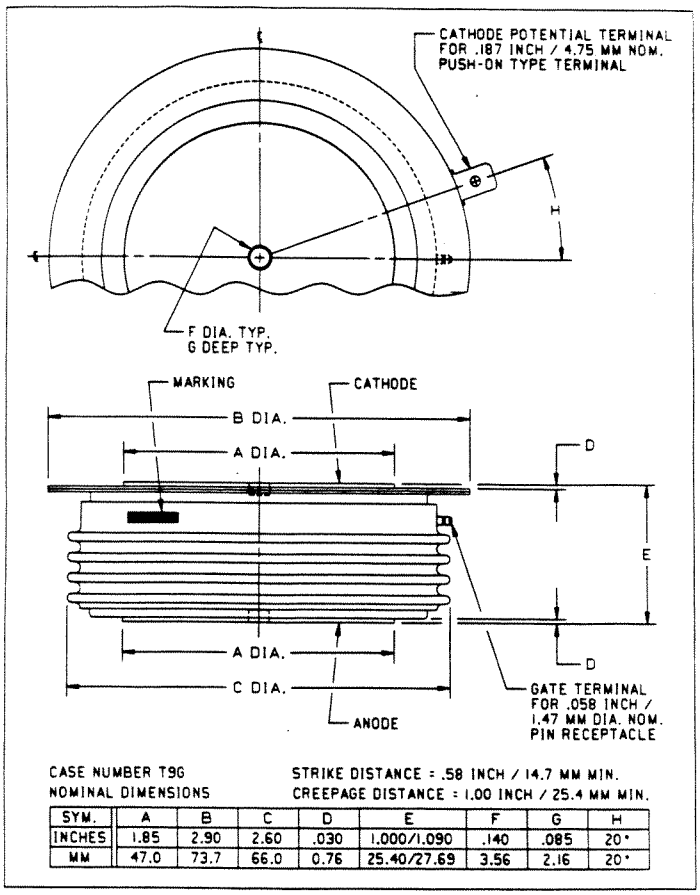
*Powerex, Inc., Hillis Street, Youngwood, Pennsylvania 15697 (412)925-7272*
*Powerex Europe, S.A., 428 Avenue G. Durand, BP107, 72003 Le Mans, France(43) 72.75.15*




CASE NUMBER T9G
NOMINAL DIMENSIONS

STRIKE DISTANCE = .58 INCH / 14.7 MM MIN.
CREEPAGE DISTANCE = 1.00 INCH / 25.4 MM MIN.

| SYM. | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| INCHES | 1.85 | 2.90 | 2.60 | .030 | 1.000/1.090 | .140 | .085 | 20° |
| MM | 47.0 | 73.7 | 66.0 | 0.76 | 25.40/27.69 | 3.56 | 2.16 | 20° |

# Fast Switching Thyristor

*1000 Amperes/Up to 2000 Volts*

## Description:

Powerex Silicon Controlled Rectifiers (SCR) are designed for high current, fast switching applications. The involute, interdigitated gate pattern optimizes the turn-on area for high di/dt capability.

## Features:

- Low Switching Losses at High Frequency
- Interdigitated, di/namic Gate Structure
- Up to 2000 Volt Off-State and Reverse Blocking Capability
- Hermetic Packaging

## Applications:

- Induction Heating
- Transportation
- Inverters

## Ordering Information

Select the complete five or six digit device part number from the table below.

| Type | Voltage Code | $V_{DRM}$ $V_{RRM}$ |
|---|---|---|
| **C712** | **L** | 2000 V |
| | **PN** | 1800 V |
| | **PM** | 1600 V |
| | **PD** | 1400 V |
| | **PB** | 1200 V |

*Powerex, Inc., Hillis Street, Youngwood, Pennsylvania 15697 (412)925-7272*
*Powerex Europe, S.A., 428 Avenue G. Durand, BP107, 72003 Le Mans, France(43) 72.75.15*

