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TMOS E-FET™

Power Field Effect Transistor

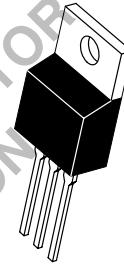
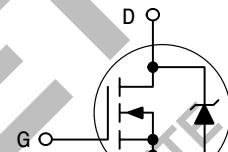
N-Channel Enhancement-Mode Silicon Gate

This high voltage MOSFET uses an advanced termination scheme to provide enhanced voltage-blocking capability without degrading performance over time. In addition, this advanced TMOS E-FET is designed to withstand high energy in the avalanche and commutation modes. This new energy efficient design also offers a drain-to-source diode with a fast recovery time. Designed for low voltage, high speed switching applications in power supplies, converters, PWM motor controls, these devices are particularly well suited for bridge circuits where diode speed and commutating safe operating areas are critical and offer additional safety margin against unexpected voltage transients.

- Robust High Voltage Termination
- Avalanche Energy Specified
- Source-to-Drain Diode Recovery Time Comparable to a Discrete Fast Recovery Diode
- Diode is Characterized for Use in Bridge Circuits
- I_{DSS} and $V_{DS(on)}$ Specified at Elevated Temperature

MTP8N50E

TMOS POWER FET
8.0 AMPERES
500 VOLTS
 $R_{DS(on)} = 0.8 \text{ OHM}$



CASE 221A-09, Style 5
TO-220AB

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

Rating	Symbol	Value	Unit
Drain-to-Source Voltage	V_{DSS}	500	Vdc
Drain-to-Gate Voltage ($R_{GS} = 1.0 \text{ M}\Omega$)	V_{DGR}	500	Vdc
Gate-to-Source Voltage – Continuous – Non-repetitive ($t_p \leq 10 \text{ ms}$)	V_{GS} V_{GSM}	± 20 ± 40	Vdc Vpk
Drain Current — Continuous @ $T_C = 25^\circ\text{C}$ — Continuous @ $T_C = 100^\circ\text{C}$ — Single Pulse ($t_p \leq 10 \mu\text{s}$)	I_D I_D I_{DM}	8.0 5.0 32	Adc Adc Apk
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	125 1.0	Watts W/ $^\circ\text{C}$
Operating and Storage Temperature Range	T_J, T_{stg}	-55 to 150	$^\circ\text{C}$
Single Pulse Drain-to-Source Avalanche Energy – STARTING $T_J = 25^\circ\text{C}$ ($V_{DD} = 25 \text{ Vdc}$, $V_{GS} = 10 \text{ Vdc}$, PEAK $I_L = 8.0 \text{ Apk}$, $L = 16 \text{ mH}$, $R_G = 25 \Omega$)	E_{AS}	510	mJ
Thermal Resistance – Junction-to-Case – Junction-to-Ambient	$R_{\theta JC}$ $R_{\theta JA}$	1.0 62.5	$^\circ\text{C/W}$
Maximum Lead Temperature for Soldering Purposes, 1/8" from Case for 5 sec.	T_L	260	$^\circ\text{C}$

