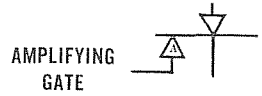


# HIGH SPEED Silicon Controlled Rectifier

**800Volts      110A RMS**

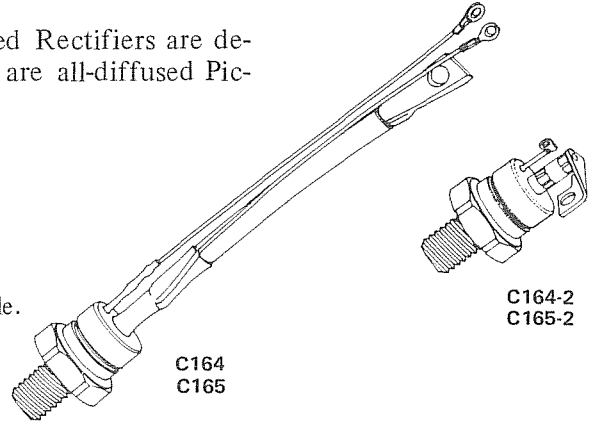
**C164 / C165**



The General Electric C164 and C165 Silicon Controlled Rectifiers are designed for power switching at high frequencies. These are all-diffused Pic-Pic devices, employing the field-proven amplifying gate.

**FEATURES:**

- High di/dt Ratings.
- High dv/dt Capability with Selections Available.
- Excellent Surge and I<sup>2</sup>t Ratings Providing Easy Fusing.
- Guaranteed Maximum Turn-Off Time with Selections Available.
- Rugged Hermetic Package with Long Creepage Path.



Equipment designers can use the C164 and C165 SCR's in demanding applications such as:

- Choppers
- Sonar Transmitters
- Cycloconverters
- Inverters
- Induction Heaters
- DC to DC Converters

### MAXIMUM ALLOWABLE RATINGS

TYPES	REPETITIVE PEAK OFF-STATE VOLTAGE, $V_{DRM}^1$ $T_J = -40^\circ\text{C to } +125^\circ\text{C}$	REPETITIVE PEAK REVERSE VOLTAGE, $V_{RRM}^1$ $T_J = -40^\circ\text{C to } +125^\circ\text{C}$	NON-REPETITIVE PEAK REVERSE VOLTAGE, $V_{RSM}^1$ $T_J = +125^\circ\text{C}$
C164/C165A	100 Volts	100 Volts	200 Volts
C164/C165B	200	200	300
C164/C165C	300	300	400
C164/C165D	400	400	500
C164/C165E	500	500	600
C164/C165M	600	600	720
C165S	700	700	840
C165N	800	800	960

<sup>1</sup> Half sine wave waveform, 10 ms max. pulse width.

RMS On-State Current, $I_{T(RMS)}$ . . . . .	110 Amperes
Peak One Cycle Surge (Non-Repetitive) On-State Current, $I_{TSM}$ (60 Hz) . . . . .	1800 Amperes
Peak One Cycle Surge (Non-Repetitive) On-State Current, $I_{TSM}$ (50 Hz) . . . . .	1700 Amperes
I <sup>2</sup> t (for fusing) for times $\geq$ 1.5 milliseconds. . . . .	9,500 (RMS Ampere) <sup>2</sup> Seconds
I <sup>2</sup> t (for fusing) for times $\geq$ 8.3 milliseconds . . . . .	13,500 (RMS Ampere) <sup>2</sup> Seconds
Critical Rate-of-Rise of On-State Current, Non-Repetitive† . . . . .	800 A/ $\mu$ s
Critical Rate-of-Rise of On-State Current, Repetitive† . . . . .	500 A/ $\mu$ s
Average Gate Power Dissipation, $P_{G(AV)}$ . . . . .	2 Watts
Storage Temperature, $T_{stg}$ . . . . .	-40°C to +150°C
Operating Temperature, $T_J$ . . . . .	-40°C to +125°C
Stud Torque . . . . .	125-150 In-Lb 14-17 N-m

† di/dt ratings established in accordance with EIA-NEMA Standard RS-397, Section 5.2.2.6 for conditions of max. rated  $V_{DRM}$ ; 20 volts, 20 ohms gate trigger source with 0.5 $\mu$ s short circuit trigger current rise time.

