

NTTFS002N04CL

MOSFET – Power, Single, N-Channel 40 V, 2.2 mΩ, 142 A



ON Semiconductor®

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Features

- Small Footprint (3.3 x 3.3 mm) for Compact Design
- Low $R_{DS(on)}$ to Minimize Conduction Losses
- Low Capacitance to Minimize Driver Losses
- These Devices are Pb-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}	± 20	V
Continuous Drain Current $R_{\theta JC}$ (Notes 1, 2, 3, 4)	Steady State	$T_C = 25^\circ\text{C}$	I_D	142
		$T_C = 100^\circ\text{C}$		80
Power Dissipation $R_{\theta JC}$ (Notes 1, 2, 3)		$T_C = 25^\circ\text{C}$	P_D	85
		$T_C = 100^\circ\text{C}$		27
Continuous Drain Current $R_{\theta JA}$ (Notes 1, 3, 4)	Steady State	$T_A = 25^\circ\text{C}$	I_D	28
		$T_A = 100^\circ\text{C}$		20
Power Dissipation $R_{\theta JA}$ (Notes 1, 3)		$T_A = 25^\circ\text{C}$	P_D	3.2
		$T_A = 100^\circ\text{C}$		1.6
Pulsed Drain Current	$T_A = 25^\circ\text{C}$, $t_p = 10\ \mu\text{s}$	I_{DM}	706	A
Operating Junction and Storage Temperature Range		T_J , T_{Stg}	-55 to +175	°C
Source Current (Body Diode)		I_S	70.4	A
Single Pulse Drain-to-Source Avalanche Energy ($I_{L(pk)} = 10.2\ \text{A}$)		E_{AS}	268	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		T_L	260	°C

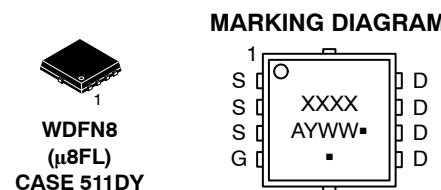
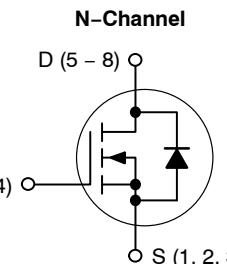
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

THERMAL RESISTANCE MAXIMUM RATINGS (Note 1)

Parameter	Symbol	Value	Unit
Junction-to-Case – Steady State (Note 3)	$R_{\theta JC}$	1.8	°C/W
Junction-to-Ambient – Steady State (Note 3)	$R_{\theta JA}$	46.5	

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. Psi (Ψ) is used as required per JESD51-12 for packages in which substantially less than 100% of the heat flows to single case surface.
3. Surface-mounted on FR4 board using a 650 mm², 2 oz. Cu pad.
4. Continuous DC current rating. Maximum current for pulses as long as 1 second is higher but is dependent on pulse duration and duty cycle.

$V_{(BR)DSS}$	$R_{DS(on)}$ MAX	I_D MAX
40 V	2.2 mΩ @ 10 V	
	3.5 mΩ @ 4.5 V	142 A



XXXX = 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.

NTTFS002N04CL

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(\text{BR})\text{DSS}}$	$V_{\text{GS}} = 0 \text{ V}, I_D = 250 \mu\text{A}$	40			V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{\text{GS}} = 0 \text{ V}, V_{\text{DS}} = 40 \text{ V}$	$T_J = 25^\circ\text{C}$		10	μA
			$T_J = 125^\circ\text{C}$		250	
Gate-to-Source Leakage Current	I_{GSS}	$V_{\text{DS}} = 0 \text{ V}, V_{\text{GS}} = 20 \text{ V}$			100	nA

ON CHARACTERISTICS (Note 5)

Gate Threshold Voltage	$V_{\text{GS}(\text{TH})}$	$V_{\text{GS}} = V_{\text{DS}}, I_D = 90 \mu\text{A}$	1.2		2.0	V
Drain-to-Source On Resistance	$R_{\text{DS}(\text{on})}$	$V_{\text{GS}} = 10 \text{ V}, I_D = 50 \text{ A}$		1.8	2.2	$\text{m}\Omega$
		$V_{\text{GS}} = 4.5 \text{ V}, I_D = 50 \text{ A}$		2.8	3.5	
Forward Transconductance	g_{FS}	$V_{\text{DS}} = 15 \text{ V}, I_D = 50 \text{ A}$			135	S

