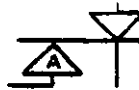


# High Power 77 mm THYRISTORS

|             |
|-------------|
| C781        |
| C782 / C785 |
| C784 / C787 |

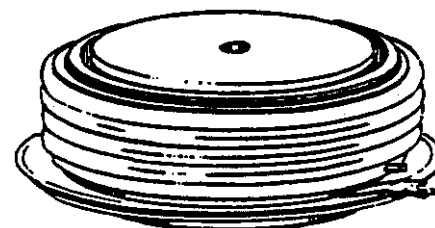
$$I_{T(AV)} = 1650 - 2500A / V_{DRM}, V_{RRM} = 1800V - 4400V$$

AMPLIFYING GATE



The C781, C782, & C784 group of reverse blocking thyristors feature a nominal 77mm silicon junction design having an exclusive linear amplifying gate. These are manufactured by the proven multi-diffusion process to optimize high blocking voltage capability with low on state voltage and recovery characteristics.

These are commonly used for phase controlled applications such as DC motor control power supplies, cycloconverters and load commutated inverters.



**THYRISTOR (SCR) PRESSPAK**

See package styles on page 8  
height  
1.0 inch C785, C787  
1.4 inch C781, C782, C784

## MAXIMUM ALLOWABLE RATINGS

| TYPE   | REPETITIVE PEAK OFF-STATE<br>AND REVERSE VOLTAGE<br>$V_{DRM}/V_{RRM}^1$<br>$T_J = -40^\circ C$ to $+125^\circ C$ | REPETITIVE PEAK OFF-STATE<br>AND REVERSE VOLTAGE<br>$V_{DRM}/V_{RRM}^1$<br>$T_J = 0^\circ C$ to $+125^\circ C$ | $V_{TM}^2$ @ 2 KA<br>$T_J = 125^\circ C$ | $I_{TSM}^3$ | $I_{AV}^4$<br>$T_C = 70^\circ C$ |
|--------|------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|------------------------------------------|-------------|----------------------------------|
|        |                                                                                                                  |                                                                                                                |                                          | 8.3ms/10ms  |                                  |
| C784DD | 4400 Volts                                                                                                       | 4500 Volts                                                                                                     | 1.85 V                                   | 26KA/24KA   | 1650A                            |
| C784DC | 4300                                                                                                             | 4400                                                                                                           |                                          |             |                                  |
| C784DB | 4200                                                                                                             | 4300                                                                                                           |                                          |             |                                  |
| C784DA | 4100                                                                                                             | 4200                                                                                                           |                                          |             |                                  |
| C784DP | 4000                                                                                                             | 4100                                                                                                           |                                          |             |                                  |
| C784CT | 3900                                                                                                             | 4000                                                                                                           |                                          |             |                                  |
| C784CN | 3800                                                                                                             | 3900                                                                                                           |                                          |             |                                  |
| C784CS | 3700                                                                                                             | 3800                                                                                                           |                                          |             |                                  |
| C784CM | 3600                                                                                                             | 3700                                                                                                           |                                          |             |                                  |
| C782LS | 2700                                                                                                             | 2800                                                                                                           | 1.35V                                    | 35KA/32KA   | 2300A                            |
| C782LM | 2600                                                                                                             | 2700                                                                                                           |                                          |             |                                  |
| C782LE | 2500                                                                                                             | 2600                                                                                                           |                                          |             |                                  |
| C782LD | 2400                                                                                                             | 2500                                                                                                           |                                          |             |                                  |
| C781LA | 2100 Volt                                                                                                        | 2200 Volt                                                                                                      | 1.20V                                    | 45KA/41.5KA | 2500A                            |
| C781L  | 2000                                                                                                             | 2100                                                                                                           |                                          |             |                                  |
| C781PT | 1900                                                                                                             | 2000                                                                                                           |                                          |             |                                  |
| C781PN | 1800                                                                                                             | 1900                                                                                                           |                                          |             |                                  |

Externally applied mounting force..... 7000-9000 lb. 31.1-40.0 KN

DC Thermal Resistance Junction to case,  $R_{thj-c}$ .....  $0.012^\circ C/W$

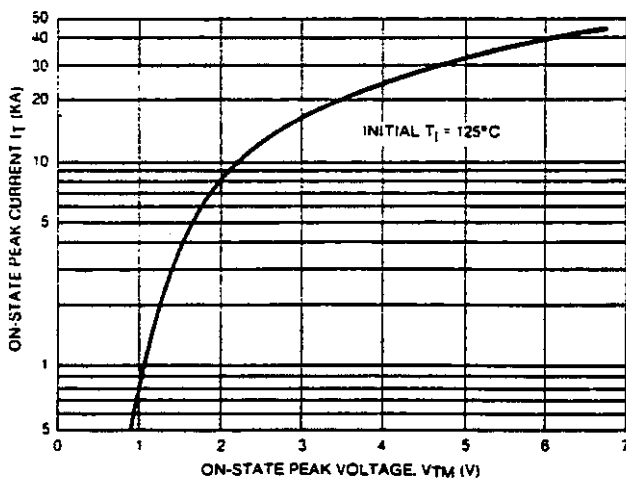
Storage Temperature .....  $-40^\circ$  to  $+150^\circ C$

### NOTES:

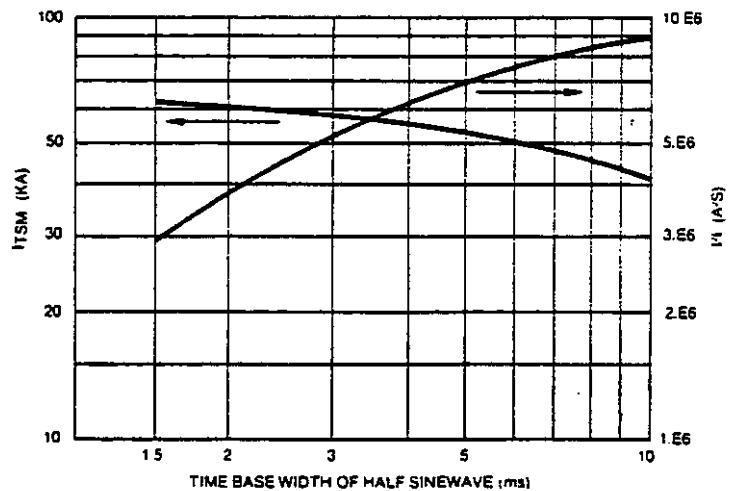
1. Sinusoidal waveform 50/60Hz. Device under test must be assembled with recommended mounting force to a heat dissipator at less than  $0.3^\circ C/W$ .
2. Instantaneous peak values, half sine (8.3 ms - 10 ms) or trapezoidal (30 A/ $\mu s$ ,  $\leq 2.5$  msec)
3. Non-repetitive surge current rating - crest of half sinewave.
4. Full cycle average current - continuous half sinewave @ 50/60Hz (see mounting instruction).

