

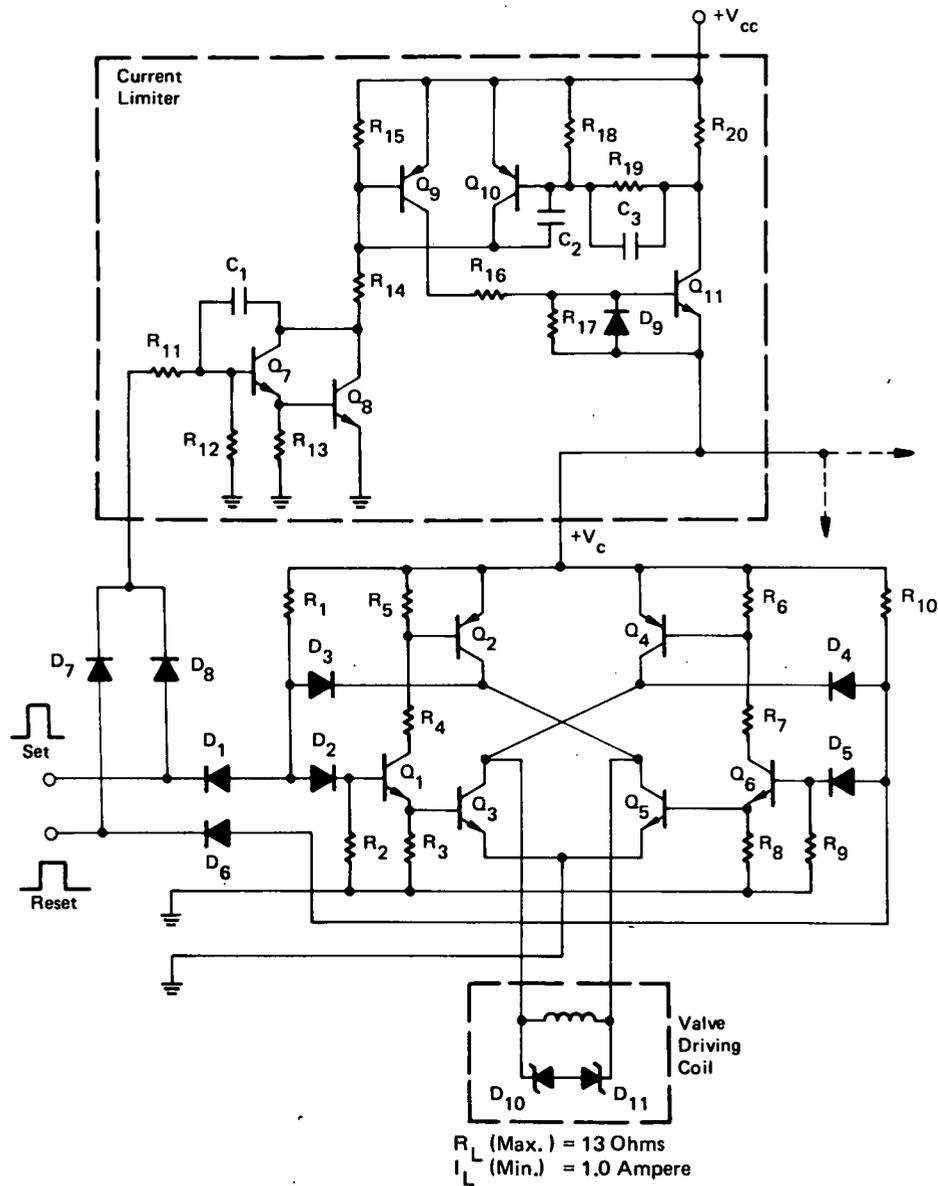
NASA TECH BRIEF

NASA Pasadena Office



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Fail-Safe Bidirectional Valve Driver



Bidirectional Valve Driver

(continued overleaf)

The problem:

Bidirectional valve driver circuits which operate from a single power supply are subject to damage when the load is shorted or shorted to ground.

The solution:

Cross-coupled diodes are added to a commonly used bidirectional valve driver circuit to protect the circuit and power supply.

How it's done:

When the set/reset command [+2.7 volts (peak), 20-millisecond duration] is received, the current limiter is turned on and applies power ($+V_c$) to the valve driver. The current limit is set to 1.3 amperes and protects the power supply ($+V_{cc}$) in the event of a short circuit (see figure). The cross-coupled diodes D_3 and D_4 prevent simultaneous execution of the set and reset commands.

Valve actuation is prevented in the event the actuator coil is shorted to ground; under normal operation, the coil is isolated from ground. Should the coil become grounded, cross-coupling diode D_2 prevents valve actuation by clamping point A. In addition, when the coil is shorted, transistors Q_2 and Q_3 are protected by holding Q_2 off. However, with R_5 properly adjusted,

Q_3 will be turned on just enough to drive D_3 and R_1 (Q_3 collector current) while maintaining Q_2 in an off state.

Notes:

1. This circuit may be used in systems requiring fail-safe bidirectional valve operation, particularly in chemical- and petroleum-processing control systems and computer-controlled hydraulic or pneumatic systems.
2. Requests for further information may be directed to:
Technology Utilization Officer
NASA Pasadena Office
4800 Oak Grove Drive
Pasadena, California 91103
Reference: TSP73-10450

Patent status:

NASA has decided not to apply for a patent.

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