

# MOSFET - Power, Single N-Channel, STD Gate, SO-8FL

## 80 V, 4.5 mΩ, 94 A

### Product Preview

## NTMFS4D5N08X

#### Features

- Low  $Q_{RR}$ , Soft Recovery Body Diode
- Low  $R_{DS(on)}$  to Minimize Conduction Losses
- Low  $Q_G$  and Capacitance to Minimize Driver Losses
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

#### Typical Applications

- Synchronous Rectification (SR) in DC-DC and AC-DC
- Primary Switch in Isolated DC-DC Converter
- Motor Drives

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

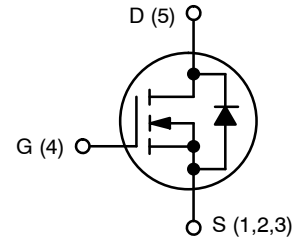
Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	$V_{DSS}$	80	V
Gate-to-Source Voltage	$V_{GS}$	$\pm 20$	V
Continuous Drain Current (Note 1)	$I_D$	$T_C = 25^\circ\text{C}$	94
		$T_C = 100^\circ\text{C}$	67
Power Dissipation (Note 1)	$T_C = 25^\circ\text{C}$	$P_D$	82
Pulsed Drain Current	$I_{DM}$	$T_C = 25^\circ\text{C}$ , $t_p = 100 \mu\text{s}$	360
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to +175	$^\circ\text{C}$
Source Current (Body Diode)	$I_S$	139	A
Single Pulse Avalanche Energy ( $I_{PK} = 35 \text{ A}$ ) (Note 3)	$E_{AS}$	61	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.

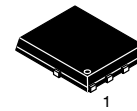
1. Surface-mounted on FR4 board using 1 in<sup>2</sup> pad size, 1 oz. Cu pad.
2. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
3.  $E_{AS}$  of 61 mJ is based on started  $T_J = 25 \text{ C}$ ,  $I_{AS} = 35 \text{ A}$ ,  $V_{DD} = 64 \text{ V}$ ,  $V_{GS} = 10 \text{ V}$ , 100% avalanche tested.

This document contains information on a product under development. onsemi reserves the right to change or discontinue this product without notice.

$V_{(BR)DSS}$	$R_{DS(ON) MAX}$	$I_D MAX$
80 V	4.5 mΩ @ 10 V	94 A

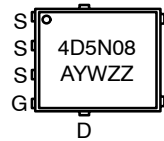


N-CHANNEL MOSFET



DFN5 (SO-8FL)  
CASE 488AA

#### MARKING DIAGRAM



4D5N08 = 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 3 of this data sheet.

# NTMFS4D5N08X

## THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	1.8	$^{\circ}C/W$
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	39	

- Surface-mounted on FR4 board using 1 in<sup>2</sup> pad, 1 oz. Cu.
- $R_{\theta JA}$  is determined by the user's board design.

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

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

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0 V, I_D = 1 mA$	80			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$\Delta V_{(BR)DSS} / \Delta T_J$	$I_D = 1 mA$ , Referenced to $25^{\circ}C$		32		$mV/^{\circ}C$
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 80 V, T_J = 25^{\circ}C$			1.0	$\mu A$
		$V_{DS} = 80 V, T_J = 125^{\circ}C$			250	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 20 V, V_{GS} = 0 V$			100	nA

### ON CHARACTERISTICS

Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10 V, I_D = 19 A$		4.0	4.5	$m\Omega$
		$V_{GS} = 6 V, I_D = 10 A$		6.1	9.1	
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 96 \mu A$	2.4		3.6	V
Gate Threshold Voltage Temperature Coefficient	$\Delta V_{GS(TH)} / \Delta T_J$	$V_{GS} = V_{DS}, I_D = 96 \mu A$		-7		$mV/^{\circ}C$
Forward Transconductance	$g_{FS}$	$V_{DS} = 5 V, I_D = 19 A$		61		S

### CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	$C_{ISS}$	$V_{GS} = 0 V, V_{DS} = 40 V, f = 1 MHz$		1714		pF
Output Capacitance	$C_{OSS}$			493		
Reverse Transfer Capacitance	$C_{RSS}$			7.5		
Output Charge	$Q_{OSS}$			35		nC
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 6 V, V_{DD} = 40 V, I_D = 19 A$		15		nC
Threshold Gate Charge	$Q_{G(TH)}$	$V_{GS} = 10 V, V_{DD} = 40 V, I_D = 19 A$		24		
Gate-to-Source Charge	$Q_{GS}$			5.3		
Gate-to-Drain Charge	$Q_{GD}$			8.1		
Gate Plateau Voltage	$V_{GP}$			3.8		
Gate Resistance	$R_G$	$f = 1 MHz$		1.5		$\Omega$

### SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{d(ON)}$	Resistive Load, $V_{GS} = 0/10 V, V_{DD} = 40 V,$ $I_D = 19 A, R_G = 2.5 \Omega$		11		ns
Rise Time	$t_r$			24		
Turn-Off Delay Time	$t_{d(OFF)}$			16		
Fall Time	$t_f$			30		

### SOURCE-TO-DRAIN DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0 V, I_S = 19 A, T_J = 25^{\circ}C$		0.82	1.2	V
		$V_{GS} = 0 V, I_S = 19 A, T_J = 125^{\circ}C$		0.66		

# NTMFS4D5N08X

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>SOURCE-TO-DRAIN DIODE CHARACTERISTICS</b>						
Reverse Recovery Time	t <sub>RR</sub>	V <sub>GS</sub> = 0 V, di/dt = 1000 A/μs, I <sub>S</sub> = 19 A, V <sub>DD</sub> = 40 V		19		ns
Charge Time	t <sub>a</sub>			10		
Discharge Time	t <sub>b</sub>			8.5		
Reverse Recovery Charge	Q <sub>RR</sub>			101		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.

## DEVICE ORDERING INFORMATION

Device	Marking	Package	Shipping†
NTMFS4D5N08XT1G	4D5N08	DFN5 (Pb-Free)	1500 / 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.