MTP8N50E

ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Drain-to-Source Breakdown Voltage ($V_{GS} = 0$ Vdc, $I_D = 250$ μA dc) Temperature Coefficient (Positive)	$V_{(\text{BR})\text{DSS}}$	500 —	— 500	— —	Vdc $\text{mV}/^\circ\text{C}$
Zero Gate Voltage Drain Current ($V_{DS} = 500$ Vdc, $V_{GS} = 0$ Vdc) ($V_{DS} = 400$ Vdc, $V_{GS} = 0$ Vdc, $T_J = 125^\circ\text{C}$)	I_{DSS}	— —	— —	250 1000	μA dc
Gate-Body Leakage Current ($V_{GS} = \pm 20$ Vdc, $V_{DS} = 0$ Vdc)	I_{GSS}	— —	— —	100	nAdc
ON CHARACTERISTICS (1)					
Gate Threshold Voltage ($V_{DS} = V_{GS}$, $I_D = 250$ μA dc) Threshold Temperature Coefficient (Negative)	$V_{GS(\text{th})}$	2.0 —	2.8 6.3	4.0 —	Vdc $\text{mV}/^\circ\text{C}$
Static Drain-to-Source On-Resistance ($V_{GS} = 10$ Vdc, $I_D = 4.0$ Adc)	$R_{DS(\text{on})}$	—	0.6	0.8	Ohms
Drain-to-Source On-Voltage ($V_{GS} = 10$ Vdc) ($I_D = 8.0$ Adc) ($I_D = 4.0$ Adc, $T_J = 125^\circ\text{C}$)	$V_{DS(\text{on})}$	— —	5.0 —	7.2 6.4	Vdc
Forward Transconductance ($V_{DS} = 15$ Vdc, $I_D = 4.0$ Adc)	g_{FS}	4.0	—	—	mhos
DYNAMIC CHARACTERISTICS					
Input Capacitance	$(V_{DS} = 25$ Vdc, $V_{GS} = 0$ Vdc, $f = 1.0$ MHz)	C_{iss}	—	1450	1680
Output Capacitance		C_{oss}	—	190	246
Transfer Capacitance		C_{rss}	—	45.4	144
SWITCHING CHARACTERISTICS (2)					
Turn-On Delay Time	$(R_{\text{go}} + C_{17n} = 9.1$ Ω)	$t_{\text{d}(\text{on})}$	—	15	50
Rise Time		t_r	—	33	72
Turn-Off Delay Time		$t_{\text{d}(\text{off})}$	—	40	150
Fall Time		t_f	—	32	60
Gate Charge (see Figure 8)	$(V_{DS} = 400$ Vdc, $I_D = 8.0$ Adc, $V_{GS} = 10$ Vdc)	Q_T	—	40	64
		Q_1	—	8.0	—
		Q_2	—	17	—
		Q_3	—	17.3	—
SOURCE-DRAIN DIODE CHARACTERISTICS					
Forward On-Voltage ($I_S = 8.0$ Adc, $V_{GS} = 0$ Vdc) ($I_S = 8.0$ Adc, $V_{GS} = 0$ Vdc, $T_J = 125^\circ\text{C}$)	V_{SD}	—	1.2	2.0	Vdc
		—	1.1	—	
Reverse Recovery Time	$(I_S = 8.0$ Adc, $V_{GS} = 0$ Vdc, $dI_S/dt = 100$ A/ μs)	t_{rr}	—	320	—
		t_a	—	179	—
		t_b	—	141	—
Reverse Recovery Stored Charge		Q_{RR}	—	3.0	μC
INTERNAL PACKAGE INDUCTANCE					
Internal Drain Inductance (Measured from the drain lead 0.25" from package to center of die)	L_D	—	4.5	—	nH
Internal Source Inductance (Measured from the source lead 0.25" from package to source bond pad)	L_S	—	7.5	—	

(1) Pulse Test: Pulse Width ≤ 300 μs , Duty Cycle $\leq 2.0\%$.

(2) Switching characteristics are independent of operating junction temperature.

