Silicon Controlled Rectifier

Flat Pack Design

Up to 600 Volts 5 Amperes (RMS)

Model C108

PRODUCT FEATURES

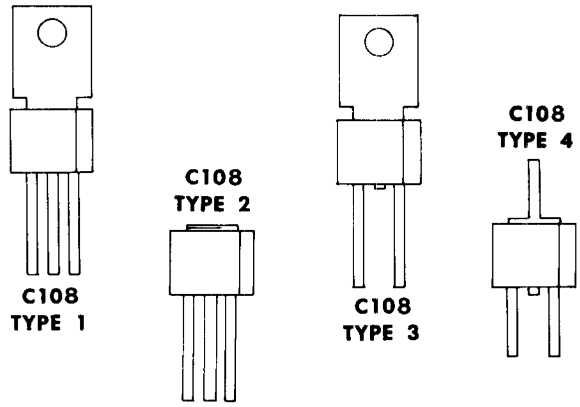
The Type C108 Silicon Controlled Rectifier (SCR) has the following outstanding features:

LOW COST

SENSITIVE Operates directly from low signal sensors such as thermistors, photo-conductive cells, etc.

VERSATILE Designed for a variety of mount-down methods—printed circuit, plug-in socket, screws, or point-to-point soldering

RUGGED, COMPACT Uses a solid plastic encapsulant in rectangular shape for high density packaging



(FULL SIZE)

TYPICAL APPLICATIONS

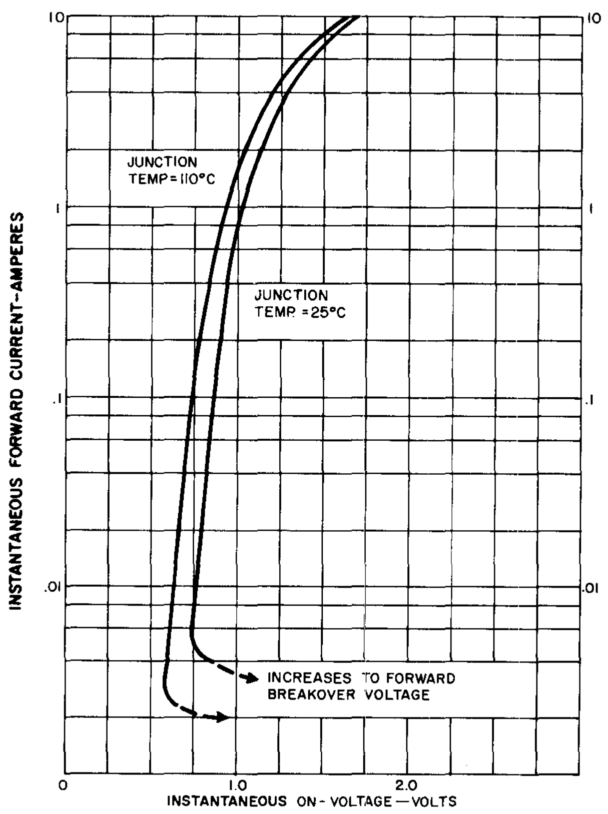
MOTOR CONTROL	Electric Model Trains Sewing Machines Movie Projectors Food Mixers Electric Fans Slot Racing Cars
LIGHT	Flame Detectors Moving-Light Signs (Chasers) Driver for Computer Readout Lights Harbor Buoy Flashers Automotive Warning Systems Nixie & Neon Drivers
TEMPERATURE	Range Surface Unit (Hybrid) Chemical Processing (Photographic, etc.) Food Warmer Tray Bearing Temperature Sensor Electric Blanket Control
PRESSURE	Auto Oil Pressure Gage Hot Water Boiler Safety Monitor
TIME	Photo Darkroom Exposure Oven Timer Vending Machine Logic Industrial Process Control
LIQUID LEVEL	Basement Sump Pump Automatic Coffee Maker Automatic Shutoff for Vending Machines
REMOTE CONTROL	Armchair TV Control Master Switching Stations for Home Garage Door Openers Power Switch
DRYNESS	Clothes Dryness Sensor
PROXIMITY	Burglar Alarm Touch Switch Electric Door Openers
COUNTING	Low Speed Ring Counters Shift Registers
SWITCHING	Relay Replacement Solenoid Drivers Latching Relay Replacement Power Flip Flops Low Power Inverters Thyratron Tube Replacement
AMPLIFIERS	Gate Amplifier for Larger SCR's, Triacs —Blenders —Hand Tools
IGNITION	Small Gas Engines Gas Appliances
DETECTION	Voltage (Battery Charger) Current (Crowbar)