# *C712*
## *Fast Switching SCR*
## *1000 Amperes Avg / Up to 2000 Volts*

### Absolute Maximum Ratings

| Characteristics | Symbol | | Units |
|---|---|---|---|
| RMS On-State Current | $I_{T(RMS)}$ | 1570 | A |
| Average Current | $I_{T(AV)}$ | 1000 | A |
| Peak One Cycle Surge On-State Current (Non-Repetitive) 60Hz | $I_{TSM}$ | 20,000 | A |
| Peak One Cycle Surge On-State Current (Non-Repetitive) 50Hz | $I_{TSM}$ | 18,500 | A |
| Critical Rate-of-Rise of On-State Current (Non-Repetitive) | di/dt | 800 | A/$\mu$s |
| Critical Rate-of-Rise of On-State Current (Repetitive) | di/dt | 200 | A/$\mu$s |
| $I^2t$ for Fusing for One Cycle | $I^2t$ | 1,660,000 | $A^2s$ |
| Peak Gate Power Dissipation | $P_{GM}$ | 100 | W |
| Average Gate Power Dissipation | $P_{G(av)}$ | 5 | W |
| Operating Temperature | $T_{STG}$ | -40 to 125°C | °C |
| Storage Temperature | $T_J$ | -40 to 125°C | °C |
| Mounting Force | | 5000 to 6000<br>22.2 - 26.6 | lb.<br>kN |

*Powerex, Inc., Hillis Street, Youngwood, Pennsylvania 15697 (412)925-7272*
*Powerex Europe, S.A., 428 Avenue G. Durand, BP107, 72003 Le Mans, France(43) 72.75.15*

# *C712*

***Fast Switching SCR***

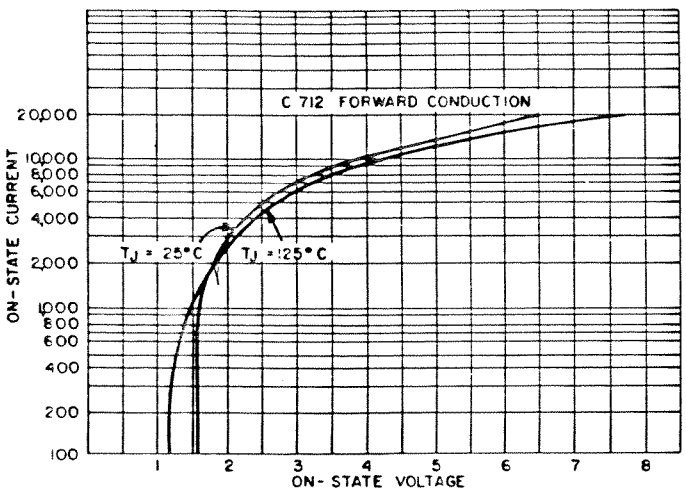
***1000 Amperes Avg / Up to 2000 Volts***

