

MAC4DSM, MAC4DSN

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.

Features

- 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
- Low IGT – 10 mA Maximum in 3 Quadrants
- High Immunity to dv/dt – 50 V/ μ s at 125°C
- Epoxy Meets UL 94 V-0 @ 0.125 in
- ESD Ratings: Human Body Model, 3B > 8000 V
Machine Model, C > 400 V
- Pb-Free Packages are Available

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

| Rating | Symbol | Value | Unit |
|---|--|------------|------------------------|
| Peak Repetitive Off-State Voltage (Note 1) ($T_J = -40$ to 125°C , Sine Wave, 50 to 60 Hz, Gate Open) MAC4DSM MAC4DSN | V_{DRM} , V_{RRM} | 600 800 | V |
| On-State RMS Current (Full Cycle Sine Wave, 60 Hz, $T_C = 108^\circ\text{C}$) | $I_{\text{T(RMS)}}$ | 4.0 | A |
| Peak Non-Repetitive Surge Current (One Full Cycle Sine Wave, 60 Hz, $T_J = 125^\circ\text{C}$) | I_{TSM} | 40 | A |
| Circuit Fusing Consideration ($t = 8.3$ msec) | I^2t | 6.6 | A^2sec |
| Peak Gate Power (Pulse Width ≤ 10 μ sec, $T_C = 108^\circ\text{C}$) | P_{GM} | 2.0 | W |
| Average Gate Power ($t = 8.3$ msec, $T_C = 108^\circ\text{C}$) | $P_{\text{G(AV)}}$ | 1.0 | W |
| Peak Gate Current (Pulse Width ≤ 20 μ sec, $T_C = 108^\circ\text{C}$) | I_{GM} | 4.0 | A |
| Peak Gate Voltage (Pulse Width ≤ 20 μ sec, $T_C = 108^\circ\text{C}$) | V_{GM} | 5.0 | V |
| Operating Junction Temperature Range | T_J | -40 to 125 | $^\circ\text{C}$ |
| Storage Temperature Range | T_{stg} | -40 to 150 | $^\circ\text{C}$ |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

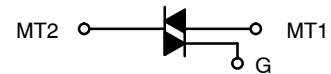
1. V_{DRM} and V_{RRM} for all types can be applied on a continuous basis. Blocking voltages shall not be tested with a constant current source such that the voltage ratings of the device are exceeded.



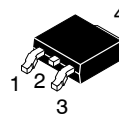
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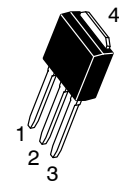
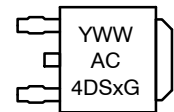
TRIACS 4.0 AMPERES RMS 600 – 800 VOLTS



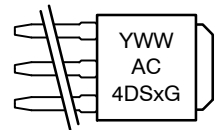
MARKING DIAGRAMS



**DPAK
CASE 369C
STYLE 6**



**DPAK-3
CASE 369D
STYLE 6**



Y = Year
WW = Work Week
AC4DSx = Device Code
x = M or N
G = Pb-Free Package

PIN ASSIGNMENT

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

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

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

MAC4DSM, MAC4DSN

THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|---|---|-----------------|------|
| Thermal Resistance, – Junction-to-Case – Junction-to-Ambient – Junction-to-Ambient (Note 2) | $R_{\theta JC}$ $R_{\theta JA}$ $R_{\theta JA}$ | 3.5 88 80 | °C/W |
| Maximum Lead Temperature for Soldering Purposes (Note 3) | T_L | 260 | °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 ($V_D = \text{Rated } V_{DRM}, V_{RRM}; \text{ Gate Open}$) | I_{DRM}, I_{RRM} | – | – | 0.01 2.0 | mA |
| | | | | | $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$ |

