

# NTMS3P03R2

## Power MOSFET -3.05 Amps, -30 Volts

### P-Channel SOIC-8

#### Features

- High Efficiency Components in a Single SOIC-8 Package
- High Density Power MOSFET with Low  $R_{DS(on)}$
- Miniature SOIC-8 Surface Mount Package – Saves Board Space
- Diode Exhibits High Speed with Soft Recovery
- $I_{DSS}$  Specified at Elevated Temperature
- Avalanche Energy Specified
- Mounting Information for the SOIC-8 Package is Provided
- Pb-Free Package is Available

#### Applications

- DC-DC Converters
- Low Voltage Motor Control
- Power Management in Portable and Battery-Powered Products, i.e.: Computers, Printers, PCMCIA Cards, Cellular & Cordless Telephones



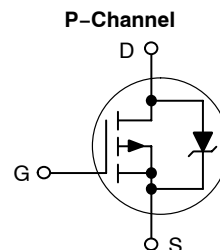
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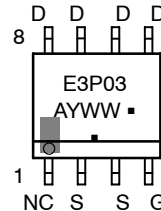
**-3.05 AMPERES**

**-30 VOLTS**

**0.085  $\Omega$  @  $V_{GS} = -10$  V**



#### MARKING DIAGRAM & PIN ASSIGNMENT



E3P03 = Specific Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

#### ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
NTMS3P03R2	SOIC-8	2500/Tape & Reel
NTMS3P03R2G	SOIC-8 (Pb-Free)	2500/Tape & Reel

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

# NTMS3P03R2

## MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain-to-Source Voltage	$V_{DSS}$	-30	V
Gate-to-Source Voltage – Continuous	$V_{GS}$	$\pm 20$	V
Thermal Resistance – Junction-to-Ambient (Note 1) Total Power Dissipation @ $T_A = 25^\circ\text{C}$ Continuous Drain Current @ $25^\circ\text{C}$ Continuous Drain Current @ $70^\circ\text{C}$ Pulsed Drain Current (Note 4)	$R_{\theta JA}$ $P_D$ $I_D$ $I_D$ $I_{DM}$	171 0.73 -2.34 -1.87 -8.0	$^\circ\text{C/W}$ W A A A
Thermal Resistance – Junction-to-Ambient (Note 2) Total Power Dissipation @ $T_A = 25^\circ\text{C}$ Continuous Drain Current @ $25^\circ\text{C}$ Continuous Drain Current @ $70^\circ\text{C}$ Pulsed Drain Current (Note 4)	$R_{\theta JA}$ $P_D$ $I_D$ $I_D$ $I_{DM}$	100 1.25 -3.05 -2.44 -12	$^\circ\text{C/W}$ W A A A
Thermal Resistance – Junction-to-Ambient (Note 3) Total Power Dissipation @ $T_A = 25^\circ\text{C}$ Continuous Drain Current @ $25^\circ\text{C}$ Continuous Drain Current @ $70^\circ\text{C}$ Pulsed Drain Current (Note 4)	$R_{\theta JA}$ $P_D$ $I_D$ $I_D$ $I_{DM}$	62.5 2.0 -3.86 -3.1 -15	$^\circ\text{C/W}$ W A A A
Operating and Storage Temperature Range	$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$
Single Pulse Drain-to-Source Avalanche Energy – Starting $T_J = 25^\circ\text{C}$ ( $V_{DD} = -30\text{ Vdc}$ , $V_{GS} = -4.5\text{ Vdc}$ , Peak $I_L = -7.5\text{ Apk}$ , $L = 5\text{ mH}$ , $R_G = 25\ \Omega$ )	$E_{AS}$	140	mJ
Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds	$T_L$	260	$^\circ\text{C}$

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. Minimum FR-4 or G-10 PCB,  $t = \text{steady state}$ .
2. Mounted onto a 2" square FR-4 Board (1" sq. 2 oz Cu 0.06" thick single sided),  $t = \text{steady state}$ .
3. Mounted onto a 2" square FR-4 Board (1" sq. 2 oz Cu 0.06" thick single sided),  $t \leq 10\text{ seconds}$ .
4. Pulse Test: Pulse Width = 300  $\mu\text{s}$ , Duty Cycle = 2%.