## Electrical Characteristics, $T_J = 25°C$ unless otherwise specified

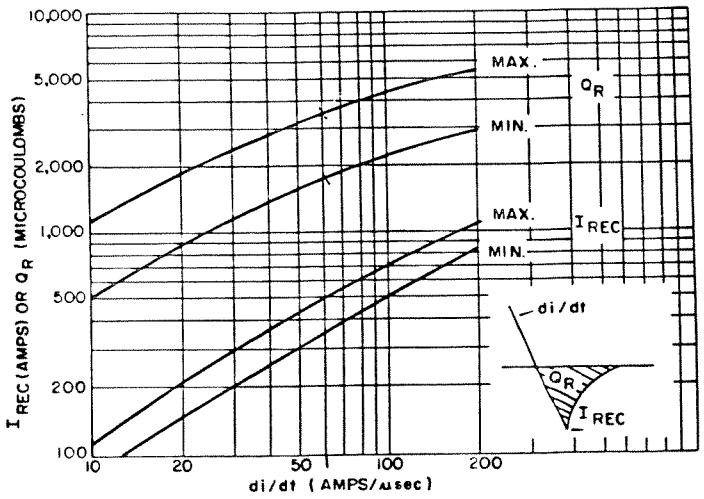
| Characteristics | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| Repetitive Peak Reverse Leakage Current | $I_{RRM}$ | $T_J = 125°C$, $V_D = V_{RRM}$ | | | 90 | mA |
| Repetitive Peak Forward Leakage Current | $I_{DRM}$ | $T_J = 125°C$, $V_D = V_{DRM}$ | | | 90 | mA |
| Peak On-State Voltage | $V_{TM}$ | $T_J = 125°C$, $I_{TM} = 1000A$ Duty Cycle < 0.01% | | | 1.45 | V |
| Typical Delay Time | $t_d$ | Switching from 140V, 20V, 10 Ohm gate, 0.5μs rise time, $T_J = 25°C$ | | 1.5 | | μs |
| Maximum Turn-Off Time | $t_q$ | $T_J = 125°C$, $I_T = 1000A$, $V_R > 50V$ $dv/dt = 400V/\mu s$ linear to 80% $V_{DRM}$ | | | 55 | μs |
| Minimum Critical dv/dt - Linear to VDRM | dv/dt | $T_J = 125°C$, $V_{DRM} = 80\%$ rated Gate Open | 500 | | | V/μs |
| Gate Trigger Current | $I_{GT}$ | $T_J = 25°C$, $V_D = 10V$, $R_L = 3$ Ohm | | 120 | | mA |
| Gate Trigger Voltage | $V_{GT}$ | $T_J = 0$ to $125°C$, $V_D = 10V$ $R_L = 3$ Ohm | | 3.0 | | V |
| Peak Reverse Gate Voltage | $V_{GRM}$ | | | | 20 | V |

## Thermal Characteristics

| Characteristics | Symbol | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Maximum Thermal Resistance, Double Sided Cooling | | | | | |
| Junction to Case | $R_{\theta JC}$ | | | .023 | °C/W |
| Case to Sink | $R_{\theta CS}$ | | | .0075 | °C/W |




FORWARD CONDUCTION CHARACTERISTIC
ON-STATE



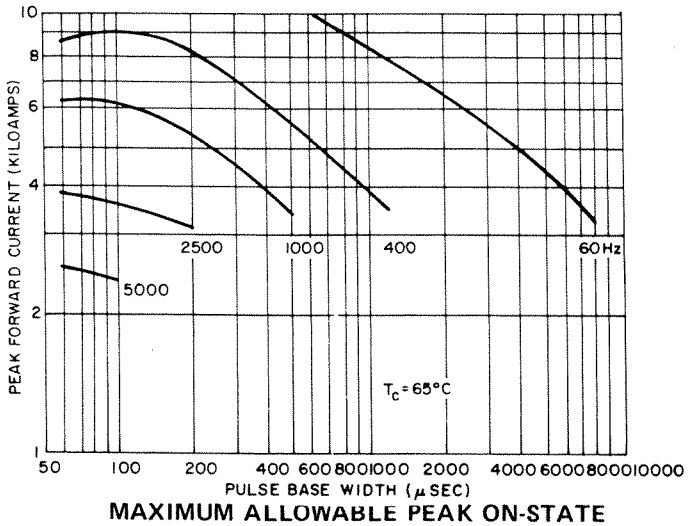

RECOVERED CHARGE (125°C)

*Powerex, Inc., Hillis Street, Youngwood, Pennsylvania 15697 (412)925-7272*
*Powerex Europe, S.A., 428 Avenue G. Durand, BP107, 72003 Le Mans, France(43) 72.75.15*

