

MAC15M, MAC15N

Preferred Device

Triacs

Silicon Bidirectional Thyristors

Designed for high performance full-wave ac control applications where high noise immunity and high commutating di/dt are required.

- Blocking Voltage to 800 Volts
- On-State Current Rating of 15 Amperes RMS at 80°C
- Uniform Gate Trigger Currents in Three Modes
- High Immunity to dv/dt — 250 V/μs minimum at 125°C
- Minimizes Snubber Networks for Protection
- Industry Standard TO-220AB Package
- High Commutating di/dt — 9.0 A/ms minimum at 125°C
- Operational in Three Quadrants, Q1, Q2, and Q3
- Device Marking: Logo, Device Type, e.g., MAC15M, Date Code

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

Rating	Symbol	Value	Unit
Peak Repetitive Off-State Voltage ⁽¹⁾ (-40 to 125°C, Sine Wave, 50 to 60 Hz, Gate Open) MAC15M MAC15N	V_{DRM} , V_{RRM}	600 800	Volts
On-State RMS Current (Full Cycle Sine Wave, 60 Hz, $T_C = 80^\circ\text{C}$)	$I_{\text{T(RMS)}}$	15	A
Peak Non-repetitive Surge Current (One Full Cycle Sine Wave, 60 Hz, $T_J = 125^\circ\text{C}$)	I_{TSM}	150	A
Circuit Fusing Consideration ($t = 8.3 \text{ ms}$)	I^2t	93	A^2s
Peak Gate Power (Pulse Width $\leq 1.0 \mu\text{s}$, $T_C = 80^\circ\text{C}$)	P_{GM}	20	Watts
Average Gate Power ($t = 8.3 \text{ ms}$, $T_C = 80^\circ\text{C}$)	$P_{\text{G(AV)}}$	0.5	Watts
Operating Junction Temperature Range	T_J	-40 to +125	°C
Storage Temperature Range	T_{stg}	-40 to +150	°C

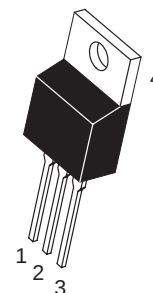
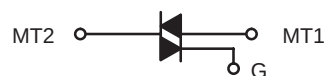
(1) V_{DRM} and V_{RRM} for all types can be applied on a continuous basis. Blocking voltages shall not be tested with a constant current source such that the voltage ratings of the devices are exceeded.



ON Semiconductor

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TRIACS
15 AMPERES RMS
600 thru 800 VOLTS



TO-220AB
CASE 221A
STYLE 4

PIN ASSIGNMENT

1	Main Terminal 1
2	Main Terminal 2
3	Gate
4	Main Terminal 2

ORDERING INFORMATION

Device	Package	Shipping
MAC15M	TO220AB	50 Units/Rail
MAC15N	TO220AB	50 Units/Rail

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

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THERMAL CHARACTERISTICS

Symbol	Characteristic	Value	Unit
$R_{\theta JC}$ $R_{\theta JA}$	Thermal Resistance — Junction to Case — Junction to Ambient	2.0 62.5	$^{\circ}\text{C/W}$
T_L	Maximum Lead Temperature for Soldering Purposes 1/8" from Case for 10 Seconds	260	$^{\circ}\text{C}$

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

Symbol	Characteristic	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

I_{DRM} , I_{RRM}	Peak Repetitive Blocking Current ($V_D = \text{Rated } V_{DRM}, V_{RRM}$; Gate Open) $T_J = 25^{\circ}\text{C}$ $T_J = 125^{\circ}\text{C}$	— —	— —	0.01 2.0	mA
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ON CHARACTERISTICS