MAXIMUM ALLOWABLE RATINGS

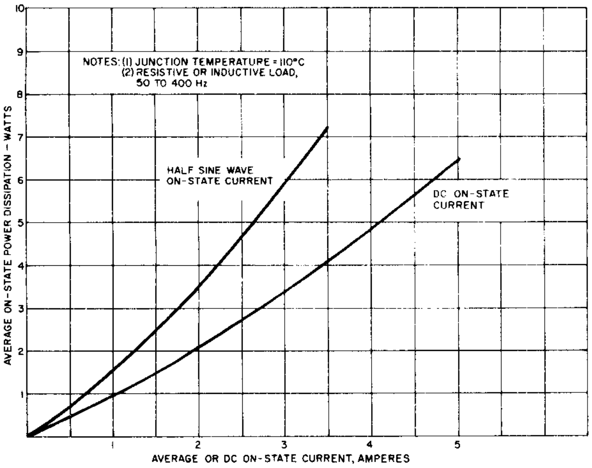
Type	Repetitive Peak Forward Blocking Voltage, V_{FXM} R_{GK} = 1000 Ohms T_J = -40°C to +110°C	Working and Repetitive Peak Reverse Voltage, V_{ROM}(wkg) and V_{ROM}(rep) T_J = -40°C to +110°C
C108Q1, C108Q2, C108Q3, C108Q4	15 Volts	15 Volts
C108Y1, C108Y2, C108Y3, C108Y4	30 Volts	30 Volts
C108F1, C108F2, C108F3, C108F4	50 Volts	50 Volts
C108A1, C108A2, C108A3, C108A4	100 Volts	100 Volts
C108B1, C108B2, C108B3, C108B4	200 Volts	200 Volts
C108C1, C108C2, C108C3, C108C4	300 Volts	300 Volts
C108D1, C108D2, C108D3, C108D4	400 Volts	400 Volts
C108E1, C108E2, C108E3, C108E4	500 Volts	500 Volts
C108M1, C108M2, C108M3, C108M4	600 Volts	600 Volts

RMS Forward Current, On-State . . . . 5 Amperes
Rate of Rise of Forward Current (non-repetitive), di/dt (See Chart 9) . . . . 50 Amperes/Microsecond
Peak Forward Current, On-State (repetitive) . . . . 75 Amperes*
Peak One Cycle Surge Forward Current, Non-Repetitive, I_{FM} (surge) . . . . 30 Amperes
I^2t (for fusing) . . . . 1.0 Ampere^2 seconds (for times 1.5 Milliseconds)
Peak Gate Power, P_{GM} . . . . 0.5 Watt
Average Gate Power, $P_{G(AV)}$ . . . . 0.1 Watt
Peak Gate Current, I_{GFM} . . . . 0.2 Amperes
Peak Reverse Gate Voltage, V_{GRM} . . . . 6 Volts
Storage Temperature, T_{stg} . . . . -40°C to +150°C
Operating Temperature . . . . -40°C to +110°C

