

## MOSFET – Power, Dual, N-Channel

**40 V, 2.65 mΩ, 145 A**

## NTMFD5C446NL

### Features

- Small Footprint (5x6 mm) for Compact Design
- 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

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

Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	$V_{DSS}$	40	V
Gate-to-Source Voltage	$V_{GS}$	$\pm 20$	V
Continuous Drain Current $R_{\theta JC}$ (Notes 1, 2, 3)	$T_C = 25^\circ\text{C}$	$I_D$	A
		145	
Power Dissipation $R_{\theta JC}$ (Notes 1, 2)	$T_C = 100^\circ\text{C}$		
		105	
Power Dissipation $R_{\theta JA}$ (Notes 1, 2)	$T_A = 25^\circ\text{C}$	$P_D$	W
		125	
Continuous Drain Current $R_{\theta JA}$ (Notes 1, 2, 3)	$T_A = 100^\circ\text{C}$		
		62	
Power Dissipation $R_{\theta JA}$ (Notes 1 & 2)	$T_A = 25^\circ\text{C}$	$I_D$	A
		25	
	$T_A = 100^\circ\text{C}$		
		18	
Pulsed Drain Current	$T_A = 25^\circ\text{C}$ , $t_p = 10\ \mu\text{s}$	$P_D$	W
		3.5	
Operating Junction and Storage Temperature	$T_A = 100^\circ\text{C}$		
		1.8	
Pulsed Drain Current	$I_{DM}$	644	A
Operating Junction and Storage Temperature	$T_J, T_{stg}$	-55 to +175	°C
Source Current (Body Diode)	$I_S$	91	A
Single Pulse Drain-to-Source Avalanche Energy ( $I_{L(pk)} = 11\ \text{A}$ )	$E_{AS}$	171	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)	$T_L$	260	°C

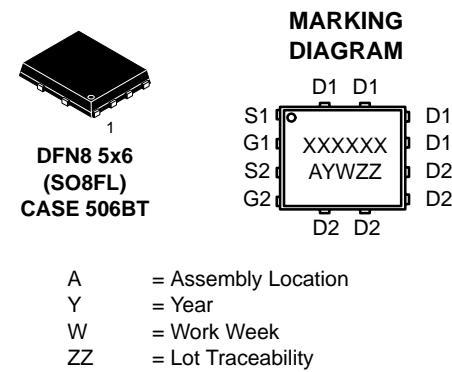
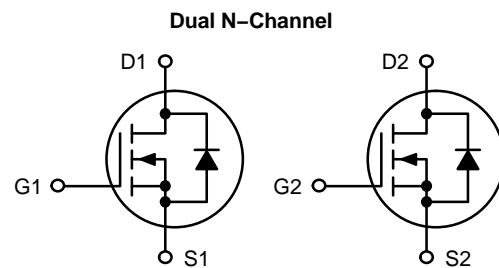
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

### THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction-to-Case – Steady State	$R_{\theta JC}$	1.38	°C/W
Junction-to-Ambient – Steady State (Note 2)	$R_{\theta JA}$	46.9	

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. Surface-mounted on FR4 board using a 650 mm<sup>2</sup>, 2 oz. Cu pad.
3. Maximum current for pulses as long as 1 second is higher but is dependent on pulse duration and duty cycle.

$V_{(BR)DSS}$	$R_{DS(ON)}\text{ MAX}$	$I_D\text{ MAX}$
40 V	2.65 mΩ @ 10 V	145 A
	3.9 mΩ @ 4.5 V	



### ORDERING INFORMATION

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

# NTMFD5C446NL

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

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

Drain-to-Source Breakdown Voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA		40			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	V <sub>(BR)DSS</sub> /T <sub>J</sub>				23		mV/°C
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 40 V	T <sub>J</sub> = 25 °C		10		μA
			T <sub>J</sub> = 125°C			100	
Gate-to-Source Leakage Current	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = 20 V				100	nA