CHARGES AND CAPACITANCES

Input Capacitance	C_{iss}	$V_{\text{GS}} = 0 \text{ V}, f = 1.0 \text{ MHz}, V_{\text{DS}} = 25 \text{ V}$		2940		pF
Output Capacitance	C_{oss}			1260		
Reverse Transfer Capacitance	C_{rss}			47		
Threshold Gate Charge	$Q_{\text{G}(\text{TH})}$	$V_{\text{GS}} = 10 \text{ V}, V_{\text{DS}} = 20 \text{ V}, I_D = 50 \text{ A}$		5.3		nC
Gate-to-Source Charge	Q_{GS}			9.6		
Gate-to-Drain Charge	Q_{GD}			7.4		
Total Gate Charge	$Q_{\text{G}(\text{TOT})}$	$V_{\text{GS}} = 10 \text{ V}, V_{\text{DS}} = 20 \text{ V}, I_D = 50 \text{ A}$		49		nC

SWITCHING CHARACTERISTICS (Note 6)

Turn-On Delay Time	$t_{\text{d}(\text{on})}$	$V_{\text{GS}} = 10 \text{ V}, V_{\text{DS}} = 20 \text{ V}, I_D = 50 \text{ A}$		14		ns
Rise Time	t_r			77		
Turn-Off Delay Time	$t_{\text{d}(\text{off})}$			70		
Fall Time	t_f			22		

DRAIN-SOURCE DIODE CHARACTERISTICS

Forward Diode Voltage	V_{SD}	$V_{\text{GS}} = 0 \text{ V}, I_S = 50 \text{ A}$	$T_J = 25^\circ\text{C}$		0.84	1.2	V
			$T_J = 125^\circ\text{C}$		0.72		
Reverse Recovery Time	t_{RR}	$V_{\text{GS}} = 0 \text{ V}, dI_S/dt = 100 \text{ A}/\mu\text{s}, I_S = 50 \text{ A}$			54		ns
Charge Time	t_a				24		
Discharge Time	t_b				30		
Reverse Recovery Charge	Q_{RR}				43		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.

5. Pulse Test: Pulse Width $\leq 300 \mu\text{s}$, Duty Cycle $\leq 2\%$.
6. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

