NTMD6P02, NVMD6P02

Power MOSFET

6 A, 20 V, P−Channel SOIC−8, Dual

Features

- Ultra Low $R_{DS(on)}$
- Higher Efficiency Extending Battery Life
- Logic Level Gate Drive
- Miniature Dual SOIC−8 Surface Mount Package
- Diode Exhibits High Speed, Soft Recovery
- Avalanche Energy Specified
- These Devices are Pb−Free and are RoHS Compliant
- NVMD 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.: Cellular and Cordless Telephones, and PCMCIA Cards

ON Semiconductor®

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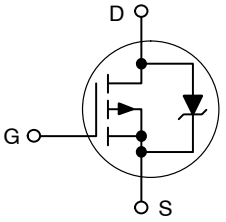
6 AMPERES, 20 VOLTS

P−Channel



MAXIMUM RATINGS

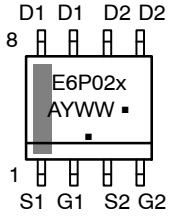
Rating	Symbol	Value	Unit
Drain−to−Source Voltage	V_{DSS}	−20	V
Gate−to−Source Voltage − Continuous	V_{GS}	±12	V
Thermal Resistance − Junction−to−Ambient (Note 1)	$R_{\theta JA}$	62.5	°C/W
Total Power Dissipation @ T_A = 25°C	P_D	2.0	W
Continuous Drain Current @ T_A = 25°C	I_D	−7.8	A
Continuous Drain Current @ T_A = 70°C	I_D	−5.7	A
Maximum Operating Power Dissipation	P_D	0.5	W
Maximum Operating Drain Current	I_D	−3.89	A
Pulsed Drain Current (Note 4)	I_{DM}	−40	A
Thermal Resistance − Junction−to−Ambient (Note 2)	$R_{\theta JA}$	98	°C/W
Total Power Dissipation @ T_A = 25°C	P_D	1.28	W
Continuous Drain Current @ T_A = 25°C	I_D	−6.2	A
Continuous Drain Current @ T_A = 70°C	I_D	−4.6	A
Maximum Operating Power Dissipation	P_D	0.3	W
Maximum Operating Drain Current	I_D	−3.01	A
Pulsed Drain Current (Note 4)	I_{DM}	−35	A
Thermal Resistance − Junction−to−Ambient (Note 3)	$R_{\theta JA}$	166	°C/W
Total Power Dissipation @ T_A = 25°C	P_D	0.75	W
Continuous Drain Current @ T_A = 25°C	I_D	−4.8	A
Continuous Drain Current @ T_A = 70°C	I_D	−3.5	A
Maximum Operating Power Dissipation	P_D	0.2	W
Maximum Operating Drain Current	I_D	−2.48	A
Pulsed Drain Current (Note 4)	I_{DM}	−30	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 = −5.0 Apk, L = 40 mH, R_G = 25 Ω)	E_{AS}	500	mJ
Maximum Lead Temperature for Soldering Purposes 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 in sq, 2 oz. Cu 0.06″ thick single sided), t = 10 seconds.
2. Mounted onto a 2″ square FR−4 Board (1 in 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%.

MARKING DIAGRAM & PIN ASSIGNMENT

SOIC−8
CASE 751
STYLE 11



E6P02 = 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†
NTMD6P02R2G	SOIC−8 (Pb−Free)	2500 / Tape & Reel
NTMD6P02R2SG	SOIC−8 (Pb−Free)	2500 / Tape & Reel
NVMD6P02R2G	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

