

# MOSFET - Power, Single N-Channel, Power33

## 25 V, 1.3 mΩ, 150 A



ON Semiconductor®

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## NTTFS1D8N02P1E

### Features

- Small Footprint 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

### Typical Applications

- DC-DC Converters
- Power Load Switch
- Notebook Battery Management

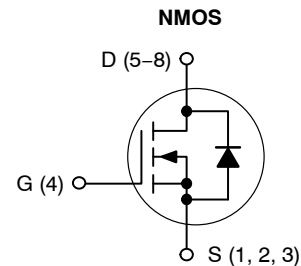
### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

Parameter			Symbol	Value	Unit
Drain-to-Source Voltage			$V_{DS}$	25	V
Gate-to-Source Voltage			$V_{GS}$	+16, -12	V
Continuous Drain Current $R_{\theta JC}$ (Note 1)	Steady State	$T_C = 25^\circ\text{C}$	$I_D$	150	A
		$T_C = 85^\circ\text{C}$		108	
Power Dissipation $R_{\theta JC}$ (Note 1)		$T_C = 25^\circ\text{C}$	$P_D$	46	W
Continuous Drain Current $R_{\theta JA}$ (Notes 1, 3)	Steady State	$T_A = 25^\circ\text{C}$	$I_D$	36	A
		$T_A = 85^\circ\text{C}$		26	
Power Dissipation $R_{\theta JA}$ (Notes 1, 3)		$T_A = 25^\circ\text{C}$	$P_D$	2.7	W
Continuous Drain Current $R_{\theta JA}$ (Notes 2, 3)	Steady State	$T_A = 25^\circ\text{C}$	$I_D$	20	A
		$T_A = 85^\circ\text{C}$		14	
Power Dissipation $R_{\theta JA}$ (Notes 2, 3)		$T_A = 25^\circ\text{C}$	$P_D$	0.8	W
Pulsed Drain Current	$T_A = 25^\circ\text{C}, t_p = 10 \mu\text{s}$		$I_{DM}$	508	A
Single Pulse Drain-to-Source Avalanche Energy ( $I_{L(pk)} = 48.3 \text{ A}, L = 0.1 \text{ mH}$ ) (Note 4)			$E_{AS}$	117	mJ
Operating Junction and Storage Temperature Range			$T_J, T_{stg}$	-55 to +150	$^\circ\text{C}$
Lead Temperature Soldering Reflow for Soldering Purposes (1/8" from case for 10 s)			$T_L$	260	$^\circ\text{C}$

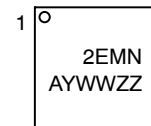
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Surface-mounted on FR4 board using a 1 in<sup>2</sup> pad size, 2 oz Cu pad.
2. Surface-mounted on FR4 board using minimum pad size, 2 oz Cu pad.
3. The entire application environment impacts the thermal resistance values shown. They are not constants and are only valid for the particular conditions noted. Actual continuous current will be limited by thermal & electro-mechanical application board design.  $R_{\theta CA}$  is determined by the user's board design.
4. 100% UIS tested at  $L = 0.1 \text{ mH}, I_{AV} = 32 \text{ A}$ .

$V_{(BR)DS}$	$R_{DS(ON)} \text{ MAX}$	$I_D \text{ MAX}$
25 V	1.3 mΩ @ 10 V	150 A
	1.8 mΩ @ 4.5 V	

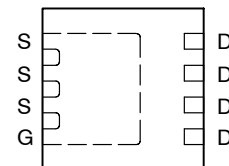


### MARKING DIAGRAM



2EMN = Specific Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week  
ZZ = Assembly Lot Code

### PIN CONNECTIONS



(Top View)

### ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

# NTTFS1D8N02P1E

## THERMAL RESISTANCE RATINGS

Parameter	Symbol	Max	Unit
Junction-to-Case – Steady State (Note 1)	$R_{\theta JC}$	2.7	°C/W
Junction-to-Ambient – Steady State (Note 1)	$R_{\theta JA}$	47	
Junction-to-Ambient – Steady State (Note 2)	$R_{\theta JA}$	152	

