

# MOSFET – Power, Single N-Channel, Logic Level, DUAL COOL<sup>®</sup> DFN8 5x6 40 V, 0.7 mΩ, 349 A

## Product Preview NTMFSC0D7N04XL

### Features

- Low  $R_{DS(on)}$  to Minimize Conduction Loss
- Low  $Q_{RR}$  with Soft Recovery to Minimize  $E_{RR}$  Loss and Voltage Spike
- Low  $Q_G$  and Capacitance to Minimize Driving and Switching Loss
- Advanced Dual-Sided Cooled Packaging
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

### Typical Applications

- High Switching Frequency DC-DC Conversion
- Synchronous Rectification

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

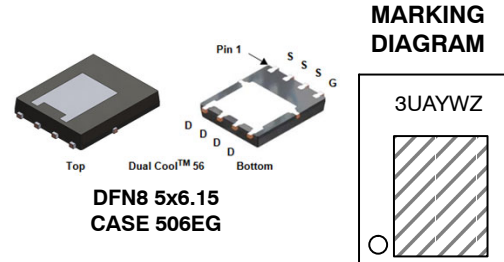
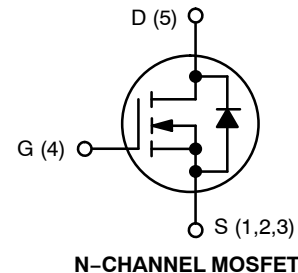
Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	$V_{DS}$	40	V
Gate-to-Source Voltage	DC $V_{GS}$	$\pm 20$	V
Continuous Drain Current (Note 2)	$T_C = 25^\circ\text{C}$ $I_D$	349	A
	$T_C = 100^\circ\text{C}$	247	
Power Dissipation (Note 2)	$T_C = 25^\circ\text{C}$ $P_D$	167	W
	$T_C = 100^\circ\text{C}$	83	
Pulsed Drain Current	$T_C = 25^\circ\text{C}$ , $t_p = 100 \mu\text{s}$ $I_{DM}$	1667	A
Pulsed Source Current (Body Diode)	$I_{SM}$	1667	
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	$-55$ to $+175$	$^\circ\text{C}$
Source Current (Body Diode)	$I_S$	256	A
Single Pulse Avalanche Energy ( $I_{PK} = 97 \text{ A}$ ) (Note 3)	$E_{AS}$	470	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 470 mJ is based on started  $T_J = 25^\circ\text{C}$ ,  $I_{AS} = 97 \text{ A}$ ,  $V_{DD} = 32 \text{ V}$ ,  $V_{GS} = 10 \text{ V}$ , 100% avalanche tested.

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

$V_{(BR)DSS}$	$R_{DS(ON)} \text{ MAX}$	$I_D \text{ MAX}$
40 V	0.7 mΩ @ 10 V	349 A
	1.1 mΩ @ 4.5 V	



3U = Specific Device Code  
A = Assembly Location  
Y = Year  
W = Work Week  
Z = Assembly Lot Code

### ORDERING INFORMATION

See detailed ordering, marking and shipping information on page 6 of this data sheet.

# NTMFSC0D7N04XL

## THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case, Bottom	$R_{\theta JC}$	0.9	$^{\circ}\text{C/W}$
Thermal Resistance, Junction-to-Case, Top	$R_{\theta JT}$	1.4	$^{\circ}\text{C/W}$
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	38	$^{\circ}\text{C/W}$

## 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	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	40			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$\Delta V_{(BR)DSS} / \Delta T_J$	$I_D = 1\text{ mA}$ , Referenced to $25^{\circ}\text{C}$		16.6		$\text{mV}/^{\circ}\text{C}$
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 40\text{ V}, T_J = 25^{\circ}\text{C}$			10	$\mu\text{A}$
		$V_{DS} = 40\text{ V}, T_J = 125^{\circ}\text{C}$			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	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 49\text{ A}$		0.58	0.7	$\text{m}\Omega$
		$V_{GS} = 6\text{ V}, I_D = 49\text{ A}$		0.66	0.9	
		$V_{GS} = 4.5\text{ V}, I_D = 39\text{ A}$		0.77	1.1	
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$	1.3		2.2	V
Gate Threshold Voltage Temperature Coefficient	$\Delta V_{GS(TH)} / \Delta T_J$	$V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$		-5.35		$\text{mV}/^{\circ}\text{C}$
Forward Transconductance	$g_{FS}$	$V_{DS} = 5\text{ V}, I_D = 49\text{ A}$		245		S

### CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}, V_{DS} = 20\text{ V}, f = 1\text{ MHz}$		7090		$\text{pF}$
Output Capacitance	$C_{OSS}$			1860		
Reverse Transfer Capacitance	$C_{RSS}$			40		
Output Charge	$Q_{OSS}$	$V_{GS} = 0\text{ V}, V_{DS} = 20\text{ V}$		72		$\text{nC}$
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5\text{ V}, V_{DD} = 20\text{ V}; I_D = 49\text{ A}$		42		
		$V_{GS} = 6\text{ V}, V_{DD} = 20\text{ V}; I_D = 49\text{ A}$		57		
		$V_{GS} = 10\text{ V}, V_{DD} = 20\text{ V}; I_D = 49\text{ A}$		96		
Threshold Gate Charge	$Q_{G(TH)}$	$V_{GS} = 10\text{ V}, V_{DD} = 20\text{ V}; I_D = 49\text{ A}$		11		
Gate-to-Source Charge	$Q_{GS}$			20		
Gate-to-Drain Charge	$Q_{GD}$			6		
Gate Plateau Voltage	$V_{GP}$			2.89		V
Gate Resistance	$R_G$	$f = 1\text{ MHz}$		0.5		$\Omega$

### SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{d(ON)}$	Resistive Load, $V_{GS} = 0/10\text{ V}, V_{DD} = 20\text{ V},$ $I_D = 49\text{ A}, R_G = 2.5\text{ }\Omega$		25		ns
Rise Time	$t_r$			7		
Turn-Off Delay Time	$t_{d(OFF)}$			64		
Fall Time	$t_f$			5		

# NTMFSC0D7N04XL

## 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>						
Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = 49\text{ A}, T_J = 25^\circ\text{C}$		0.8	1.2	V
		$V_{GS} = 0\text{ V}, I_S = 49\text{ A}, T_J = 125^\circ\text{C}$		0.65		
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, dl/dt = 300\text{ A}/\mu\text{s},$ $I_S = 49\text{ A}, V_{DD} = 20\text{ V}$		39		ns
Charge Time	$t_a$			21		
Discharge Time	$t_b$			18		
Reverse Recovery Charge	$Q_{RR}$			87		

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.

