

# MOSFET - Power, Single N-Channel, STD Gate, SO8FL 40 V, 3.9 mΩ, 80 A

## NTMFS4D0N04XM

### Features

- Low  $R_{DS(on)}$  to Minimize Conduction Losses
- Low Capacitance to Minimize Driver Losses
- Small Footprint (5 x 6 mm) with Compact Design
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

### Applications

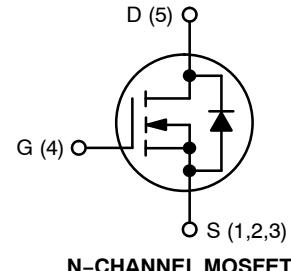
- Motor Drive
- Battery Protection
- Synchronous Rectification

### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise stated)

Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	$V_{DSS}$	40	V
Gate-to-Source Voltage	$V_{GS}$	$\pm 20$	V
Continuous Drain Current	$I_D$	80	A
		57	
Power Dissipation	$P_D$	43	W
Pulsed Drain Current	$I_D$	450	A
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to +175	°C
Source Current (Body Diode)	$I_S$	59	A
Single Pulse Avalanche Energy ( $I_{PK} = 3.6$ A)	$E_{AS}$	138	mJ
Lead Temperature for Soldering Purposes	$T_L$	260	°C

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

$V_{(BR)DSS}$	$R_{DS(ON)}$ MAX	$I_D$ MAX
40 V	3.9 mΩ @ 10 V	80 A



DFN5 5x6, 1.27P (SO-8FL)  
CASE 488AA

### MARKING DIAGRAM



4D0N4 = Specific Device Code  
 A = Assembly Location  
 Y = Year  
 W = Work Week  
 ZZ = Lot Traceability

### ORDERING INFORMATION

See detailed ordering, marking and shipping information on page 5 of this data sheet.

# NTMFS4D0N04XM

## THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case (Note 2)	$R_{\theta,JC}$	3.5	°C/W
Thermal Resistance, Junction-to-Ambient (Notes 1, 2)	$R_{\theta,JA}$	42	

1. Surface-mounted on FR4 board using 650 mm<sup>2</sup>, 2 oz Cu pad.
2. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.

## ELECTRICAL CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(\text{BR})DSS}$	$V_{GS} = 0 \text{ V}, I_D = 1 \text{ mA}, T_J = 25^\circ\text{C}$	40			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$\Delta V_{(\text{BR})DSS}/\Delta T_J$	$I_D = 1 \text{ mA}$ . Referenced to $25^\circ\text{C}$		15		mV/°C
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 40 \text{ V}, T_J = 25^\circ\text{C}$			1	μA
		$V_{DS} = 40 \text{ V}, T_J = 125^\circ\text{C}$			20	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{GS} = 20 \text{ V}, V_{DS} = 0 \text{ V}$			100	nA

### ON CHARACTERISTICS

Drain-to-Source On Resistance	$R_{DS(\text{on})}$	$V_{GS} = 10 \text{ V}, I_D = 6 \text{ A}, T_J = 25^\circ\text{C}$		3.4	3.9	mΩ
Gate Threshold Voltage	$V_{GS(\text{TH})}$	$V_{GS} = V_{DS}, I_D = 30 \mu\text{A}, T_J = 25^\circ\text{C}$	2.5		3.5	V
Gate Threshold Voltage Temperature Coefficient	$\Delta V_{GS(\text{TH})}/\Delta T_J$	$V_{GS} = V_{DS}, I_D = 30 \mu\text{A}$		-7.36		mV/°C
Forward Transconductance	$g_{FS}$	$V_{DS} = 5 \text{ V}, I_D = 6 \text{ A}$		32		S

### CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	$C_{ISS}$	$V_{GS} = 0 \text{ V}, V_{DS} = 25 \text{ V}, f = 1 \text{ MHz}$	784		pF
Output Capacitance	$C_{OSS}$		504		
Reverse Transfer Capacitance	$C_{RSS}$		10		
Output Charge	$Q_{OSS}$		20		nC
Total Gate Charge	$Q_{G(\text{TOT})}$	$V_{GS} = 10 \text{ V}, V_{DD} = 32 \text{ V}, I_D = 6 \text{ A}$	12		
Threshold Gate Charge	$Q_{G(\text{TH})}$		2		
Gate-to-Source Charge	$Q_{GS}$		3		
Gate-to-Drain Charge	$Q_{GD}$		2		
Gate Resistance	$R_G$		1.6		Ω

### SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{d(\text{ON})}$	Resistive Load, $V_{GS} = 10 \text{ V}, V_{DD} = 32 \text{ V},$ $I_D = 6 \text{ A}, R_G = 0 \Omega$	7		ns
Rise Time	$t_r$		8		
Turn-Off Delay Time	$t_{d(\text{OFF})}$		10		
Fall Time	$t_f$		9		

### SOURCE-TO-DRAIN DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0 \text{ V}, I_S = 6 \text{ A}, T_J = 25^\circ\text{C}$	0.78	1.2	V
		$V_{GS} = 0 \text{ V}, I_S = 6 \text{ A}, T_J = 125^\circ\text{C}$	0.63		
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0 \text{ V}, dI/dt = 100 \text{ A}/\mu\text{s},$ $I_S = 6 \text{ A}, V_{DD} = 32 \text{ V}$	53		ns
Charge Time	$t_a$		9		
Discharge Time	$t_b$		44		
Reverse Recovery Charge	$Q_{RR}$		18		nC

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

## TYPICAL CHARACTERISTICS

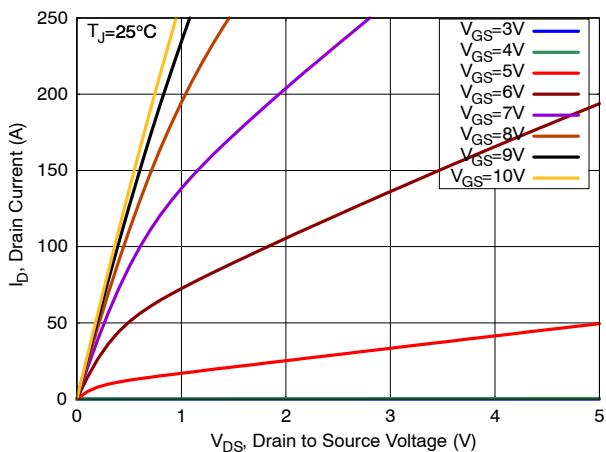


Figure 1. On-Region Characteristics

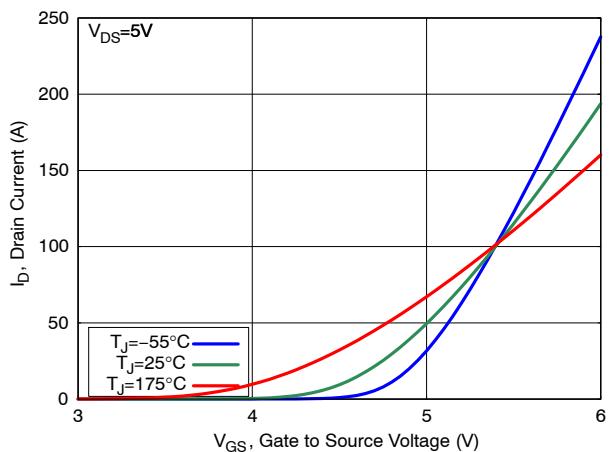


Figure 2. Transfer Characteristics

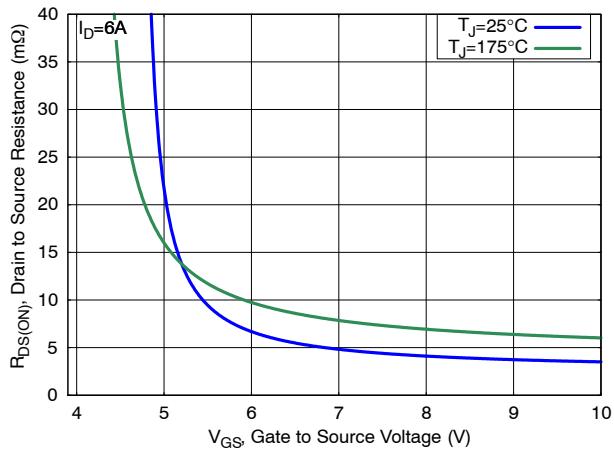


Figure 3. On-Resistance vs. Gate Voltage

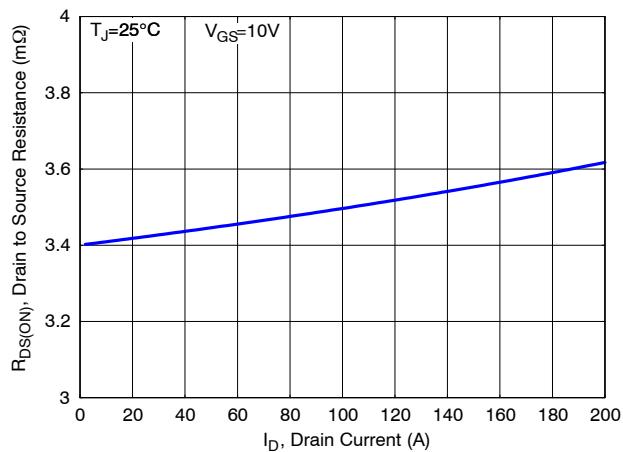


Figure 4. On-Resistance vs. Drain Current

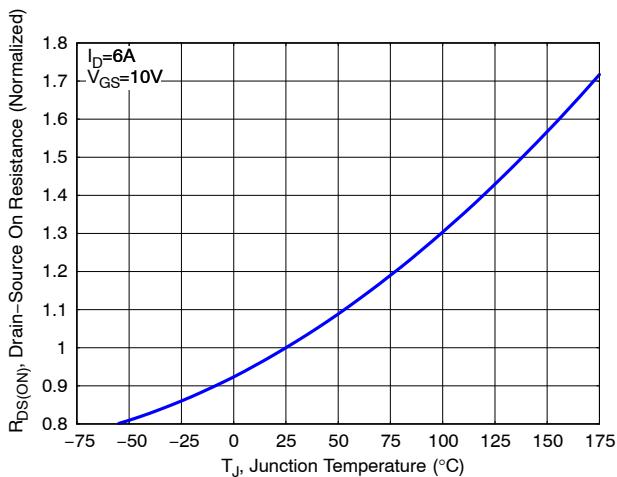


Figure 5. Normalized ON Resistance vs. Junction Temperature

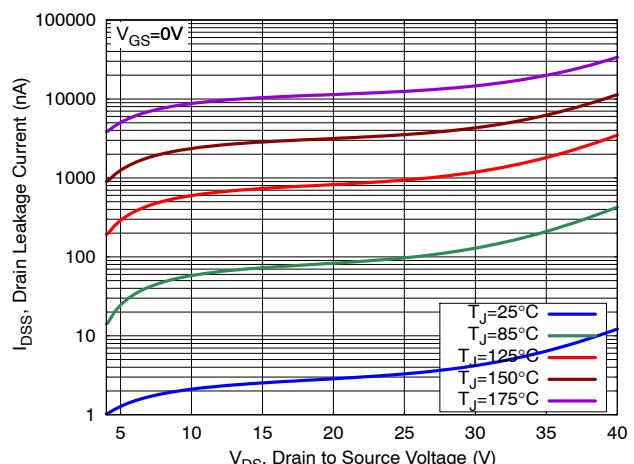


