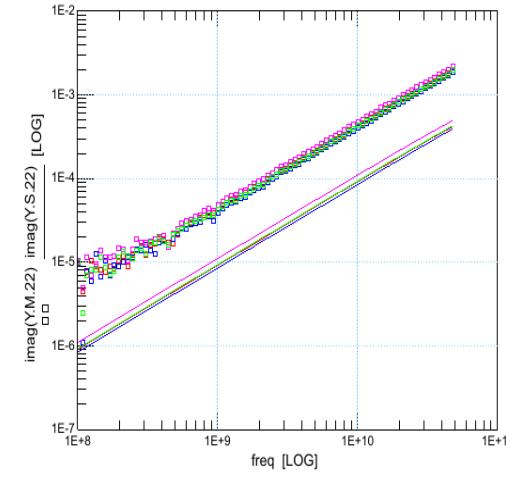


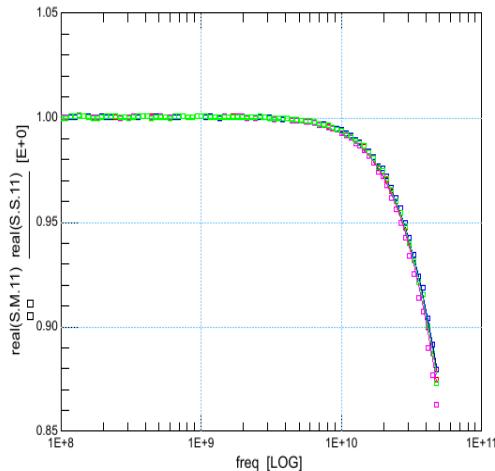
MSG/MAG = f(Vg,Vd)

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

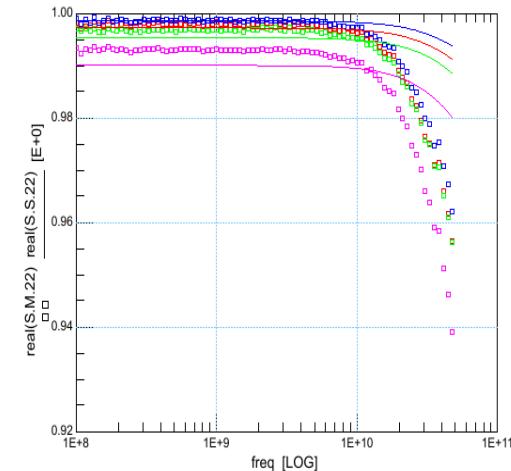
Y-Parameter, T = 27°C

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

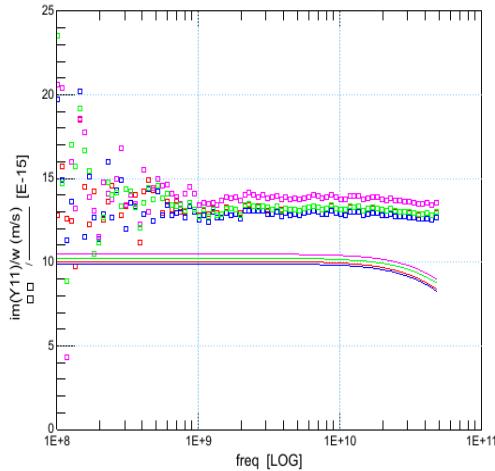
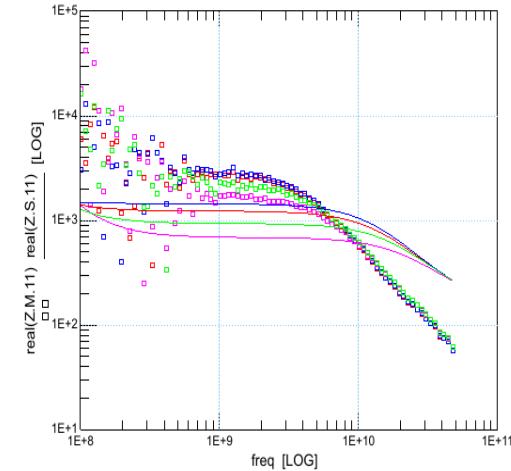
re(Y₂₁) = f(V_g,V_d)im(Y₂₁) = f(V_g,V_d)re(Y₁₂) = f(V_g,V_d)im(Y₁₂) = f(V_g,V_d)re(Y₂₂) = f(V_g,V_d)im(Y₂₂) = f(V_g,V_d)

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

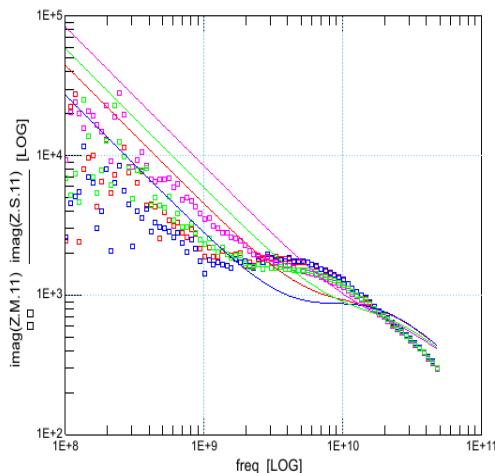
re(S11) = f(Vg, Vd)



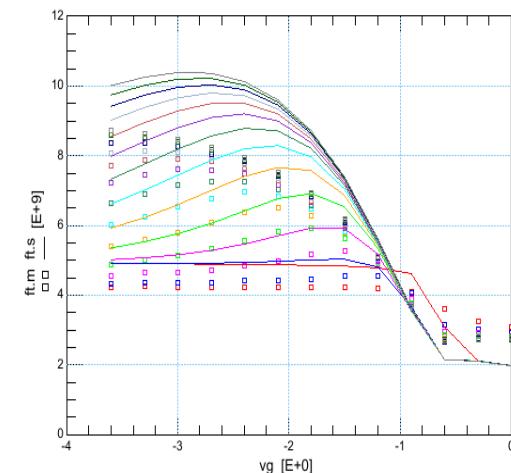
re(S22) = f(Vg, Vd)

im(Y11) divided by ω 

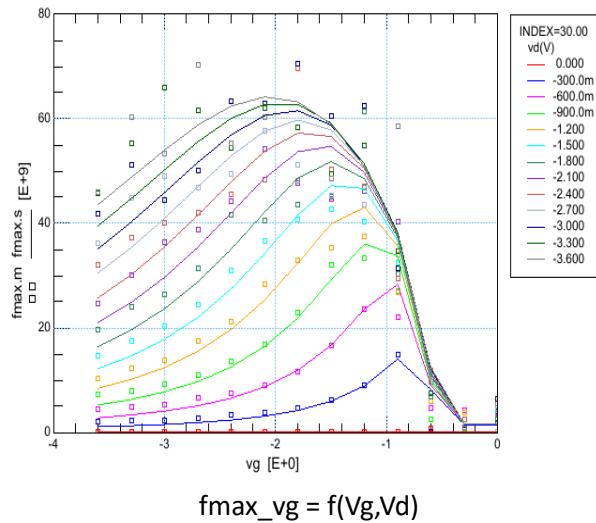
re(Z11) = f(Vg, Vd)



im(Z11) = f(Vg, Vd)

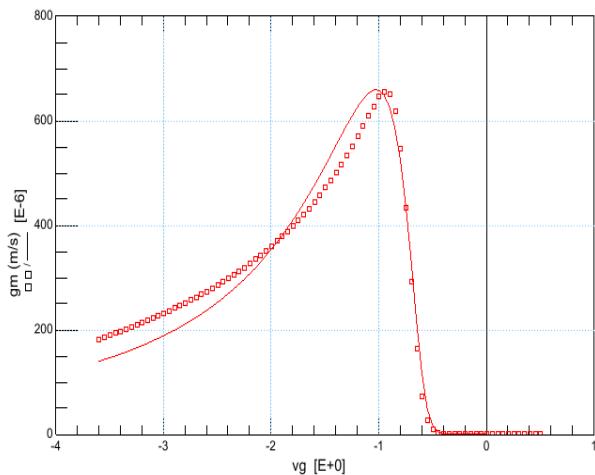
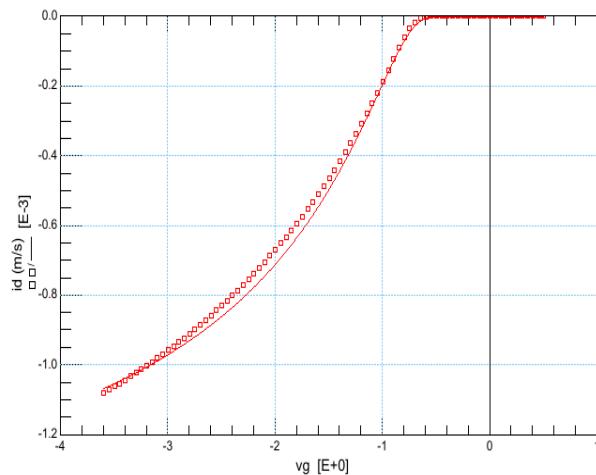


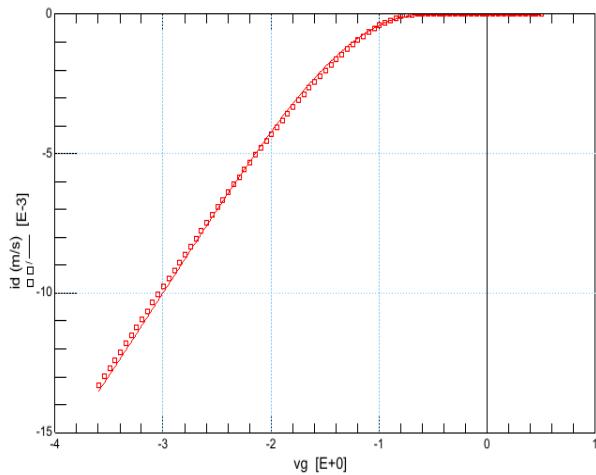
fT_vg = f(Vg, Vd)



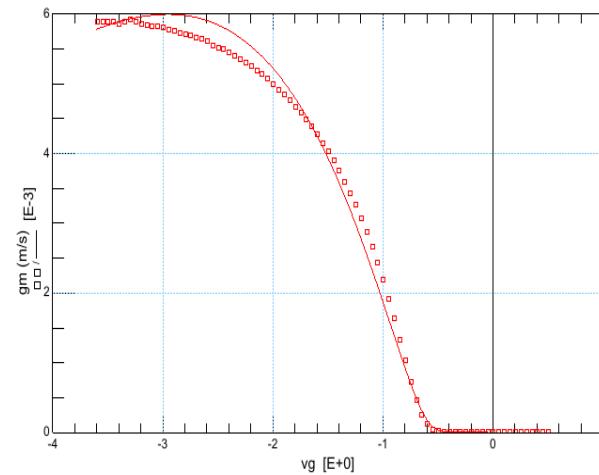
5.8 NF05_WF10u0_L0u4_S453A_D4

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

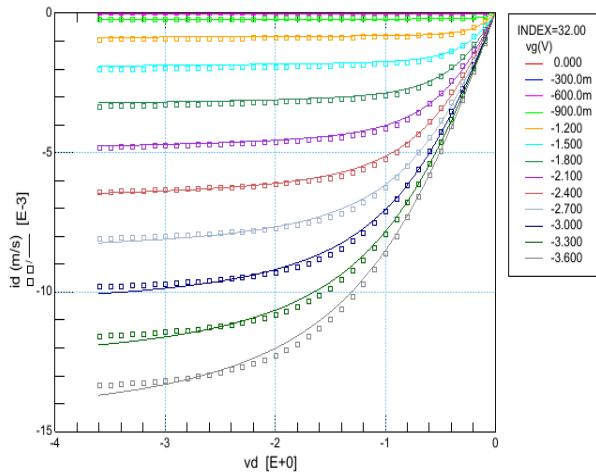




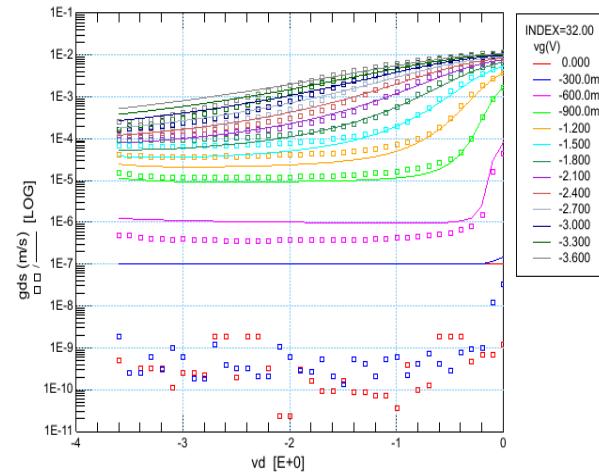
Id = f(Vg) @ Vd = -3.3V



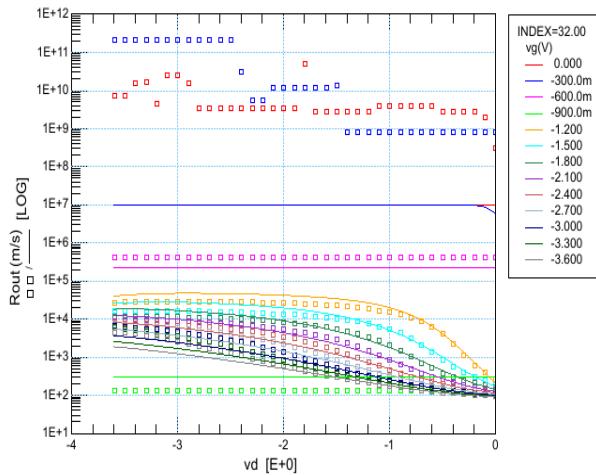
gm = f(Vg) @ Vd = -3.3V

IdVd, T = 27°C

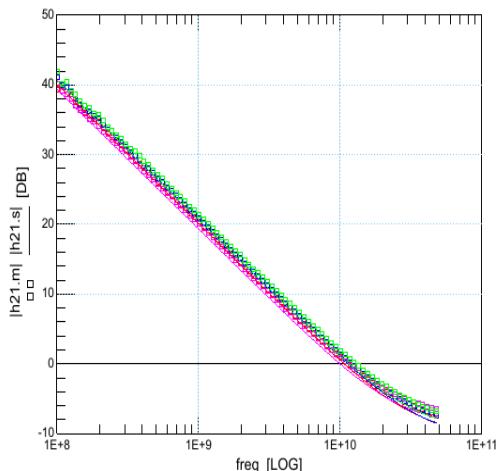
Id = f(Vd)



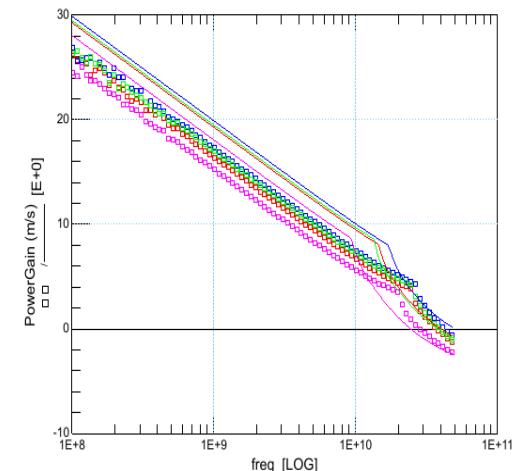
gds = f(Vd)



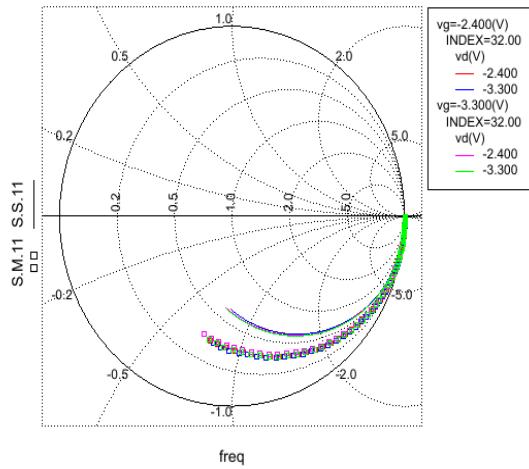
Rout = f(Vd)