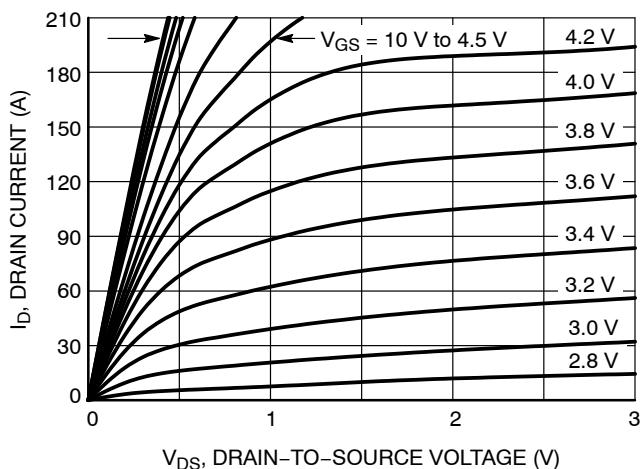


Figure 1. On-Region Characteristics

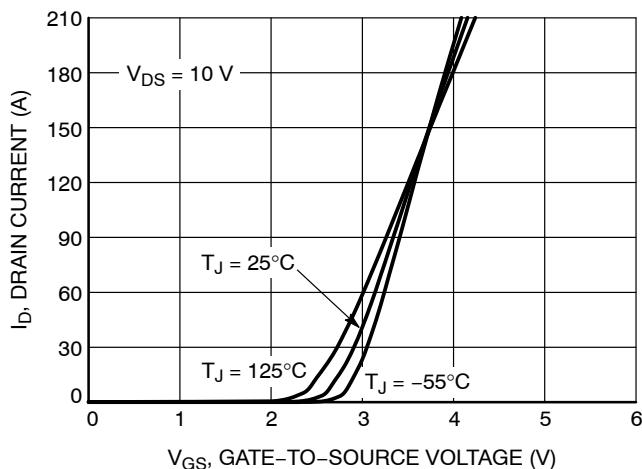


Figure 2. Transfer Characteristics

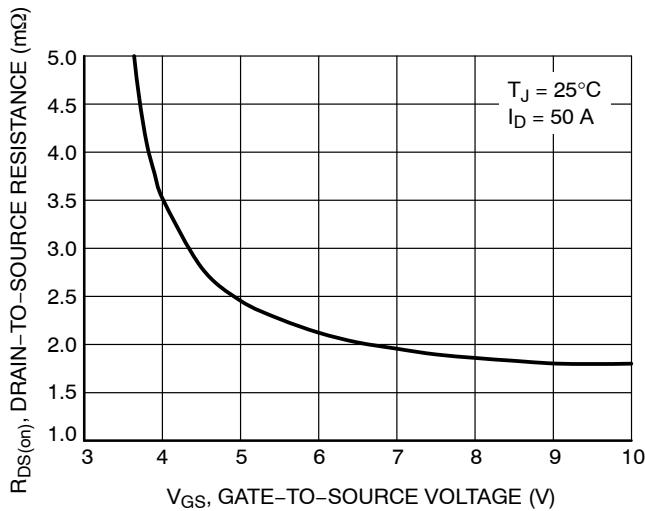


Figure 3. On-Resistance vs. Gate-to-Source Voltage

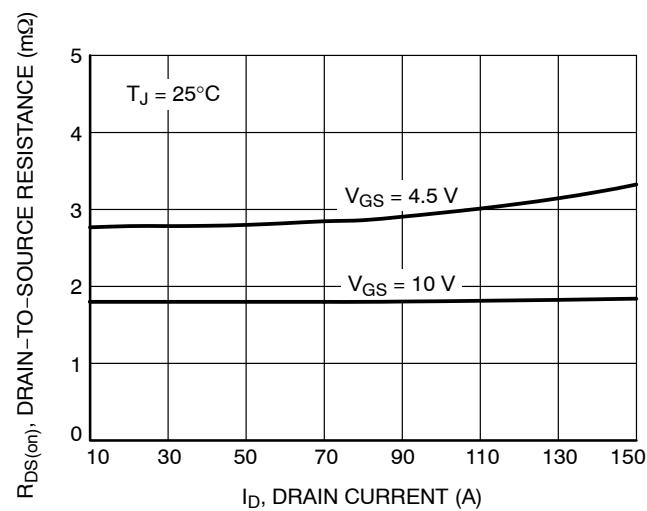


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

