

# MOSFET - Power, Single N-Channel, STD Gate, SO8FL

80 V, 3 mΩ, 135 A

**NTMFS3D5N08X**

## Features

- Low Q<sub>RR</sub>, Soft Recovery Body Diode
- Low R<sub>DSON</sub> to Minimize Conduction Losses
- Low Q<sub>G</sub> 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

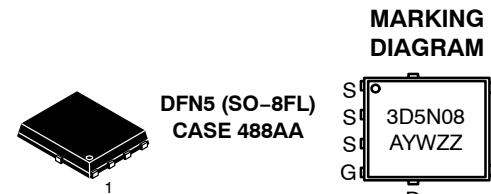
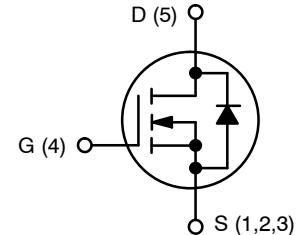
## MAXIMUM RATINGS (T<sub>J</sub> = 25°C unless otherwise stated)

Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	V <sub>DSS</sub>	80	V
Gate-to-Source Voltage	V <sub>GS</sub>	±20	V
Continuous Drain Current (Note 1)	T <sub>C</sub> = 25°C	I <sub>D</sub>	A
	T <sub>C</sub> = 100°C		
Power Dissipation (Note 1)	T <sub>C</sub> = 25°C	P <sub>D</sub>	W
Pulsed Drain Current	T <sub>C</sub> = 25°C, t <sub>p</sub> = 100 µs	I <sub>DM</sub>	A
Pulsed Source Current (Body Diode)		I <sub>SM</sub>	
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55 to +175	°C
Source Current (Body Diode)	I <sub>S</sub>	179	A
Single Pulse Avalanche Energy (I <sub>PK</sub> = 47 A) (Note 3)	E <sub>AS</sub>	110	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)	T <sub>L</sub>	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.

1. The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
2. Actual continuous current will be limited by thermal & electromechanical application board design.
3. E<sub>AS</sub> of 110 mJ is based on started T<sub>J</sub> = 25°C, I<sub>AS</sub> = 47 A, V<sub>DD</sub> = 64 V, V<sub>GS</sub> = 10 V, 100% avalanche tested

V <sub>(BR)DSS</sub>	R <sub>DSON</sub> MAX	I <sub>D</sub> MAX
80 V	3 mΩ @ 10 V	135 A



3D5N08 = 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.

# NTMFS3D5N08X

## THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta,JC}$	1.26	$^{\circ}\text{C}/\text{W}$
Thermal Resistance, Junction-to-Ambient (Notes 4 and 5)	$R_{\theta,JA}$	39	

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

## 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	$V_{(\text{BR})\text{DSS}}$	$V_{\text{GS}} = 0 \text{ V}, I_D = 1 \text{ mA}$	80			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$\Delta V_{(\text{BR})\text{DSS}}/\Delta T_J$	$I_D = 1 \text{ mA}$ . Referenced to $25^{\circ}\text{C}$		31.6		$\text{mV}/^{\circ}\text{C}$
Zero Gate Voltage Drain Current	$I_{\text{DSS}}$	$V_{\text{DS}} = 80 \text{ V}, T_J = 25^{\circ}\text{C}$		1		$\mu\text{A}$
		$V_{\text{DS}} = 80 \text{ V}, T_J = 125^{\circ}\text{C}$		250		
Gate-to-Source Leakage Current	$I_{\text{GSS}}$	$V_{\text{DS}} = 0 \text{ V}, V_{\text{GS}} = 20 \text{ V}$		100		nA

