NTMD6N02R2

Power MOSFET
6.0 Amps, 20 Volts

N–Channel Enhancement Mode
Dual SO–8 Package

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
- SOIC–8 Mounting Information Provided
- Pb–Free Package is Available

Applications

- DC–DC Converters
- Low Voltage Motor Control
- Power Management in Portable and Battery–Powered Products, for example, Computers, Printers, Cellular and Cordless Telephones and PCMCIA Cards

ON Semiconductor®

http://onsemi.com

V_{DSS}	$R_{DS(ON)}$ TYP	I_D MAX
20 V	35 mΩ @ V_{GS} = 4.5 V	6.0 A

N–Channel

SOIC–8
CASE 751
STYLE 11

**MARKING DIAGRAM
& PIN ASSIGNMENT**

Source 1 — 1 — 8 — Drain 1
Gate 1 — 2 — 7 — Drain 1
Source 2 — 3 — 6 — Drain 2
Gate 2 — 4 — 5 — Drain 2

E6N02
ALYW∎

(Top View)

E6N02 = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
∎ = Pb–Free Package
(Note: Microdot may be in either location)

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

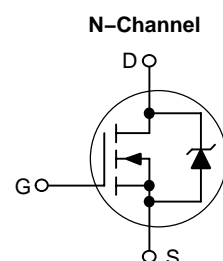| Rating	Symbol	Value	Unit
Drain–to–Source Voltage	V_{DSS}	20	V
Drain–to–Gate Voltage (R_{GS} = 1.0 MΩ)	V_{DGR}	20	V
Gate–to–Source Voltage – Continuous	V_{GS}	± 12	V
Thermal Resistance, Junction–to–Ambient (Note 1)	$R_{\theta JA}$	62.5	°C/W
Total Power Dissipation @ T_A = 25°C	P_D	2.0	W
Continuous Drain Current @ T_A = 25°C	I_D	6.5	A
Continuous Drain Current @ T_A = 70°C	I_D	5.5	A
Pulsed Drain Current (Note 4)	I_{DM}	50	A
Thermal Resistance, Junction–to–Ambient (Note 2)	$R_{\theta JA}$	102	°C/W
Total Power Dissipation @ T_A = 25°C	P_D	1.22	W
Continuous Drain Current @ T_A = 25°C	I_D	5.07	A
Continuous Drain Current @ T_A = 70°C	I_D	4.07	A
Pulsed Drain Current (Note 4)	I_{DM}	40	A
Thermal Resistance Junction–to–Ambient (Note 3)	$R_{\theta JA}$	172	°C/W
Total Power Dissipation @ T_A = 25°C	P_D	0.73	W
Continuous Drain Current @ T_A = 25°C	I_D	3.92	A
Continuous Drain Current @ T_A = 70°C	I_D	3.14	A
Pulsed Drain Current (Note 4)	I_{DM}	30	A

1. Mounted onto a 2 in square FR–4 Board (1 in sq. 2 oz. Cu 0.06 in thick single sided), t < 10 seconds.
2. Mounted onto a 2 in square FR–4 Board (1 in sq. 2 oz. Cu 0.06 in thick single sided), t = steady state.
3. Minimum FR–4 or G–10 PCB, t = steady state.
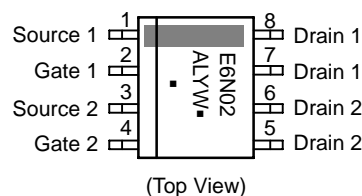4. Pulse Test: Pulse Width = 10 μs, Duty Cycle = 2%.

ORDERING INFORMATION

Device	Package	Shipping†
NTMD6N02R2	SOIC–8	2500/Tape & Reel
NTMD6N02R2G	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 Specification Brochure, BRD8011/D.