S-Parameter, T = 27°C

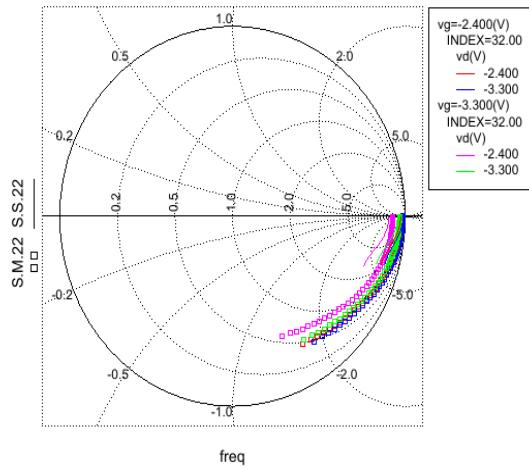
$$|h21| = f(Vg, Vd)$$



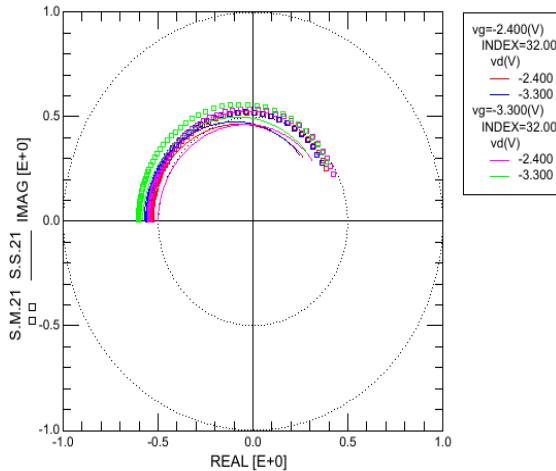
$$MSG/MAG = f(Vg, Vd)$$



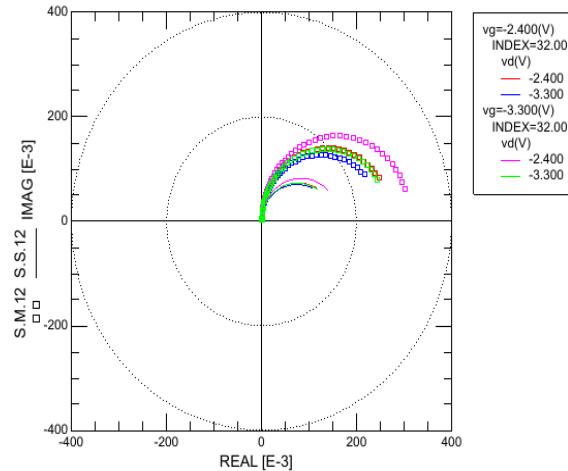
$$S11 = f(Vg, Vd)$$



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

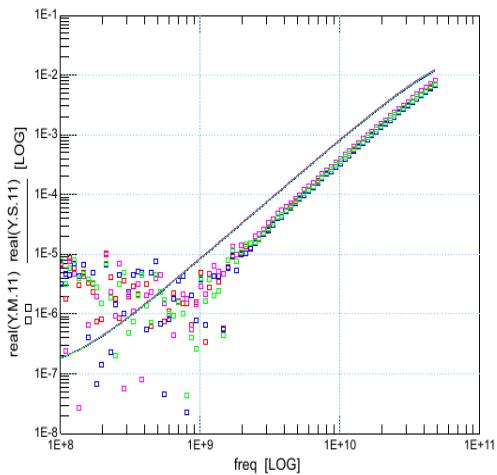


$$S21 = f(Vg, Vd)$$

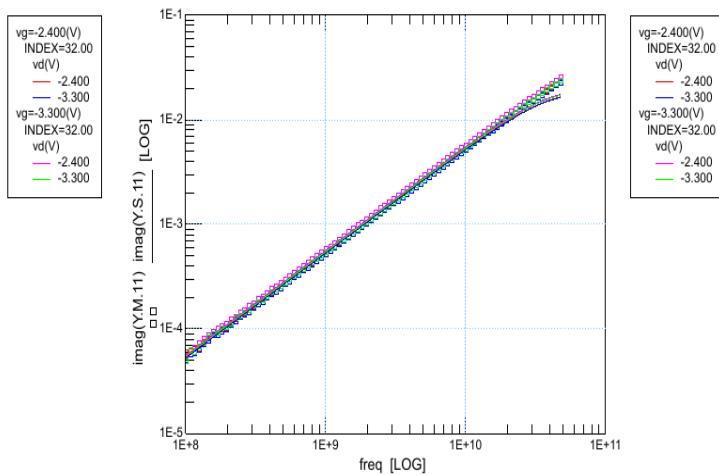


$$S12 = f(Vg, Vd)$$

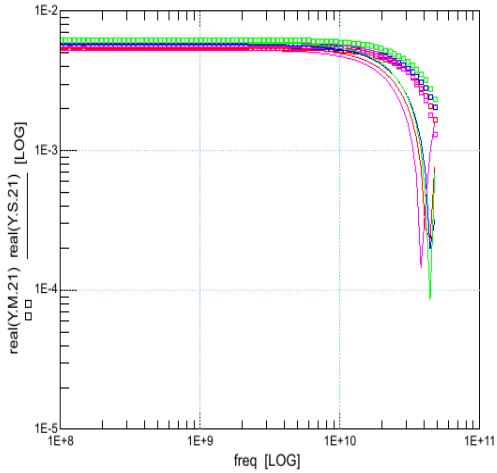
Y-Parameter, T = 27°C



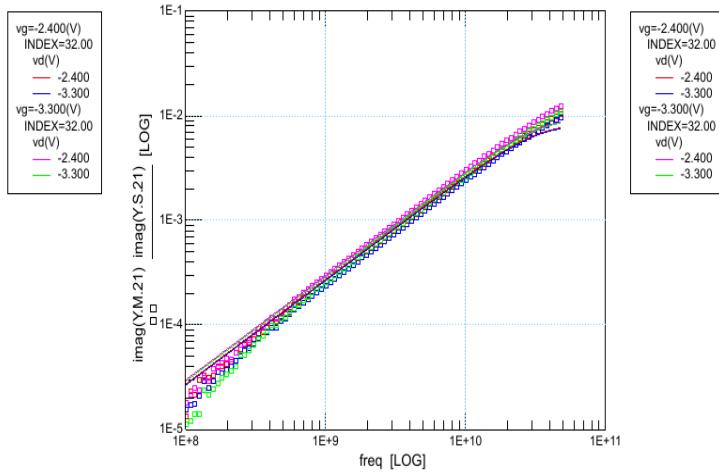
$$\text{re}(Y_{11}) = f(V_g, V_d)$$



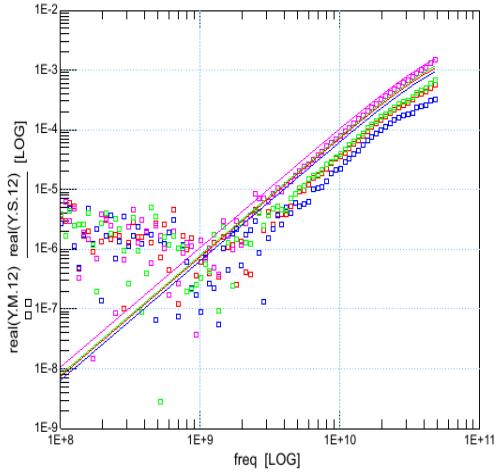
$$\text{im}(Y_{11}) = f(V_g, V_d)$$



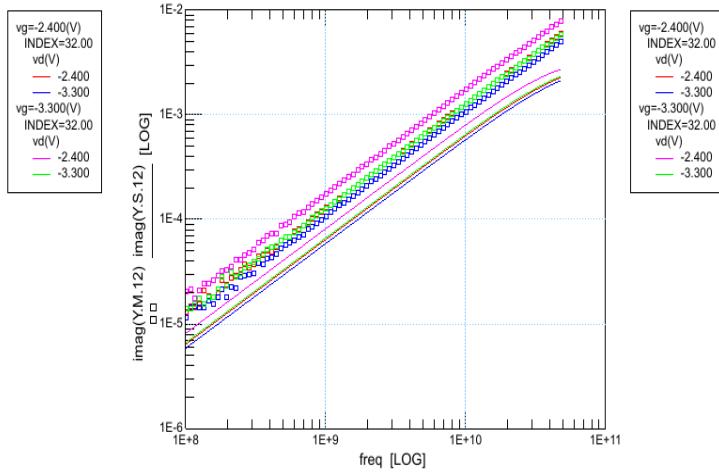
$$\text{re}(Y_{21}) = f(V_g, V_d)$$



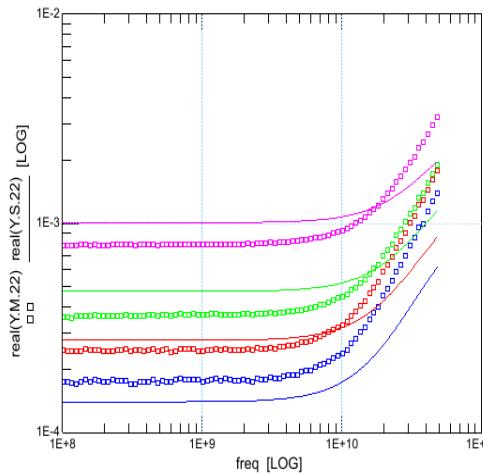
$$\text{im}(Y_{21}) = f(V_g, V_d)$$



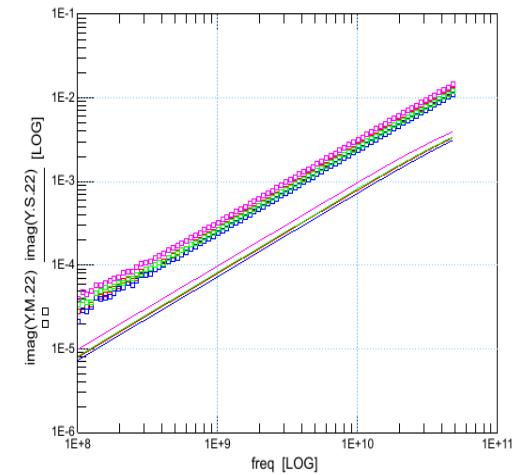
$$\text{re}(Y_{12}) = f(V_g, V_d)$$



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

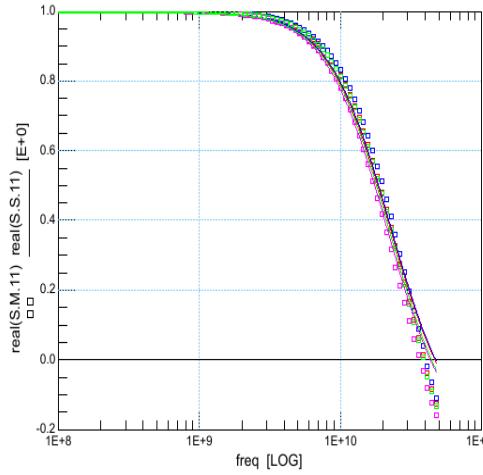


$$\text{real}(Y_{22}) = f(V_g, V_d)$$

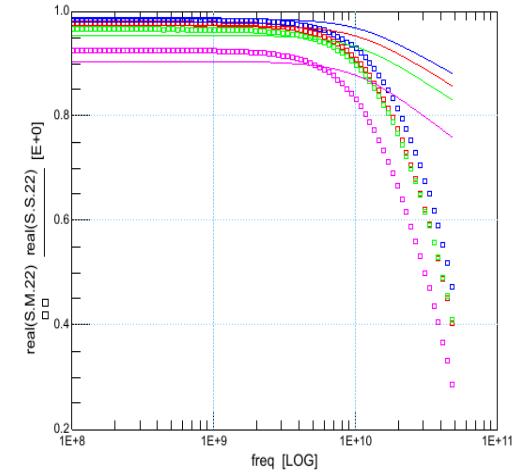


$$\text{imag}(Y_{22}) = f(V_g, V_d)$$

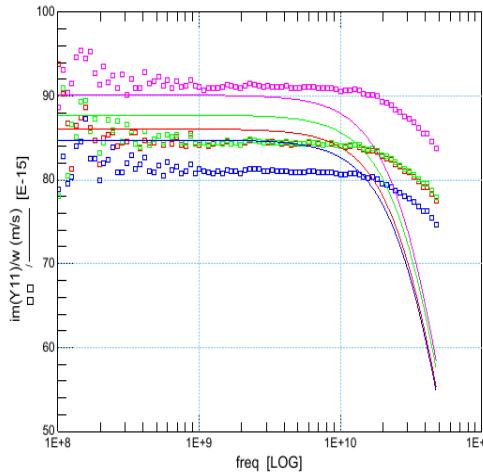
Verify Plots, $T = 27^\circ\text{C}$



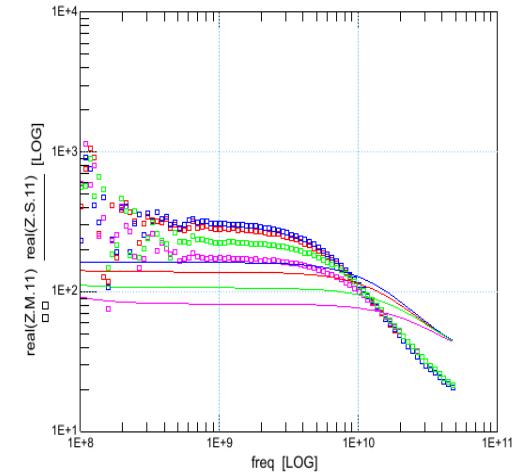
$$\text{real}(S_{11}) = f(V_g, V_d)$$



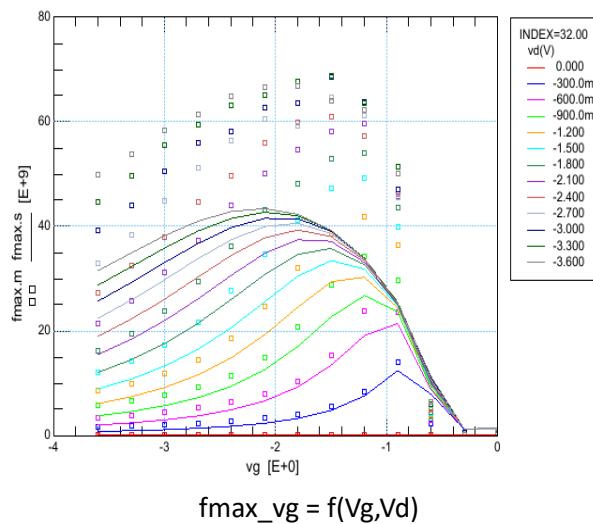
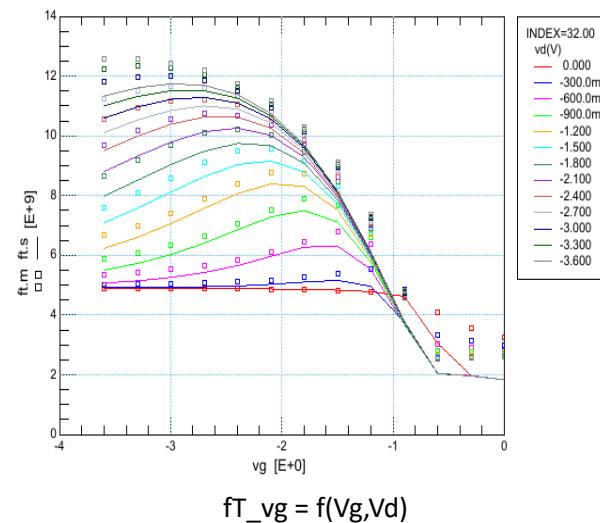
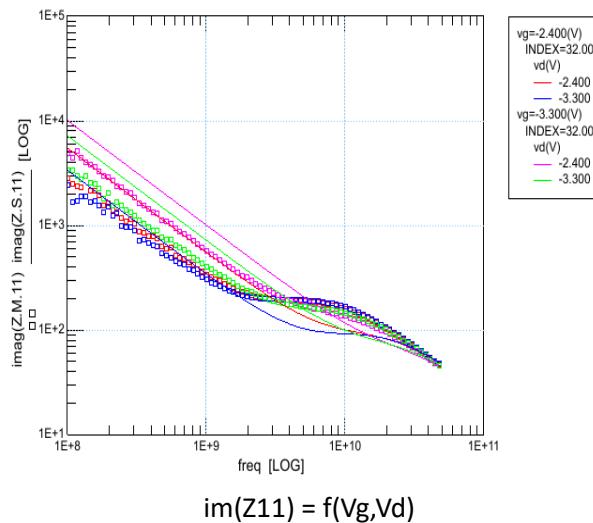
$$\text{real}(S_{22}) = f(V_g, V_d)$$



$$\text{im}(Y_{11}) \text{ divided by } \omega$$

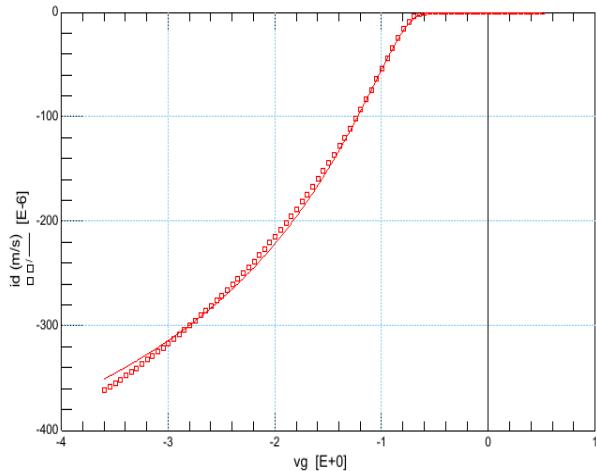


$$\text{real}(Z_{11}) = f(V_g, V_d)$$

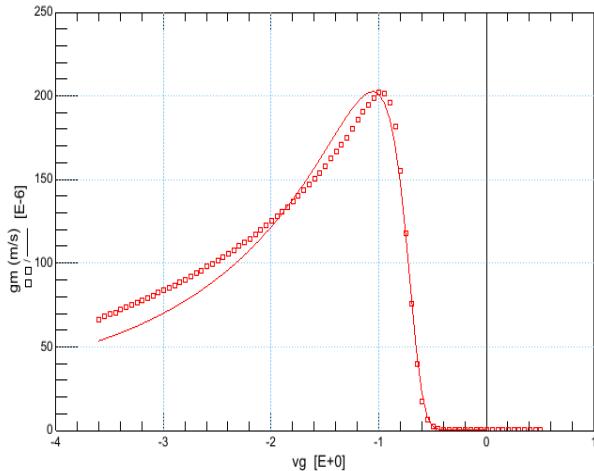


5.9 NF04_WF05u0_L0u5_S453A_D0

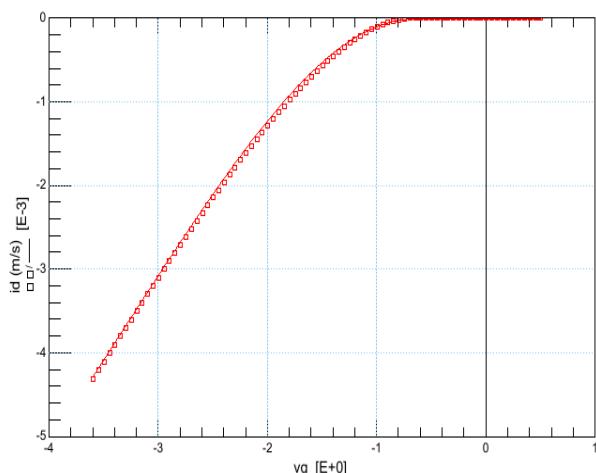
Id Vg, $T = 27^\circ\text{C}$



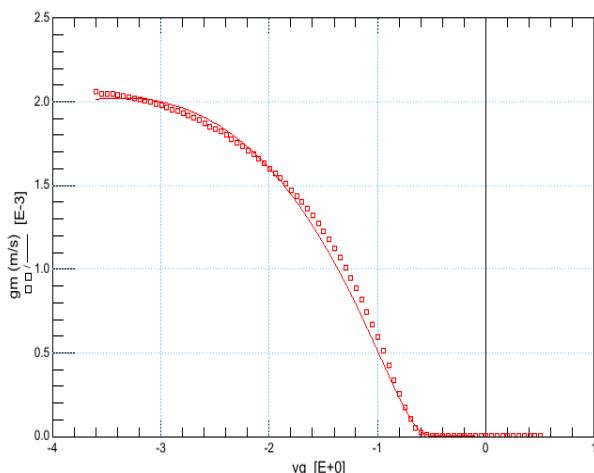
$$Id = f(Vg) \text{ @ } Vd = -0.1\text{V}$$



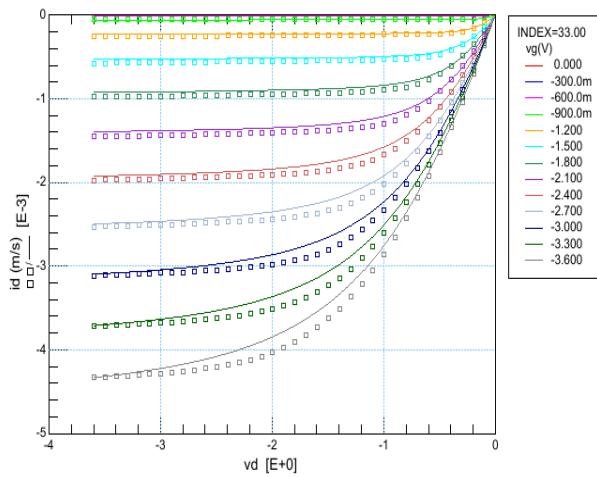
$$gm = f(Vg) \text{ @ } Vd = -0.1\text{V}$$



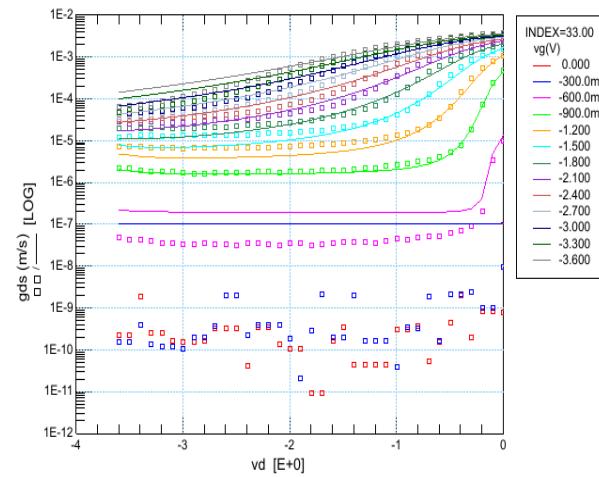
$$Id = f(Vg) \text{ @ } Vd = -3.3\text{V}$$



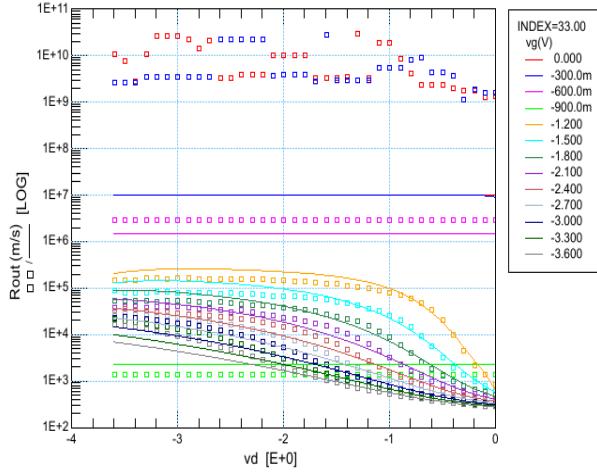
$$gm = f(Vg) \text{ @ } Vd = -3.3\text{V}$$

IdVd, T = 27°C


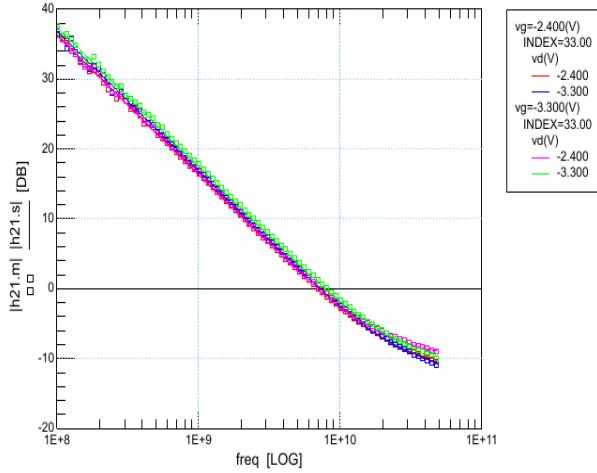
$$Id = f(Vd)$$



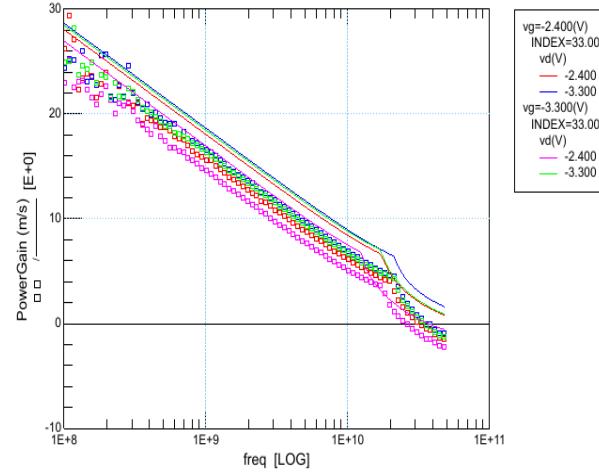
$$gds = f(Vd)$$



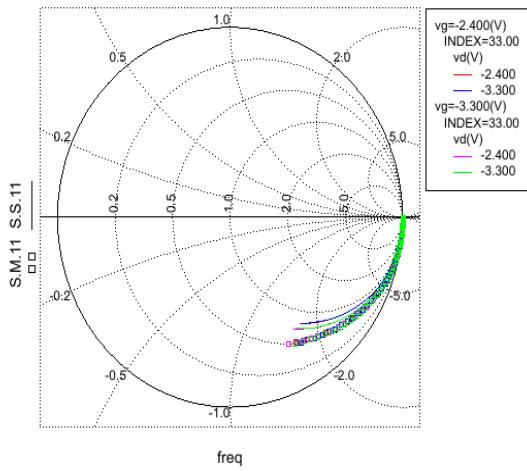
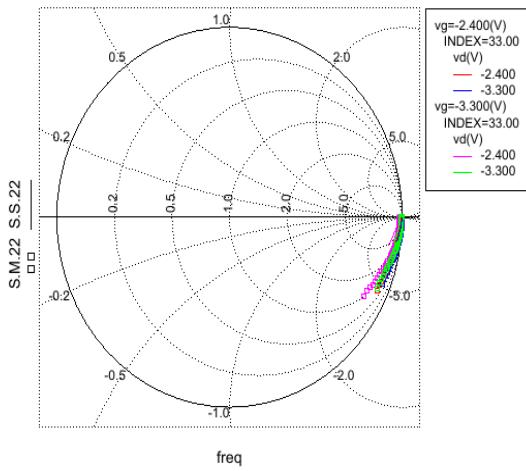
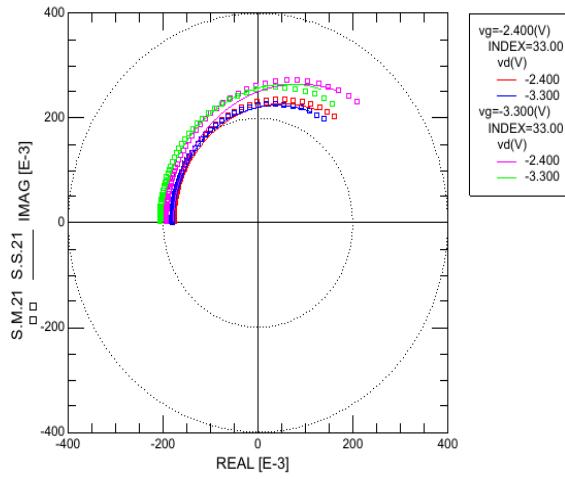
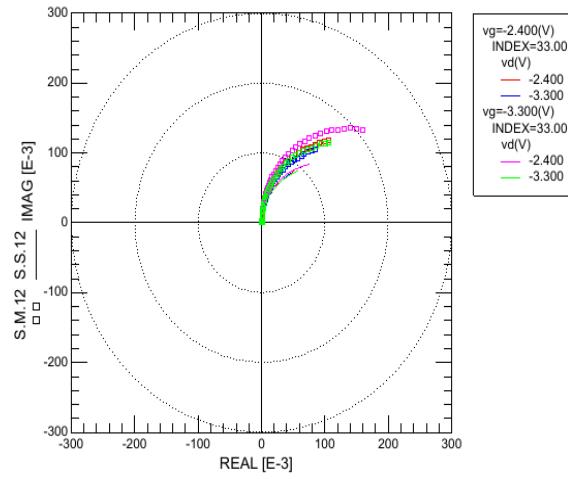
$$Rout = f(Vd)$$

S-Parameter, T = 27°C


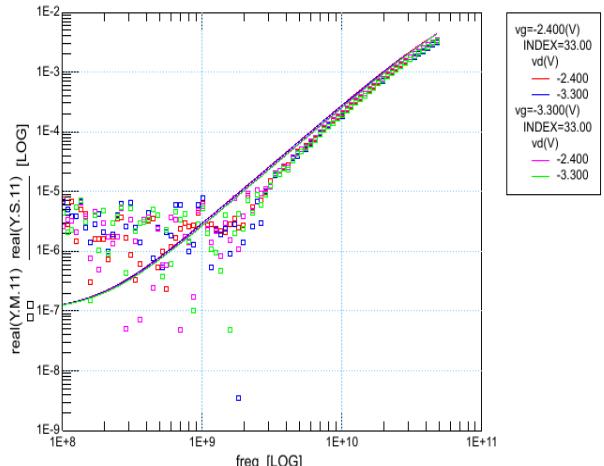
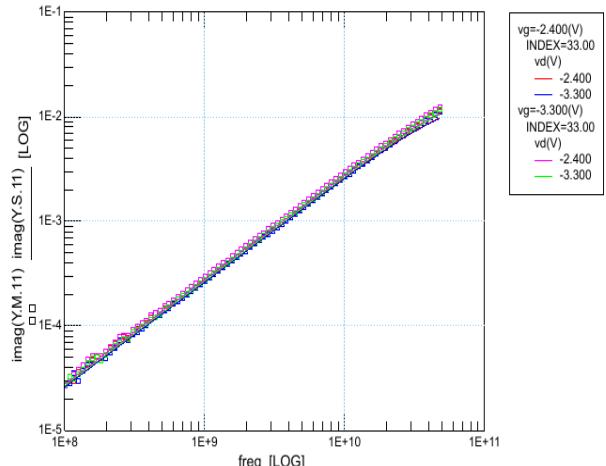
$$|h21| = f(Vg, Vd)$$

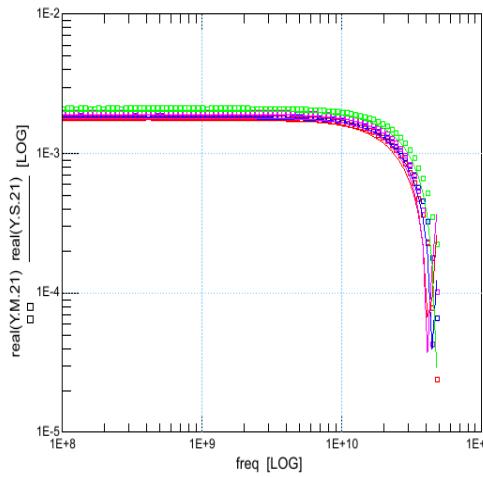
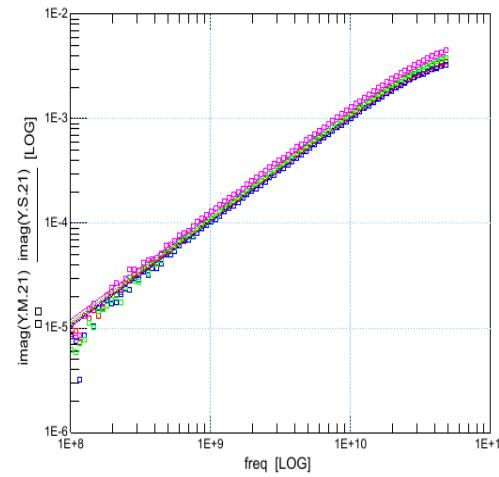
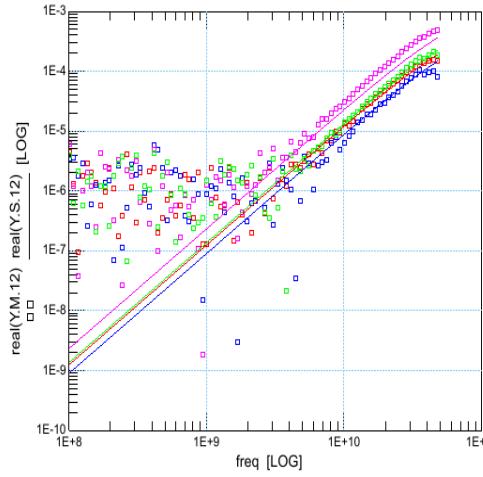
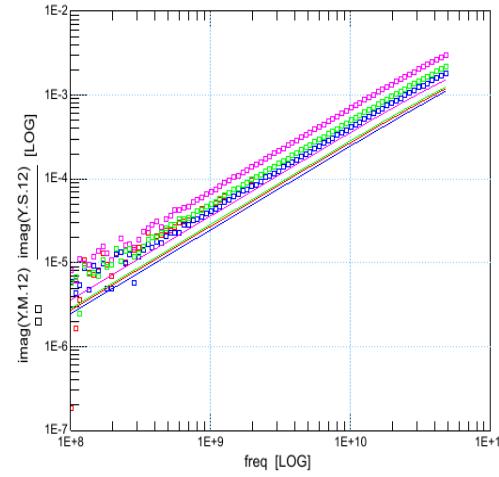
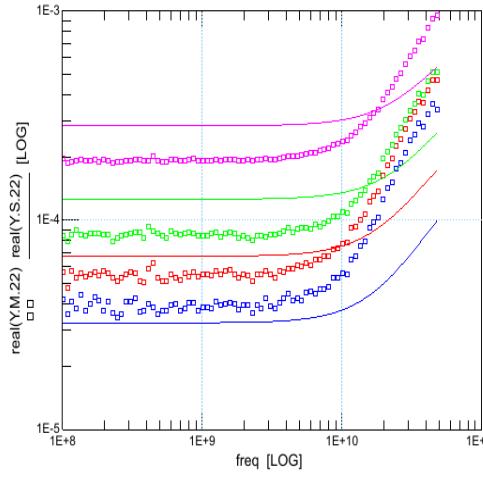
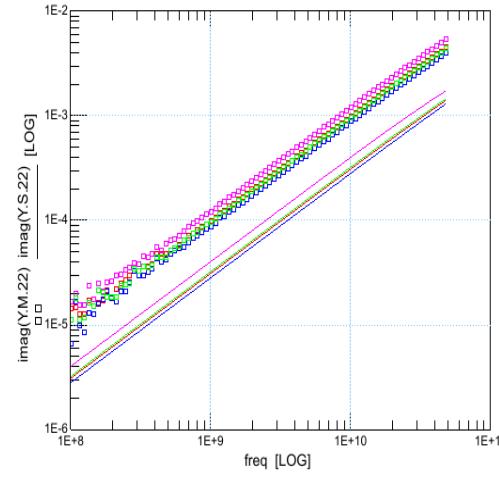


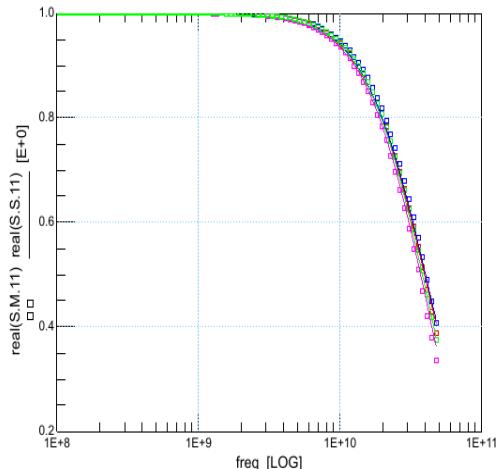
$$MSG/MAG = f(Vg, Vd)$$

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

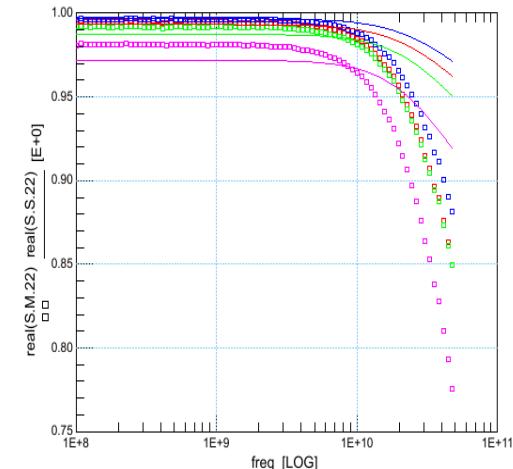
Y-Parameter, $T = 27^\circ\text{C}$

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

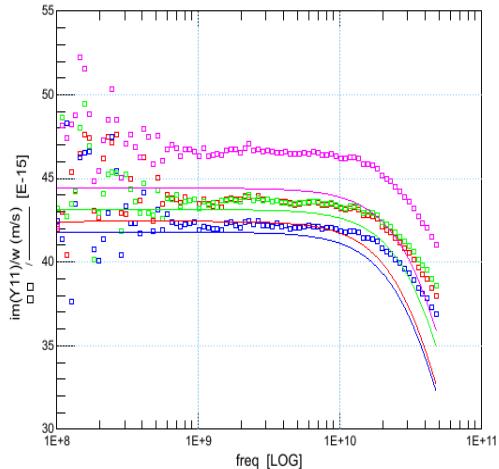
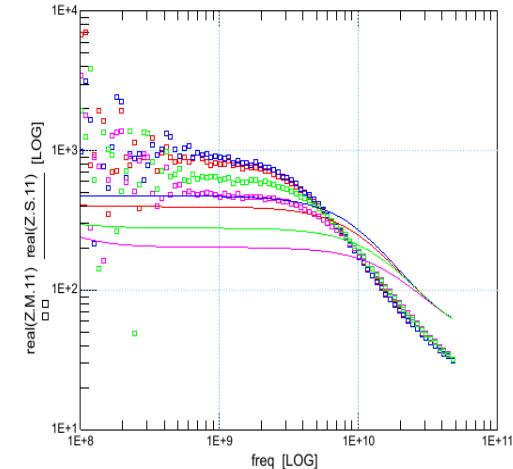
re(γ_{21}) = f(Vg,Vd)im(γ_{21}) = f(Vg,Vd)re(γ_{12}) = f(Vg,Vd)im(γ_{12}) = f(Vg,Vd)re(γ_{22}) = f(Vg,Vd)im(γ_{22}) = f(Vg,Vd)

