NTMS5P02, NVMS5P02

Power MOSFET
-5.4 Amps, -20 Volts

P−Channel Enhancement−Mode
Single SOIC−8 Package

ON Semiconductor®

http://onsemi.com

V_{DSS}	$R_{DS(ON)}$ TYP	I_D MAX
−20 V	26 mΩ @ −4.5 V	−5.4 A

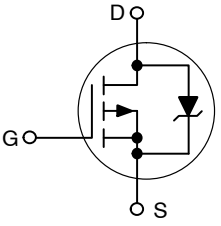
Features

- High Density Power MOSFET with Ultra Low $R_{DS(on)}$ Providing Higher Efficiency
- Miniature SOIC−8 Surface Mount Package − Saves Board Space
- Diode Exhibits High Speed with Soft Recovery
- I_{DSS} Specified at Elevated Temperature
- Drain−to−Source Avalanche Energy Specified
- Mounting Information for the SOIC−8 Package is Provided
- These Devices are Pb−Free and are RoHS Compliant
- NVMS Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q101 Qualified and PPAP Capable

Applications

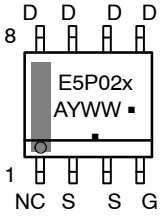
- Power Management in Portable and Battery−Powered Products, i.e.: Computers, Printers, PCMCIA Cards, Cellular & Cordless Telephones

Single P−Channel



MARKING DIAGRAM & PIN ASSIGNMENT

SOIC−8
CASE 751
STYLE 13



E5P02 = Specific Device Code
x = Blank or S
A = Assembly Location
Y = Year
WW = Work Week
▪ = Pb−Free Package

(Note: Microdot may be in either location)

ORDERING INFORMATION

Device	Package	Shipping†
NTMS5P02R2G	SOIC−8 (Pb−Free)	2500 / Tape & Reel
NVMS5P02R2G	SOIC−8 (Pb−Free)	2500 / Tape & 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

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Drain−to−Source Voltage	V_{DSS}	−20	V
Drain−to−Gate Voltage (R_{GS} = 1.0 mΩ)	V_{DGR}	−20	V
Gate−to−Source Voltage − Continuous	V_{GS}	±10	V
Thermal Resistance −			
Junction−to−Ambient (Note 1)	$R_{\theta JA}$	50	°C/W
Total Power Dissipation @ T_A = 25°C	P_D	2.5	W
Continuous Drain Current @ 25°C	I_D	−7.05	A
Continuous Drain Current @ 70°C	I_D	−5.62	A
Maximum Operating Power Dissipation	P_D	1.2	W
Maximum Operating Drain Current	I_D	−4.85	A
Pulsed Drain Current (Note 4)	I_{DM}	−28	A
Thermal Resistance −			
Junction−to−Ambient (Note 2)	$R_{\theta JA}$	85	°C/W
Total Power Dissipation @ T_A = 25°C	P_D	1.47	W
Continuous Drain Current @ 25°C	I_D	−5.40	A
Continuous Drain Current @ 70°C	I_D	−4.30	A
Maximum Operating Power Dissipation	P_D	0.7	W
Maximum Operating Drain Current	I_D	−3.72	A
Pulsed Drain Current (Note 4)	I_{DM}	−20	A
Thermal Resistance −			
Junction−to−Ambient (Note 3)	$R_{\theta JA}$	159	°C/W
Total Power Dissipation @ T_A = 25°C	P_D	0.79	W
Continuous Drain Current @ 25°C	I_D	−3.95	A
Continuous Drain Current @ 70°C	I_D	−3.15	A
Maximum Operating Power Dissipation	P_D	0.38	W
Maximum Operating Drain Current	I_D	−2.75	A
Pulsed Drain Current (Note 4)	I_{DM}	−12	A
Operating and Storage Temperature Range	T_J, T_{stg}	−55 to +150	°C
Single Pulse Drain−to−Source Avalanche Energy − Starting T_J = 25°C (V_{DD} = −20 Vdc, V_{GS} = −5.0 Vdc, Peak I_L = −8.5 Apk, L = 10 mH, R_G = 25 Ω)	E_{AS}	360	mJ
Maximum Lead Temperature for Soldering Purposes, 1/8″ from case for 10 seconds	T_L	260	°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. Mounted onto a 2″ square FR−4 Board (1″ sq. 2 oz Cu 0.06″ thick single sided), t ≤ 10 seconds.
2. Mounted onto a 2″ square FR−4 Board (1″ sq. 2 oz Cu 0.06″ thick single sided), t = steady state.
3. Minimum FR−4 or G−10 PCB, t = Steady State.
4. Pulse Test: Pulse Width = 300 μs, Duty Cycle = 2%.

