SC141, SC146 Series

File Number **1167**

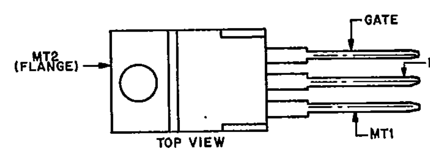
6-A and 10-A Silicon Triacs

Three-Lead Plastic Types for Power-Control and Power-Switching Applications

Features:

- *800 V, 125 Deg. C T_J operating*
- *High dv/dt and di/dt capability*
- *Low switching losses*
- *High pulse current capability*
- *Low forward and reverse leakage*
- *Sipos oxide glass multilayer passivation system*
- *Advanced unisurface construction*
- *Precise ion implanted diffusion source*

TERMINAL DESIGNATIONS



92CS-39970

JEDEC TO-220AB

The RCA-SC141 and SC146 series triacs are gate-controlled full-wave silicon switches.

These devices are designed to switch from an off-state to an on-state for either polarity of applied voltage with positive or negative gate triggering voltages. They have an on-state current rating of 6-A at T_C = 75°C (SC141 series) and 10-A at T_C = 80° (SC146 series) and repetitive off-state voltage ratings, of 200, 400, 500, 600, and 800 volts.

All devices utilize the JEDEC TO-220AB (VERSAWATT) plastic package.

MAXIMUM RATINGS, *Absolute-Maximum Values:*

	SC141B SC146B	SC141D SC146D	SC141E SC146E	SC141M SC146M	SC141N SC146N	
V_{DROM}• T_J = -40 to 125°C	200	400	500	600	800	V
$I_{T(RMS)}$ θ = 360°:						
For SC141 series, T_C = 75°C			6			A
For SC146 series, T_C = 80°C			10			A
For other conditions			See Fig. 4			
I_{TSM}:						
For one full cycle of applied principal voltage, at current and temperature shown above for $I_{T(RMS)}$:		SC141 Series		SC146 Series		
60 Hz (sinusoidal)		80		120		A
50 Hz (sinusoidal)		75		110		A
For more than one cycle of applied principal voltage			See Fig. 5			
di/dt:						
V_D = V_{DROM}, I_G = 200 mA, t_r = 0.1 μs			70			A/μs
I^2t [At T_C shown for $I_{T(RMS)}$, half-sine wave]:		SC141 Series		SC146 Series		
t = 10 ms		25		70		A^2s
2.5 ms		17		45		A^2s
0.5 ms		10		25		A^2s
I_{GTM}▪						
For 1 μs max.			4			A
P_{GM} (For 1 μs max., $I_{GTM} \leq$ 4 A)			10			W
$P_{G(AV)}$			0.5			W
T_{stg}			-40 to 125			°C
T_C			-40 to 125			
T_T (During soldering for 10 s max.)			230			°C

•For either polarity of main terminal 2 voltage (V_{MT2}) with reference to main terminal 1.
▪For either polarity of gate voltage (V_G) with reference to main terminal 1.

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ELECTRICAL CHARACTERISTICS
At Maximum Ratings Unless Otherwise Specified, and at Indicated Temperatures

CHARACTERISTIC	LIMITS For All Types Except as Specified			UNITS
	Min.	Typ.	Max.	
I_{DROM}●				
V_{DROM} = Max. rated value, T_C = 25°C	–	–	0.1	mA
= 125°C	–	–	0.5	
v_{TM}●				
T_C = 25°C, i_T = 8.5 A (peak SC141 series	–	–	1.83	V
= 14 A (peak) SC146 series	–	–	1.65	
I_{HO}●				
Gate open, initial principal current = 500 mA (dc)				
v_D = 12 V, T_C = 25°C	–	–	50	mA
= −40°C	–	–	100	
I_L●				
R_{GK} = 100 Ω, t_W = 50 μs, $t_r = t_f$ = 5 μs, f = 1 kHz,				
T_C = 25°C Mode V_{MT2} V_G				
1+ + +	–	–	100	
111− − −	–	–	100	
1− + −	–	–	200	
T_C = −40°C 1+ + +	–	–	200	
111− − −	–	–	200	
1− + −	–	–	400	
dv/dt● (Commutating)				
$v_D = V_{DROM}$, $I_{T(RMS)}$ = Max. rated value,				
di/dt = 3.2 A/ms, T_C = 80°C SC141 series	4	–	–	V/μs
di/dt = 5.4 A/ms, T_C = 80°C SC146 series	4	–	–	
dv/dt● (Off-State)				
$v_D = V_{DROM}$, T_C = 100°C, Exponential voltage rise				
SC141 series	30	100	–	
SC146 series	100	250	–	
I_{GT}●■ v_D = 12 V (dc)				
T_C = 25°C R_L–Ω Mode V_{MT2} V_G				
100 1+ + +	–	–	50	mA
100 111− − −	–	–	50	
50 1− + −	–	–	50	
T_C = −40°C 50 1+ + +	–	–	80	
50 111− − −	–	–	80	
25 1− + −	–	–	80	
V_{GT}●■ v_D = 12 V (dc)				
T_C = 25°C R_L–Ω Mode V_{MT2} V_G				
100 1+ + +	–	–	2.5	V
100 111− − −	–	–	2.5	
50 1− + −	–	–	2.5	
T_C = −40°C 50 1+ + +	–	–	3.5	
50 111− − −	–	–	3.5	
25 1− + −	–	–	3.5	