TYPICAL ELECTRICAL CHARACTERISTICS

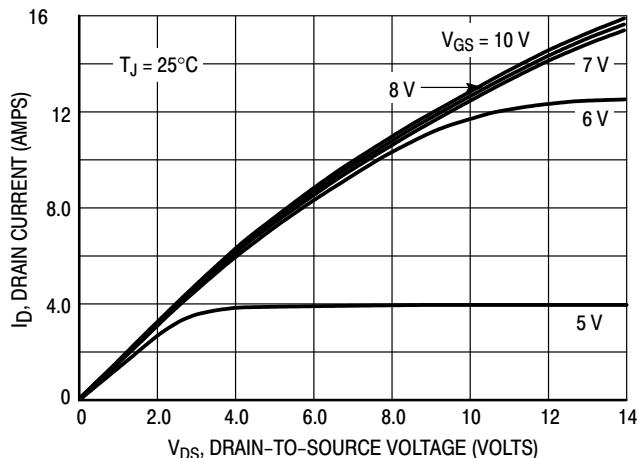


Figure 1. On-Region Characteristics

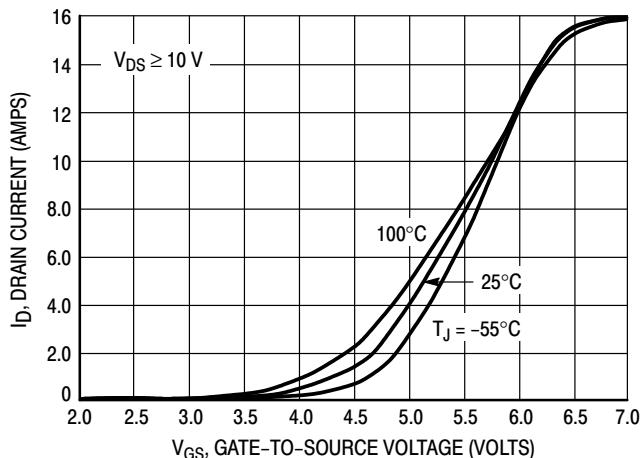


Figure 2. Transfer Characteristics

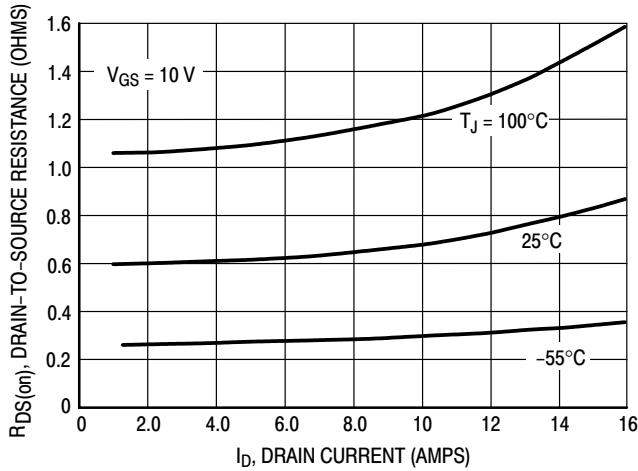


Figure 3. On-Resistance versus Drain Current and Temperature

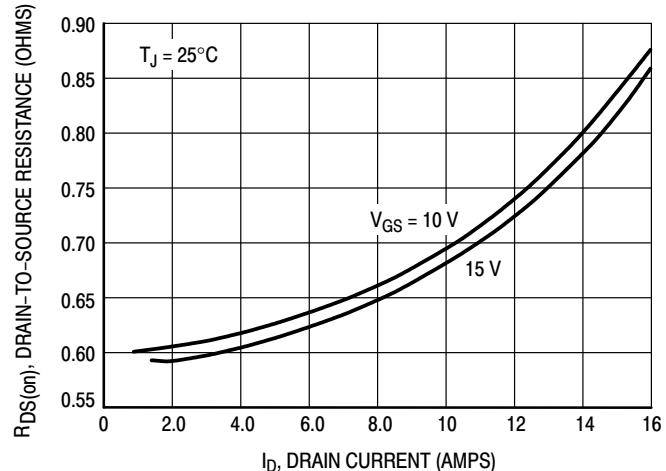


Figure 4. On-Resistance versus Drain Current and Gate Voltage

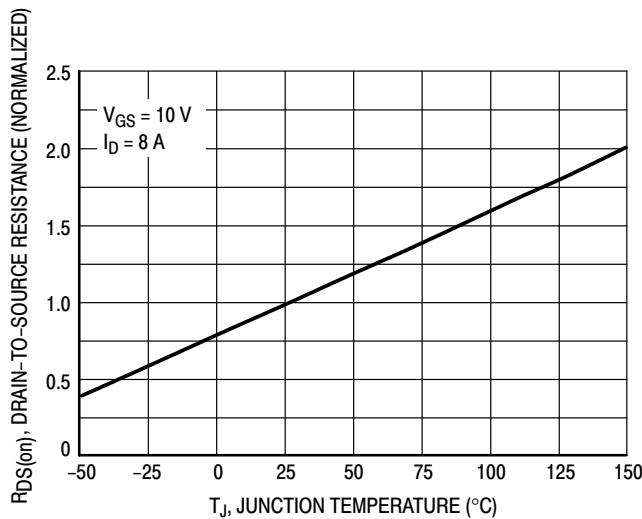


