

# MAC4DCM, MAC4DCN

Preferred Device

## Triacs

### Silicon Bidirectional Thyristors

Designed for high volume, low cost, industrial and consumer applications such as motor control; process control; temperature, light and speed control.

- Small Size Surface Mount DPAK Package
- Passivated Die for Reliability and Uniformity
- Blocking Voltage to 800 V
- On-State Current Rating of 4.0 Amperes RMS at 108°C
- High Immunity to  $dv/dt$  — 500 V/ $\mu s$  at 125°C
- High Immunity to  $di/dt$  — 6.0 A/ms at 125°C
- Device Marking: Logo, Device Type with “M” truncated, e.g., MAC4DCM: AC4DCM, Date Code

#### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

| Rating                                                                                                                                                 | Symbol                   | Value          | Unit                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|----------------|------------------------|
| Peak Repetitive Off-State Voltage <sup>(1)</sup><br>( $T_J = -40$ to $125^\circ\text{C}$ , Sine Wave,<br>50 to 60 Hz, Gate Open)<br>MAC4DCM<br>MAC4DCN | $V_{DRM}$ ,<br>$V_{RRM}$ | 600<br>800     | Volts                  |
| On-State RMS Current<br>(Full Cycle Sine Wave, 60 Hz,<br>$T_C = 108^\circ\text{C}$ )                                                                   | $I_T(\text{RMS})$        | 4.0            | Amps                   |
| Peak Non-Repetitive Surge Current<br>(One Full Cycle Sine Wave, 60 Hz,<br>$T_J = 125^\circ\text{C}$ )                                                  | $I_{TSM}$                | 40             | Amps                   |
| Circuit Fusing Consideration<br>( $t = 8.3$ msec)                                                                                                      | $I^2t$                   | 6.6            | $\text{A}^2\text{sec}$ |
| Peak Gate Power<br>(Pulse Width $\leq 10$ $\mu\text{sec}$ , $T_C = 108^\circ\text{C}$ )                                                                | $P_{GM}$                 | 0.5            | Watt                   |
| Average Gate Power<br>( $t = 8.3$ msec, $T_C = 108^\circ\text{C}$ )                                                                                    | $P_{G(AV)}$              | 0.1            | Watt                   |
| Peak Gate Current<br>(Pulse Width $\leq 10$ $\mu\text{sec}$ , $T_C = 108^\circ\text{C}$ )                                                              | $I_{GM}$                 | 0.5            | Amp                    |
| Peak Gate Voltage<br>(Pulse Width $\leq 10$ $\mu\text{sec}$ , $T_C = 108^\circ\text{C}$ )                                                              | $V_{GM}$                 | 5.0            | Volts                  |
| Operating Junction Temperature Range                                                                                                                   | $T_J$                    | $-40$ to $125$ | $^\circ\text{C}$       |
| Storage Temperature Range                                                                                                                              | $T_{stg}$                | $-40$ to $150$ | $^\circ\text{C}$       |

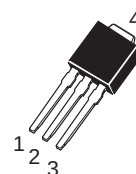
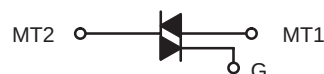
(1)  $V_{DRM}$  and  $V_{RRM}$  for all types can be applied on a continuous basis. Blocking voltages shall not be tested with a constant current source such that the voltage ratings of the device are exceeded.



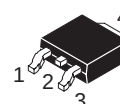
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### TRIACS 4.0 AMPERES RMS 600 thru 800 VOLTS



D-PAK  
CASE 369  
STYLE 6



D-PAK  
CASE 369A  
STYLE 6

#### PIN ASSIGNMENT

|   | PIN ASSIGNMENT  |
|---|-----------------|
| 1 | Main Terminal 1 |
| 2 | Main Terminal 2 |
| 3 | Gate            |
| 4 | Main Terminal 2 |

#### ORDERING INFORMATION

| Device    | Package   | Shipping                       |
|-----------|-----------|--------------------------------|
| MAC4DCMT4 | DPAK 369A | 16mm Tape and Reel (2.5K/Reel) |
| MAC4DCM-1 | DPAK 369  | 75 Units/Rail                  |
| MAC4DCNT4 | DPAK 369A | 16mm Tape and Reel (2.5K/Reel) |
| MAC4DCN-1 | DPAK 369  | 75 Units/Rail                  |

Preferred devices are recommended choices for future use and best overall value.

