

SC141, SC146 Series

File Number 1167

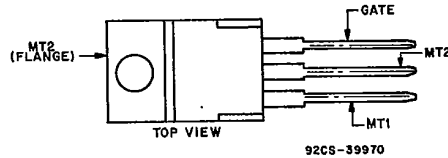
6-A and 10-A Silicon Triacs

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  $T_C = 75^\circ\text{C}$  (SC141 series) and 10-A at  $T_C = 80^\circ\text{C}$  (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 $125^\circ\text{C}$ .....	200	400	500	600	800	V
$I_{T(RMS)}$ $\theta = 360^\circ$ :						
For SC141 series, $T_C = 75^\circ\text{C}$ .....	6					A
For SC146 series, $T_C = 80^\circ\text{C}$ .....	10					A
For other conditions .....	See Fig. 4					
$I_{TSM}^{\dagger}$ :						
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					
$di/dt$ :	70					A/ $\mu\text{s}$
$V_D = V_{DROM}$ , $I_G = 200$ mA, $t_r = 0.1$ $\mu\text{s}$ .....						
$I^2t$ [At $T_C$ shown for $I_{T(RMS)}$ , half-sine wave]:	SC141 Series		SC146 Series			
$t = 10$ ms .....	25		70			A <sup>2</sup> s
2.5 ms .....	17		45			A <sup>2</sup> s
0.5 ms .....	10		25			A <sup>2</sup> s
$I_{GTM}^{\ddagger}$ :						
For 1 $\mu\text{s}$ max. ....	4					A
$P_{GM}$ (For 1 $\mu\text{s}$ max., $I_{GTM} \leq 4$ A) .....	10					W
$P_{G(M)}$ .....	0.5					W
$T_{sto}$ .....	-40 to 125					$^\circ\text{C}$
$T_C$ .....	-40 to 125					$^\circ\text{C}$
$T_T$ (During soldering for 10 s max.) .....	230					$^\circ\text{C}$

\*For either polarity of main terminal 2 voltage ( $V_{MT2}$ ) with reference to main terminal 1.  
 $\dagger$ 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.	
$I_{DROM}^{\bullet}$ $V_{DROM} = \text{Max. rated value, } T_C = 25^{\circ}\text{C}$ $= 125^{\circ}\text{C}$	-	-	0.1 0.5	mA
$V_{TM}^{\bullet}$ $T_C = 25^{\circ}\text{C, } i_T = 8.5 \text{ A (peak SC141 series)}$ $= 14 \text{ A (peak SC146 series)}$	-	-	1.83 1.65	V
$I_{HO}^{\bullet}$ Gate open, initial principal current = 500 mA (dc) $v_D = 12 \text{ V, } T_C = 25^{\circ}\text{C}$ $= -40^{\circ}\text{C}$	-	-	50 100	mA
$I_L^{\bullet}$ $R_{GK} = 100 \Omega, t_W = 50 \mu\text{s, } t_r = t_f = 5 \mu\text{s, } f = 1 \text{ kHz,}$ $T_C = 25^{\circ}\text{C}$				
Mode $V_{MT2}$ $V_G$				
1+ + +	-	-	100	
111- - -	-	-	100	
1- + -	-	-	200	
$T_C = -40^{\circ}\text{C}$				
1+ + +	-	-	200	
111- - -	-	-	200	
1- + -	-	-	400	
$dv/dt^{\bullet}$ (Commutating) $v_D = V_{DROM}, I_T(\text{RMS}) = \text{Max. rated value,}$ $di/dt = 3.2 \text{ A/ms, } T_C = 80^{\circ}\text{C}$ SC141 series $di/dt = 5.4 \text{ A/ms, } T_C = 80^{\circ}\text{C}$ SC146 series	4	-	-	V/ $\mu\text{s}$
$dv/dt^{\bullet}$ (Off-State) $v_D = V_{DROM}, T_C = 100^{\circ}\text{C, Exponential voltage rise}$ SC141 series SC146 series	30 100	100 250	- -	
$I_{GT}^{\bullet\bullet}$ $v_D = 12 \text{ V (dc)}$ $T_C = 25^{\circ}\text{C}$				mA
$R_L - \Omega$ Mode $V_{MT2}$ $V_G$				
100 1+ + +	-	-	50	
100 111- - -	-	-	50	
50 1- + -	-	-	50	
$T_C = -40^{\circ}\text{C}$				
50 1+ + +	-	-	80	
50 111- - -	-	-	80	
25 1- + -	-	-	80	
$V_{GT}^{\bullet\bullet}$ $v_D = 12 \text{ V (dc)}$ $T_C = 25^{\circ}\text{C}$				V
$R_L - \Omega$ Mode $V_{MT2}$ $V_G$				
100 1+ + +	-	-	2.5	
100 111- - -	-	-	2.5	
50 1- + -	-	-	2.5	
$T_C = -40^{\circ}\text{C}$				
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.	
$V_{GD}^*$ $V_D = V_{DROM}$ , $R_L = 1k\Omega$ , $T_C = 100^\circ C$ (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), $T_C = 25^\circ C$	-	1.6	2.5	$\mu s$

