

# MTB8N50E

Designer's™ Data Sheet

TMOS E-FET™

## High Energy Power FET D<sup>2</sup>PAK for Surface Mount N-Channel Enhancement-Mode Silicon Gate



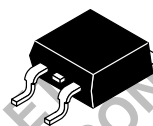
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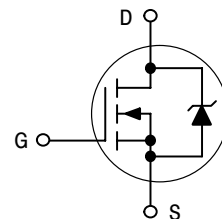
The D<sup>2</sup>PAK package has the capability of housing a larger die than any existing surface mount package which allows it to be used in applications that require the use of surface mount components with higher power and lower  $R_{DS(on)}$  capabilities. This high voltage MOSFET uses an advanced 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
- Short Heatsink Tab Manufactured – Not Sheared
- Specifically Designed Leadframe for Maximum Power Dissipation
- Available in 24 mm 13-inch/800 Unit Tape & Reel, Add T4 Suffix to Part Number

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



D<sup>2</sup>PAK  
CASE 418B-02  
Style 2



# MTB8N50E

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

Rating	Symbol	Value	Unit
Drain-to-Source Voltage	V <sub>DSS</sub>	500	Vdc
Drain-to-Gate Voltage (R <sub>GS</sub> = 1.0 MΩ)	V <sub>DGR</sub>	500	Vdc
Gate-to-Source Voltage – Continuous – Non-repetitive (tp ≤ 10 ms)	V <sub>GS</sub> V <sub>GSM</sub>	±20 ±40	Vdc Vpk
Drain Current — Continuous @ T <sub>C</sub> = 25°C — Continuous @ T <sub>C</sub> = 100°C — Single Pulse (tp ≤ 10 μs)	I <sub>D</sub> I <sub>D</sub> I <sub>DM</sub>	8.0 5.0 32	Adc Adc Apk
Total Power Dissipation @ T <sub>C</sub> = 25°C Derate above 25°C	P <sub>D</sub>	125 1.0	Watts W/°C
Operating and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-55 to 150	°C
Single Pulse Drain-to-Source Avalanche Energy – STARTING T <sub>J</sub> = 25°C (V <sub>DD</sub> = 25 Vdc, V <sub>GS</sub> = 10 Vdc, PEAK I <sub>L</sub> = 8.0 Apk, L = 16 mH, R <sub>G</sub> = 25 Ω)	E <sub>AS</sub>	510	mJ
Thermal Resistance – Junction-to-Case – Junction-to-Ambient – Junction-to-Ambient <sup>(1)</sup>	R <sub>θJC</sub> R <sub>θJA</sub> R <sub>θJA</sub>	1.0 62.5 50	°C/W
Maximum Lead Temperature for Soldering Purposes, 1/8" from Case for 5 sec.	T <sub>L</sub>	260	°C

(1) When surface mounted to an FR4 board using the minimum recommended pad size.

This document contains information on a new product. Specifications and information herein are subject to change without notice.

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## ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage (V <sub>GS</sub> = 0 Vdc, I <sub>D</sub> = 250 μAdc) Temperature Coefficient (Positive)	V <sub>(BR)DSS</sub>	500 —	— 500	— —	Vdc mV/°C
Zero Gate Voltage Drain Current (V <sub>DS</sub> = 500 Vdc, V <sub>GS</sub> = 0 Vdc) (V <sub>DS</sub> = 400 Vdc, V <sub>GS</sub> = 0 Vdc, T <sub>J</sub> = 125°C)	I <sub>DSS</sub>	— —	— —	10 100	μAdc
Gate-Body Leakage Current (V <sub>GS</sub> = ±20 Vdc, V <sub>DS</sub> = 0 Vdc)	I <sub>GSS</sub>	—	—	100	nAdc