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted) (Note 5)

Characteristic		Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Drain−to−Source Breakdown Voltage (V_{GS} = 0 Vdc, I_D = −250 μAdc) Temperature Coefficient (Positive)		$V_{(BR)DSS}$	 −20 −	 − −15	 − −	Vdc mV/°C
Zero Gate Voltage Drain Current (V_{DS} = −16 Vdc, V_{GS} = 0 Vdc, T_J = 25°C) (V_{DS} = −16 Vdc, V_{GS} = 0 Vdc, T_J = 125°C) (V_{DS} = −20 Vdc, V_{GS} = 0 Vdc, T_J = 25°C)		I_{DSS}	 − − −	 − − −0.2	 −1.0 −10 −	μAdc
Gate−Body Leakage Current (V_{GS} = −10 Vdc, V_{DS} = 0 Vdc)		I_{GSS}	 −	 −	 −100	nAdc
Gate−Body Leakage Current (V_{GS} = +10 Vdc, V_{DS} = 0 Vdc)		I_{GSS}	 −	 −	 100	nAdc
ON CHARACTERISTICS						
Gate Threshold Voltage (V_{DS} = V_{GS}, I_D = −250 μAdc) Temperature Coefficient (Negative)		$V_{GS(th)}$	 −0.65 −	 −0.9 2.9	 −1.25 −	Vdc mV/°C
Static Drain−to−Source On−State Resistance (V_{GS} = −4.5 Vdc, I_D = −5.4 Adc) (V_{GS} = −2.5 Vdc, I_D = −2.7 Adc)		$R_{DS(on)}$	 − −	 0.026 0.037	 0.033 0.048	Ω
Forward Transconductance (V_{DS} = −9.0 Vdc, I_D = −5.4 Adc)		g_{FS}	−	15	−	Mhos
DYNAMIC CHARACTERISTICS						
Input Capacitance	(V_{DS} = −16 Vdc, V_{GS} = 0 Vdc, f = 1.0 MHz)	C_{iss}	−	1375	1900	pF
Output Capacitance		C_{oss}	−	510	900	
Reverse Transfer Capacitance		C_{rss}	−	200	380	
SWITCHING CHARACTERISTICS (Notes 6 & 7)						
Turn−On Delay Time	(V_{DD} = −16 Vdc, I_D = −1.0 Adc, V_{GS} = −4.5 Vdc, R_G = 6.0 Ω)	$t_{d(on)}$	−	18	35	ns
Rise Time		t_r	−	25	50	
Turn−Off Delay Time		$t_{d(off)}$	−	70	125	
Fall Time		t_f	−	55	100	
Turn−On Delay Time	(V_{DD} = −16 Vdc, I_D = −5.4 Adc, V_{GS} = −4.5 Vdc, R_G = 6.0 Ω)	$t_{d(on)}$	−	22	−	ns
Rise Time		t_r	−	70	−	
Turn−Off Delay Time		$t_{d(off)}$	−	65	−	
Fall Time		t_f	−	90	−	
Total Gate Charge	(V_{DS} = −16 Vdc, V_{GS} = −4.5 Vdc, I_D = −5.4 Adc)	Q_{tot}	−	20	35	nC
Gate−Source Charge		Q_{gs}	−	4.0	−	
Gate−Drain Charge		Q_{gd}	−	7.0	−	
BODY−DRAIN DIODE RATINGS (Note 6)						
Diode Forward On−Voltage	(I_S = −5.4 Adc, V_{GS} = 0 V) (I_S = −5.4 Adc, V_{GS} = 0 Vdc, T_J = 125°C)	V_{SD}	 −	 −0.95 −0.72	 −1.25 −	Vdc
Reverse Recovery Time	(I_S = −5.4 Adc, V_{GS} = 0 Vdc, dI_S/dt = 100 A/μs)	t_{rr}	−	40	75	ns
		t_a	−	20	−	
		t_b	−	20	−	
Reverse Recovery Stored Charge		Q_{RR}	−	0.03	−	μC

5. Handling precautions to protect against electrostatic discharge is mandatory.
6. Indicates Pulse Test: Pulse Width = 300 μs max, Duty Cycle = 2%.
7. Switching characteristics are independent of operating junction temperature.