# NTMS3P03R2

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise noted) (Note 5)

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 $\mu$ Adc) Temperature Coefficient (Positive)	V <sub>(BR)DSS</sub>	-30 -	- -30	- -	Vdc mV/°C
Zero Gate Voltage Drain Current (V <sub>DS</sub> = -30 Vdc, V <sub>GS</sub> = 0 Vdc, T <sub>J</sub> = 25°C) (V <sub>DS</sub> = -30 Vdc, V <sub>GS</sub> = 0 Vdc, T <sub>J</sub> = 125°C)	I <sub>DSS</sub>	- -	- -	-1.0 -10	$\mu$ Adc
Gate-Body Leakage Current (V <sub>GS</sub> = -20 Vdc, V <sub>DS</sub> = 0 Vdc)	I <sub>GSS</sub>	-	-	-100	nAdc
Gate-Body Leakage Current (V <sub>GS</sub> = +20 Vdc, V <sub>DS</sub> = 0 Vdc)	I <sub>GSS</sub>	-	-	100	nAdc

### ON CHARACTERISTICS

Gate Threshold Voltage (V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250 $\mu$ Adc) Temperature Coefficient (Negative)	V <sub>GS(th)</sub>	-1.0 -	-1.7 3.6	-2.5 -	Vdc
Static Drain-to-Source On-State Resistance (V <sub>GS</sub> = -10 Vdc, I <sub>D</sub> = -3.05 Adc) (V <sub>GS</sub> = -4.5 Vdc, I <sub>D</sub> = -1.5 Adc)	R <sub>DS(on)</sub>	- -	0.063 0.090	0.085 0.115	$\Omega$
Forward Transconductance (V <sub>DS</sub> = -15 Vdc, I <sub>D</sub> = -3.05 Adc)	g <sub>FS</sub>	-	5.0	-	Mhos

### DYNAMIC CHARACTERISTICS

Input Capacitance	(V <sub>DS</sub> = -24 Vdc, V <sub>GS</sub> = 0 Vdc, f = 1.0 MHz)	C <sub>iss</sub>	-	520	750	pF
Output Capacitance		C <sub>oss</sub>	-	170	325	
Reverse Transfer Capacitance		C <sub>rss</sub>	-	70	135	

### SWITCHING CHARACTERISTICS (Notes 6 & 7)

Turn-On Delay Time	(V <sub>DD</sub> = -24 Vdc, I <sub>D</sub> = -3.05 Adc, V <sub>GS</sub> = -10 Vdc, R <sub>G</sub> = 6.0 $\Omega$ )	t <sub>d(on)</sub>	-	12	22	ns
Rise Time		t <sub>r</sub>	-	16	30	
Turn-Off Delay Time		t <sub>d(off)</sub>	-	45	80	
Fall Time		t <sub>f</sub>	-	45	80	
Turn-On Delay Time	(V <sub>DD</sub> = -24 Vdc, I <sub>D</sub> = -1.5 Adc, V <sub>GS</sub> = -4.5 Vdc, R <sub>G</sub> = 6.0 $\Omega$ )	t <sub>d(on)</sub>	-	16	-	ns
Rise Time		t <sub>r</sub>	-	42	-	
Turn-Off Delay Time		t <sub>d(off)</sub>	-	32	-	
Fall Time		t <sub>f</sub>	-	35	-	
Total Gate Charge	(V <sub>DS</sub> = -24 Vdc, V <sub>GS</sub> = -10 Vdc, I <sub>D</sub> = -3.05 Adc)	Q <sub>tot</sub>	-	16	25	nC
Gate-Source Charge		Q <sub>gs</sub>	-	2.0	-	
Gate-Drain Charge		Q <sub>gd</sub>	-	4.5	-	