### ON CHARACTERISTICS (1)

Gate Threshold Voltage (V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μAdc) Threshold Temperature Coefficient (Negative)	V <sub>GS(th)</sub>	2.0 —	3.0 6.3	4.0 —	Vdc mV/°C
Static Drain-to-Source On-Resistance (V <sub>GS</sub> = 10 Vdc, I <sub>D</sub> = 4.0 Adc)	R <sub>DS(on)</sub>	—	0.6	0.8	Ohms
Drain-to-Source On-Voltage (V <sub>GS</sub> = 10 Vdc) (I <sub>D</sub> = 8.0 Adc) (I <sub>D</sub> = 4.0 Adc, T <sub>J</sub> = 125°C)	V <sub>DS(on)</sub>	— —	— —	7.2 6.4	Vdc
Forward Transconductance, (V <sub>DS</sub> = 15 Vdc, I <sub>D</sub> = 4.0 Adc)	g <sub>FS</sub>	4.0	—	—	mhos

### DYNAMIC CHARACTERISTICS

Input Capacitance	(V <sub>DS</sub> = 25 Vdc, V <sub>GS</sub> = 0 Vdc, f = 1.0 MHz)	C <sub>iss</sub>	—	1450	1680	pF
Output Capacitance		C <sub>oss</sub>	—	190	264	
Transfer Capacitance		C <sub>rss</sub>	—	45.4	144	

### SWITCHING CHARACTERISTICS (2)

Turn-On Delay Time	(R <sub>Gon</sub> = 9.1 Ω)	t <sub>d(on)</sub>	—	15	50	ns
Rise Time		t <sub>r</sub>	—	33	72	
Turn-Off Delay Time		t <sub>d(off)</sub>	—	40	150	
Fall Time		t <sub>f</sub>	—	32	60	
Gate Charge (see Figure 8)	(V <sub>DS</sub> = 400 Vdc, I <sub>D</sub> = 8.0 Adc, V <sub>GS</sub> = 10 Vdc)	Q <sub>T</sub>	—	40	64	nC
		Q <sub>1</sub>	—	8.0	—	
		Q <sub>2</sub>	—	17	—	
		Q <sub>3</sub>	—	17.3	—	

### SOURCE-DRAIN DIODE CHARACTERISTICS

Forward On-Voltage (I <sub>S</sub> = 8.0 Adc, V <sub>GS</sub> = 0 Vdc) (I <sub>S</sub> = 8.0 Adc, V <sub>GS</sub> = 0 Vdc, T <sub>J</sub> = 125°C)	V <sub>SD</sub>	— —	1.2 1.1	2.0 —	Vdc
Reverse Recovery Time	(I <sub>S</sub> = 8.0 Adc, V <sub>GS</sub> = 0 Vdc, dI <sub>S</sub> /dt = 100 A/μs)	t <sub>rr</sub>	—	320	ns
		t <sub>a</sub>	—	179	
		t <sub>b</sub>	—	141	
Reverse Recovery Stored Charge	Q <sub>RR</sub>	—	3.0	—	μC

### INTERNAL PACKAGE INDUCTANCE

Internal Drain Inductance (Measured from the drain lead 0.25" from package to center of die)	L <sub>D</sub>	—	4.5	—	nH
Internal Source Inductance (Measured from the source lead 0.25" from package to source bond pad)	L <sub>S</sub>	—	7.5	—	