Thermal Characteristics				
$R_{\theta JC}$	SC141 series	-	-	3.0
	SC146 series	-	-	2.2
$R_{\theta JA}$		-	-	75
$R_{\theta JC}(ac)^*$				$^\circ C/W$
During ac current conduction	SC141 series	-	-	2.22
	SC146 series	-	-	1.5

- 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

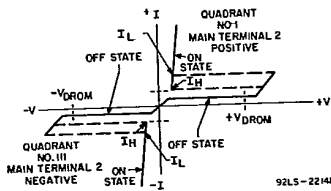


Fig. 1 - Principal voltage-current characteristic.

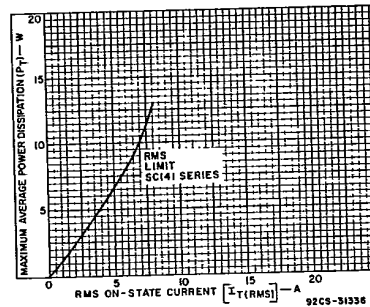


Fig. 2 - Power dissipation as a function of on-state current for SC141 series.

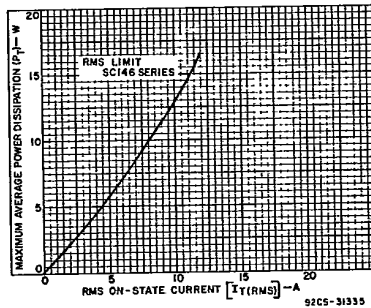


Fig. 3 - Power dissipation as a function of on-state current for SC146 series.

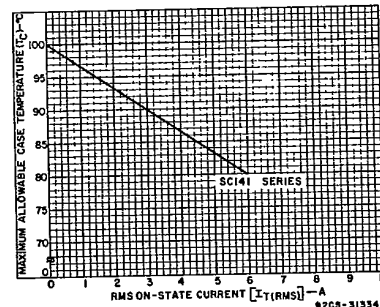


Fig. 4 - Maximum allowable case-temperature as a function of on-state current for SC141 series.

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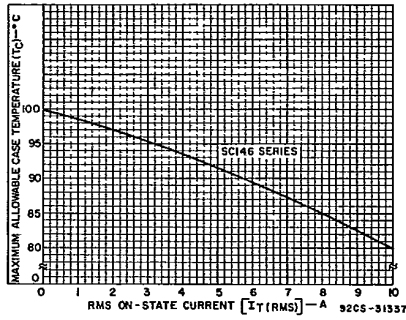


Fig. 5 - Maximum allowable case-temperature as a function of on-state current for SC146 series.