Figure 6. Drain Leakage Current vs. Drain Voltage

## TYPICAL CHARACTERISTICS (continued)

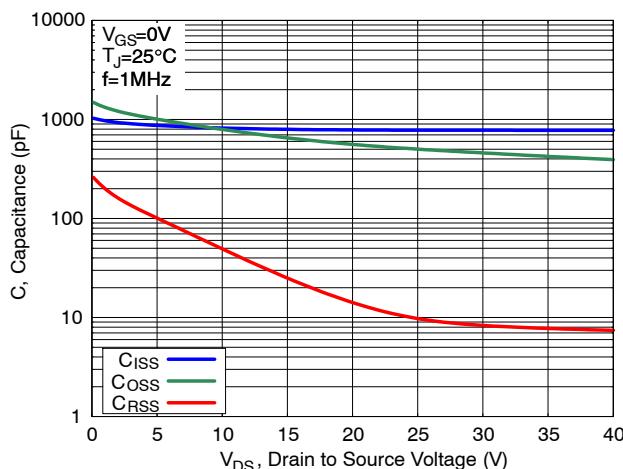


Figure 7. Capacitance Characteristics

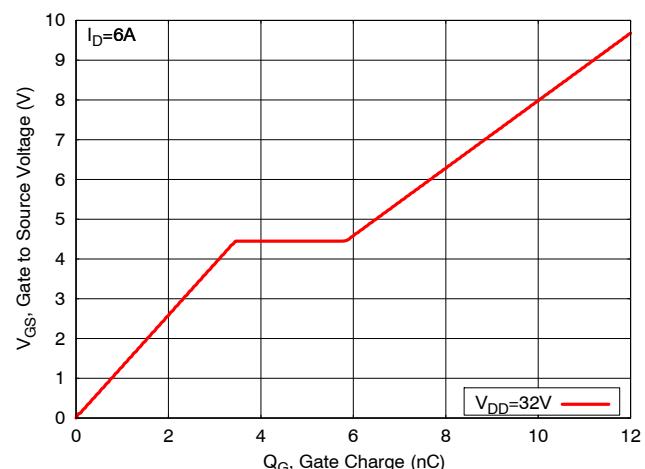


Figure 8. Gate Charge Characteristics

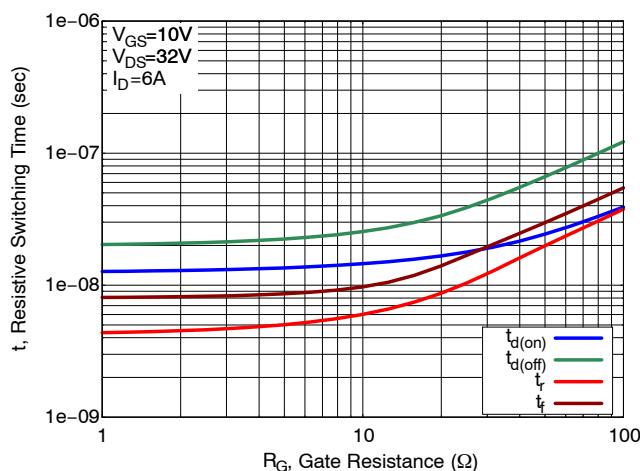


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

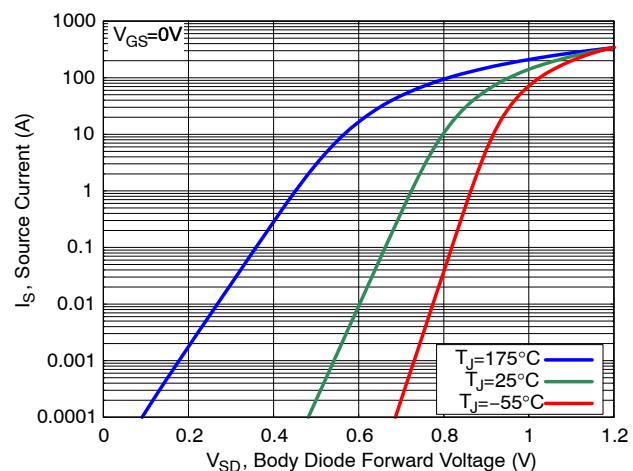


Figure 10. Diode Forward Characteristics

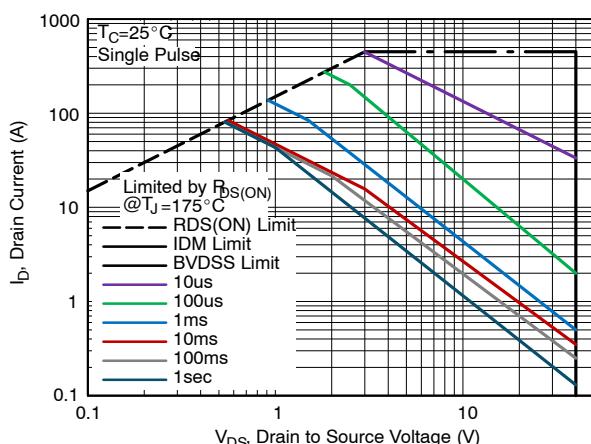


Figure 11. Maximum Rated Forward Biased Safe Operating Area

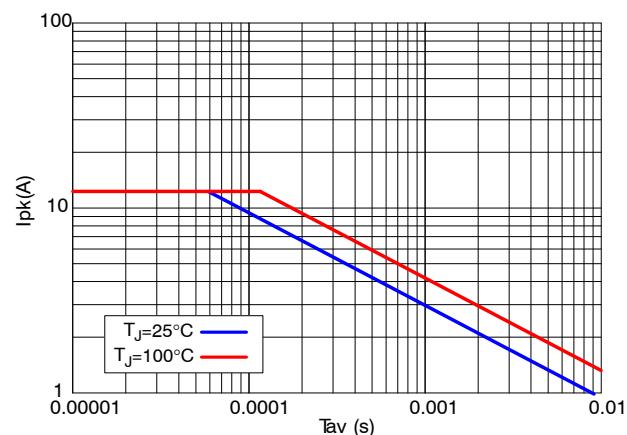


Figure 12. Ipeak vs. Time in Avalanche

