

# MAC4DLM

Preferred Device

## Sensitive Gate 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
- Four-Quadrant Triggering
- Blocking Voltage to 600 V
- On-State Current Rating of 4.0 Amperes RMS at 93°C
- Low Level Triggering and Holding Characteristics
- Epoxy Meets UL 94, V-0 @ 0.125 in
- ESD Ratings: Human Body Model, 3B > 8000 V  
Machine Model, C > 400 V

#### MAXIMUM RATINGS (T<sub>J</sub> = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Peak Repetitive Off-State Voltage (Note 1) (T <sub>J</sub> = -40 to 110°C, Sine Wave, 50 to 60 Hz, Gate Open)	V <sub>DRM</sub> , V <sub>RRM</sub>	600	V
On-State RMS Current (Full Cycle Sine Wave, 60 Hz, T <sub>C</sub> = 93°C)	I <sub>T(RMS)</sub>	4.0	A
Peak Non-Repetitive Surge Current (One Full Cycle, 60 Hz, T <sub>J</sub> = 110°C)	I <sub>TSM</sub>	40	A
Circuit Fusing Consideration (t = 8.3 msec)	I <sup>2</sup> t	6.6	A <sup>2</sup> sec
Peak Gate Power (Pulse Width ≤ 10 μsec, T <sub>C</sub> = 93°C)	P <sub>GM</sub>	0.5	W
Average Gate Power (t = 8.3 msec, T <sub>C</sub> = 93°C)	P <sub>G(AV)</sub>	0.1	W
Peak Gate Current (Pulse Width ≤ 10 μsec, T <sub>C</sub> = 93°C)	I <sub>GM</sub>	0.2	A
Peak Gate Voltage (Pulse Width ≤ 10 μsec, T <sub>C</sub> = 93°C)	V <sub>GM</sub>	5.0	V
Operating Junction Temperature Range	T <sub>J</sub>	-40 to 110	°C
Storage Temperature Range	T <sub>stg</sub>	-40 to 150	°C

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

V<sub>DRM</sub> and V<sub>RRM</sub> 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.



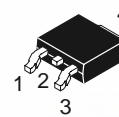
ON Semiconductor®

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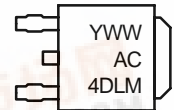
**TRIACS**  
**4.0 AMPERES RMS**  
**600 VOLTS**



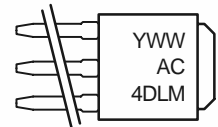
#### MARKING DIAGRAMS



DPAK  
CASE 369C  
STYLE 6



DPAK-3  
CASE 369D  
STYLE 6



Y = Year  
WW = Work Week

#### 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.



# MAC4DLM

## THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance – Junction-to-Case	$R_{\theta JC}$	3.5	$^{\circ}C/W$
– Junction-to-Ambient	$R_{\theta JA}$	88	
– Junction-to-Ambient (Note 2)	$R_{\theta JA}$	80	
Maximum Lead Temperature for Soldering Purposes (Note 3)	$T_L$	260	$^{\circ}C$

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

Characteristic	Symbol	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Peak Repetitive Blocking Current ( $V_D = \text{Rated } V_{DRM}, V_{RRM}; \text{ Gate Open}$ )	$I_{DRM},$ $I_{RRM}$	–	–	0.01	mA
$T_J = 25^{\circ}C$					
$T_J = 110^{\circ}C$		–	–	2.0	

### 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) ( $V_D = 12 \text{ V}, R_L = 100 \Omega$ )	$I_{GT}$	–	1.8	3.0	mA
MT2(+), G(+)		–	2.1	3.0	
MT2(+), G(-)		–	2.4	3.0	
MT2(-), G(-)		–	4.2	5.0	
MT2(-), G(+)					
Gate Trigger Voltage (Continuous dc) ( $V_D = 12 \text{ V}, R_L = 100 \Omega$ )	$V_{GT}$	0.5	0.62	1.3	V
MT2(+), G(+)		0.5	0.57	1.3	
MT2(+), G(-)		0.5	0.65	1.3	
MT2(-), G(-)		0.5	0.74	1.3	
MT2(-), G(+)					
Gate Non-Trigger Voltage ( $V_D = 12 \text{ V}, R_L = 100 \Omega, T_J = 110^{\circ}C$ )	$V_{GD}$	0.1	0.4	–	V
MT2(+), G(+); MT2(+), G(-); MT2(-), G(-); MT2(-), G(+)					
Holding Current ( $V_D = 12 \text{ V}, \text{ Gate Open}, \text{ Initiating Current} = \pm 200 \text{ mA}$ )	$I_H$	–	1.5	15	mA
Latching Current	$I_L$	–	1.75	10	mA
MT2(+), G(+) ( $V_D = 12 \text{ V}, I_G = 5.0 \text{ mA}$ )		–	5.2	10	
MT2(+), G(-) ( $V_D = 12 \text{ V}, I_G = 5.0 \text{ mA}$ )		–	2.1	10	
MT2(-), G(-) ( $V_D = 12 \text{ V}, I_G = 5.0 \text{ mA}$ )		–	2.2	10	
MT2(-), G(+) ( $V_D = 12 \text{ V}, I_G = 10 \text{ mA}$ )					

