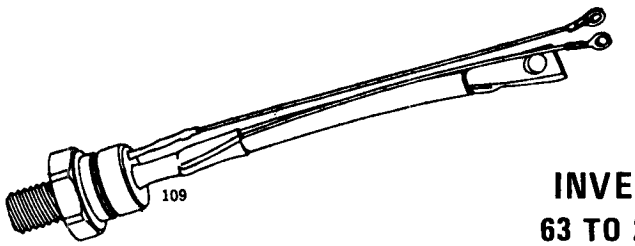
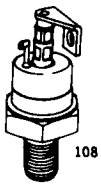
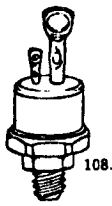



# INVERTER SCR's
## 63 TO 270 AMPERES



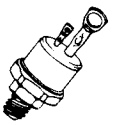

| GE TYPE | | C48/C148 | C49/C149 | C154, 156 | C155, 157 | C158, 159 | C164, 165 | C354, 355 | C358 |
|---|---|---|---|---|---|---|---|---|---|
| CONSTRUCTION | | ALL DIFFUSED | ALL DIFFUSED | AMPLIFYING GATE | AMPLIFYING GATE | AMPLIFYING GATE | AMPLIFYING GATE | AMPLIFYING GATE | AMPLIFYING GATE |
| **ELECTRICAL SPECIFICATIONS** | | | | | | | | | |
| VOLTAGE RANGE | | 600-1200 | 100-600 | 100-600 | 100-600 | 500-1200 | 100-600 | 100-800 | 500-1200 |
| **FORWARD CONDUCTION** | | | | | | | | | |
| $I_{T(RMS)}$ | Max. forward conduction sinusoidal @ $T_C$ = 65°C, 50% duty (A) | | | | | | | | |
| | @ 60 Hz | 110/63 | 110/63 | 110 | 110 | 110 | 110 | 270 | 225 |
| | @ 600 Hz | 110/63 | 110/63 | 110 | 110 | 110 | 110 | 250 | 225 |
| | @ 1200 Hz | 110/63 | 110/63 | 110 | 110 | 110 | 110 | 225 | 225 |
| | @ 2500 Hz | 110/63 | 110/63 | 110 | 110 | 100 | 110 | 150 | 175 |
| | @ 5000 Hz | 110/63 | 110/63 | 110 | 110 | 90 | 110 | – | 140 |
| $I_{TSM}$ | Max. peak one cycle, non-repetitive surge current (A) | 700 | 1000 | 1800 | 1800 | 1600 | 1800 | 1800 | 1600 |
| $I^2t$ | Max. $I^2t$ for fusing for 5 to 8.3 msec ($A^2$ sec) | 2000 | 4150 | 13,200 | 13,200 | 10,500 | 13,500 | 13,200 | 10,500 |
| $R\theta_{JC}$ | Max. thermal Impedance (°C) | .35 | .35 | .3 | .3 | .3 | .3 | .13 | .135 |
| $t_d + t_r$ | Typical turn-on time ($\mu$sec) | 2 | 2 | 2 | 2 | 5 | 2.0 | 2 | 5 |
| $t_q$ | Turn-off time @ rated voltage and $T_J$ $V_R$ = 50V min. ($\mu$sec) @ 20V/$\mu$sec reapplied | 30, 40 | 10, 15 | 10 | 20 | 30 | <10, 15 | 10 | 30 |
| | @ 100V/$\mu$sec reapplied | – | | 15 | 25 | 35 | <10, 15 | 15, 25 | 35 |
| | @ 200V/$\mu$sec reapplied | 40, 50 | 20, 25 | 20 | | 40 | 10, 20 | 20, – | 40 |
| di/dt | Critical rate-of-rise of on-state current (A/$\mu$sec) | 100 | 100 | 100 | 100 | 500 | 500 | 100 | 500 |
| $T_J$ | Junction operating temperature range (°C) | ← | | | | -40 to 125°C | | | → |
| **BLOCKING** | | | | | | | | | |
| dv/dt | Critical rate-of-rise off-state voltage exponential to rated $V_{DRM}$ @ Max. T (V/$\mu$sec) | 200 | 200 | 200 | 100 | 200 | 200 | 200 | 200 |
| **FIRING** | | | | | | | | | |
| $I_{GT}$ | Max. required gate current to trigger (mA) @ –40°C | 300 | 300 | 200 | 200 | 300 | 400 | 200 | 300 |
| | @ 125°C | 120 | 120 | 120 | 120 | 125 | 175 | 120 | 125 |
| $V_{GT}$ | Max. required voltage to trigger (V) @ –40°C | 3 | 3 | 3 | 3 | 5 | 5 | 3 | 5 |
| | @ 125°C (Min.) | .15 | .15 | .15 | .15 | .15 | .15 | .15 | .15 |
| **VOLTAGE TYPES** | | | | | | | | | |
| Repetitive Peak Forward and Reverse Voltages | | | | | | | | | |
| 100 | | | C49A<br>C149A | C154A<br>C156A | C155A<br>C157A | | C164A<br>C165A | C354A<br>C355A | |
| 150 | | | C49G<br>C149G | C154G<br>C156G | C155G<br>C157G | | | C354G<br>C355G | |
| 200 | | | C49B<br>C149B | C154B<br>C156B | C155B<br>C157B | | C164B<br>C165B | C354B<br>C355B | |
| 300 | | | C49C<br>C149C | C154C<br>C156C | C155C<br>C157C | | C164C<br>C165C | C354C<br>C355C | |
| 400 | | | C49D<br>C149D | C154D<br>C156D | C155D<br>C157D | | C164D<br>C165D | C354D<br>C355D | |
| 500 | | | C49E<br>C149E | C154E<br>C156E | C155E<br>C157E | C158E<br>C159E | C164E<br>C165E | C354E<br>C355E | C358E |
| 600 | | C48M<br>C148M | C49M<br>C149M | C154M<br>C156M | C155M<br>C157M | C158M<br>C159M | C164M<br>C165M | C354M<br>C355M | C358M |
| 700 | | C48S<br>C148S | | | | C158S<br>C159S | C165S | | C358S |
| 800 | | C48N<br>C148N | | | | C158N<br>C159N | C165N | | C358N |
| 900 | | C48T<br>C148T | | | | C158T<br>C159T | | | C358T |
| 1000 | | C48P<br>C148P | | | | C158P<br>C159P | | | C358P |
| 1100 | | C48PA<br>C148PA | | | | C158PA<br>C159PA | | | C358PA |
| 1200 | | C48PB<br>C148PB | | | | C158PB<br>C159PB | | | C358PB |
| PACKAGE TYPE | | ½"/¼" STUD | ½"/¼" STUD | ½" STUD | ½" STUD | ½" STUD | ½" STUD | ½" PRESS PAK | ½" PRESS PAK |
| PACKAGE OUTLINE NO. | | 109/108.1 | 109/108.1 | 109, 108 | 109, 108 | 109, 108 | 109 | 280 | 280 |

