SCR crowbar circuit fires quickly and surely

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A monolithic voltage regulator's presence in an SCR crowbar circuit makes the circuit fast-acting, dependable, and capable of producing fast-risetime drive currents as large as several amperes. The circuit shown in the diagram is simple yet effective, providing a drive current of 200 milliamperes with a risetime of 1 microsecond. The 723-type IC regulator is used as a comparator that contains its own stable reference voltage source. The setpoint of the comparator establishes the protection voltage level for the power-supply bus.

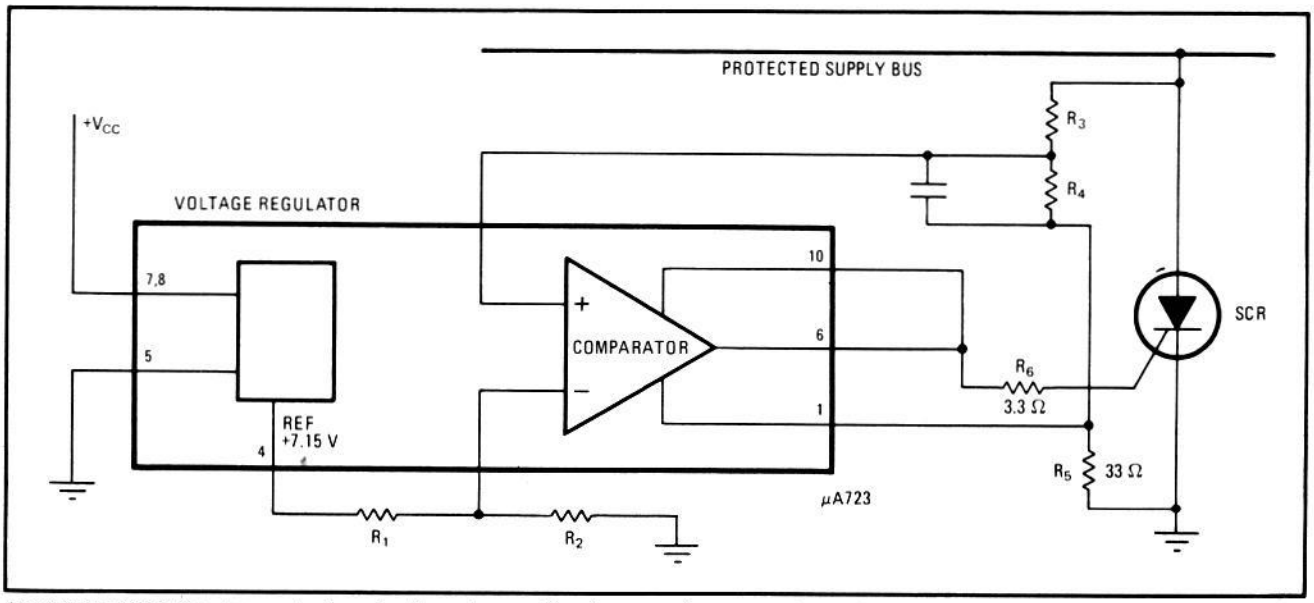
A satisfactory crowbar circuit for good power-supply protection generally asks a lot of the crowbar SCR. Typically, power supplies have large output capacitances that impose high surge currents and di/dt levels on the crowbar SCR when it is fired. These large current surges can cause SCR failure or degradation if the SCR drive current is inadequate or soft (has a slow risetime).

The gate drive required to attain the SCR's specified surge and di/dt capability may be many times greater than the worst-case gate drive needed for turn-on. In addition, for best di/dt resistance, the risetime of the gate drive should be quite short, preferably less than a microsecond.

Many simple crowbar circuits use such devices as zener diodes to fire the crowbar SCR. Although this results in a soft turn-on that will fire the SCR at least once, the dependability of such a scheme is questionable.

The circuit shown, however, is hard-firing. Resistors R_1 and R_2 make up a voltage divider that nominally sets the voltage at the inverting input of the comparator to 2 volts. Another voltage divider, consisting of resistors R_3 and R_4, samples the power-supply bus and drives the comparator's noninverting input. When the voltage on the power-supply bus exceeds the setpoint of the comparator, the output of the regulator rises. This voltage rise, which appears across resistor R_5, adds (in phase) to the voltage at the comparator's noninverting input, providing rapid regeneration, as well as a fast-rising pulse to drive the SCR.

Resistor R_6 limits the SCR drive current to about 200 milliamperes, a value that is adequate for sensitive-gate or amplifying-gate devices. To obtain larger drive currents of up to several amperes, an emitter-follower stage can be added at the output of the regulator. The capacitor acts as a filter to prevent the crowbar from firing in response to transient voltages. □



Hard-firing SCR. Crowbar protection circuit employs an IC voltage regulator to produce a fast-risetime large-value gate drive current for the SCR. The regulator, which is used as a comparator, has its own voltage reference source. When the voltage on the power-supply bus exceeds the set point of the comparator, the regulator's output voltage increases, producing a large fast-rising pulse that fires the SCR.