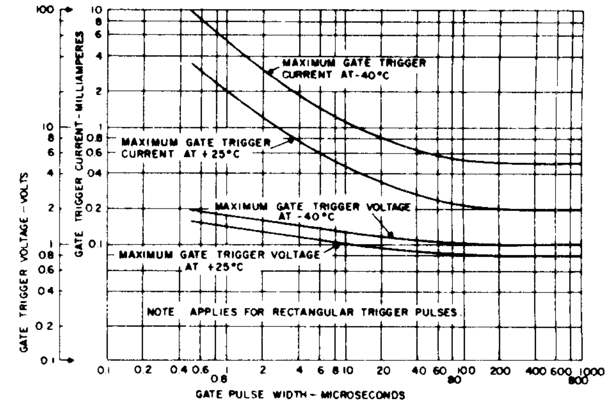
*This rating applies for operation at 60 Hz, 75°C maximum tab (or anode) lead temperature, switching from 80 volts peak, sinusoidal current pulse width 10 μsec, minimum, 15 μsec. maximum.



1. Maximum Forward Characteristics, On State



2. Maximum On-State Power Dissipation

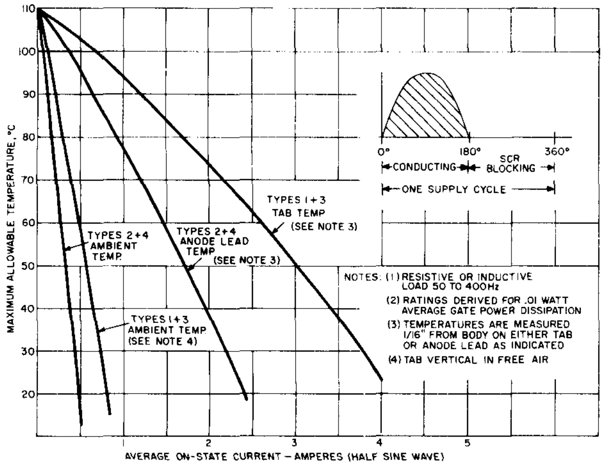


3. Maximum Gate Trigger Current and Voltage Variation with Trigger Pulse Width

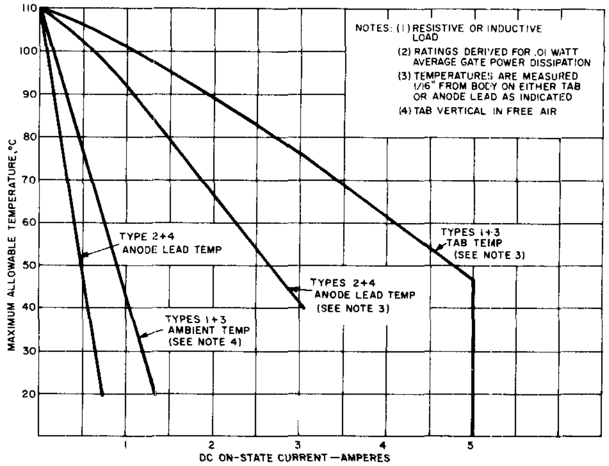
CHARACTERISTICS

Test	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Reverse or Forward Blocking Current (All Types)	I_{RRM} or I_{DRM}	–	0.1	10	μA	$V_{RRM} = V_{DRM}$ = Rated Value. T_L = 25°C, R_{GK} = 1000 Ohms
		–	10	100	μA	$V_{RRM} = V_{DRM}$ = Rated Value. T_L = 110°C, R_{GK} = 1000 Ohms.
*DC Gate Trigger Current	I_{GT}	–	30	200	μAdc	T_L = 25°C, V_D = 6 Vdc, R_L = 100 Ohms R_{GK} = 1000 Ohms
		–	75	500	μAdc	T_L = -40°C, V_D = 6 Vdc, R_L = 100 Ohms R_{GK} = 1000 Ohms
DC Gate Trigger Voltage	V_{GT}	0.4	0.5	0.8	Volts DC	T_L = 25°C, V_D = 6 Vdc, R_L = 100 Ohms R_{GK} = 1000 Ohms
		0.5	0.7	1.0	Volts DC	T_L = -40°C, V_D = 6 Vdc, R_L = 100 Ohms R_{GK} = 1000 Ohms
		0.2	–	–	Volts DC	T_L = 110°C, V_D = Rated V_{DRM} Value R_L = 3000 Ohms, R_{GK} = 1000 Ohms
Peak On-Voltage	V_{TM}	–	1.2	1.35	Volts	T_L = 25°C, I_{TM} = 5 Amperes Peak, Single Half Sine Wave Pulse, 2 Millisec. Wide