# NTMFS4D0N04XM

## TYPICAL CHARACTERISTICS (continued)

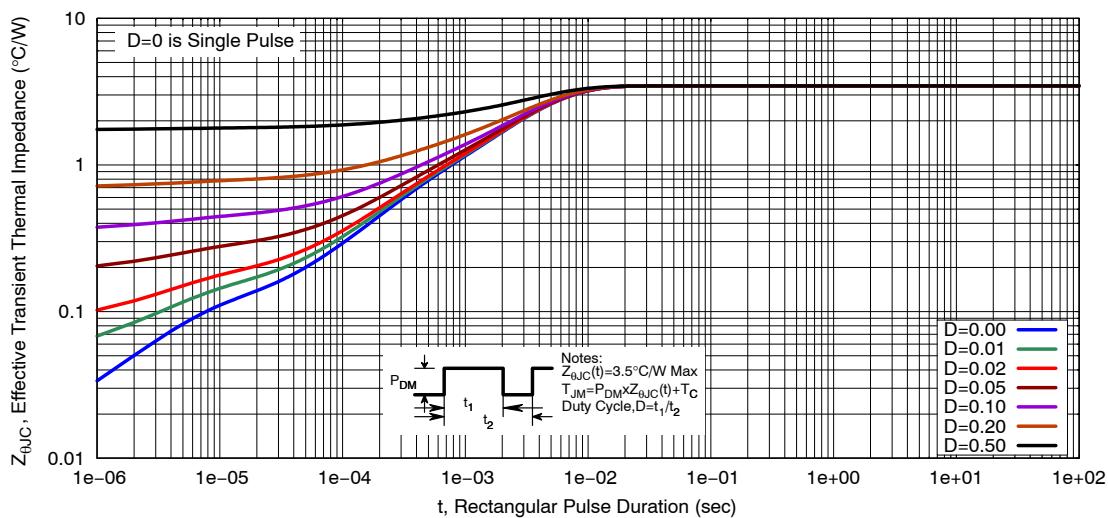


Figure 13. Transient Thermal Response

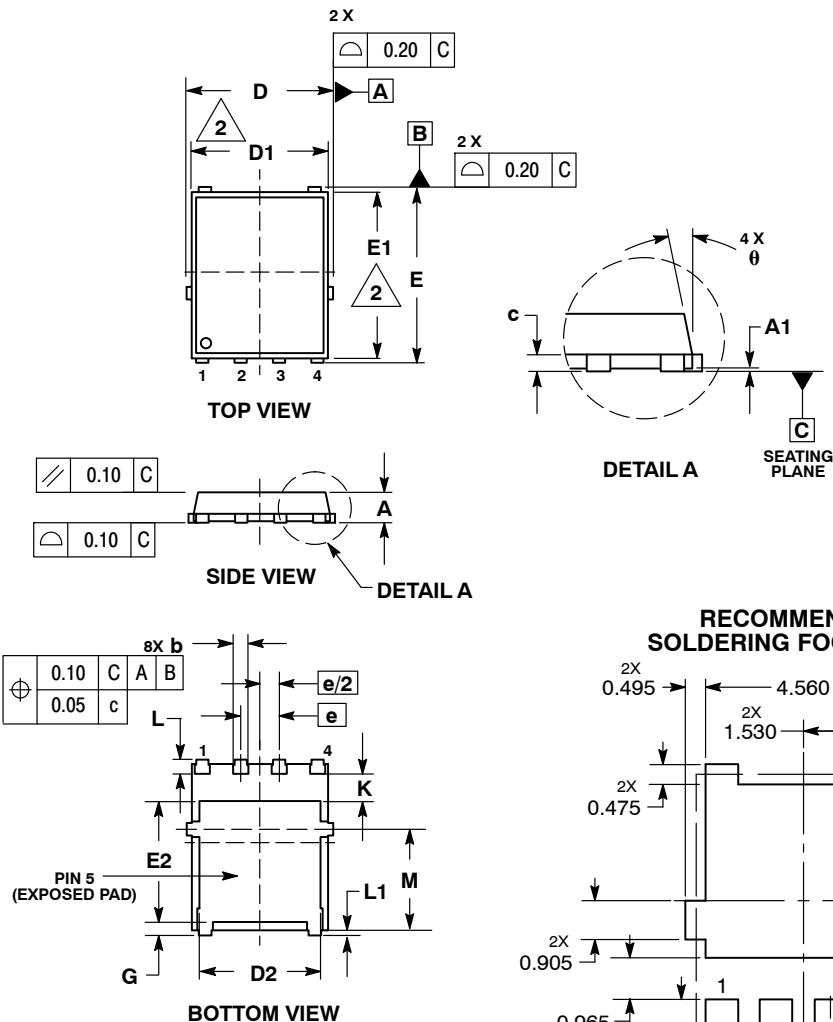
## DEVICE ORDERING INFORMATION

Device	Marking	Package	Shipping <sup>†</sup>
NTMFS4D0N04XMT1G	4D0N4	DFN5 (Pb-Free)	1500 / 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 Specifications Brochure, BRD8011/D.

## PACKAGE DIMENSIONS

**DFN5 5x6, 1.27P  
(SO-8FL)  
CASE 488AA  
ISSUE N**

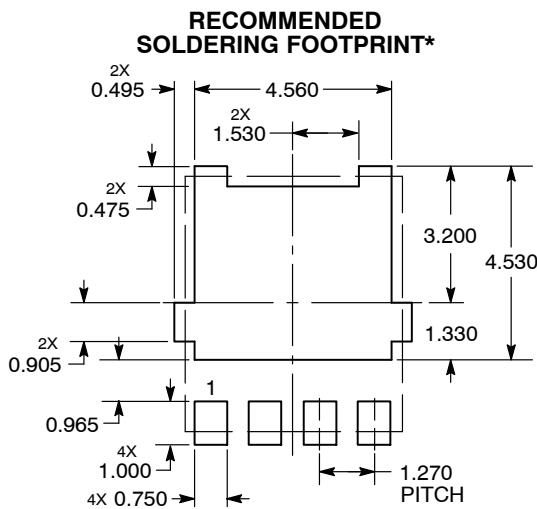


**STYLE 1:**  
PIN 1. SOURCE  
2. SOURCE  
3. SOURCE  
4. GATE  
5. DRAIN

**STYLE 2:**  
PIN 1. ANODE  
2. ANODE  
3. ANODE  
4. NO CONNECT  
5. CATHODE

**NOTES:**  
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.  
2. CONTROLLING DIMENSION: MILLIMETER.  
3. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.90	1.00	1.10
A1	0.00	---	0.05
b	0.33	0.41	0.51
c	0.23	0.28	0.33
D	5.00	5.15	5.30
D1	4.70	4.90	5.10
D2	3.80	4.00	4.20
E	6.00	6.15	6.30
E1	5.70	5.90	6.10
E2	3.45	3.65	3.85
e	1.27 BSC		
G	0.51	0.575	0.71
K	1.20	1.35	1.50
L	0.51	0.575	0.71
L1	0.125 REF		
M	3.00	3.40	3.80
$\theta$	0 °	---	12 °



DIMENSIONS: MILLIMETERS

\*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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