# MAC4DCM, MAC4DCN

## THERMAL CHARACTERISTICS

| Characteristic                                                 | Symbol          | Max | Unit                 |
|----------------------------------------------------------------|-----------------|-----|----------------------|
| Thermal Resistance — Junction to Case                          | $R_{\theta JC}$ | 3.5 | $^{\circ}\text{C/W}$ |
| — Junction to Ambient                                          | $R_{\theta JA}$ | 88  |                      |
| — Junction to Ambient <sup>(1)</sup>                           | $R_{\theta JA}$ | 80  |                      |
| Maximum Lead Temperature for Soldering Purposes <sup>(2)</sup> | $T_L$           | 260 | $^{\circ}\text{C}$   |

## ELECTRICAL CHARACTERISTICS ( $T_J = 25^{\circ}\text{C}$ unless otherwise noted; Electricals apply in both directions)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

## OFF CHARACTERISTICS

|                                                                                           |                    |   |   |      |    |
|-------------------------------------------------------------------------------------------|--------------------|---|---|------|----|
| Peak Repetitive Blocking Current<br>( $V_D = \text{Rated } V_{DRM}, V_{RRM}$ ; Gate Open) | $I_{DRM}, I_{RRM}$ | — | — | 0.01 | mA |
| $T_J = 125^{\circ}\text{C}$                                                               |                    | — | — | 2.0  |    |

## ON CHARACTERISTICS

|                                                                                                                                                                |          |                   |                   |                   |       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------------------|-------------------|-------------------|-------|
| Peak On-State Voltage <sup>(3)</sup><br>( $I_{TM} = \pm 6.0 \text{ A}$ )                                                                                       | $V_{TM}$ | —                 | 1.3               | 1.6               | Volts |
| Gate Trigger Current (Continuous dc) ( $V_D = 12 \text{ V}, R_L = 100 \Omega$ )<br>MT2(+), G(+)<br>MT2(+), G(–)<br>MT2(–), G(–)                                | $I_{GT}$ | 8.0<br>8.0<br>8.0 | 12<br>18<br>22    | 35<br>35<br>35    | mA    |
| Gate Trigger Voltage (Continuous dc) ( $V_D = 12 \text{ V}, R_L = 100 \Omega$ )<br>MT2(+), G(+)<br>MT2(+), G(–)<br>MT2(–), G(–)                                | $V_{GT}$ | 0.5<br>0.5<br>0.5 | 0.8<br>0.8<br>0.8 | 1.3<br>1.3<br>1.3 | Volts |
| Gate Non-Trigger Voltage (Continuous dc) ( $V_D = 12 \text{ V}, R_L = 100 \Omega$ )<br>MT2(+), G(+); MT2(+), G(–); MT2(–), G(–)<br>$T_J = 125^{\circ}\text{C}$ | $V_{GD}$ | 0.2               | 0.4               | —                 | Volts |
| Holding Current<br>( $V_D = 12 \text{ V}$ , Gate Open, Initiating Current = $\pm 200 \text{ mA}$ )                                                             | $I_H$    | 6.0               | 22                | 35                | mA    |
| Latching Current ( $V_D = 12 \text{ V}, I_G = 35 \text{ mA}$ )<br>MT2(+), G(+)<br>MT2(+), G(–)<br>MT2(–), G(–)                                                 | $I_L$    | —<br>—<br>—       | 30<br>50<br>20    | 60<br>80<br>60    | mA    |

## DYNAMIC CHARACTERISTICS

| Characteristic                                                                                                                                                                                                                                                                                   | Symbol     | Min | Typ  | Max | Unit             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-----|------|-----|------------------|
| Rate of Change of Commutating Current<br>( $V_D = 400 \text{ V}, I_{TM} = 4.0 \text{ A}$ , Commutating $dv/dt = 18 \text{ V}/\mu\text{sec}$ ,<br>Gate Open, $T_J = 125^{\circ}\text{C}$ , $f = 250 \text{ Hz}$ , $CL = 5.0 \mu\text{F}$ , $LL = 20 \text{ mH}$ ,<br>No Snubber)<br>See Figure 16 | $di/dt(c)$ | 6.0 | 8.4  | —   | A/ms             |
| Critical Rate of Rise of Off-State Voltage<br>( $V_D = 0.67 \times \text{Rated } V_{DRM}$ , Exponential Waveform,<br>Gate Open, $T_J = 125^{\circ}\text{C}$ )                                                                                                                                    | $dv/dt$    | 500 | 1700 | —   | V/ $\mu\text{s}$ |

(1) Surface mounted on minimum recommended pad size.

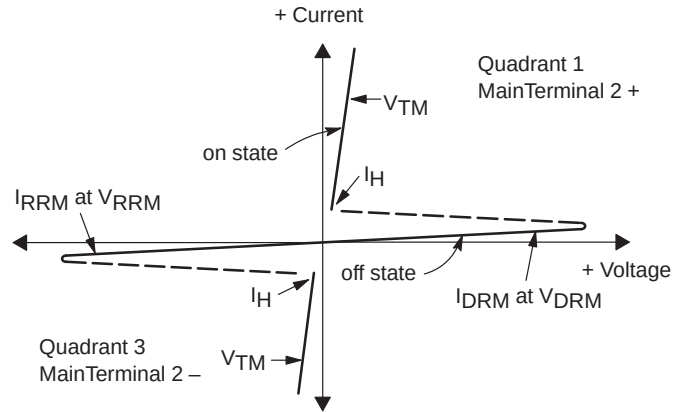
(2) 1/8" from case for 10 seconds.