Holding Current	I_H	0.3	1.0	3.0	mAdc	T_L = 25°C, V_D = 12 Vdc, R_{GK} = 1000 Ohms
		0.4	2.0	6.0	mAdc	T_L = -40°C, V_D = 12 Vdc, R_{GK} = 1000 Ohms
		0.14	0.6	2.0	mAdc	T_L = 110°C, V_D = 12 Vdc, R_{GK} = 1000 Ohms
Latching Current	I_L	0.3	1.5	4.0	mAdc	T_L = 25°C, V_D = 12 Vdc, R_{GK} = 1000 Ohms
		0.4	3.0	8.0	mAdc	T_L = -40°C, V_D = 12 Vdc, R_{GK} = 1000 Ohms
Critical Rate of Rise of Forward Blocking Voltage	dv/dt	–	8	–	Volts/ Micro-second	T_L = 110°C, V_D = Rated V_{DRM} Value R_{GK} = 1000 Ohms
Turn On Time	t_d+t_r	–	1.2	–	Micro-seconds	T_L = 25°C, V_{DX} = Rated V_{DRM} Value I_{FM} = 1 Ampere, Gate Pulse = 4 Volts, 300 Ohms, 5 Microseconds Wide.
Circuit Commutated Turn-Off Time	t_q	–	40	100	Micro-seconds	T_L = 110°C, rectangular current waveform. Rate of rise of current < 10 amps/μsec. Rate of reversal of current <5 amps/μsec. I_{TM} = 1 Amp (50 μsec pulse). Repetition Rate = 60 pps. V_{RRM} = Rated. V_R = 15 Volts Minimum. V_{DRM}= Rated. Rate of Rise Reapplied Forward Blocking Voltage = 5 Volts/μsec. Gate Bias = 0 Volts, 100 Ohms (during turn-off time interval).

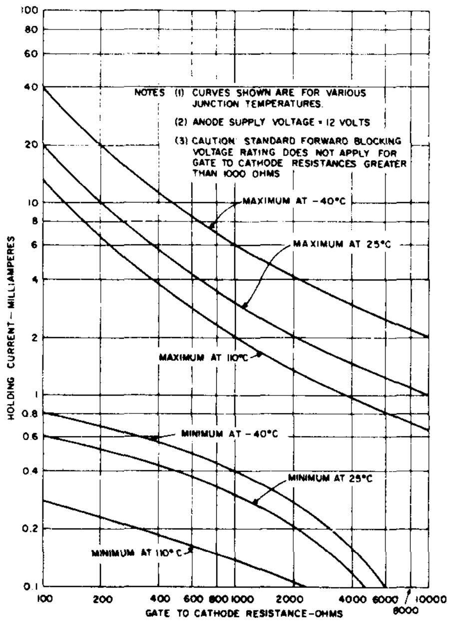
The lead temperature (T_L) is measured in the center of the tab, 1/16 inch from the body on Type 1 and Type 3 devices and in the center of the anode lead, 1/16 inch from the body on Type 2 and Type 4 devices.