## C781 CHARACTERISTICS

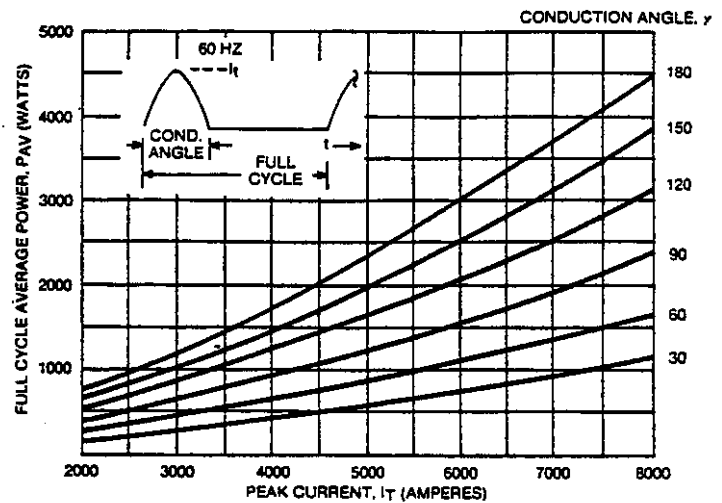
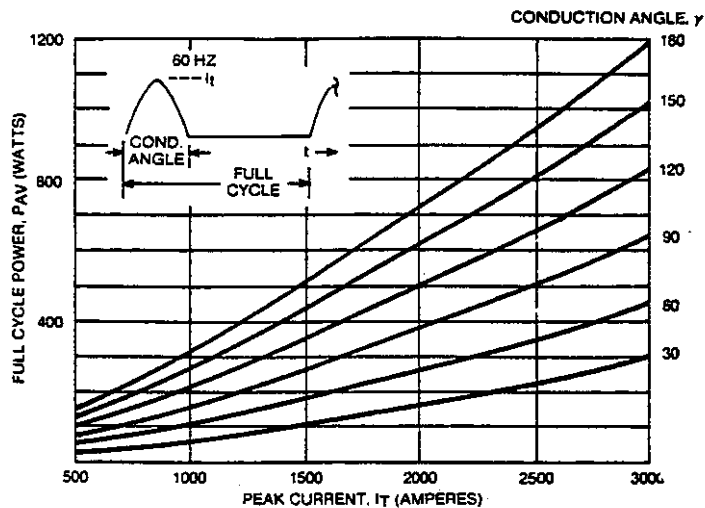
| CHARACTERISTIC                                                                                         | SYMBOL                 | UNITS     | MIN.              | TYPE              | MAX.               | TEST CONDITIONS                                                                                                                                       |
|--------------------------------------------------------------------------------------------------------|------------------------|-----------|-------------------|-------------------|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Peak Off-state Current                                                                                 | $I_{DRM}$<br>$I_{DRM}$ | ma<br>ma  |                   |                   | 10<br>150          | $T_j = 25^\circ\text{C}$ Gate Opened<br>$= 125^\circ\text{C}$ Gate Opened                                                                             |
| Peak Reverse Current                                                                                   | $I_{RRM}$<br>$I_{RRM}$ | ma<br>ma  |                   |                   | 10<br>150          | $T_j = 25^\circ\text{C}$ Gate Opened<br>$= 125^\circ\text{C}$ Gate Opened                                                                             |
| Critical exponential rate of rise of off-state voltage (higher rates may cause destructive switching). | $dv/dt$                | $V/\mu s$ | 500               |                   |                    | $T_j = 125^\circ\text{C}$ $V_D = 0.8V_{DRM}$<br>open gate                                                                                             |
| Delay Time                                                                                             | $t_d$                  | $\mu s$   | 1.5               | 2.5               | 3.0                | $T_j = 125^\circ\text{C}$ , $V_D = 1500V$                                                                                                             |
| Gate Trigger Current                                                                                   | $I_{GT}$               | ma        |                   |                   | 250                | $T_j = 25^\circ\text{C}$ , $V_D = 12V$ DC                                                                                                             |
| Gate Trigger Voltage                                                                                   | $V_{GT}$               | V         |                   |                   | 4.2                |                                                                                                                                                       |
| Non-Trigger Current                                                                                    | $I_{GDM}$              | ma        | 15                |                   |                    | $T_j = 125^\circ\text{C}$ , $V_D = 1000V$<br>AC Crest                                                                                                 |
| Non-Trigger Voltage                                                                                    | $V_{GDM}$              | V         | 0.5               |                   |                    |                                                                                                                                                       |
| Operational Gate Current. Voltage requirement                                                          | $I_{GA}$<br>$V_{GA}$   | A<br>V    | 1.1<br>13         |                   |                    | Gate source:<br>- open circuit - 30V<br>- short circuit - 2A<br>- rise time $\approx 0.5\mu s$<br>- duration $t_p > t_d$                              |
| Conventional Circuit Commutating Turn-off time (with reverse voltage)                                  | $t_q$                  | $\mu s$   |                   | 250               | 400                | $T_j = 125^\circ\text{C}$ , $I_T = 2000$ A<br>$t_p > 2ms$<br>$di/dt = 5A/\mu s$<br>$V_r = 100V$<br>$dv/dt = 1000V/\mu s$<br>$V$ reapplied = 1000V     |
| Holding Current                                                                                        | $I_H$                  | ma        | 40<br>24<br>20    | 60<br>36<br>30    | 150<br>90<br>75    | $T_j = 25^\circ\text{C}$ , $di/dt = -5ma/\mu s$<br>$105^\circ\text{C}$ , $E_{rms} = 7.5V_{rms}$<br>$125^\circ\text{C}$ , $R = 10$ ohms<br>Freq = 60Hz |
| Latching Current                                                                                       | $I_L$                  | ma        | 250<br>155<br>130 | 400<br>250<br>210 | 1000<br>620<br>530 | $T_j = 25^\circ\text{C}$ , Gate Drive<br>$105^\circ\text{C}$ , 30V 10 ohms<br>$125^\circ\text{C}$ , duration 15 $\mu s$                               |