### BODY-DRAIN DIODE RATINGS (Note 6)

Diode Forward On-Voltage	(I <sub>S</sub> = -3.05 Adc, V <sub>GS</sub> = 0 V) (I <sub>S</sub> = -3.05 Adc, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125°C)	V <sub>SD</sub>	- -	-0.96 -0.78	-1.25 -	Vdc
Reverse Recovery Time	(I <sub>S</sub> = -3.05 Adc, V <sub>GS</sub> = 0 Vdc, dI <sub>S</sub> /dt = 100 A/ $\mu$ s)	t <sub>rr</sub>	-	34	-	ns
		t <sub>a</sub>	-	18	-	
		t <sub>b</sub>	-	16	-	
Reverse Recovery Stored Charge		Q <sub>RR</sub>	-	0.03	-	$\mu$ C

- Handling precautions to protect against electrostatic discharge is mandatory.
- Indicates Pulse Test: Pulse Width = 300  $\mu$ s max, Duty Cycle = 2%.
- Switching characteristics are independent of operating junction temperature.

TYPICAL ELECTRICAL CHARACTERISTICS

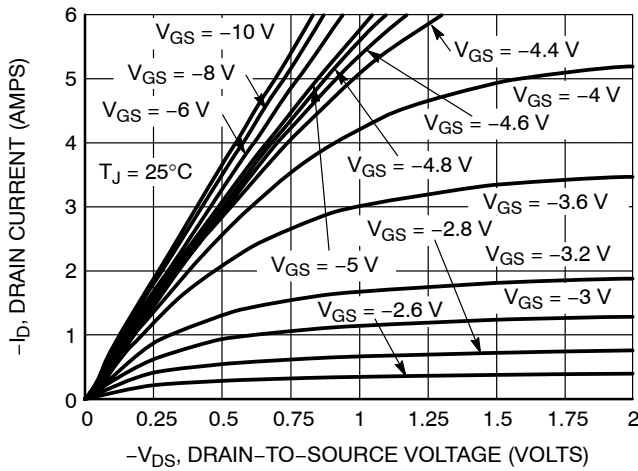


Figure 1. On-Region Characteristics

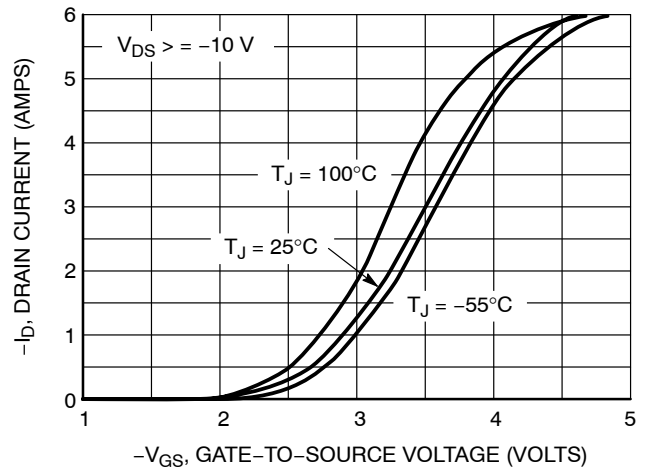


Figure 2. Transfer Characteristics

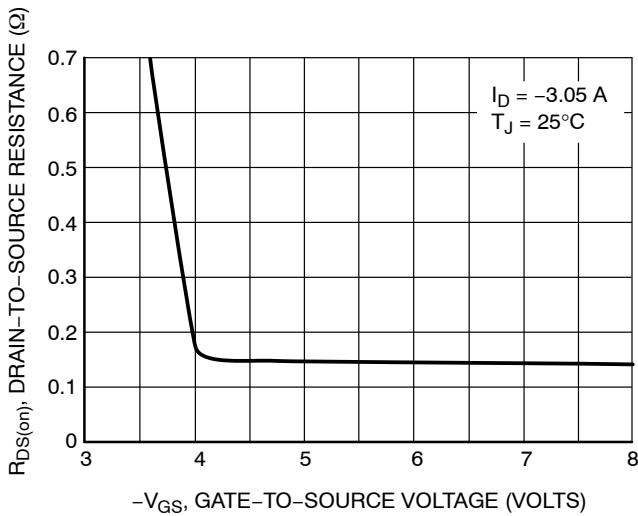


Figure 3. On-Resistance vs. Gate-to-Source Voltage

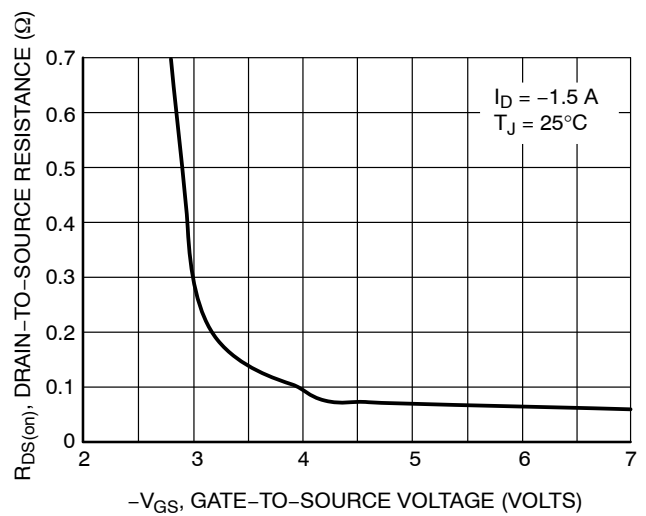


Figure 4. On-Resistance vs. Gate-to-Source Voltage

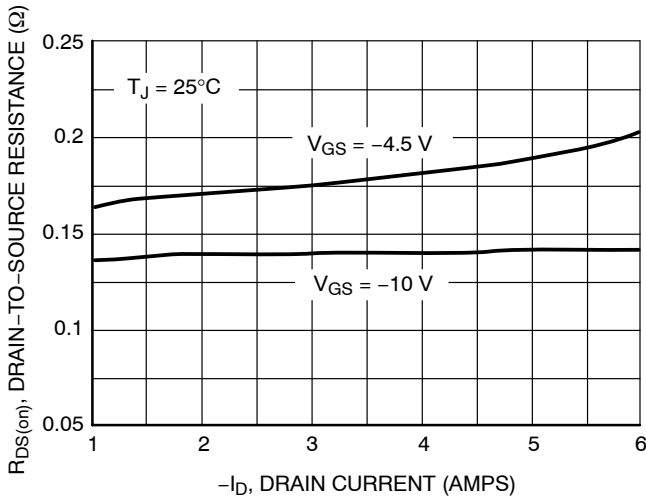


Figure 5. On-Resistance vs. Drain Current and Gate Voltage

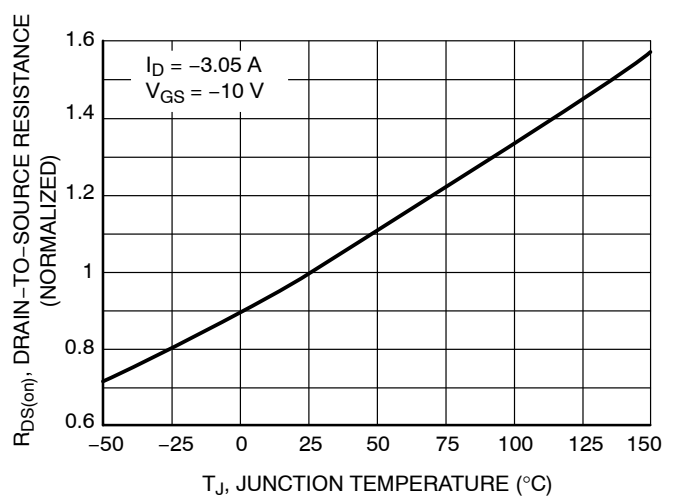
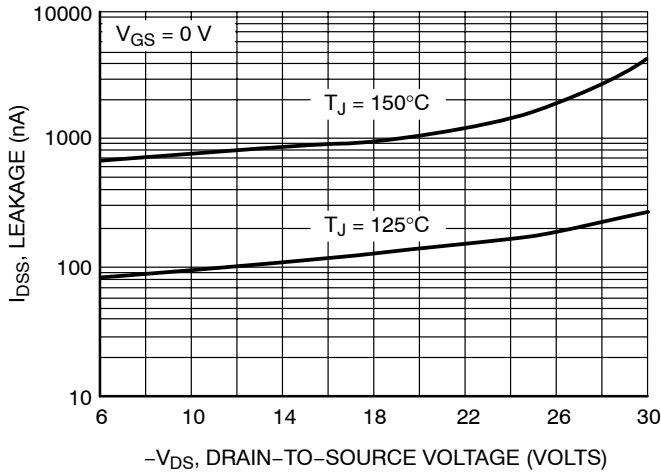
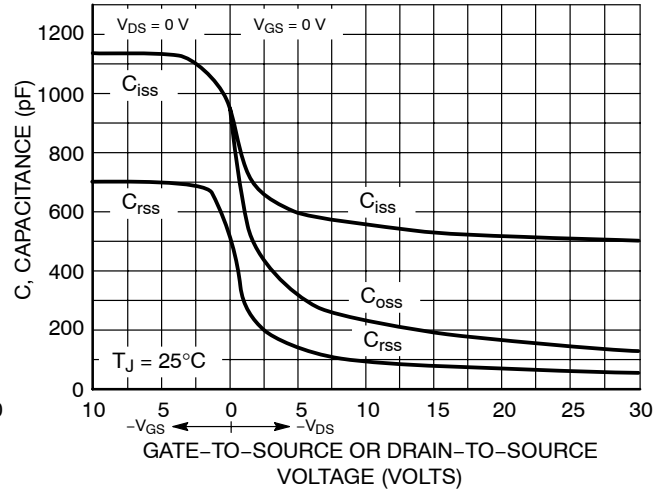


