



# CMOS028FDSOI Technology

## Vertical PNP bipolar transistor models

### DK1.2\_RF\_mmW

Comparison with DK1.1\_RF\_mmW model(s)

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## General information on models

- Maximum supply voltage is - V.
- Validity domain is defined as follows:
  - ✓ Device temperature varies from -40 C °C to 150 C °C.

## Output parameters definitions

- Model(s): vnpn
  - ✓  $I_c$  : Collector current
  - ✓  $I_b$  : Base current
  - ✓ Beta : DC gain current

# **vpnp**

## **Electrical characteristics per geometry**

**vpnp @ l=3.2e-6, w=3.2e-6, soa=0, temp=25.0, vbe=0.6**

DK1.2\_RF\_mmW wrt DK1.1\_RF\_mmW

	TYP	IMIN	IMAX	BMIN	BMAX
<b>Ic [nA]</b>	7.19 0.0%	5.36 0.0%	9.08 0.0%	6.04 0.0%	7.88 0.0%
<b>Ib [nA]</b>	4.09 0.0%	2.7 0.0%	5.54 0.0%	4.74 0.0%	3.45 0.0%
<b>Beta []</b>	1.76 0.0%	1.99 0.0%	1.64 0.0%	1.27 0.0%	2.29 0.0%

**vpnp @ l=3.2e-6, w=3.2e-6, soa=0, temp=25.0, vbe=0.7**

DK1.2\_RF\_mmW wrt DK1.1\_RF\_mmW

	TYP	IMIN	IMAX	BMIN	BMAX
<b>Ic [nA]</b>	351 0.0%	261.9 0.0%	443 0.0%	294.9 0.0%	384.6 0.0%
<b>Ib [nA]</b>	198.4 0.0%	130.7 0.0%	268.7 0.0%	230.8 0.0%	166.3 0.0%
<b>Beta []</b>	1.77 0.0%	2 0.0%	1.65 0.0%	1.28 0.0%	2.31 0.0%

# **vpnp**

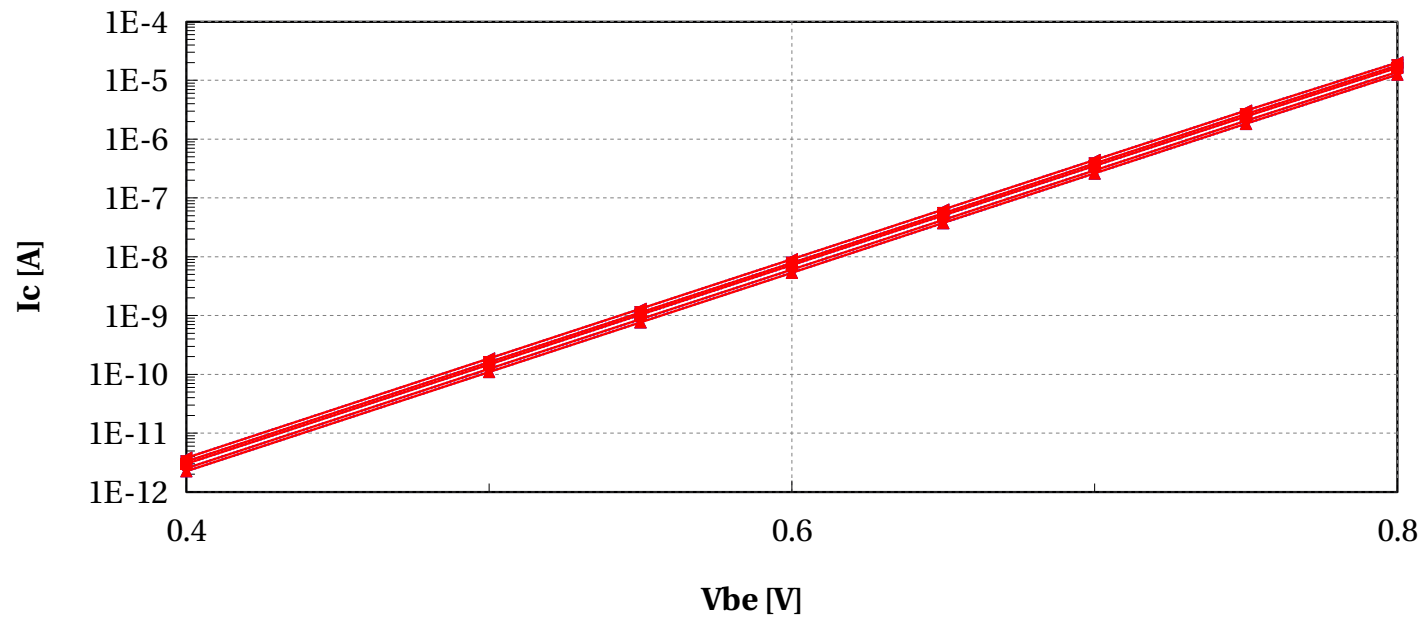
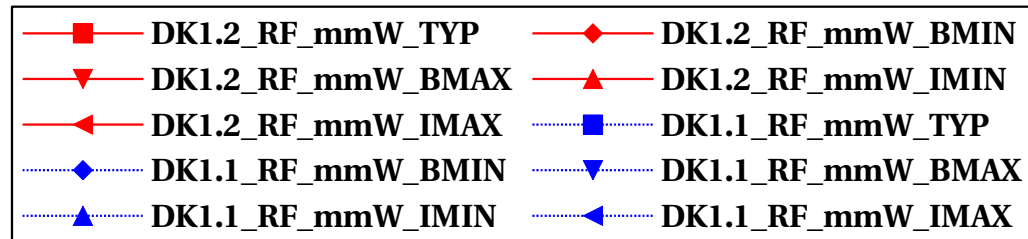
## **Electrical characteristics scaling**