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

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 −	− −11.6	− −	Vdc mV/°C
Zero Gate Voltage Drain Current (V_{DS} = −20 Vdc, V_{GS} = 0 Vdc, T_J = 25°C) (V_{DS} = −20 Vdc, V_{GS} = 0 Vdc, T_J = 70°C)		I_{DSS}	− −	− −	−1.0 −5.0	μAdc
Gate−Body Leakage Current (V_{GS} = −12 Vdc, V_{DS} = 0 Vdc)		I_{GSS}	−	−	−100	nAdc
Gate−Body Leakage Current (V_{GS} = +12 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)		$V_{GS(th)}$	−0.6 −	−0.88 2.6	−1.20 −	Vdc mV/°C
Static Drain−to−Source On−State Resistance (V_{GS} = −4.5 Vdc, I_D = −6.2 Adc) (V_{GS} = −2.5 Vdc, I_D = −5.0 Adc) (V_{GS} = −2.5 Vdc, I_D = −3.1 Adc)		$R_{DS(on)}$	− − −	0.027 0.038 0.038	0.033 0.050 −	Ω
Forward Transconductance (V_{DS} = −10 Vdc, I_D = −6.2 Adc)		g_{FS}	−	15	−	Mhos
DYNAMIC CHARACTERISTICS						
Input Capacitance	(V_{DS} = −16 Vdc, V_{GS} = 0 Vdc, f = 1.0 MHz)	C_{iss}	−	1380	1700	pF
Output Capacitance		C_{oss}	−	515	775	
Reverse Transfer Capacitance		C_{rss}	−	250	450	
SWITCHING CHARACTERISTICS (Notes 5 and 6)						
Turn−On Delay Time	(V_{DD} = −10 Vdc, I_D = −1.0 Adc, V_{GS} = −10 Vdc, R_G = 6.0 Ω)	$t_{d(on)}$	−	15	25	ns
Rise Time		t_r	−	20	50	
Turn−Off Delay Time		$t_{d(off)}$	−	85	125	
Fall Time		t_f	−	50	110	
Turn−On Delay Time	(V_{DD} = −16 Vdc, I_D = −6.2 Adc, V_{GS} = −4.5 Vdc, R_G = 6.0 Ω)	$t_{d(on)}$	−	17	−	ns
Rise Time		t_r	−	65	−	
Turn−Off Delay Time		$t_{d(off)}$	−	50	−	
Fall Time		t_f	−	80	−	
Total Gate Charge	(V_{DS} = −16 Vdc, V_{GS} = −4.5 Vdc, I_D = −6.2 Adc)	Q_{tot}	−	20	35	nC
Gate−Source Charge		Q_{gs}	−	4.0	−	
Gate−Drain Charge		Q_{gd}	−	8.0	−	
BODY−DRAIN DIODE RATINGS (Note 5)						
Diode Forward On−Voltage	(I_S = −1.7 Adc, V_{GS} = 0 Vdc) (I_S = −1.7 Adc, V_{GS} = 0 Vdc, T_J = 125°C)	V_{SD}	− −	−0.80 −0.65	−1.2 −	Vdc
Diode Forward On−Voltage	(I_S = −6.2 Adc, V_{GS} = 0 Vdc) (I_S = −6.2 Adc, V_{GS} = 0 Vdc, T_J = 125°C)	V_{SD}	− −	−0.95 −0.80	− −	Vdc
Reverse Recovery Time	(I_S = −1.7 Adc, V_{GS} = 0 Vdc, dI_S/dt = 100 A/μs)	t_{rr}	−	50	80	ns
		t_a	−	20	−	
		t_r	−	30	−	
Reverse Recovery Stored Charge		Q_{RR}	−	0.04	−	μC

5. Indicates Pulse Test: Pulse Width = 300 μs max, Duty Cycle = 2%.
6. Switching characteristics are independent of operating junction temperature.

*Handling precautions to protect against electrostatic discharge are mandatory.