### ON CHARACTERISTICS

Drain-to-Source On Resistance	$R_{\text{DS}(\text{on})}$	$V_{\text{GS}} = 10 \text{ V}, I_D = 31 \text{ A}$		2.6	3	$\text{m}\Omega$
		$V_{\text{GS}} = 6 \text{ V}, I_D = 15 \text{ A}$		4.0	5.8	
Gate Threshold Voltage	$V_{\text{GS}(\text{TH})}$	$V_{\text{GS}} = V_{\text{DS}}, I_D = 153 \mu\text{A}$	2.4		3.6	V
Gate Threshold Voltage Temperature Coefficient	$\Delta V_{\text{GS}(\text{TH})}/\Delta T_J$	$V_{\text{GS}} = V_{\text{DS}}, I_D = 153 \mu\text{A}$		-7.5		$\text{mV}/^{\circ}\text{C}$
Forward Transconductance	$g_{\text{FS}}$	$V_{\text{DS}} = 5 \text{ V}, I_D = 31 \text{ A}$		97		S

### CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	$C_{\text{iss}}$	$V_{\text{GS}} = 0 \text{ V}, V_{\text{DS}} = 40 \text{ V}, f = 1 \text{ MHz}$		2680		$\text{pF}$
Output Capacitance	$C_{\text{oss}}$			780		
Reverse Transfer Capacitance	$C_{\text{rss}}$			12		
Output Charge	$Q_{\text{oss}}$			56		$\text{nC}$
Total Gate Charge	$Q_{\text{G}(\text{TOT})}$	$V_{\text{GS}} = 6 \text{ V}, V_{\text{DD}} = 40 \text{ V}; I_D = 31 \text{ A}$		23		
				38		
				8		
		$V_{\text{GS}} = 10 \text{ V}, V_{\text{DD}} = 40 \text{ V}; I_D = 31 \text{ A}$		13		
				6		
				4.7		
				0.7		
Gate Resistance	$R_{\text{G}}$	$f = 1 \text{ MHz}$				$\Omega$

### SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{\text{d}(\text{ON})}$	Resistive Load, $V_{\text{GS}} = 0/10 \text{ V}, V_{\text{DD}} = 40 \text{ V},$ $I_D = 31 \text{ A}, R_{\text{G}} = 2.5 \Omega$		23		$\text{ns}$
Rise Time	$t_r$			7		
Turn-Off Delay Time	$t_{\text{d}(\text{OFF})}$			32		
Fall Time	$t_f$			5		

### SOURCE-TO-DRAIN DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{\text{SD}}$	$V_{\text{GS}} = 0 \text{ V}, I_S = 31 \text{ A}, T_J = 25^{\circ}\text{C}$		0.82	1.2	$\text{V}$
		$V_{\text{GS}} = 0 \text{ V}, I_S = 31 \text{ A}, T_J = 125^{\circ}\text{C}$		0.66		

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>SOURCE-TO-DRAIN DIODE CHARACTERISTICS</b>						
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0 \text{ V}$ , $dI/dt = 1000 \text{ A}/\mu\text{s}$ , $I_S = 31 \text{ A}$ , $V_{DD} = 40 \text{ V}$		22		ns
Charge Time	$t_a$			12		
Discharge Time	$t_b$			10		
Reverse Recovery Charge	$Q_{RR}$			144		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 <sup>†</sup>
NTMFS3D5N08XT1G	3D5N08	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.

