NTMS5P02, NVMS5P02

MOSFET – Power, Single, P-Channel, Enhancement Mode, SOIC-8

-5.4 A, -20 V

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
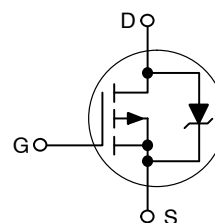
Single P−Channel
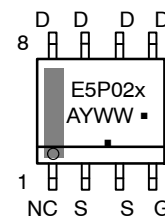
MARKING DIAGRAM & PIN ASSIGNMENT

SOIC−8
CASE 751
STYLE 13

D D D D

8

E5P02x
AYWW ▪

1

NC   S   S   G

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

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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)
  Total Power Dissipation @ T_A = 25°C
  Continuous Drain Current @ 25°C
  Continuous Drain Current @ 70°C
  Maximum Operating Power Dissipation
  Maximum Operating Drain Current
  Pulsed Drain Current (Note 4)
	$R_{\theta JA}$
	P_D
	I_D
	I_D
	P_D
	I_D
	I_{DM}
		50
		2.5
		−7.05
		−5.62
		1.2
		−4.85
		−28
			°C/W
			W
			A
			A
			W
			A
			A

Thermal Resistance −
  Junction−to−Ambient (Note 2)
  Total Power Dissipation @ T_A = 25°C
  Continuous Drain Current @ 25°C
  Continuous Drain Current @ 70°C
  Maximum Operating Power Dissipation
  Maximum Operating Drain Current
  Pulsed Drain Current (Note 4)
	$R_{\theta JA}$
	P_D
	I_D
	I_D
	P_D
	I_D
	I_{DM}
		85
		1.47
		−5.40
		−4.30
		0.7
		−3.72
		−20
			°C/W
			W
			A
			A
			W
			A
			A

Thermal Resistance −
  Junction−to−Ambient (Note 3)
  Total Power Dissipation @ T_A = 25°C
  Continuous Drain Current @ 25°C
  Continuous Drain Current @ 70°C
  Maximum Operating Power Dissipation
  Maximum Operating Drain Current
  Pulsed Drain Current (Note 4)
	$R_{\theta JA}$
	P_D
	I_D
	I_D
	P_D
	I_D
	I_{DM}
		159
		0.79
		−3.95
		−3.15
		0.38
		−2.75
		−12
			°C/W
			W
			A
			A
			W
			A
			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	$V_{(BR)DSS}$				Vdc
(V_{GS} = 0 Vdc, I_D = –250 μAdc)		–20	–	–	
Temperature Coefficient (Positive)		–	–15	–	mV/°C
Zero Gate Voltage Drain Current	I_{DSS}				μAdc
(V_{DS} = –16 Vdc, V_{GS} = 0 Vdc, T_J = 25°C)		–	–	–1.0	
(V_{DS} = –16 Vdc, V_{GS} = 0 Vdc, T_J = 125°C)		–	–	–10	
(V_{DS} = –20 Vdc, V_{GS} = 0 Vdc, T_J = 25°C)		–	–0.2	–	
Gate–Body Leakage Current	I_{GSS}				nAdc
(V_{GS} = –10 Vdc, V_{DS} = 0 Vdc)		–	–	–100	
Gate–Body Leakage Current	I_{GSS}				nAdc
(V_{GS} = +10 Vdc, V_{DS} = 0 Vdc)		–	–	100	
ON CHARACTERISTICS					
Gate Threshold Voltage	$V_{GS(th)}$				Vdc
(V_{DS} = V_{GS}, I_D = –250 μAdc)		–0.65	–0.9	–1.25	
Temperature Coefficient (Negative)		–	2.9	–	mV/°C
Static Drain–to–Source On–State Resistance	$R_{DS(on)}$				Ω
(V_{GS} = –4.5 Vdc, I_D = –5.4 Adc)		–	0.026	0.033	
(V_{GS} = –2.5 Vdc, I_D = –2.7 Adc)		–	0.037	0.048	
Forward Transconductance (V_{DS} = –9.0 Vdc, I_D = –5.4 Adc)	g_{FS}	–	15	–	Mhos
DYNAMIC CHARACTERISTICS					
Input Capacitance	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	$t_{d(on)}$	–	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	$t_{d(on)}$	–	22	–	ns
Rise Time	t_r	–	70	–	
Turn–Off Delay Time	$t_{d(off)}$	–	65	–	
Fall Time	t_f	–	90	–	
Total Gate Charge	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	V_{SD}				Vdc
(I_S = –5.4 Adc, V_{GS} = 0 V)		–	–0.95	–1.25	
(I_S = –5.4 Adc, V_{GS} = 0 Vdc, T_J = 125°C)		–	–0.72	–	
Reverse Recovery Time	t_{rr}	–	40	75	ns
	t_a	–	20	–	
	t_b	–	20	–	
Reverse Recovery Stored Charge	Q_{RR}	–	0.03	–	μC