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

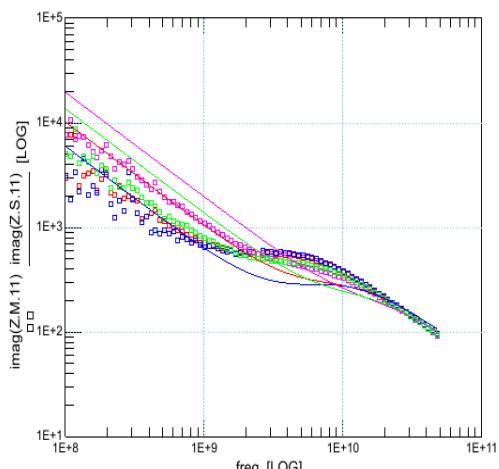
re(S11) = f(Vg, Vd)



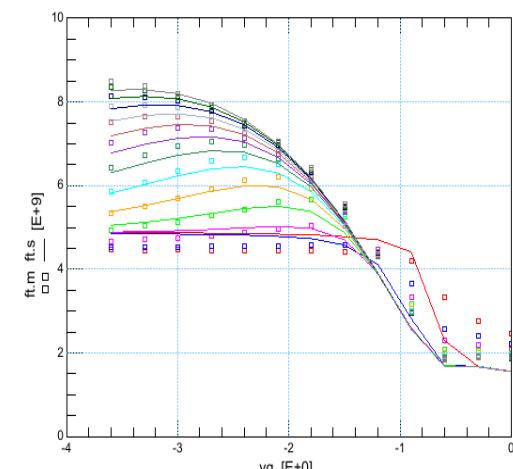
re(S22) = f(Vg, Vd)

im(Y11) divided by ω 

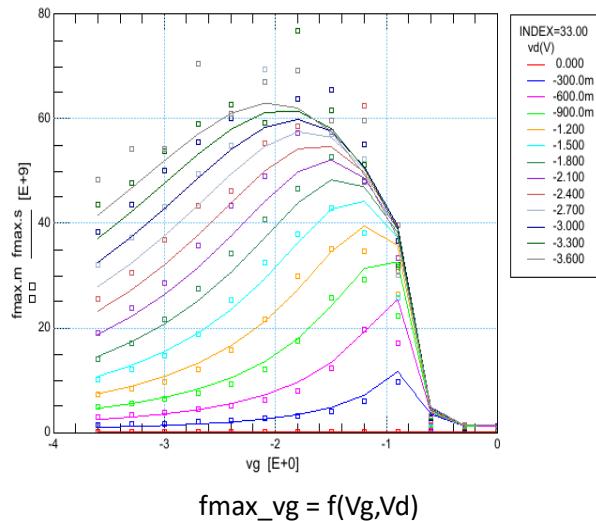
re(Z11) = f(Vg, Vd)



im(Z11) = f(Vg, Vd)

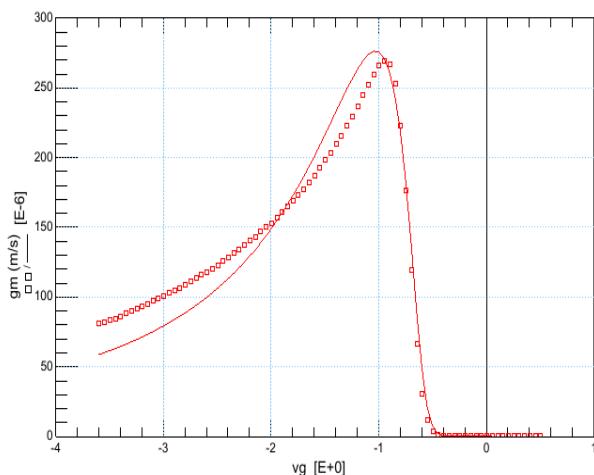
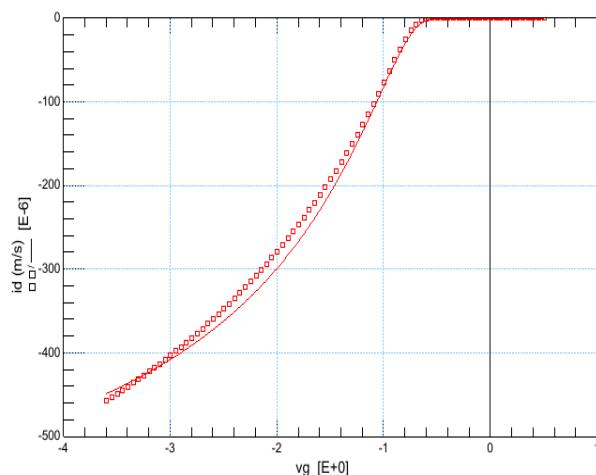


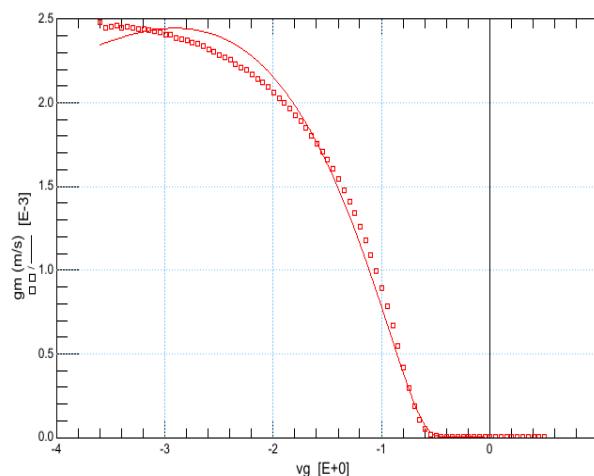
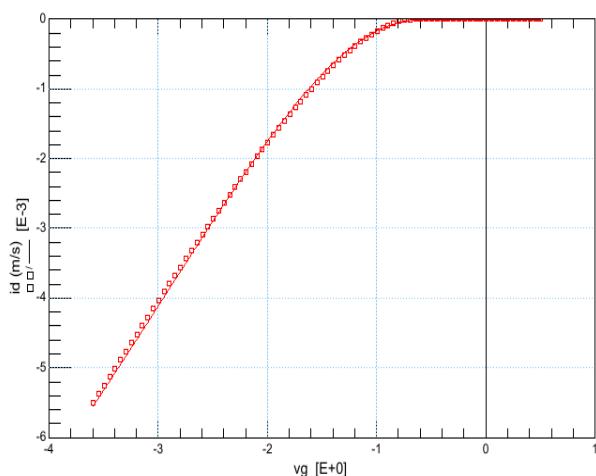
fT_vg = f(Vg, Vd)



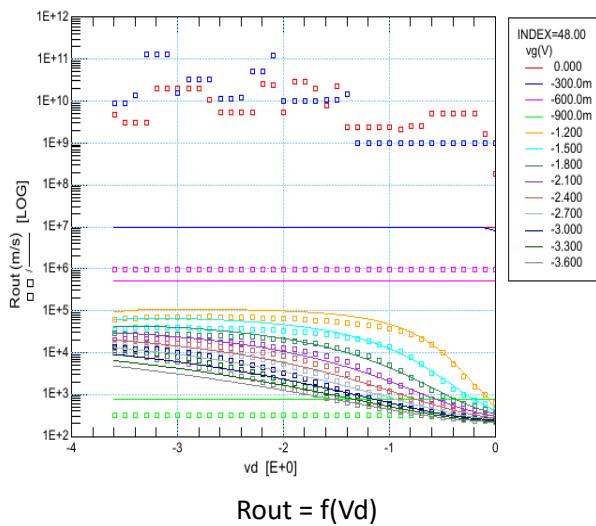
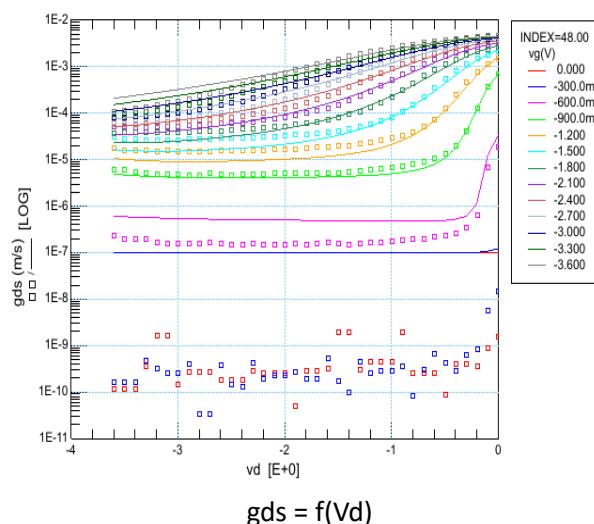
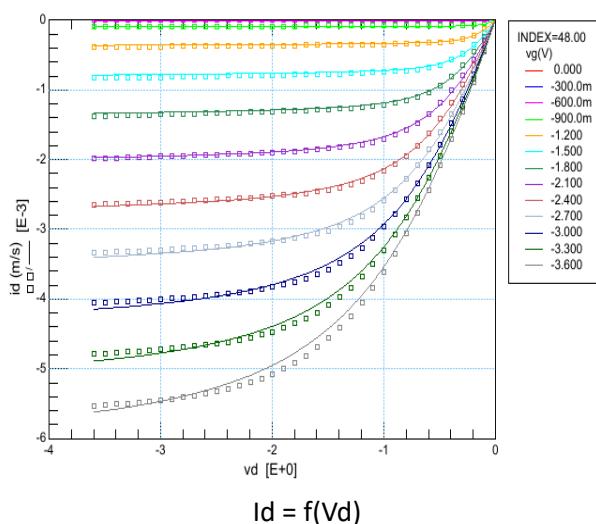
5.10NF04_WF05u0_L0u4_post_C5

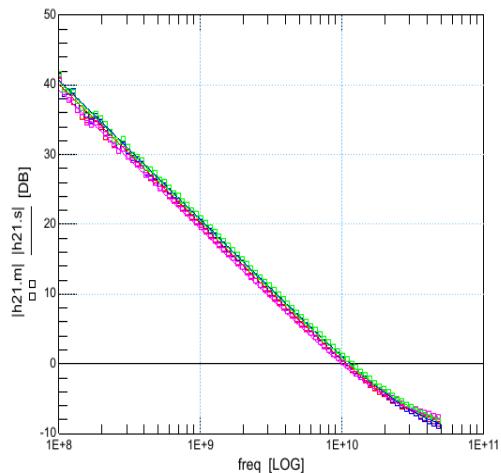
I_dVg , $T = 27^\circ C$



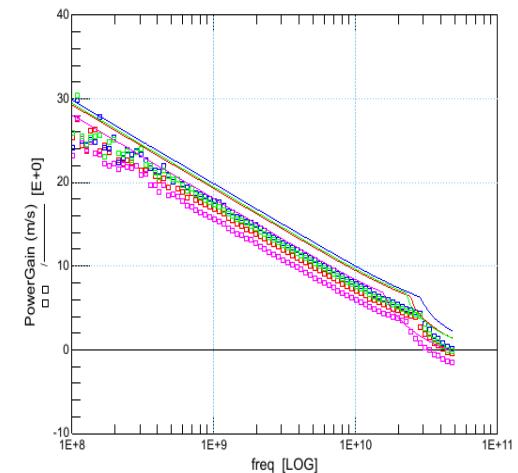


IdVd, T = 27°C

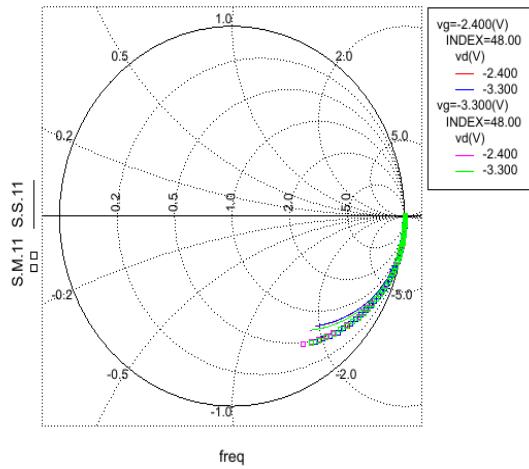


S-Parameter, T = 27°C

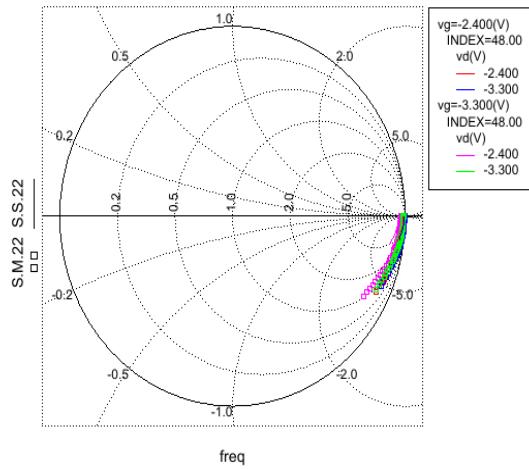
$$|h21| = f(Vg, Vd)$$



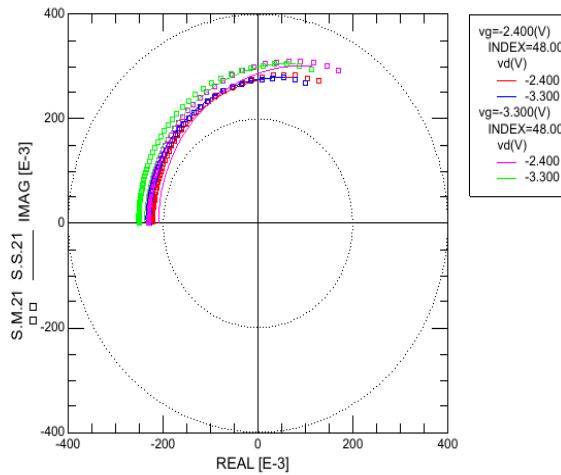
$$MSG/MAG = f(Vg, Vd)$$



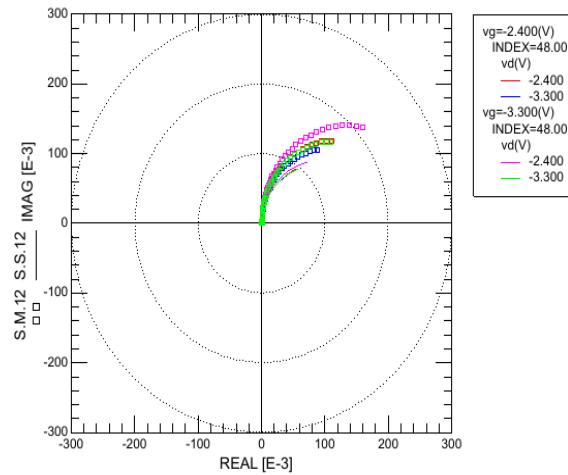
$$S11 = f(Vg, Vd)$$



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

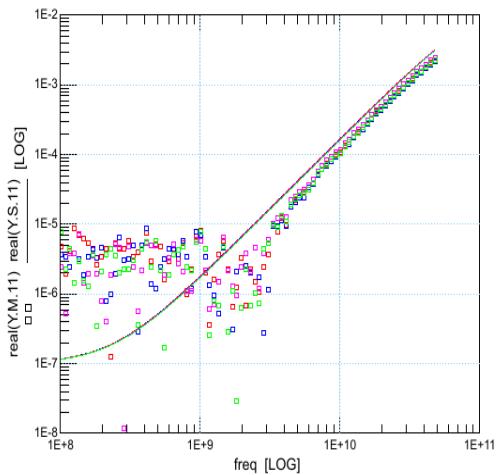


$$S21 = f(Vg, Vd)$$

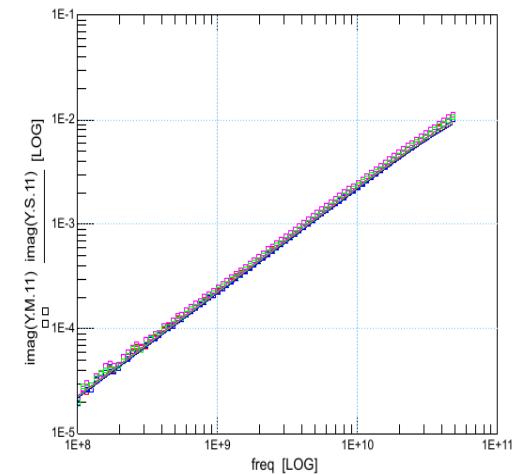


$$S12 = f(Vg, Vd)$$

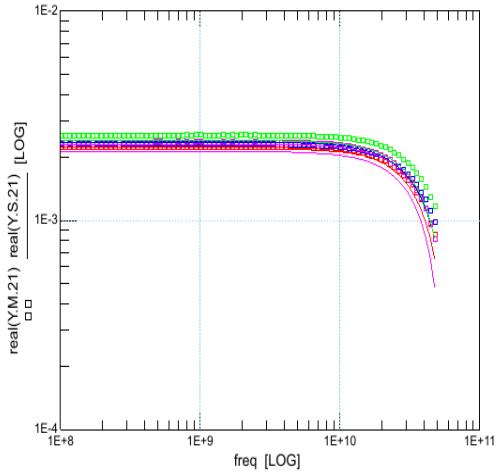
Y-Parameter, T = 27°C



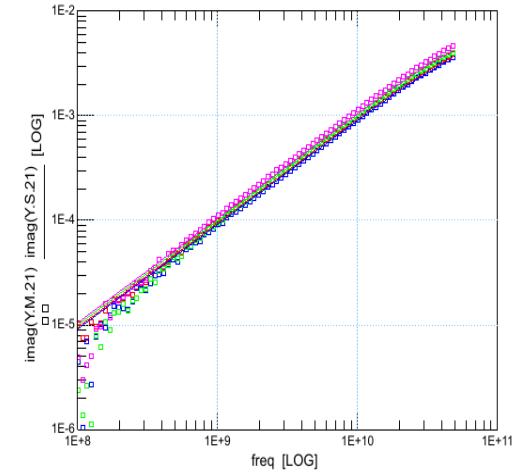
$$\text{re}(Y11) = f(Vg, Vd)$$



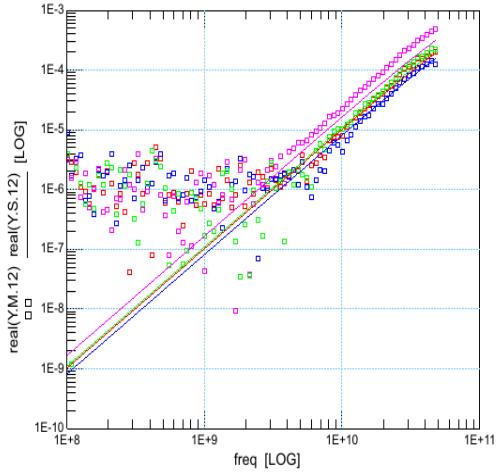
$$\text{im}(Y11) = f(Vg, Vd)$$



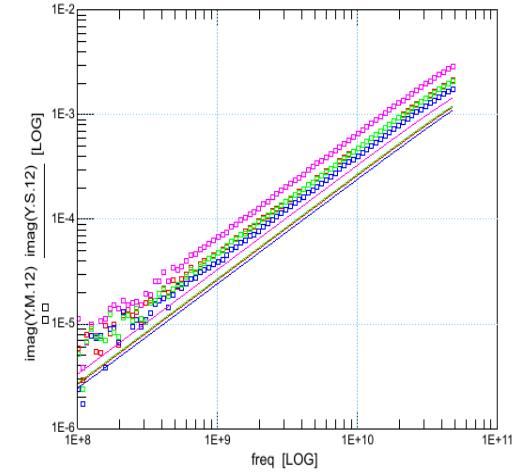
$$\text{re}(Y21) = f(Vg, Vd)$$



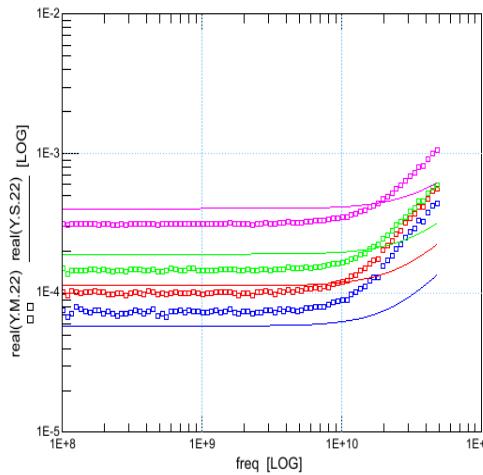
$$\text{im}(Y21) = f(Vg, Vd)$$



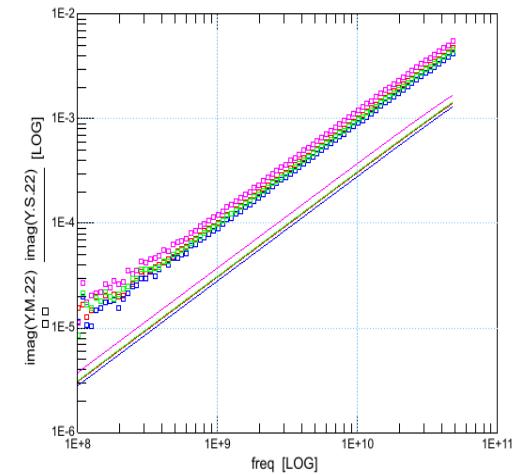
$$\text{re}(Y12) = f(Vg, Vd)$$



$$\text{im}(Y12) = f(Vg, Vd)$$

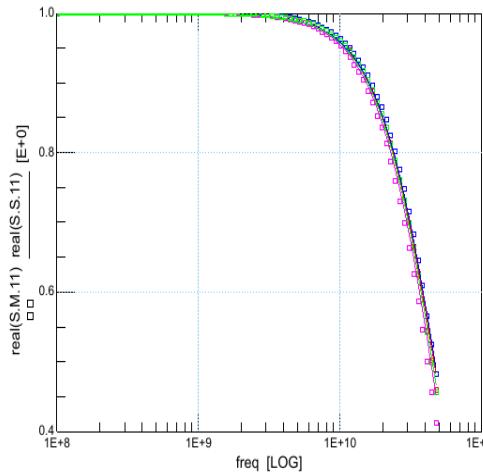


$$\text{real}(Y_{22}) = f(V_g, V_d)$$

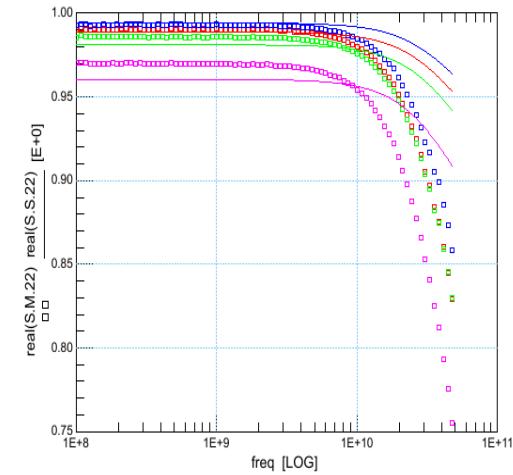


$$\text{imag}(Y_{22}) = f(V_g, V_d)$$

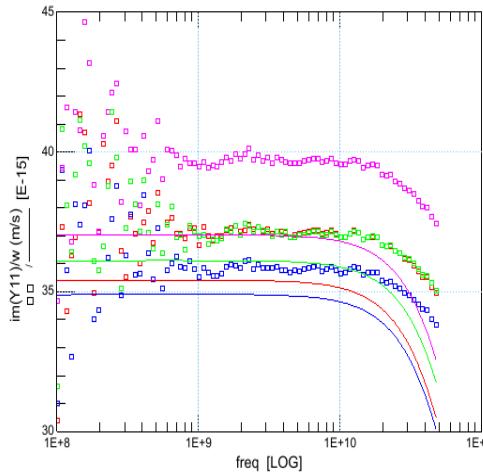
Verify Plots, $T = 27^\circ\text{C}$



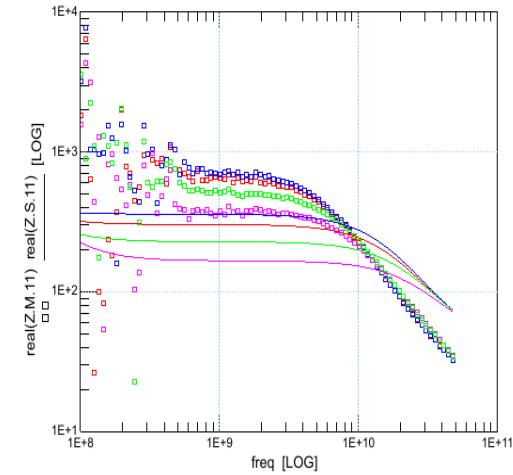
$$\text{real}(S_{11}) = f(V_g, V_d)$$



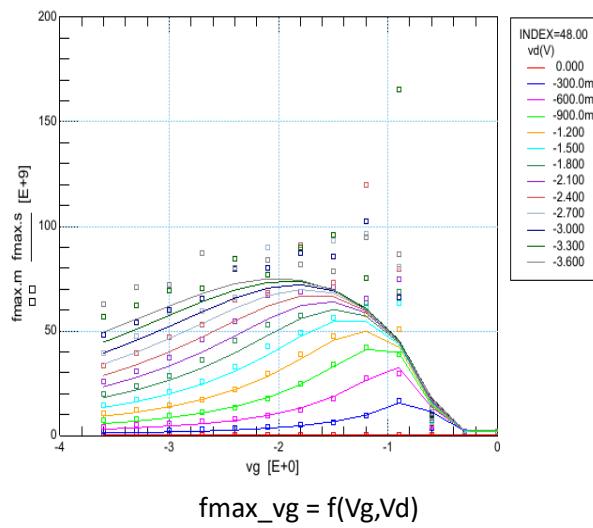
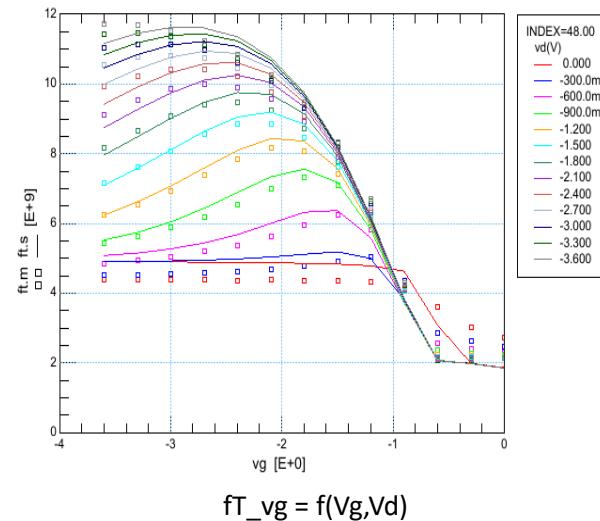
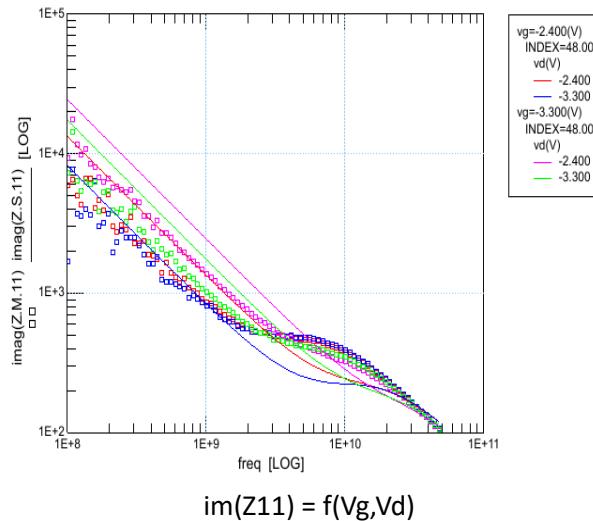
$$\text{real}(S_{22}) = f(V_g, V_d)$$