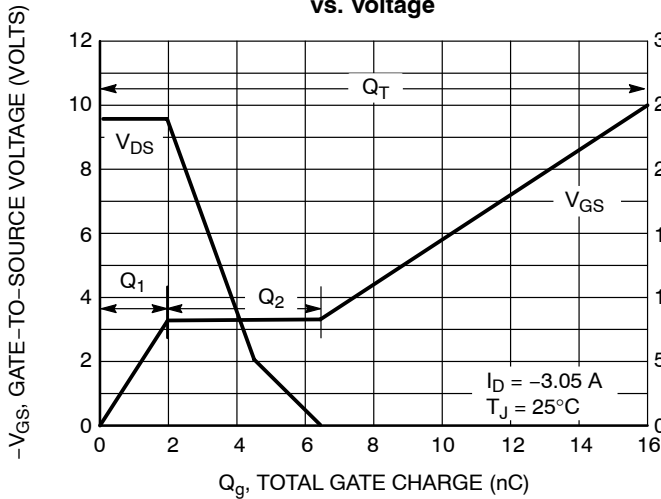
Figure 6. On Resistance Variation with Temperature



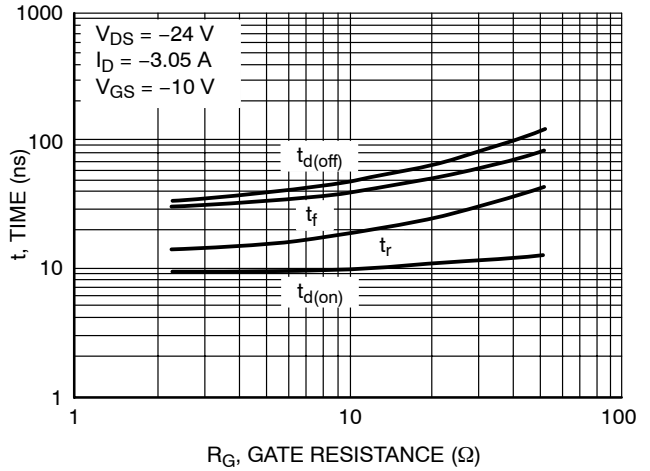
**Figure 7. Drain-to-Source Leakage Current vs. Voltage**