Dynamic characteristics measurement conditions: (V_{DS} = –16 Vdc, V_{GS} = 0 Vdc, f = 1.0 MHz)

Switching characteristics (first group): (V_{DD} = –16 Vdc, I_D = –1.0 Adc, V_{GS} = –4.5 Vdc, R_G = 6.0 Ω)

Switching characteristics (second group): (V_{DD} = –16 Vdc, I_D = –5.4 Adc, V_{GS} = –4.5 Vdc, R_G = 6.0 Ω)

Gate charge conditions: (V_{DS} = –16 Vdc, V_{GS} = –4.5 Vdc, I_D = –5.4 Adc)

Reverse recovery conditions: (I_S = –5.4 Adc, V_{GS} = 0 Vdc, dI$_S$/dt = 100 A/μs)

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.

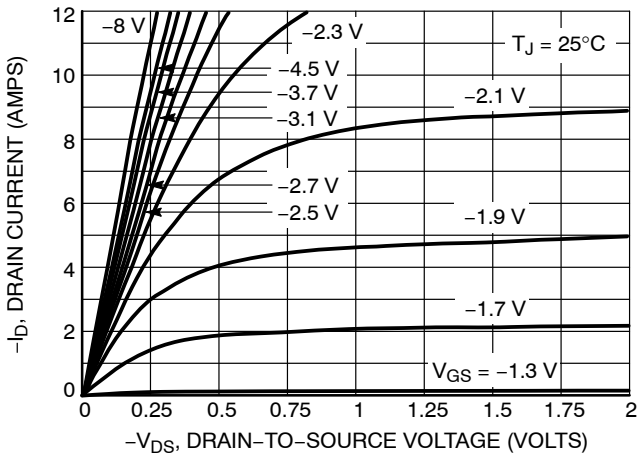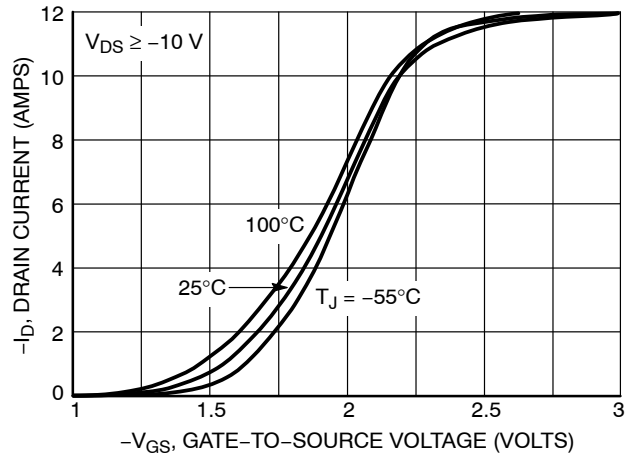**Figure 1. On−Region Characteristics**