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

Rating	Symbol	Value	Unit
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 = 6.0 Apk, L = 20 mH, R_G = 25 Ω)	E_{AS}	360	mJ
Maximum Lead Temperature for Soldering Purposes for 10 seconds	T_L	260	°C

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)	$V_{(BR)DSS}$	20	–	–	Vdc
Temperature Coefficient (Positive)		–	19.2	–	mV/°C
Zero Gate Voltage Drain Current	I_{DSS}				µAdc
(V_{DS} = 20 Vdc, V_{GS} = 0 Vdc, T_J = 25°C)		–	–	1.0	
(V_{DS} = 20 Vdc, V_{GS} = 0 Vdc, T_J = 125°C)		–	–	10	
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)	$V_{GS(th)}$	0.6	0.9	1.2	Vdc
Temperature Coefficient (Negative)		–	−3.0	–	mV/°C
Static Drain−to−Source On−State Resistance	$R_{DS(on)}$				Ω
(V_{GS} = 4.5 Vdc, I_D = 6.0 Adc)		–	0.028	0.035	
(V_{GS} = 4.5 Vdc, I_D = 4.0 Adc)		–	0.028	0.043	
(V_{GS} = 2.7 Vdc, I_D = 2.0 Adc)		–	0.033	0.048	
(V_{GS} = 2.5 Vdc, I_D = 3.0 Adc)		–	0.035	0.049	
Forward Transconductance (V_{DS} = 12 Vdc, I_D = 3.0 Adc)	g_{FS}	–	10	–	Mhos
DYNAMIC CHARACTERISTICS					
Input Capacitance	C_{iss}	–	785	1100	pF
Output Capacitance (V_{DS} = 16 Vdc, V_{GS} = 0 Vdc, f = 1.0 MHz)	C_{oss}	–	260	450	
Reverse Transfer Capacitance	C_{rss}	–	75	180	
SWITCHING CHARACTERISTICS (Notes 6 and 7)					
Turn−On Delay Time	$t_{d(on)}$	–	12	20	ns
Rise Time (V_{DD} = 16 Vdc, I_D = 6.0 Adc, V_{GS} = 4.5 Vdc, R_G = 6.0 Ω)	t_r	–	50	90	
Turn−Off Delay Time	$t_{d(off)}$	–	45	75	
Fall Time	t_f	–	80	130	
Turn−On Delay Time	$t_{d(on)}$	–	11	18	ns
Rise Time (V_{DD} = 16 Vdc, I_D = 4.0 Adc, V_{GS} = 4.5 Vdc, R_G = 6.0 Ω)	t_r	–	35	65	
Turn−Off Delay Time	$t_{d(off)}$	–	45	75	
Fall Time	t_f	–	60	110	
Total Gate Charge	Q_{tot}	–	12	20	nC
Gate−Source Charge (V_{DS} = 16 Vdc, V_{GS} = 4.5 Vdc, I_D = 6.0 Adc)	Q_{gs}	–	1.5	–	
Gate−Drain Charge	Q_{gd}	–	4.0	–	

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.

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Characteristic		Symbol	Min	Typ	Max	Unit
BODY−DRAIN DIODE RATINGS (Note 9)						
Diode Forward On−Voltage	(I_S = 4.0 Adc, V_{GS} = 0 Vdc) (I_S = 6.0 Adc, V_{GS} = 0 Vdc) (I_S = 6.0 Adc, V_{GS} = 0 Vdc, T_J = 125°C)	V_{SD}	– – –	0.83 0.88 0.75	1.1 1.2 –	Vdc
Reverse Recovery Time	(I_S = 6.0 Adc, V_{GS} = 0 Vdc, dI_S/dt = 100 A/µs)	t_{rr}	–	30	–	ns
		t_a	–	15	–	
		t_b	–	15	–	
Reverse Recovery Stored Charge		Q_{RR}	–	0.02	–	µC

