

CMOS090 technology HVT MOS transistor models Release DK_MIKRON



SPICE Model Characteristics : L/W/T scalings -

Crosscheck NMOS/PMOS

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TR&D / STD / T2D /

Modeling / CM2A

General information on HVT MOS transistor models

Supply voltage (V_{dd}) is 1.2 V.

Validity domain is defined as follows:

Drawn gate length varies from 0.1 μm to 1 μm .

Drawn transistor width varies from 0.12 μm to 1.0 μm .

Device temperature varies from $-40\text{ }^{\circ}\text{C}$ to $+150\text{ }^{\circ}\text{C}$.

V_{gs} , V_{ds} and V_{bs} vary from 0 V to 1.32 V (i.e. $V_{dd} + 10\%$).

Conditions of simulation

Simulations were done with Bench v3.6.3sram using Eldo simulator v6.7_1.2.

If not explicitly mentioned elsewhere, temperature is set to temp ° C and Vbs to 0 V.

Extra global parameters used:

- hvt_dev = 0

Output parameters definition

In what follows, M, W and L (all default to 1) designate the number of devices in parallel (i.e. multiplication factor), the total drawn gate width and the drawn gate length, respectively.

- **Vt_lin**: Threshold voltage defined as V_{gs} value for which drain current is $40e-9 \text{ A/sq} \cdot M \cdot W / L$ at $V_{ds} = 0.025 \text{ V}$.
- **Vt_sat**: Threshold voltage defined as V_{gs} value for which drain current is $40e-9 \text{ A/sq} \cdot M \cdot W / L$ at $V_{ds} = 1.2 \text{ V}$.
- **Ilow**: Drain current at $V_{gs} = 0.6 \text{ V}$, $V_{ds} = 1.2 \text{ V}$.
- **Ihigh**: Drain current at $V_{gs} = 1.2 \text{ V}$, $V_{ds} = 0.6 \text{ V}$.
- **Ieff**: Average drain current $(I_{low} + I_{high}) / 2$.
- **Ilin**: Drain current at $V_{gs} = 1.2 \text{ V}$, $V_{ds} = 0.025 \text{ V}$.
- **Isat**: Drain current at $V_{gs} = 1.2 \text{ V}$, $V_{ds} = 1.2 \text{ V}$.
- **Ioffsat**: Drain current at $V_{gs} = 0 \text{ V}$, $V_{ds} = 1.2 \text{ V}$.
- **Slp_sat**: Sub-threshold slope at $V_{ds} = 1.2 \text{ V}$, extracted from drain current vs. V_{gs} curve between its minimum and $40e-9 \text{ A/sq} \cdot M \cdot W / L$.
- **Ig_on**: Gate current at $V_{ds} = 0 \text{ V}$ and $V_{gs} = 1.2 \text{ V}$.
- **Ioff_g**: Gate current at $V_{gs} = 0 \text{ V}$, $V_{ds} = 1.2 \text{ V}$.
- **Ioff_s**: Source current at $V_{gs} = 0 \text{ V}$, $V_{ds} = 1.2 \text{ V}$.

- **Ioff_b**: Bulk current at $V_{gs} = 0\text{ V}$, $V_{ds} = 1.2\text{ V}$.
- **Cgg_inv**: Total gate capacitance at $V_{gs} = 1.2\text{ V}$, $V_{ds} = 0\text{ V}$, $f = 100\text{ k Hz}$.
- **Cgg_mean**: Average total gate capacitance for V_{gs} values between 0 V and 1.2 V , $V_{ds} = 0\text{ V}$, $f = 100\text{ k Hz}$.
- **Cgd_0V**: Gate-to-Drain capacitance at $V_{gs} = 0\text{ V}$, $V_{ds} = 0\text{ V}$, $f = 100\text{ k Hz}$.
- **Cbd_off**: Bulk-to-Drain capacitance at $V_{gs} = 0\text{ V}$, $V_{ds} = 0\text{ V}$, $f = 100\text{ k Hz}$.
- **Gm_c**: Drain transconductance at $V_{gs} = V_{t_lin} + 0.2\text{ V}$, $V_{ds} = 0.6\text{ V}$, $f = 100\text{ k Hz}$.
- **Gd_c**: Drain conductance at $V_{gs} = V_{t_lin} + 0.2\text{ V}$, $V_{ds} = 0.6\text{ V}$, $f = 100\text{ k Hz}$.
- **Gain_c**: Voltage gain defined as Gm_c / Gd_c .
- **VtGmmax**: Threshold voltage at $V_{ds} = 0.025\text{ V}$ derived from Gm max method.

NHVT

Electrical characteristics per geometry

**nhvt W=1.0e-6 L=0.1e-6 po2act=0.63e-6 tometer=1 lpe=0 @
temp=25**

	HVT_SS	HVT_TT	HVT_FF
Vt_lin [mV]	528	478	425
Vt_sat [mV]	451	392	328
Ilin [uA]	34.721	40.862	48.041
Isat [uA]	329.34	400.36	483.97
Ioffsat [pA]	2.8096	10.507	50.708
Slp_sat [mV/dec]	86.36	84.9	83.62
Ig_on [pA]	2.0086	4	7.9656
Ioff_g [pA]	-0.39429	-0.77565	-1.5291
Ioff_s [pA]	-2.4153	-9.7316	-49.178
Ioff_b [aA]	-14.282	-85.197	-705.2
Cgg_inv [fF]	1.4468	1.4021	1.3529
Cggmean [fF]	1.2039	1.1938	1.1801
Cgd_0V [aF]	401.99	410.18	419.06
Cbd_off [aF]	859	756.51	649.6
Gm_c [uS]	286.27	322.26	366.98

**nhvt W=1.0e-6 L=0.1e-6 po2act=0.63e-6 tometer=1 lpe=0 @
temp=25**

	HVT_SS	HVT_TT	HVT_FF
Gain_c []	18.639	16.302	13.964
VtGmmax [mV]	620	571	519

**nhvt W=0.12e-6 L=0.1e-6 po2act=0.63e-6 tometer=1 lpe=0 @
temp=25**

	HVT_SS	HVT_TT	HVT_FF
Vt_lin [mV]	452	397	339
Vt_sat [mV]	374	311	242
Ilin [uA]	4.3527	5.5504	7.048
Isat [uA]	42.603	55.287	71.123
Ioffsat [pA]	2.4473	11.169	65.428
Slp_sat [mV/dec]	86.49	85.26	84.18
Ig_on [fA]	250.2	539.1	1154.8
Ioff_g [fA]	-40.981	-87.625	-186.28
Ioff_s [pA]	-2.4063	-11.082	-65.242
Ioff_b [aA]	-6.2937	-29.111	-192.14
Cgg_inv [aF]	243.58	248.11	251.09
Cggmean [aF]	219.67	226.28	232.04
Cgd_0V [aF]	74.83	78.589	82.614
Cbd_off [aF]	117.59	109.82	99.324
Gm_c [uS]	31.868	37.996	45.814

**nhvt W=0.12e-6 L=0.1e-6 po2act=0.63e-6 tometer=1 lpe=0 @
temp=25**

	HVT_SS	HVT_TT	HVT_FF
Gain_c []	18.547	16.305	14.014
VtGmmax [mV]	546	496	442

**nhvt W=1.0e-6 L=1.0e-6 po2act=0.63e-6 tometer=1 lpe=0 @
temp=25**

	HVT_SS	HVT_TT	HVT_FF
Vt_lin [mV]	400	357	315
Vt_sat [mV]	375	332	290
Ilin [uA]	4.8449	5.3509	5.8902
Isat [uA]	58.99	69.55	81.442
Ioffsat [pA]	1.032	2.7088	7.6444
Slp_sat [mV/dec]	79.09	77.65	76.28
Ig_on [pA]	22.812	47.487	98.608
Ioff_g [pA]	-0.39429	-0.77565	-1.5291
Ioff_s [pA]	-0.63767	-1.933	-6.1145
Ioff_b [aA]	-30.758	-134.05	-848.48
Cgg_inv [fF]	12.035	12.369	12.716
Cggmean [fF]	8.8549	9.3583	9.8987
Cgd_0V [aF]	458.67	477.42	507.58
Cbd_off [aF]	864.55	767.1	670.05
Gm_c [uS]	25.523	26.929	28.598

**nhvt W=1.0e-6 L=1.0e-6 po2act=0.63e-6 tometer=1 lpe=0 @
temp=25**

	HVT_SS	HVT_TT	HVT_FF
Gain_c []	113.85	114.36	114.81
VtGmmax [mV]	506	465	424

PHVT

Electrical characteristics per geometry

**phvt W=1.0e-6 L=0.1e-6 po2act=0.63e-6 tometer=1 lpe=0 @
temp=25**

	HVT_SS	HVT_TT	HVT_FF
Vt_lin [mV]	539	504	466
Vt_sat [mV]	445	394	333
Ilin [uA]	9.103	10.543	12.281
Isat [uA]	129.63	160.02	199.78
Ioffsat [pA]	2.8669	10.38	50.332
Slp_sat [mV/dec]	85.47	84.95	84.61
Ig_on [fA]	502.13	1030.1	2122.2
Ioff_g [fA]	-28.181	-51.549	-93.466
Ioff_s [pA]	-2.8387	-10.328	-50.238
Ioff_b [fA]	-0.017891	-0.13288	-1.2239
Cgg_inv [fF]	1.3654	1.3169	1.2643
Cggmean [fF]	1.167	1.1484	1.126
Cgd_0V [aF]	377.27	384.6	392.5
Cbd_off [aF]	841.74	739.12	632.29
Gm_c [uS]	128.95	148.24	173.3

**phvt W=1.0e-6 L=0.1e-6 po2act=0.63e-6 tometer=1 lpe=0 @
temp=25**

	HVT_SS	HVT_TT	HVT_FF
Gain_c []	13.872	11.406	9.1263
VtGmmax [mV]	546	519	490

**phvt W=0.12e-6 L=0.1e-6 po2act=0.63e-6 tometer=1 lpe=0 @
temp=25**

	HVT_SS	HVT_TT	HVT_FF
Vt_lin [mV]	539	500	459
Vt_sat [mV]	444	390	327
Ilin [uA]	1.0633	1.3173	1.6319
Isat [uA]	15.424	20.352	27.002
Ioffsat [fA]	353.16	1359.7	6946.7
Slp_sat [mV/dec]	85.5	84.98	84.49
Ig_on [fA]	60.391	132.85	291.68
Ioff_g [fA]	-3.3817	-6.6351	-12.829
Ioff_s [pA]	-0.34977	-1.3531	-6.9335
Ioff_b [aA]	-3.6727	-32.654	-327.16
Cgg_inv [aF]	234.05	237.46	239.3
Cggmean [aF]	212.04	217.27	221.53
Cgd_0V [aF]	71.961	75.297	78.781
Cbd_off [aF]	123.28	113.99	102.01
Gm_c [uS]	15.434	18.643	22.86

**phvt W=0.12e-6 L=0.1e-6 po2act=0.63e-6 tometer=1 lpe=0 @
temp=25**

	HVT_SS	HVT_TT	HVT_FF
Gain_c []	13.822	11.444	9.1911
VtGmmax [mV]	544	517	488

**phvt W=1.0e-6 L=1.0e-6 po2act=0.63e-6 tometer=1 lpe=0 @
temp=25**

	HVT_SS	HVT_TT	HVT_FF
Vt_lin [mV]	458	430	401
Vt_sat [mV]	430	402	374
Ilin [uA]	1.0163	1.0924	1.1728
Isat [uA]	13.536	15.202	17.028
Ioffsat [fA]	197.62	402.38	828.76
Slp_sat [mV/dec]	77.69	77.14	76.63
Ig_on [pA]	3.2987	6.9832	14.792
Ioff_g [fA]	-107.54	-211.25	-415.93
Ioff_s [fA]	-90.065	-191.01	-411.67
Ioff_b [fA]	-0.01427	-0.12019	-1.1673
Cgg_inv [fF]	11.818	12.129	12.453
Cggmean [fF]	8.4486	8.832	9.2385
Cgd_0V [aF]	427.14	436.92	448.26
Cbd_off [aF]	843.32	741.59	636.14
Gm_c [uS]	10.782	11.403	12.015

**phvt W=1.0e-6 L=1.0e-6 po2act=0.63e-6 tometer=1 lpe=0 @
temp=25**

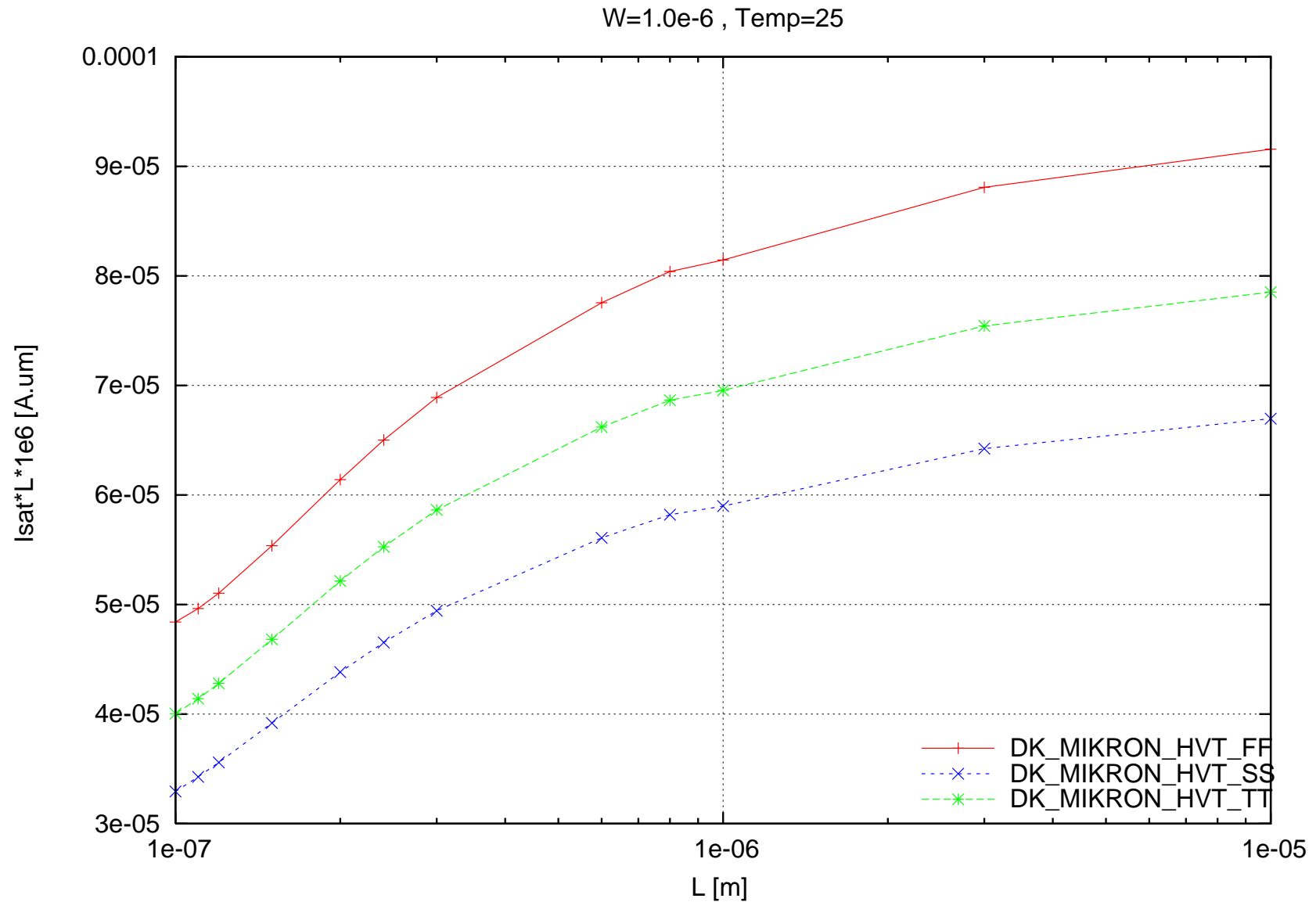
	HVT_SS	HVT_TT	HVT_FF
Gain_c []	129.39	128.85	128.73
VtGmmax [mV]	449	422	396

NHVT

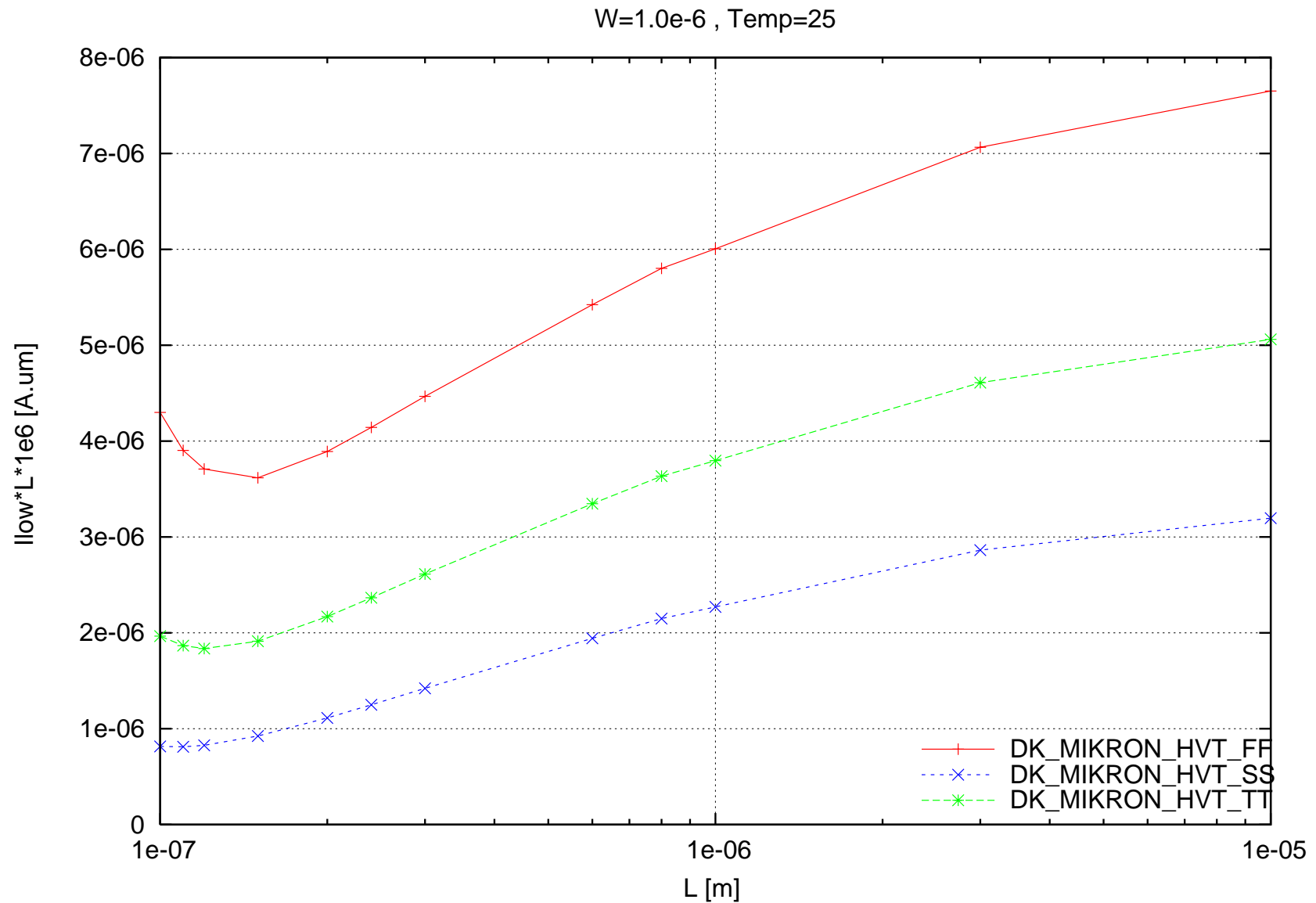
Electrical characteristics scaling

Scaling versus Length for NMOS ($W=1.0e-6$, Temp=25, $po2act=0.63e-6$, LPE=0)

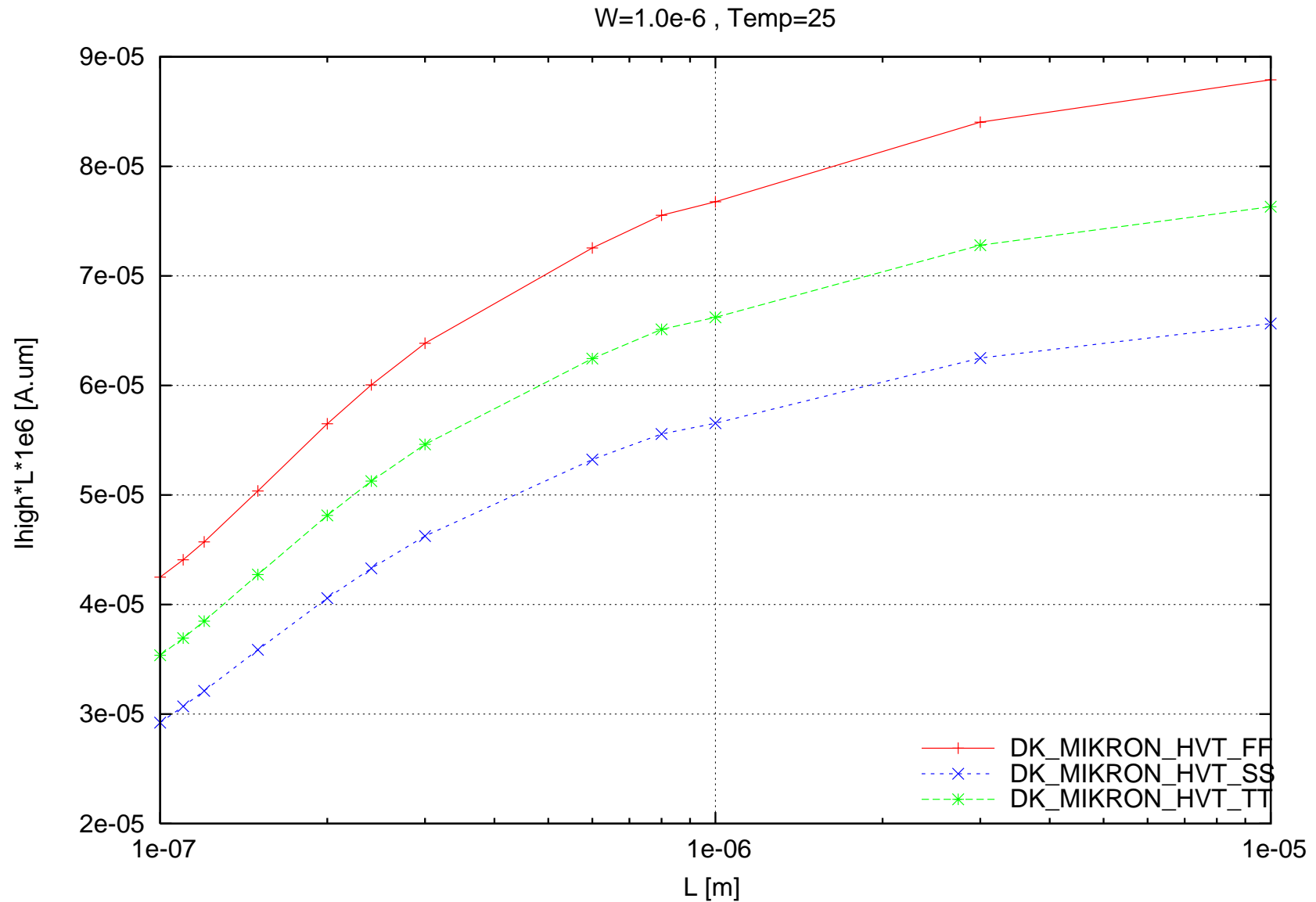
nhvt Isat*L*1e6 [A.um] vs. L [m] , W=1.0e-6 , Temp=25



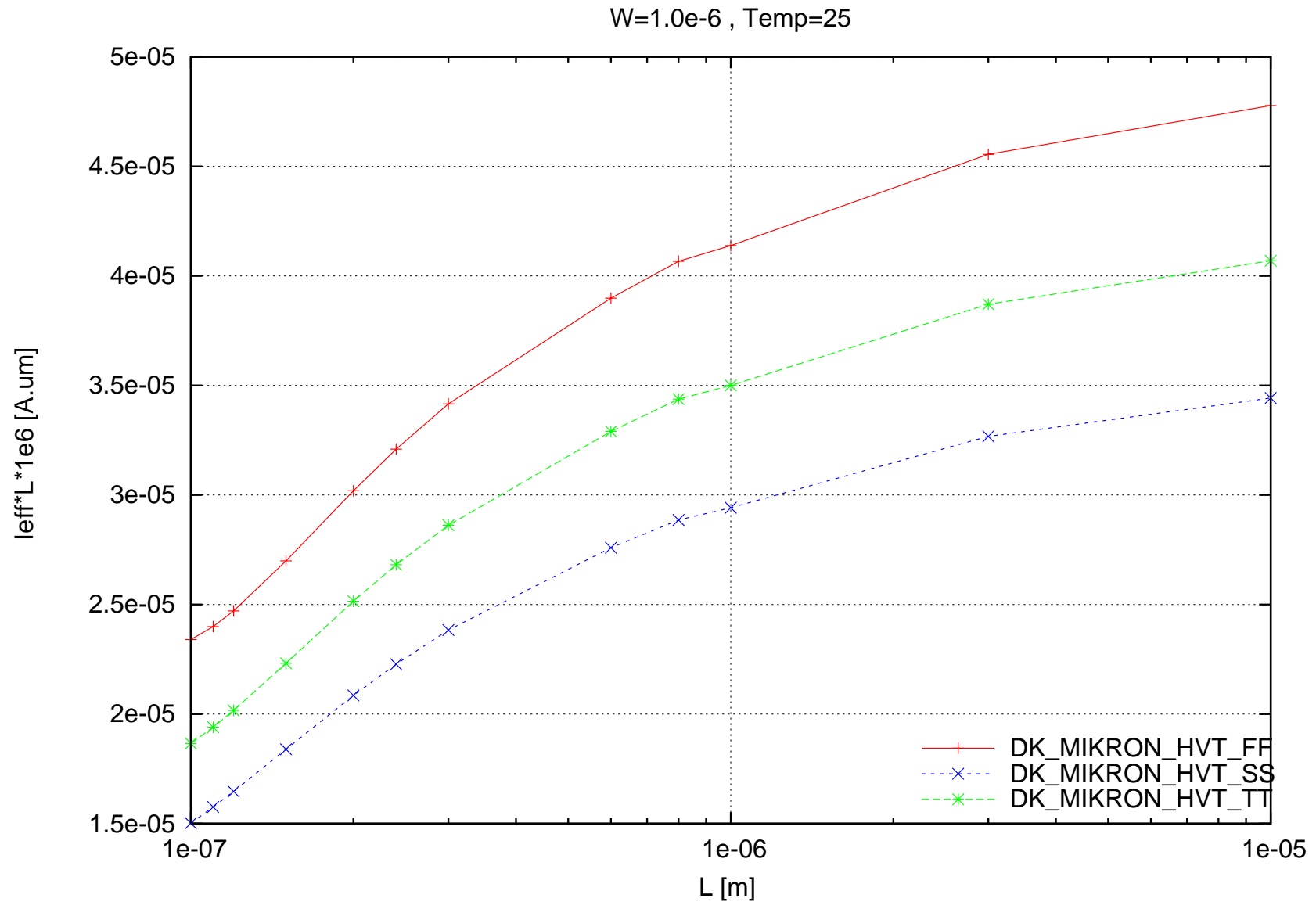
nhvt $I_{low} * L * 1e6$ [A.um] vs. L [m] , $W=1.0e-6$, Temp=25



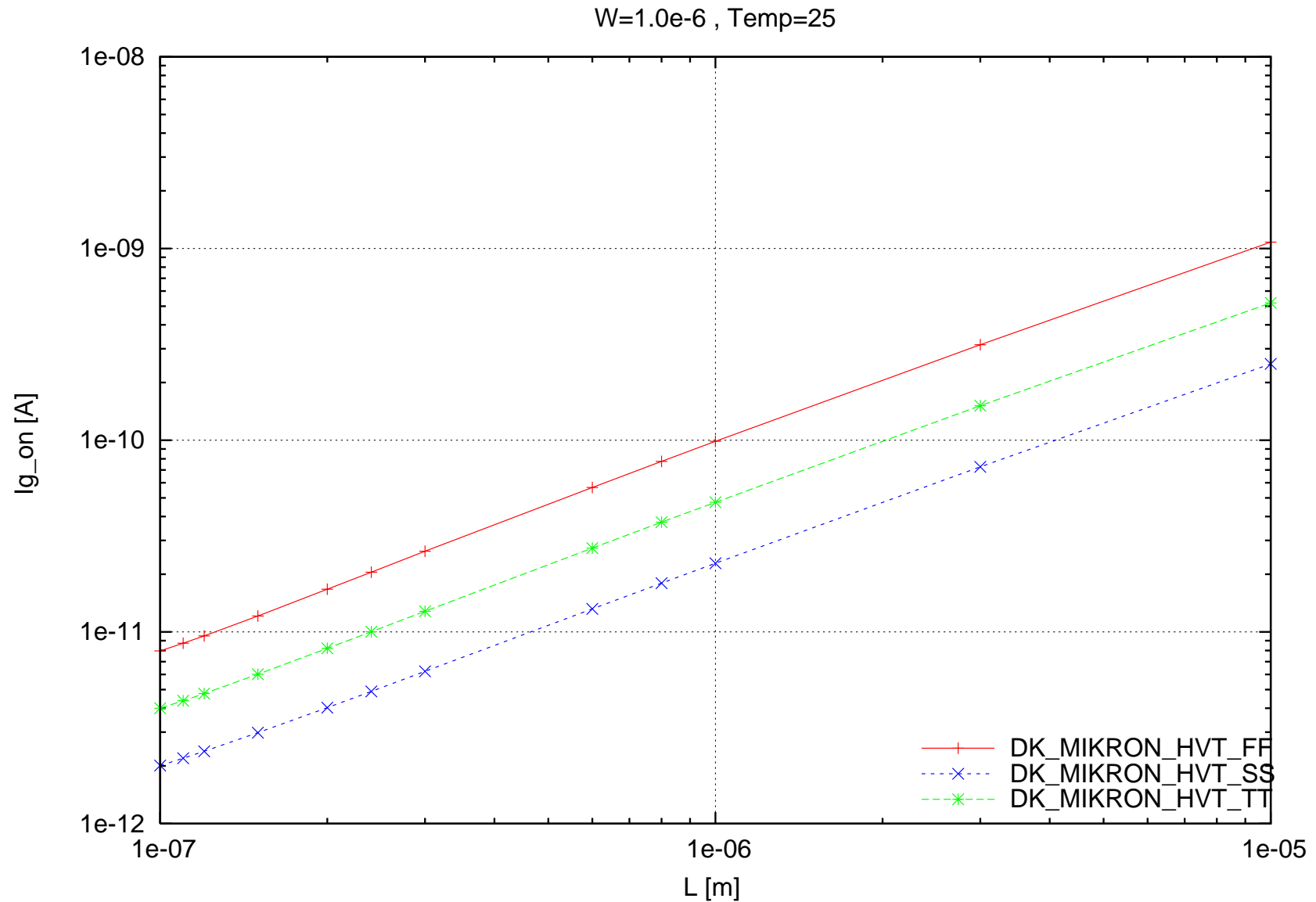
nhvt lhigh*L*1e6 [A.um] vs. L [m] , W=1.0e-6 , Temp=25



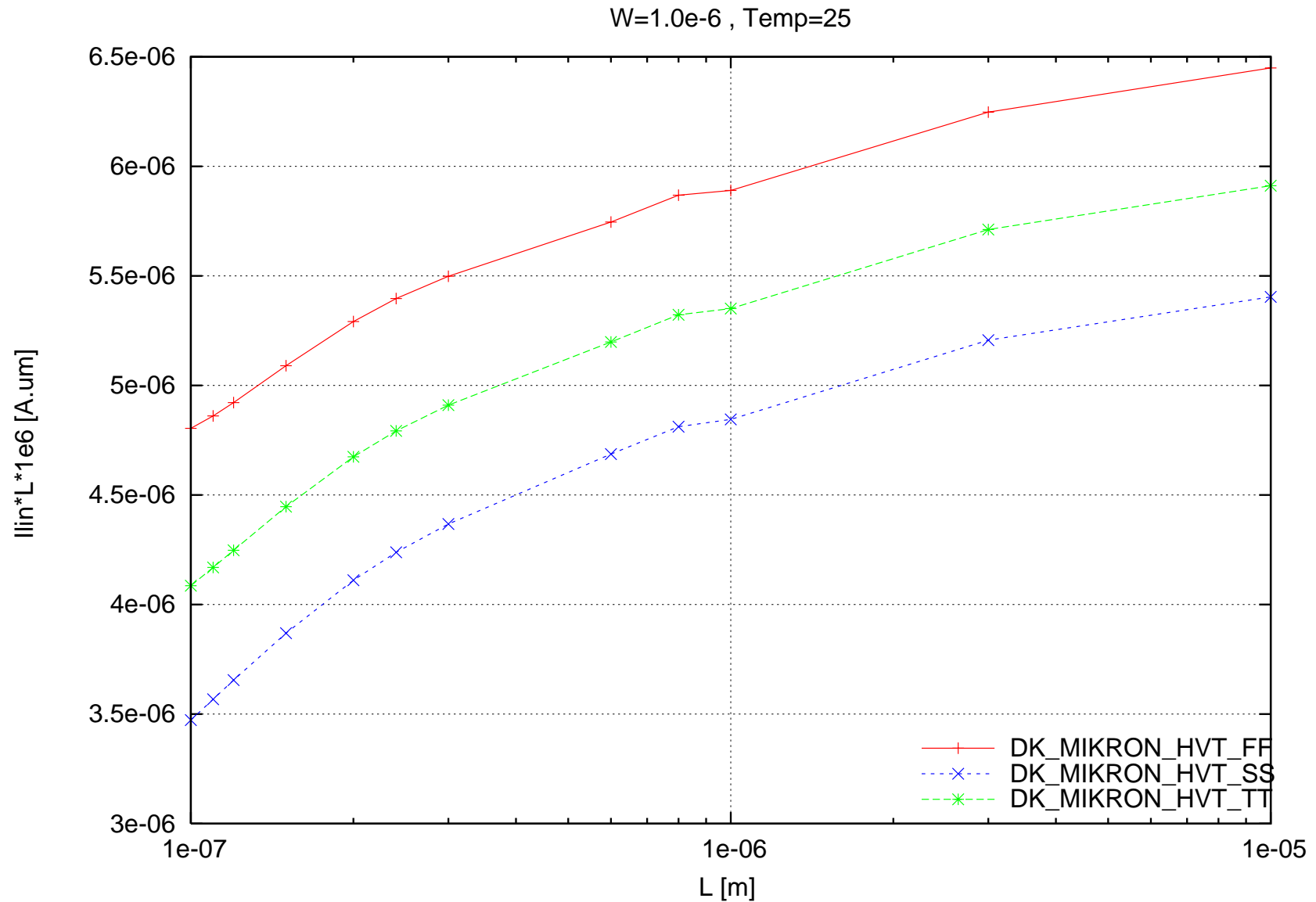
nhvt leff*L*1e6 [A.um] vs. L [m] , W=1.0e-6 , Temp=25



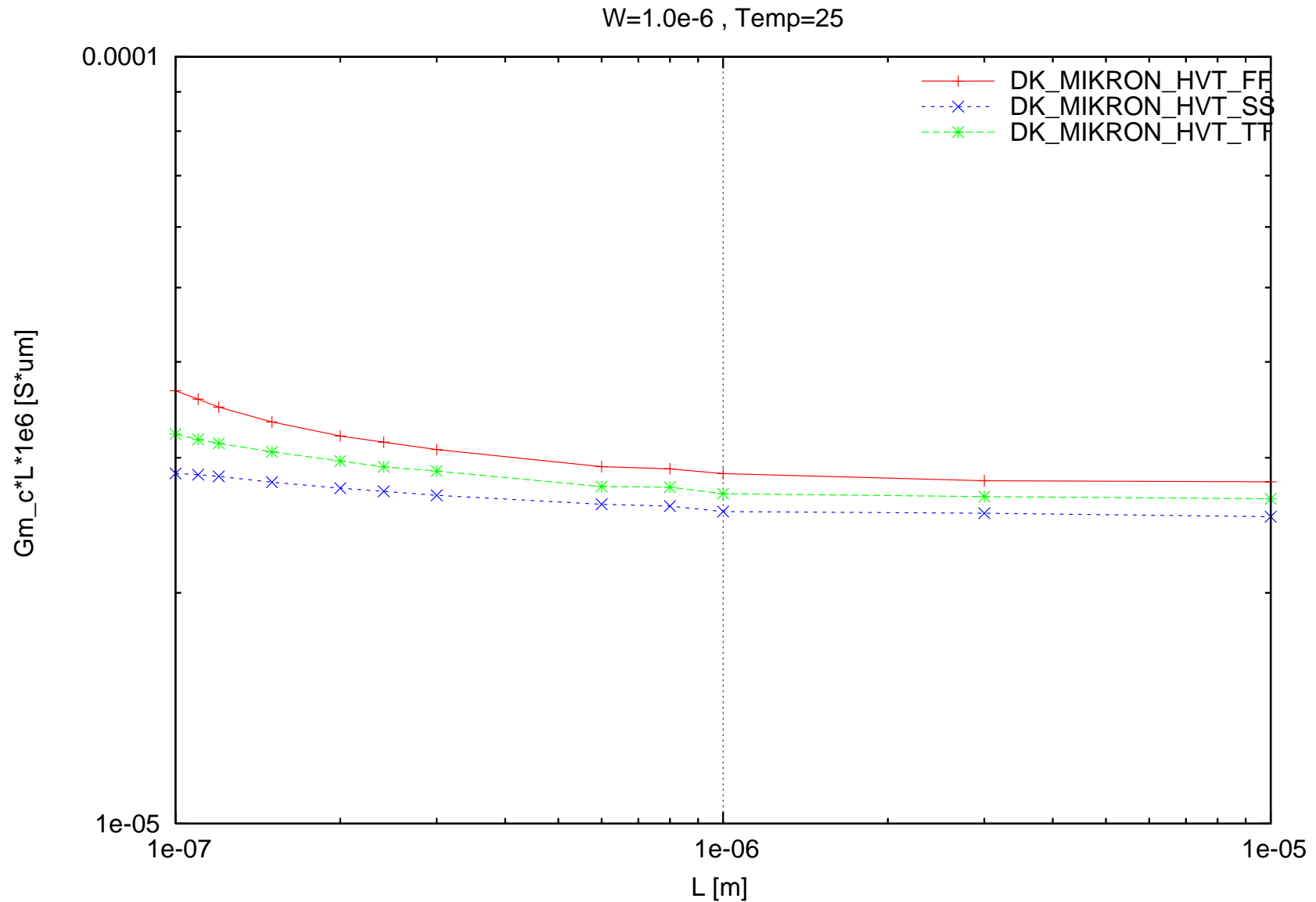
nhvt Ig_on [A] vs. L [m] , W=1.0e-6 , Temp=25



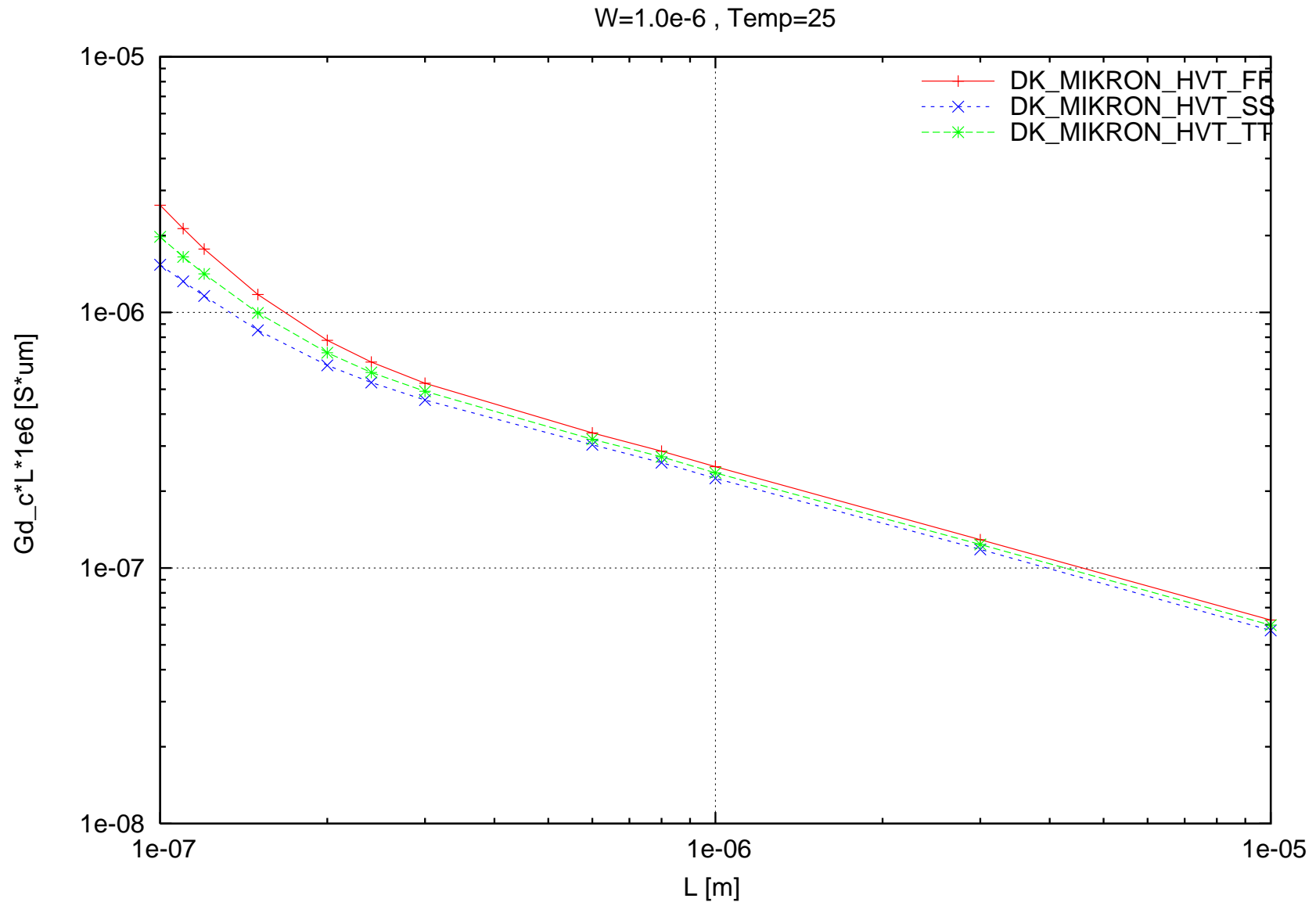
nhvt Ilin*L*1e6 [A.um] vs. L [m] , W=1.0e-6 , Temp=25



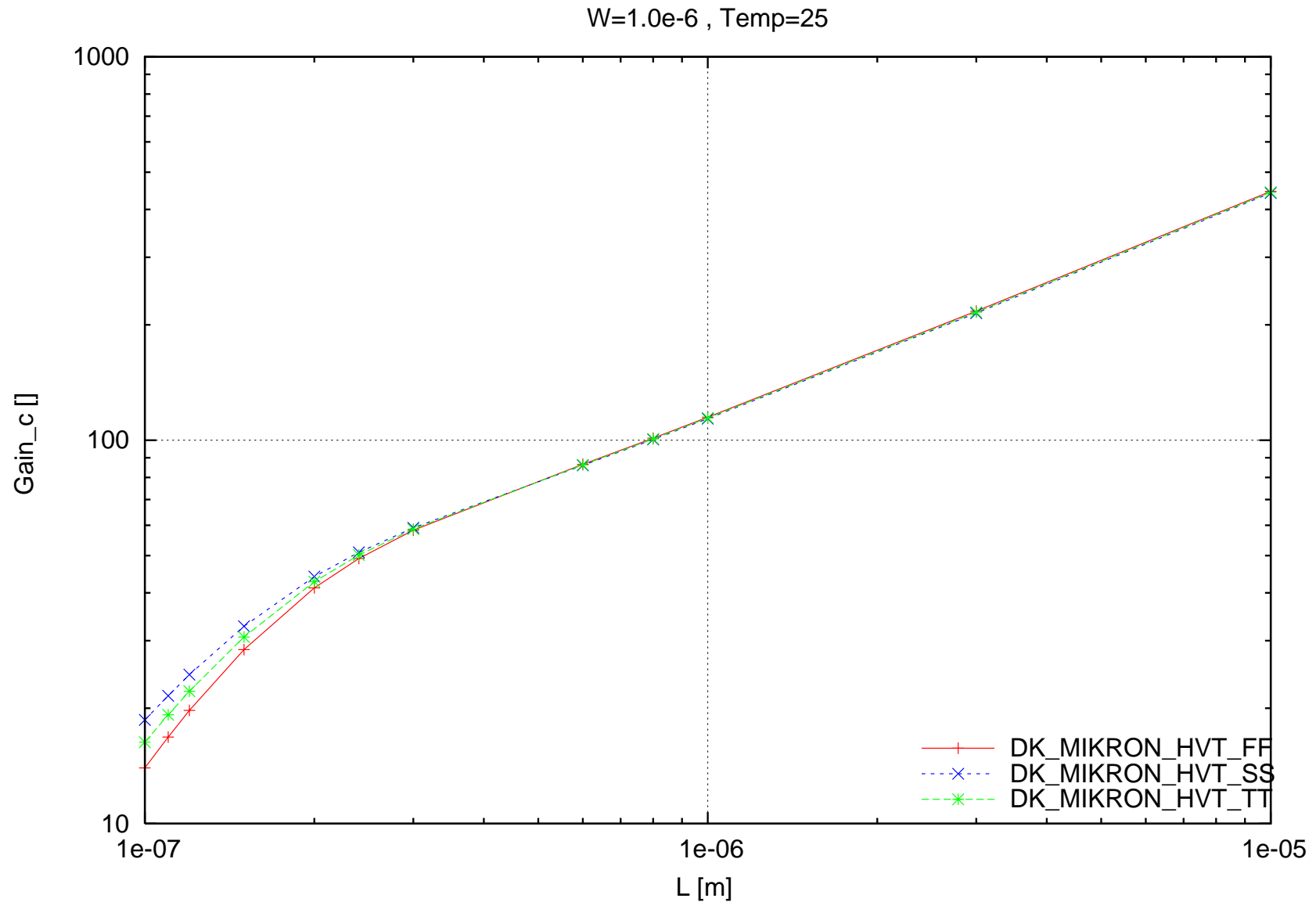
nhvt Gm_c*L*1e6 [S*um] vs. L [m] , W=1.0e-6 , Temp=25



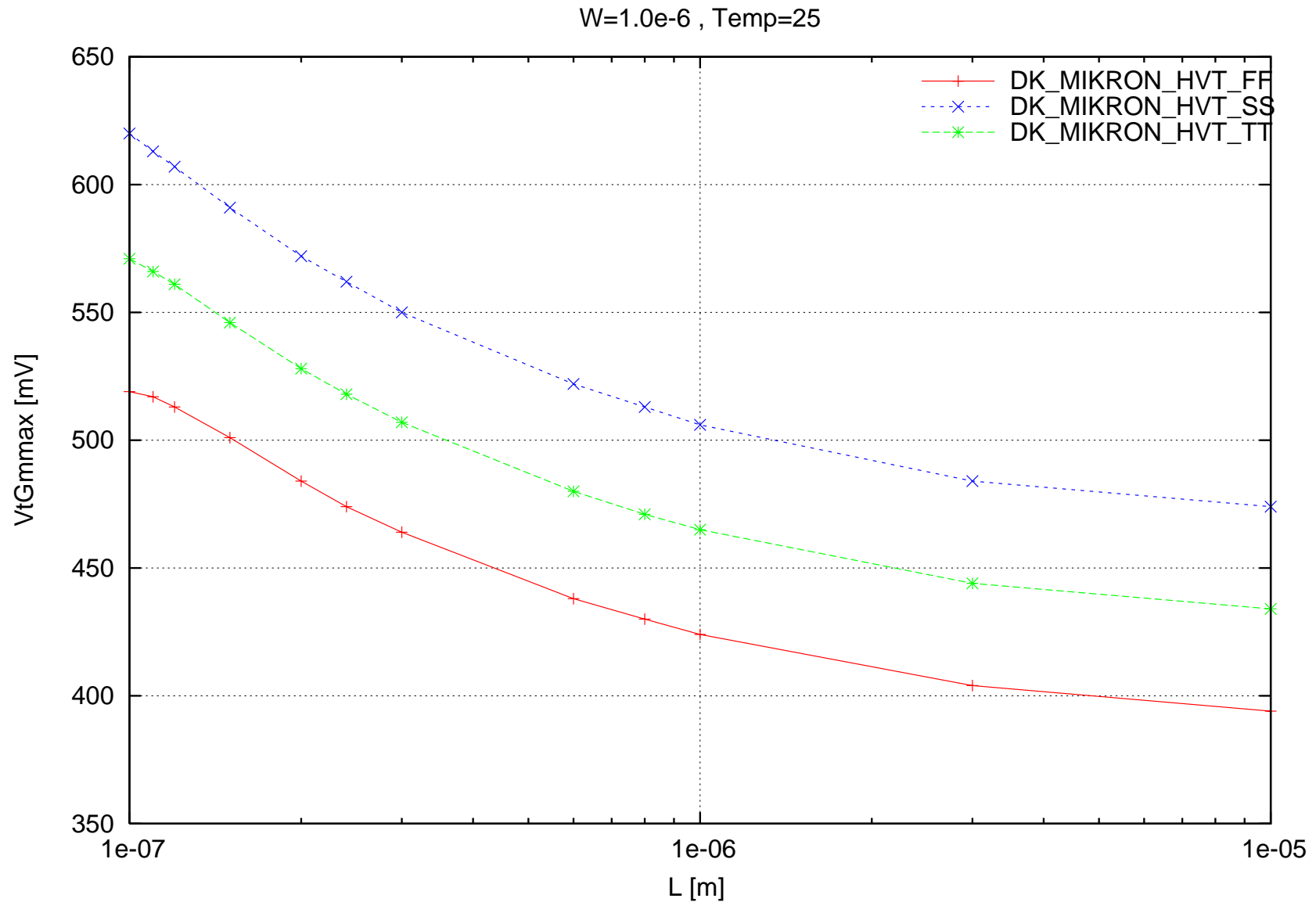
nhvt Gd_c*L*1e6 [S*um] vs. L [m] , W=1.0e-6 , Temp=25



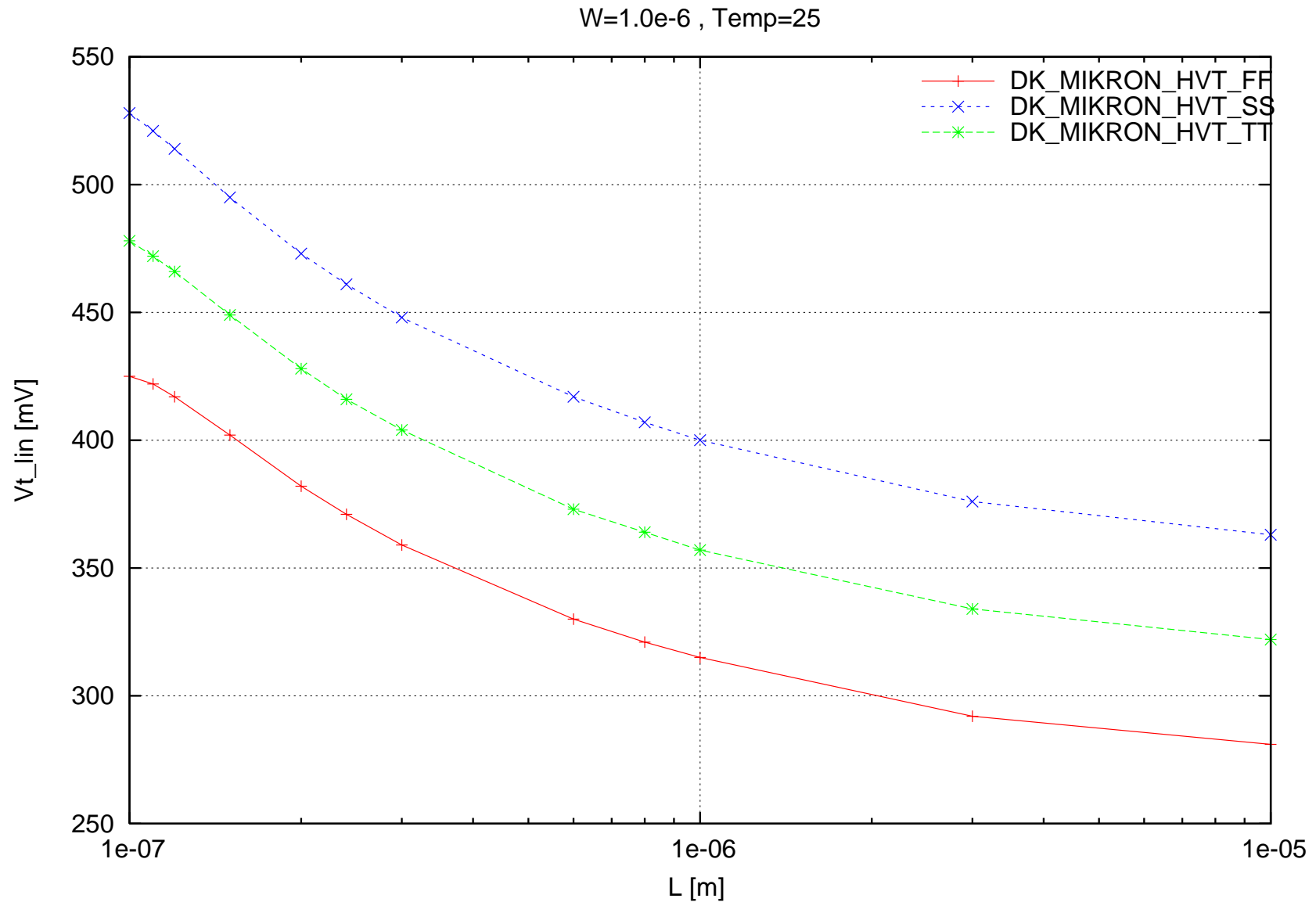
nhvt Gain_c [] vs. L [m] , W=1.0e-6 , Temp=25