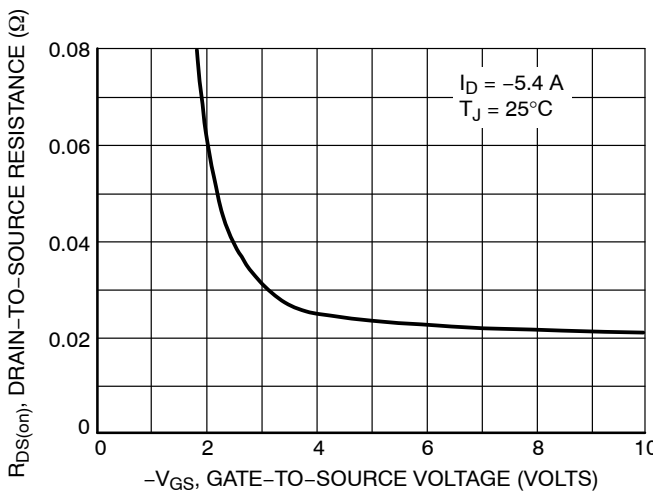**Figure 2. Transfer Characteristics**

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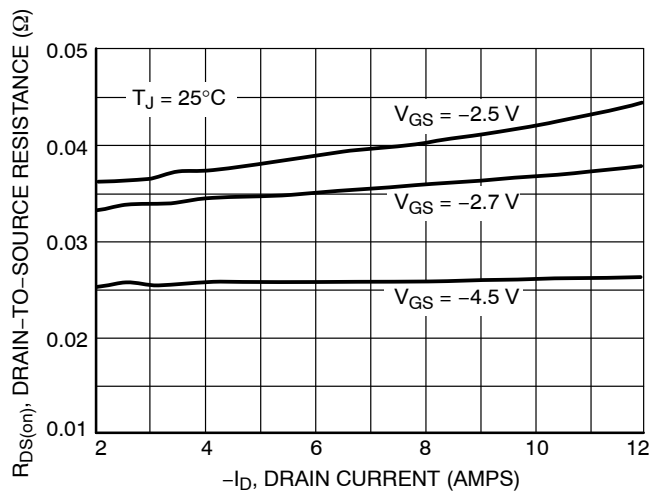Gate−To−Source Voltage**

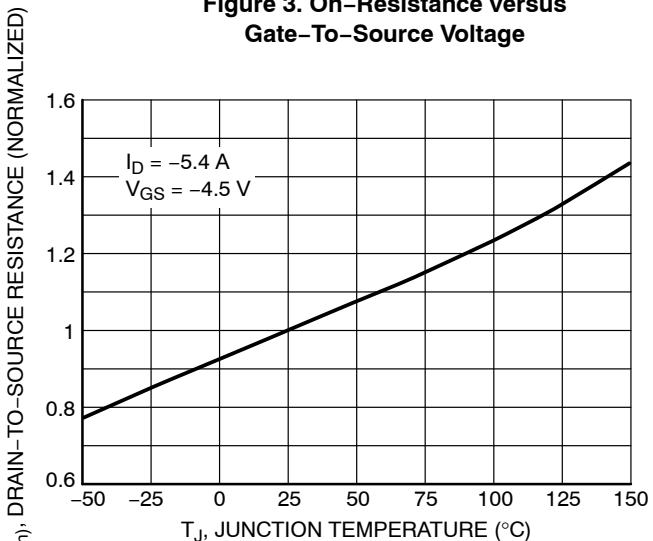**Figure 4. On-Resistance versus Drain Current
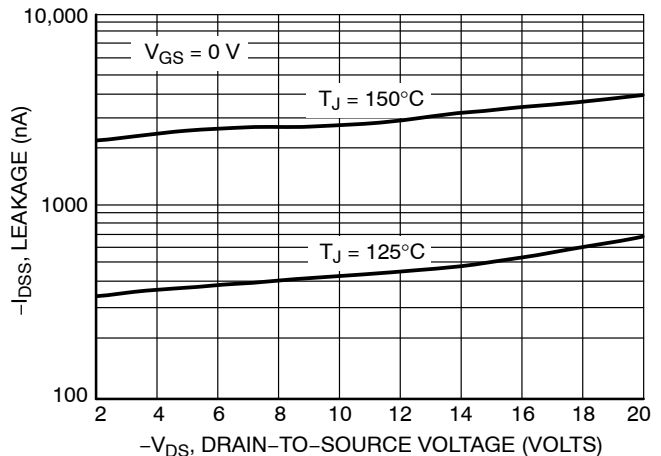and Gate Voltage**