Figure 5. On-Resistance Variation with Temperature

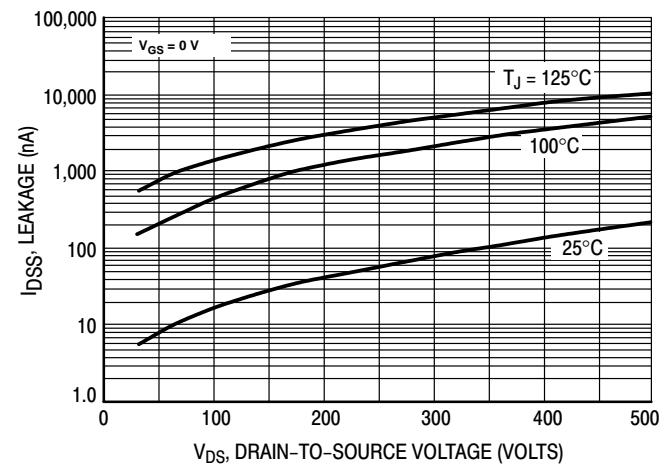


Figure 6. Drain-to-Source Leakage Current versus Voltage

TYPICAL ELECTRICAL CHARACTERISTICS

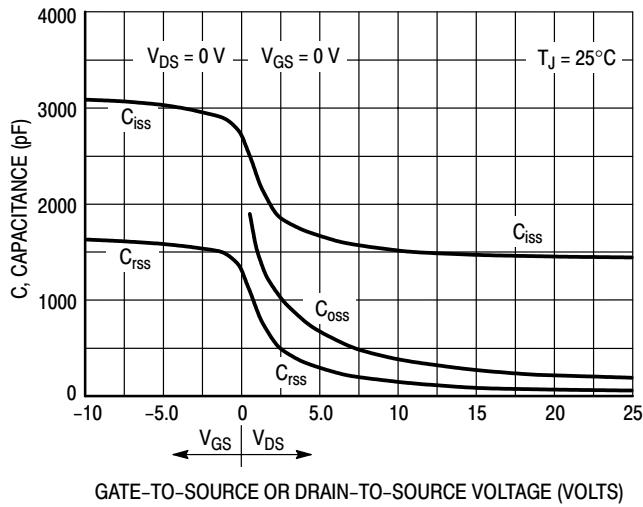


Figure 7. Capacitance Variation

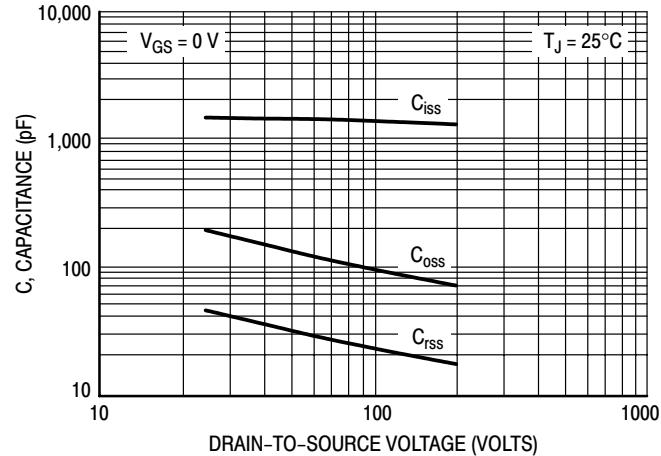


Figure 8. High Voltage Capacitance Variation

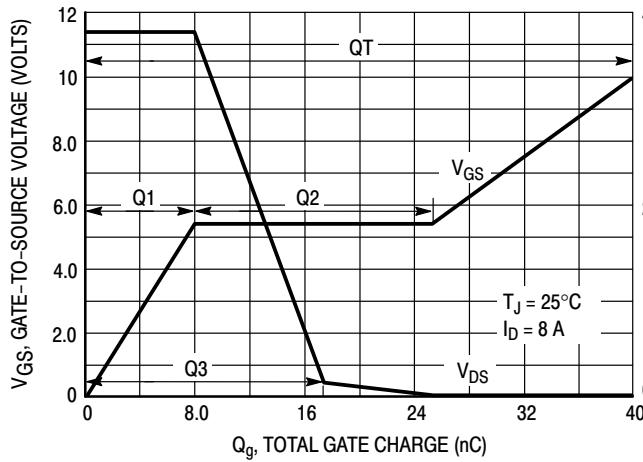