# NTMFS4D5N08X

## TYPICAL CHARACTERISTICS

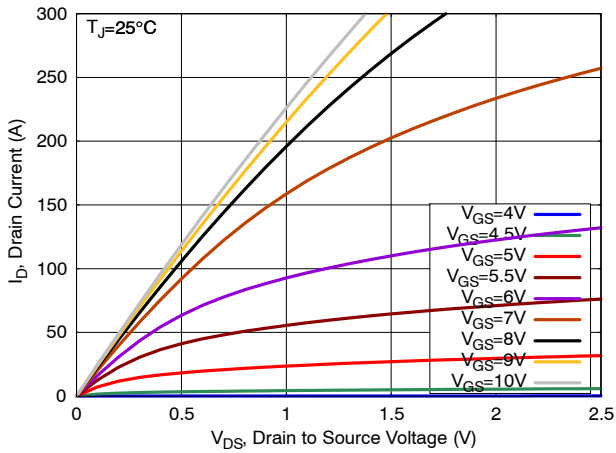


Figure 1. On-Region Characteristics

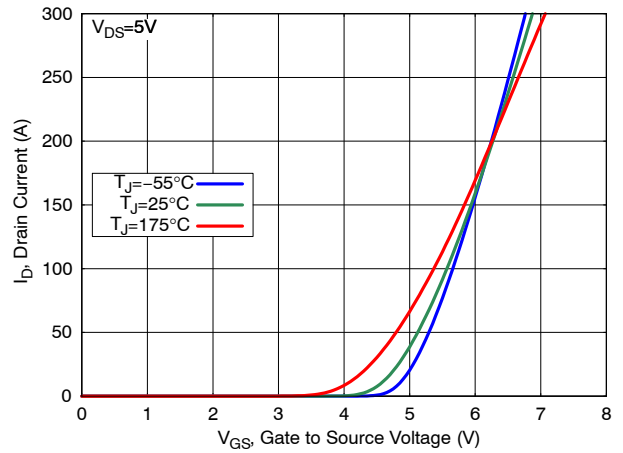


Figure 2. Transfer Characteristics

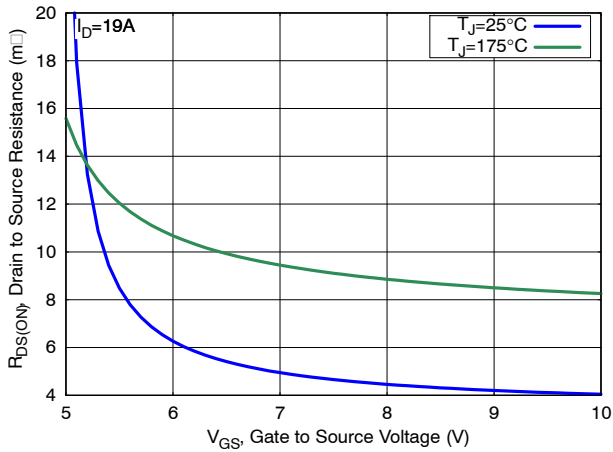


Figure 3. On-Resistance vs. Gate Voltage

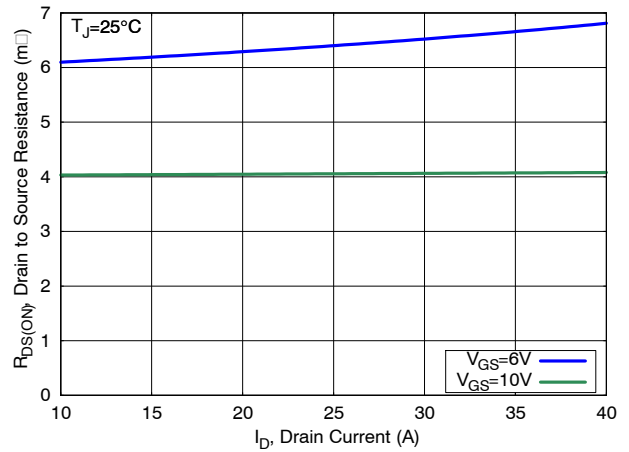


Figure 4. On-Resistance vs. Drain Current

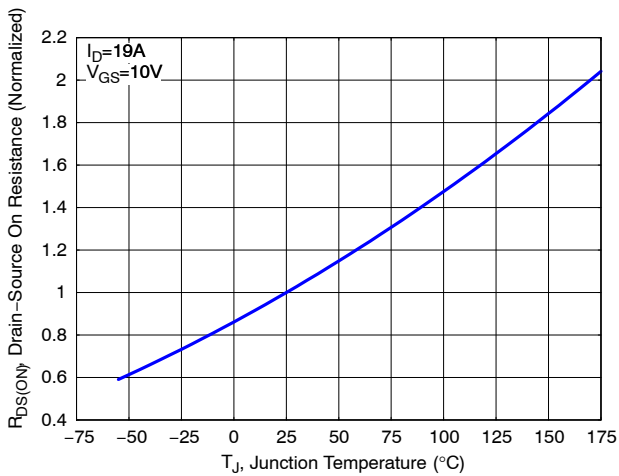


Figure 5. Normalized ON Resistance vs. Junction Temperature

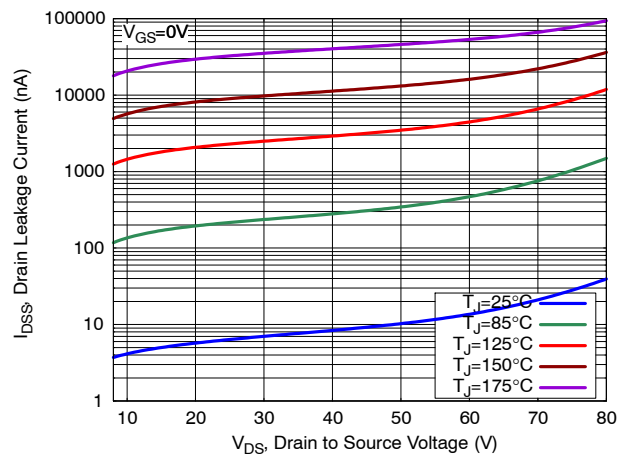


