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

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

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$^2$ ........................................ Switching from 1200 Volts, 500 A/\text{usec}
Repetitive Rate-of-Rise of Anode Current ................................................................. Switching from 1200 Volts, 200 A/\text{usec}
$I^t$ (for fusing) (at 1.5 milliseconds) (See Figure 9) ............................................. 80,000 Ampere$^2$ 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

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**Dimensions:**

- $A \, \Omega = 2.30 \text{ in (58.0 mm)}$
- $B \, \Omega = 1.35 \text{ in (34.3 mm)}$
- $D = 1.04 \text{ in (26.4 mm)}$
<table>
<thead>
<tr>
<th>CHARACTERISTICS</th>
<th>TEST</th>
<th>SYMBOL</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>UNITS</th>
<th>TEST CONDITIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak Off-State and Reverse Currents</td>
<td>$I_{DRM}$ and $I_{RRM}$</td>
<td>-</td>
<td>10</td>
<td>15</td>
<td>mA</td>
<td>$T_J = +25^\circ C$, $V = V_{DRM} = V_{RRM}$</td>
<td></td>
</tr>
<tr>
<td>Peak Off-State and Reverse Currents</td>
<td>$I_{DRM}$ and $I_{RRM}$</td>
<td>-</td>
<td>45</td>
<td>60</td>
<td>mA</td>
<td>$T_J = +125^\circ C$, $V = V_{DRM} = V_{RRM}$</td>
<td></td>
</tr>
<tr>
<td>Effective Thermal Resistance Junction-to-Case</td>
<td>$R_{\theta JC}$</td>
<td>-</td>
<td>-</td>
<td>.04</td>
<td>°C/Watt</td>
<td>Double-Side Cooled (DC)</td>
<td></td>
</tr>
<tr>
<td>Critical Linear Rate-of-Rise of Forward Blocking Voltage (Higher values may cause device switching)</td>
<td>$dv/dt$</td>
<td>400</td>
<td>-</td>
<td>-</td>
<td>V/μsec</td>
<td>$T_J = +125^\circ C$, $V_{DRM} = .80$ Rated Gate Open$^1$</td>
<td></td>
</tr>
<tr>
<td>Delay Time</td>
<td>$t_d$</td>
<td>-</td>
<td>1.6</td>
<td>3.0</td>
<td>μsec</td>
<td>Switching from 900 Volts, 20 Volt, 10 Ohm Gate 0.5 μsec Rise Time, $T_J = 25^\circ C$</td>
<td></td>
</tr>
<tr>
<td>Gate Pulse Width Necessary to Trigger</td>
<td>-</td>
<td>-</td>
<td>10</td>
<td>-</td>
<td>μsec</td>
<td>See Figure 11.</td>
<td></td>
</tr>
<tr>
<td>Gate Trigger Current</td>
<td>$I_G$</td>
<td>-</td>
<td>120</td>
<td>180</td>
<td>mA</td>
<td>$T_C = 25^\circ C$, $V_D = 0$ Vdc, $R_L = 3$ Ohms</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5.0</td>
<td>30</td>
<td>-</td>
<td>$T_C = +125^\circ C$, $V_D = .5$ x Rated, $R_L = 1000$ Ohms</td>
<td></td>
</tr>
<tr>
<td>Gate Trigger Voltage</td>
<td>$V_{GT}$</td>
<td>-</td>
<td>3.5</td>
<td>5.0</td>
<td>Vdc</td>
<td>$T_C = 25^\circ C$, $V_D = 10$ Vdc, $R_L = 3$ Ohms</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>.3</td>
<td>-</td>
<td>-</td>
<td>$T_C = 125^\circ C$, $V_D = .5$ x Rated, $R_L = 1000$ Ohms</td>
<td></td>
</tr>
<tr>
<td>Peak On-State Voltage</td>
<td>$V_{TM}$</td>
<td>-</td>
<td>-</td>
<td>2.9</td>
<td>Volts</td>
<td>$T_C = +125^\circ C$, $I_T = 2000$ Amps. Peak Duty Cycle $\leq 0.01%$</td>
<td></td>
</tr>
</tbody>
</table>
| Conventional Circuit Commutated Turn-Off Time (With Reverse Voltage) | $t_q$ | - | 40 | 50 | μsec | (1) $T_C = +125^\circ C$  
(2) $I_T = 500$ Amps.  
(3) $V_R \geq 50$ Volts  
(4) 80% $V_{DRM}$ Reapplied$^1$  
(5) Rate-of-rise of Forward Blocking Voltage = 400 V/μsec.  
(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 | μsec | (1) $T_C = +125^\circ C$  
(2) $I_T = 500$ Amps.  
(3) $V_R = 2$ Volts Min.  
(4) 80% $V_{DRM}$ Reapplied$^1$  
(5) Rate-of-rise of Forward Blocking Voltage = 400 V/μsec.  
(6) Gate Bias = Open During Turn-Off Interval  
(7) Duty Cycle $\leq 0.01\%$ |

$^1$ 1440 V is maximum for C613PT and C613L.
1. MAXIMUM ALLOWABLE PEAK ON-STATE CURRENT VS. PULSE WIDTH ($T_C = 65^\circ C$)

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

3. ENERGY PER PULSE FOR SINUSOIDAL PULSES

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

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

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, 0.5$\mu$sec rise time.
4. Reverse voltage $\leq 50V$. If no bypass diode is used, reverse recovery losses must be added.
6. ENERGY PER PULSE FOR TRAPEZOIDAL CURRENT WAVEFORMS FOR 100A/μSEC. RISING DI/DT

7. FORWARD CONDUCTION CHARACTERISTICS ON-STATE

8. RECOVERED CHARGE (125°C)

9. SUB-CYCLE SURGE AND I²t RATING FOLLOWING RATED LOAD CONDITIONS (Sinusoidal Waveform)

NOTES:
1. Switching voltage range: Vp = 15V - 0.8 VDRM.
2. Peak snubber discharge current ≤ 50A. RC ≤ 10μsec.
3. High gate drive: 20V/10 Ohms, 0.5μsec rise time.
4. Reverse voltage ≤ 50V.
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 \( \leq 0.5\mu s\); \( T_D \geq 10\mu s\).
4. Loadline 15V/30Ω is the minimum usable gate drive. Snubber resistances must be \( > 30 \Omega \) when turning on from \( \geq 800V \) bias. Delay-time may be increased, \( dI/dt \) rating \( \leq 100A/\mu s\).