# *HIGH SPEED*
# Silicon Controlled Rectifier

**C148**

**1200 VOLTS** **63A RMS**

The General Electric C148 Silicon Controlled Rectifier is designed for power switching at high frequencies. This is an all-diffused device which is considerable smaller in size than comparably rated high power SCR's.



**FEATURES:**

- Fully characterized for operation inverter and chopper applications.
- High dv/dt with selections available.
- Excellent surge and $I^2t$ ratings providing easy fusing.
- Compact hermetic package, ¼ – 28 stud.

Equipment designers can use the C148 in demanding applications, such as:

- Choppers
- Inverters
- Induction Heaters
- High Frequency Lighting
- Cycloconverters
- DC to DC conversion

## MAXIMUM ALLOWABLE RATINGS

| TYPES | REPETITIVE PEAK OFF-STATE VOLTAGE, $V_{DRM}$[1] $T_J$ = -40°C to +125°C | REPETITIVE PEAK REVERSE VOLTAGE, $V_{RRM}$[1] $T_J$ = -40°C to +125°C | NON-REPETITIVE PEAK REVERSE VOLTAGE, $V_{RSM}$[1] $T_J$ = +125°C |
|---|---|---|---|
| C148M | 600 Volts | 600 Volts | 720 Volts |
| C148S | 700 | 700 | 840 |
| C148N | 800 | 800 | 960 |
| C148T | 900 | 900 | 1080 |
| C148P | 1000 | 1000 | 1200 |
| C148PA | 1100 | 1100 | 1320 |
| C148PB | 1200 | 1200 | 1440 |

[1] Half sinewave waveform, 10 ms max. pulse width.