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

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

TYPICAL ELECTRICAL CHARACTERISTICS

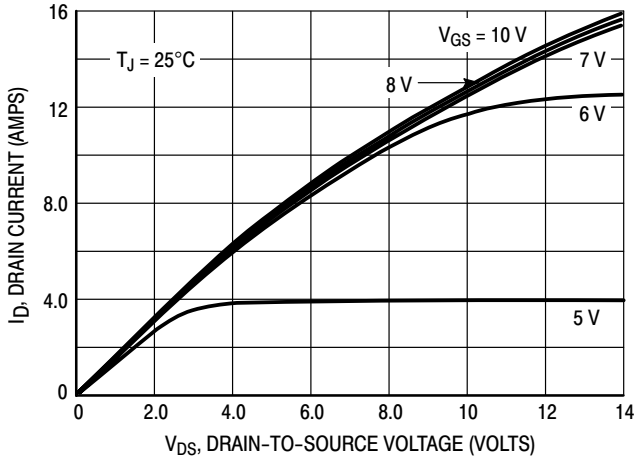


Figure 1. On-Region Characteristics

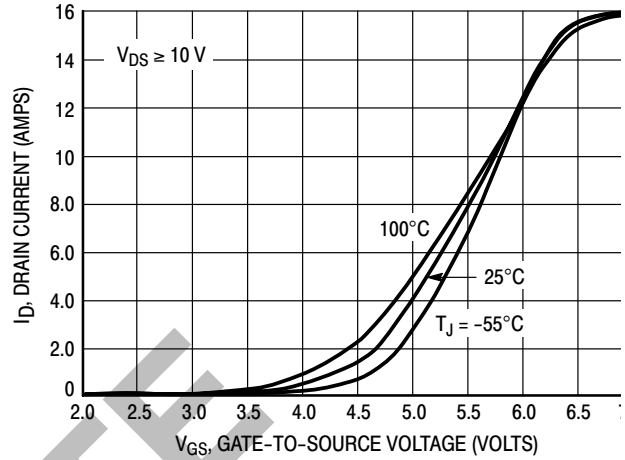


Figure 2. Transfer Characteristics

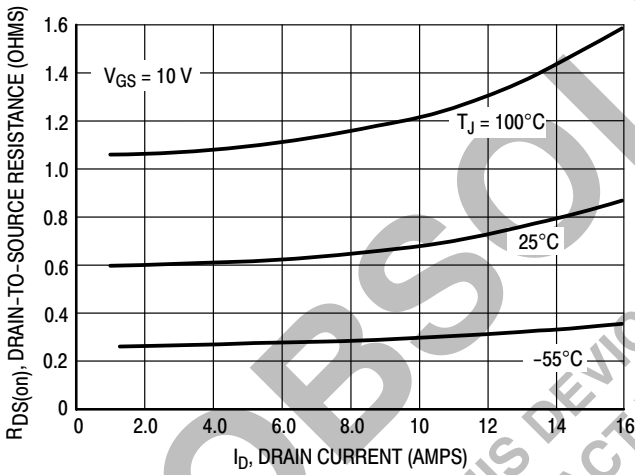


Figure 3. On-Resistance versus Drain Current and Temperature

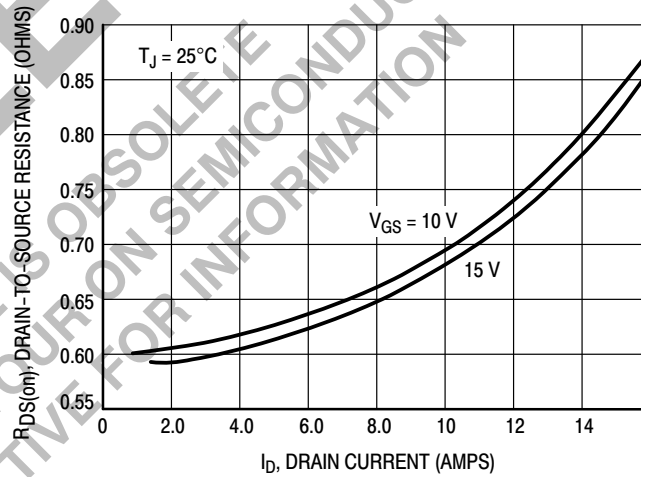


