

# MOSFET - Power, Single N-Channel, SO8FL

40 V, 2.35 mΩ, 111 A

## NTMFS2D3N04XM

### 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

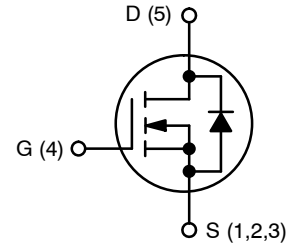
- Motor Drive
- Battery Protection
- Oring

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

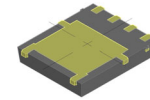
Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	$V_{DSS}$	40	V
Gate-to-Source Voltage	DC $V_{GS}$	$\pm 20$	V
Continuous Drain Current	$I_D$	$T_C = 25^\circ\text{C}$	111 A
		$T_C = 100^\circ\text{C}$	78
Power Dissipation	$T_C = 25^\circ\text{C}$	$P_D$	53 W
Continuous Drain Current $R_{\theta JA}$	$I_{DA}$	$T_A = 25^\circ\text{C}$	29 A
		$T_A = 100^\circ\text{C}$	21
Pulsed Drain Current	$T_C = 25^\circ\text{C}, t_p = 10 \mu\text{s}$	$I_{DM}$	682 A
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to +175	$^\circ\text{C}$
Source Current (Body Diode)	$I_S$	76	A
Single Pulse Avalanche Energy ( $I_{PK} = 6.5 \text{ A}$ )	$E_{AS}$	155	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)	$T_L$	260	$^\circ\text{C}$

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.

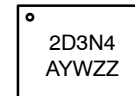
$V_{(BR)DSS}$	$R_{DS(on)} \text{ MAX}$	$I_D \text{ MAX}$
40 V	2.35 mΩ @ $V_{GS} = 10 \text{ V}$	111 A



N-CHANNEL MOSFET



DFN5 (SO8-FL)  
CASE 488AA



2D3N4 = Specific Device Code  
A = Assembly Location  
Y = Year  
W = Work Week  
ZZ = Assembly Lot Code

### ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 5 of this data sheet.

# NTMFS2D3N04XM

## THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case (Note 2)	$R_{\theta JC}$	2.82	°C/W
Thermal Resistance, Junction-to-Ambient (Notes 1, 2)	$R_{\theta JA}$	41.1	

- Surface mounted on FR4 board using 650 mm<sup>2</sup>, 2 oz Cu pad.
- 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 Condition	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}, T_J = 25^\circ\text{C}$	40			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$\Delta V_{(BR)DSS} / \Delta T_J$	$I_D = 1\text{ mA}$ , Referenced to $25^\circ\text{C}$		15		mV/°C
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 40\text{ V}, T_J = 25^\circ\text{C}$			10	μA
		$V_{DS} = 40\text{ V}, T_J = 125^\circ\text{C}$			100	
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	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 20\text{ A}, T_J = 25^\circ\text{C}$		2.03	2.35	mΩ
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 60\text{ }\mu\text{A}, T_J = 25^\circ\text{C}$	2.5		3.5	V
Gate Threshold Voltage Temperature Coefficient	$\Delta V_{GS(TH)} / \Delta T_J$	$V_{GS} = V_{DS}, I_D = 60\text{ }\mu\text{A}$		-7.21		mV/°C
Forward Trans-conductance	$g_{FS}$	$V_{DS} = 5\text{ V}, I_D = 20\text{ A}$		89.2		S

### CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}, V_{DS} = 20\text{ V}, f = 1\text{ MHz}$		1421		pF
Output Capacitance	$C_{OSS}$			1015		
Reverse Transfer Capacitance	$C_{RSS}$			24		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 10\text{ V}, V_{DD} = 20\text{ V}, I_D = 50\text{ A}$		22.1		nC
Threshold Gate Charge	$Q_{G(TH)}$			4.18		
Gate-to-Source Charge	$Q_{GS}$			6.68		
Gate-to-Drain Charge	$Q_{GD}$			4.07		
Gate Resistance	$R_G$	$f = 1\text{ MHz}$		0.93		Ω

### SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{d(ON)}$	Resistive Load, $V_{GS} = 0/10\text{ V}, V_{DD} = 20\text{ V},$ $I_D = 50\text{ A}, R_G = 0\text{ }\Omega$		15.8		ns
Rise Time	$t_r$			5.19		
Turn-Off Delay Time	$t_{d(OFF)}$			22.2		
Fall Time	$t_f$			4.69		

### SOURCE-TO-DRAIN DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = 20\text{ A}, T_J = 25^\circ\text{C}$		0.82		V
		$V_{GS} = 0\text{ V}, I_S = 20\text{ A}, T_J = 125^\circ\text{C}$		0.69		
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, I_S = 50\text{ A},$ $di/dt = 100\text{ A}/\mu\text{s}, V_{DD} = 20\text{ V}$		33.3		ns
Charge Time	$t_a$			14.6		
Discharge Time	$t_b$			18.7		
Reverse Recovery Charge	$Q_{RR}$			23.1		

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.

# NTMFS2D3N04XM

## TYPICAL CHARACTERISTICS

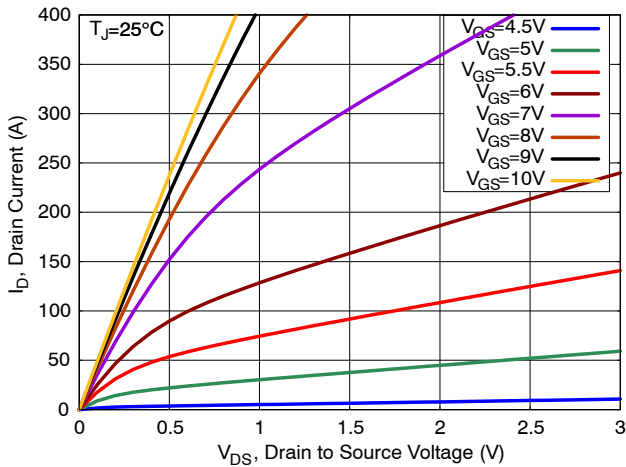


Figure 1. On-Region Characteristics

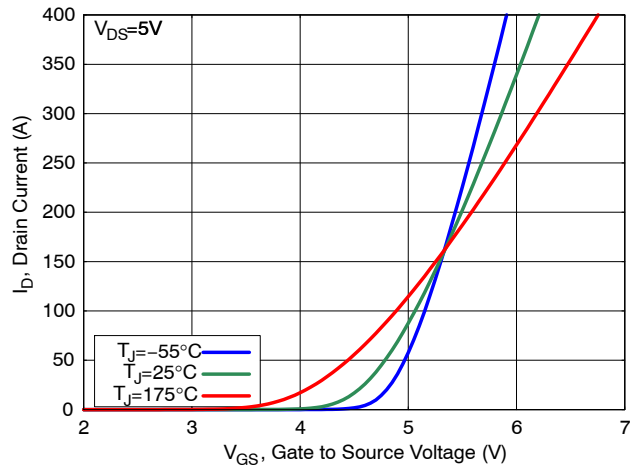


Figure 2. Transfer Characteristics

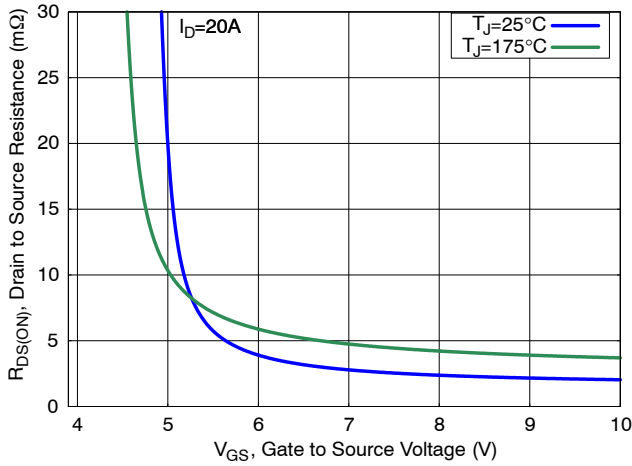


Figure 3. On-Resistance vs.  $V_{GS}$

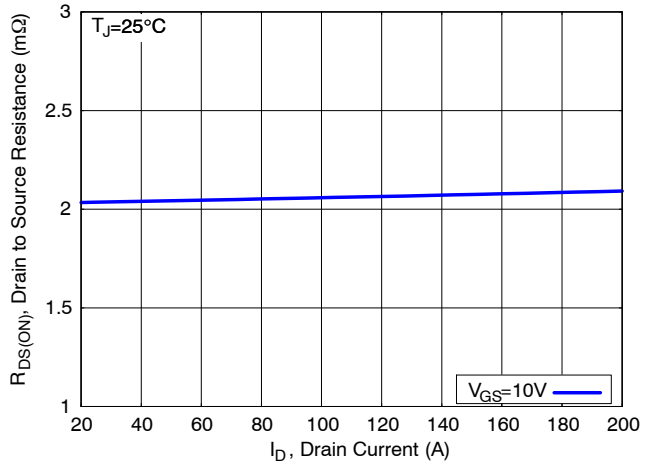


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

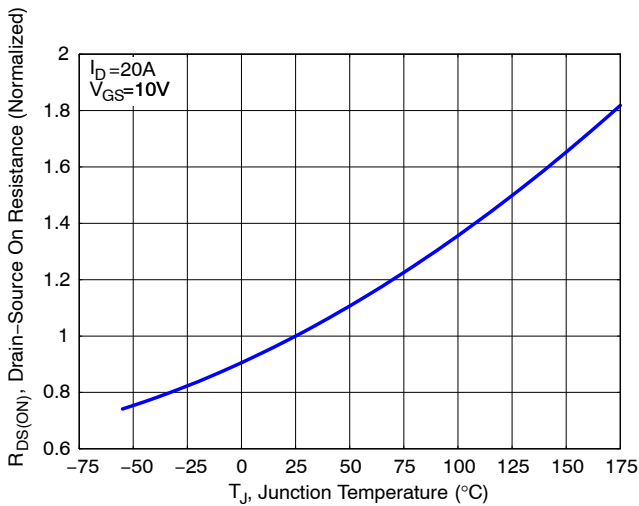