RMS On-State Current, $I_{T(RMS)}$ . . . . . 63 Amperes
Peak One Cycle Surge (Non-Repetitive) On-State Current, $I_{TSM}$ (60 Hz) . . . . . 700 Amperes
Peak One Cycle Surge (Non-Repetitive) On-State Current, $I_{TSM}$ (50 Hz) . . . . . 670 Amperes
$I^2t$ (for fusing) for times ⩾ 1.5 milliseconds . . . . . 1360 (RMS Ampere)$^2$ Seconds
$I^2t$ (for fusing) for times ⩾ 8.3 milliseconds . . . . . 2000 (RMS Ampere)$^2$ Seconds
Critical Rate-of-Rise of On-State Current, Non-Repetitive. . . . . 100 A/μs †
Critical Rate-of-Rise of On-State Current, Repetitive . . . . . 75 A/μs †
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 . . . . . 30 Lb.-In.
3.4 N-m

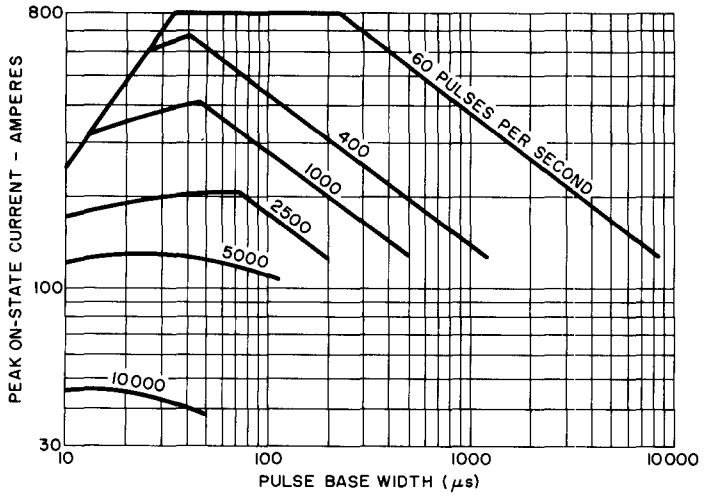
†di/dt ratings established in accordance with EIA-NEMA Standard RS-397, Section 5.2.2.6 for conditions of max. rated $V_{DRM}$; 20 volts, 20 ohms gate trigger source with 0.5μs short circuit trigger current rise time.

## CHARACTERISTICS

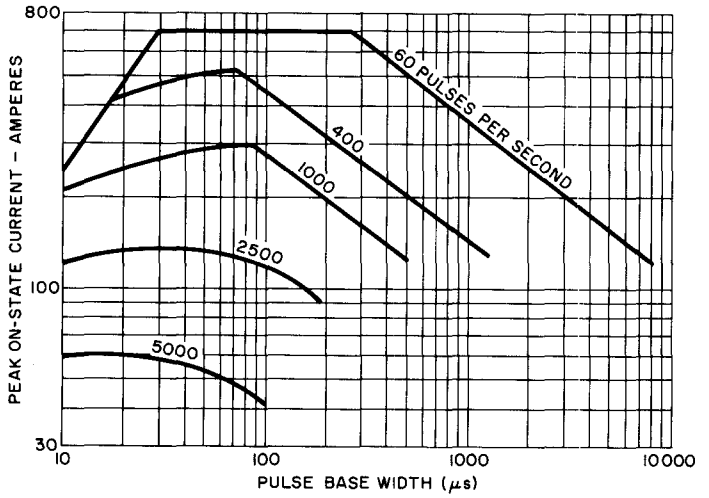
| TEST | SYMBOL | MIN. | TYP. | MAX. | UNITS | TEST CONDITIONS |
|---|---|---|---|---|---|---|
| Repetitive Peak Reverse and Off-State Current | $I_{RRM}$ and $I_{DRM}$ | – | 7 | 12 | mA | $T_J$ = -40°C to +125°C, $V = V_{DRM} = V_{RRM}$ |
| Thermal Resistance | $R_{\theta JC}$ | – | – | .35 | °C/Watt | Junction-to-Case |
| Critical Rate-of-Rise of Off-State Voltage (Higher values may cause device switching) | dv/dt | 200 | – | – | V/μsec | $T_J$ = +125°C, Gate Open. $V_{DRM}$ = Rated using Linear or Exponential Rising Waveform. Exponential $dv/dt = \frac{V_{DRM}}{\tau}$ (.632) |
| Higher minimum dv/dt selections available – consult factory. | | | | | | |
| DC Gate Trigger Current | $I_{GT}$ | – | – | 150 | mAdc | $T_C$ = +25°C, $V_D$ = 6 Vdc, $R_L$ = 3 Ohms |
| | | – | – | 300 | | $T_C$ = -40°C, $V_D$ = 6 Vdc, $R_L$ = 3 Ohms |
| | | – | – | 125 | | $T_C$ = +125°C, $V_D$ = 6 Vdc, $R_L$ = 3 Ohms |
| DC Gate Trigger Voltage | $V_{GT}$ | – | – | 3.0 | Vdc | $T_C$ = 25°C, $V_D$ = 6 Vdc, $R_L$ = 3 Ohms |
| | | – | – | 3.5 | | $T_C$ = -40°C, $V_D$ = 6 Vdc, $R_L$ = 3 Ohms |
| | | 0.25 | – | – | | $T_C$ = +125°C, Rated $V_{DRM}$, $R_L$ = 1000 Ohms |
| Peak On-State Voltage | $V_{TM}$ | – | – | 4.0 | Volts | $T_C$ = +25°C, $I_{TM}$ = 500 Amps Peak, 1 millisecond wide pulse. Duty cycle ≤ 1% |
| Conventional Circuit Commutated Turn-Off Time | $t_q$ | | | | μsec | (1) $T_C$ = +125°C<br>(2) $I_{TM}$ = 150 Amps.<br>(3) $V_R$ = 50 Volts Min.<br>(4) $V_{DRM}$ (Reapplied)<br>(5) Rate-of-Rise of Reapplied Off-State Voltage = 20 V/μsec (linear).<br>(6) Commutation di/dt = 5 Amps/μsec<br>(7) Repetition Rate = 1 pps.<br>(8) Gate Bias During Turn-Off Interval = 0 Volts, 100 Ohms |
| C148 – 30 | | – | – | 30 | | |
| C148 – 40 | | – | – | 40 | | |
| C148 – 30 | | – | 38 | † | | (1) $T_C$ = +125°C<br>(2) $I_{TM}$ = 150 Amps<br>(3) $V_R$ = 50 Volts Min.<br>(4) $V_{DRM}$ (Reapplied)<br>(5) Rate-of-Rise of Reapplied Off-State Voltage = 200 V/μsec (linear).<br>(6) Commutation di/dt = 5 Amps/μsec.<br>(7) Repetition Rate = 1 pps.<br>(8) Gate Bias During Turn-Off Interval = 0 Volts, 100 Ohms. |
| C148 – 40 | | – | 48 | † | | |
| Conventional Circuit Commutated Turn-Off Time (with Feedback Diode) | $t_q$ | | | | μsec | (1) $T_C$ = +125°C<br>(2) $I_{TM}$ = 150 Amps<br>(3) $V_R$ = 1 volt<br>(4) $V_{DRM}$ (Reapplied)<br>(5) Rate-of-Rise of Off-State Voltage = 200 V/μsec (linear).<br>(6) Commutation di/dt = 5 Amps/μsec.<br>(7) Repetition Rate = 1 pps.<br>(8) Gate Bias During Turn-Off Interval = 0 Volts, 100 Ohms. |
| C148 – 30 | | – | 45 | – | | |
| C148 – 40 | | – | 55 | – | | |