## Ic scaling versus Vbe (W=3.2um&L=3.2um,Temp=25C)

# vpnp, Ic [A] vs Vbe [V]

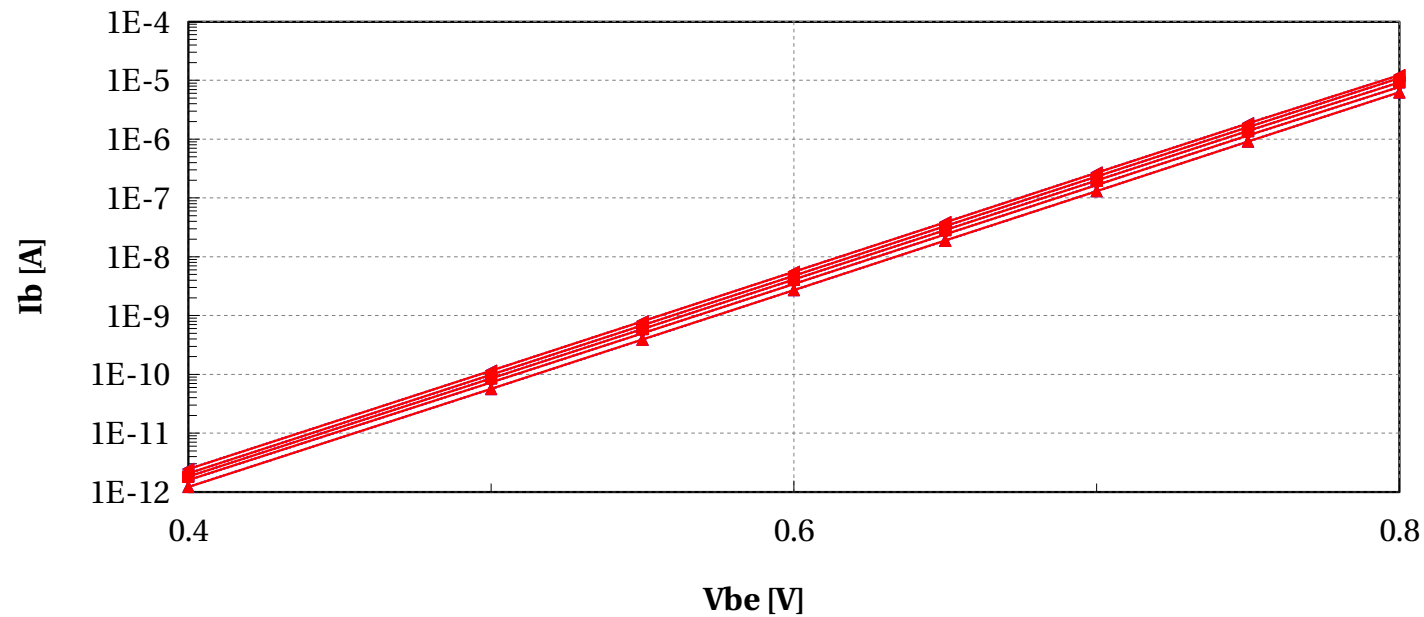
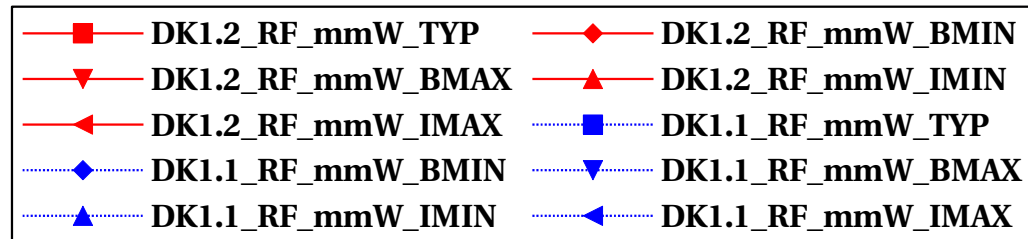
$L=3.2e-06$  and  $W=3.2e-06$  and  $Temp=25$



