INTRODUCTION TO CURRENT MIRRORS

by

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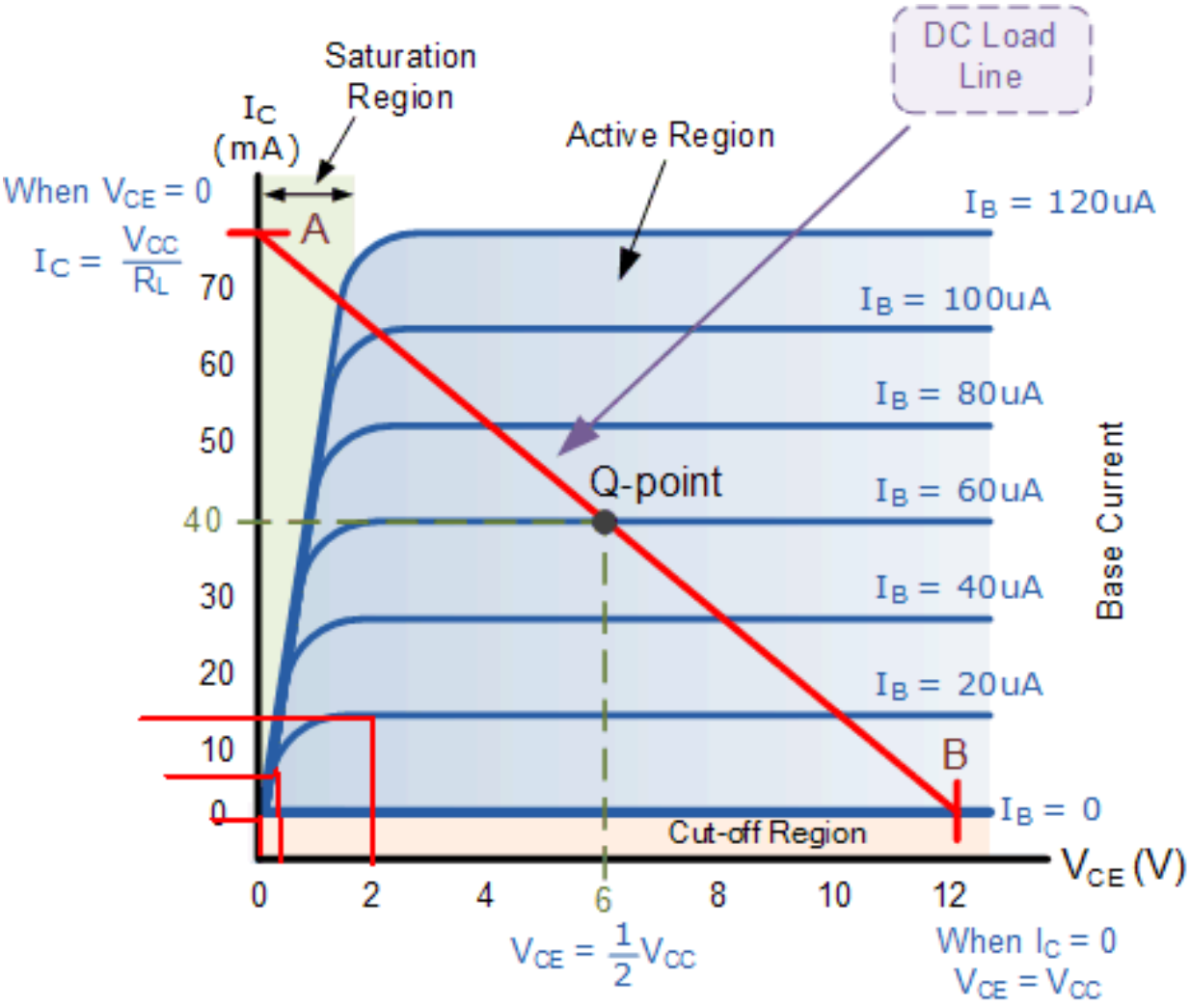
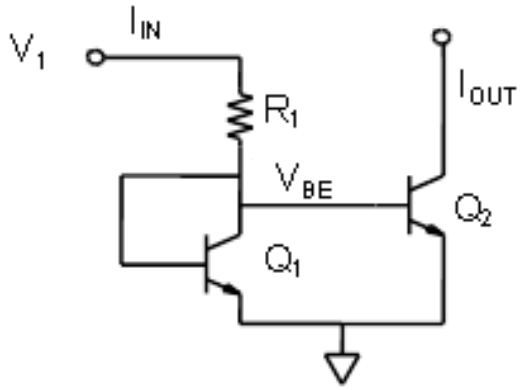
First, we shall consider the basic BJT current mirror.