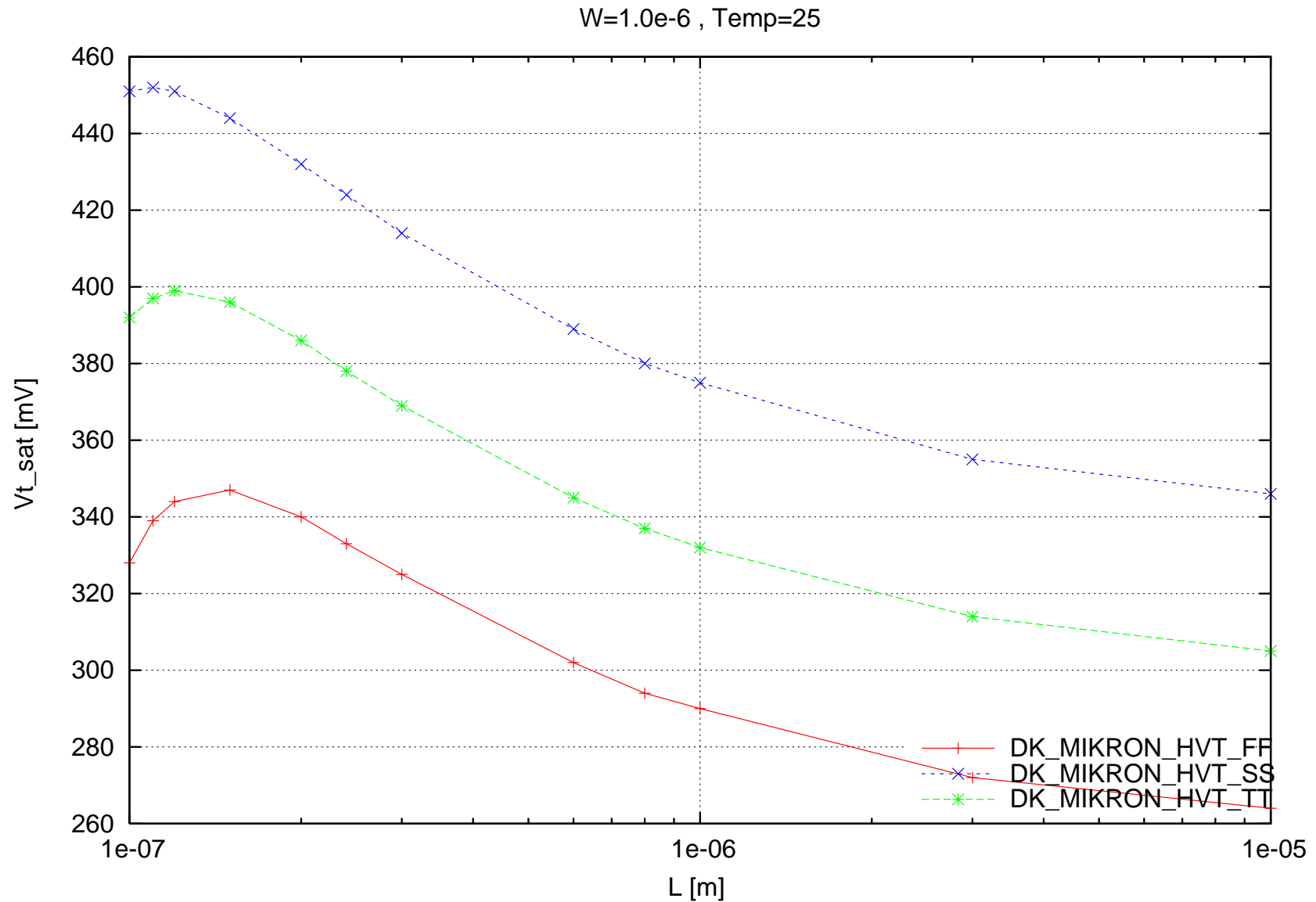
nhvt V_{tGmax} [mV] vs. L [m] , $W=1.0e-6$, $Temp=25$



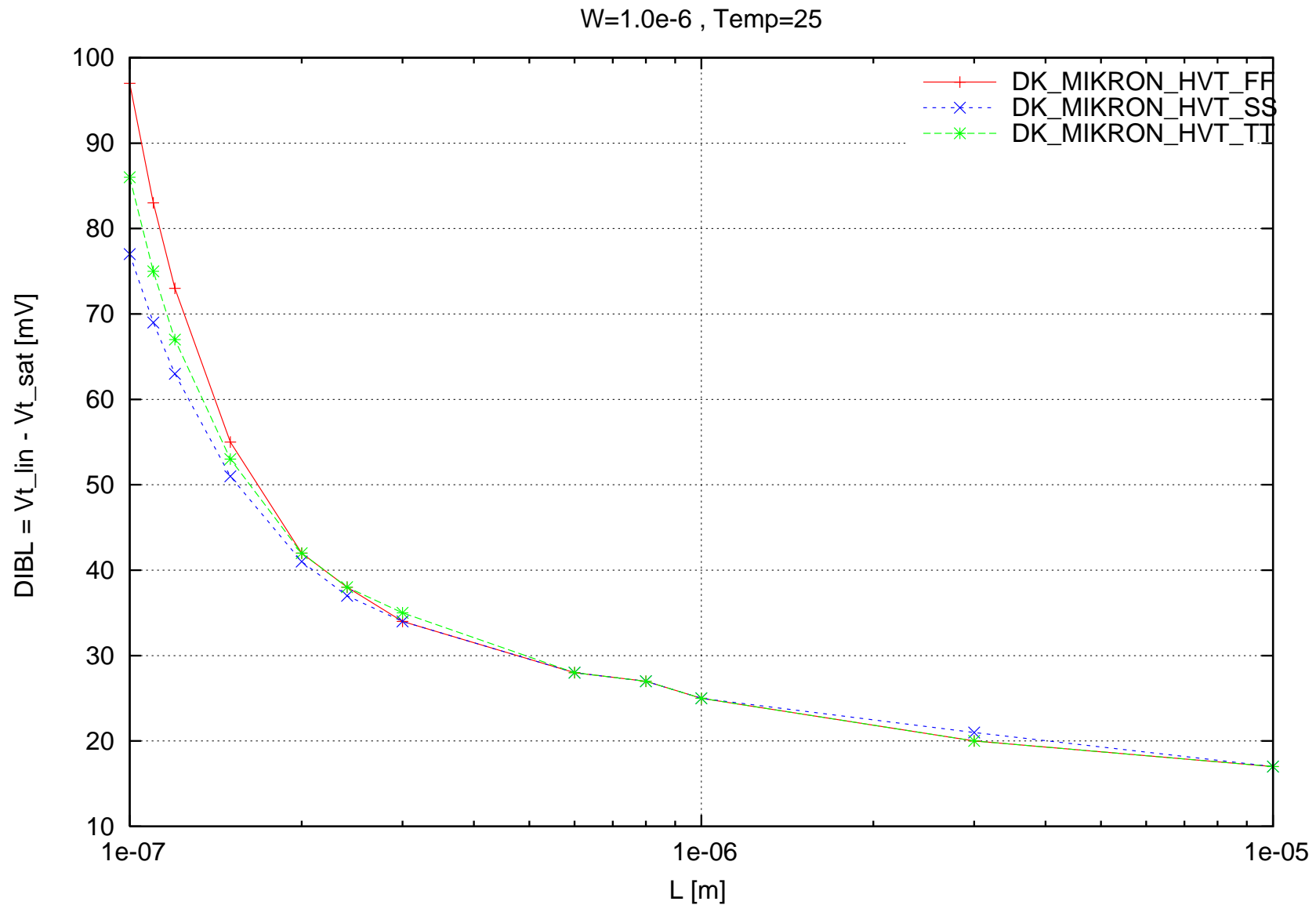
nhvt Vt_lin [mV] vs. L [m] , W=1.0e-6 , Temp=25



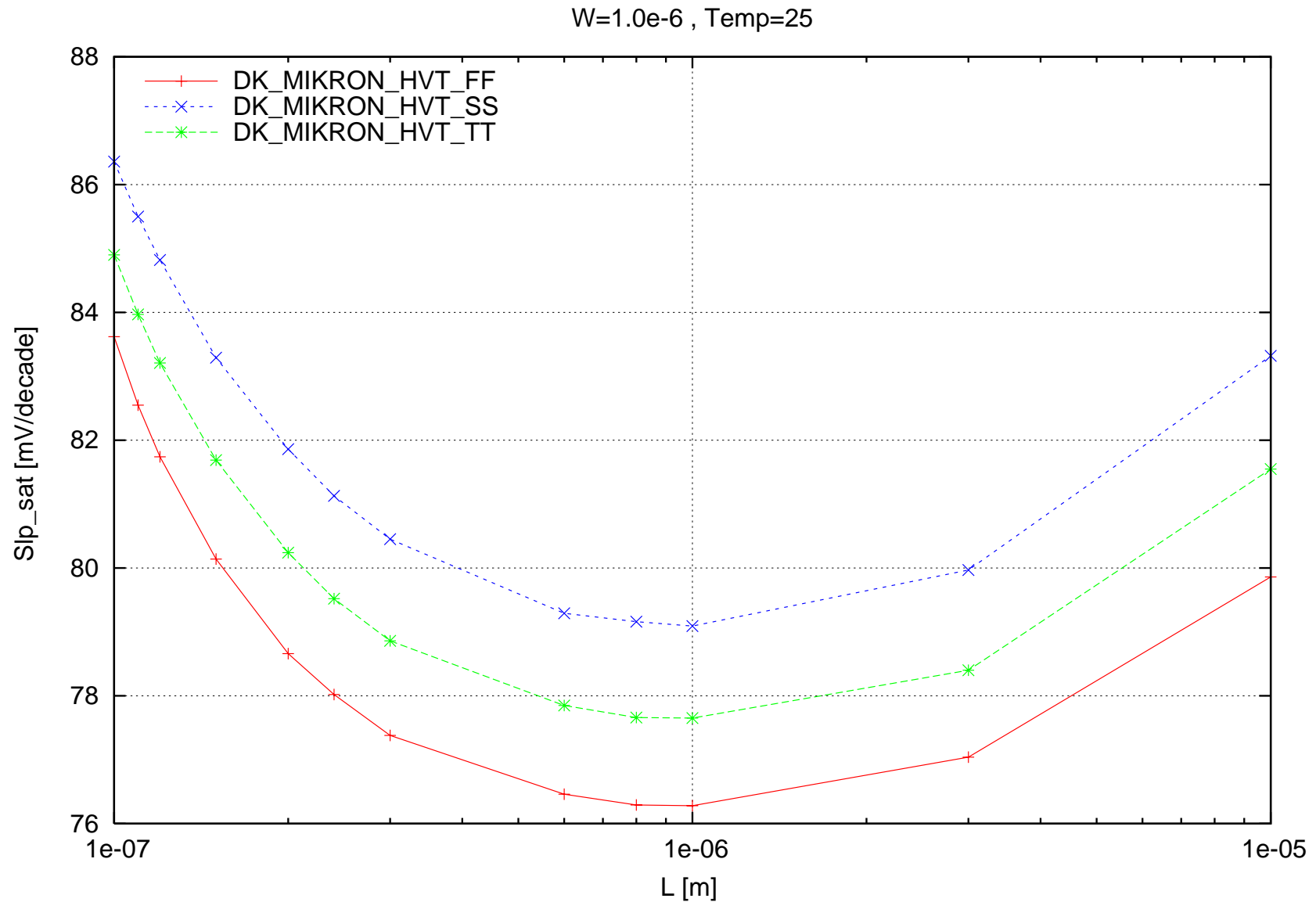
nhvt Vt_sat [mV] vs. L [m] , W=1.0e-6 , Temp=25



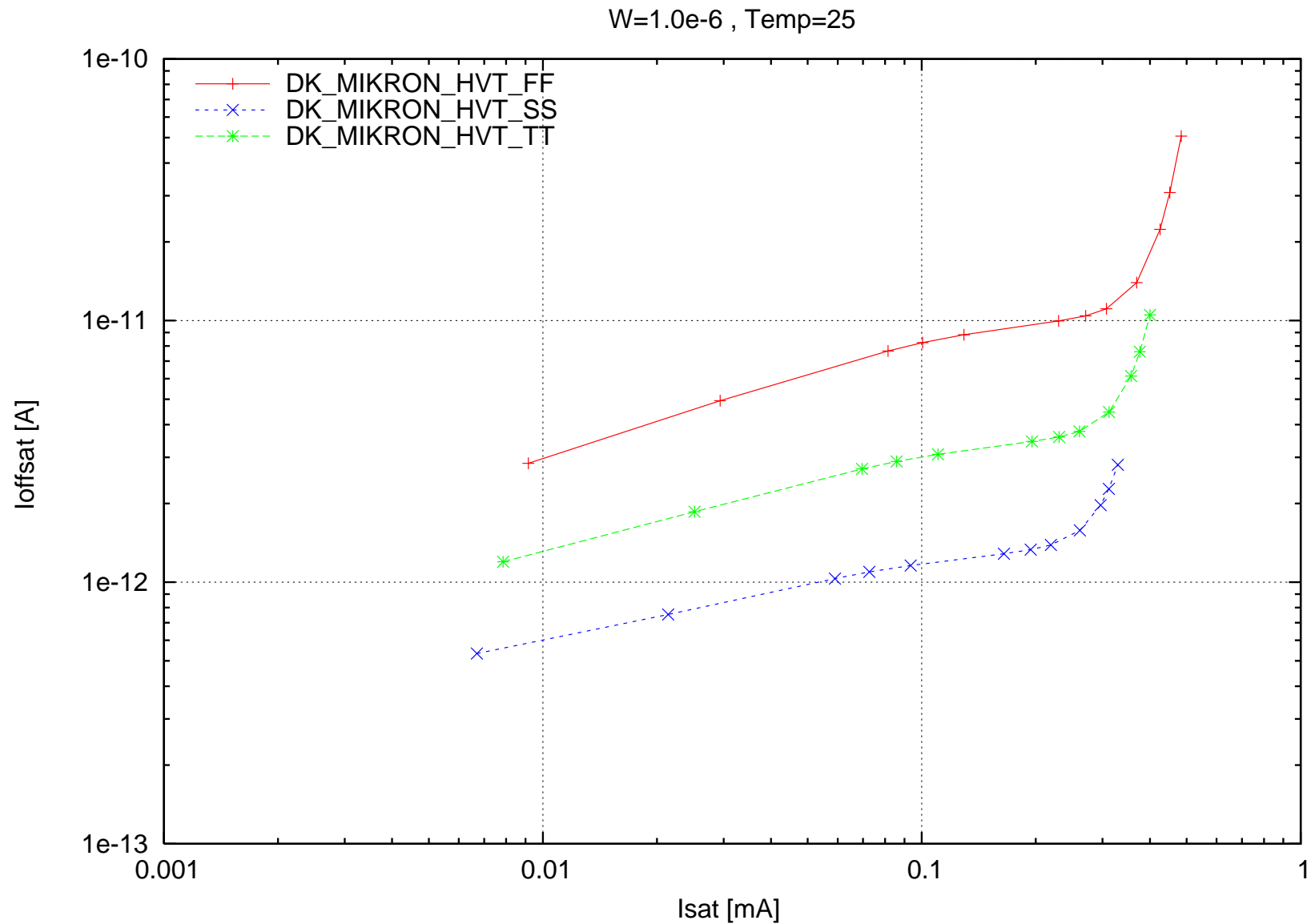
nhvt DIBL = $V_{t_lin} - V_{t_sat}$ [mV] vs. L [m] , $W=1.0e-6$, Temp=25



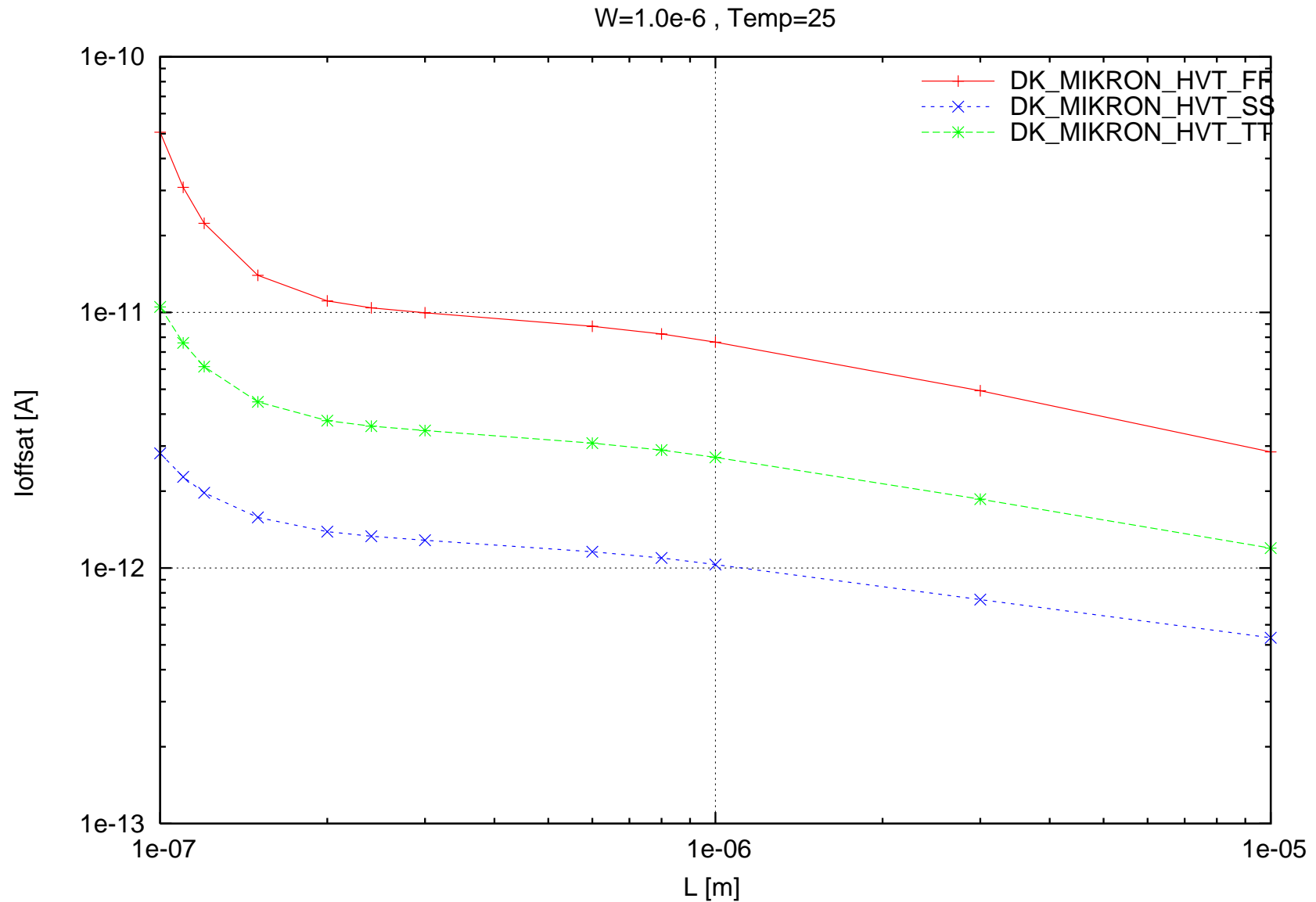
nhvt Slp_sat [mV/decade] vs. L [m] , W=1.0e-6 , Temp=25



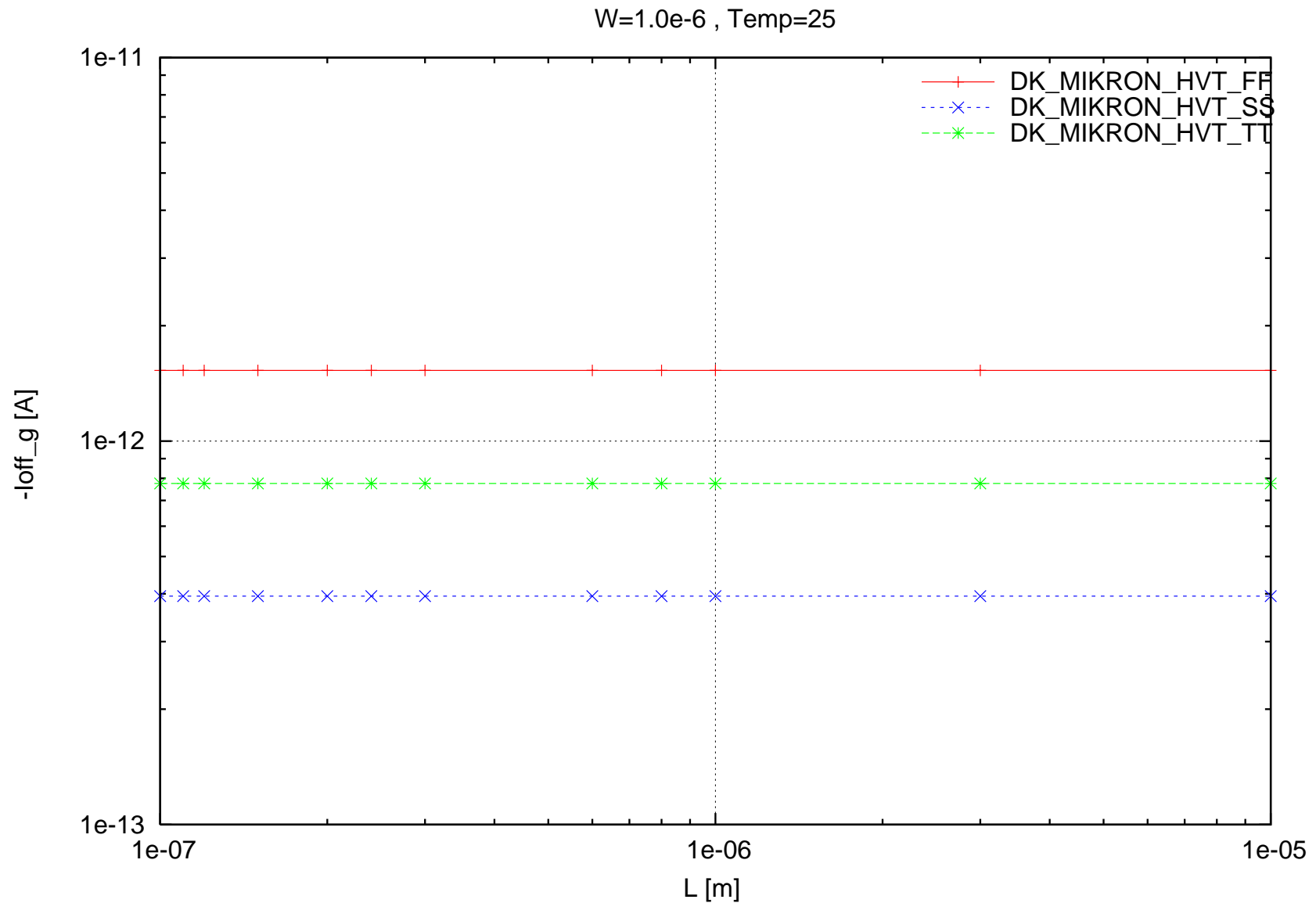
nhvt loffsat [A] vs. Isat [mA] , W=1.0e-6 , Temp=25



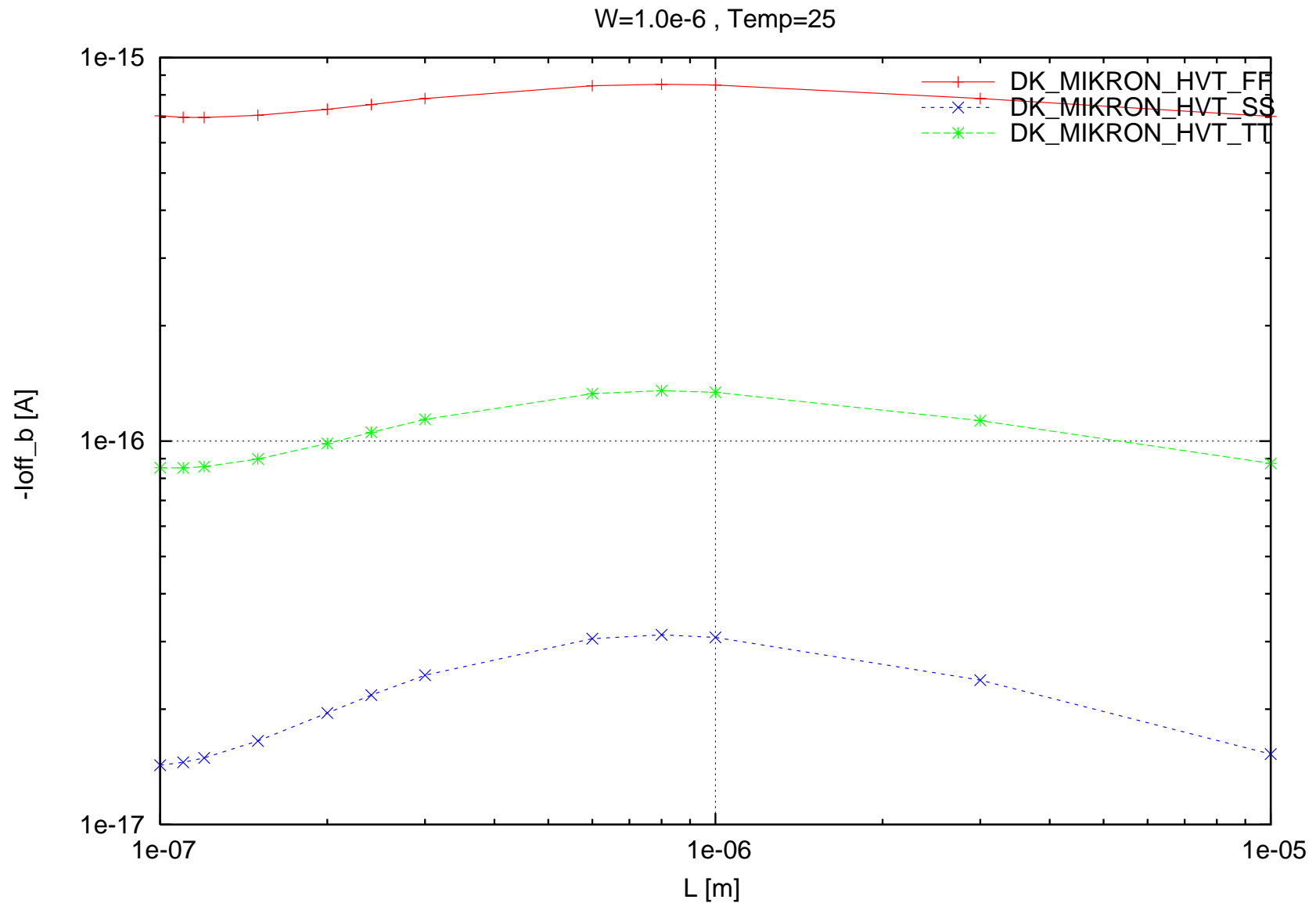
nhvt loffsat [A] vs. L [m] , W=1.0e-6 , Temp=25



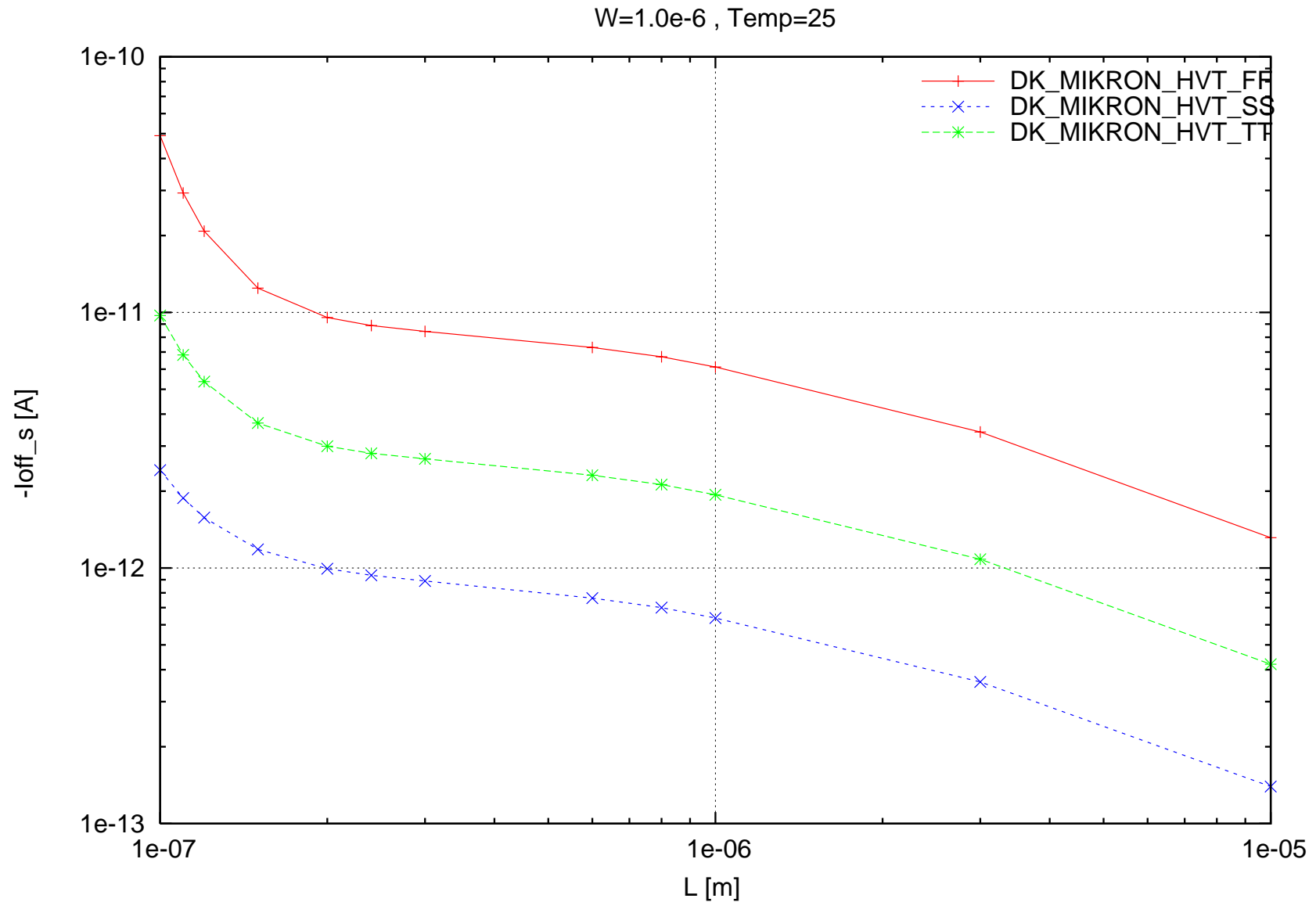
nhvt -loff_g [A] vs. L [m] , W=1.0e-6 , Temp=25



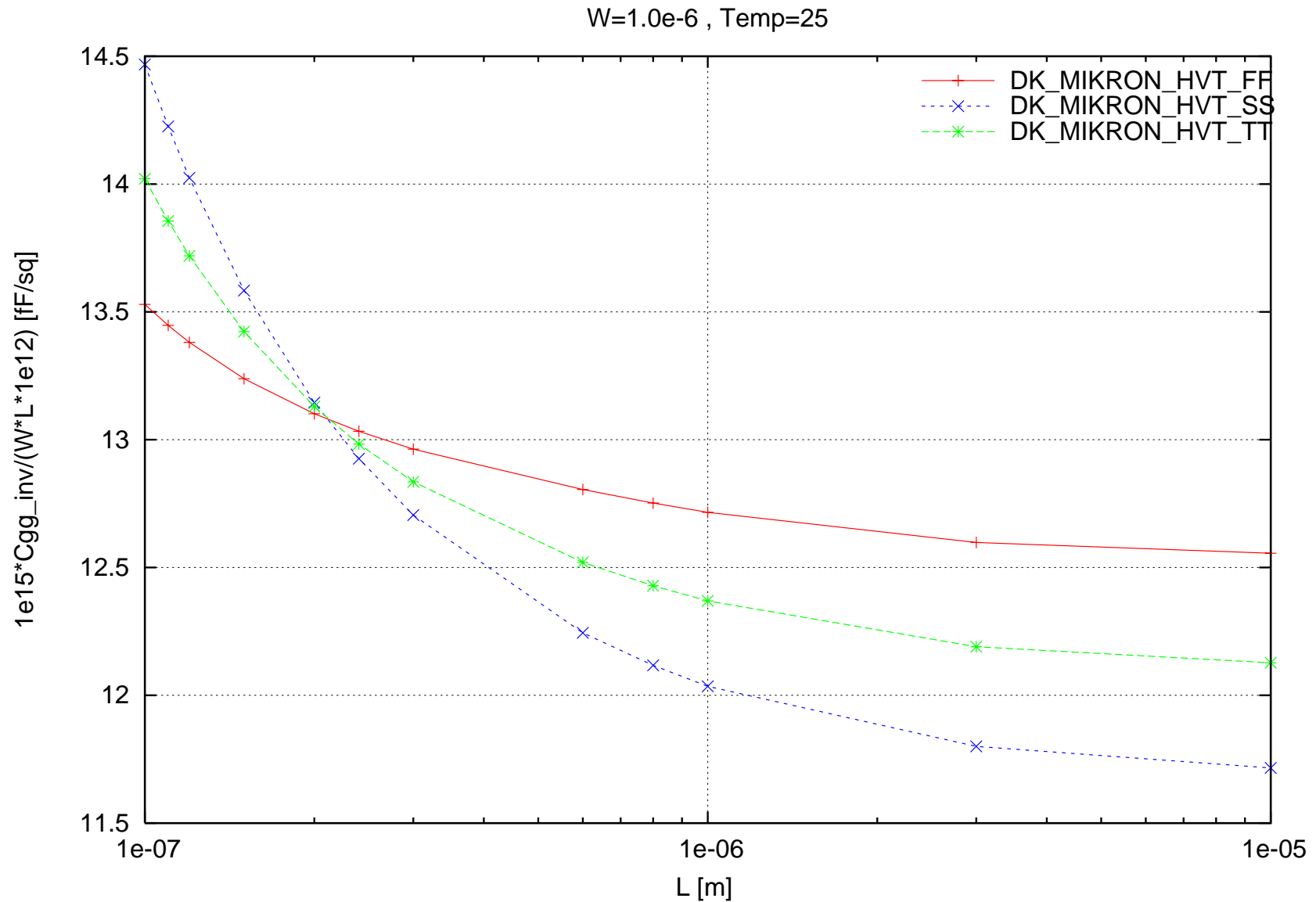
nhvt -loff_b [A] vs. L [m] , W=1.0e-6 , Temp=25



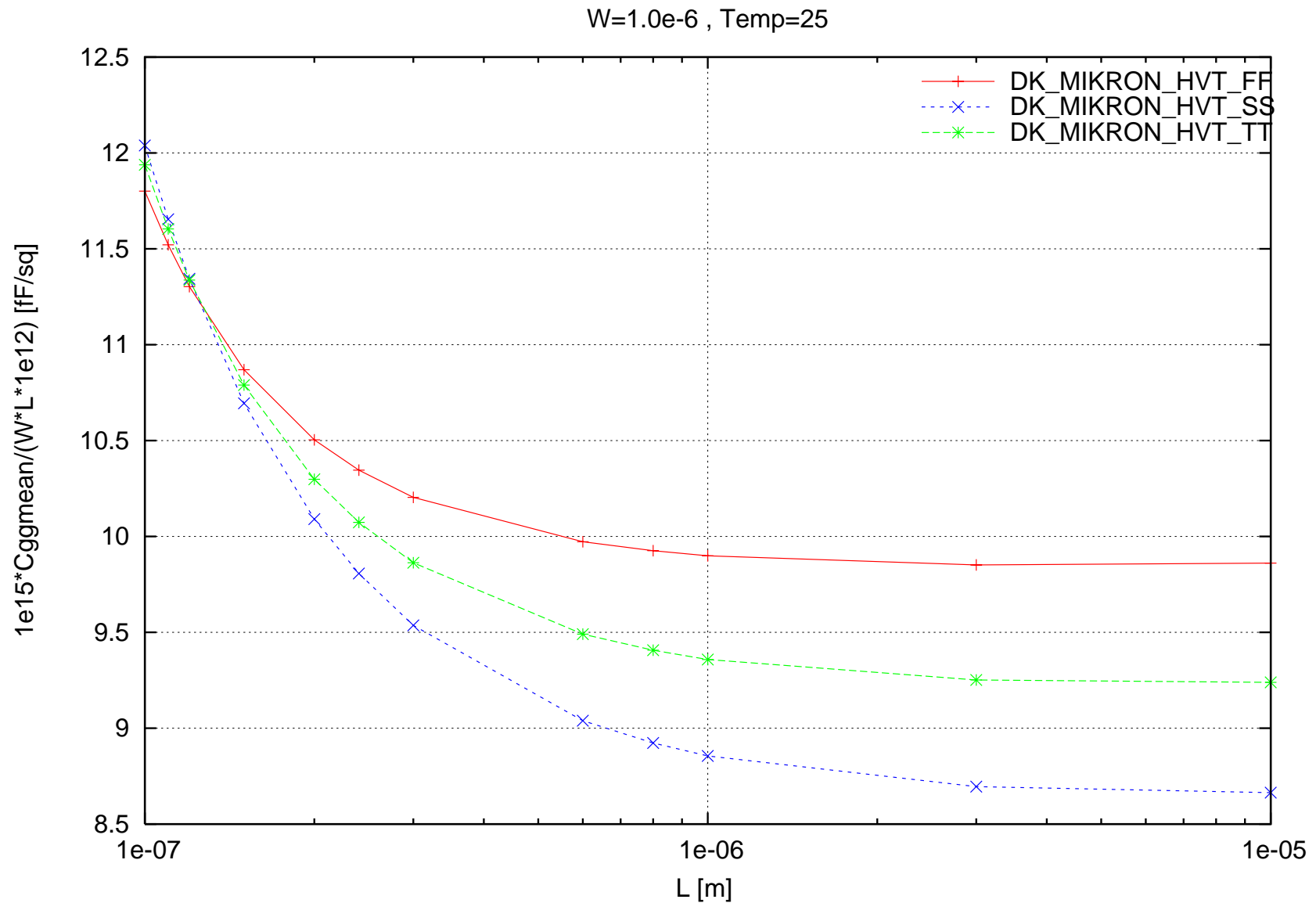
nhvt -loff_s [A] vs. L [m] , W=1.0e-6 , Temp=25



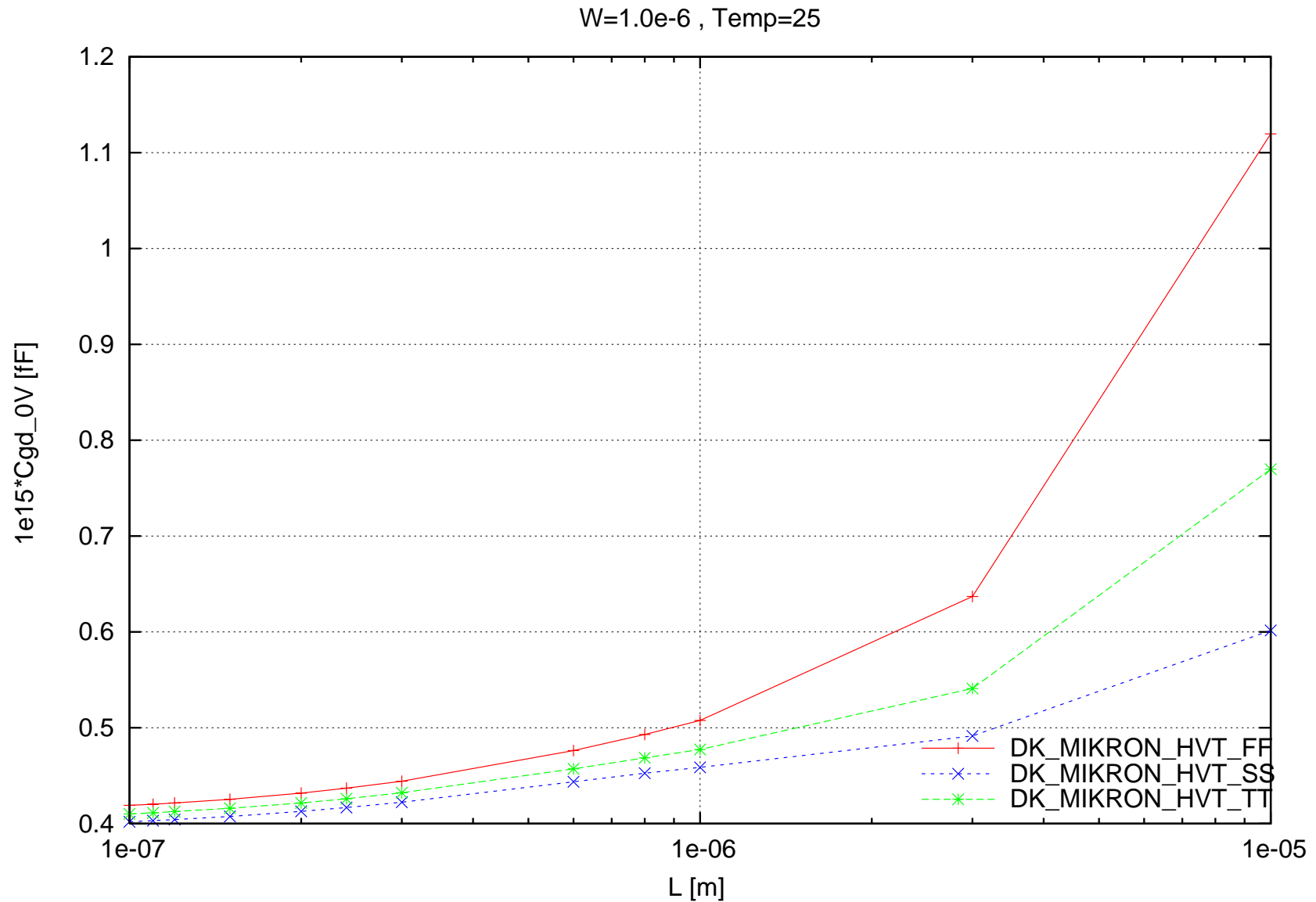
nhvt $1e15 \cdot C_{gg_inv} / (W \cdot L \cdot 1e12)$ [fF/sq] vs. L [m] , W=1.0e-6 , Temp=25



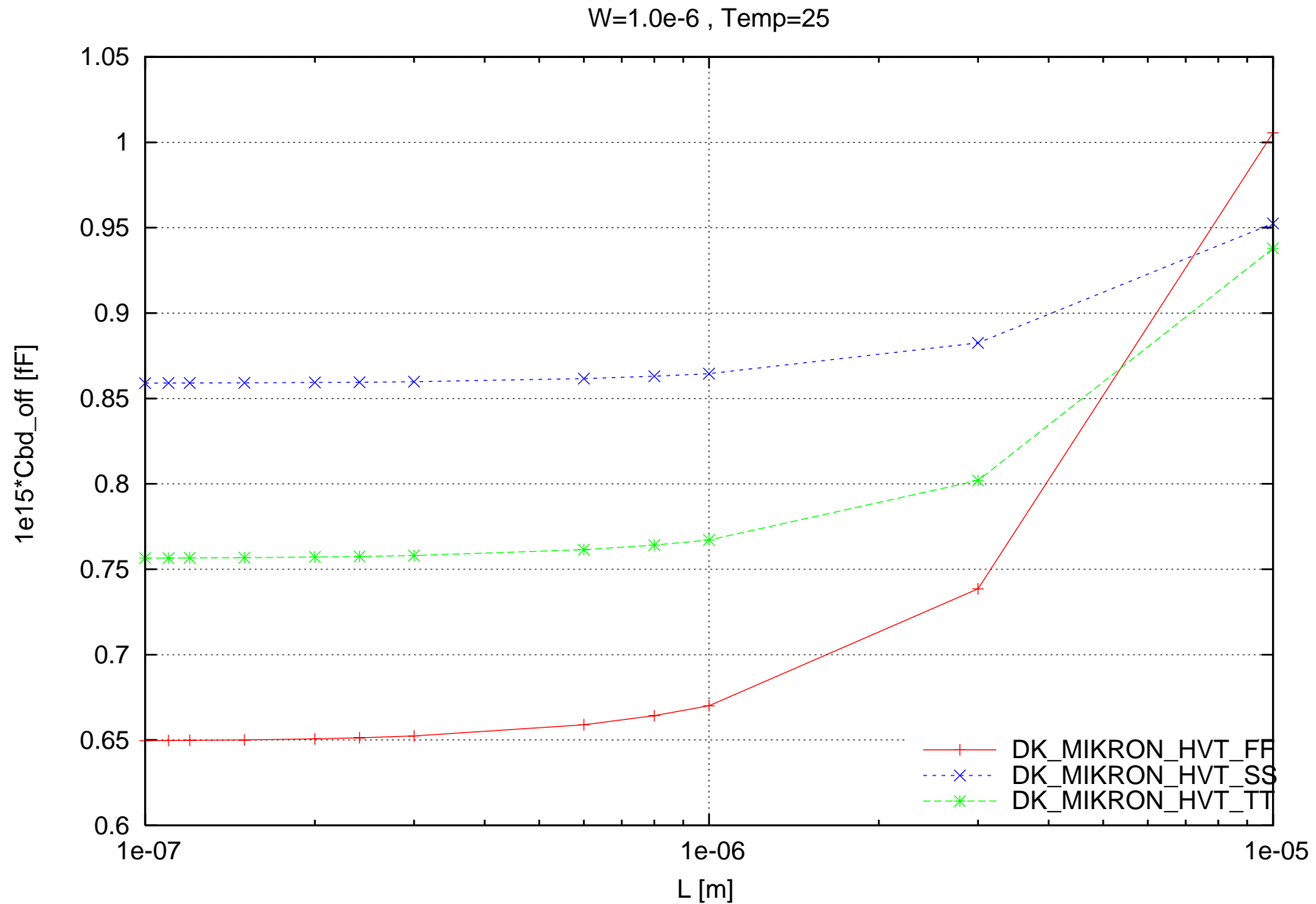
nhvt $1e15 \cdot C_{ggmean} / (W \cdot L \cdot 1e12)$ [fF/sq] vs. L [m] , W=1.0e-6 , Temp=25



nhvt 1e15*Cgd_0V [fF] vs. L [m] , W=1.0e-6 , Temp=25

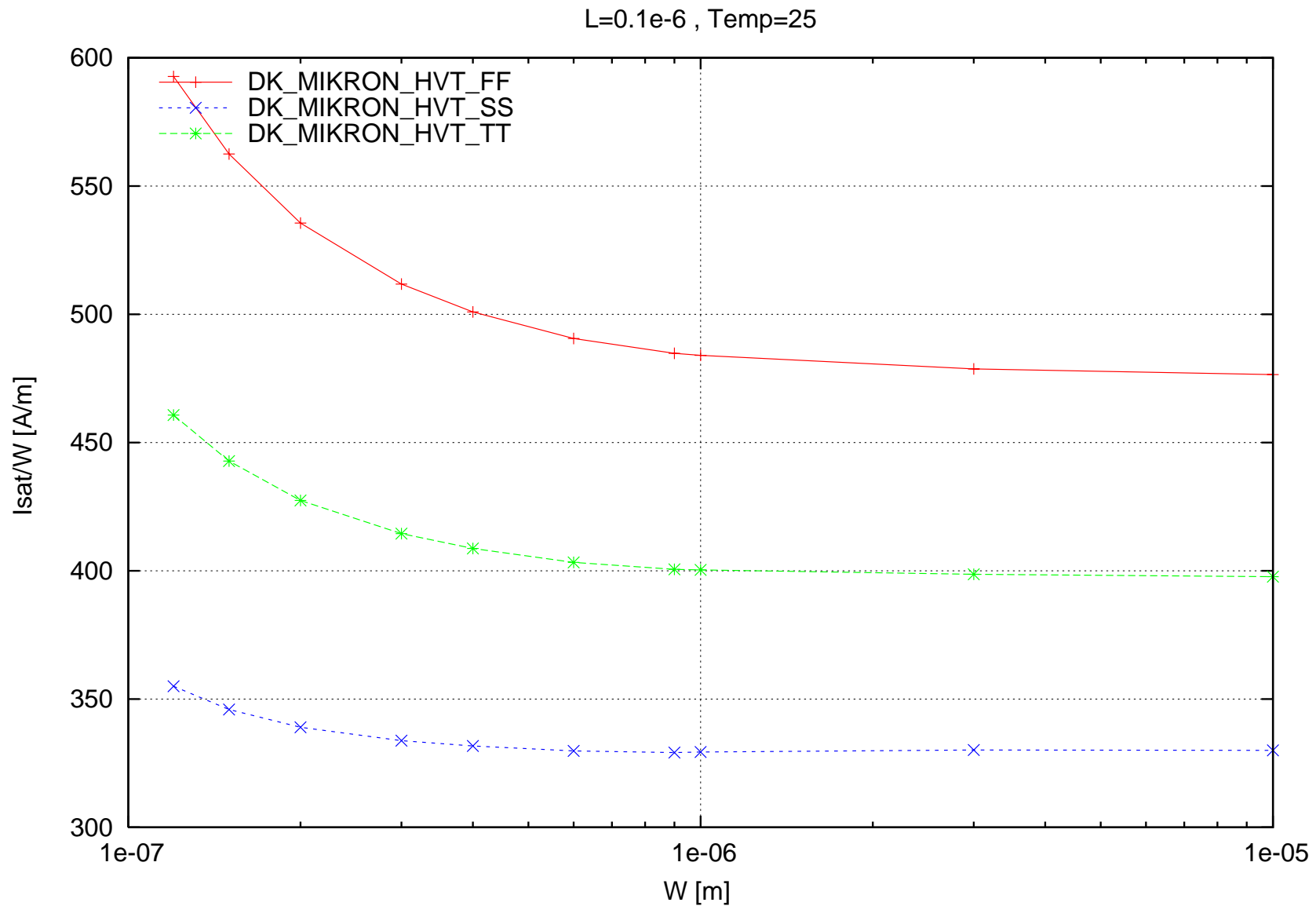


nhvt 1e15*Cbd_off [fF] vs. L [m] , W=1.0e-6 , Temp=25

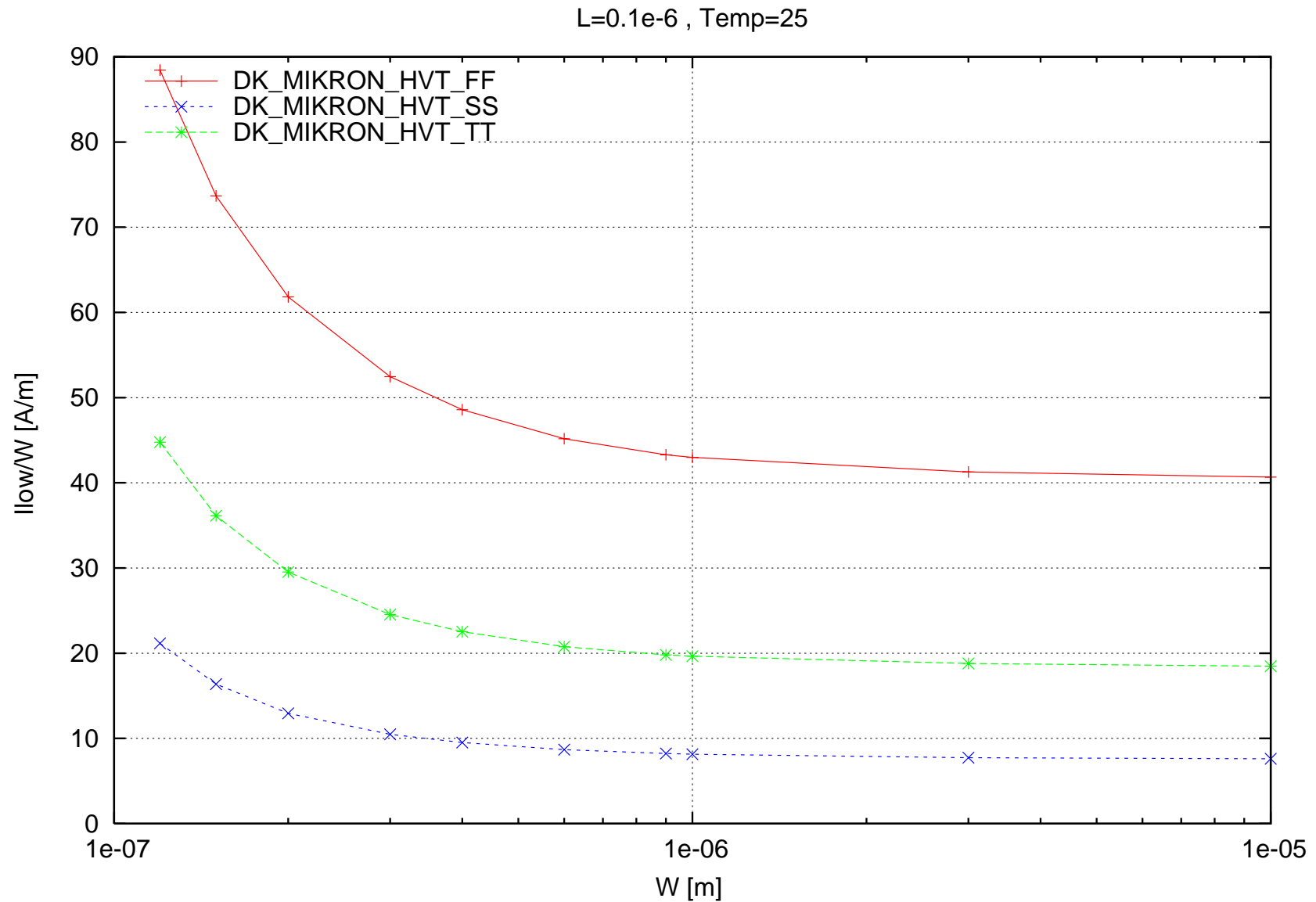


Scaling versus Width for NMOS ($L=0.1\text{e-}6$, Temp=25, po2act=0.63e-6, LPE=0)

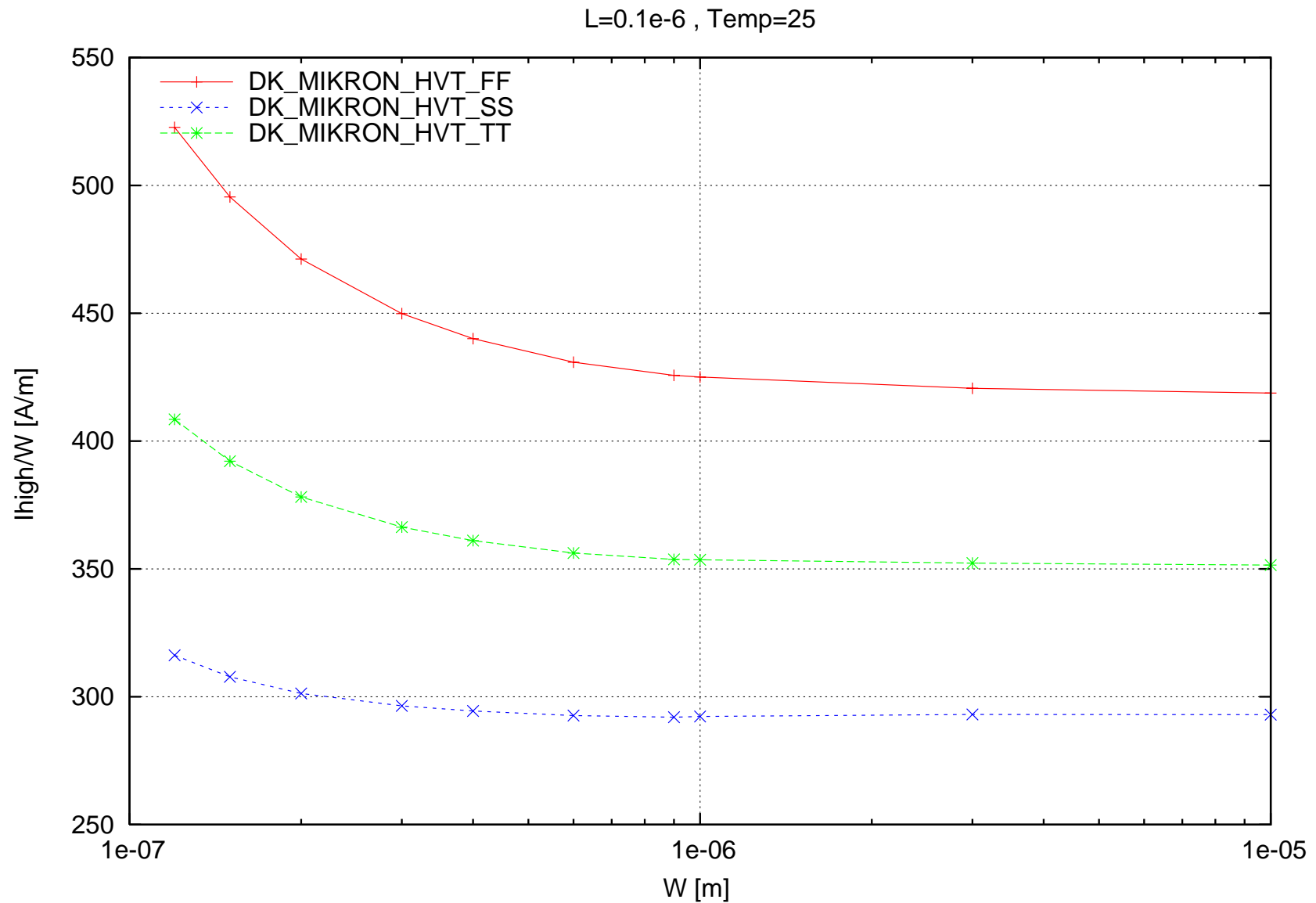
nhvt Isat/W [A/m] vs. W [m] , L=0.1e-6 , Temp=25