$$\text{im}(Y_{11}) \text{ divided by } \omega$$

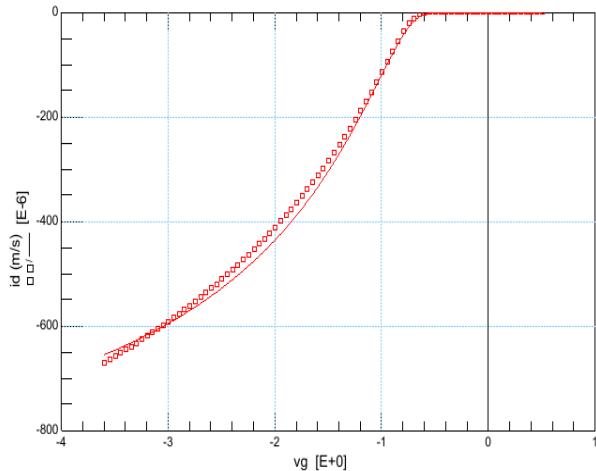


$$\text{real}(Z_{11}) = f(V_g, V_d)$$

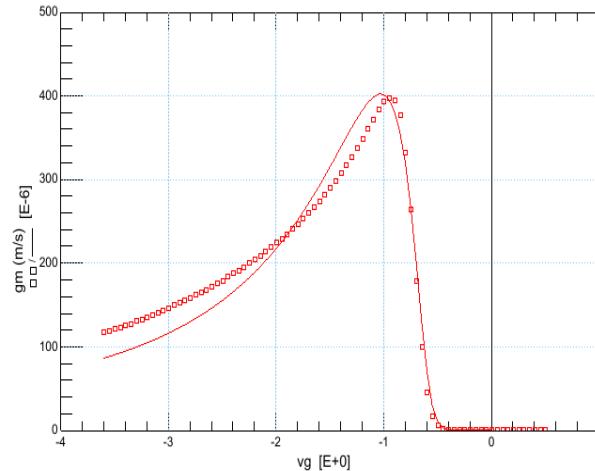


5.11 NF04_WF07u5_L0u4_S453A_D2

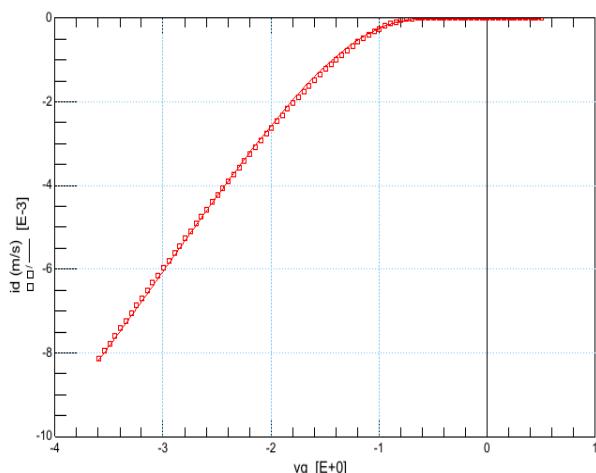
$IdVg$, $T = 27^\circ\text{C}$



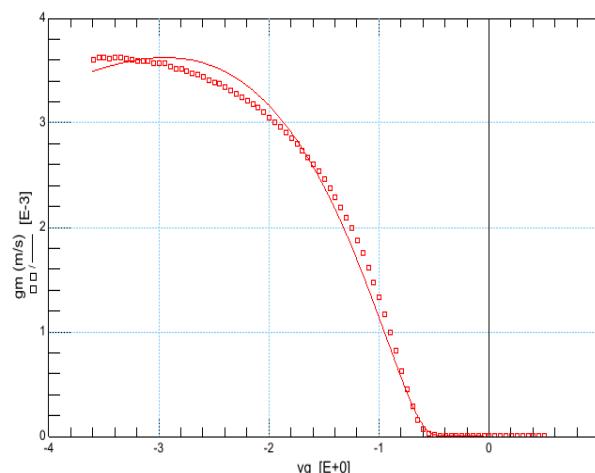
$$Id = f(Vg) \text{ @ } Vd = -0.1\text{V}$$



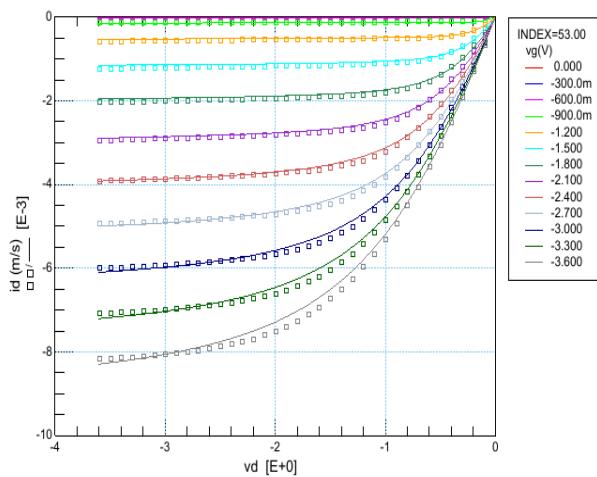
$$gm = f(Vg) \text{ @ } Vd = -0.1\text{V}$$



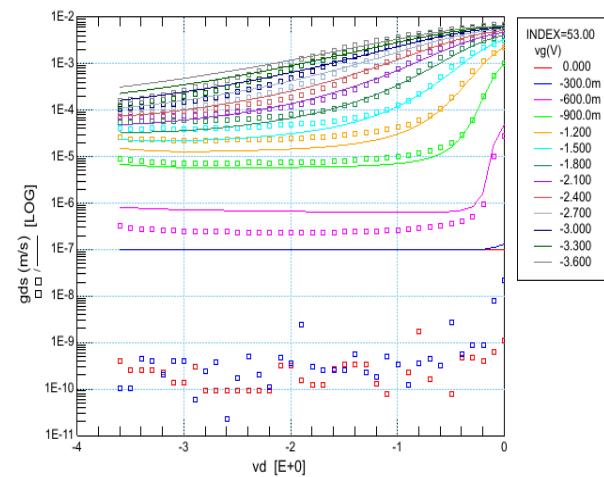
$$Id = f(Vg) \text{ @ } Vd = -3.3\text{V}$$



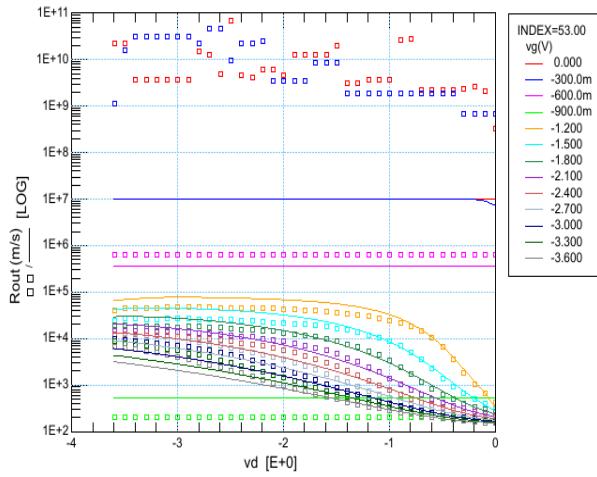
$$gm = f(Vg) \text{ @ } Vd = -3.3\text{V}$$

IdVd, T = 27°C

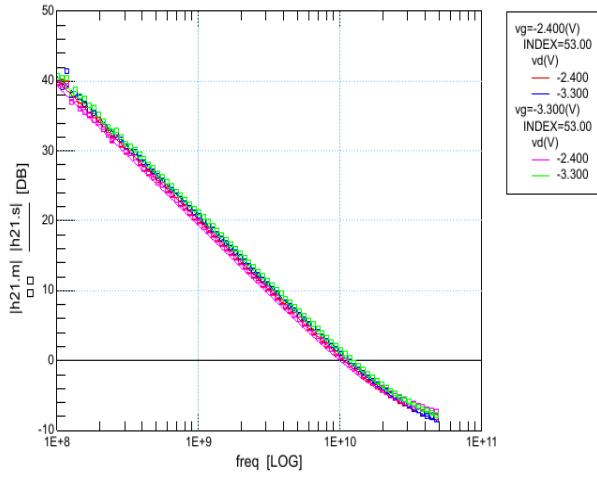
$$Id = f(Vd)$$



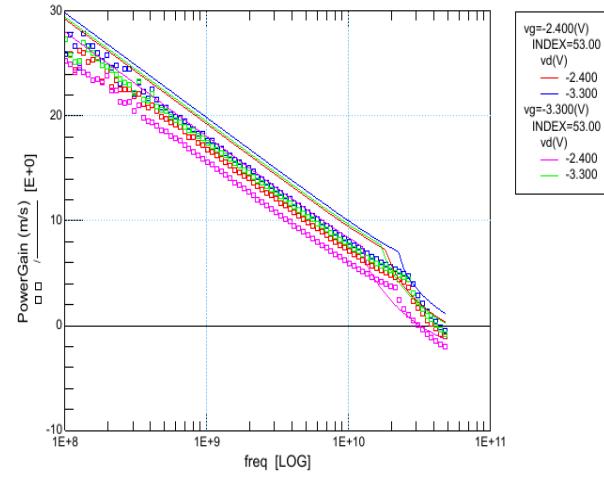
$$gds = f(Vd)$$



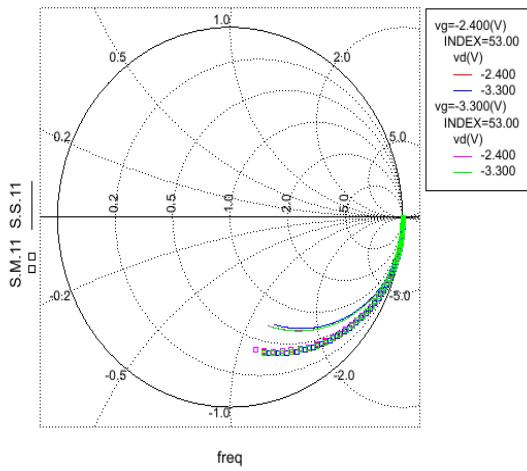
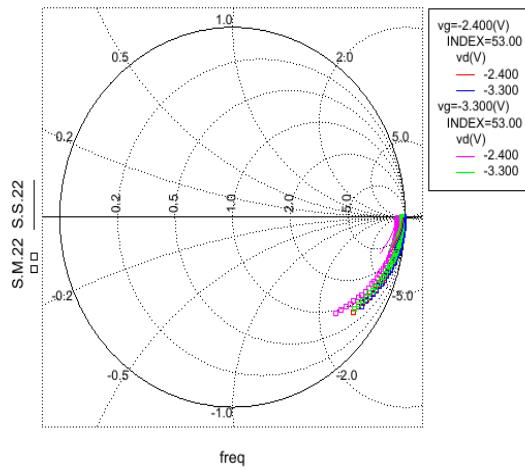
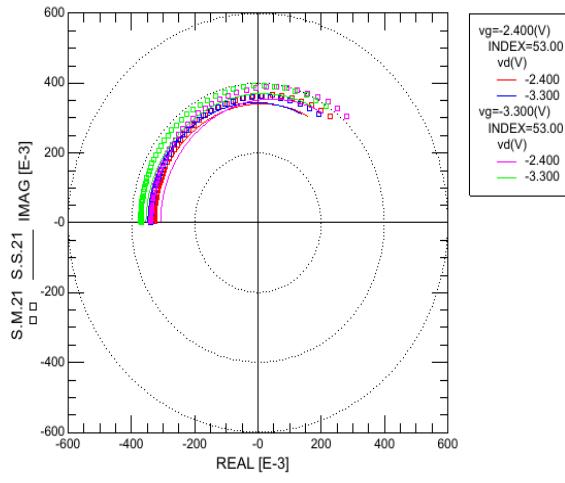
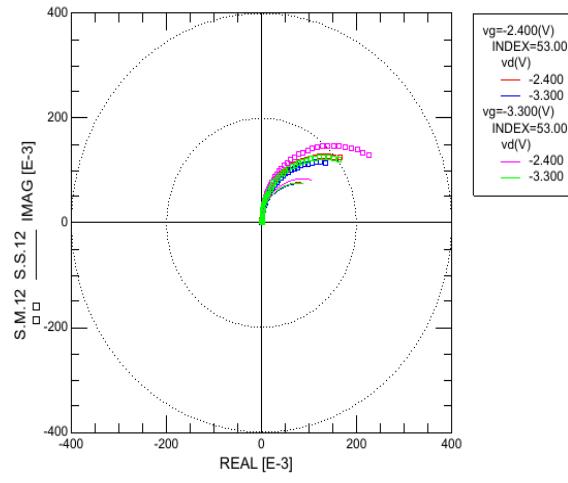
$$Rout = f(Vd)$$

S-Parameter, T = 27°C

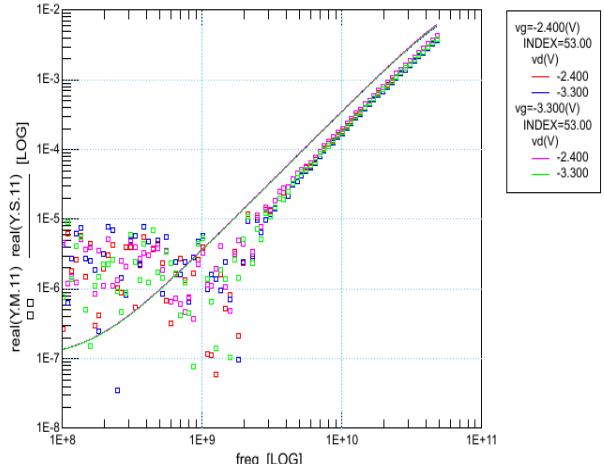
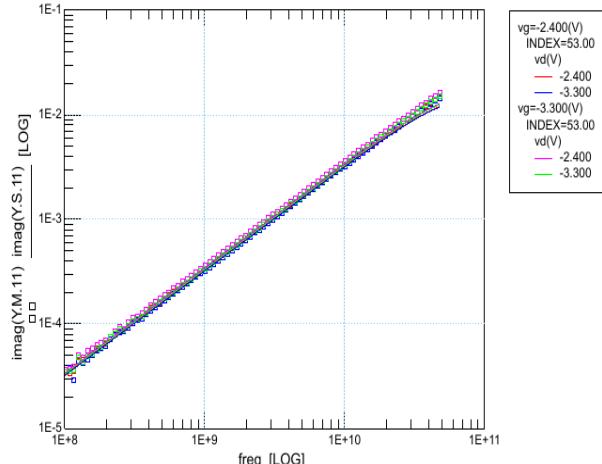
$$|h21| = f(Vg, Vd)$$

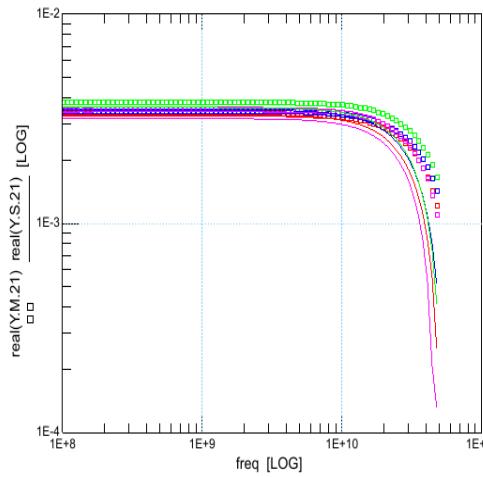


$$MSG/MAG = f(Vg, Vd)$$

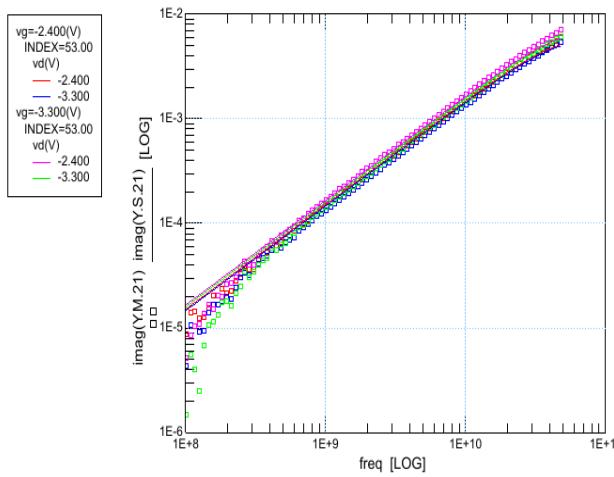
 $S11 = f(Vg, Vd)$  $S22 = f(Vg, Vd)$  $S21 = f(Vg, Vd)$  $S12 = f(Vg, Vd)$

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

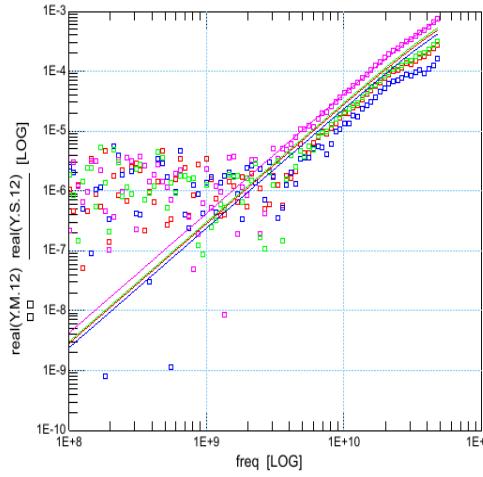
 $\text{re}(Y11) = f(Vg, Vd)$  $\text{im}(Y11) = f(Vg, Vd)$



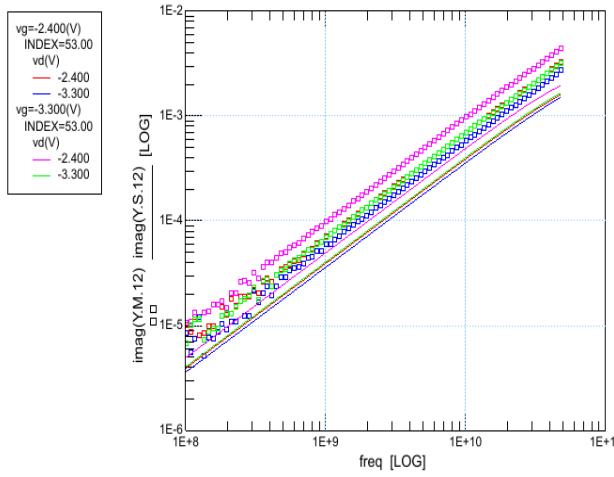
re(Y21) = f(Vg,Vd)



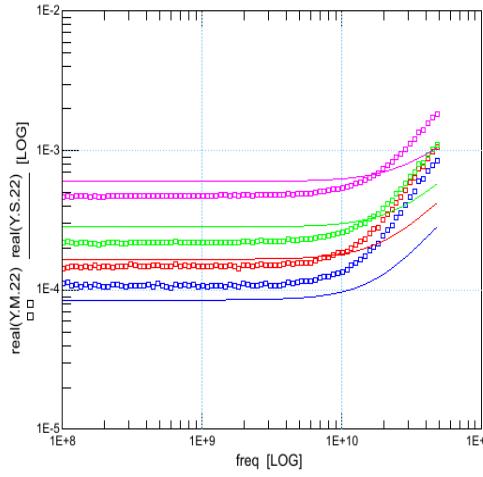
im(Y21) = f(Vg,Vd)



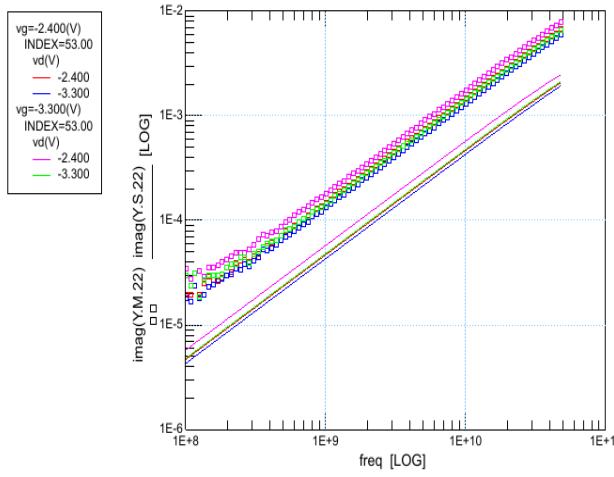
re(Y12) = f(Vg,Vd)



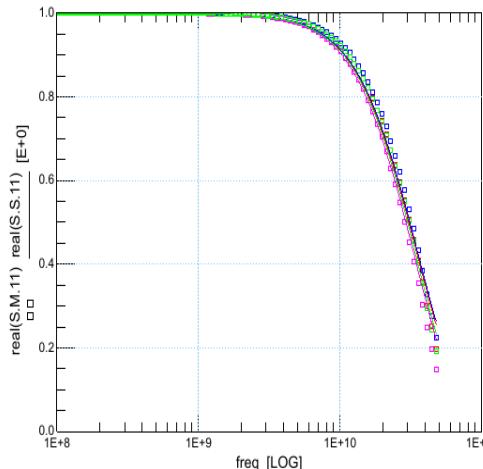
im(Y12) = f(Vg,Vd)



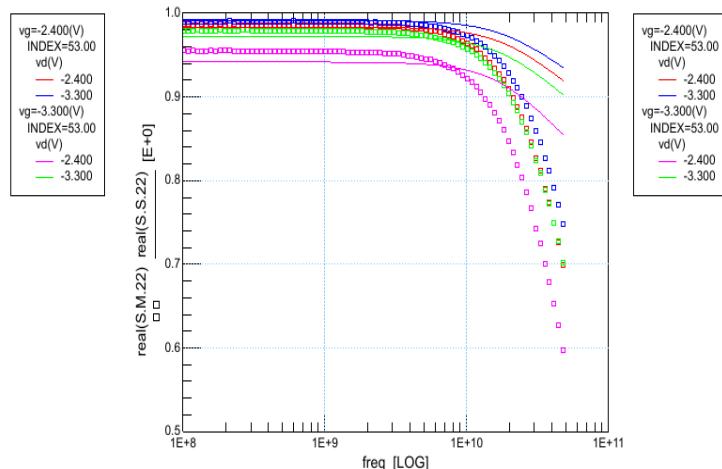
re(Y22) = f(Vg,Vd)



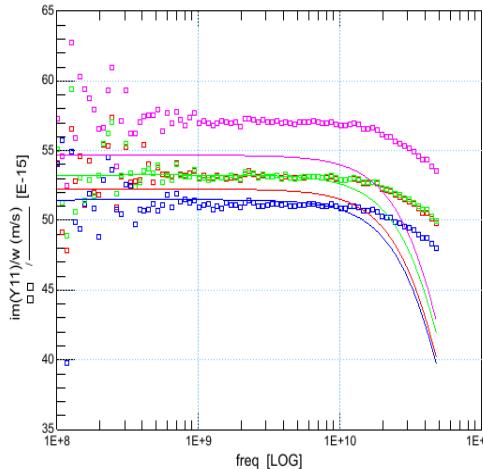
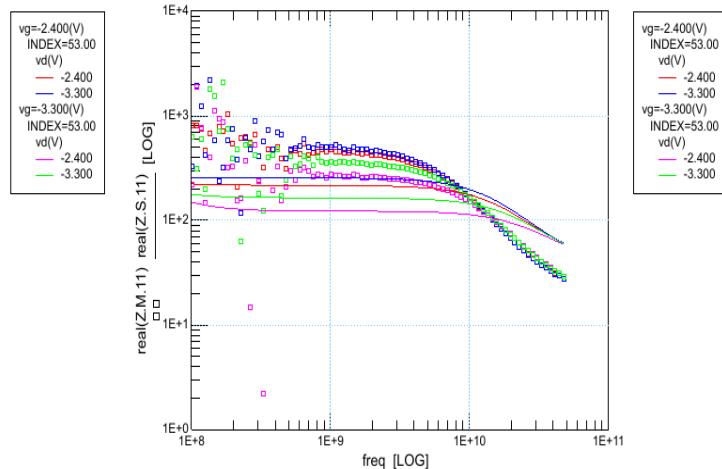
im(Y22) = f(Vg,Vd)

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

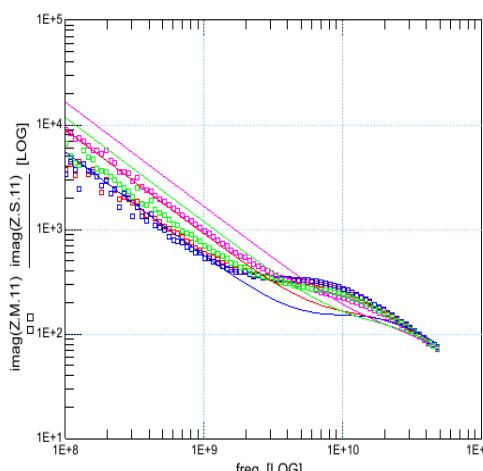
re(S11) = f(Vg, Vd)



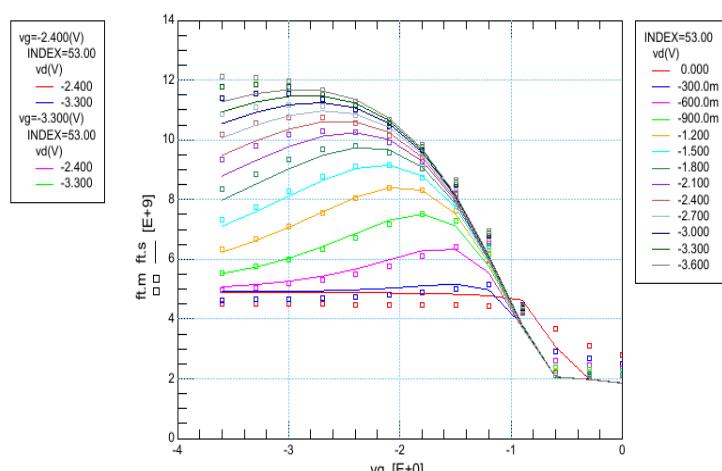
re(S22) = f(Vg, Vd)

im(Y11) divided by ω 

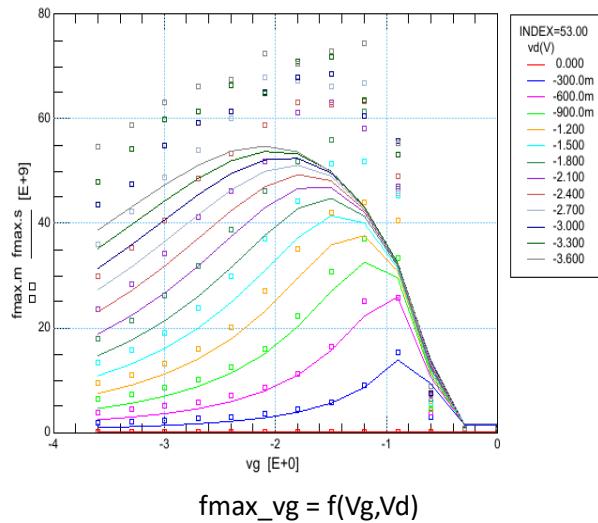
re(Z11) = f(Vg, Vd)



im(Z11) = f(Vg, Vd)