†Consult factory for a specified maximum turn-off time.

## SINE WAVE CURRENT RATING DATA



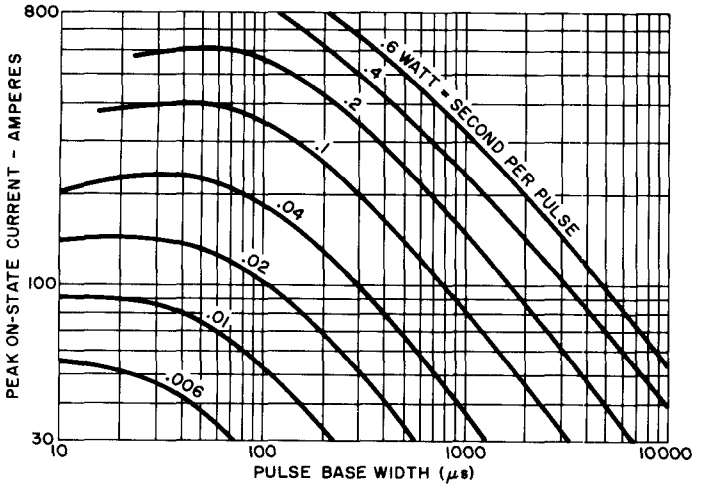

**1. Maximum allowable peak on-state current vs. pulse width ($T_C$ = 65°C)**




**2. Maximum allowable peak on-state current vs. pulse width ($T_C$ = 90°C)**

**NOTES:**
**(Pertaining to Sine and Rectangular Wave Current Ratings)**

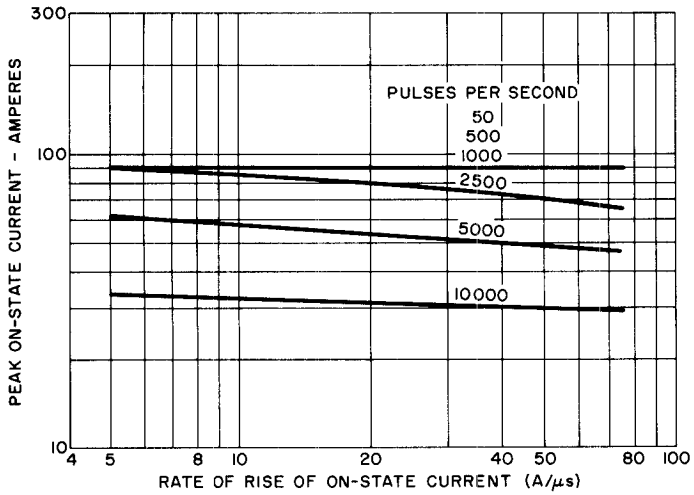
1. Switching voltage = 800 volts.
2. Maximum ckt. dv/dt = 200 volts/μsec.
3. Reverse voltage applied = $V_R \leqslant 800$ volts.
4. R-C Snubber ckt. = .25 μf, 20Ω.