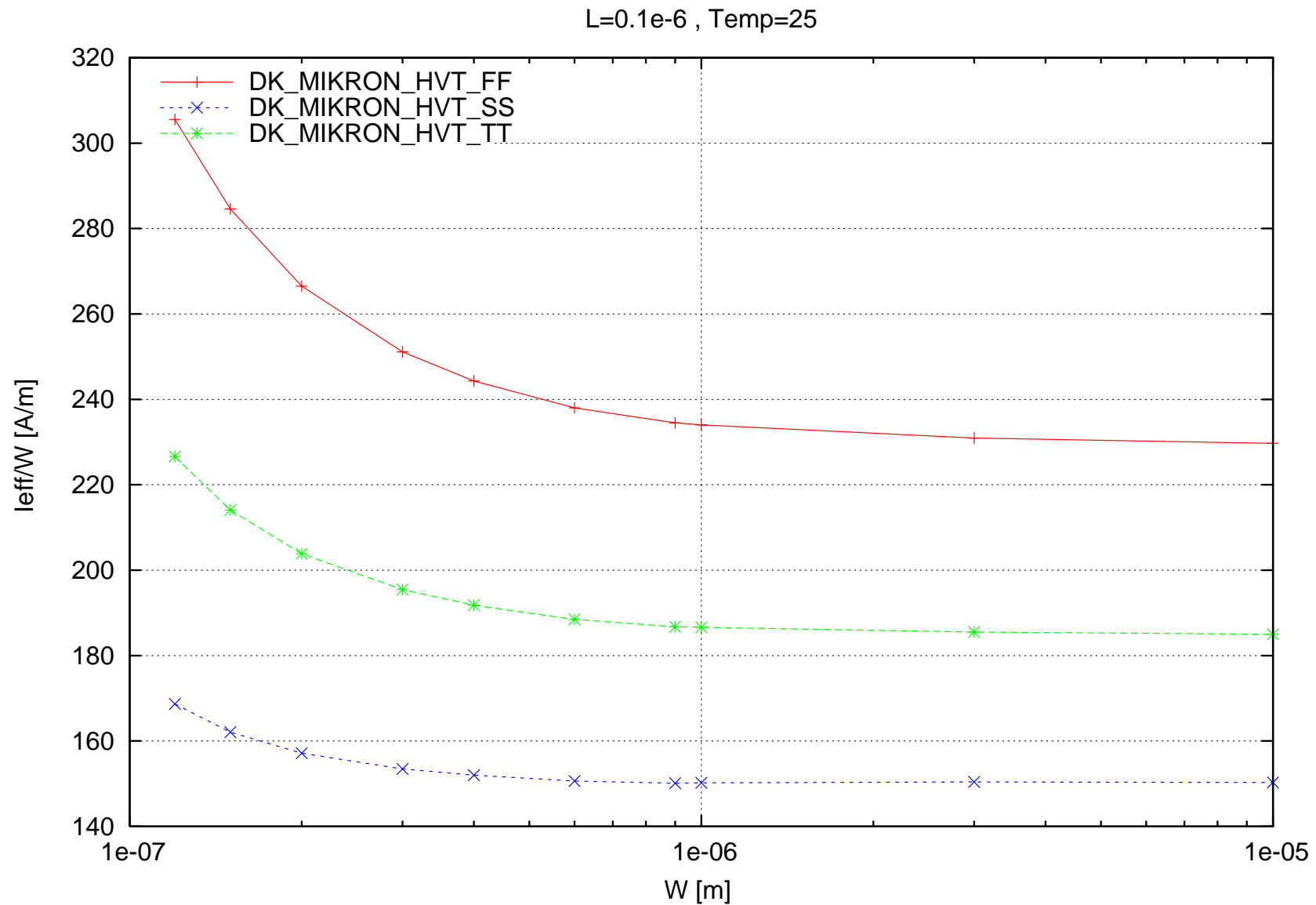
nhvt I_{low}/W [A/m] vs. W [m] , L=0.1e-6 , Temp=25



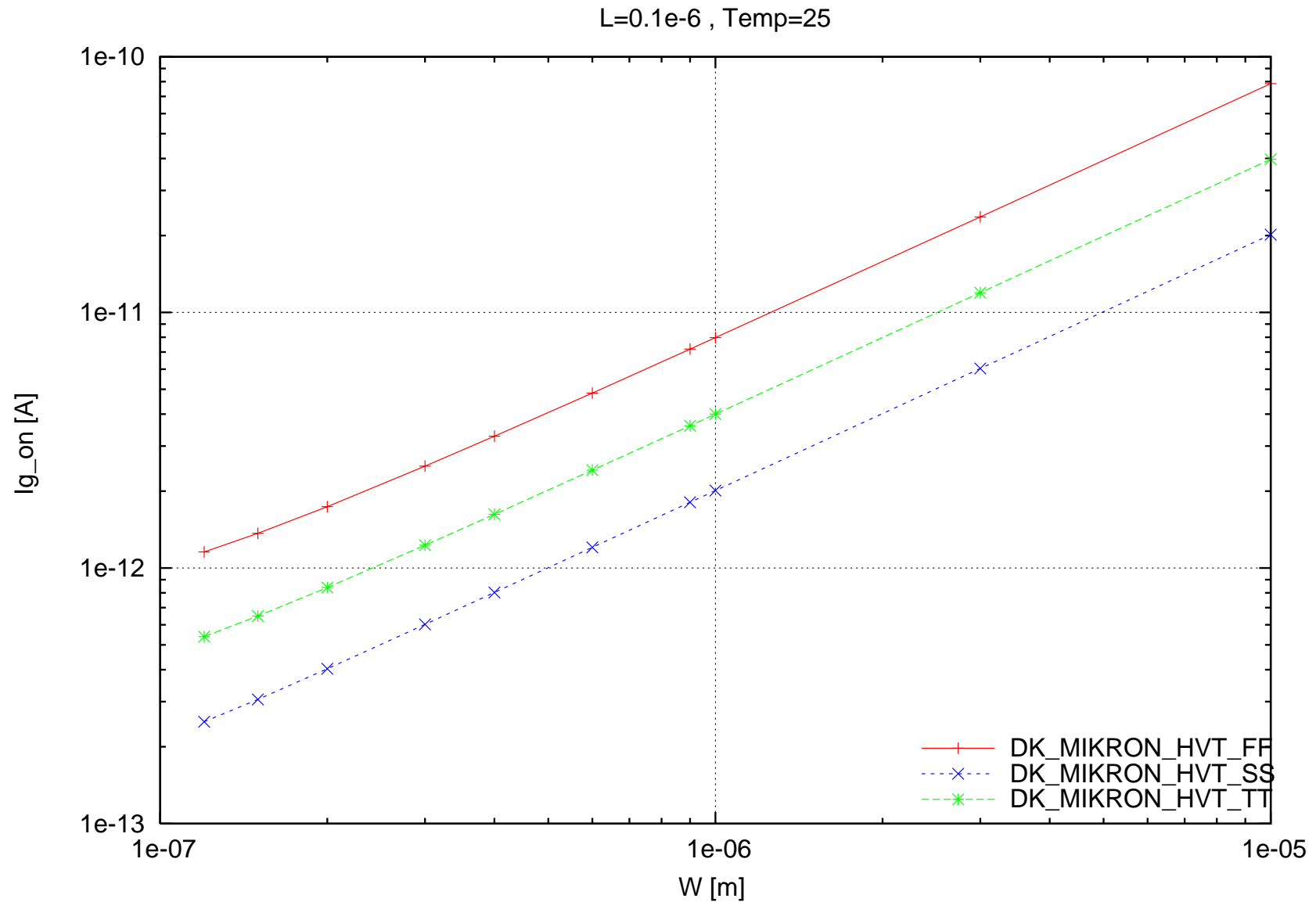
nhvt I_{high}/W [A/m] vs. W [m] , L=0.1e-6 , Temp=25



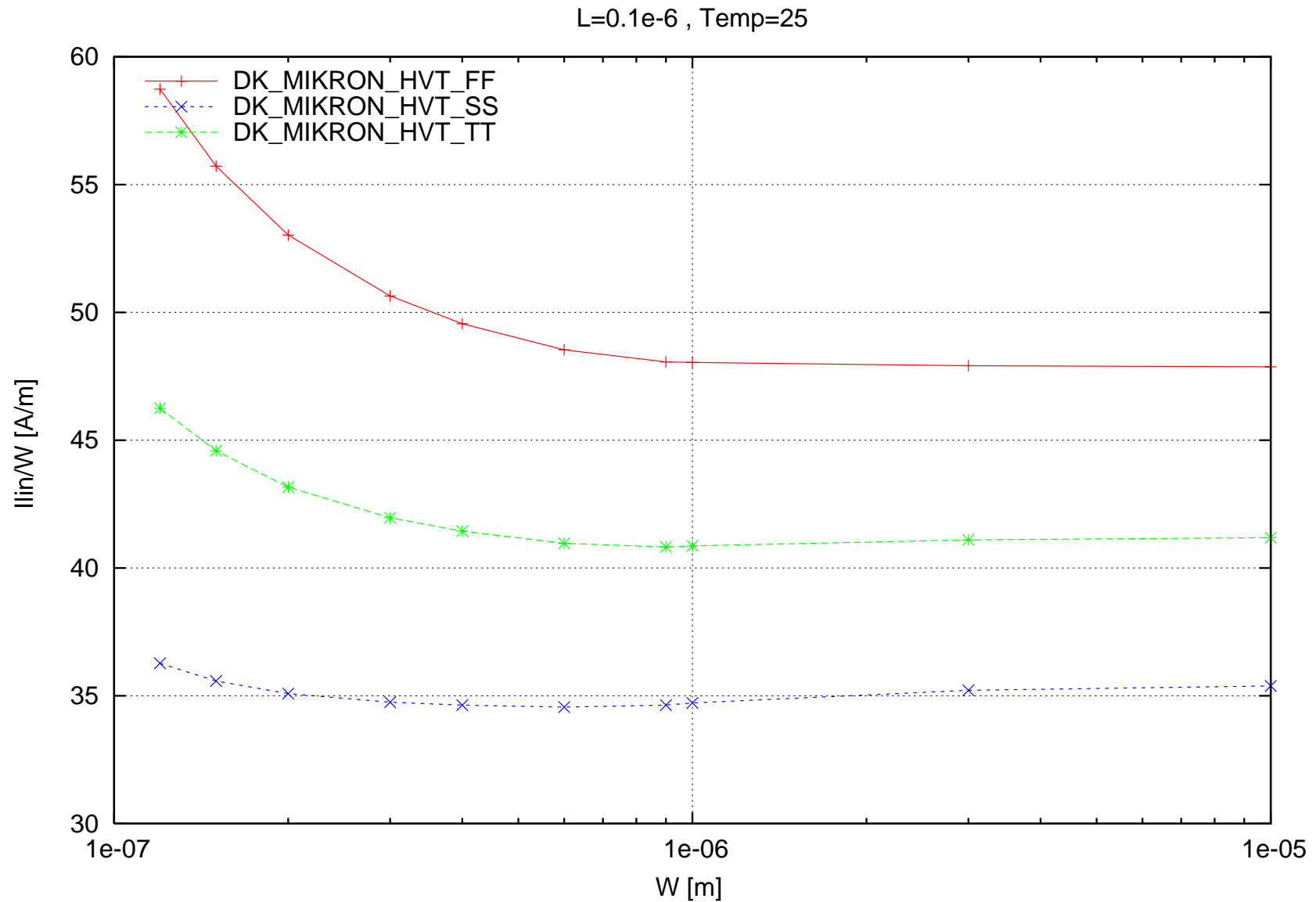
nhvt leff/W [A/m] vs. W [m] , L=0.1e-6 , Temp=25



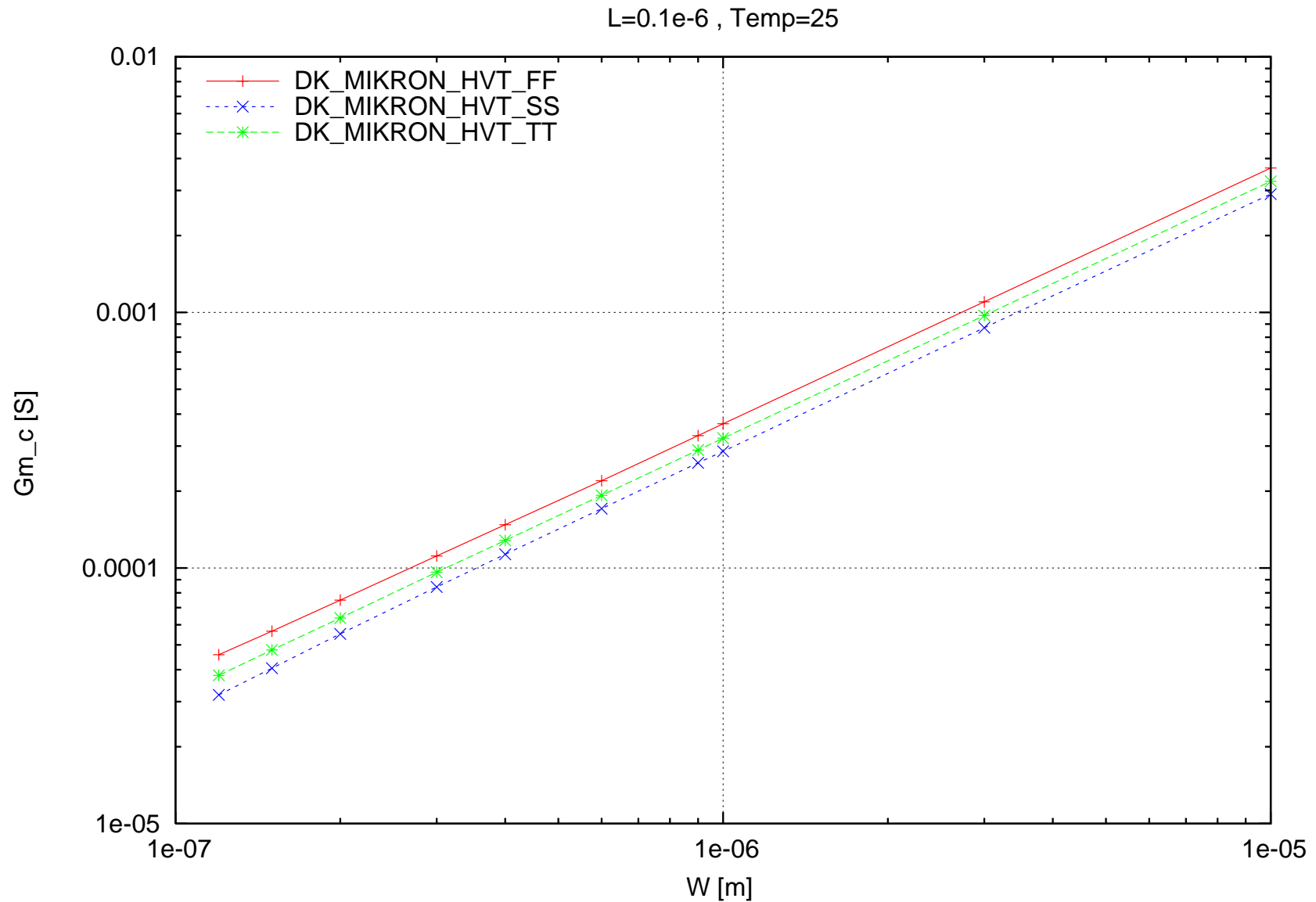
nhvt Ig_on [A] vs. W [m] , L=0.1e-6 , Temp=25



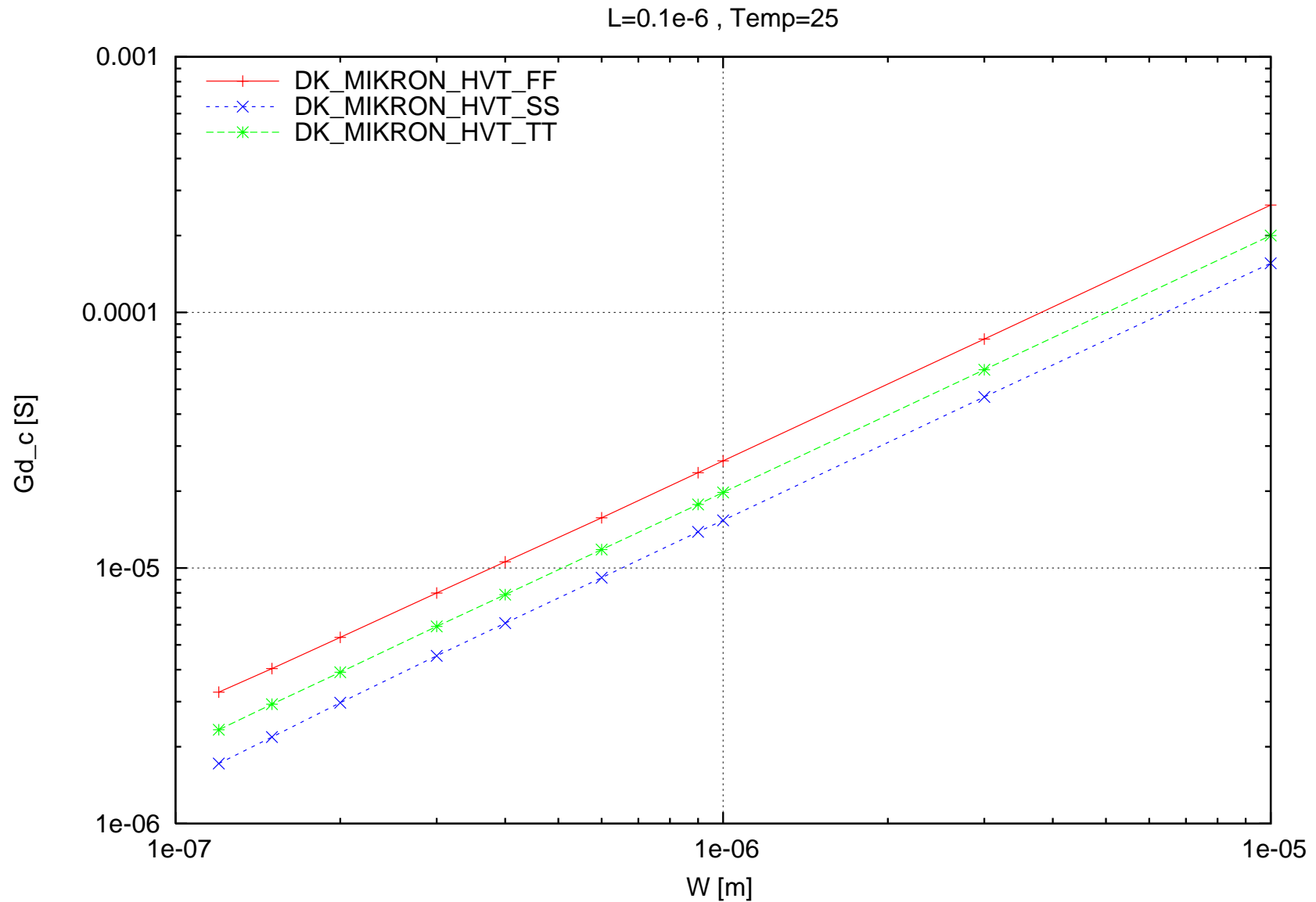
nhvt Ilin/W [A/m] vs. W [m] , L=0.1e-6 , Temp=25



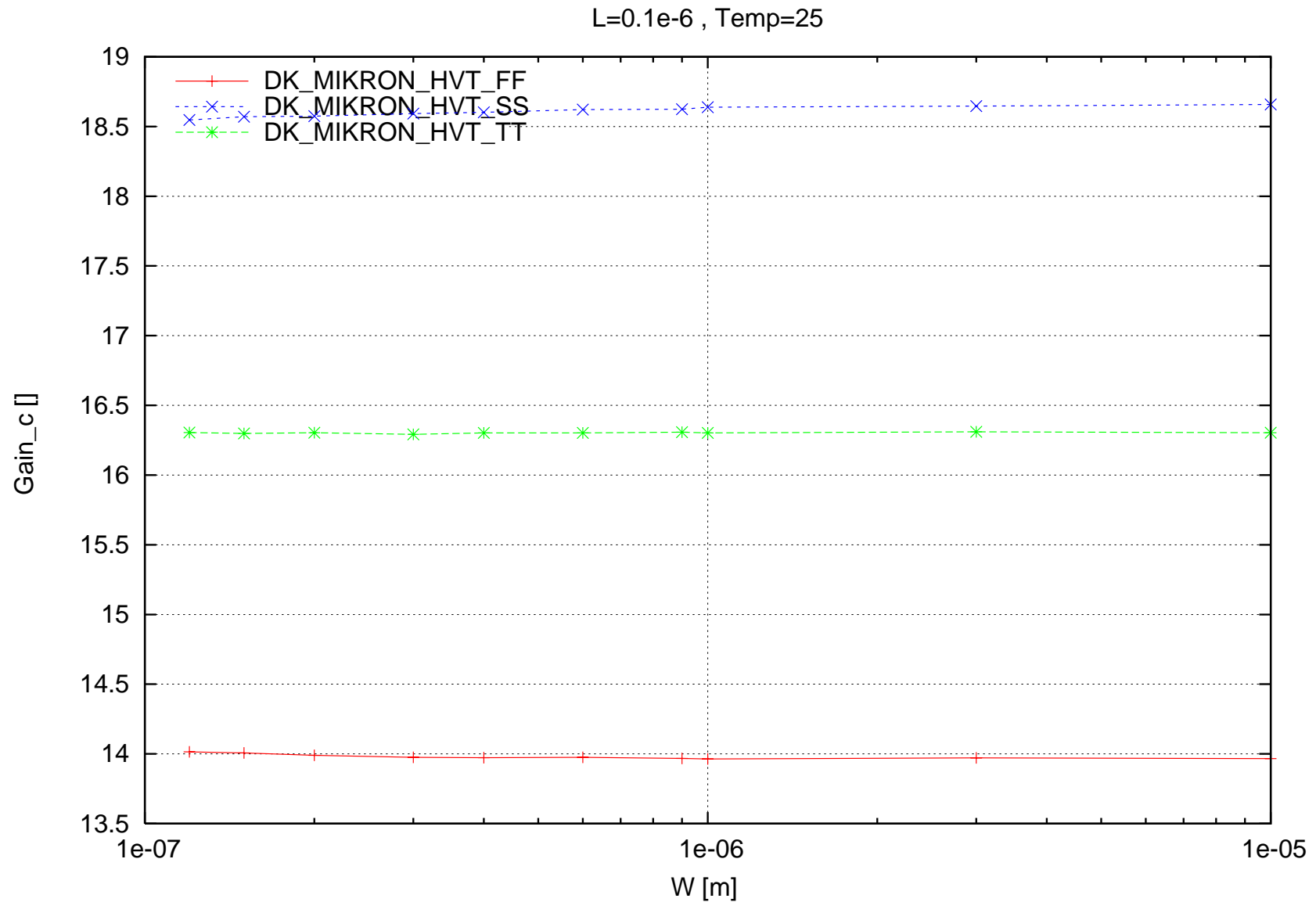
nhvt Gm_c [S] vs. W [m] , L=0.1e-6 , Temp=25



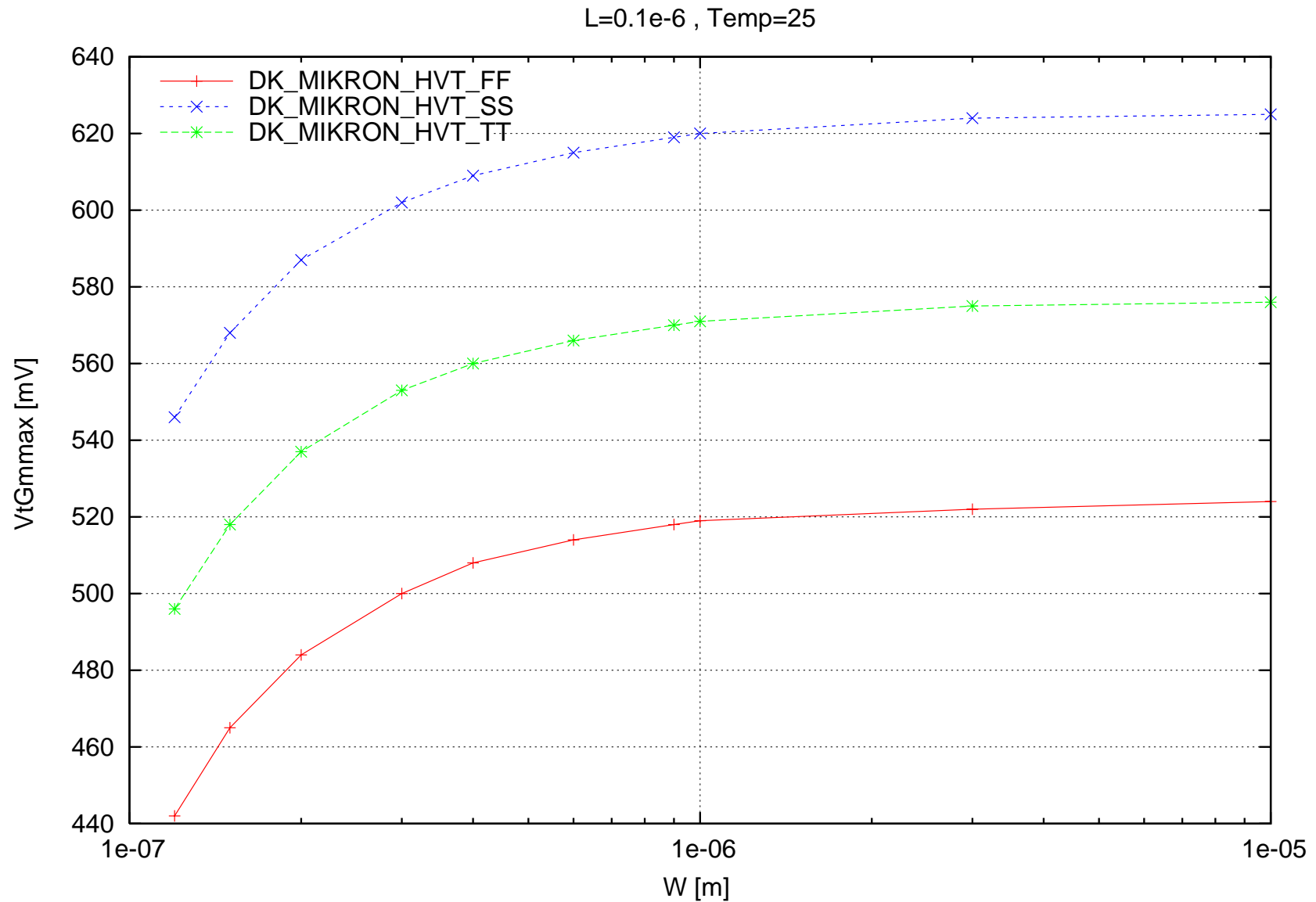
nhvt Gd_c [S] vs. W [m] , L=0.1e-6 , Temp=25



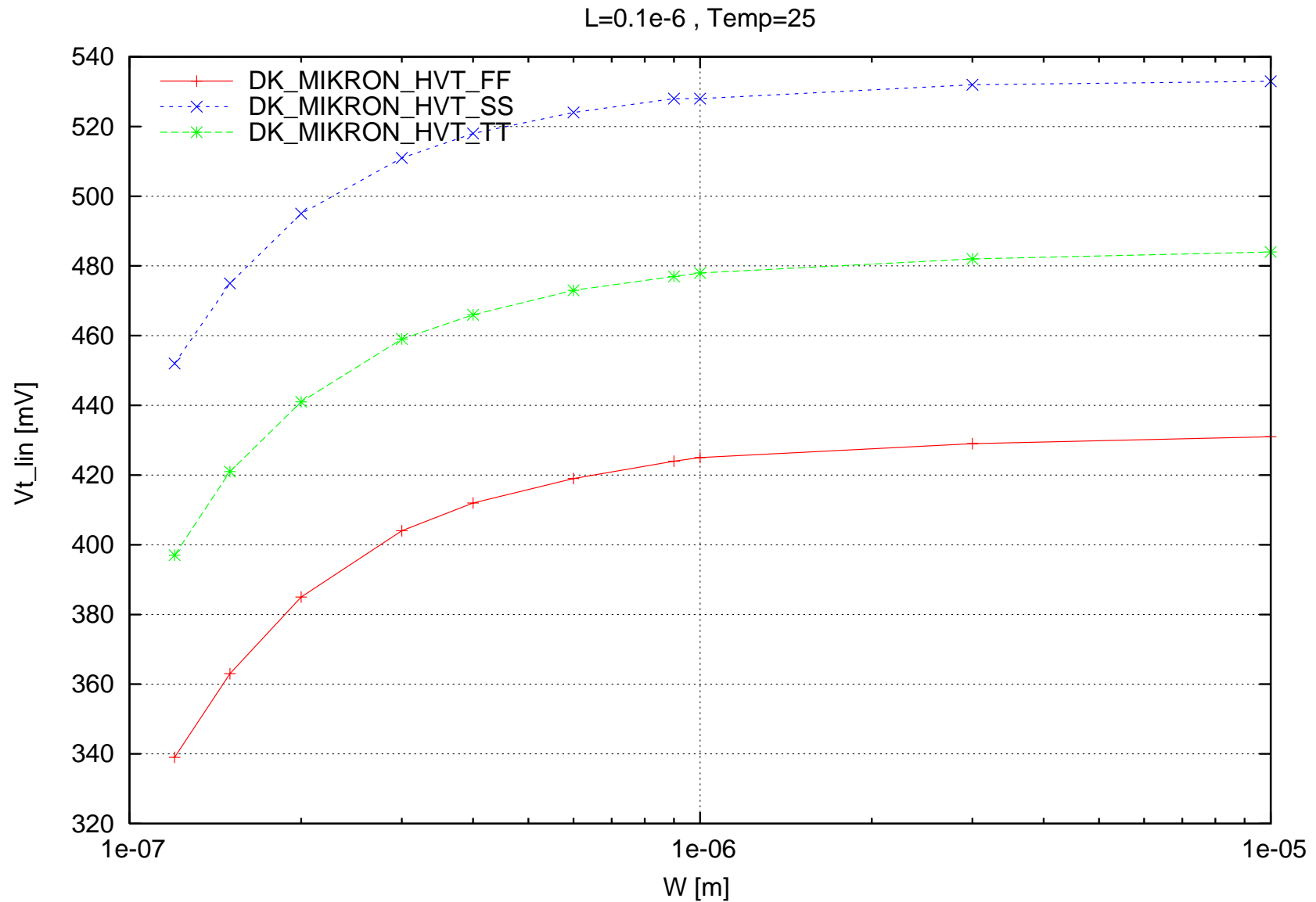
nhvt Gain_c [] vs. W [m] , L=0.1e-6 , Temp=25



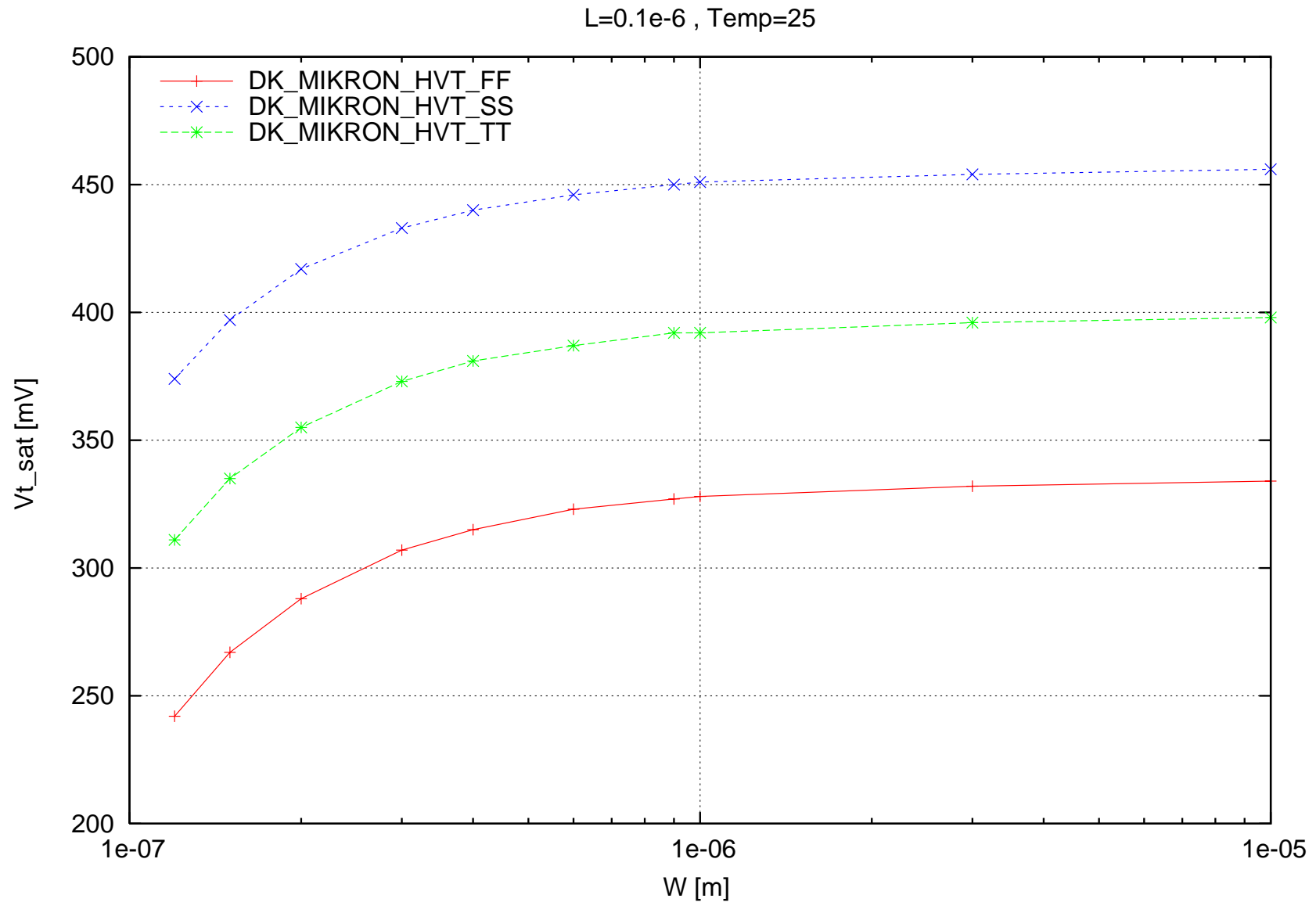
nhvt V_{tGmax} [mV] vs. W [m] , $L=0.1e-6$, Temp=25



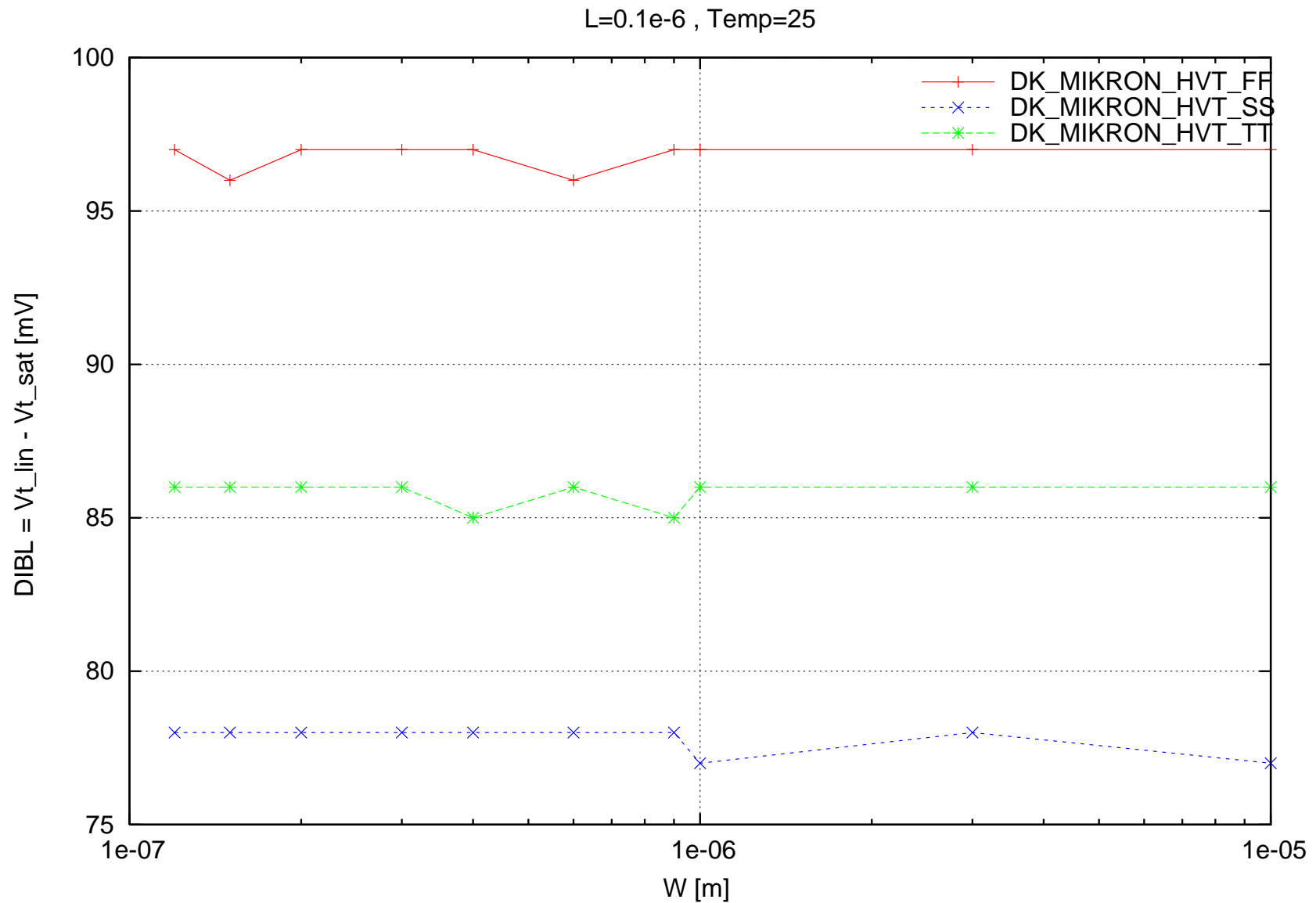
nhvt Vt_lin [mV] vs. W [m] , L=0.1e-6 , Temp=25



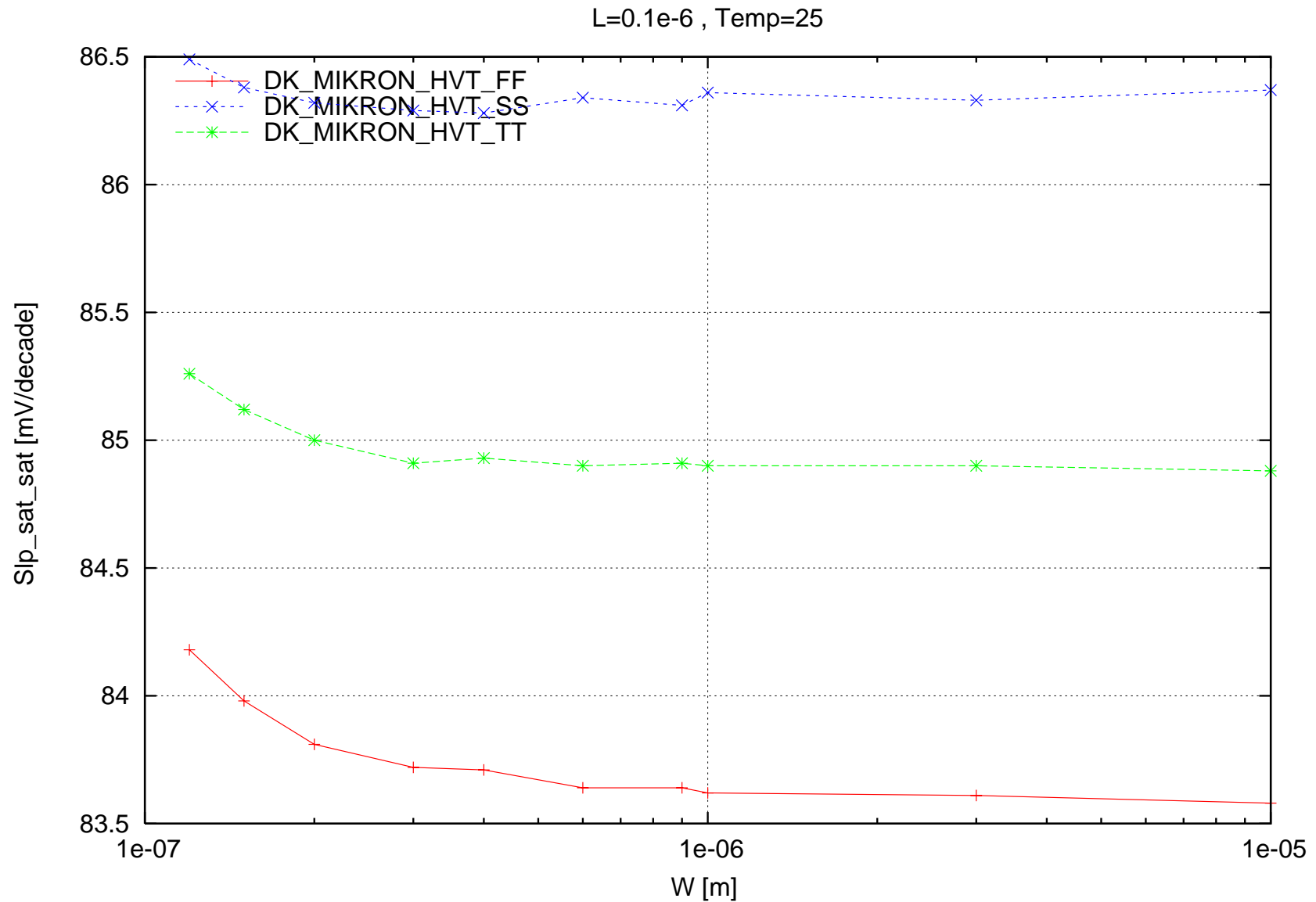
nhvt Vt_sat [mV] vs. W [m] , L=0.1e-6 , Temp=25



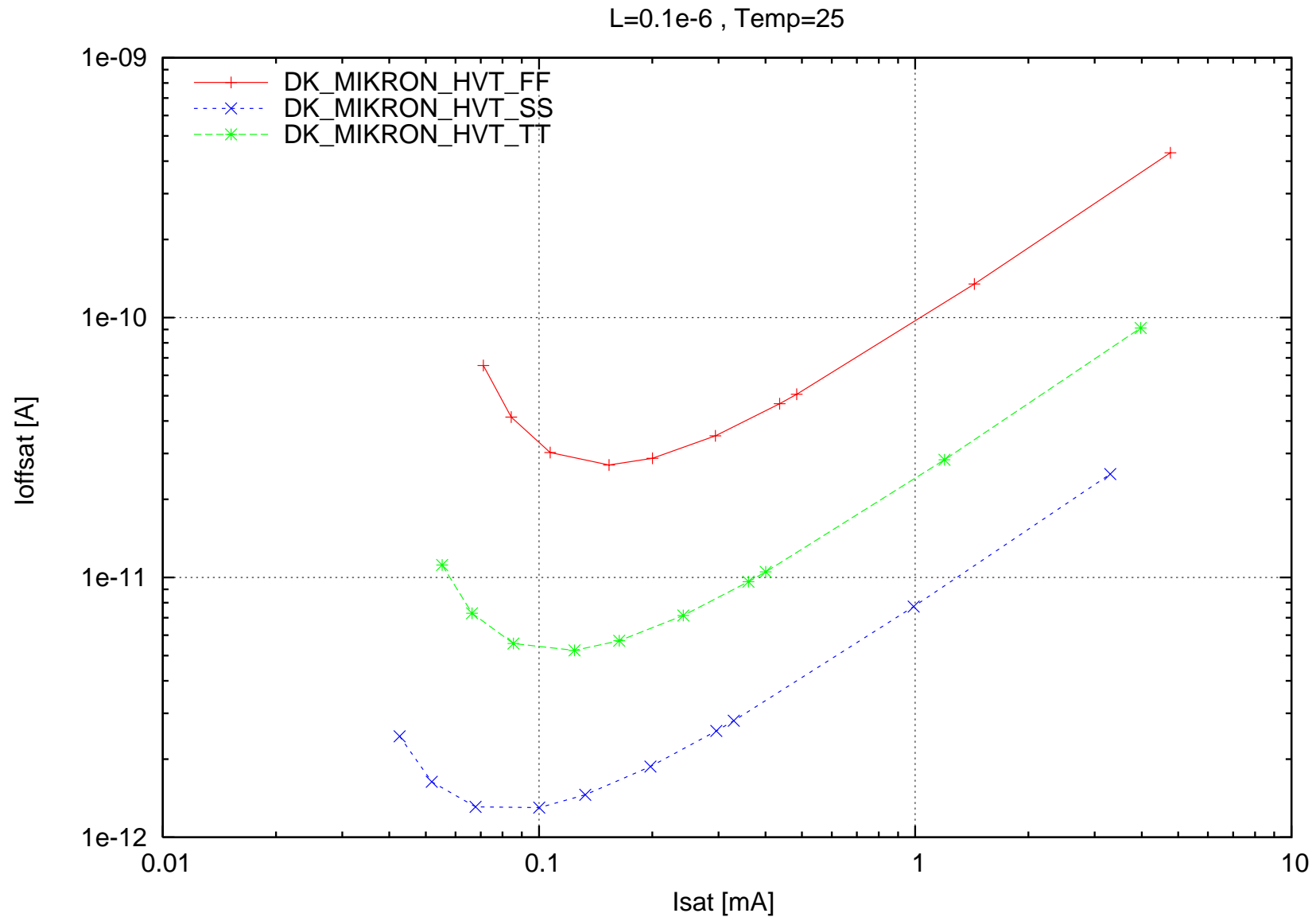
nhvt DIBL = $V_{t_lin} - V_{t_sat}$ [mV] vs. W [m] , $L=0.1e-6$, Temp=25



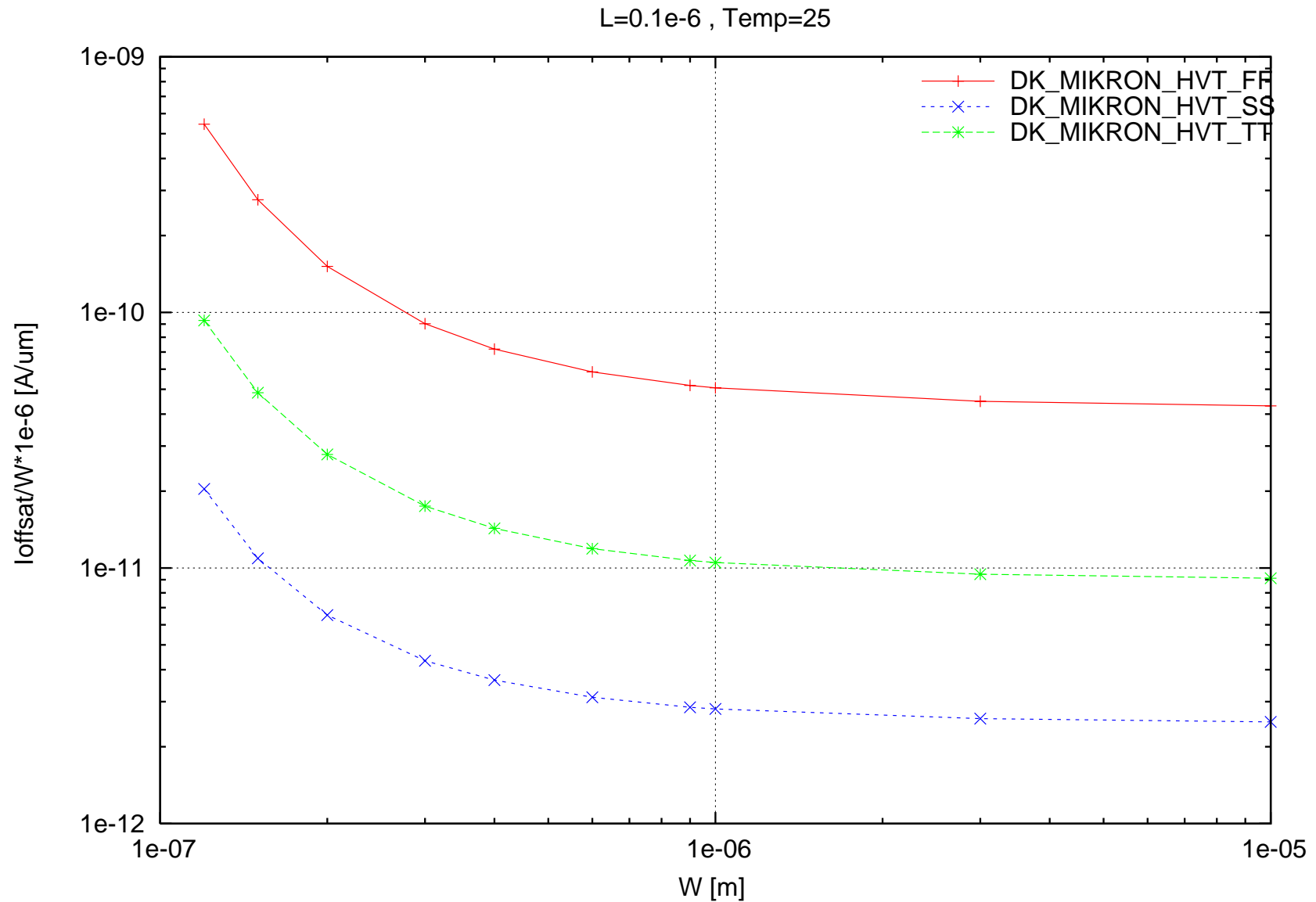
nhvt SIp_sat_sat [mV/decade] vs. W [m] , L=0.1e-6 , Temp=25



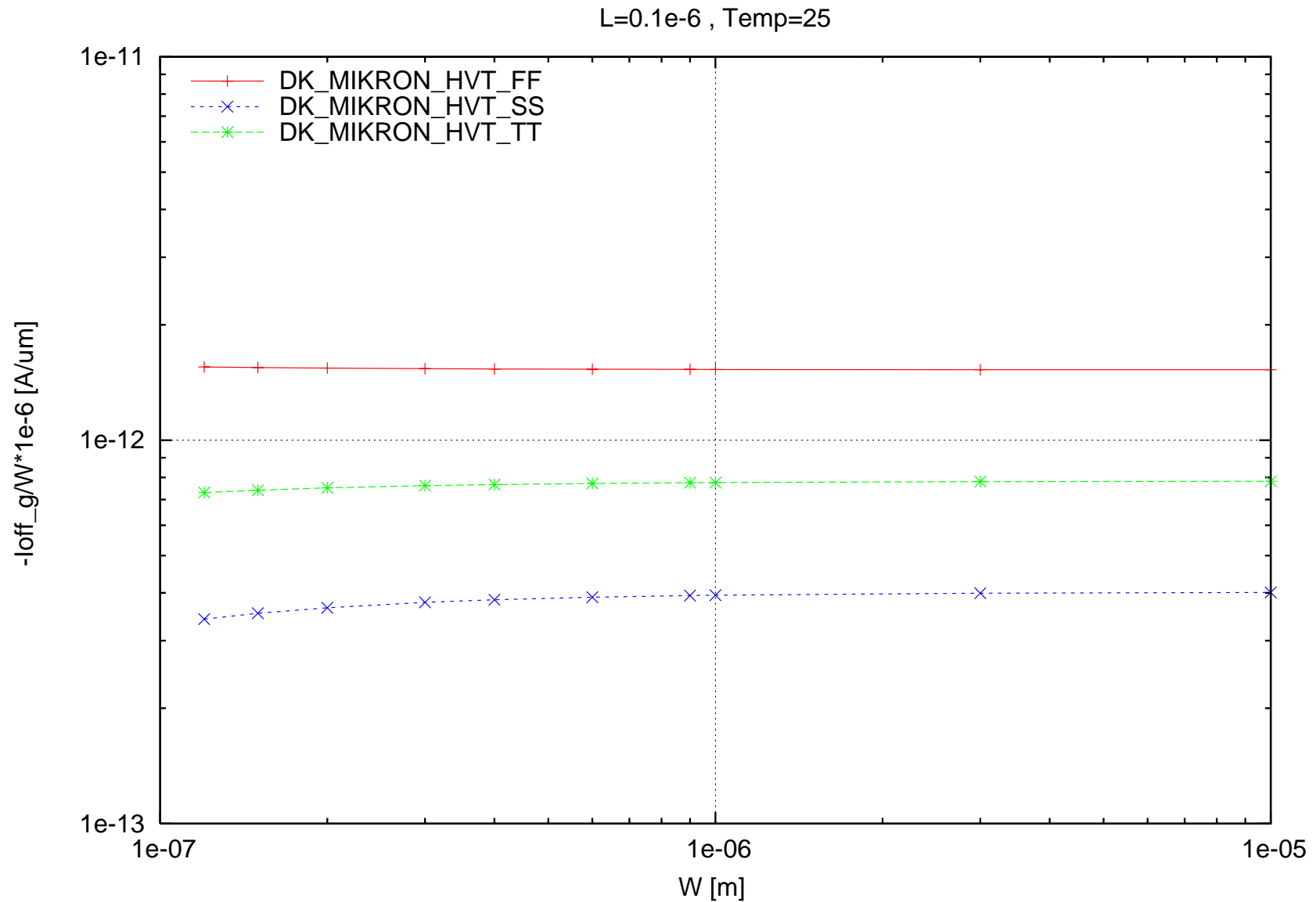
nhvt loffsat [A] vs. Isat [mA] , L=0.1e-6 , Temp=25



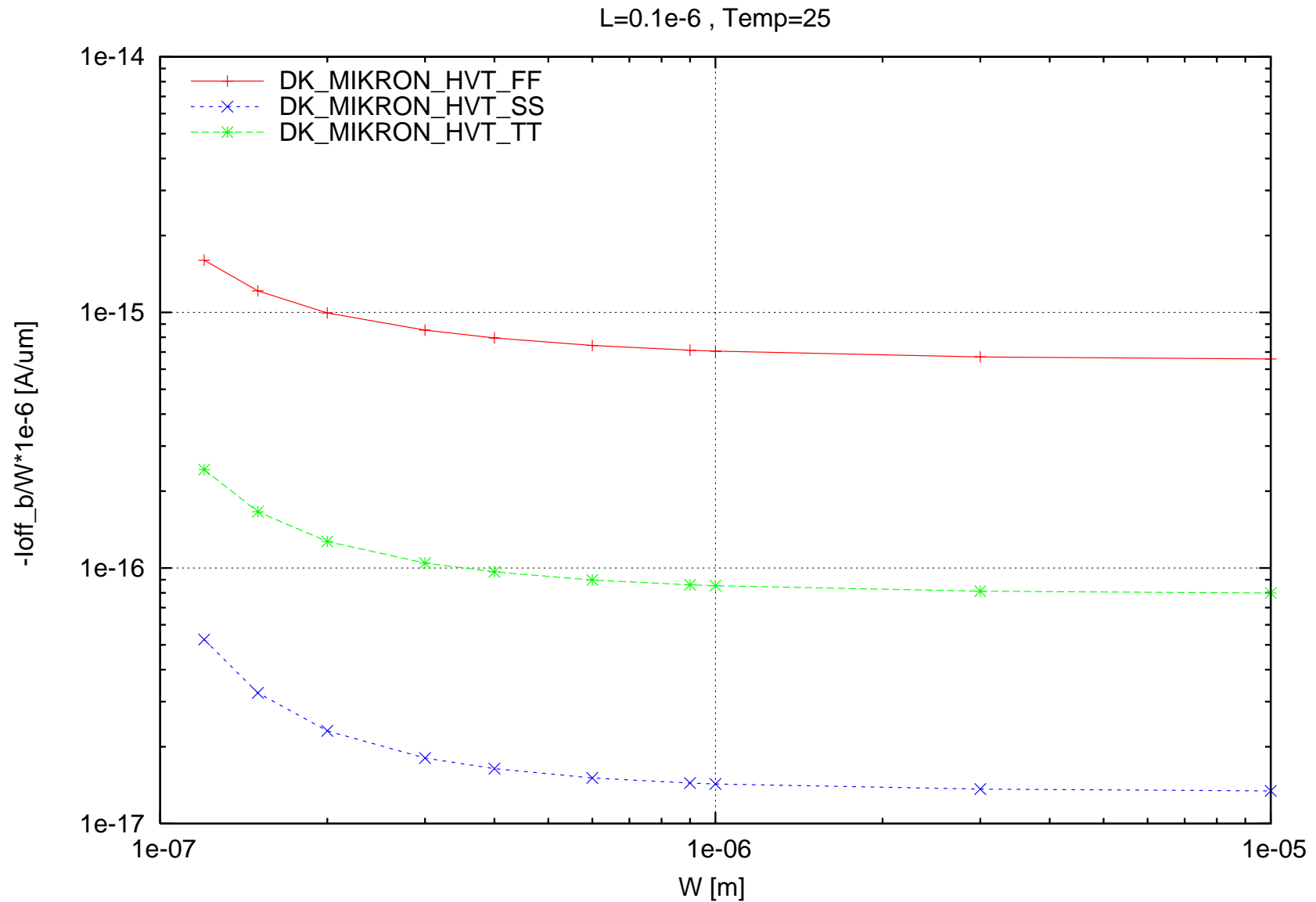
nhvt loffsat/W*1e-6 [A/um] vs. W [m] , L=0.1e-6 , Temp=25