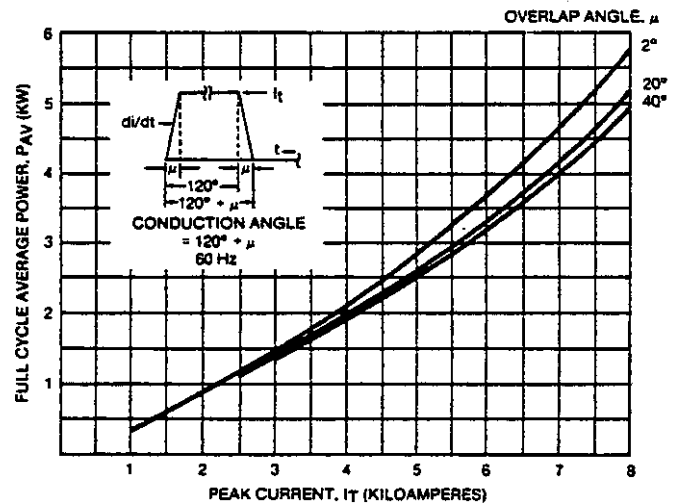
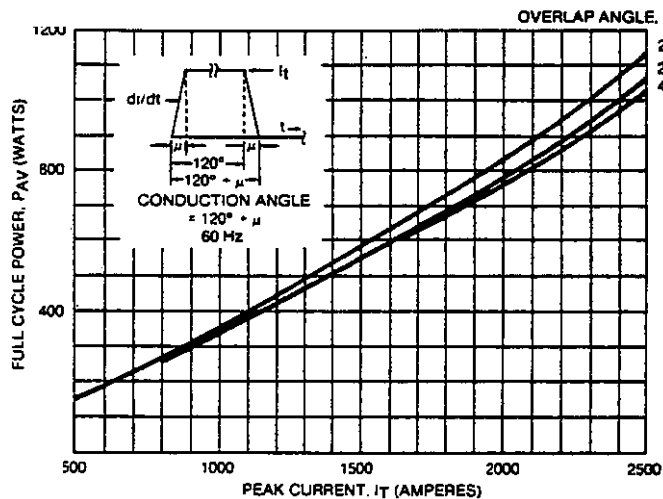
**MAXIMUM FORWARD CONDUCTION  
CHARACTERISTIC ON-STATE**



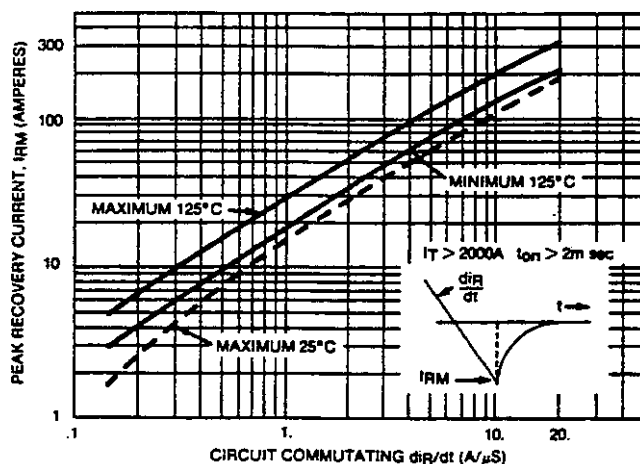
**NON-REPETITIVE  $I_{TSM}$  and  $I^2t$  CAPABILITY  
FOR FUSE COORDINATION**



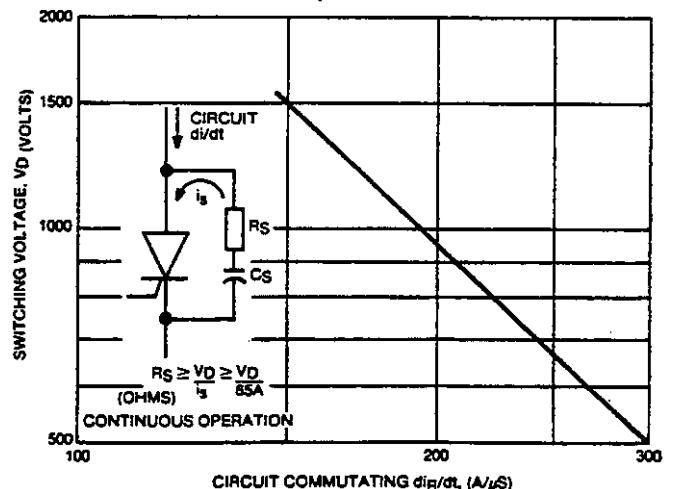
**MAXIMUM FULL CYCLE AVERAGE POWER DISSIPATION FOR SINEWAVE CURRENT AT VARIOUS CONDUCTING ANGLES. EFFECT OF VARIABLE CONDUCTING AREA IS INCLUDED. (DIGITAL DATA IS AVAILABLE)**



**MAXIMUM FULL CYCLE AVERAGE POWER DISSIPATION FOR THREE PHASE RECTIFIER (120° CONDUCTION) AT SEVERAL OVERLAP ANGLES, " $\mu$ ". EFFECT OF VARIABLE CONDUCTING AREA IS INCLUDED. (DIGITAL DATA IS AVAILABLE)**



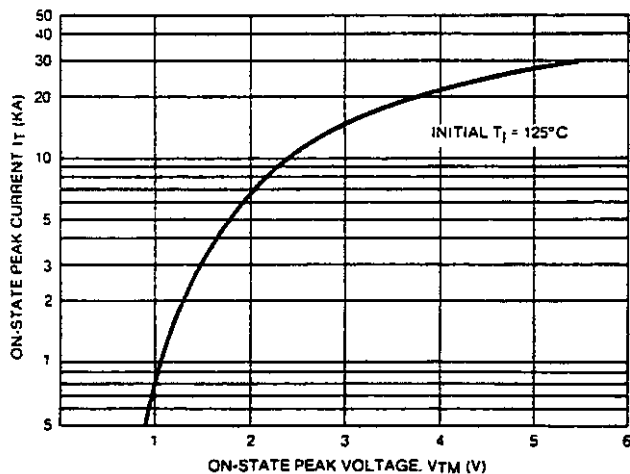
**PEAK RECOVERY CURRENT VERSUS COMMUTATING CIRCUIT DI/DT**