Figure 5. On-Resistance Variation with Temperature

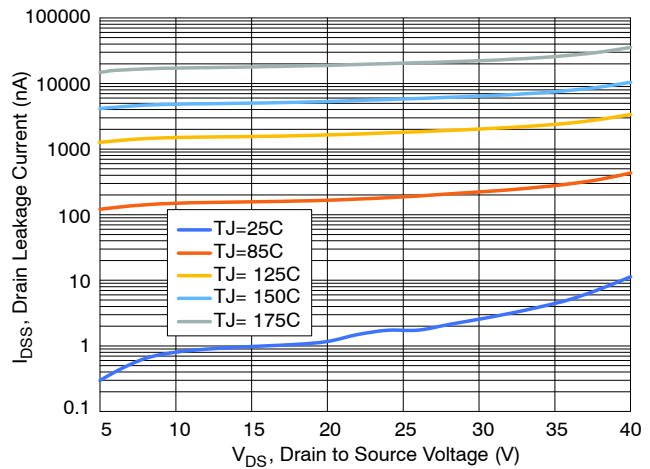


Figure 6. Drain-to-Source Leakage Current vs. Voltage

# NTMFS2D3N04XM

## TYPICAL CHARACTERISTICS

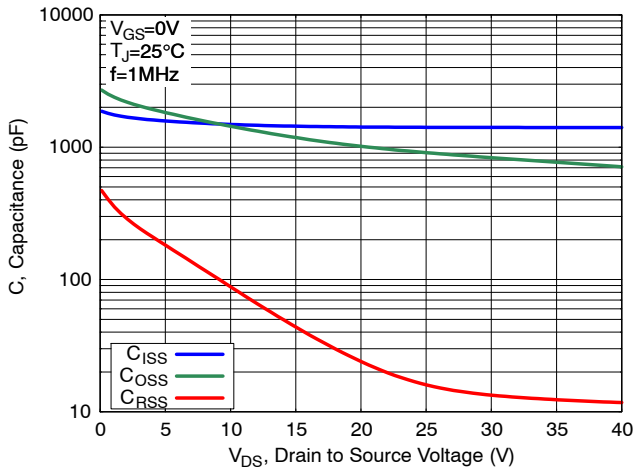


Figure 7. Capacitance Characteristics

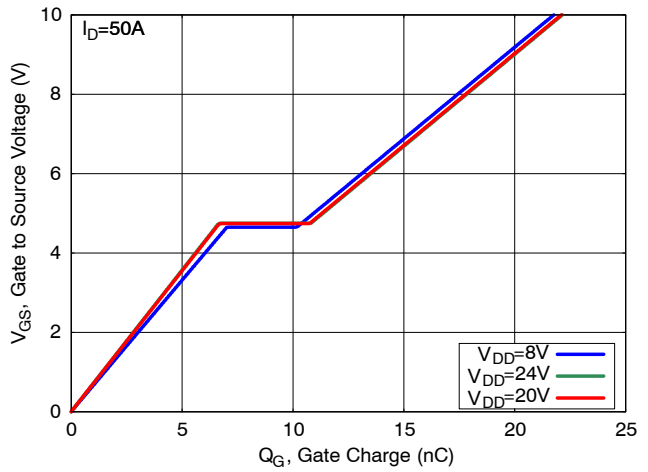


Figure 8. Gate-to-Source Voltage vs. Total Charge

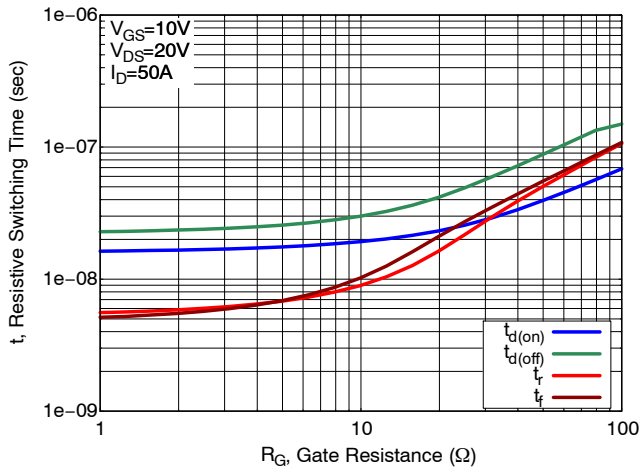


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

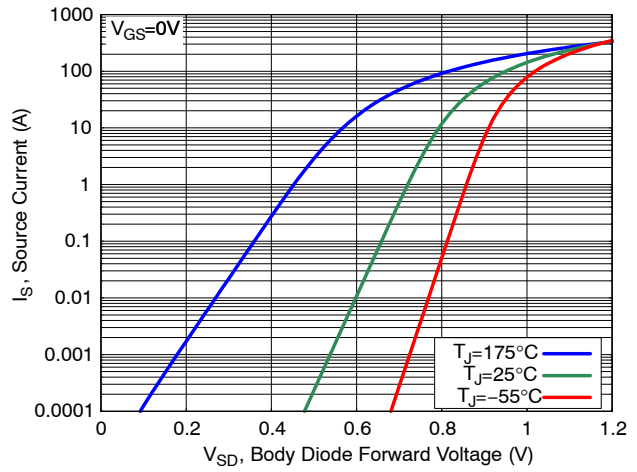


Figure 10. Diode Forward Voltage vs. Current

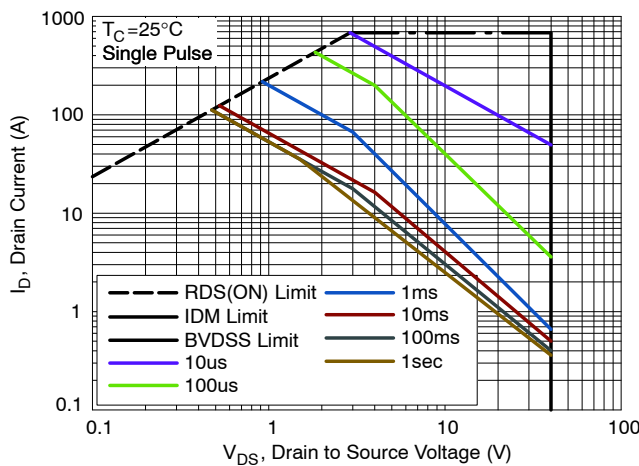


Figure 11. Safe Operating Area (SOA)

