

IHP
SG13G2
SG13G2 DC CV NMOS HV

Rev. 1.2 (190924)

Date: February 4, 2023

Table of Content:

1	Documentation	5
1.1	Included Effects in Simulation Model.....	5
1.2	Time range measurement	5
2	Setup.....	6
2.1	Measurement Conditions	6
2.1.1	Measurement Conditions for Transistors.....	6
2.1.2	Measurement Conditions for Capacitance.....	7
2.2	Devices	7
2.2.1	Setup of DC Test Devices	7
2.2.2	Setup of CV Test Devices	9
3	Corner Devices	11
3.1	Target Values vs. Simulated Values.....	11
3.1.1	W = 10.00u, L = 450.0n, NF = 1	11
3.1.2	W = 10.00u, L = 10.00u, NF = 1	11
3.1.3	W = 300.0n, L = 450.0n, NF = 1	11
4	DC Transistors	12
4.1	Summarized Results	12
4.1.1	Threshold Voltage Linear Region	12
4.1.2	Threshold Voltage in Saturation	13
4.1.3	Maximum Drain Current in Linear Region.....	13
4.1.4	Maximum Drain Current in Saturation Region	14
4.2	W10u0_L10u0_S557_3.....	15
4.3	W0u3_L10u0_S547_4.....	39
4.4	W10u0_L0u5_S387_5.....	63
4.5	W10u0_L0u35_S556_3.....	69
4.6	W10u0_L0u5_T356_S387_5.....	75
4.7	W0u3_L0u35_S560_3.....	81
4.8	W10u0_L0u5_S556_4.....	87
4.9	W10u0_L3u0_S557_1.....	111
4.10	W10u0_L5u0_S557_2.....	117
4.11	W10u0_L1u2_S556_5.....	123
4.12	W05u0_L10u0_S558_1.....	129

4.13	W02u0_L10u0_S558_5.....	135
4.14	W0u6_L10u0_S559_5.....	141
4.15	W02u0_L3u0_S558_4.....	147
4.16	W0u6_L1u2_S559_4.....	171
4.17	W02u0_L1u2_S558_3.....	195
4.18	W05u0_L5u0_S557_5.....	201
4.19	W0u3_L1u2_S560_5.....	207
4.20	W0u6_L0u35_S559_2.....	213
4.21	W0u6_L0u5_S559_3.....	219
4.22	W0u3_L0u5_S560_4.....	225
4.23	W02u0_L0u33_S558_2.....	249
4.24	W10u0_L0u33_S556_2.....	255
4.25	W10u0_L0u4_T356_S387_4.....	261
4.26	W0u3_L0u3_S560_1.....	267
4.27	W10u0_L0u45_T356_S384M_1.....	273
4.28	W0u15_L0u33_S547_5.....	279
4.29	W10u0_L0u4_S387_4.....	285
4.30	W10u0_L0u3_S556_1.....	291
4.31	W0u3_L0u45_T356_S384M_3.....	297
4.32	W0u3_L0u33_S560_2.....	303
4.33	W0u6_L0u33_S559_1.....	309
4.34	W05u0_L0u33_S557_4.....	315
5	RF Transistors.....	321
5.1	NF04_WF05u0_L_0u5_post_90	321
5.2	NF04_WF05u0_L_0u5_S453A_90.....	326
5.3	NF08_WF02u5_L_0u45_S453A_A1	332
5.4	NF01_WF05u0_L_0u45_S453A_C1	337
5.5	NF04_WF05u0_L_0u45_S453A_83.....	343
5.6	NF04_WF05u0_L_0u45_post_83.....	348
5.7	NF10_WF10u0_L_0u45_S453A_80.....	354
5.8	NF04_WF02u5_L_0u45_S453A_91.....	359
5.9	NF05_WF10u0_L_0u45_S453A_A4	365
5.10	NF04_WF07u5_L_0u45_S453A_94.....	370
5.11	NF01_WF10u0_L_0u45_S453A_B1	376

5.12	NF10_WF01u0_L_0u45_S453A_B4	381
5.13	NF04_WF05u0_L_10u0_S453A_14.....	387
6	Capacitances	392
6.1	Gate Oxide Capacitance	392
6.2	Junction Capacitance Bulk - Drain.....	393
6.3	Junction Capacitance Bulk - Source.....	393
6.4	Overlap Capacitance.....	394
7	Diodes.....	394
7.1	Diode Bulk - Drain	394
7.2	Diode Bulk - Source	395
8	Temperature Measurement	396
8.1	Transistors	396
8.1.1	W10u0_L10u0_S557_3.....	396
8.1.2	W0u3_L10u0_S547_4.....	397
8.1.3	W10u0_L0u5_S556_4.....	398
8.1.4	W02u0_L3u0_S558_4.....	399
8.1.5	W0u6_L1u2_S559_4.....	401
8.1.6	W0u3_L0u5_S560_4.....	402
8.2	Junction Capacitance	403
8.2.1	Bulk - Drain	403
8.2.2	Bulk - Source	403
8.3	Parasitic Diodes	404
8.3.1	Bulk - Drain	404
8.3.2	Bulk - Source	405
9	Flicker Noise	406
9.1	Measurement Conditions	406
9.2	Devices	406
10	Change History	407

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 f(Vth)		3	Ref. Setup: idvg Idref: 100.0n Offset: -200.0m Resolution: 1.000m Steps: 200.0m

					200.0m
	vb	-3.6		1	
	vs	0		1	
idvg	vg	-500m	3.6	83	
	vd	100m	3.3	3	
idvd	vd	0	3.6	37	
	vg	0	3.6	13	
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
Intrinsic	1 VD	-3.6	100m	3.6	D	G
	1 VG	0	0	0	D	G

2.2 Devices

2.2.1 Setup of DC Test Devices

Name	W[um]	L[um]	AD[um ²]	AS[um ²]	PD[um]	PS[um]	NRD	NRs	NF	Comment	Size Category
W10u0_L10u0_S557_3	10	10	3.4	3.4	20.7	20.7	0	0	1		Large
W0u3_L10u0_S547_4	300m	10	102m	102m	1.28	1.28	0	0	1		Narrow
W10u0_L0u5_S387_5	10	500m	3.4	3.4	20.7	20.7	0	0	1		Short
W10u0_L0u35_S556_3	10	350	3.4	3.4	20.	20.	0	0	1		Short

		m			7	7					
W10u0_L0u5_T356_S387_5	10	500 m	0	0	0	0	0	0	1		Short
W0u3_L0u35_S560_3	300 m	350 m	102 m	102 m	1.2 8	1.2 8	0	0	1		Small
W10u0_L0u5_S556_4	10	500 m	3.4	3.4	20. 7	20. 7	0	0	1		L Scale
W10u0_L3u0_S557_1	10	3	3.4	3.4	20. 7	20. 7	0	0	1		L Scale
W10u0_L5u0_S557_2	10	5	3.4	3.4	20. 7	20. 7	0	0	1		L Scale
W10u0_L1u2_S556_5	10	1.2	3.4	3.4	20. 7	20. 7	0	0	1		L Scale
W05u0_L10u0_S558_1	5	10	1.7	1.7	10. 7	10. 7	0	0	1		W Scale
W02u0_L10u0_S558_5	2	10	680 m	680 m	4.6 8	4.6 8	0	0	1		W Scale
W0u6_L10u0_S559_5	600 m	10	204 m	204 m	1.8 8	1.8 8	0	0	1		W Scale
W02u0_L3u0_S558_4	2	3	680 m	680 m	4.6 8	4.6 8	0	0	1		LW Scale
W0u6_L1u2_S559_4	600 m	1.2	204 m	204 m	1.8 8	1.8 8	0	0	1		LW Scale
W02u0_L1u2_S558_3	2	1.2	680 m	680 m	4.6 8	4.6 8	0	0	1		LW Scale
W05u0_L5u0_S557_5	5	5	1.7	1.7	10. 7	10. 7	0	0	1		LW Scale
W0u3_L1u2_S560_5	300 m	1.2	102 m	102 m	1.2 8	1.2 8	0	0	1		LW Scale
W0u6_L0u35_S559_2	600 m	350 m	204 m	204 m	1.8 8	1.8 8	0	0	1		LW Scale
W0u6_L0u5_S559_3	600 m	500 m	204 m	204 m	1.8 8	1.8 8	0	0	1		LW Scale
W0u3_L0u5_S560_4	300 m	500 m	102 m	102 m	1.2 8	1.2 8	0	0	1		LW Scale
W02u0_L0u33_S558_2	2	330 m	680 m	680 m	4.6 8	4.6 8	0	0	1		Additional
W10u0_L0u33_S556_2	10	330 m	3.4	3.4	20. 7	20. 7	0	0	1		Additional
W10u0_L0u4_T356_S387_4	10	400 m	0	0	0	0	0	0	1		Additional

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

2.2.2 Setup of CV Test Devices

Name	W[um]	L[um]	NF	AD[um ²]	AS[um ²]	PD[um]	PS[um]	Comment	Size Category
Junction Capacitance Bulk - Drain									
CJBDarea_S350B_5			1	37.5 K		850		B- High, S/D- Low	BD Area
Junction Capacitance Bulk - Source									
CJBSarea_S350B_5			1	0		0		B- High, S/D- Low	BS Area

CJBSperim_S350B_6			1	0		0		B-High, S/D-Low	BS Perim
Oxide Capacitance									
Cox_S342K_3	160	250	1					B-High, G-Low	Oxide
Overlap Capacitance									
Cgds1_S350B_9	6K	300 m	600	1.14 K	1.14 K	6.25 K	6.25 K	G-High, S/D-Low, B+Sub-GND	Overlap GDS
Cgdsb1_S350B_9	6K	300 m	600	1.14 K	1.14 K	6.25 K	6.25 K	G-High, S/D+B-Low	Overlap GDSB
Cgds2_S350B_10	400	10	40	79.8	79.8	436	436	G-High, S/D-Low, B+Sub-GND	Overlap 1 GDS
Cgdsb2_S350B_10	400	10	200	79.8	79.8	436	436	G-High, S/D+B-Low	Overlap 1 GDSB
Intrinsic Capacitance									
Cbdsg1_S350B_9	6K	300 m	600	1.14 K	1.14 K	6.25 K	6.25 K	B+S/D-High, G-Low	Intrinsic
Cbdsg2_S350B_10	400	10	40	79.8	79.8	436	436	B+S/D-High, G-Low	Intrinsic

3 Corner Devices

3.1 Target Values vs. Simulated Values

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

	Slow			Typic.			Fast		
	Target	Sim.	Error [%]	Target	Sim.	Error [%]	Target	Sim.	Error [%]
VT	770m	770m	0	700m	700m	0	630m	630m	0
Ron*W	-	-	-	1.42	1.42	0	-	-	-
Ion/W	480	482	-0.31	550	550	0	620	622	-0.33
log(Ioff/W)	-14	-13.1	-2.86	-13	-12.8	-1.69	-12	-12.2	1.6

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

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

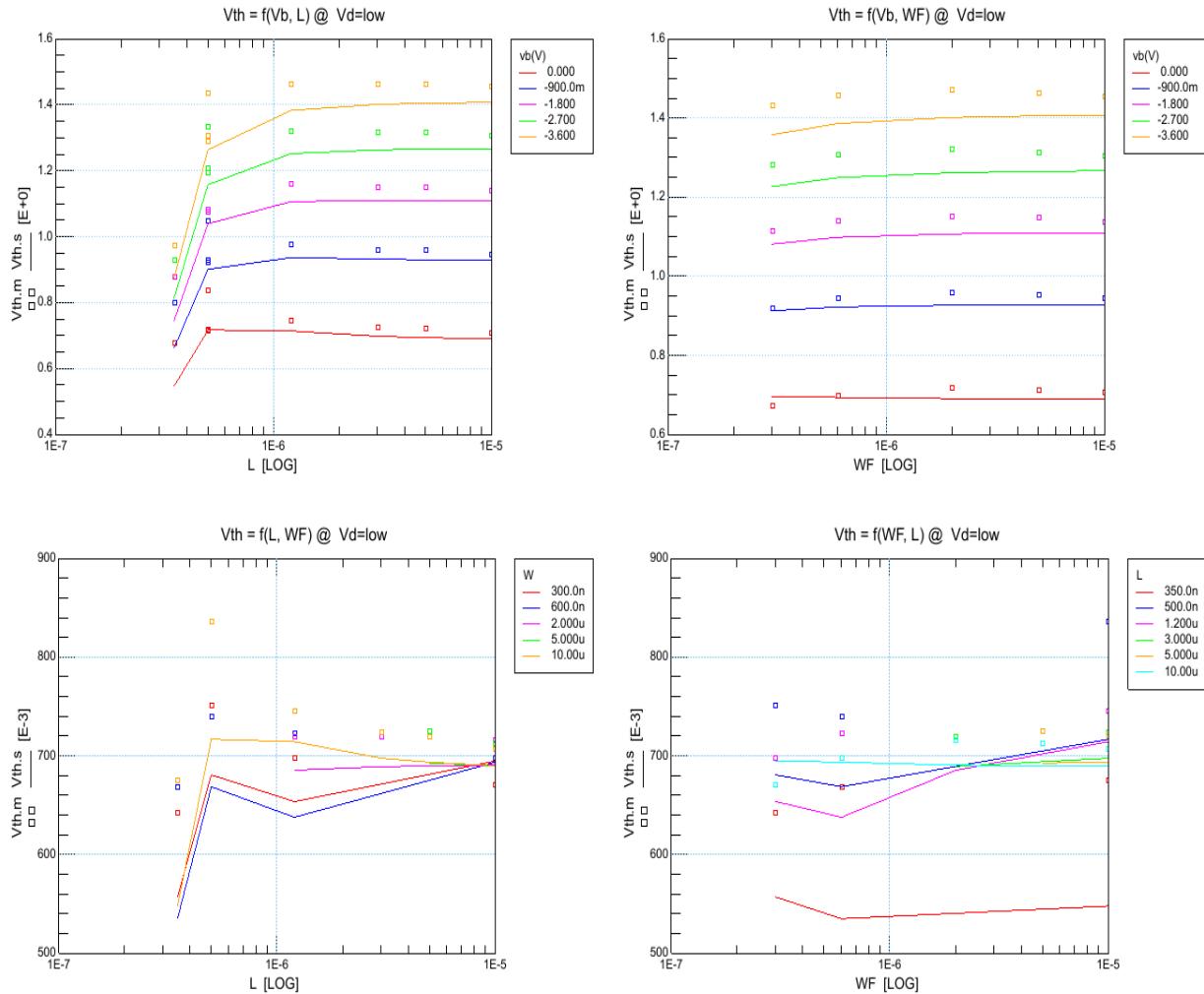
3.1.3 W = 300.0n, L = 450.0n, NF = 1

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

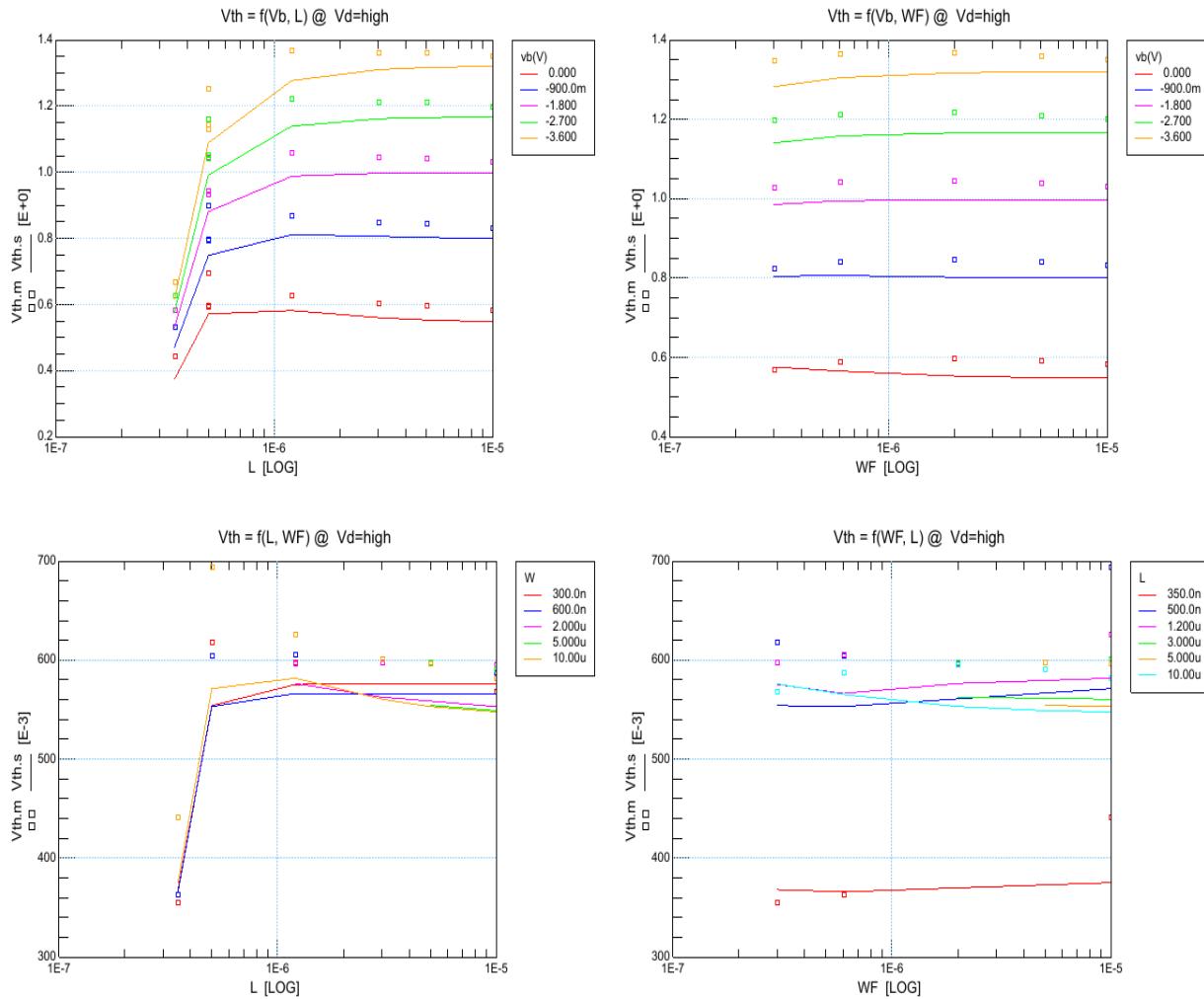
4 DC Transistors

4.1 Summarized Results

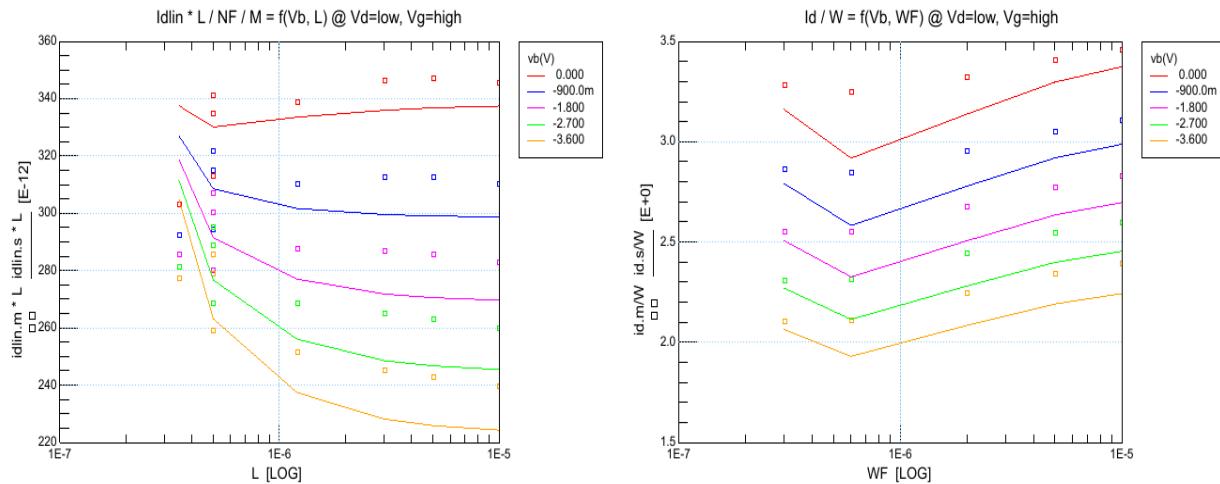
4.1.1 Threshold Voltage Linear Region

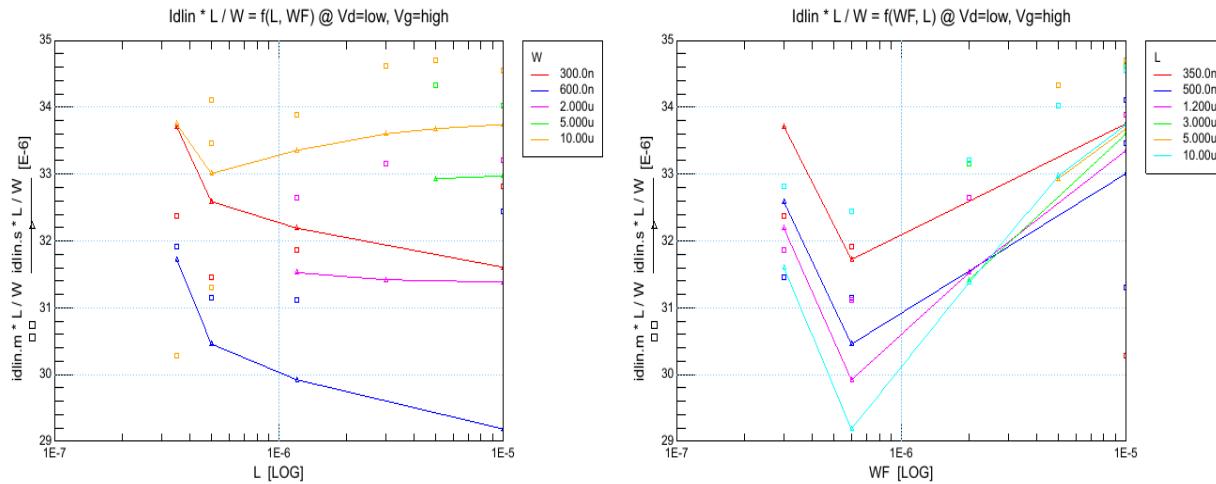


4.1.2 Threshold Voltage in Saturation

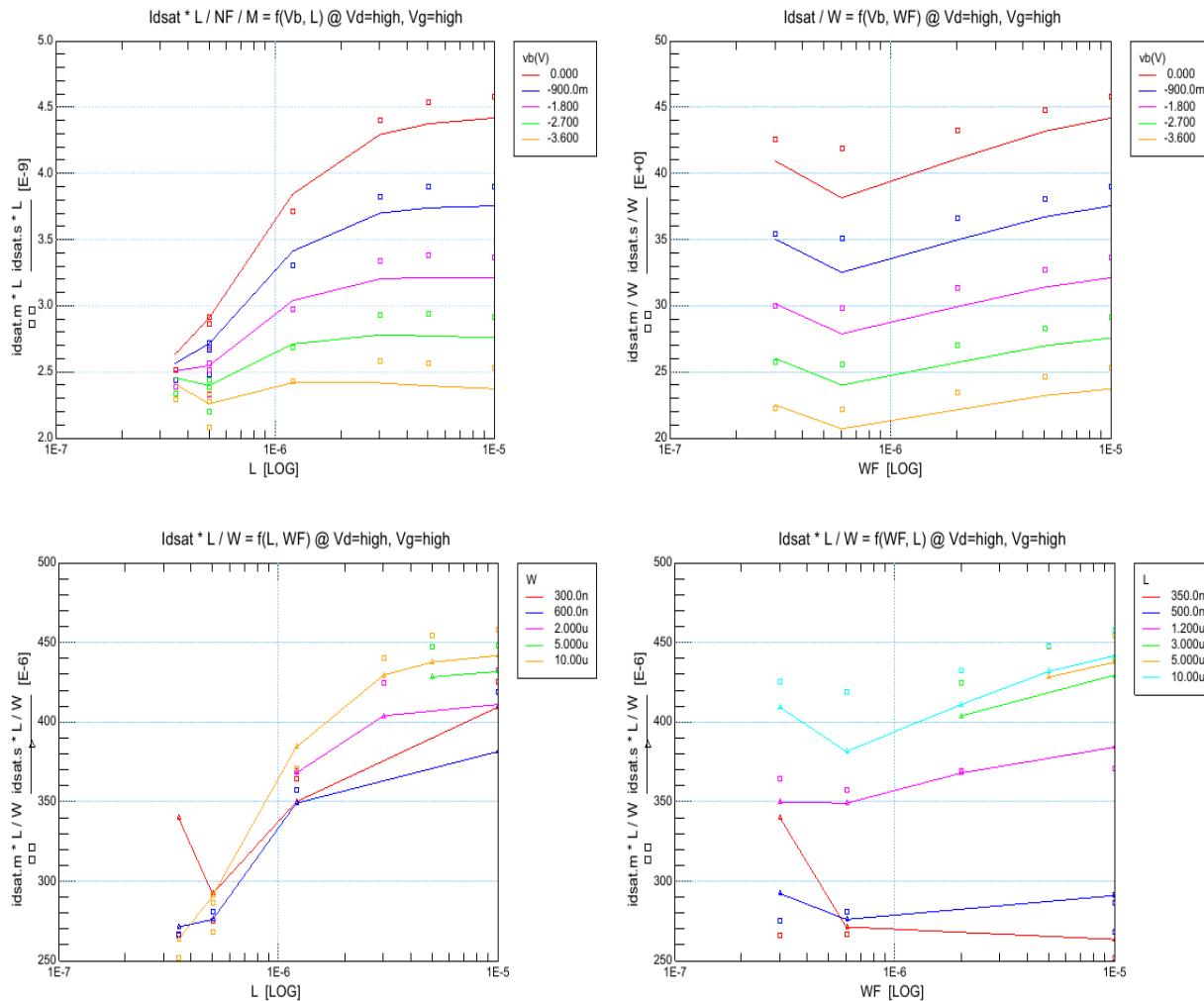


4.1.3 Maximum Drain Current in Linear Region



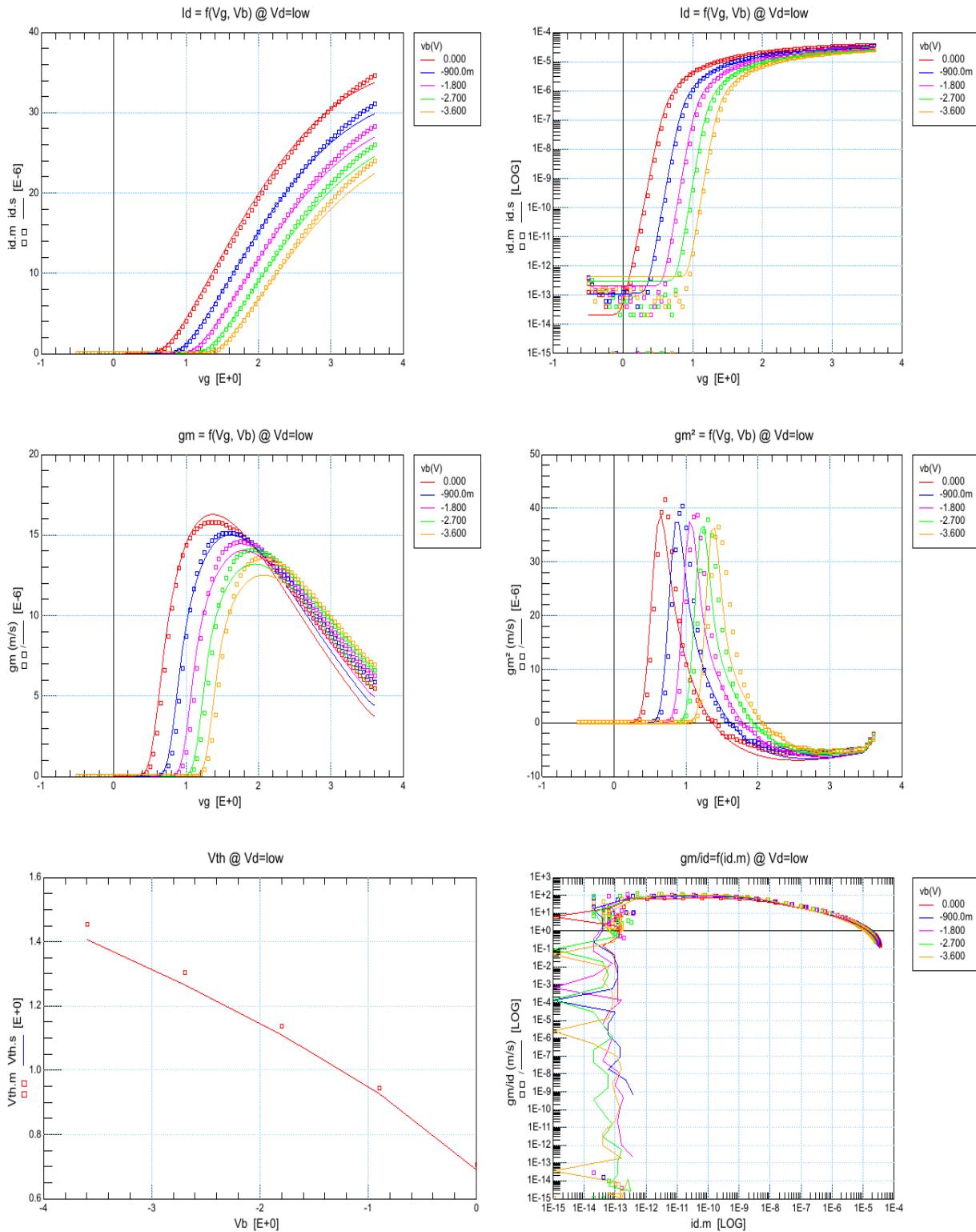


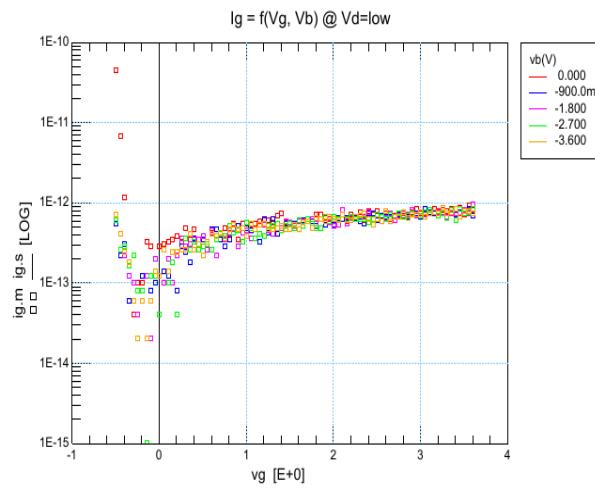
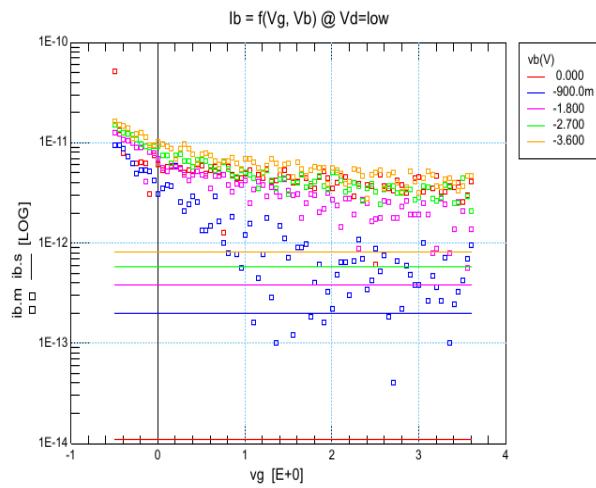
4.1.4 Maximum Drain Current in Saturation Region



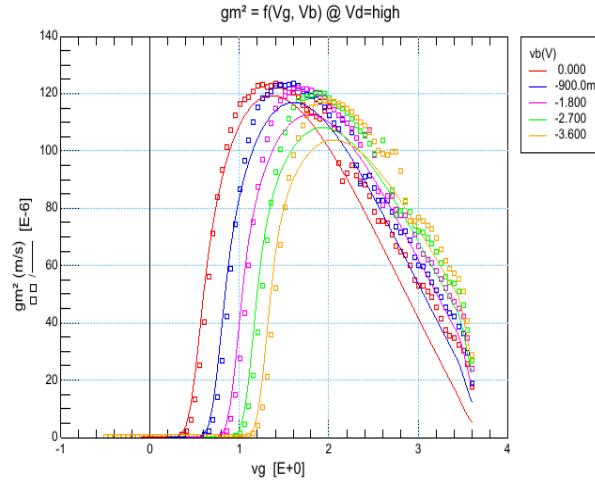
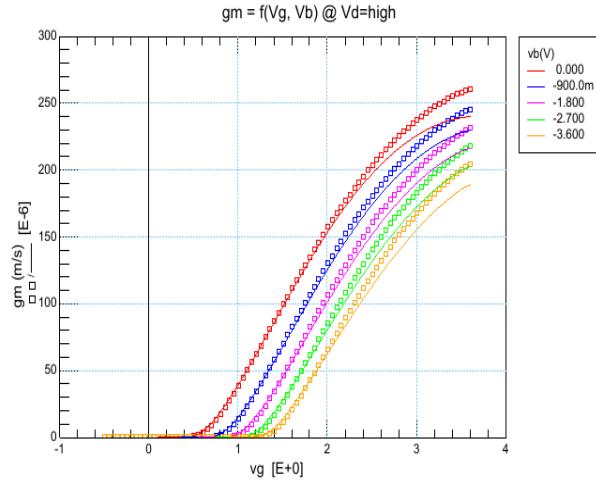
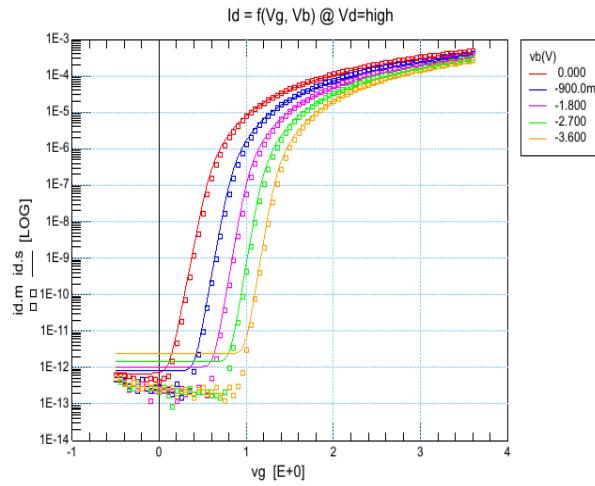
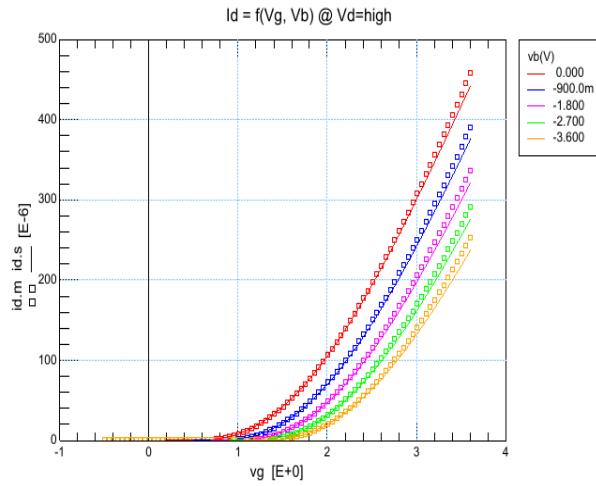
4.2 W10u0_L10u0_S557_3

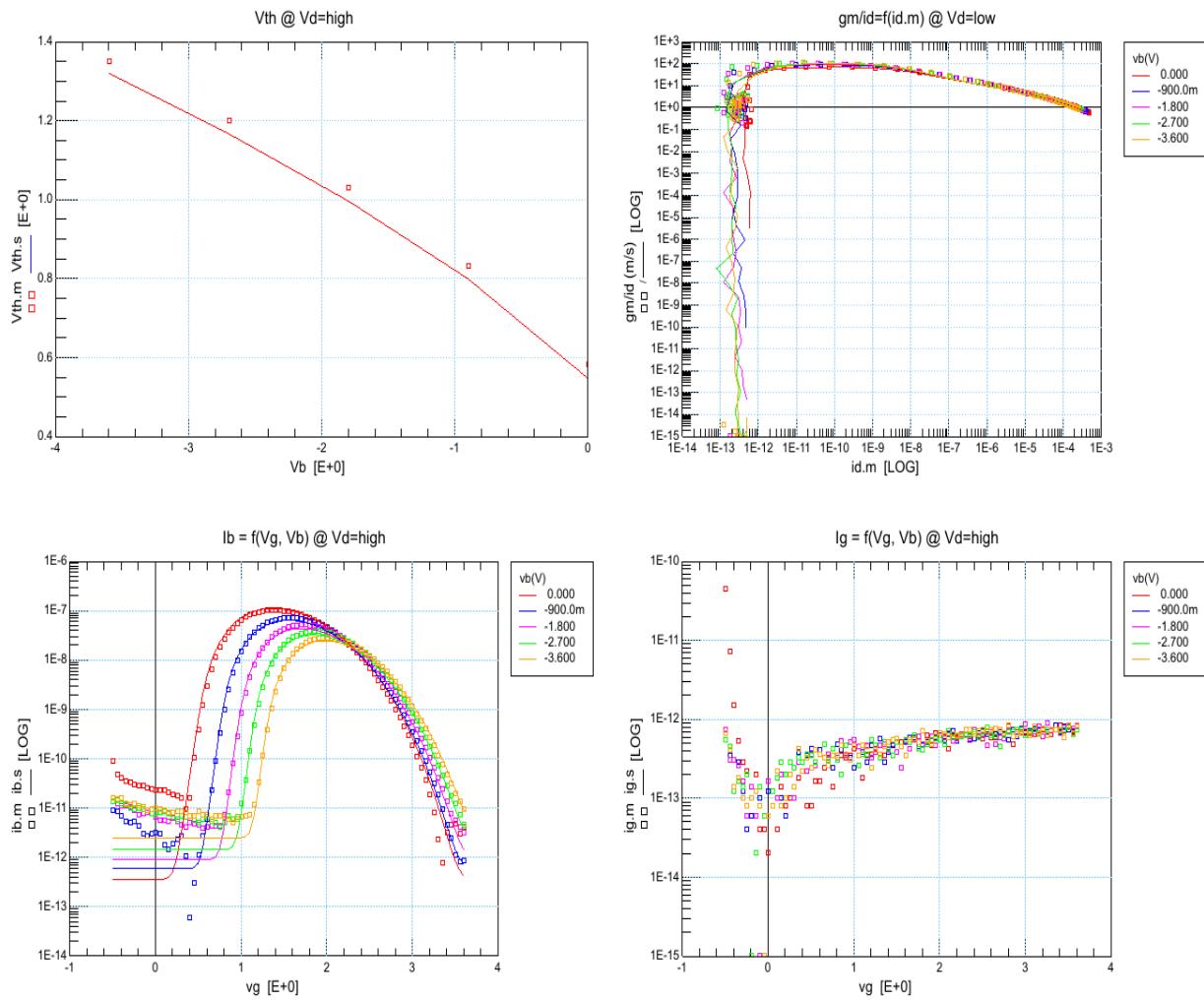
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



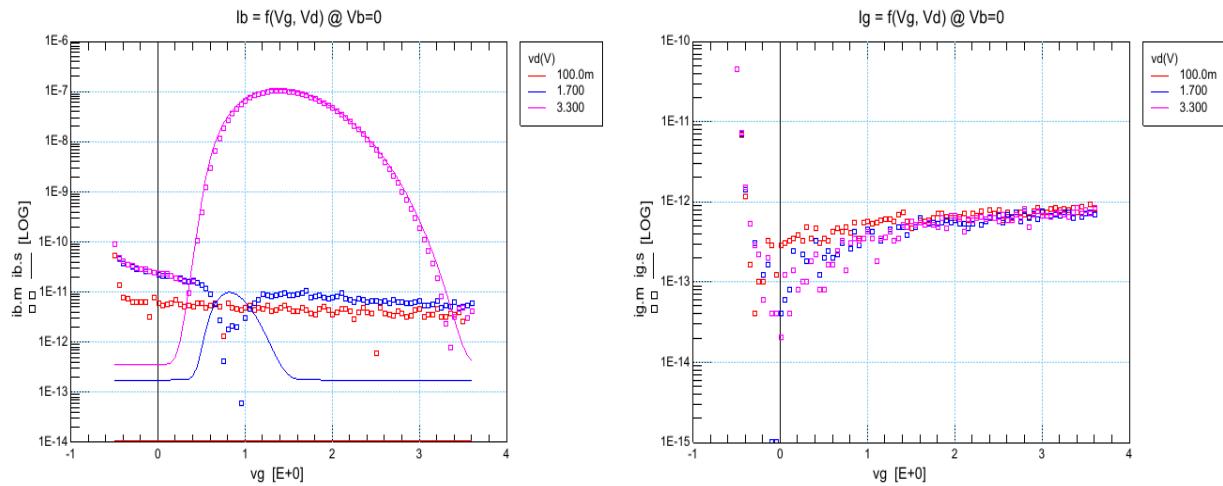


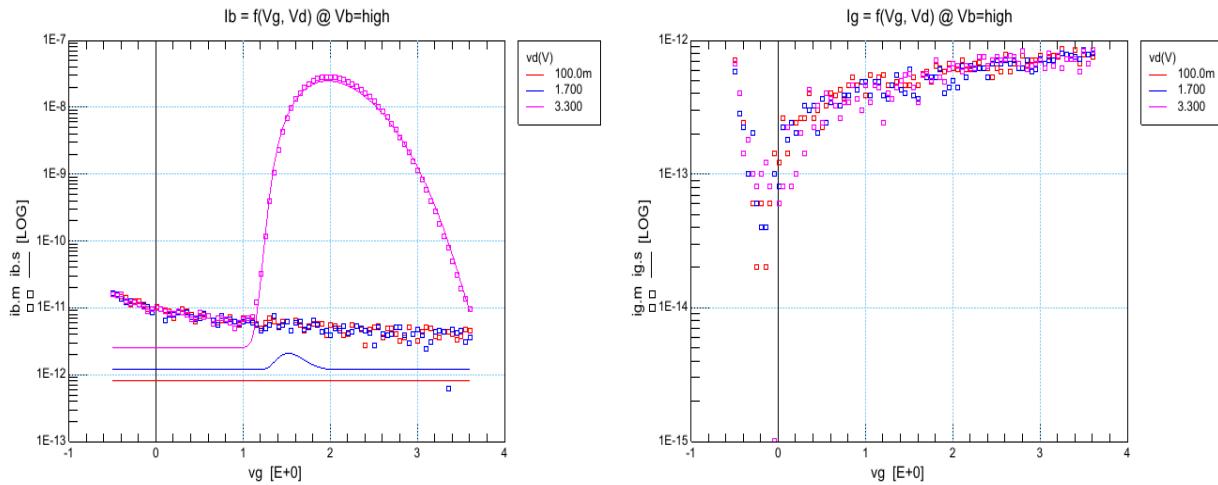
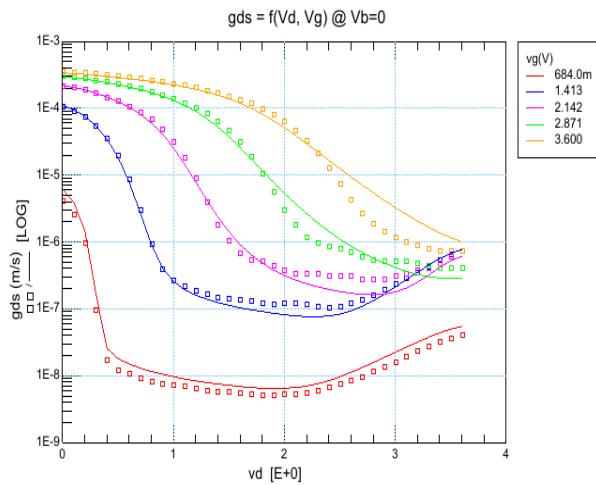
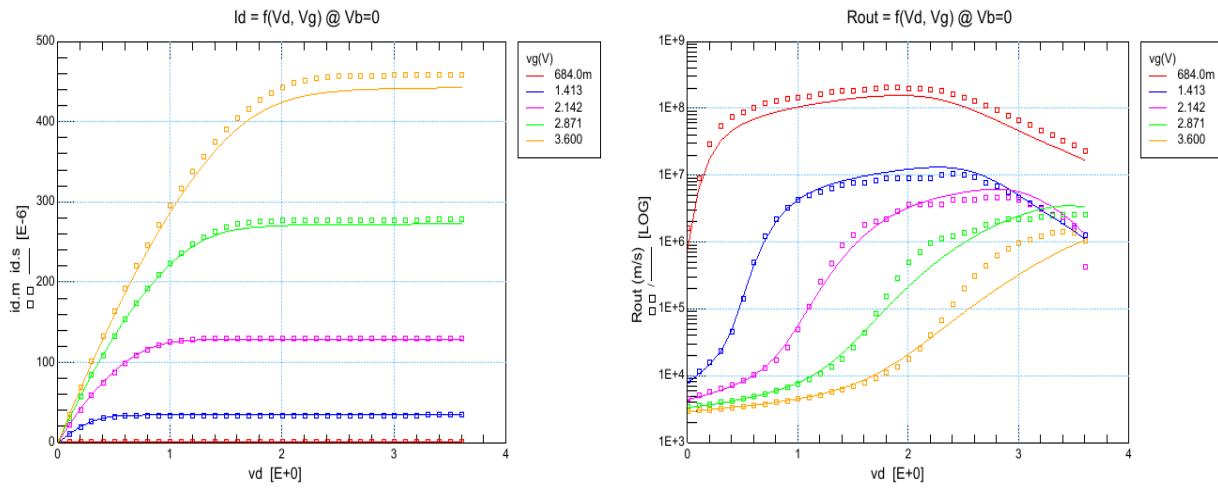
$i_{dvg}, V_d = 3.3V, T = 27^\circ C$

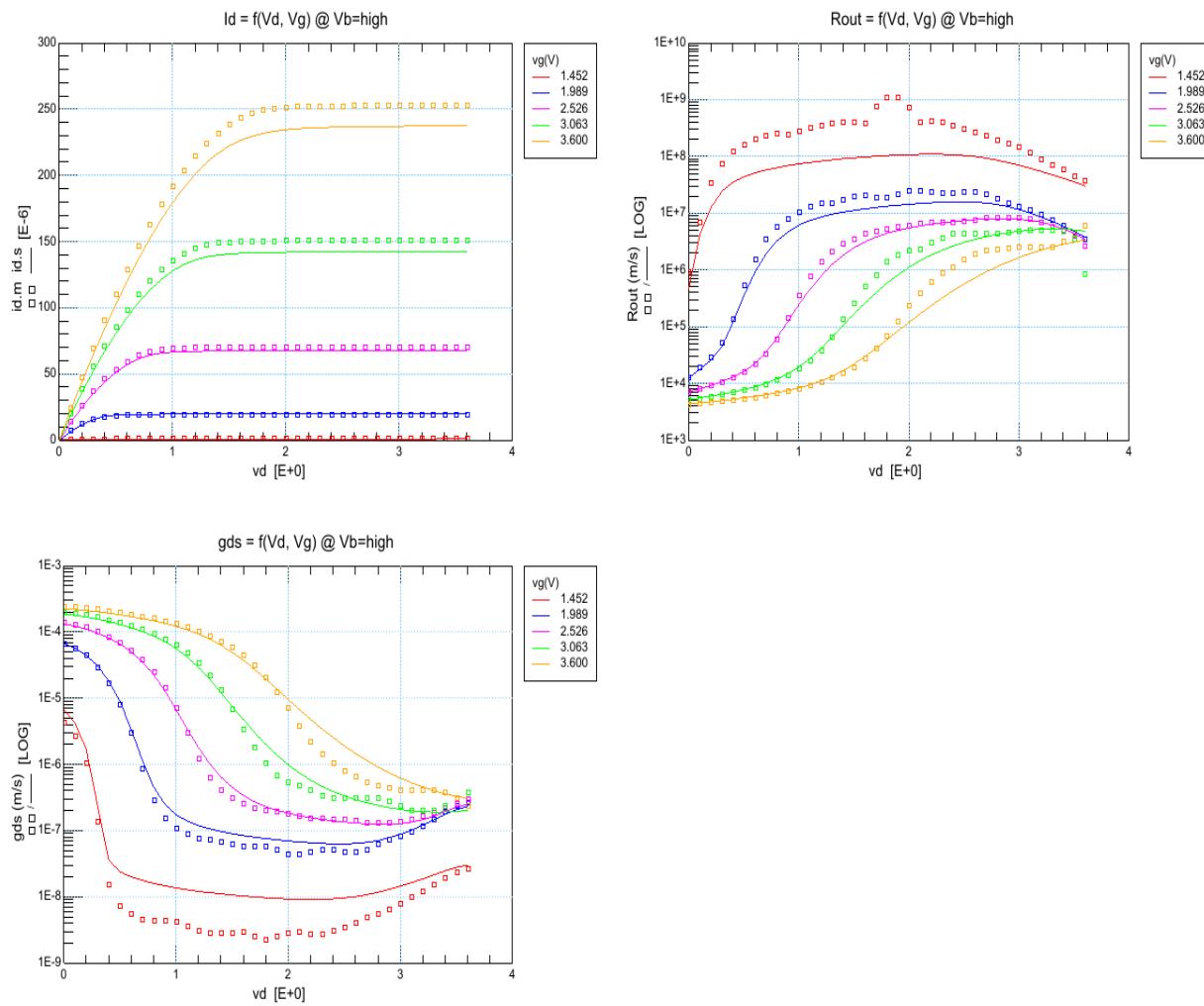
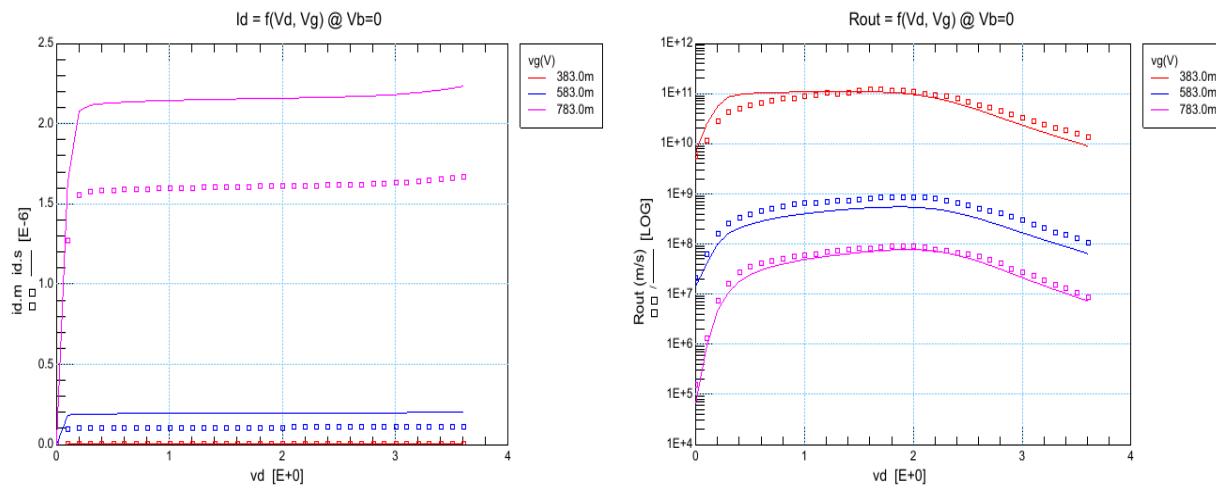


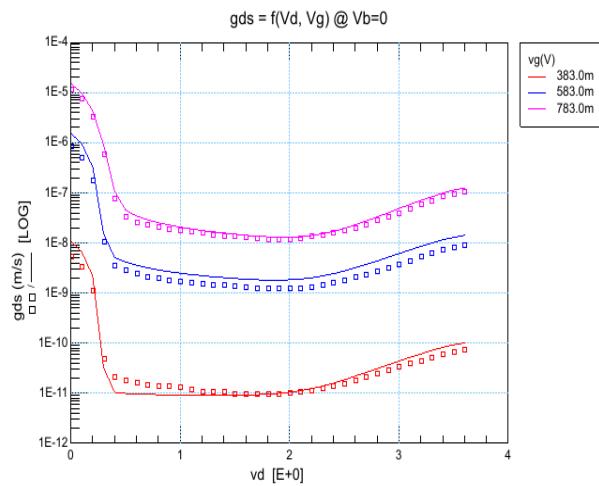


$i_{dvg}, I_b, I_g, V_b = 0V, T = 27^\circ C$

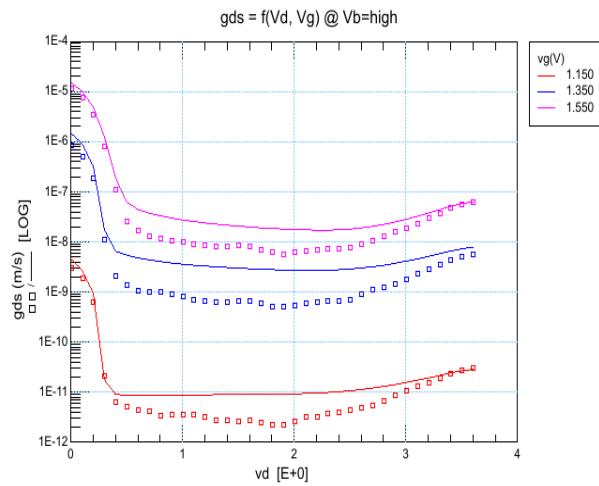
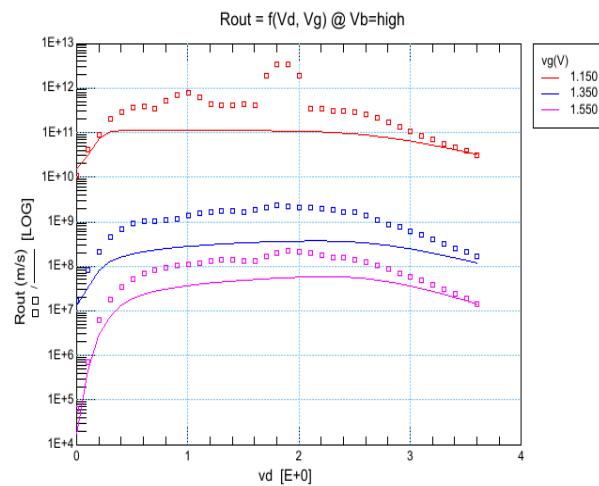
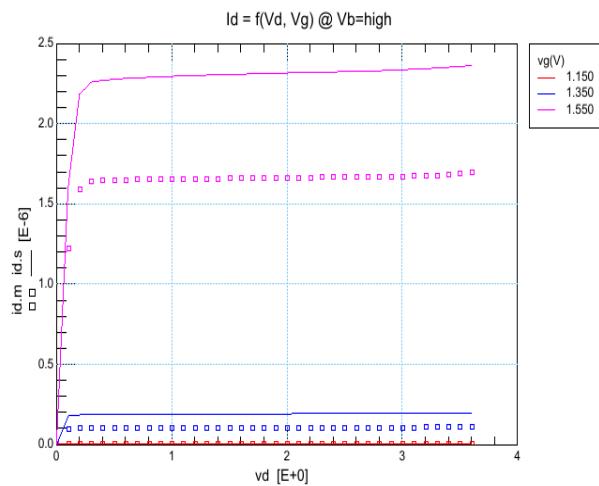


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


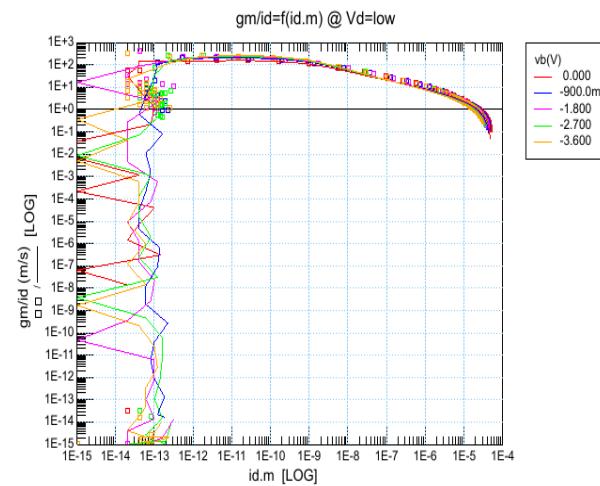
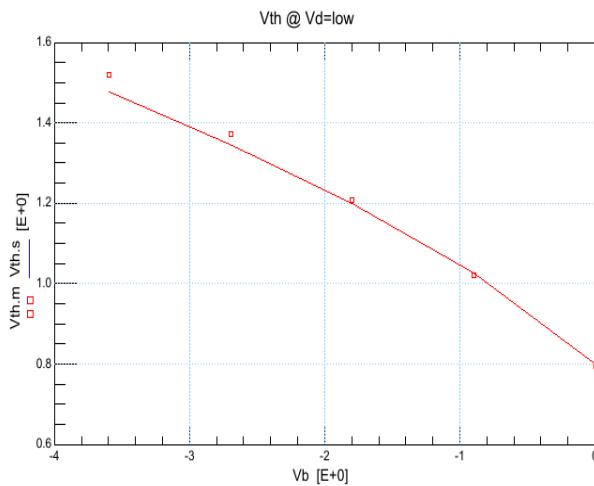
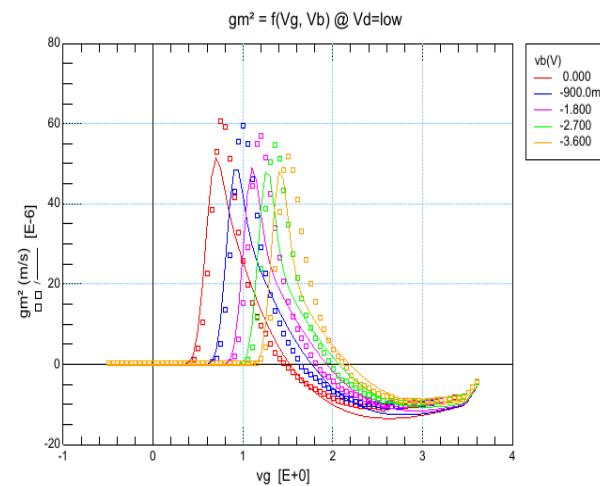
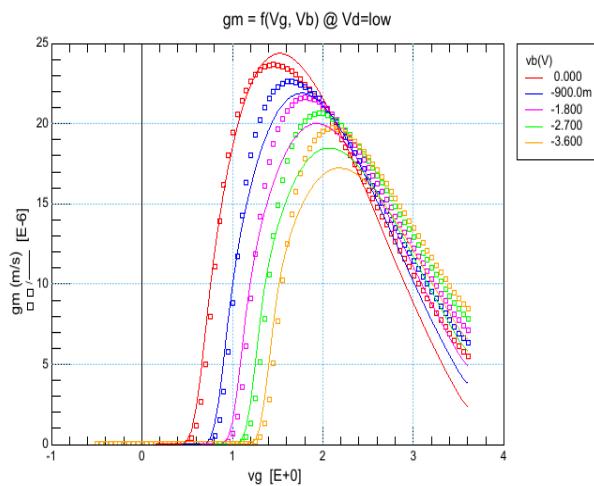
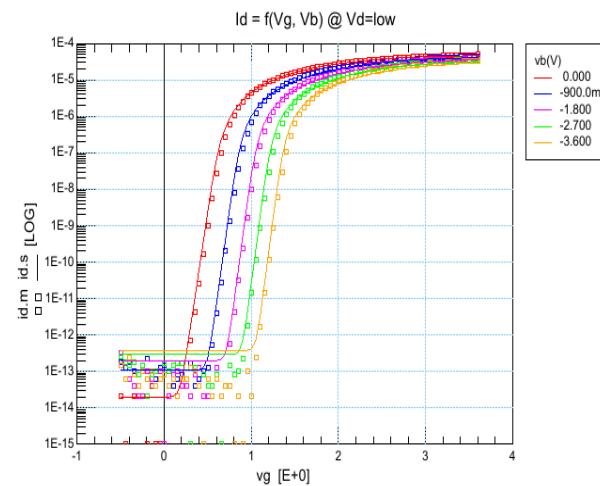
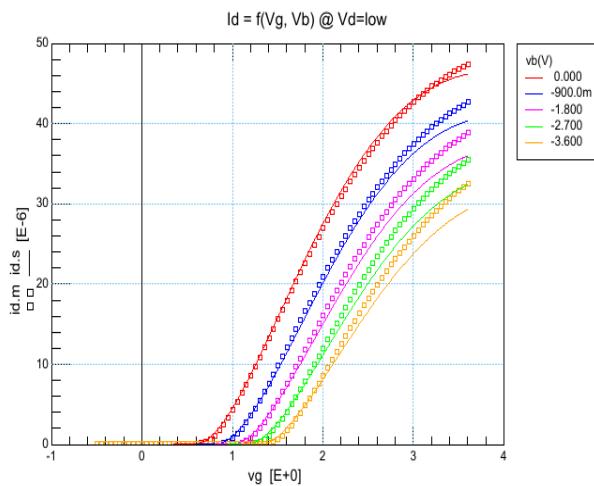
idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


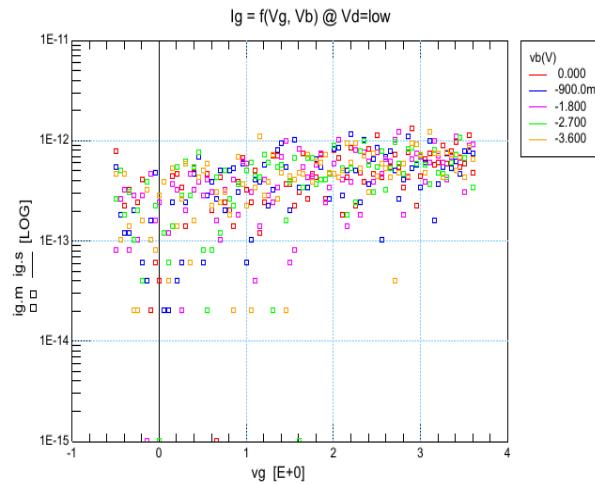
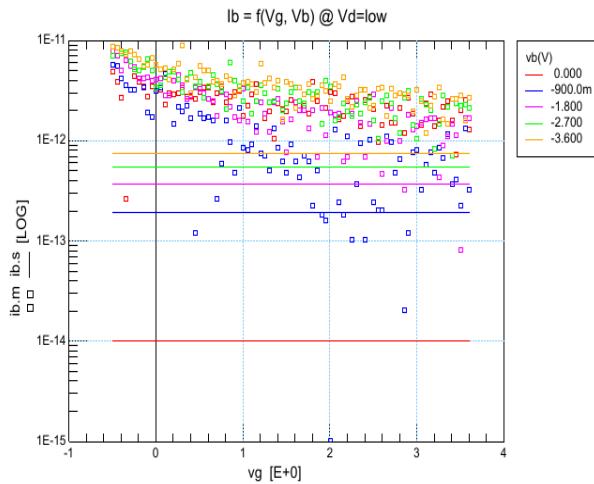


idvd_vth_vbmin, Vb = -3.6V, T = 27°C

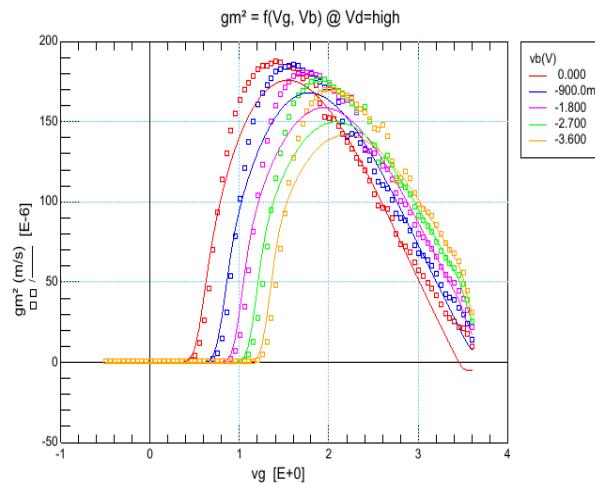
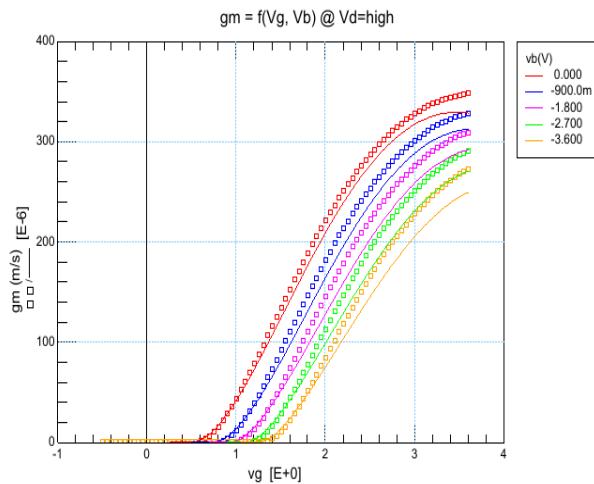
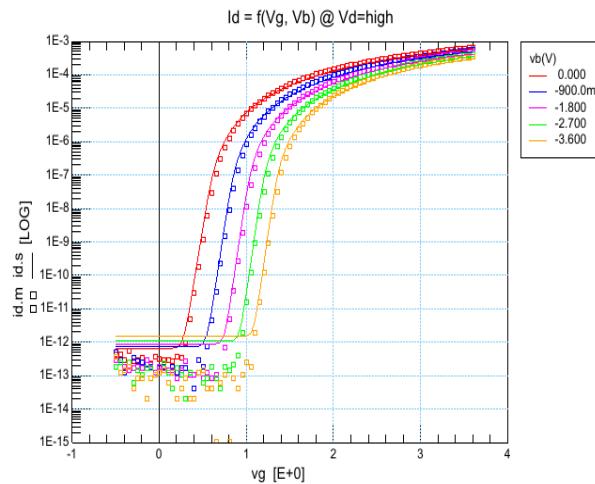
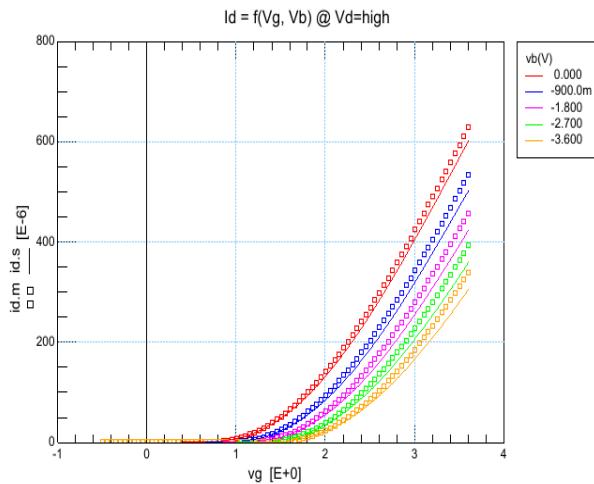


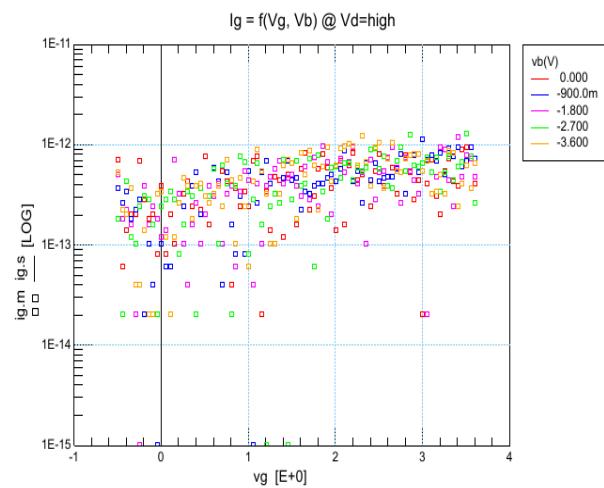
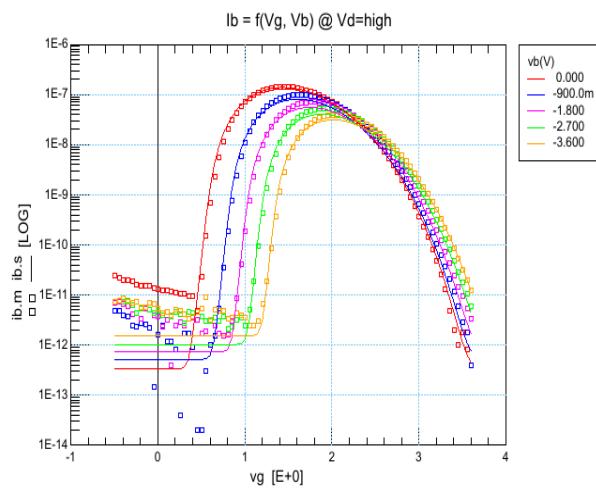
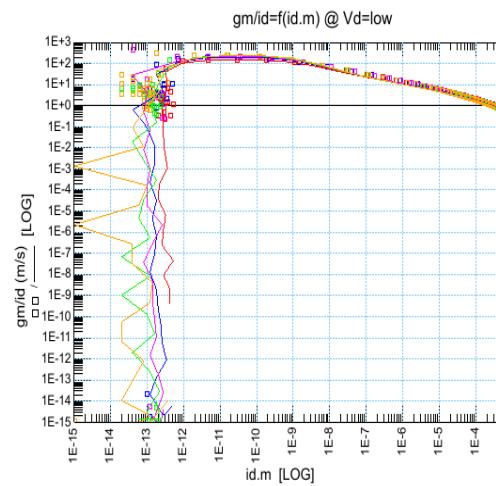
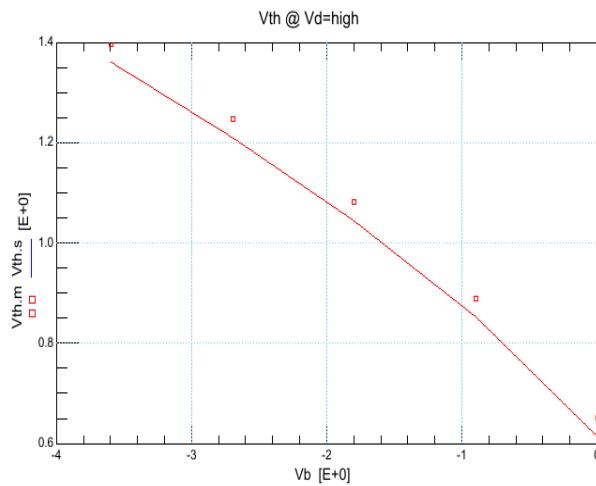
idvg, Vd = 0.1V, T = -40°C



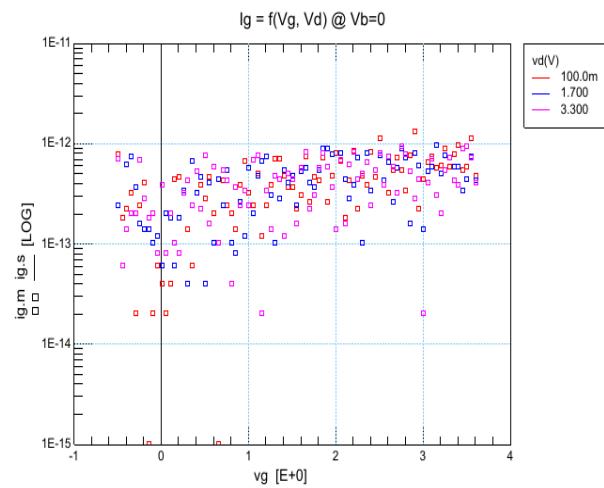
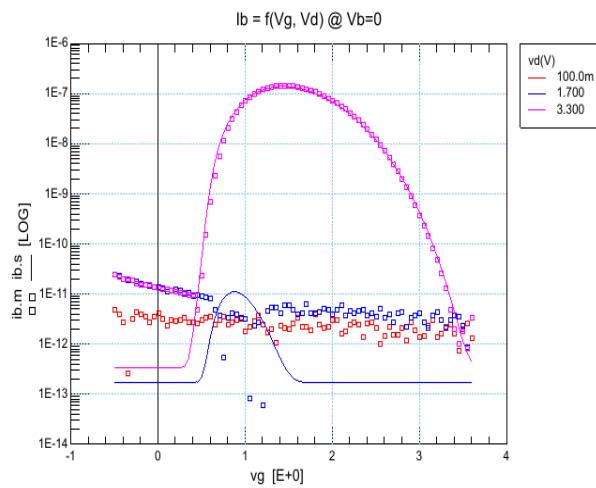


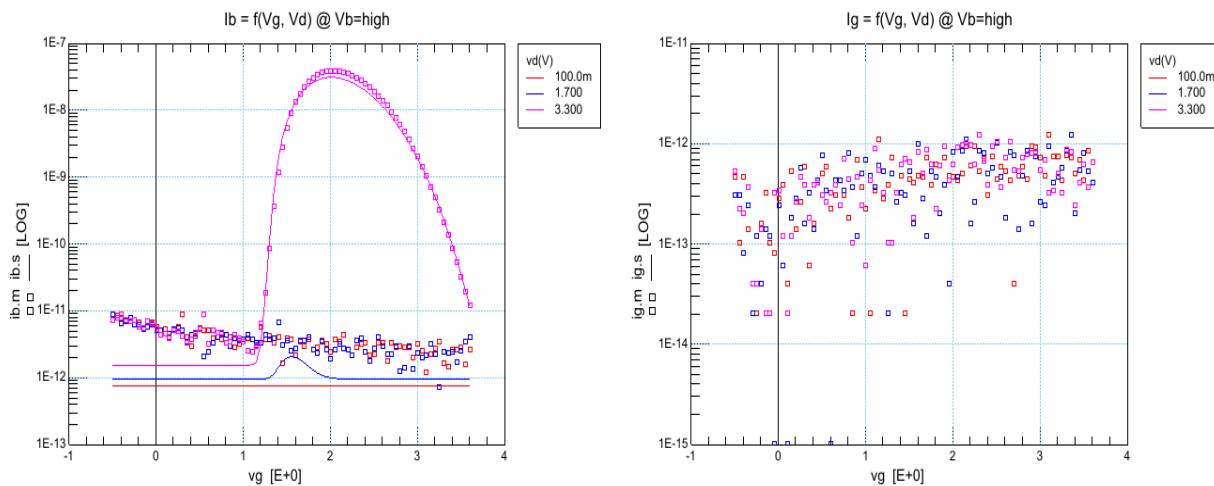
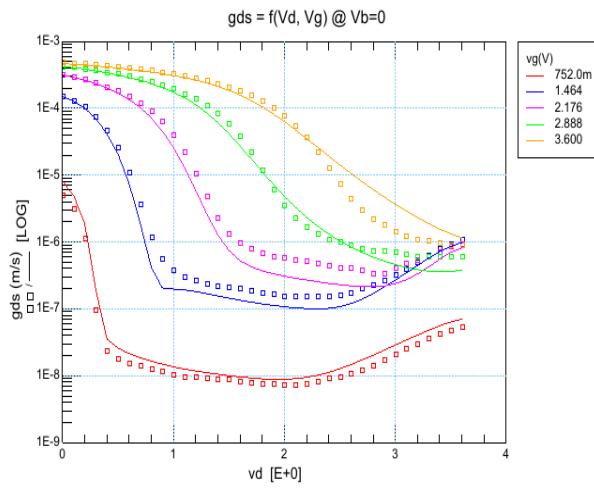
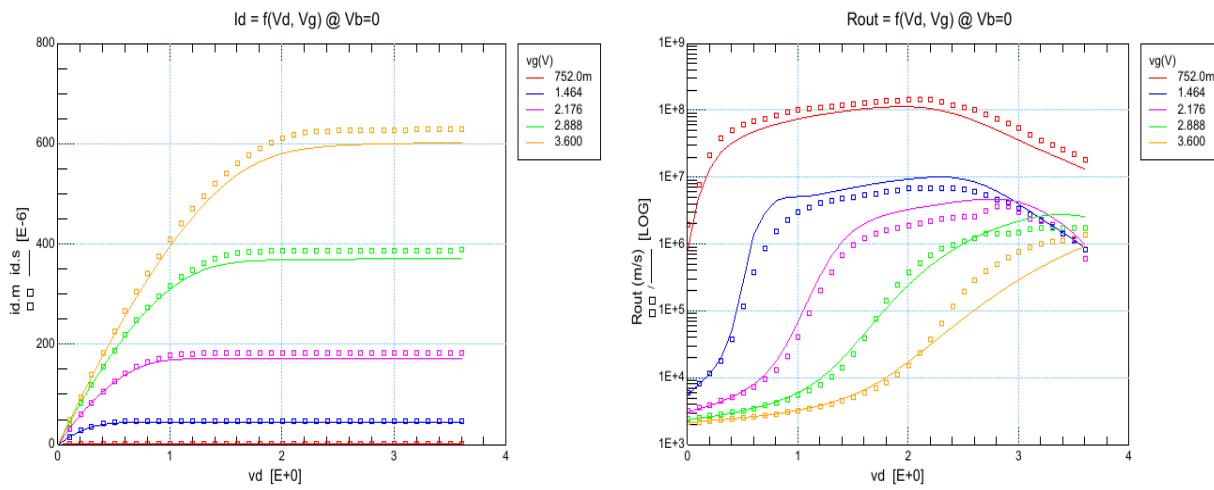
$idvg, Vd = 3.3V, T = -40^{\circ}\text{C}$

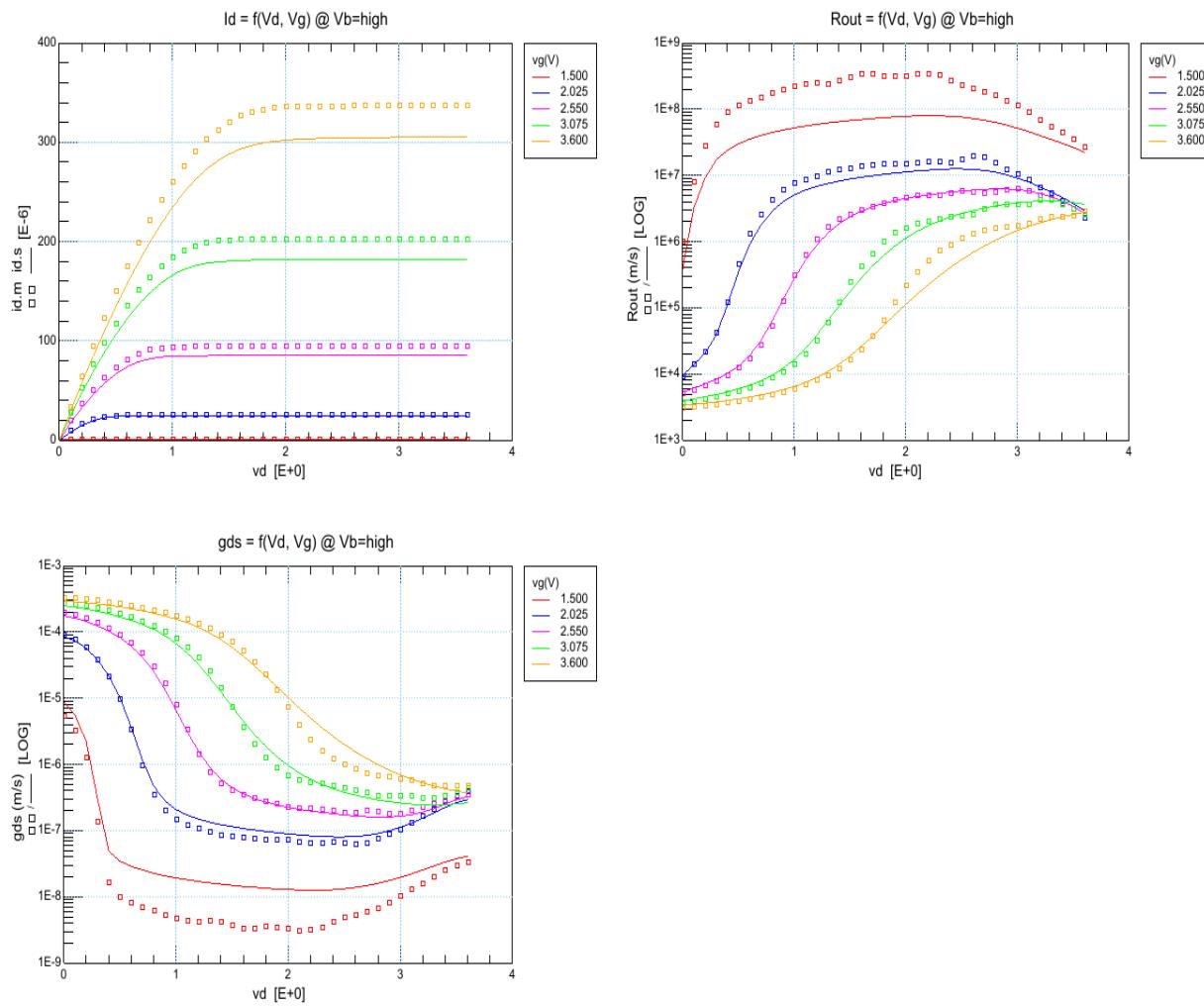
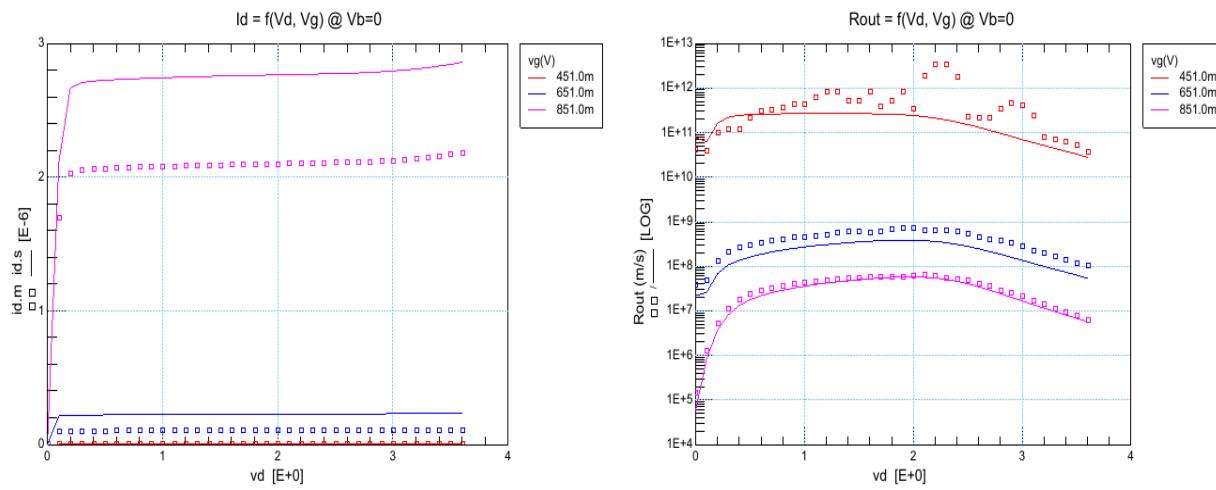


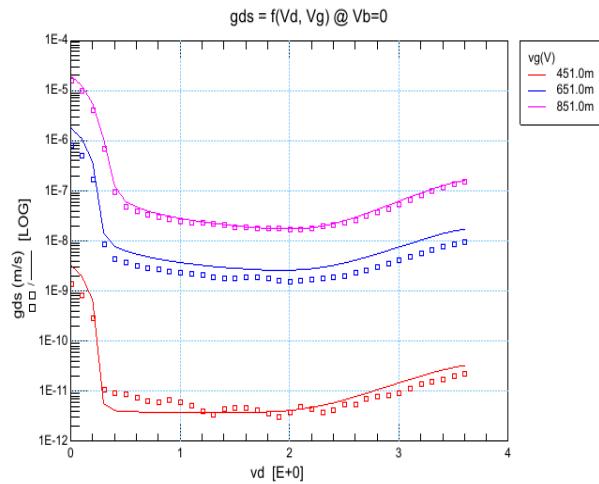


idvg, lb, lg, Vb = 0V, T = -40°C

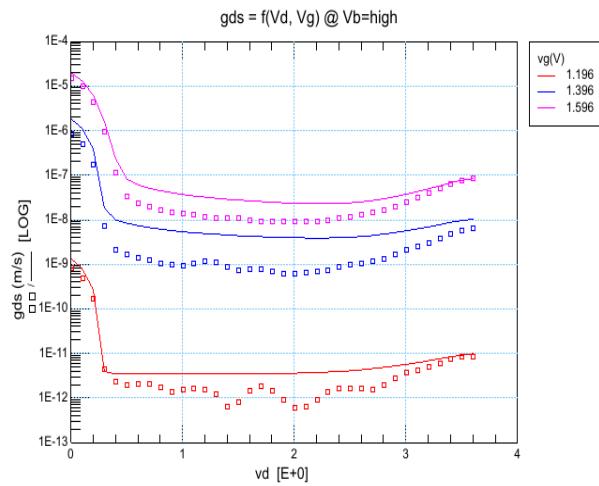
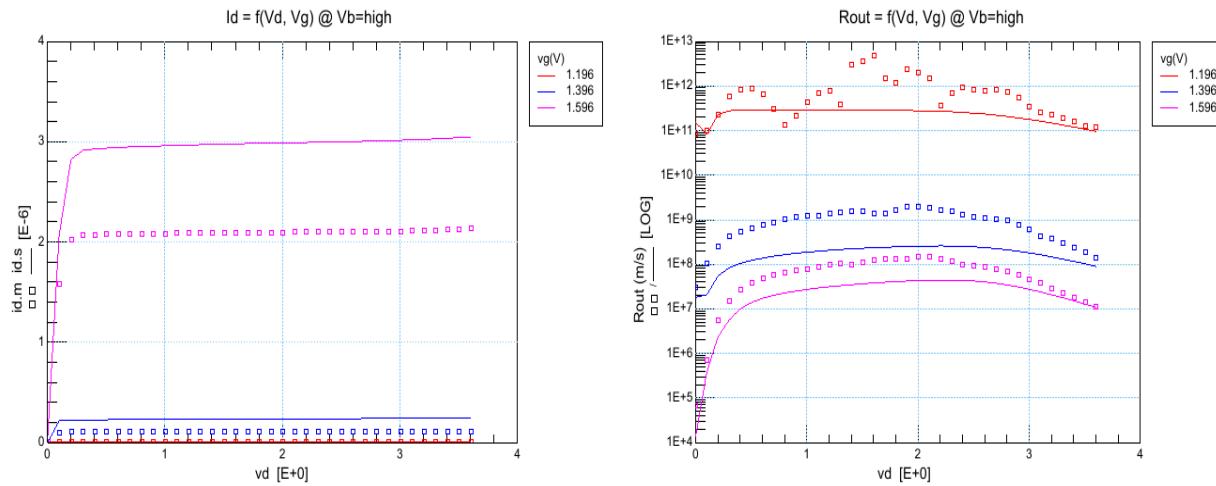


idvg, Ib,Ig, Vb = -3.6V, T = -40°C

idvd, Vb = 0V, T = -40°C


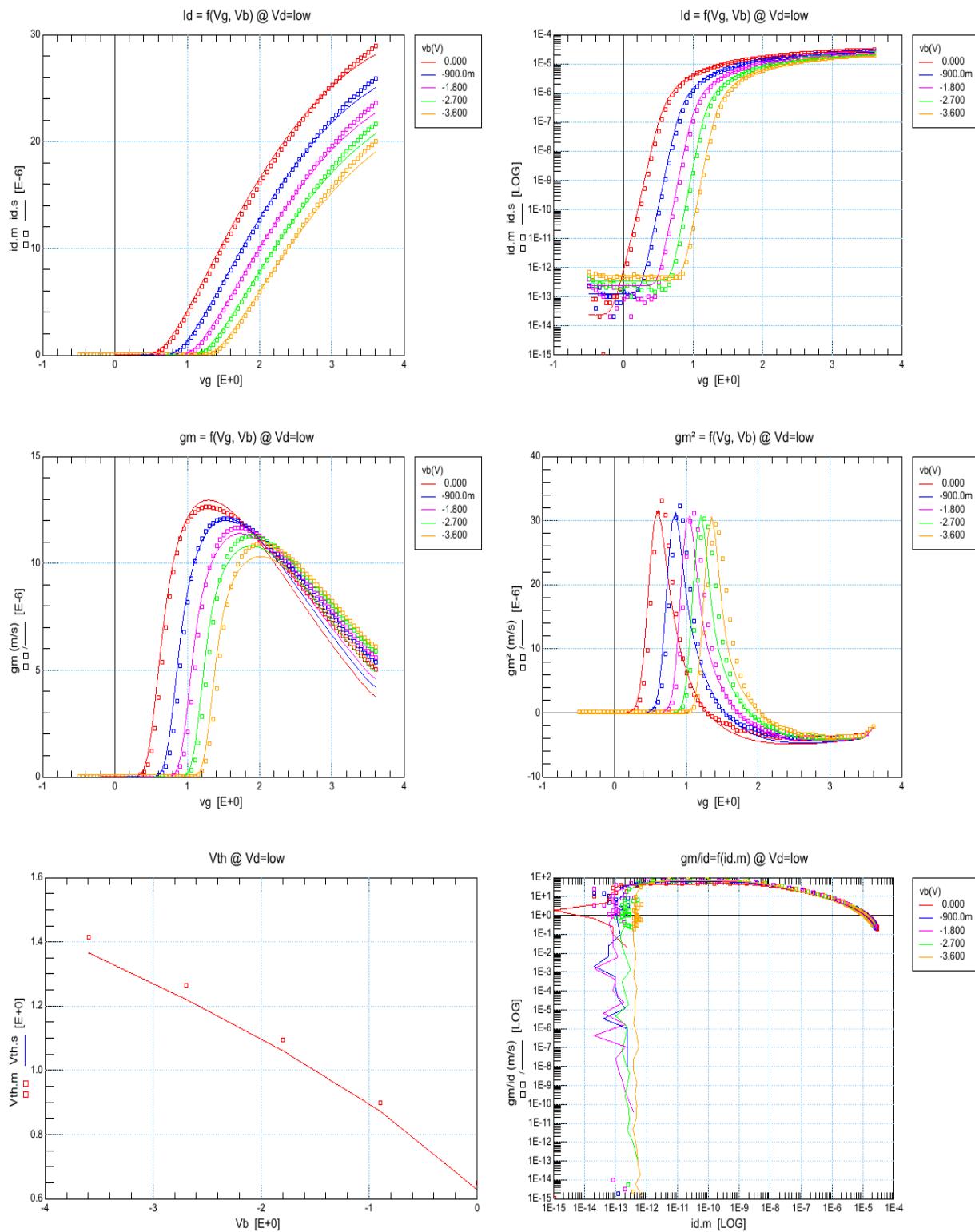
idvd_vbmin, Vb = -3.6V, T = -40°C

idvd_vth, Vb = 0V, T = -40°C


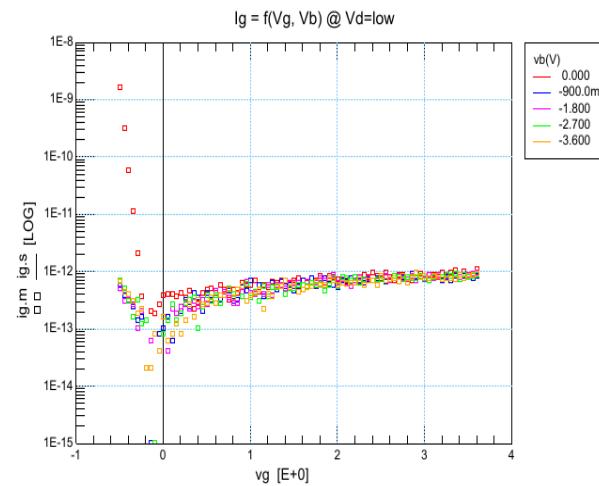
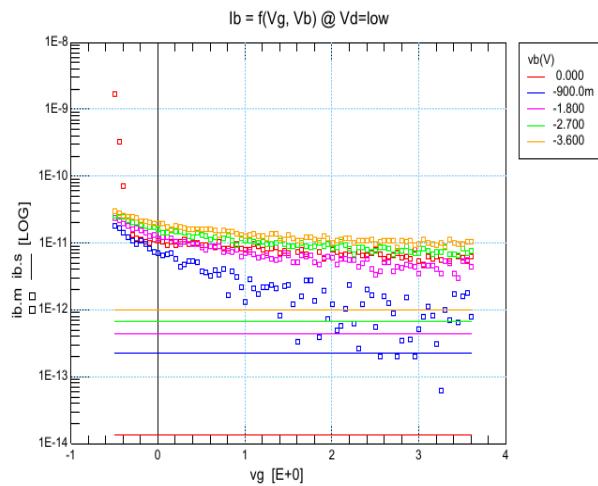


idvd_vth_vbmin, Vb = -3.6V, T = -40°C

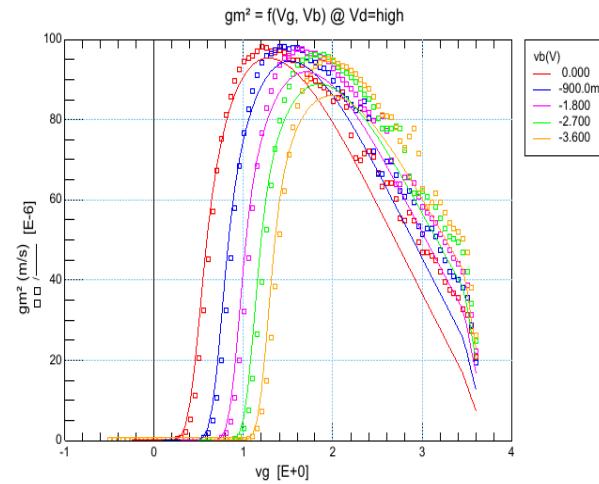
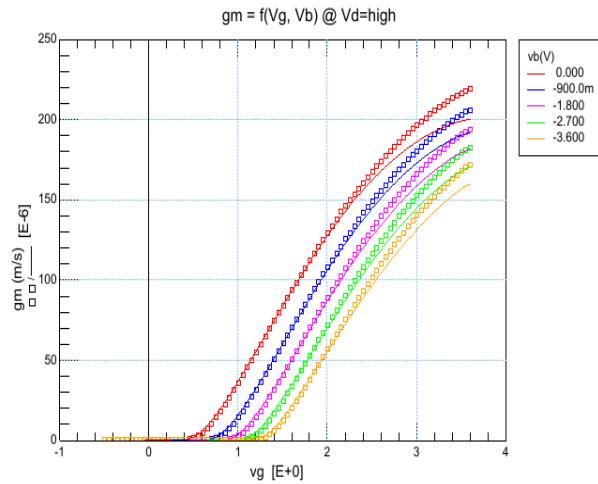
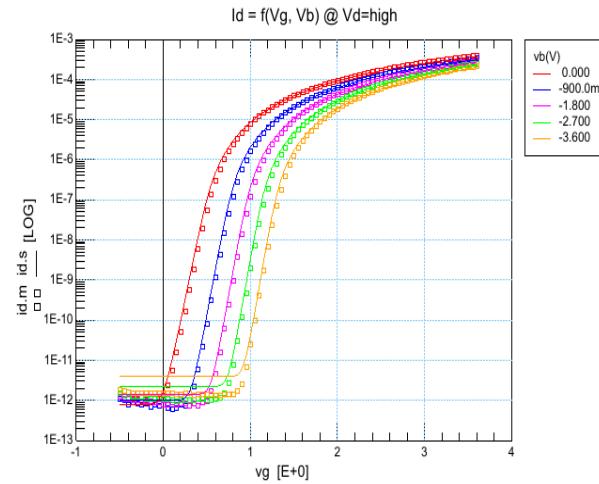
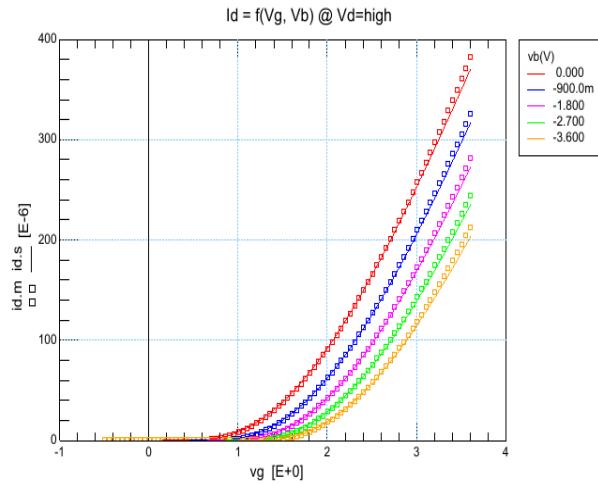


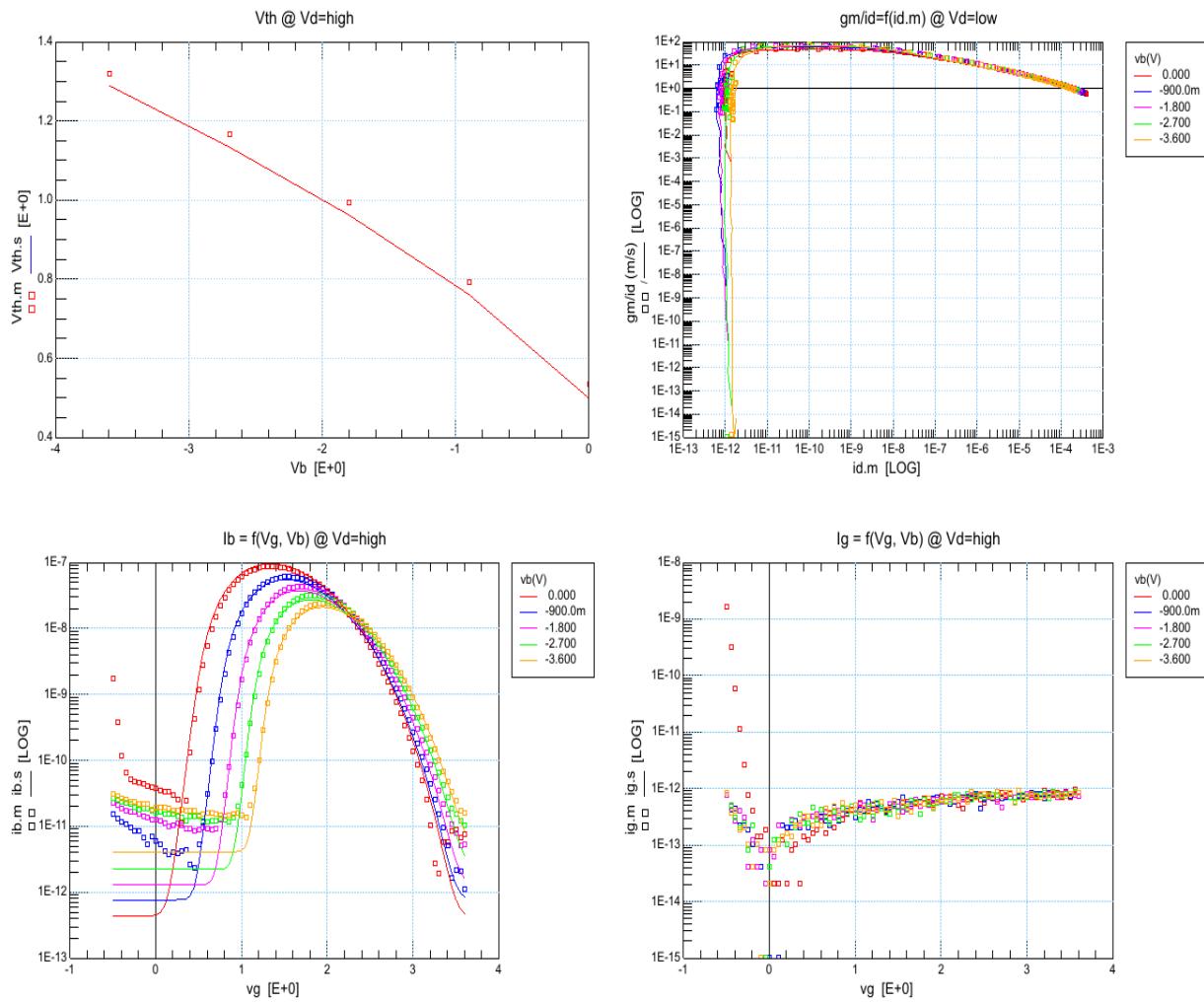
idvg, Vd = 0.1V, T = 70°C



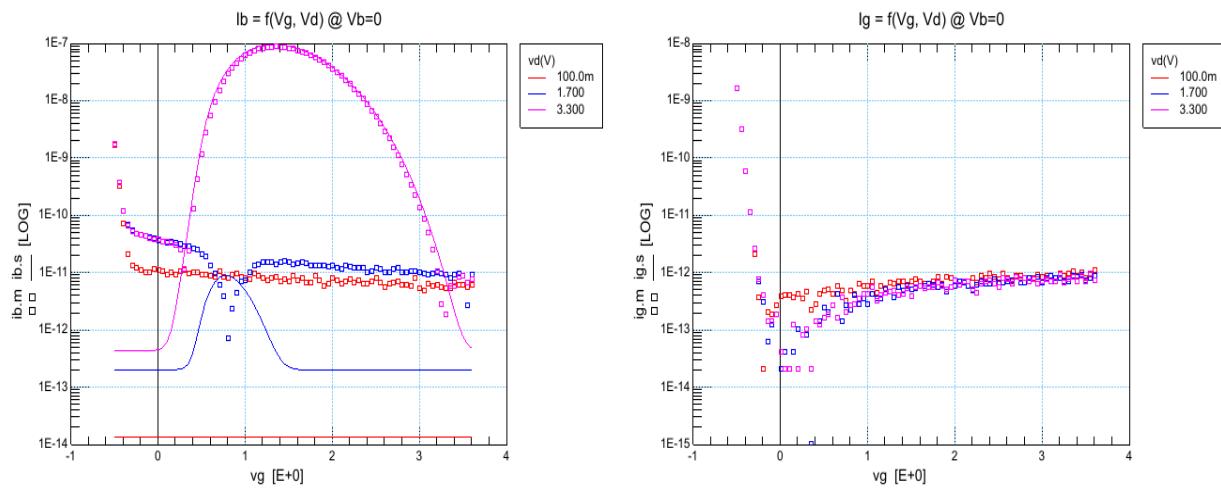


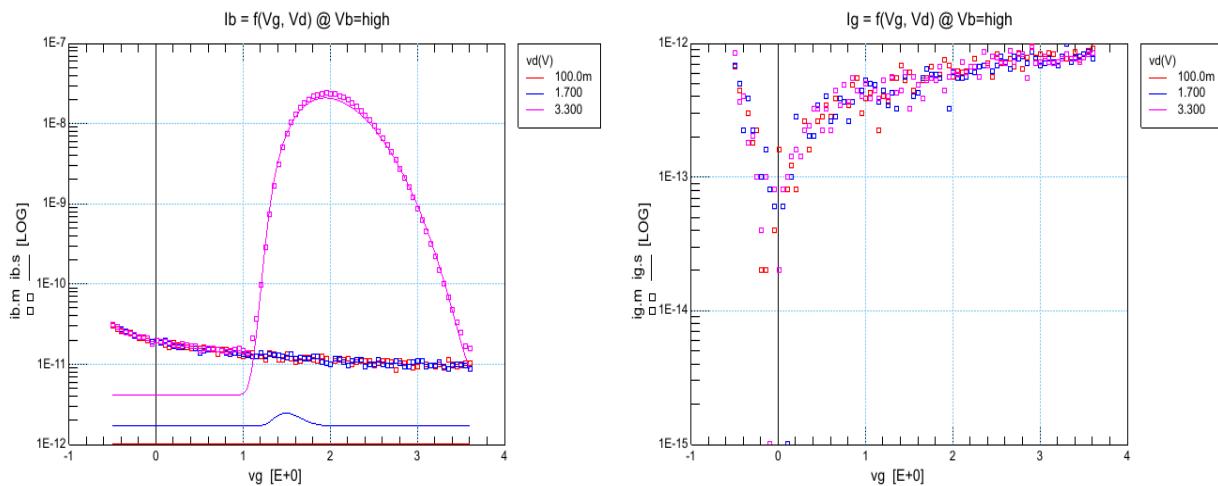
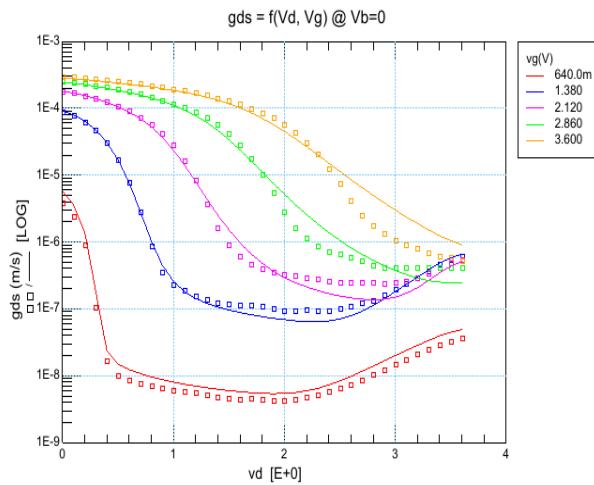
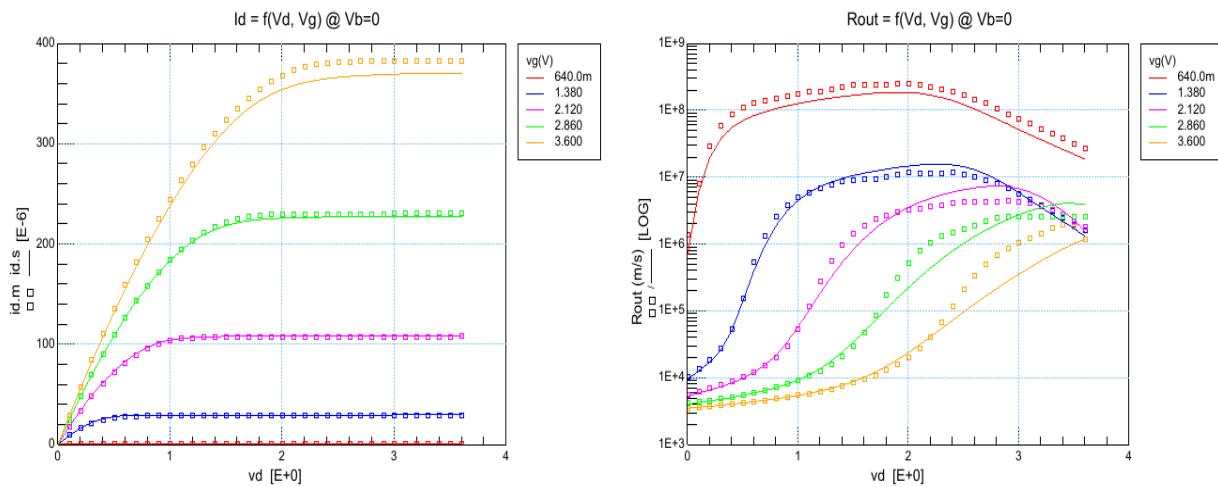
$i_{dvg}, V_d = 3.3V, T = 70^\circ\text{C}$

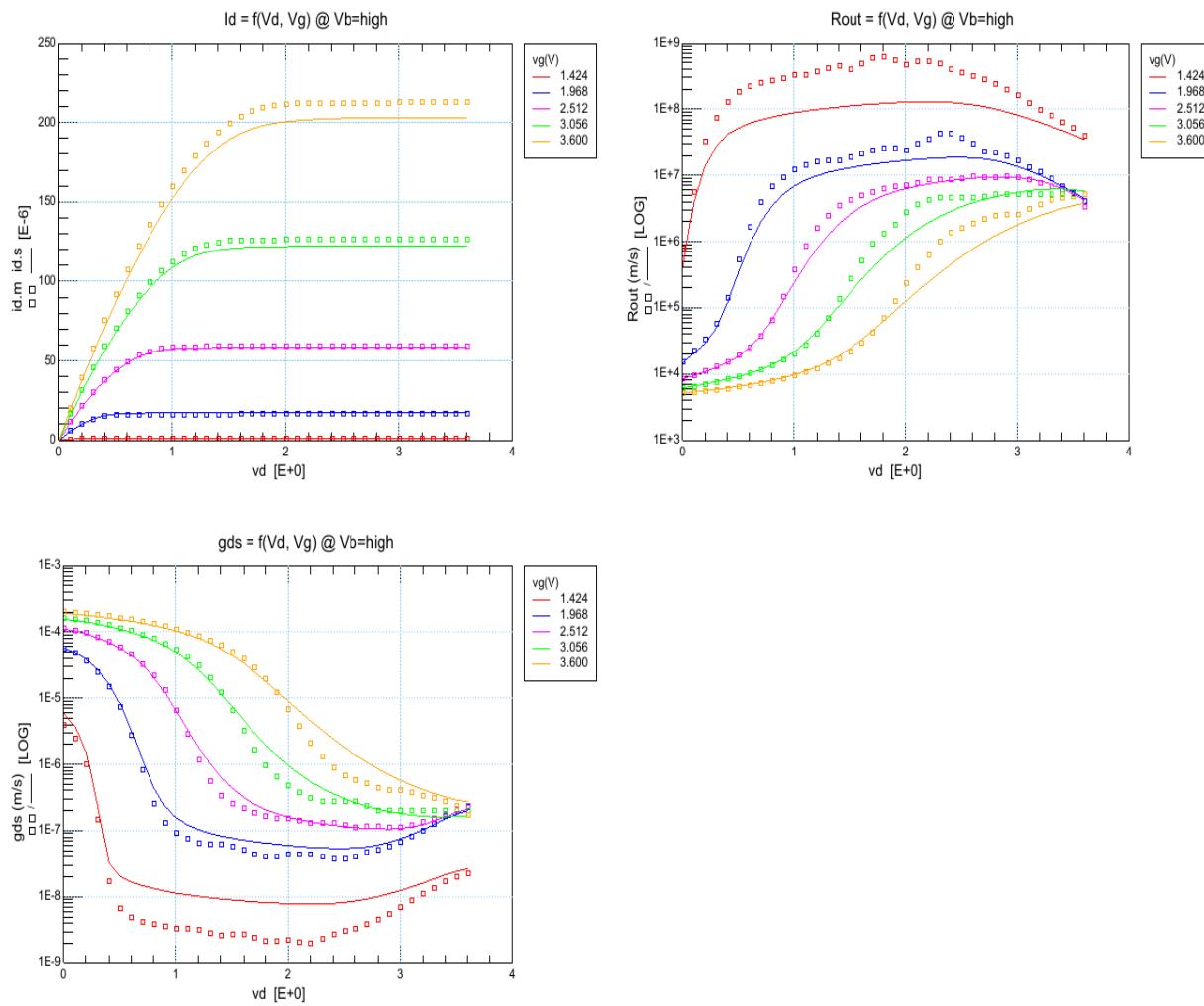
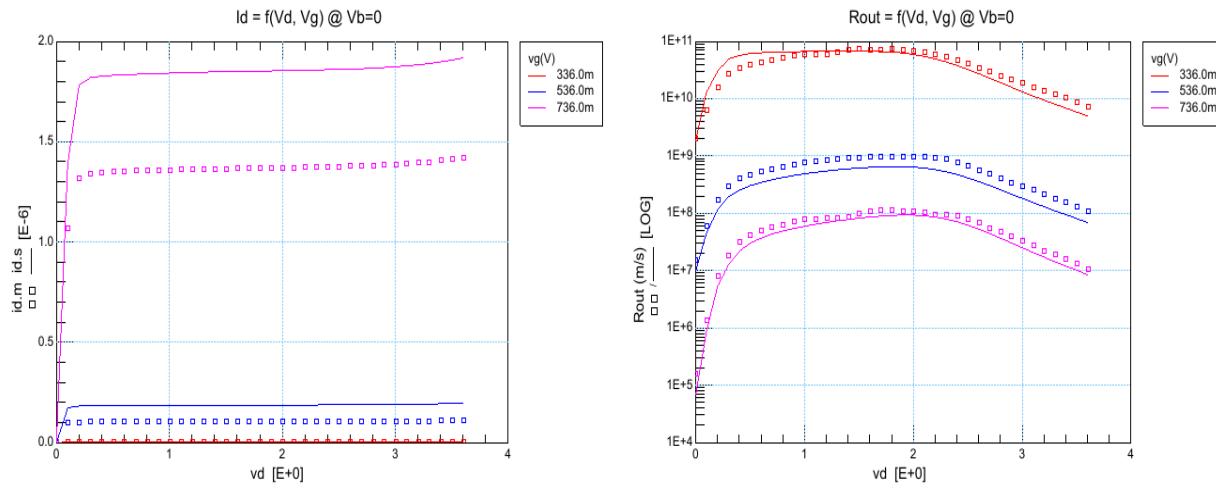


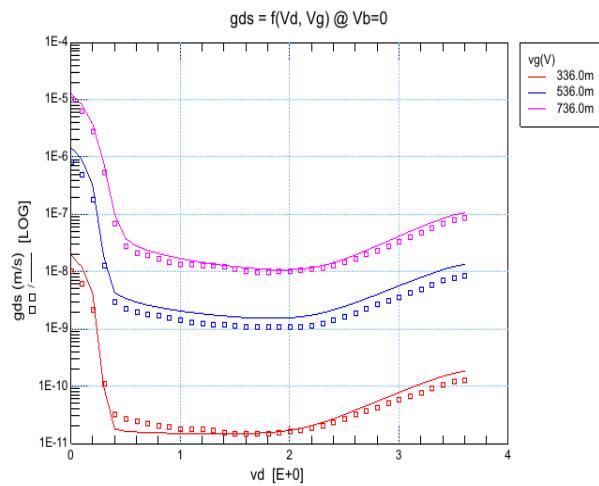


idvg, Ib,Ig, Vb = 0V, T = 70°C

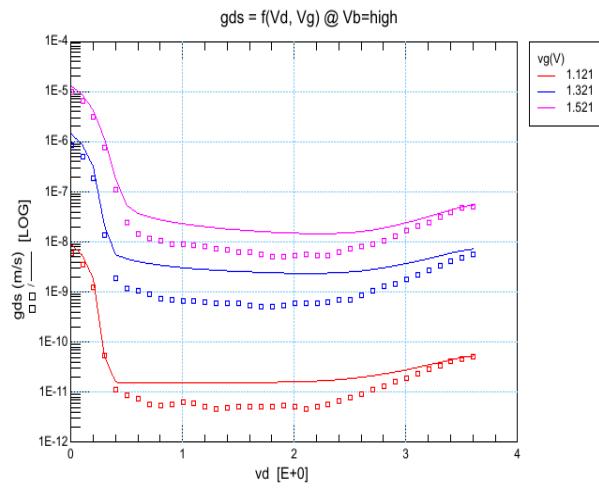
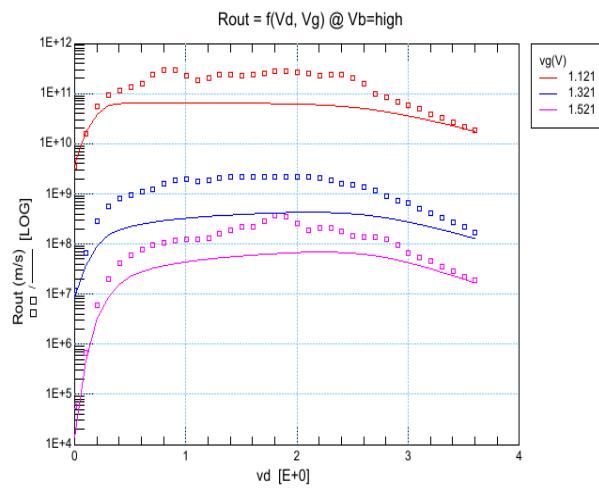
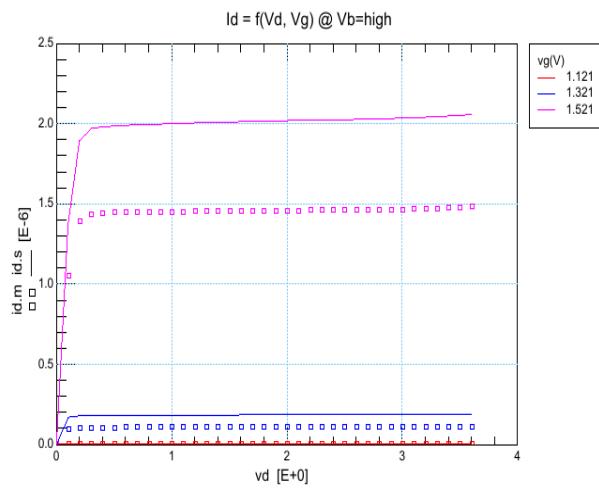


idvg, Ib,Ig, Vb = -3.6V, T = 70°C

idvd, Vb = 0V, T = 70°C


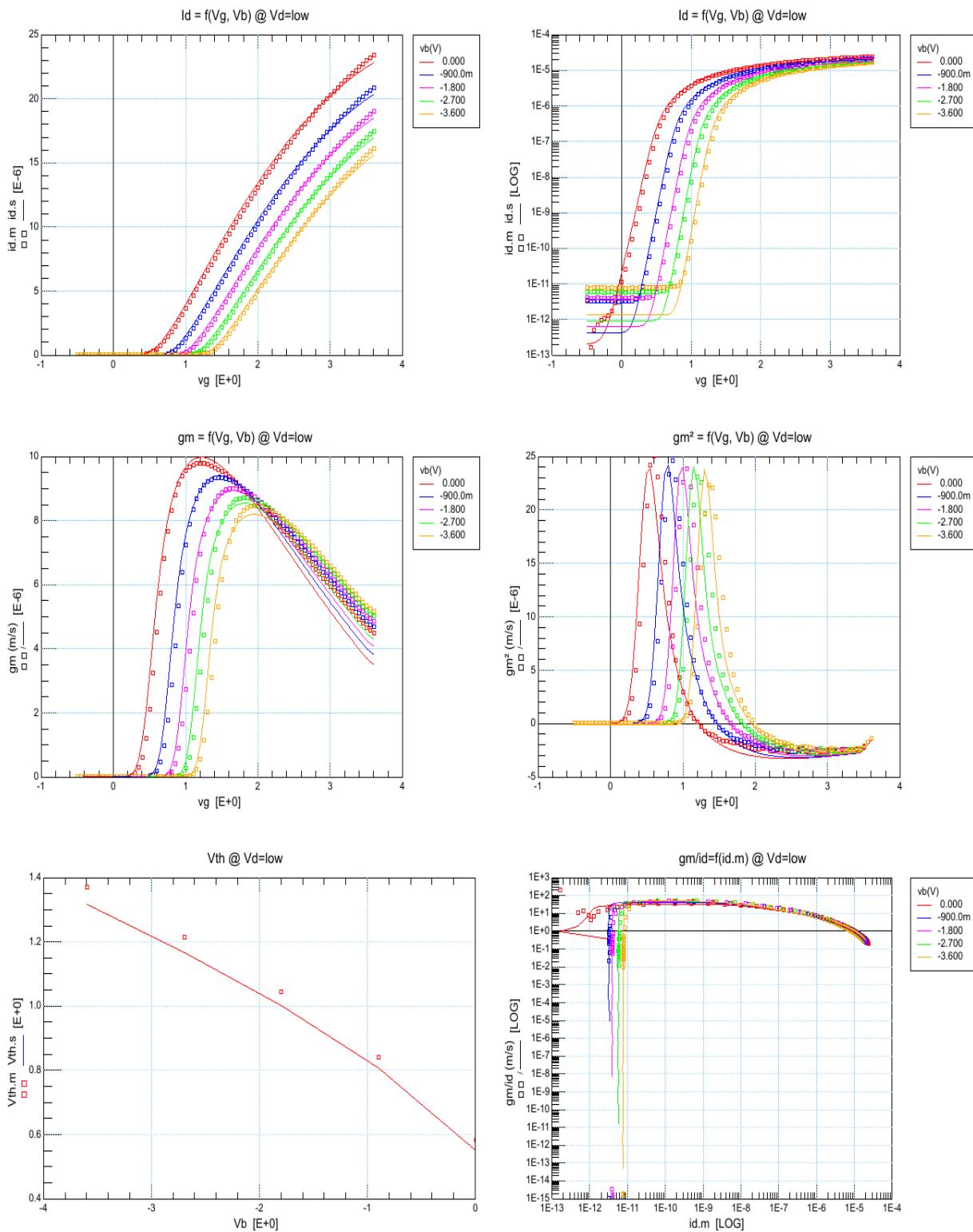
idvd_vbmin, Vb = -3.6V, T = 70°C

idvd_vth, Vb = 0V, T = 70°C


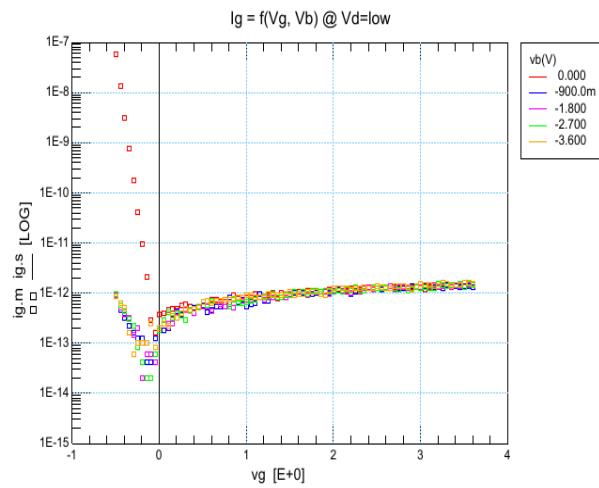
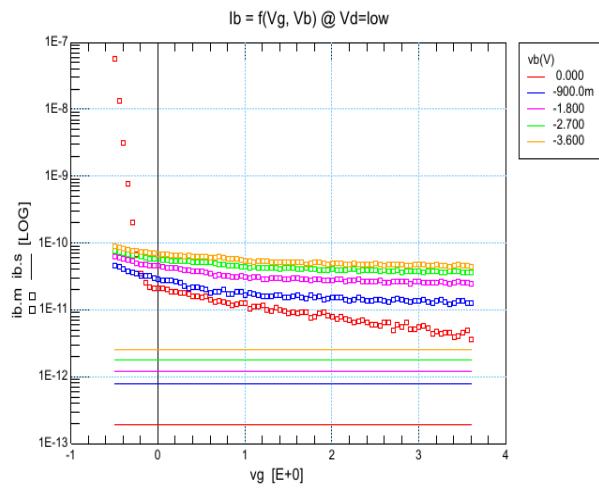


idvd_vth_vbmin, Vb = -3.6V, T = 70°C

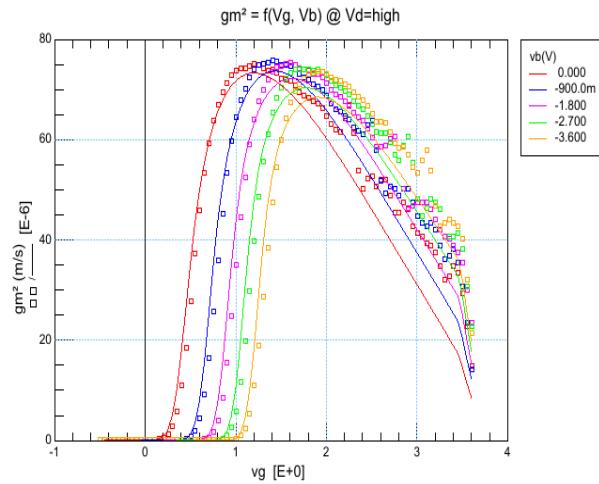
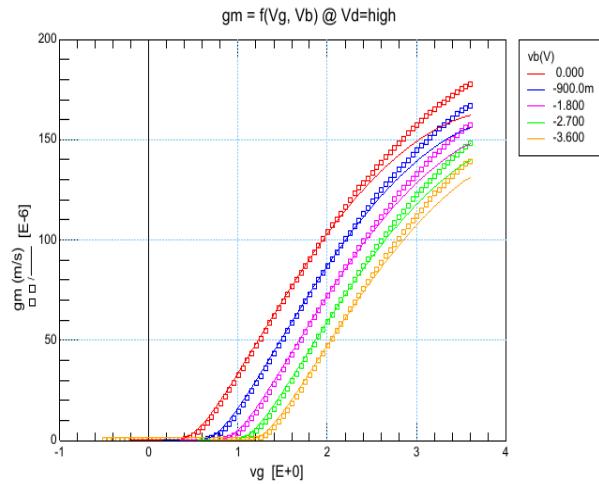
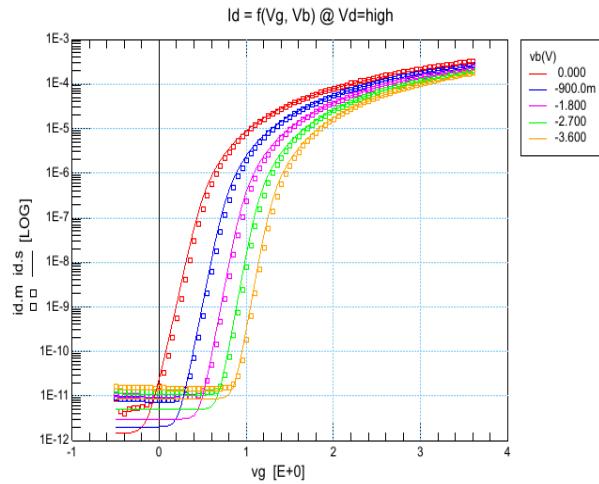
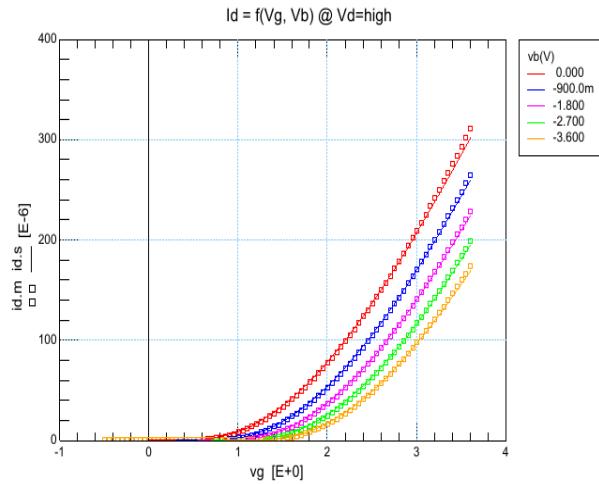


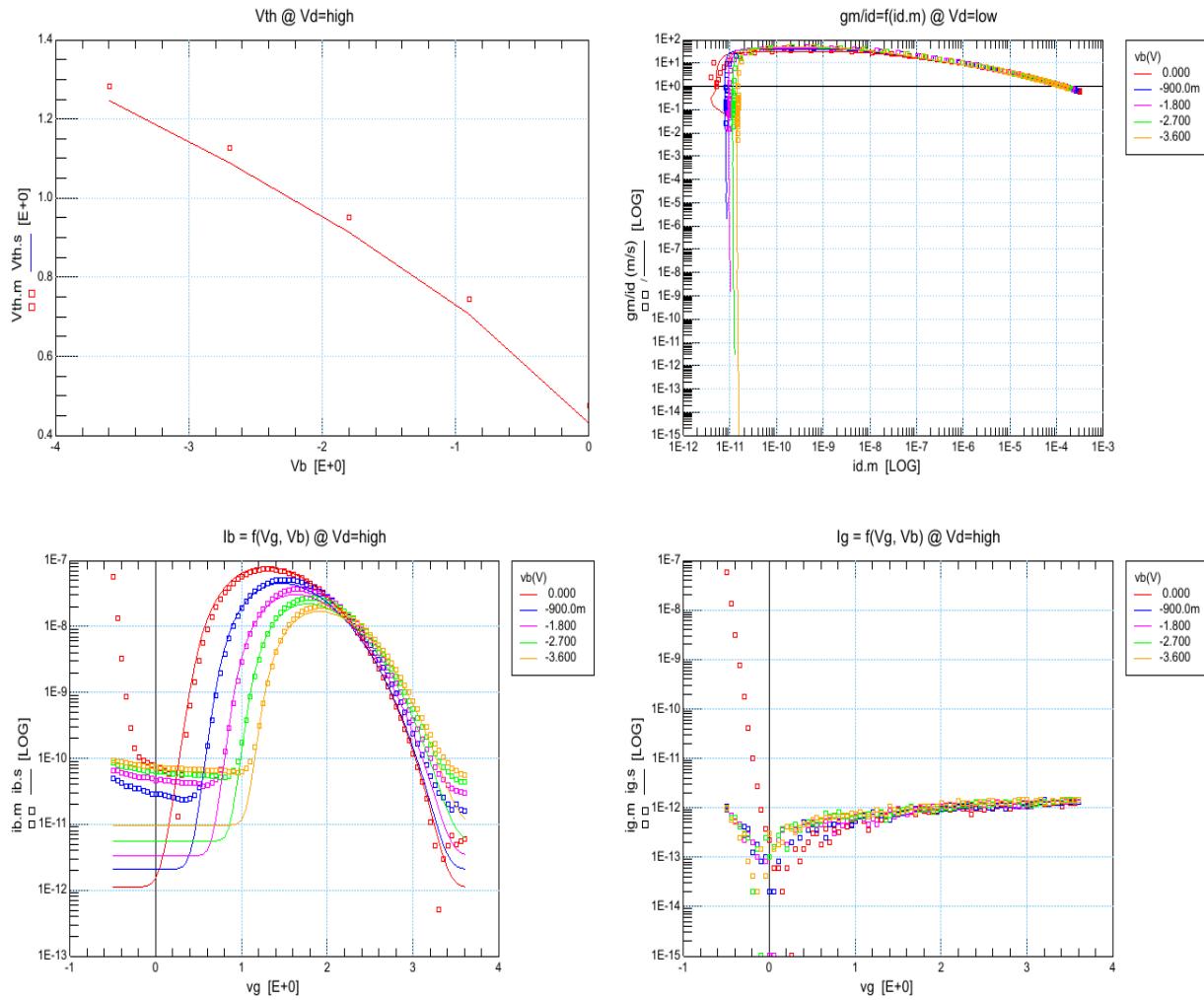
idvg, Vd = 0.1V, T = 125°C



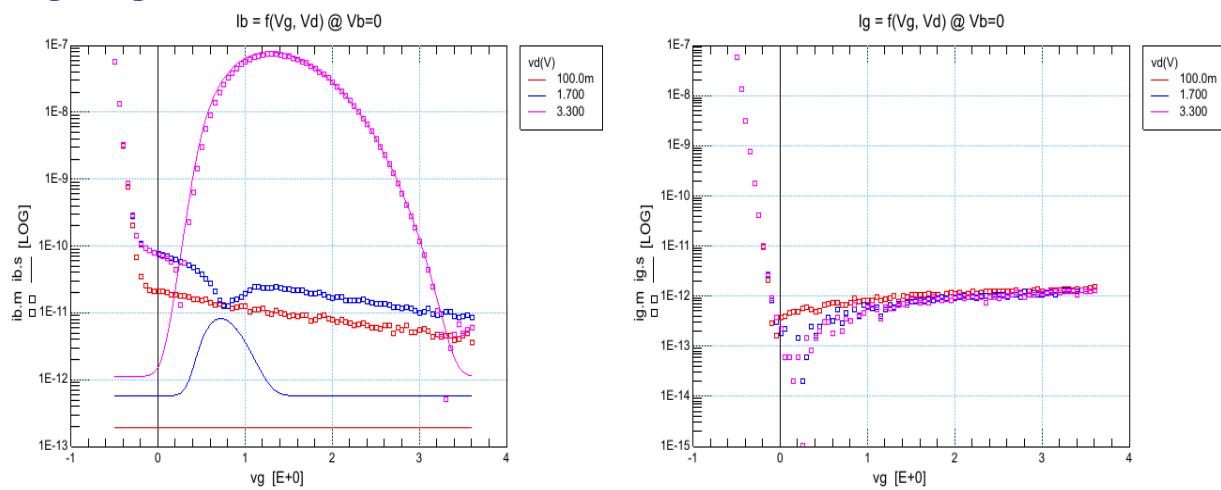


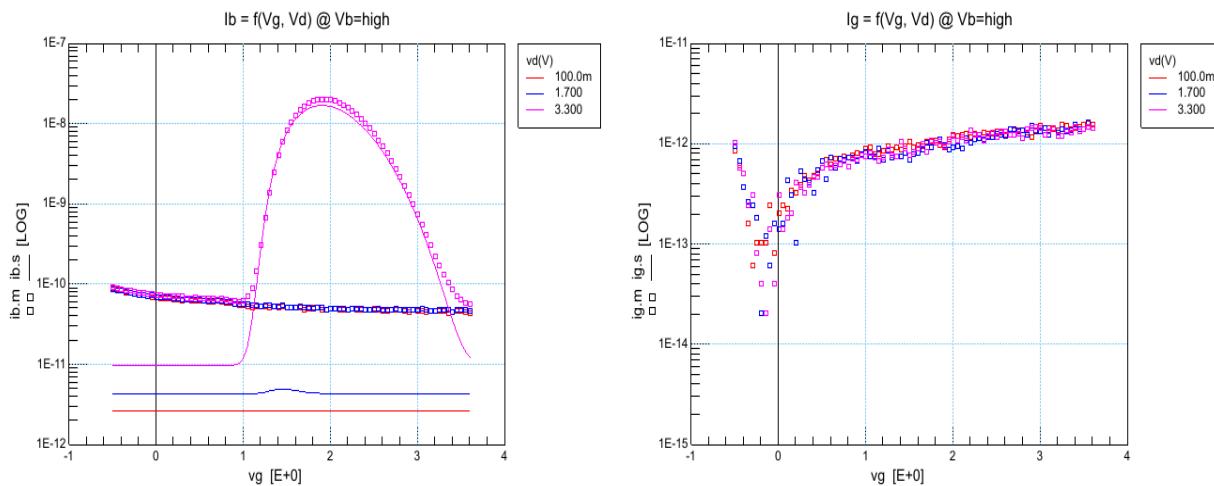
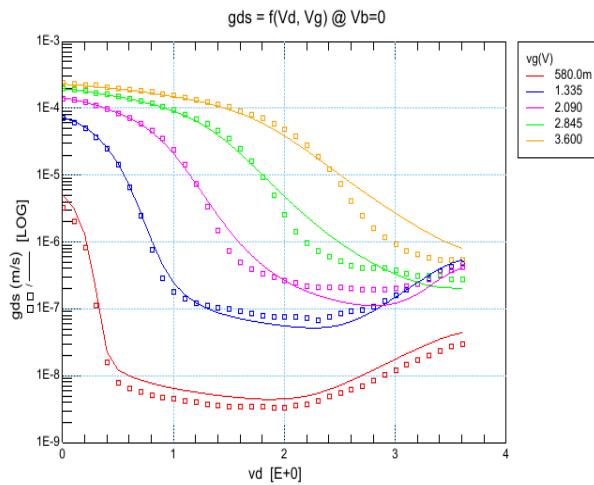
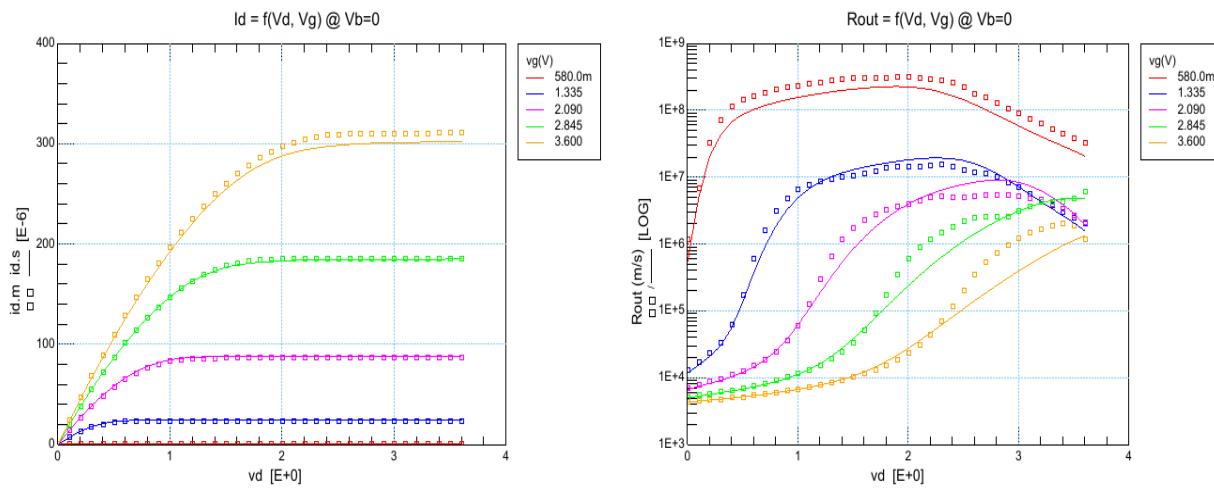
idvg, Vd = 3.3V, T = 125°C

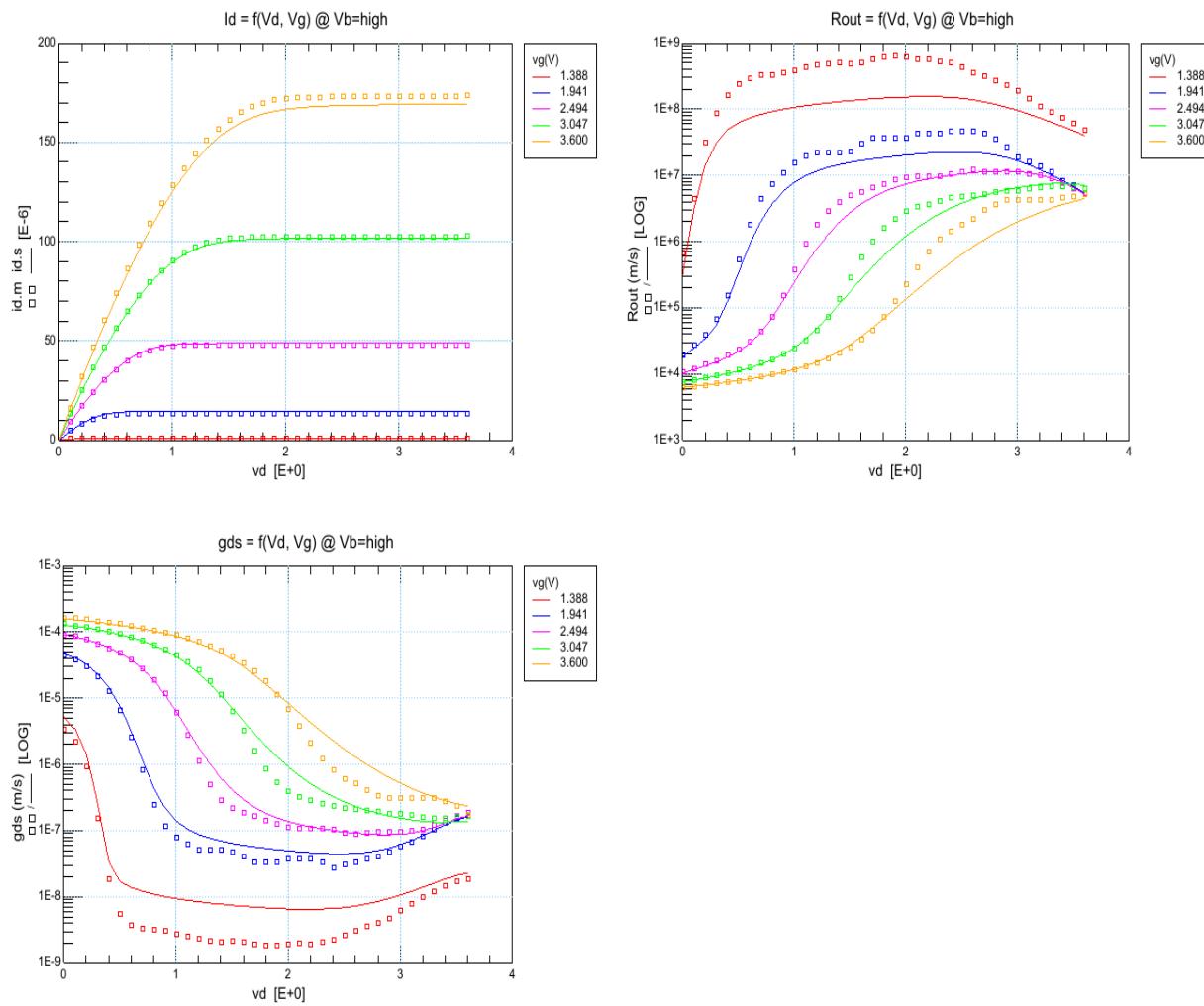
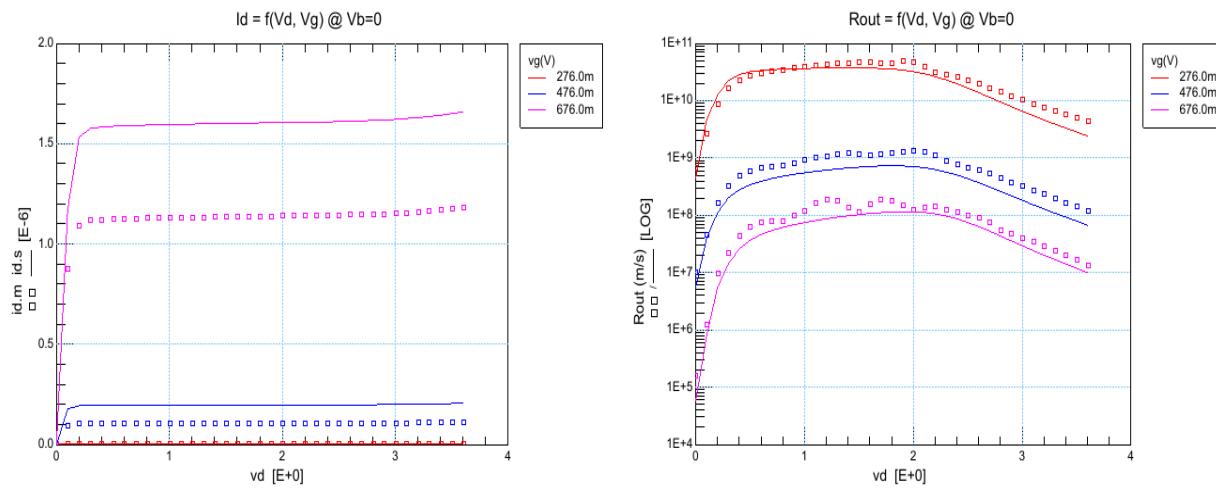


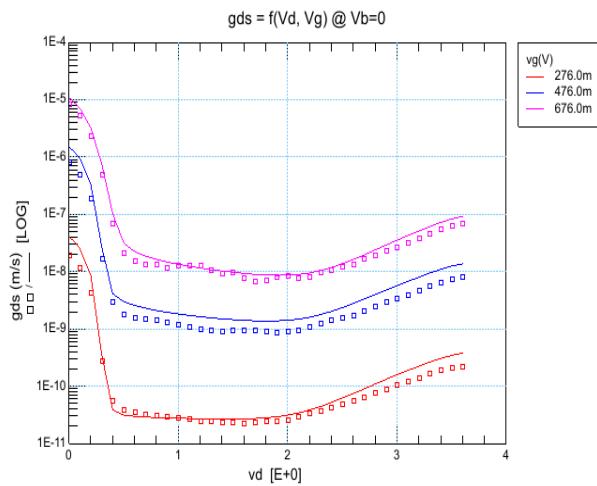


idvg, Ib,Ig, Vb = 0V, T = 125°C

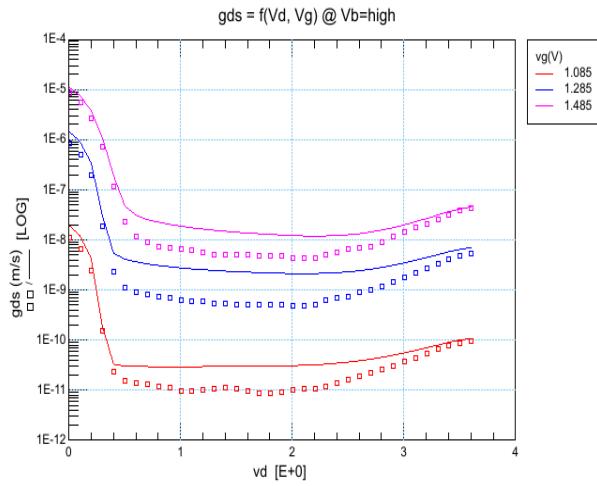
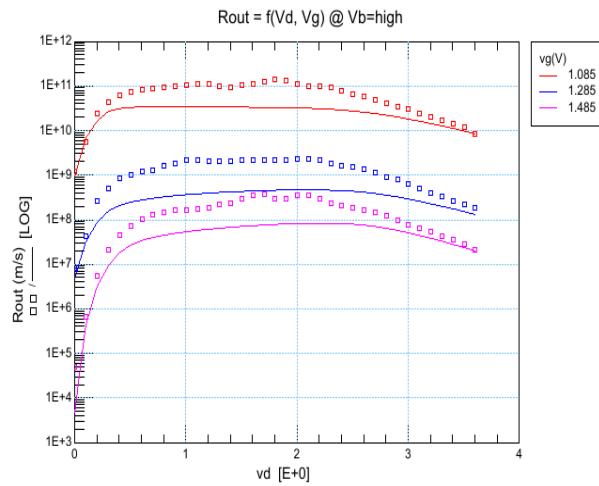
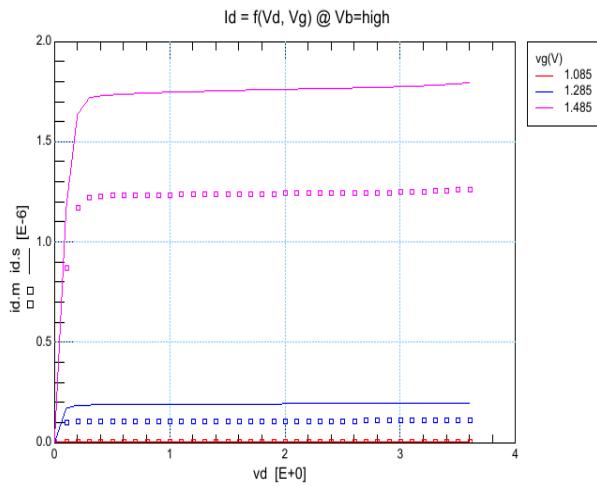


idvg, Ib,Ig, Vb = -3.6V, T = 125°C

idvd, Vb = 0V, T = 125°C


idvd_vbmin, Vb = -3.6V, T = 125°C

idvd_vth, Vb = 0V, T = 125°C


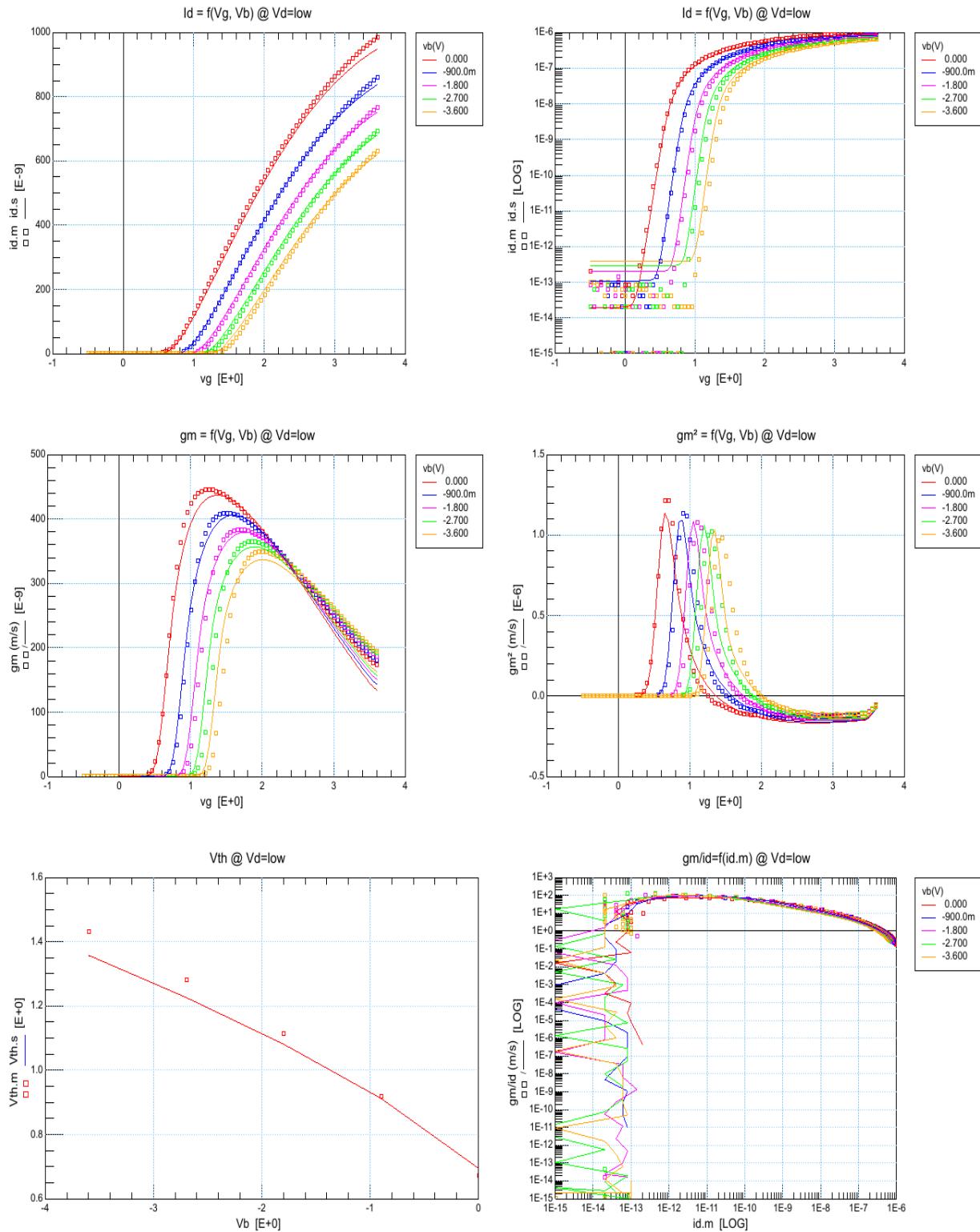


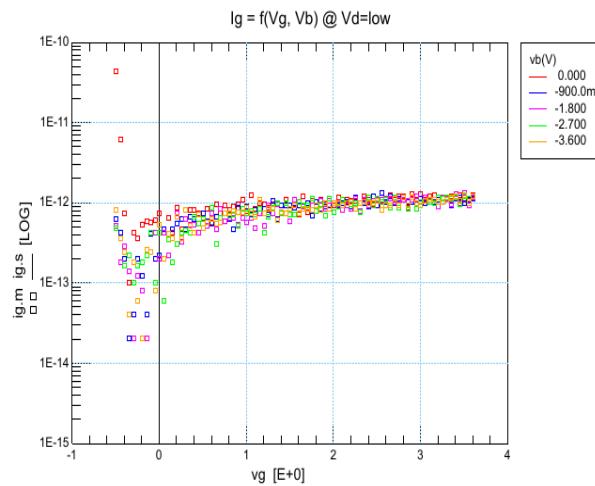
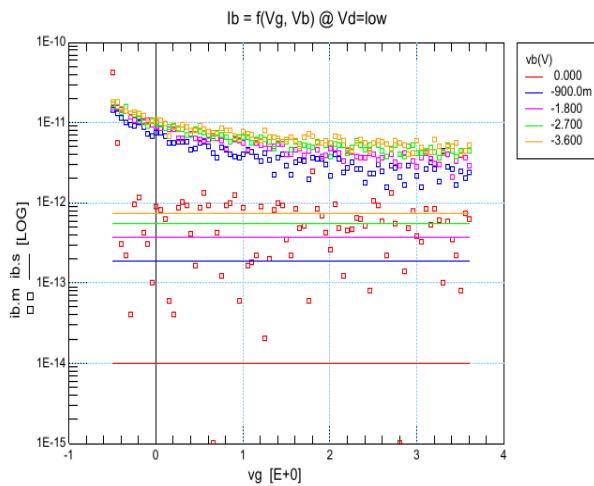
idvd_vth_vbmin, Vb = -3.6V, T = 125°C



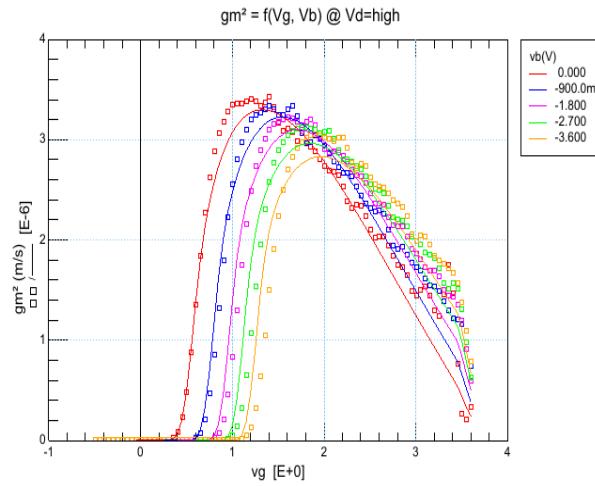
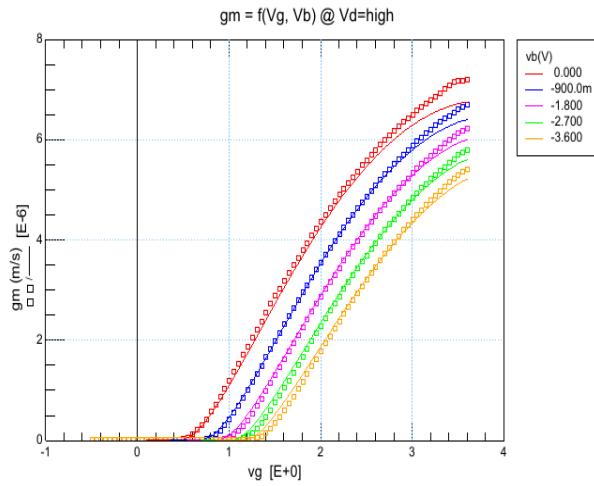
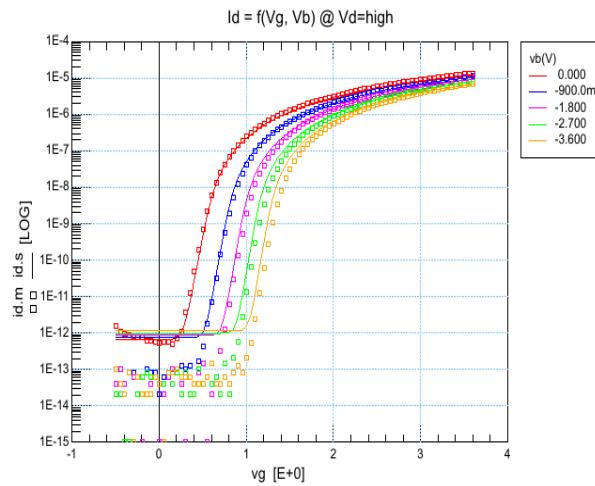
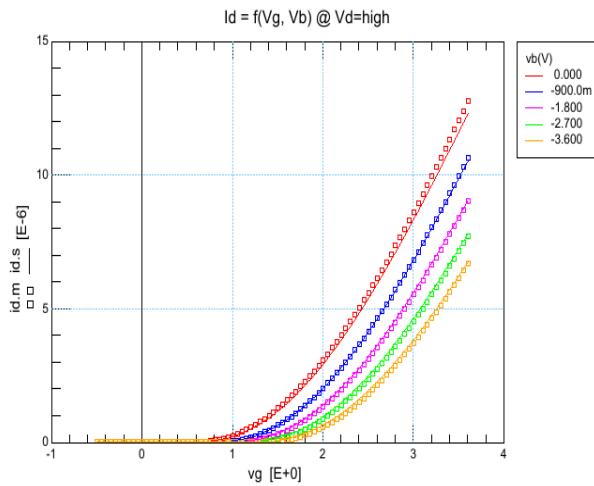
4.3 W0u3_L10u0_S547_4

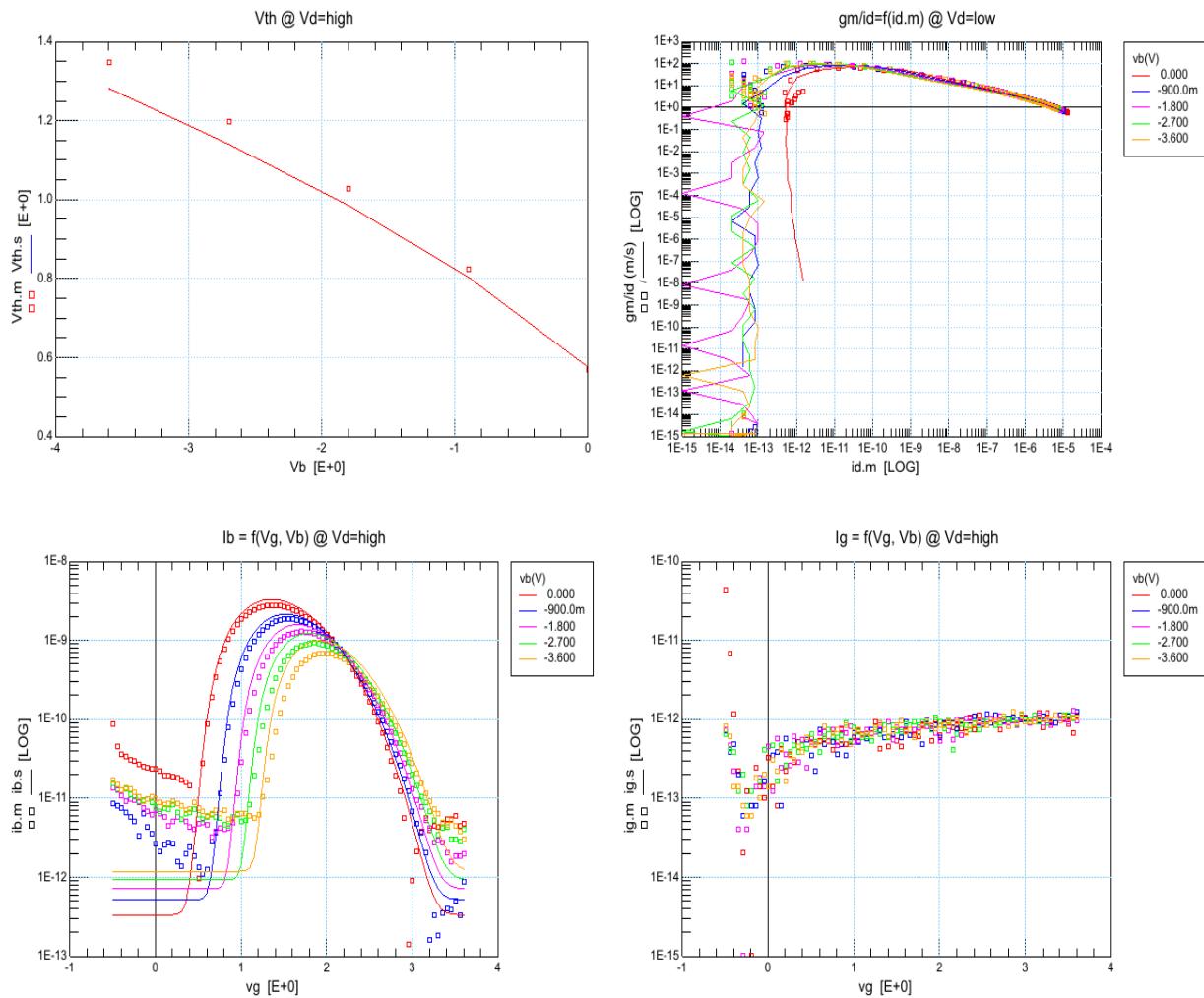
idvg, Vd = 0.1V, T = 27°C



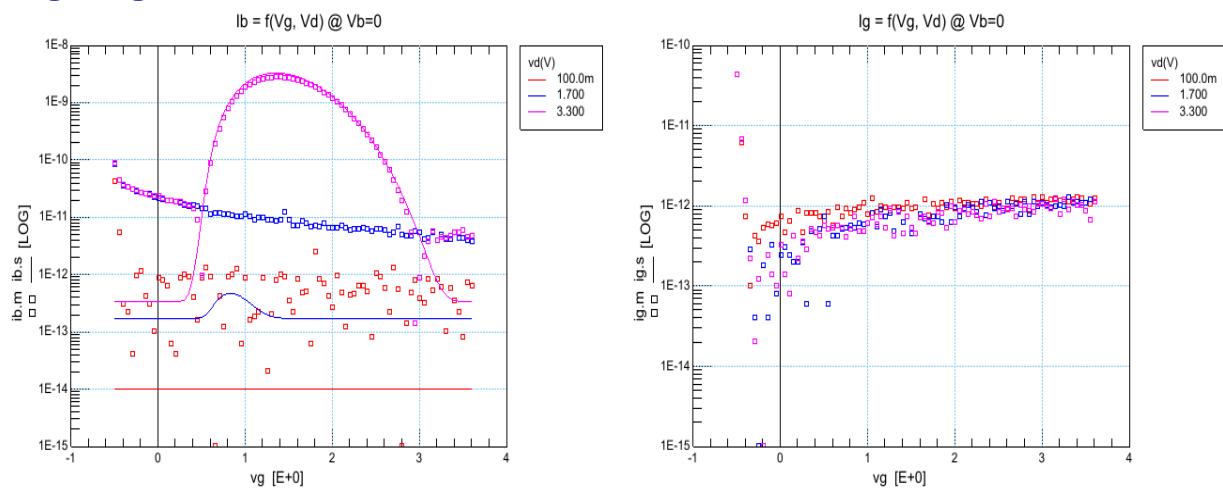


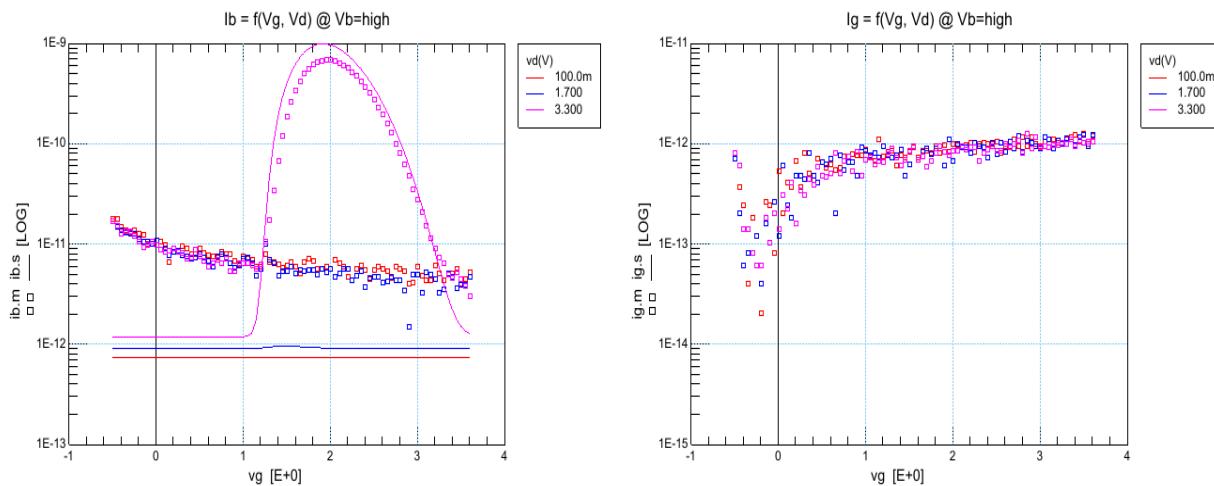
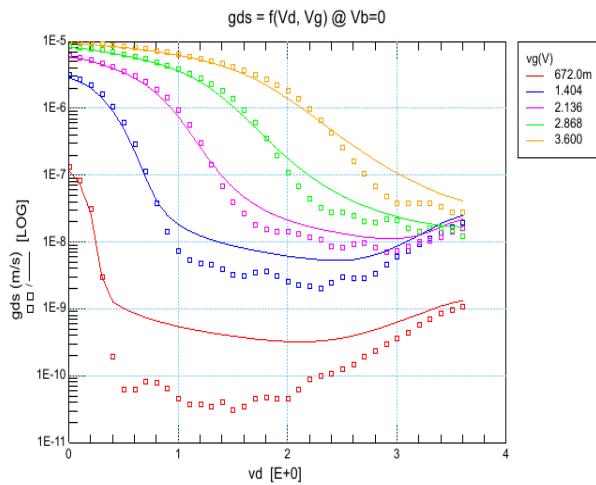
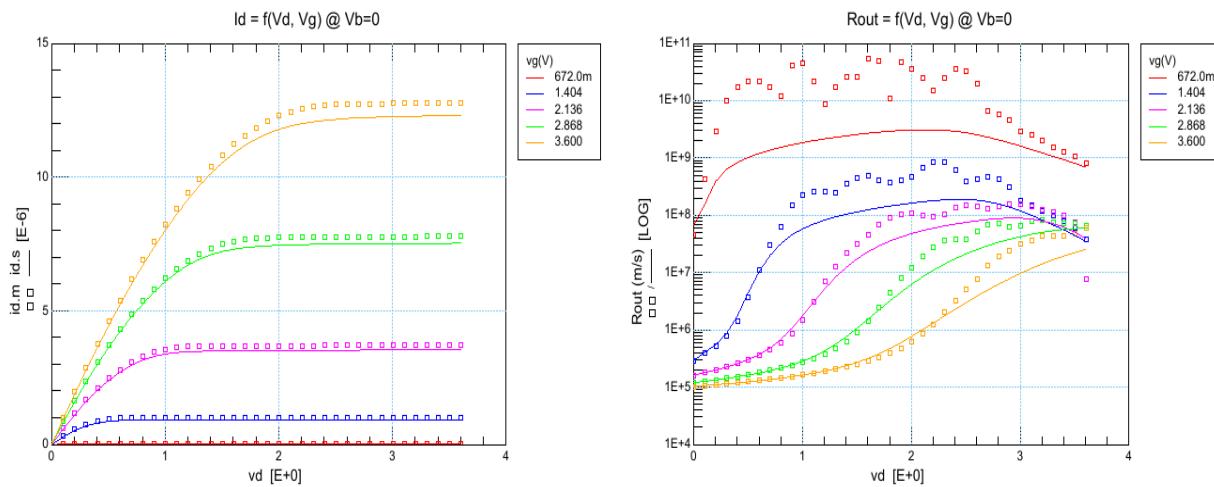
idvg, Vd = 3.3V, T = 27°C

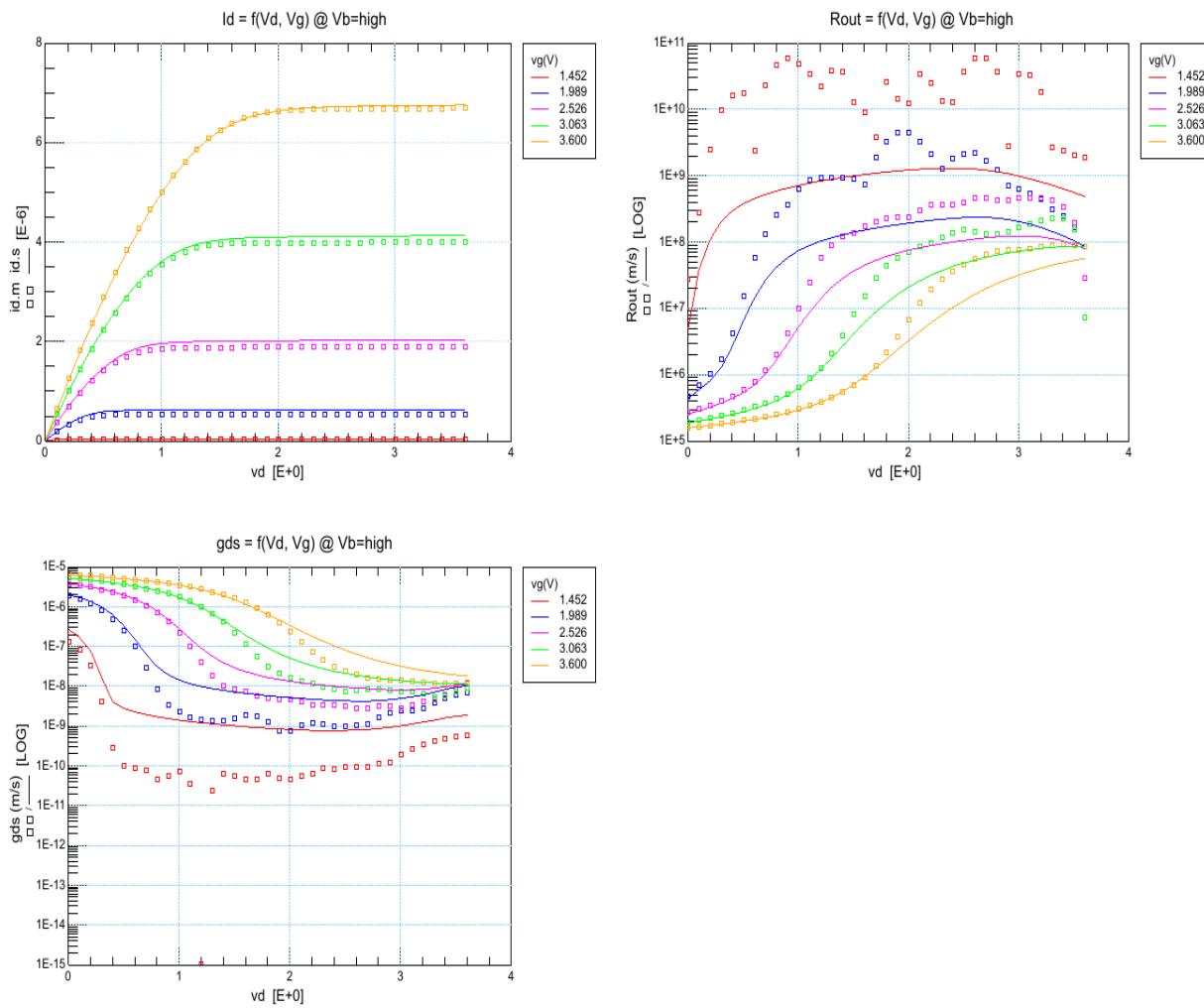
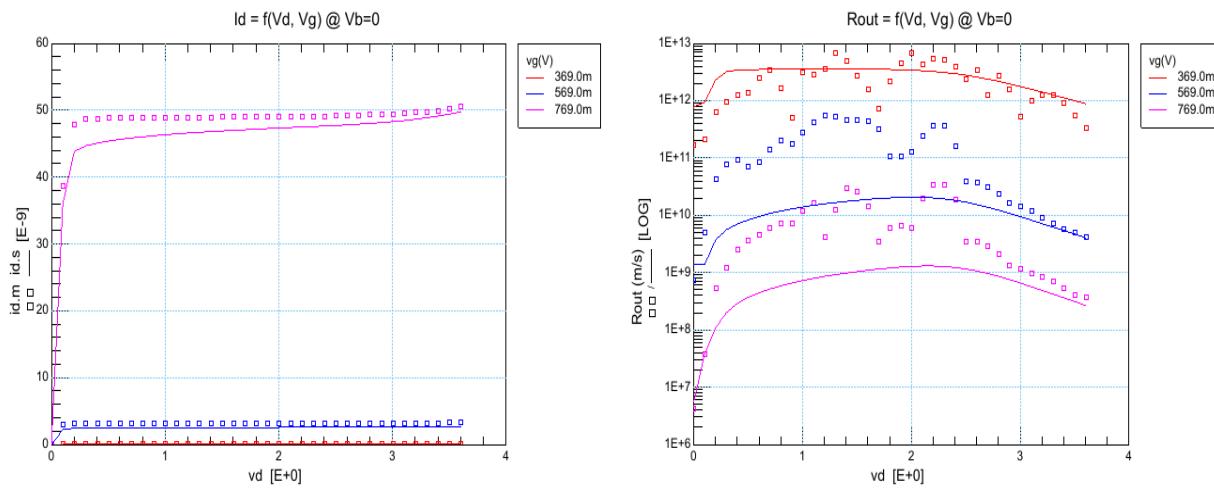


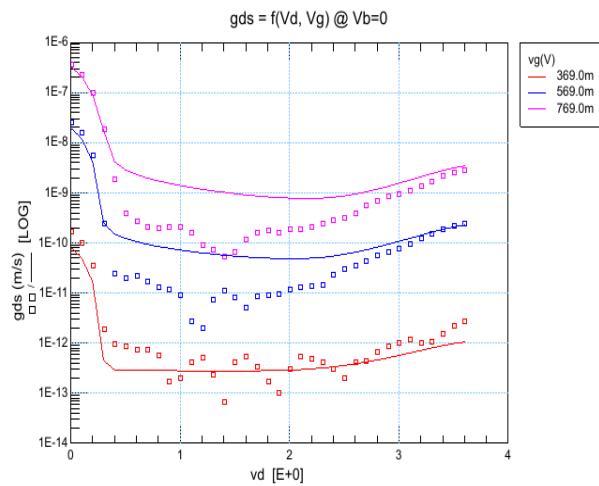


idvg, Ib, Ig, Vb = 0V, T = 27°C

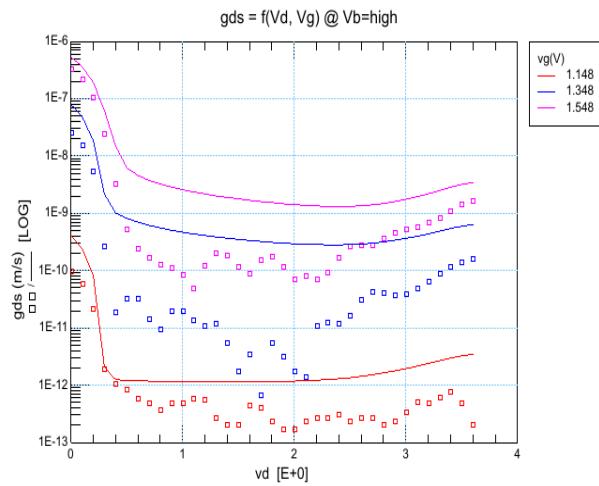
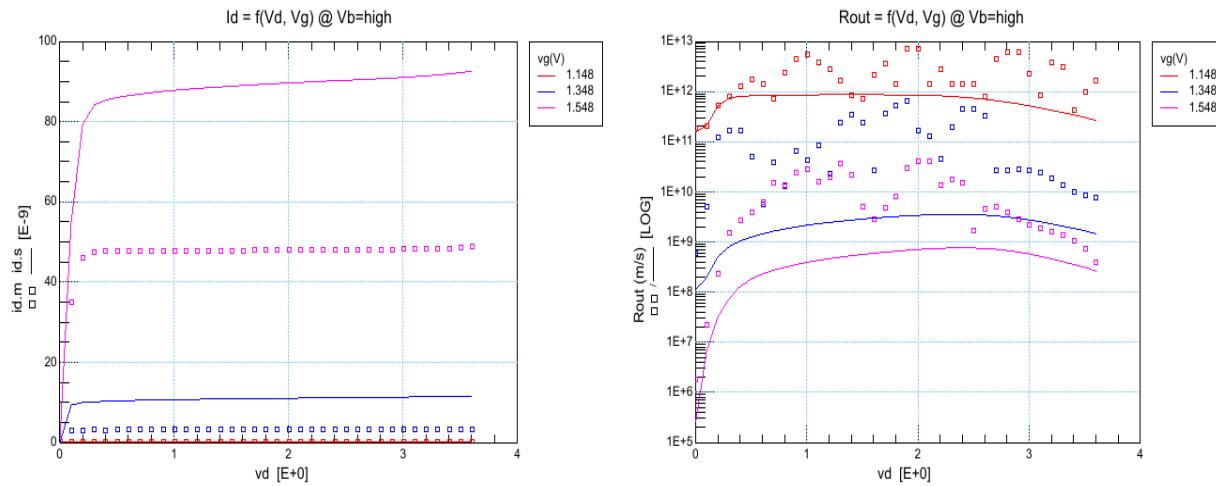


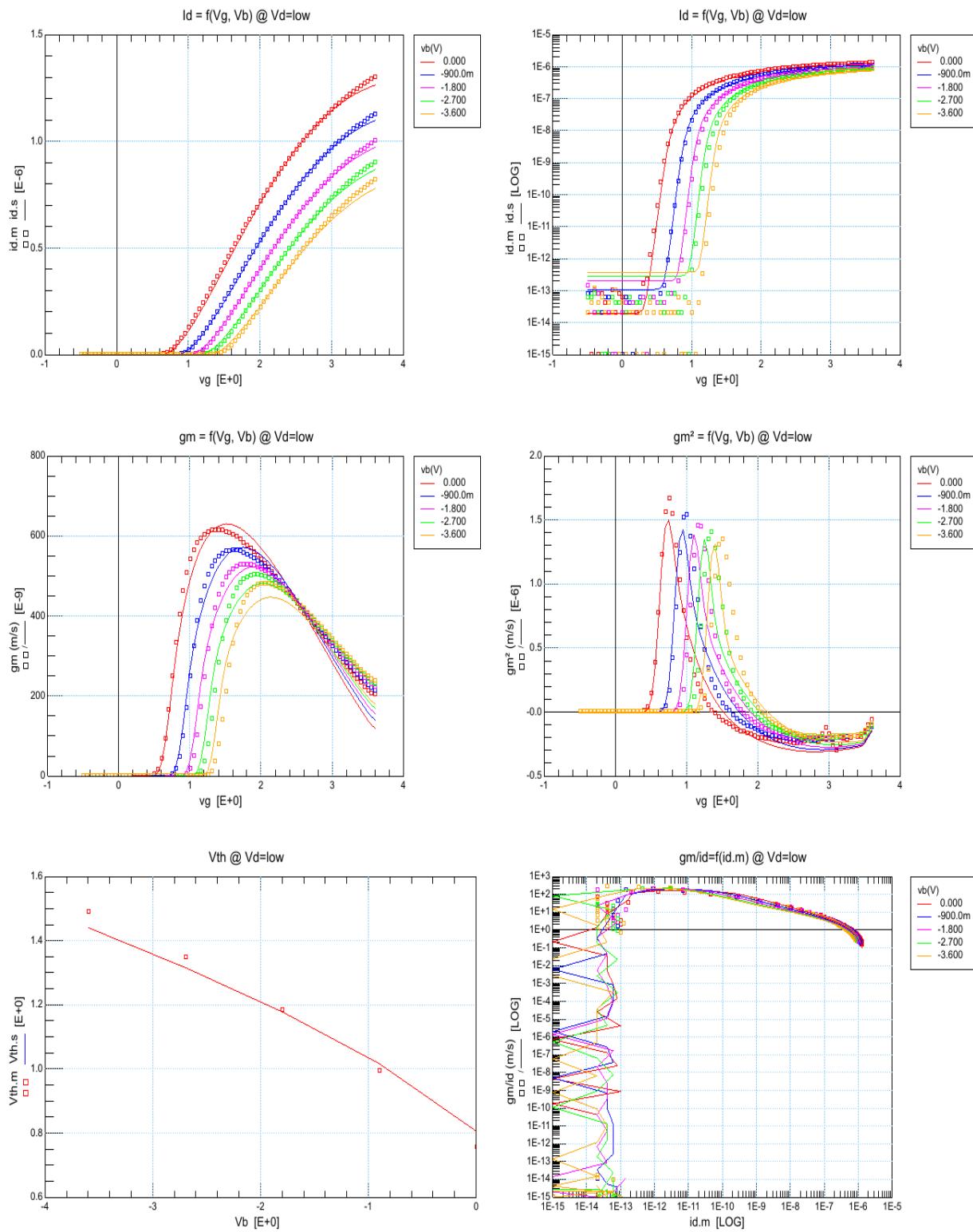
idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


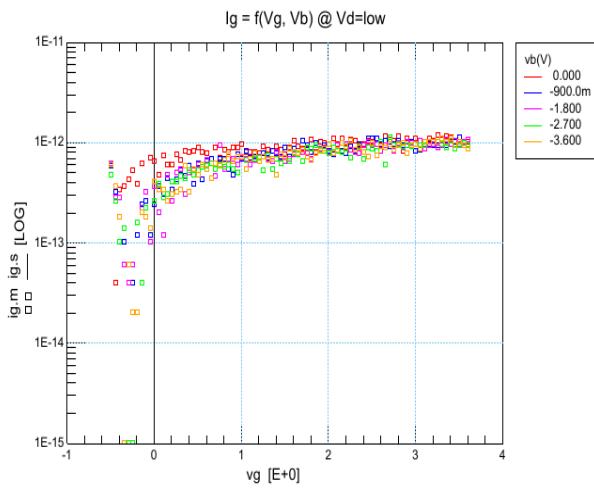
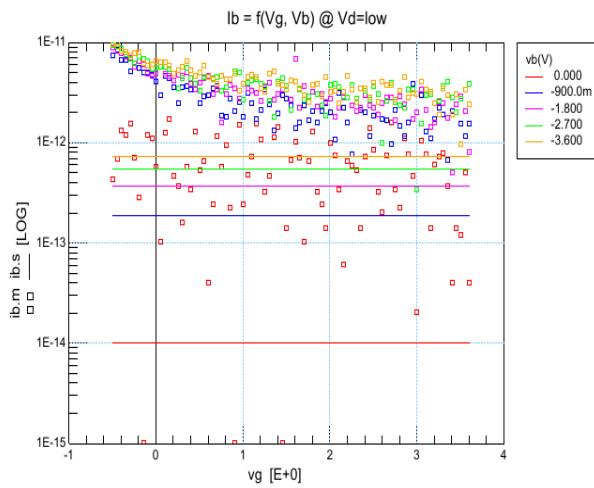
idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C




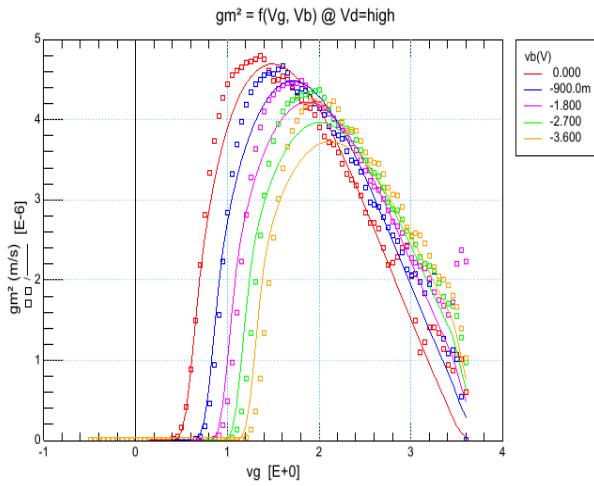
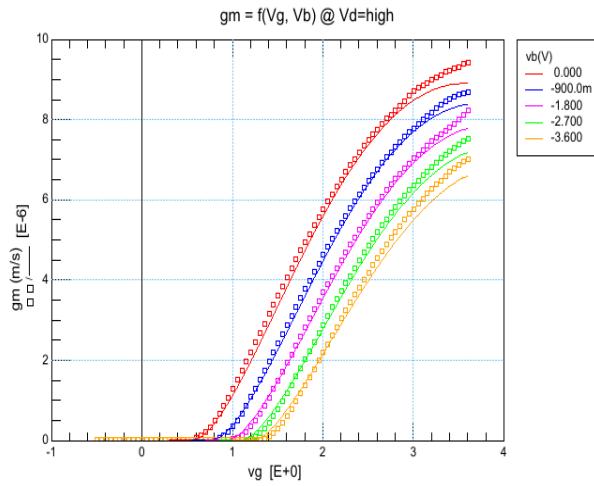
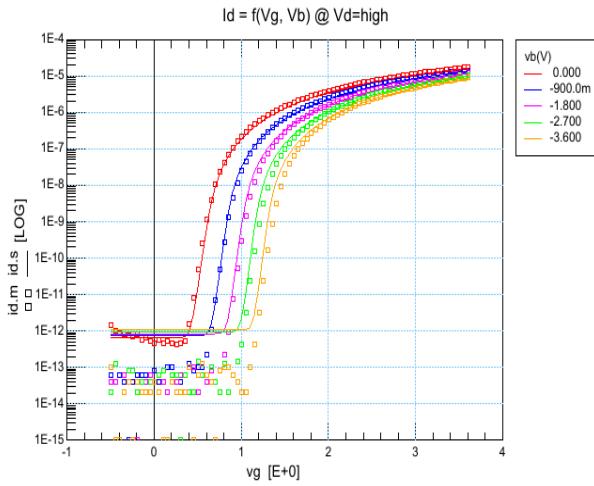
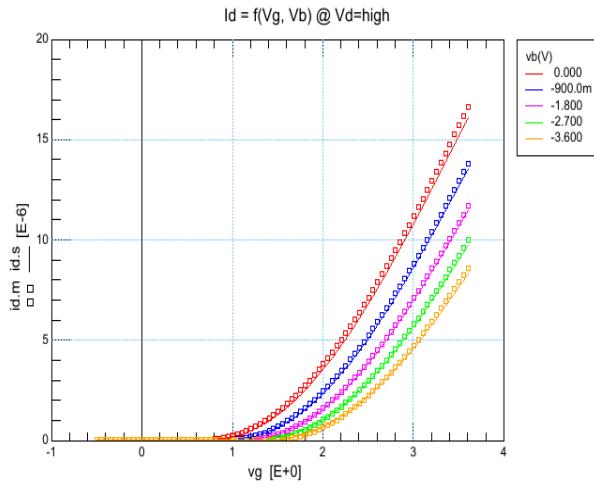
idvd_vth_vbmin, Vb = -3.6V, T = 27°C

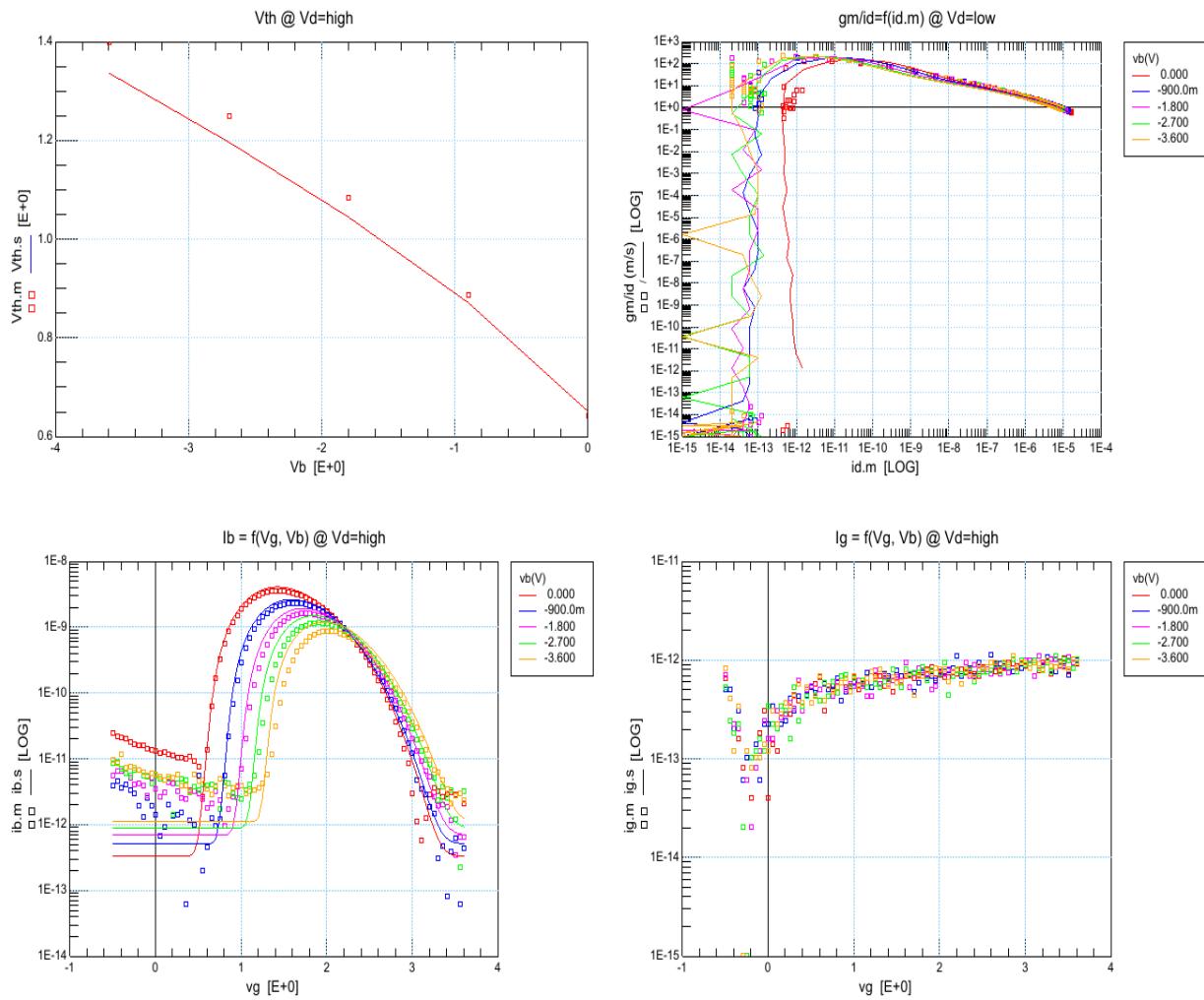


idvg, Vd = 0.1V, T = -40°C


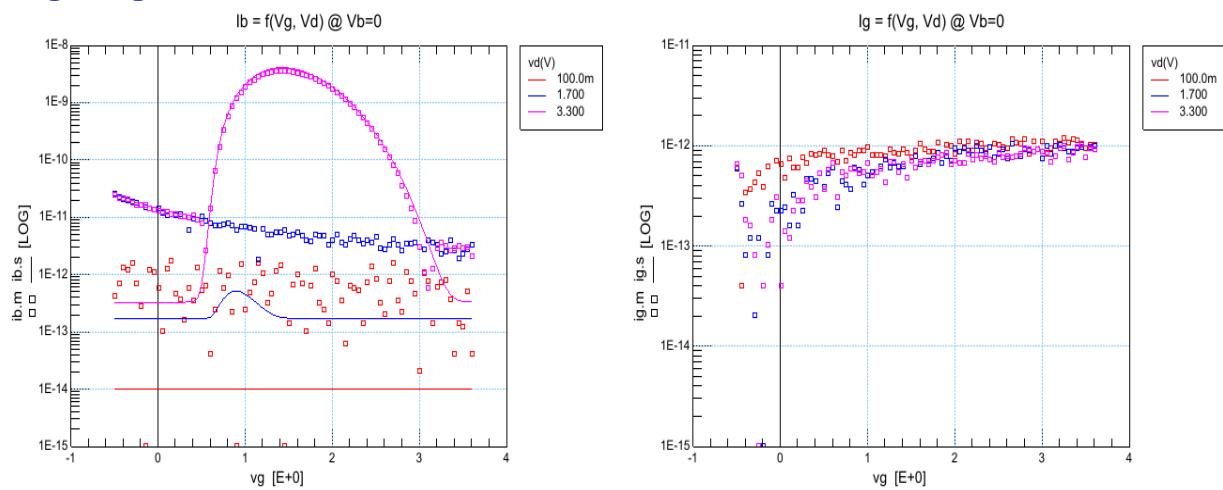


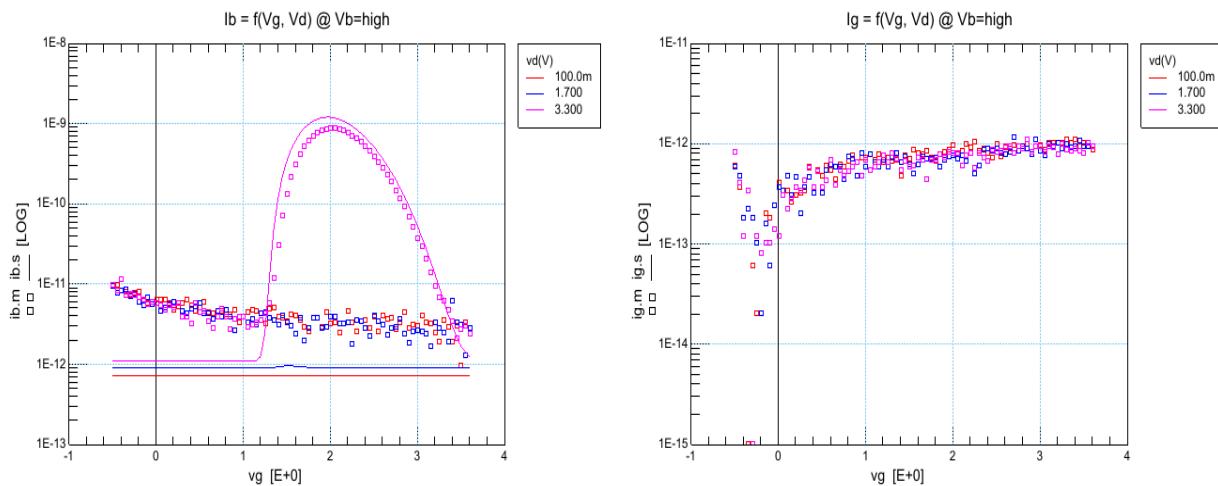
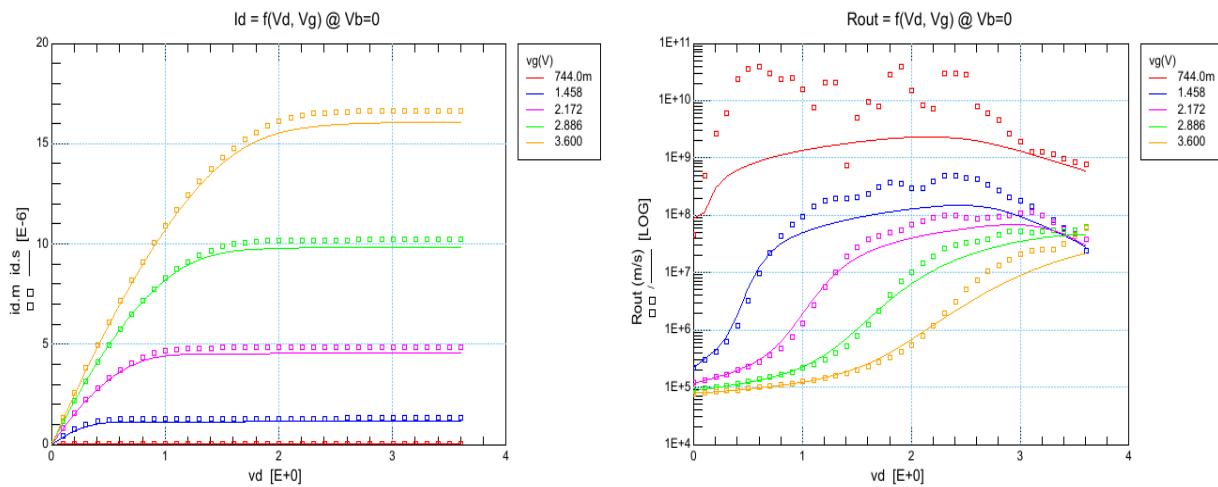
$i_{dvg}, V_d = 3.3V, T = -40^\circ\text{C}$

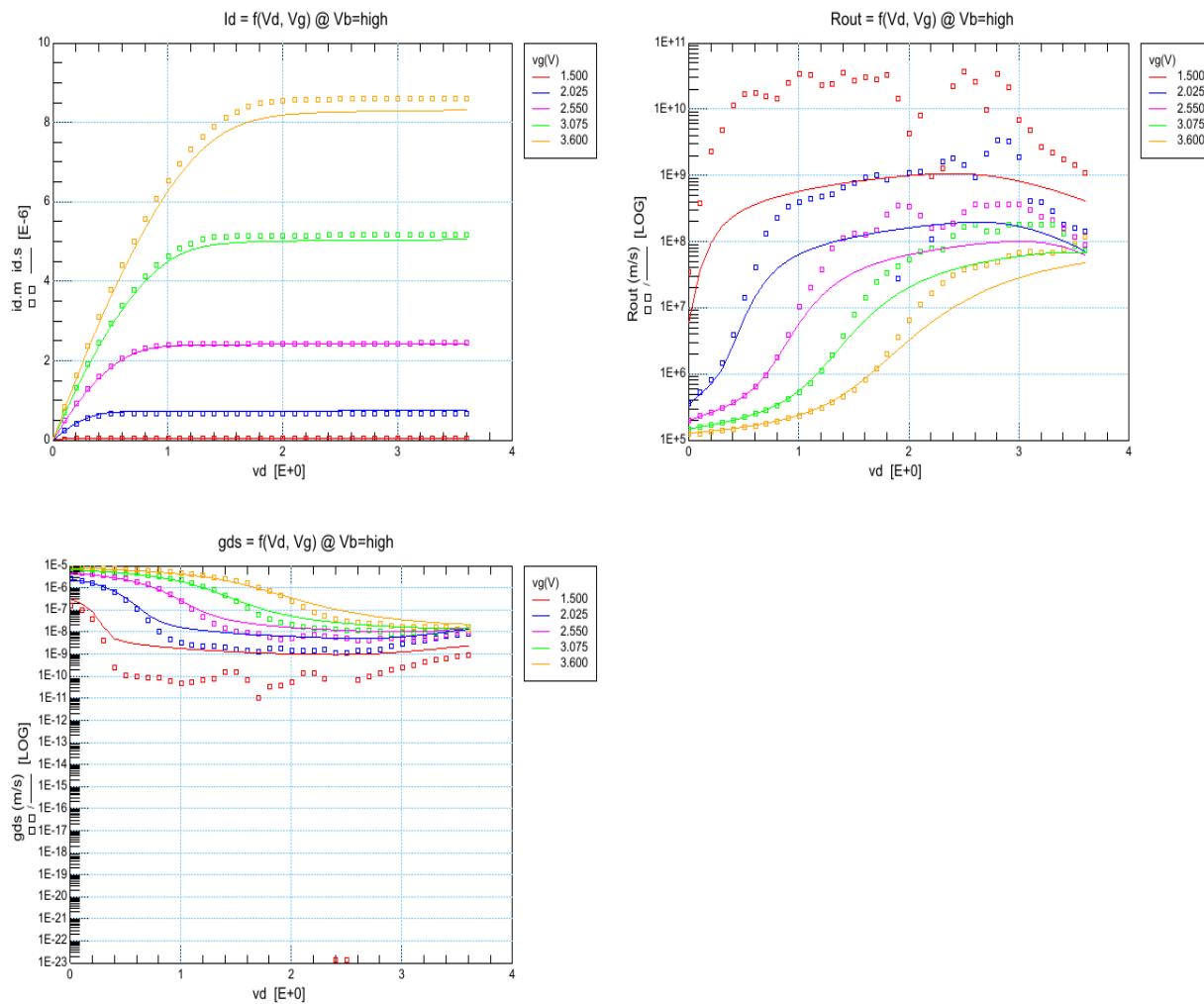
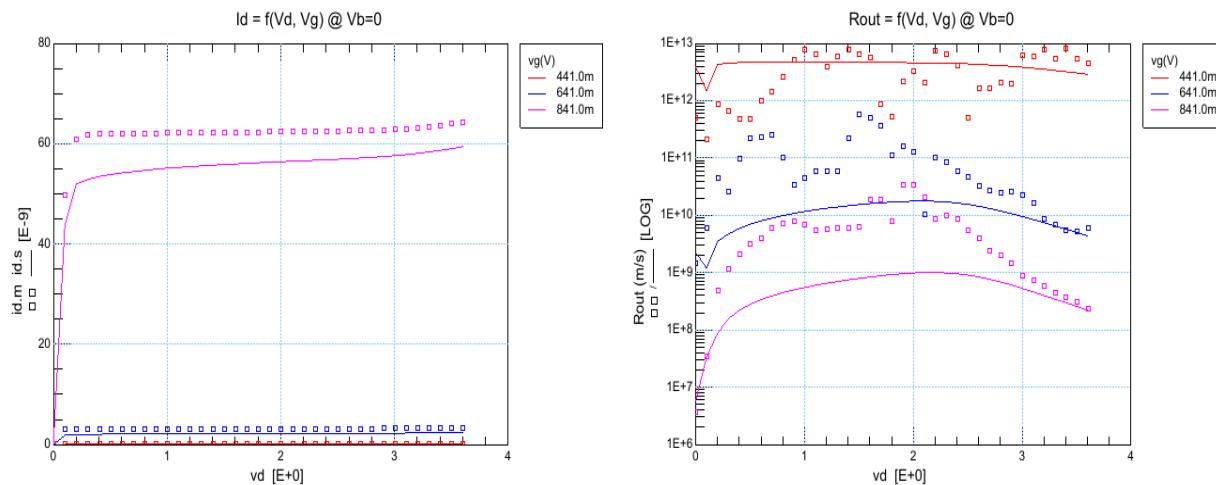


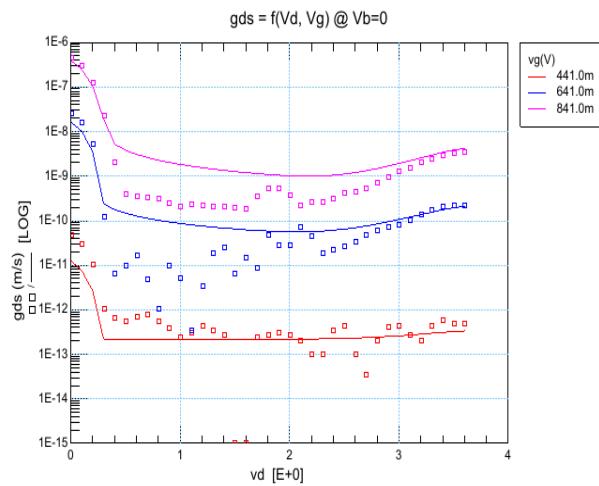


idvg, Ib, Ig, Vb = 0V, T = -40°C

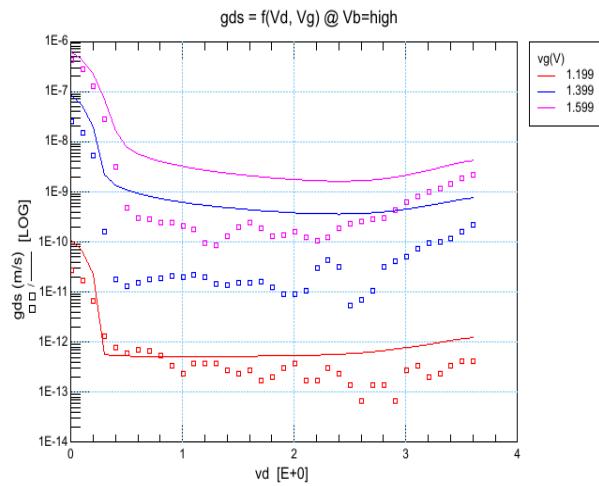
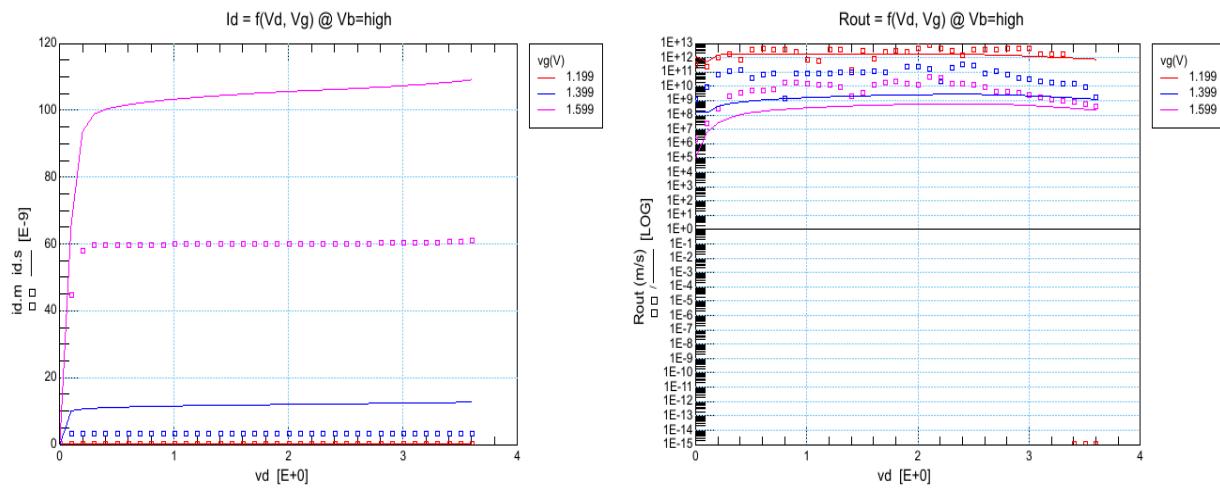


idvg, Ib,Ig, Vb = -3.6V, T = -40°C

idvd, Vb = 0V, T = -40°C


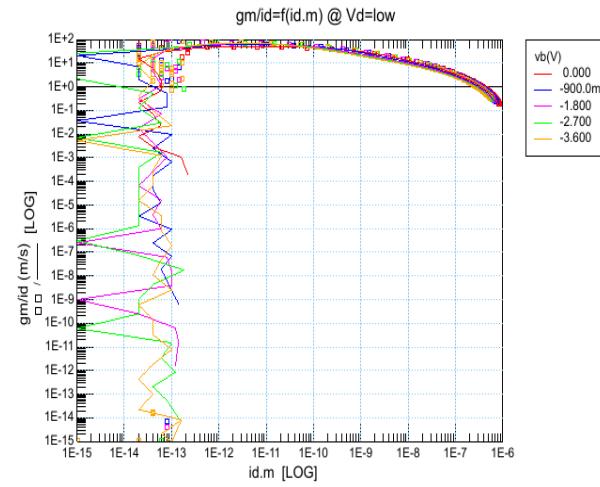
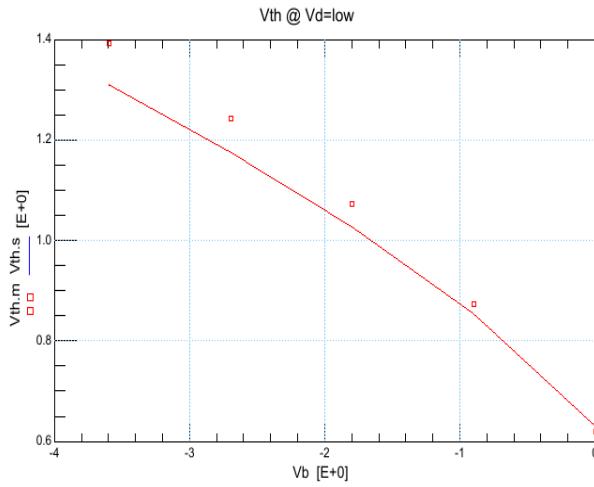
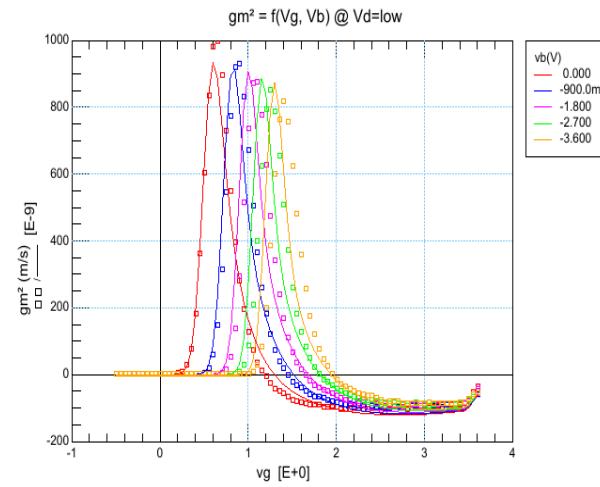
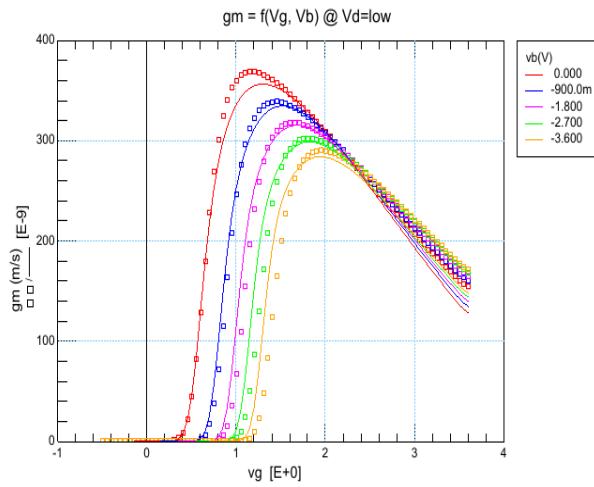
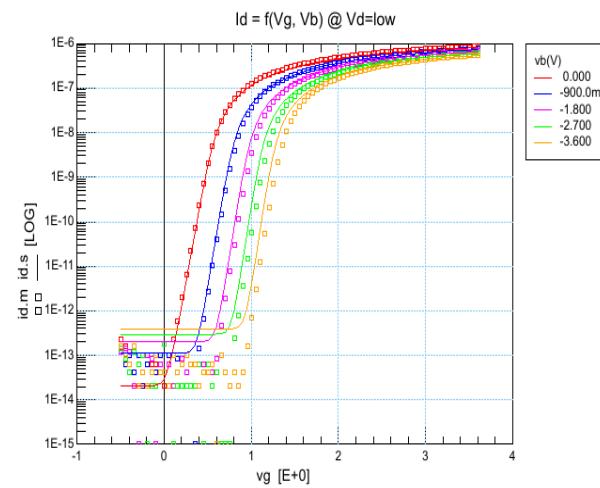
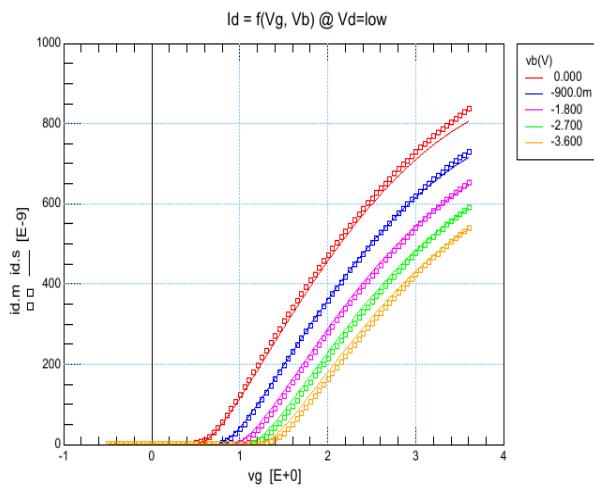
idvd_vbmin, Vb = -3.6V, T = -40°C

idvd_vth, Vb = 0V, T = -40°C


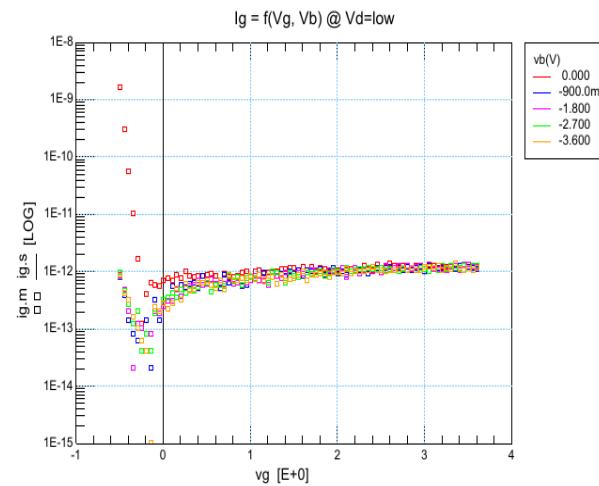
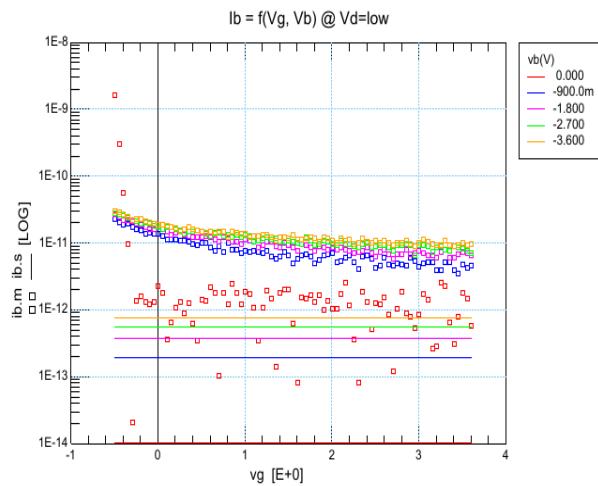


idvd_vth_vbmin, Vb = -3.6V, T = -40°C

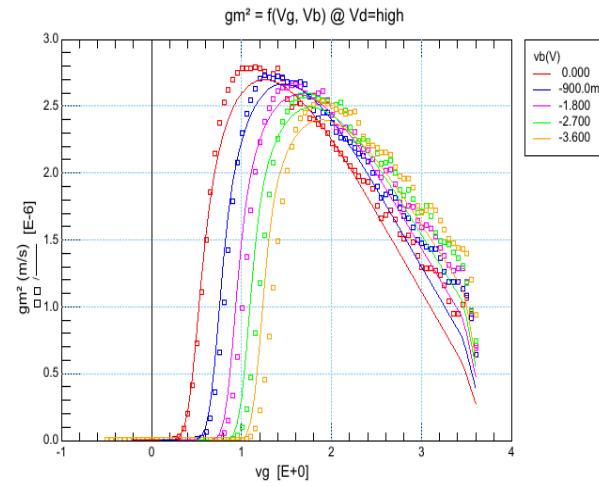
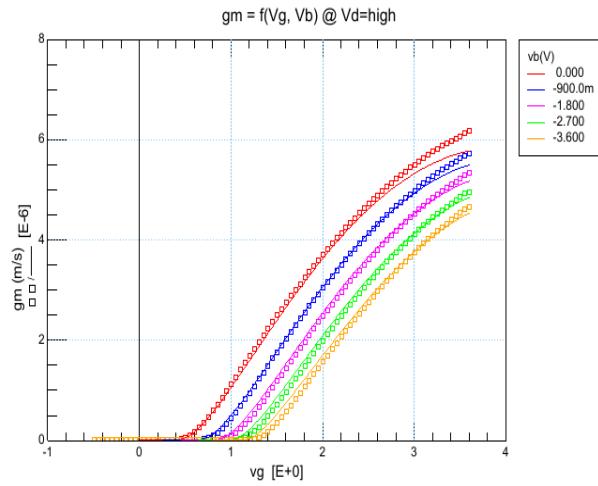
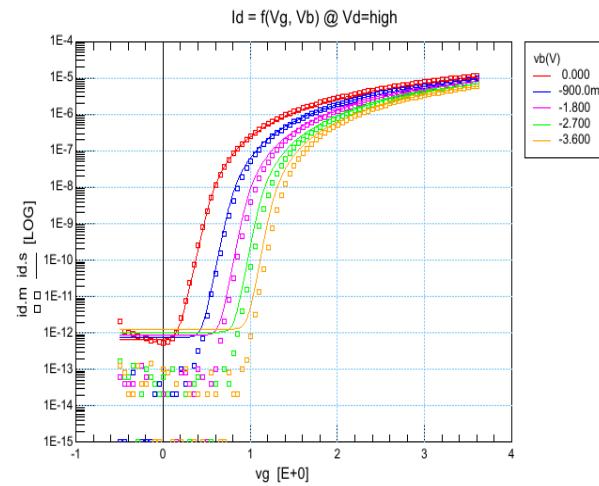
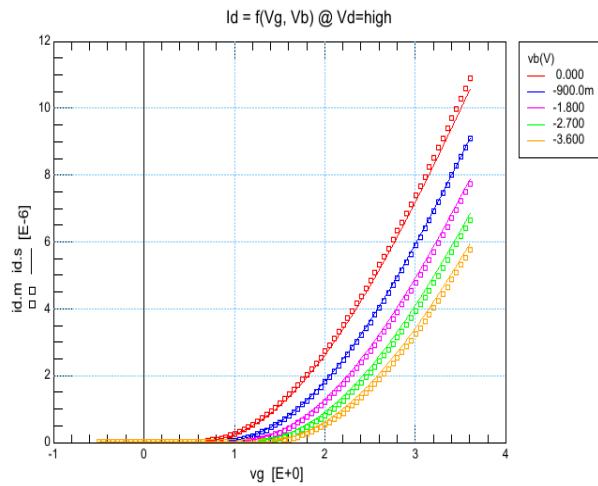


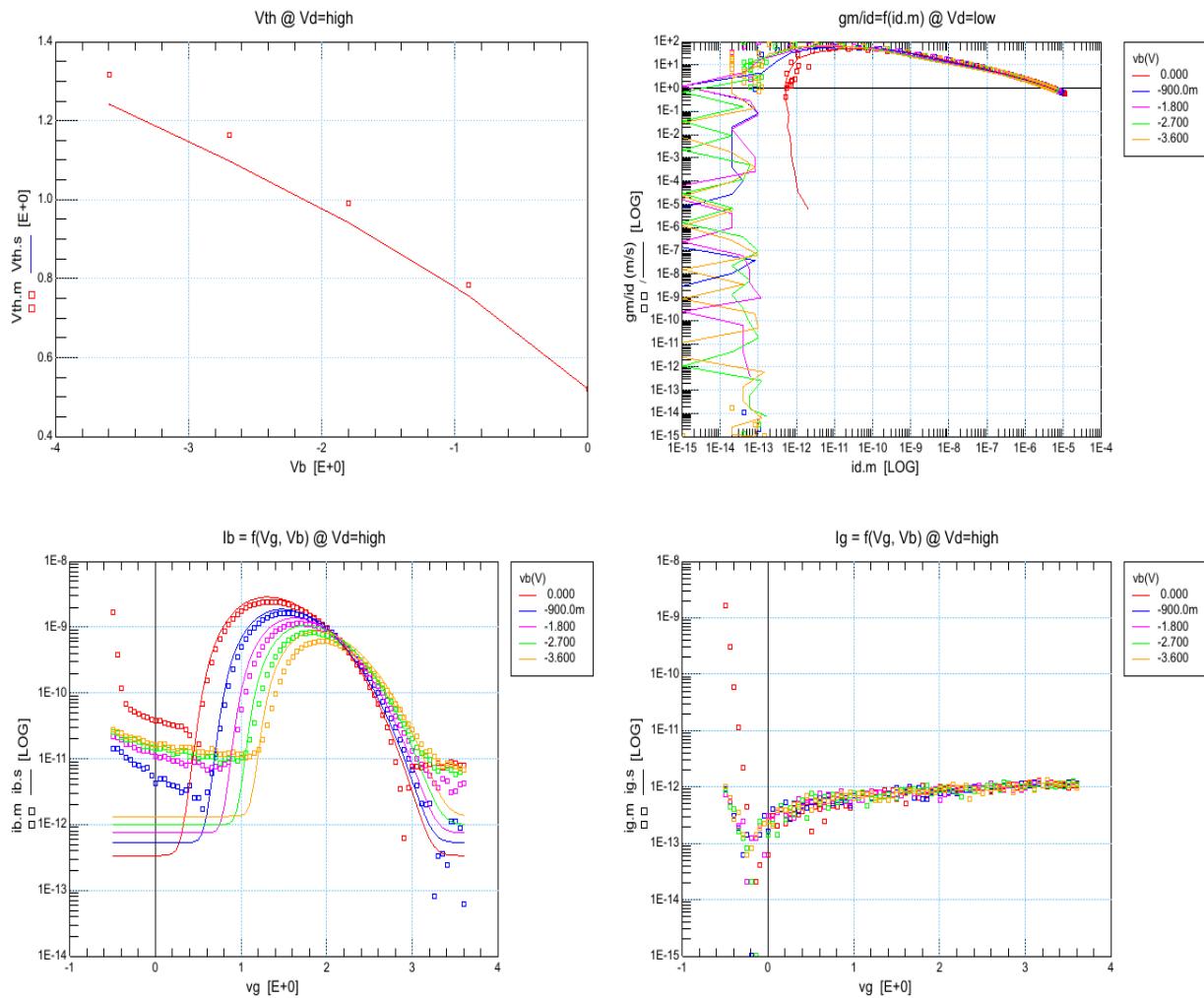
idvg, Vd = 0.1V, T = 70°C



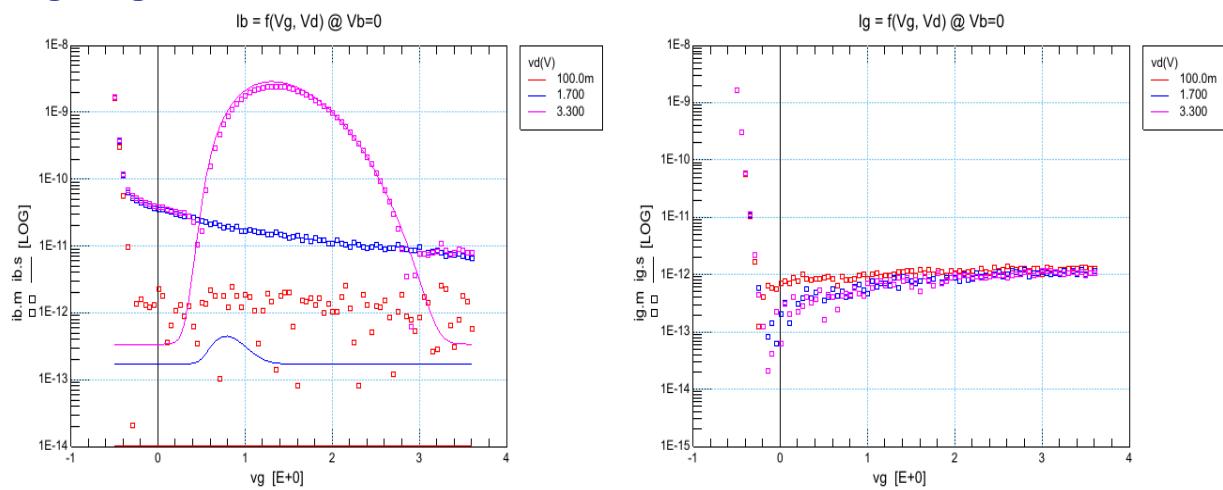


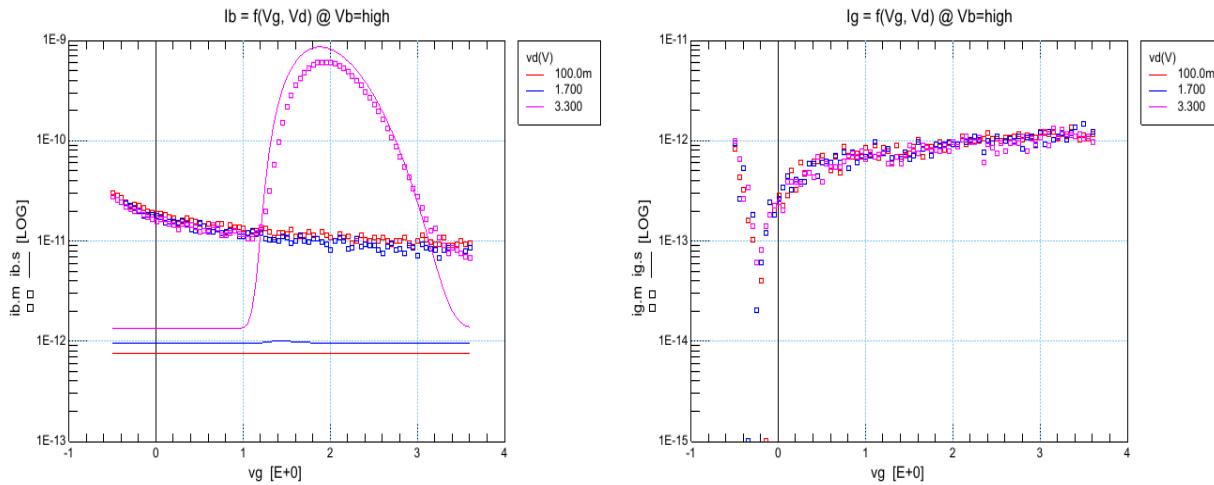
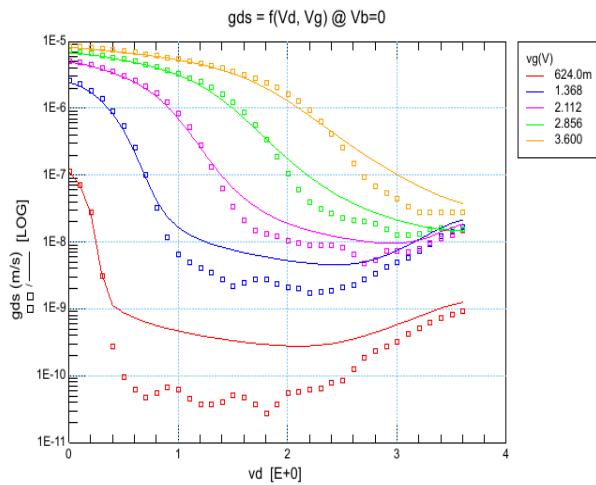
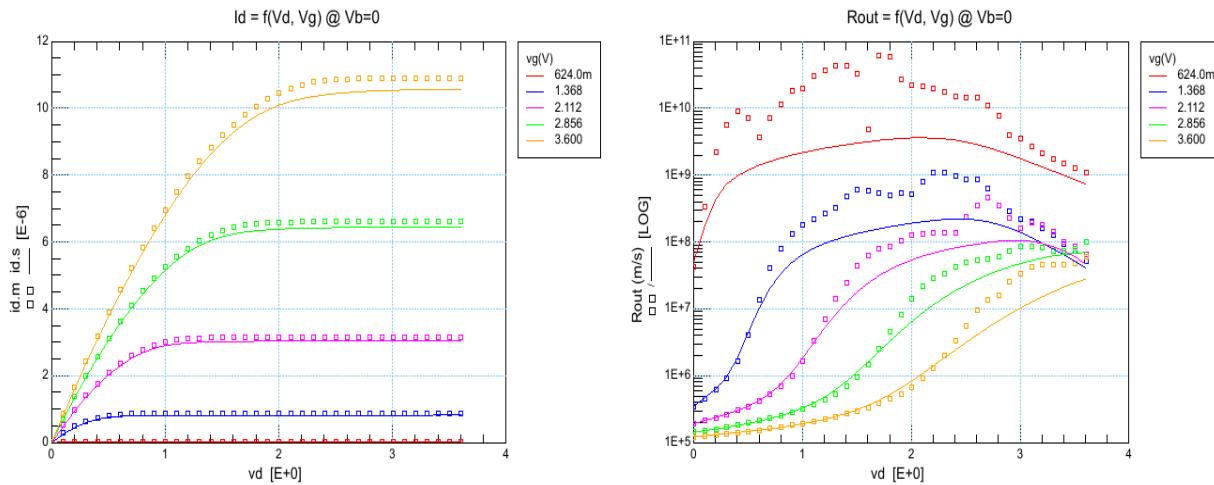
$i_{dvg}, V_d = 3.3V, T = 70^\circ\text{C}$

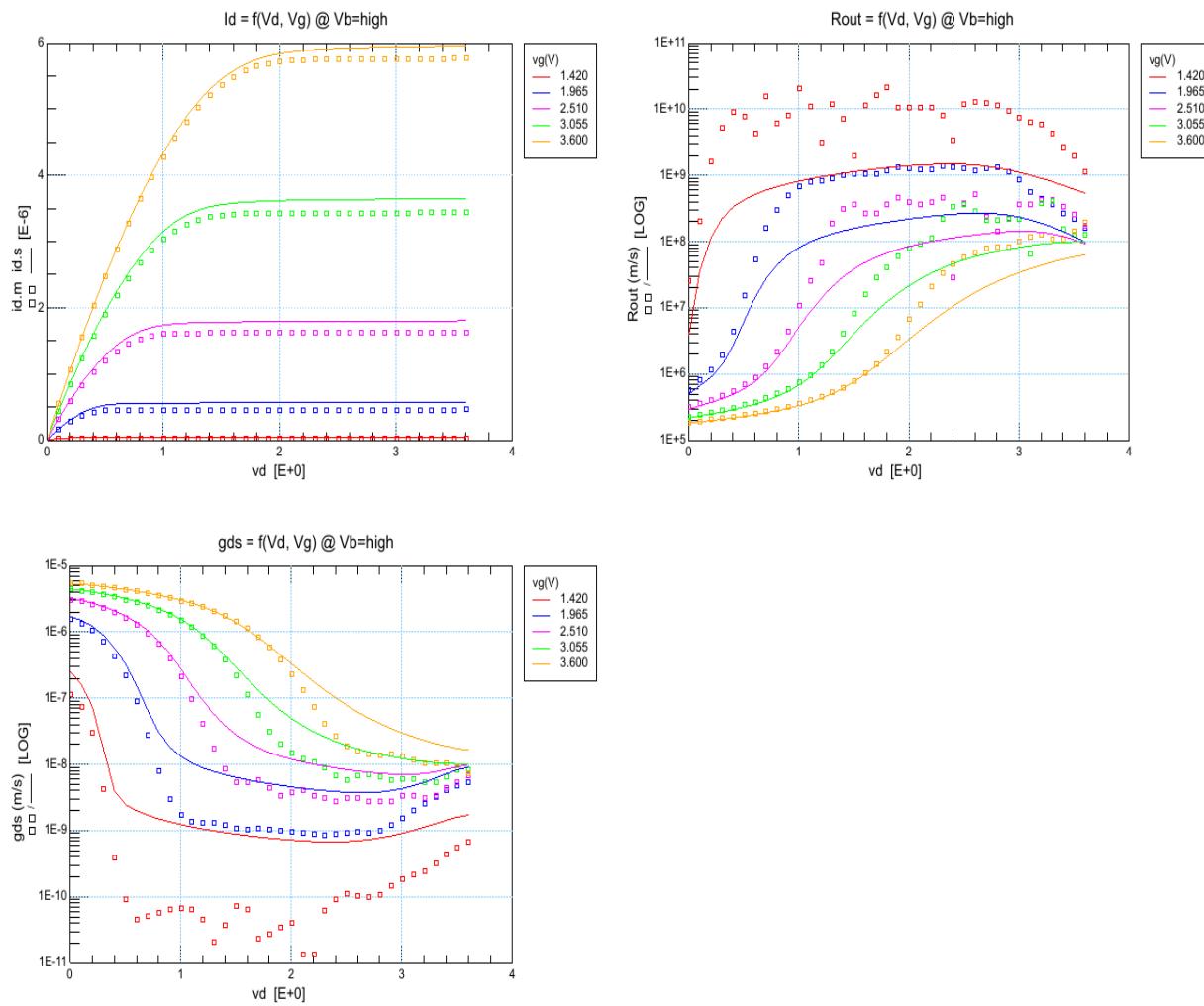
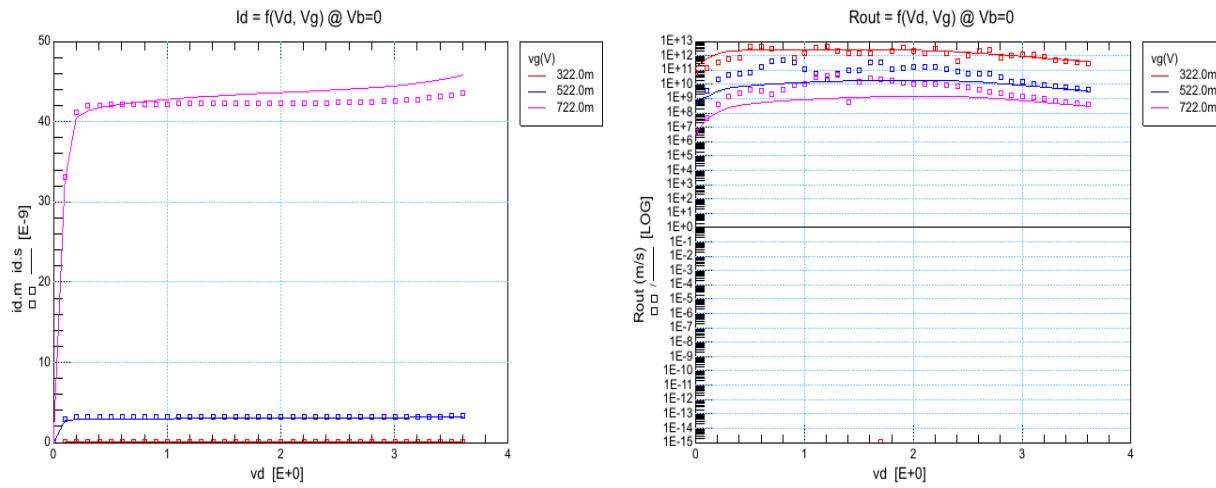


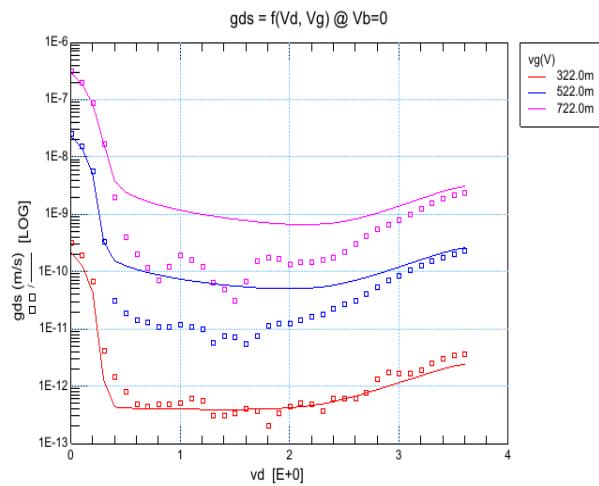


idvg, Ib,Ig, Vb = 0V, T = 70°C

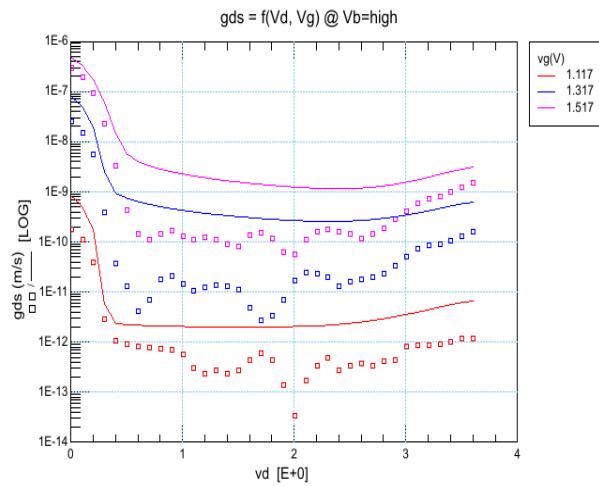
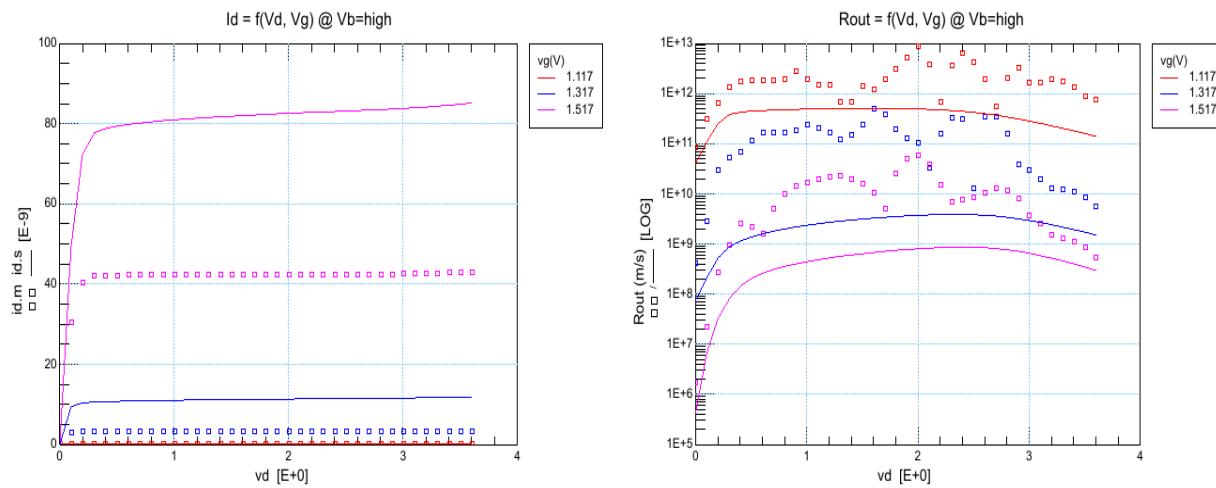


idvg, Ib,Ig, Vb = -3.6V, T = 70°C

idvd, Vb = 0V, T = 70°C


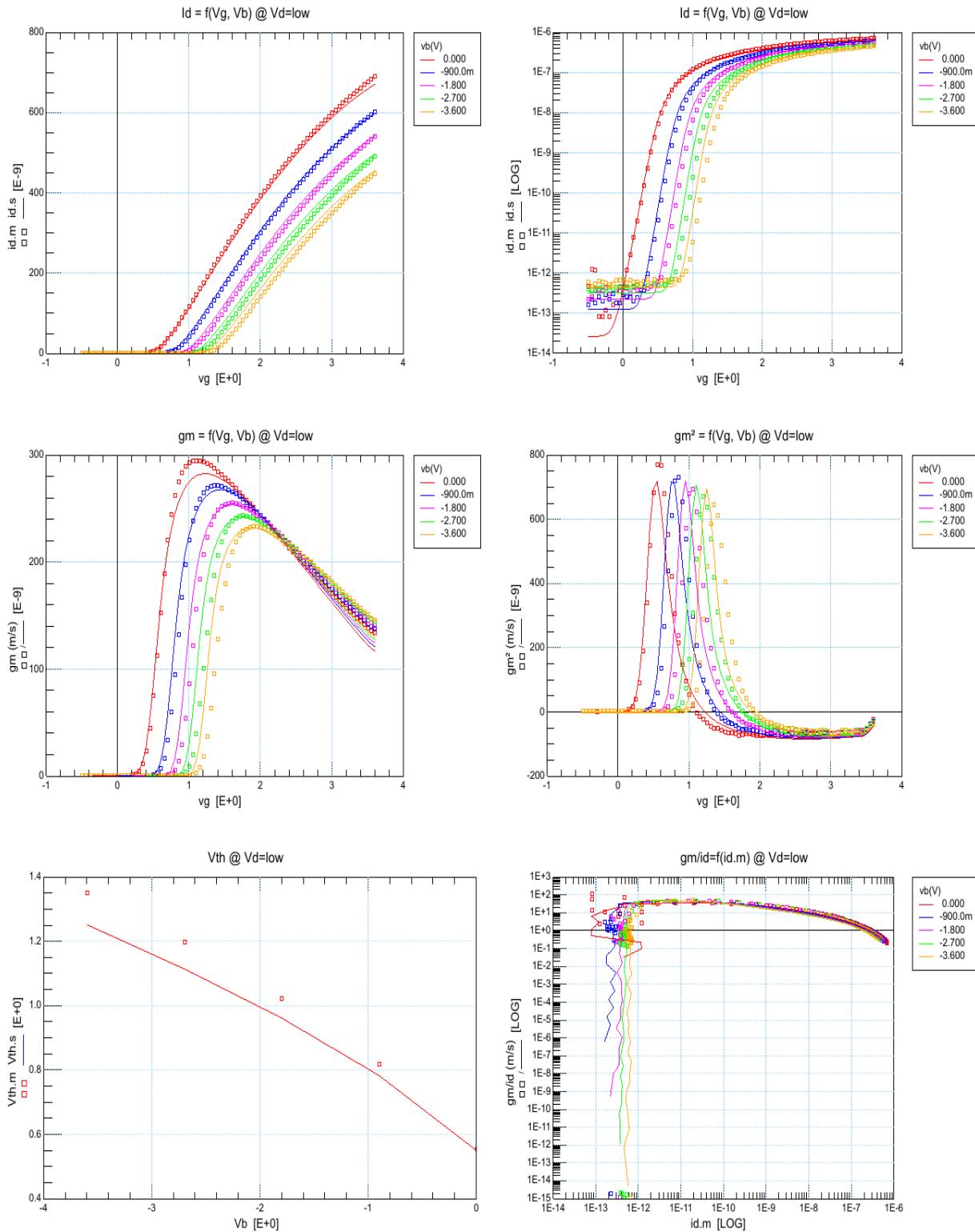
idvd_vbmin, Vb = -3.6V, T = 70°C

idvd_vth, Vb = 0V, T = 70°C


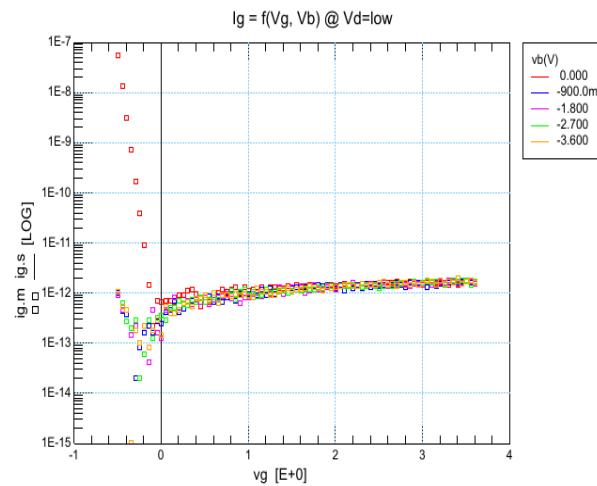
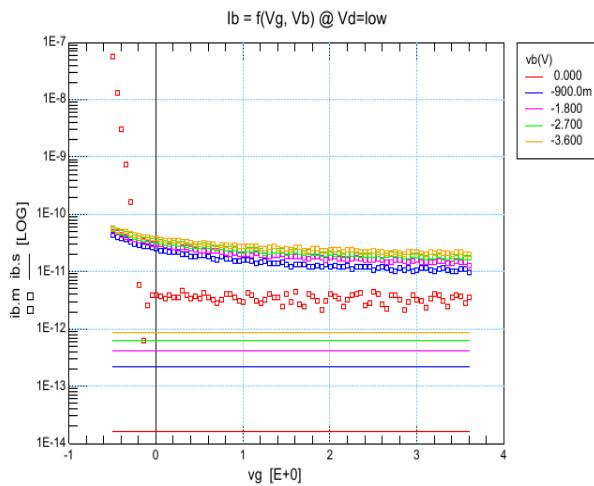


idvd_vth_vbmin, Vb = -3.6V, T = 70°C

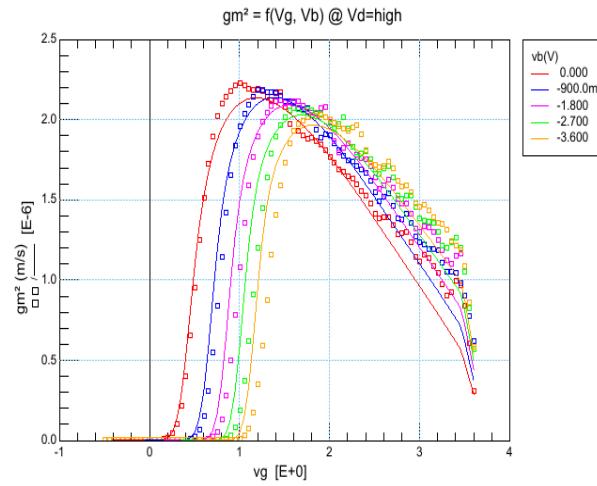
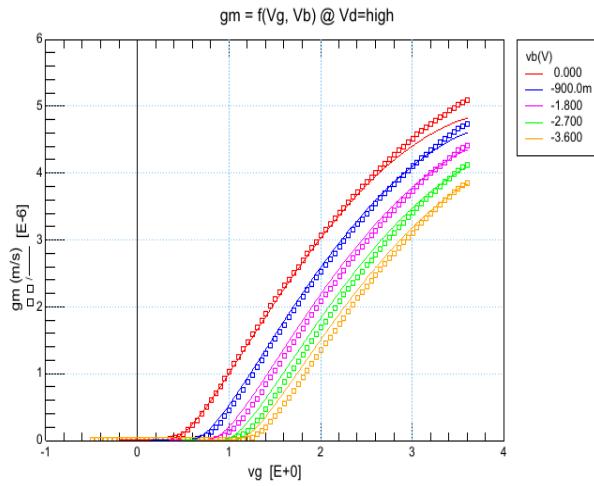
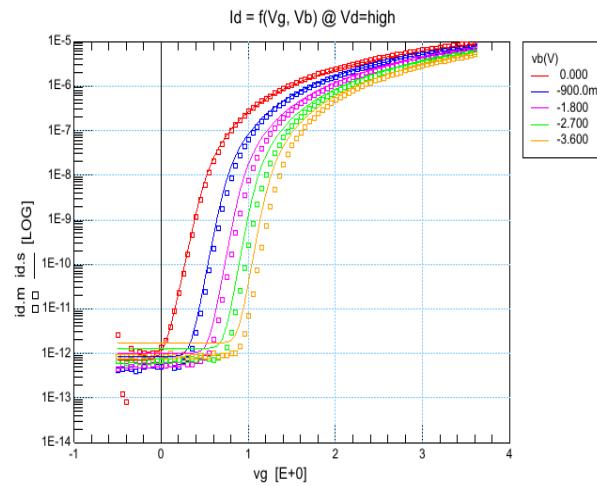
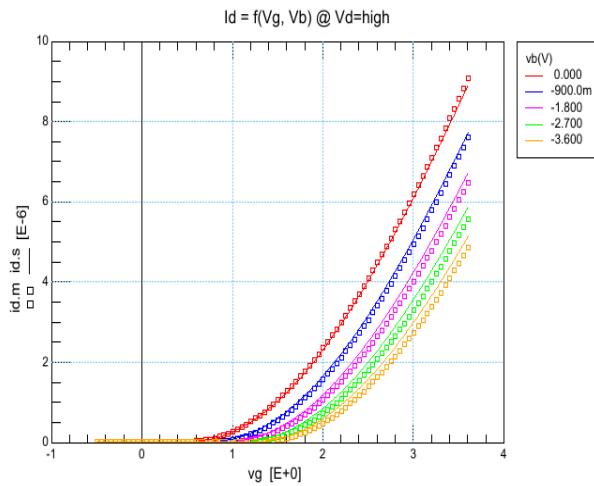