## CHARACTERISTICS

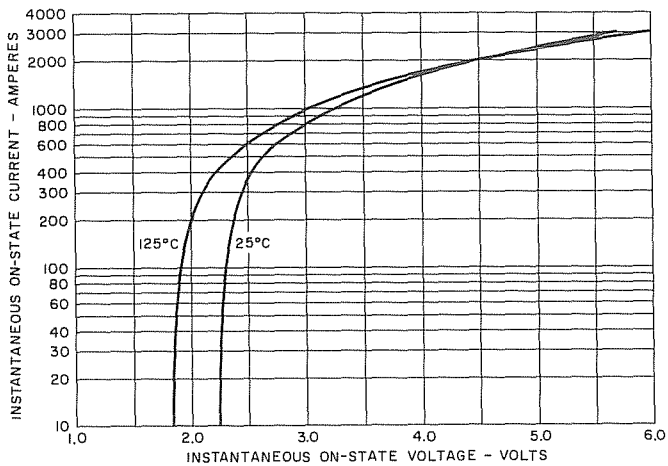
TEST	SYMBOL	MIN.	TYP.	MAX.	UNITS	TEST CONDITION
Peak Reverse and Off-State Current	$I_{RRM}$ and $I_{DRM}$	—	5	12	mA	$T_J = +25^\circ\text{C}$ , $V = V_{DRM} = V_{RRM}$
Peak Reverse and Off-State Current	$I_{RRM}$ and $I_{DRM}$	—	12	17	mA	$T_J = +125^\circ\text{C}$ , $V = V_{DRM} = V_{RRM}$
Thermal Resistance	$R_{\theta JC}$	—	—	0.3	$^\circ\text{C}/\text{Watt}$	Junction-to-Case
Critical Rate-of-Rise of Off-State Voltage (Higher values may cause device switching)	dv/dt	200	500	—	V/ $\mu\text{sec}$	$T_J = +125^\circ\text{C}$ , Gate Open. $V_{DRM} =$ Rated linear or exponential rising waveform. Exponential dv/dt = $\frac{V_{DRM}}{\tau}$ (.632)
Higher minimum dv/dt selections available – consult factory.						
Holding Current	$I_H$	—	40	1000	mA dc	$T_J = +25^\circ\text{C}$ , Anode Supply = 24 Vdc. Initial On-State Current = 2 Amps.
DC Gate Trigger Current	$I_{GT}$	—	70	250	mA dc	$T_C = +25^\circ\text{C}$ , $V_D = 6\text{ Vdc}$ , $R_L = 3\text{ Ohms}$
		—	100	400		$T_C = -40^\circ\text{C}$ , $V_D = 6\text{ Vdc}$ , $R_L = 3\text{ Ohms}$
		—	25	175		$T_C = +125^\circ\text{C}$ , $V_D = 6\text{ Vdc}$ , $R_L = 3\text{ Ohms}$
DC Gate Trigger Voltage	$V_{GT}$	—	3	5	Vdc	$T_C = -40^\circ\text{C}$ to $0^\circ\text{C}$ , $V_D = 6\text{ Vdc}$ , $R_L = 3\text{ Ohms}$
		—	1.25	3.0		$T_C = 0^\circ\text{C}$ to $+125^\circ\text{C}$ , $V_D = 6\text{ Vdc}$ , $R_L = 3\text{ Ohms}$
		0.15	—	—		$T_C = 125^\circ\text{C}$ , $V_{DRM}$ , $R_L = 1000\text{ Ohms}$
Peak On-State Voltage	$V_{TM}$	—	1.9	2.6	Volts	$T_C = +25^\circ\text{C}$ , $I_{TM} = 500\text{ Amps. Peak}$ . Duty Cycle $\leq .01\%$ .
Delay Time	$t_d$	—	0.5	2.0	$\mu\text{sec}$	$T_C = +25^\circ\text{C}$ , $I_T = 50\text{ A dc}$ , $V_{DRM}$ . Gate Supply: 20 Volt Open Circuit, 20 Ohm, 0.1 $\mu\text{sec}$ max. rise time††, †††
Conventional Circuit Commutated Turn-Off Time (with Reverse Voltage) Faster Maximum Turn-Off Times Available, Consult Factory	$t_q$	—	—	—	$\mu\text{sec}$	(1) $T_C = +125^\circ\text{C}$ (2) $I_{TM} = 150\text{ Amps}$ . (3) $V_R = 50\text{ Volts Min}$ . (4) $V_{DRM}$ Reapplied (5) Rate-of-Rise of Reapplied Off-State Voltage = 200V/ $\mu\text{sec}$ (linear) (6) Commutation di/dt = 5 Amps/ $\mu\text{sec}$ (7) Repetition Rate = 1 pps. (8) Gate bias during turn-off interval = 0 volts, 100 ohms
	C164	—	8	10		
	C165	—	15	20		
Conventional Circuit Commutated Turn-Off Time (with Feedback Diode)	$t_q$ (diode)	—	—	—	$\mu\text{sec}$	(1) $T_C = +125^\circ\text{C}$ (2) $I_{TM} = 150\text{ Amps}$ . (3) $V_R = 1\text{ Volt}$ (4) $V_{DRM}$ , Reapplied (5) Rate-of-Rise of Reapplied Off-State Voltage = 200V/ $\mu\text{sec}$ (linear) (6) Commutation di/dt = 5 Amps/ $\mu\text{sec}$ (7) Repetition Rate = 1 pps. (8) Gate bias during turn-off interval = 0 volts, 100 ohms.
	C164	—	15	†		
	C165	—	20	†		