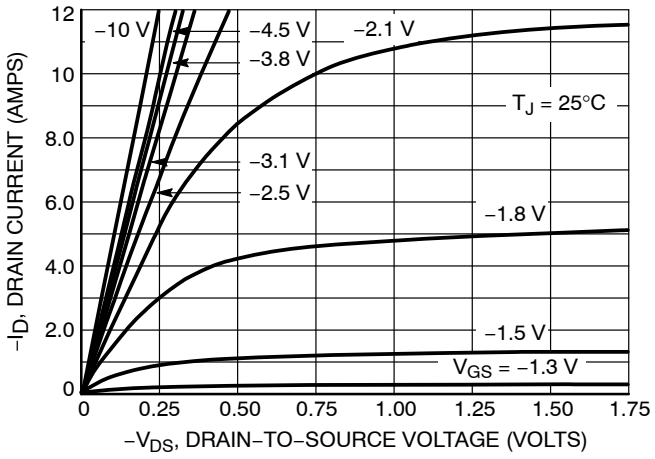


Figure 1. On−Region Characteristics

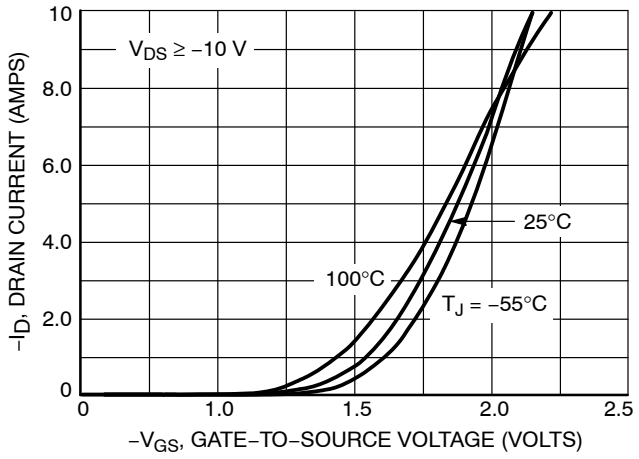


Figure 2. Transfer Characteristics

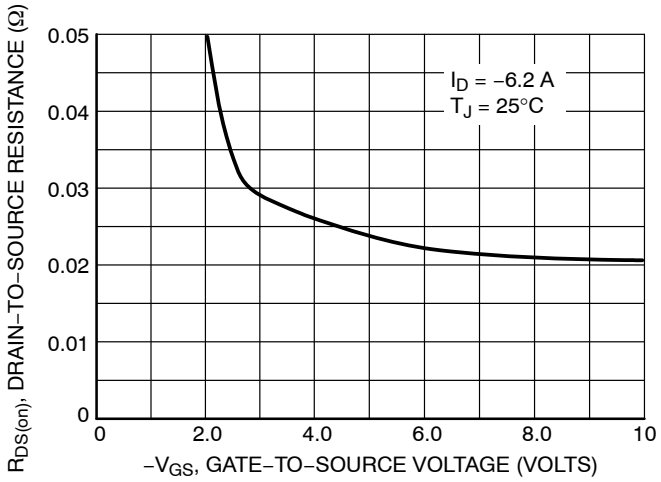


Figure 3. On−Resistance versus Gate−To−Source Voltage

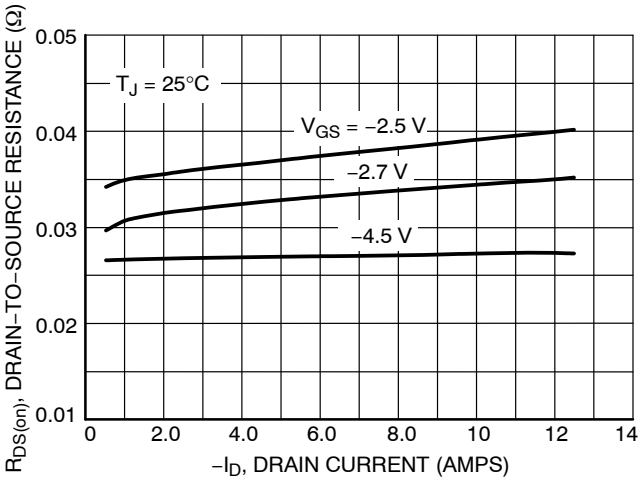


Figure 4. On-Resistance versus Drain Current and Gate Voltage

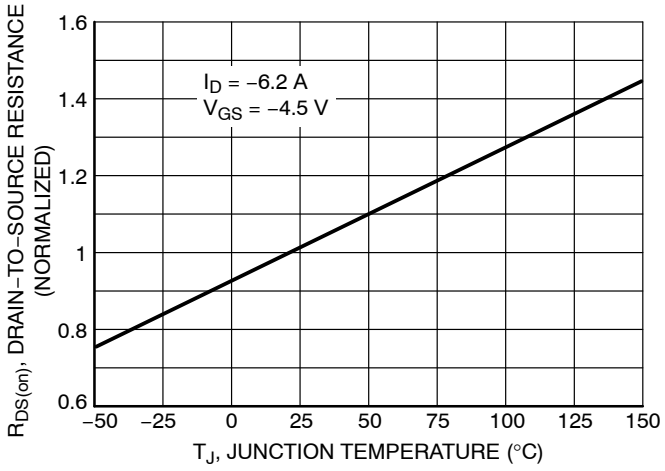


Figure 5. On−Resistance Variation with Temperature