8. Handling precautions to protect against electrostatic discharge is mandatory.
9. Indicates Pulse Test: Pulse Width = 300 µs max, Duty Cycle = 2%.
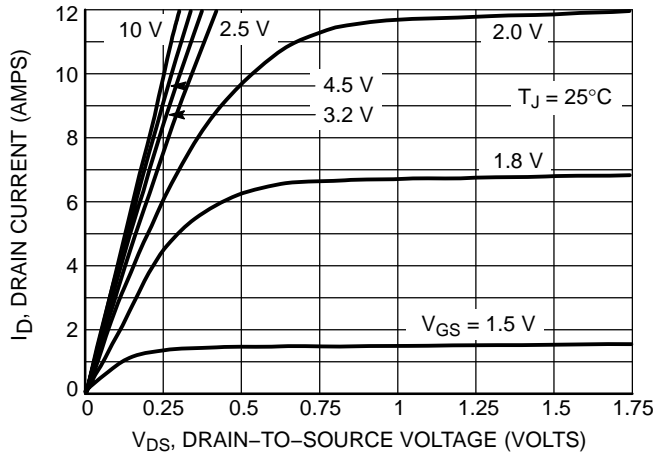
Figure 1. On−Region Characteristics
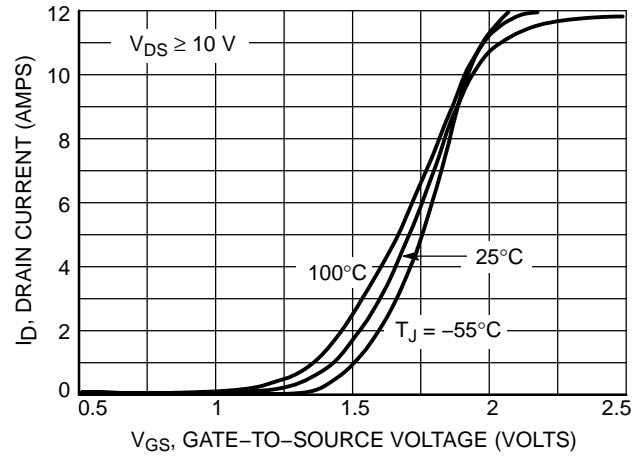
Figure 2. Transfer Characteristics
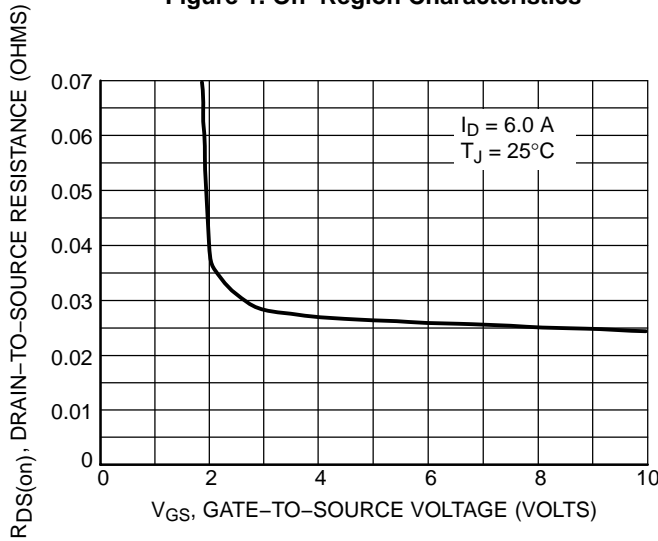
Figure 3. On−Resistance versus Gate−To−Source Voltage
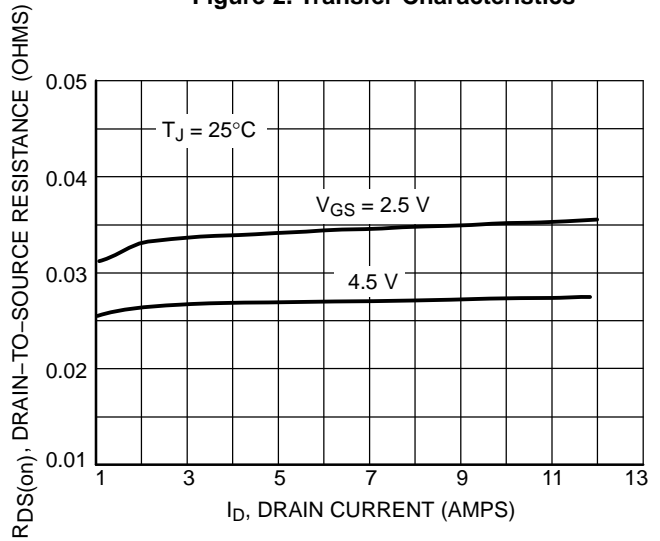
Figure 4. On-Resistance versus Drain Current and Gate Voltage
