

MOSFET – N-Channel, POWERTRENCH®

30 V, 88 A, 2.7 mΩ

FDMC86012

General Description

This device has been designed specifically to improve the efficiency of DC/DC converters. Using new techniques in MOSFET construction, the various components of gate charge and capacitance have been optimized to reduce switching losses. Low gate resistance and very low Miller charge enable excellent performance with both adaptive and fixed dead time gate drive circuits. Very low $r_{DS(on)}$ has been maintained to provide a sub logic-level device.

Features

- Max $R_{DS(on)}$ = 2.7 mΩ at V_{GS} = 4.5 V, I_D = 23 A
- Max $R_{DS(on)}$ = 4.7 mΩ at V_{GS} = 2.5 V, I_D = 17.5 A
- High Performance Technology for Extremely low $R_{DS(on)}$
- Termination is Lead-free
- 100% UIL Tested
- Pb-Free, Halide Free and RoHS Compliant

Applications

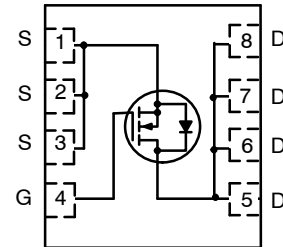
- 3.3 V Input Synchronous Buck Switch
- Synchronous Rectifier

MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

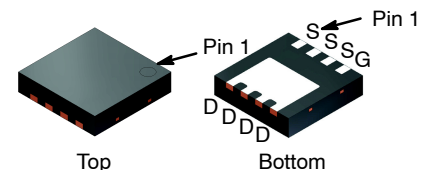
Symbol	Parameter	Value	Unit
V_{DS}	Drain to Source Voltage	30	V
V_{GS}	Gate to Source Voltage	±12	V
I_D	Drain Current: Continuous, T_C = 25°C Continuous, T_A = 25°C (Note 1a) Pulsed (Note 4)	88 23 230	A
E_{AS}	Single Pulse Avalanche Energy (Note 3)	337	mJ
P_D	Power Dissipation: T_C = 25°C T_A = 25°C (Note 1a)	54 2.3	W
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to +150	°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_{DS}	$R_{DS(on)}$ MAX	I_D MAX
30 V	2.7 mΩ @ 4.5 V	88 A
	4.7 mΩ @ 2.5 V	

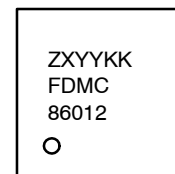


N-CHANNEL MOSFET



WDFN8 3.3 × 3.3, 0.65P
CASE 483AW

MARKING DIAGRAM



- Z = Assembly Plant Code
 XYY = 3-Digit Date Code Format
 KK = 2-Alphanumeric Lot Run Traceability Code
 FDMC86012 = Specific Device Code

ORDERING INFORMATION

Device	Package	Shipping†
FDMC86012	WDFN8 (Pb-Free, Halide Free)	3000 / Tape & Reel

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

THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case (Note 1)	2.3	$^{\circ}\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	53	

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

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

BV_{DSS}	Drain to Source Breakdown Voltage	$I_D = 250\ \mu\text{A}$, $V_{GS} = 0\ \text{V}$	30	–	–	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, referenced to 25°C	–	43	–	$\text{mV}/^{\circ}\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 24\ \text{V}$, $V_{GS} = 0\ \text{V}$	–	–	1	μA
I_{GSS}	Gate to Source Leakage Current	$V_{GS} = \pm 12\ \text{V}$, $V_{DS} = 0\ \text{V}$	–	–	± 100	nA

ON CHARACTERISTICS

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 250\ \mu\text{A}$	0.8	1.0	1.5	V
$\Delta V_{GS(th)} / \Delta T_J$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, referenced to 25°C	–	–4	–	$\text{mV}/^{\circ}\text{C}$
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 4.5\ \text{V}$, $I_D = 23\ \text{A}$	–	2.2	2.7	$\text{m}\Omega$
		$V_{GS} = 2.5\ \text{V}$, $I_D = 17.5\ \text{A}$	–	3.4	4.7	
		$V_{GS} = 4.5\ \text{V}$, $I_D = 23\ \text{A}$, $T_J = 125^{\circ}\text{C}$	–	3.5	4.3	
g_{FS}	Forward Transconductance	$V_{DD} = 5\ \text{V}$, $I_D = 23\ \text{A}$	–	144	–	S

