

# MOSFET - Power, Single N-Channel, STD Gate, $\mu$ 8FL

40 V, 1.43 m $\Omega$ , 178 A

## NTTFS1D4N04XM

### Features

- Low  $R_{DS(on)}$  to Minimize Conduction Losses
- Low Capacitance to Minimize Driver Losses
- Small Footprint (3.3 x 3.3 mm) for Compact Design
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

### Applications

- Motor Drive
- Battery Protection
- Synchronous Rectification

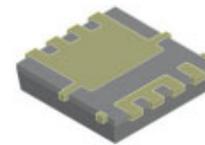
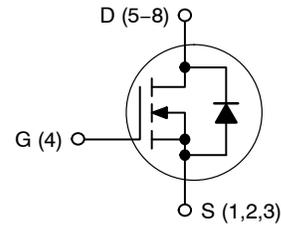
### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise stated)

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	$I_D$	$T_C = 25^\circ\text{C}$	178
		$T_C = 100^\circ\text{C}$	126
Power Dissipation	$T_C = 25^\circ\text{C}$	$P_D$	83 W
Continuous Drain Current $R_{\theta JA}$	$I_{DA}$	$T_A = 25^\circ\text{C}$	35
		$T_A = 100^\circ\text{C}$	25
Pulsed Drain Current	$T_C = 25^\circ\text{C}, t_p = 10 \mu\text{s}$	$I_{DM}$	1305 A
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to +175	$^\circ\text{C}$
Source Current (Body Diode)	$I_S$	71	A
Single Pulse Avalanche Energy ( $I_{PK} = 35 \text{ A}$ )	$E_{AS}$	89	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.

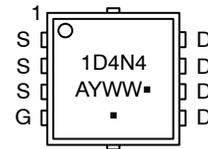
$V_{(BR)DSS}$	$R_{DS(on) MAX}$	$I_D MAX$
40 V	1.43 m $\Omega$ @ $V_{GS} = 10 \text{ V}$	178 A

### N-CHANNEL MOSFET



WDFN8  
( $\mu$ 8FL)  
CASE 511DY

### MARKING DIAGRAM



1D4N4 = Specific Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

### ORDERING INFORMATION

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

# NTTFS1D4N04XM

## THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case (Note 2)	$R_{\theta JC}$	1.8	°C/W
Thermal Resistance, Junction-to-Ambient (Notes 1, 2)	$R_{\theta JA}$	46.4	

- 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°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	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 20\text{ A}, T_J = 25^\circ\text{C}$		1.24	1.43	mΩ
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 90\text{ }\mu\text{A}, T_J = 25^\circ\text{C}$	2.5	3	3.5	V
Gate Threshold Voltage Temperature Coefficient	$\Delta V_{GS(TH)} / \Delta T_J$	$V_{GS} = V_{DS}, I_D = 90\text{ }\mu\text{A}$		-7.33		mV/°C
Forward Trans-conductance	$g_{FS}$	$V_{DS} = 5\text{ V}, I_D = 20\text{ A}$		103		S

### CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}, V_{DS} = 20\text{ V}, f = 1\text{ MHz}$		2278		pF
Output Capacitance	$C_{OSS}$			1621		
Reverse Transfer Capacitance	$C_{RSS}$			36		
Output Charge	$Q_{OSS}$	$V_{GS} = 0\text{ V}, V_{DS} = 20\text{ V}$		49		nC
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 10\text{ V}, V_{DD} = 20\text{ V}; I_D = 50\text{ A}$		35.4		
Threshold Gate Charge	$Q_{G(TH)}$			6.7		
Gate-to-Source Charge	$Q_{GS}$			10.5		
Gate-to-Drain Charge	$Q_{GD}$			6.5		
Gate Resistance	$R_G$		$f = 1\text{ MHz}$		0.7	

### SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{d(ON)}$	Resistive Load, $V_{GS} = 0/10\text{ V}, V_{DD} = 20\text{ V},$ $I_D = 50\text{ A}, R_G = 0\text{ }\Omega$		19		ns
Rise Time	$t_r$			6		
Turn-Off Delay Time	$t_{d(OFF)}$			28		
Fall Time	$t_f$			5		