## 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	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	25			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$	$I_D = 1\text{ mA}$ , ref to $25^\circ\text{C}$		16		mV/°C
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0\text{ V}, V_{DS} = 20\text{ V}$	$T_J = 25^\circ\text{C}$		10	$\mu\text{A}$
			$T_J = 125^\circ\text{C}$		100	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = +16\text{ V}, -12\text{ V}$			$\pm 100$	$\pm\text{nA}$

### ON CHARACTERISTICS (Note 5)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 660\text{ }\mu\text{A}$	1.2		2.0	V
Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$	$I_D = 660\text{ }\mu\text{A}$ , ref to $25^\circ\text{C}$		-4.4		mV/°C
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 17\text{ A}$		1.05	1.3	m $\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 13\text{ A}$		1.3	1.8	
Forward Transconductance	$g_{FS}$	$V_{DS} = 5\text{ V}, I_D = 17\text{ A}$		118		S
Gate Resistance	$R_G$	$T_A = 25^\circ\text{C}$		0.6		$\Omega$

### CHARGES & CAPACITANCES

Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}, V_{DS} = 13\text{ V}, f = 1\text{ MHz}$		2980		pF
Output Capacitance	$C_{OSS}$			805		
Reverse Capacitance	$C_{RSS}$			41		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 13\text{ V}; I_D = 17\text{ A}$		17.1		nC
Threshold Gate Charge	$Q_{G(TH)}$			4		
Gate-to-Drain Charge	$Q_{GD}$			2.7		
Gate-to-Source Charge	$Q_{GS}$			7		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 10\text{ V}, V_{DS} = 13\text{ V}; I_D = 17\text{ A}$		39		

### SWITCHING CHARACTERISTICS, $V_{GS} = 4.5\text{ V}$ (Note 5)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 4.5\text{ V}, V_{DD} = 13\text{ V}, I_D = 17\text{ A}, R_G = 6\text{ }\Omega$		21.3		ns
Rise Time	$t_r$			8		
Turn-Off Delay Time	$t_{d(OFF)}$			30		
Fall Time	$t_f$			7		

### SWITCHING CHARACTERISTICS, $V_{GS} = 10\text{ V}$ (Note 5)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 10\text{ V}, V_{DD} = 13\text{ V}, I_D = 17\text{ A}, R_G = 6\text{ }\Omega$		13		ns
Rise Time	$t_r$			2.8		
Turn-Off Delay Time	$t_{d(OFF)}$			44		
Fall Time	$t_f$			5.4		

### SOURCE-TO-DRAIN DIODE CHARACTERISTICS

Forward Diode Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = 17\text{ A}$	$T_J = 25^\circ\text{C}$		0.77	1.2	V
			$T_J = 125^\circ\text{C}$		0.61		
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, di/dt = 100\text{ A}/\mu\text{s}, I_S = 17\text{ A}$		34			ns
Reverse Recovery Charge	$Q_{RR}$			22			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. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