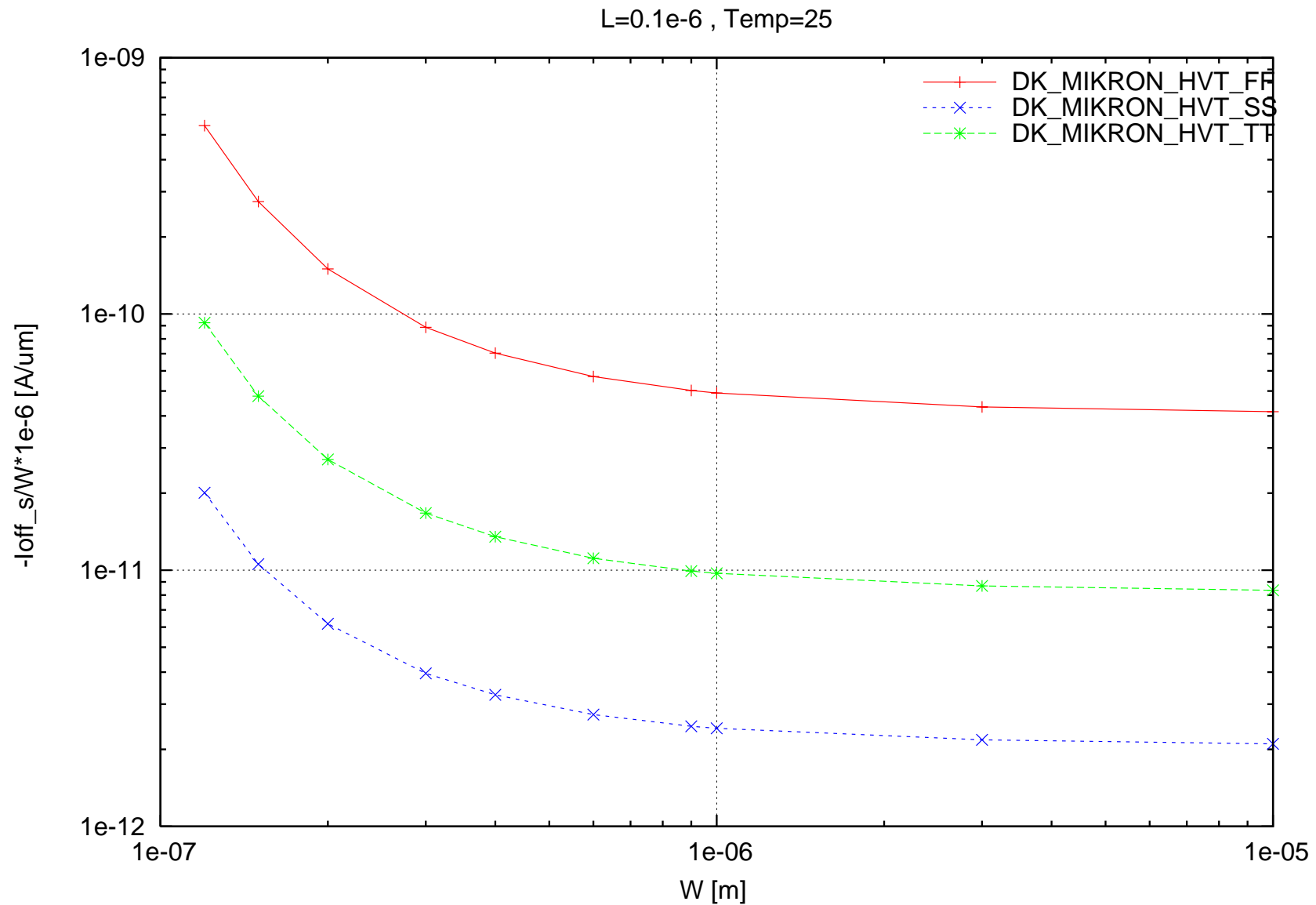
nhvt -loff_g/W*1e-6 [A/um] vs. W [m] , L=0.1e-6 , Temp=25



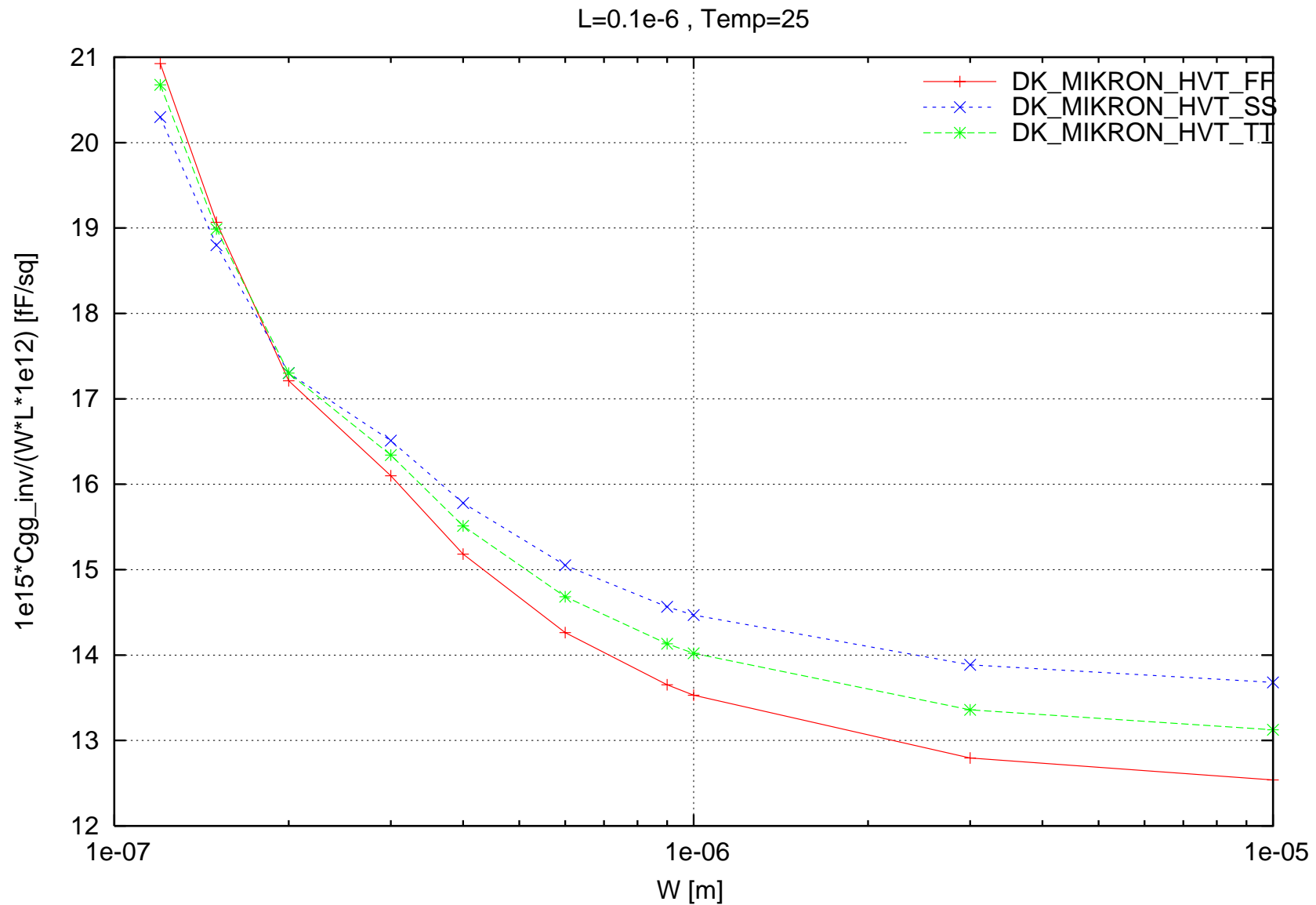
nhvt -loff_b/W*1e-6 [A/um] vs. W [m] , L=0.1e-6 , Temp=25



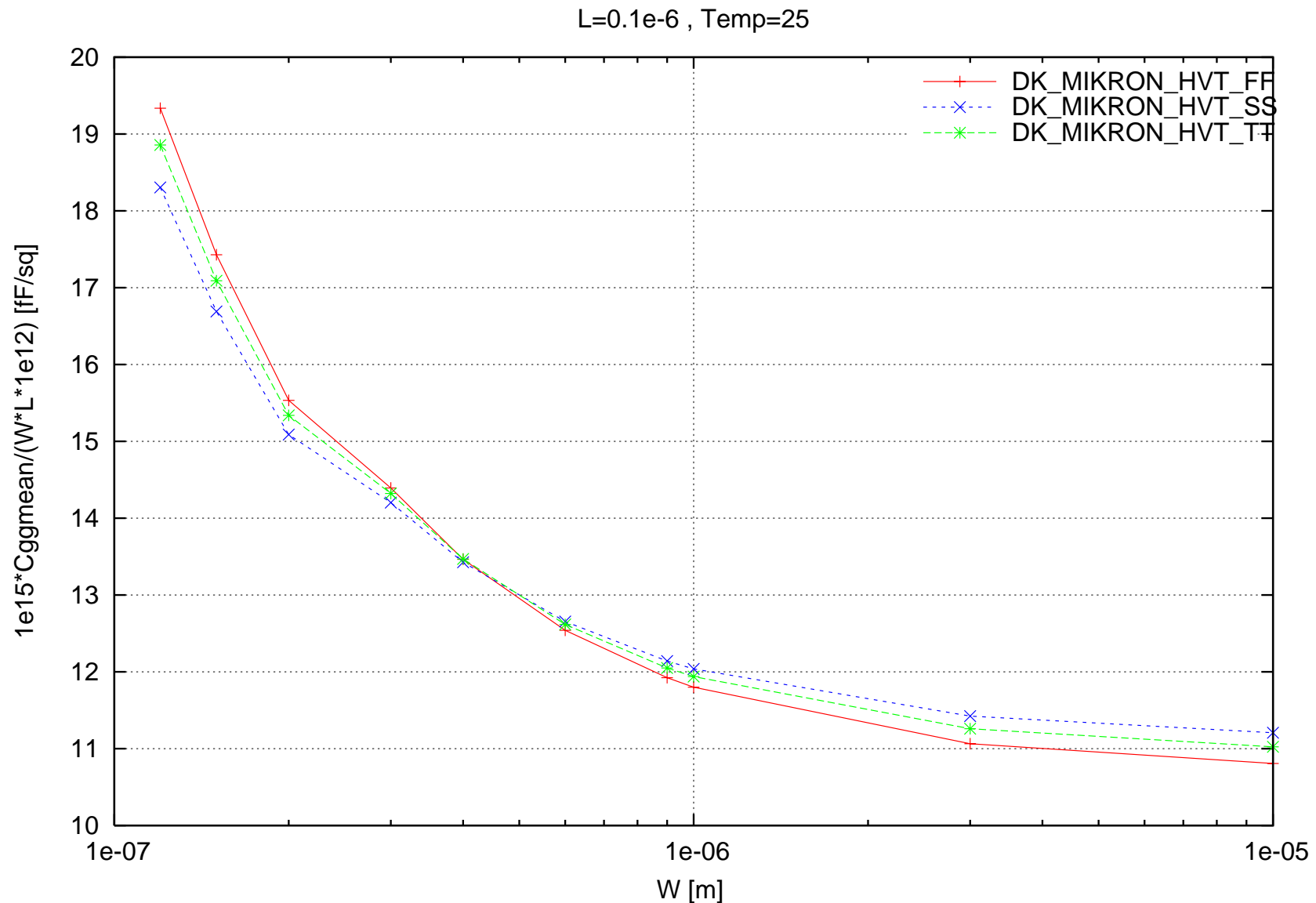
nhvt -loff_s/W*1e-6 [A/um] vs. W [m] , L=0.1e-6 , Temp=25



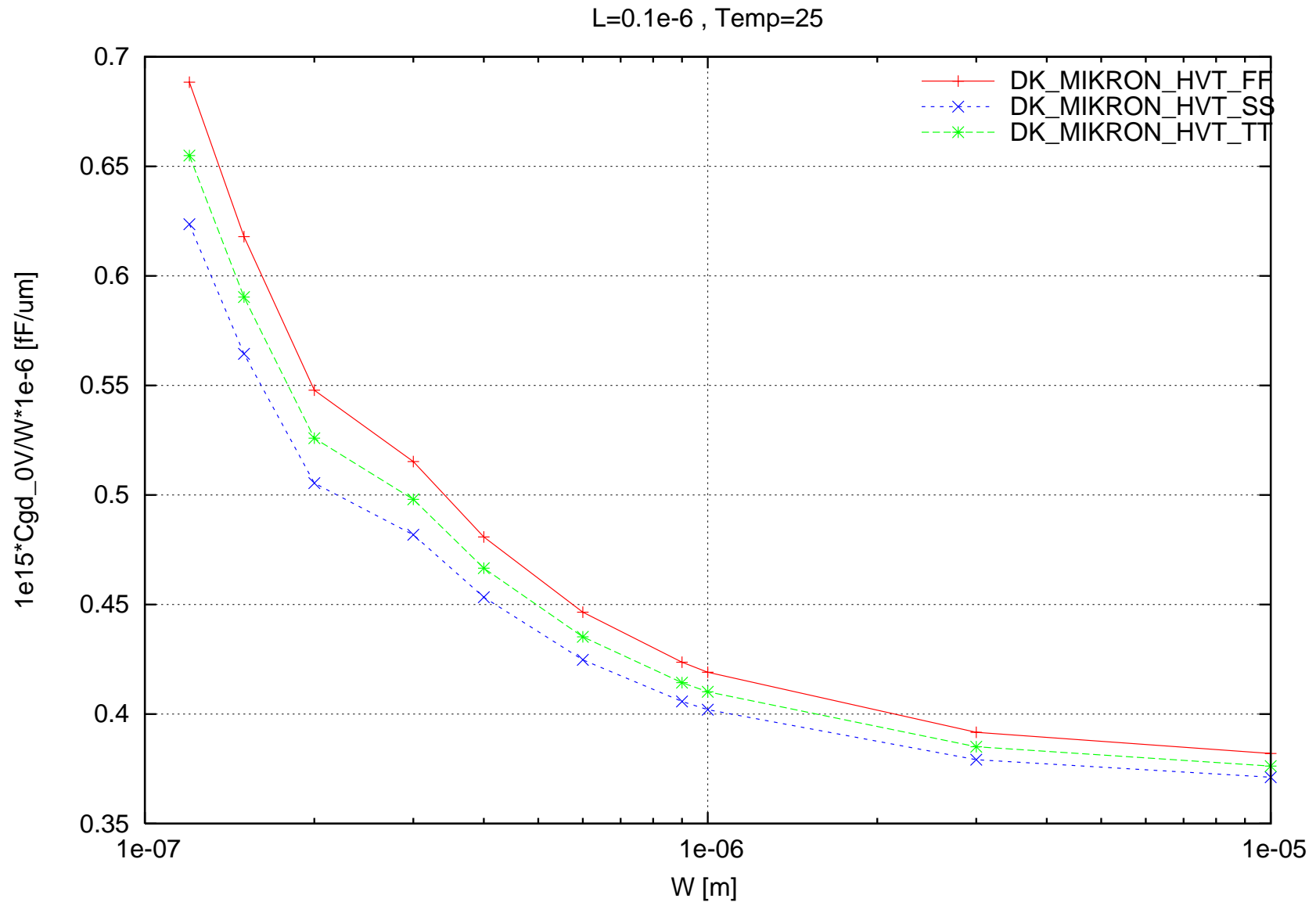
nhvt $1e15 \cdot C_{gg_inv} / (W \cdot L \cdot 1e12)$ [fF/sq] vs. W [m] , L=0.1e-6 , Temp=25



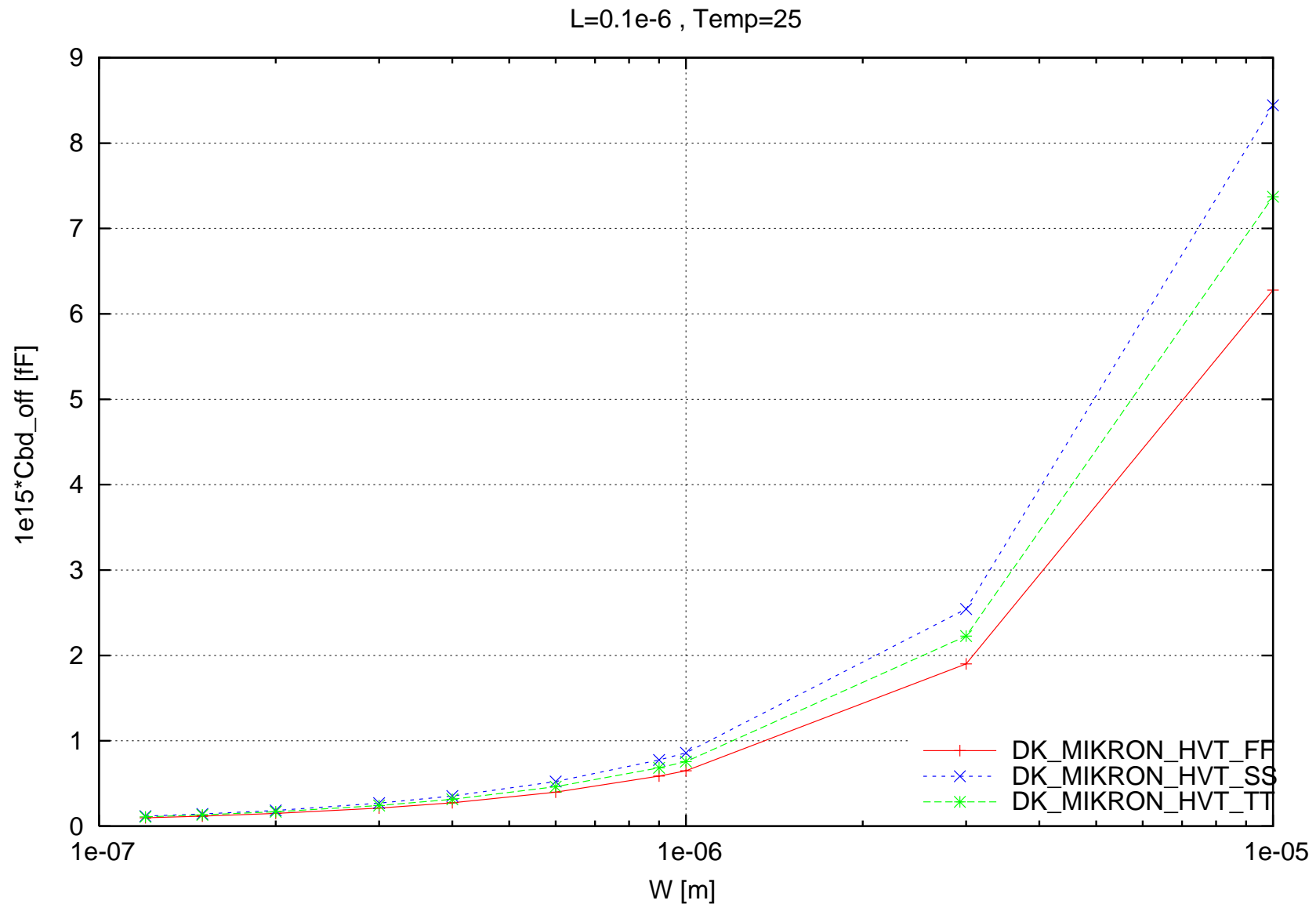
nhvt $1e15 \cdot C_{ggmean} / (W \cdot L \cdot 1e12)$ [fF/sq] vs. W [m] , L=0.1e-6 , Temp=25



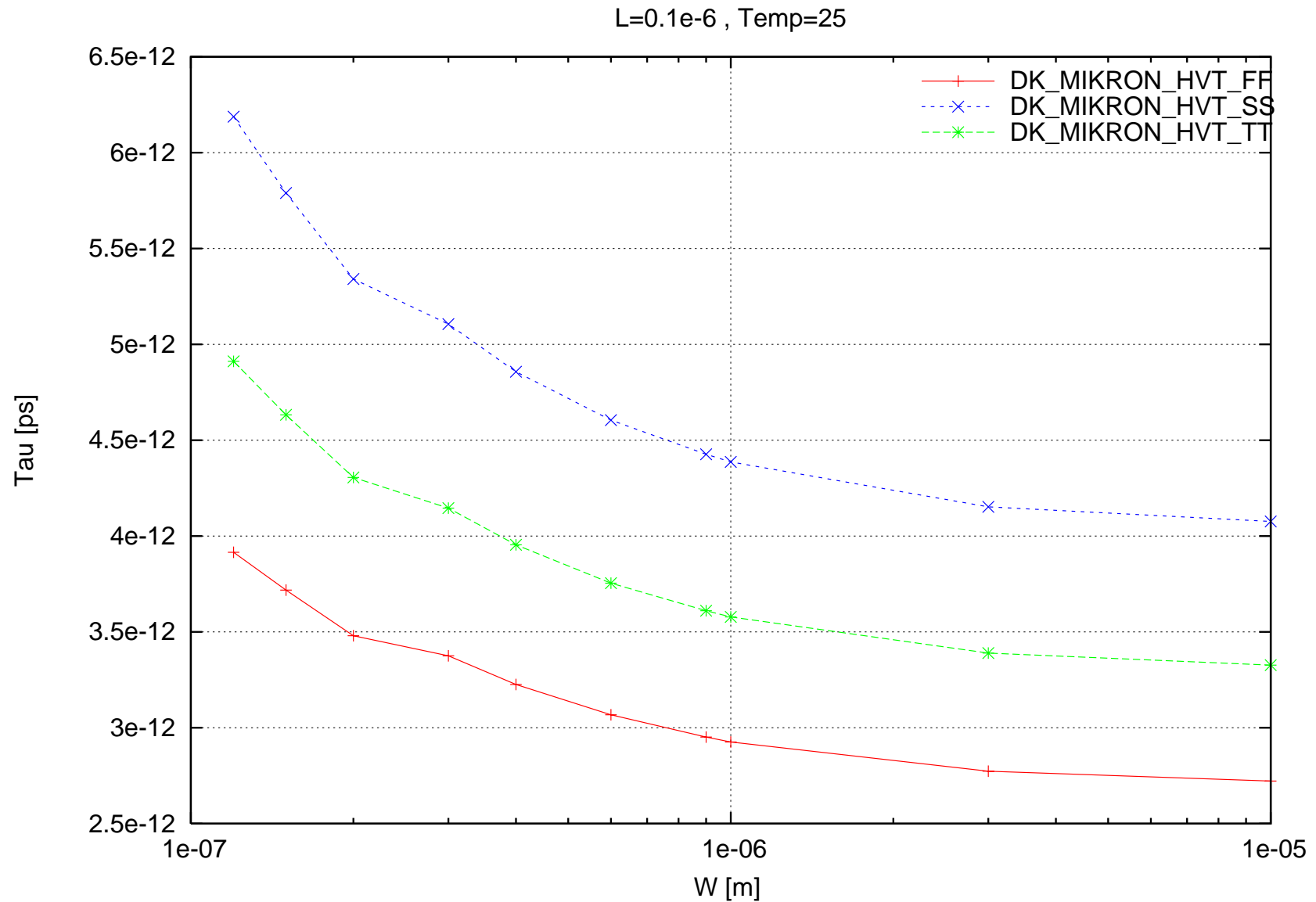
nhvt 1e15*Cgd_0V/W*1e-6 [fF/um] vs. W [m] , L=0.1e-6 , Temp=25



nhvt 1e15*Cbd_off [fF] vs. W [m] , L=0.1e-6 , Temp=25

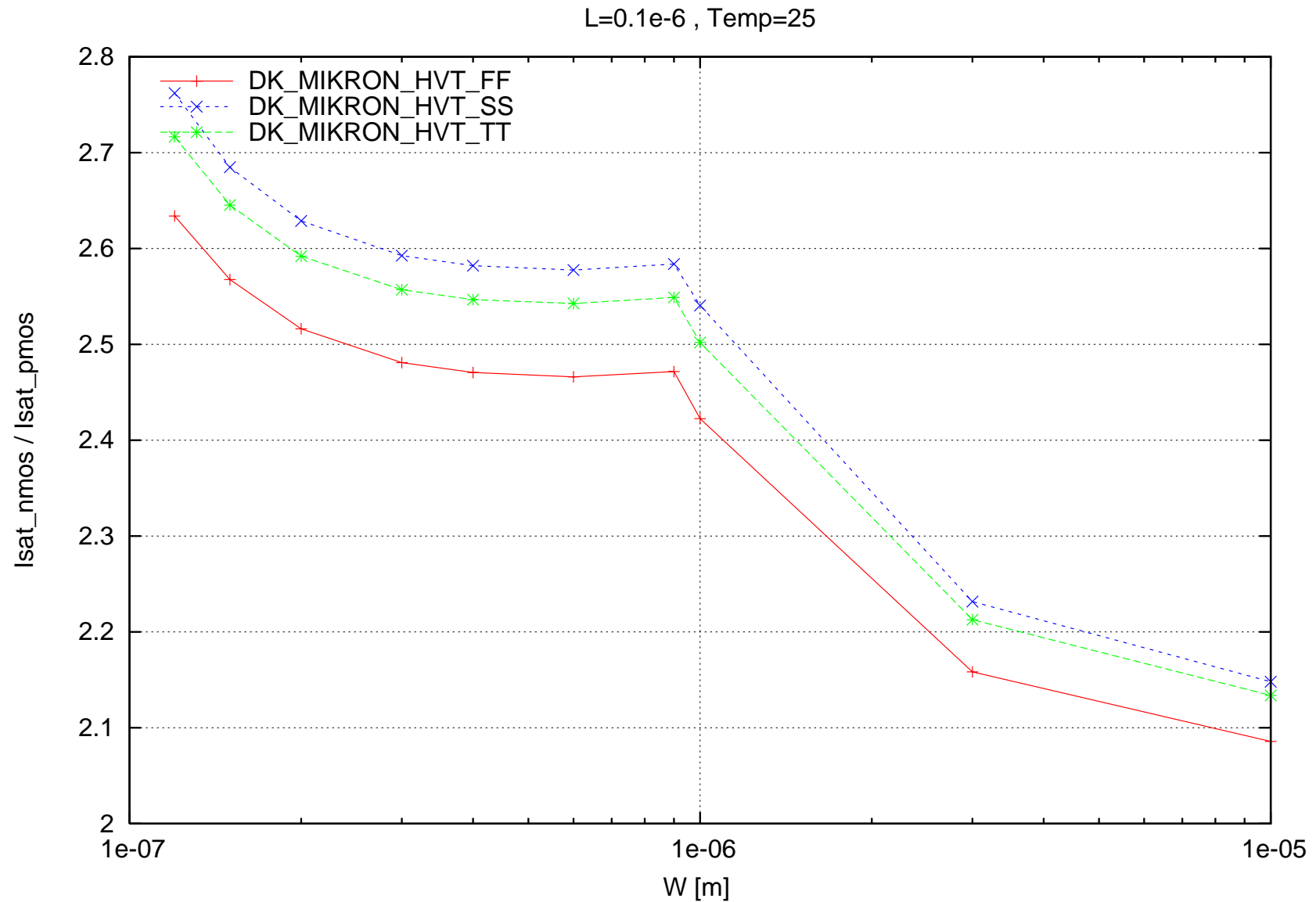


nhvt Tau [ps] vs. W [m] , L=0.1e-6 , Temp=25

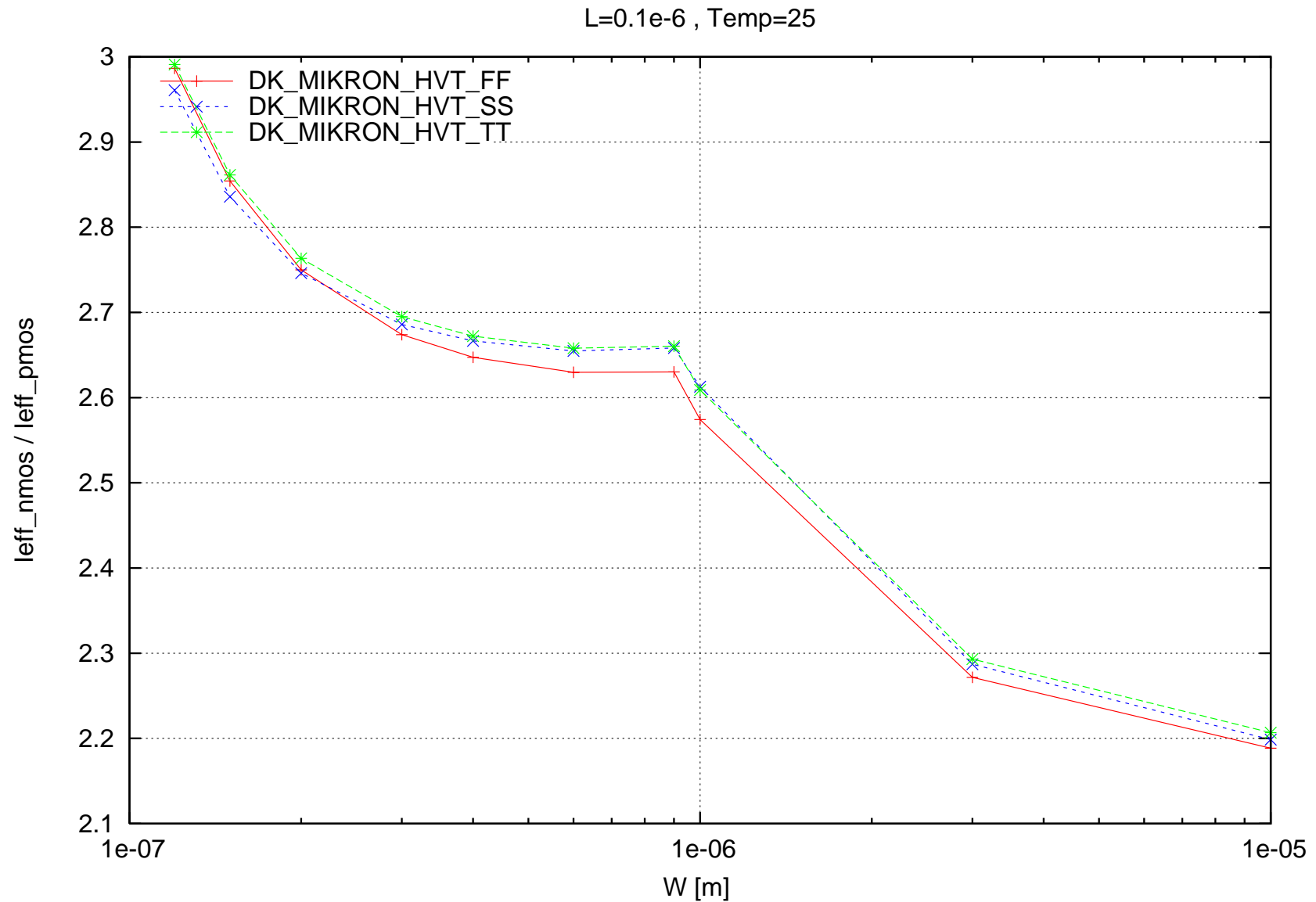


Crosscheck NMOS/PMOS ($L=0.1\text{e-}6$, Temp=25, po2act=0.63e-6, LPE=0)

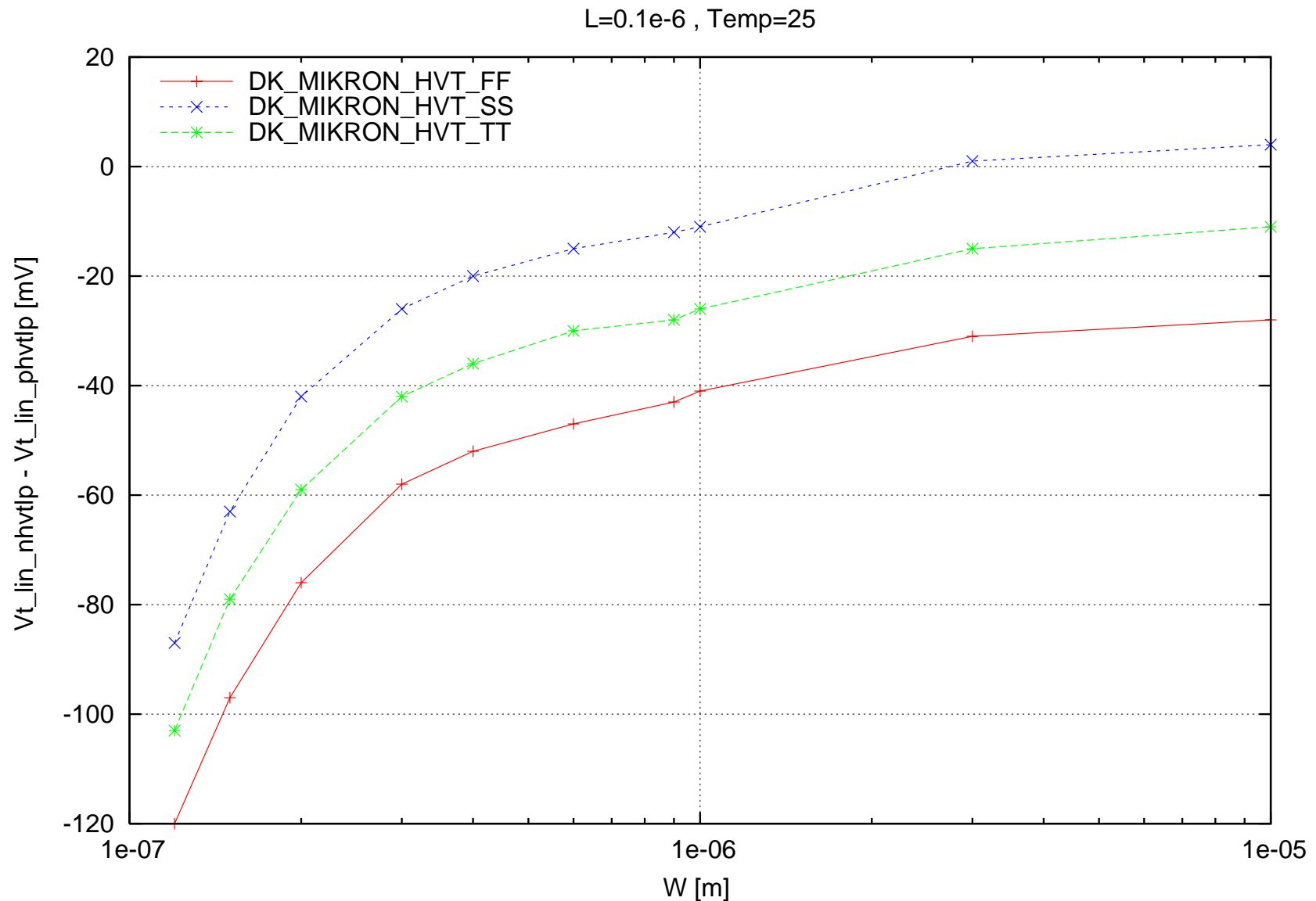
nhvt Isat_nmos / Isat_pmos vs. W [m] , L=0.1e-6 , Temp=25



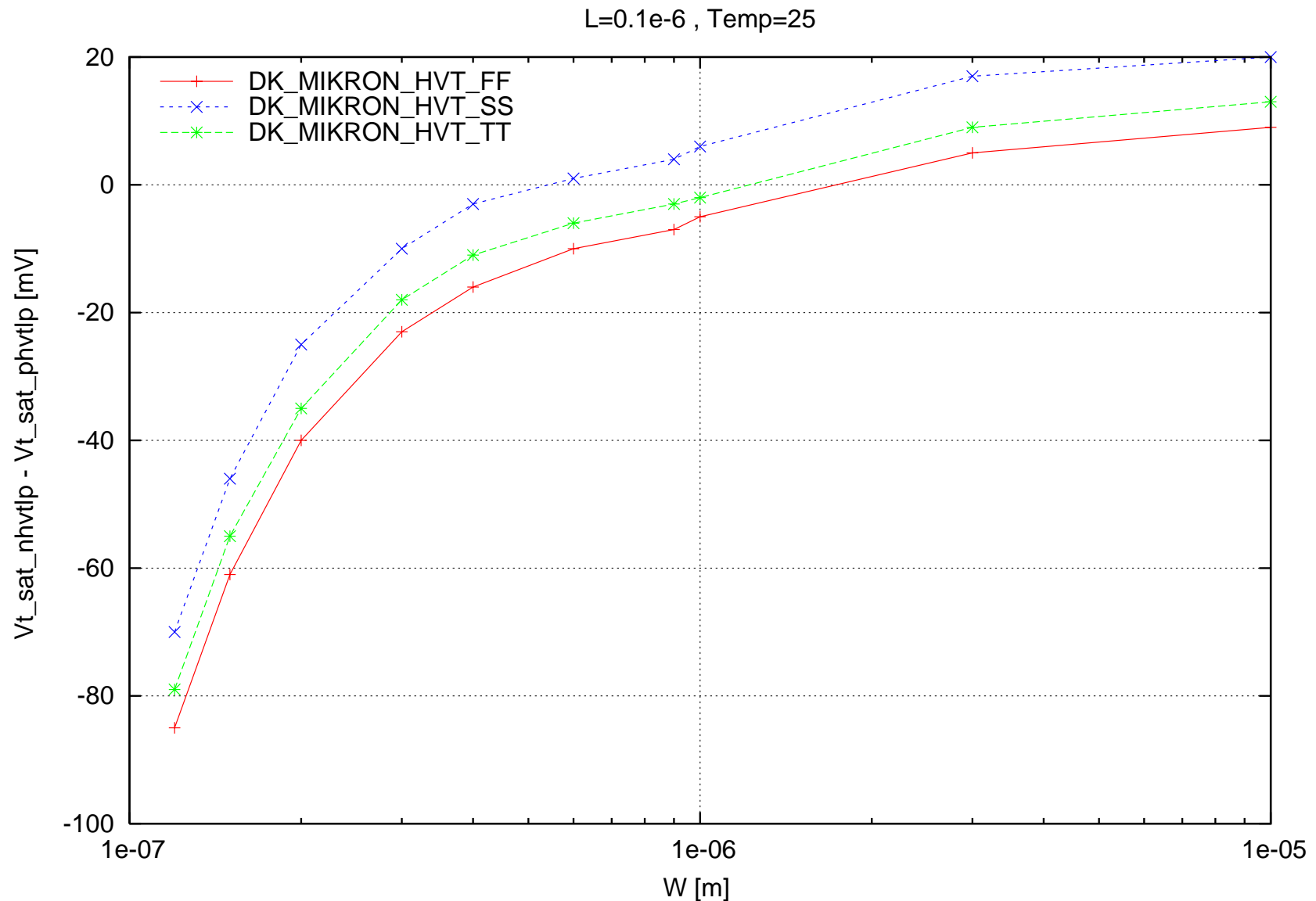
nhvt leff_nmos / leff_pmos vs. W [m] , L=0.1e-6 , Temp=25



nhvt $V_{t_lin_nhvtlp} - V_{t_lin_phvtlp}$ [mV] vs. W [m] , $L=0.1e-6$, Temp=25

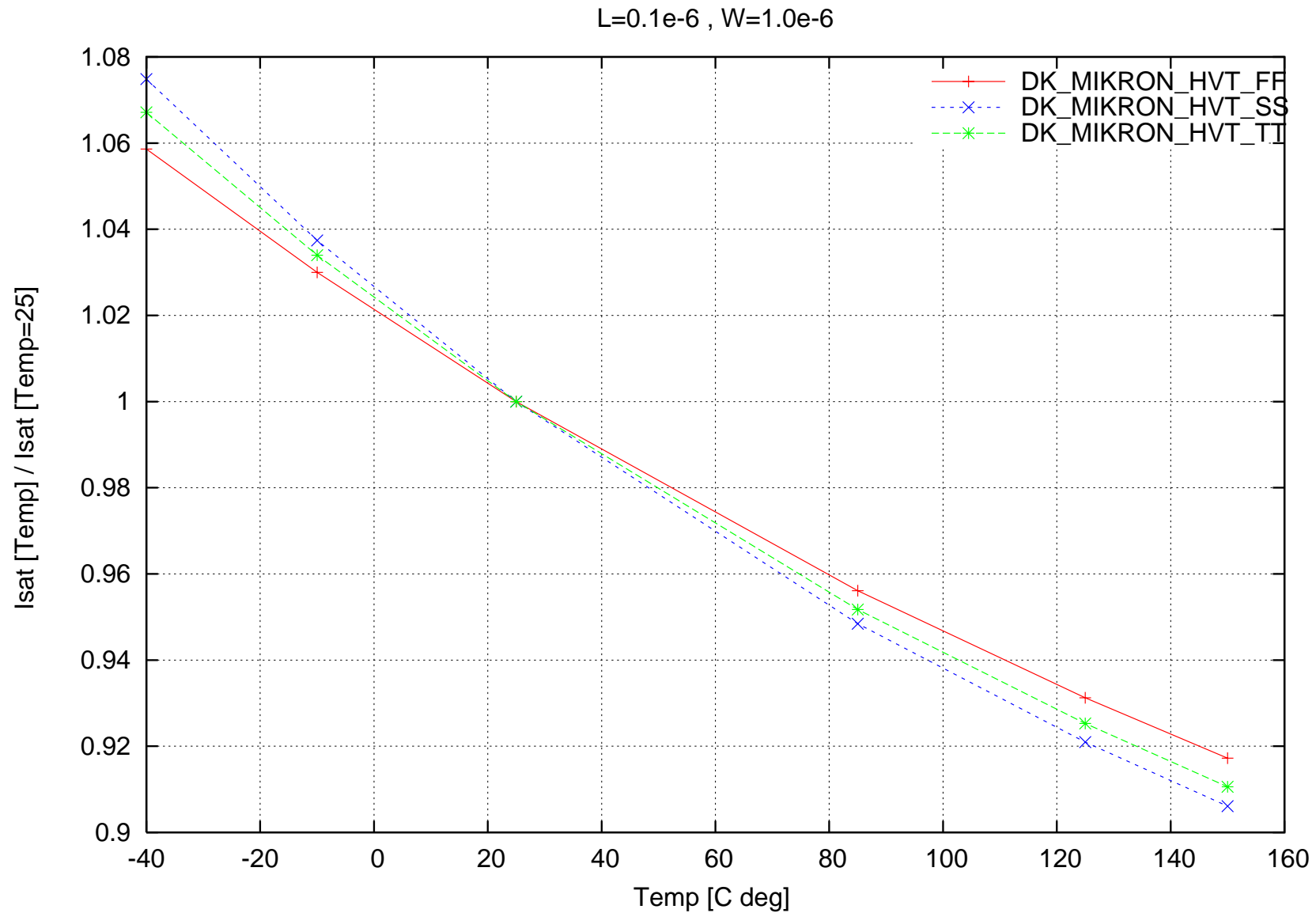


nhvt $V_{t_sat_nhvtlp} - V_{t_sat_phvtlp}$ [mV] vs. W [m] , $L=0.1e-6$, Temp=25

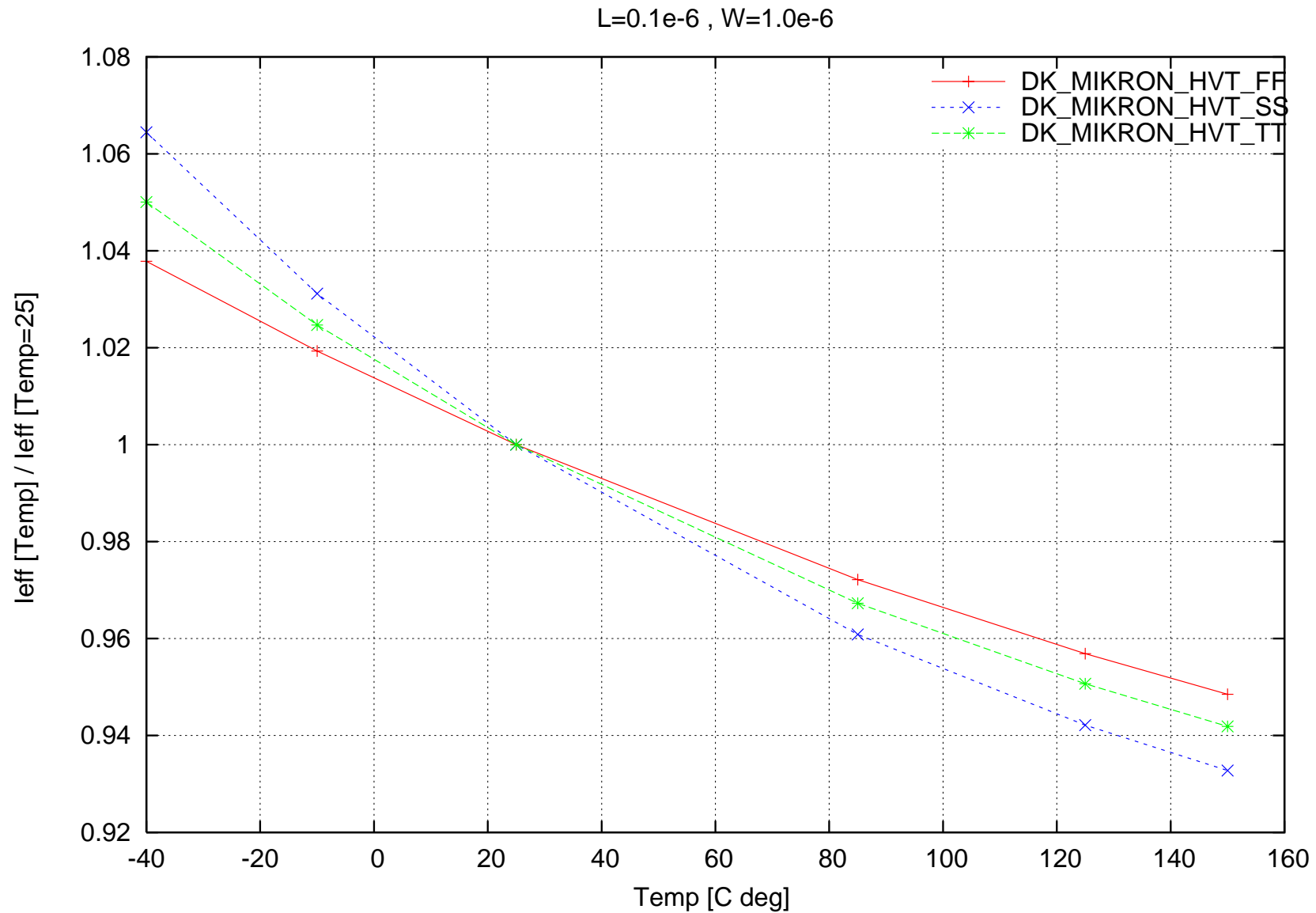


Scaling versus Temp for NMOS ($L=0.1\text{e-}6$, $W=1.0\text{e-}6$, $po2act=0.63\text{e-}6$, $LPE=0$)

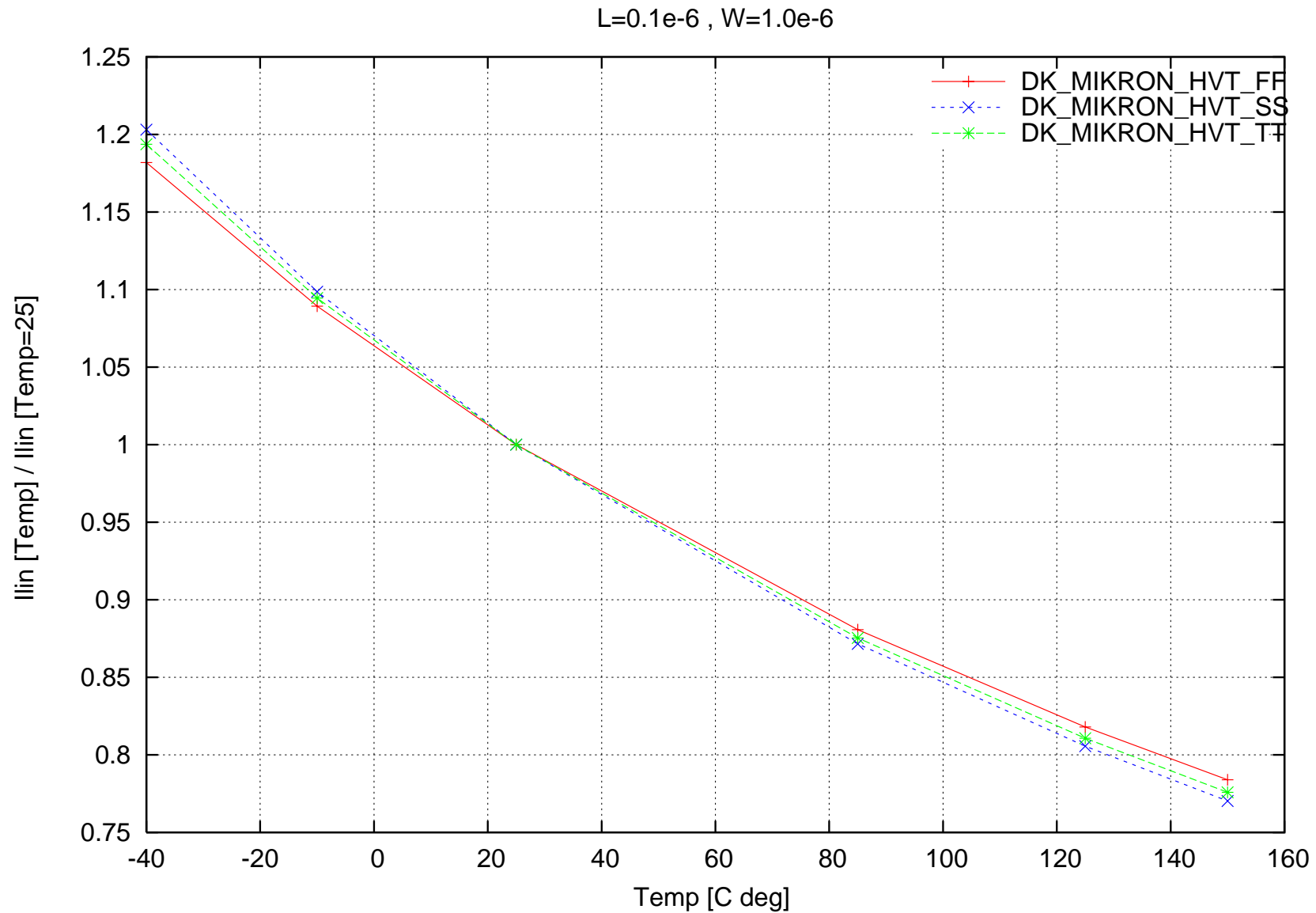
nhvt Isat [Temp] / Isat [Temp=25] vs. Temp [C deg] , L=0.1e-6 , W=1.0e-6



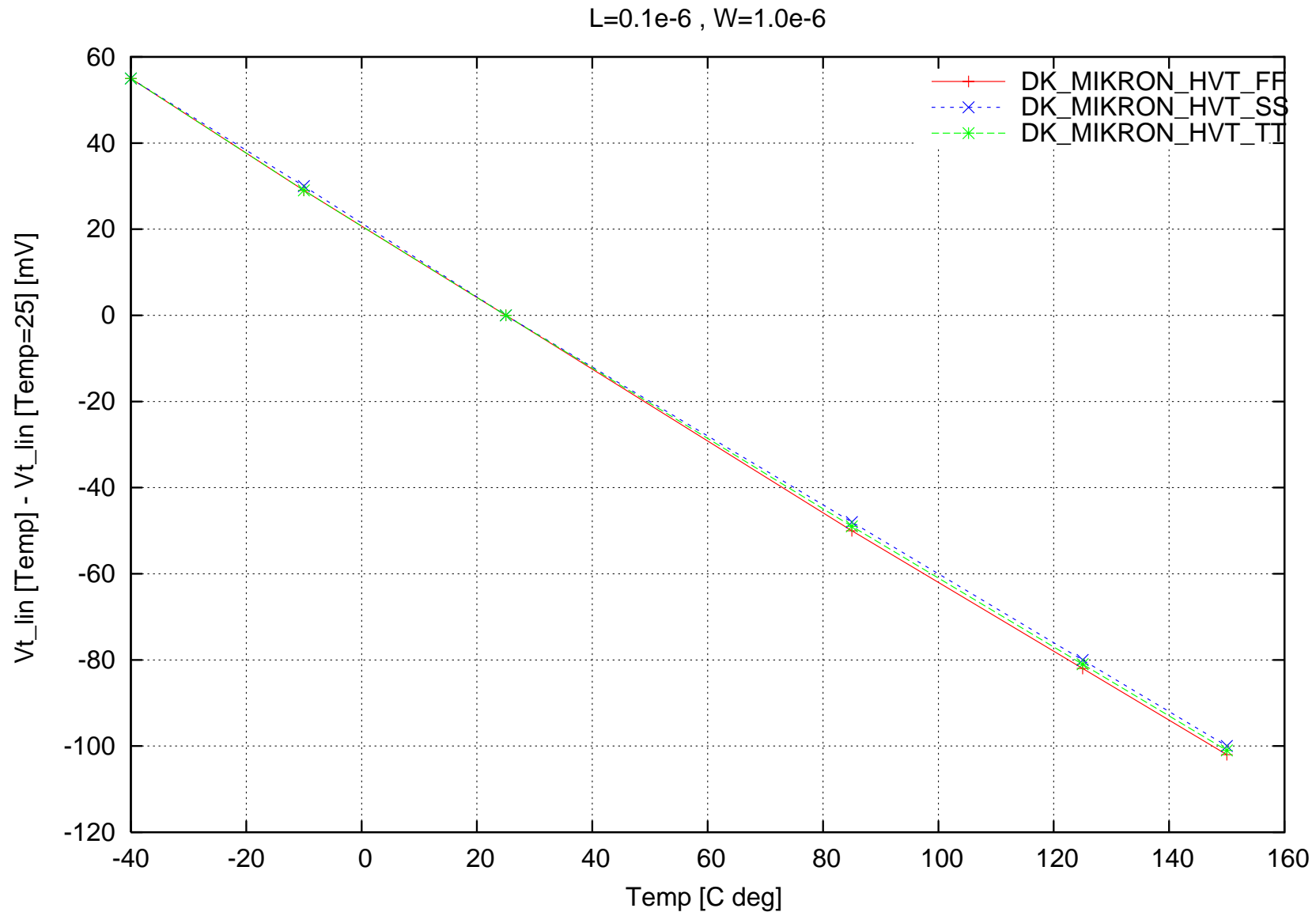
nhvt $I_{eff} [Temp] / I_{eff} [Temp=25]$ vs. Temp [C deg] , $L=0.1e-6$, $W=1.0e-6$