(3) Pulse Test: Pulse Width  $\leq 2.0 \text{ msec}$ , Duty Cycle  $\leq 2\%$ .

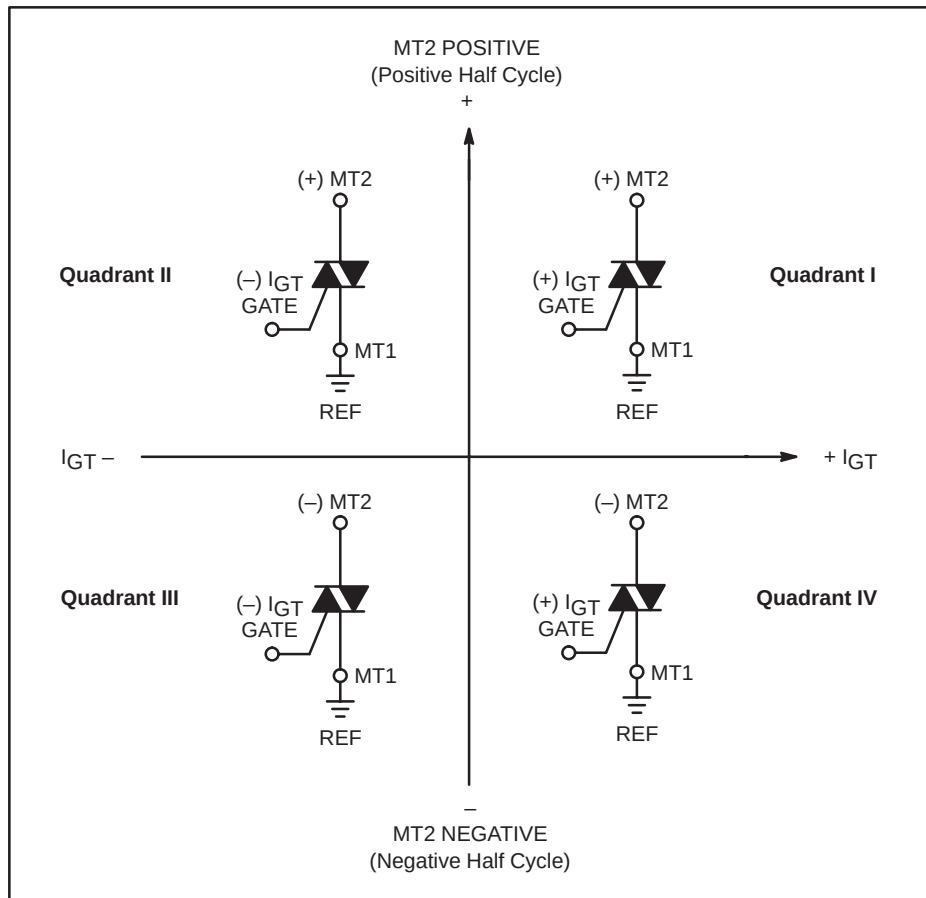
## MAC4DCM, MAC4DCN

### Voltage Current Characteristic of Triacs (Bidirectional Device)

| Symbol    | Parameter                                 |
|-----------|-------------------------------------------|
| $V_{DRM}$ | Peak Repetitive Forward Off State Voltage |
| $I_{DRM}$ | Peak Forward Blocking Current             |
| $V_{RRM}$ | Peak Repetitive Reverse Off State Voltage |
| $I_{RRM}$ | Peak Reverse Blocking Current             |
| $V_{TM}$  | Maximum On State Voltage                  |
| $I_H$     | Holding Current                           |



### Quadrant Definitions for a Triac



All polarities are referenced to MT1.

With in-phase signals (using standard AC lines) quadrants I and III are used.