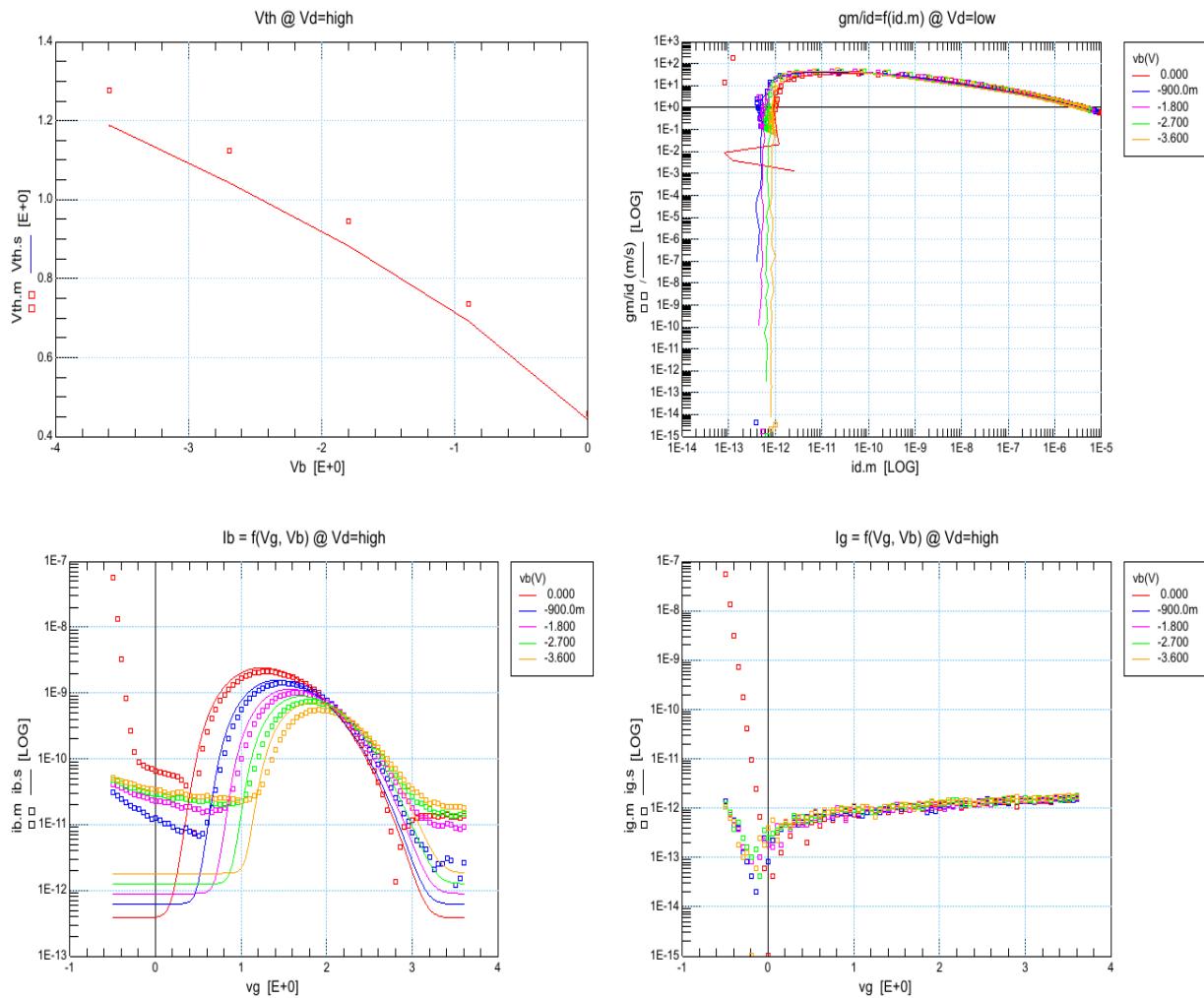
idvg, Vd = 0.1V, T = 125°C



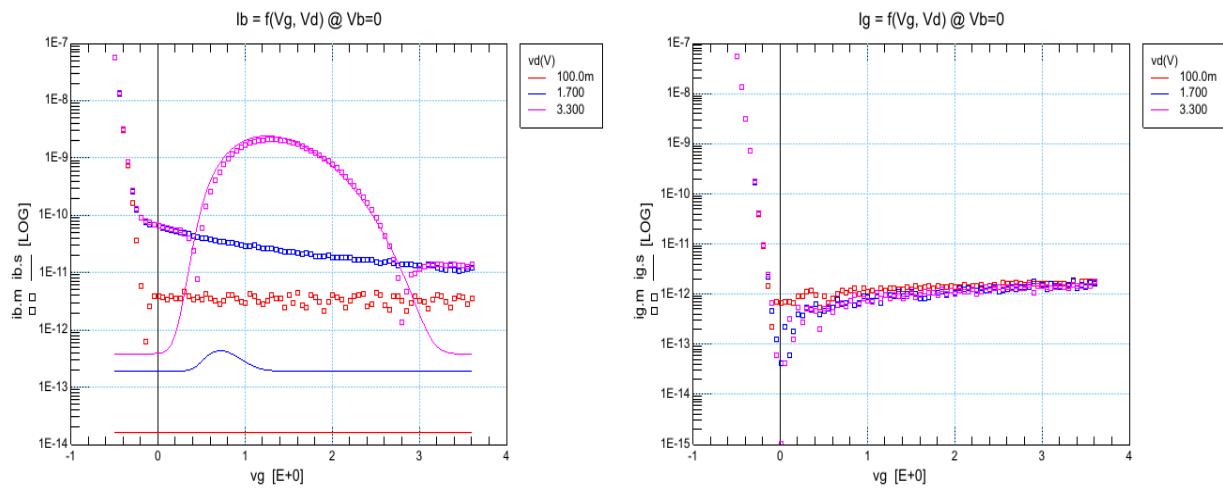


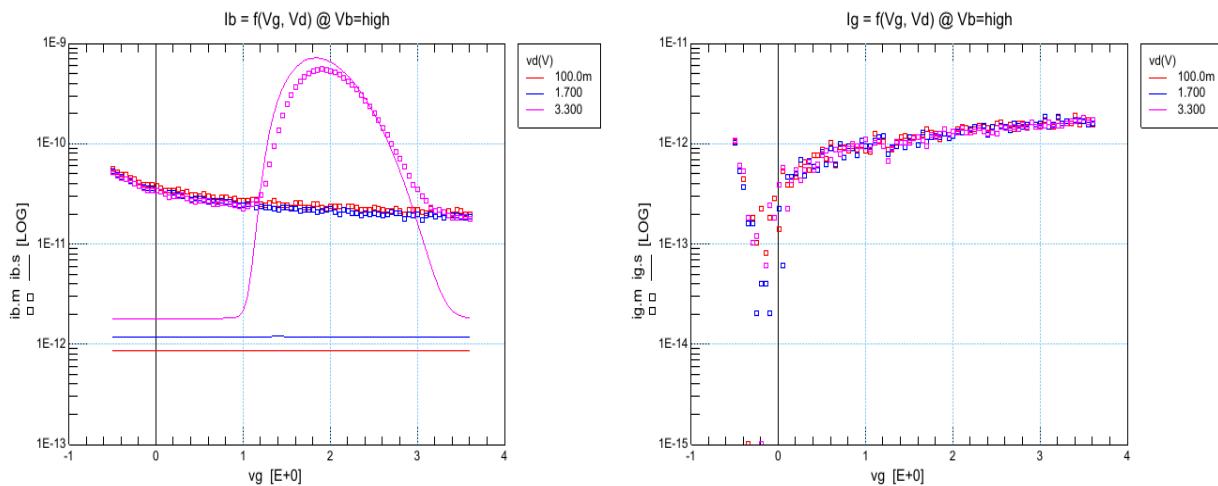
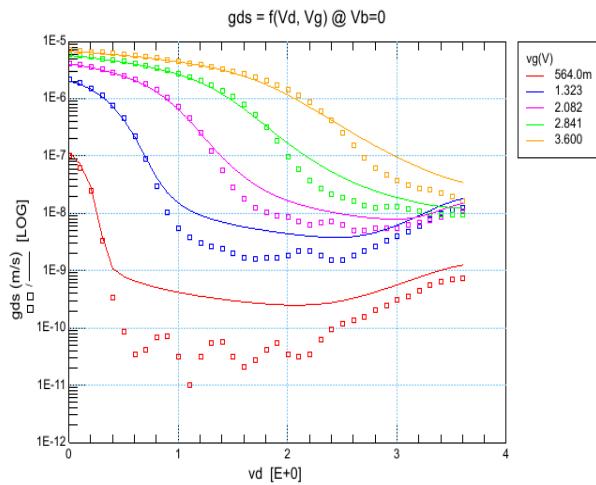
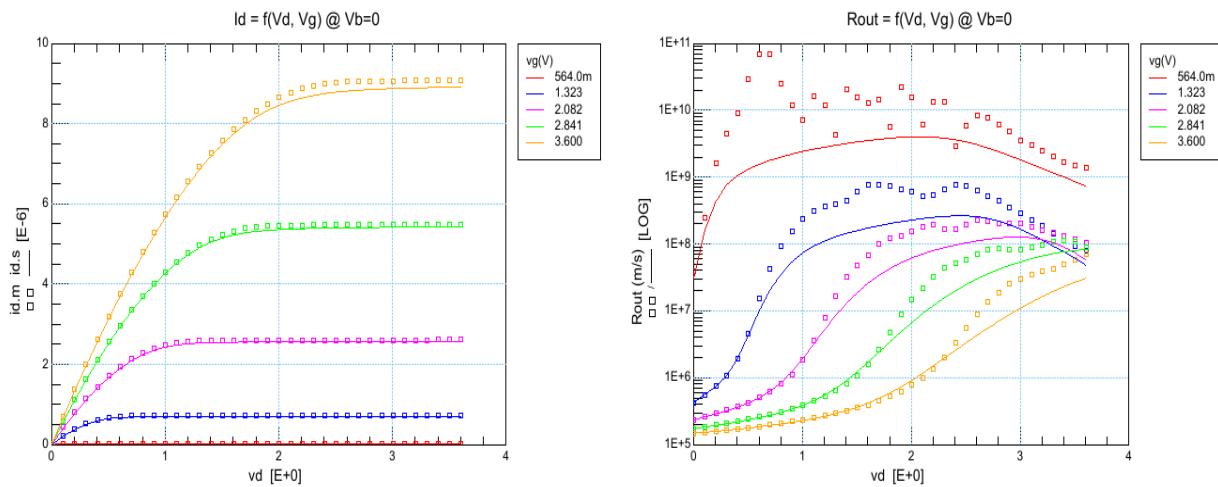
$i_{dvg}, V_d = 3.3V, T = 125^\circ\text{C}$

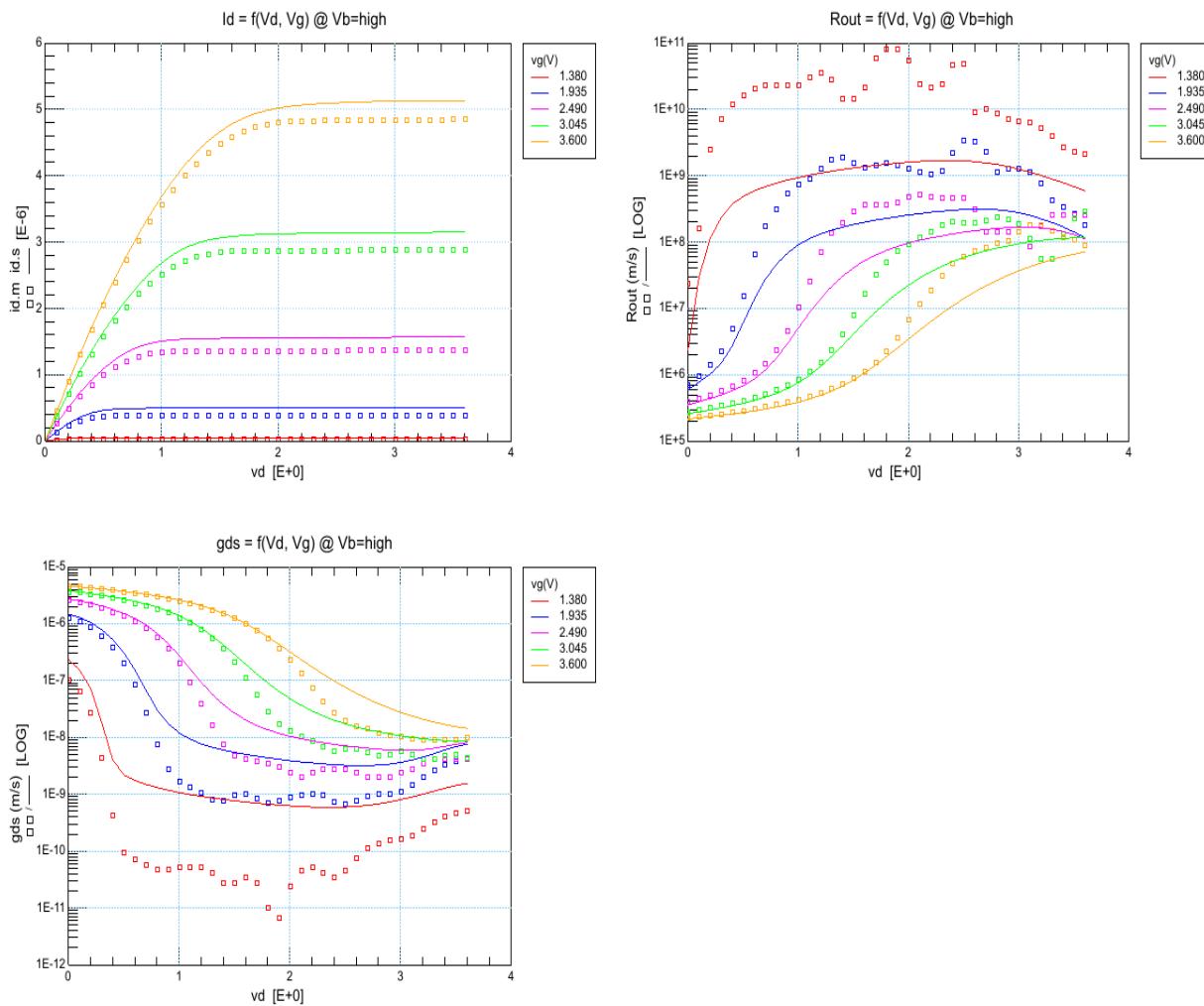
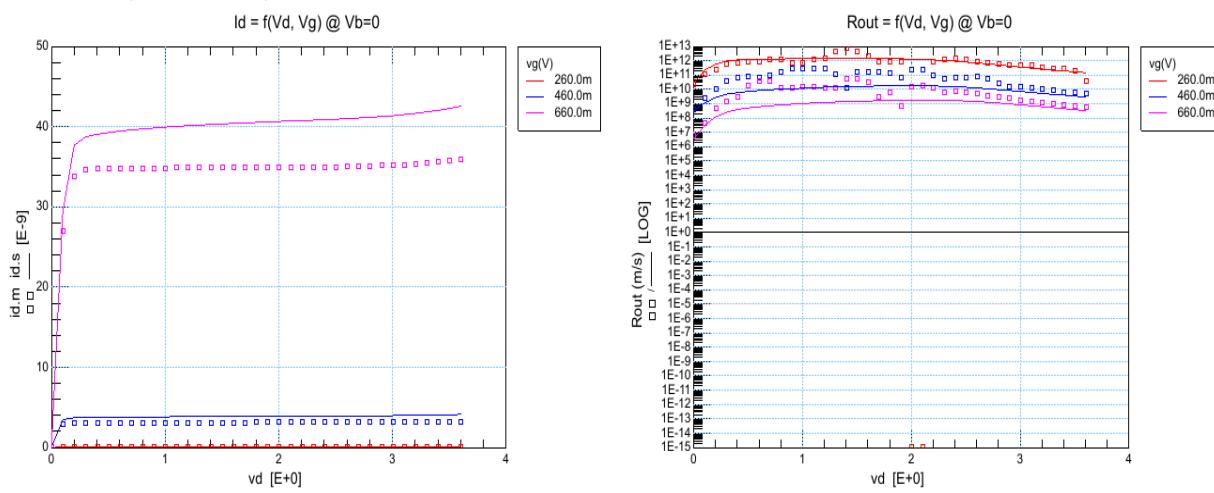


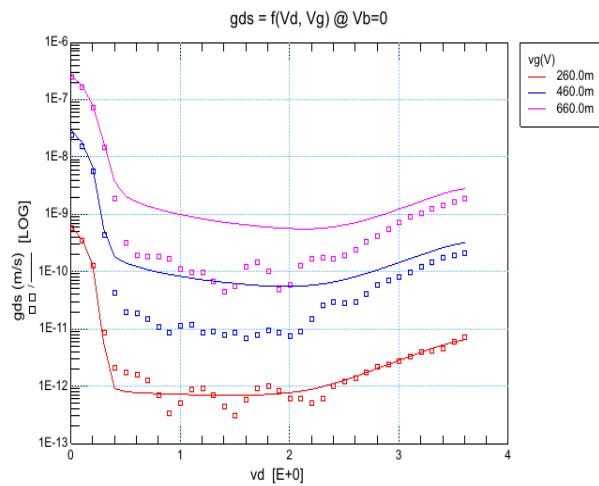


idvg, Ib,Ig, Vb = 0V, T = 125°C

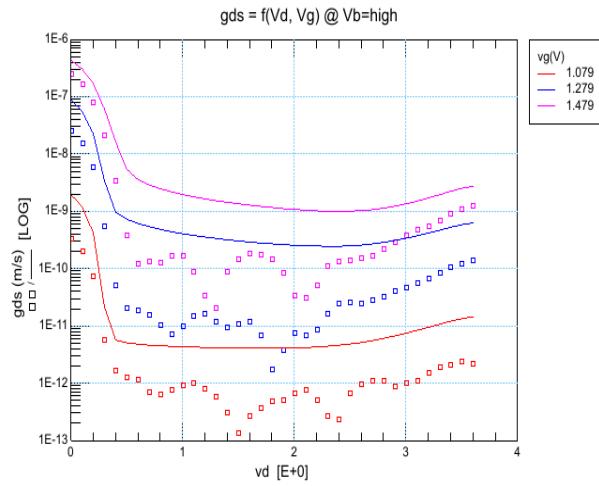
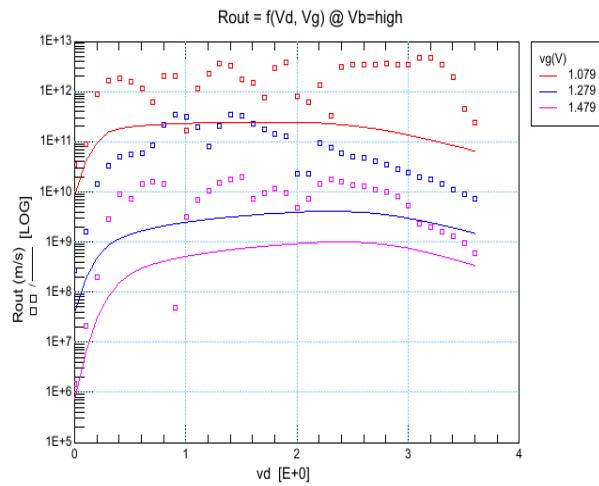
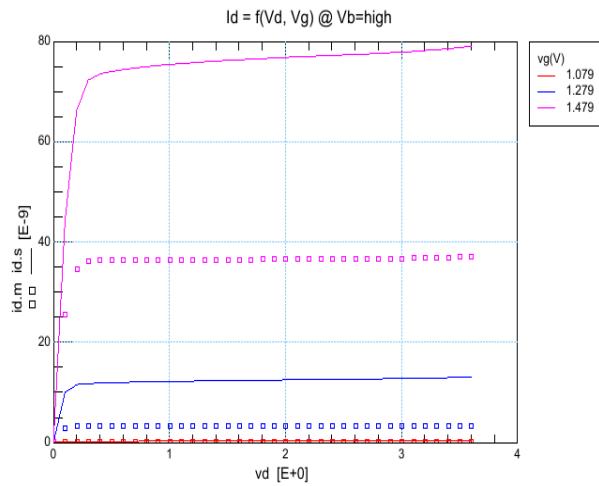


idvg, Ib,Ig, Vb = -3.6V, T = 125°C

idvd, Vb = 0V, T = 125°C


idvd_vbmin, Vb = -3.6V, T = 125°C

idvd_vth, Vb = 0V, T = 125°C


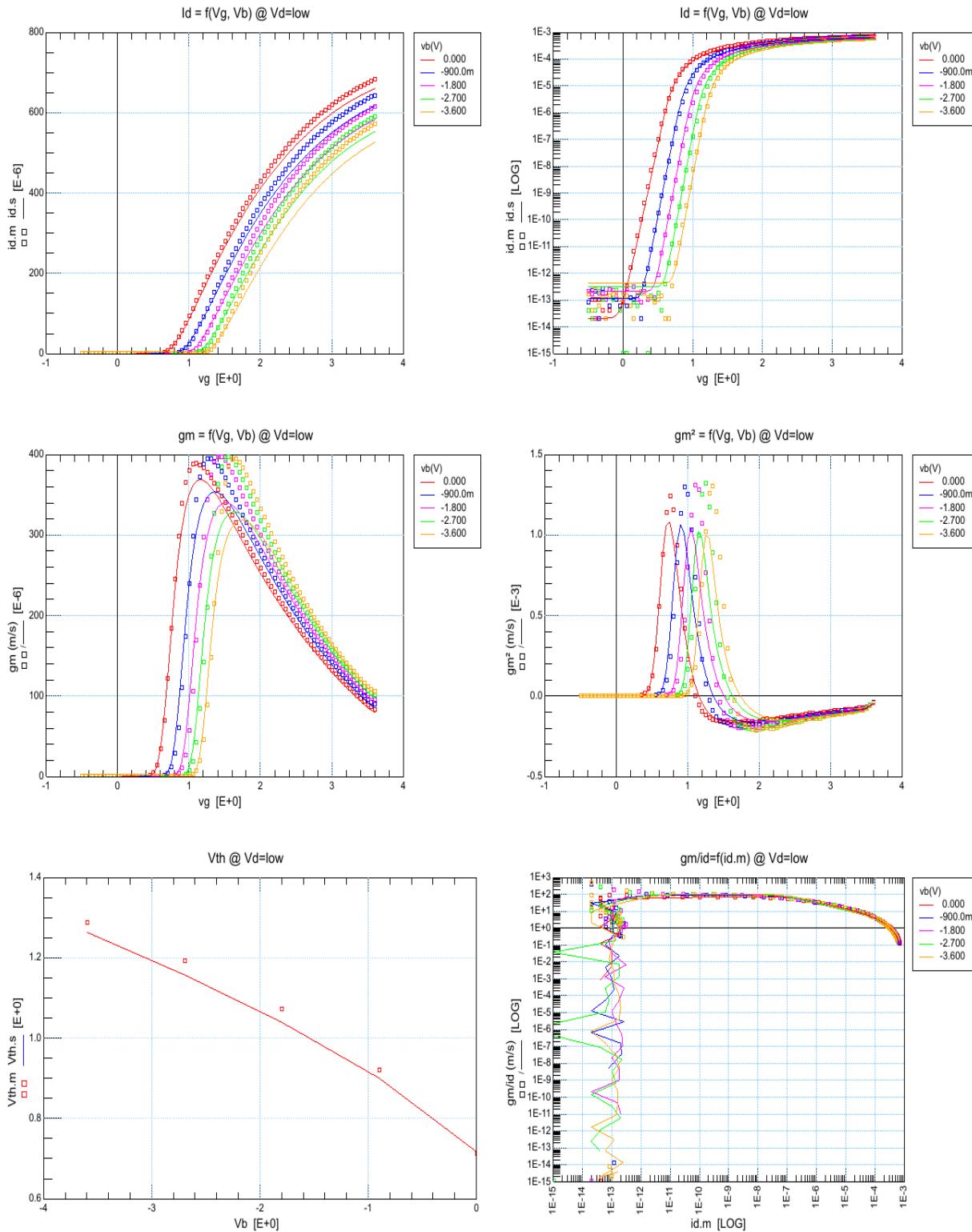


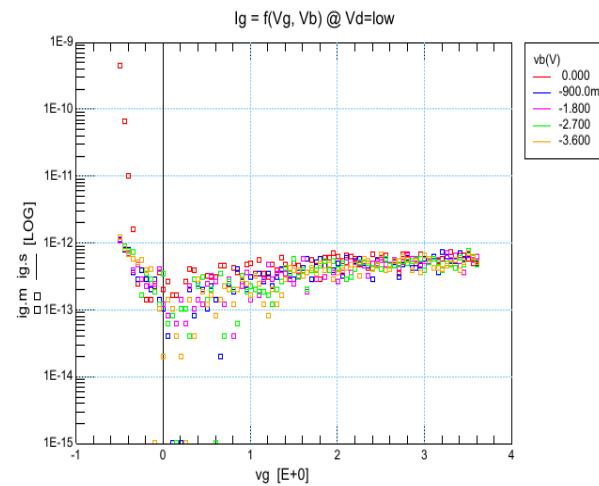
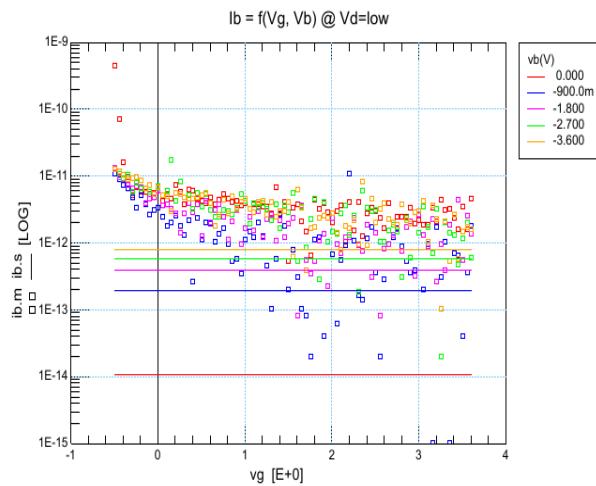
idvd_vth_vbmin, Vb = -3.6V, T = 125°C



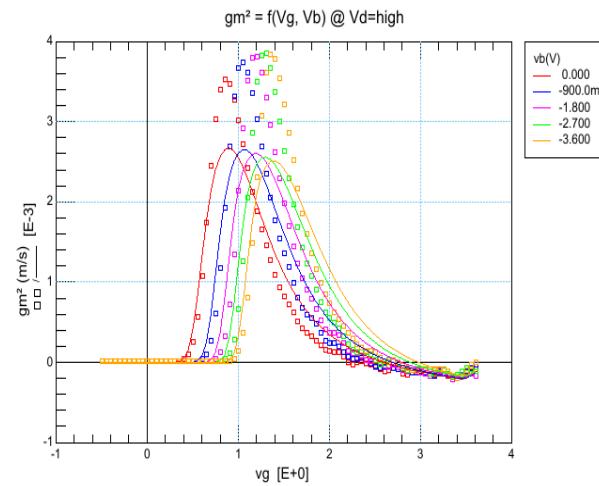
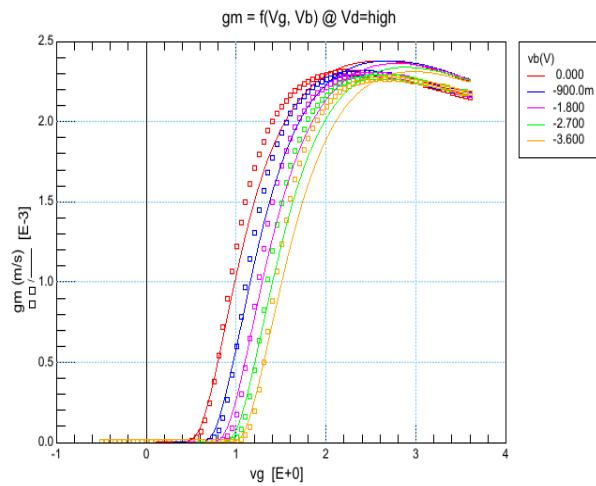
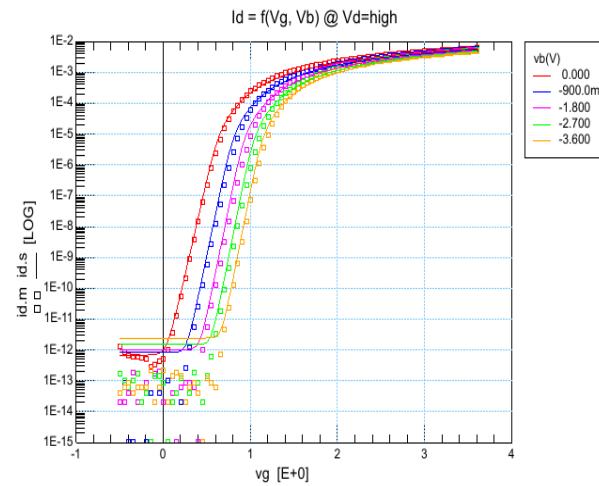
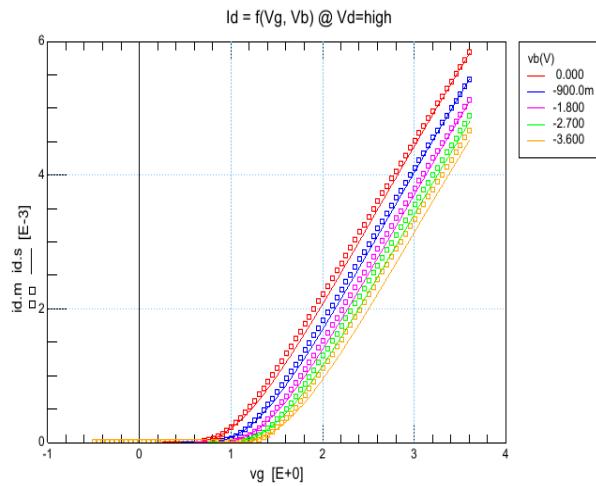
4.4 W10u0_L0u5_S387_5

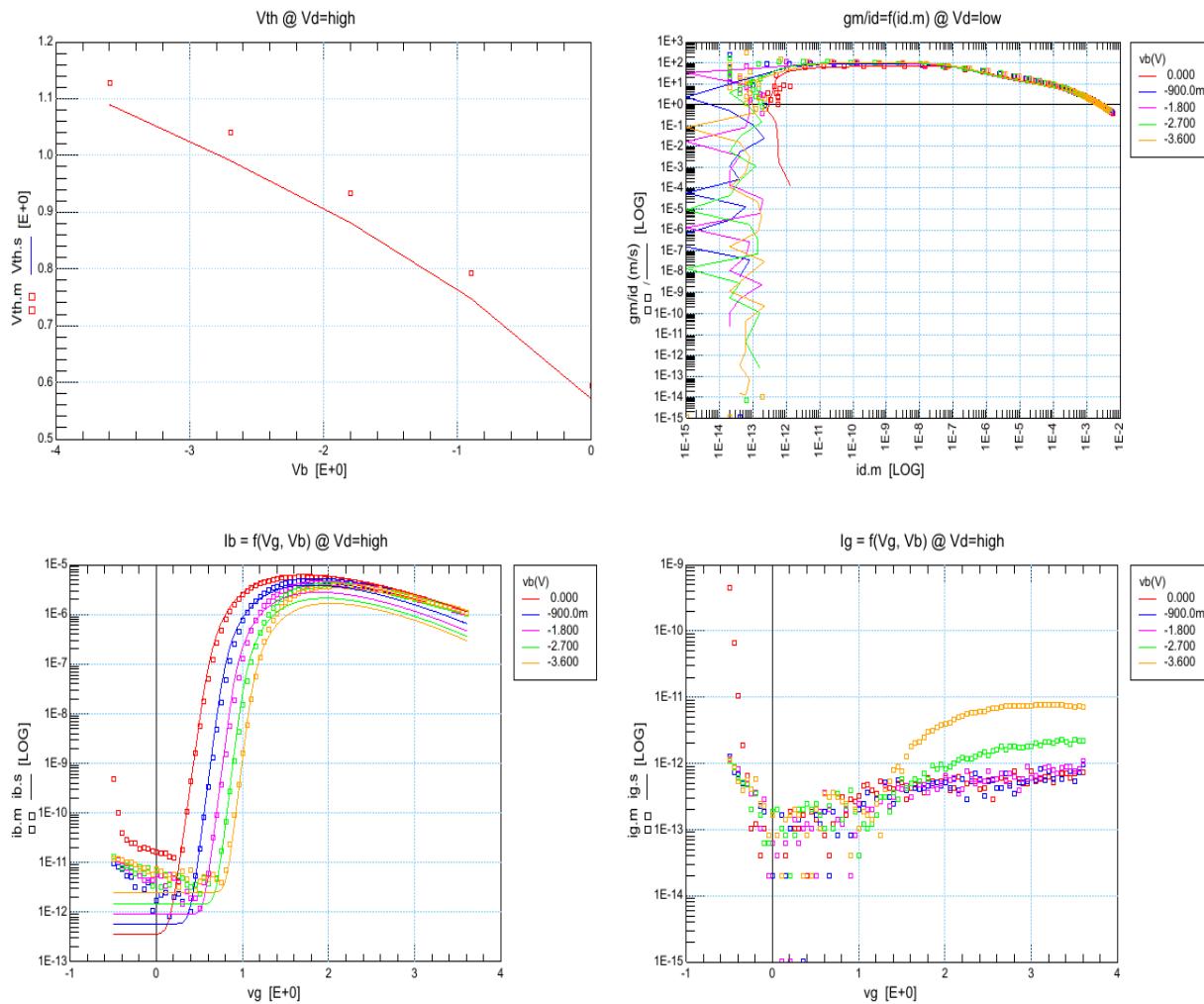
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



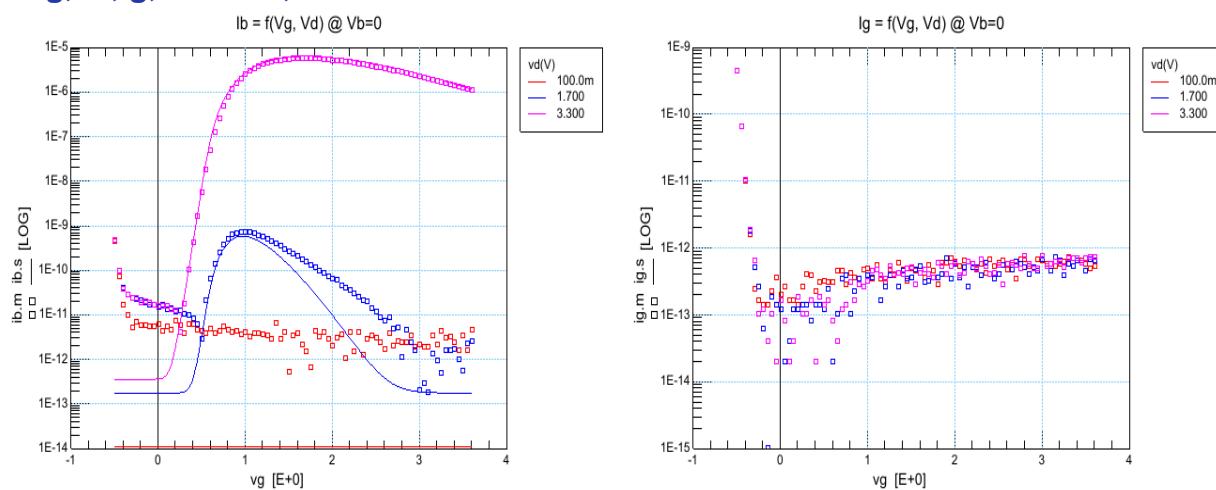


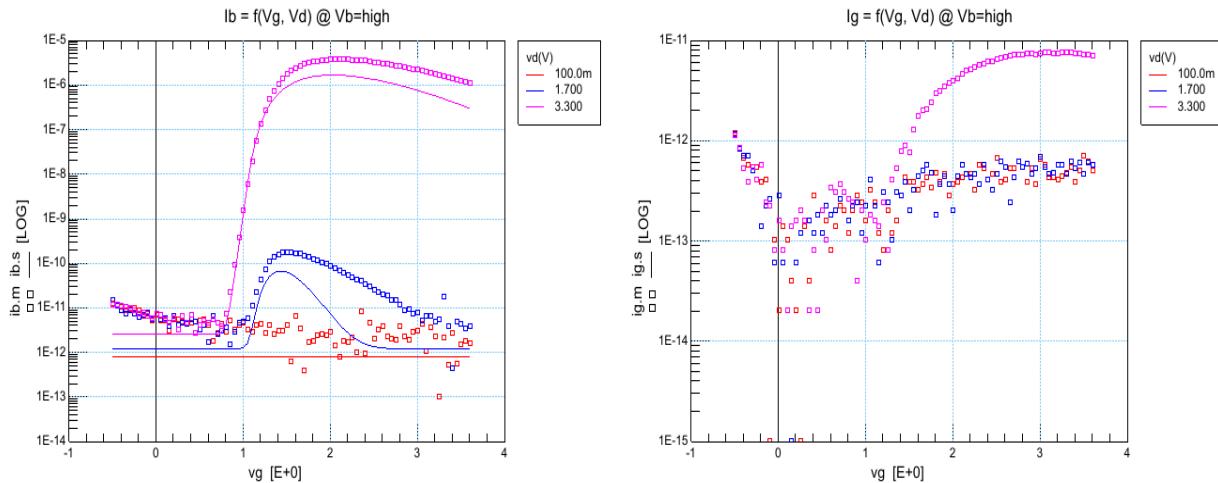
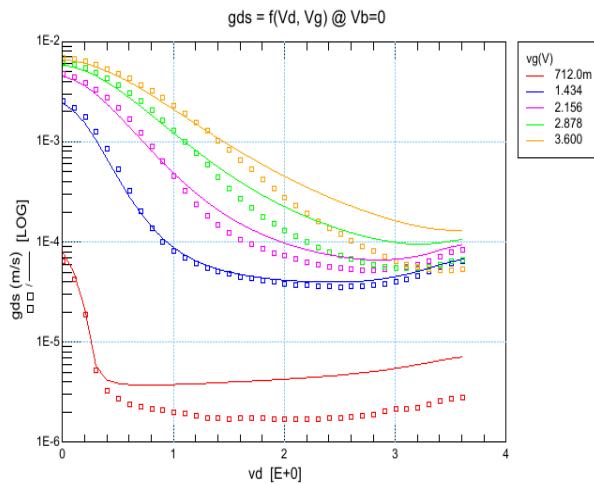
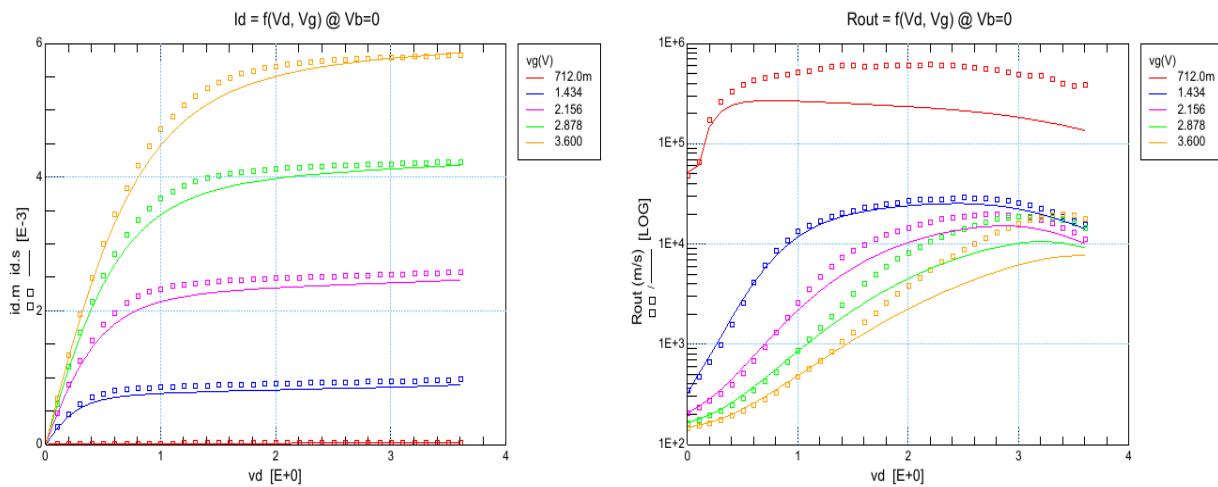
$i_{dvg}, V_d = 3.3V, T = 27^\circ\text{C}$

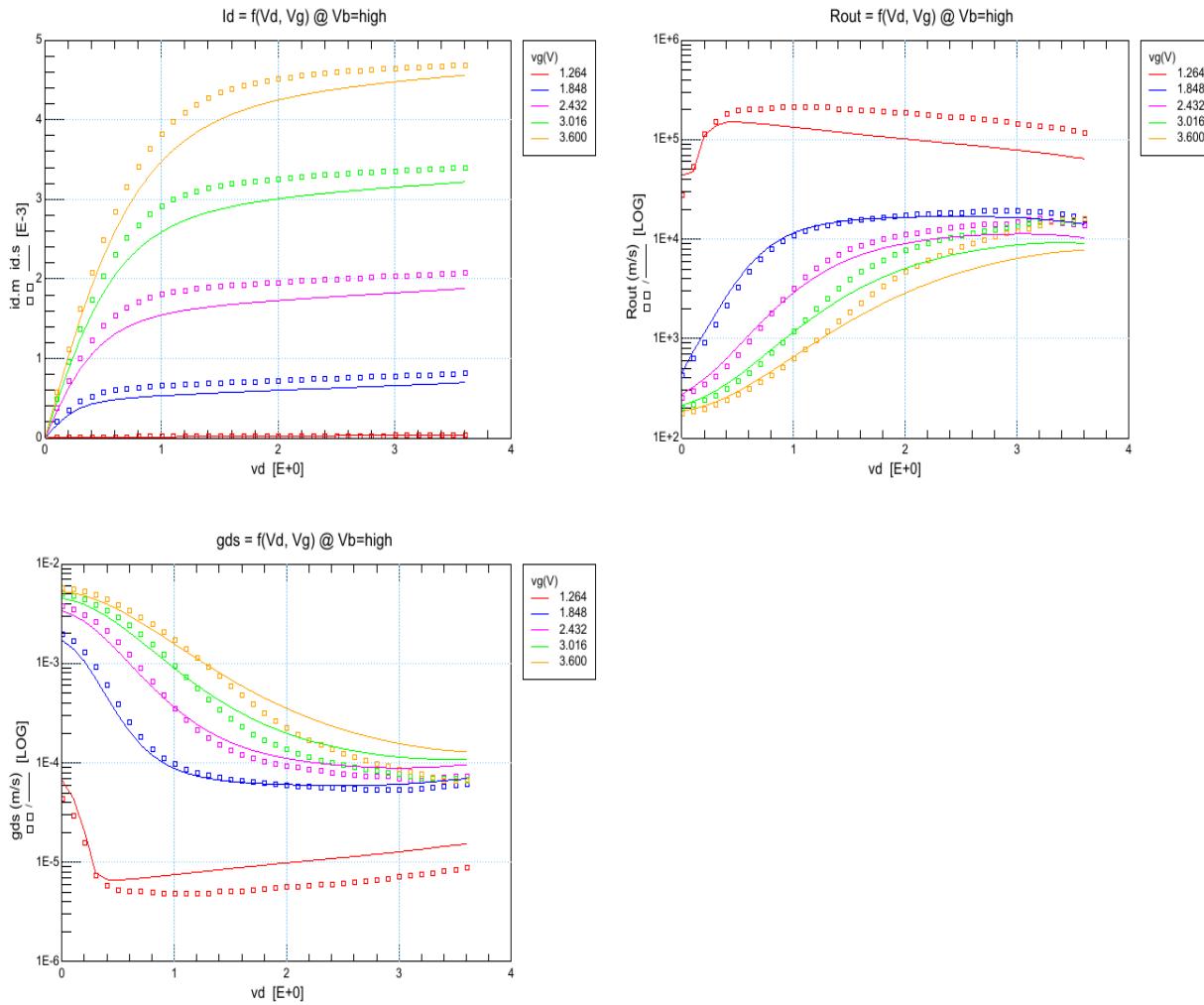
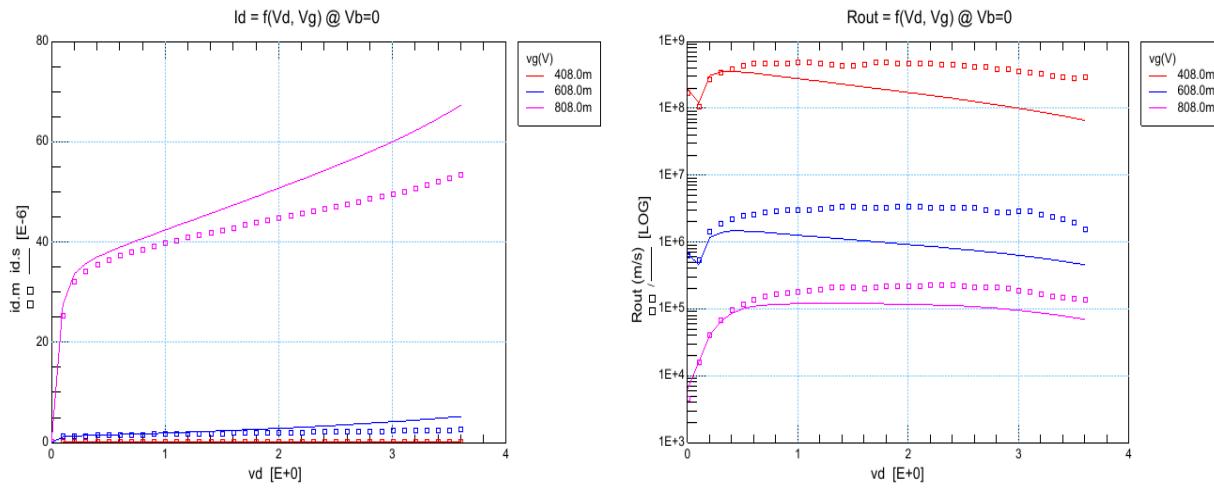


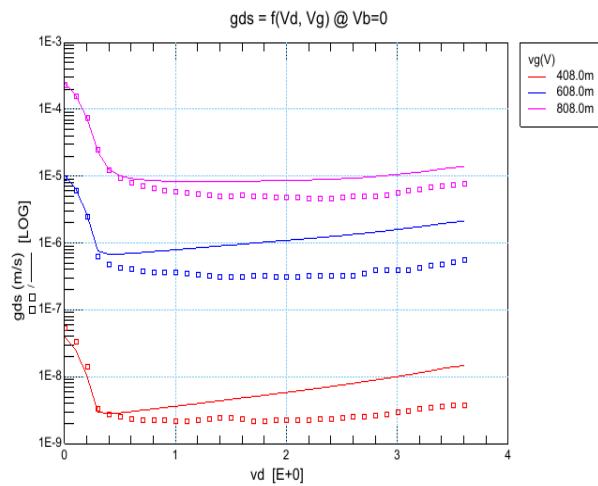


idvg, Ib, Ig, Vb = 0V, T = 27°C

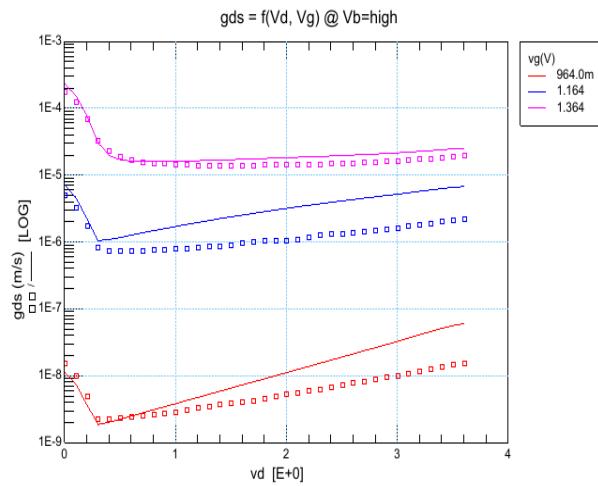
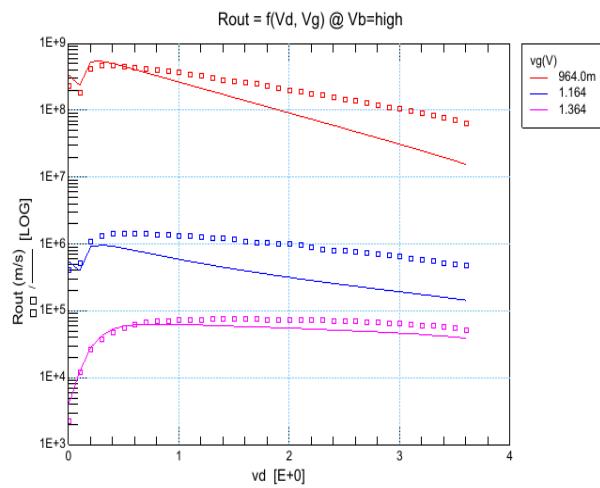
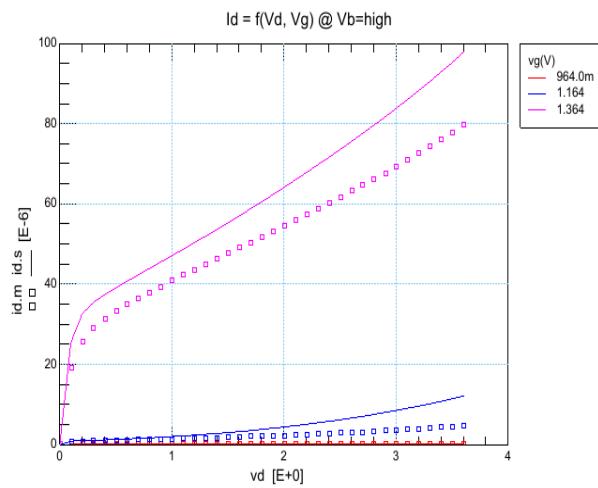


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


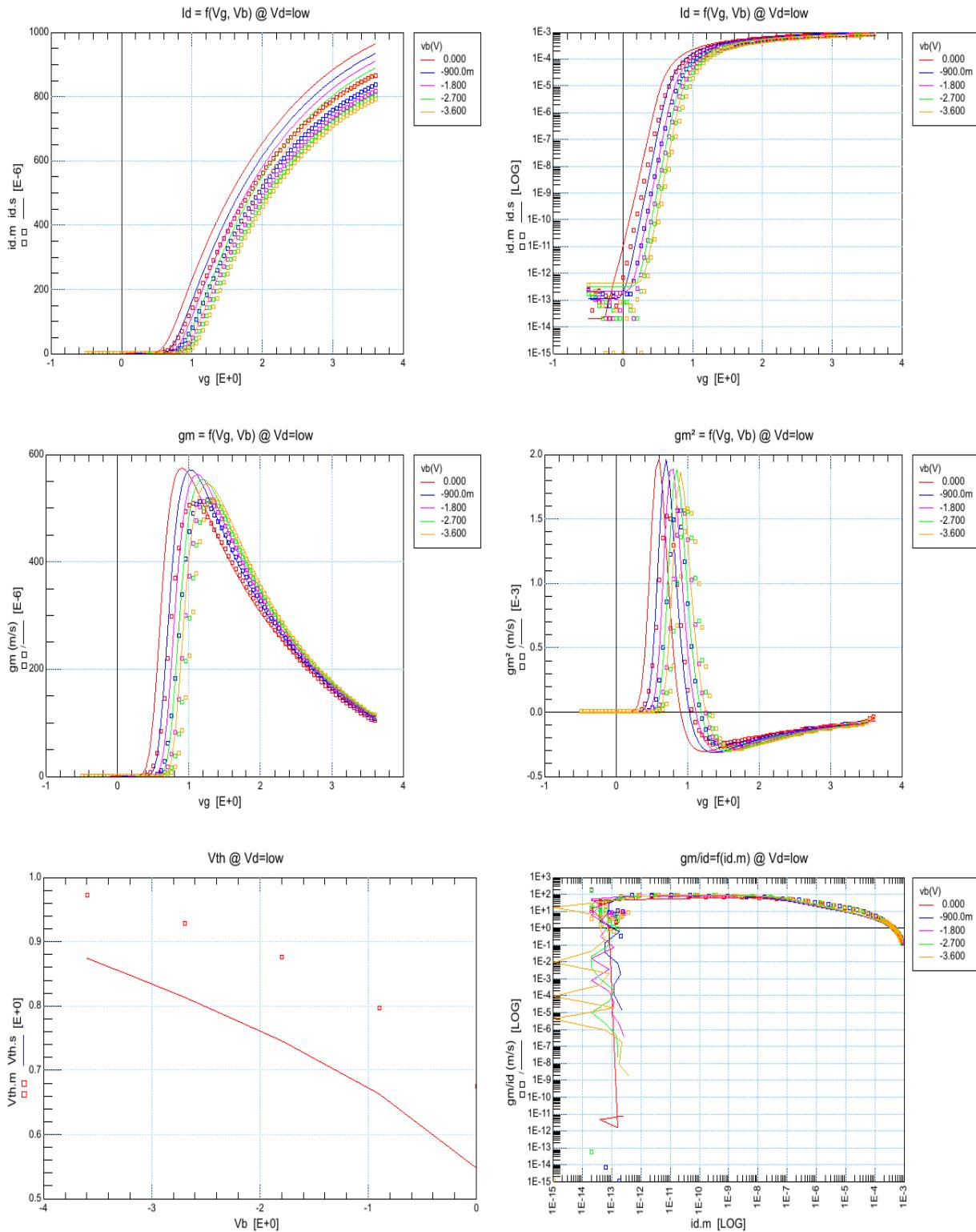


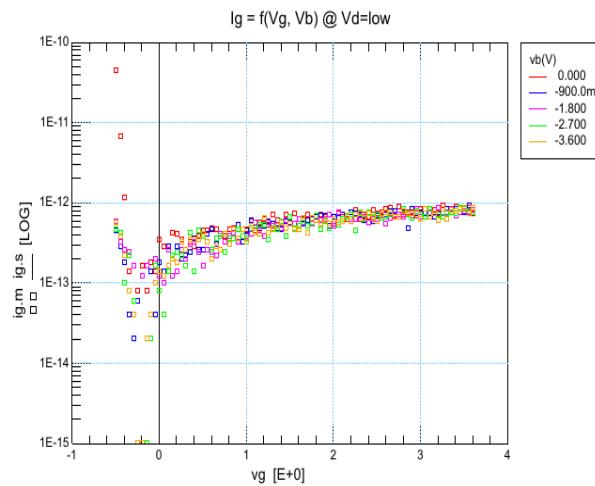
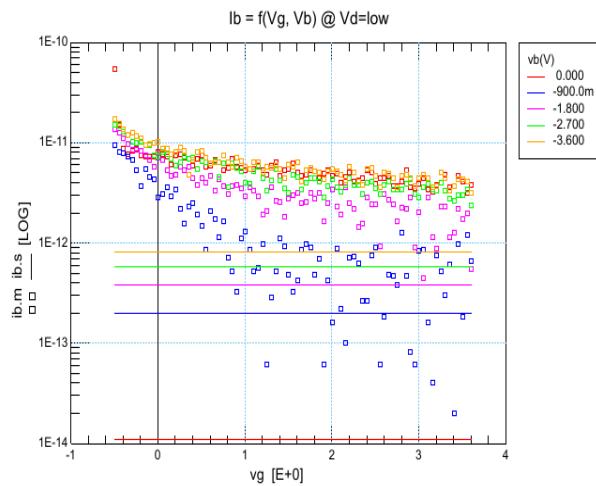
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



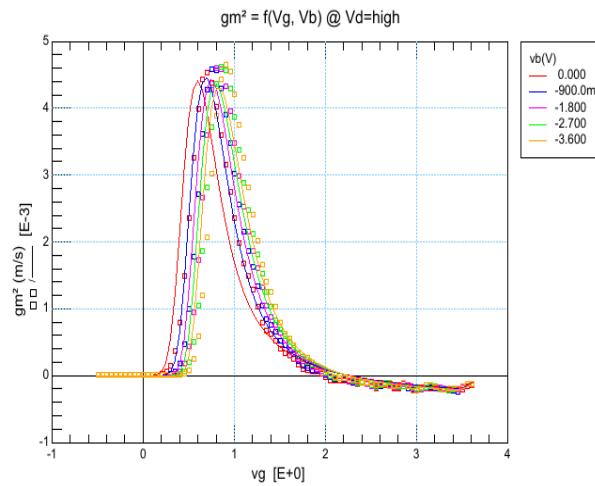
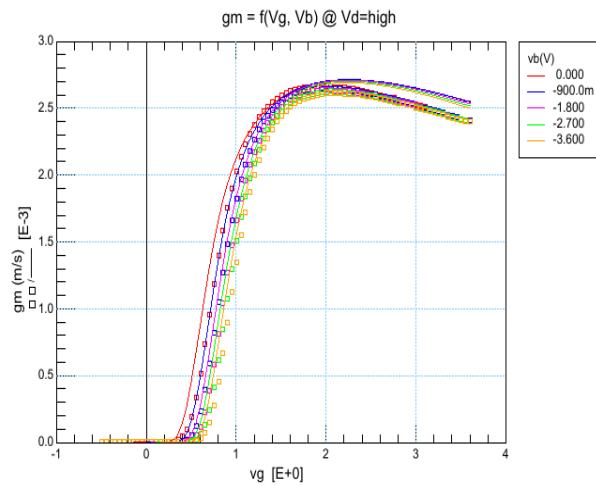
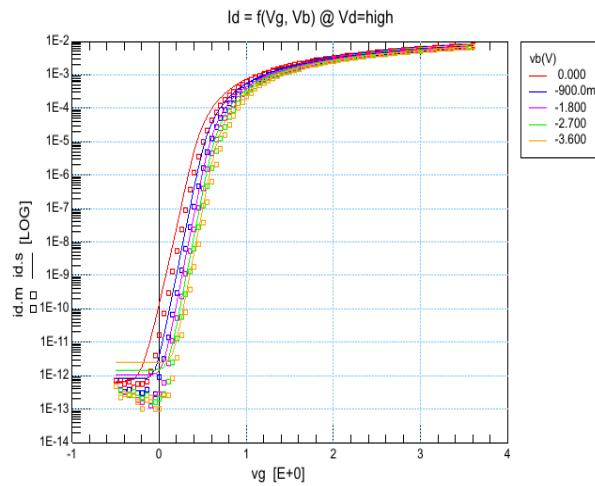
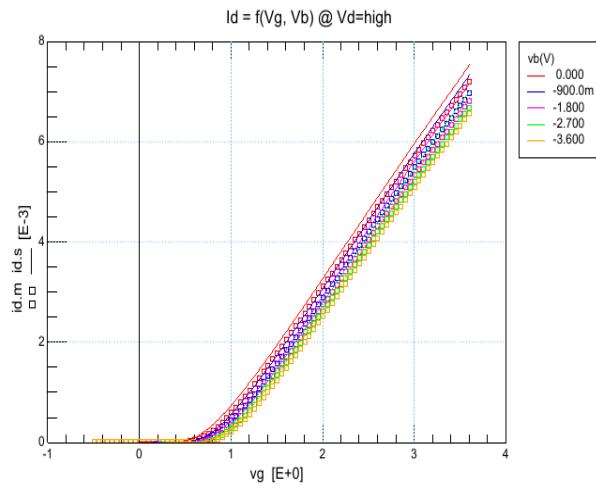
4.5 W10u0_L0u35_S556_3

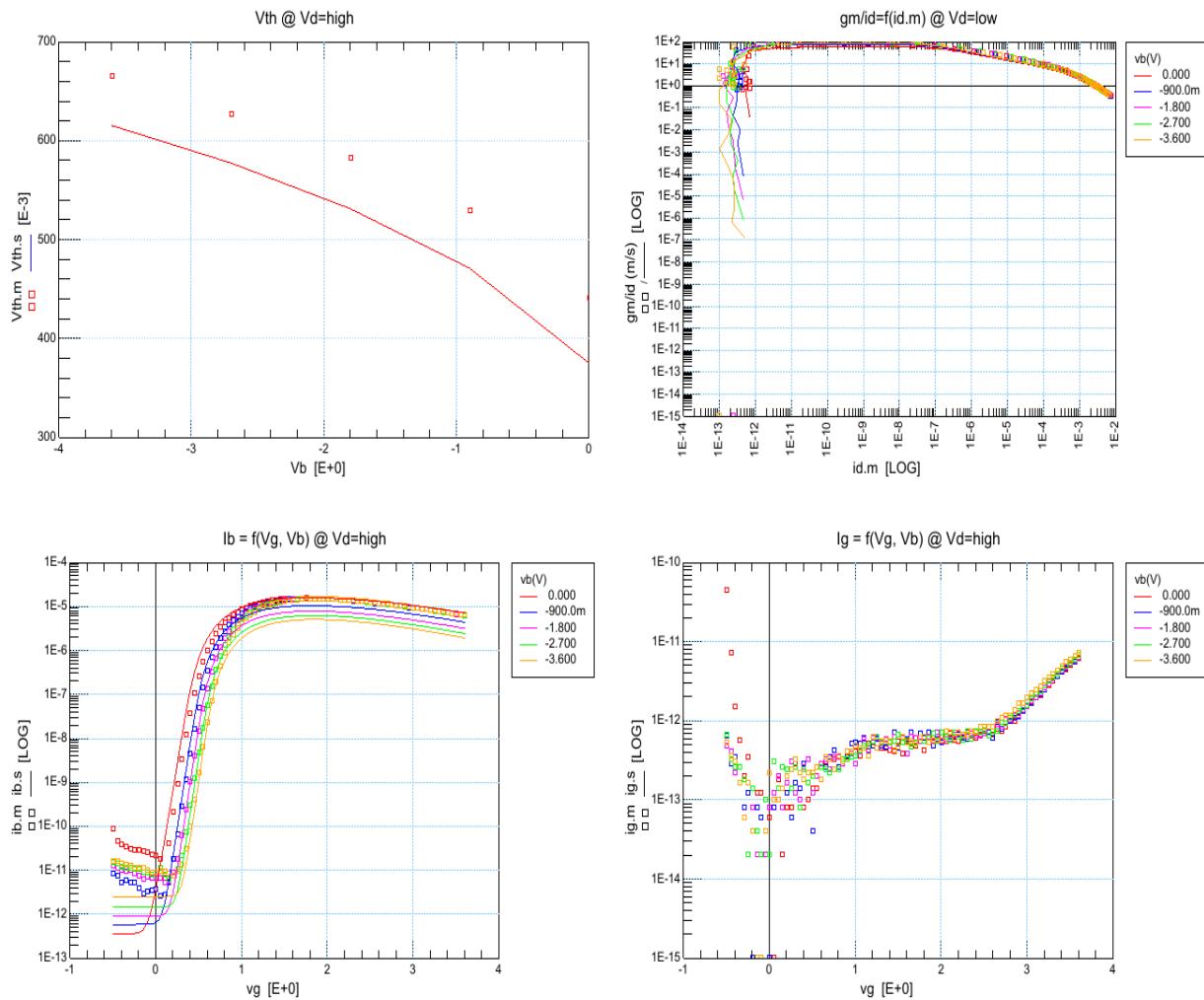
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



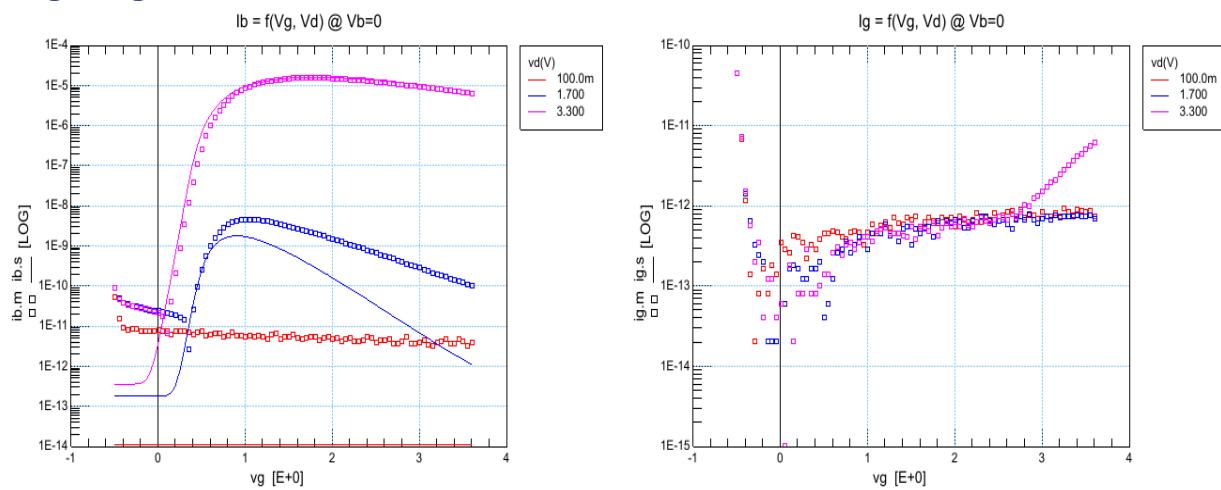


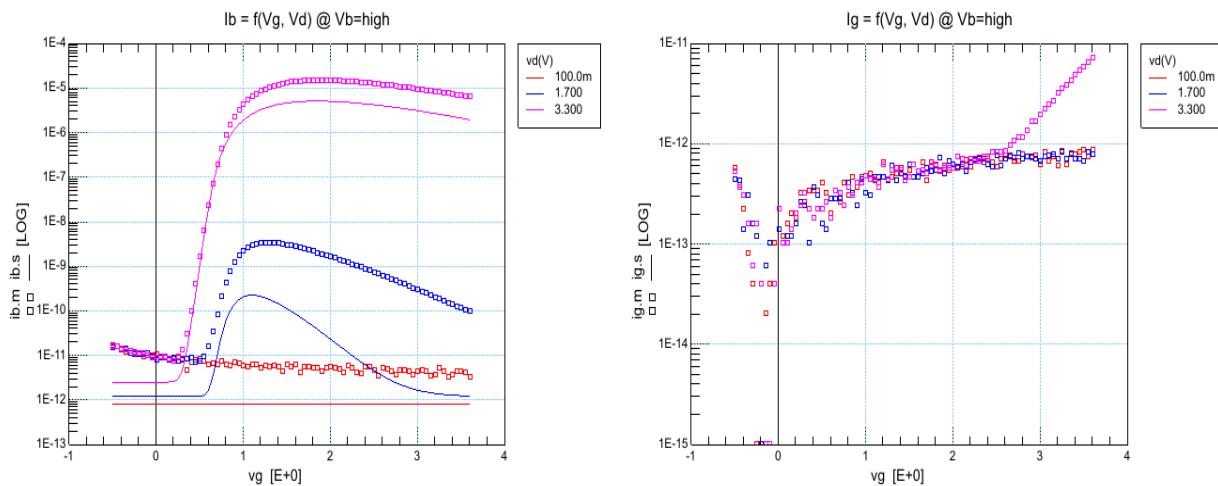
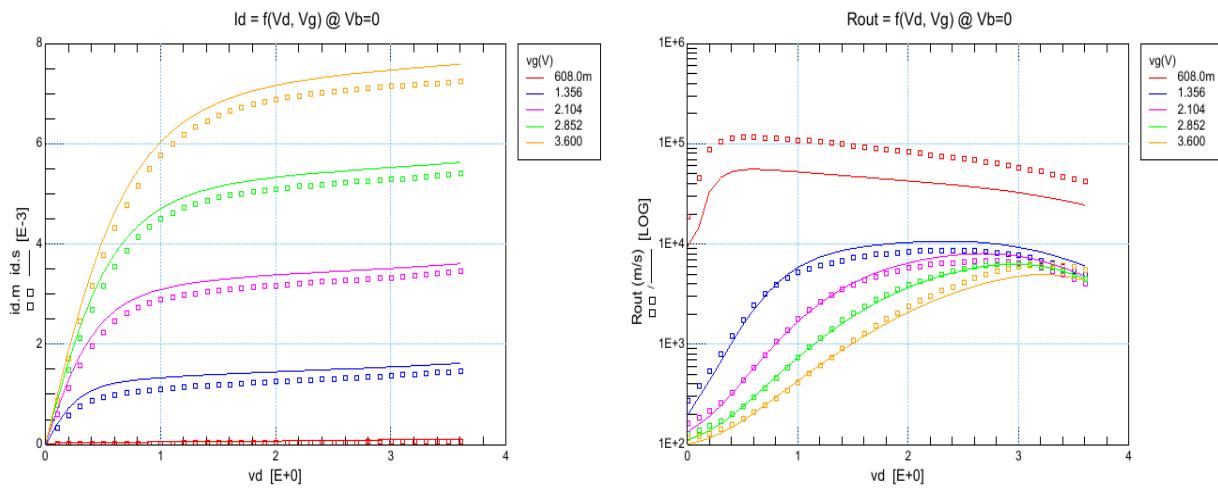
$idvg, Vd = 3.3V, T = 27^\circ C$

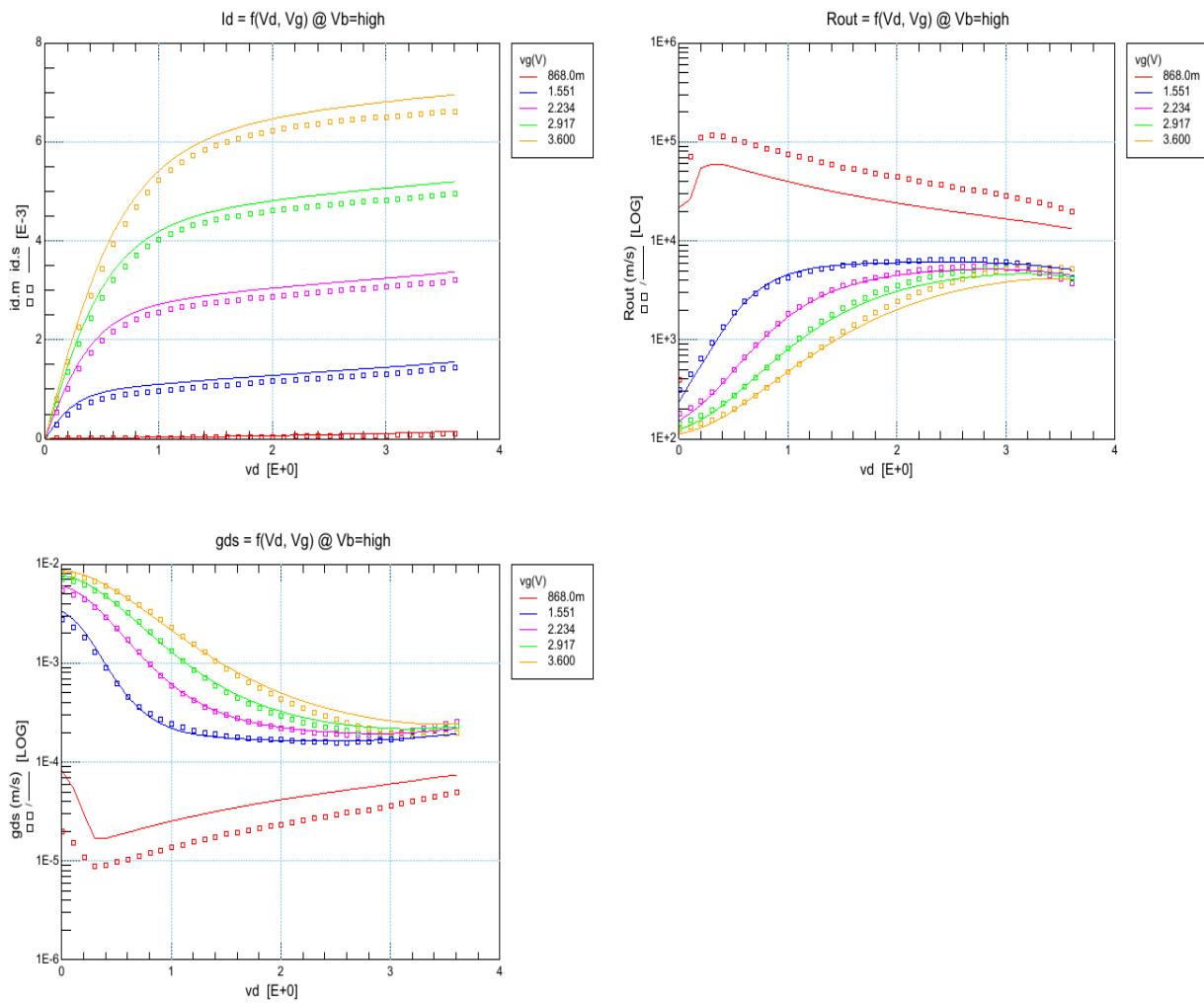
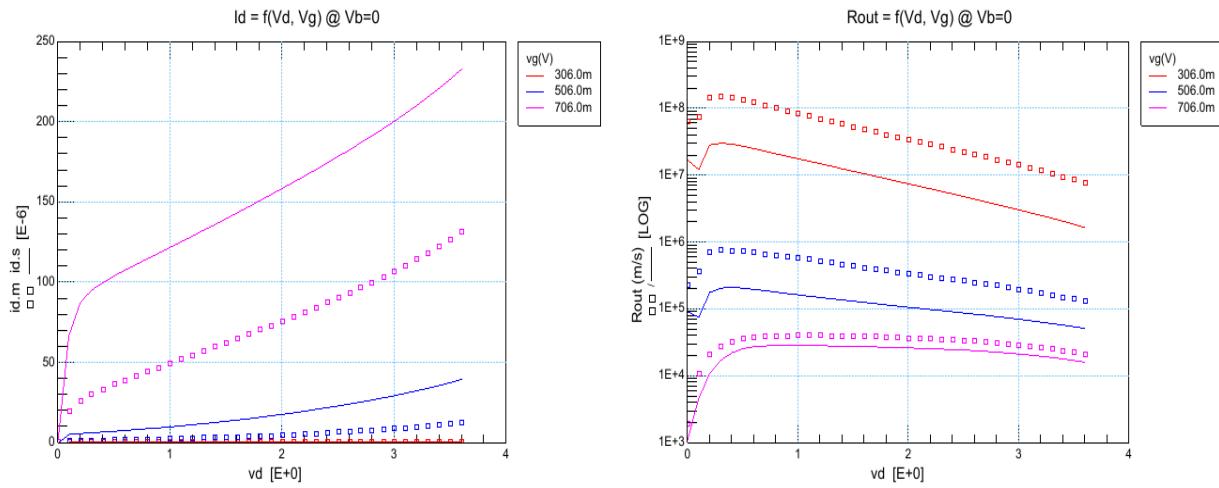


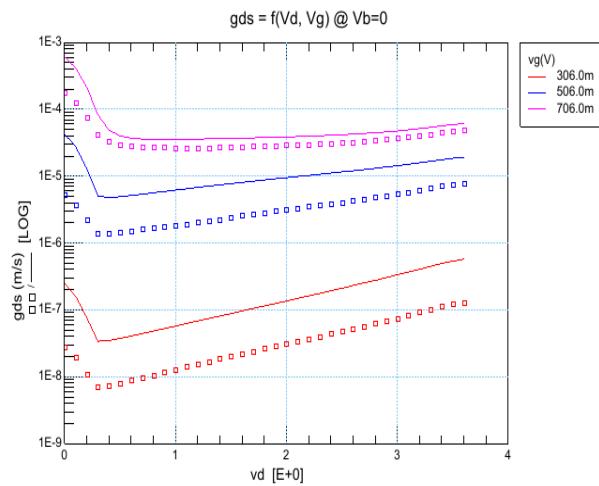


idvg, Ib,Ig, Vb = 0V, T = 27°C

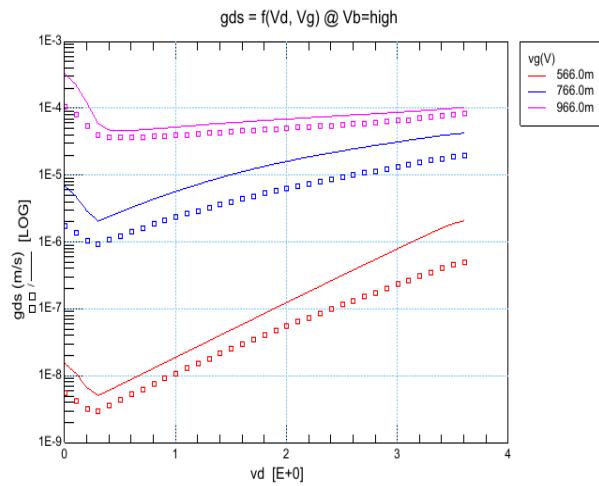
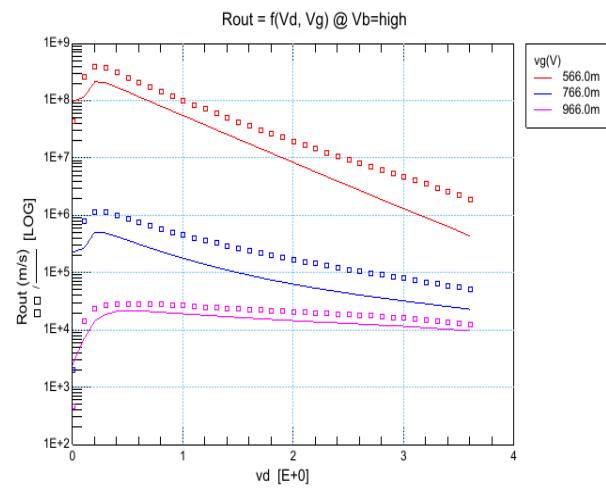
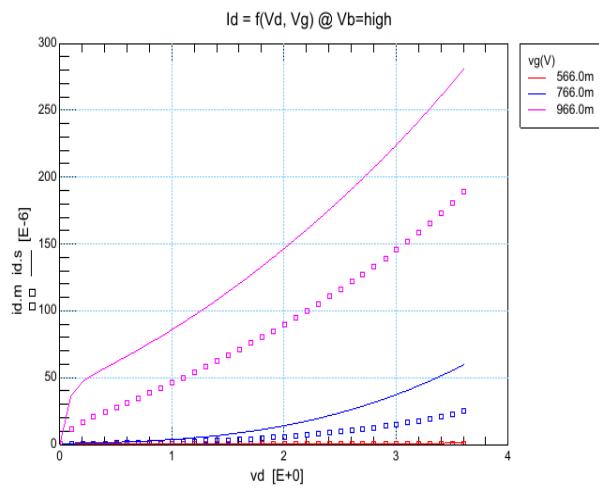


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


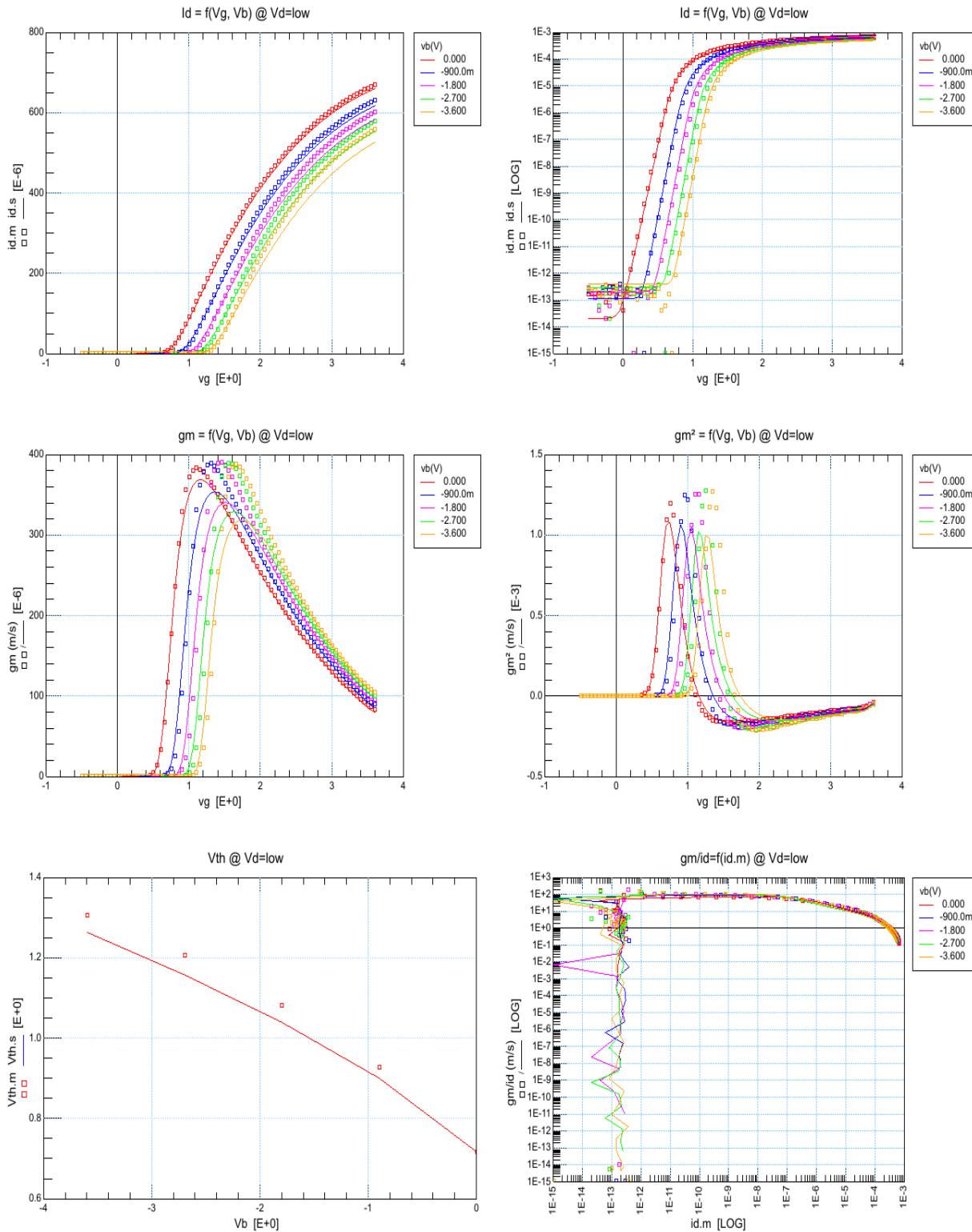


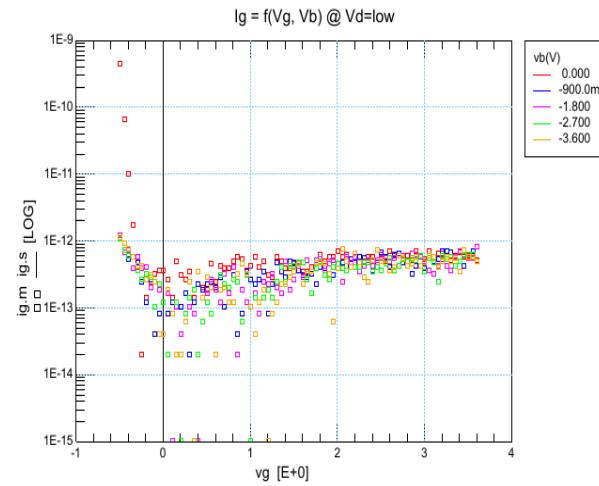
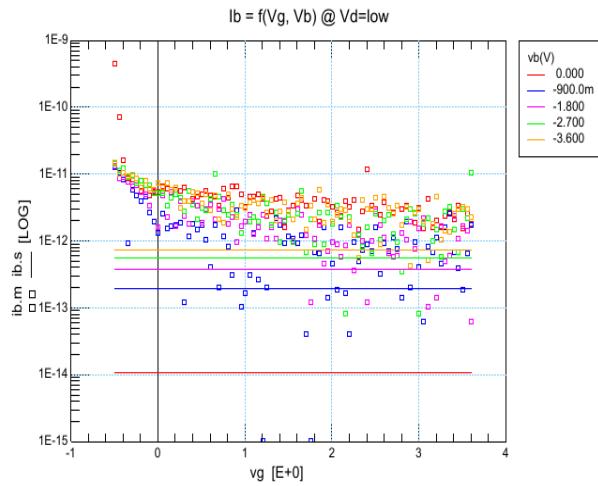
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



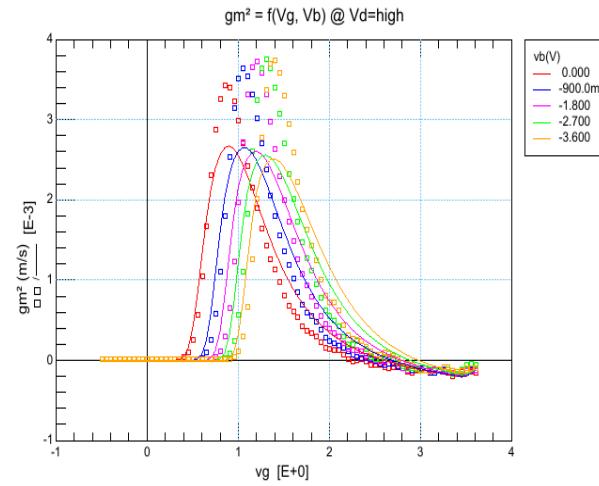
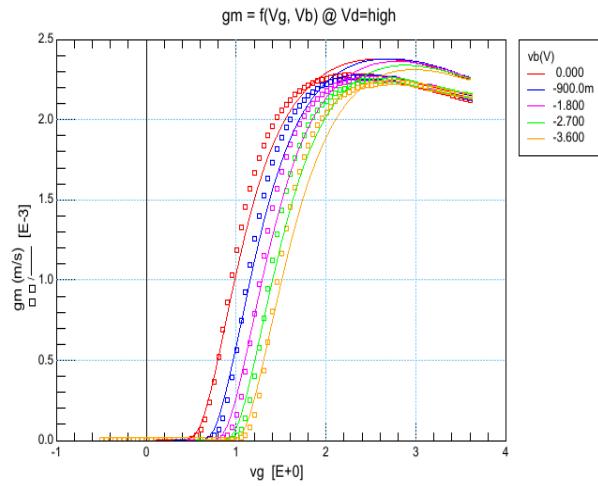
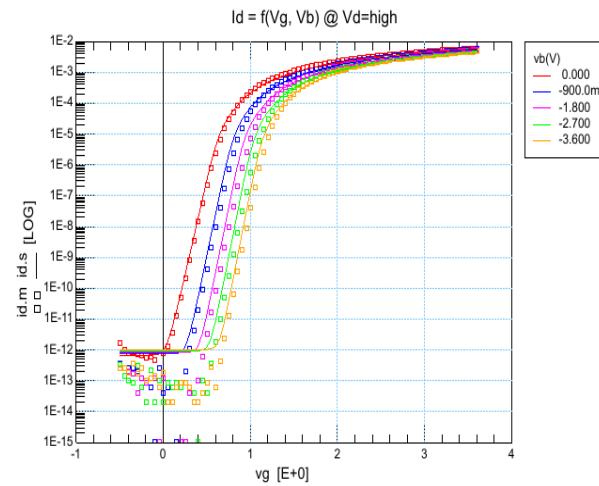
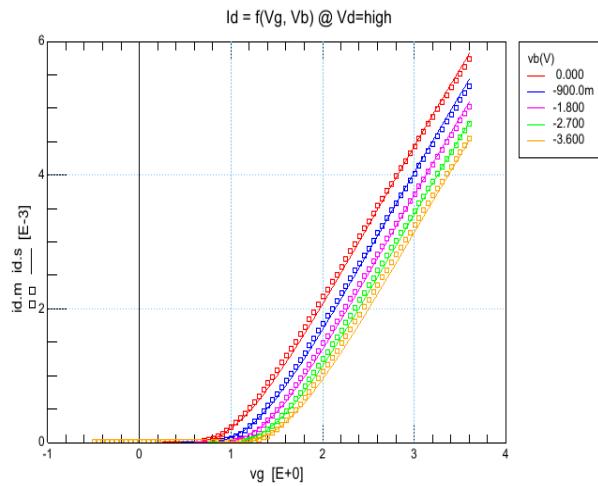
4.6 W10u0_L0u5_T356_S387_5

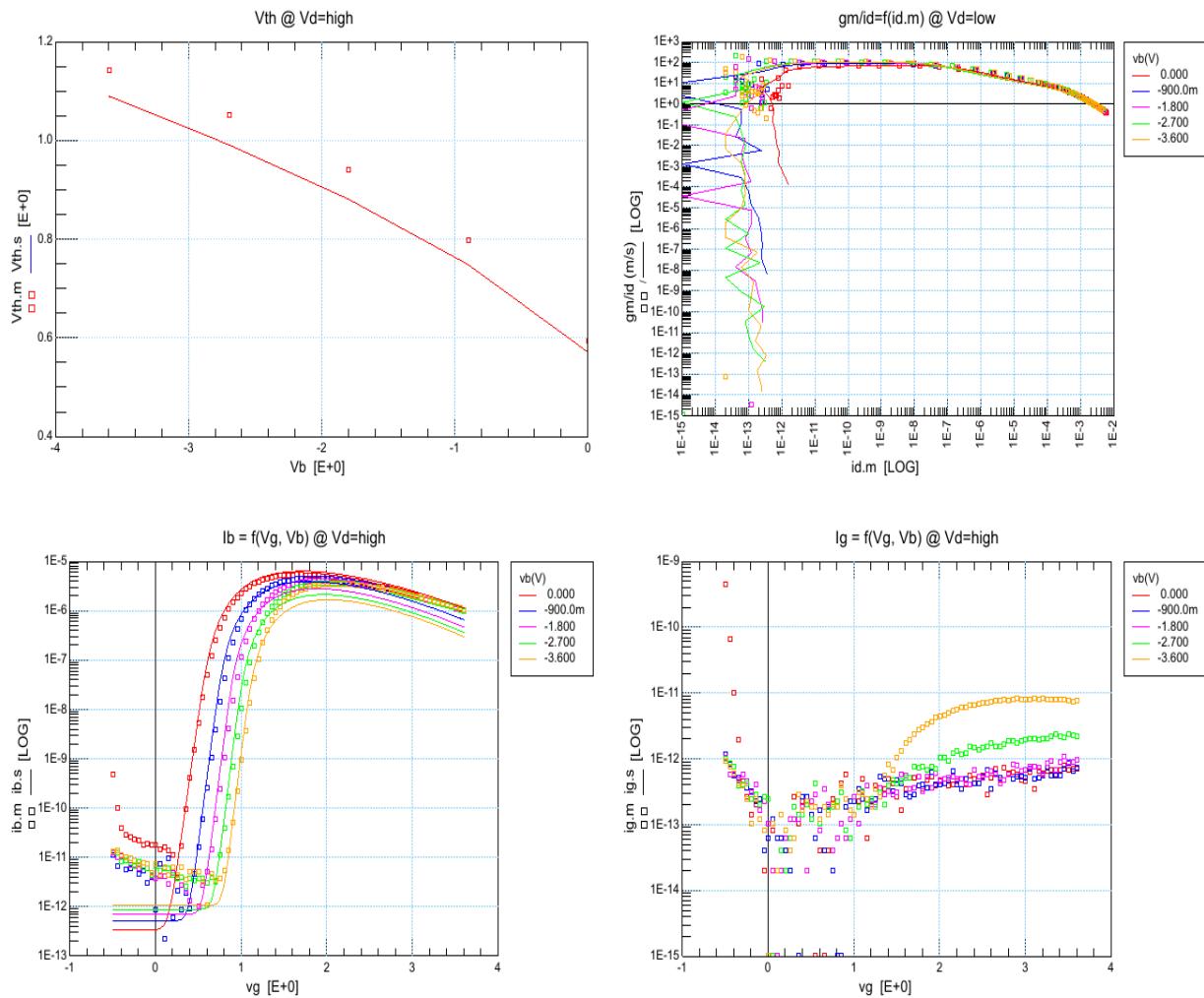
id_{vg} , $V_d = 0.1V$, $T = 27^\circ C$

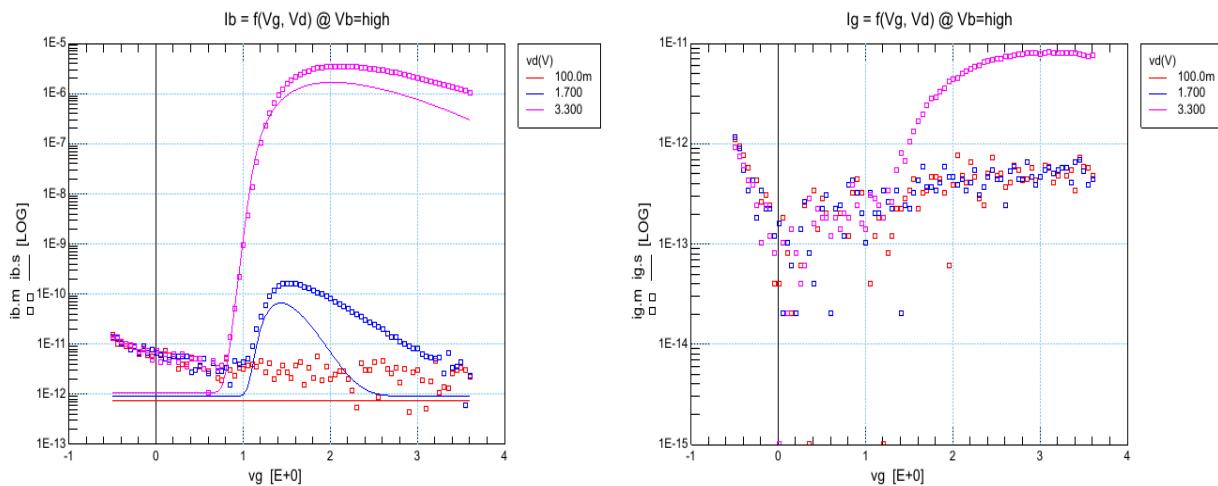
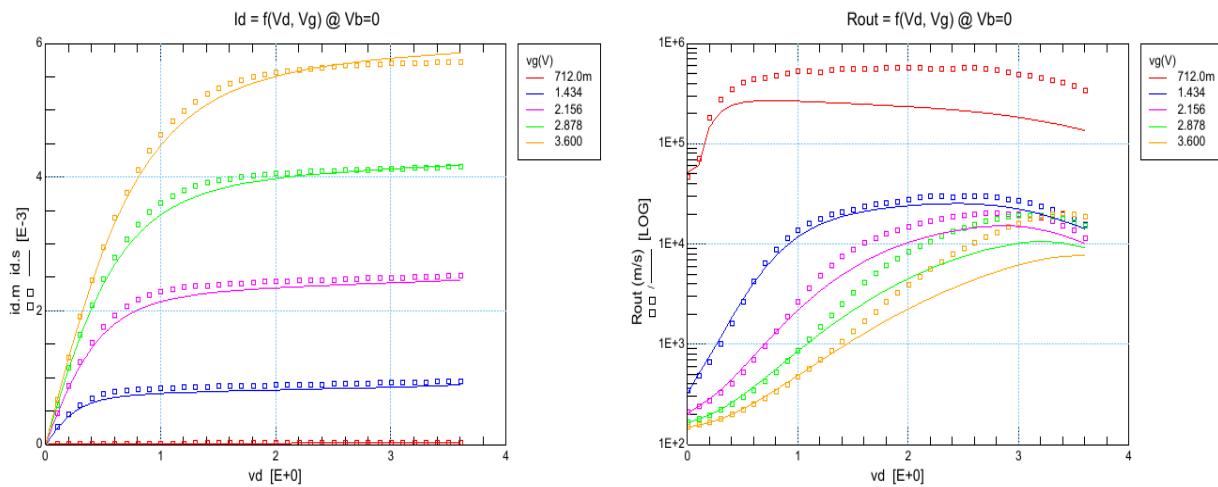


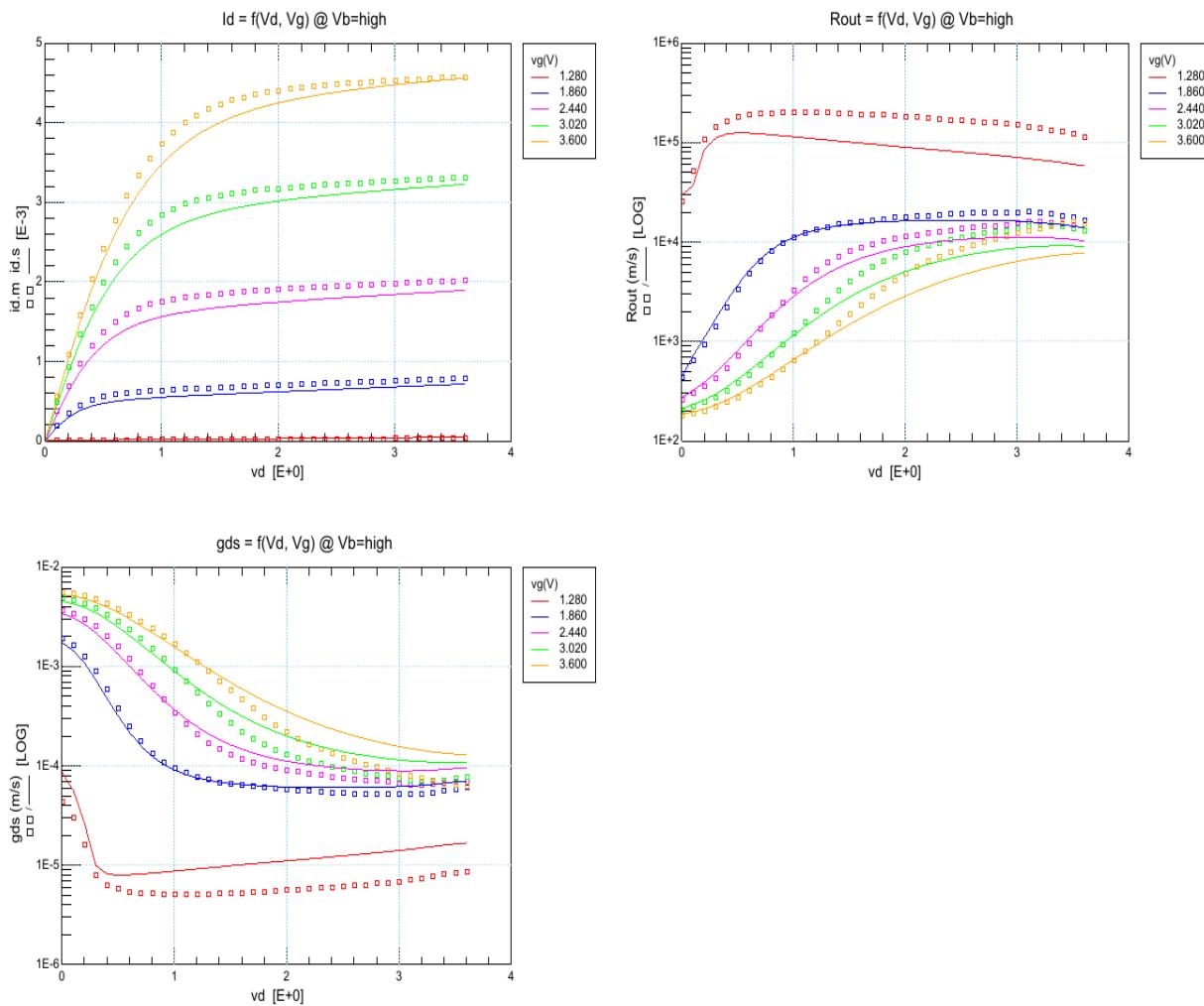
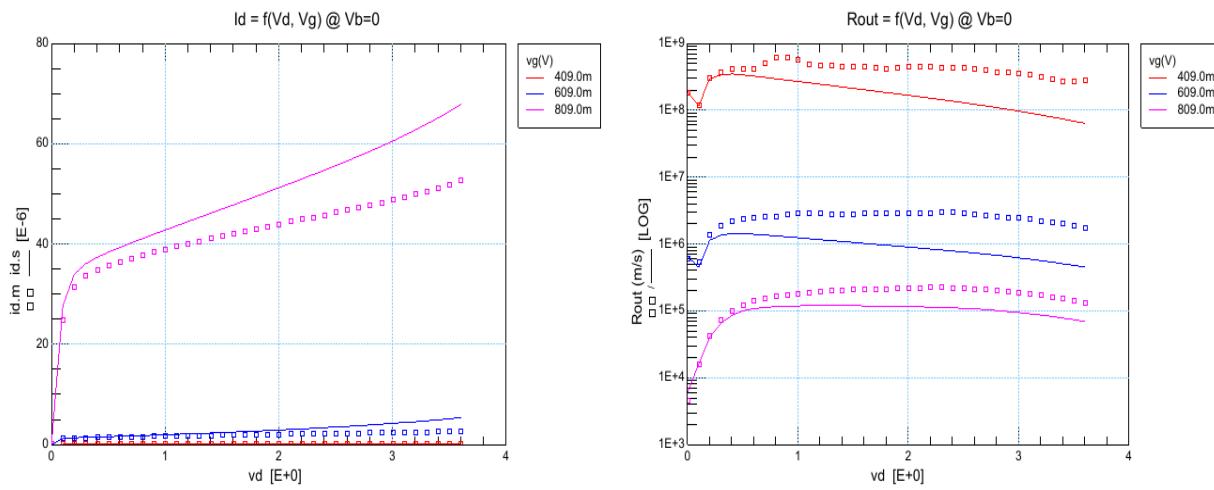


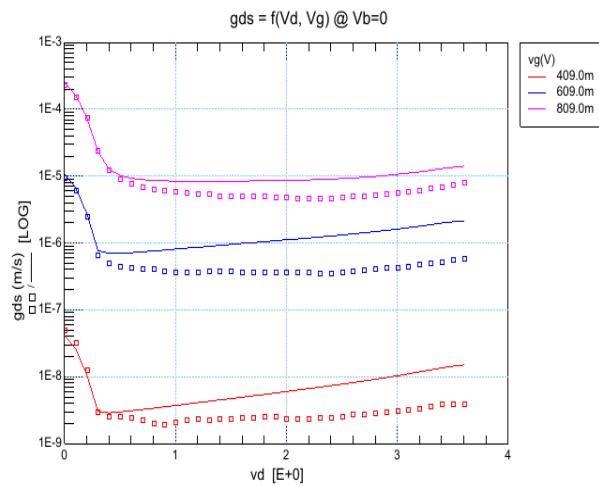
$i_{dvg}, V_d = 3.3V, T = 27^\circ\text{C}$



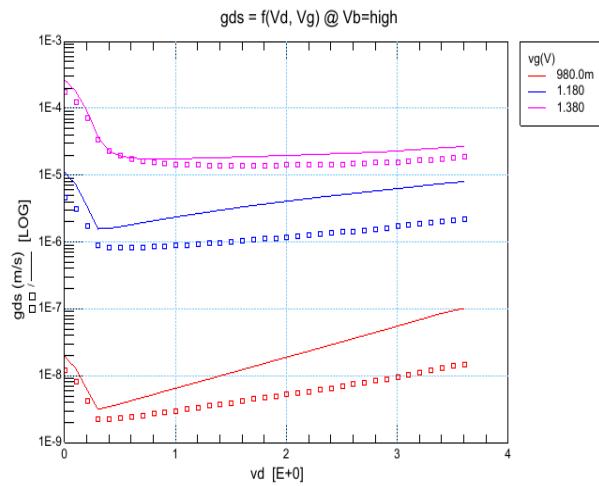
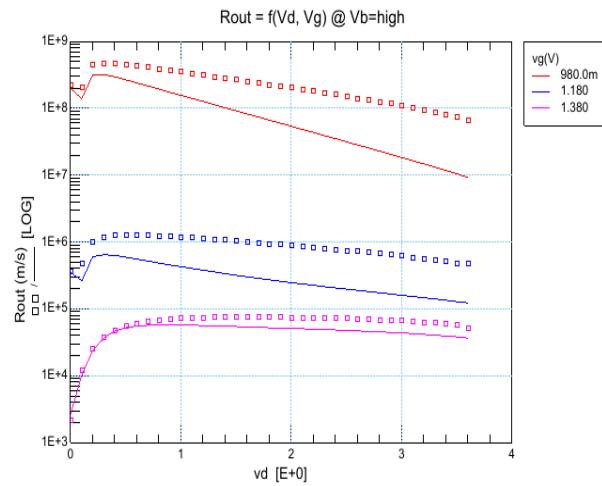
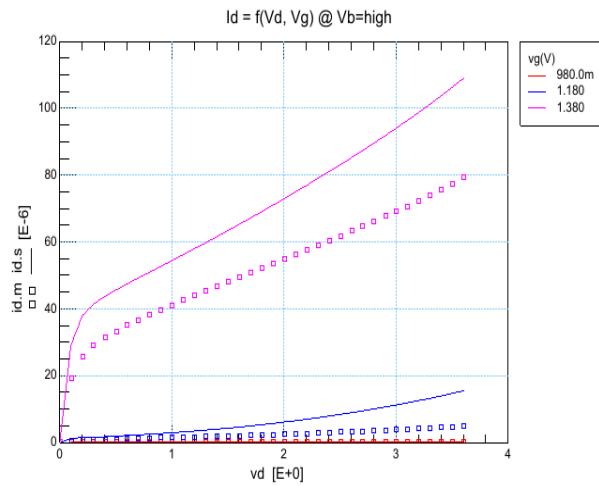


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


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

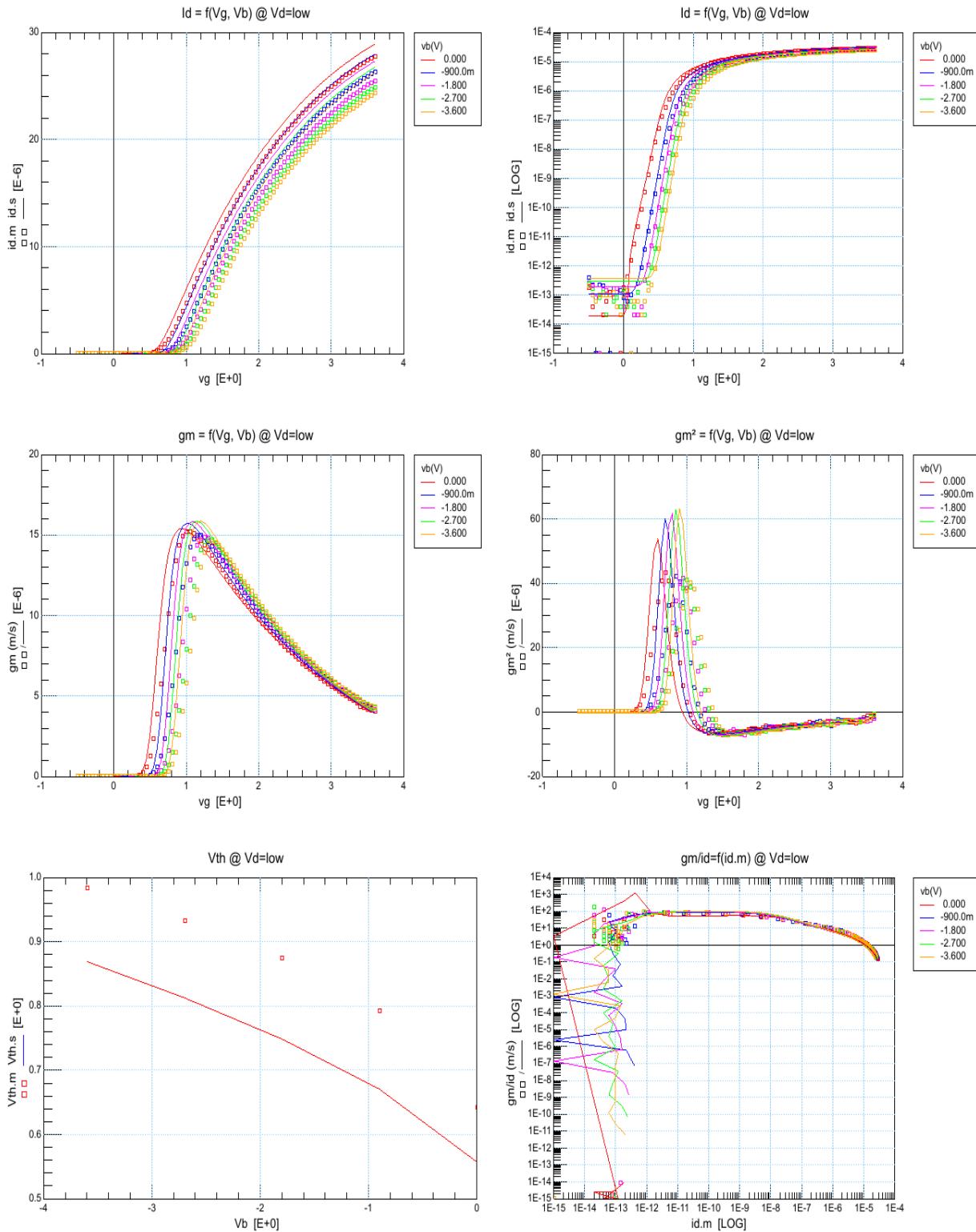


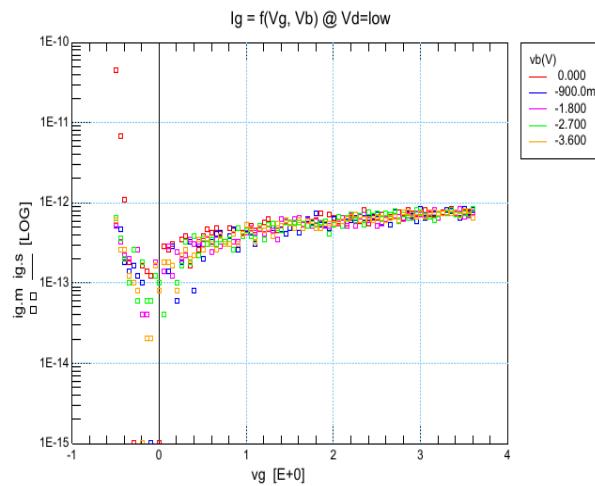
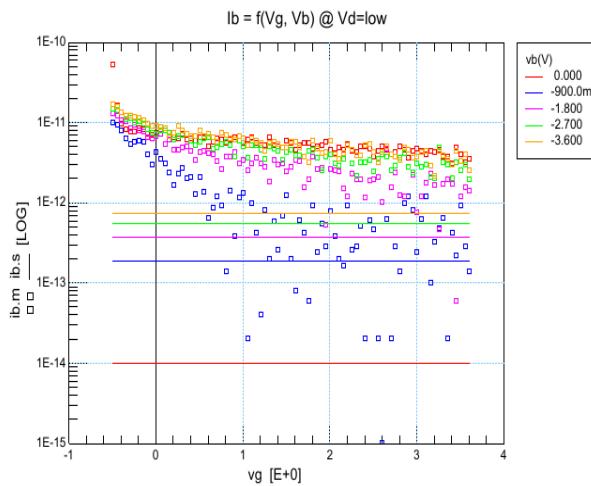
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



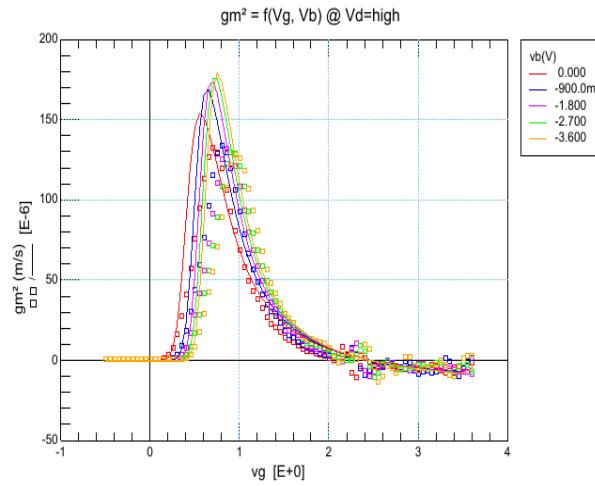
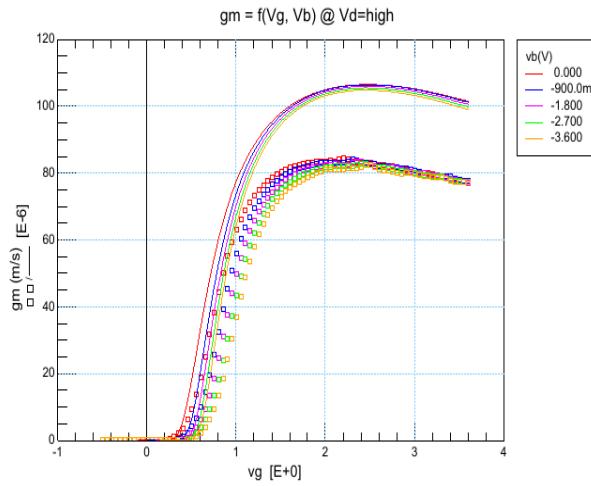
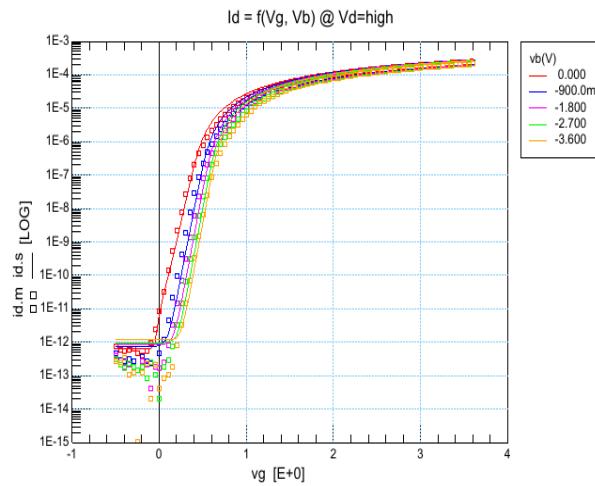
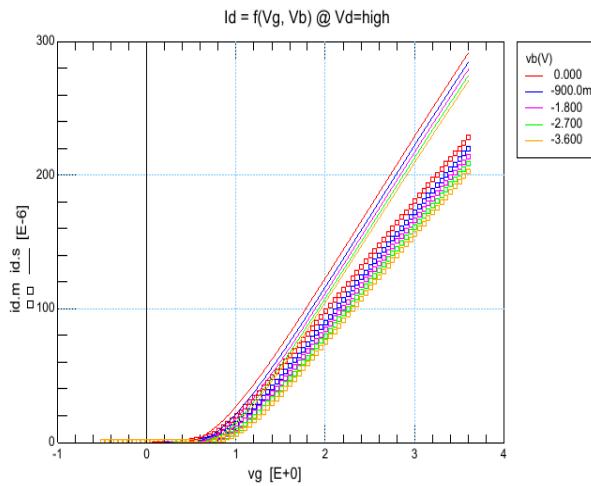
4.7 W0u3_L0u35_S560_3

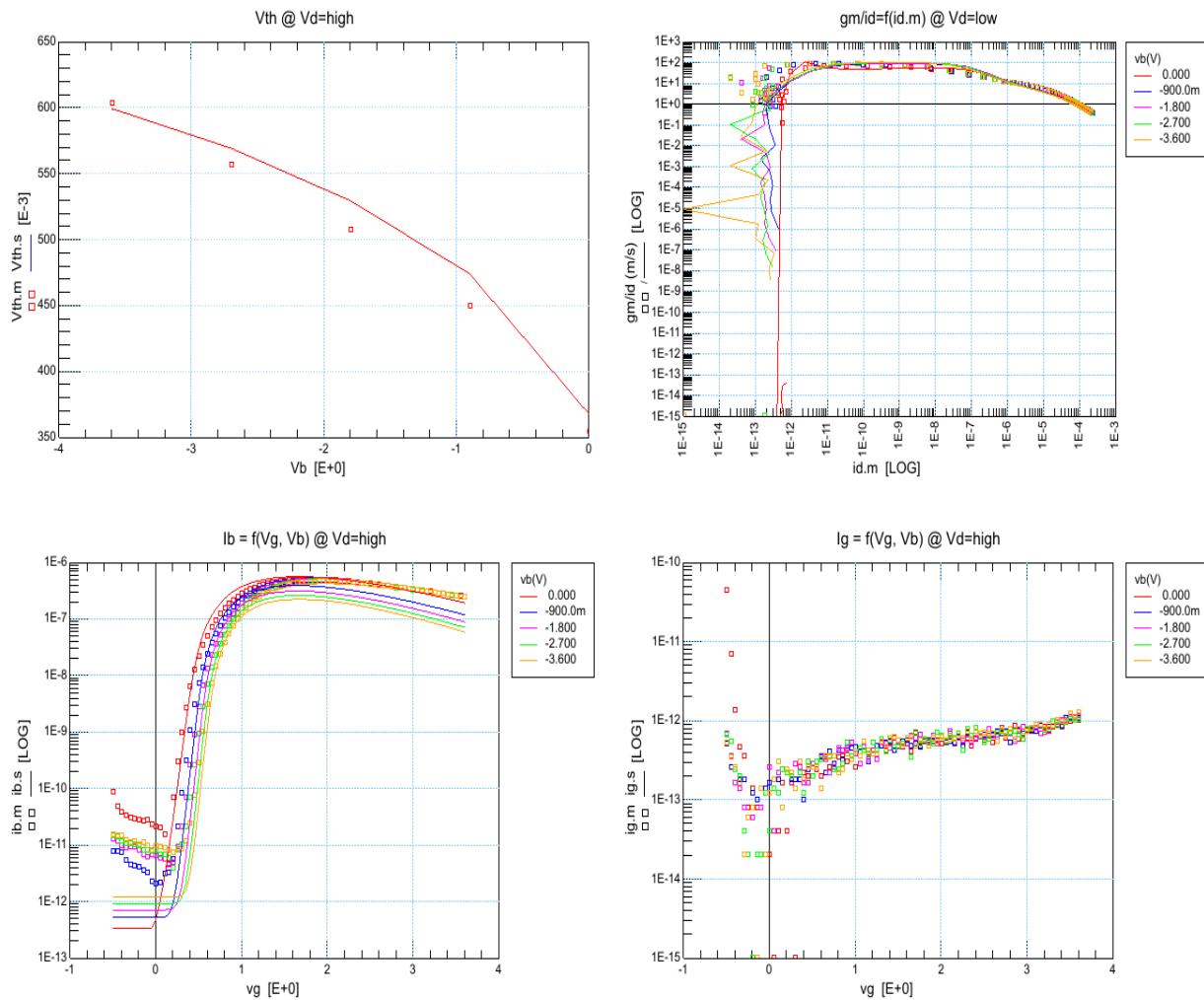
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



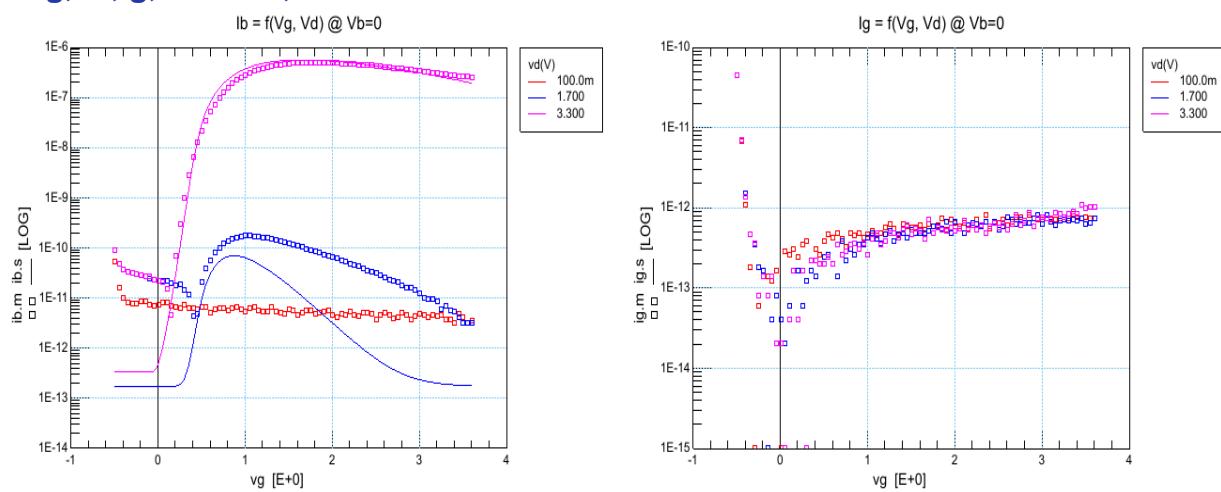


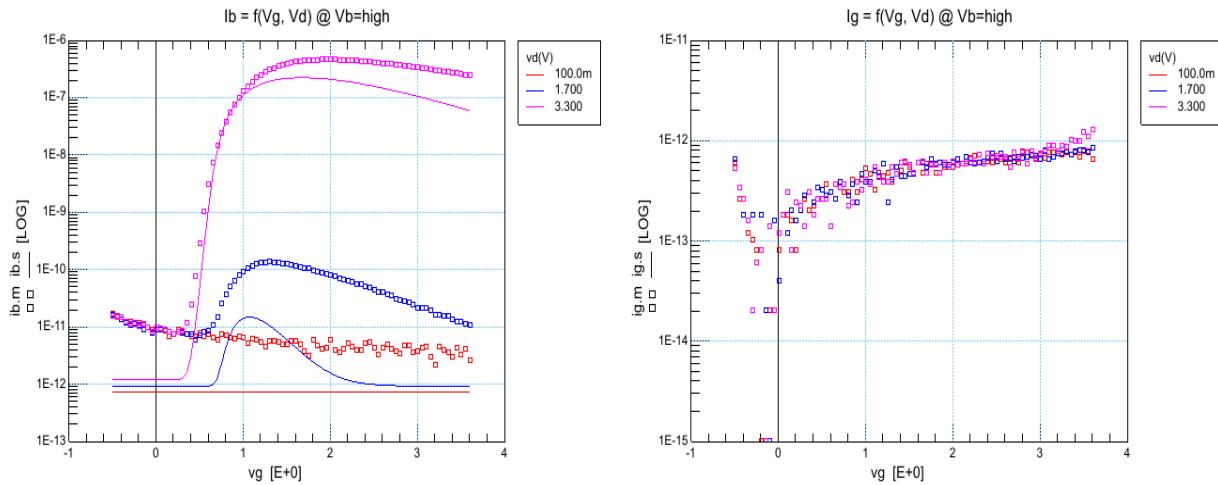
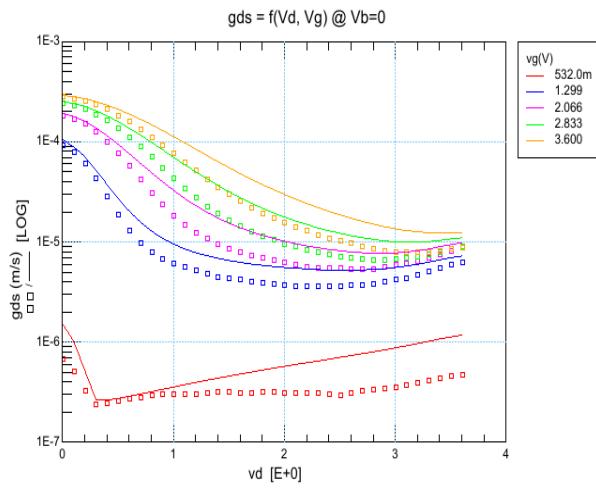
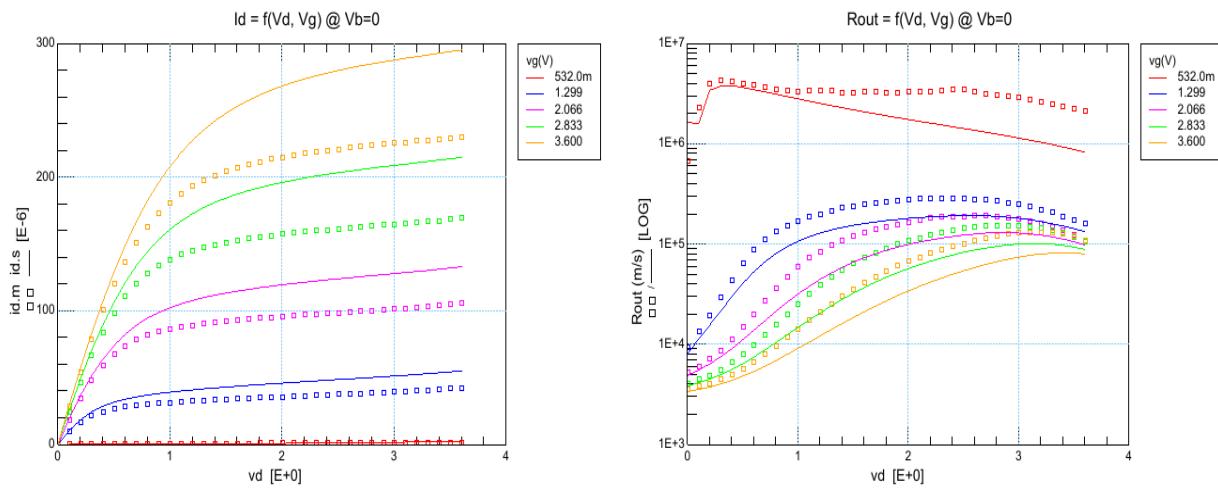
$idvg, Vd = 3.3V, T = 27^\circ C$

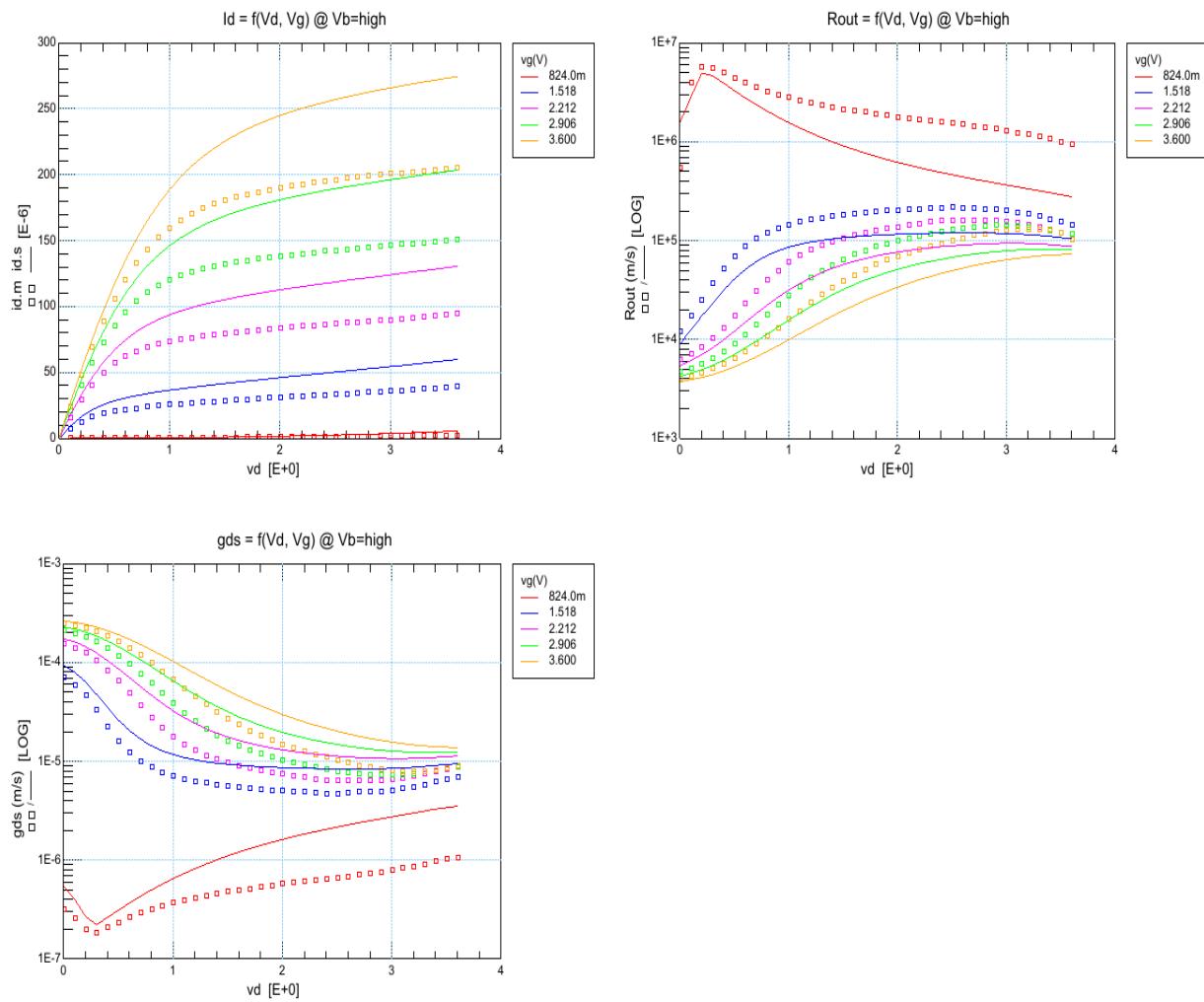
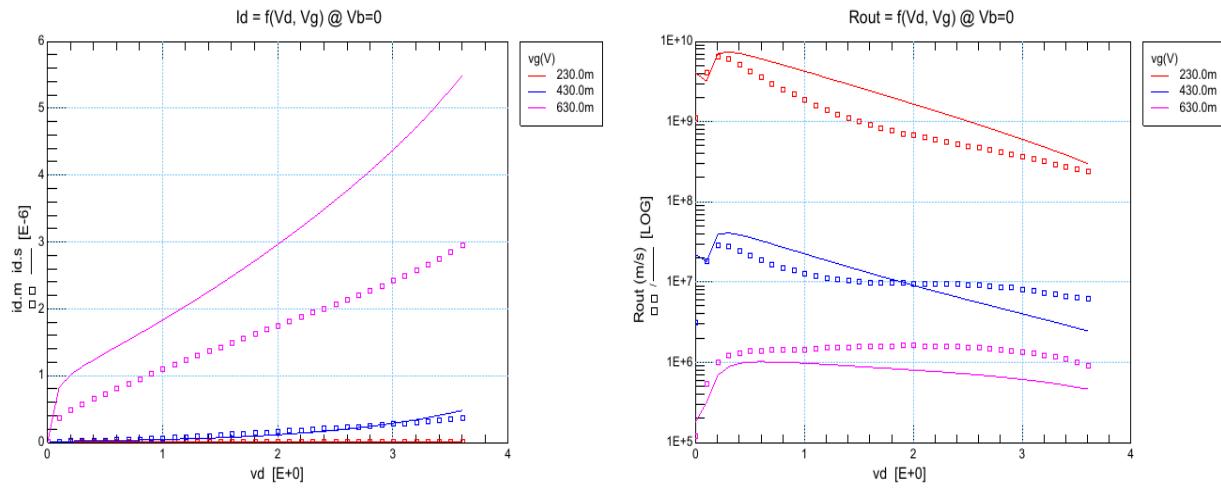


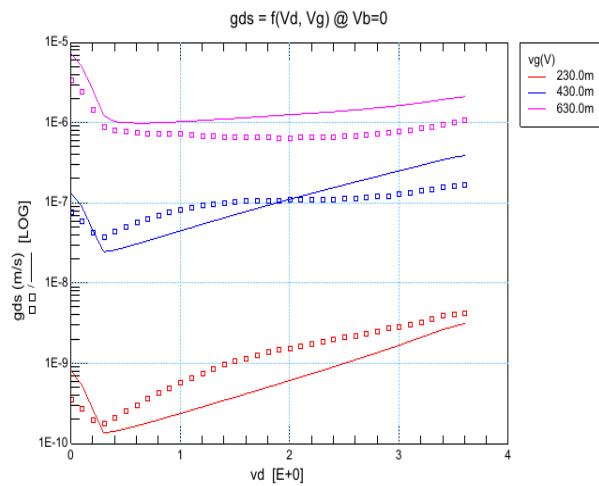


idvg, Ib, Ig, Vb = 0V, T = 27°C

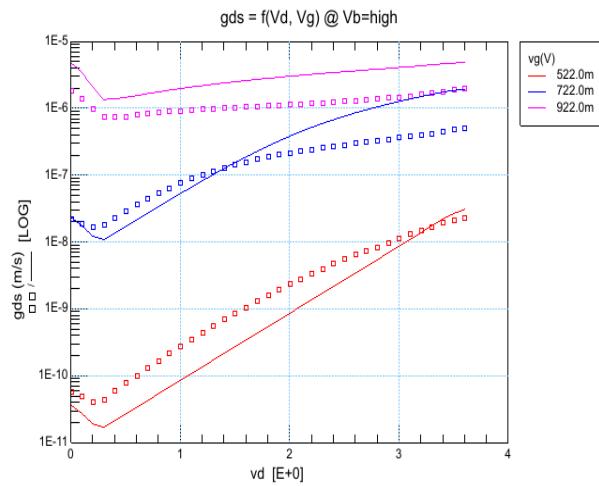
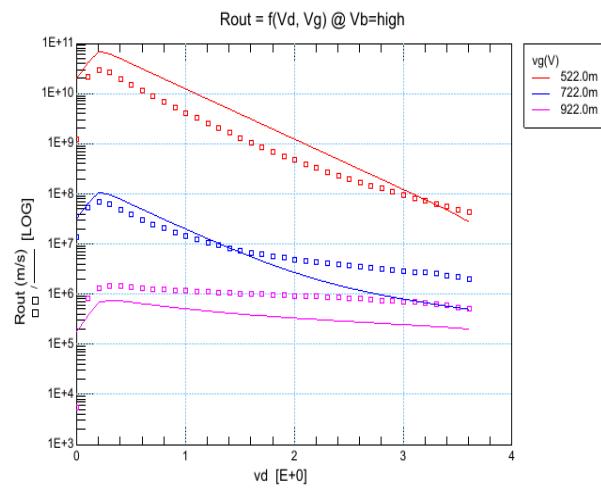
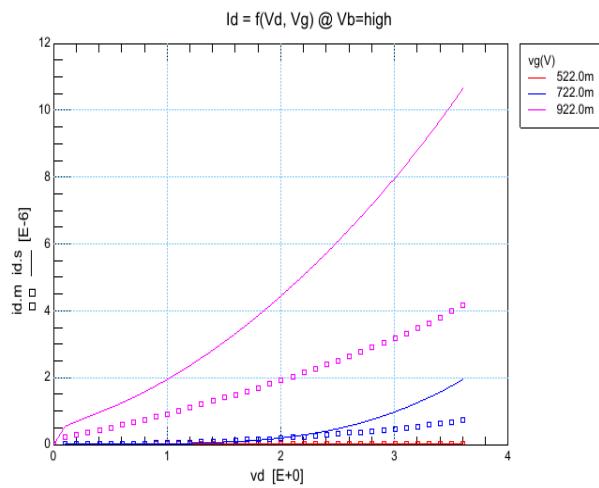


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


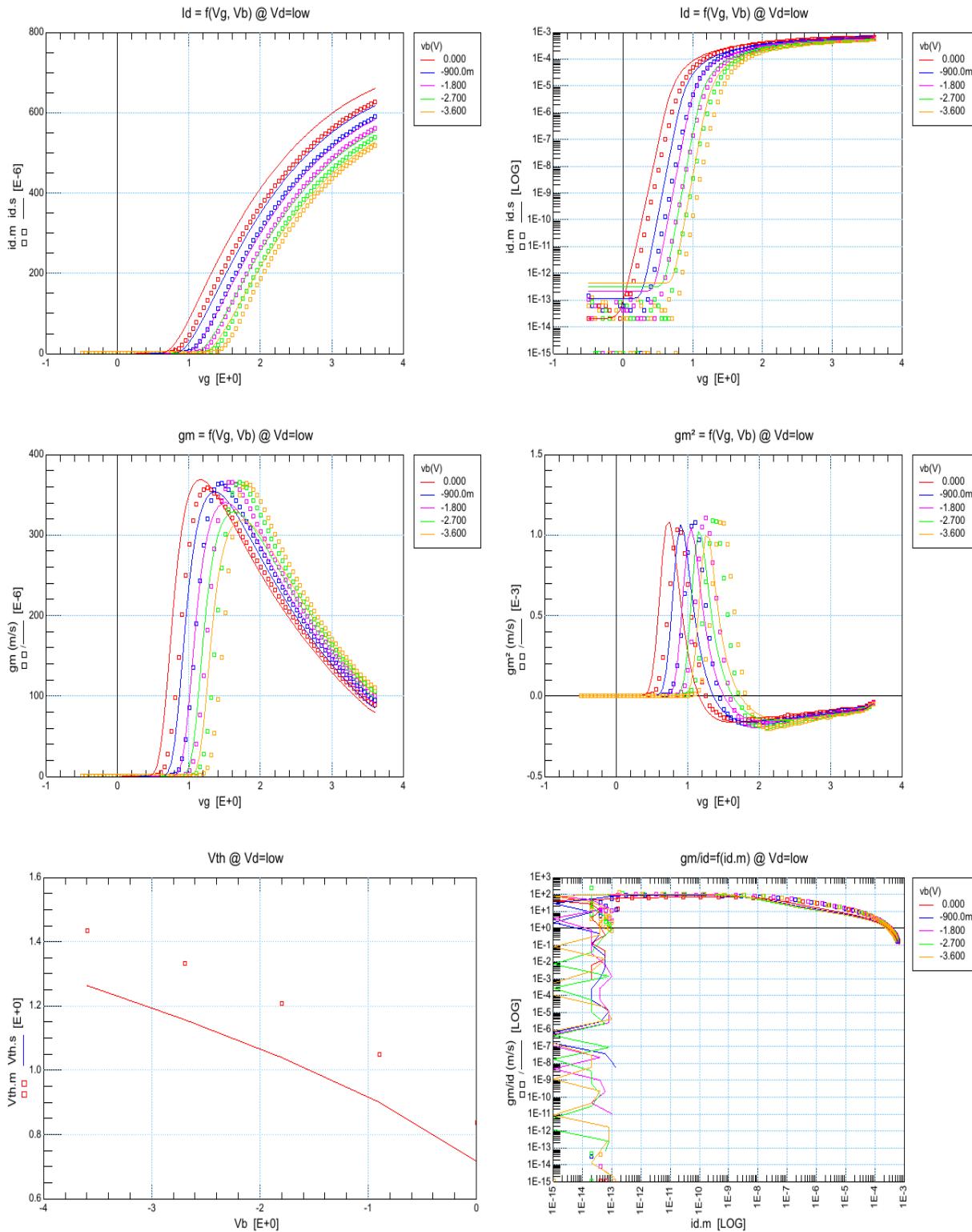


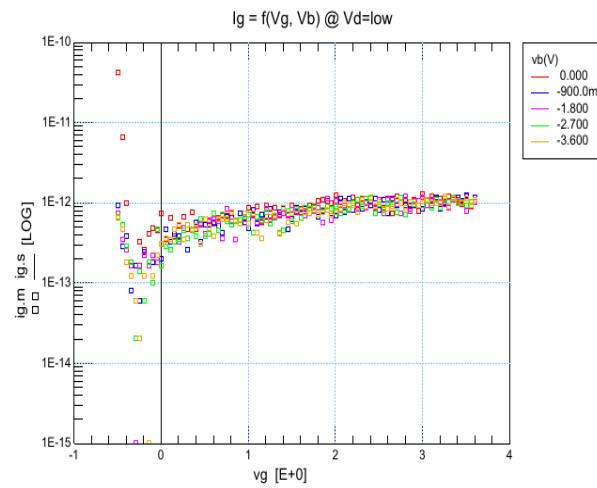
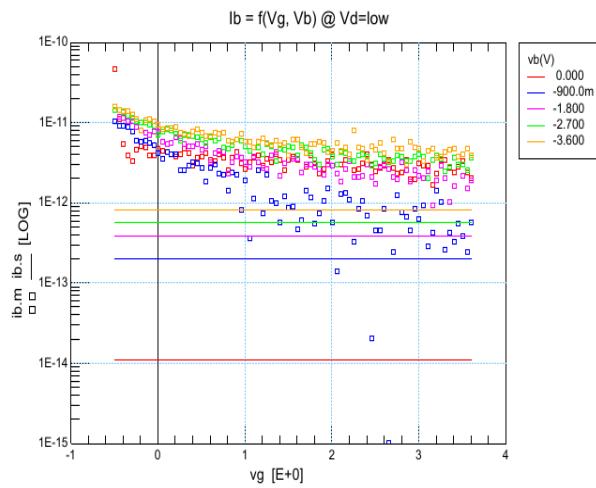
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



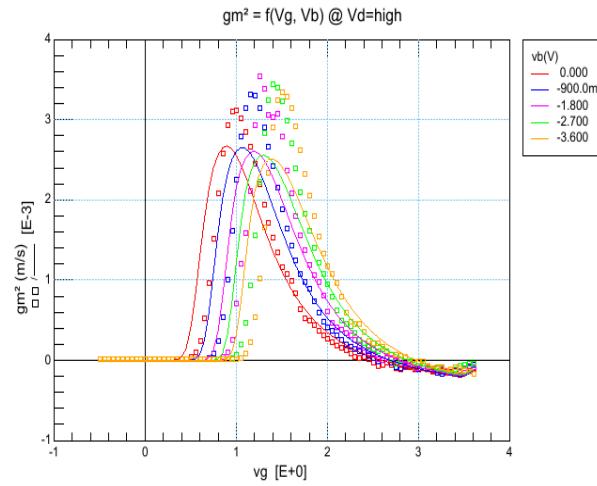
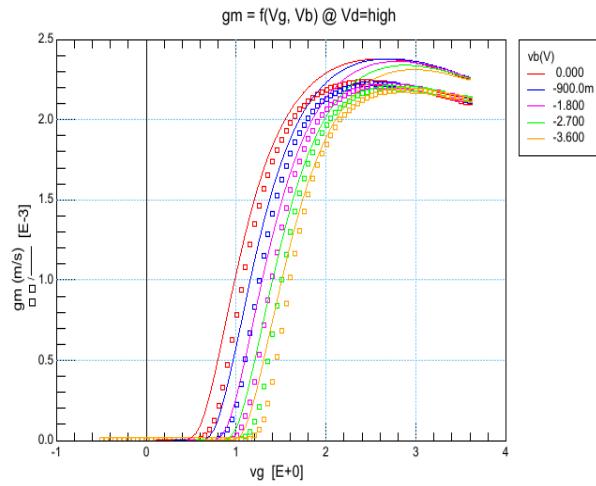
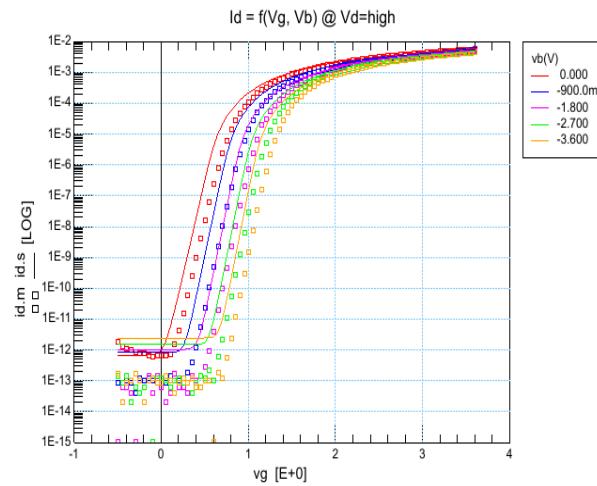
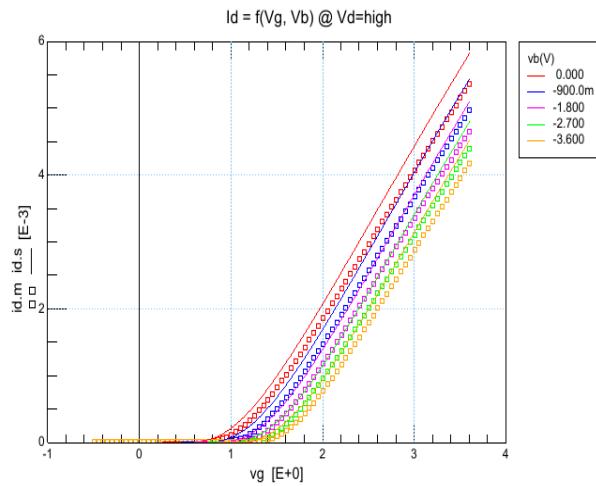
4.8 W10u0_L0u5_S556_4

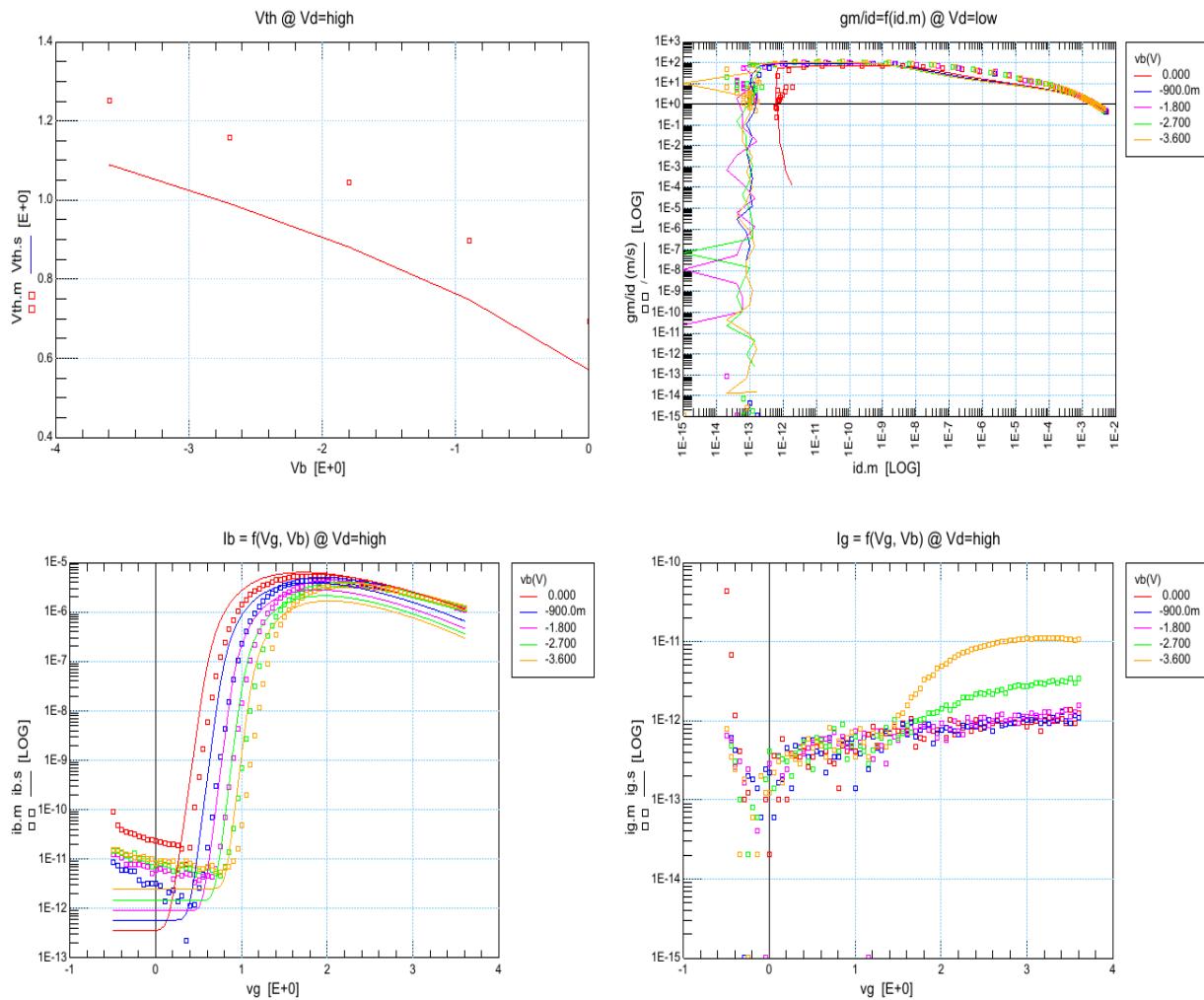
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



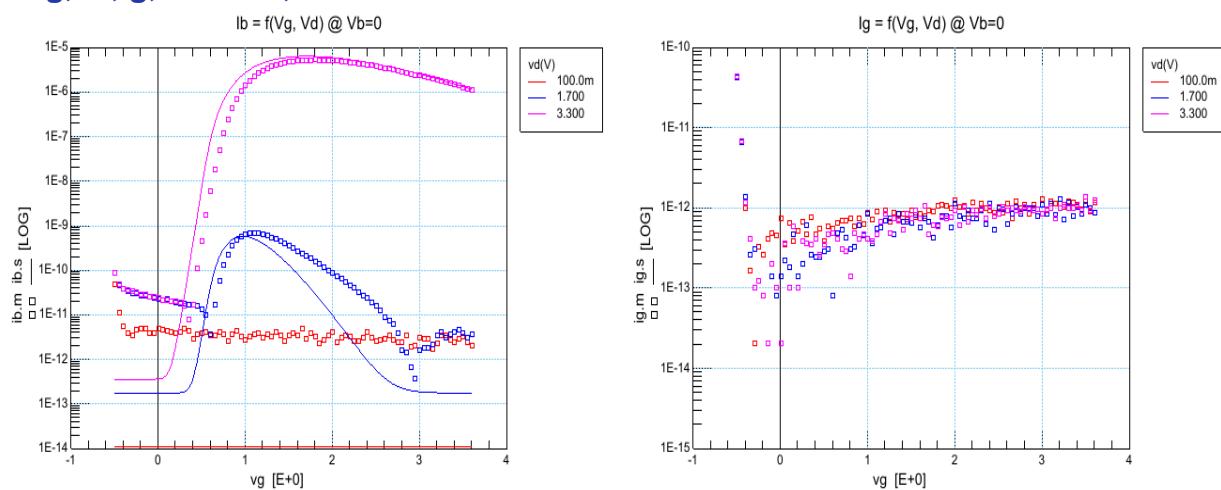


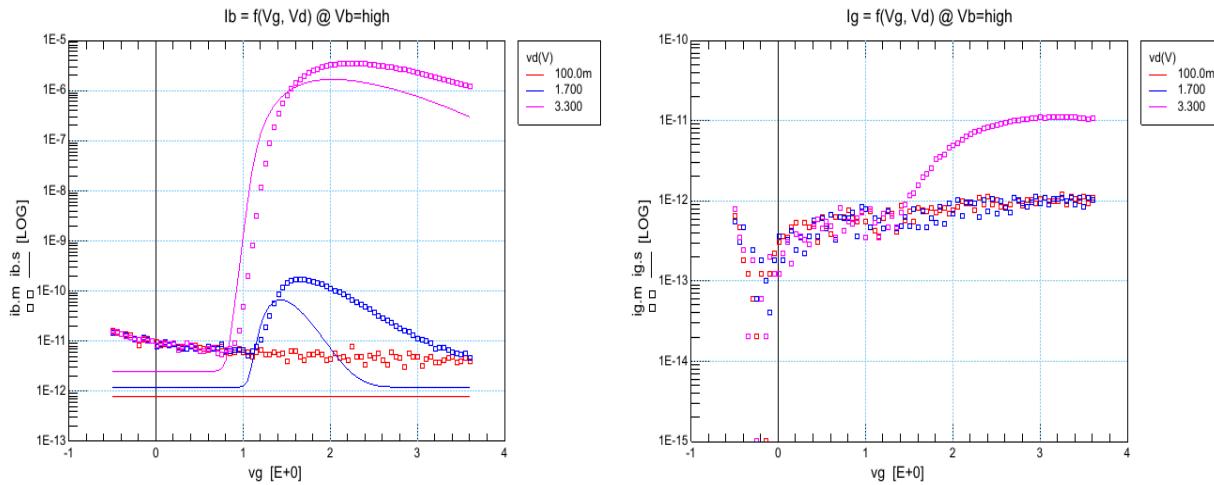
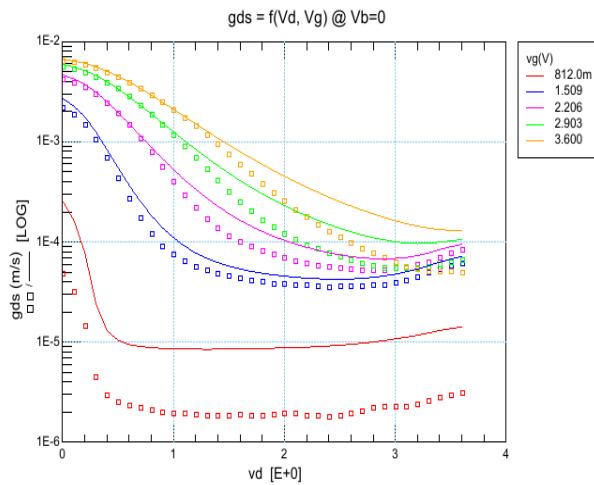
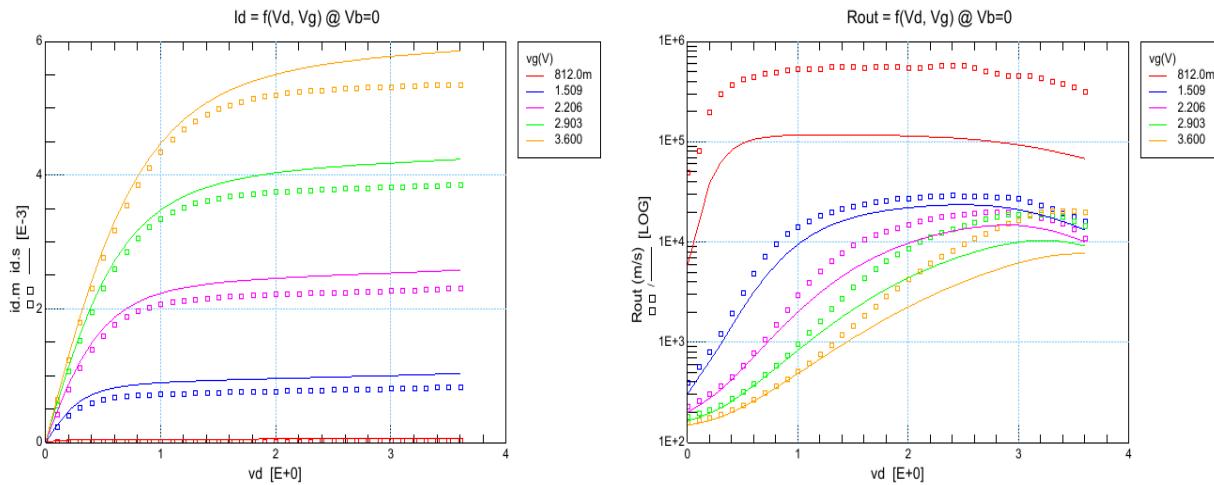
$i_{dvg}, V_d = 3.3V, T = 27^\circ\text{C}$

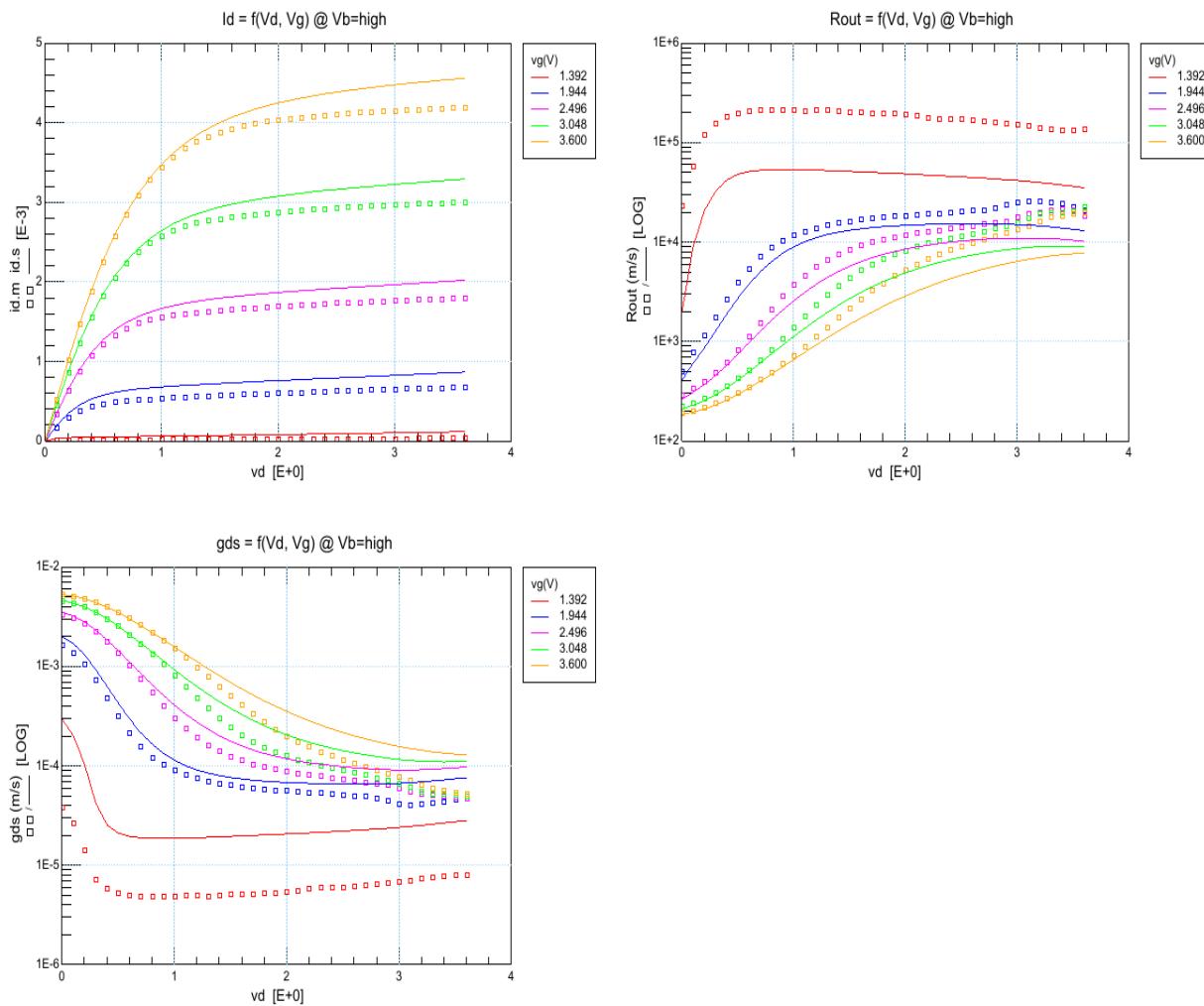
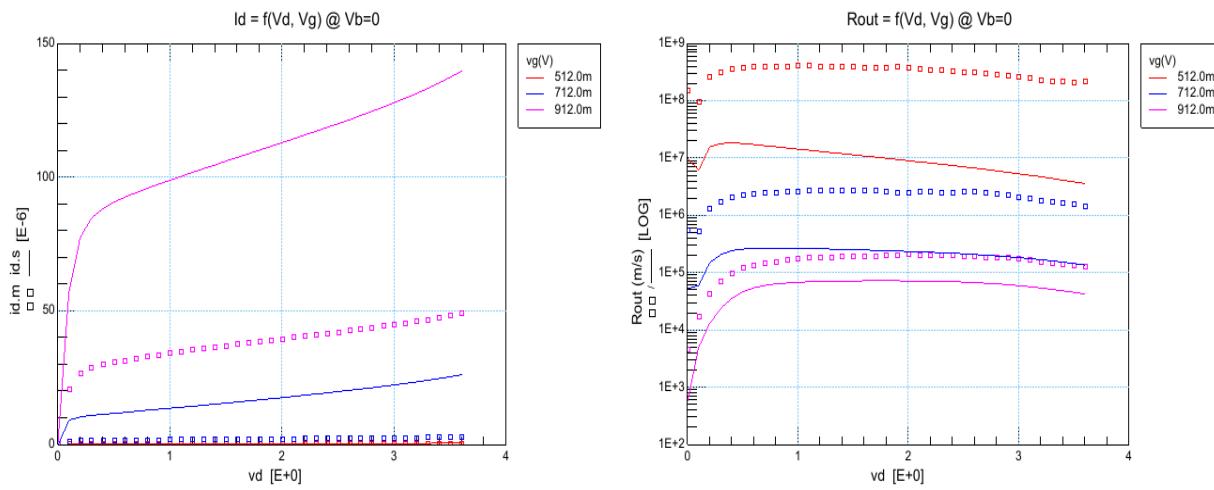


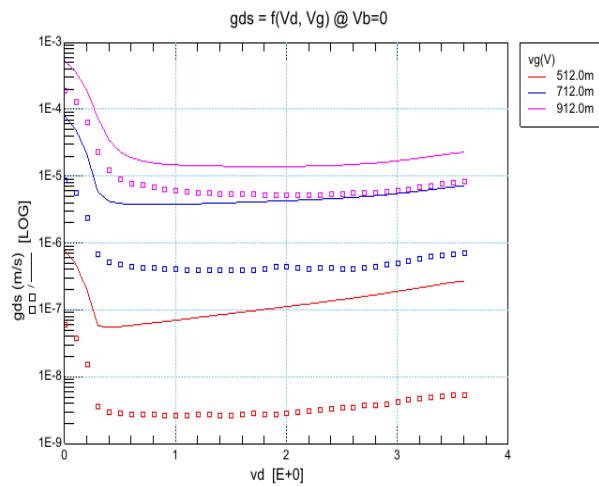


idvg, Ib, Ig, Vb = 0V, T = 27°C

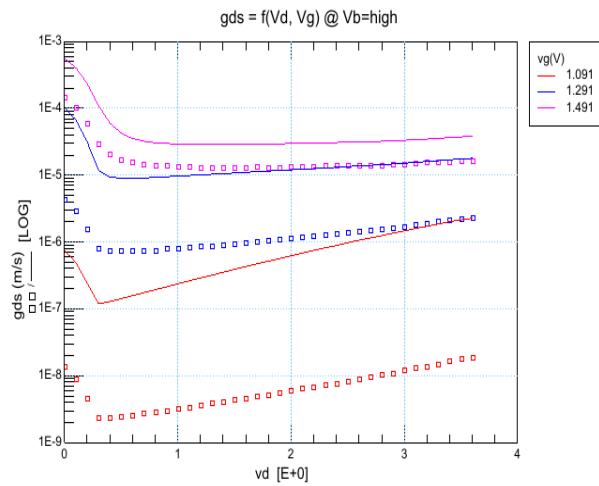
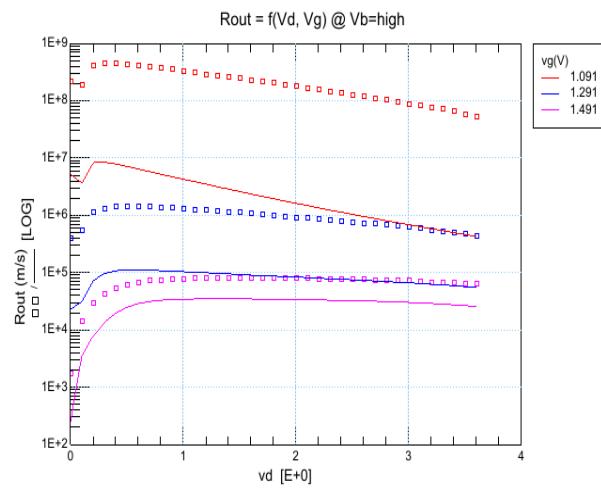
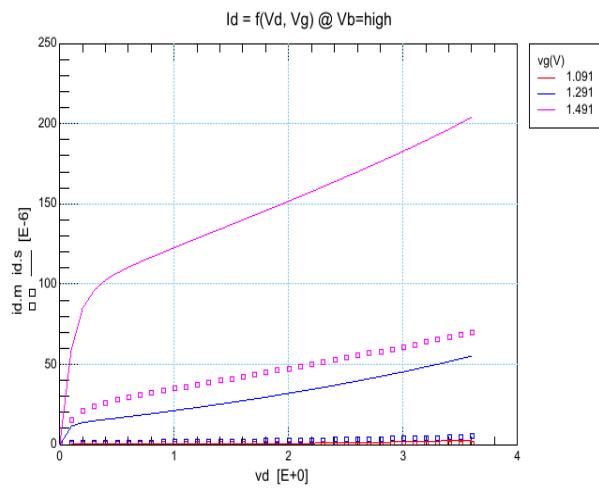


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


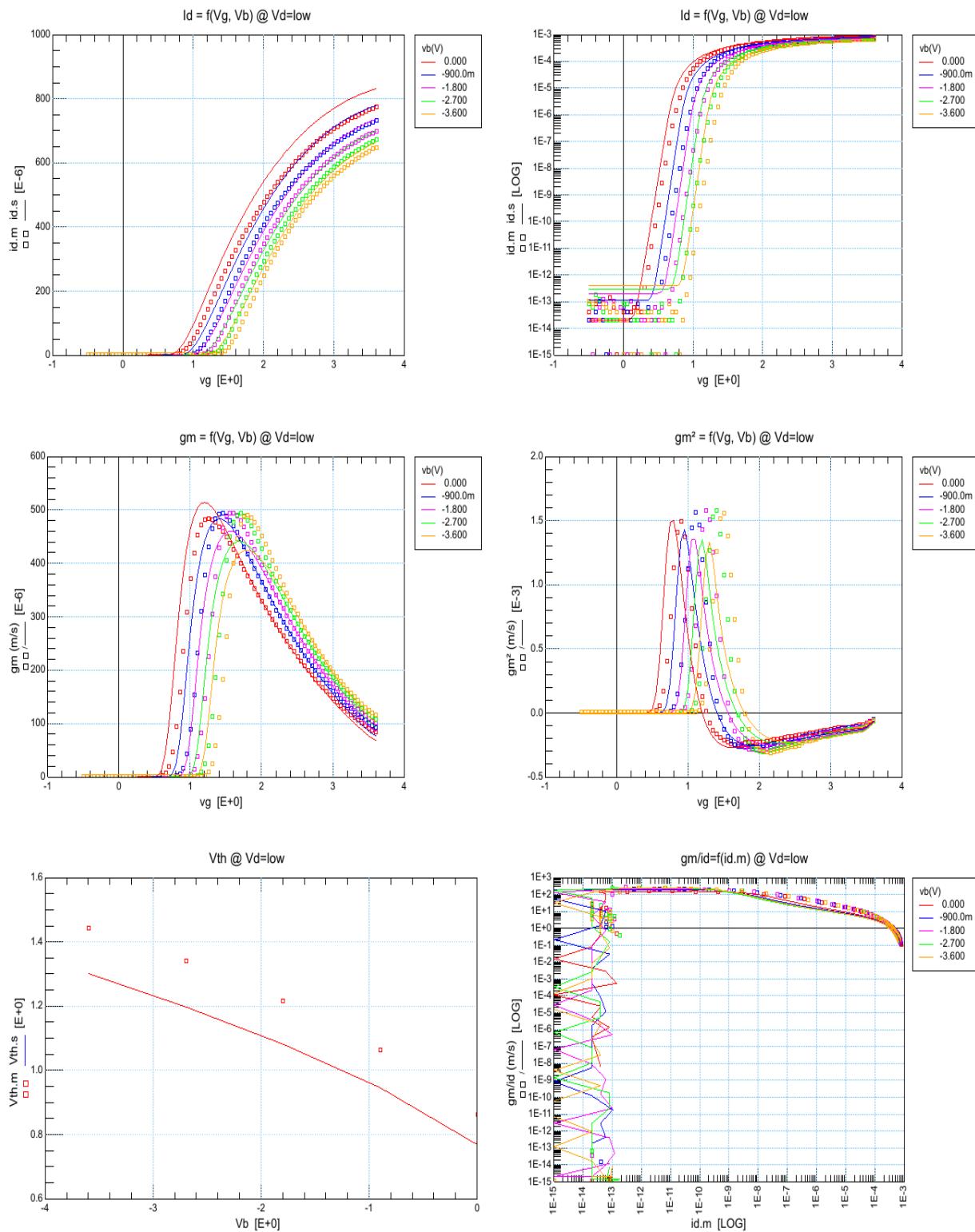
idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


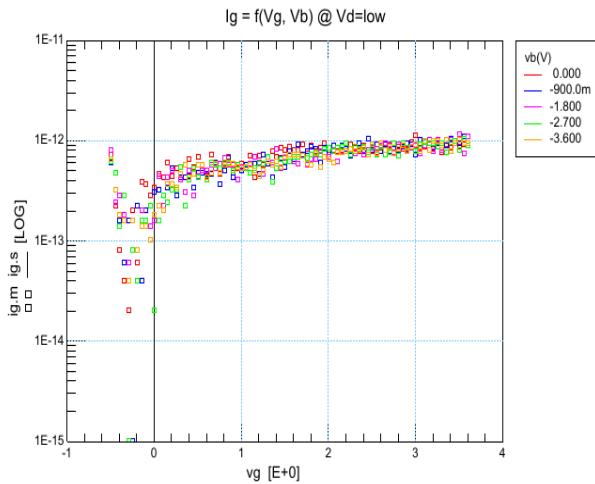
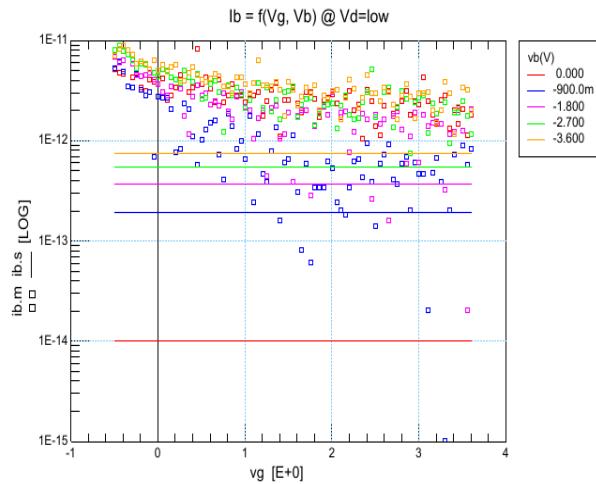


idvd_vth_vbmin, Vb = -3.6V, T = 27°C

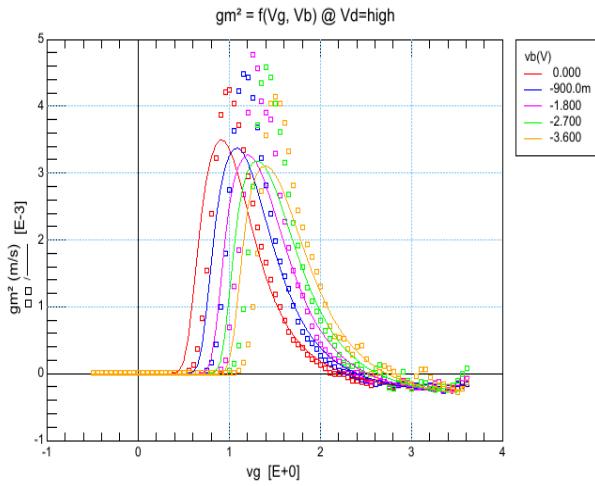
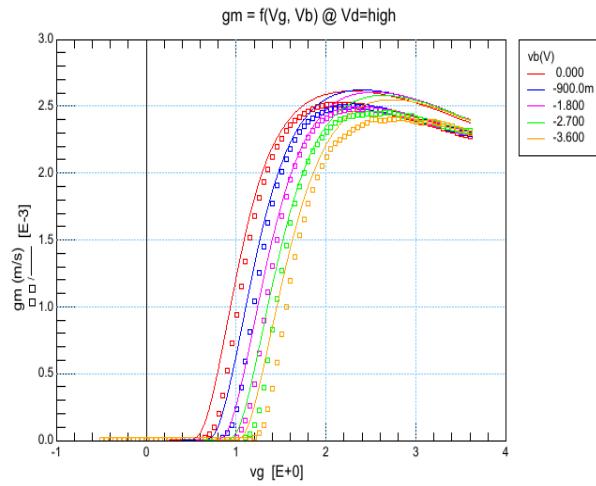
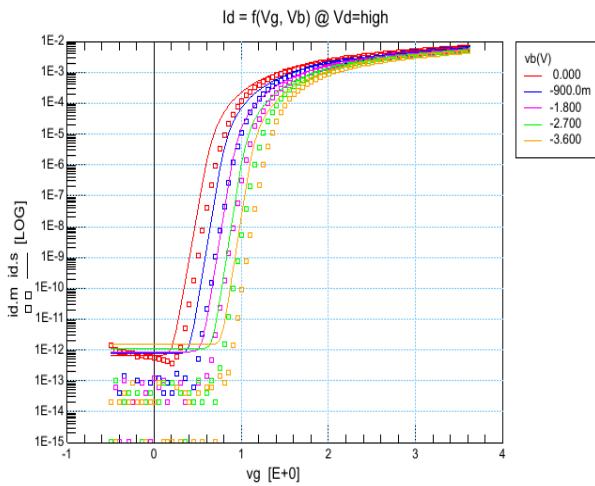
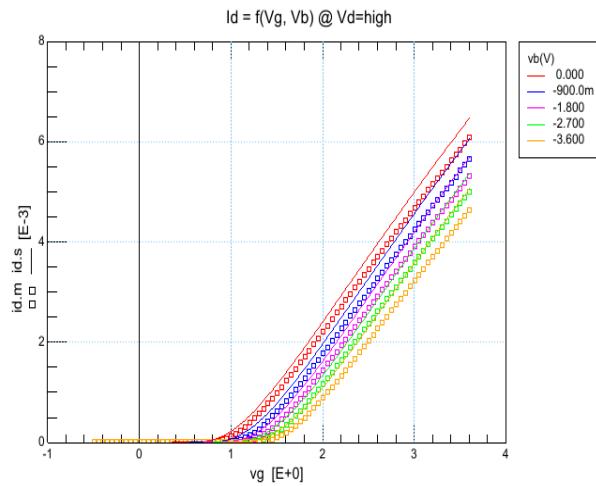


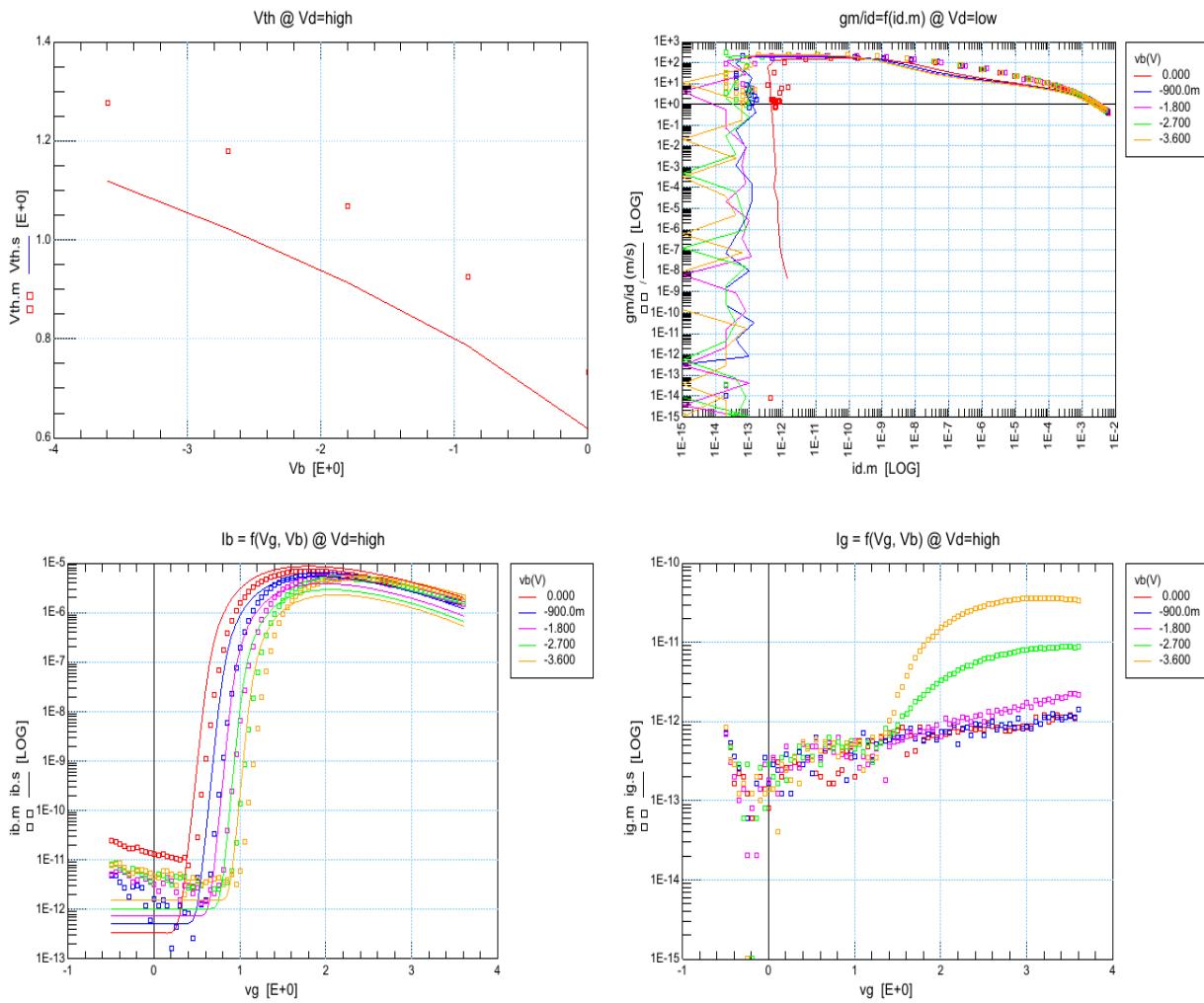
idvg, Vd = 0.1V, T = -40°C



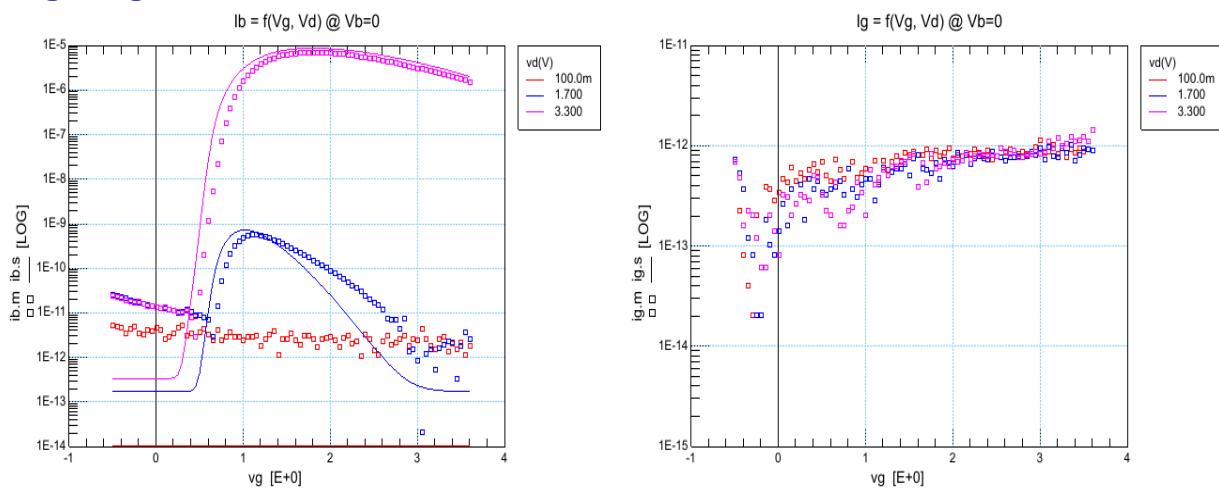


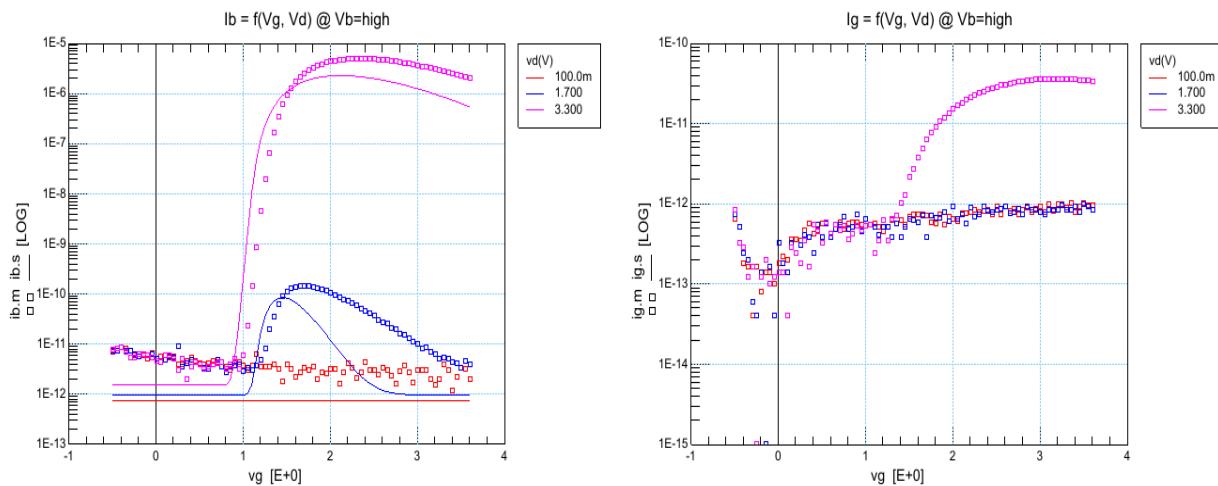
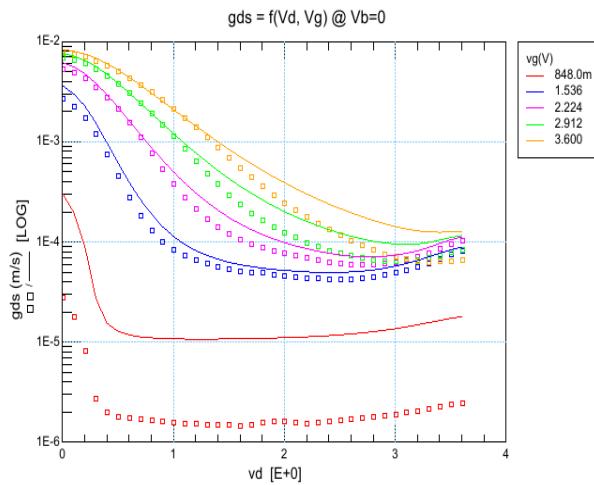
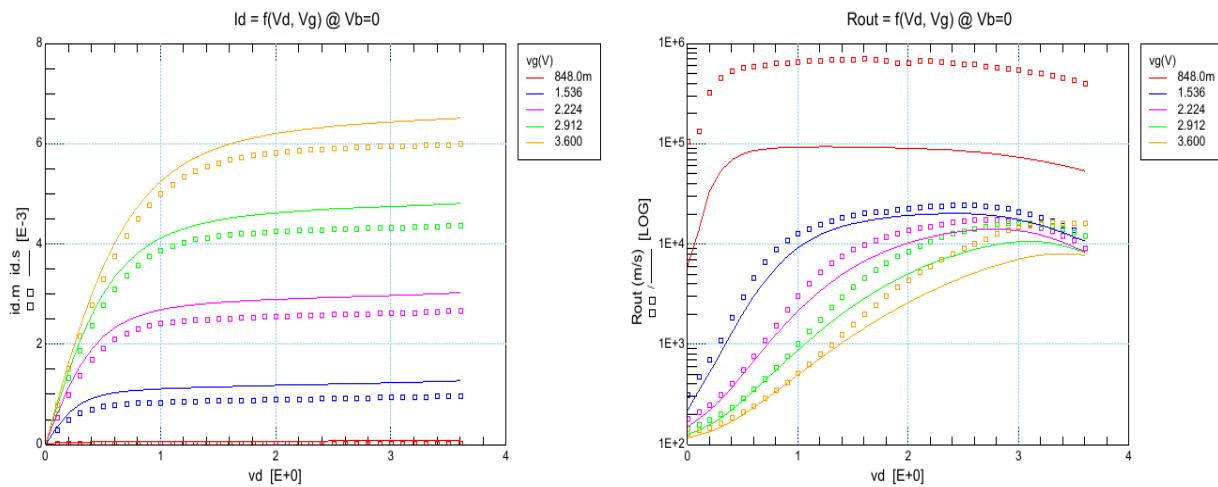
i_{dvg} , $V_d = 3.3V$, $T = -40^\circ\text{C}$

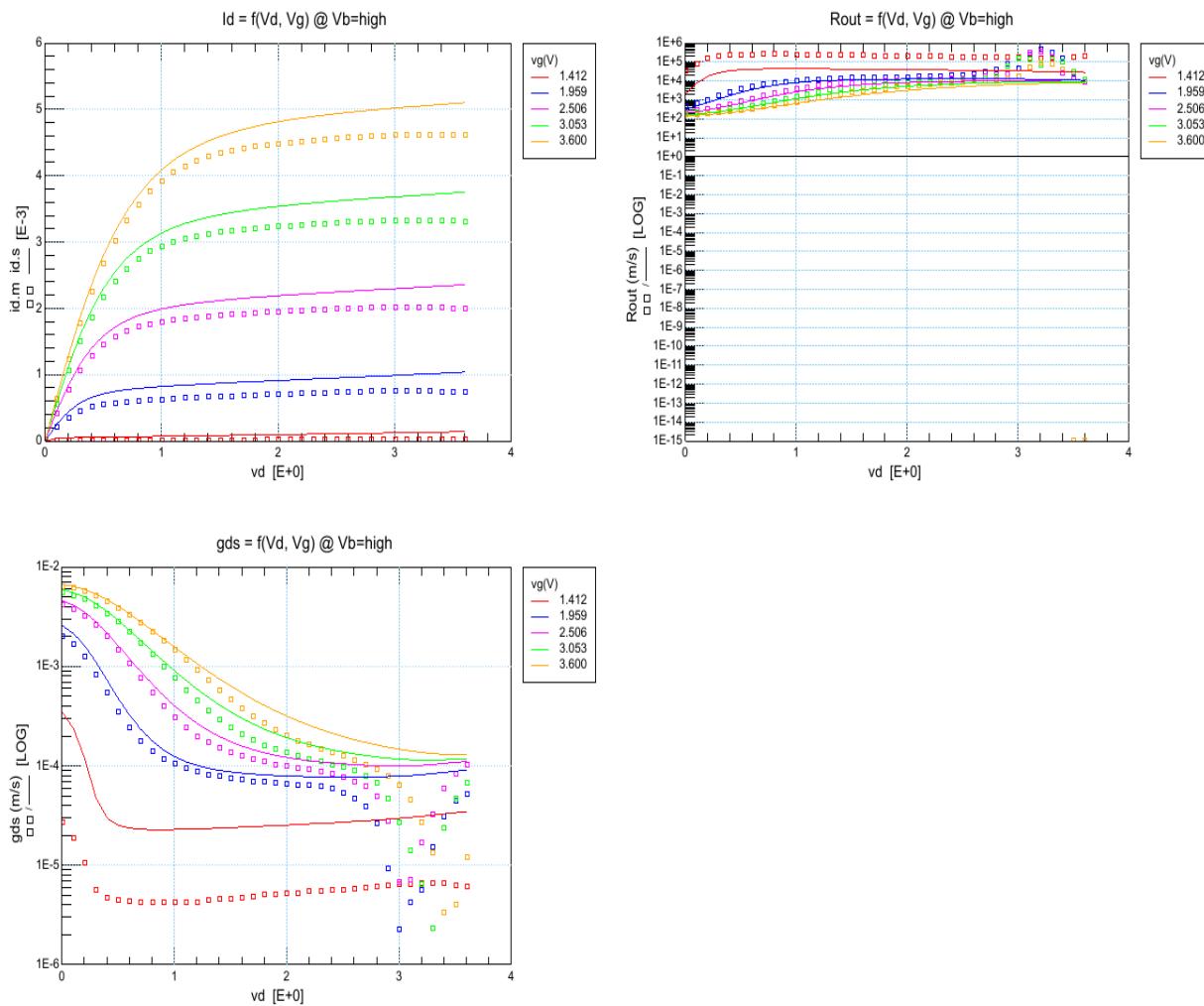
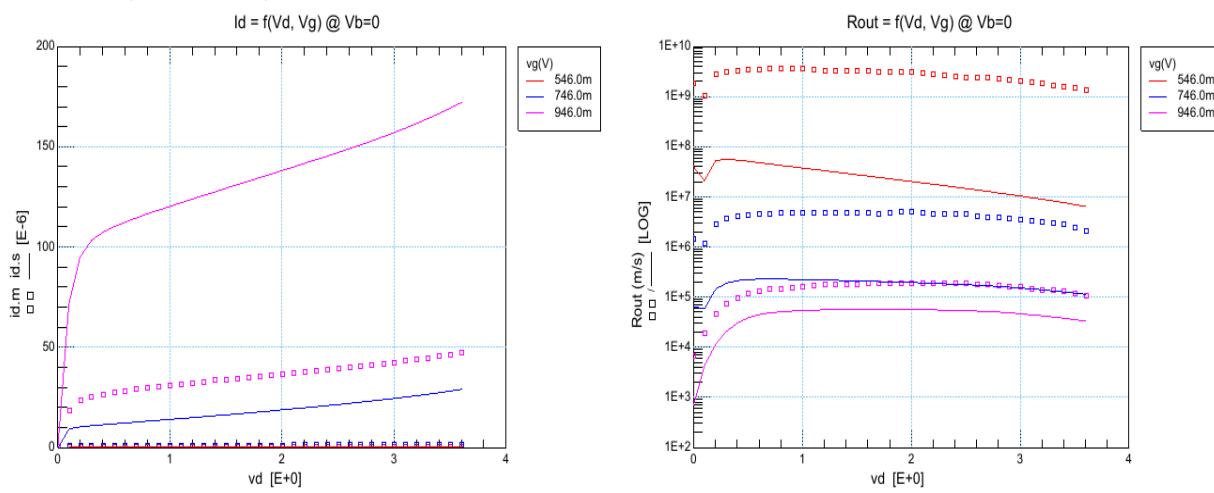


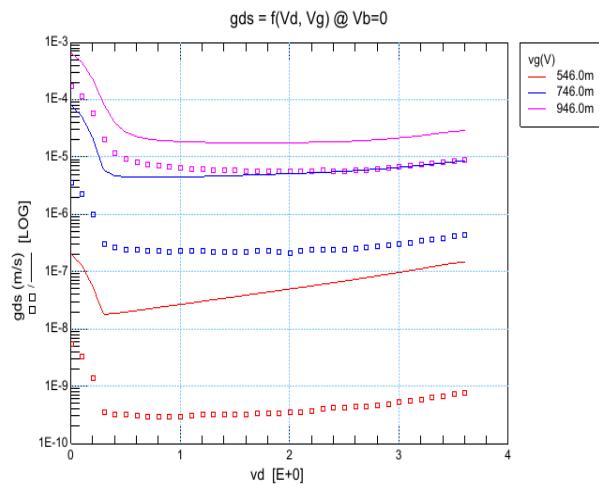


idvg, Ib,Ig, Vb = 0V, T = -40°C

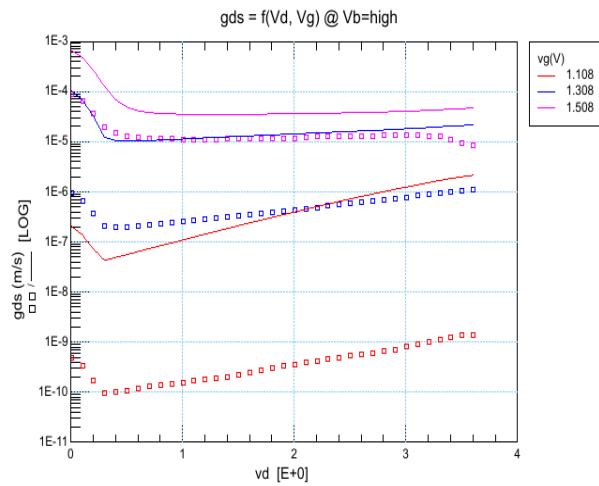
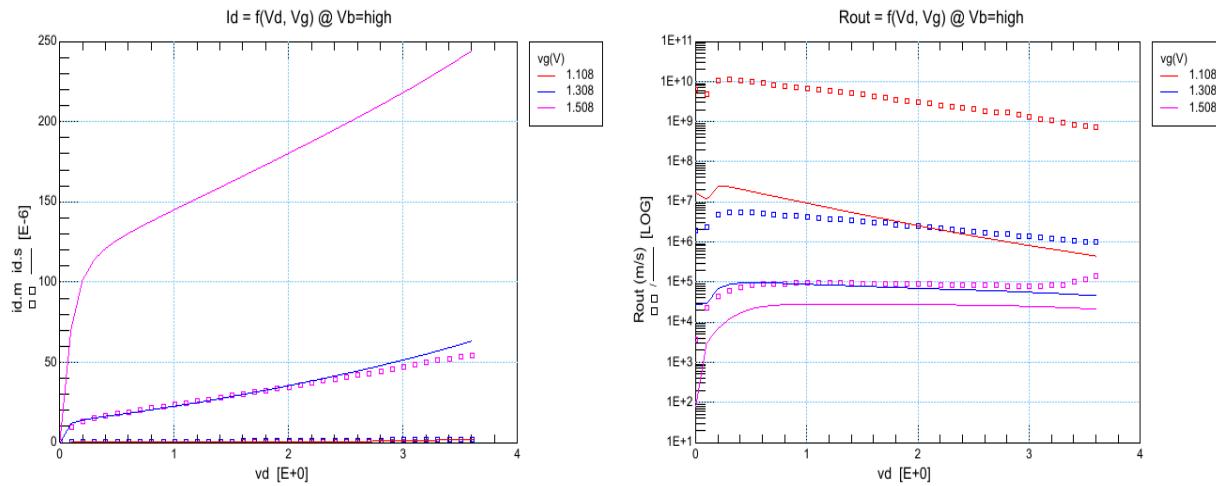


idvg, Ib,Ig, Vb = -3.6V, T = -40°C

idvd, Vb = 0V, T = -40°C


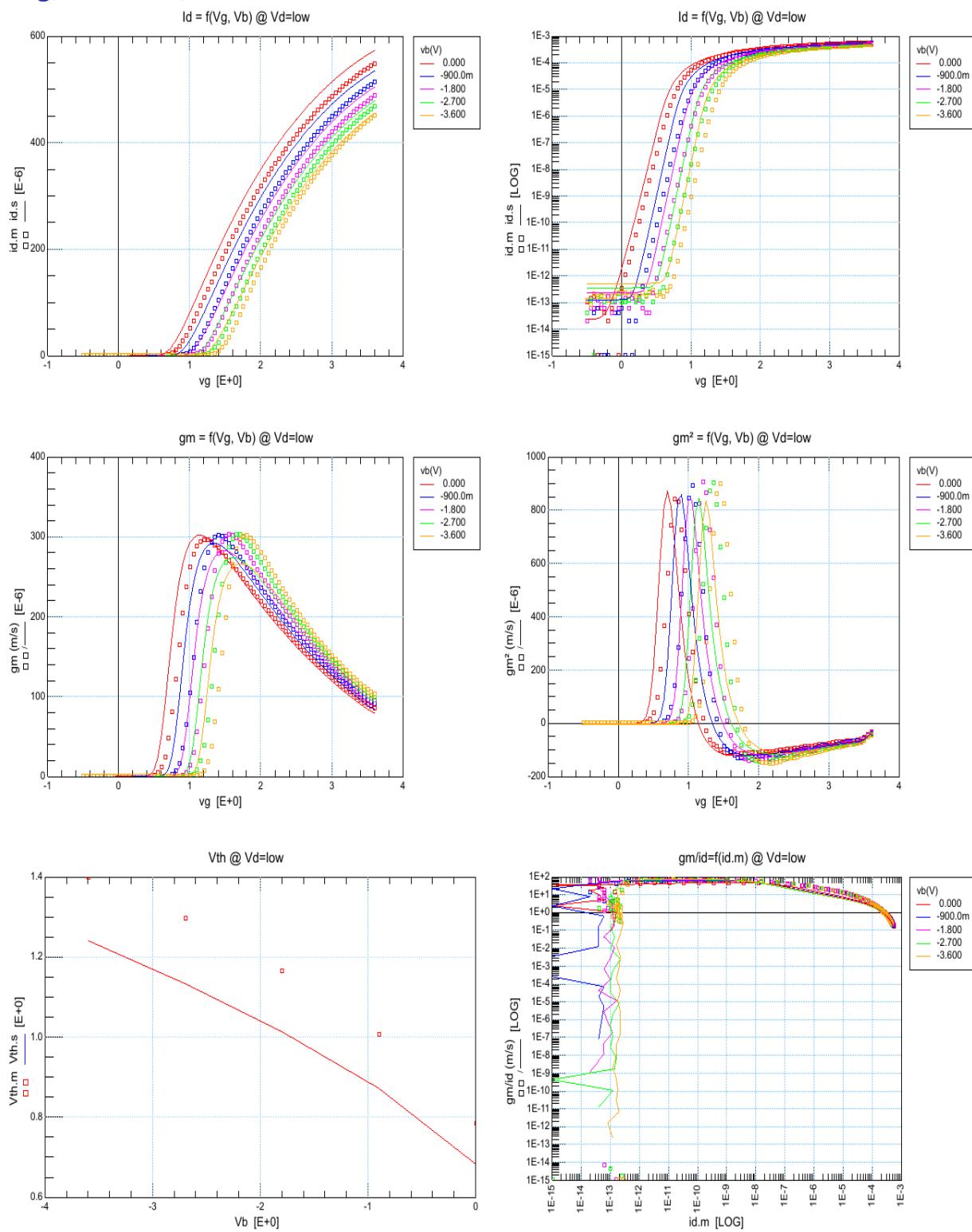
idvd_vbmin, Vb = -3.6V, T = -40°C

idvd_vth, Vb = 0V, T = -40°C


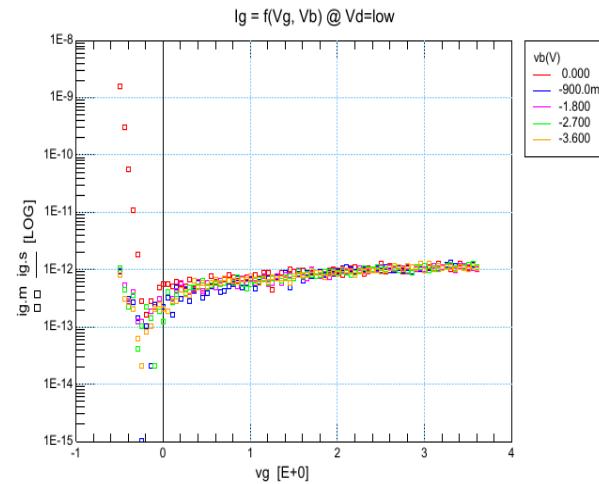
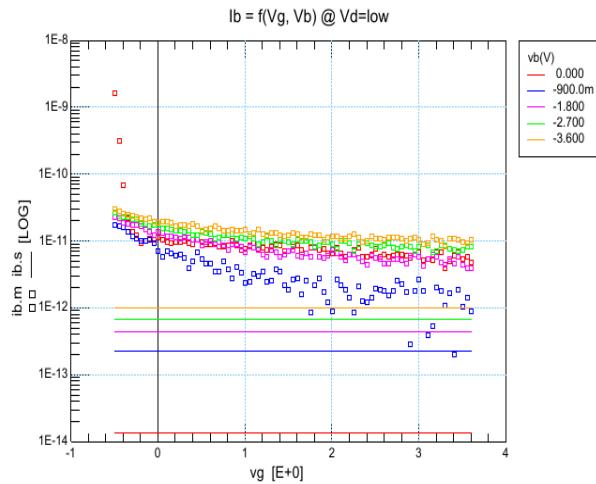


idvd_vth_vbmin, Vb = -3.6V, T = -40°C

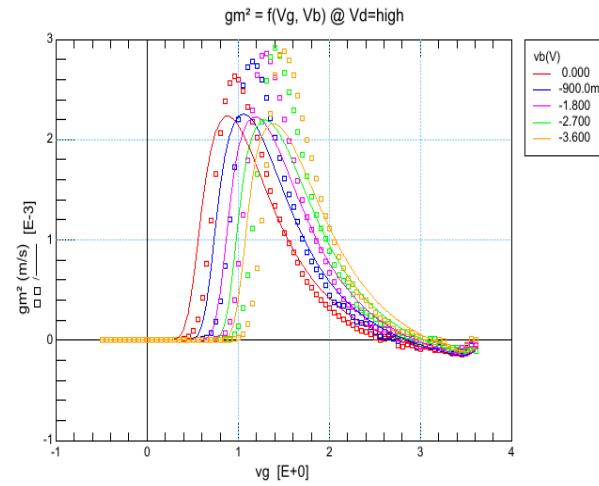
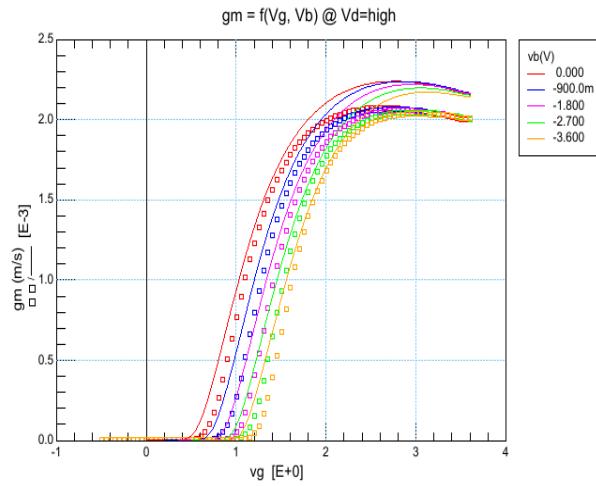
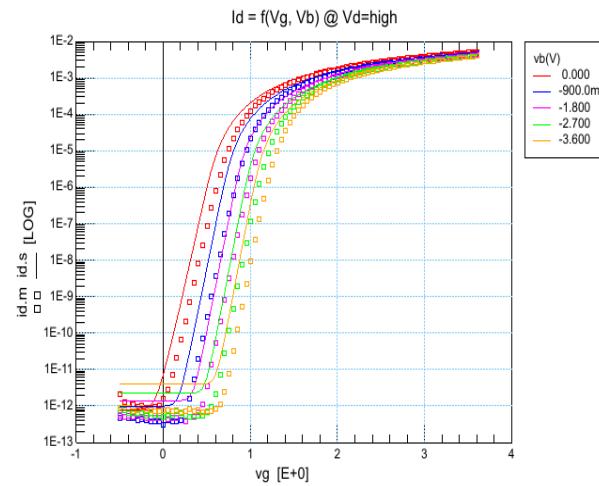
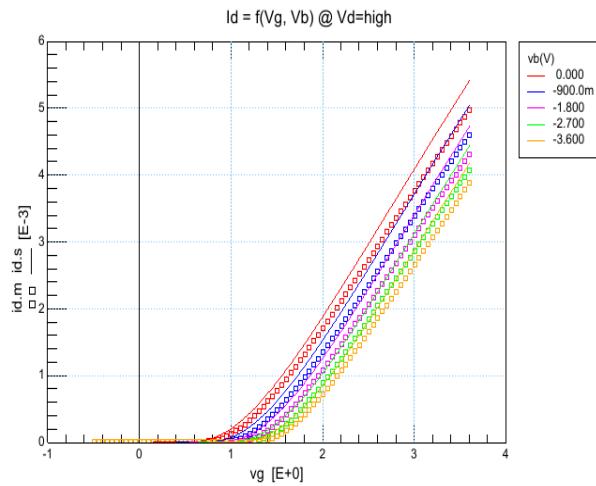


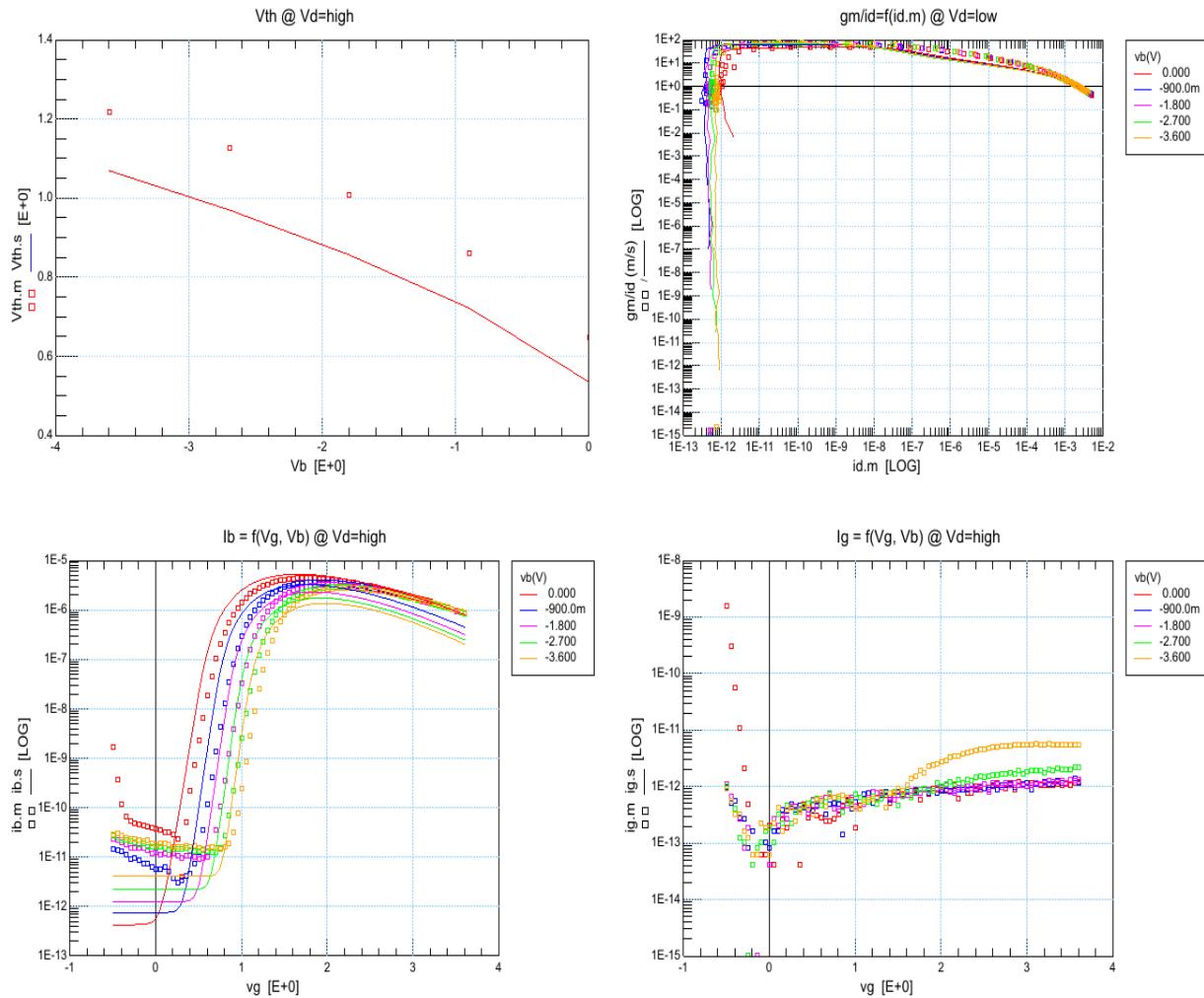
idvg, Vd = 0.1V, T = 70°C



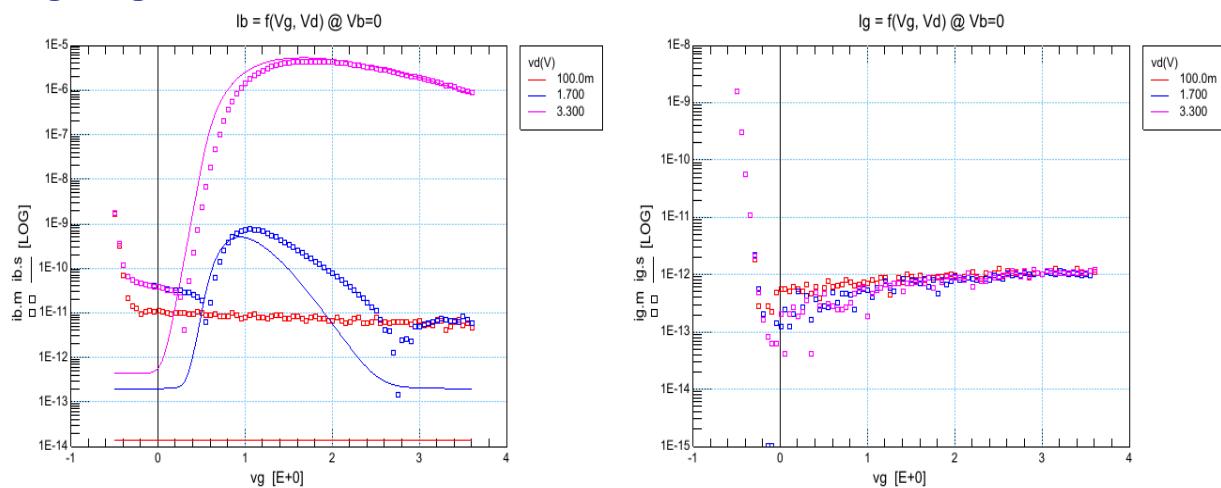


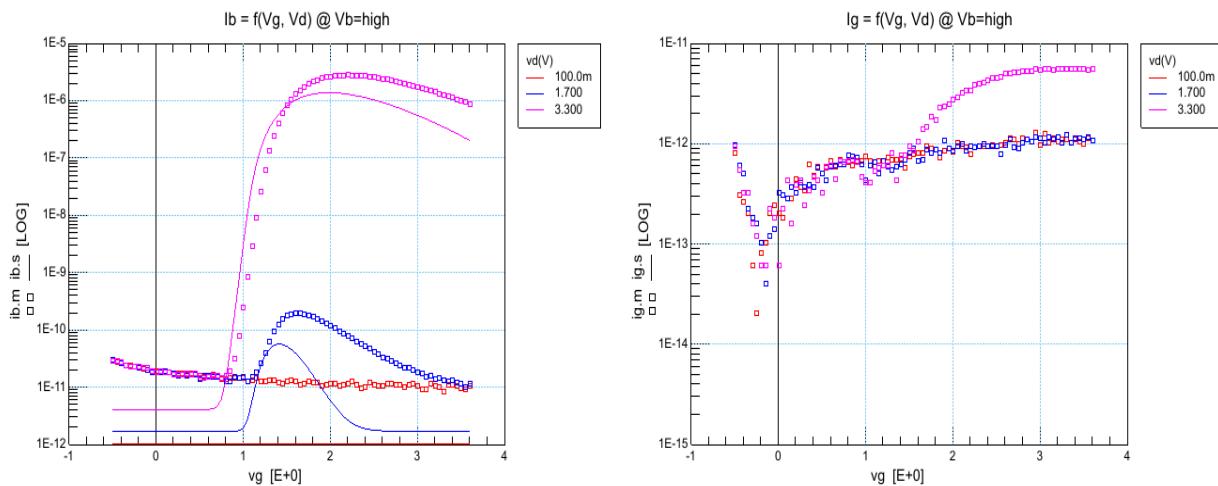
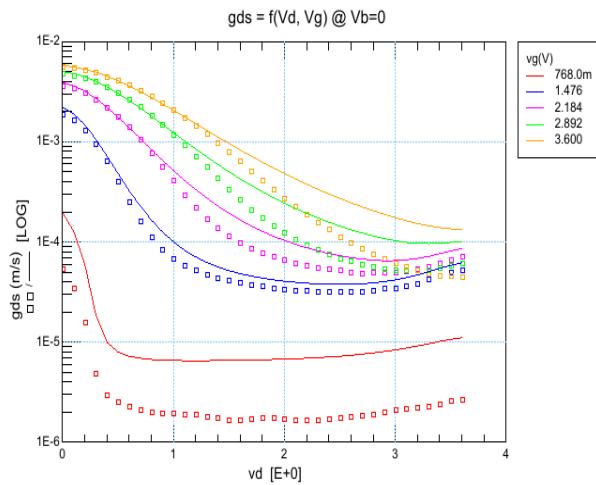
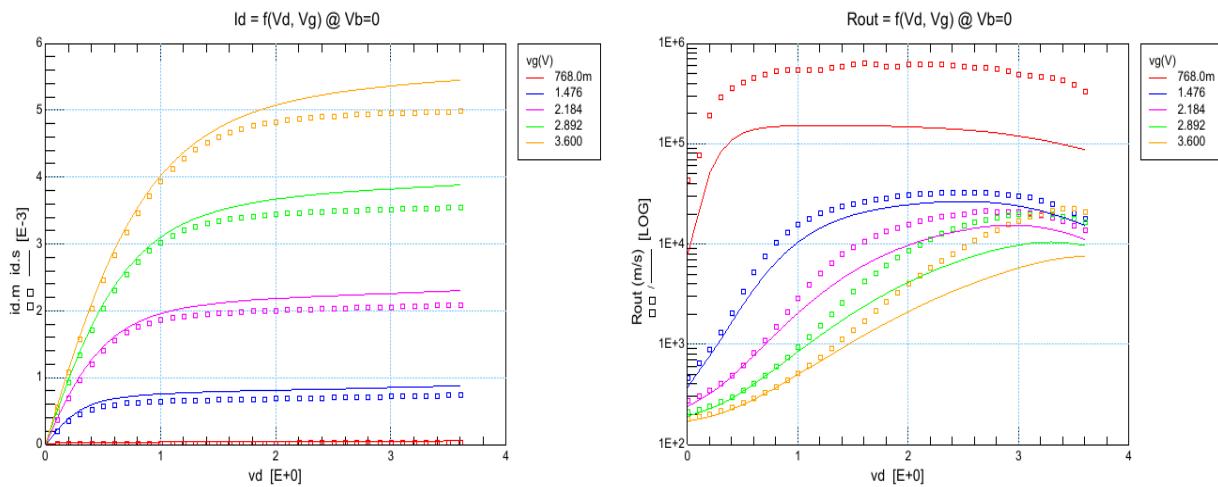
idvg, Vd = 3.3V, T = 70°C

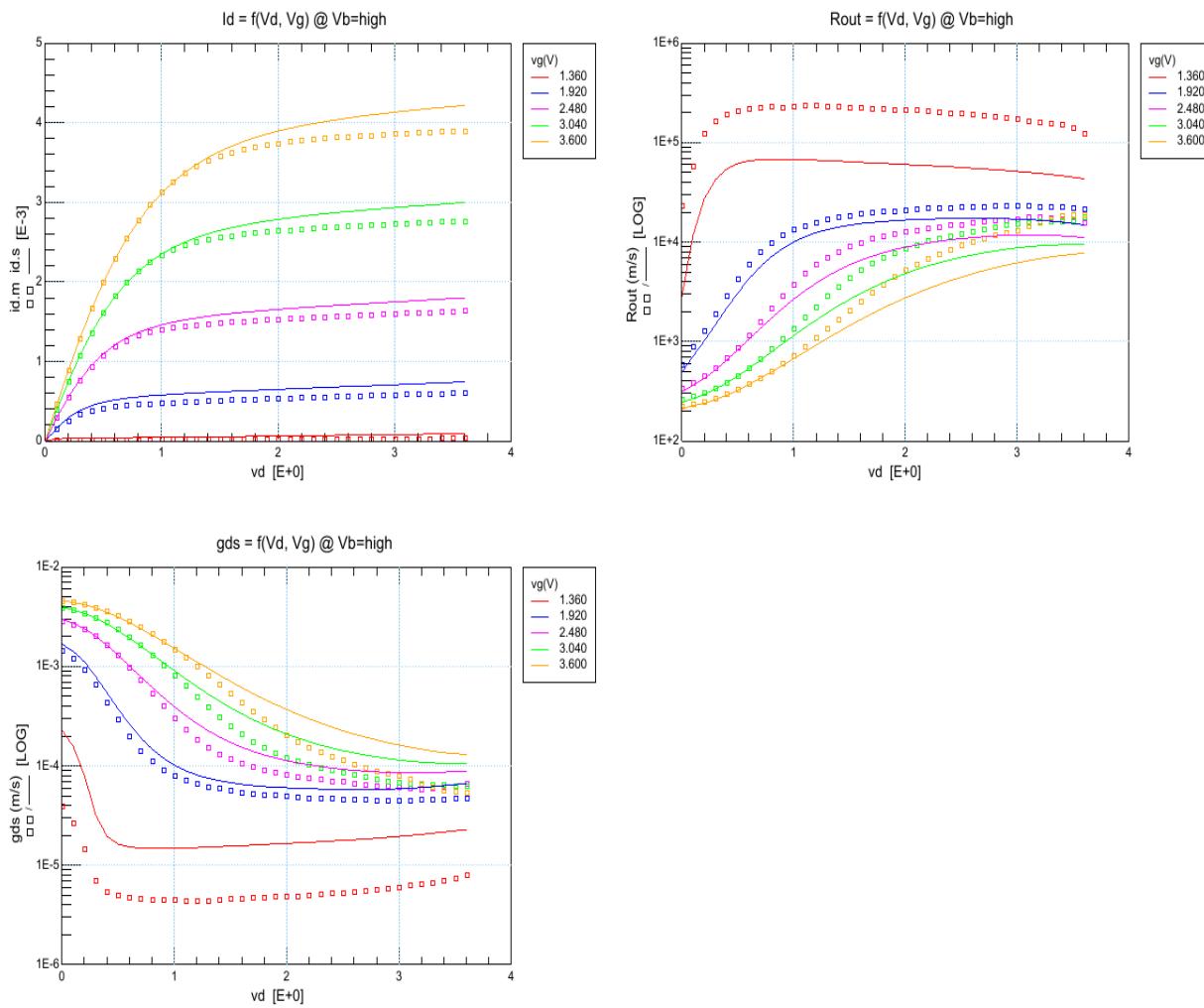
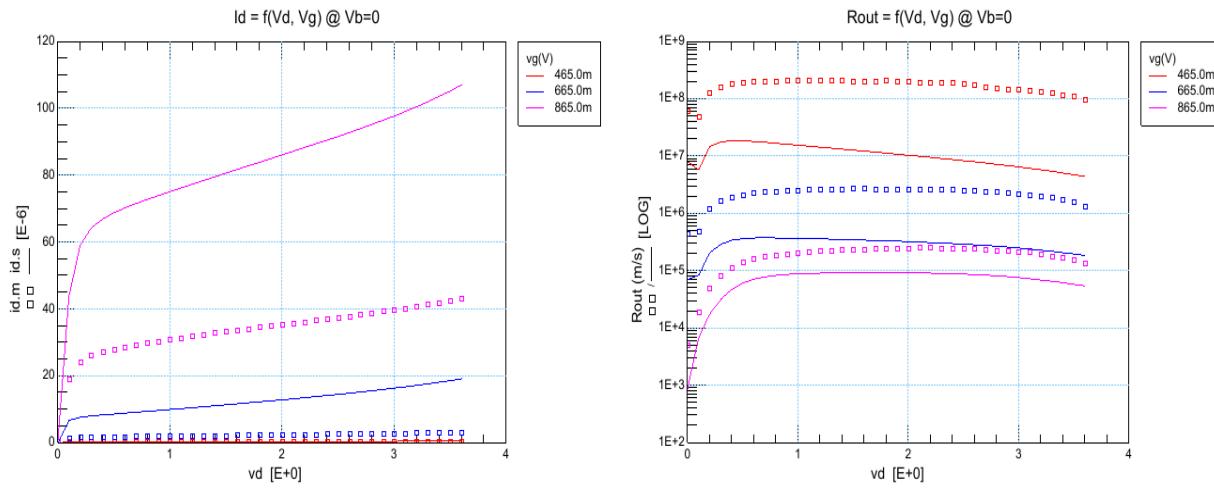


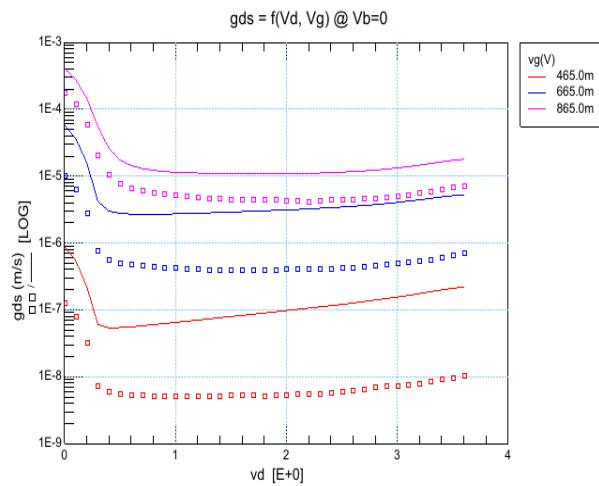


idvg, Ib,Ig, Vb = 0V, T = 70°C

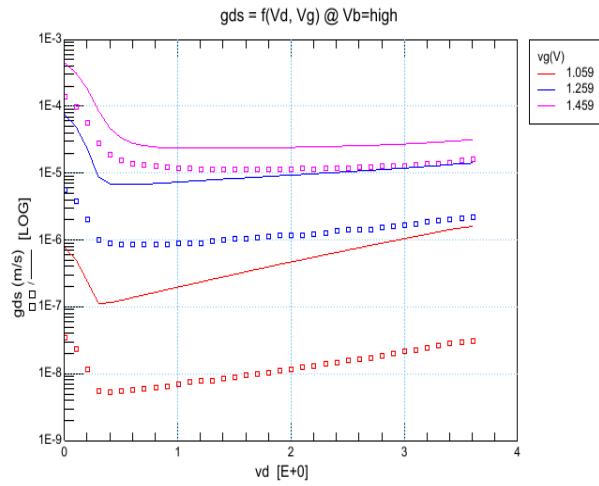
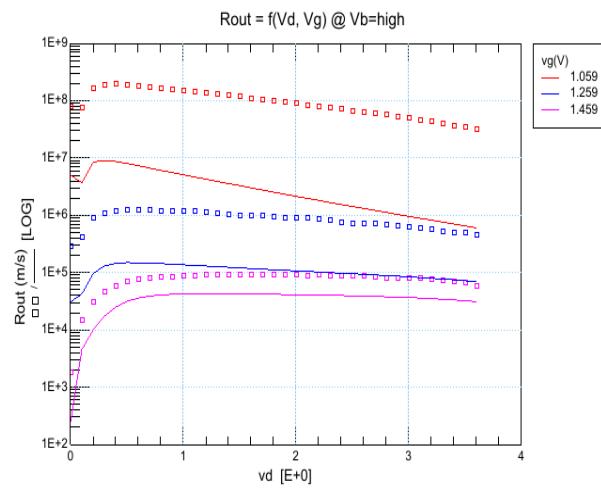
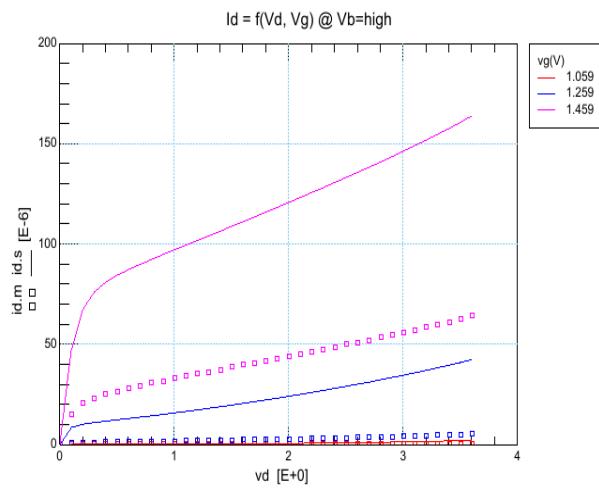


idvg, Ib,Ig, Vb = -3.6V, T = 70°C

idvd, Vb = 0V, T = 70°C


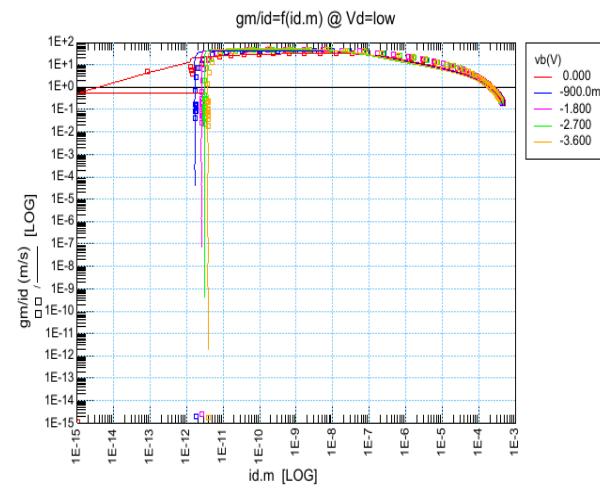
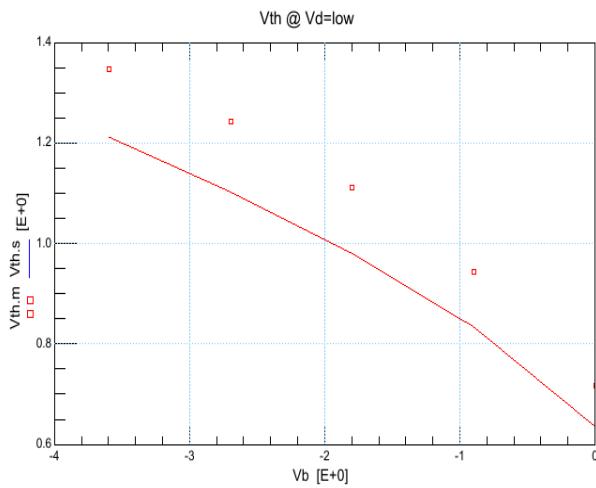
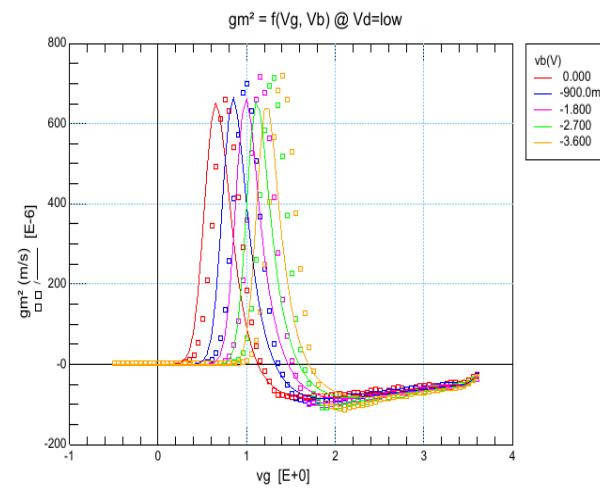
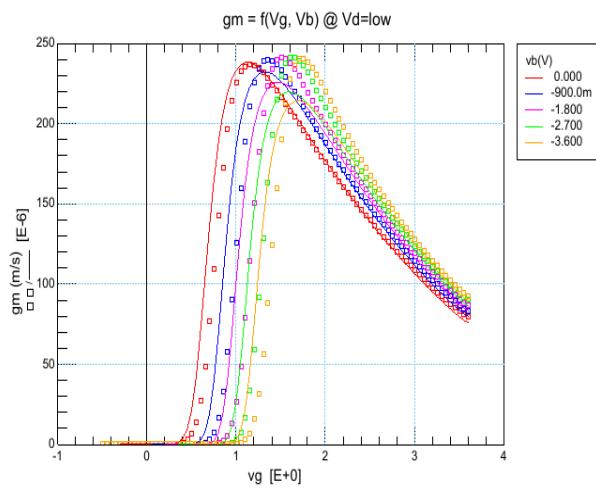
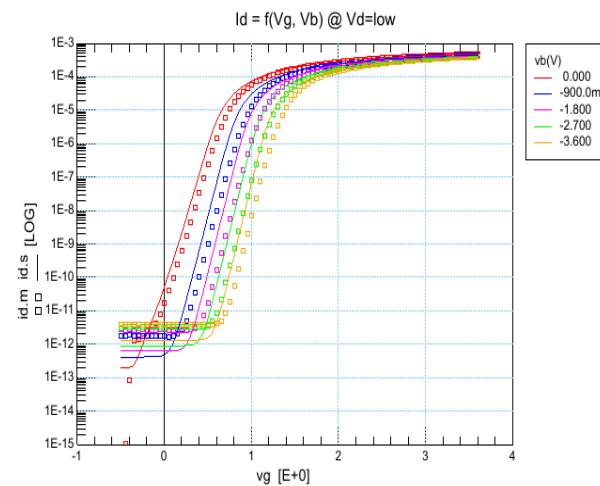
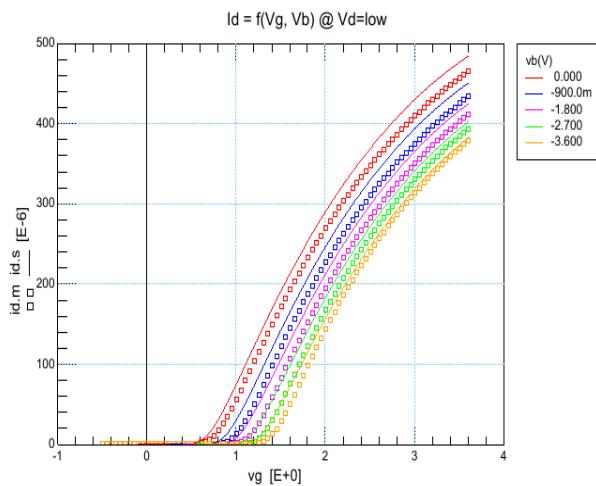
idvd_vbmin, Vb = -3.6V, T = 70°C

idvd_vth, Vb = 0V, T = 70°C


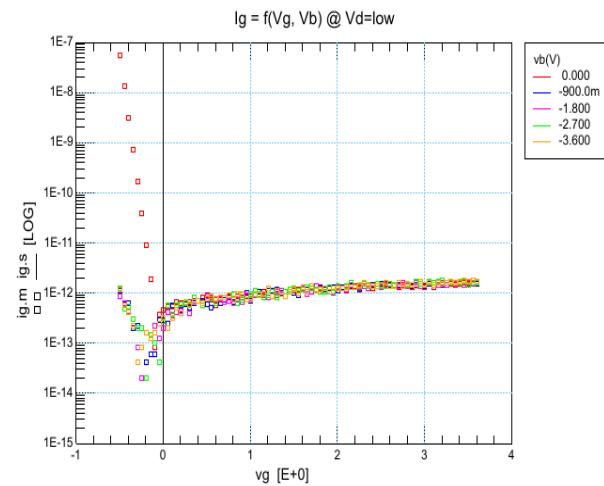
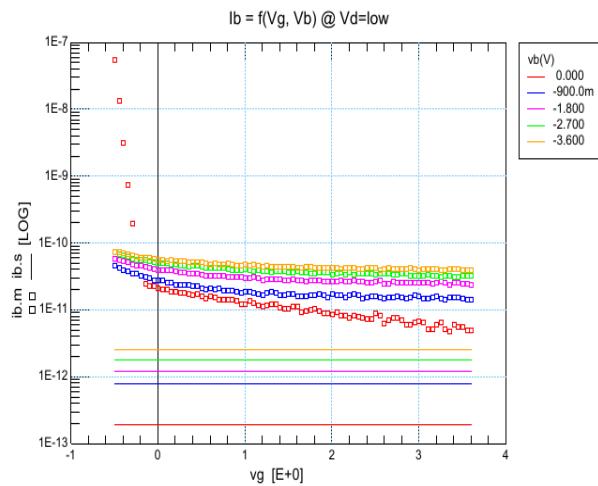


idvd_vth_vbmin, Vb = -3.6V, T = 70°C

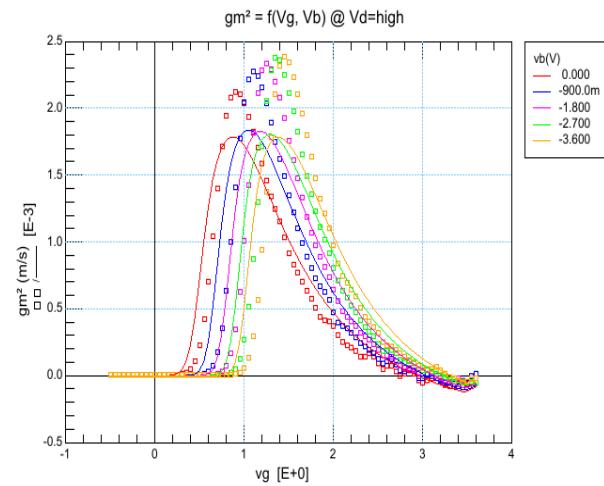
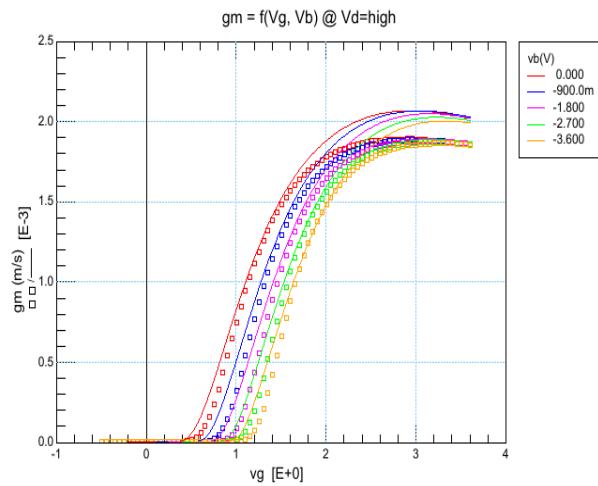
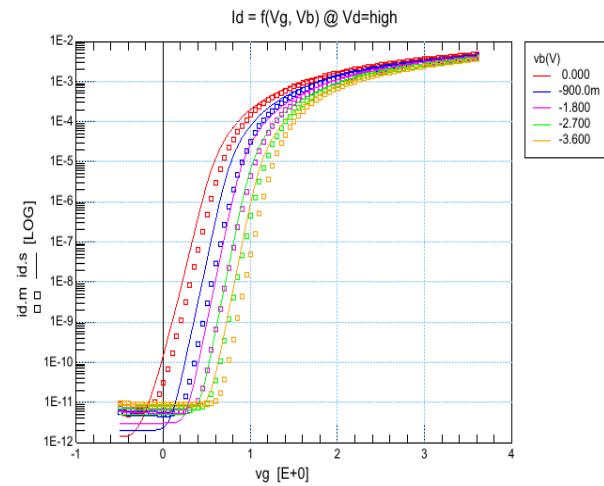
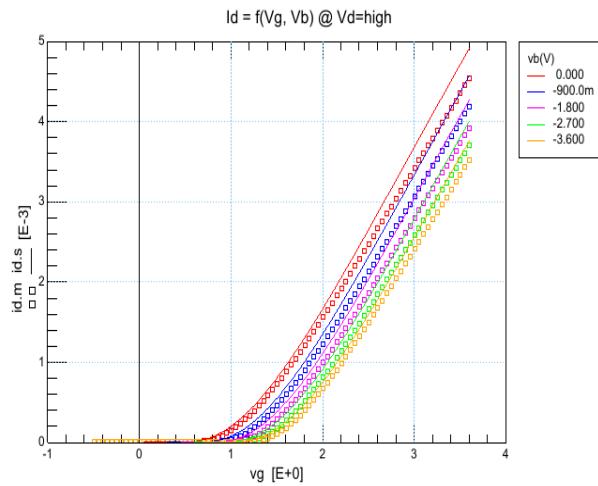