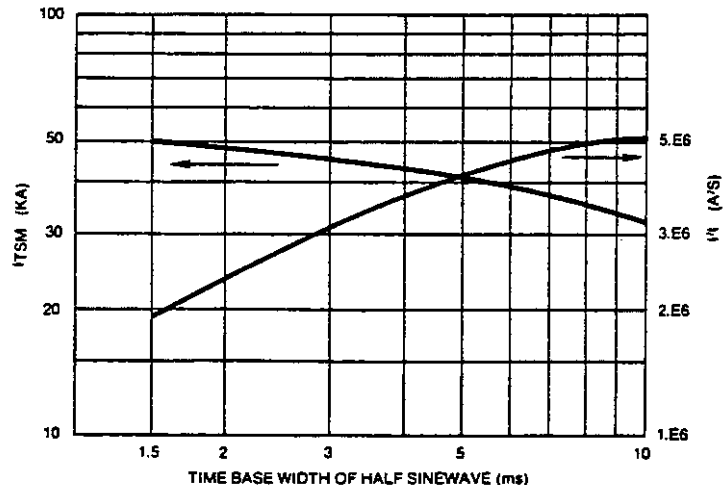
**MAXIMUM ALLOWABLE REPETITIVE DI/DT AS FUNCTION OF ANODE VOLTAGE BIAS. LIMITATION ON ADDITIONAL SNUBBER DISCHARGE IS INDICATED.**

## C782 / C785 CHARACTERISTICS

| CHARACTERISTIC                                                                                         | SYMBOL                 | UNITS                  | MIN.              | TYPE              | MAX.               | TEST CONDITIONS                                                                                                                                                                                   |
|--------------------------------------------------------------------------------------------------------|------------------------|------------------------|-------------------|-------------------|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Peak Off-state Current                                                                                 | $I_{DRM}$<br>$I_{DRM}$ | ma<br>ma               |                   |                   | 10<br>150          | $T_j = 25^\circ\text{C}$ Gate Opened<br>$= 125^\circ\text{C}$ Gate Opened                                                                                                                         |
| Peak Reverse Current                                                                                   | $I_{RRM}$<br>$I_{RRM}$ | ma<br>ma               |                   |                   | 10<br>150          | $T_j = 25^\circ\text{C}$ Gate Opened<br>$= 125^\circ\text{C}$ Gate Opened                                                                                                                         |
| Critical exponential rate of rise of off-state voltage (higher rates may cause destructive switching). | $dv/dt$                | $\text{V}/\mu\text{s}$ | 500               |                   |                    | $T_j = 125^\circ\text{C}$ , $V_D = 0.8V_{DRM}$<br>open gate                                                                                                                                       |
| Delay Time                                                                                             | $t_d$                  | $\mu\text{s}$          | 1.5               | 2.5               | 3.0                | $T_j = 125^\circ\text{C}$ , $V_D = 1800\text{V}$                                                                                                                                                  |
| Gate Trigger Current                                                                                   | $I_{GT}$               | ma                     |                   |                   | 250                | $T_j = 25^\circ\text{C}$ , $V_D = 12\text{V DC}$                                                                                                                                                  |
| Gate Trigger Voltage                                                                                   | $V_{GT}$               | V                      |                   |                   | 4.2                |                                                                                                                                                                                                   |
| Non-Trigger Current                                                                                    | $I_{GDM}$              | ma                     | 15                |                   |                    | $T_j = 125^\circ\text{C}$ , $V_D = 1300\text{V}$<br>AC Crest                                                                                                                                      |
| Non-Trigger Voltage                                                                                    | $V_{GDM}$              | V                      | 0.5               |                   |                    |                                                                                                                                                                                                   |
| Operational Gate Current - Voltage requirement                                                         | $I_{GA}$<br>$V_{GA}$   | A<br>V                 | 1.1<br>13         |                   |                    | Gate source:<br>- open circuit - 30V<br>- short circuit - 2A<br>- rise time $\approx 0.5\mu\text{s}$<br>- duration $t_p > t_d$                                                                    |
| Conventional Circuit Commutating Turn-off time (with reverse voltage)                                  | $t_q$                  | $\mu\text{s}$          |                   | 250               | 400                | $T_j = 125^\circ\text{C}$ , $I_T = 2000\text{ A}$<br>$t_p > 2\text{ms}$<br>$di/dt = 5\text{A}/\mu\text{s}$<br>$V_r = 100\text{V}$<br>$dv/dt = 1000\text{V}/\mu\text{s}$<br>$V$ reappplied = 1500V |
| Holding Current                                                                                        | $I_H$                  | ma                     | 40<br>24<br>20    | 70<br>42<br>35    | 200<br>120<br>100  | $T_j = 25^\circ\text{C}$ , $di/dt = -.5\text{ma}/\mu\text{s}$<br>$105^\circ\text{C}$ , $E_{rms} = 7.5\text{Vrms}$<br>$125^\circ\text{C}$ , $R = 10\text{ ohms}$<br>Freq = 60Hz                    |
| Latching Current                                                                                       | $I_L$                  | ma                     | 300<br>210<br>190 | 600<br>420<br>375 | 1000<br>700<br>630 | $T_j = 25^\circ\text{C}$ , Gate Drive<br>$105^\circ\text{C}$ , 30V / 10 ohms<br>$125^\circ\text{C}$ , duration 15 $\mu\text{s}$                                                                   |