V_{TM}	Peak On-State Voltage ⁽¹⁾ ($I_{TM} = \pm 21 \text{ A Peak}$)	—	1.2	1.6	Volts
I_{GT}	Gate Trigger Current (Continuous DC) ($V_D = 12 \text{ V}$, $R_L = 100 \Omega$) MT2(+), G(+) MT2(+), G(–) MT2(–), G(–)	5.0 5.0 5.0	13 16 18	35 35 35	mA
I_H	Hold Current ($V_D = 12 \text{ Vdc}$, Gate Open, Initiating Current = $\pm 150 \text{ mA}$)	—	20	40	mA
I_L	Latching Current ($V_D = 24 \text{ V}$, $I_G = 35 \text{ mA}$) MT2(+), G(+) MT2(+), G(–) MT2(–), G(–)	— — —	33 36 33	50 80 50	mA
V_{GT}	Gate Trigger Voltage ($V_D = 12 \text{ V}$, $R_L = 100 \Omega$) MT2(+), G(+) MT2(+), G(–) MT2(–), G(–)	0.5 0.5 0.5	0.75 0.72 0.82	1.5 1.5 1.5	Volts

DYNAMIC CHARACTERISTICS

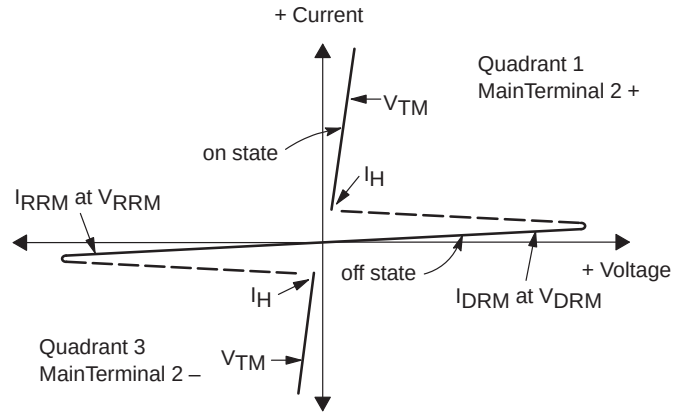
$(di/dt)_C$	Rate of Change of Commutating Current; See Figure 10. ($V_D = 400 \text{ V}$, $I_{TM} = 6.0 \text{ A}$, Commutating $dv/dt = 24 \text{ V}/\mu\text{s}$, Gate Open, $T_J = 125^{\circ}\text{C}$, $f = 250 \text{ Hz}$, No Snubber) $C_L = 10 \mu\text{F}$ $L_L = 40 \text{ mH}$	9.0	—	—	A/ms
dv/dt	Critical Rate of Rise of Off-State Voltage ($V_D = \text{Rated } V_{DRM}$, Exponential Waveform, Gate Open, $T_J = 125^{\circ}\text{C}$)	250	—	—	V/ μs

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

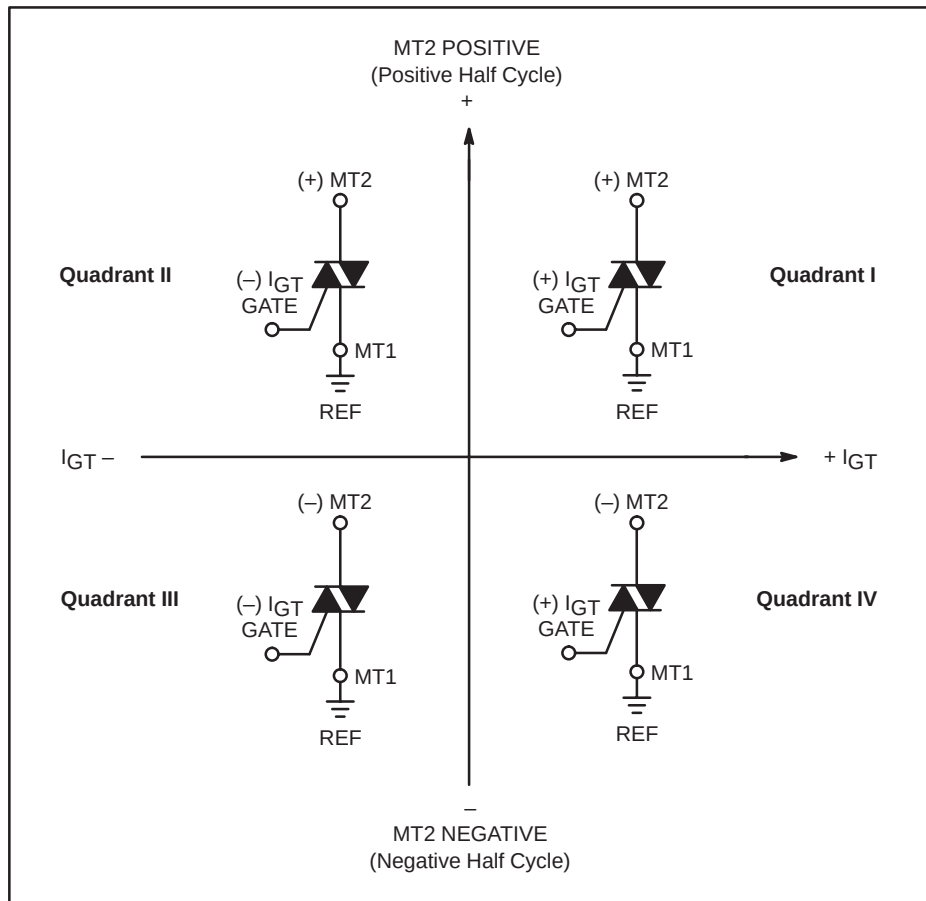
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Voltage Current Characteristic of Triacs (Bidirectional Device)