DYNAMIC CHARACTERISTICS

C_{iss}	Input Capacitance	$V_{DS} = 15\ \text{V}$, $V_{GS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	–	3625	5075	pF
C_{oss}	Output Capacitance		–	1230	1725	pF
C_{rss}	Reverse Transfer Capacitance		–	185	260	pF
R_g	Gate Resistance		0.1	0.9	3.0	Ω

SWITCHING CHARACTERISTICS

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 15\ \text{V}$, $I_D = 23\ \text{A}$, $V_{GS} = 4.5\ \text{V}$, $R_{GEN} = 6\ \Omega$	–	20	32	ns
t_r	Rise Time		–	11	20	ns
$t_{d(off)}$	Turn-Off Delay Time		–	43	69	ns
t_f	Fall Time		–	8	16	ns
$Q_{g(TOT)}$	Total Gate Charge	$V_{GS} = 0\ \text{V}$ to $4.5\ \text{V}$, $V_{DD} = 15\ \text{V}$, $I_D = 23\ \text{A}$	–	27	38	nC
		$V_{GS} = 0\ \text{V}$ to $2.5\ \text{V}$, $V_{DD} = 15\ \text{V}$, $I_D = 23\ \text{A}$	–	16	23	nC
Q_{gs}	Gate to Source Charge	$V_{DD} = 15\ \text{V}$, $I_D = 23\ \text{A}$	–	5.8	–	nC
Q_{gd}	Gate to Drain "Miller" Charge	$V_{DD} = 15\ \text{V}$, $I_D = 23\ \text{A}$	–	5.4	–	nC

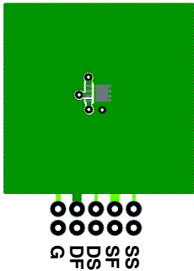
ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise noted) (continued)

Symbol	Parameter	Test Condition	Min	Typ	Max	Unit
DRAIN-SOURCE DIODE CHARACTERISTICS						
V_{SD}	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 23\text{ A}$ (Note 2)	–	0.8	1.3	V
		$V_{GS} = 0\text{ V}, I_S = 1.9\text{ A}$ (Note 2)	–	0.7	1.2	
t_{rr}	Reverse Recovery Time	$I_F = 23\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$	–	40	64	ns
Q_{rr}	Reverse Recovery Charge		–	23	37	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.

NOTES:

- $R_{\theta JA}$ is determined with the device mounted on a 1 in² pad 2 oz copper pad on a 1.5 x 1.5 in. board of FR-4 material. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



a) $53^\circ\text{C}/\text{W}$ when mounted on a 1 in² pad of 2 oz copper.



b) $125^\circ\text{C}/\text{W}$ when mounted on a minimum pad of 2 oz copper.

- Pulse Test: Pulse Width < 300 μs , Duty cycle < 2.0%.
- E_{AS} of 337 mJ is based on starting $T_J = 25^\circ\text{C}$; N-ch: $L = 3\text{ mH}$, $I_{AS} = 15\text{ A}$, $V_{DD} = 30\text{ V}$, $V_{GS} = 10\text{ V}$. 100% test at $L = 0.3\text{ mH}$, $I_{AS} = 33\text{ A}$.
- Pulsed I_d limited by junction temperature, $t_d \leq 100\text{ }\mu\text{s}$, please refer to SOA curve for more details.