# NTMFSC0D7N04XL

## TYPICAL CHARACTERISTICS

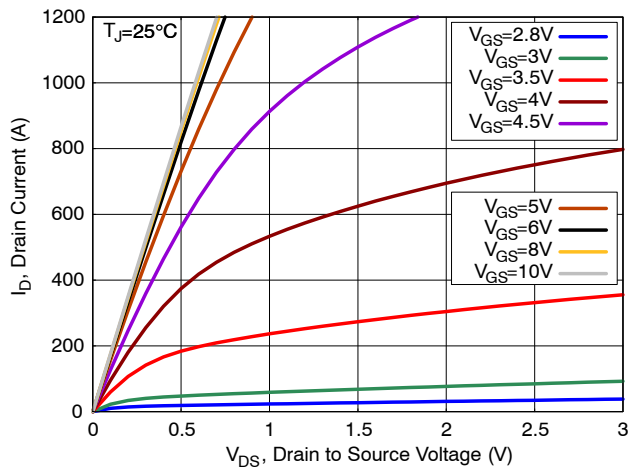


Figure 1. On-Region Characteristics

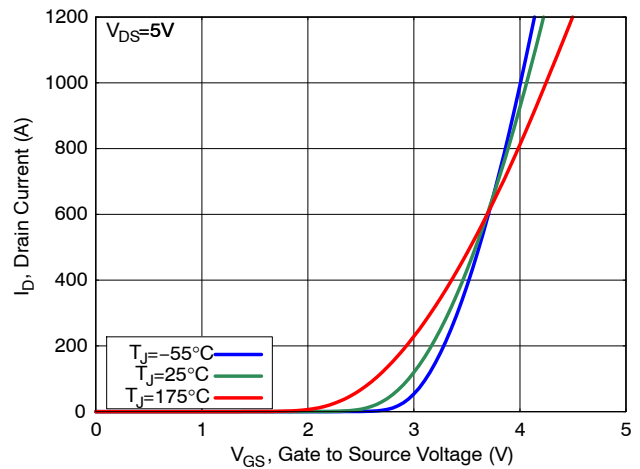


Figure 2. Transfer Characteristics

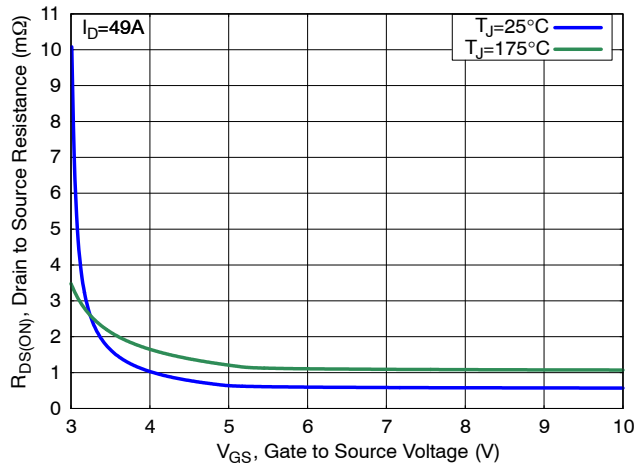


Figure 3. On-Resistance vs. Gate Voltage

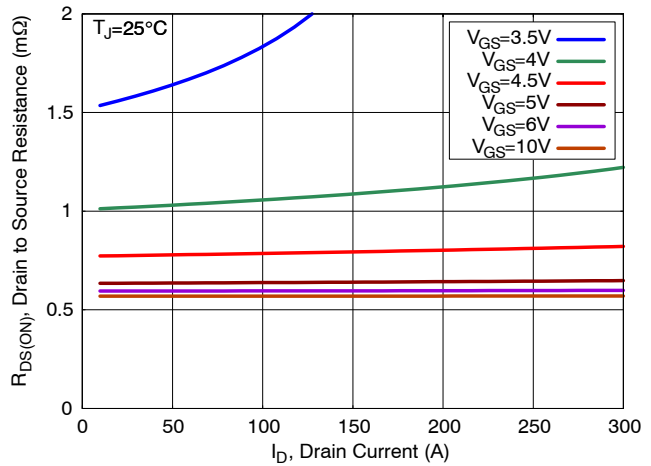


Figure 4. On-Resistance vs. Drain Current

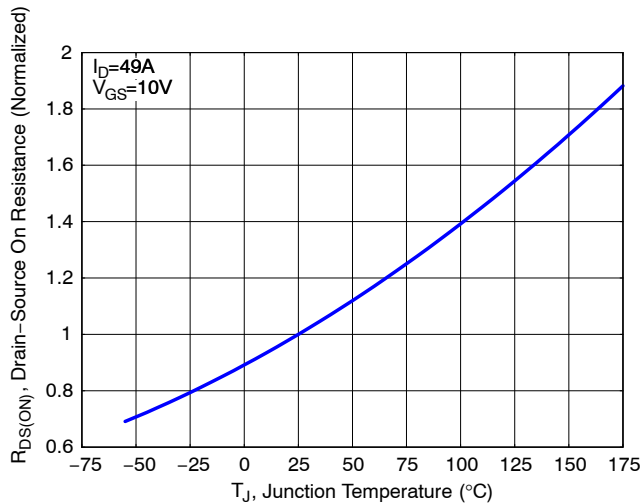


Figure 5. Normalized ON Resistance vs. Junction Temperature

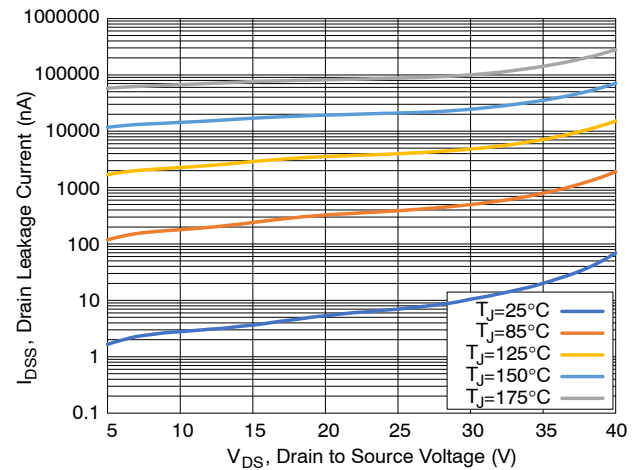


Figure 6. Drain Leakage Current vs. Drain Voltage

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## TYPICAL CHARACTERISTICS (continued)