**3. Energy per pulse for sinusoidal pulses ($T_J$ = 125°C)**

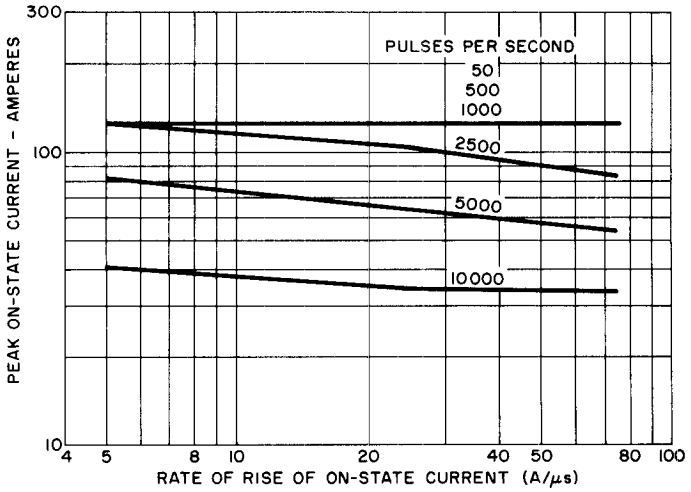
# RECTANGULAR WAVE CURRENT RATING

## 50% DUTY CYCLE

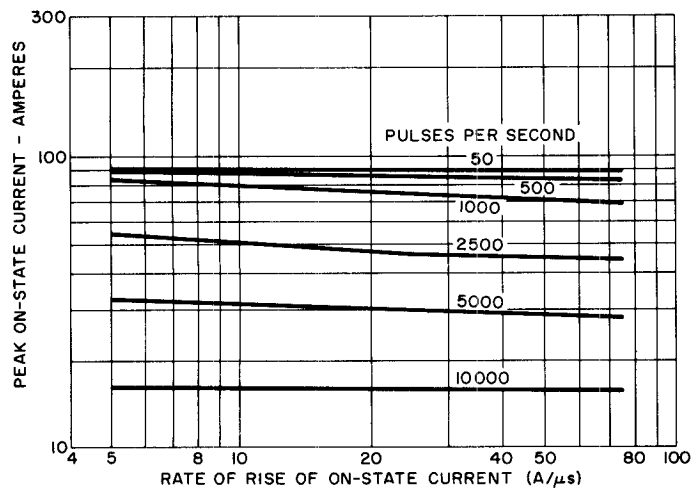



**4. Maximum allowable peak on-state current vs. di/dt ($T_C$ = 65°C)**

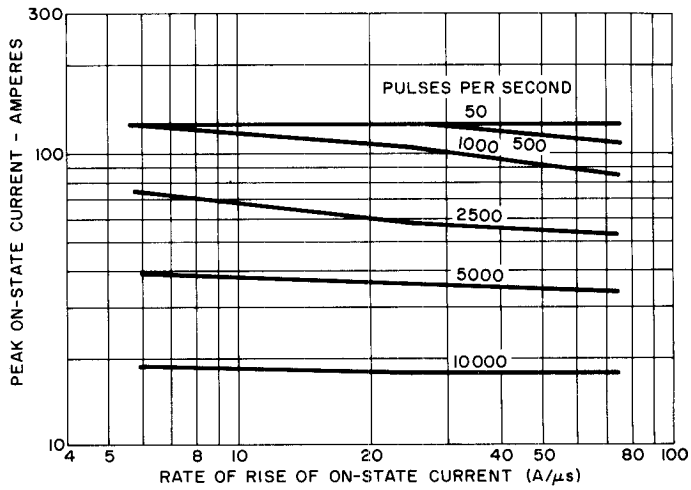
## 25% DUTY CYCLE




**5. Maximum allowable peak on-state current vs. di/dt ($T_C$ = 65°C)**

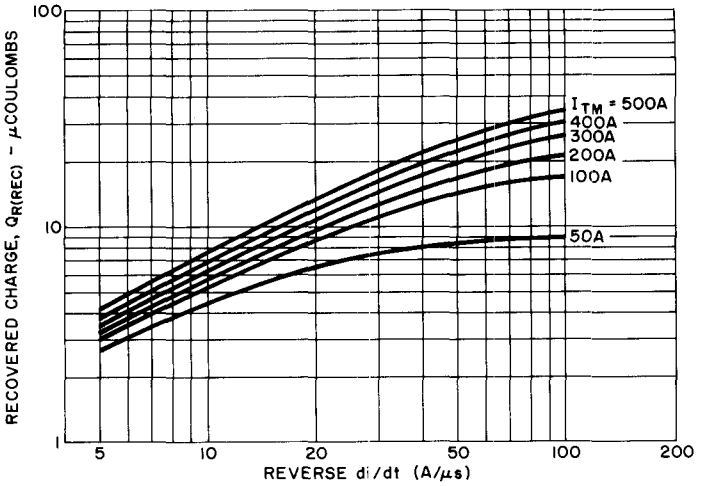



**6. Maximum allowable peak on-state current vs. di/dt ($T_C$ = 90°C)**

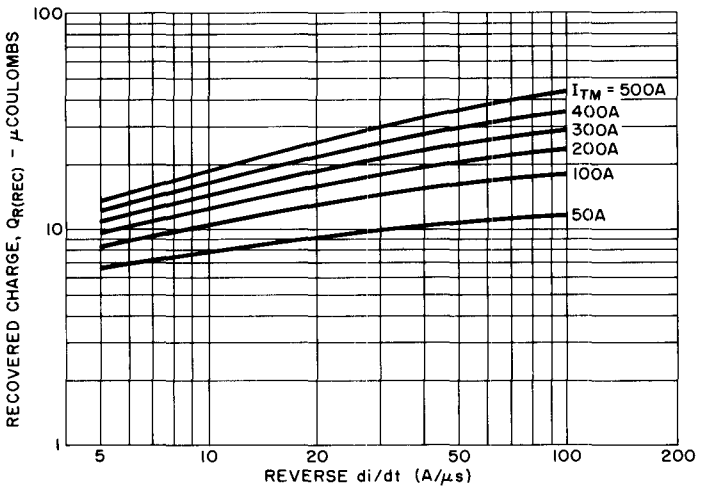



**7. Maximum allowable peak on-state current vs. di/dt ($T_C$ = 90°C)**

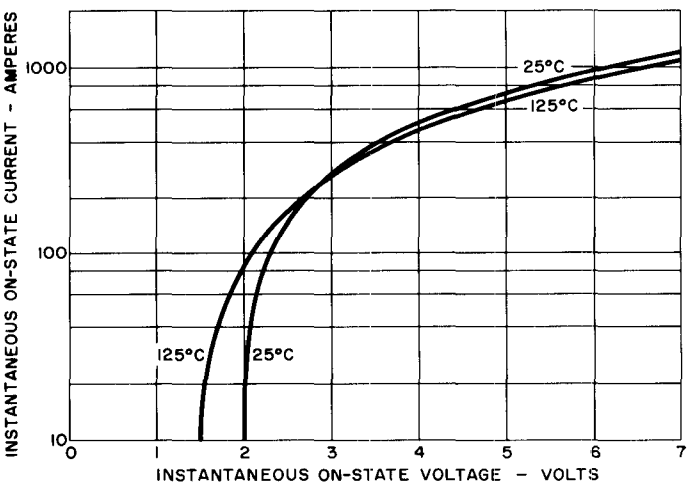
## RECOVERED CHARGE DATA



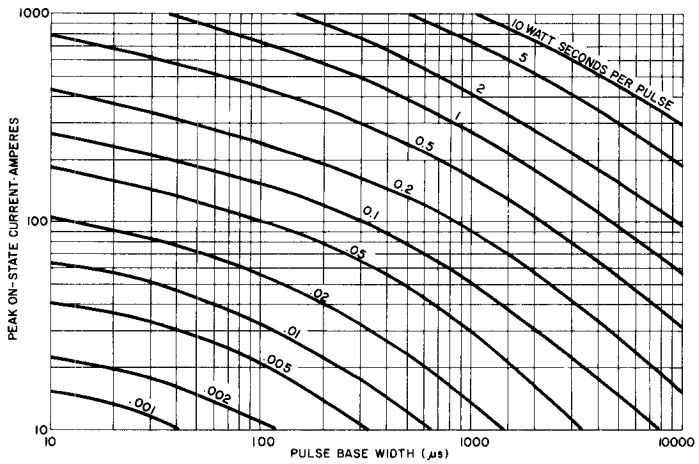