† Consult factory for specified maximum turn-off time.

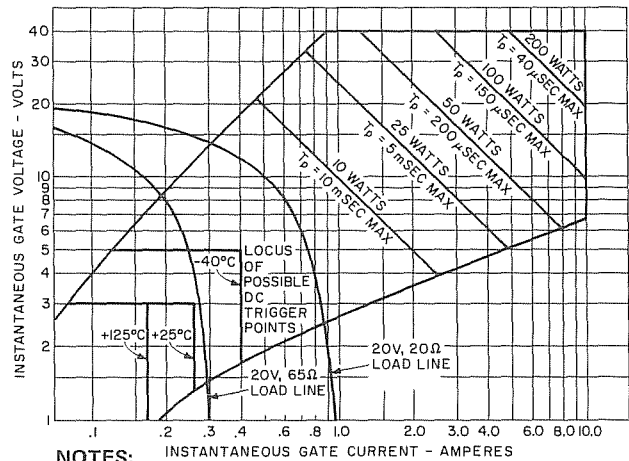
†† Delay time may increase significantly at the gate drive approaches the  $I_{GT}$  of the Device Under Test.

††† Current risetime as measured with a current probe, or voltage risetime across a non-inductive resistor.

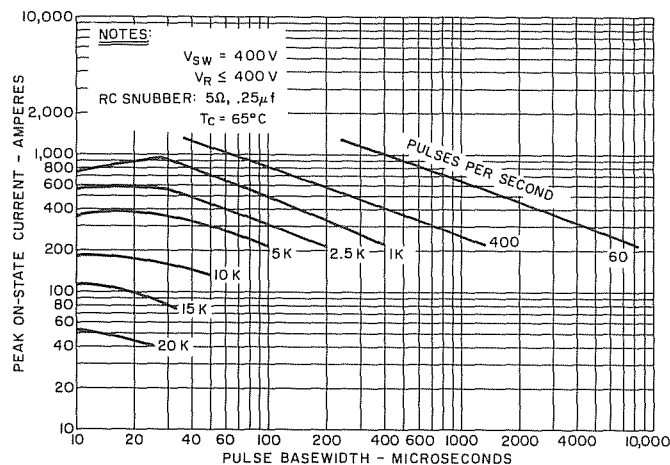
**C164, C165**



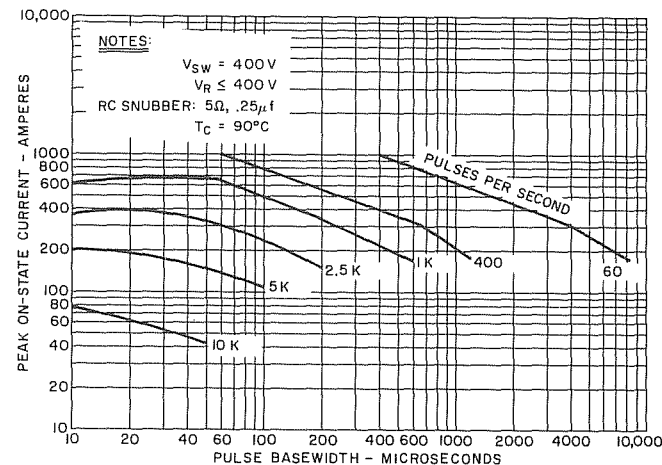
**1. MAXIMUM ON-STATE CHARACTERISTICS**



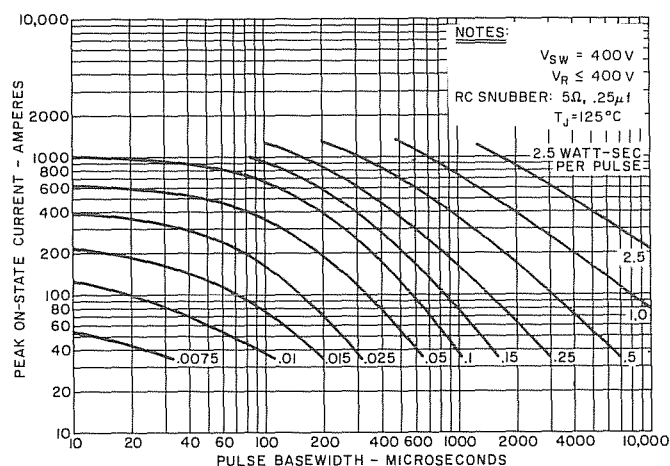