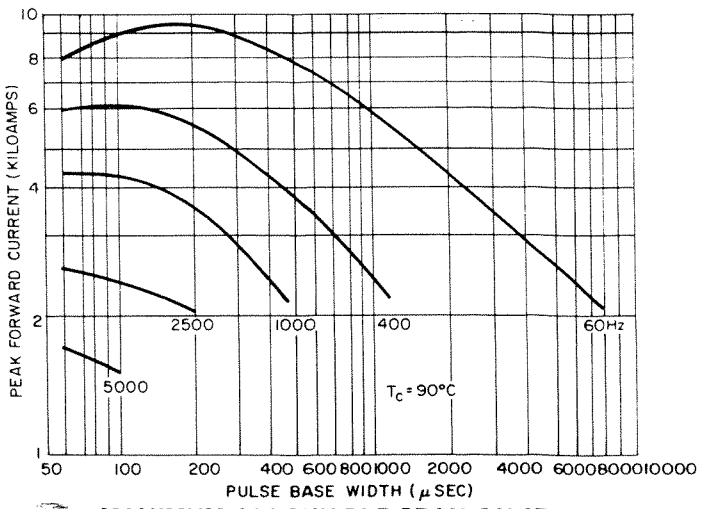
# *C712*

## *Fast Switching SCR*

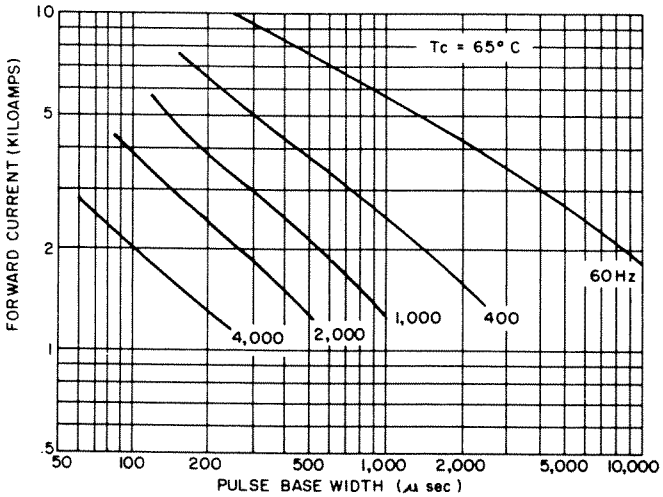
## *1000 Amperes Avg / Up to 2000 Volts*



