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NASA TECH BRIEF

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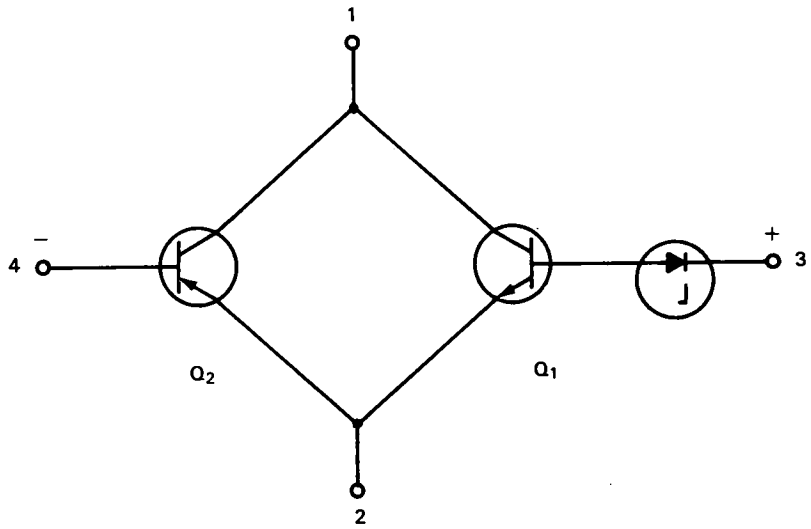
Electronic Bidirectional Valve Circuit Prevents Crossover Distortion and Threshold Effect



The problem:

To switch or alternate an ac signal without crossover distortion or threshold effect poses a basic circuit problem. The problem becomes critical when the signal voltage level is low enough that the forward drop of a junction diode (0.5 to 1.2v) is significant. The ac signal, after passing through the bidirectional valve circuit, suffers distortion due to the diode threshold effect.

The solution:

A four-terminal network that forms a bidirectional thresholdless valve.

How it's done:

The zener voltage is selected at a level that is sufficiently low to protect the emitter-base junctions of Q1 and Q2 from reverse voltage breakdown. Terminals 1 and 2 provide the ac signal input while terminals 3 and 4 provide the dc control voltage.

A control signal must be sufficient alone or in conjunction with the instantaneous ac voltage to break down the zener diode and the base-emitter-emitter-base thresholds in order to turn on the bidirectional thresholdless valve. With the control-signal supply voltage reduced to zero, terminals 1 and 2 will block an instantaneous voltage of either polarity equal to the zener voltage. When operated from a dc current source, the ac signal current component is alternated by an amount equal to the product of gain times dc bias current.

(continued overleaf)

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Notes:

1. Proper operation requires that the dc and ac signal sources be isolated electrically except at the network junction.
2. Amplitude modulation of an ac carrier is possible without crossover distortion provided the dc drive approaches a current source.
3. The prime advantage of this network is that an isolated control signal is sufficient for circuit turn-on without requiring an isolated dc power supply of sufficient capacity to carry the ac load current.
4. Inquiries concerning this innovation may be directed to:

   Technology Utilization Officer
   Manned Spacecraft Center
   Houston, Texas 77058
   Reference: B66-10420

Patent status:

No patent action is contemplated by NASA.

Source: A. Kernick
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