ON CHARACTERISTICS

| | | | | | |
|---|----------|-------------------|--------------------|-------------------|----|
| Peak On-State Voltage (Note 4) ($I_{TM} = \pm 6.0 \text{ A}$) | V_{TM} | – | 1.3 | 1.6 | V |
| Gate Trigger Current (Continuous dc) ($V_D = 12 \text{ V}, R_L = 100 \Omega$) MT2(+), G(+) MT2(+), G(–) MT2(–), G(–) | I_{GT} | 2.9 2.9 2.9 | 4.0 5.0 7.0 | 10 10 10 | mA |
| Gate Trigger Voltage (Continuous dc) ($V_D = 12 \text{ V}, R_L = 100 \Omega$) MT2(+), G(+) MT2(+), G(–) MT2(–), G(–) | V_{GT} | 0.5 0.5 0.5 | 0.7 0.65 0.7 | 1.3 1.3 1.3 | V |
| Gate Non-Trigger Voltage (Continuous dc) ($V_D = 12 \text{ V}, R_L = 100 \Omega$) MT2(+), G(+); MT2(+), G(–); MT2(–), G(–) | V_{GD} | 0.2 | 0.4 | – | V |
| Holding Current ($V_D = 12 \text{ V}, \text{ Gate Open}, \text{ Initiating Current} = \pm 200 \text{ mA}$) | I_H | 2.0 | 5.5 | 15 | mA |
| Latching Current ($V_D = 12 \text{ V}, I_G = 10 \text{ mA}$) MT2(+), G(+) MT2(+), G(–) MT2(–), G(–) | I_L | – – – | 6.0 10 6.0 | 30 30 30 | mA |

DYNAMIC CHARACTERISTICS

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|------------|-----|-----|-----|------------------|
| Rate of Change of Commutating Current ($V_D = 400 \text{ V}, I_{TM} = 3.5 \text{ A}, \text{ Commutating } dv/dt = 10 \text{ V}/\mu\text{sec}, \text{ Gate Open}, T_J = 125^\circ\text{C}, f = 500 \text{ Hz}, CL = 5.0 \mu\text{F}, LL = 20 \text{ mH}, \text{ No Snubber}$) See Figure 16 | $di/dt(c)$ | 3.0 | 4.0 | – | A/ms |
| Critical Rate of Rise of Off-State Voltage ($V_D = 0.67 \times \text{Rated } V_{DRM}, \text{ Exponential Waveform}, \text{ Gate Open}, T_J = 125^\circ\text{C}$) | dv/dt | 50 | 175 | – | V/ μs |

2. These ratings are applicable when surface mounted on the minimum pad sizes recommended.
3. 1/8" from case for 10 seconds.
4. Pulse Test: Pulse Width ≤ 2.0 msec, Duty Cycle $\leq 2\%$.

ORDERING INFORMATION

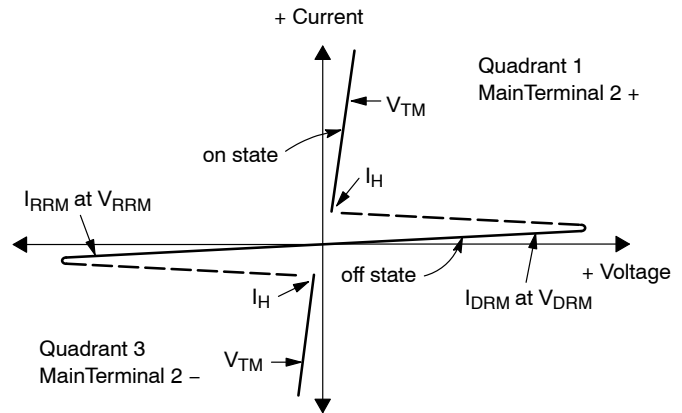
| Device | Package Type | Package | Shipping† |
|--------------|---------------------|---------|--------------------|
| MAC4DSM-001 | DPAK-3 | 369D | 75 Units / Rail |
| MAC4DSM-001G | DPAK-3 (Pb-Free) | 369D | 75 Units / Rail |
| MAC4DSMT4 | DPAK | 369C | 2500 / Tape & Reel |
| MAC4DSMT4G | DPAK (Pb-Free) | 369C | 2500 / Tape & Reel |
| MAC4DSN-001 | DPAK-3 | 369D | 75 Units / Rail |
| MAC4DSN-001G | DPAK-3 (Pb-Free) | 369D | 75 Units / Rail |
| MAC4DSNT4 | DPAK | 369C | 2500 / Tape & Reel |
| MAC4DSNT4G | DPAK (Pb-Free) | 369C | 2500 / Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