**Figure 5. On−Resistance Variation with
Temperature**
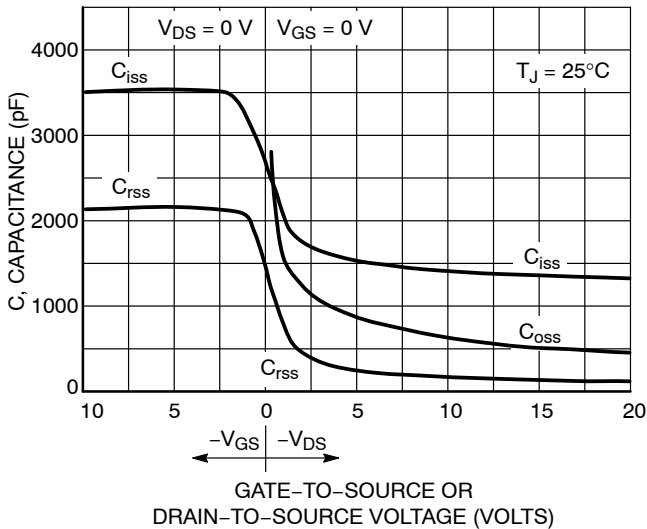
**Figure 6. Drain−To−Source Leakage Current
versus Voltage**

Figure 7. Capacitance Variation

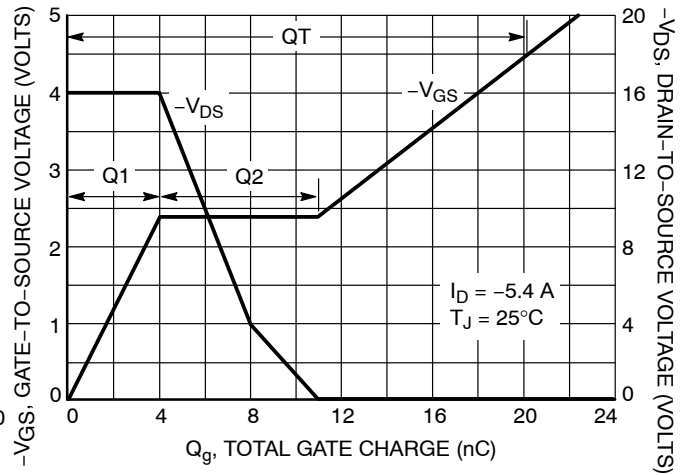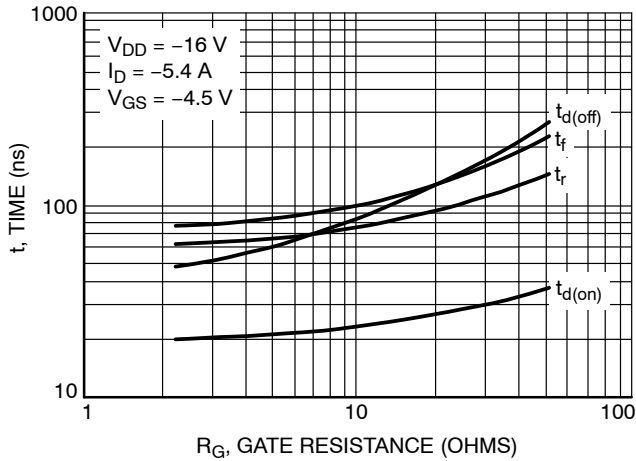**Figure 8. Gate−To−Source and Drain−To−Source Voltage versus Total Charge**

