NPN_Curve

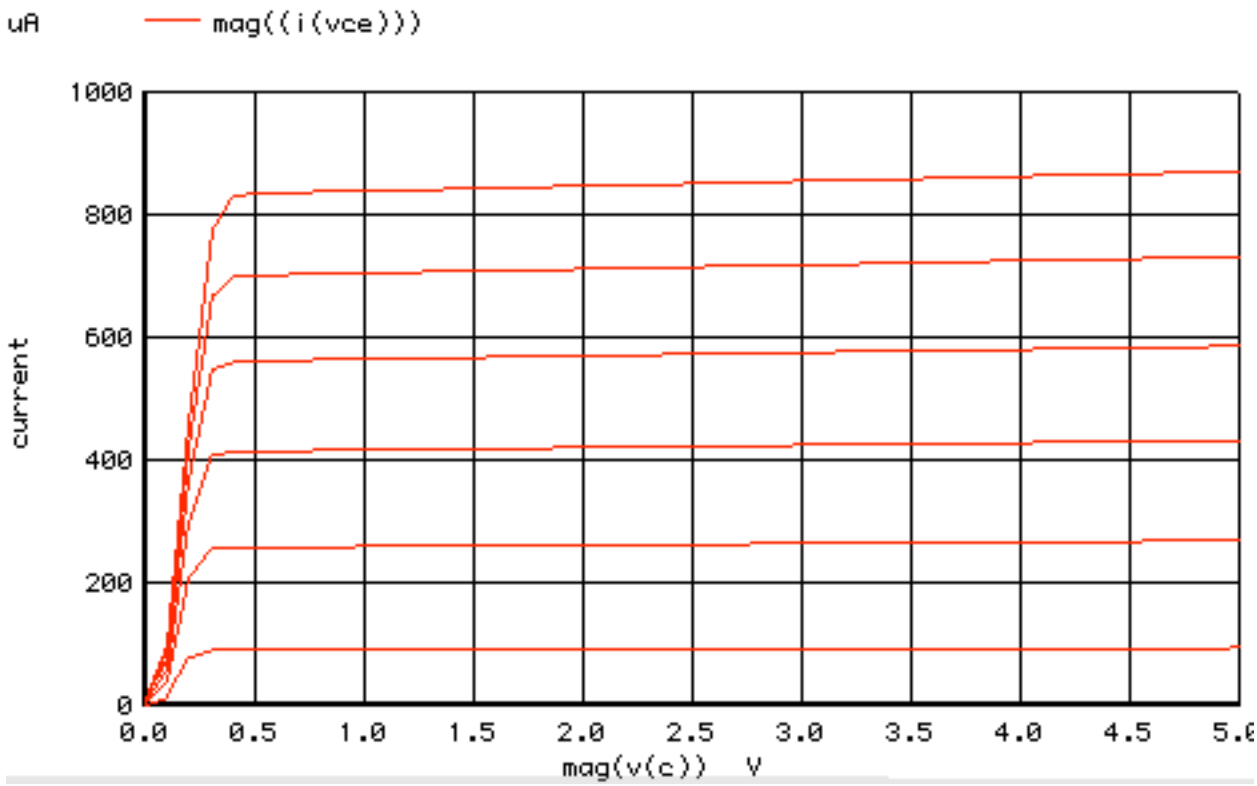
```
* LOOK At  Beta, RC, VAF, VSAT
*
*
*     ____
*     |   0|                  _________
*     |   _|_                |        | VCE
*     |  /  _\               |C       _|_
*     |_ \/ \/              _|       /2v \
*    /// /\_/\          __|'  npnv   \___/
*        \___/      B  |  |`->        |
*      IB  |          |     |   0     |
*          |__________|     |_________|
*                             _|_
*                             ///
*

VCE       C   0   DC   2V
IB        0   B   DC   10u
Q1        C   B   0    NPNV

.control
dc        vce 0V 5V .1V  ib 1uA 10uA 2uA
run
plot      mag((i(vce))) vs mag(v(c))  title Typical_CurveTracer
setscale c
plot      -i(vce)                     title Typical_CurveTracer
.endc

.MODEL  NPNV    NPN(
+ IS=15.51E-18  NF=1.005     BF=110      VAF=130.2    IKF=0.0057
+               NR=1.006     BR=0.4822   VAR=4.286    IKR=
0.0002472
+ ISE=9.15E-17  NE=2
+ ISC=1E-21     NC=2
+ RB=732        RBM=441.2                             IRB=7.5E-04
+ RE=15.33      RC=109.1
+ CJE=1.727E-14 VJE=0.6408   MJE=0.2563
+ CJC=1.826E-14 VJC=0.6399   MJC=0.3531
+ CJS=2.939E-14 VJS=0.3488   MJS=0.1813  XCJC=0.4201
+ TF=1.65E-11   XTF=1.25     VTF=1       ITF=0.003532
+ TR=6E-09      FC=0.88      PTF=205
+ KF=1.000E-16  AF=1
+ XTB=2         EG=1.11      XTI=5       TNOM=25       )
.END
```

```
**
**
**                               |(C)|    NPN
**     SPICE MODEL               |___|
**    <actual_behavior>            |
**    <varies from spice model !>  / RC 110ohms    VAF=215
**                                 \
**                                 /                    4fF
**        _________________________|_____________________
**        |       |      |      |    |      |     _|_   _|_Cjs
**        |       |12fF  |      |    |Ir/BR |Irn / _ \  ___
**        |       |      |      /   _|_    _|_   \/ \/   |gnd!
**       _|_Cjcx _|_Cjc _|_Cdc  \    ^      ^    /\_/\  _|_
**       ___     ___    ___     /   /_\    /_\   \___/ \sub/
**   ___  |   Rbb'|      | gmin \    |      |   Ic |    \ /
**  |(B)|_|_/\  __|______|______|____|______|      | |   V
**  |___|     \/  |      |      |   _|_    _|_     | V (hidden)
**      600ohms  _|_Cje _|_Cde  \   \ /    \ /     |
**     BF=116    ___    ___     /   _v_    _v_     |
**                |20fF  | gmin \    |If/Bf |Ifn   |
**                |______|______|____|______|______|
**                                 |
**                  TF=8ps         / RE 15ohms
**                                 \
**                                 /
**                                _|_
**                               |(E)|
**                               |___|
**
**
```


uA
mag((i(vce)))
1000
800
600
400
200
0
current
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
mag(v(c)) V