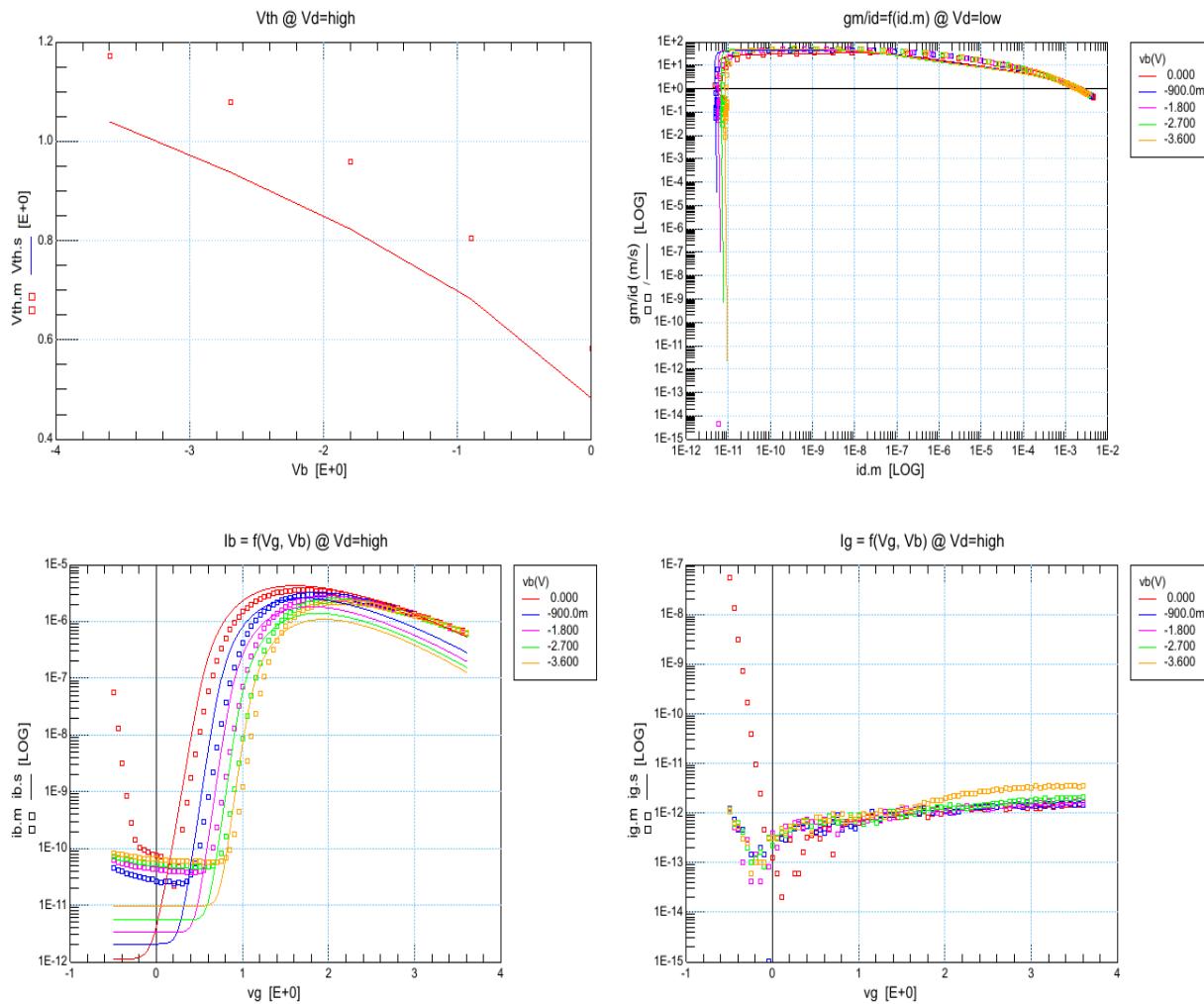
idvg, Vd = 0.1V, T = 125°C



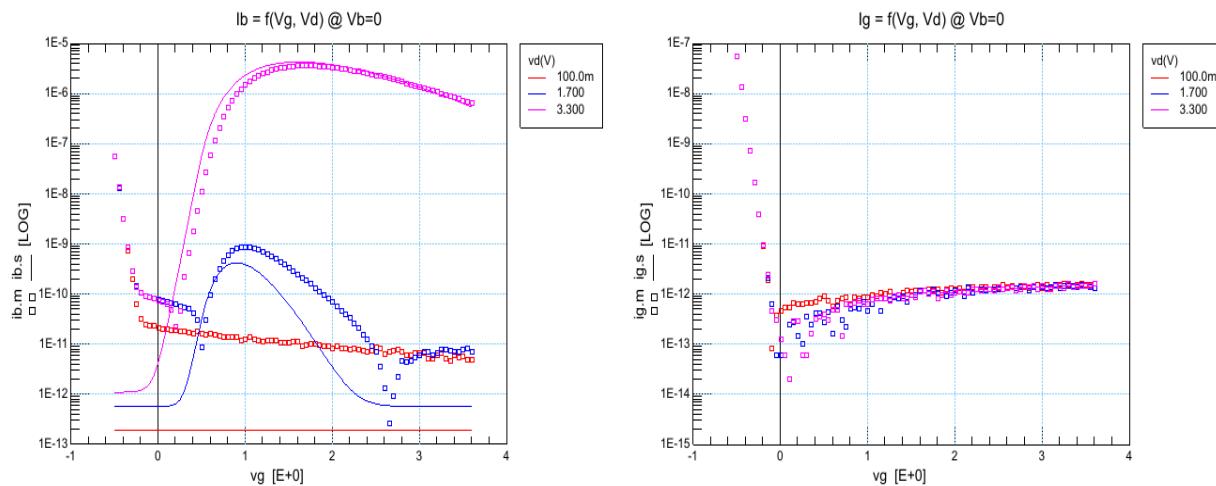


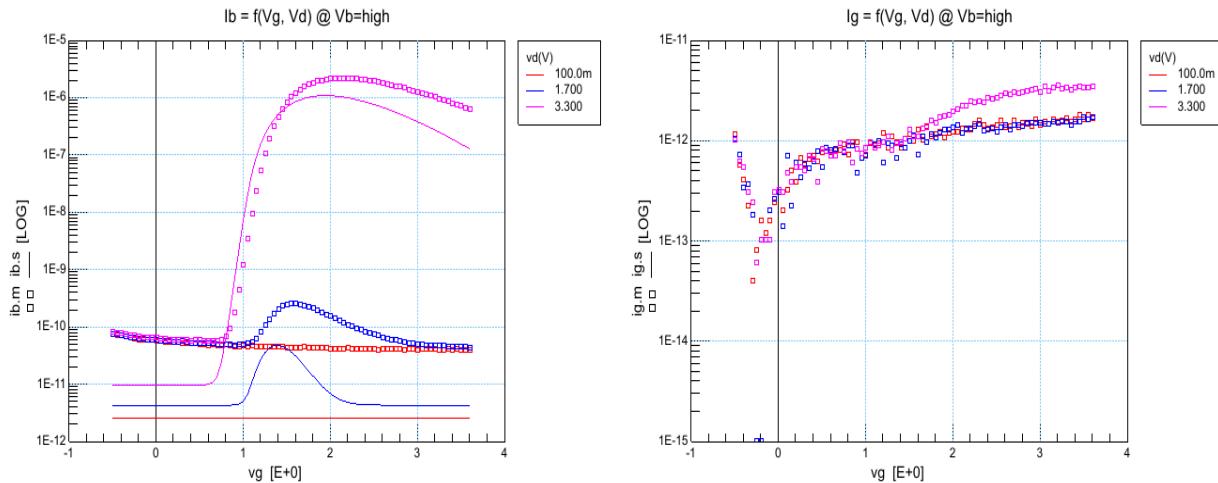
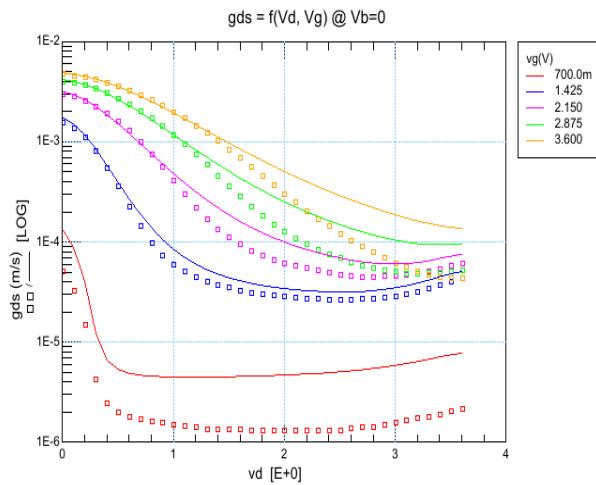
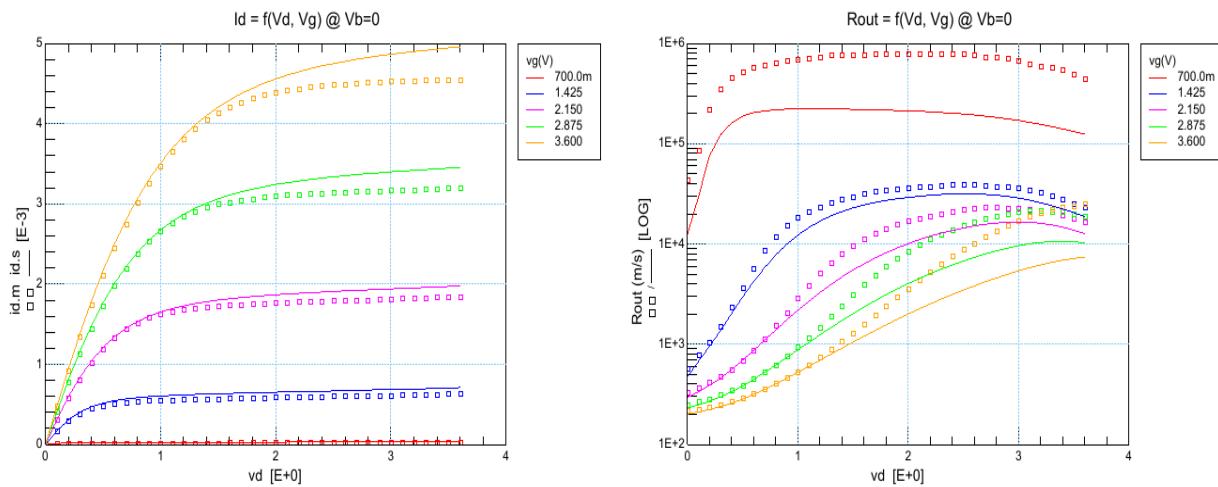
$i_{dvg}, V_d = 3.3V, T = 125^\circ\text{C}$

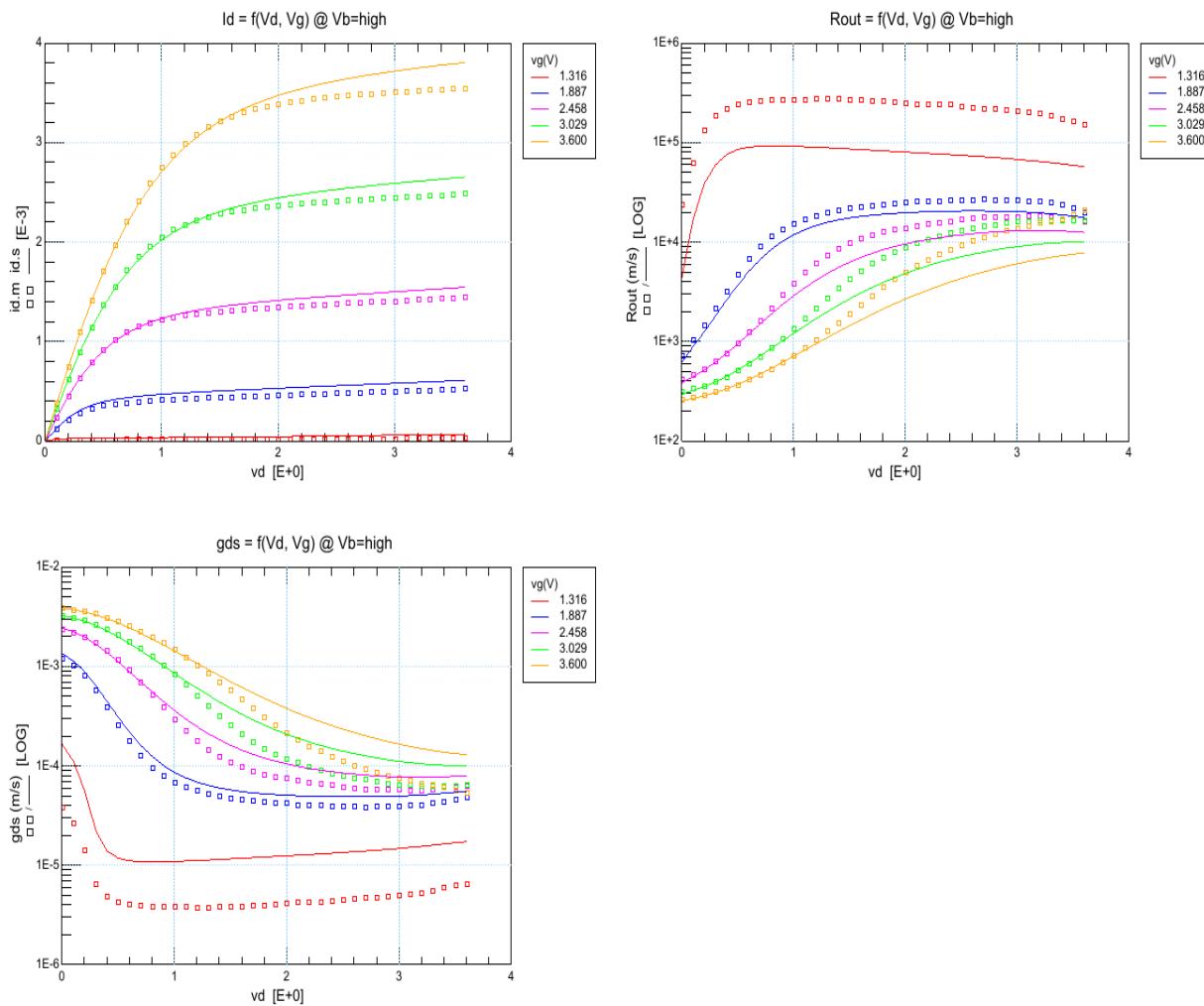
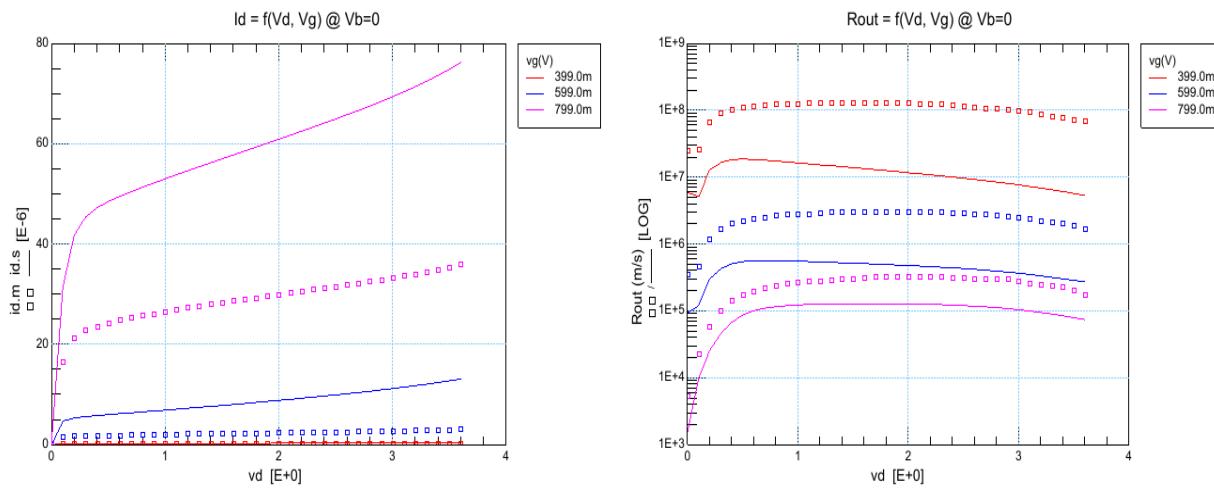


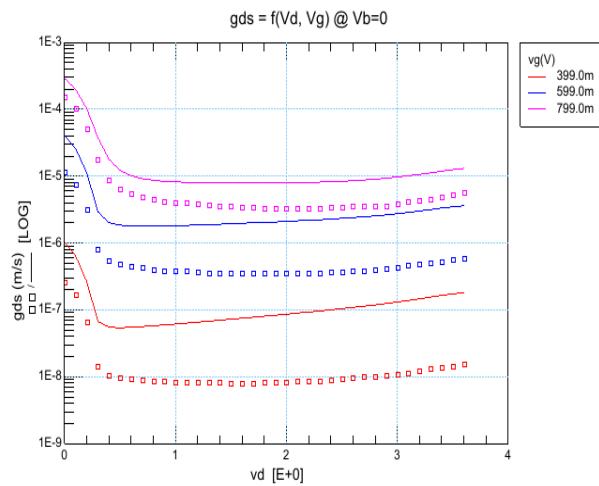


idvg, Ib,Ig, Vb = 0V, T = 125°C

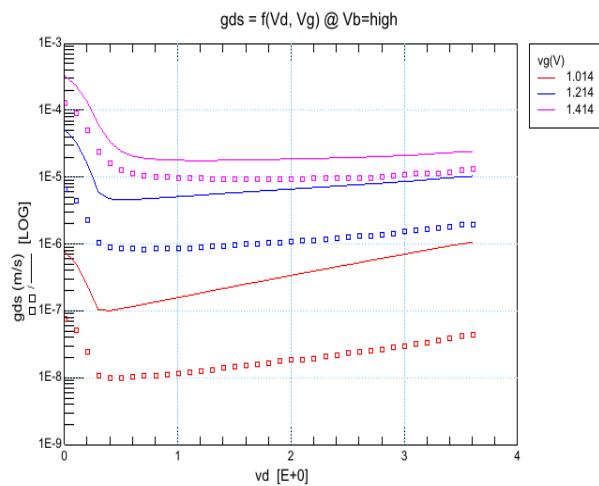
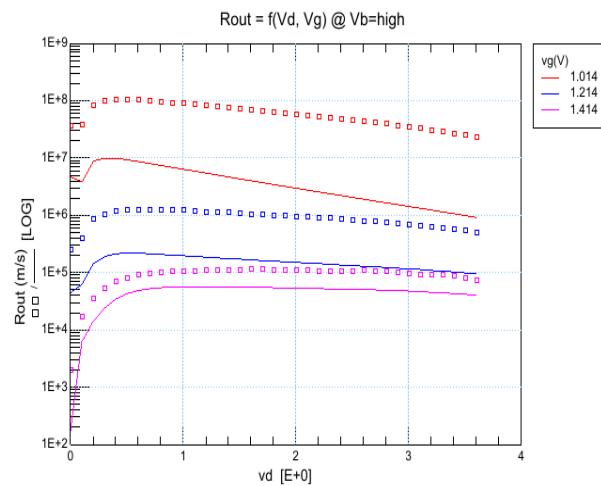
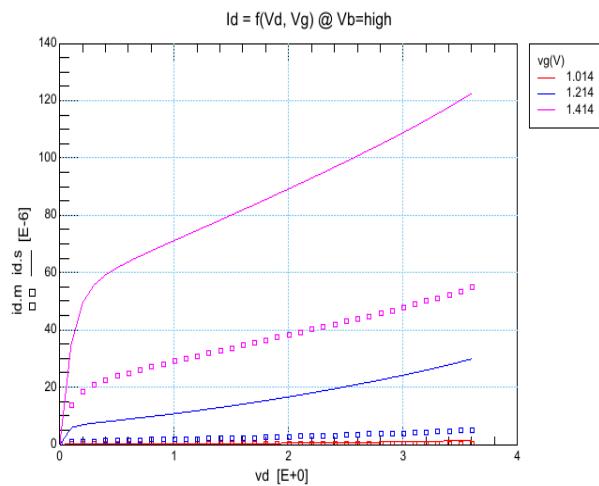


idvg, Ib,Ig, Vb = -3.6V, T = 125°C

idvd, Vb = 0V, T = 125°C


idvd_vbmin, Vb = -3.6V, T = 125°C

idvd_vth, Vb = 0V, T = 125°C


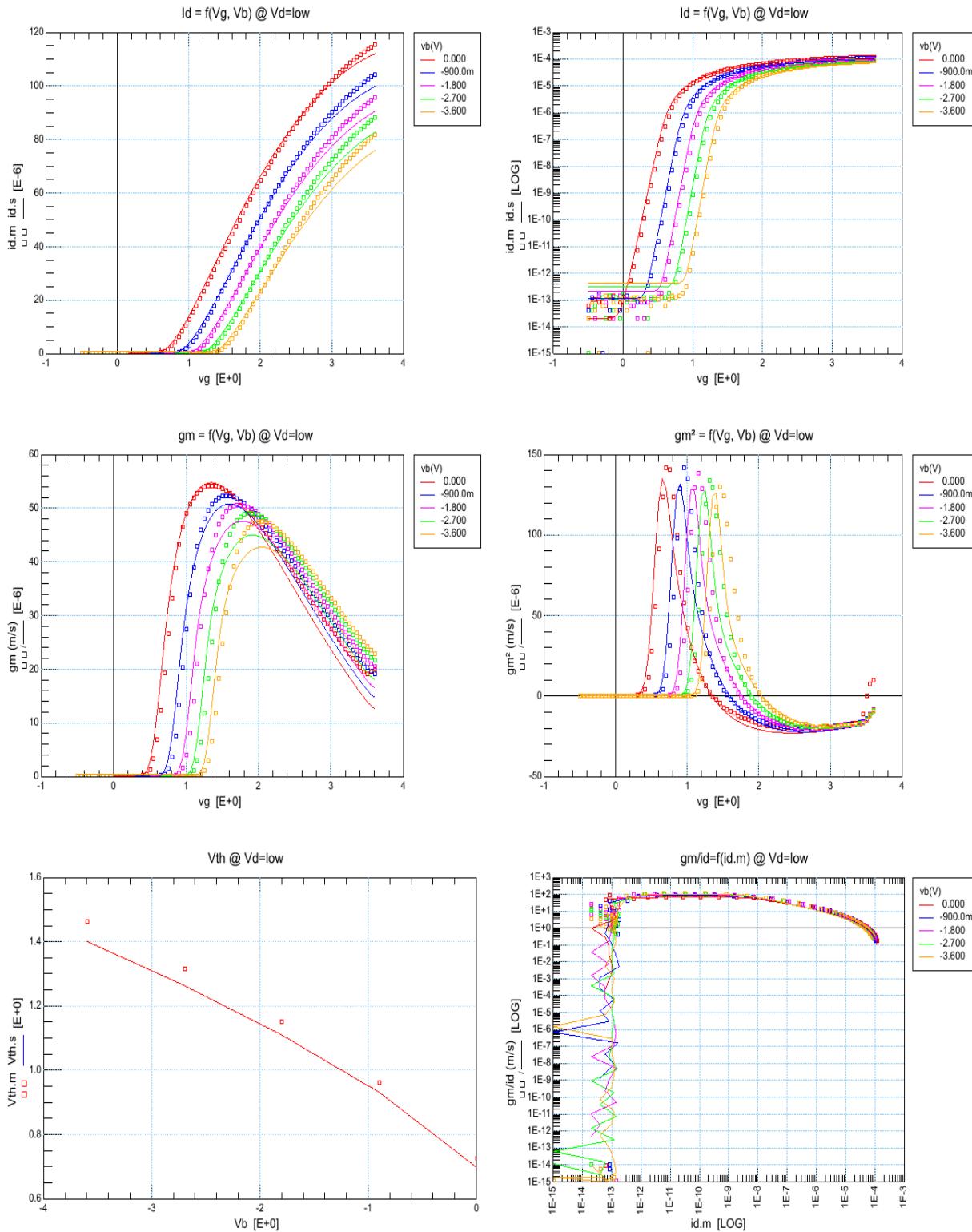


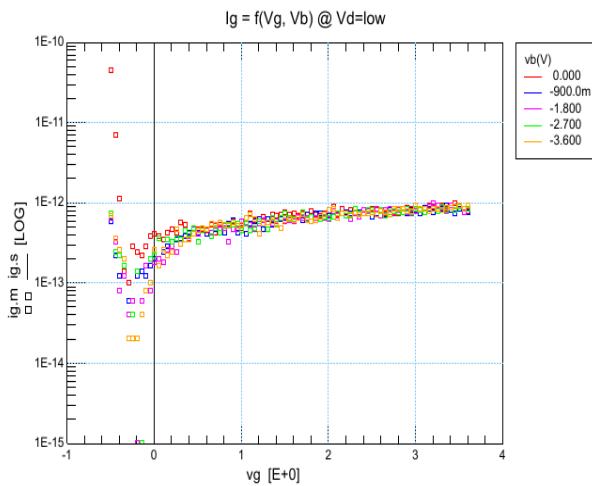
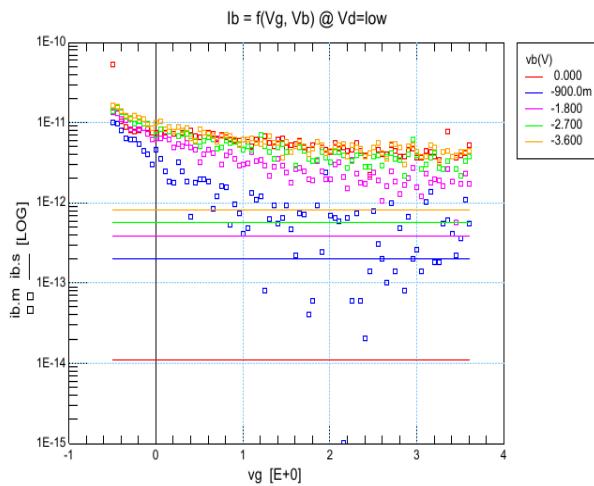
idvd_vth_vbmin, Vb = -3.6V, T = 125°C



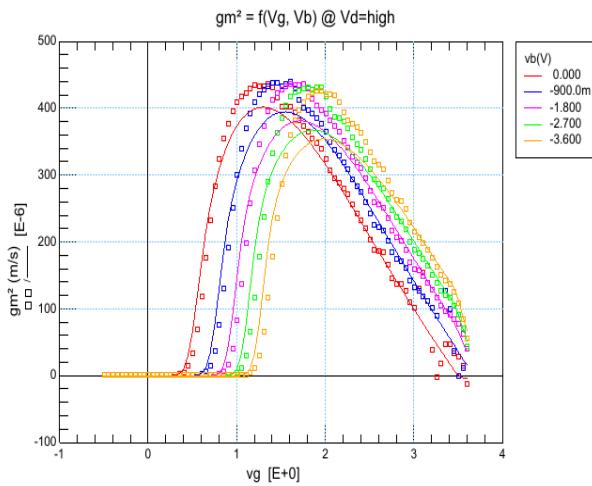
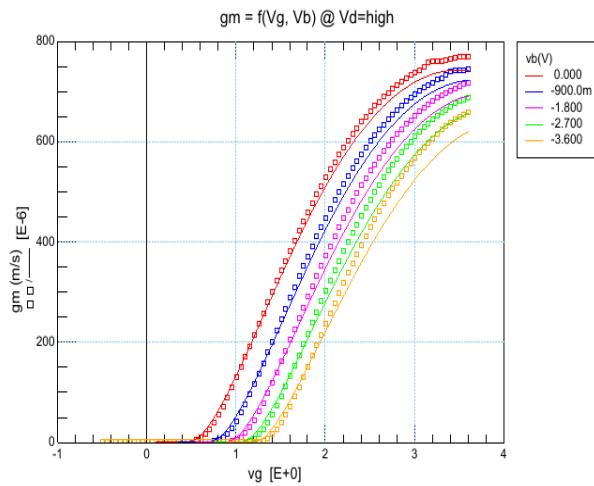
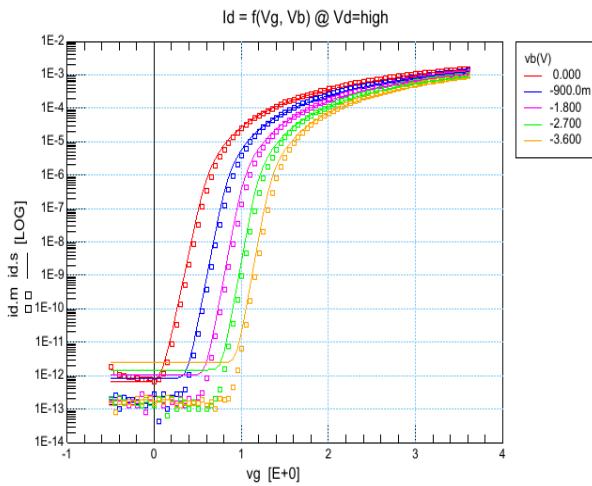
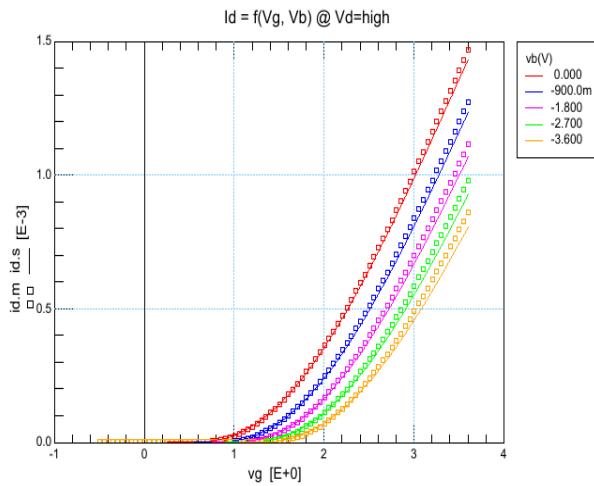
4.9 W10u0_L3u0_S557_1

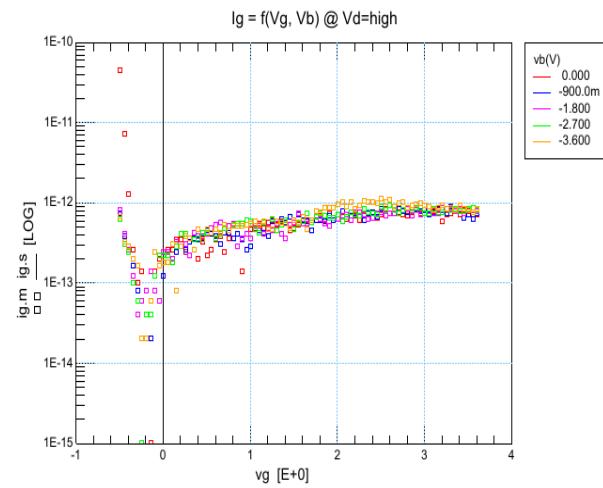
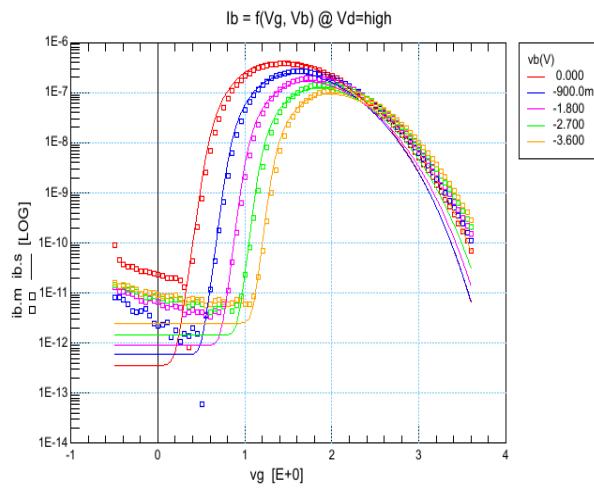
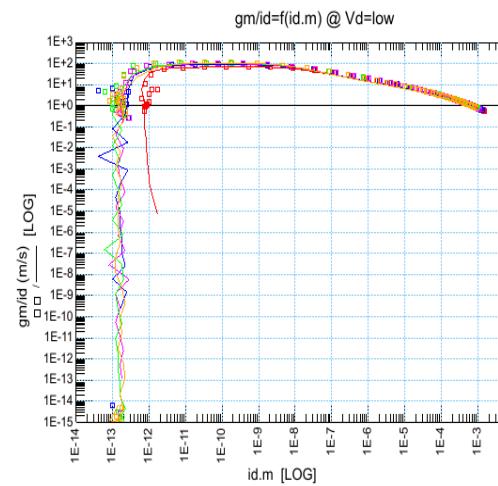
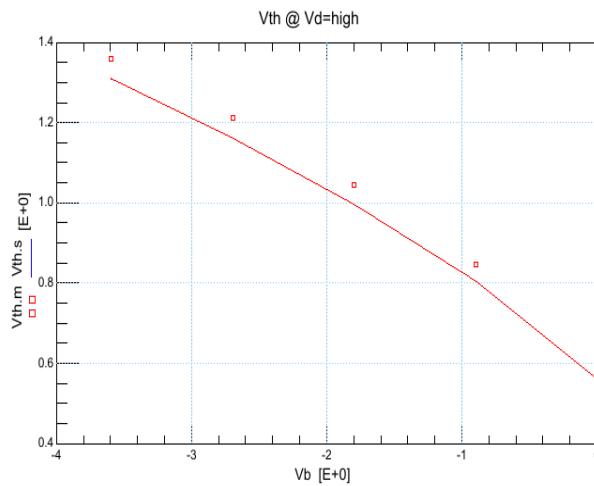
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



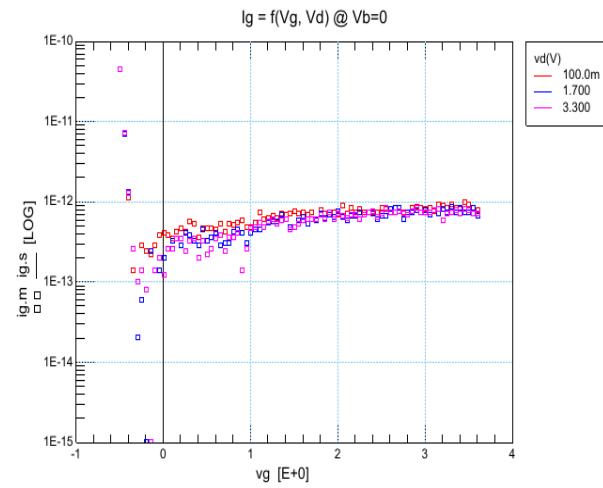
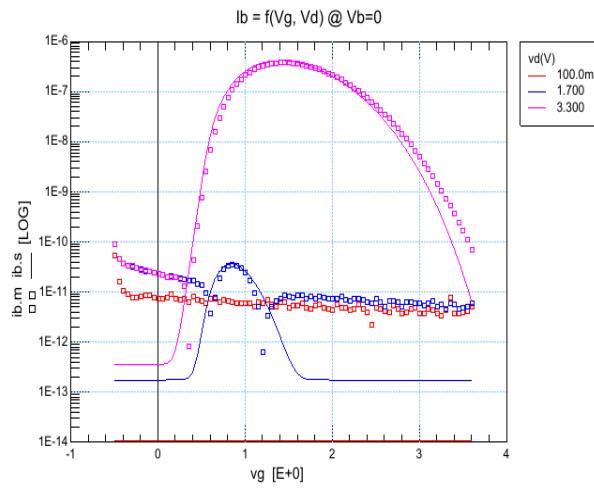


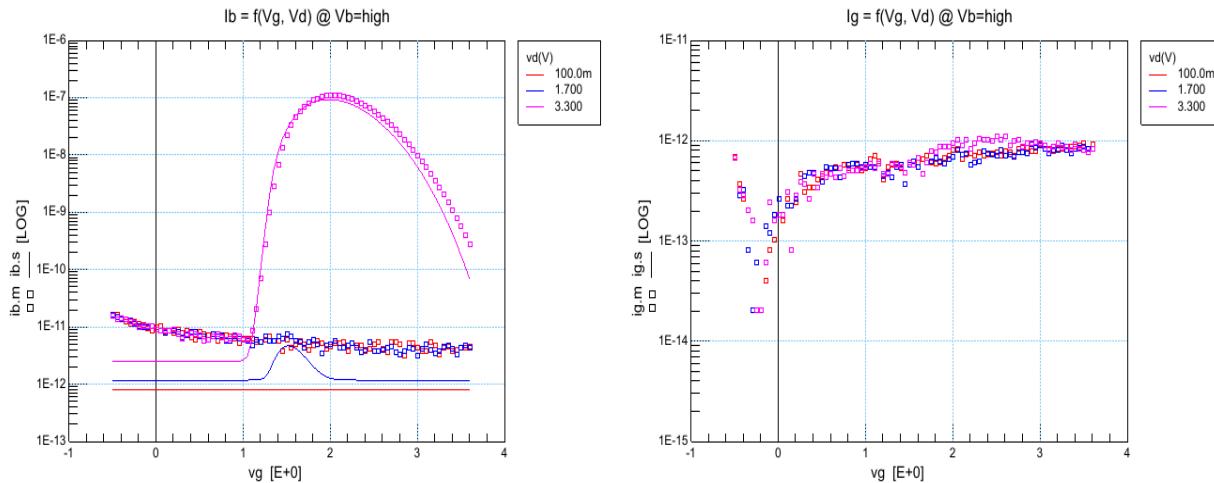
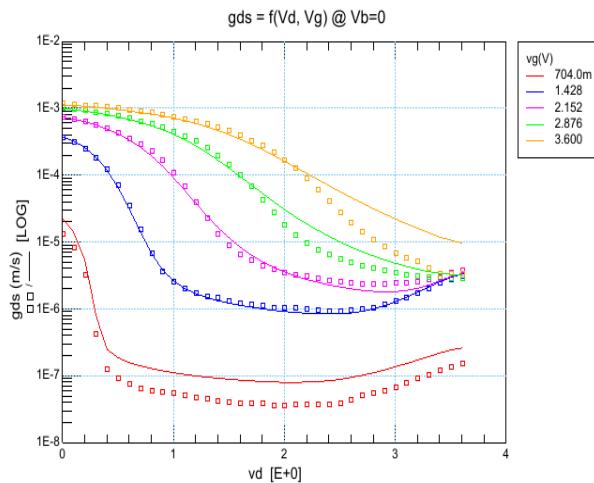
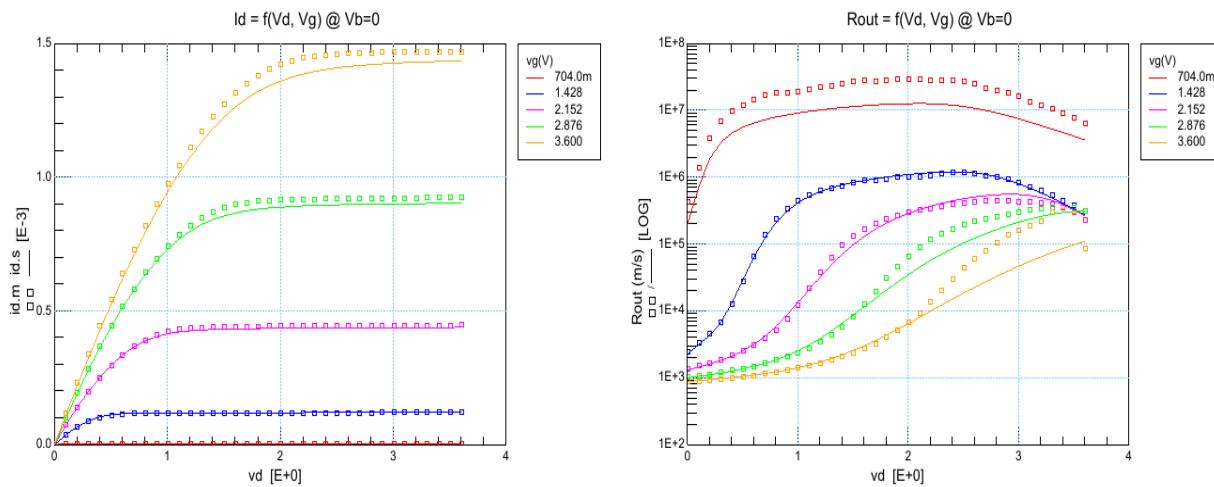
idvg, Vd = 3.3V, T = 27°C

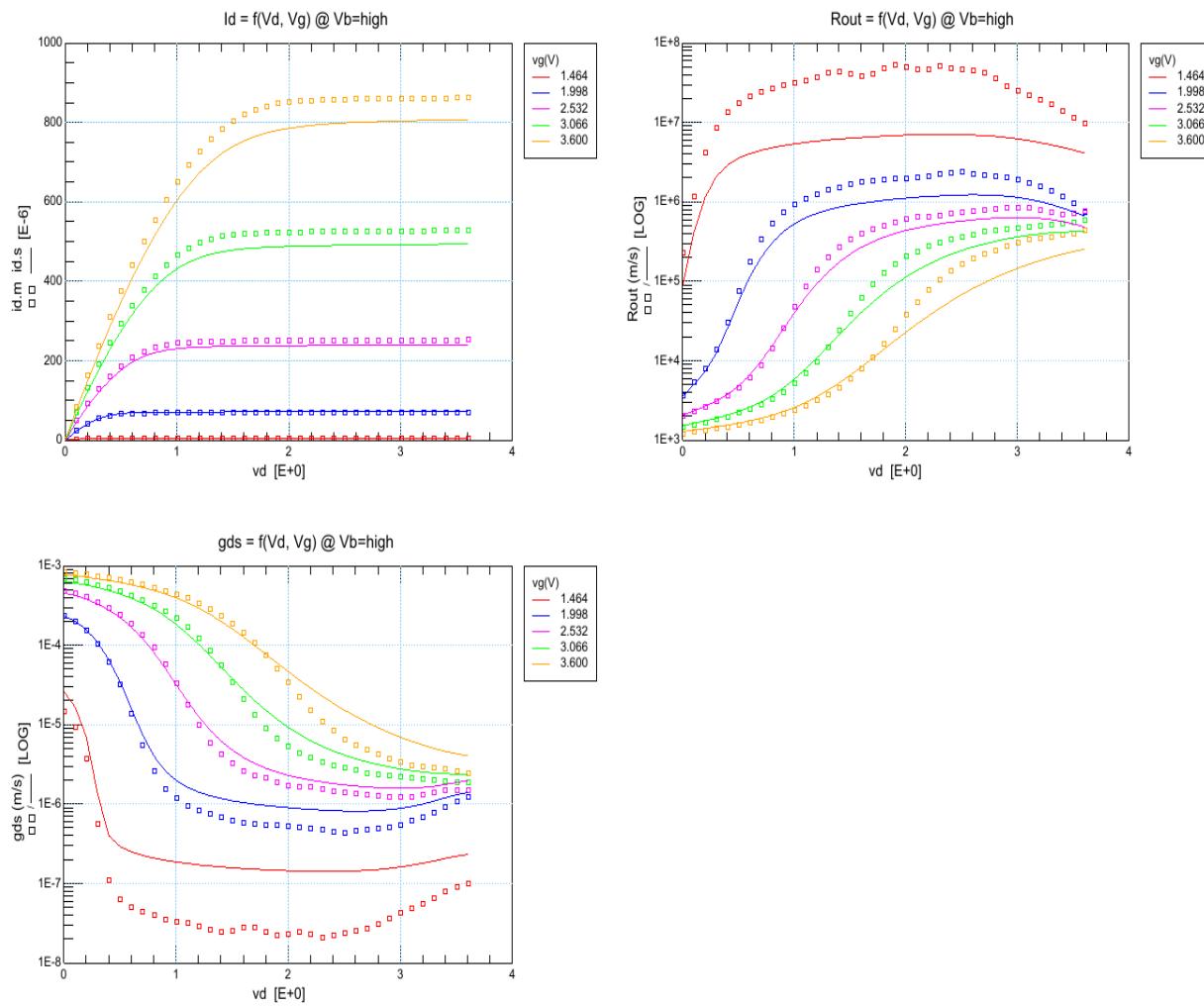
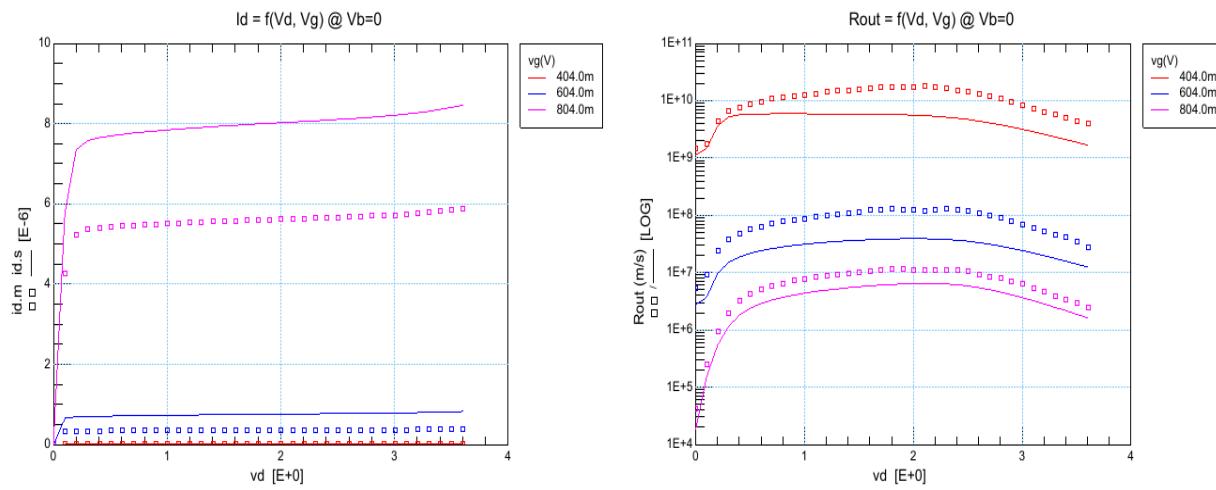


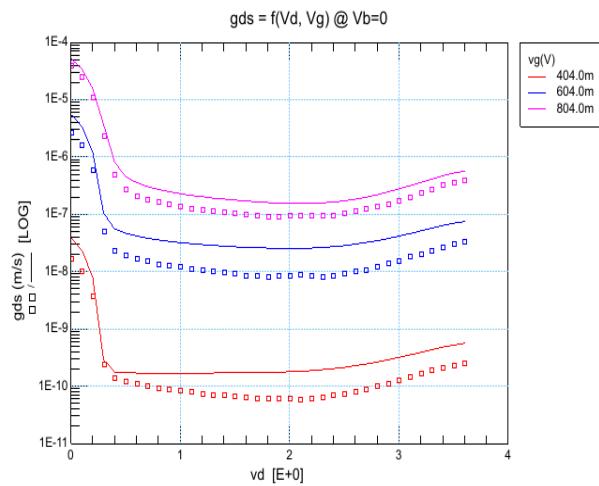


idvg, lb, lg, Vb = 0V, T = 27°C

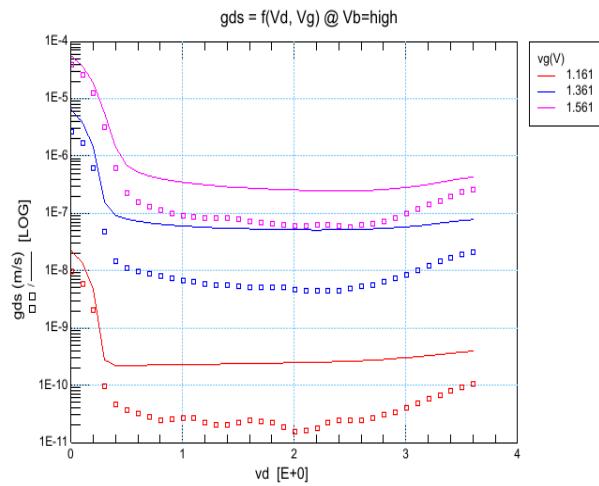
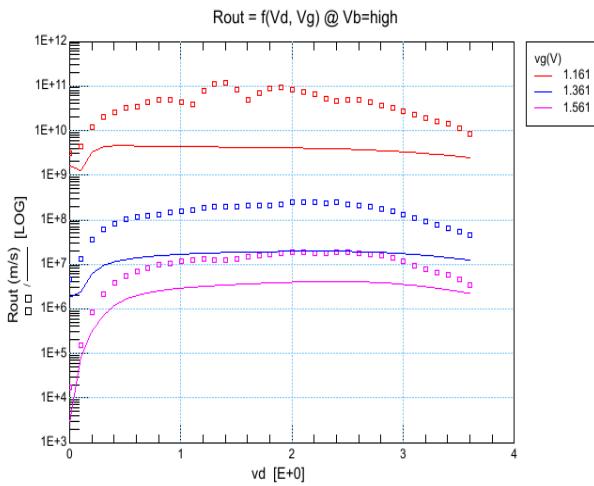
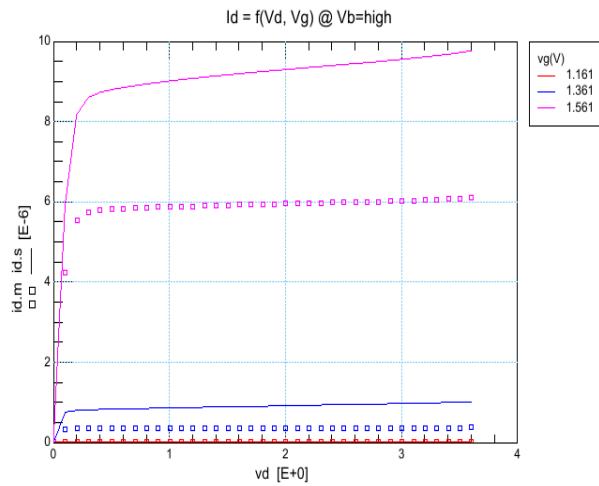


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


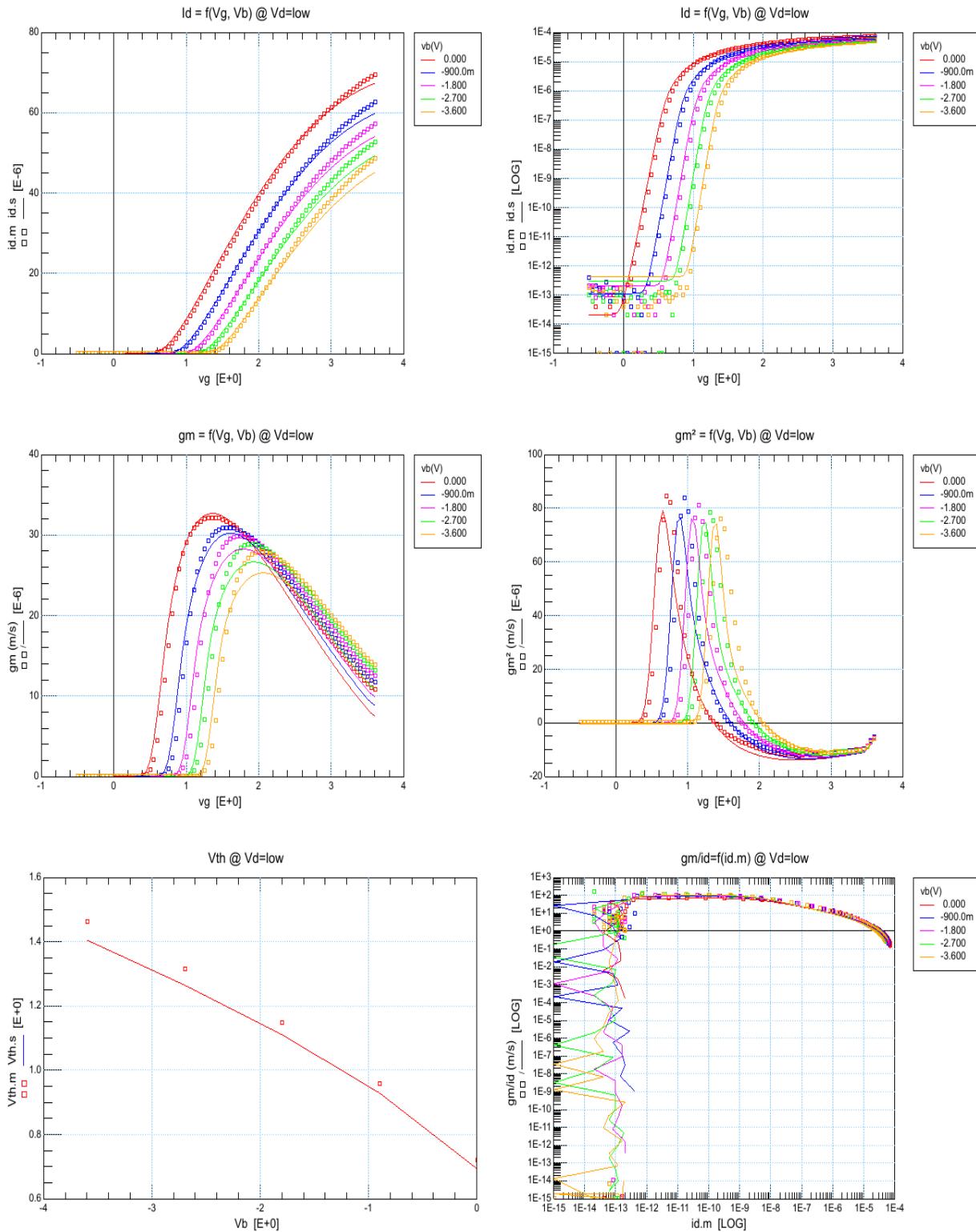


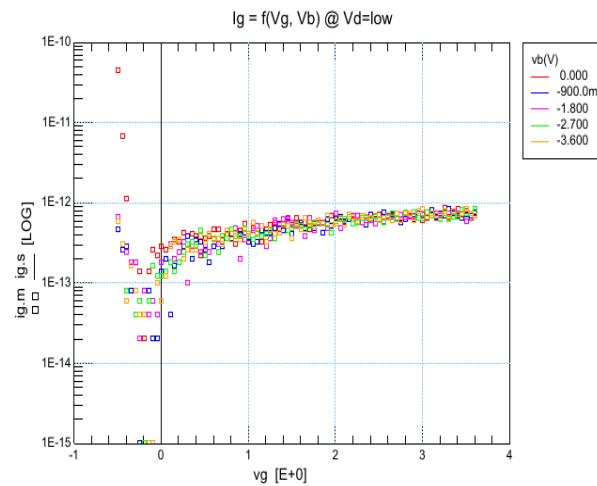
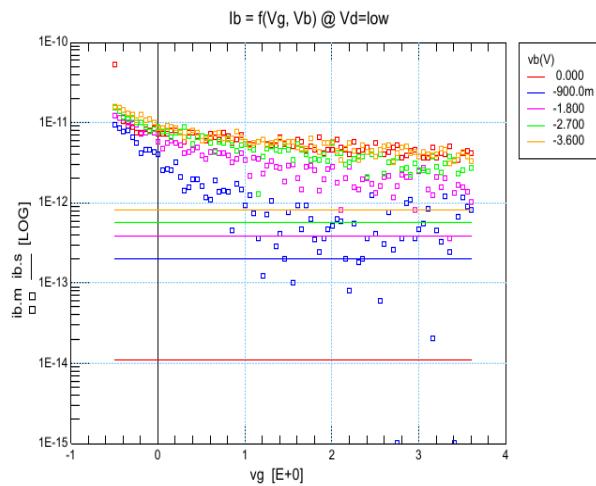
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



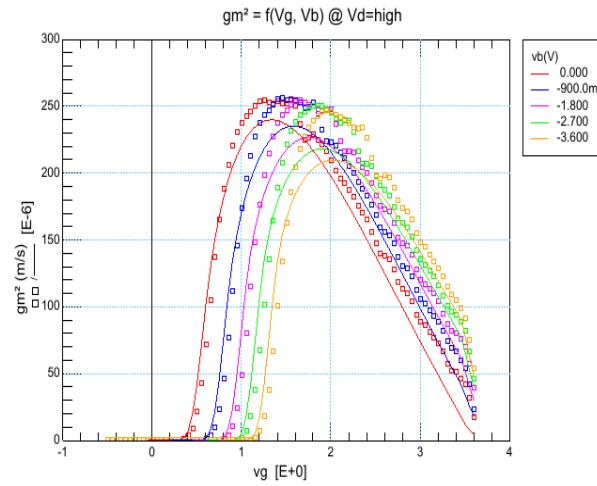
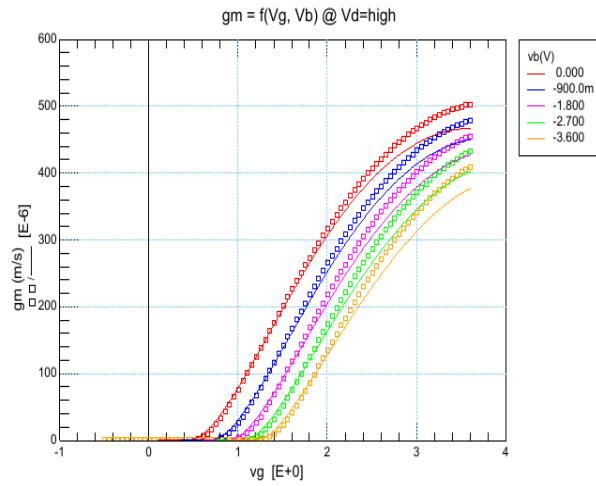
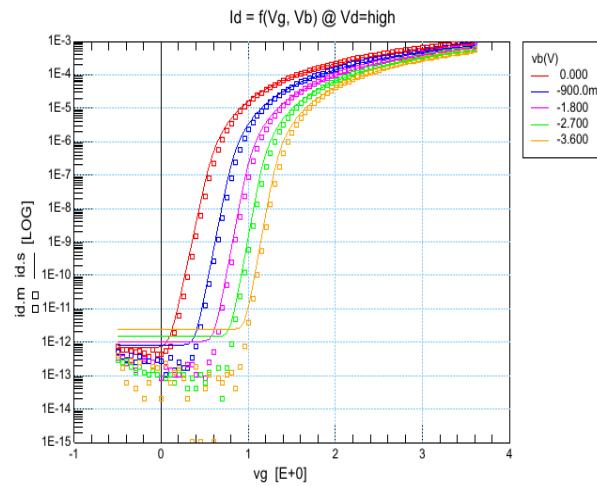
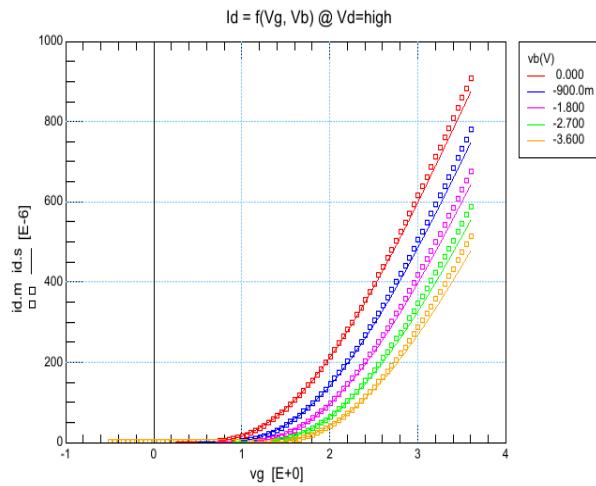
4.10W10u0_L5u0_S557_2

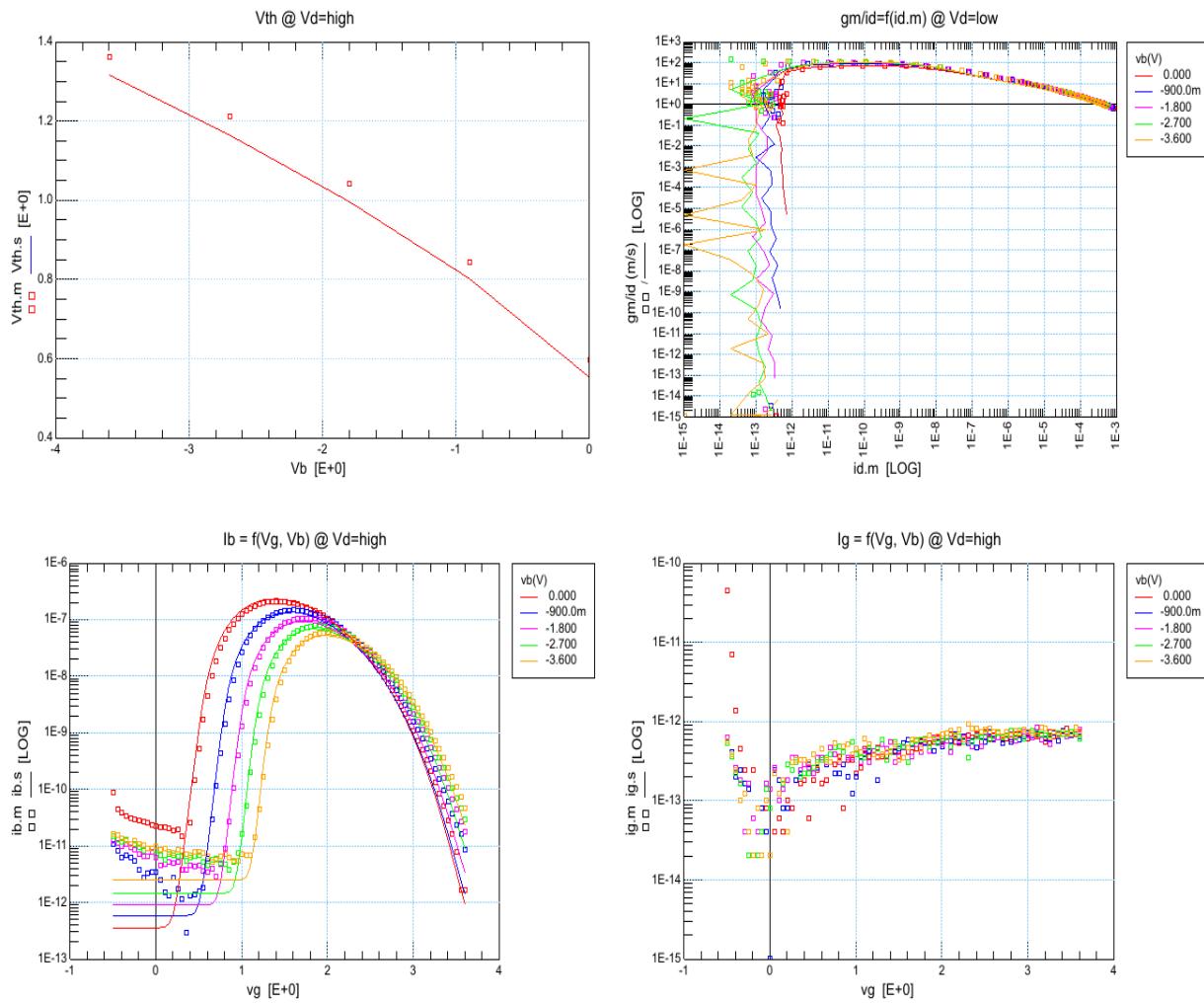
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



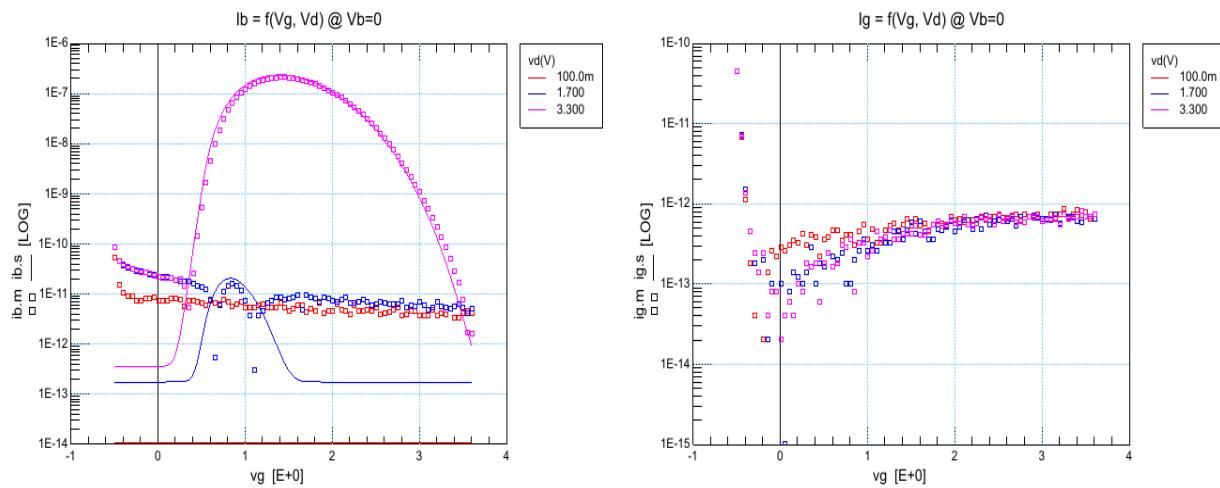


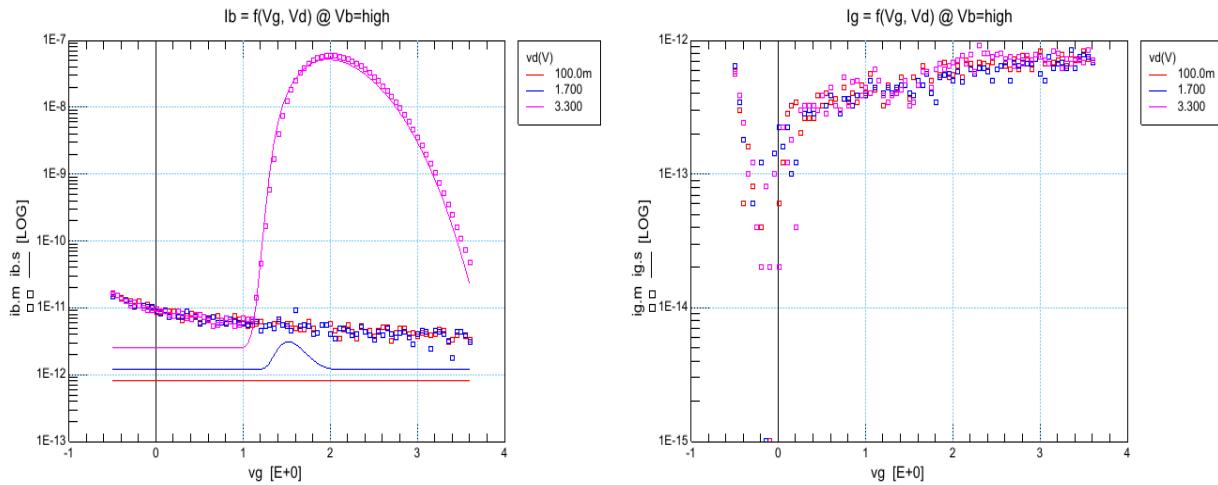
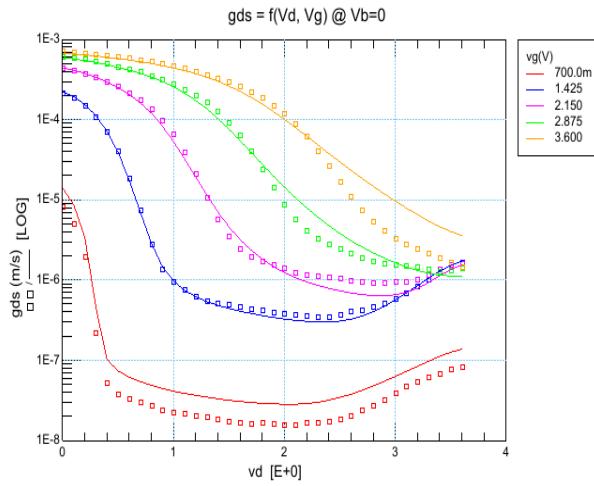
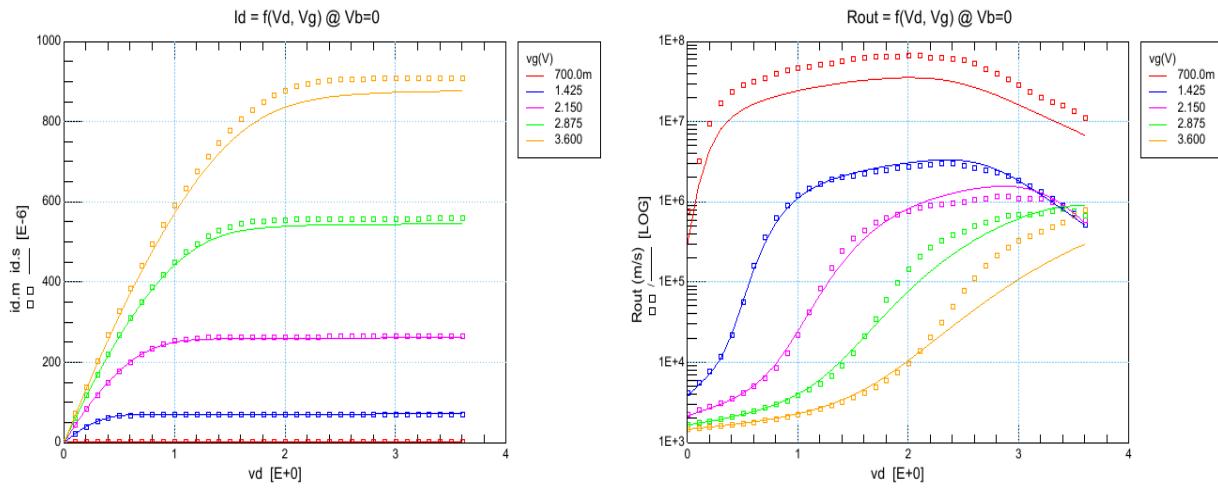
$i_{dvg}, V_d = 3.3V, T = 27^\circ\text{C}$

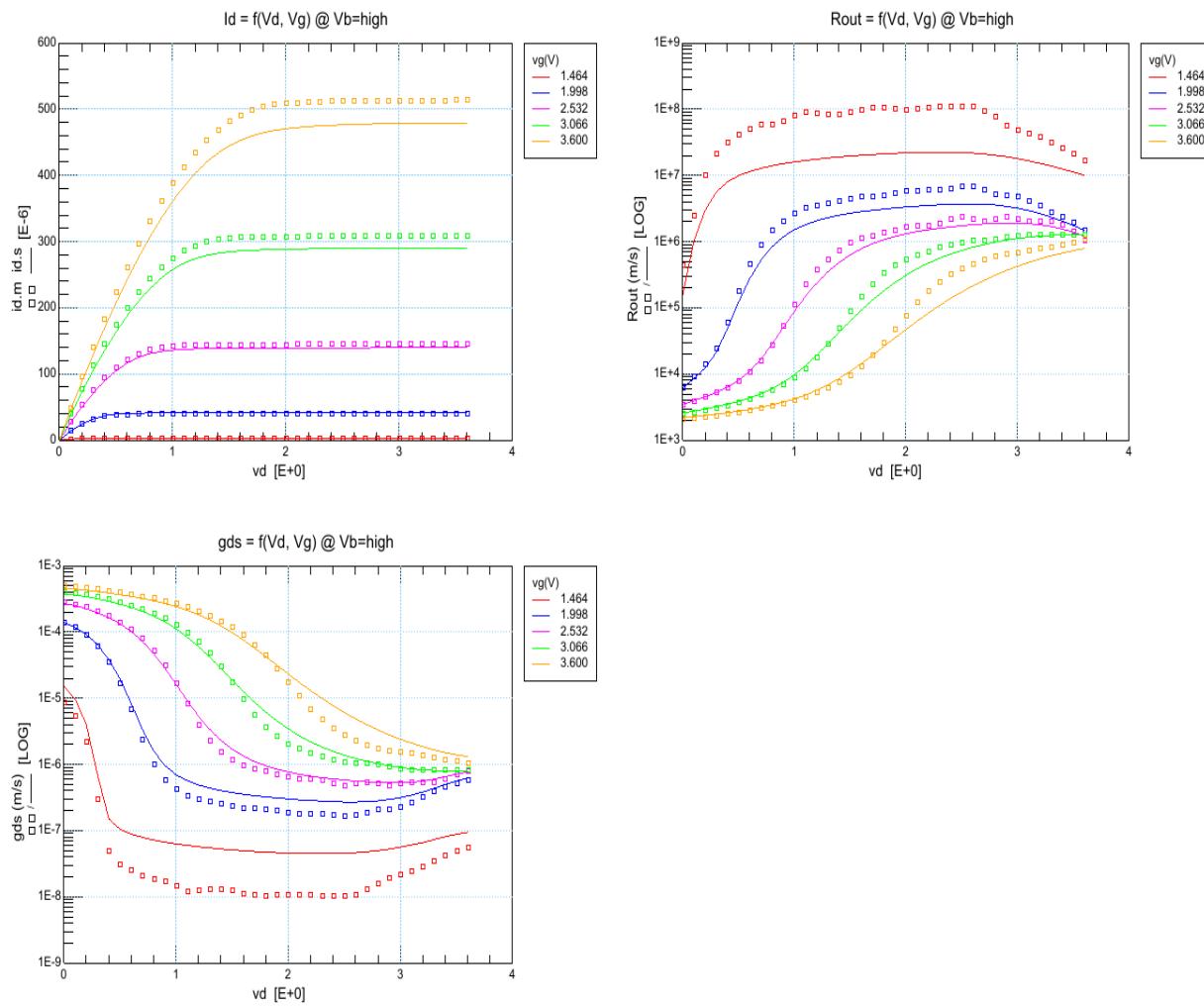
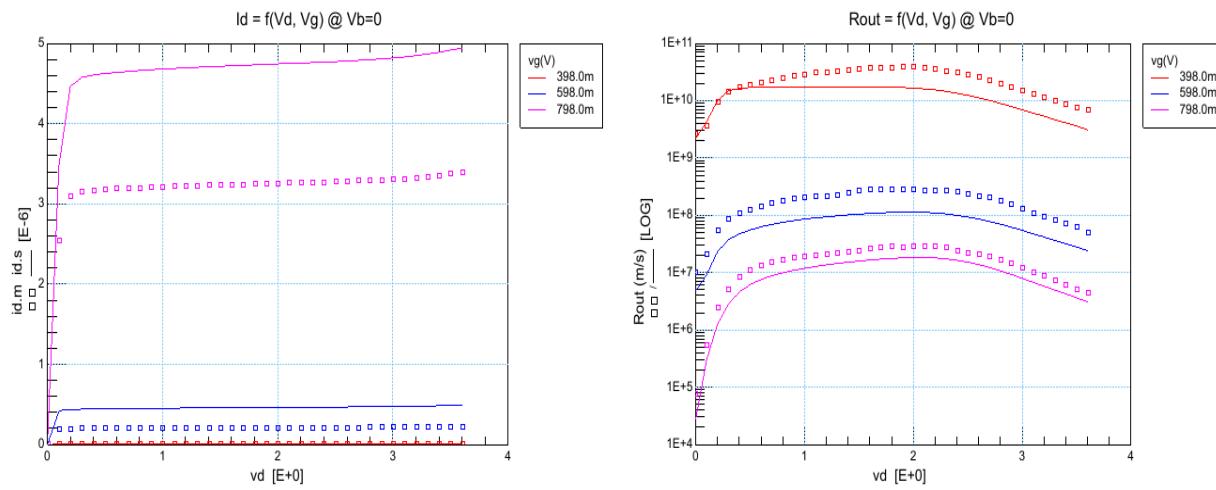


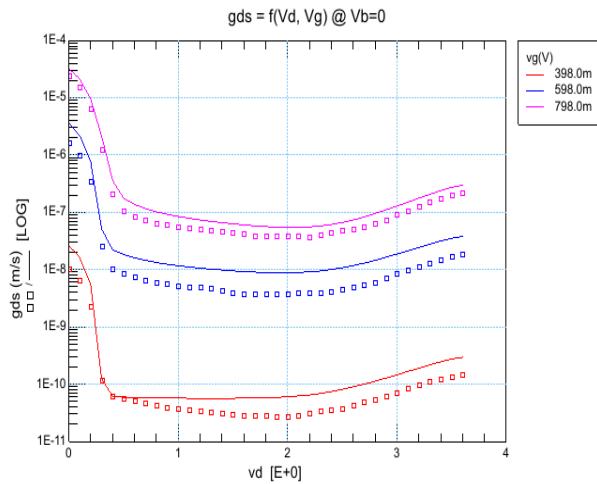


idvg, Ib,Ig, Vb = 0V, T = 27°C

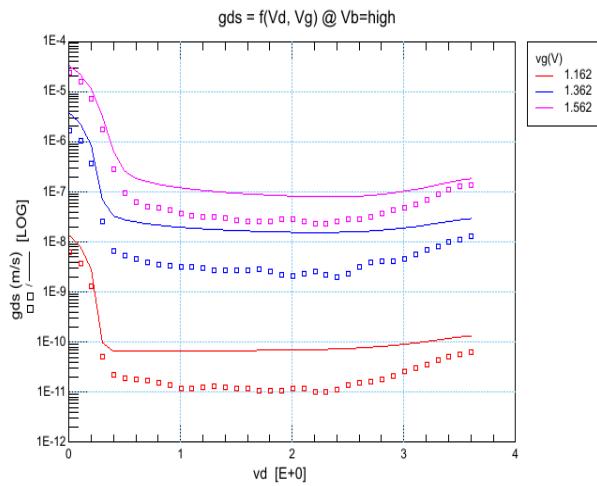
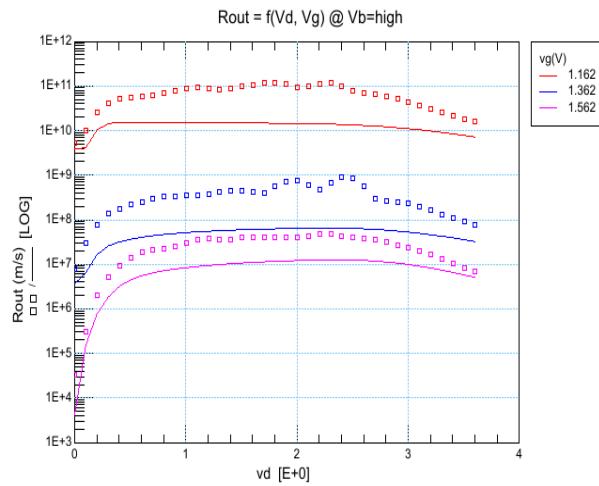
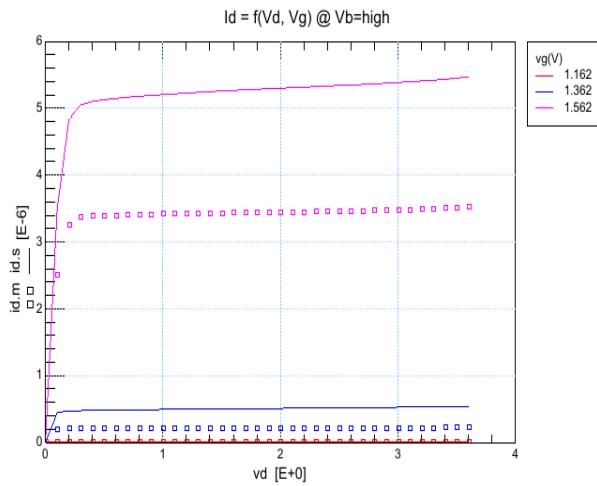


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


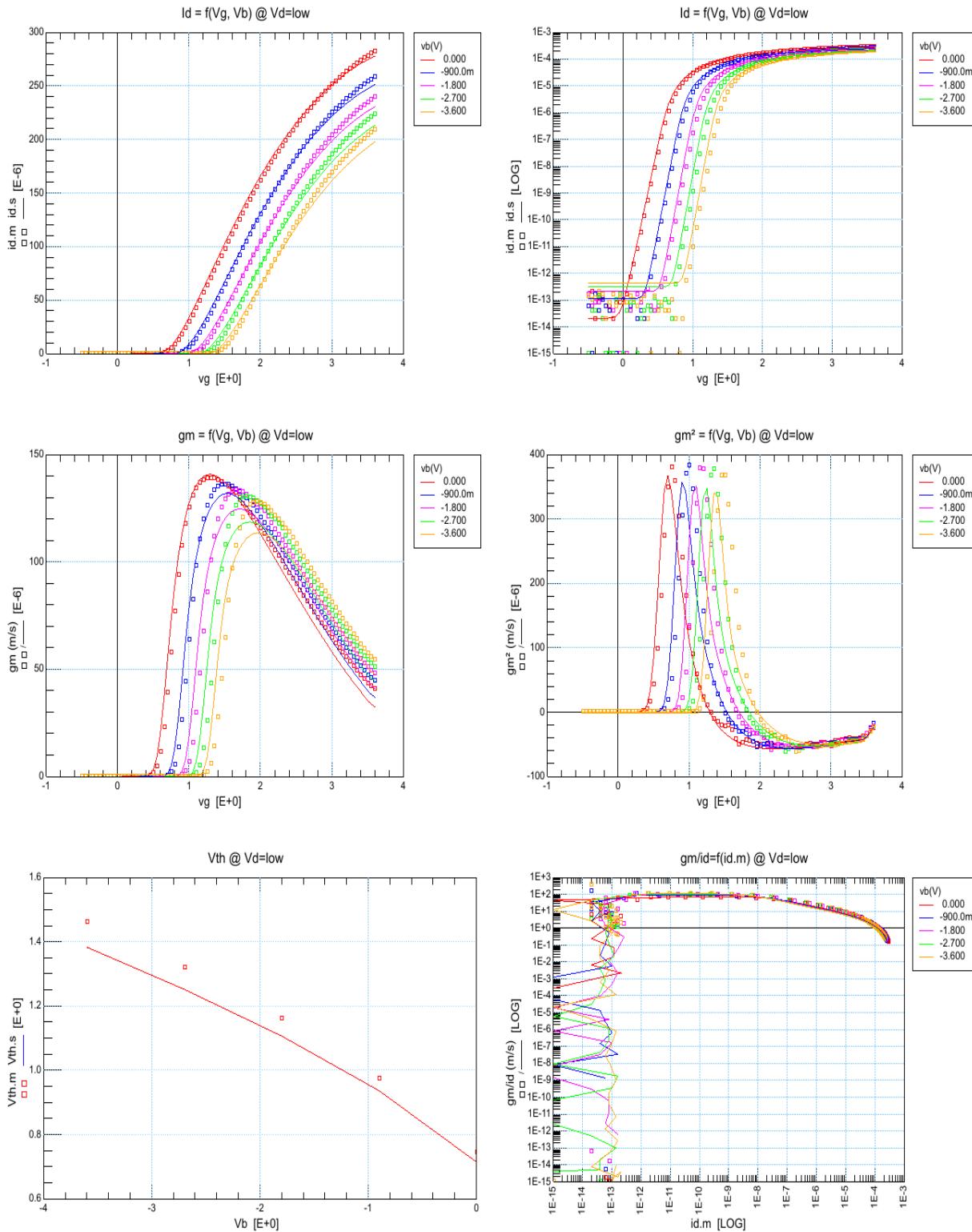


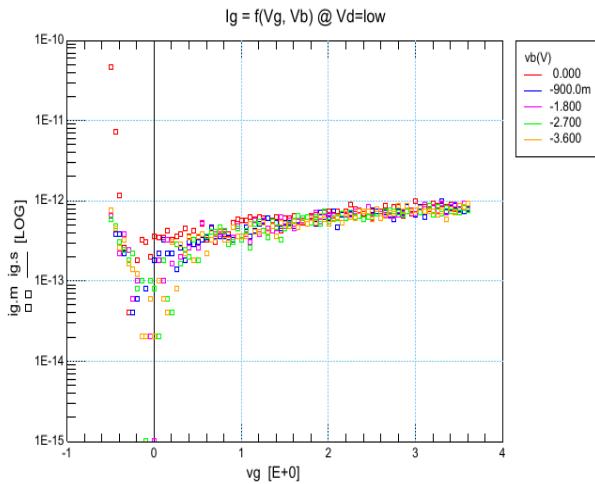
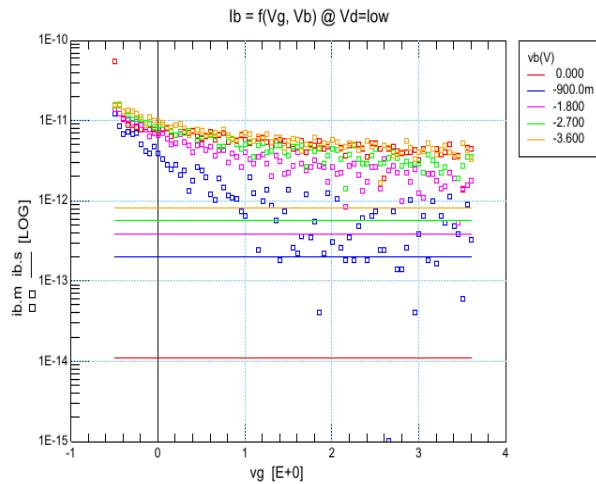
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



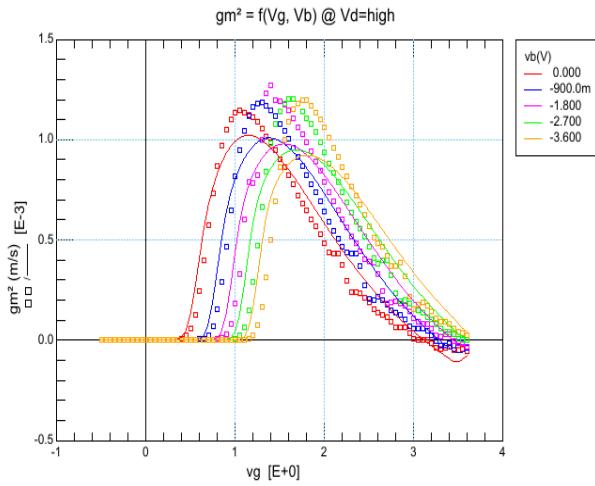
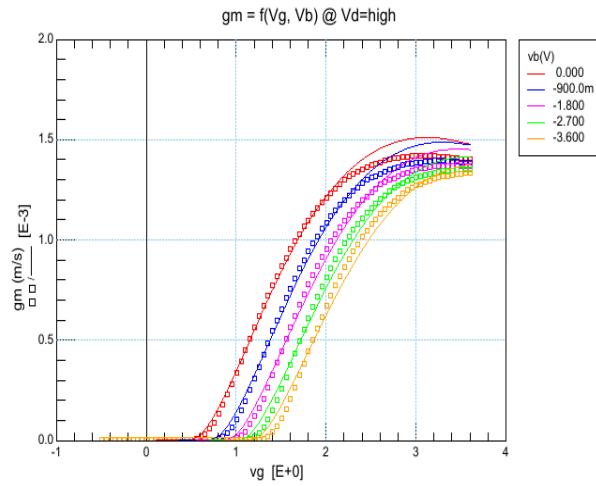
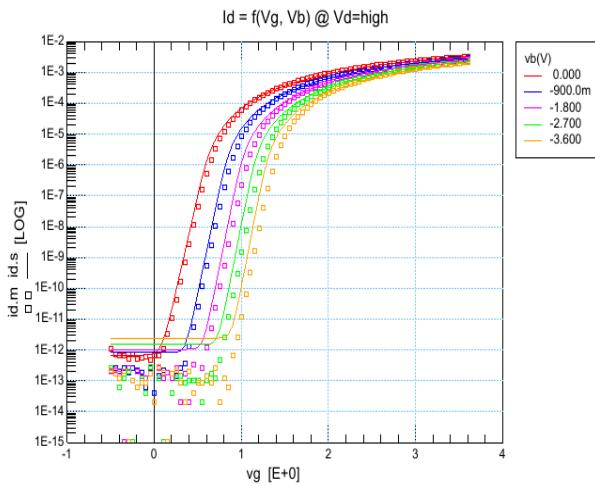
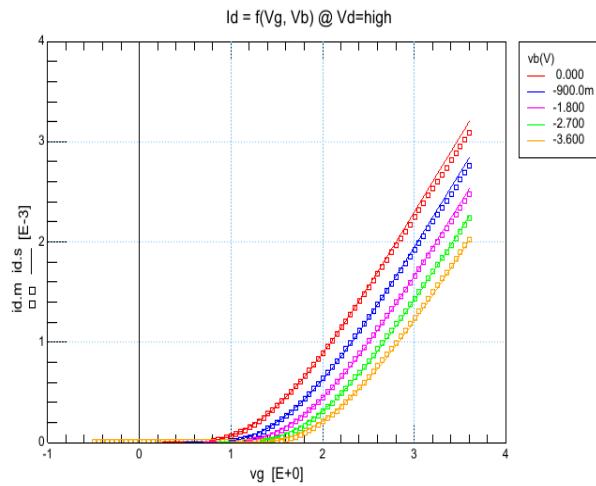
4.11 W10u0_L1u2_S556_5

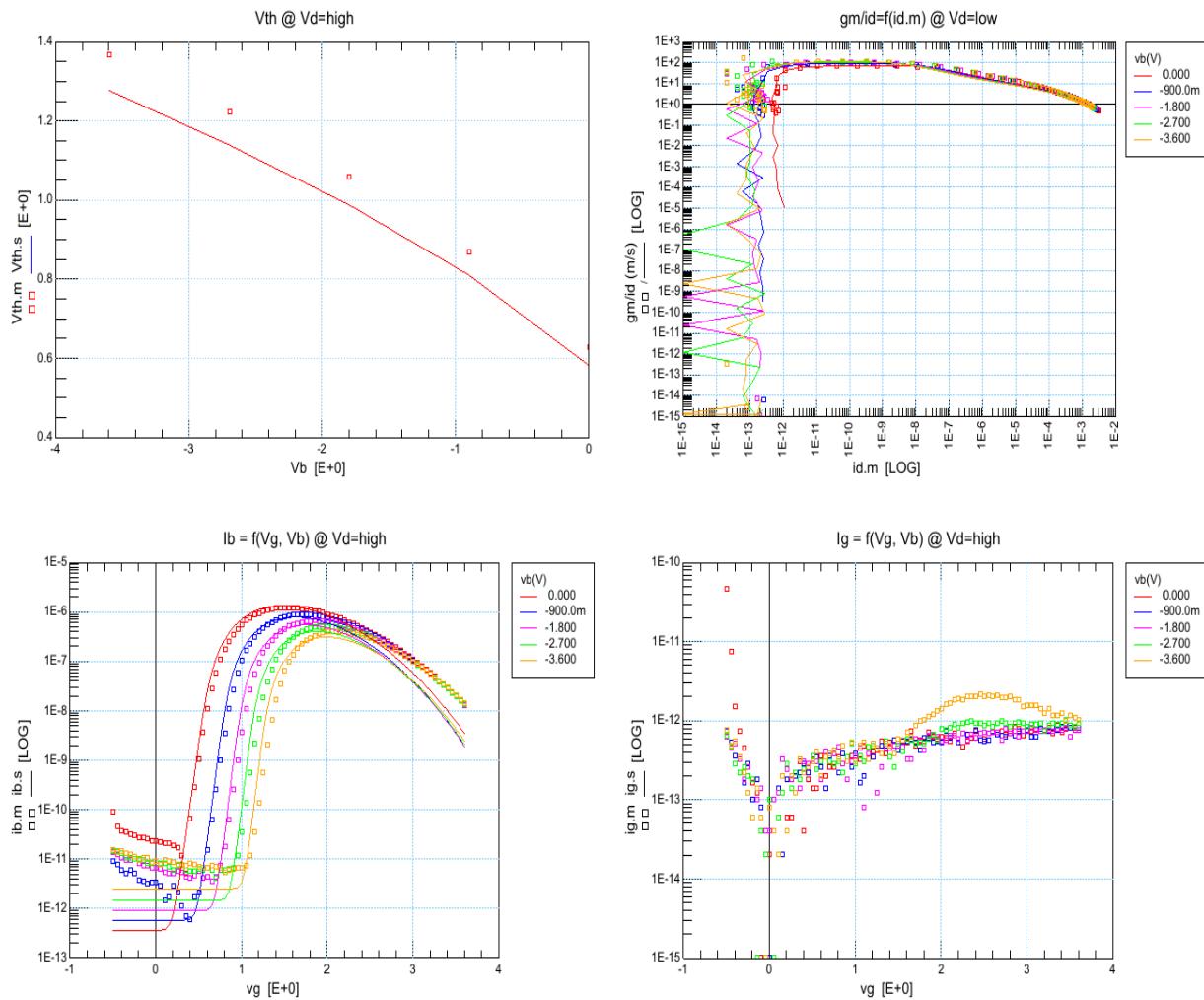
id_{vg} , $V_d = 0.1V$, $T = 27^\circ C$



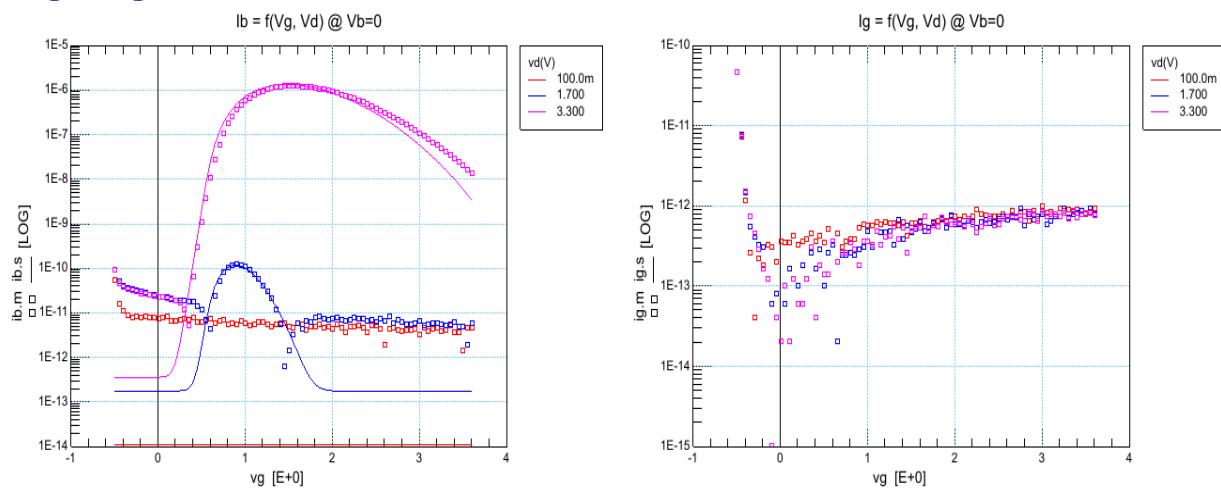


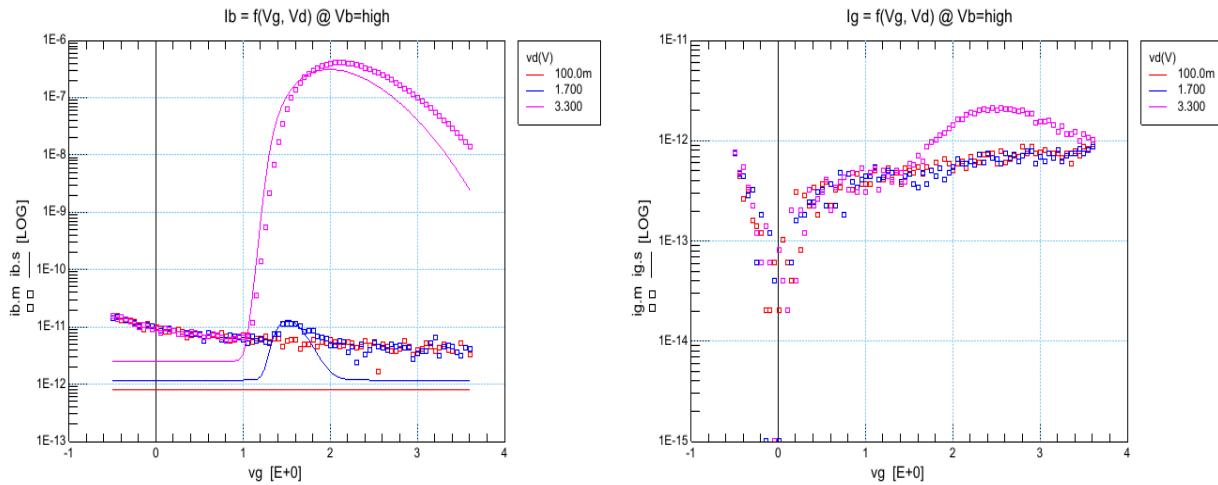
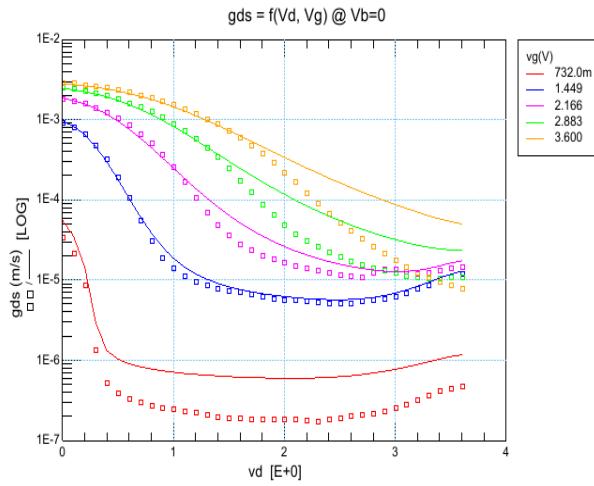
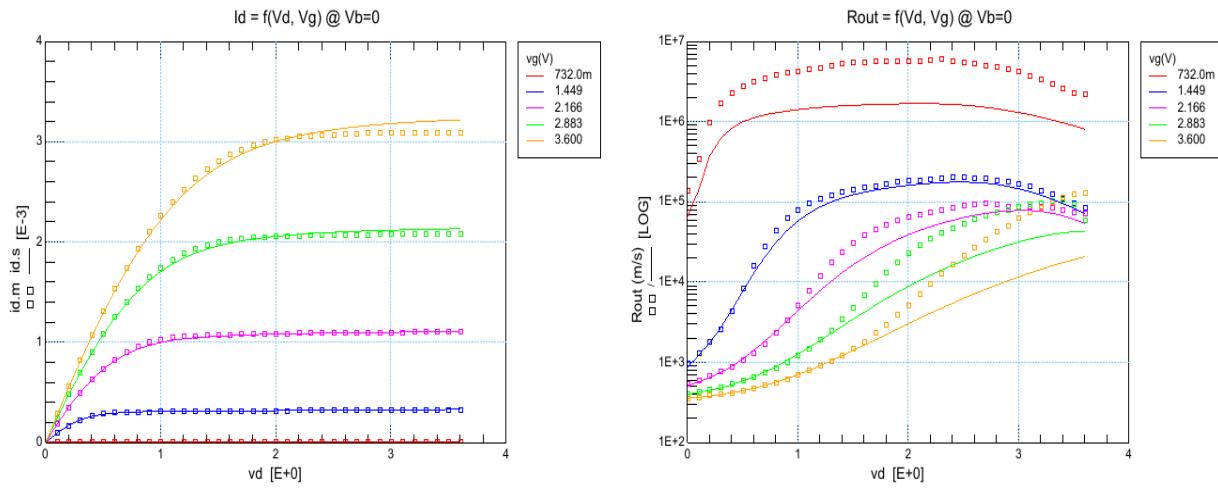
$i_{dvg}, V_d = 3.3V, T = 27^\circ\text{C}$

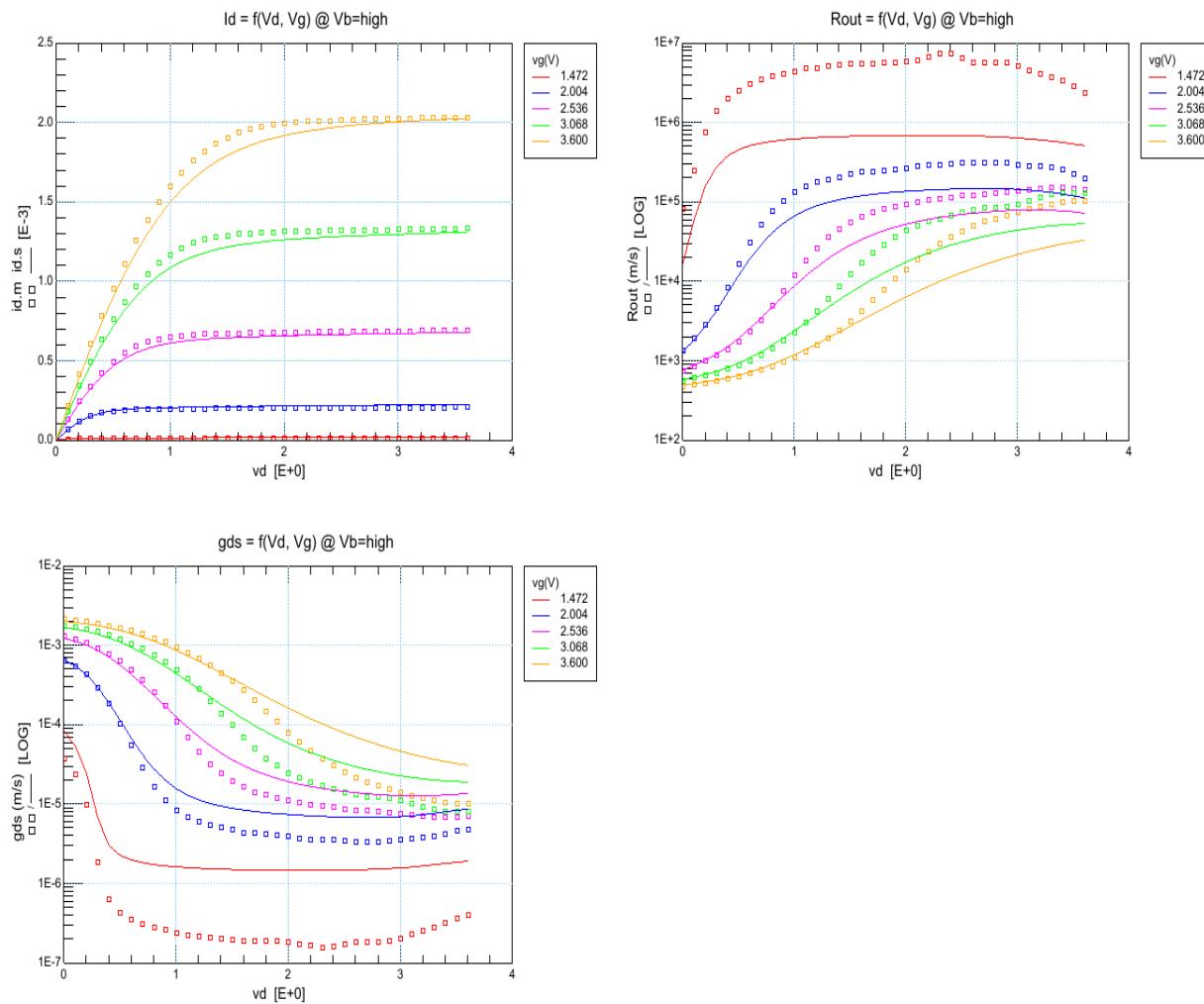
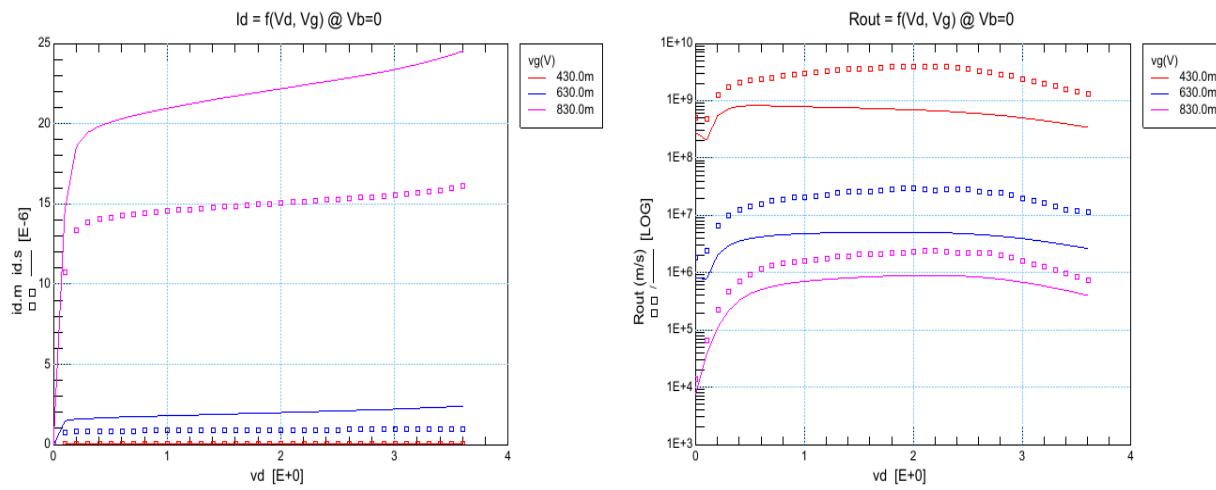


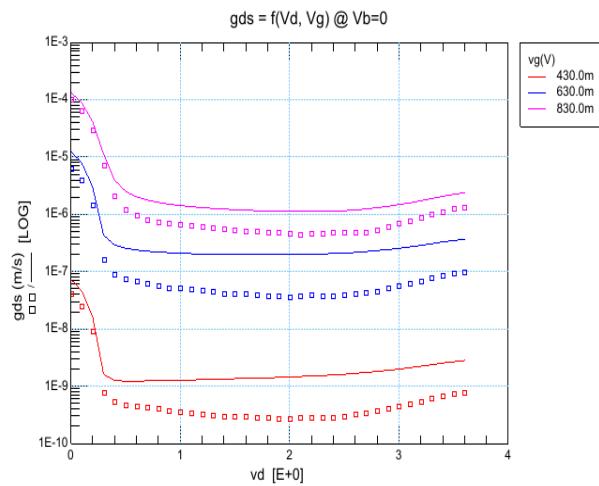


idvg, Ib, Ig, Vb = 0V, T = 27°C

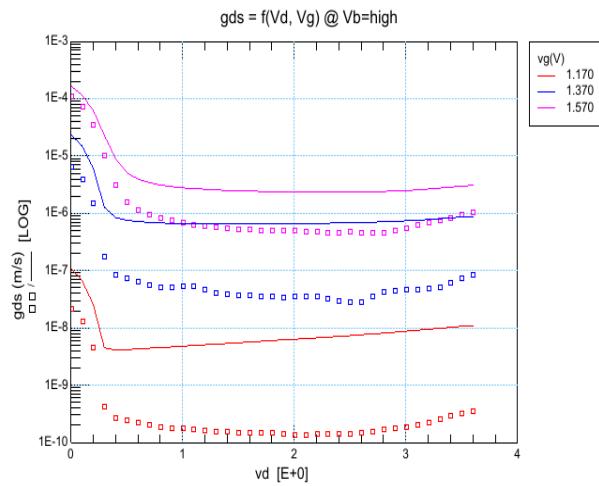
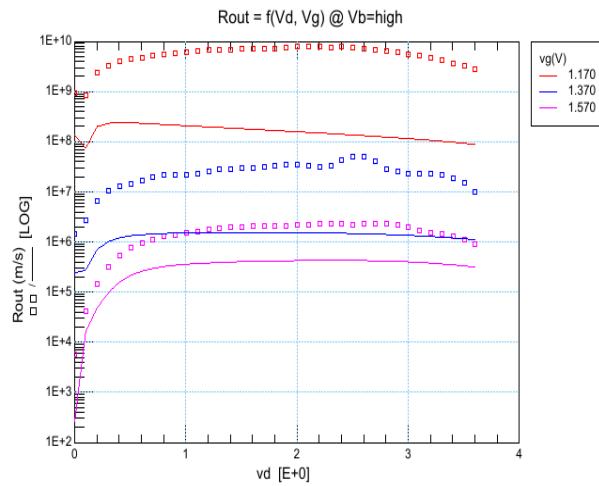
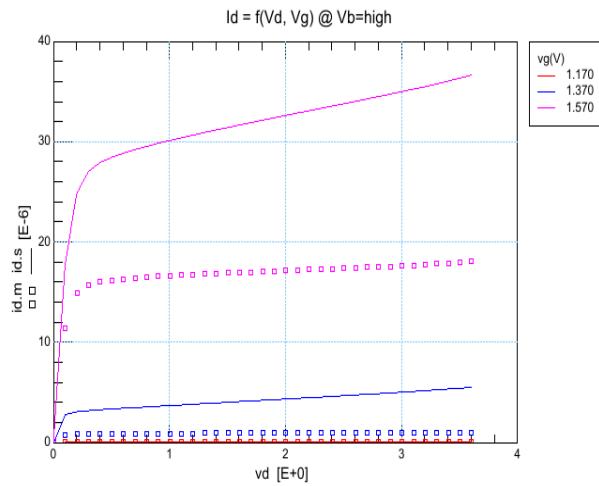


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


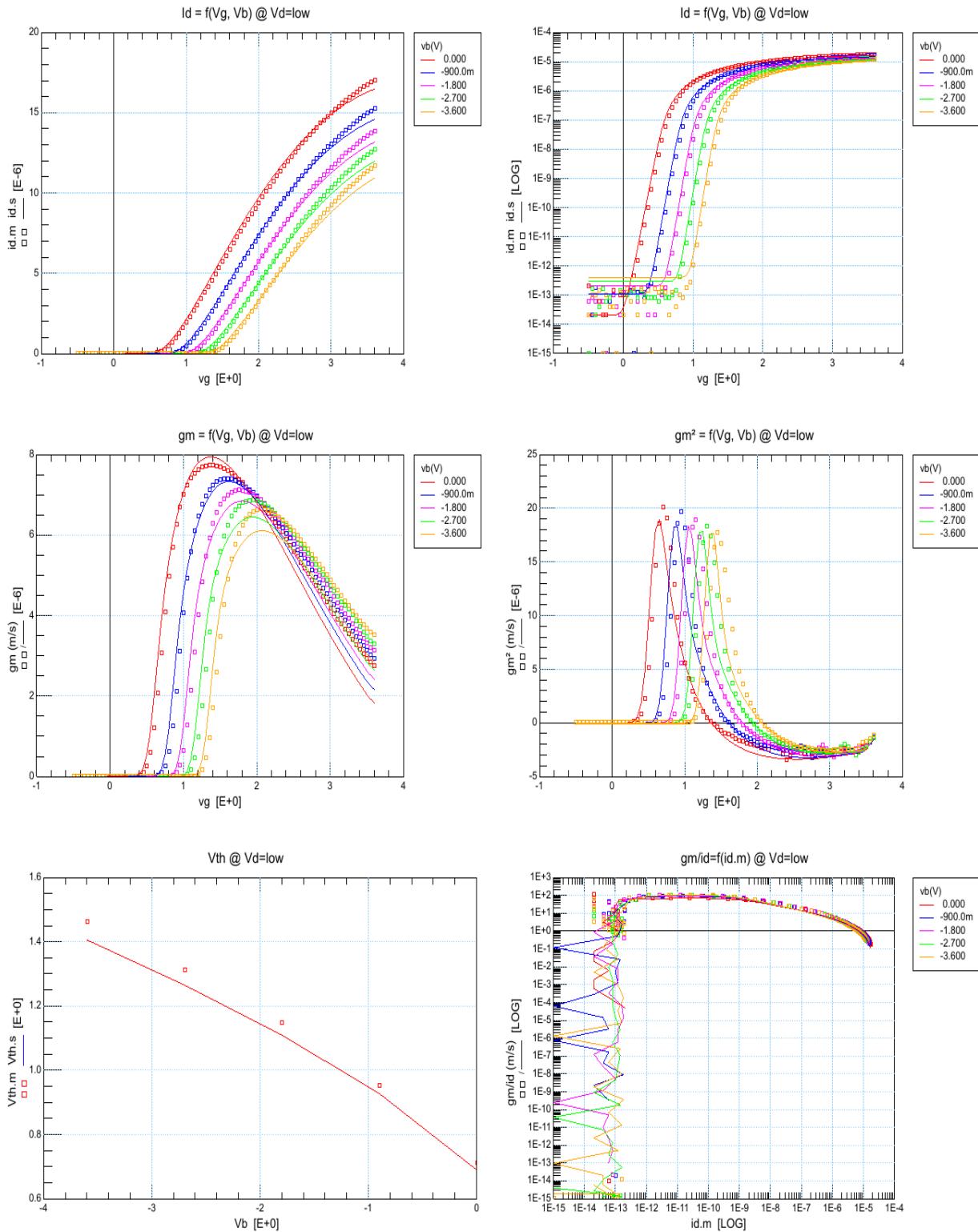


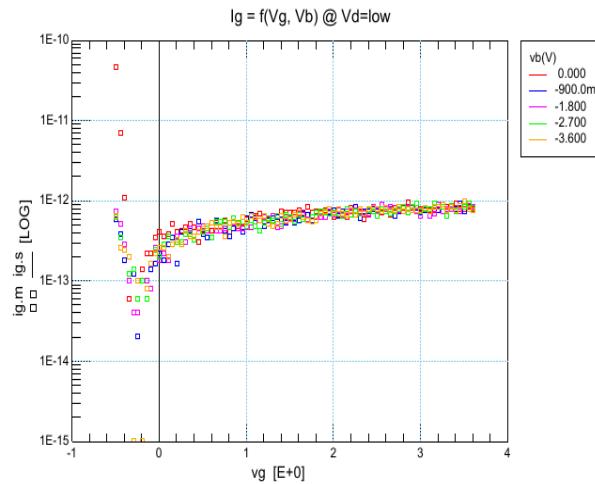
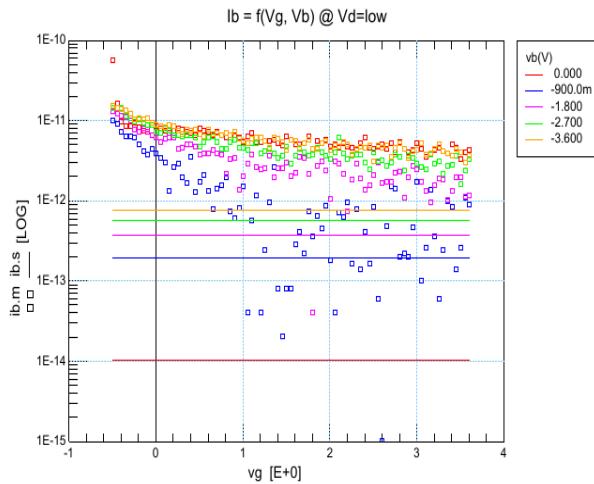
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



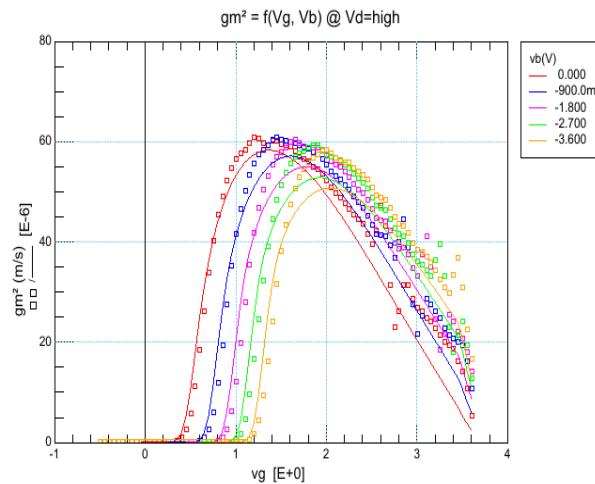
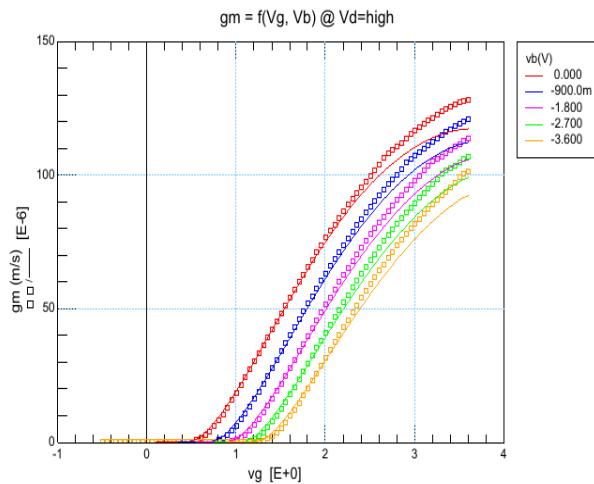
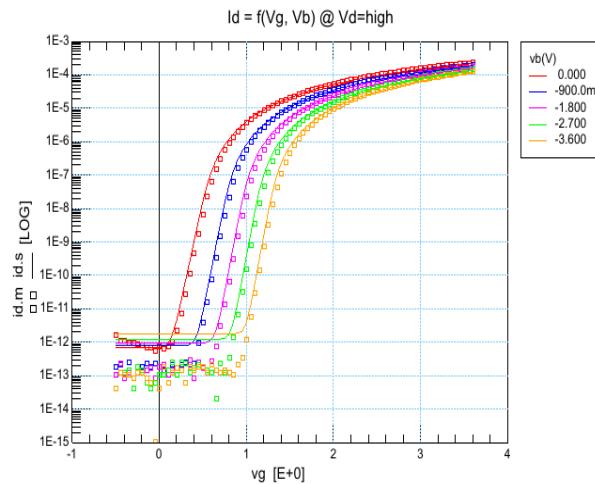
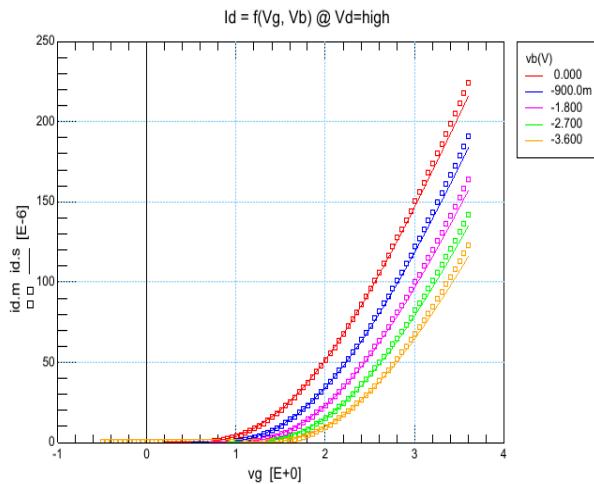
4.12 W05u0_L10u0_S558_1

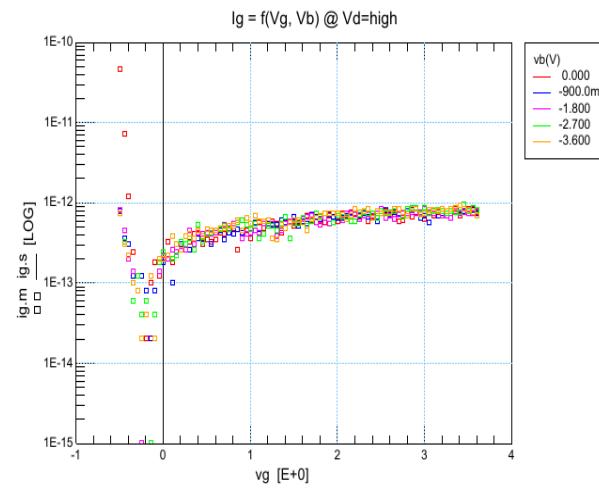
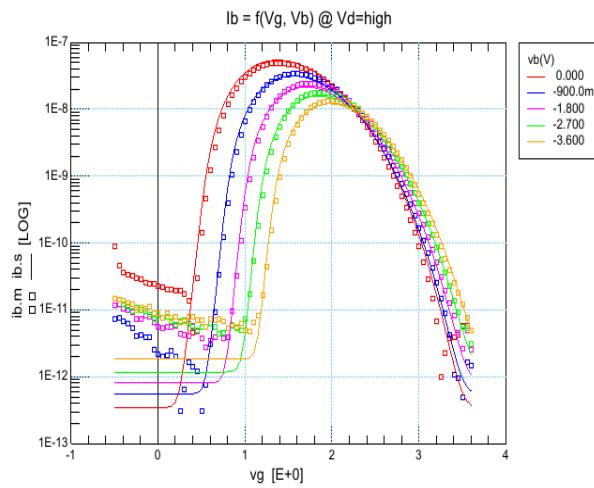
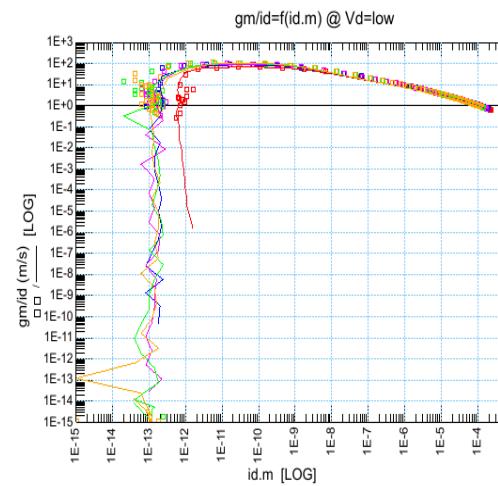
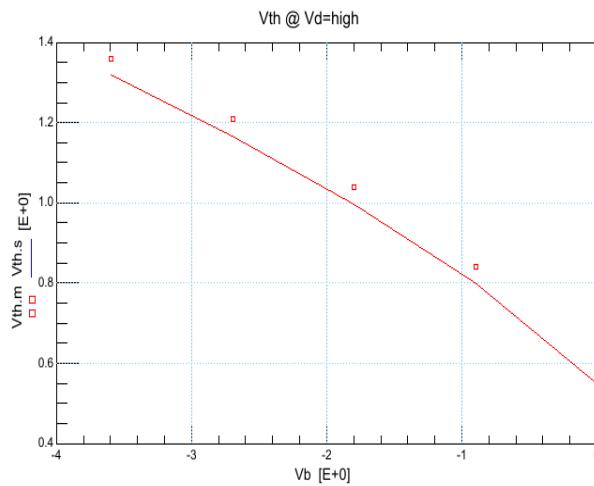
$idv_g, V_d = 0.1V, T = 27^\circ C$



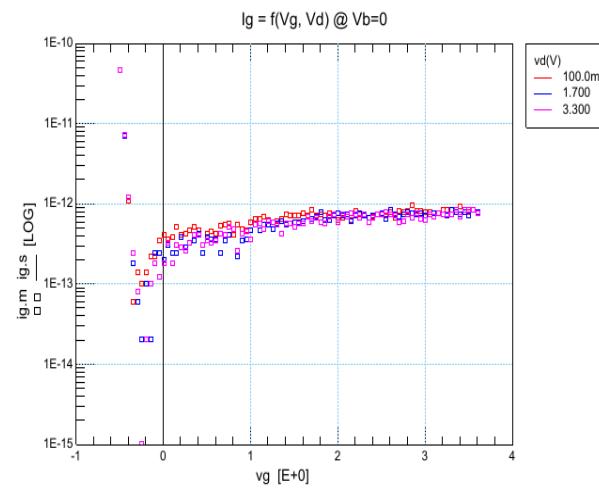
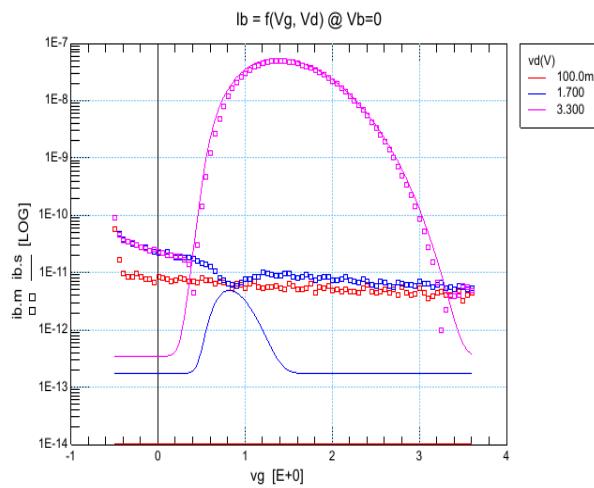


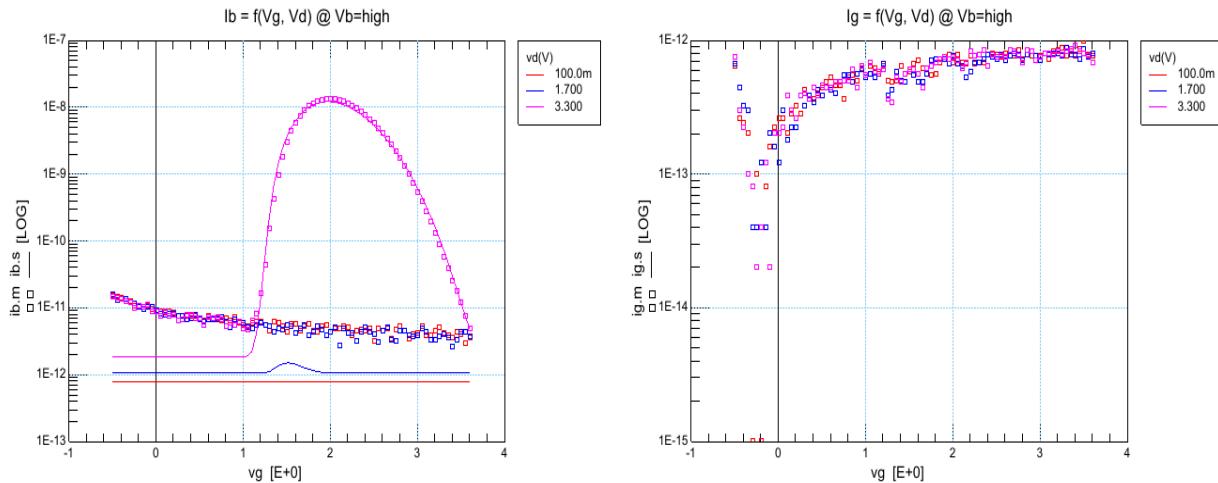
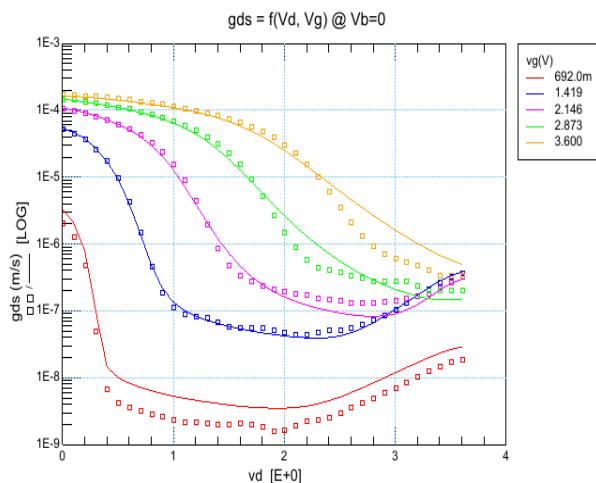
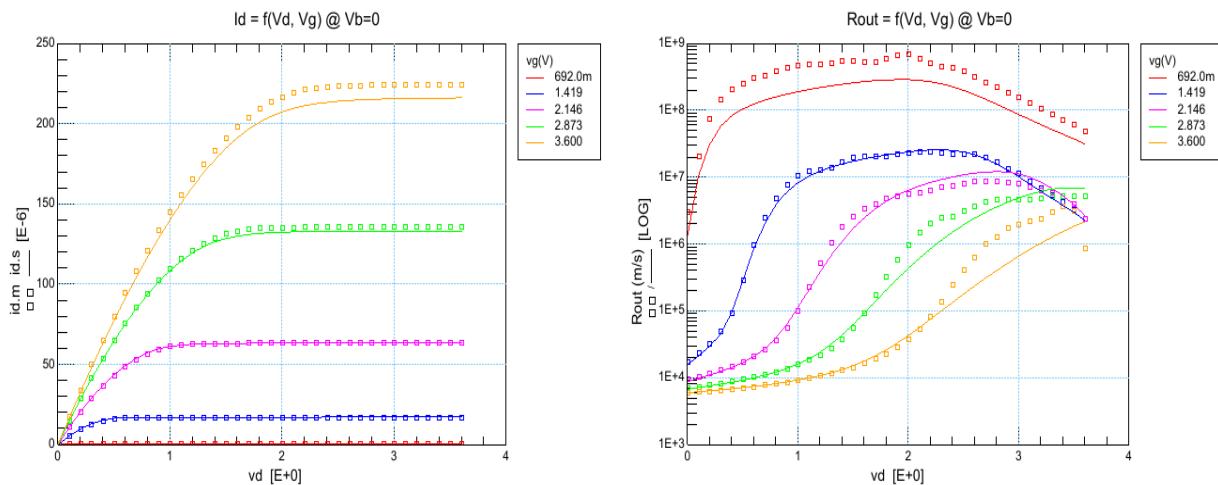
$i_{dvg}, V_d = 3.3V, T = 27^\circ\text{C}$

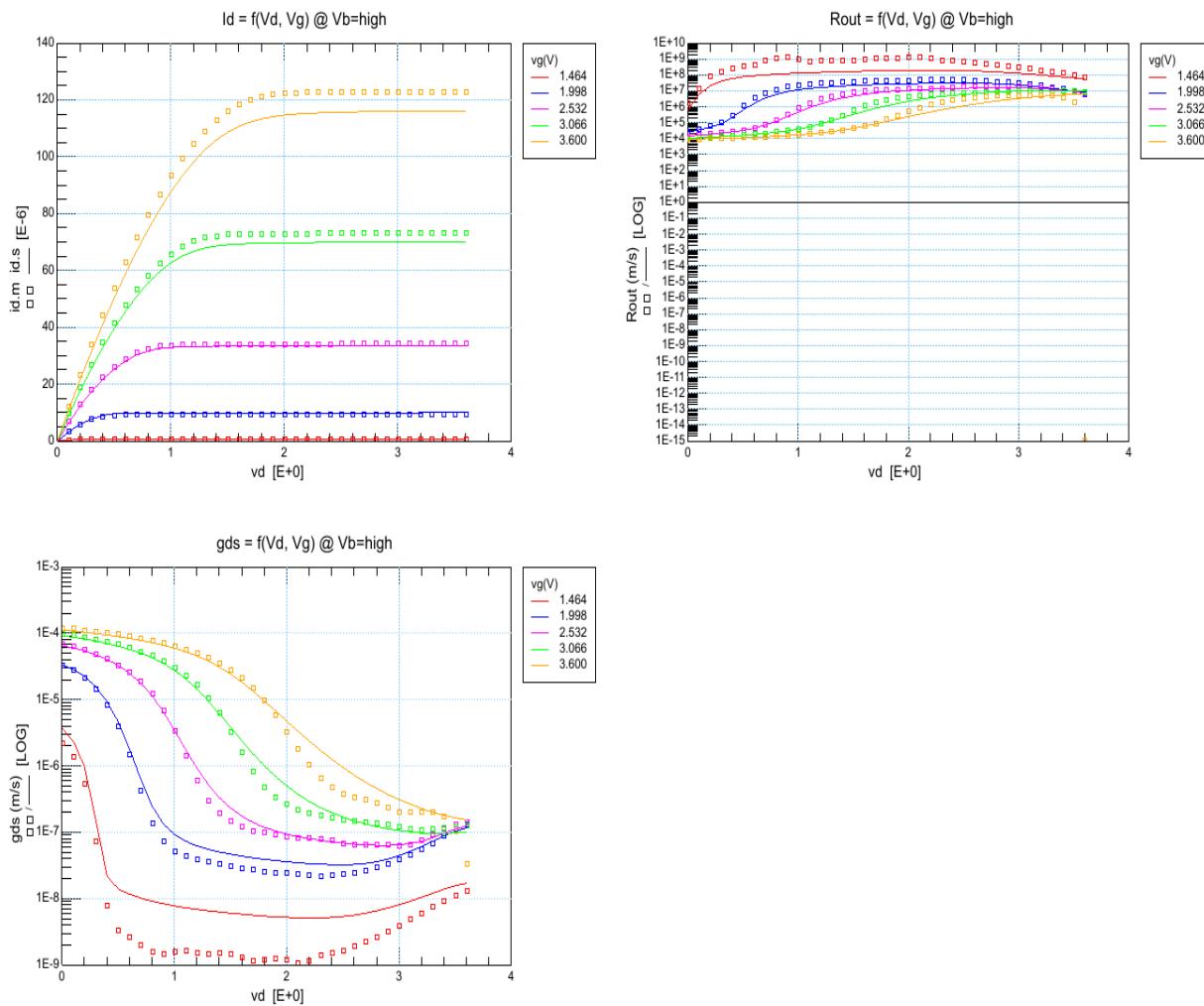
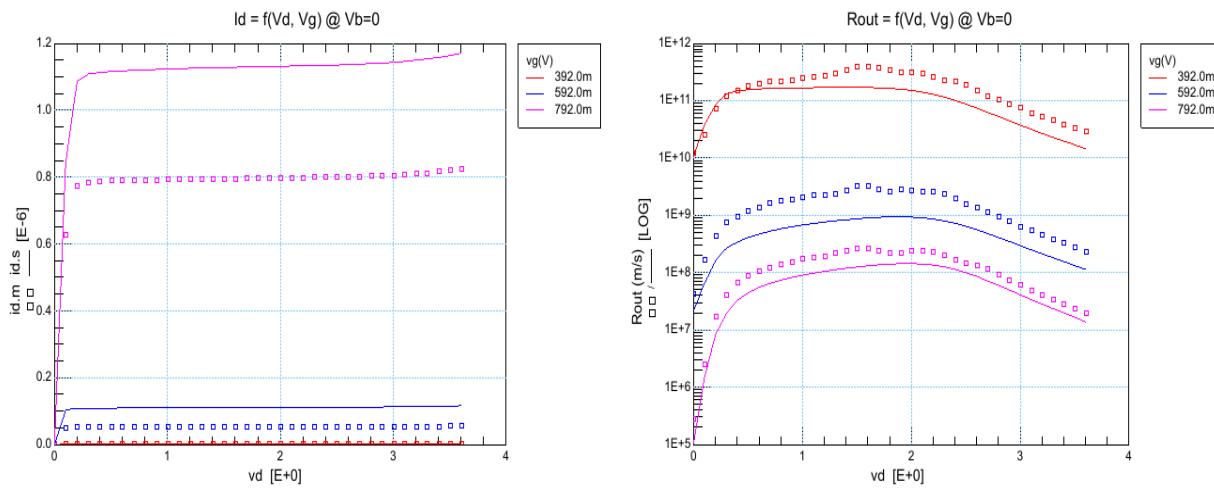


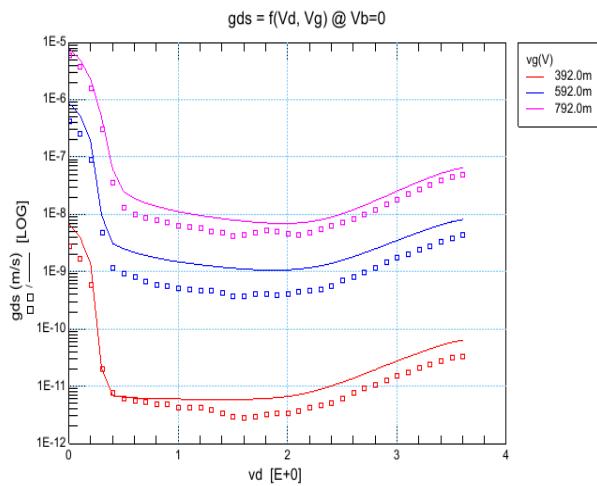


idvg, lb, lg, Vb = 0V, T = 27°C

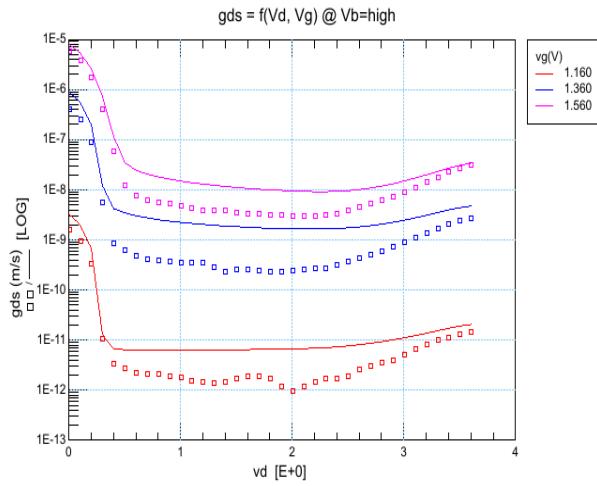
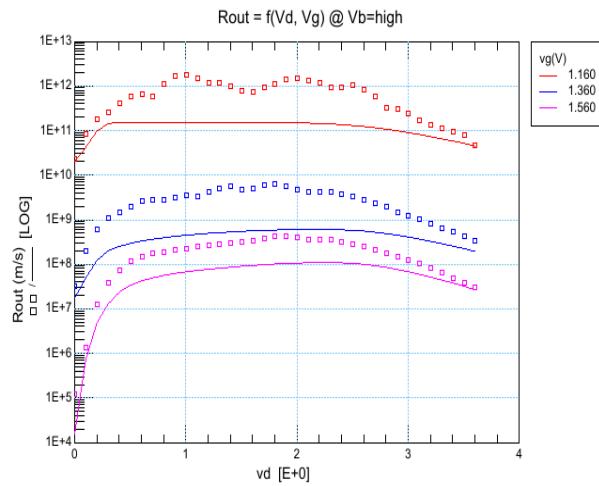
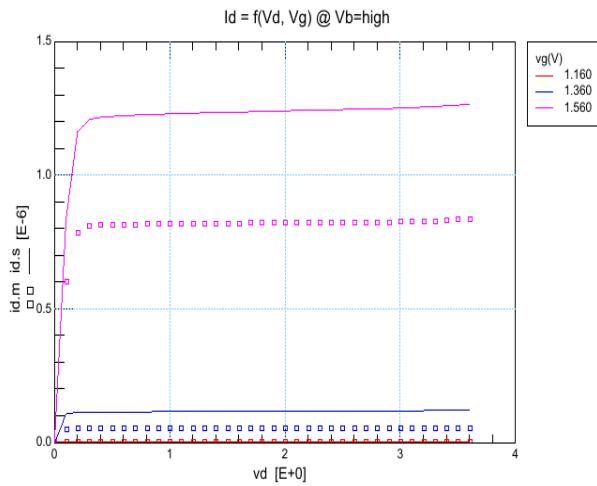


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


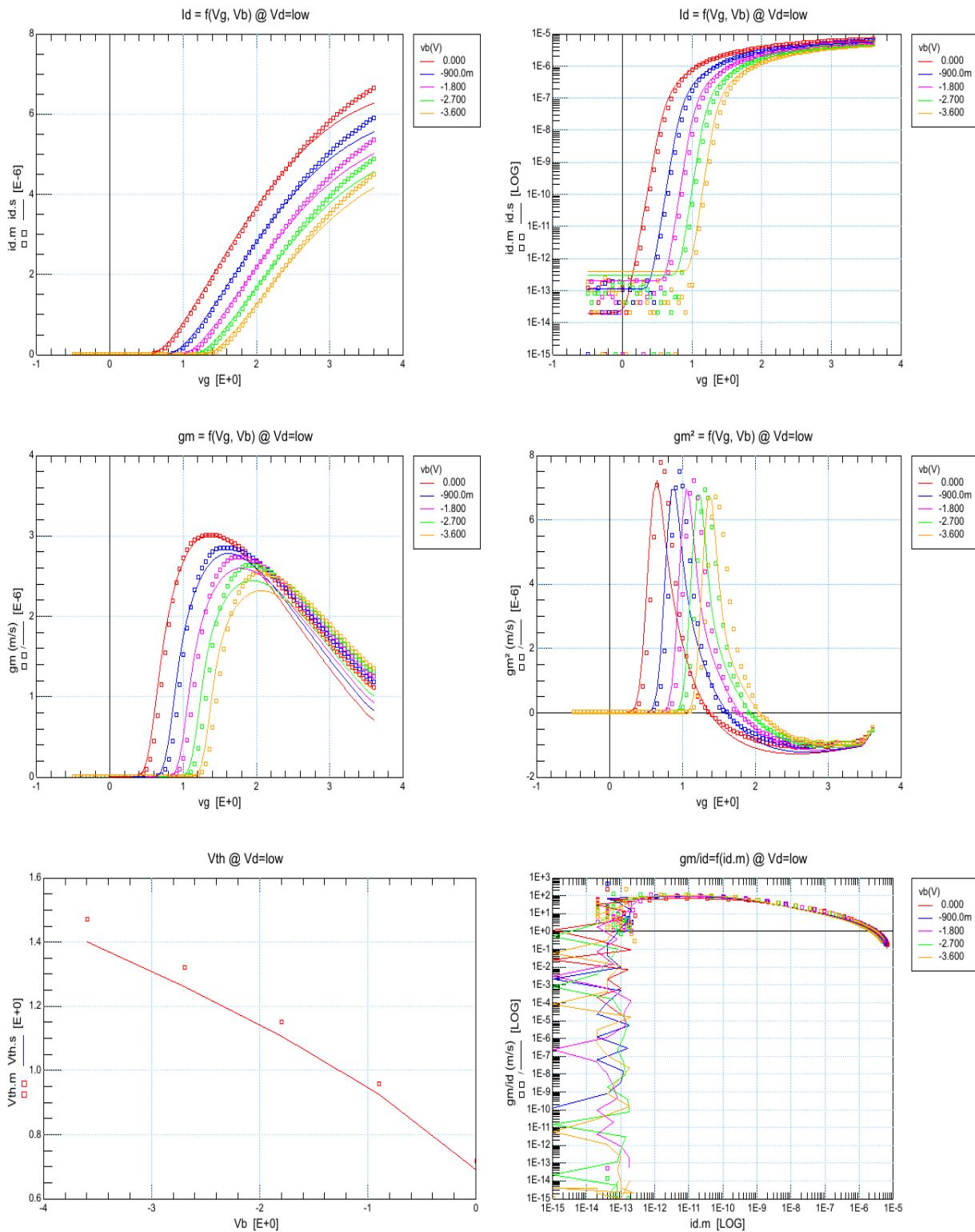


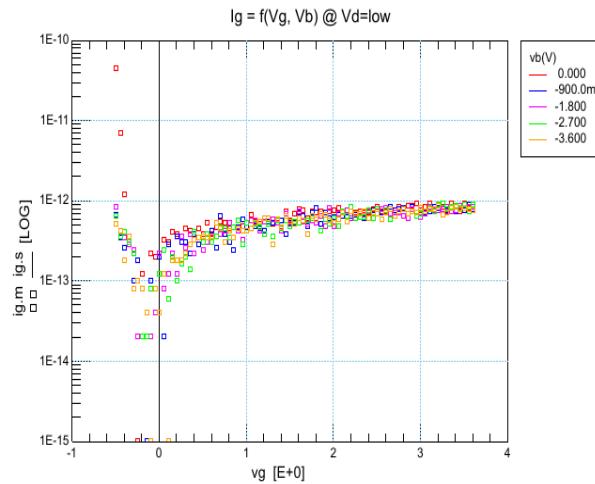
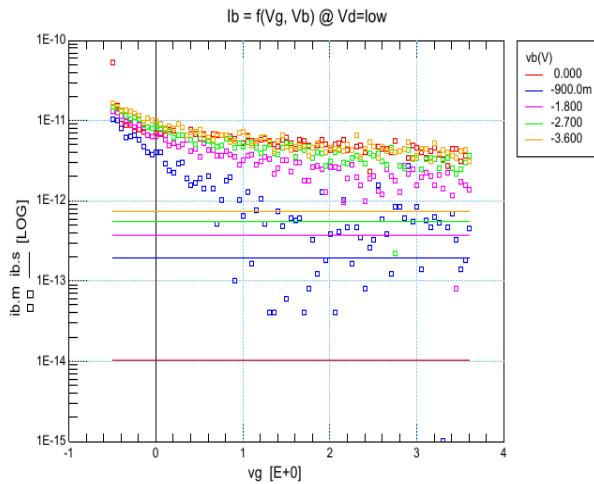
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



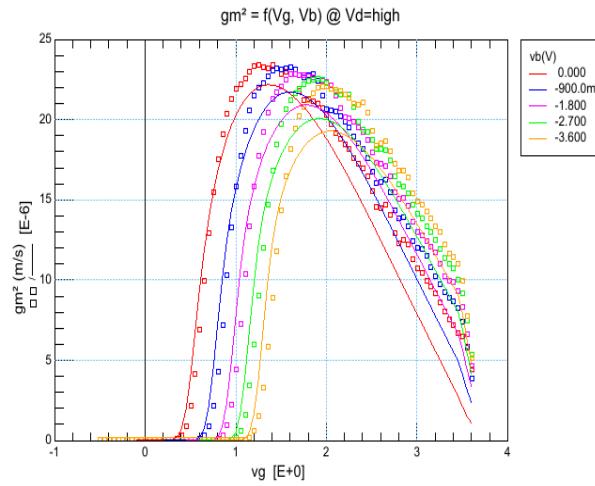
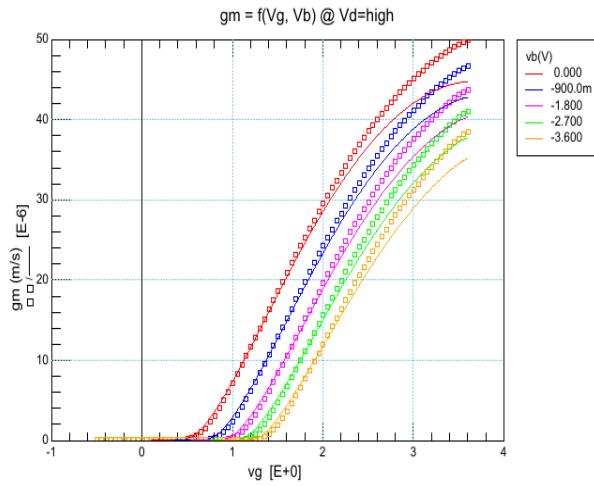
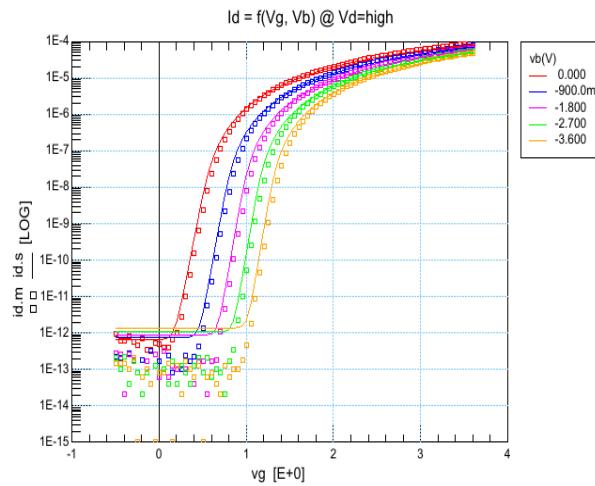
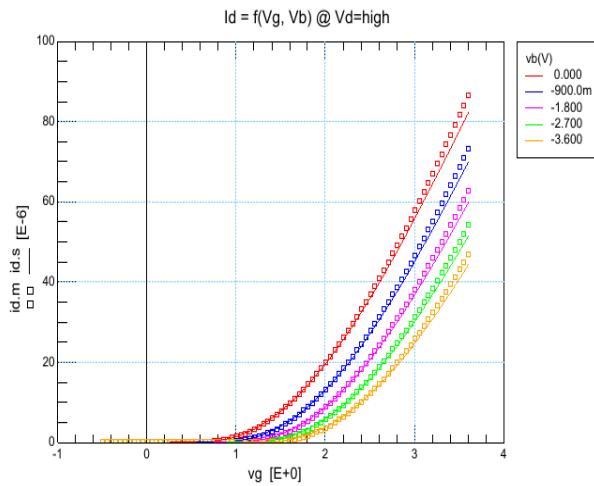
4.13 W02u0_L10u0_S558_5

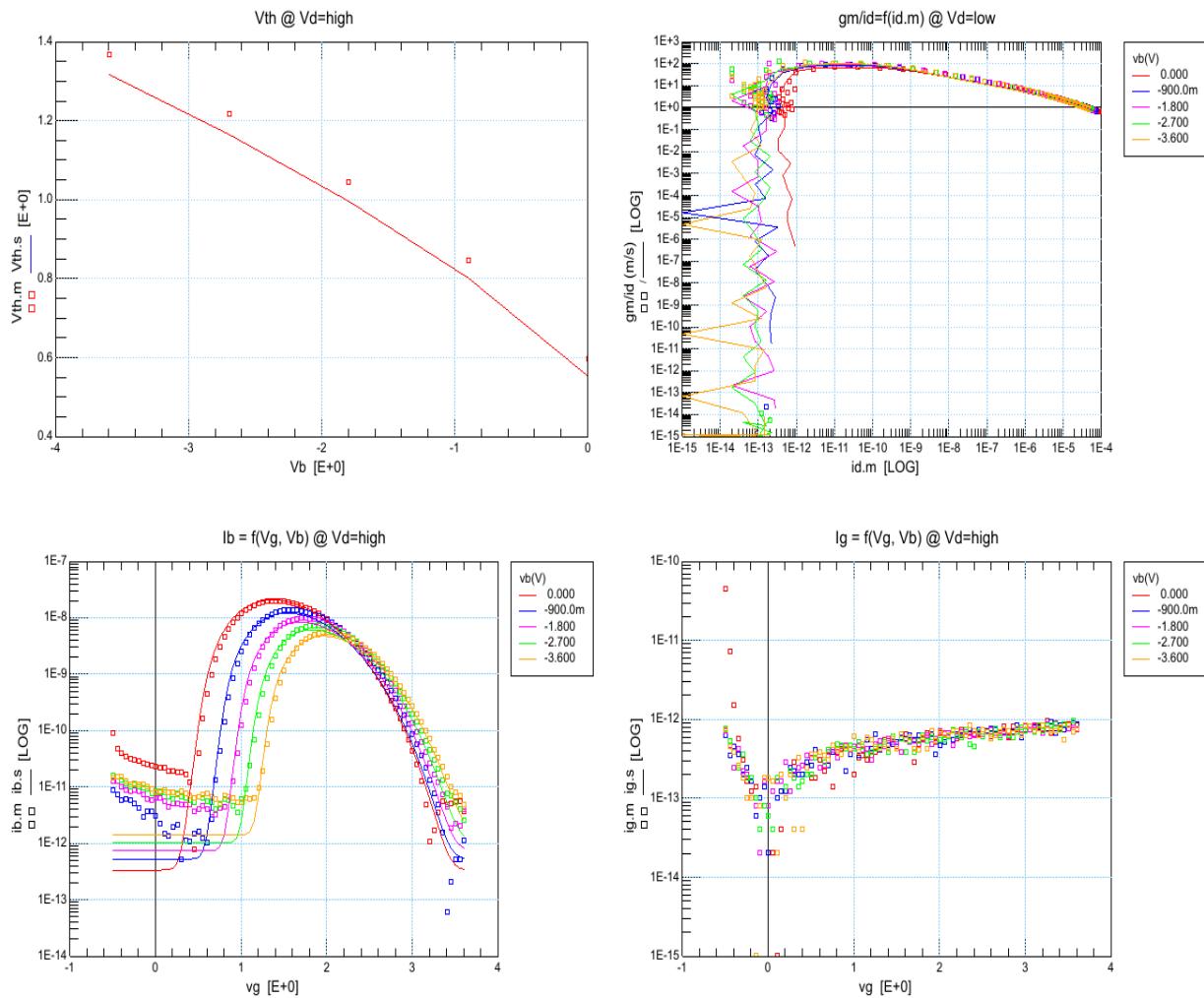
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



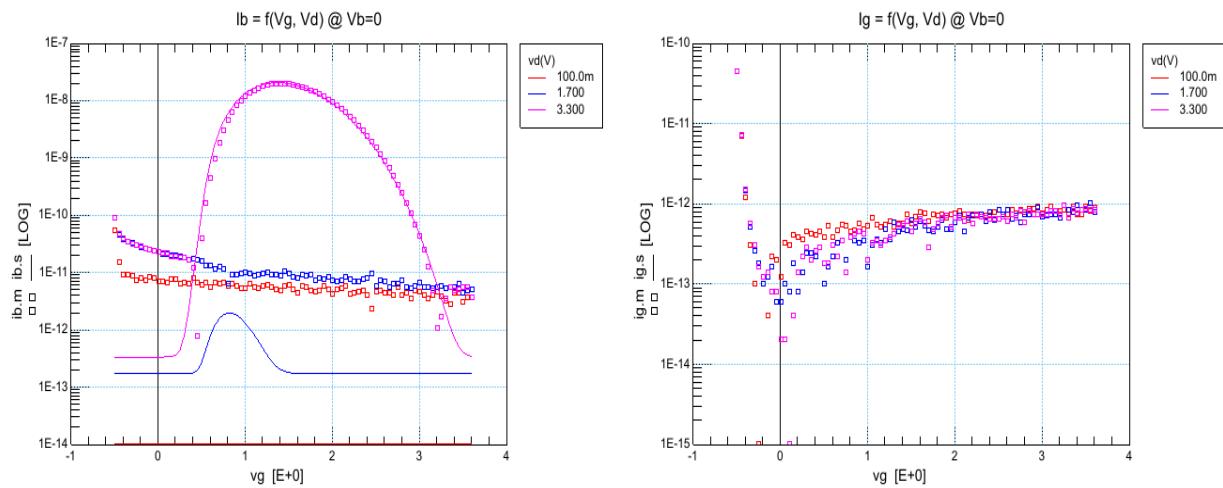


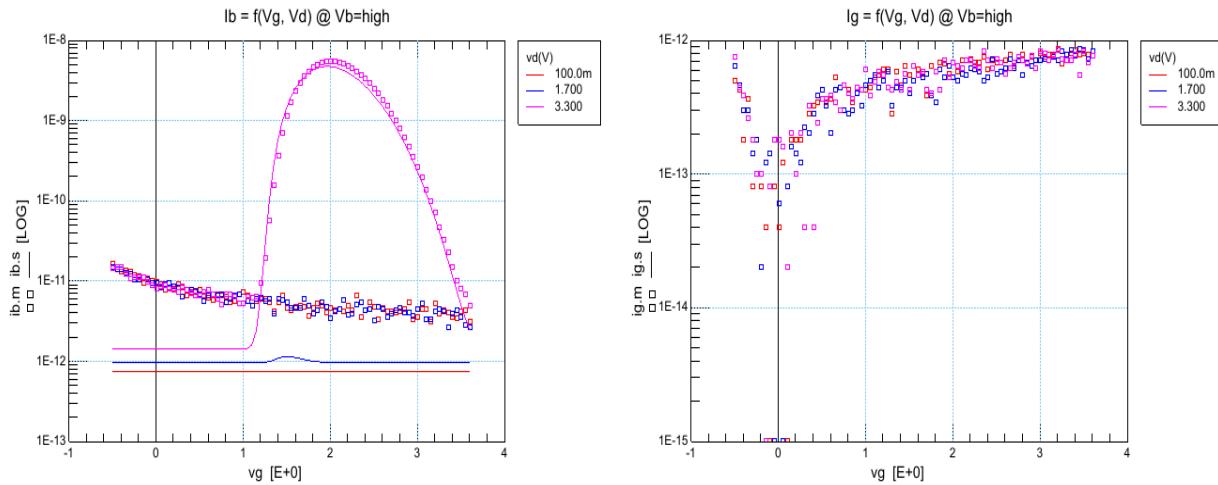
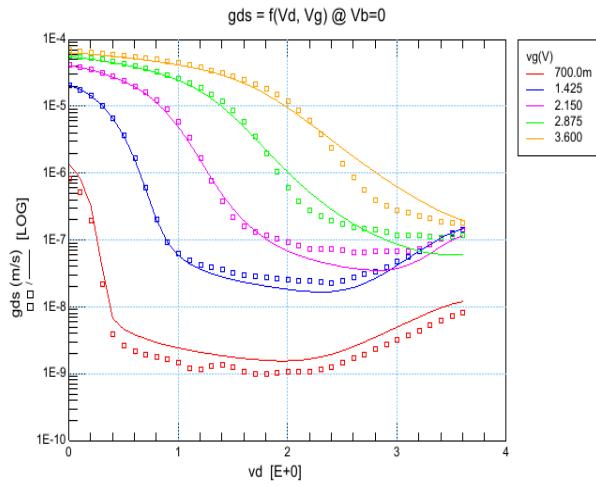
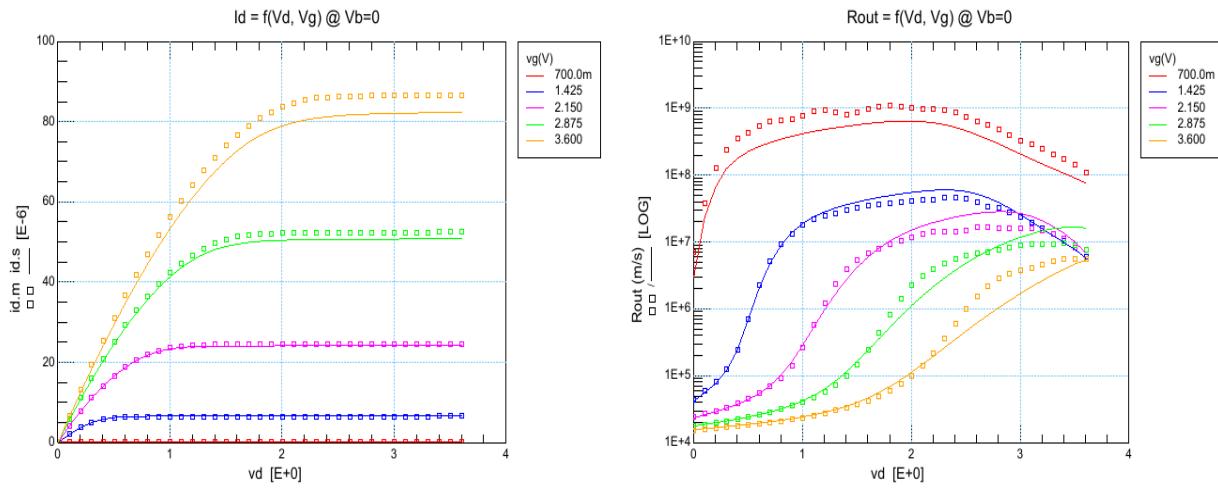
$i_{dvg}, V_d = 3.3V, T = 27^\circ\text{C}$

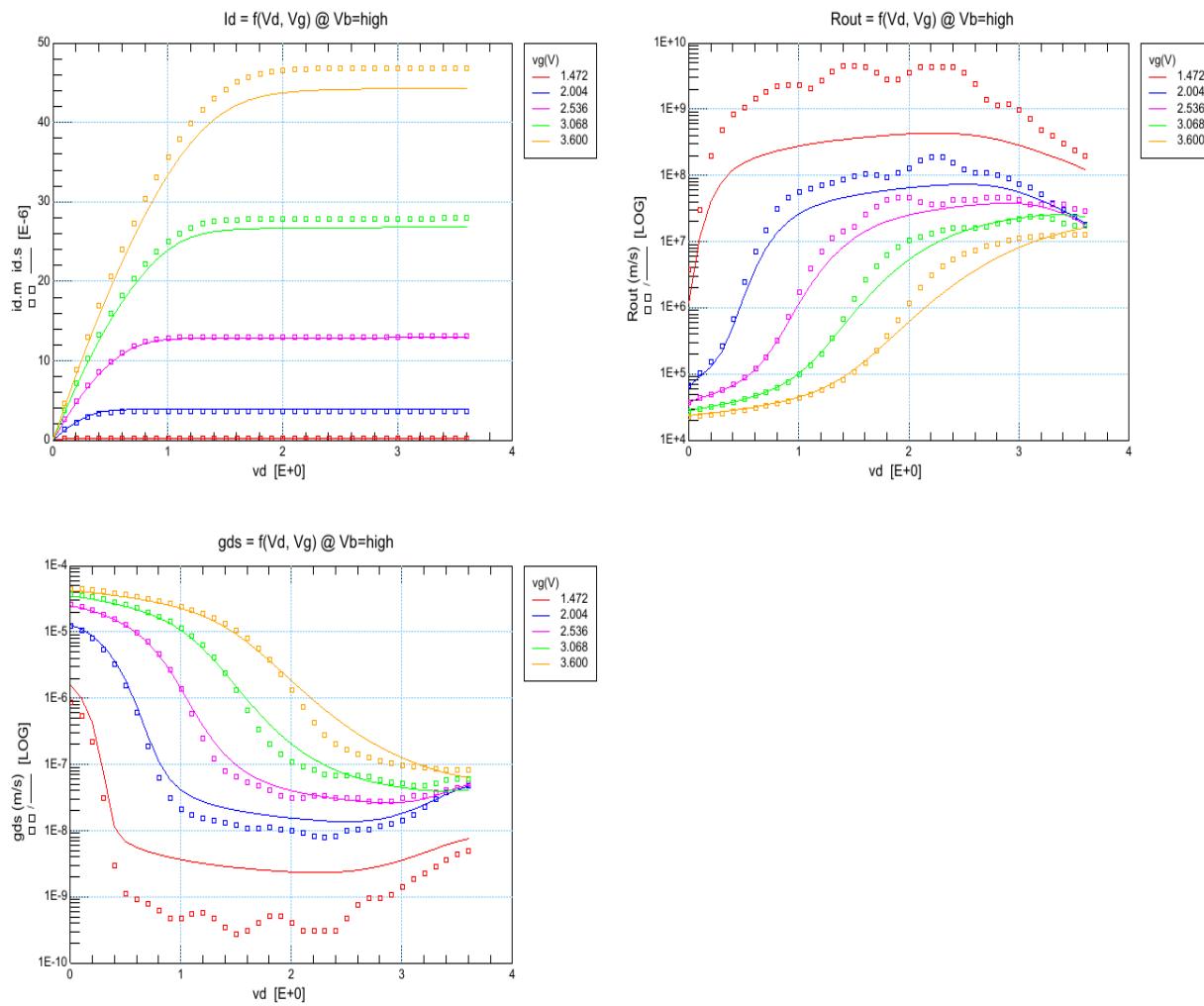
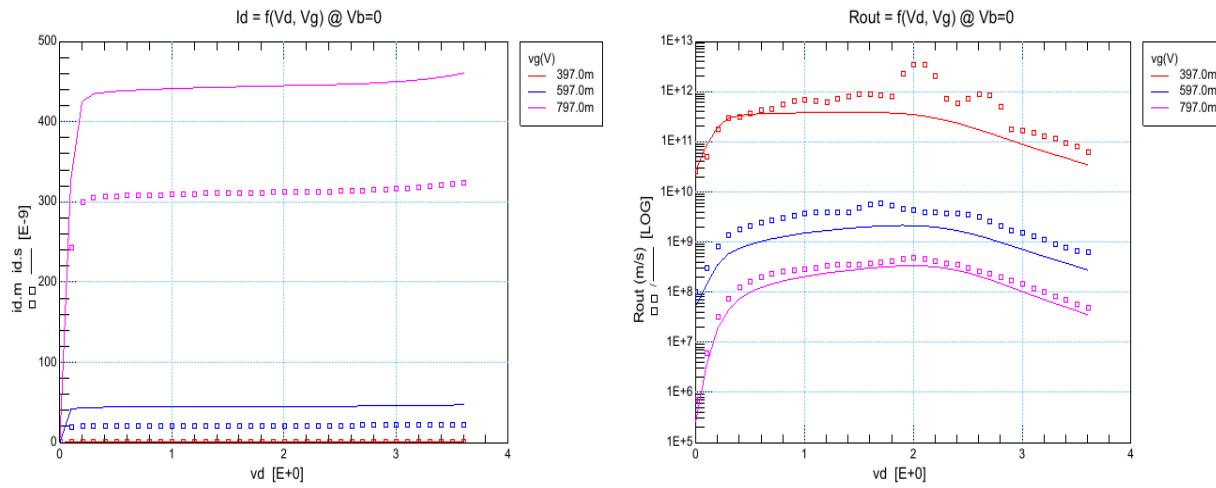


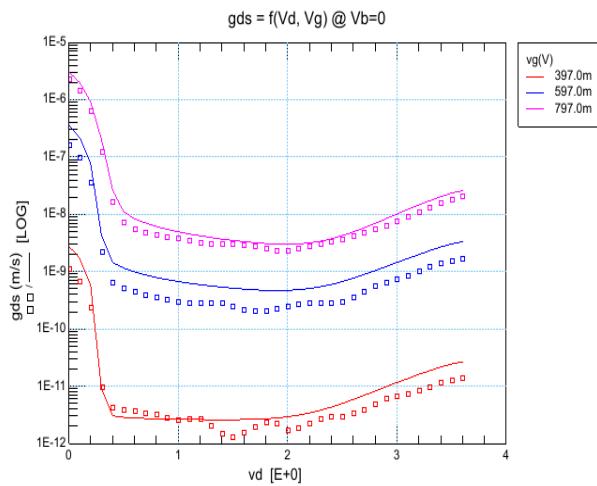


idvg, Ib,Ig, Vb = 0V, T = 27°C

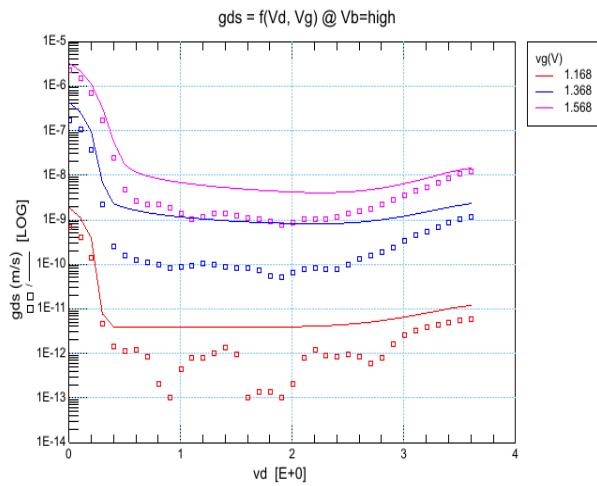
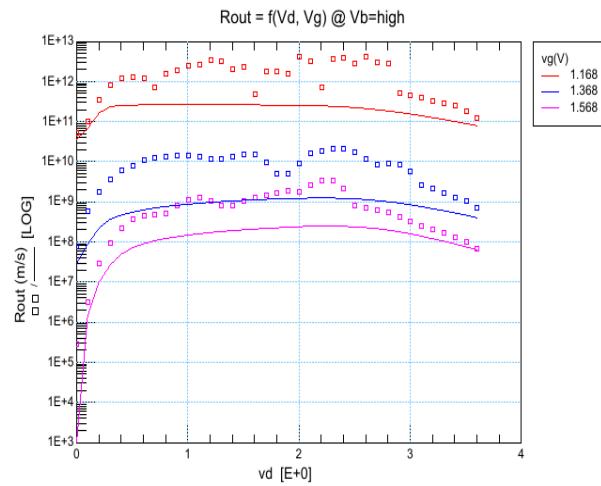
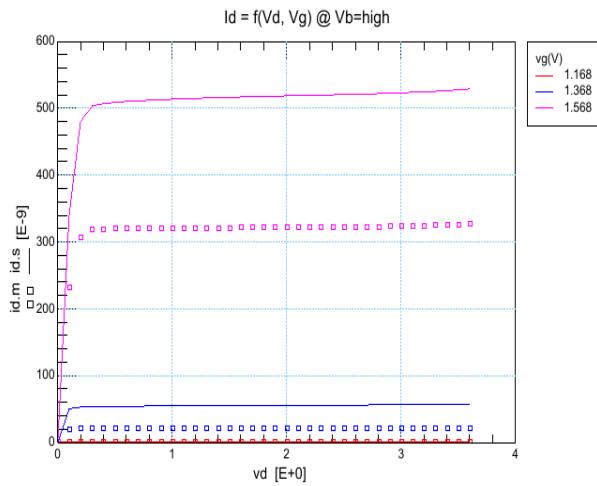


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


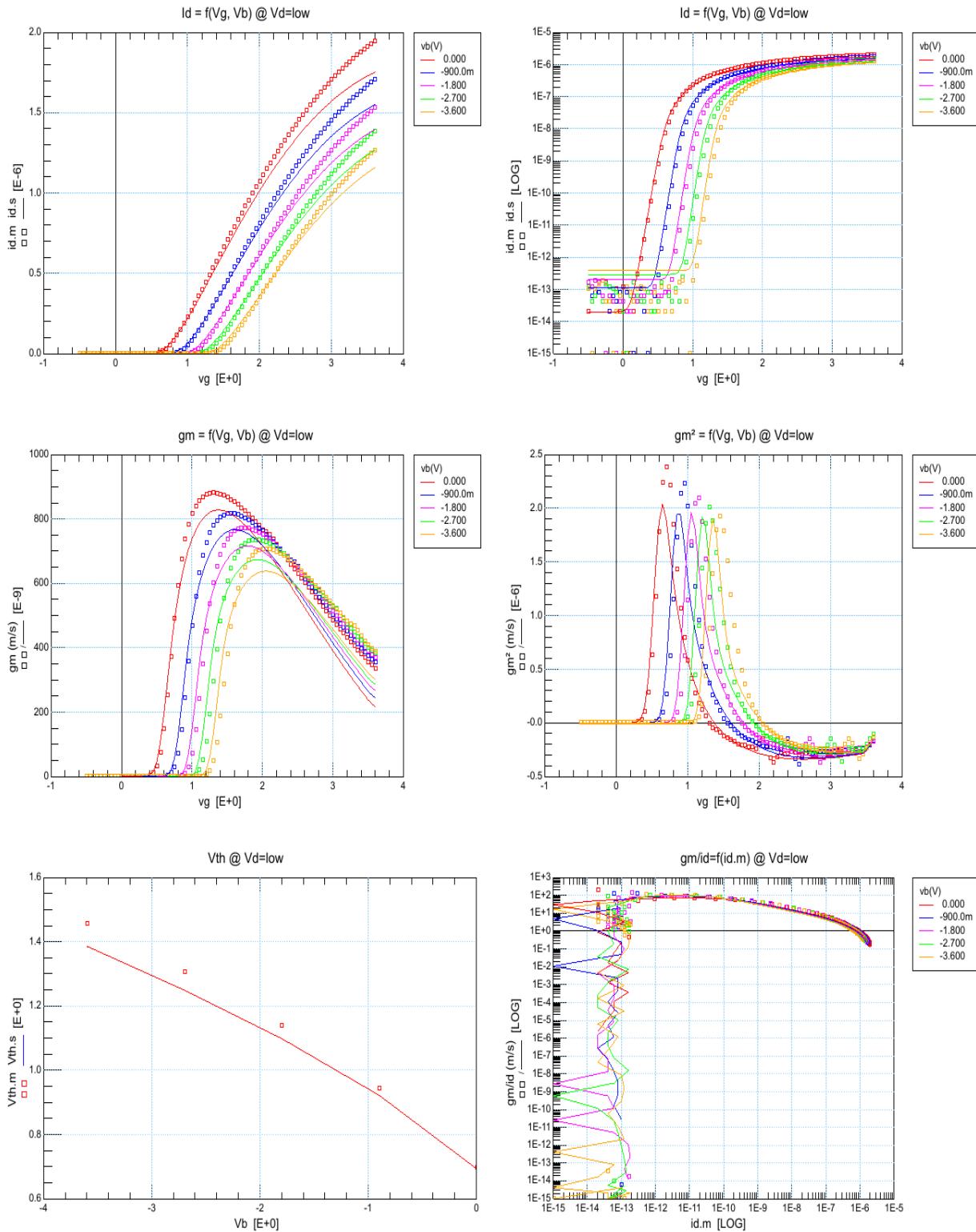


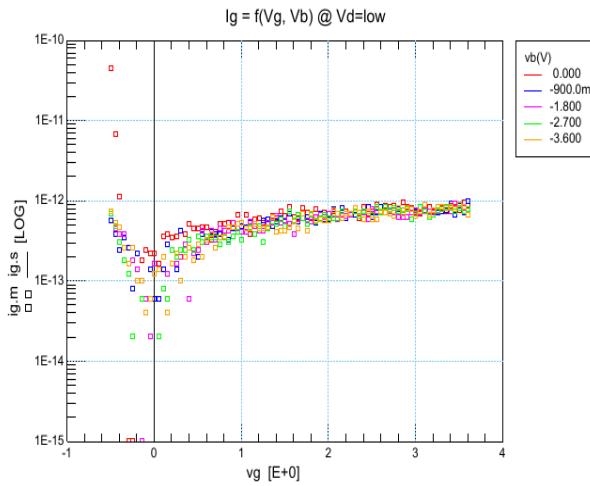
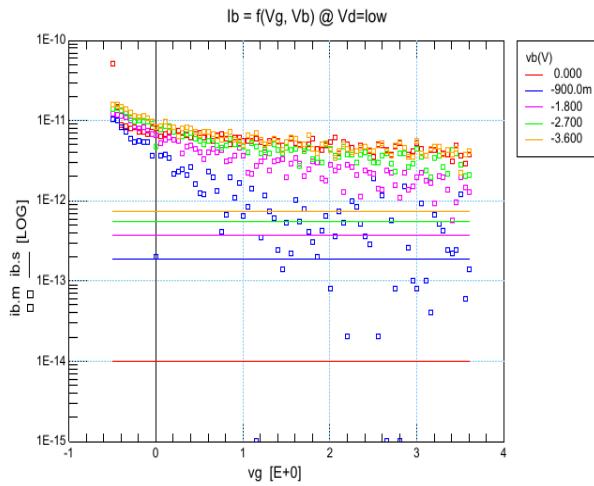
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



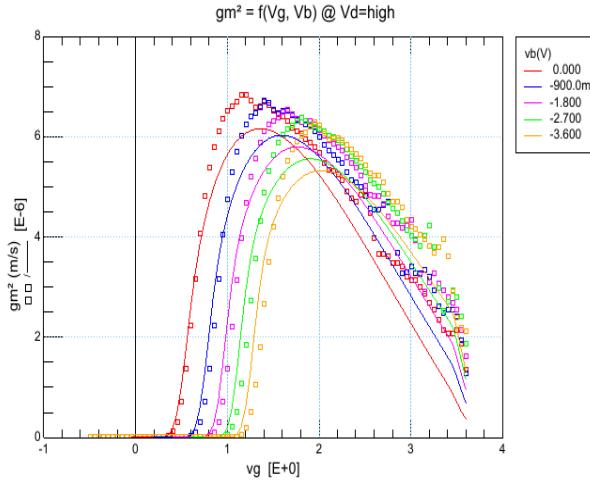
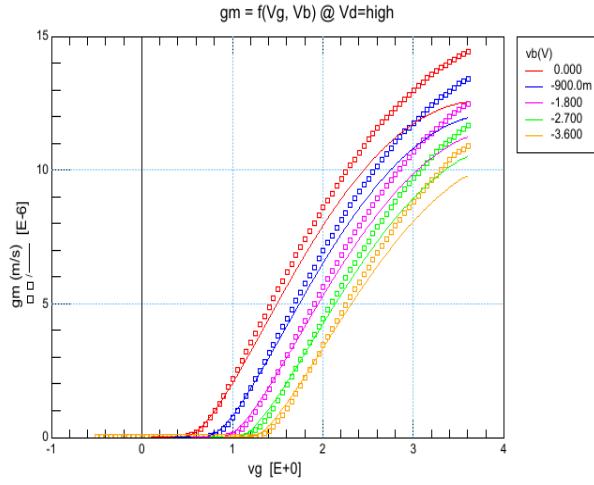
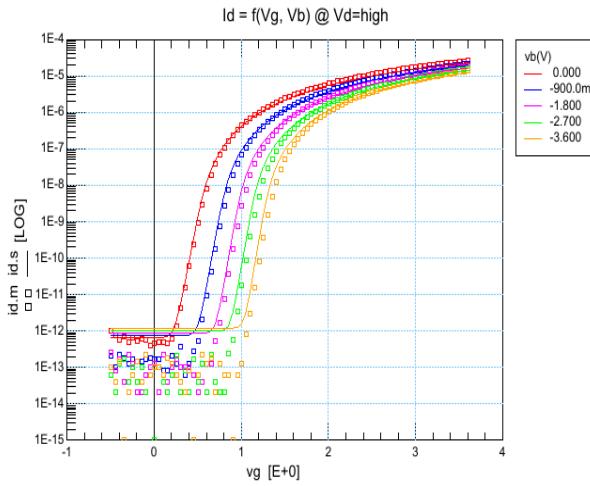
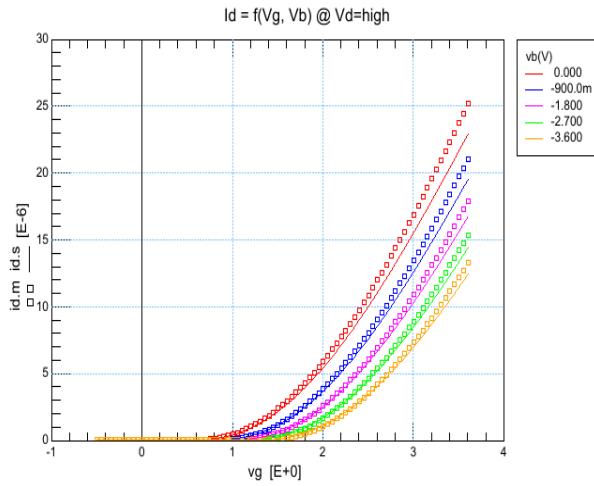
4.14 W0u6_L10u0_S559_5

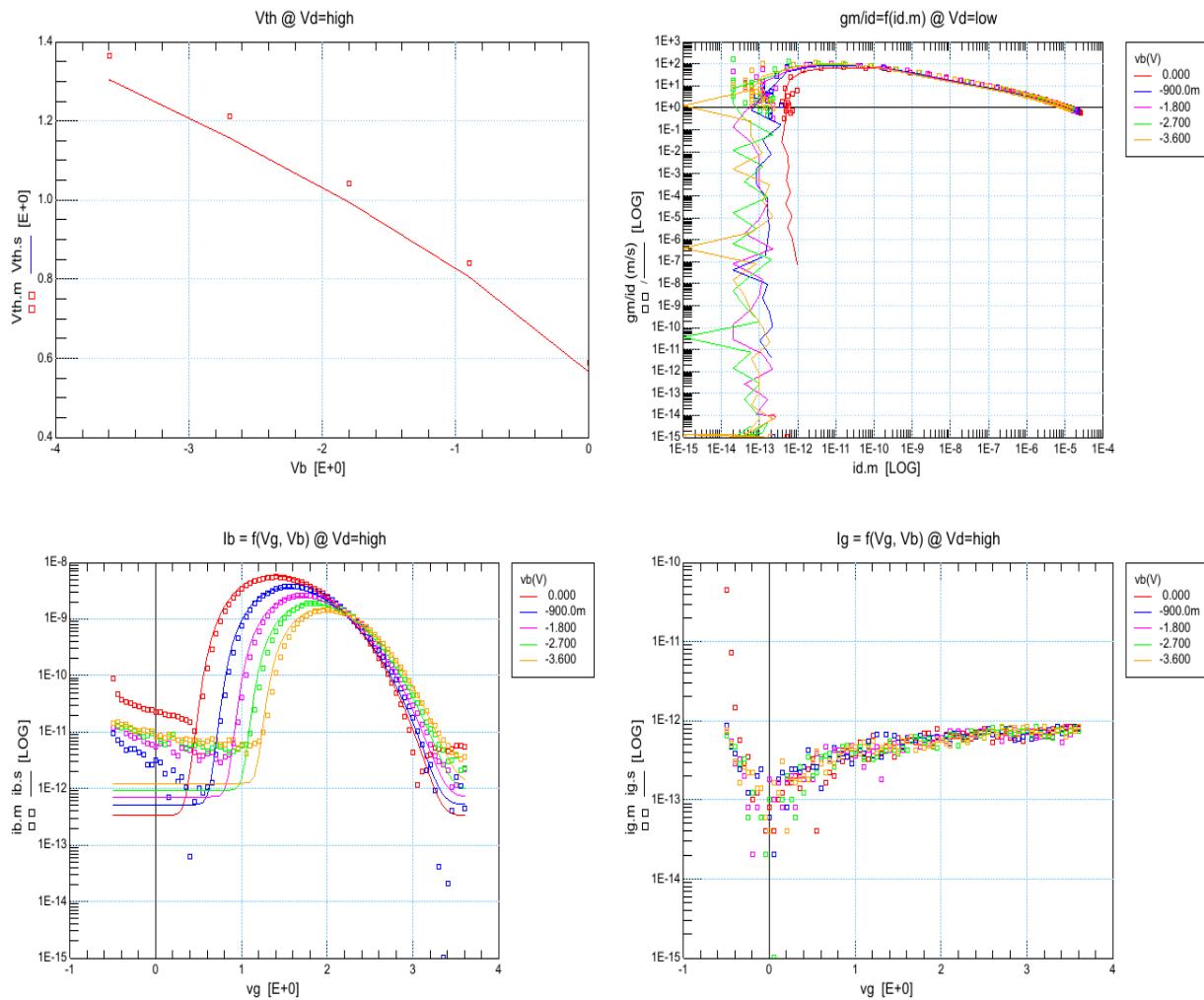
$idv_g, V_d = 0.1V, T = 27^\circ C$



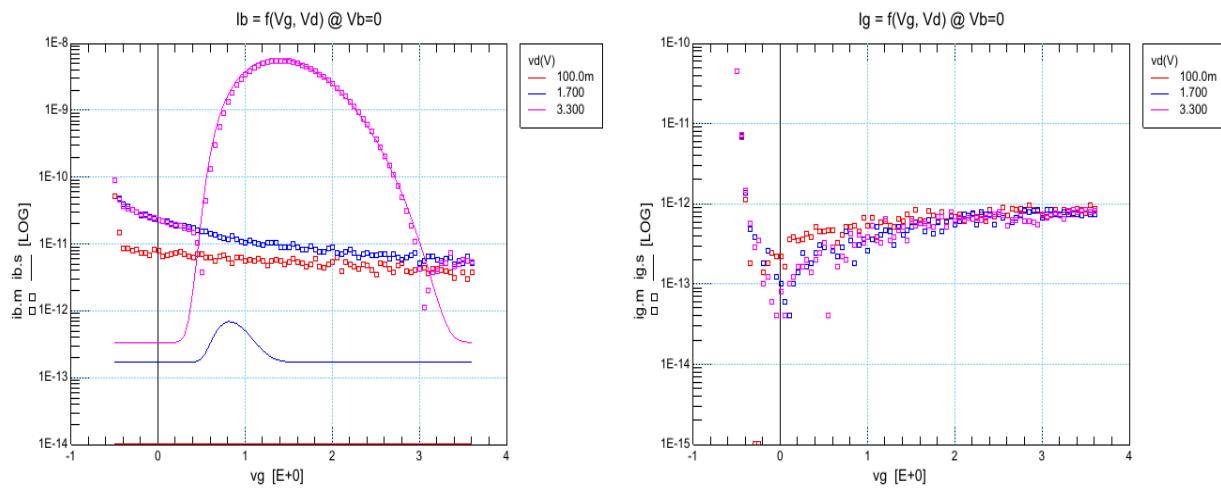


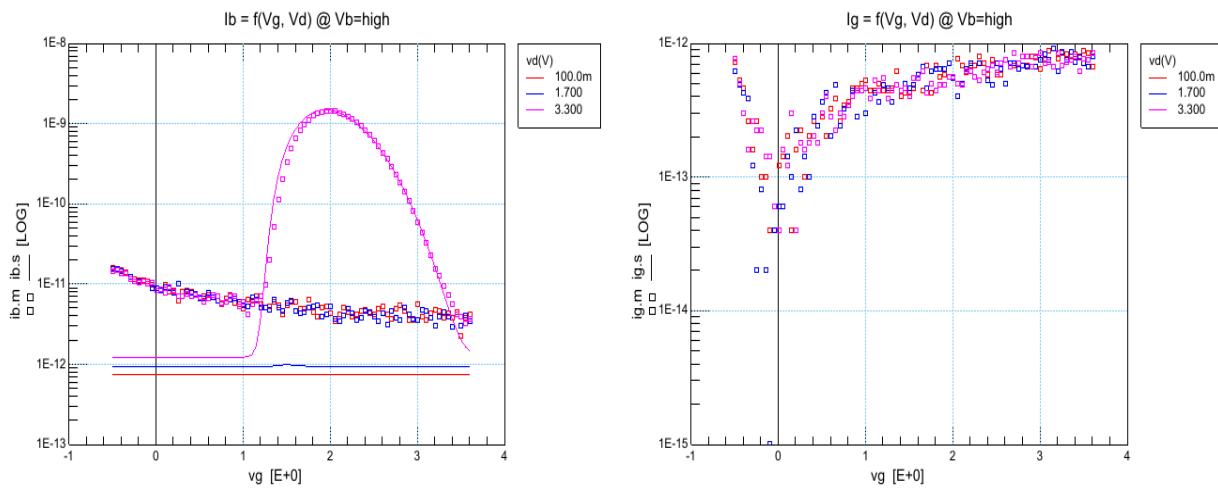
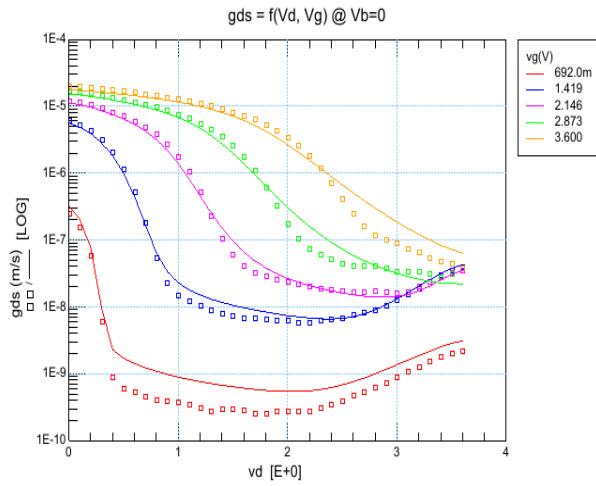
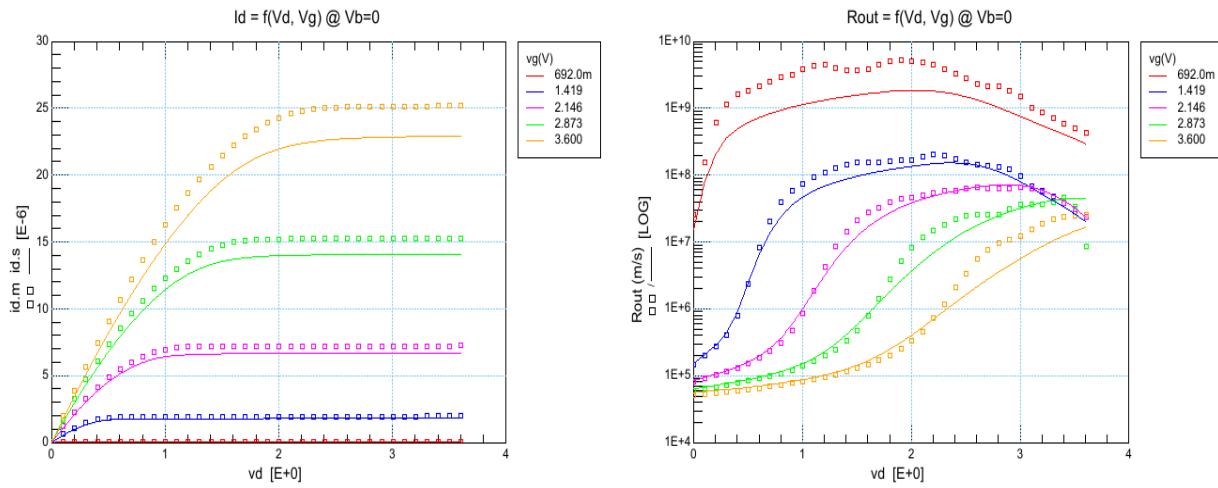
idvg, Vd = 3.3V, T = 27°C

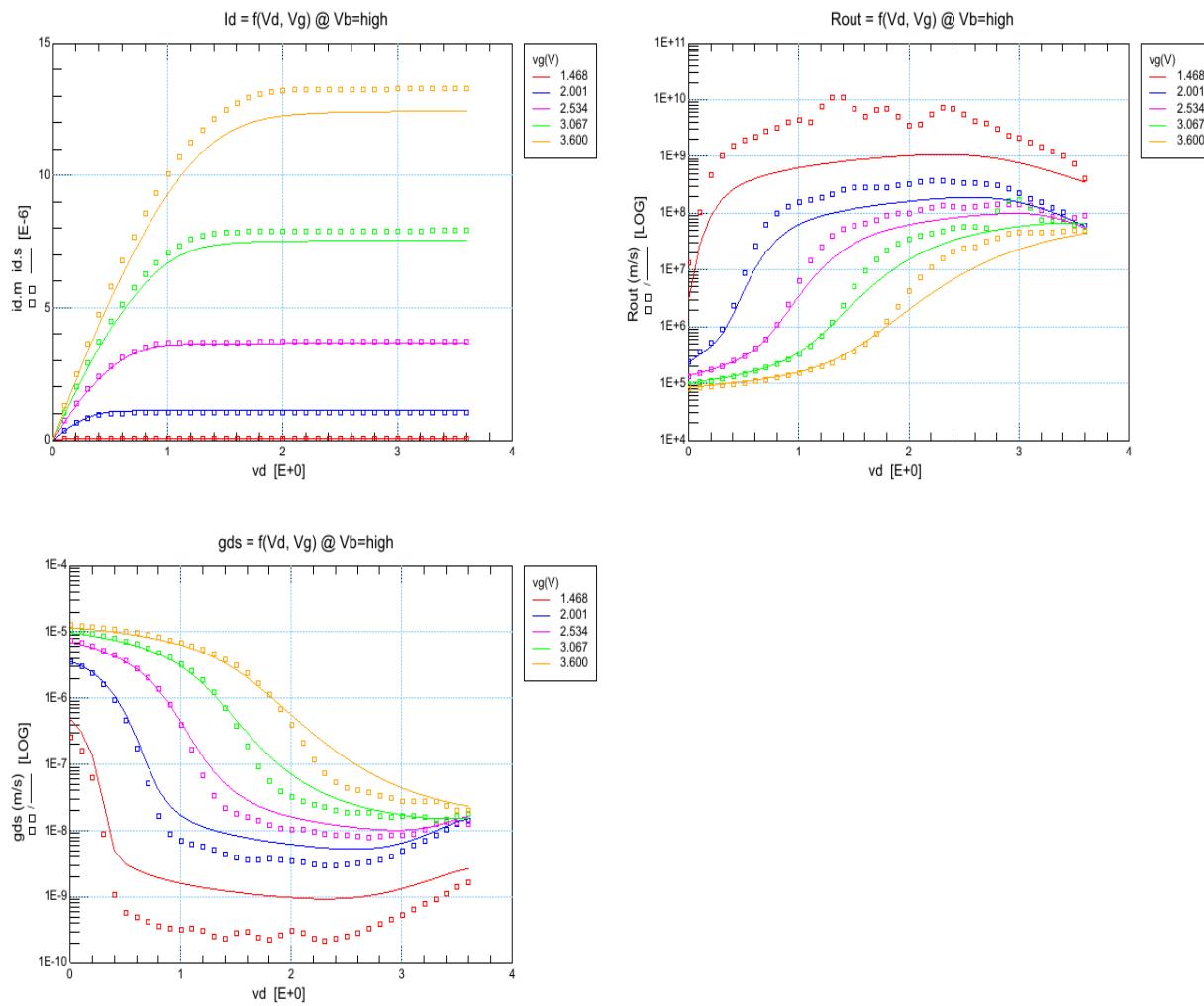
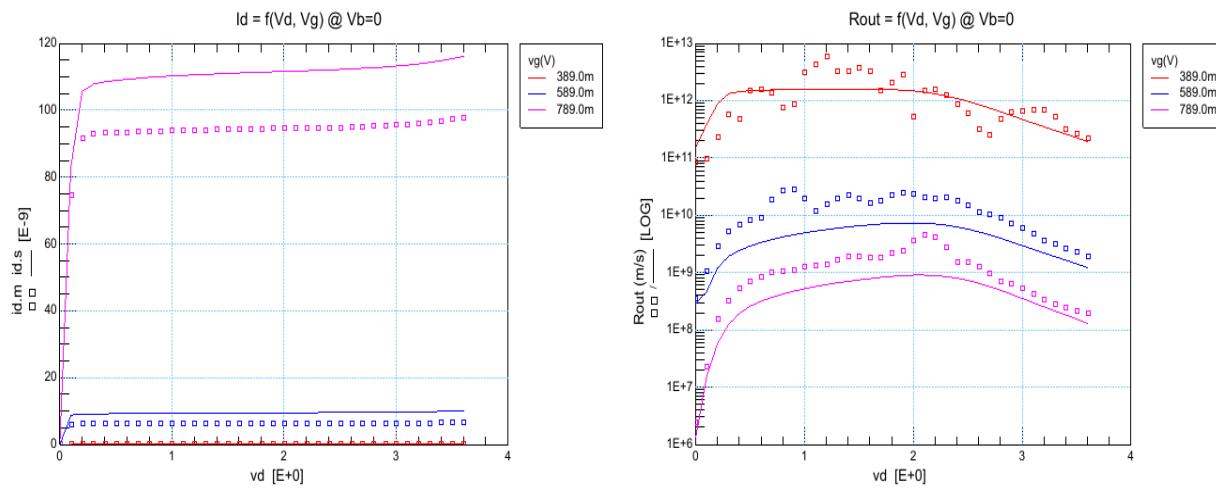


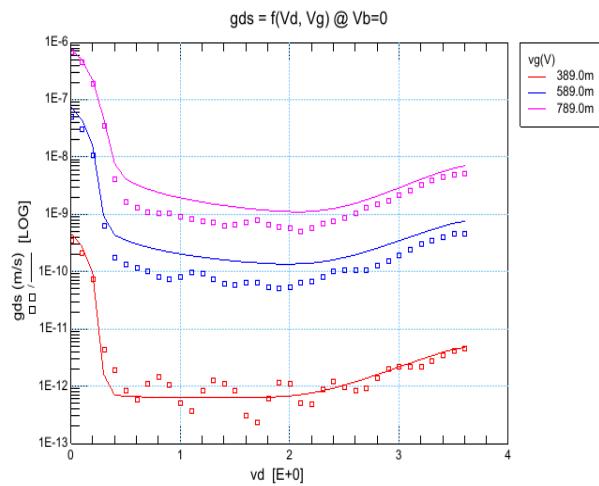


idvg, Ib, Ig, Vb = 0V, T = 27°C

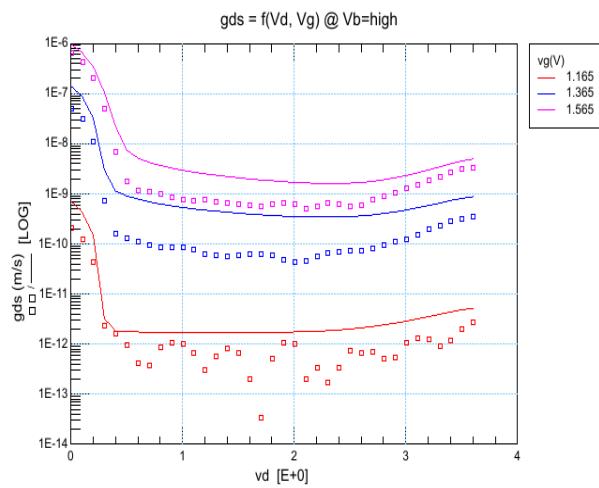
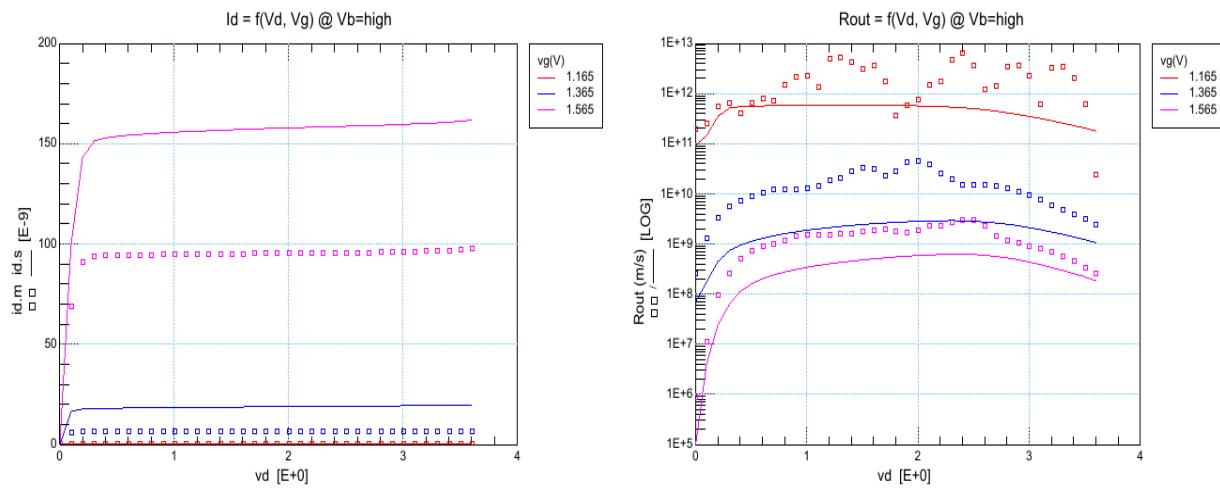


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


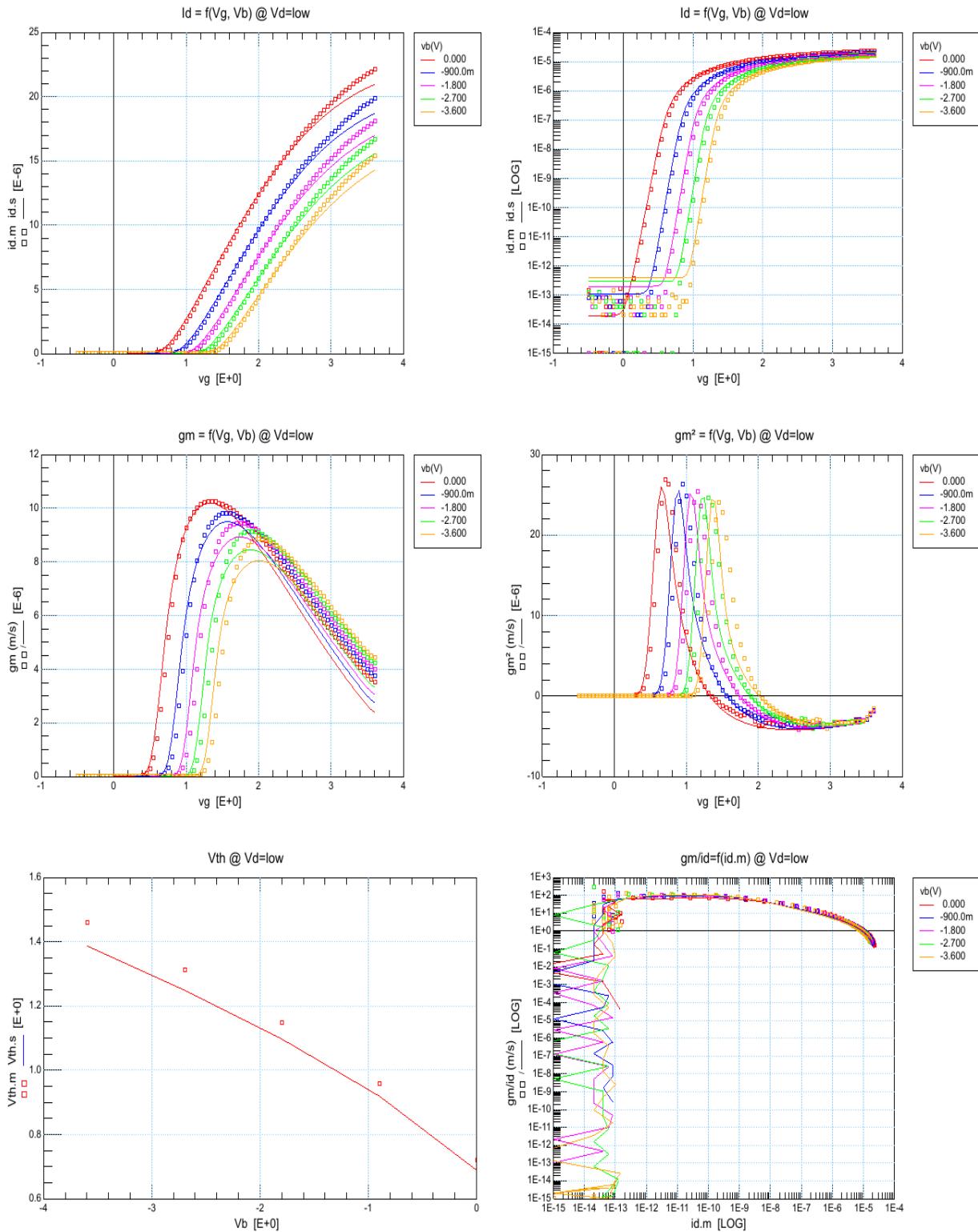


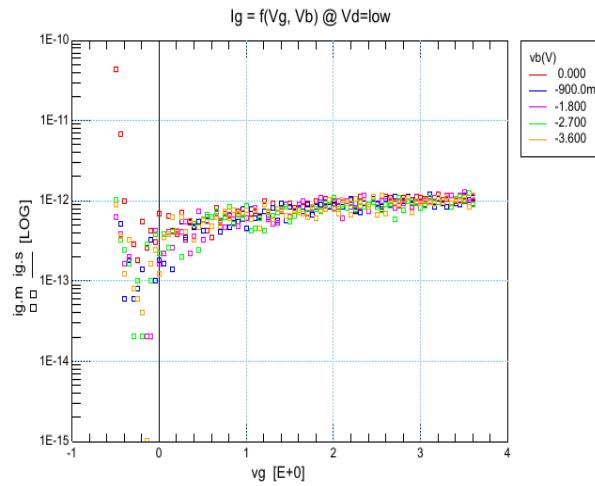
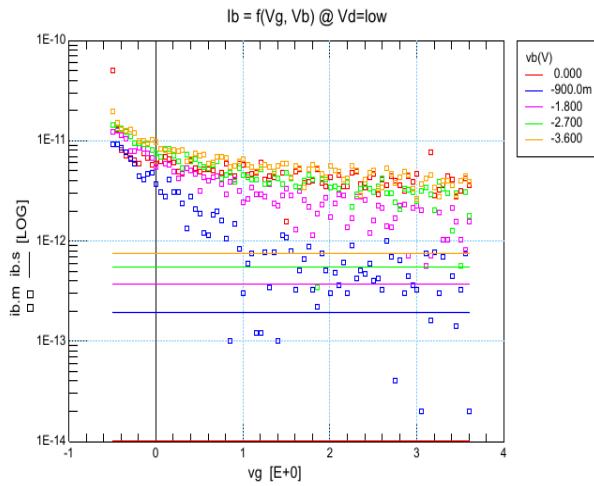
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



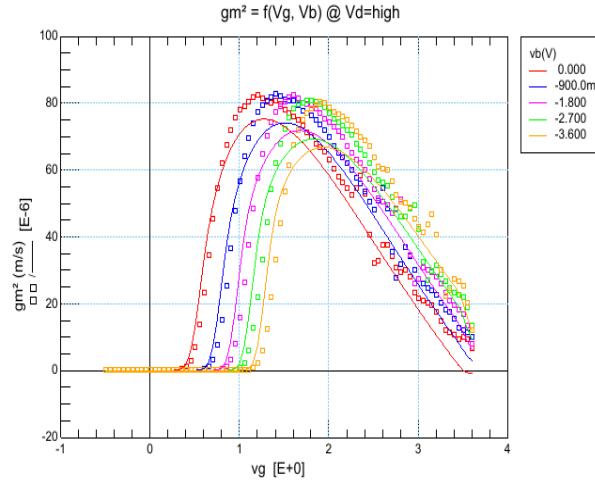
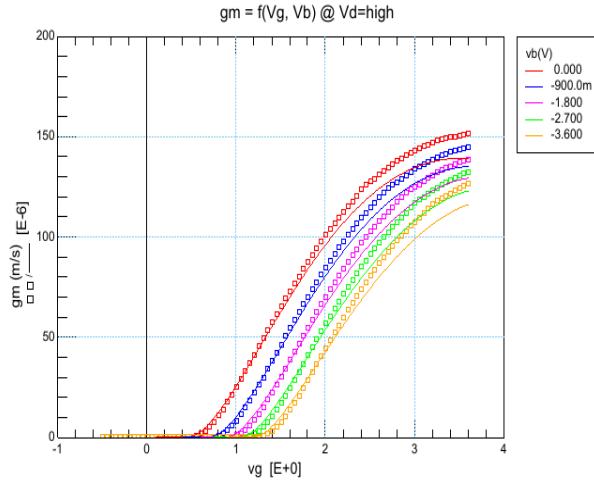
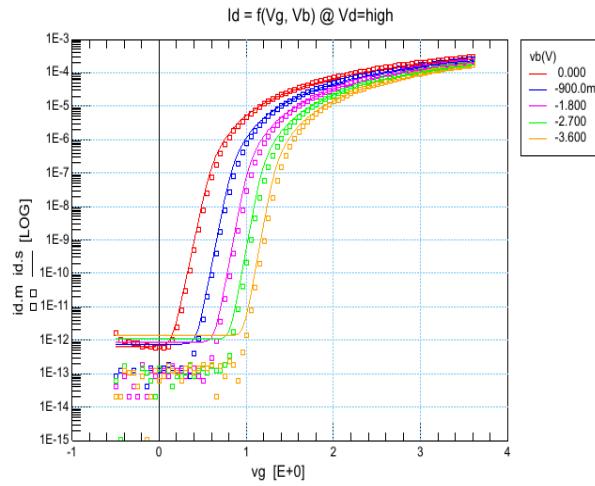
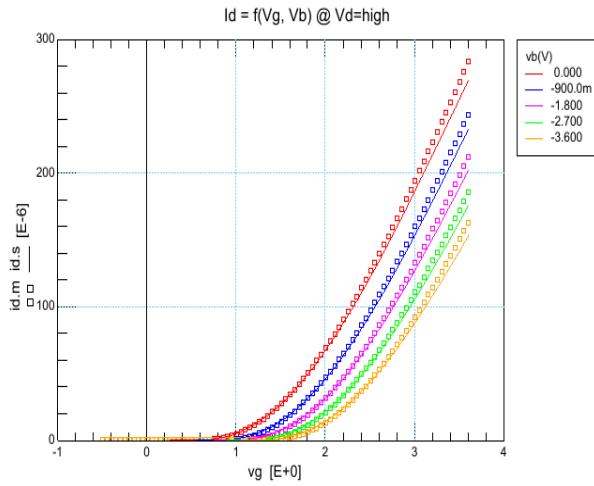
4.15 W02u0_L3u0_S558_4

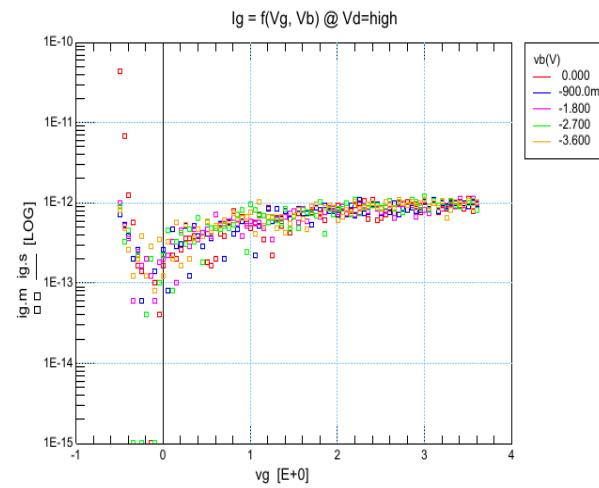
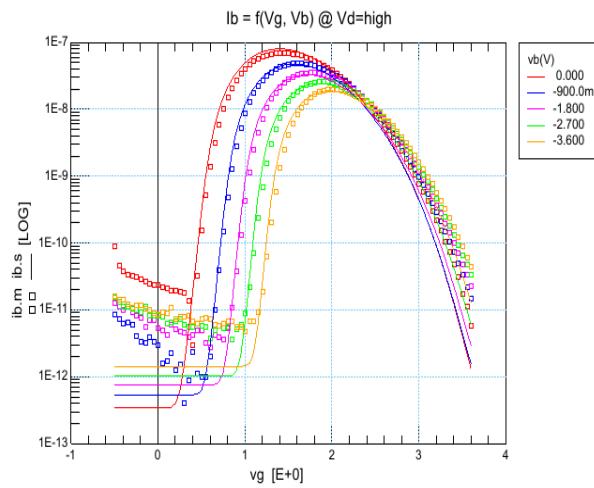
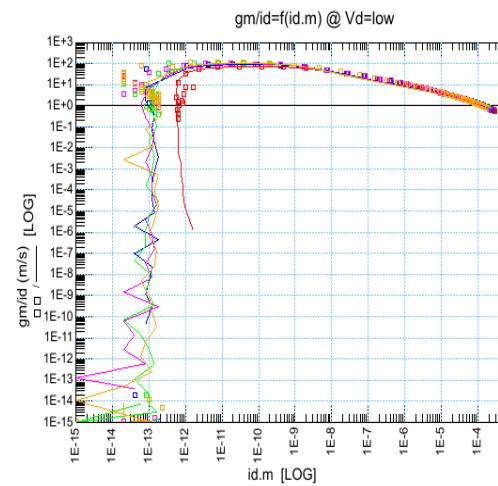
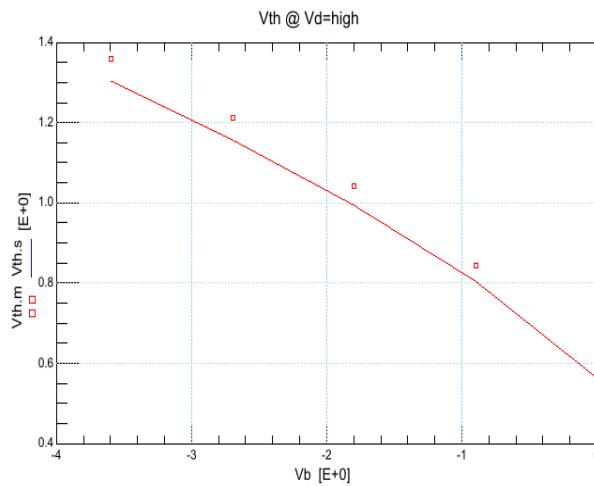
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



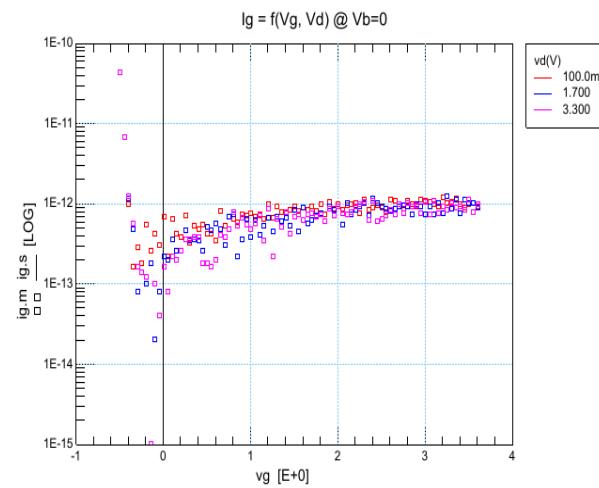
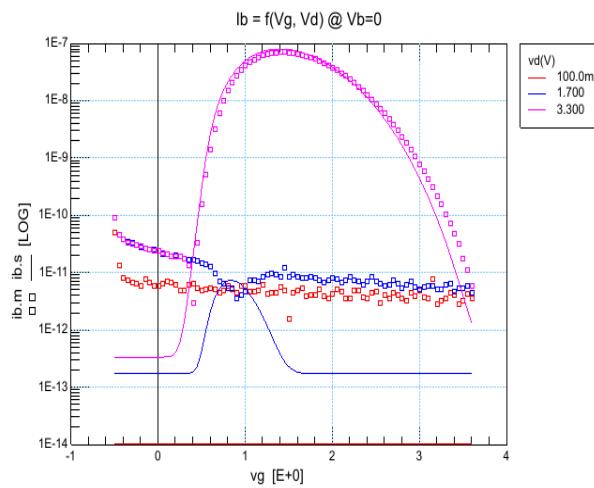


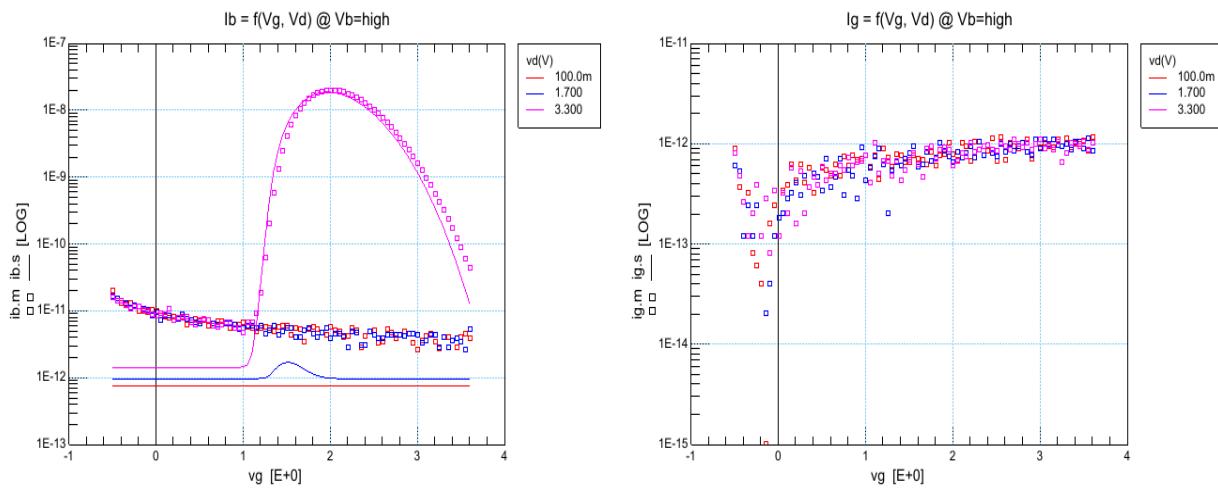
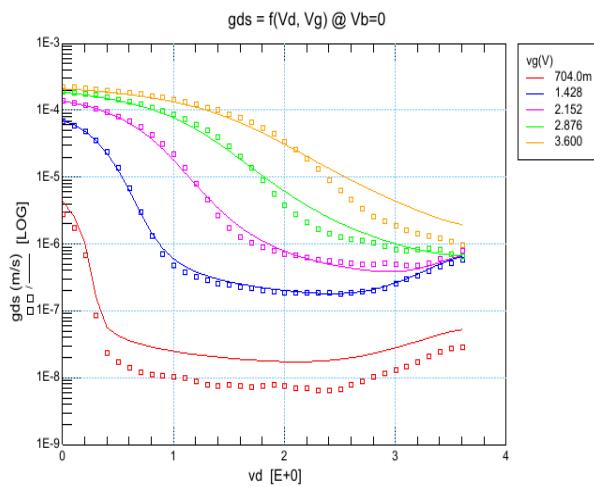
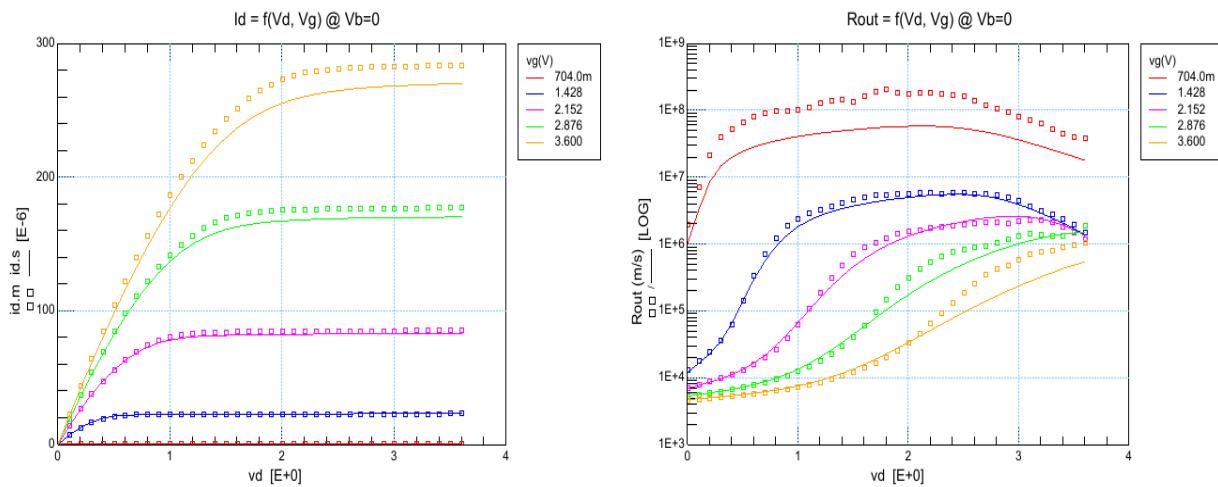
$i_{dvg}, V_d = 3.3V, T = 27^\circ\text{C}$

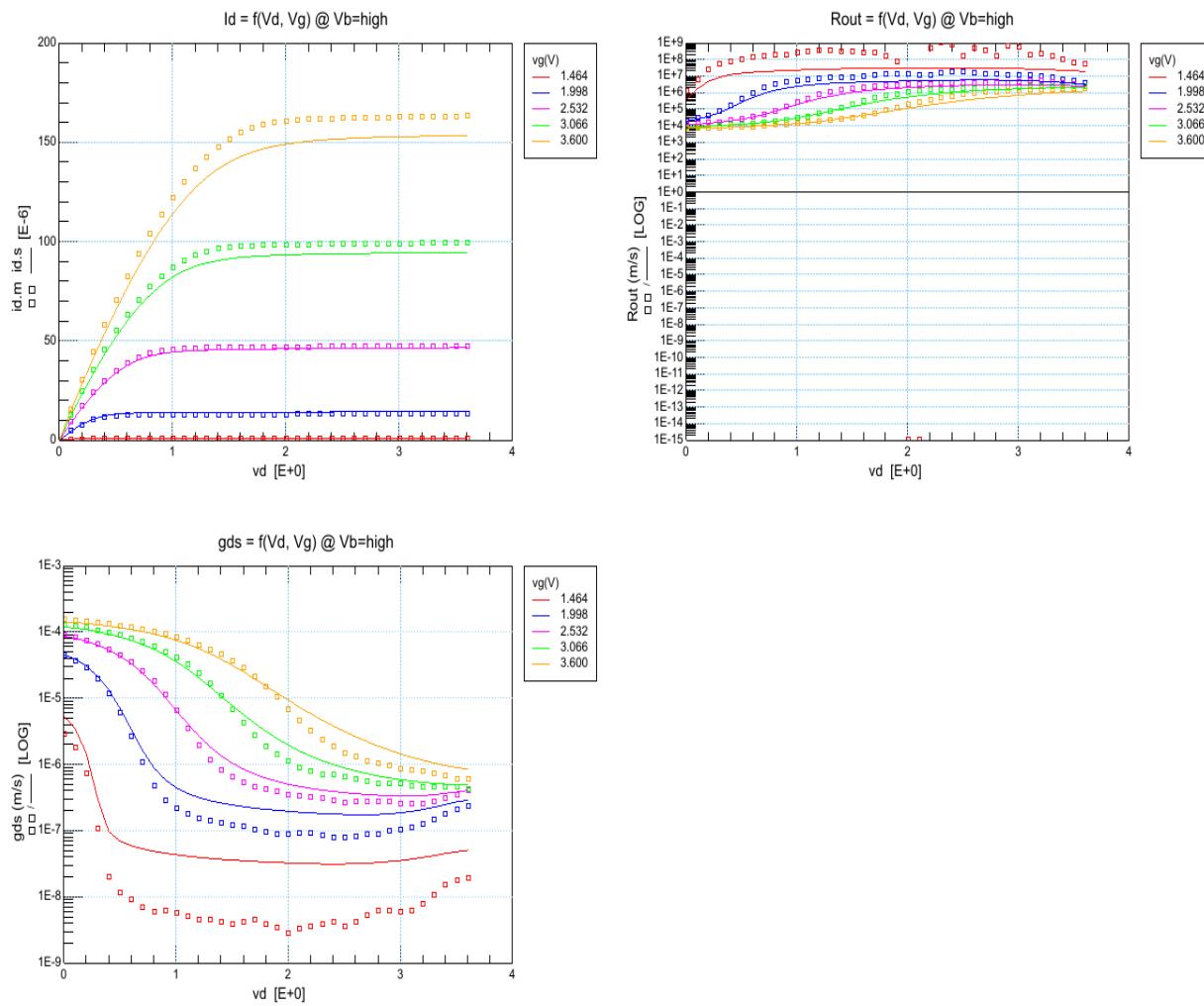
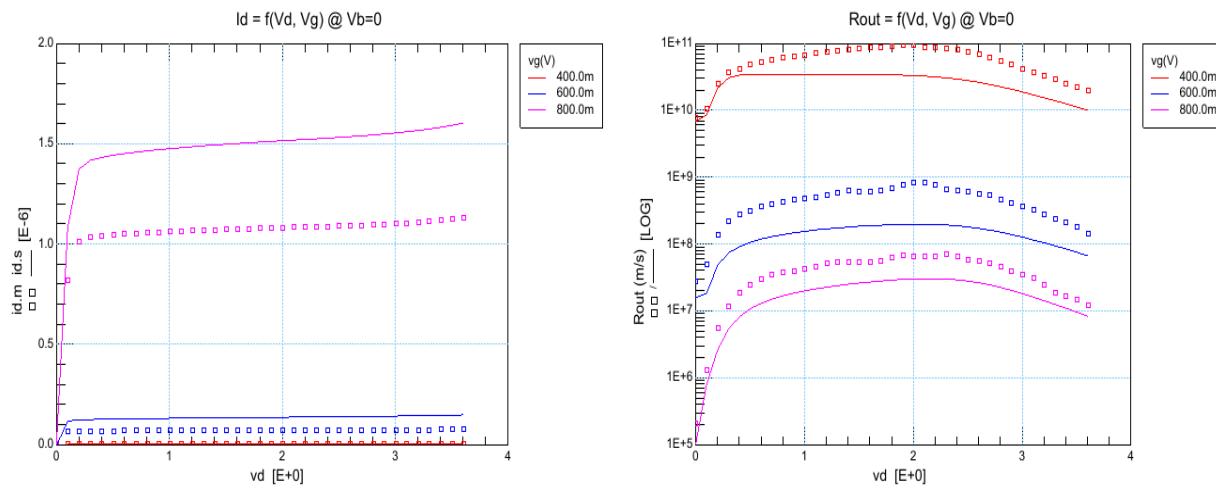


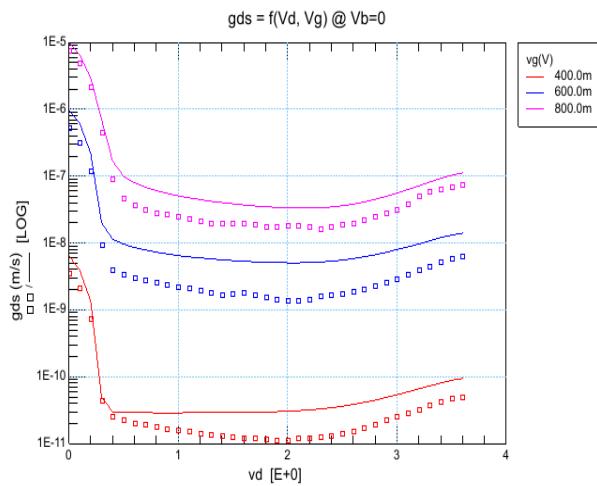


idvg, lb, lg, Vb = 0V, T = 27°C

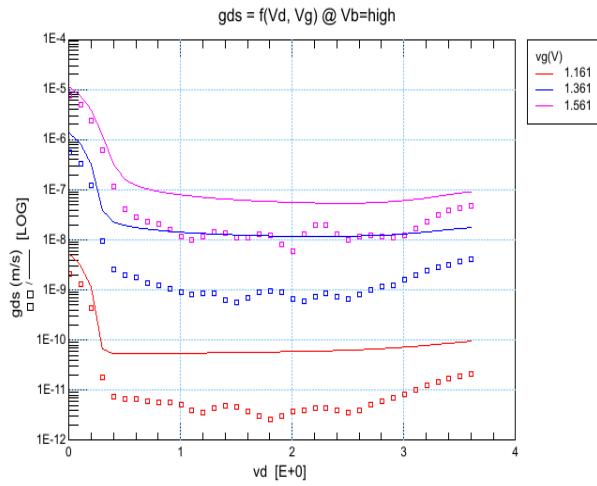
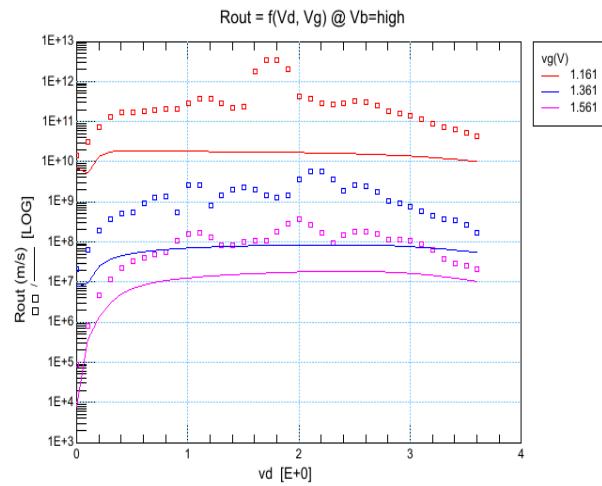
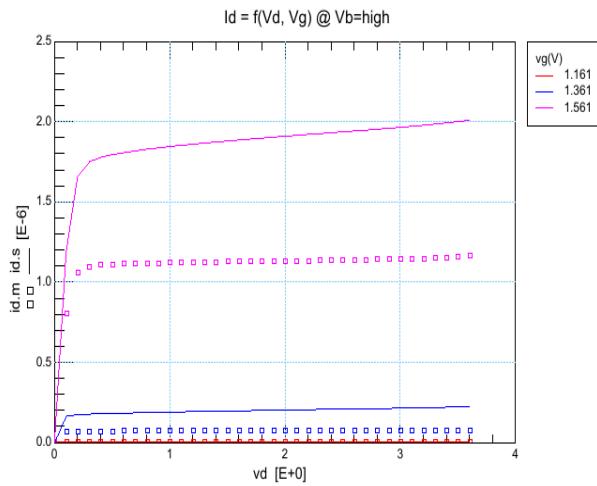


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


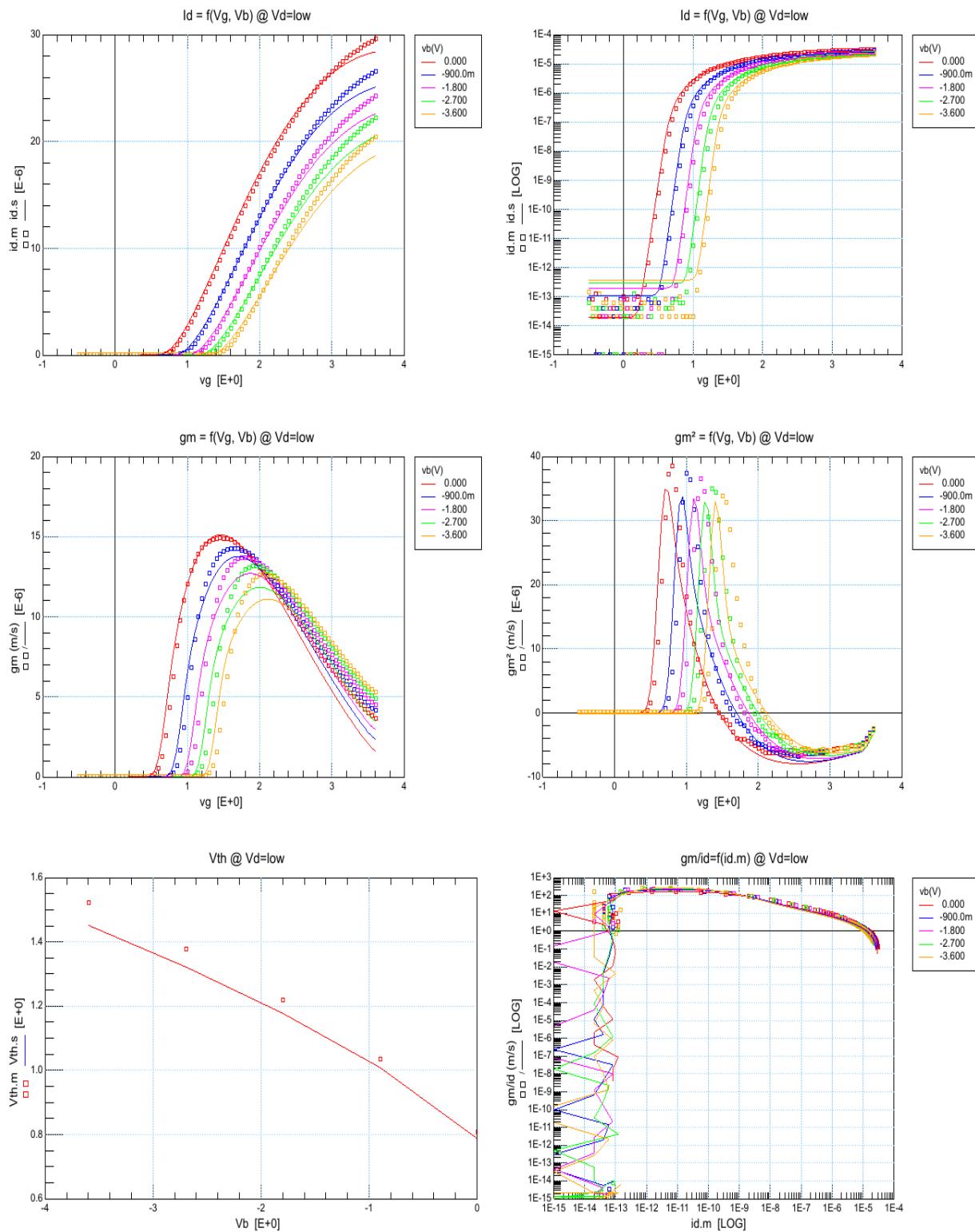
idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


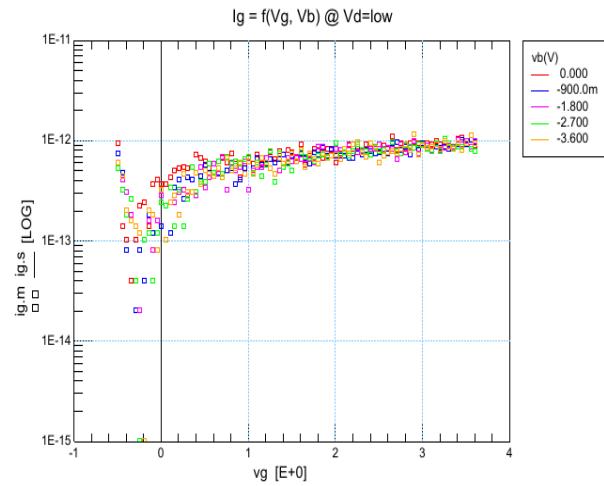
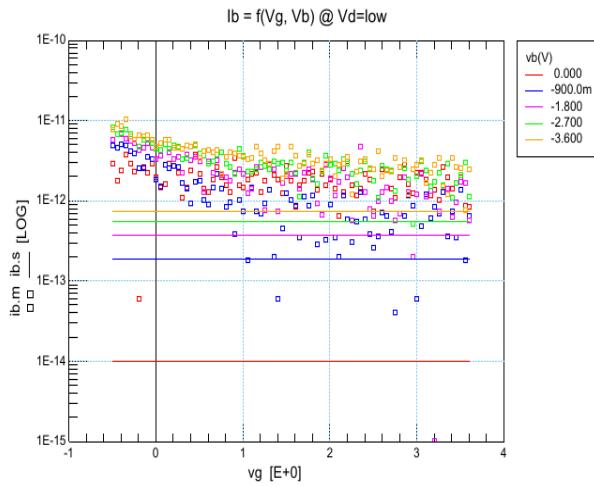


idvd_vth_vbmin, Vb = -3.6V, T = 27°C

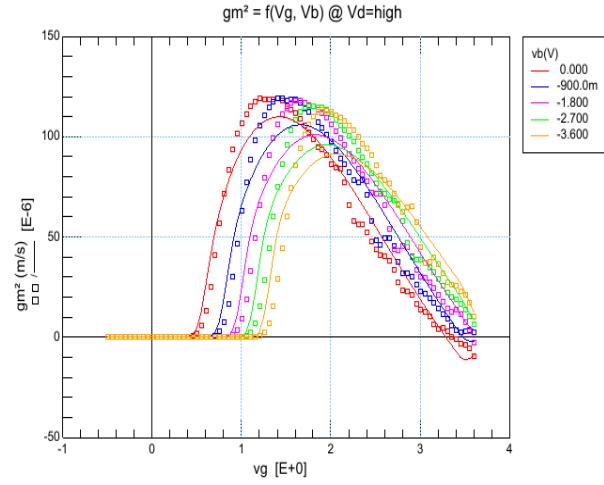
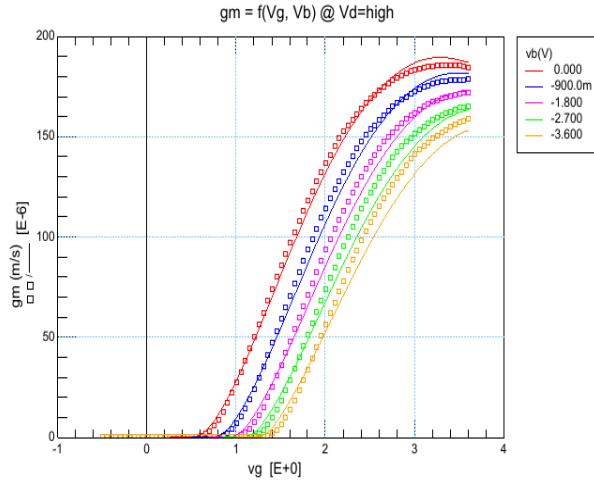
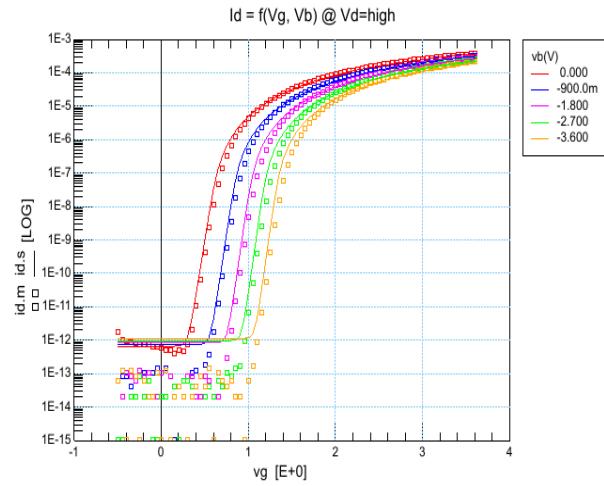
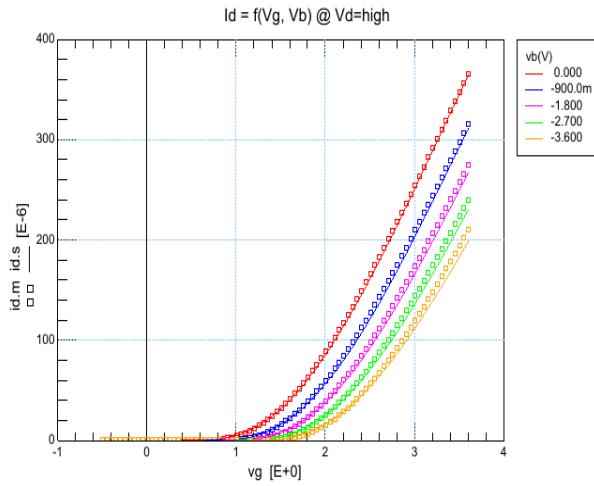


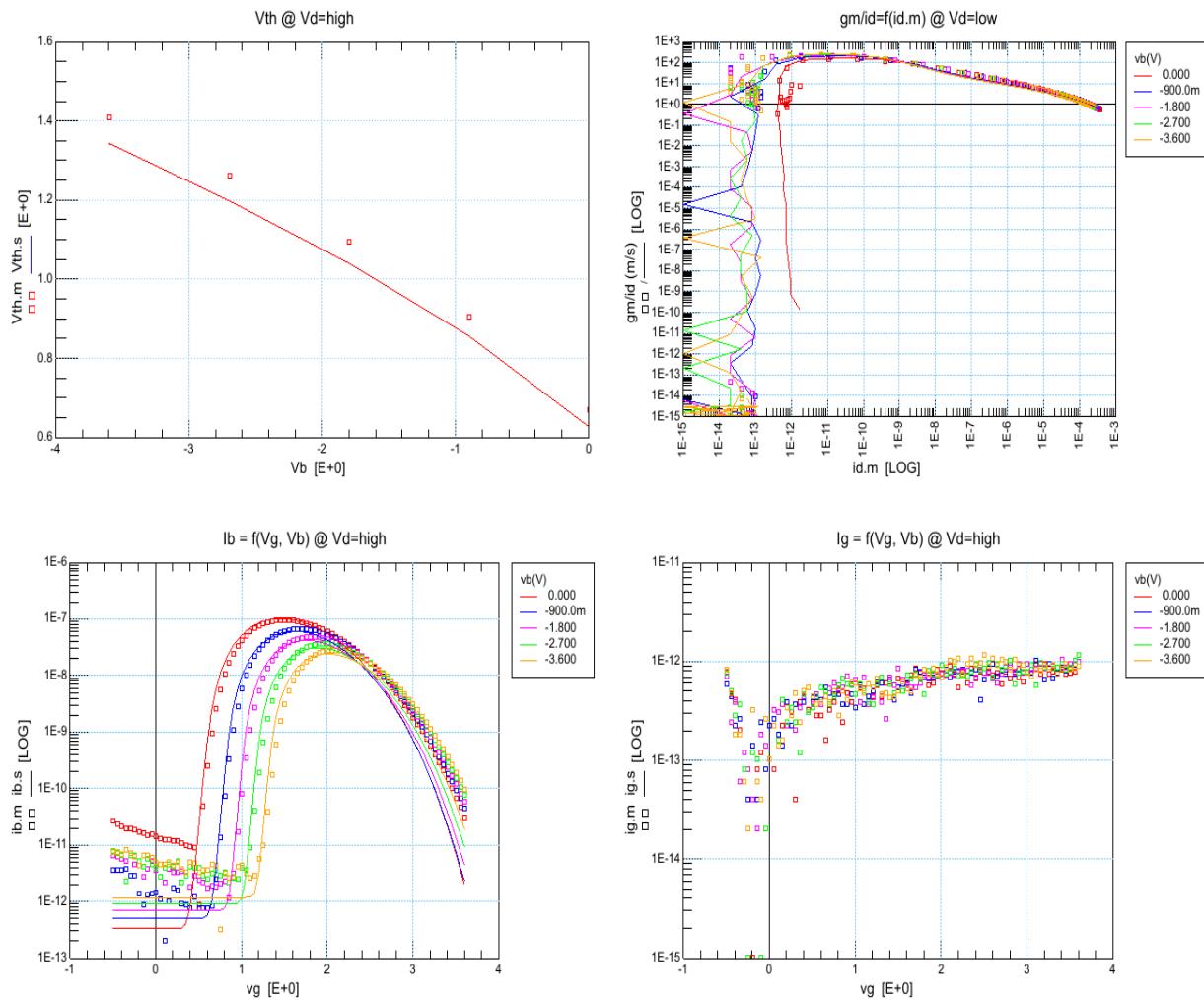
idvg, Vd = 0.1V, T = -40°C



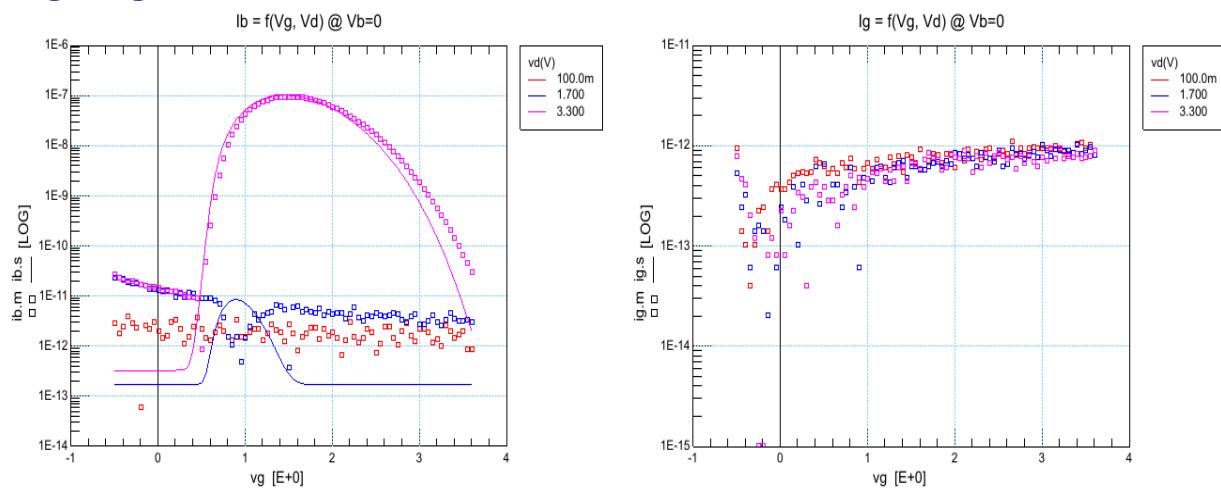


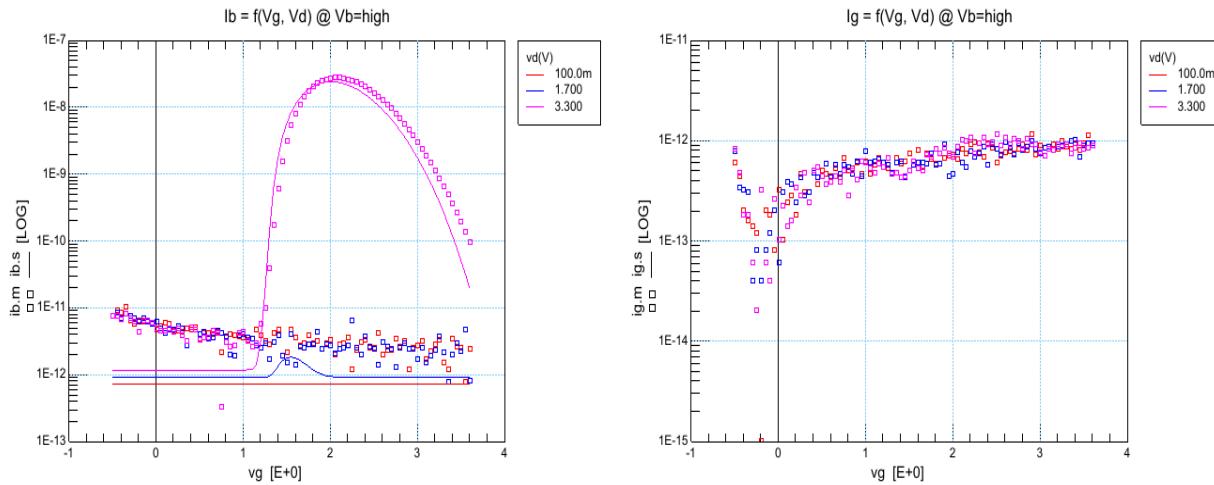
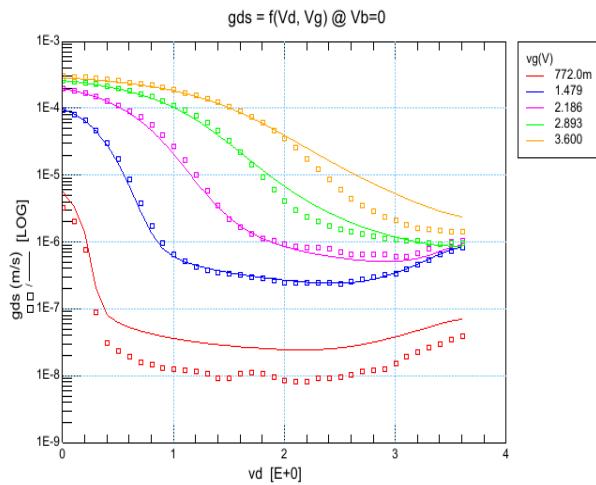
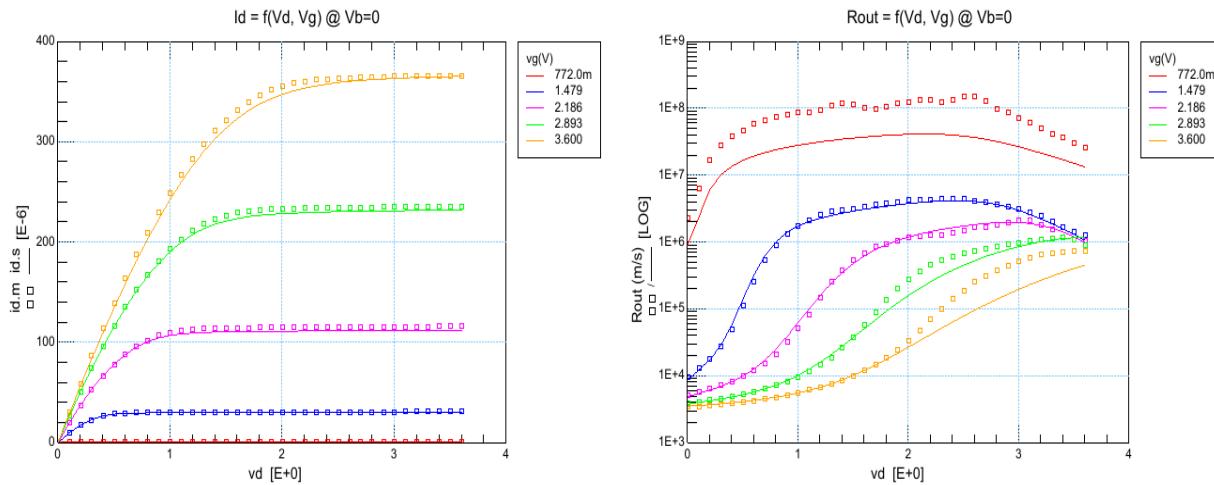
$i_{dvg}, V_d = 3.3V, T = -40^\circ\text{C}$