### ON CHARACTERISTICS (Note 4)

Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 90 μA		1.2		2.2	V
Negative Threshold Temperature Coefficient	V <sub>GS(TH)/T<sub>J</sub></sub>				-5.2		mV/°C
Drain-to-Source On Resistance	R <sub>DSS(on)</sub>	V <sub>GS</sub> = 10 V	I <sub>D</sub> = 20 A		2.2	2.65	mΩ
		V <sub>GS</sub> = 4.5 V	I <sub>D</sub> = 20 A		3.0	3.9	
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 50 A			138		S

### CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	C <sub>ISS</sub>	V <sub>GS</sub> = 0 V, f = 1 MHz, V <sub>DS</sub> = 25 V		3170		pF
Output Capacitance	C <sub>OSS</sub>			1270		
Reverse Transfer Capacitance	C <sub>rss</sub>			48		
Total Gate Charge	Q <sub>G(TOT)</sub>	V <sub>GS</sub> = 4.5 V, V <sub>DS</sub> = 32 V; I <sub>D</sub> = 50 A	V <sub>GS</sub> = 4.5 V, V <sub>DS</sub> = 32 V; I <sub>D</sub> = 50 A	25		nC
Total Gate Charge	Q <sub>G(TOT)</sub>		V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 32 V; I <sub>D</sub> = 50 A	54		
Threshold Gate Charge	Q <sub>G(TH)</sub>			5.7		
Gate-to-Source Charge	Q <sub>GS</sub>			10.7		
Gate-to-Drain Charge	Q <sub>GD</sub>			7.0		
Plateau Voltage	V <sub>GP</sub>			5.7		V

### SWITCHING CHARACTERISTICS (Note 5)

Turn-On Delay Time	t <sub>d(ON)</sub>	V <sub>GS</sub> = 4.5 V, V <sub>DS</sub> = 32 V, I <sub>D</sub> = 5 A, R <sub>G</sub> = 1.0 Ω		14.8		ns
Rise Time	t <sub>r</sub>			16.8		
Turn-Off Delay Time	t <sub>d(OFF)</sub>			34.9		
Fall Time	t <sub>f</sub>			15.2		

### DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V <sub>SD</sub>	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 20 A	T <sub>J</sub> = 25°C		0.8		V
			T <sub>J</sub> = 125°C		0.7		
Reverse Recovery Time	t <sub>RR</sub>	V <sub>GS</sub> = 0 V, dI <sub>S</sub> /dt = 50 A/μs, I <sub>S</sub> = 5 A			54		ns
Charge Time	t <sub>a</sub>				24		
Discharge Time	t <sub>b</sub>				30		
Reverse Recovery Charge	Q <sub>RR</sub>				55		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.

4. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.

5. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

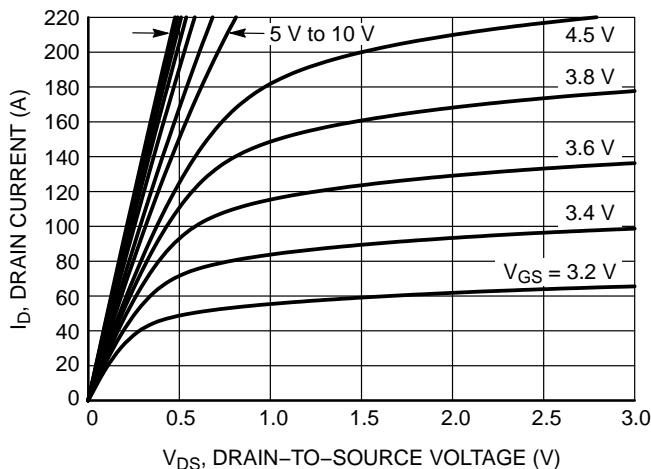


Figure 1. On-Region Characteristics

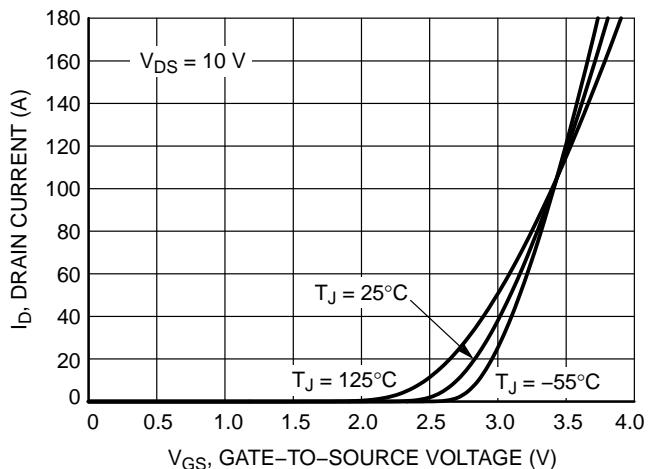


Figure 2. Transfer Characteristics

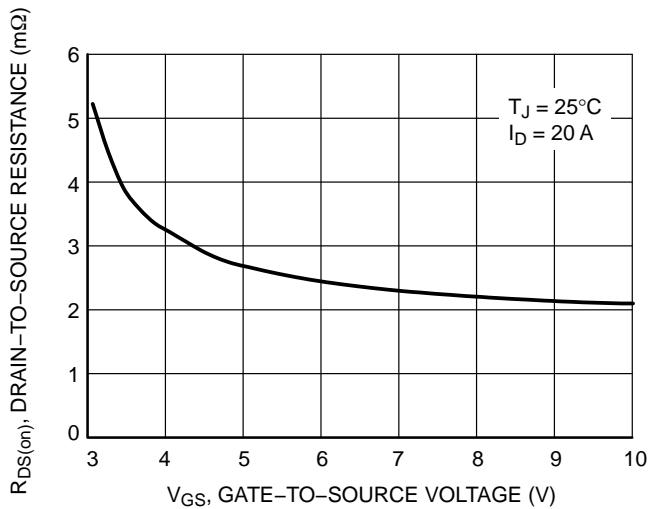