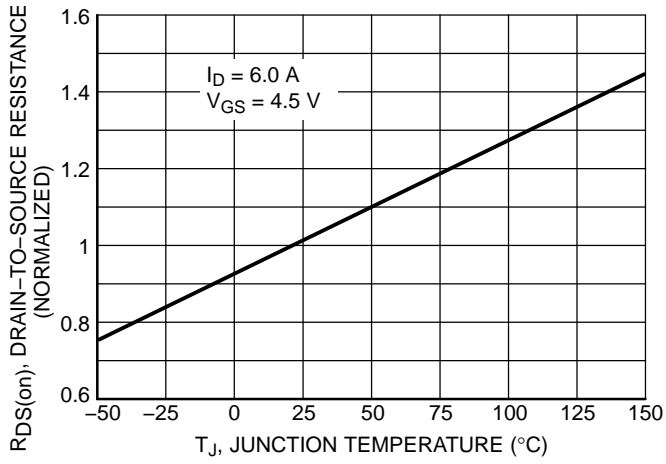
Figure 5. On–Resistance Variation with Temperature
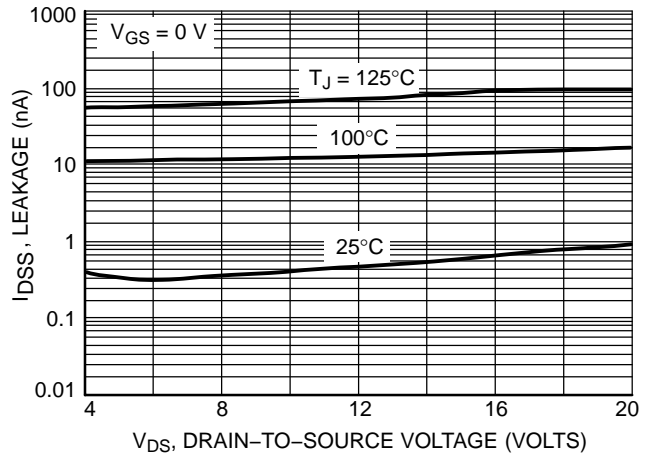
Figure 6. Drain–To–Source Leakage Current versus Voltage
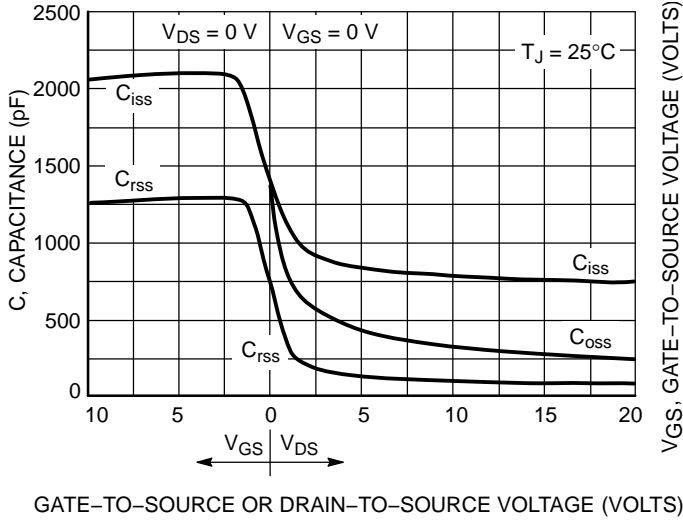
Figure 7. Capacitance Variation
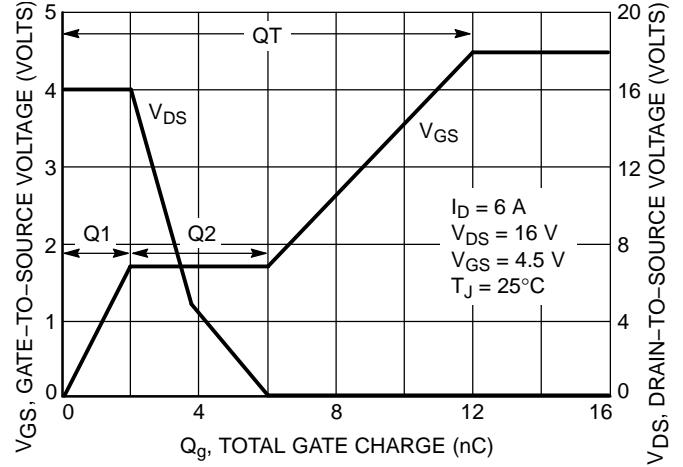
Figure 8. Gate–To–Source and Drain–To–Source Voltage versus Total Charge
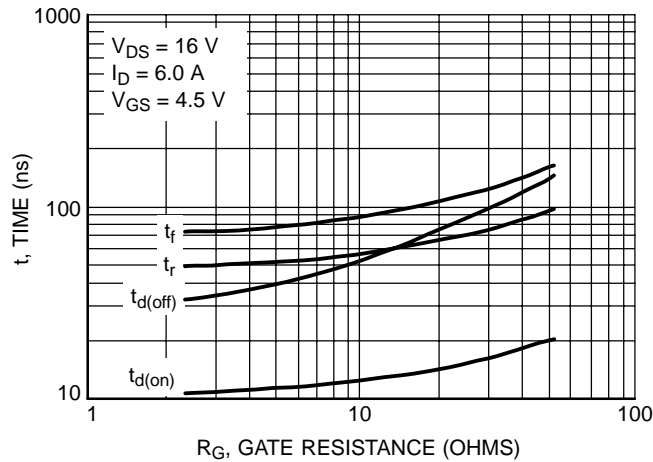
Figure 9. Resistive Switching Time Variation versus Gate Resistance