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.

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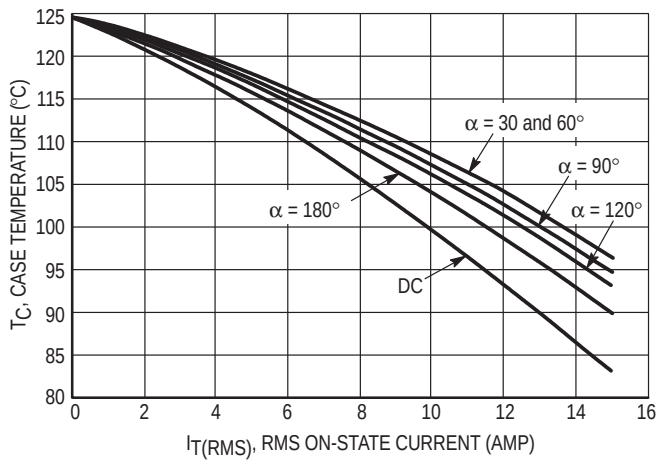


Figure 1. RMS Current Derating

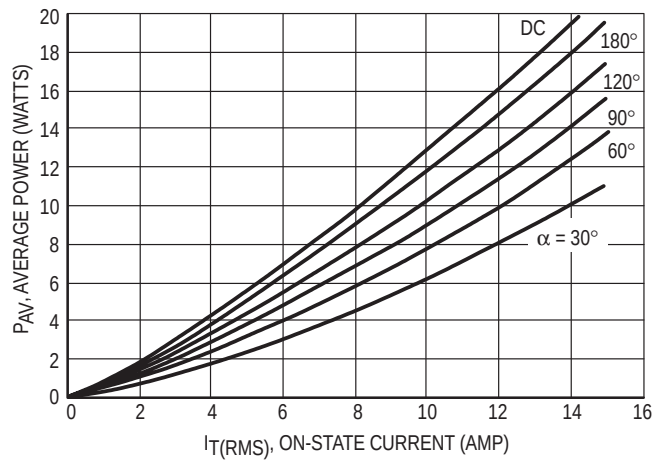


Figure 2. On-State Power Dissipation

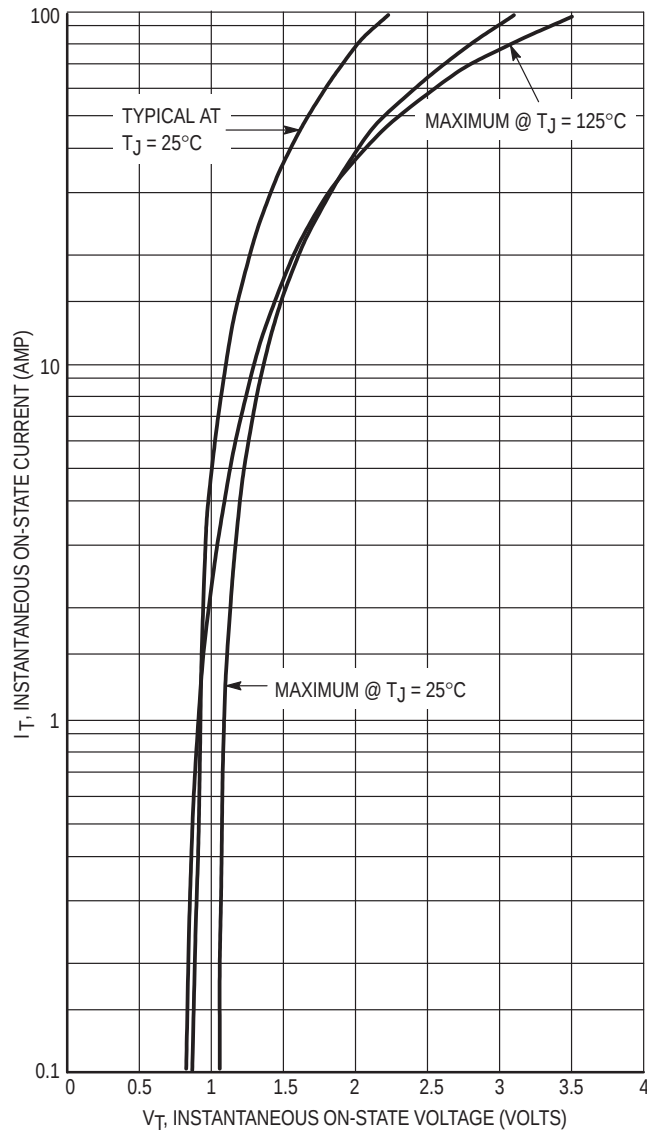