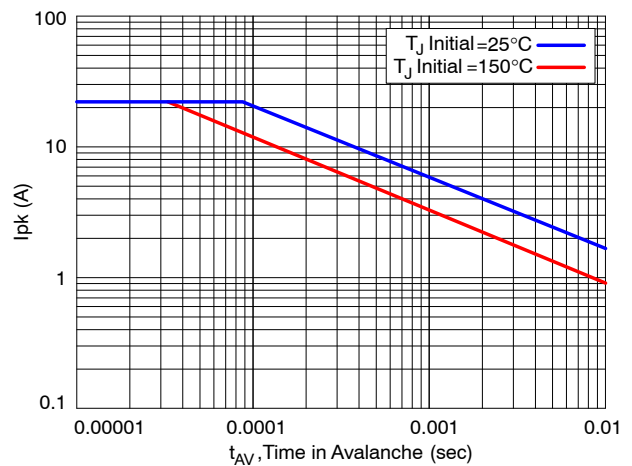


Figure 12. Avalanche Current vs Pulse Time (UIS)

# NTMFS2D3N04XM

## TYPICAL CHARACTERISTICS

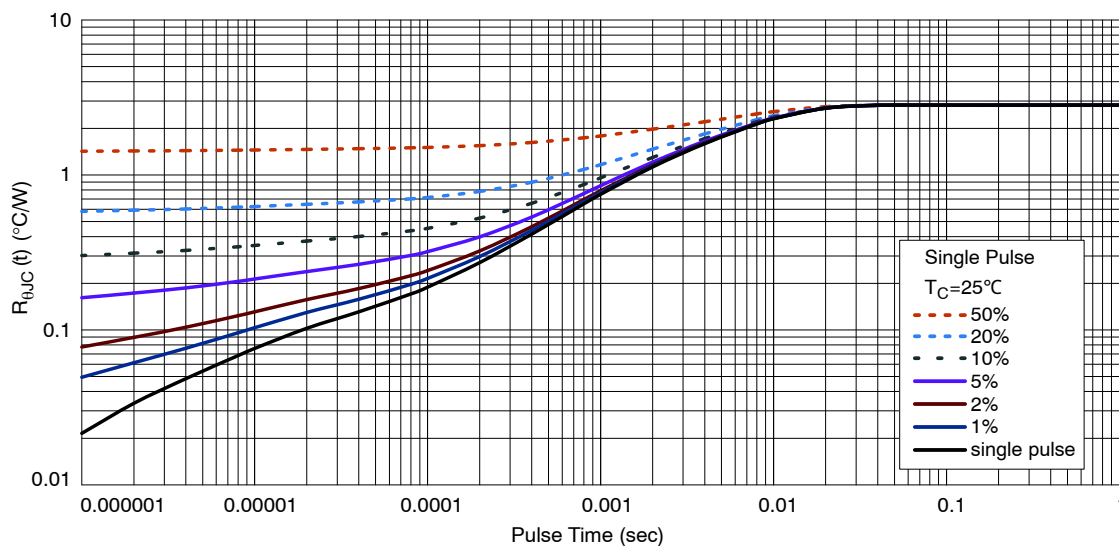


Figure 13. Transient Thermal Response

### ORDERING INFORMATION

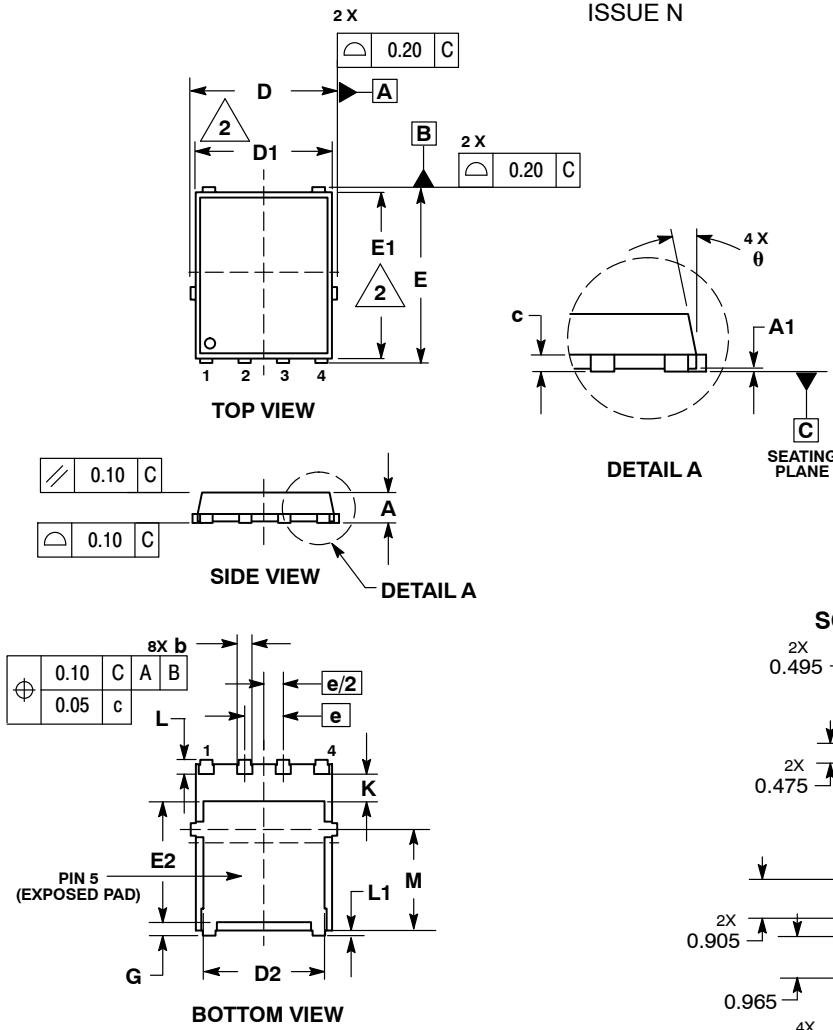
Device	Marking	Package	Shipping <sup>†</sup>
NTMFS2D3N04XMT1G	2D3N4	DFN5 (Pb-Free)	1500 / Tape & Reel

<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.

# NTMFS2D3N04XM

## PACKAGE DIMENSIONS

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