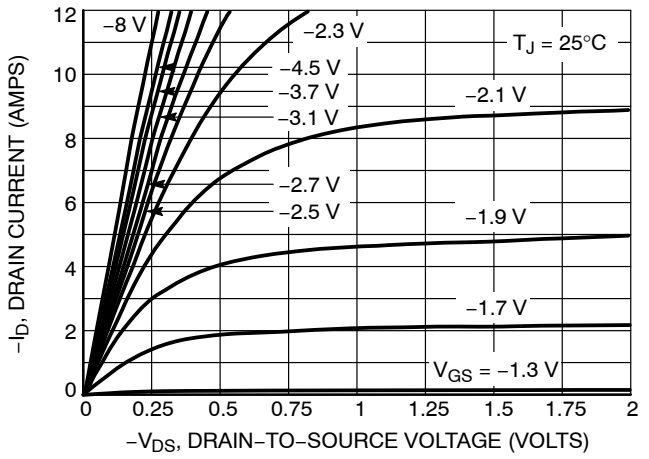


Figure 1. On−Region Characteristics

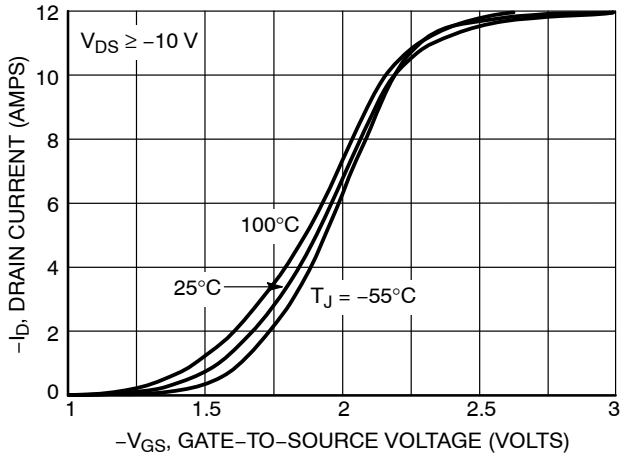


Figure 2. Transfer Characteristics

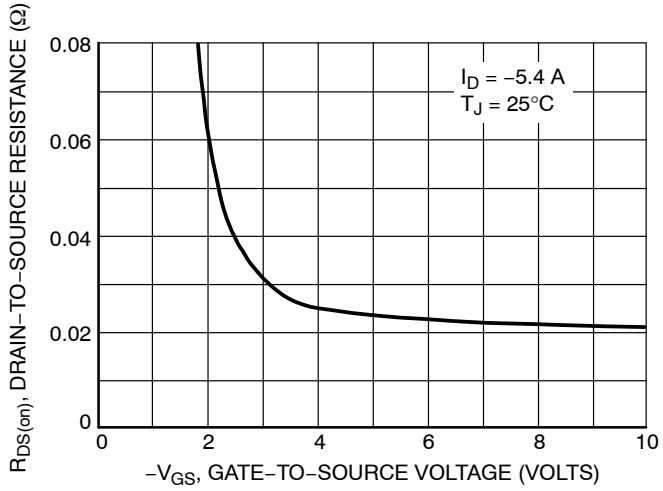


Figure 3. On−Resistance versus Gate−To−Source Voltage

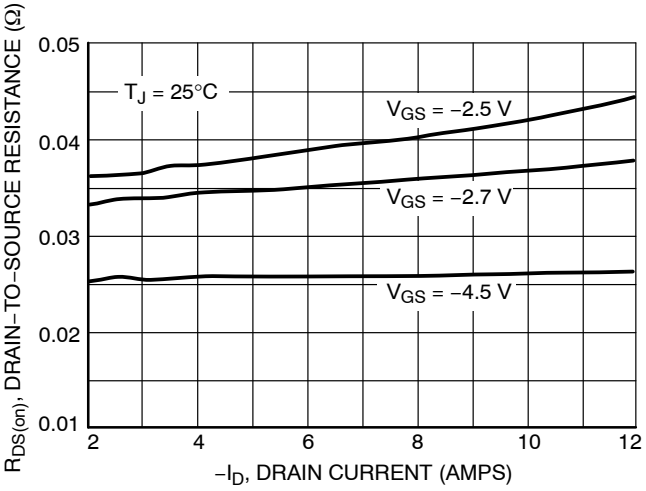


Figure 4. On-Resistance versus Drain Current and Gate Voltage

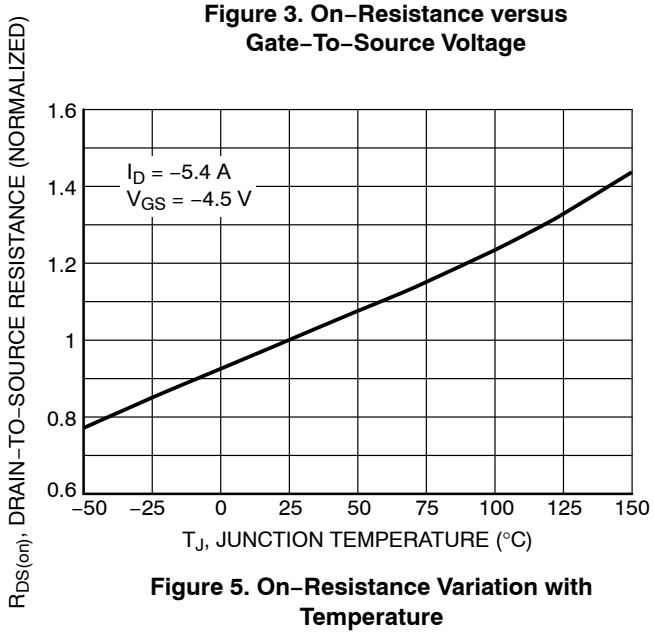


Figure 5. On−Resistance Variation with Temperature

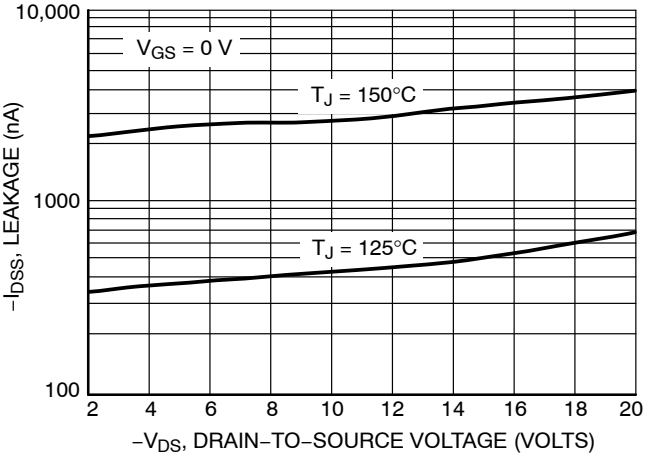