### DYNAMIC CHARACTERISTICS

Characteristic	Symbol	Min	Typ	Max	Unit
Rate of Change of Commutating Current ( $V_D = 200 \text{ V}, I_{TM} = 1.8 \text{ A}, \text{ Commutating } dv/dt = 1.0 \text{ V}/\mu\text{sec},$ $T_J = 110^{\circ}C, f = 250 \text{ Hz}, CL = 5.0 \mu\text{fd}, LL = 80 \text{ mH}, RS = 56 \Omega,$ $CS = 0.03 \mu\text{fd}$ ) With snubber see Figure 11	$di/dt(c)$	–	3.0	–	A/ms
Critical Rate of Rise of Off-State Voltage ( $V_D = 0.67 \times \text{Rated } V_{DRM}, \text{ Exponential Waveform},$ $\text{ Gate Open}, T_J = 110^{\circ}C$ )	$dv/dt$	10	–	–	V/ $\mu\text{s}$

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  $\leq 2.0 \text{ msec}$ , Duty Cycle  $\leq 2\%$ .

### ORDERING INFORMATION

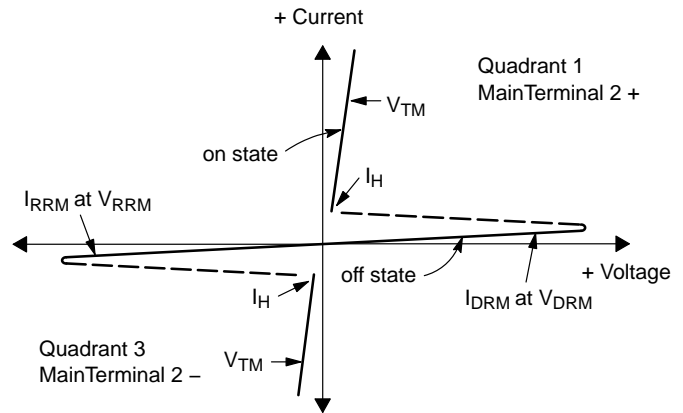
Device	Package Type	Package	Shipping†
MAC4DLM-001	DPAK-3	369D	75 Units / Rail
MAC4DLMT4	DPAK	369C	16 mm Tape & Reel (2.5 k / Reel)

†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.