### SOURCE-TO-DRAIN DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = 20\text{ A}, T_J = 25^\circ\text{C}$		0.79	1.2	V
		$V_{GS} = 0\text{ V}, I_S = 20\text{ A}, T_J = 125^\circ\text{C}$		0.64		
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, I_S = 50\text{ A},$ $dI/dt = 100\text{ A}/\mu\text{s}, V_{DD} = 20\text{ V}$		44		ns
Charge Time	$t_a$			21		
Discharge Time	$t_b$			23		
Reverse Recovery Charge	$Q_{RR}$			47		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.

# NTTFS1D4N04XM

## TYPICAL CHARACTERISTICS

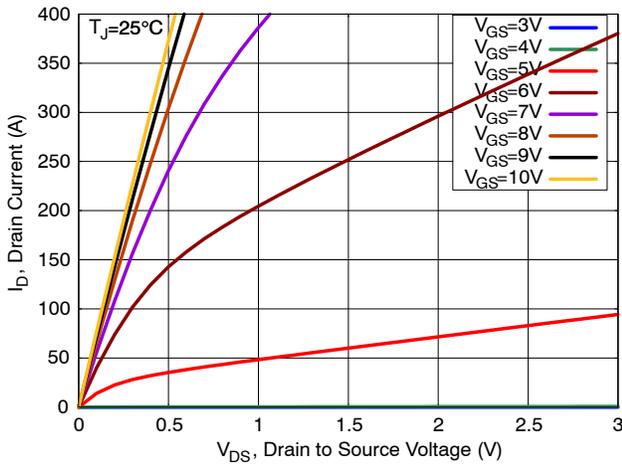


Figure 1. On-Region Characteristics

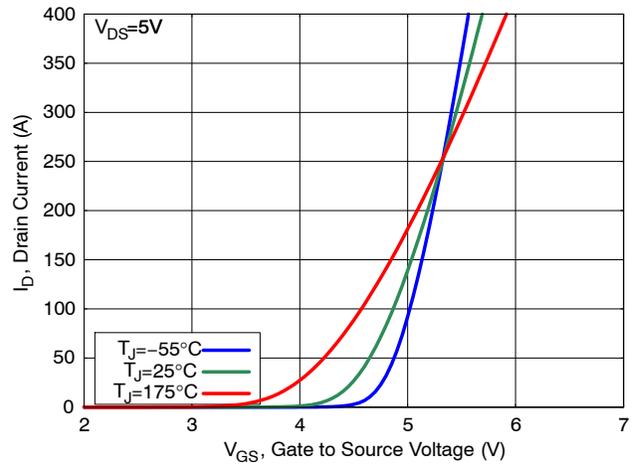


Figure 2. Transfer Characteristics

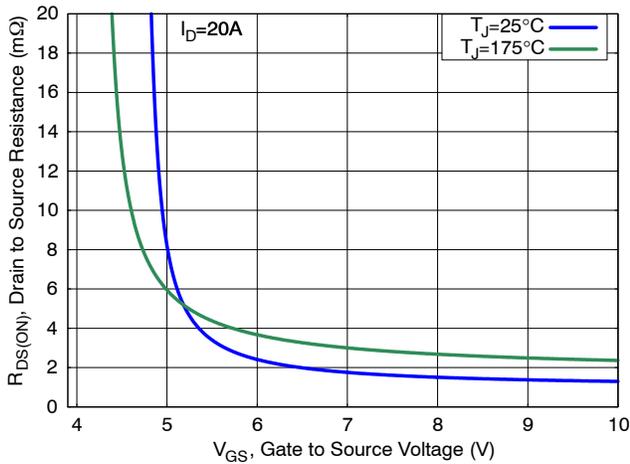


Figure 3. On-Resistance vs. Gate Voltage

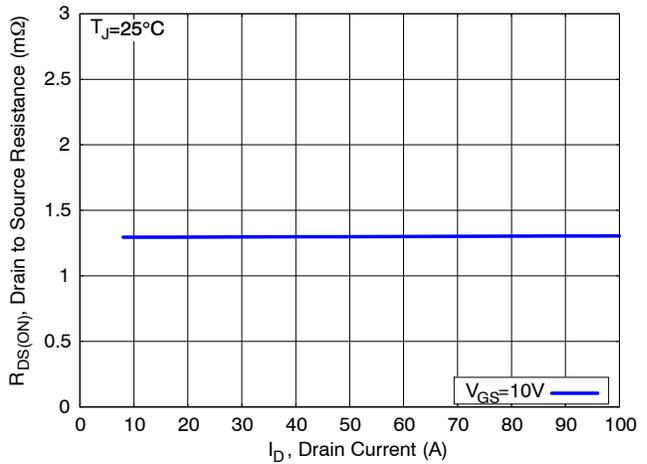


Figure 4. On-Resistance vs. Drain Current

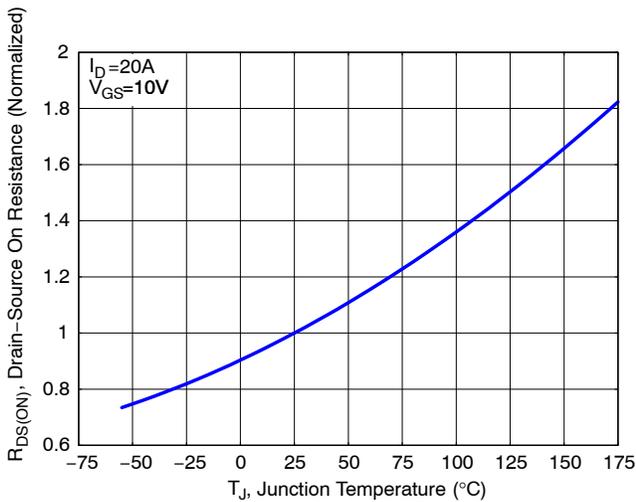


Figure 5. Normalized ON Resistance vs. Junction Temperature

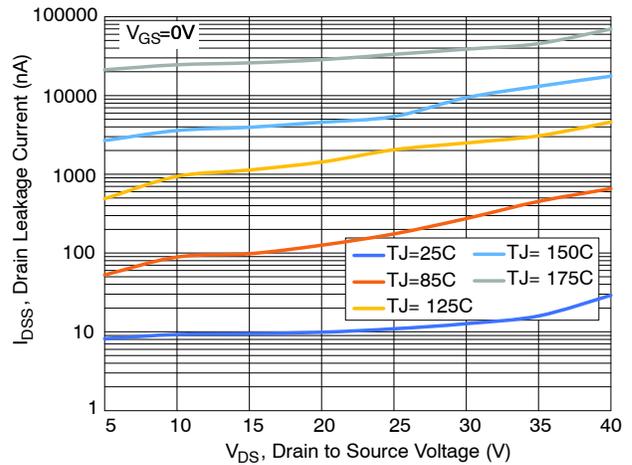