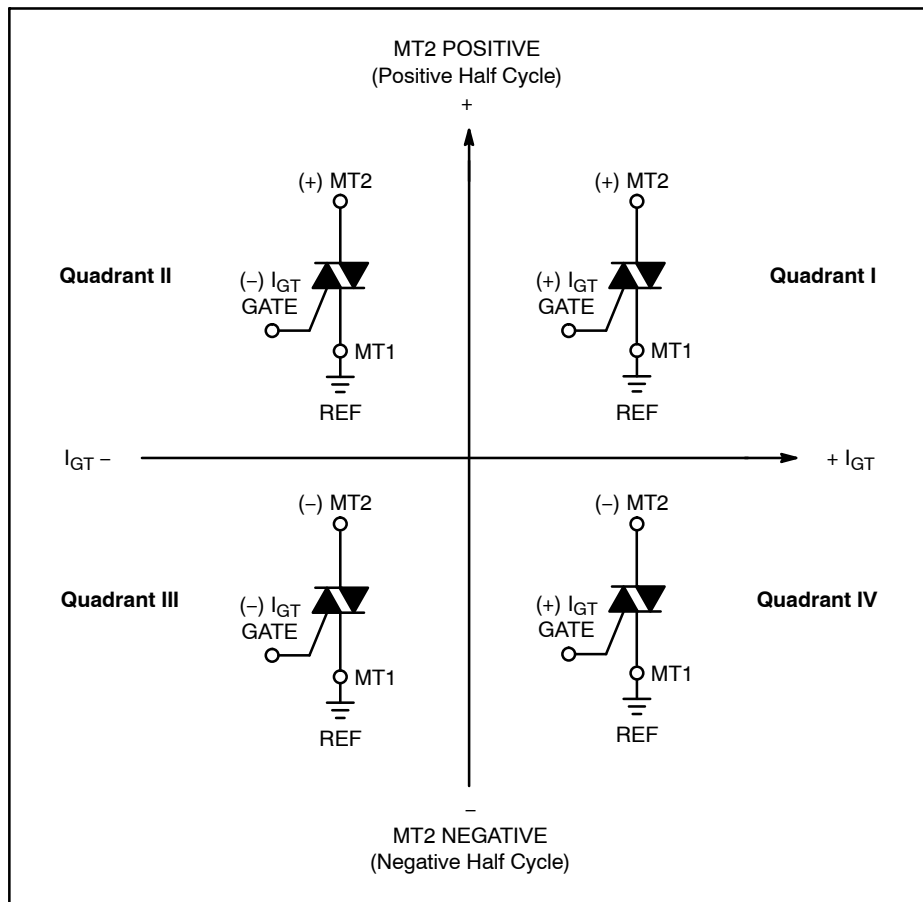
MAC4DSM, MAC4DSN

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.