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ELECTRICAL CHARACTERISTICS (Cont'd)

At Maximum Ratings Unless Otherwise Specified, and at Indicated Temperatures

CHARACTERISTIC	LIMITS For All Types Except as Specified			UNITS
	Min.	Typ.	Max.	
V_{GD}● $v_D = V_{DROM}$, $R_L = 1k\Omega$, $T_C = 100°C$ (For all triggering modes)	0.2	–	–	V
t_{gt} $v_D = V_{DROM}$, I_G = 80 mA, $t_r = 0.1\ \mu s$, i_T = 25 A (peak), $T_C = 25°C$	–	1.6	2.5	µs

Thermal Characteristics

		Min.	Typ.	Max.	UNITS
$R_{\theta JC}$	SC141 series	–	–	3.0	°C/W
	SC146 series			2.2	°C/W
$R_{\theta JA}$		–	–	75	°C/W
$R_{\theta JC(ac)}$* During ac current conduction	SC141 series	–	–	2.22	°C/W
	SC146 series	–	–	1.5	°C/W

● For either polarity of main terminal 2 voltage (V_{MT2}) with reference to main terminal 1.
■ For either polarity of gate voltage (V_G) with reference to main terminal 1.
* This characteristic is useful in the calculation of junction-temperature rise above T_C for ac current conduction and applies for a 50 or 60 Hz full sine wave of current. It can be calculated with the following formula:

$$\text{Apparent thermal resistance} = \frac{T_{J(max.)} - T_C}{P_{T(AV)}}$$

where: $T_{J(max.)}$ = maximum junction temperature
T_C = case temperature
$P_{T(AV)}$ = average on-state power

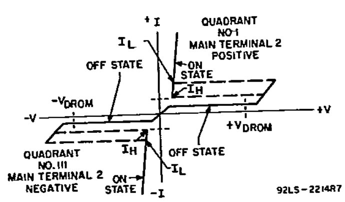

Fig. 1 – Principal voltage-current characteristic.

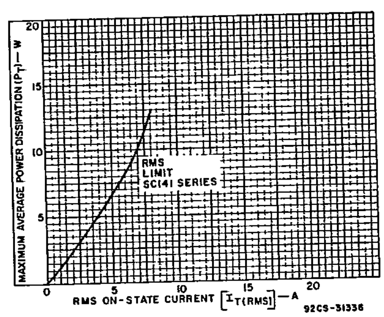

Fig. 2 – Power dissipation as a function of on-state current for SC141 series.

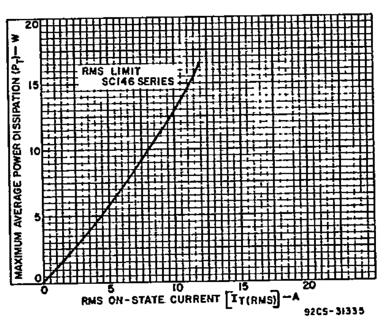

Fig. 3 – Power dissipation as a function of on-state current for SC146 series.

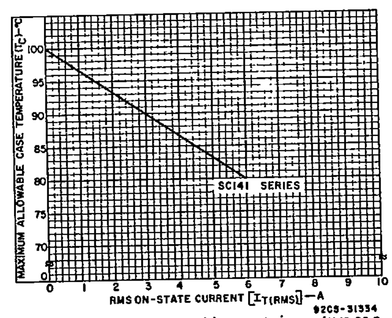

Fig. 4 – Maximum allowable case-temperature as a function of on-state current for SC141 series.