Figure 6. Drain-to-Source Leakage Current vs. Voltage

# NTTFS1D4N04XM

## TYPICAL CHARACTERISTICS

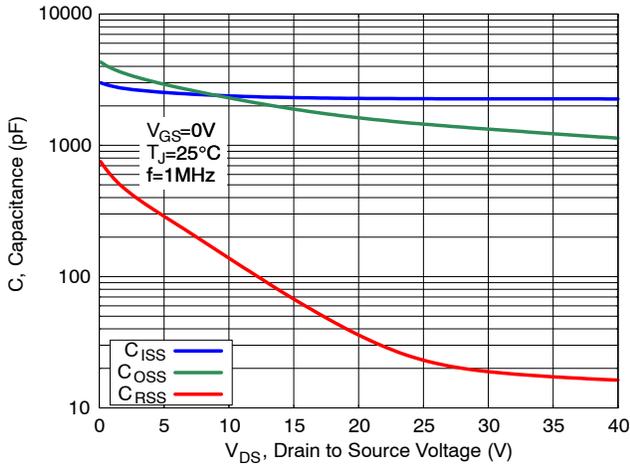


Figure 7. Capacitance Characteristics

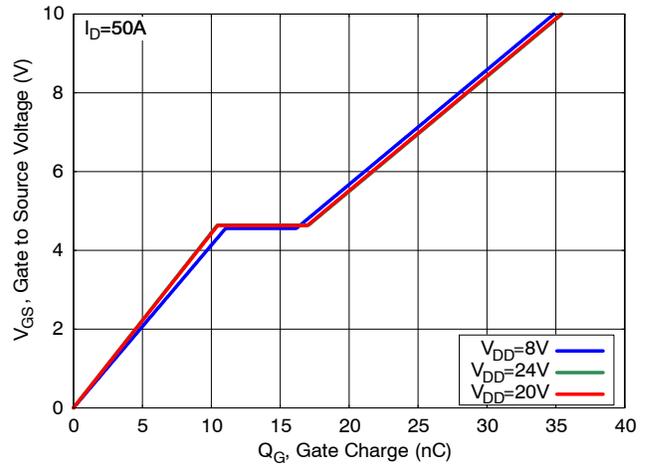


Figure 8. Gate Charge Characteristics

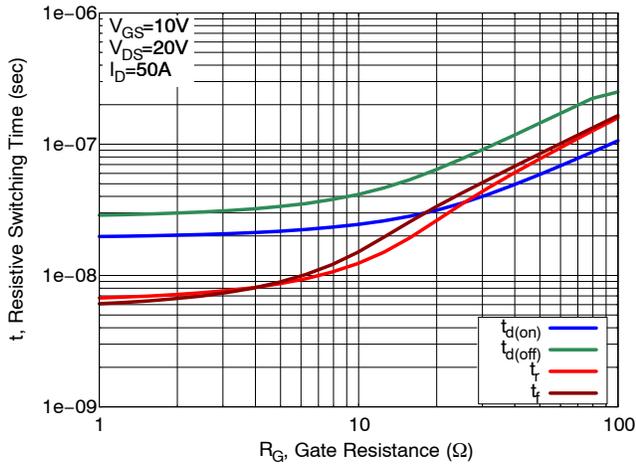


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

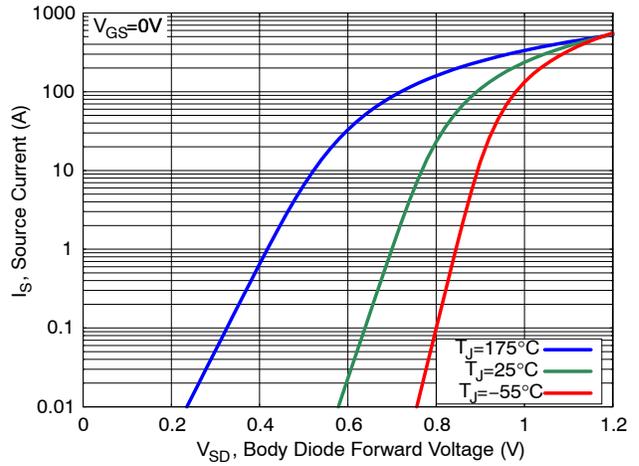


Figure 10. Diode Forward Characteristics

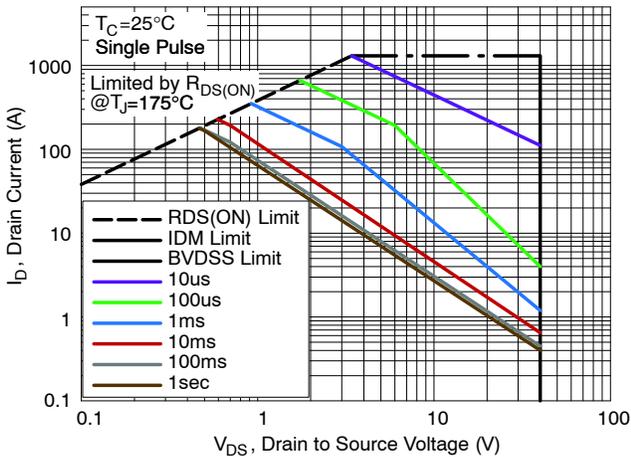


Figure 11. Safe Operating Area (SOA)