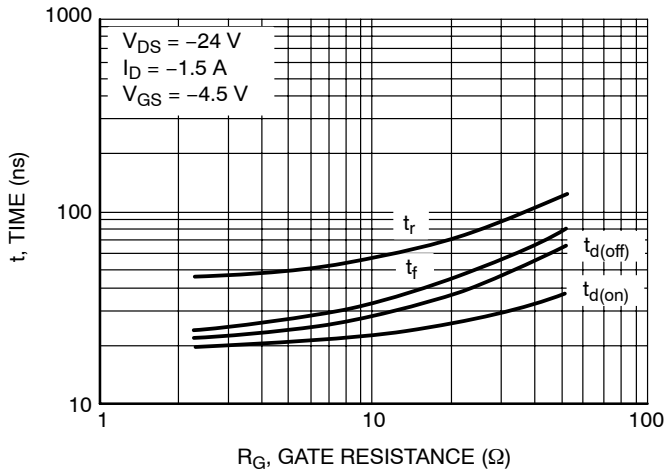
**Figure 8. Capacitance Variation**



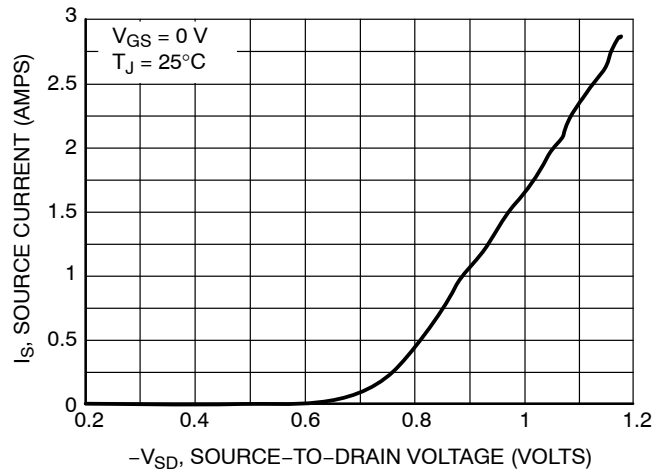
**Figure 9. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge**