Figure 4. On-Resistance versus Drain Current and Gate Voltage

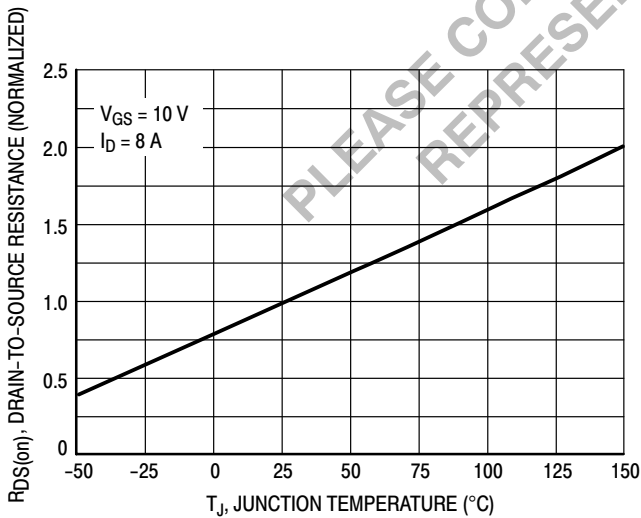


Figure 5. On-Resistance Variation with Temperature

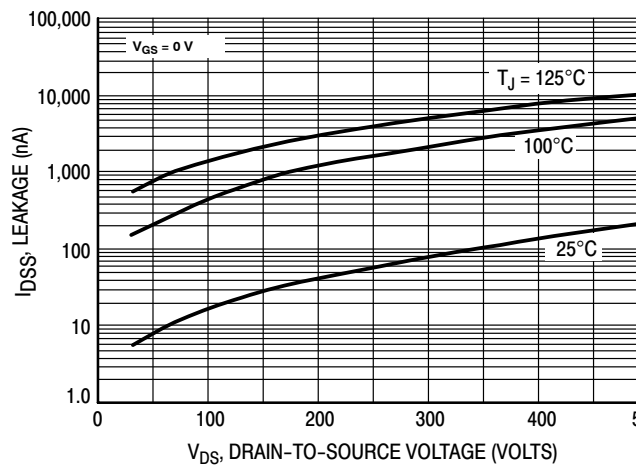


Figure 6. Drain-to-Source Leakage Current versus Voltage

TYPICAL ELECTRICAL CHARACTERISTICS

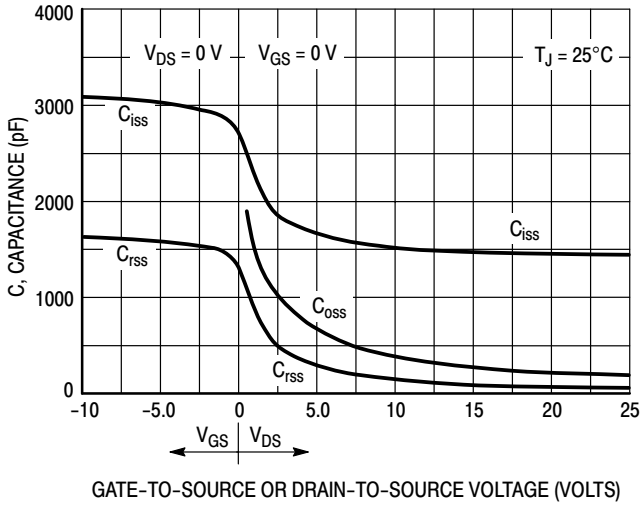


Figure 7. Capacitance Variation

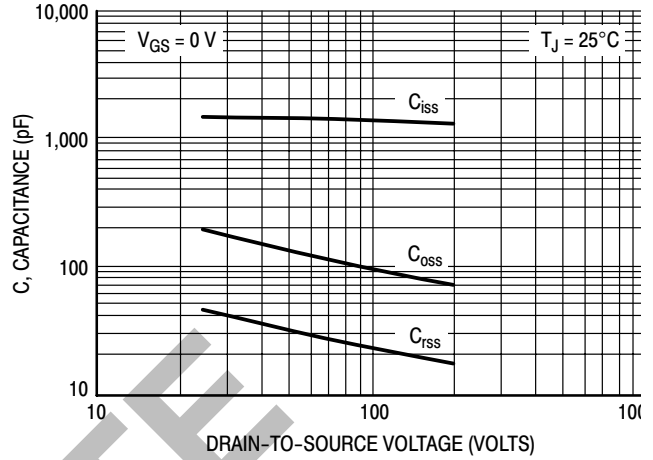


Figure 8. High Voltage Capacitance Variation

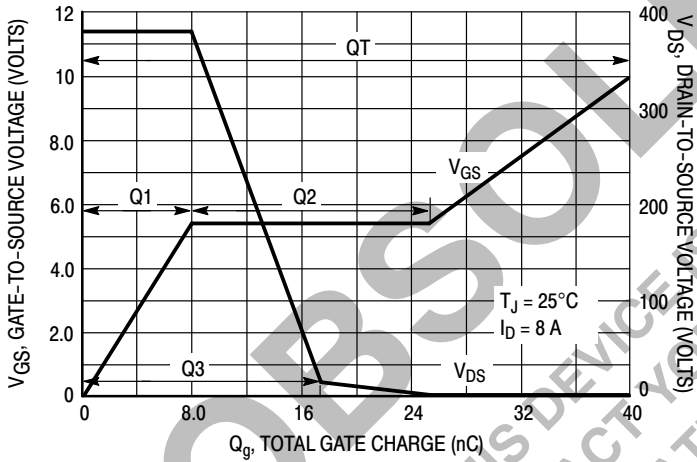