TYPICAL CHARACTERISTICS

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

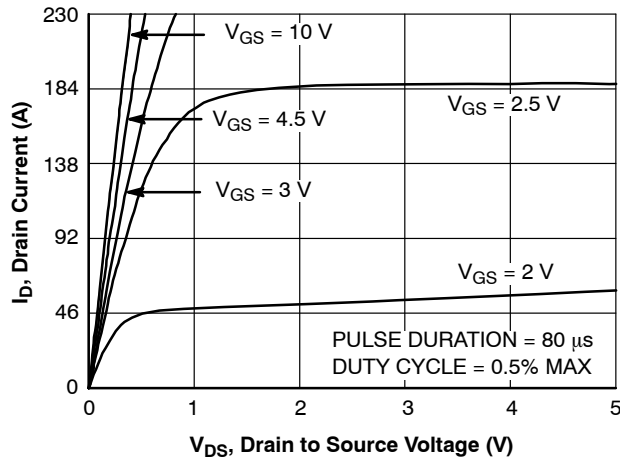


Figure 1. On-Region Characteristics

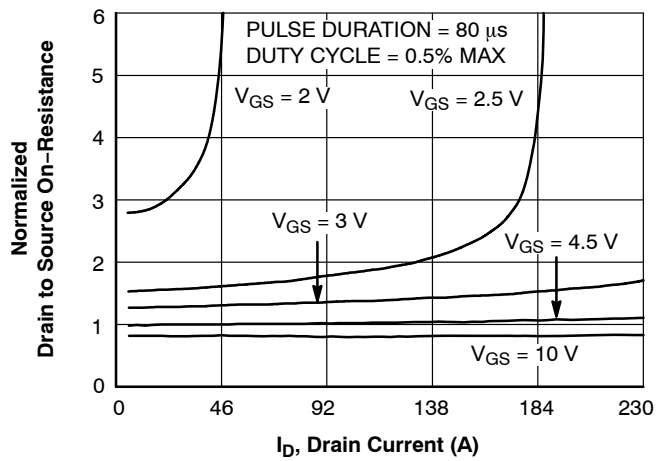


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

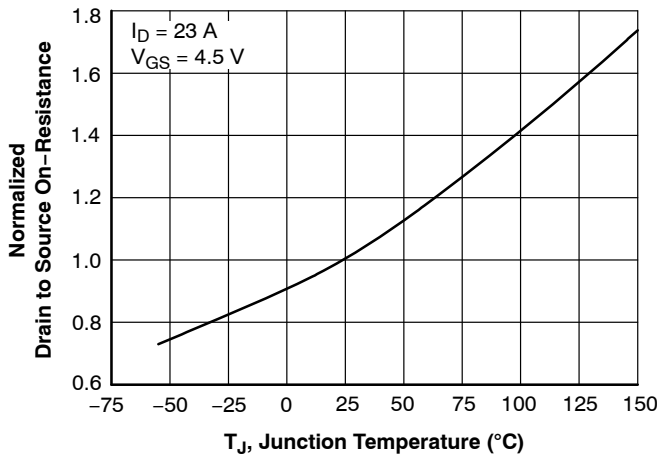


Figure 3. Normalized On-Resistance vs. Junction Temperature

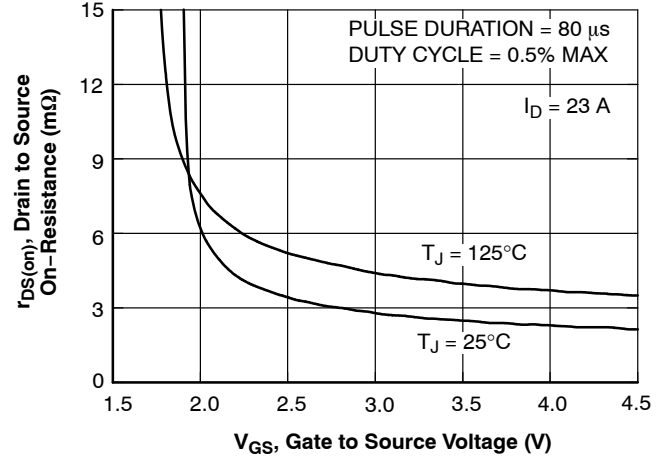


Figure 4. On-Resistance vs. Gate to Source Voltage

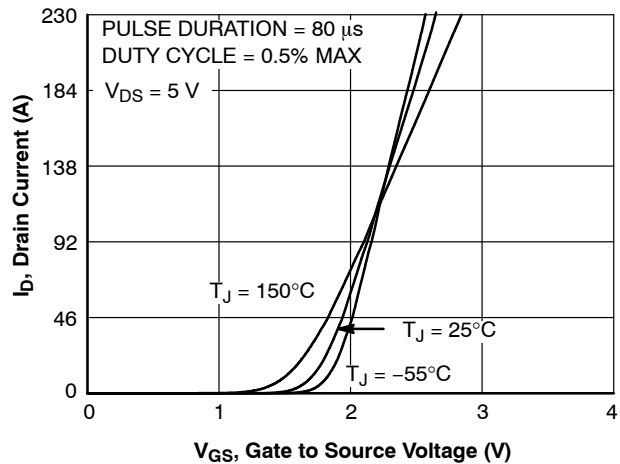


Figure 5. Transfer Characteristics

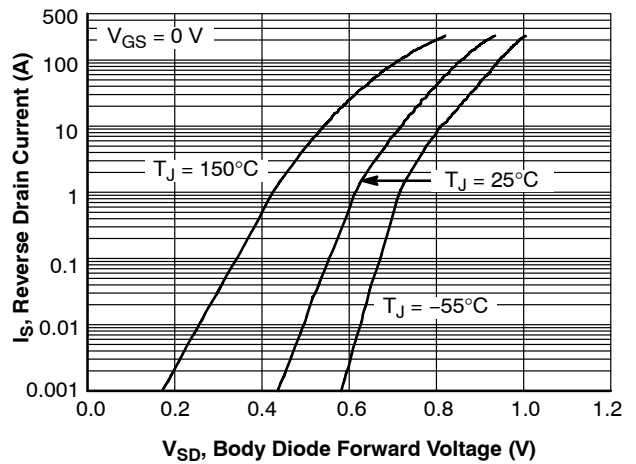


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

TYPICAL CHARACTERISTICS (continued)