# **Ib scaling versus Vbe (W=3.2um&L=3.2um,Temp=25C)**

# vpnp, Ib [A] vs Vbe [V]

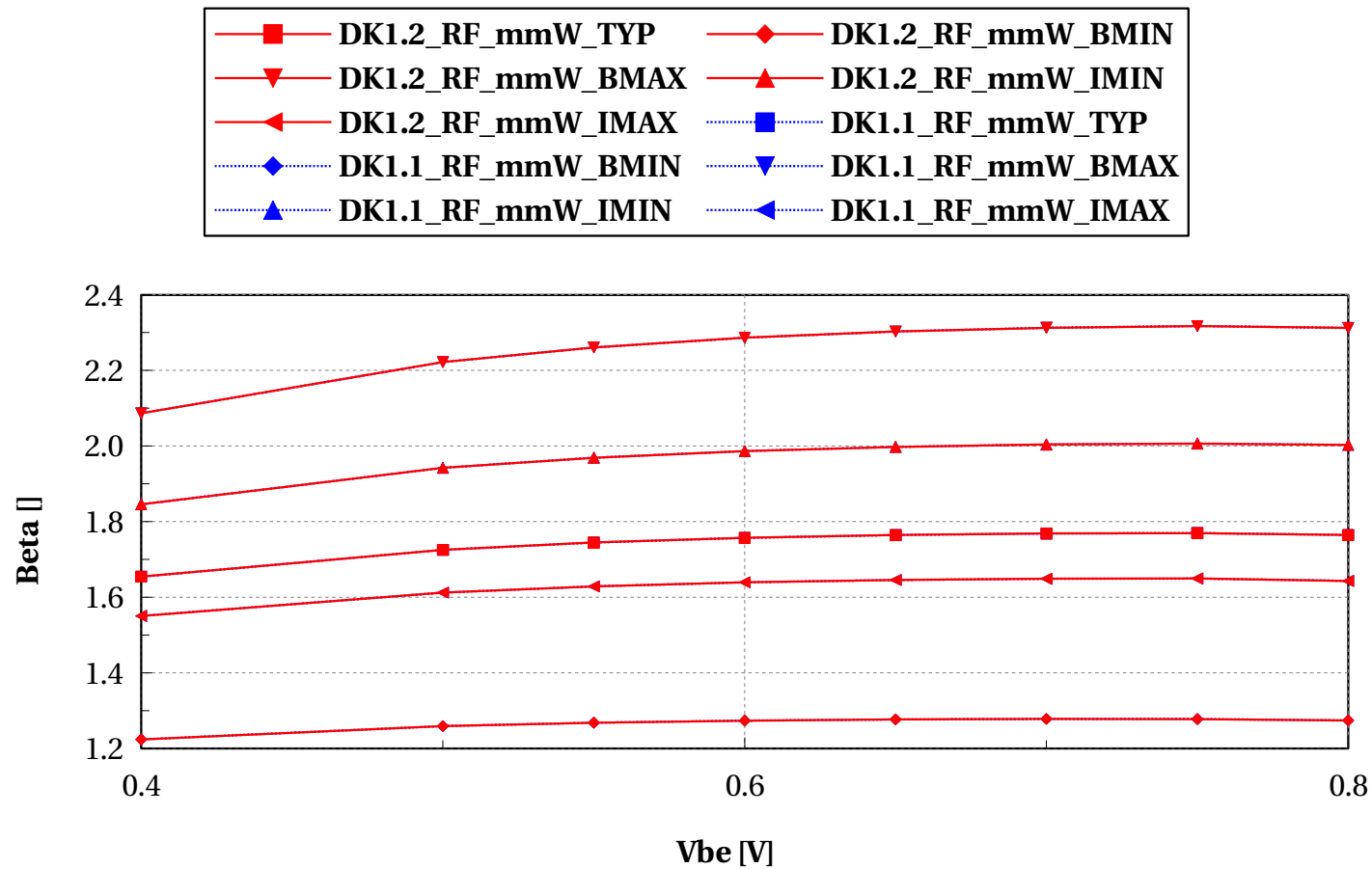
L==3.2e-06 and W==3.2e-06 and Temp==25



## Beta scaling versus $V_{be}$ ( $W=3.2\mu m \& L=3.2\mu m$ , Temp=25C)

# vpnp, Beta [] vs Vbe [V]

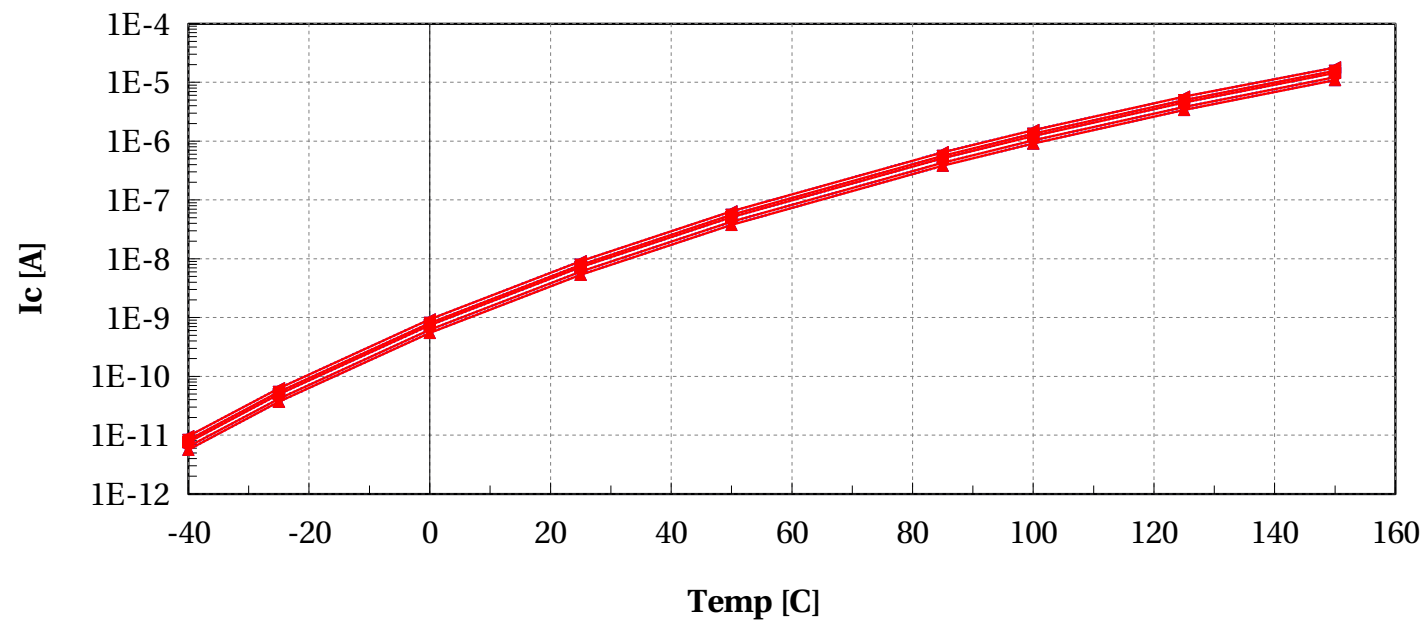
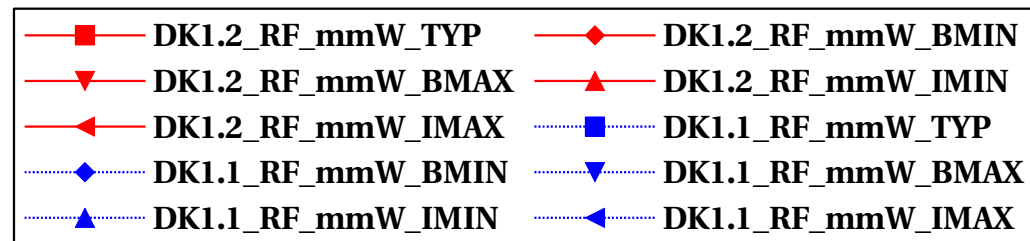
L==3.2e-06 and W==3.2e-06 and Temp==25