Figure 9. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

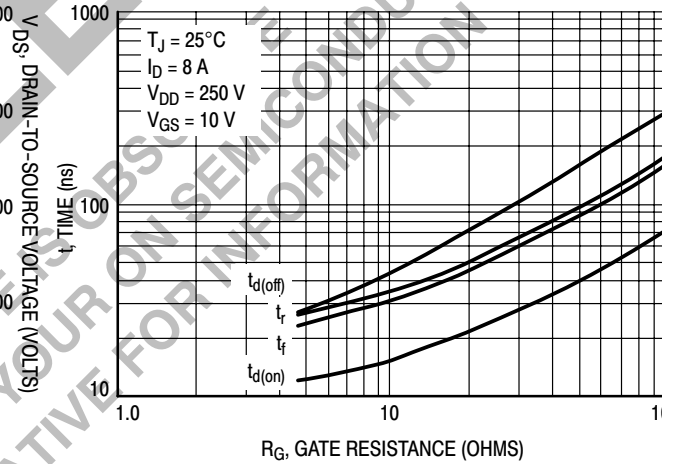


Figure 10. Resistive Switching Time Variation versus Gate Resistance

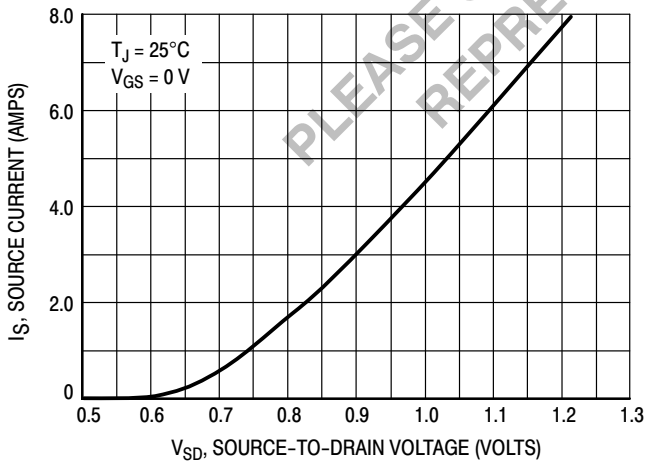


Figure 11. Diode Forward Voltage versus Current

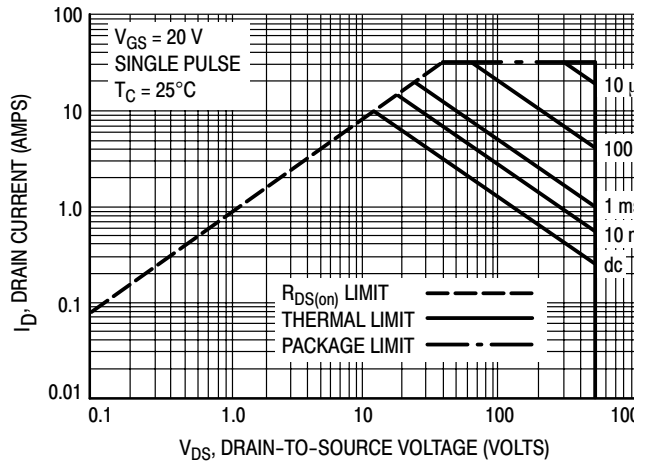


Figure 12. Maximum Rated Forward Biased Safe Operating Area

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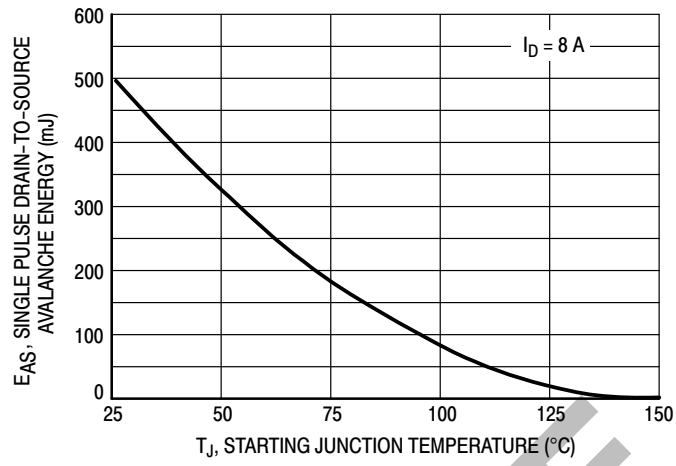