## TYPICAL CHARACTERISTICS

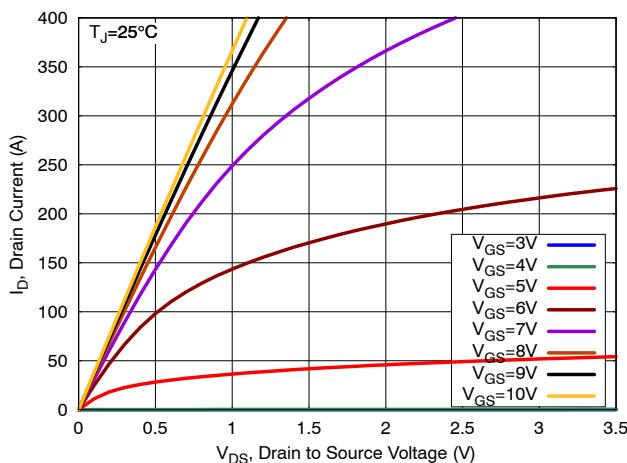


Figure 1. On-Region Characteristics

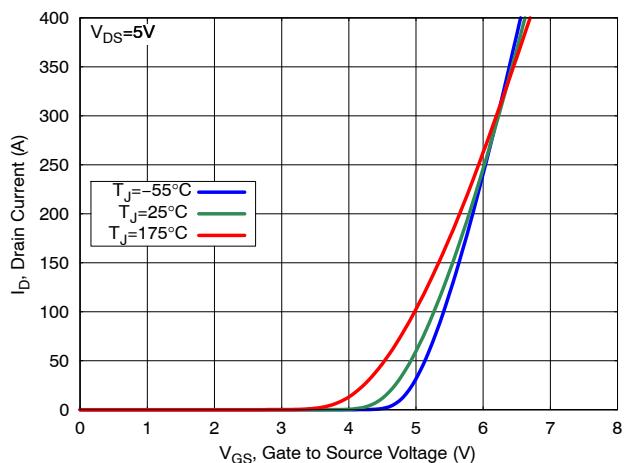


Figure 2. Transfer Characteristics

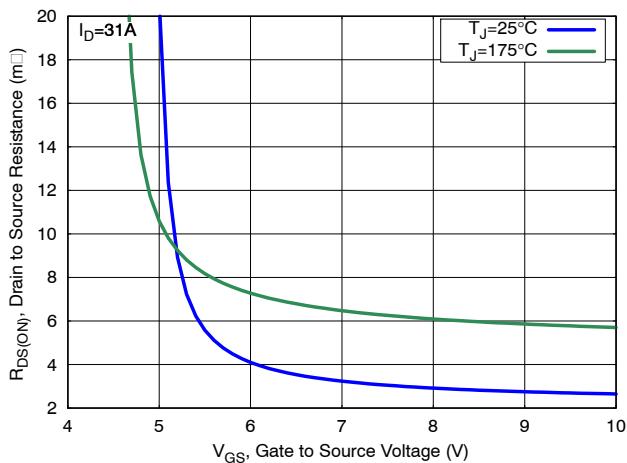


Figure 3. On-Resistance vs. Gate Voltage

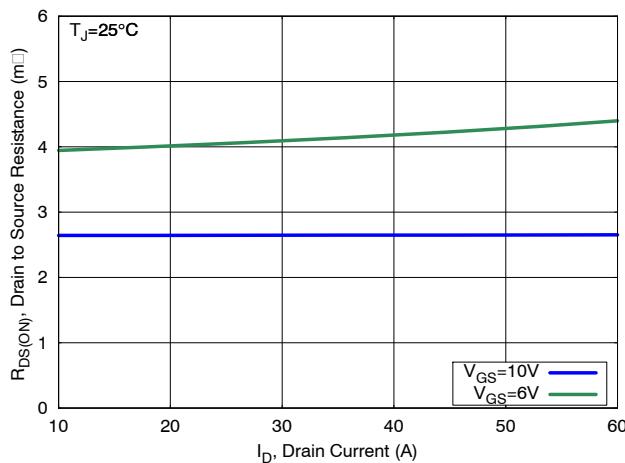


Figure 4. On-Resistance vs. Drain Current