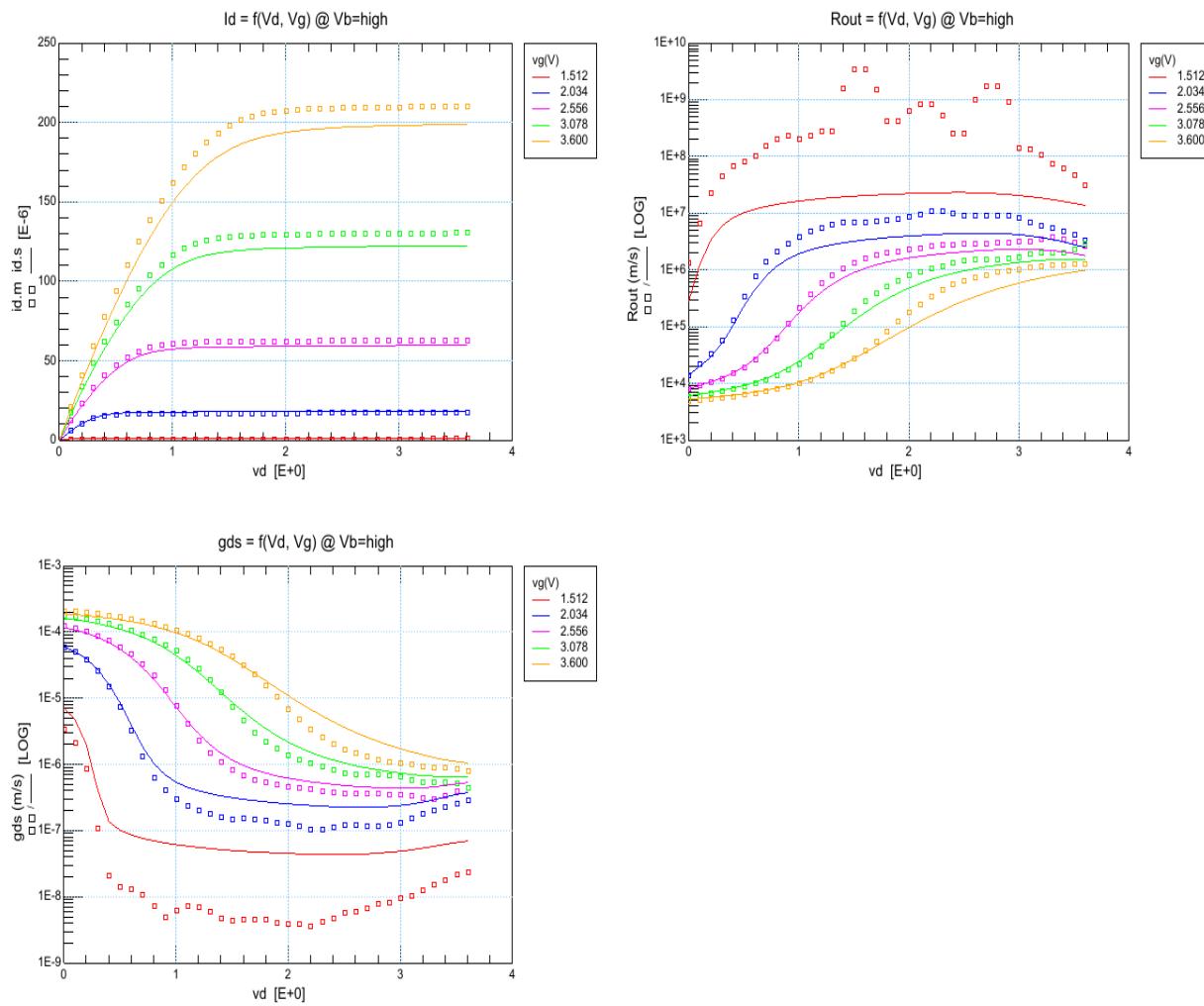
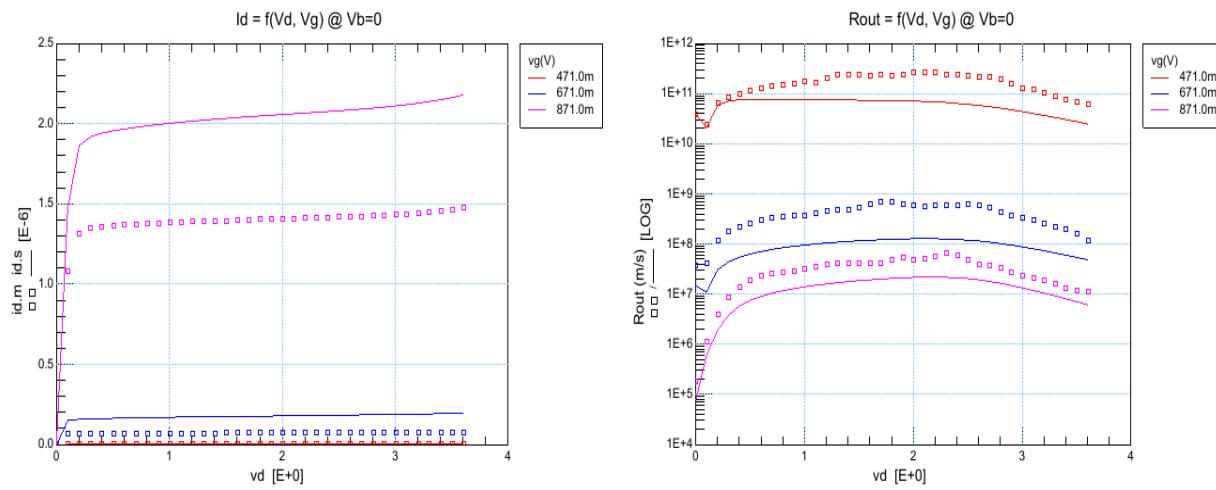


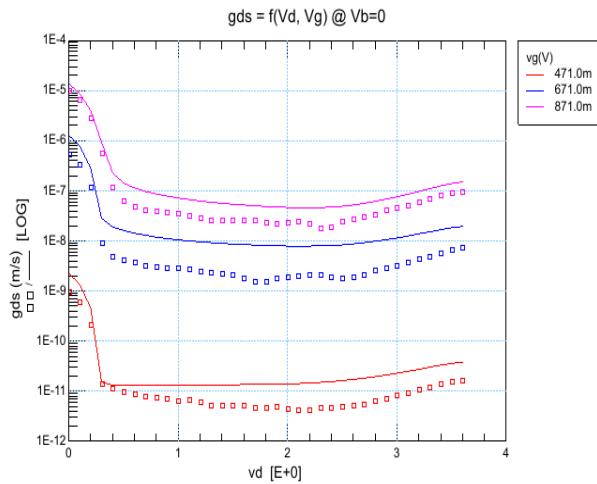


$idvg, I_b, I_g, V_b = 0V, T = -40^\circ C$

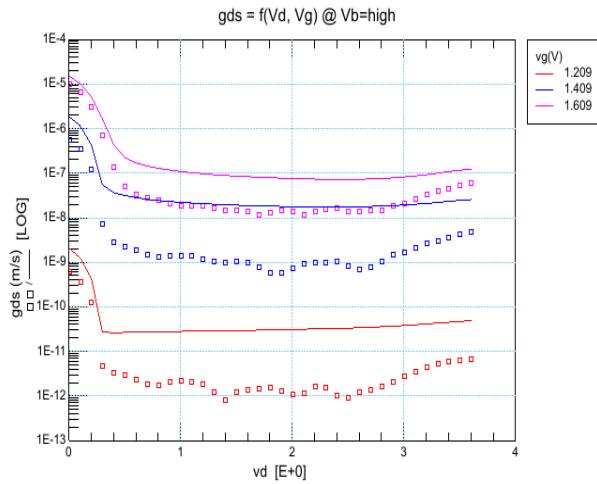
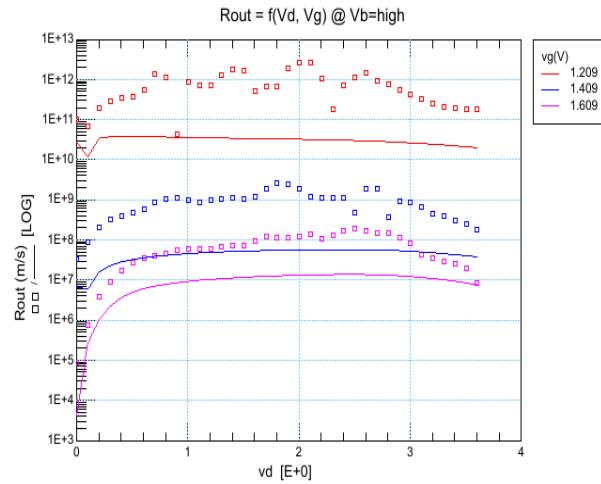
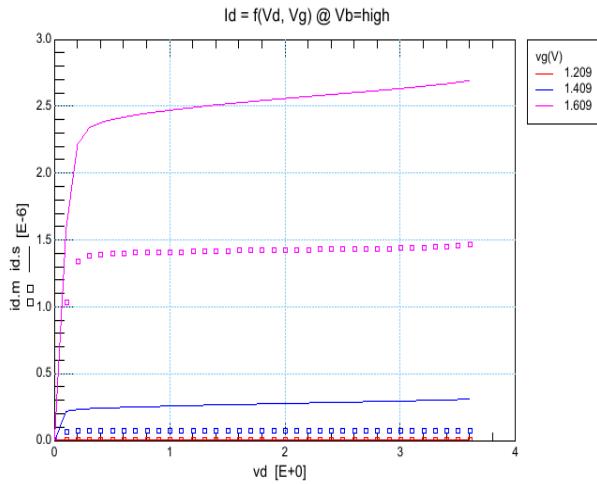


idvg, Ib,Ig, Vb = -3.6V, T = -40°C

idvd, Vb = 0V, T = -40°C


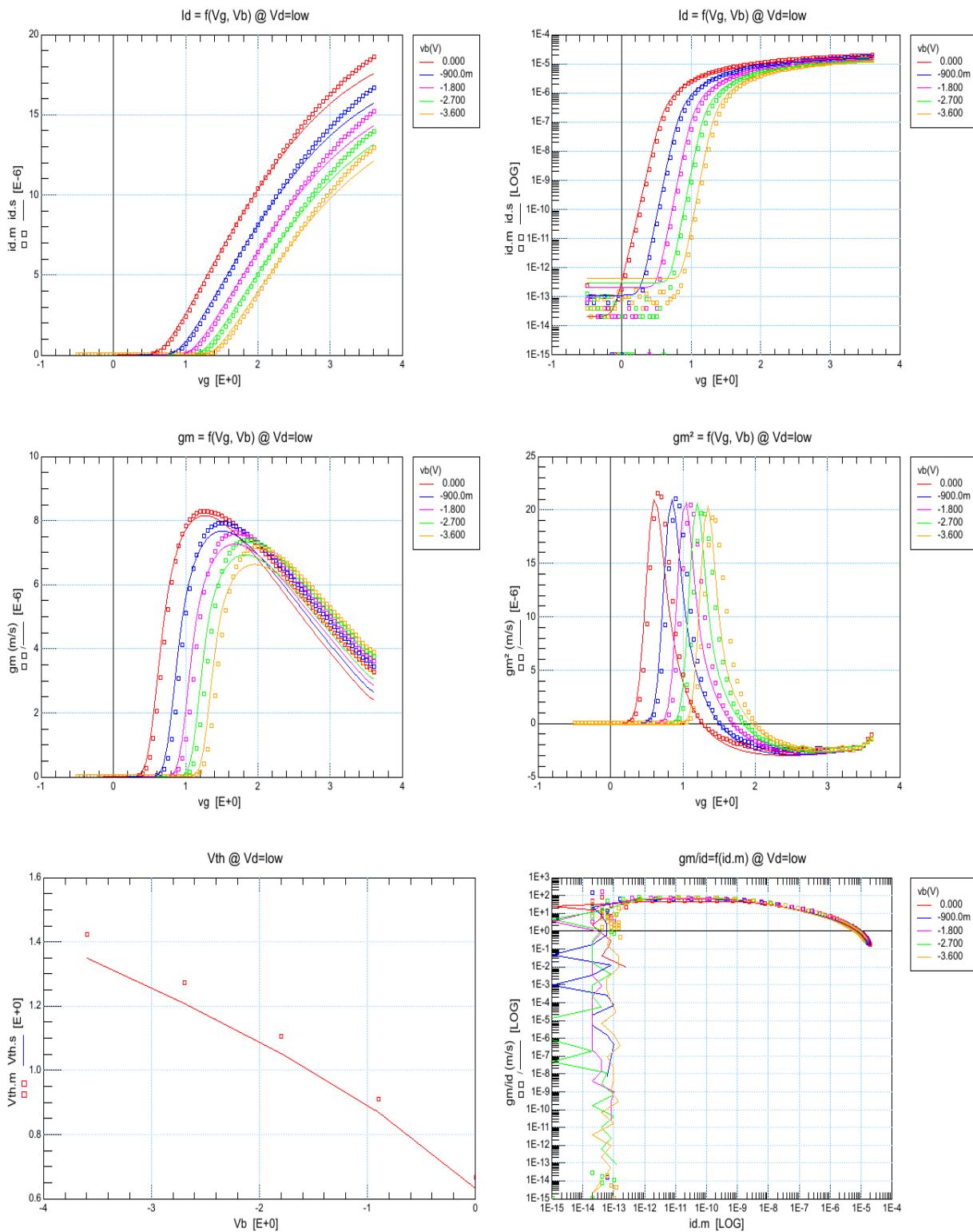
idvd_vbmin, Vb = -3.6V, T = -40°C

idvd_vth, Vb = 0V, T = -40°C


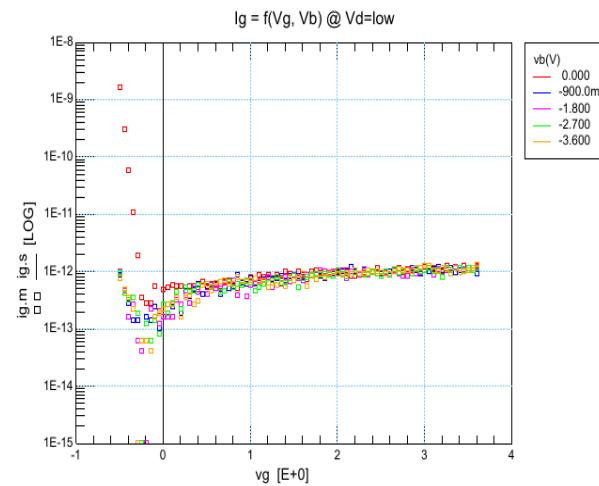
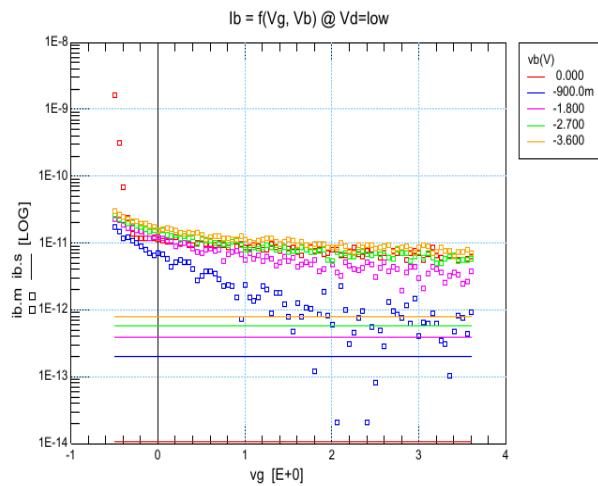


idvd_vth_vbmin, Vb = -3.6V, T = -40°C

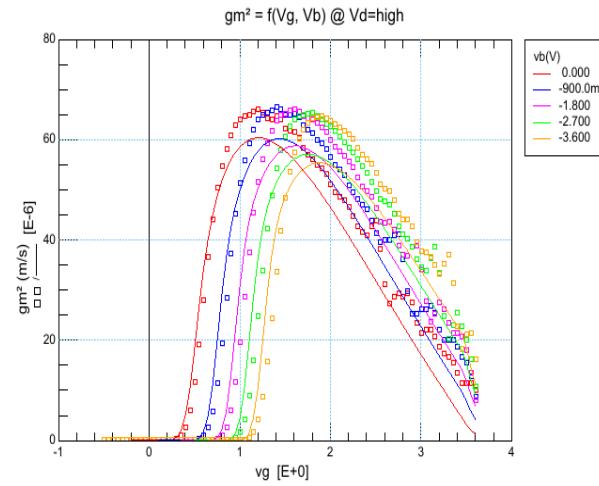
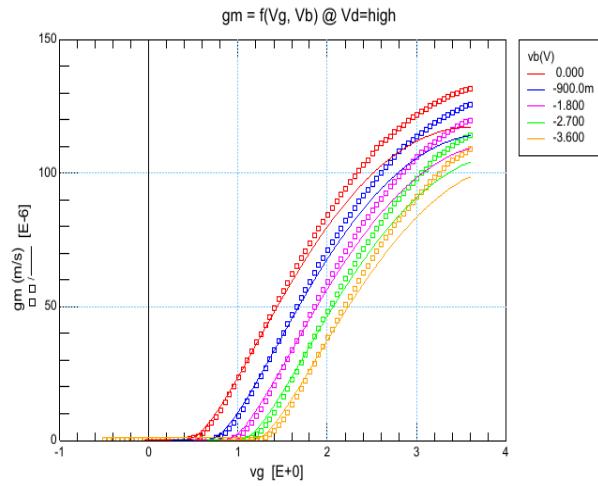
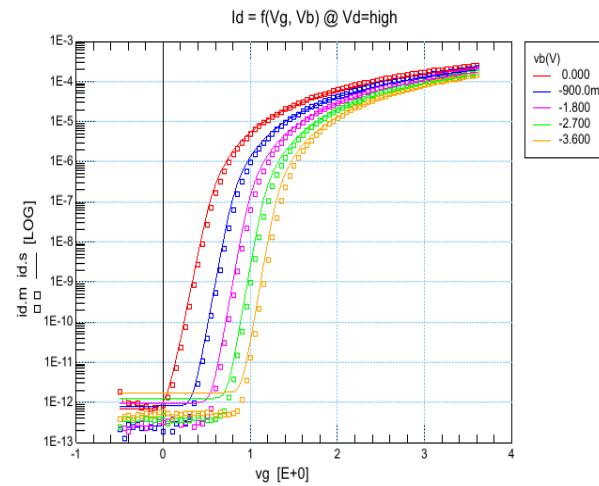
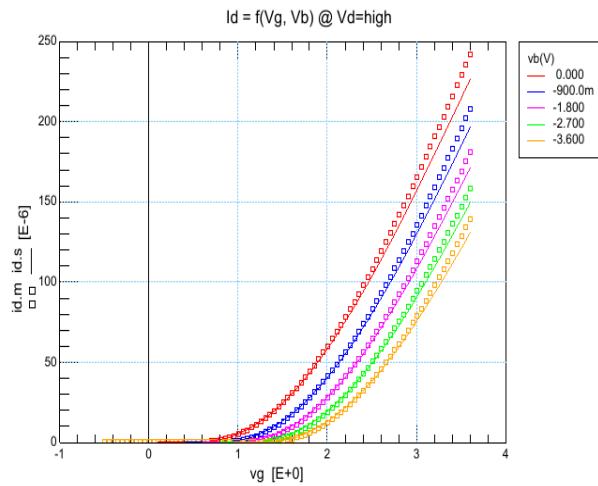


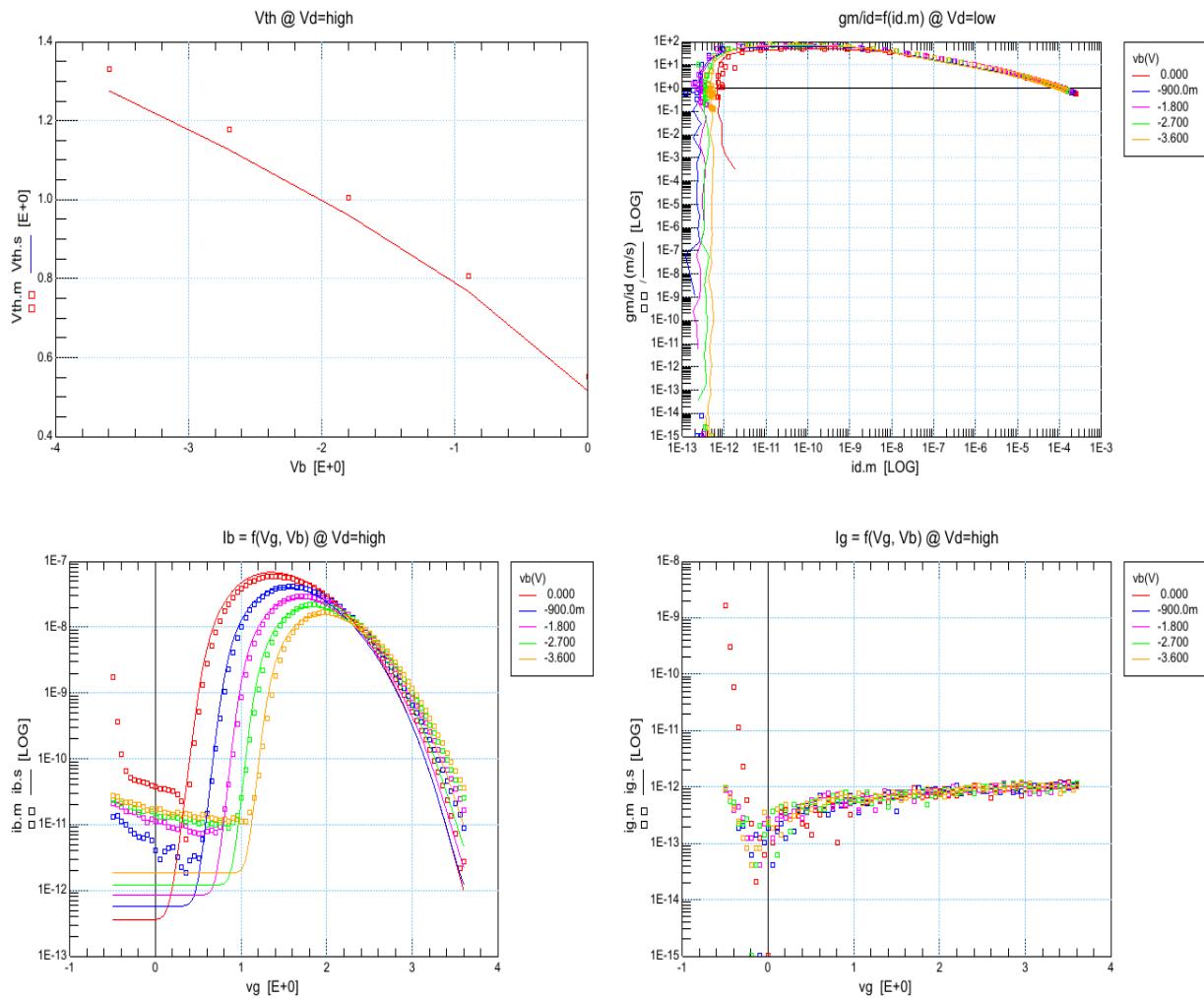
$idvg$, $Vd = 0.1V$, $T = 70^\circ C$



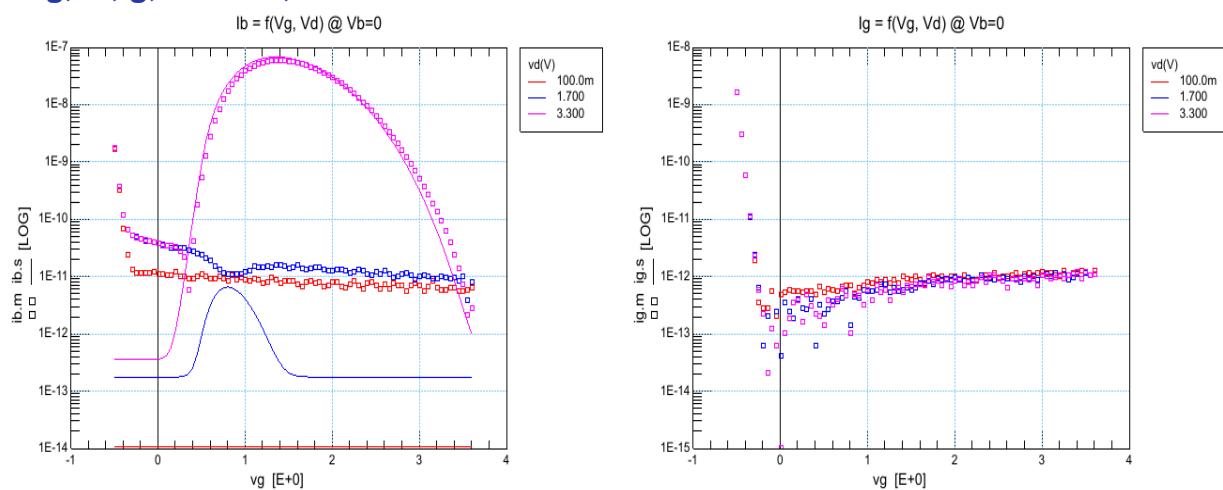


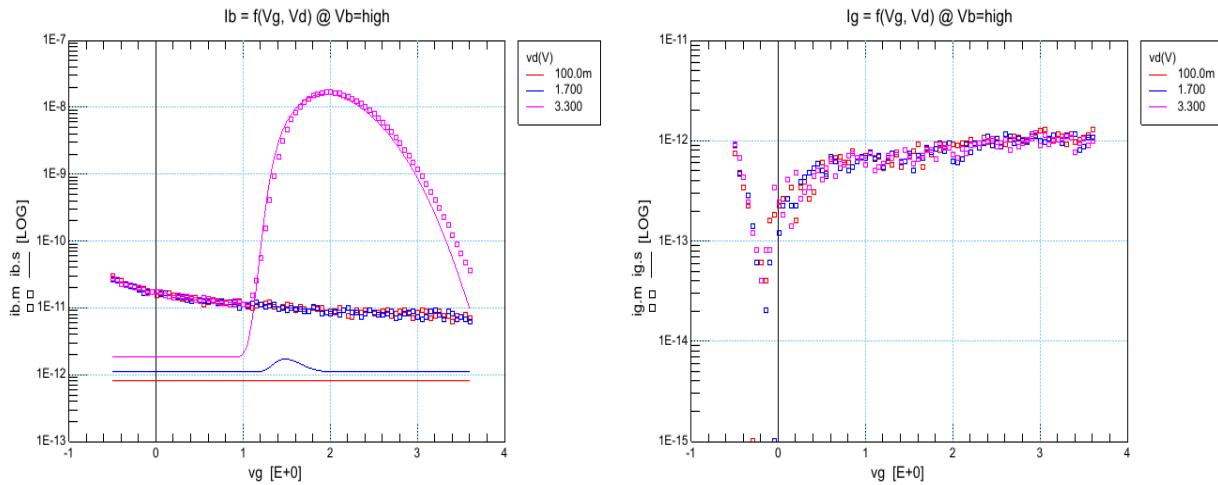
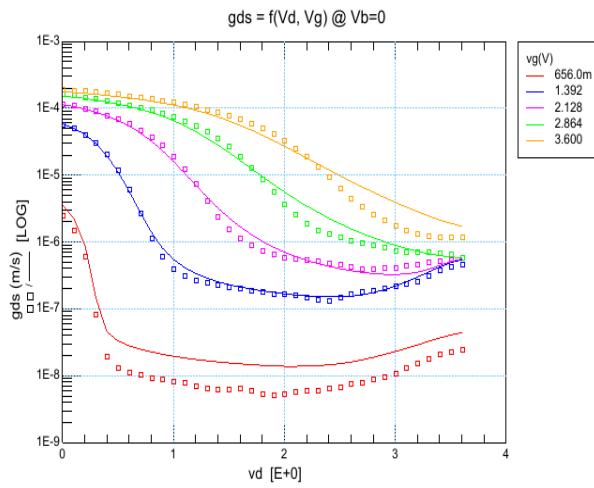
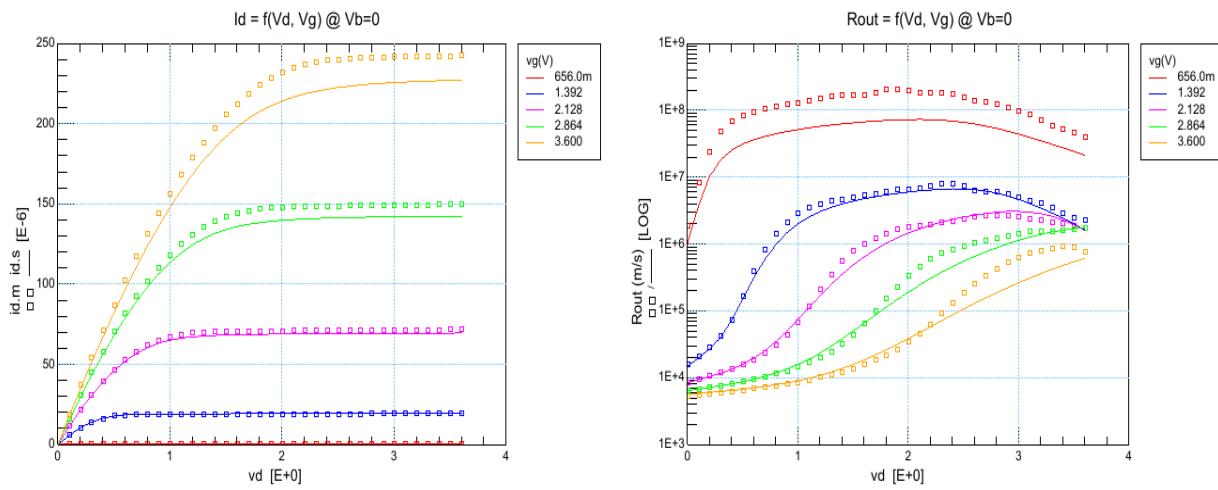
$i_{dvg}, V_d = 3.3V, T = 70^\circ\text{C}$

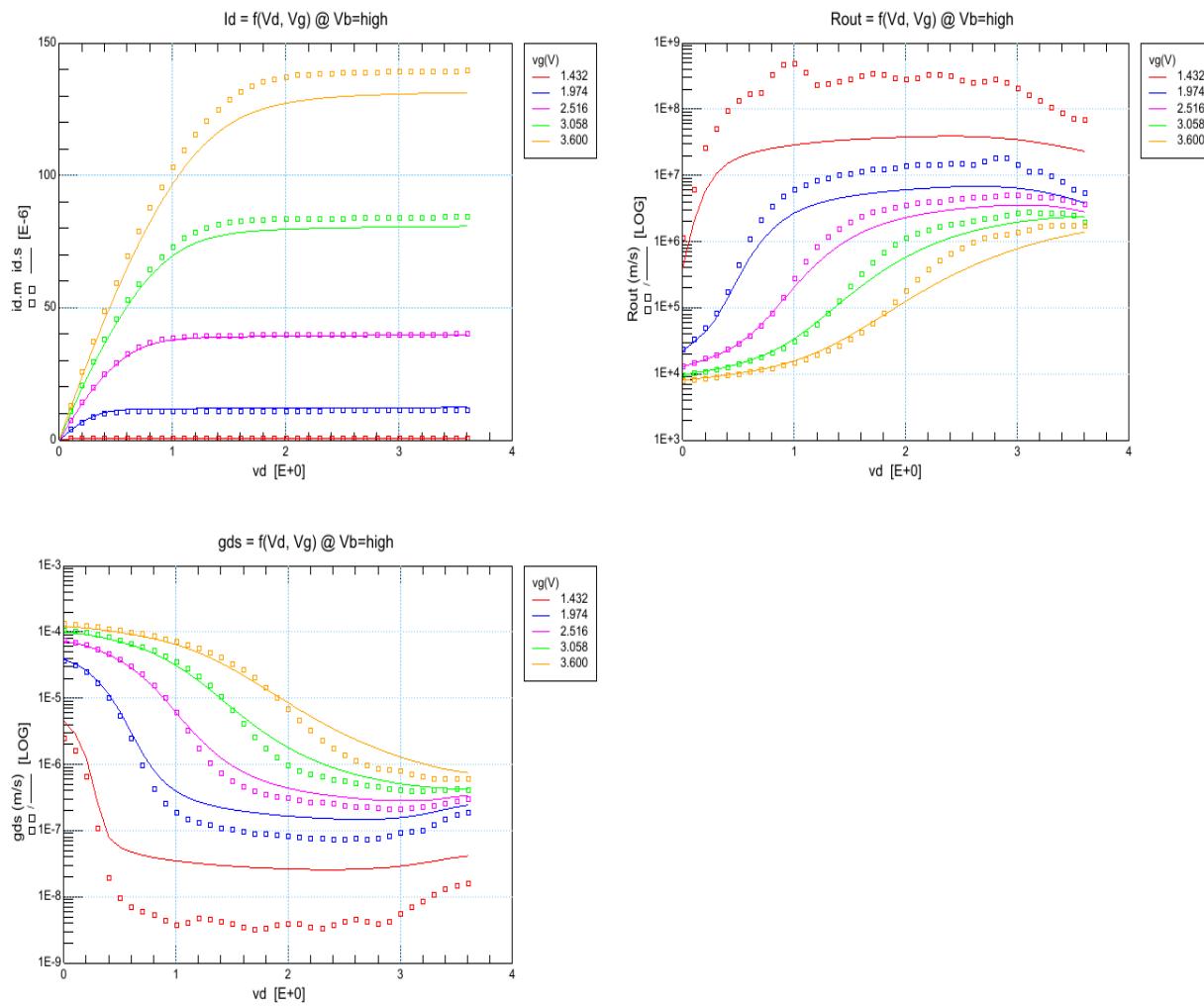
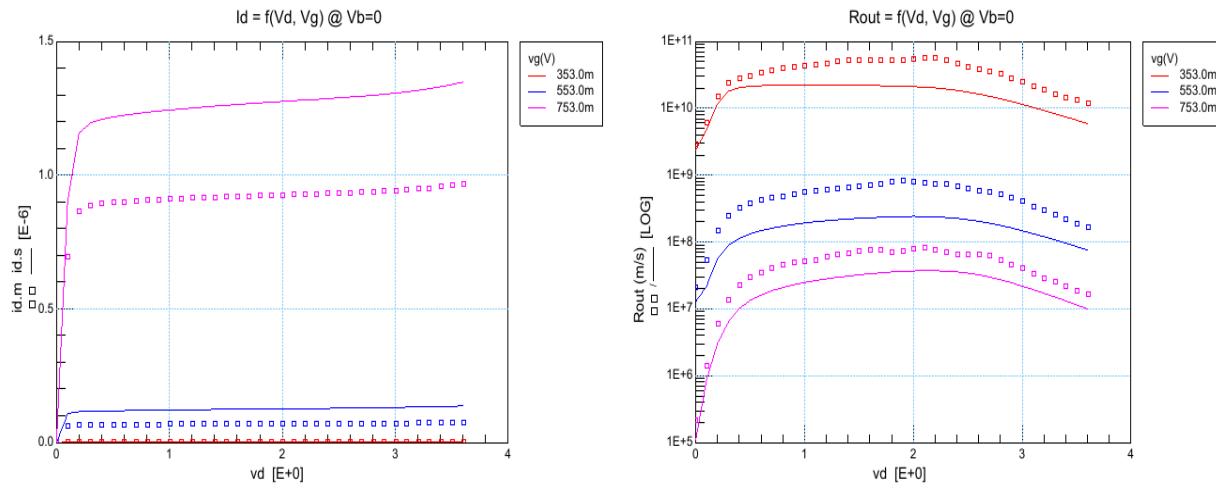


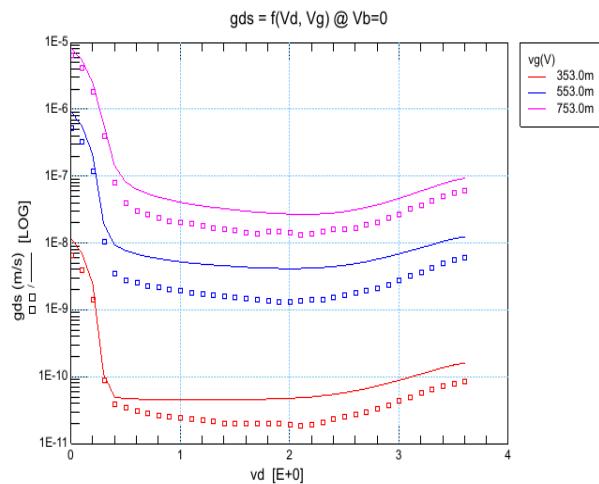


idvg, Ib,Ig, Vb = 0V, T = 70°C

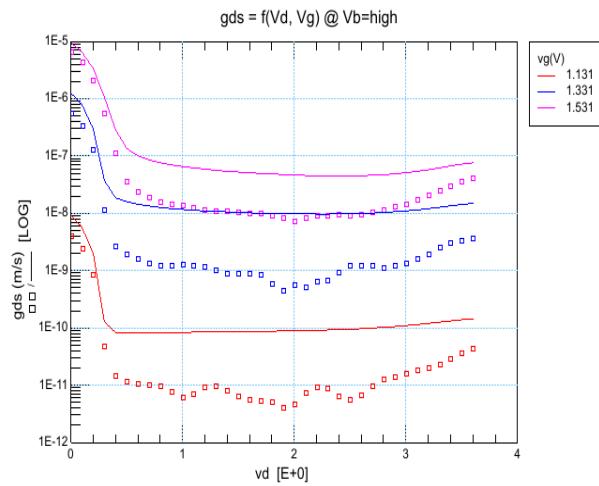
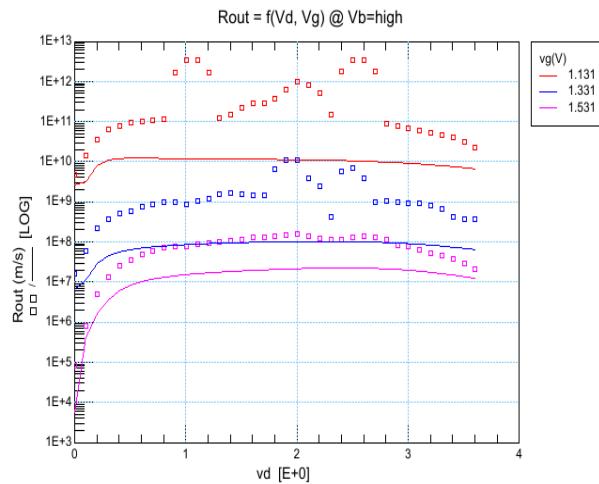
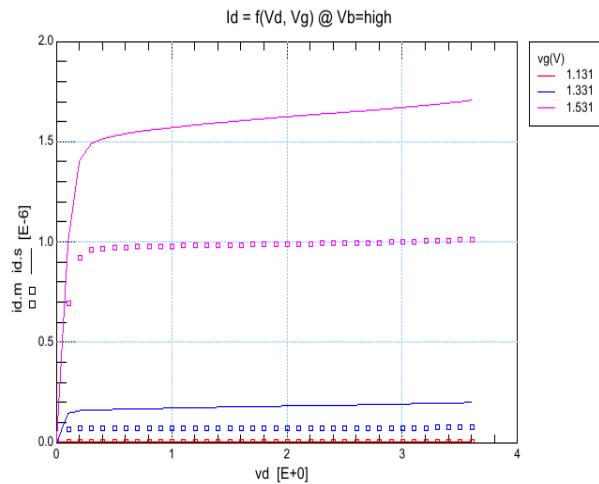


idvg, Ib,Ig, Vb = -3.6V, T = 70°C

idvd, Vb = 0V, T = 70°C


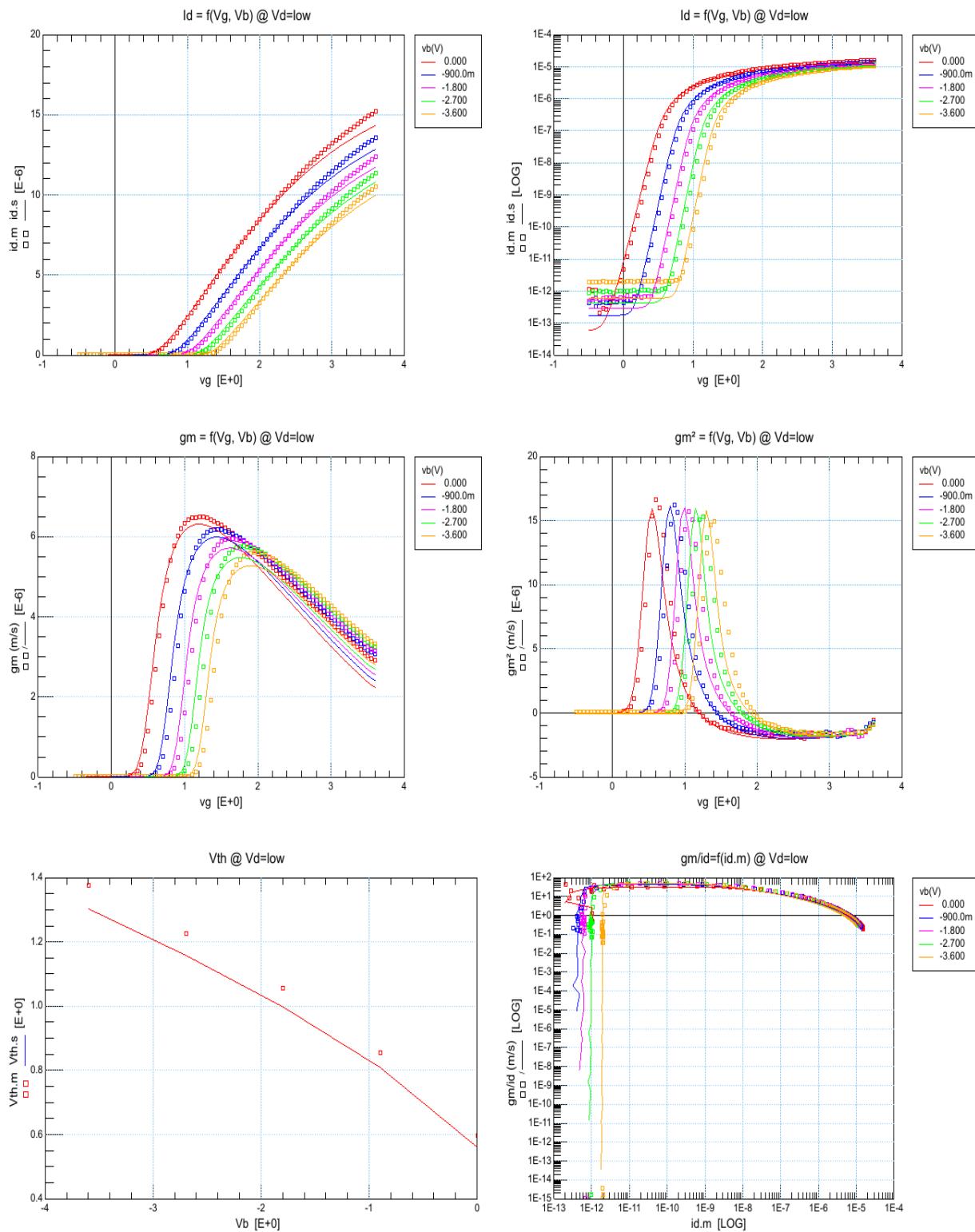
idvd_vbmin, Vb = -3.6V, T = 70°C

idvd_vth, Vb = 0V, T = 70°C


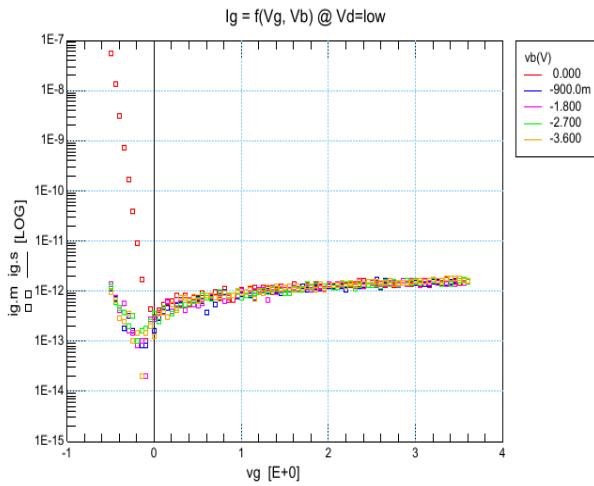
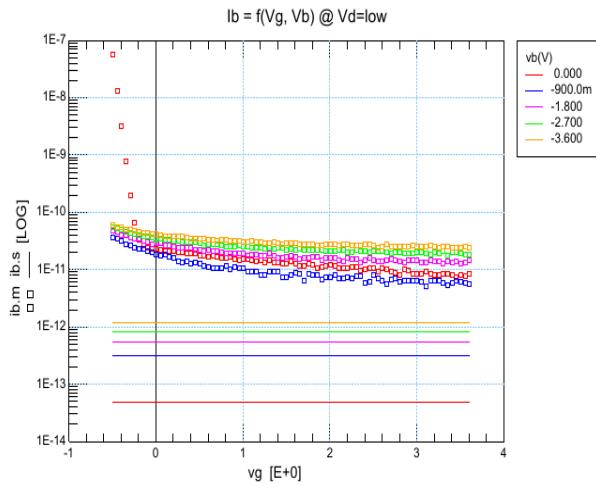


idvd_vth_vbmin, Vb = -3.6V, T = 70°C

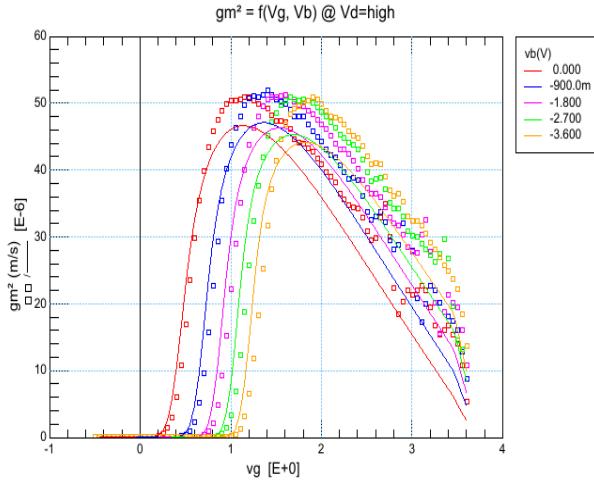
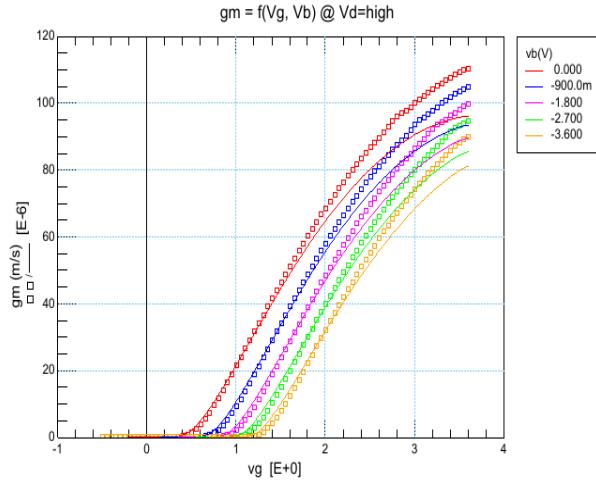
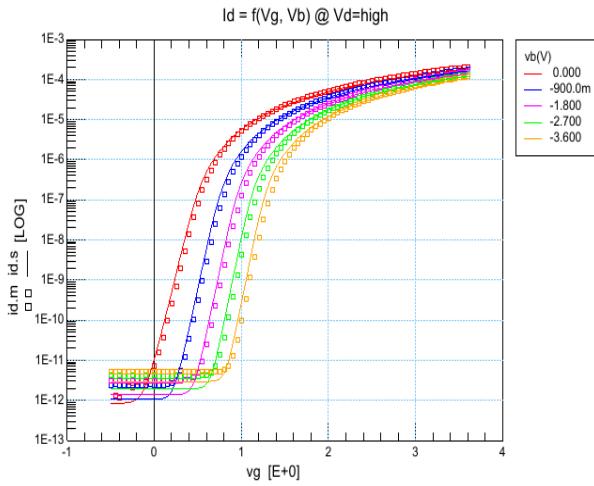
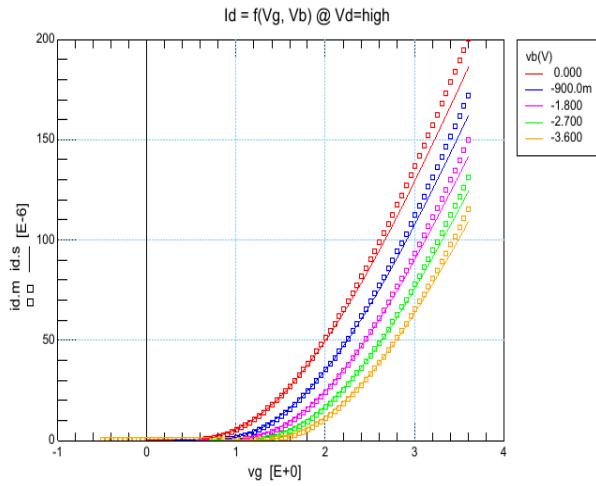


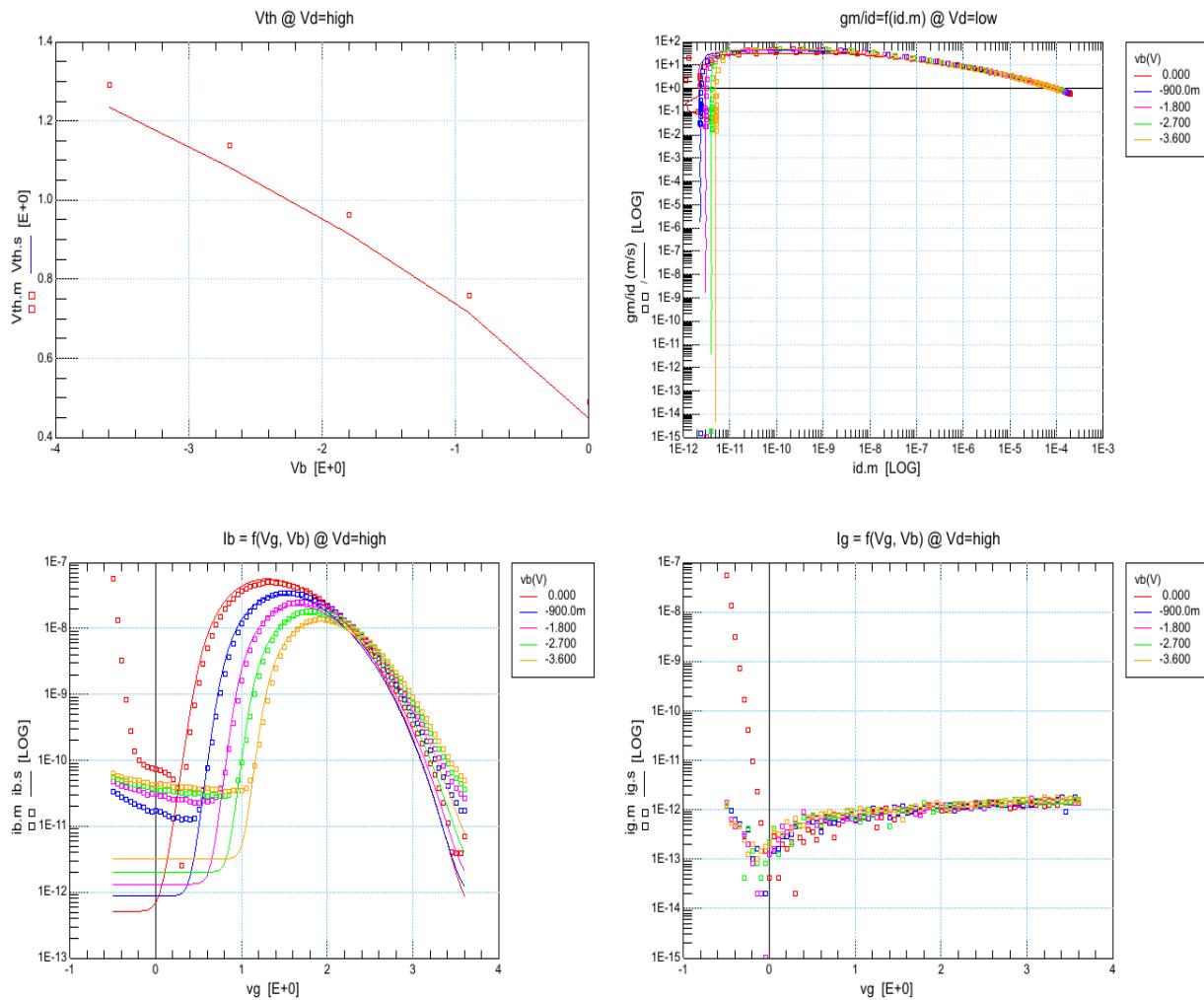
idvg, Vd = 0.1V, T = 125°C



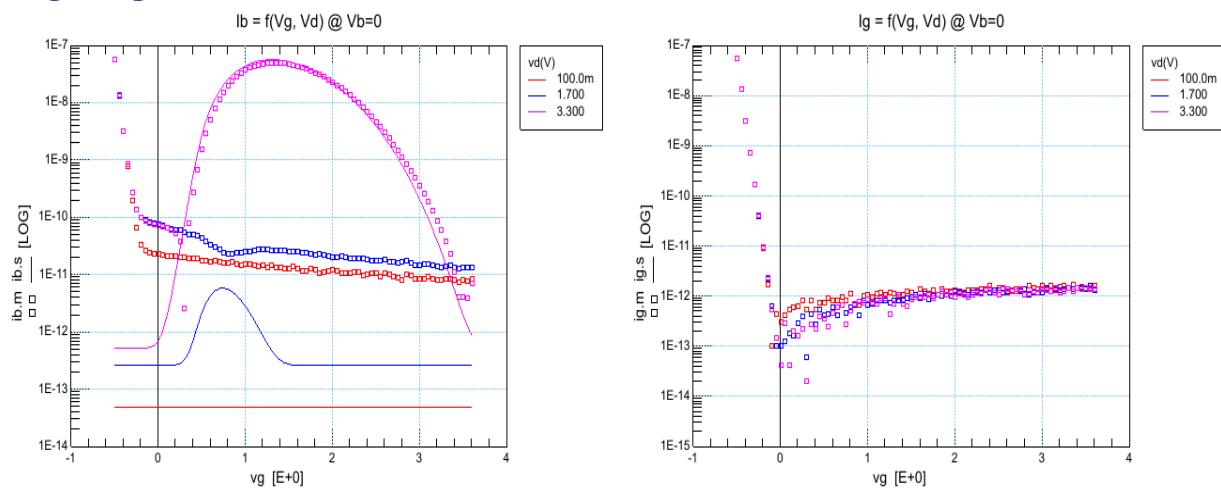


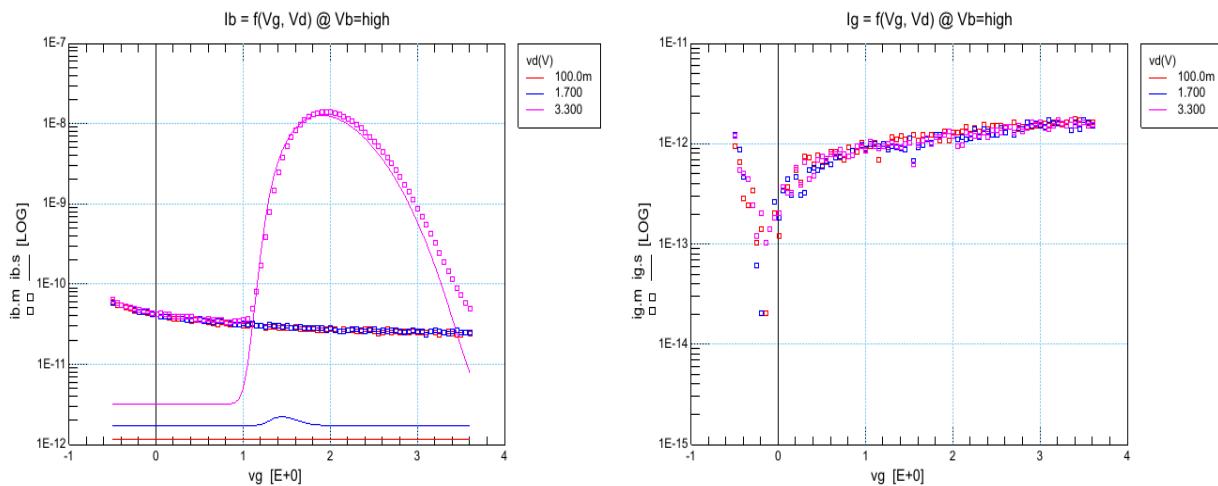
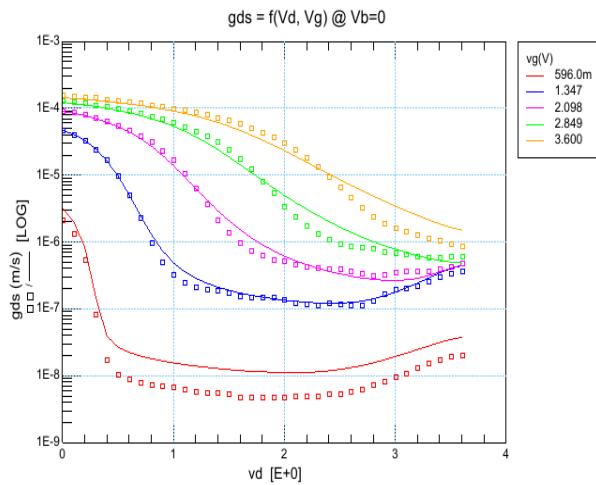
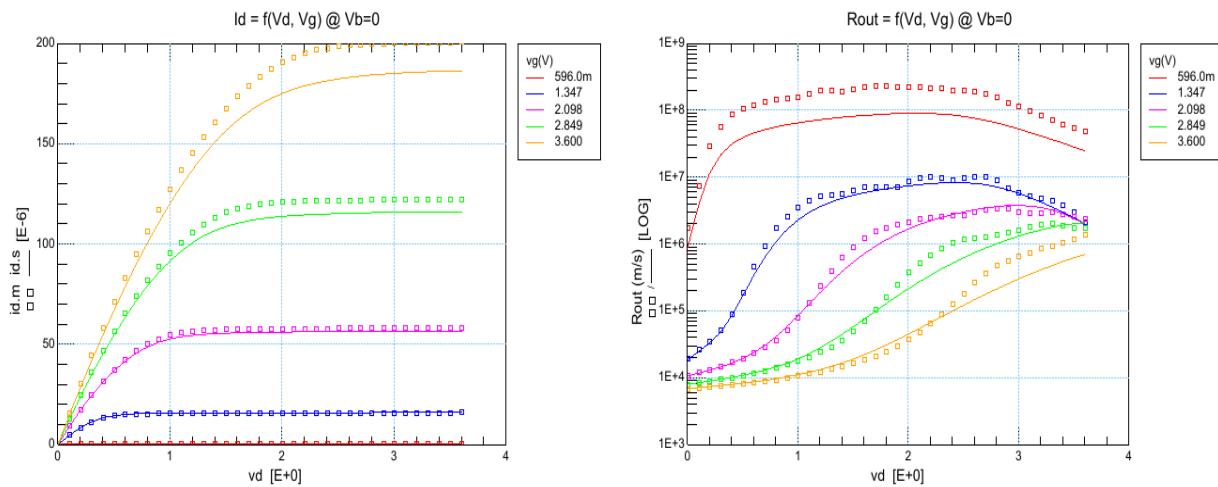
$i_{dvg}, V_d = 3.3V, T = 125^\circ\text{C}$

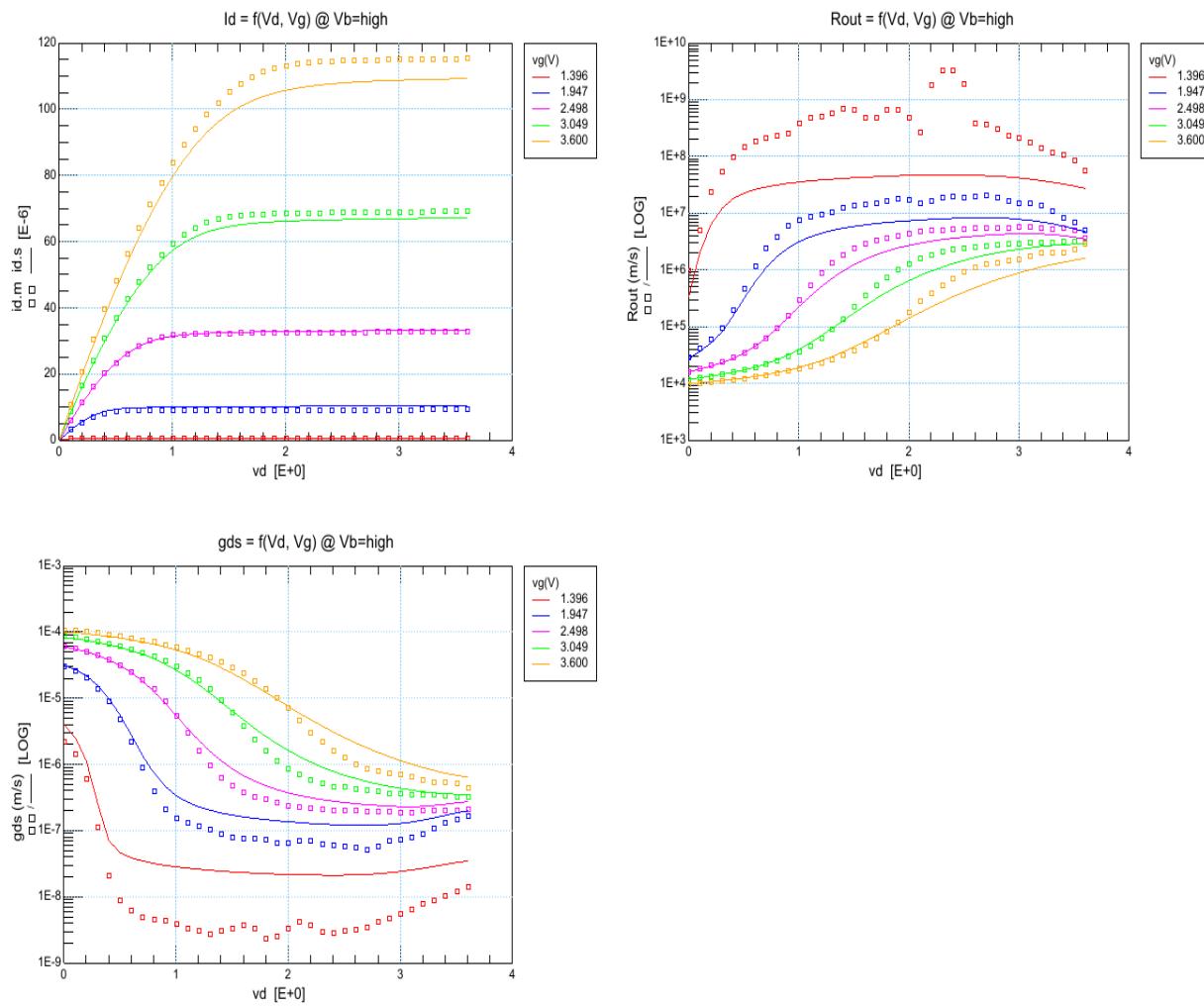
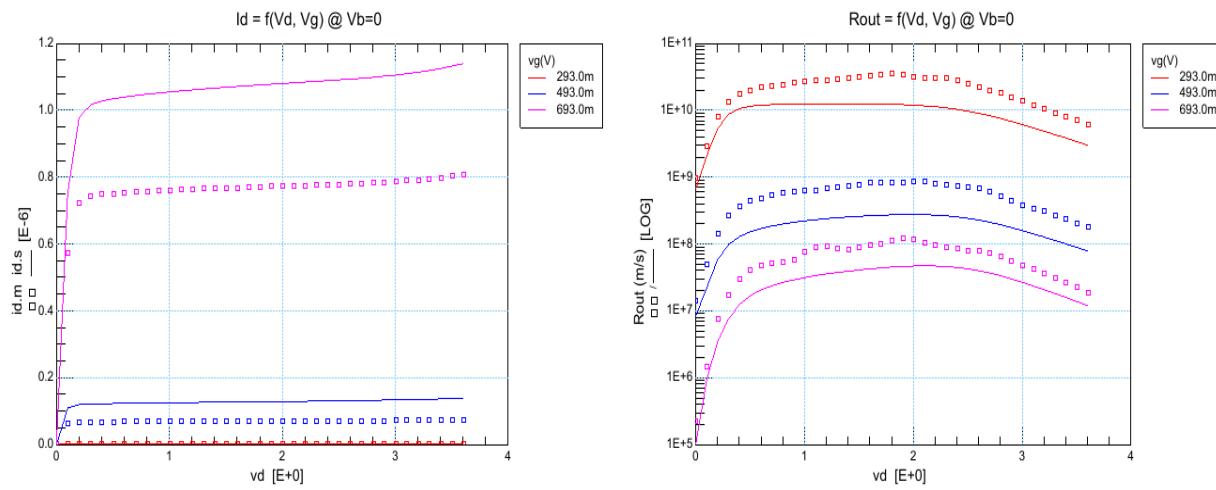


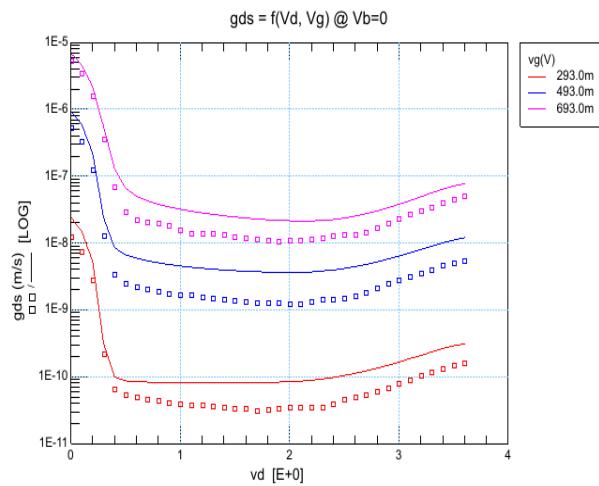


idvg, Ib,Ig, Vb = 0V, T = 125°C

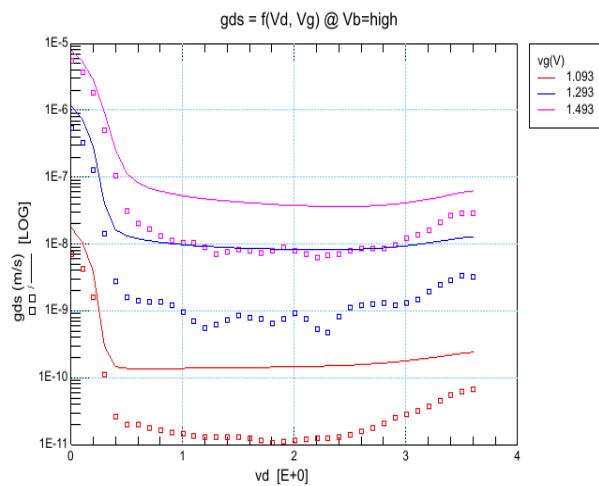
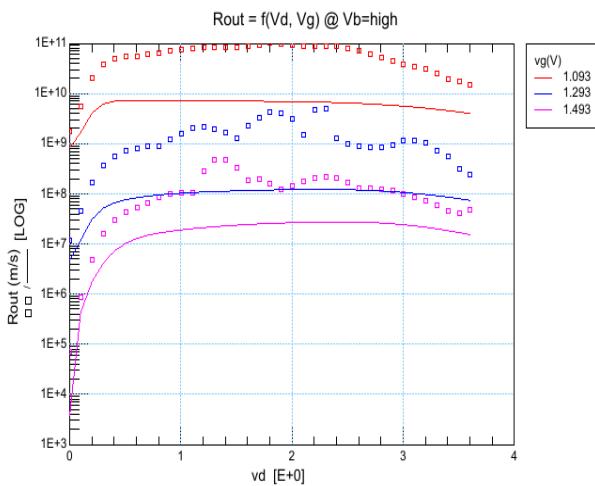
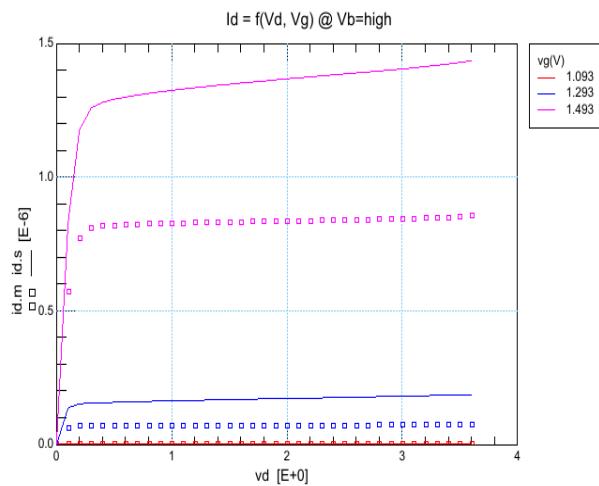


idvg, Ib,Ig, Vb = -3.6V, T = 125°C

idvd, Vb = 0V, T = 125°C


idvd_vbmin, Vb = -3.6V, T = 125°C

idvd_vth, Vb = 0V, T = 125°C


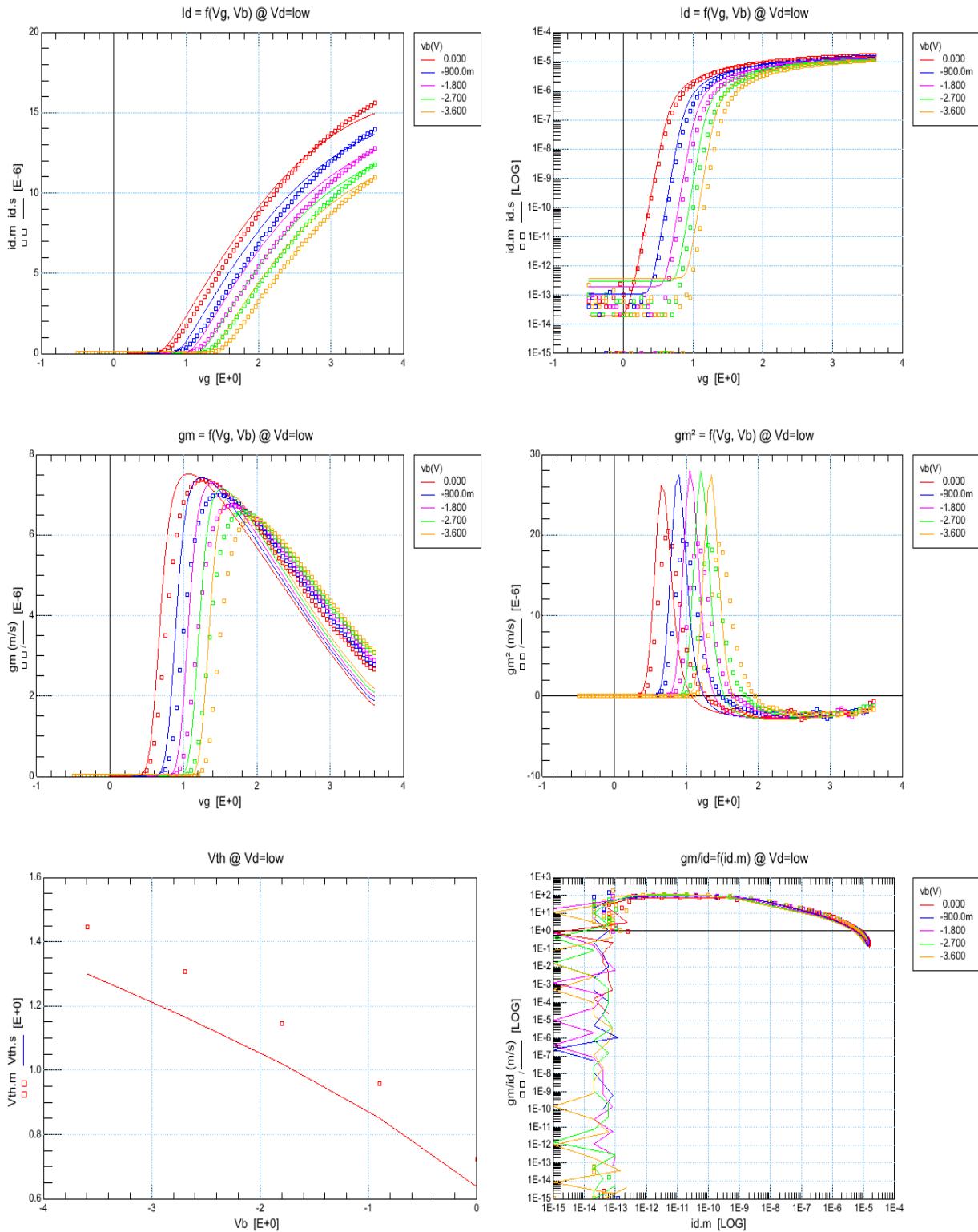


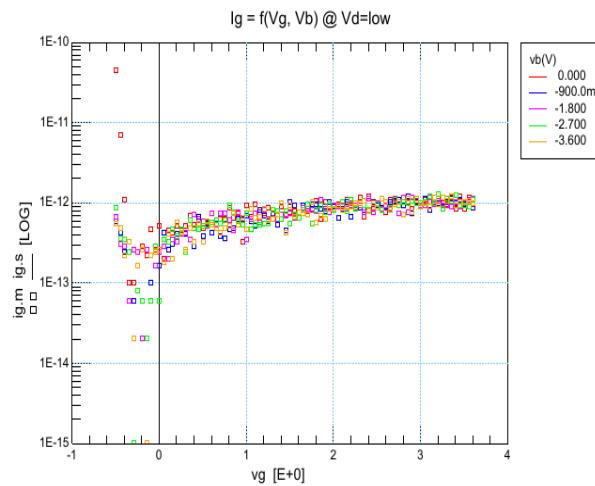
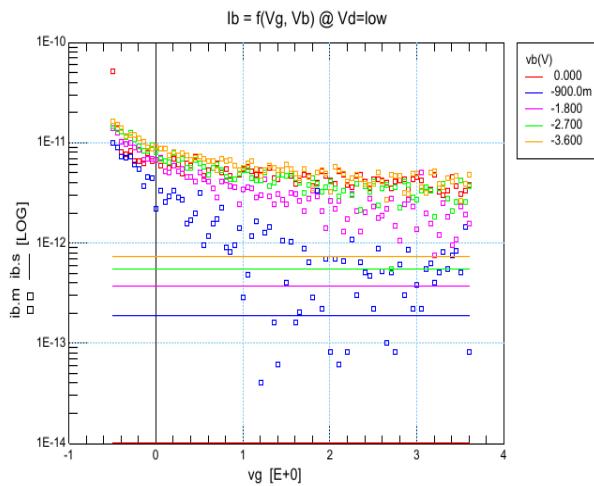
idvd_vth_vbmin, Vb = -3.6V, T = 125°C



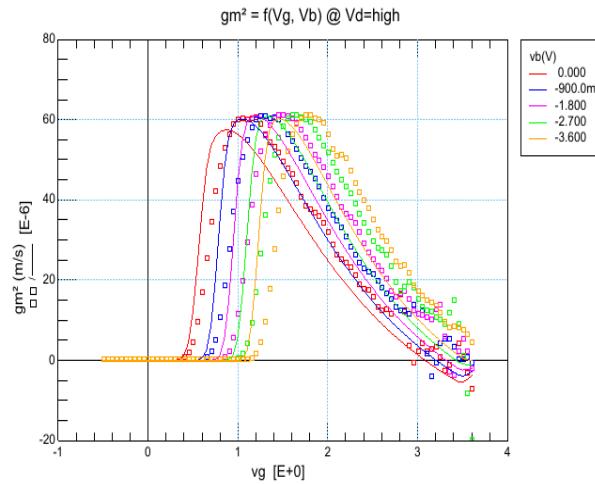
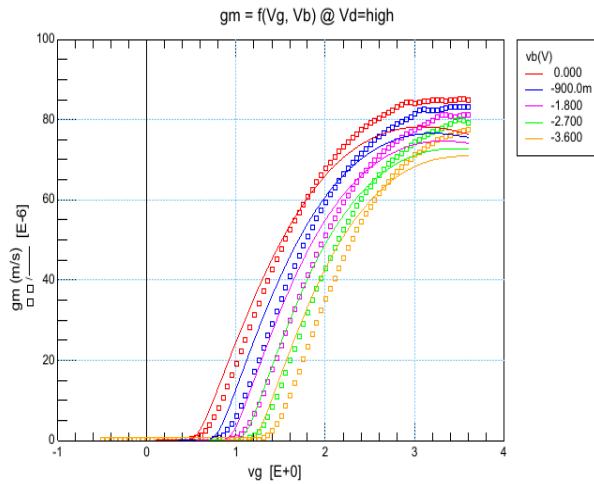
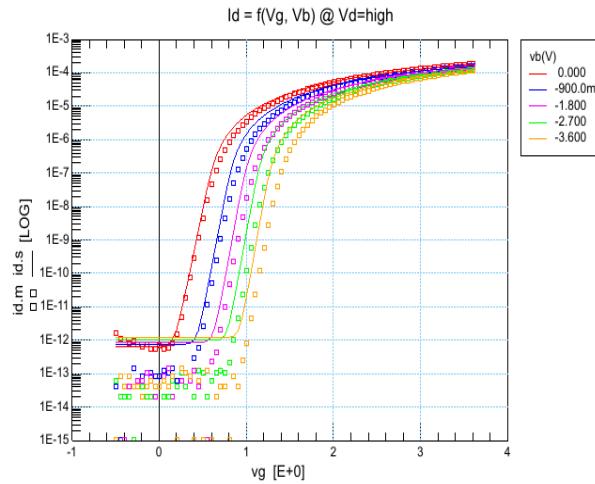
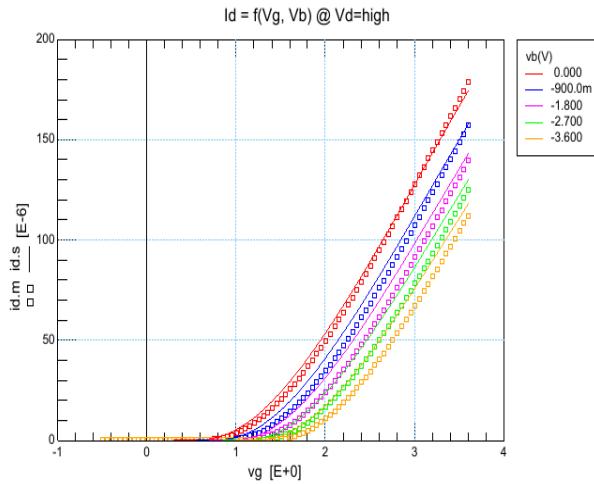
4.16 W0u6_L1u2_S559_4

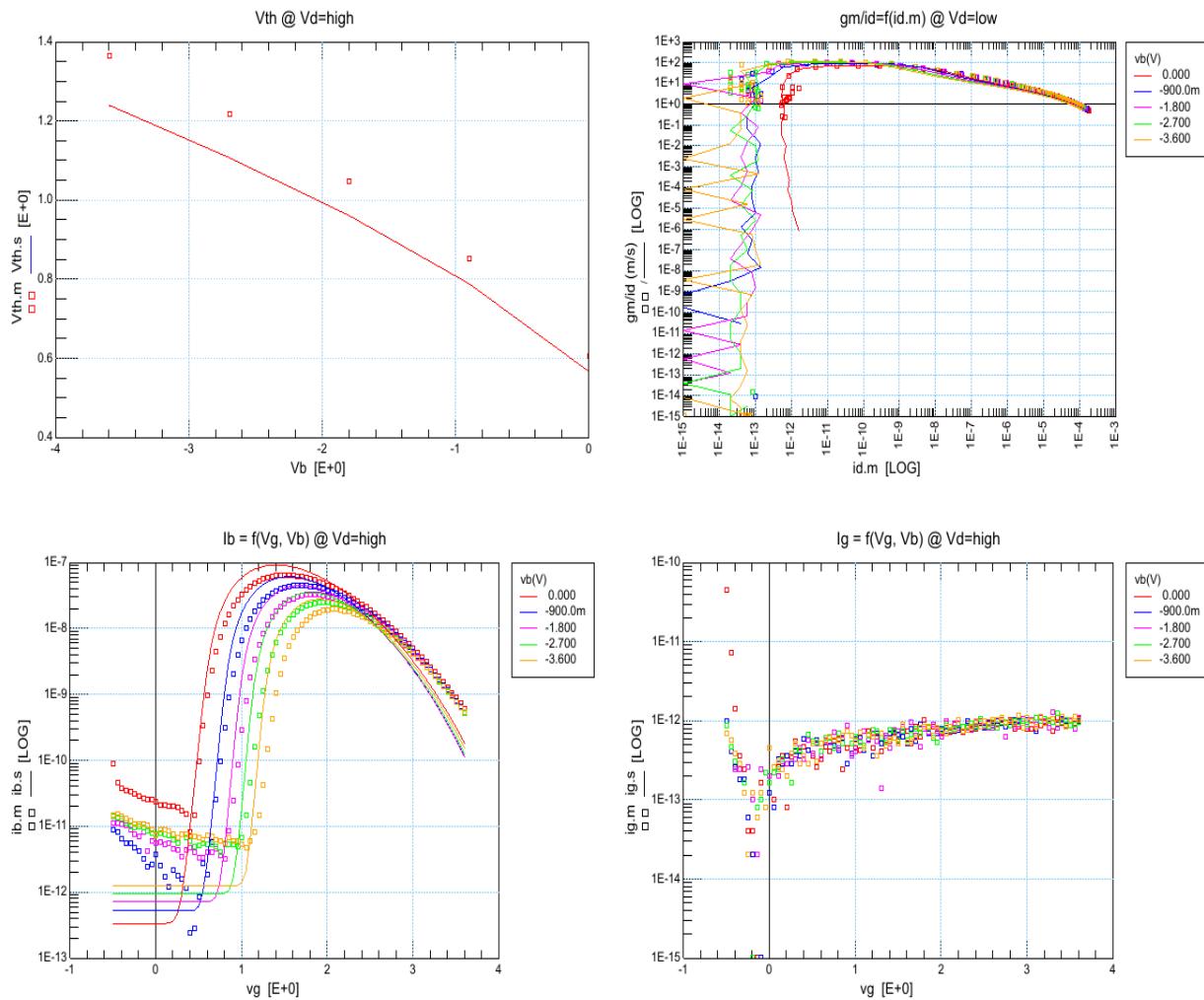
$idv_g, V_d = 0.1V, T = 27^\circ C$



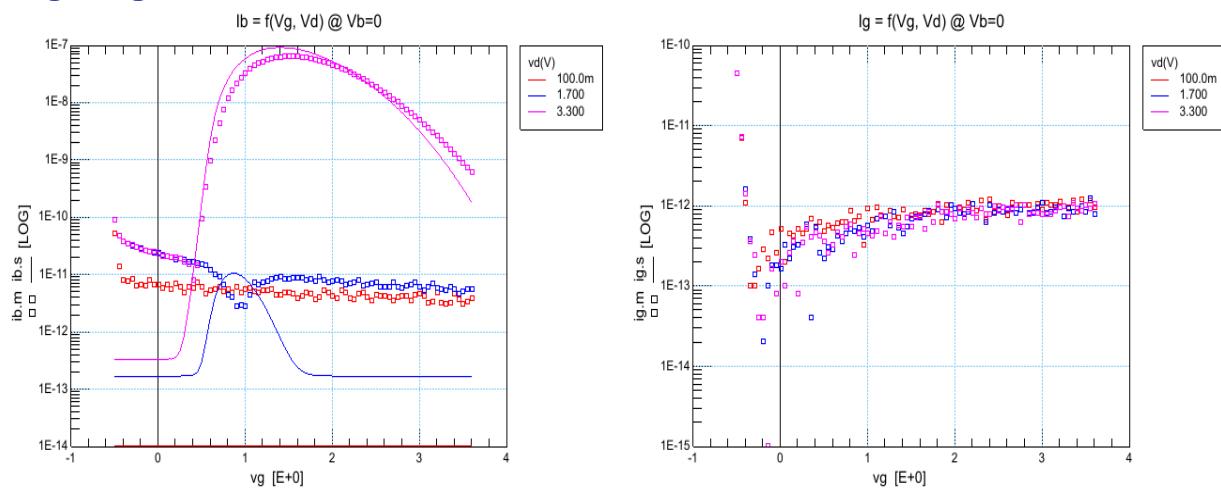


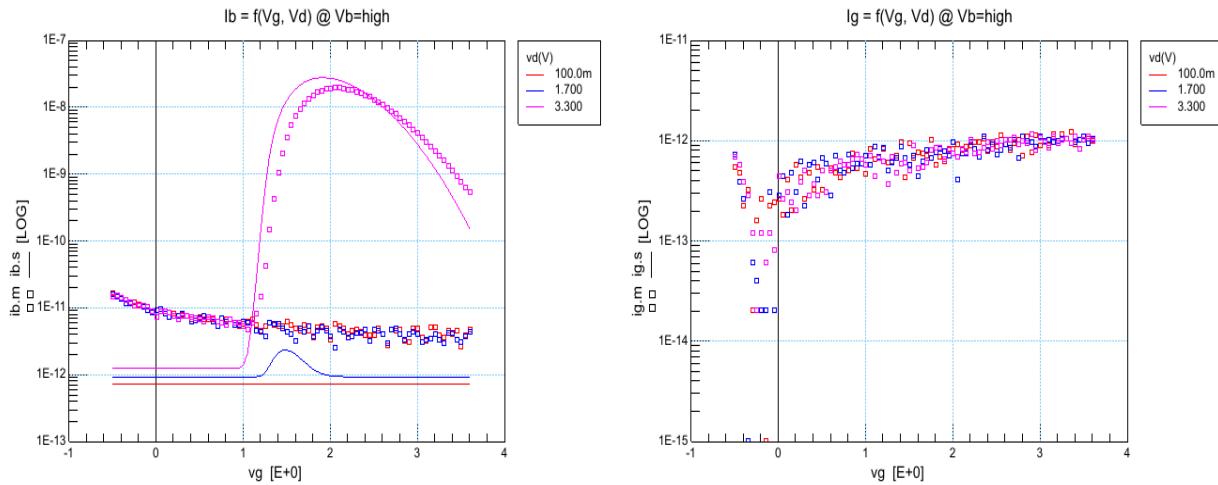
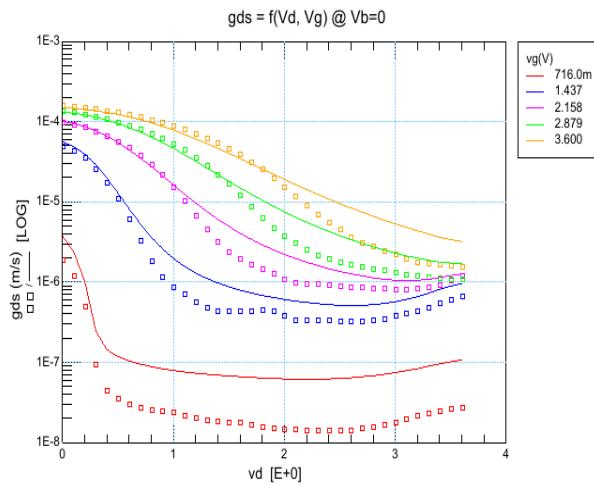
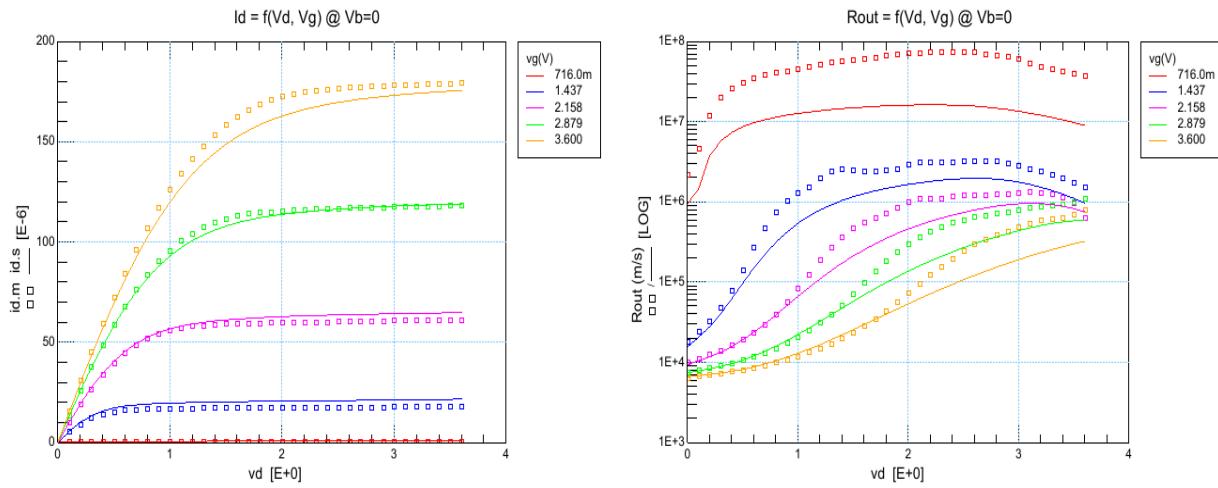
$i_{dvg}, V_d = 3.3V, T = 27^\circ\text{C}$

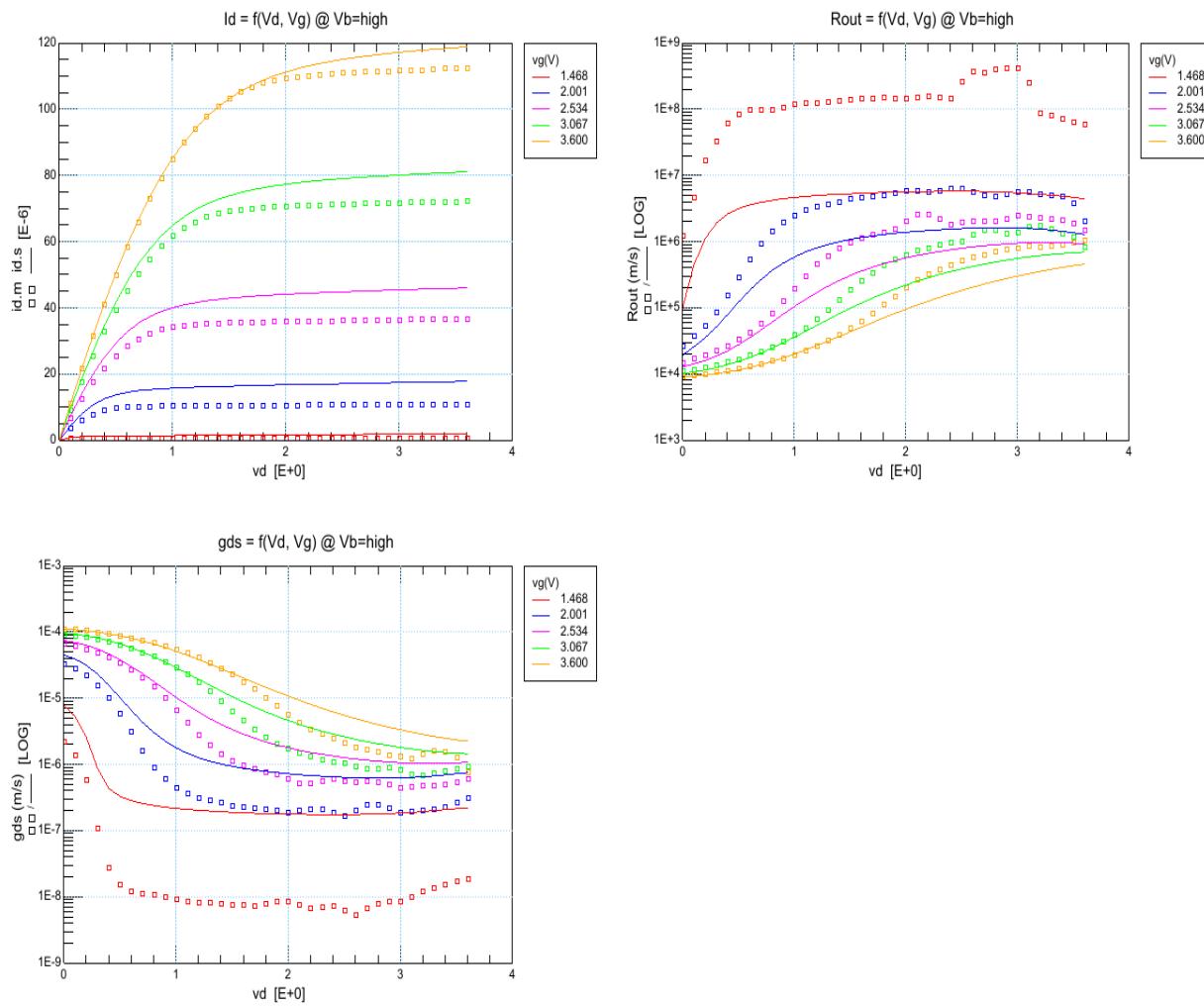
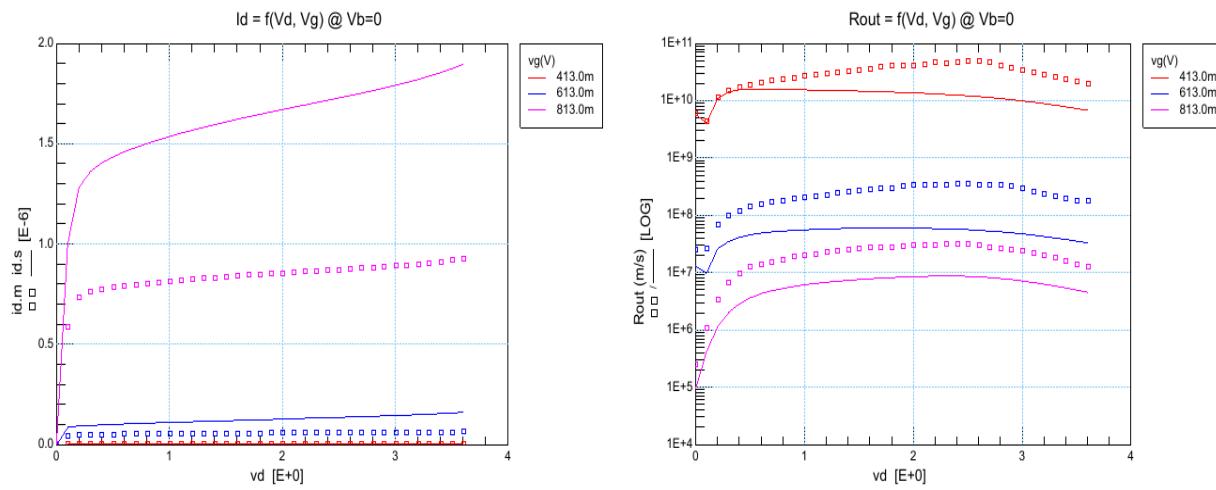


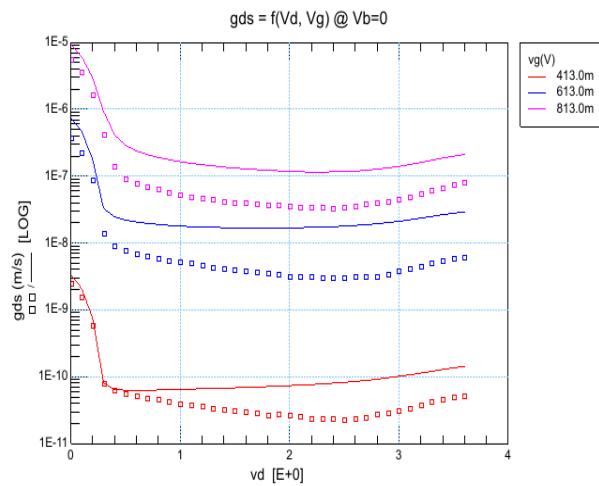


idvg, Ib, Ig, Vb = 0V, T = 27°C

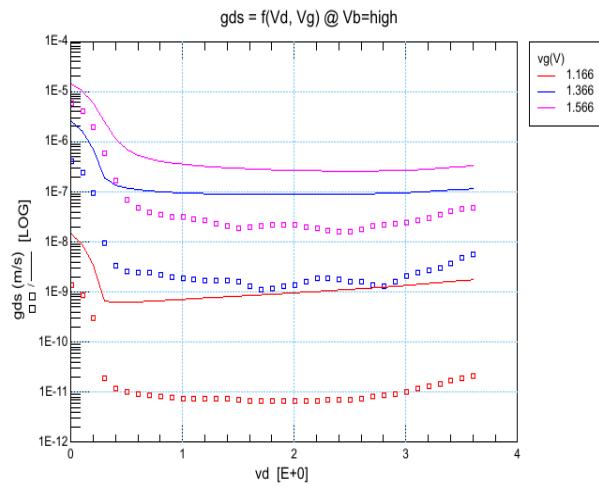
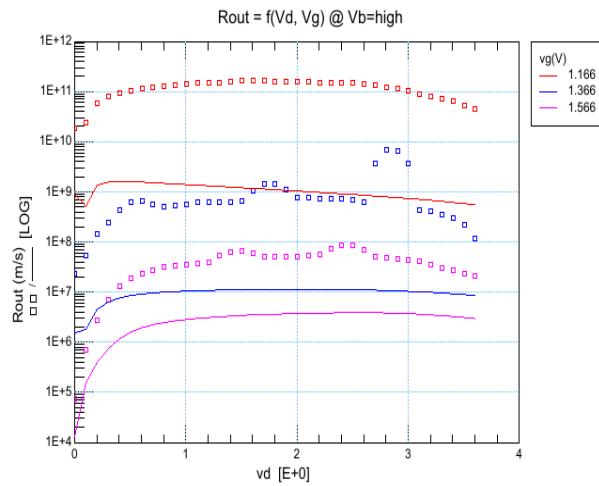
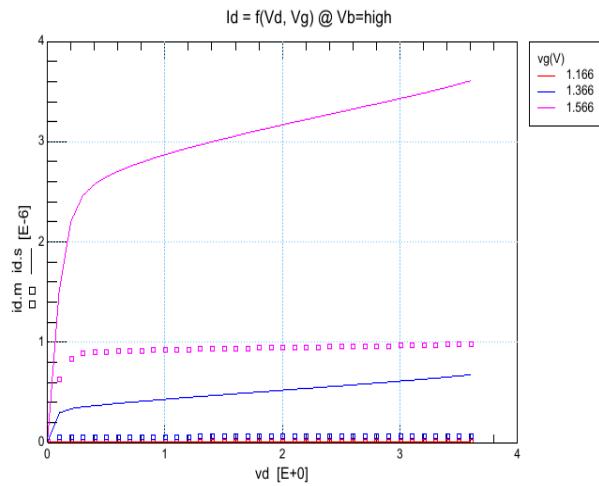


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


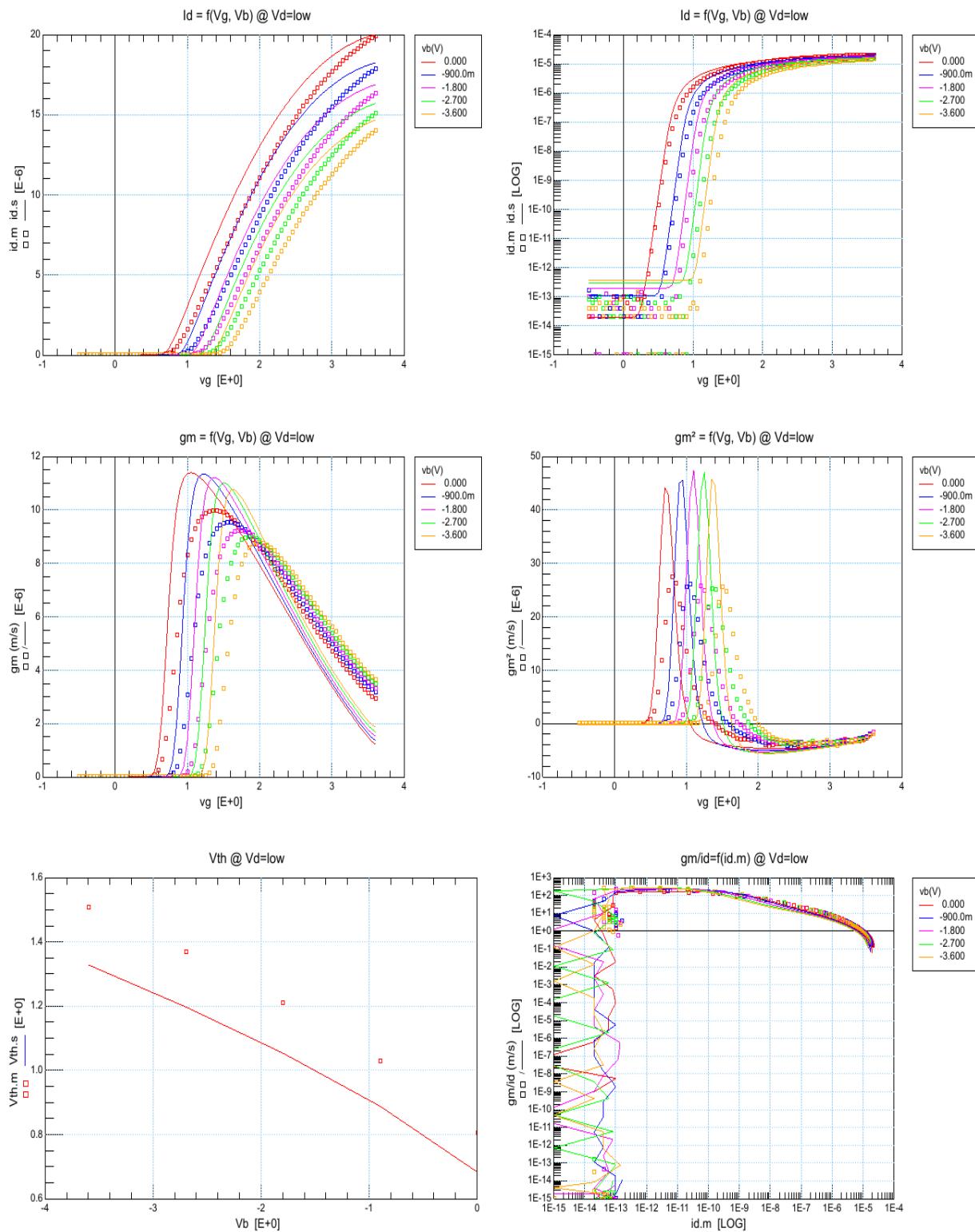
idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


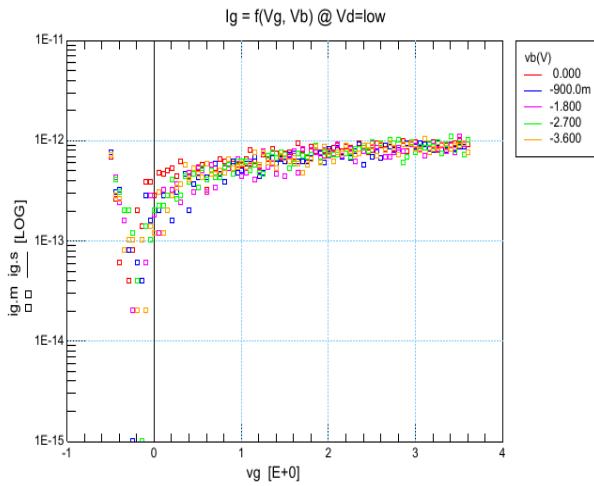
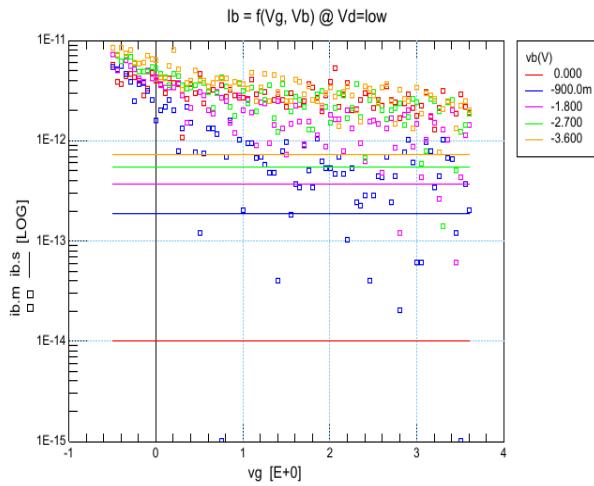


idvd_vth_vbmin, Vb = -3.6V, T = 27°C

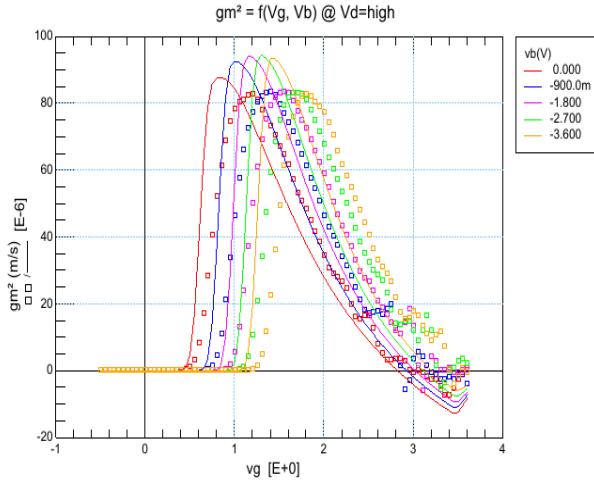
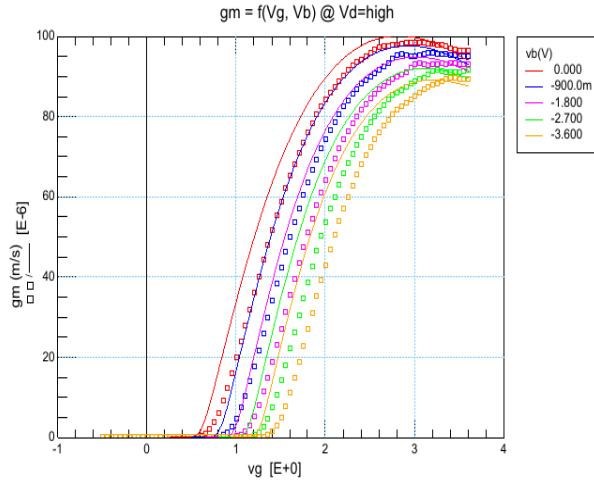
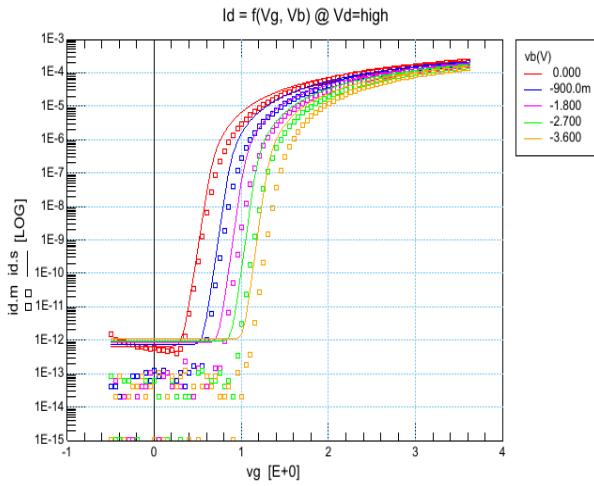
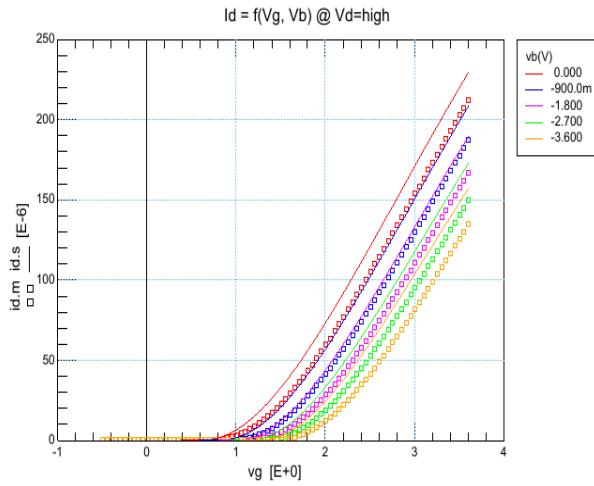


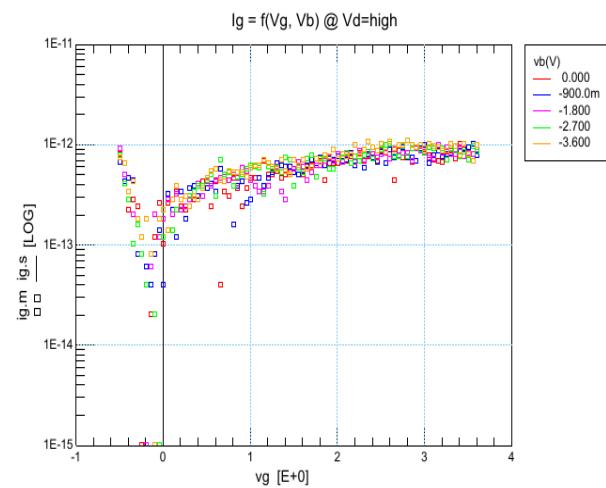
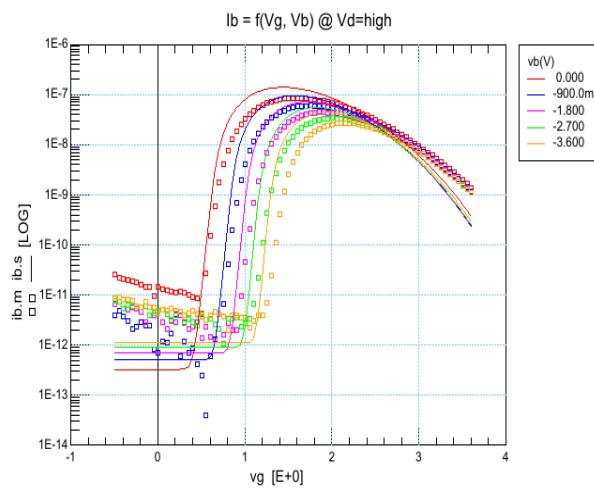
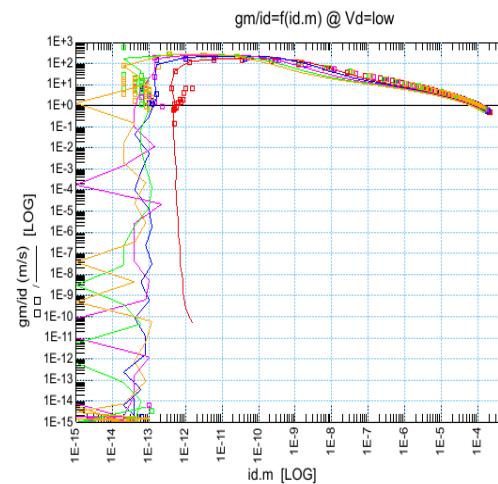
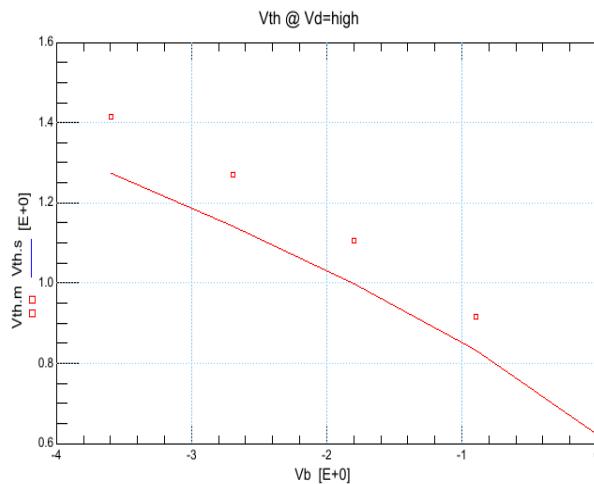
idvg, Vd = 0.1V, T = -40°C



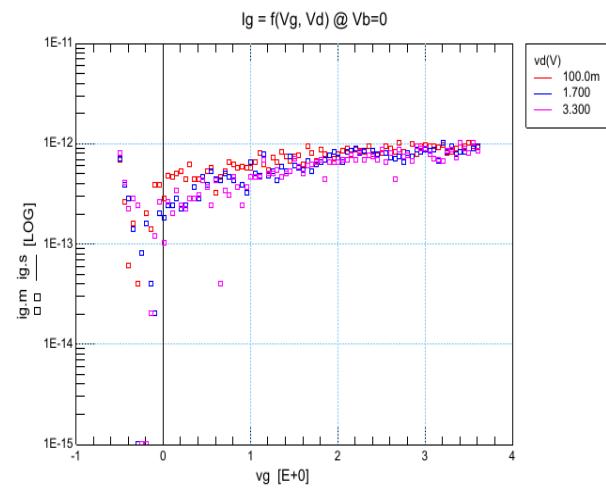
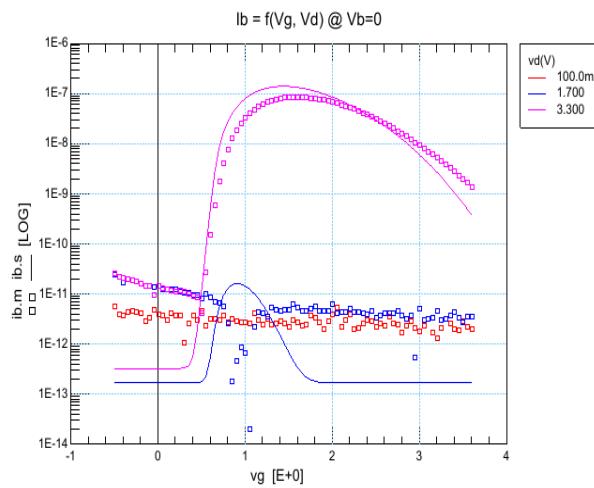


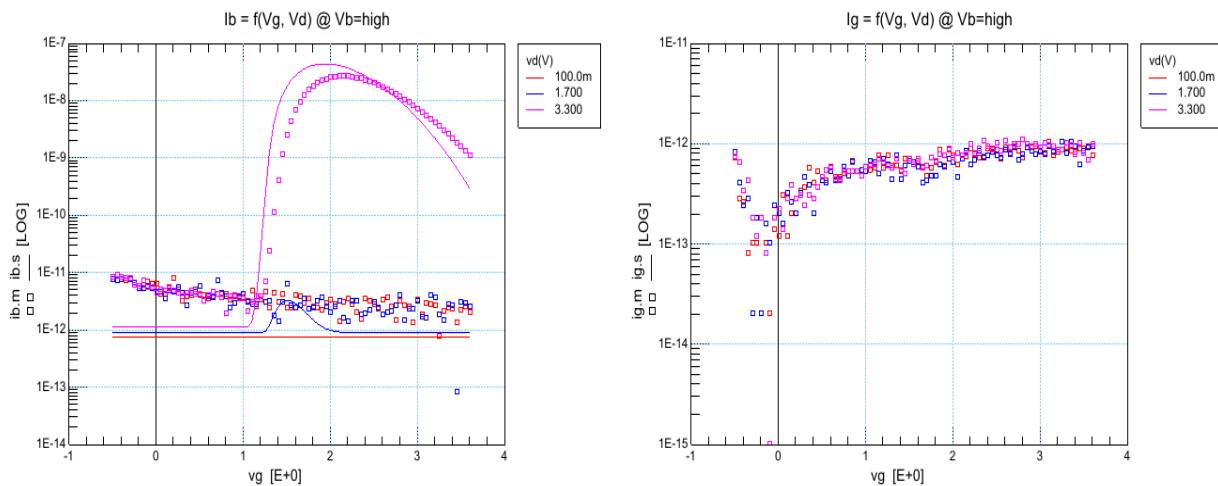
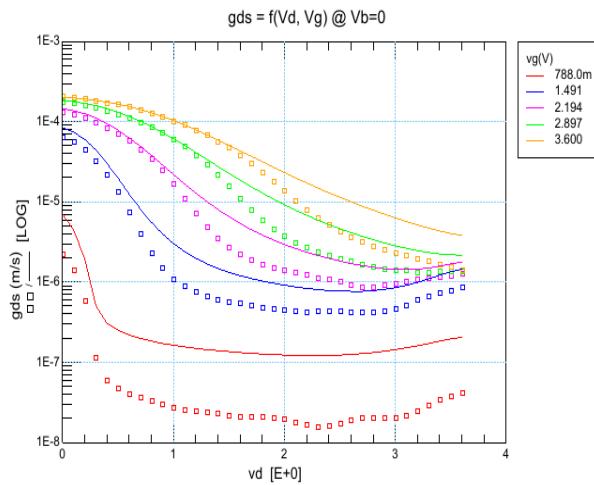
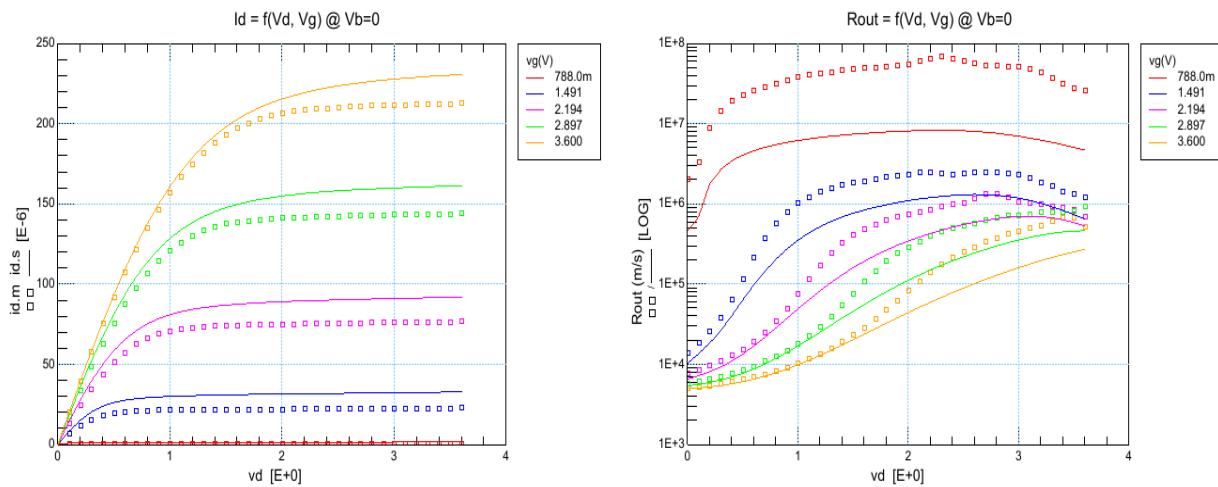
$i_{dvg}, V_d = 3.3V, T = -40^\circ\text{C}$

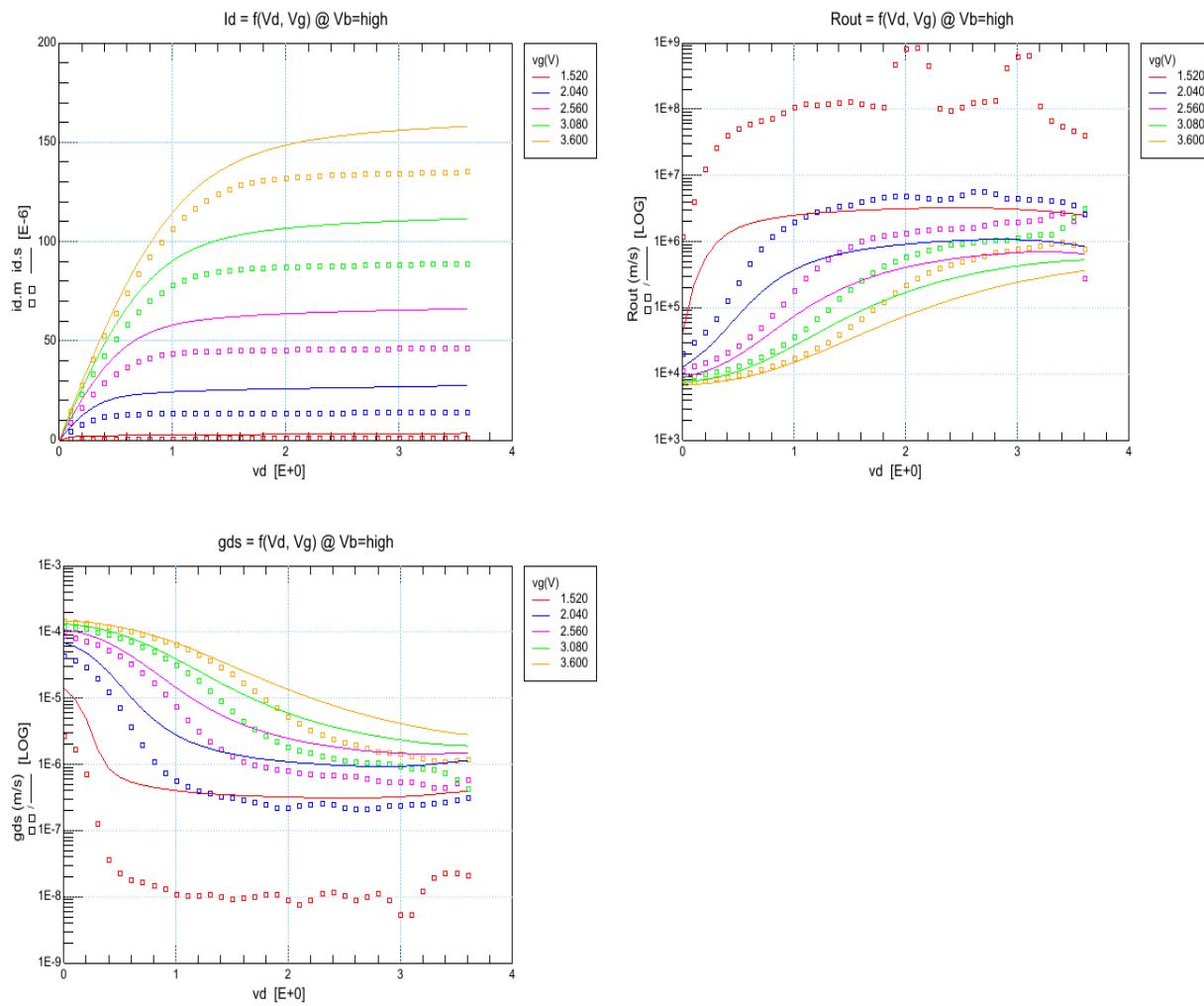
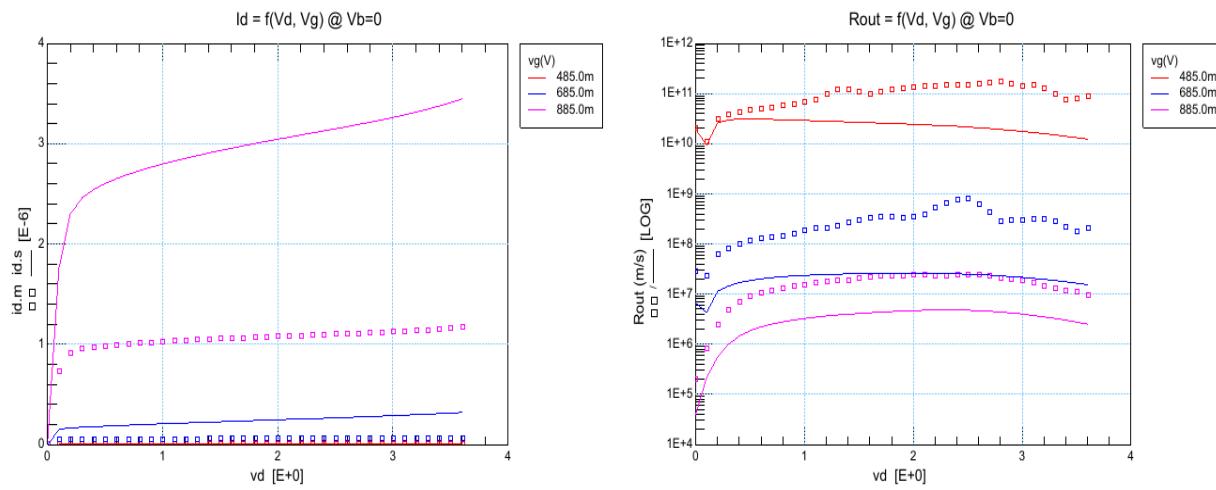


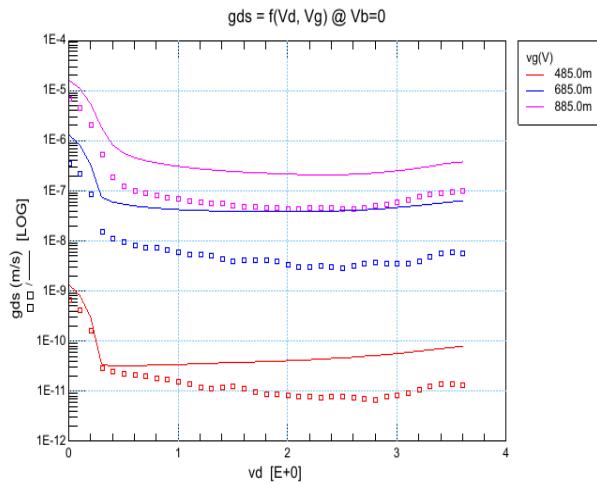


idvg, lb, lg, Vb = 0V, T = -40°C

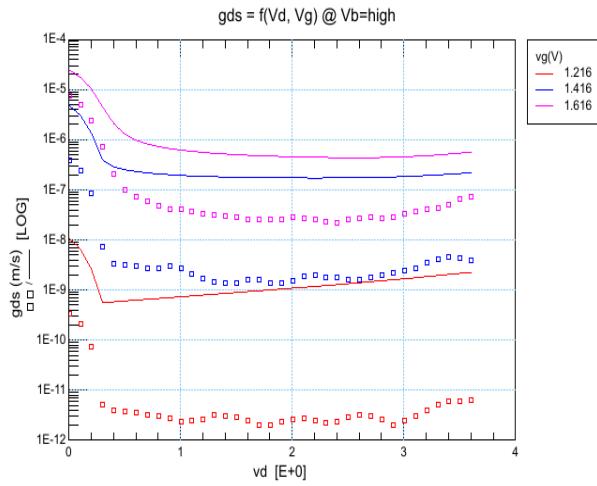
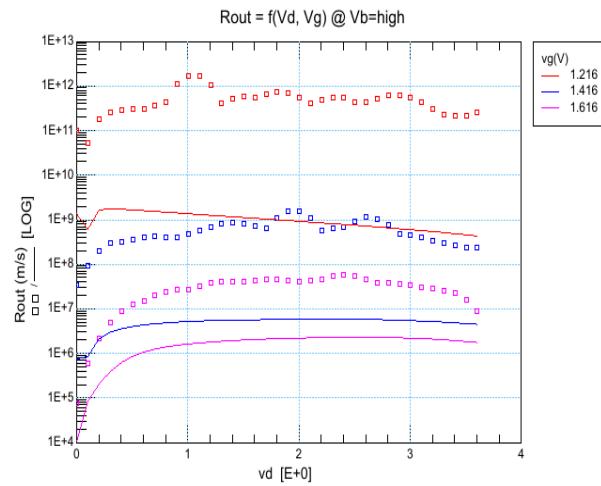
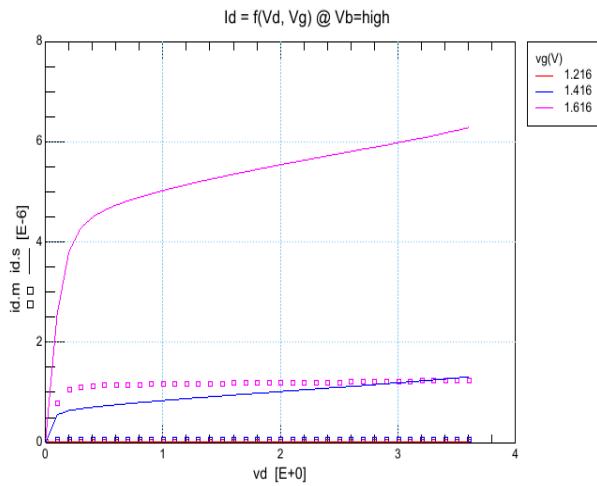


idvg, Ib,Ig, Vb = -3.6V, T = -40°C

idvd, Vb = 0V, T = -40°C


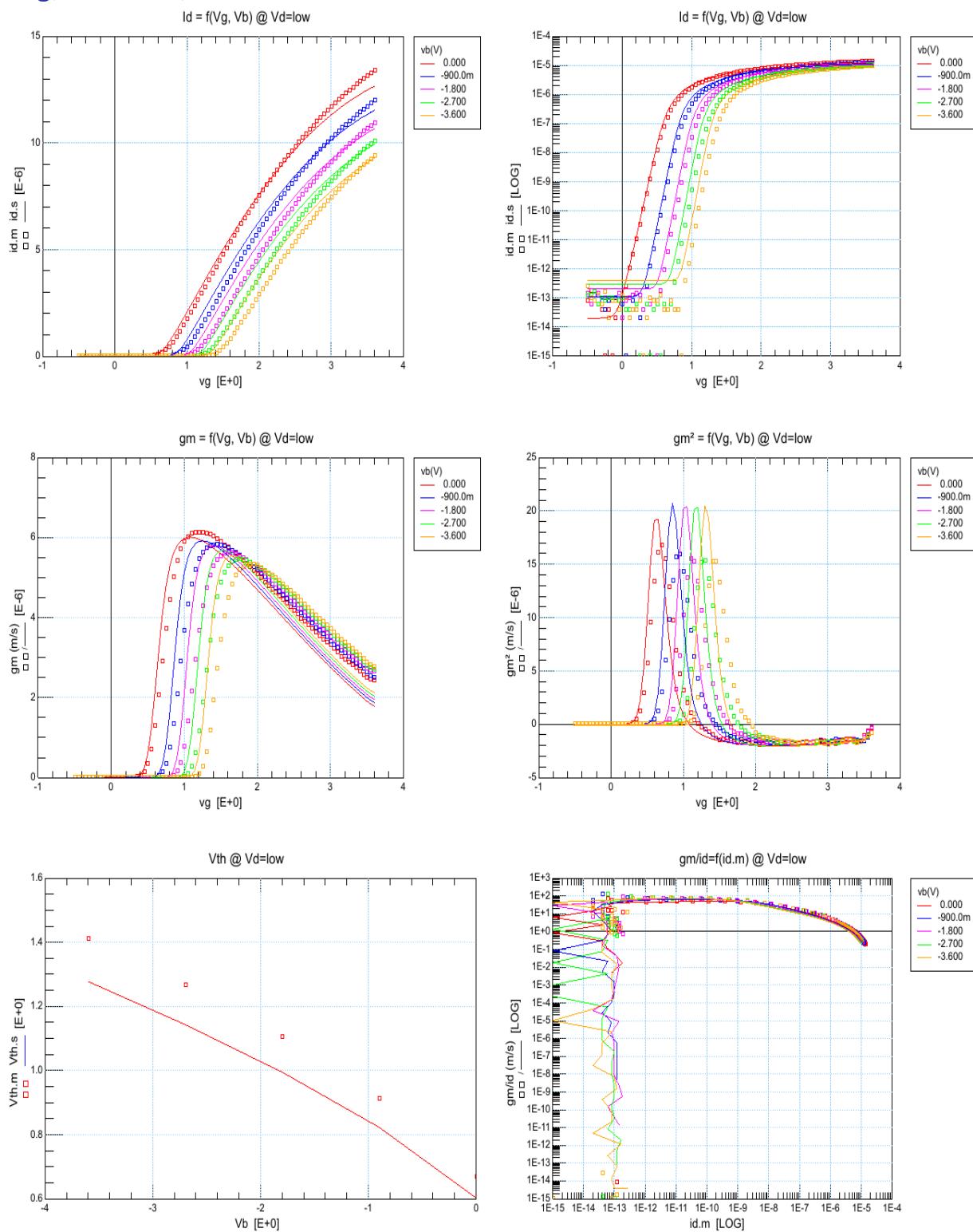
idvd_vbmin, Vb = -3.6V, T = -40°C

idvd_vth, Vb = 0V, T = -40°C


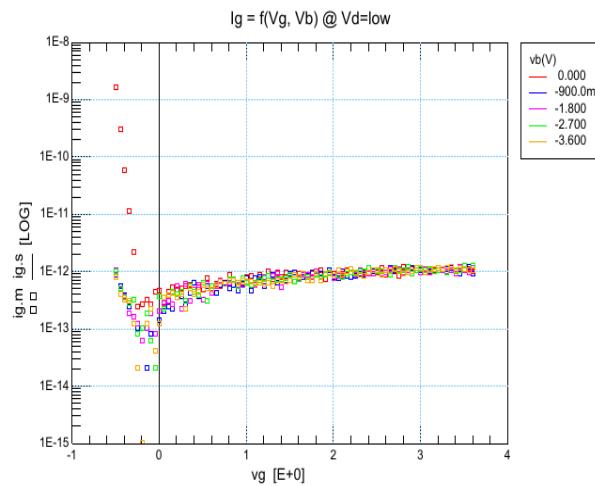
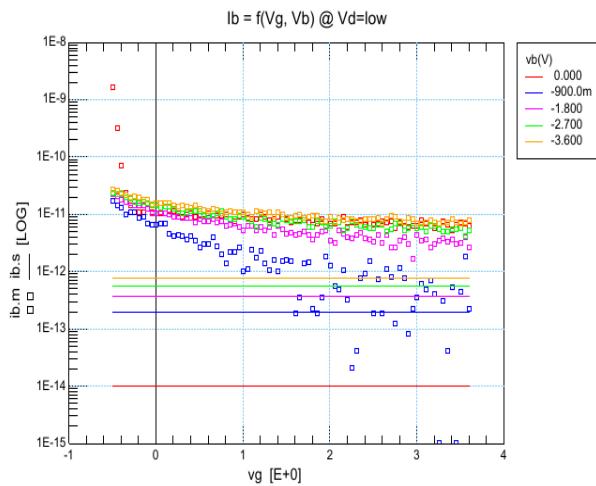


idvd_vth_vbmin, Vb = -3.6V, T = -40°C

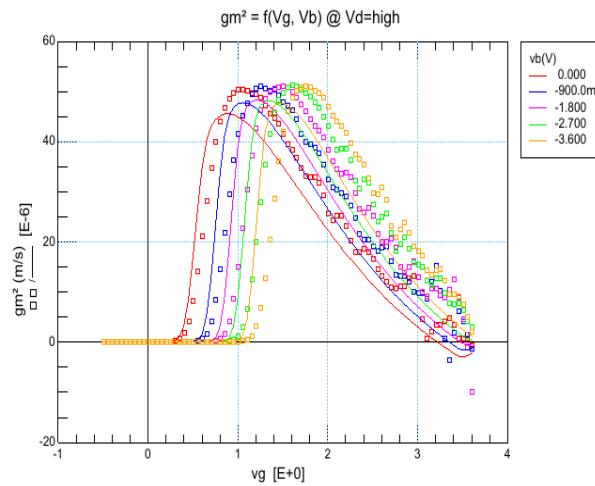
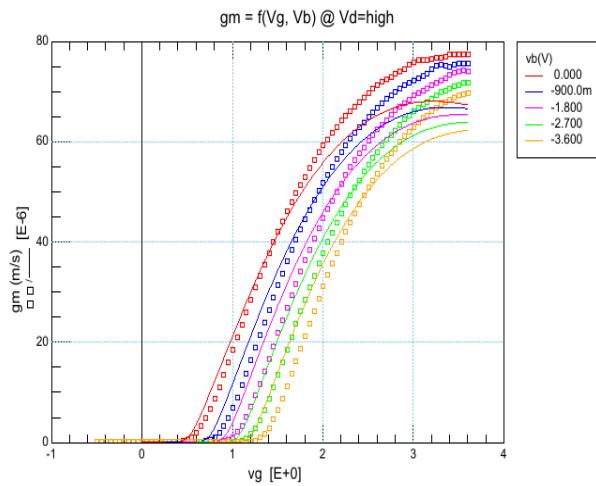
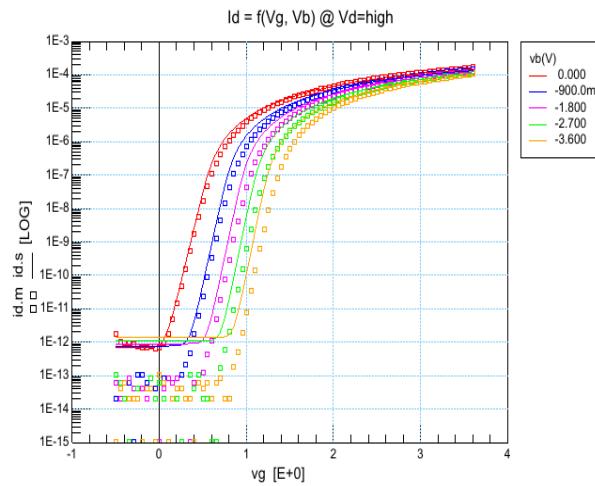
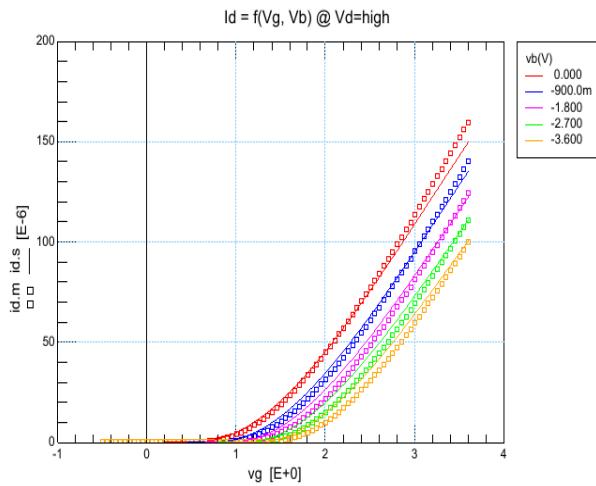


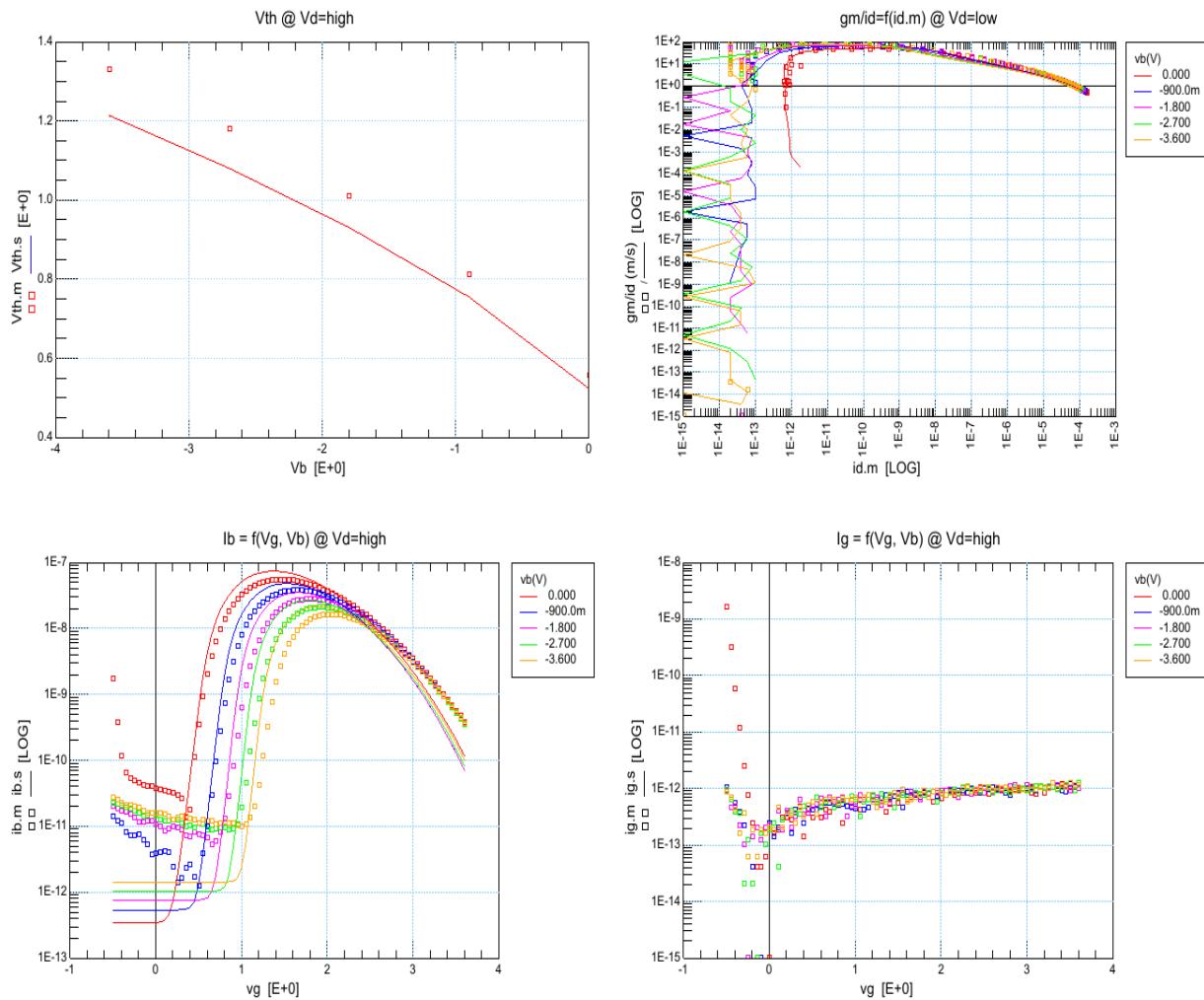
idvg, Vd = 0.1V, T = 70°C



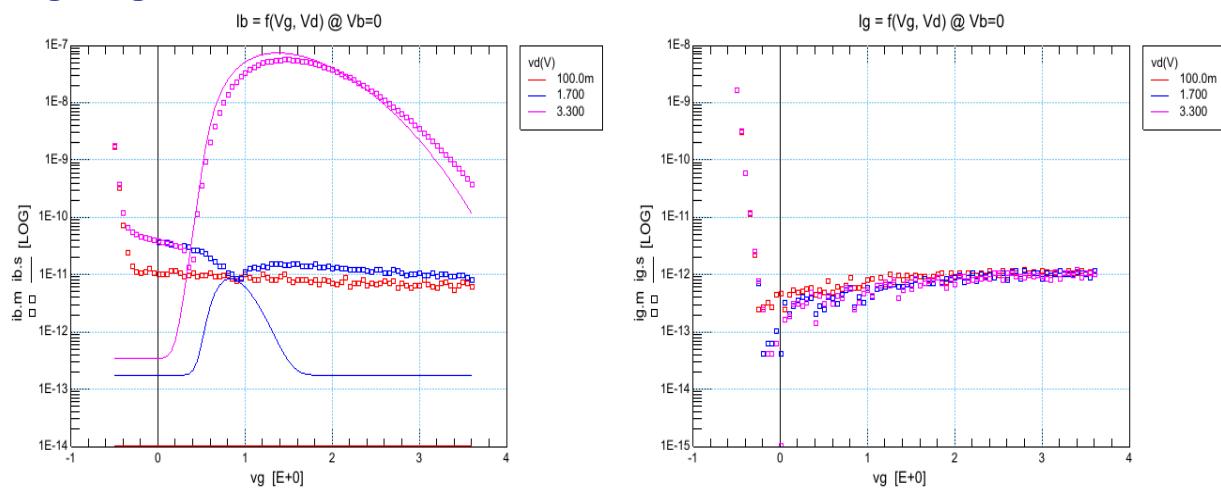


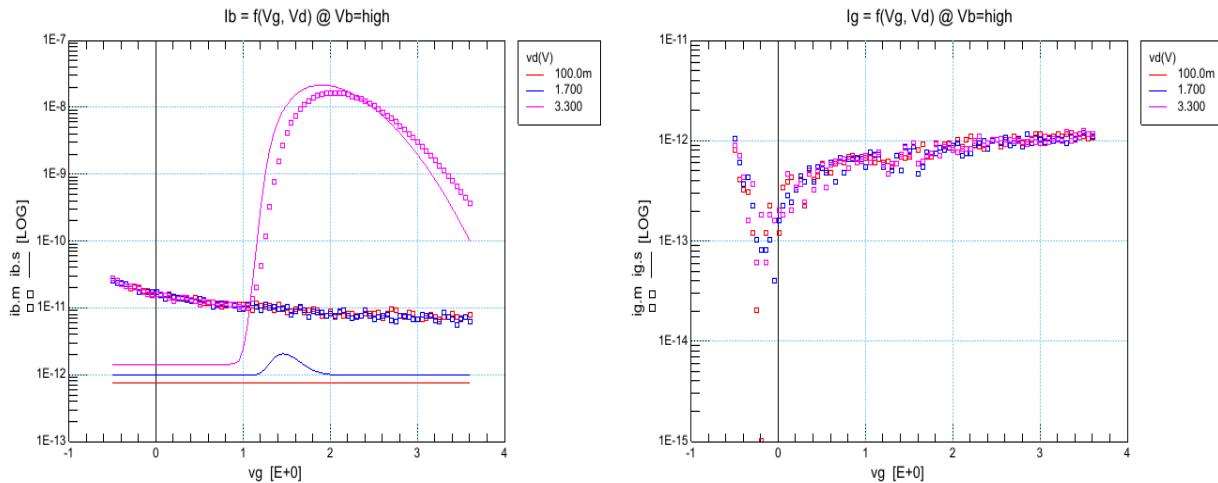
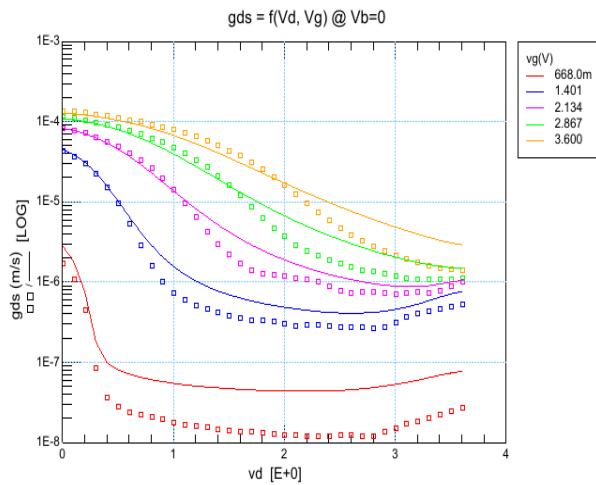
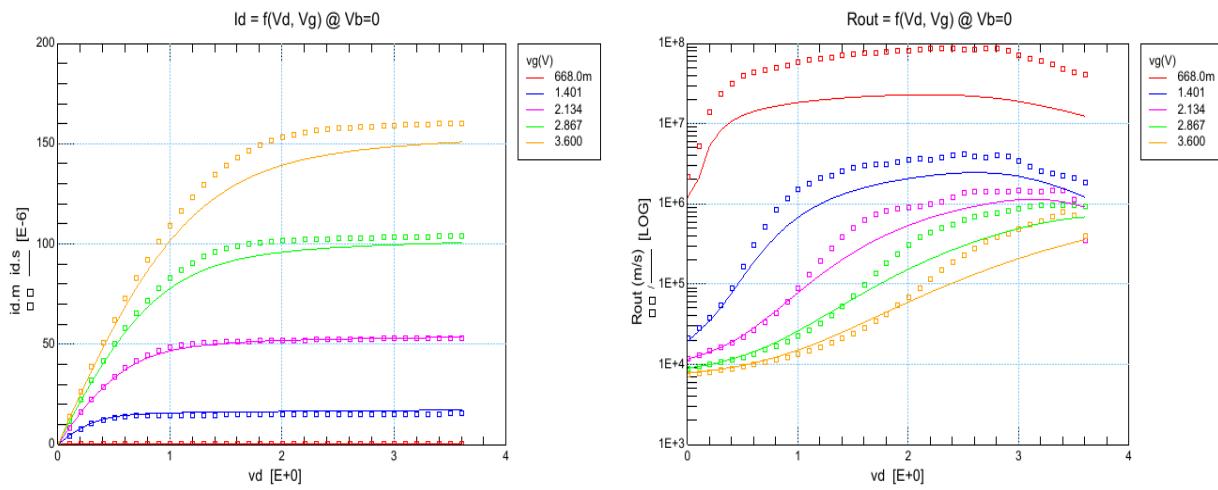
$idvg$, $Vd = 3.3V$, $T = 70^\circ C$

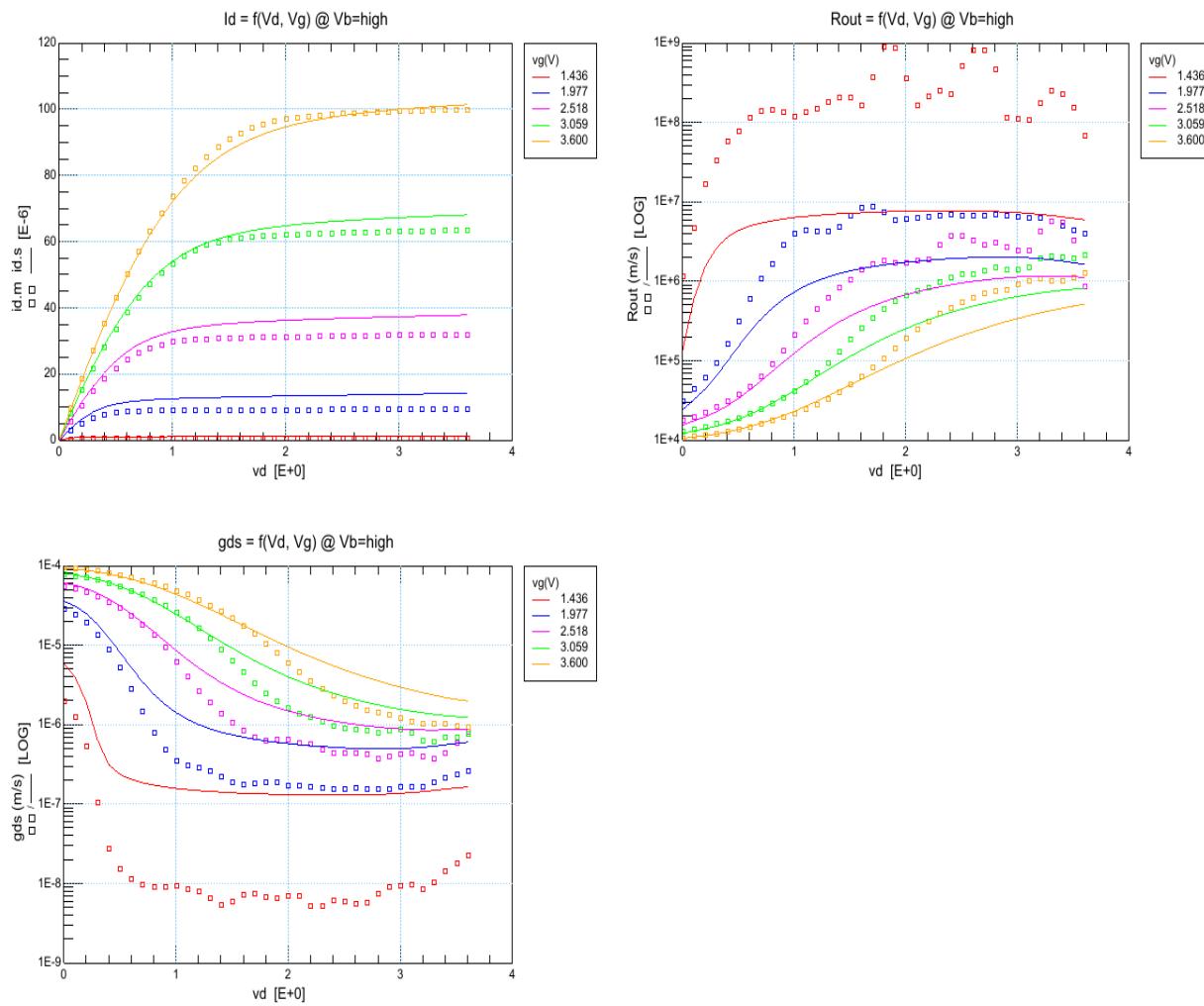
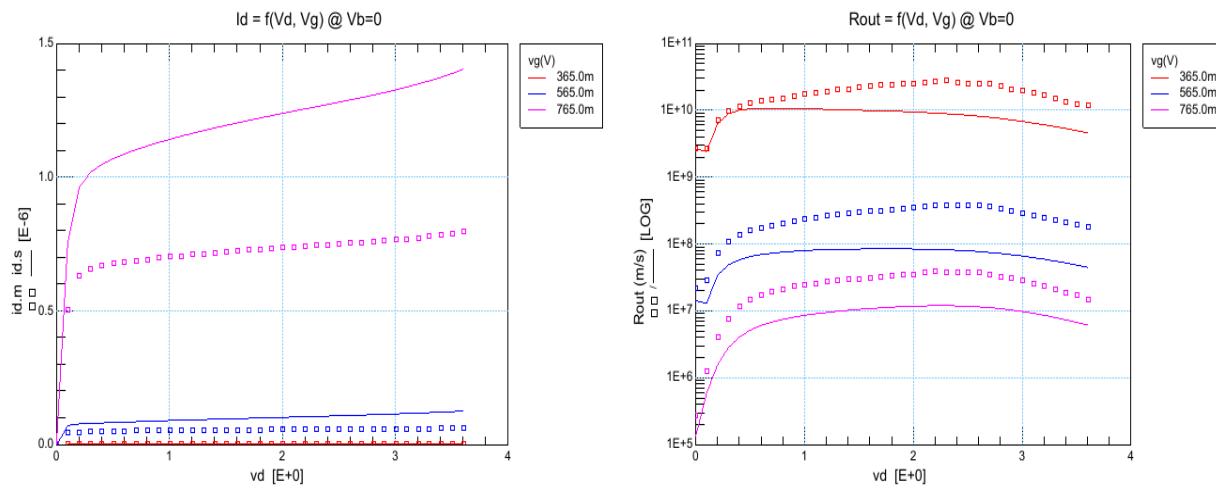


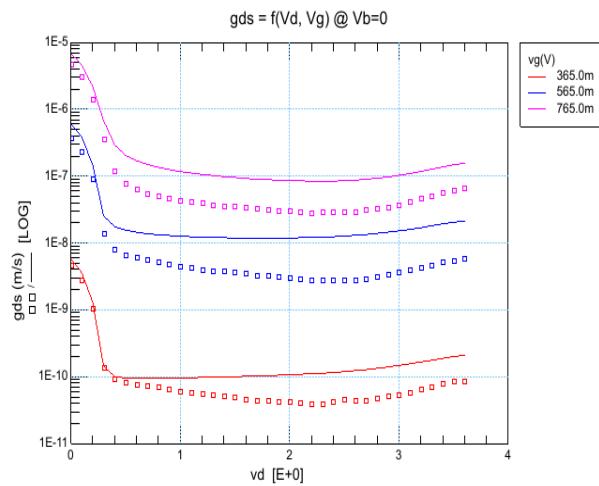


idvg, Ib,Ig, Vb = 0V, T = 70°C

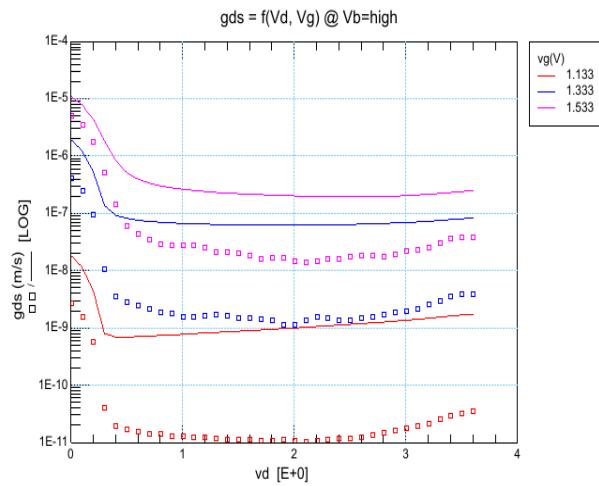
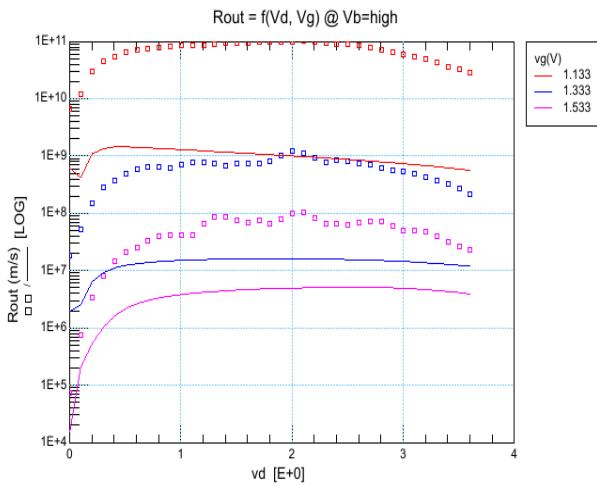
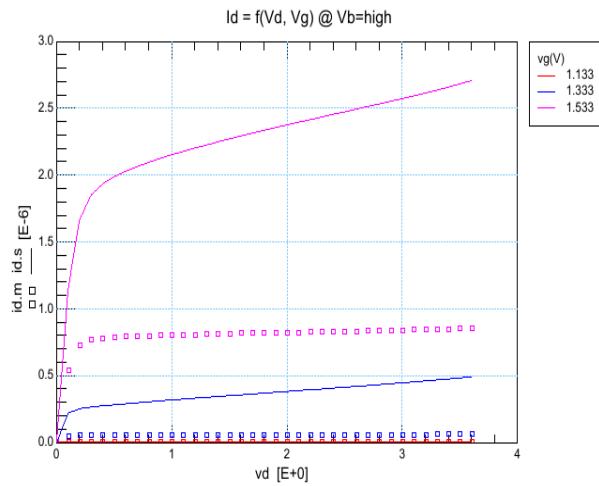


idvg, Ib,Ig, Vb = -3.6V, T = 70°C

idvd, Vb = 0V, T = 70°C


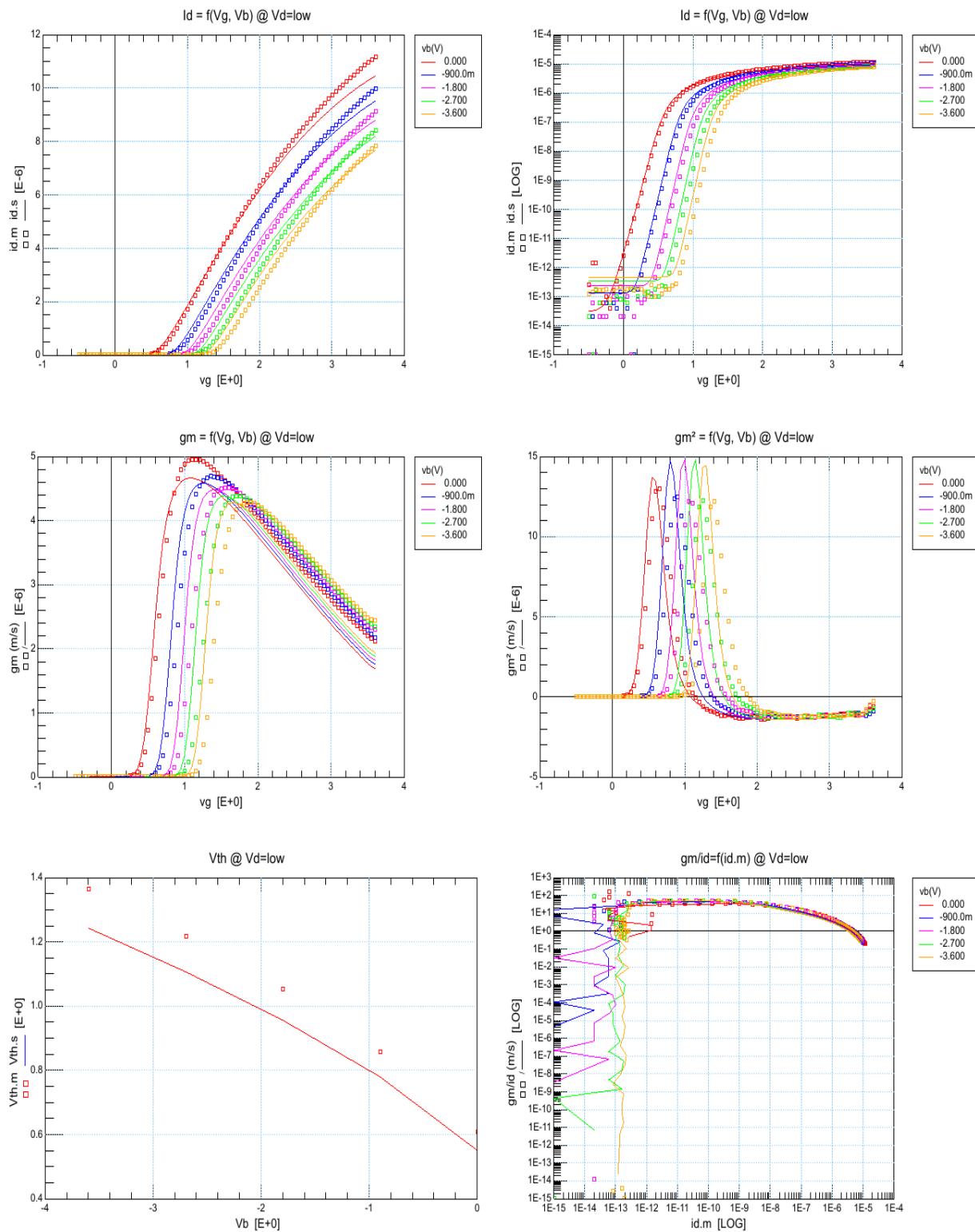
idvd_vbmin, Vb = -3.6V, T = 70°C

idvd_vth, Vb = 0V, T = 70°C


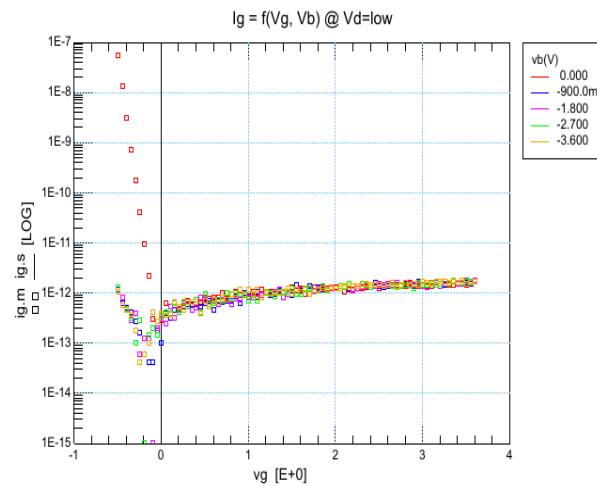
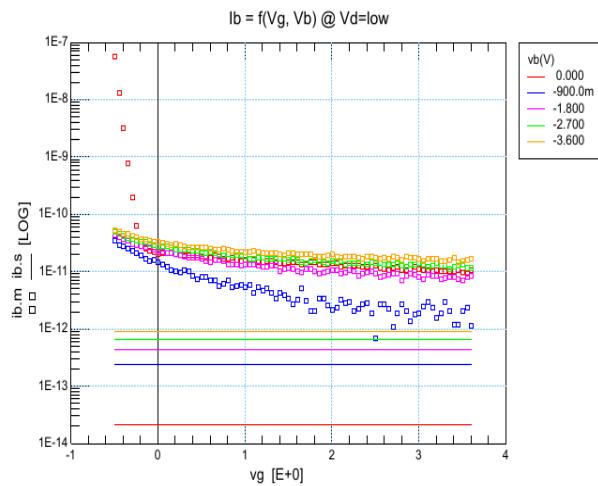


idvd_vth_vbmin, Vb = -3.6V, T = 70°C

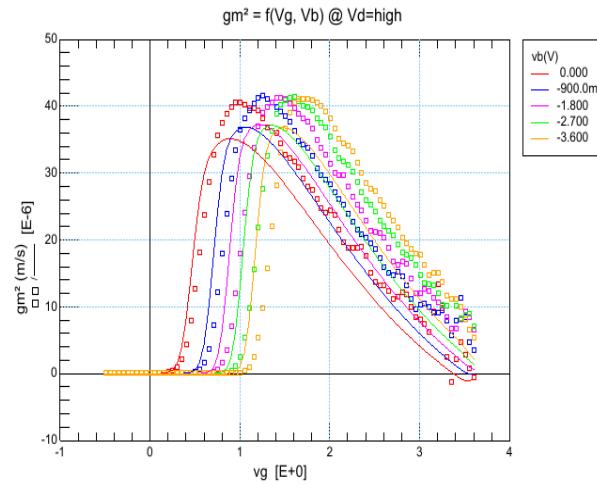
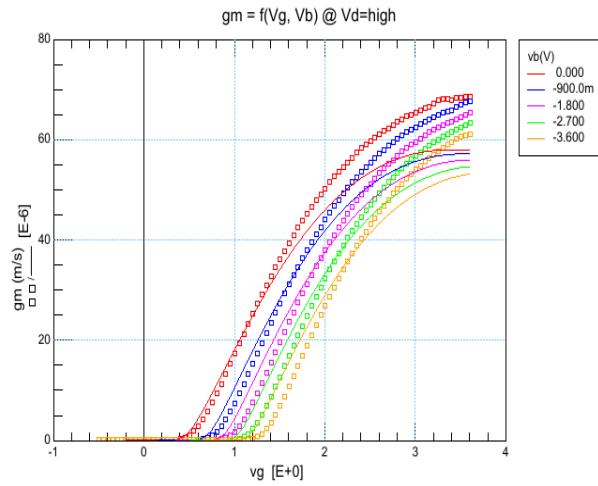
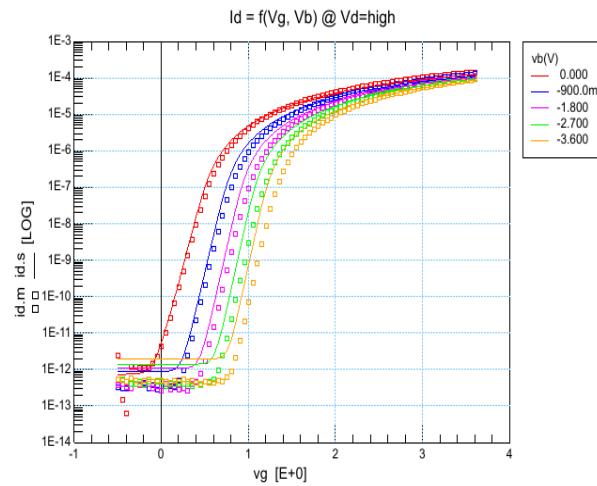
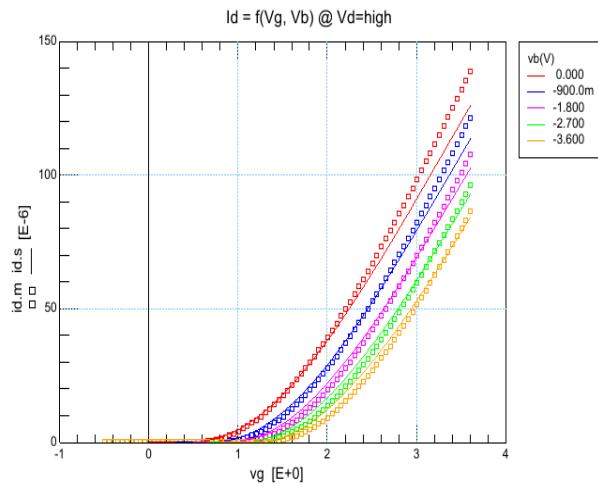


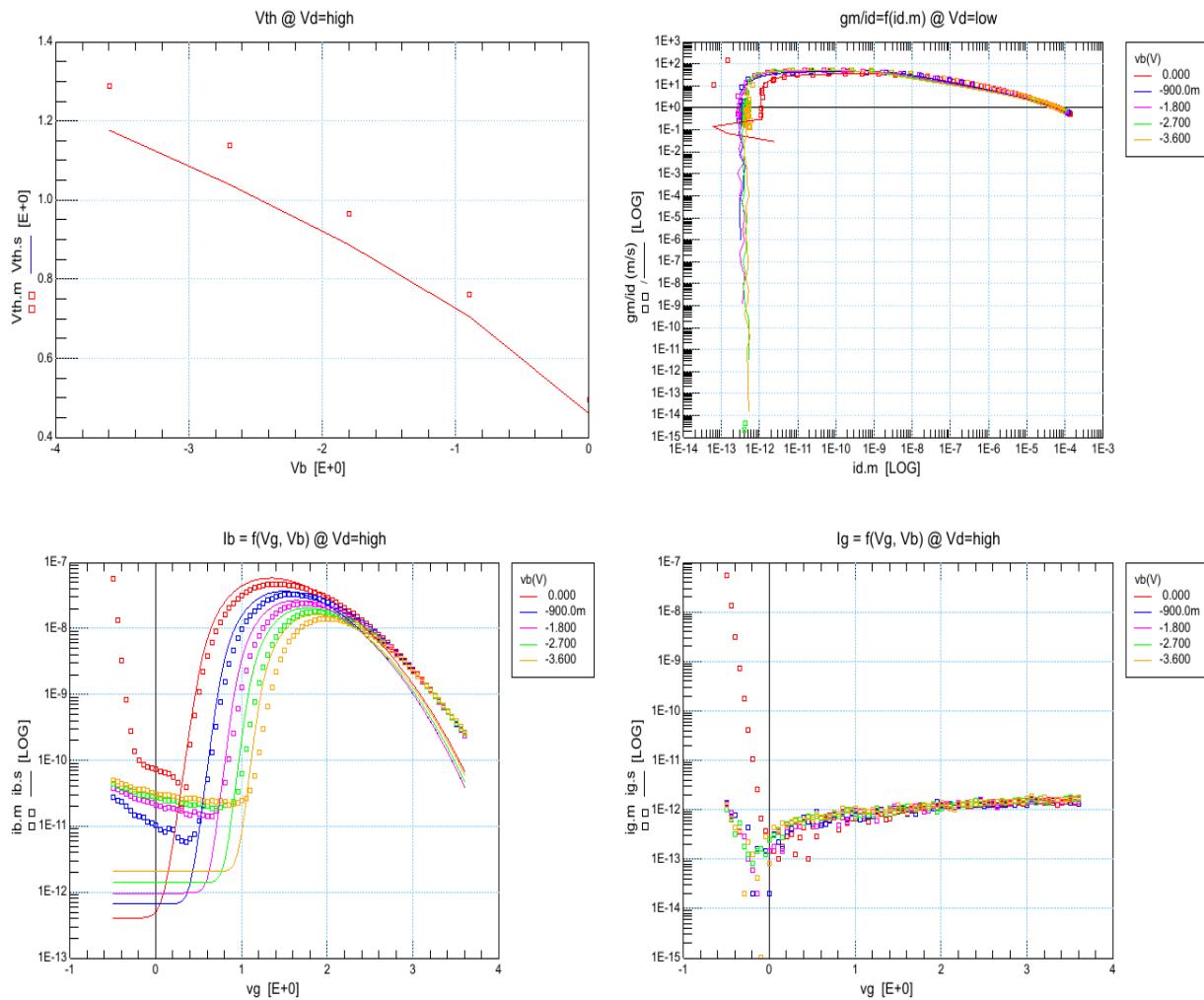
idvg, Vd = 0.1V, T = 125°C



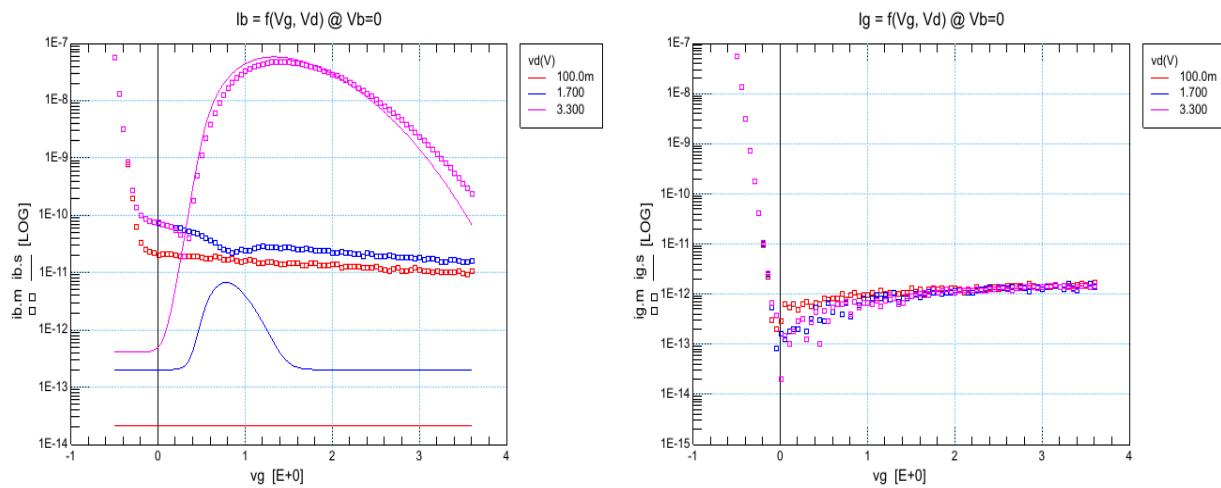


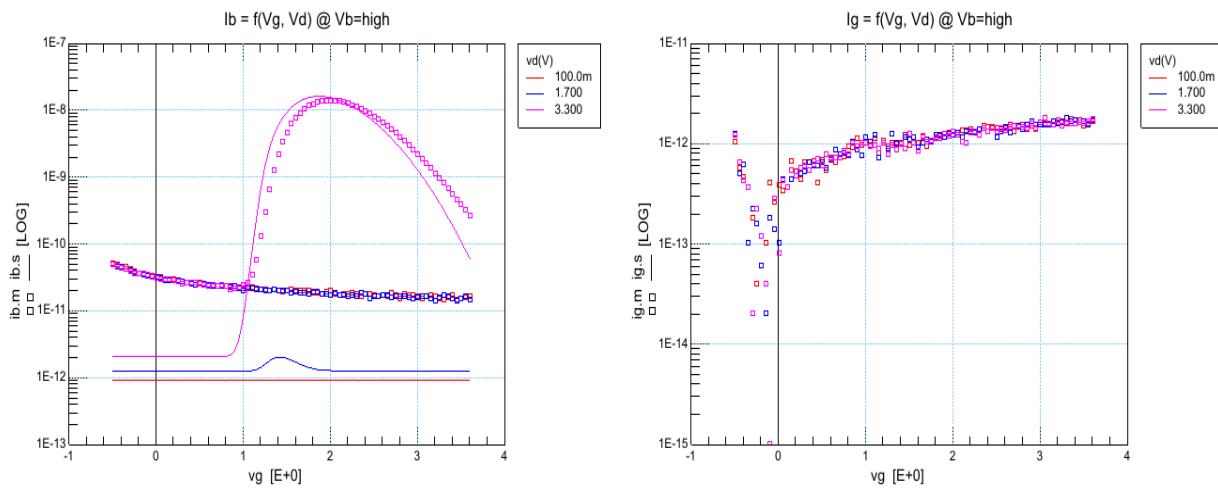
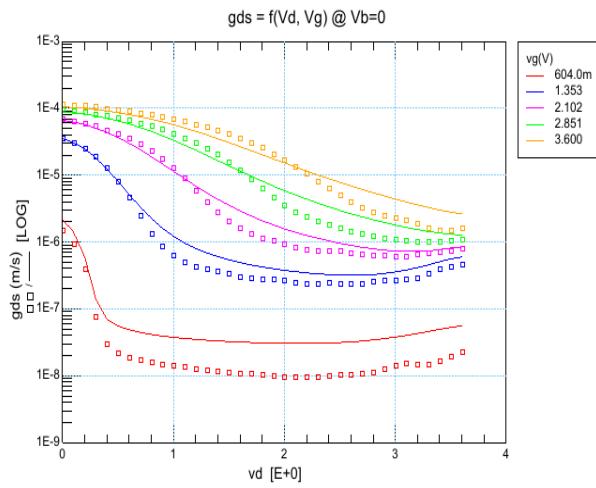
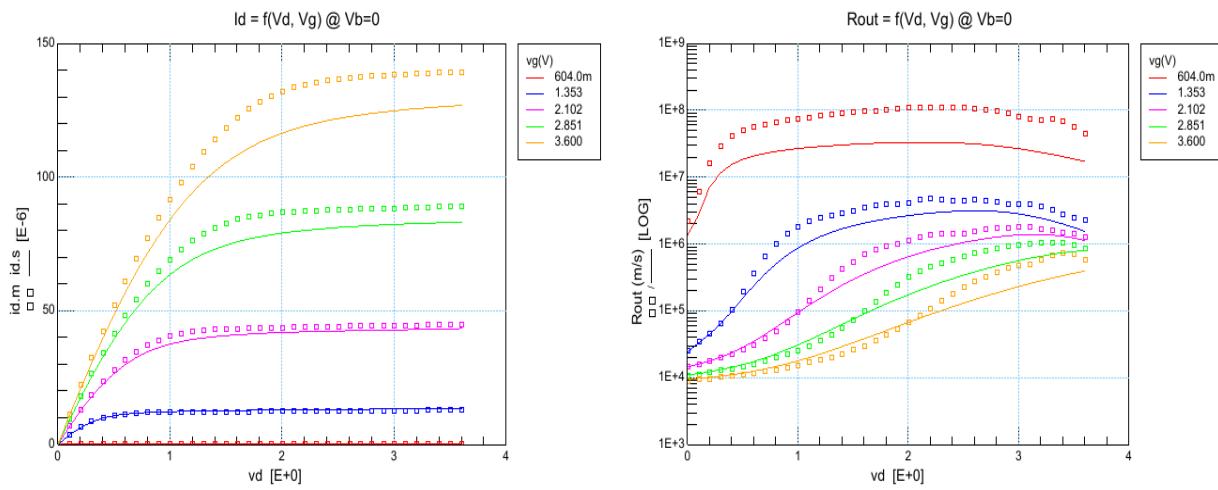
$idvg, Vd = 3.3V, T = 125^{\circ}C$

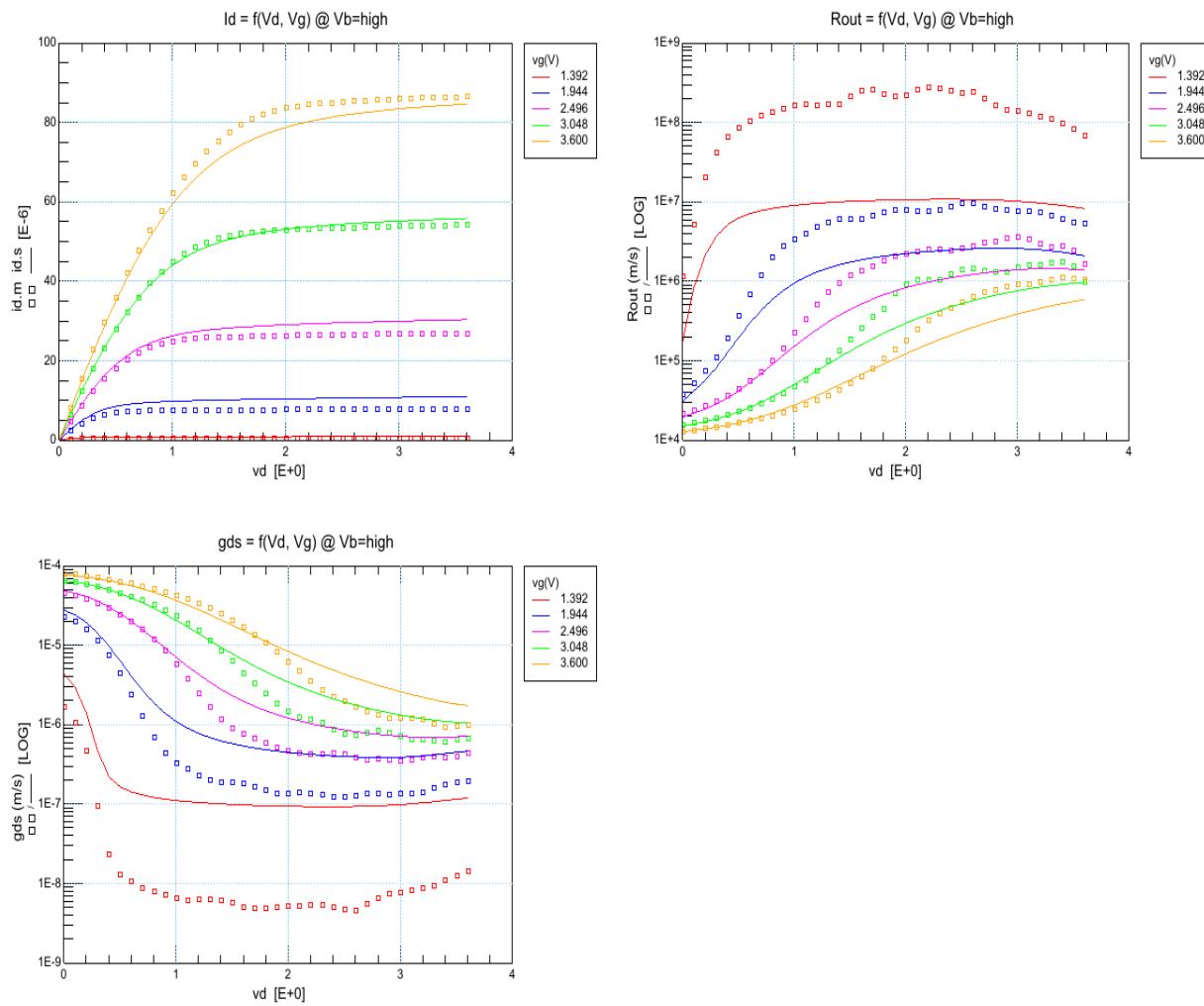
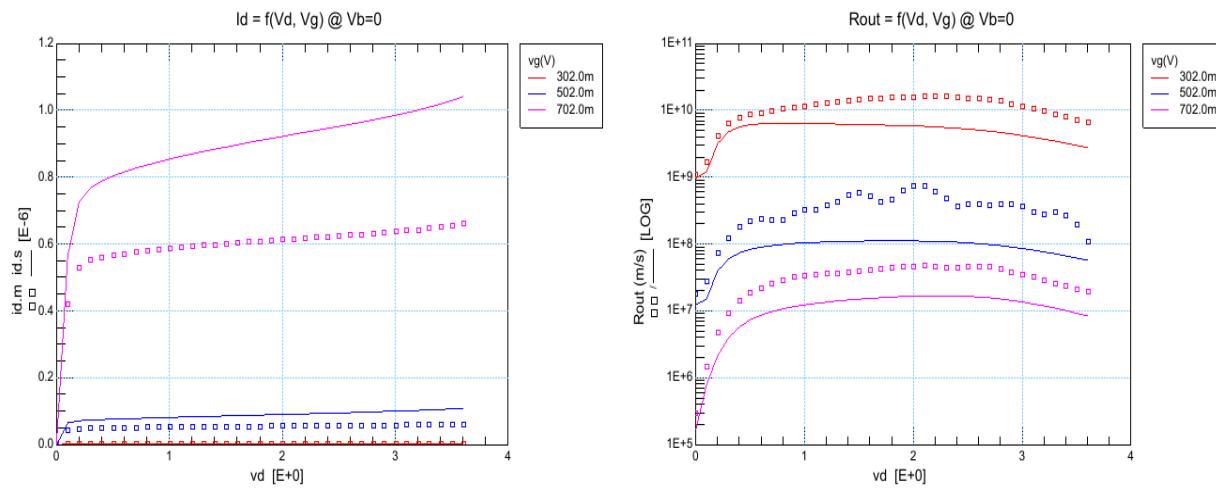


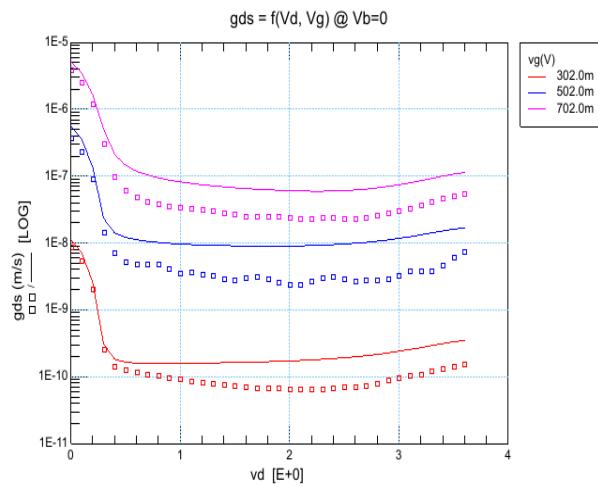


idvg, Ib,Ig, Vb = 0V, T = 125°C

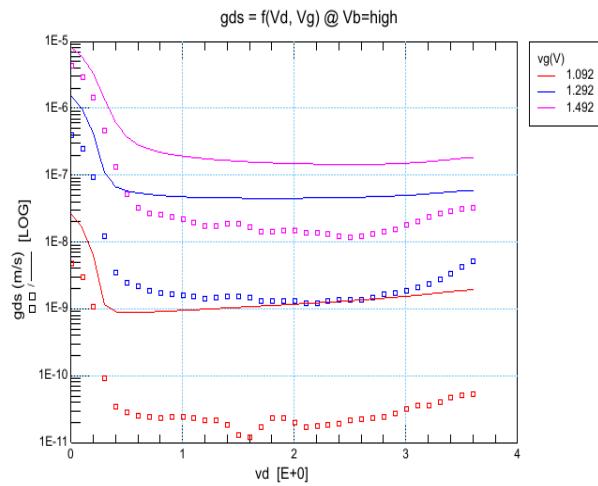
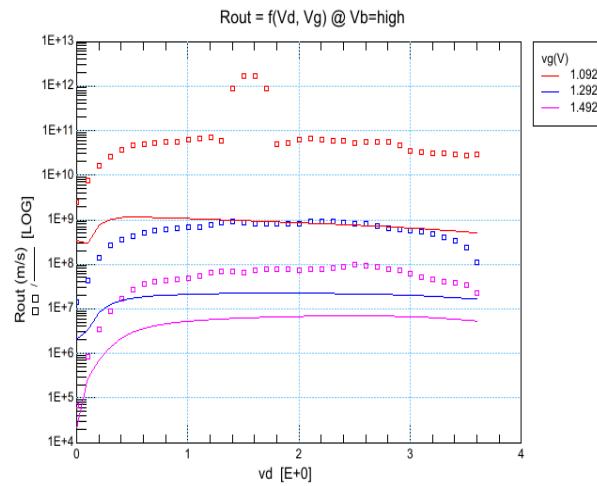
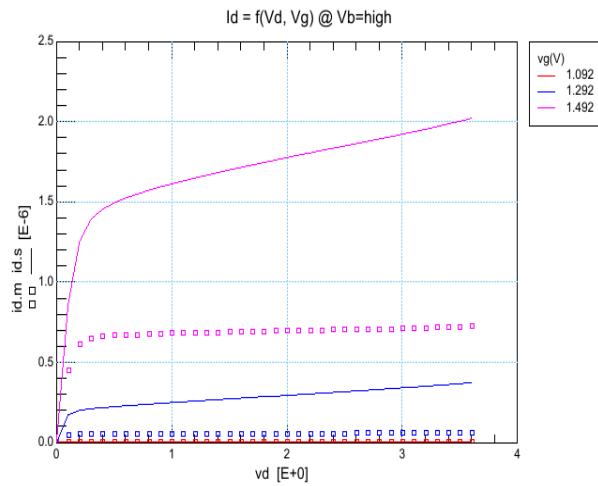


idvg, Ib,Ig, Vb = -3.6V, T = 125°C

idvd, Vb = 0V, T = 125°C


idvd_vbmin, Vb = -3.6V, T = 125°C

idvd_vth, Vb = 0V, T = 125°C


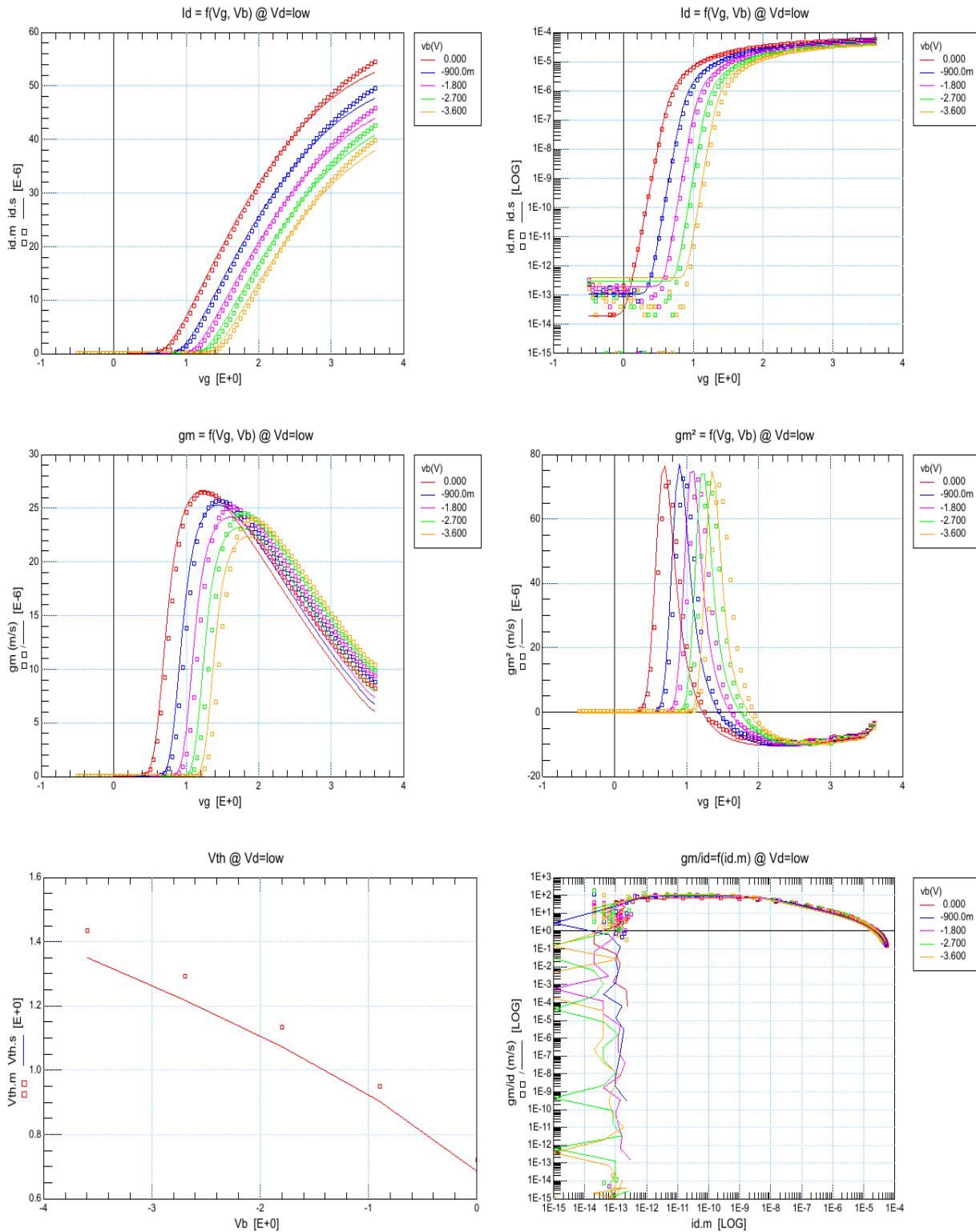


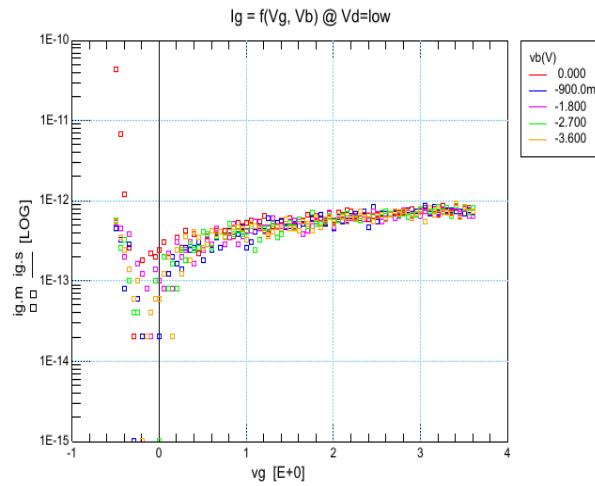
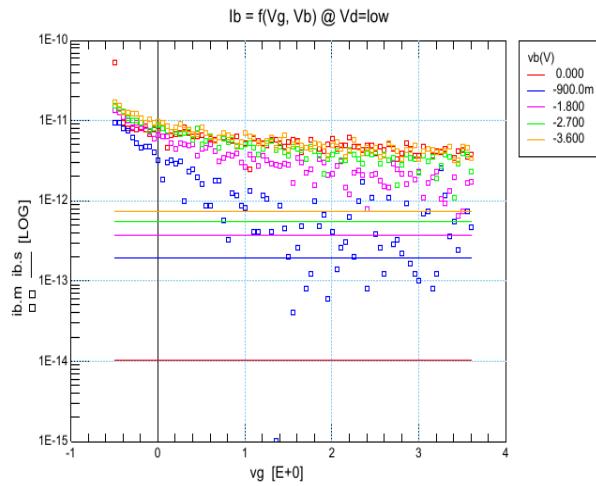
idvd_vth_vbmin, Vb = -3.6V, T = 125°C



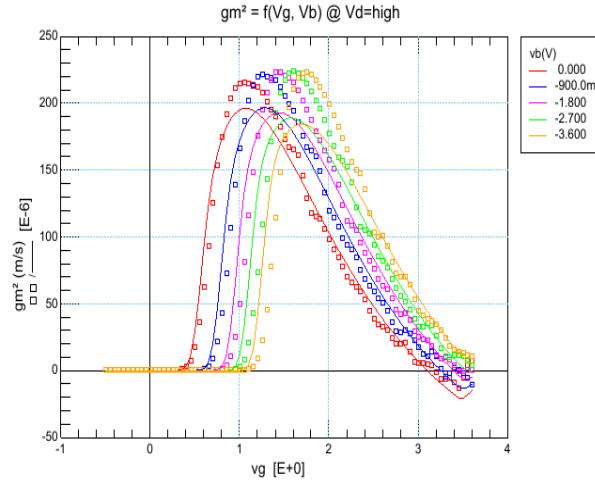
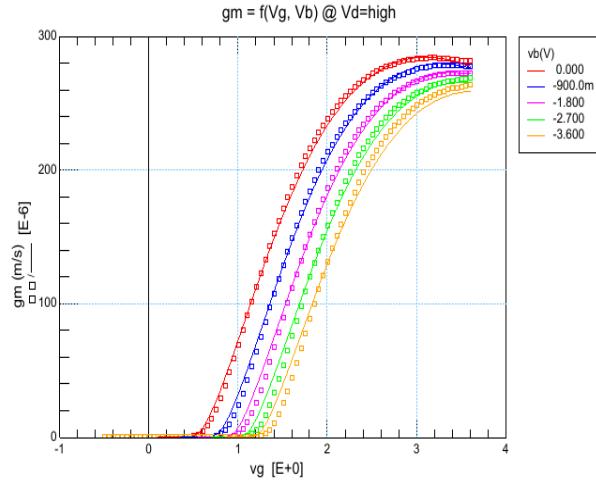
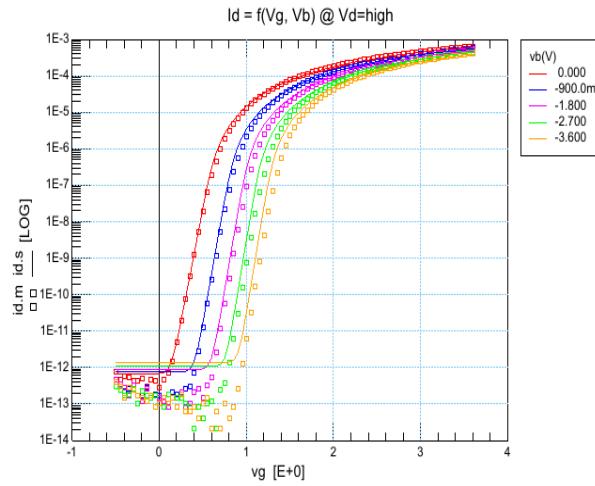
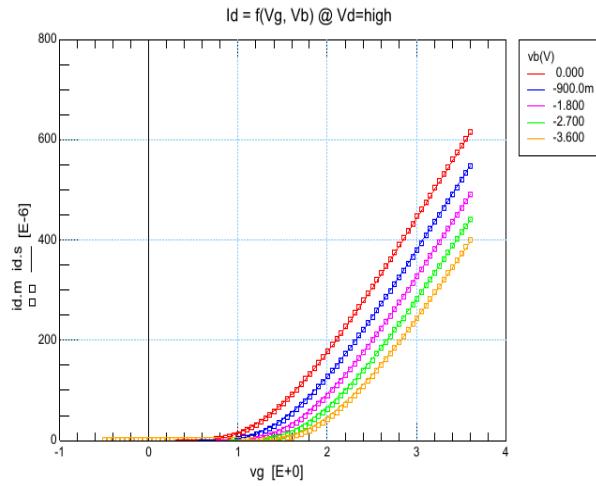
4.17W02u0_L1u2_S558_3

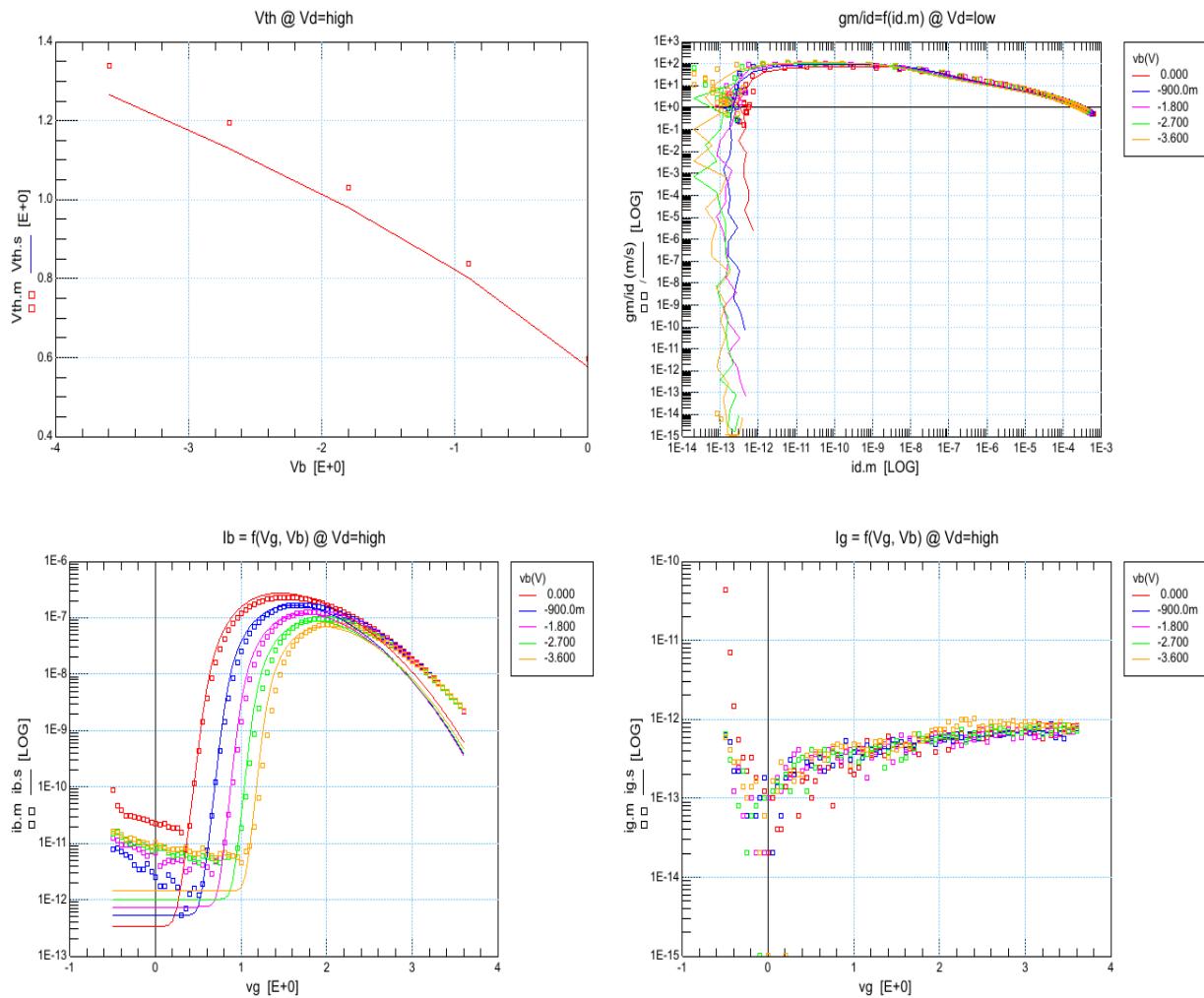
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



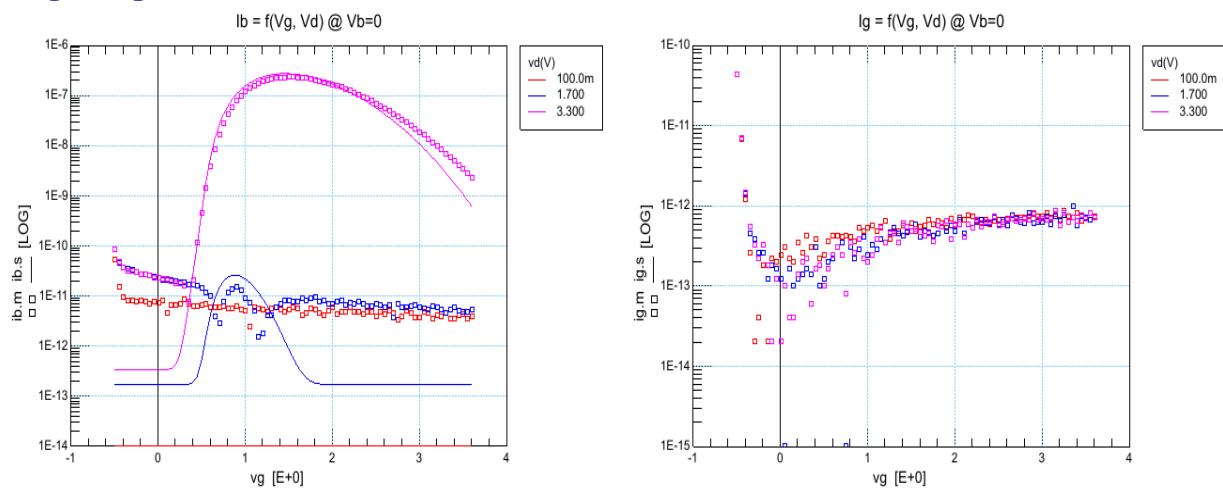


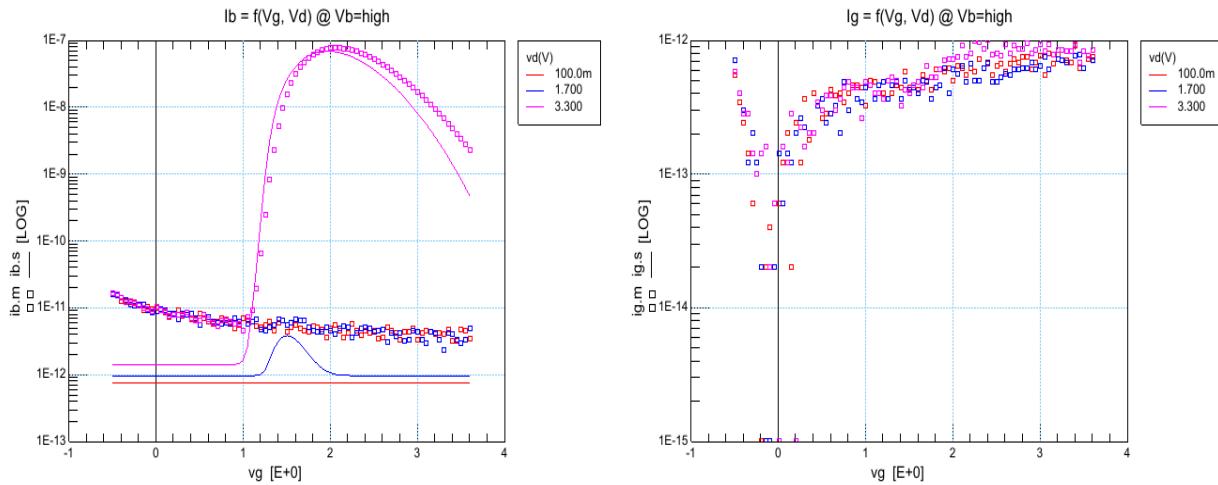
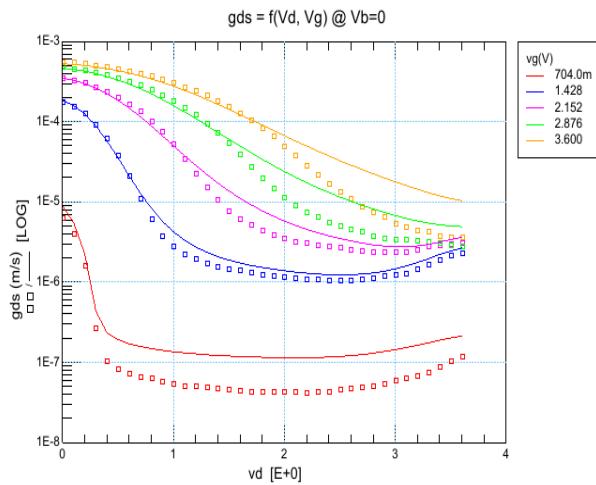
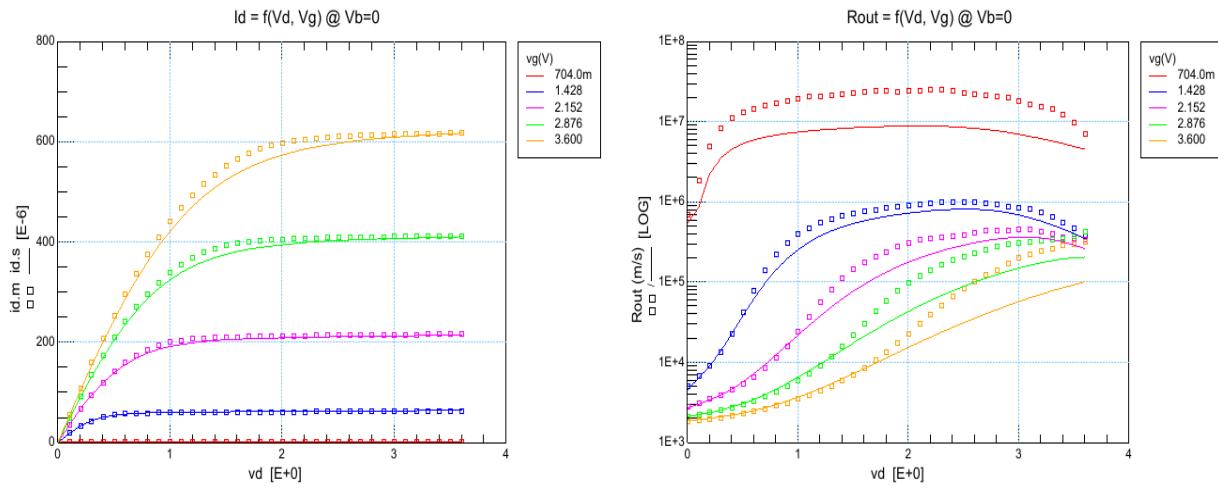
idvg, Vd = 3.3V, T = 27°C

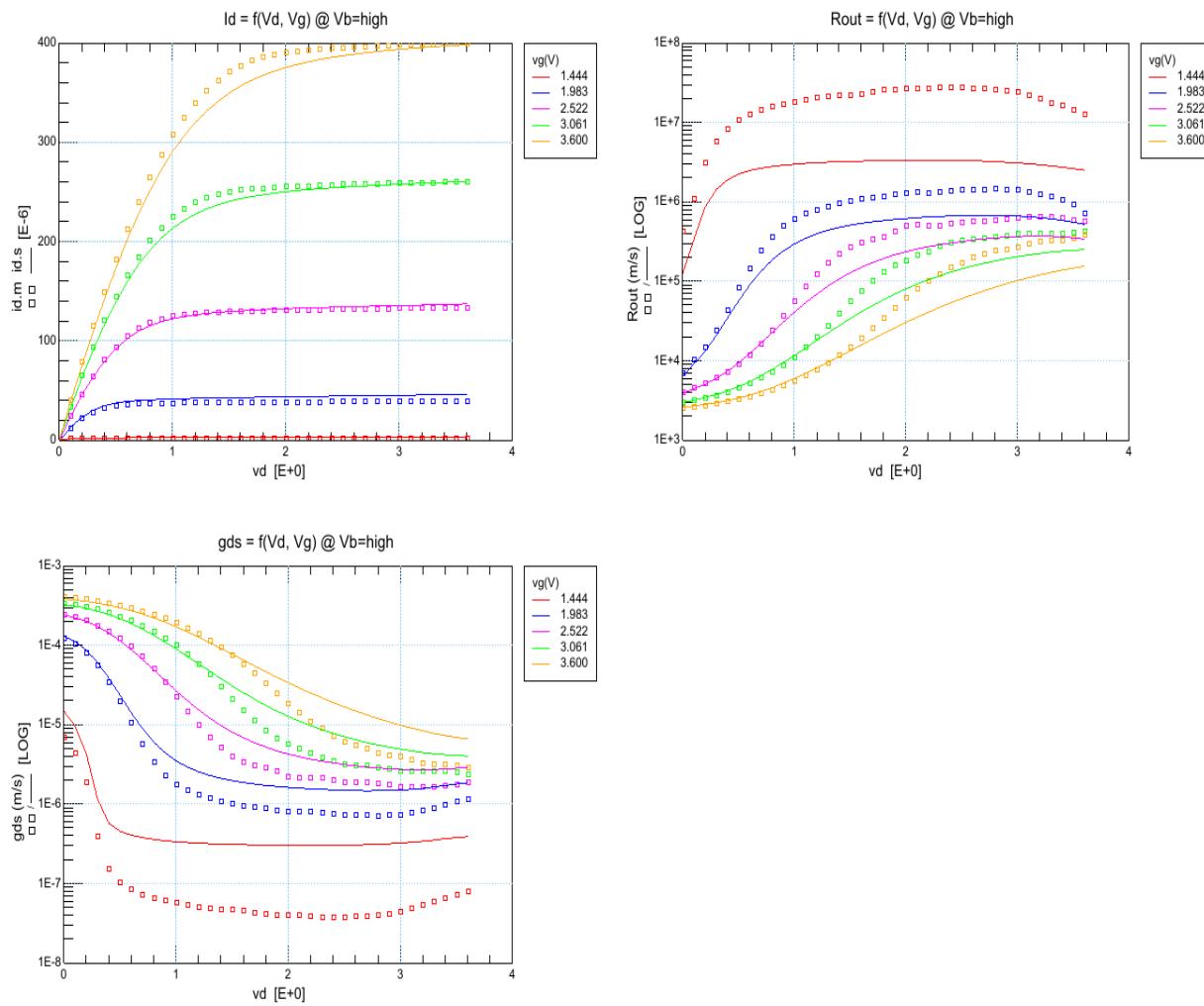
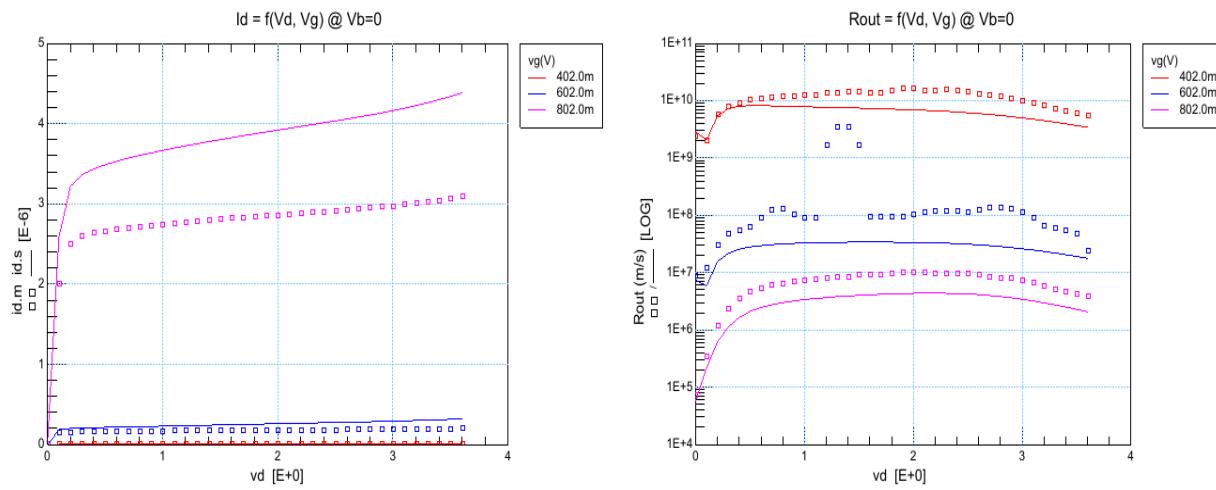


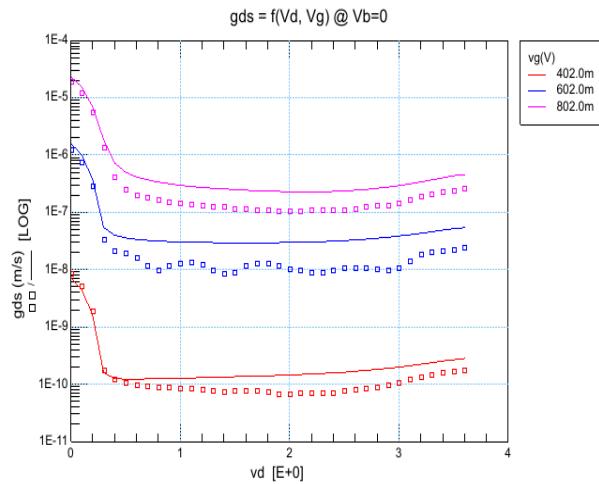


idvg, Ib,Ig, Vb = 0V, T = 27°C

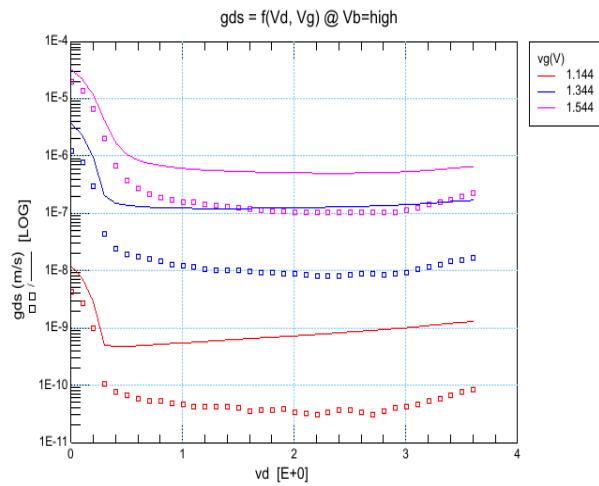
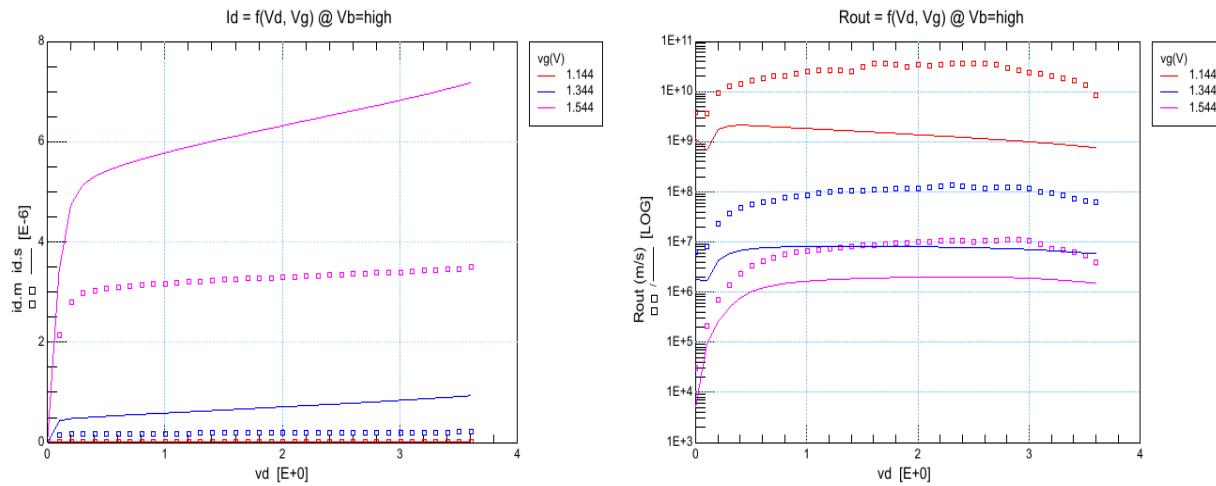


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


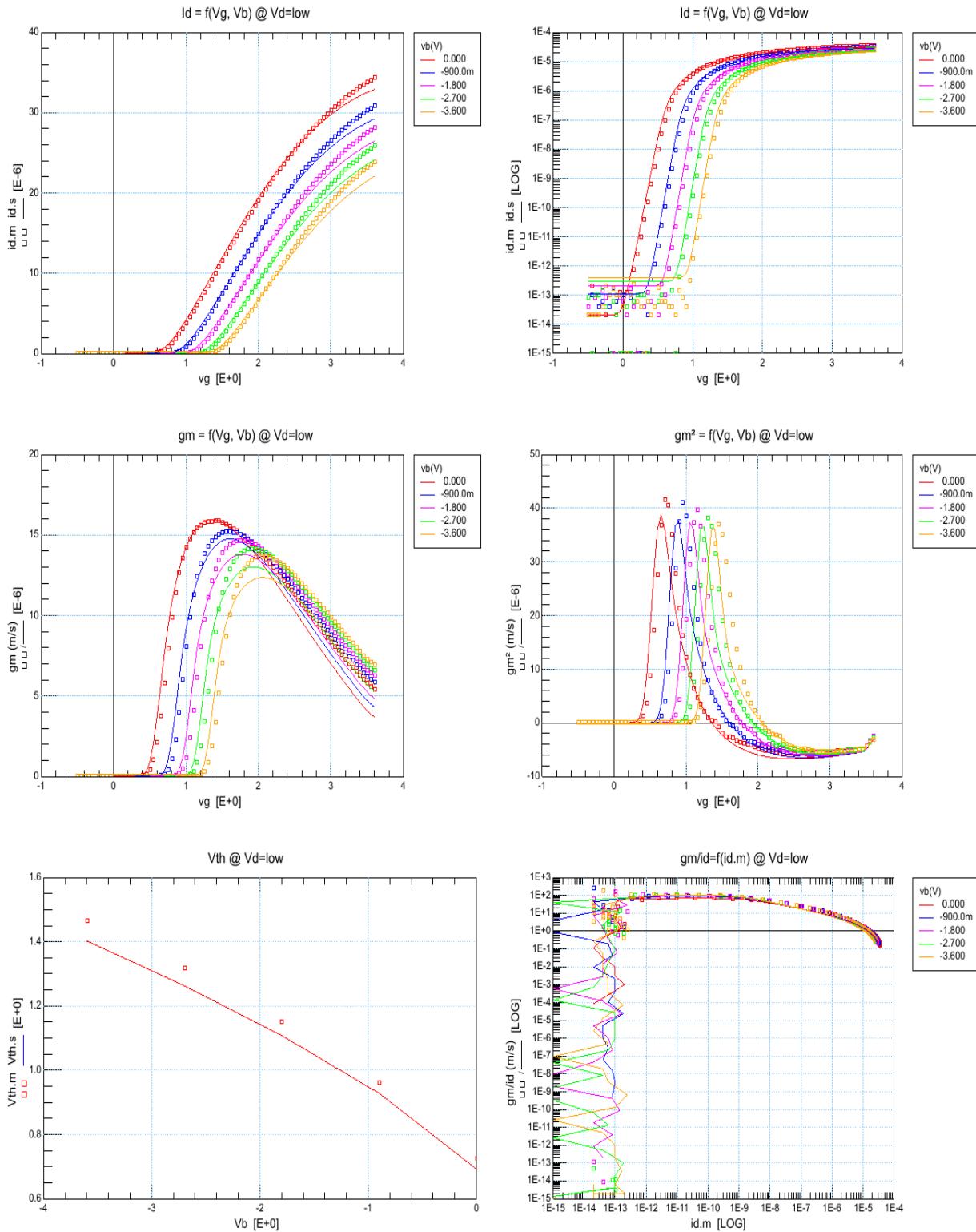


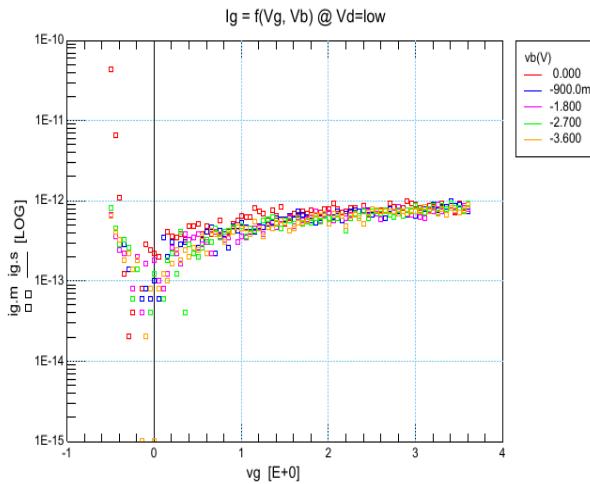
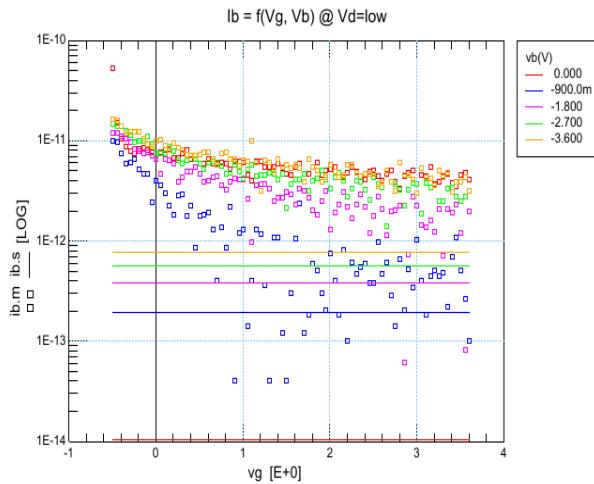
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



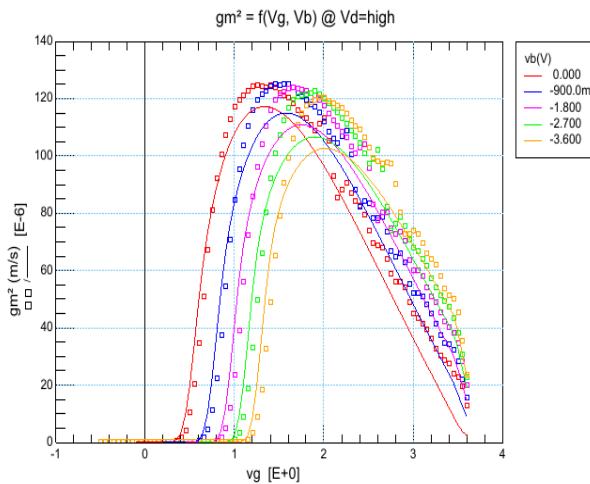
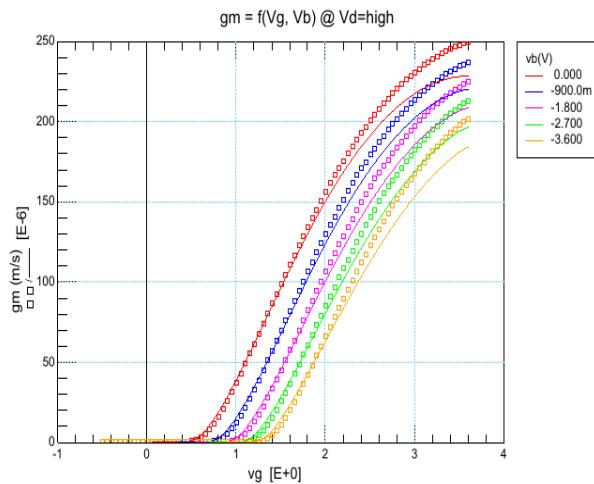
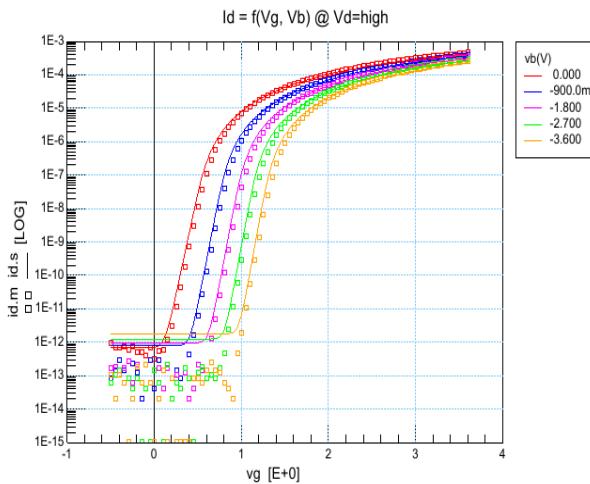
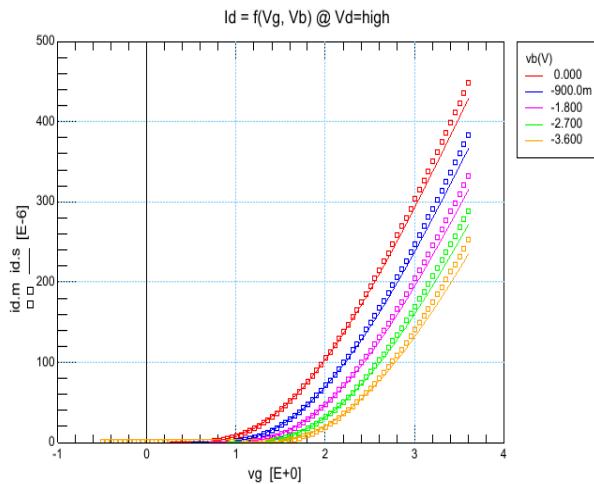
4.18W05u0_L5u0_S557_5

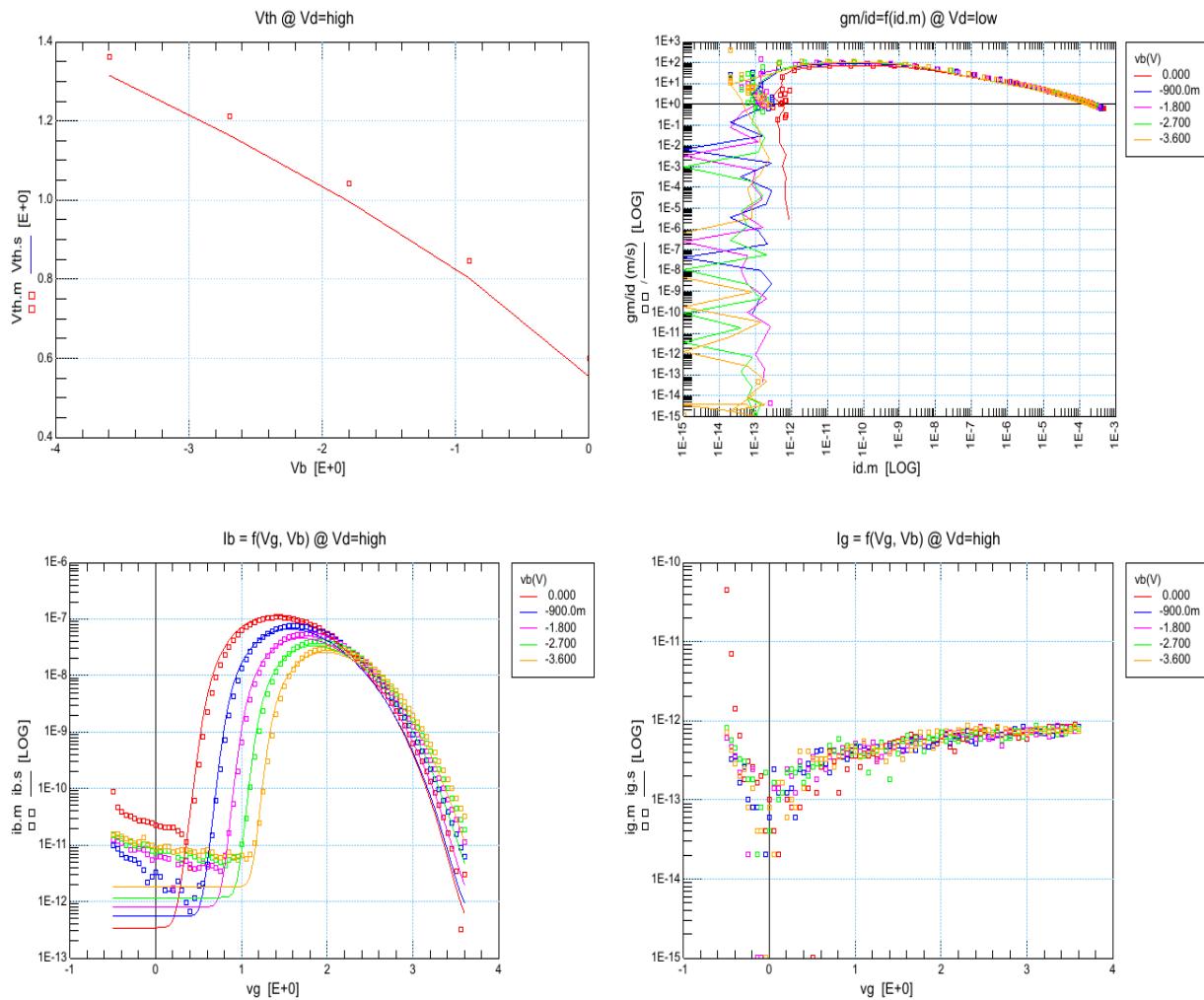
idvg, Vd = 0.1V, T = 27°C



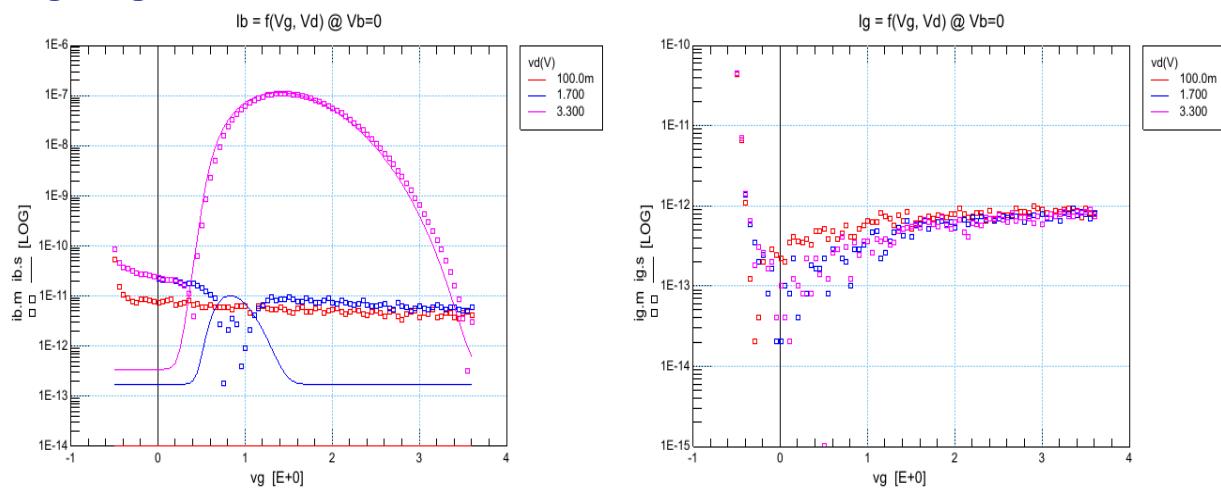


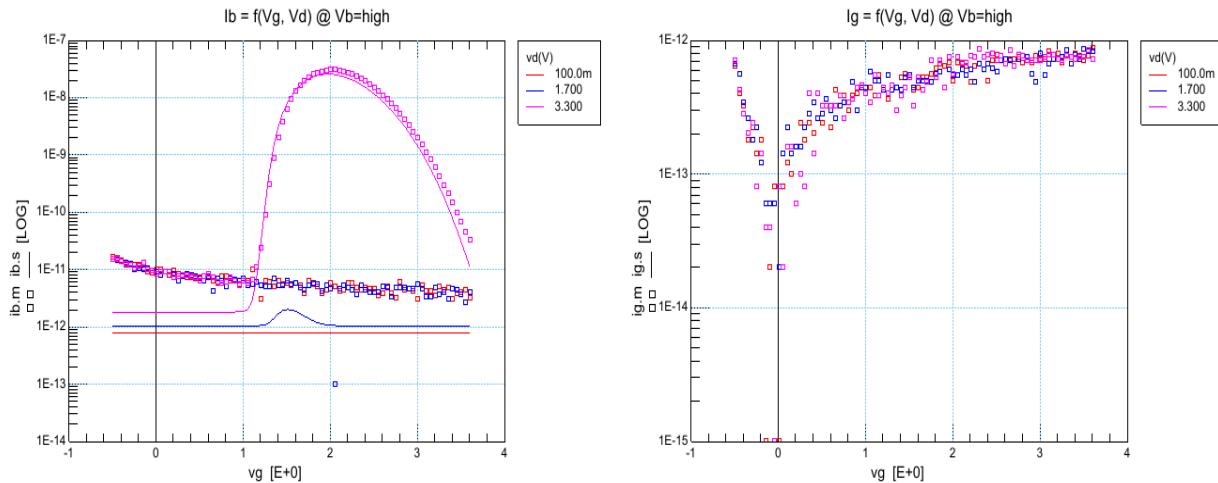
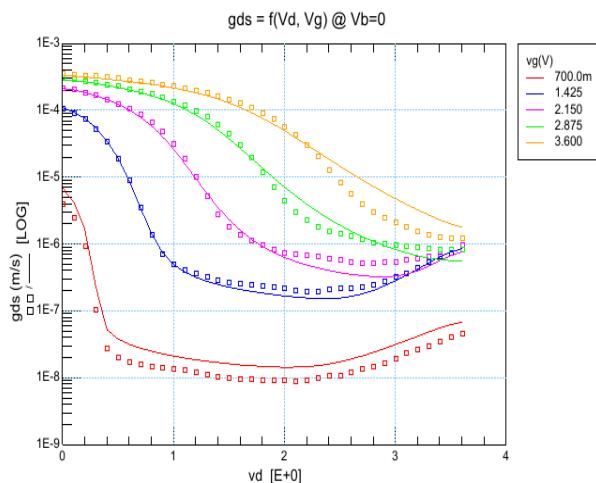
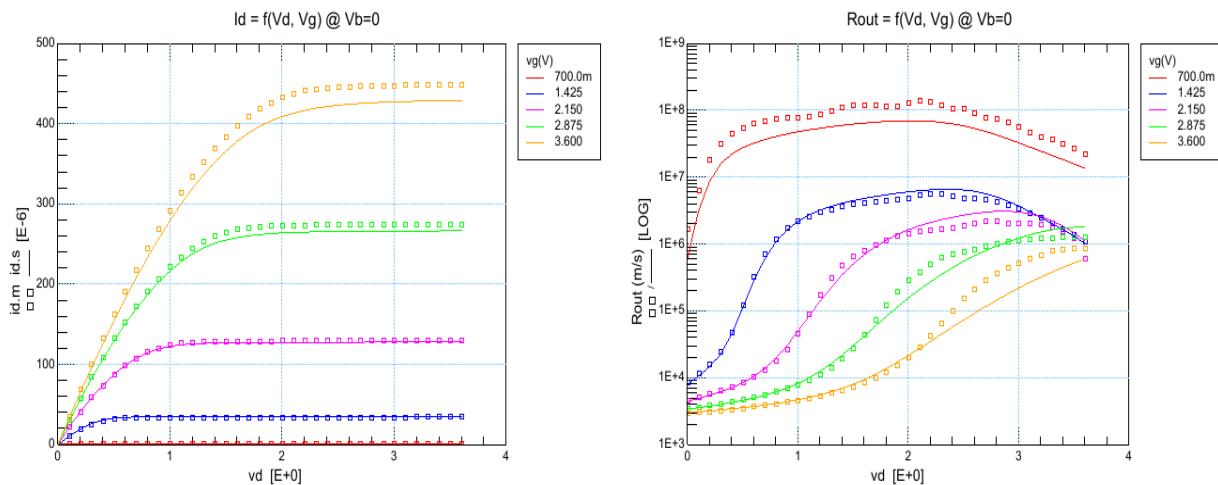
$idvg, Vd = 3.3V, T = 27^\circ C$

