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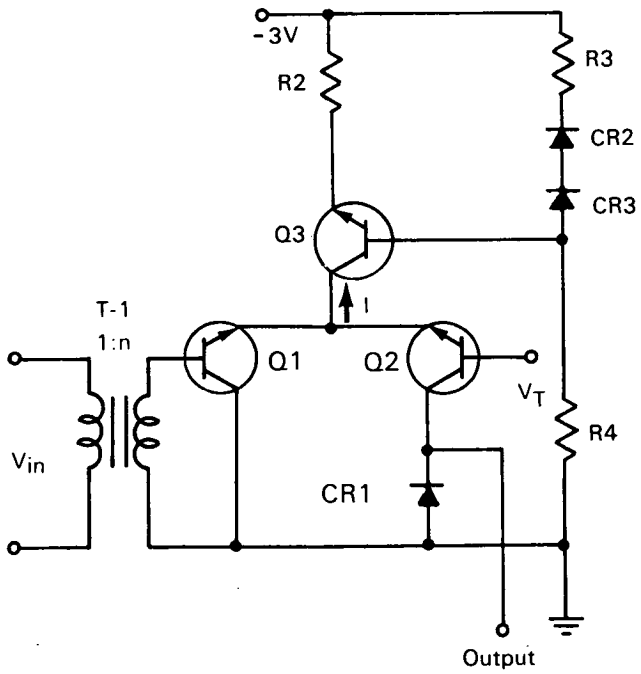
NASA TECH BRIEF

Wide-Range Pulse-Height Discriminator



Schematic Diagram of the Pulse-Height Discriminator

The problem:

To develop an improved pulse-height discriminator with the following attributes: Discriminator level very low (in the millivolt range); simple adjustment over wide range (dynamic range, ≤ 100); stability with age within one percent at temperatures between −20° and +60°C. Discriminator should respond to relatively narrow pulses (500 nsec), draw little power (milliwatts), and require simple circuitry.

The solution:

A novel pulse-height discriminator that at least meets these requirements. A constant-current generator (Q3 transistor, together with R2, R3, CR2 and CR3), shown in the figure, drives the common emitters of transistors Q1 and Q2. In the absence of an input signal V_{in}, Q1 conducts while Q2 is cut off. Transistor Q1 is biased "on" because of the essentially zero dc voltage on its base, due to the low dc impedance of the secondary of transformer T1. Transistor Q2 is biased "off" because of the voltage (V_T) applied to its base. The constant-current drive I is made equal to $2I_p$, where I_p is the peak current of the the peak current of the tunnel diode CR1.

When an input pulse V_{in} is applied, which causes a pulse across the secondary of T1 with amplitude V_T, the constant-current drive is distributed equally between Q1 and Q2. Therefore the current (I_p) flowing in the collector circuit of Q2 causes the tunnel diode (CR1) to switch to its high voltage state, yielding an output. Thus, an output pulse is yielded whenever the input-pulse amplitude exceeds V_T/n. Setting of the value of V_T determines the pulse-amplitude discrimination level.

Possible variations of the discriminator include use of (1) an input circuit, with very low dc output impedance, in place of T1; and (2) tunnel diodes for CR1 with lower and higher I_p than 0.5mA.

Novel features of this discriminator include use of (1) a constant-current drive, equal to $2I_p$, driving the common emitters of Q1 and Q2; (2) essentially zero dc impedance in the base circuit of Q1, making the circuit's performance essentially independent of the Q1 and Q2 gains; (3) a tunnel diode in the collector circuit of Q2 to effect trigger action at very low currents; and (4) the biasing arrangement on Q2 to effect wide range of adjustment of the pulse-height discrimination level.

(continued overleaf)

Note:

Requests for further information may be directed to:
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Patent status:

No patent action is contemplated by NASA.

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