**NOTES:**  
 1. The locus of possible DC trigger points lies outside the boundaries shown at various case temperatures.  
 2. GATE TRIGGER CHARACTERISTICS AND POWER RATINGS



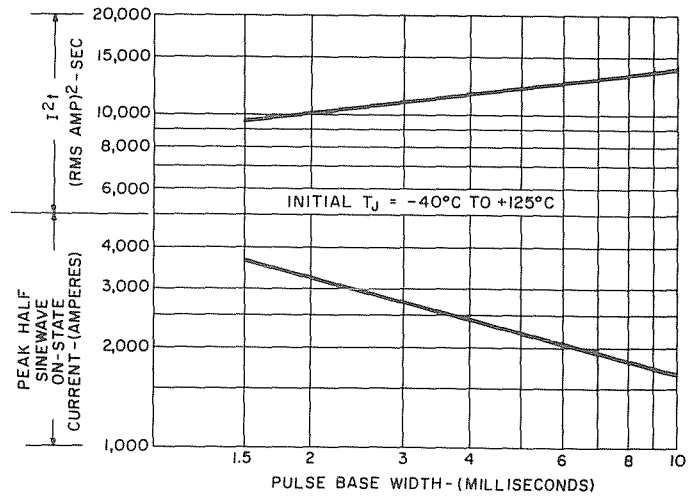
**3. MAXIMUM ALLOWABLE PEAK ON-STATE CURRENT VS. PULSE WIDTH ( $T_C = 65^\circ C$ )**



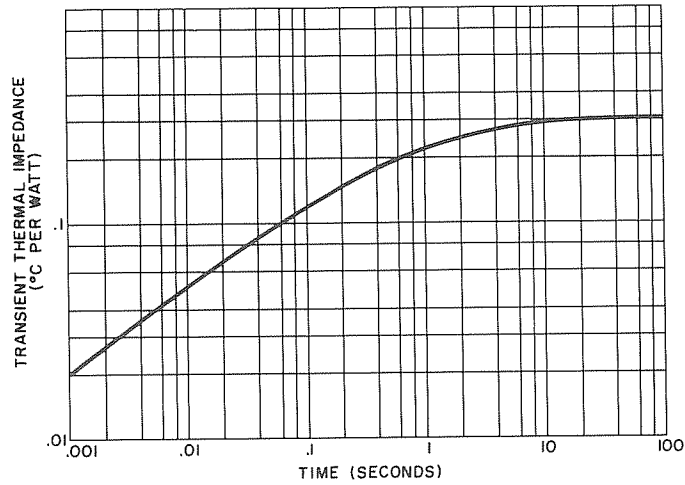
**4. MAXIMUM ALLOWABLE PEAK ON-STATE CURRENT VS. PULSE WIDTH ( $T_C = 90^\circ C$ )**