Figure 6. Drain Leakage Current vs. Drain Voltage

# NTMFS4D5N08X

## TYPICAL CHARACTERISTICS

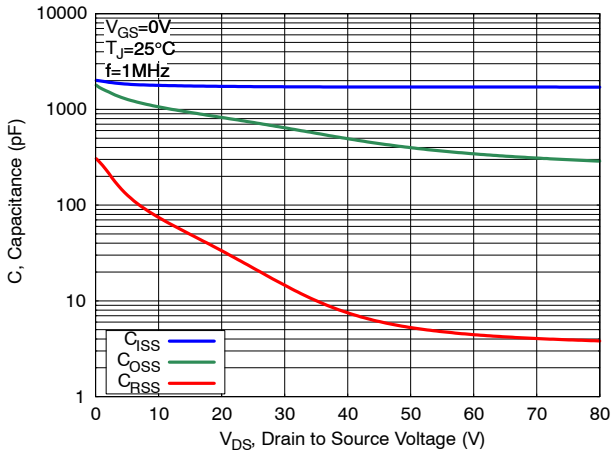


Figure 7. Capacitance Characteristics

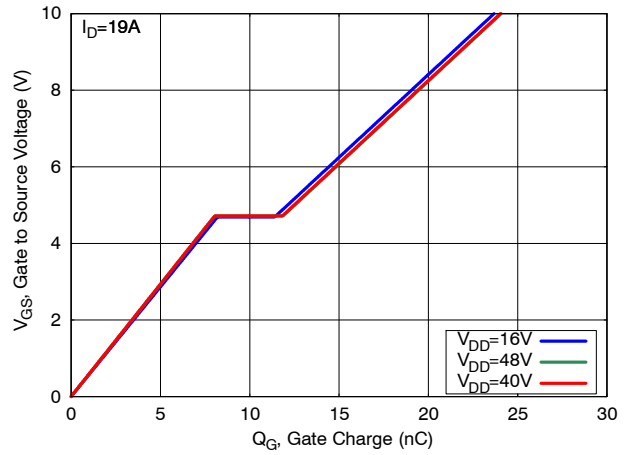


Figure 8. Gate Charge Characteristics

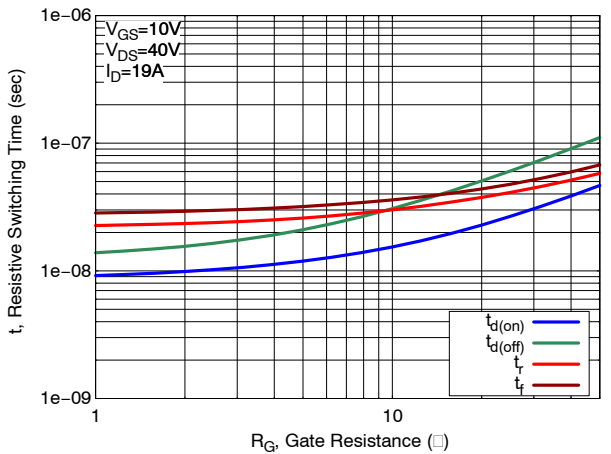


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

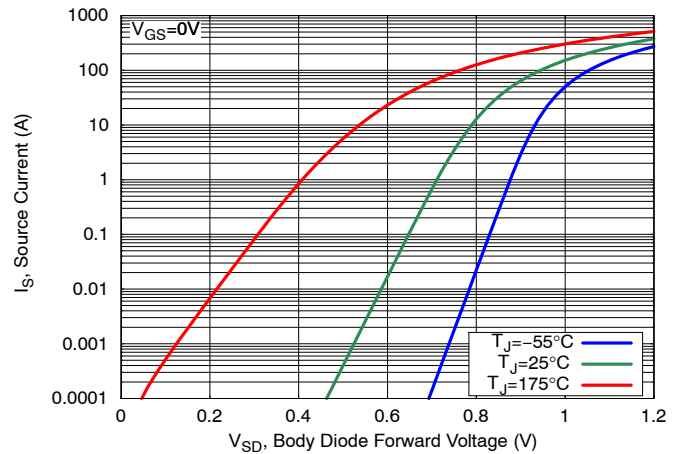


Figure 10. Diode Forward Characteristics

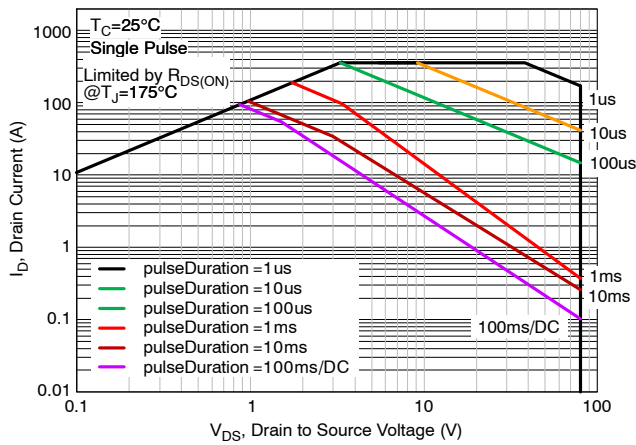


Figure 11. Safe Operating Area (SOA)