# MAC4DCM, MAC4DCN

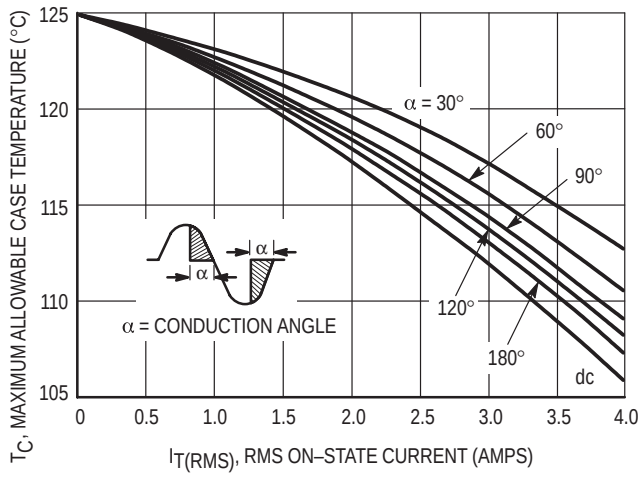


Figure 1. RMS Current Derating

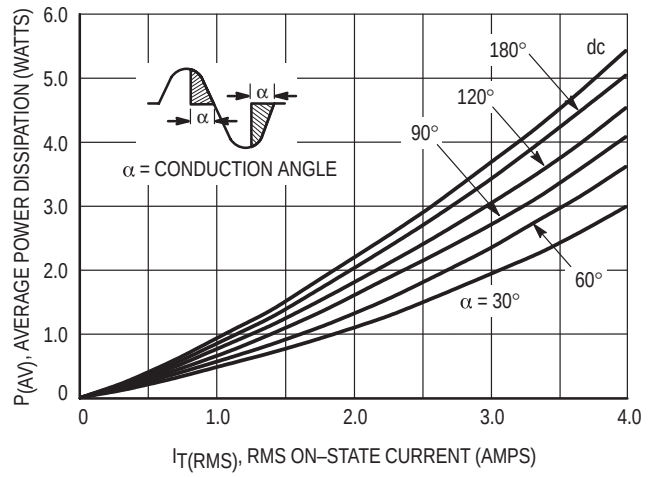


Figure 2. On-State Power Dissipation

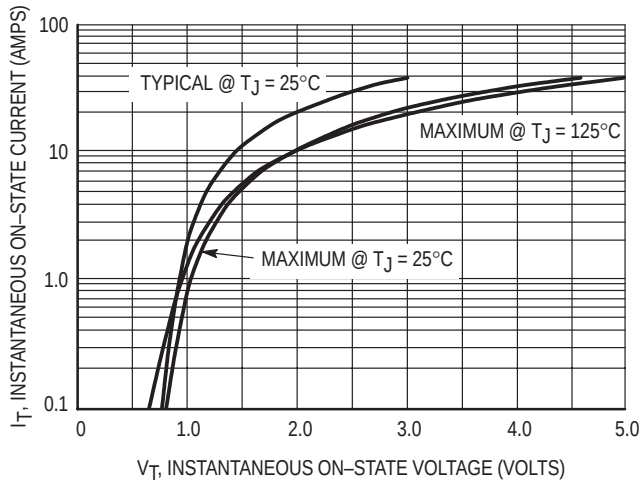


Figure 3. On-State Characteristics

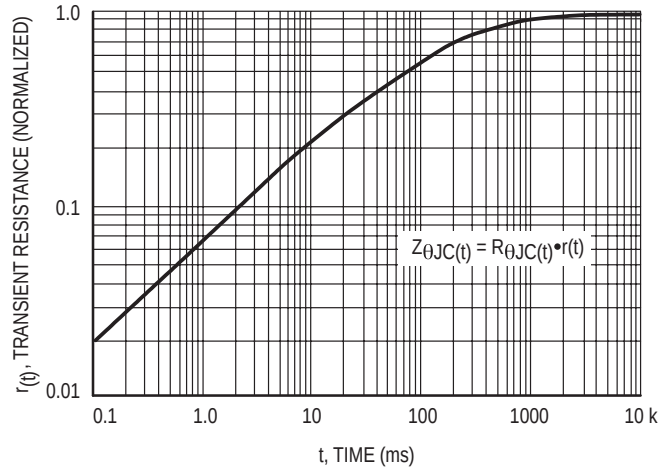


Figure 4. Transient Thermal Response

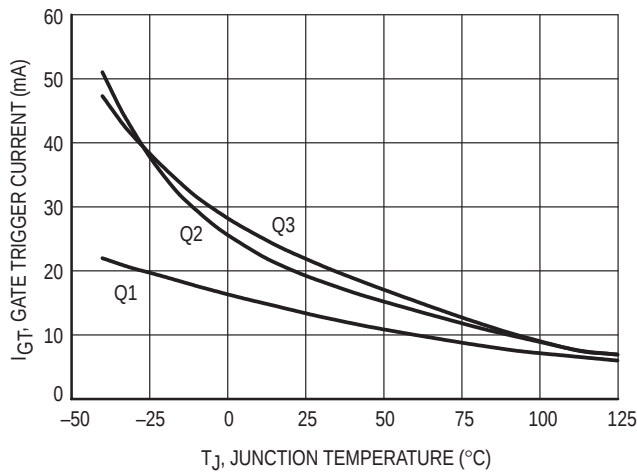


Figure 5. Typical Gate Trigger Current versus Junction Temperature