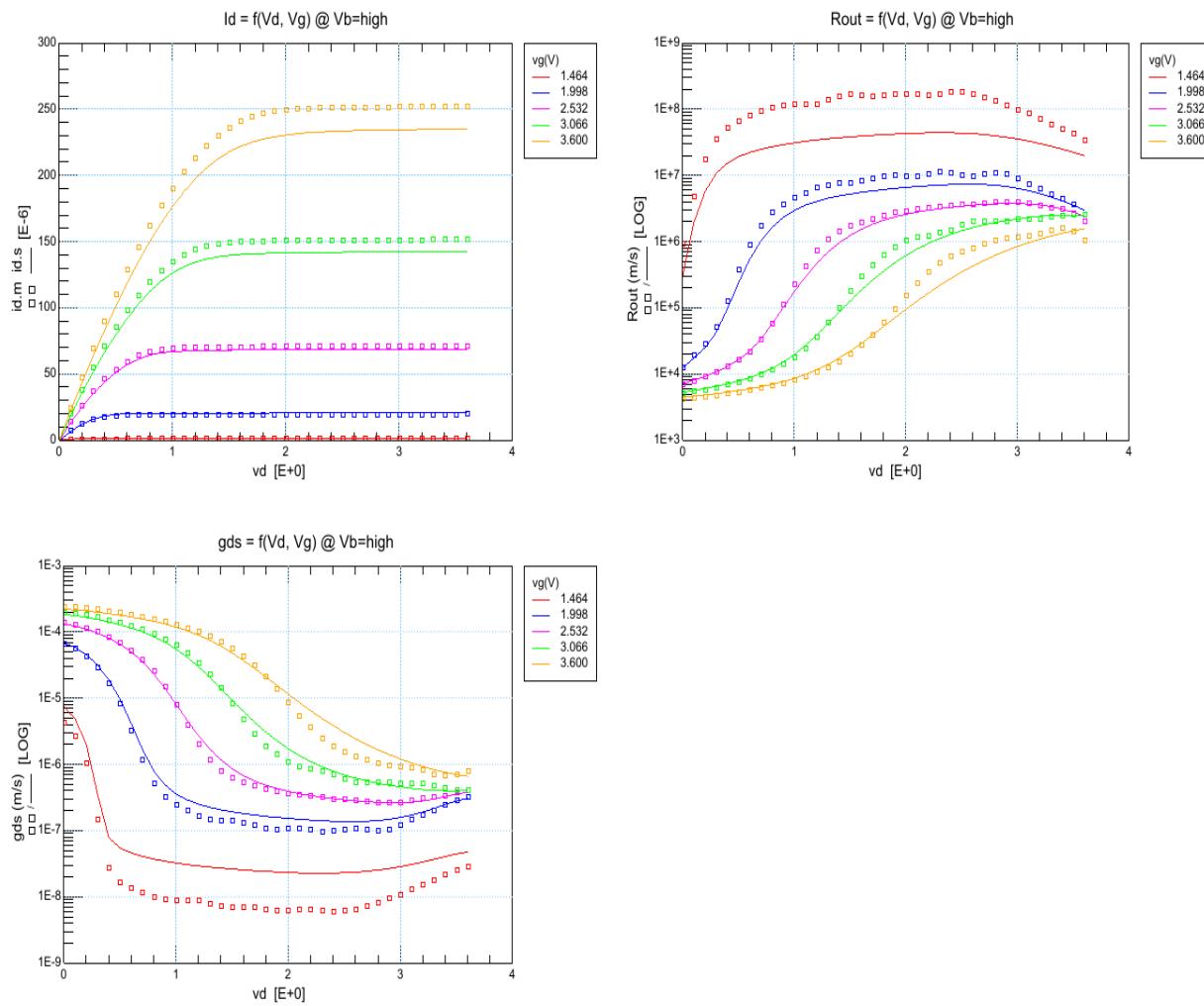
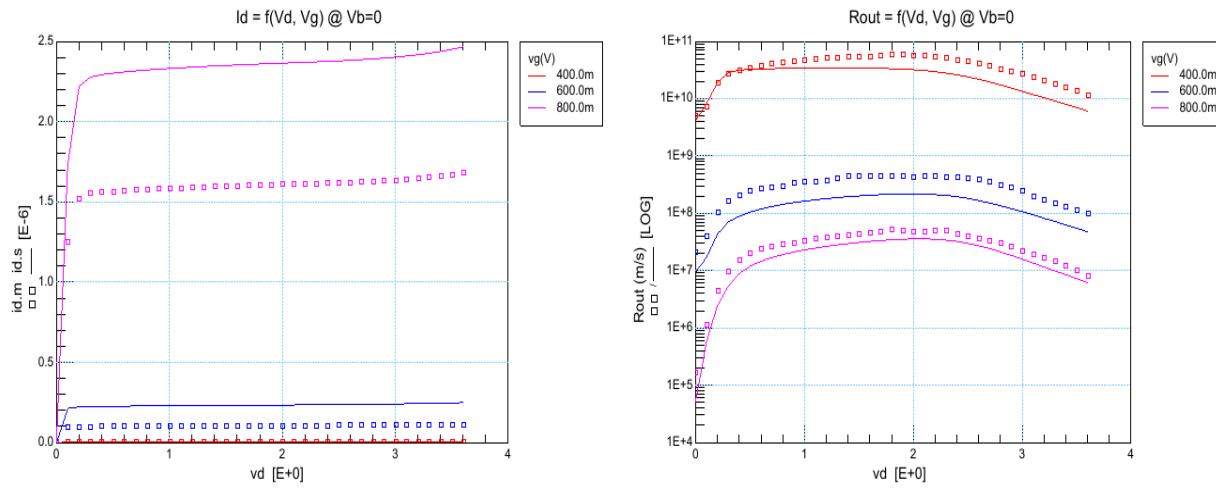


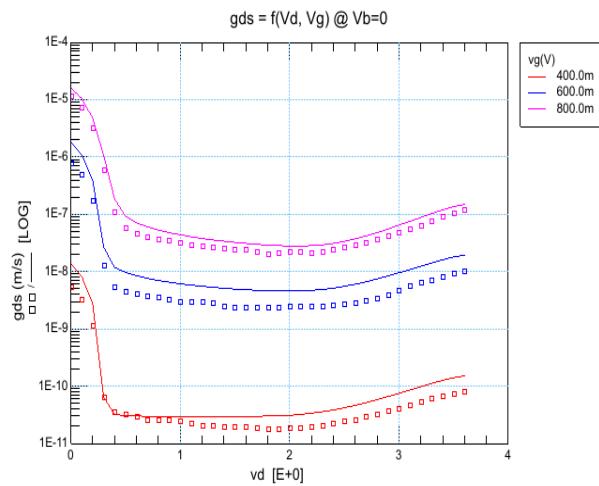


$idvg, lb, lg, Vb = 0V, T = 27^\circ C$

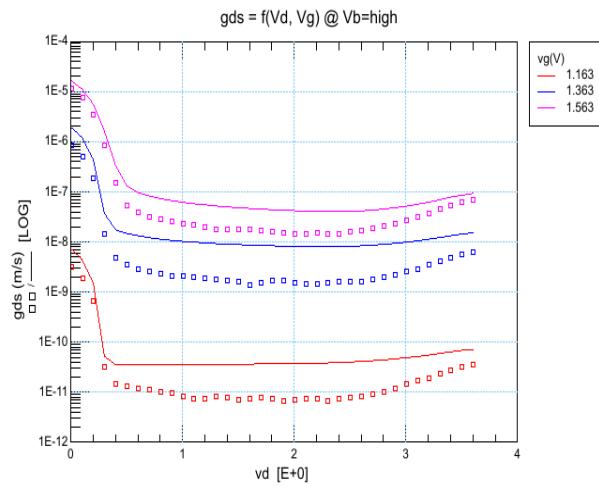
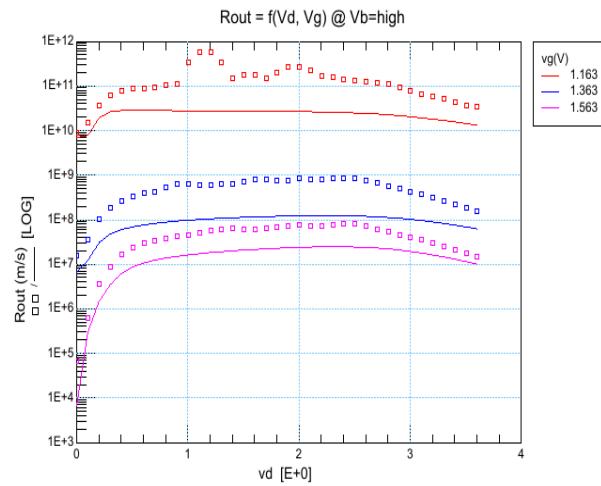
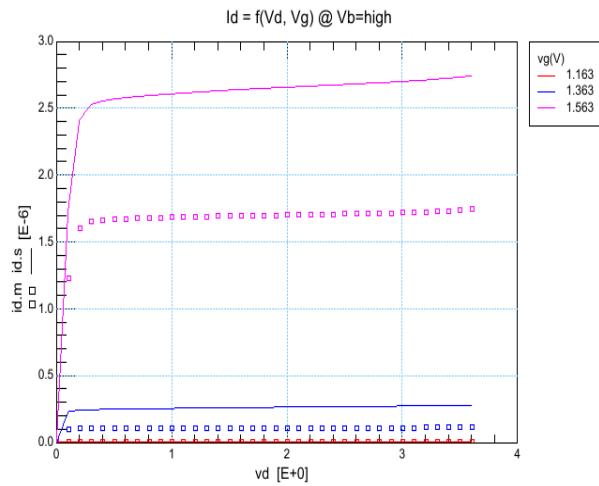


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


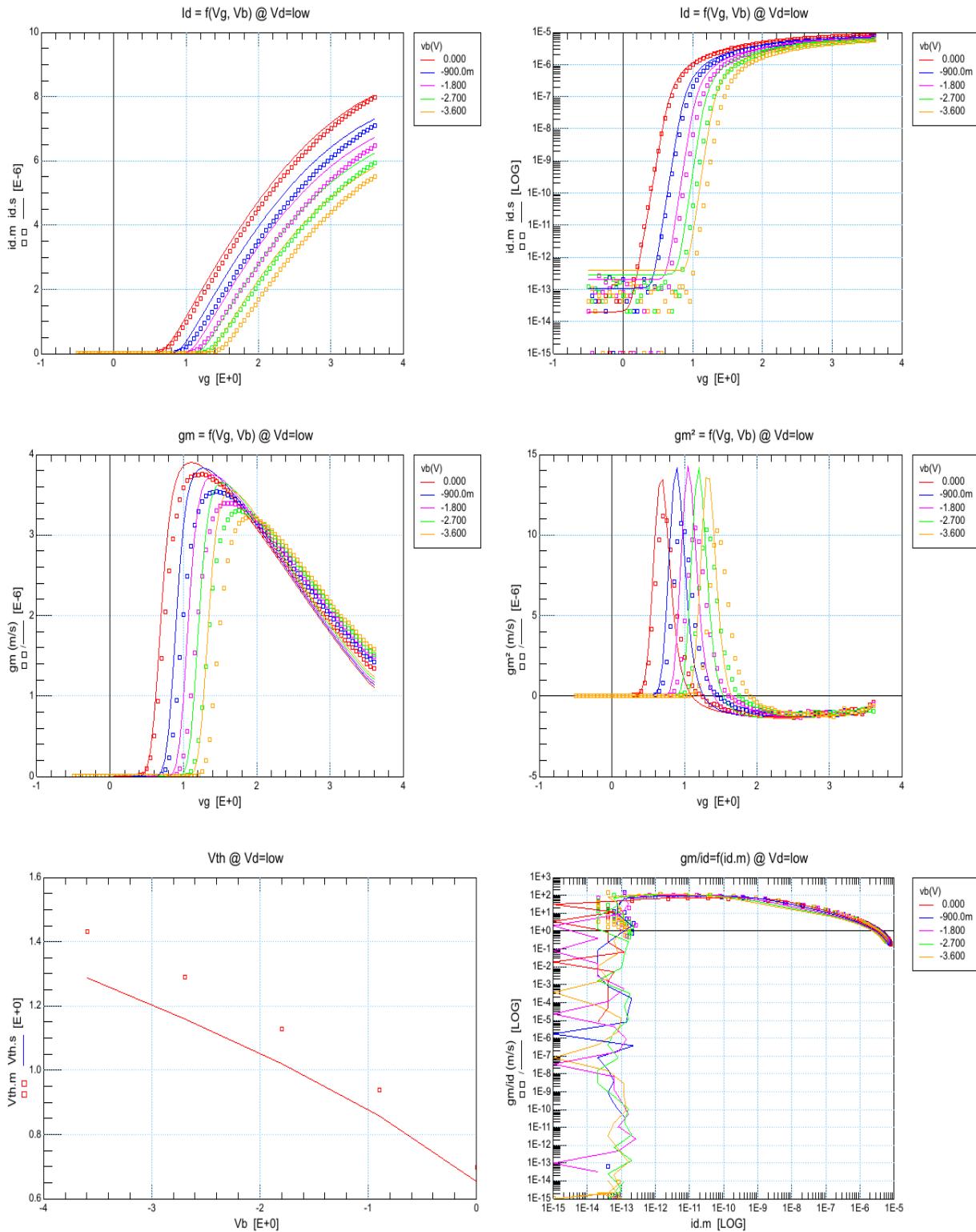


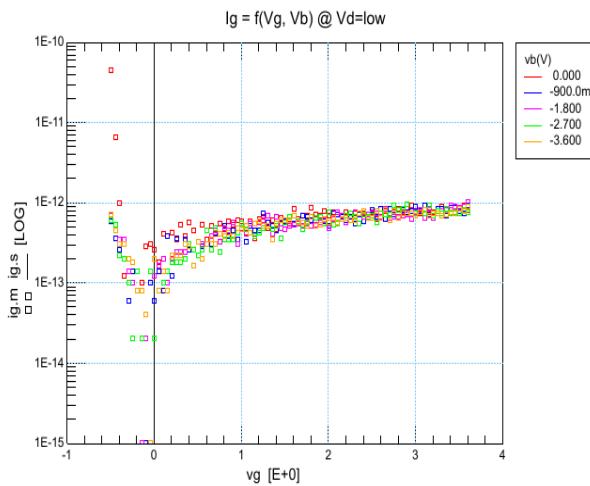
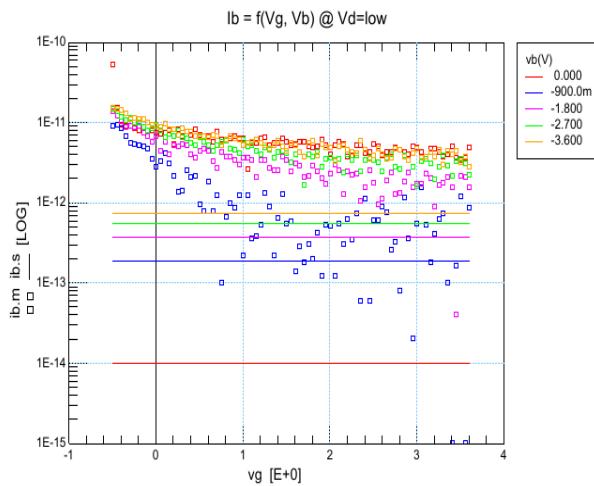
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



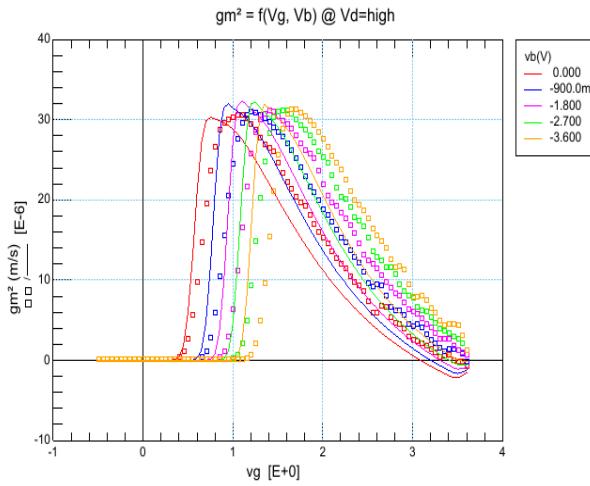
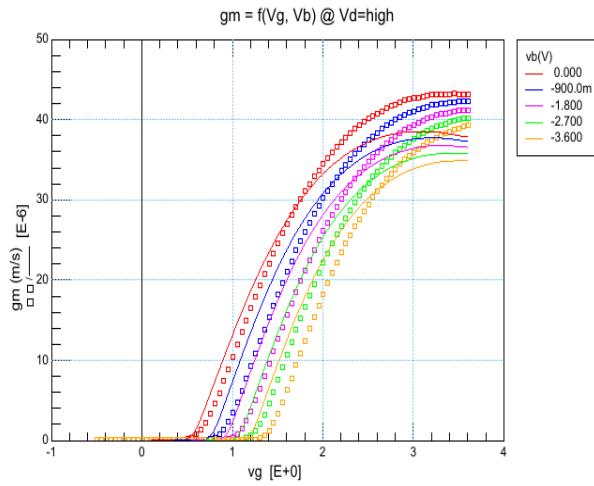
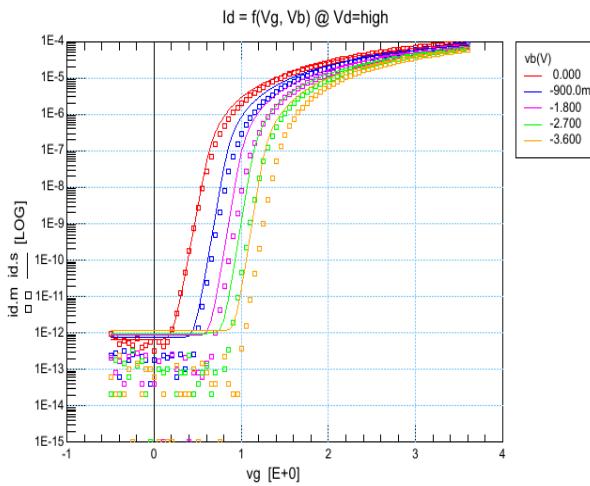
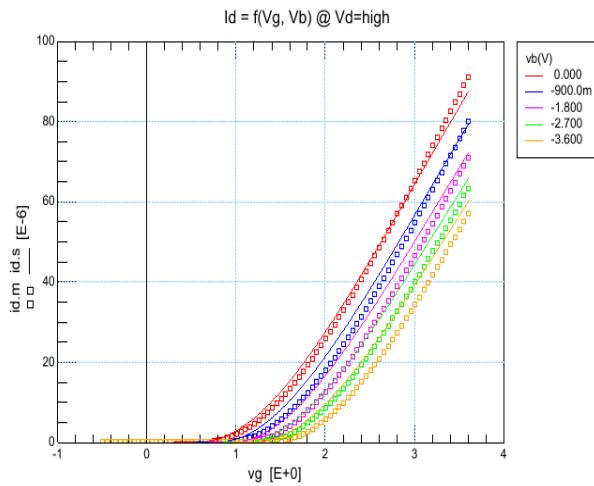
4.19 W0u3_L1u2_S560_5

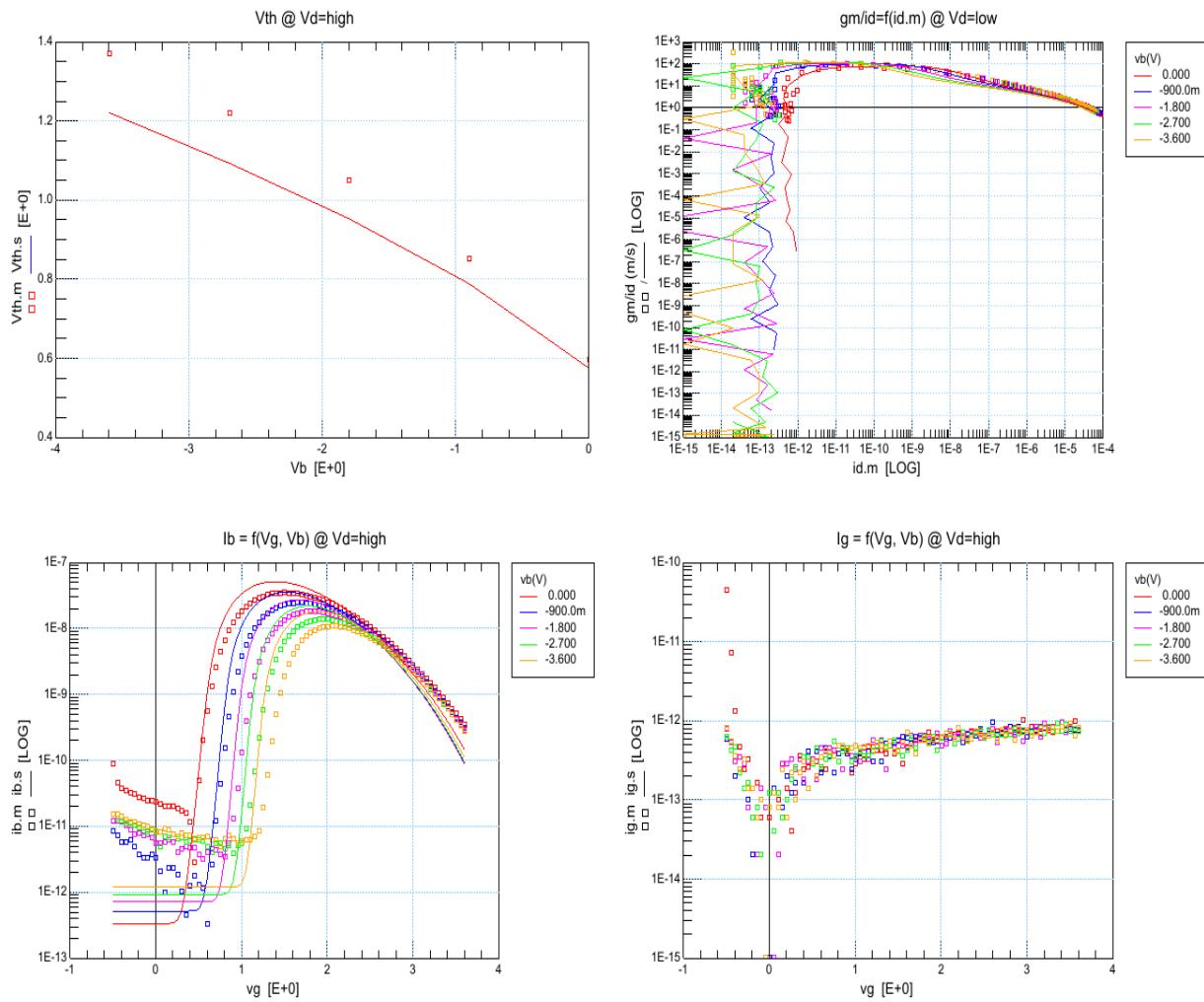
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



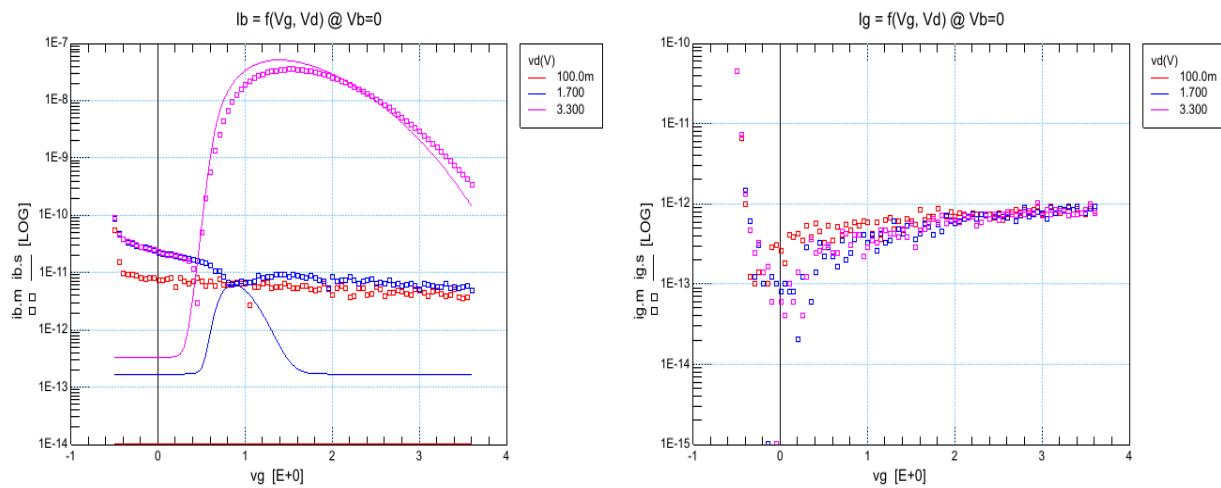


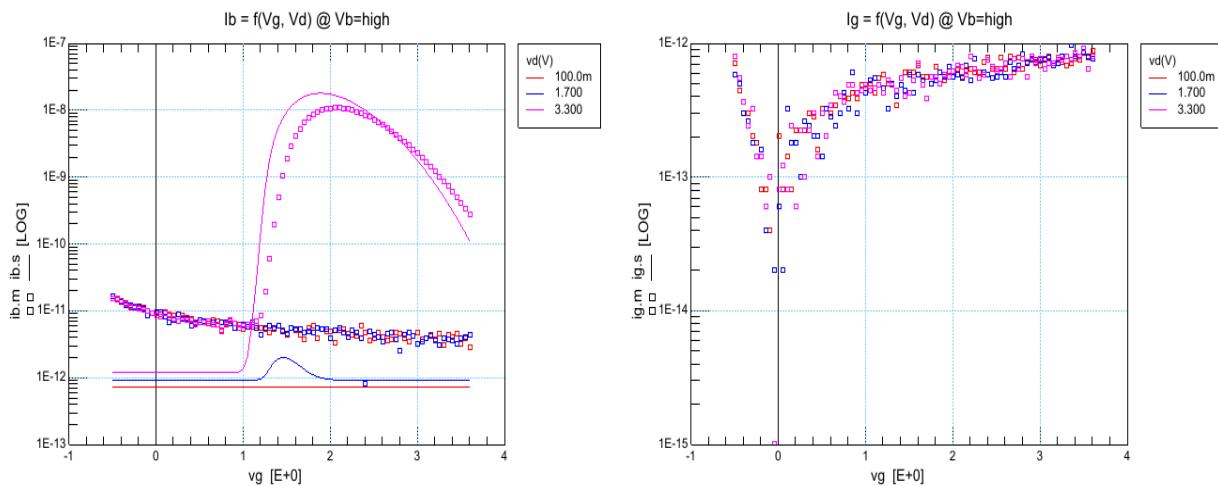
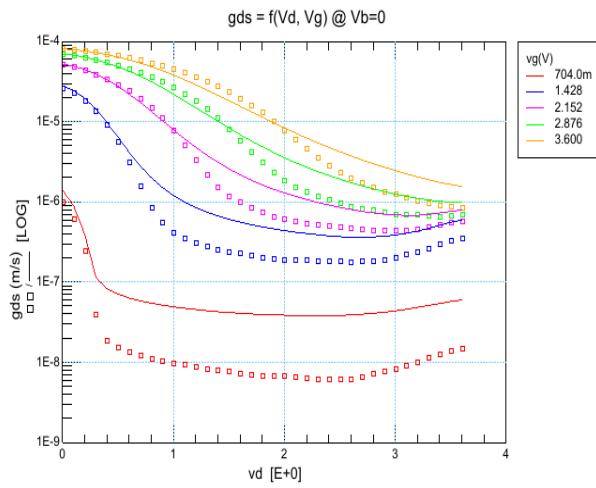
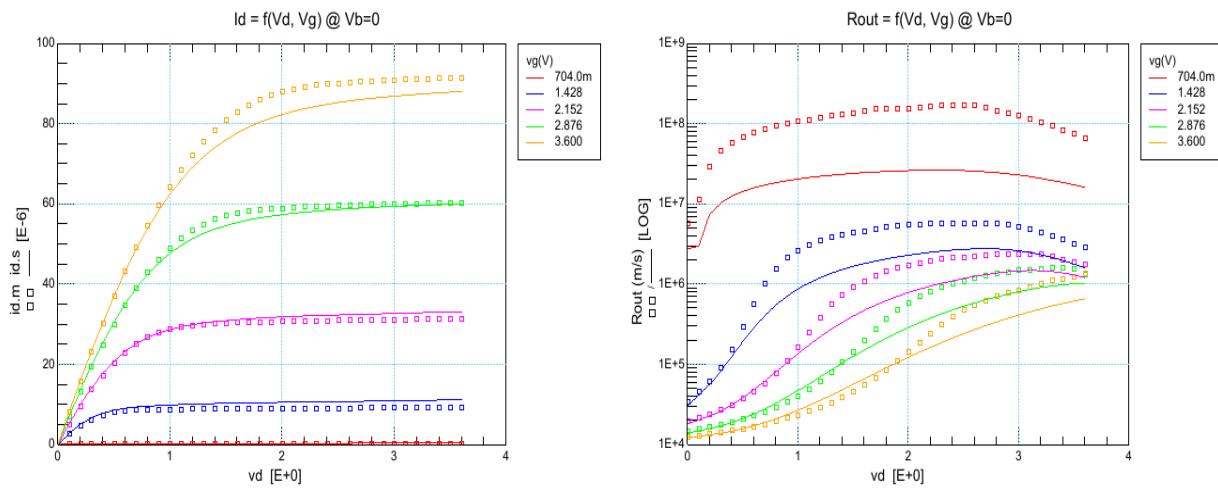
idvg, Vd = 3.3V, T = 27°C

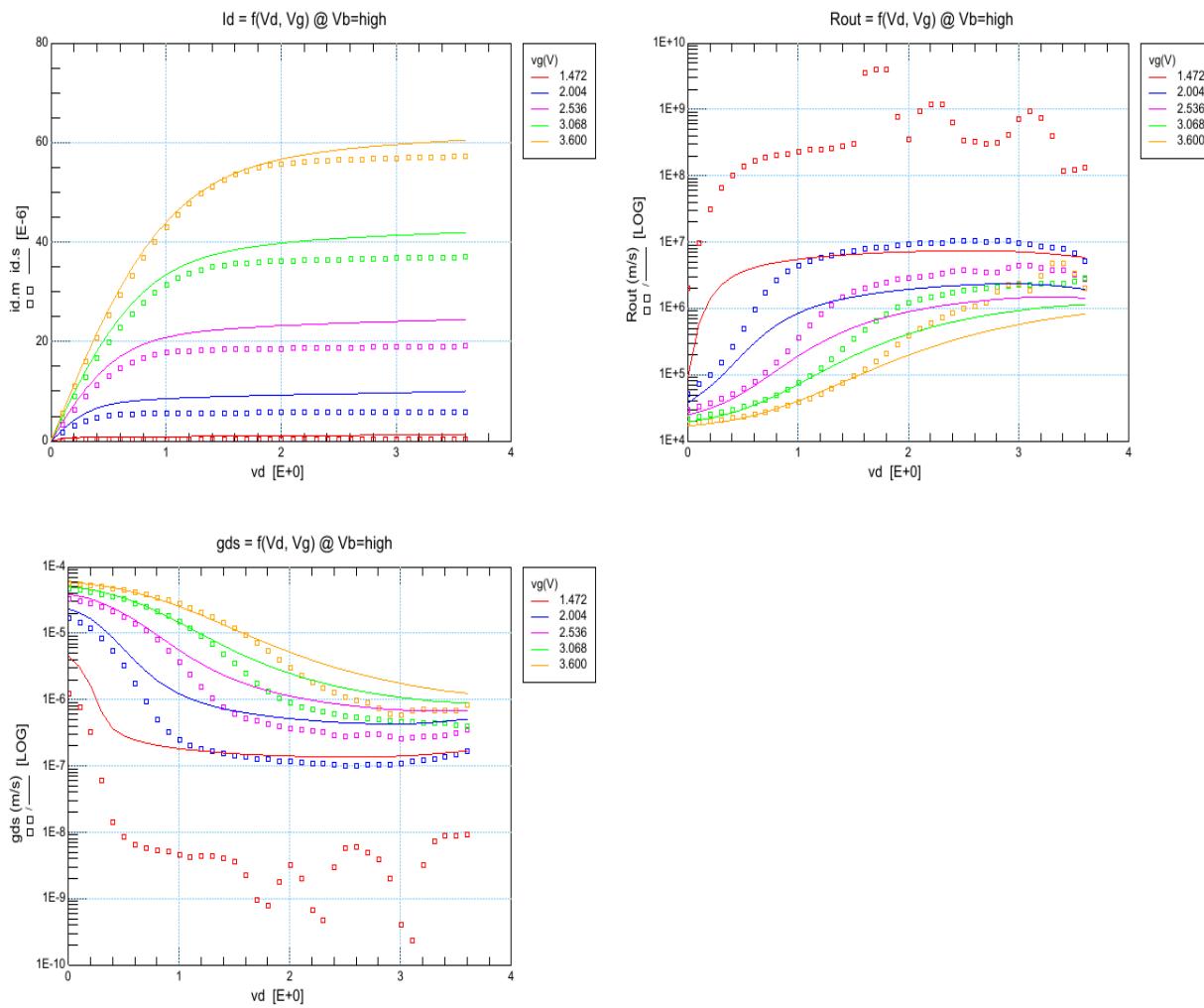
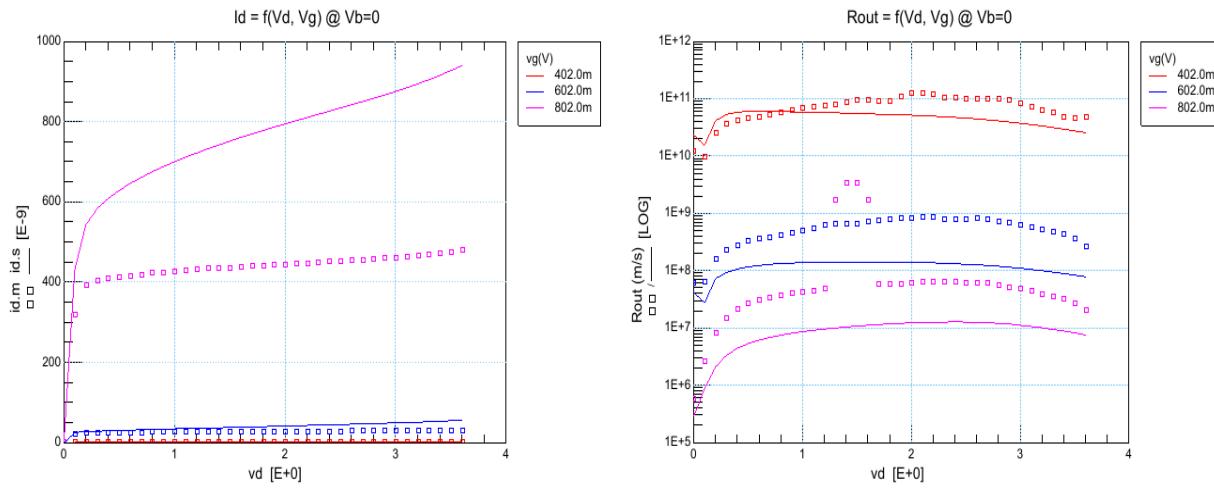


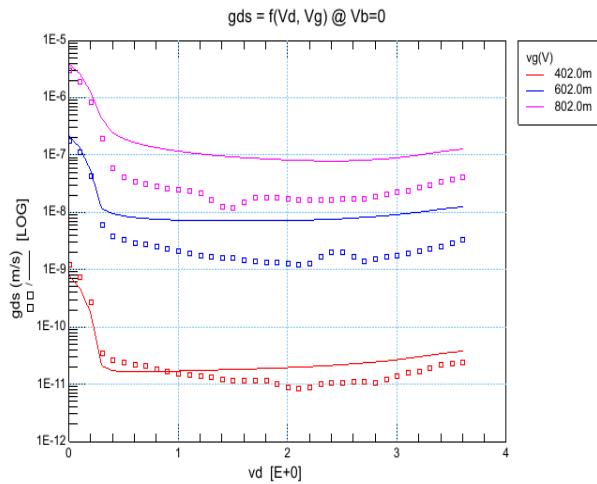


$idvg, I_b, I_g, V_b = 0V, T = 27^\circ\text{C}$

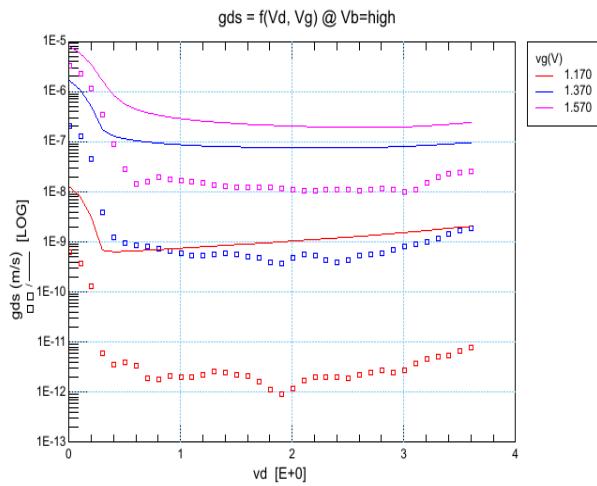
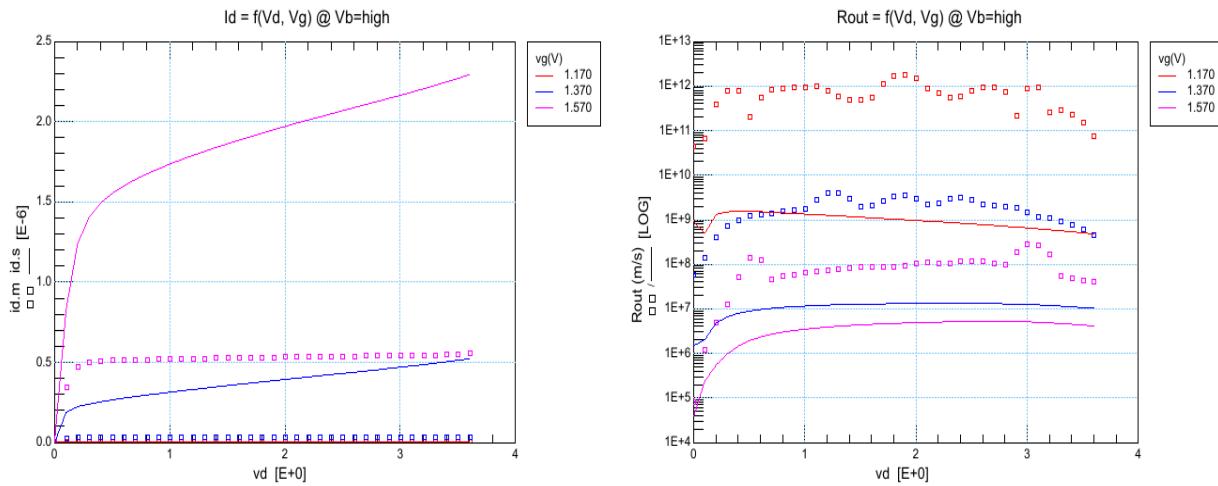


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


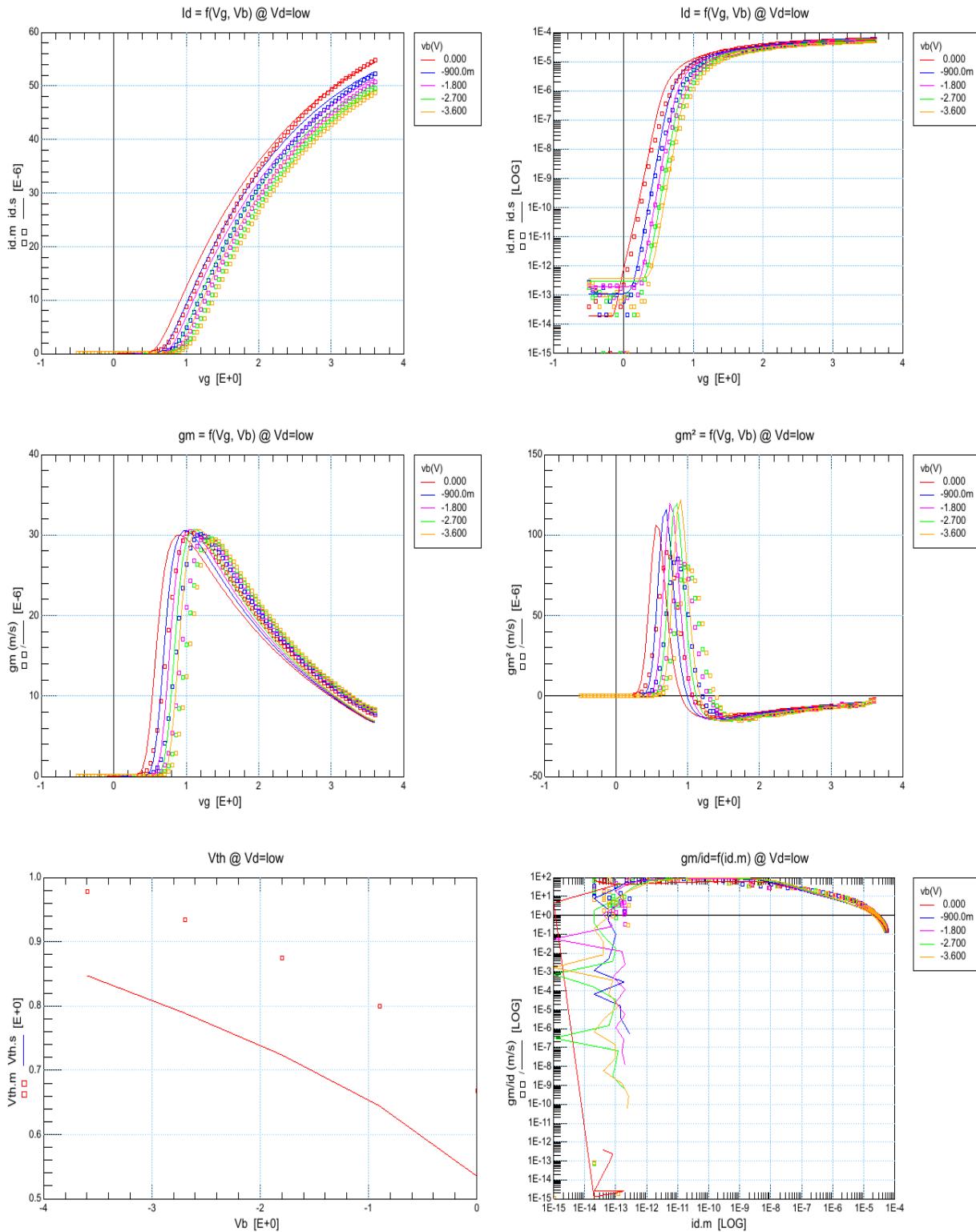


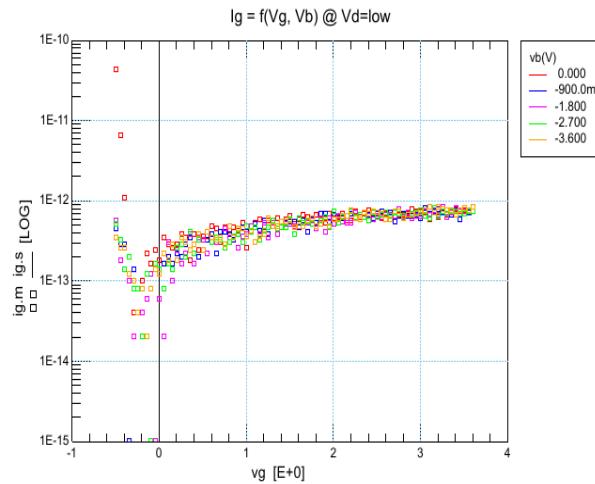
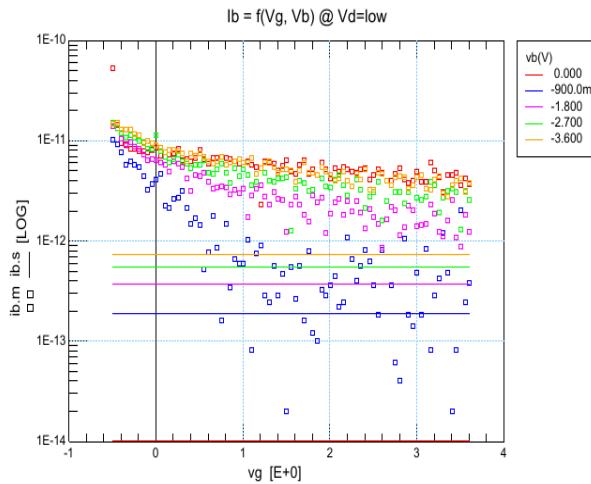
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



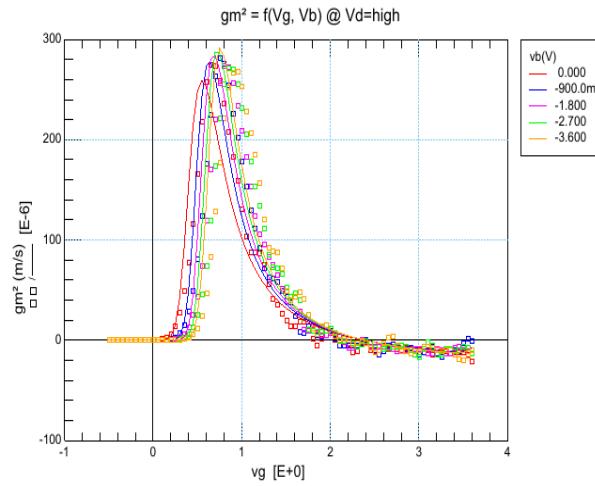
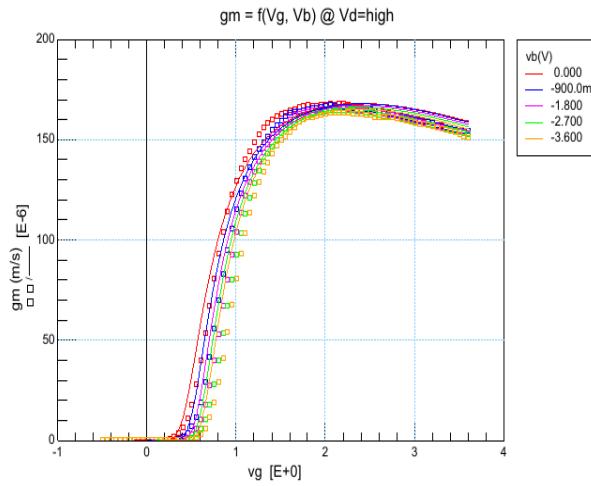
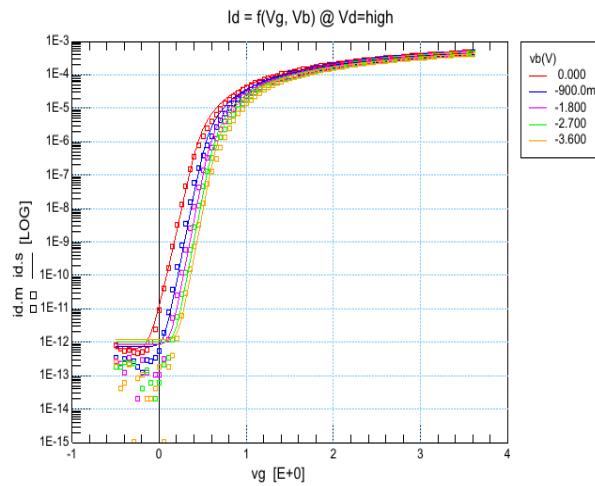
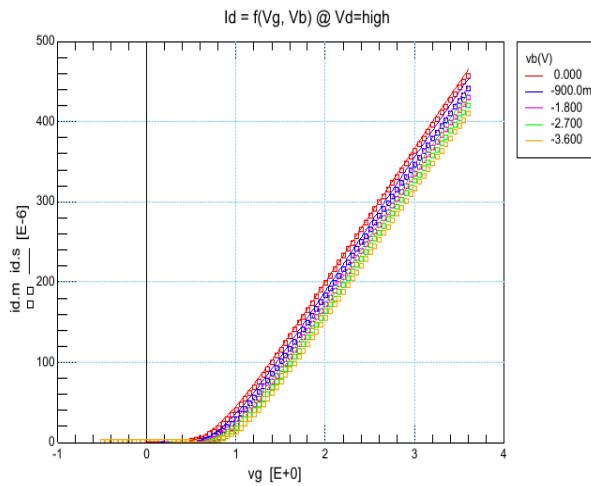
4.20 W0u6_L0u35_S559_2

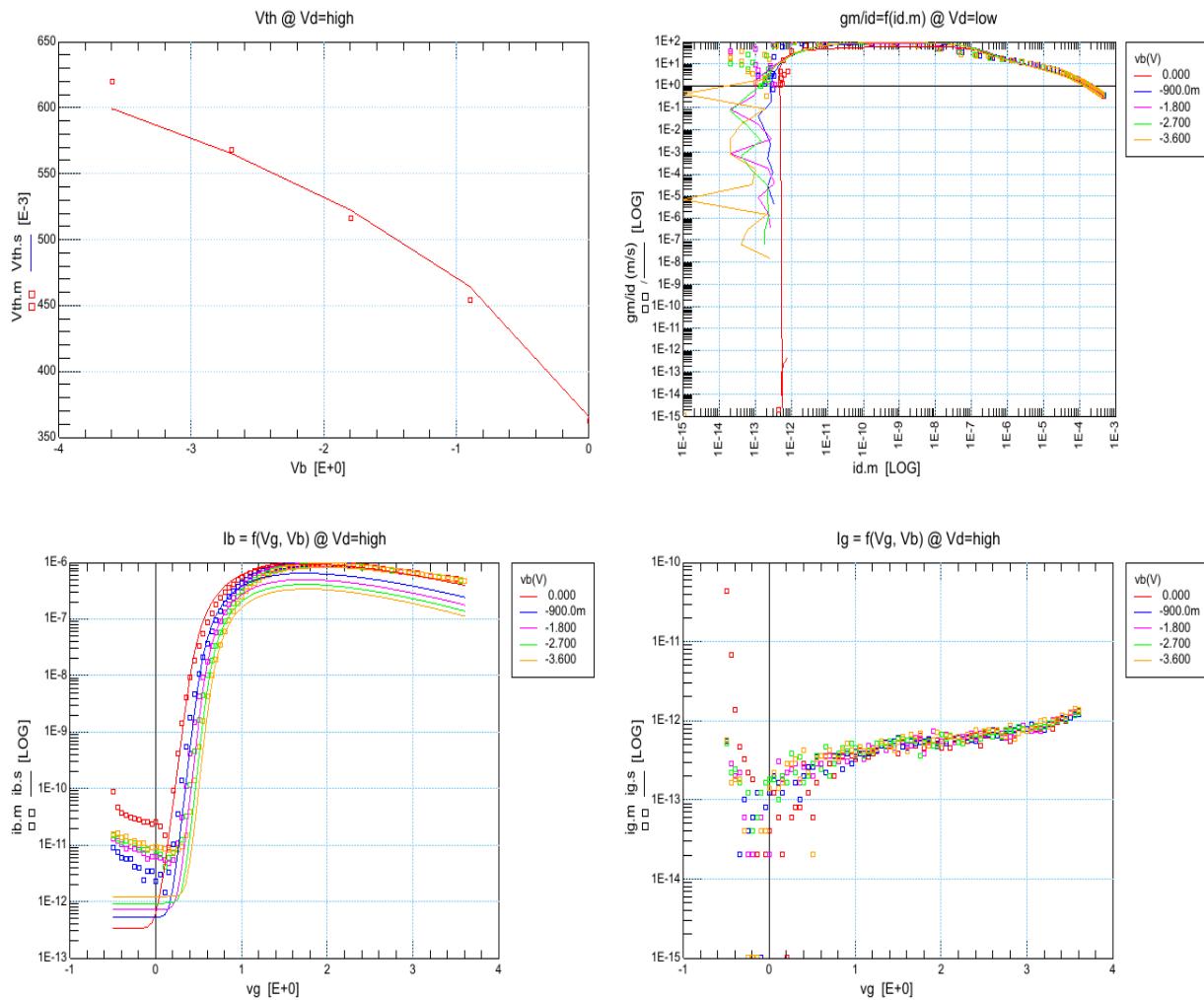
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



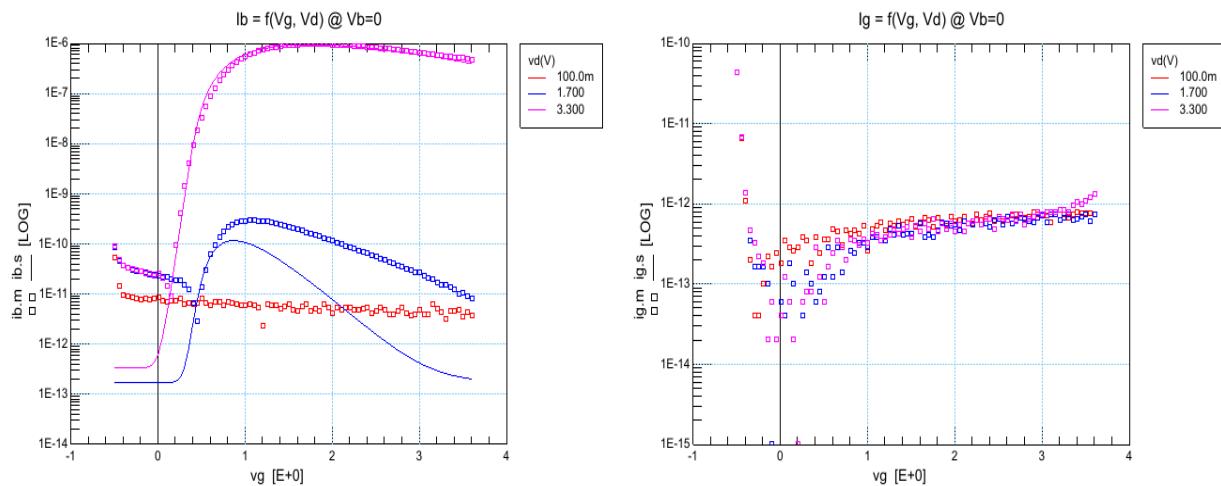


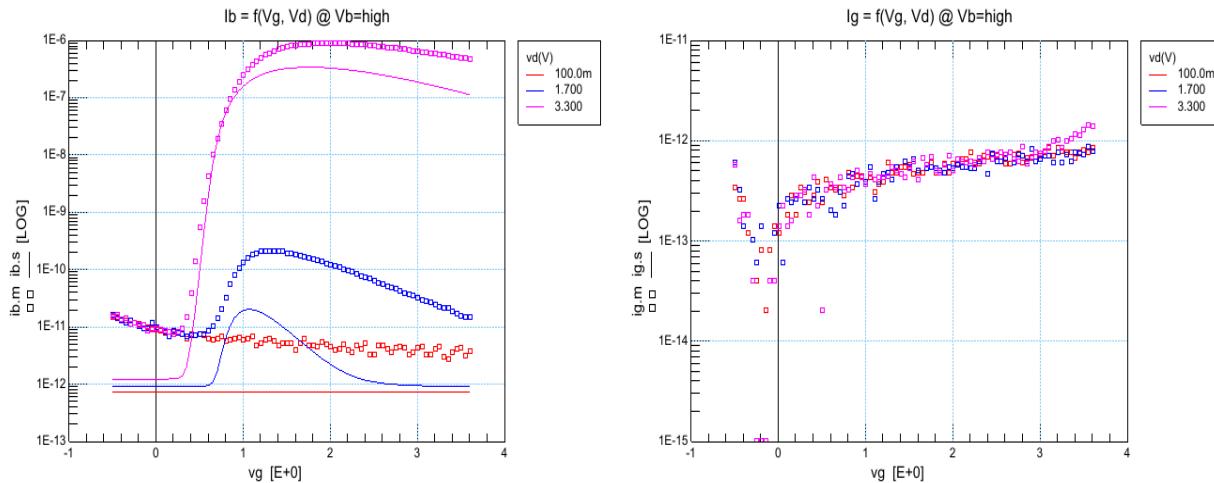
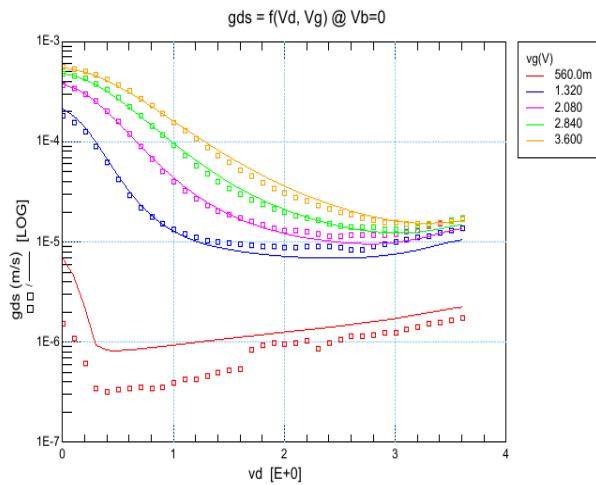
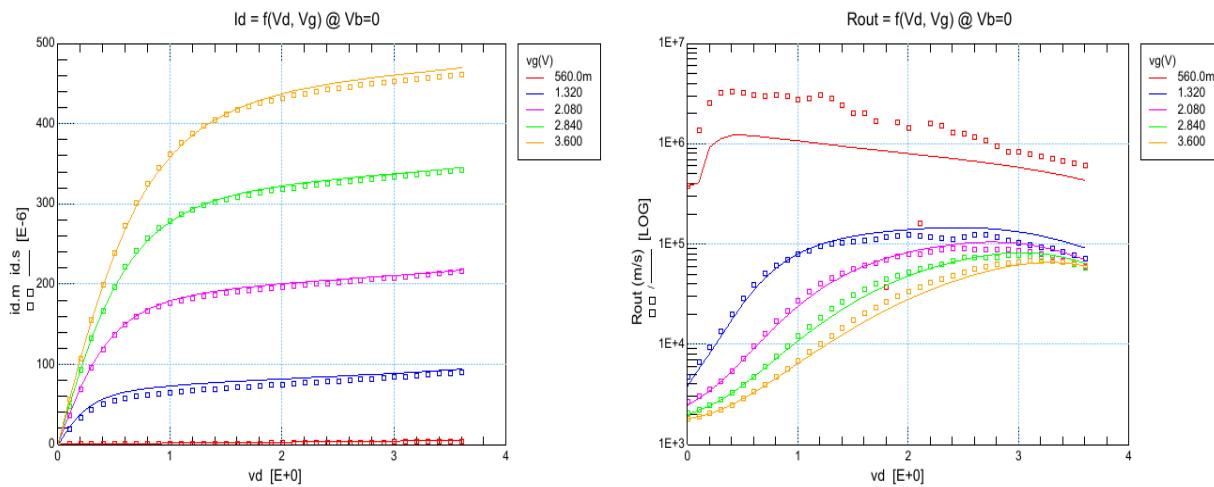
idvg, Vd = 3.3V, T = 27°C

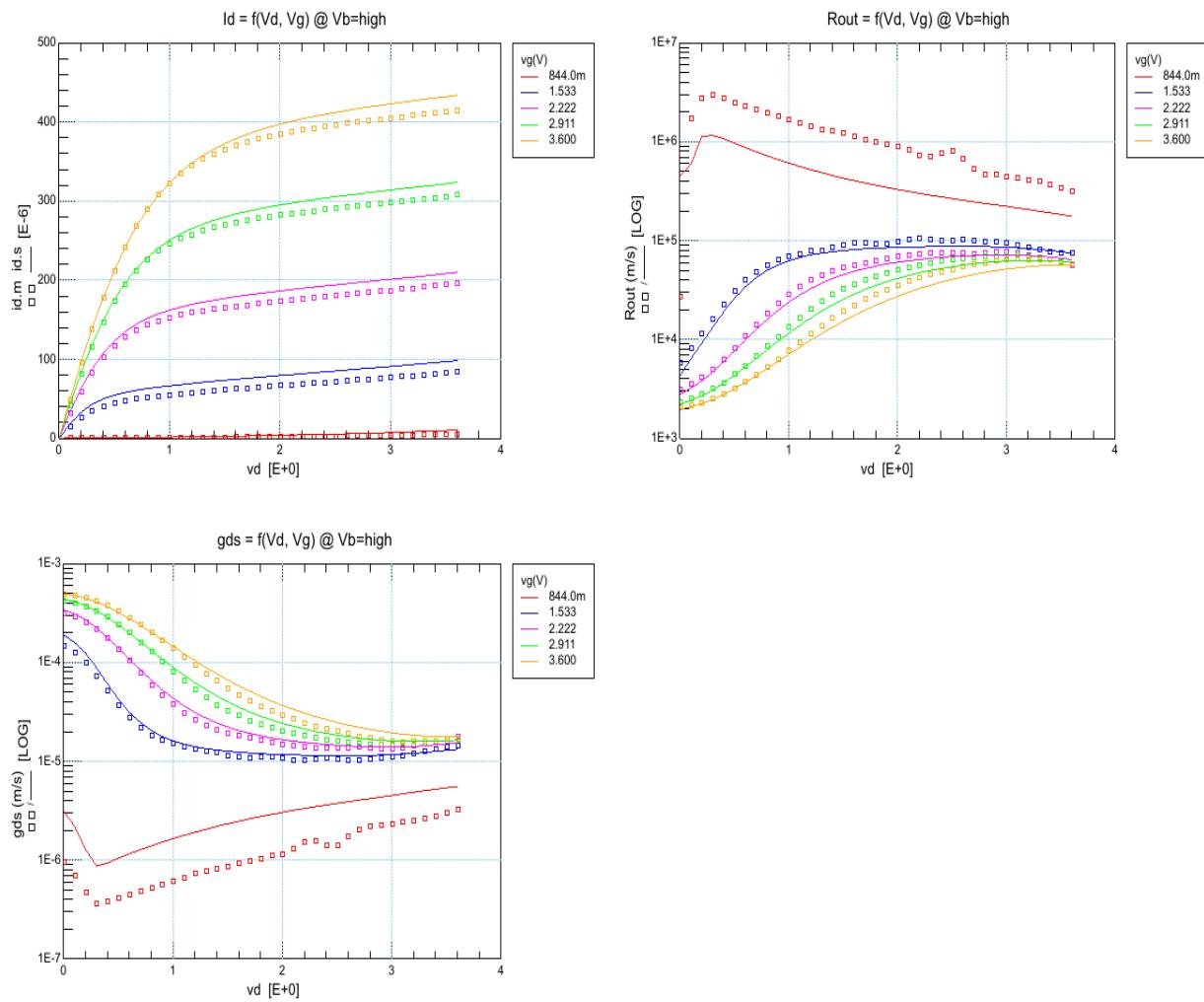
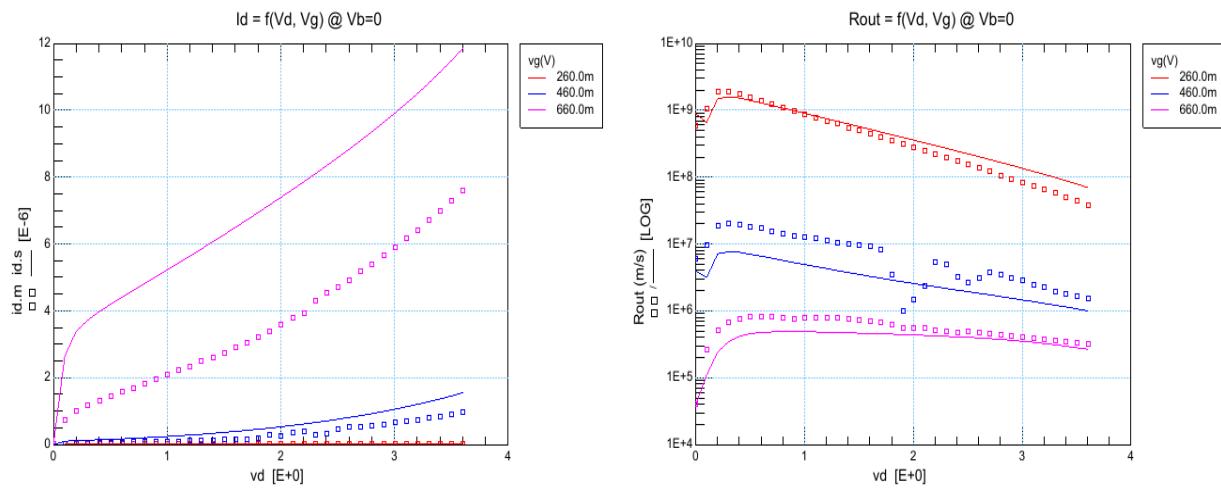


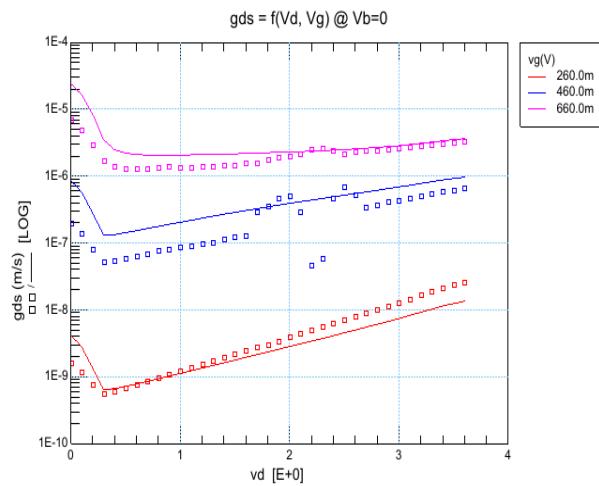


idvg, lb, lg, Vb = 0V, T = 27°C

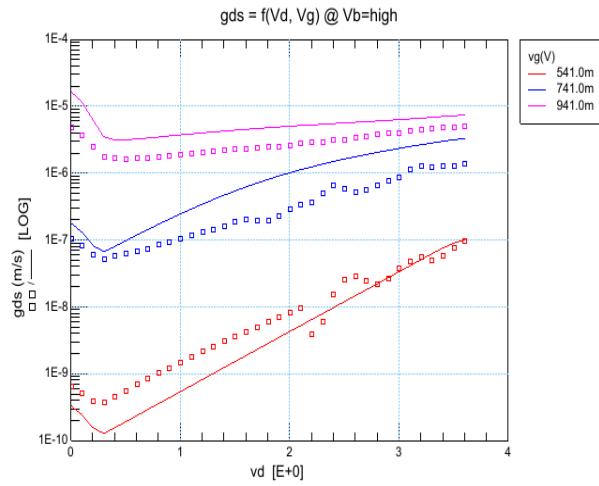
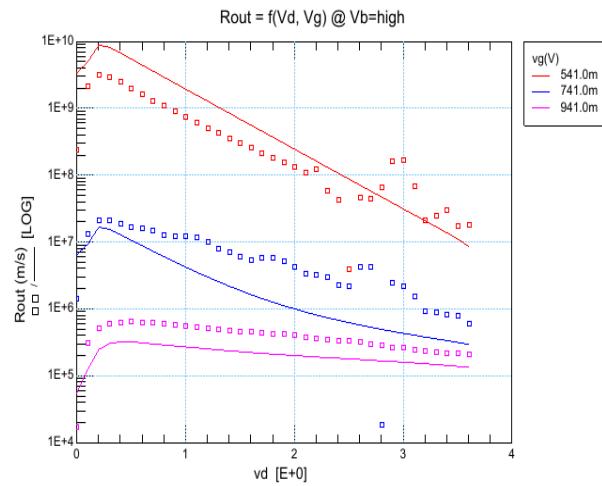
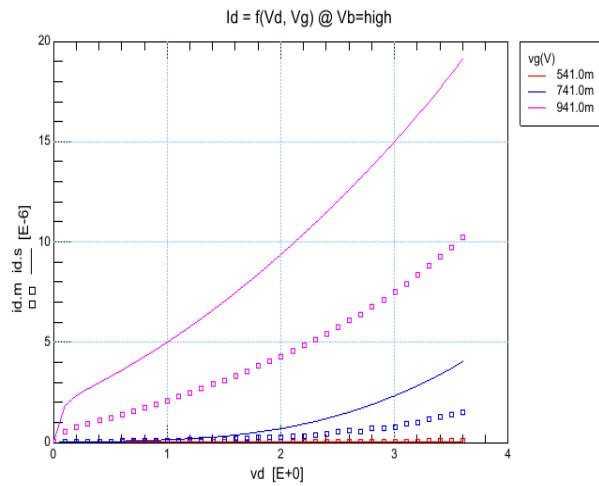


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


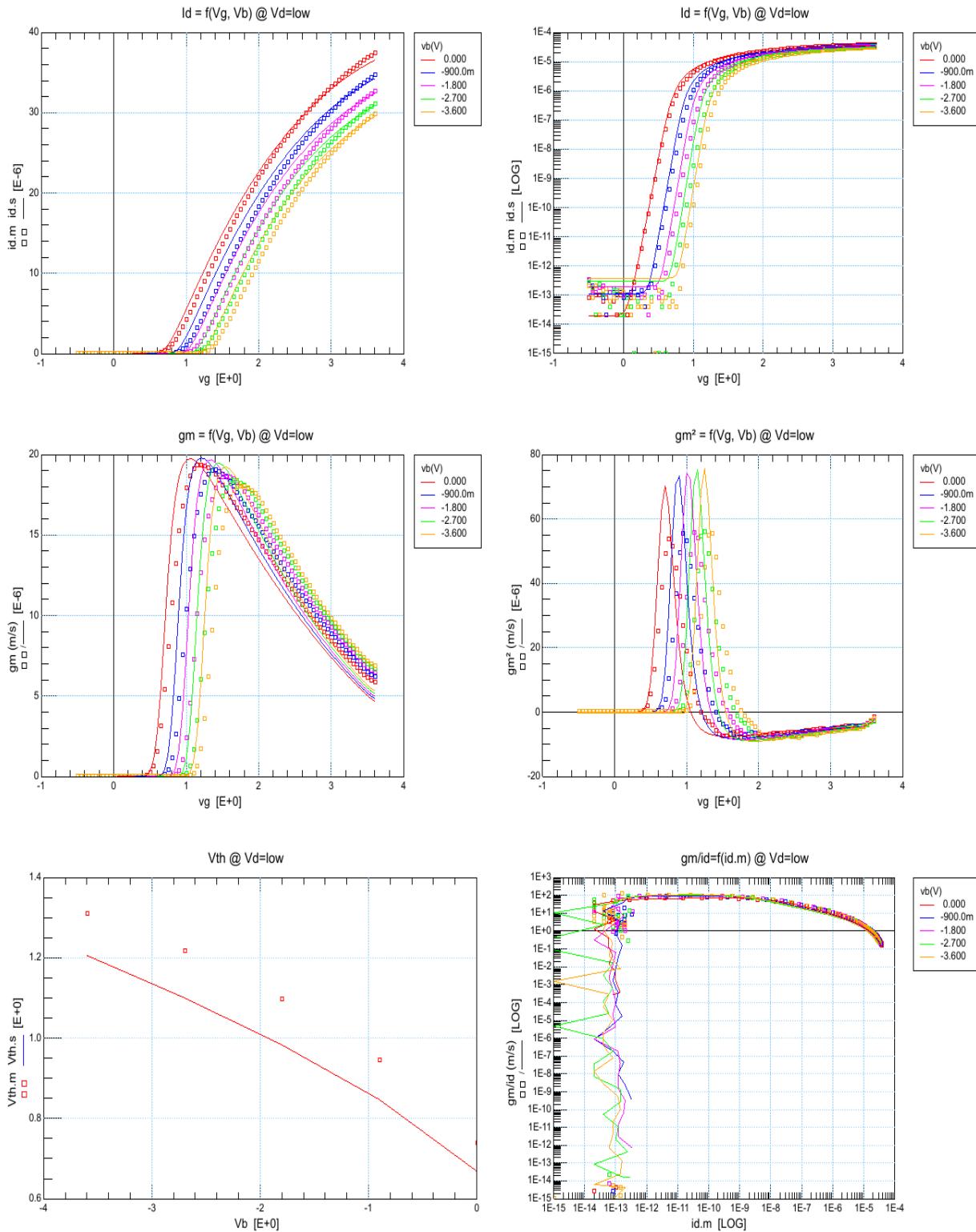


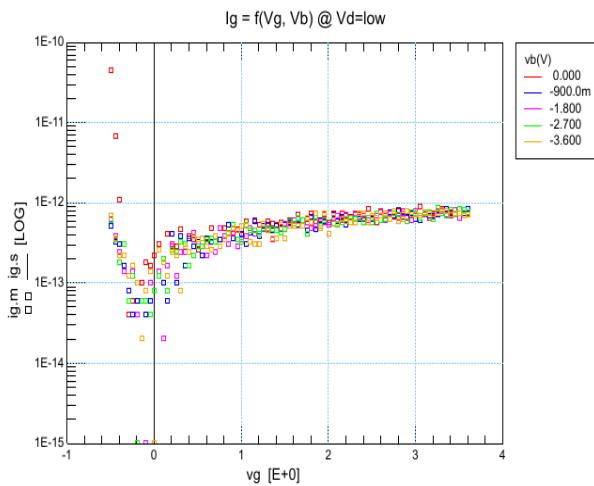
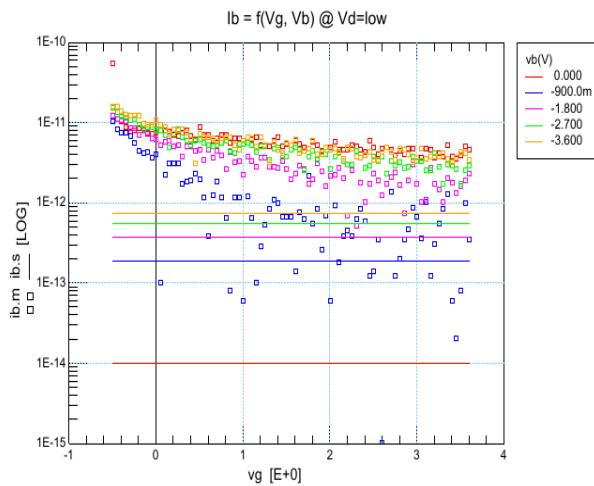
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



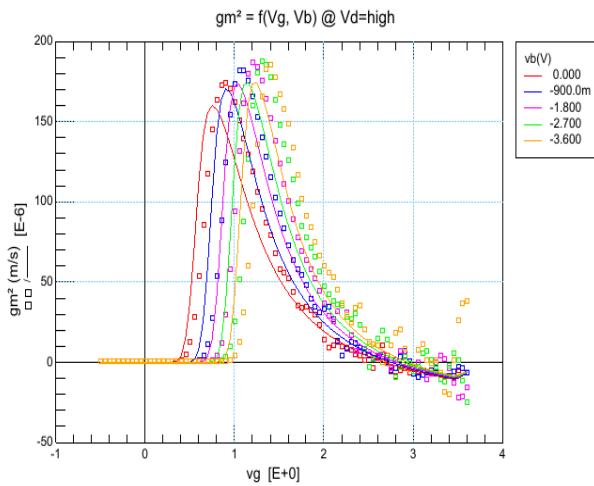
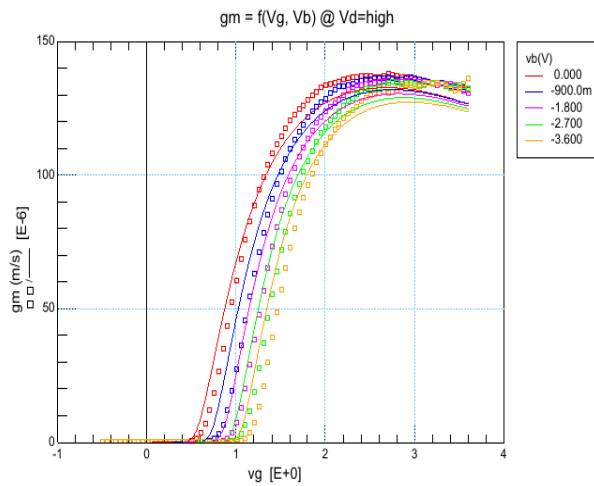
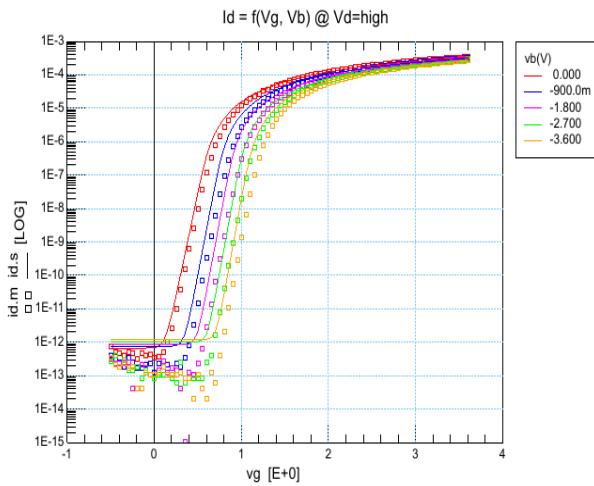
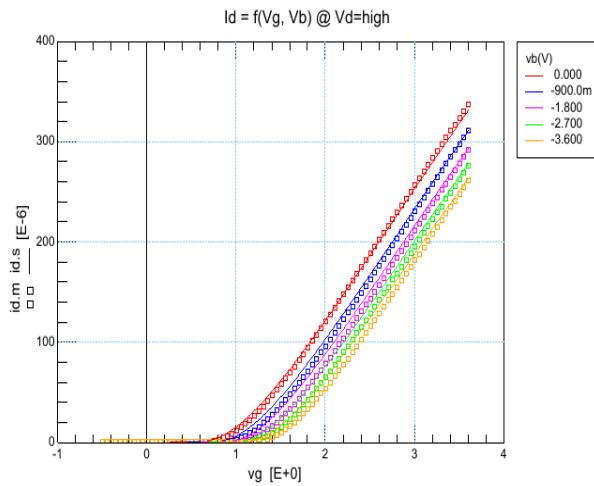
4.21 W0u6_L0u5_S559_3

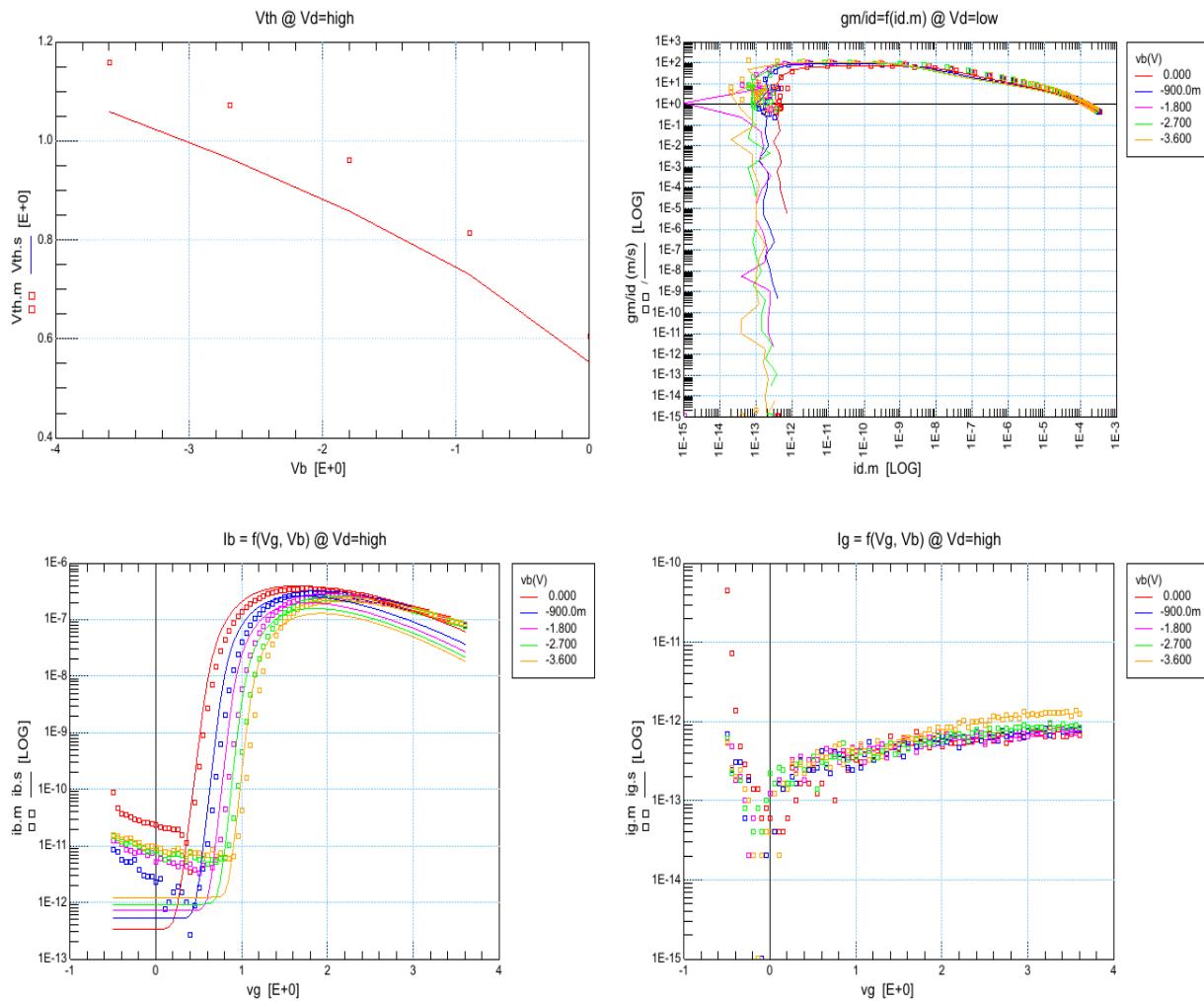
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



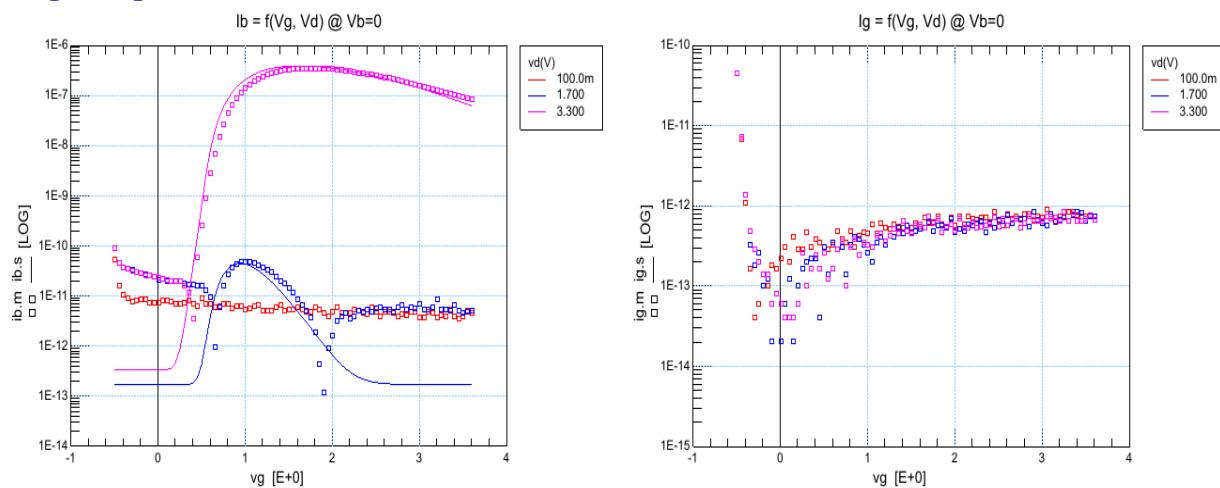


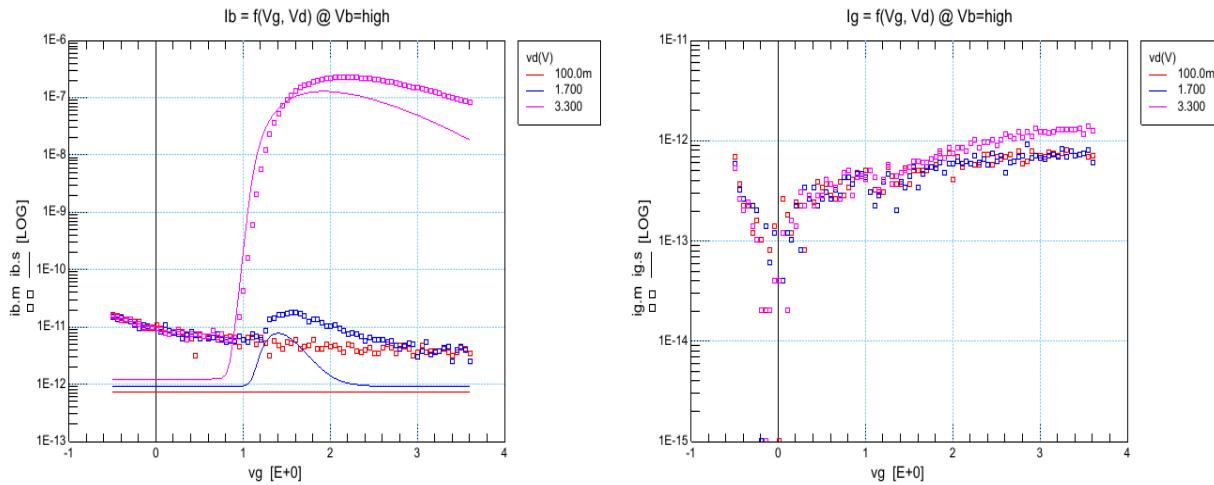
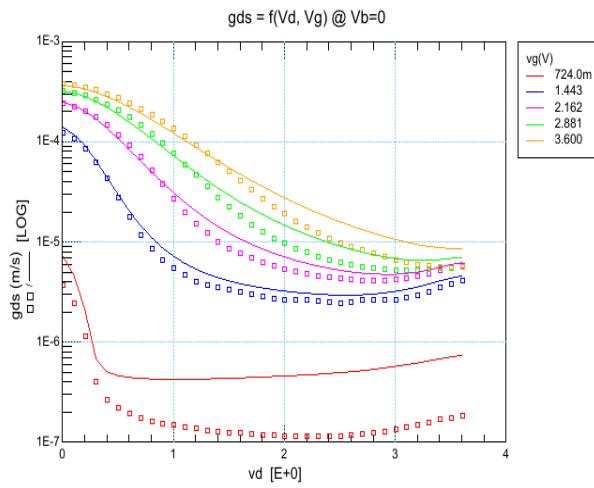
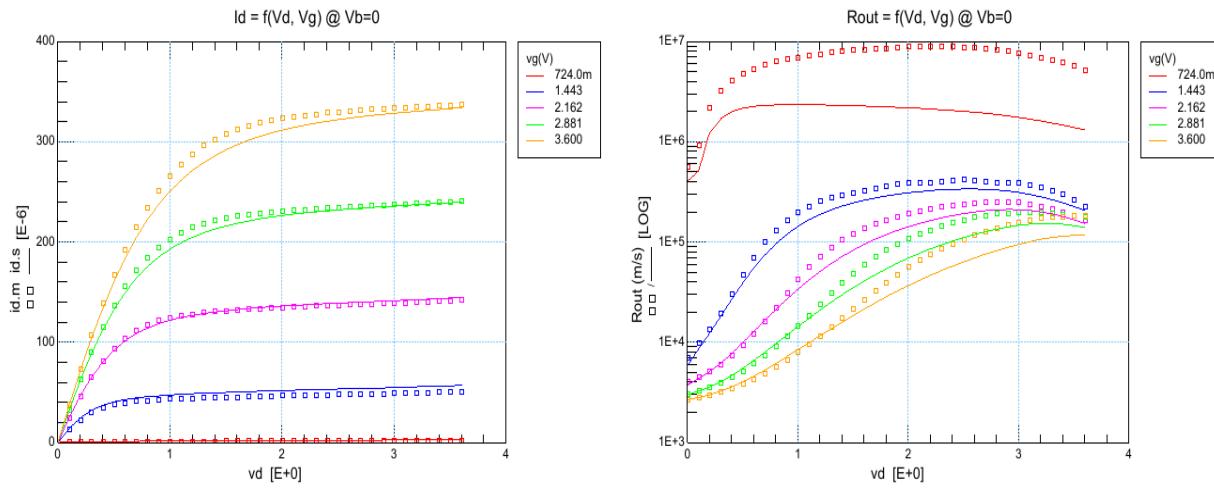
idvg, Vd = 3.3V, T = 27°C

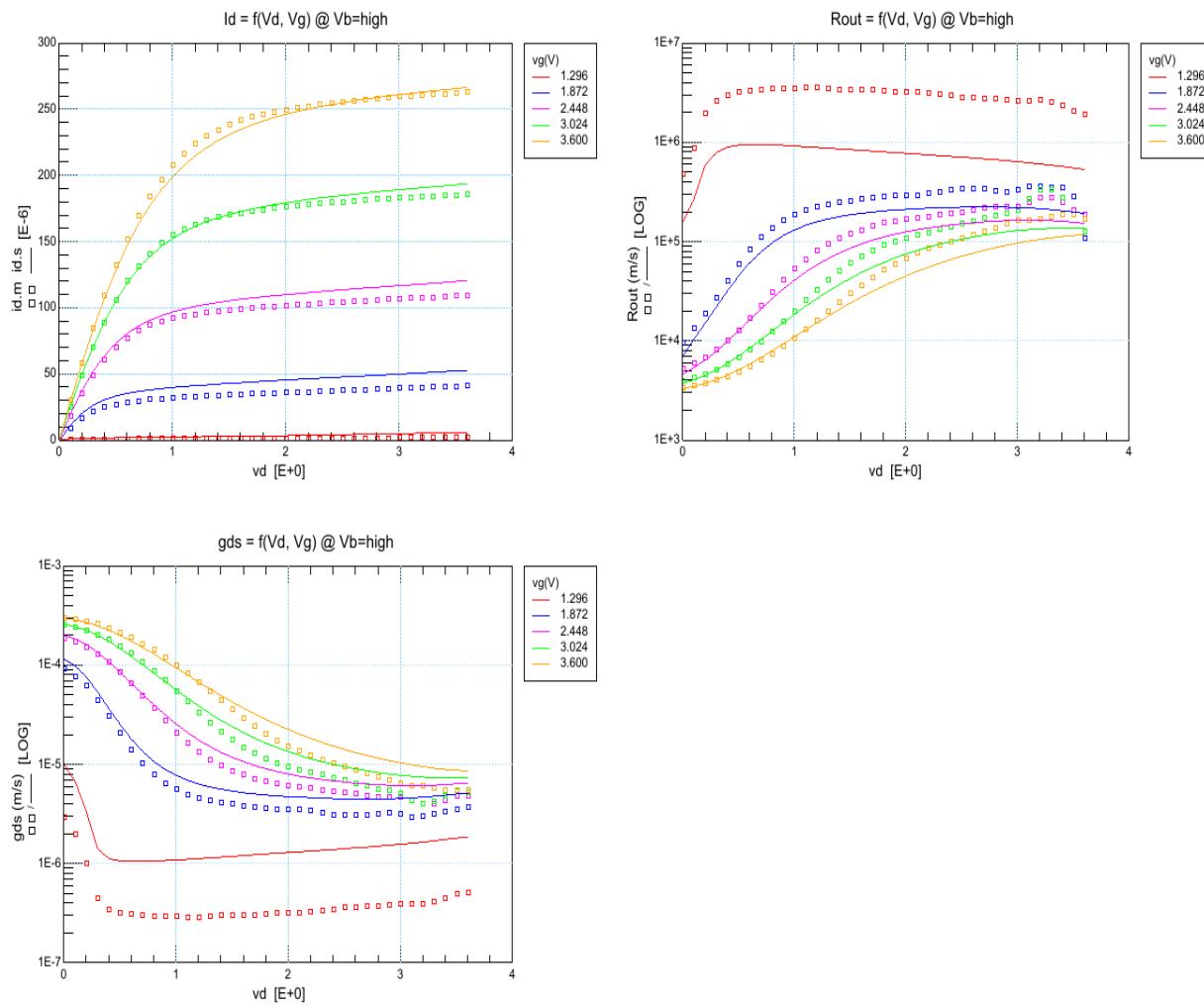
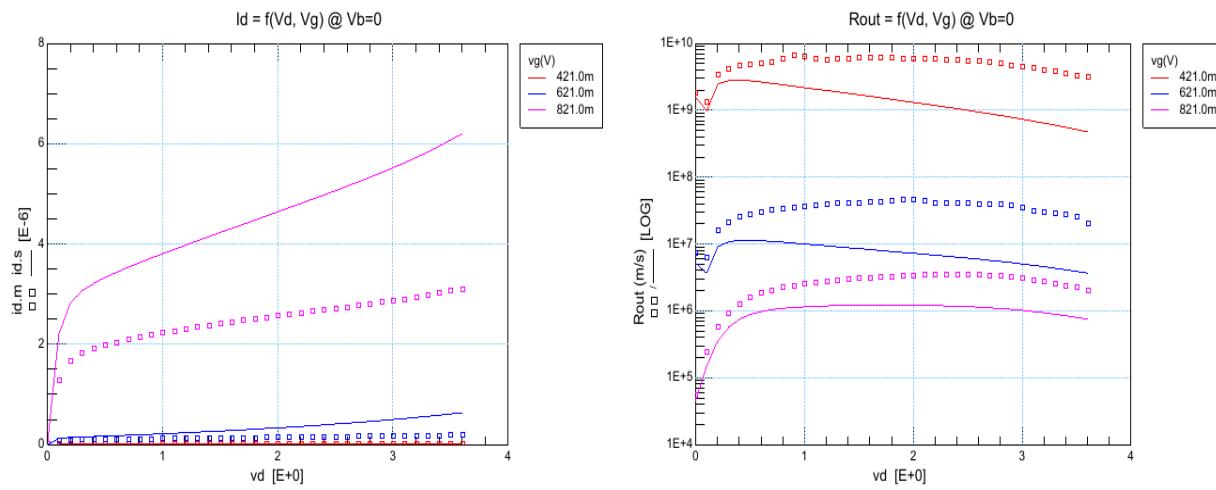


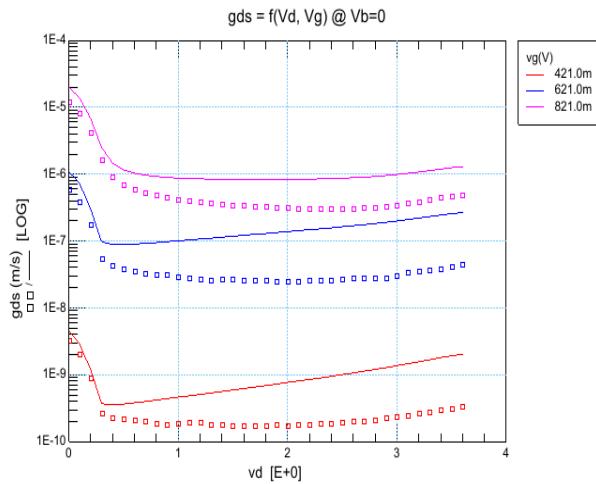


idvg, Ib, Ig, Vb = 0V, T = 27°C

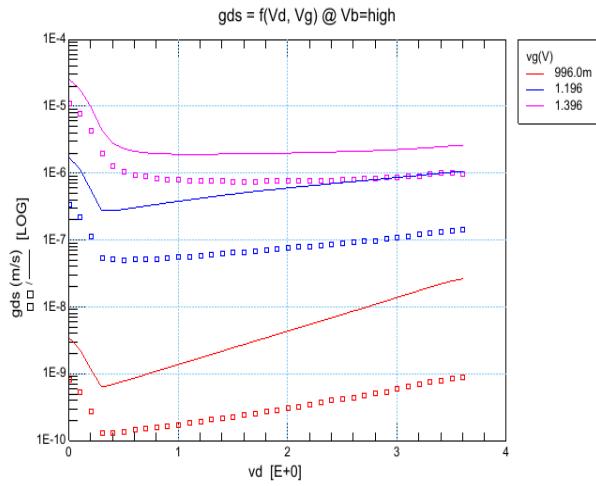
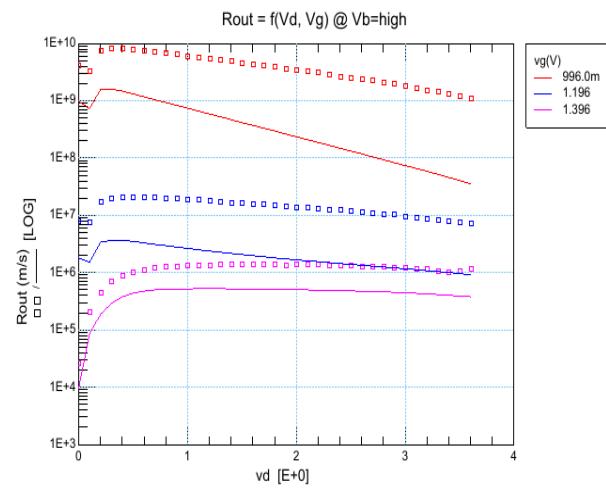
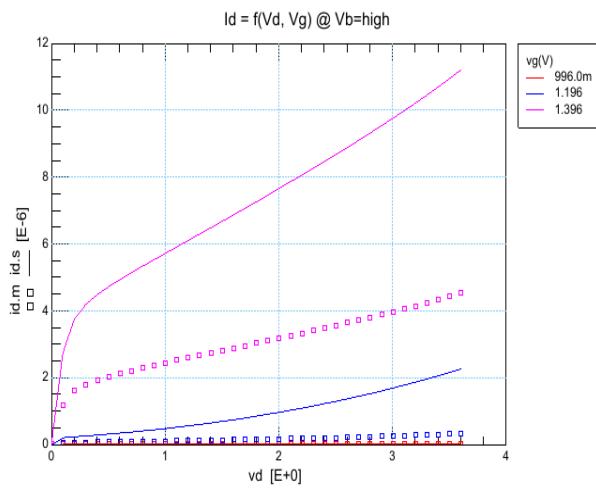


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


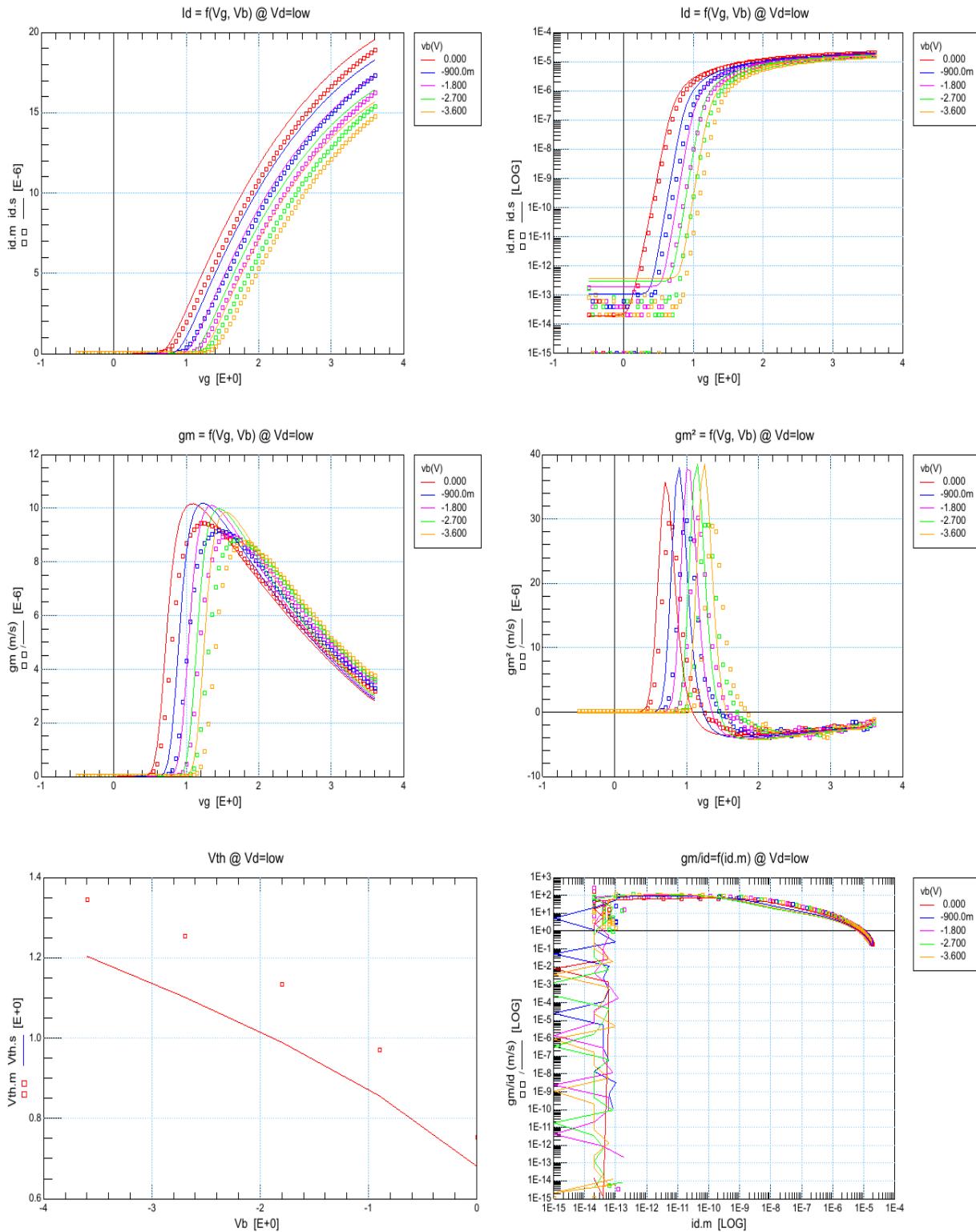


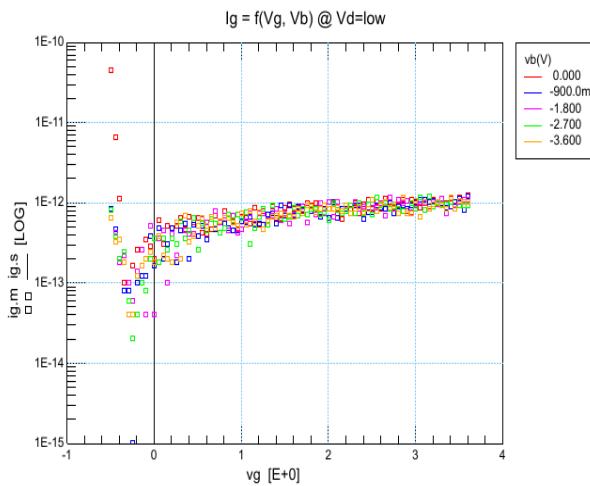
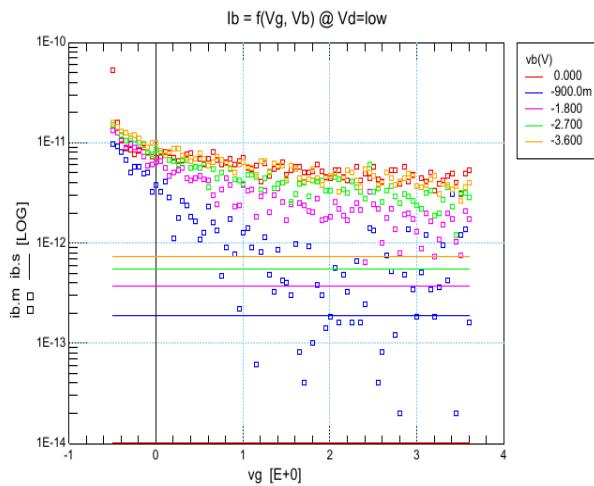
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



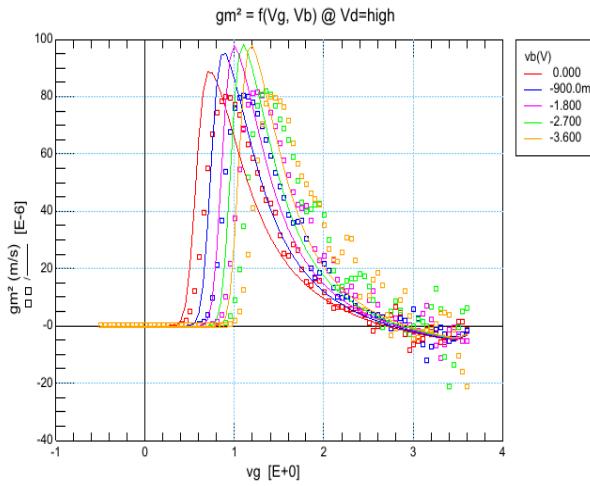
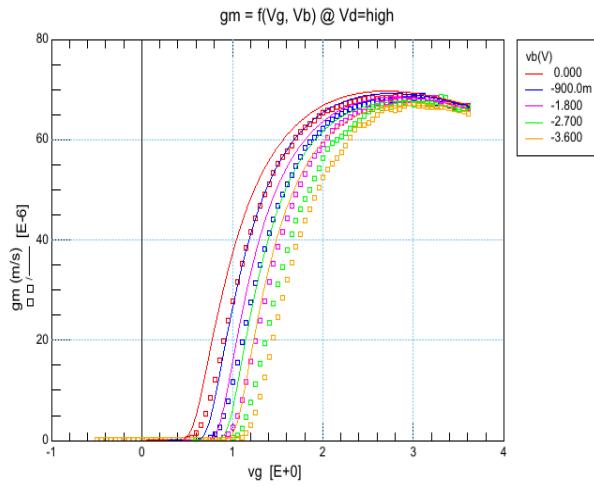
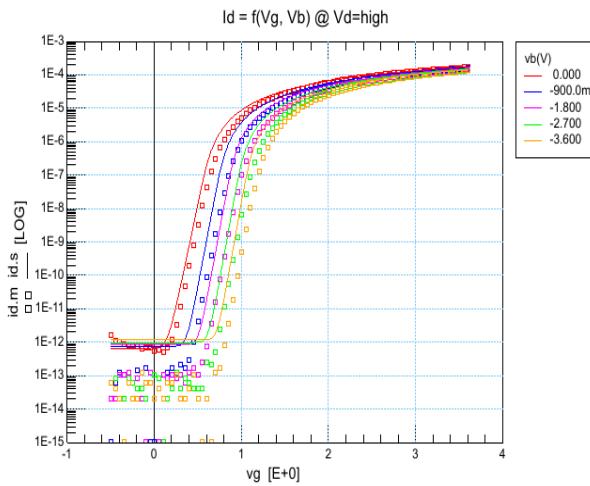
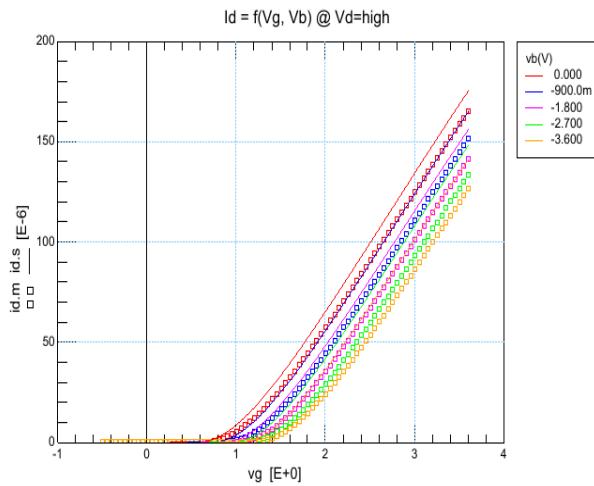
4.22 W0u3_L0u5_S560_4

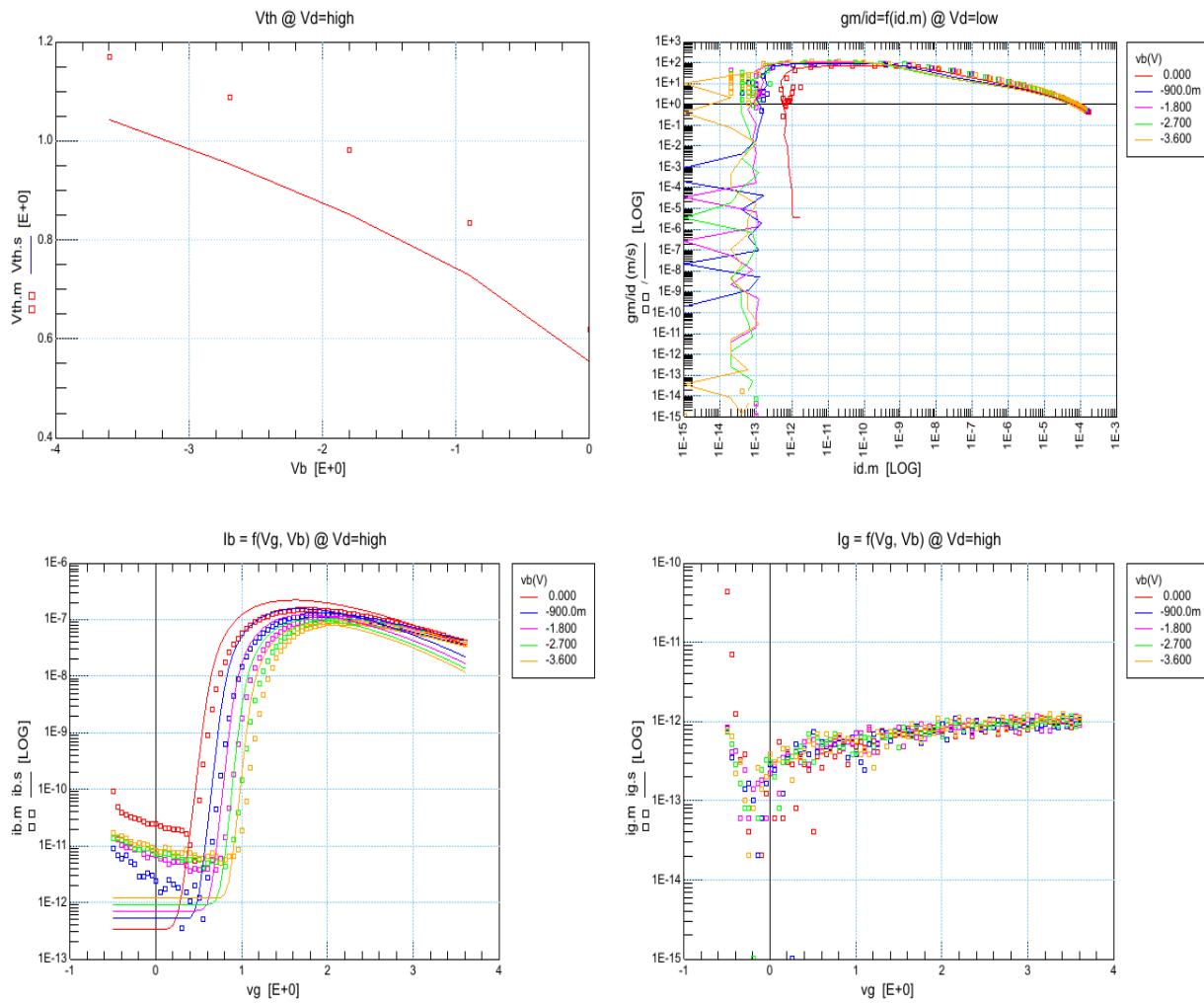
$idvg, Vd = 0.1V, T = 27^\circ C$



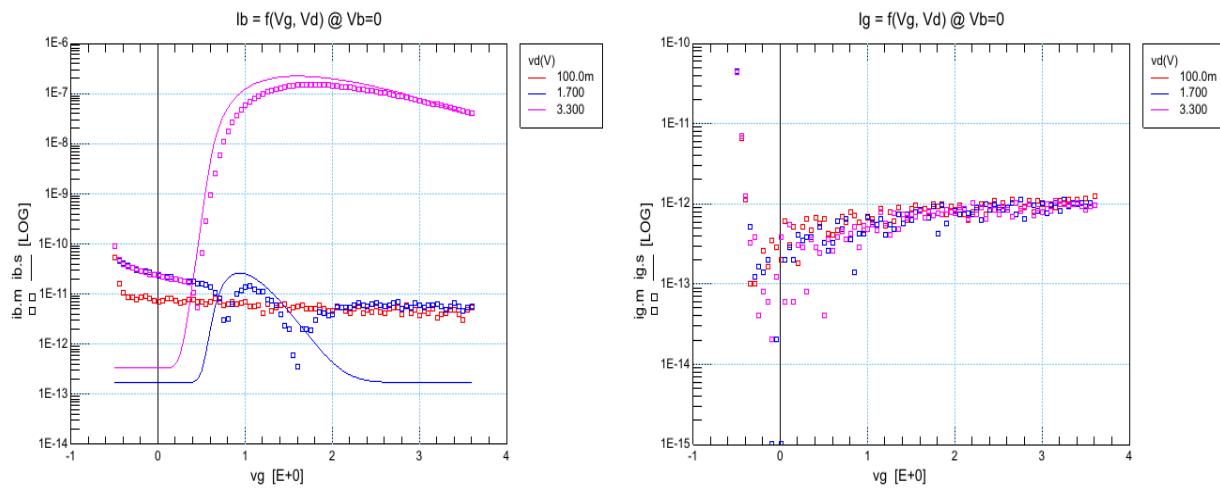


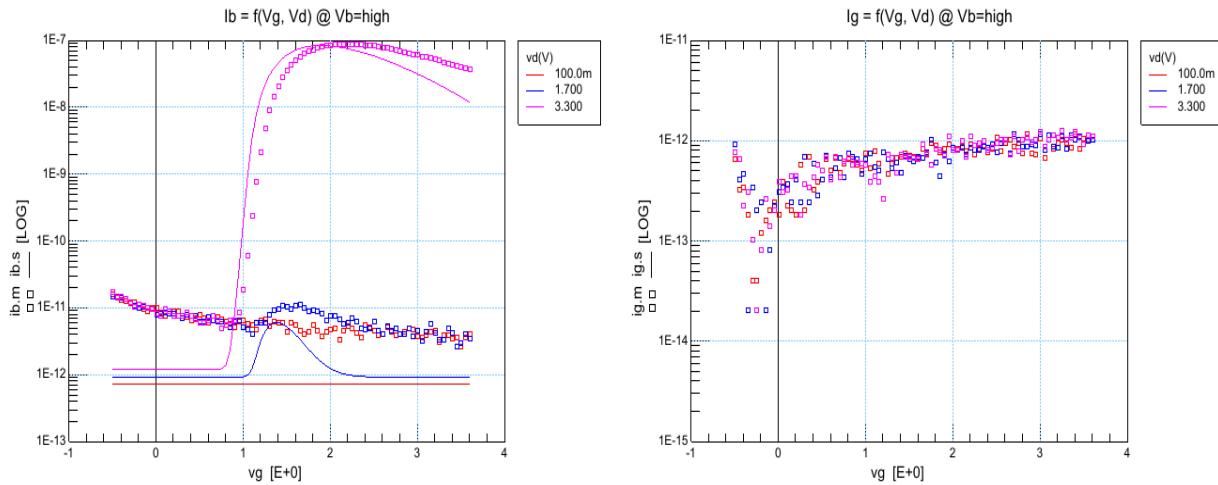
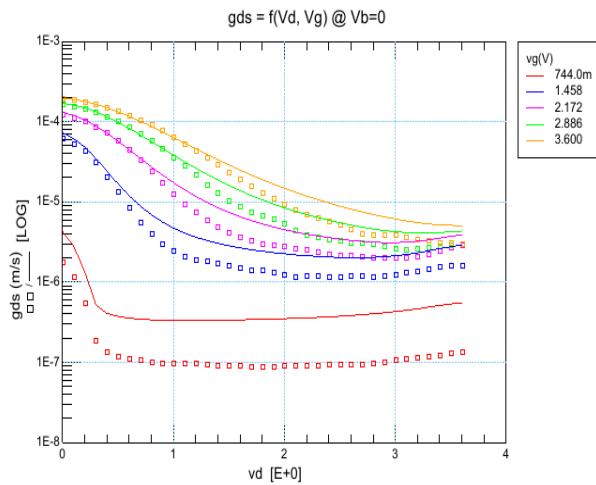
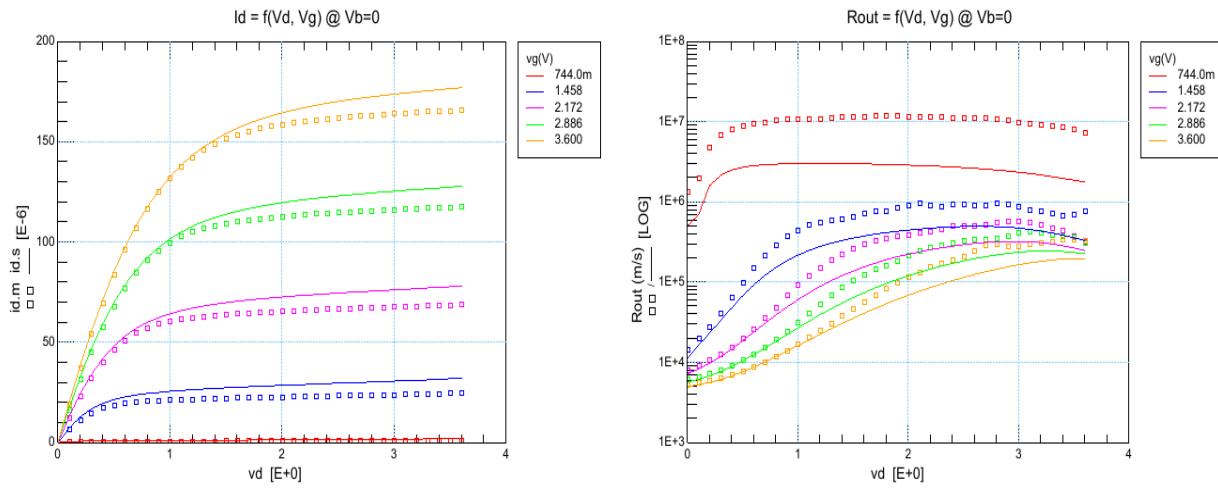
$i_d v_g, V_d = 3.3V, T = 27^\circ\text{C}$

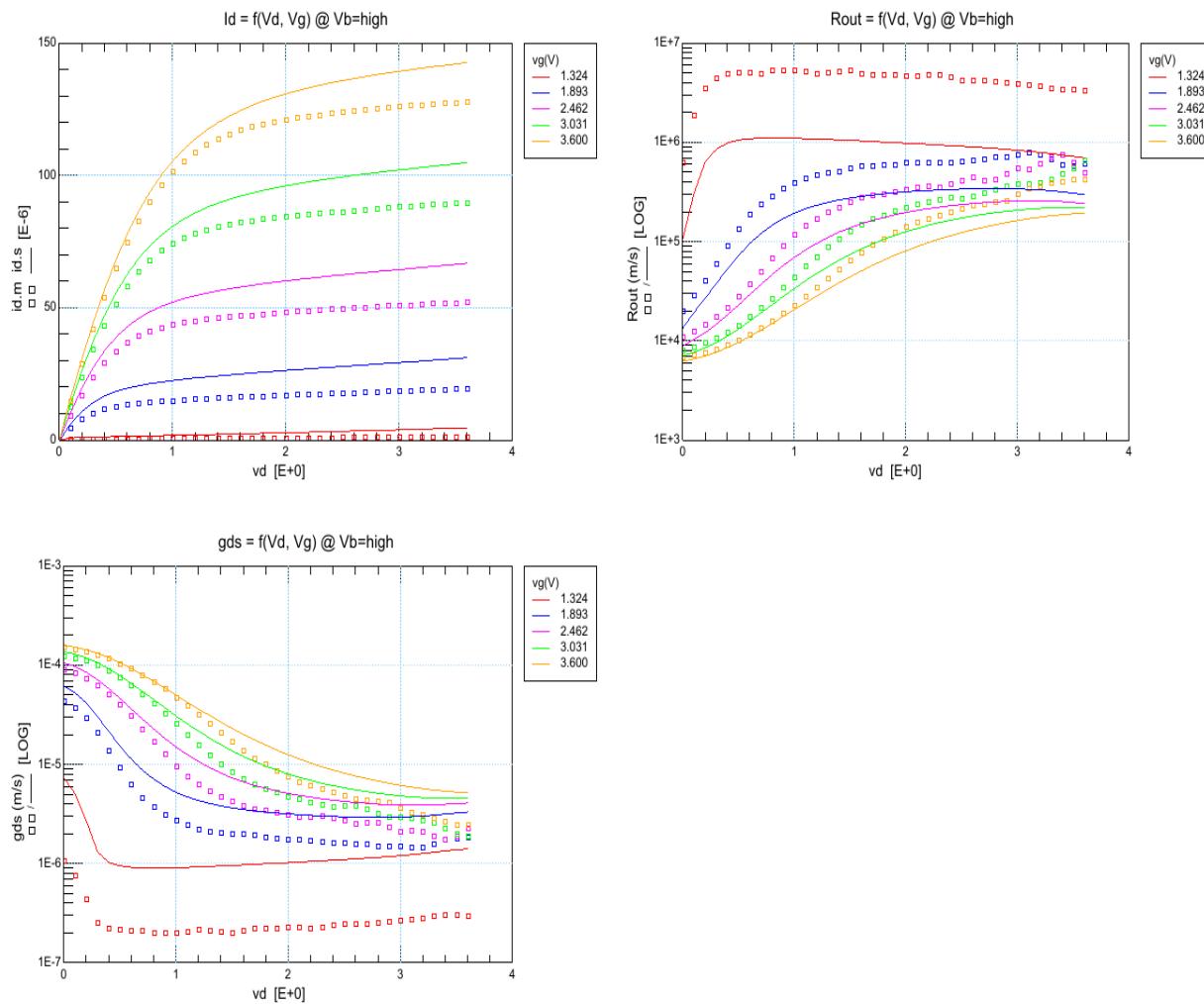
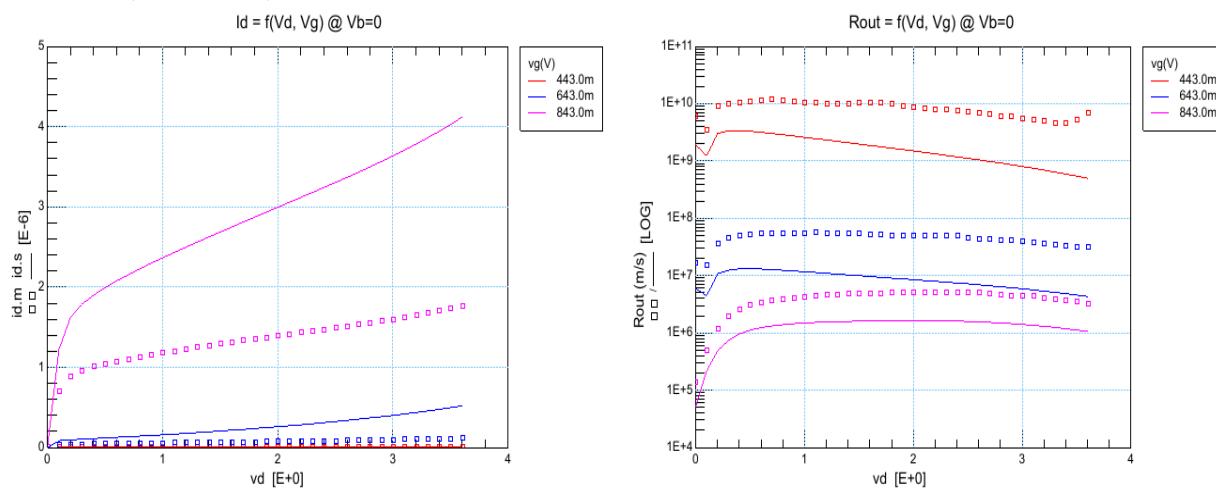


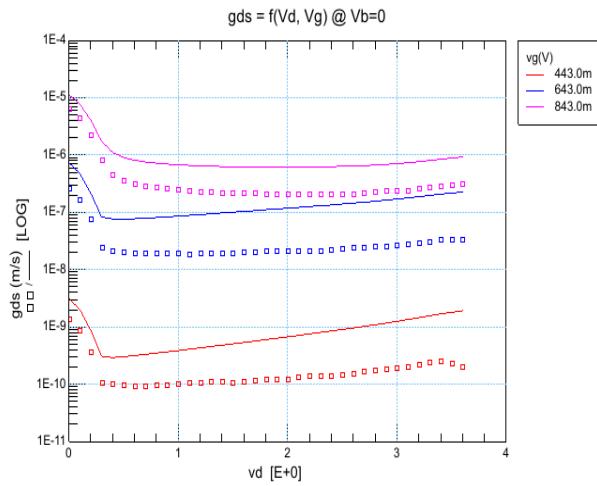


$idvg, lb, lg, Vb = 0V, T = 27^\circ C$

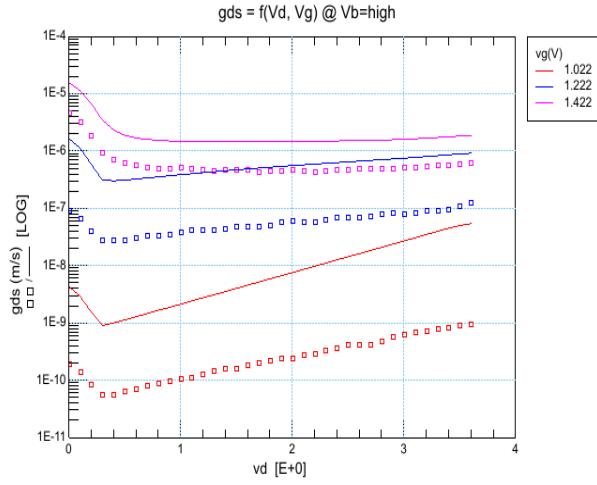
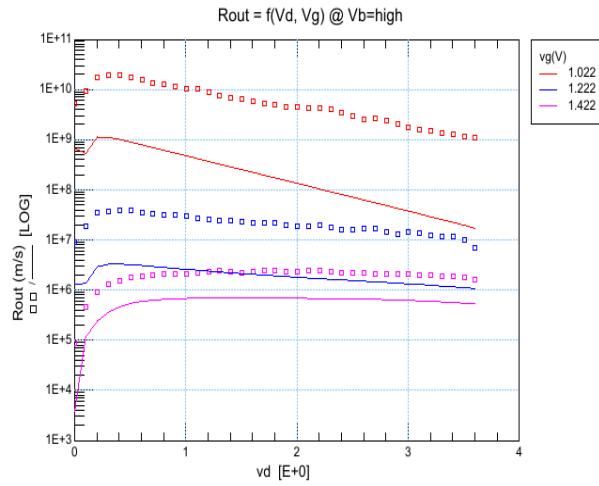
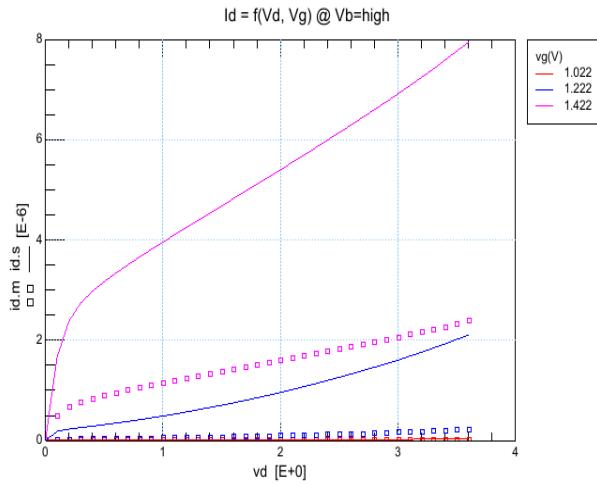


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


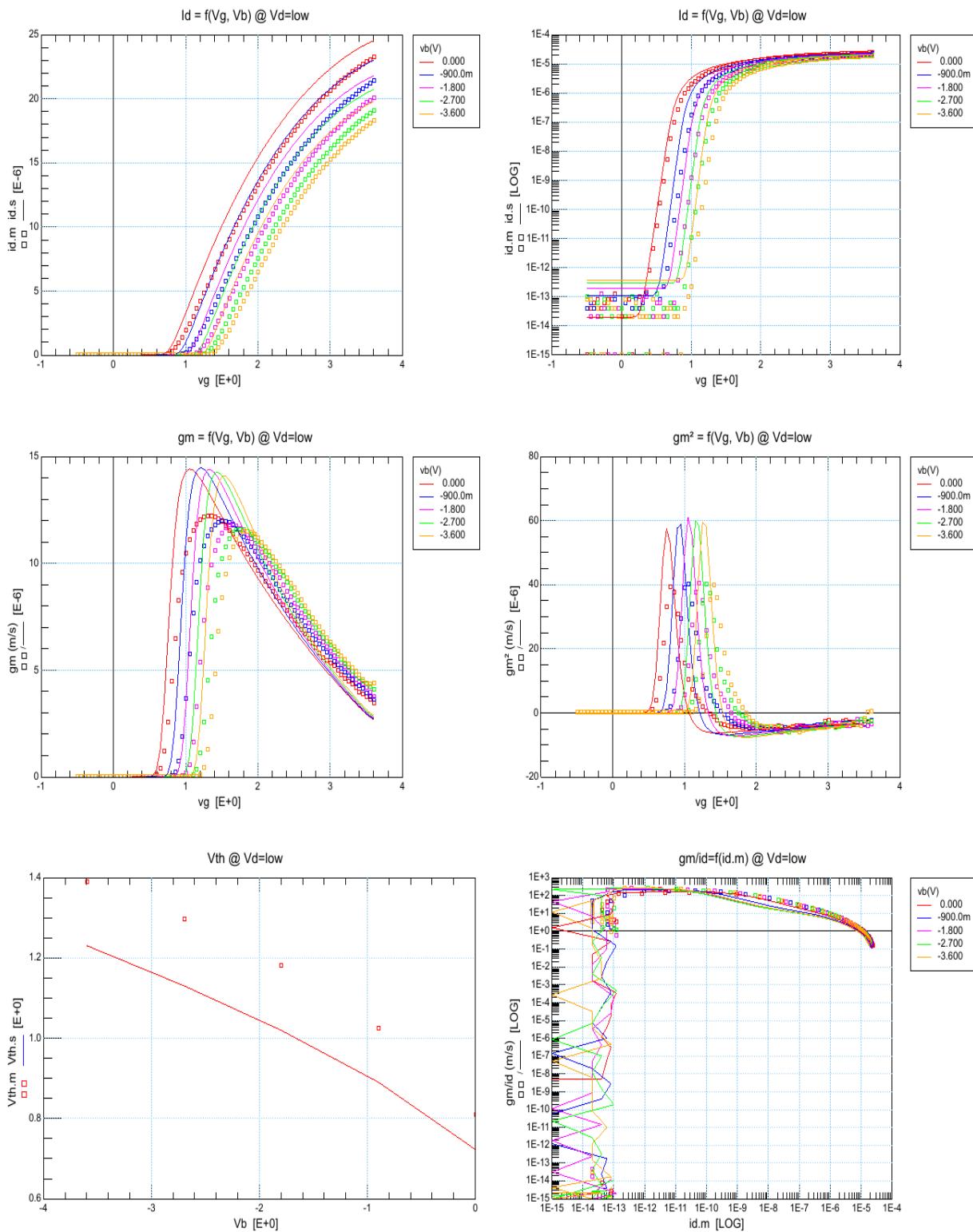
idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


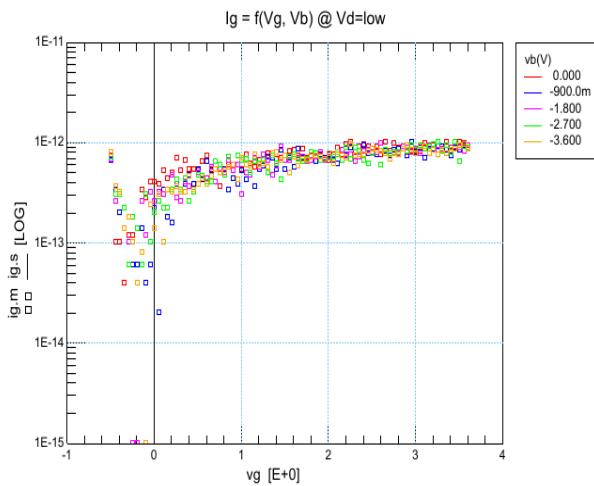
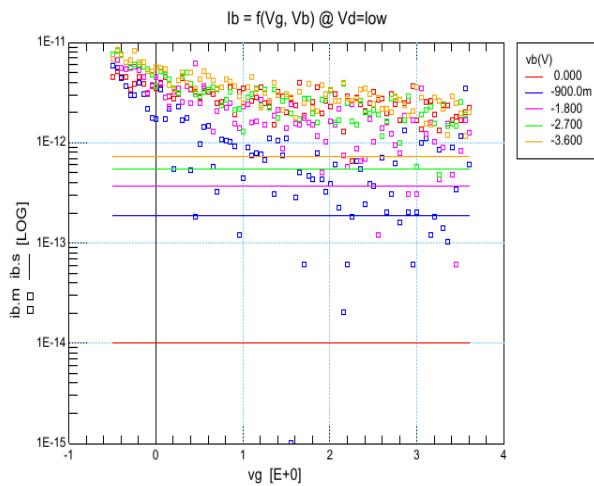


idvd_vth_vbmin, Vb = -3.6V, T = 27°C

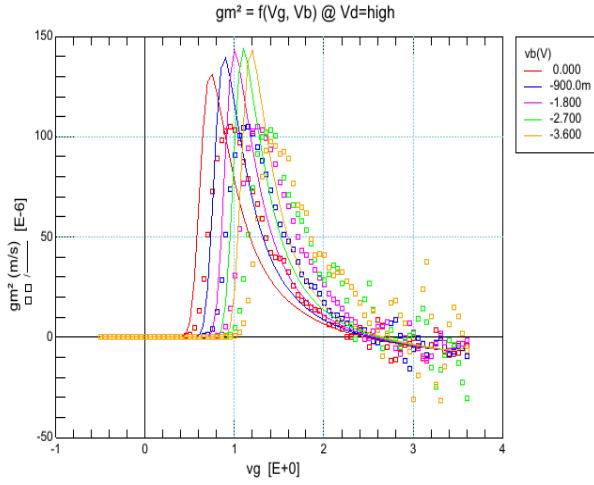
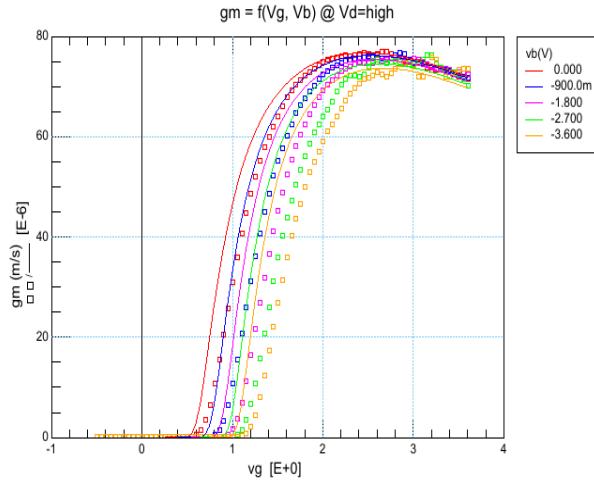
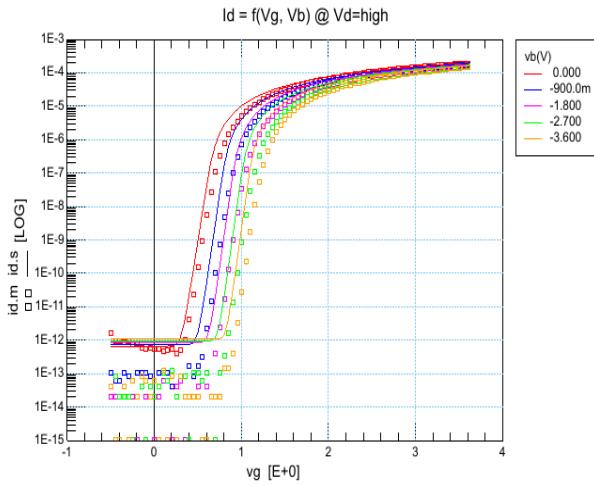
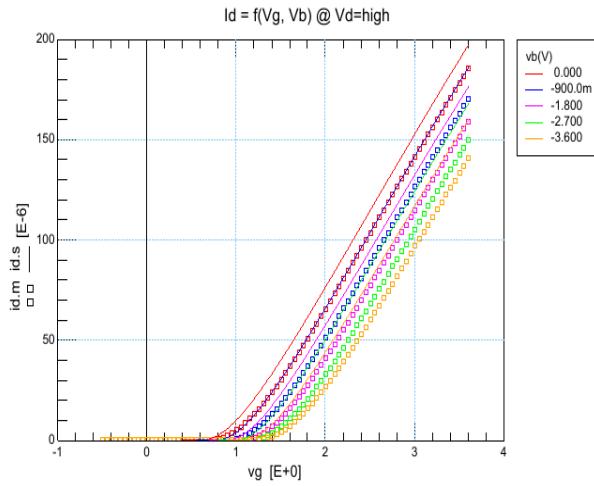


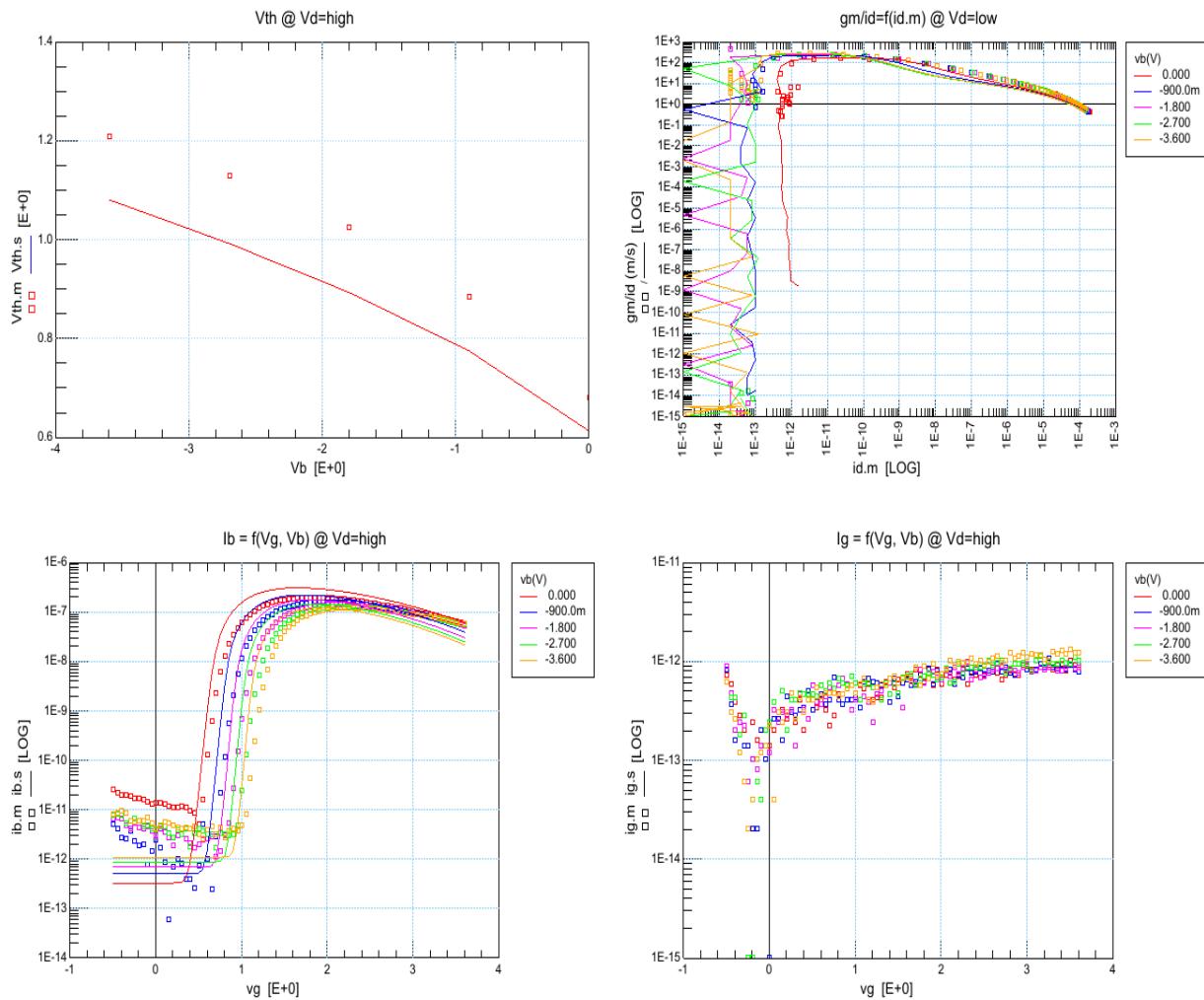
idvg, Vd = 0.1V, T = -40°C



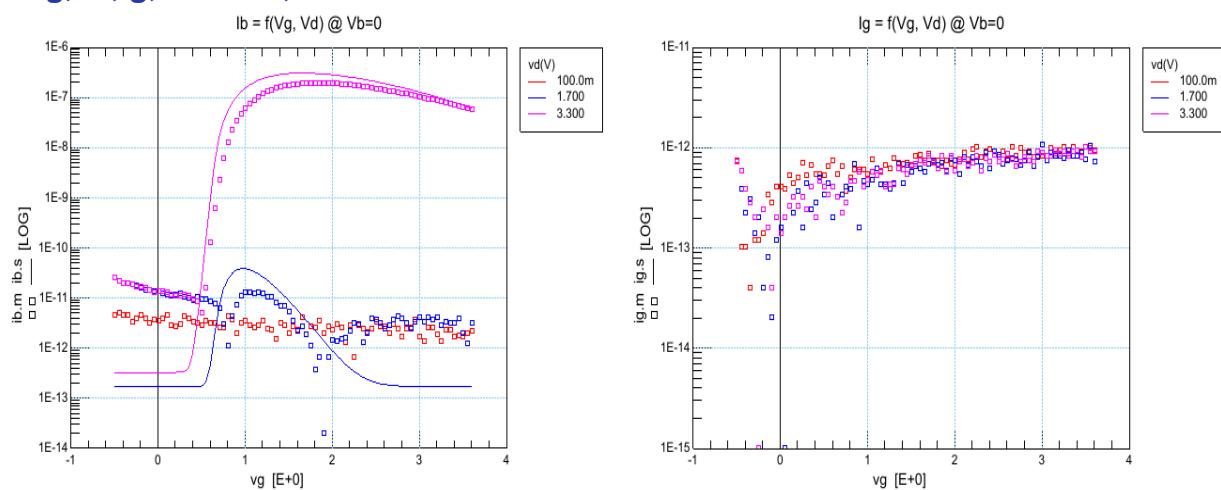


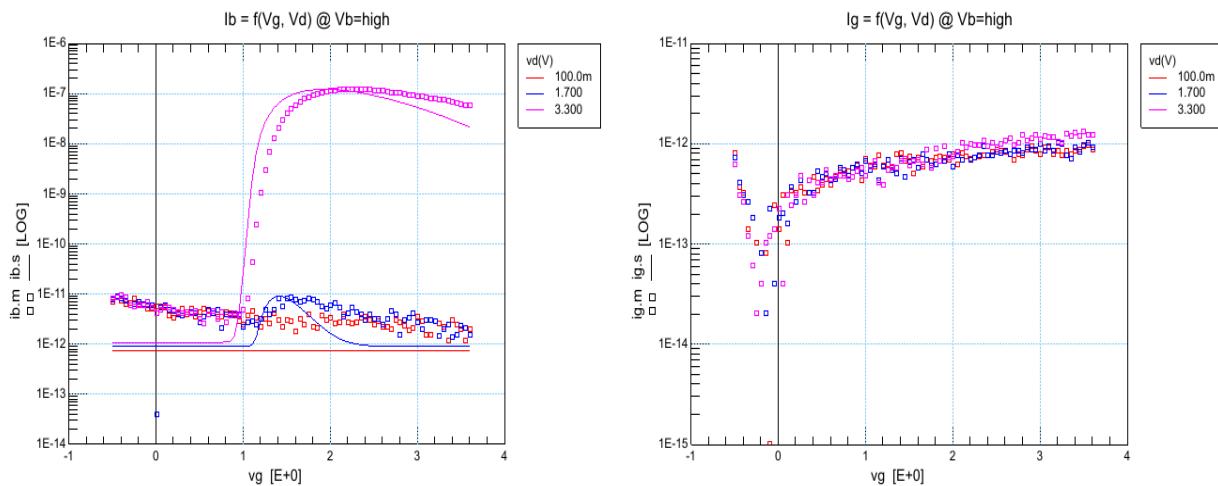
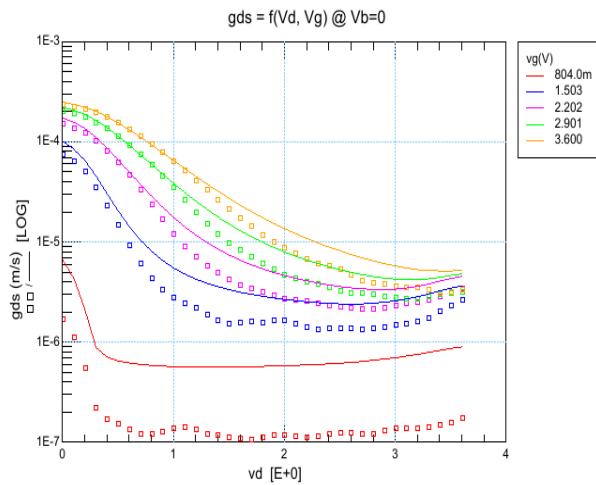
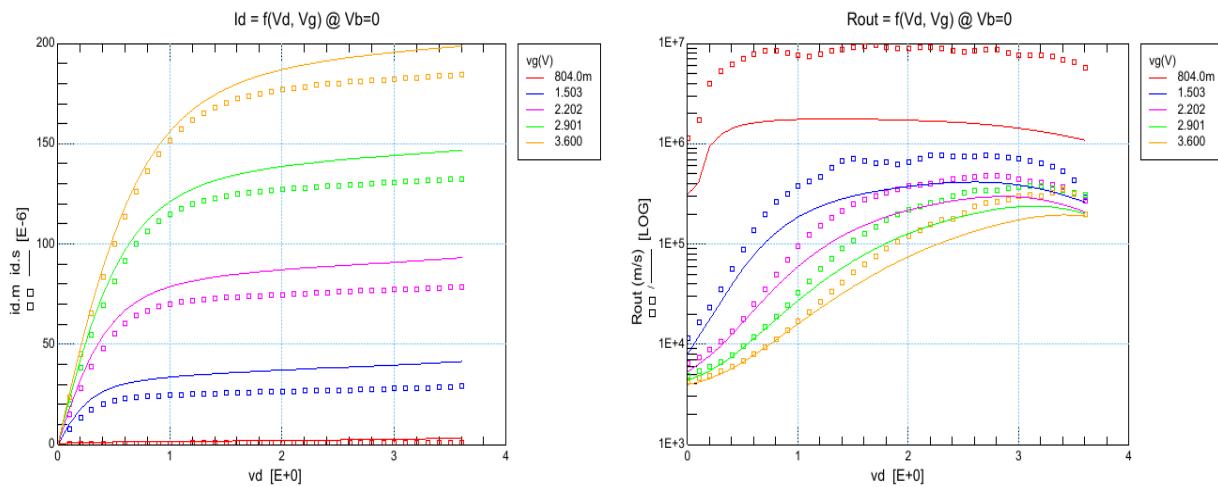
$idvg, Vd = 3.3V, T = -40^{\circ}C$

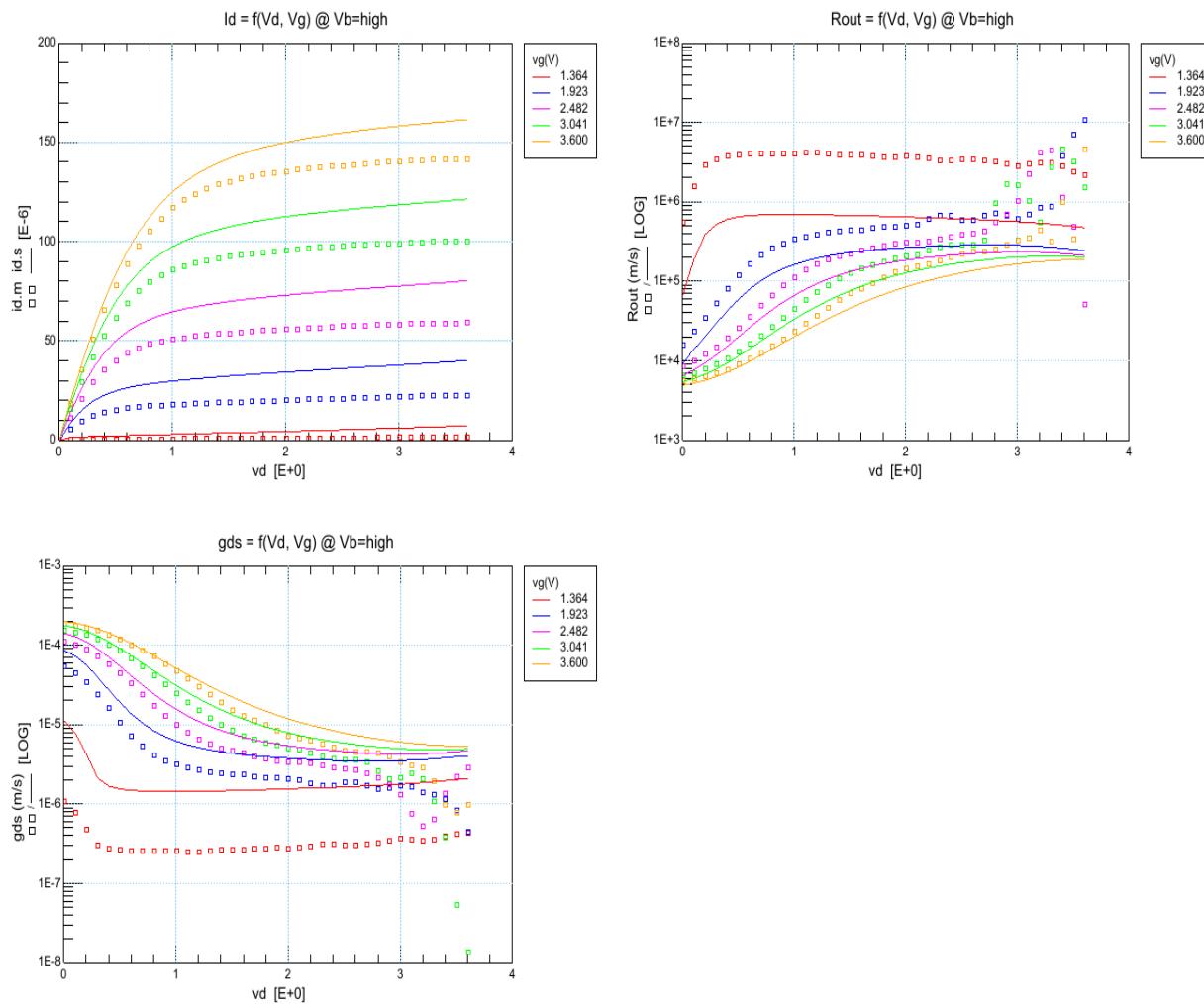
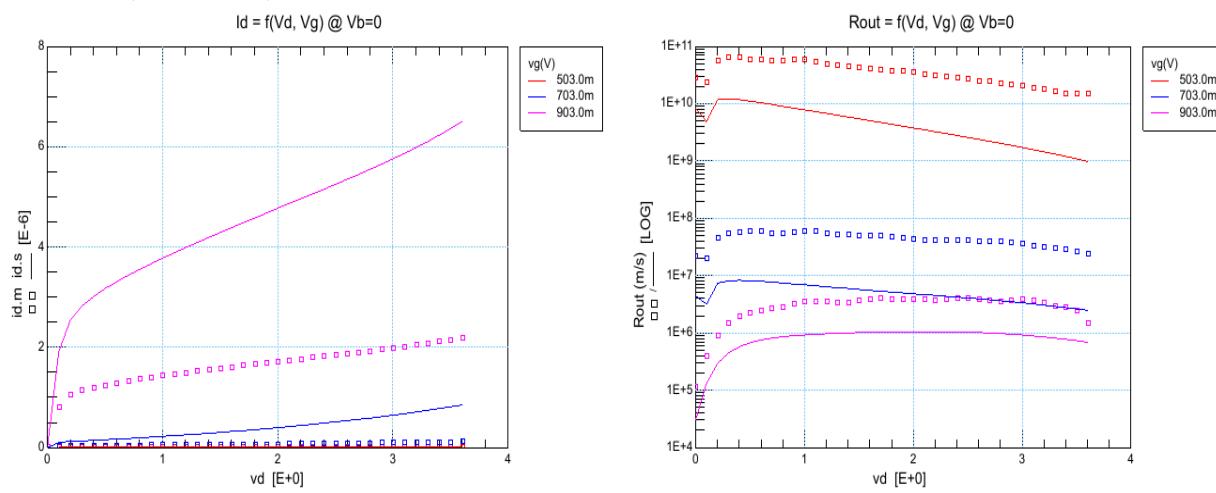


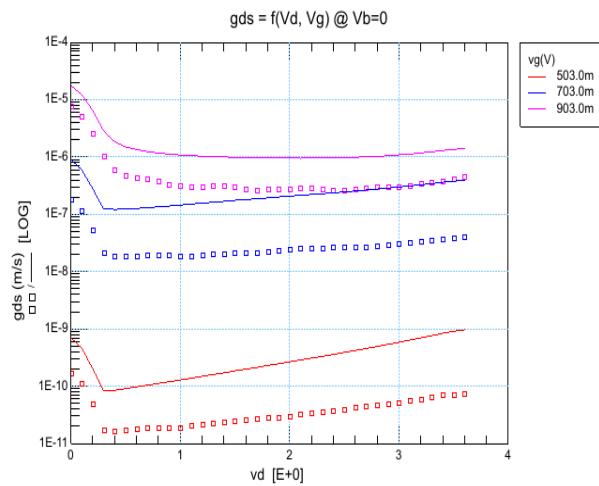


idvg, Ib,Ig, Vb = 0V, T = -40°C

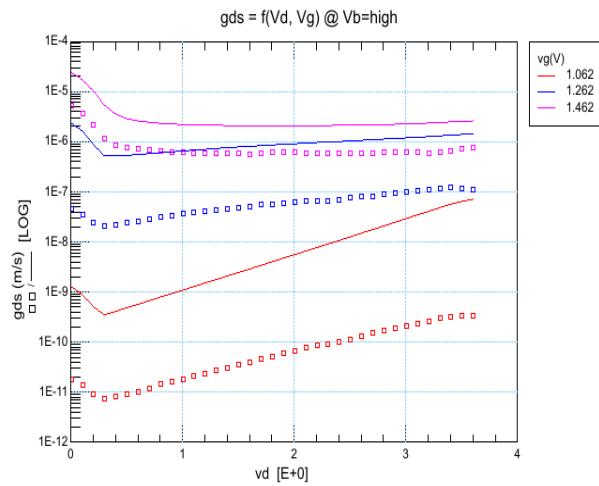
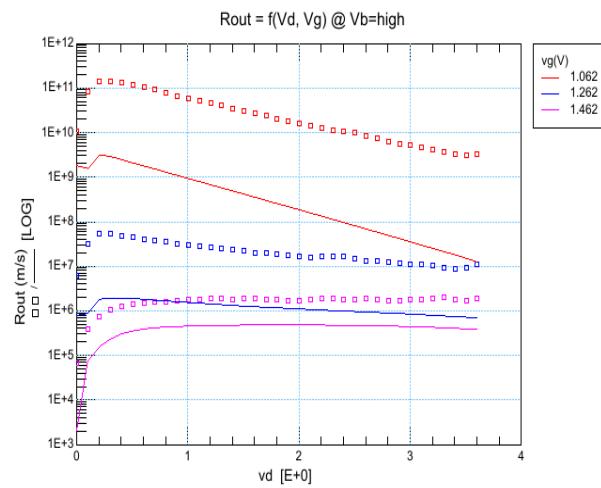
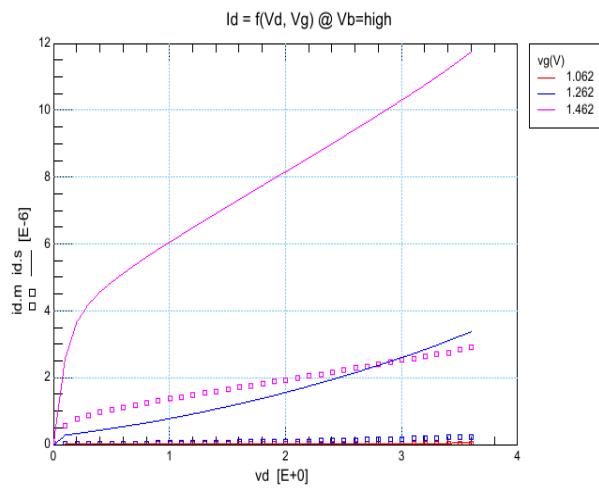


idvg, Ib,Ig, Vb = -3.6V, T = -40°C

idvd, Vb = 0V, T = -40°C


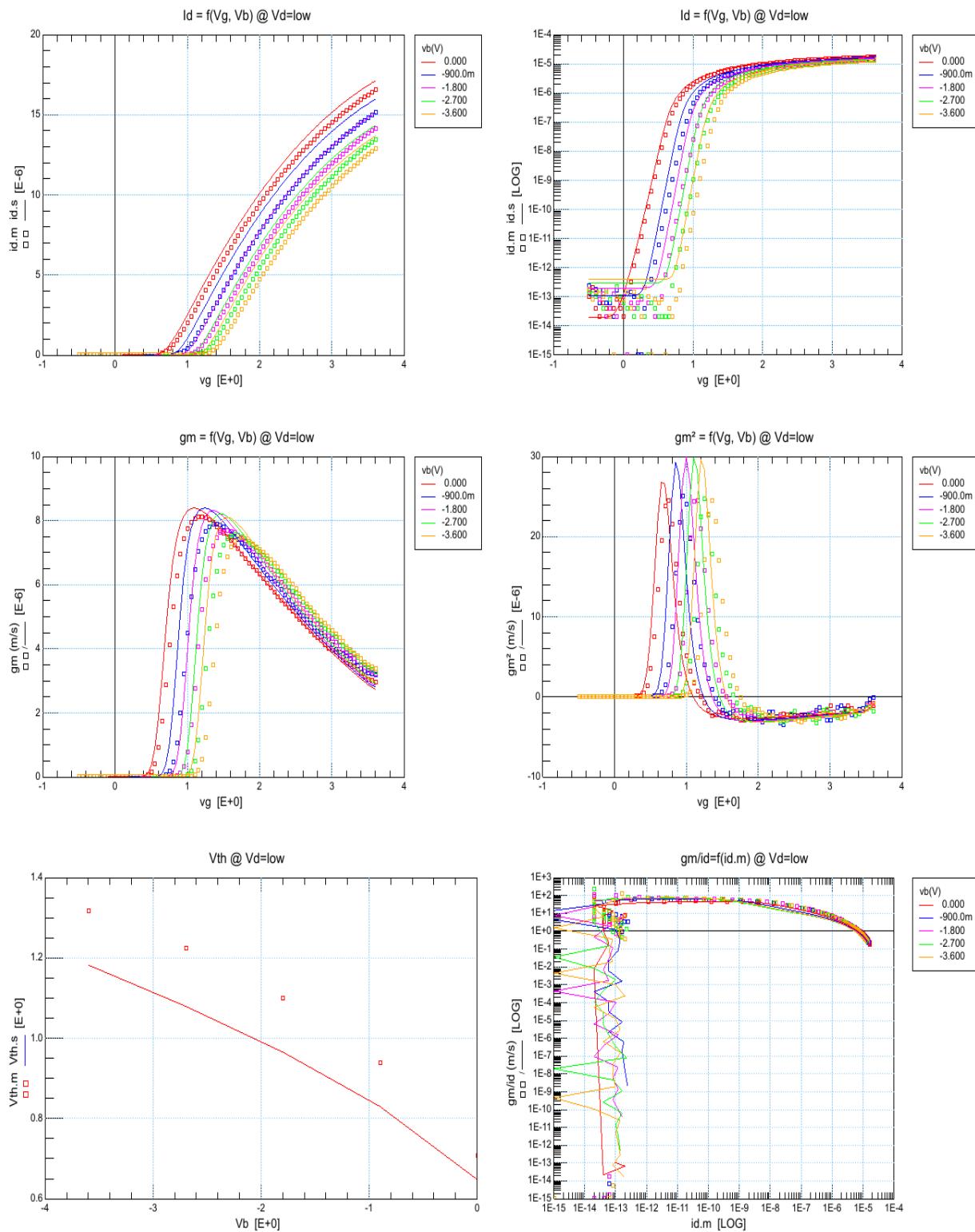
idvd_vbmin, Vb = -3.6V, T = -40°C

idvd_vth, Vb = 0V, T = -40°C


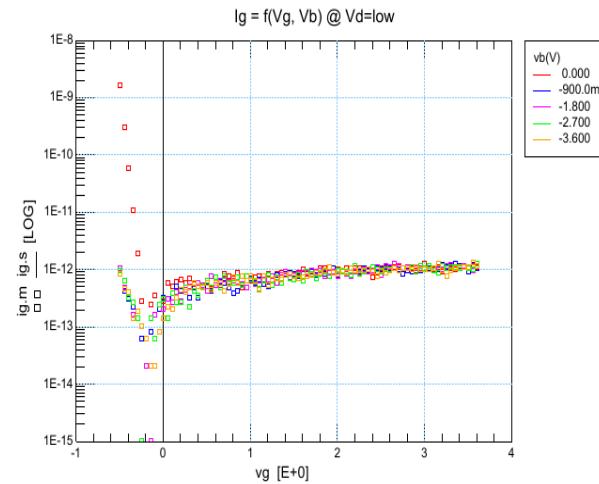
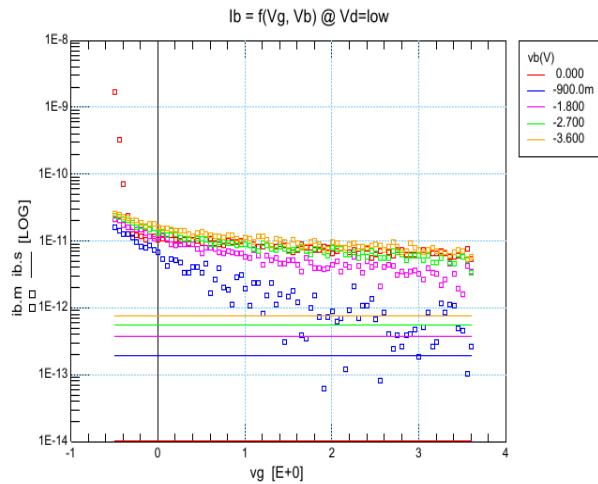


idvd_vth_vbmin, Vb = -3.6V, T = -40°C

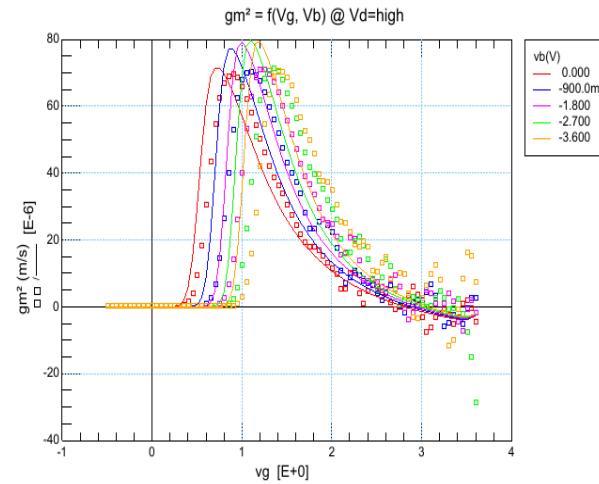
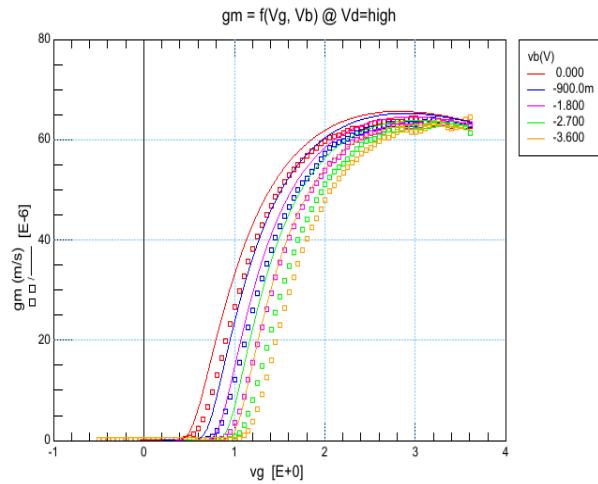
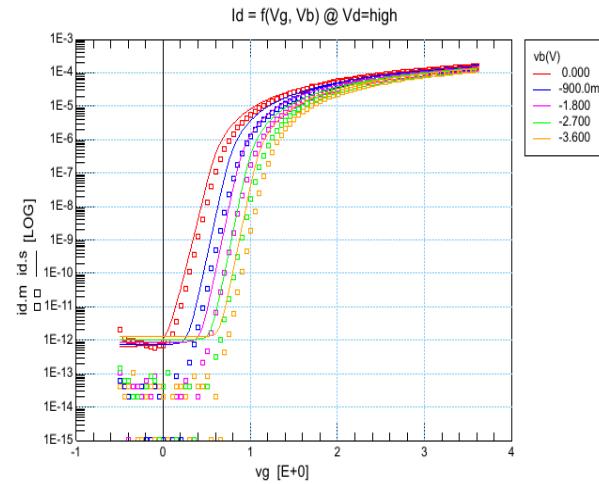
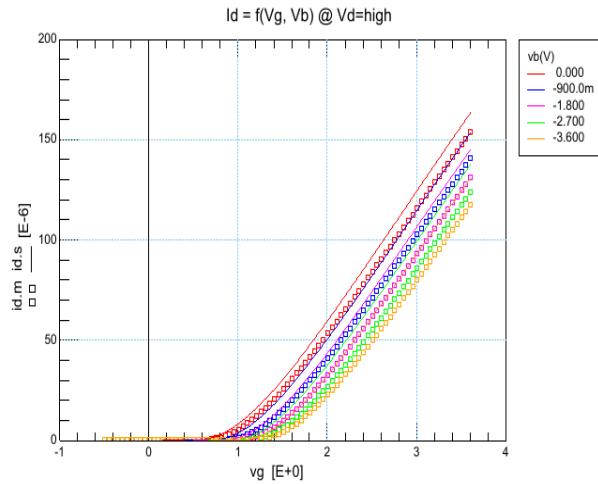


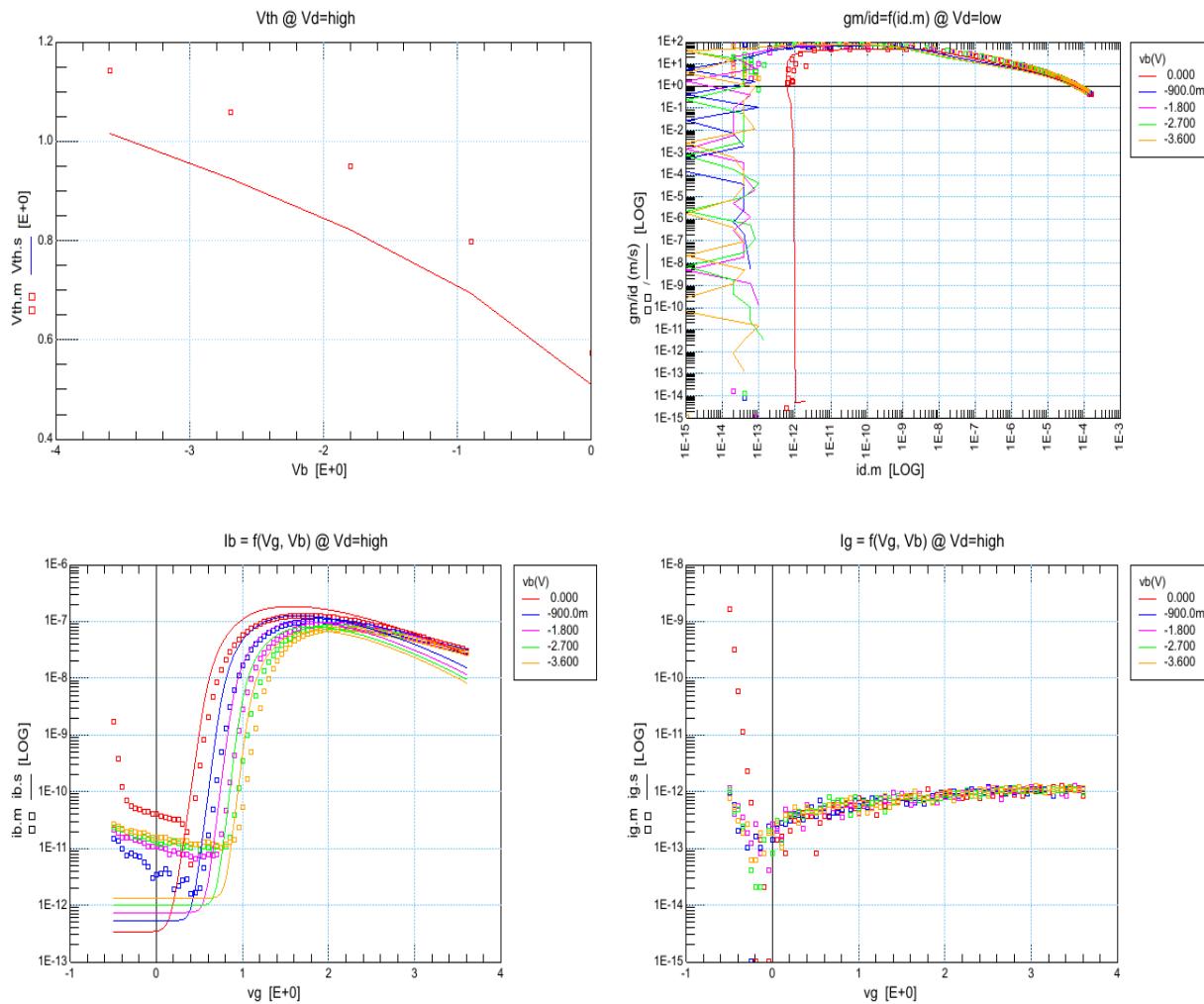
idvg, Vd = 0.1V, T = 70°C



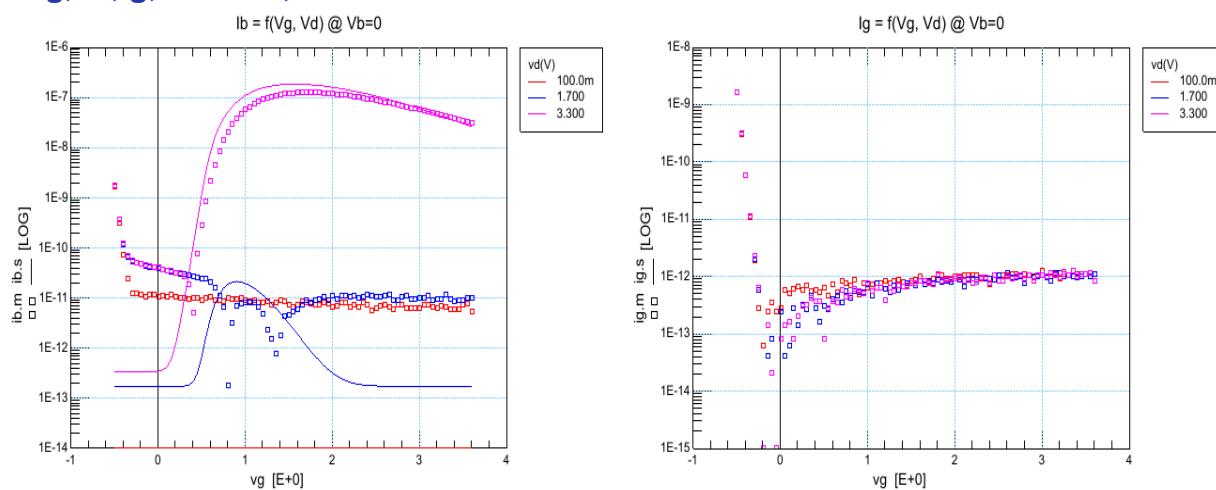


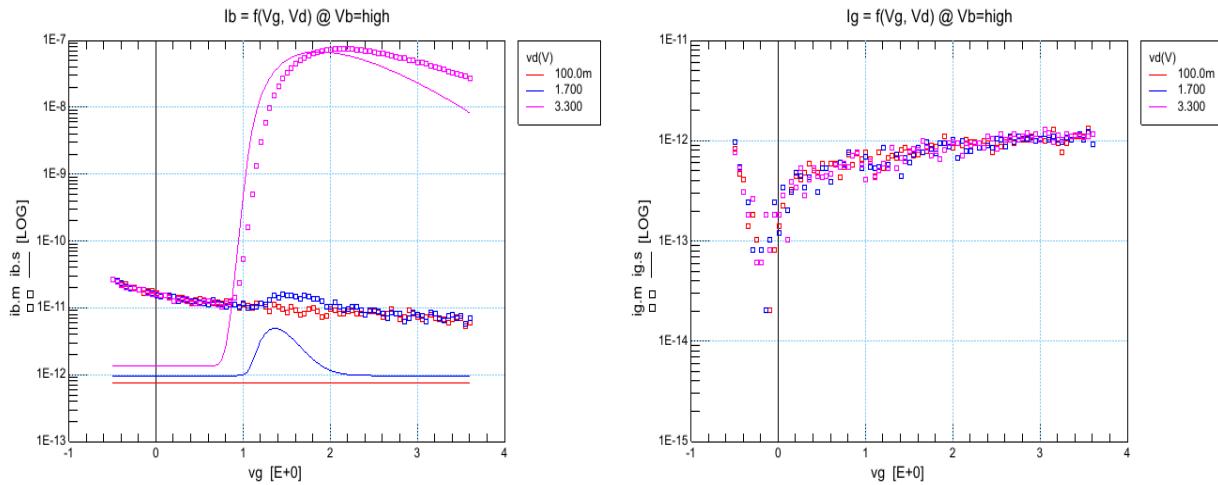
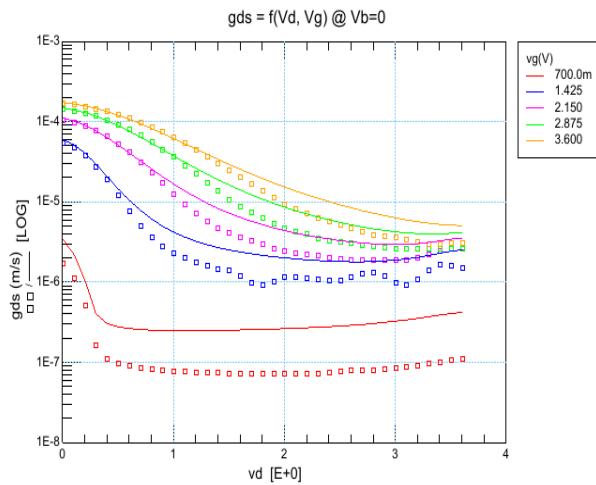
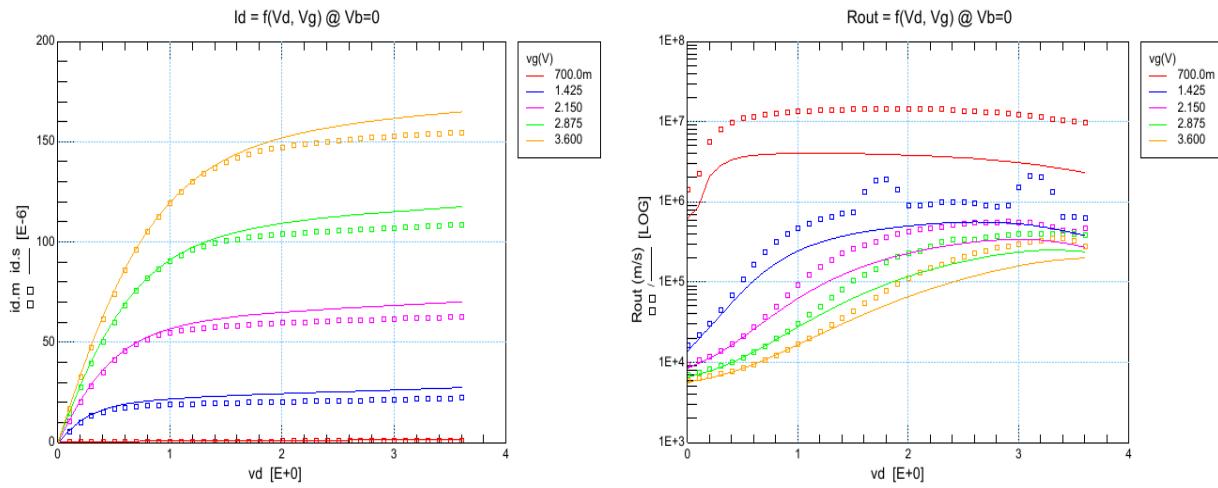
$idvg$, $Vd = 3.3V$, $T = 70^\circ C$

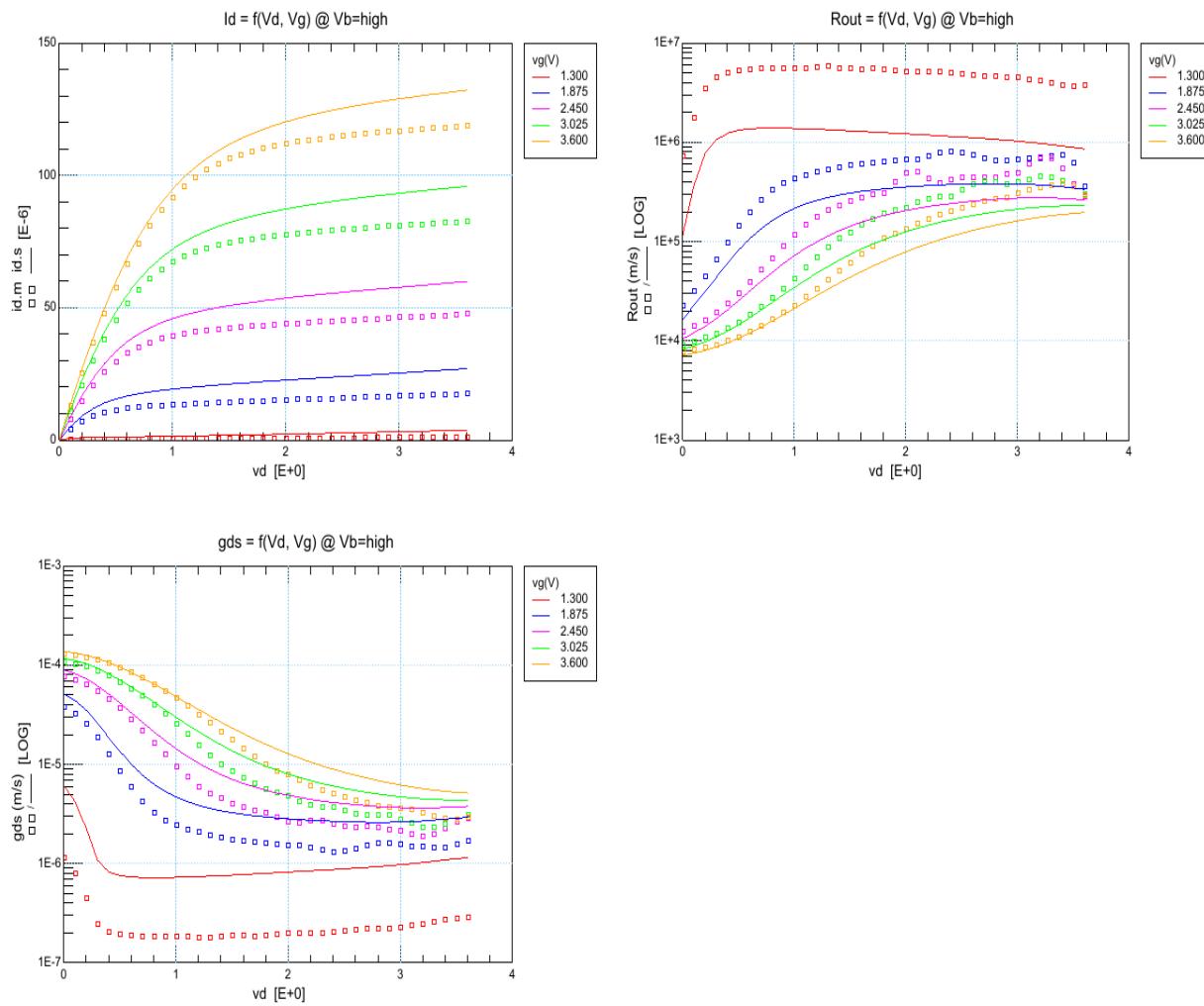
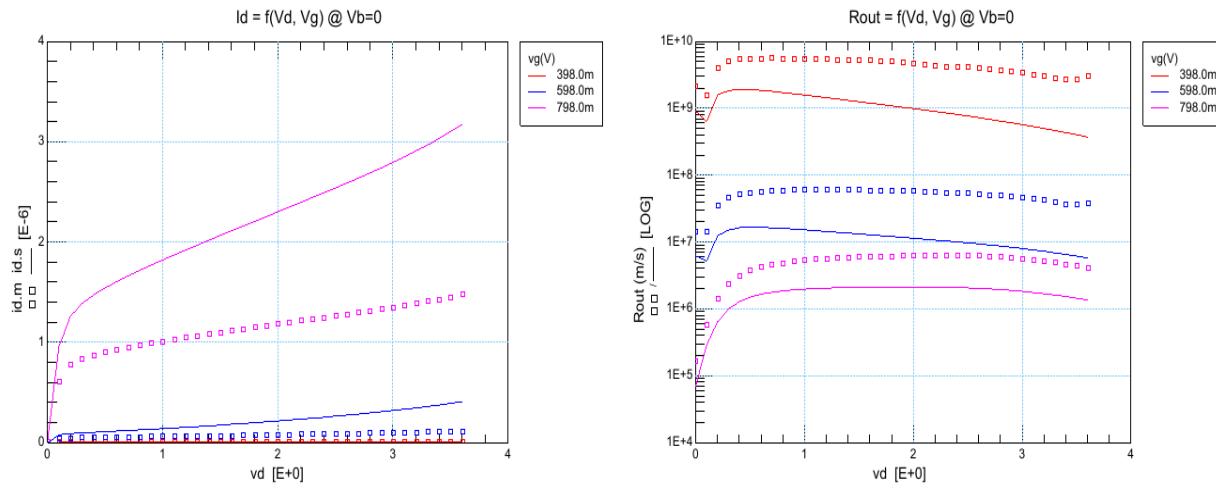


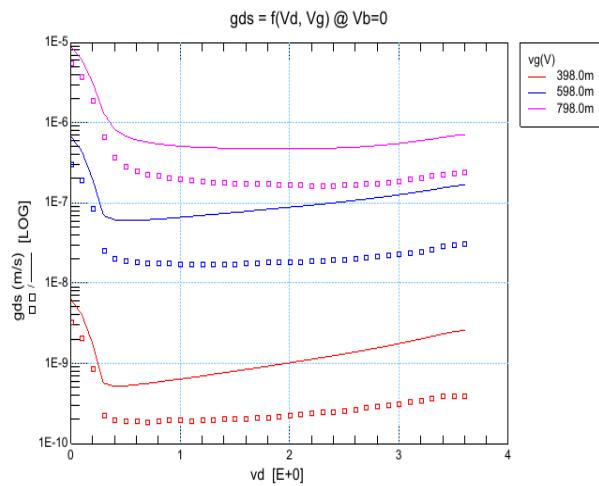


idvg, Ib, Ig, Vb = 0V, T = 70°C

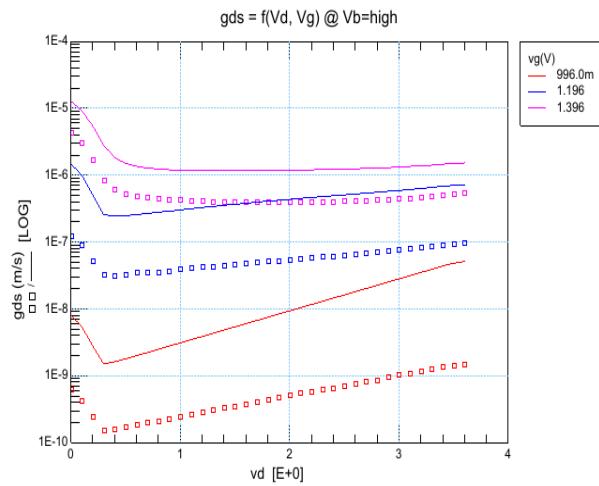
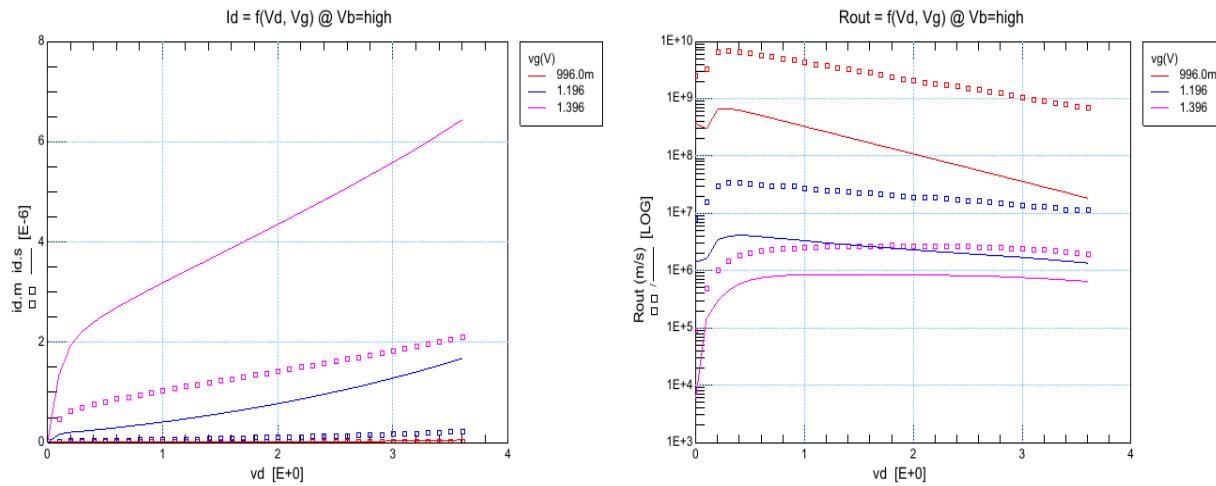


idvg, Ib,Ig, Vb = -3.6V, T = 70°C

idvd, Vb = 0V, T = 70°C


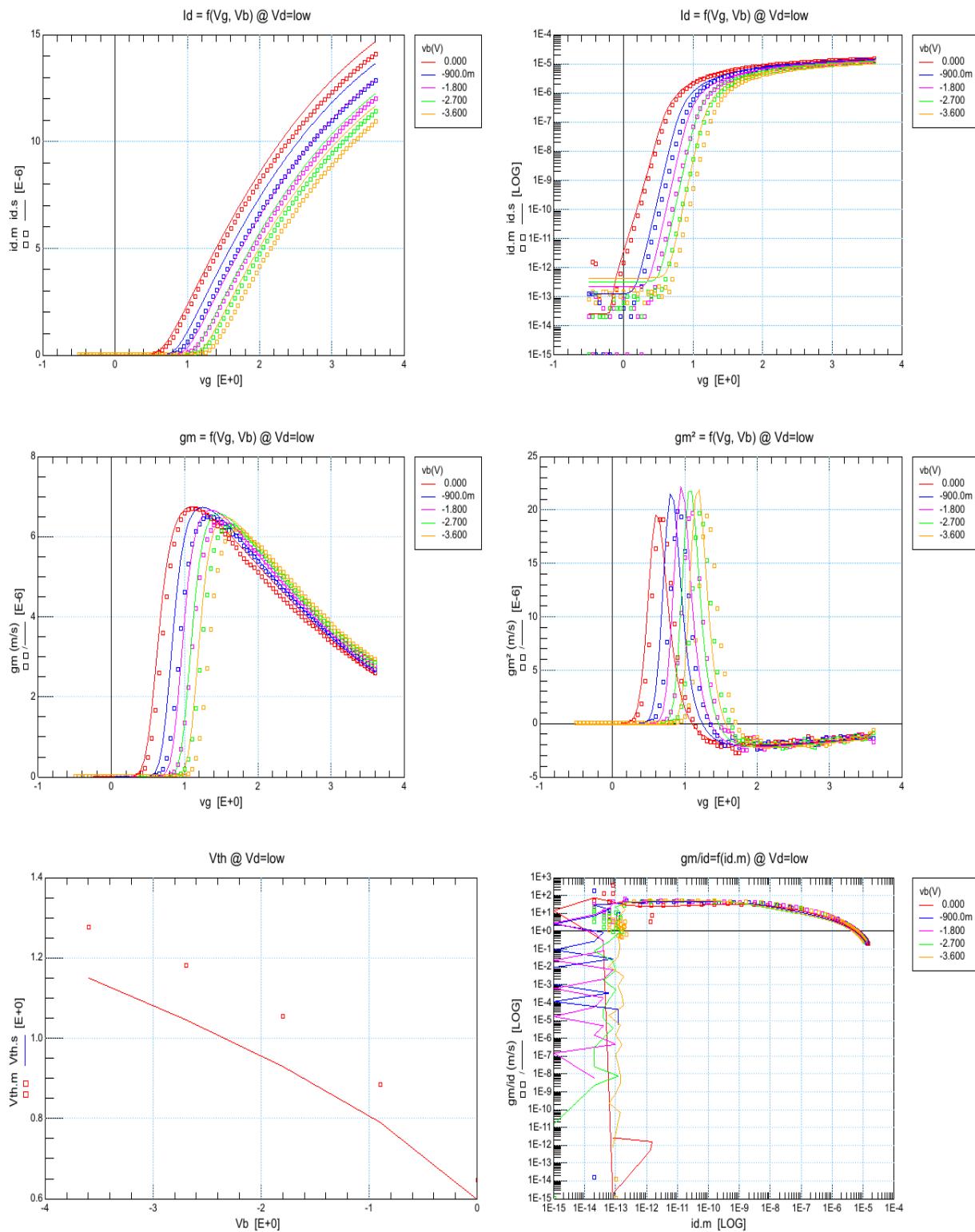
idvd_vbmin, Vb = -3.6V, T = 70°C

idvd_vth, Vb = 0V, T = 70°C


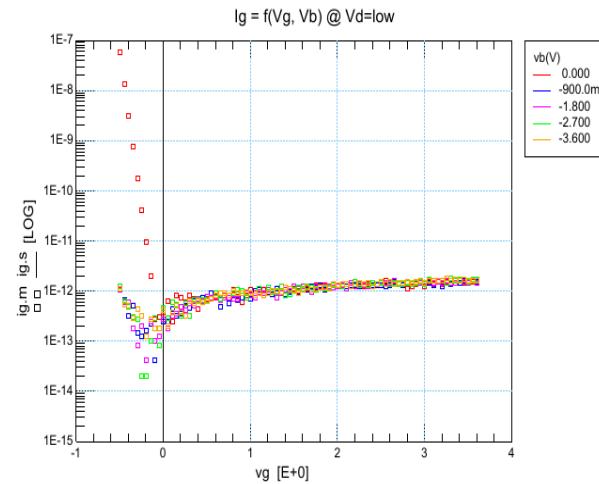
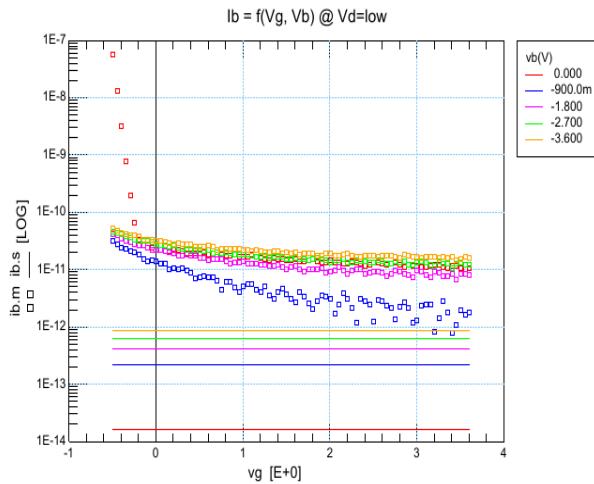


idvd_vth_vbmin, Vb = -3.6V, T = 70°C

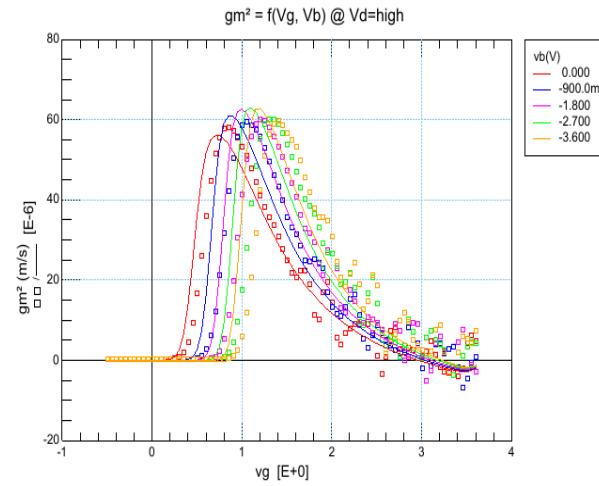
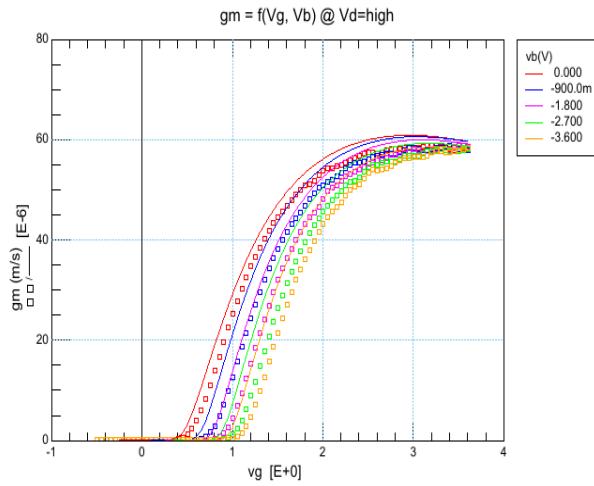
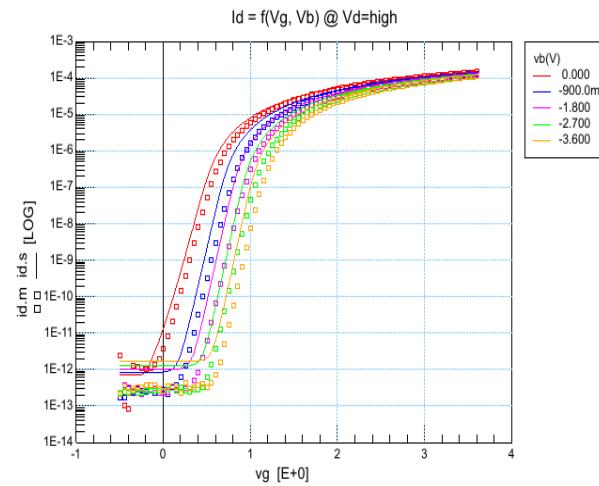
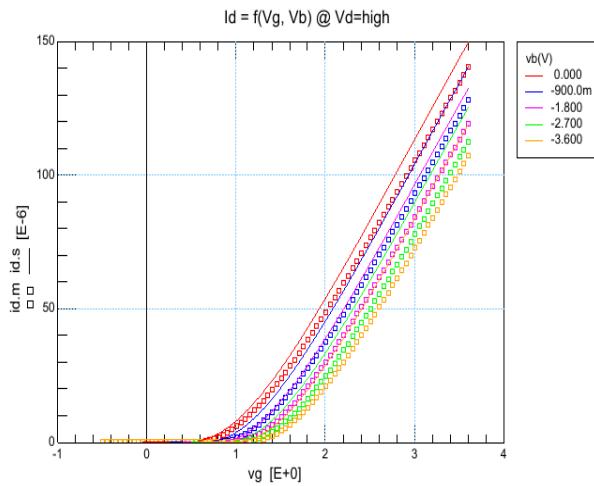


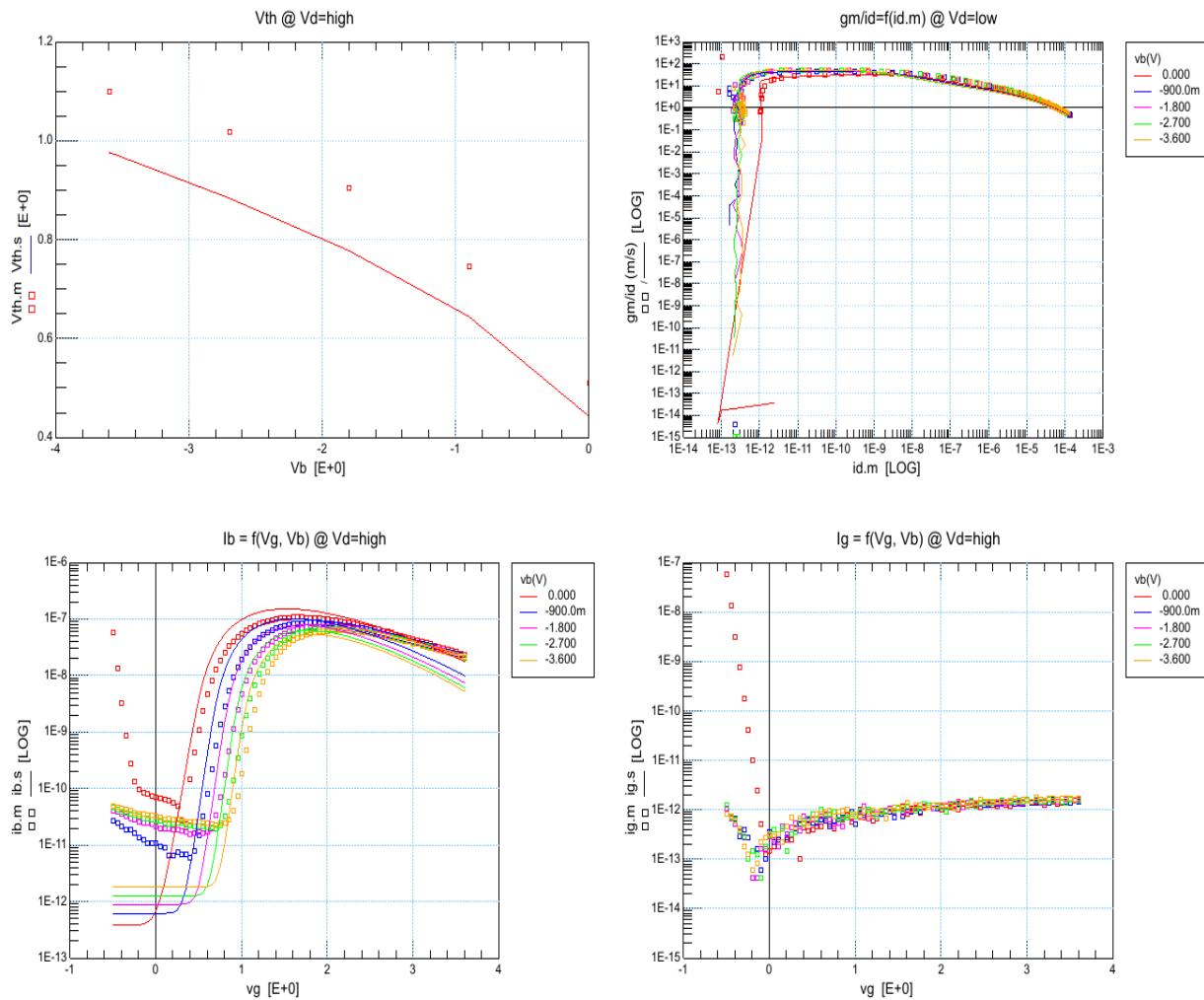
idvg, Vd = 0.1V, T = 125°C



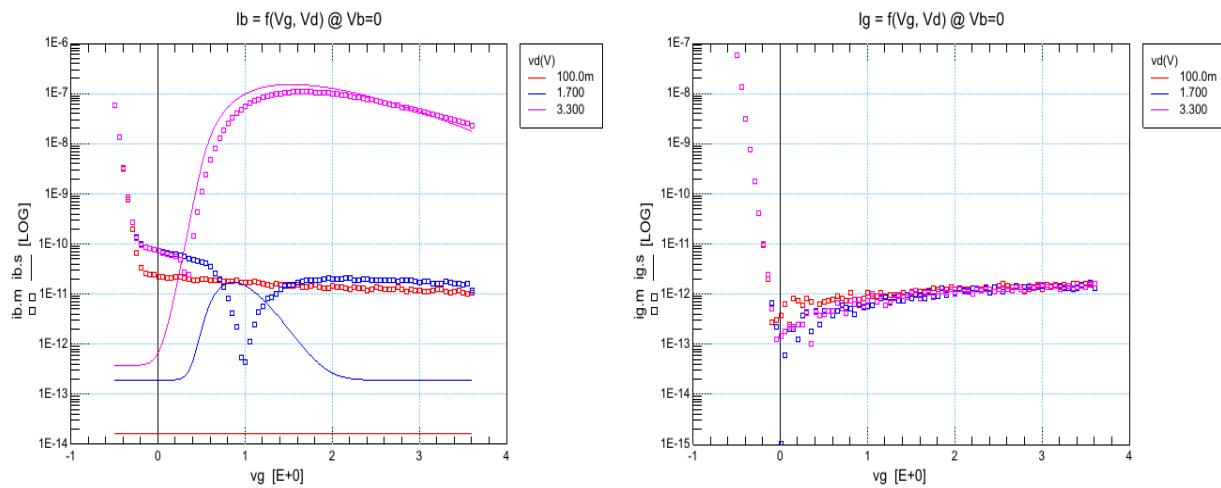


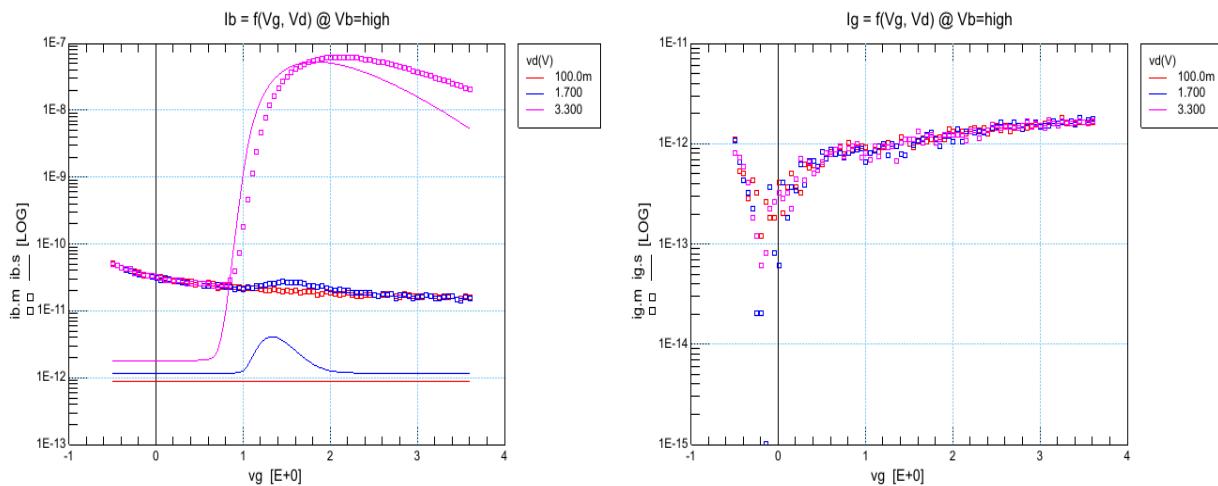
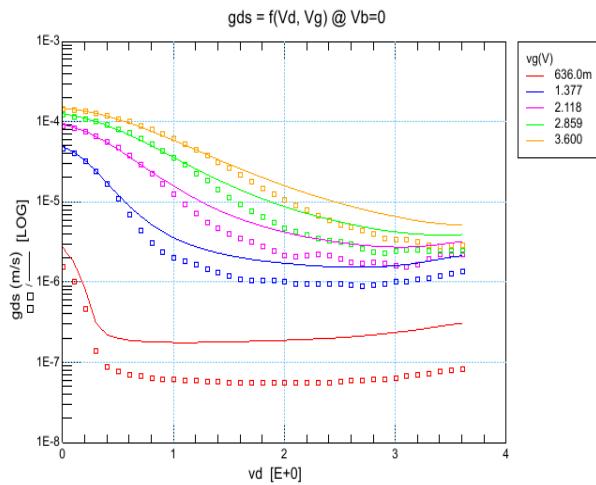
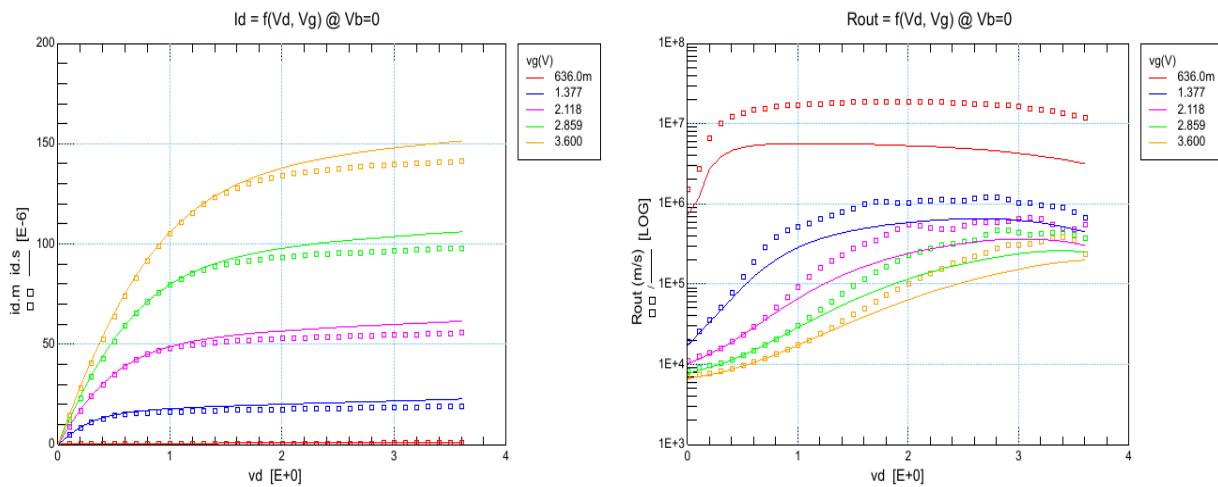
$i_{dvg}, V_d = 3.3V, T = 125^\circ\text{C}$

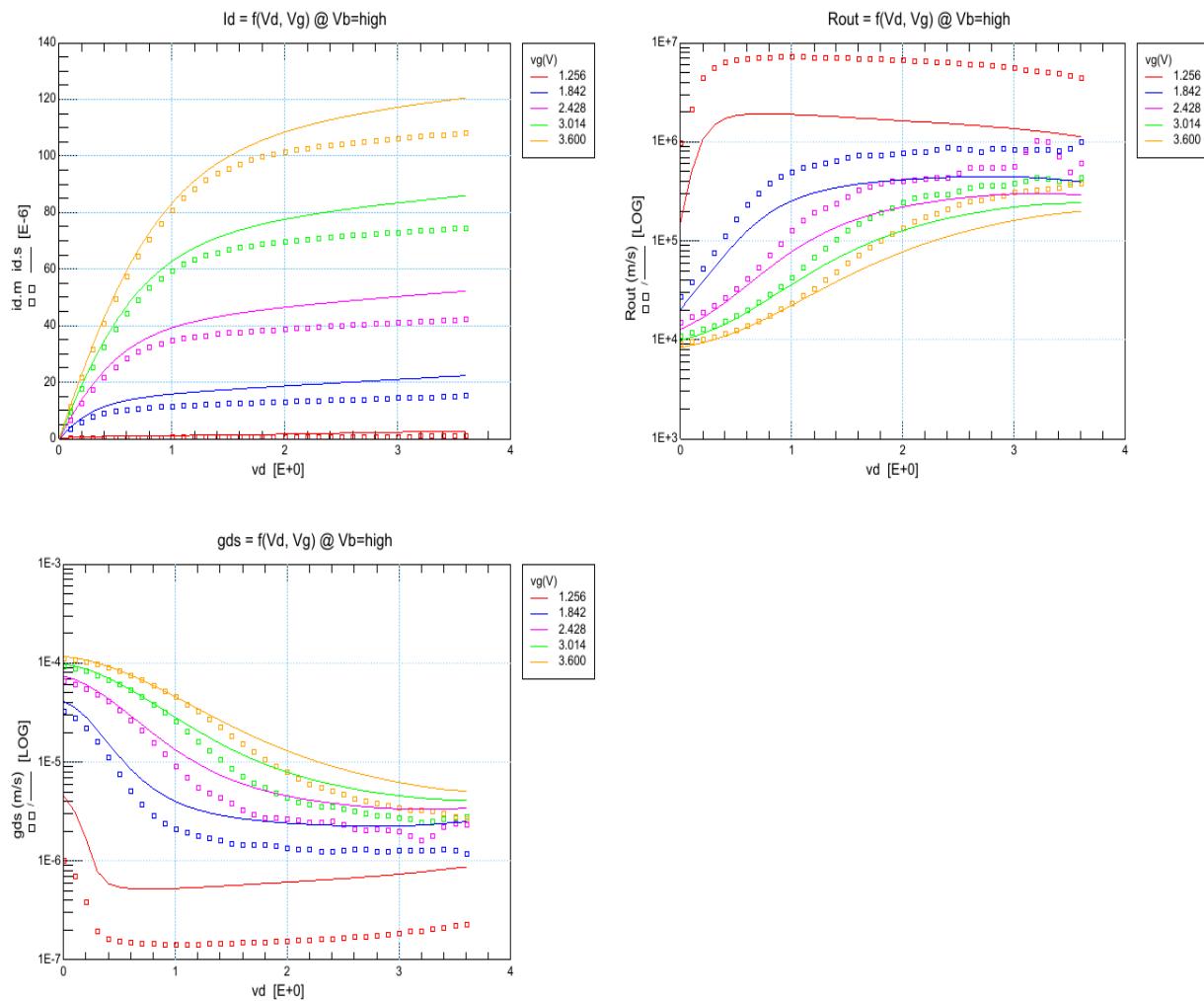
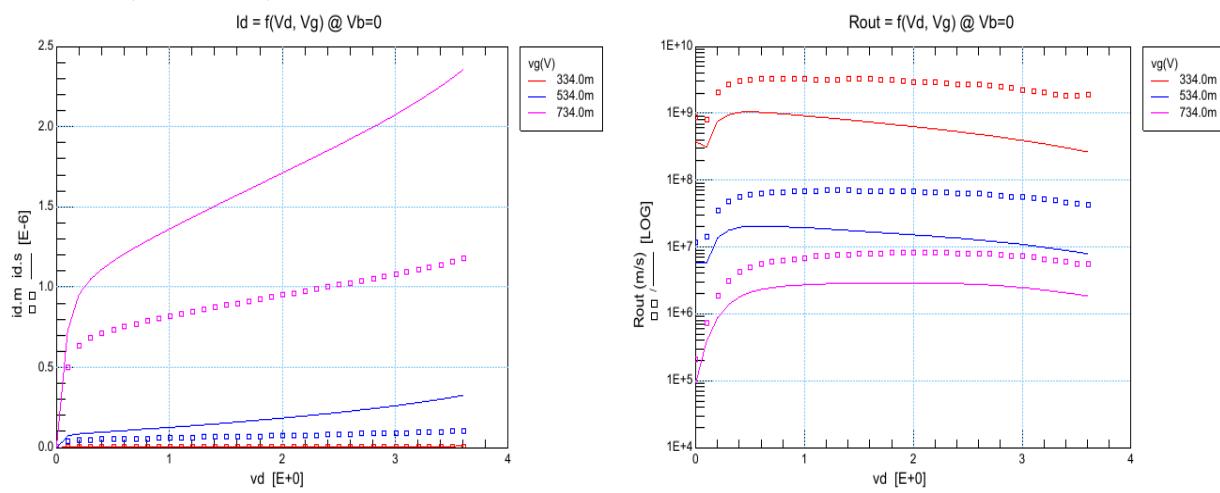


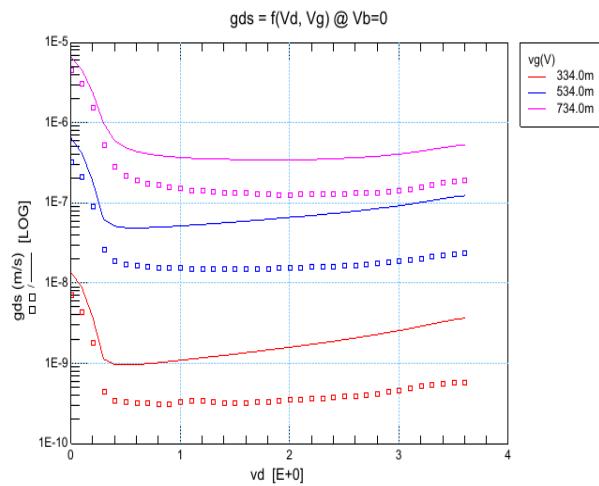


idvg, Ib,Ig, Vb = 0V, T = 125°C

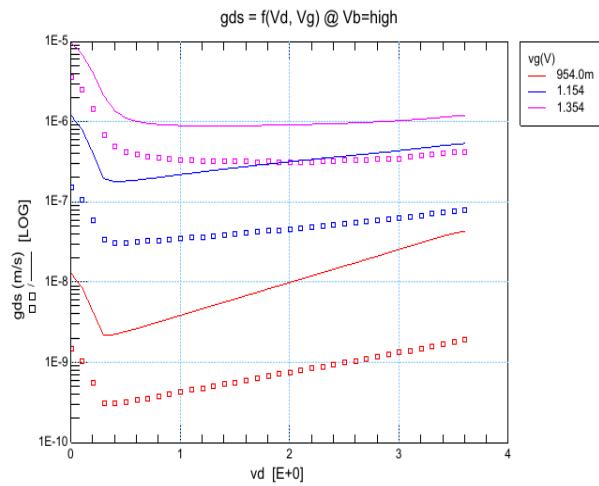
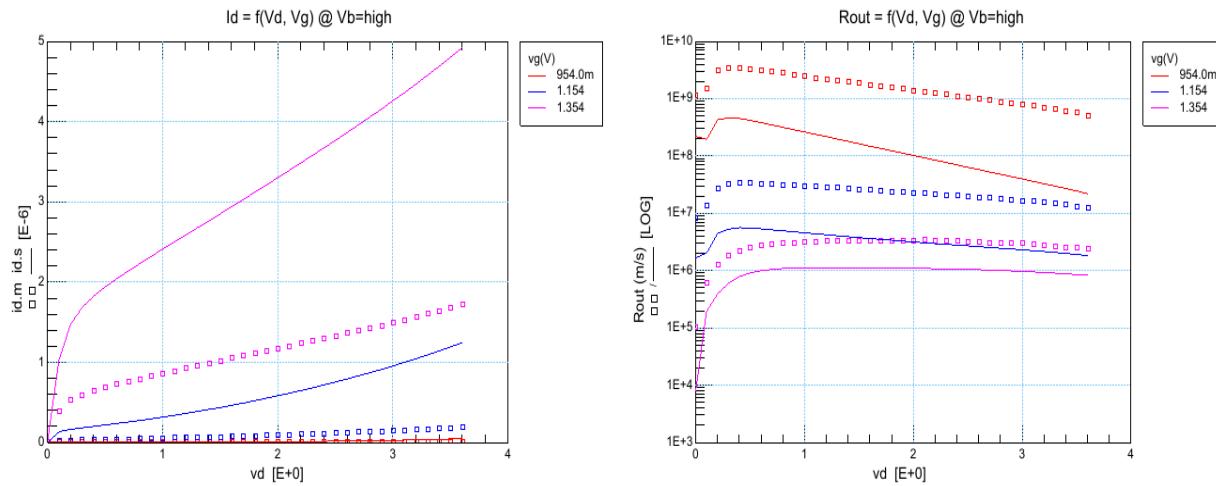


idvg, Ib,Ig, Vb = -3.6V, T = 125°C

idvd, Vb = 0V, T = 125°C


idvd_vbmin, Vb = -3.6V, T = 125°C

idvd_vth, Vb = 0V, T = 125°C


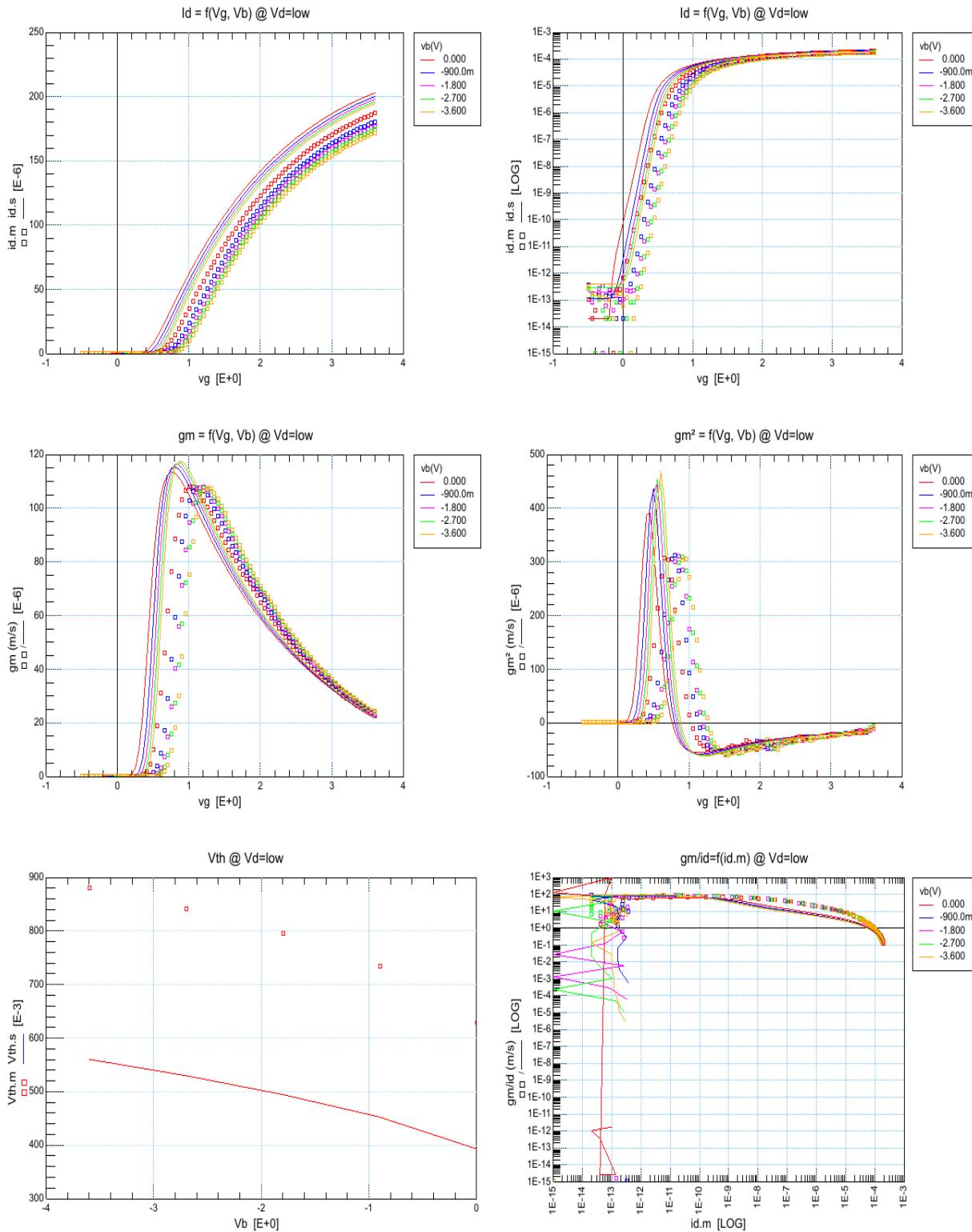


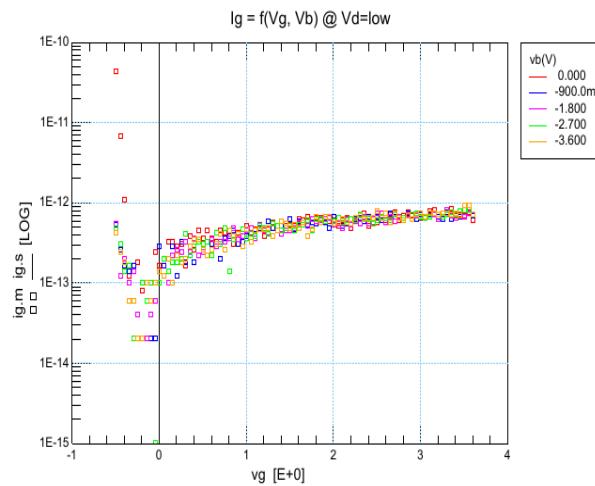
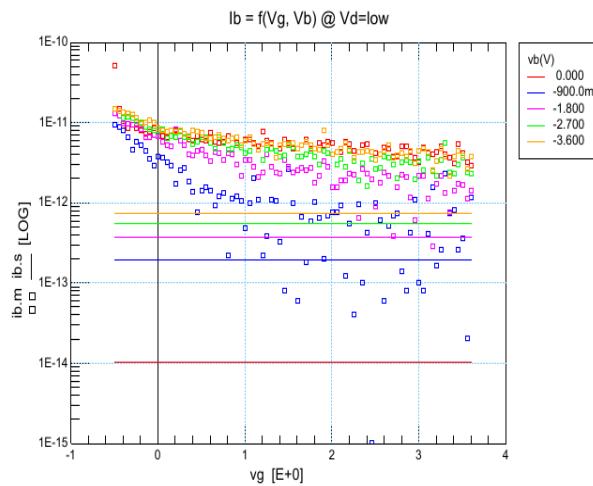
idvd_vth_vbmin, Vb = -3.6V, T = 125°C



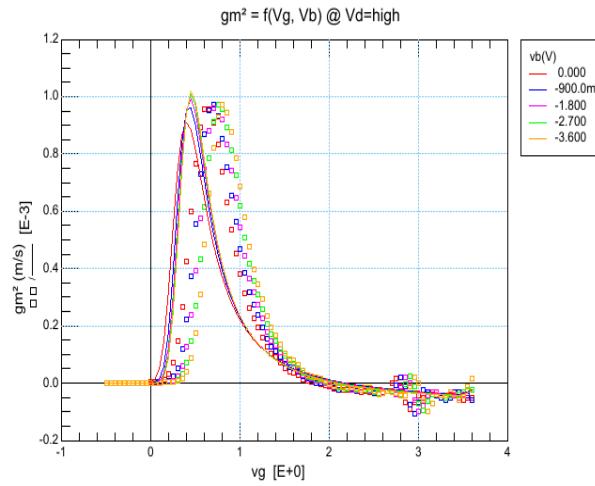
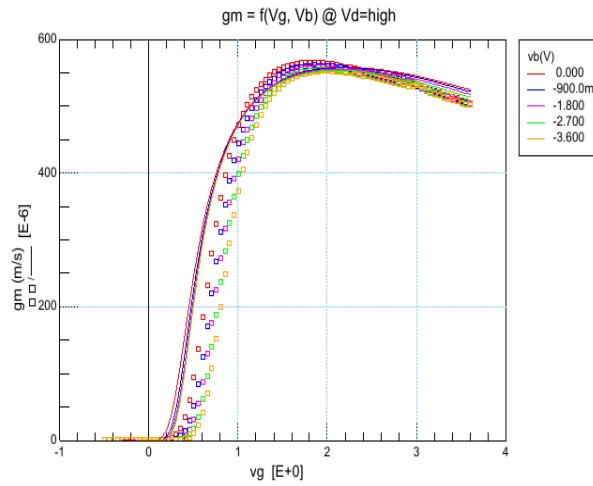
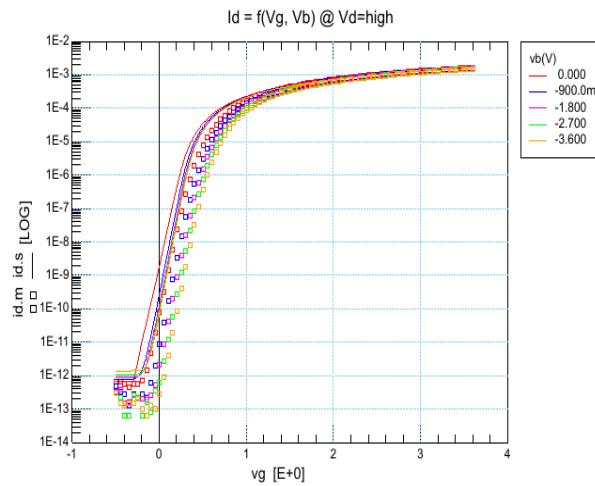
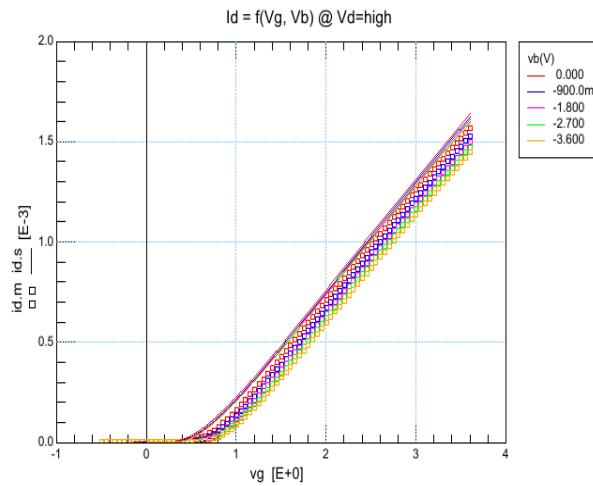
4.23 W02u0_L0u33_S558_2

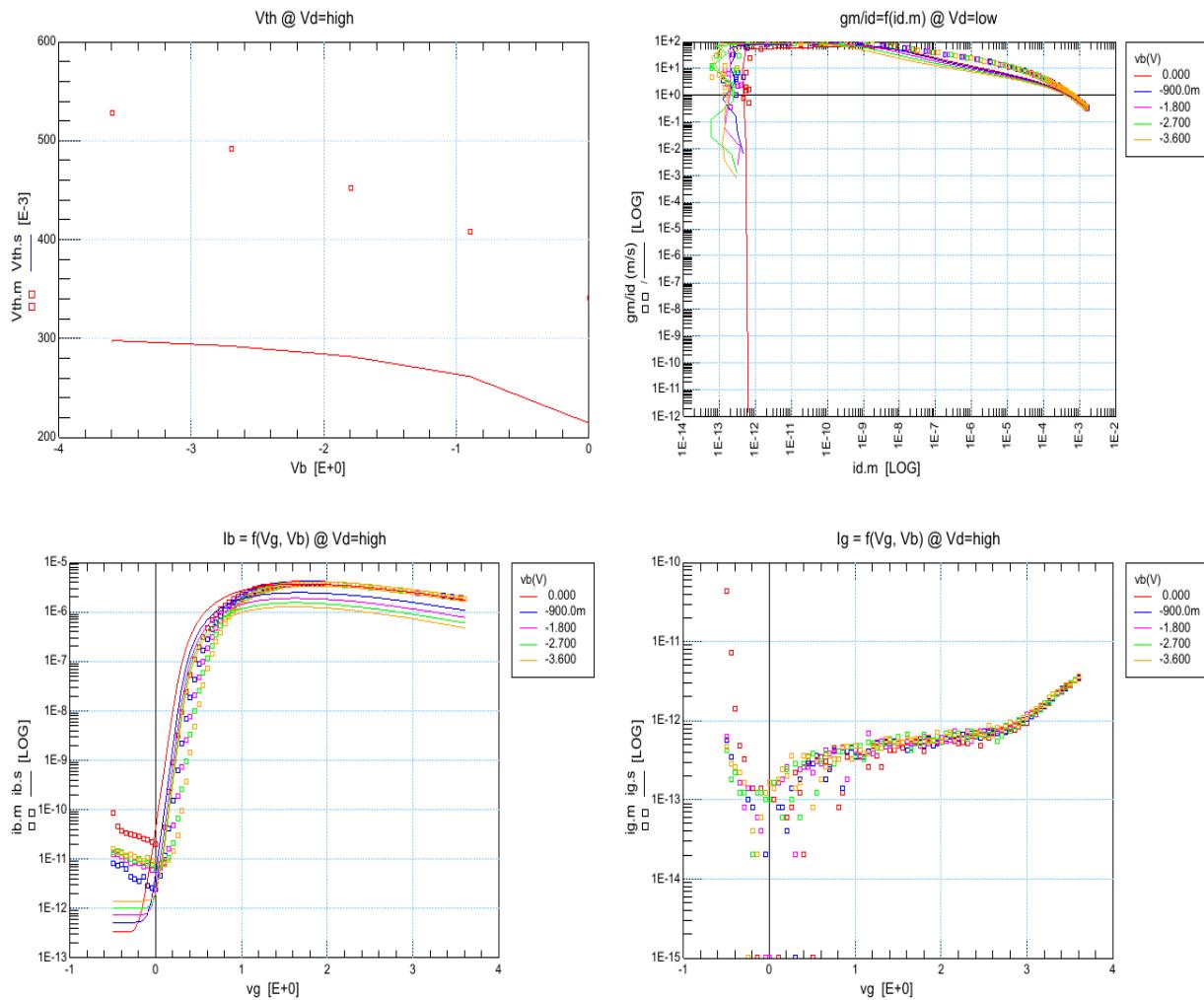
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



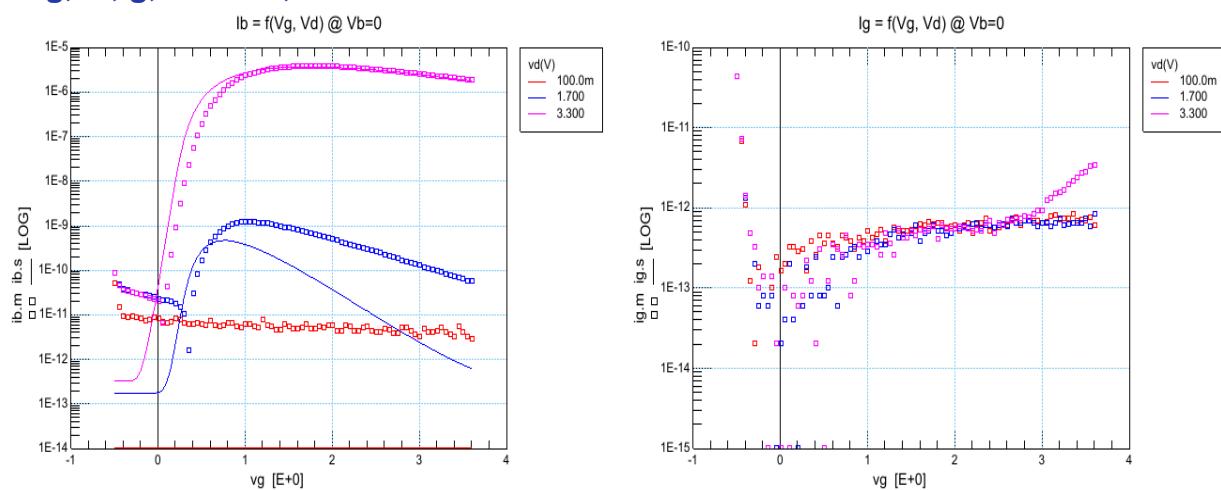


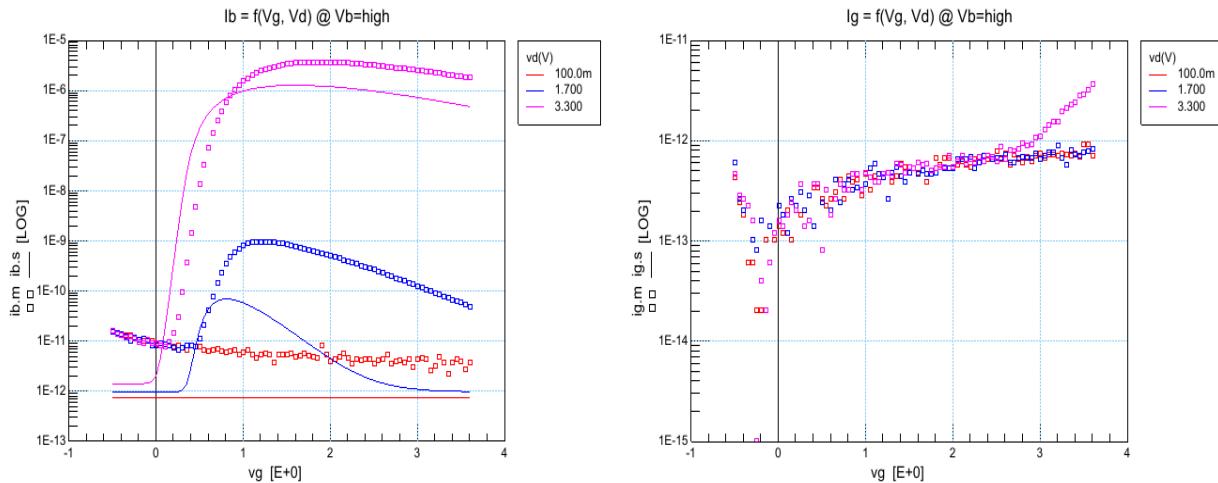
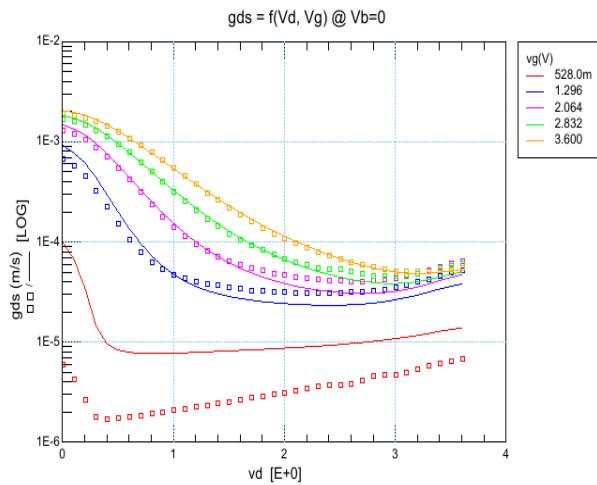
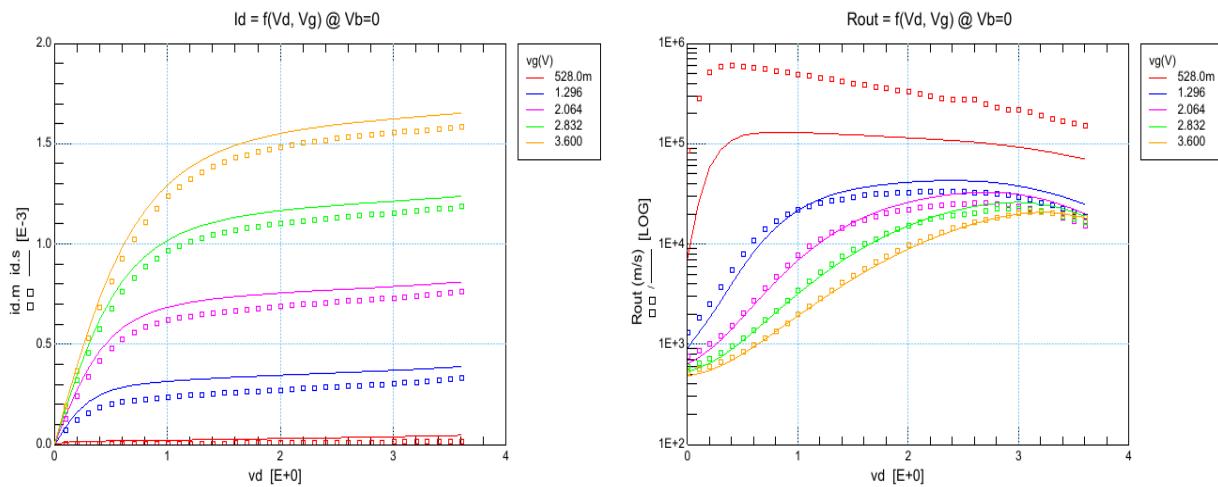
$idvg$, $Vd = 3.3V$, $T = 27^\circ C$

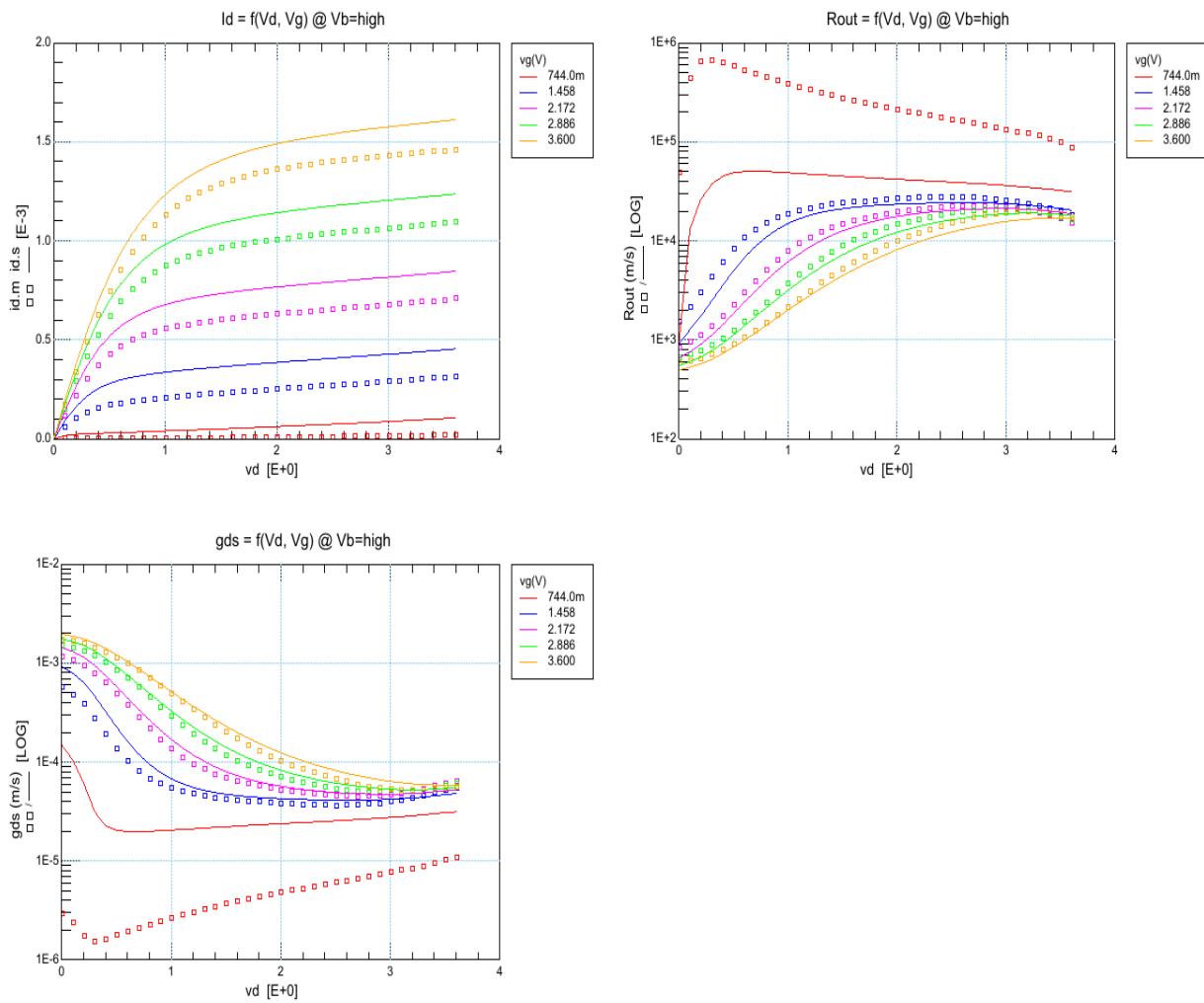
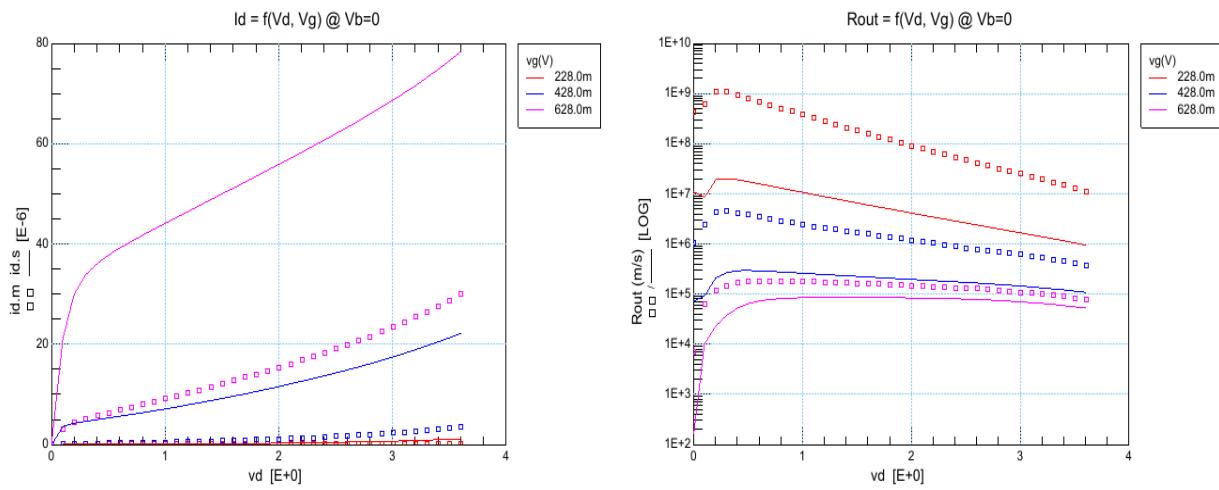