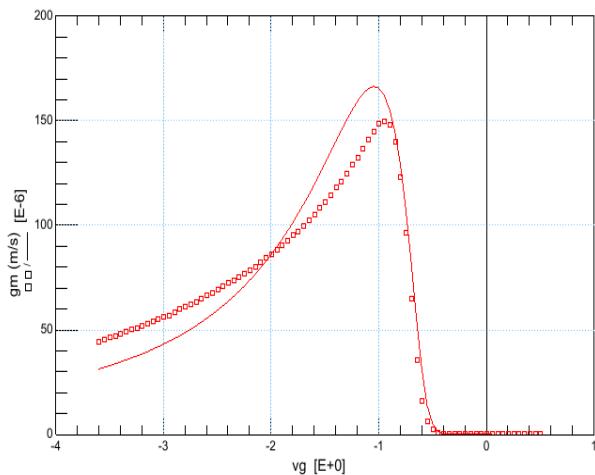
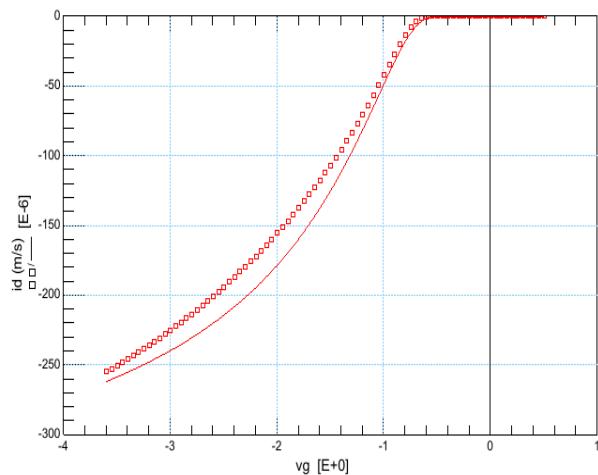


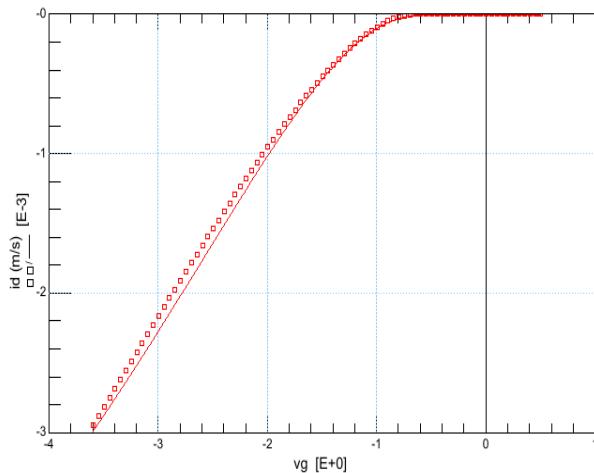
fT_vg = f(Vg, Vd)



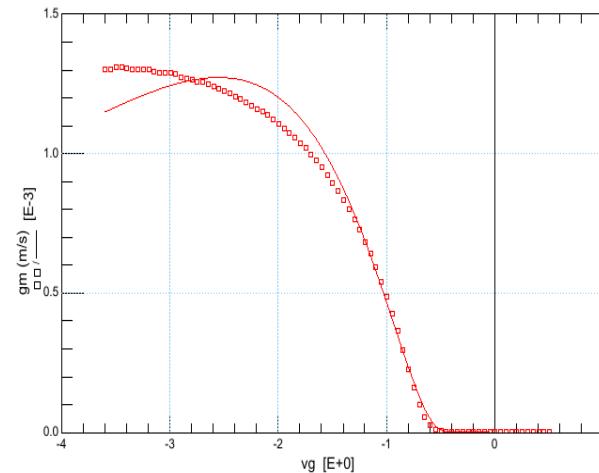
5.12 NF10_WF01u0_L0u4_S453A_E0

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



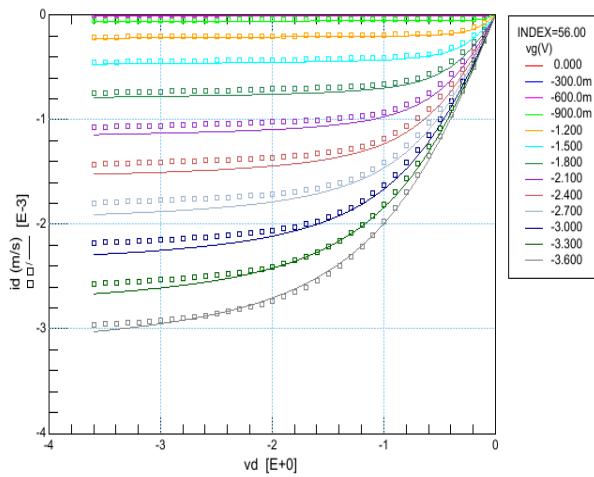


Id = f(Vg) @ Vd = -3.3V

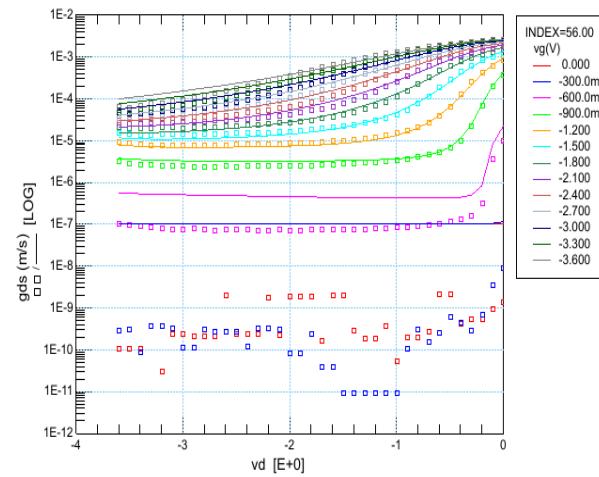


gm = f(Vg) @ Vd = -3.3V

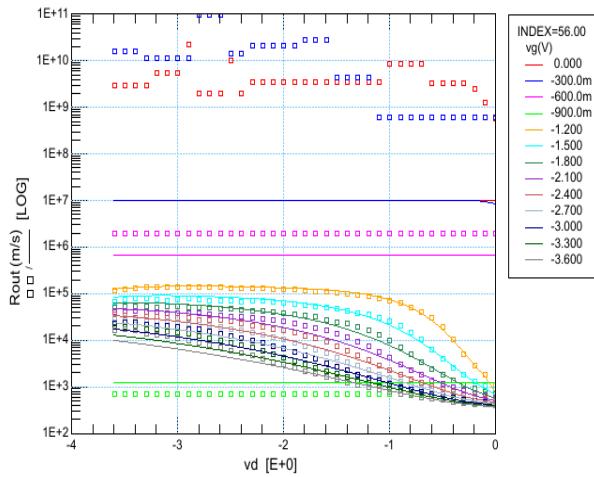
IdVd, T = 27°C



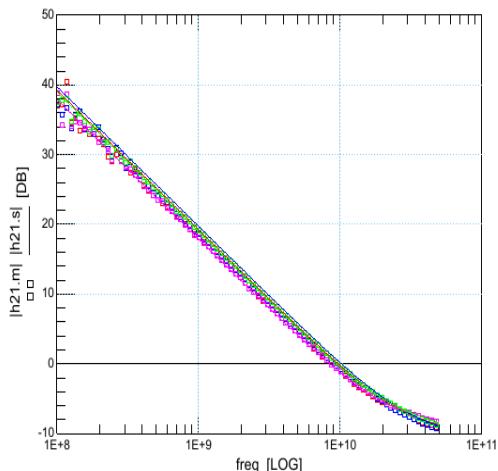
Id = f(Vd)



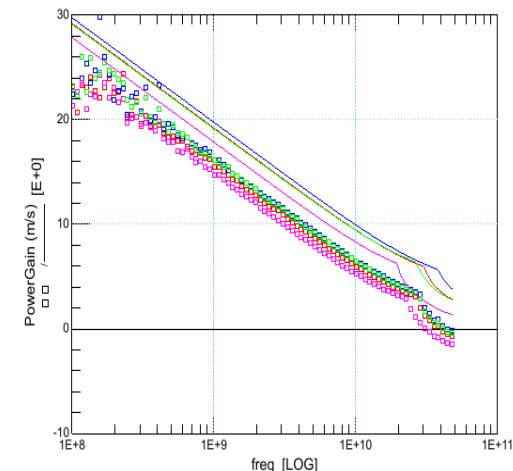
gds = f(Vd)



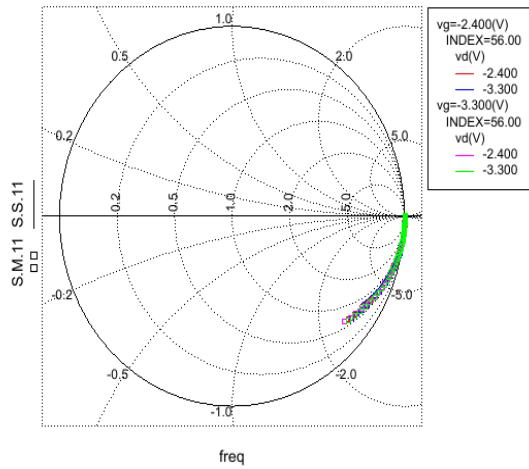
Rout = f(Vd)

S-Parameter, T = 27°C

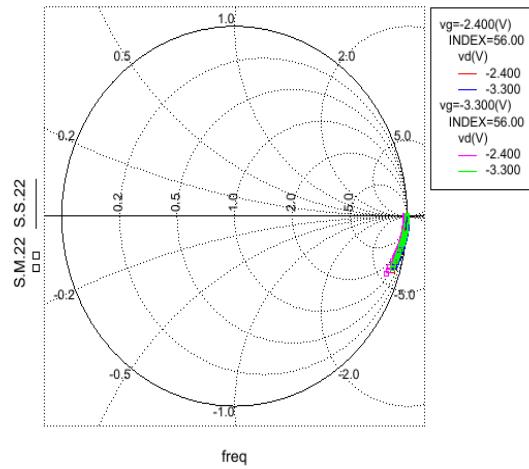
$$|h21| = f(Vg, Vd)$$



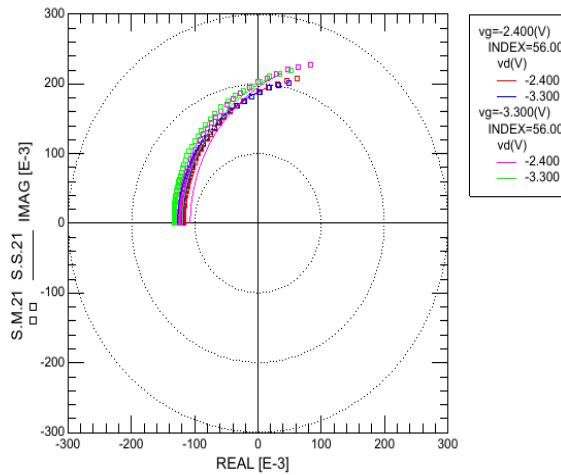
$$MSG/MAG = f(Vg, Vd)$$



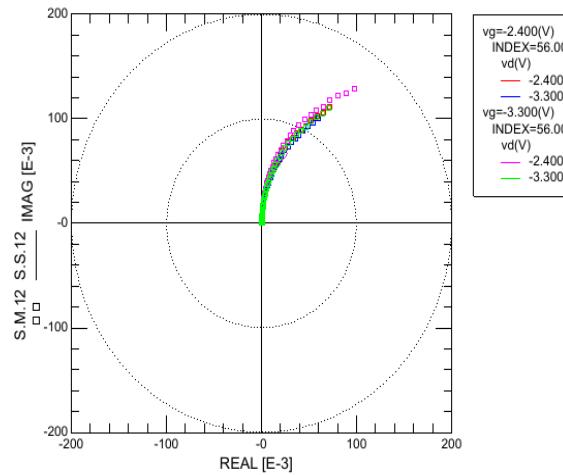
$$S11 = f(Vg, Vd)$$



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

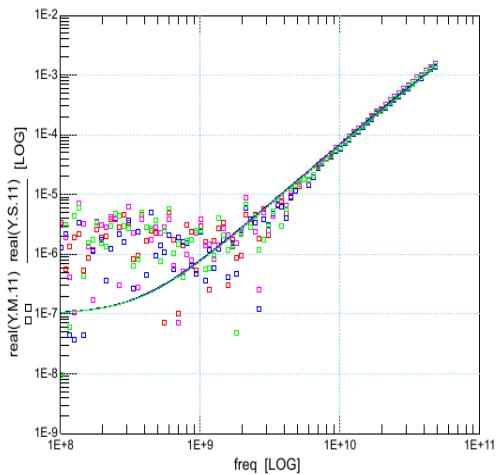


$$S21 = f(Vg, Vd)$$

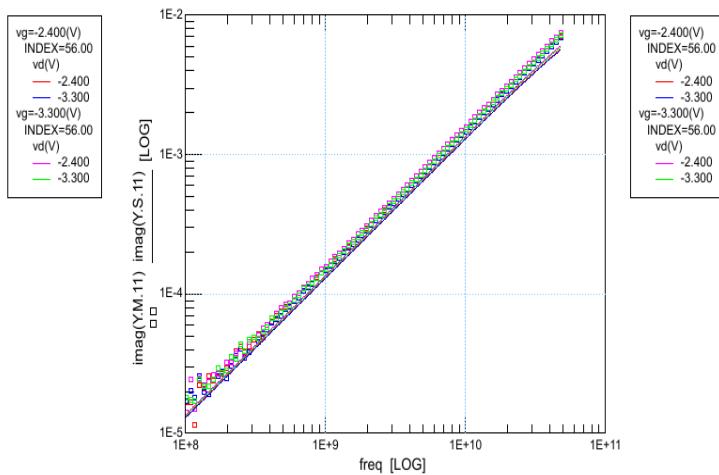


$$S12 = f(Vg, Vd)$$

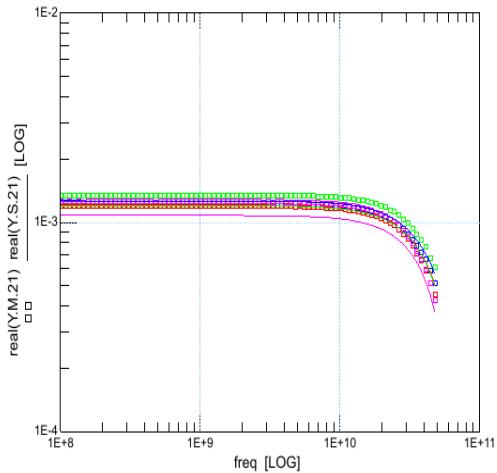
Y-Parameter, T = 27°C



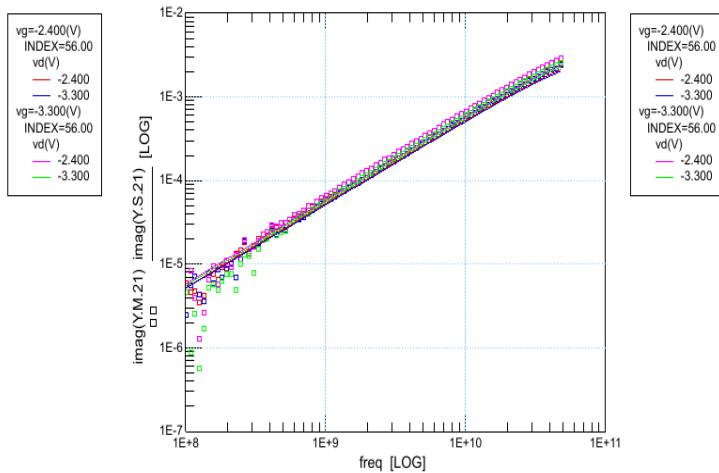
$$\text{re}(Y_{11}) = f(V_g, V_d)$$



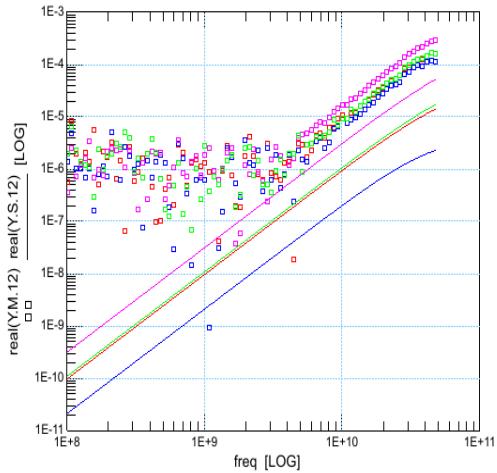
$$\text{im}(Y_{11}) = f(V_g, V_d)$$



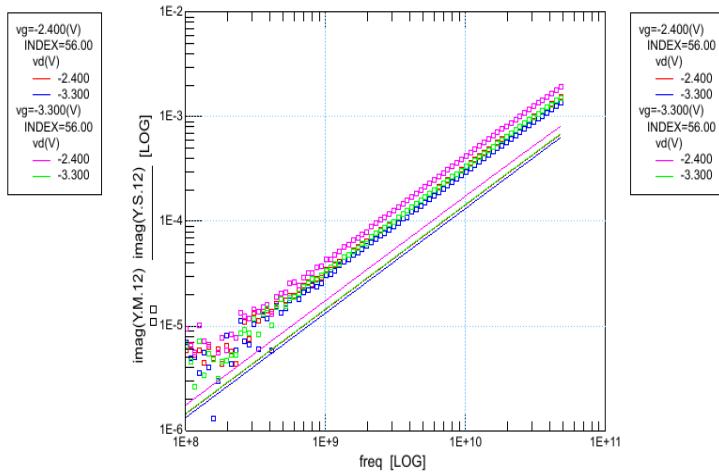
$$\text{re}(Y_{21}) = f(V_g, V_d)$$



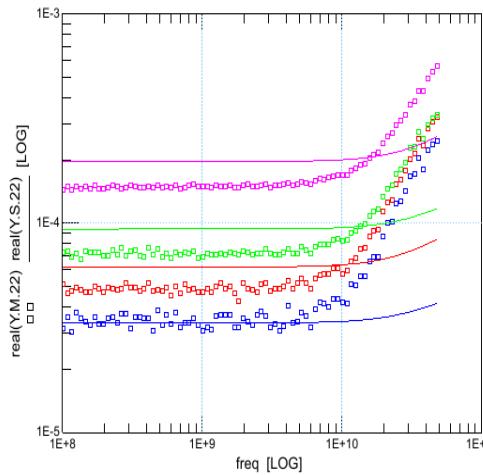
$$\text{im}(Y_{21}) = f(V_g, V_d)$$



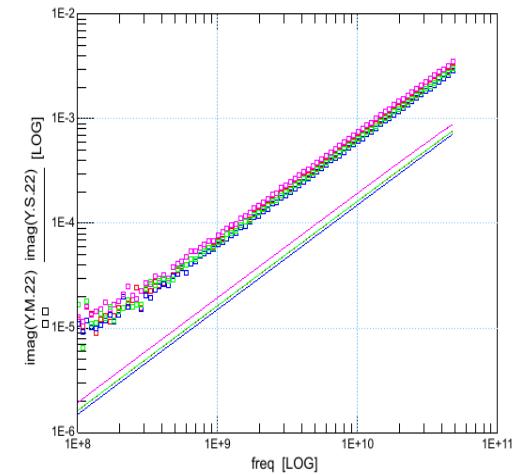
$$\text{re}(Y_{12}) = f(V_g, V_d)$$



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

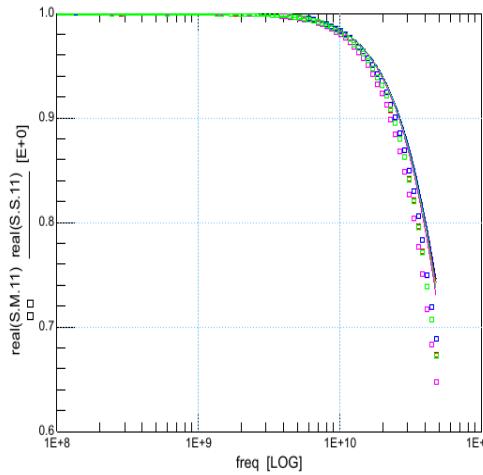


$$\text{real}(Y_{22}) = f(V_g, V_d)$$

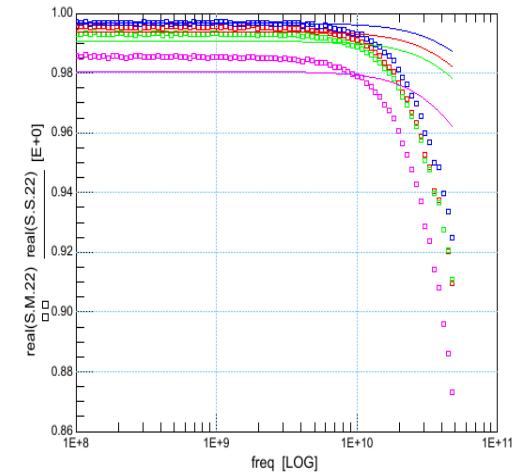


$$\text{imag}(Y_{22}) = f(V_g, V_d)$$

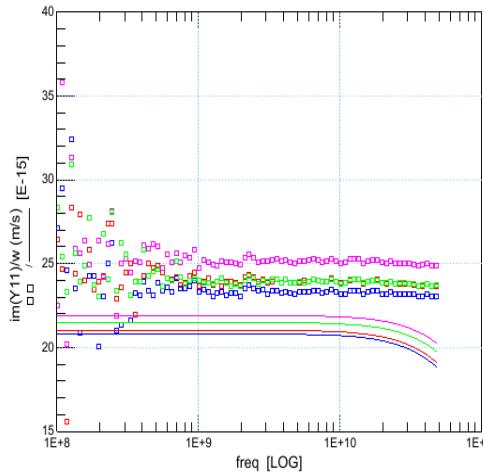
Verify Plots, $T = 27^\circ\text{C}$



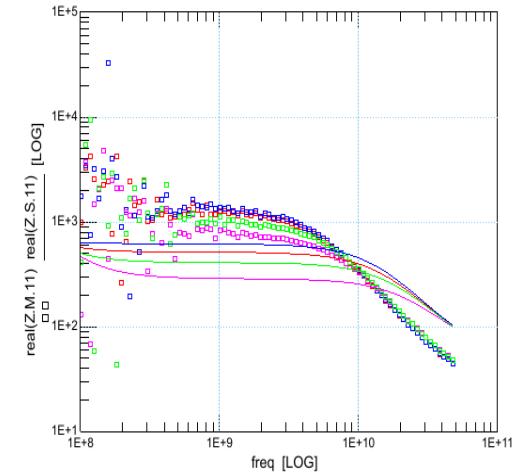
$$\text{real}(S_{11}) = f(V_g, V_d)$$



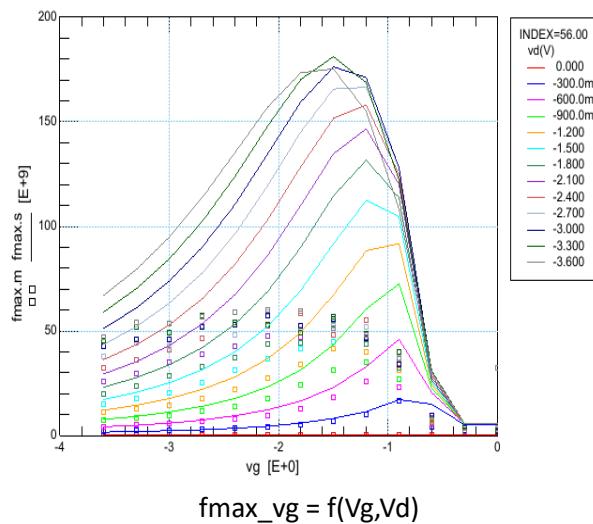
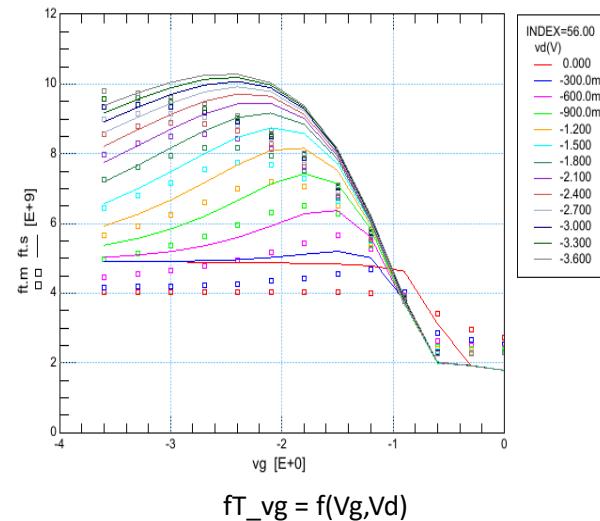
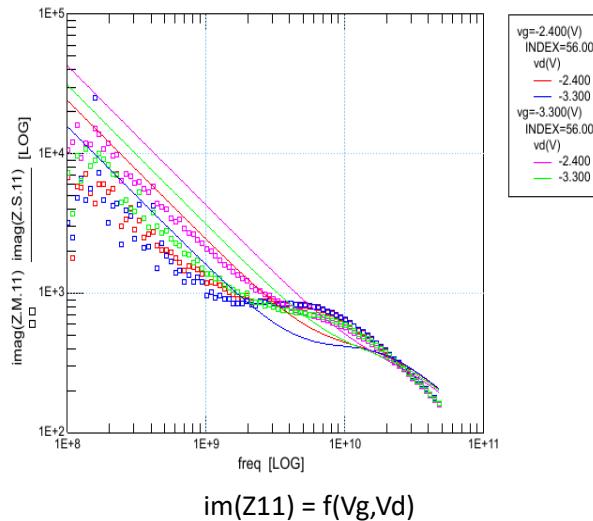
$$\text{real}(S_{22}) = f(V_g, V_d)$$