**11. Typical recovered charge data ($T_J$ = 25°C)**
**(Sinewave Current Waveform)**



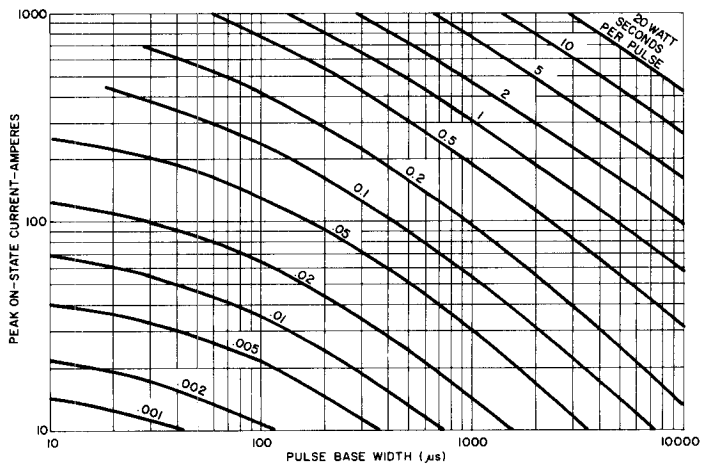

**12. Typical recovered charge data ($T_J$ = 125°C)**
**(Sinewave Current Waveform)**



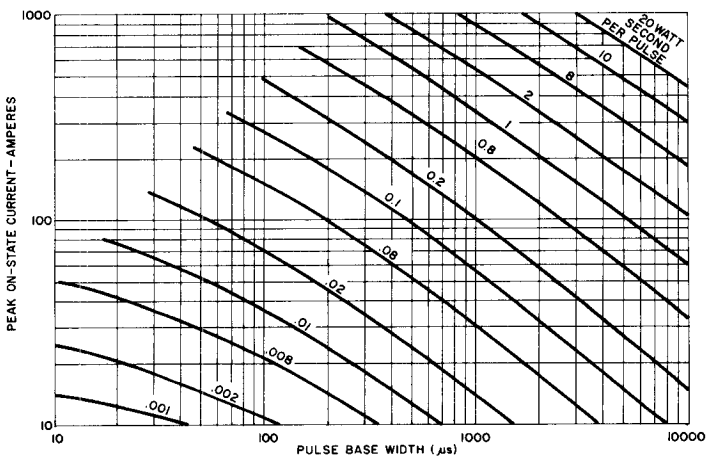

**13. Maximum On-State Characteristics**



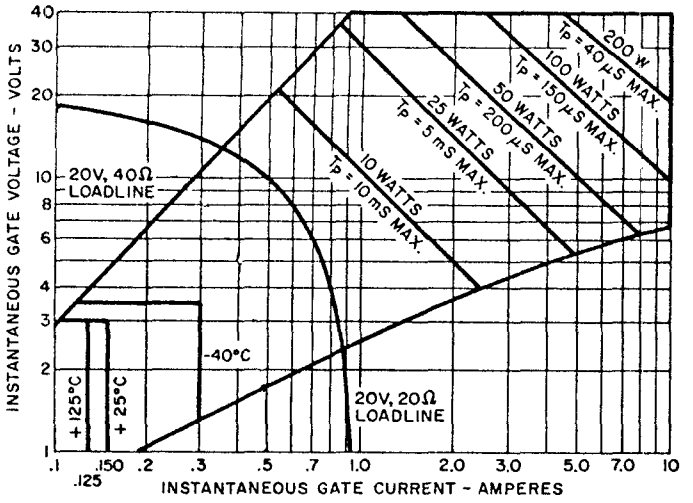

**8. Energy per pulse vs. peak current and pulse width (di/dt = 100A/μsec)**
**$T_J$ = 125°C**




**9. Energy per pulse vs. peak current and pulse width (di/dt = 25A/μsec)**
**$T_J$ = 125°C**



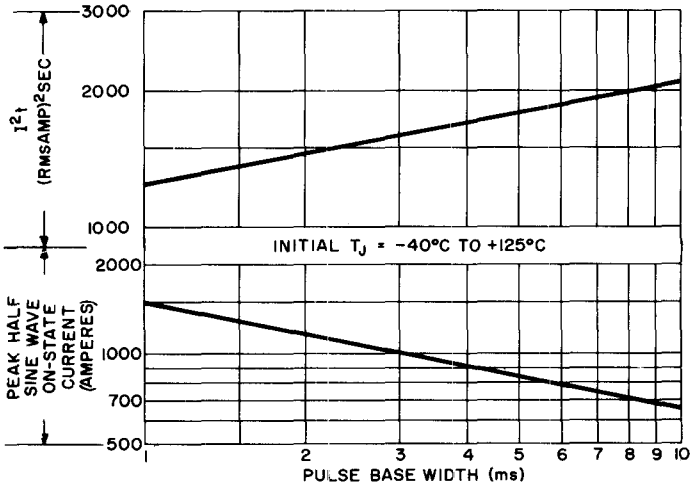

**10. Energy per pulse vs. peak current and pulse width (di/dt = 5A/μsec)**
**$T_J$ = 125°C**



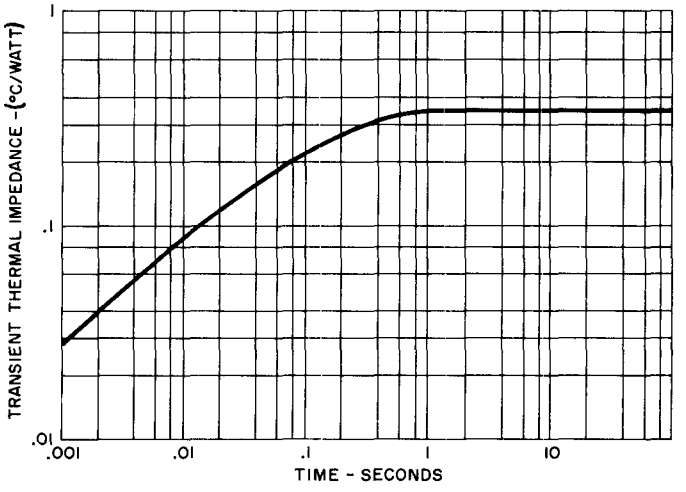