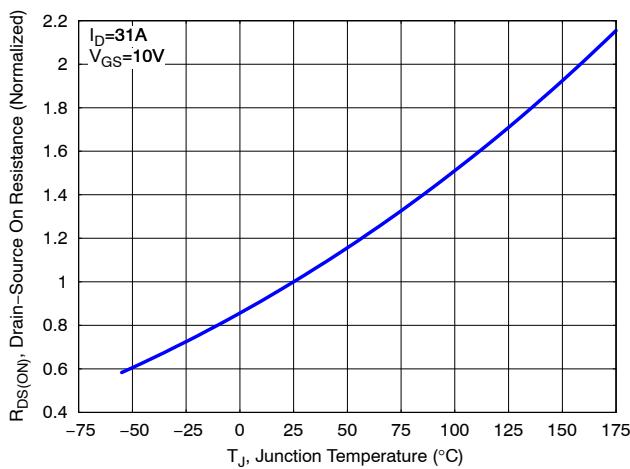


Figure 5. Normalized ON Resistance vs. Junction Temperature

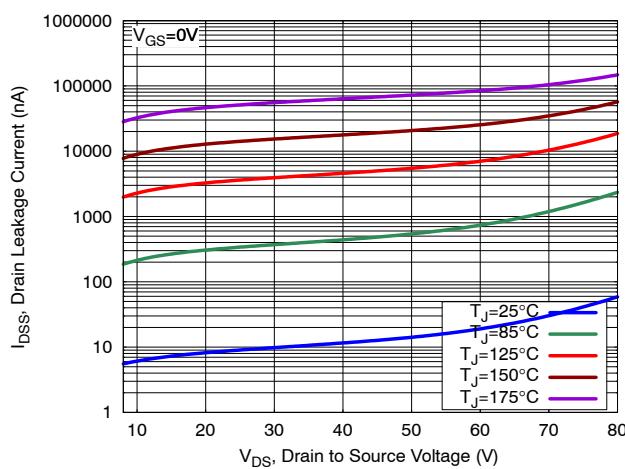


Figure 6. Drain Leakage Current vs. Drain Voltage

## TYPICAL CHARACTERISTICS

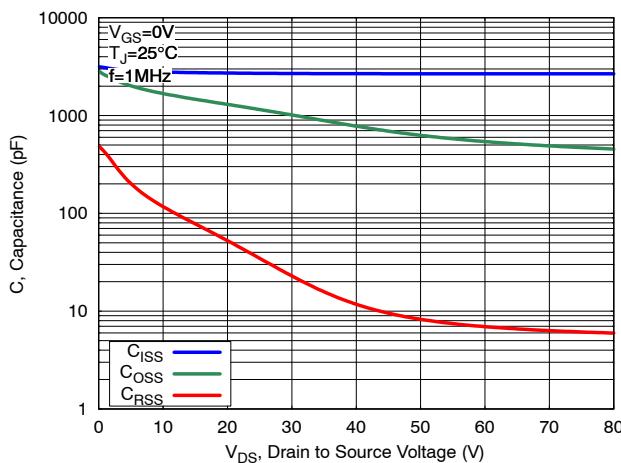


Figure 7. Capacitance Characteristics