Figure 13. Maximum Avalanche Energy versus Starting Junction Temperature

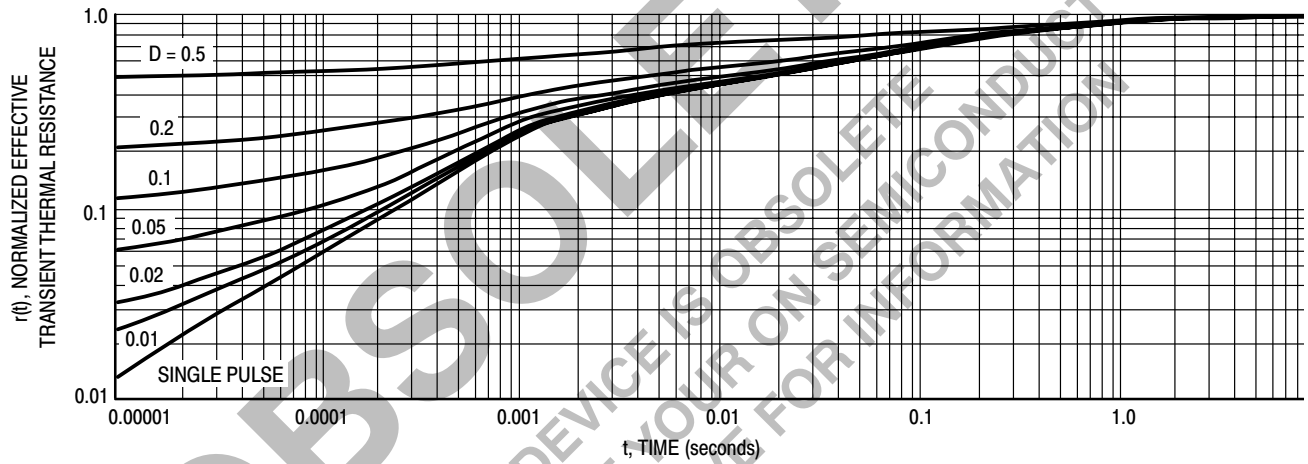
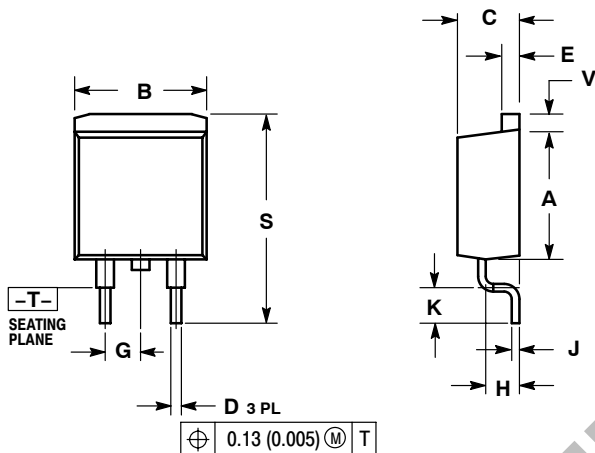


Figure 14. Thermal Response

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## PACKAGE DIMENSIONS

### CASE 418B-02 ISSUE B



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

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.340	0.380	8.64	9.65
B	0.380	0.405	9.65	10.29
C	0.160	0.190	4.06	4.83
D	0.020	0.035	0.51	0.89
E	0.045	0.055	1.14	1.40
G	0.100 BSC		2.54 BSC	
H	0.080	0.110	2.03	2.79
J	0.018	0.025	0.46	0.64
K	0.090	0.110	2.29	2.79
S	0.575	0.625	14.60	15.88
V	0.045	0.055	1.14	1.40

- STYLE 2:  
PIN 1. GATE  
2. DRAIN  
3. SOURCE  
4. DRAIN

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