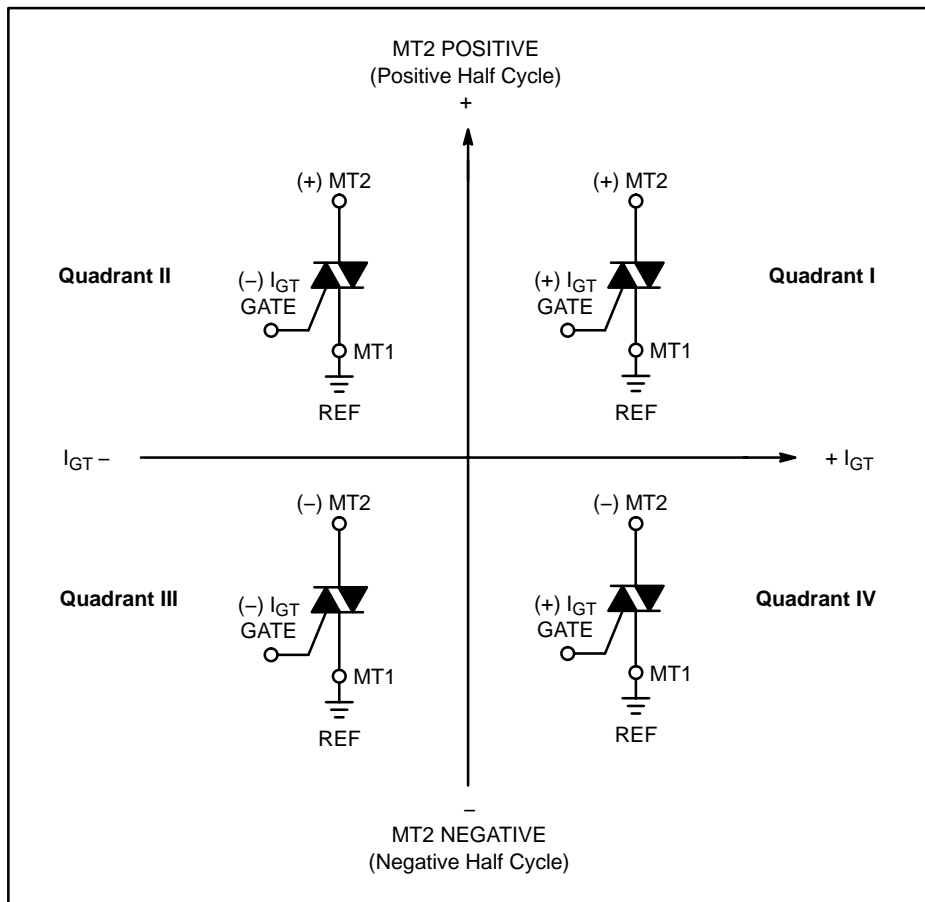
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## Voltage Current Characteristic of Triacs (Bidirectional Device)

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.