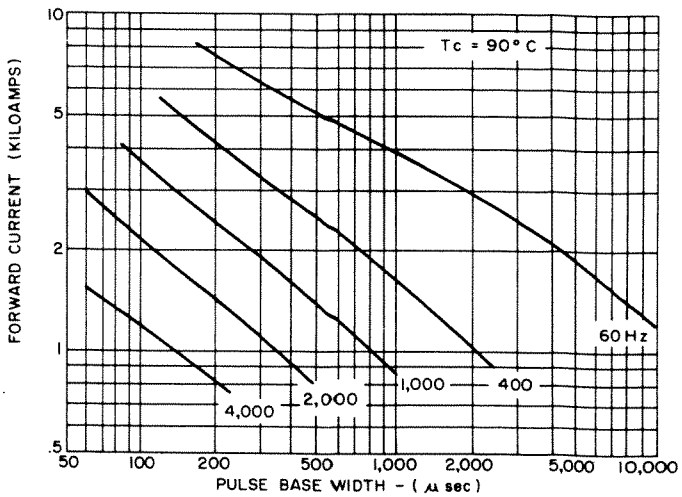

MAXIMUM ALLOWABLE PEAK ON-STATE CURRENT VS. PULSE WIDTH AT $T_C$ = 65°C




MAXIMUM ALLOWABLE PEAK ON-STATE CURRENT VS. PULSE WIDTH AT $T_C$ = 90°C



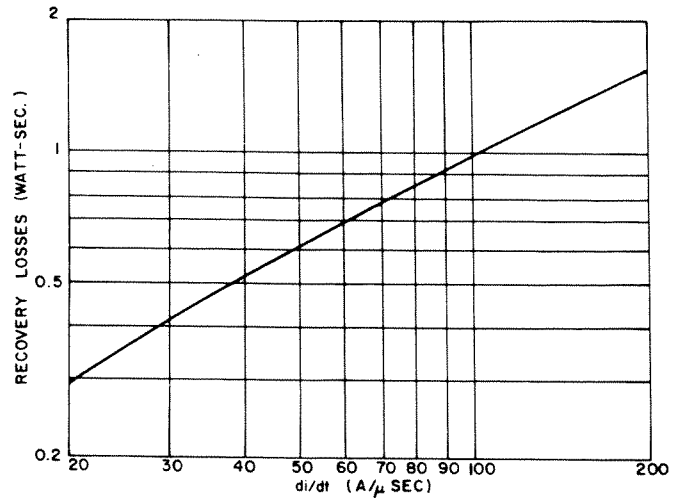

MAXIMUM ALLOWABLE PEAK ON-STATE CURRENT FOR TRAPEZOIDAL CURRENT WAVEFORMS FOR $T_C$ = 65°C




MAXIMUM ALLOWABLE PEAK ON-STATE CURRENT FOR TRAPEZOIDAL CURRENT WAVEFORMS FOR $T_C$ = 90°C

*Powerex, Inc., Hillis Street, Youngwood, Pennsylvania 15697 (412)925-7272*
*Powerex Europe, S.A., 428 Avenue G. Durand, BP107, 72003 Le Mans, France(43) 72.75.15*

# *C712*
## *Fast Switching SCR*
## *1000 Amperes Avg / Up to 2000 Volts*




**RECOVERY CURRENT**
**SWITCHING LOSSES**

**NOTES:**

If no bypass diode is used with this thyristor, the switching losses during recovery can be significant. The actual magnitude of these losses will vary widely depending on circuit conditions and snubber design.

This curve represents typical recovery losses versus circuit di/dt. Since this curve is typical, it serves primarily to alert the equipment designer to the possible need for special design attention. The switching losses in a given circuit may be calculated with the following equation:

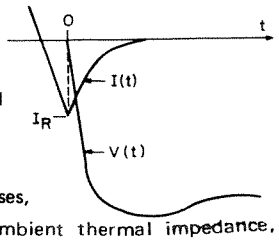
$$SLR = \int_o^{\infty} I(t) \cdot V/t \; dt$$

Where SLR is the recovery switching losses; I (t) is the recovery current decay; V(t) is the recovery voltage; and t = o occurs at the peak of the recovery current. I (t) may be expressed as an exponential decay:

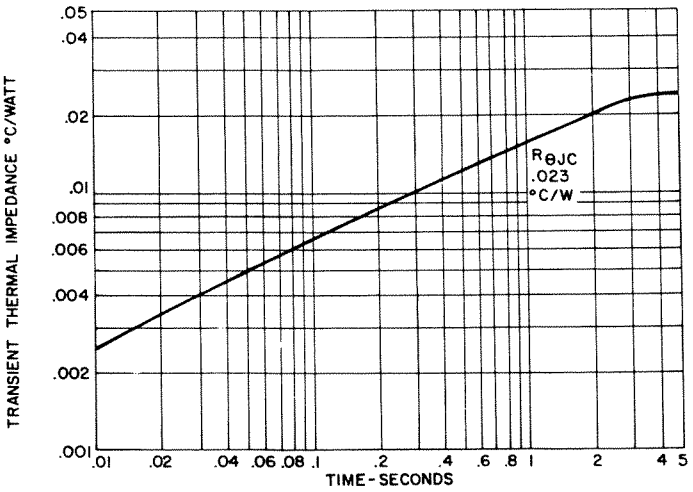
$$I(t) = I_{Re} - (t/T)$$

Where $I_R$ is the peak recovery current and T = 2.5μsec. The junction temperature rise due to the recovery losses may be computed as follows:

$$\Delta T_j = F * \sigma_{\kappa} * R\theta_{JA} + \alpha_{\kappa} * 3.5$$




Where $\sigma_{\kappa}$ is the recovery losses, $R\theta_{JA}$ is the DC junction to ambient thermal impedance, and F is the operating frequency.