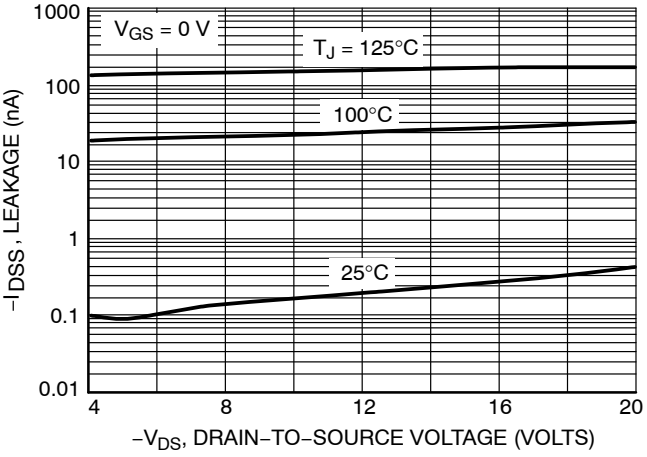


Figure 6. Drain−To−Source Leakage Current versus Voltage

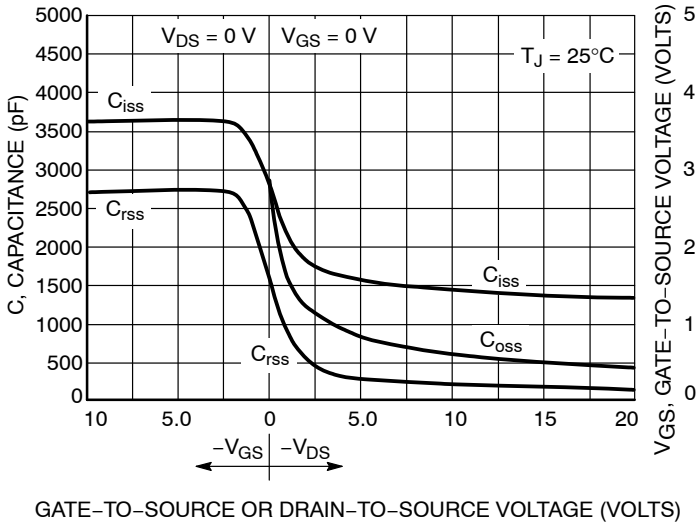


Figure 7. Capacitance Variation

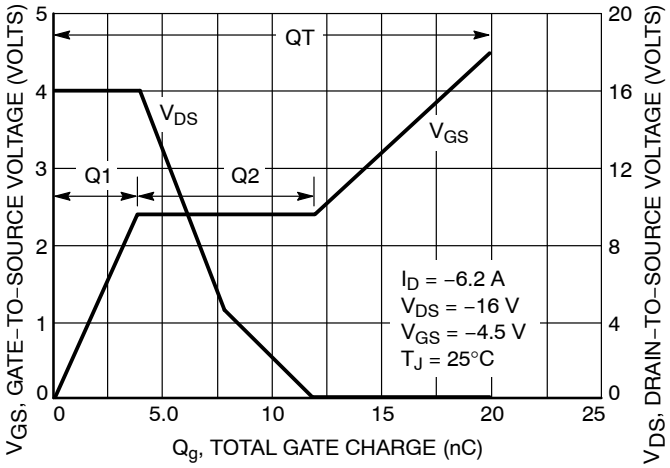


Figure 8. Gate−To−Source and Drain−To−Source Voltage versus Total Charge

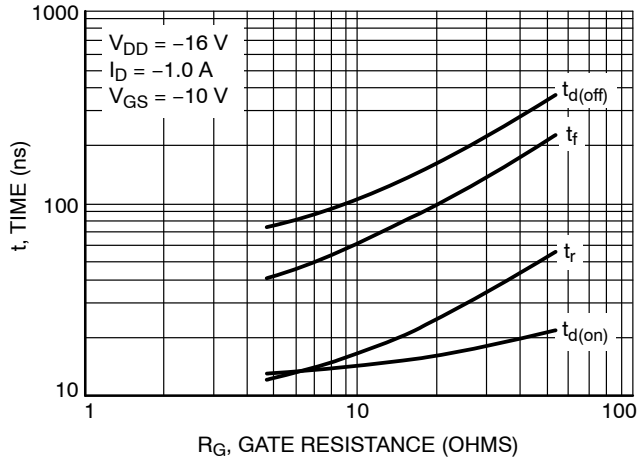


Figure 9. Resistive Switching Time Variation versus Gate Resistance

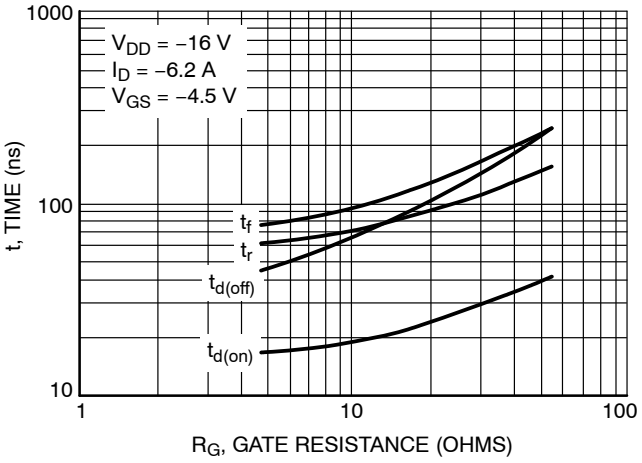