MAC4DSM, MAC4DSN

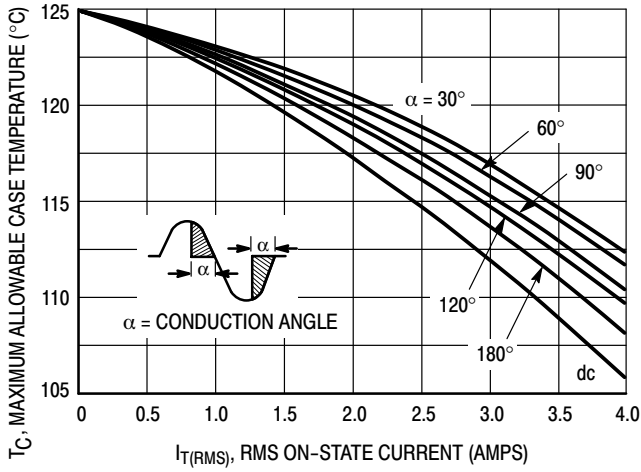


Figure 1. RMS Current Derating

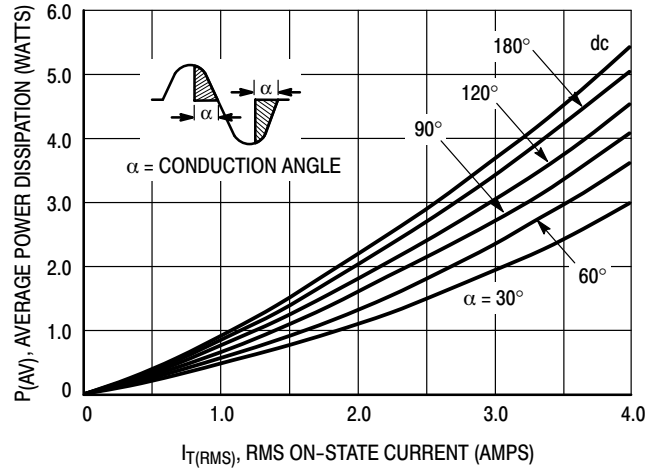


Figure 2. On-State Power Dissipation

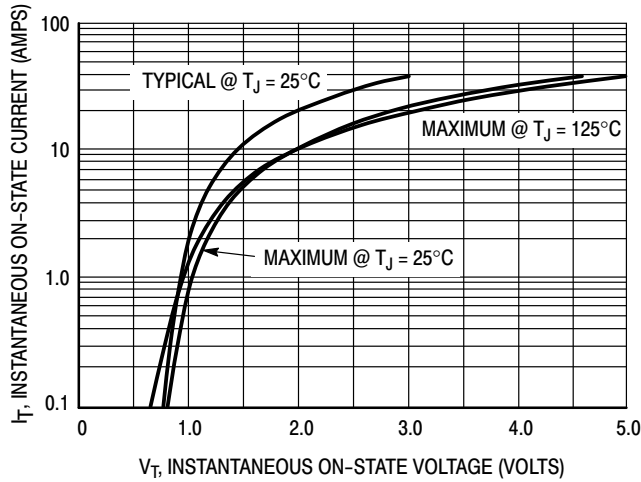


Figure 3. On-State Characteristics

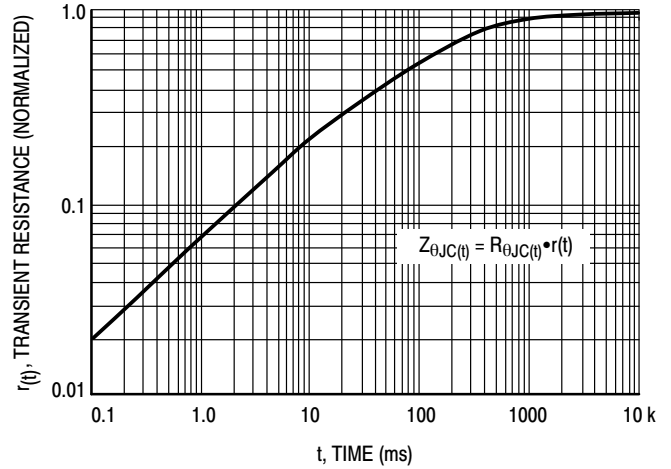


Figure 4. Transient Thermal Response

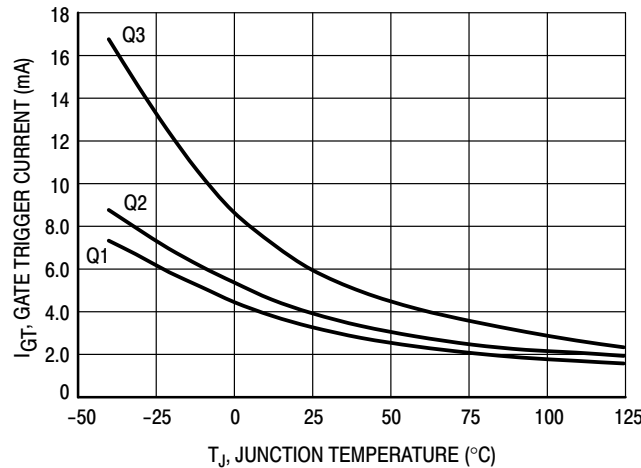


Figure 5. Typical Gate Trigger Current versus Junction Temperature