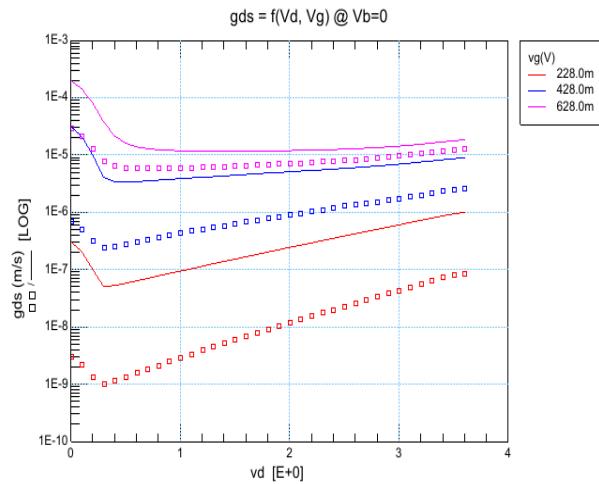


idvg, Ib, Ig, Vb = 0V, T = 27°C

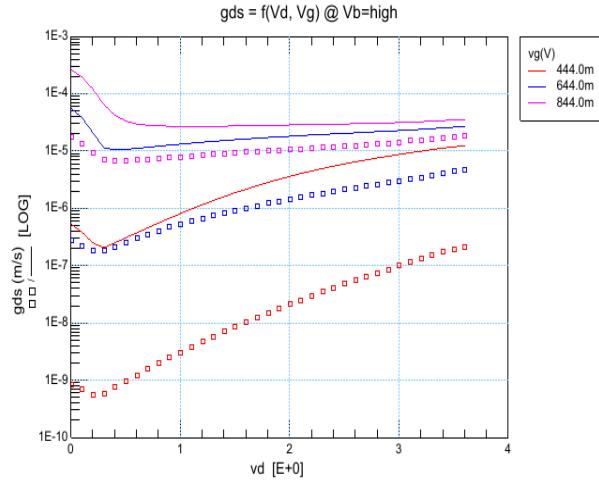
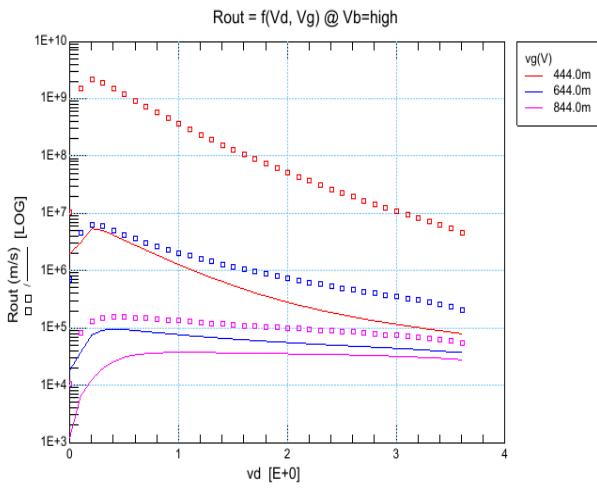
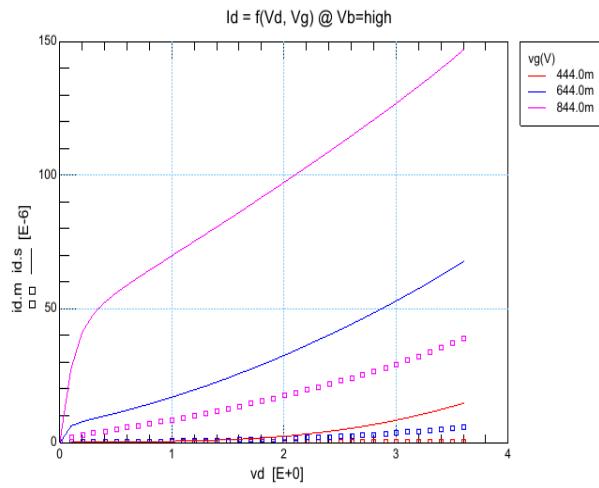


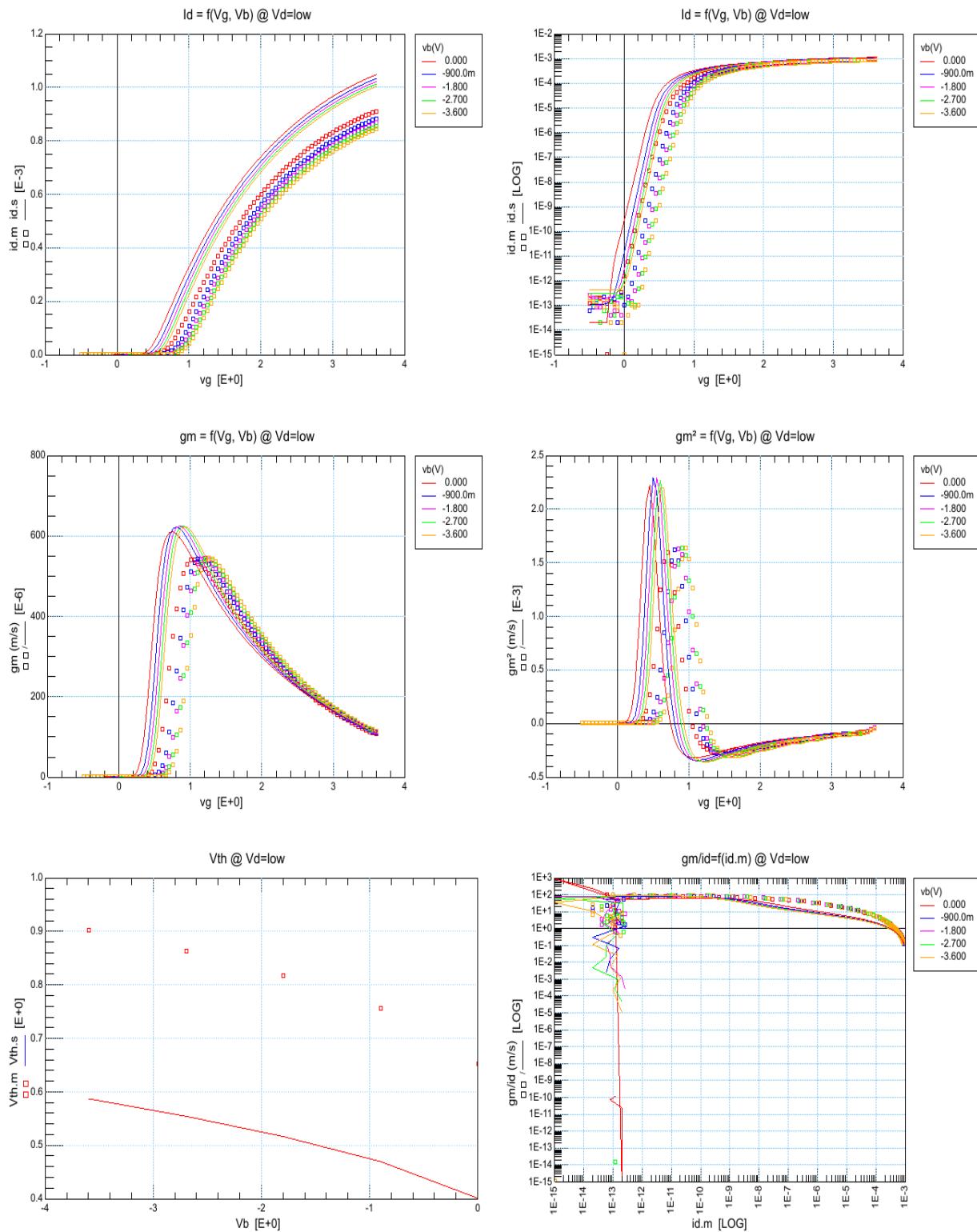
idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


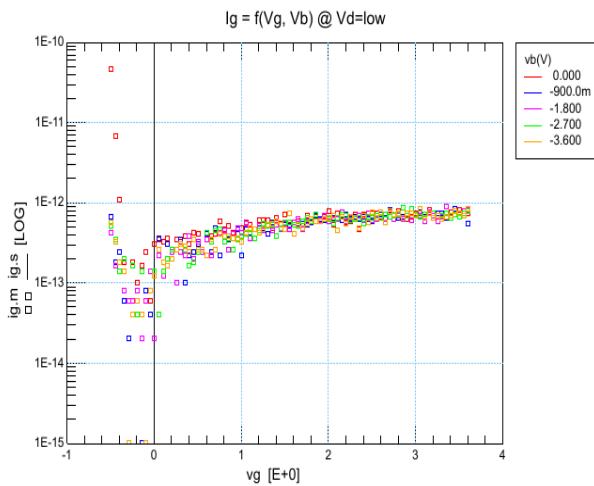
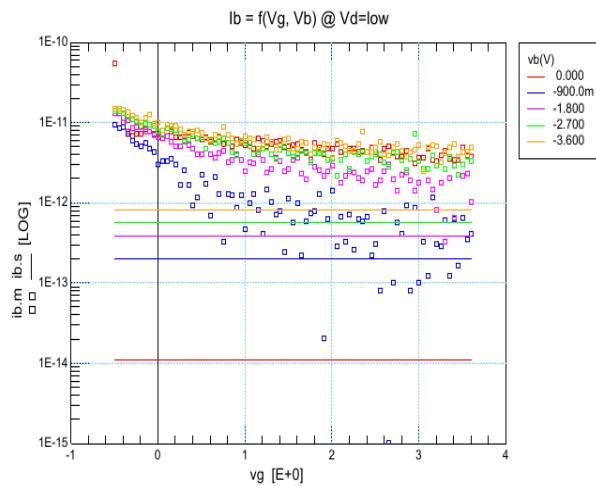
idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C




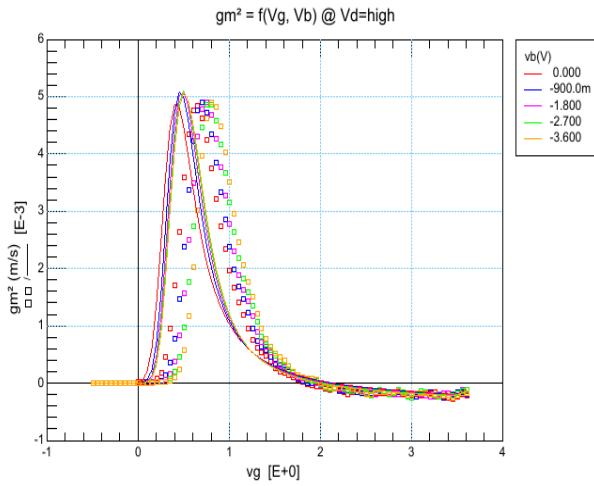
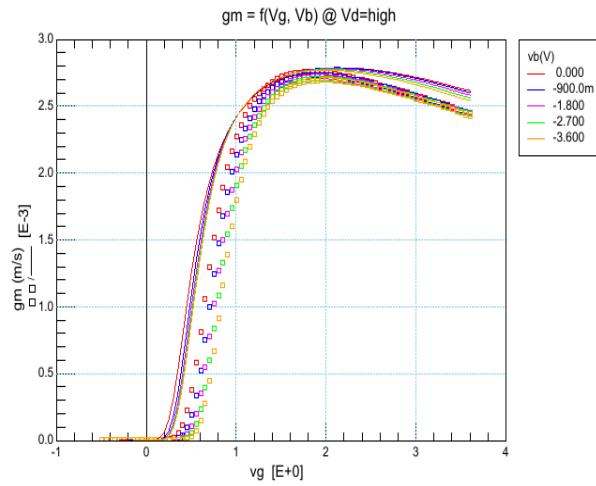
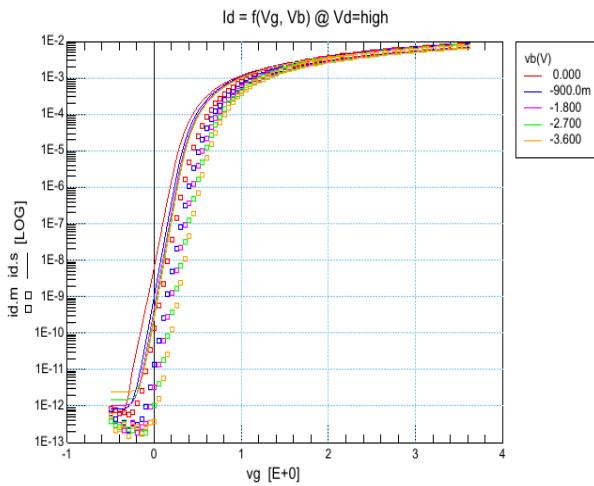
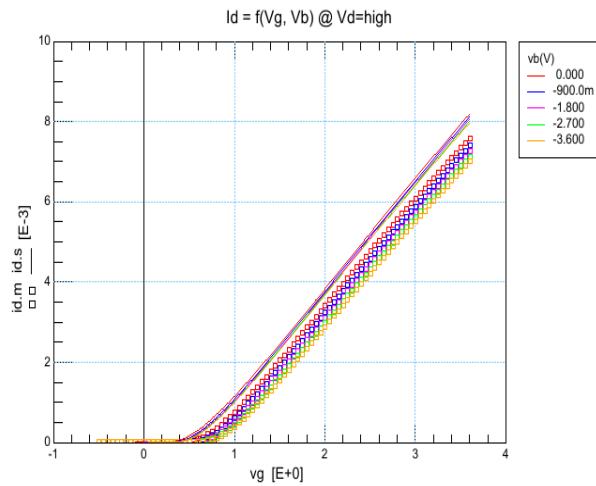
idvd_vth_vbmin, Vb = -3.6V, T = 27°C

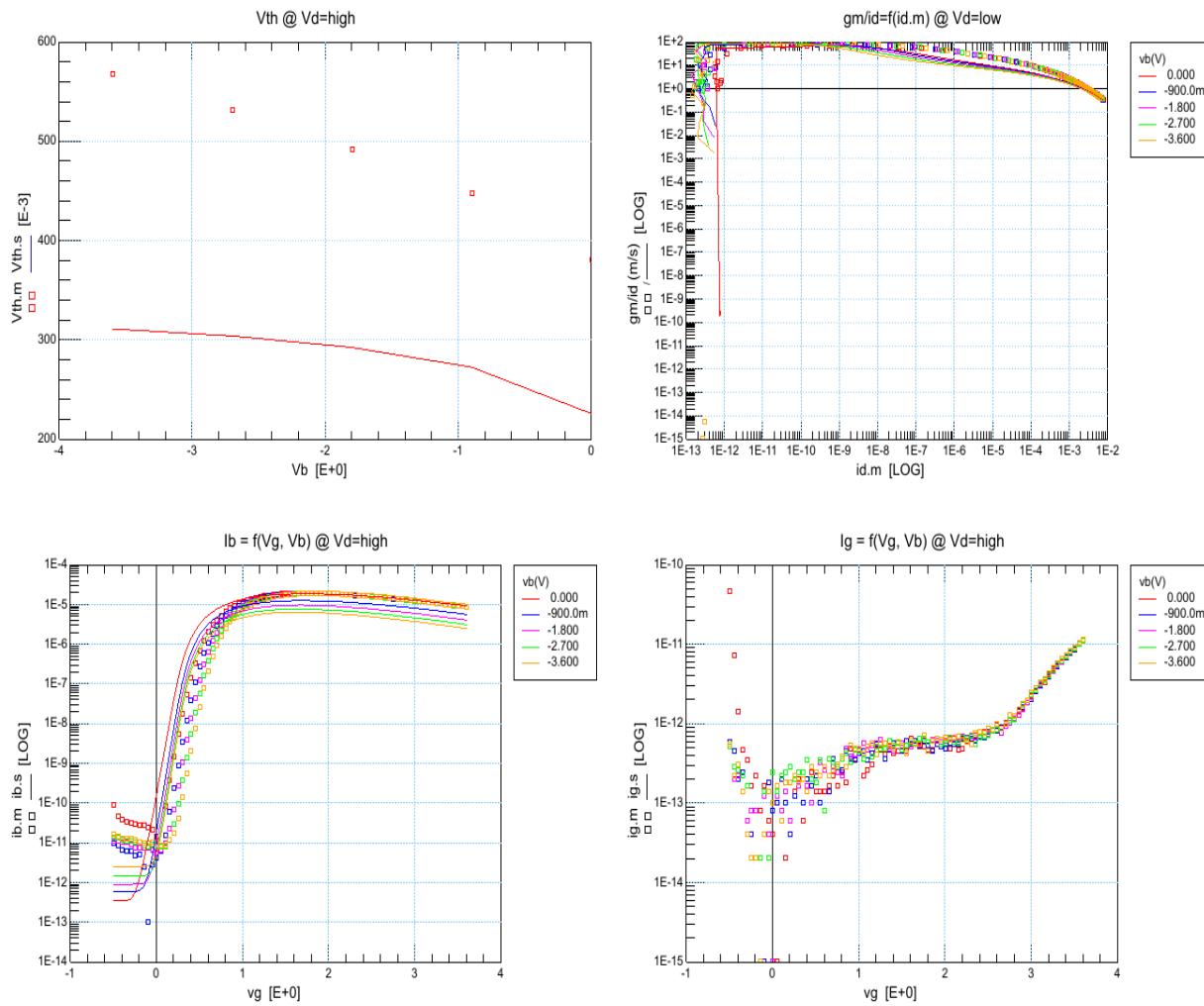


4.24 W10u0_L0u33_S556_2**idvg, Vd = 0.1V, T = 27°C**

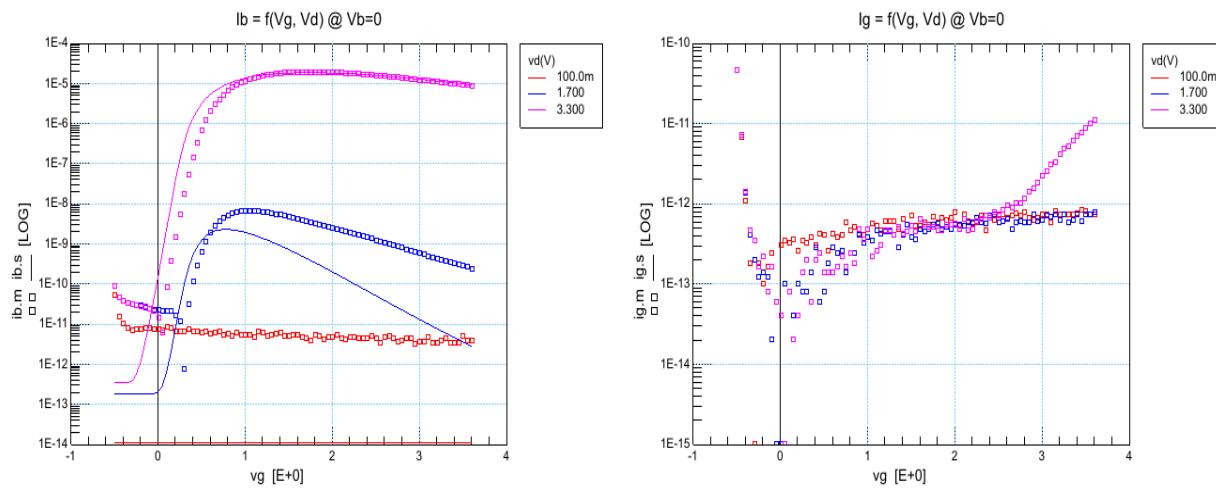


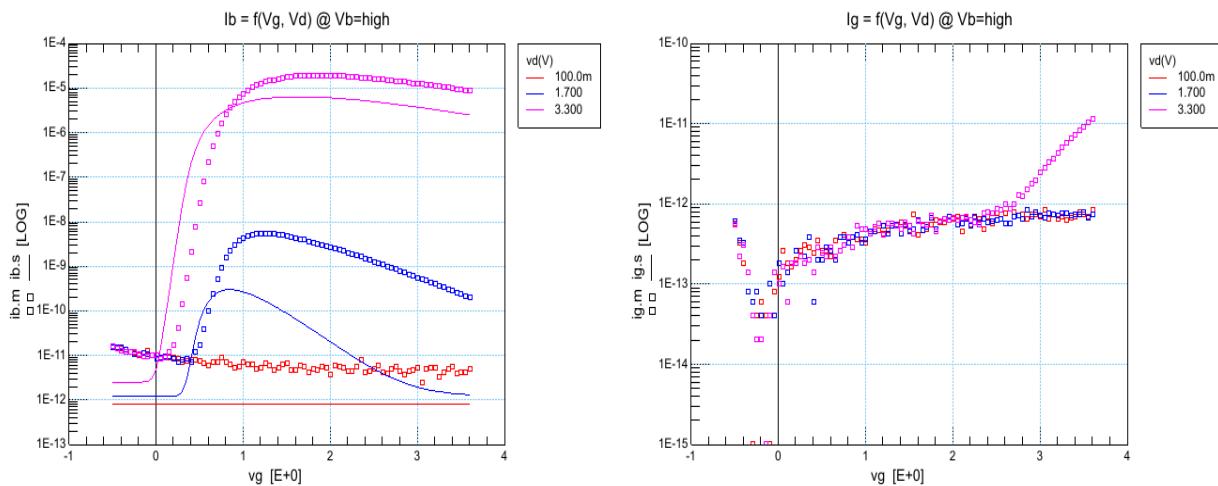
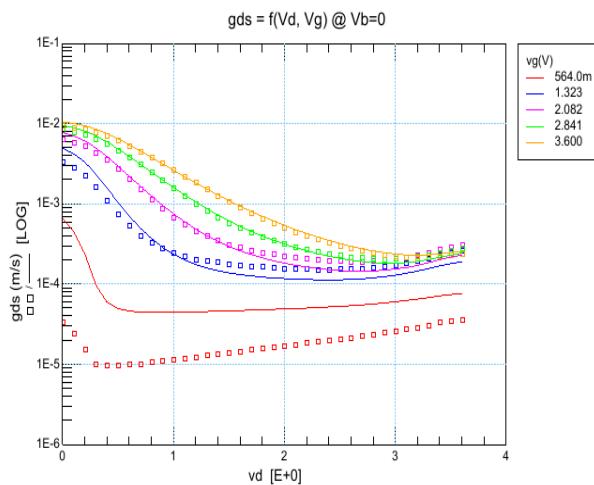
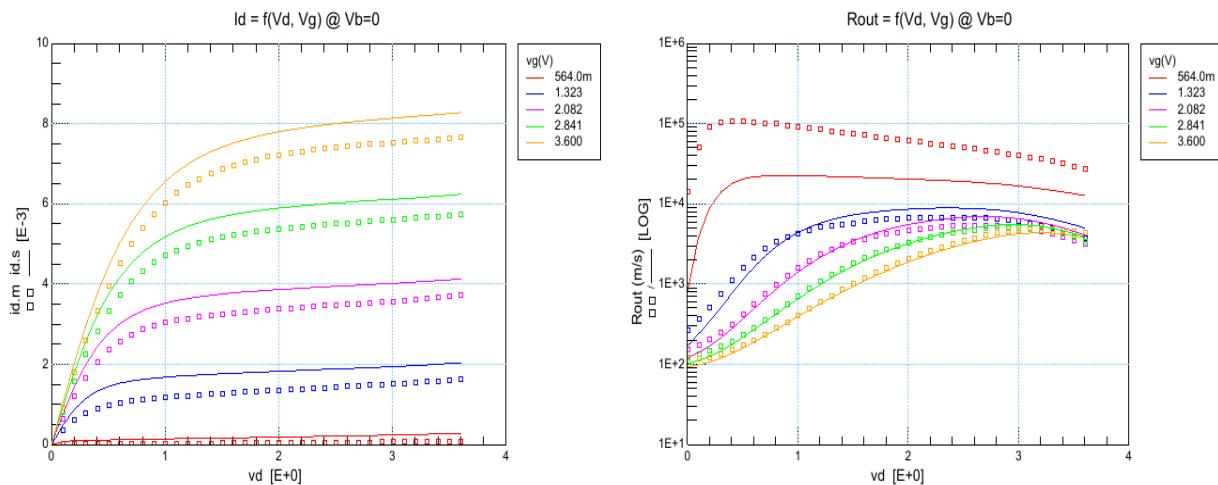
$i_{dvg}, V_d = 3.3V, T = 27^\circ\text{C}$

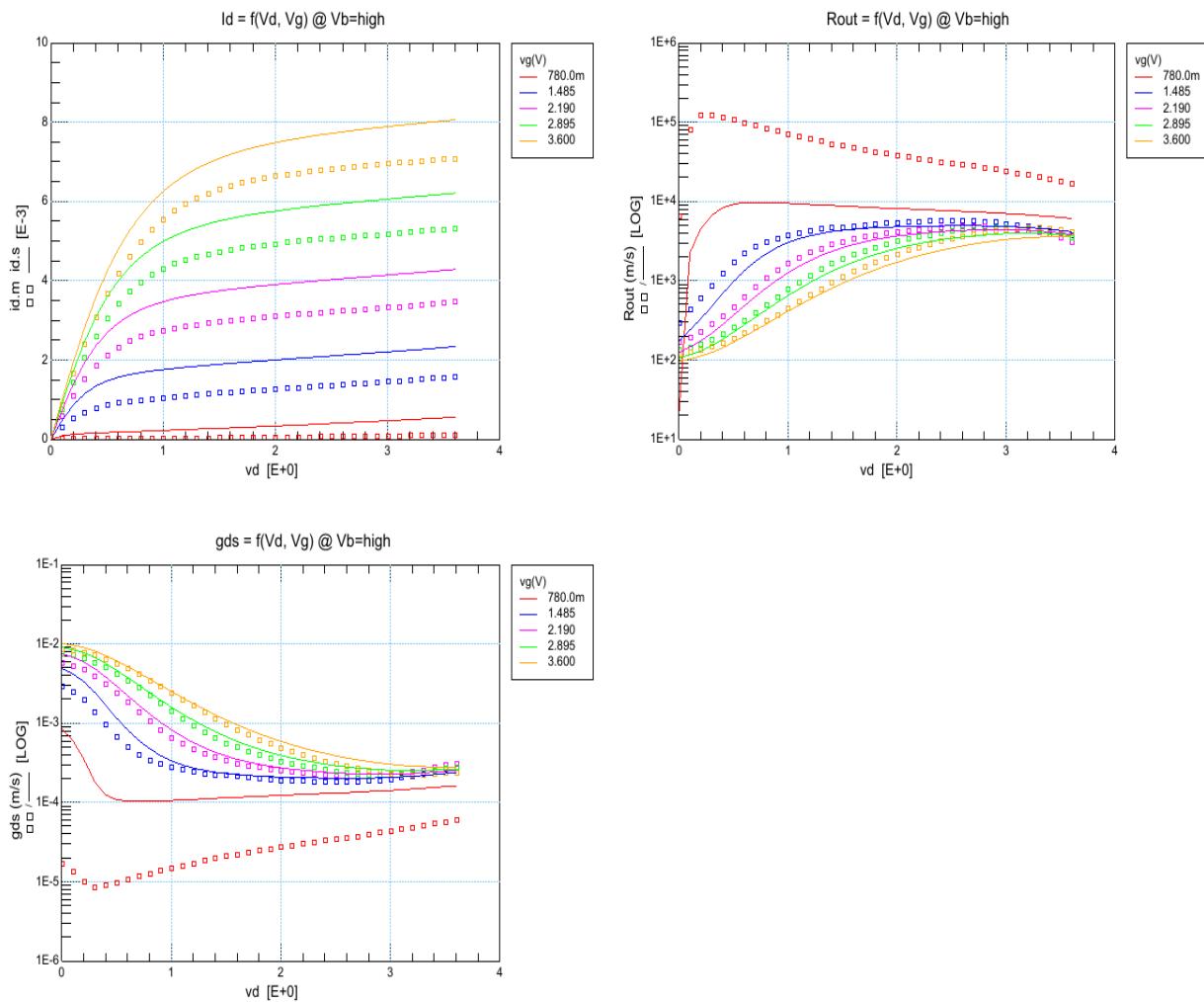
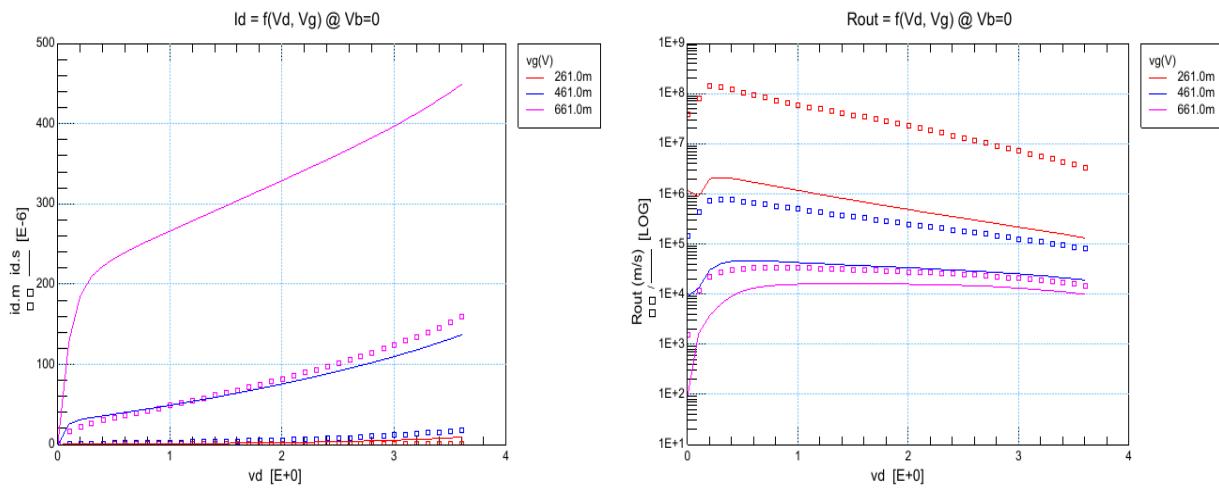


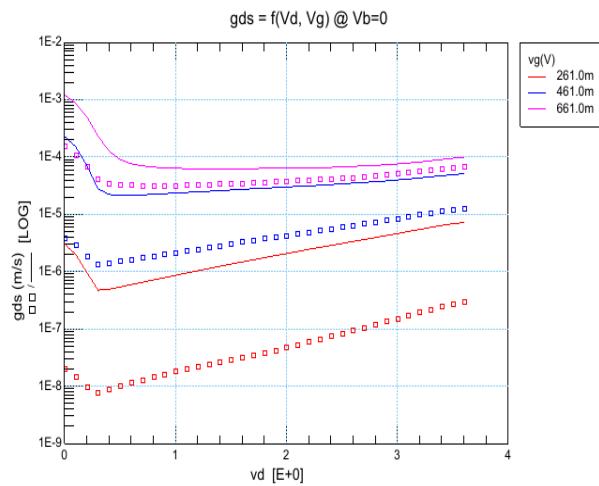


$i_{dvg}, I_b, I_g, V_b = 0V, T = 27^\circ C$

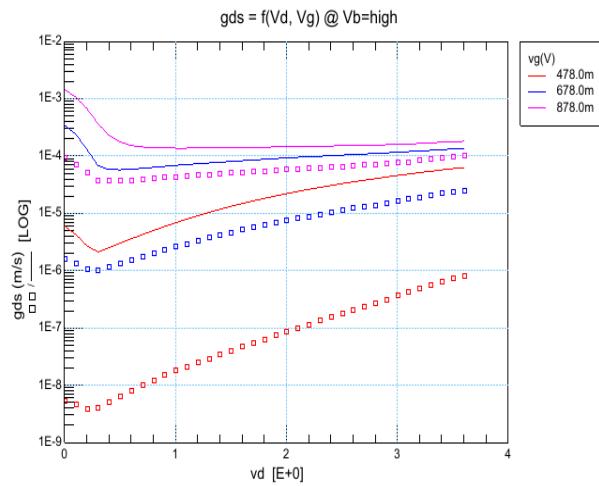
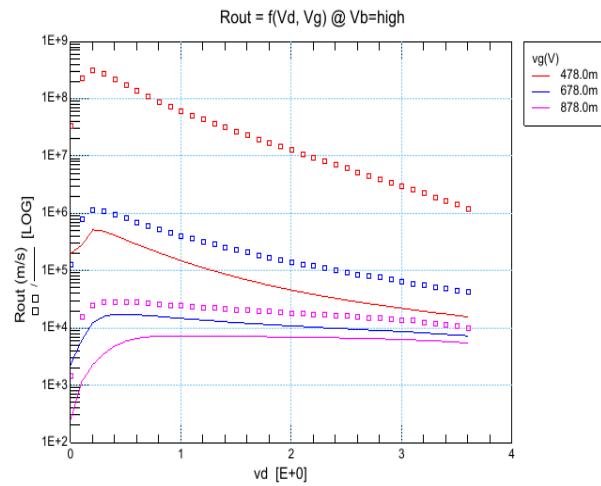
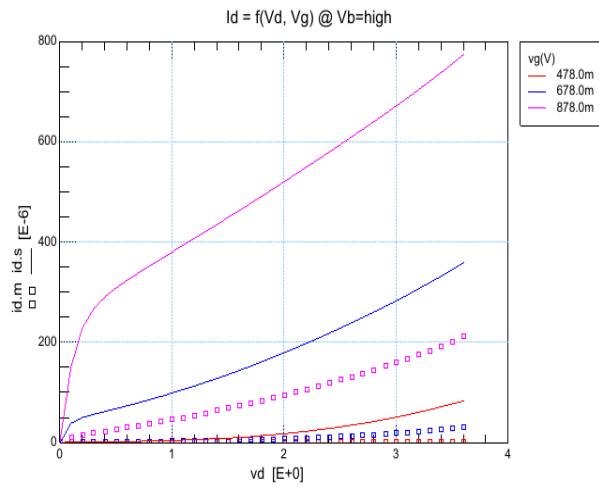


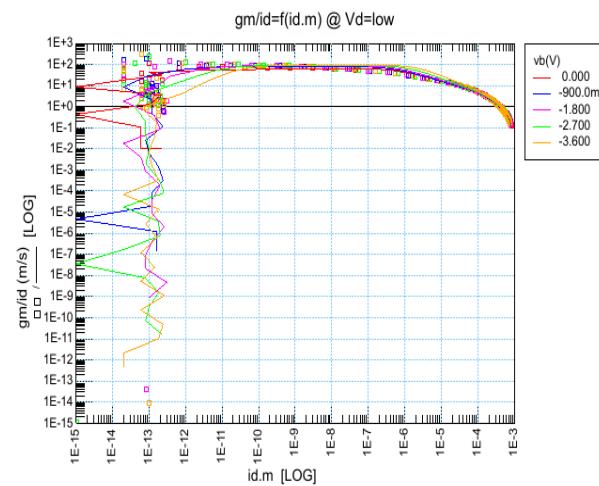
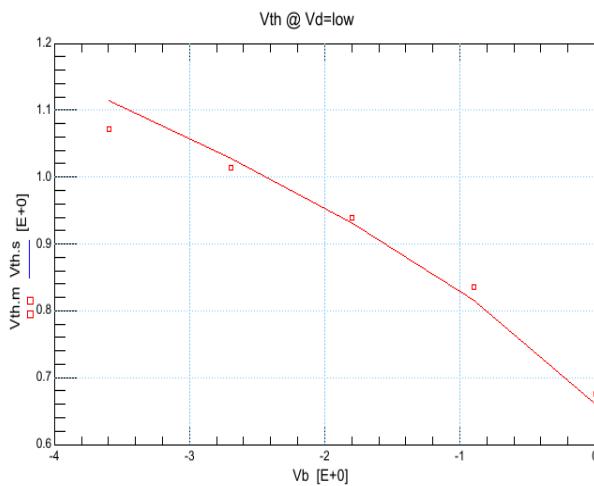
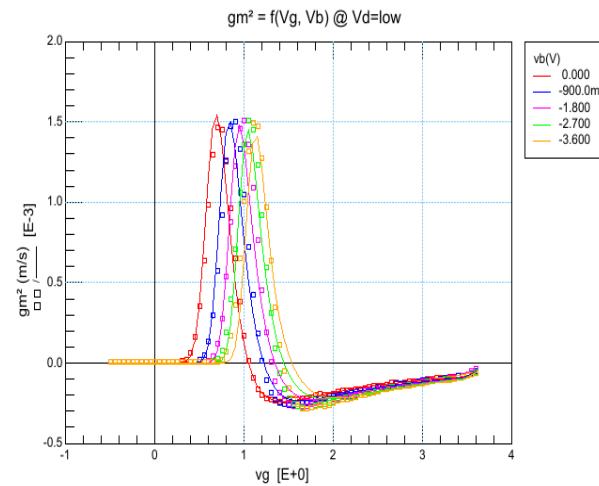
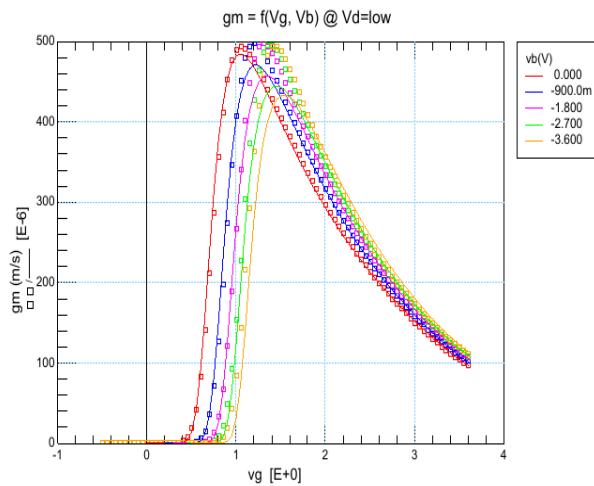
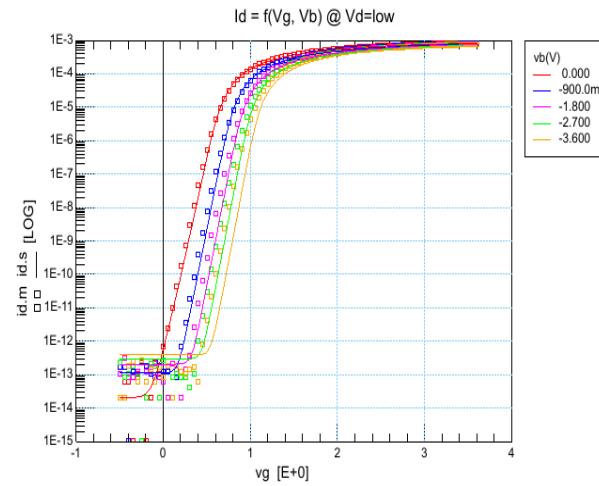
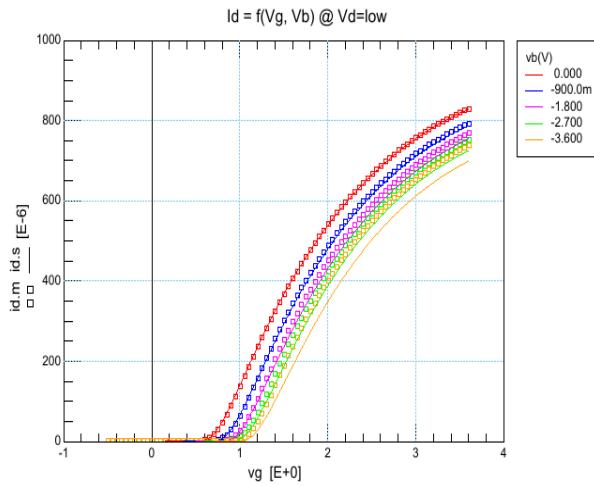
idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


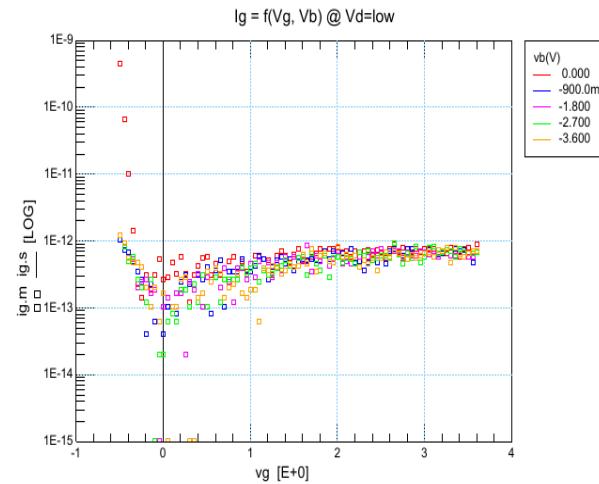
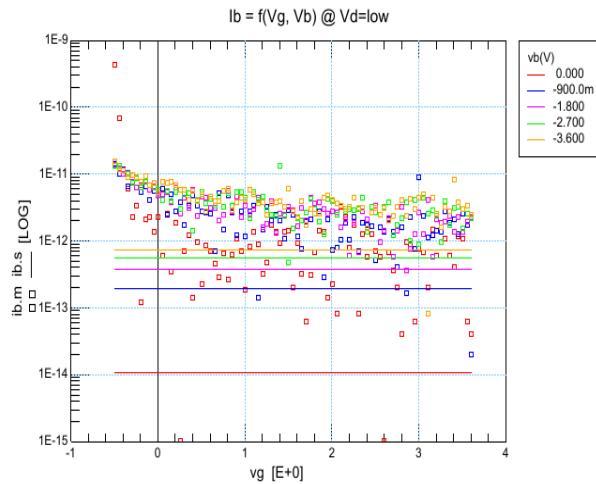
idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C




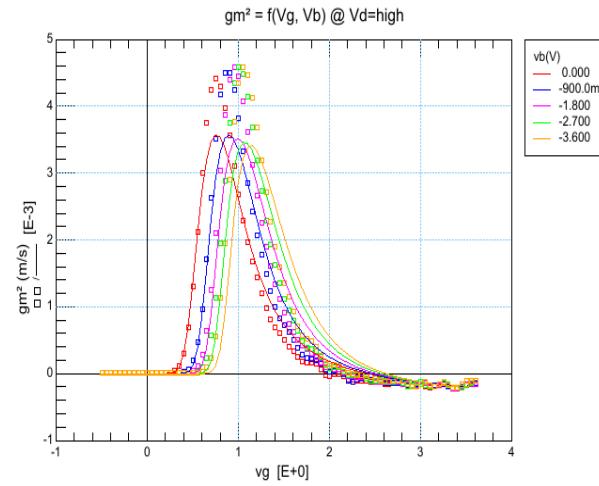
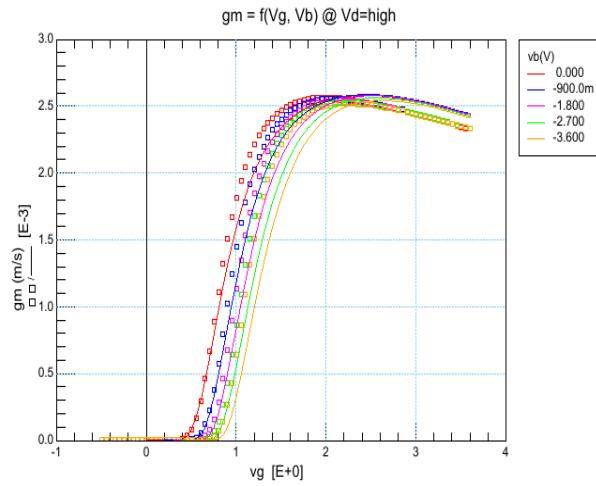
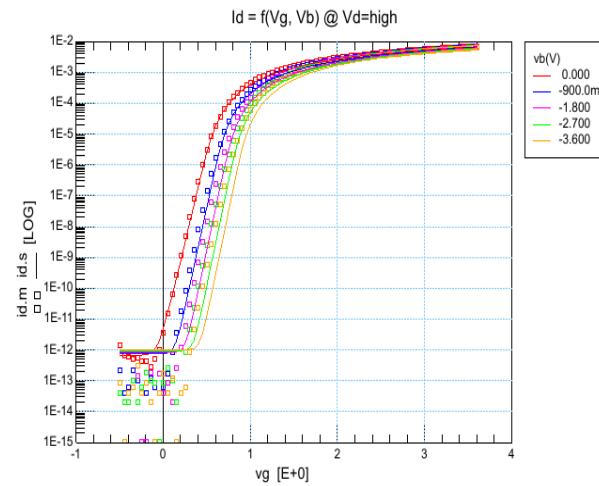
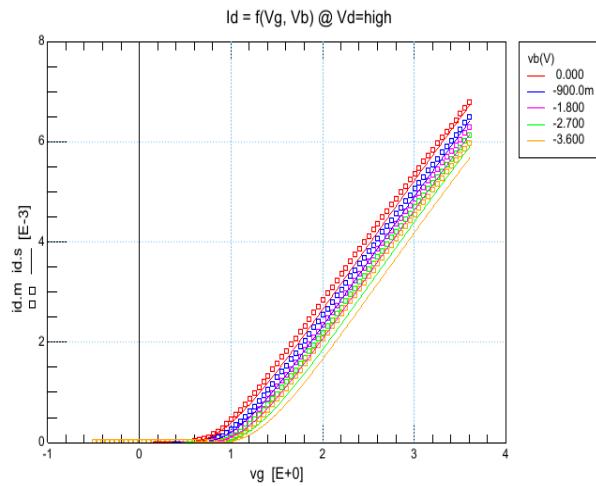
idvd_vth_vbmin, Vb = -3.6V, T = 27°C

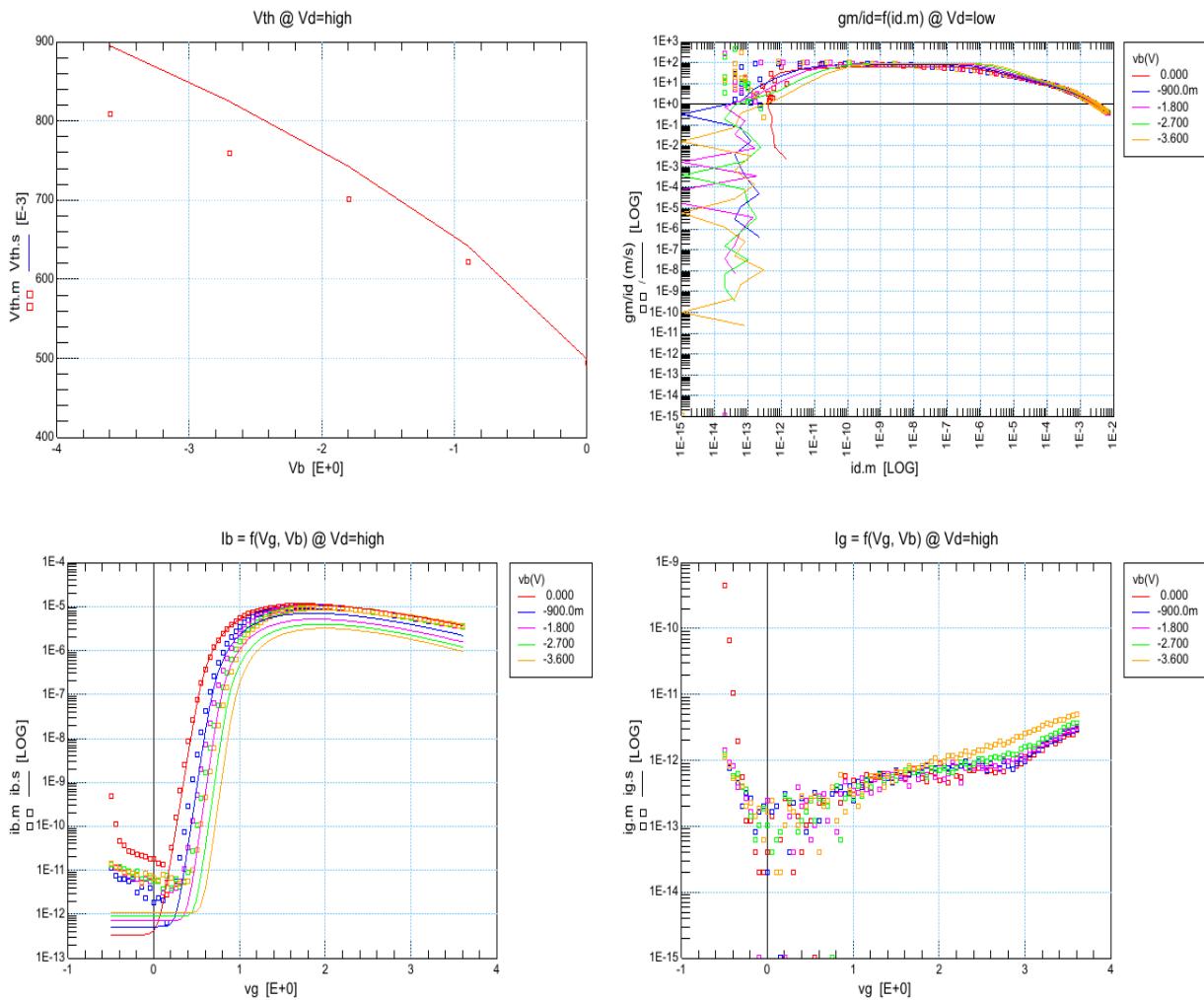


4.25 W10u0_L0u4_T356_S387_4**idvg, Vd = 0.1V, T = 27°C**

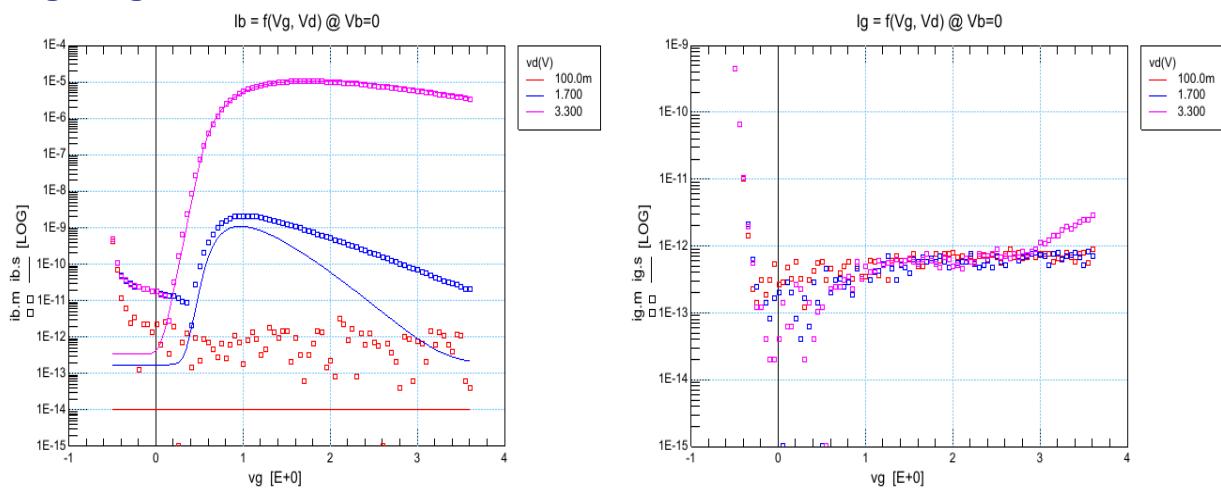


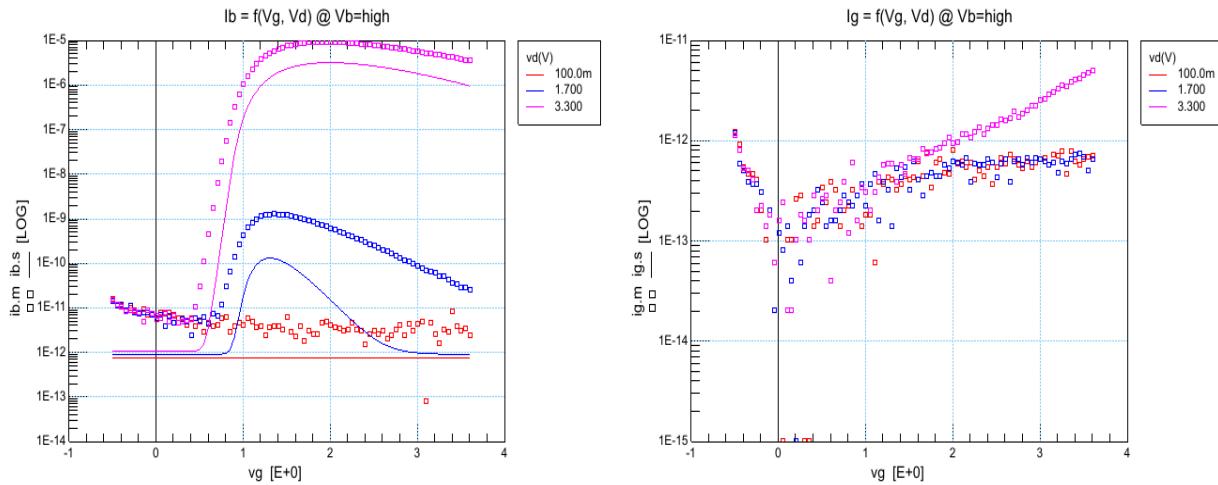
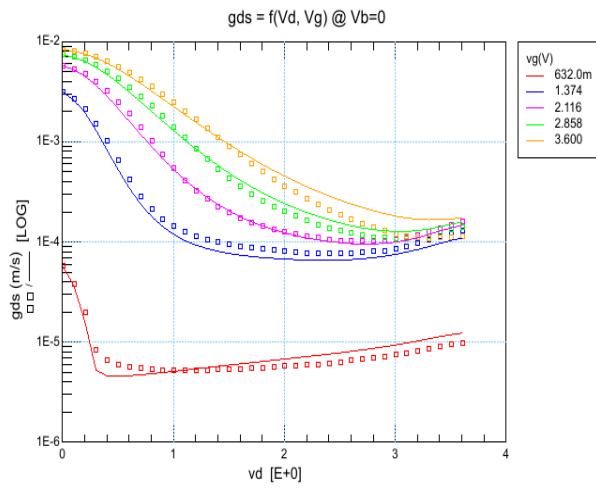
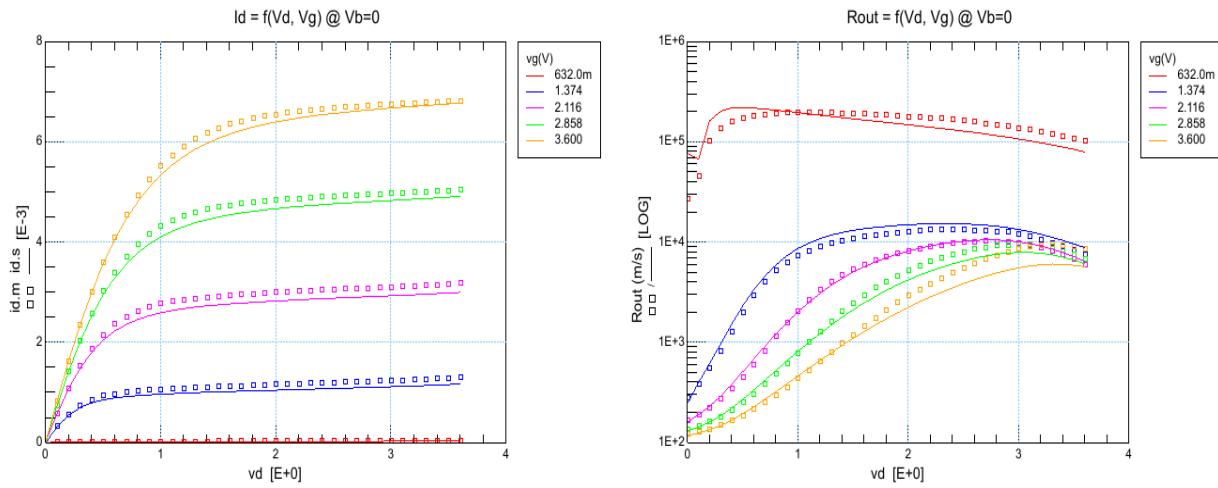
$idvg, Vd = 3.3V, T = 27^\circ C$

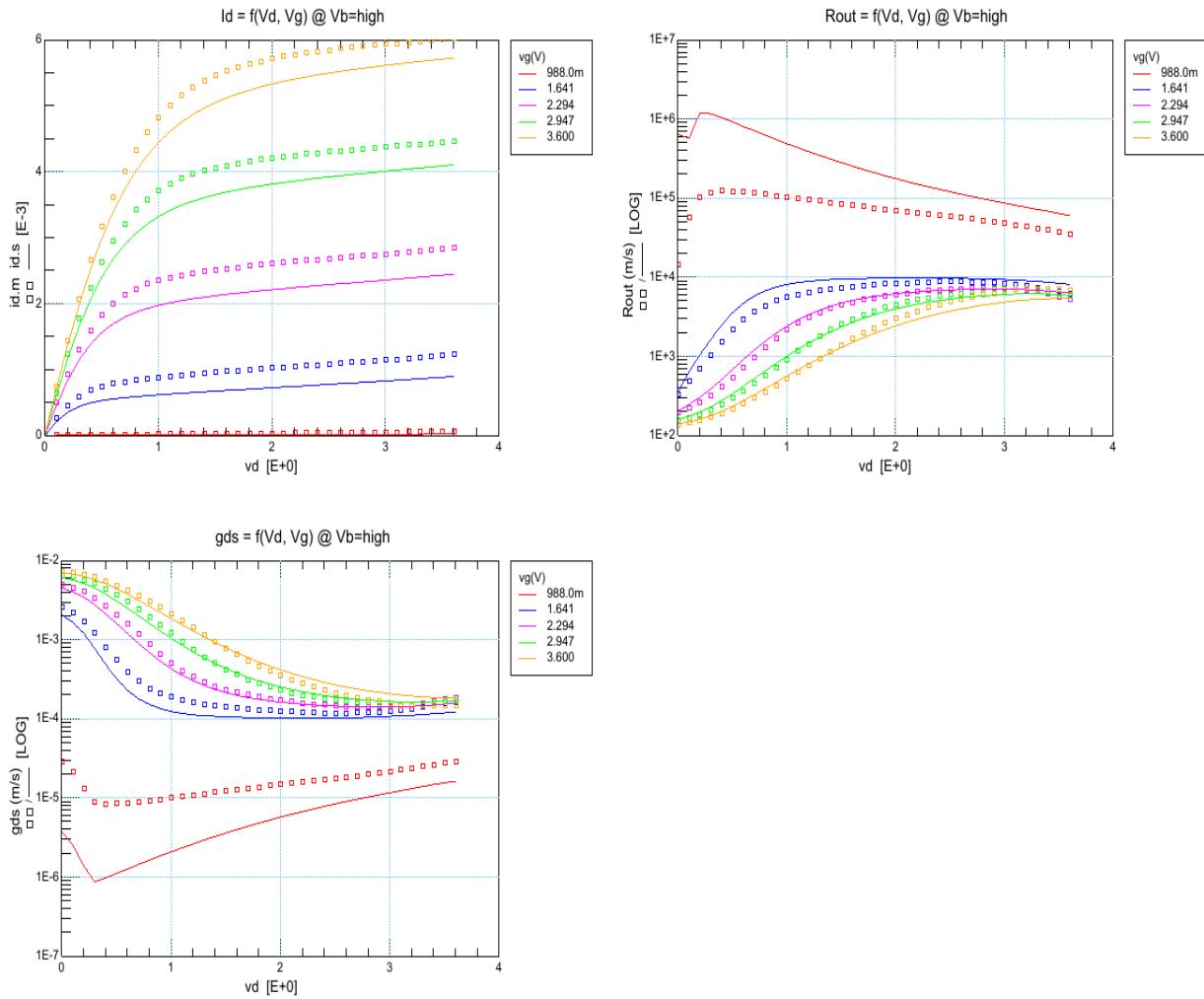
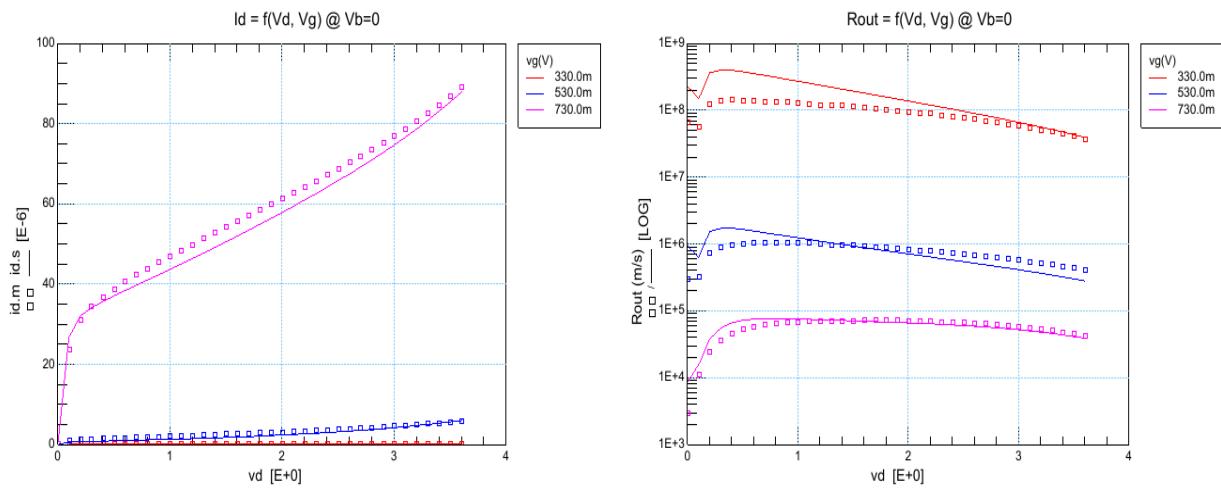


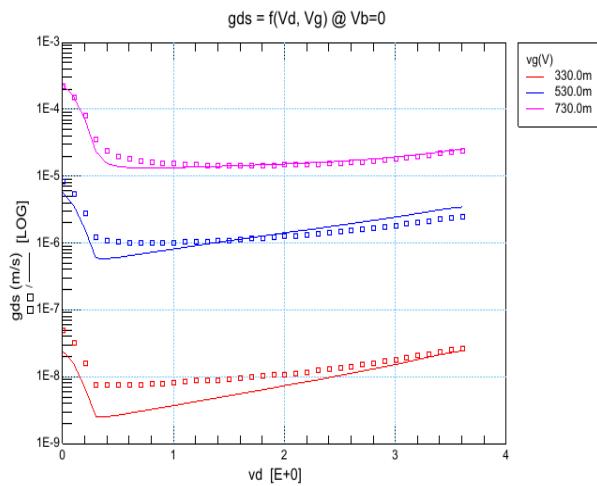


id_{vg} , I_b , I_g , $V_b = 0V$, $T = 27^\circ C$

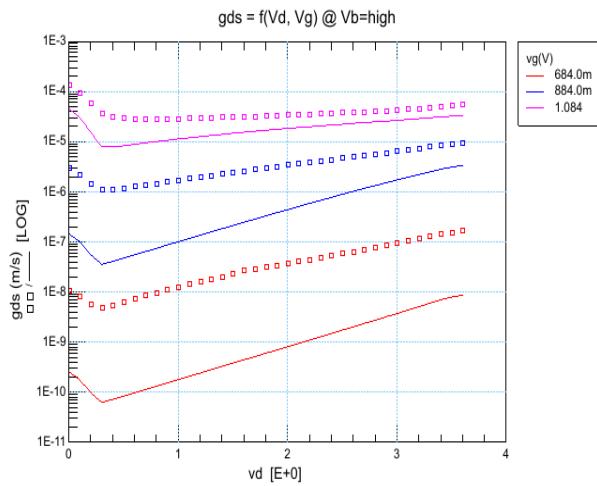
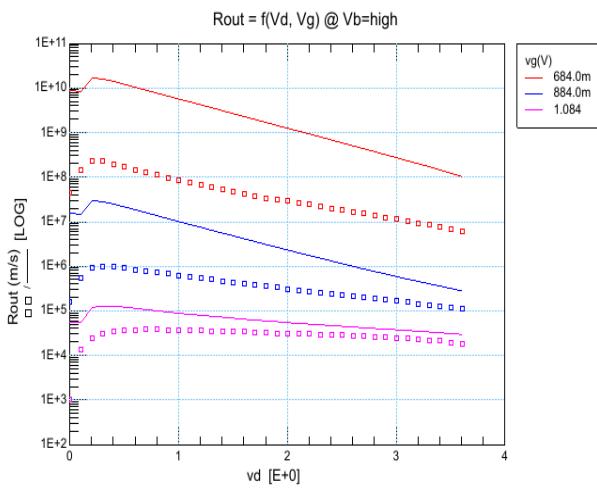
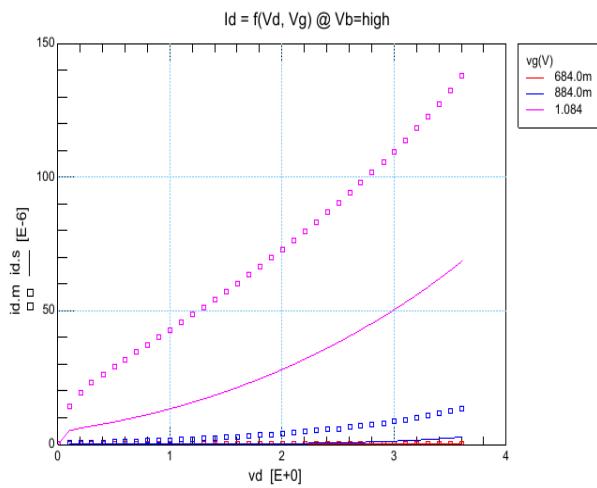


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


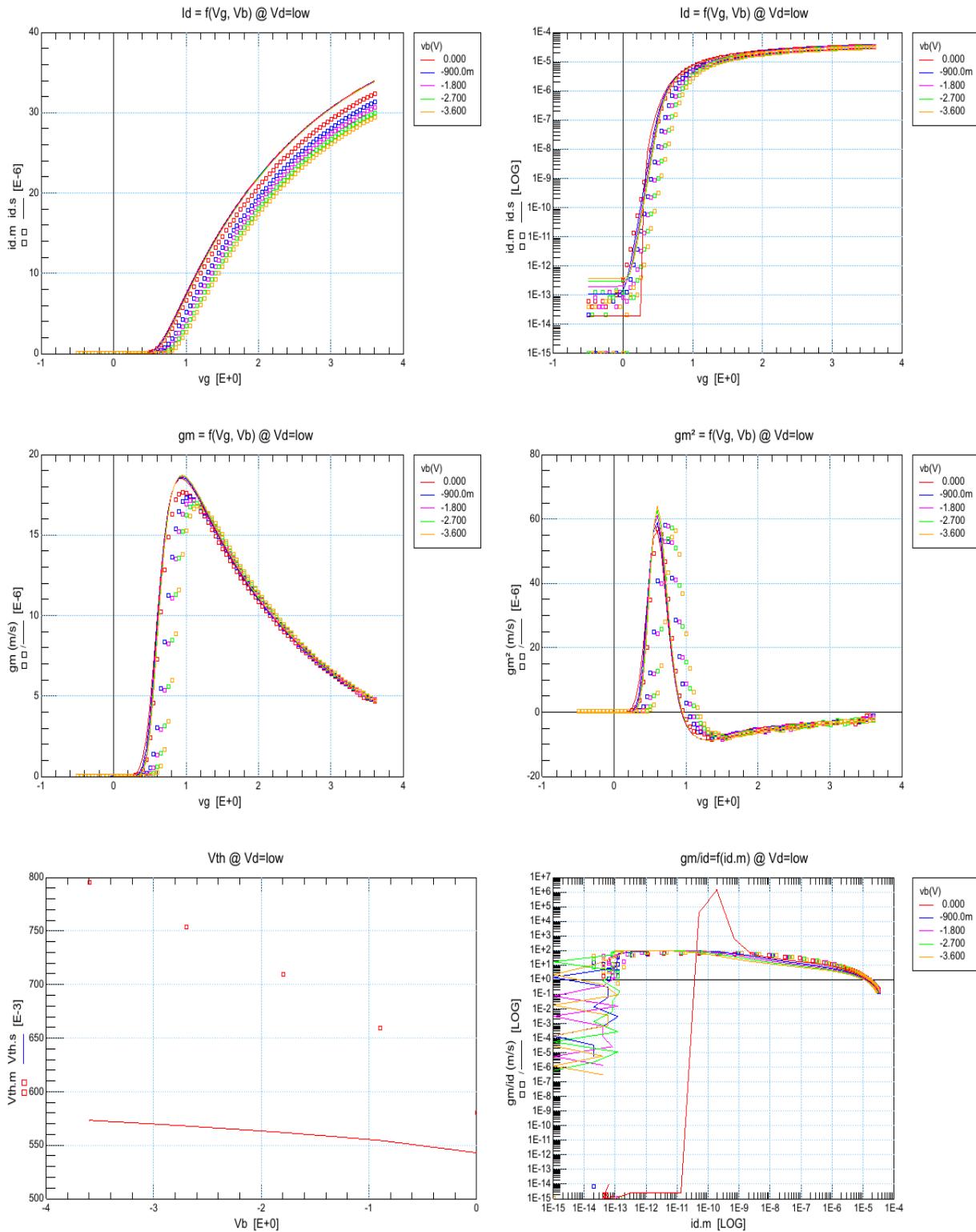


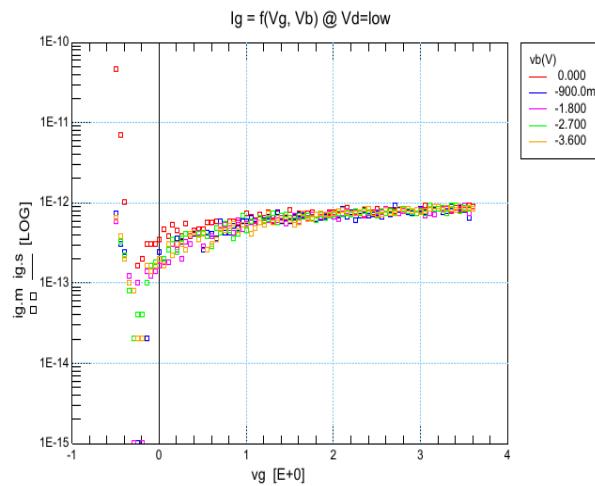
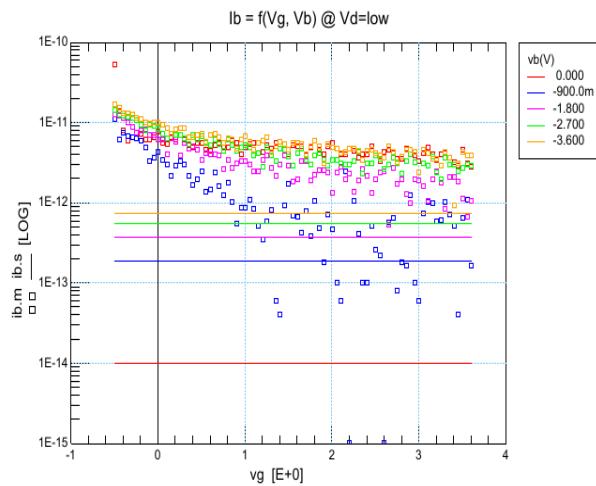
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



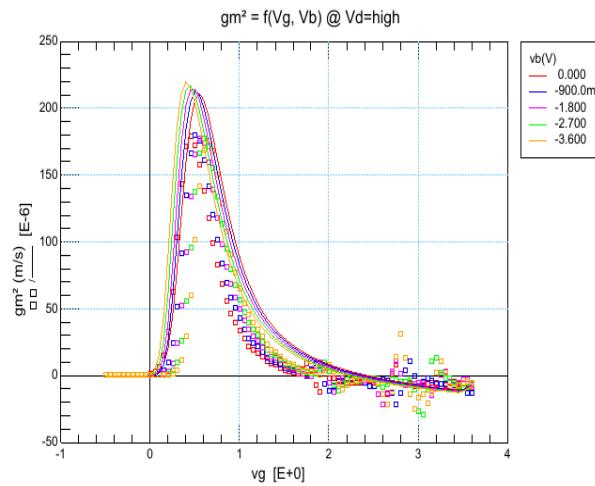
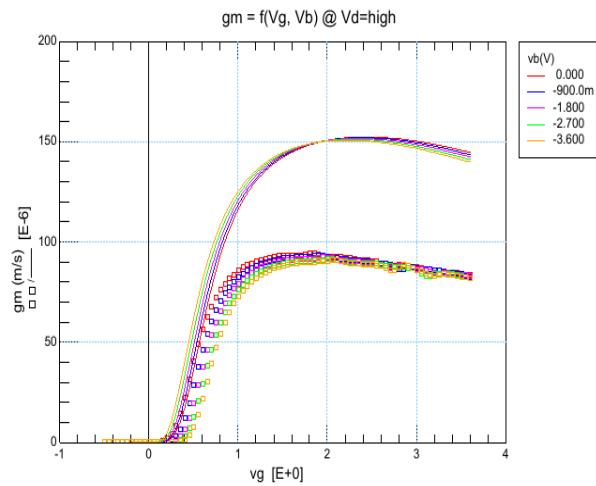
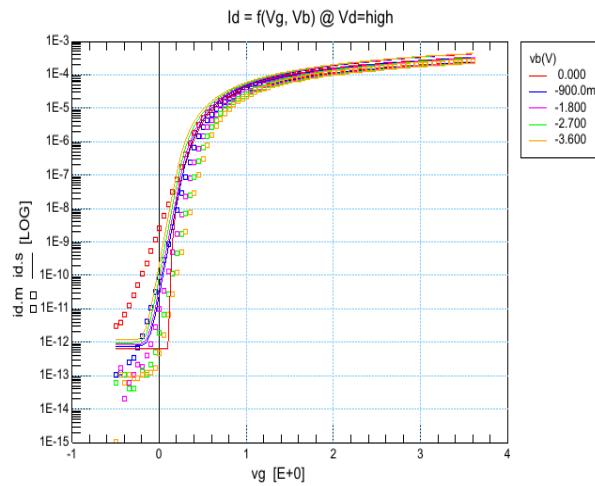
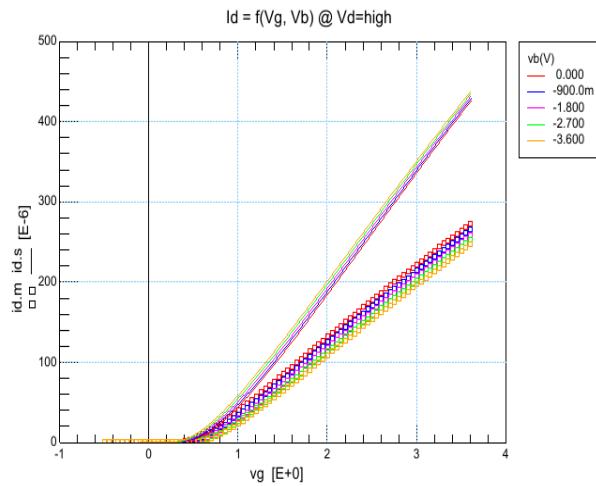
4.26 W0u3_L0u3_S560_1

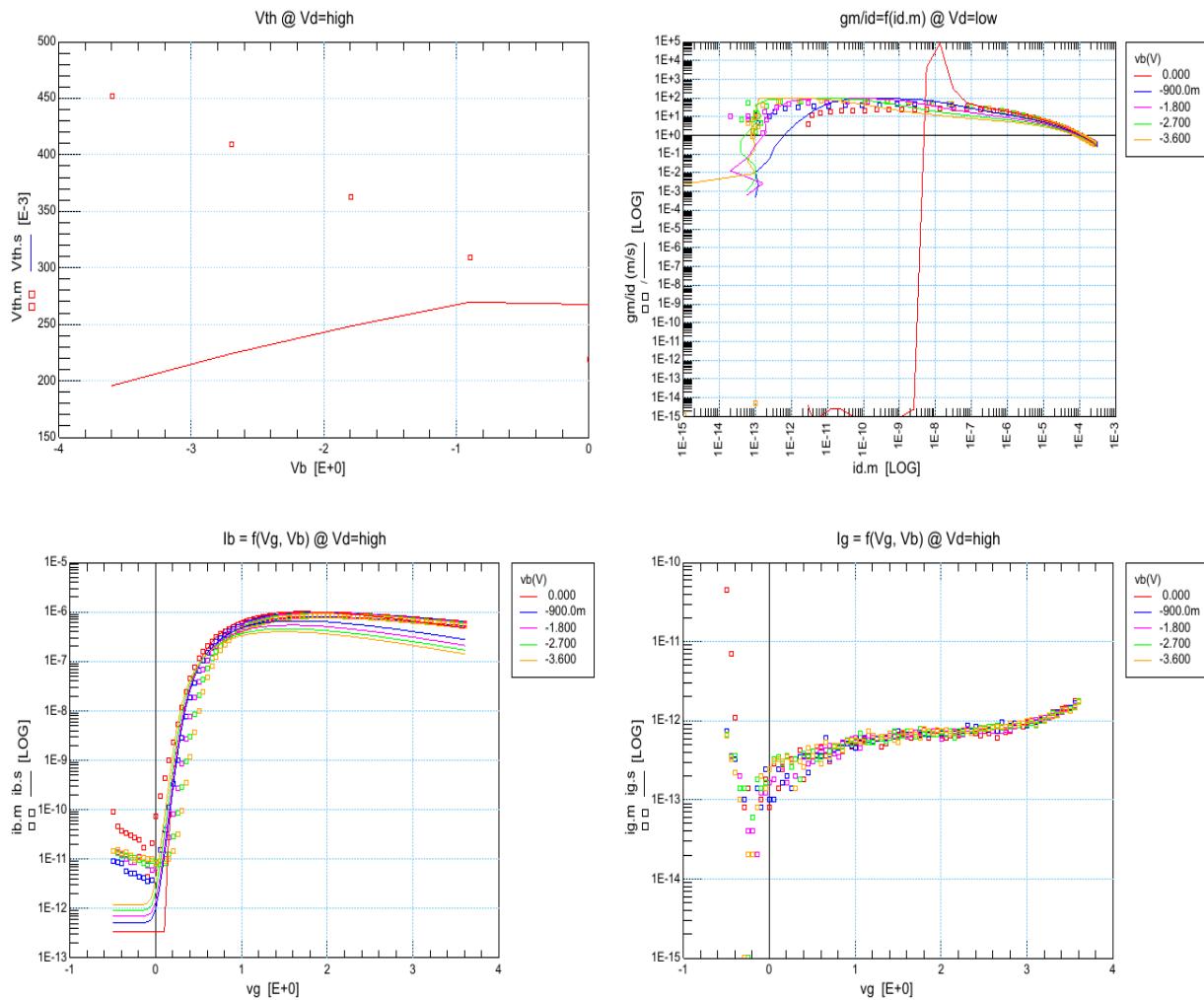
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



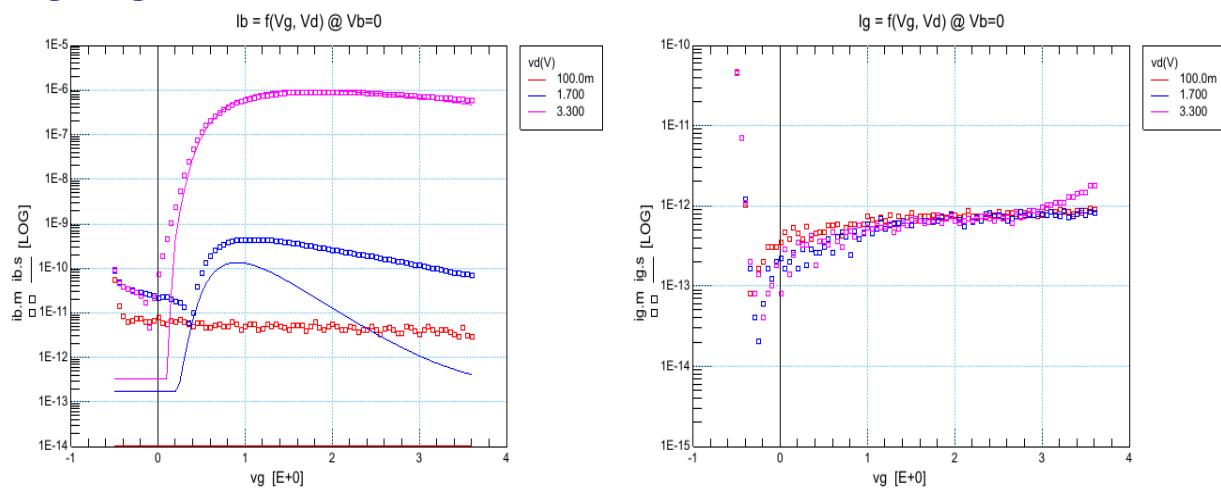


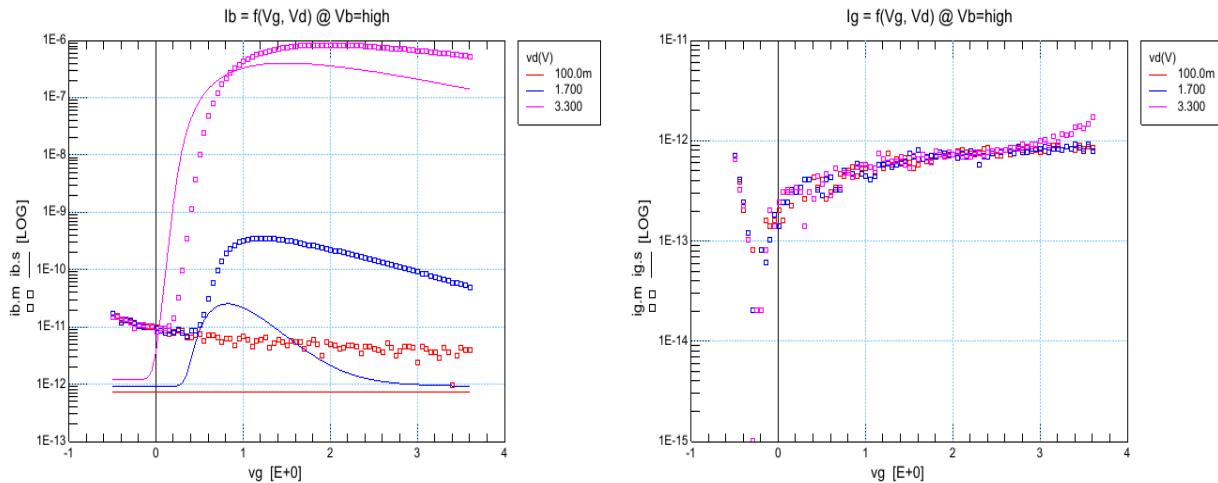
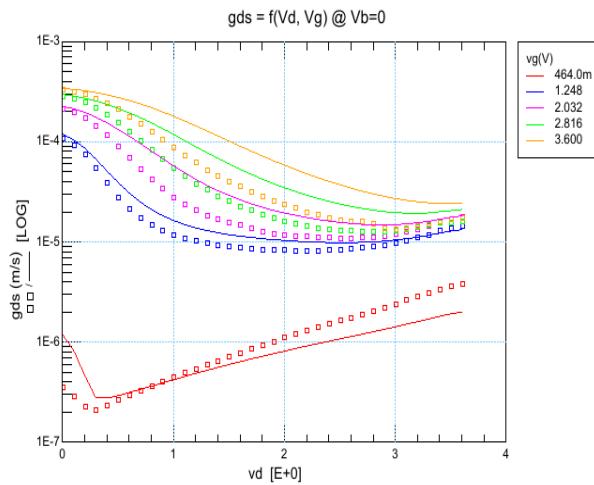
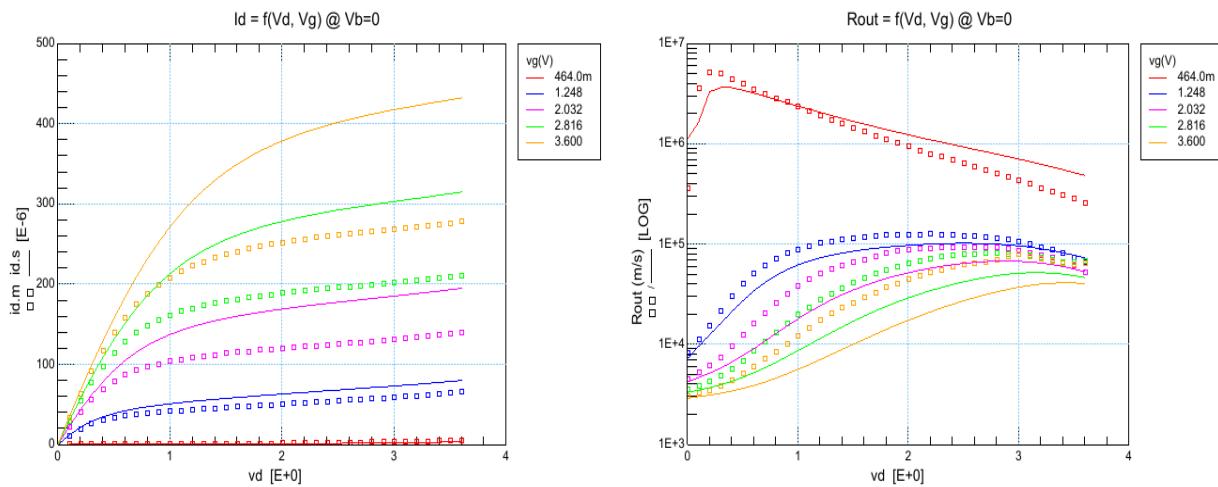
$idvg, Vd = 3.3V, T = 27^\circ C$

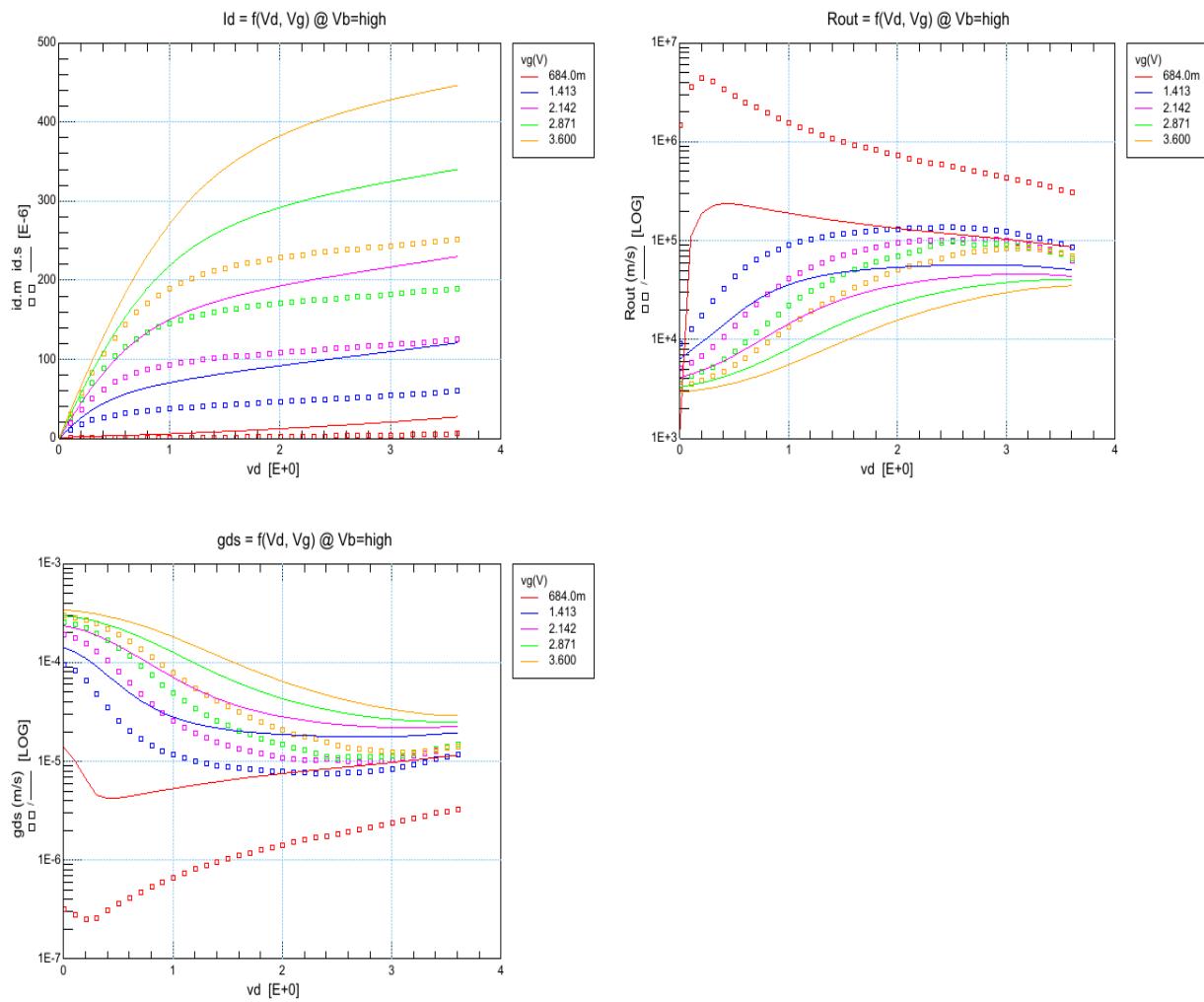
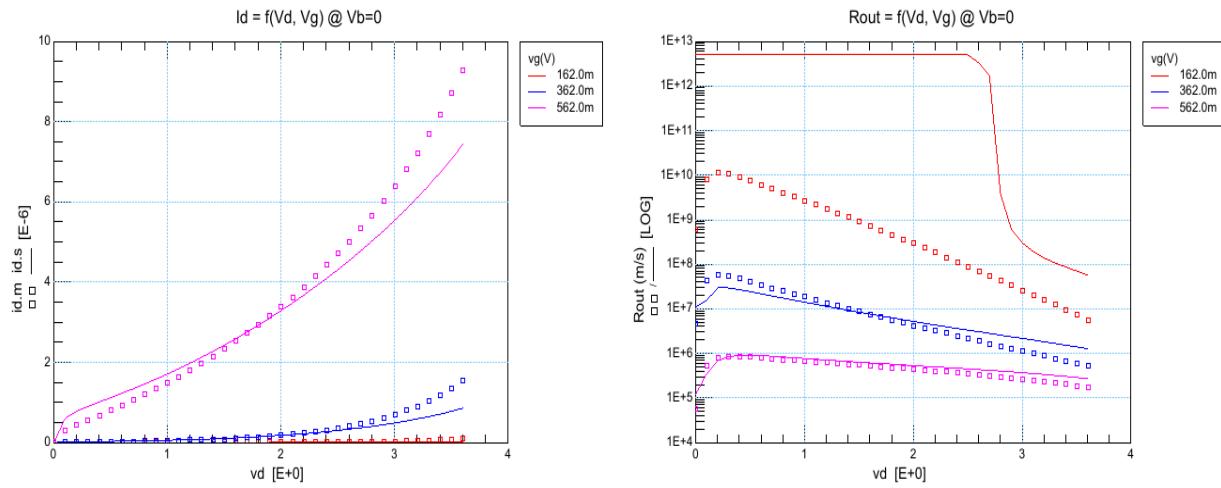


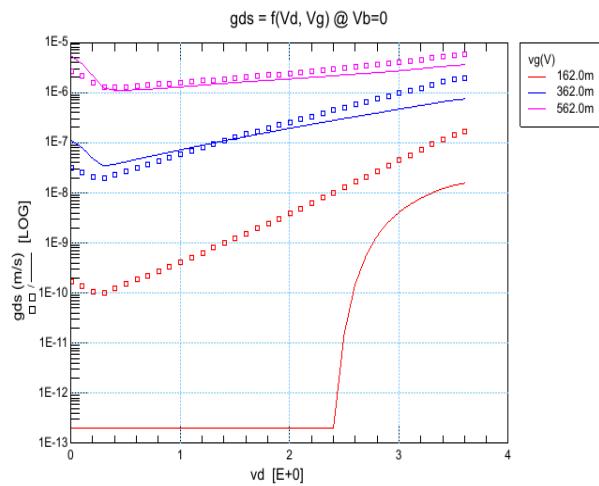


idvg, Ib, Ig, Vb = 0V, T = 27°C

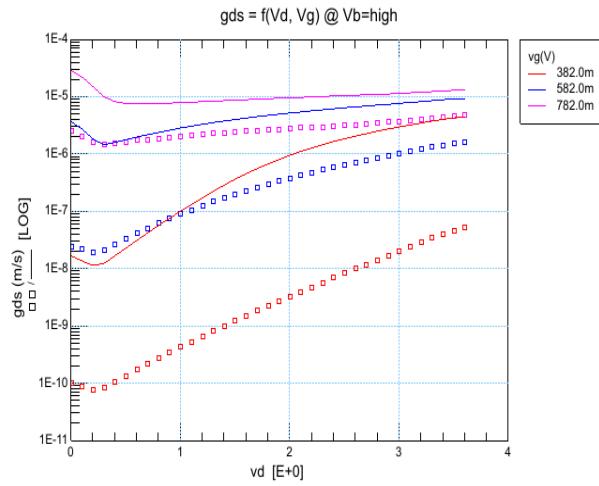
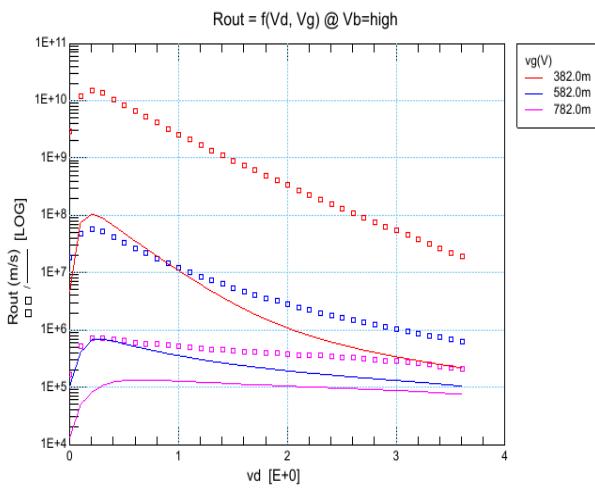
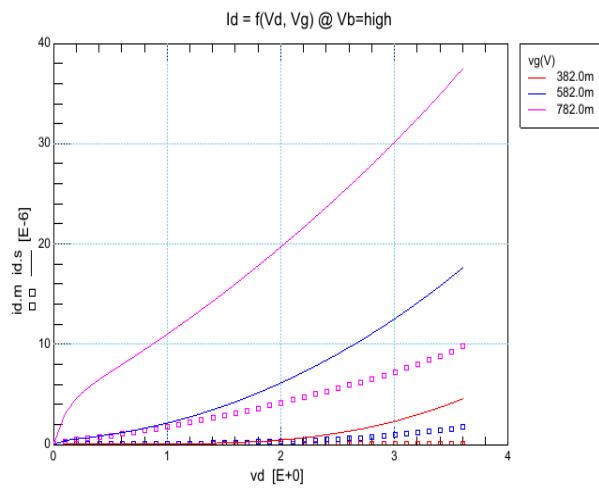


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


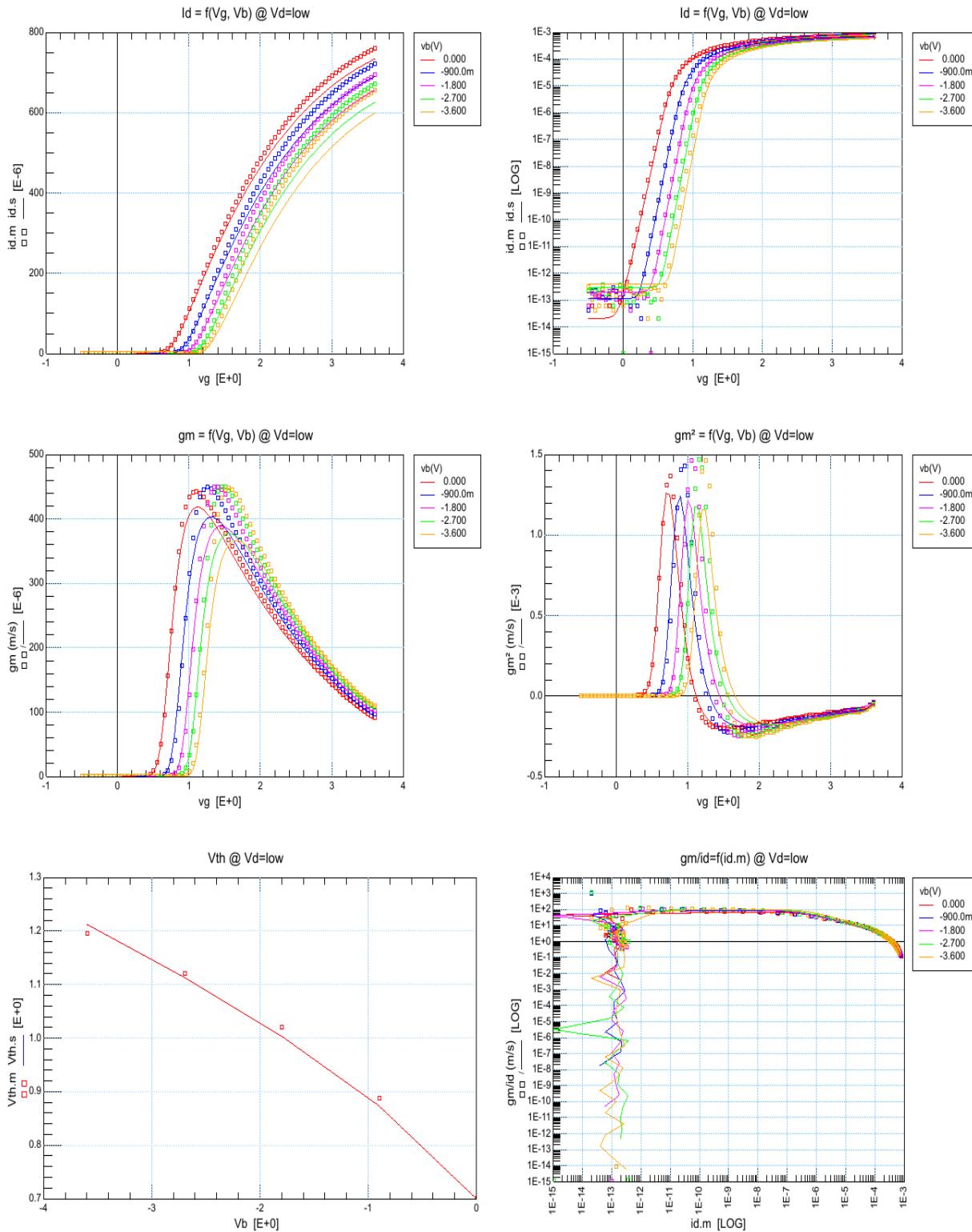


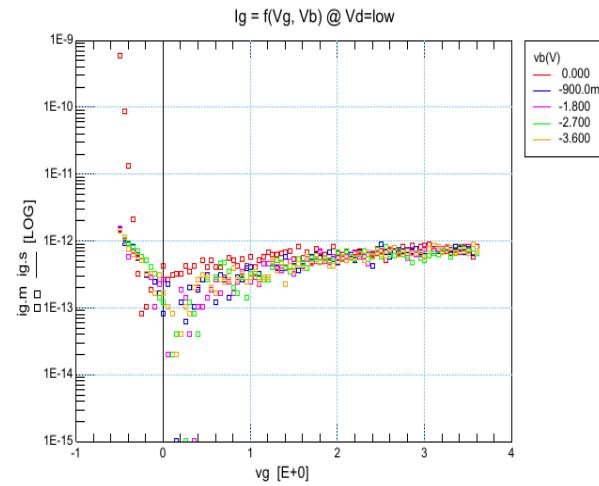
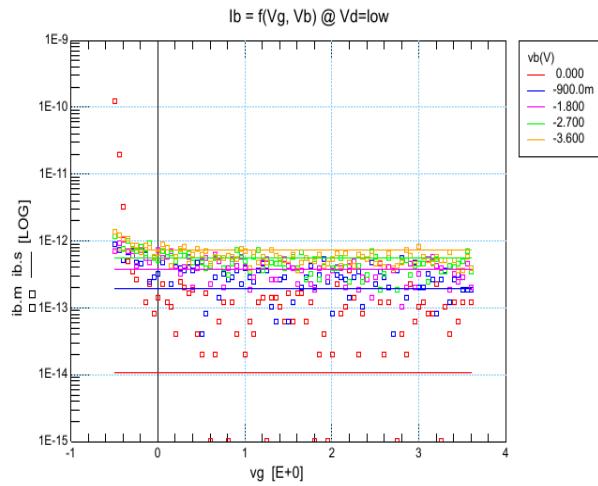
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



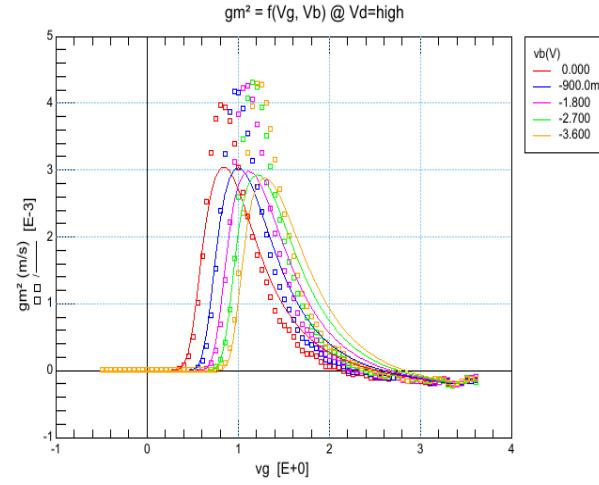
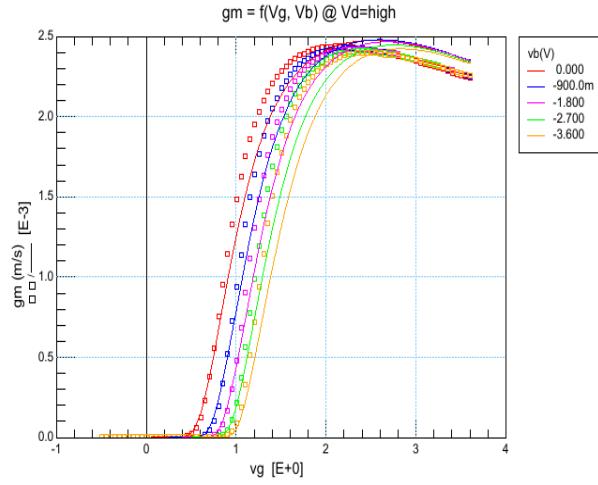
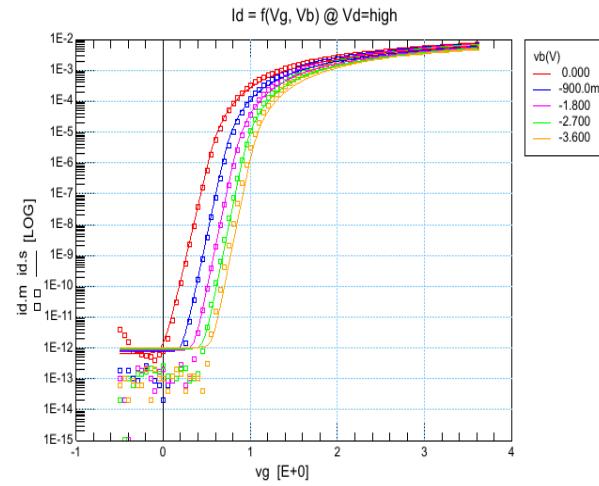
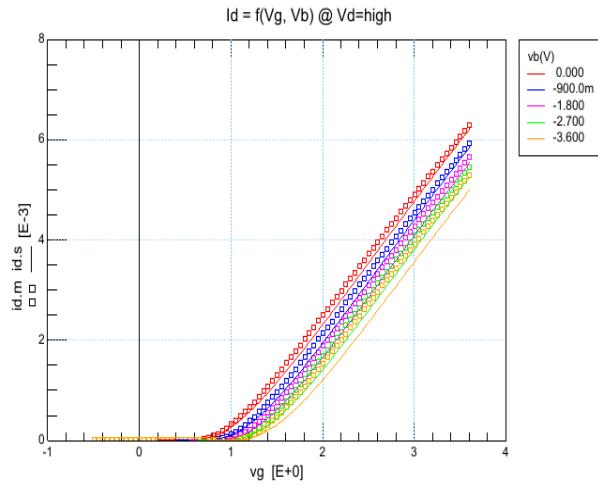
4.27W10u0_L0u45_T356_S384M_1

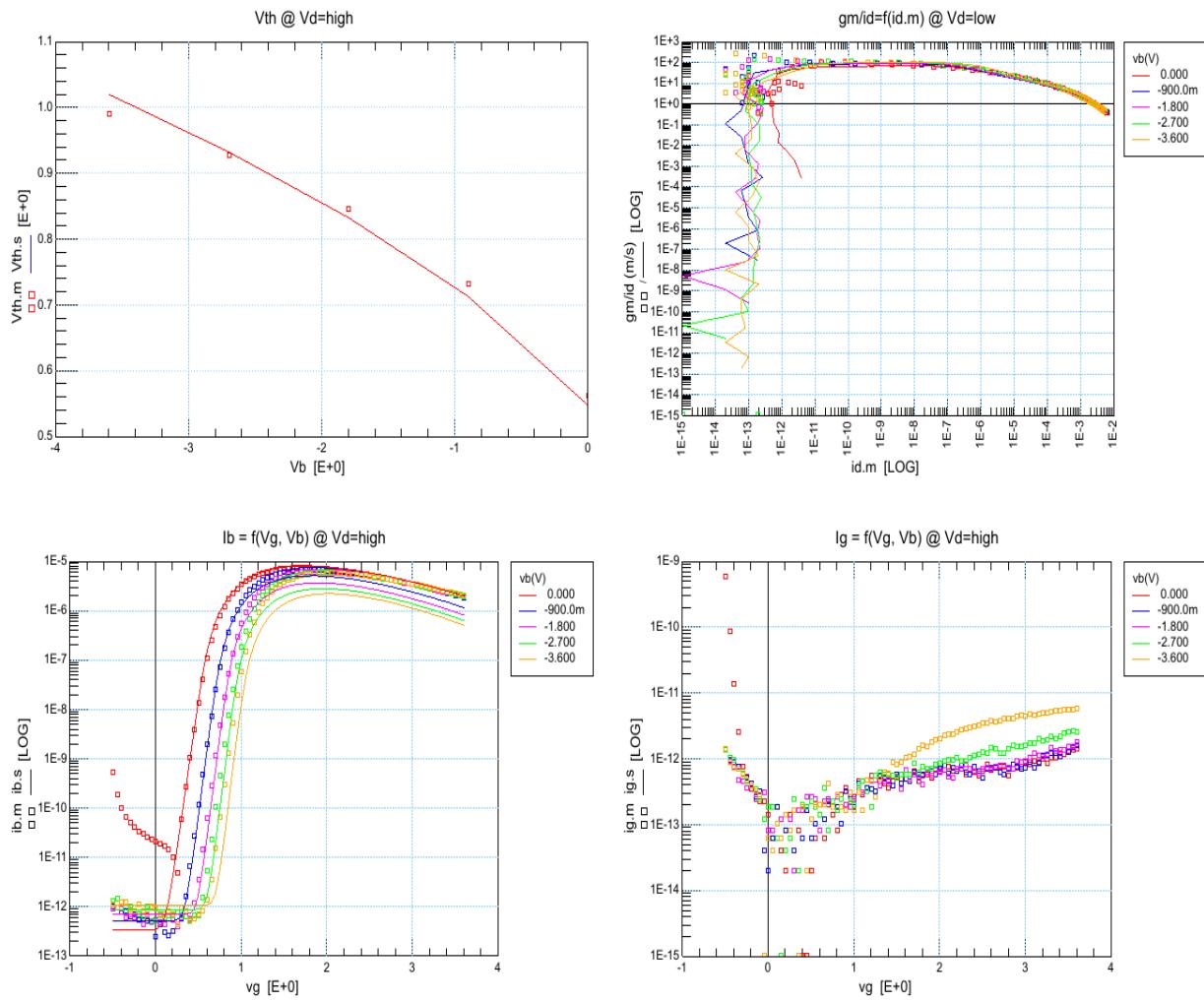
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



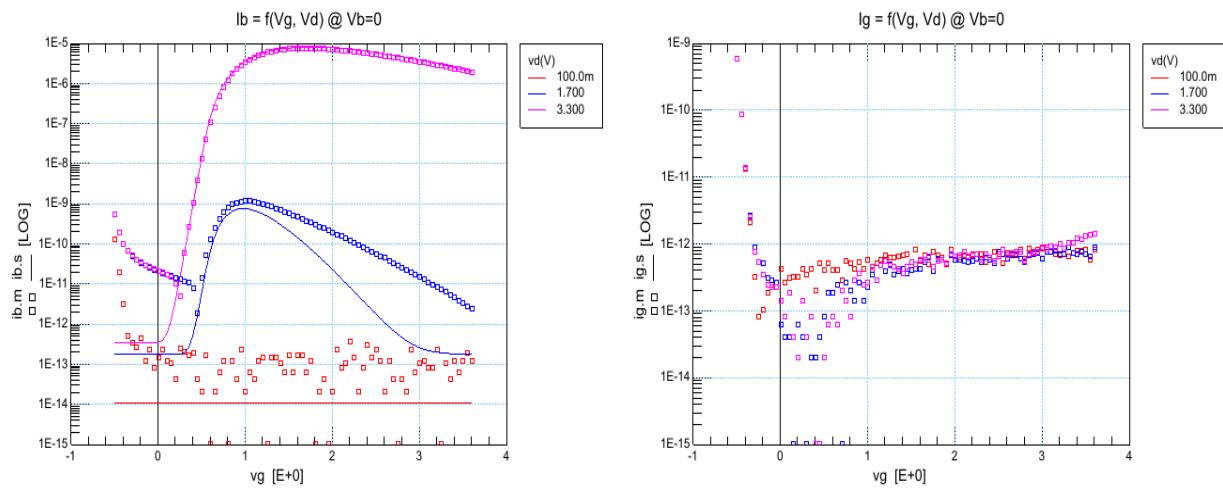


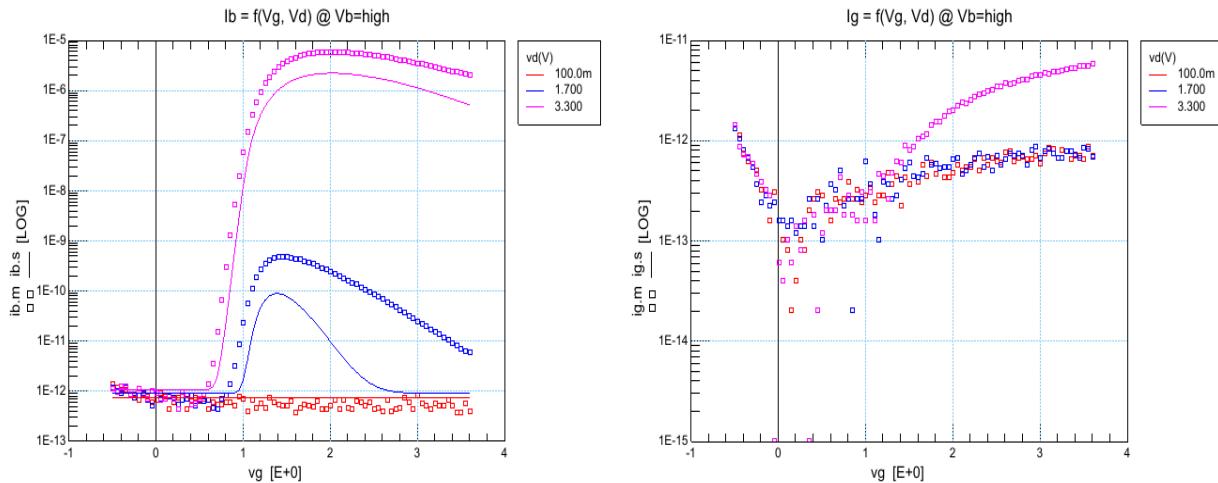
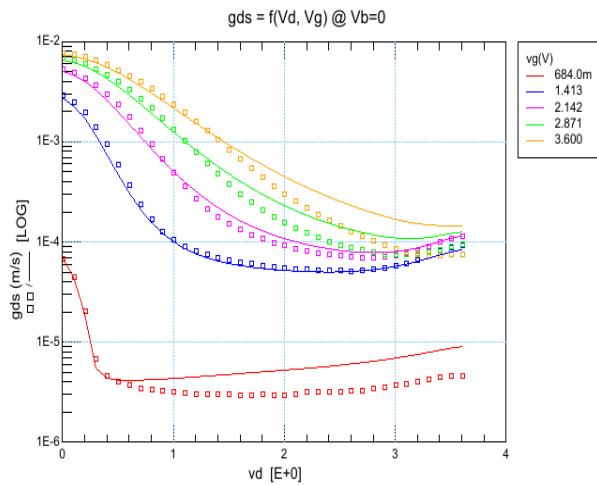
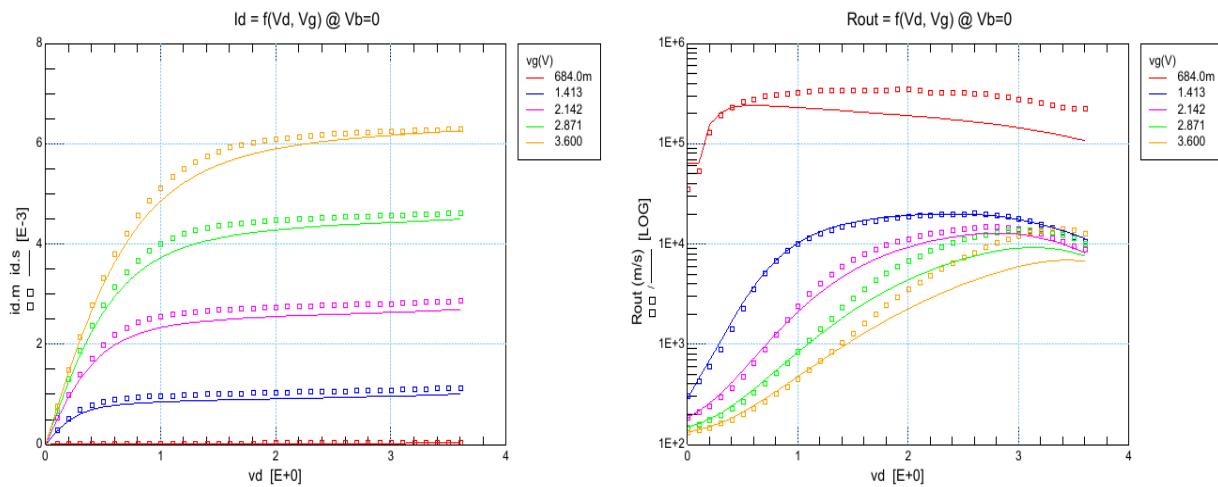
$i_{dvg}, V_d = 3.3V, T = 27^\circ\text{C}$

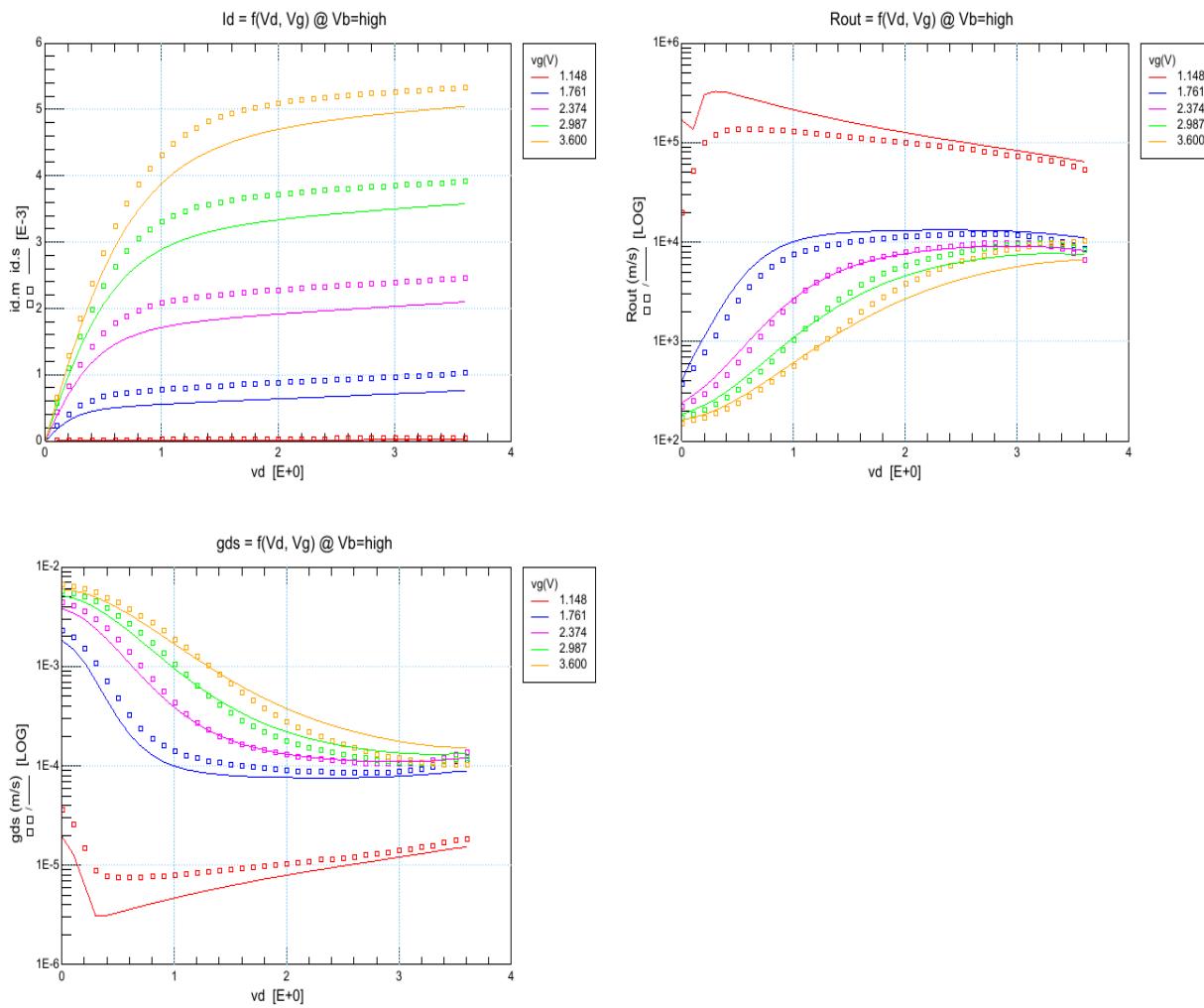
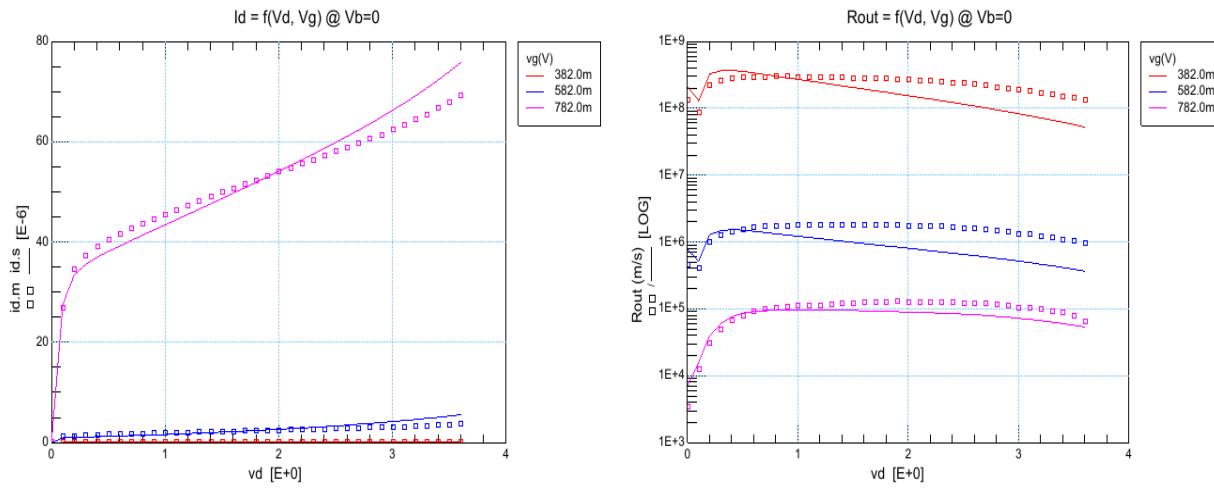


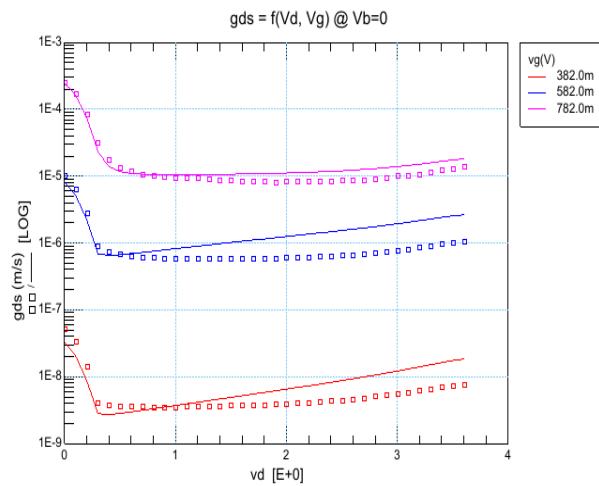


idvg, Ib,Ig, Vb = 0V, T = 27°C

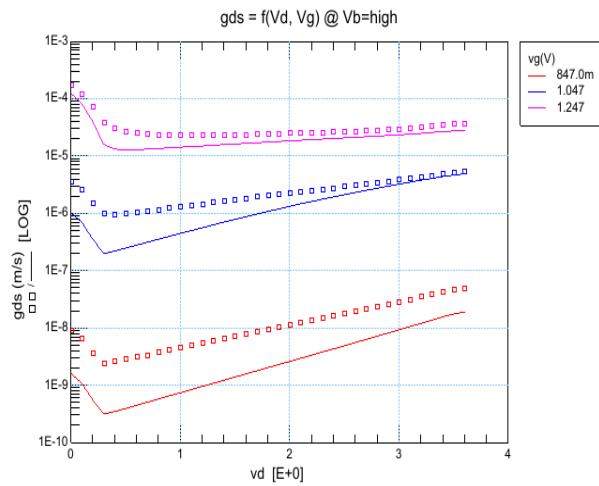
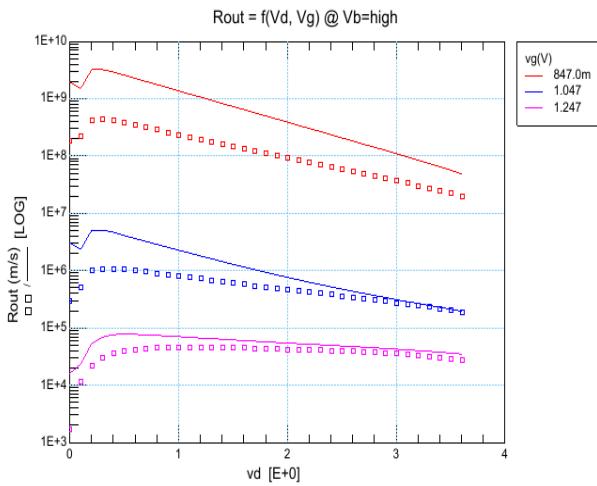
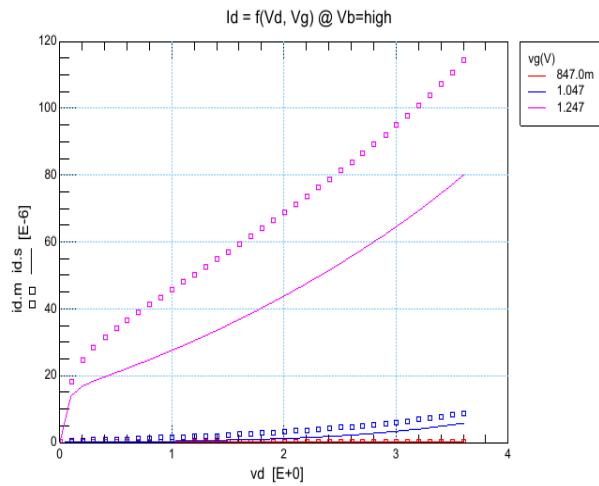


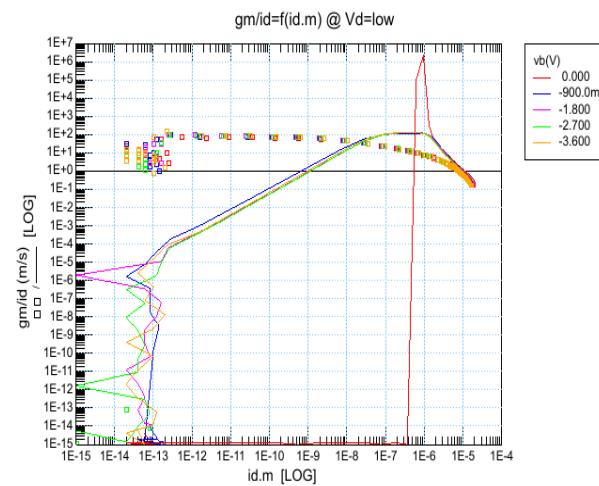
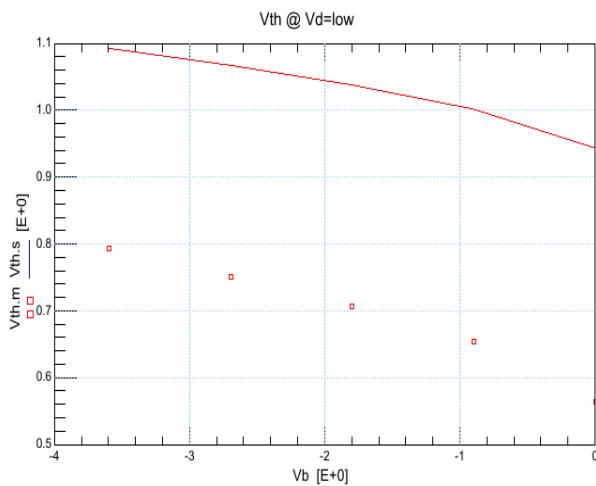
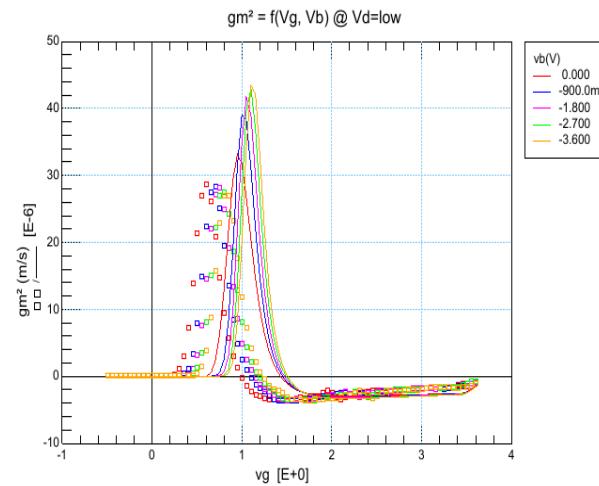
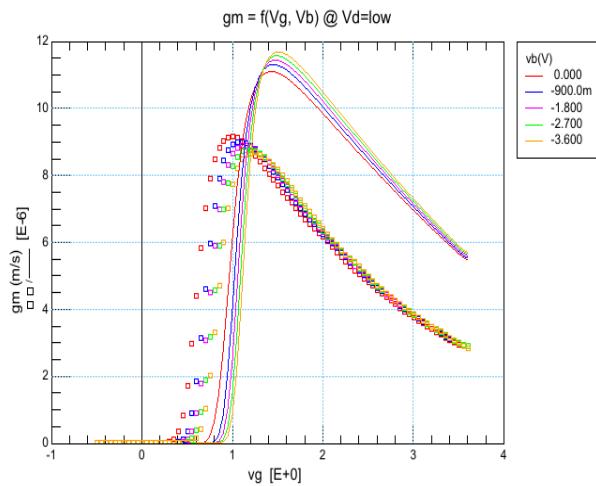
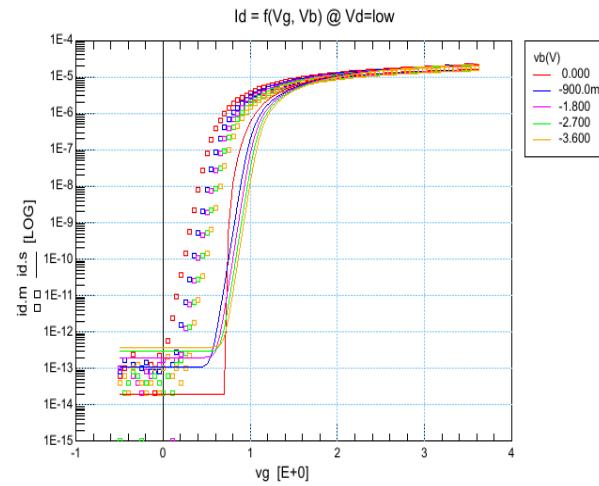
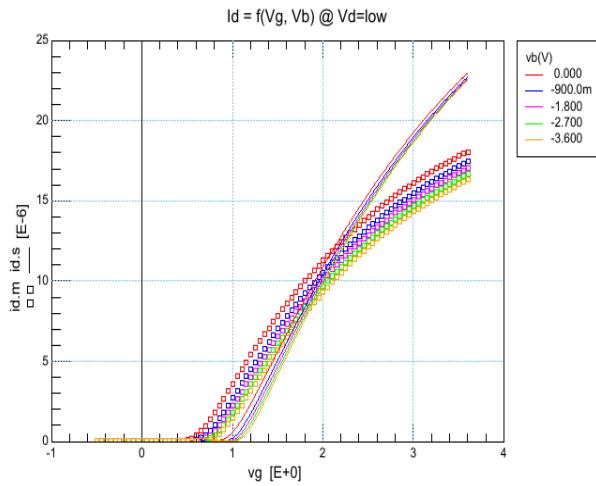
idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


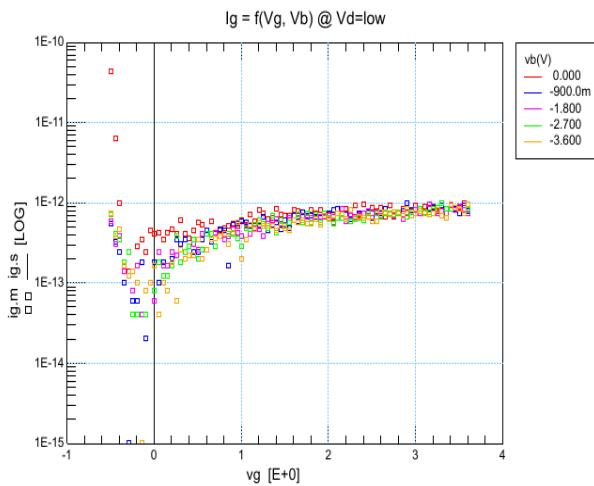
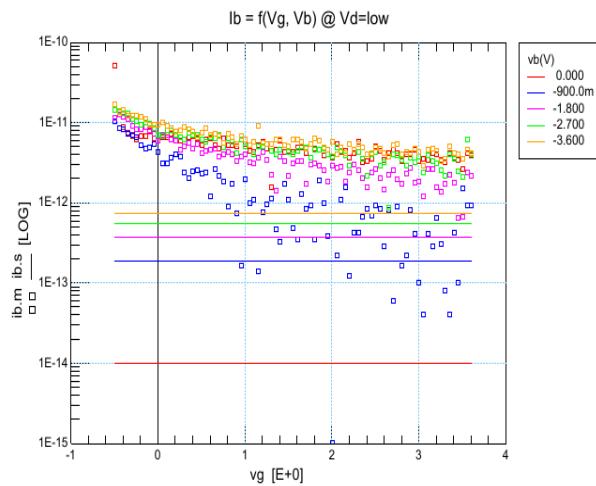
idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C




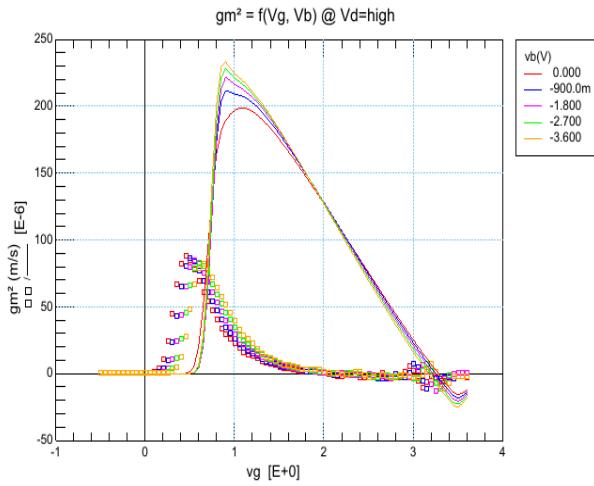
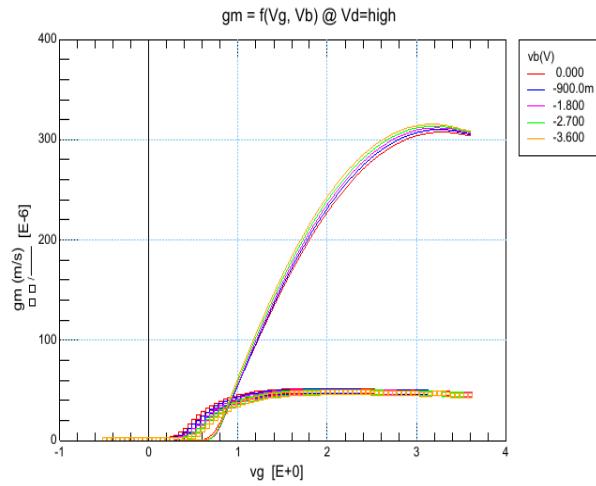
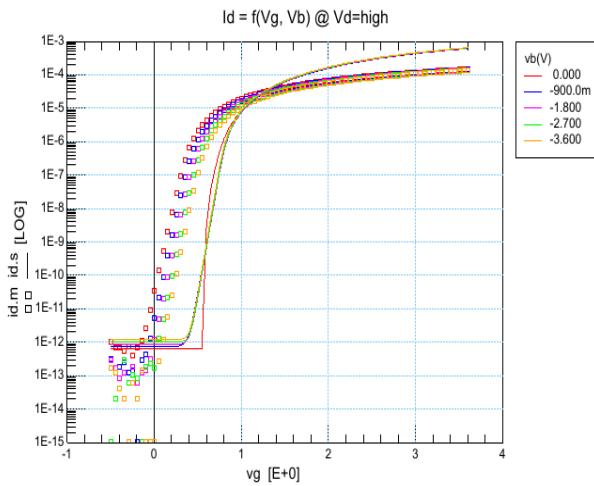
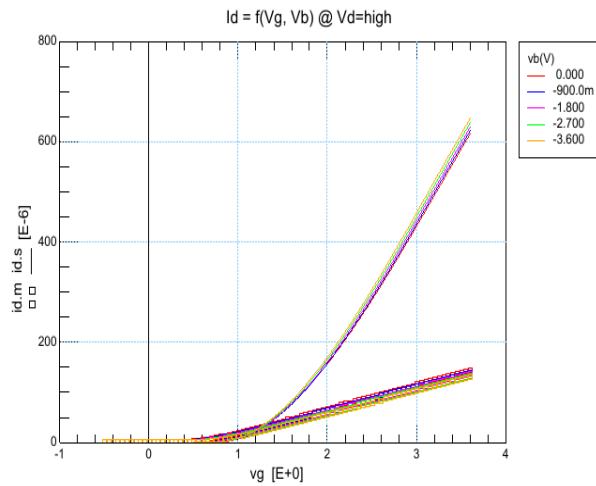
idvd_vth_vbmin, Vb = -3.6V, T = 27°C

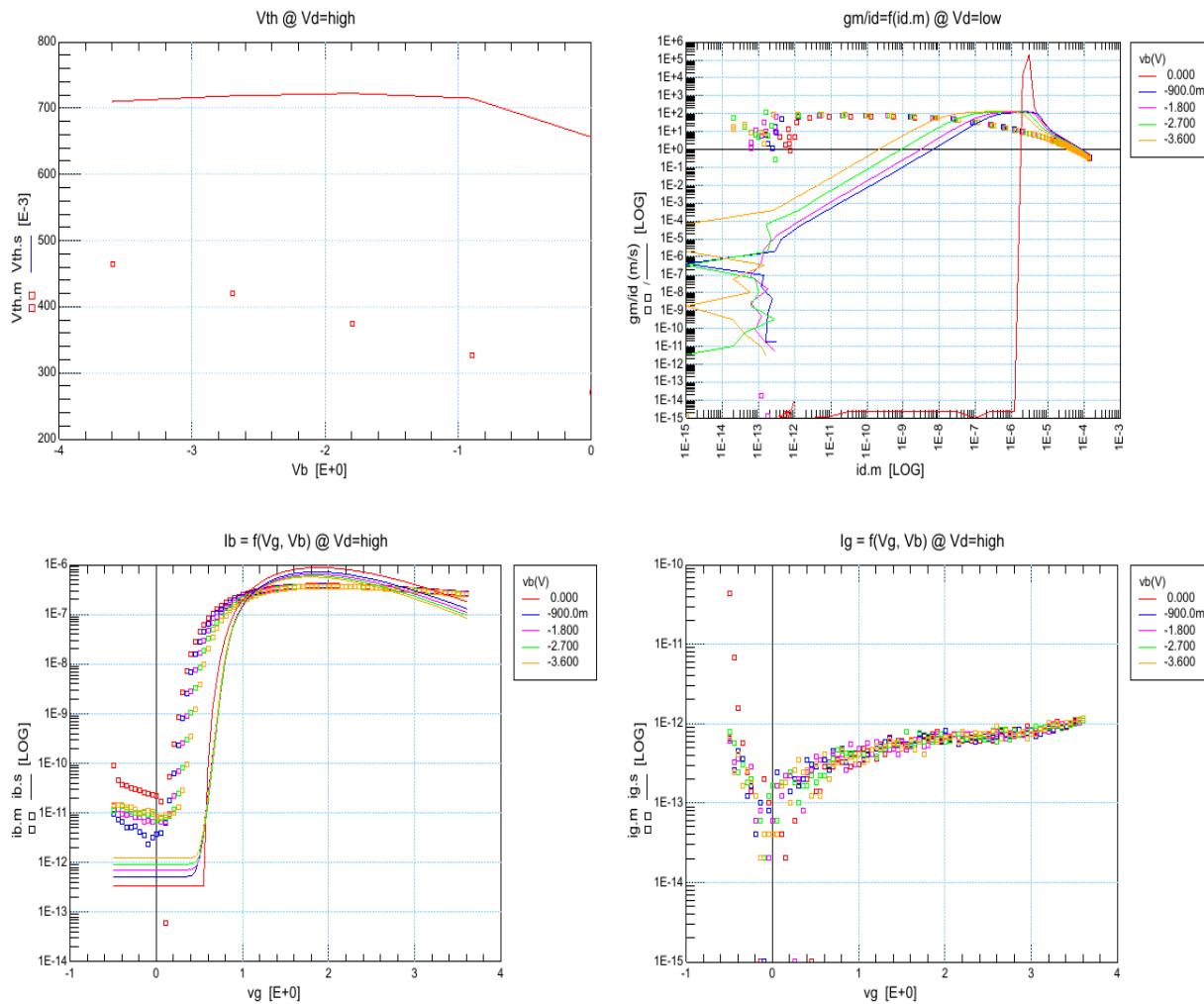


4.28 W0u15_L0u33_S547_5**idvg, Vd = 0.1V, T = 27°C**

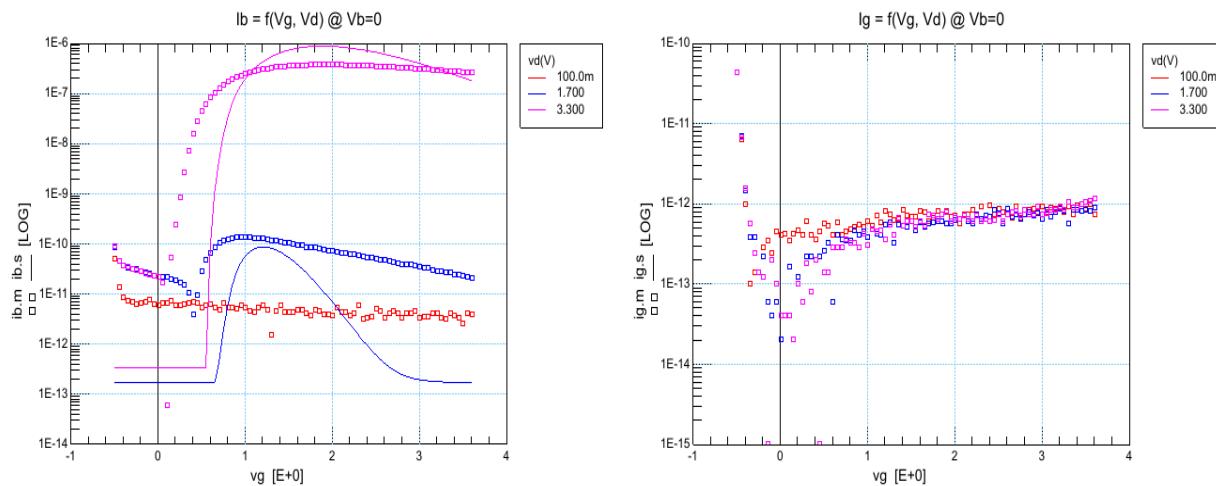


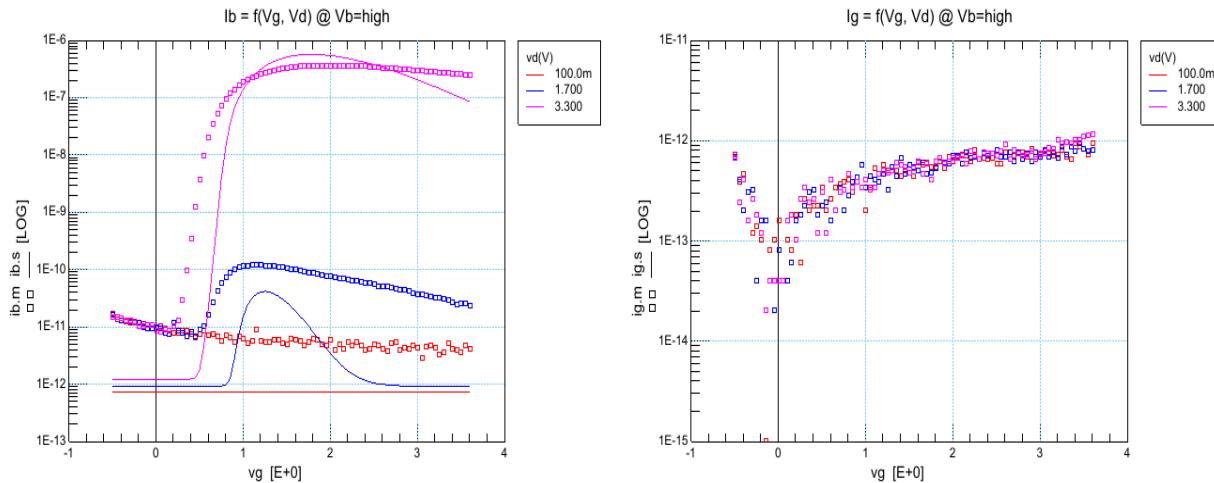
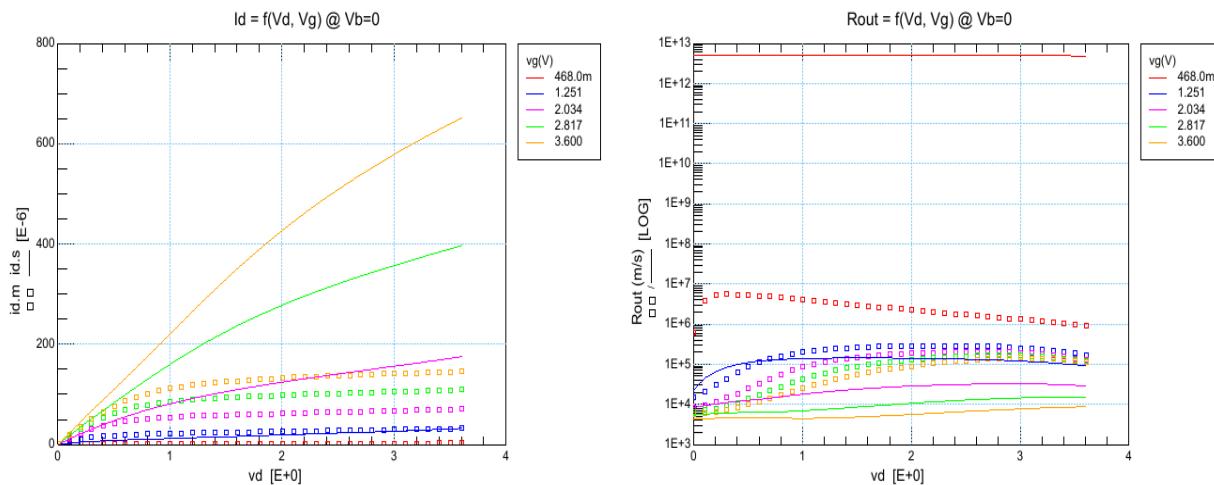
$i_{dvg}, V_d = 3.3V, T = 27^\circ\text{C}$

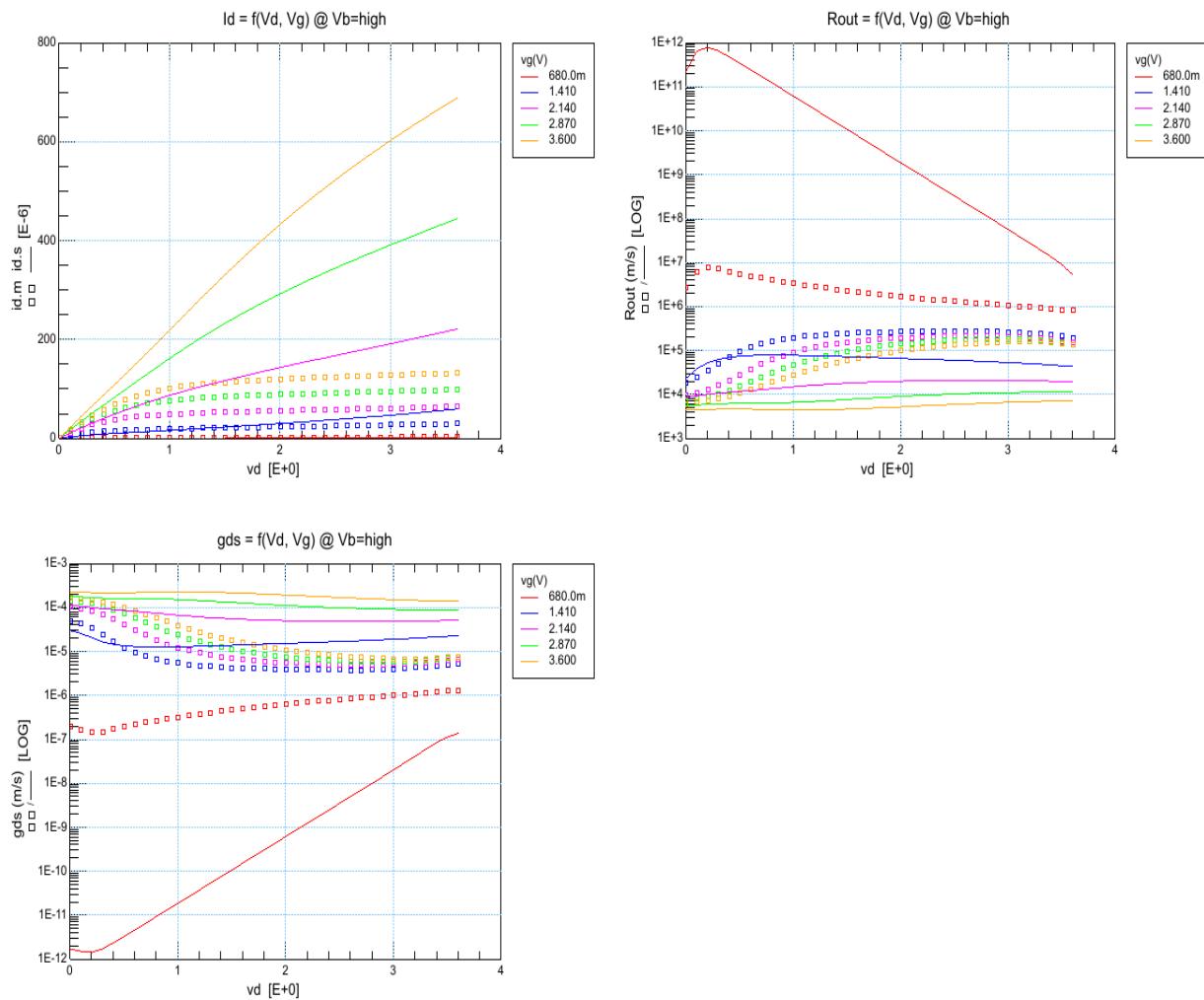
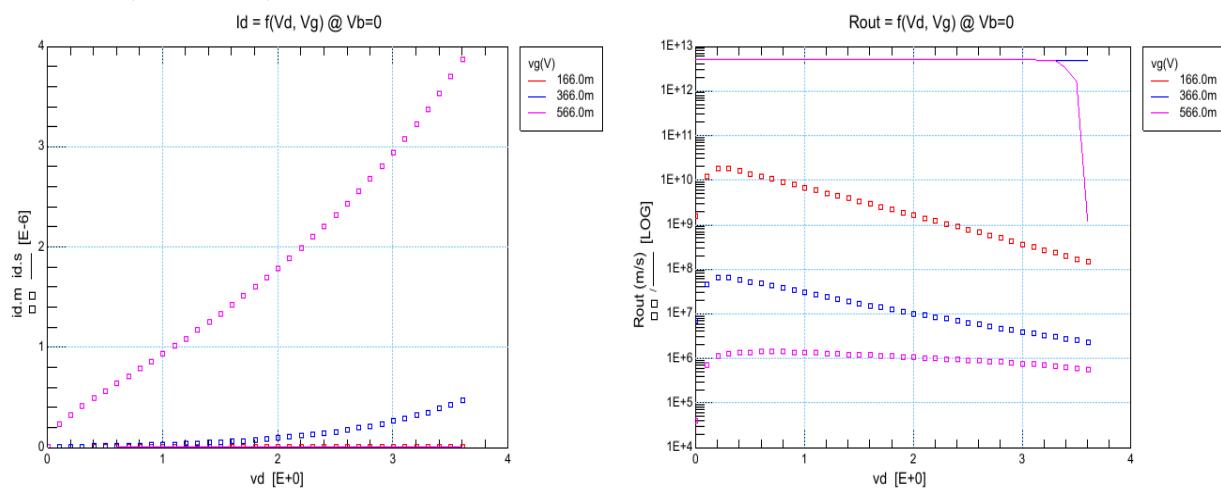


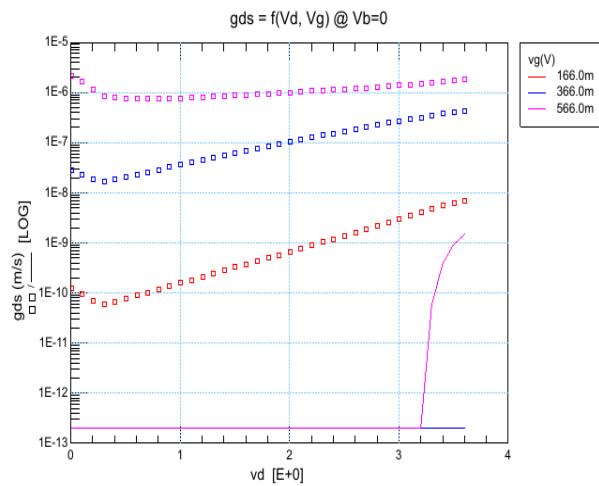


idvg, Ib, Ig, Vb = 0V, T = 27°C

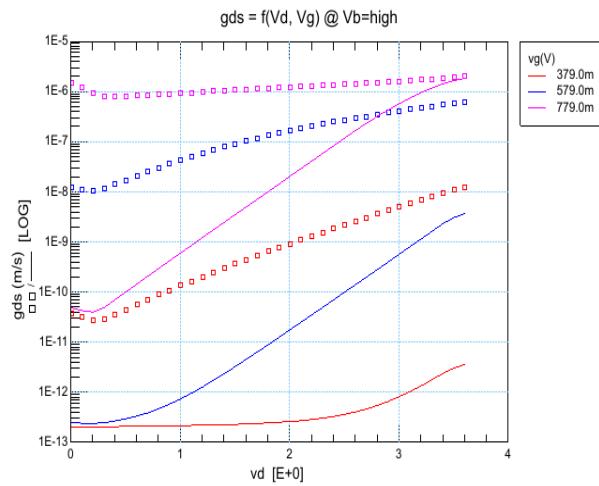
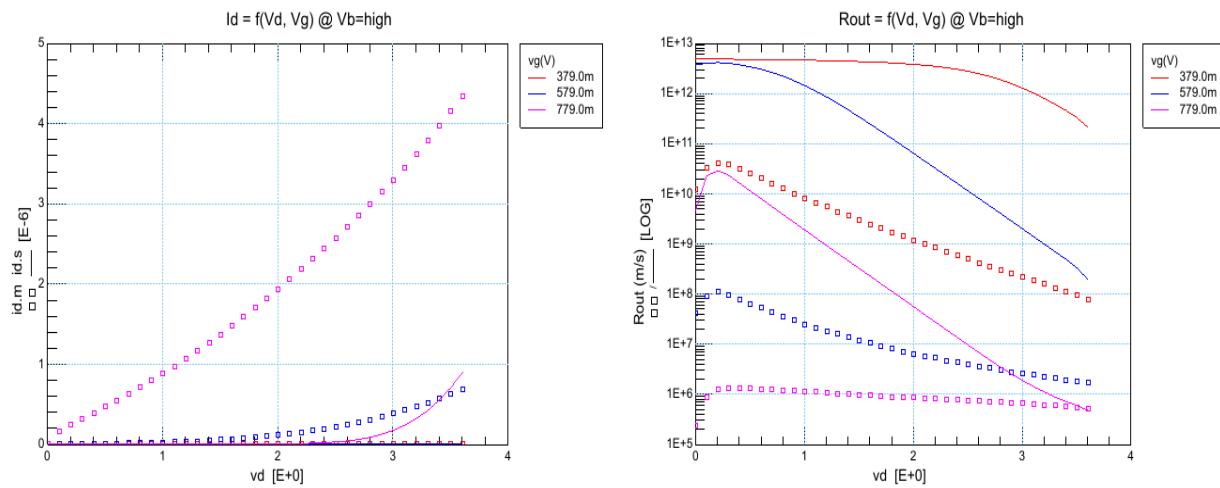


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


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

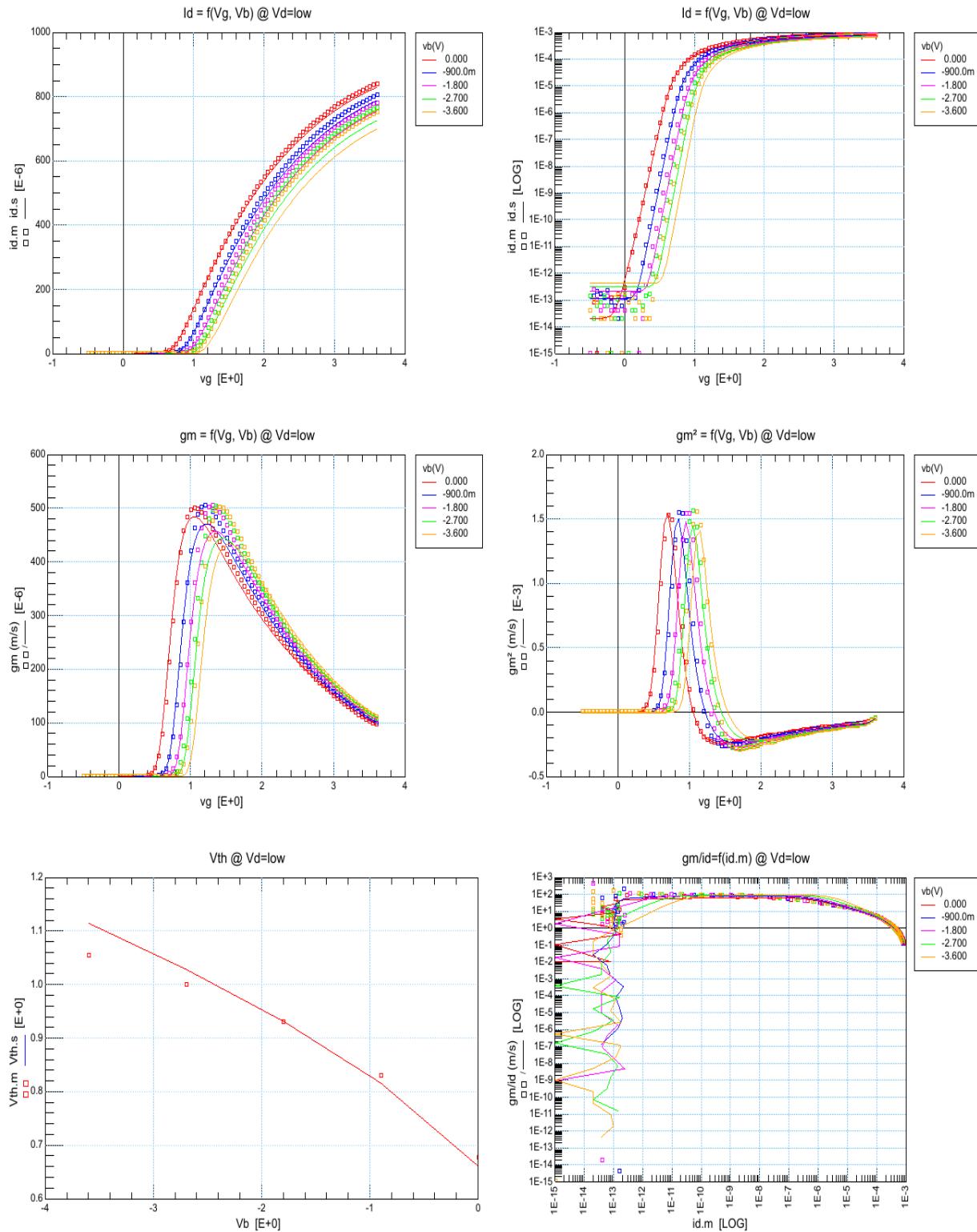


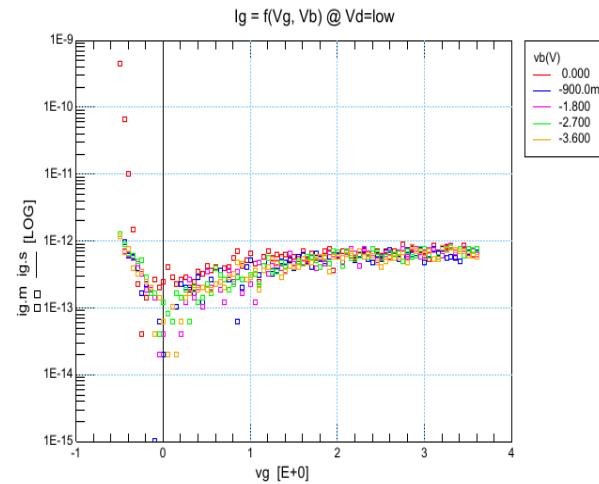
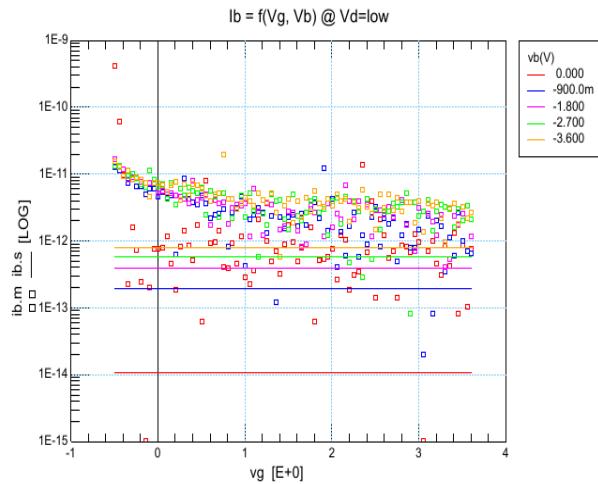
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



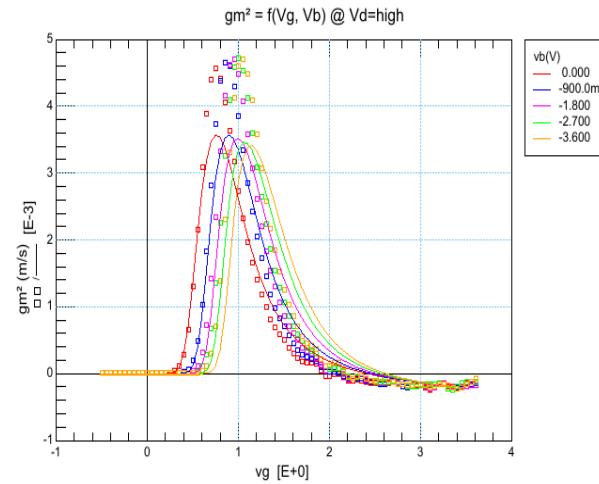
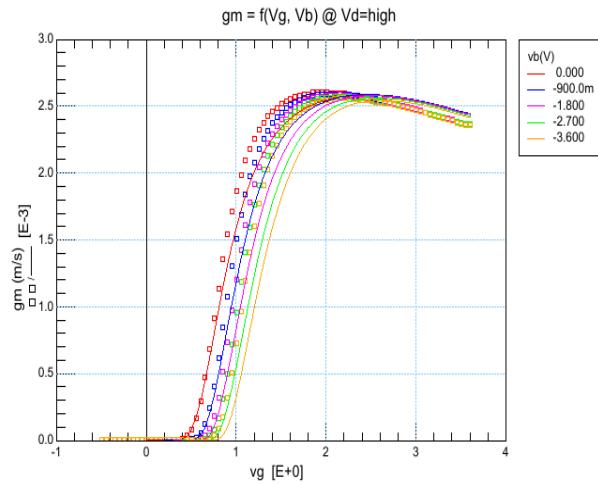
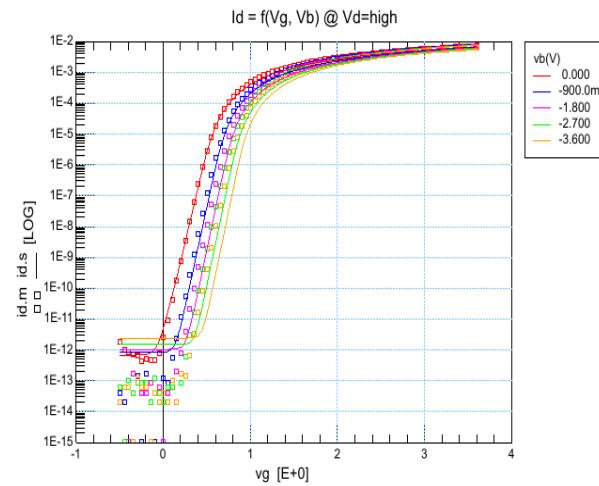
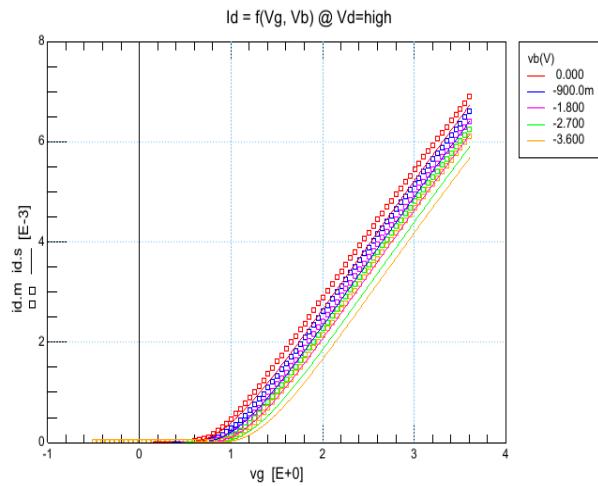
4.29 W10u0_L0u4_S387_4

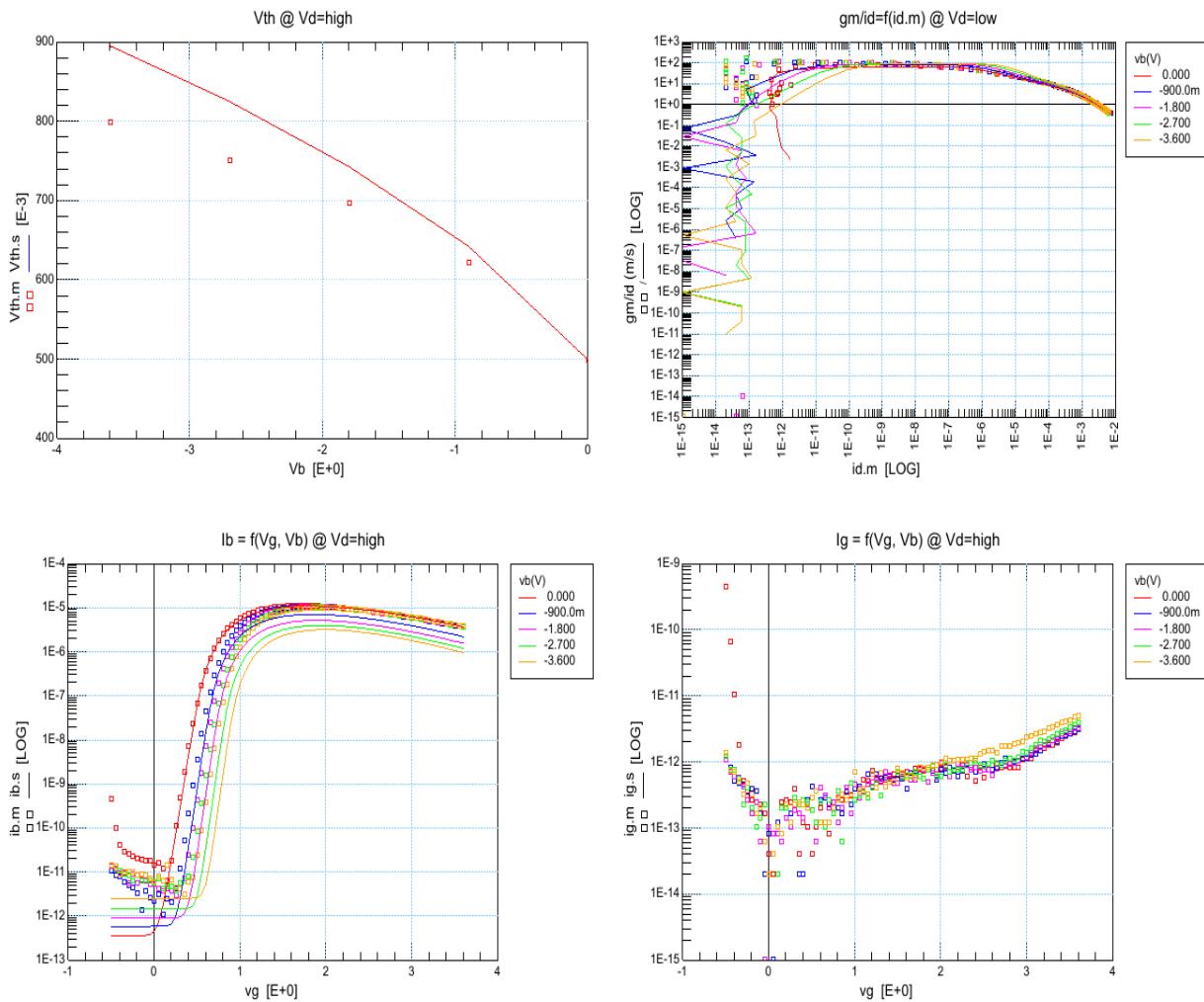
$idv_g, V_d = 0.1V, T = 27^\circ C$



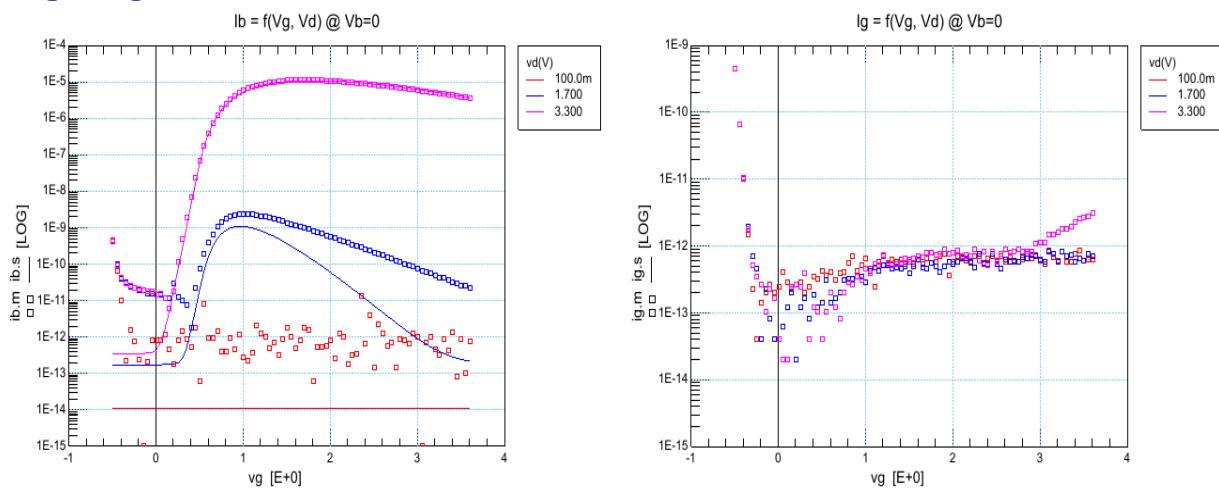


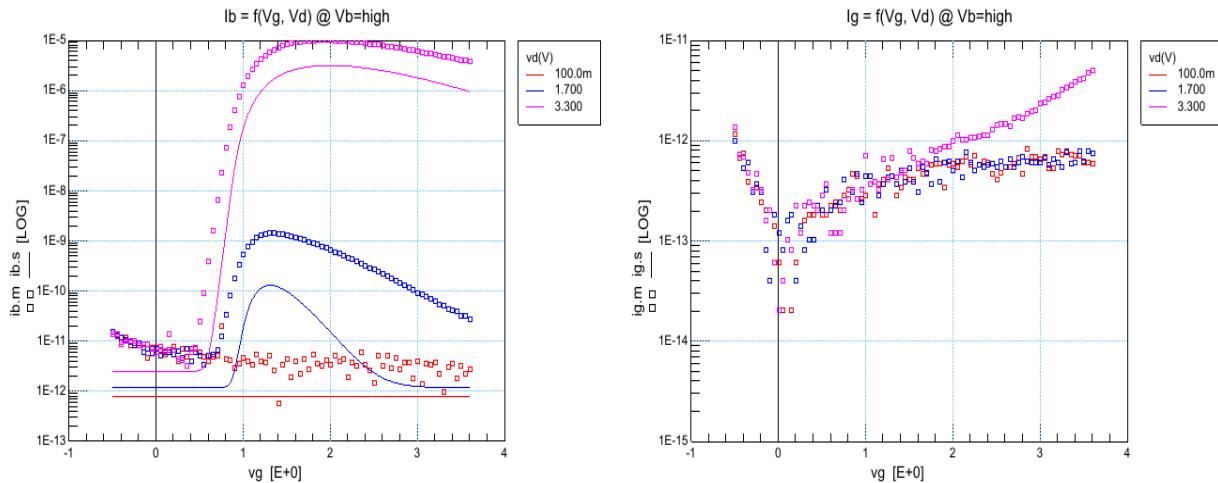
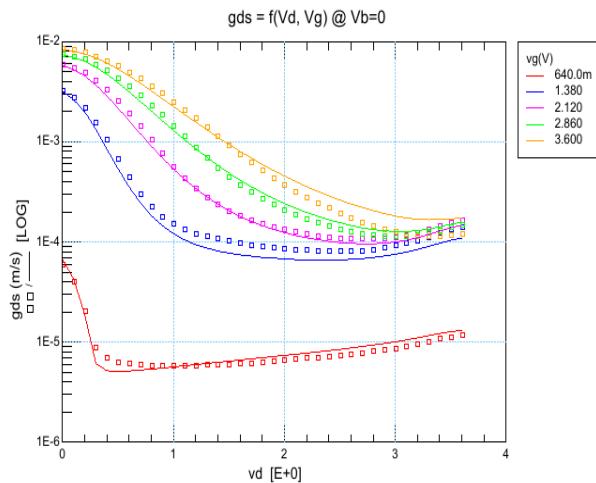
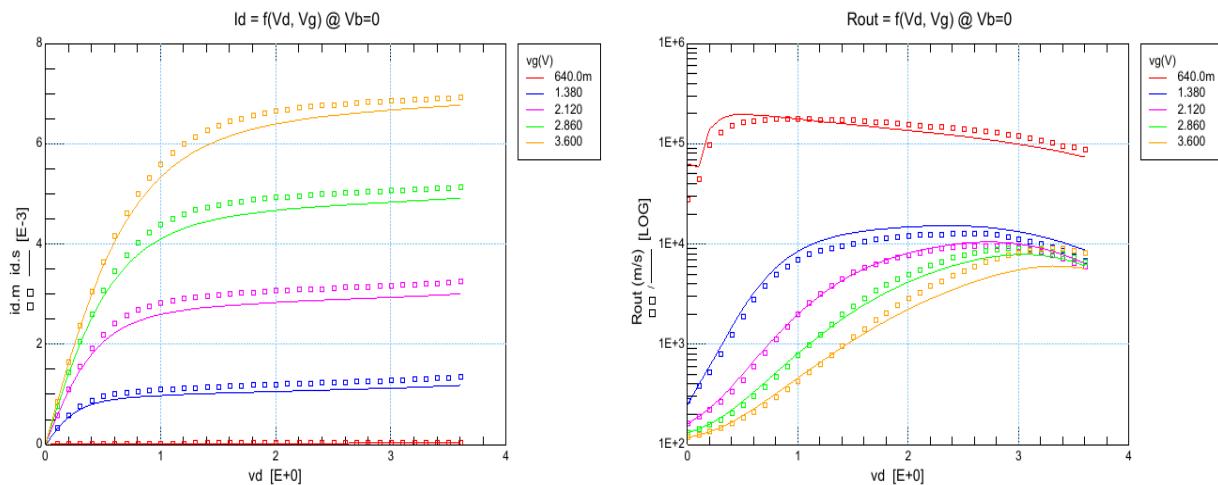
$i_{dvg}, V_d = 3.3V, T = 27^\circ C$

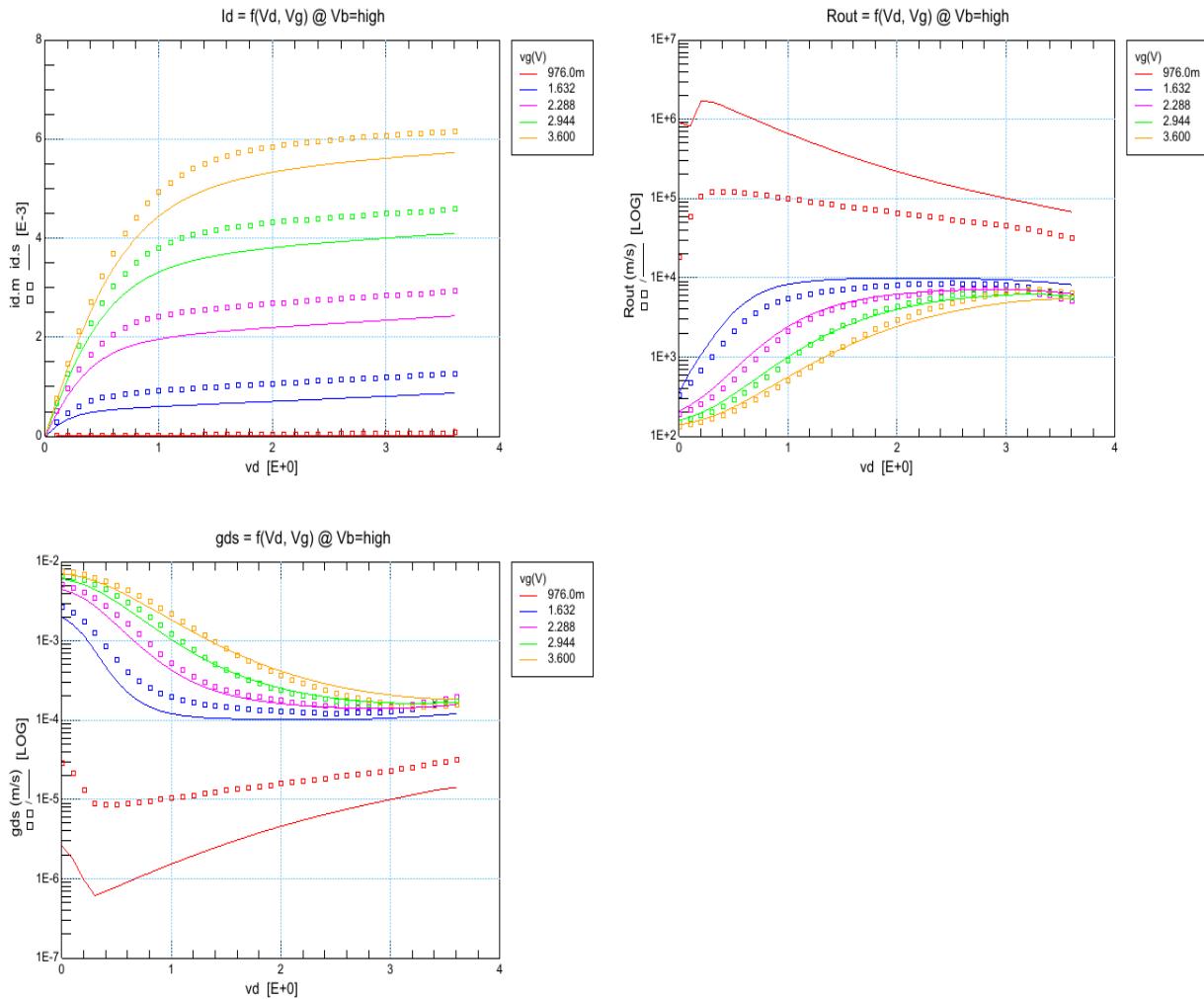
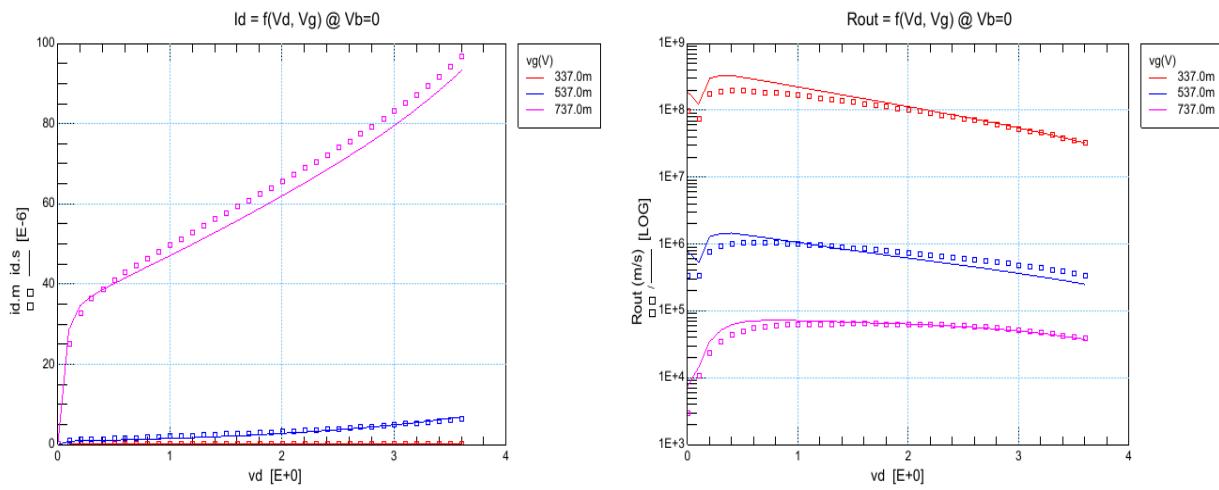


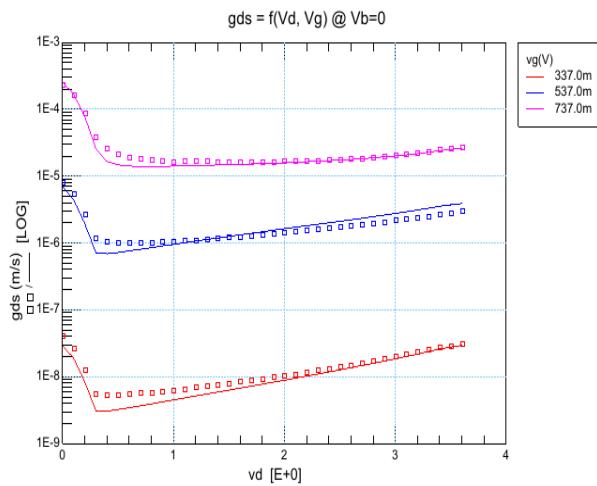


idvg, Ib,Ig, Vb = 0V, T = 27°C

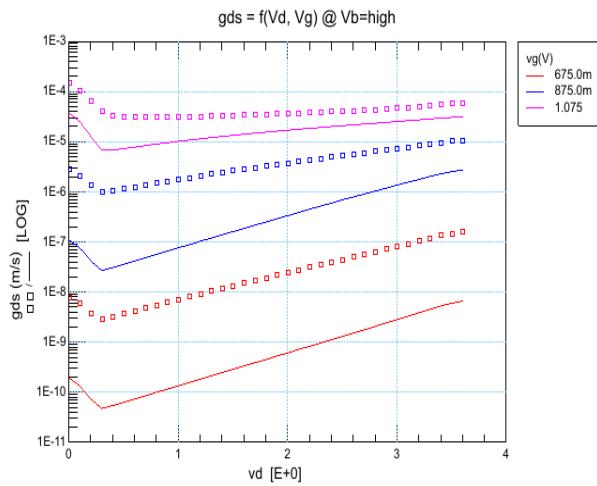
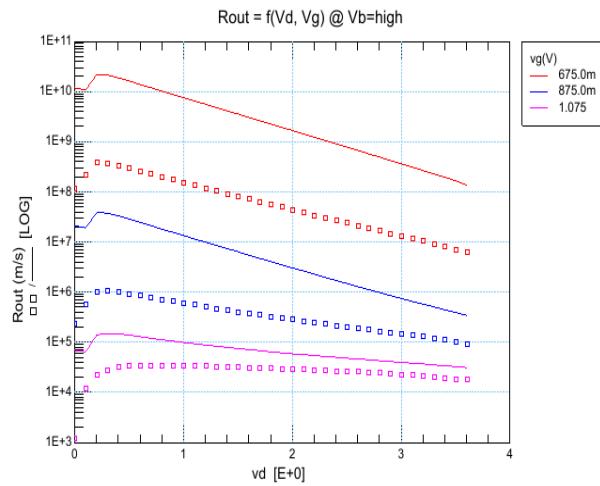
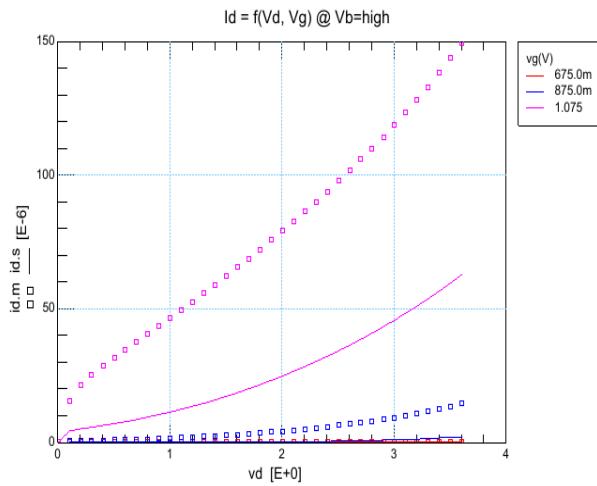


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


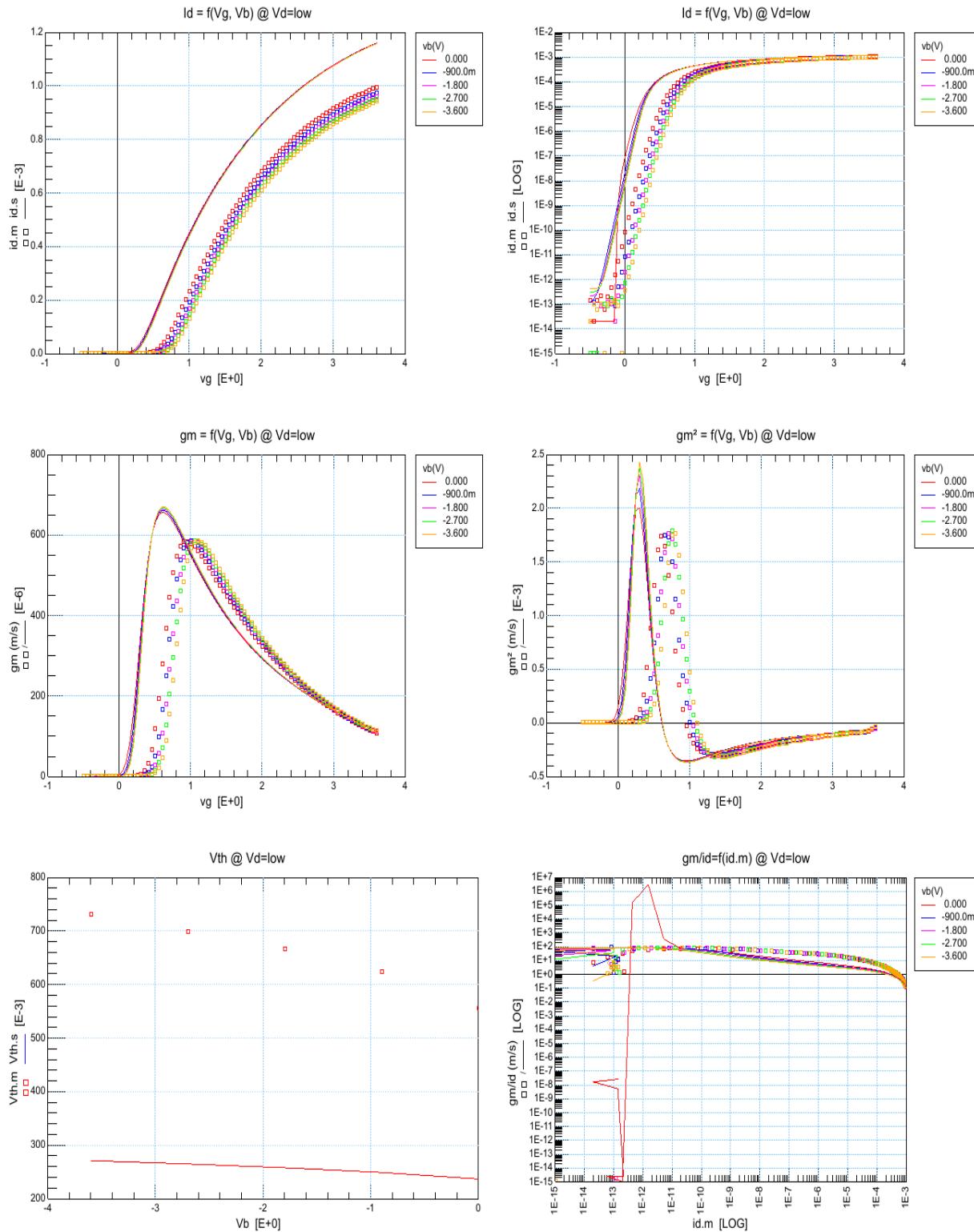


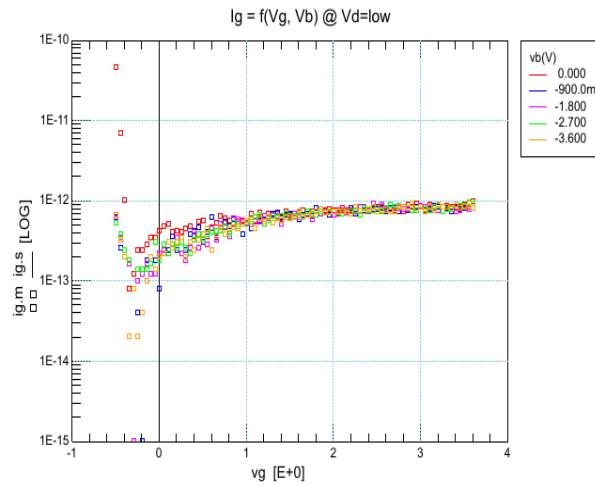
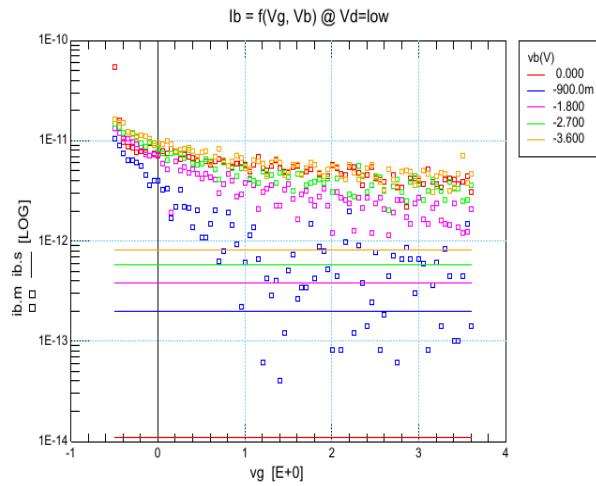
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



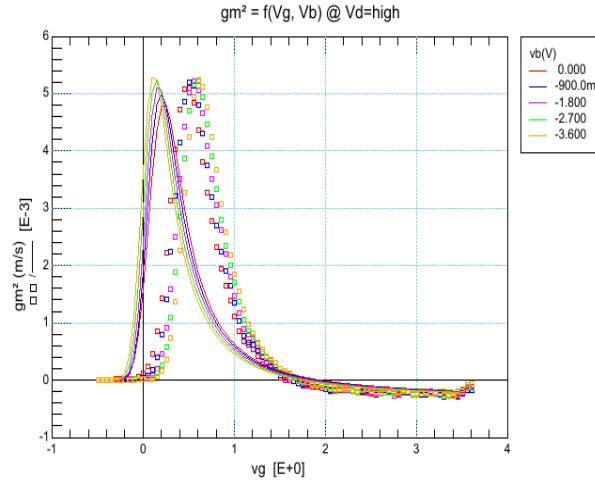
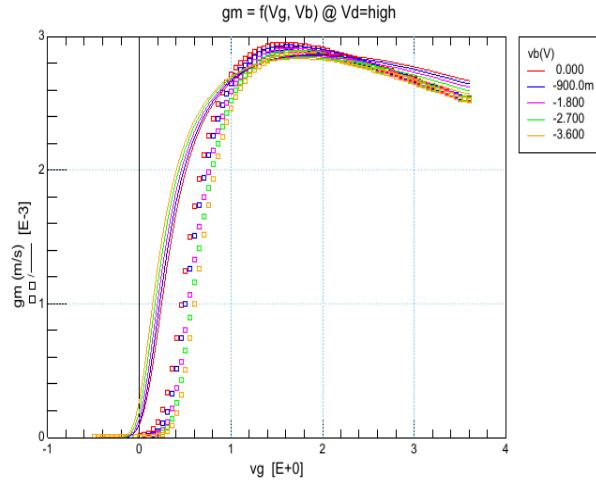
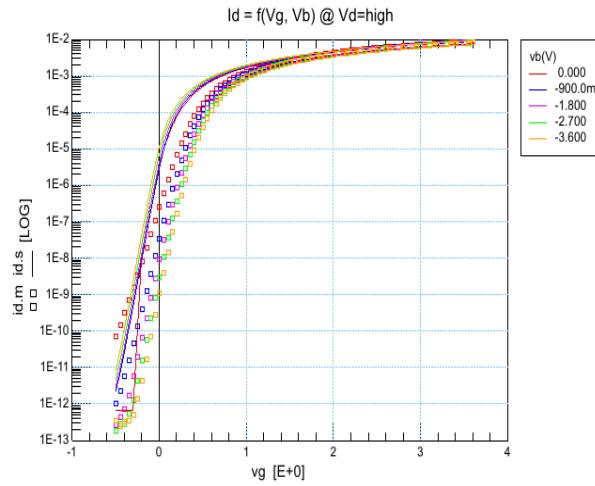
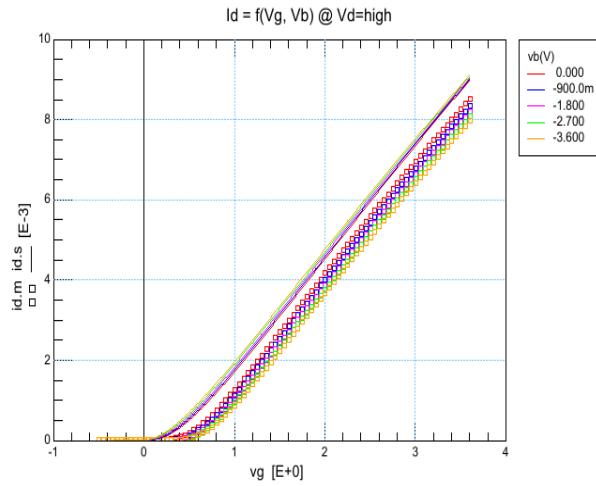
4.30 W10u0_L0u3_S556_1

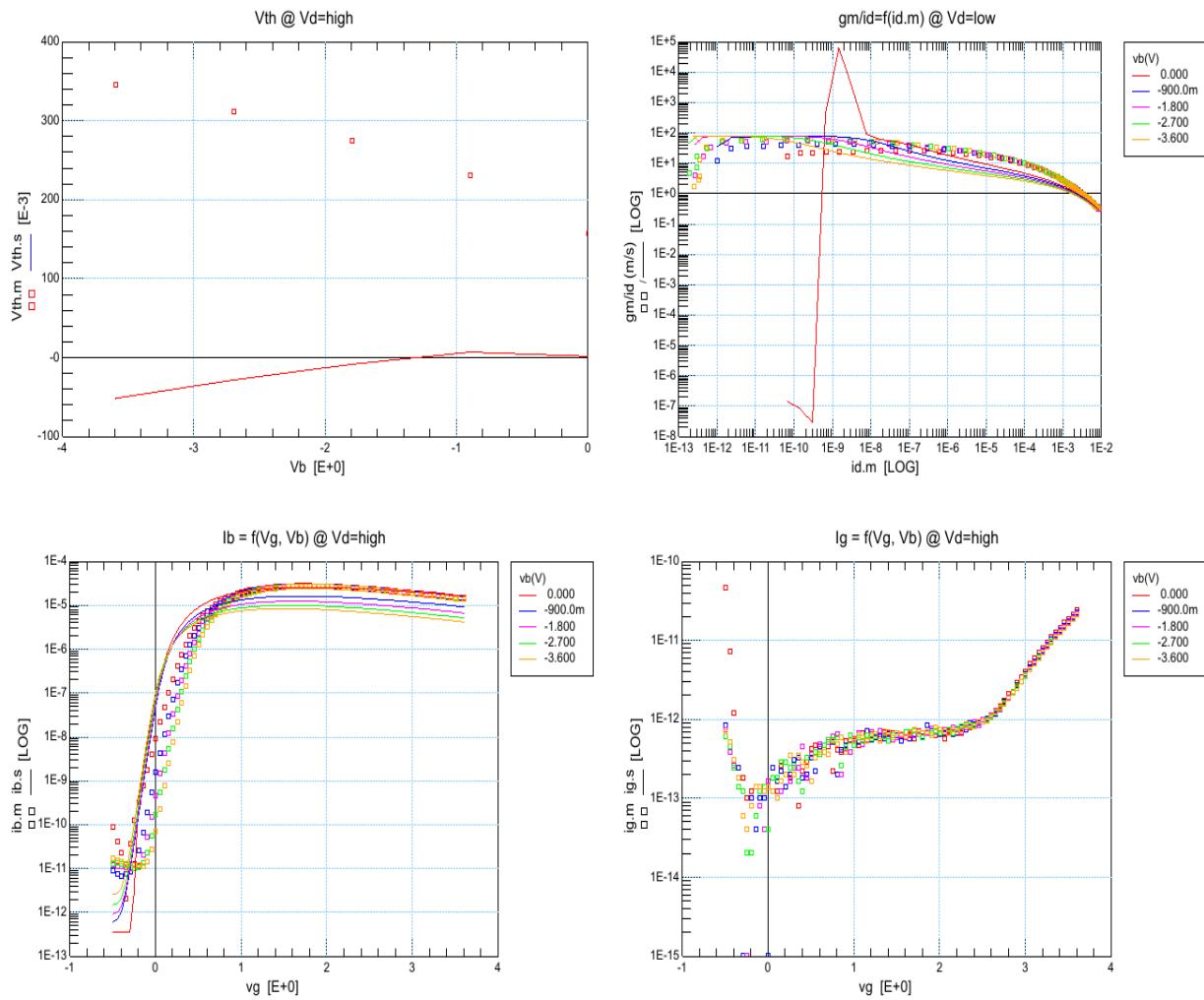
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



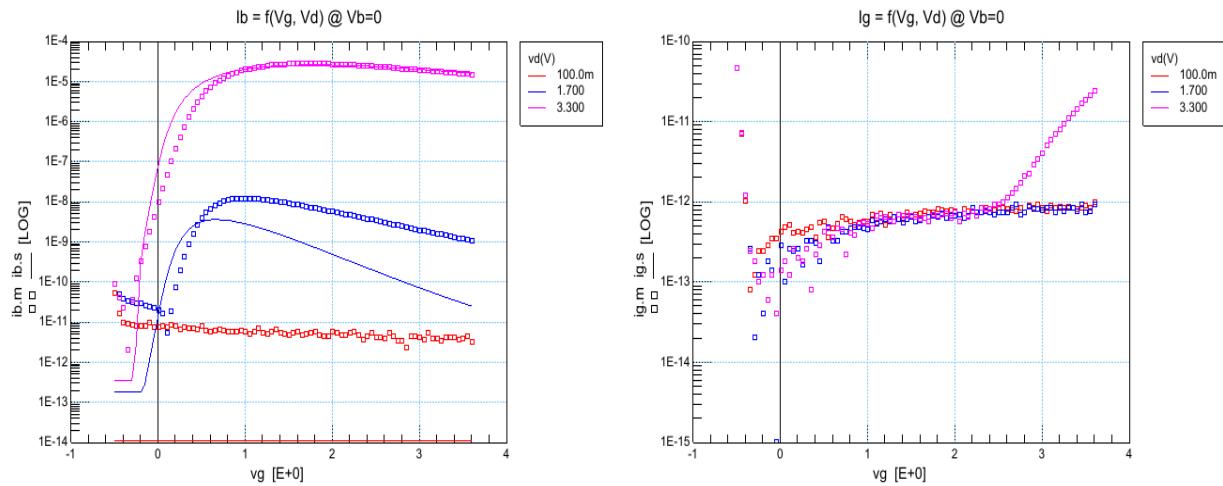


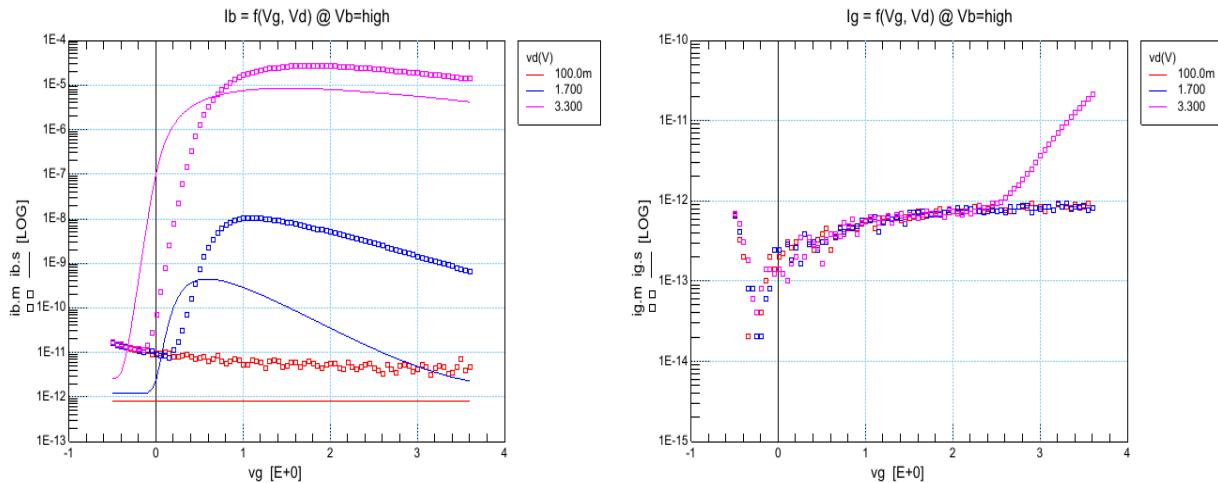
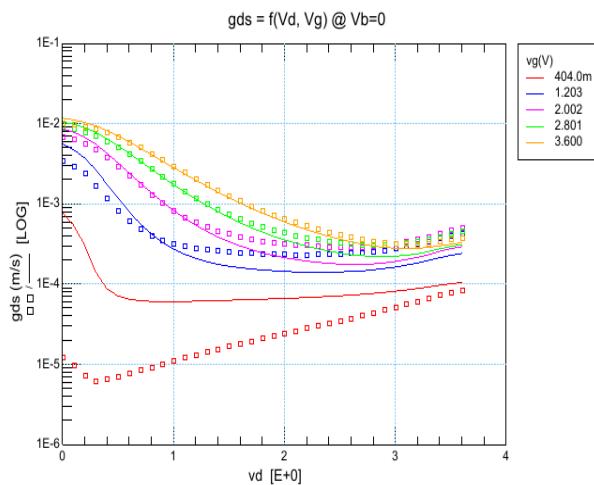
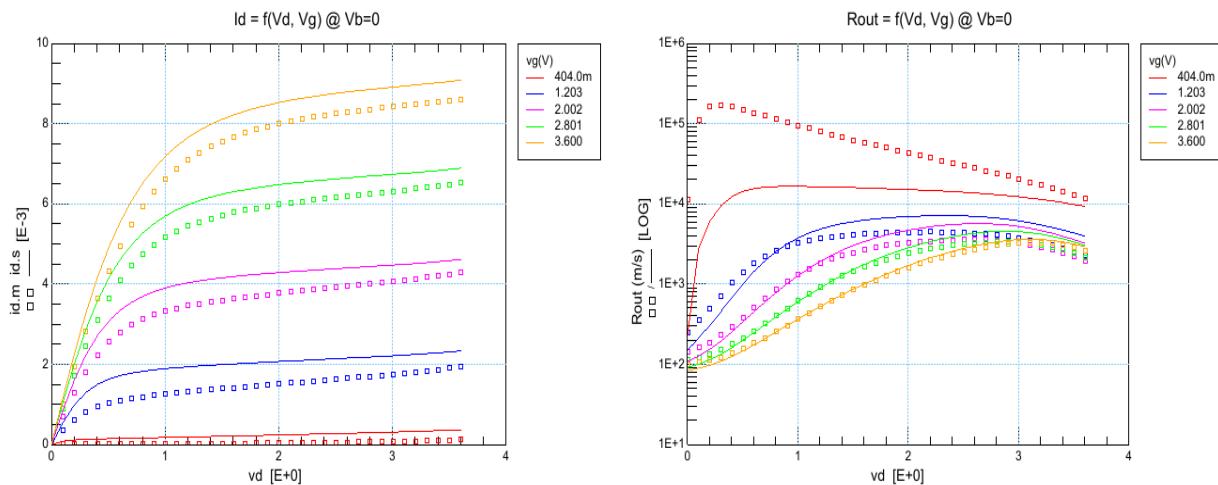
$idvg, Vd = 3.3V, T = 27^\circ C$

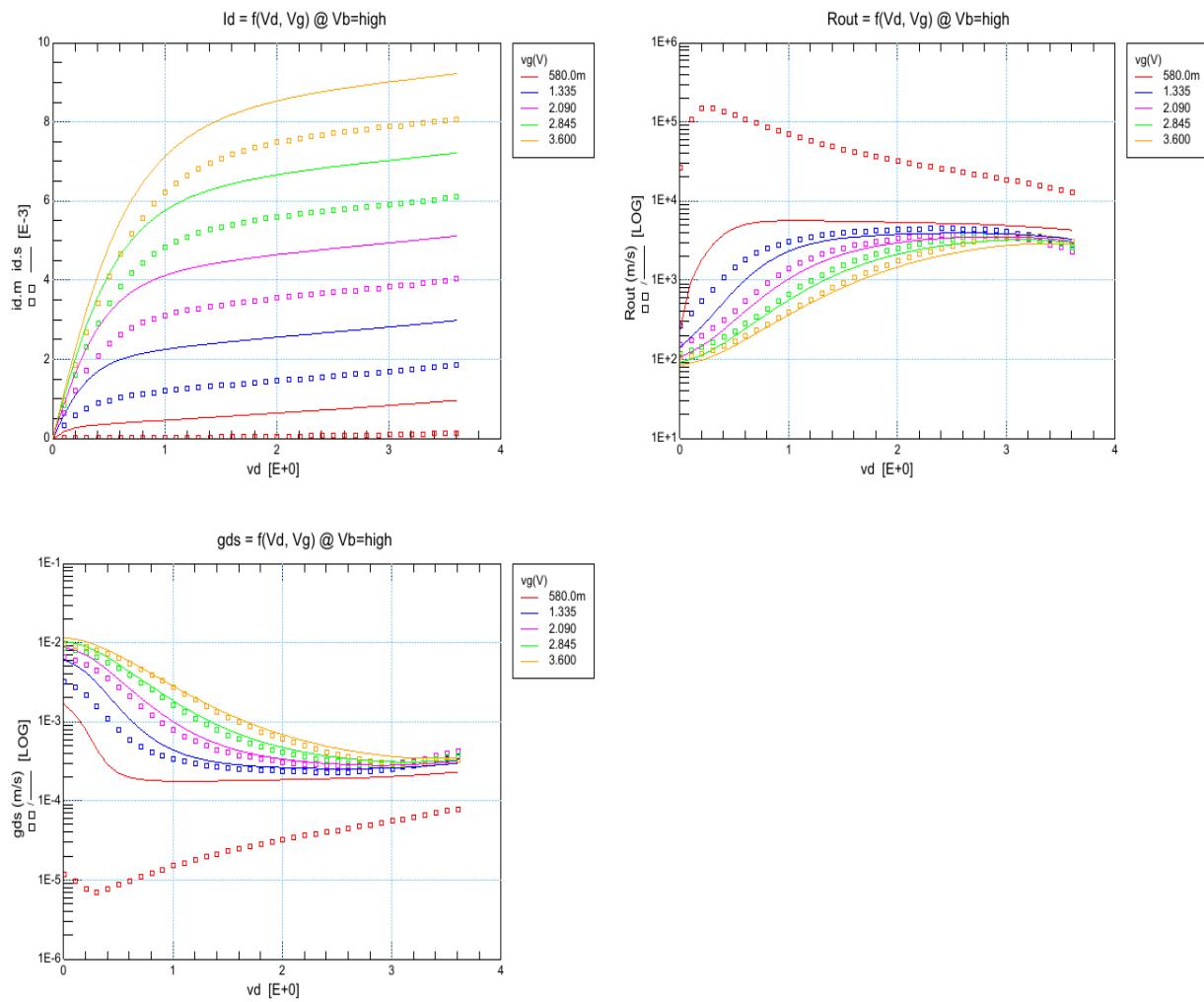
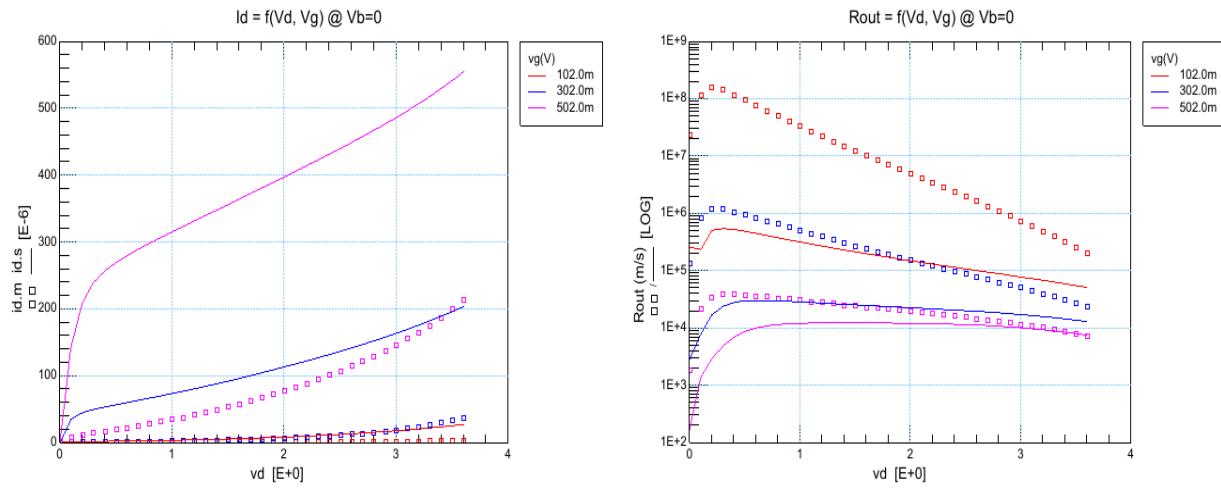


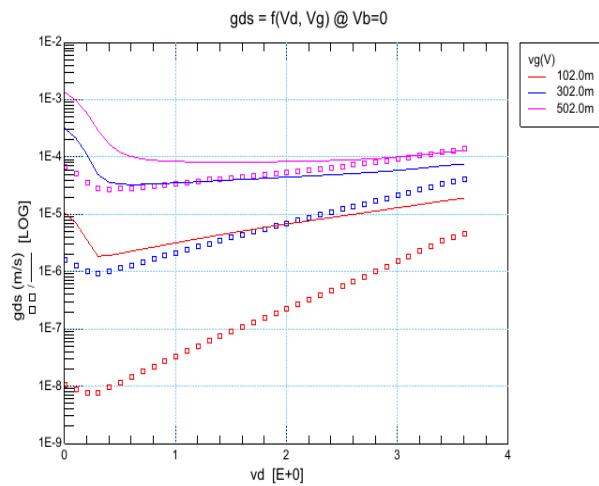


idvg, Ib, Ig, Vb = 0V, T = 27°C

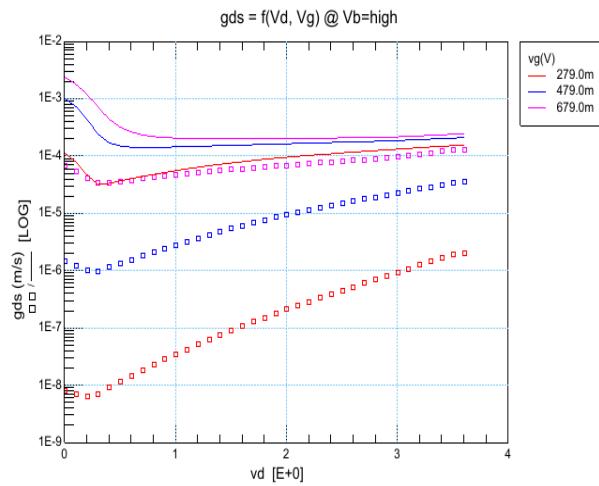
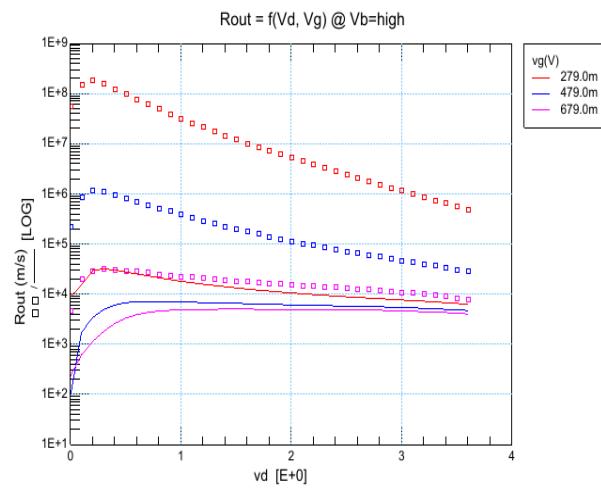
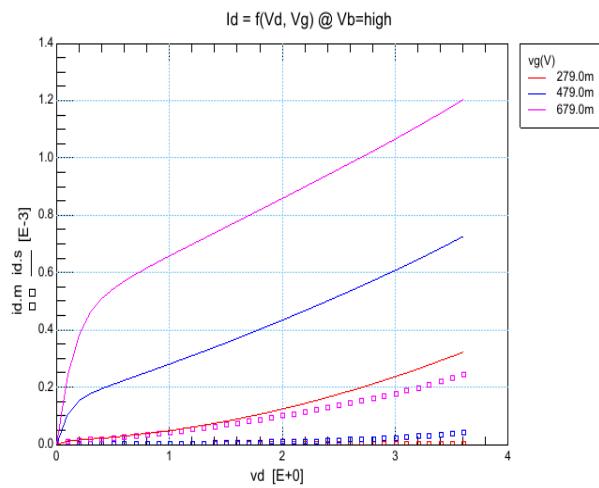


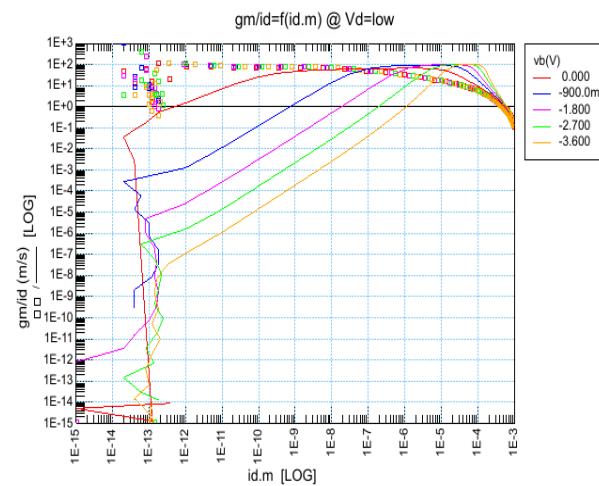
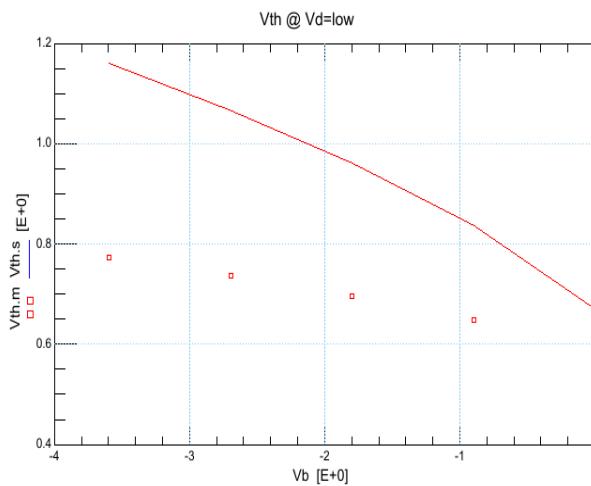
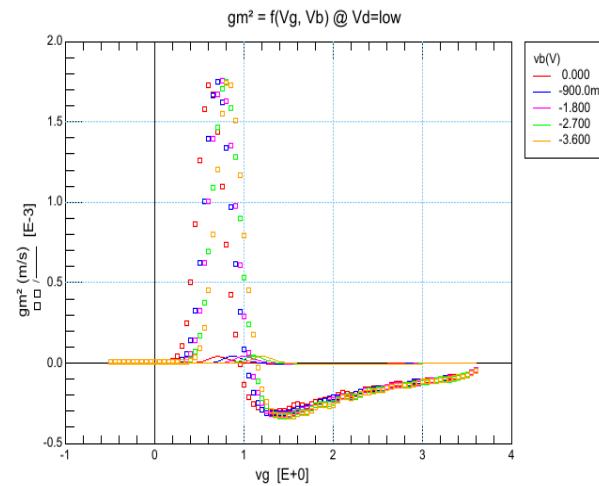
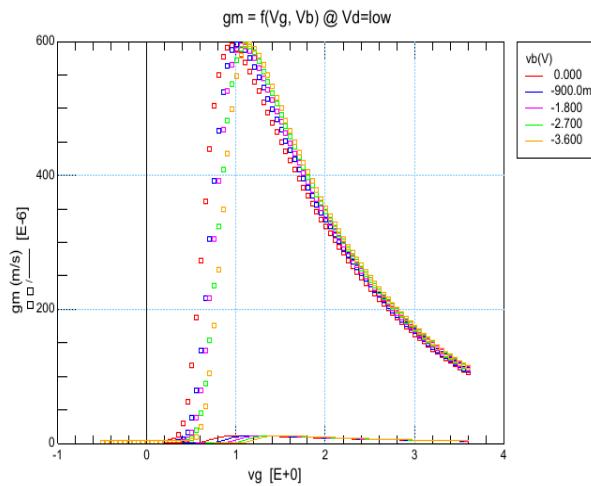
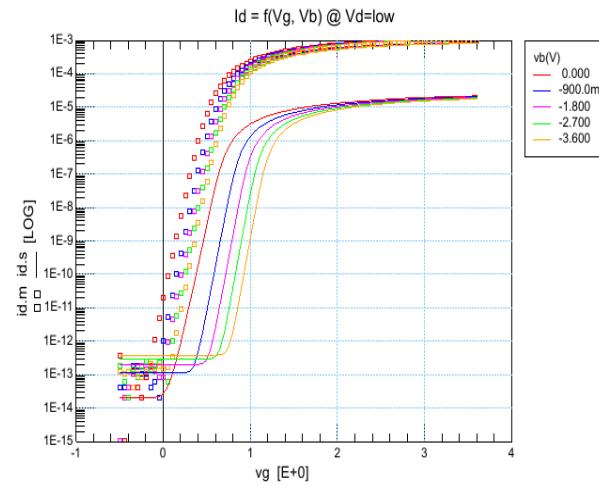
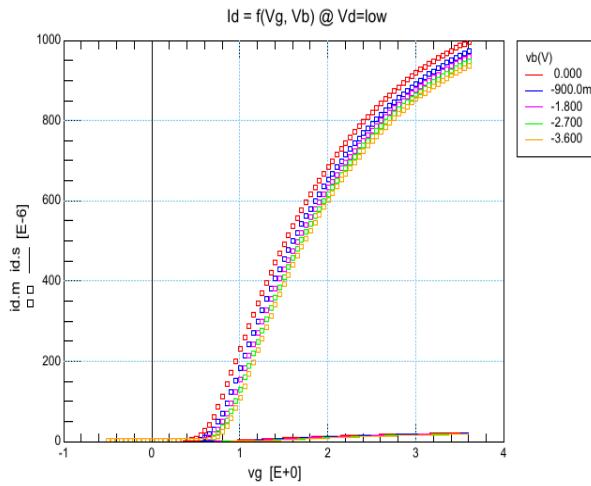
idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


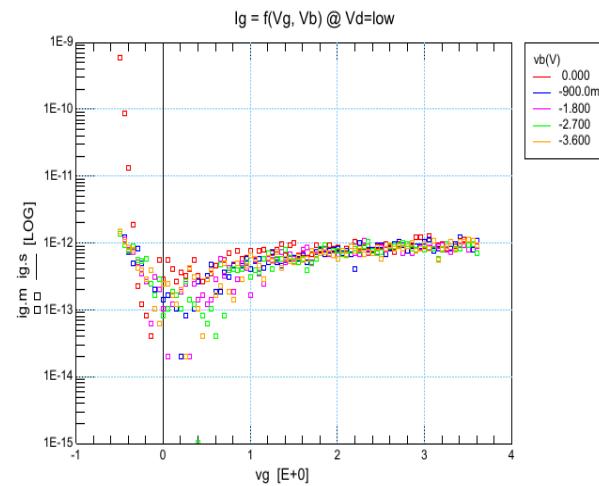
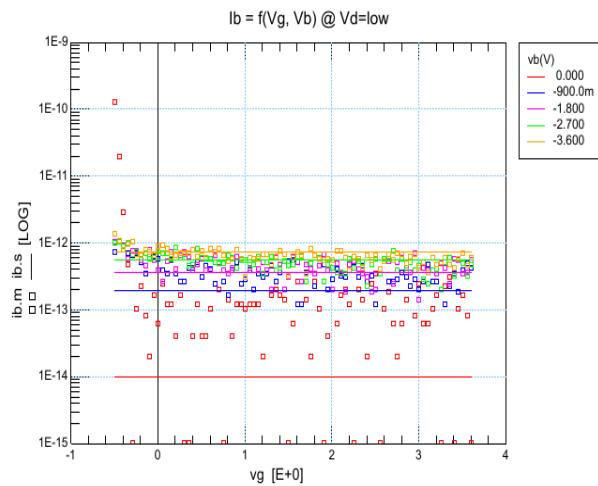
idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C




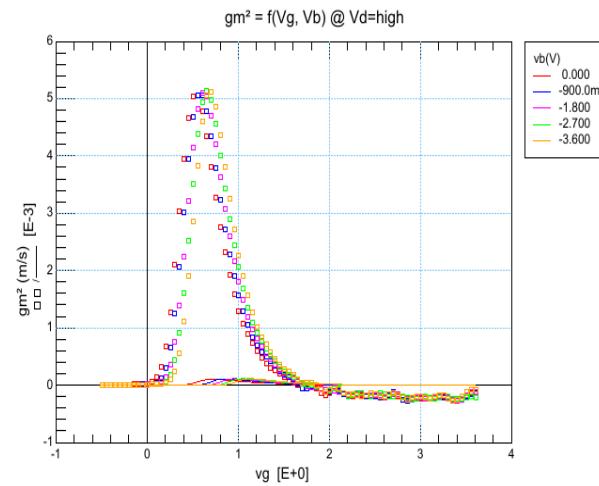
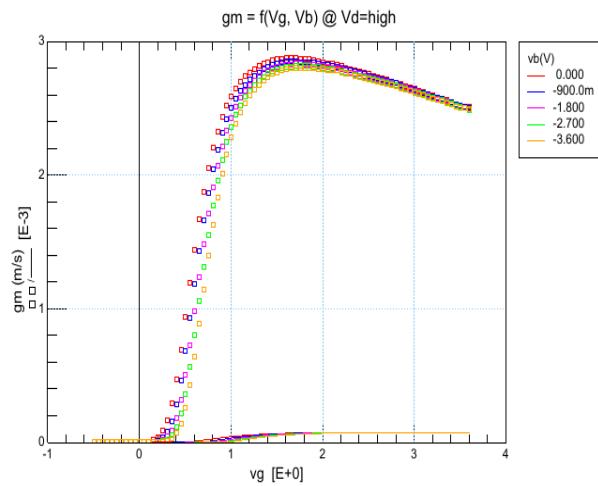
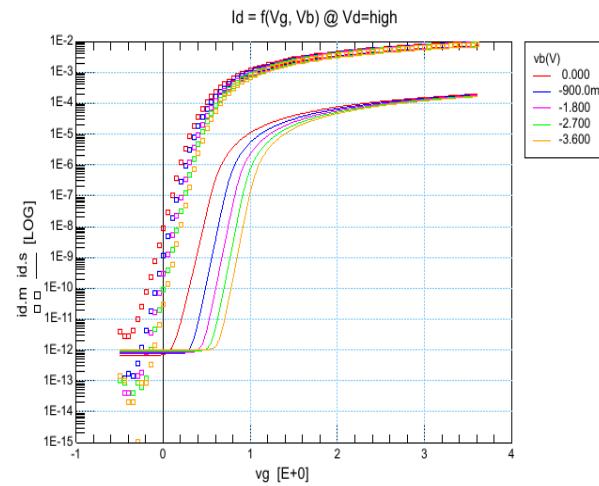
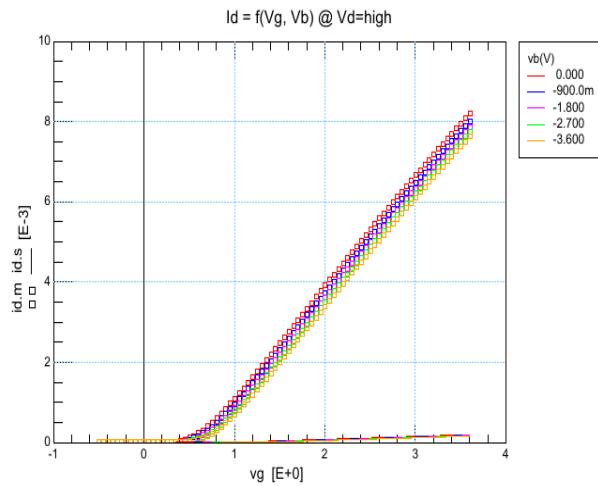
idvd_vth_vbmin, Vb = -3.6V, T = 27°C

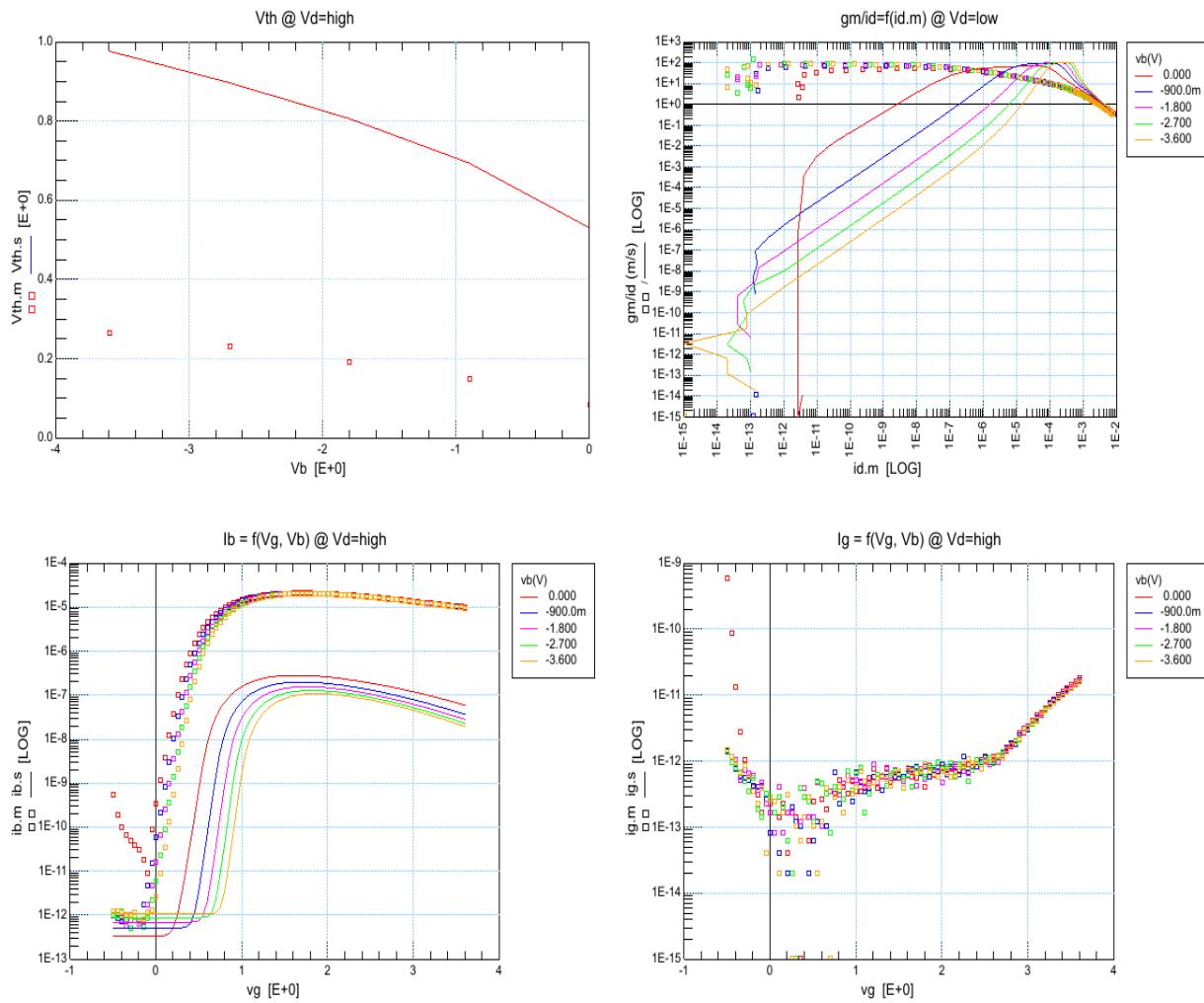


4.31 W0u3_L0u45_T356_S384M_3**idvg, Vd = 0.1V, T = 27°C**

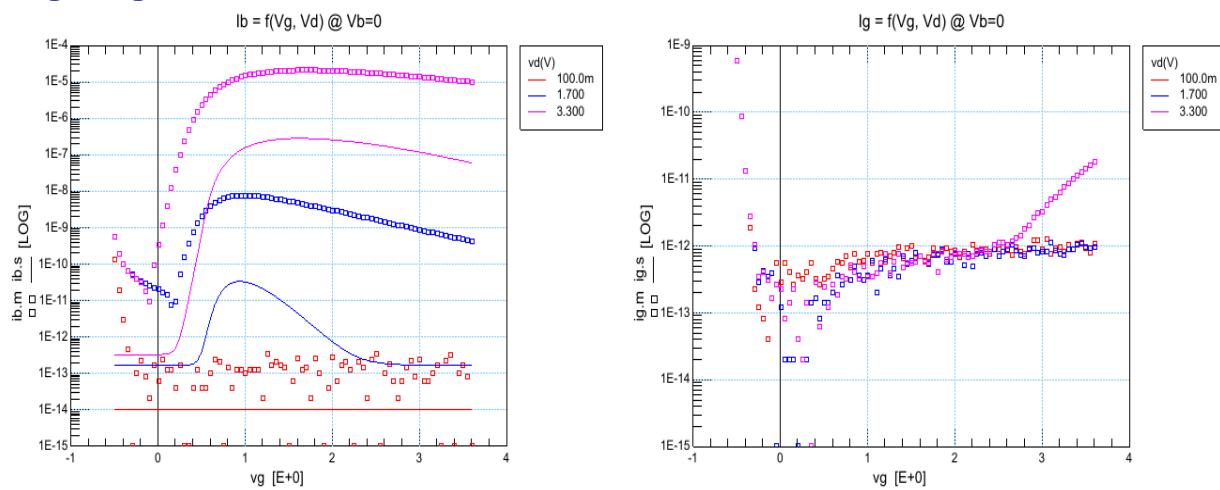


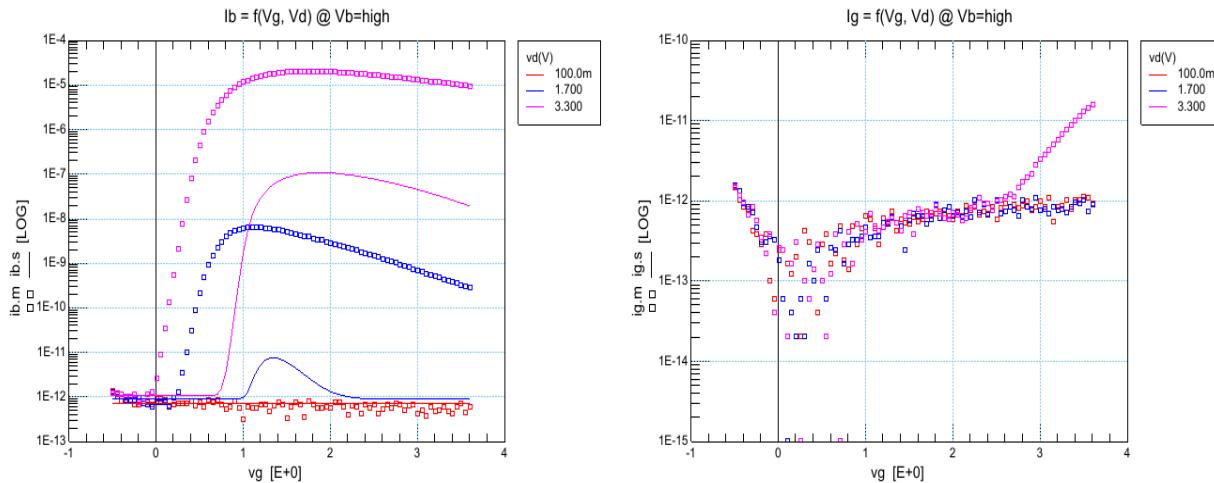
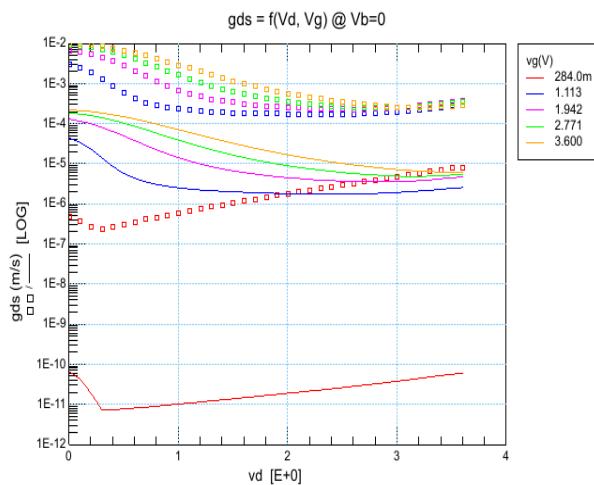
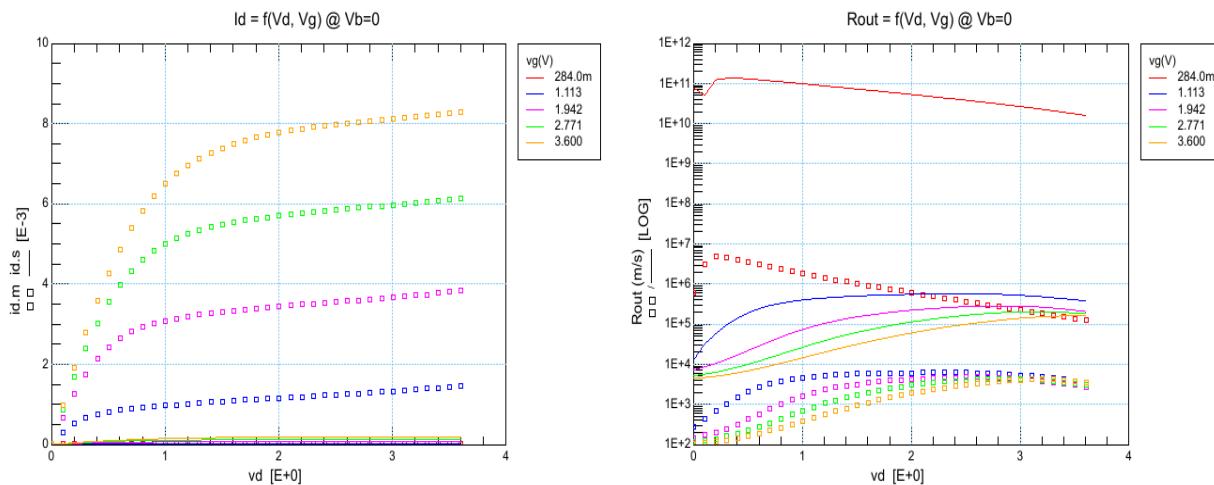
$idvg, Vd = 3.3V, T = 27^\circ C$

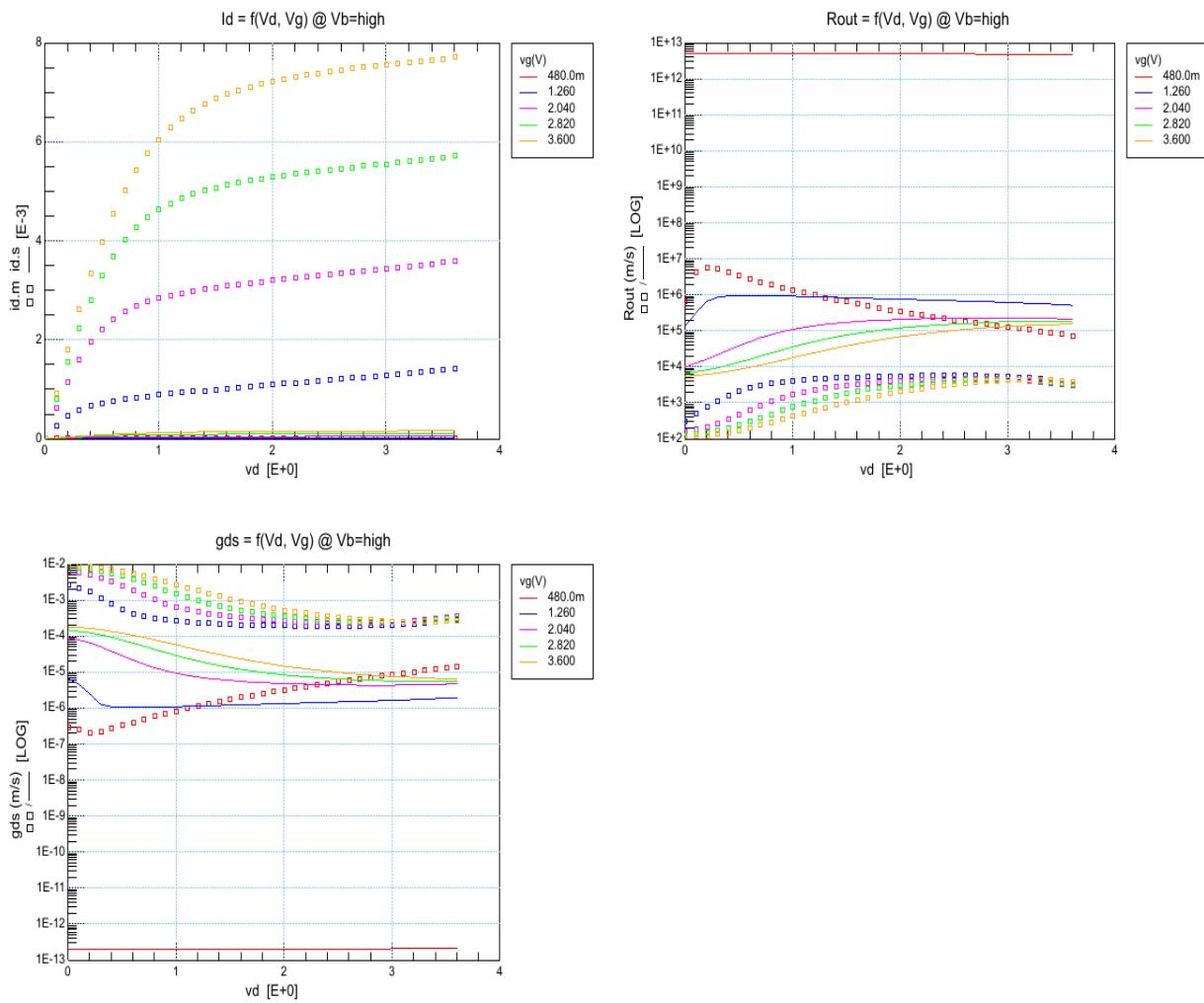
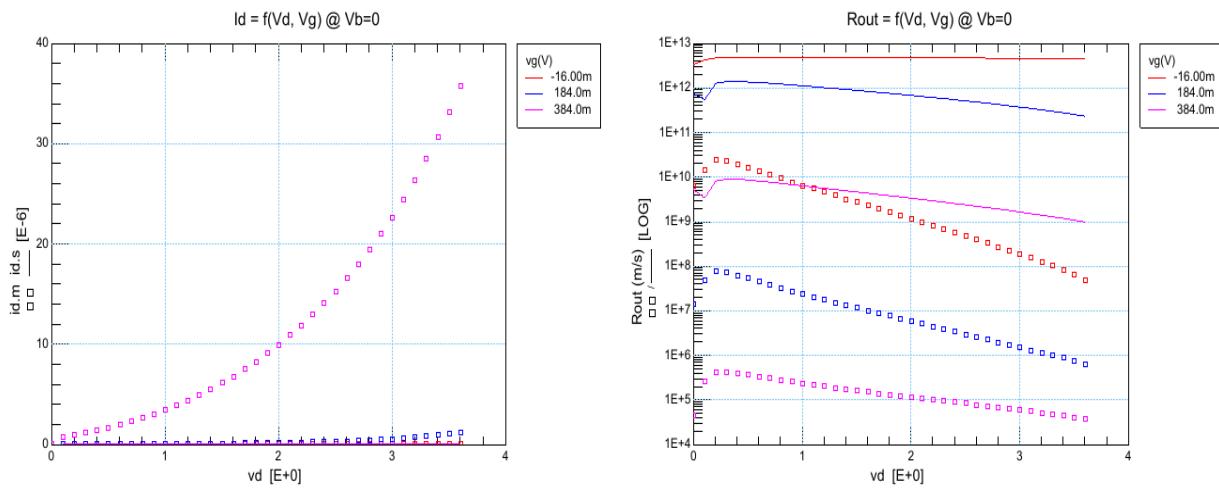