**NOTES:**

1. Locus of possible DC trigger points lies outside the boundaries shown at the various case temperatures.
2. Rectangular gate pulses.
3. $T_p$ = gate current pulse width.

**14. Gate Trigger Characteristics and Power Rating**

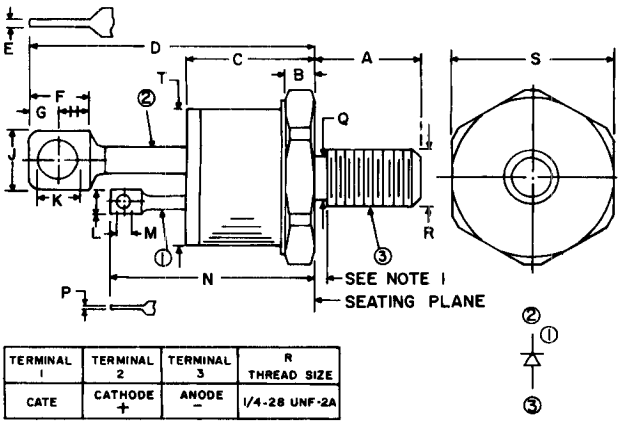



**15. Sub-Cycle Surge (Non-Repetitive) On-State Current And $I^2t$ Rating**




**16. Transient Thermal Impedance — Junction-To-Case**

# OUTLINE DRAWING




| TERMINAL 1 | TERMINAL 2 | TERMINAL 3 | R THREAD SIZE |
|---|---|---|---|
| CATE | CATHODE + | ANODE − | 1/4-28 UNF-2A |

NOTE: 1. COMPLETE THREADS TO WITHIN 2 1/2 THD. OF SEATING PLANE.
2. ONE STEEL, CADMIUM PLATED NUT AND ONE STEEL, CADMUIM PLATED LOCKWASHER SUPPLIED WITH EACH DEVICE.

| SYM. | INCHES MIN. | INCHES MAX. | METRIC MM MIN. | METRIC MM MAX. | SYM. | INCHES MIN. | INCHES MAX. | METRIC MM MIN. | METRIC MM MAX. |
|---|---|---|---|---|---|---|---|---|---|
| A | .422 | .452 | 10.72 | 11.47 | L | .090 | .115 | 2.29 | 2.91 |
| B | .120 | .135 | 3.05 | 3.42 | M | .055 | .066 | 1.40 | 1.67 |
| C | .534 | .565 | 13.57 | 14.34 | N | .831 | .901 | 21.11 | 22.88 |
| D | 1.230 | 1.290 | 31.25 | 32.78 | P | .012 | — | .31 | — |
| E | .029 | .062 | .74 | 1.56 | Q | .220 | — | 5.59 | — |
| F | .258 | REF. | 6.55 | REF. | S | .676 | .684 | 17.18 | 17.36 |
| G | .138 | REF. | 3.50 | REF. | T | — | .597 | — | 15.15 |
| H | .115 | — | 2.83 | — | | | | | |
| J | .240 | .300 | 6.10 | 7.62 | | | | | |
| K | .169 | .182 | 4.30 | 4.62 | | | | | |