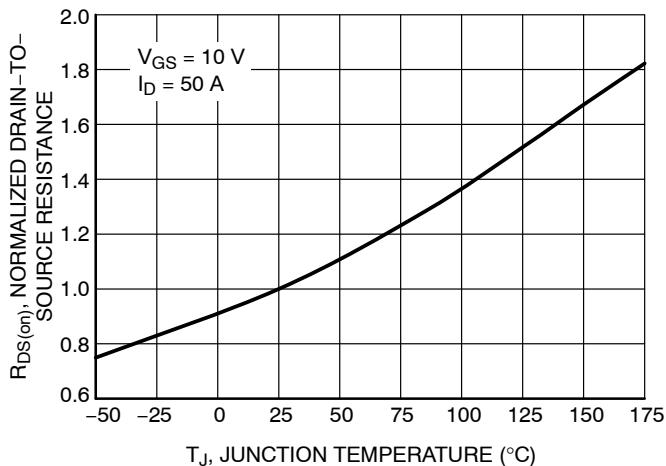


Figure 5. On-Resistance Variation with Temperature

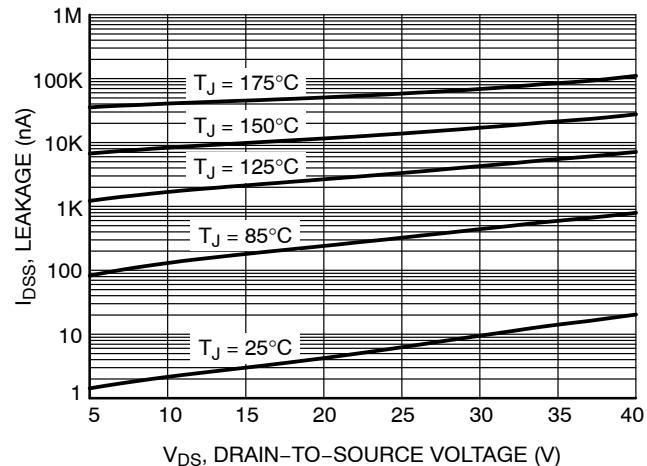


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

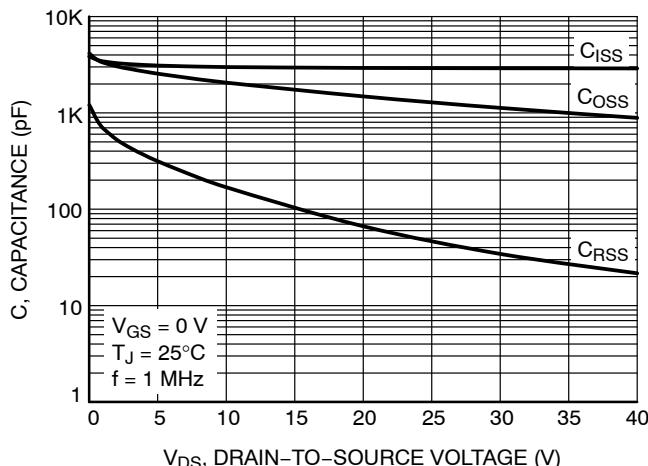


Figure 7. Capacitance Variation

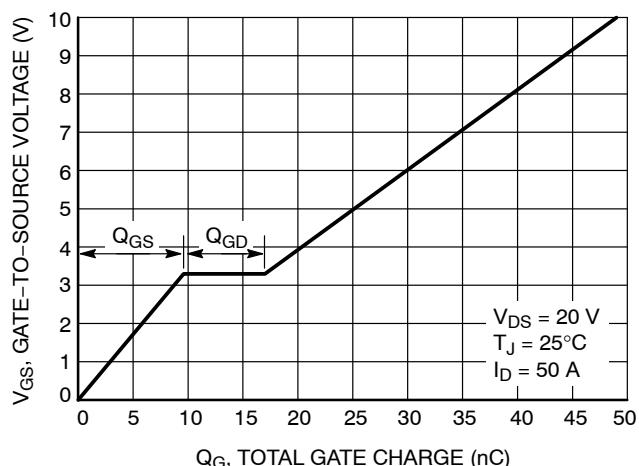