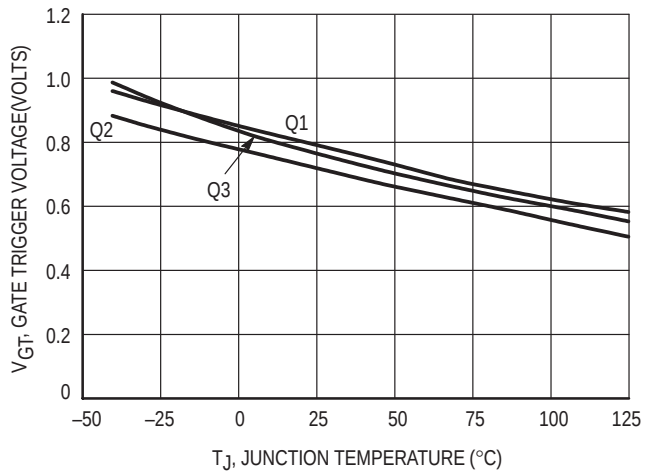
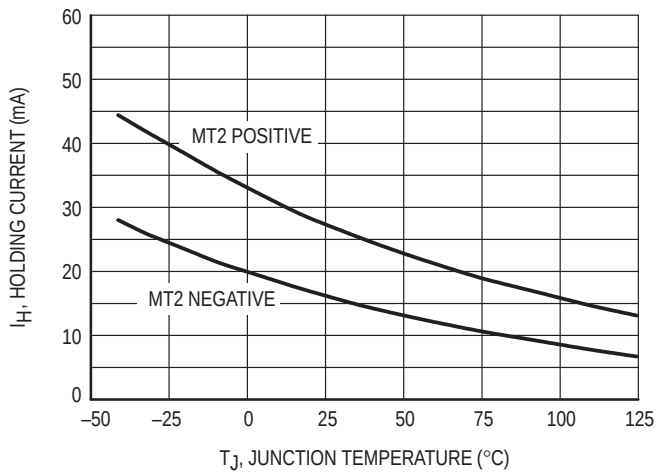
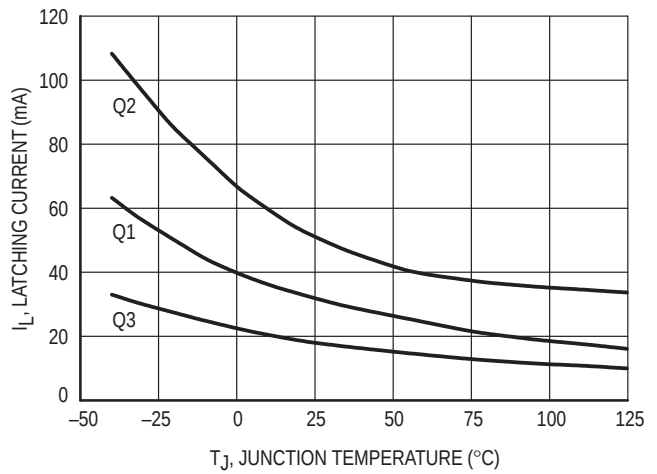


Figure 6. Typical Gate Trigger Voltage versus Junction Temperature

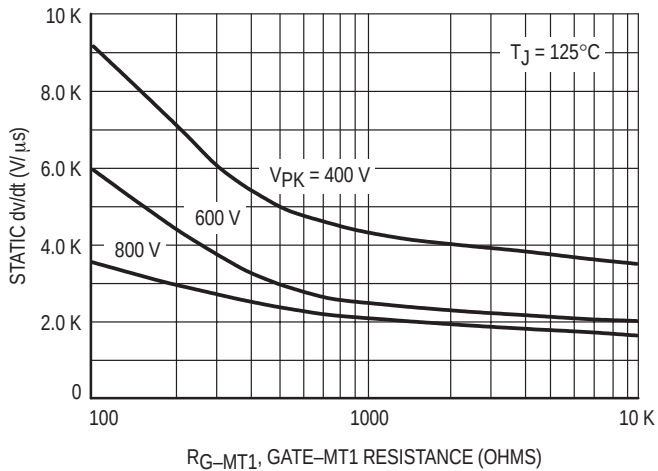
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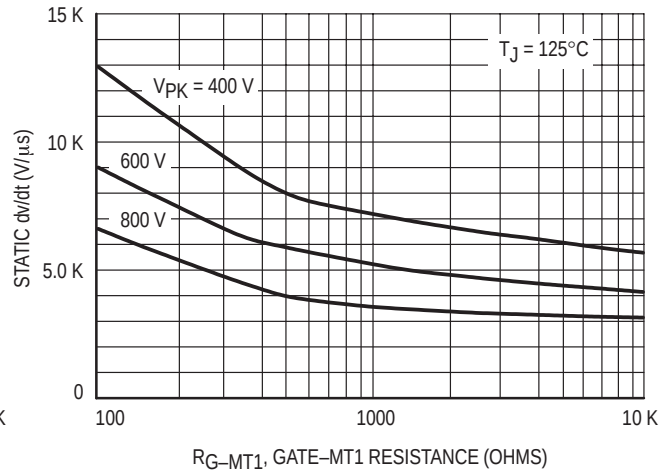
**Figure 7. Typical Holding Current versus Junction Temperature**