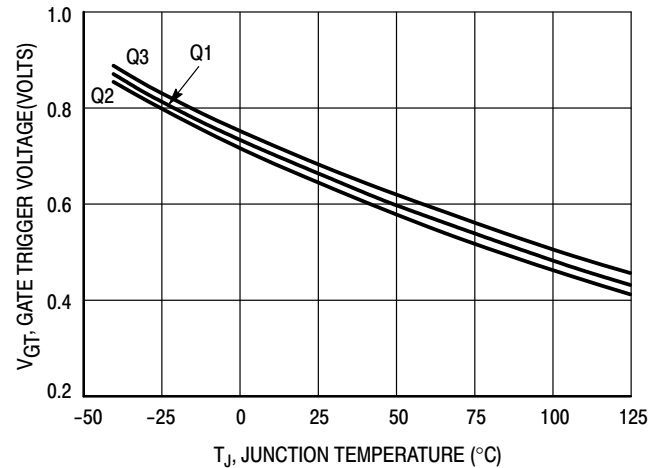


Figure 6. Typical Gate Trigger Voltage versus Junction Temperature

MAC4DSM, MAC4DSN

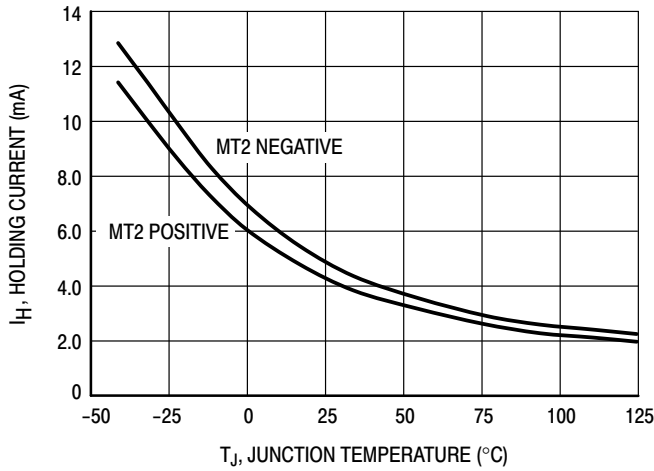


Figure 7. Typical Holding Current versus Junction Temperature

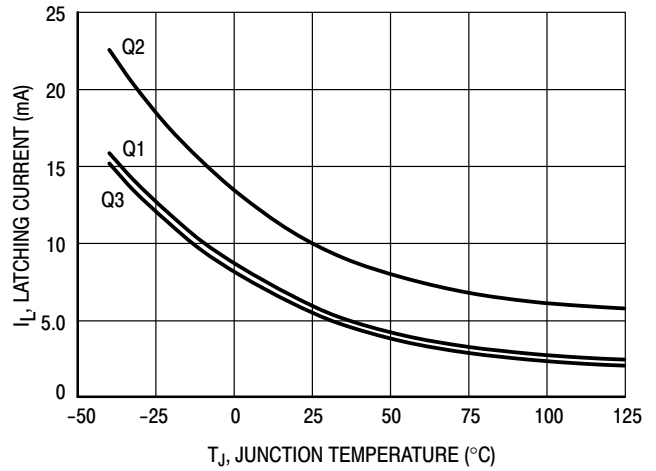


Figure 8. Typical Latching Current versus Junction Temperature

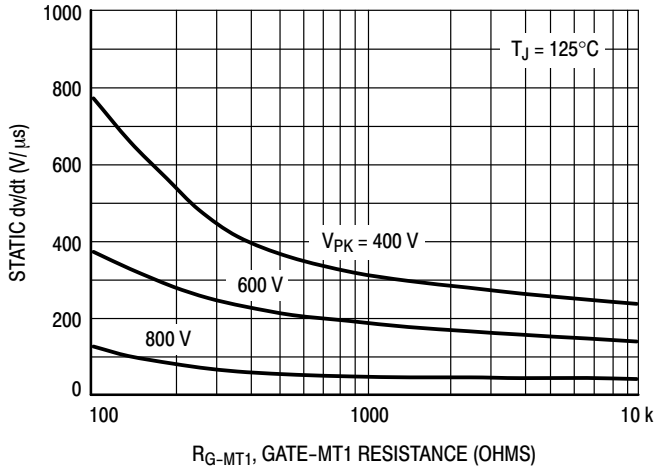


Figure 9. Exponential Static dv/dt versus Gate-MT1 Resistance, MT2(+)