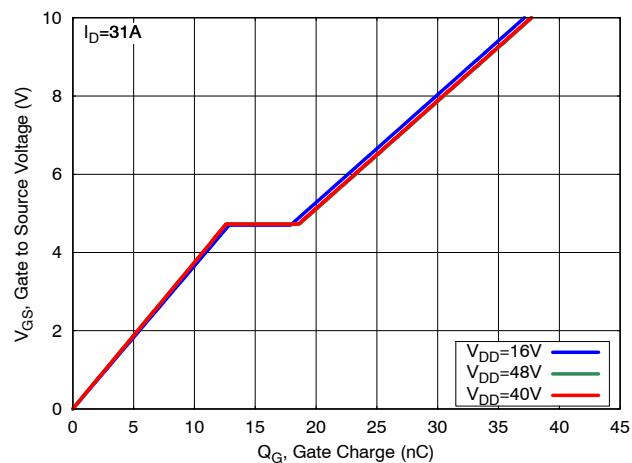


Figure 8. Gate Charge Characteristics

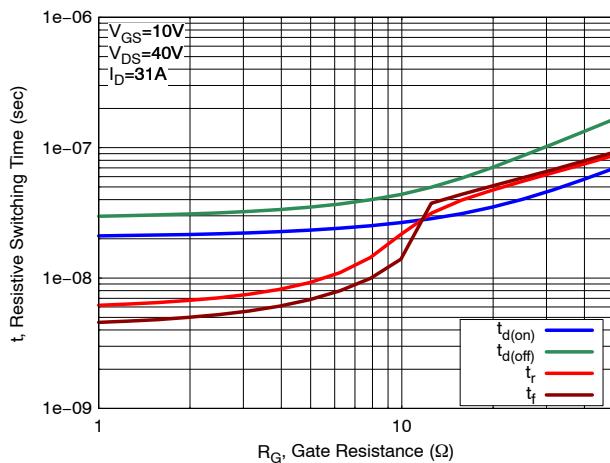


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

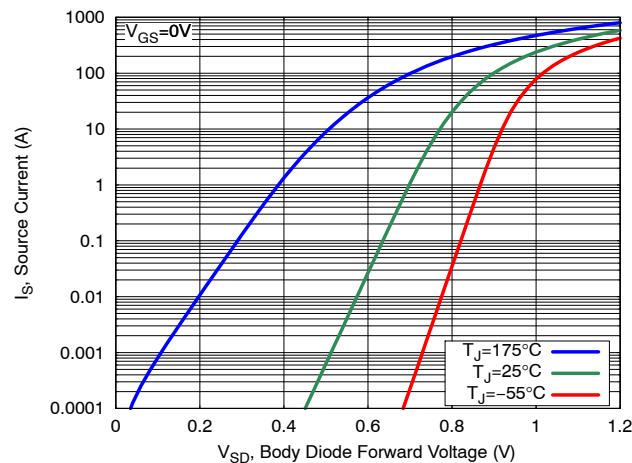


Figure 10. Diode Forward Characteristics

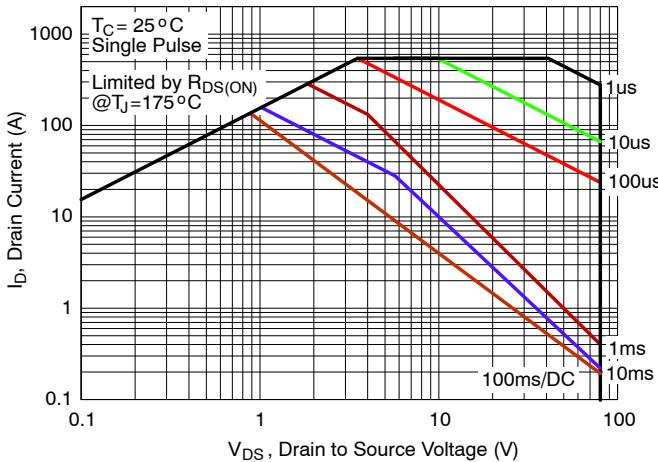


Figure 11. Safe Operating Area (SOA)