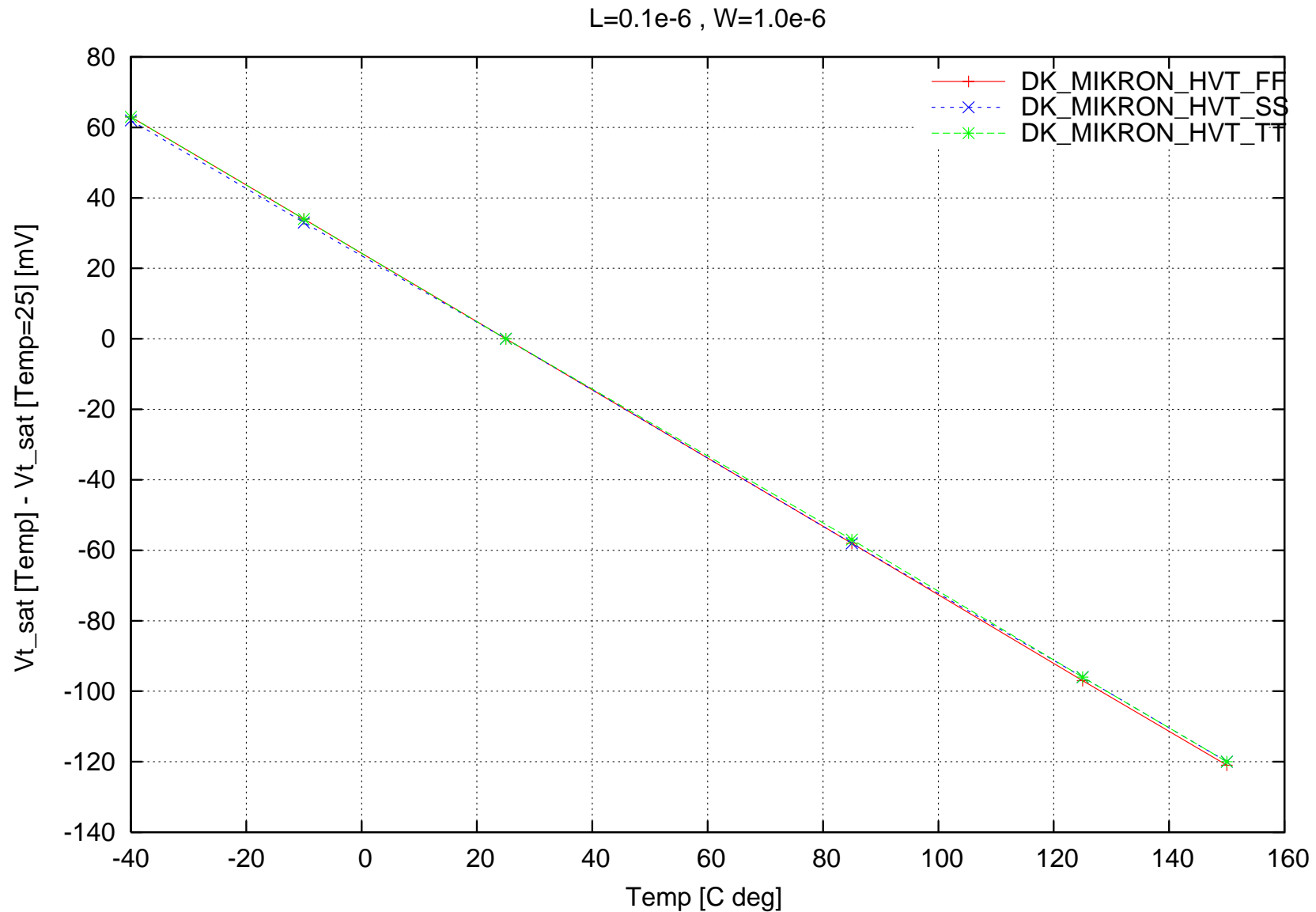
nhvt $I_{lin} [Temp] / I_{lin} [Temp=25]$ vs. Temp [C deg] , $L=0.1e-6$, $W=1.0e-6$



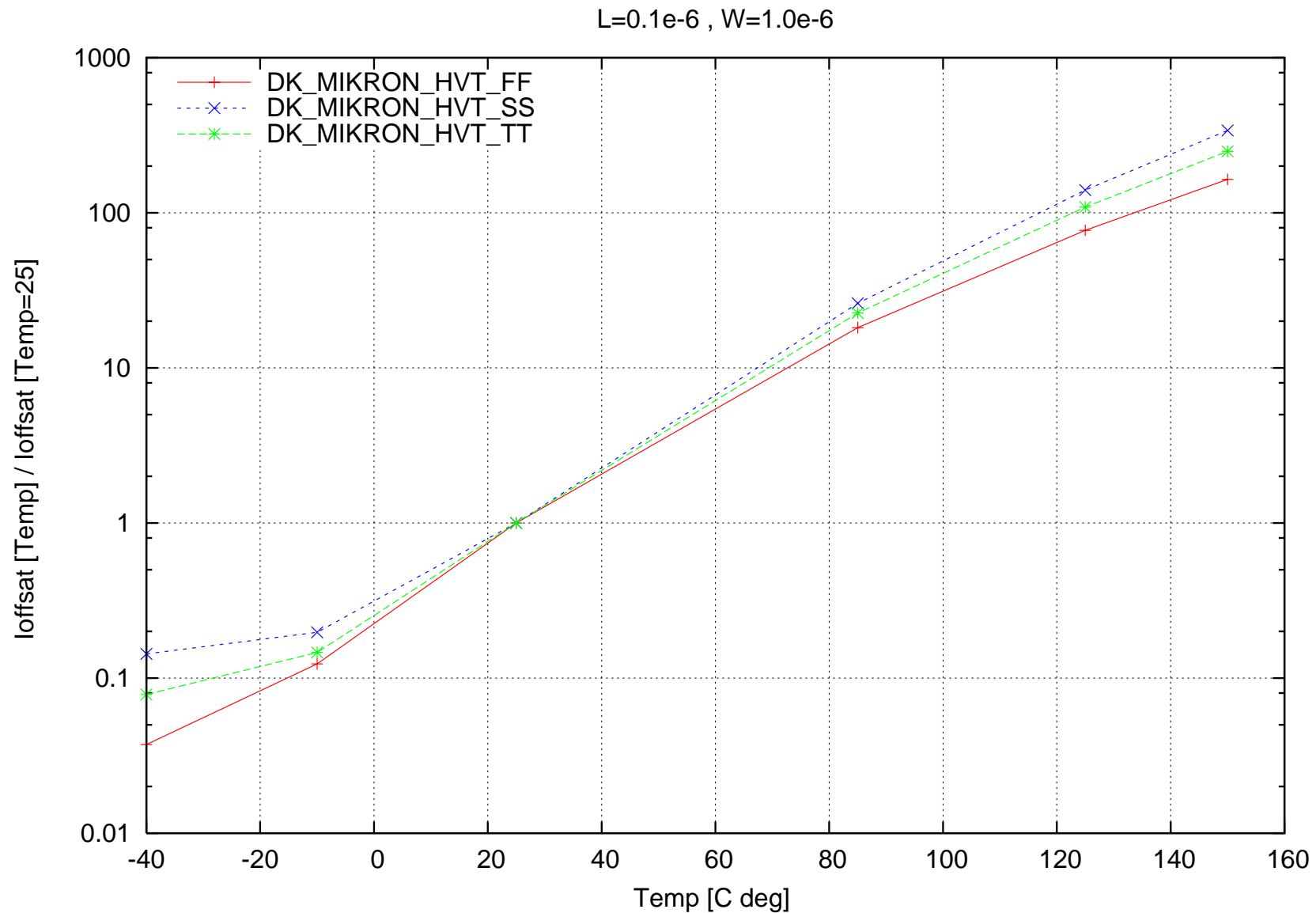
nhvt Vt_lin [Temp] - Vt_lin [Temp=25] [mV] vs. Temp [C deg] , L=0.1e-6 , W=1.0e-6



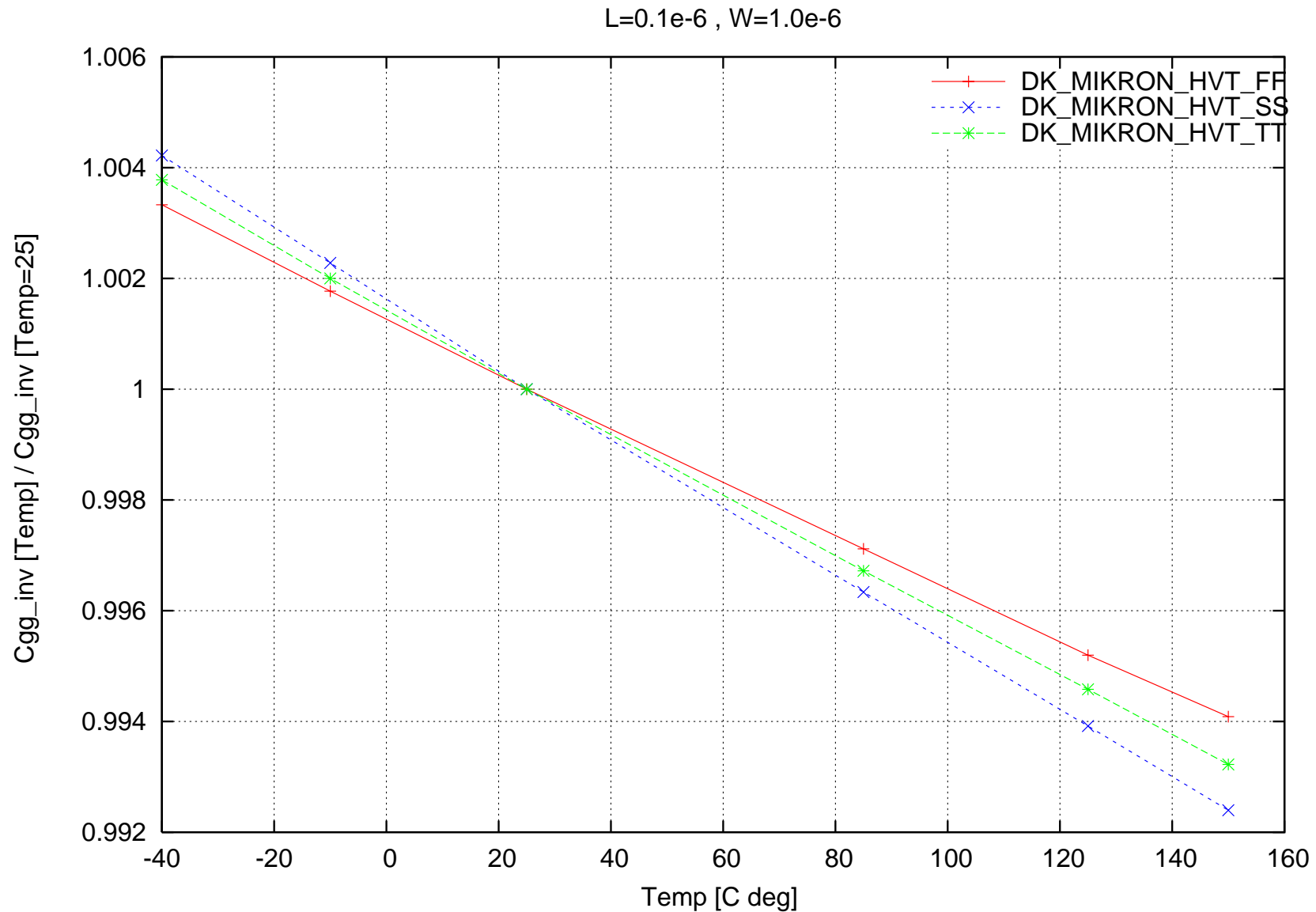
nhvt Vt_sat [Temp] - Vt_sat [Temp=25] [mV] vs. Temp [C deg] , L=0.1e-6 , W=1.0e-6



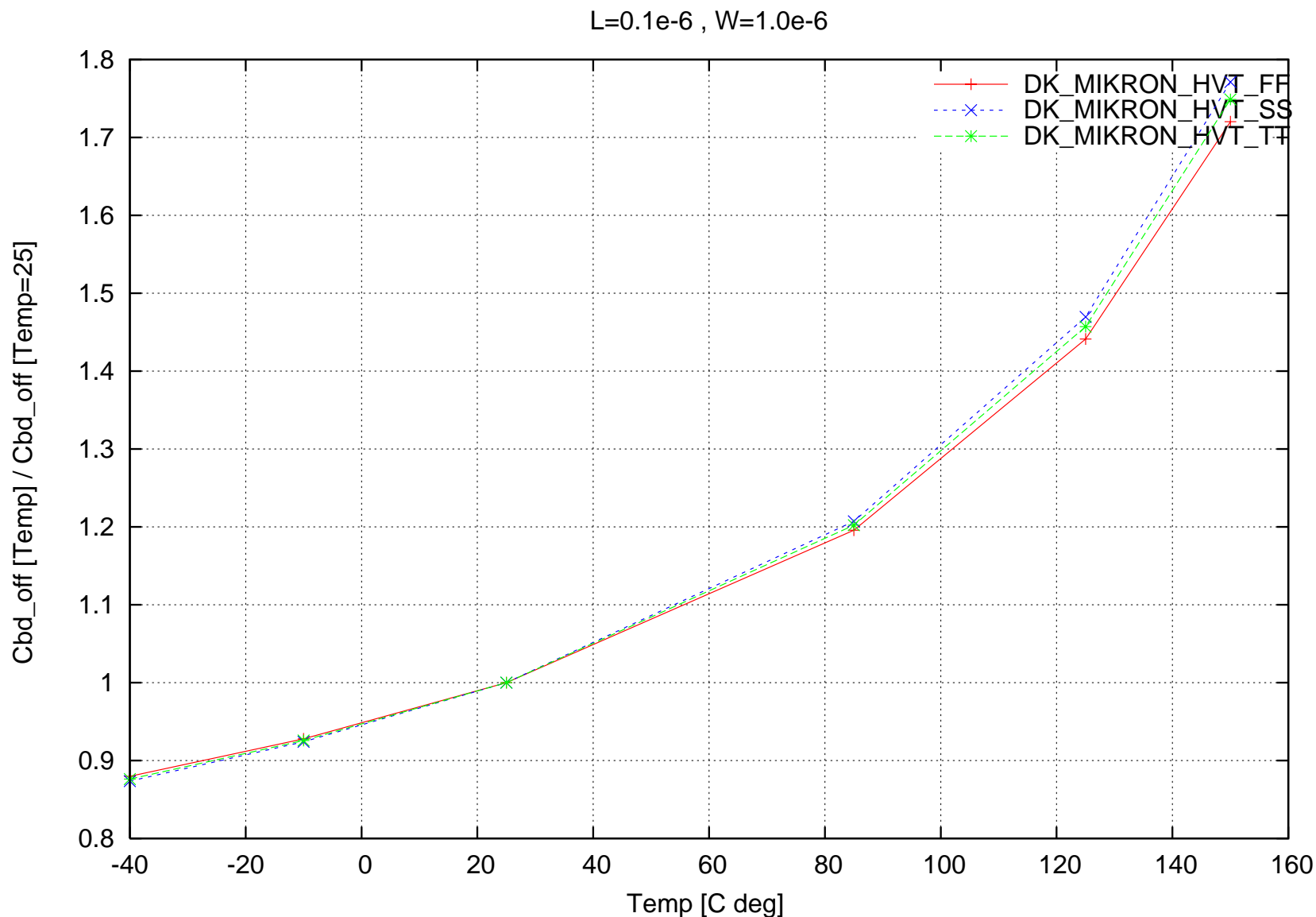
nhvt loffsat [Temp] / loffsat [Temp=25] vs. Temp [C deg] , L=0.1e-6 , W=1.0e-6



nhvt Cgg_inv [Temp] / Cgg_inv [Temp=25] vs. Temp [C deg] , L=0.1e-6 , W=1.0e-6



nhvt Cbd_off [Temp] / Cbd_off [Temp=25] vs. Temp [C deg] , L=0.1e-6 , W=1.0e-6

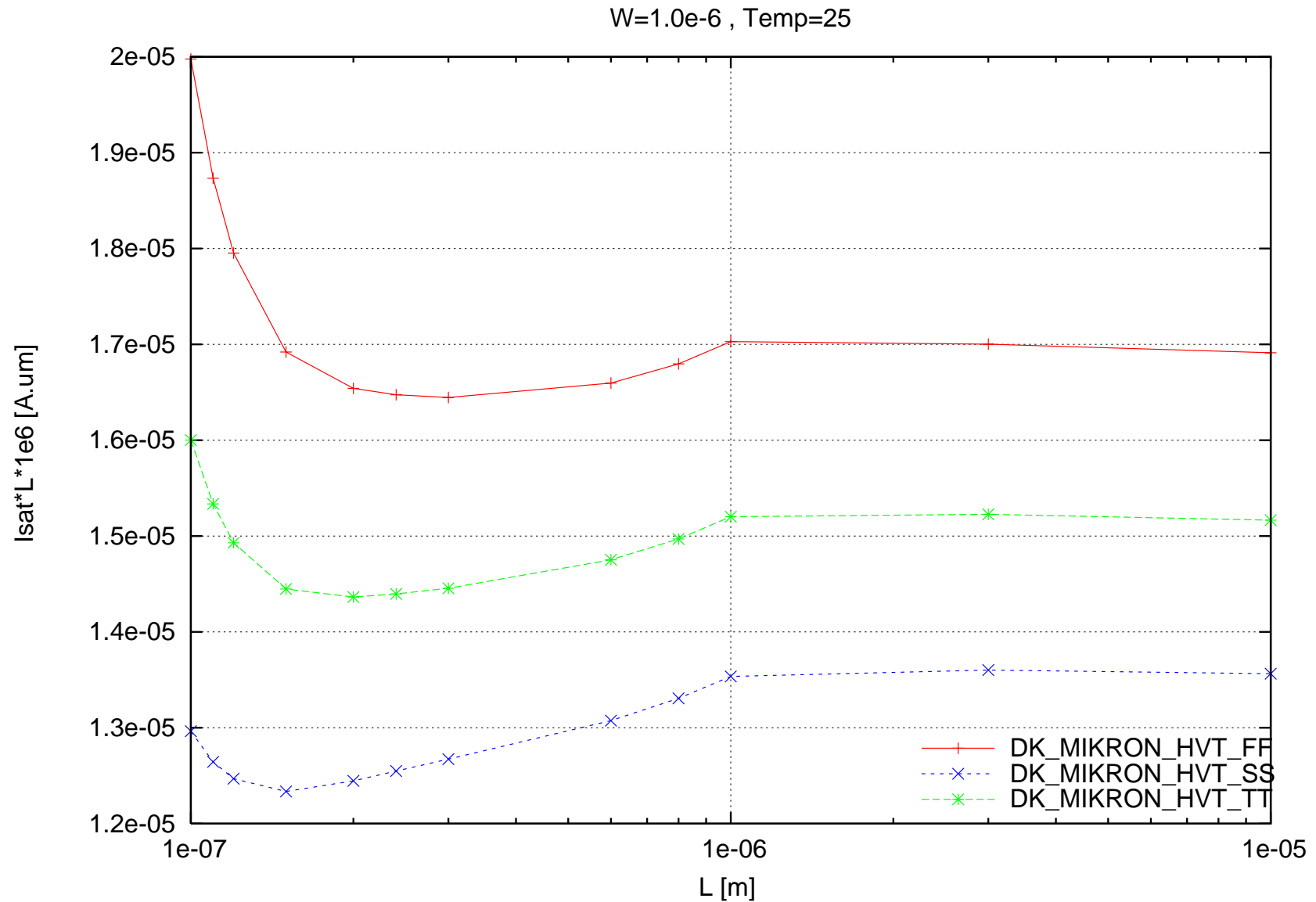


PHVT

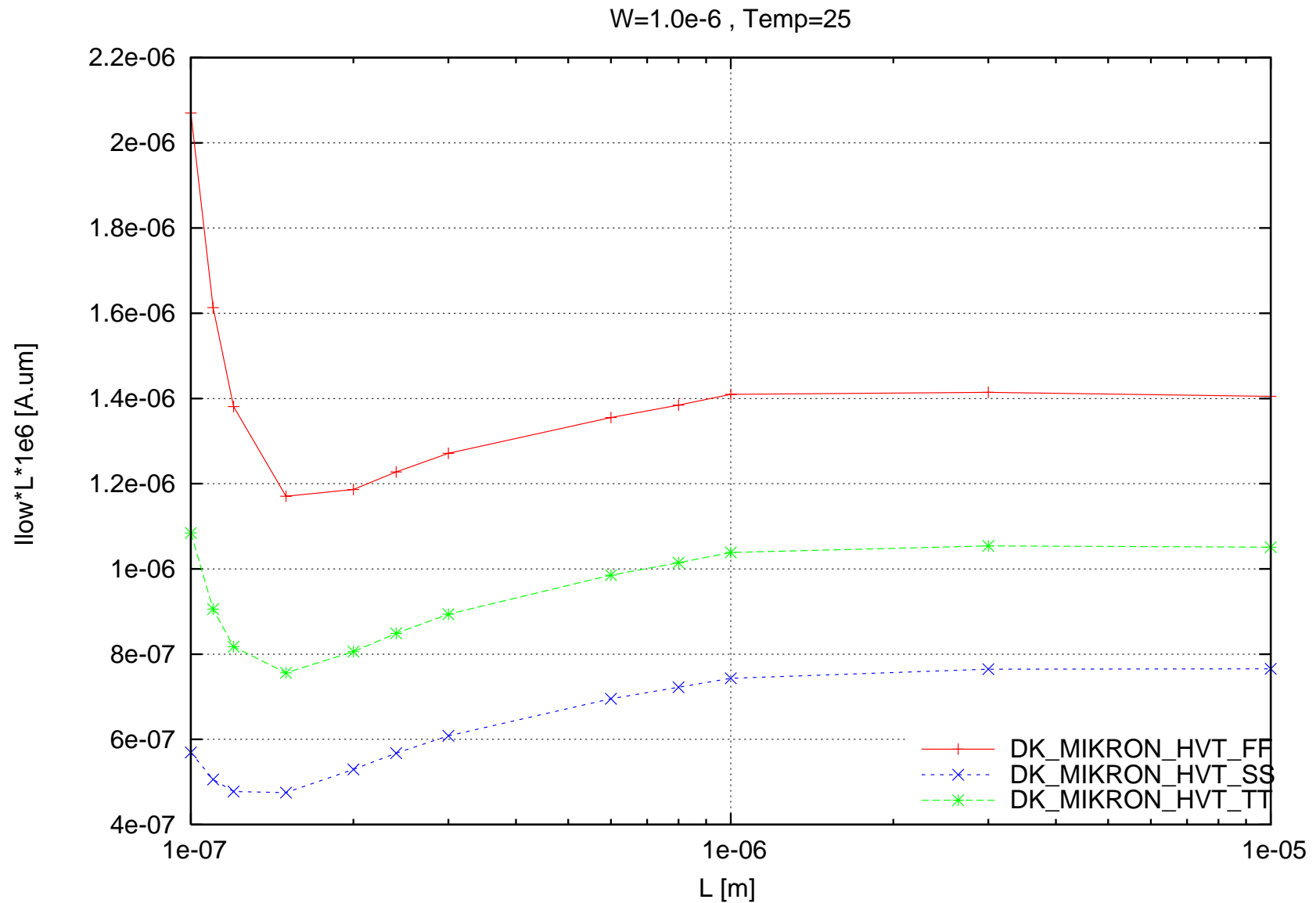
Electrical characteristics scaling

Scaling versus Length for PMOS ($W=1.0\text{e-}6$, Temp=25, $po2act=0.63\text{e-}6$, LPE=0)

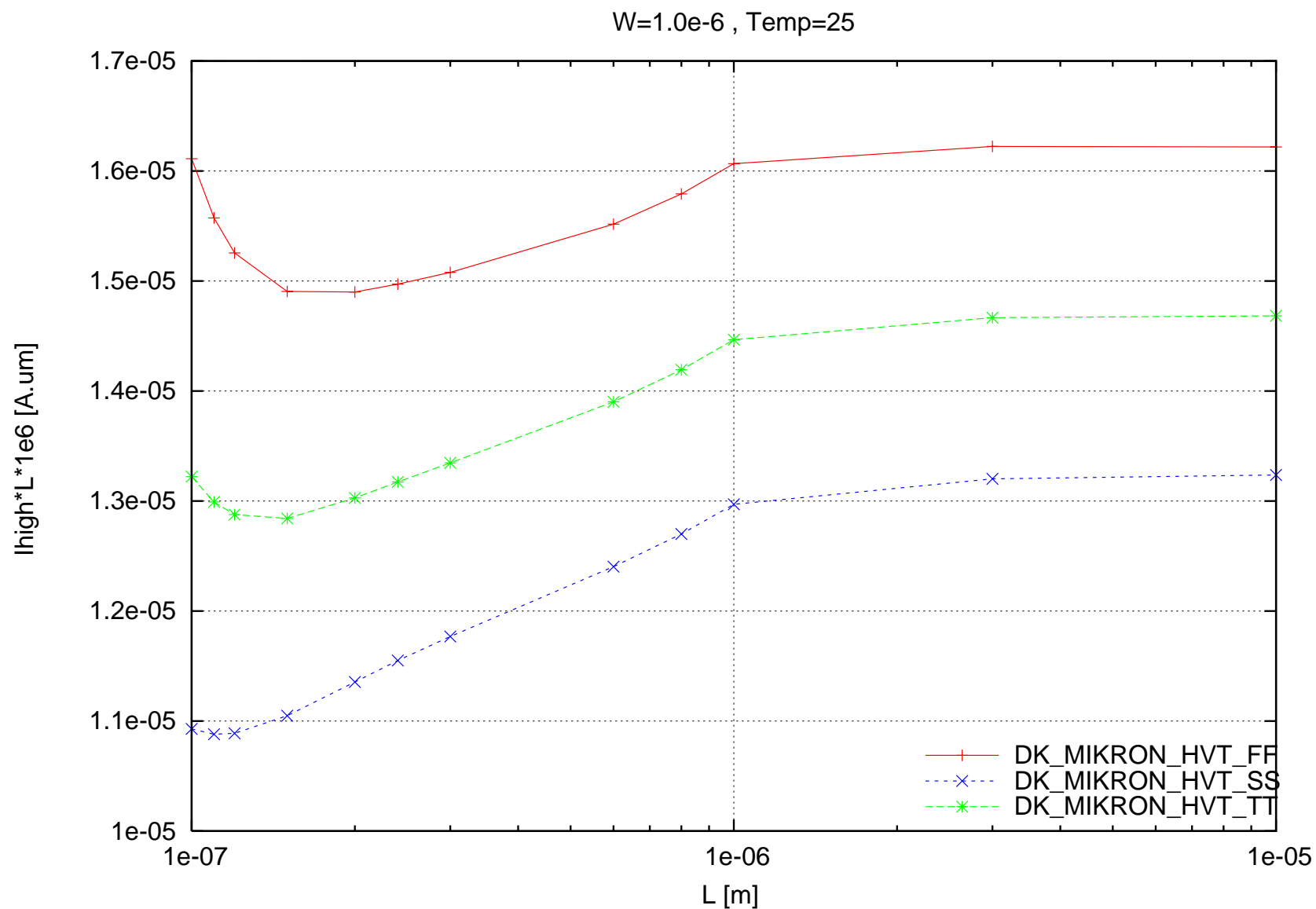
phvt Isat*L*1e6 [A.um] vs. L [m] , W=1.0e-6 , Temp=25



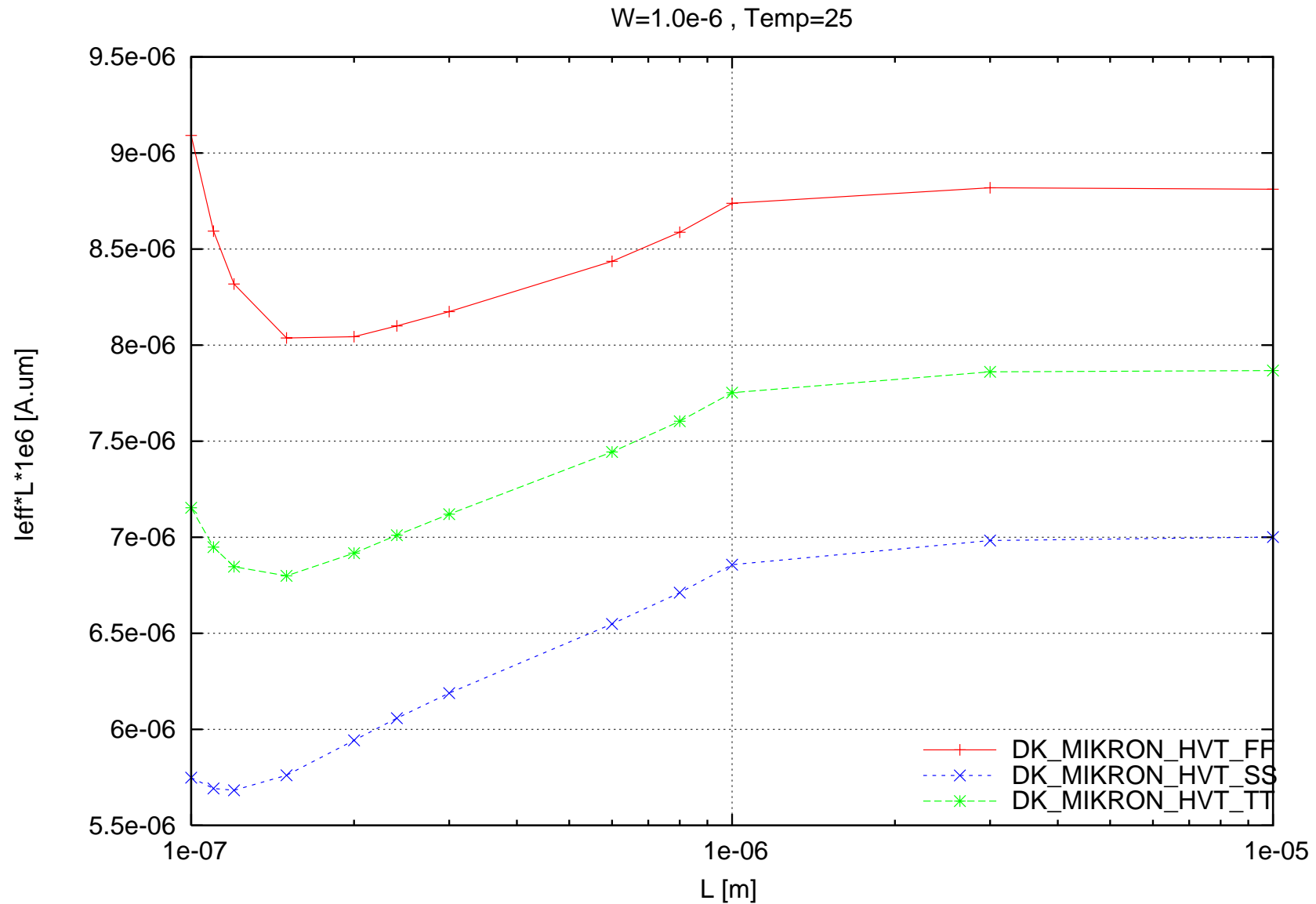
phvt llow*L*1e6 [A.um] vs. L [m] , W=1.0e-6 , Temp=25



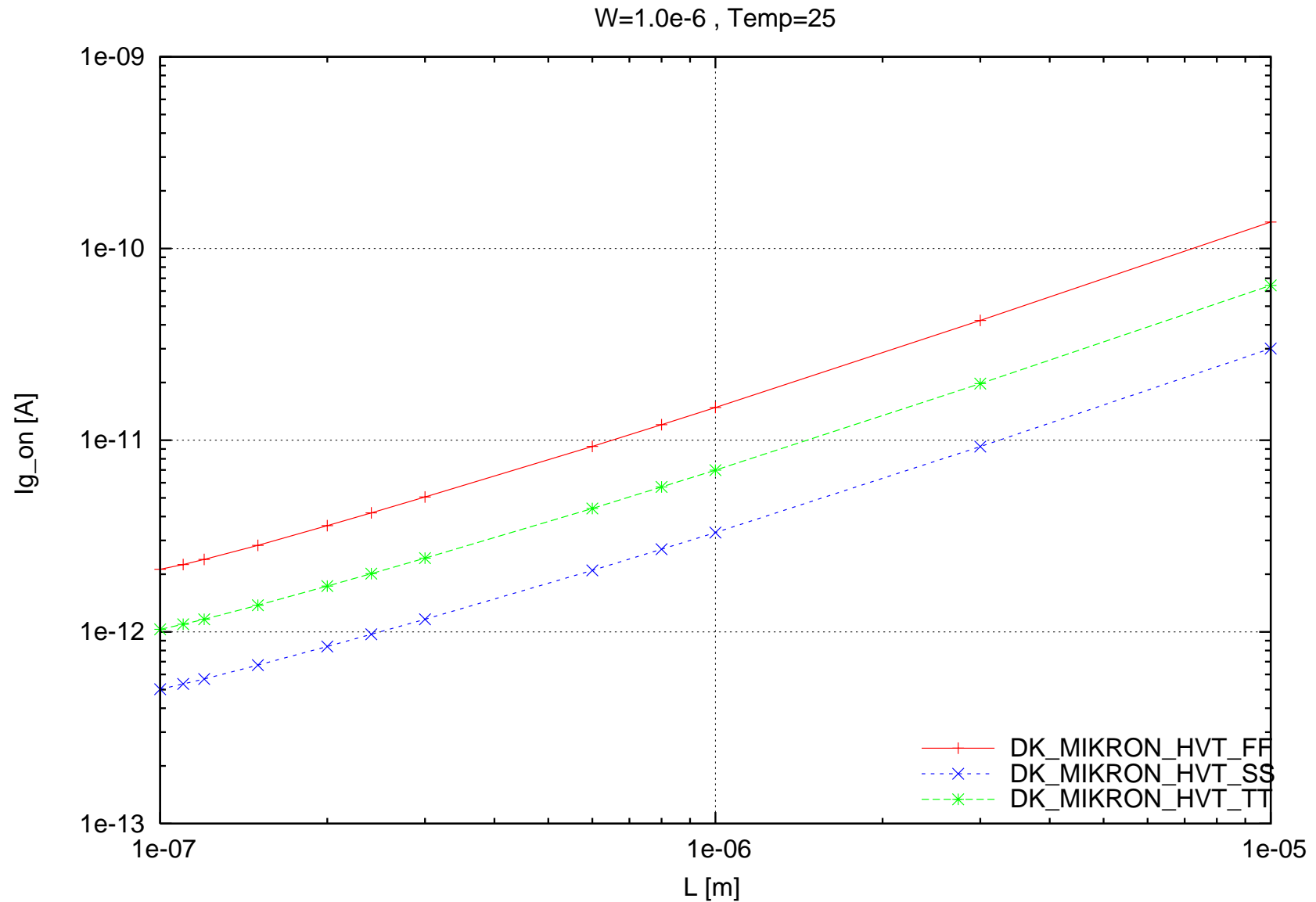
phvt lhigh*L*1e6 [A.um] vs. L [m] , W=1.0e-6 , Temp=25



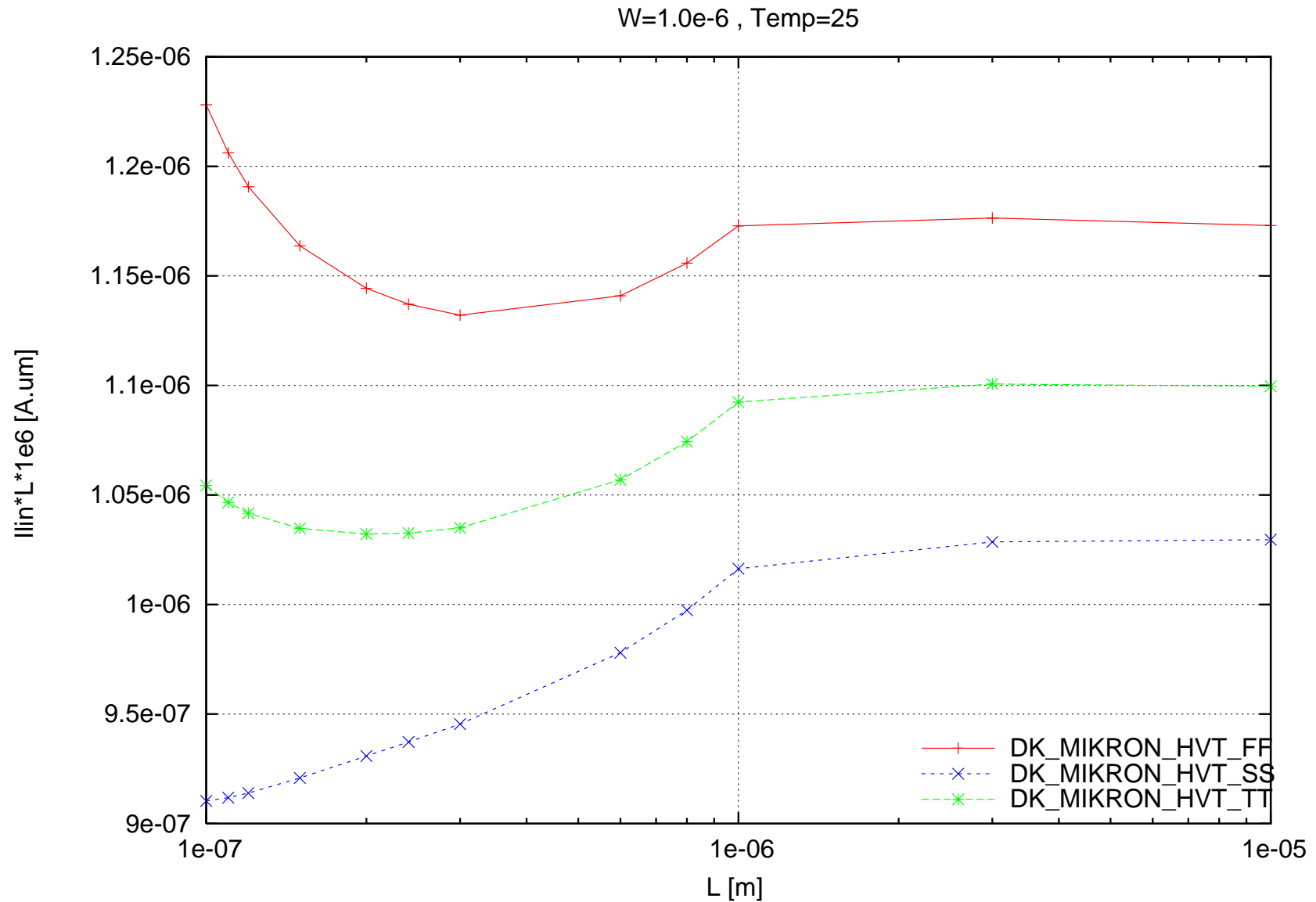
phvt leff*L*1e6 [A.um] vs. L [m] , W=1.0e-6 , Temp=25



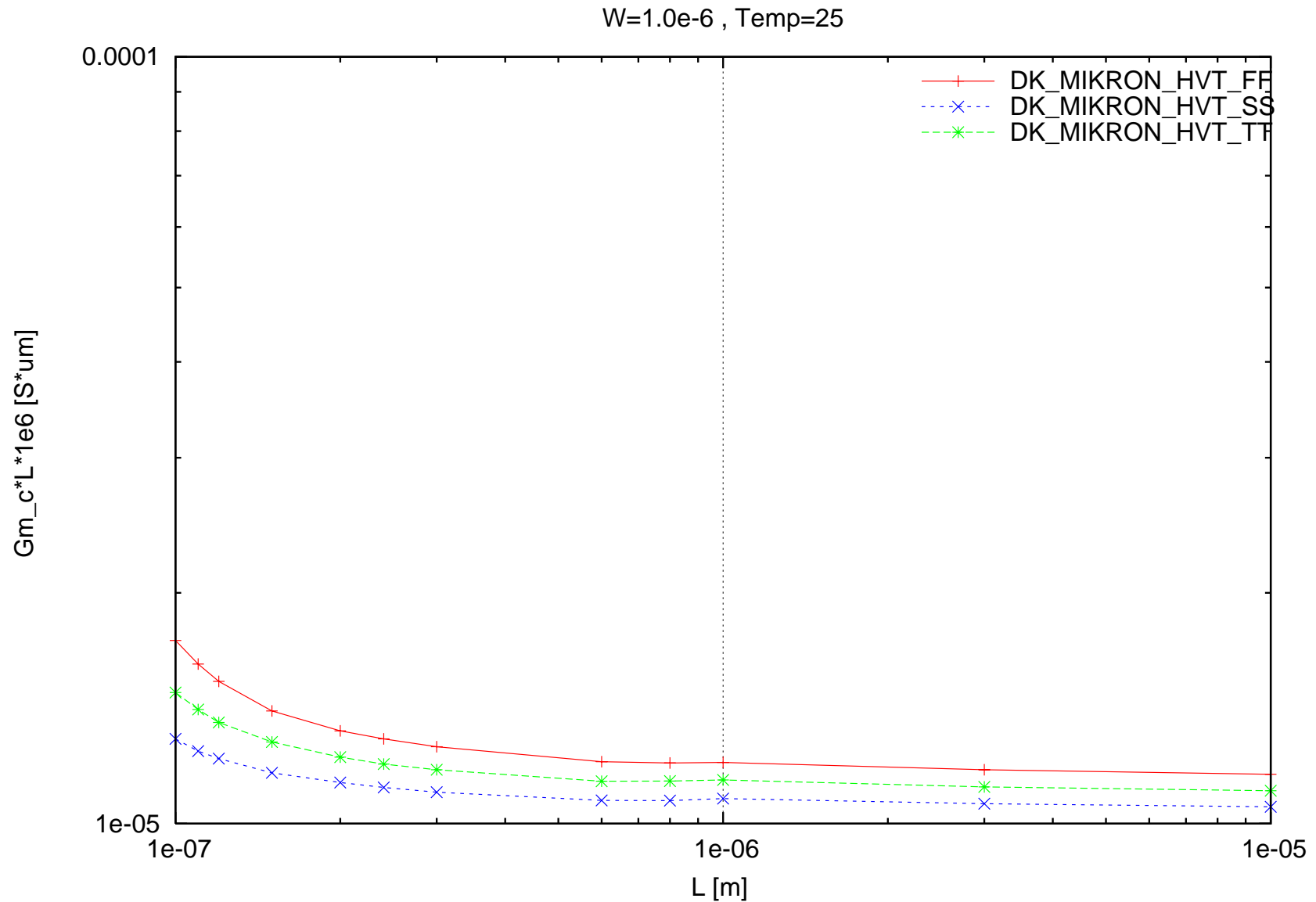
phvt Ig_on [A] vs. L [m] , W=1.0e-6 , Temp=25



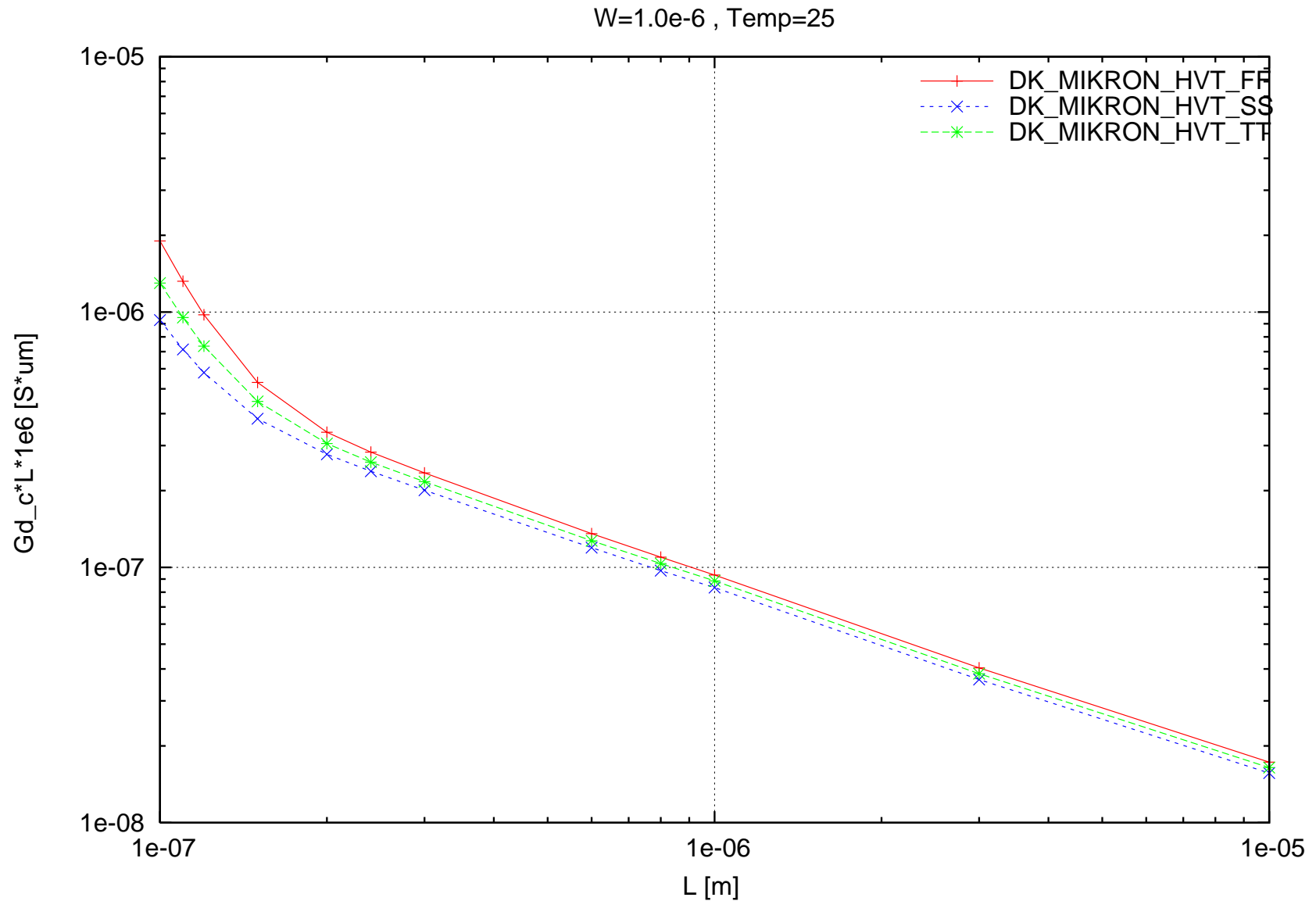
phvt llin*L*1e6 [A.um] vs. L [m] , W=1.0e-6 , Temp=25



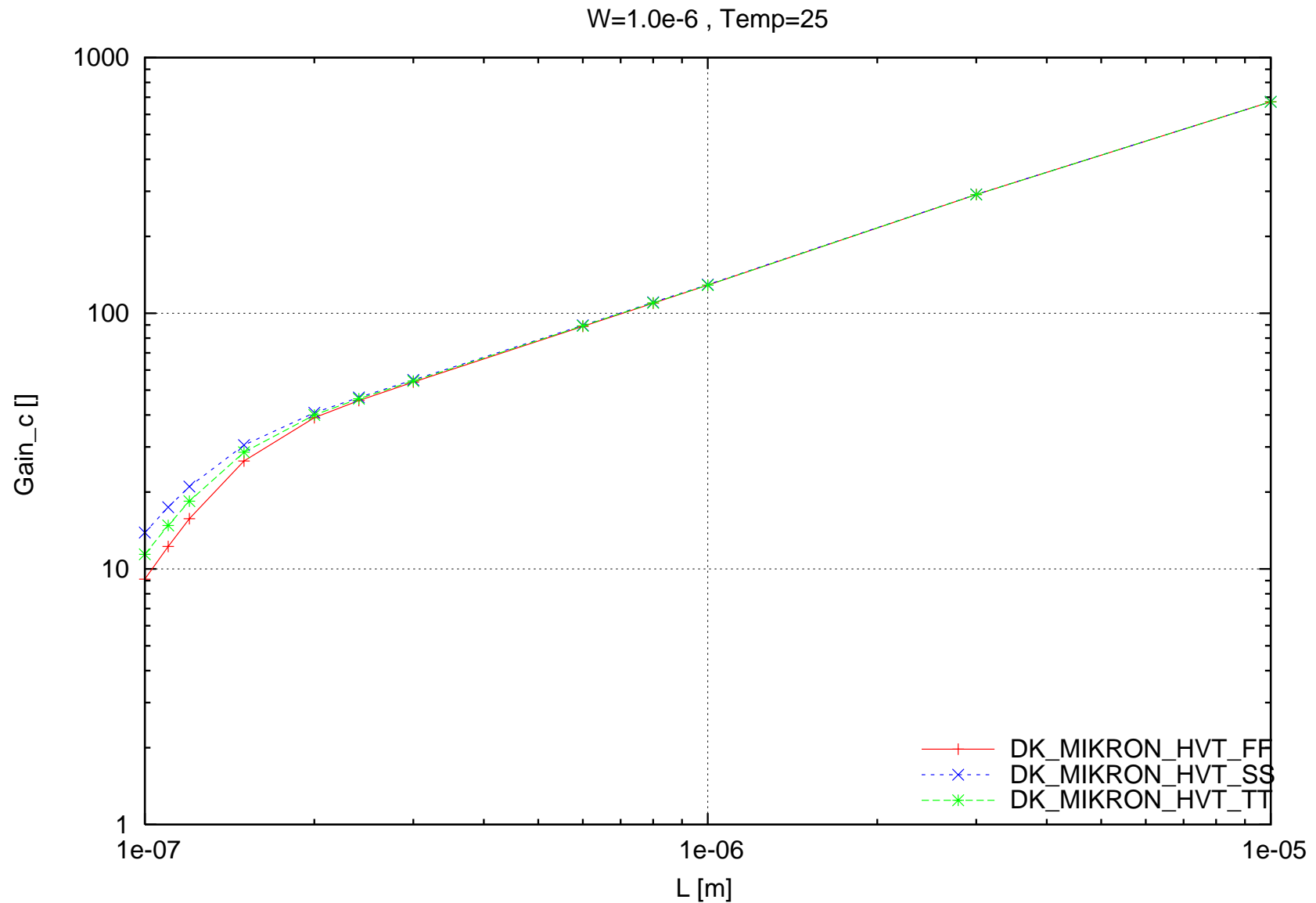
phvt Gm_c*L*1e6 [S*um] vs. L [m] , W=1.0e-6 , Temp=25



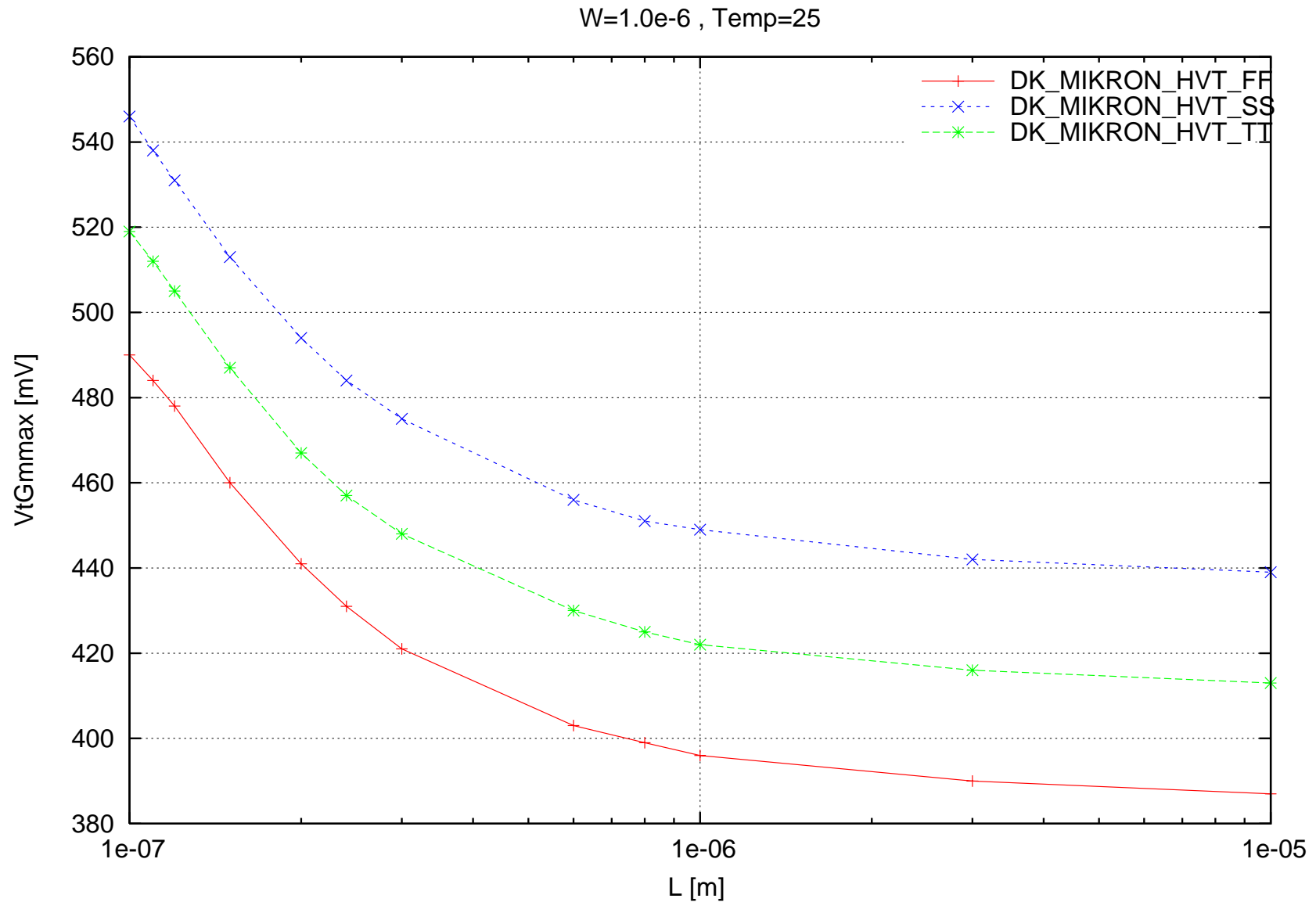
phvt Gd_c*L*1e6 [S*um] vs. L [m] , W=1.0e-6 , Temp=25