**NOTES:**

1. Add .006°C/W to account for both case to dissipator interfaces when properly mounted; e.g., $R\theta_{JS}$ = .029° C/W. See Mounting Instructions.
2. DC Thermal Impedance is based on average full cycle junction temperature. Instantaneous junction temperature may be calculated using the following modifications:
   - end of conducting portion of cycle
     - 120° sq. wave add .0025°C/W along entire curve
     - 180° sq. wave add .0018°C/W along entire curve
     - 180° sine wave add .0010°C/W along entire curve
   - end of full cycle
     - any wave, subtract .001°C/W along entire curve

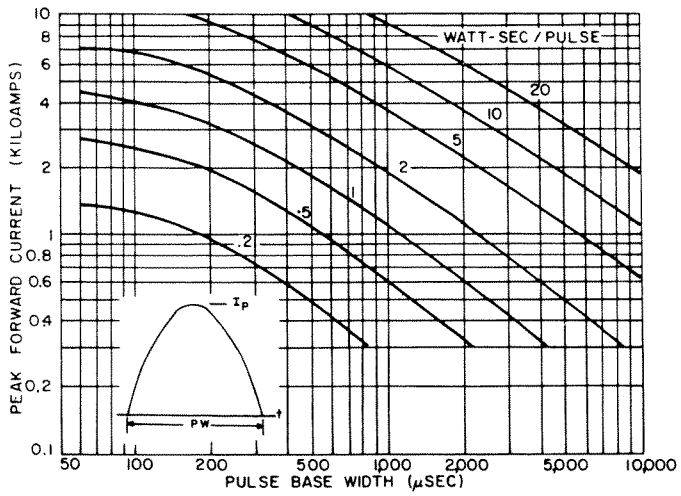
**TRANSIENT THERMAL RESISTANCE — JUNCTION-TO-CASE**

*Powerex, Inc., Hillis Street, Youngwood, Pennsylvania 15697 (412)925-7272*
*Powerex Europe, S.A., 428 Avenue G. Durand, BP107, 72003 Le Mans, France(43) 72.75.15*

# *C712*

## *Fast Switching SCR*

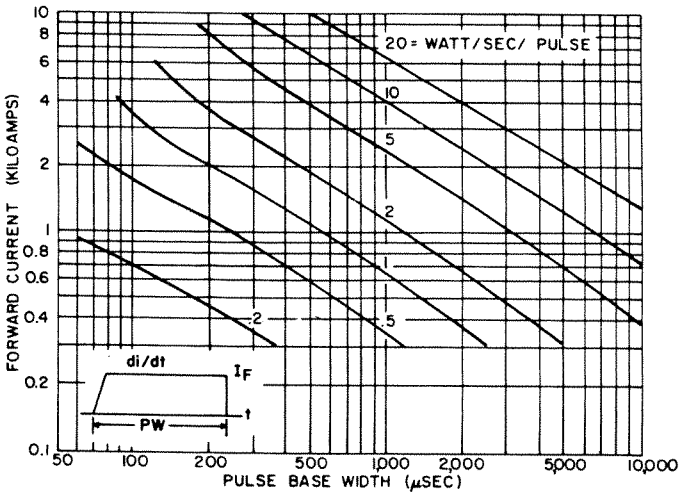
## *1000 Amperes Avg / Up to 2000 Volts*




ENERGY PER PULSE FOR SINUSOIDAL PULSES

**NOTES:**

1. —— Switching capability and losses with bypass diode.
2. Switching voltage from 15 Volts to 0.8 $V_{DRM}$.
3. Snubber discharge $<$ 50 Amps. RC time constant $<$ 10 μsec.
4. High gate drive, 20V/10 Ohms, 0.5 μsec rise time.




ENERGY PER PULSE FOR TRAPEZOIDAL CURRENT WAVEFORMS

**NOTES:**

1. Switching voltage from 15 Volts to 0.8 $V_{DRM}$.
2. DI/DT during turn-on: 100A/μsec.
3. Reverse voltage $<$ 50 Volts. If no bypass diode is used, recovery switching losses must be added.
4. RC snubber time constant $<$ 10 μsec.
5. High gate drive: 20V/10 Ohms, 0.5 μsec rise time.