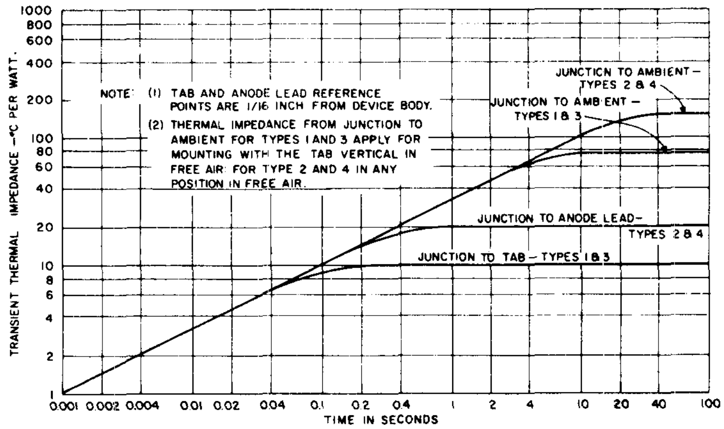
4. Maximum Allowable Temperatures for Half Sine Wave On-State Current



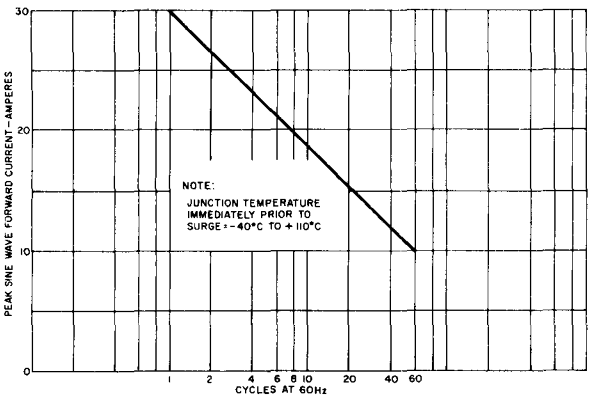
5. Maximum Allowable Temperatures for DC On-State Current



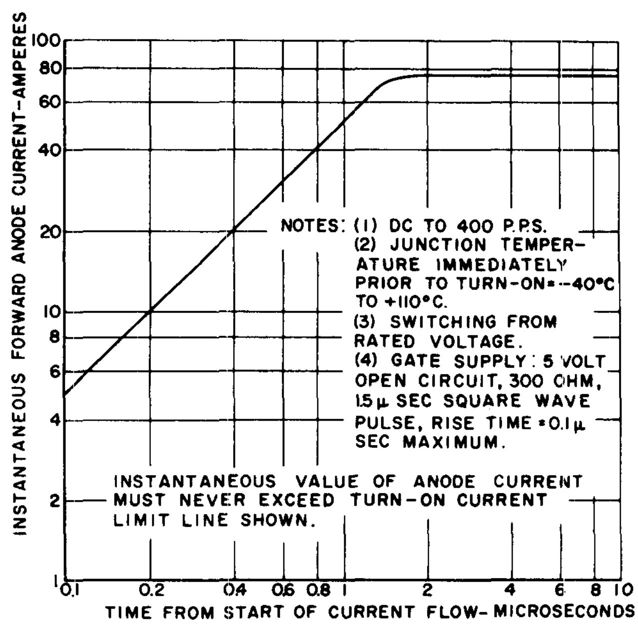
6. Maximum and Minimum Holding Current Variation with External Gate-to-Cathode Resistance



7. Maximum Transient Thermal Impedance



8. Maximum Allowable Non-Repetitive Peak Surge Forward Current



9. Turn-On Current Limit

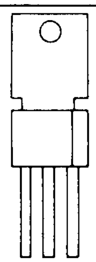
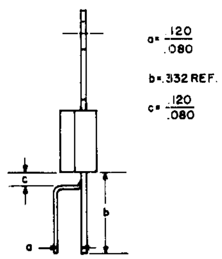
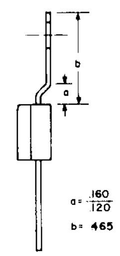
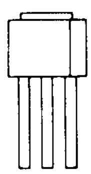
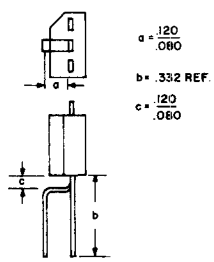
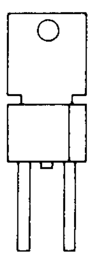
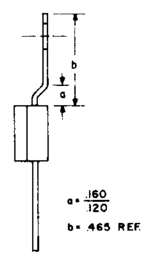
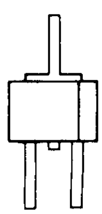
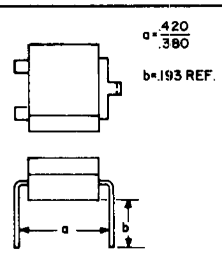
MOUNTING METHODS