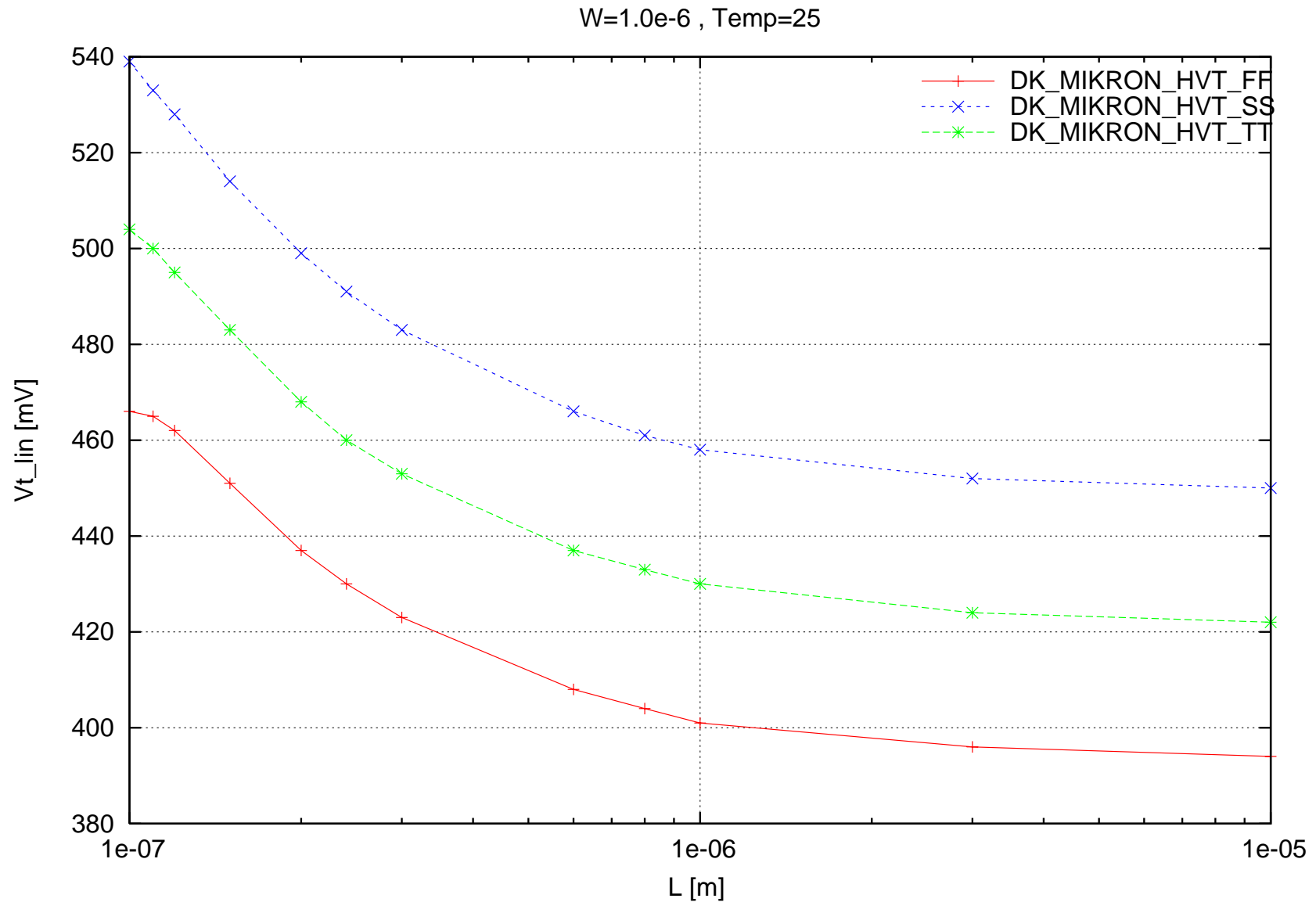
phvt Gain_c [] vs. L [m] , W=1.0e-6 , Temp=25



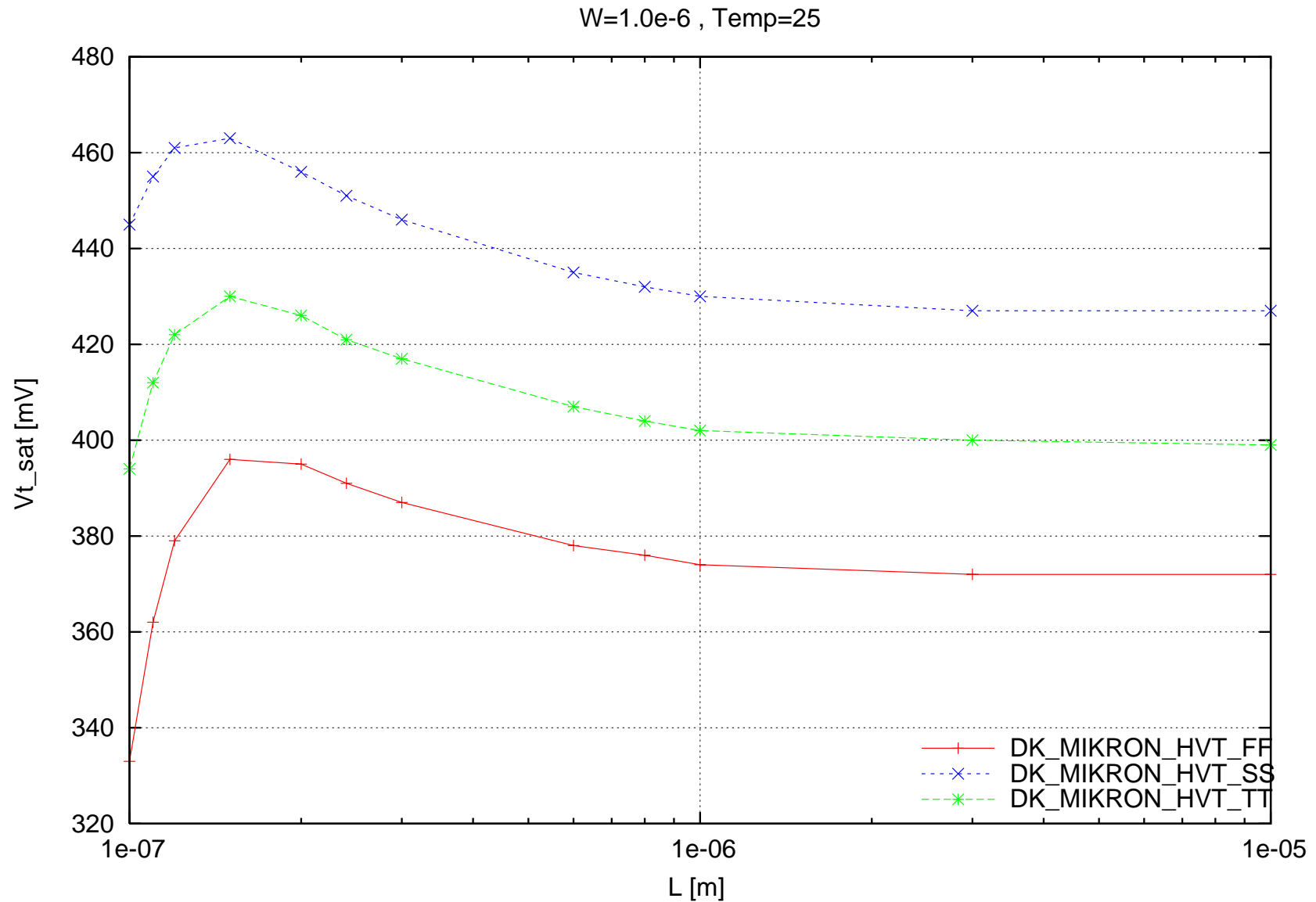
phvt V_{tGmax} [mV] vs. L [m] , $W=1.0e-6$, $Temp=25$



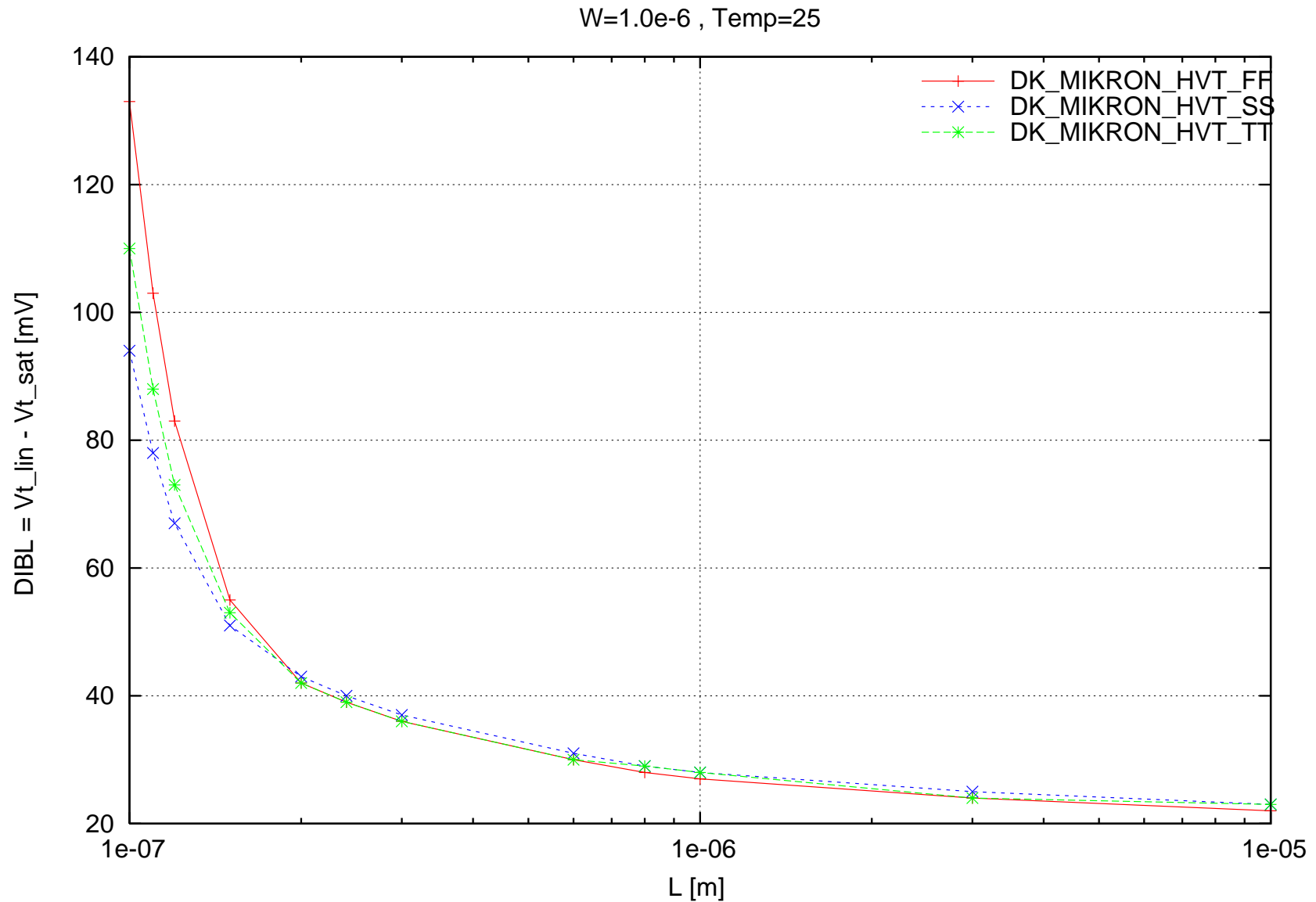
phvt Vt_lin [mV] vs. L [m] , W=1.0e-6 , Temp=25



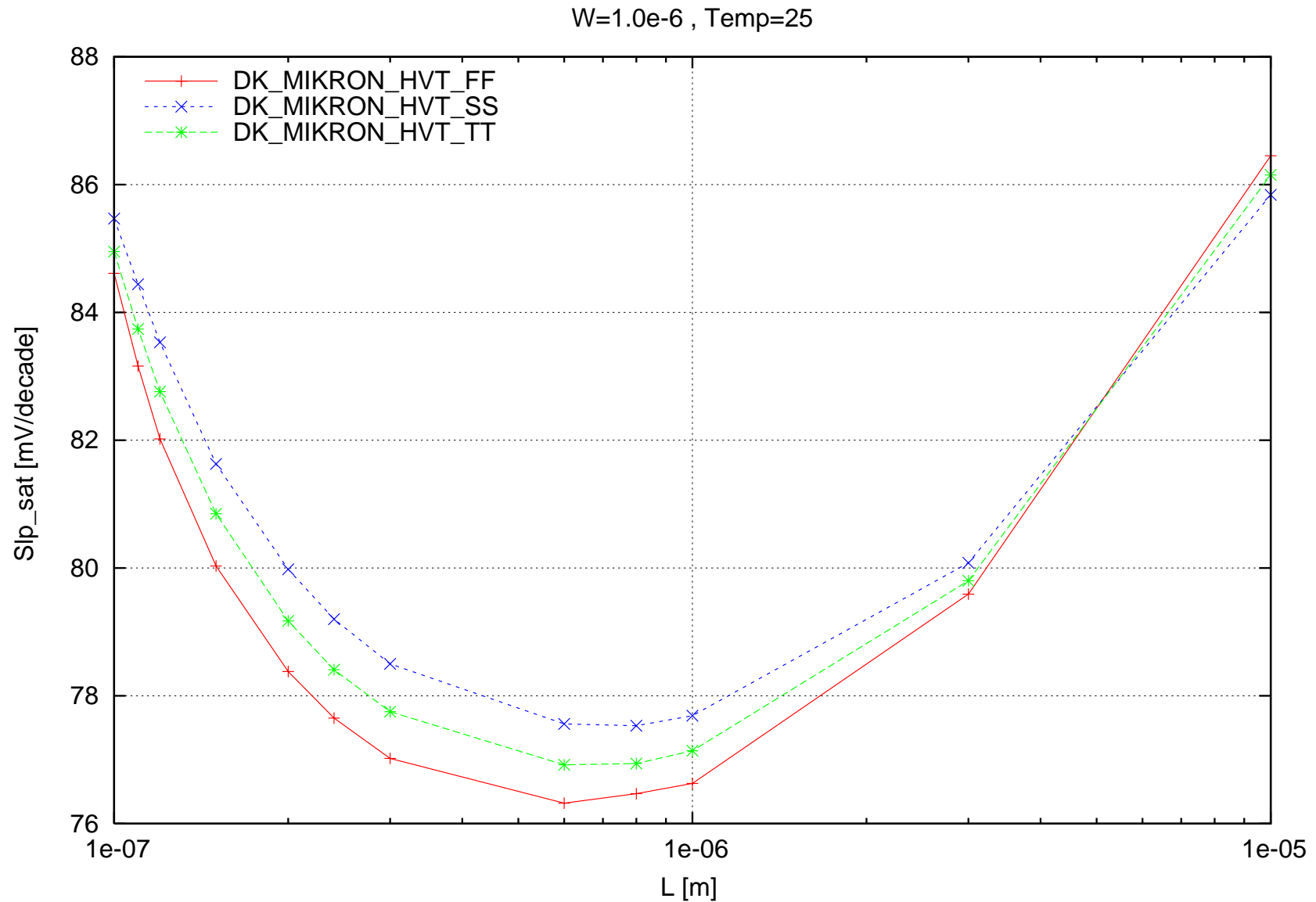
phvt Vt_sat [mV] vs. L [m] , W=1.0e-6 , Temp=25



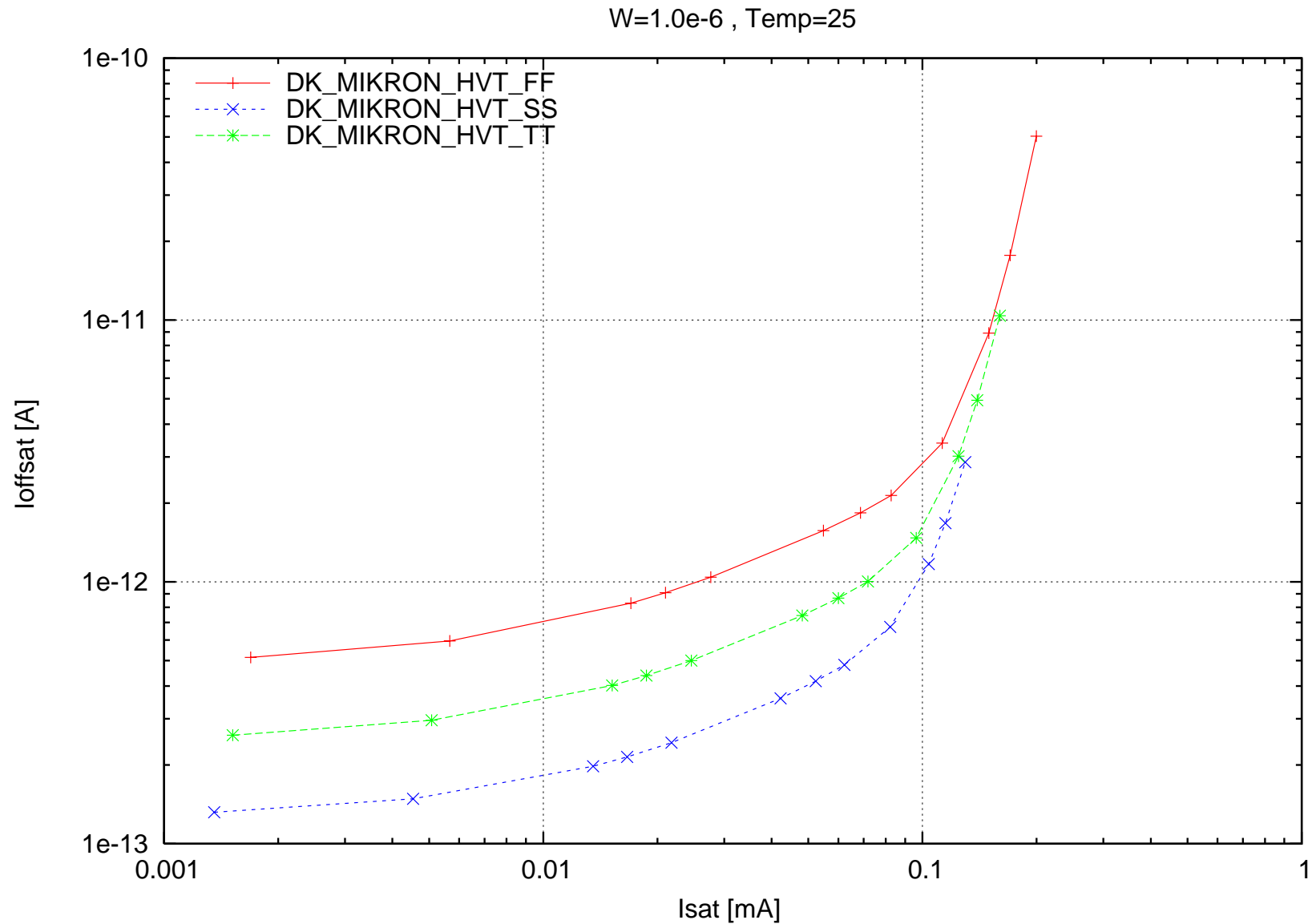
phvt DIBL = $V_{t_lin} - V_{t_sat}$ [mV] vs. L [m] , $W=1.0e-6$, Temp=25



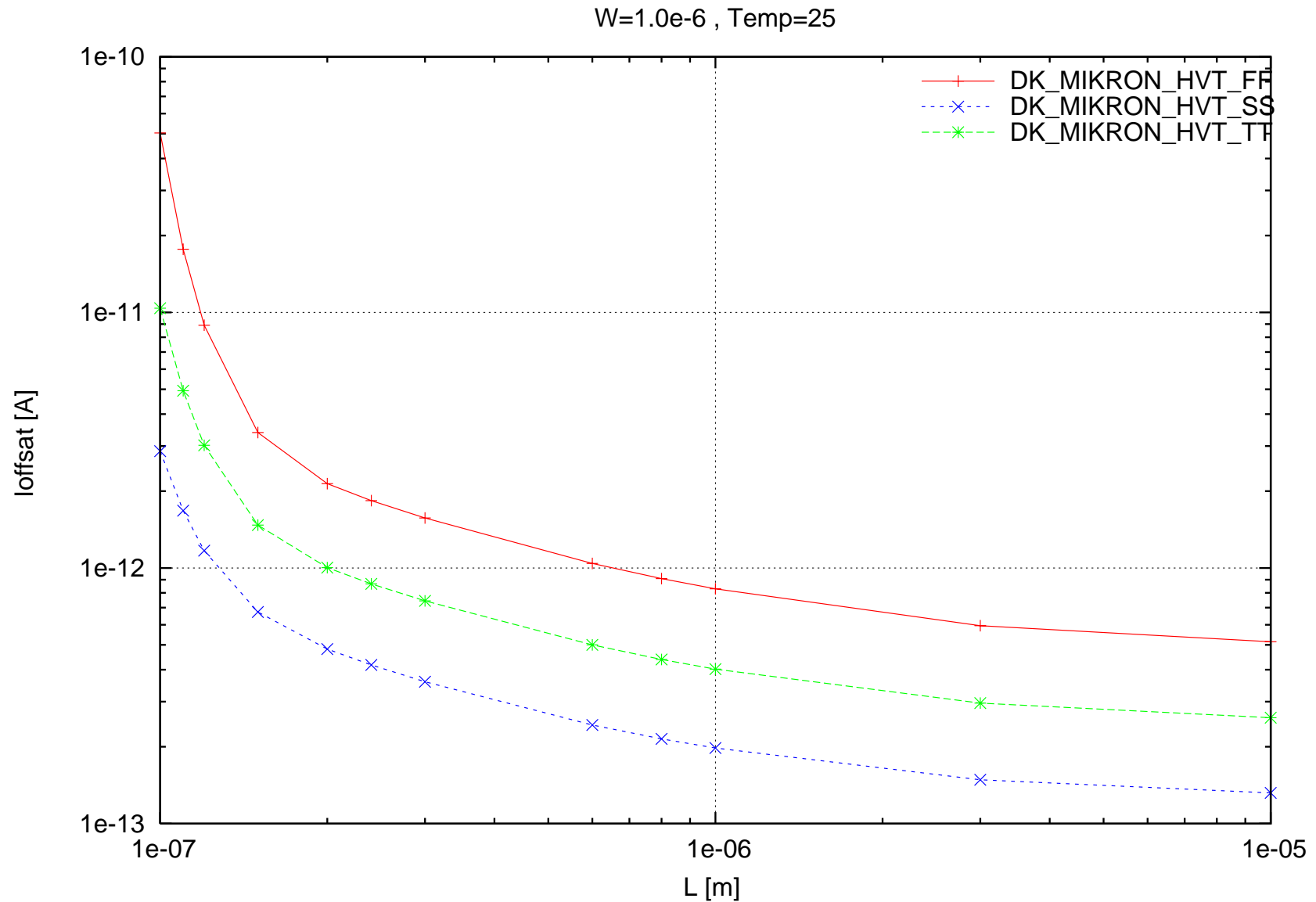
phvt Slp_sat [mV/decade] vs. L [m] , W=1.0e-6 , Temp=25



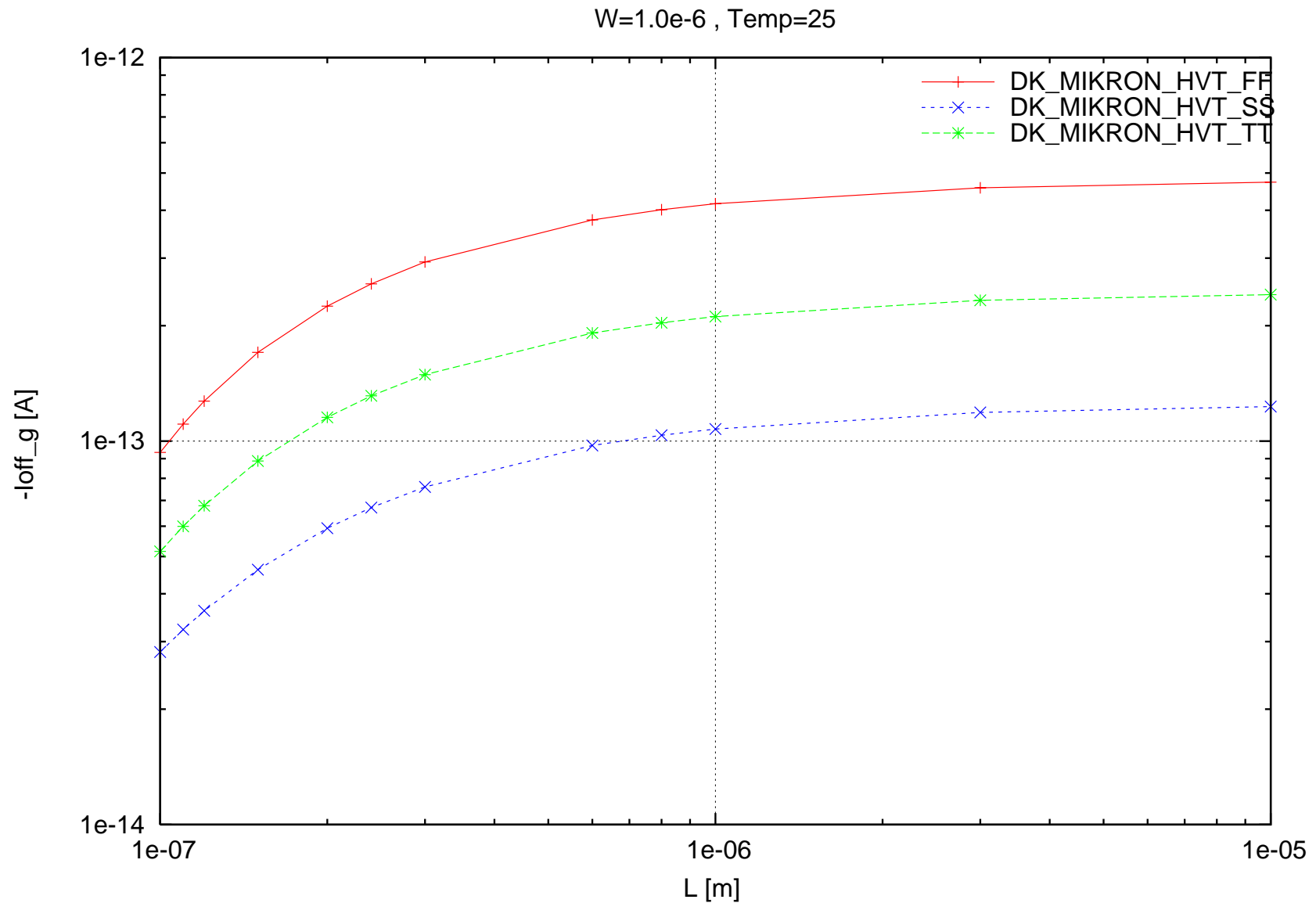
phvt I_{offsat} [A] vs. I_{sat} [mA] , W=1.0e-6 , Temp=25



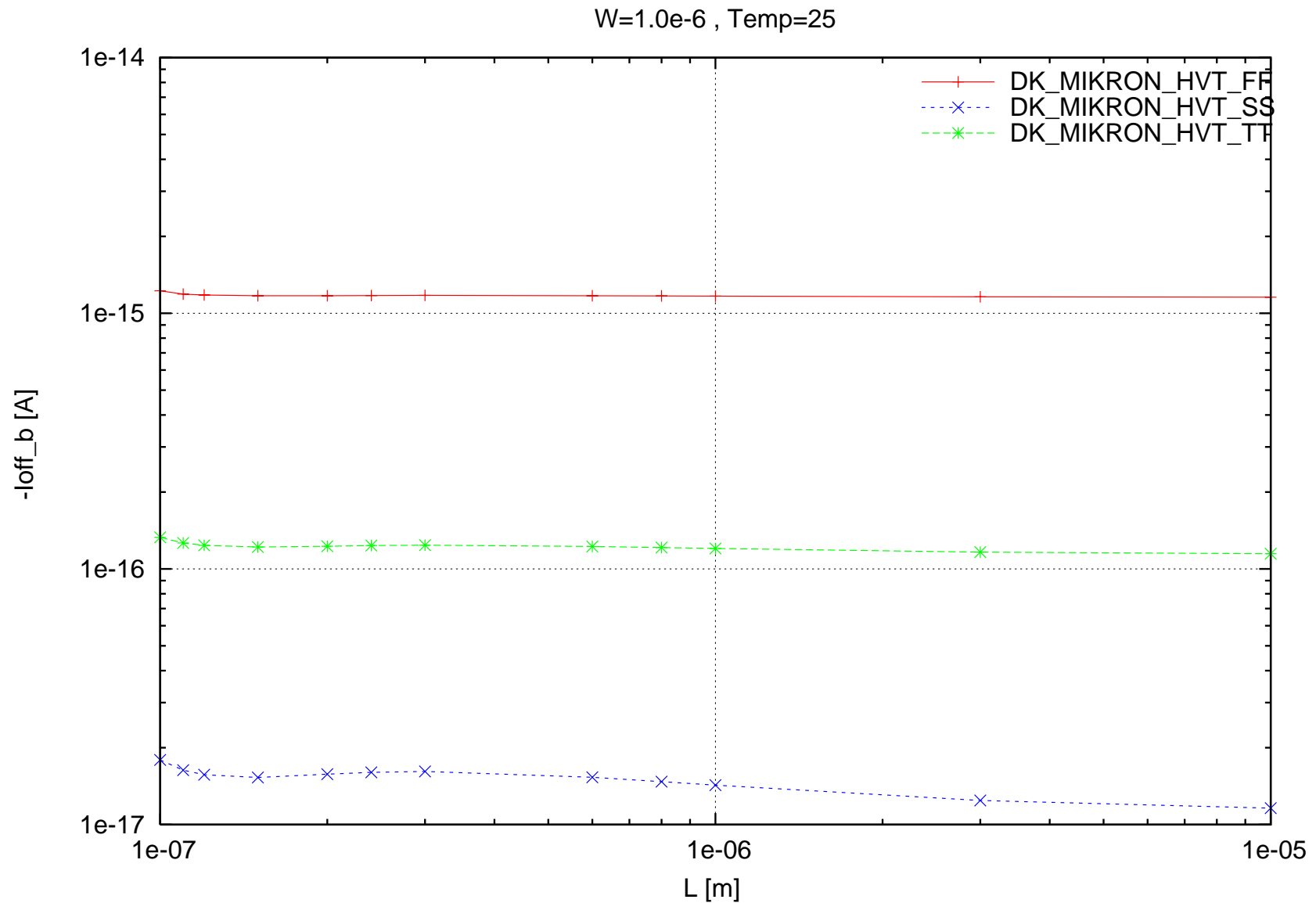
phvt loffsat [A] vs. L [m] , W=1.0e-6 , Temp=25



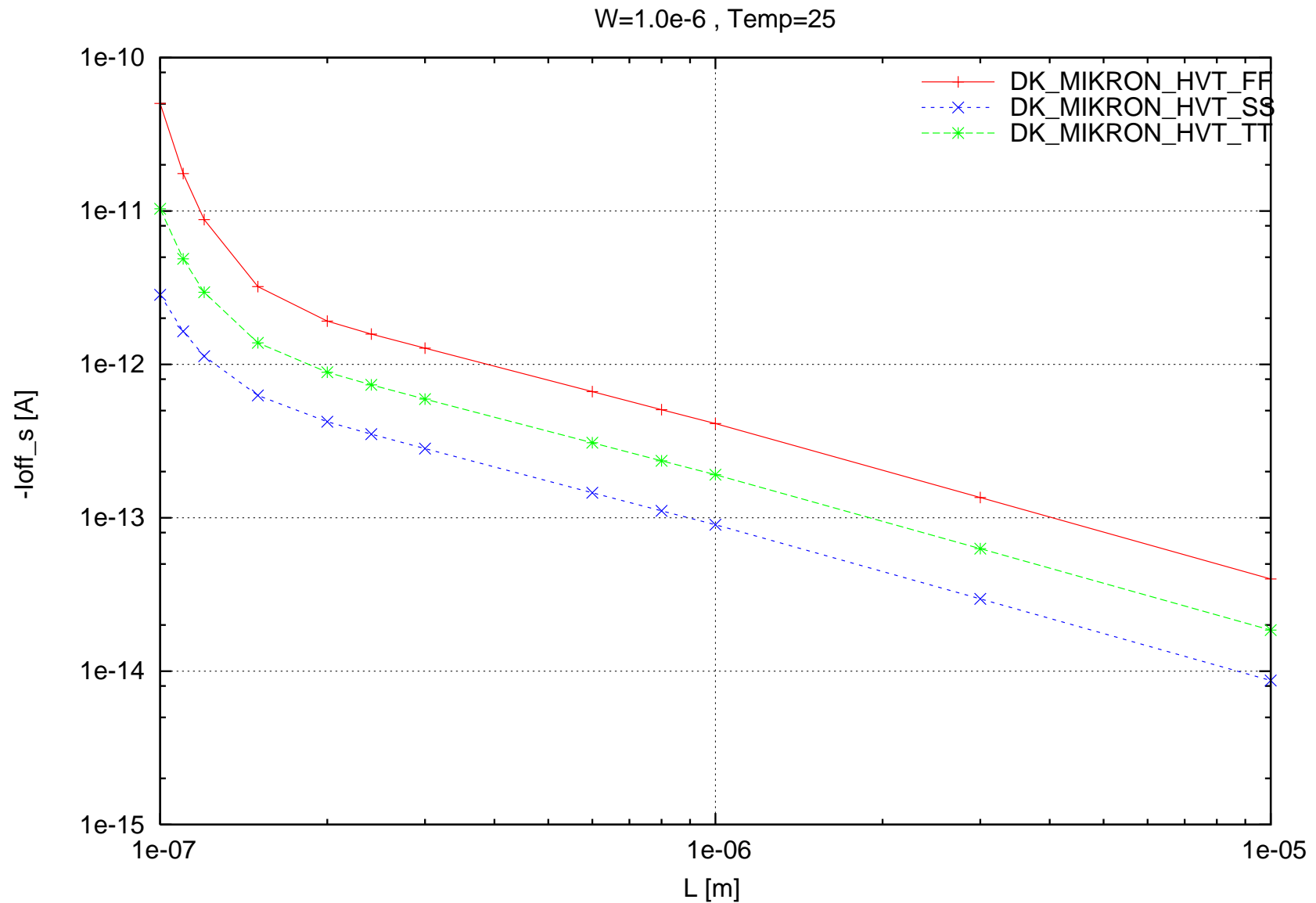
phvt -loff_g [A] vs. L [m] , W=1.0e-6 , Temp=25



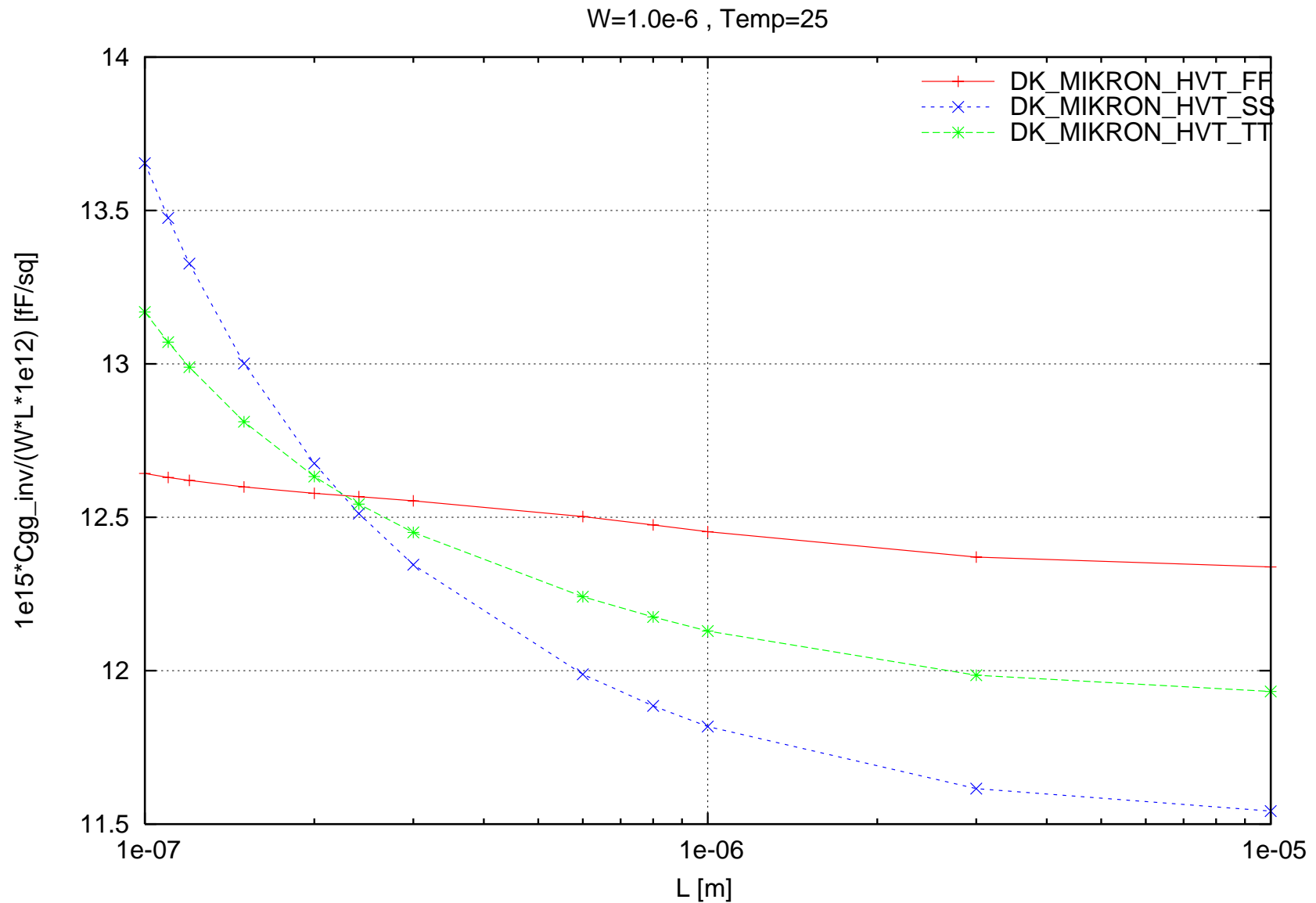
phvt -loff_b [A] vs. L [m] , W=1.0e-6 , Temp=25



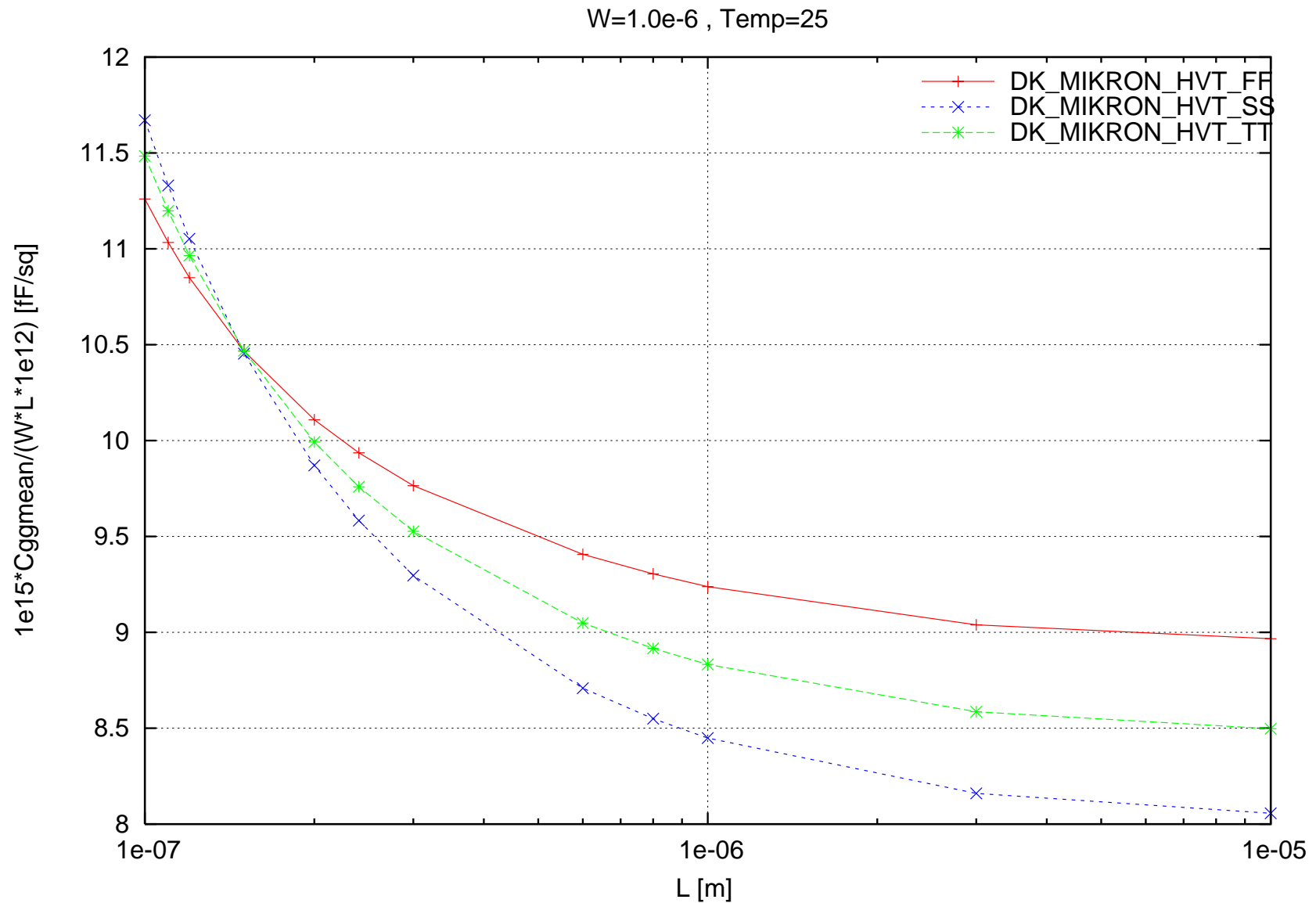
phvt -loff_s [A] vs. L [m] , W=1.0e-6 , Temp=25



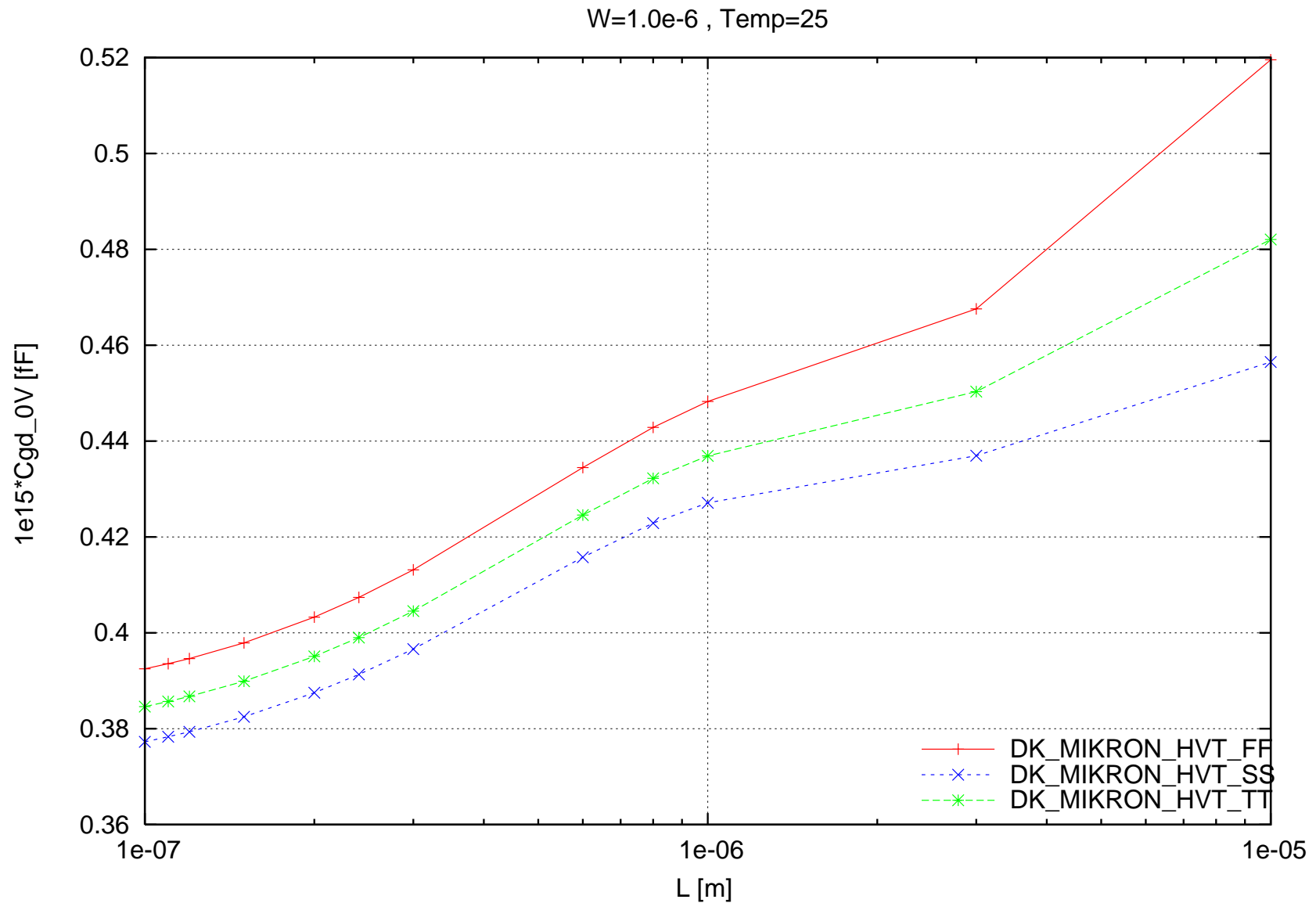
phvt $1e15 \cdot C_{gg_inv} / (W \cdot L \cdot 1e12)$ [fF/sq] vs. L [m] , W=1.0e-6 , Temp=25



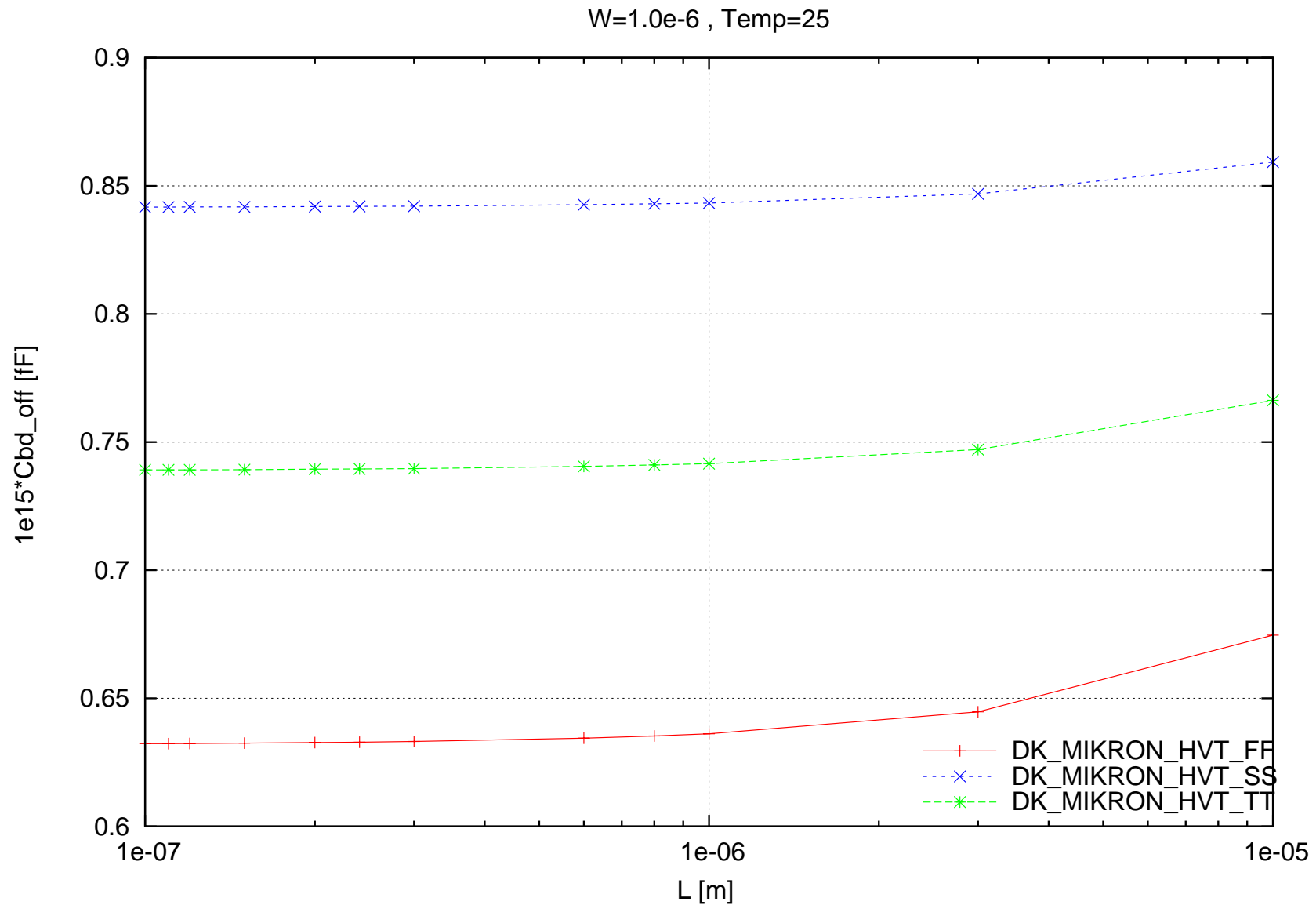
phvt $1e15 \cdot C_{ggmean} / (W \cdot L \cdot 1e12)$ [fF/sq] vs. L [m] , W=1.0e-6 , Temp=25



phvt 1e15*Cgd_0V [fF] vs. L [m] , W=1.0e-6 , Temp=25

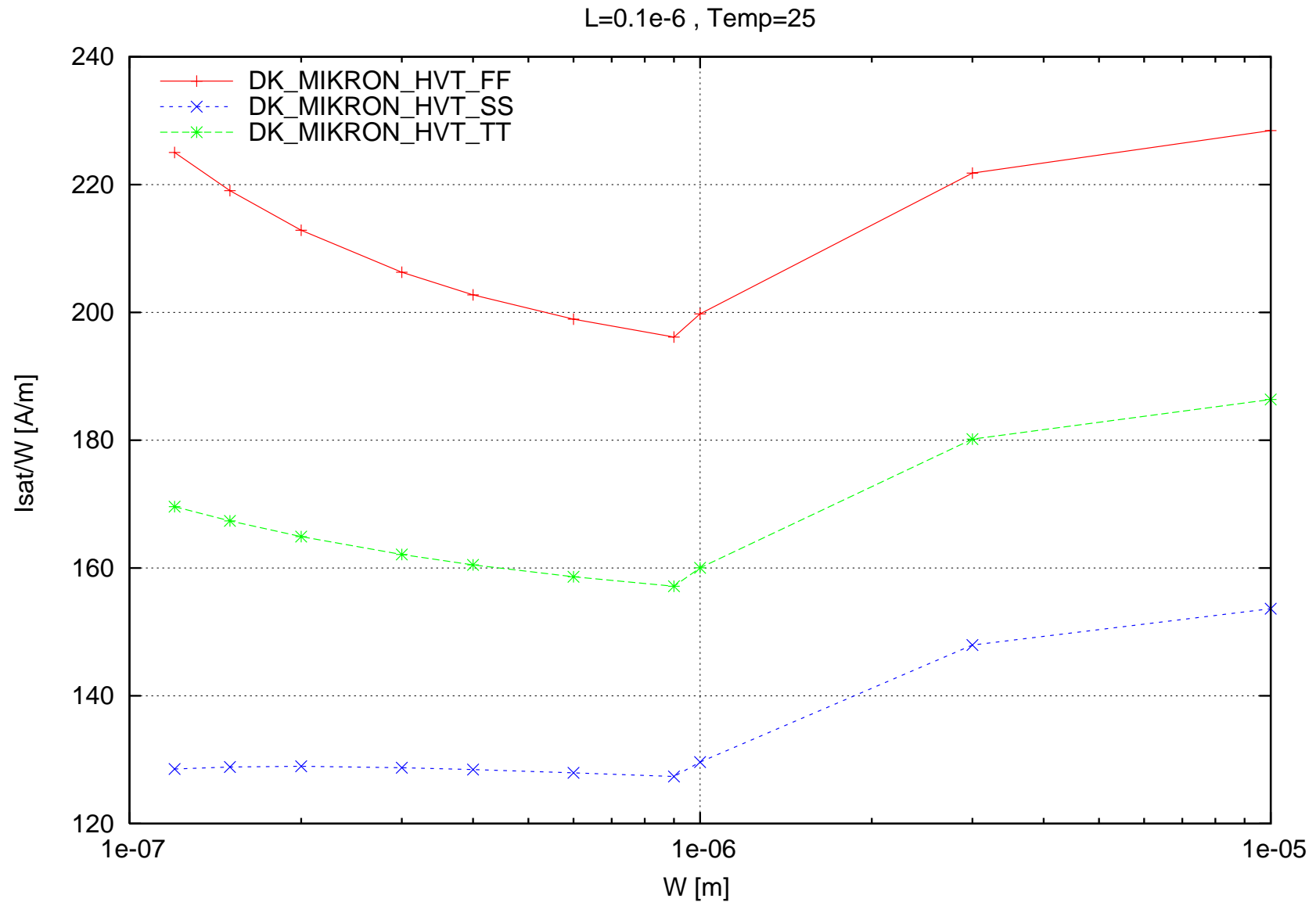


phvt 1e15*Cbd_off [fF] vs. L [m] , W=1.0e-6 , Temp=25

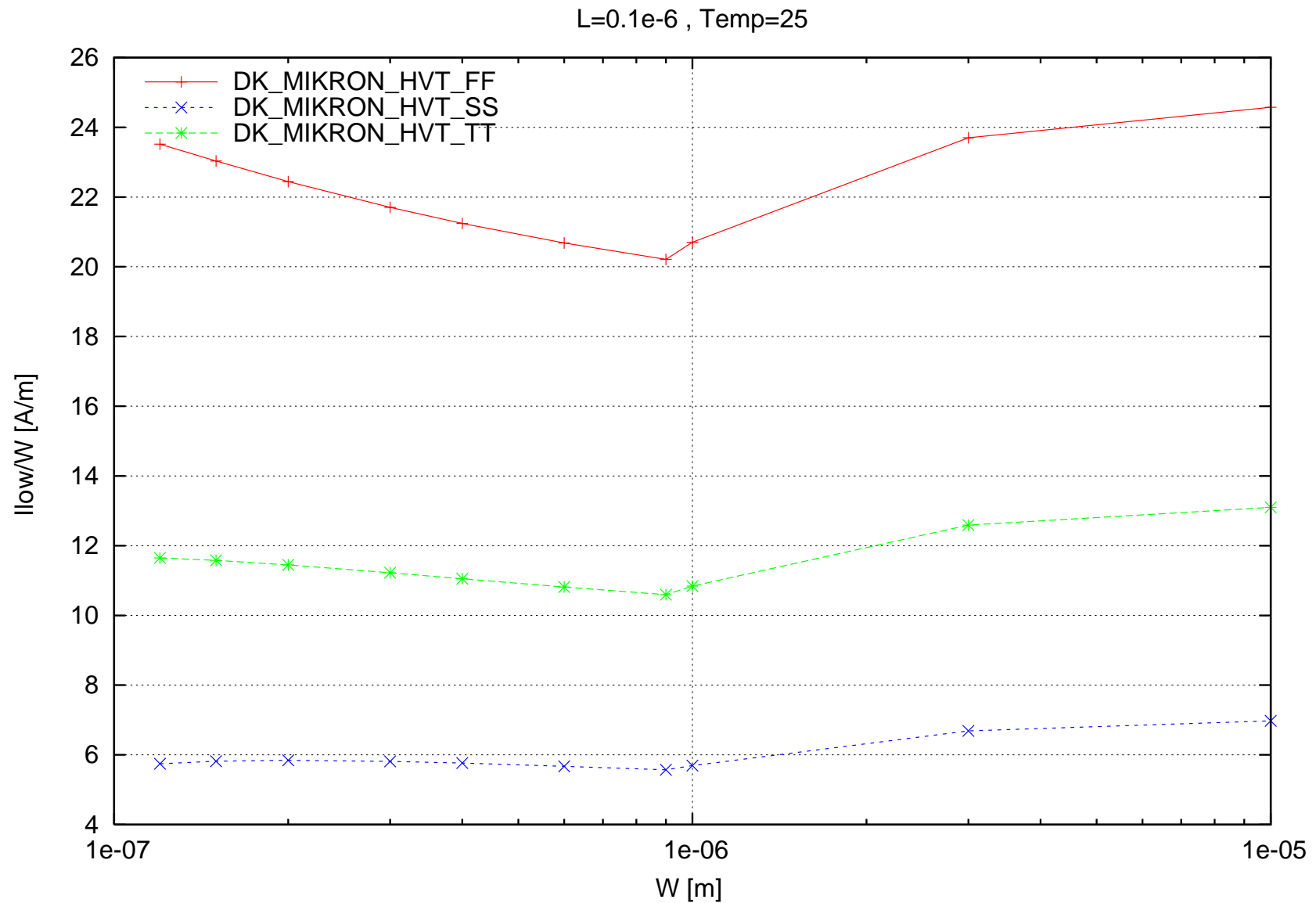


Scaling versus Width for PMOS ($L=0.1\text{e-}6$, Temp=25, $\text{po2act}=0.63\text{e-}6$, LPE=0)