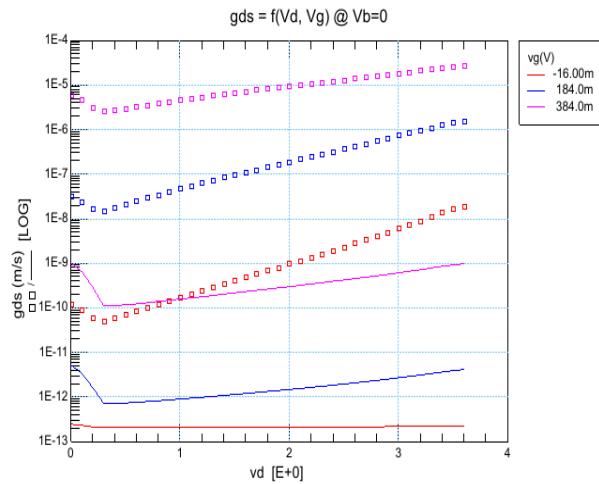


idvg, Ib, Ig, Vb = 0V, T = 27°C

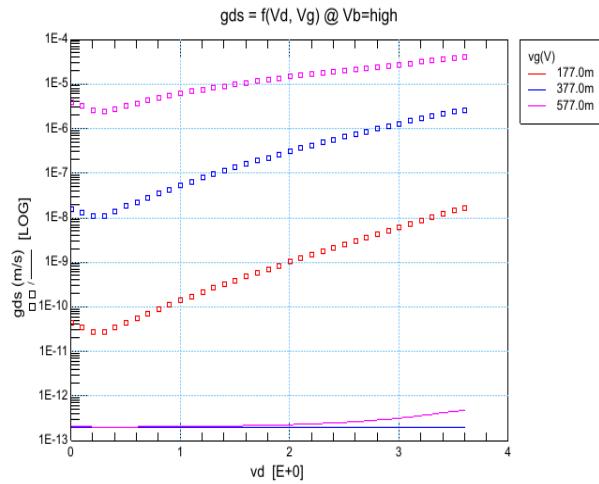
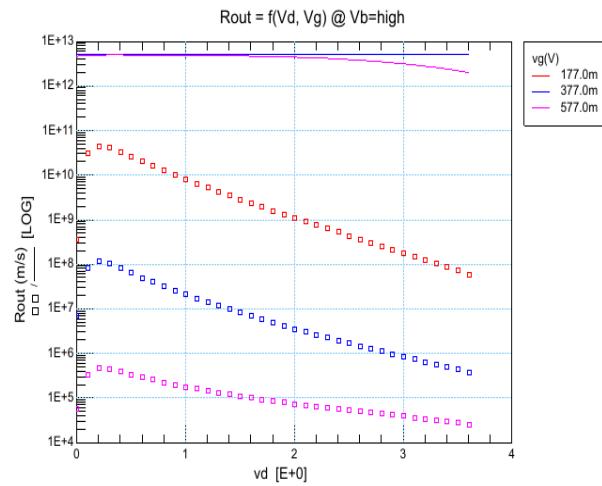
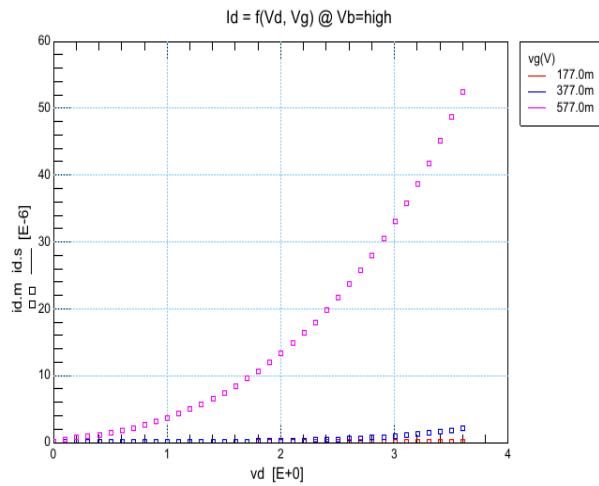


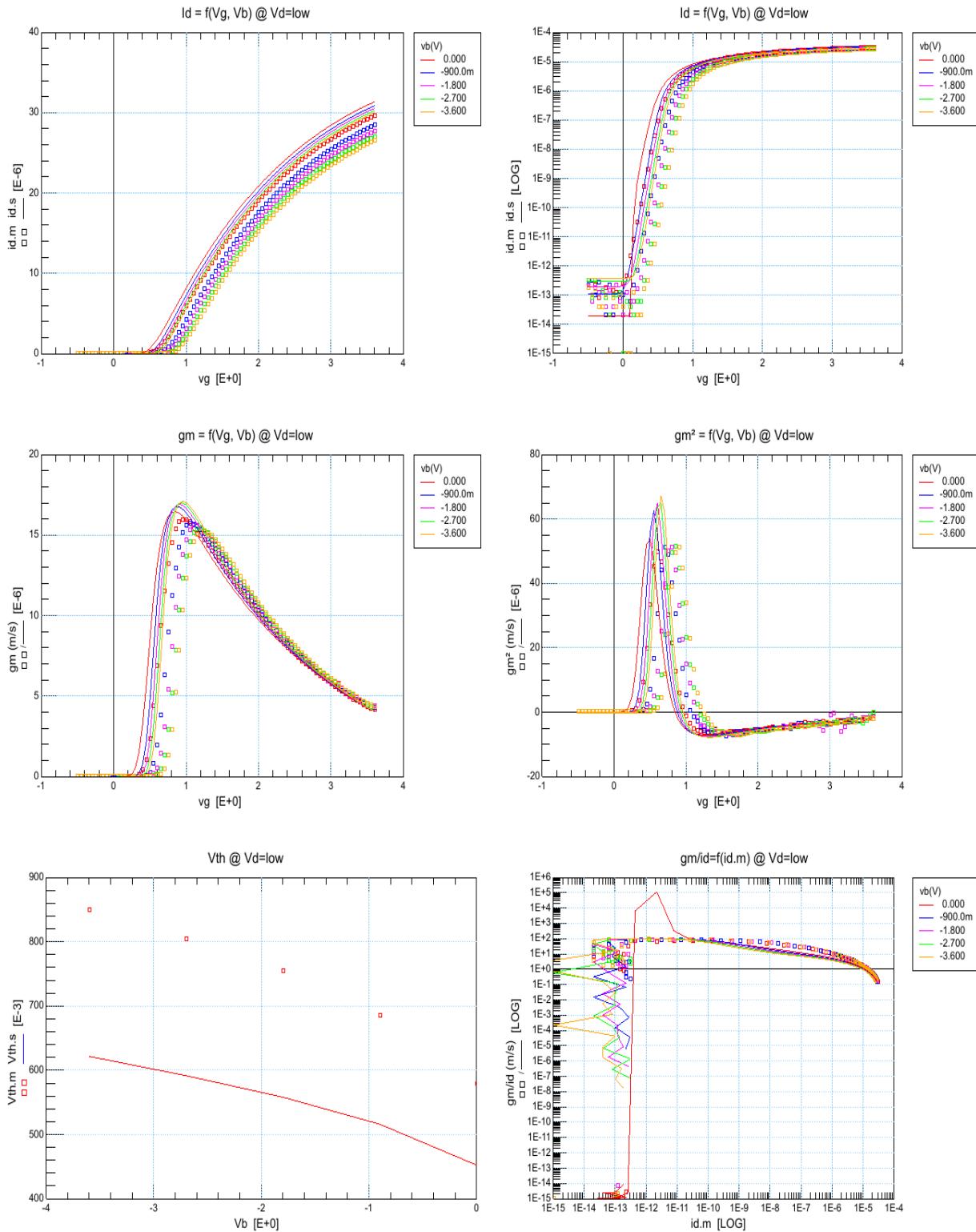
idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


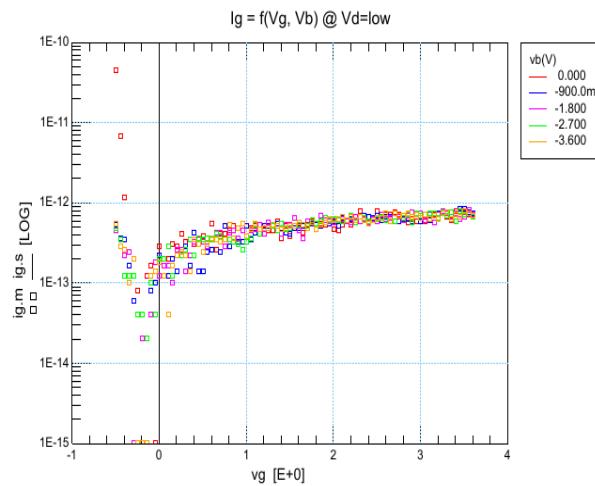
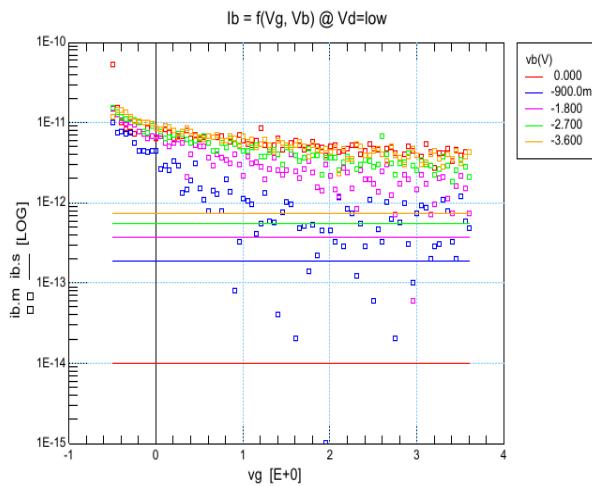
idvd_vbmin, Vb = -3.6V, T = 27°C**idvd_vth, Vb = 0V, T = 27°C**



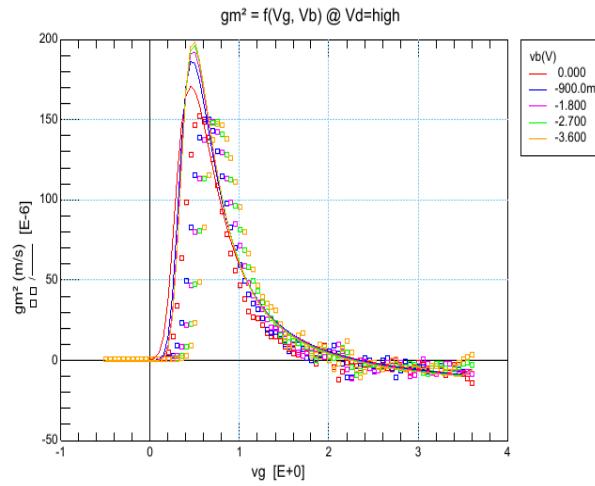
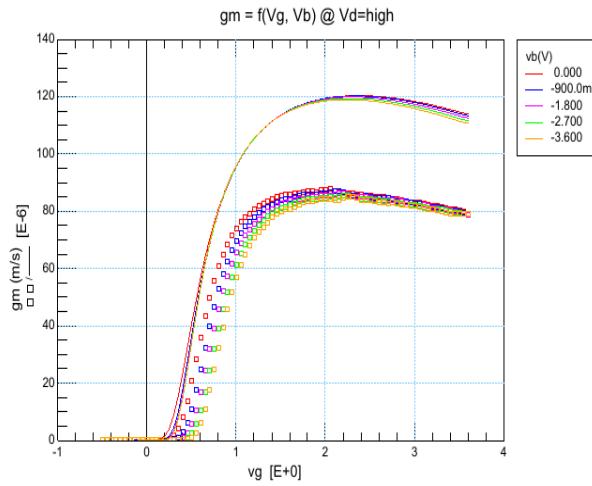
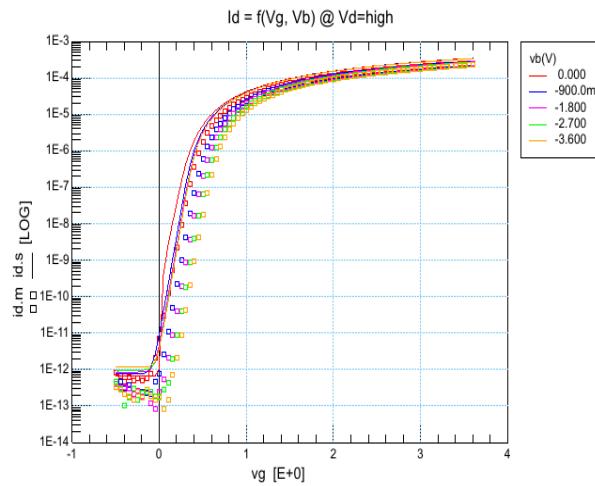
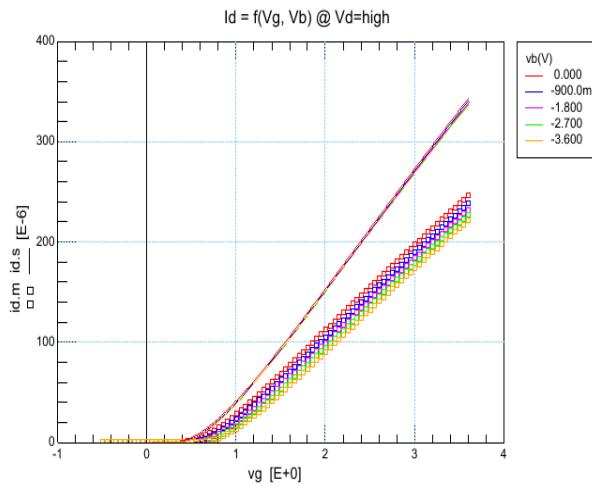
idvd_vth_vbmin, Vb = -3.6V, T = 27°C

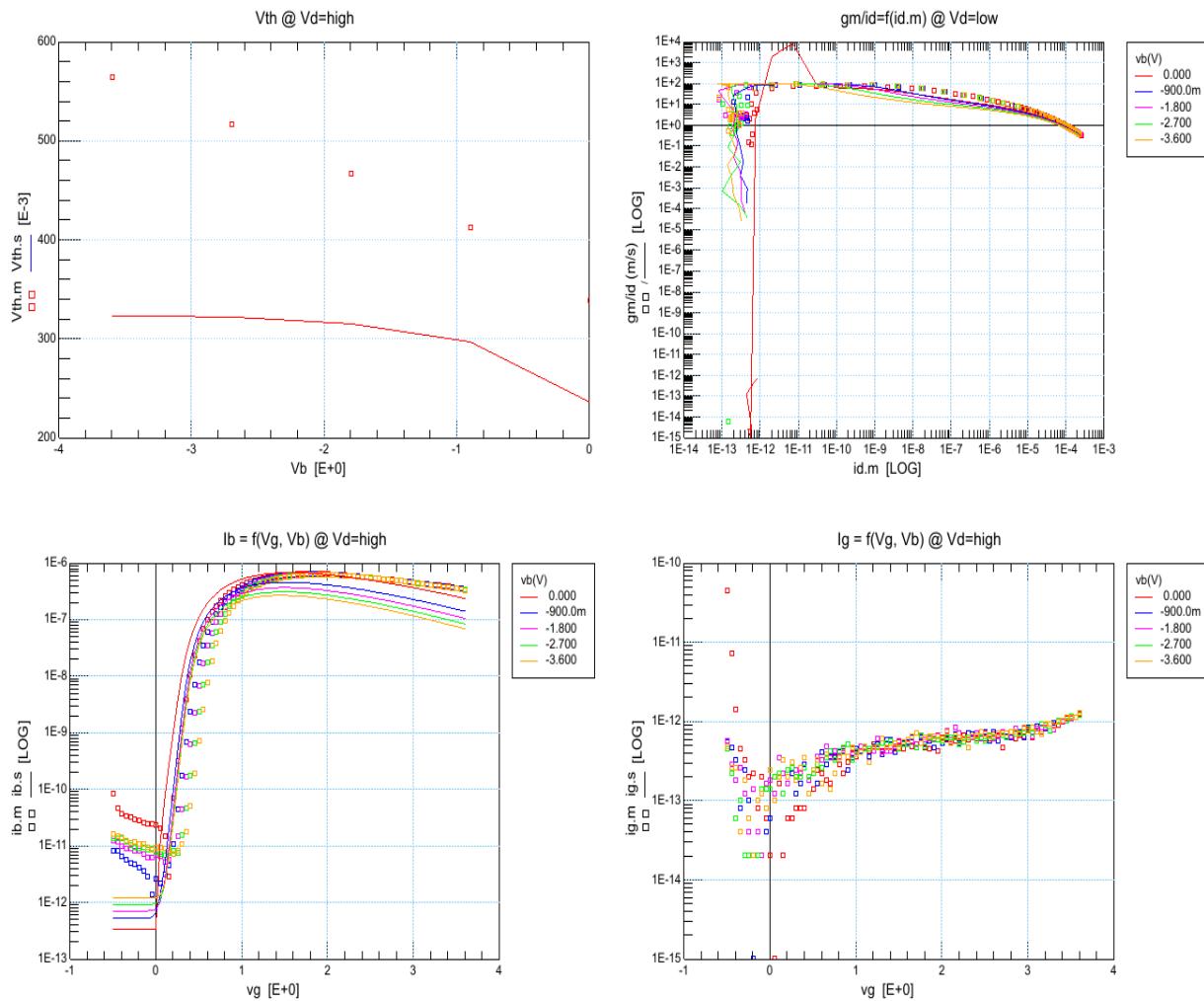


4.32 W0u3_L0u33_S560_2**idvg, Vd = 0.1V, T = 27°C**

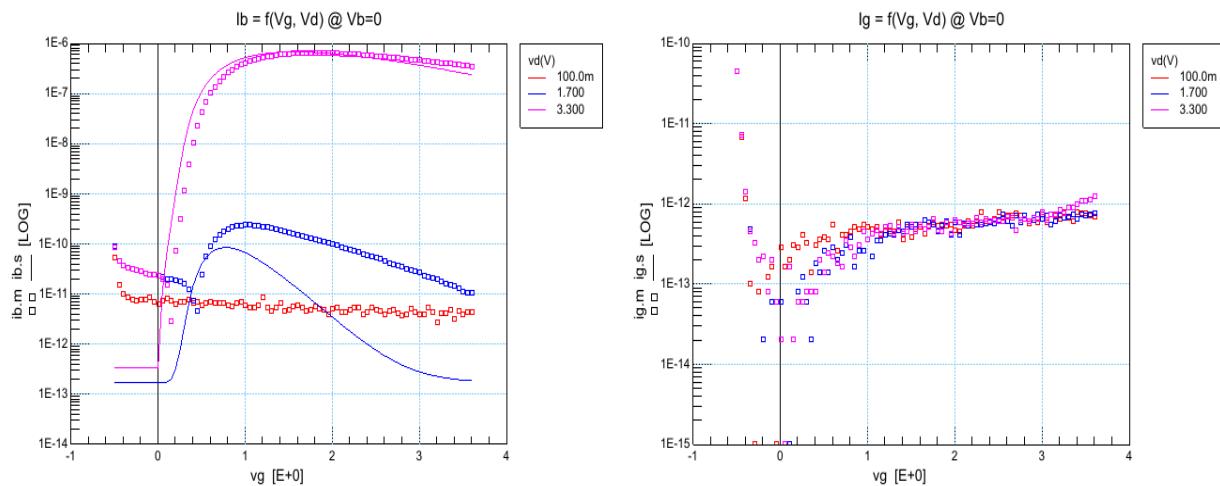


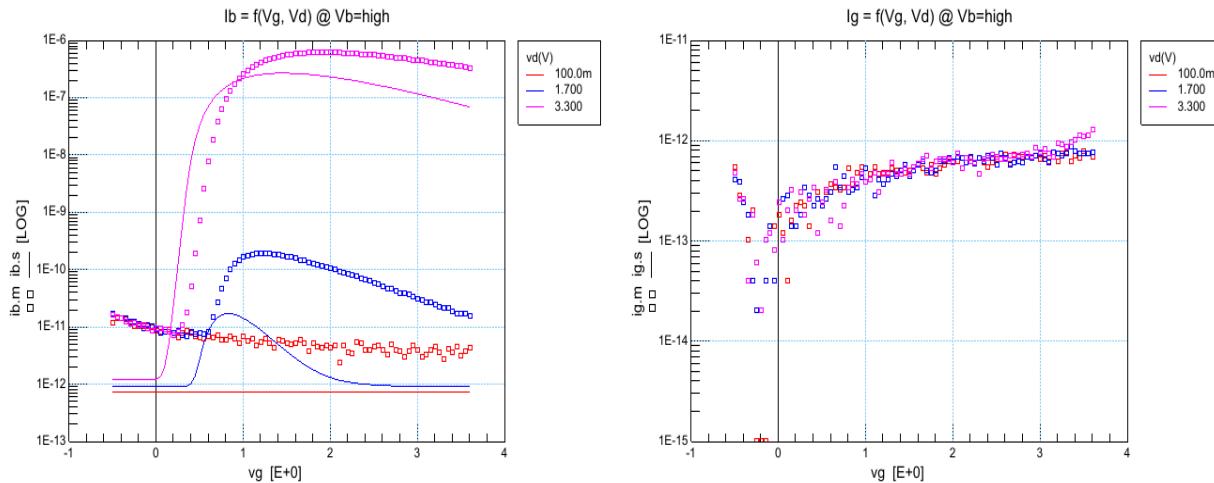
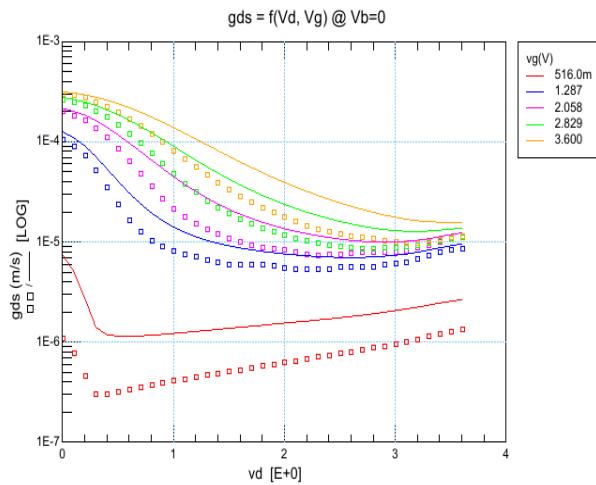
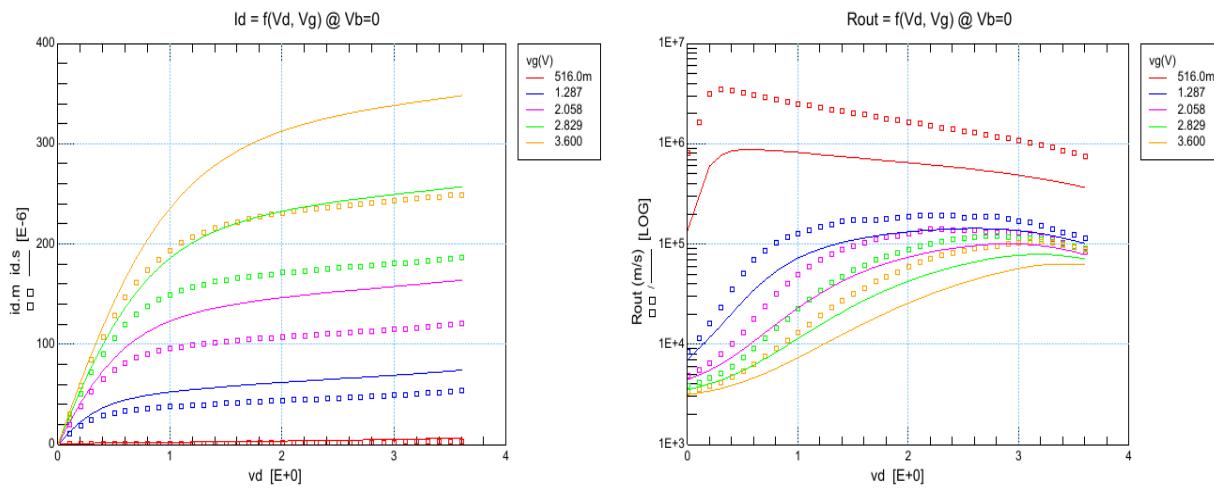
$i_{dvg}, V_d = 3.3V, T = 27^\circ\text{C}$

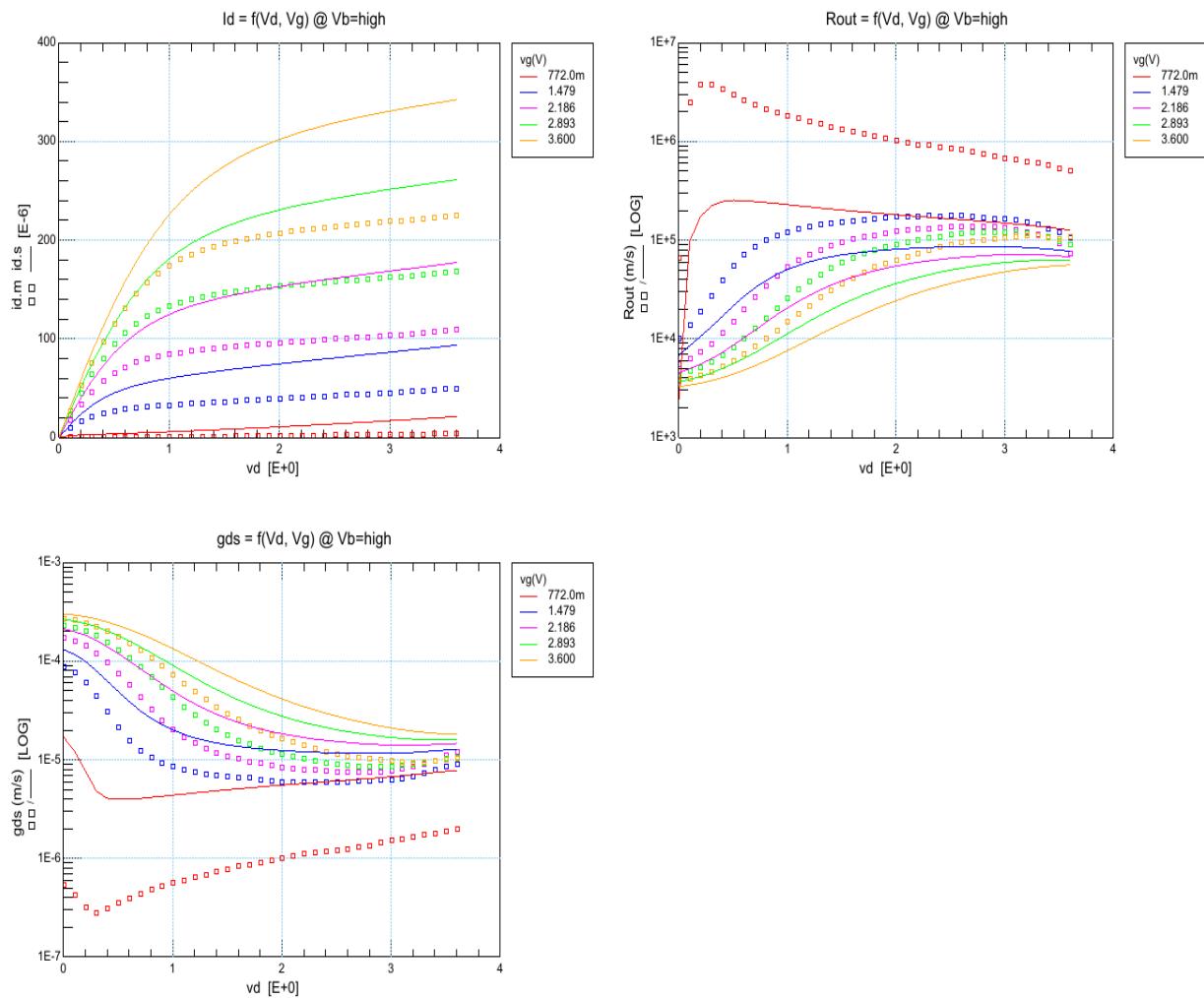
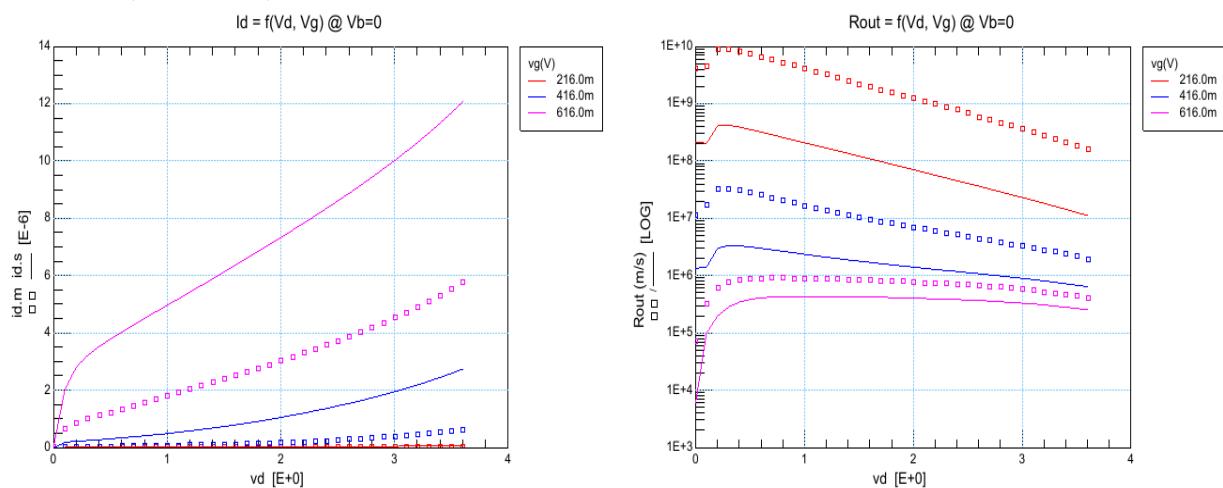


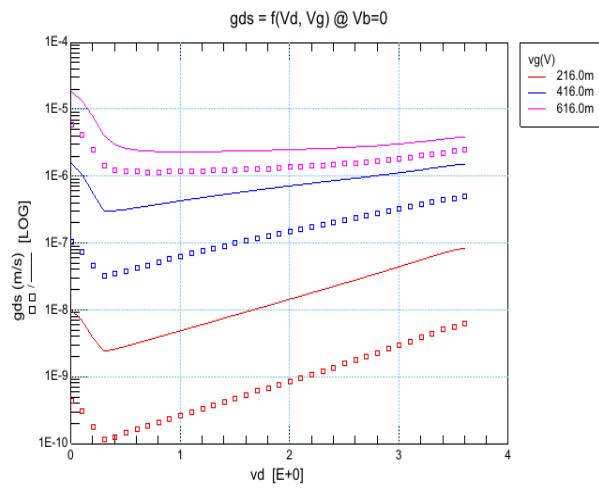


$i_{dvg}, I_b, I_g, V_b = 0V, T = 27^\circ C$

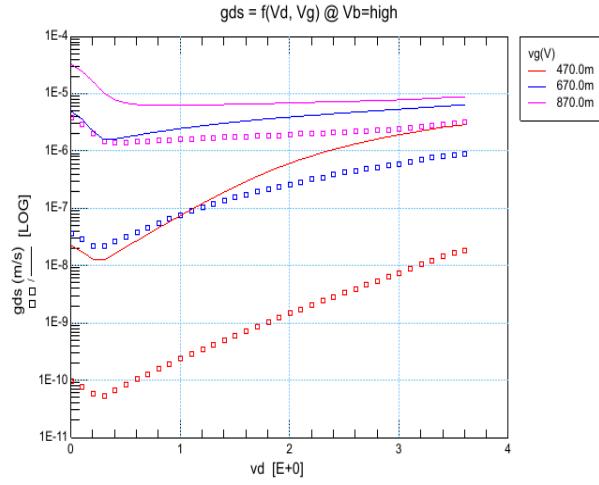
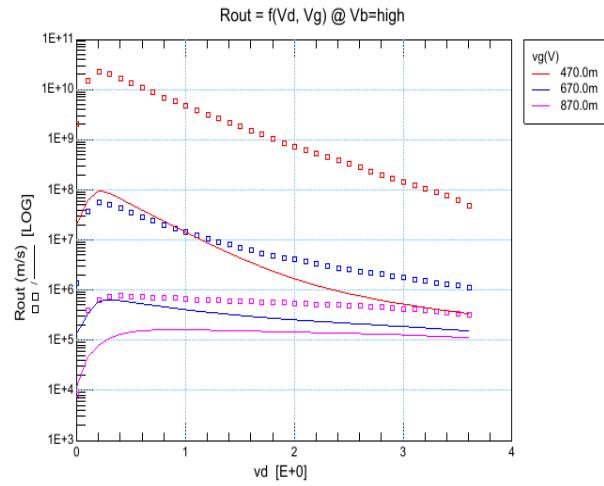
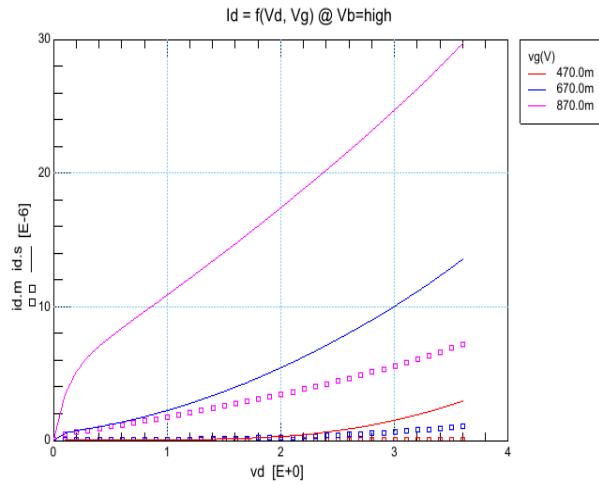


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


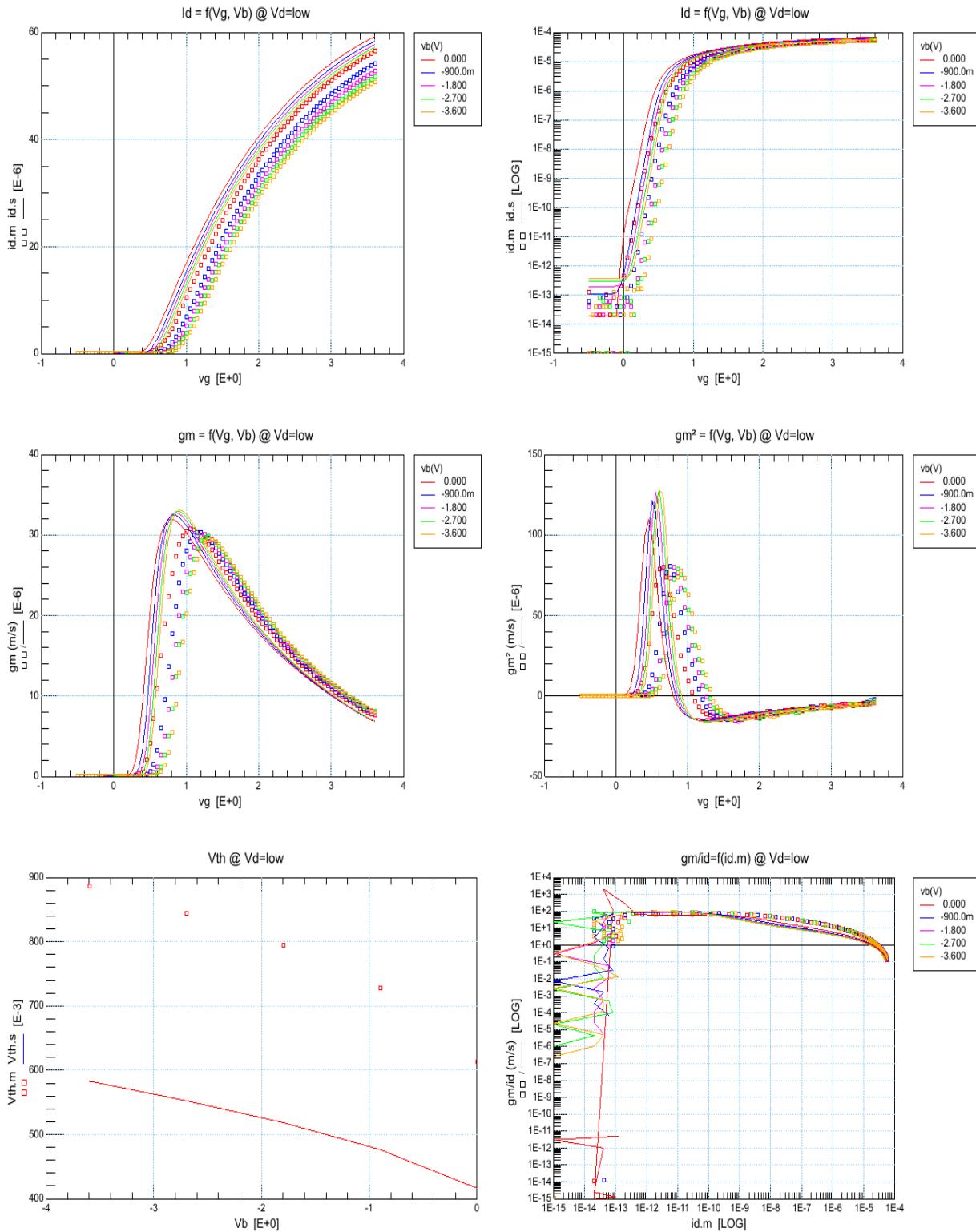


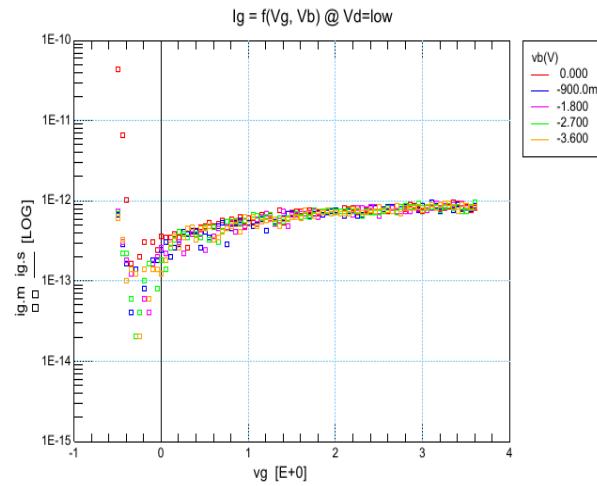
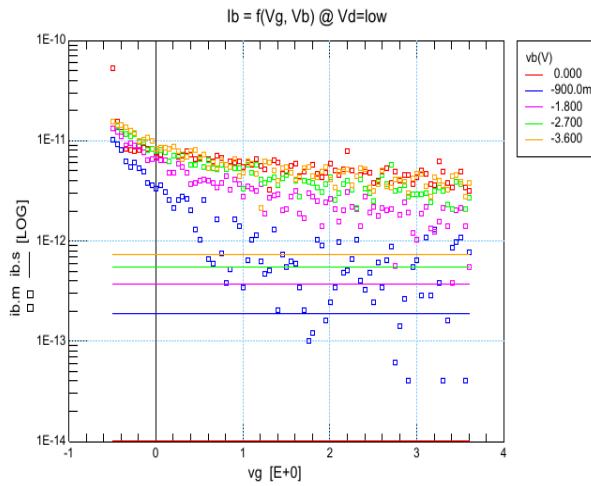
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



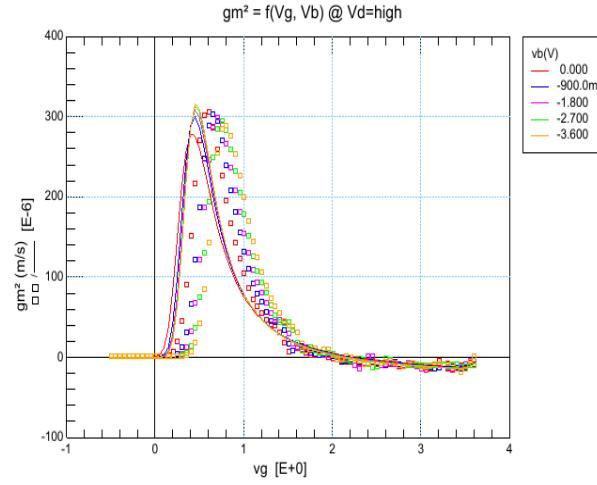
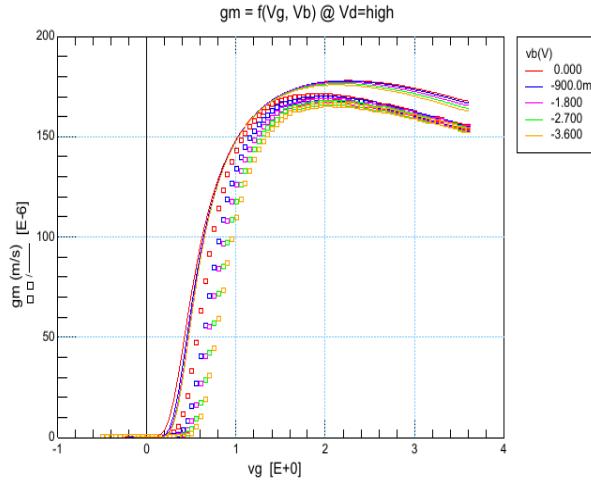
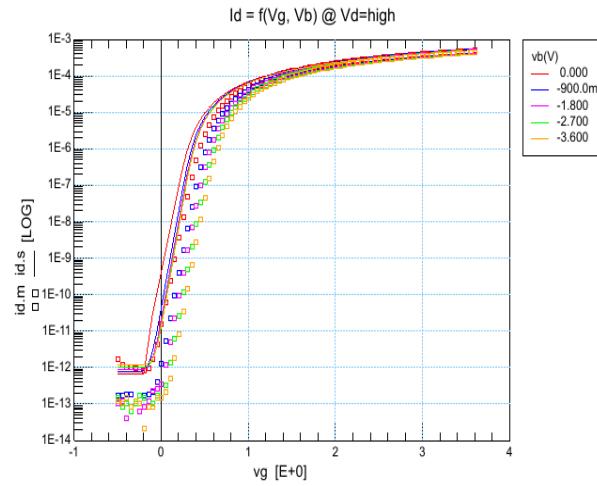
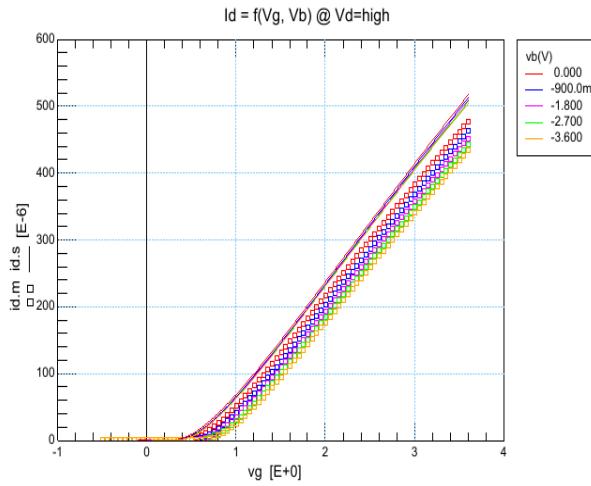
4.33 W0u6_L0u33_S559_1

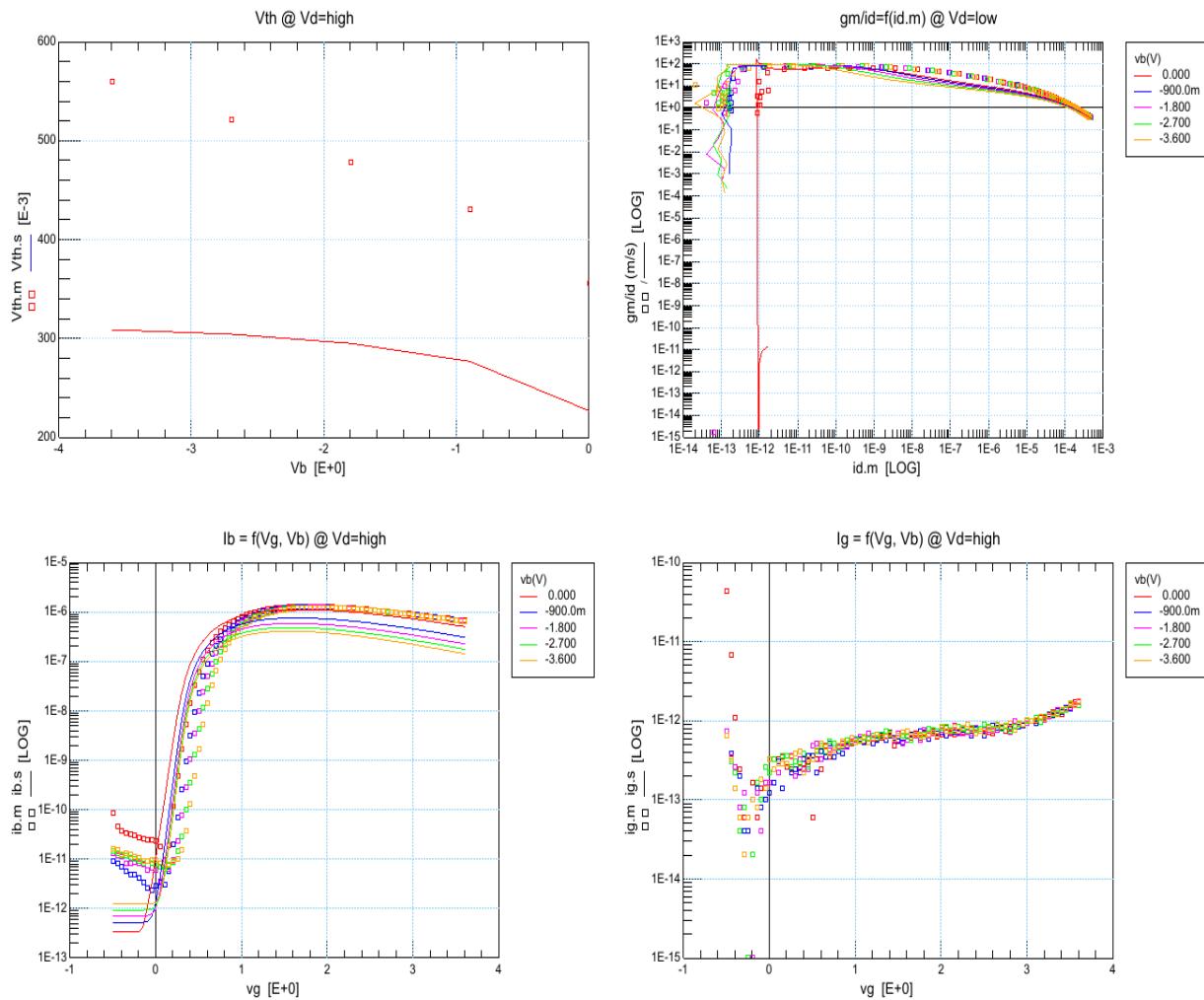
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



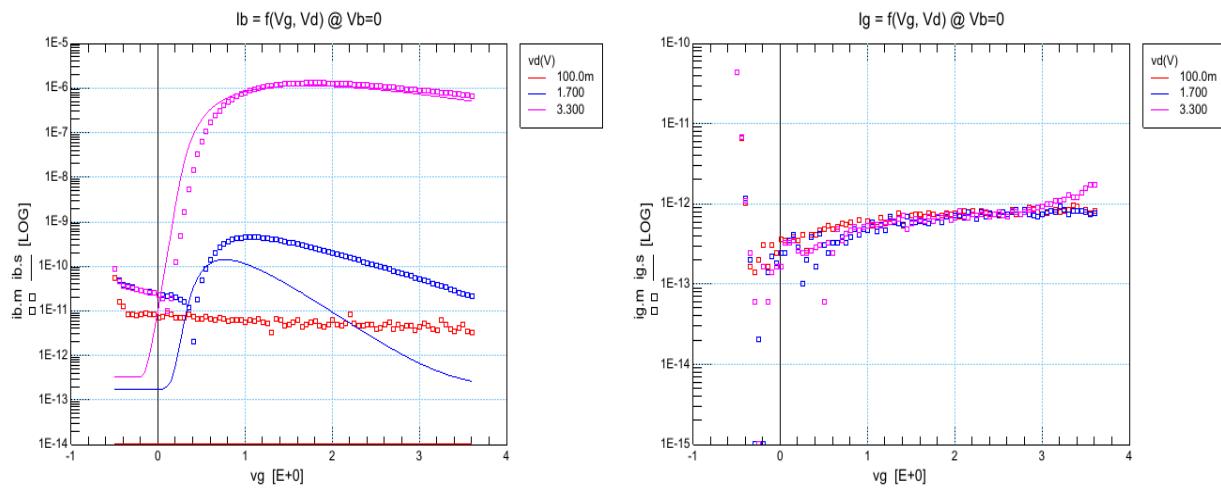


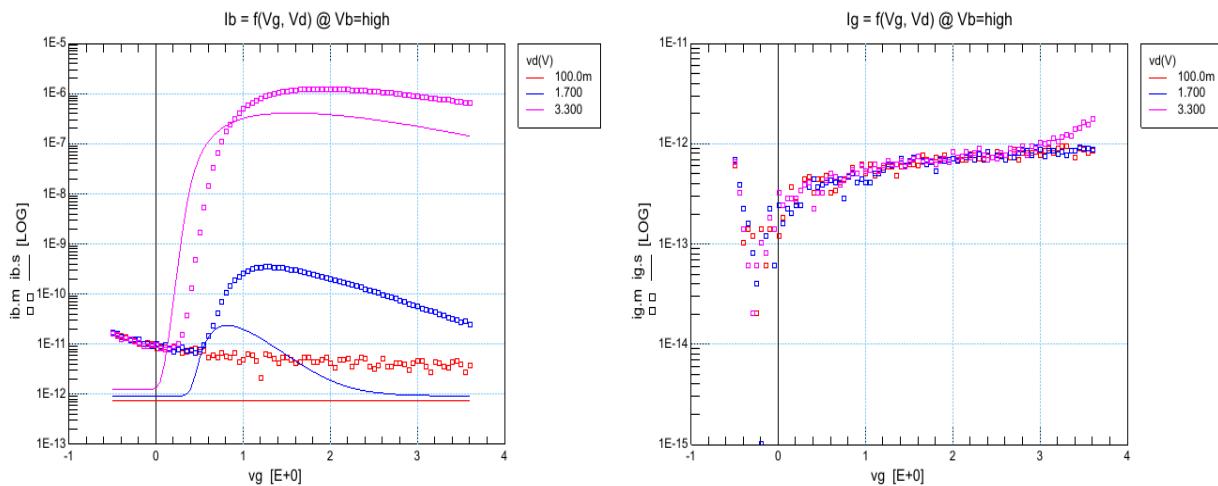
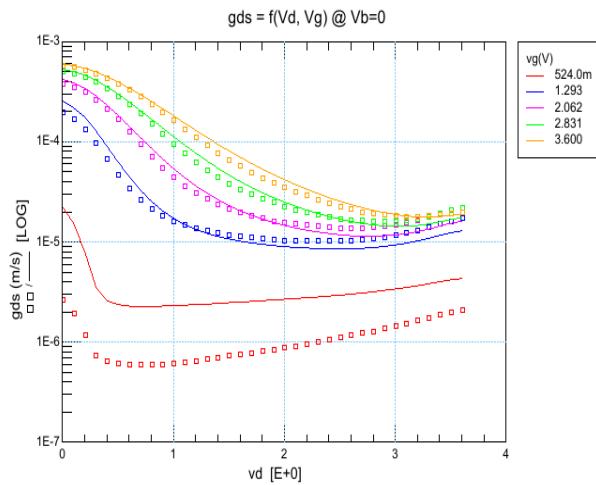
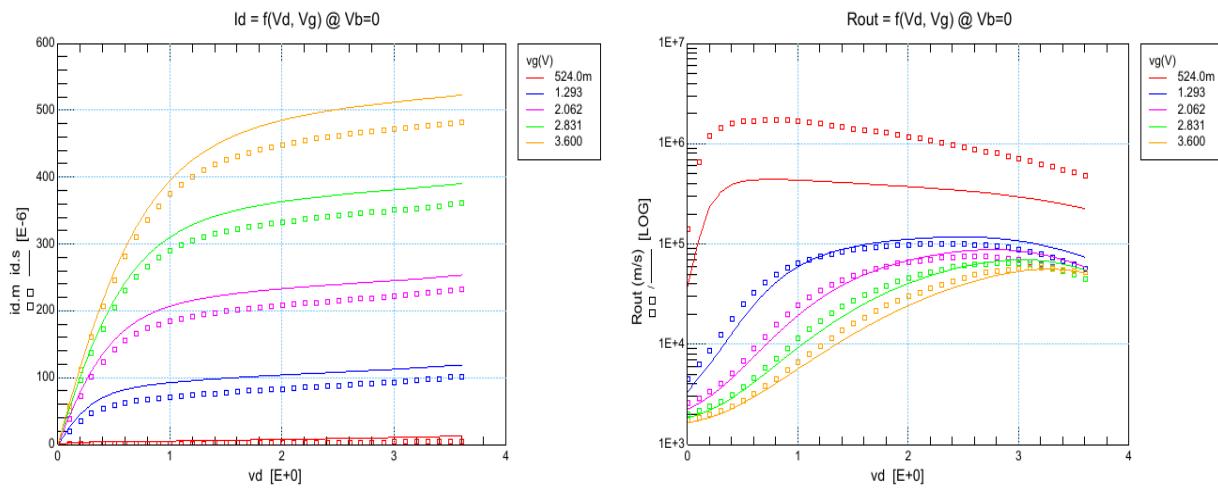
$i_{dvg}, V_d = 3.3V, T = 27^\circ\text{C}$

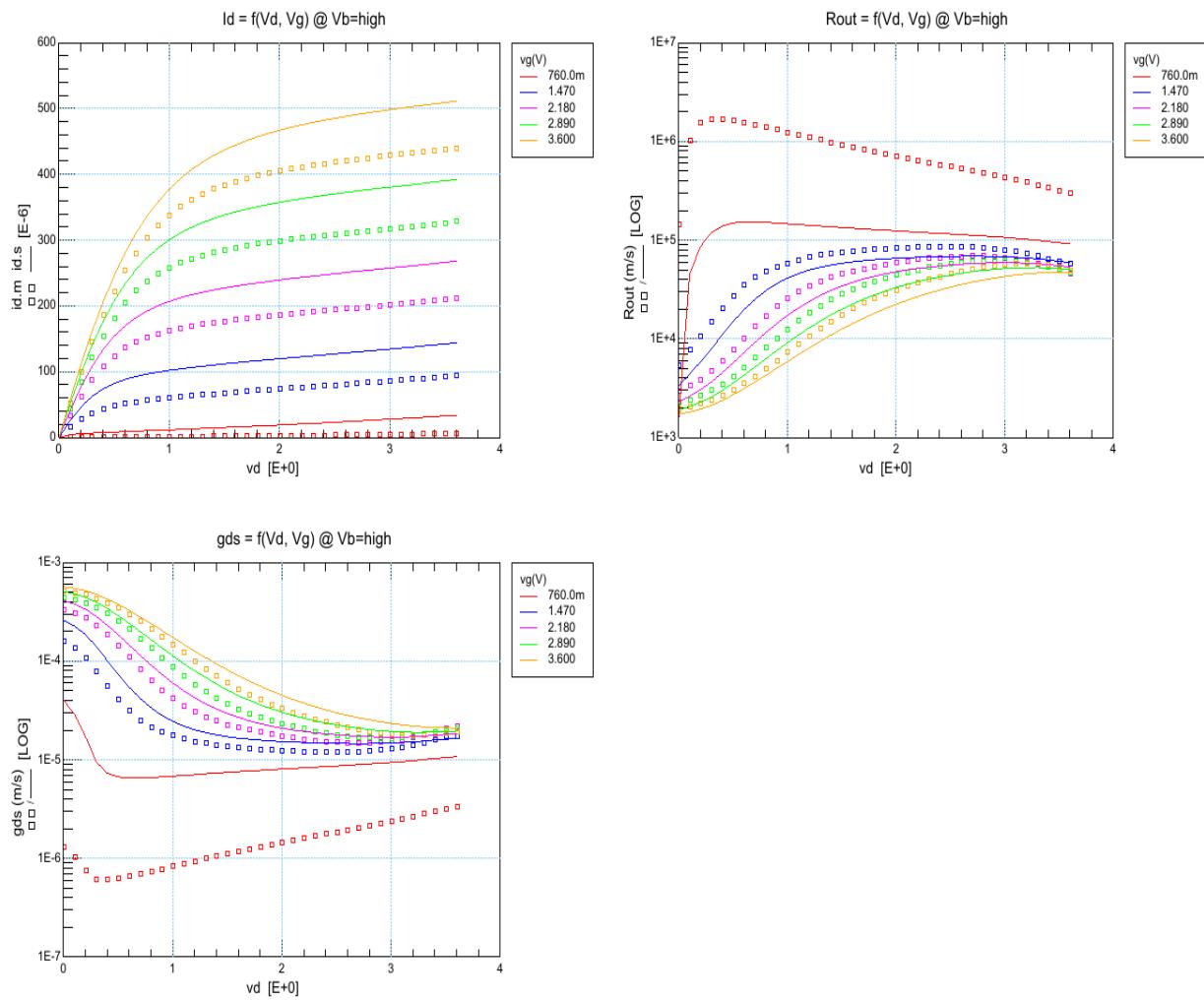
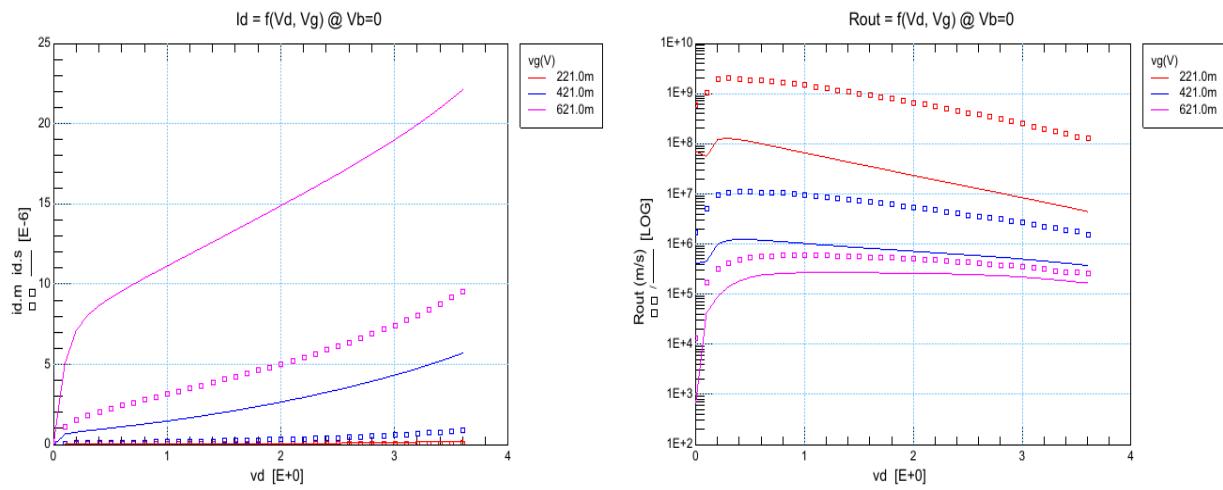


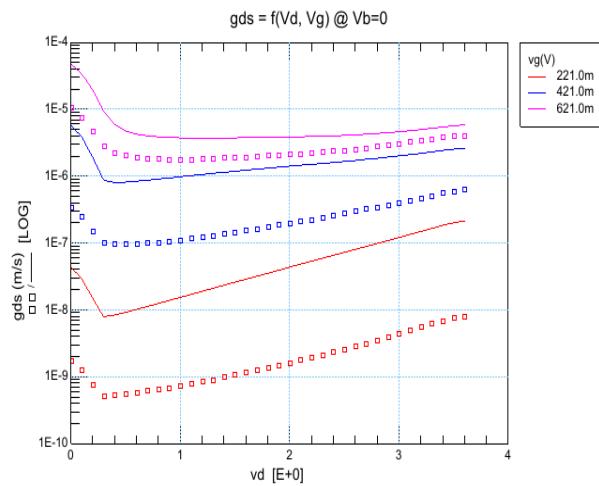


idvg, Ib, Ig, Vb = 0V, T = 27°C

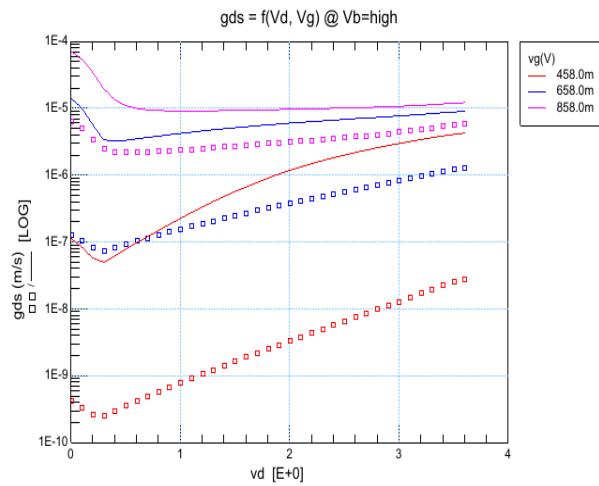
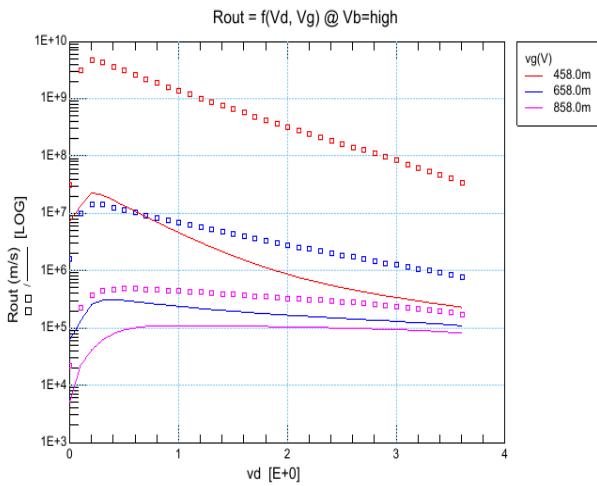
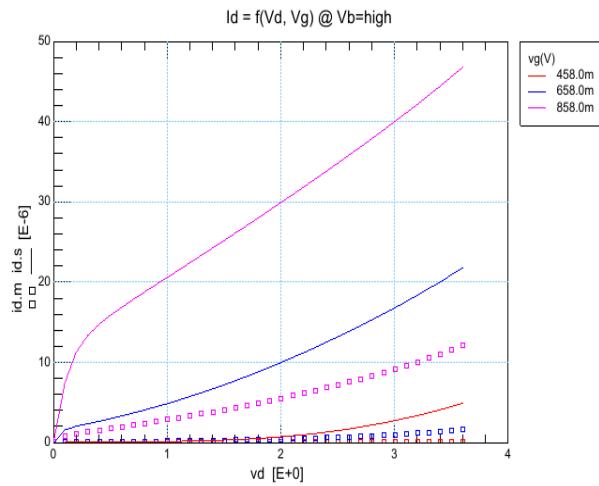


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C


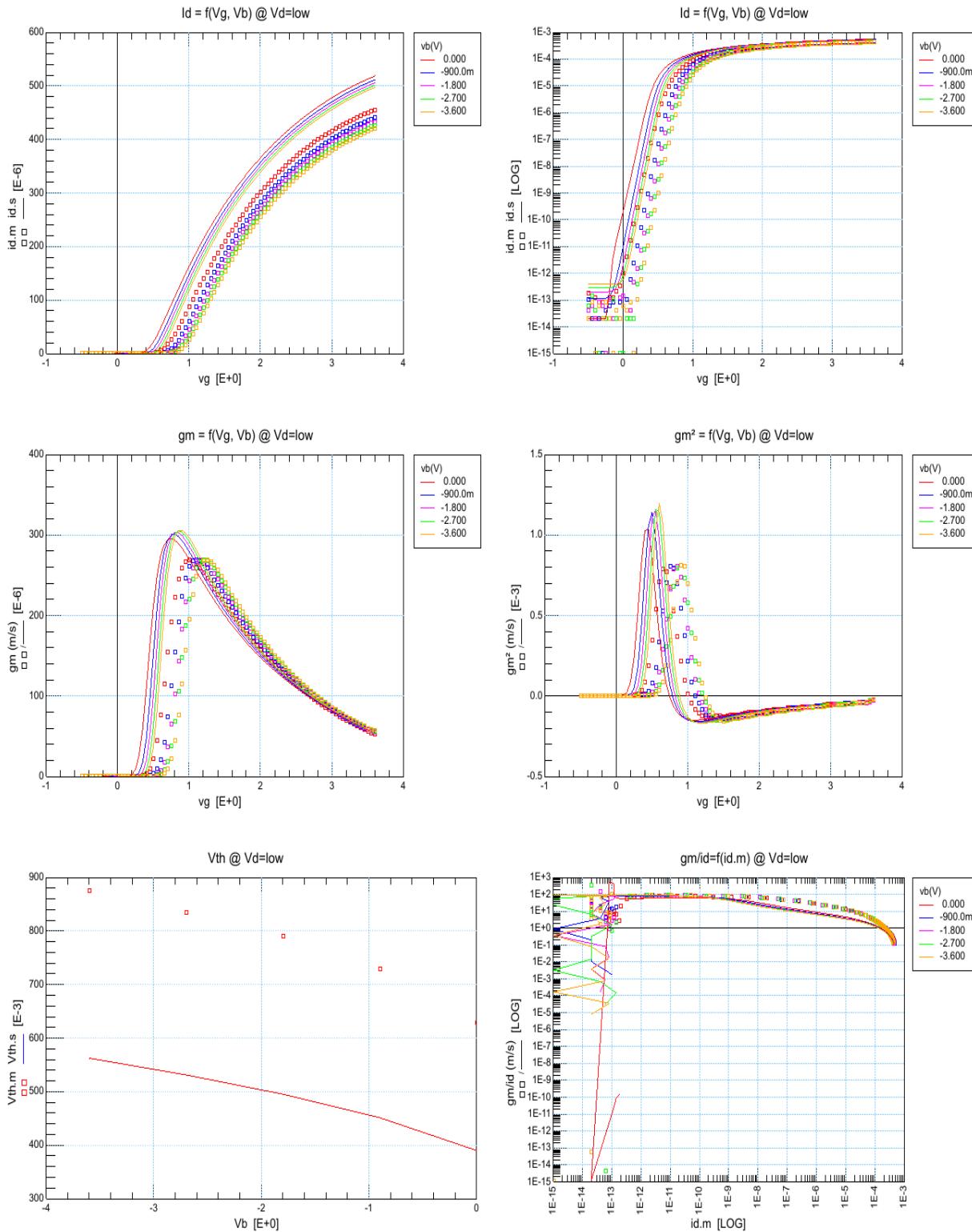


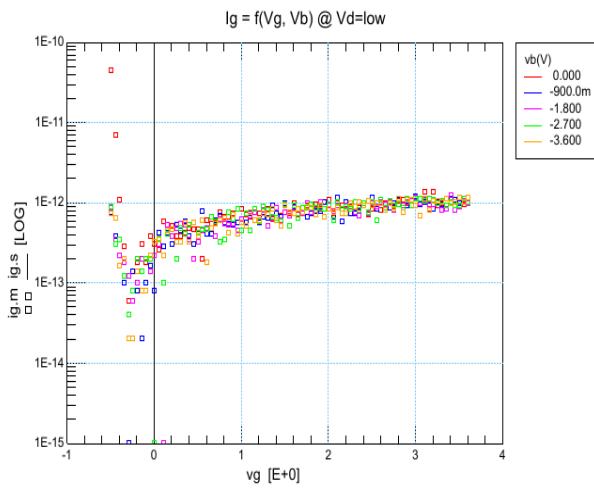
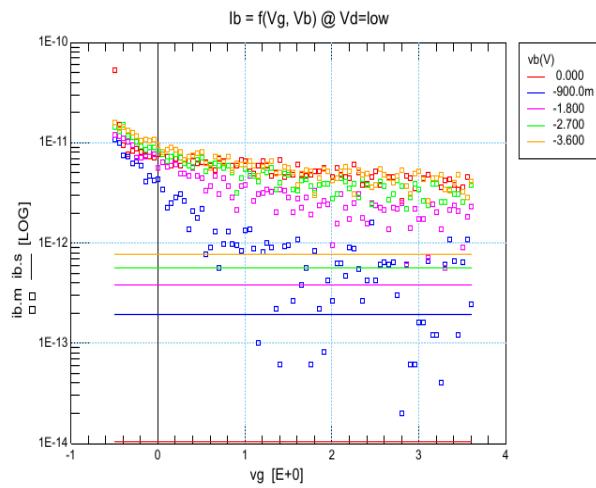
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



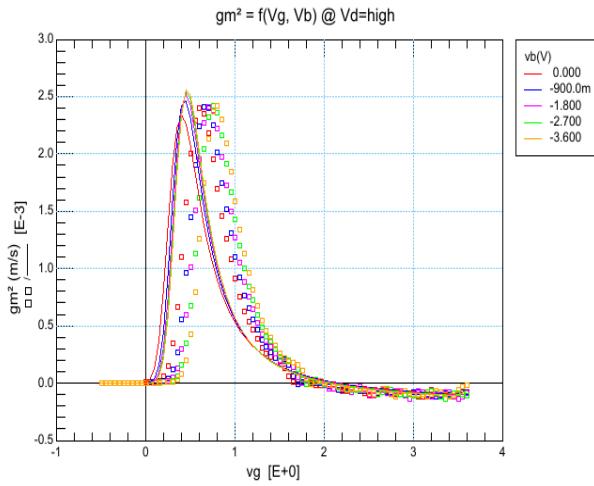
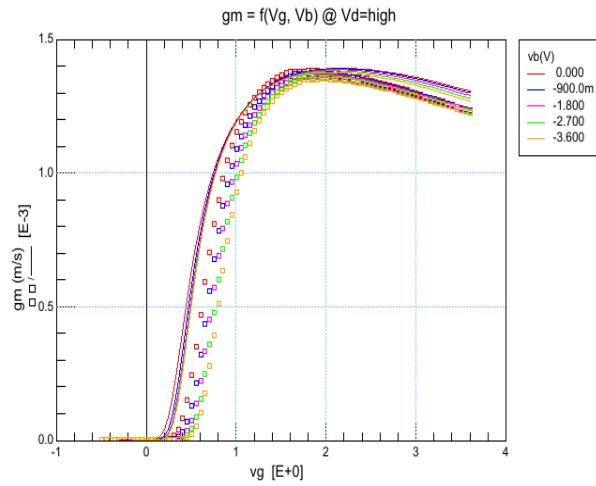
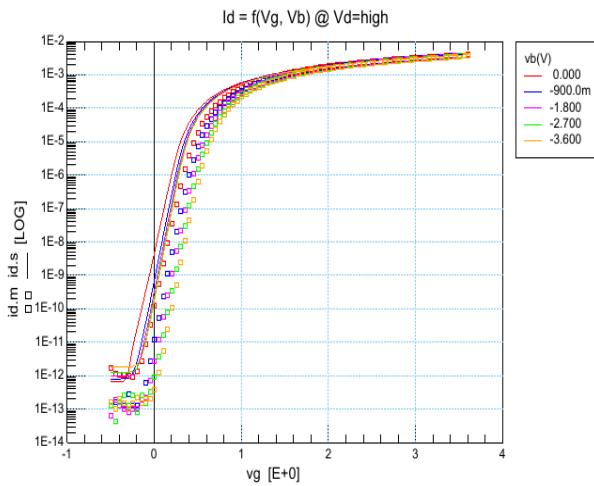
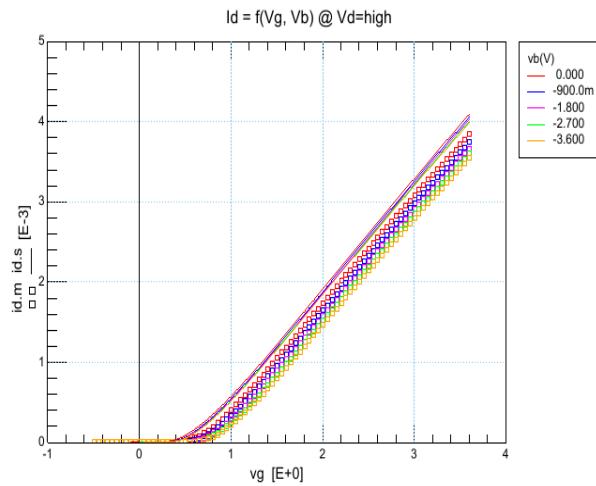
4.34 W05u0_L0u33_S557_4

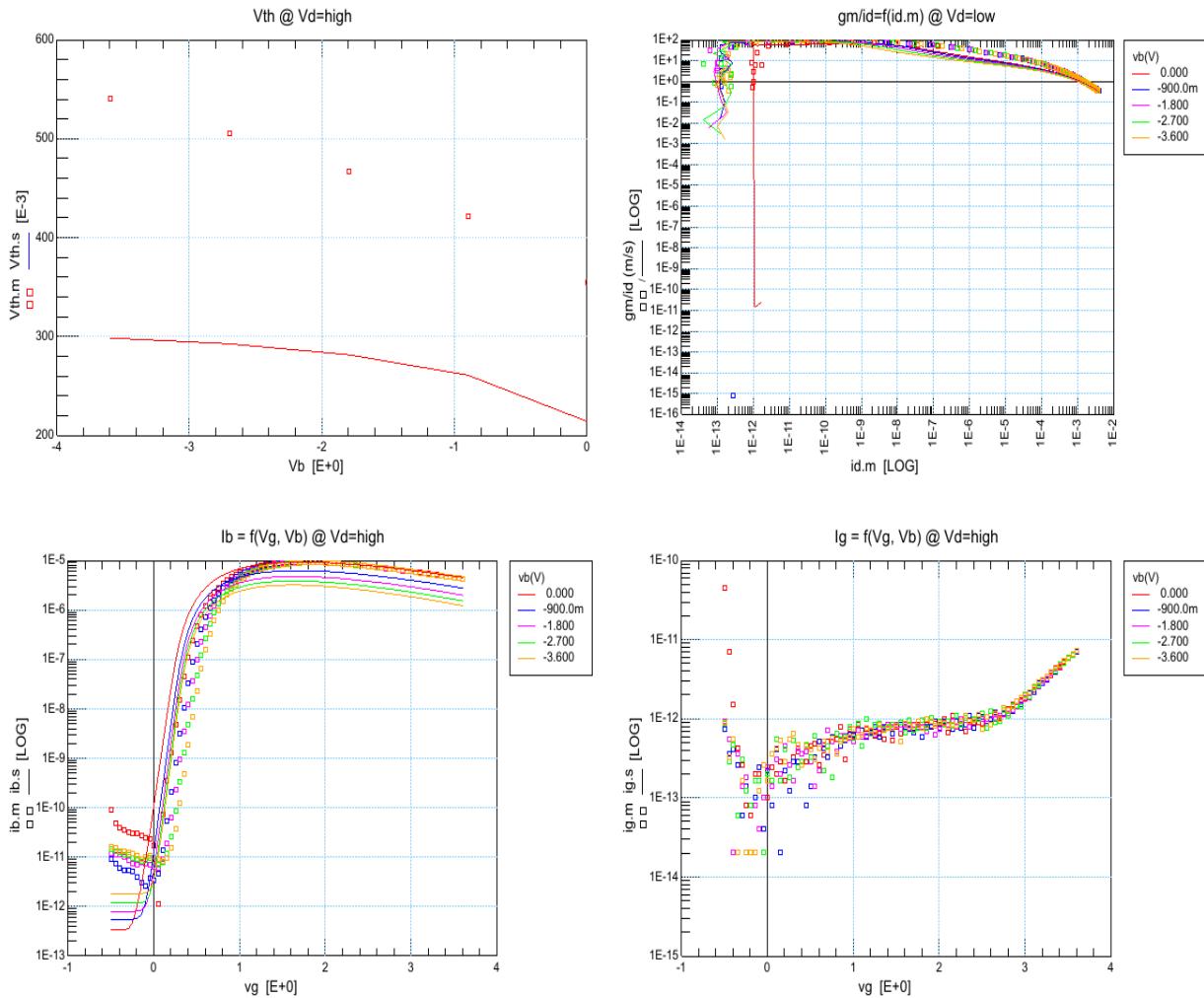
$idvg$, $Vd = 0.1V$, $T = 27^\circ C$



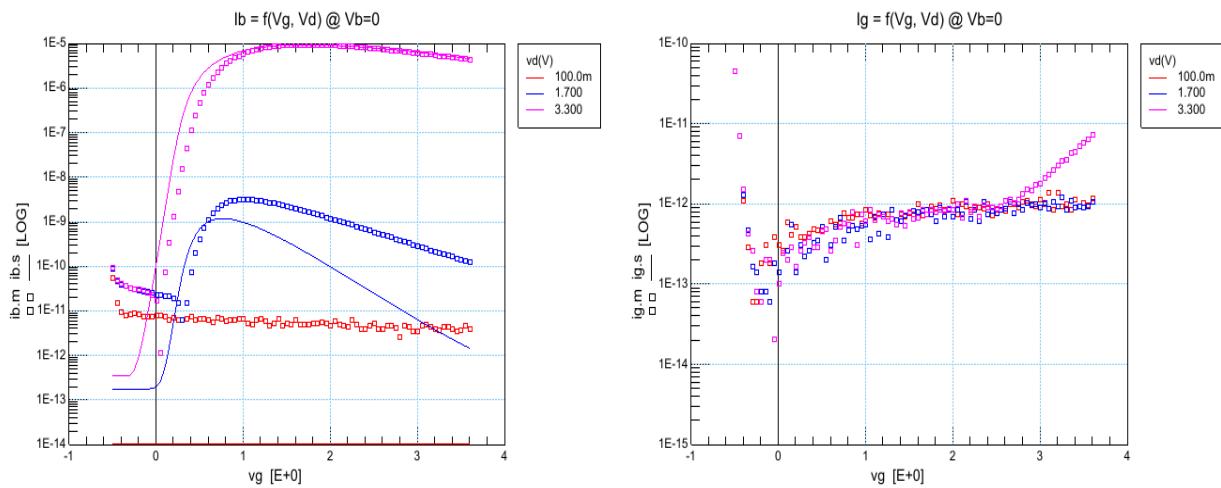


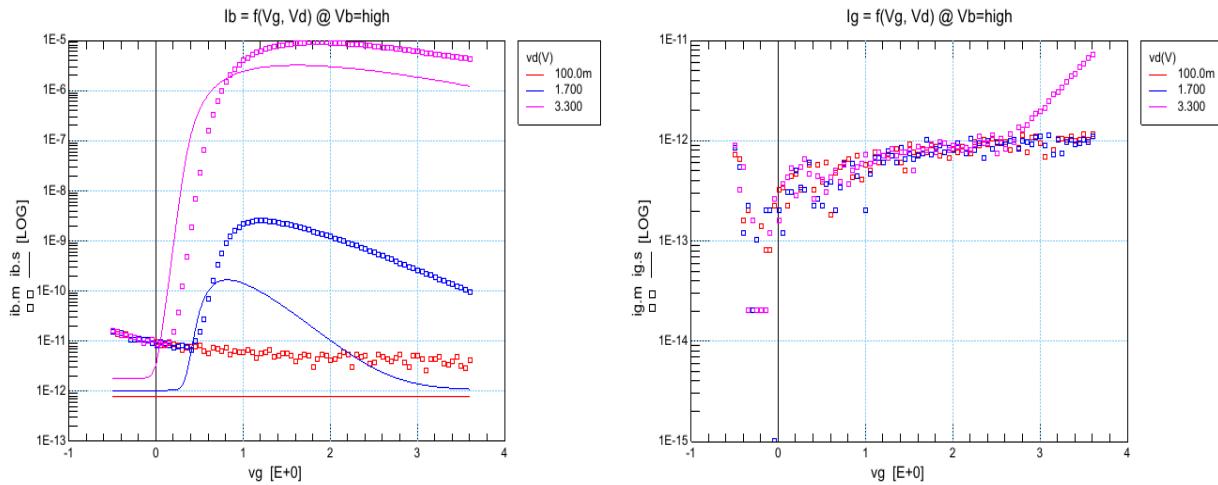
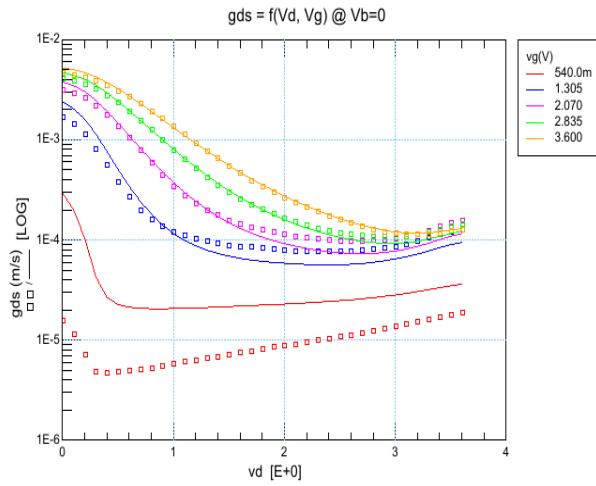
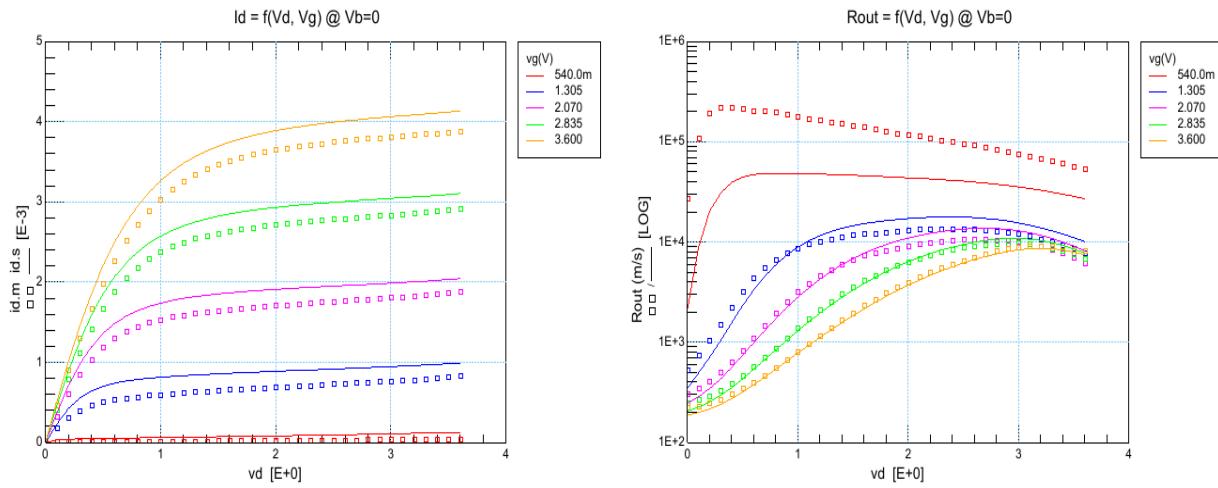
$idvg, Vd = 3.3V, T = 27^\circ C$

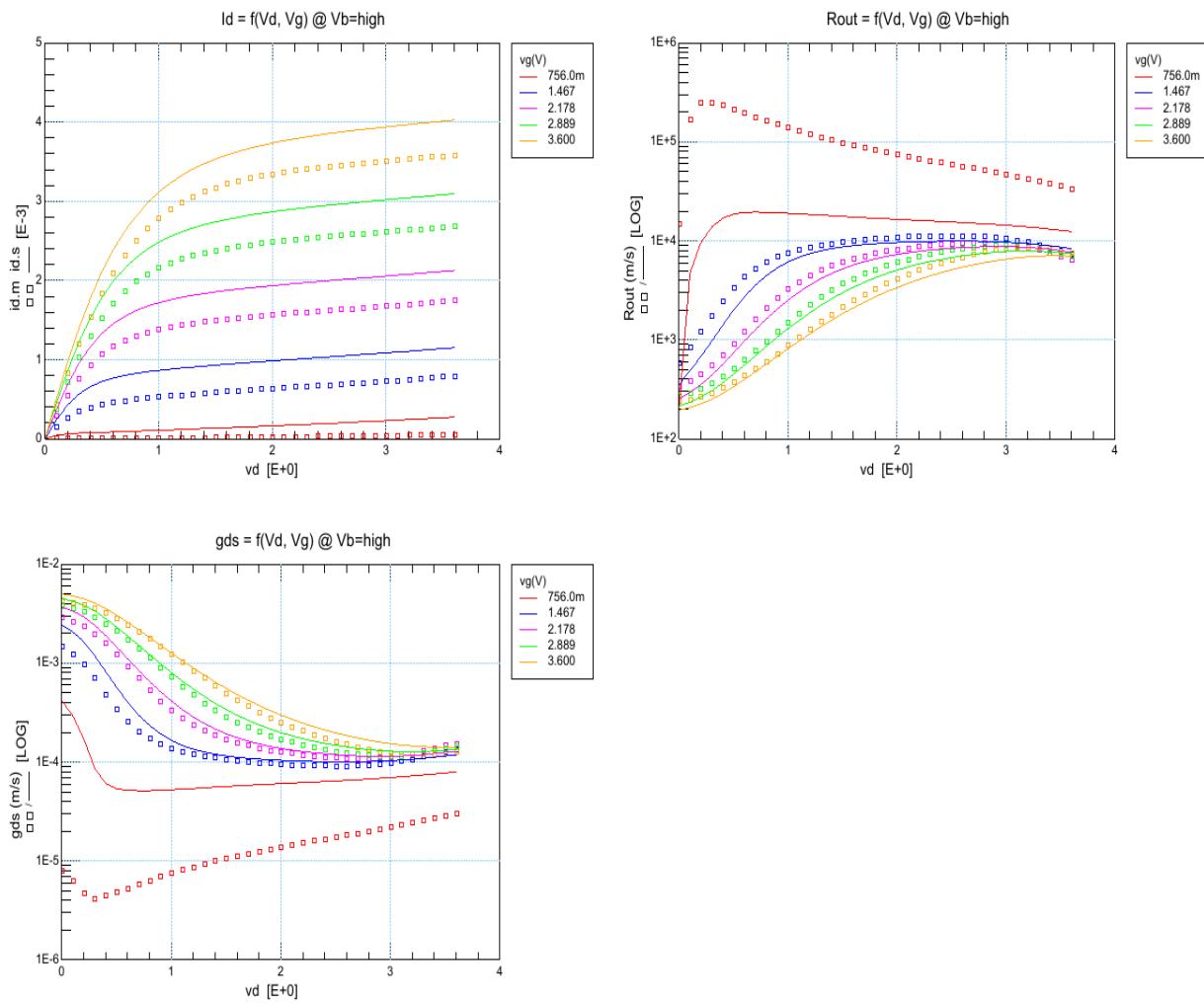
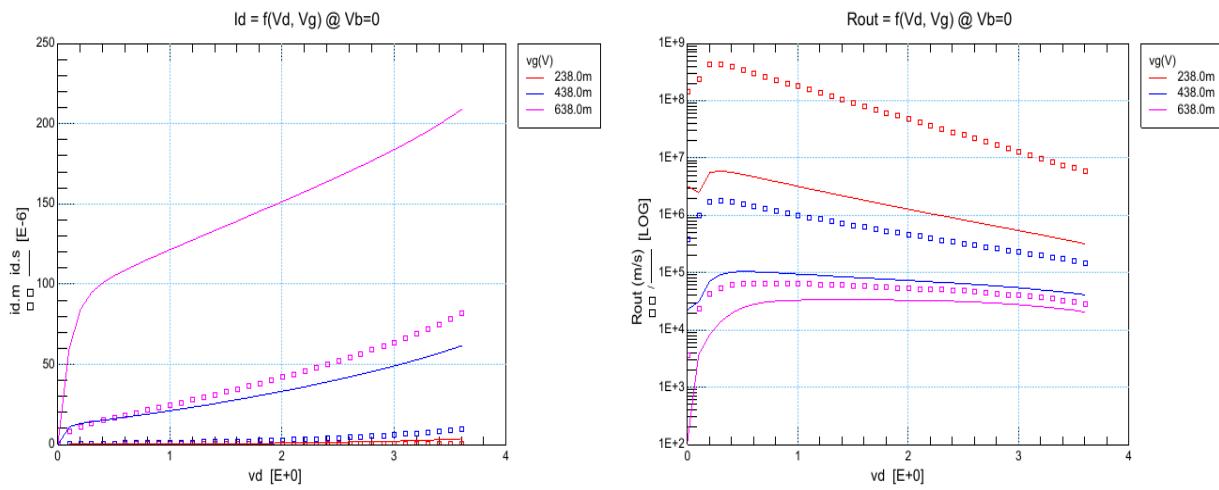


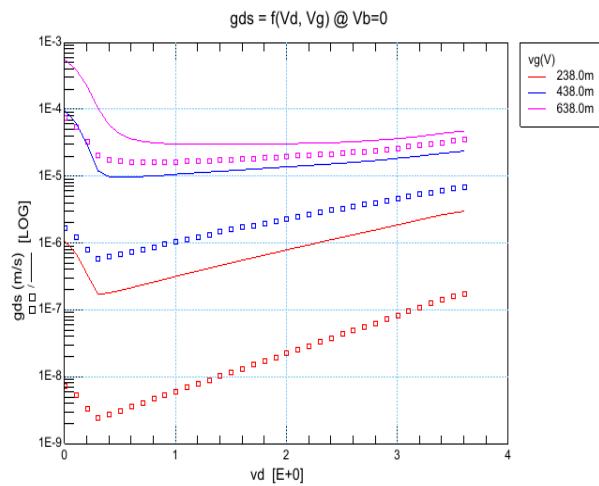


idvg, Ib, Ig, Vb = 0V, T = 27°C

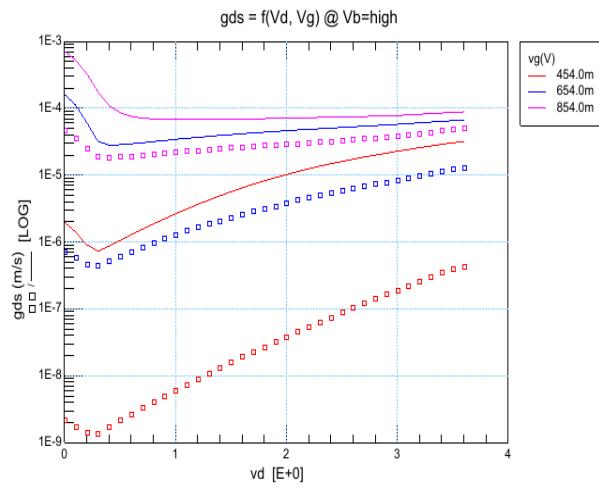
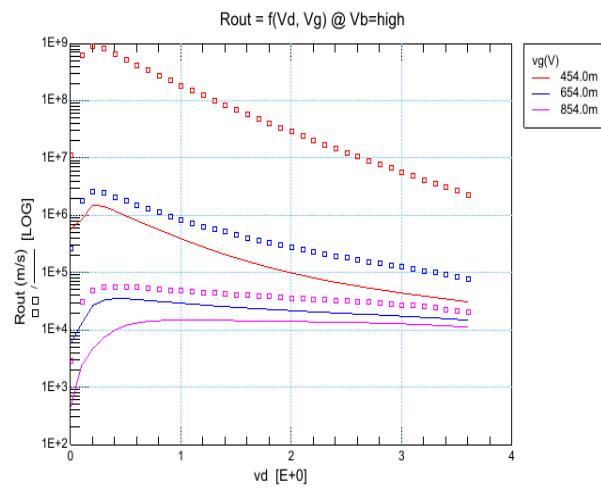
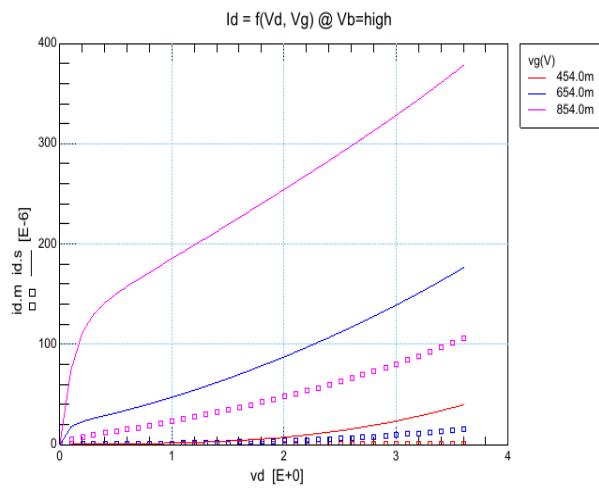


idvg, Ib,Ig, Vb = -3.6V, T = 27°C

idvd, Vb = 0V, T = 27°C


idvd_vbmin, Vb = -3.6V, T = 27°C

idvd_vth, Vb = 0V, T = 27°C




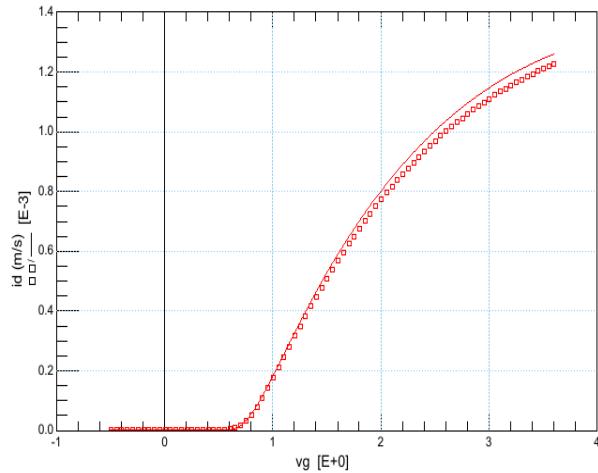
idvd_vth_vbmin, Vb = -3.6V, T = 27°C



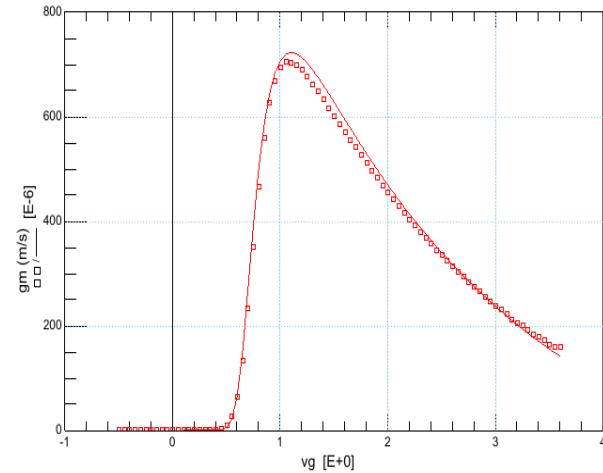
5 RF Transistors

5.1 NF04_WF05u0_L_0u5_post_90

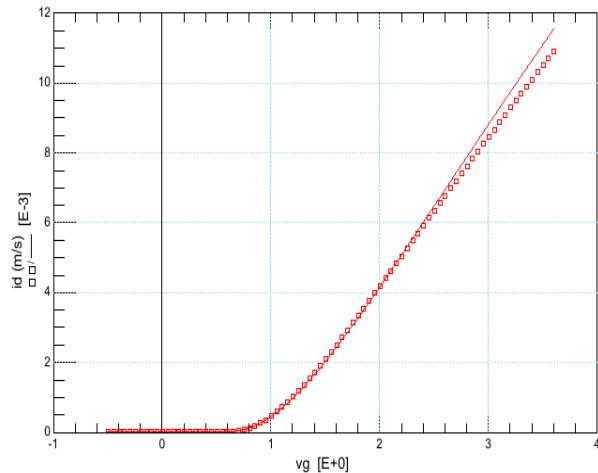
$IdVg$, $T = 27^\circ\text{C}$



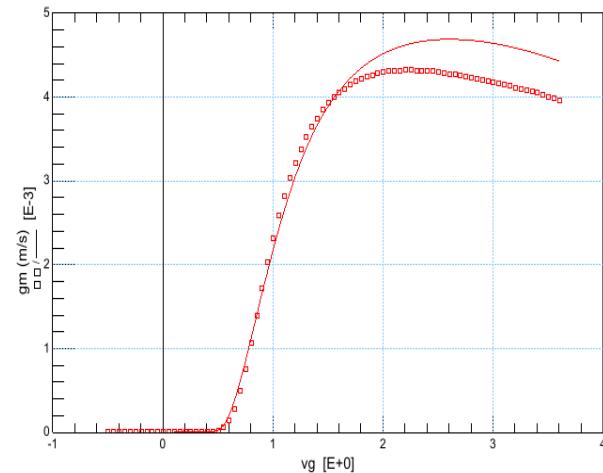
$Id = f(Vg) @ Vd = 0.1\text{V}$



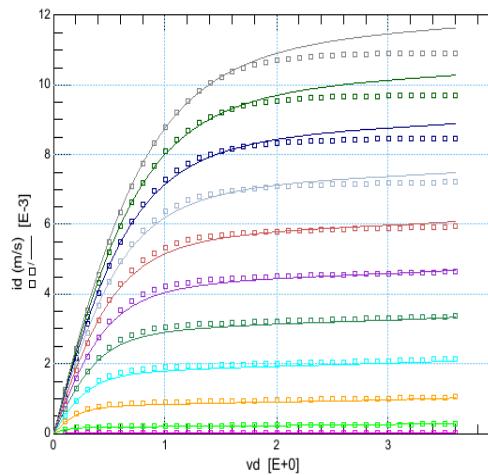
$gm = f(Vg) @ Vd = 0.1\text{V}$



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

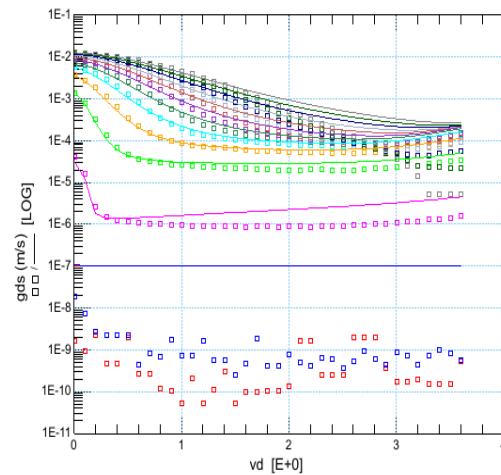


$gm = f(Vg) @ Vd = 3.3\text{V}$

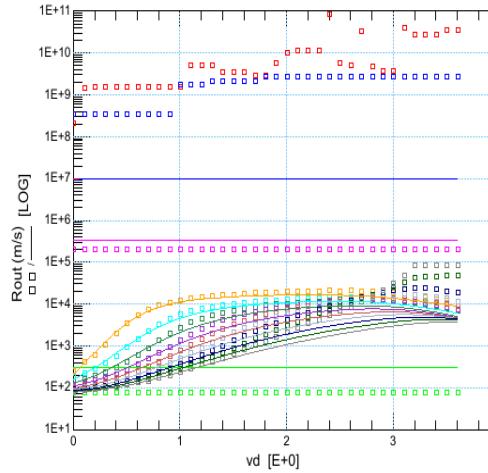
IdVd, T = 27°C


$$Id = f(Vd)$$

INDEX=10.00
vg(V)
0.000
300.0m
600.0m
900.0m
1.200
1.500
1.800
2.100
2.400
2.700
3.000
3.300
3.600

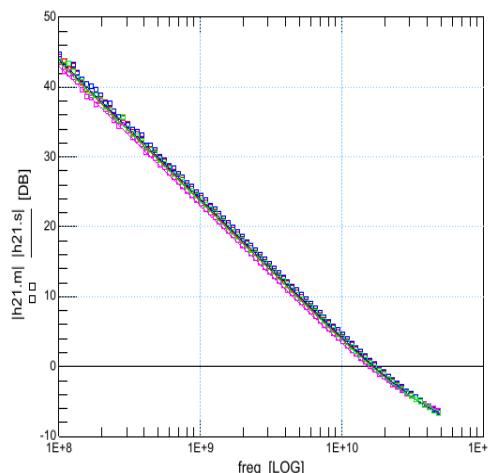


$$gds = f(Vd)$$



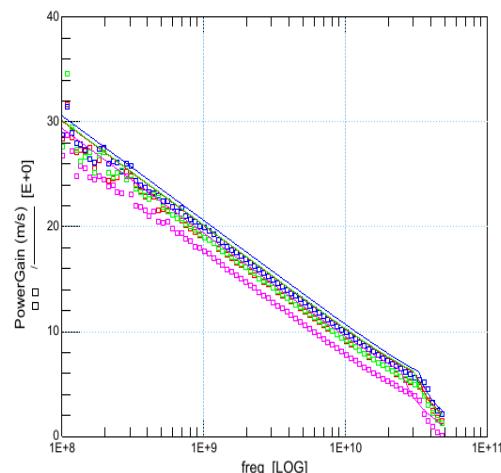
$$Rout = f(Vd)$$

INDEX=10.00
vg(V)
0.000
300.0m
600.0m
900.0m
1.200
1.500
1.800
2.100
2.400
2.700
3.000
3.300
3.600

S-Parameter, T = 27°C


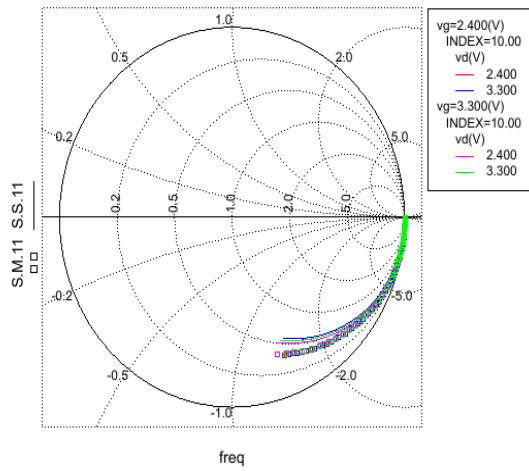
$$|h21| = f(Vg, Vd)$$

vg=2.400(V)
INDEX=10.00
vd(V)
2.400
3.300
vg=3.300(V)
INDEX=10.00
vd(V)
2.400
3.300

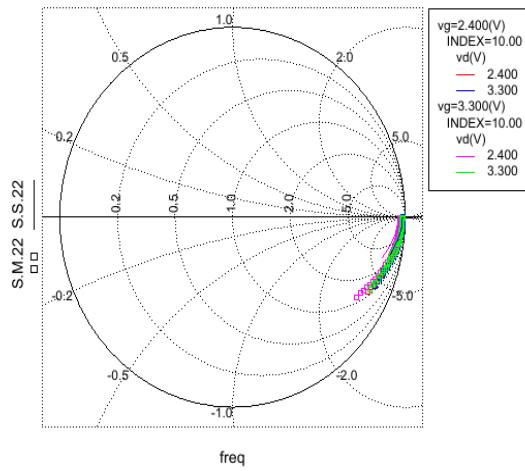


$$MSG/MAG = f(Vg, Vd)$$

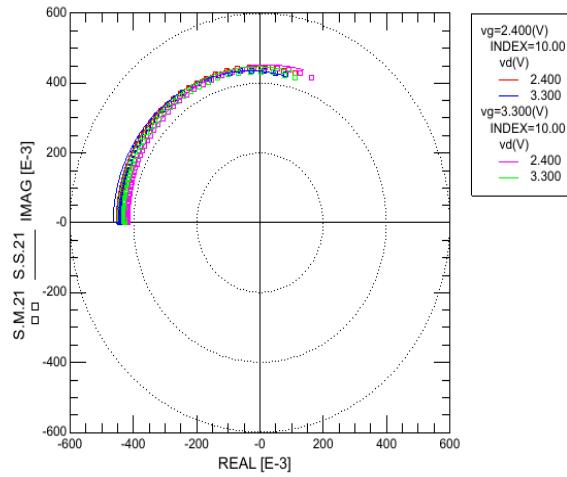
vg=2.400(V)
INDEX=10.00
vd(V)
2.400
3.300
vg=3.300(V)
INDEX=10.00
vd(V)
2.400
3.300



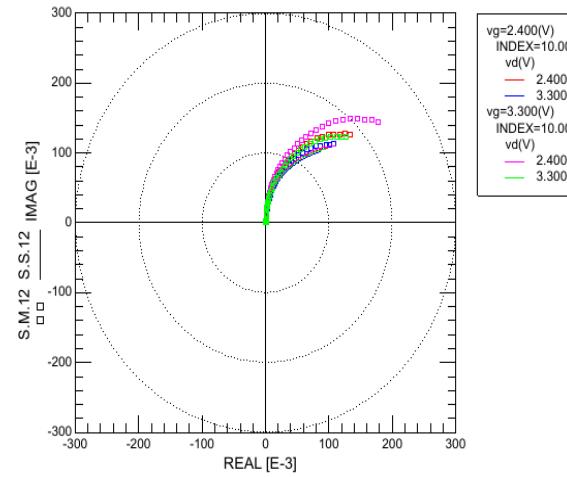
S11 = f(Vg,Vd)



S22 = f(Vg,Vd)

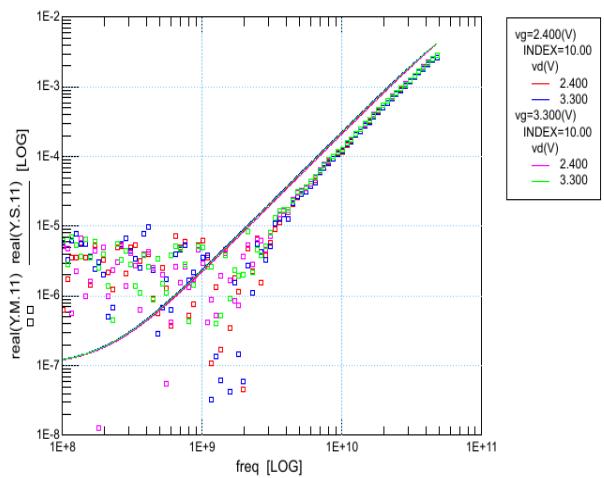


S21 = f(Vg,Vd)

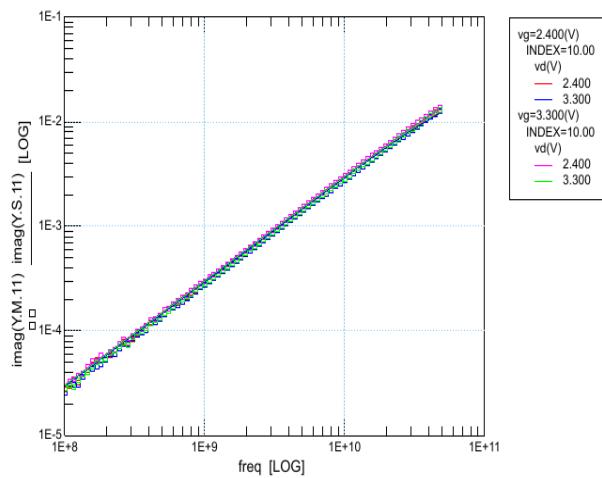


S12 = f(Vg,Vd)

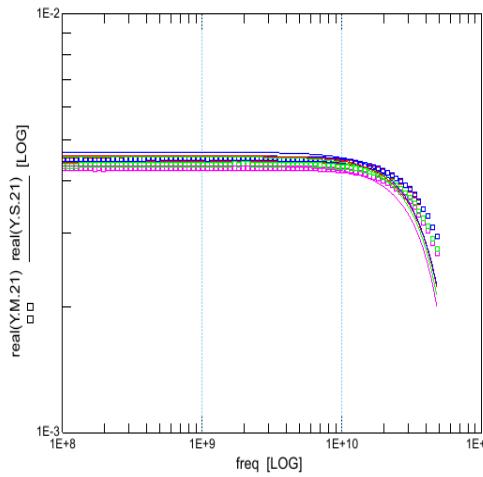
Y-Parameter, T = 27°C



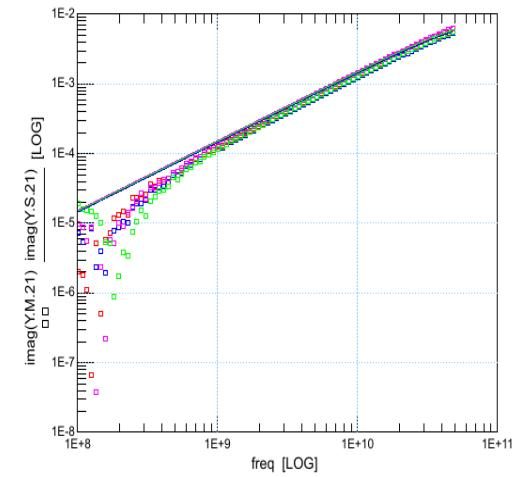
re(Y11) = f(Vg,Vd)



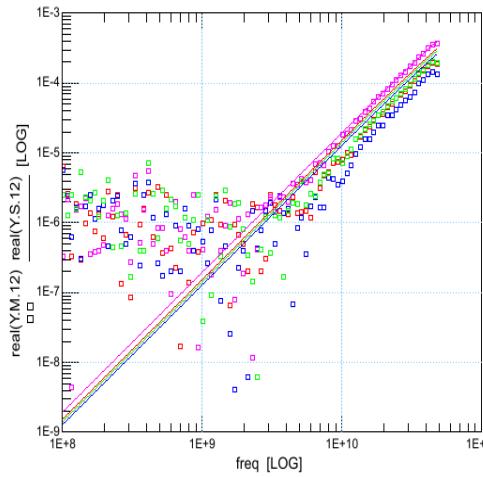
im(Y11) = f(Vg,Vd)



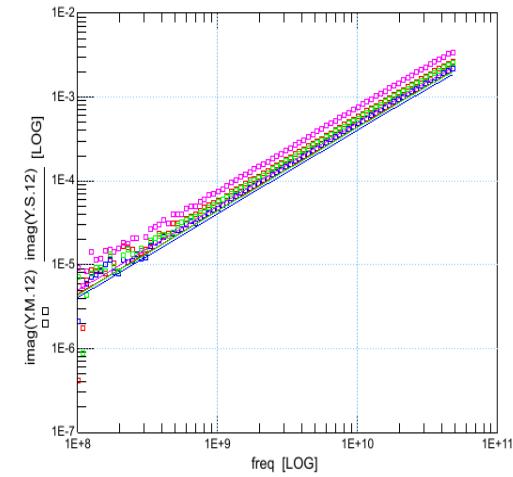
re(Y21) = f(Vg,Vd)



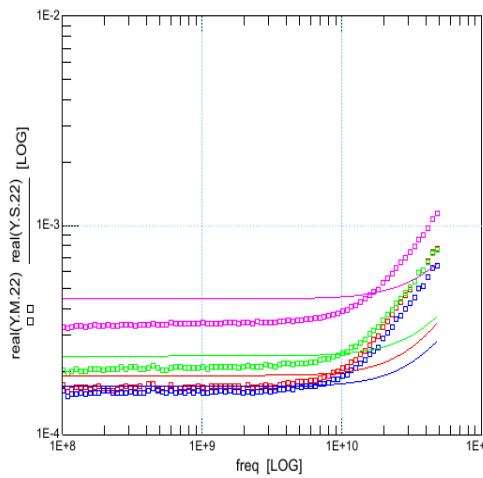
im(Y21) = f(Vg,Vd)



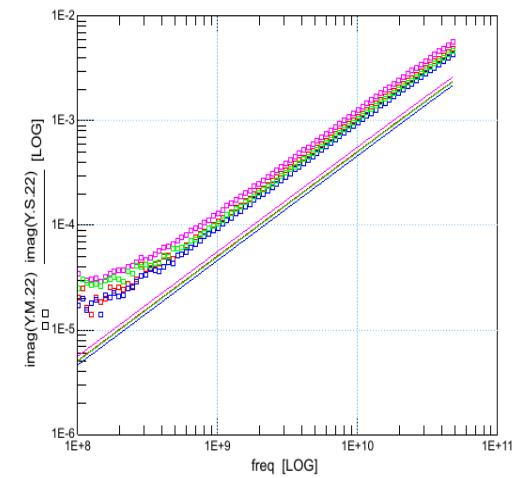
re(Y12) = f(Vg,Vd)



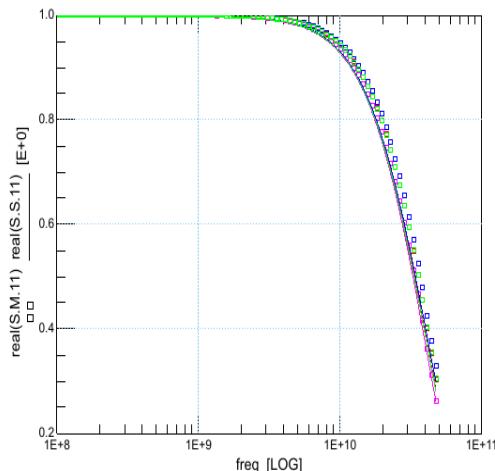
im(Y12) = f(Vg,Vd)



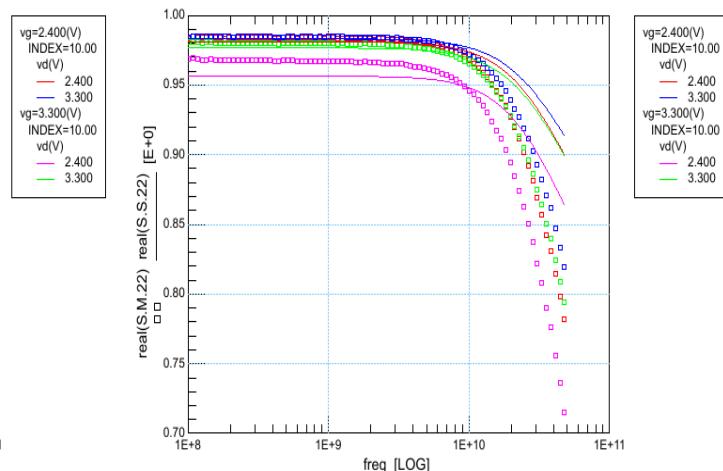
re(Y22) = f(Vg,Vd)



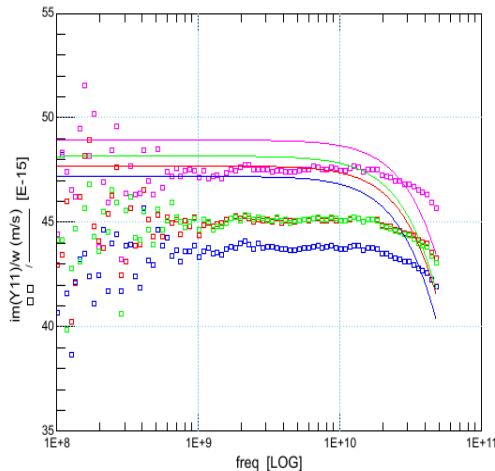
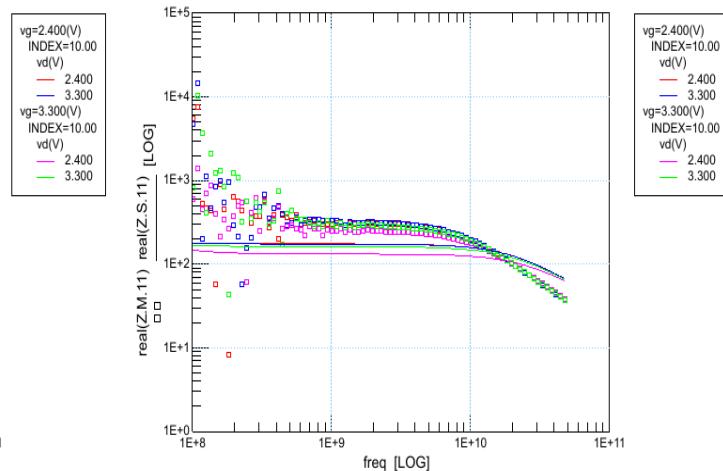
im(Y22) = f(Vg,Vd)

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

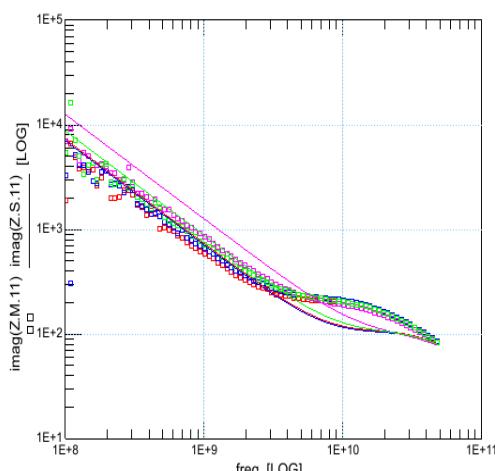
re(S11) = f(Vg, Vd)



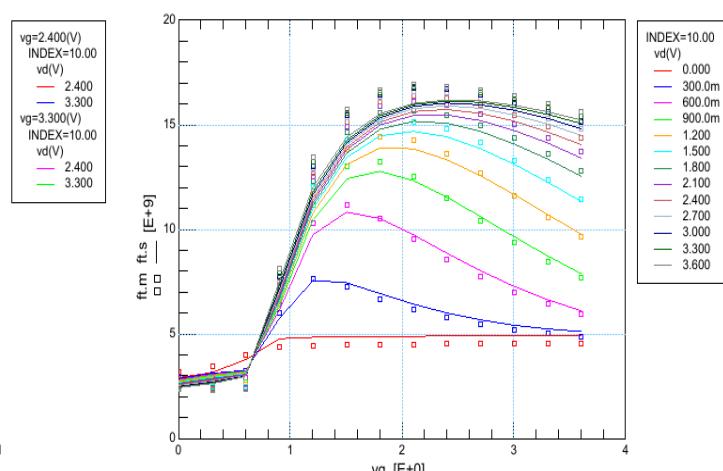
re(S22) = f(Vg, Vd)

im(Y11) divided by ω 

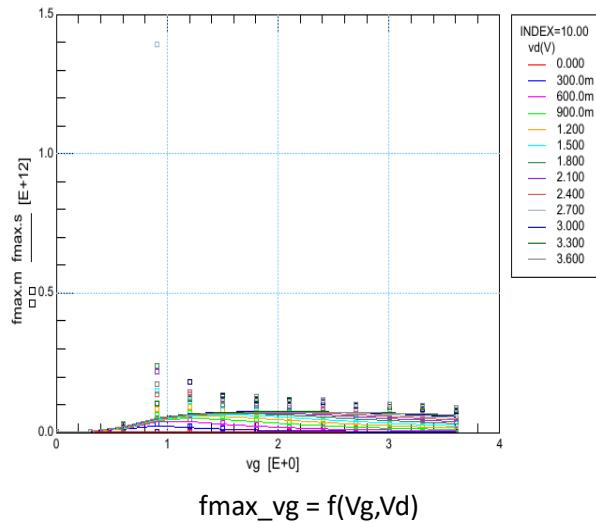
re(Z11) = f(Vg, Vd)



im(Z11) = f(Vg, Vd)



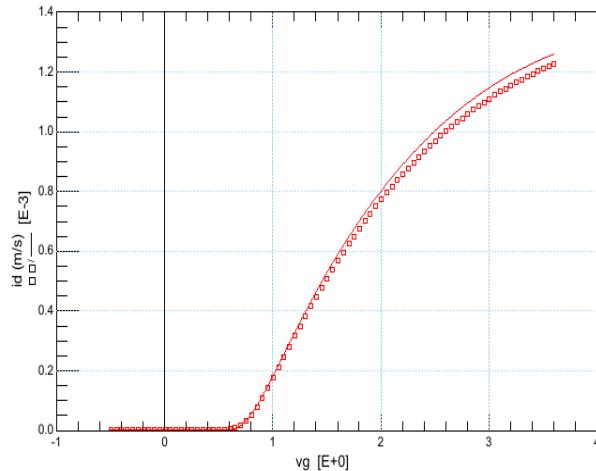
fT_vg = f(Vg, Vd)



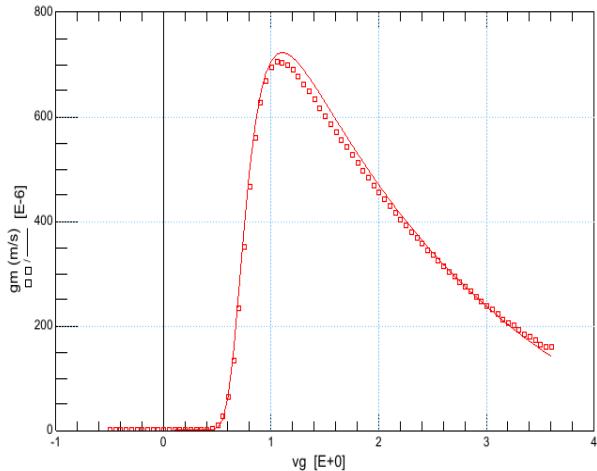
$$f_{max_vg} = f(V_g, V_d)$$

5.2 NF04_WF05u0_L_0u5_S453A_90

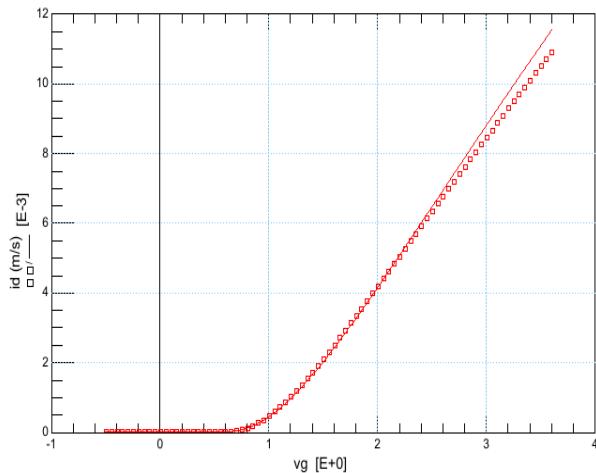
I_d vs V_g , $T = 27^\circ\text{C}$



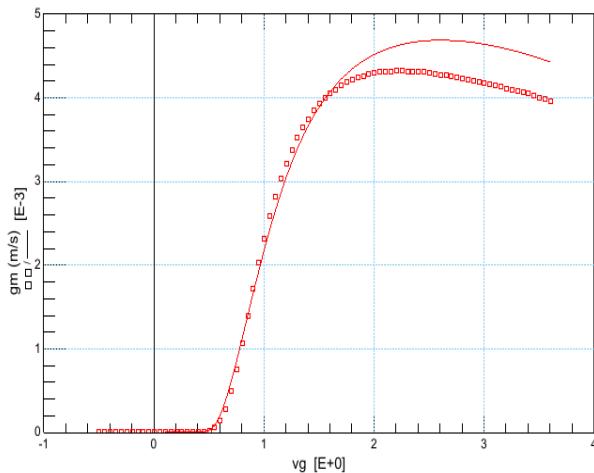
$$I_d = f(V_g) @ V_d = 0.1V$$



$$g_m = f(V_g) @ V_d = 0.1V$$

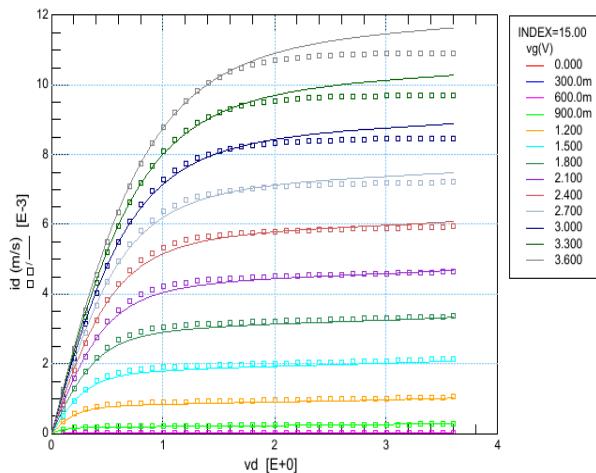


$$Id = f(Vg) @ Vd = 3.3V$$

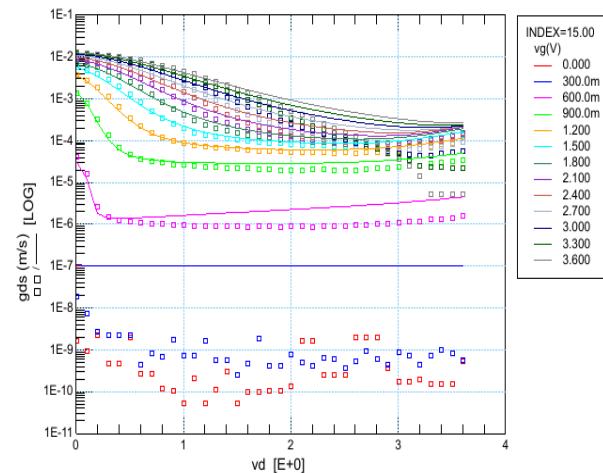


$$gm = f(Vg) @ Vd = 3.3V$$

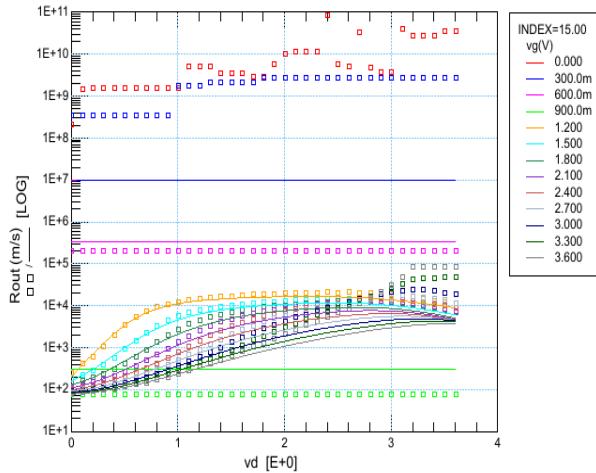
IdVd, T = 27°C



$$Id = f(Vd)$$

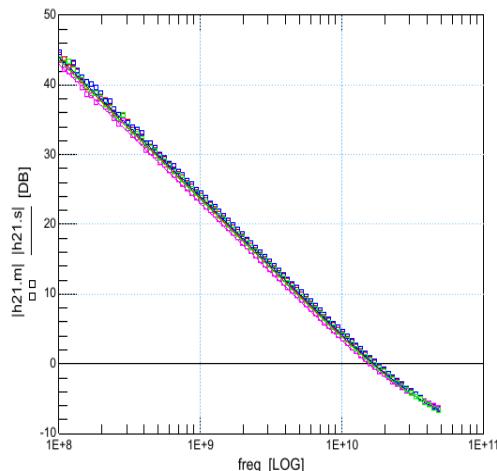


$$gds = f(Vd)$$

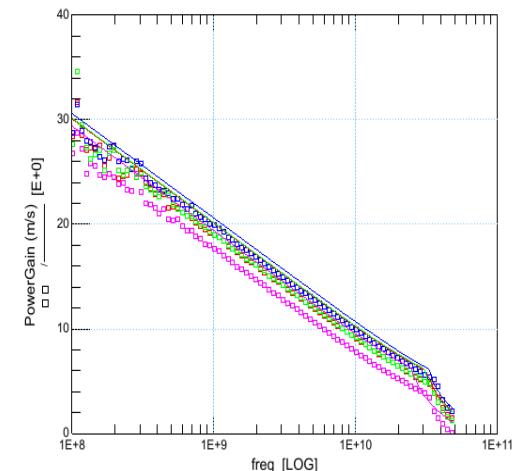


$$Rout = f(Vd)$$

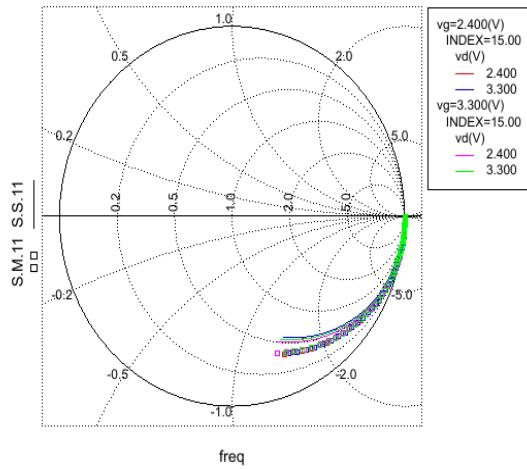
S-Parameter, T = 27°C



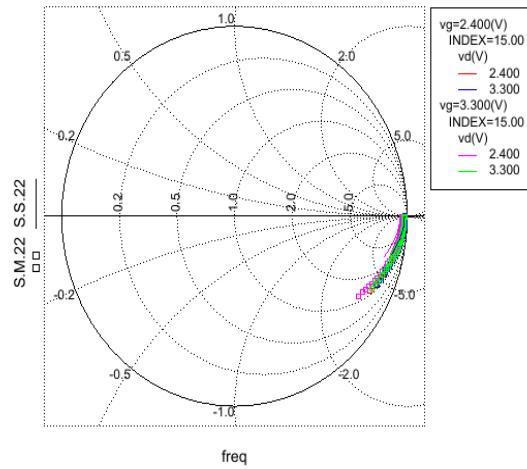
$$|h21| = f(Vg, Vd)$$



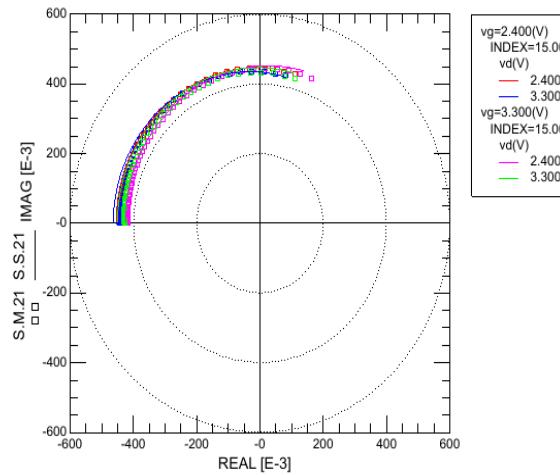
$$MSG/MAG = f(Vg, Vd)$$



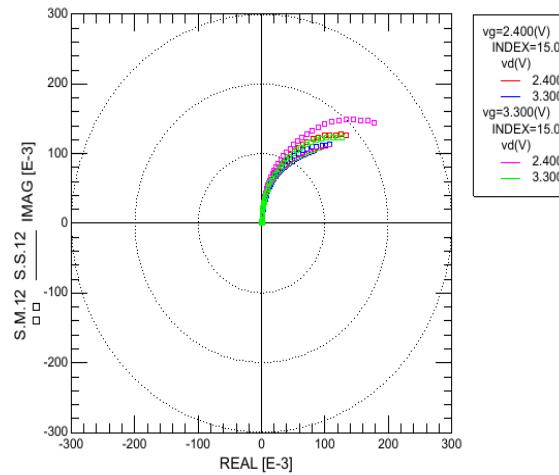
$$S11 = f(Vg, Vd)$$



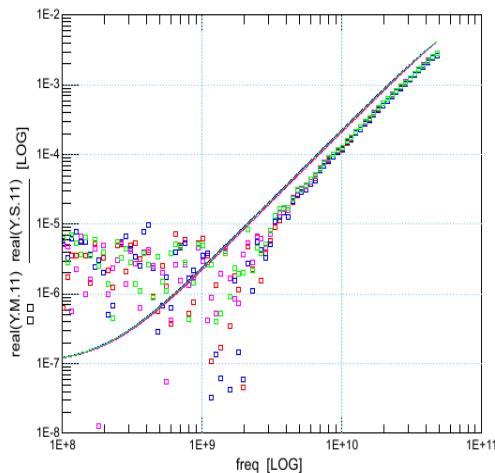
$$S22 = f(Vg, Vd)$$



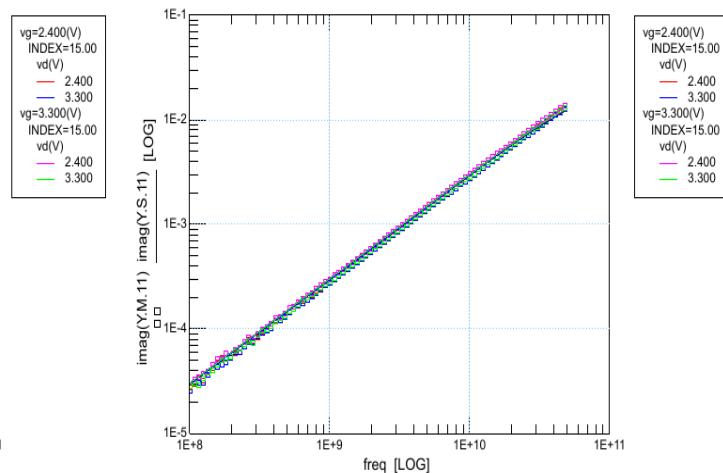
$$S21 = f(Vg, Vd)$$



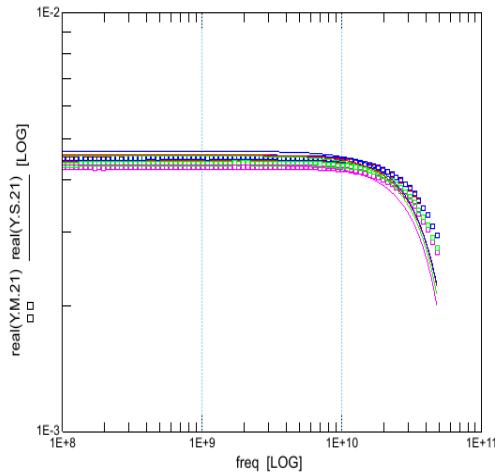
$$S12 = f(Vg, Vd)$$

Y-Parameter, T = 27°C

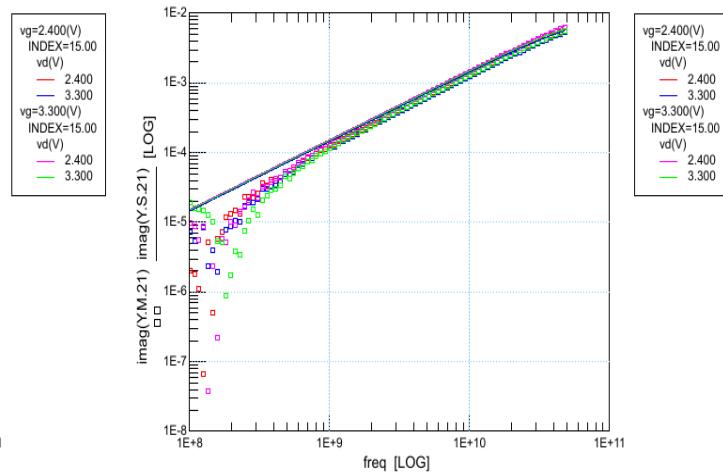
$$\text{re}(Y11) = f(Vg, Vd)$$



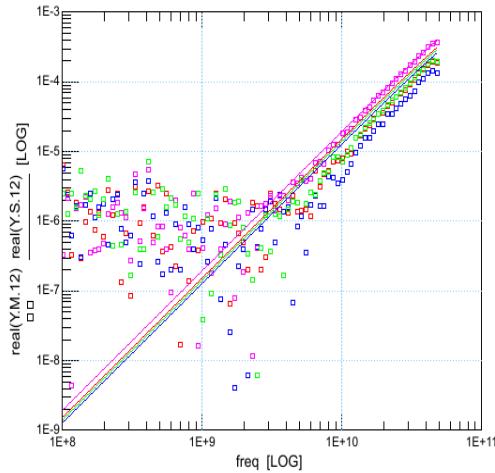
$$\text{im}(Y11) = f(Vg, Vd)$$



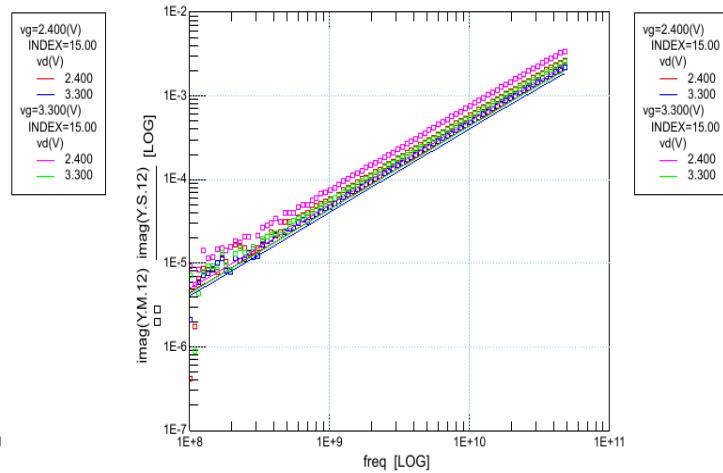
$$\text{re}(Y21) = f(Vg, Vd)$$



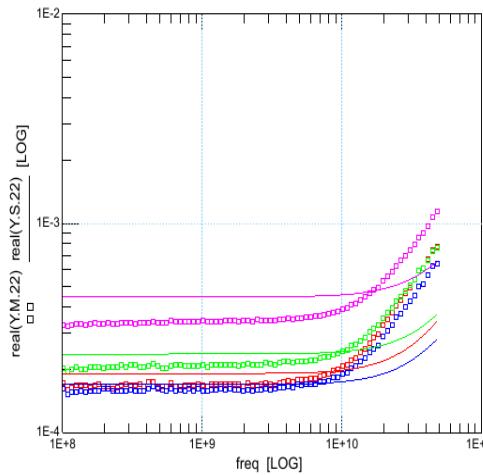
$$\text{im}(Y21) = f(Vg, Vd)$$



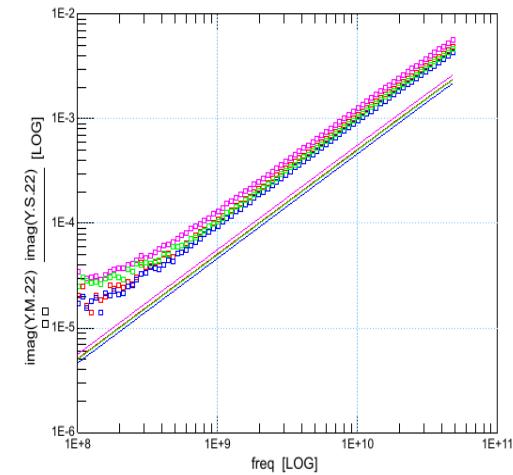
$$\text{re}(Y12) = f(Vg, Vd)$$



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

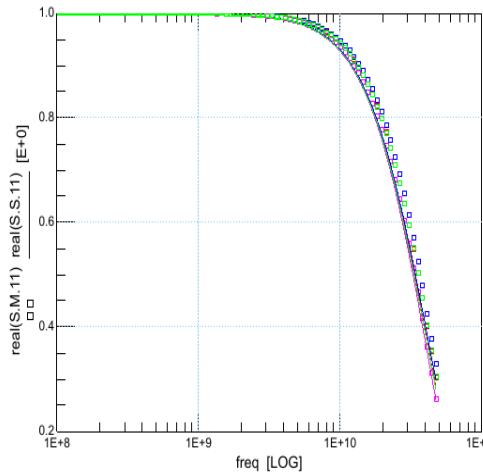


$$\text{real}(Y_{22}) = f(V_g, V_d)$$

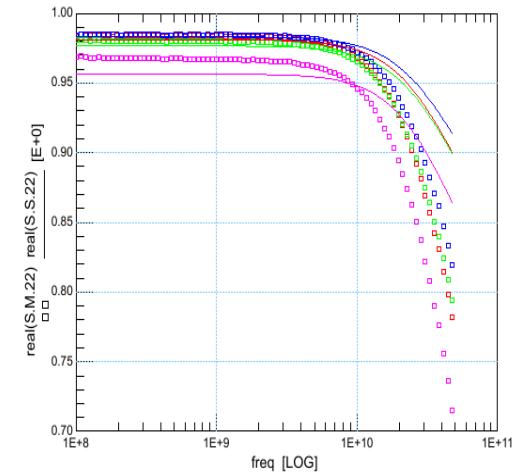


$$\text{imag}(Y_{22}) = f(V_g, V_d)$$

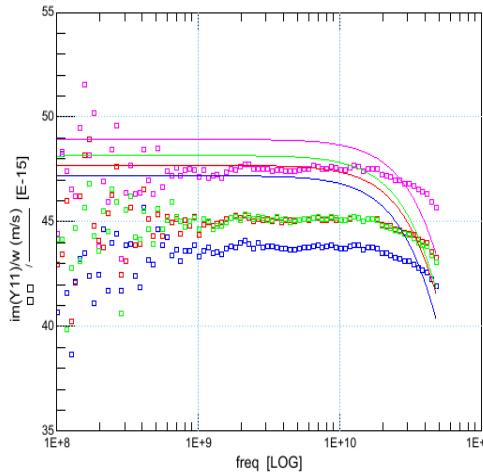
Verify Plots, $T = 27^\circ\text{C}$



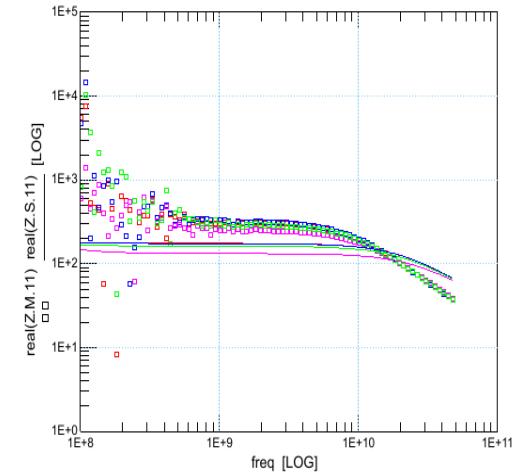
$$\text{real}(S_{11}) = f(V_g, V_d)$$



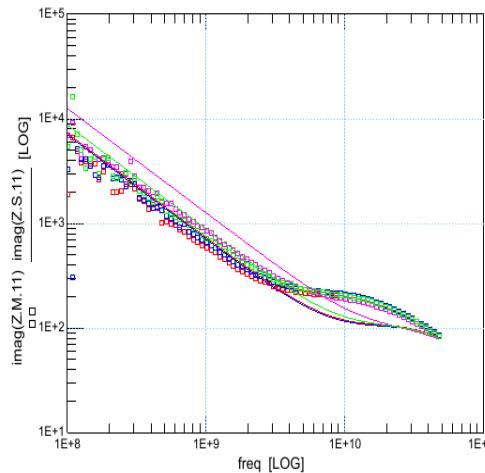
$$\text{real}(S_{22}) = f(V_g, V_d)$$



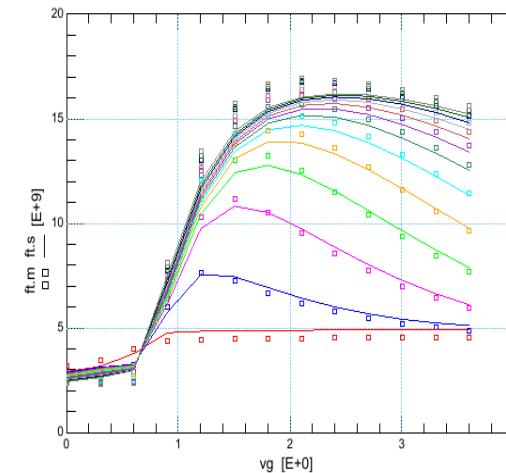
$$\text{im}(Y_{11}) \text{ divided by } \omega$$



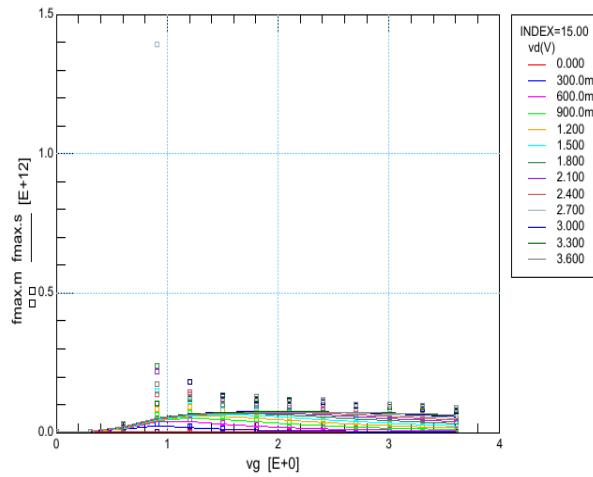
$$\text{real}(Z_{11}) = f(V_g, V_d)$$



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



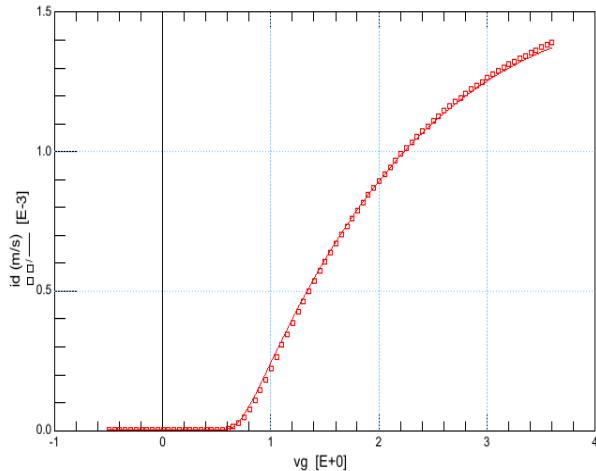
$$fT_{vg} = f(V_g, V_d)$$



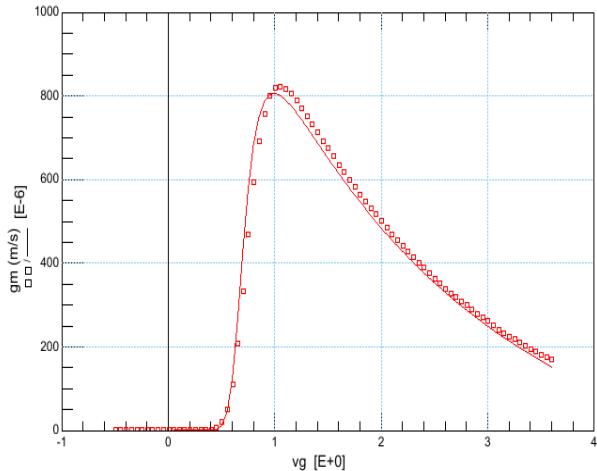
$$f_{\text{max},vg} = f(V_g, V_d)$$

5.3 NF08_WF02u5_L_0u45_S453A_A1

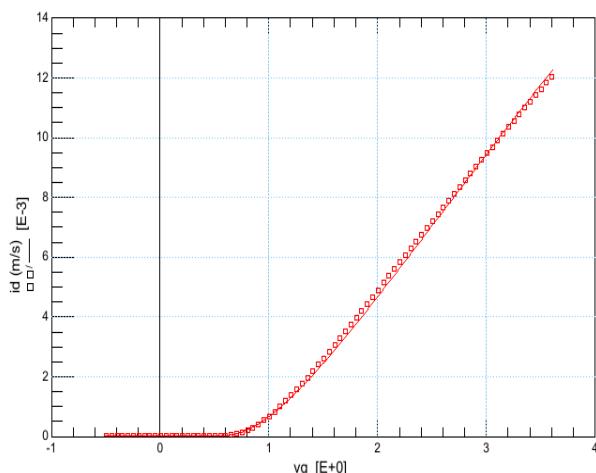
$IdVg$, $T = 27^\circ\text{C}$



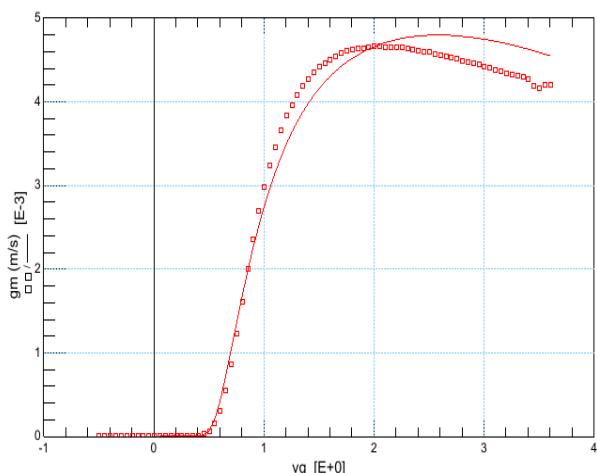
$Id = f(Vg)$ @ $Vd = 0.1\text{V}$



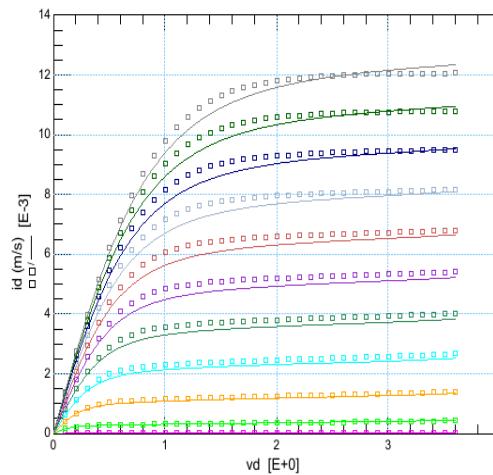
$gm = f(Vg)$ @ $Vd = 0.1\text{V}$



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

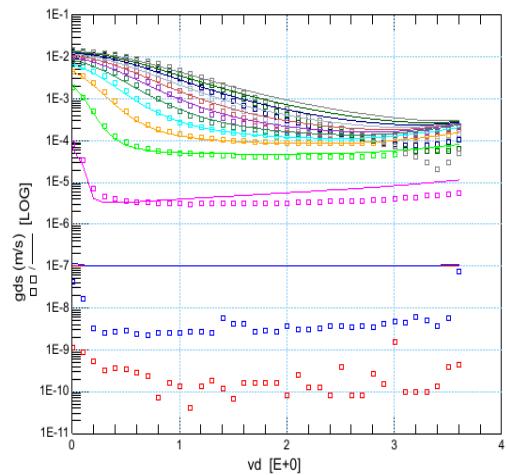


$gm = f(Vg)$ @ $Vd = 3.3\text{V}$

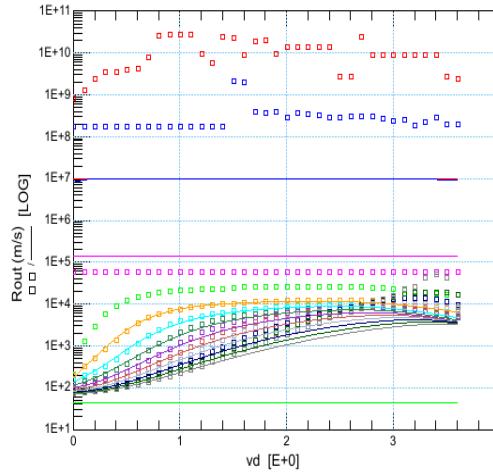
IdVd, T = 27°C

$$Id = f(Vd)$$

INDEX=21.00
vg(V)
0.000
300.0m
600.0m
900.0m
1.200
1.500
1.800
2.100
2.400
2.700
3.000
3.300
3.600

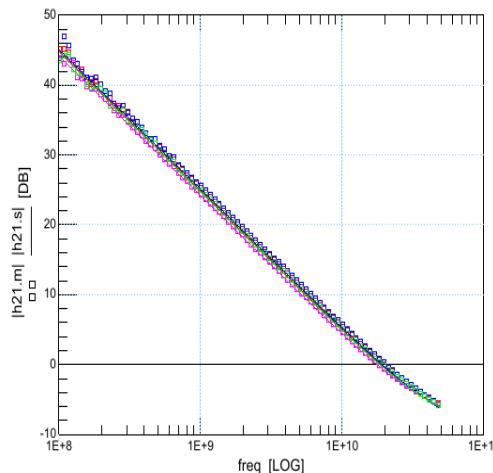


$$gds = f(Vd)$$



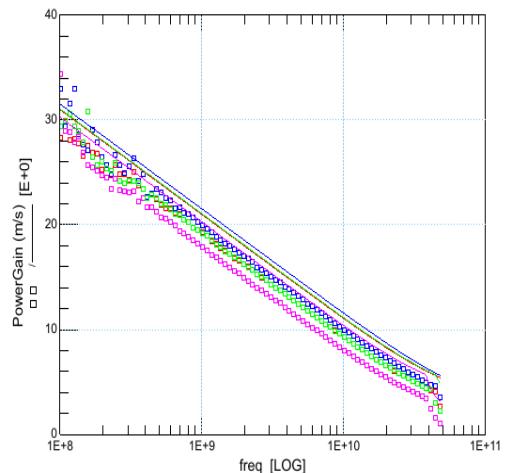
$$Rout = f(Vd)$$

INDEX=21.00
vg(V)
0.000
300.0m
600.0m
900.0m
1.200
1.500
1.800
2.100
2.400
2.700
3.000
3.300
3.600

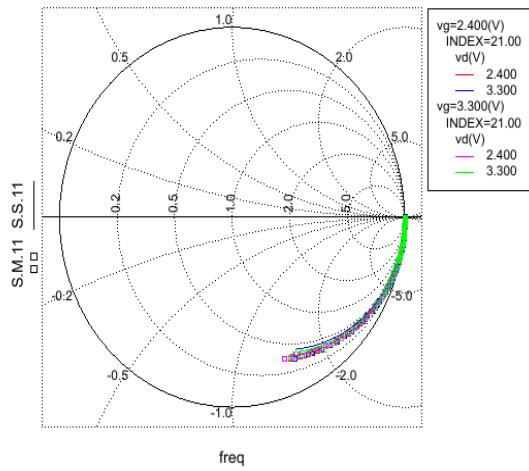
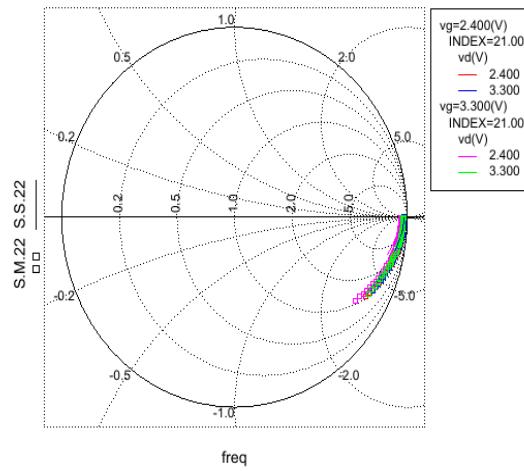
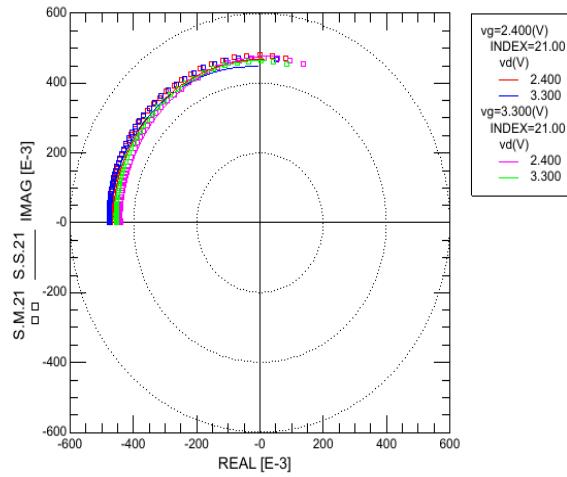
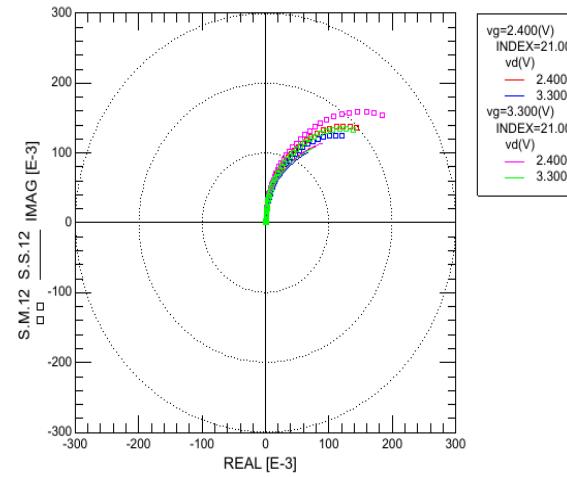
S-Parameter, T = 27°C

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

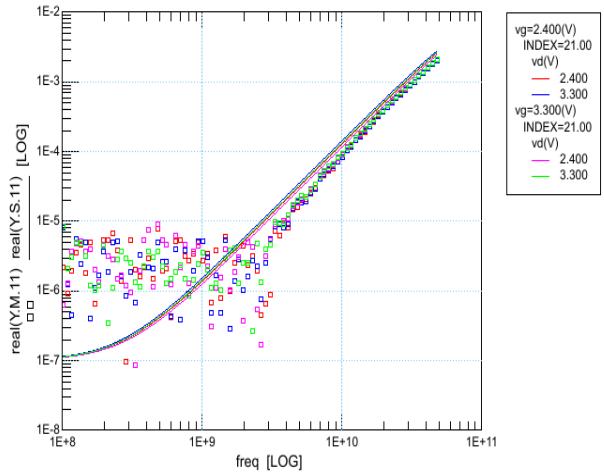
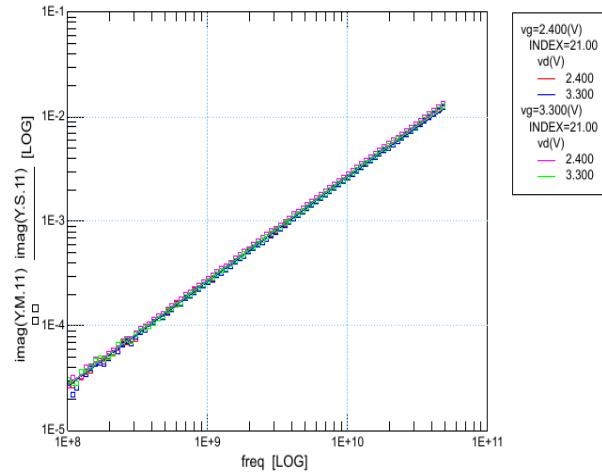
vg=2.400(V)
INDEX=21.00
vd(V)
2.400
3.300
vg=3.300(V)
INDEX=21.00
vd(V)
2.400
3.300

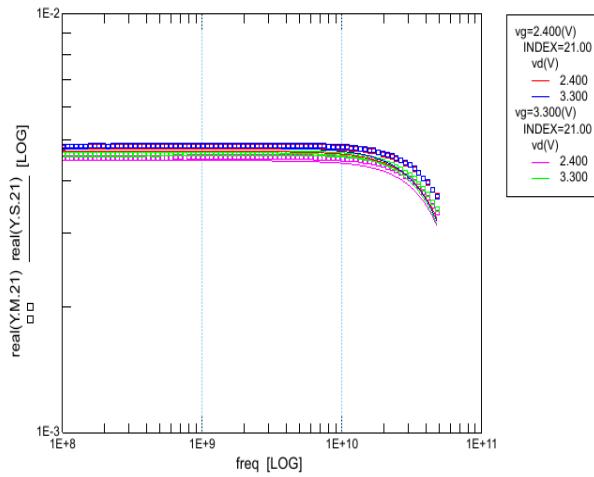


$$MSG/MAG = f(Vg, Vd)$$

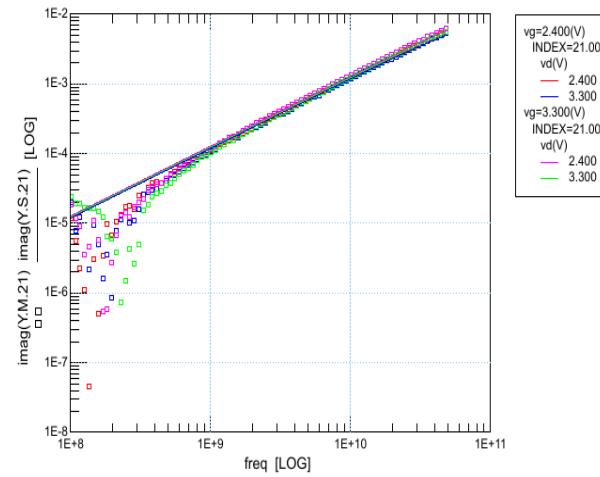
 $S_{11} = f(V_g, V_d)$  $S_{22} = f(V_g, V_d)$  $S_{21} = f(V_g, V_d)$  $S_{12} = f(V_g, V_d)$

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

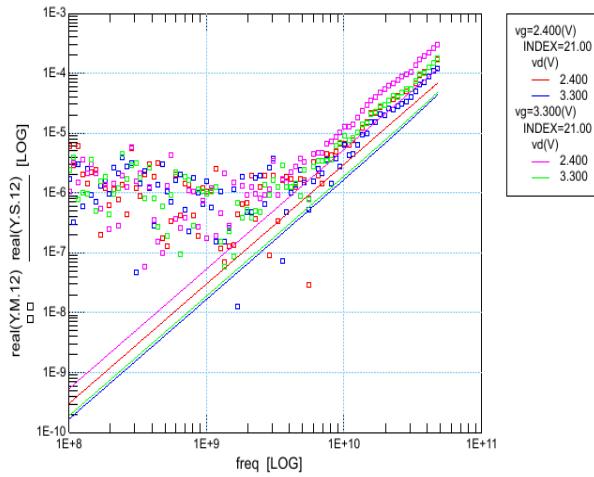
 $\text{re}(Y_{11}) = f(V_g, V_d)$  $\text{im}(Y_{11}) = f(V_g, V_d)$



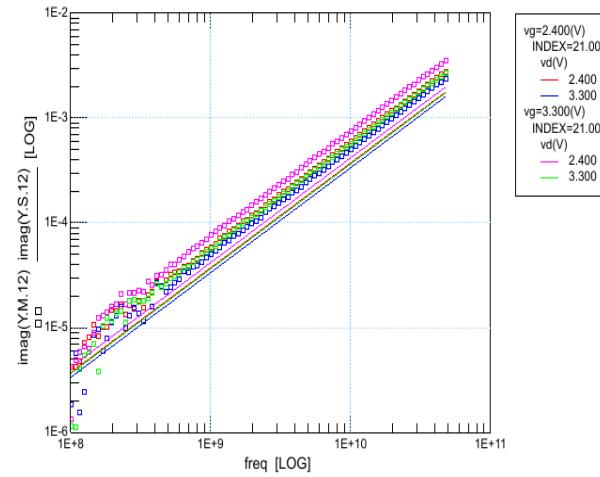
re(Y21) = f(Vg,Vd)



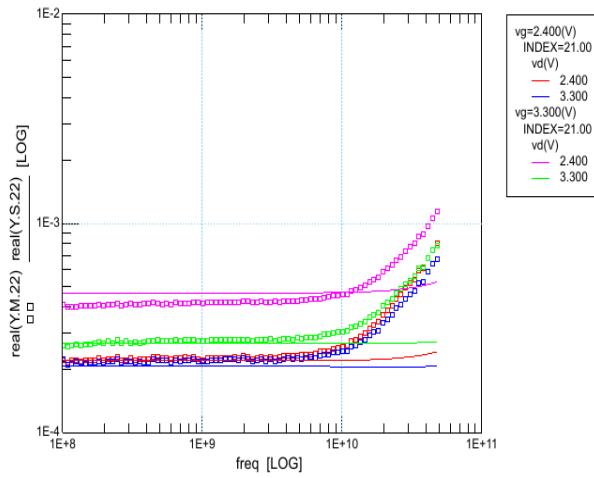
im(Y21) = f(Vg,Vd)



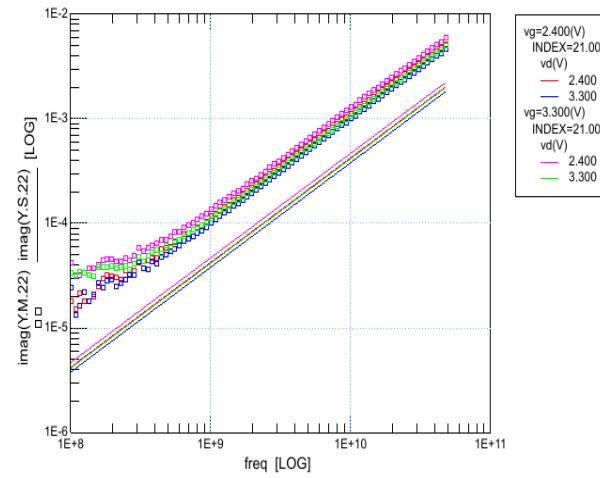
re(Y12) = f(Vg,Vd)



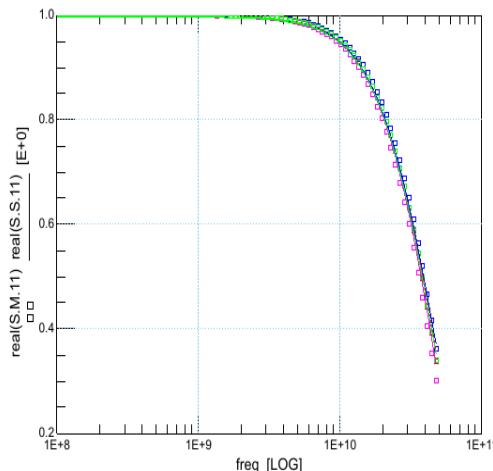
im(Y12) = f(Vg,Vd)



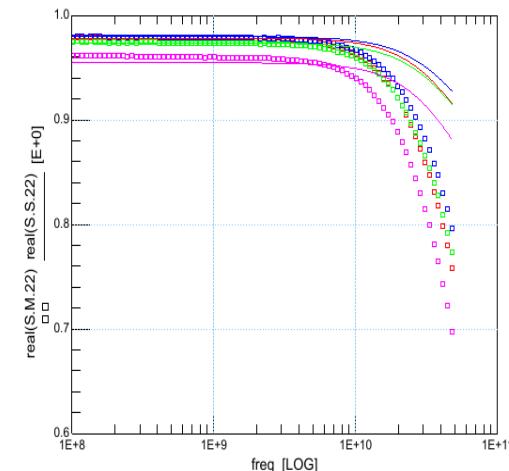
re(Y22) = f(Vg,Vd)



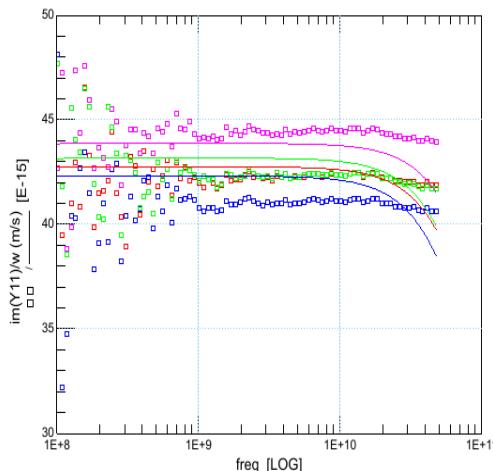
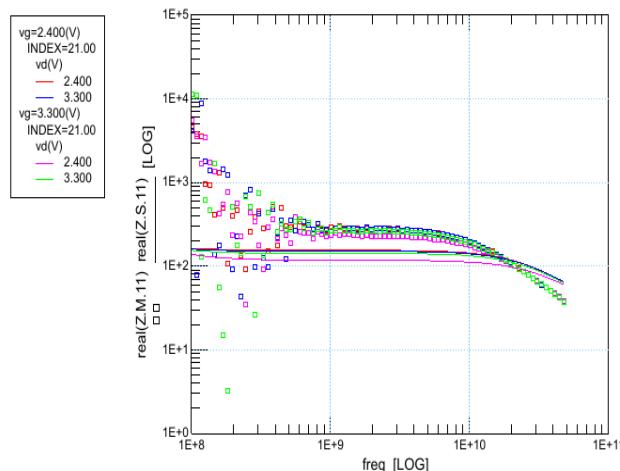
im(Y22) = f(Vg,Vd)

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

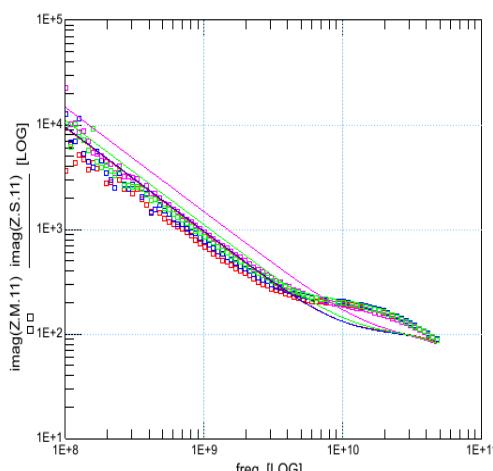
re(S11) = f(Vg, Vd)



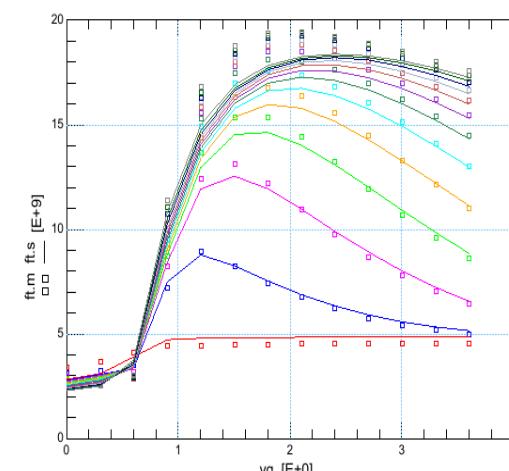
re(S22) = f(Vg, Vd)

im(Y11) divided by ω 

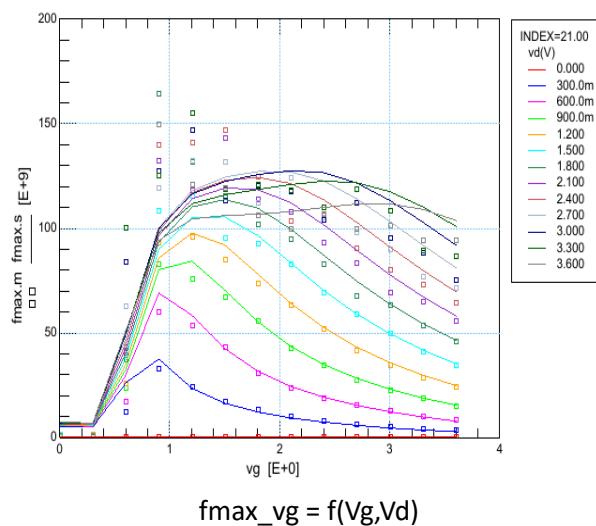
re(Z11) = f(Vg, Vd)



im(Z11) = f(Vg, Vd)



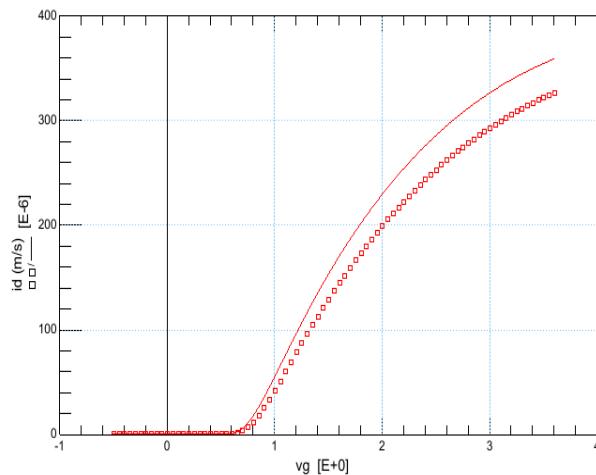
fT_vg = f(Vg, Vd)



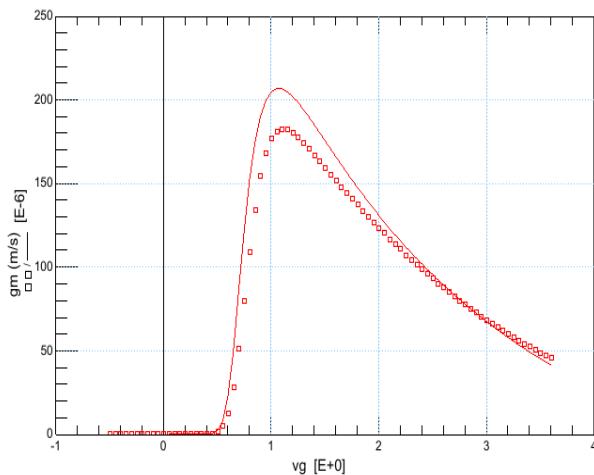
$$f_{max_vg} = f(V_g, V_d)$$

5.4 NF01_WF05u0_L_0u45_S453A_C1

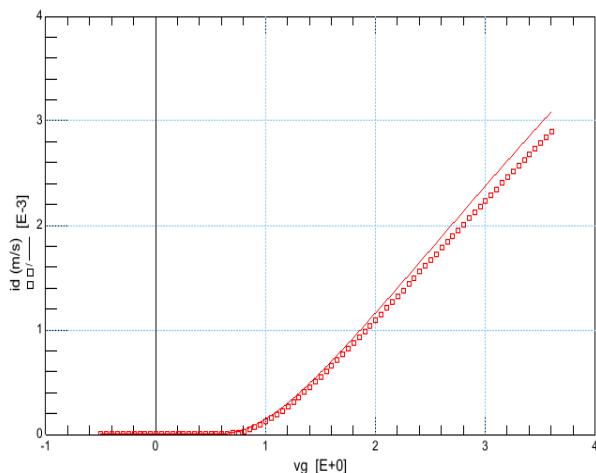
$I_d V_g$, $T = 27^\circ C$



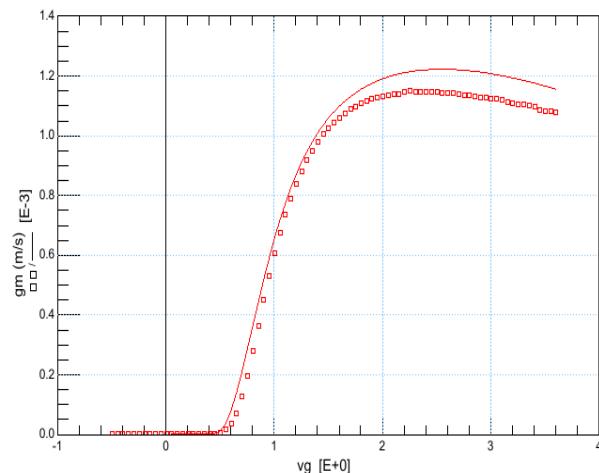
$$I_d = f(V_g) @ V_d = 0.1V$$



$$g_m = f(V_g) @ V_d = 0.1V$$

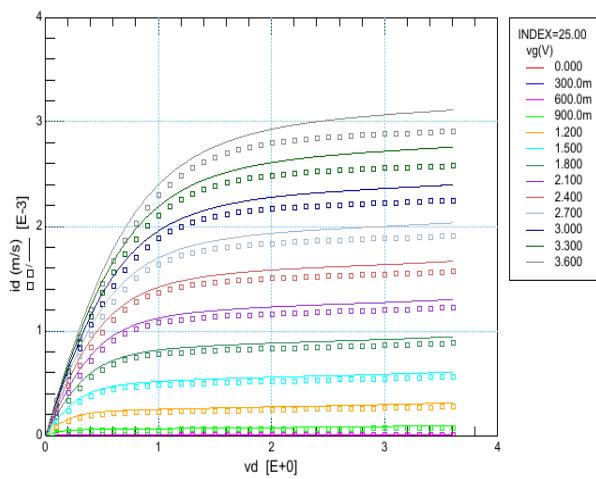


$$Id = f(Vg) @ Vd = 3.3V$$

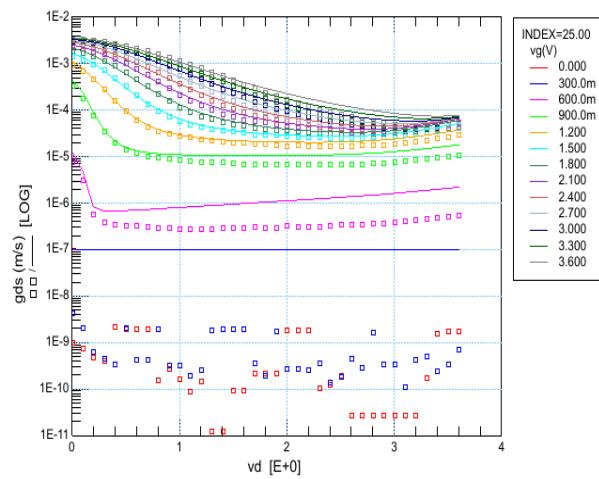


$$gm = f(Vg) @ Vd = 3.3V$$

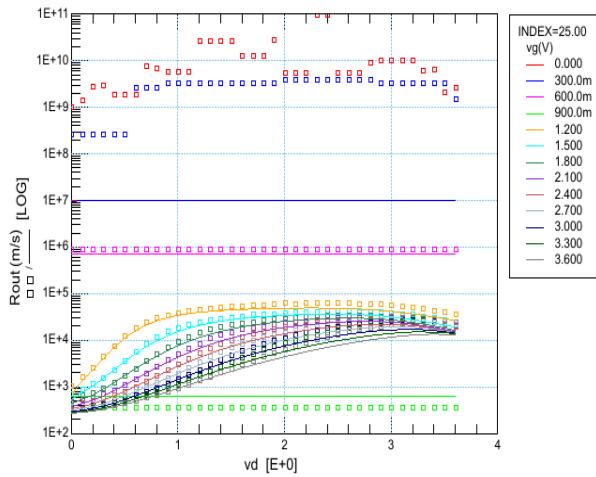
IdVd, T = 27°C



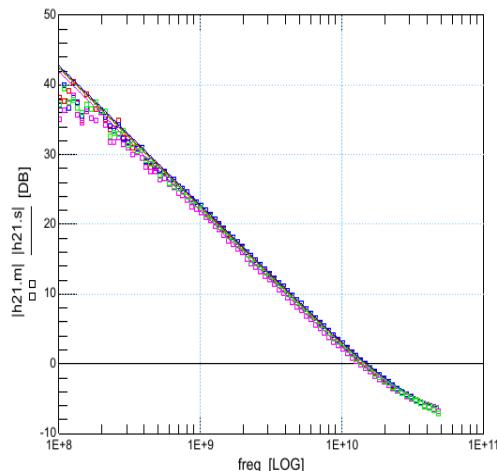
$$Id = f(Vd)$$



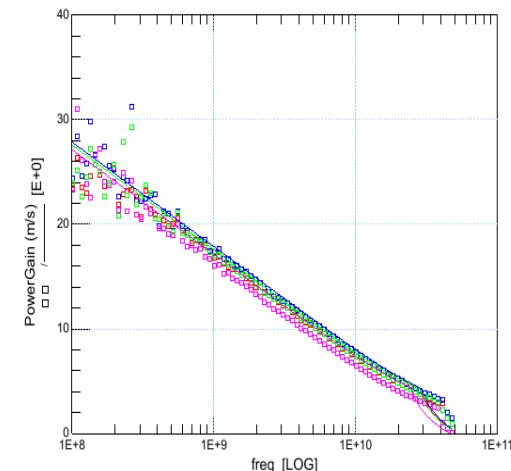
$$gds = f(Vd)$$



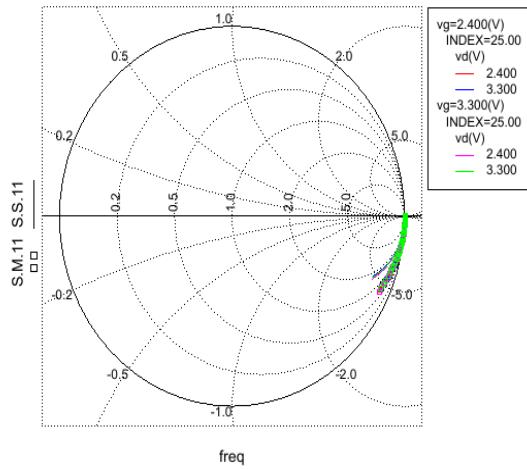
$$Rout = f(Vd)$$

S-Parameter, T = 27°C

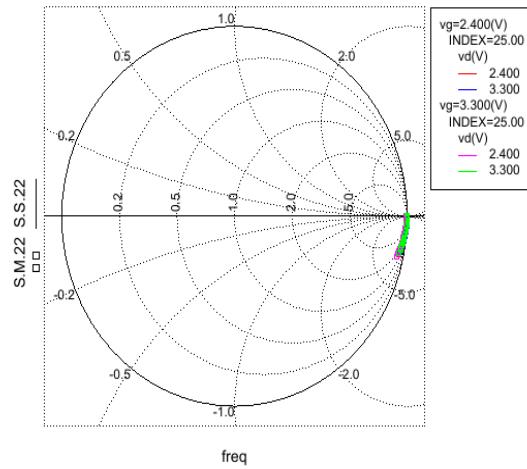
$$|h_{21}| = f(Vg, Vd)$$



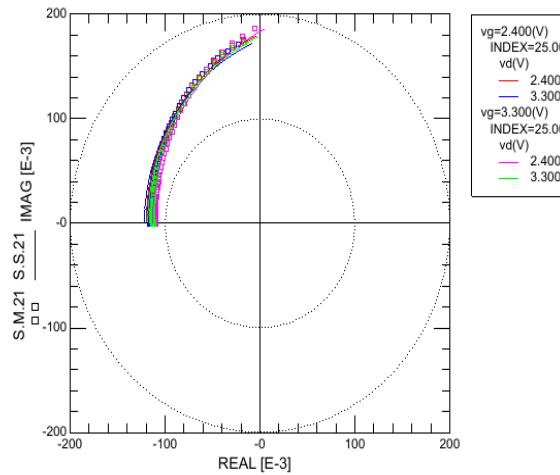
$$MSG/MAG = f(Vg, Vd)$$



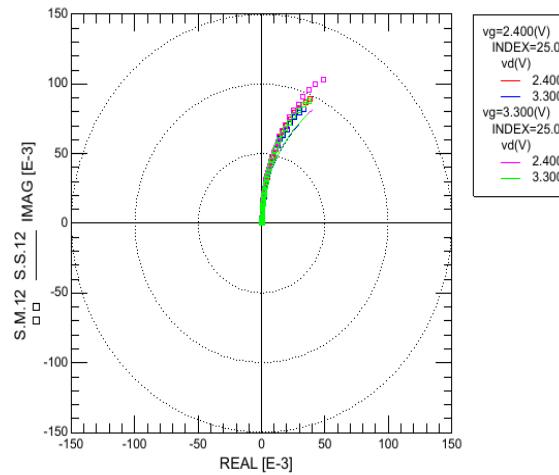
$$S_{11} = f(Vg, Vd)$$



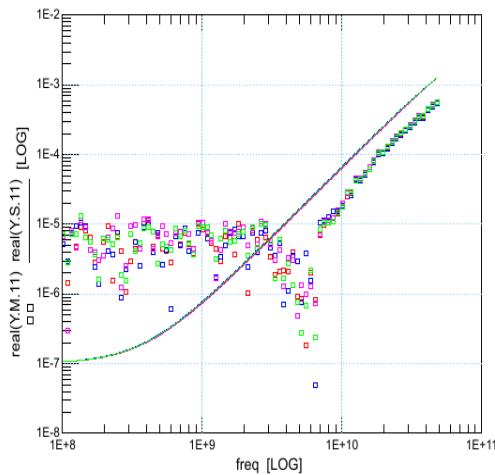
$$S_{22} = f(Vg, Vd)$$



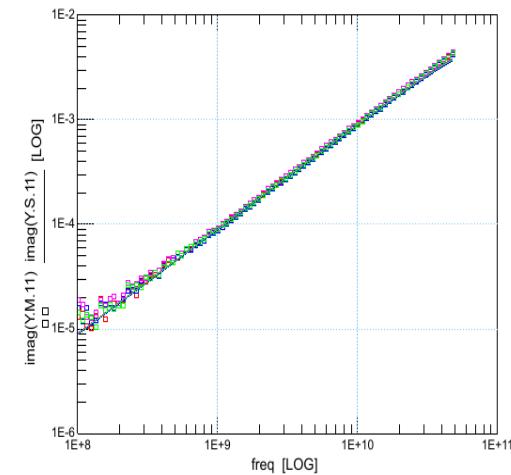
$$S_{21} = f(Vg, Vd)$$



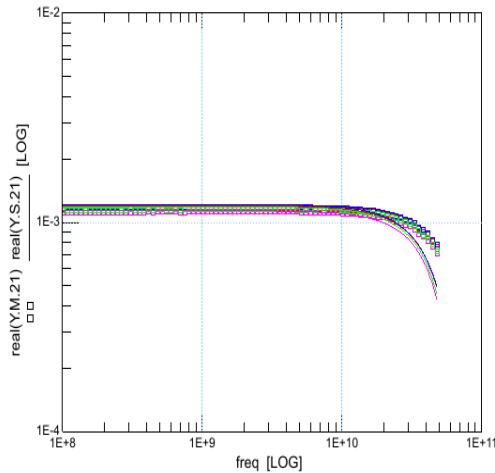
Y-Parameter, T = 27°C



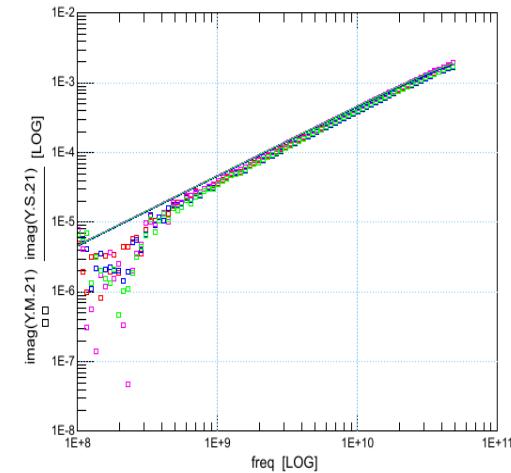
$$\text{re}(Y_{11}) = f(V_g, V_d)$$



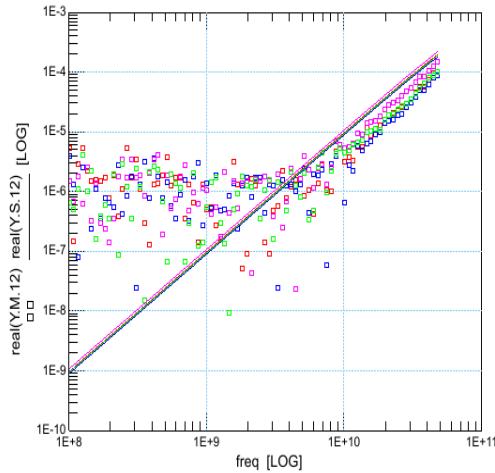
$$\text{im}(Y_{11}) = f(V_g, V_d)$$



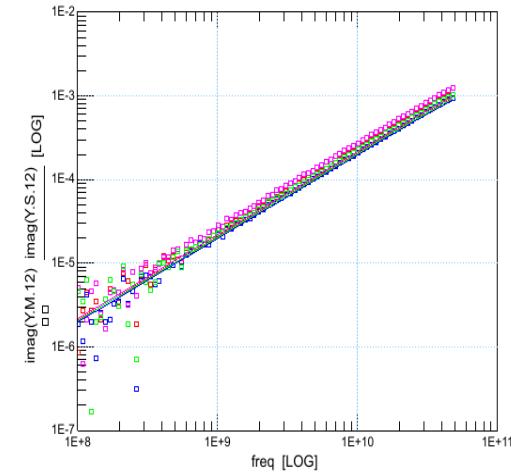
$$\text{re}(Y_{21}) = f(V_g, V_d)$$



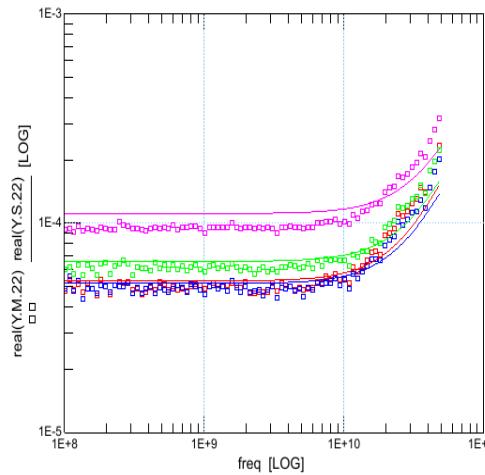
$$\text{im}(Y_{21}) = f(V_g, V_d)$$



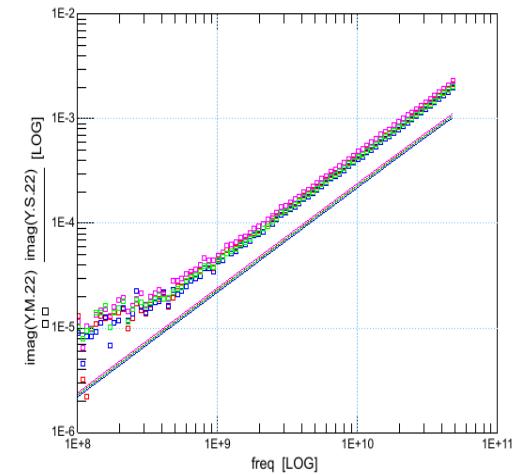
$$\text{re}(Y_{12}) = f(V_g, V_d)$$



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

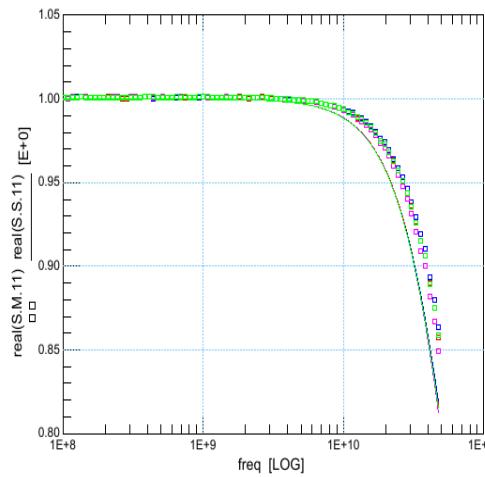


$$\text{re}(Y_{22}) = f(V_g, V_d)$$

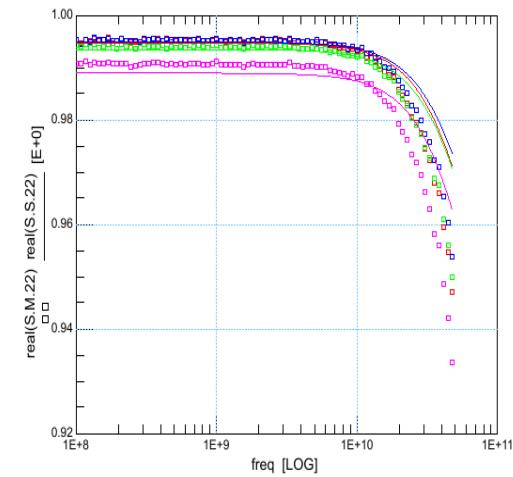


$$\text{im}(Y_{22}) = f(V_g, V_d)$$

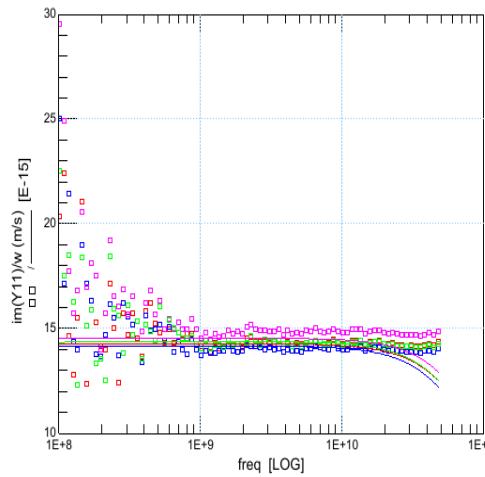
Verify Plots, $T = 27^\circ\text{C}$



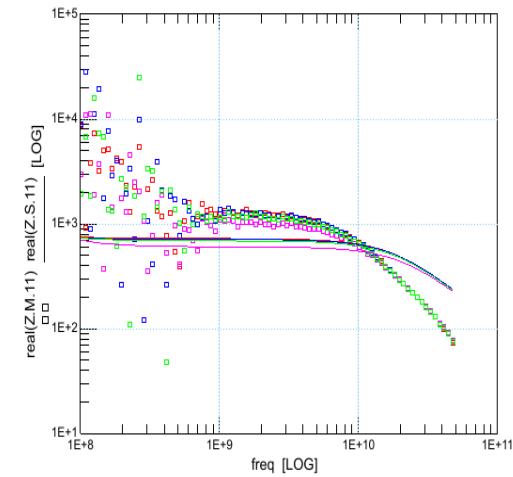
$$\text{re}(S_{11}) = f(V_g, V_d)$$



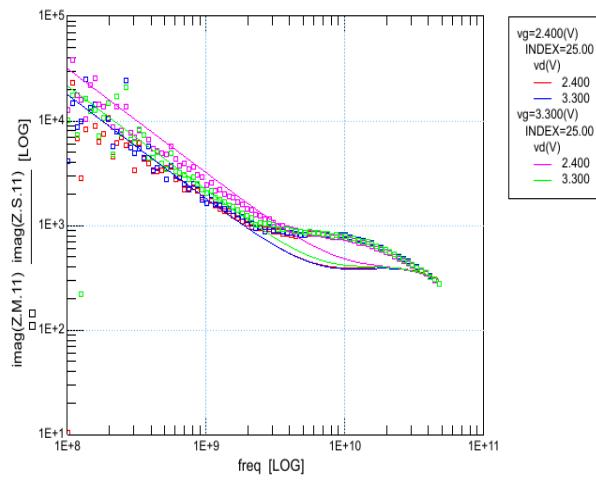
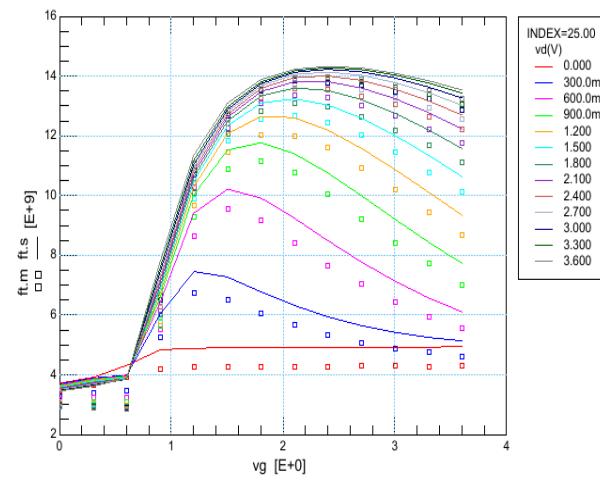
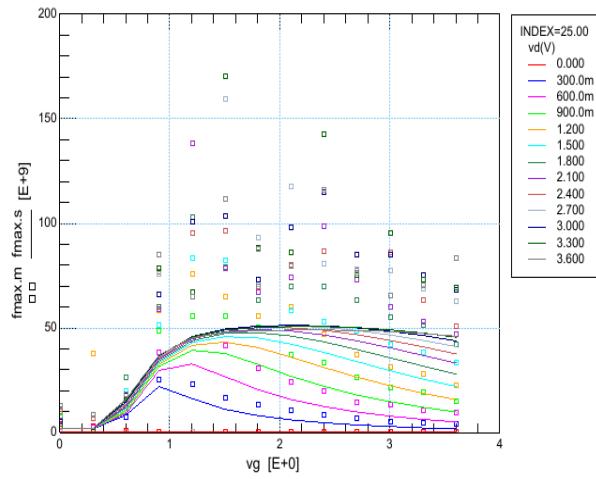
$$\text{re}(S_{22}) = f(V_g, V_d)$$



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

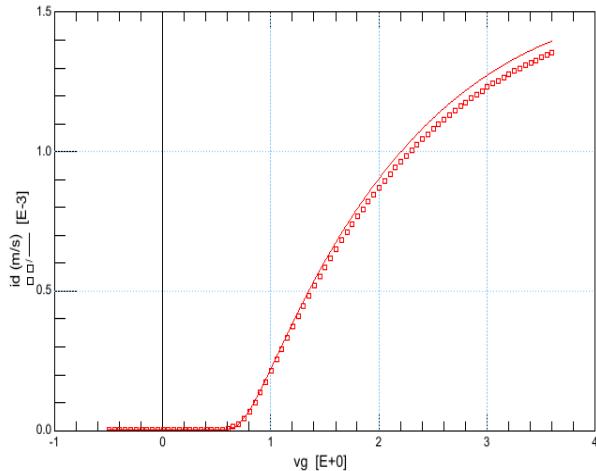


$$\text{re}(Z_{11}) = f(V_g, V_d)$$

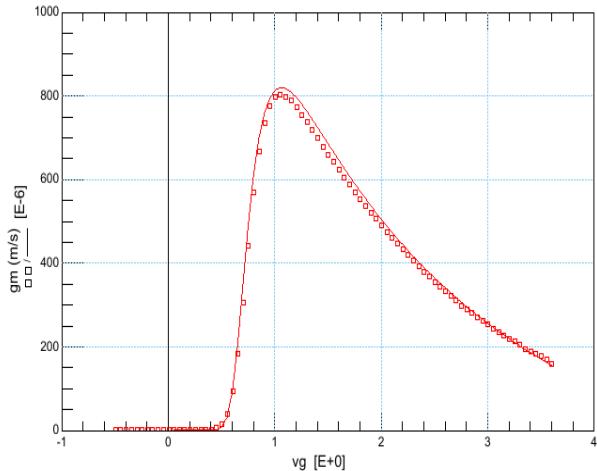
 $\text{im}(Z_{11}) = f(V_g, V_d)$  $fT_{vg} = f(V_g, V_d)$  $f_{\text{max},vg} = f(V_g, V_d)$

5.5 NF04_WF05u0_L_0u45_S453A_83

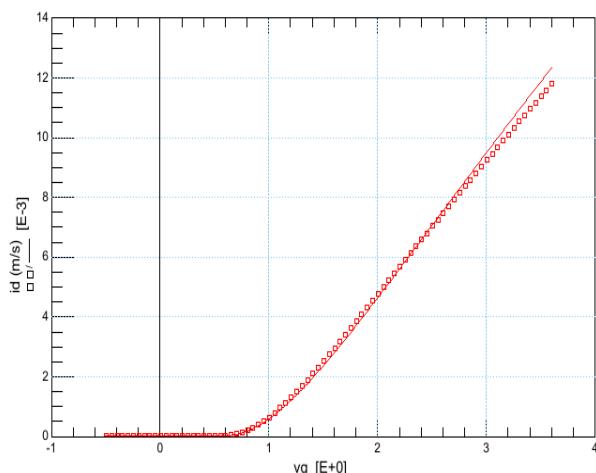
Id , $T = 27^\circ\text{C}$



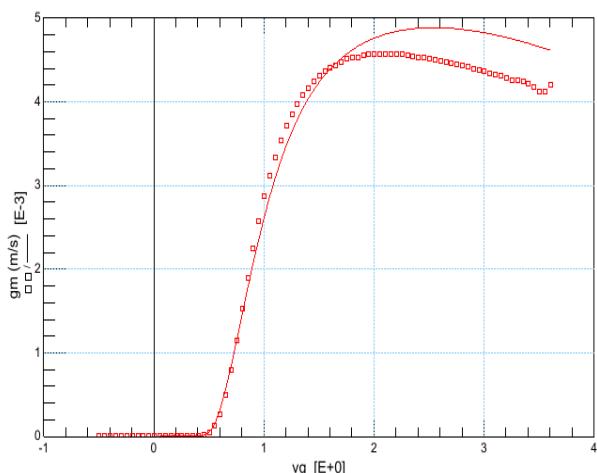
$Id = f(Vg) @ Vd = 0.1\text{V}$



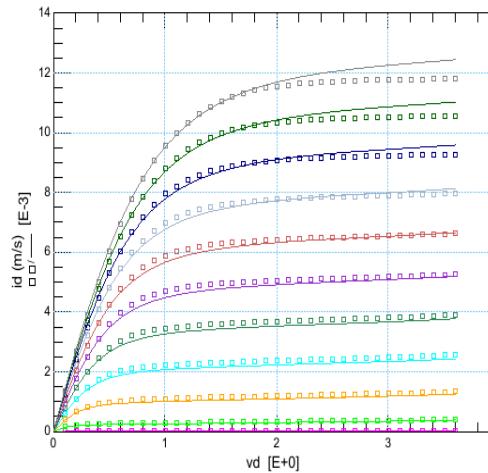
$gm = f(Vg) @ Vd = 0.1\text{V}$



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

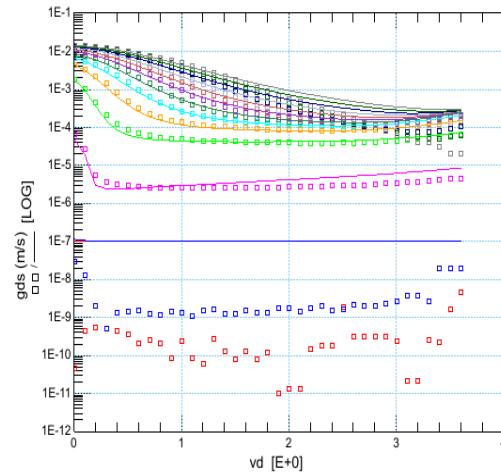


$gm = f(Vg) @ Vd = 3.3\text{V}$

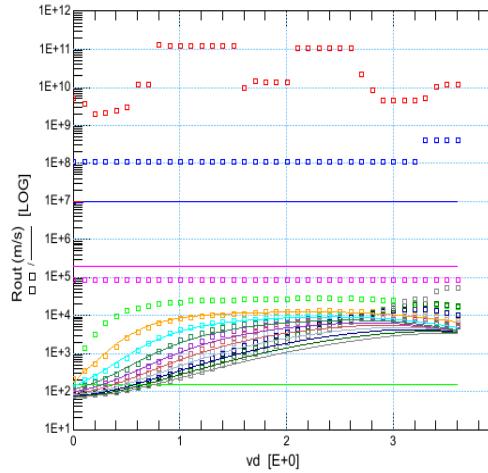
IdVd, T = 27°C


Id = f(Vd)

INDEX=29.00
vg(V)
0.000
300.0m
600.0m
900.0m
1.200
1.500
1.800
2.100
2.400
2.700
3.000
3.300
3.600

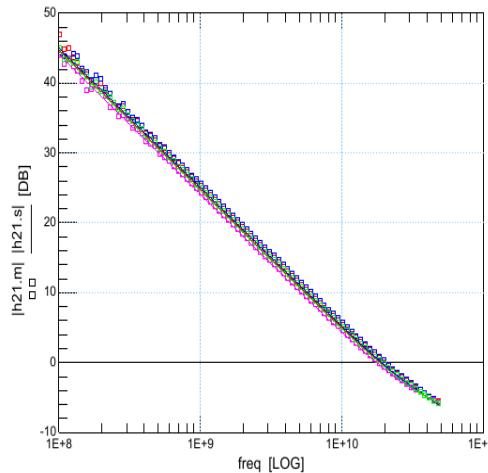


gds = f(Vd)



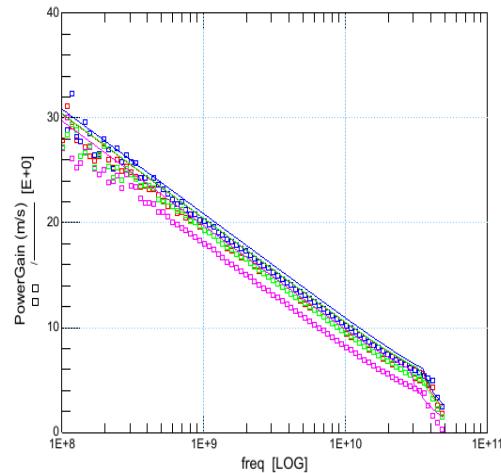
Rout = f(Vd)

INDEX=29.00
vg(V)
0.000
300.0m
600.0m
900.0m
1.200
1.500
1.800
2.100
2.400
2.700
3.000
3.300
3.600

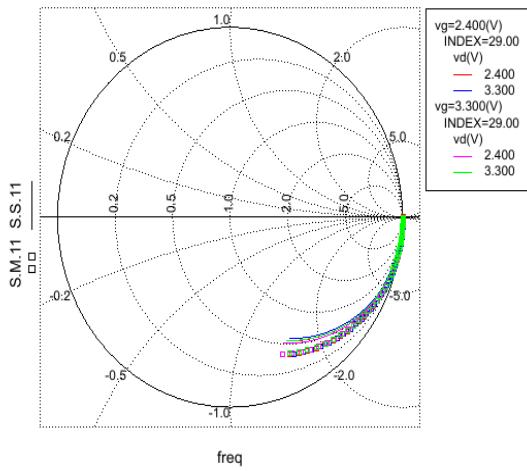
S-Parameter, T = 27°C


|h21| = f(Vg,Vd)

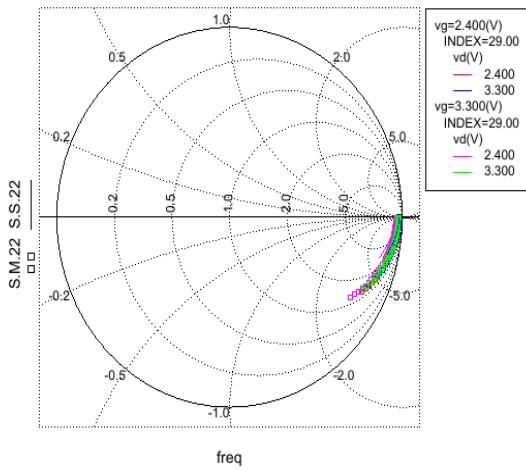
vg=2.400(V)
INDEX=29.00
vd(V)
2.400
3.300
vg=3.300(V)
INDEX=29.00
vd(V)
2.400
3.300



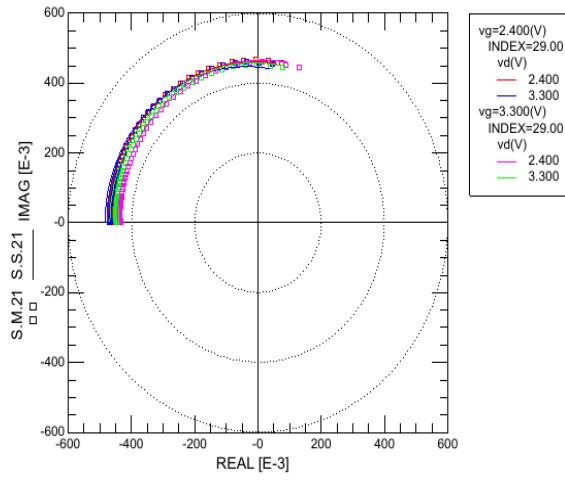
MSG/MAG = f(Vg,Vd)



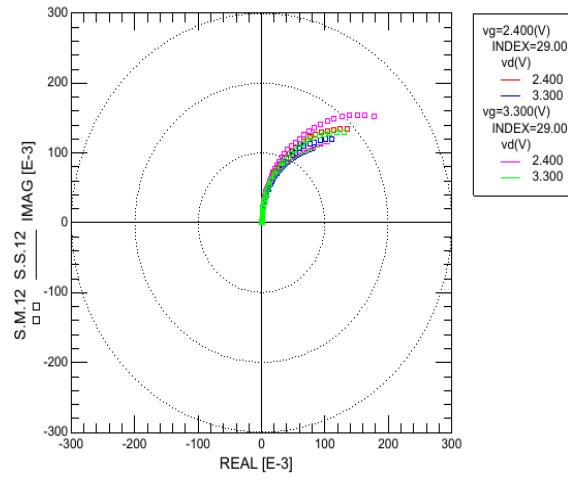
S11 = f(Vg,Vd)



S22 = f(Vg,Vd)

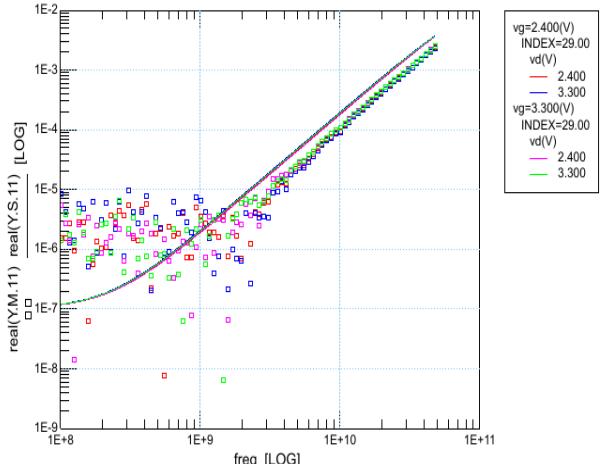


S21 = f(Vg,Vd)

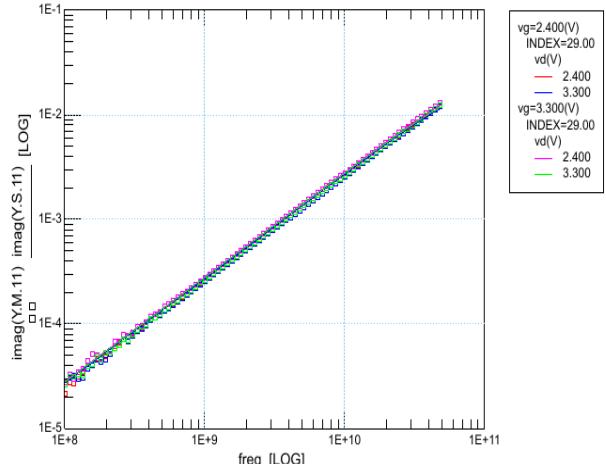


S12 = f(Vg,Vd)

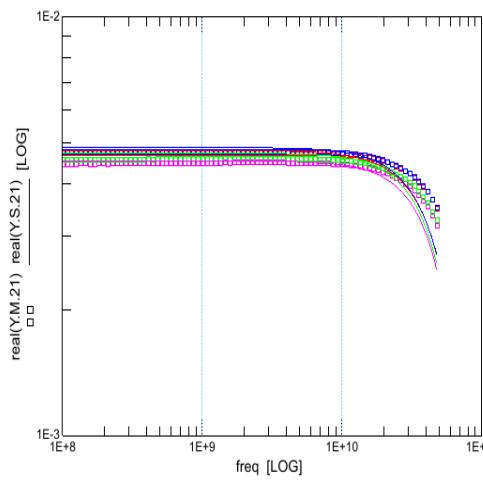
Y-Parameter, T = 27°C



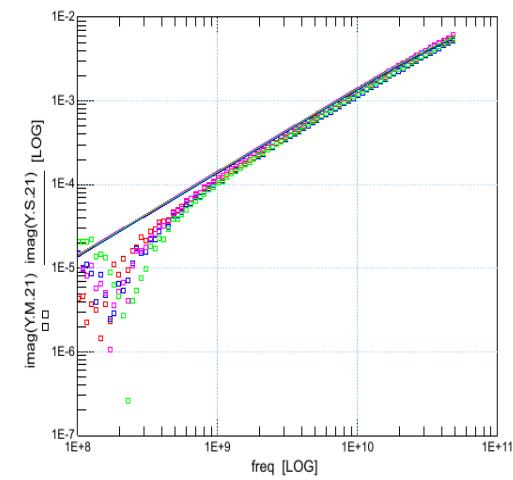
re(Y11) = f(Vg,Vd)



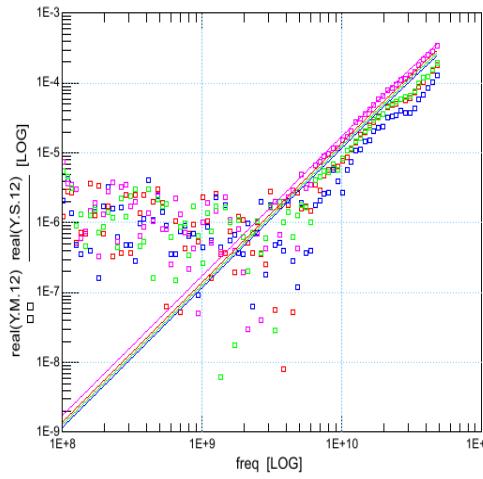
im(Y11) = f(Vg,Vd)



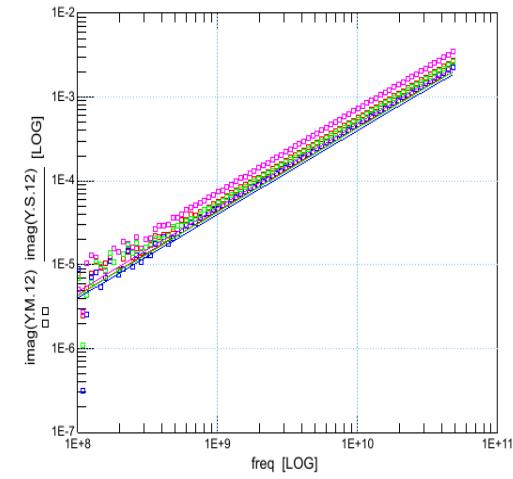
re(Y21) = f(Vg,Vd)



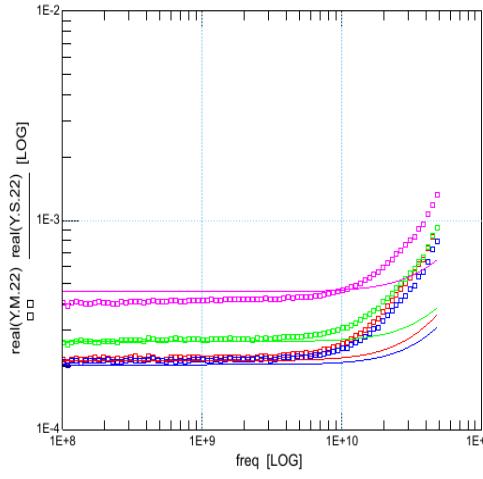
im(Y21) = f(Vg,Vd)



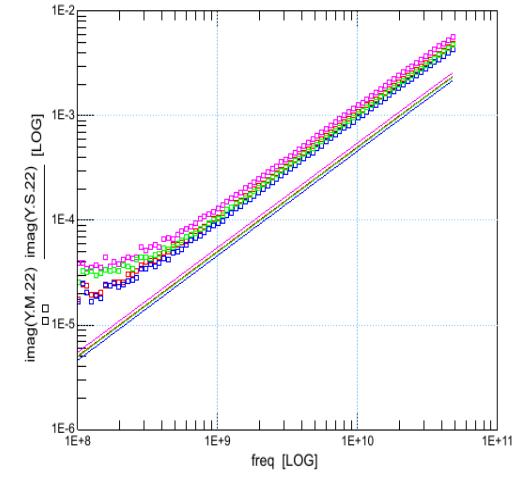
re(Y12) = f(Vg,Vd)



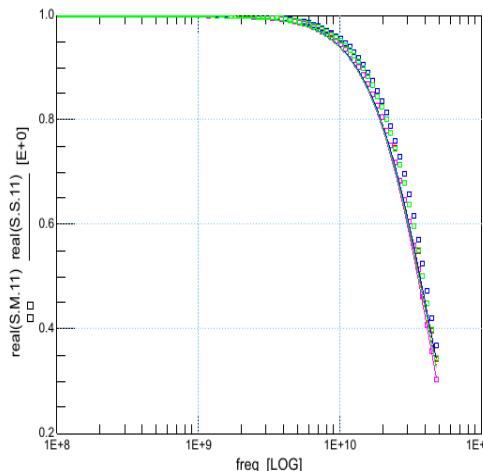
im(Y12) = f(Vg,Vd)



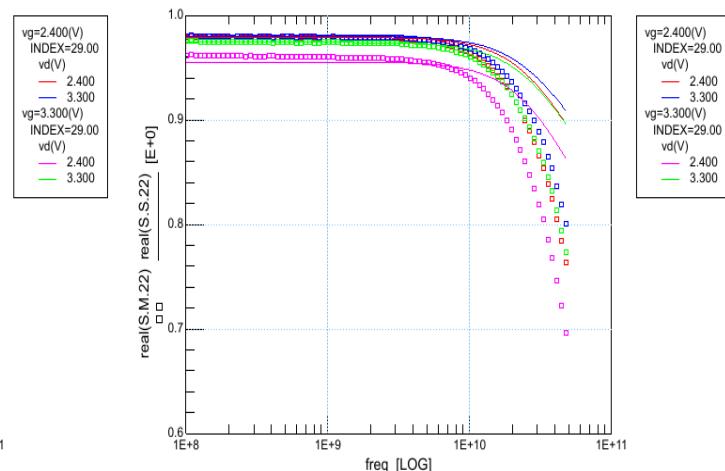
re(Y22) = f(Vg,Vd)



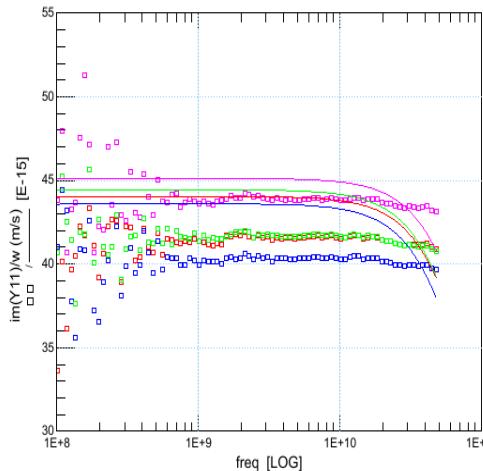
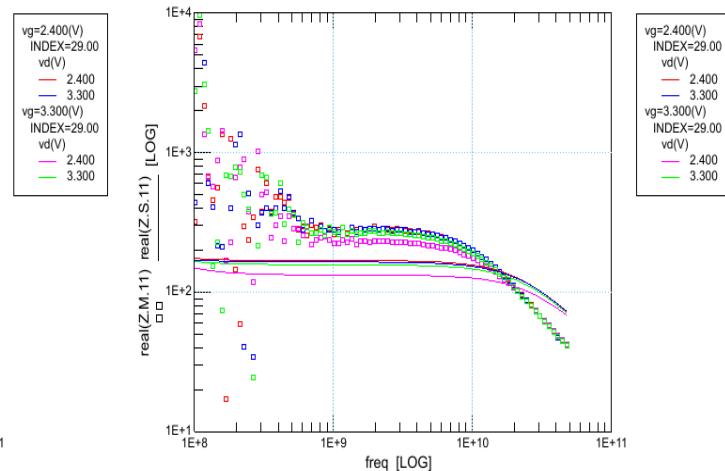
im(Y22) = f(Vg,Vd)

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

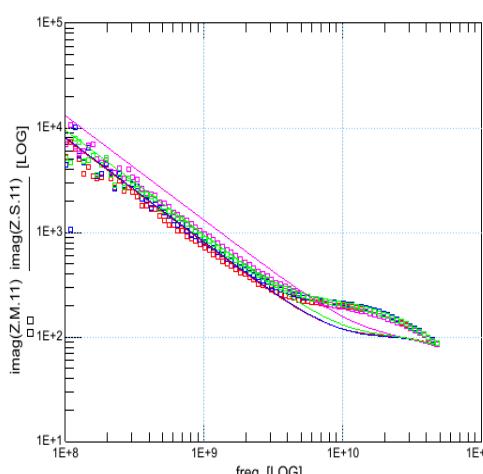
re(S11) = f(Vg, Vd)



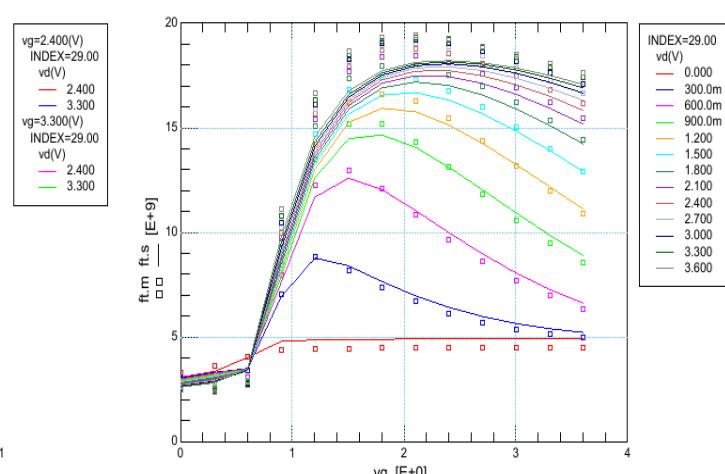
re(S22) = f(Vg, Vd)

im(Y11) divided by ω 

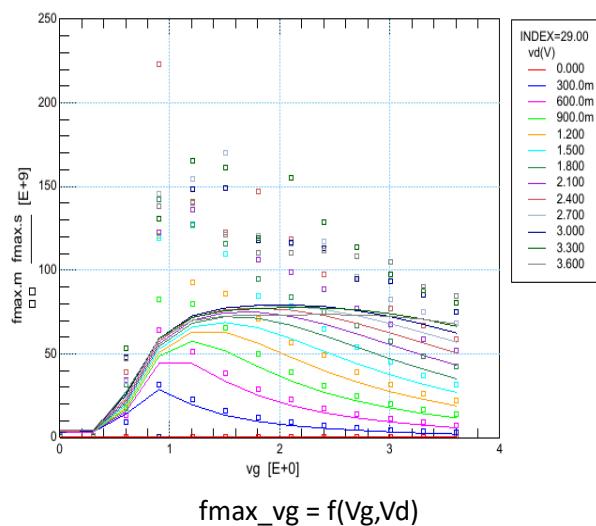
re(Z11) = f(Vg, Vd)



im(Z11) = f(Vg, Vd)

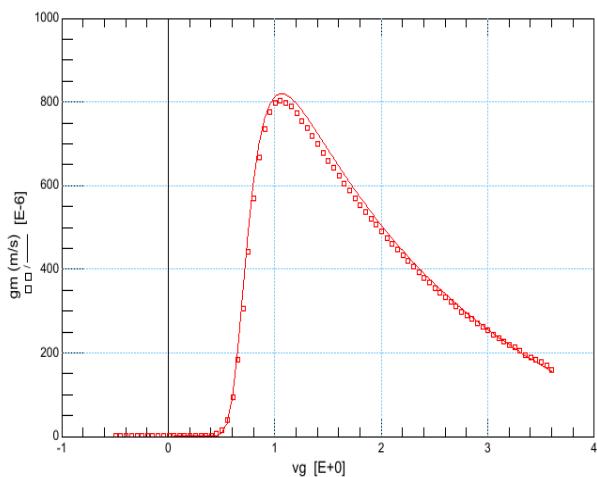
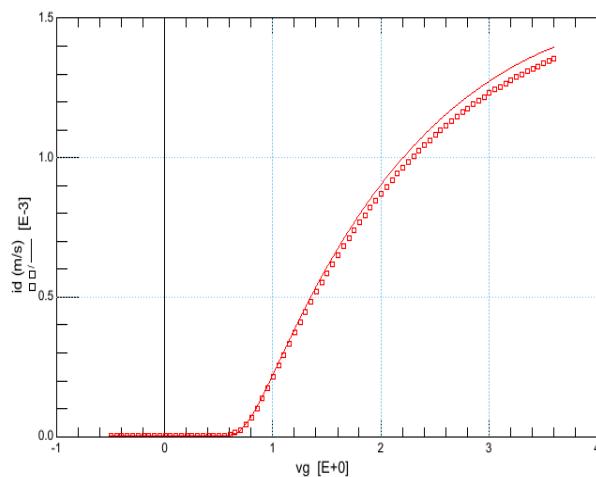


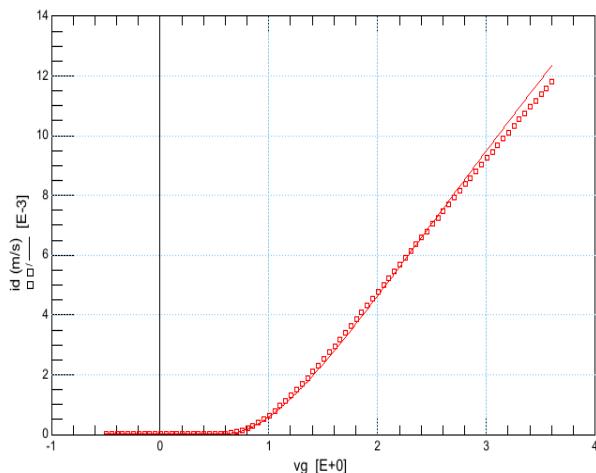
fT_vg = f(Vg, Vd)



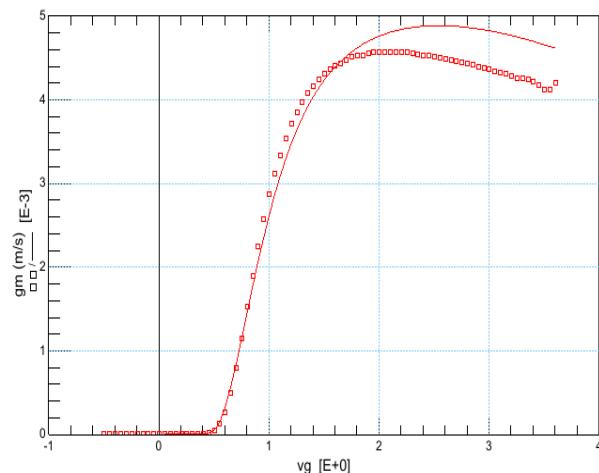
5.6 NF04_WF05u0_L_0u45_post_83

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



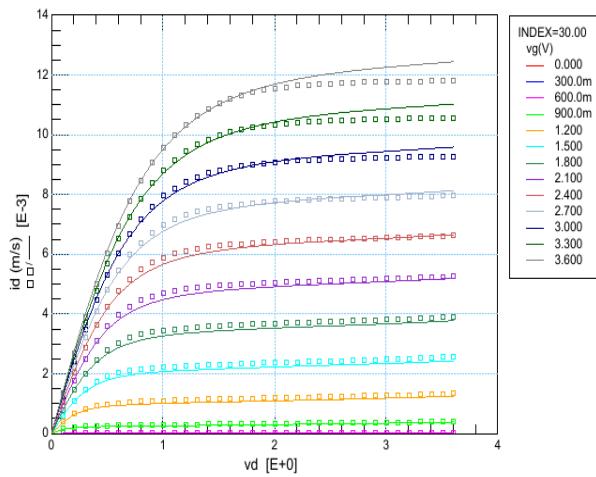


$$Id = f(Vg) @ Vd = 3.3V$$

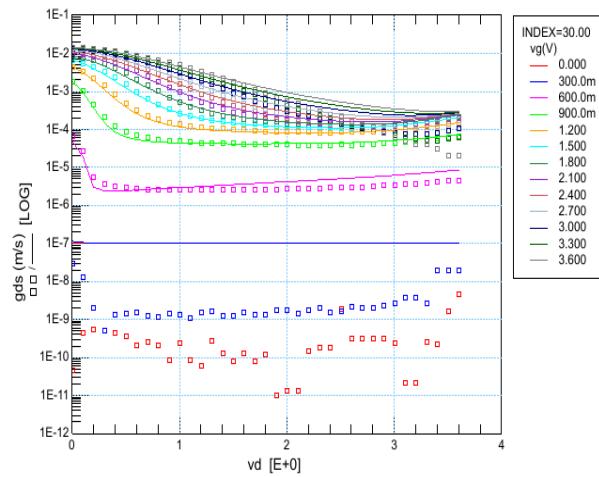


$$gm = f(Vg) @ Vd = 3.3V$$

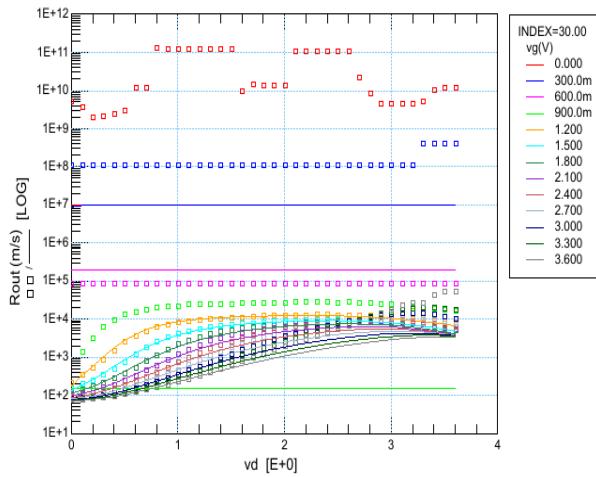
IdVd, T = 27°C



$$Id = f(Vd)$$

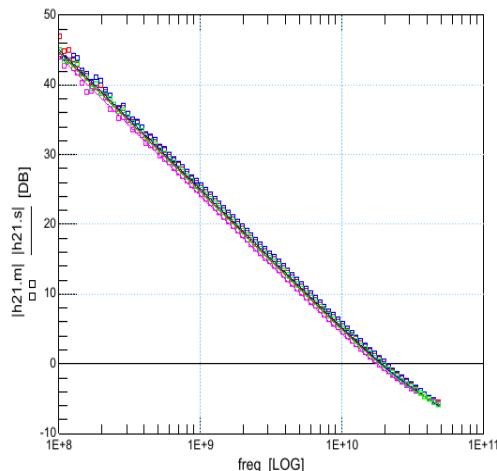


$$gds = f(Vd)$$

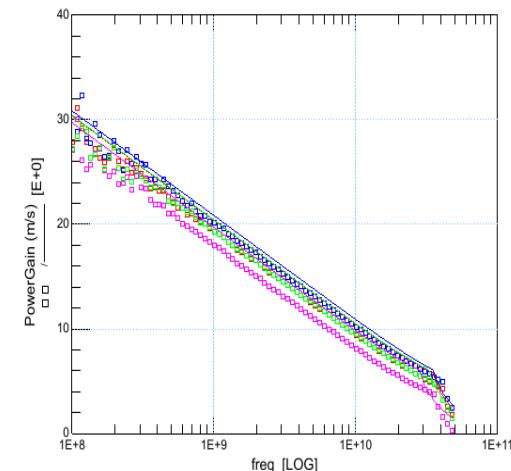


$$Rout = f(Vd)$$

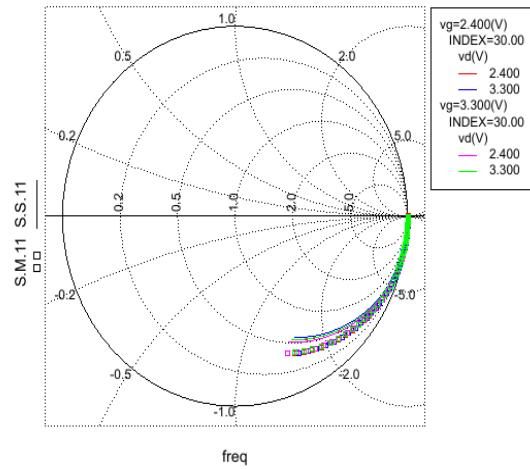
S-Parameter, T = 27°C



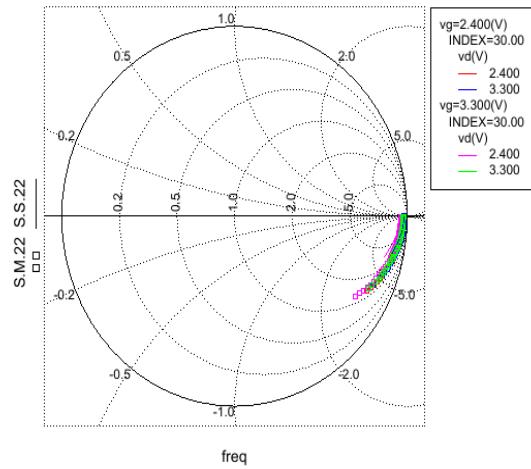
$$|h_{21}| = f(V_g, V_d)$$



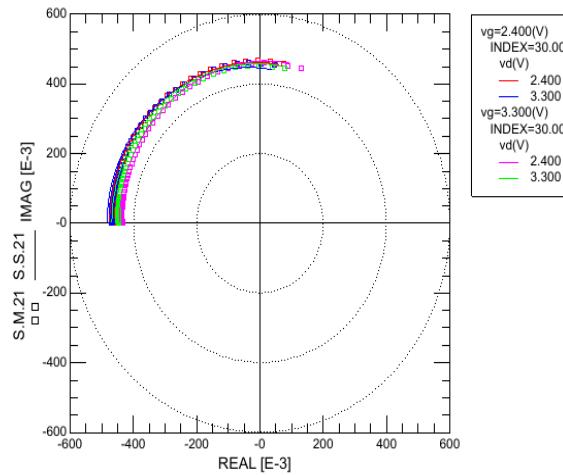
$$MSG/MAG = f(V_g, V_d)$$



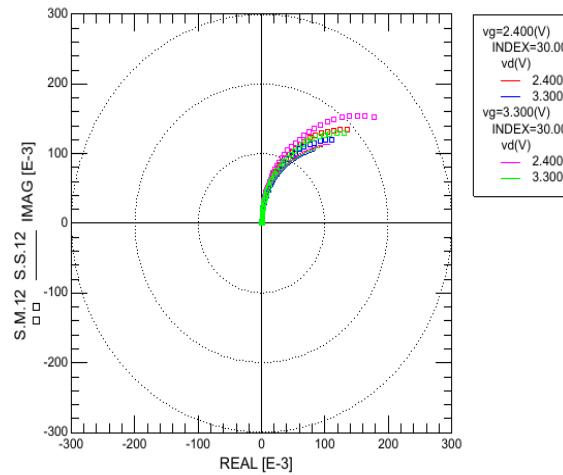
$$S_{11} = f(V_g, V_d)$$



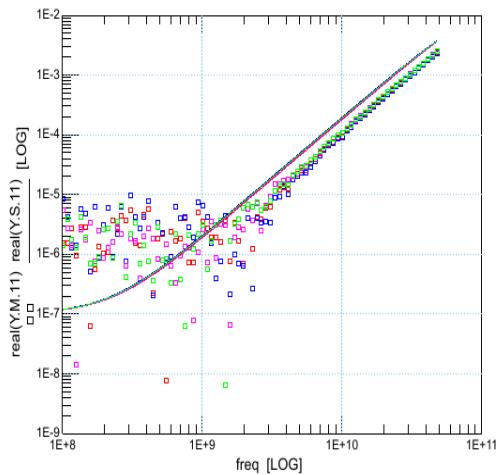
$$S_{22} = f(V_g, V_d)$$



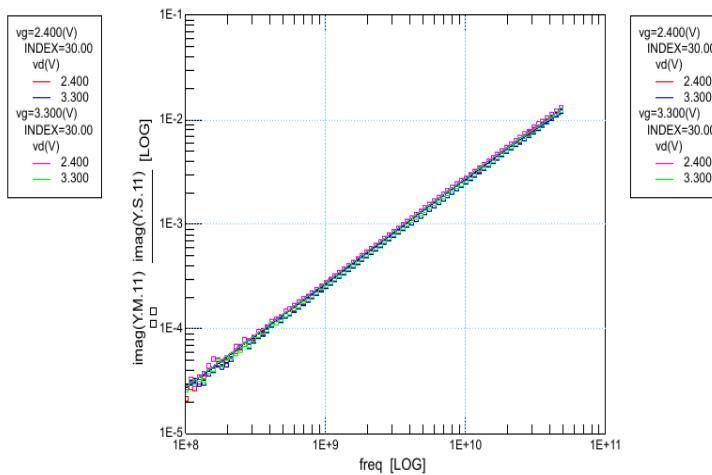
$$S_{21} = f(V_g, V_d)$$



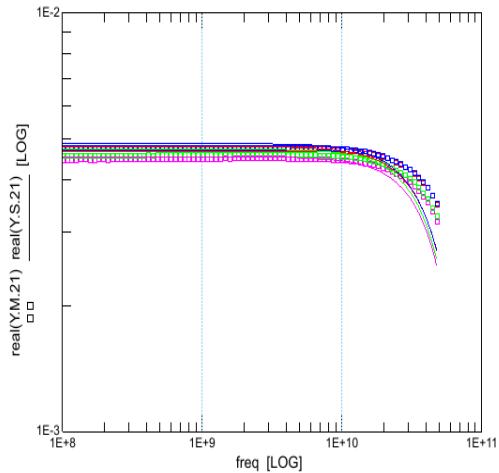
$$S_{12} = f(V_g, V_d)$$

Y-Parameter, T = 27°C

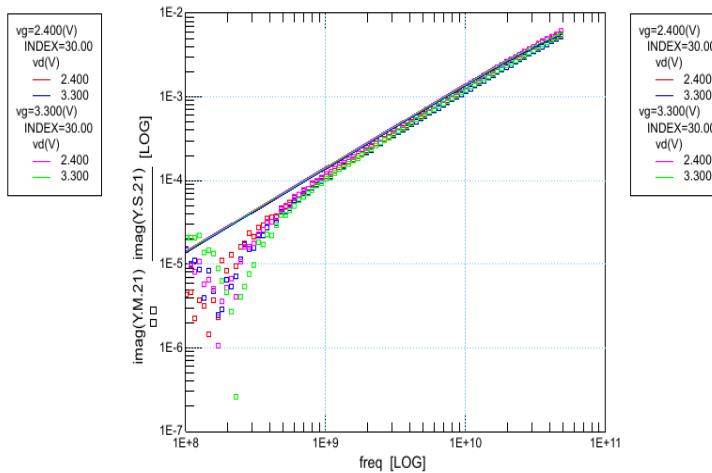
$$\text{re}(Y_{11}) = f(V_g, V_d)$$



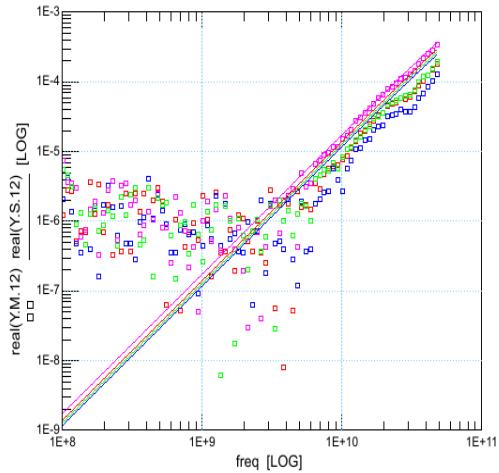
$$\text{im}(Y_{11}) = f(V_g, V_d)$$



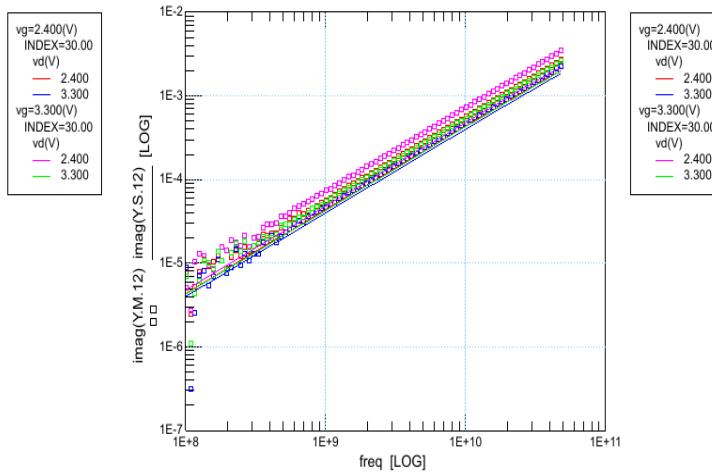
$$\text{re}(Y_{21}) = f(V_g, V_d)$$



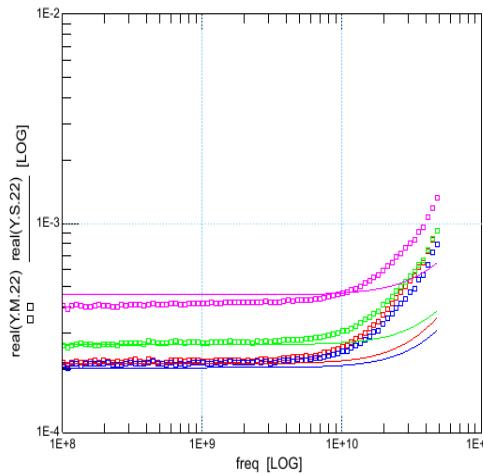
$$\text{im}(Y_{21}) = f(V_g, V_d)$$



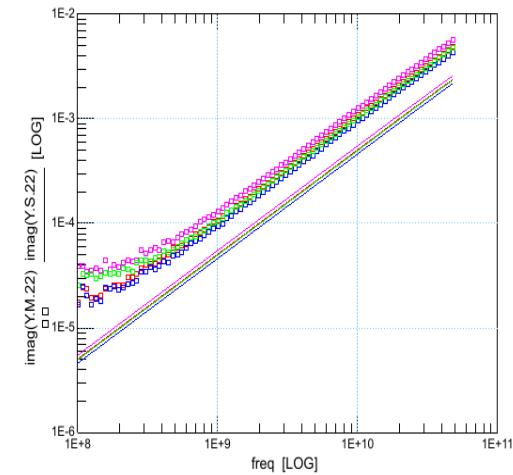
$$\text{re}(Y_{12}) = f(V_g, V_d)$$



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

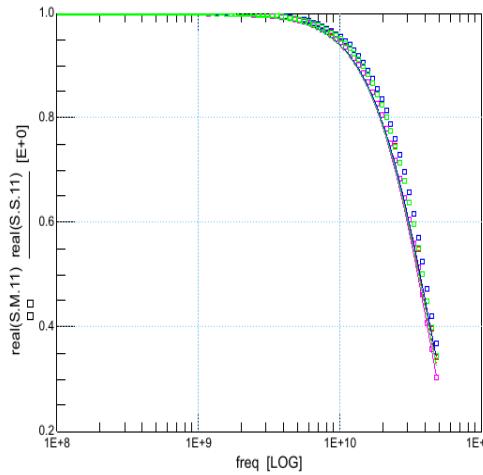


$$\text{re}(Y22) = f(Vg, Vd)$$

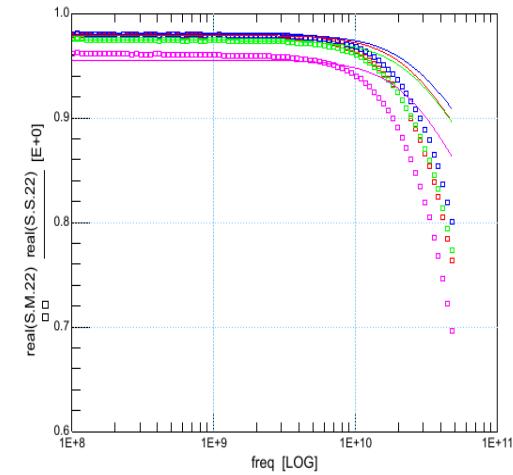


$$\text{im}(Y22) = f(Vg, Vd)$$

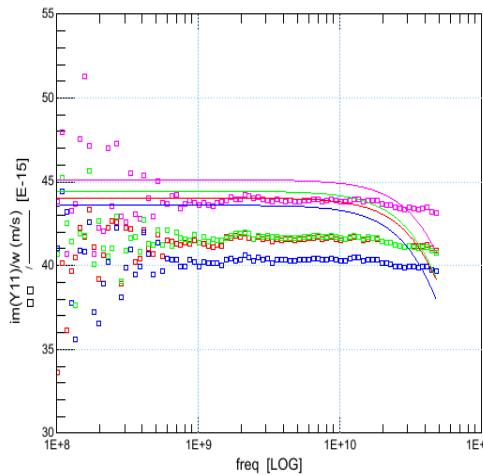
Verify Plots, T = 27°C



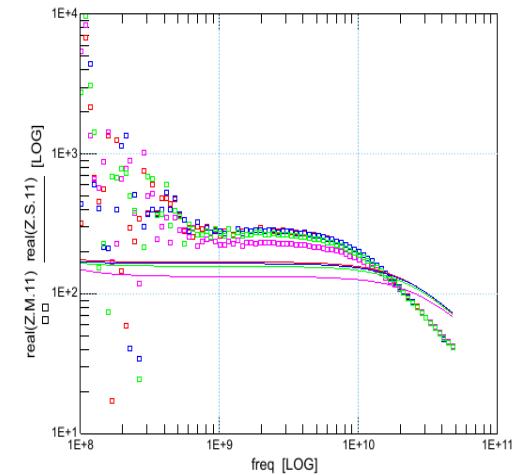
$$\text{re}(S11) = f(Vg, Vd)$$



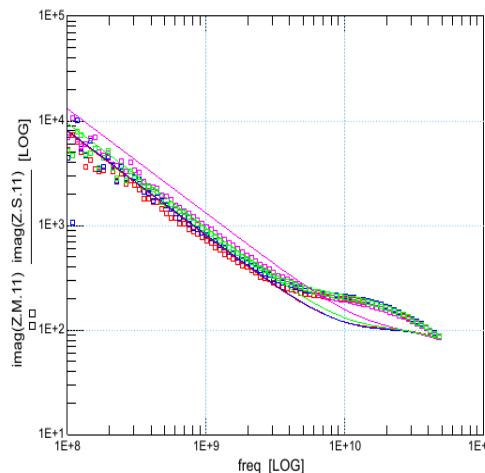
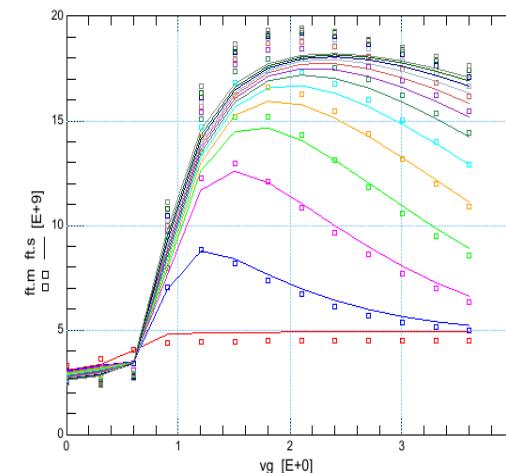
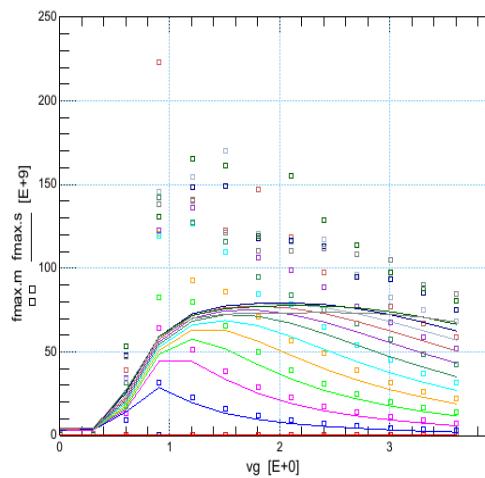
$$\text{re}(S22) = f(Vg, Vd)$$