Figure 6. Drain−To−Source Leakage Current versus Voltage

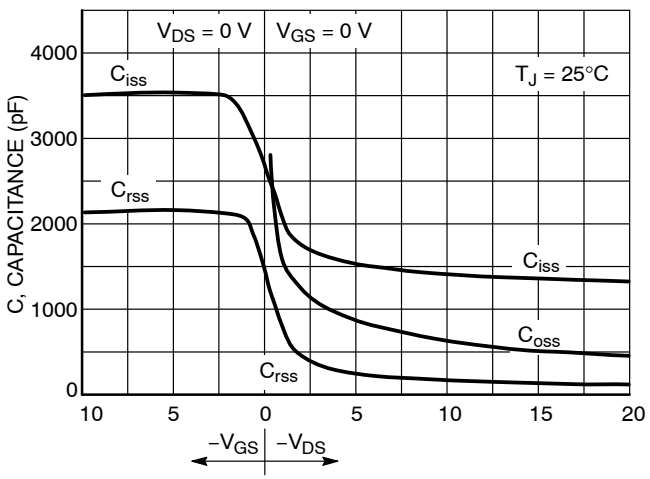


Figure 7. Capacitance Variation

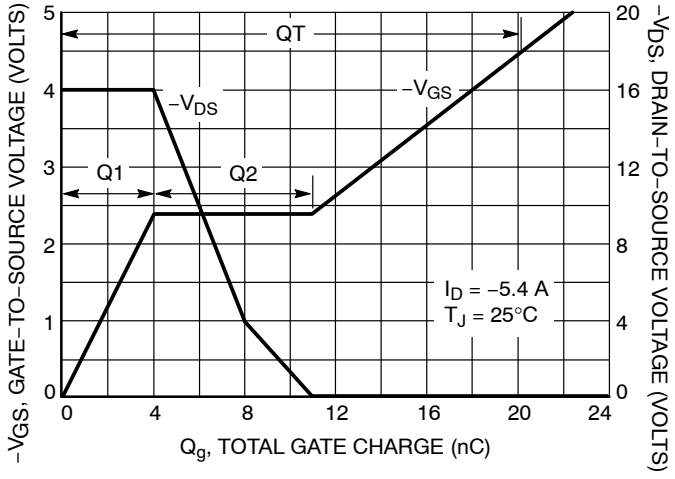


Figure 8. Gate−To−Source and Drain−To−Source Voltage versus Total Charge

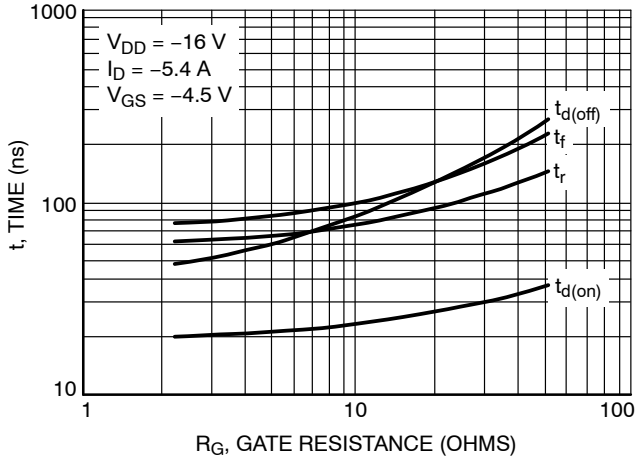


Figure 9. Resistive Switching Time Variation versus Gate Resistance

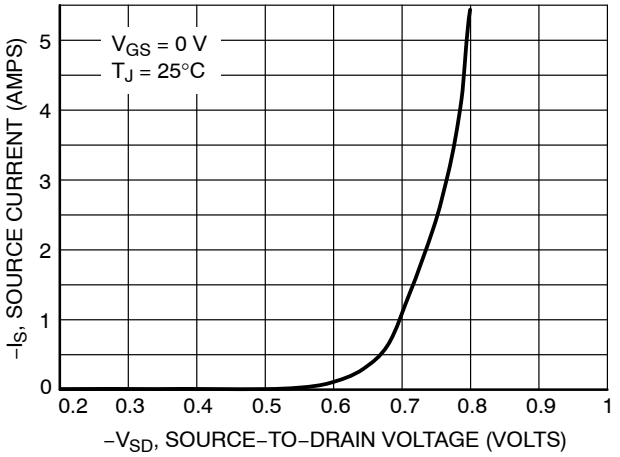


Figure 10. Diode Forward Voltage versus Current

DRAIN−TO−SOURCE DIODE CHARACTERISTICS