Figure 9. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

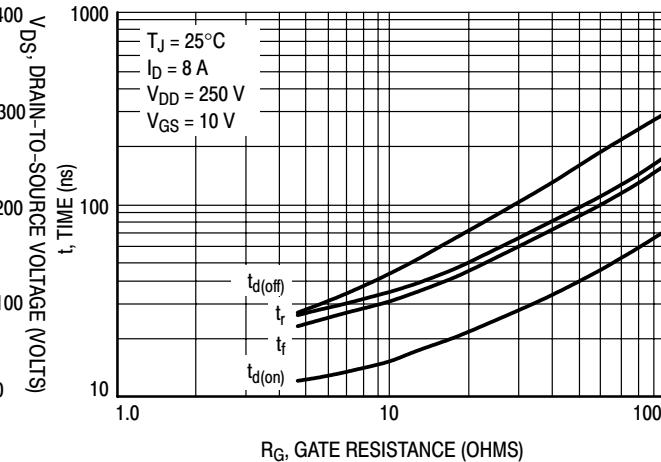


Figure 10. Resistive Switching Time Variation versus Gate Resistance

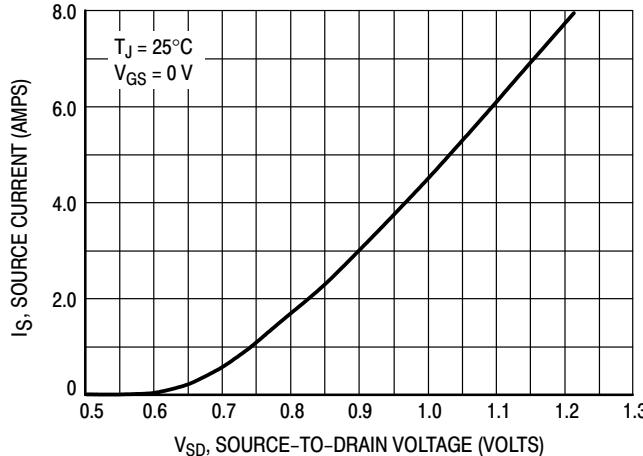


Figure 11. Diode Forward Voltage versus Current

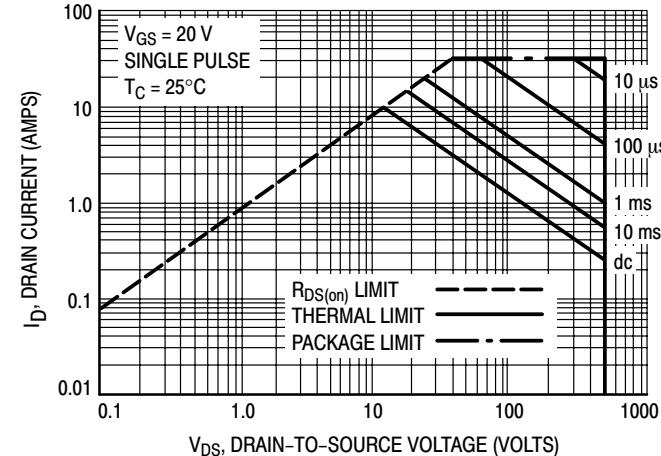


Figure 12. Maximum Rated Forward Biased Safe Operating Area

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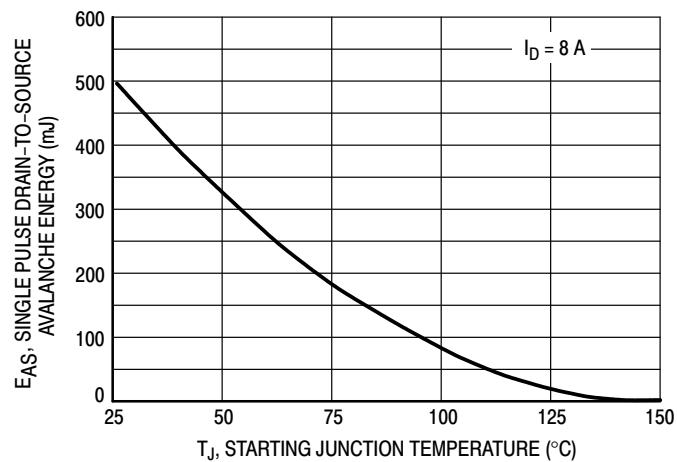