$$\text{im}(Y_{11}) \text{ divided by } \omega$$

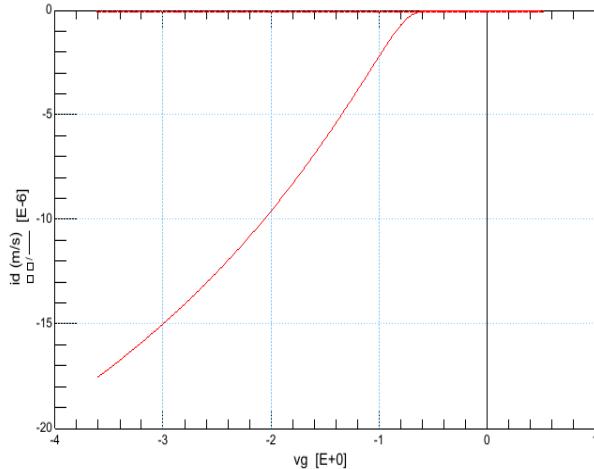


$$\text{real}(Z_{11}) = f(V_g, V_d)$$

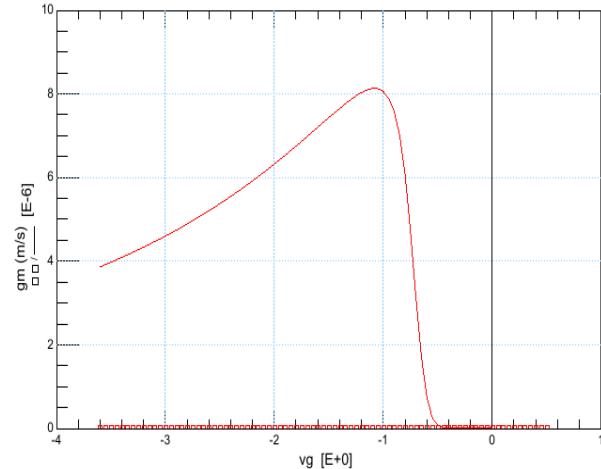


5.13NF04_WF05u0_L10u0_S453A_21

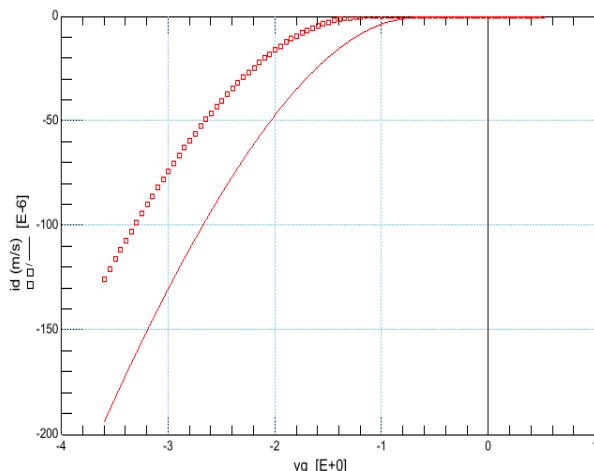
$IdVg$, $T = 27^\circ\text{C}$



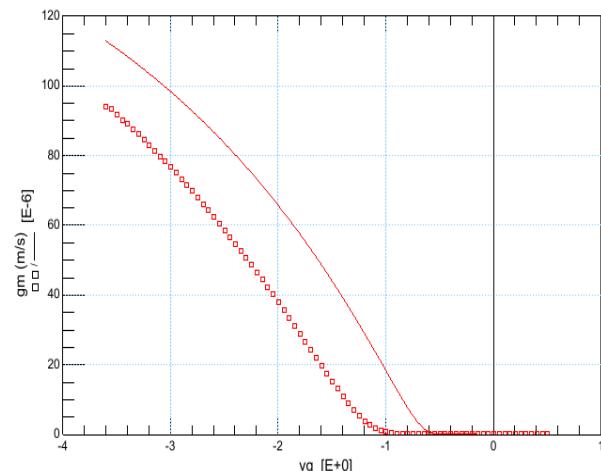
$Id = f(Vg)$ @ $Vd = -0.1\text{V}$



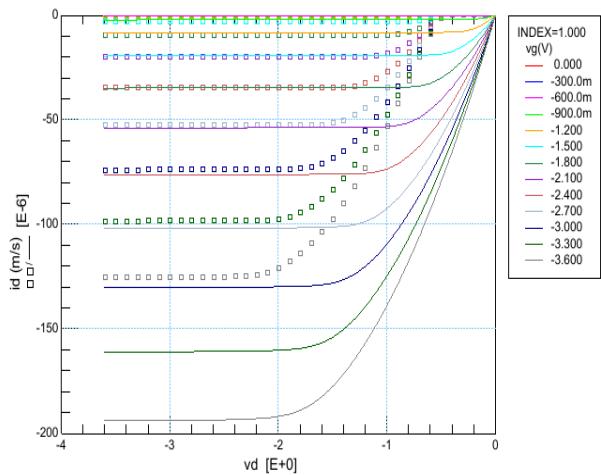
$gm = f(Vg)$ @ $Vd = -0.1\text{V}$



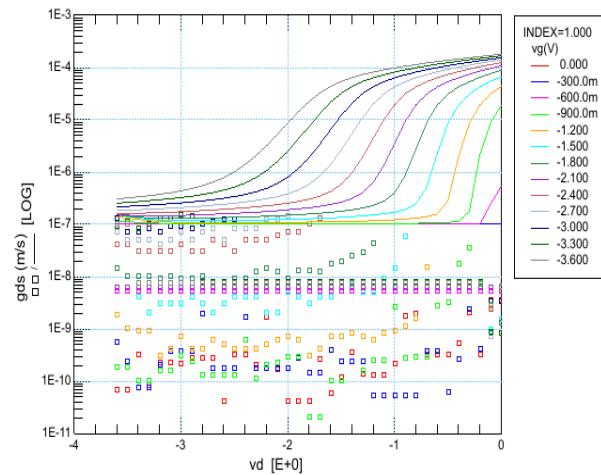
$Id = f(Vg)$ @ $Vd = -3.3\text{V}$



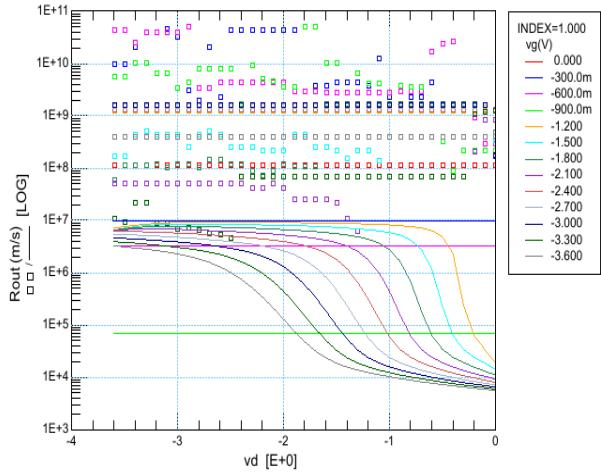
$gm = f(Vg)$ @ $Vd = -3.3\text{V}$

IdVd, T = 27°C

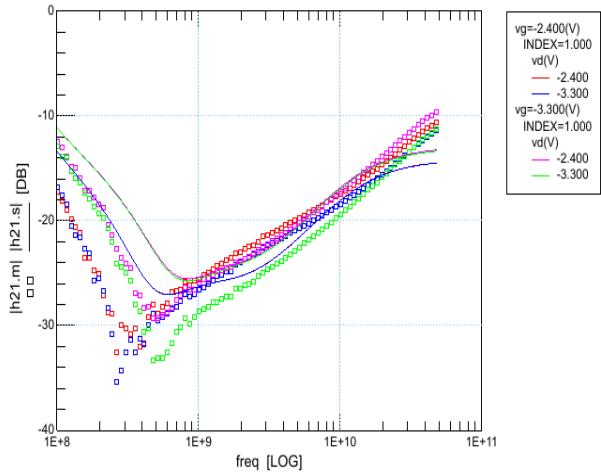
$$Id = f(Vd)$$



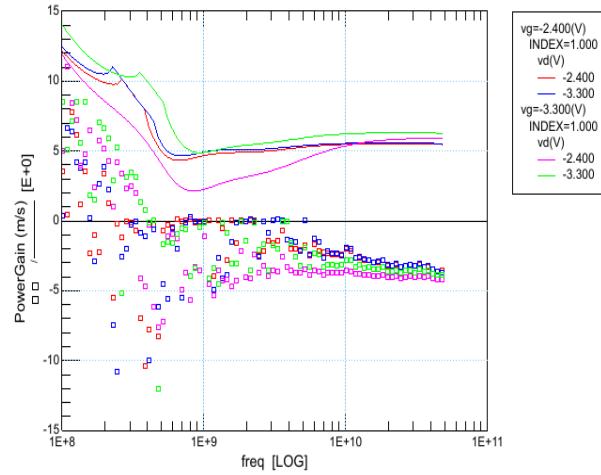
$$gds = f(Vd)$$



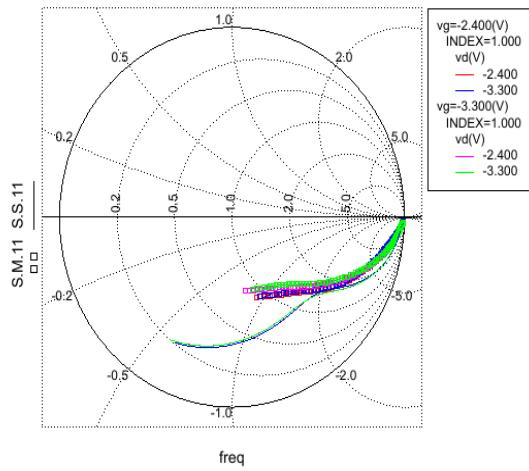
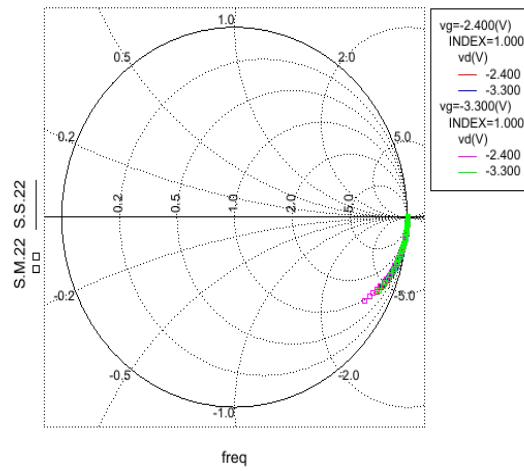
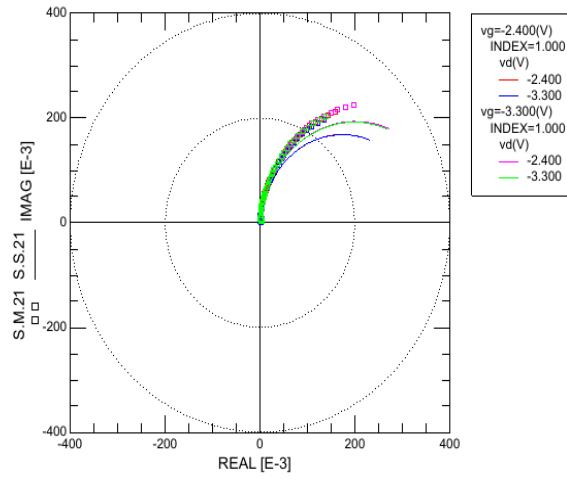
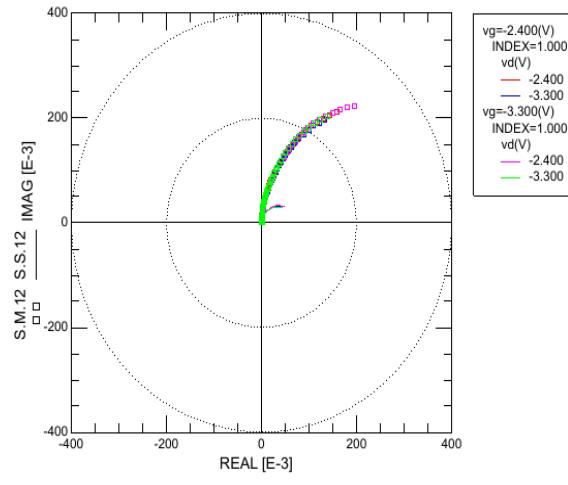
$$Rout = f(Vd)$$

S-Parameter, T = 27°C

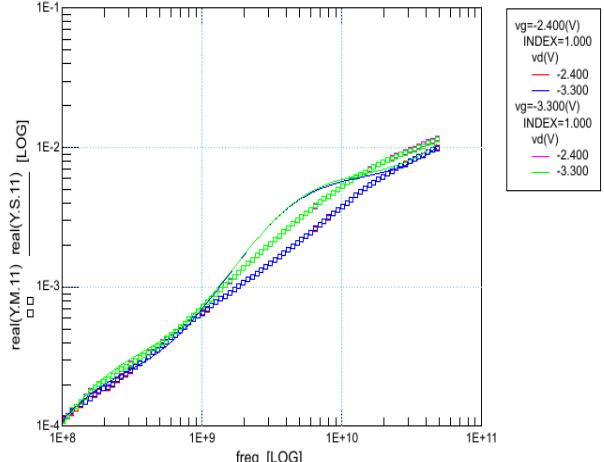
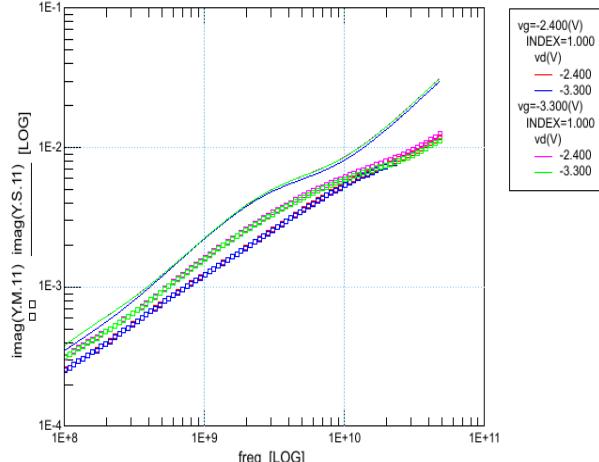
$$|h21| = f(Vg, Vd)$$

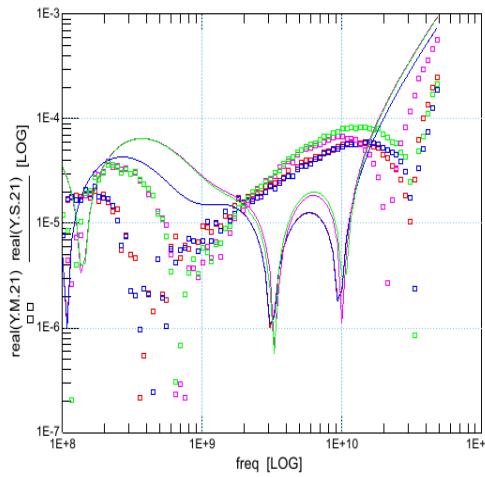
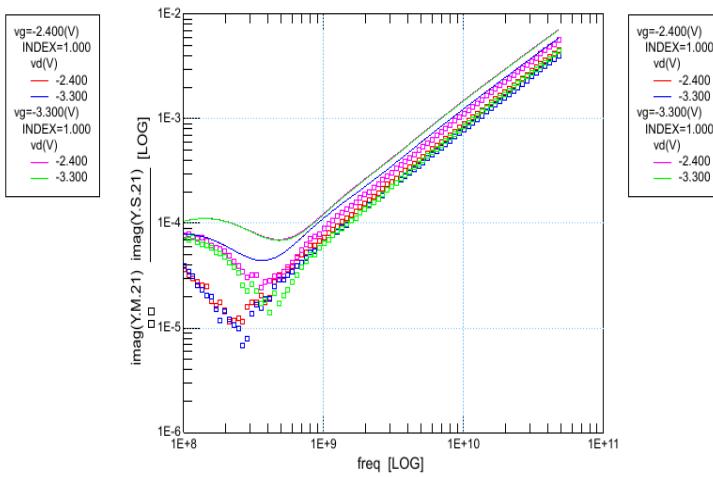
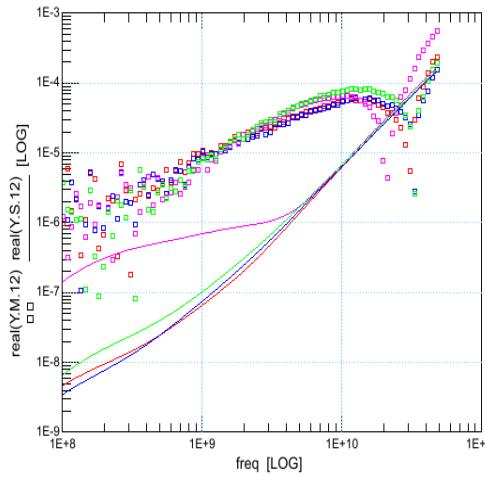
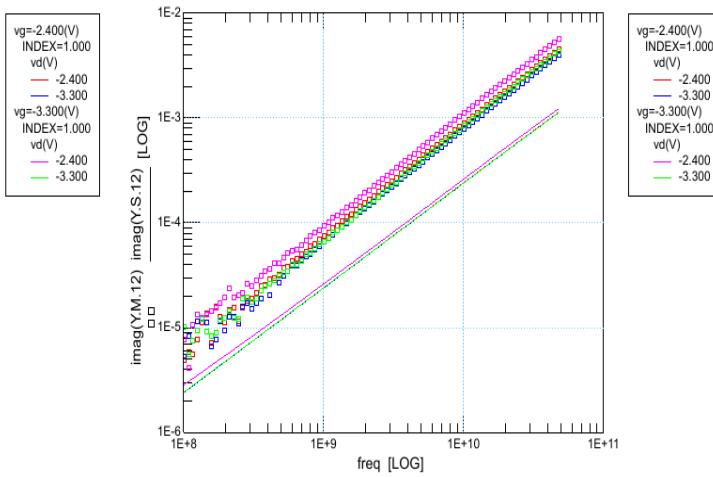
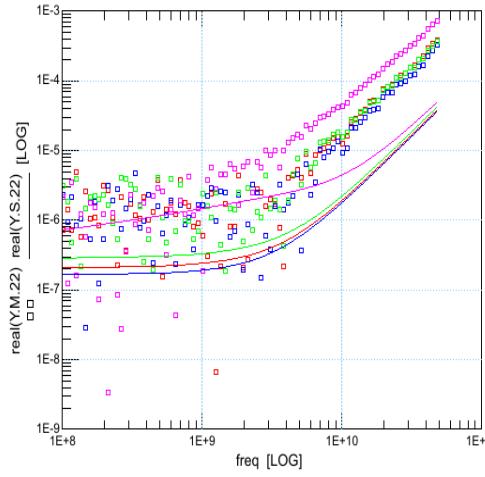
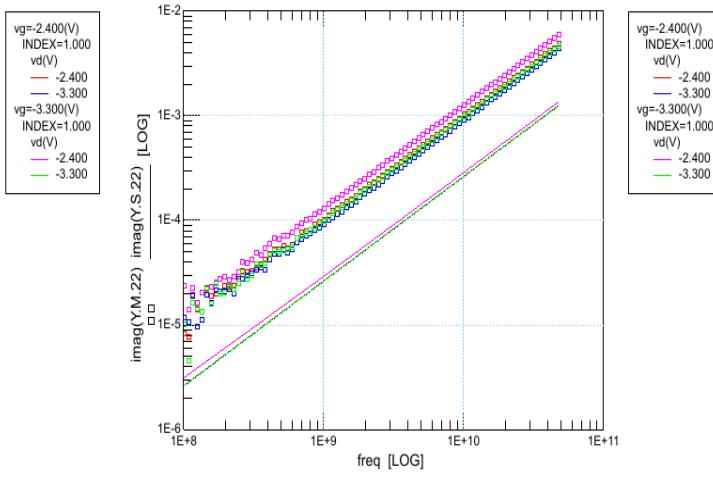


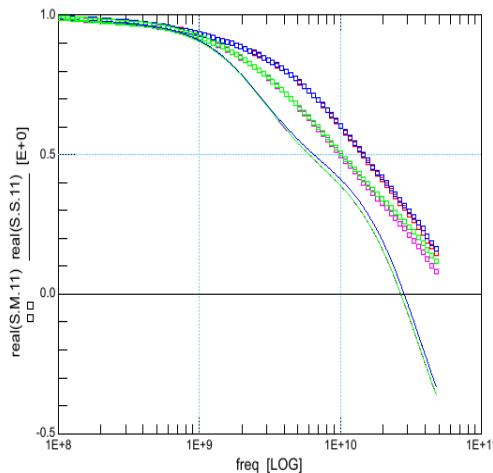
$$MSG/MAG = f(Vg, Vd)$$

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

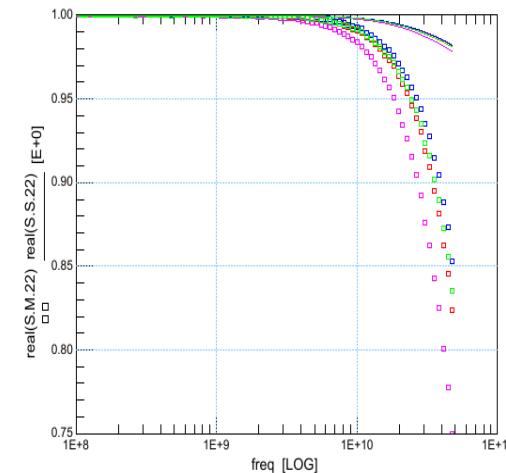
Y-Parameter, T = 27°C

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

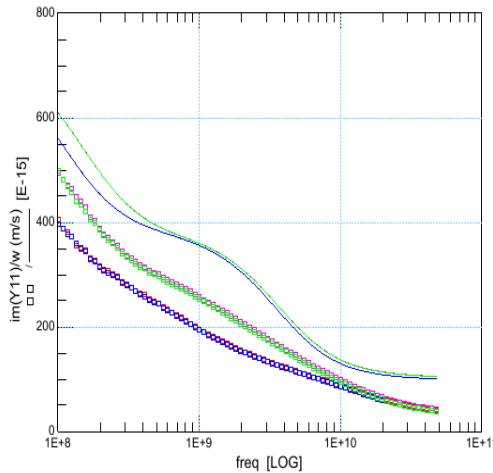
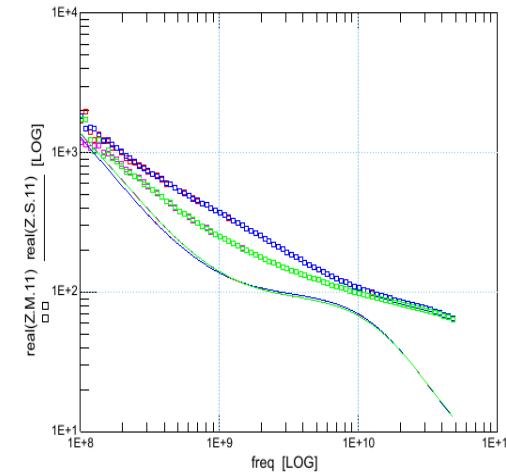
 $\text{re}(Y_{21}) = f(Vg, Vd)$  $\text{im}(Y_{21}) = f(Vg, Vd)$  $\text{re}(Y_{12}) = f(Vg, Vd)$  $\text{im}(Y_{12}) = f(Vg, Vd)$  $\text{re}(Y_{22}) = f(Vg, Vd)$  $\text{im}(Y_{22}) = f(Vg, Vd)$

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

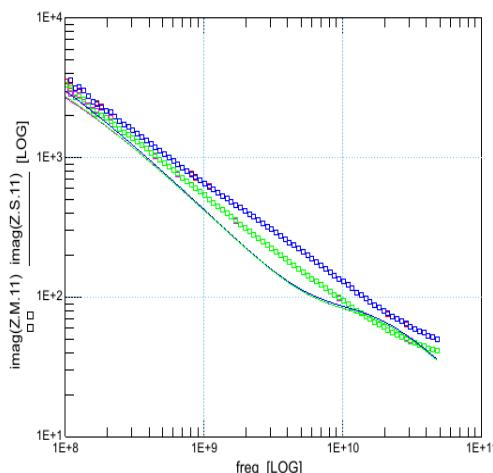
re(S11) = f(Vg, Vd)



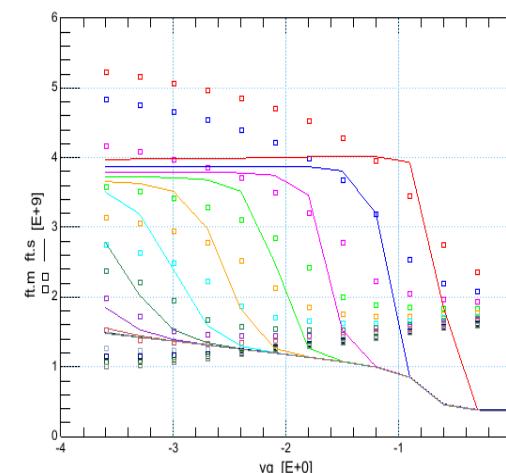
re(S22) = f(Vg, Vd)

im(Y11) divided by ω 

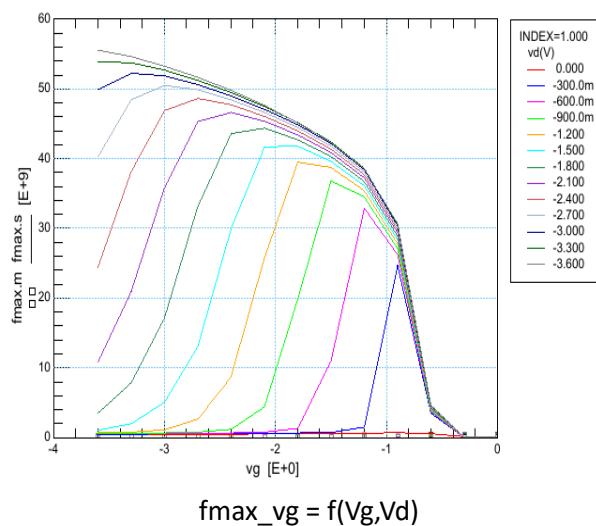
re(Z11) = f(Vg, Vd)



im(Z11) = f(Vg, Vd)



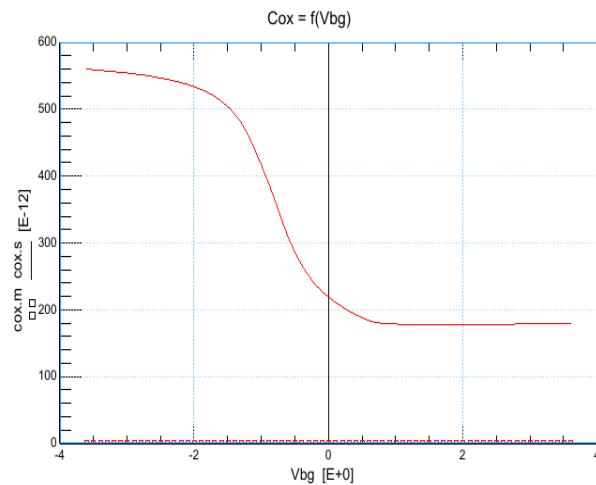
fT_vg = f(Vg, Vd)



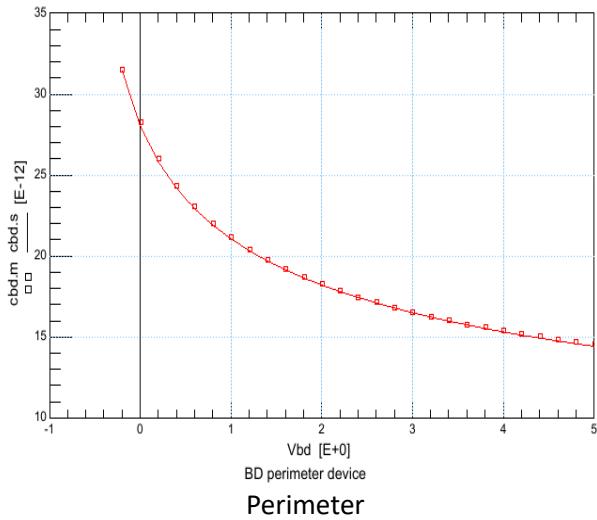
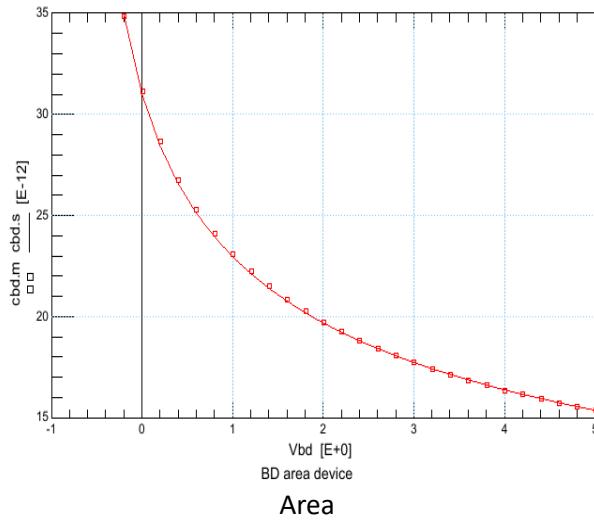
$$f_{max,vg} = f(V_g, V_d)$$