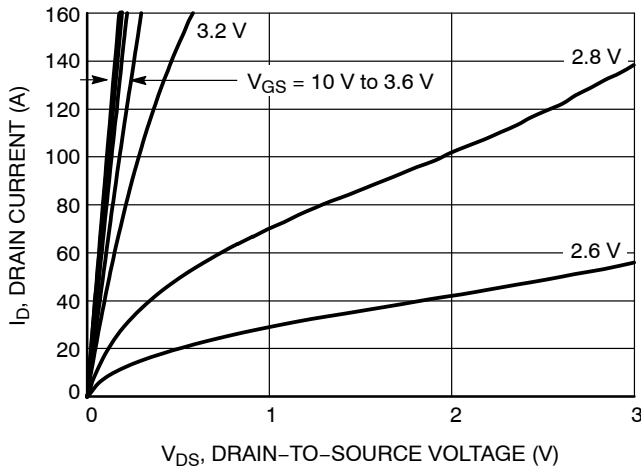


Figure 1. On-Region Characteristics

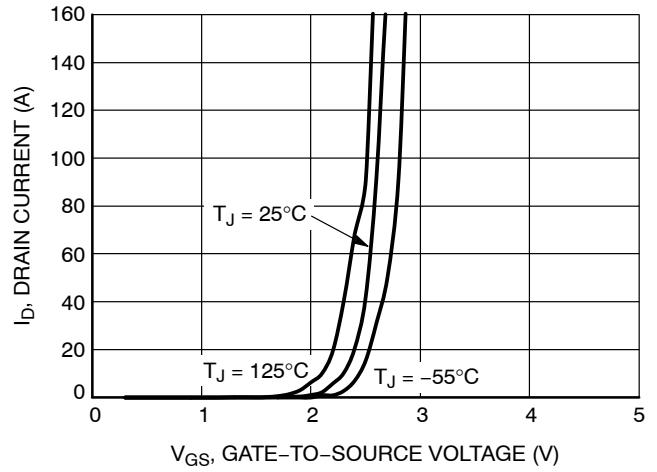


Figure 2. Transfer Characteristics

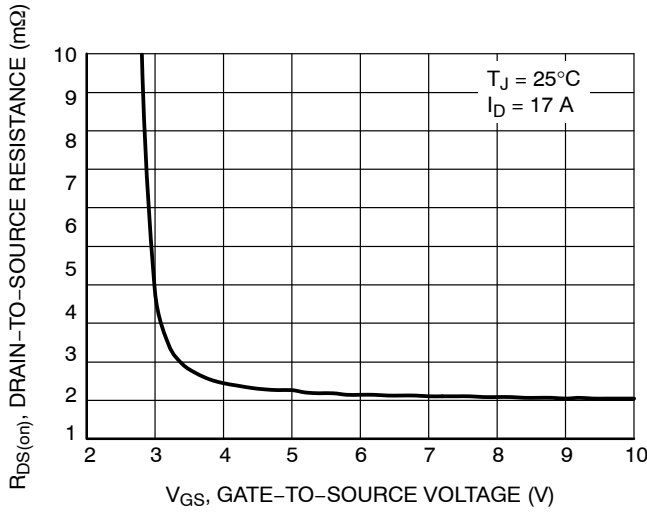


Figure 3. On-Resistance vs. Gate-to-Source Voltage

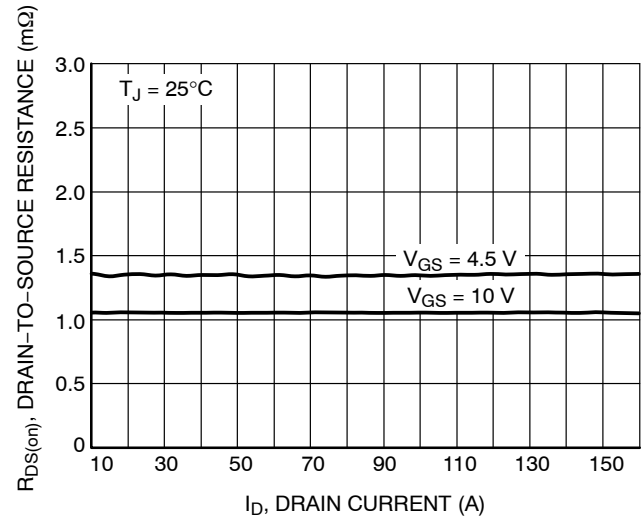


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

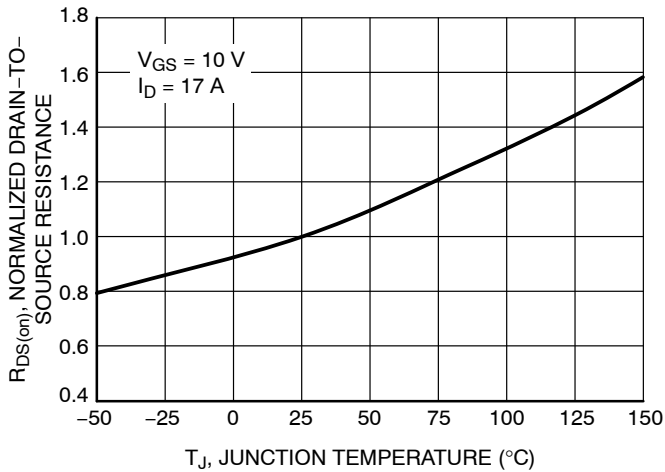


Figure 5. On-Resistance Variation with Temperature

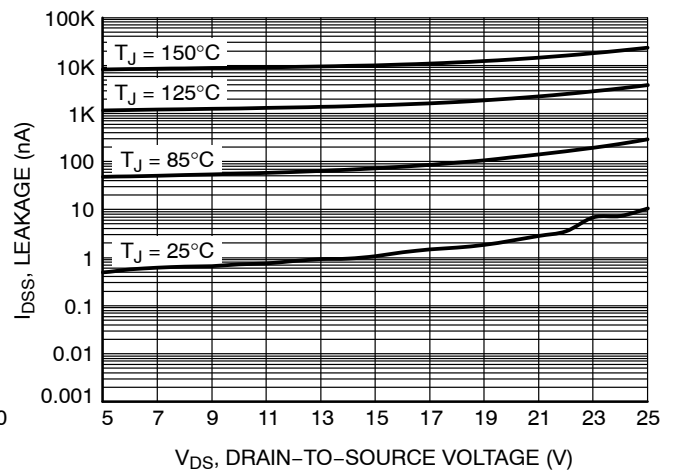


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

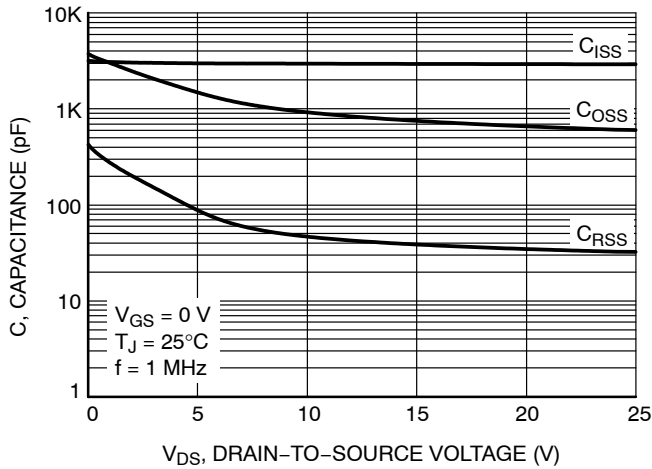


Figure 7. Capacitance Variation

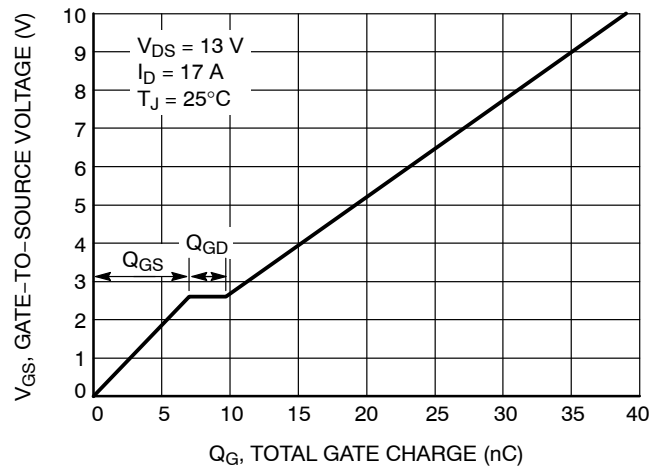