Figure 13. Maximum Avalanche Energy versus Starting Junction Temperature

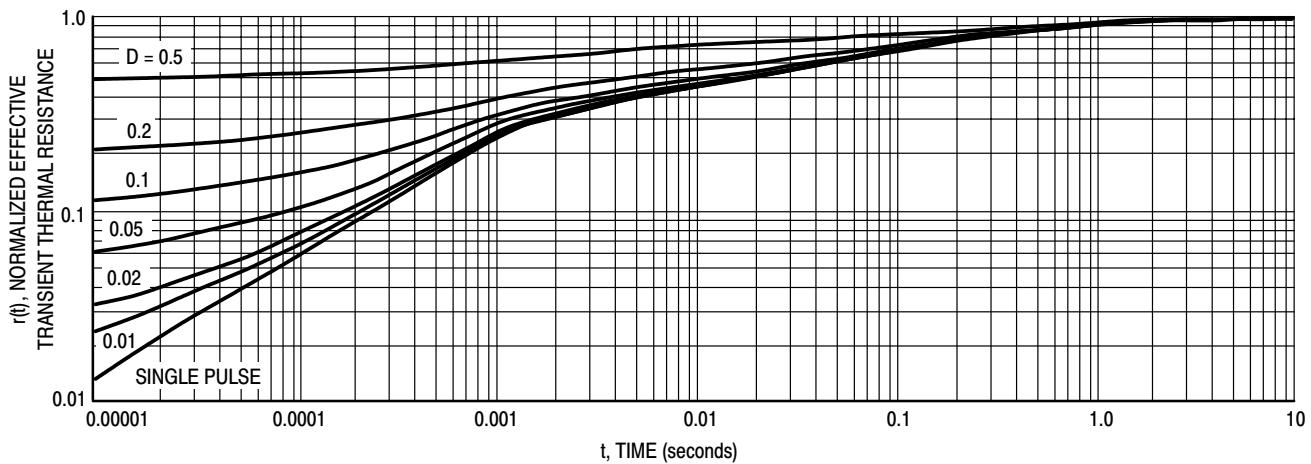
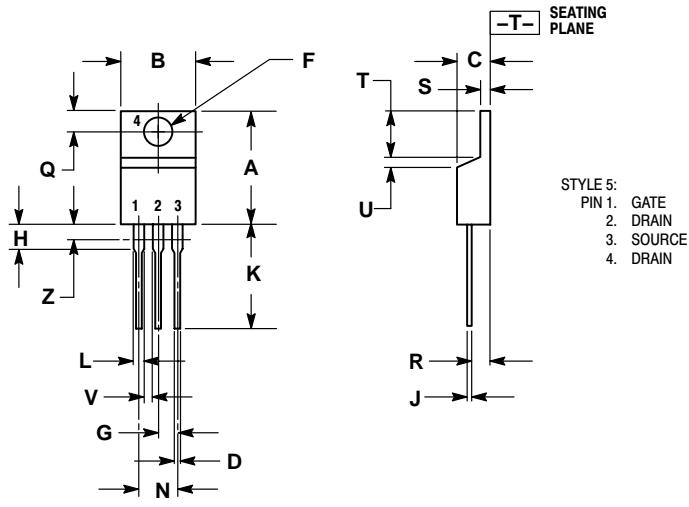


Figure 14. Thermal Response

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PACKAGE DIMENSIONS CASE 221A-09 ISSUE AA



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

Notes

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JAPAN: ON Semiconductor, Japan Customer Focus Center
4-32-1 Nishi-Gotanda, Shinagawa-ku, Tokyo, Japan 141-0031
Phone: 81-3-5740-2700
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