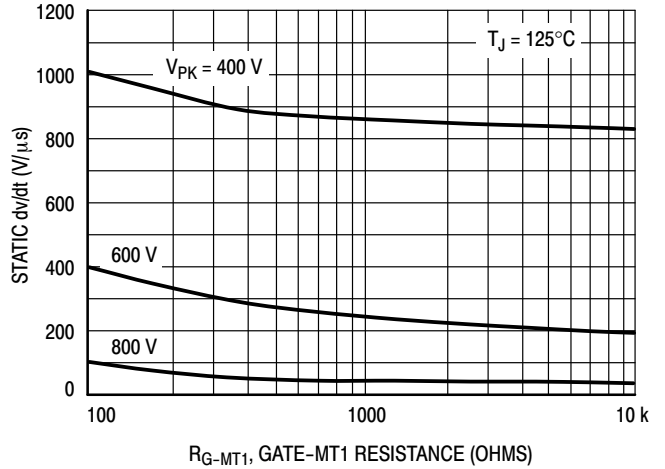


Figure 10. Exponential Static dv/dt versus Gate-MT1 Resistance, MT2(-)

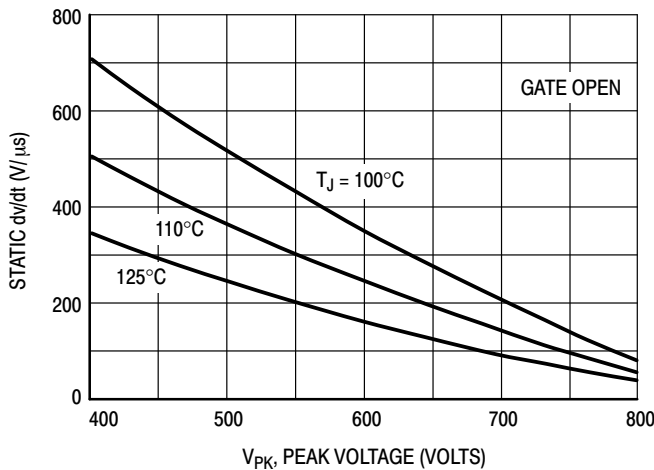


Figure 11. Exponential Static dv/dt versus Peak Voltage, MT2(+)

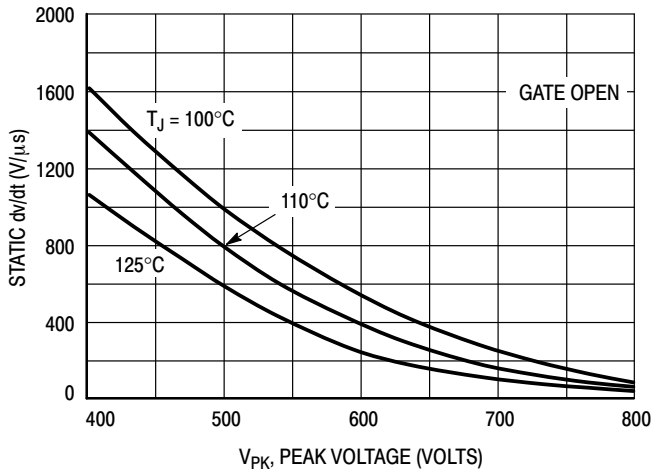


Figure 12. Exponential Static dv/dt versus Peak Voltage, MT2(-)

MAC4DSM, MAC4DSN

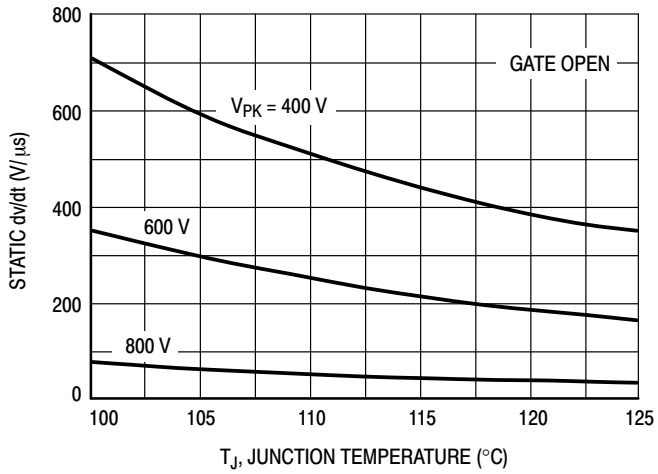


Figure 13. Typical Exponential Static dv/dt versus Junction Temperature, MT2(+)