Figure 8. Gate-to-Source Voltage vs. Total Charge

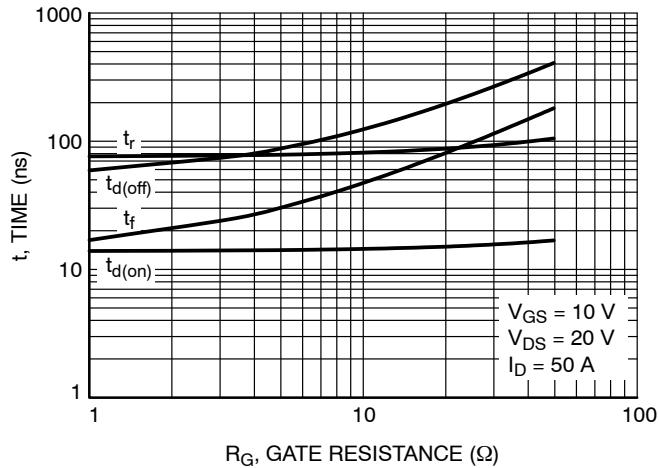


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

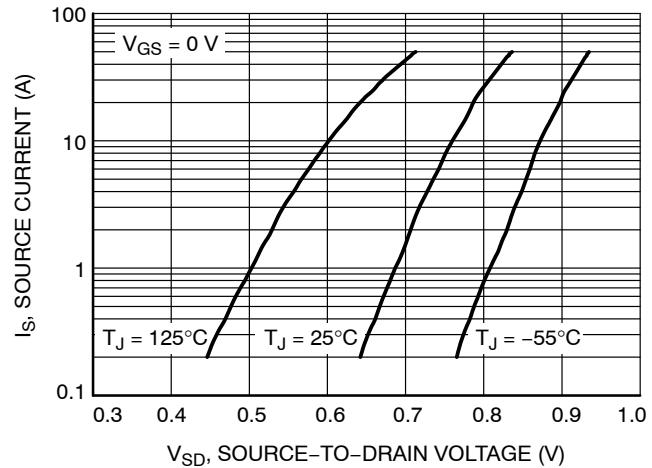


Figure 10. Diode Forward Voltage vs. Current

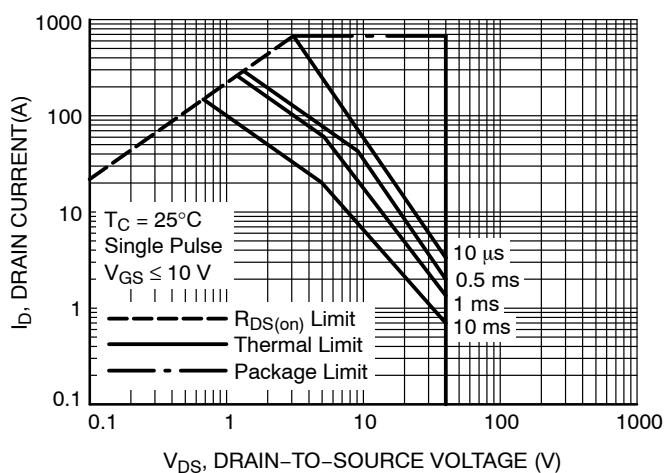
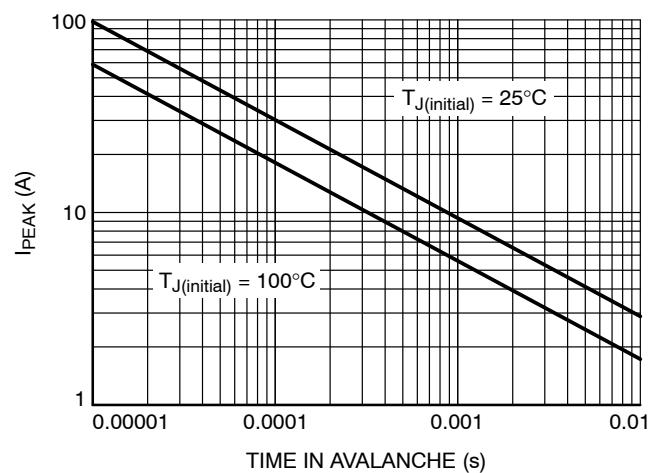