# MAC4DLM

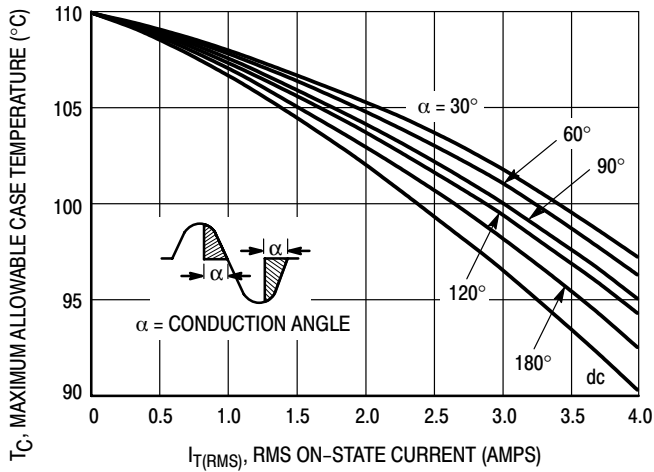


Figure 1. RMS Current Derating

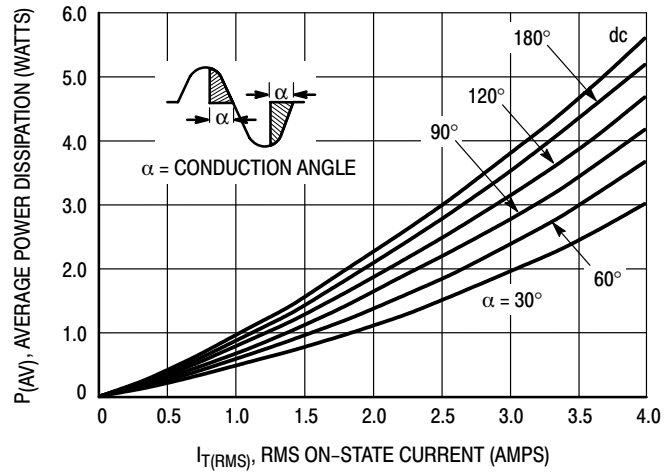


Figure 2. On-State Power Dissipation

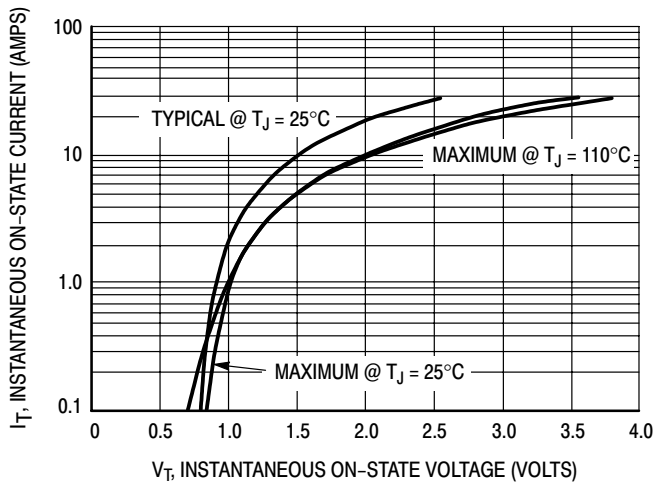


Figure 3. On-State Characteristics

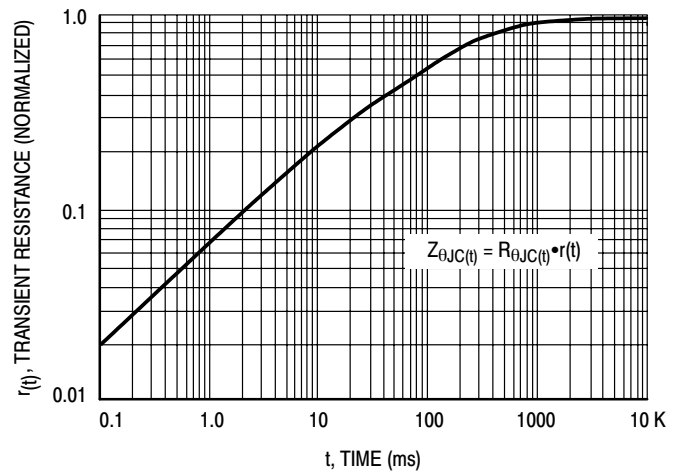


Figure 4. Transient Thermal Response

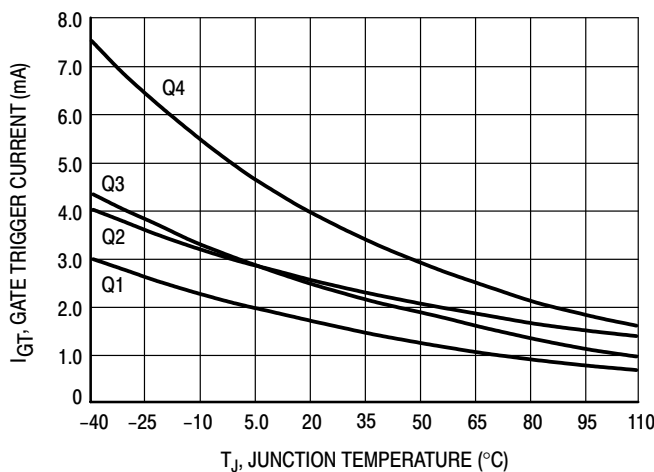


Figure 5. Typical Gate Trigger Current versus Junction Temperature

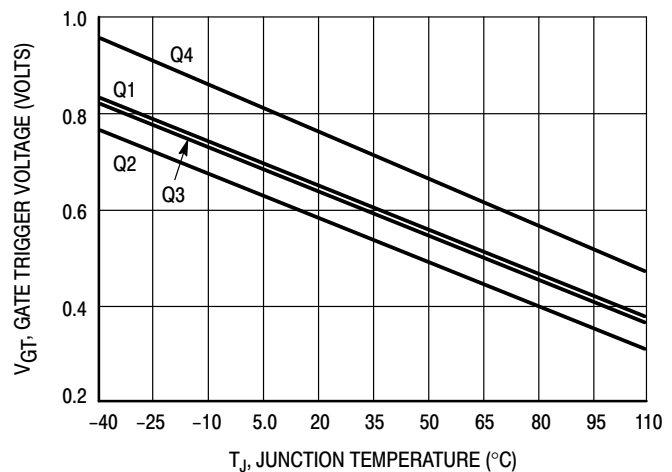
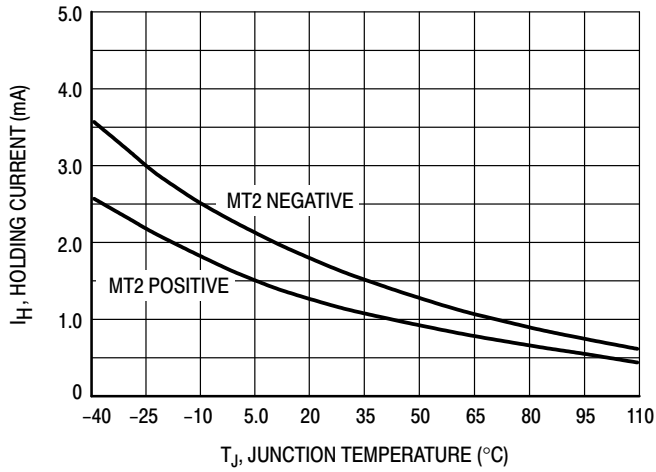
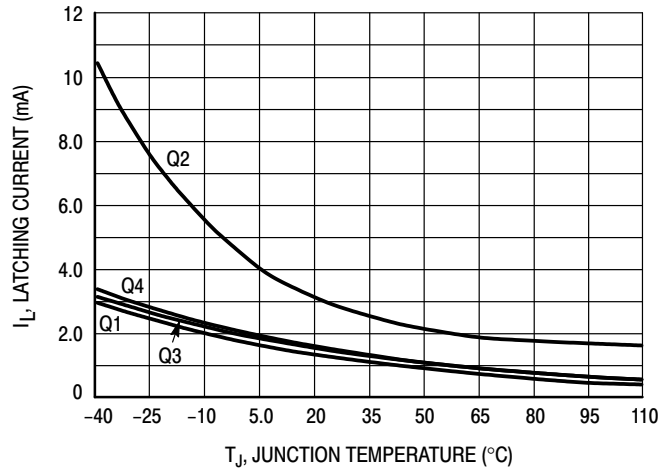