**MAXIMUM FORWARD CONDUCTION  
CHARACTERISTIC ON-STATE**

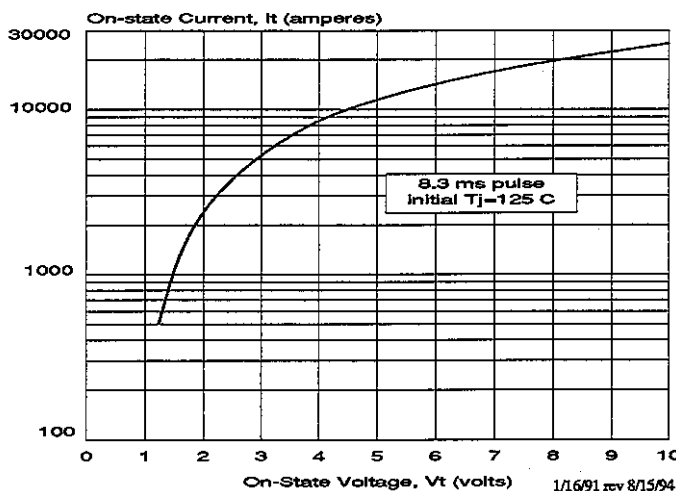


**NON-REPETITIVE  $I_{TSM}$  and  $I^2t$  CAPABILITY  
FOR FUSE COORDINATION**

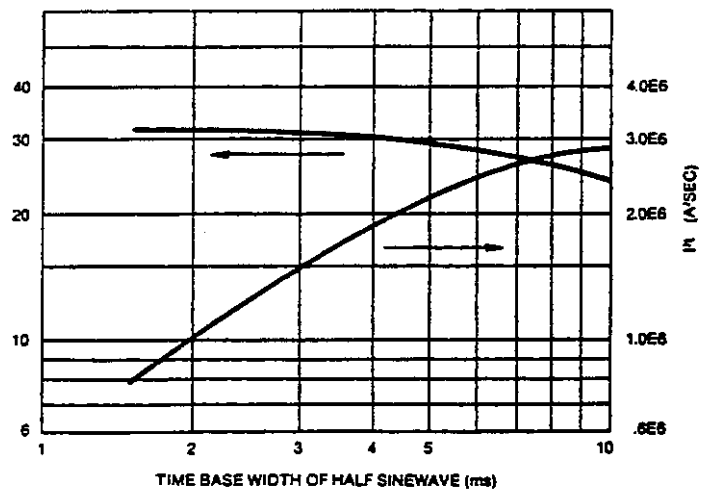
## C784 / C787 CHARACTERISTICS

| CHARACTERISTIC                                                                                         | SYMBOL                 | UNITS     | MIN.              | TYPE              | MAX.               | TEST CONDITIONS                                                                                                                                  |
|--------------------------------------------------------------------------------------------------------|------------------------|-----------|-------------------|-------------------|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Peak Off-state Current                                                                                 | $I_{DRM}$<br>$I_{DRM}$ | ma<br>ma  |                   |                   | 20<br>300          | $T_j = 25^\circ\text{C}$ Gate Opened<br>$= 125^\circ\text{C}$ Gate Opened                                                                        |
| Peak Reverse Current                                                                                   | $I_{RRM}$<br>$I_{RRM}$ | ma<br>ma  |                   |                   | 20<br>200          | $T_j = 25^\circ\text{C}$ Gate Opened<br>$= 125^\circ\text{C}$ Gate Opened                                                                        |
| Critical exponential rate of rise of off-state voltage (higher rates may cause destructive switching). | $dv/dt$                | $V/\mu s$ | 1000              |                   |                    | $T_j = 125^\circ\text{C}$ , $V_D = 0.7V_{DRM}$ open gate                                                                                         |
| Delay Time                                                                                             | $t_d$                  | $\mu s$   | 1.5               | 2.5               | 3.0                | $T_j = 125^\circ\text{C}$ , $V_D = 2000V$                                                                                                        |
| Gate Trigger Current*                                                                                  | $I_{GT}$               | ma        |                   |                   | 300                | $T_j = 25^\circ\text{C}$ , $V_D = 12V$ DC                                                                                                        |
| Gate Trigger Voltage*                                                                                  | $V_{GT}$               | V         |                   |                   | 4.5                |                                                                                                                                                  |
| Non-Trigger Current                                                                                    | $I_{GDM}$              | ma        | 15                |                   |                    | $T_j = 115^\circ\text{C}$ , $V_D = 2000V$<br>AC Crest                                                                                            |
| Non-Trigger Voltage                                                                                    | $V_{GDM}$              | V         | 0.8               |                   |                    |                                                                                                                                                  |
| Operational Gate Current. Voltage requirement                                                          | $I_{GA}$<br>$V_{GA}$   | A<br>V    | 1.5<br>25         |                   |                    | Gate source:<br>- open circuit - 40V<br>- short circuit - 4A<br>- rise time $\approx 0.5\mu s$<br>- duration $t_p > t_d$                         |
| Conventional Circuit Commutating Turn-off time (with reverse voltage)                                  | $t_q$                  | $\mu s$   |                   |                   | 400                | $T_j = 100^\circ\text{C}$ , $I_T = 2000A$<br>$t_p > 2ms$<br>$di/dt = 5A/\mu s$<br>$V_r = 100V$<br>$dv/dt = 1000V/\mu s$<br>$V$ reapplied = 2000V |
| Holding Current                                                                                        | $I_H$                  | ma        | 45<br>27<br>22    | 80<br>48<br>40    | 250<br>150<br>125  | $T_j = 25^\circ\text{C}$ , $di/dt = -.5ma/\mu s$<br>$105^\circ\text{C}$ , $E = 7.5V_{rms}$<br>$125^\circ\text{C}$ , $R = 10$ ohms<br>Freq = 60Hz |
| Latching Current                                                                                       | $I_L$                  | ma        | 300<br>225<br>205 | 450<br>340<br>310 | 1000<br>750<br>690 | $T_j = 25^\circ\text{C}$ Gate Drive<br>$105^\circ\text{C}$ 30V/10 ohms<br>$125^\circ\text{C}$ duration 15 $\mu s$                                |

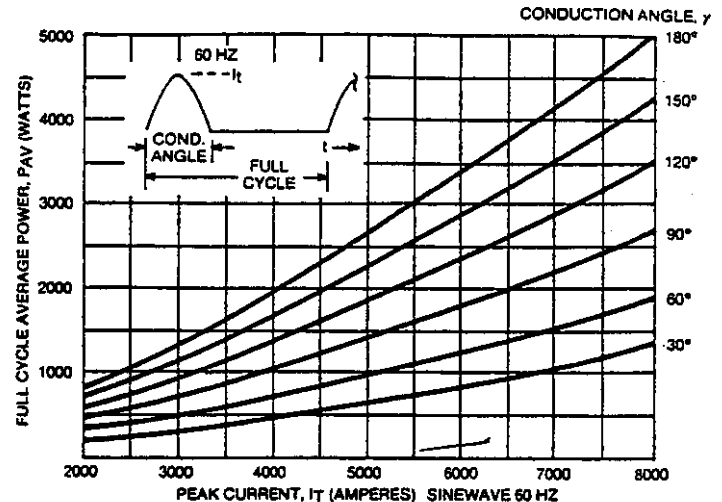
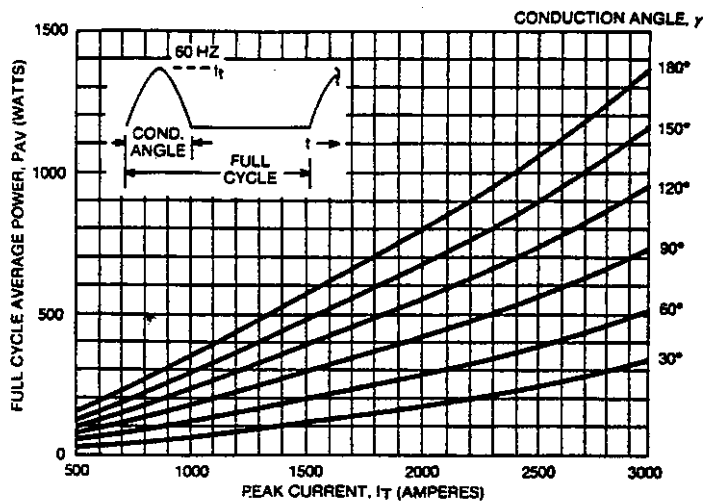
\*DC trigger current and voltage are indicated as a characteristic. Turn-on in this manner will not support rated  $di/dt$ .



