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NASA TECH BRIEF

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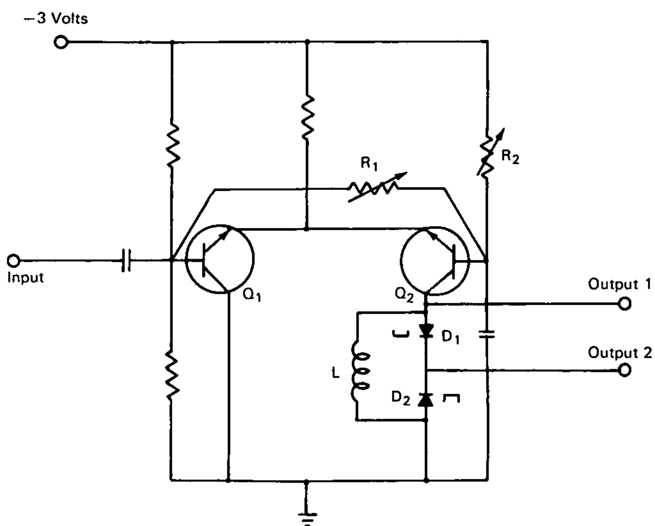
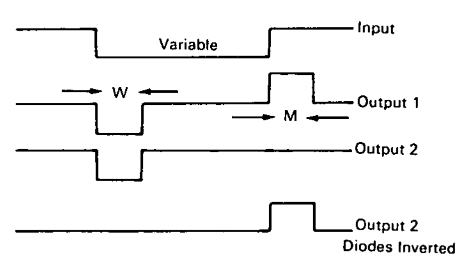
Threshold Detector Produces Narrow Pulses at High Repetition Rates





The problem: To generate fixed-duration output pulses in the nanosecond range at input pulse repetition rates up to 5 megacycles whenever the input pulse amplitude is greater than a fixed threshold level. Prior art required gating and differentiating to produce trigger pulses to drive monostable or blocking oscillators. Such circuitry is complex, consumes a relatively large amount of power, and does not readily lend itself to use with high repetition rate inputs.

The solution: A solid-state device consisting of two tunnel diodes back-to-back in parallel with an inductance driven by a constant-current generator. Input pulses of variable width in the nanosecond range yield output pulses of fixed width. The circuit produces pulse repetition rates in the megacycle range and exhibits low power drain.

How it's done: Stages Q_1 and Q_2, together with tunnel diodes D_1 and D_2, form a threshold detector circuit in which the voltage across D_1 switches to its high-voltage state and produces output pulse W whenever the input exceeds the threshold level. Diode D_2 remains in its low-voltage state and presents a very low impedance. Current through inductance L, starting at zero due to its initial high impedance, will increase with time, thereby decreasing current flow through D_1 and D_2 Voltage across D_1 will decrease to near zero and D_1 will switch to its low-voltage state at a point in time when most of the current is flowing through L, which presents such low impedance that the output voltage will be approximately zero for the remainder of the input pulse. As the input pulse reaches zero, current through L now flows through D_1 and D_2 in

(continued overleaf)

the opposite direction causing D_2 to switch to its high-voltage state and produce output pulse M as D_1 remains in its low-voltage state. Threshold level in D_1 and D_2 is set by adjusting R_1 and R_2. The value of L determines output pulse width. The circuit configuration shown yielded 50 nanosecond pulses for an inductance of 56 microhenries.

Notes:

1. All possible combinations of output pulse polarity relative to pulse input polarity are available by arrangement of D_1 and D_2 and the input polarity.
2. Because the output pulses occur at the rise and/or fall times of the input pulses, the circuit is useful as a zero-crossing detector.
3. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Goddard Space Flight Center
   Greenbelt, Maryland, 20771
   Reference: B65-10310

Patent status: NASA encourages the immediate commercial use of this invention. Inquiries about obtaining rights for its commercial use may be made to NASA, Code AGP, Washington, D.C., 20546.

Source: Norman M. Garrahan
(GSFC-383)