Recall the typical BJT output characteristic given a load R_L:

Once the base to emitter voltage exceeds ~ +0.7 v (assuming an NPN transistor) the transistor turns on.



OPERATING REGIONS IN A BJT

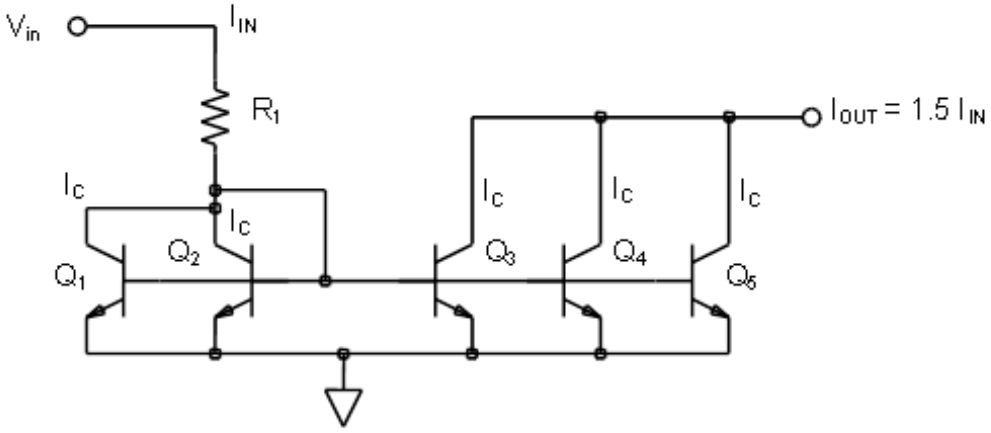


NPN BJT IMPLEMENTATION OF BASIC CURRENT MIRROR

(Q1 and Q2 are identically fabricated on same chip and at same temperature).

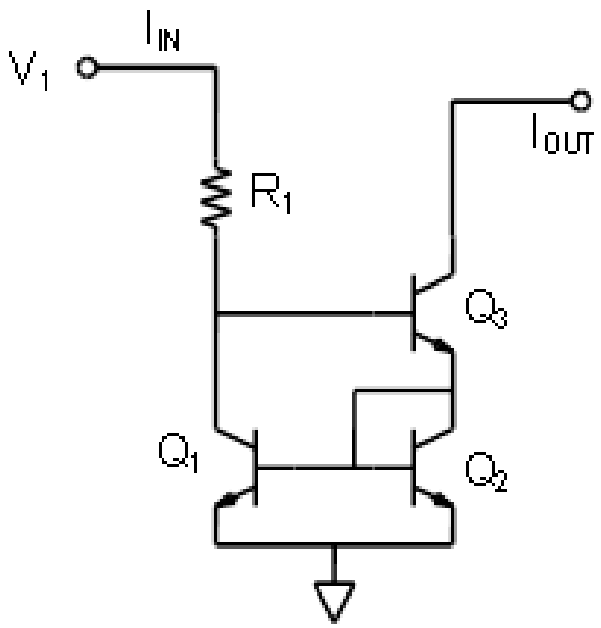
$$I_{in} = \sim (V1 - 0.7)/R_1$$

But $V_{BE1} = V_{BE2}$ by construction and, assuming Q_1 is on then so is Q_2. Further as the I_C vs V_{CE} characteristic curves are the same then $I_{out} = I_{in}$



CHANGING I_{out} USING BASIC BJT CURRENT MIRROR

(again all transistors identically fabricated on same chip).