Figure 9. Resistive Switching Time Variation versus Gate Resistance
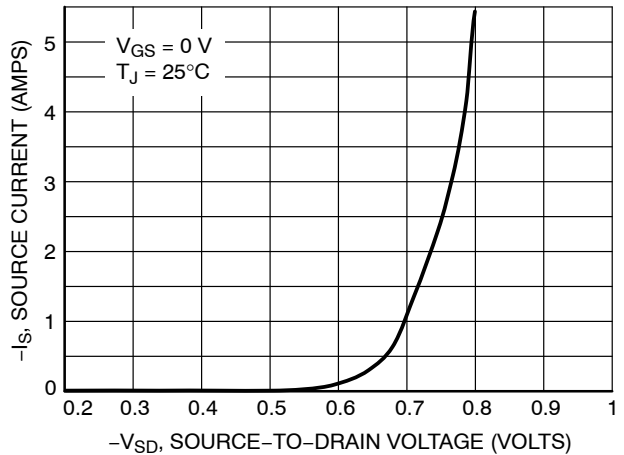
Figure 10. Diode Forward Voltage versus Current

DRAIN−TO−SOURCE DIODE CHARACTERISTICS
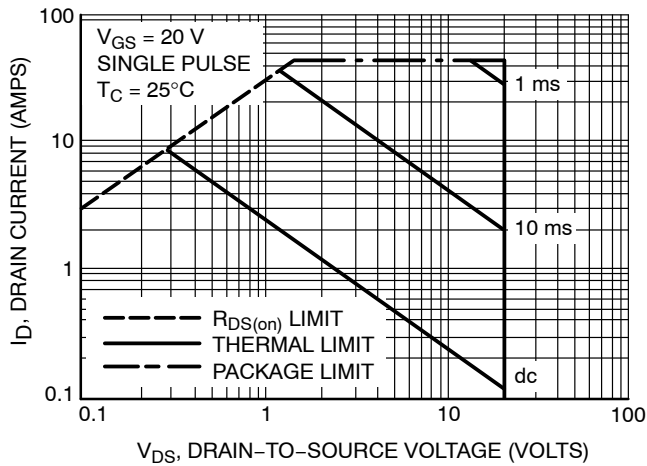
Figure 11. Maximum Rated Forward Biased Safe Operating Area
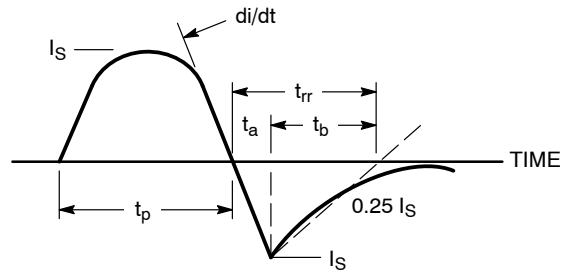
Figure 12. Diode Reverse Recovery Waveform

