SC141, SC146 Series

File Number **1167**

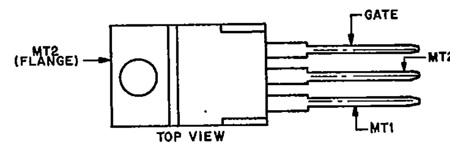
6-A and 10-A Silicon Triacs

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



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.

SC141, SC146 Series

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}●				mA
Gate open, initial principal current = 500 mA (dc)				
v_D = 12 V, T_C = 25°C	–	–	50	
= −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/μs
v_D = V_{DROM}, $I_{T(RMS)}$ = Max. rated value,				
di/dt = 3.2 A/ms, T_C = 80°C SC141 series	4	–	–	
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)				mA
T_C = 25°C R_L–Ω Mode V_{MT2} V_G				
100 1+ + +	–	–	50	
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)				V
T_C = 25°C R_L–Ω Mode V_{MT2} V_G				
100 1+ + +	–	–	2.5	
100 111− − −	–	–	2.5	
50 1− + −	–	–	2.5	
T_C = −40°C 50 1+ + +	–	–	3.5	
50 111− − −	–	–	3.5	
25 1− + −	–	–	3.5	

SC141, SC146 Series

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 μs, i_T = 25 A (peak), $T_C = 25°C$	–	1.6	2.5	μs
Thermal Characteristics				
$R_{\theta JC}$ SC141 series	–	–	3.0	°C/W
$R_{\theta JC}$ 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
$R_{\theta JC(ac)}$* During ac current conduction 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

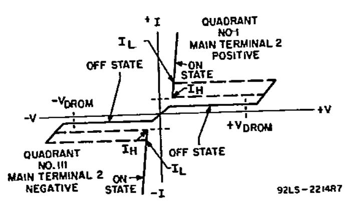


Fig. 1 – Principal voltage-current characteristic.

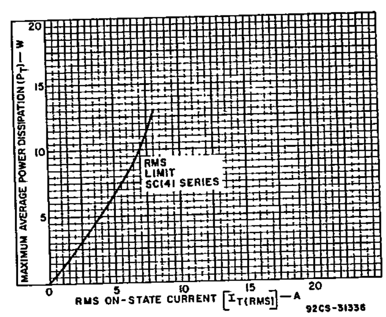


Fig. 2 – Power dissipation as a function of on-state current for SC141 series.

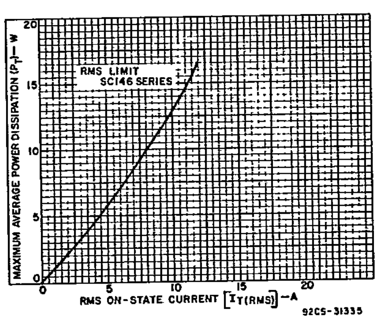


Fig. 3 – Power dissipation as a function of on-state current for SC146 series.

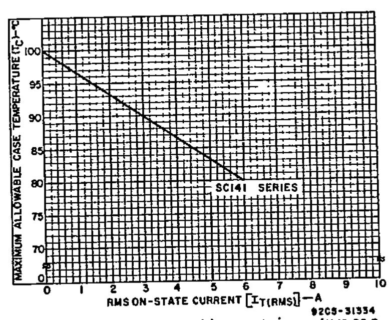


Fig. 4 – Maximum allowable case-temperature as a function of on-state current for SC141 series.

SC141, SC146 Series

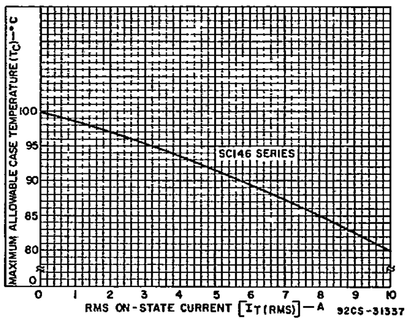


Fig. 5 — Maximum allowable case-temperature as a function of on-state current for SC146 series.