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

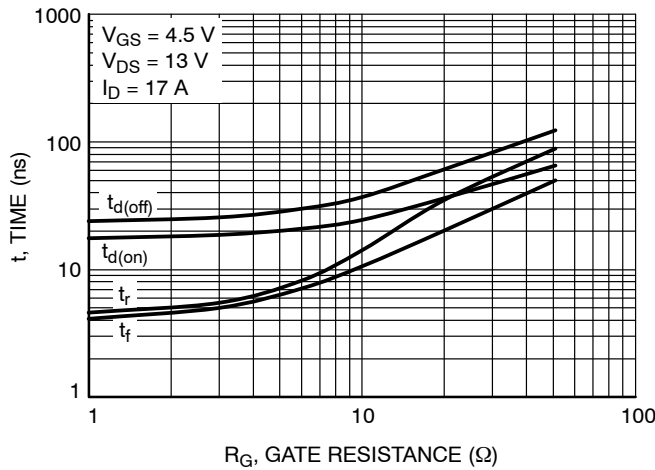


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

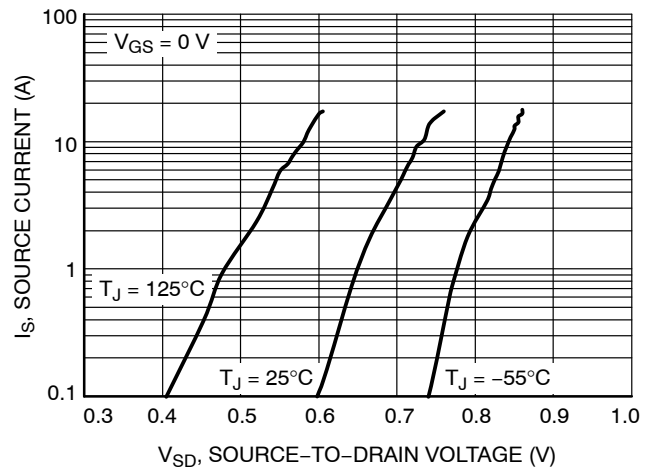


Figure 10. Diode Forward Voltage vs. Current

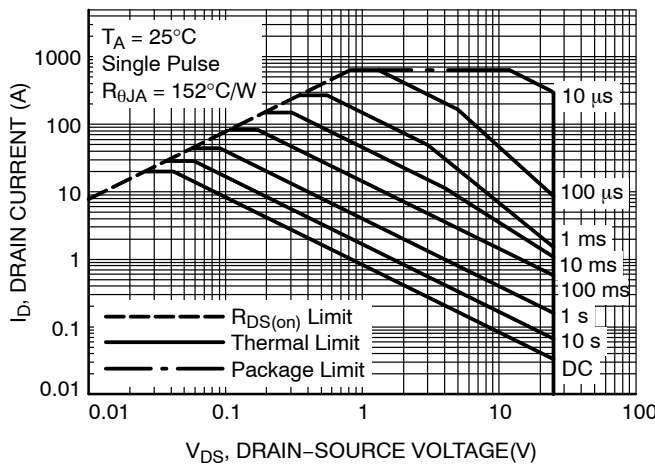


Figure 11. Safe Operating Area

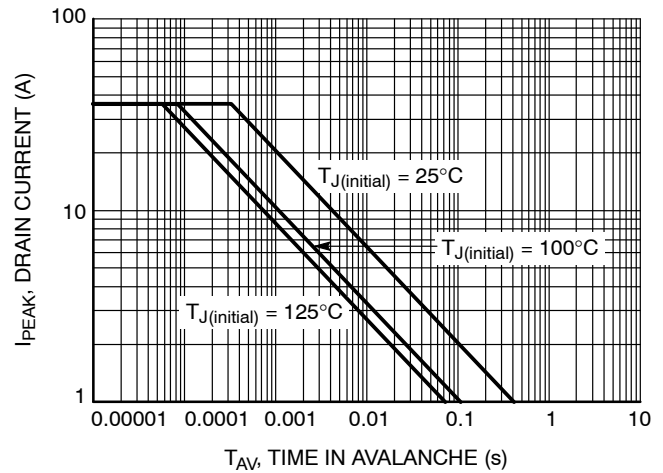


Figure 12.  $I_{PEAK}$  vs. Time in Avalanche

# NTTFS1D8N02P1E

## TYPICAL CHARACTERISTICS

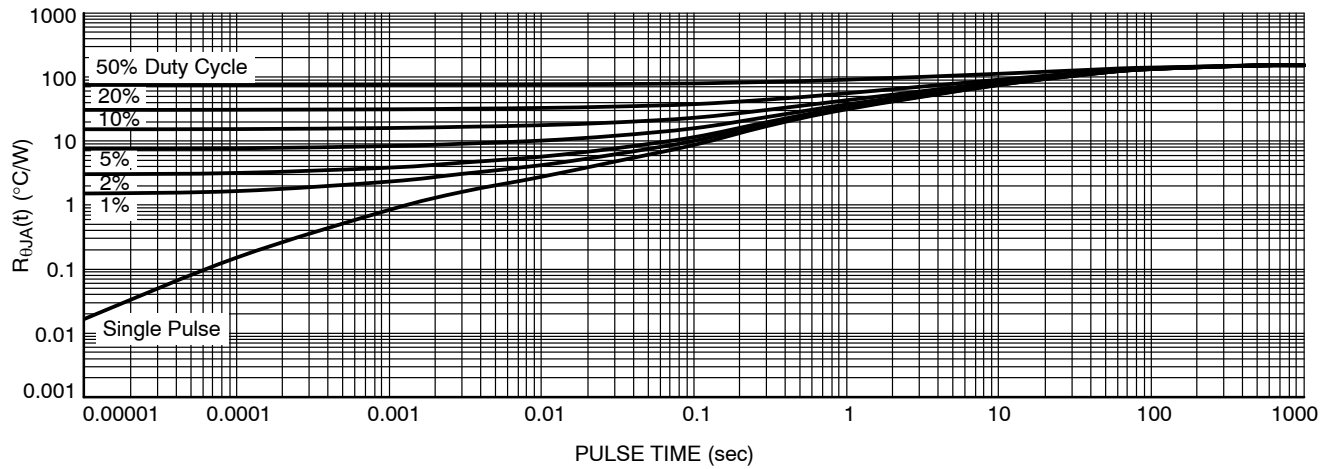


Figure 13. Thermal Characteristics

## ORDERING INFORMATION

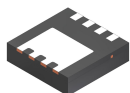
Device	Marking	Package	Shipping <sup>†</sup>
NTTFS1D8N02P1E	2EMN	Power33 (Pb-Free)	3000 / Tape & Reel