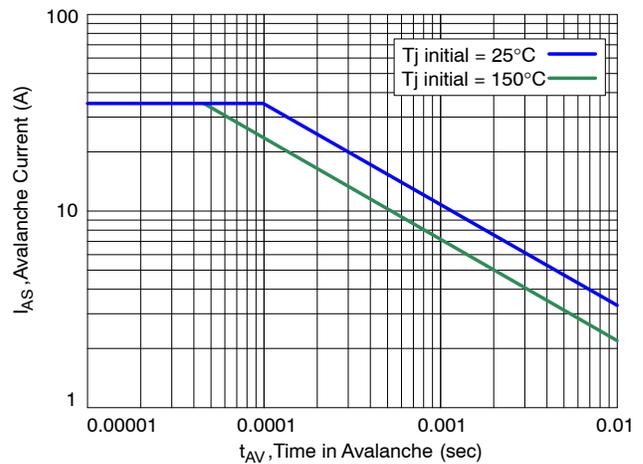


Figure 12. Avalanche Current vs. Pulse Time (UIS)

# NTTFS1D4N04XM

## TYPICAL CHARACTERISTICS

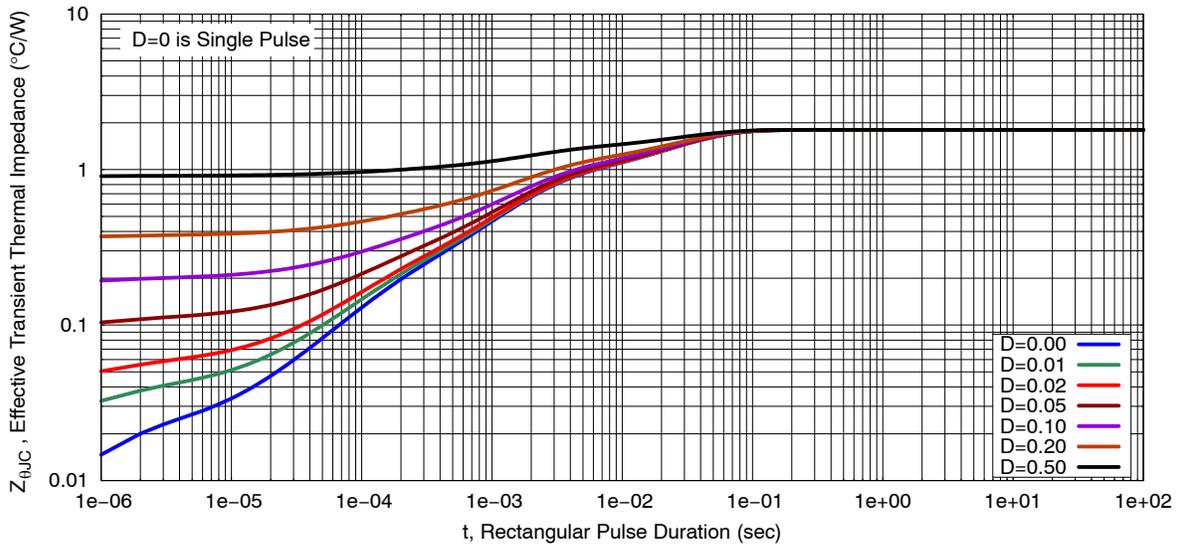


Figure 13. Transient Thermal Response

### ORDERING INFORMATION

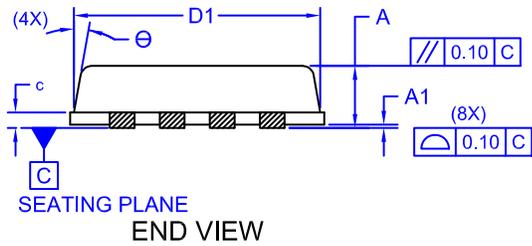
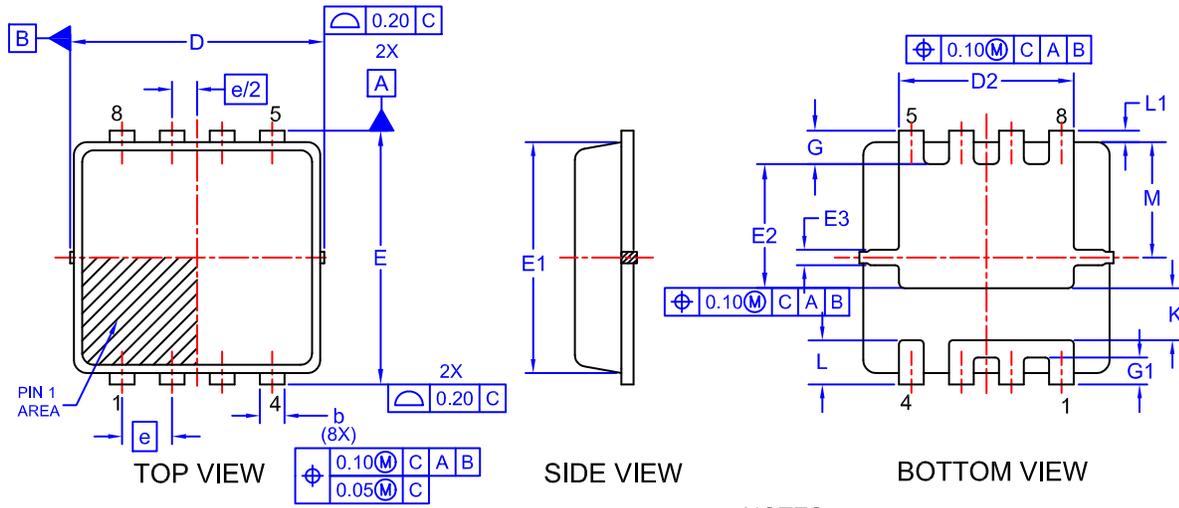
Device	Marking	Package	Shipping†
NTTFS1D4N04XMTAG	1D4N4	WDFN8 (Pb-Free)	1500 / Tape & Reel

†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.

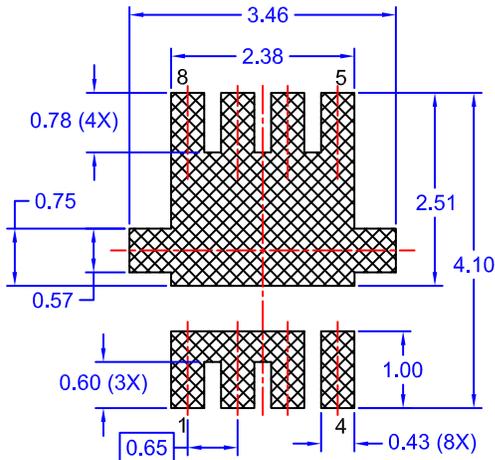
# NTTFS1D4N04XM

## PACKAGE DIMENSIONS

WDFN8 3.3x3.3, 0.65P  
CASE 511DY  
ISSUE A



- NOTES:**
1. CONTROLLING DIMENSION: MILLIMETERS
  2. DIMENSIONS D1 & E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS NOR GATE BURRS.



DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0.00	-	0.05
b	0.23	0.33	0.43
c	0.15	0.20	0.25
D	3.20	3.30	3.40
D1	2.95	3.13	3.30
D2	1.98	2.20	2.40
E	3.20	3.30	3.40
E1	2.80	3.00	3.15
E2	1.40	1.60	1.80
E3	0.15	0.25	0.40
e	0.65 BSC		
G	0.30	0.43	0.55
G1	0.25	0.35	0.45
K	0.55	0.75	0.95
L	0.35	0.52	0.65
L1	0.06	0.15	0.30
M	1.35	1.50	1.60
$\theta$	0	-	12

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