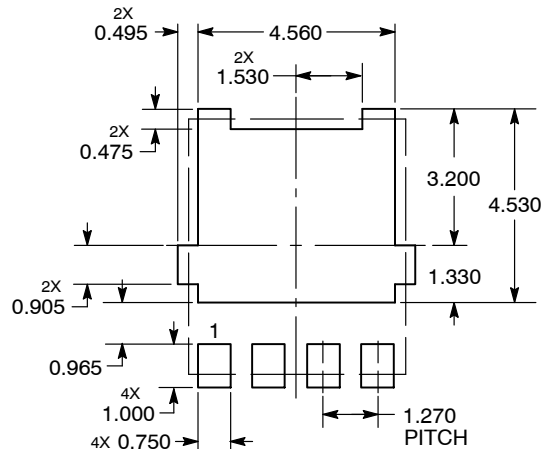


**NOTES:**

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
θ	0 °	---	12 °

### RECOMMENDED SOLDERING FOOTPRINT\*



DIMENSIONS: MILLIMETERS

- |               |               |
|---------------|---------------|
| STYLE 1:      | STYLE 2:      |
| PIN 1. SOURCE | PIN 1. ANODE  |
| 2. SOURCE     | 2. ANODE      |
| 3. SOURCE     | 3. ANODE      |
| 4. GATE       | 4. NO CONNECT |
| 5. DRAIN      | 5. CATHODE    |

\*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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