SC141, SC146 Series

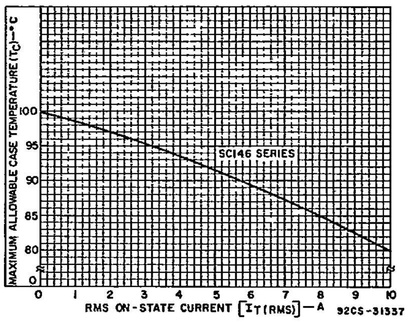

Fig. 5 — Maximum allowable case-temperature as a function of on-state current for SC146 series.

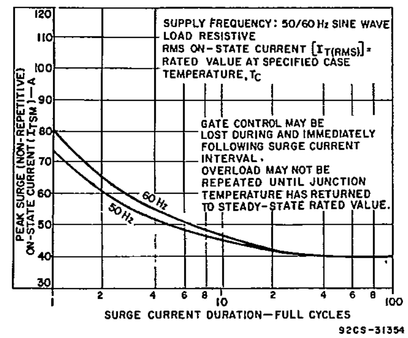

Fig. 6 — Peak surge on-state current as a function of surge current duration for SC141 series.

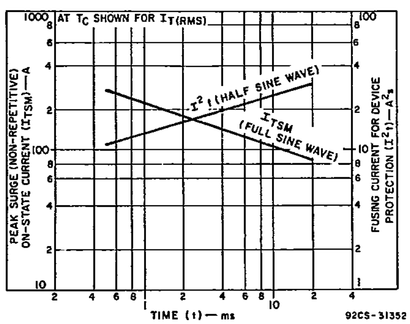

Fig. 7 — Peak surge on-state current and fusing current as a function of time for SC141 series.

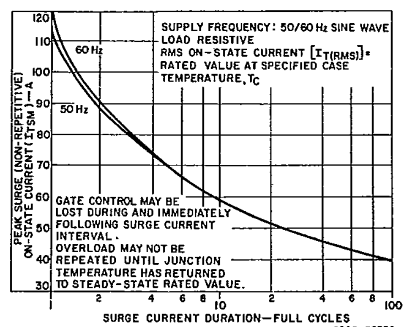

Fig. 8 — Peak surge on-state current as a function of surge current duration for SC146 series.

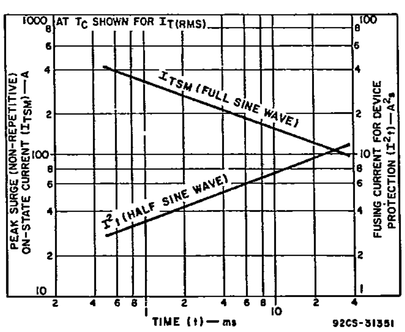

Fig. 9 — Peak surge on-state current and fusing current as a function of time for SC146 series.

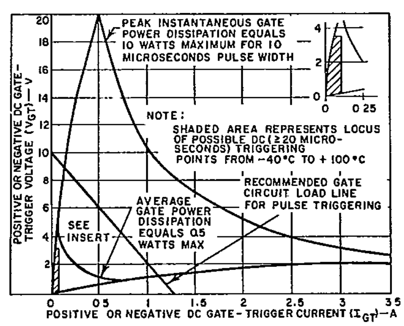

Fig. 10 — Gate pulse characteristics for all triggering modes.

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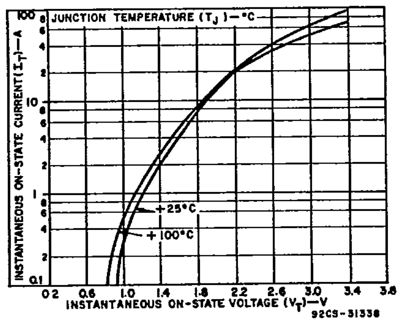

Fig. 11 – On-state current as a function of on-state voltage for SC141 series.

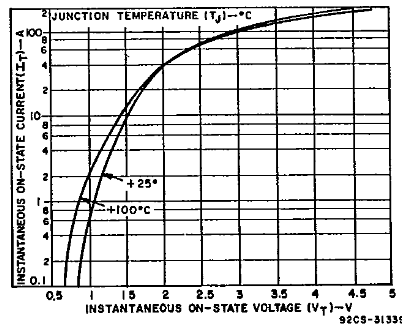

Fig. 12 – On-state current as a function of on-state voltage for SC146 series.

