

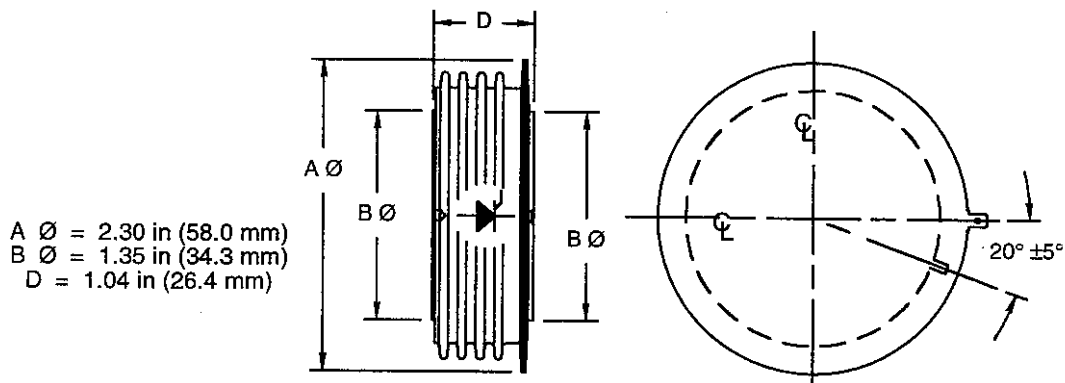
The C613 is ideal for forced commutation. It is processed by multi-diffusion, utilizing 40mm diameter silicon with a unique involute pilot gate. It is supplied in a disk package ready to mount using commercially available heat dissipators and mechanical clamping hardware.

**MAXIMUM ALLOWABLE RATINGS**

TYPE	$V_{DRM}/V_{RRM}^1$ REPETITIVE $T_J = -40^{\circ}\text{C to } +125^{\circ}\text{C}$	$V_{DRM}/V_{RRM}^1$ REPETITIVE $T_J = 0^{\circ}\text{C to } +125^{\circ}\text{C}$	TRANSIENT PEAK REVERSE VOLTAGE <sup>1</sup> , $V_{RSM}$ $T_J = -40^{\circ}\text{C to } +125^{\circ}\text{C}$
C613L	2000 Volts	2100 Volts	2100 Volts
C613PT	1900	2000	2000
C613PN	1800	1900	1900
C613PS	1700	1800	1800
C613PM	1600	1700	1700
C613PE	1500	1600	1600

Consult factory for lower rated voltage devices.

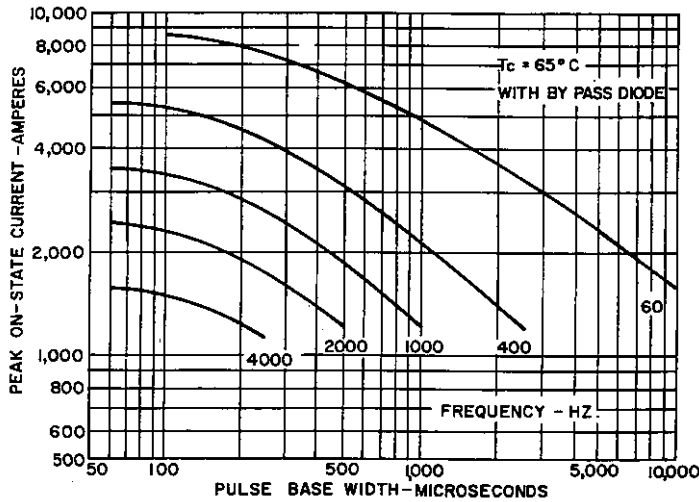
Peak One-Cycle Surge On-State Current, $I_{TSM}$ (8.3 msec)	6,500 Amperes
Maximum Rate-of-Rise of Anode Current Turn-On Interval <sup>2</sup>	Switching from 1200 Volts, 500 A/ $\mu\text{sec}$
Repetitive Rate-of-Rise of Anode Current	Switching from 1200 Volts, 200 A/ $\mu\text{sec}$
$I^2t$ (for fusing) (at 1.5 milliseconds) (See Figure 9)	80,000 Ampere <sup>2</sup> Seconds
Peak Gate Power Dissipation, $P_{GM}$	50 Watts
Average Gate Power Dissipation, $P_{G(AV)}$	5 Watts
Peak Reverse Gate Voltage, $V_{GRM}$	20 Volts
Storage and Operating Temperature, $T_{stg}$ and $T_J$	Refer Above
Mounting Force Required	3500 – 4200 Lbs. 15.6 – 18.7 KN