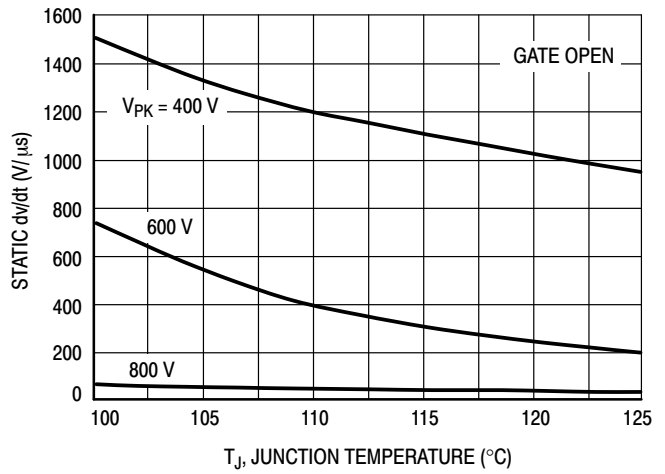


Figure 14. Typical Exponential Static dv/dt versus Junction Temperature, MT2(-)

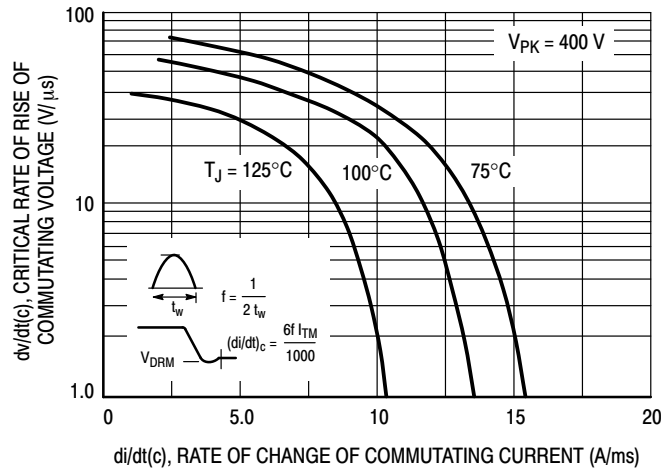
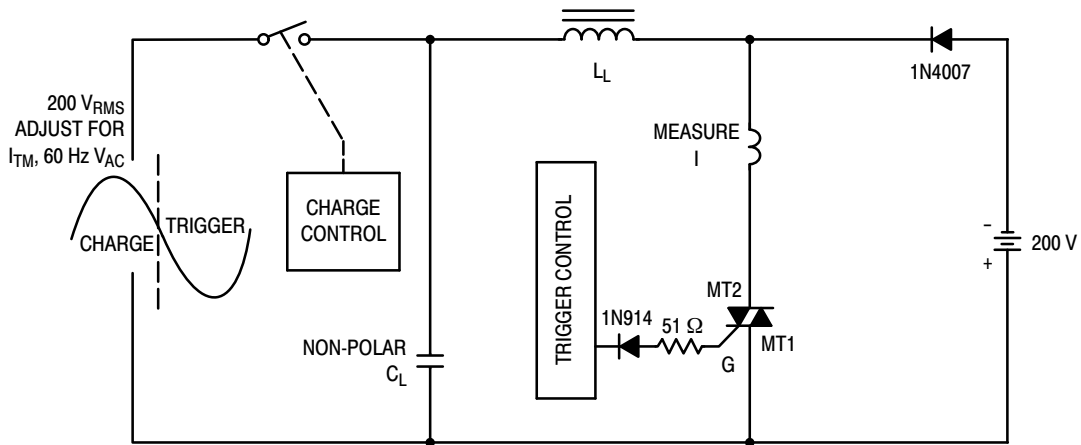