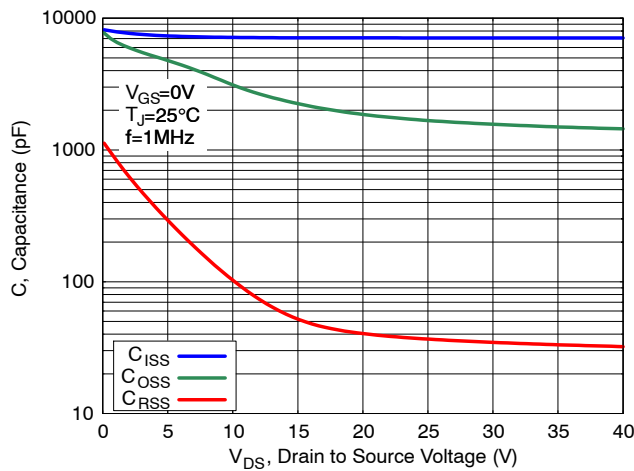


Figure 7. Capacitance Characteristics

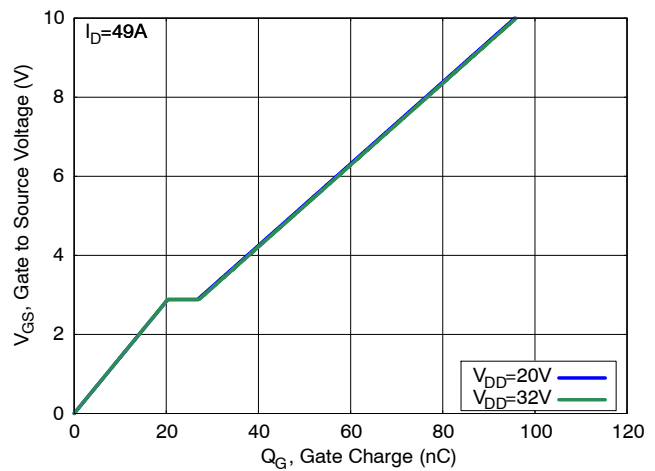


Figure 8. Gate Charge Characteristics

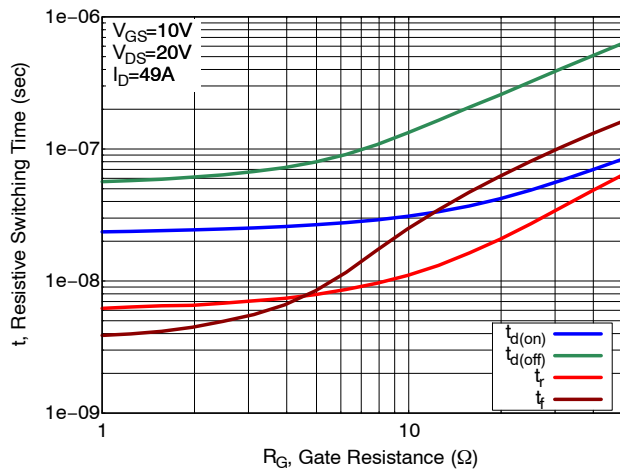


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

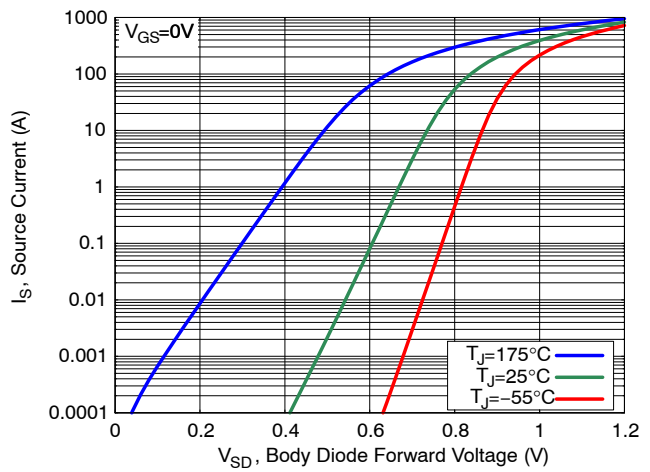


Figure 10. Diode Forward Characteristics

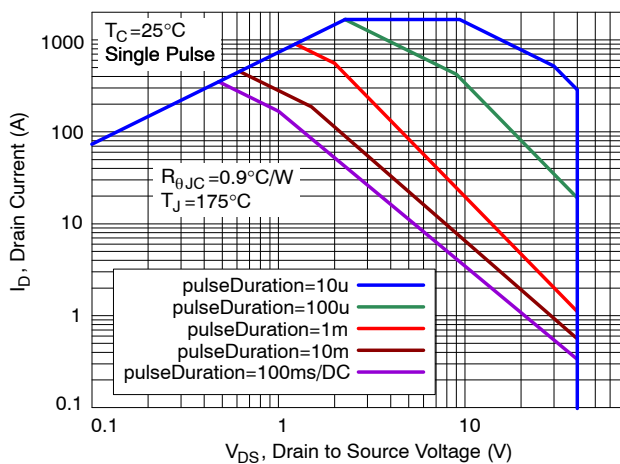


Figure 11. Safe Operating Area (SOA)