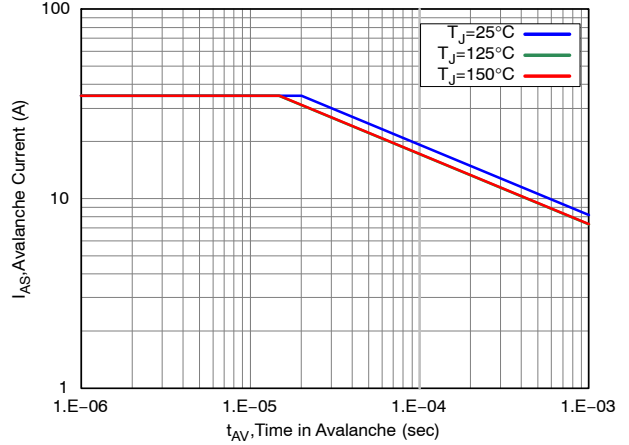


Figure 12. Avalanche Current vs Pulse Time (UIS)

# NTMFS4D5N08X

## TYPICAL CHARACTERISTICS

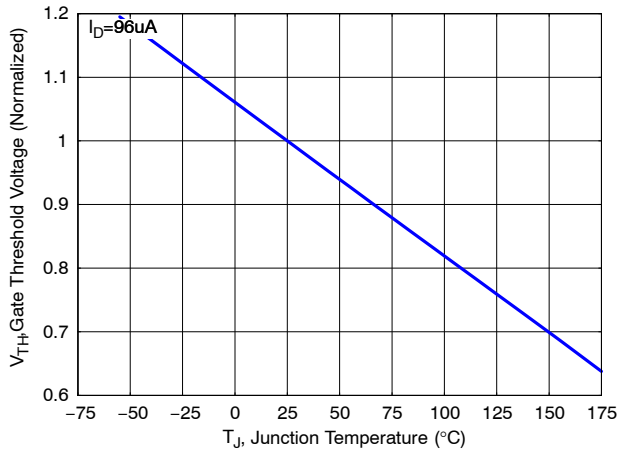


Figure 13. Gate Threshold Voltage vs Junction Temperature

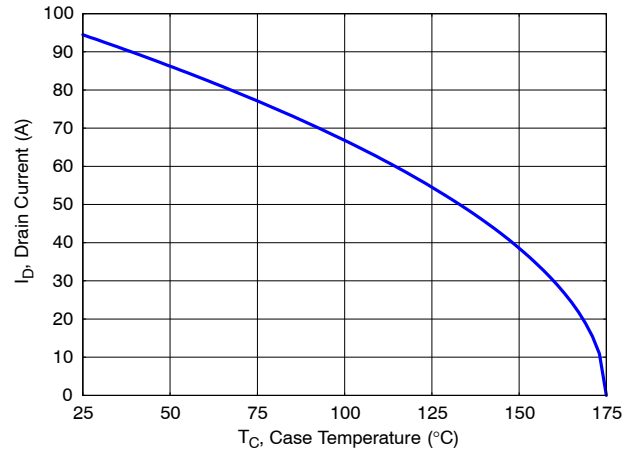


Figure 14. Maximum Current vs. Case Temperature

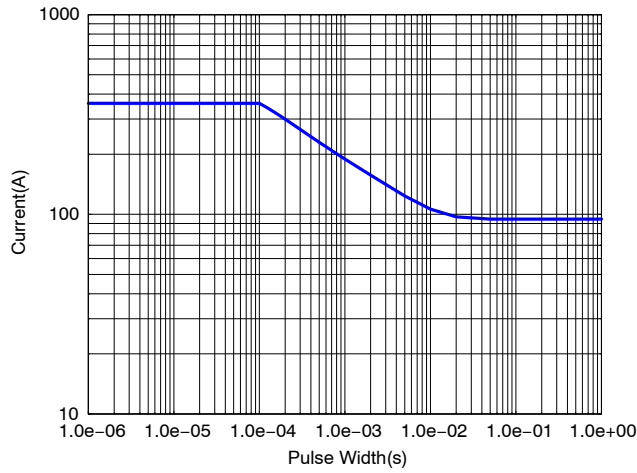


Figure 15. IDM vs. Pulse Width

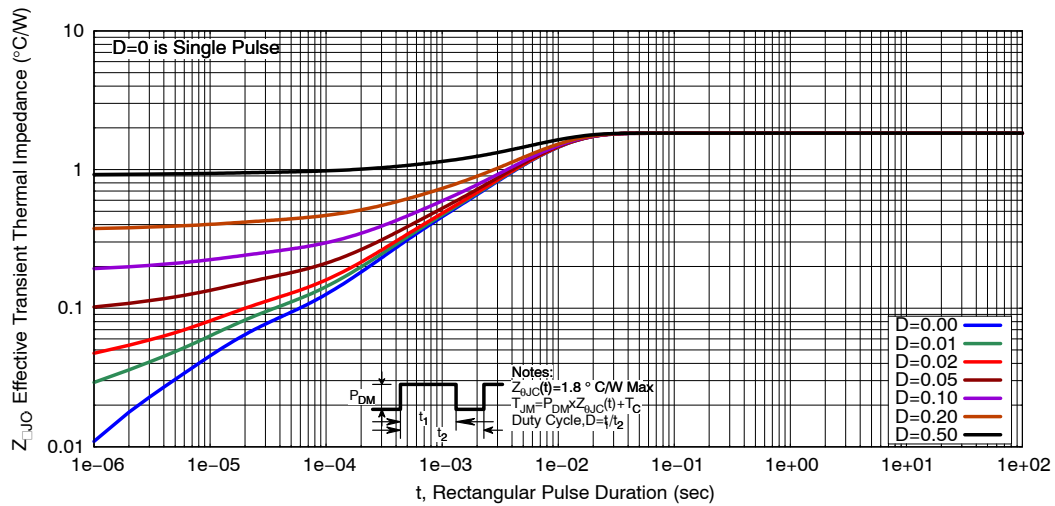


Figure 16. Transient Thermal Response

# NTMFS4D5N08X

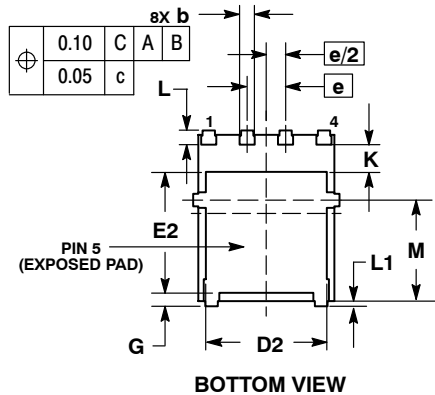