DRAIN–TO–SOURCE DIODE CHARACTERISTICS
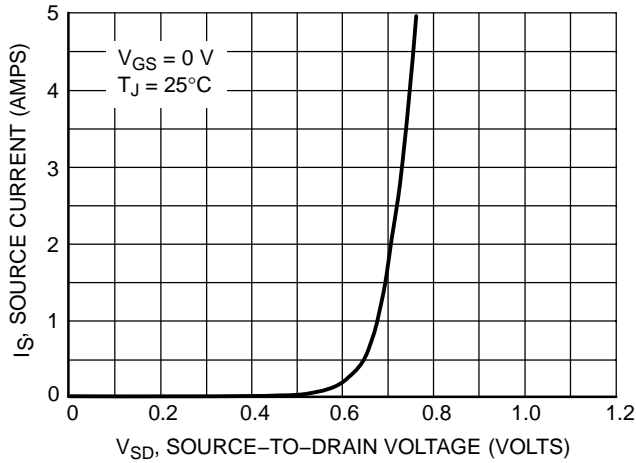
Figure 10. Diode Forward Voltage versus Current
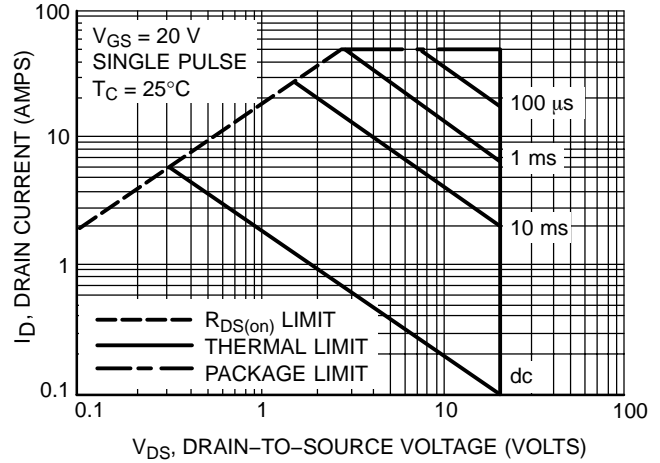
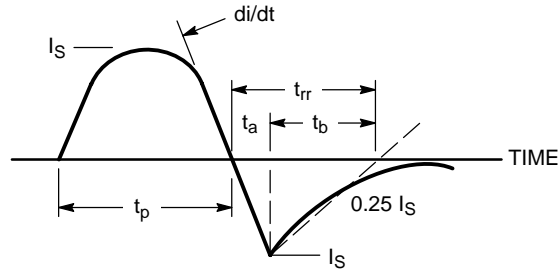
Figure 11. Maximum Rated Forward Biased Safe Operating Area

