NPN_Curve

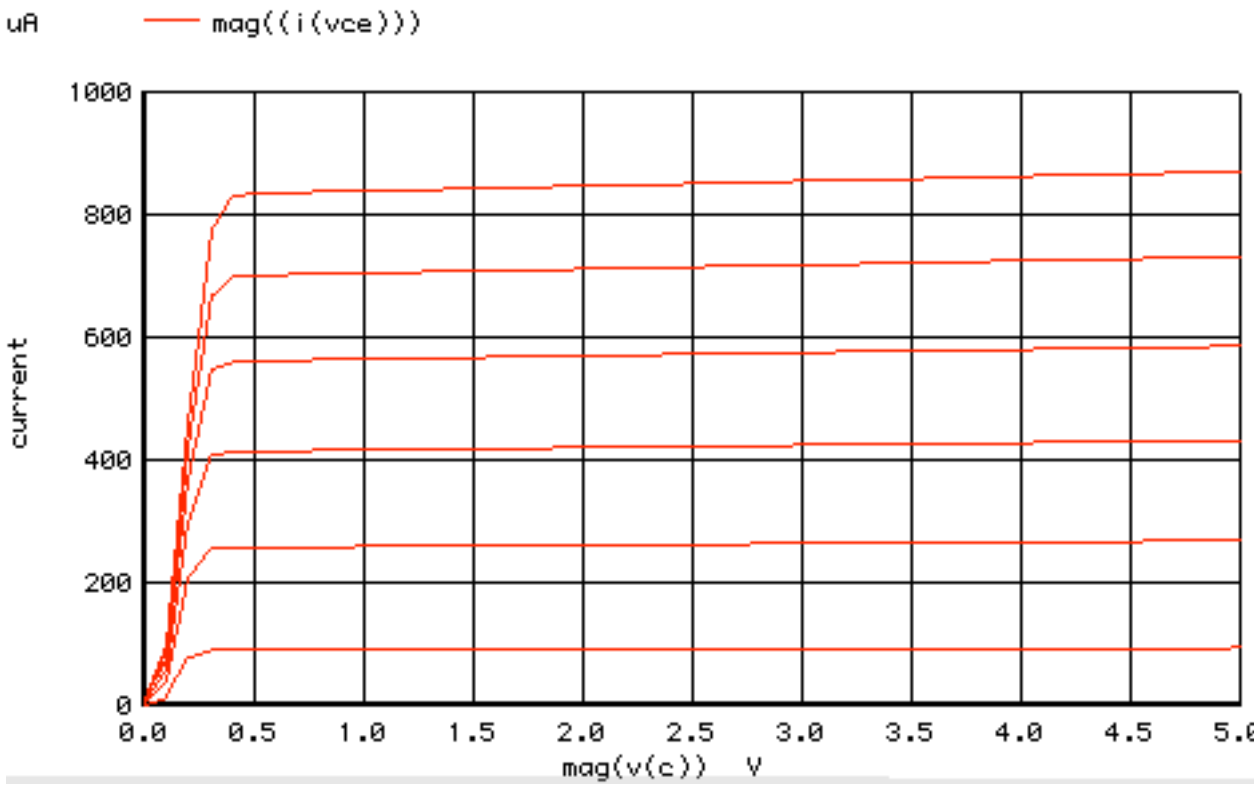
```
* LOOK At  Beta, RC, VAF, VSAT
*
*
*     ____
*     |   0|                    _________
*     |    |_|_                |         | VCE
*     |   /   \                |C        |_|_
*     |   \ _ /                |        /2v \
*    _|_  \/ \/              _|  npnv   \___/
*    ///  /\_/\          ___|'
*         \___/      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
.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