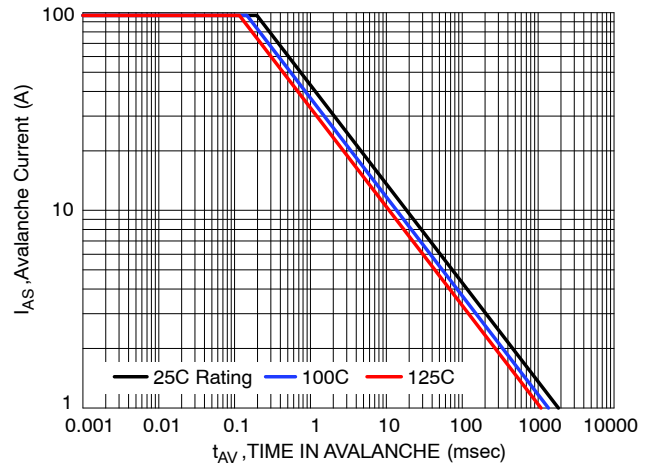


Figure 12. Avalanche Current vs. Pulse Time (UIS)

# NTMFSC0D7N04XL

## TYPICAL CHARACTERISTICS (continued)

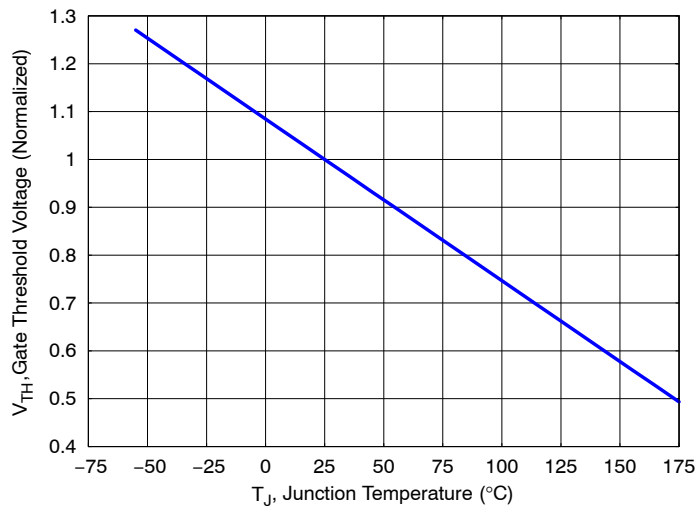


Figure 13. Gate Threshold Voltage vs. Junction Temperature

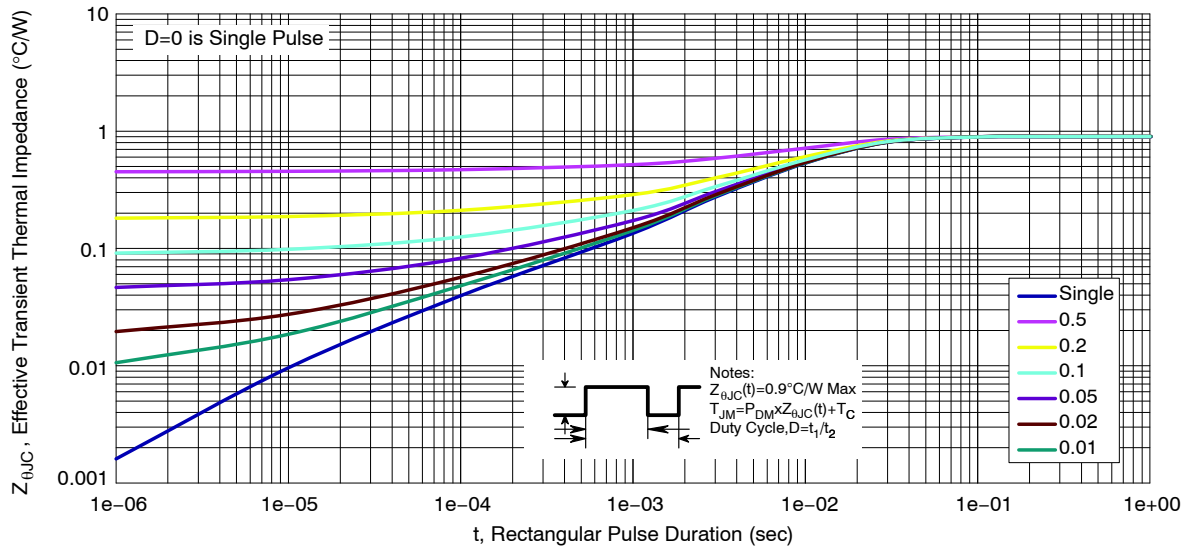


Figure 14. Thermal Characteristics

### DEVICE ORDERING INFORMATION

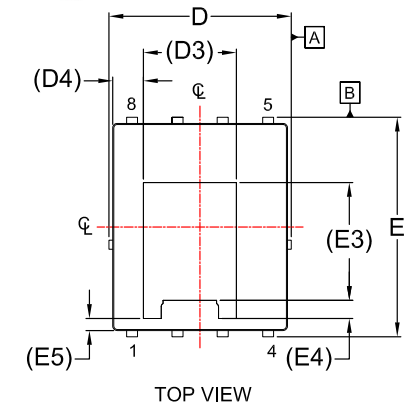
Device	Marking	Package	Shipping <sup>†</sup>
NTMFSC0D7N04XLTWG	3U	DFN8 5x6 (Pb-Free/Halogen Free)	3000 / Tape & Reel

<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.

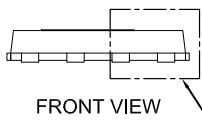
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**DFN8 5x6.15, 1.27P, DUAL COOL**  
**CASE 506EG**  
**ISSUE D**

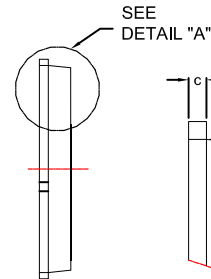
DATE 25 AUG 2020



TOP VIEW



FRONT VIEW

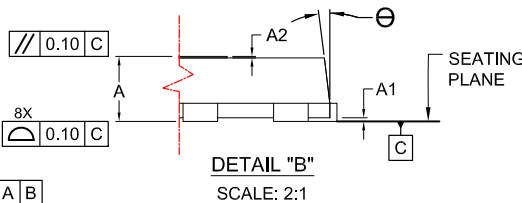
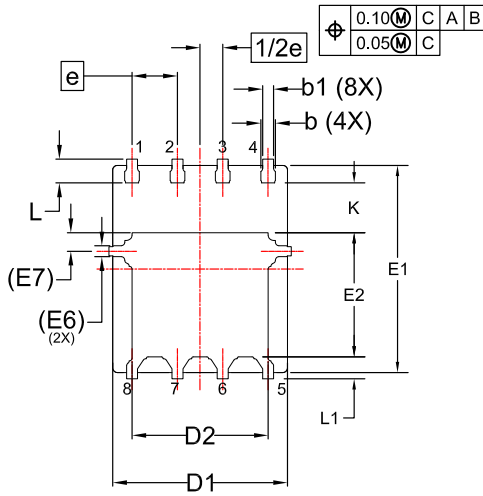


SIDE VIEW

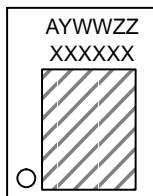
DETAIL "A"  
SCALE: 2:1

## NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.
4. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.
5. 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.


DETAIL "B"  
SCALE: 2:1


BOTTOM VIEW

**GENERIC MARKING DIAGRAM\***


XXXX = Specific Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
ZZ = Assembly Lot Code

\*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.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.85	0.90	0.95
A1	-	-	0.05
A2	-	-	0.05
b	0.31	0.41	0.51
b1	0.21	0.31	0.41
c	0.20	0.25	0.30
D	4.90	5.00	5.10
D1	4.80	4.90	5.00
D2	3.67	3.82	3.97
D3	2.60 REF		
D4	0.86 REF		
E	6.05	6.15	6.25
E1	5.70	5.80	5.90
E2	3.38	3.48	3.58
E3	3.30 REF		
E4	0.50 REF		
E5	0.34 REF		
E6	0.30 REF		
E7	0.52 REF		
e	1.27 BSC		
1/2e	0.635 BSC		
K	1.30	1.40	1.50
L	0.56	0.66	0.76
L1	0.52	0.62	0.72
Θ	0°	---	12°

LAND PATTERN RECOMMENDATION  
\*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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