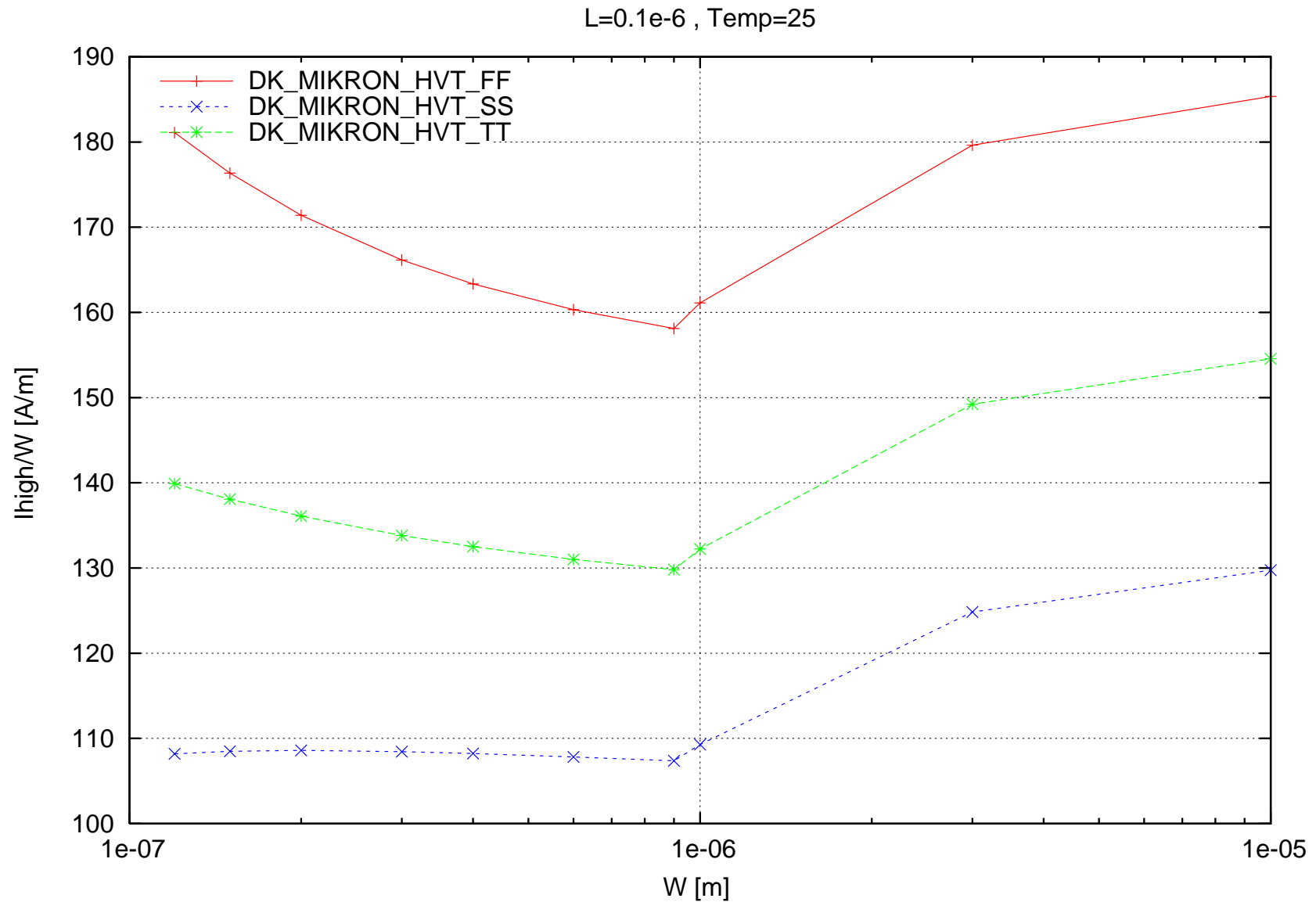
phvt Isat/W [A/m] vs. W [m] , L=0.1e-6 , Temp=25



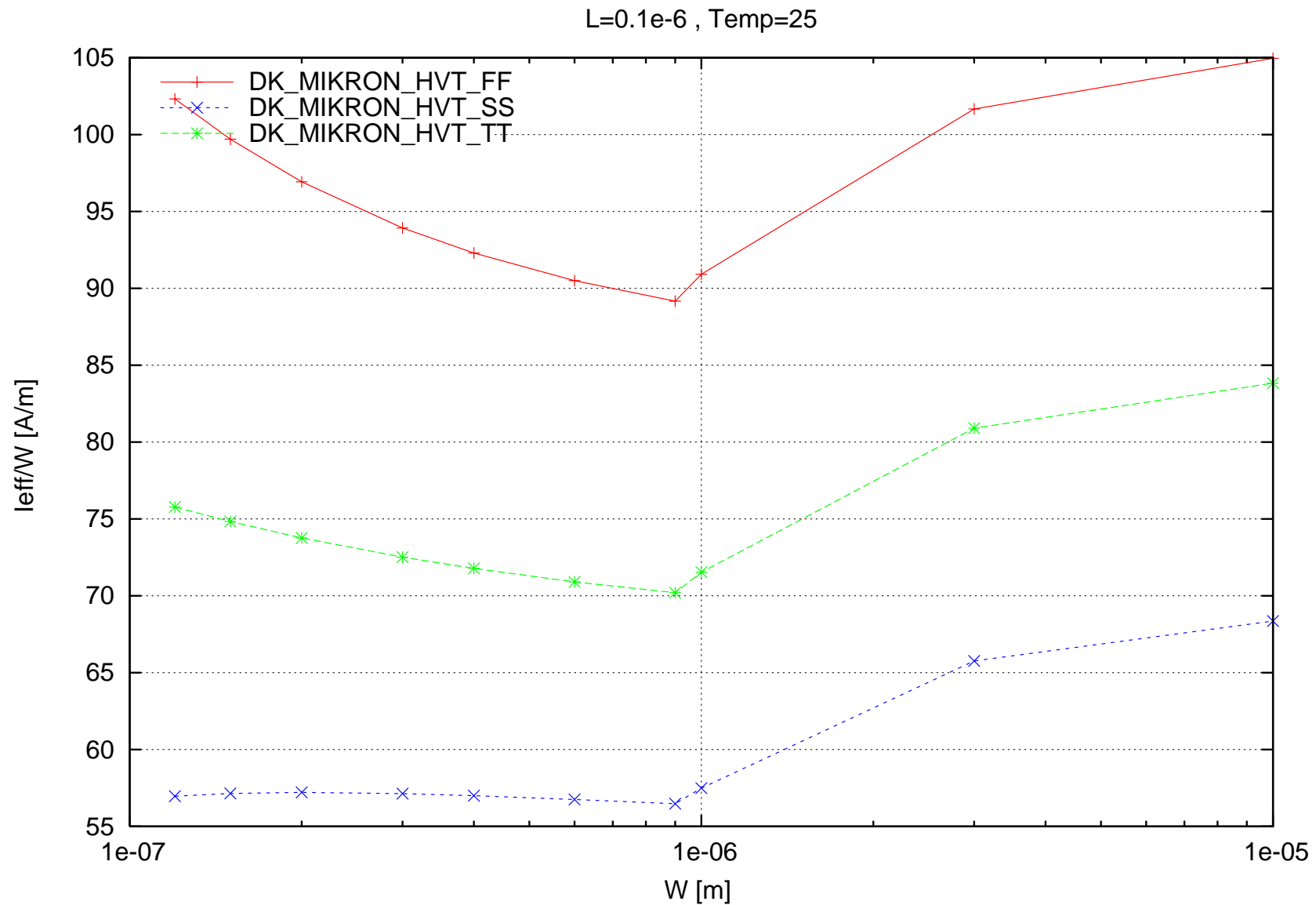
phvt I_{low}/W [A/m] vs. W [m] , L=0.1e-6 , Temp=25



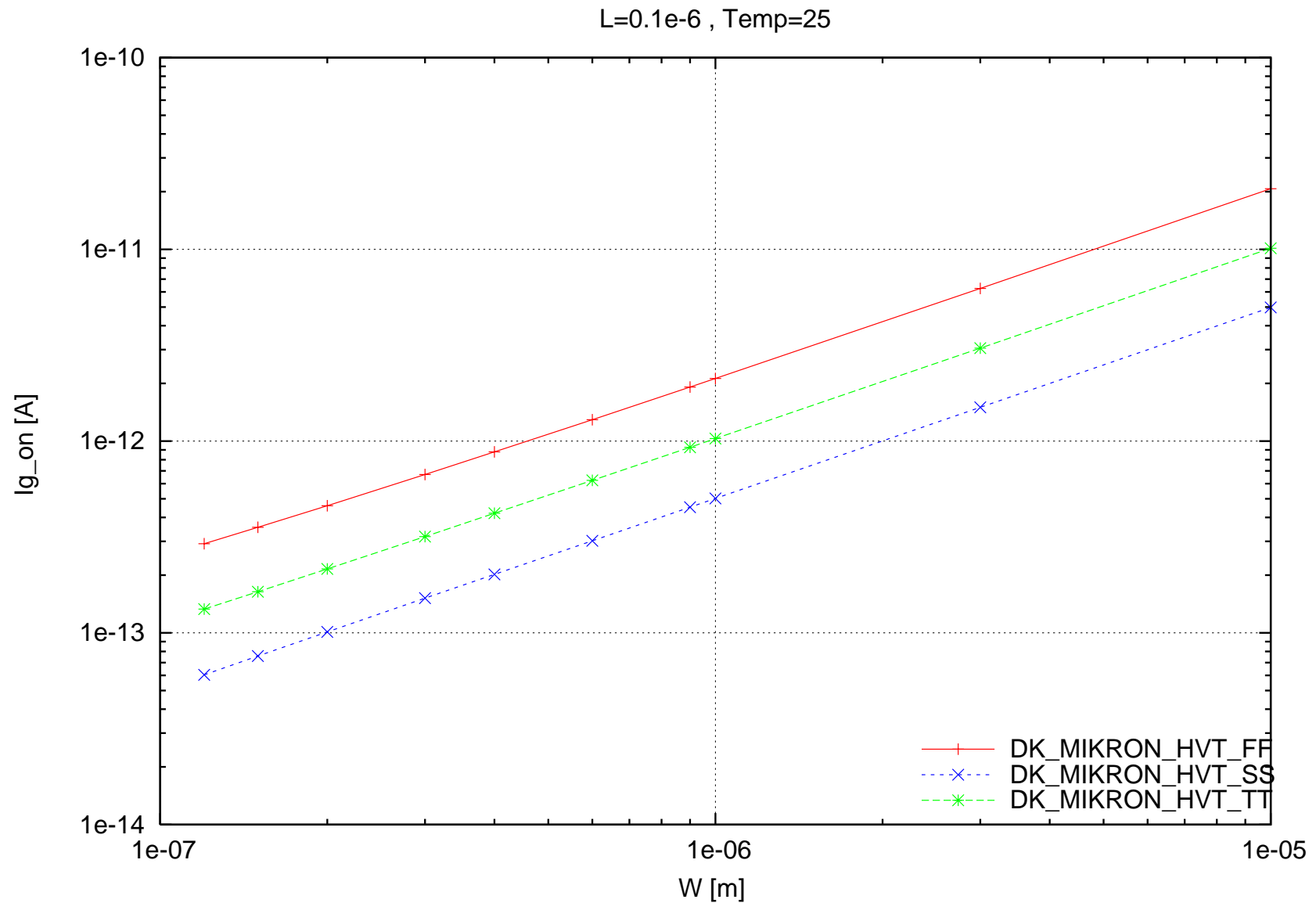
phvt I_{high}/W [A/m] vs. W [m] , L=0.1e-6 , Temp=25



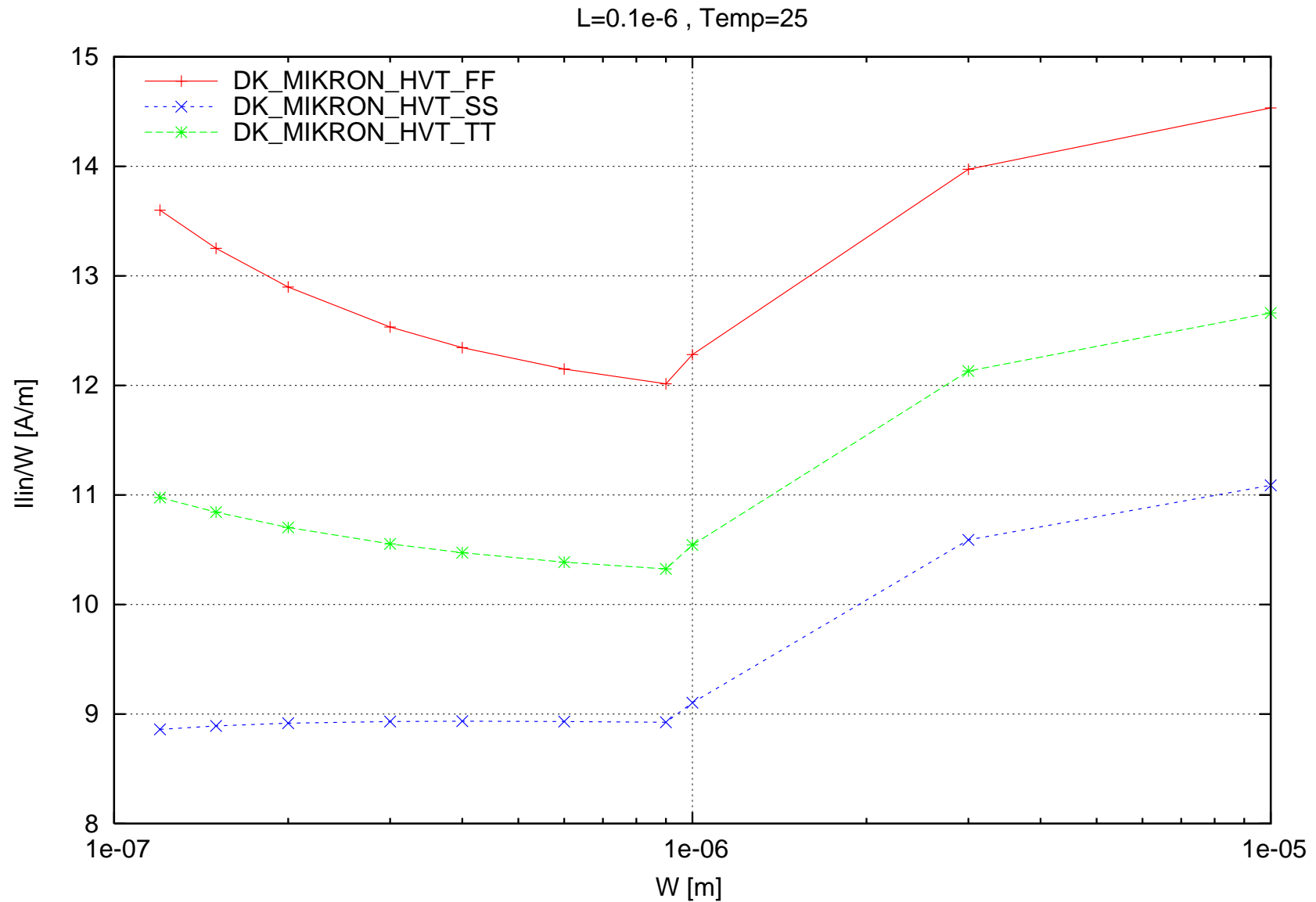
phvt leff/W [A/m] vs. W [m] , L=0.1e-6 , Temp=25



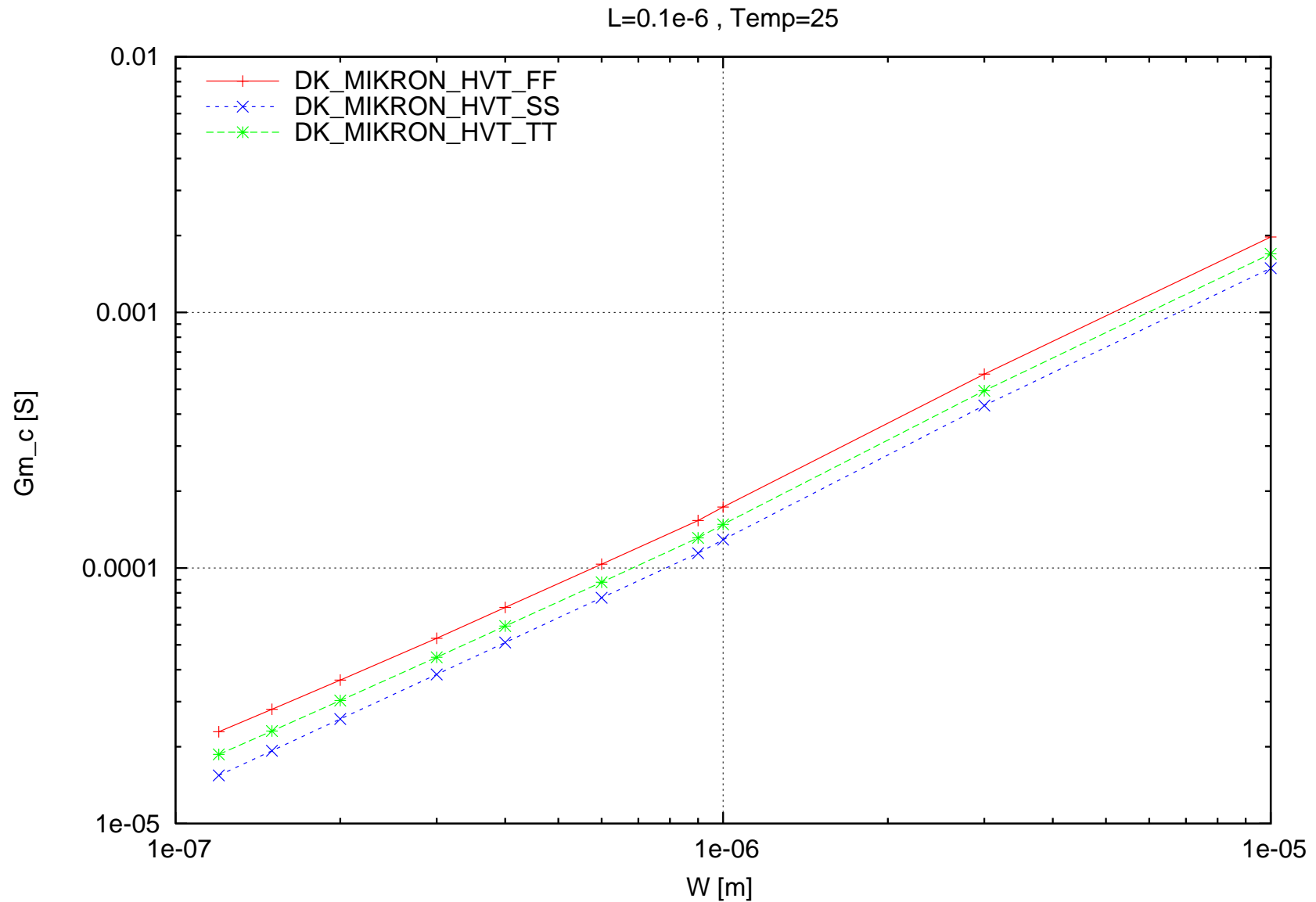
phvt Ig_on [A] vs. W [m] , L=0.1e-6 , Temp=25



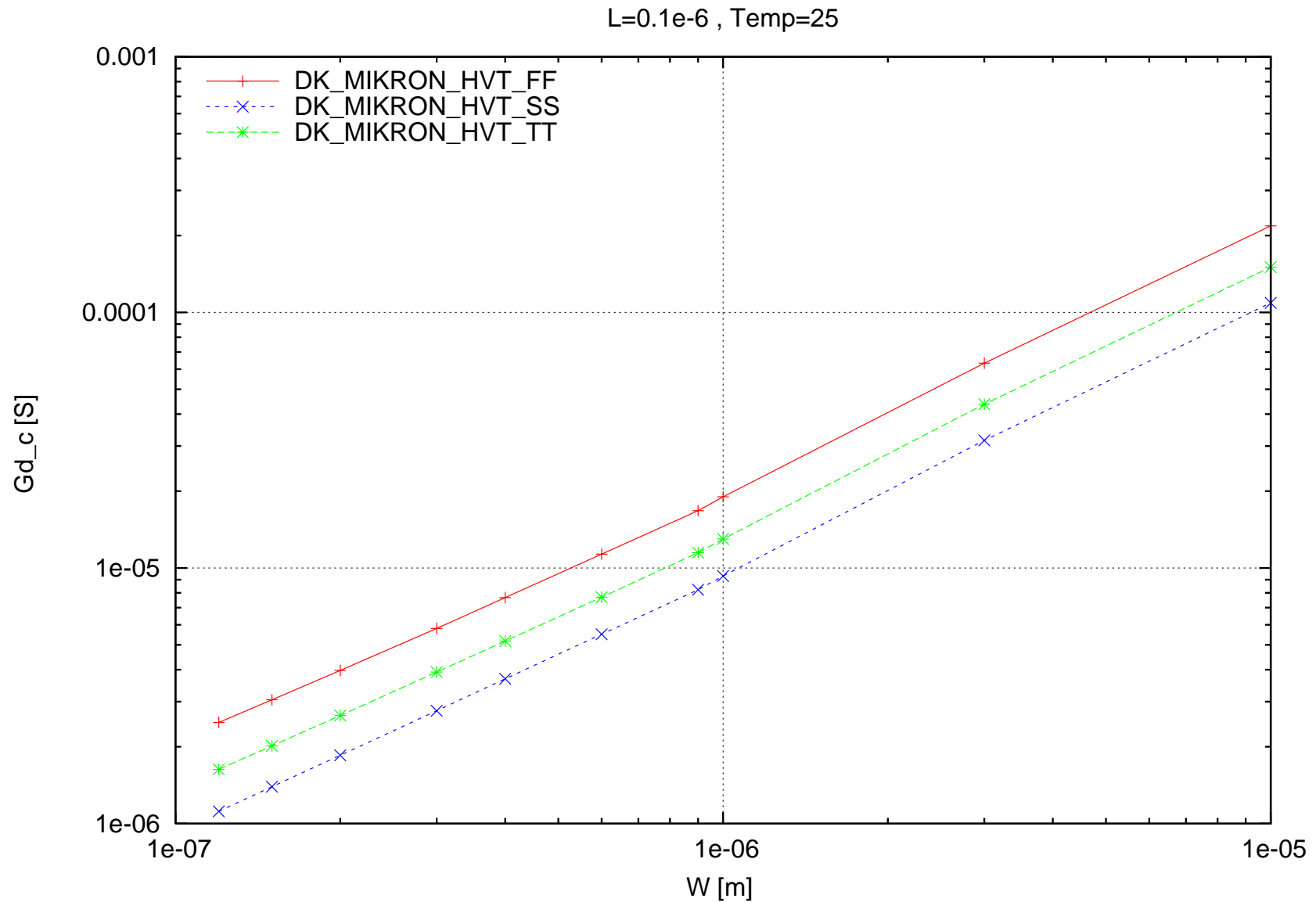
phvt Ilin/W [A/m] vs. W [m] , L=0.1e-6 , Temp=25



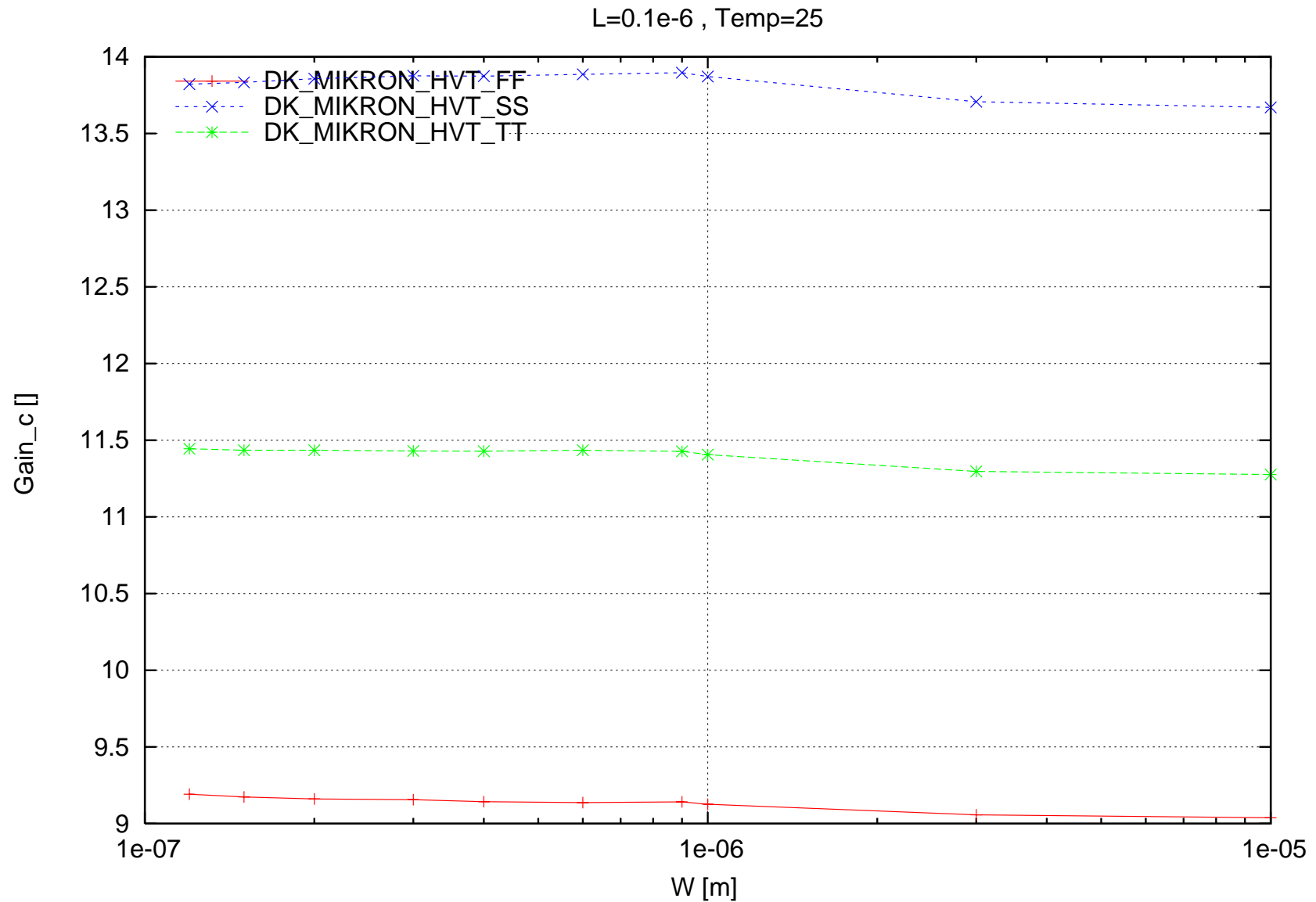
phvt Gm_c [S] vs. W [m] , L=0.1e-6 , Temp=25



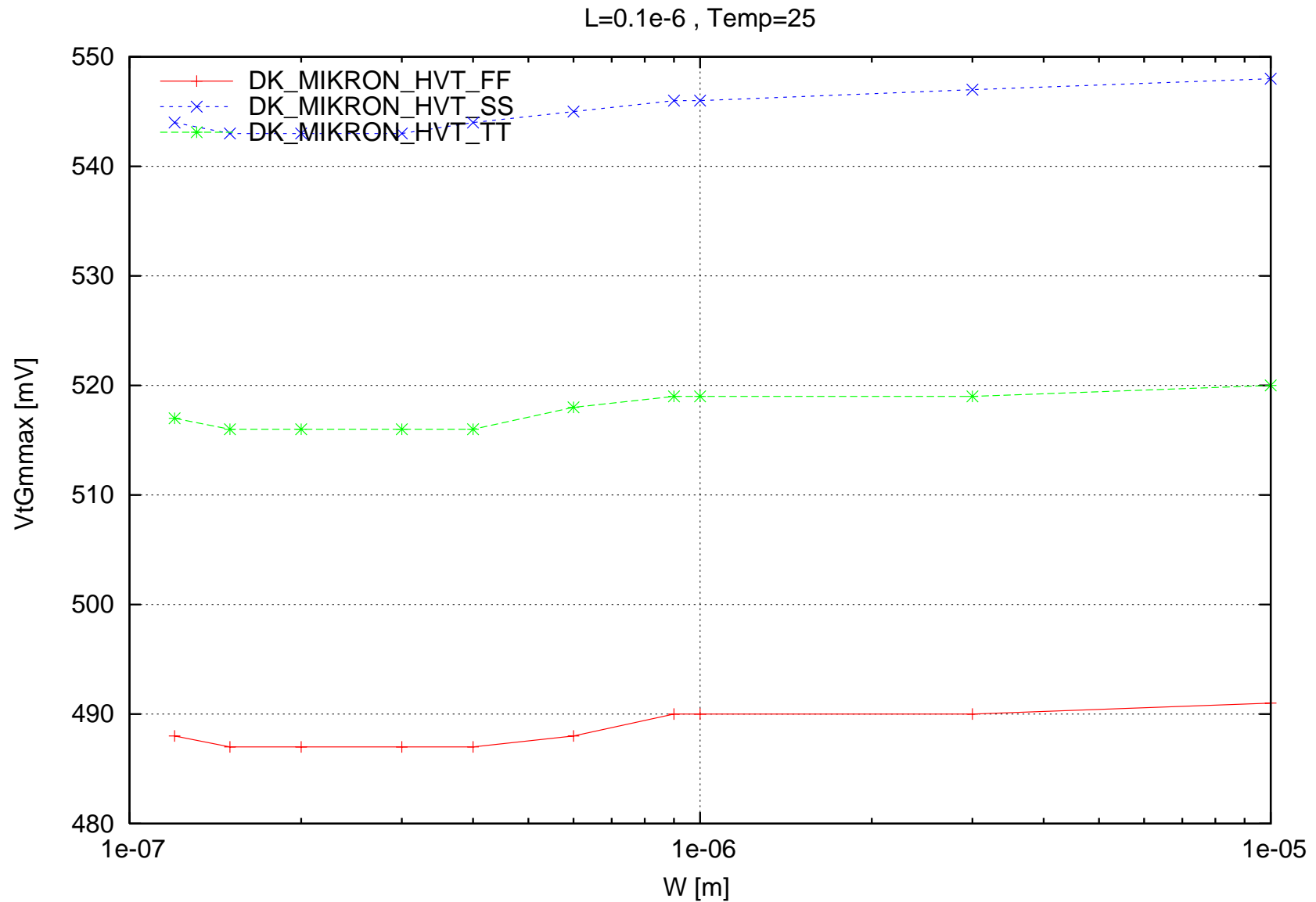
phvt Gd_c [S] vs. W [m] , L=0.1e-6 , Temp=25



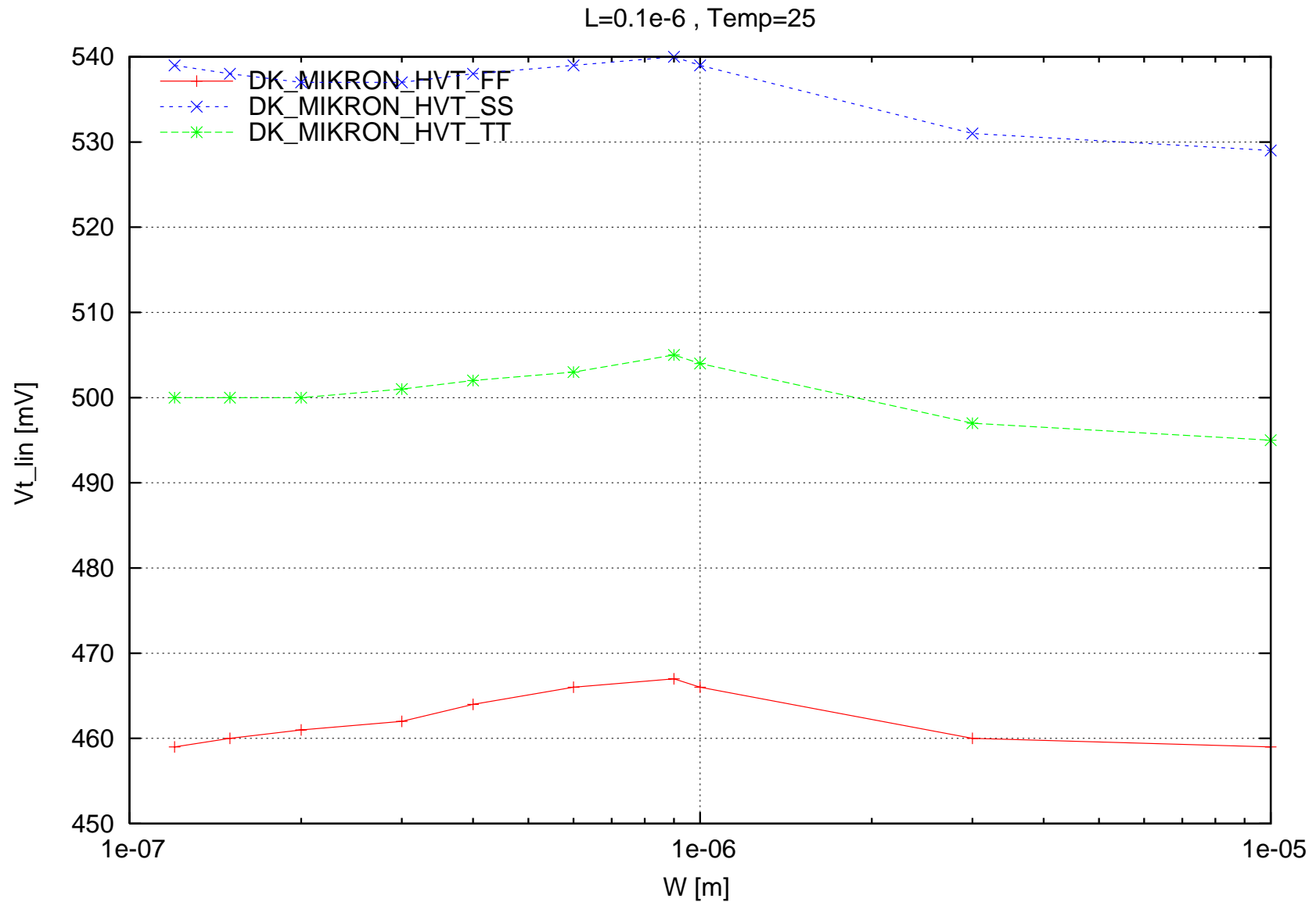
phvt Gain_c [] vs. W [m] , L=0.1e-6 , Temp=25



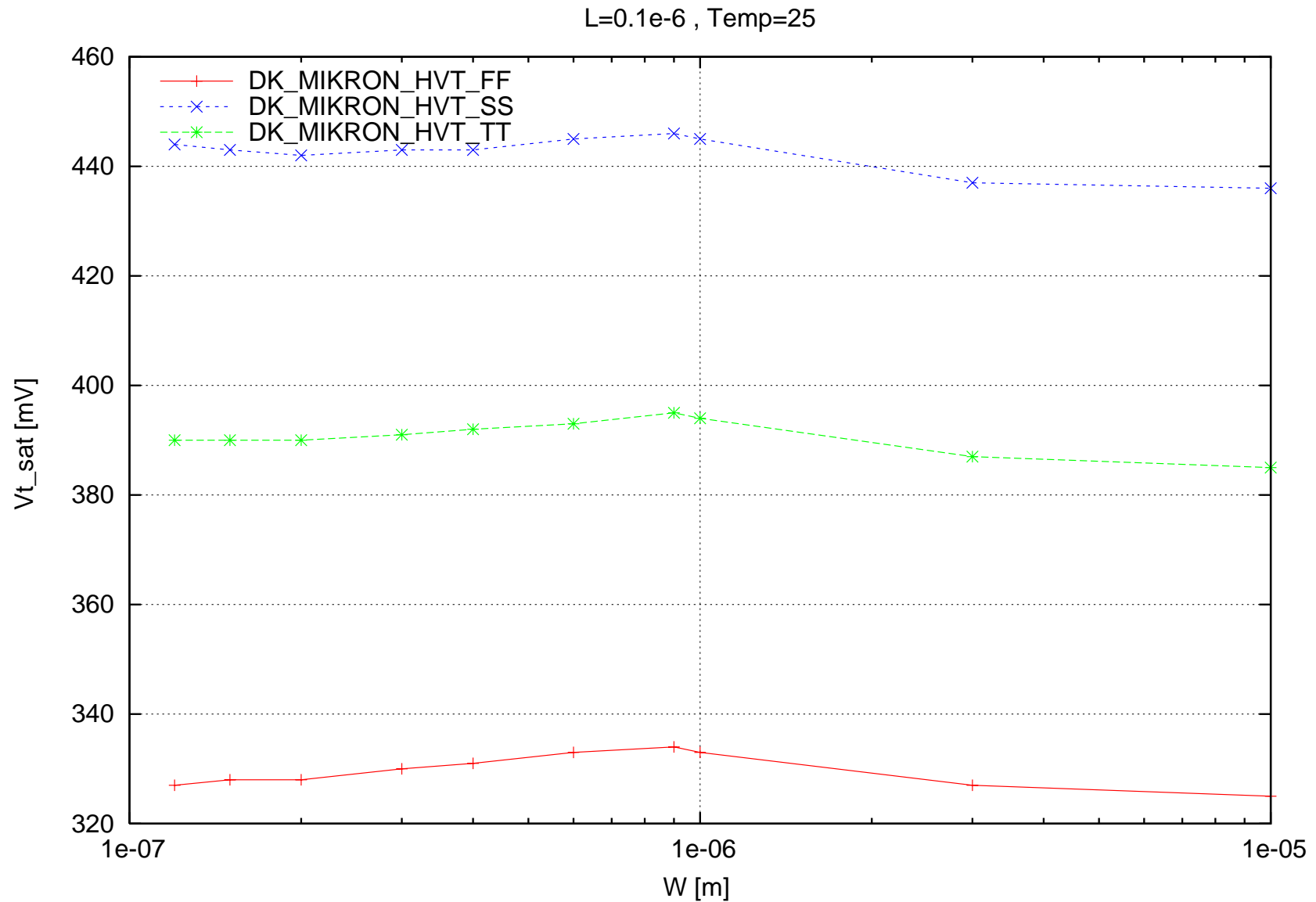
phvt VtGmmax [mV] vs. W [m] , L=0.1e-6 , Temp=25



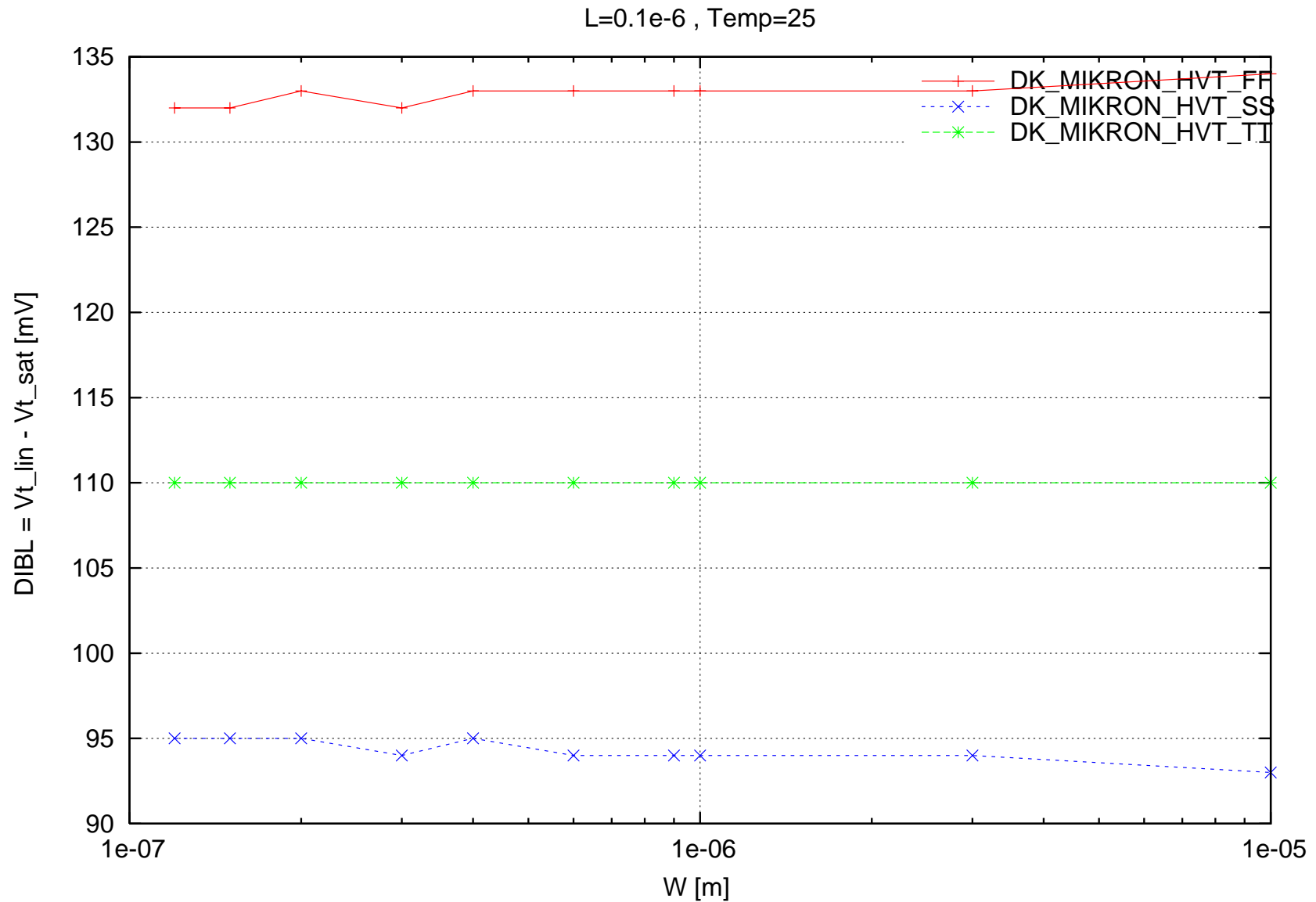
phvt Vt_lin [mV] vs. W [m] , L=0.1e-6 , Temp=25



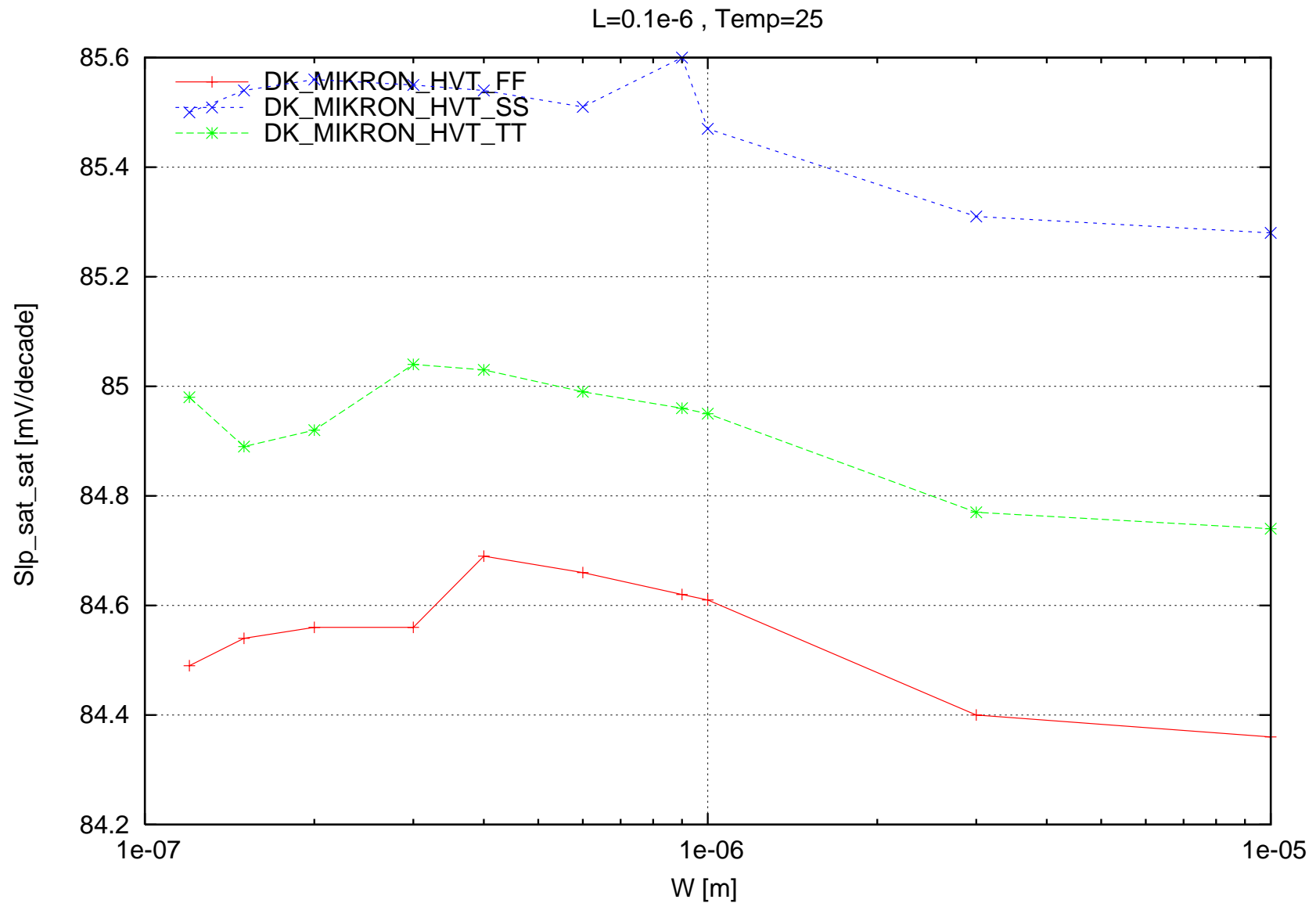
phvt Vt_sat [mV] vs. W [m] , L=0.1e-6 , Temp=25



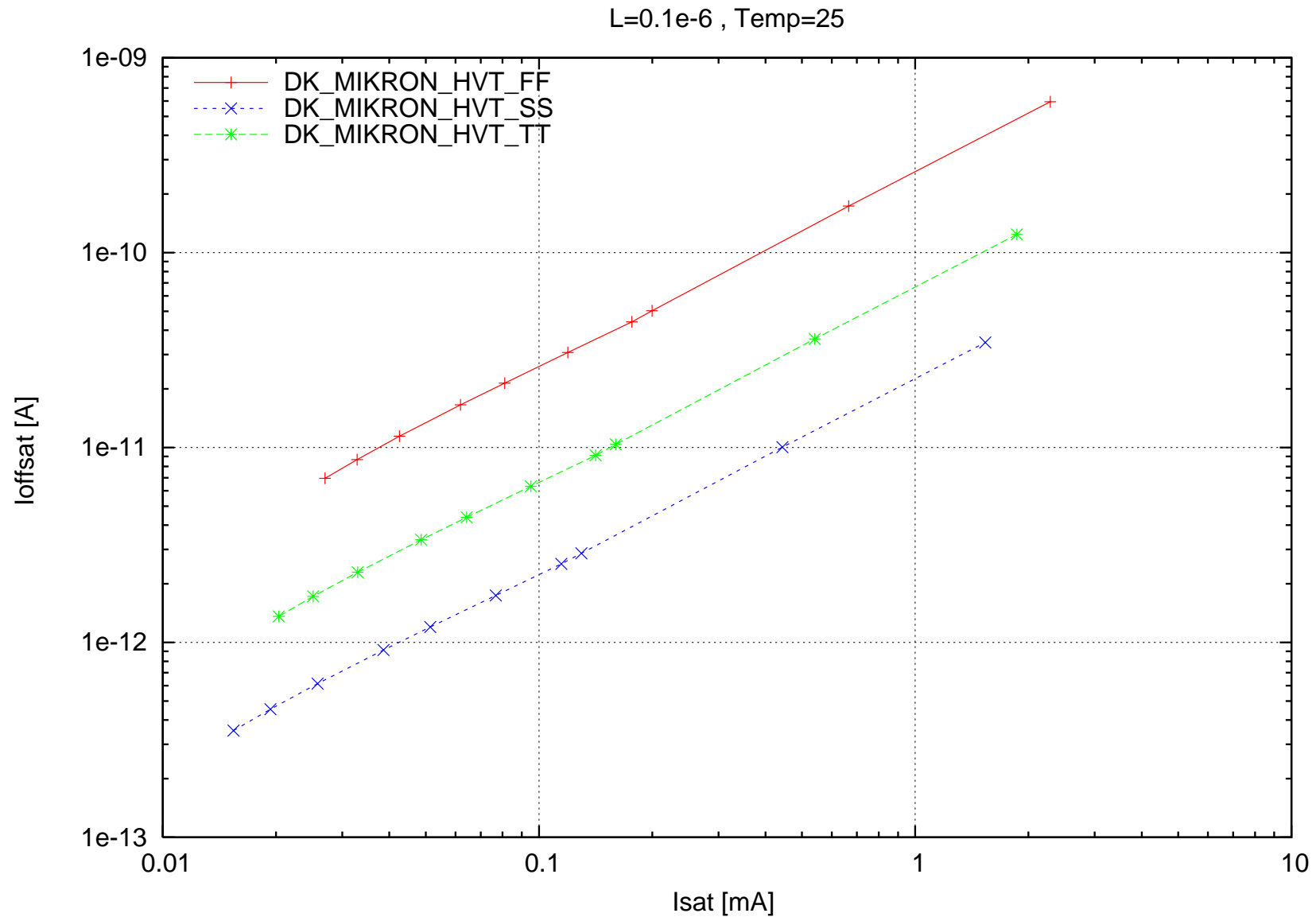
phvt DIBL = $V_{t_lin} - V_{t_sat}$ [mV] vs. W [m] , $L=0.1e-6$, Temp=25



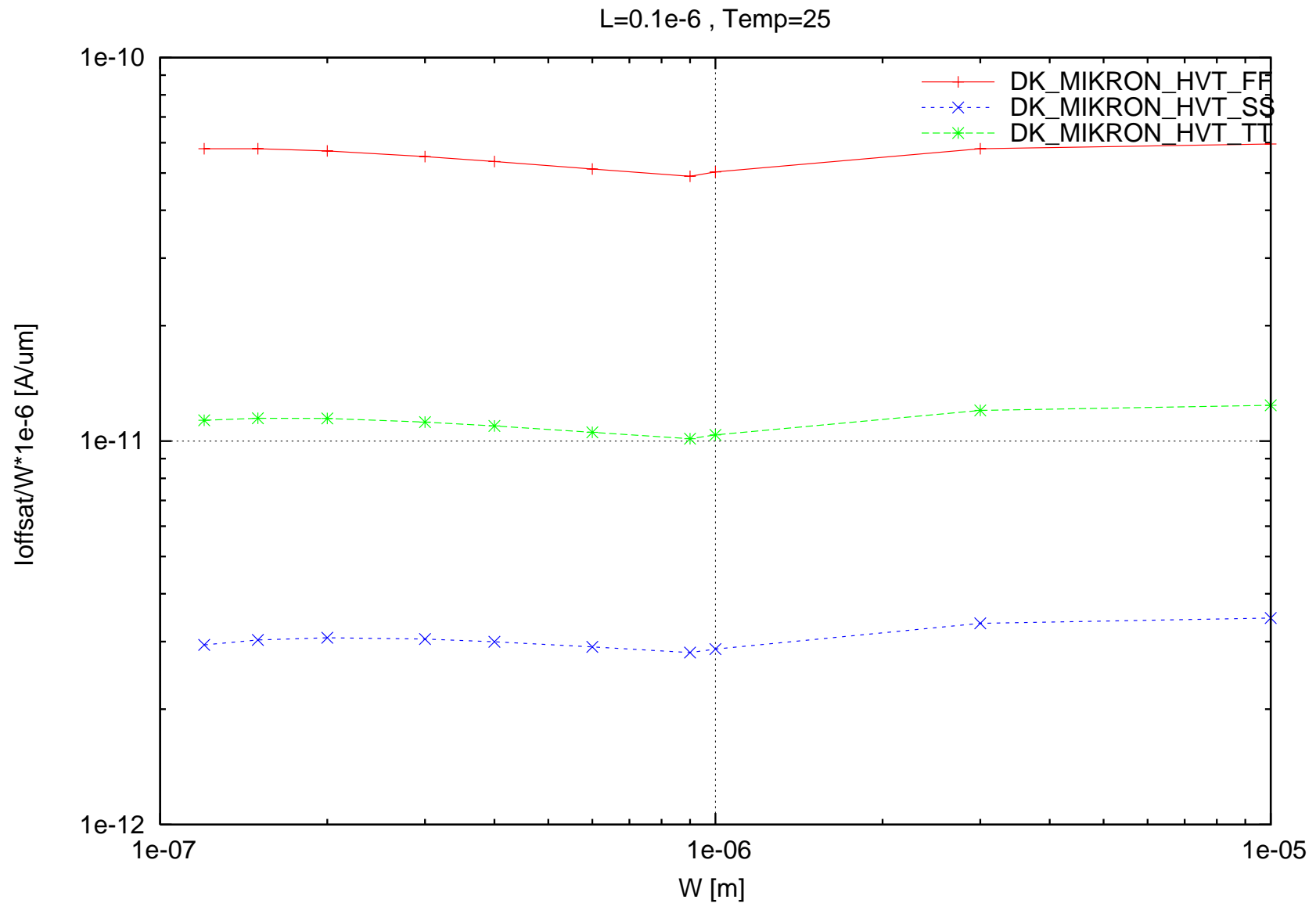
phvt SIp_sat_sat [mV/decade] vs. W [m] , L=0.1e-6 , Temp=25



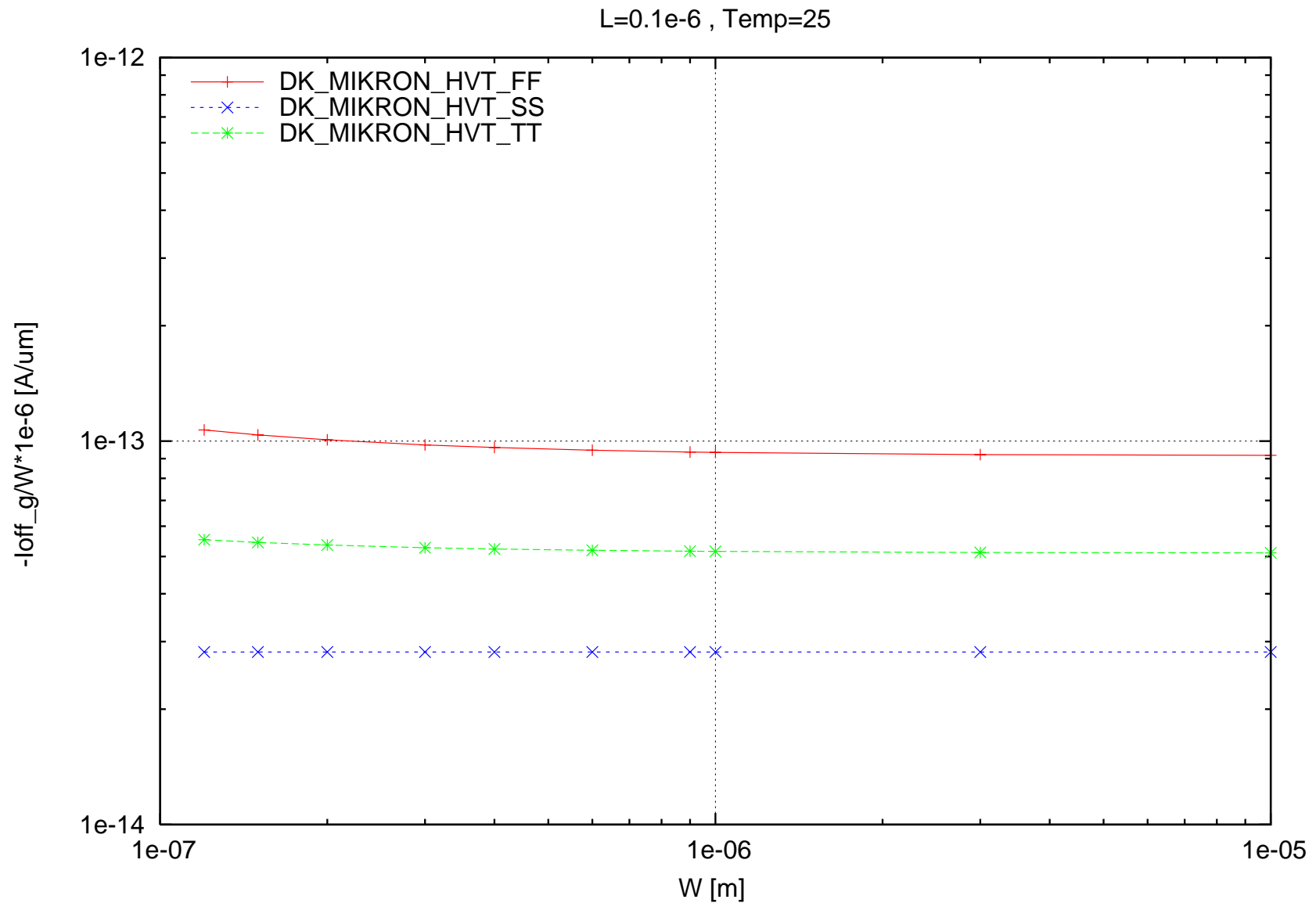
phvt loffsat [A] vs. Isat [mA] , L=0.1e-6 , Temp=25



