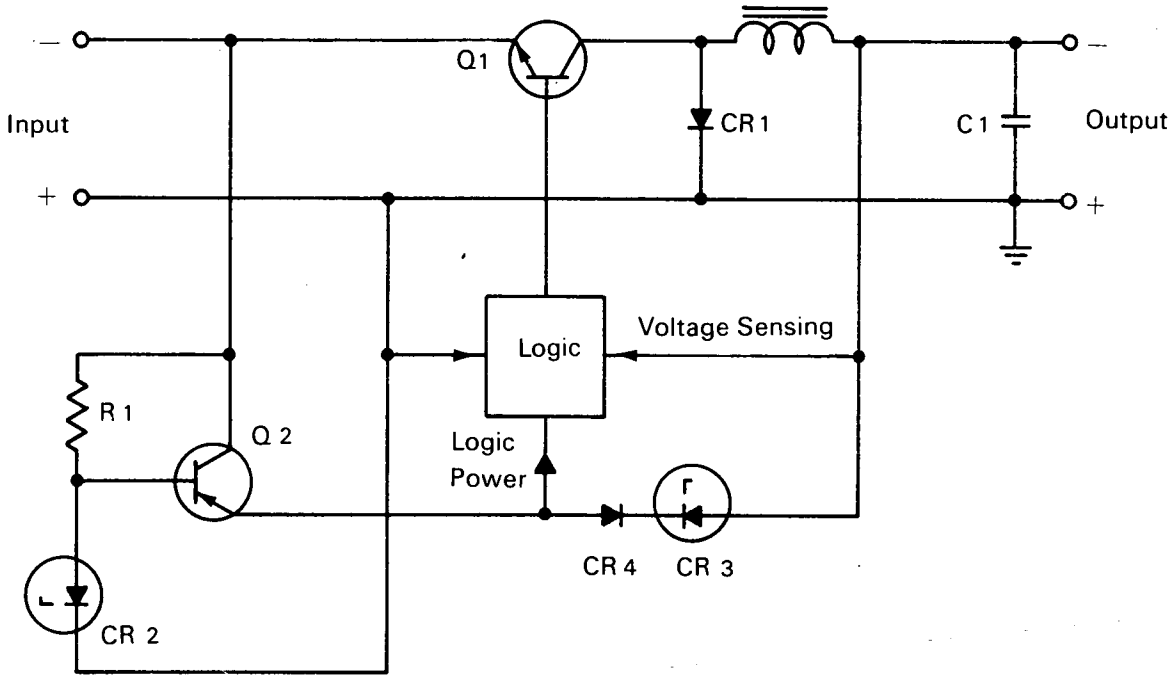
NASA TECH BRIEF

Self-Starting Circuit for Switching Regulators



Switching type regulators which use a logic circuit to sense a change in output voltage and provide a correction signal for dc power sources are being used in an increasing number of applications.

The power supply to the logic circuitry is critical since any changes are reflected in the logic output. The best source of power for the logic circuit is from the output of the regulator. This, however, poses an additional problem since the output of the regulator is zero in the absence of any control signal from the logic circuit.

Conventional circuits have used push-buttons, separate power supplies, and secondary regulators. Separate power supplies and secondary regulators offer reasonable solutions; however, both require extra power to supply regulated voltage.

A newly-developed circuit overcomes the objections to all of these systems. As shown, a transistor (Q2) is connected with its collector tied to the high side of the input power line. The emitter is tied to the supply line to the logic circuitry. The base is connected to the mid-point of a series combination of R1 and zener diode CR2 across the input power line, the zener diode being in the low side to provide a relatively fixed voltage to the base of Q2. The logic circuit is connected to the output of the regulator through zener diode CR3

(continued overleaf)

and diode CR4 in series. The purpose of the zener diode is to drop the regulator voltage to a value several volts below the regulator output. Diode CR4 prevents power on the logic supply line from flowing into the load during the starting interval. When power is applied, the output of the regulator is zero and the emitter of Q2 is at ground potential. Since the base is then forward biased by CR2, current will flow through Q2 to the logic circuitry. The logic circuitry, now being energized, will sense the lack of regulator voltage output and supply drive power to turn on Q1. The voltage of the output of the regulator will rise. As soon as the regulator output voltage exceeds the sum of CR3, forward drop of CR4, and emitter voltage at Q2, it will start supplying power to the logic circuitry. As the voltage rises, the emitter of Q2 will follow. Since the various voltages have been selected so the normal operating voltage at the logic circuitry and the emitter of Q2 will exceed the base voltage on Q2 as supplied by CR2, Q2 will then be back biased and cut off. The drain on the input power supply, regardless of voltage level, will be just a few milliamperes through CR2. The logic circuit will then be supplied by well-regulated power out of the switching regulator.

Notes:

1. The total power consumed by the logic circuitry is held to a minimum, the circuit is automatically self-starting, and receives the optimum regulated supply power.
2. No further documentation is available.
3. Technical questions may be directed to:
   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 41135
   Reference: B69-10128

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D. C. 20546.

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