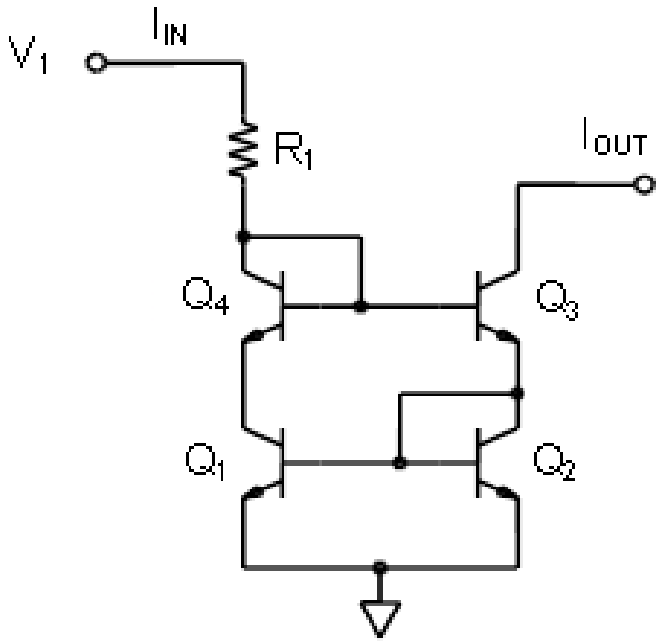


WILSON CURRENT MIRROR USING 3 NPN BJTs

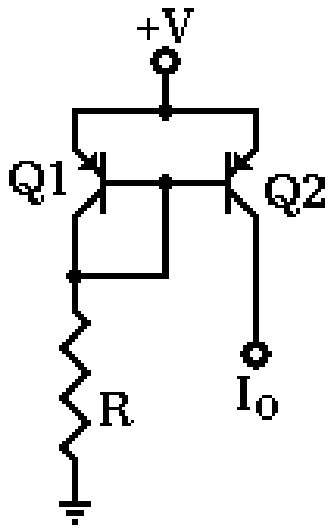
I_{in} = ~ (V1 – 0.7 – 0.7)/R_1

Again I_{OUT} ~ I_{in}

(Wilson's design makes I_{out} a stiffer current sink)

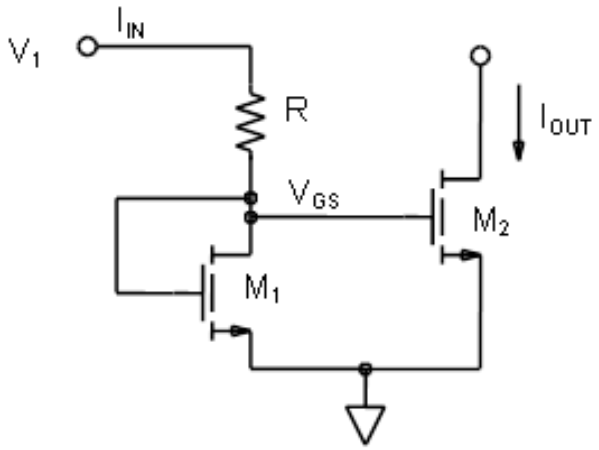


IMPROVED (balanced) WILSON CURRENT MIRROR USING BJTs



BASIC BJT CURRENT MIRROR USING PNP TRANSISTORS

Again I_0 ~ I_R but it is sourced now (goes out) rather than sunk



BASIC MOSFET CURRENT MIRROR

(Can parallel up multiple M2 MOSFETS to get $2xI_{IN}$, $3xI_{in}$, etc.)