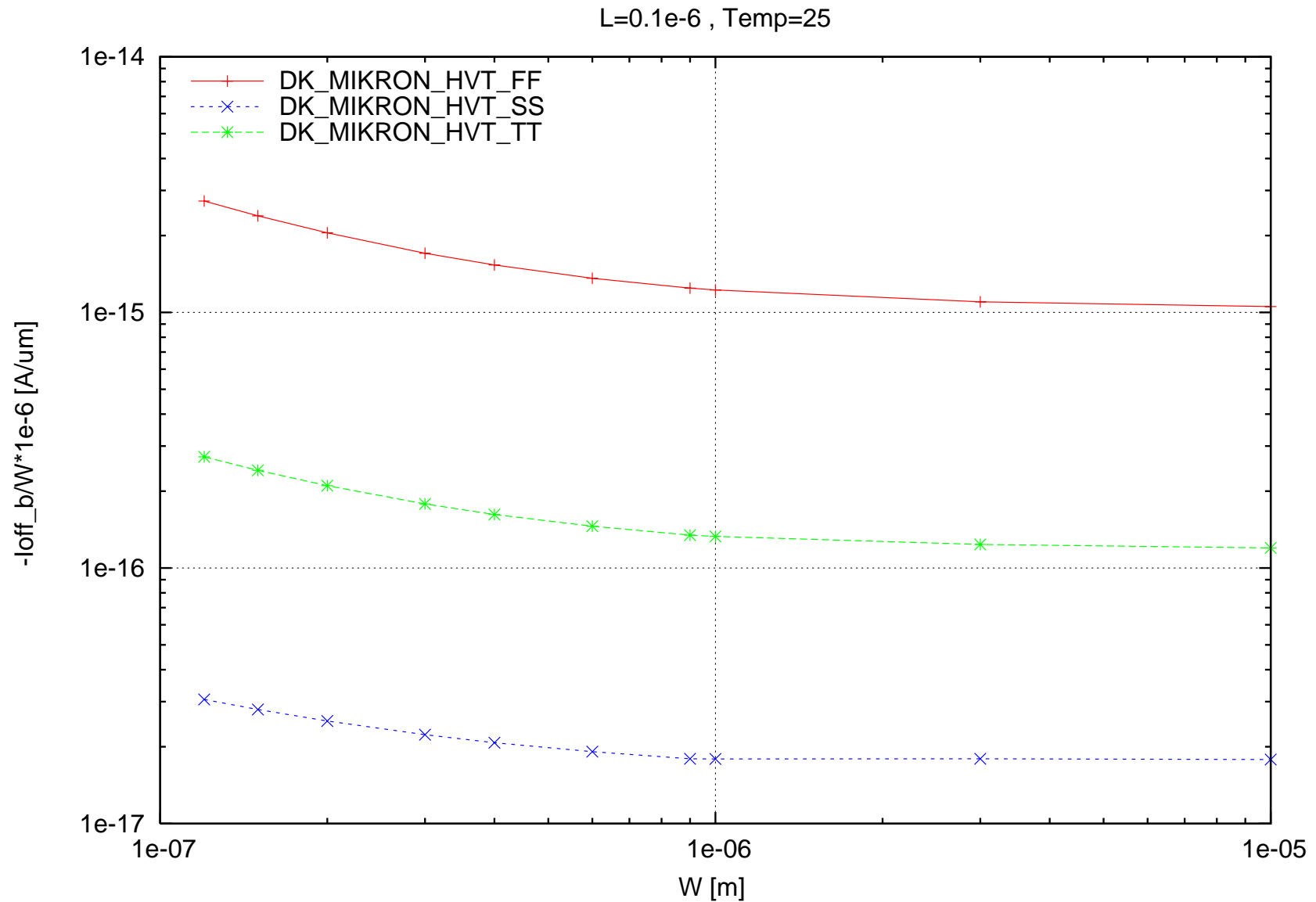
phvt loffsat/W*1e-6 [A/um] vs. W [m] , L=0.1e-6 , Temp=25



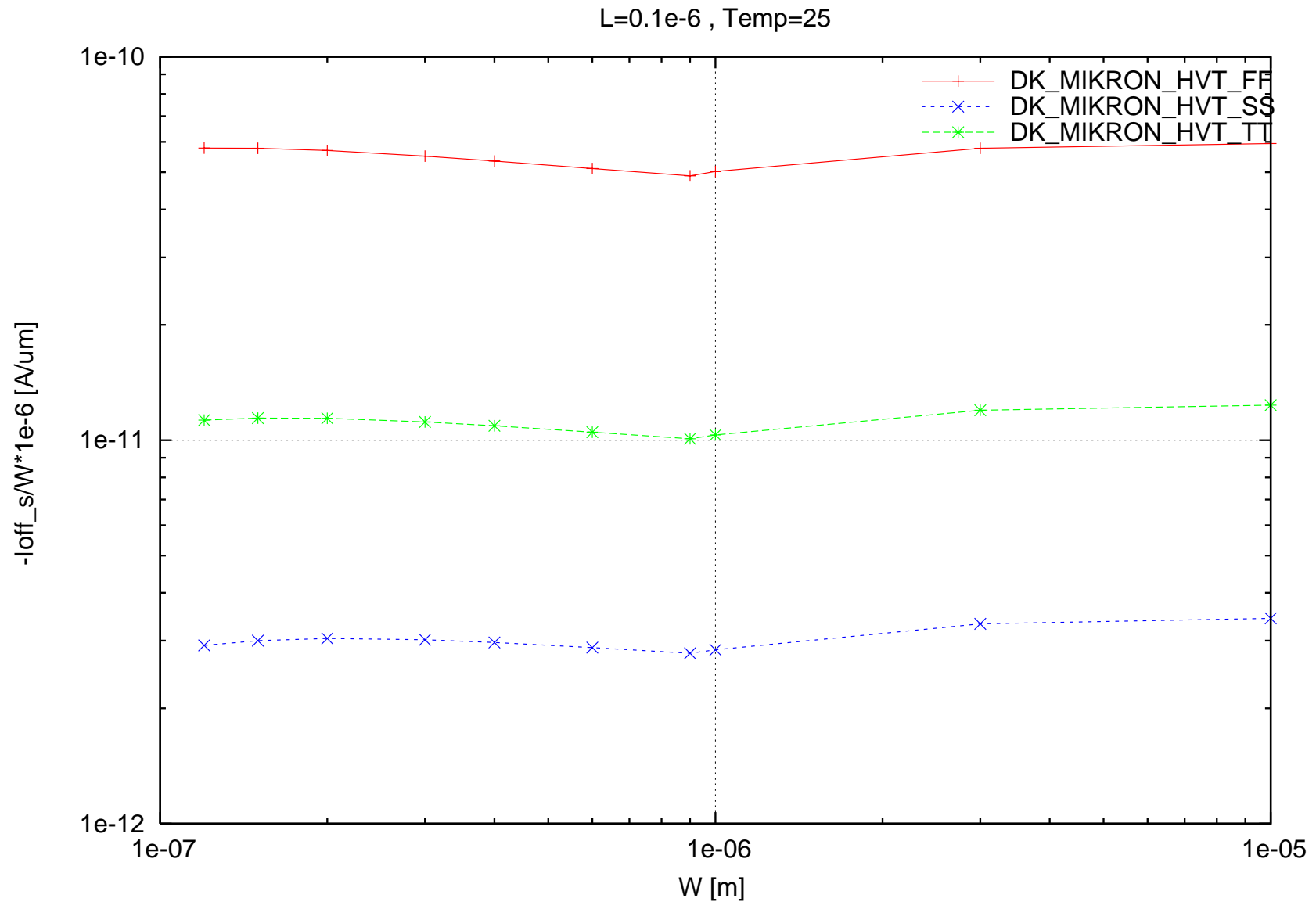
phvt -loff_g/W*1e-6 [A/um] vs. W [m] , L=0.1e-6 , Temp=25



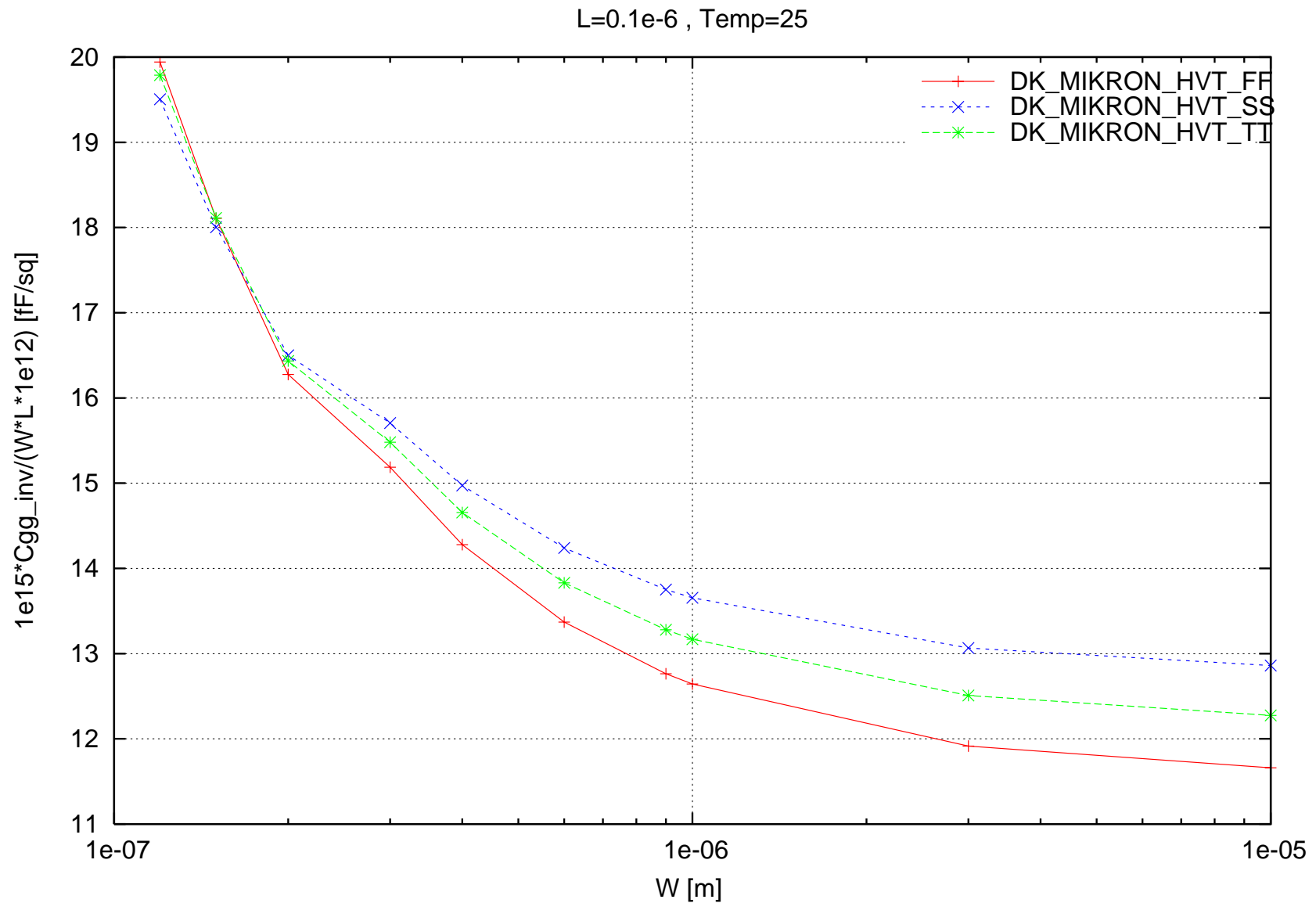
phvt -loff_b/W*1e-6 [A/um] vs. W [m] , L=0.1e-6 , Temp=25



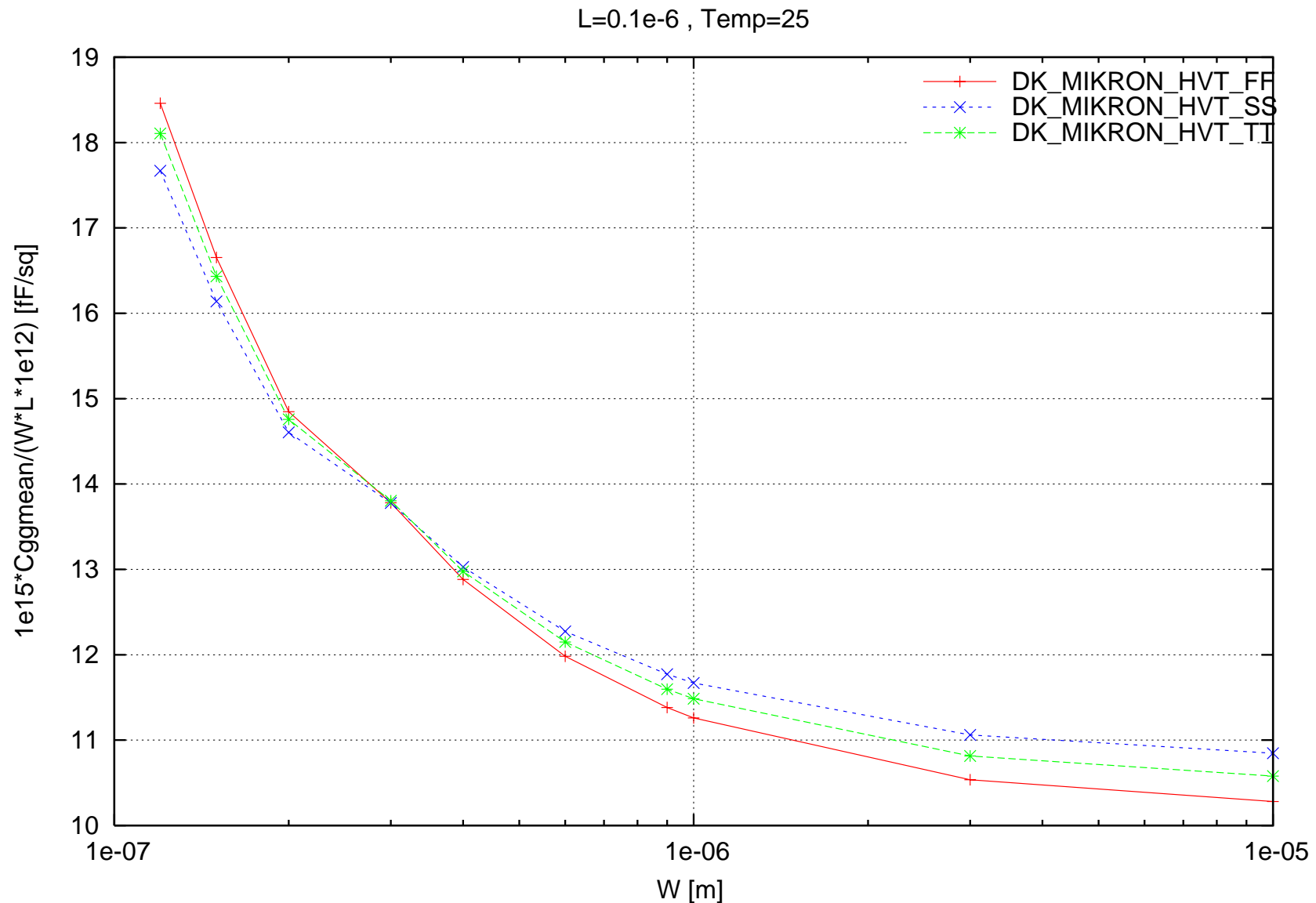
phvt -loff_s/W*1e-6 [A/um] vs. W [m] , L=0.1e-6 , Temp=25



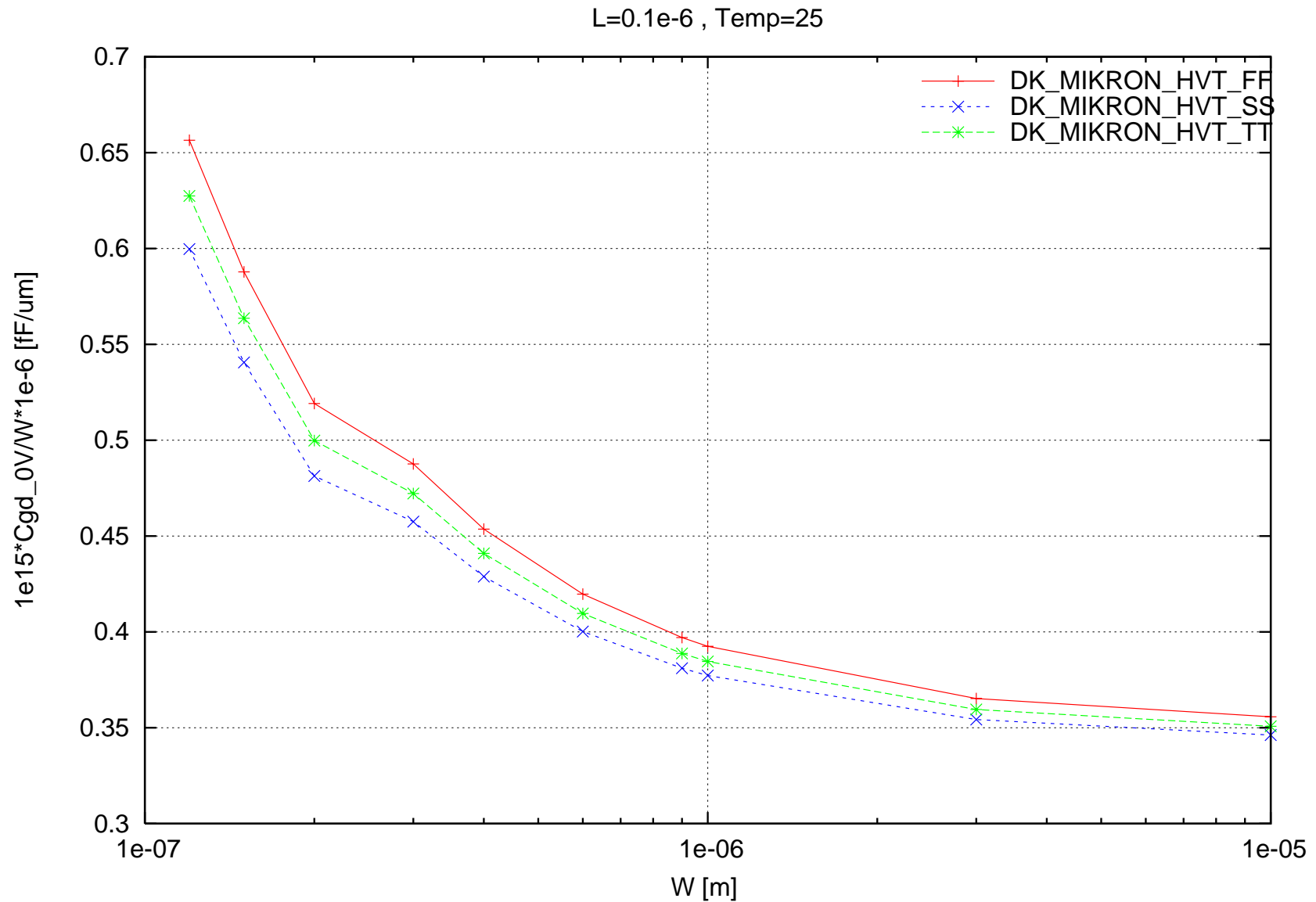
phvt $1e15 \cdot C_{gg_inv} / (W \cdot L \cdot 1e12)$ [fF/sq] vs. W [m] , L=0.1e-6 , Temp=25



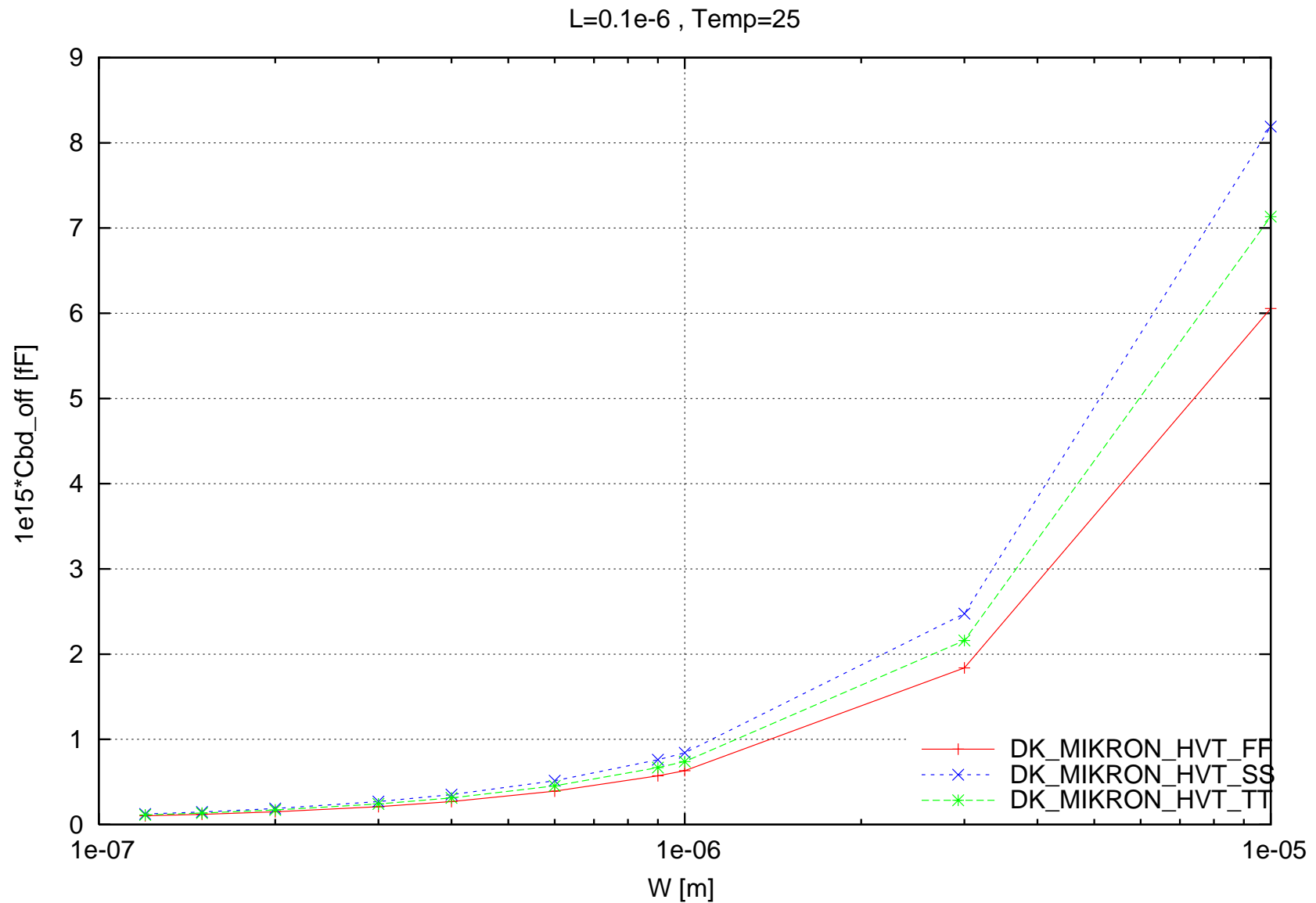
phvt $1e15 \cdot C_{ggmean} / (W \cdot L \cdot 1e12)$ [fF/sq] vs. W [m] , L=0.1e-6 , Temp=25



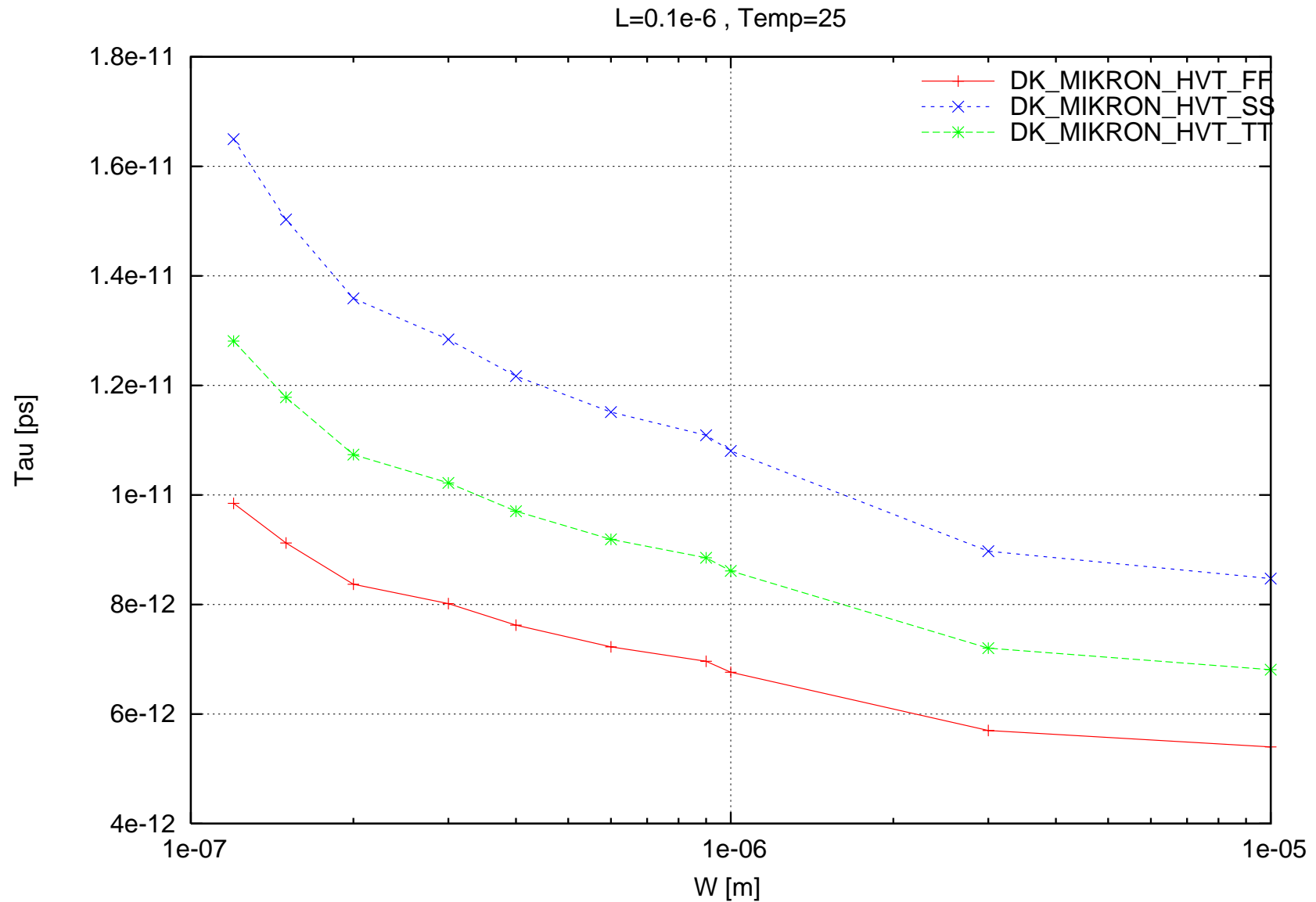
phvt 1e15*Cgd_0V/W*1e-6 [fF/um] vs. W [m] , L=0.1e-6 , Temp=25



phvt 1e15*Cbd_off [fF] vs. W [m] , L=0.1e-6 , Temp=25

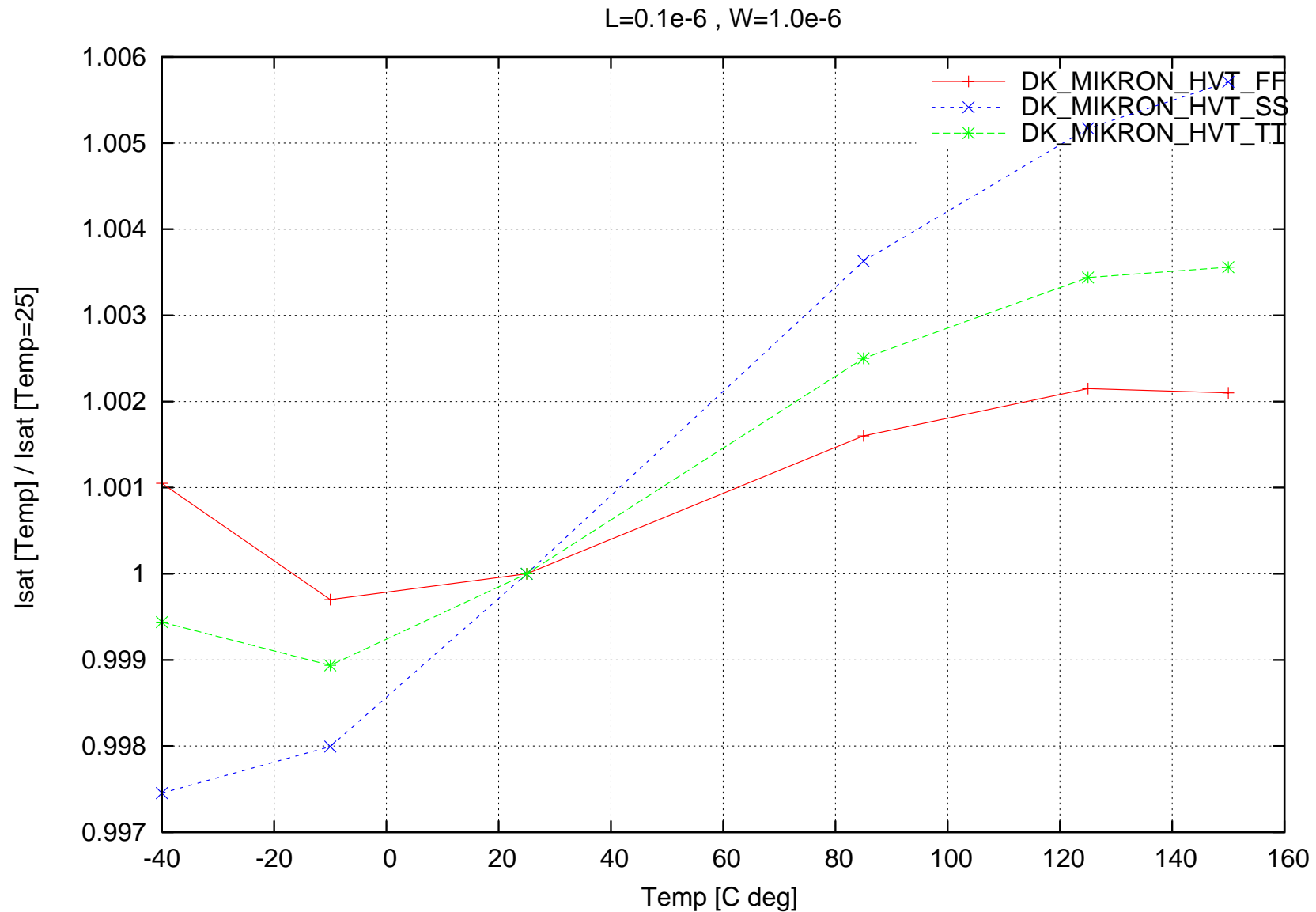


phvt Tau [ps] vs. W [m] , L=0.1e-6 , Temp=25

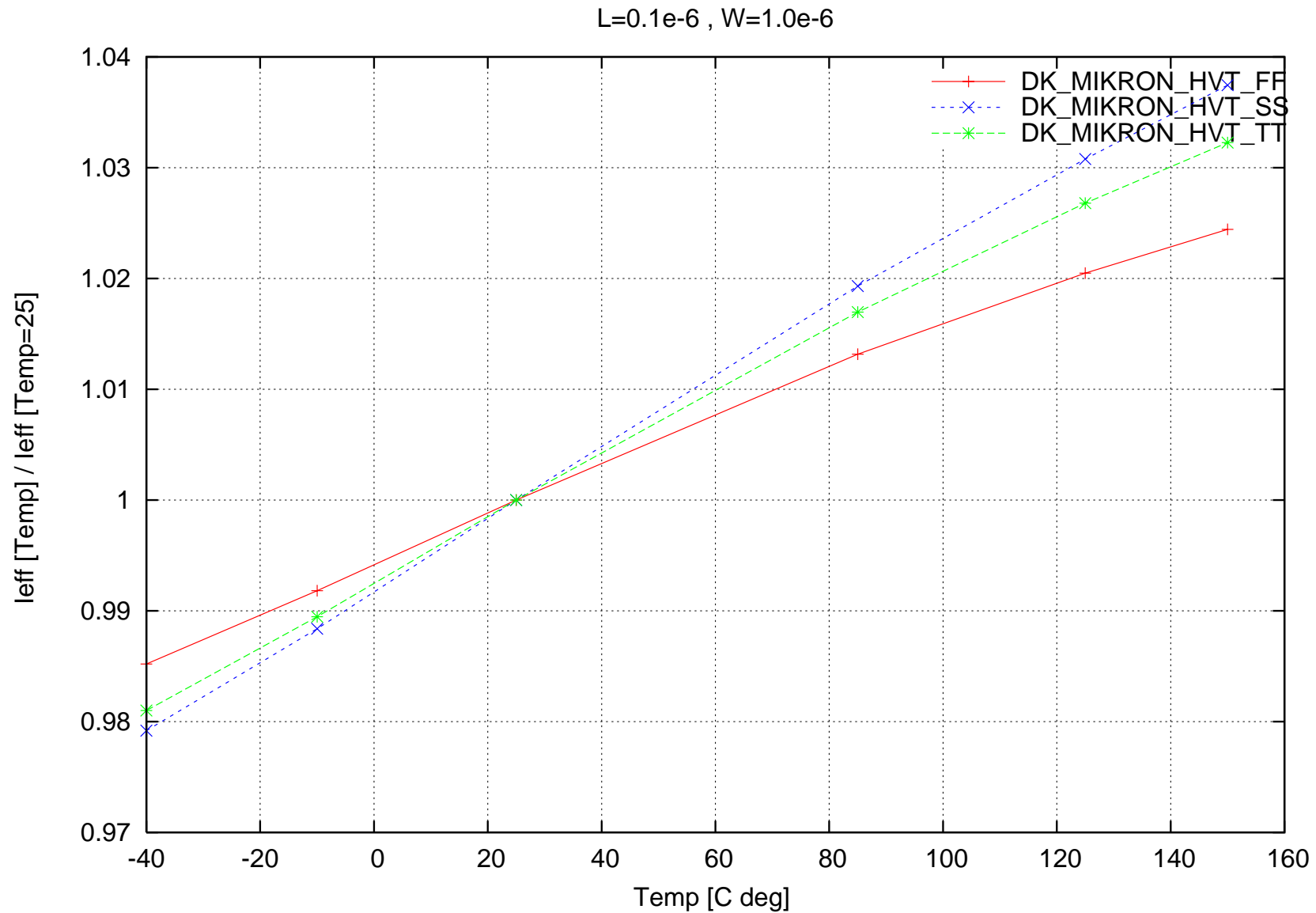


Scaling versus Temp for PMOS ($L=0.1\text{e-}6$, $W=1.0\text{e-}6$, $po2act=0.63\text{e-}6$, $LPE=0$)

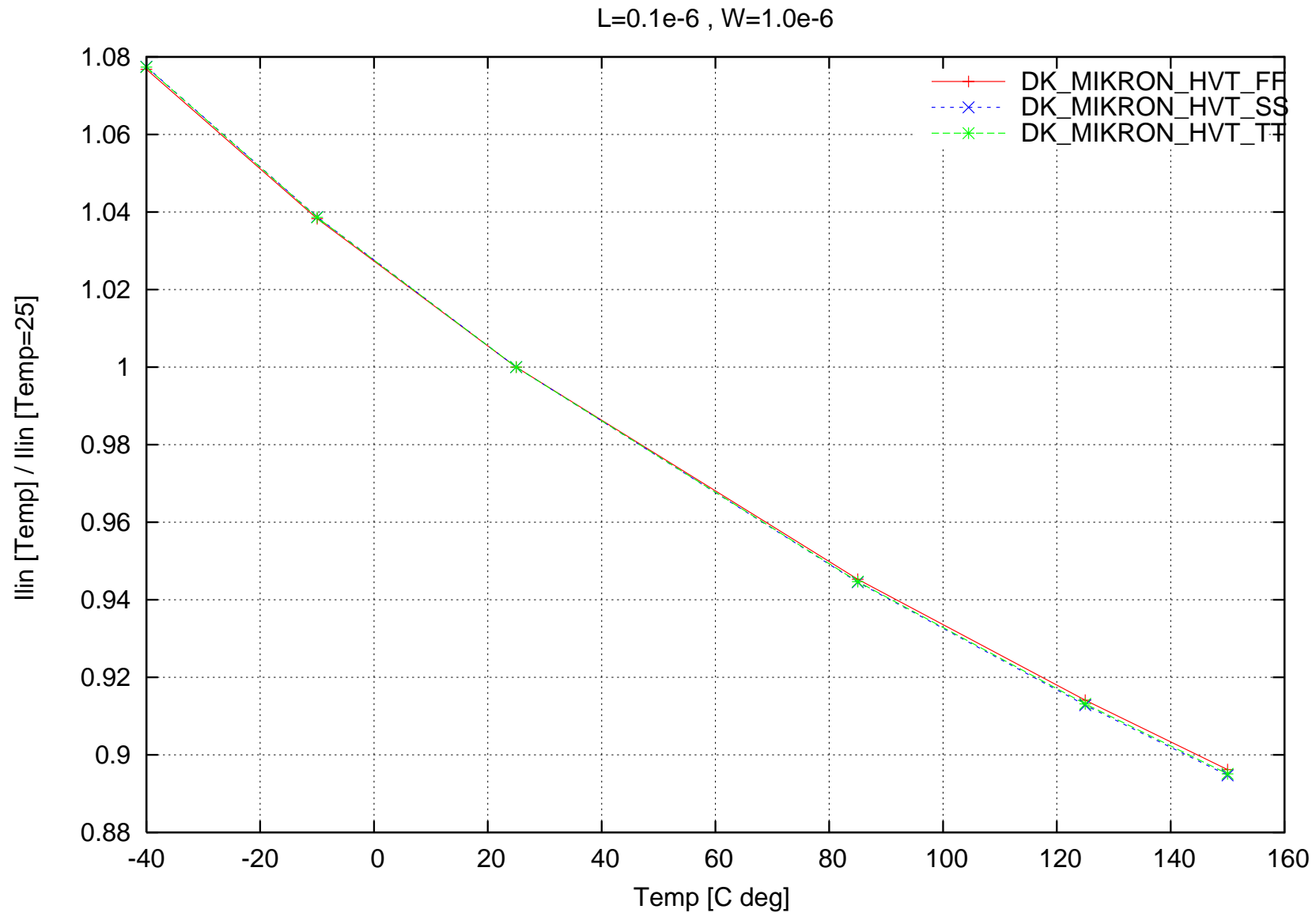
phvt Isat [Temp] / Isat [Temp=25] vs. Temp [C deg] , L=0.1e-6 , W=1.0e-6



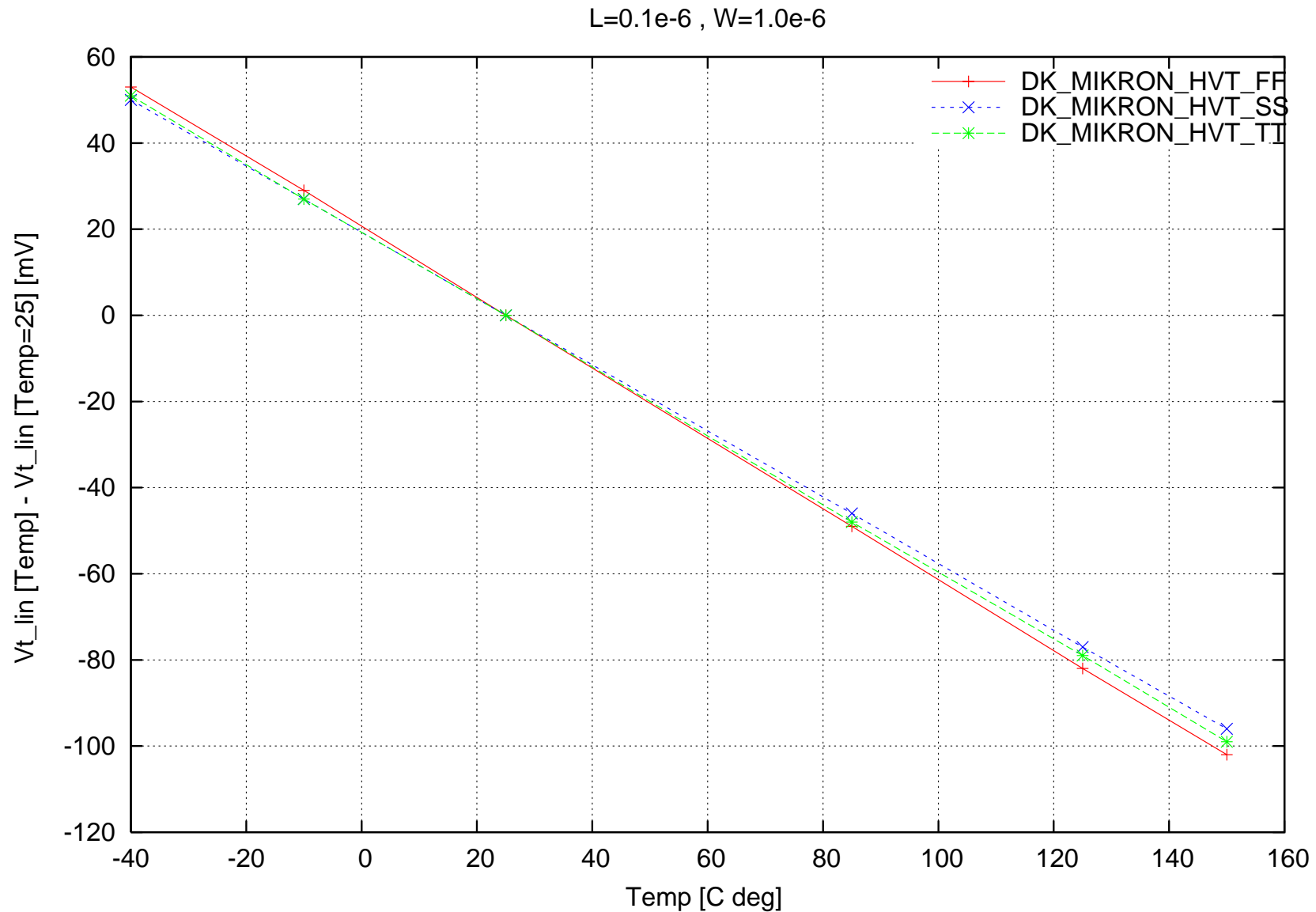
phvt leff [Temp] / leff [Temp=25] vs. Temp [C deg] , L=0.1e-6 , W=1.0e-6



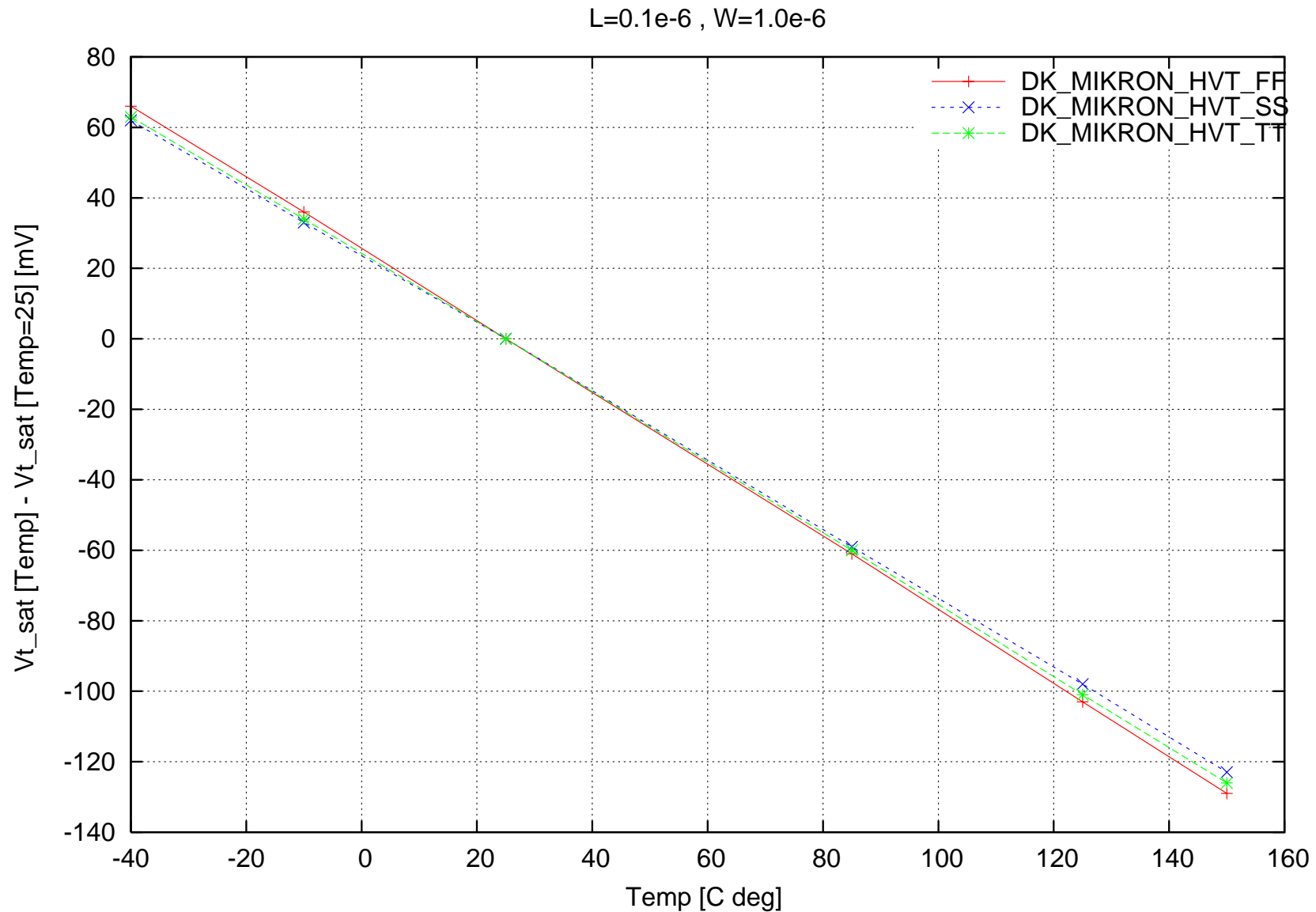
phvt $I_{lin} [Temp] / I_{lin} [Temp=25]$ vs. Temp [C deg] , $L=0.1e-6$, $W=1.0e-6$



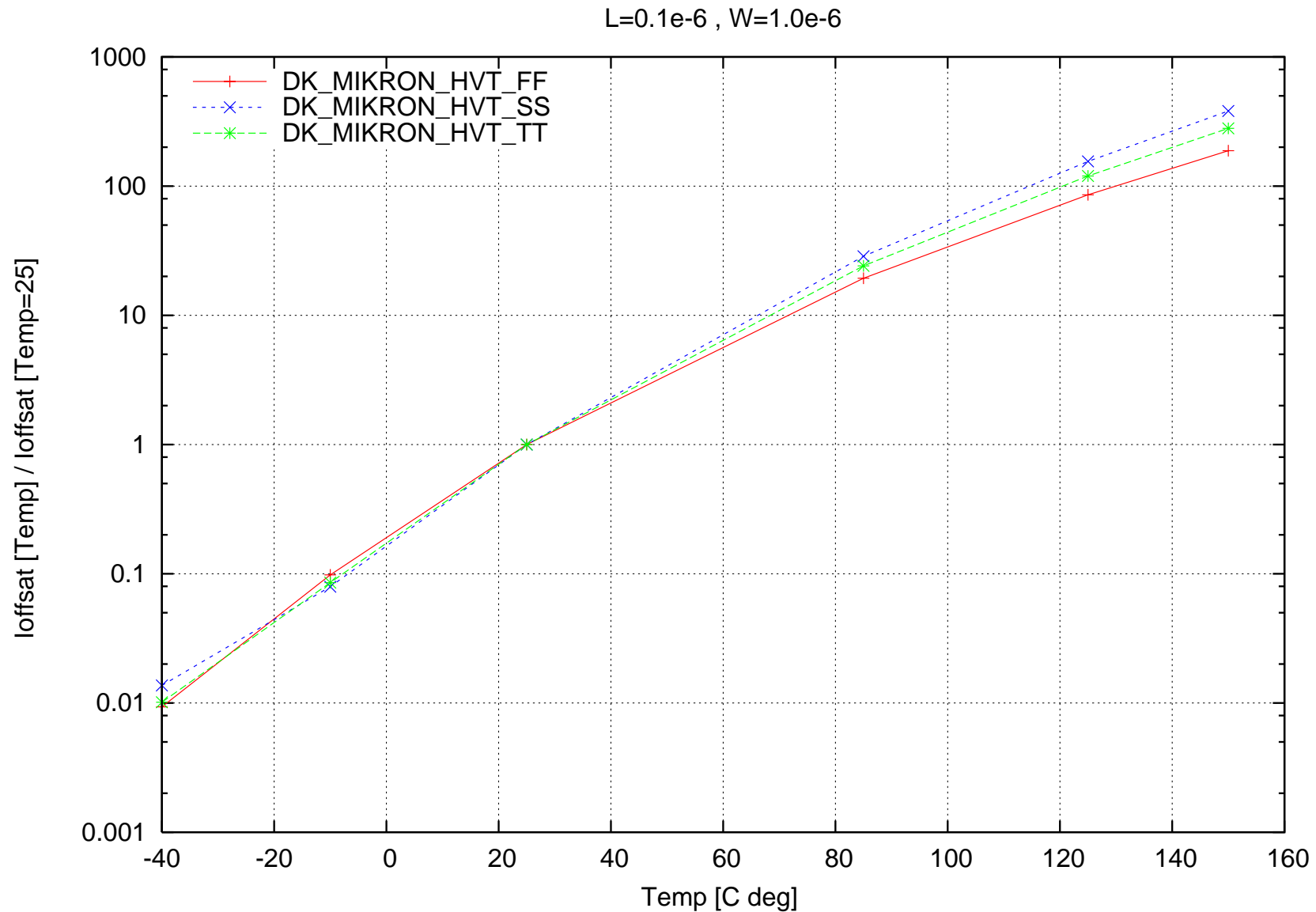
phvt Vt_lin [Temp] - Vt_lin [Temp=25] [mV] vs. Temp [C deg] , L=0.1e-6 , W=1.0e-6



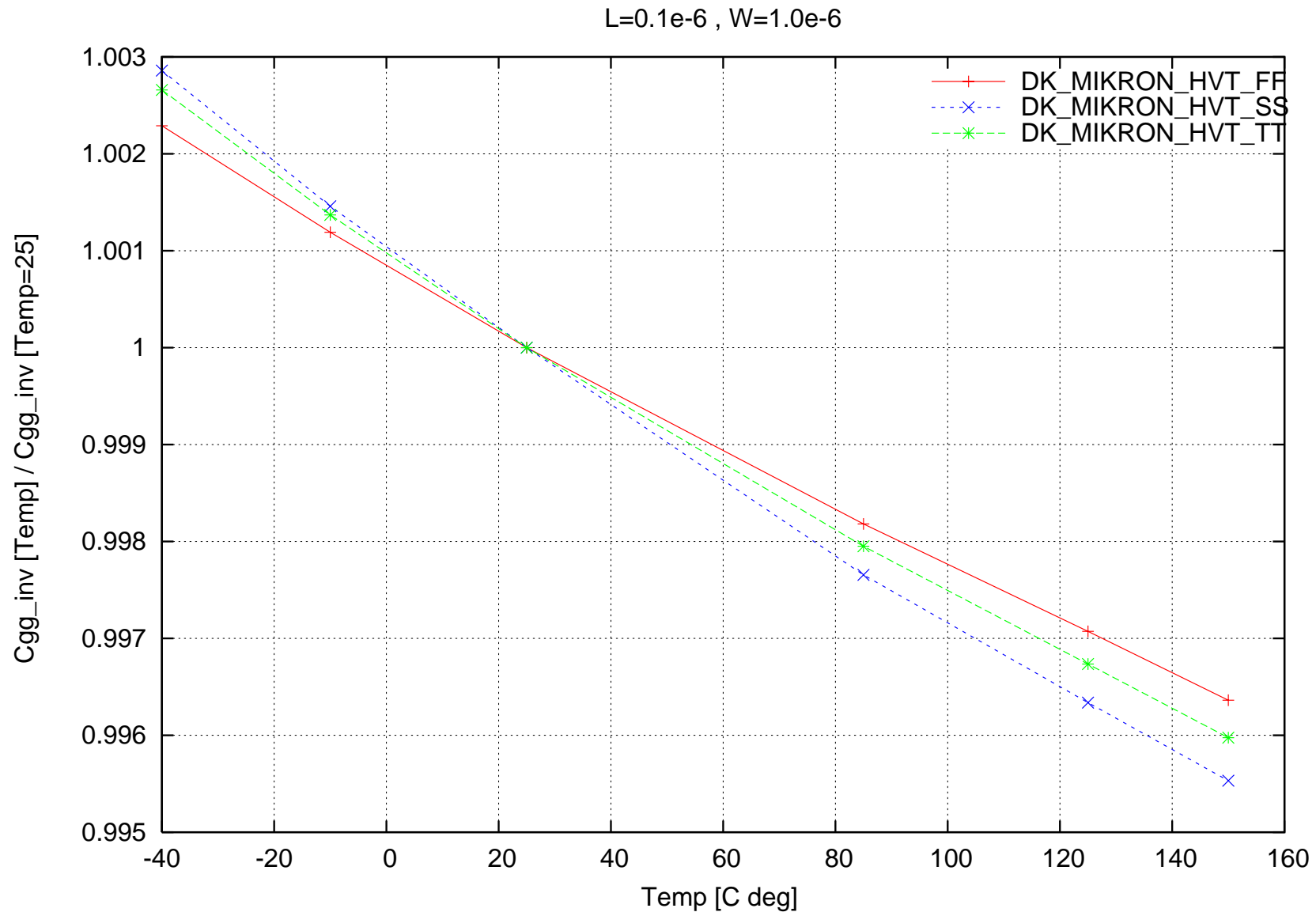
phvt Vt_sat [Temp] - Vt_sat [Temp=25] [mV] vs. Temp [C deg] , L=0.1e-6 , W=1.0e-6



phvt loffsat [Temp] / loffsat [Temp=25] vs. Temp [C deg] , L=0.1e-6 , W=1.0e-6



phvt Cgg_inv [Temp] / Cgg_inv [Temp=25] vs. Temp [C deg] , L=0.1e-6 , W=1.0e-6



phvt Cbd_off [Temp] / Cbd_off [Temp=25] vs. Temp [C deg] , L=0.1e-6 , W=1.0e-6