Figure 3. On-Resistance vs. Gate-to-Source Voltage

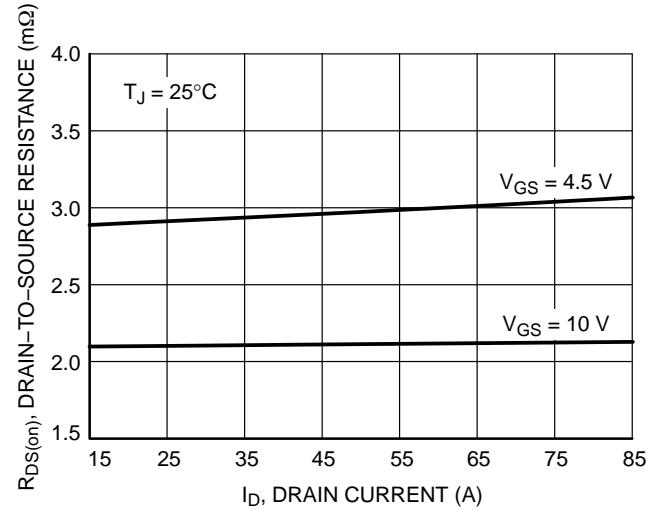


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

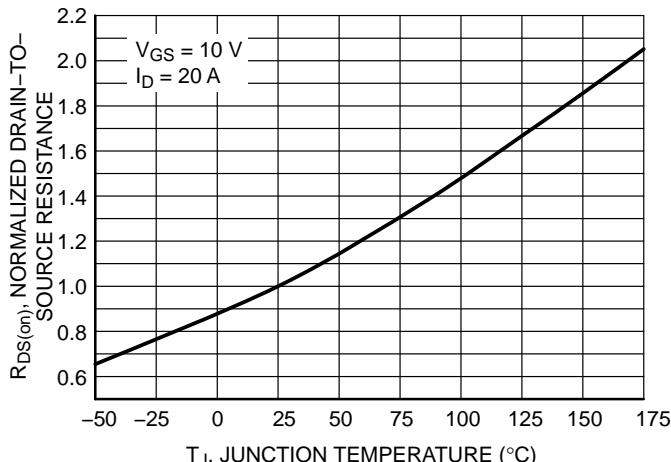


Figure 5. On-Resistance Variation with Temperature

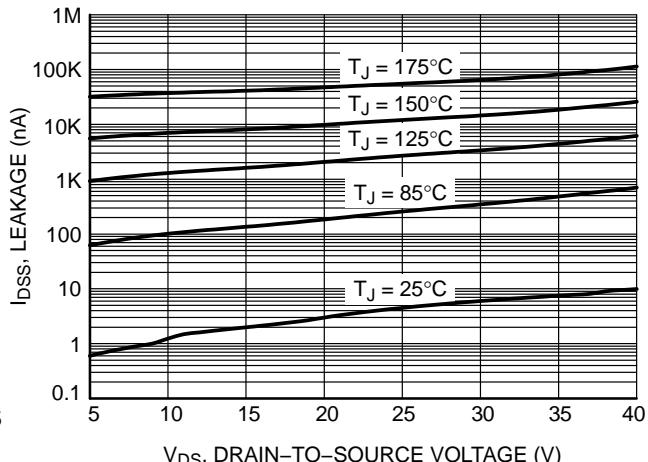