Figure 10. Resistive Switching Time Variation versus Gate Resistance

DRAIN−TO−SOURCE DIODE CHARACTERISTICS

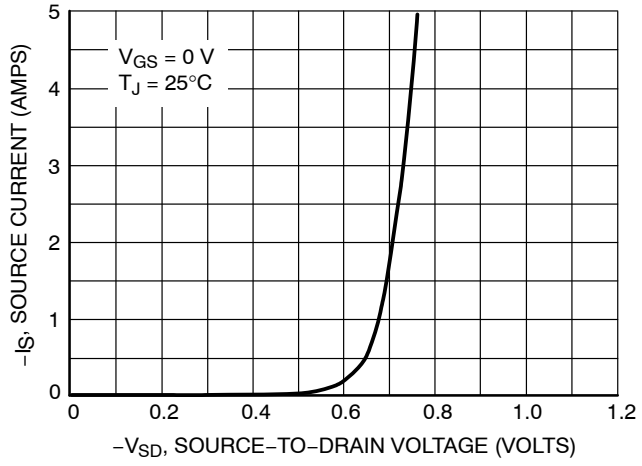


Figure 11. Diode Forward Voltage versus Current

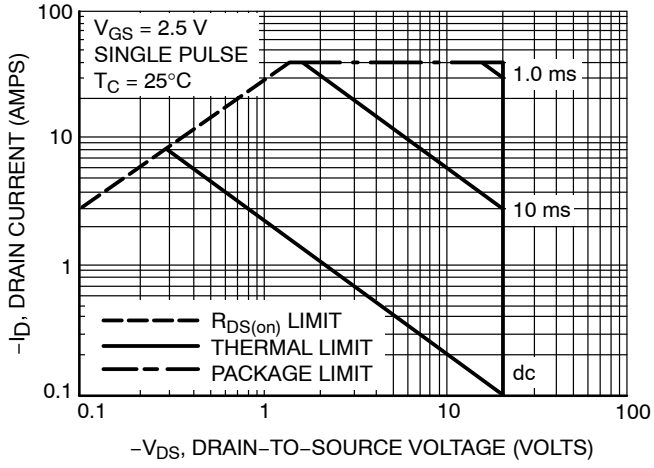


Figure 12. Maximum Rated Forward Biased Safe Operating Area

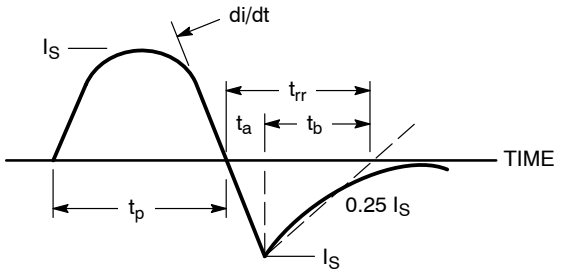


Figure 13. Diode Reverse Recovery Waveform

TYPICAL ELECTRICAL CHARACTERISTICS

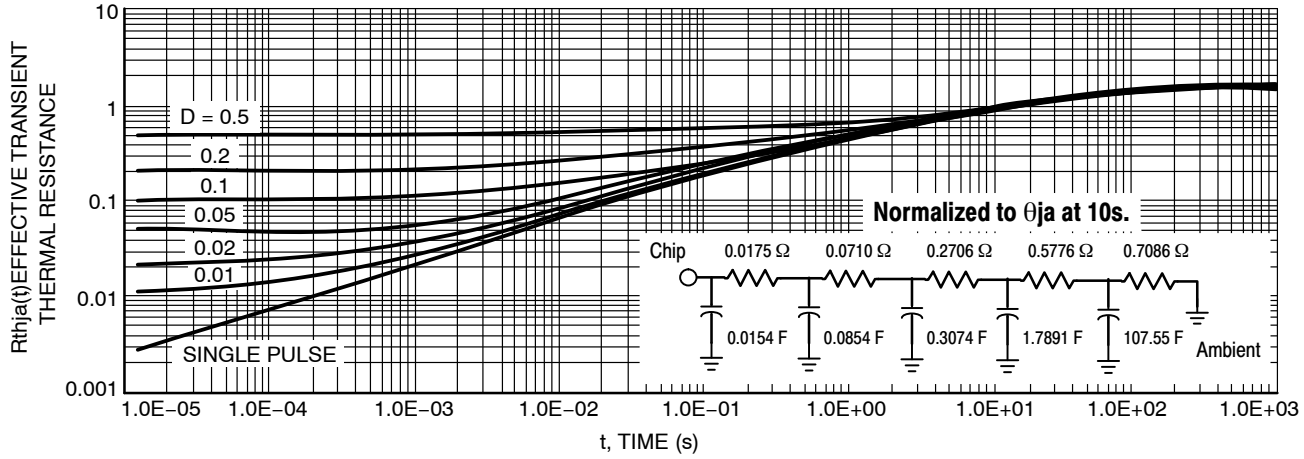
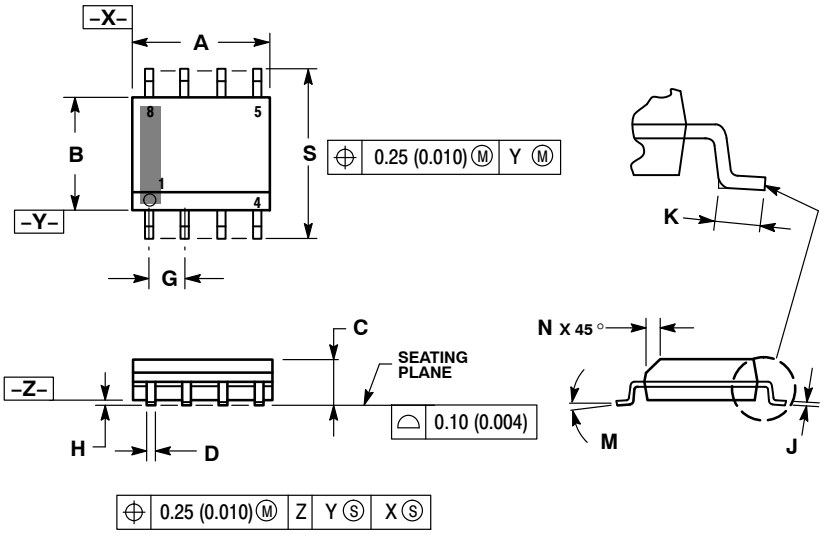


Figure 14. Thermal Response

PACKAGE DIMENSIONS

SOIC−8 NB
CASE 751−07
ISSUE AK

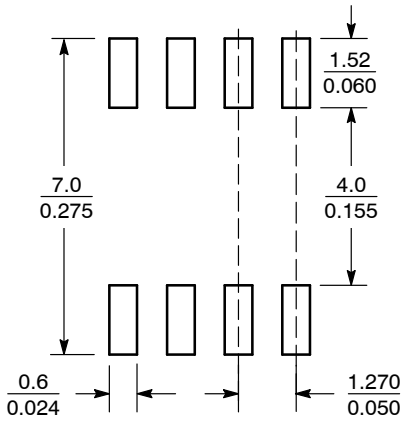


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) 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 11:
PIN 1. SOURCE 1
2. GATE 1
3. SOURCE 2
4. GATE 2
5. DRAIN 2
6. DRAIN 2
7. DRAIN 1
8. DRAIN 1

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

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NTMD6P02R2/D