Figure 6. Typical Gate Trigger Voltage versus Junction Temperature

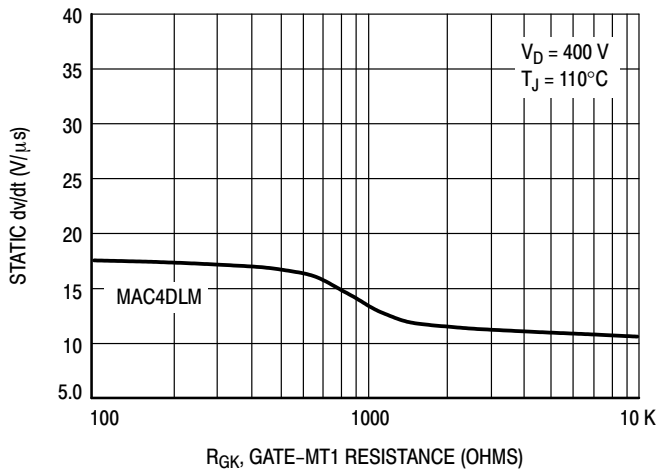
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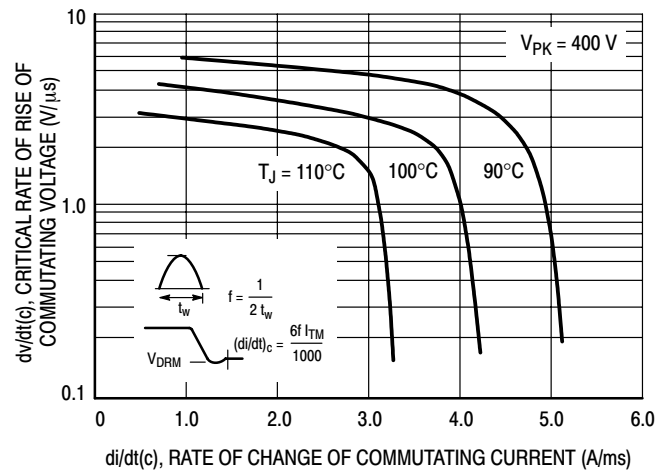
**Figure 7. Typical Holding Current versus Junction Temperature**