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TYPICAL ELECTRICAL CHARACTERISTICS
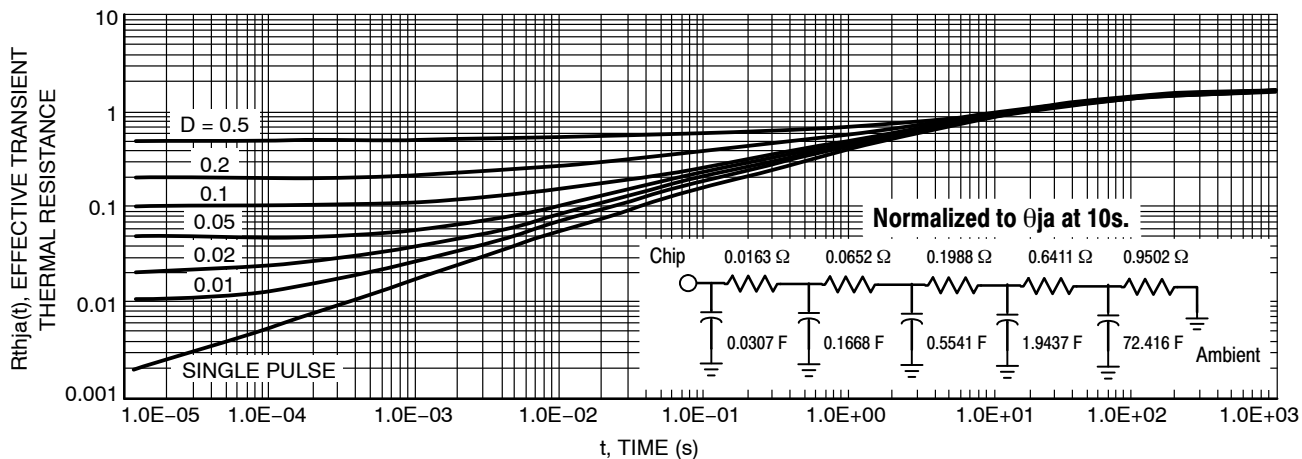
Figure 13. Thermal Response

NTMS5P02, NVMS5P02

PACKAGE DIMENSIONS

SOIC−8 NB
CASE 751−07
ISSUE AK
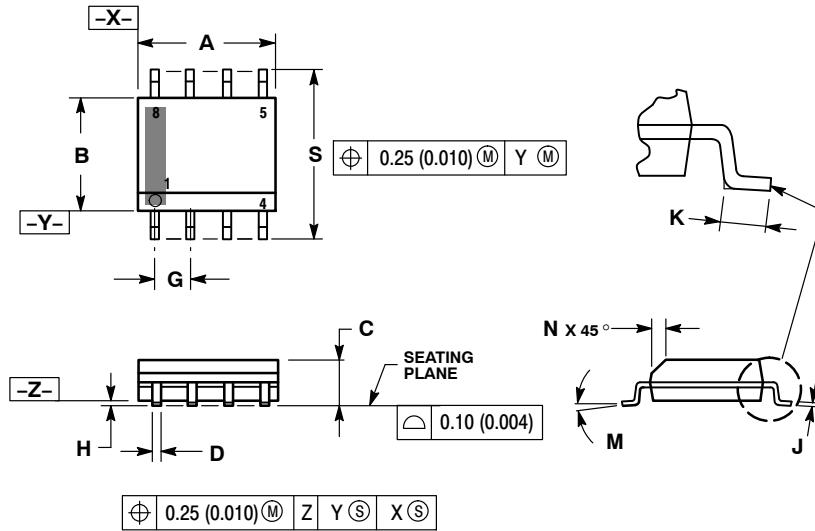
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.
6. 751−01 THRU 751−06 ARE OBSOLETE. NEW STANDARD IS 751−07.

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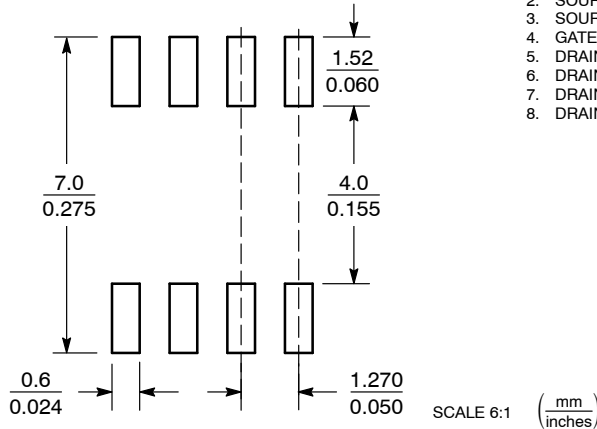
*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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