Figure 3. On-State Characteristics

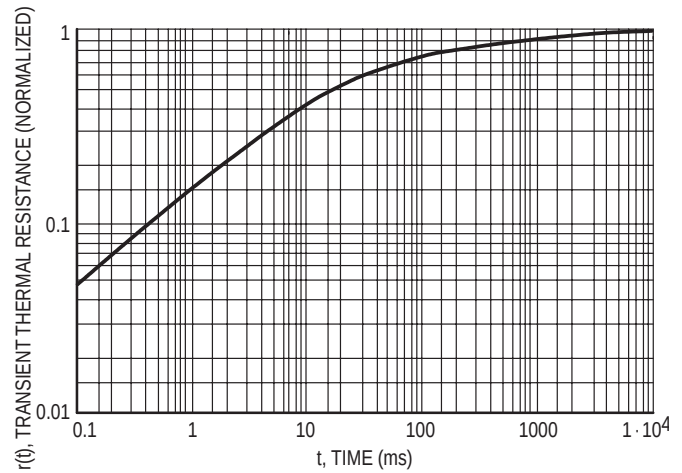


Figure 4. Transient Thermal Response

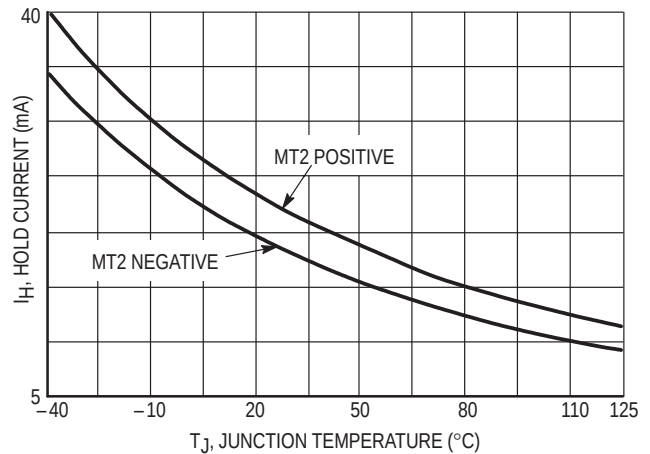


Figure 5. Hold Current Variation

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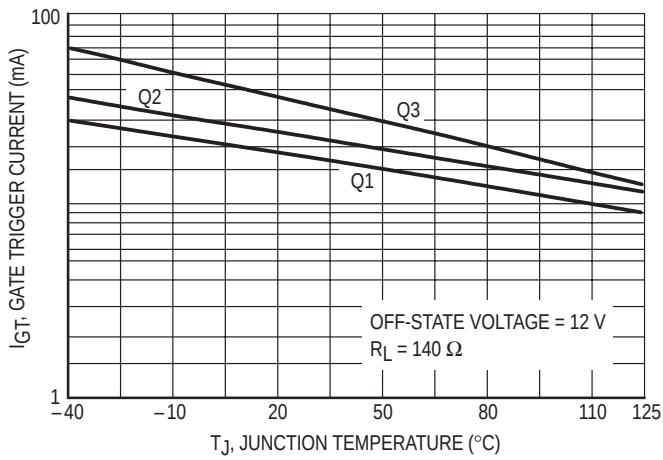