Figure 11. Maximum Rated Forward Biased Safe Operating Area

Figure 12. I_{PEAK} vs. Time in Avalanche

NTTFS002N04CL

TYPICAL CHARACTERISTICS

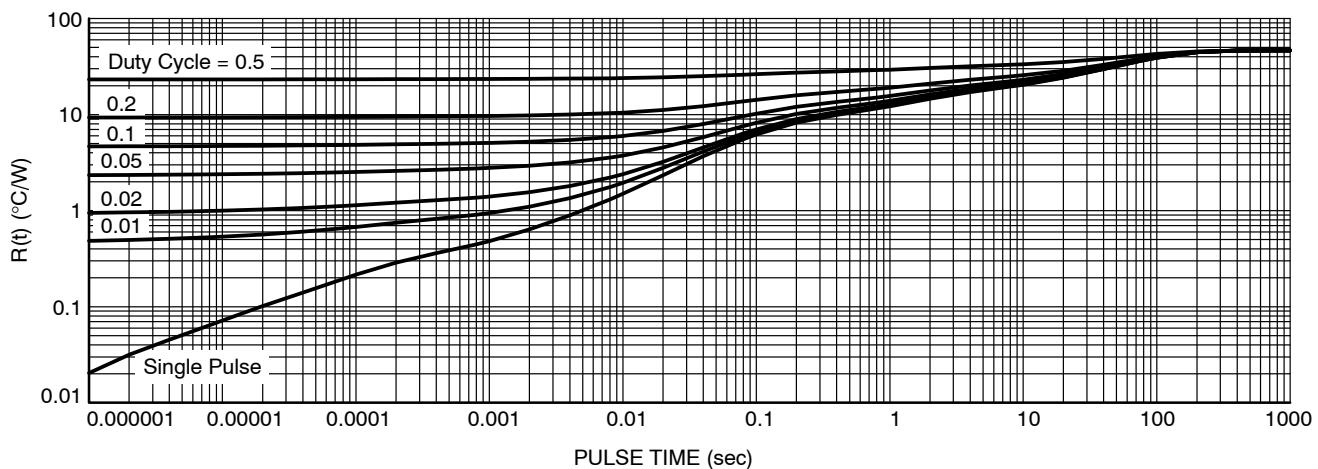


Figure 13. Thermal Characteristics

DEVICE ORDERING INFORMATION

Device	Marking	Package	Shipping [†]
NTTFS002N04CLTAG	02NL	WDFN8 (Pb-Free)	1500 / Tape & Reel

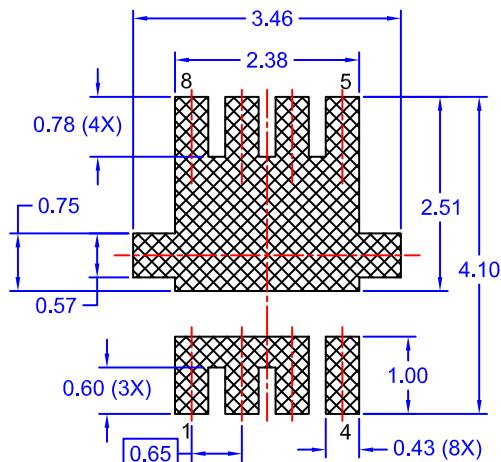
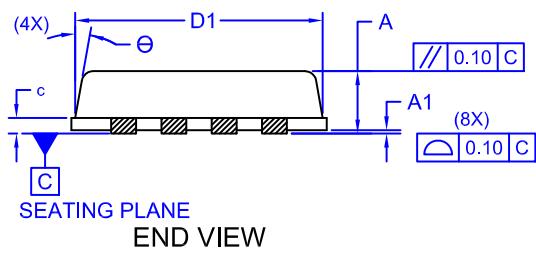
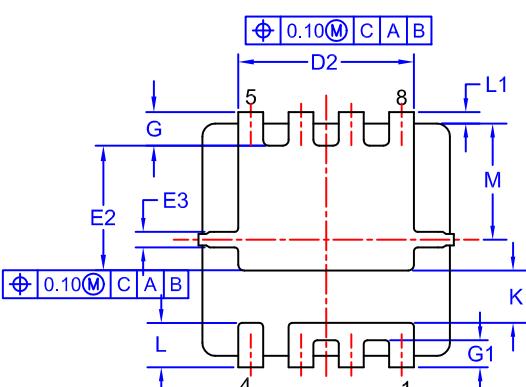
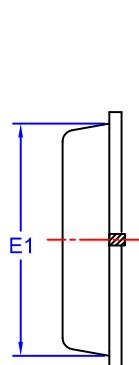
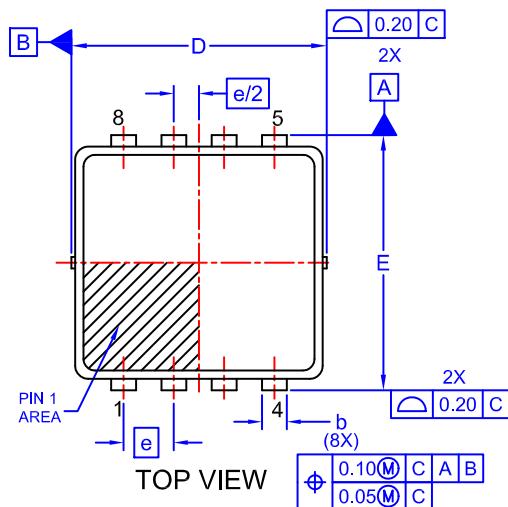
[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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
Θ	0	-	12

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