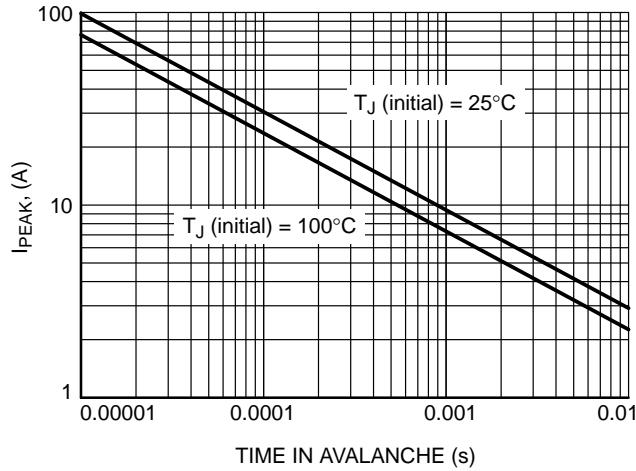
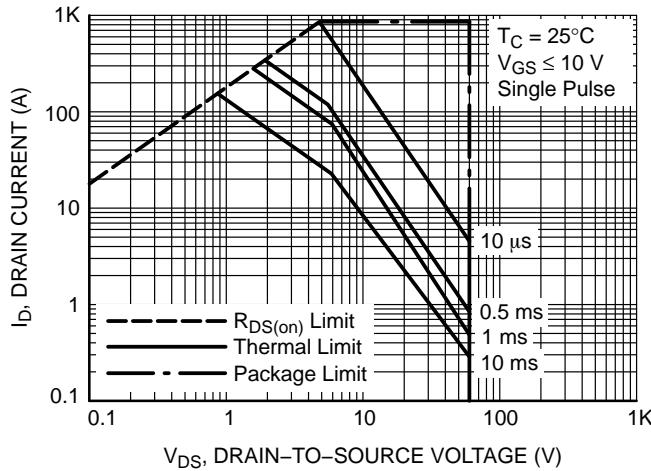
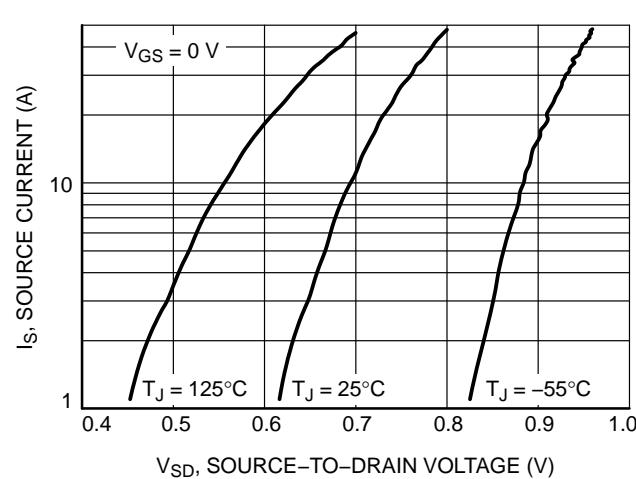
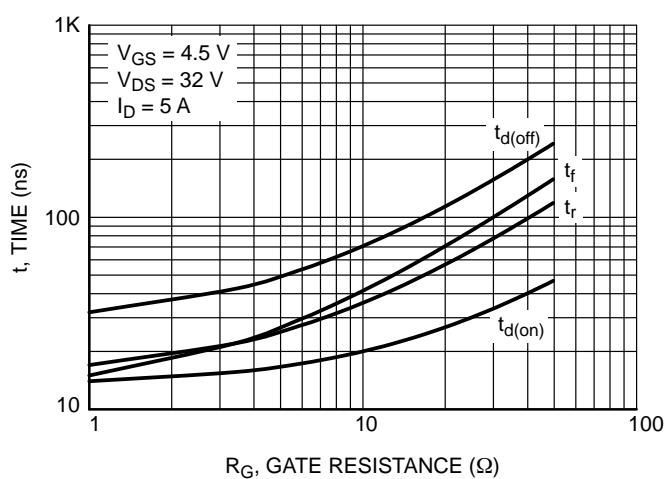
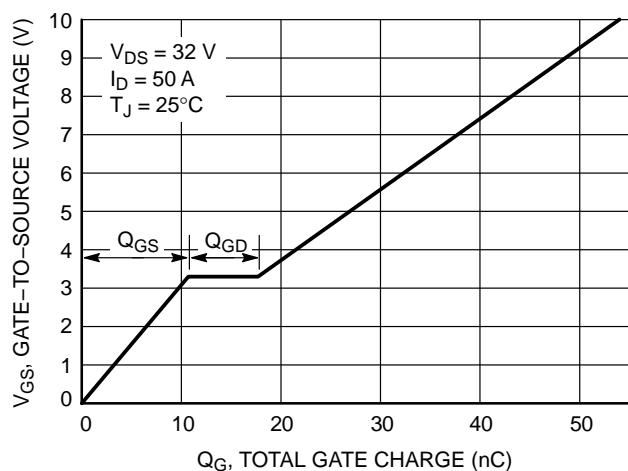
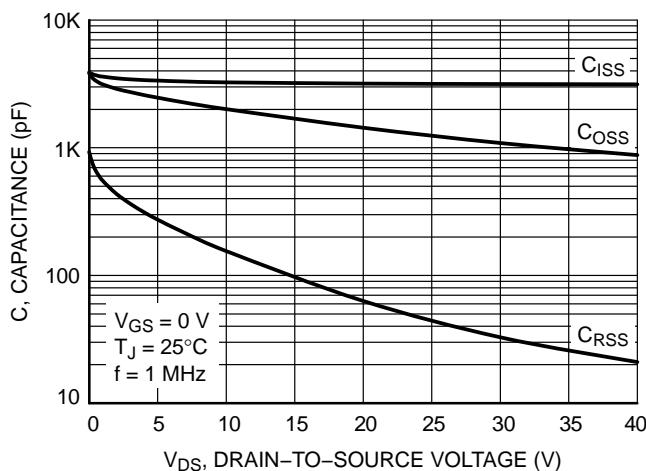