**5. ENERGY PER PULSE FOR SINUSOIDAL PULSES**

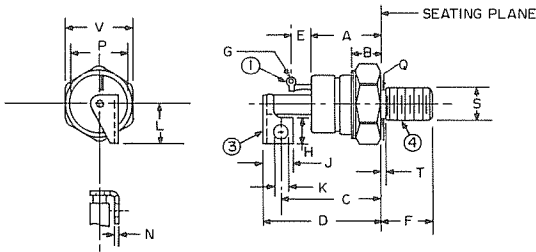


**6. SUB-CYCLE SURGE (NON-REPETITIVE) ON-STATE CURRENT AND  $I^2t$  RATING**



7. TRANSIENT THERMAL IMPEDANCE – JUNCTION-TO-CASE

OUTLINE DRAWING

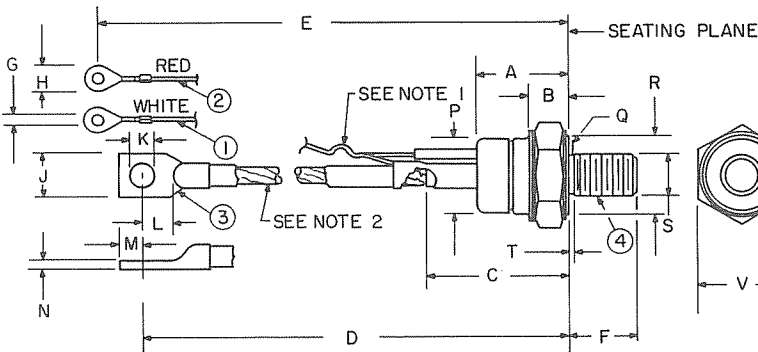


MODEL	TERMINAL ①	TERMINAL ③	TERMINAL ④	S THREAD SIZE
C164-2 C165-2	GATE	CATHODE +	ANODE -	1/2-20 UNF-2A

NOTES:

- ONE NUT AND ONE LOCKWASHER SUPPLIED WITH EACH UNIT. MATERIAL OF HARDWARE IS STEEL, CAD PLATED.
- "T" DIM. IS AREA OF UNTHREADED PORTION. COMPLETE THDS. ARE WITHIN 2.5 THREADS OF SEATING PLANE.
- ANGULAR ORIENTATION OF TERMINALS IS UNDEFINED.

SYM	INCHES		METRIC MM		SYM	INCHES		METRIC MM		NOTES
	MIN.	MAX.	MIN.	MAX.		MIN.	MAX.	MIN.	MAX.	
A	1.020	1.140	25.90	28.96	L	.590	.640	14.98	16.26	
B	.390	.500	9.90	12.70						
C	1.460	REF.	7.92	REF.	N	.058	.070	1.47	1.78	
D	1.660	1.800	42.16	45.72						
E	.312	REF.	7.92	REF.	P	.840	.910	21.33	23.11	
F	.797	.827	20.24	21.01						
G	.060	.075	1.52	1.91	Q	.425	.499	10.79	12.67	
H	.385	.415	9.77	10.54	T	—	.060	—	1.52	2
J	.445	.485	11.30	12.32	V	1.052	1.063	26.72	27.00	
K	.198	.212	5.02	5.38						



SYM	INCHES		METRIC MM		SYM	INCHES		METRIC MM		NOTES
	MIN.	MAX.	MIN.	MAX.		MIN.	MAX.	MIN.	MAX.	
A	1.020	1.140	25.90	28.96	L	.330	—	8.38	—	
B	.390	.500	9.90	12.70	M	.275	.325	6.98	8.26	
C	1.570	1.750	39.87	44.45	N	.065	.095	1.65	2.41	
D	6.000	6.390	152.40	162.31	P	.840	.910	21.33	23.11	
E	6.850	7.500	173.99	190.50	Q	.425	.499	10.79	12.67	
F	.797	.827	20.24	21.01	R	.920	—	23.36	—	4
G	.140	.150	3.55	3.81	T	—	.060	—	1.57	5
H	—	.300	—	7.62						
J	.500	.610	12.70	15.49	V	1.052	1.063	26.72	27.00	
K	.260	.281	6.60	7.14						

MODEL	TERMINAL ①	TERMINAL ②	TERMINAL ③	TERMINAL ④	S THREAD SIZE
C164 C165	GATE	AUX CATHODE	CATHODE +	ANODE -	1/2 20UNF-2A



NOTES:

- GATE & AUX. CATHODE LEADS SUPPLIED LIGHTLY TWISTED TOGETHER.
- FLEXIBLE COPPER LEAD.
- ONE NUT AND ONE LOCKWASHER SUPPLIED WITH EACH UNIT. MATERIAL OF HARDWARE IS STEEL, CAD PLATED.
- "R" DIM. IS DIA. OF EFFECTIVE SEATING AREA.
- "T" DIM. IS AREA OF UNTHREADED PORTION. COMPLETE THDS. ARE WITHIN 2.5 THREADS OF SEATING PLANE.
- ANGULAR ORIENTATION OF TERMINALS IS UNDEFINED.