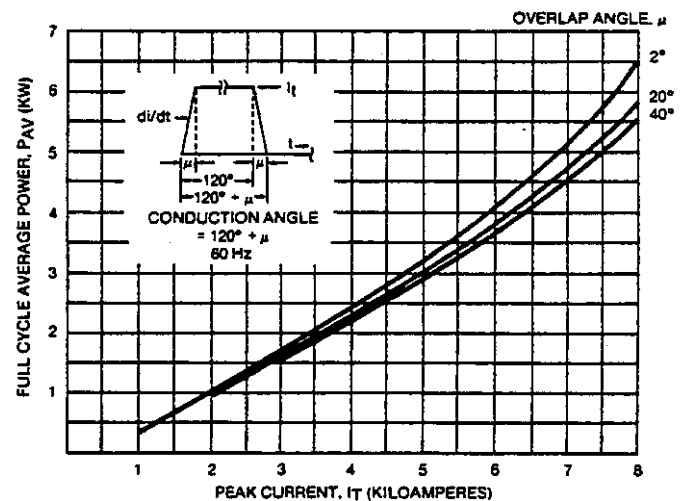
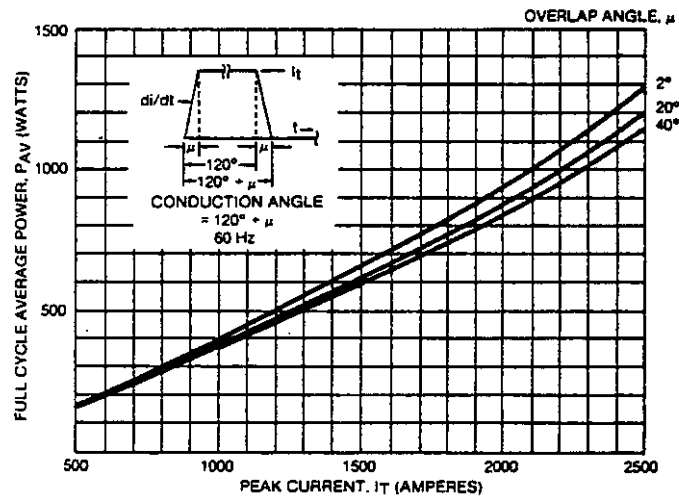
**MAXIMUM FORWARD CONDUCTION  
CHARACTERISTIC ON-STATE**



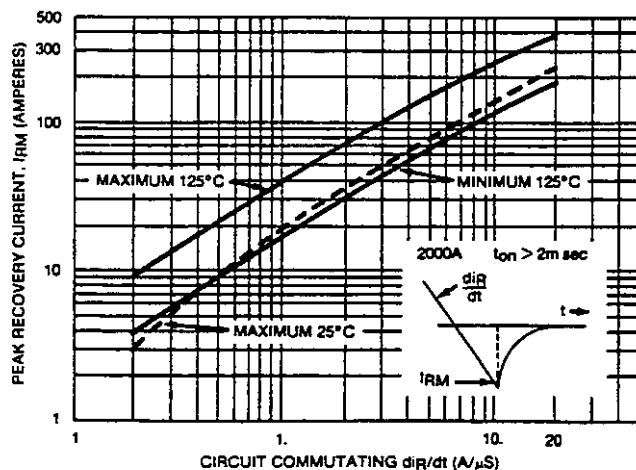
**NON-REPETITIVE  $I_{TSM}$  and  $I^2t$  CAPABILITY  
FOR FUSE COORDINATION**



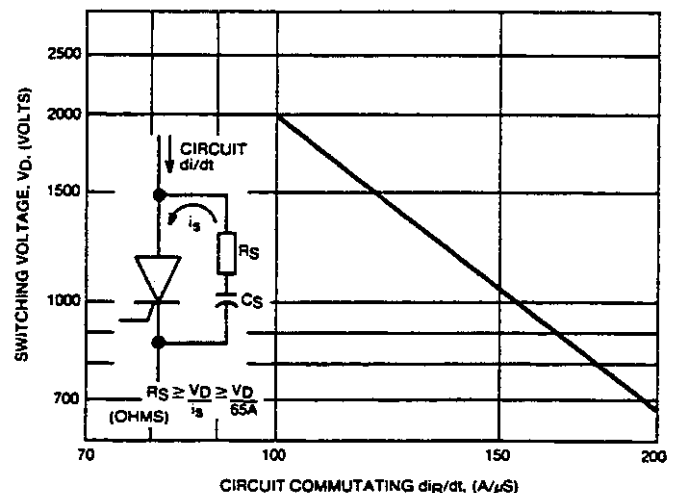
**MAXIMUM FULL CYCLE AVERAGE POWER DISSIPATION FOR SINEWAVE CURRENT AT VARIOUS CONDUCTING ANGLES. EFFECT OF VARIABLE CONDUCTING AREA IS INCLUDED. (DIGITAL DATA IS AVAILABLE)**