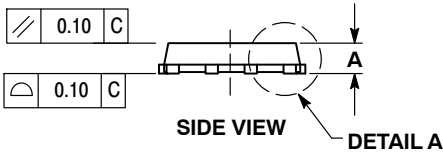
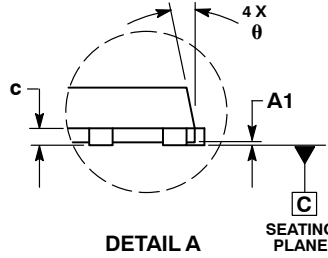
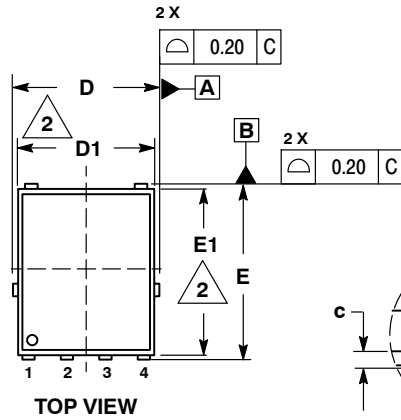
## PACKAGE DIMENSIONS

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

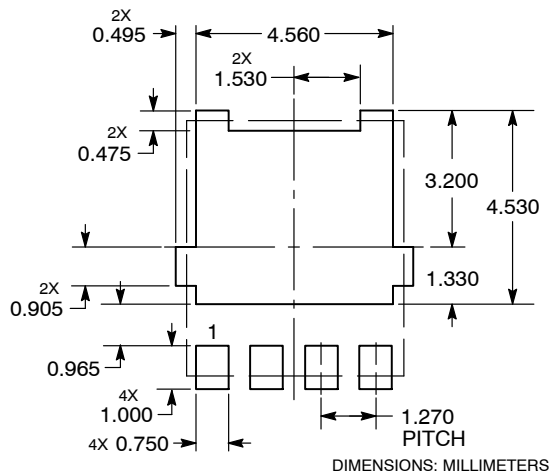
NOTES:

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\*



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

\*For additional information on our Pb-Free strategy and soldering details, please download the **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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