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

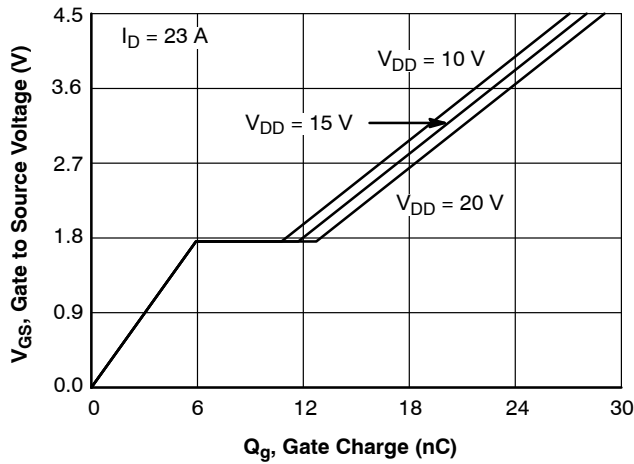


Figure 7. Gate Charge Characteristics

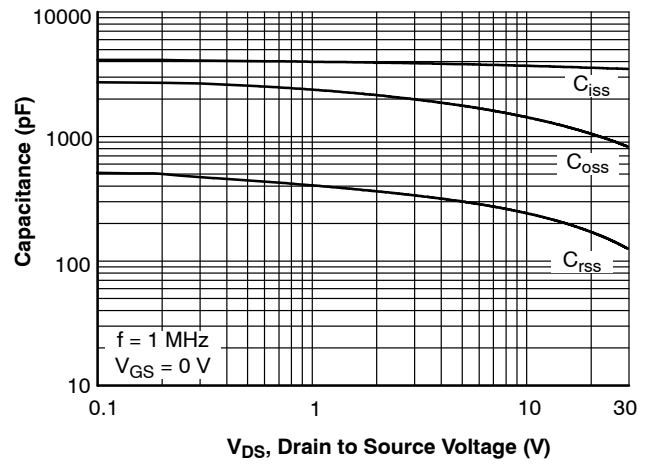


Figure 8. Capacitance vs. Drain to Source Voltage

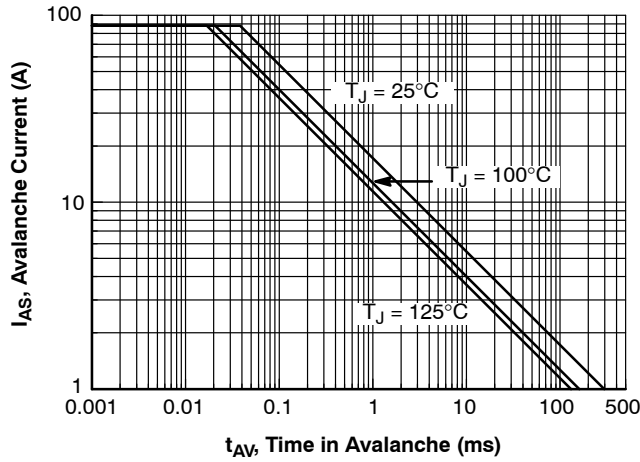


Figure 9. Unclamped Inductive Switching Capability