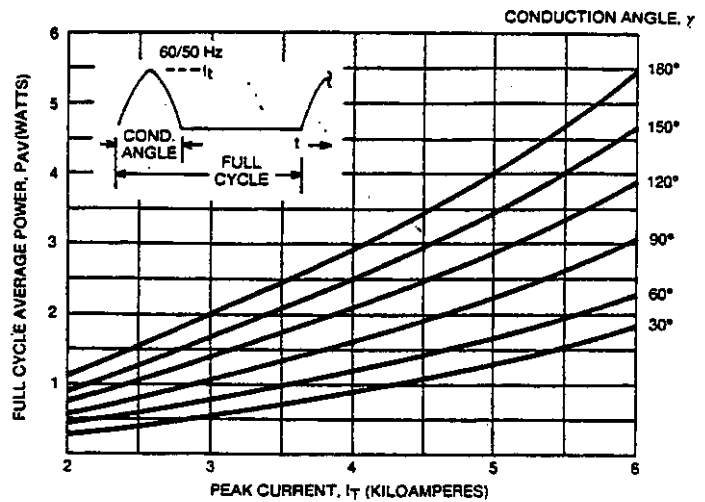
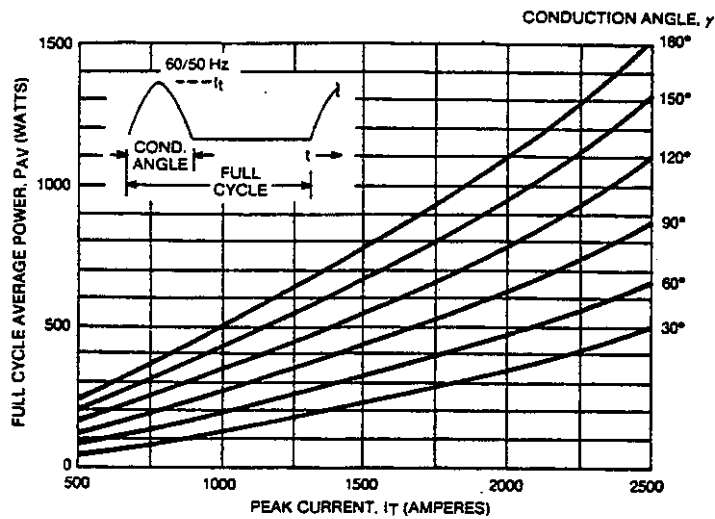
**MAXIMUM FULL CYCLE AVERAGE POWER DISSIPATION FOR THREE PHASE RECTIFIER (120° CONDUCTION) AT SEVERAL OVERLAP ANGLES, " $\mu$ ". EFFECT OF VARIABLE CONDUCTING AREA IS INCLUDED. (DIGITAL DATA IS AVAILABLE)**



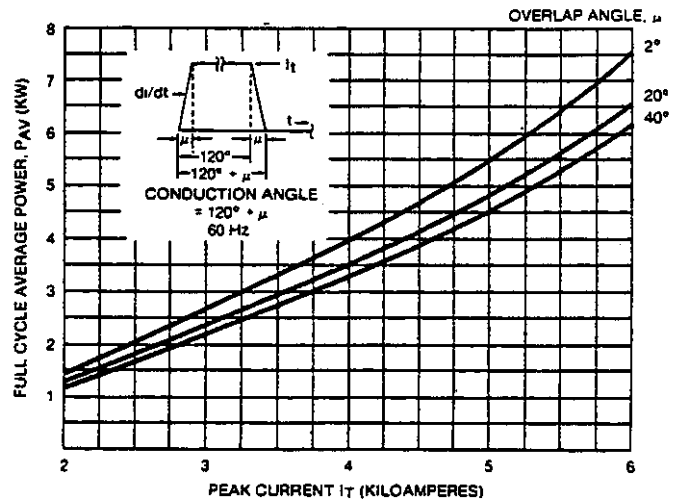
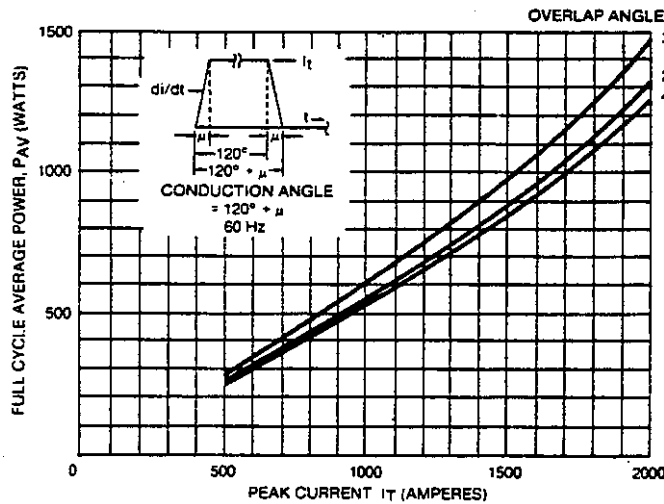
**PEAK RECOVERY CURRENT VERSUS COMMUTATING CIRCUIT  $DI/DT$**



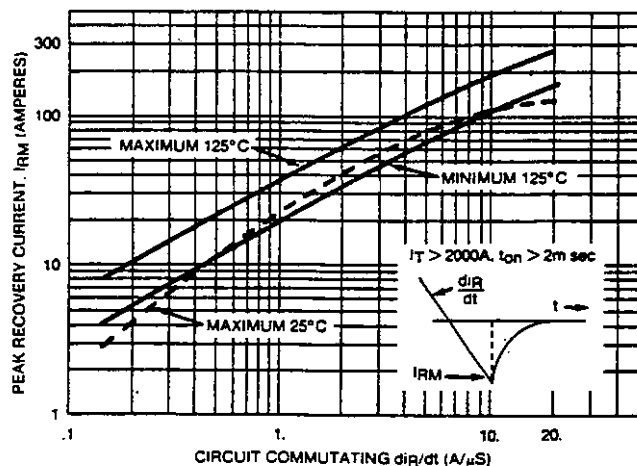
**MAXIMUM ALLOWABLE REPETITIVE  $DI/DT$  AS FUNCTION OF ANODE VOLTAGE BIAS. LIMITATION ON ADDITIONAL SNUBBER DISCHARGE IS INDICATED.**



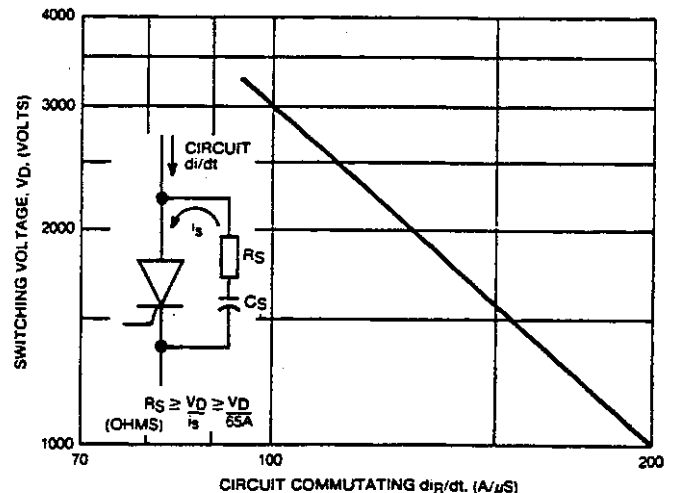
**MAXIMUM FULL CYCLE AVERAGE POWER DISSIPATION FOR SINEWAVE CURRENT AT VARIOUS CONDUCTING ANGLES. EFFECT OF VARIABLE CONDUCTING AREA IS INCLUDED. (DIGITAL DATA IS AVAILABLE)**