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS



## TYPICAL CHARACTERISTICS

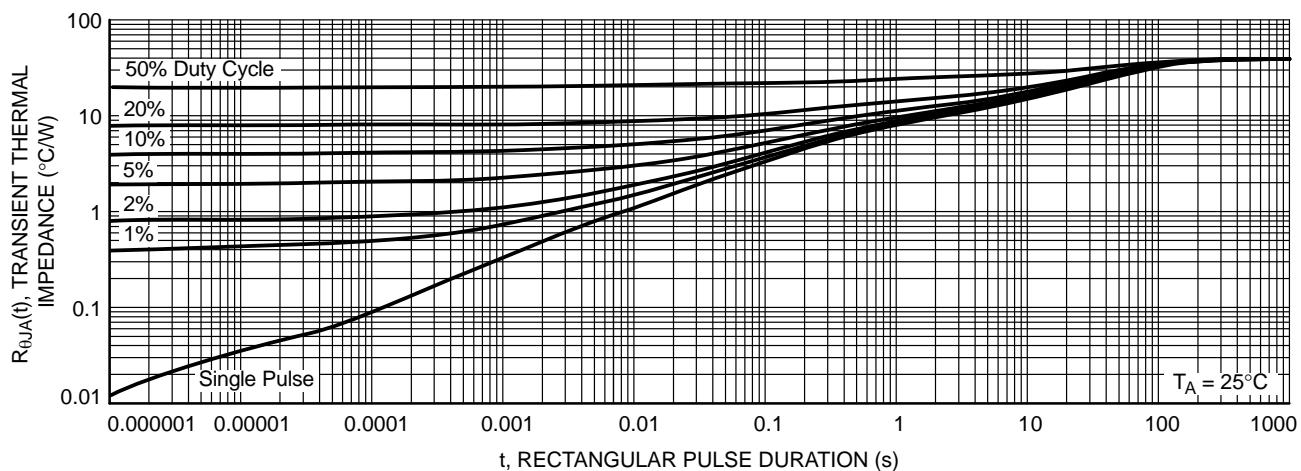


Figure 13. Thermal Response

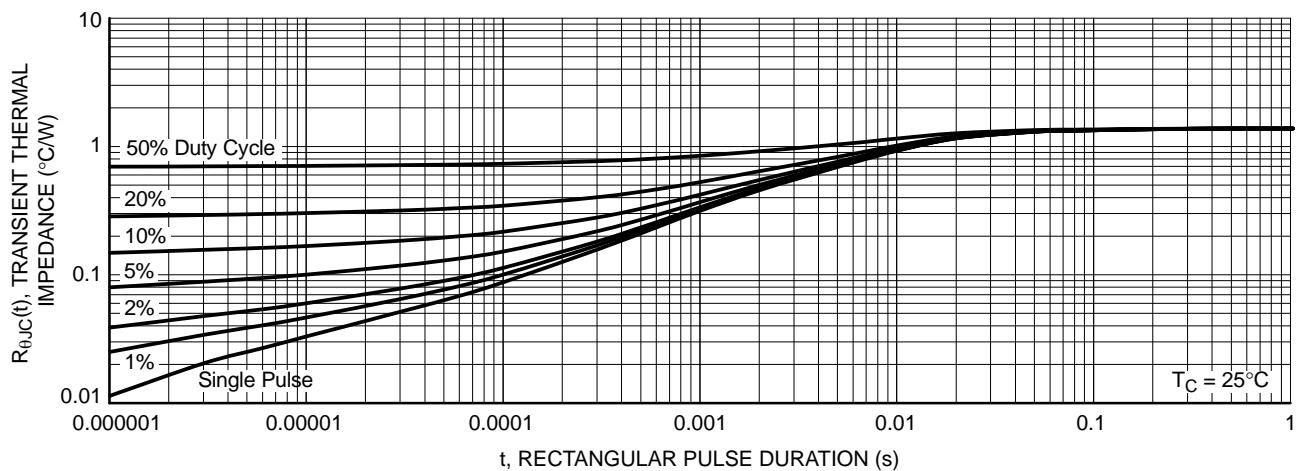


Figure 14. Thermal Response

## DEVICE ORDERING INFORMATION

Device	Marking	Package	Shipping <sup>†</sup>
NTMFD5C446NLT1G	5C446L	DFN8 (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.