## **Ic scaling versus Temp (W=3.2um&L=3.2um,Vbe=0.6V)**

# vpnp, Ic [A] vs Temp [C]

$L=3.2e-06$  and  $W=3.2e-06$  and  $V_{be}=0.6$

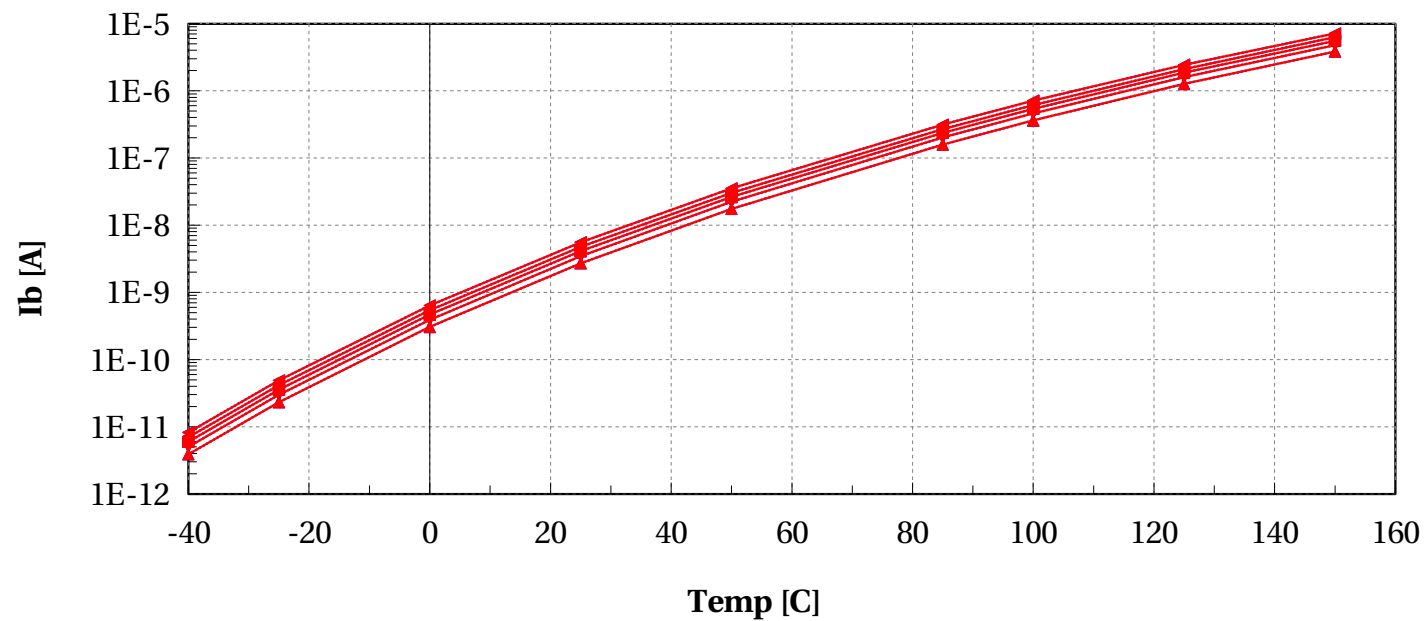
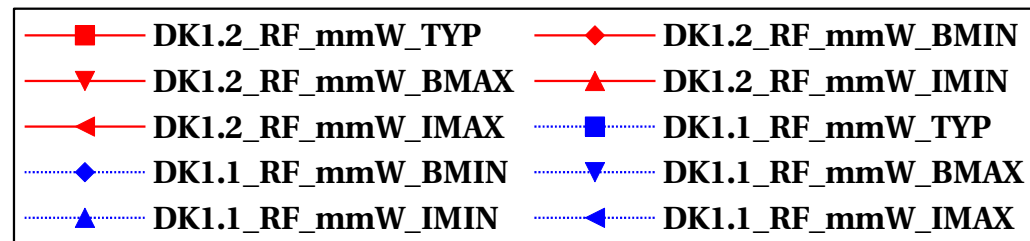