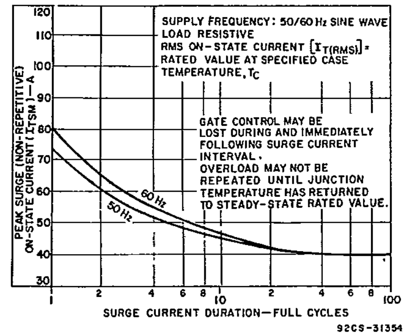


Fig. 6 — Peak surge on-state current as a function of surge current duration for SC141 series.

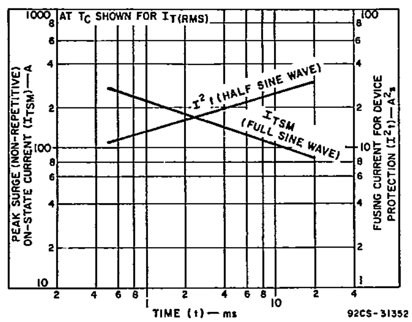


Fig. 7 — Peak surge on-state current and fusing current as a function of time for SC141 series.

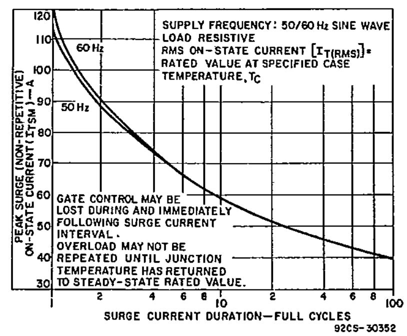


Fig. 8 — Peak surge on-state current as a function of surge current duration for SC146 series.

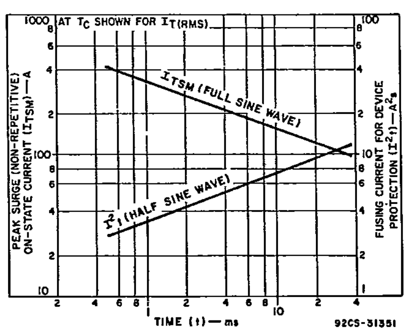


Fig. 9 — Peak surge on-state current and fusing current as a function of time for SC146 series.

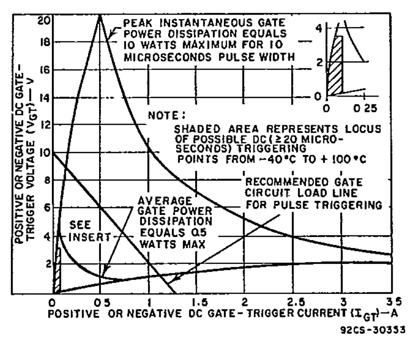


Fig. 10 — Gate pulse characteristics for all triggering modes.

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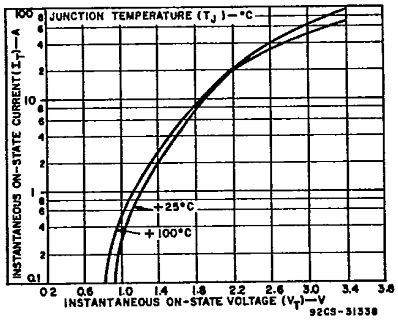

Fig. 11 – On-state current as a function of on-state voltage for SC141 series.

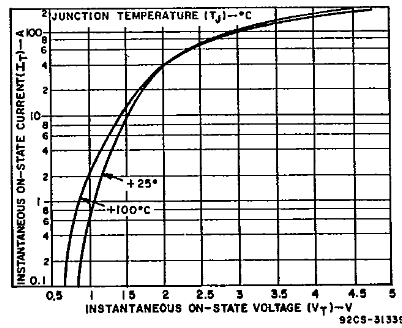

Fig. 12 – On-state current as a function of on-state voltage for SC146 series.

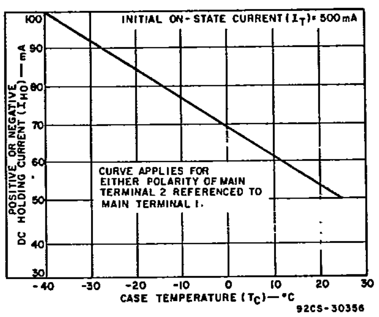

Fig. 13 – DC holding current as a function of case temperature.