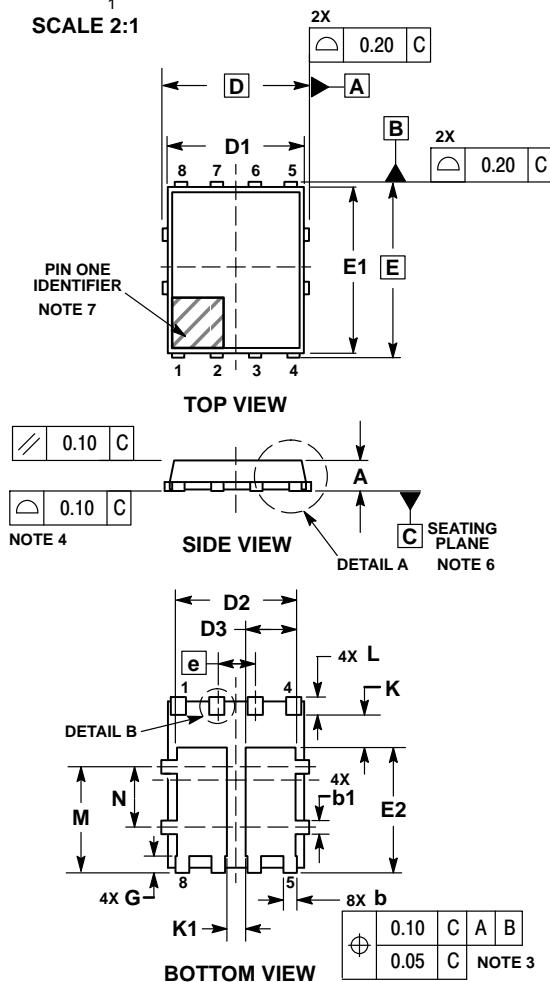
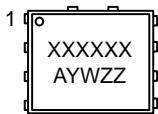
SCALE 2:1

## DFN8 5x6, 1.27P Dual Flag (SO8FL-Dual)

CASE 506BT

ISSUE F

DATE 23 NOV 2021

GENERIC  
MARKING DIAGRAM\*

XXXXXX = Specific Device Code

A = Assembly Location

Y = Year

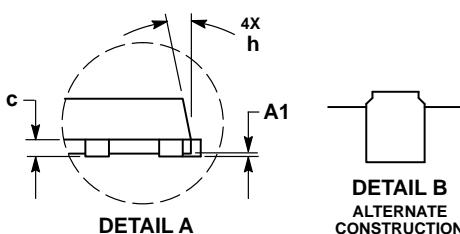
W = Work Week

ZZ = Lot Traceability

\*This information is generic. Please refer to device data sheet for actual part marking.  
Pb-Free indicator, "G" or microdot "■", may or may not be present. Some products may not follow the Generic Marking.

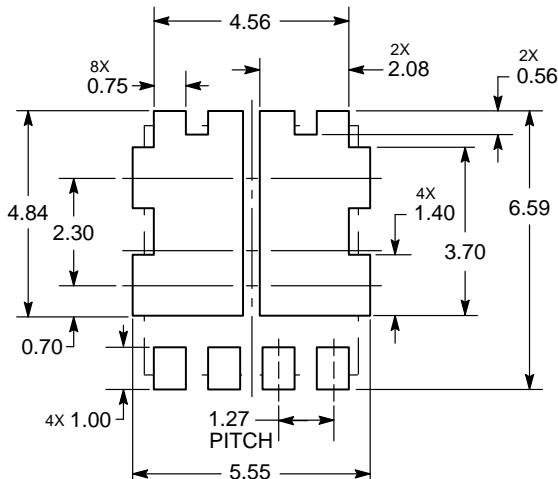
## NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 MM FROM THE TERMINAL TIP.
4. PROFILE TOLERANCE APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.
5. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.
6. SEATING PLANE IS DEFINED BY THE TERMINALS. A1 IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.
7. A VISUAL INDICATOR FOR PIN 1 MUST BE LOCATED IN THIS AREA.



DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.90	—	1.10
A1	—	—	0.05
b	0.33	0.42	0.51
b1	0.33	0.42	0.51
c	0.20	—	0.33
D	5.15 BSC	—	—
D1	4.70	4.90	5.10
D2	3.90	4.10	4.30
D3	1.50	1.70	1.90
E	6.15 BSC	—	—
E1	5.70	5.90	6.10
E2	3.90	4.15	4.40
e	1.27 BSC	—	—
G	0.45	0.55	0.65
h	—	—	12°
K	0.51	—	—
K1	0.56	—	—
L	0.48	0.61	0.71
M	3.25	3.50	3.75
N	1.80	2.00	2.20

## SOLDERING FOOTPRINT\*



DIMENSION: MILLIMETERS

\*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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DESCRIPTION:	DFN8 5X6, 1.27P DUAL FLAG (SO8FL-DUAL)	PAGE 1 OF 1

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