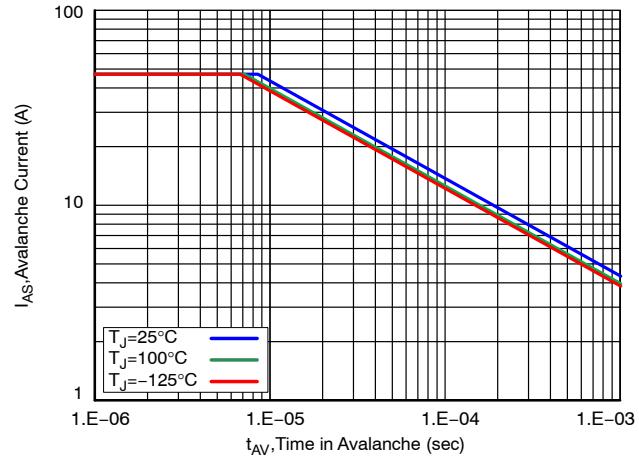
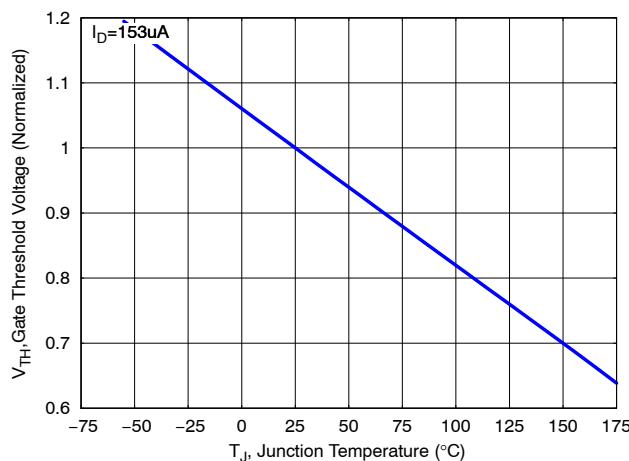
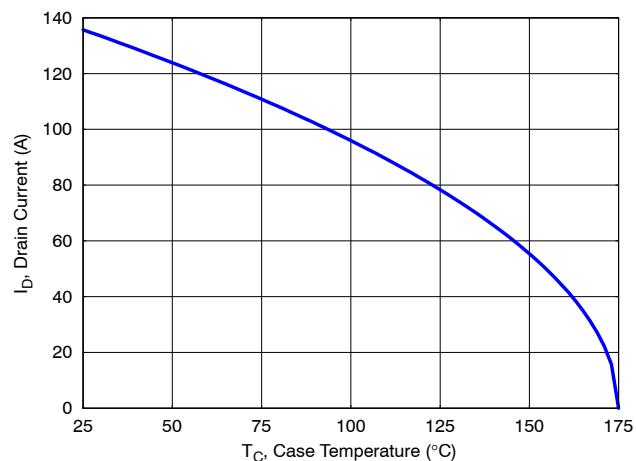


Figure 12. Avalanche Current vs Pulse Time (UIS)