## **Ib scaling versus Temp (W=3.2um&L=3.2um,Vbe=0.6V)**

# vpnp, Ib [A] vs Temp [C]

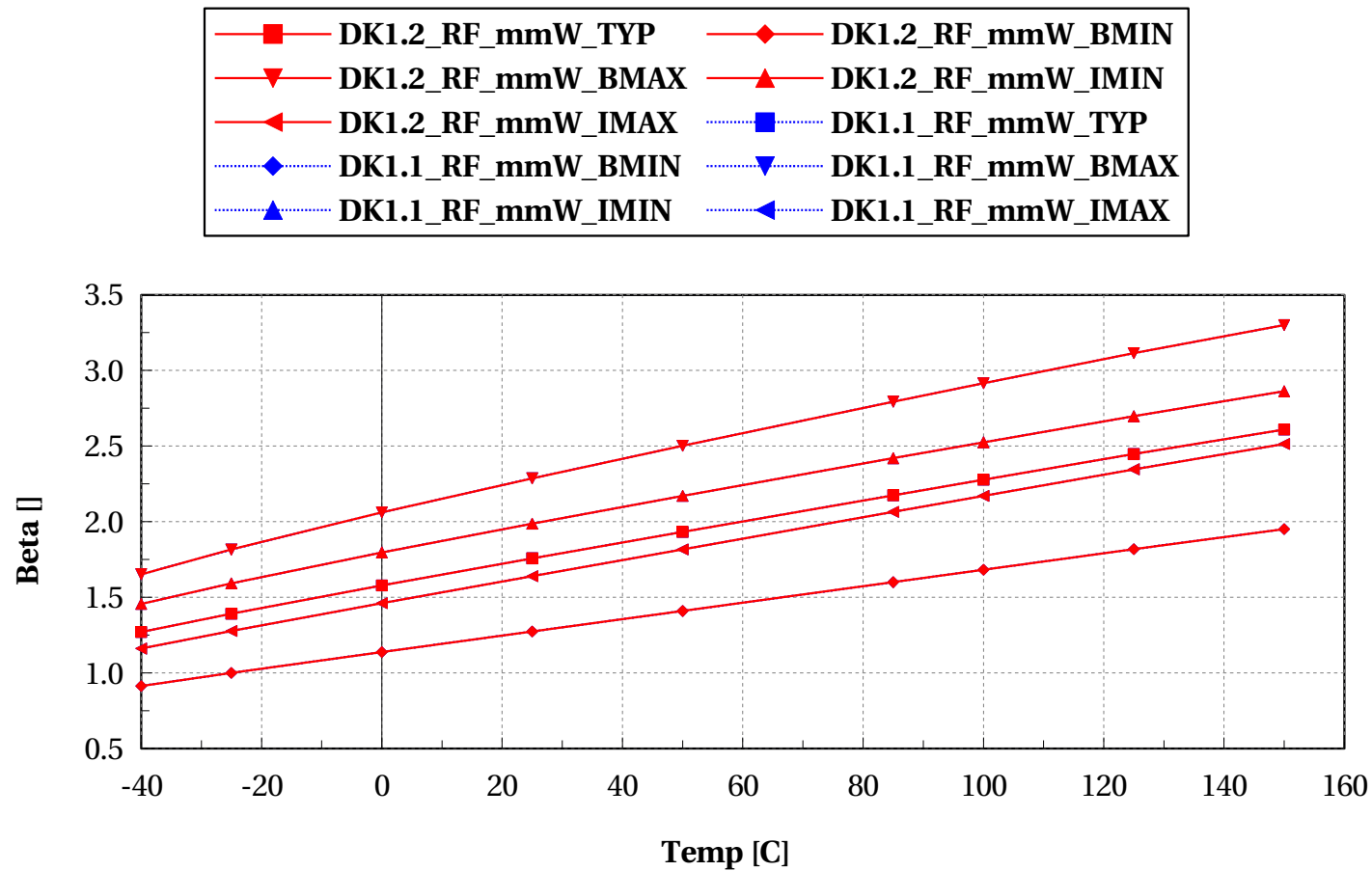
$L=3.2e-06$  and  $W=3.2e-06$  and  $V_{be}=0.6$