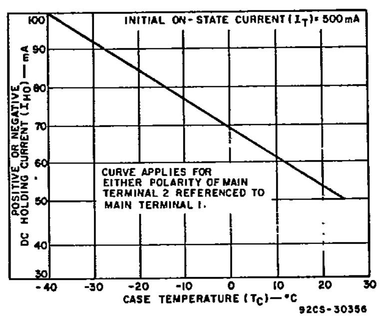

Fig. 13 – DC holding current as a function of case temperature.

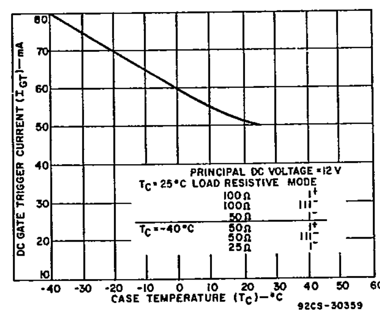

Fig. 14 – DC gate trigger current as a function of case temperature.

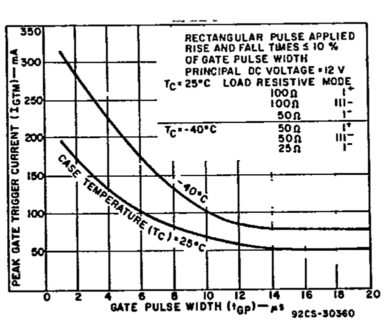

Fig. 15 – Peak gate trigger current as a function of gate pulse width.

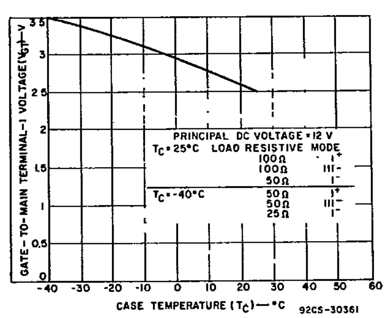

Fig. 16 – DC gate-trigger voltage as a function of case temperature.

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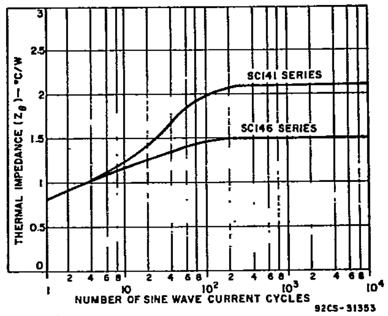
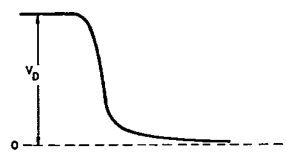


Fig. 17 — Thermal impedance as a function of sine-wave current cycles.



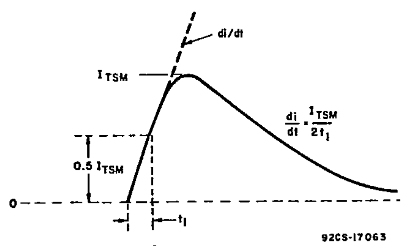


Fig. 19 — Rate-of-change of on-state current with time (defining di/dt).

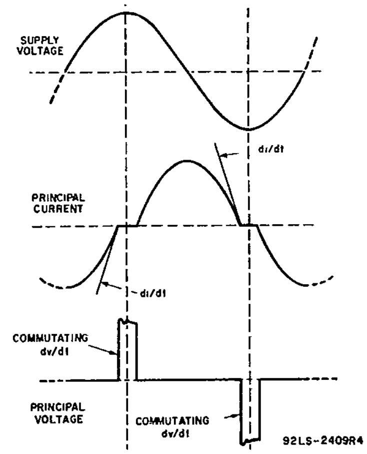


Fig. 18 — Relationship between supply voltage and principal current (inductive load) showing reference points for definition of commutating voltage (dv/dt).

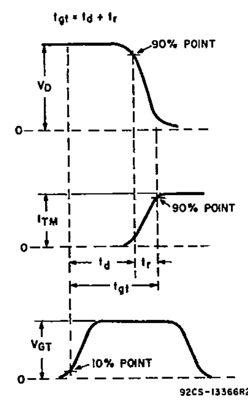


Fig. 20 — Relationship between off-state voltage, on-state current, and gate-trigger voltage showing reference points for definition of turn-on time (t_{gt}).