Figure 6. Typical Holding Current versus Junction Temperature

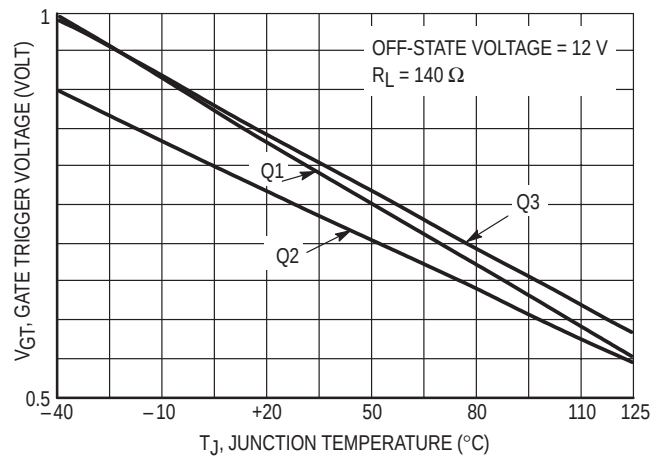


Figure 7. Gate Trigger Voltage versus Junction Temperature

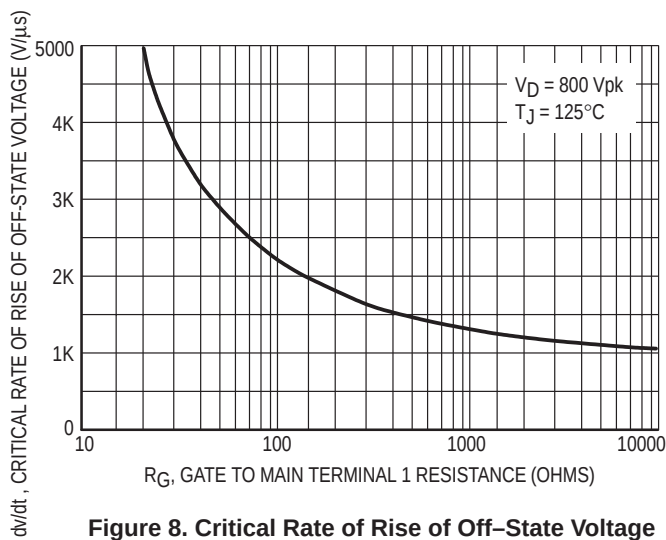


Figure 8. Critical Rate of Rise of Off-State Voltage (Exponential)