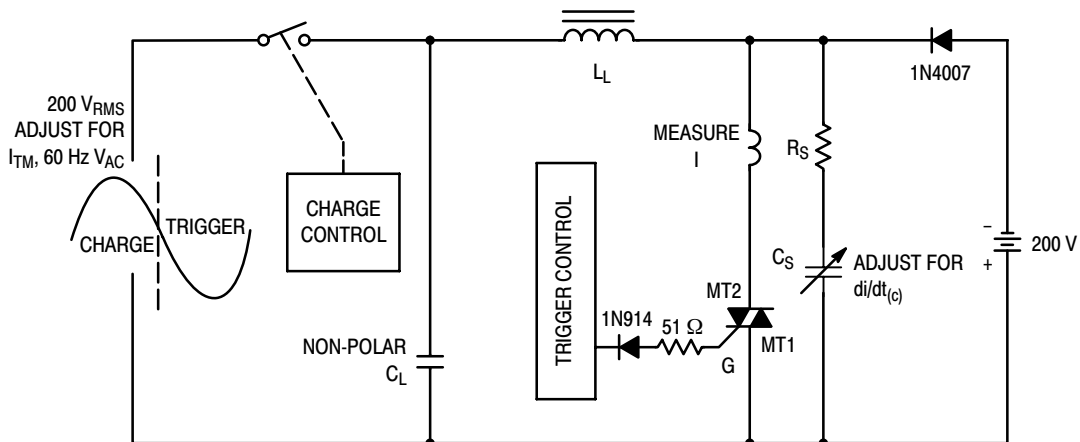
**Figure 8. Typical Latching Current versus Junction Temperature**



**Figure 9. Minimum Exponential Static dv/dt versus Gate-MT1 Resistance**



**Figure 10. Critical Rate of Rise of Commutating Voltage**



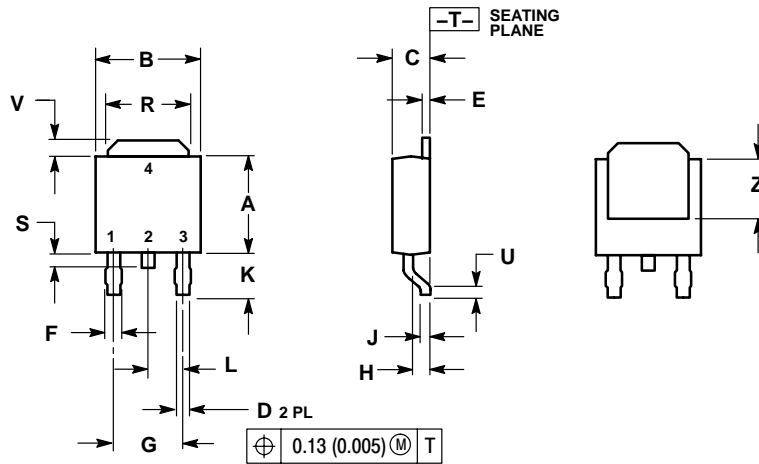
Note: Component values are for verification of rated  $(di/dt)_c$ . See AN1048 for additional information.

**Figure 11. Simplified Test Circuit to Measure the Critical Rate of Rise of Commutating Current  $(di/dt)_c$**

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## PACKAGE DIMENSIONS

DPAK  
CASE 369C  
ISSUE O

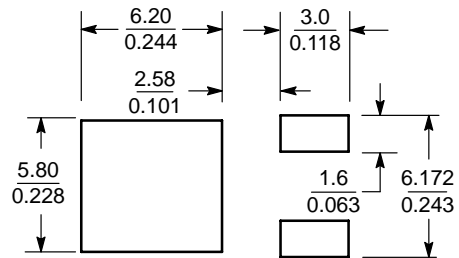


- NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
2. CONTROLLING DIMENSION: INCH.

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

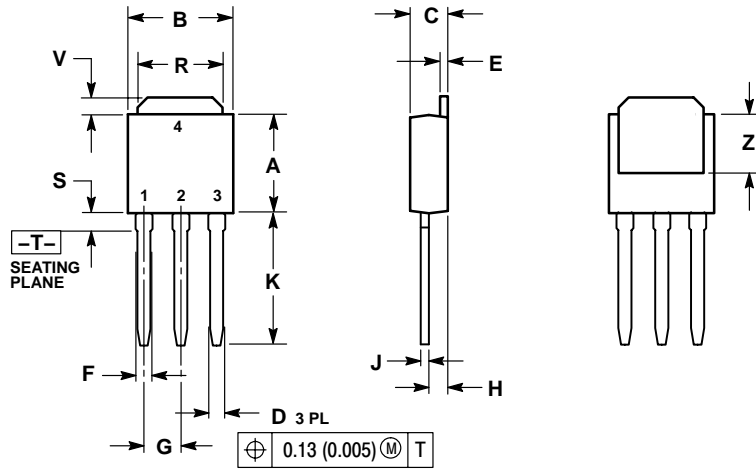


SCALE 3:1  $\left( \frac{\text{mm}}{\text{inches}} \right)$

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## PACKAGE DIMENSIONS

**DPAK-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:**

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

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