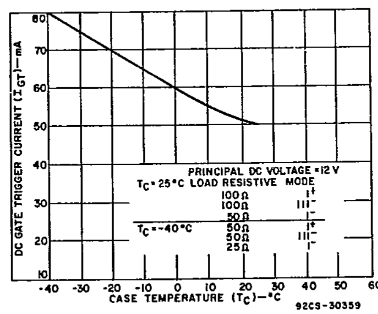

Fig. 14 – DC gate trigger current as a function of case temperature.

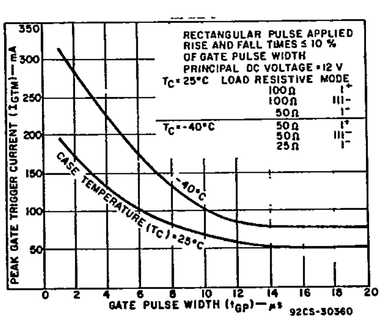

Fig. 15 – Peak gate trigger current as a function of gate pulse width.

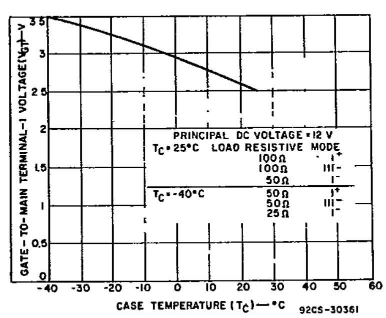

Fig. 16 – DC gate-trigger voltage as a function of case temperature.

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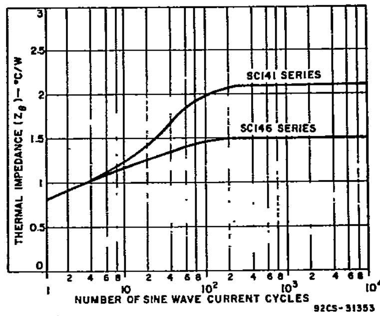


Fig. 17 — Thermal impedance as a function of sine-wave current cycles.

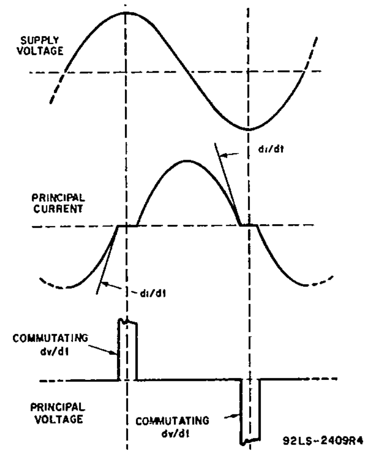
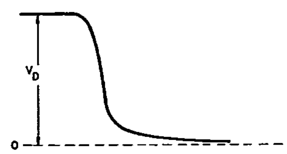


Fig. 18 — Relationship between supply voltage and principal current (inductive load) showing reference points for definition of commutating voltage (dv/dt).



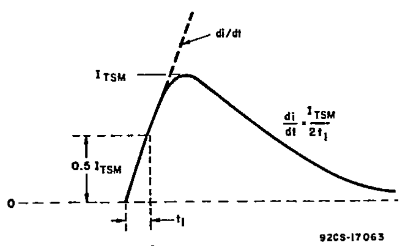


Fig. 19 — Rate-of-change of on-state current with time (defining di/dt).

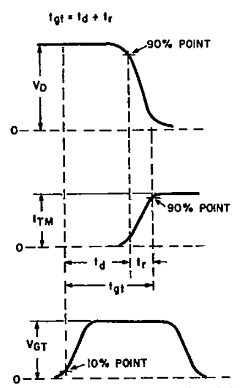


Fig. 20 — Relationship between off-state voltage, on-state current, and gate-trigger voltage showing reference points for definition of turn-on time (t_{gt}).