**Figure 10. Resistive Switching Time Variation vs. Gate Resistance**

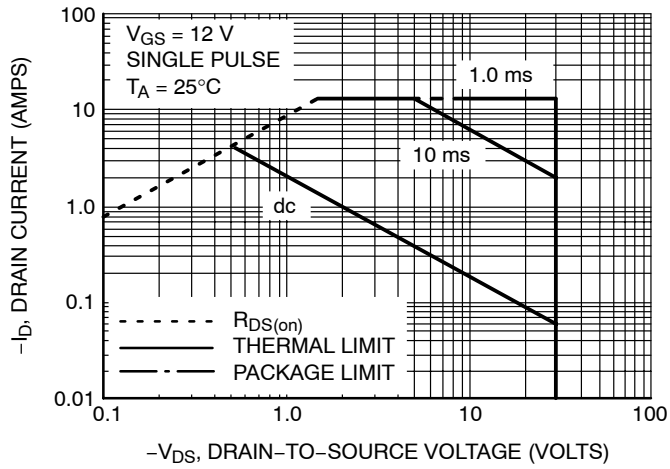


**Figure 11. Resistive Switching Time Variation vs. Gate Resistance**

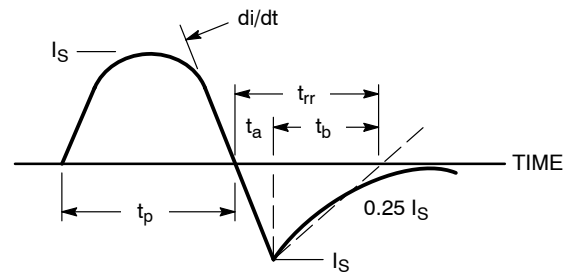


**Figure 12. Diode Forward Voltage vs. Current**

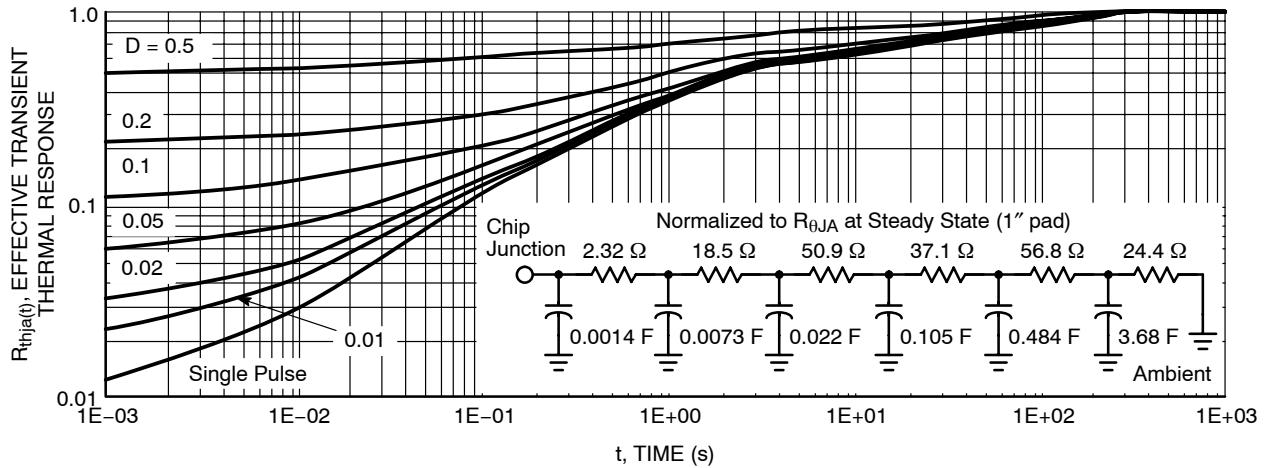
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**Figure 13. Maximum Rated Forward Biased Safe Operating Area**



**Figure 14. Diode Reverse Recovery Waveform**

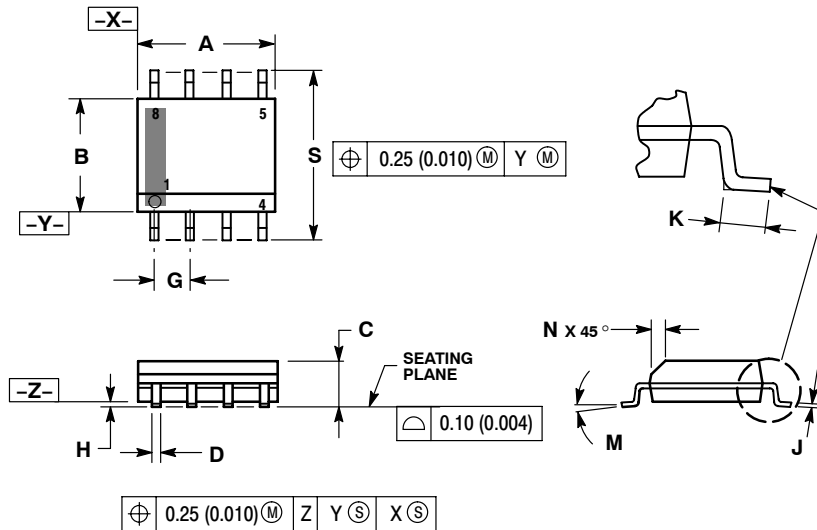


**Figure 15. FET Thermal Response**

# NTMS3P03R2

## PACKAGE DIMENSIONS

### SOIC-8 NB CASE 751-07 ISSUE AG



#### NOTES:

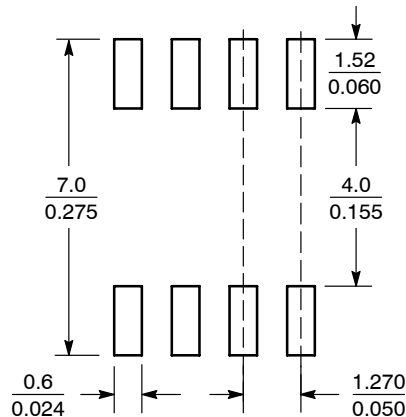
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. 751-01 THRU 751-06 ARE OBSOLETE. NEW STANDARD IS 751-07.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.197
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.053	0.069
D	0.33	0.51	0.013	0.020
G	1.27 BSC		0.050 BSC	
H	0.10	0.25	0.004	0.010
J	0.19	0.25	0.007	0.010
K	0.40	1.27	0.016	0.050
M	0°	8°	0°	8°
N	0.25	0.50	0.010	0.020
S	5.80	6.20	0.228	0.244

#### STYLE 13:

- PIN 1: N.C.
2. SOURCE
  3. SOURCE
  4. GATE
  5. DRAIN
  6. DRAIN
  7. DRAIN
  8. DRAIN

### SOLDERING FOOTPRINT\*



SCALE 6:1 (mm/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.

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