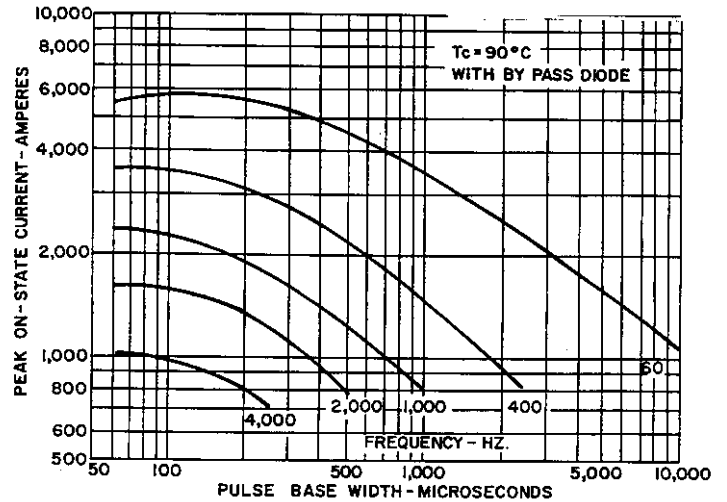
## CHARACTERISTICS

TEST	SYMBOL	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS
Peak Off-State and Reverse Currents	$I_{DRM}$ and $I_{RRM}$	—	10	15	mA	$T_J = +25^\circ\text{C}$ , $V = V_{DRM} = V_{RRM}$
Peak Off-State and Reverse Currents	$I_{DRM}$ and $I_{RRM}$	—	45	60	mA	$T_J = +125^\circ\text{C}$ , $V = V_{DRM} = V_{RRM}$
Effective Thermal Resistance Junction-to-Case	$R_{\theta JC}$	—	—	.04	$^\circ\text{C/Watt}$	Double-Side Cooled (DC)
Critical Linear Rate-of-Rise of Forward Blocking Voltage (Higher values may cause device switching)	$dv/dt$	400	—	—	$\text{V}/\mu\text{sec}$	$T_J = +125^\circ\text{C}$ , $V_{DRM} = .80$ Rated Gate Open <sup>1</sup>
Delay Time	$t_d$	—	1.6	3.0	$\mu\text{sec}$	Switching from 900 Volts, 20 Volt, 10 Ohm Gate 0.5 $\mu\text{sec}$ Rise Time, $T_J = 25^\circ\text{C}$
Gate Pulse Width Necessary to Trigger		—	—	10	$\mu\text{sec}$	See Figure 11.
Gate Trigger Current	$I_{GT}$	—	120	180	mA <sub>dc</sub>	$T_C = 25^\circ\text{C}$ , $V_D = 0$ Vdc, $R_L = 3$ Ohms
		5.0	30	—		$T_C = +125^\circ\text{C}$ , $V_D = .5$ x Rated, $R_L = 1000$ Ohms
Gate Trigger Voltage	$V_{GT}$	—	3.5	5.0	Vdc	$T_C = 25^\circ\text{C}$ , $V_D = 10$ Vdc, $R_L = 3$ Ohms
		.3	—	—		$T_C = 125^\circ\text{C}$ , $V_D = .5$ x Rated, $R_L = 1000$ Ohms
Peak On-State Voltage	$V_{TM}$	—	—	2.9	Volts	$T_C = +125^\circ\text{C}$ , $I_T = 2000$ Amps. Peak Duty Cycle $\leq 0.01\%$
Conventional Circuit Commutated Turn-Off Time (With Reverse Voltage)	$t_q$	—	40	50	$\mu\text{sec}$	(1) $T_C = +125^\circ\text{C}$ (2) $I_T = 500$ Amps. (3) $V_R \geq 50$ Volts (4) 80% $V_{DRM}$ Reapplied <sup>1</sup> (5) Rate-of-rise of Forward Blocking Voltage = 400 $\text{V}/\mu\text{sec}$ . (6) Gate Bias = Open During Turn-Off Interval = 0 Volts, 100 Ohms (7) Duty Cycle $\leq 0.01\%$
Conventional Circuit Commutated Turn-Off Time (With Feedback Diode)	$t_q$	—	45	55	$\mu\text{sec}$	(1) $T_C = +125^\circ\text{C}$ (2) $I_T = 500$ Amps. (3) $V_R = 2$ Volts Min. (4) 80% $V_{DRM}$ Reapplied <sup>1</sup> (5) Rate-of-rise of Forward Blocking Voltage = 400 $\text{V}/\mu\text{sec}$ . (6) Gate Bias = Open During Turn-Off Interval (7) Duty Cycle $\leq 0.01\%$