<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.

# MECHANICAL CASE OUTLINE

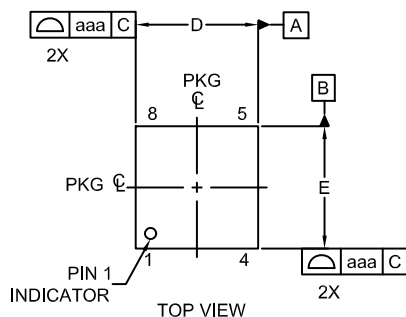
## PACKAGE DIMENSIONS

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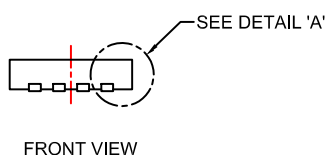


**WDFN8 3.3X3.3, 0.65P**  
CASE 483AW  
ISSUE A

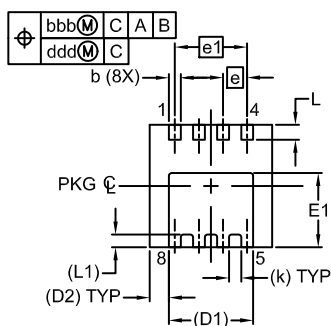
DATE 10 SEP 2019



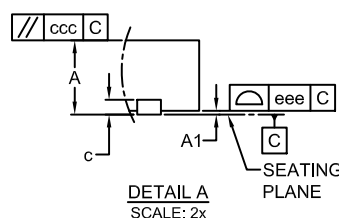
TOP VIEW



FRONT VIEW

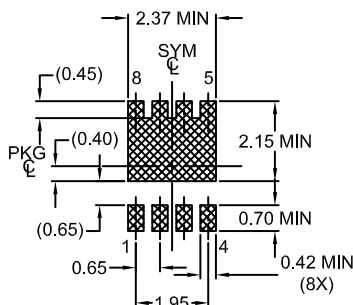


BOTTOM VIEW



DETAIL A  
SCALE: 2x

### 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.

### NOTES:

1. CONTROLLING DIMENSION: MILLIMETERS.
2. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
4. 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.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	-	-	0.05
b	0.27	0.32	0.37
c	0.15	0.20	0.25
D	3.20	3.30	3.40
D1	2.27 REF		
D2	0.52 REF		
E	3.20	3.30	3.40
E1	1.85	1.95	2.05
e	0.65 BSC		
e1	1.95 BSC		
k	0.33 REF		
L	0.30	0.40	0.50
L1	0.34 REF		
aaa	0.10		
bbb	0.10		
ccc	0.10		
ddd	0.05		
eee	0.05		

### GENERIC MARKING DIAGRAM\*



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

\*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.

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DESCRIPTION:	WDFN8 3.3X3.3, 0.65P	PAGE 1 OF 1

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