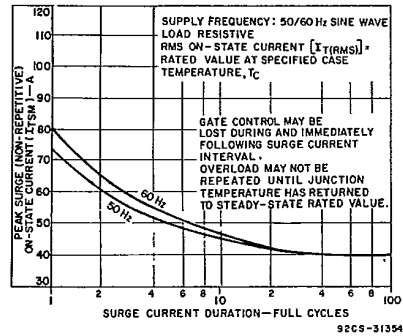


Fig. 6 - Peak surge on-state current as a function of surge current duration for SC141 series.

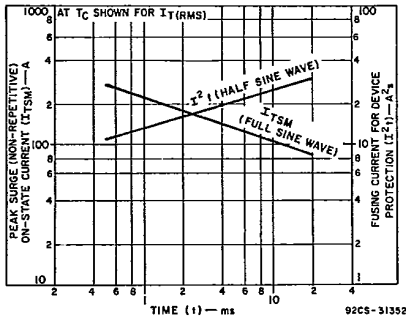


Fig. 7 - Peak surge on-state current and fusing current as a function of time for SC141 series.

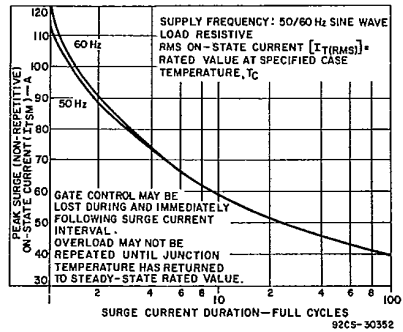


Fig. 8 - Peak surge on-state current as a function of surge current duration for SC146 series.

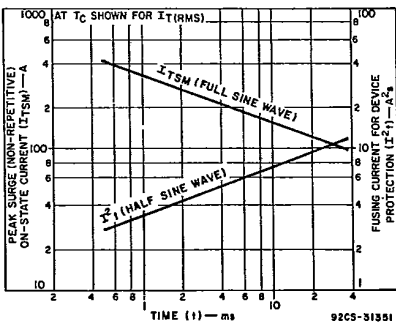


Fig. 9 - Peak surge on-state current and fusing current as a function of time for SC146 series.

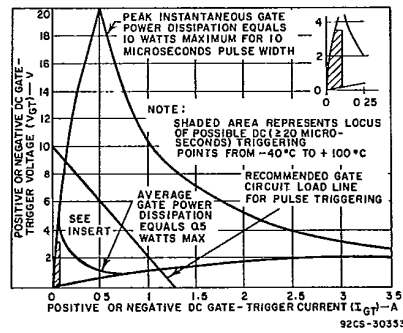


Fig. 10 - Gate pulse characteristics for all triggering modes.

Triacs

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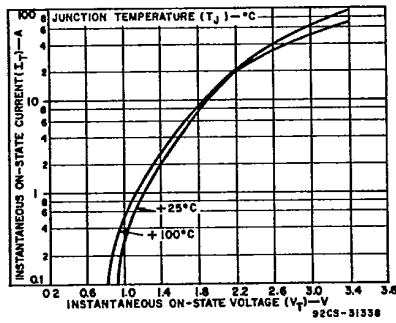


Fig. 11 - On-state current as a function of on-state voltage for SC141 series.

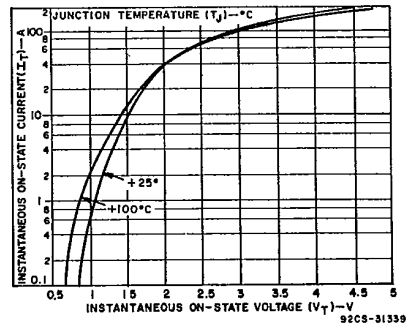


Fig. 12 - On-state current as a function of on-state voltage for SC146 series.

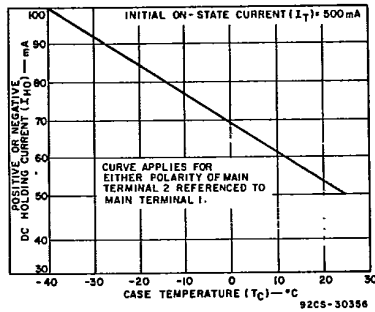


Fig. 13 - DC holding current as a function of case temperature.