The C108, because of its unique package design, is capable of being mounted in a variety of methods; depending upon the heatsink requirements and the circuit packaging methods.

The leads will bend easily, either perpendicular to the flat or to any angle, and may also be bent, if desired, immediately next to the plastic case. For sharp angle bends (90° or larger), a lead should be bent only once; since repeated bending will fatigue or break the lead. Bending in other directions may be performed as long as the lead is held firmly between the case and the bend, so that the strain on the lead is not transmitted to the plastic case.

The mounting tab may also be bent or formed into any convenient shape so long as it is held firmly between the plastic case and the area to be formed or bent. Without this precaution, bending may fracture the plastic case and permanently damage the unit.

As a service to its customers, the General Electric Company provides a lead and tab shaping capability. Any of the derived types shown in the following chart are available direct from the factory to original equipment manufacturers.

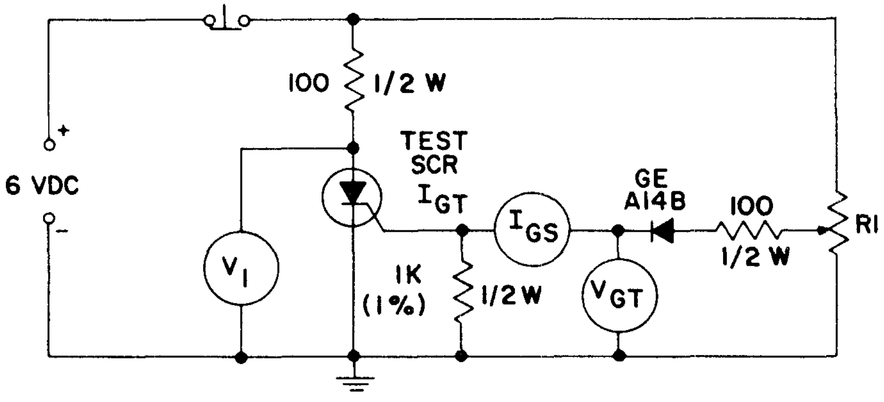
BASIC TYPES	DERIVED TYPES (The types shown below are derived from the basic types illustrated in the left-hand column.)		
	PRINTED CIRCUIT BOARD MOUNTING (Upright or Flat)	RIVET OR SCREW MOUNTING TO FLAT SURFACE	
 C108 Type 1	 C108 Type 11	 C108 Type 12	
 C108 Type 2	 C108 Type 21		
 C108 Type 3		 C108 Type 32	
 C108 Type 4	 C108 Type 41		

C108 CONVERSIONS

INCHES	MILLIMETERS	INCHES	MILLIMETERS
.120/.080	3.048/2.031	.332 REF.	8.433 REF.
.160/.120	4.064/3.047	.420/.380	10.668/9.651
.193 REF.	4.902 REF.	.465 REF.	11.811 REF.

SIMPLE TEST CIRCUIT FOR THE C108 SCR*

Gate Trigger Voltage and Current Measurement



V_1 — 0-10 volt DC meter
V_{GT} — 0-1 volt DC meter
I_{GS} — 0-1mA DC milliameter
R1 — 1K potentiometer

To measure gate trigger voltage and current, raise gate voltage (V_{GT}) until meter reading V_1 drops from 6 volts to 1 volt. Gate trigger voltage is the reading on V_{GT} *just prior* to V_1 dropping. Gate trigger current I_{GT} can be computed from the relationship:

$$I_{GT} = I_{GS} - \frac{V_{GT}}{1000} \text{ amps}$$

where I_{GS} is reading (in amps) on meter *just prior* to V_1 dropping. NOTE: I_{GT} may turn out to be a negative quantity (trigger current flows *out* from gate lead).