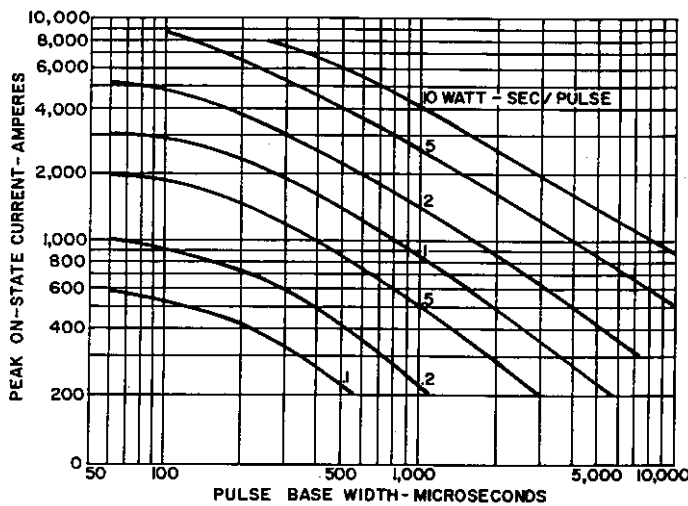
<sup>1</sup> 1 440 V is maximum for C613PT and C613L.



1. MAXIMUM ALLOWABLE PEAK ON-STATE CURRENT VS. PULSE WIDTH ( $T_C = 65^\circ\text{C}$ )



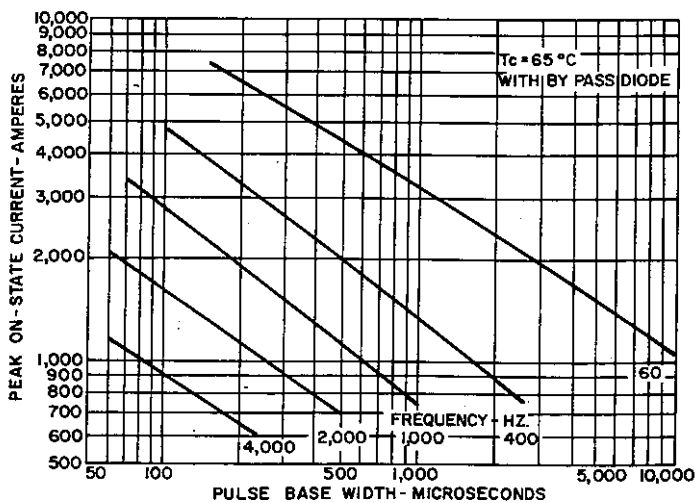
2. MAXIMUM ALLOWABLE PEAK ON-STATE CURRENT VS. PULSE WIDTH ( $T_C = 65^\circ\text{C}$ )



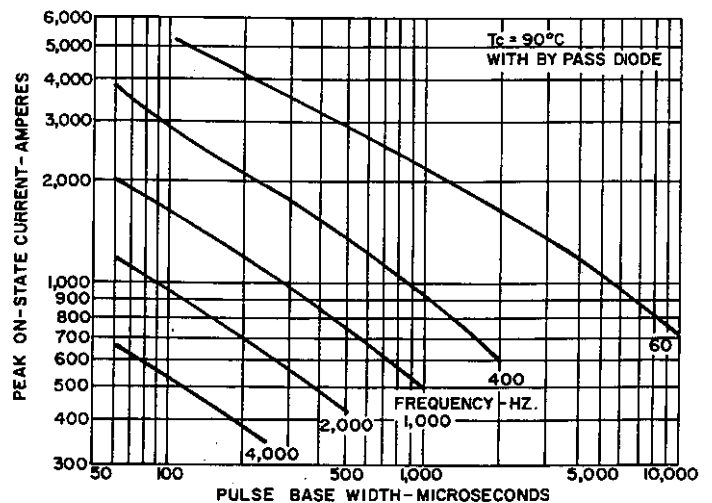
3. ENERGY PER PULSE FOR SINUSOIDAL PULSES

NOTES:

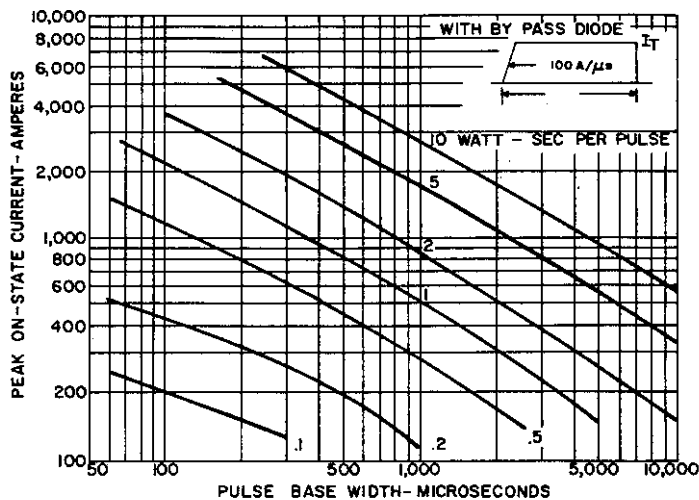
1. Switching voltage range:  $V_D = 15V - 0.8 V_{DRM}$ .
2. Peak snubber discharge current  $\leq 50A$ .  $RC \leq 10\mu\text{sec}$ .
3. High gate drive:  $20V/10 \text{ Ohms}$ ,  $0.5\mu\text{sec}$  rise time.
4. Reverse voltage  $< 50V$ . If no bypass diode is used, reverse recovery losses must be added.



4. MAXIMUM ALLOWABLE PEAK ON-STATE CURRENT FOR RISING  $DI/DT = 100 \text{ A}/\mu\text{SEC}$ . ( $T_C = 65^\circ\text{C}$ )



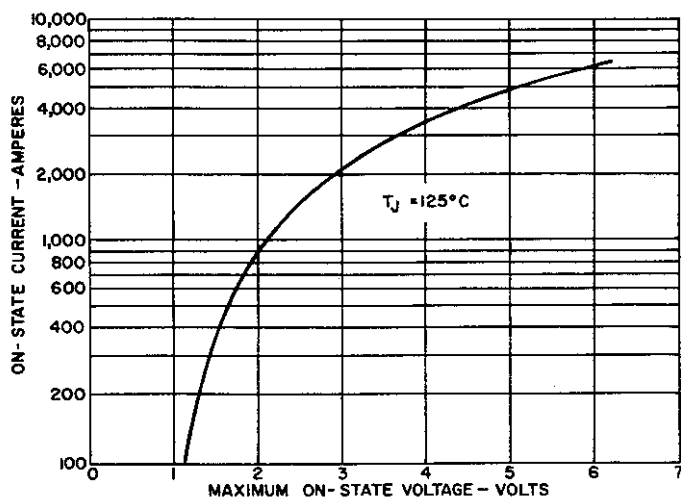
5. MAXIMUM ALLOWABLE PEAK ON-STATE CURRENT FOR RISING  $DI/DT = 100\text{A}/\mu\text{SEC}$ . ( $T_C = 90^\circ\text{C}$ )



6. ENERGY PER PULSE FOR TRAPEZOIDAL CURRENT WAVEFORMS FOR 100A/μSEC. RISING DI/DT

NOTES:

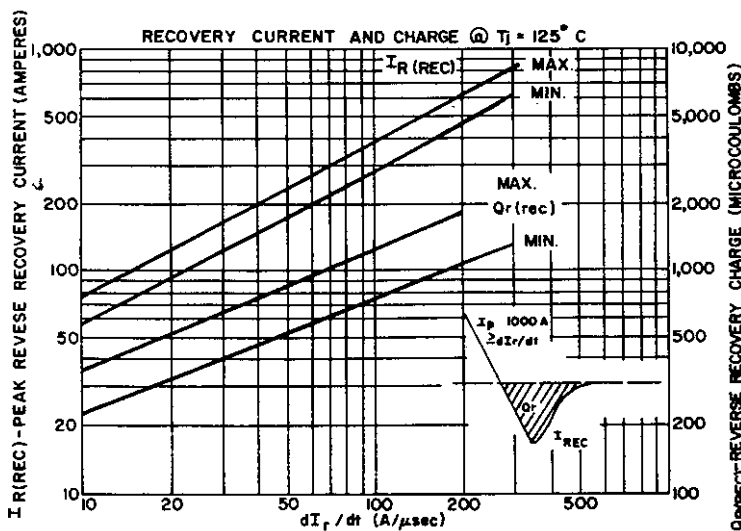
1. Switching voltage range:  $V_D = 15V - 0.8 V_{DRM}$ .
2. Peak snubber discharge current  $\leq 50A$ .  $RC \leq 10\mu sec$ .
3. High gate drive: 20V/10 Ohms, 0.5μsec rise time.
4. Reverse voltage  $\leq 50V$ .