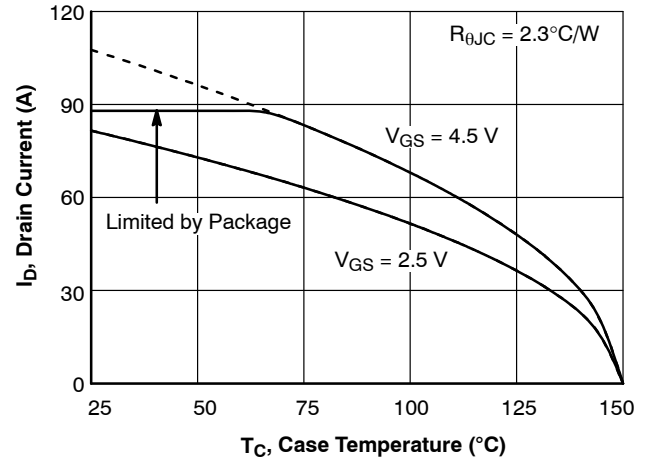


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

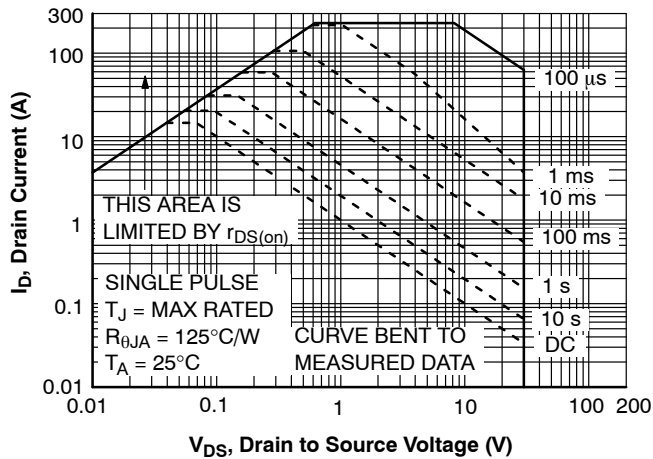


Figure 11. Forward Bias Safe Operating Area

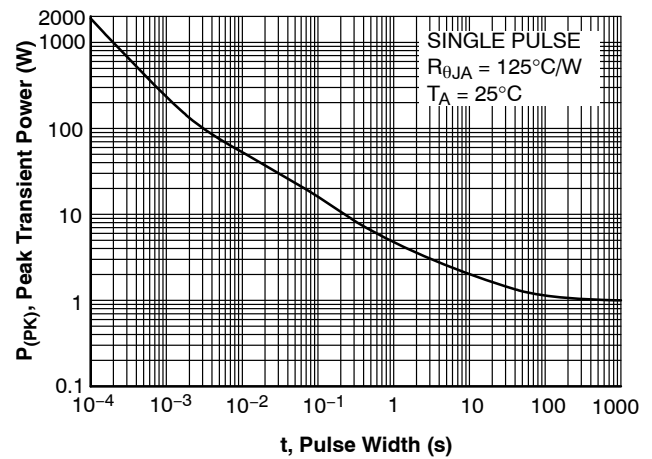


Figure 12. Single Pulse Maximum Power Dissipation

TYPICAL CHARACTERISTICS (continued)