**MAXIMUM FULL CYCLE AVERAGE POWER DISSIPATION FOR THREE PHASE RECTIFIER (120° CONDUCTION) AT SEVERAL OVERLAP ANGLES, " $\mu$ ". EFFECT OF VARIABLE CONDUCTING AREA IS INCLUDED. (DIGITAL DATA IS AVAILABLE)**

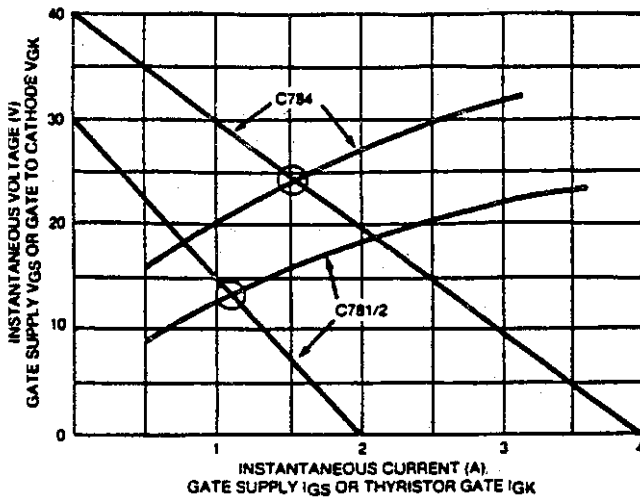


**PEAK RECOVERY CURRENT VERSUS COMMUTATING CIRCUIT DI/DT**



**MAXIMUM ALLOWABLE REPETITIVE DI/DT AS FUNCTION OF ANODE VOLTAGE BIAS. LIMITATION ON ADDITIONAL SNUBBER DISCHARGE IS INDICATED.**

## GATE CHARACTERISTICS AND GATE SUPPLY REQUIREMENTS



### Thyristor Gate Impedance

- This is enhanced by fast rising gate voltage, increasing anode bias and temperature.
- It is at a minimum for dc voltage, zero bias and low temperature (not shown).
- The maximum impedances expected for C784 and C781/C782 are indicated as curves of gate current versus gate voltage.

### Gate Supply

- Load lines for 40V/10Ω and 30V/15Ω are shown. The short circuit current rise time should be approximately 0.5μs and the duration longer than the delay time expected for the thyristor.

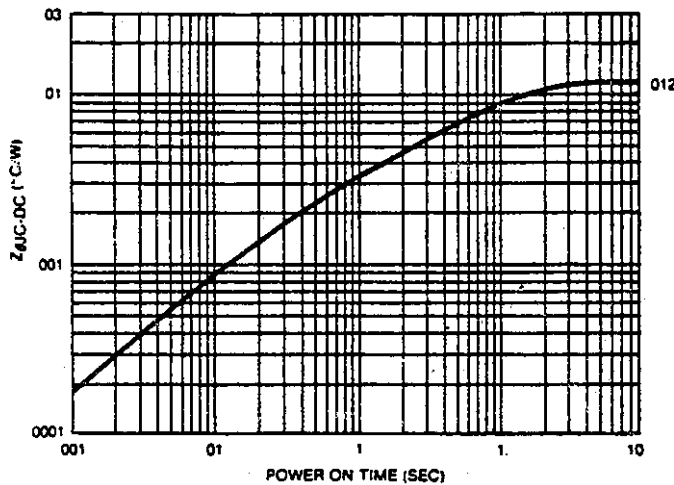
### Minimum Acceptable Gate Current

- The intersection of load line and gate characteristic (encircled) indicates the minimum value of actual current flowing into the gate that is required during the delay time interval needed for the published di/dt and snubber discharge ratings.

### Additional Gate Ratings (maximums)

- Peak gate power,  $P_{GM}$  (100μs) ..... 250W
- Average gate power,  $P_{G(AV)}$  ..... 35W
- Peak gate current ..... 20A
- Peak reverse voltage  $V_{GRM}$  ..... 20V

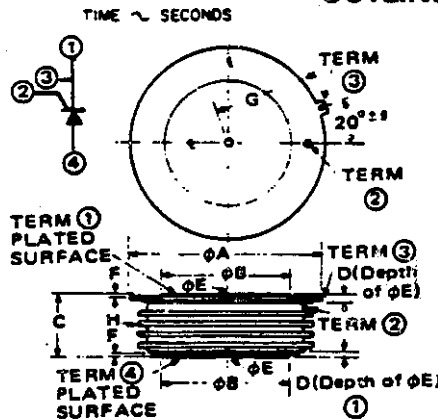
## THERMAL AND MECHANICAL INFORMATION



### NOTES:

- Add .002°C/W to account for both case to dissipator interfaces when properly mounted; e.g.,  $R_{θJS} = .014°C/W$ . See Mounting Instructions.
- 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 .0012°C/W along entire curve
    - 180° sq. wave add .0010°C/W along entire curve
    - 180° sine wave add .0005°C/W along entire curve
  - end of full cycle
    - any wave, subtract .0005°C/W along entire curve.
- Ask for general mounting instructions.

## OUTLINE DRAWING



| Symbol | Inches |       | Millimeters |        |
|--------|--------|-------|-------------|--------|
|        | Min.   | Max.  | Min.        | Max.   |
| φA     | —      | 4.350 | —           | 110.49 |
| φB     | 2.876  | 2.880 | 73.05       | 73.15  |
| C      | 1.387  | 1.447 | 35.23       | 36.75  |
| D      | .080   | —     | 2.03        | —      |
| φE     | 0.136  | 0.146 | 3.45        | 3.71   |
| F      | .020   | —     | 0.86        | —      |
| G      | 2.403  | 2.418 | 61.16       | 61.42  |
| H      | —      | —     | —           | —      |

\*\*\* for C785 & C787 only \*\*\*  
 "C" = 1.000 - 1.070 in.  
 25.40 - 27.18 mm  
 surface creepage = 1.00 in.

- Anode-Cathode Pole Faces ① ① Nickel Plated Copper.
- Mounting Force, 7000 - 9000 lb / 31.1 - 40.0 kN
- Electrical Insulation, Glazed Ceramic, Creepage 1.6 in. (40.6mm), Strike 1.0 in. (25.4mm)
- Gate Leads ② ② 18 in. #22 Terminated Nickel Plated with #8 Ring Terminal