

FIG 1

***Input values from locus**

Input Data

Result

Data sheet (approx)

Known VI Locus			
Vce	Ic	Vce	Ic
0.000	6.850	0.000	6.850
36.000	4.000	86.526316	0.000
86.526	0.000		

86.52631579

Known R's			
Vcc	40.000	Vcc	40.00
Re	0.220	Re	0.22
R1	12411.579	R1*	12411.579
R2	143.000	R2*	143.000
R3* (N=1)	220	R3* (N=1)	220
Vbe _{Q2}	0.600	Vbe _{Q2}	0.600

For N protected pairs of o/p devices, R3 actual = R3 x N = 220

Protected pairs N = 1

To find R1 and R2, (R3 (100Ω≤R3≤1kΩ) and 2-VI limiter points known)

Assume $V_{ce_{Q1}} (\text{sat}) = 0V$ (Fig 1)

At Point A, $V_{ce}=0$ (At $V_{ce}=0$, $I_{c_A} \cdot R_e$ must be $> V_{be_{Q2}}$)

OK

$$I_2 = I_1 + I_3$$

$$V_{be_{Q2}}/R_2 = (V_{cc} - V_{O_A}) / \{R_2 + R_1 R_3 / (R_1 + R_3)\} \quad (\text{MK eqn 1})$$

Hence algebraic manipulation gives:

$$V_{be_{Q2}} R_1 R_3 / R_2 = (R_1 + R_3) (V_{cc} - V_{O_A} - V_{be_{Q2}}) \dots \dots \dots 1$$

At any point B on locus MK (when $I_{c_B}=0$, V_{ce_B} should be $\geq 2 \cdot V_{cc}$)

$$I_2 = I_1 + I_3$$

$$V_{be_{Q2}}/R_2 = (V_{cc} - V_{O_B} - V_{be_{Q2}}) / R_1 + (I_{c_B} R_e - V_{be_{Q2}}) / R_3 \quad (\text{MK eqn 2})$$

Hence

$$V_{be_{Q2}} R_1 R_3 / R_2 = (V_{cc} - V_{O_B} - V_{be_{Q2}}) R_3 + (I_{c_B} R_e - V_{be_{Q2}}) R_1 \dots 2$$

So from RH sides of 1 & 2:

$$R_1 = R_3 (V_{O_A} - V_{O_B}) / (V_{cc} - V_{O_A} - I_{c_B} R_e)$$

Since $V_{O_A} = V_{cc} - I_{c_A} R_e$ and $\dots \dots \dots 3$

$$V_{O_B} = V_{cc} - V_{ce_B} - I_{c_B} R_e$$

then

$$R_1 = R_3 (V_{ce_B} + R_e (I_{c_B} - I_{c_A})) / R_e (I_{c_A} - I_{c_B}) \quad 12411.579$$

And from 1 & 3:

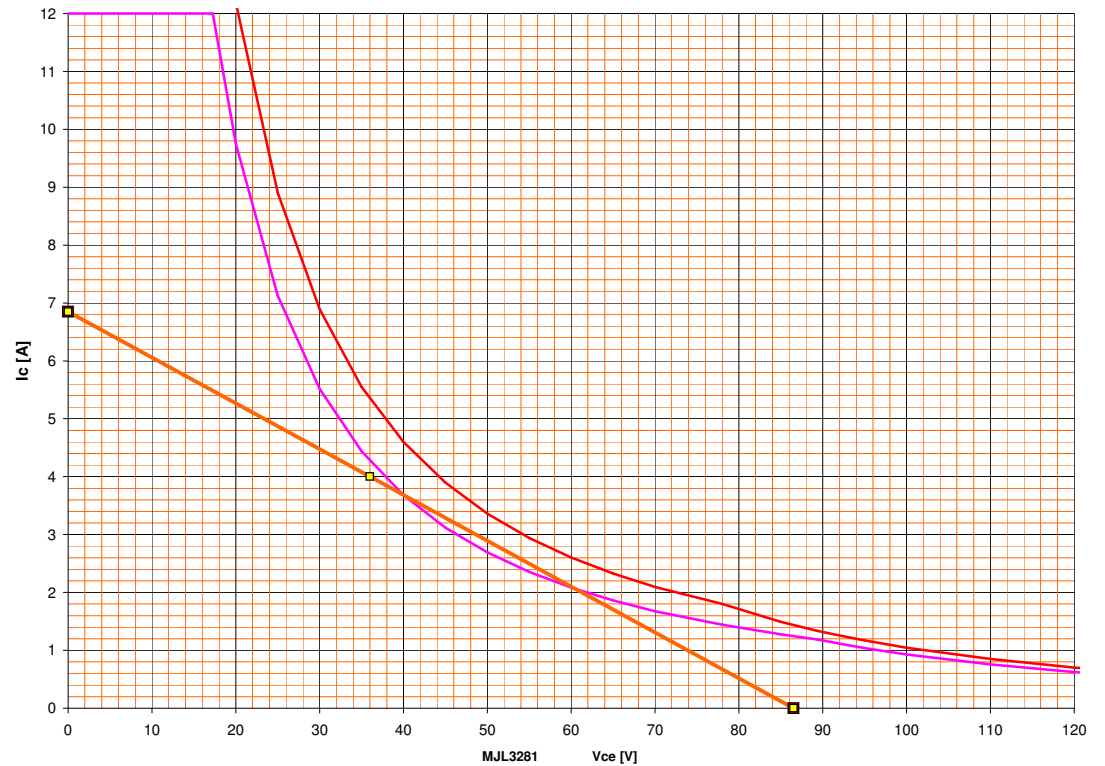
$$R_2 = V_{be_{Q2}} R_1 R_3 / \{(R_1 + R_3) (I_{c_A} R_e - V_{be_{Q2}})\} \quad 143.000$$

To find VI locus, if R1,R2,R3 known

At $V_{ce_A}=0$, $I_{c_A} = V_{be_{Q2}} (R_2 + R_1 R_3 / (R_1 + R_3)) / (R_2 R_e)$ 6.850

At $I_{c_B}=0$, $V_{ce_B} = I_{c_A} (V_{ce_A}=0) R_e (1 + R_1 / R_3)$ (V_{ce_B} should be $> 2 | V_{supply}$) 86.526

If at V_{ce_B} , $I_{c_B} = 0$ then $R_1 = R_3 (V_{ce_B} - I_{c_A} R_e) / I_{c_A} R_e$ 12411.579



— 1s@Tc25 — 1s@Tc50°C - - - Known R's — Known VI Locus