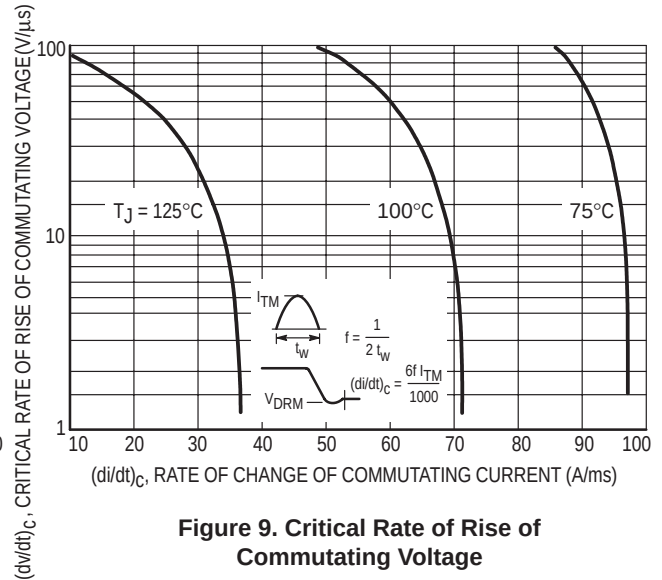
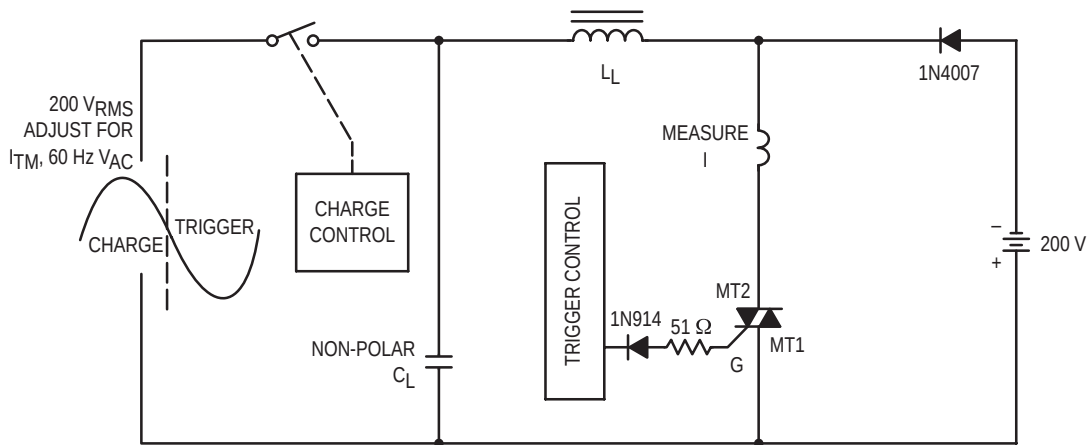


Figure 9. Critical Rate of Rise of Commutating Voltage



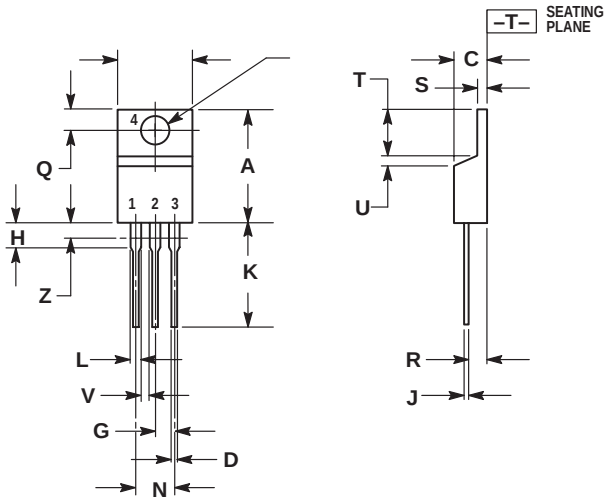
Note: Component values are for verification of rated $(di/dt)_C$. See AN1048 for additional information.

Figure 10. Simplified Test Circuit to Measure the Critical Rate of Rise of Commutating Current $(di/dt)_C$

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PACKAGE DIMENSIONS

TO-220AB CASE 221A-09 ISSUE Z



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.570	0.620	14.48	15.75
B	0.380	0.405	9.66	10.28
C	0.160	0.190	4.07	4.82
D	0.025	0.035	0.64	0.88
F	0.142	0.147	3.61	3.73
G	0.095	0.105	2.42	2.66
H	0.110	0.155	2.80	3.93
J	0.018	0.025	0.46	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.15	1.39
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
V	0.045	—	1.15	—
Z	—	0.080	—	2.04

STYLE 4:

- PIN 1. MAIN TERMINAL 1
2. MAIN TERMINAL 2
3. GATE
4. MAIN TERMINAL 2

Notes

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