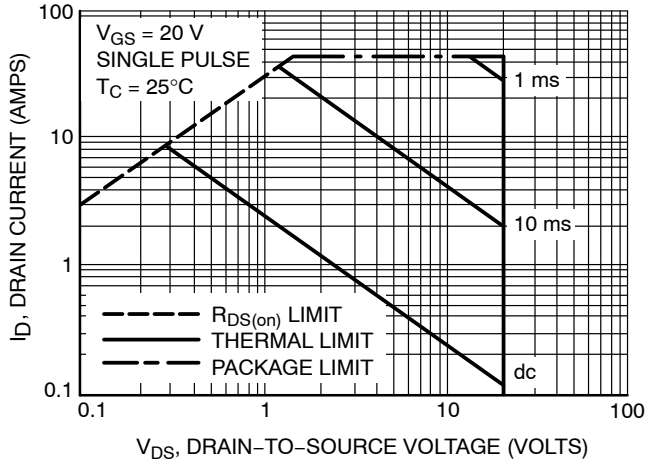


Figure 11. Maximum Rated Forward Biased Safe Operating Area

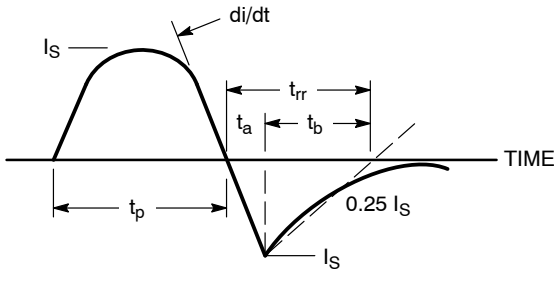


Figure 12. Diode Reverse Recovery Waveform

TYPICAL ELECTRICAL CHARACTERISTICS

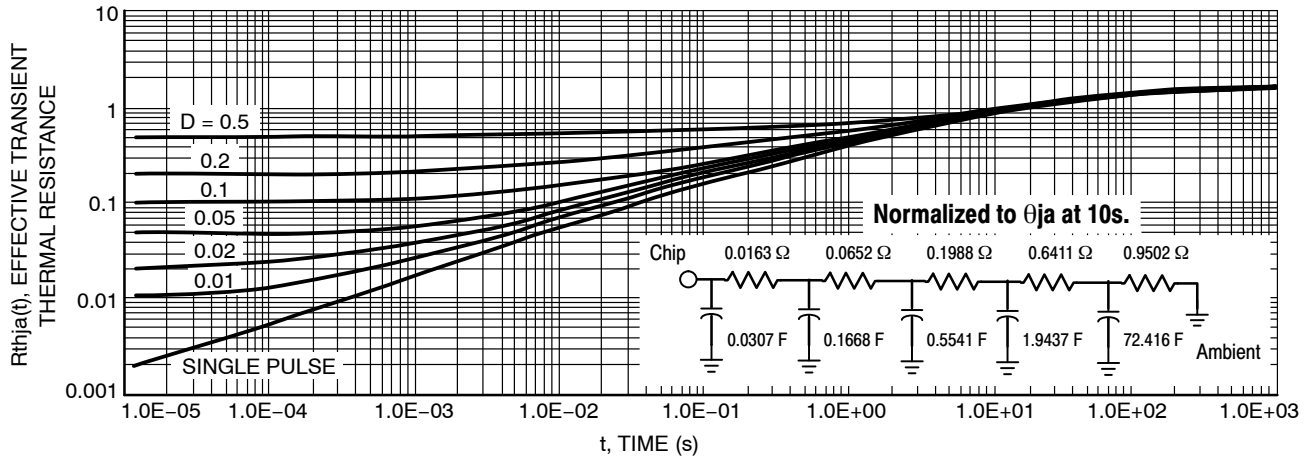
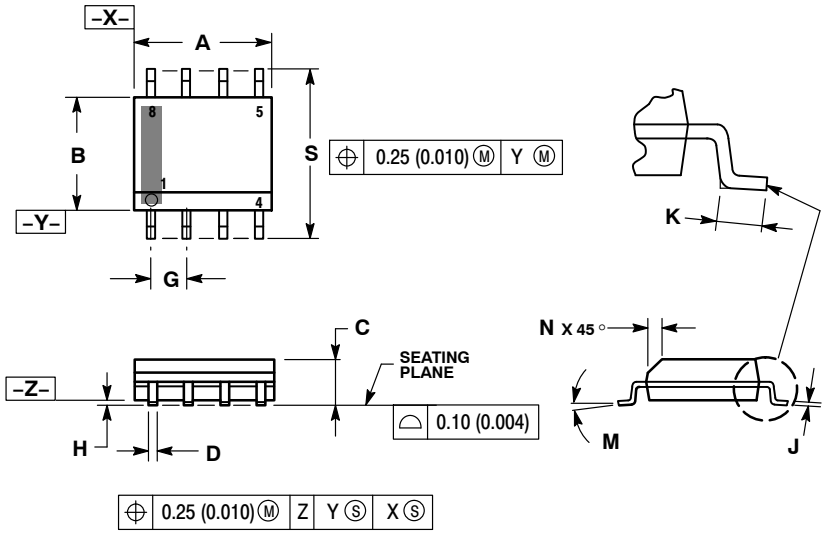


Figure 13. Thermal Response

PACKAGE DIMENSIONS

SOIC−8 NB
CASE 751−07
ISSUE AK

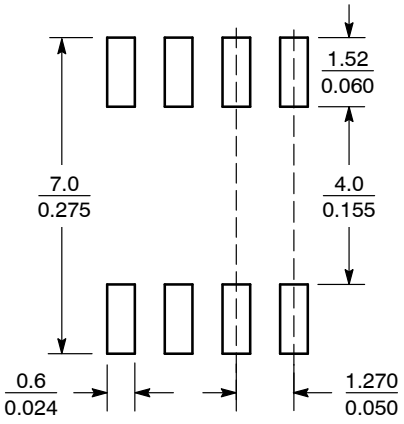


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005)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

	MILLIMETERS		INCHES	
DIM	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 $\left(\frac{\text{mm}}{\text{inches}}\right)$

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303−675−2175 or 800−344−3860 Toll Free USA/Canada
Fax: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81−3−5817−1050

ON Semiconductor Website: **www.onsemi.com**

Order Literature: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative

NTMS5P02R2/D