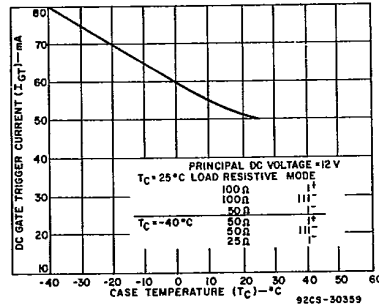


Fig. 14 - DC gate trigger current as a function of case temperature.

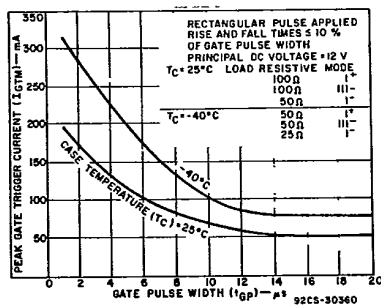


Fig. 15 - Peak gate trigger current as a function of gate pulse width.

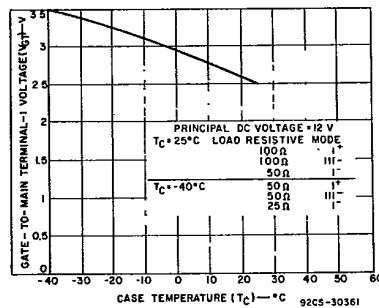


Fig. 16 - DC gate-trigger voltage as a function of case temperature.

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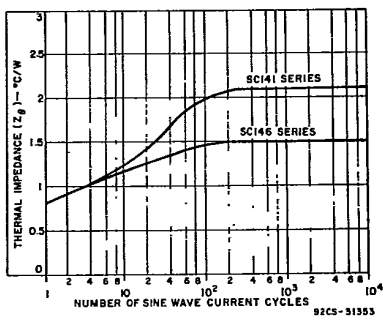


Fig. 17 - Thermal impedance as a function of sine-wave current cycles.

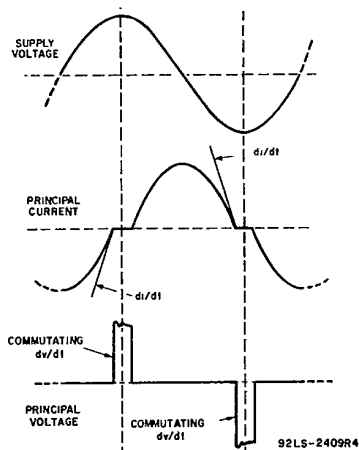


Fig. 18 - Relationship between supply voltage and principal current (inductive load) showing reference points for definition of commutating voltage ( $dv/dt$ ).

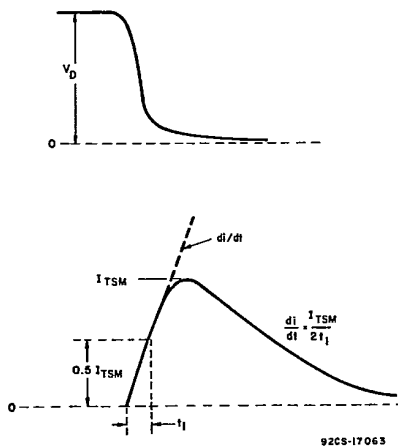


Fig. 19 - Rate-of-change of on-state current with time (defining  $di/dt$ ).

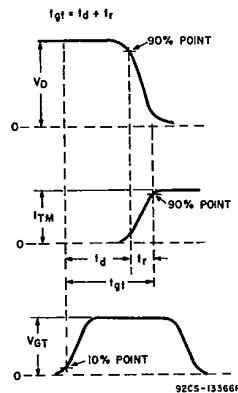


Fig. 20 - Relationship between off-state voltage, on-state current, and gate-trigger voltage showing reference points for definition of turn-on time ( $t_{gt}$ ).