## Beta scaling versus Temp (W=3.2um&L=3.2um,Vbe=0.6V)

# vpnp, Beta [] vs Temp [C]

$L=3.2e-06$  and  $W=3.2e-06$  and  $V_{be}=0.6$



# Annex

# Conditions of simulations

The simulations were done with SBenchLSF Alpha using Eldo simulator 2018.3.

- Model vnpn (DK1.2\_RF\_mmW)
  - ✓ Input Parameters
    - ✗  $v_{cb} = 0 \text{ V}$
    - ✗  $v_{be} = 0.6 \text{ V}$
    - ✗  $\text{temp} = 25 \text{ }^{\circ}\text{C}$
    - ✗  $\text{mc\_sens} = 0$
    - ✗  $\text{sbenchlsf\_release} = \text{Alpha}$
    - ✗  $\text{ams\_release} = 2018.3$
    - ✗  $\text{model\_version} = 1.2$
    - ✗  $v_{sub} = 0 \text{ V}$
    - ✗  $\text{mc\_runs} = 1000$
    - ✗  $\text{mc\_nsigma} = 3$
  - ✓ Sweep Parameters
    - ✗  $v_{be} = 0.4, 0.5, 0.55, 0.6, 0.65, 0.7, 0.75, 0.8$
    - ✗  $\text{temp} = -40.0, -25.0, 0.0, 0.0, 25.0, 50.0, 85.0, 100.0, 125.0, 150.0$
  - ✓ Extra parameters

- ✗ pnpv\_dev = 0
- ✗ vpnnp\_user = 0
- Model vpnnp (DK1.1\_RF\_mmW)
  - ✓ Input Parameters
    - ✗ vcb = 0 V
    - ✗ vbe = 0.6 V
    - ✗ temp = 25 °C
    - ✗ mc\_sens = 0
    - ✗ sbenchlsf\_release = Alpha
    - ✗ ams\_release = 2018.3
    - ✗ model\_version = 1.2
    - ✗ vsub = 0 V
    - ✗ mc\_runs = 1000
    - ✗ mc\_nsigma = 3
  - ✓ Sweep Parameters
    - ✗ vbe = 0.4, 0.5, 0.55, 0.6, 0.65, 0.7, 0.75, 0.8
    - ✗ temp = -40.0, -25.0, 0.0, 0.0, 25.0, 50.0, 85.0, 100.0, 125.0, 150.0
  - ✓ Extra parameters
    - ✗ pnpv\_dev = 0
    - ✗ vpnnp\_user = 0