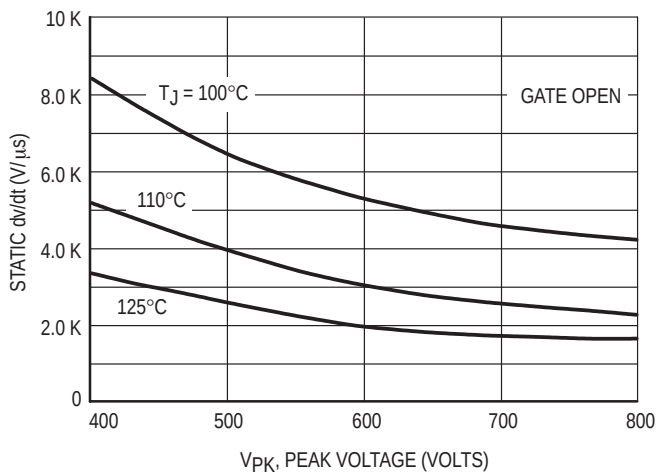
**Figure 8. Typical Latching Current versus Junction Temperature**



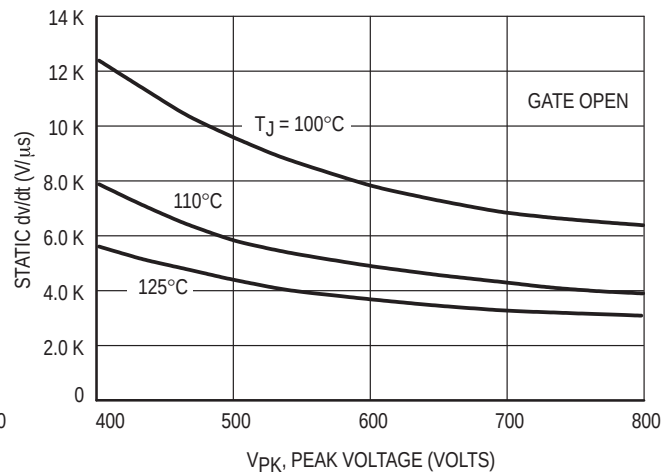
**Figure 9. Exponential Static  $dv/dt$  versus Gate-MT1 Resistance, MT2(+)**