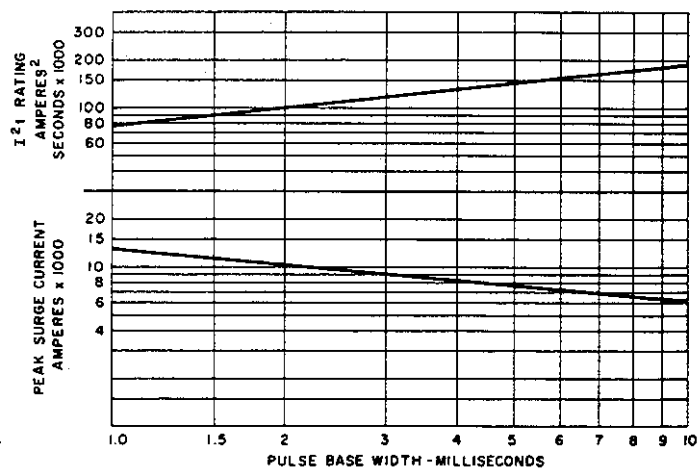
7. FORWARD CONDUCTION CHARACTERISTICS ON-STATE

NOTES:

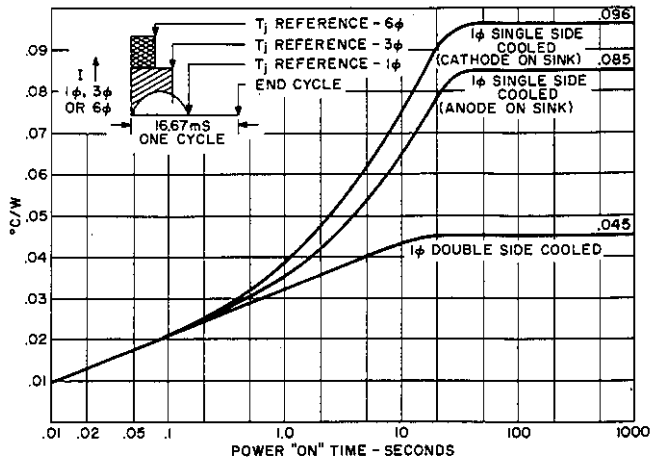
VOLTAGE (Volts)	CURRENT (Amps)
1.145	100
1.300	200
1.423	300
1.533	400
1.634	500
1.731	600
1.824	700
1.914	800
2.002	900
2.089	1000
2.174	1100
2.257	1200
2.340	1300
2.422	1400
2.503	1500
2.900	2000
3.665	3000
4.410	4000
5.142	5000
5.865	6000



8. RECOVERED CHARGE (125°C)



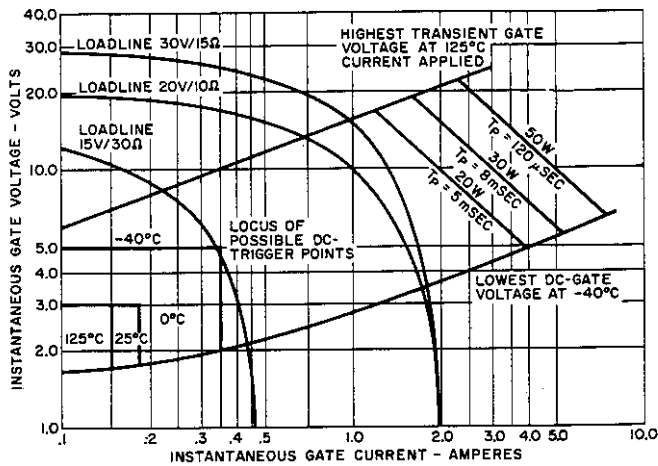
9. SUB-CYCLE SURGE AND  $I^2t$  RATING FOLLOWING RATED LOAD CONDITIONS (Sinusoidal Waveform)



10. TRANSIENT THERMAL IMPEDANCE – JUNCTION-TO-CASE

NOTES:

- For 3φ thermal resistance add .0037°C/W along entire curve length.
- For 6φ thermal resistance add .001°C/W along entire curve length.
- For DC thermal resistance subtract .005°C/W along entire curve length.



11. MAXIMUM ALLOWABLE PEAK GATE POWER VS. GATE PULSE WIDTH

NOTES:

1. Maximum allowable gate dissipation = 3 watts.
2. The locus of possible DC-trigger points lies outside the boundaries shown at various junction temperatures.
3. Loadlines 30V/15Ω, 20V/10Ω and similar are recommended as minimum gate drives for most inverter application; rise time ≤ 0.5μsec;  $T_p \geq 10 \mu\text{sec}$ .
4. Loadline 15V/30Ω is the minimum usable gate drive. Snubber resistances must be > 30Ω when turning on from ≥ 800V bias. Delay-time may be increased. di/dt rating ≤ 100A/μsec.