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

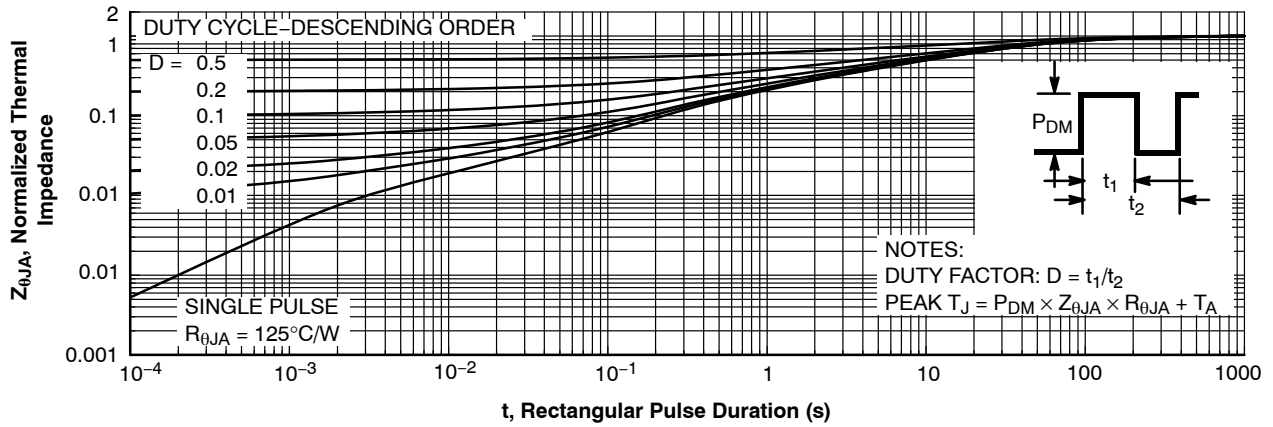
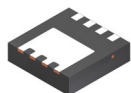
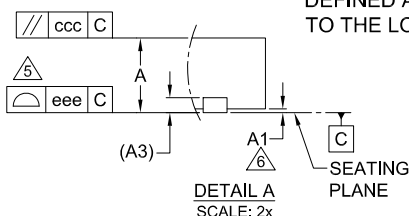
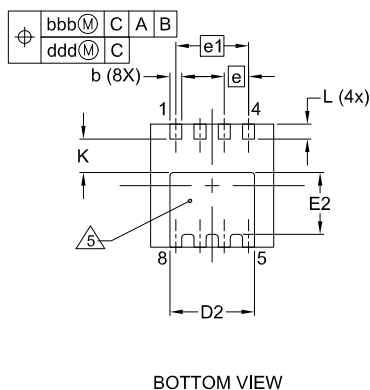
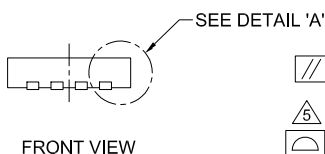
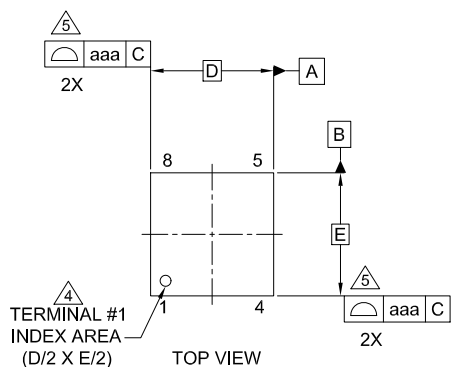


Figure 13. Junction-to-Ambient Transient Thermal Response Curve

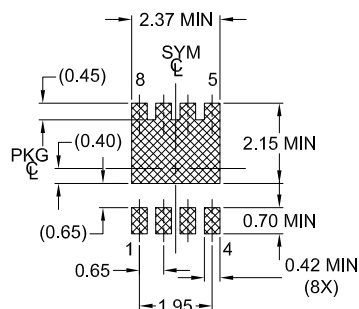


WDFN8 3.30x3.30x0.75, 0.65P
CASE 483AW
ISSUE B

DATE 22 MAR 2024



LAND PATTERN
RECOMMENDATION



NOTES:

1. DIMENSIONING AND TOLERANCING CONFORM TO ASME Y14.5-2018.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
4. THE TERMINAL #1 IDENTIFIER AND TERMINAL NUMBERING CONVENTION SHALL CONFORM TO JEP95 SEC. 3 SPP-12. DETAILS OF TERMINAL #1 IDENTIFIER ARE OPTIONAL, BUT MUST BE LOCATED WITHIN THE ZONE INDICATED. THE TERMINAL #1 IDENTIFIER MAY BE EITHER A MOLD, EMBEDDED METAL OR MARKED FEATURE.
5. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.
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.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	--	--	0.05
A3	0.20 REF		
b	0.27	0.32	0.37
D	3.30 BSC		
D2	2.17	2.27	2.37
E	3.30 BSC		
E2	1.56	1.66	1.76
e	0.65 BSC		
e1	1.95 BSC		
K	0.90	--	--
L	0.30	0.40	0.50
aaa	0.10		
bbb	0.10		
ccc	0.10		
ddd	0.05		
eee	0.05		

*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

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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