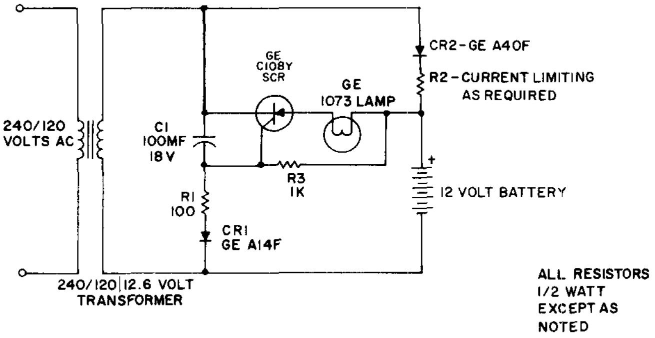
** For more sophisticated equipment suitable for testing the C108 SCR see GE Application Note 200.19 "Using Low Current SCR's".*

REPRESENTATIVE APPLICATIONS OF THE C108 SCR

1. Emergency Light

This simple circuit provides battery operated emergency lighting instantaneously upon failure of the regular AC service. When line power is restored, the emergency light turns off and the battery recharges automatically. The circuit is ideal for use in elevator cars, corridors and similar places where loss of light due to power failure would be undesirable. Completely static in operation, the circuit requires no maintenance.

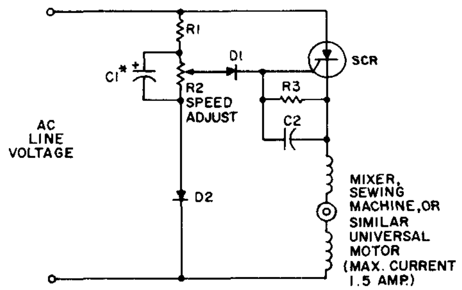
With AC power "on", capacitor C1 charges through rectifier CR1 and resistor R1 to develop a negative DC voltage at the gate of the C108Y SCR. By this means the SCR is prevented from triggering, and the emergency light stays off. At the same time, the battery is kept fully charged by rectifier CR2 and resistor R2. Should the AC power fail, C1 discharges and the SCR is triggered on by battery power through resistor R3. The SCR then energizes the emergency light. Reset is automatic when AC is restored, because the peak AC line voltage biases the SCR and turns it off.



2. Universal Motor Speed Control

This circuit can replace the carbon-pile speed controller commonly supplied with household sewing machines. It is equally effective for use with other small AC-DC motors, such as those found in food mixers and similar traffic appliances. Maximum current capability is 1.5 amps. Provision of speed-dependent feedback gives excellent torque characteristics to the motor, even at low speeds where other types of controllers are completely ineffective.

The resistor capacitor network R1-R2-C1 provides a ramp-type reference voltage superimposed on top of a DC voltage adjustable with the speed-setting potentiometer R2. This reference voltage appearing at the wiper of R2 is balanced against the residual counter emf of the motor through the SCR gate. As the motor slows down due to heavy loading, its counter emf falls, and the reference ramp triggers the SCR earlier in the AC cycle. More voltage is thereby applied to the motor causing it to pick up speed again. Performance with the C108 SCR is particularly good because the low trigger current requirements of this device allow use of a flat top reference voltage, which provides good feedback gain and close speed regulation.



Line Voltage	120V	240V
R_1	47K	100K
R_2	10K	20K
R_3	1K	1K
C_1	1μF, 50V	1μF, 100V
C_2	0.1μF, 50V	0.1μF, 50V
D_1	1N5059	1N5060
D_2	1N5059	1N5060
SCR	C108B1	C108D1

Note

* *C_1 optional, contributes to performance in some circumstances.*