**Figure 10. Exponential Static  $dv/dt$  versus Gate-MT1 Resistance, MT2(-)**

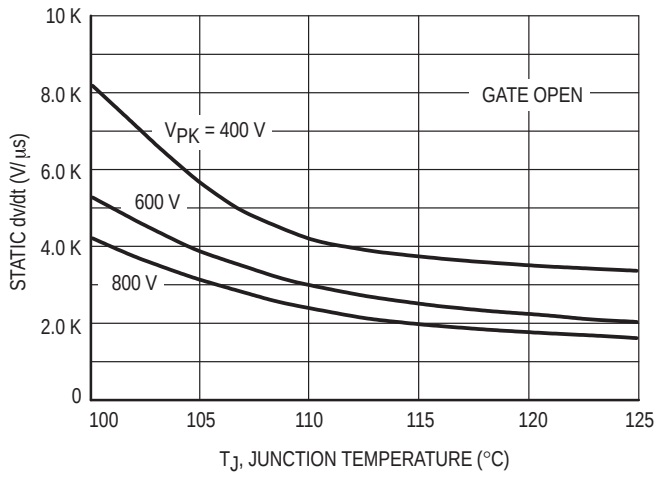


**Figure 11. Exponential Static  $dv/dt$  versus Peak Voltage, MT2(+)**

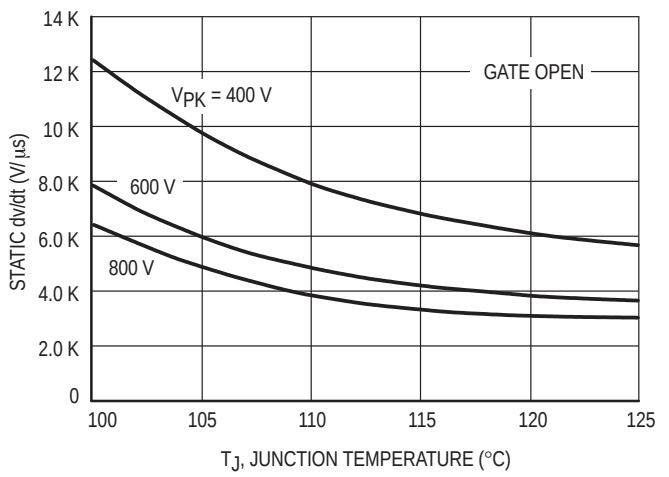


**Figure 12. Exponential Static  $dv/dt$  versus Peak Voltage, MT2(-)**

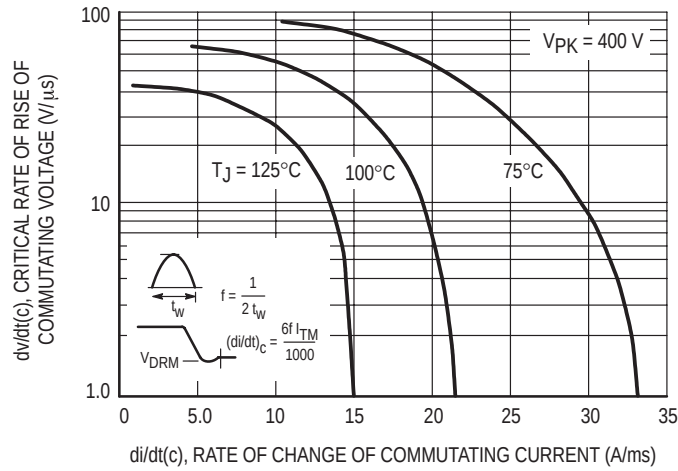
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**Figure 13. Typical Exponential Static  $dv/dt$  versus Junction Temperature, MT2(+)**

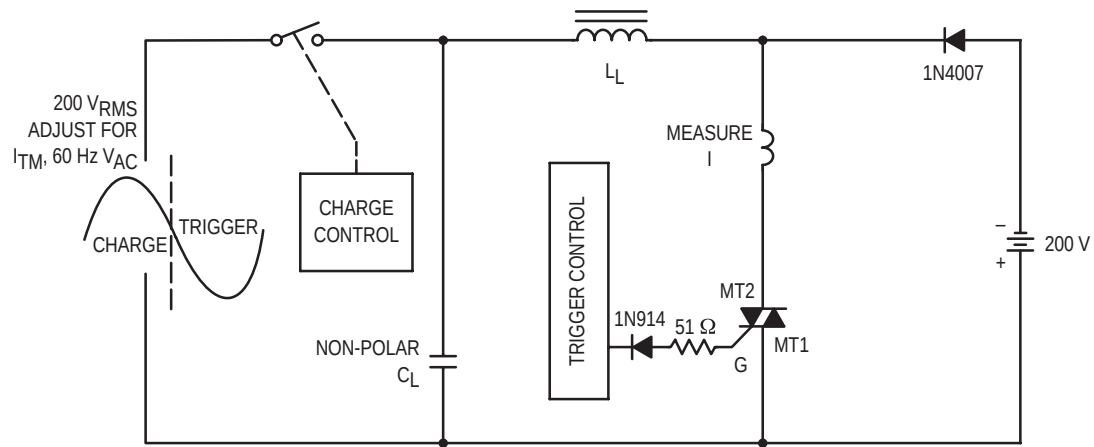


**Figure 14. Typical Exponential Static  $dv/dt$  versus Junction Temperature, MT2(-)**



**Figure 15. Critical Rate of Rise of Commutating Voltage**

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Note: Component values are for verification of rated  $(di/dt)_c$ . See AN1048 for additional information.

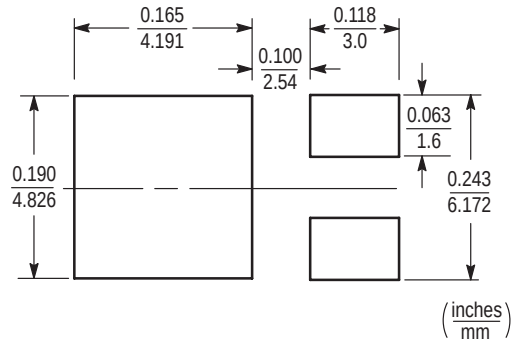
**Figure 16. Simplified Test Circuit to Measure the Critical Rate of Rise of Commutating Current  $(di/dt)_c$**

## MAC4DCM, MAC4DCN

### MINIMUM RECOMMENDED FOOTPRINT FOR SURFACE MOUNTED APPLICATIONS

Surface mount board layout is a critical portion of the total design. The footprint for the semiconductor packages must be the correct size to insure proper solder connection

interface between the board and the package. With the correct pad geometry, the packages will self align when subjected to a solder reflow process.