6 Capacitances

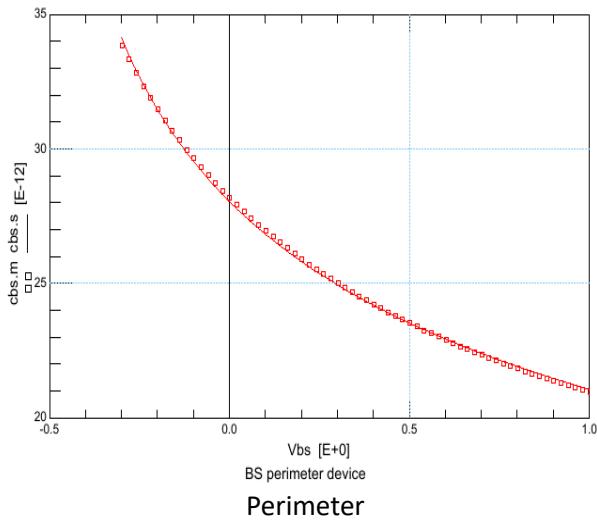
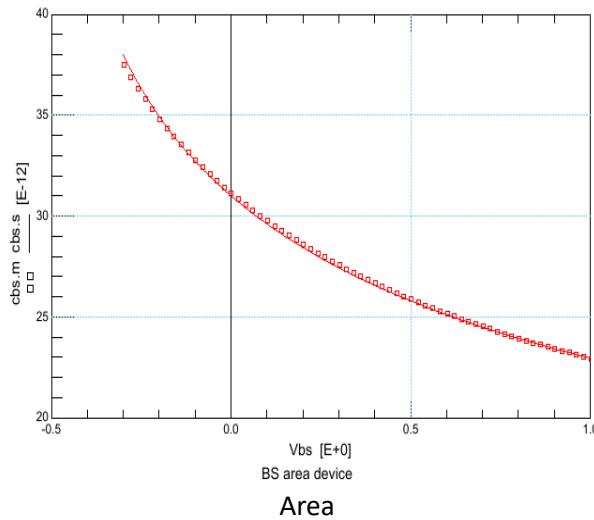
6.1 Gate Oxide Capacitance



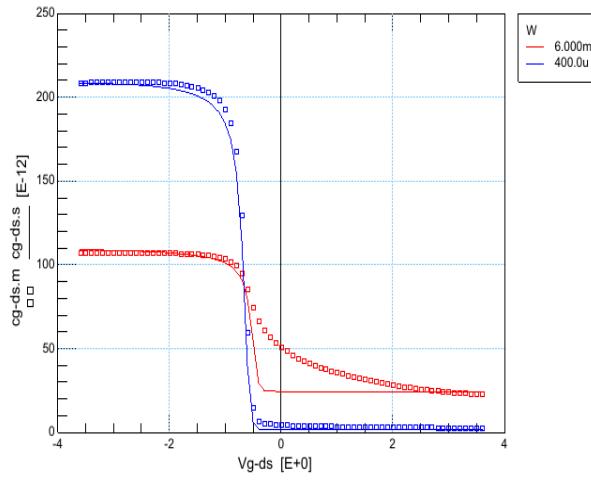
6.2 Junction Capacitance Bulk - Drain



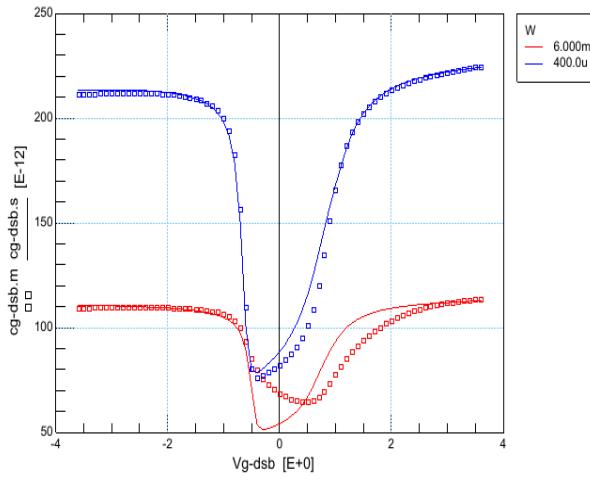
6.3 Junction Capacitance Bulk - Source



6.4 Overlap Capacitance



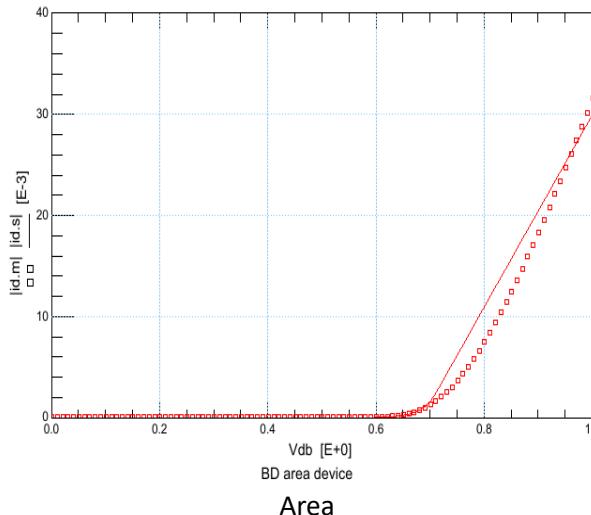
Gate - Drain, Source



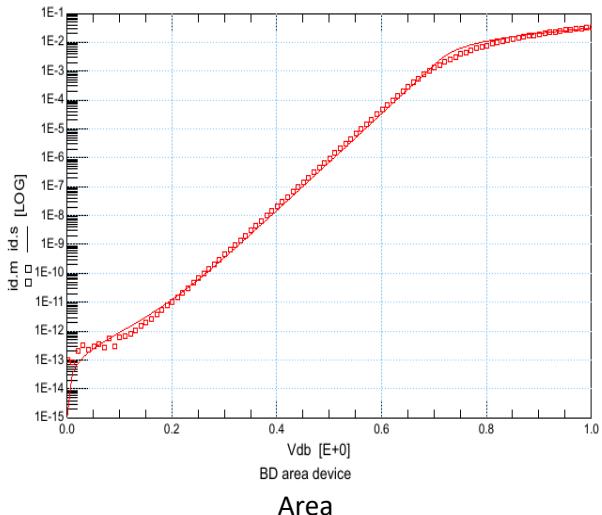
Gate - Drain, Source, Bulk

7 Diodes

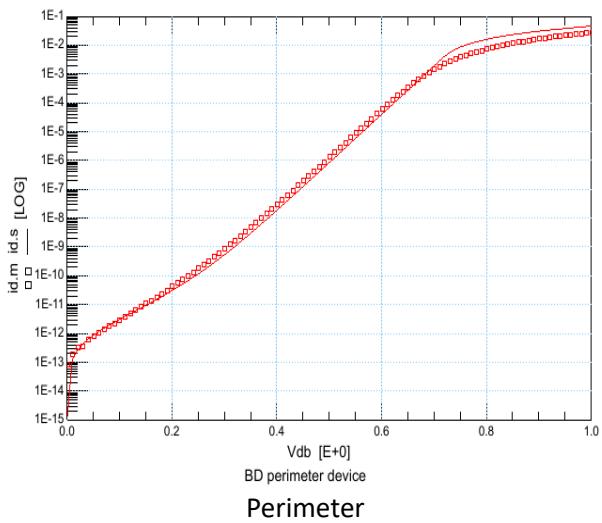
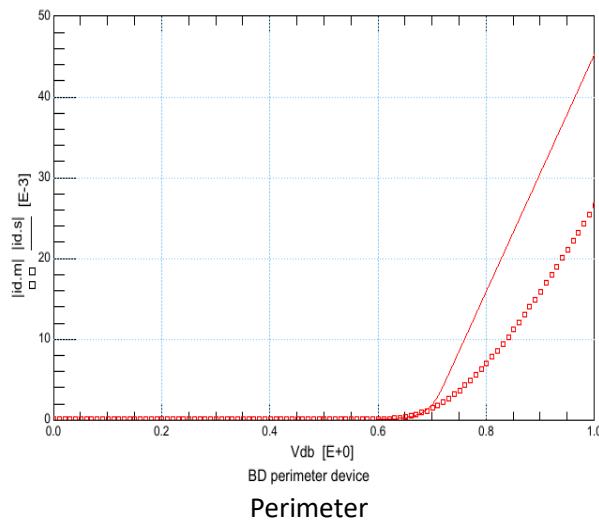
7.1 Diode Bulk - Drain



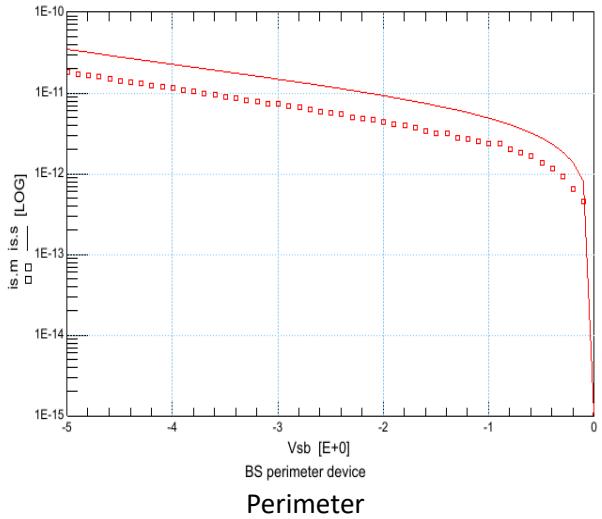
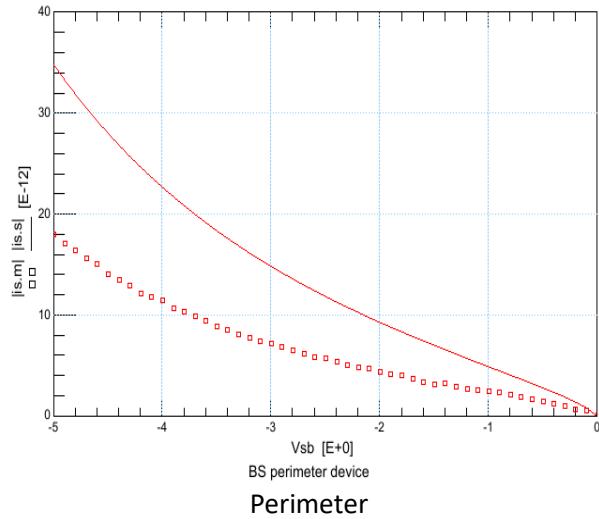
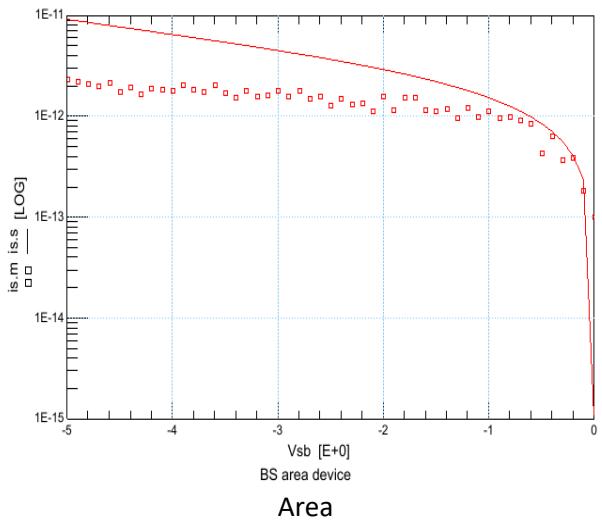
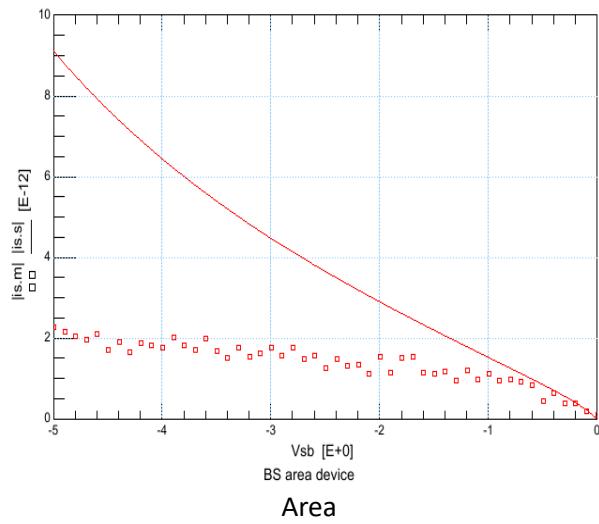
Area



Area



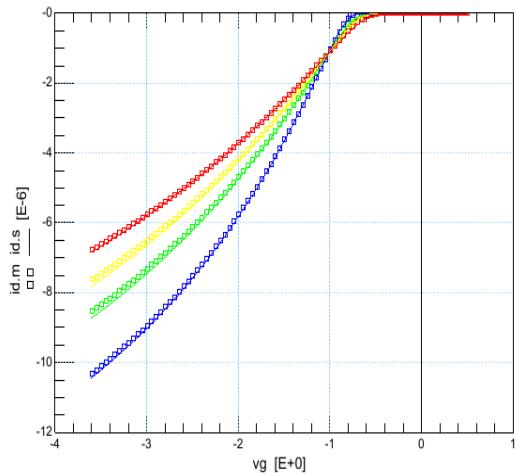
7.2 Diode Bulk - Source



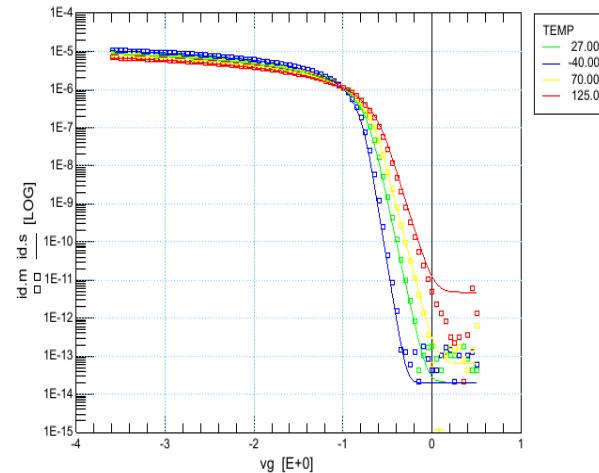
8 Temperature Measurement

8.1 Transistors

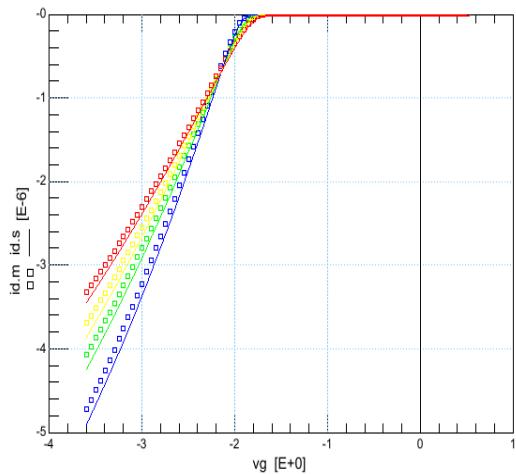
8.1.1 W10u0_L10u0_S562_3



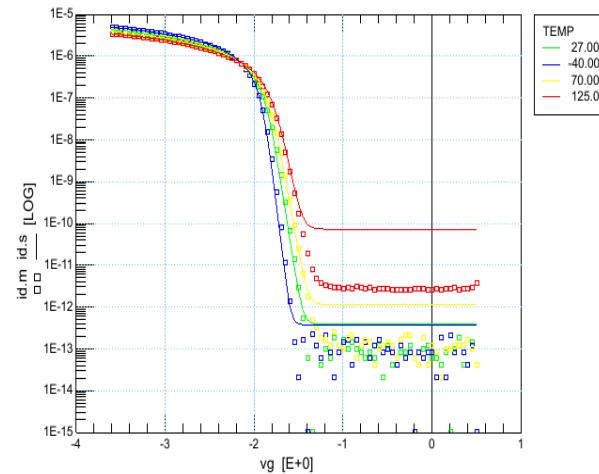
$Id = f(vg, T) @ \text{low } Vds, Vbs = 0$



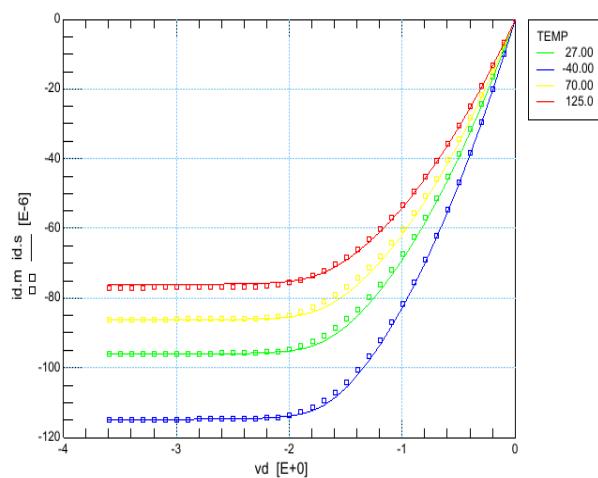
$\log(Id) = f(vg, T) @ \text{low } Vds, Vbs = 0$



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

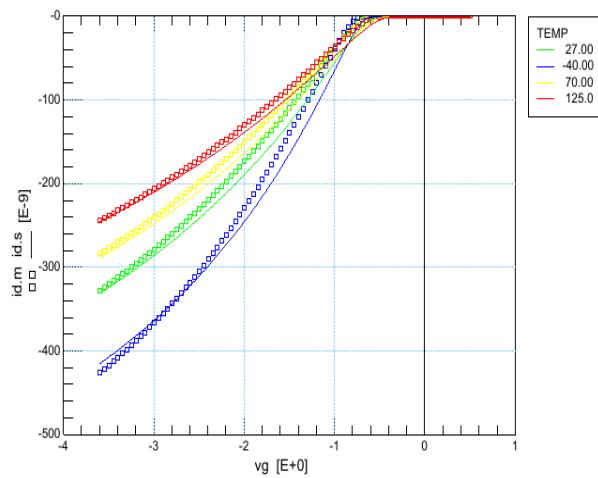


$\log(Id) = f(vg, T) @ \text{low } Vds, Vbs = \text{max}$

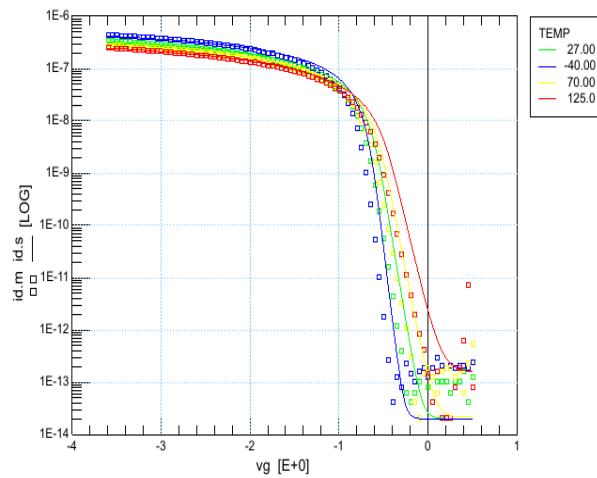


$$Id = f(Vd, Vg, T) @ Vbs = 0$$

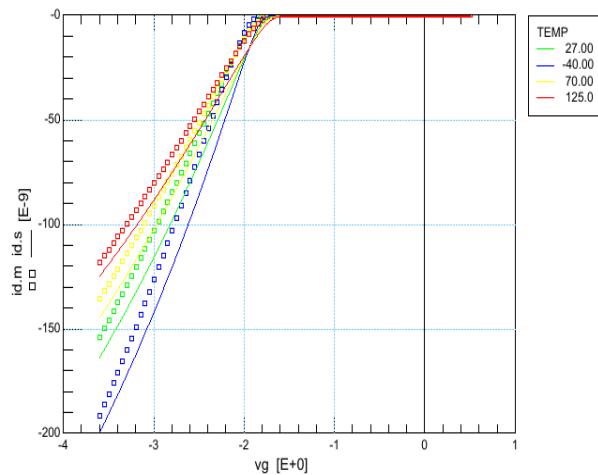
8.1.2 W0u3_L10u0_S555_4



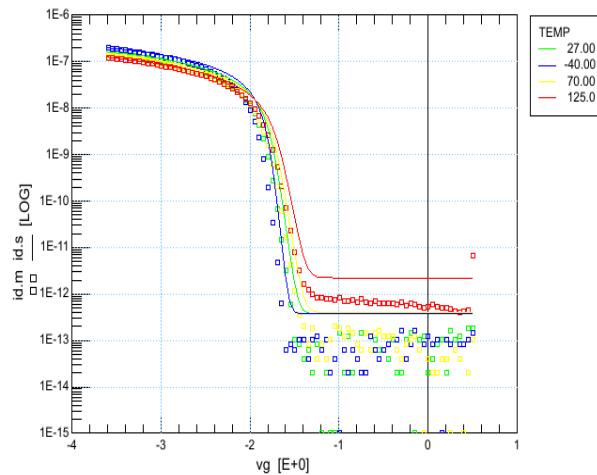
$$Id = f(vg, T) @ \text{low } Vds, Vbs = 0$$



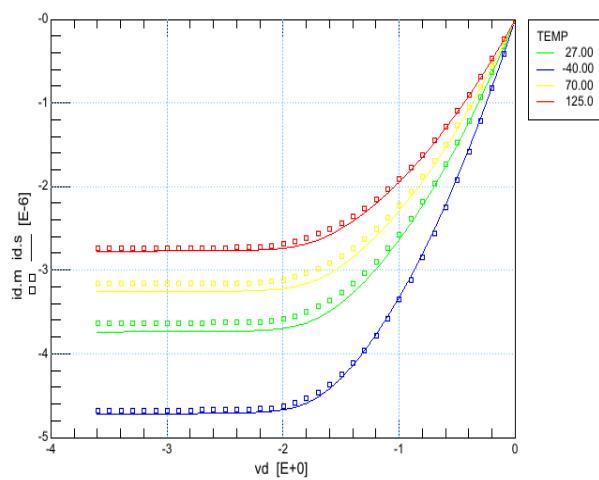
$$\log(Id) = f(vg, T) @ \text{low } Vds, Vbs = 0$$



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

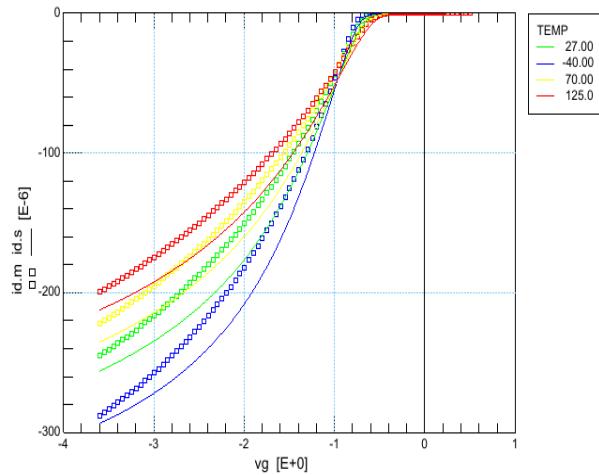


$$\log(Id) = f(vg, T) @ \text{low } Vds, Vbs = \text{max}$$

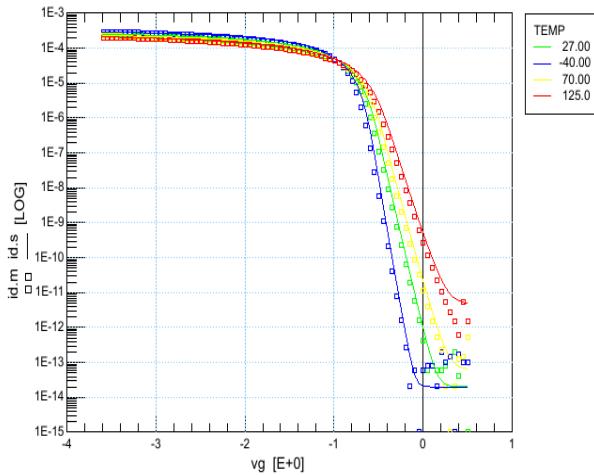


$$Id = f(Vd, Vg, T) @ Vbs = 0$$

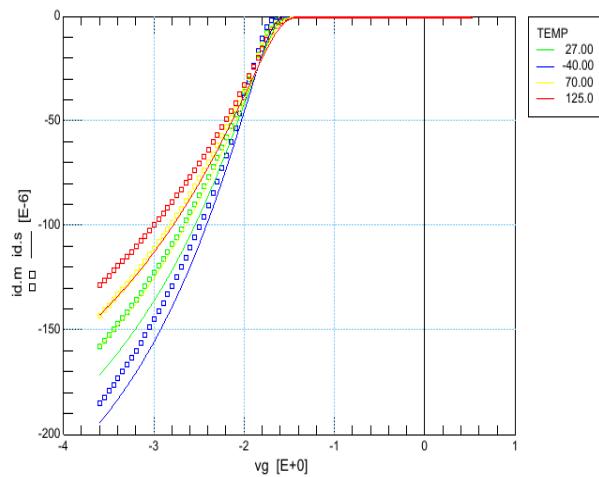
8.1.3 W10u0_L0u35_S561_3



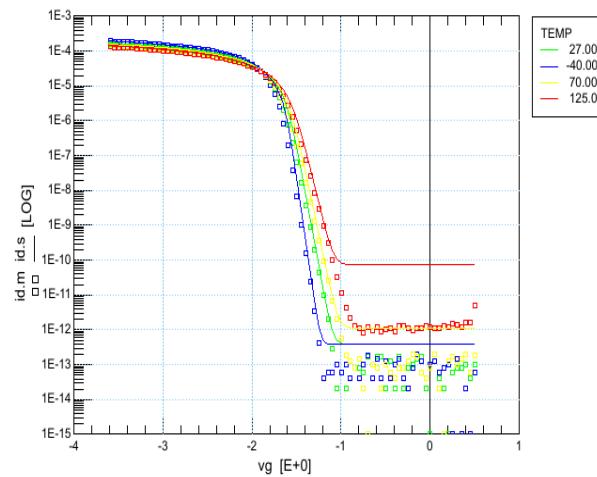
$$Id = f(vg, T) @ \text{low } Vds, Vbs = 0$$



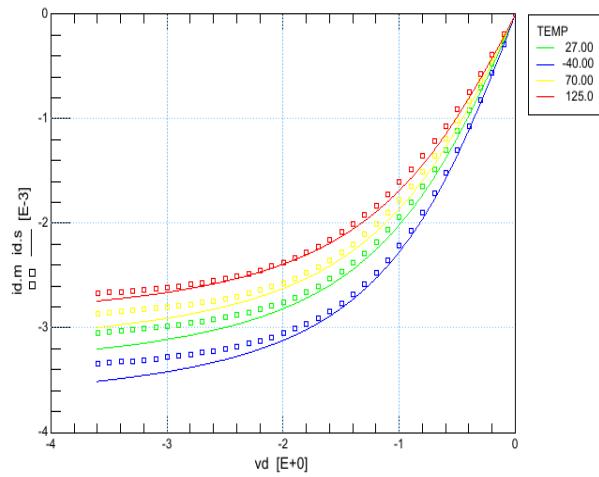
$$\log(Id) = f(vg, T) @ \text{low } Vds, Vbs = 0$$