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

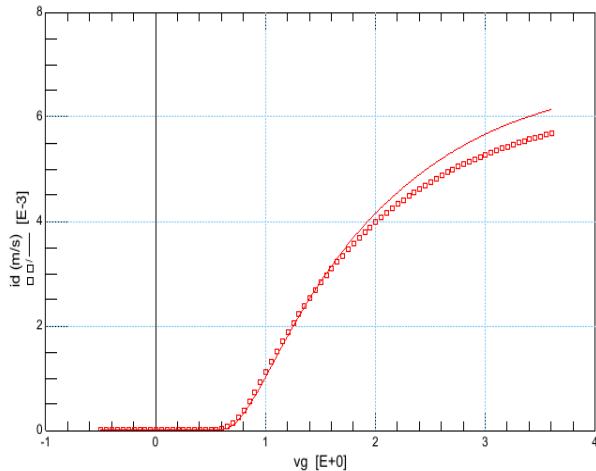


$$\text{re}(Z11) = f(Vg, Vd)$$

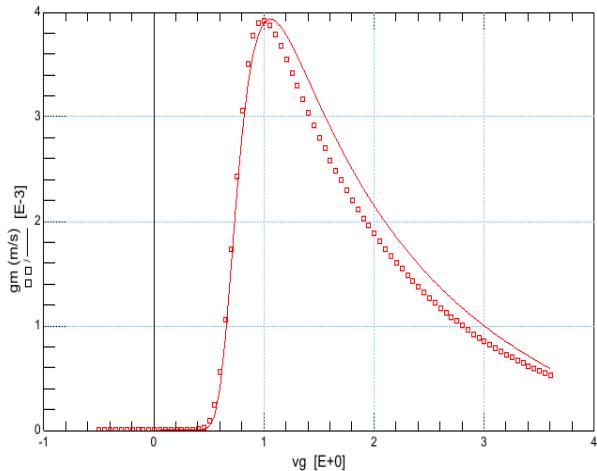
 $\text{im}(Z_{11}) = f(V_g, V_d)$  $fT_{vg} = f(V_g, V_d)$  $f_{\text{max},vg} = f(V_g, V_d)$

5.7 NF10_WF10u0_L_0u45_S453A_80

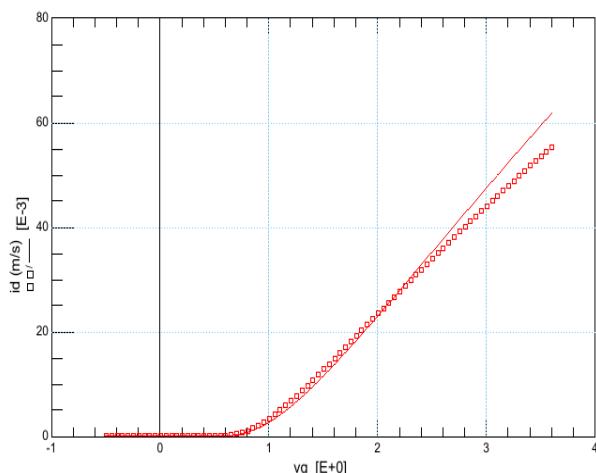
$IdVg$, $T = 27^\circ\text{C}$



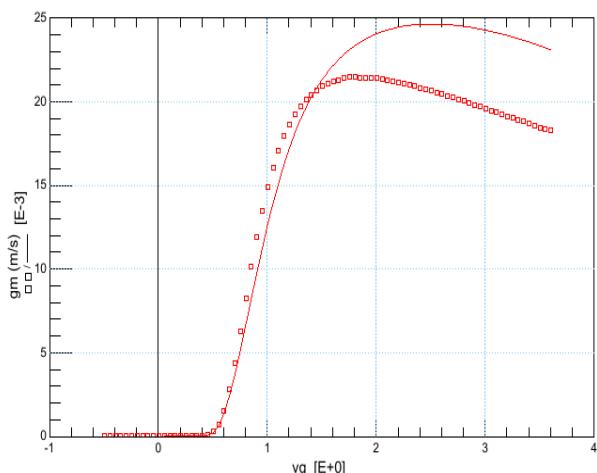
$Id = f(Vg)$ @ $Vd = 0.1\text{V}$



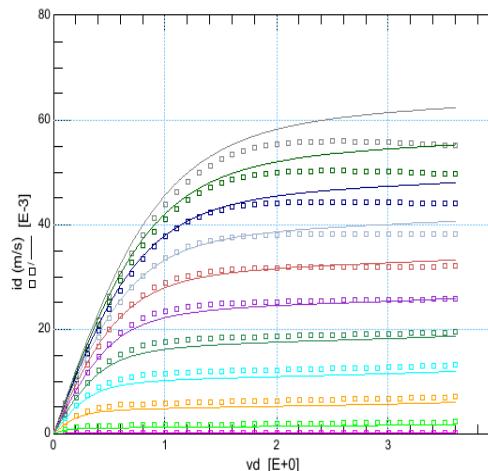
$gm = f(Vg)$ @ $Vd = 0.1\text{V}$



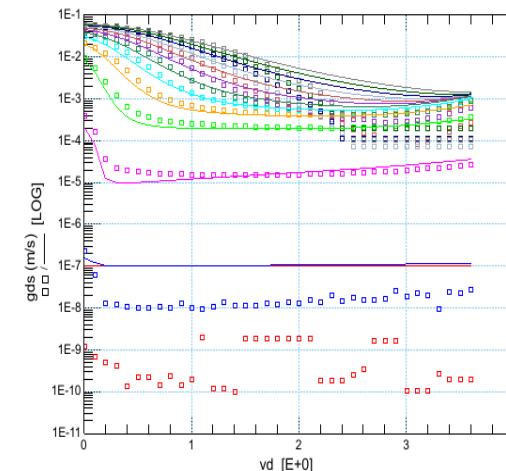
$Id = f(Vg)$ @ $Vd = 3.3\text{V}$



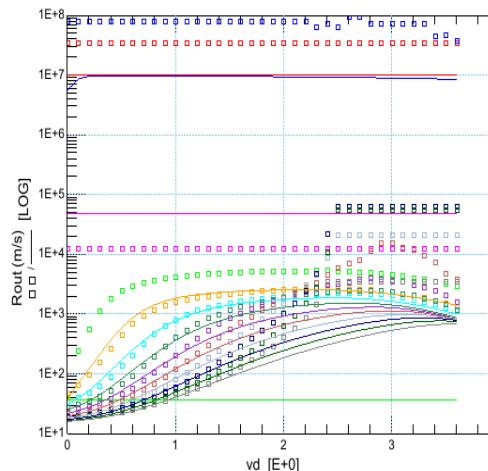
$gm = f(Vg)$ @ $Vd = 3.3\text{V}$

IdVd, T = 27°C

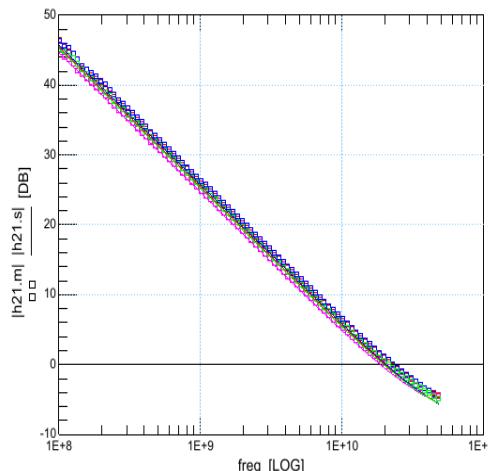
$$Id = f(Vd)$$



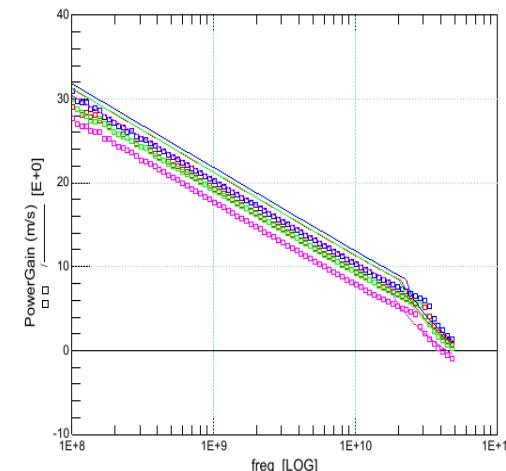
$$gds = f(Vd)$$



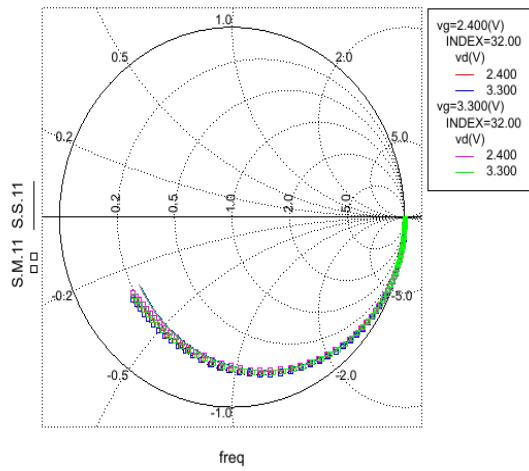
$$Rout = f(Vd)$$

S-Parameter, T = 27°C

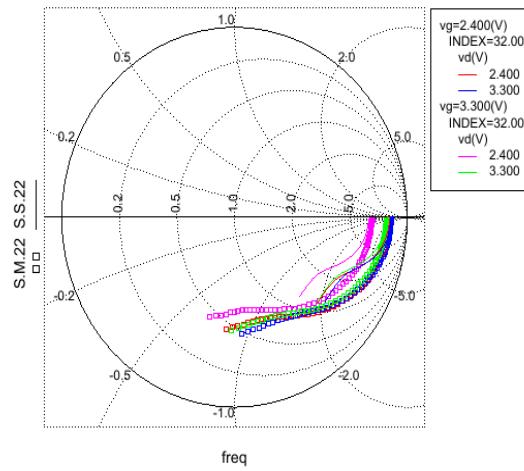
$$|h21| = f(Vg, Vd)$$



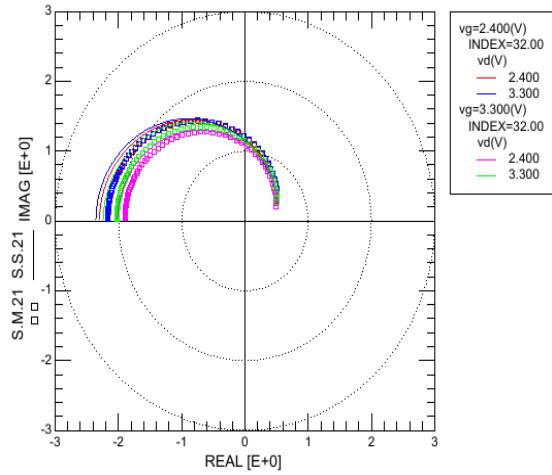
$$MSG/MAG = f(Vg, Vd)$$



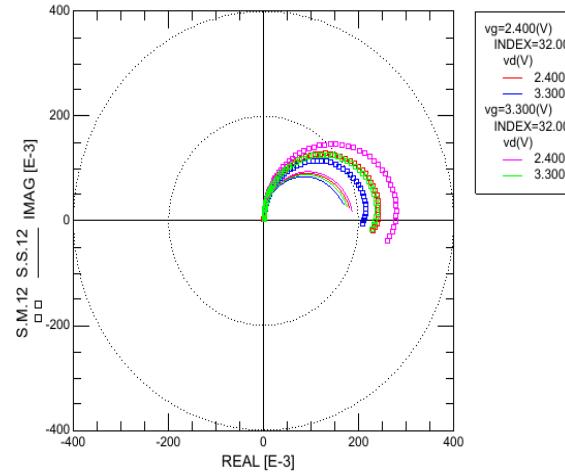
S11 = f(Vg,Vd)



S22 = f(Vg,Vd)

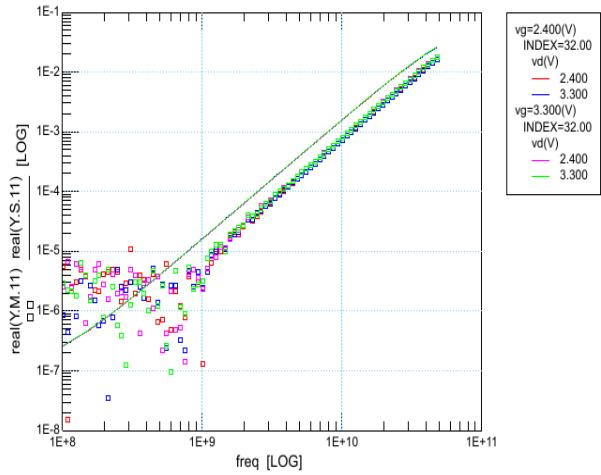


S21 = f(Vg,Vd)

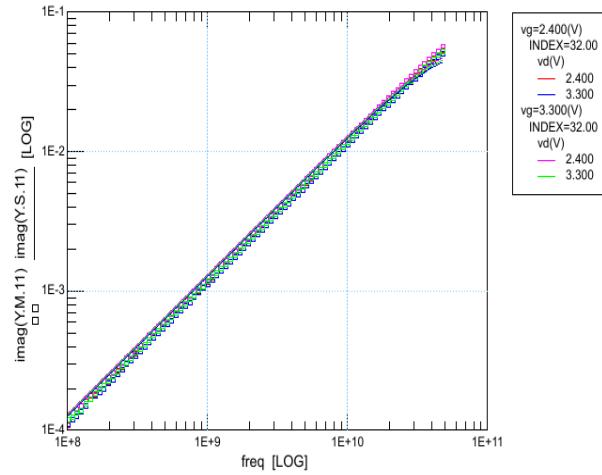


S12 = f(Vg,Vd)

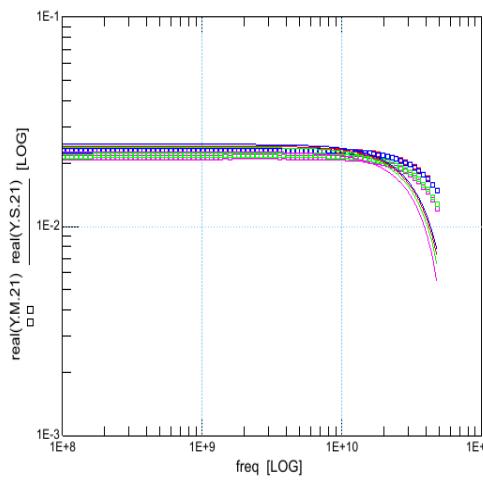
Y-Parameter, T = 27°C



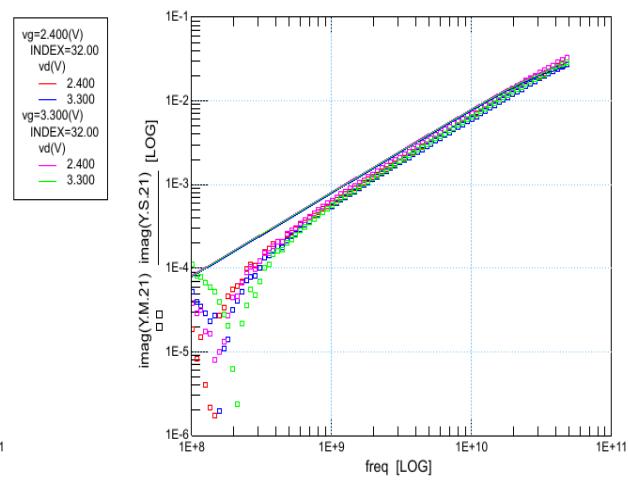
re(Y11) = f(Vg,Vd)



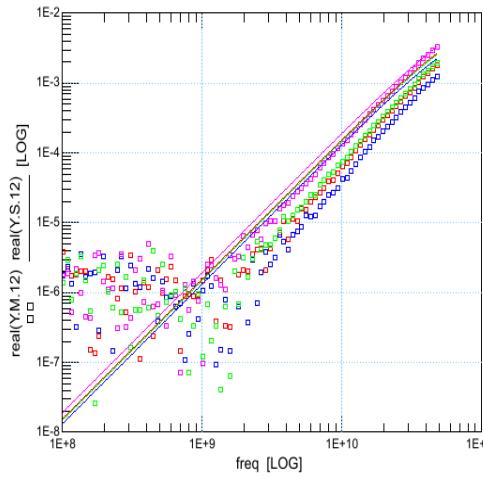
im(Y11) = f(Vg,Vd)



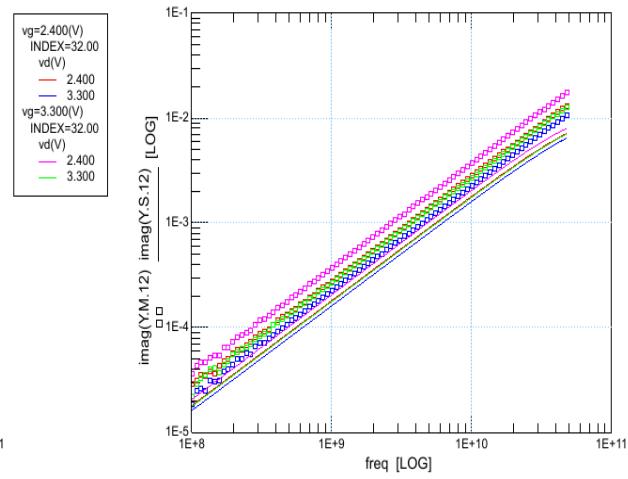
re(Y21) = f(Vg,Vd)



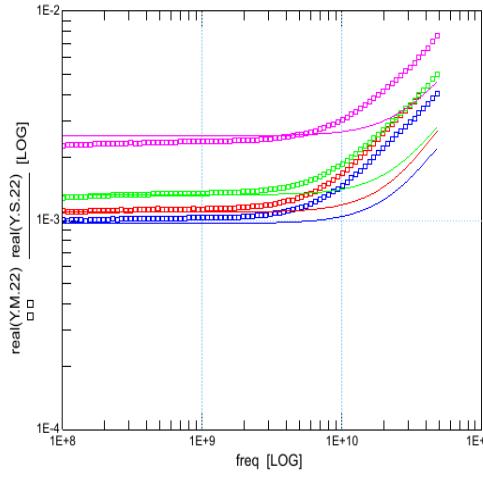
im(Y21) = f(Vg,Vd)



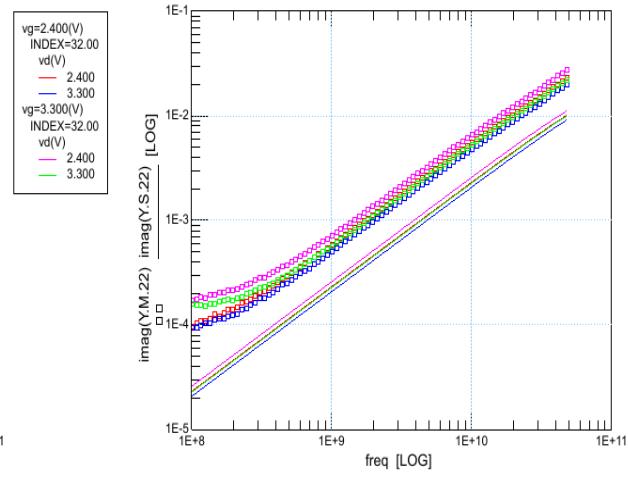
re(Y12) = f(Vg,Vd)



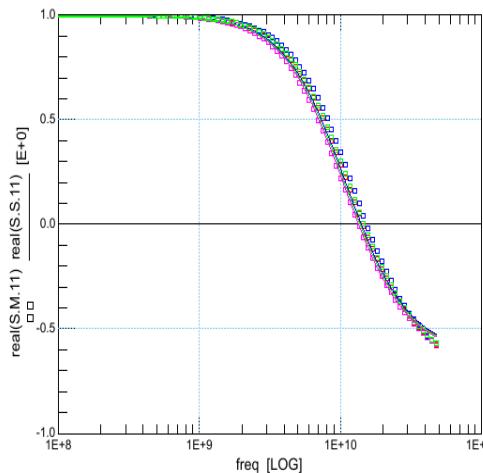
im(Y12) = f(Vg,Vd)



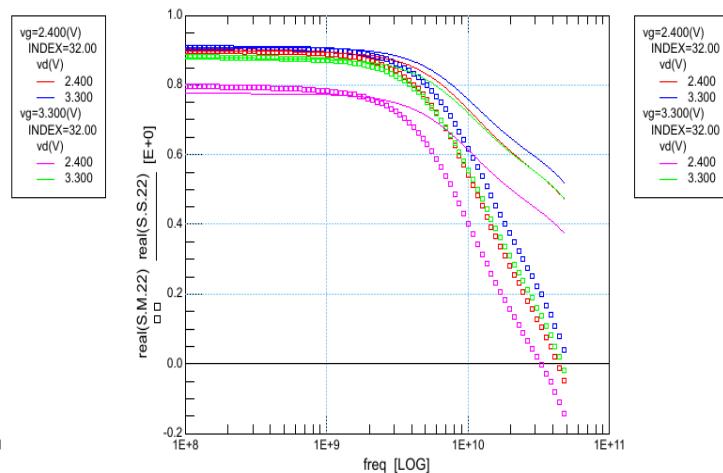
re(Y22) = f(Vg,Vd)



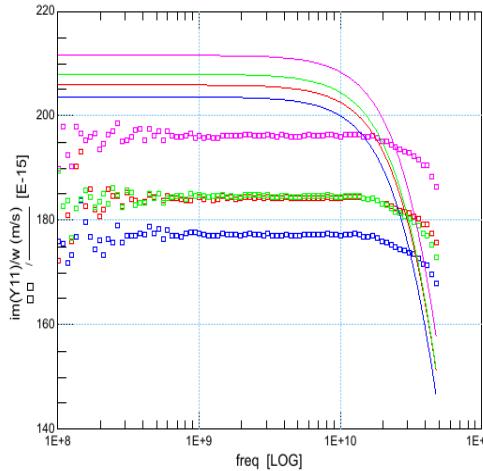
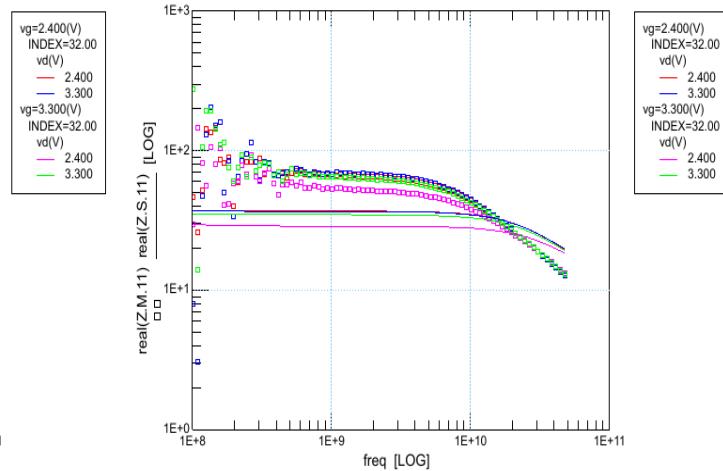
im(Y22) = f(Vg,Vd)

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

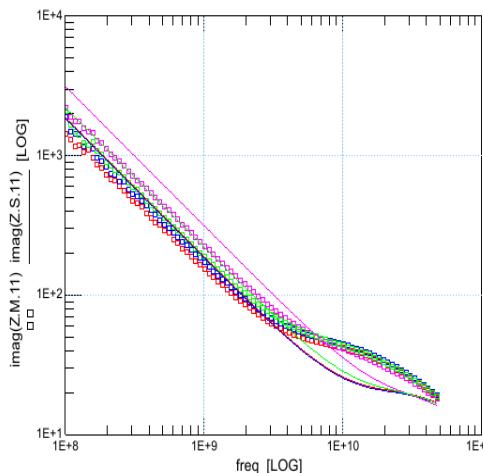
re(S11) = f(Vg, Vd)



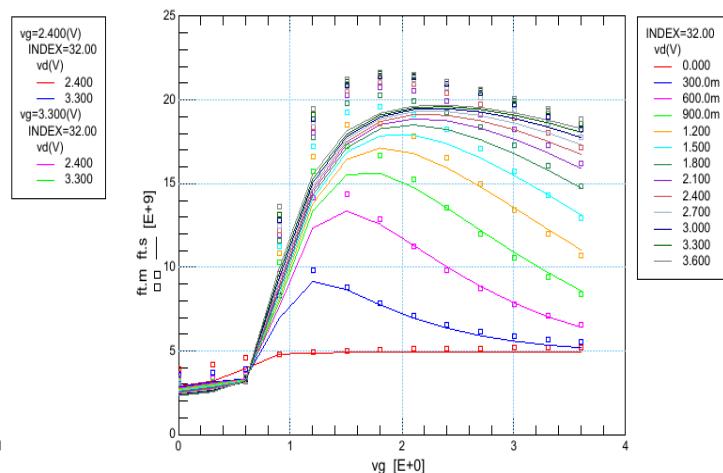
re(S22) = f(Vg, Vd)

im(Y11) divided by ω 

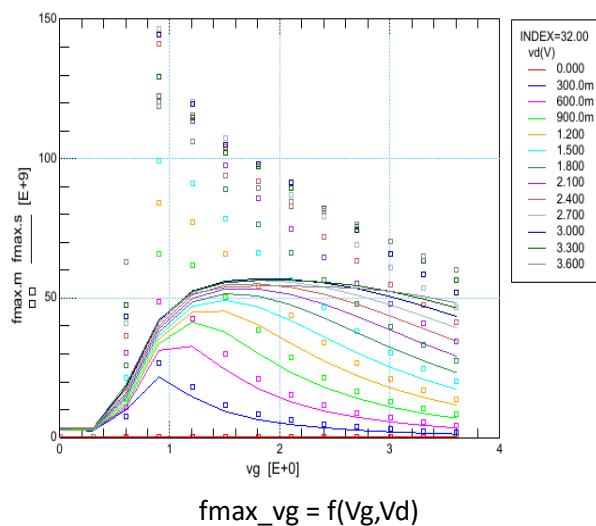
re(Z11) = f(Vg, Vd)



im(Z11) = f(Vg, Vd)

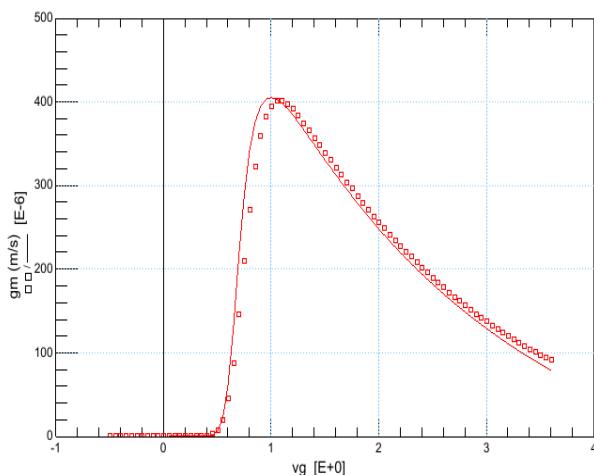
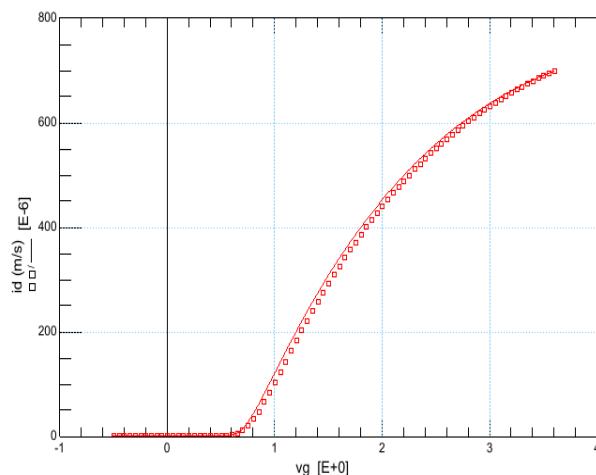


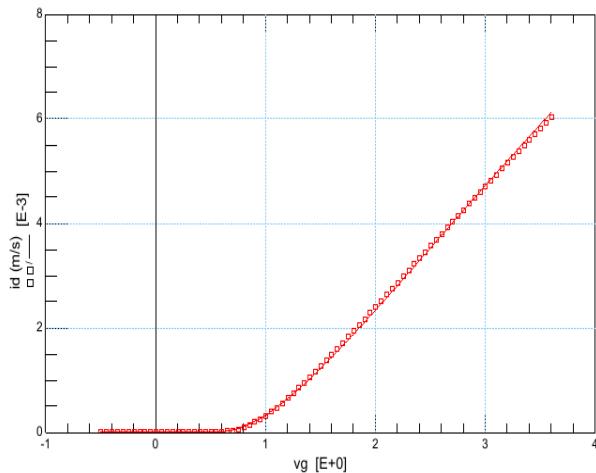
fT_vg = f(Vg, Vd)



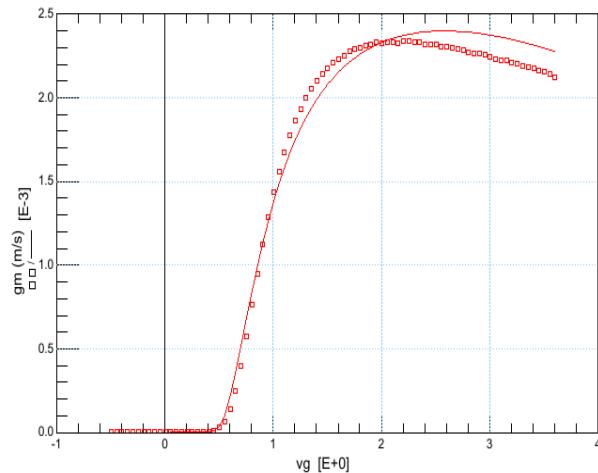
5.8 NF04_WF02u5_L_0u45_S453A_91

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



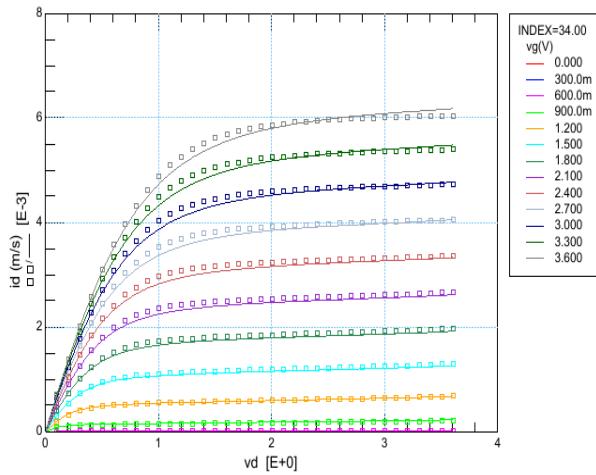


$$Id = f(Vg) @ Vd = 3.3V$$

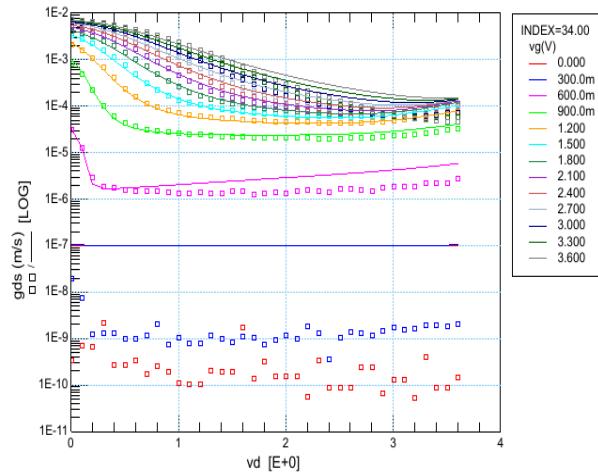


$$gm = f(Vg) @ Vd = 3.3V$$

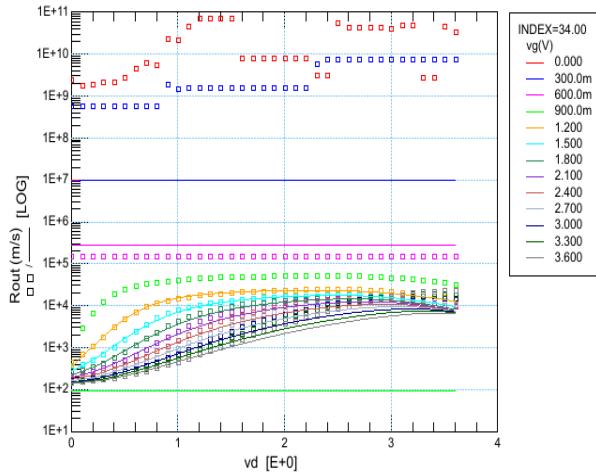
IdVd, T = 27°C



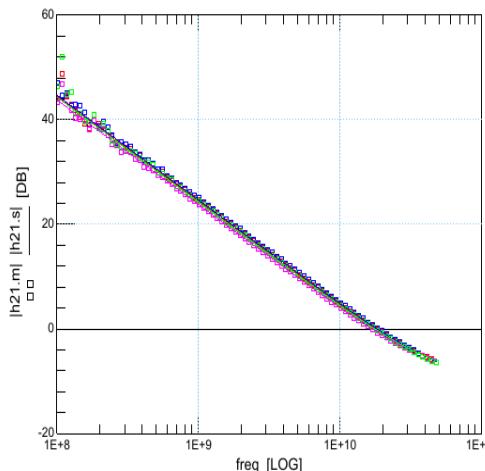
$$Id = f(Vd)$$



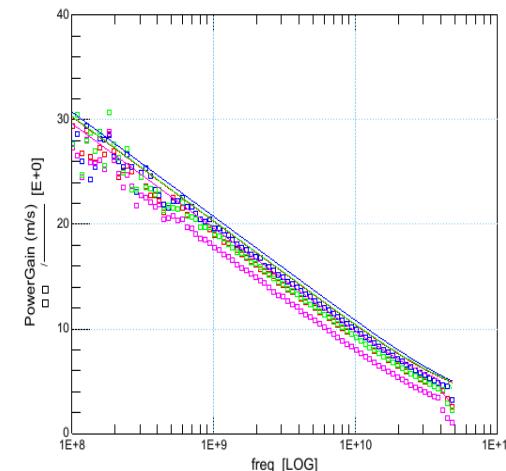
$$gds = f(Vd)$$



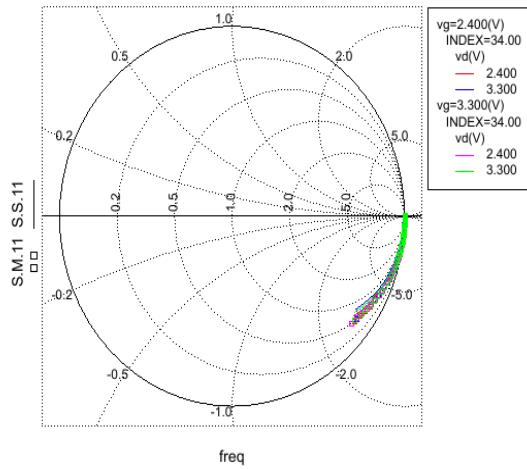
$$Rout = f(Vd)$$

S-Parameter, T = 27°C

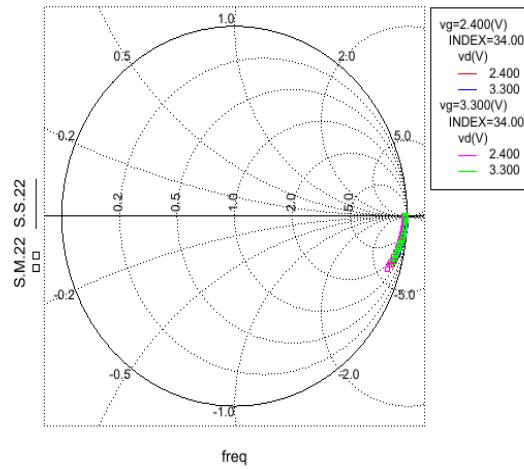
$$|h_{21}| = f(V_g, V_d)$$



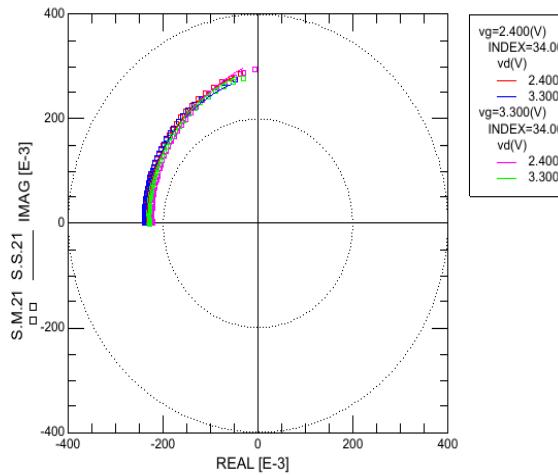
$$\text{MSG/MAG} = f(V_g, V_d)$$



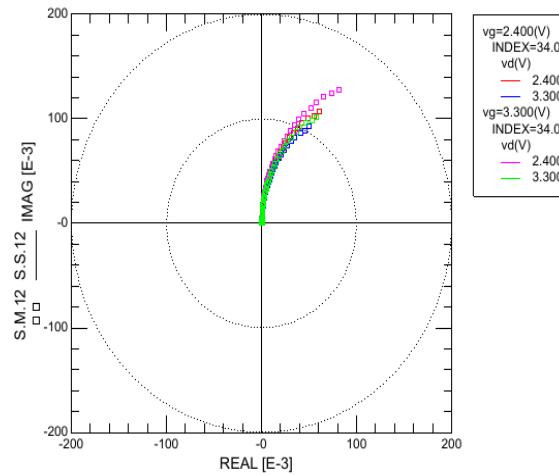
$$S_{11} = f(V_g, V_d)$$



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

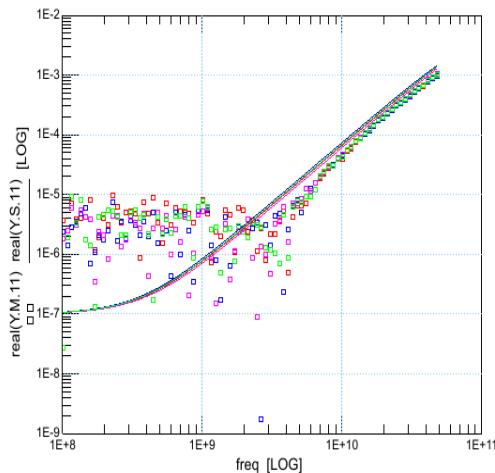


$$S_{21} = f(V_g, V_d)$$

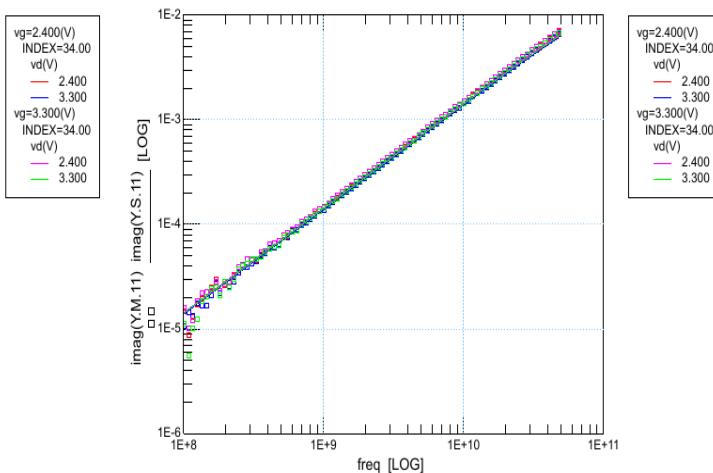


$$S_{12} = f(V_g, V_d)$$

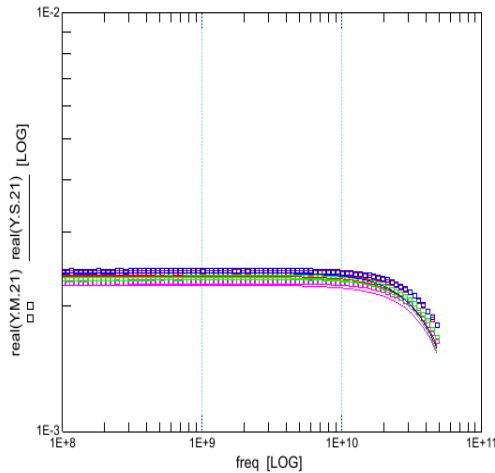
Y-Parameter, T = 27°C



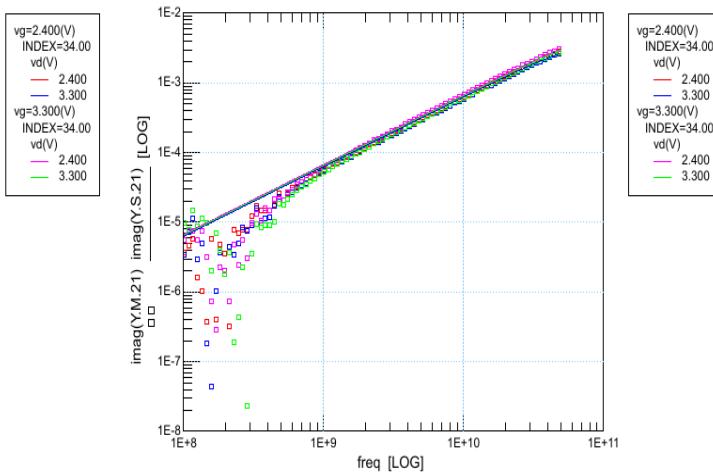
$$\text{re}(Y_{11}) = f(Vg, Vd)$$



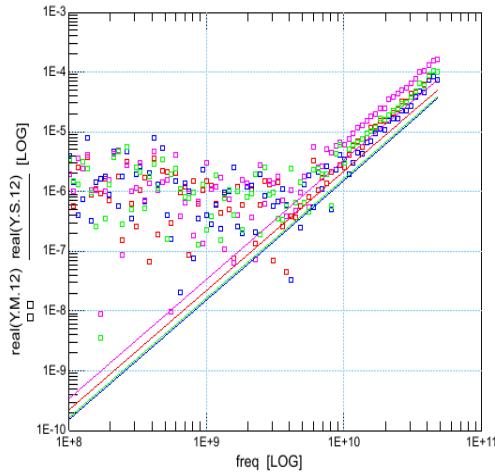
$$\text{im}(Y_{11}) = f(Vg, Vd)$$



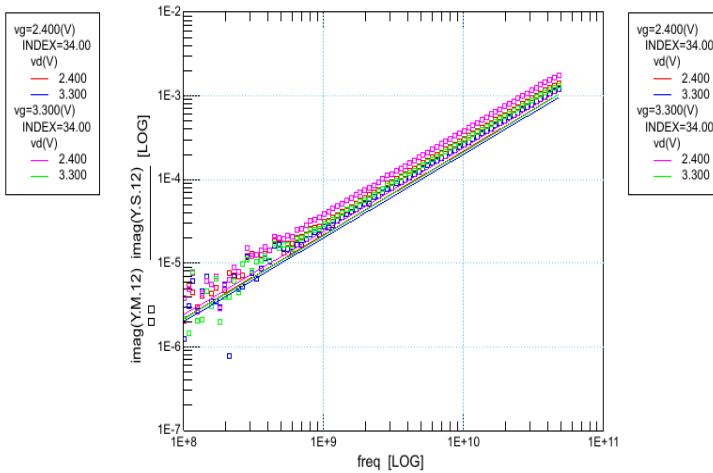
$$\text{re}(Y_{21}) = f(Vg, Vd)$$



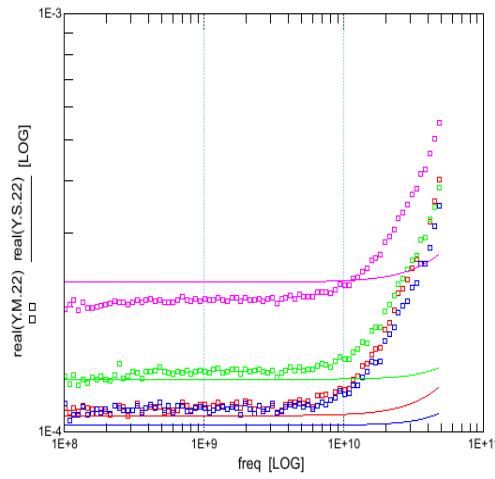
$$\text{im}(Y_{21}) = f(Vg, Vd)$$



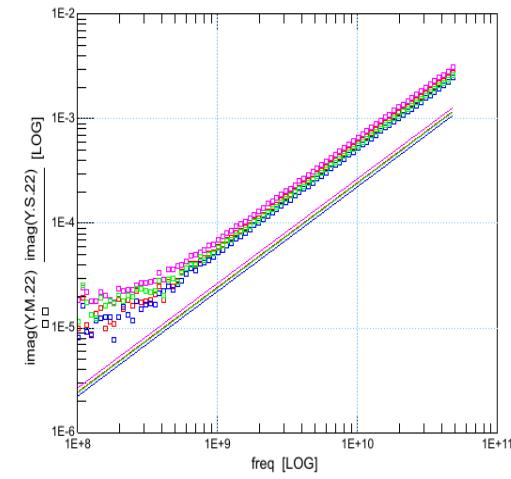
$$\text{re}(Y_{12}) = f(Vg, Vd)$$



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

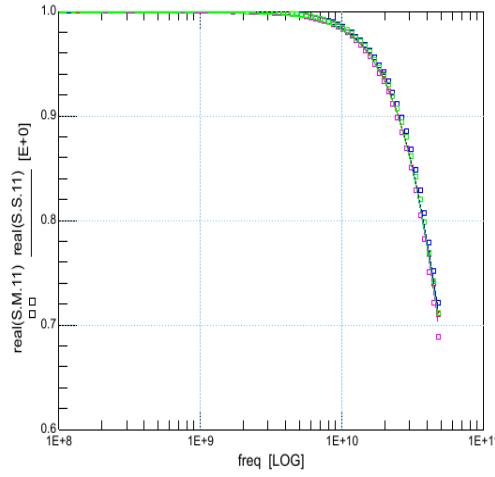


$$\text{re}(Y22) = f(Vg, Vd)$$

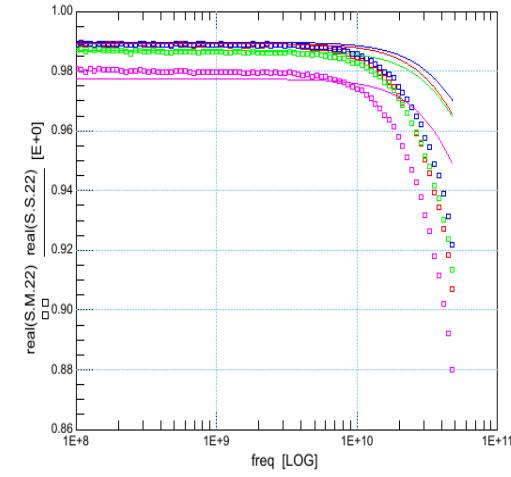


$$\text{im}(Y22) = f(Vg, Vd)$$

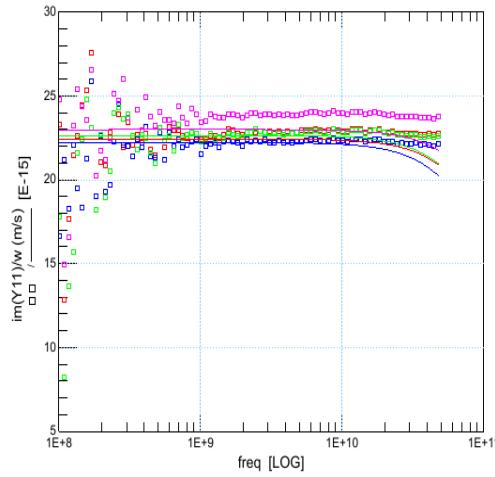
Verify Plots, T = 27°C



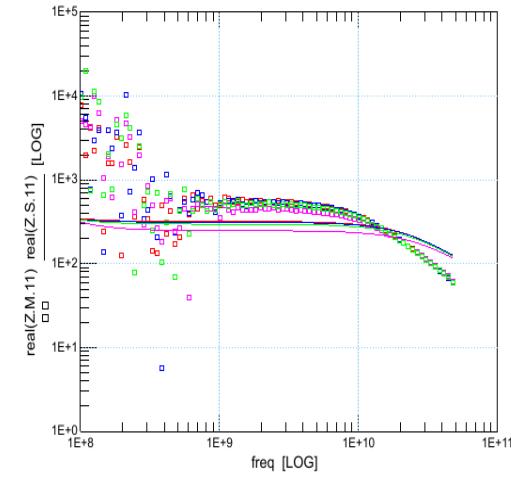
$$\text{re}(S11) = f(Vg, Vd)$$



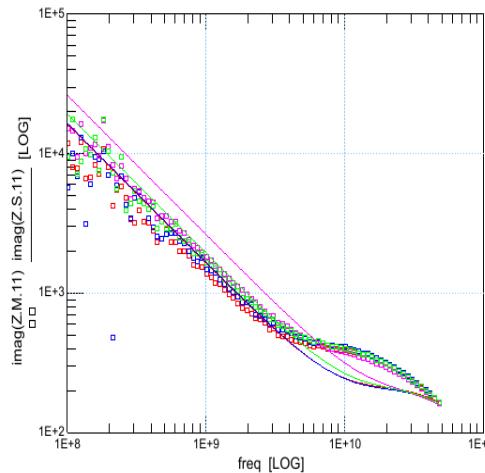
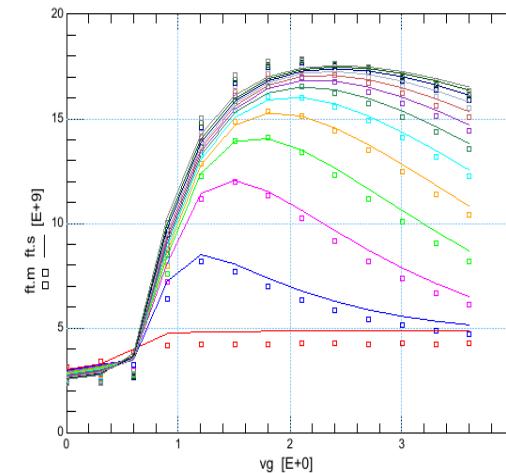
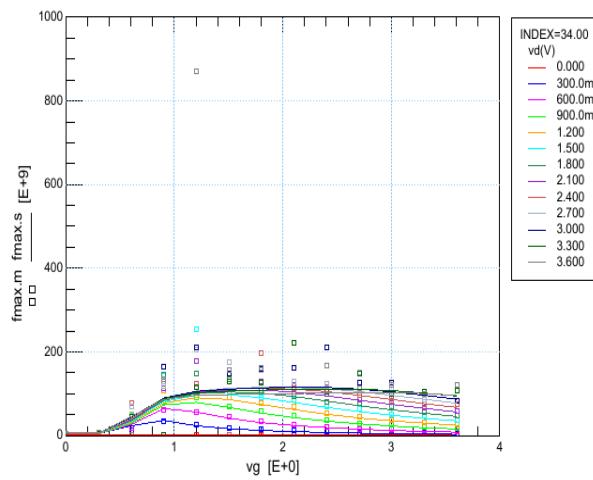
$$\text{re}(S22) = f(Vg, Vd)$$



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

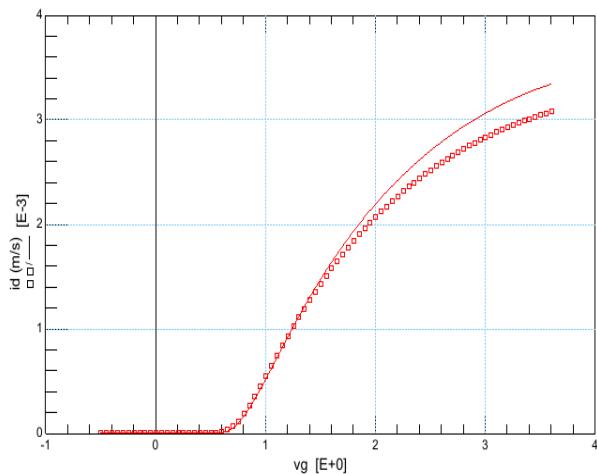


$$\text{re}(Z11) = f(Vg, Vd)$$

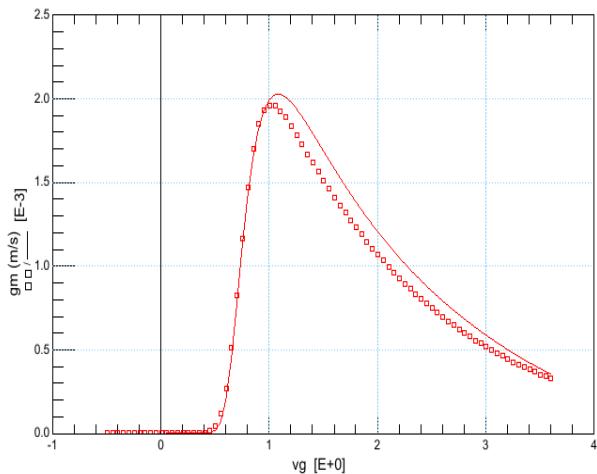
 $\text{im}(Z_{11}) = f(V_g, V_d)$  $f_{T,vg} = f(V_g, V_d)$  $f_{\text{max},vg} = f(V_g, V_d)$

5.9 NF05_WF10u0_L_0u45_S453A_A4

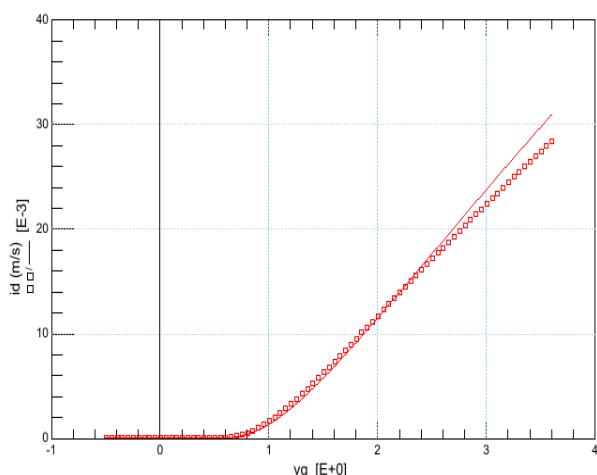
IdVg, T = 27°C



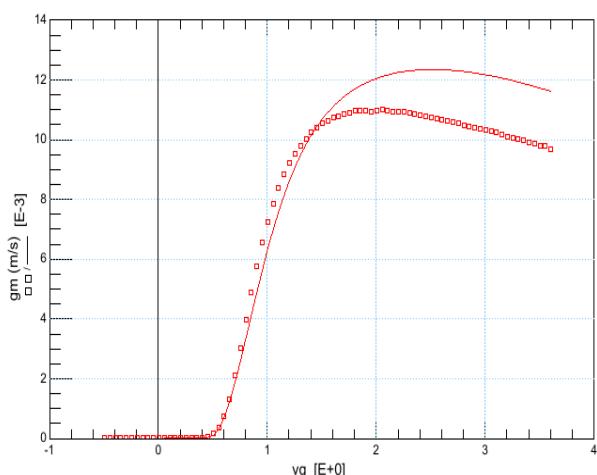
Id = f(Vg) @ Vd = 0.1V



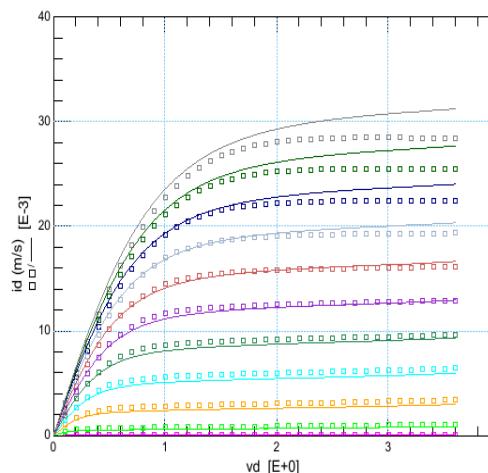
gm = f(Vg) @ Vd = 0.1V



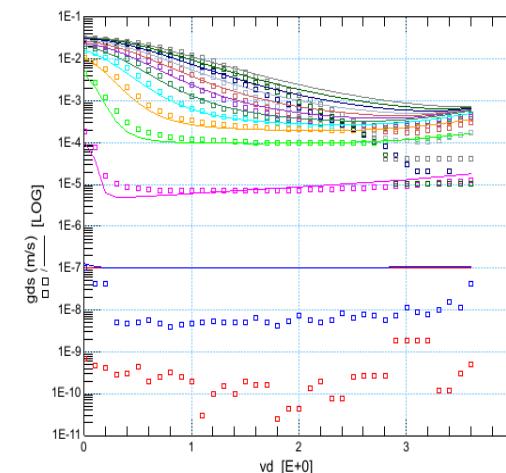
Id = f(Vg) @ Vd = 3.3V



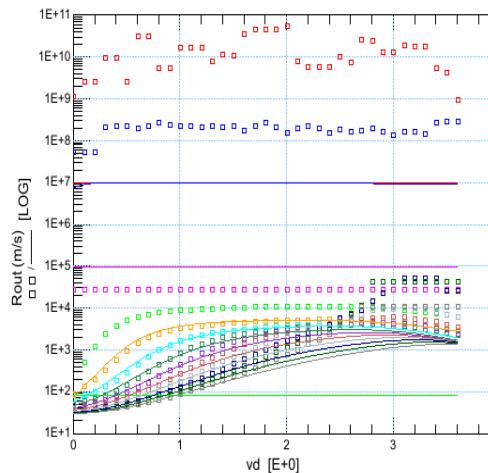
gm = f(Vg) @ Vd = 3.3V

IdVd, T = 27°C


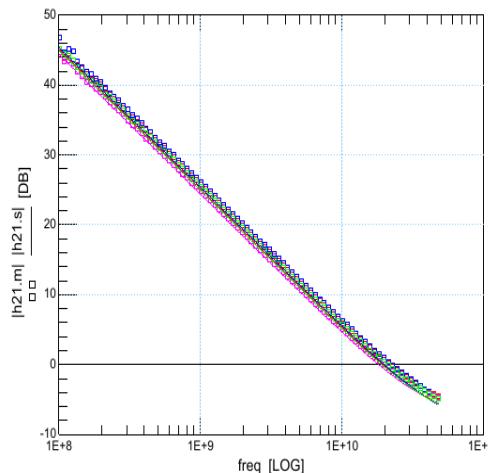
$$Id = f(Vd)$$



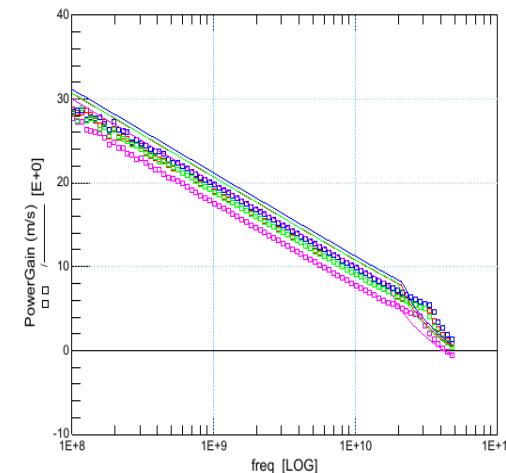
$$gds = f(Vd)$$



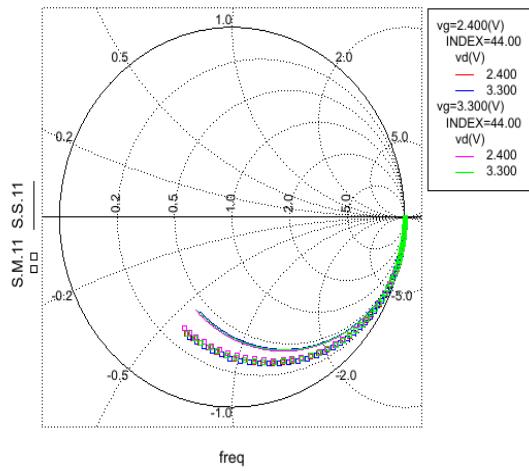
$$Rout = f(Vd)$$

S-Parameter, T = 27°C


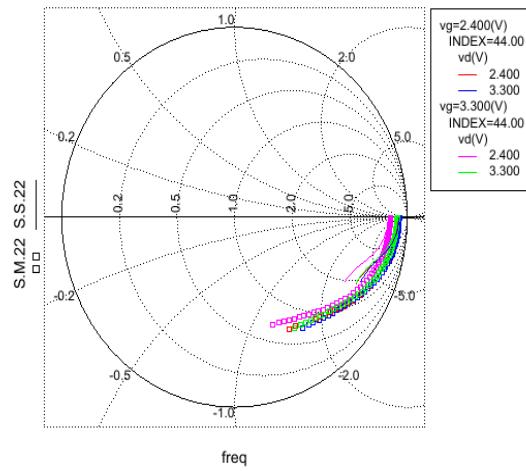
$$|h21| = f(Vg, Vd)$$



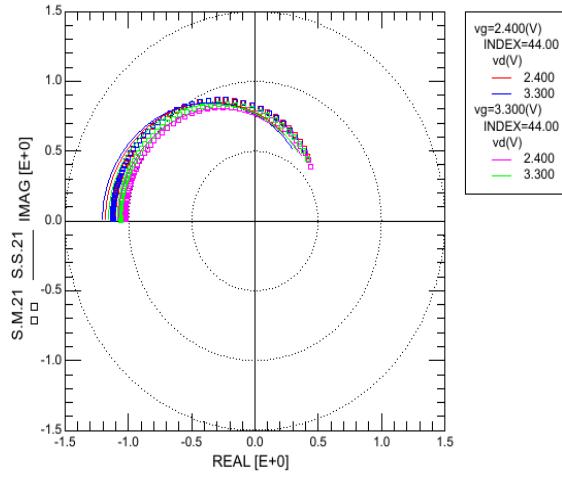
$$MSG/MAG = f(Vg, Vd)$$



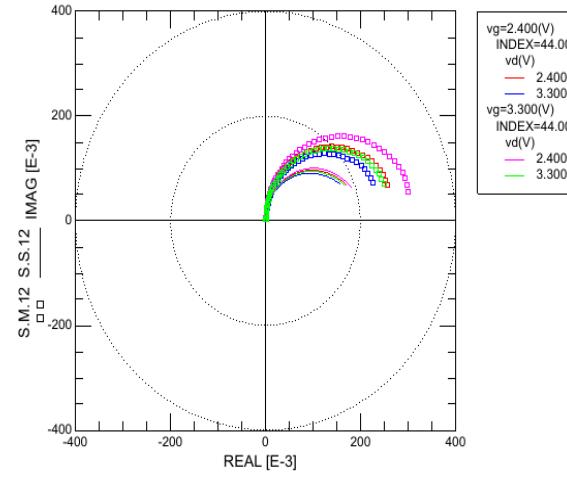
S11 = f(Vg,Vd)



S22 = f(Vg,Vd)

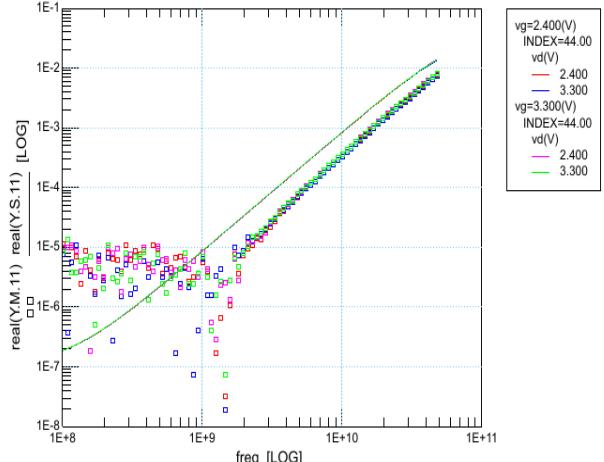


S21 = f(Vg,Vd)

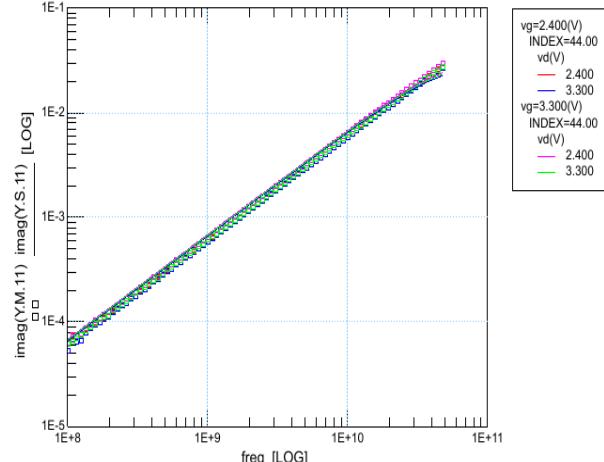


S12 = f(Vg,Vd)

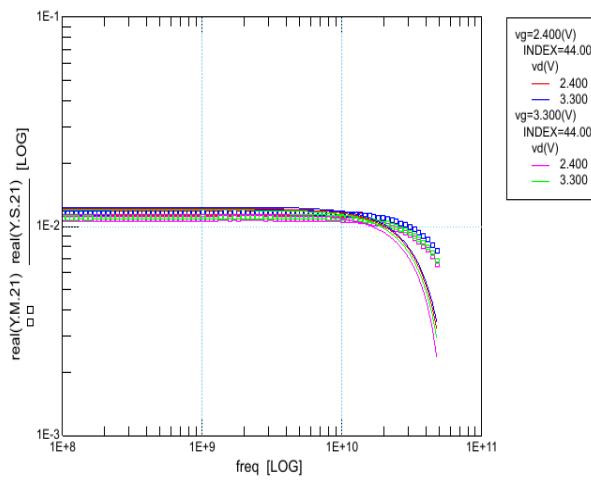
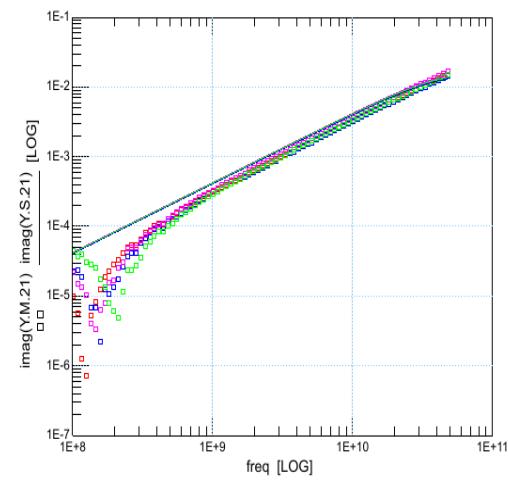
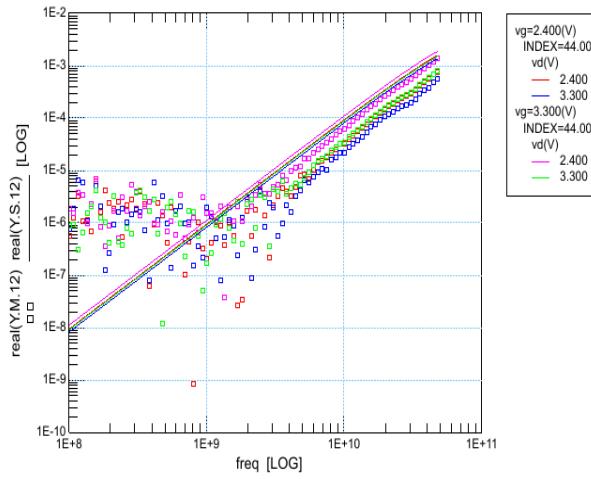
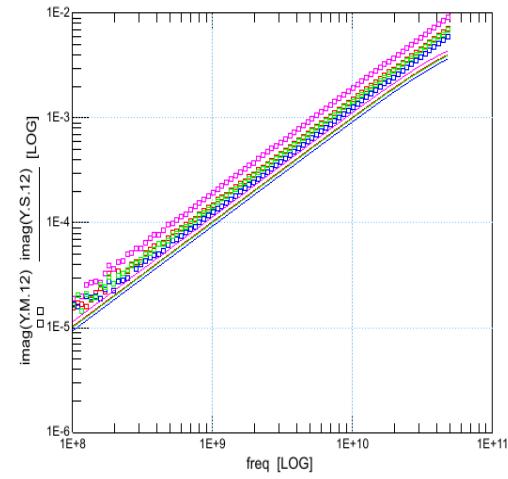
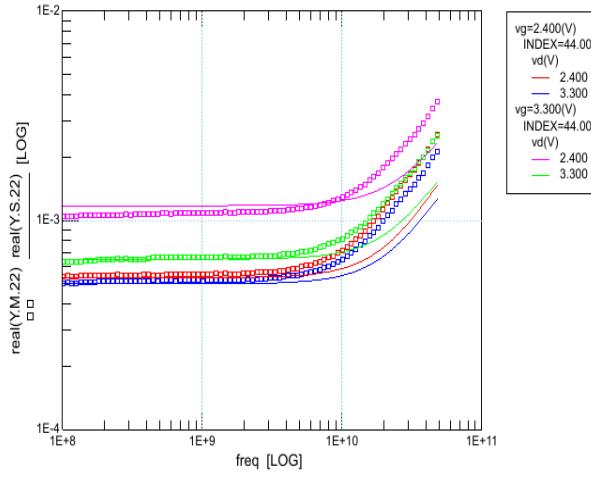
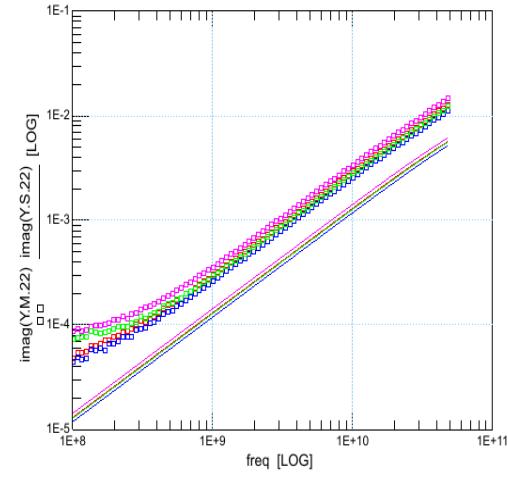
Y-Parameter, T = 27°C



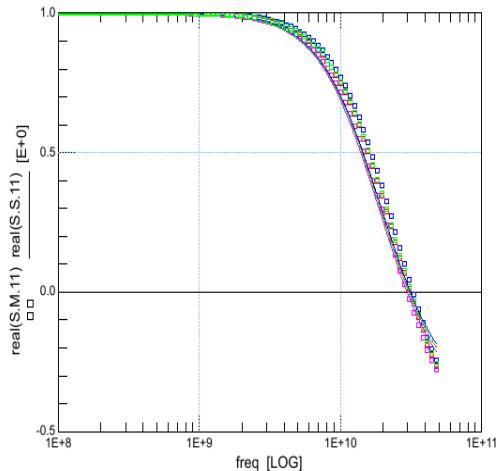
re(Y11) = f(Vg,Vd)



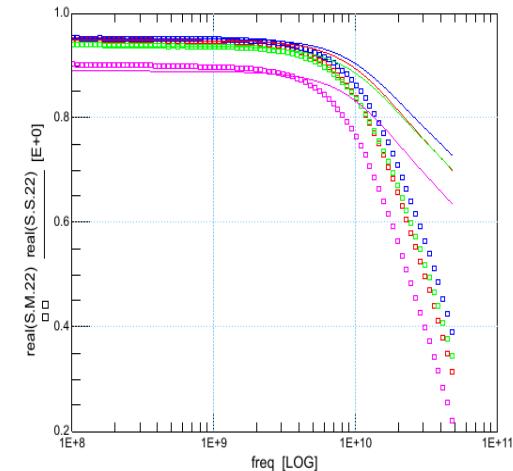
im(Y11) = f(Vg,Vd)

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)

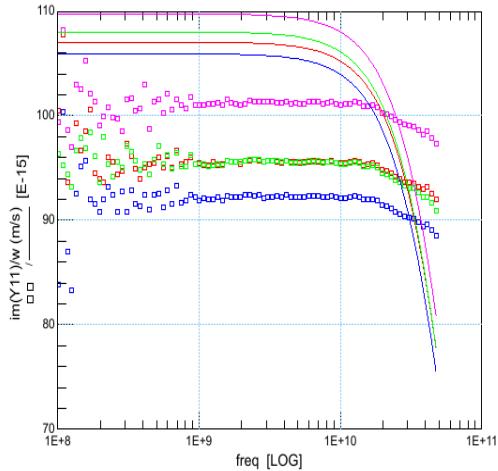
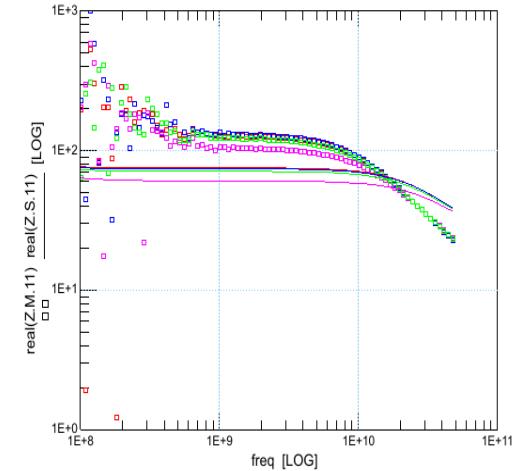
Verify Plots, T = 27°C



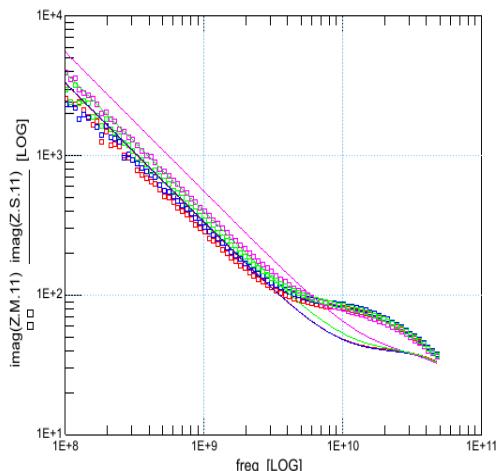
re(S11) = f(Vg, Vd)



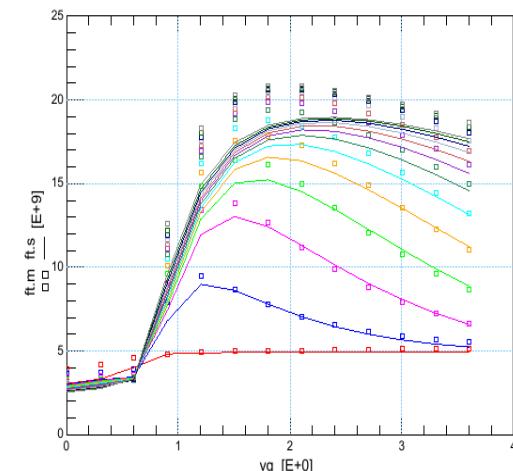
re(S22) = f(Vg, Vd)

im(Y11) divided by ω 

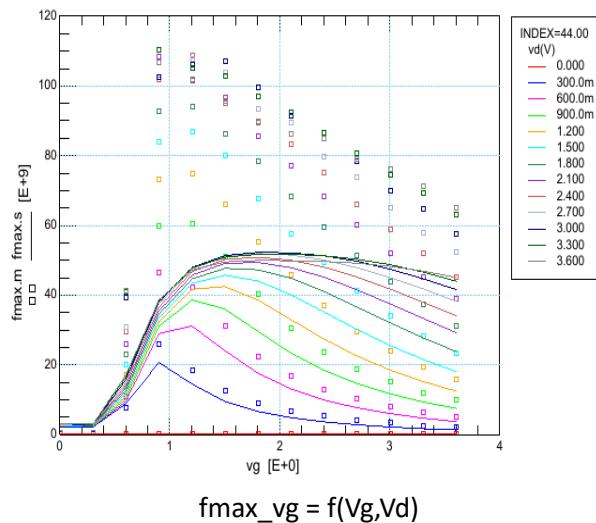
re(Z11) = f(Vg, Vd)



im(Z11) = f(Vg, Vd)



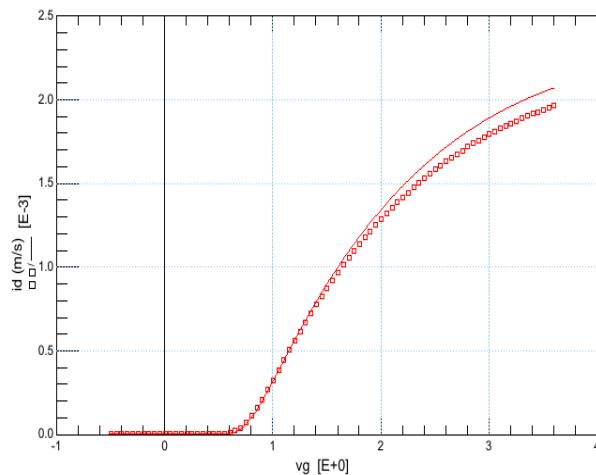
fT_vg = f(Vg, Vd)



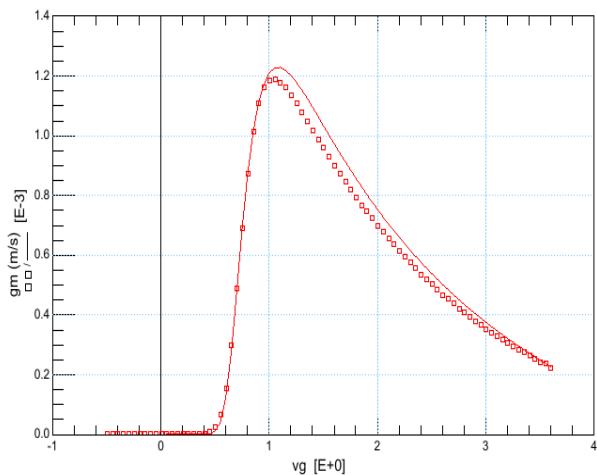
$$f_{max_vg} = f(V_g, V_d)$$

5.10NF04_WF07u5_L_0u45_S453A_94

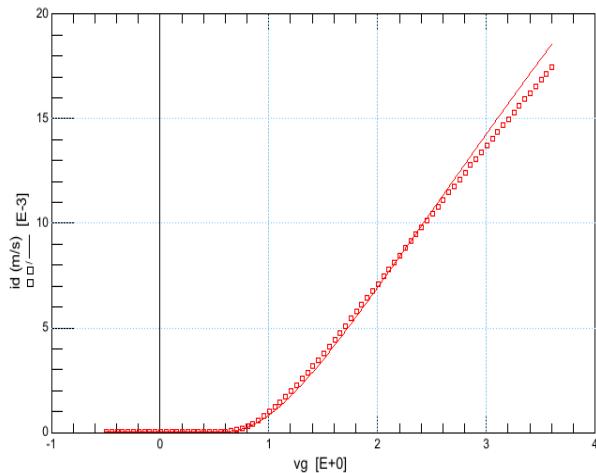
$I_d V_g$, $T = 27^\circ C$



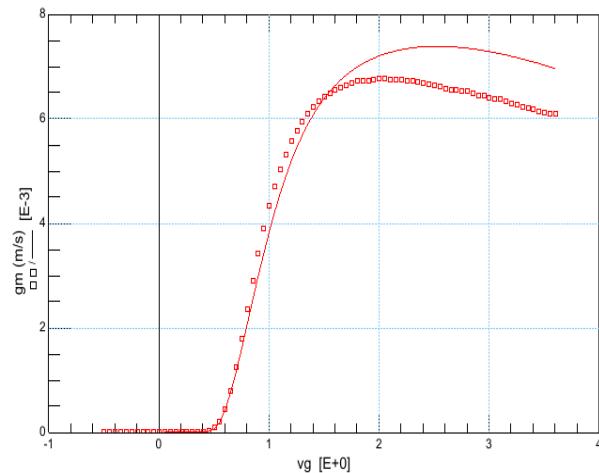
$$I_d = f(V_g) @ V_d = 0.1V$$



$$g_m = f(V_g) @ V_d = 0.1V$$

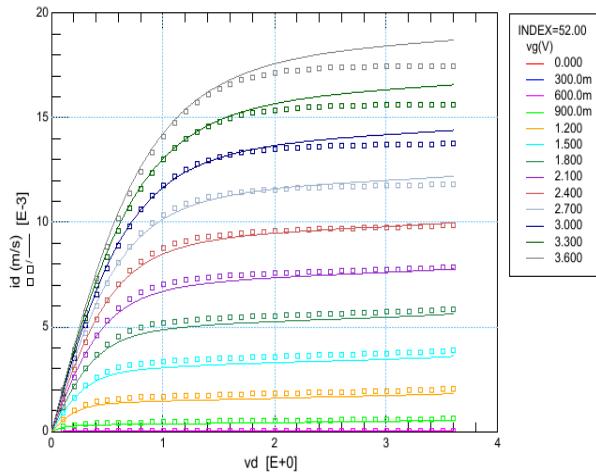


$$Id = f(Vg) @ Vd = 3.3V$$

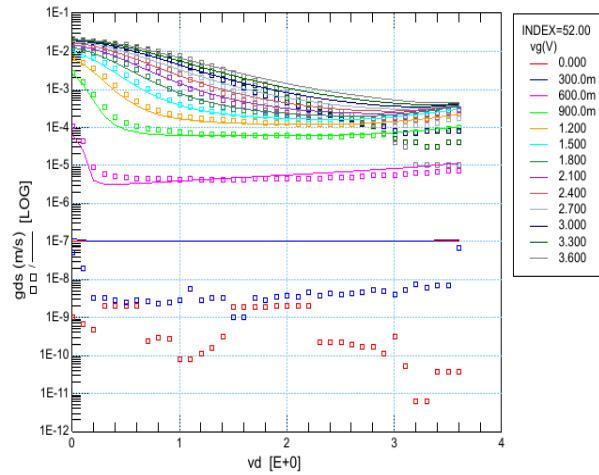


$$gm = f(Vg) @ Vd = 3.3V$$

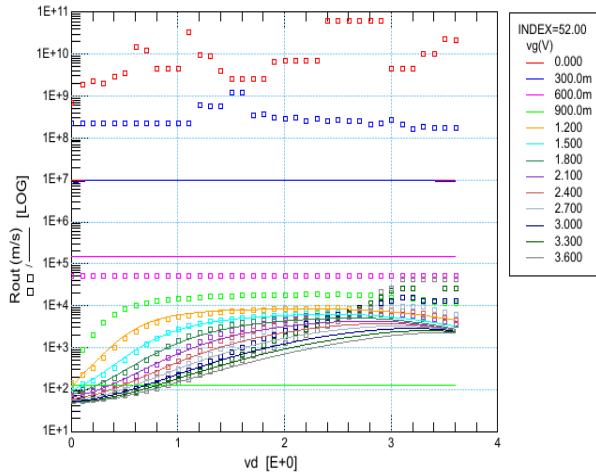
IdVd, T = 27°C



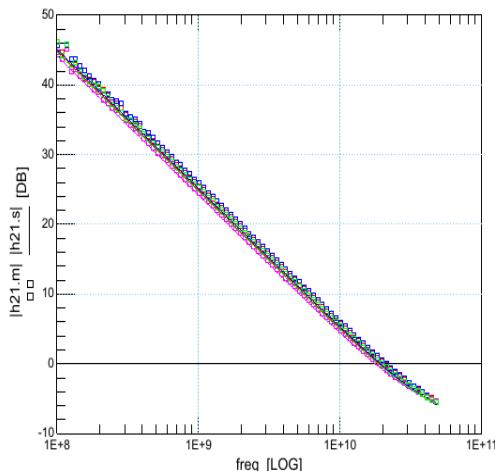
$$Id = f(Vd)$$



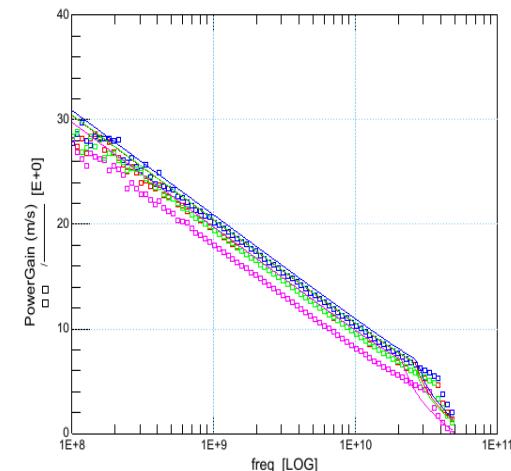
$$gds = f(Vd)$$



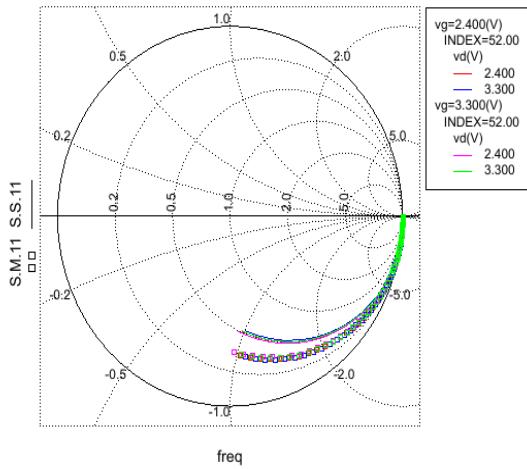
$$Rout = f(Vd)$$

S-Parameter, T = 27°C

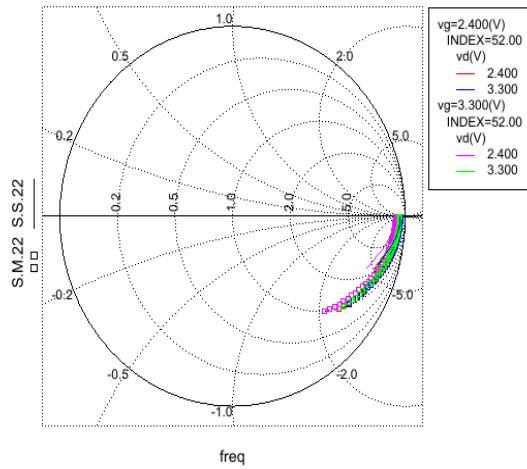
$$|h21| = f(Vg, Vd)$$



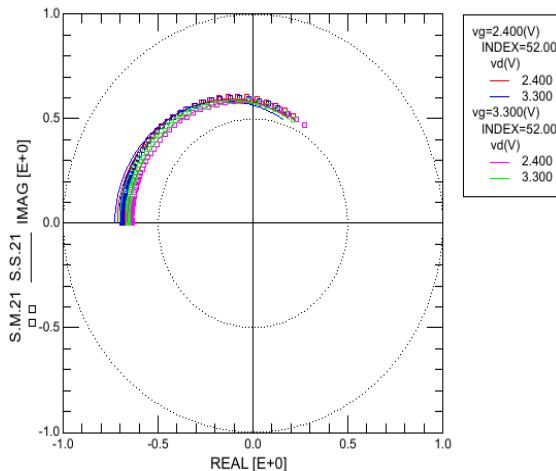
$$MSG/MAG = f(Vg, Vd)$$



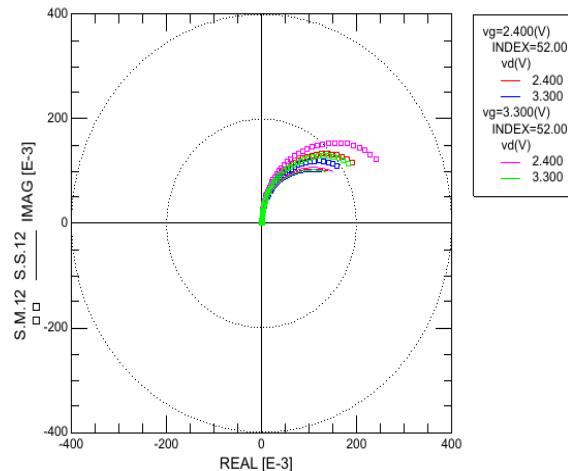
$$S11 = f(Vg, Vd)$$



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

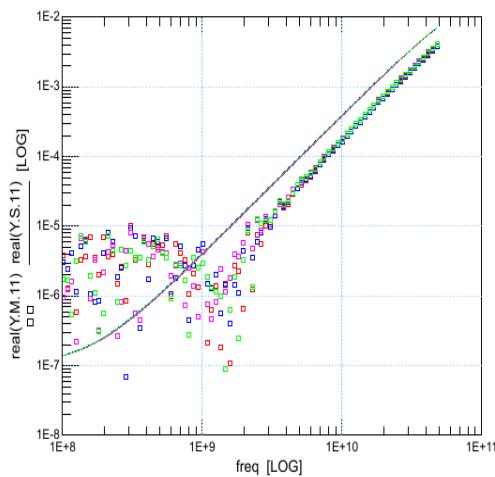


$$S21 = f(Vg, Vd)$$

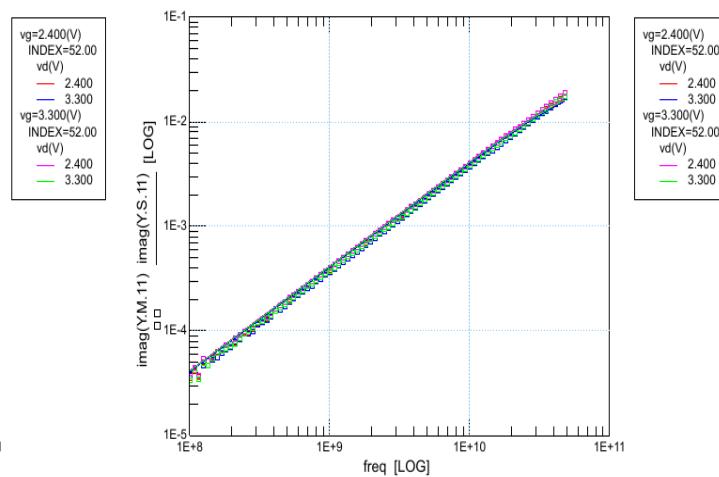


$$S12 = f(Vg, Vd)$$

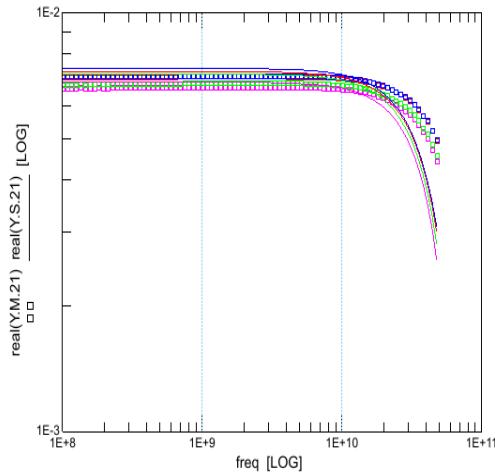
Y-Parameter, T = 27°C



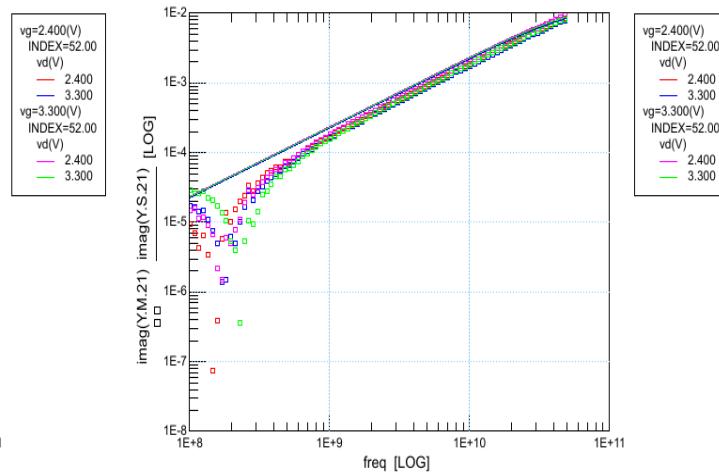
$$\text{re}(Y11) = f(Vg, Vd)$$



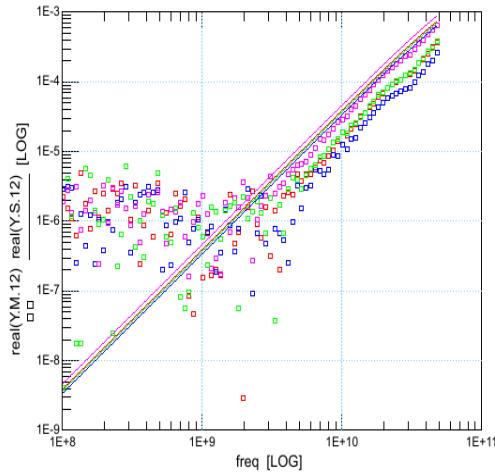
$$\text{im}(Y11) = f(Vg, Vd)$$



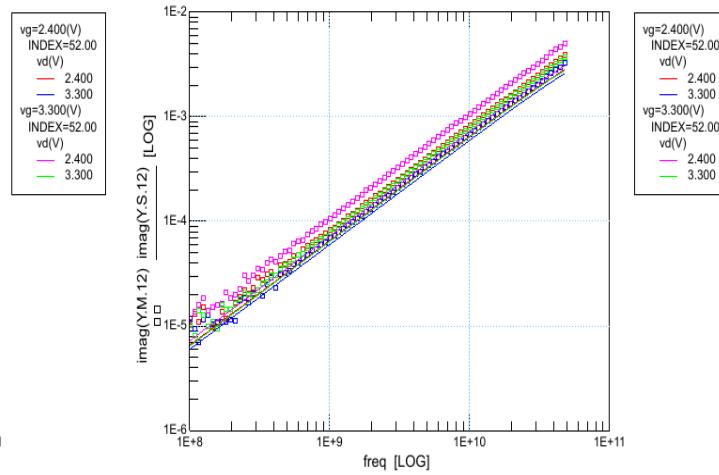
$$\text{re}(Y21) = f(Vg, Vd)$$



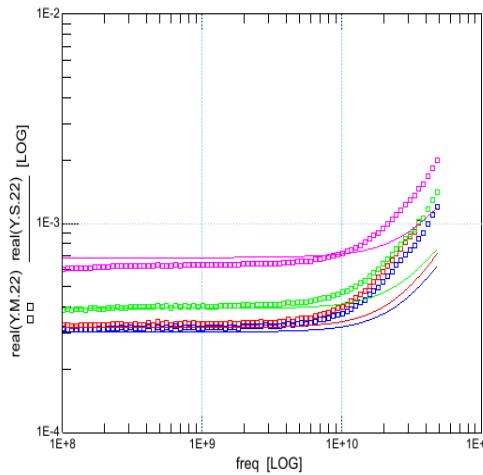
$$\text{im}(Y21) = f(Vg, Vd)$$



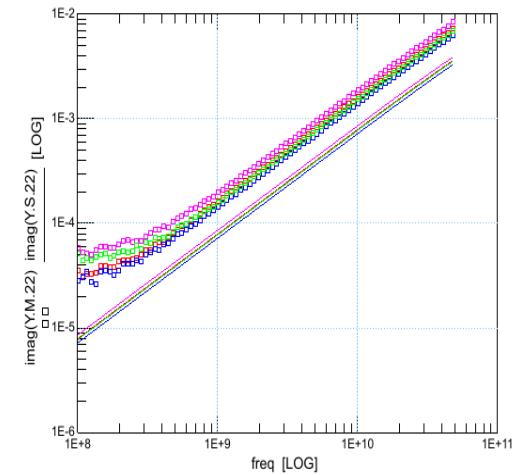
$$\text{re}(Y12) = f(Vg, Vd)$$



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

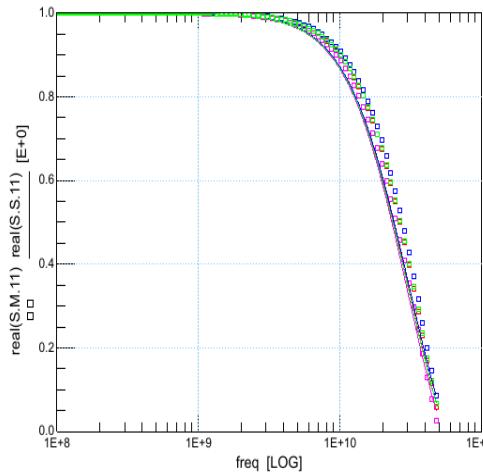


$$\text{re}(Y22) = f(Vg, Vd)$$

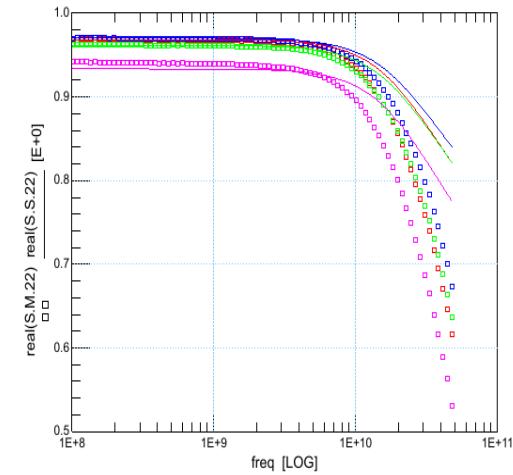


$$\text{im}(Y22) = f(Vg, Vd)$$

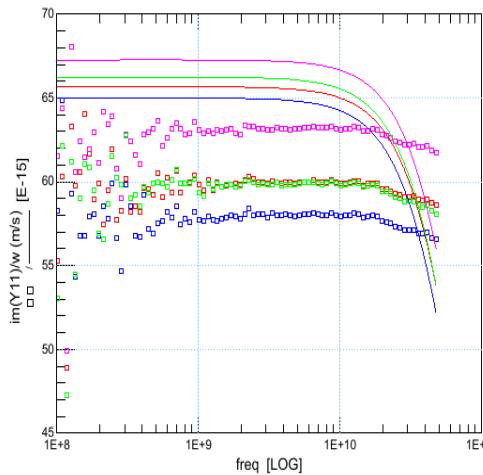
Verify Plots, T = 27°C



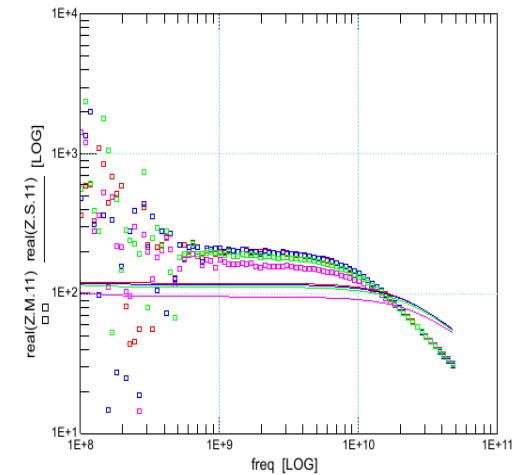
$$\text{re}(S11) = f(Vg, Vd)$$



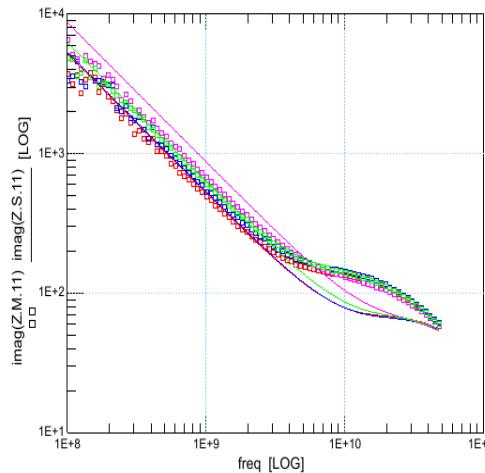
$$\text{re}(S22) = f(Vg, Vd)$$



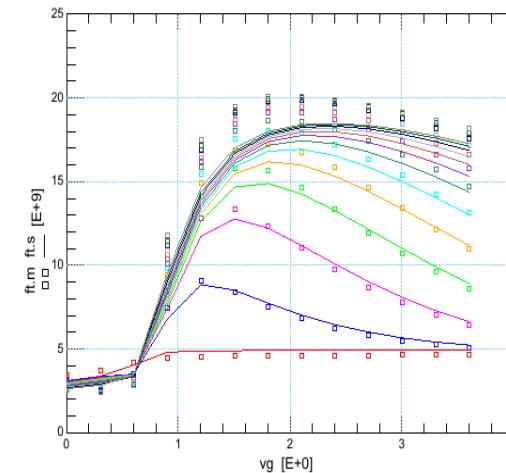
$$\text{im}(Y11) \text{ divided by } \omega$$



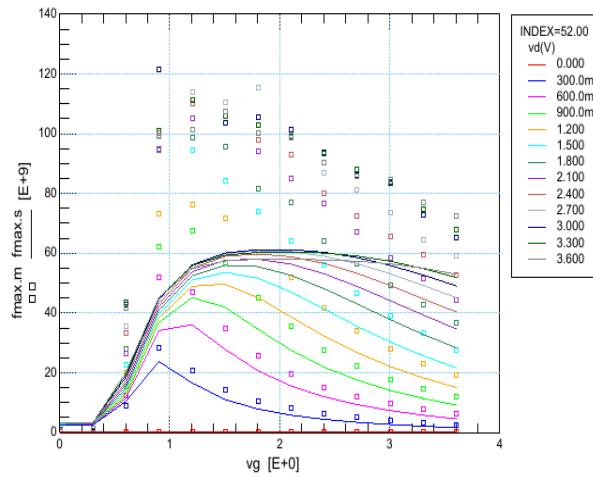
$$\text{re}(Z11) = f(Vg, Vd)$$



im(Z11) = f(Vg,Vd)



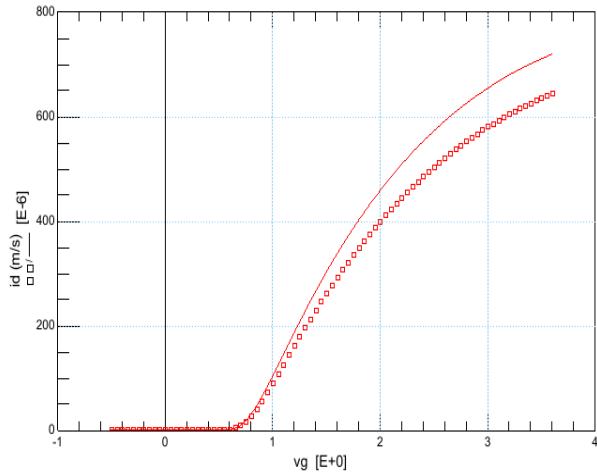
fT_vg = f(Vg,Vd)



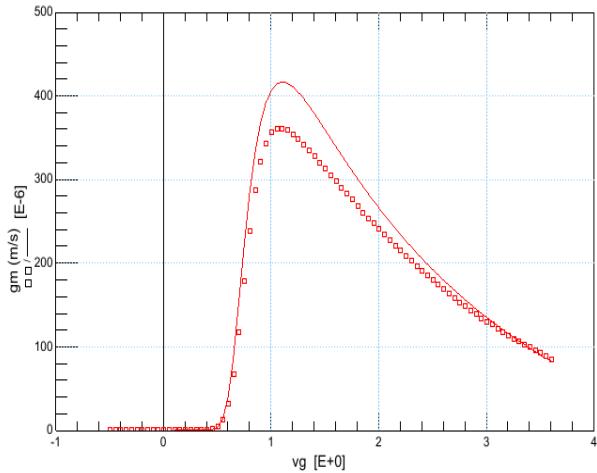
fmax_vg = f(Vg,Vd)

5.11NF01_WF10u0_L_0u45_S453A_B1

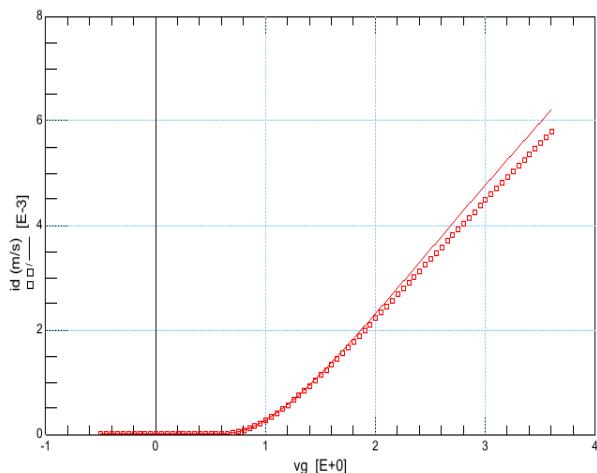
$IdVg$, $T = 27^\circ\text{C}$



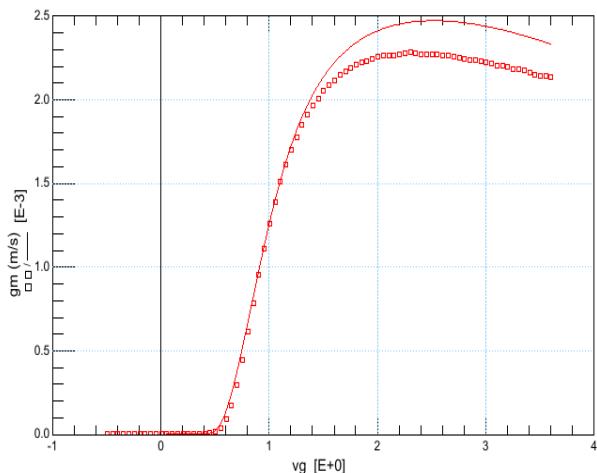
$Id = f(Vg)$ @ $Vd = 0.1\text{V}$



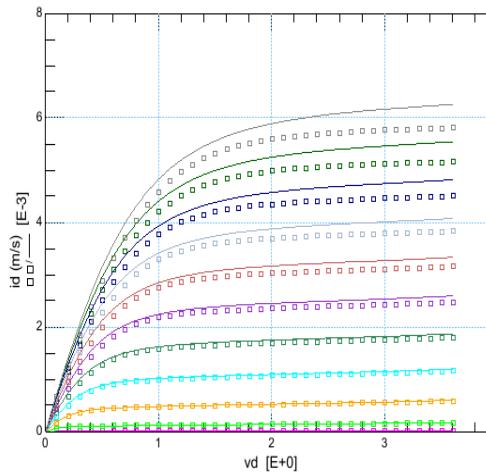
$gm = f(Vg)$ @ $Vd = 0.1\text{V}$



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

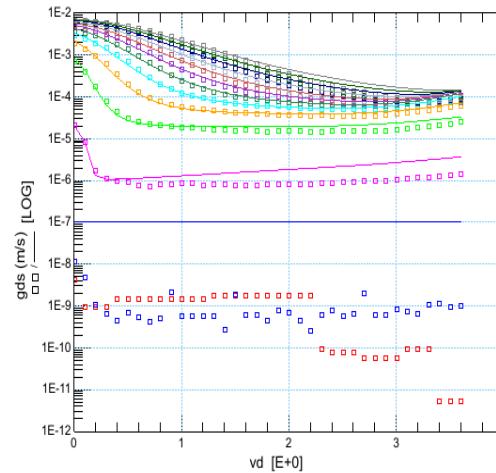


$gm = f(Vg)$ @ $Vd = 3.3\text{V}$

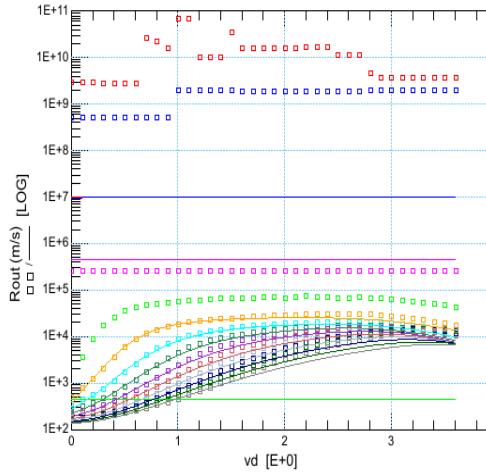
IdVd, T = 27°C


Id = f(Vd)

INDEX=54.00
vg(V)
0.000
300.0m
600.0m
900.0m
1.200
1.500
1.800
2.100
2.400
2.700
3.000
3.300
3.600

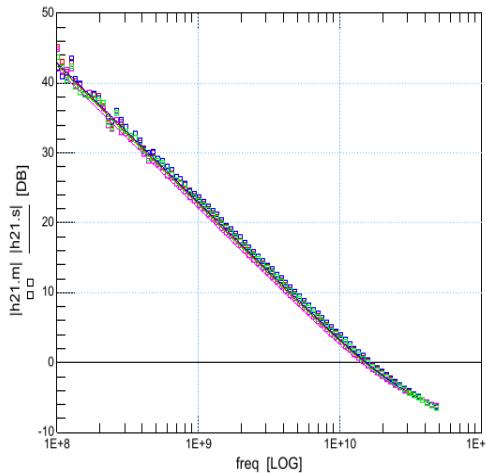


gds = f(Vd)



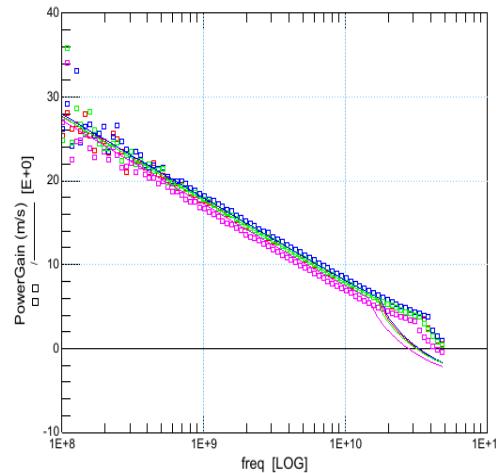
Rout = f(Vd)

INDEX=54.00
vg(V)
0.000
300.0m
600.0m
900.0m
1.200
1.500
1.800
2.100
2.400
2.700
3.000
3.300
3.600

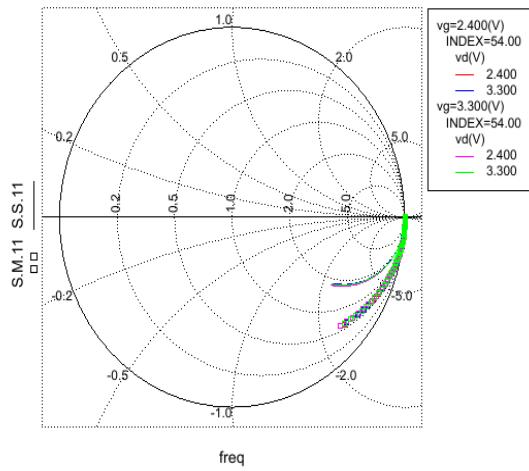
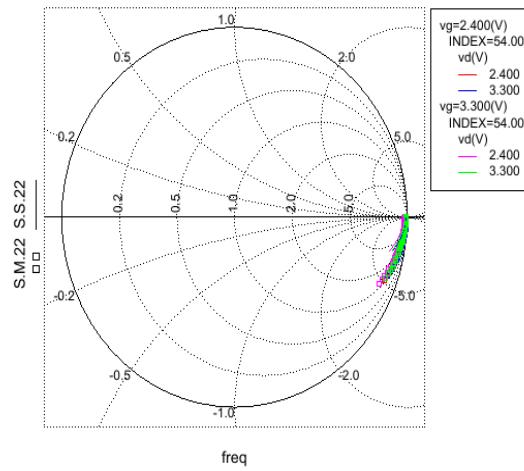
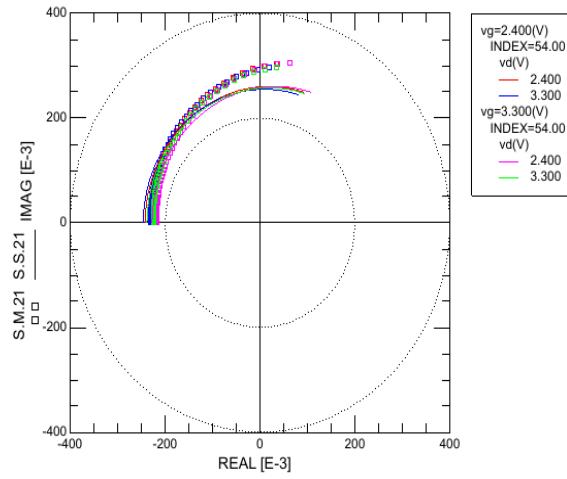
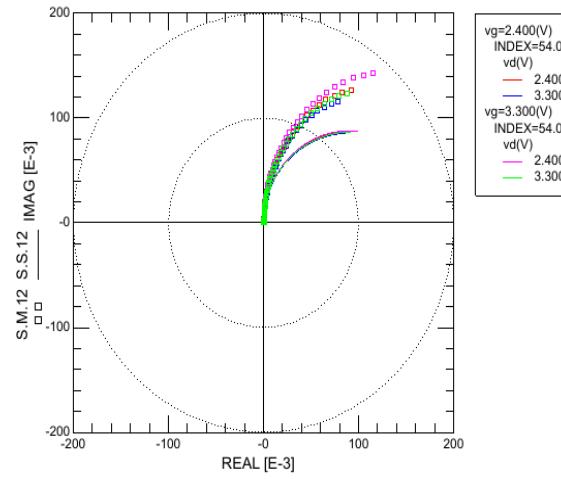
S-Parameter, T = 27°C


|h21| = f(Vg, Vd)

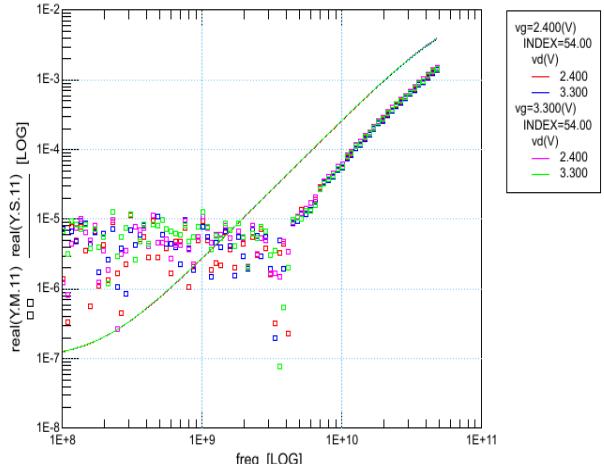
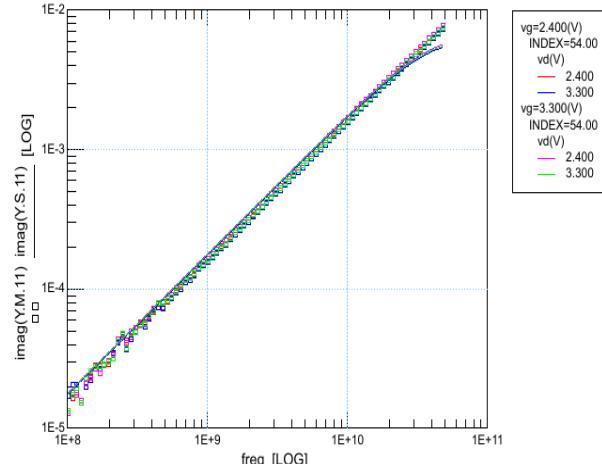
vg=2.400(V)
INDEX=54.00
vd(V)
2.400
3.300
vg=3.300(V)
INDEX=54.00
vd(V)
2.400
3.300

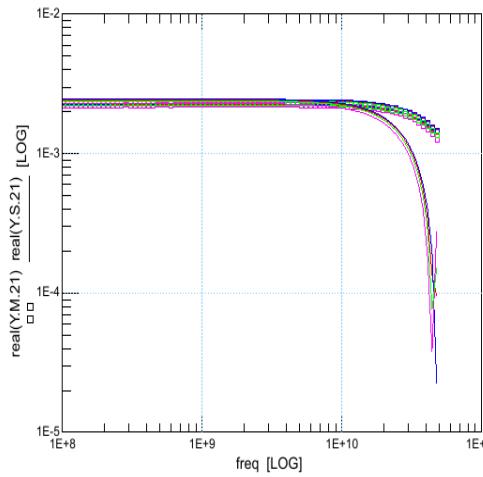


MSG/MAG = f(Vg, Vd)

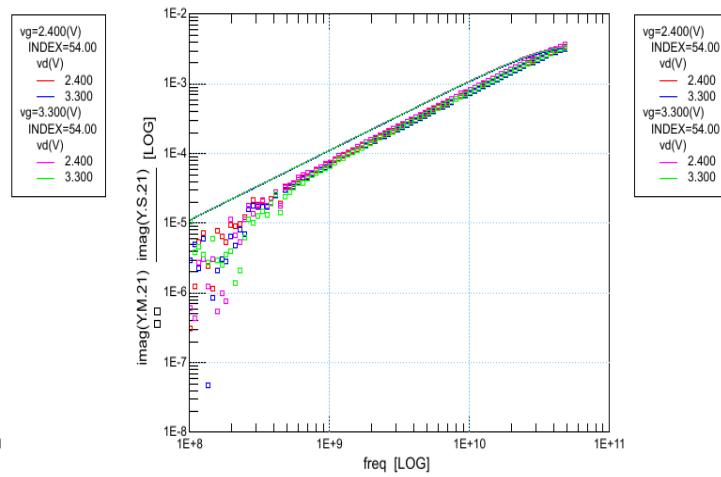
 $S11 = f(Vg, Vd)$  $S22 = f(Vg, Vd)$  $S21 = f(Vg, Vd)$  $S12 = f(Vg, Vd)$

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

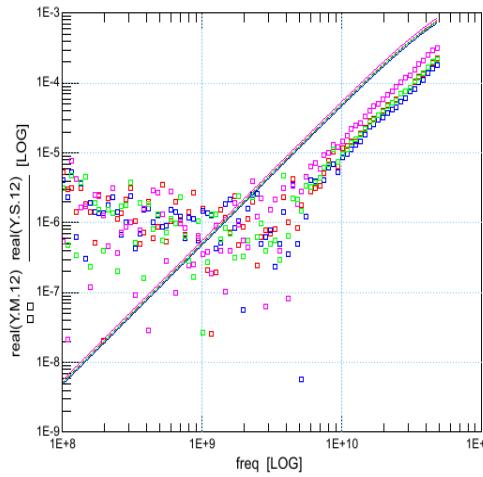
 $\text{re}(Y_{11}) = f(Vg, Vd)$  $\text{im}(Y_{11}) = f(Vg, Vd)$



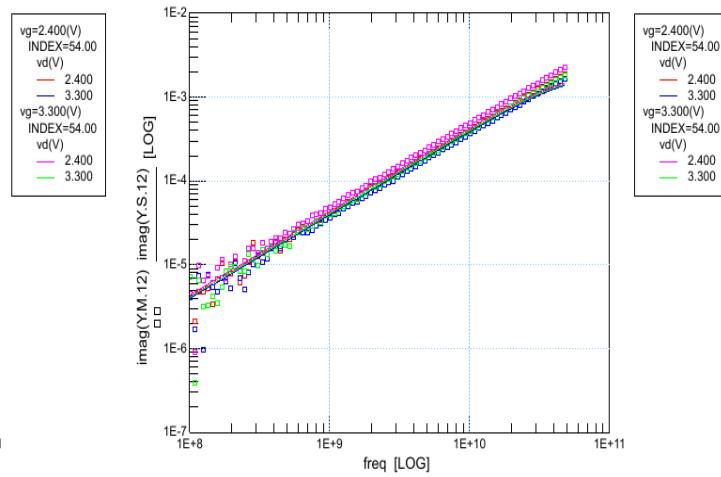
re(Y21) = f(Vg,Vd)



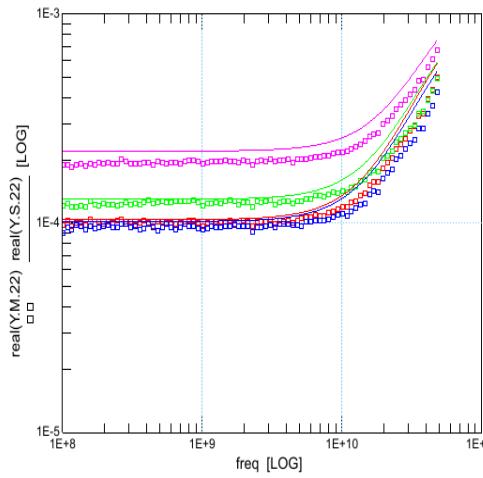
im(Y21) = f(Vg,Vd)



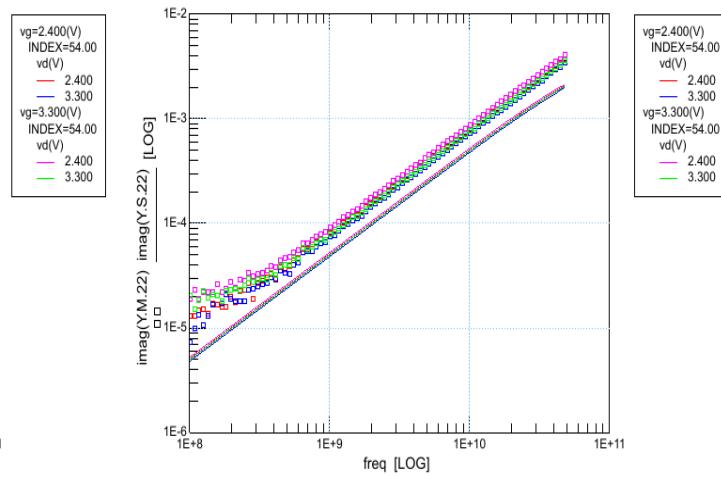
re(Y12) = f(Vg,Vd)



im(Y12) = f(Vg,Vd)

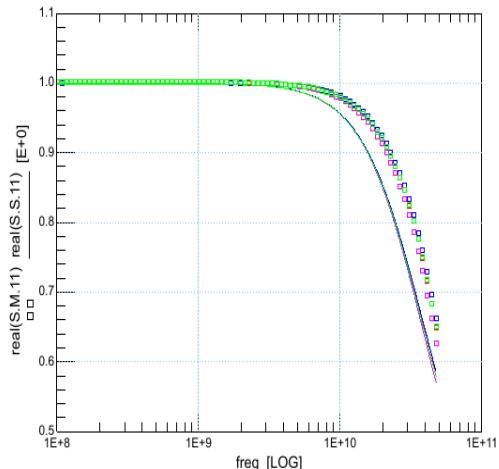
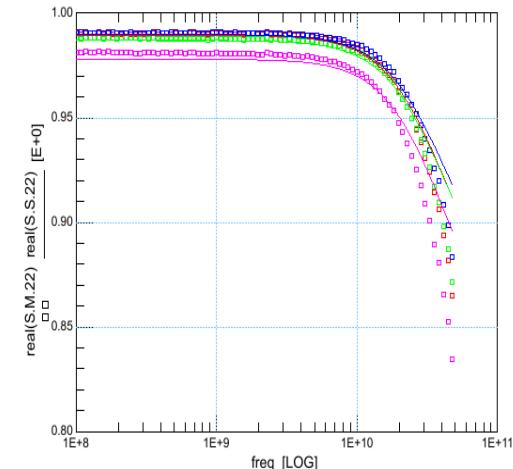
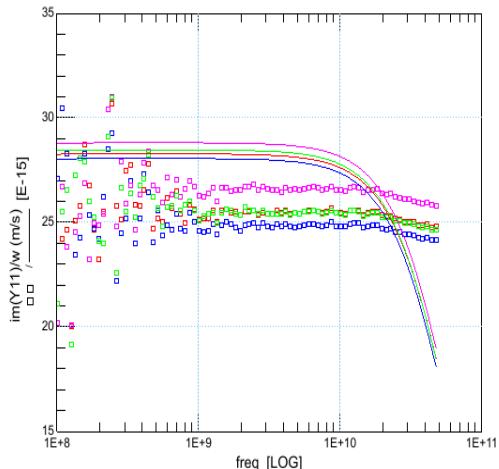
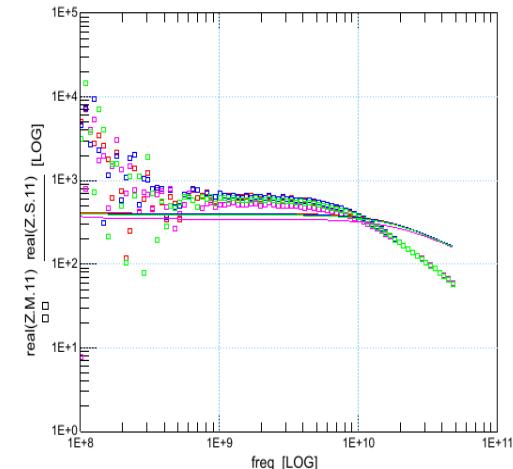
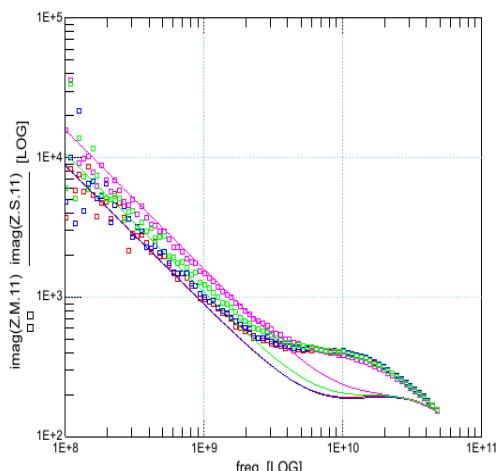
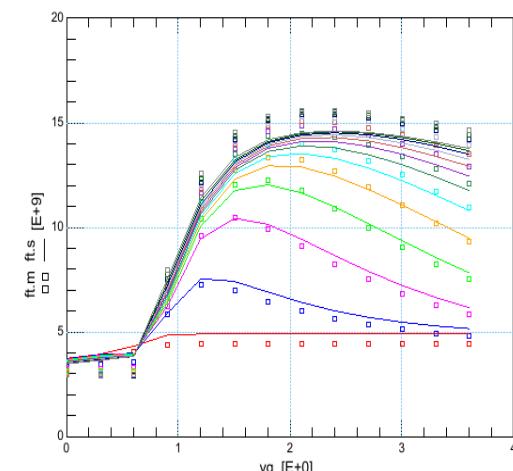


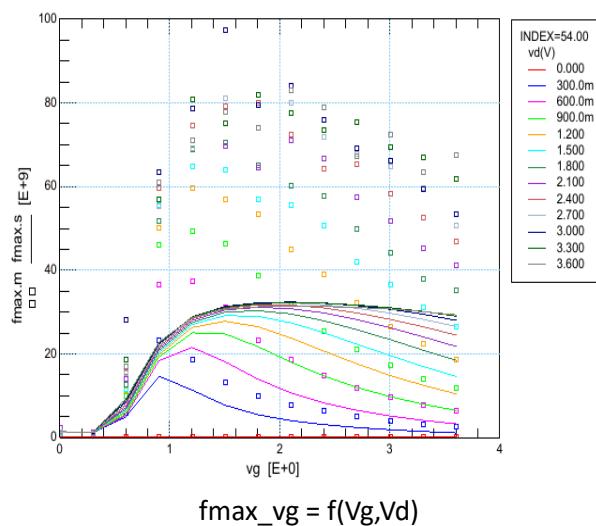
re(Y22) = f(Vg,Vd)



im(Y22) = f(Vg,Vd)

Verify Plots, T = 27°C

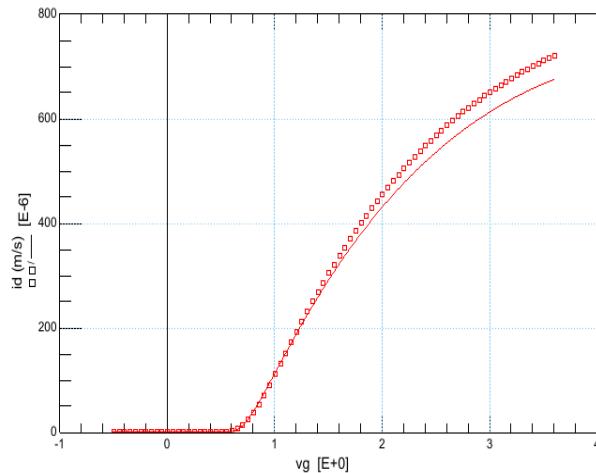
 $\text{re}(S_{11}) = f(V_g, V_d)$  $\text{re}(S_{22}) = f(V_g, V_d)$  $\text{im}(Y_{11}) \text{ divided by } \omega$  $\text{re}(Z_{11}) = f(V_g, V_d)$  $\text{im}(Z_{11}) = f(V_g, V_d)$  $fT_{vg} = f(V_g, V_d)$



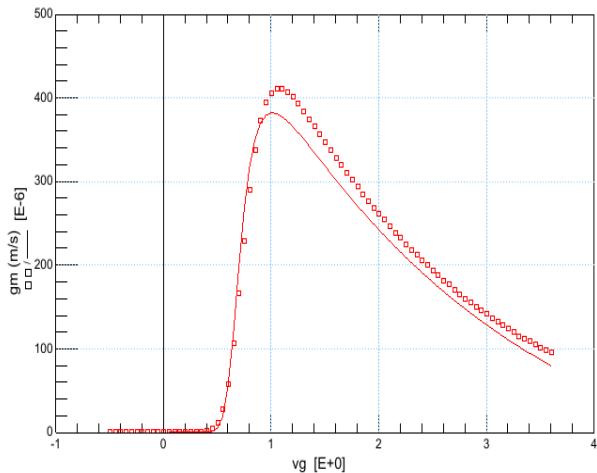
$$f_{max_vg} = f(Vg, Vd)$$

5.12 NF10_WF01u0_L_0u45_S453A_B4

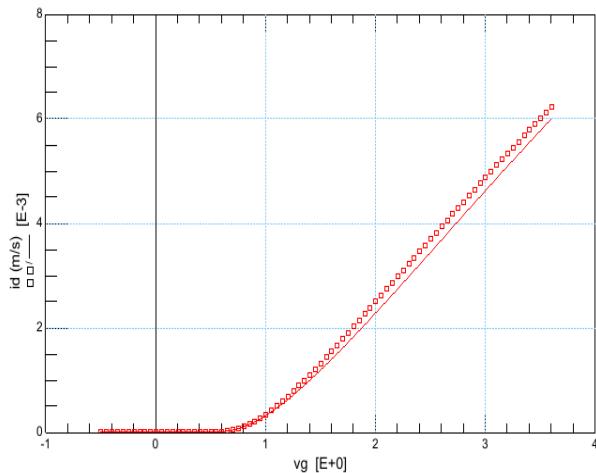
$IdVg$, $T = 27^\circ C$



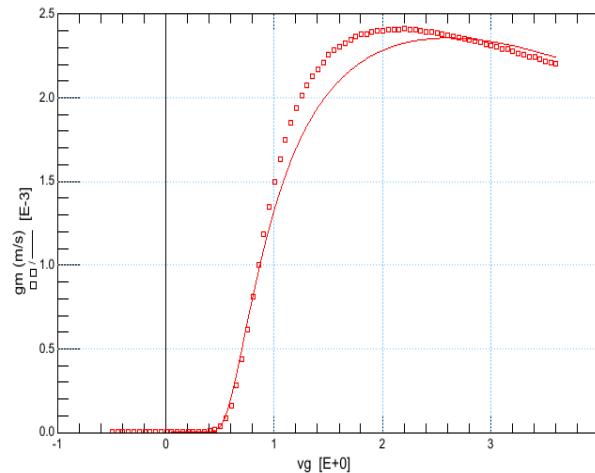
$$Id = f(Vg) @ Vd = 0.1V$$



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

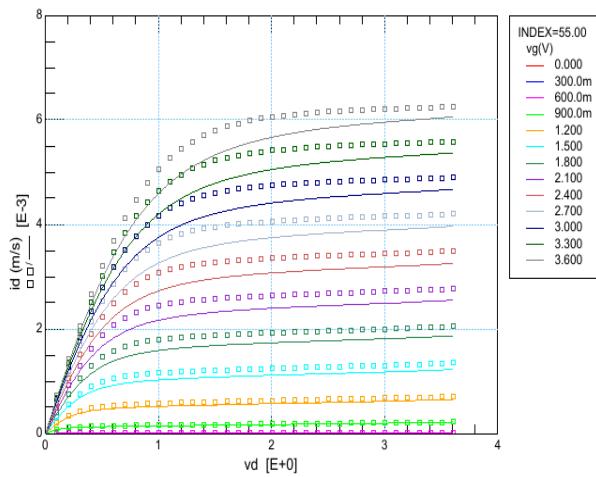


$$Id = f(Vg) @ Vd = 3.3V$$

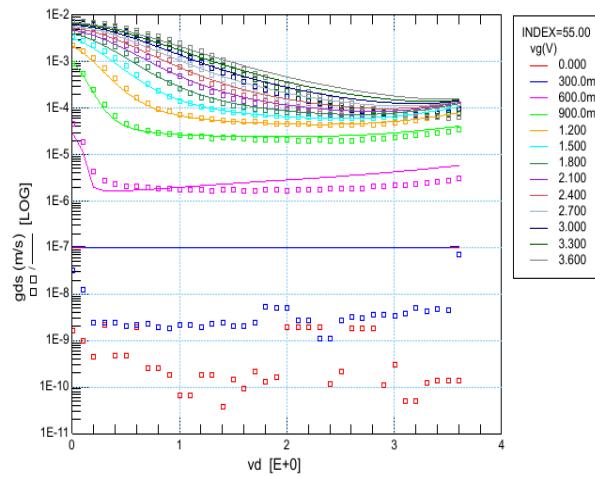


$$gm = f(Vg) @ Vd = 3.3V$$

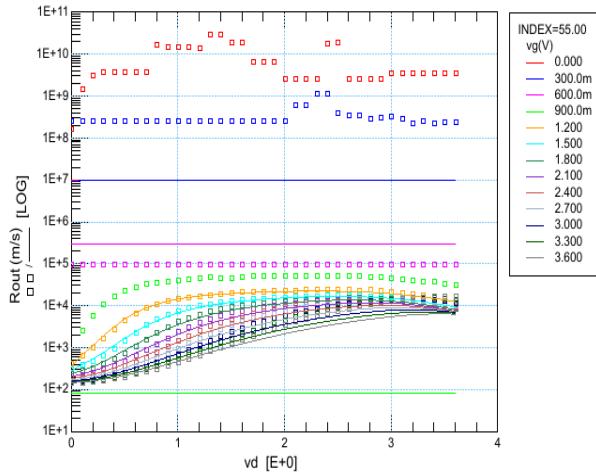
IdVd, T = 27°C



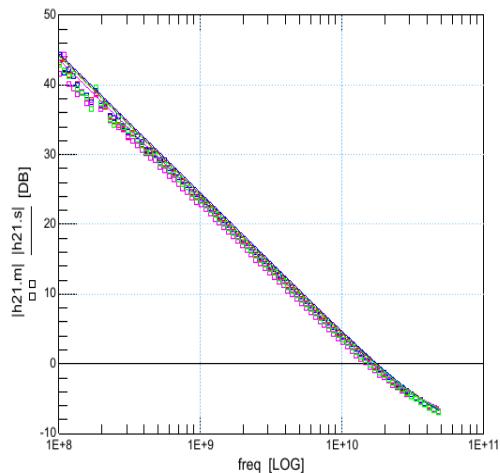
$$Id = f(Vd)$$



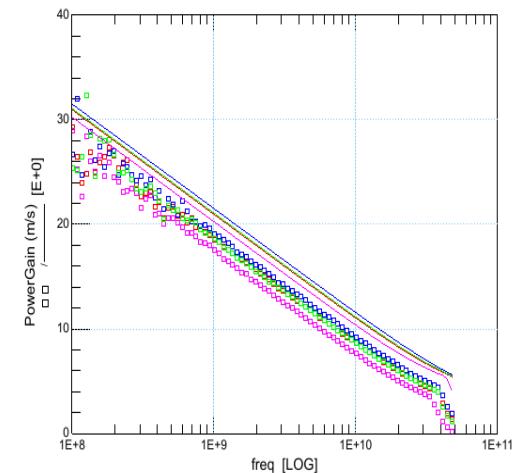
$$gds = f(Vd)$$



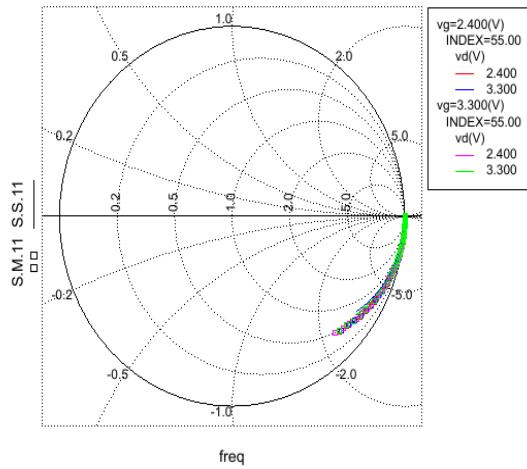
$$Rout = f(Vd)$$

S-Parameter, T = 27°C

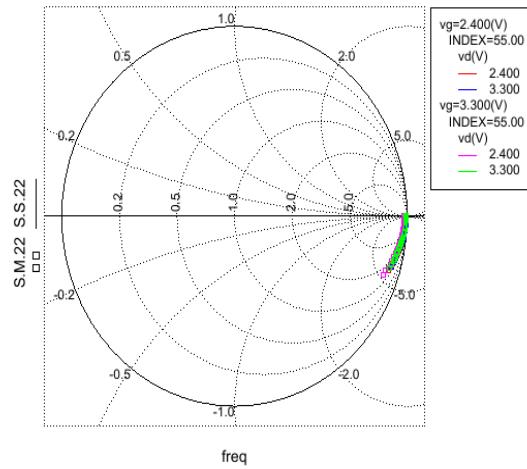
$$|h_{21}| = f(V_g, V_d)$$



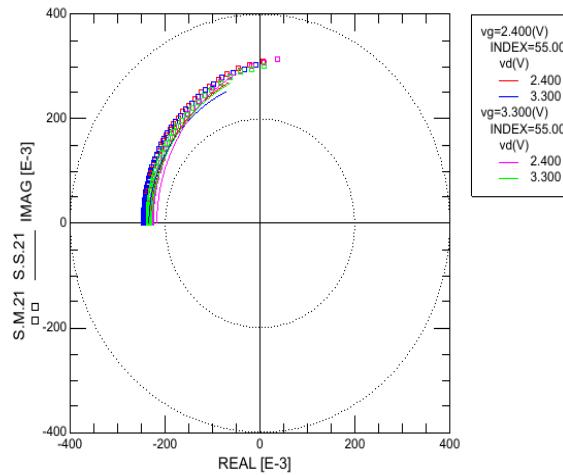
$$MSG/MAG = f(V_g, V_d)$$



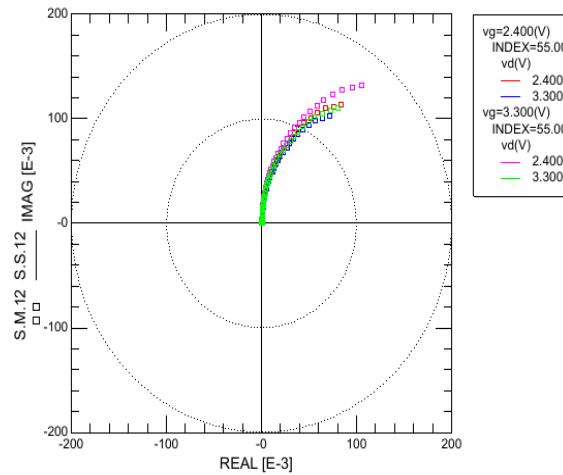
$$S_{11} = f(V_g, V_d)$$



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

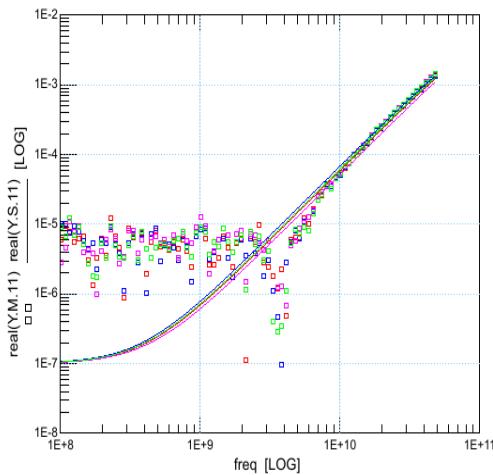


$$S_{21} = f(V_g, V_d)$$

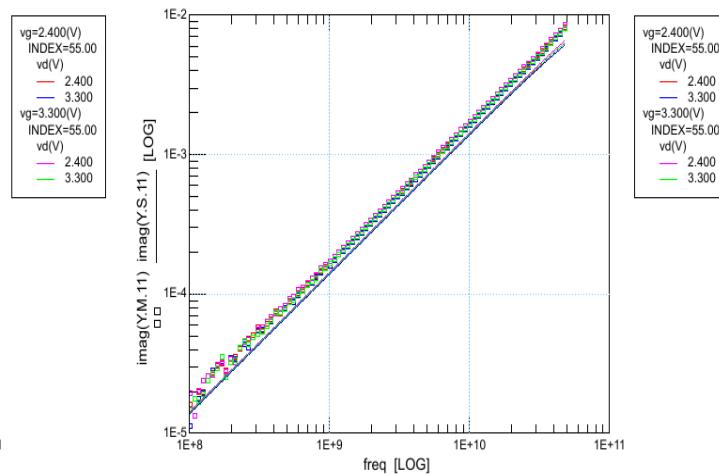


$$S_{12} = f(V_g, V_d)$$

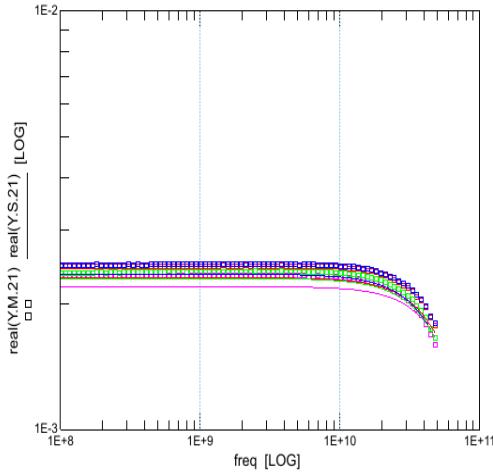
Y-Parameter, T = 27°C



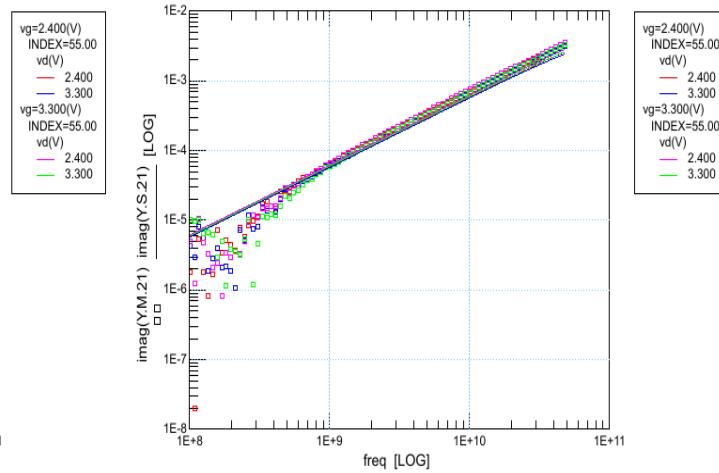
$$\text{re}(Y_{11}) = f(V_g, V_d)$$



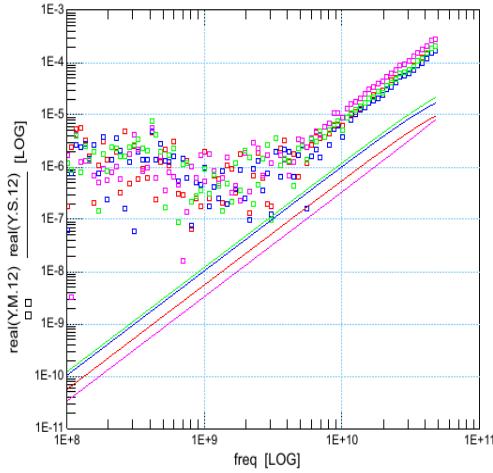
$$\text{im}(Y_{11}) = f(V_g, V_d)$$



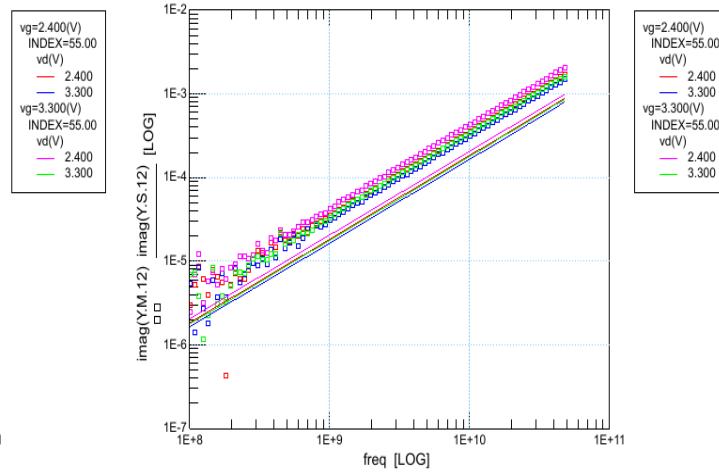
$$\text{re}(Y_{21}) = f(V_g, V_d)$$



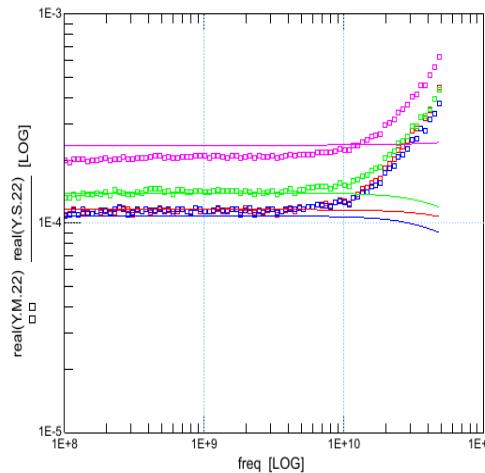
$$\text{im}(Y_{21}) = f(V_g, V_d)$$



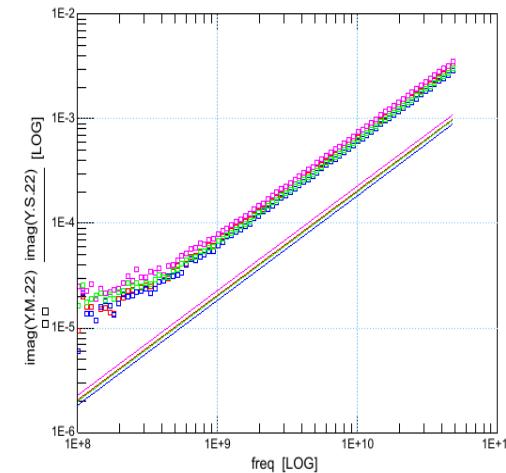
$$\text{re}(Y_{12}) = f(V_g, V_d)$$



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

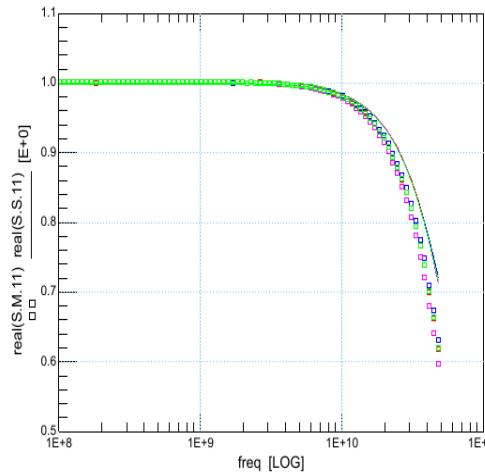


$$\text{re}(Y22) = f(Vg, Vd)$$

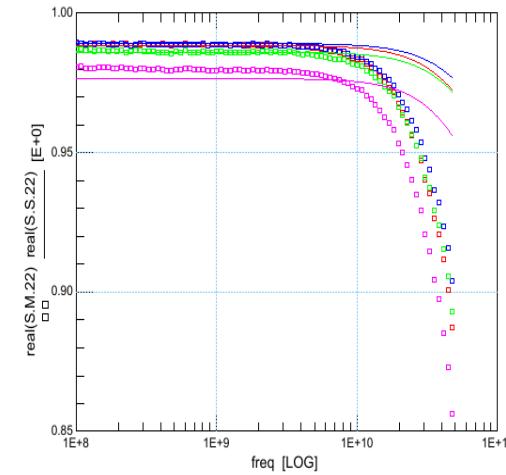


$$\text{im}(Y22) = f(Vg, Vd)$$

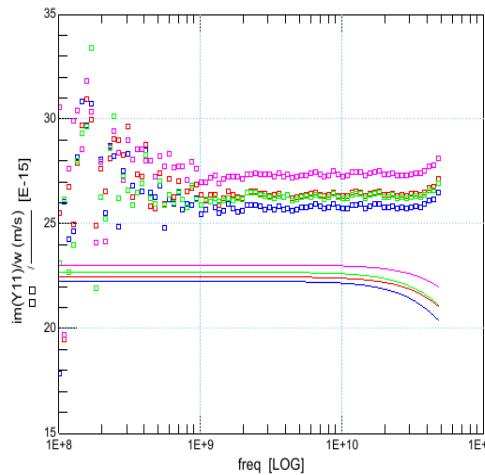
Verify Plots, T = 27°C



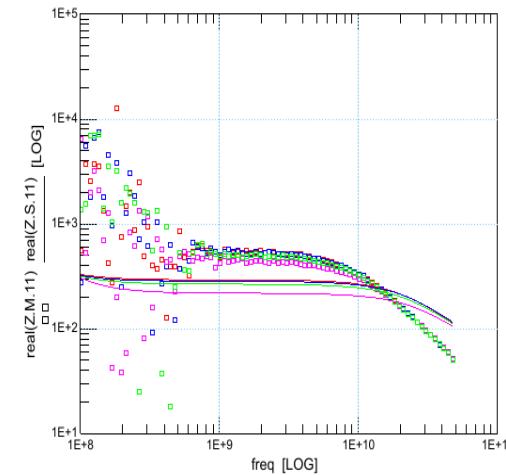
$$\text{re}(S11) = f(Vg, Vd)$$



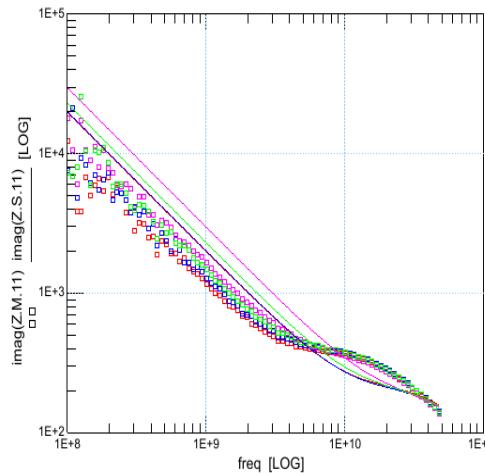
$$\text{re}(S22) = f(Vg, Vd)$$



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

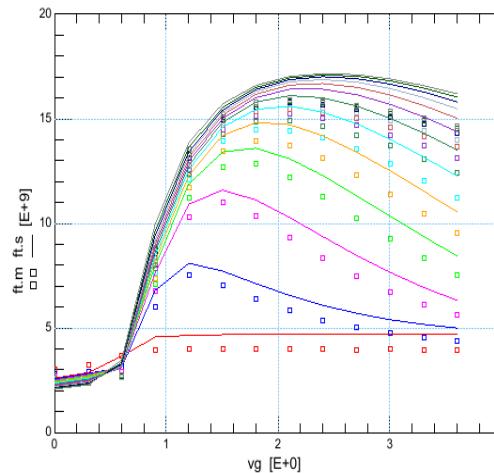


$$\text{re}(Z11) = f(Vg, Vd)$$

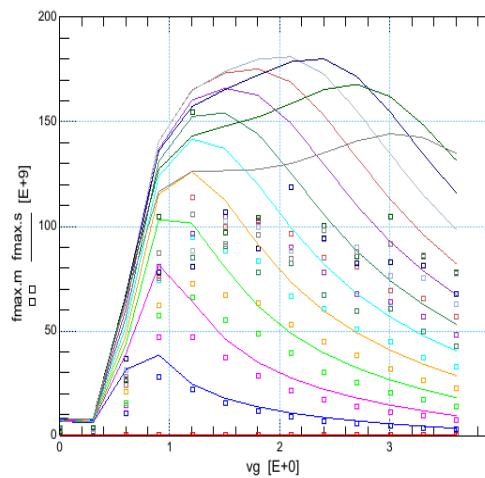
 $\text{im}(Z_{11}) = f(V_g, V_d)$

vg=2.400(V)
INDEX=55.00
vd(V)
— 2.400
— 3.000

vg=3.000(V)
INDEX=55.00
vd(V)
— 2.400
— 3.000

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

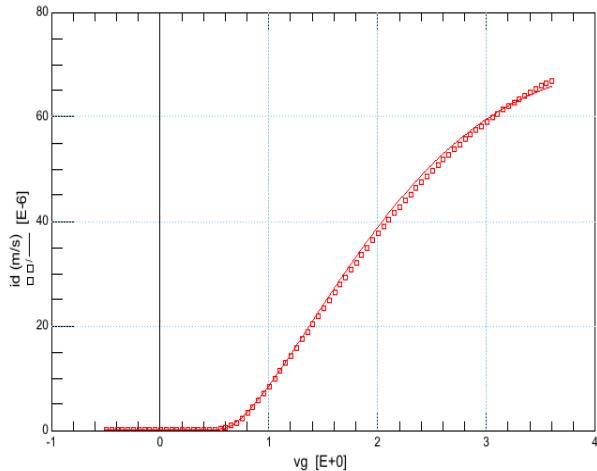
INDEX=55.00
vd(V)
— 0.000
— 300.0m
— 600.0m
— 900.0m
— 1.200
— 1.500
— 1.800
— 2.100
— 2.400
— 2.700
— 3.000
— 3.300
— 3.600

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

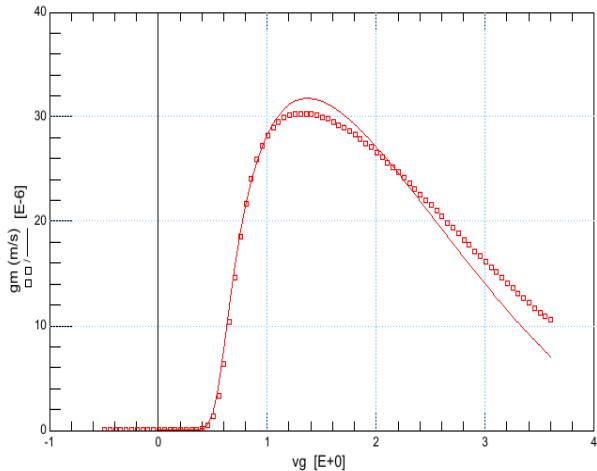
INDEX=55.00
vd(V)
— 0.000
— 300.0m
— 600.0m
— 900.0m
— 1.200
— 1.500
— 1.800
— 2.100
— 2.400
— 2.700
— 3.000
— 3.300
— 3.600

5.13NF04_WF05u0_L_10u0_S453A_14

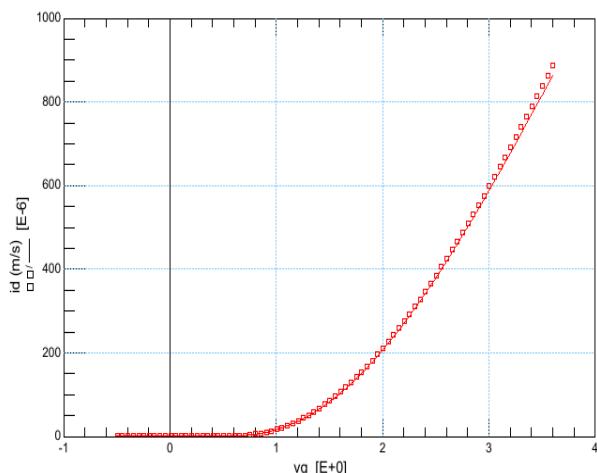
$IdVg$, $T = 27^\circ\text{C}$



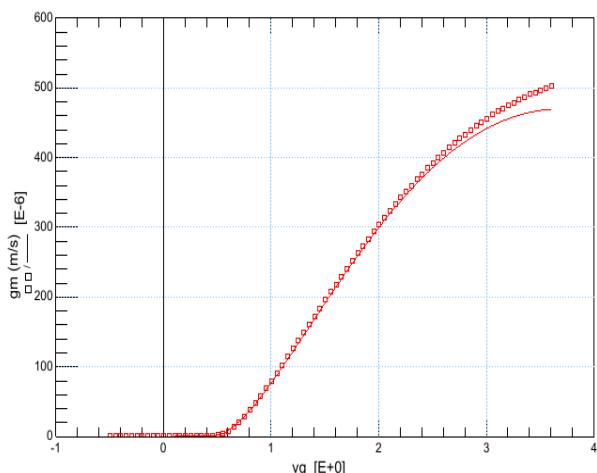
$Id = f(Vg)$ @ $Vd = 0.1\text{V}$



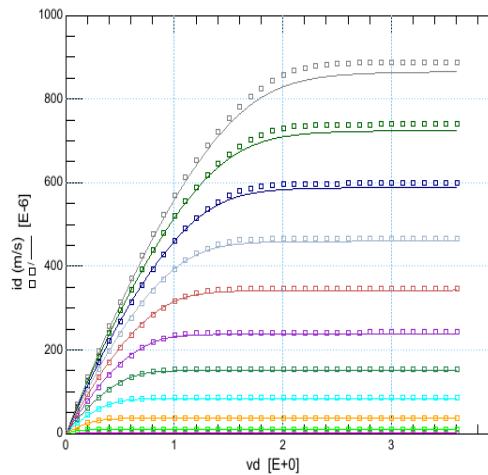
$gm = f(Vg)$ @ $Vd = 0.1\text{V}$



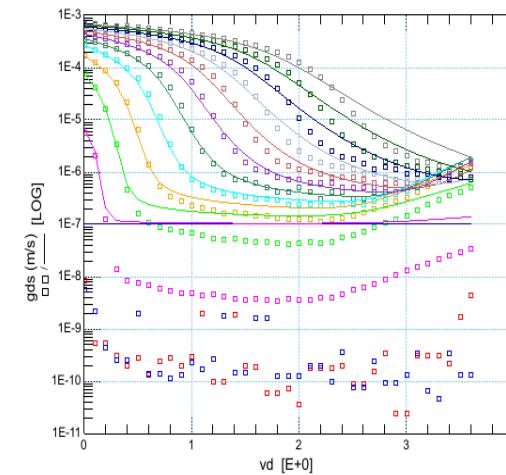
$Id = f(Vg)$ @ $Vd = 3.3\text{V}$



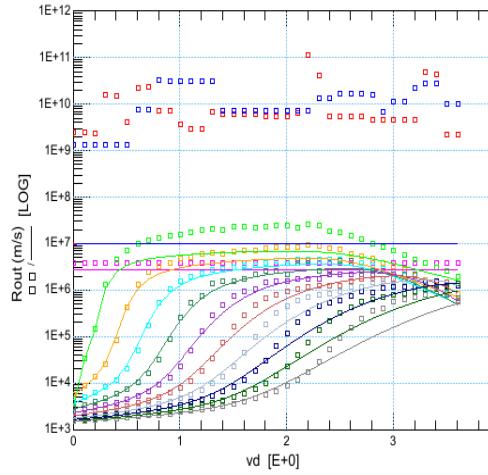
$gm = f(Vg)$ @ $Vd = 3.3\text{V}$

IdVd, T = 27°C


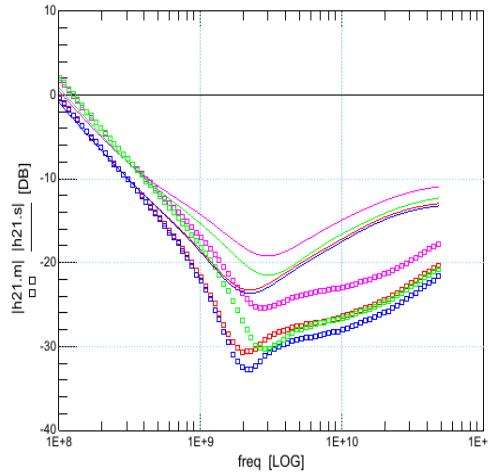
$$Id = f(Vd)$$



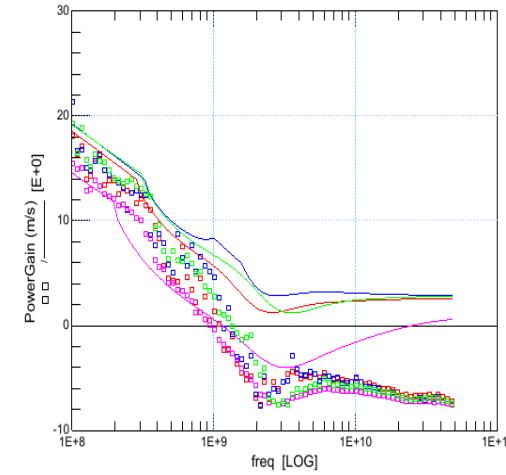
$$gds = f(Vd)$$



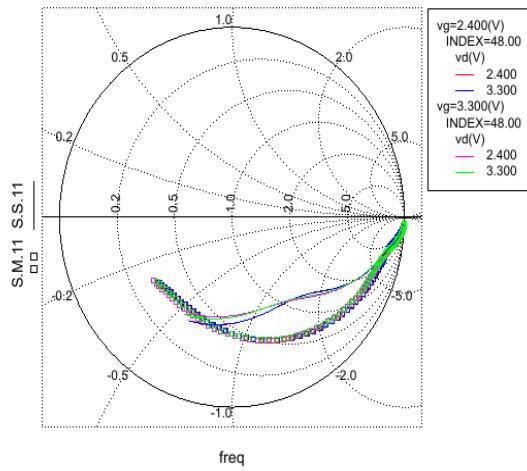
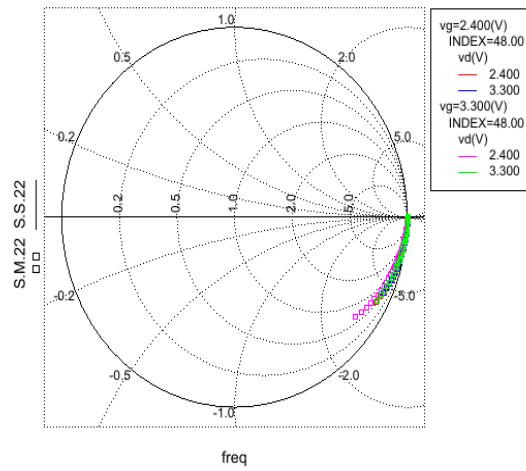
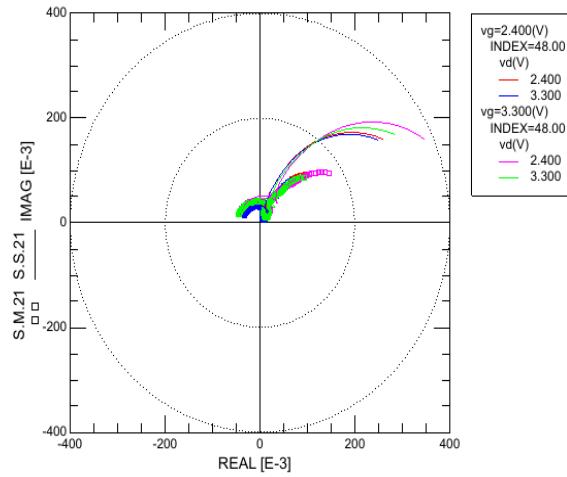
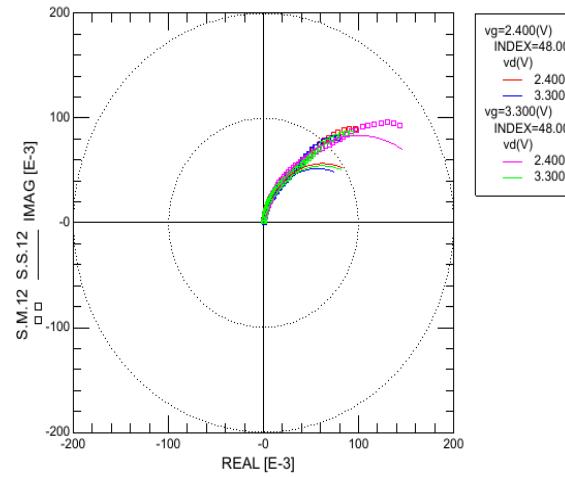
$$Rout = f(Vd)$$

S-Parameter, T = 27°C


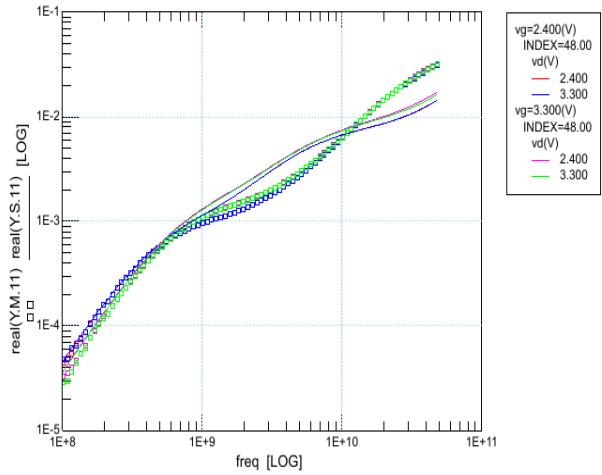
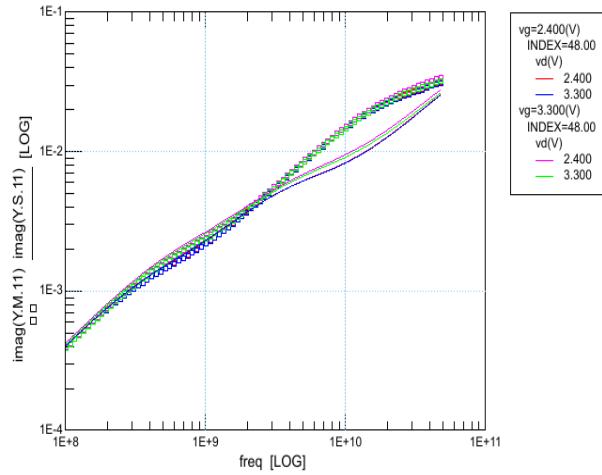
$$|h21| = f(Vg, Vd)$$

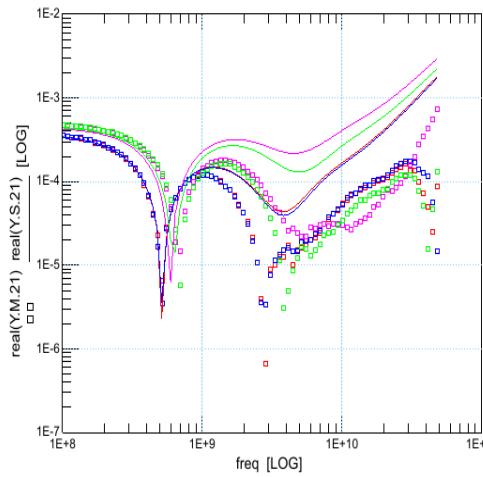


$$MSG/MAG = f(Vg, Vd)$$

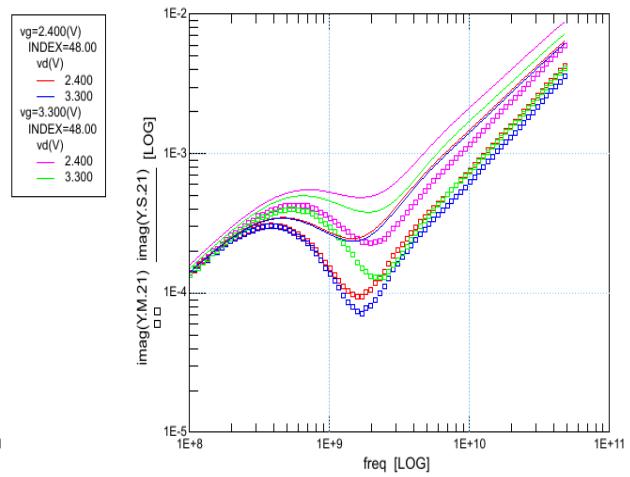
 $S11 = f(Vg, Vd)$  $S22 = f(Vg, Vd)$  $S21 = f(Vg, Vd)$  $S12 = f(Vg, Vd)$

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

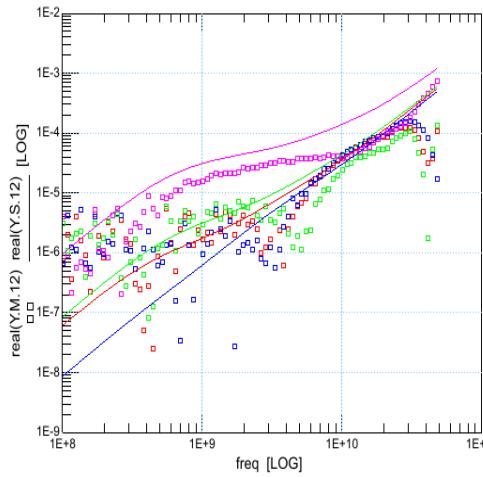
 $\text{re}(Y_{11}) = f(Vg, Vd)$  $\text{im}(Y_{11}) = f(Vg, Vd)$



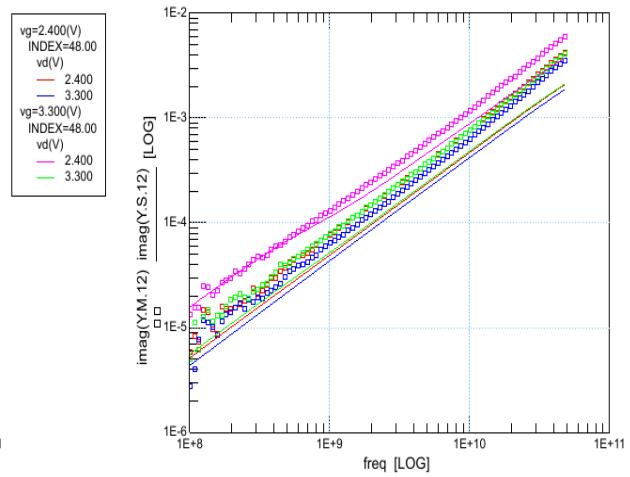
re(Y21) = f(Vg,Vd)



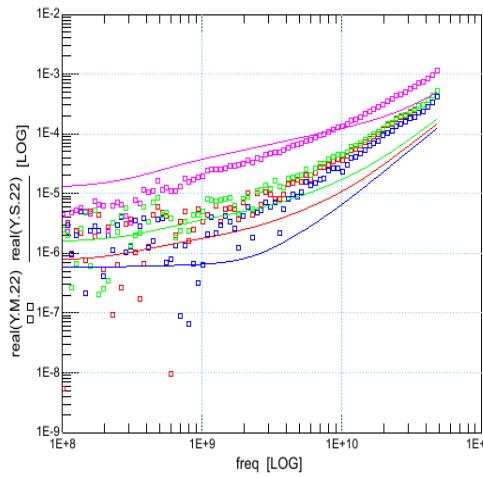
im(Y21) = f(Vg,Vd)



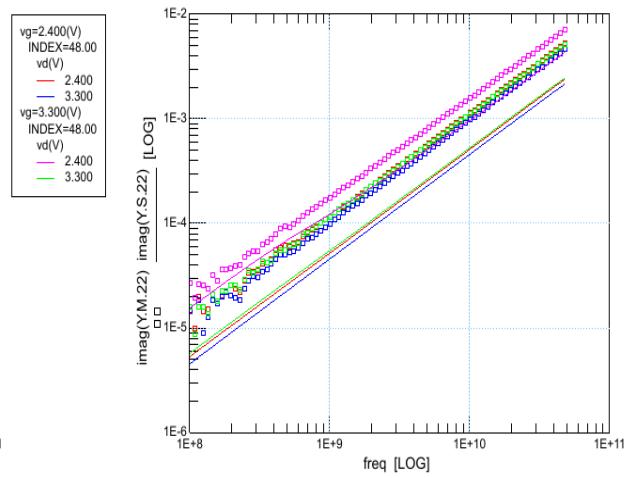
re(Y12) = f(Vg,Vd)



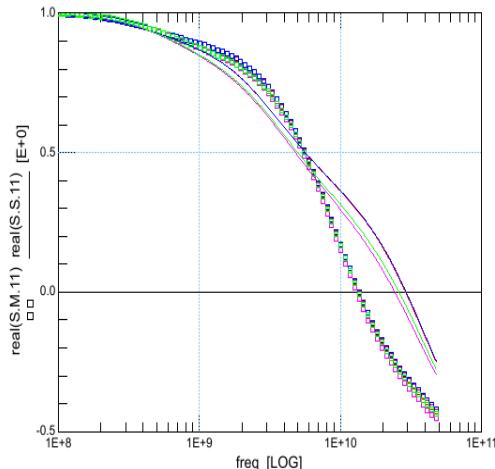
im(Y12) = f(Vg,Vd)



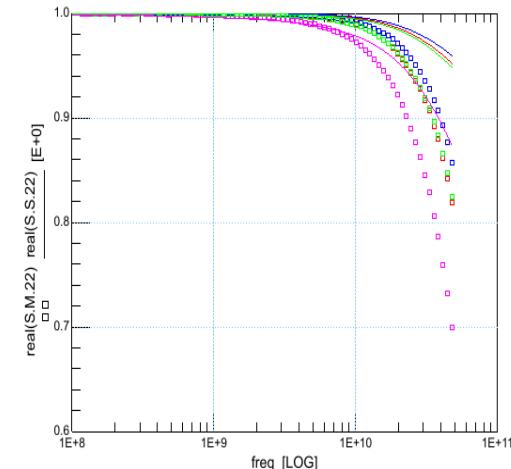
re(Y22) = f(Vg,Vd)



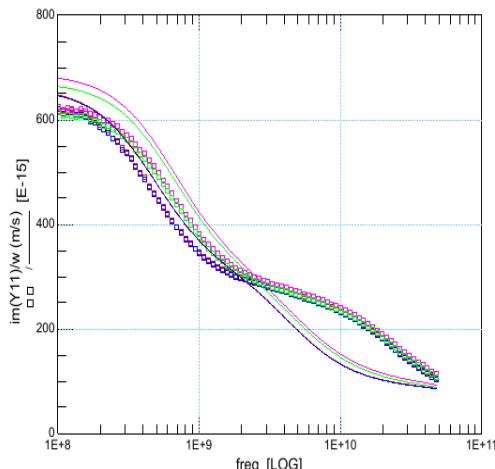
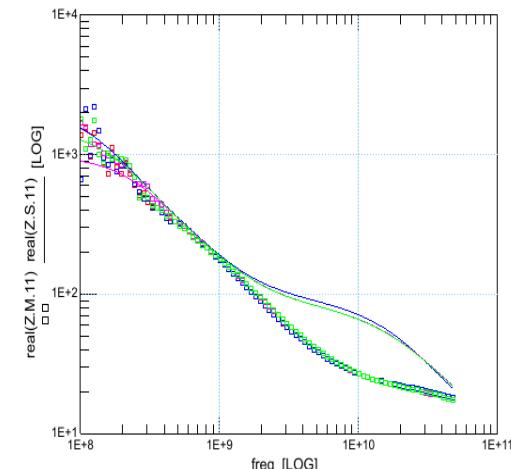
im(Y22) = f(Vg,Vd)

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

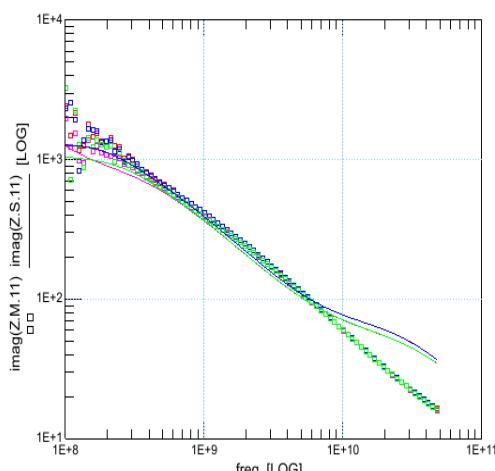
re(S11) = f(Vg, Vd)



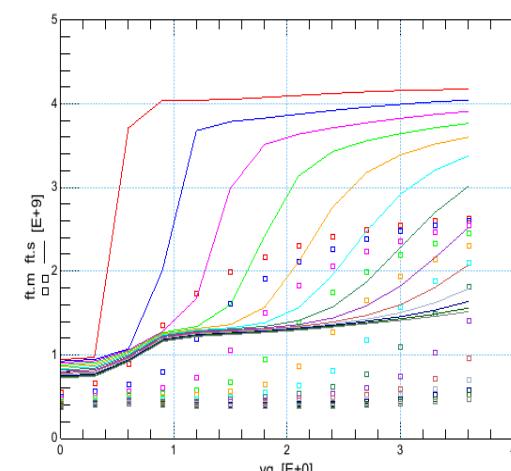
re(S22) = f(Vg, Vd)

im(Y11) divided by ω 

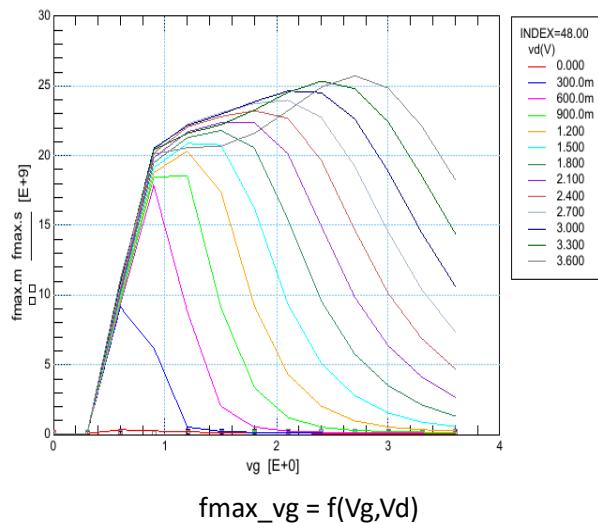
re(Z11) = f(Vg, Vd)



im(Z11) = f(Vg, Vd)

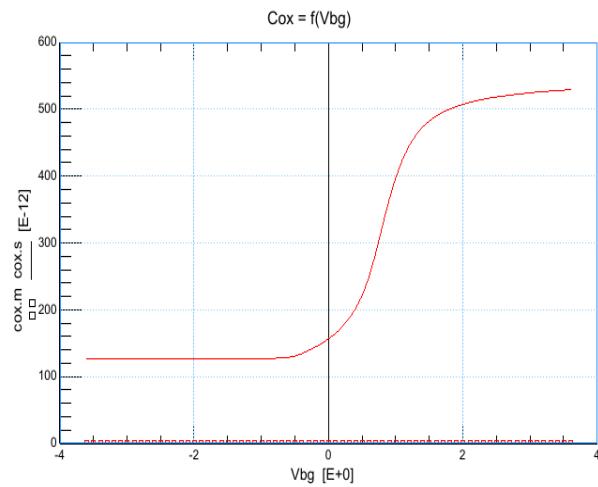


fT_vg = f(Vg, Vd)

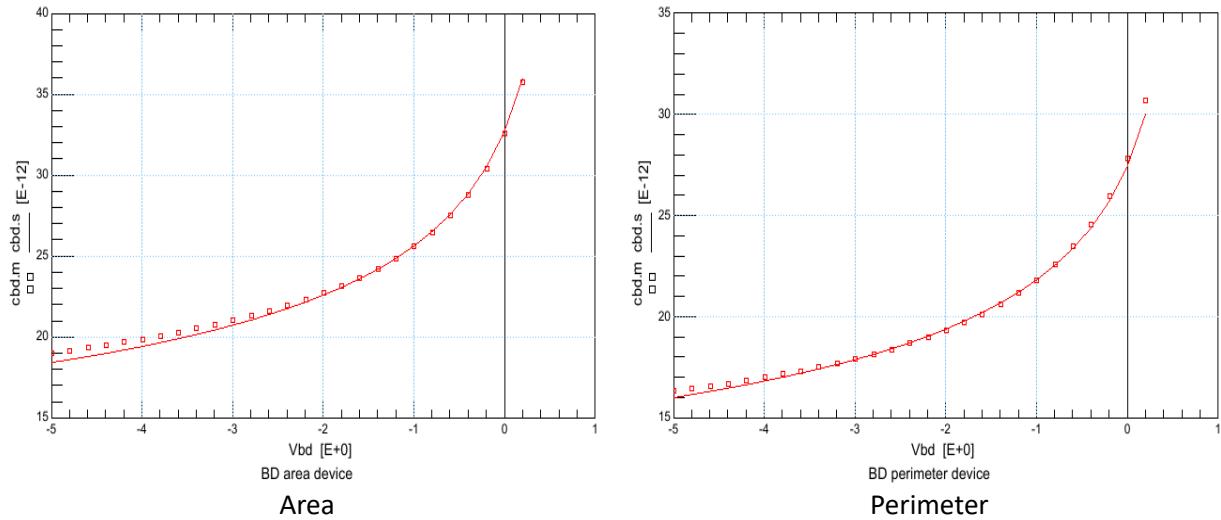


6 Capacitances

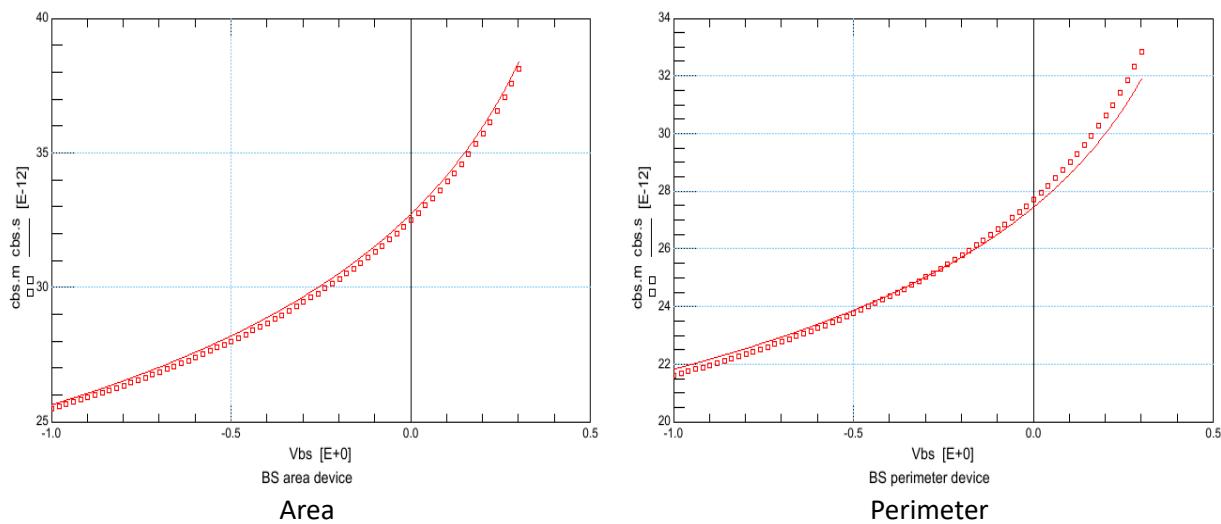
6.1 Gate Oxide Capacitance



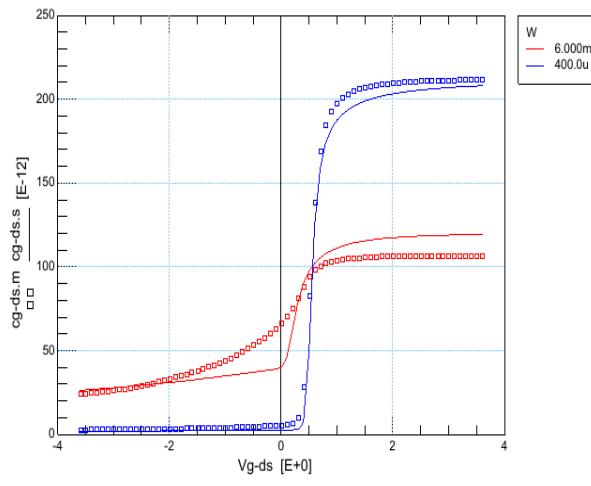
6.2 Junction Capacitance Bulk - Drain



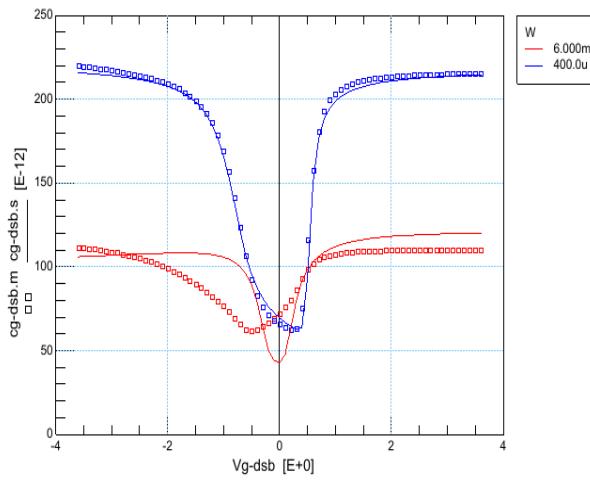
6.3 Junction Capacitance Bulk - Source



6.4 Overlap Capacitance



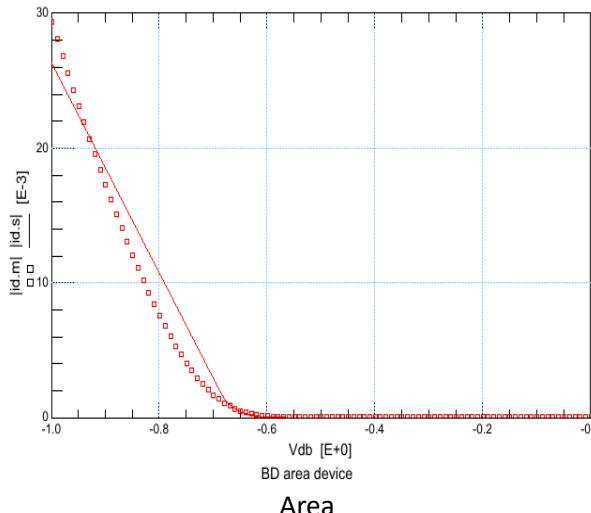
Gate - Drain,Source



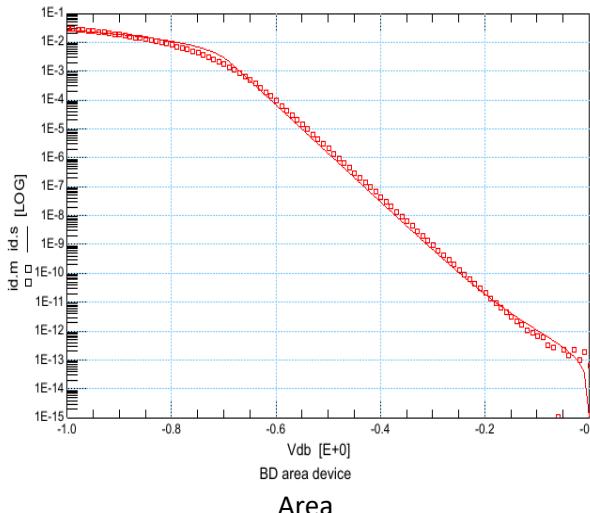
Gate - Drain,Source,Bulk

7 Diodes

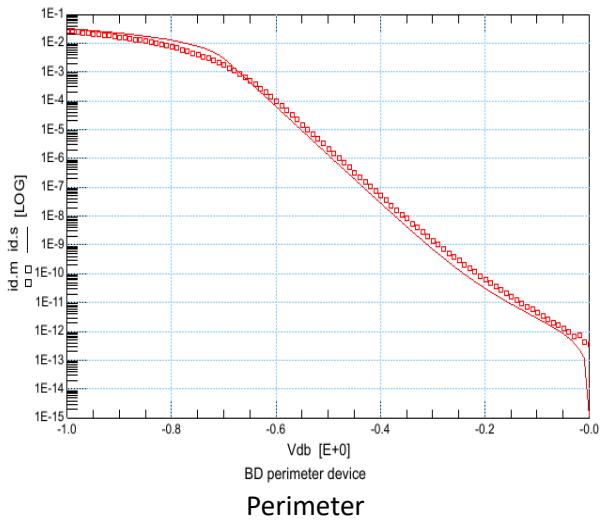
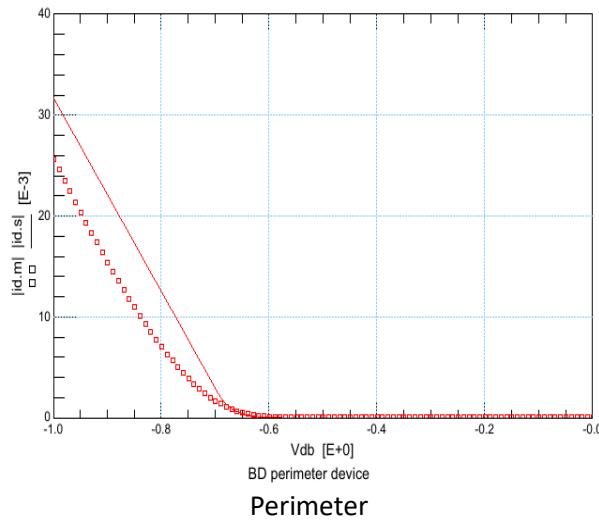
7.1 Diode Bulk - Drain



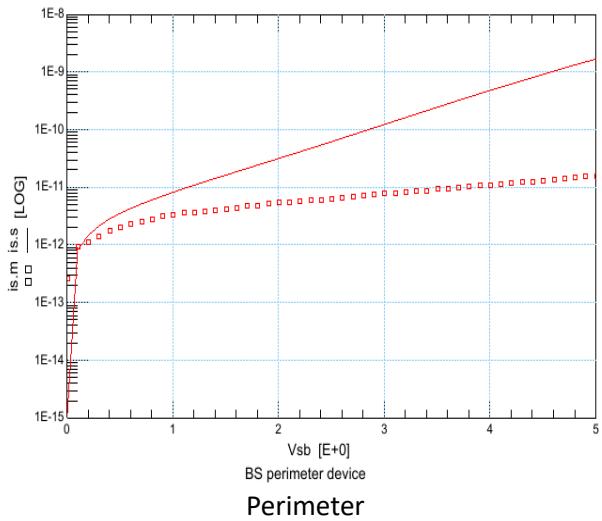
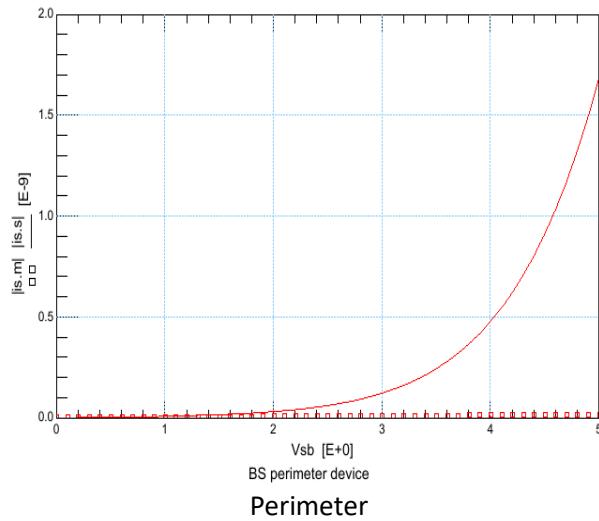
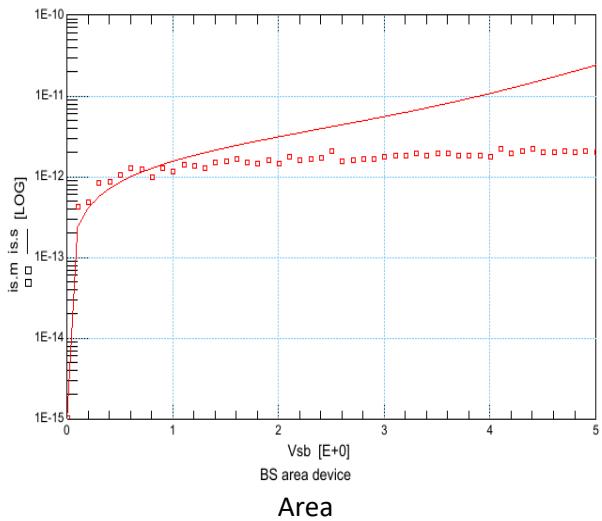
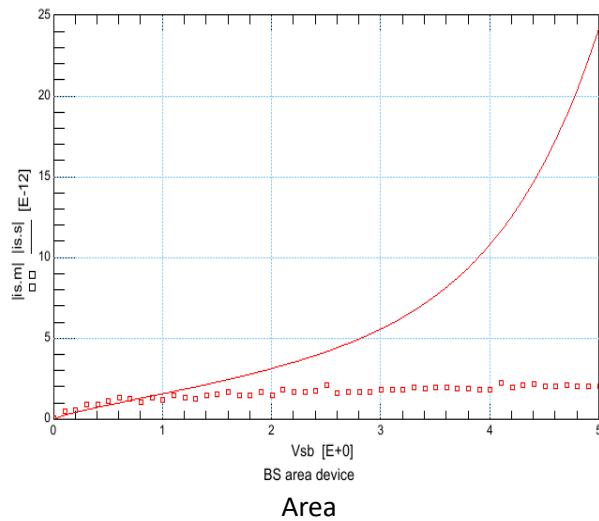
Area



Area



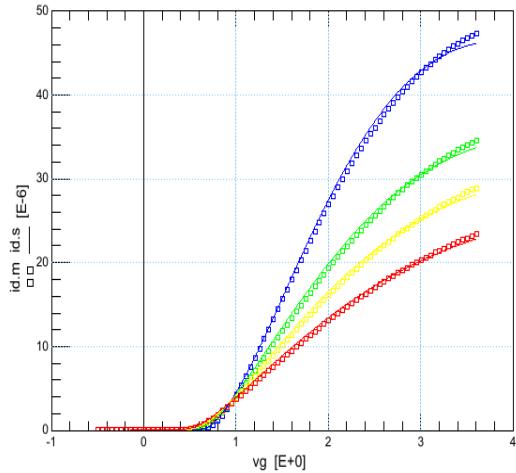
7.2 Diode Bulk - Source



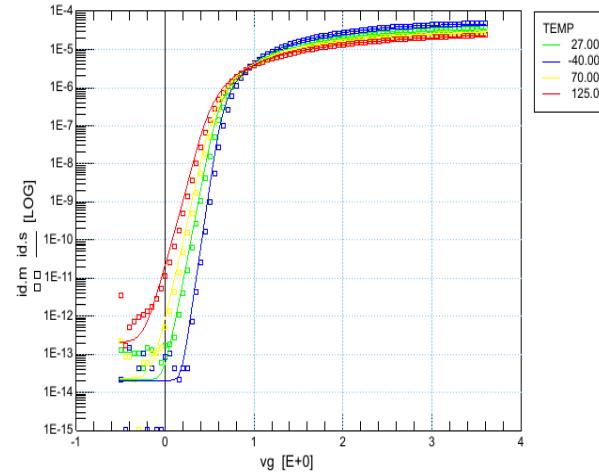
8 Temperature Measurement

8.1 Transistors

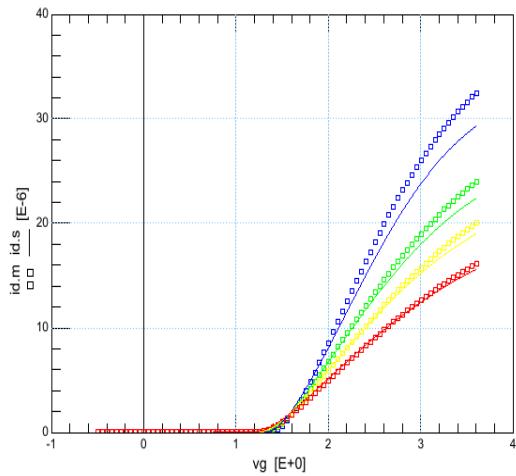
8.1.1 W10u0_L10u0_S557_3



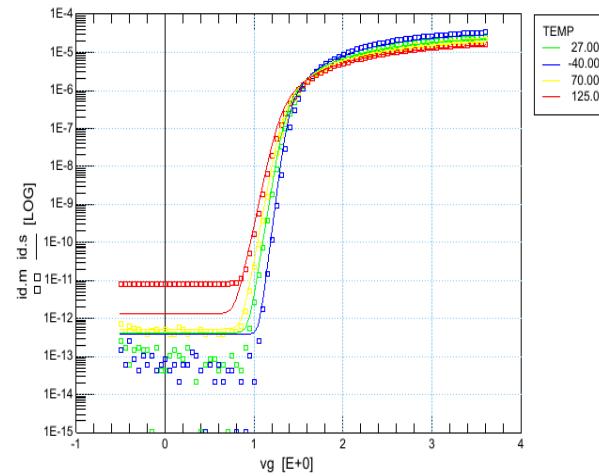
$Id = f(vg, T)$ @ low $Vds, Vbs = 0$



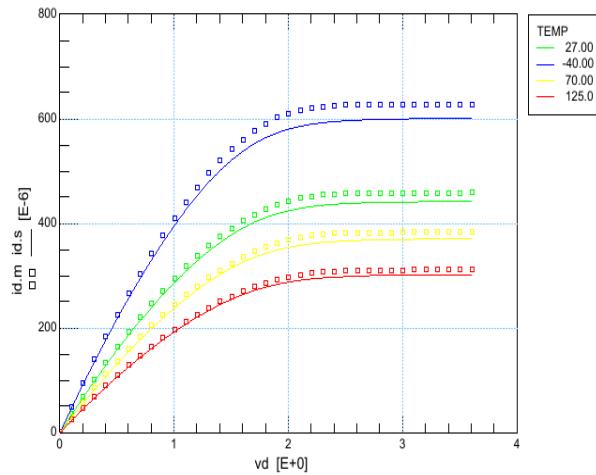
$\log(Id) = f(vg, T)$ @ low $Vds, Vbs = 0$



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

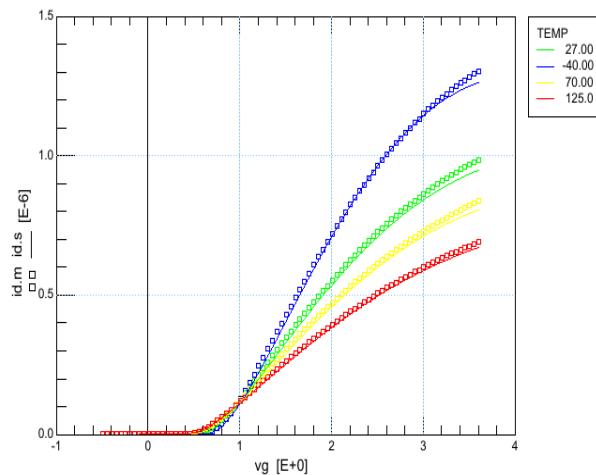


$\log(Id) = f(vg, T)$ @ low $Vds, Vbs = \text{max}$

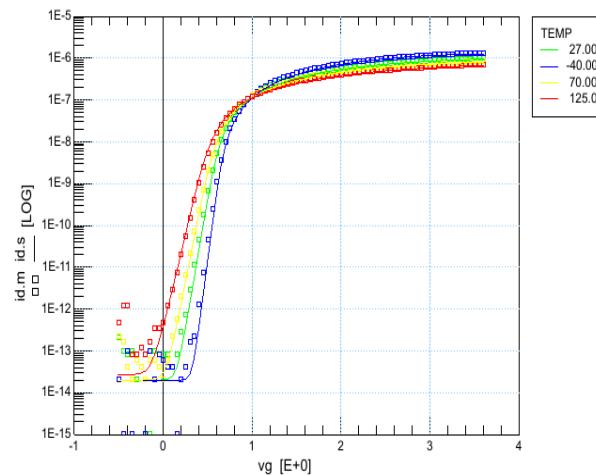


$$Id = f(Vd, Vg, T) @ Vbs = 0$$

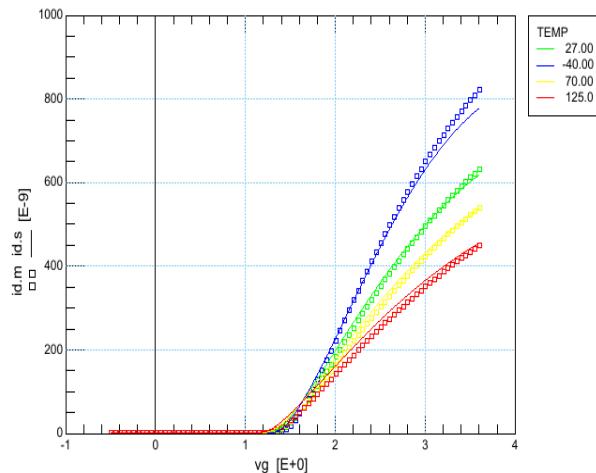
8.1.2 W0u3_L10u0_S547_4



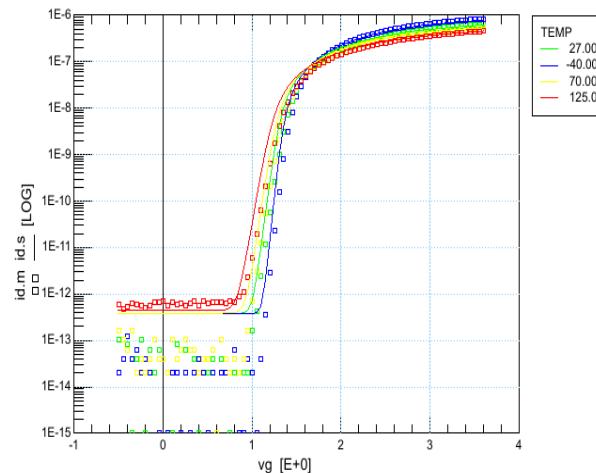
$$Id = f(vg, T) @ \text{low } Vds, Vbs = 0$$



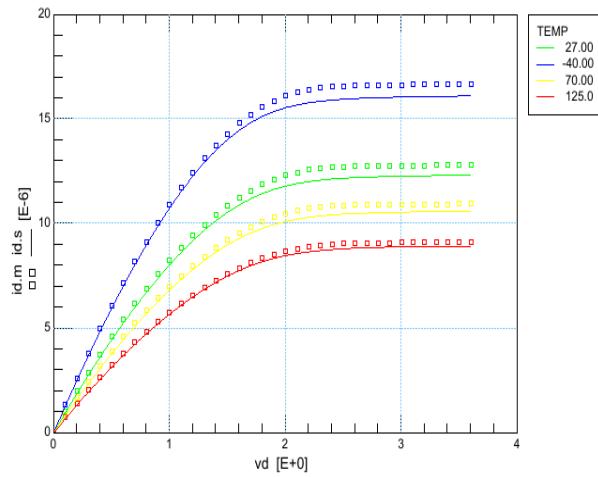
$$\log(Id) = f(vg, T) @ \text{low } Vds, Vbs = 0$$



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

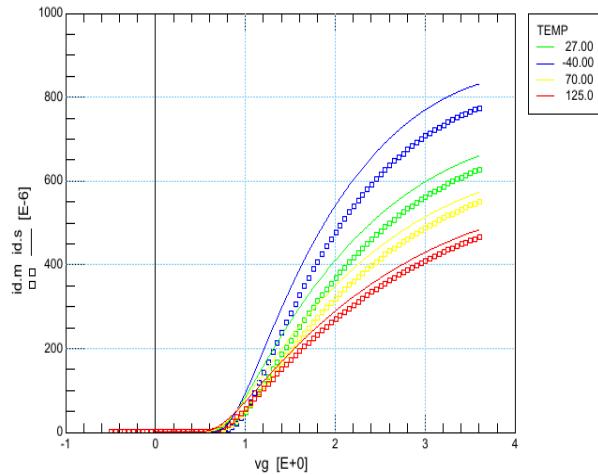


$$\log(Id) = f(vg, T) @ \text{low } Vds, Vbs = \text{max}$$

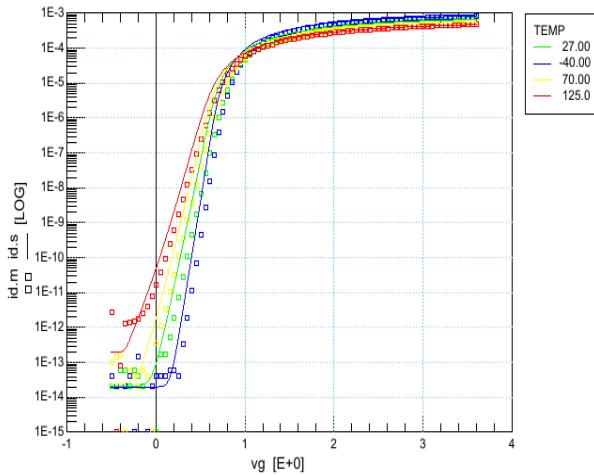


$$Id = f(Vd, Vg, T) @ Vbs = 0$$

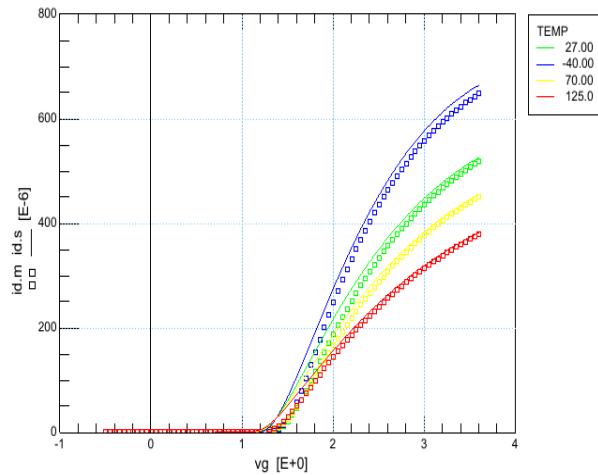
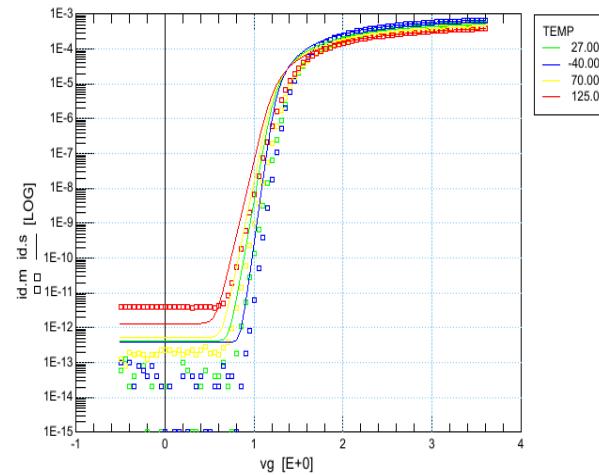
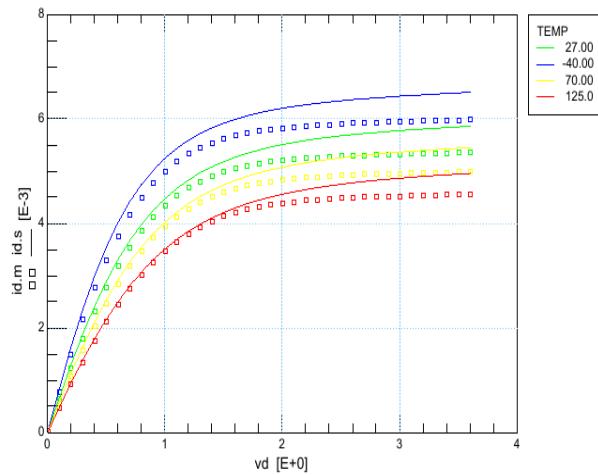
8.1.3 W10u0_L0u5_S556_4



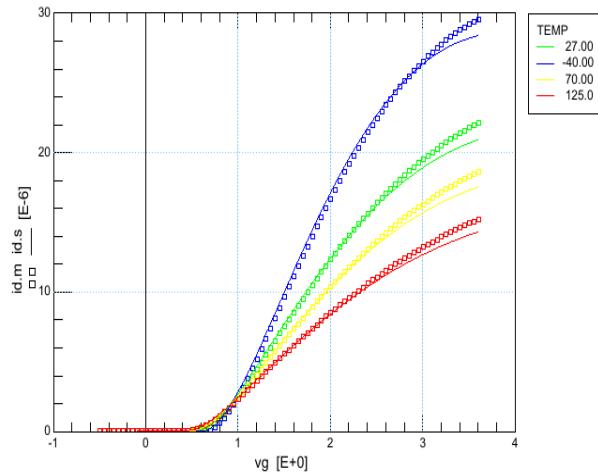
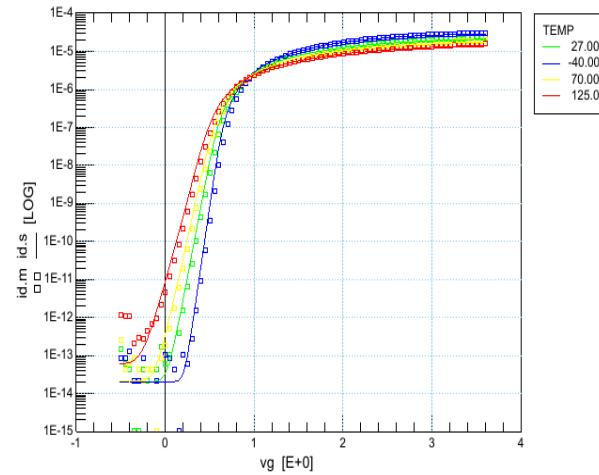
$$Id = f(Vg, T) @ \text{low } Vds, Vbs = 0$$

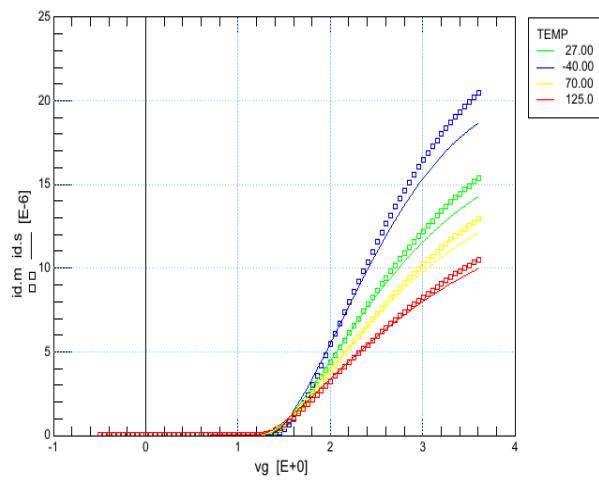
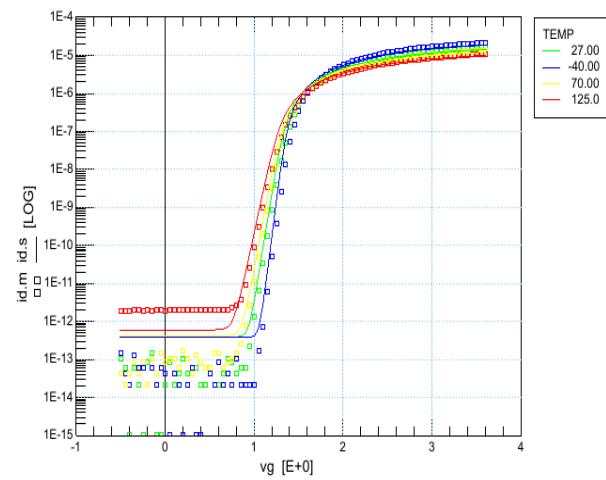
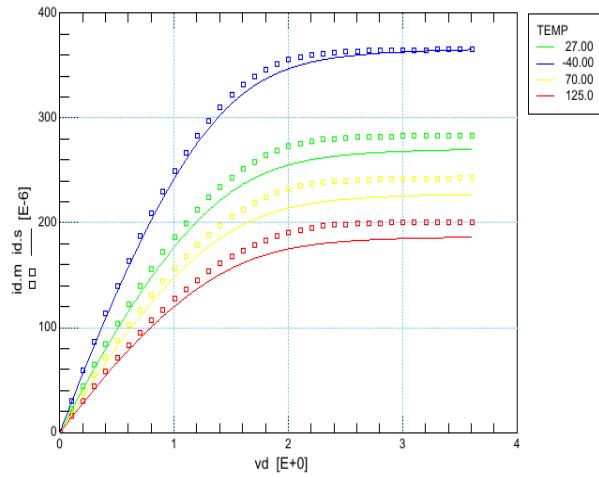


$$\log(Id) = f(Vg, T) @ \text{low } Vds, Vbs = 0$$

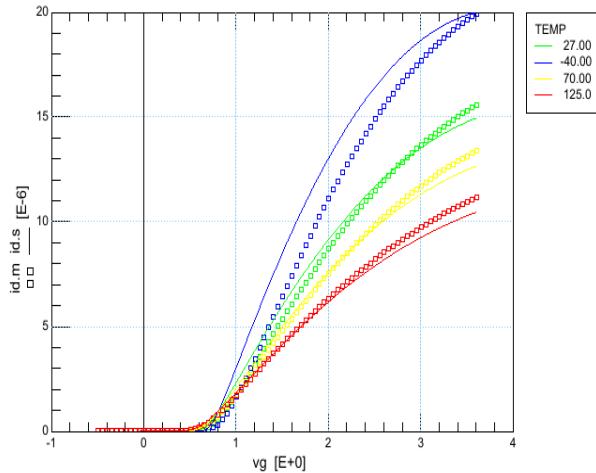
 $Id = f(Vg, T) @ \text{low } Vds, Vbs = \text{max}$  $\log(Id) = f(Vg, T) @ \text{low } Vds, Vbs = \text{max}$  $Id = f(Vd, Vg, T) @ Vbs = 0$

8.1.4 W02u0_L3u0_S558_4

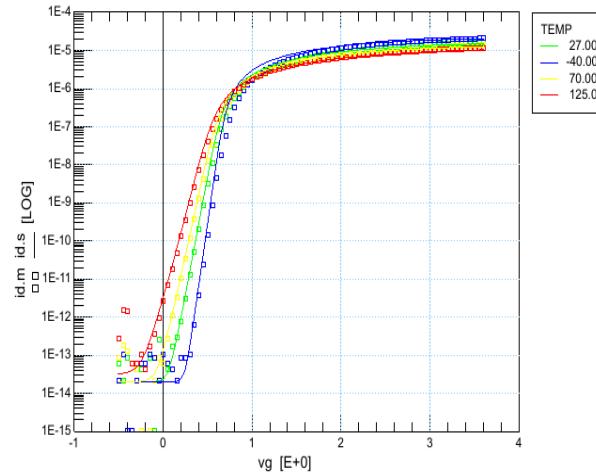
 $Id = f(Vg, T) @ \text{low } Vds, Vbs = 0$  $\log(Id) = f(Vg, T) @ \text{low } Vds, Vbs = 0$

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

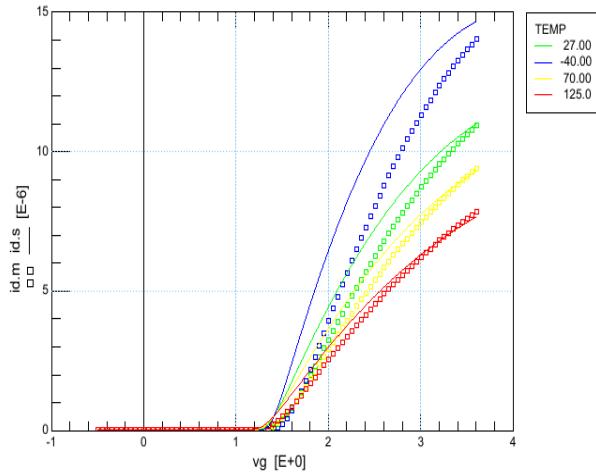
8.1.5 W0u6_L1u2_S559_4



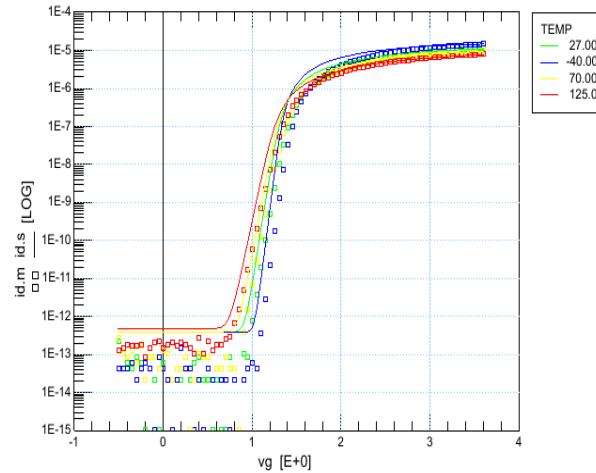
$Id = f(vg, T) @ \text{low } V_{ds}, V_{bs} = 0$



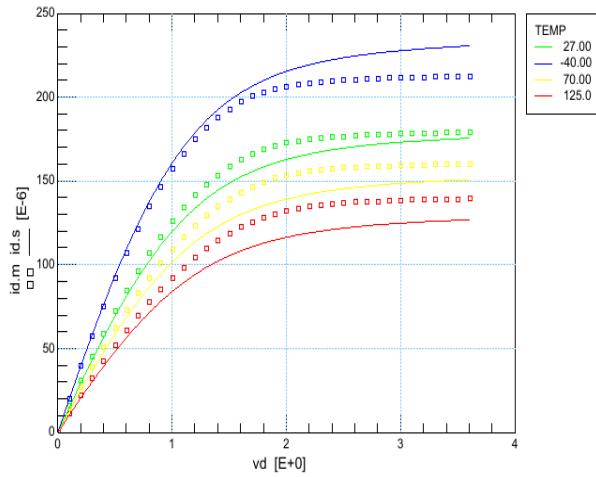
$\log(Id) = f(vg, T) @ \text{low } V_{ds}, V_{bs} = 0$



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

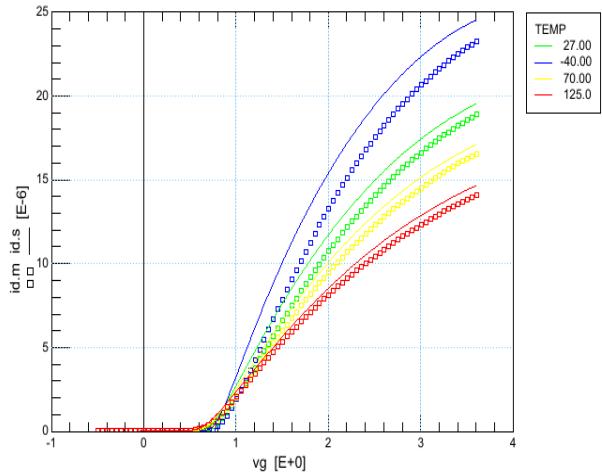


$\log(Id) = f(vg, T) @ \text{low } V_{ds}, V_{bs} = \text{max}$

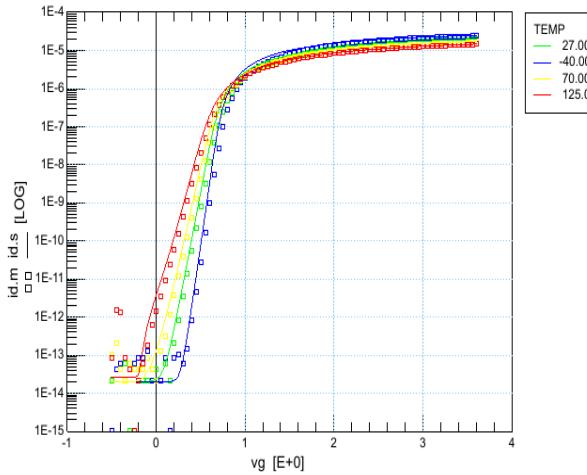


$Id = f(Vd, Vg, T) @ V_{bs} = 0$

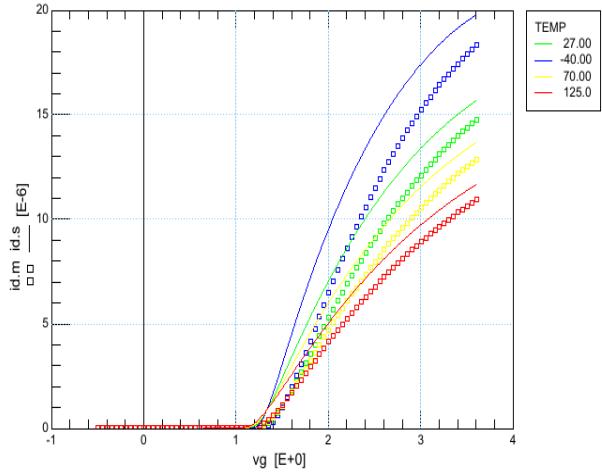
8.1.6 W0u3_L0u5_S560_4



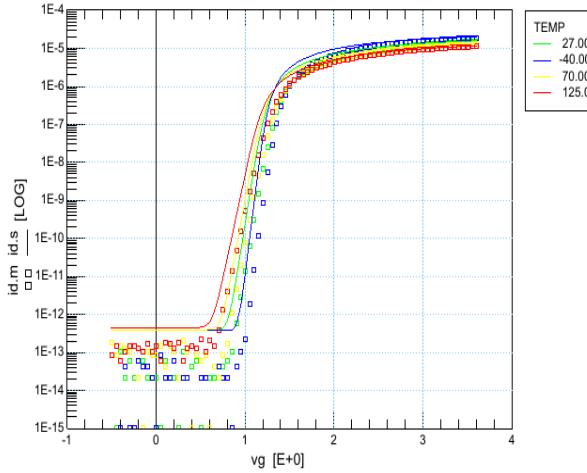
$Id = f(vg, T)$ @ low V_{ds} , $V_{bs} = 0$



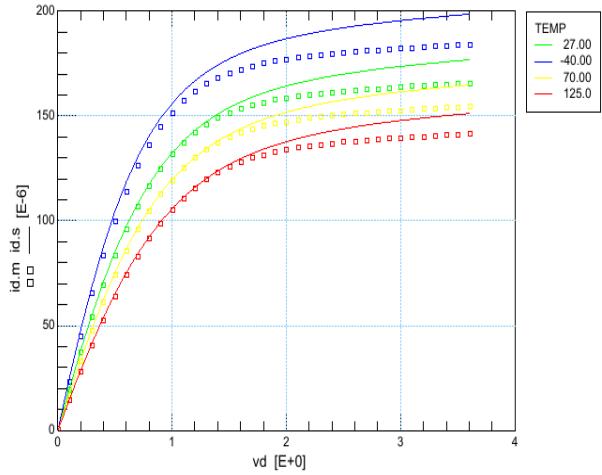
$\log(Id) = f(vg, T)$ @ low V_{ds} , $V_{bs} = 0$



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



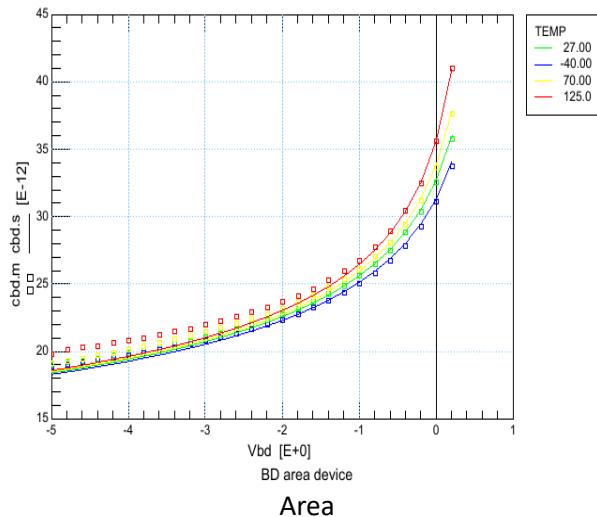
$\log(Id) = f(vg, T)$ @ low V_{ds} , $V_{bs} = \text{max}$



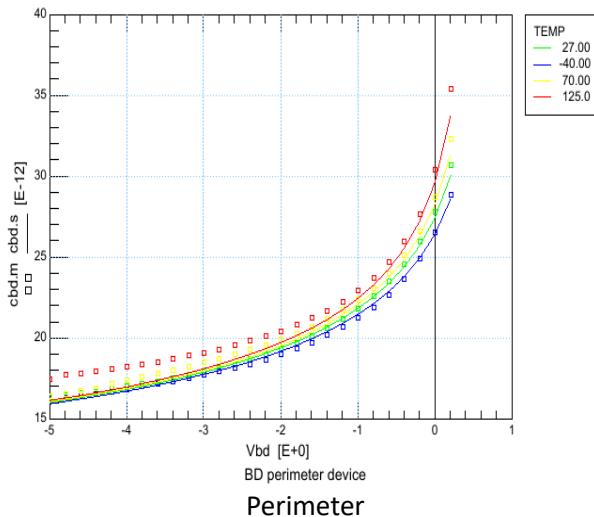
$Id = f(Vd, Vg, T)$ @ $V_{bs} = 0$

8.2 Junction Capacitance

8.2.1 Bulk - Drain

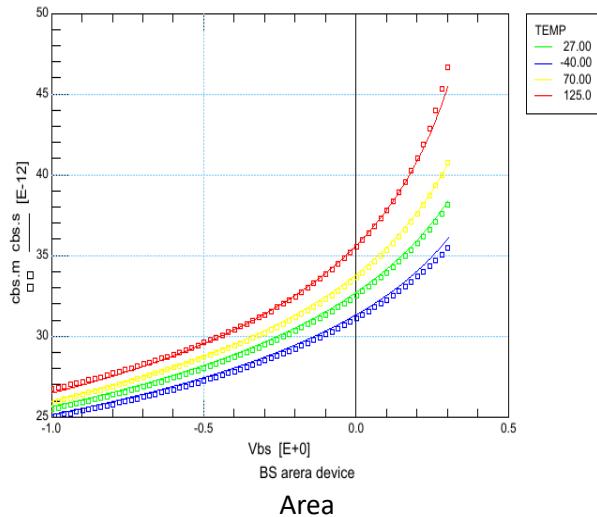


Area

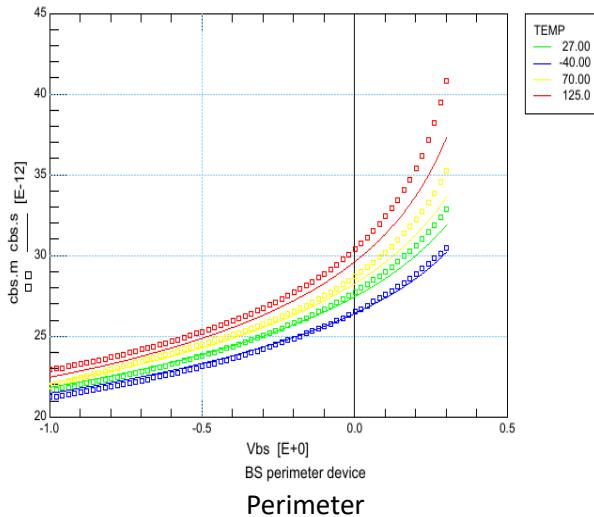


Perimeter

8.2.2 Bulk - Source



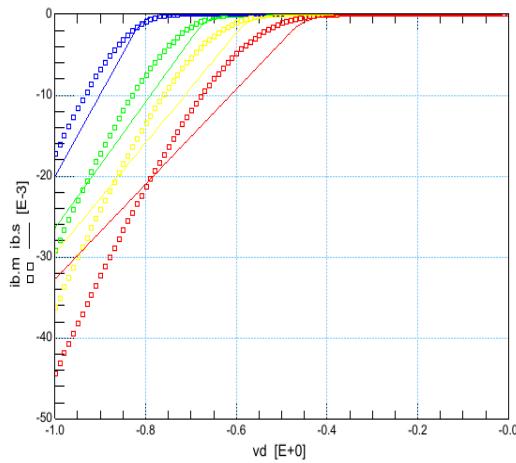
Area



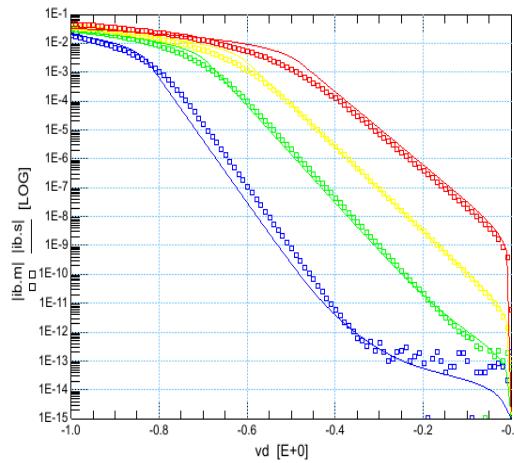
Perimeter

8.3 Parasitic Diodes

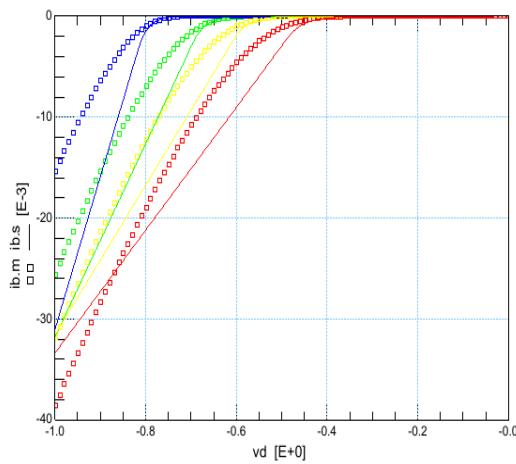
8.3.1 Bulk - Drain



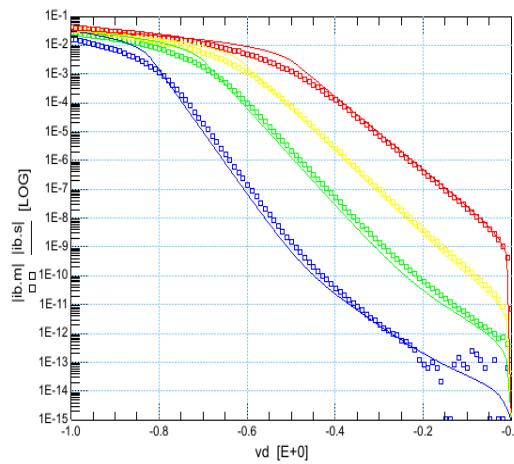
Area



Area

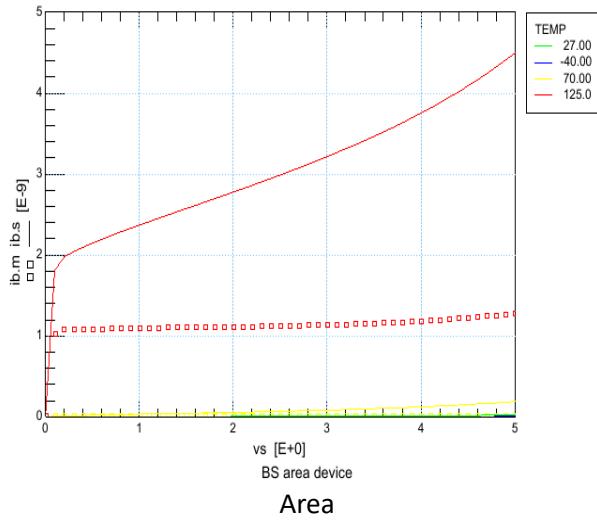


Perimeter

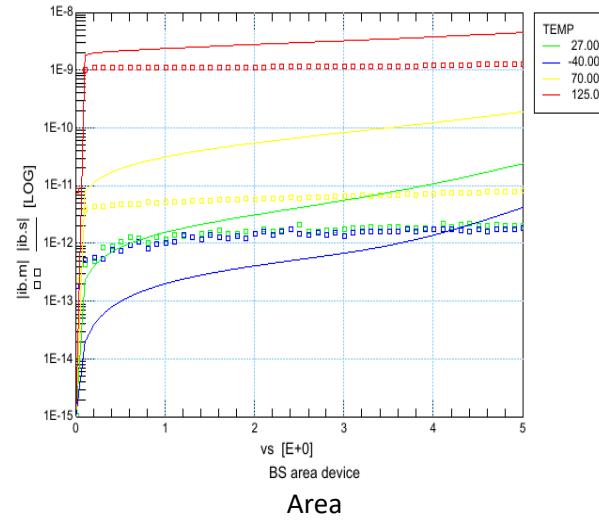


Perimeter

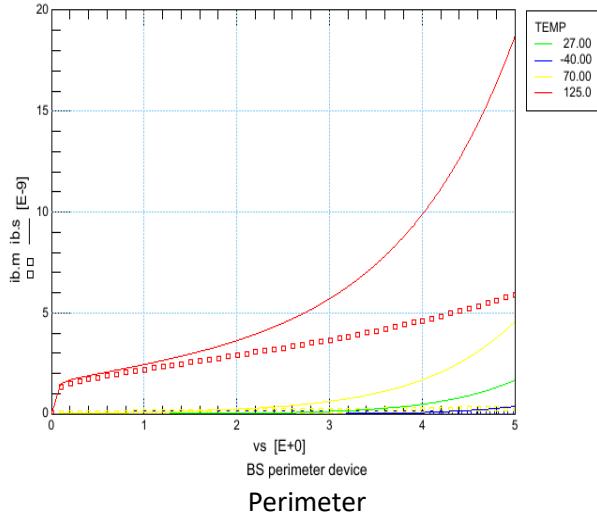
8.3.2 Bulk - Source



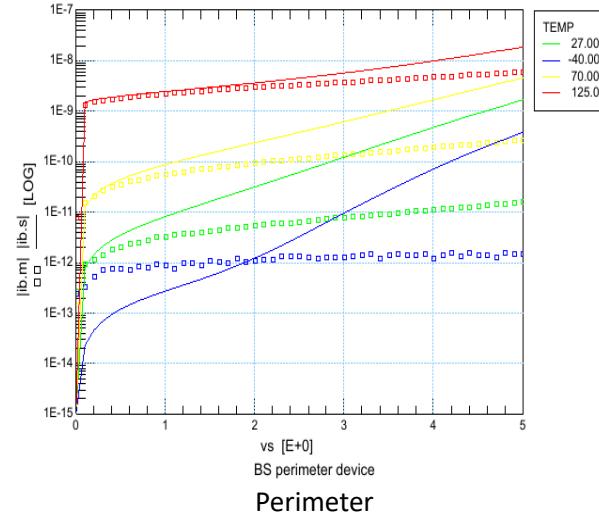
Area



Area



Perimeter



Perimeter

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