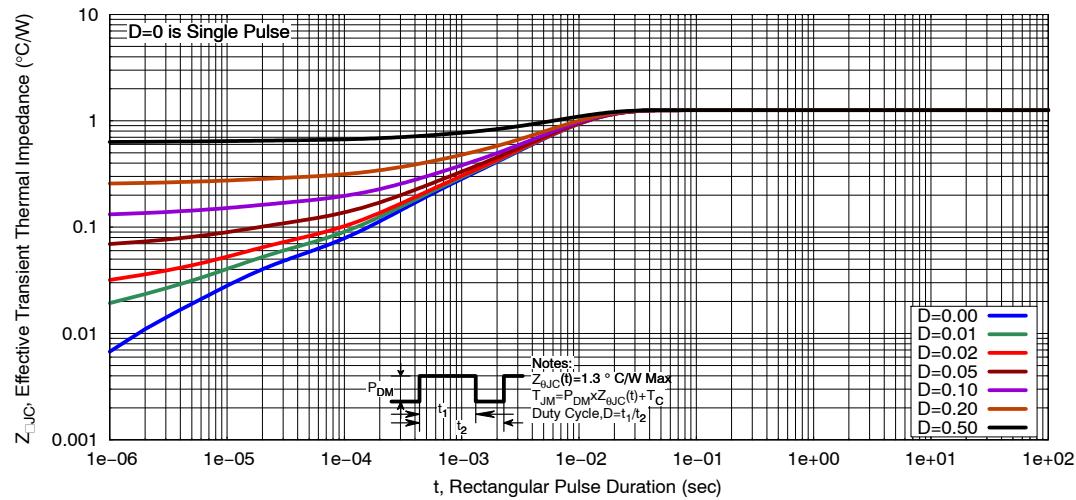
## TYPICAL CHARACTERISTICS



**Figure 13. Gate Threshold Voltage vs Junction Temperature**



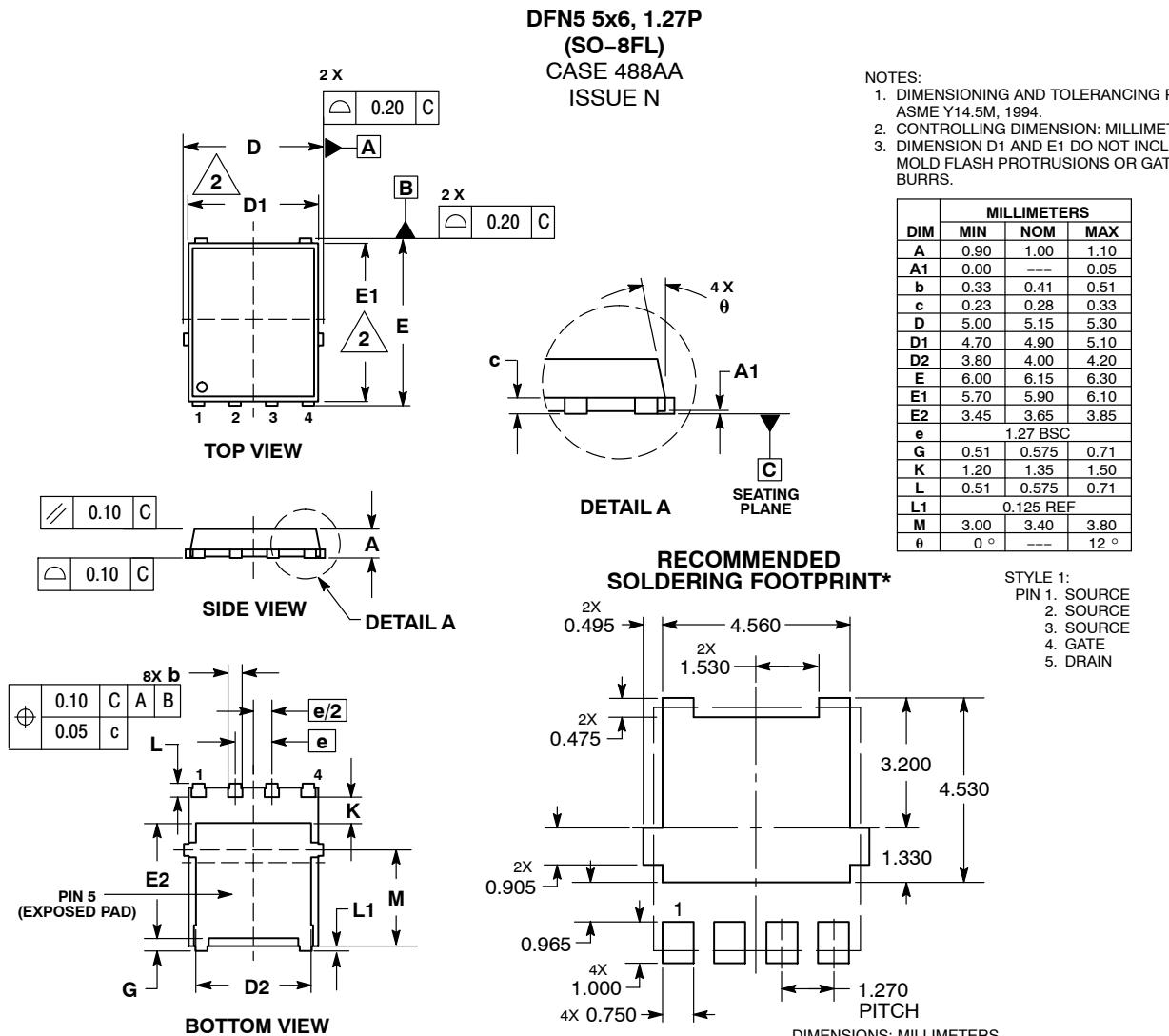
**Figure 14. Maximum Current vs. Case Temperature**



**Figure 15. Transient Thermal Response**

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## PACKAGE DIMENSIONS



\*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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