Figure 12. Diode Reverse Recovery Waveform

TYPICAL ELECTRICAL CHARACTERISTICS

$R_{\theta JC}(t) = r(t) \, R_{\theta JC}$
D CURVES APPLY FOR POWER
PULSE TRAIN SHOWN
READ TIME AT t_1
$T_{J(pk)} - T_C = P_{(pk)} \, R_{\theta JC}(t)$

DUTY CYCLE, $D = t_1/t_2$
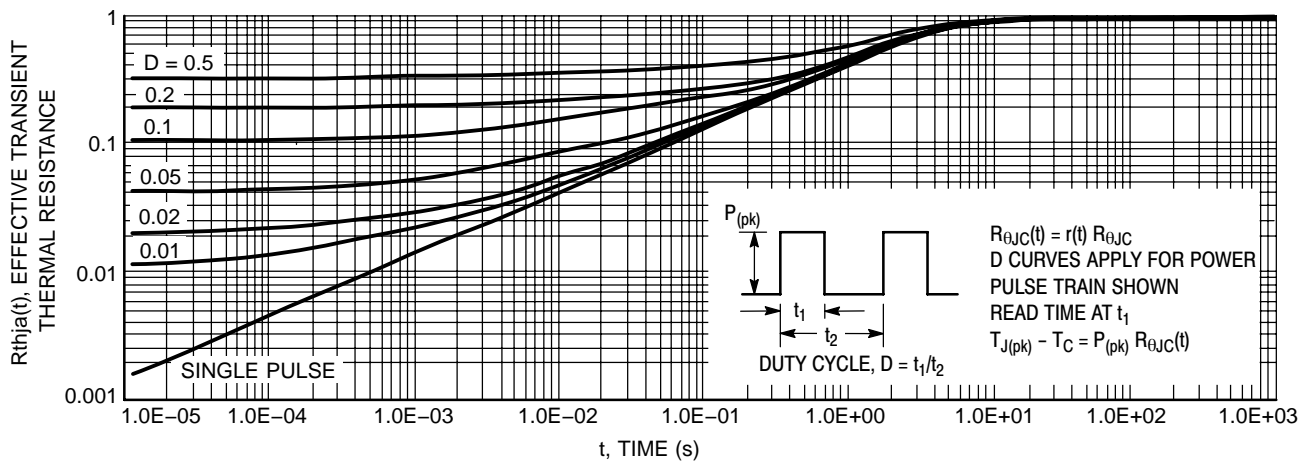
Figure 13. Thermal Response

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PACKAGE DIMENSIONS

SOIC–8
CASE 751–07
ISSUE AG
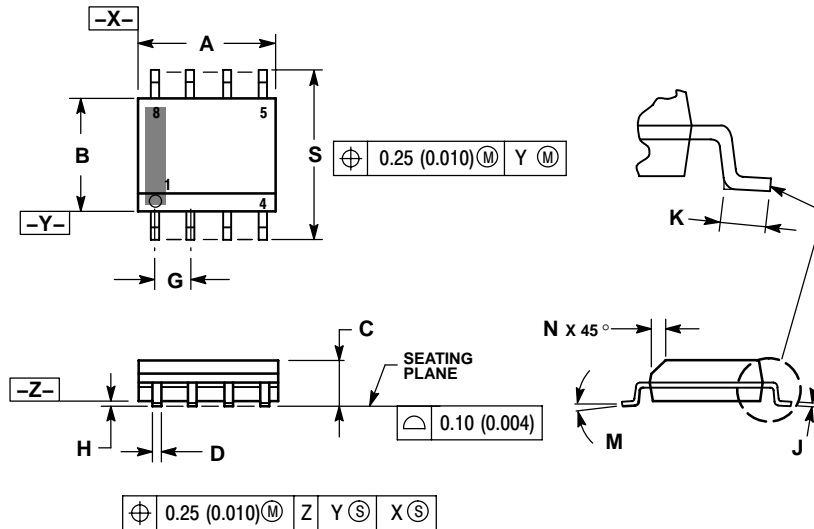
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) 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 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

$\left(\dfrac{mm}{inches}\right)$
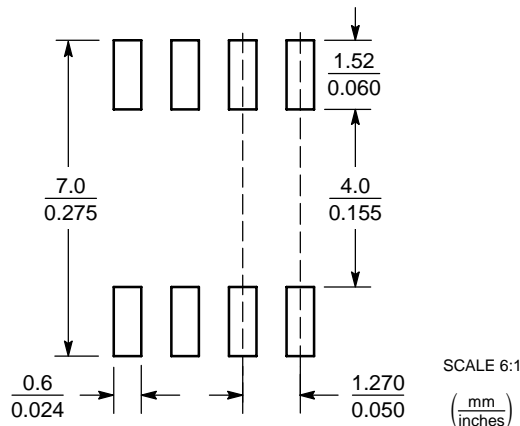
*For additional information on our Pb–Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.