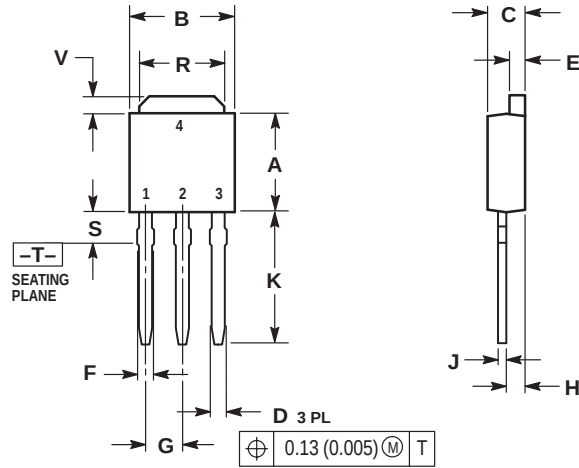
**DPAK**



# MAC4DCM, MAC4DCN

## PACKAGE DIMENSIONS

### D-PAK CASE 369-07 ISSUE L

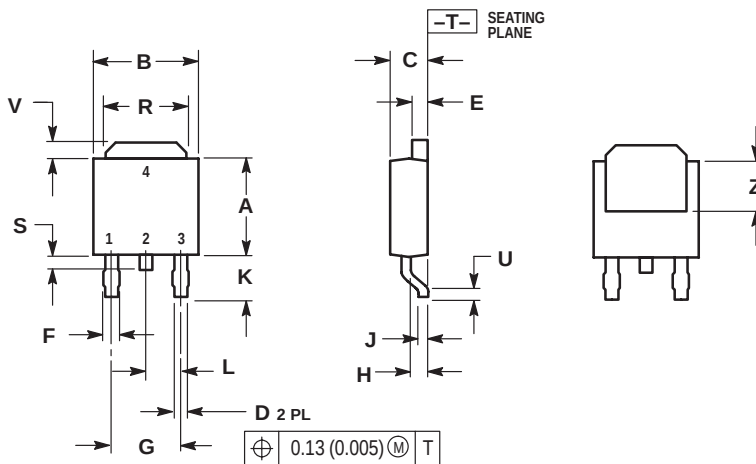


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.

| DIM | INCHES    |       | MILLIMETERS |      |
|-----|-----------|-------|-------------|------|
|     | MIN       | MAX   | MIN         | MAX  |
| A   | 0.235     | 0.250 | 5.97        | 6.35 |
| B   | 0.250     | 0.265 | 6.35        | 6.73 |
| C   | 0.086     | 0.094 | 2.19        | 2.38 |
| D   | 0.027     | 0.035 | 0.69        | 0.88 |
| E   | 0.033     | 0.040 | 0.84        | 1.01 |
| F   | 0.037     | 0.047 | 0.94        | 1.19 |
| G   | 0.090 BSC |       | 2.29 BSC    |      |
| H   | 0.034     | 0.040 | 0.87        | 1.01 |
| J   | 0.018     | 0.023 | 0.46        | 0.58 |
| K   | 0.350     | 0.380 | 8.89        | 9.65 |
| R   | 0.175     | 0.215 | 4.45        | 5.46 |
| S   | 0.050     | 0.090 | 1.27        | 2.28 |
| V   | 0.030     | 0.050 | 0.77        | 1.27 |

STYLE 6:  
PIN 1. MT1  
2. MT2  
3. GATE  
4. MT2

### D-PAK CASE 369A-13 ISSUE Z



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.

| DIM | INCHES    |       | MILLIMETERS |      |
|-----|-----------|-------|-------------|------|
|     | MIN       | MAX   | MIN         | MAX  |
| A   | 0.235     | 0.250 | 5.97        | 6.35 |
| B   | 0.250     | 0.265 | 6.35        | 6.73 |
| C   | 0.086     | 0.094 | 2.19        | 2.38 |
| D   | 0.027     | 0.035 | 0.69        | 0.88 |
| E   | 0.033     | 0.040 | 0.84        | 1.01 |
| F   | 0.037     | 0.047 | 0.94        | 1.19 |
| G   | 0.180 BSC |       | 4.58 BSC    |      |
| H   | 0.034     | 0.040 | 0.87        | 1.01 |
| J   | 0.018     | 0.023 | 0.46        | 0.58 |
| K   | 0.102     | 0.114 | 2.60        | 2.89 |
| L   | 0.090 BSC |       | 2.29 BSC    |      |
| R   | 0.175     | 0.215 | 4.45        | 5.46 |
| S   | 0.020     | 0.050 | 0.51        | 1.27 |
| U   | 0.020     | —     | 0.51        | —    |
| V   | 0.030     | 0.050 | 0.77        | 1.27 |
| Z   | 0.138     | —     | 3.51        | —    |

STYLE 6:  
PIN 1. MT1  
2. MT2  
3. GATE  
4. MT2

## Notes

## Notes

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