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

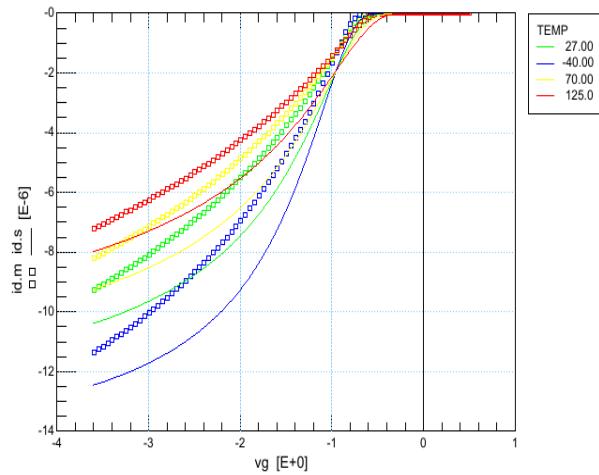


$\log(Id) = f(Vg, T) @ \text{low } Vds, Vbs = \text{max}$

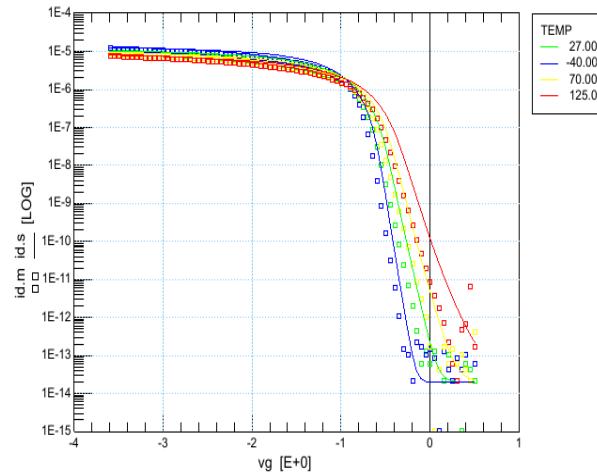


$Id = f(Vd, Vg, T) @ Vbs = 0$

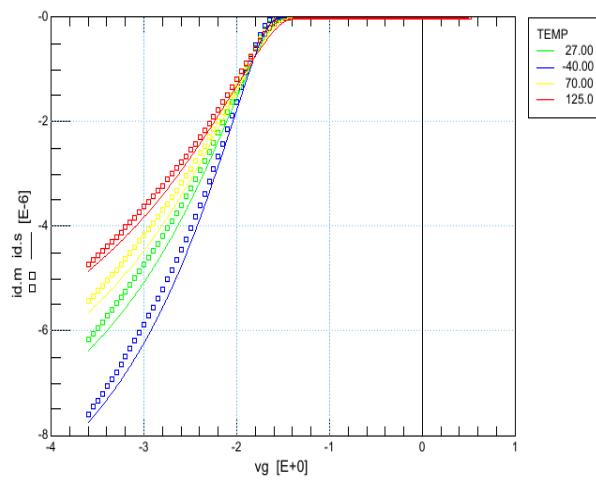
8.1.4 W0u3_L0u35_S565_3



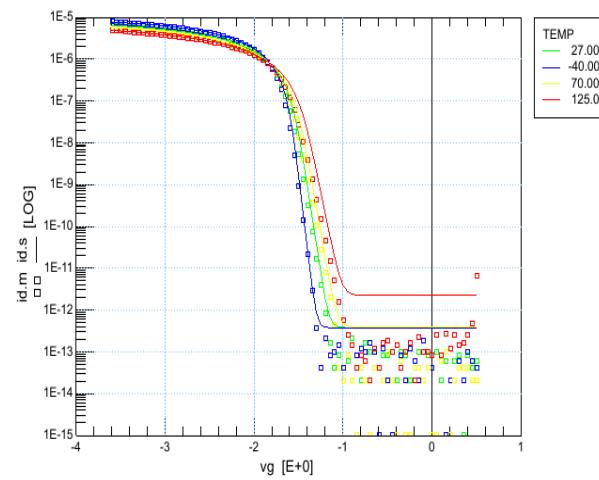
$Id = f(Vg, T) @ \text{low } Vds, Vbs = 0$



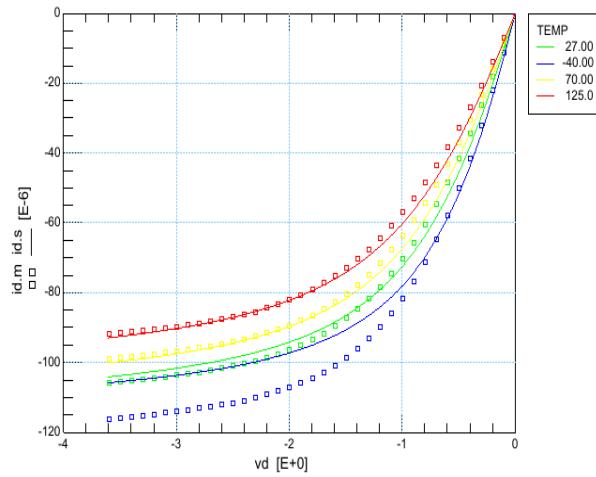
$\log(Id) = f(Vg, T) @ \text{low } Vds, Vbs = 0$



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

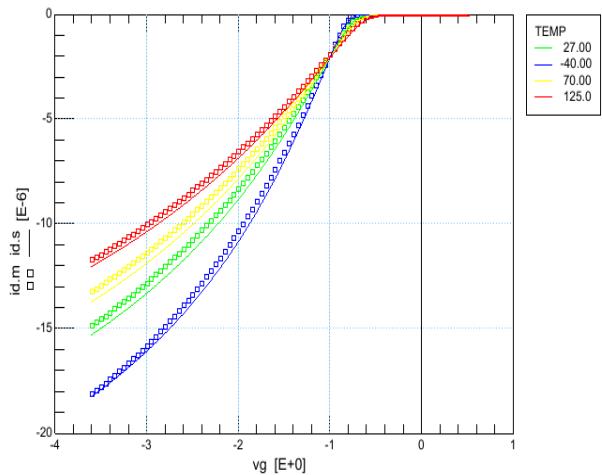


$\log(Id) = f(vg, T) @ \text{low } Vds, Vbs = \text{max}$

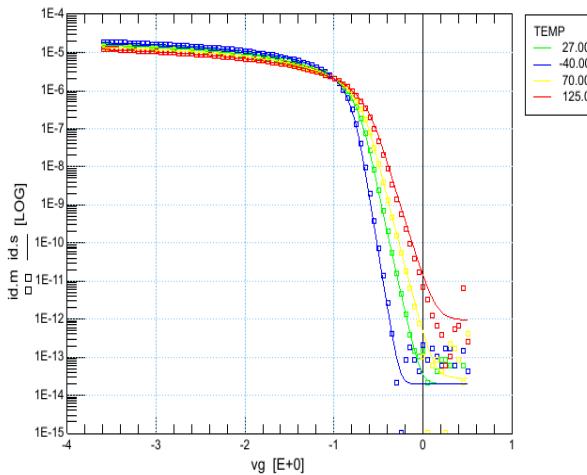


$Id = f(Vd, Vg, T) @ Vbs = 0$

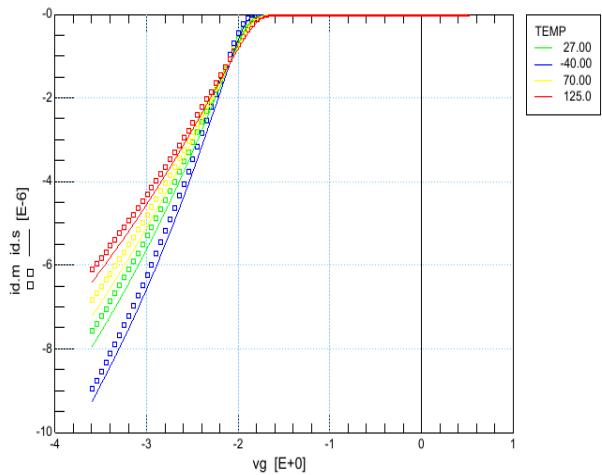
8.1.5 W02u0_L1u2_S563_3



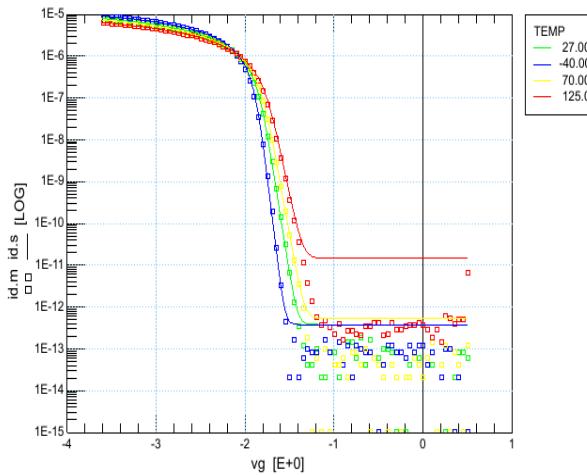
$Id = f(vg, T) @ \text{low } V_{ds}, V_{bs} = 0$



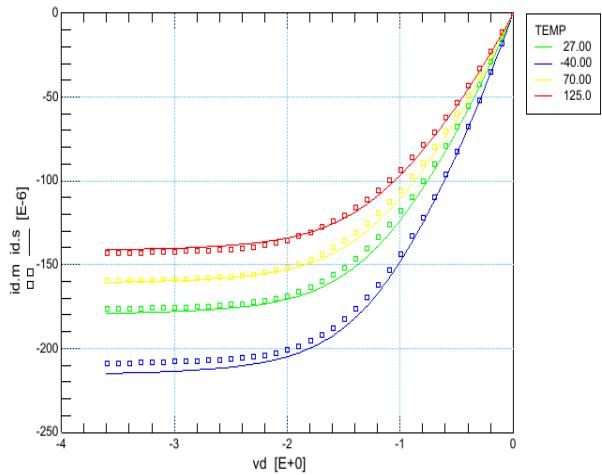
$\log(Id) = f(vg, T) @ \text{low } V_{ds}, V_{bs} = 0$



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

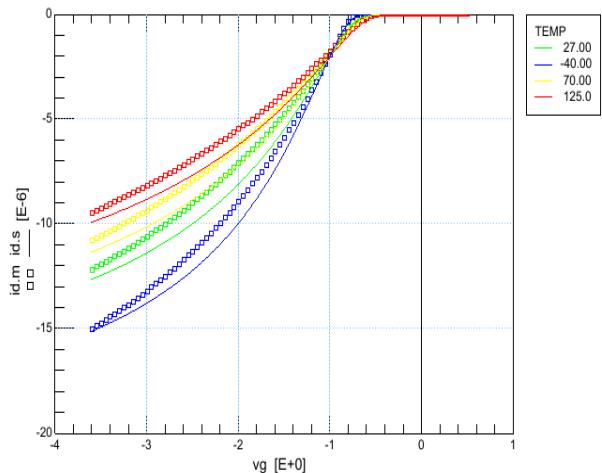


$\log(Id) = f(vg, T) @ \text{low } V_{ds}, V_{bs} = \text{max}$

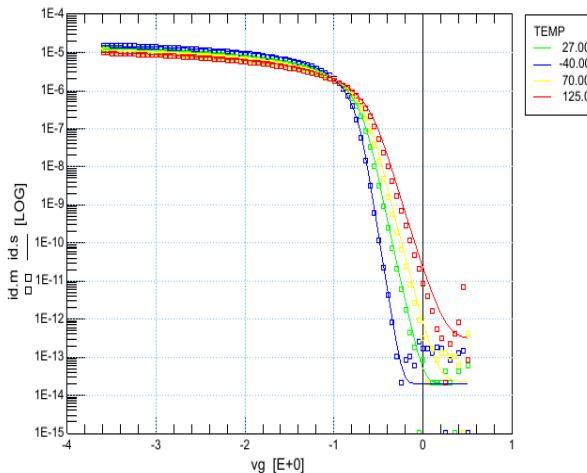


$Id = f(Vd, Vg, T) @ V_{bs} = 0$

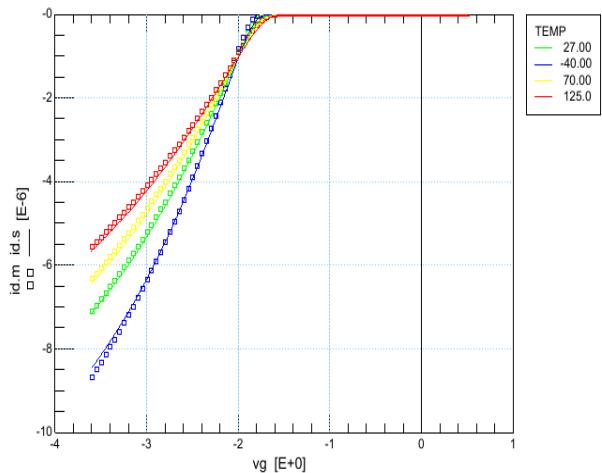
8.1.6 W0u6_L0u5_S564_3



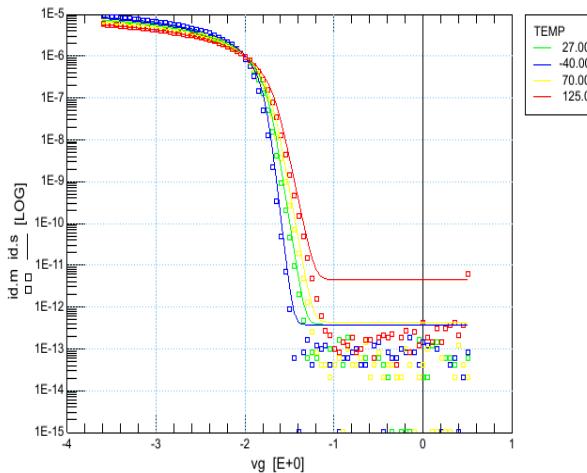
$Id = f(vg, T) @ \text{low } Vds, Vbs = 0$



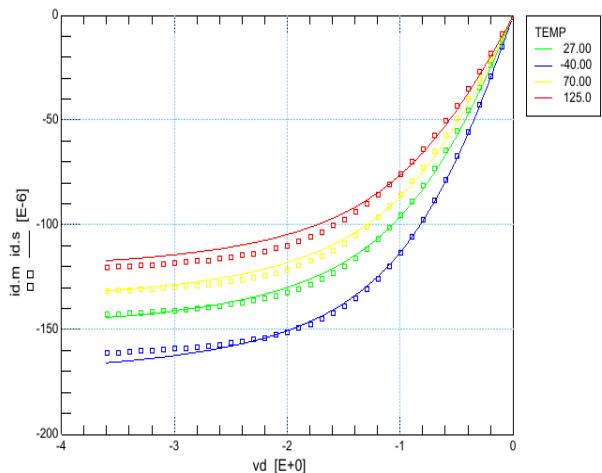
$\log(Id) = f(vg, T) @ \text{low } Vds, Vbs = 0$



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



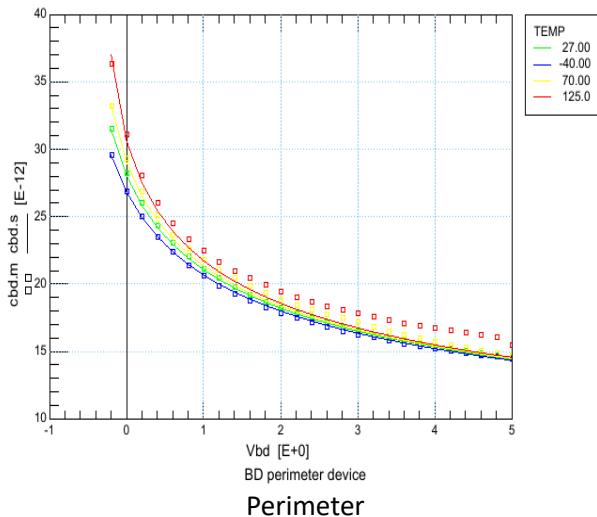
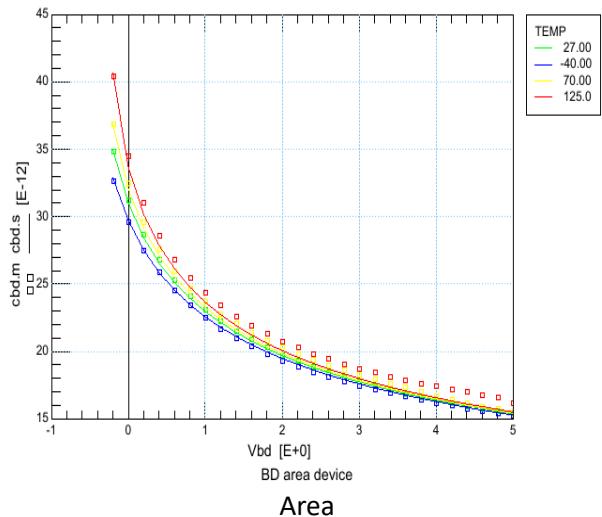
$\log(Id) = f(vg, T) @ \text{low } Vds, Vbs = \text{max}$



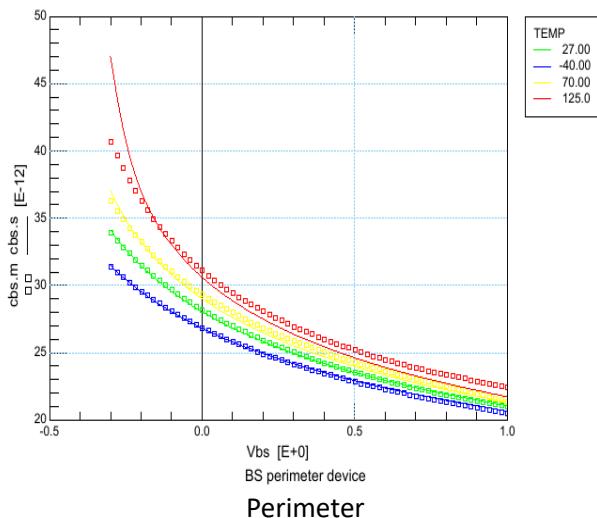
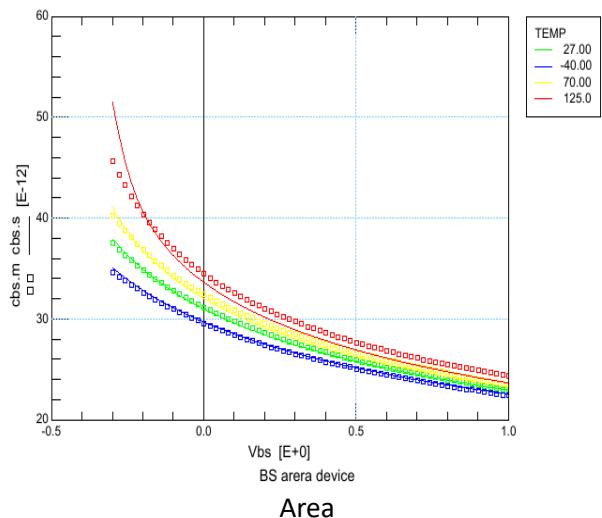
$Id = f(Vd, Vg, T) @ Vbs = 0$

8.2 Junction Capacitance

8.2.1 Bulk - Drain

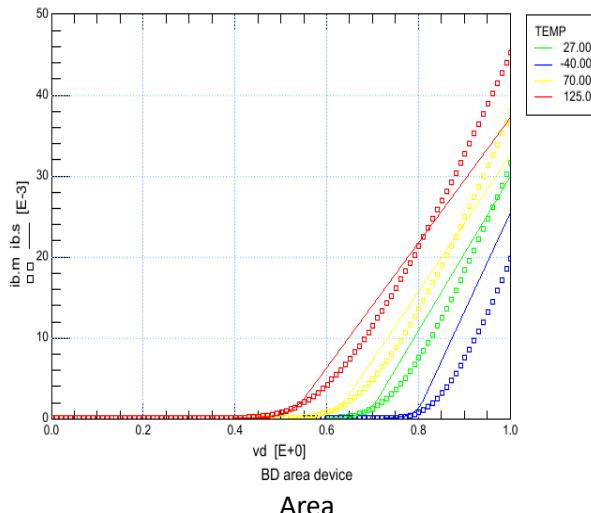


8.2.2 Bulk - Source

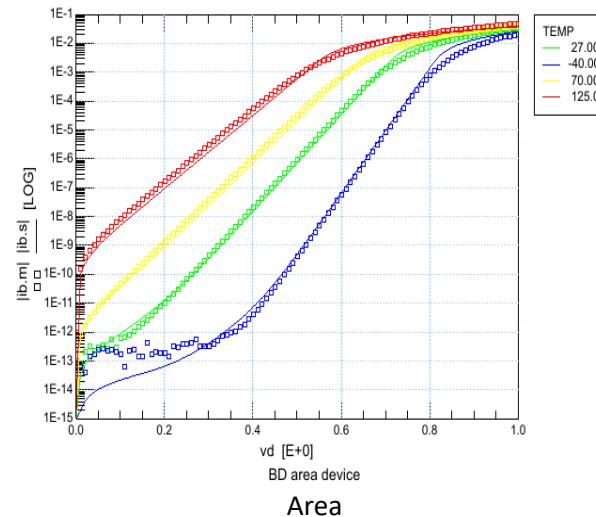


8.3 Parasitic Diodes

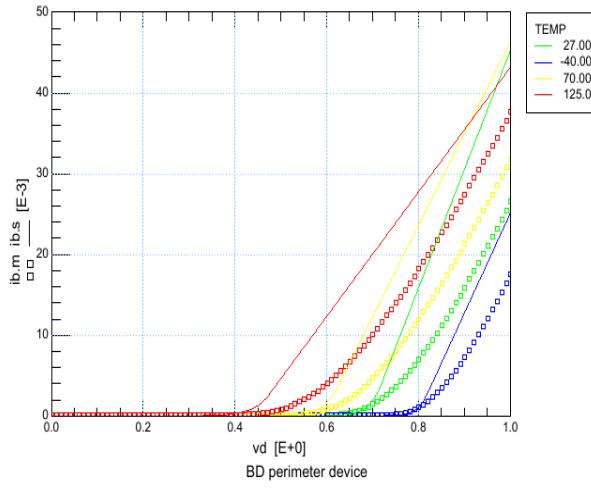
8.3.1 Bulk - Drain



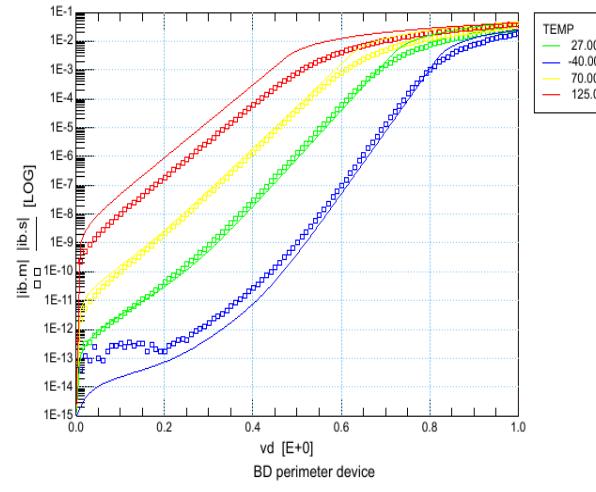
Area



Area

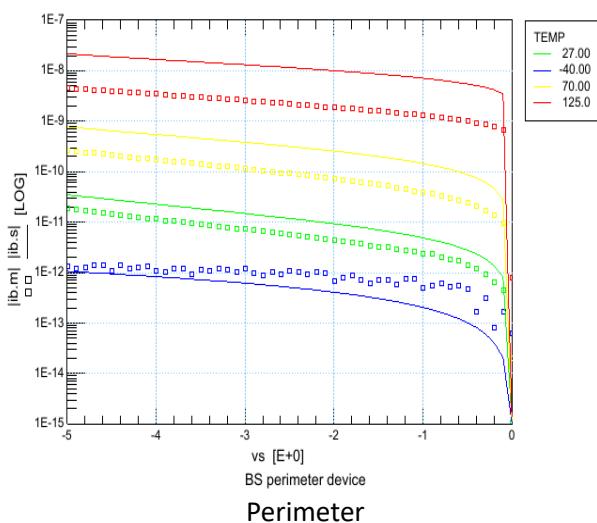
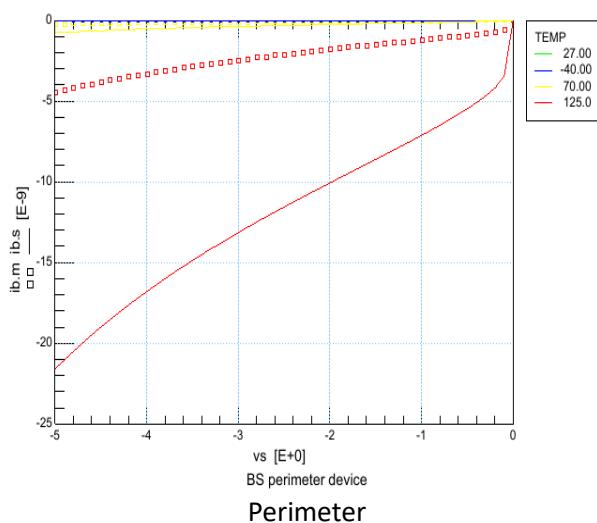
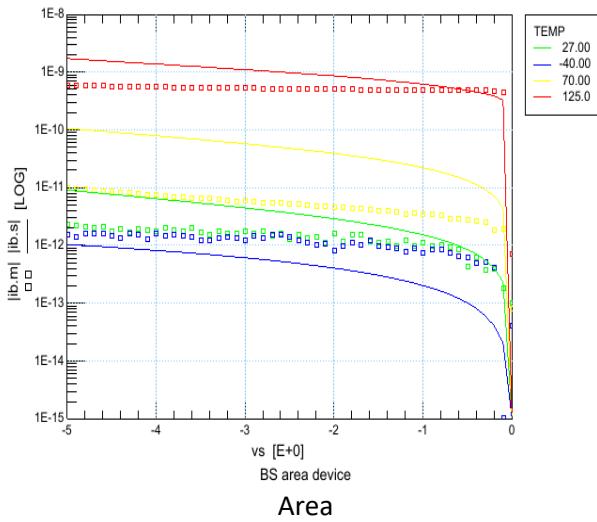
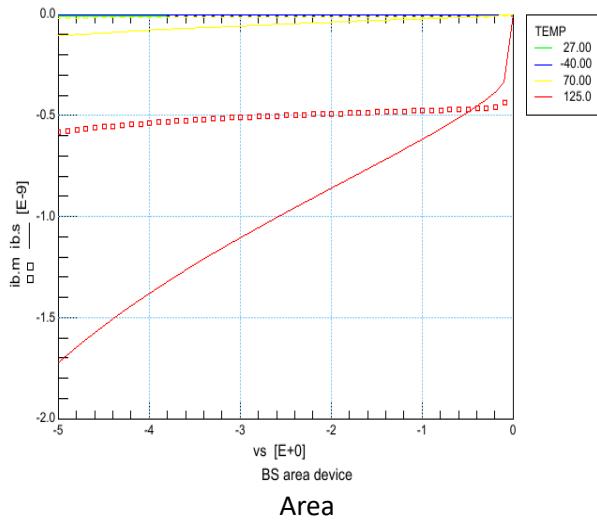


Perimeter



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