Figure 15. Critical Rate of Rise of Commutating Voltage



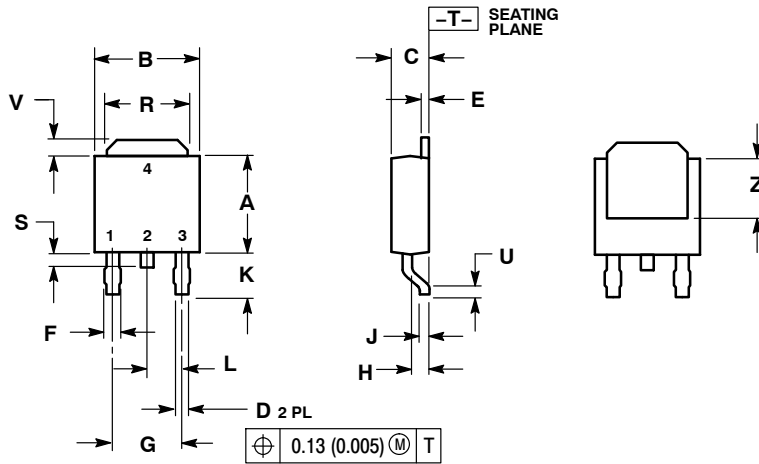
Note: Component values are for verification of rated $(di/dt)_c$. See AN1048 for additional information.

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

MAC4DSM, MAC4DSN

PACKAGE DIMENSIONS

DPAK
CASE 369C
ISSUE O

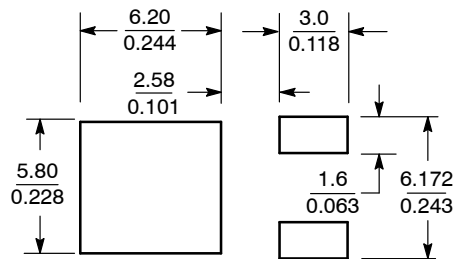


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.

| DIM | INCHES | | MILLIMETERS | |
|-----|-----------|-------|-------------|------|
| | MIN | MAX | MIN | MAX |
| A | 0.235 | 0.245 | 5.97 | 6.22 |
| 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 | 0.018 | 0.023 | 0.46 | 0.58 |
| F | 0.037 | 0.045 | 0.94 | 1.14 |
| 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 | 0.180 | 0.215 | 4.57 | 5.45 |
| S | 0.025 | 0.040 | 0.63 | 1.01 |
| U | 0.020 | --- | 0.51 | --- |
| V | 0.035 | 0.050 | 0.89 | 1.27 |
| Z | 0.155 | --- | 3.93 | --- |

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

SOLDERING FOOTPRINT*



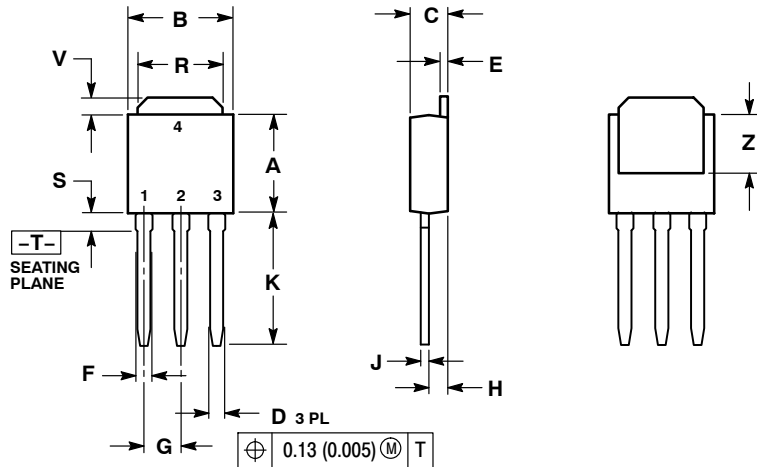
SCALE 3:1 ($\frac{\text{mm}}{\text{inches}}$)

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

MAC4DSM, MAC4DSN

PACKAGE DIMENSIONS

DKPAK-3
CASE 369D-01
ISSUE B



NOTES:

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

| DIM | INCHES | | MILLIMETERS | |
|-----|--------|-------|-------------|------|
| | MIN | MAX | MIN | MAX |
| A | 0.235 | 0.245 | 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 | 0.018 | 0.023 | 0.46 | 0.58 |
| F | 0.037 | 0.045 | 0.94 | 1.14 |
| 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 | 0.180 | 0.215 | 4.45 | 5.45 |
| S | 0.025 | 0.040 | 0.63 | 1.01 |
| V | 0.035 | 0.050 | 0.89 | 1.27 |
| Z | 0.155 | --- | 3.93 | --- |

STYLE 6:

1. MT1
2. MT2
3. GATE
4. MT2

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