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MOSFET – N-Channel, Shielded Gate, POWER TRENCH®

100 V, 57 A, 8.5 mΩ

FDMC86184

Description

This N-Channel logic MV MOSFETs is produced using onsemi advanced POWERTRENCH process that incorporates Shielded Gate technology. This process has been optimized to minimize on-state resistance and yet maintain superior switching performance with best in class soft body diode.

Features

- Shielded Gate MOSFET Technology
- Max $R_{DS(on)}$ = 8.5 mΩ at V_{GS} = 10 V, I_D = 21 A
- Max $R_{DS(on)}$ = 24.8 mΩ at V_{GS} = 6.5 V, I_D = 10 A
- 50% Lower Q_{rr} than Osthier MOSFET Supplier
- Lowers Switching Noise/EMI
- MSL1 Robust Package Design
- 100% UIL Tested
- ESD Protection Level : HBM>1kV, CDM>2kV
- These Device is Pb-Free and RoHS Compliant

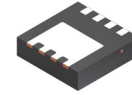
Typical Applications or Applications

- Primary DC-DC MOSFET
- Synchronous Rectifier in DC-DC and AC-DC
- Motor Drive
- Solar

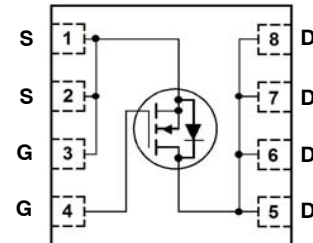
MOSFET MAXIMUM RATINGS T_A = 25°C unless otherwise noted

Symbol	Parameter	Ratings	Unit
V_{DS}	Drain to Source Voltage	100	V
V_{GS}	Gate to Source Voltage	±20	V
I_D	Drain Current – Continuous (T_A = 25°C) (Note 5) – Continuous (T_A = 100°C) (Note 5) – Continuous (T_A = 25°C) (Note 1) – Pulsed (Note 4)	57 36 12 266	A
E_{AS}	Single Pulse Avalanche Energy (Note 3)	121	mJ
P_D	Power Dissipation (T_C = 25°C) Power Dissipation (T_A = 25°C) (Note 1)	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.



WDFN8 3.3X3.3, 0.65P
CASE 483AW



MARKING DIAGRAM



FDMC86184 = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping†
FDMC86184	PQFN-8	3000 / 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](#).

THERMAL CHARACTERISTICS

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

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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Off Characteristics

BV_{DSS}	Drain to Source Breakdown Voltage	$I_D = 250\ \mu\text{A}$, $V_{GS} = 0\ \text{V}$	100	–	–	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, referenced to 25°C	–	59	–	$\text{mV}/^{\circ}\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 80\ \text{V}$, $V_{GS} = 0\ \text{V}$	–	–	1	μA
I_{GSS}	Gate to Source Leakage Current	$V_{GS} = \pm 20\ \text{V}$, $V_{DS} = 0\ \text{V}$	–	–	100	nA

On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 110\ \mu\text{A}$	2.0	3.1	4.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 110\ \mu\text{A}$, referenced to 25°C	–	–9	–	$\text{mV}/^{\circ}\text{C}$
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\ \text{V}$, $I_D = 21\ \text{A}$	–	6.4	8.5	m Ω
		$V_{GS} = 6\ \text{V}$, $I_D = 10\ \text{A}$	–	11	24.8	
		$V_{GS} = 10\ \text{V}$, $I_D = 21\ \text{A}$, $T_J = 125^{\circ}\text{C}$	–	11	18	
g_{FS}	Forward Transconductance	$V_{DS} = 5\ \text{V}$, $I_D = 21\ \text{A}$	–	49	–	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 50\ \text{V}$, $V_{GS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	–	1490	2090	pF
C_{oss}	Output Capacitance		–	906	1270	pF
C_{rss}	Reverse Transfer Capacitance		–	13	25	pF
R_g	Gate Resistance		0.1	0.4	1.2	Ω

Switching Characteristics

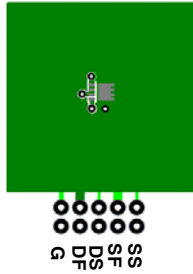
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 50\ \text{V}$, $I_D = 21\ \text{A}$, $V_{GS} = 10\ \text{V}$, $R_{GEN} = 6\ \Omega$	–	12	22	ns
t_r	Rise Time		–	4	10	ns
$t_{d(off)}$	Turn-Off Delay Time		–	17	31	ns
t_f	Fall Time		–	4	10	ns
Q_g	Total Gate Charge	$V_{GS} = 0\ \text{V}$ to $10\ \text{V}$, $V_{DD} = 50\ \text{V}$, $I_D = 21\ \text{A}$	–	21	30	nC
Q_g	Total Gate Charge	$V_{GS} = 0\ \text{V}$ to $6\ \text{V}$, $V_{DD} = 50\ \text{V}$, $I_D = 21\ \text{A}$	–	14	20	nC
Q_{gs}	Total Gate Charge	$V_{DD} = 50\ \text{V}$, $I_D = 21\ \text{A}$	–	6.5	–	nC
Q_{gd}	Gate to Drain “Miller” Charge	$V_{DD} = 50\ \text{V}$, $I_D = 21\ \text{A}$	–	4.6	–	nC
Q_{oss}	Output Charge	$V_{DD} = 50\ \text{V}$, $V_{GS} = 0\ \text{V}$	–	61	–	nC

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Drain–Source Diode Characteristics						
V_{SD}	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 2.1\text{ A}$ (Note 2)	–	0.7	1.2	V
		$V_{GS} = 0\text{ V}, I_S = 21\text{ A}$ (Note 2)	–	0.8	1.3	
t_{rr}	Reverse Recovery Time	$I_F = 10\text{ A}, di/dt = 300\text{ A}/\mu\text{s}$	–	27	44	ns
Q_{rr}	Reverse Recovery Charge		–	46	74	nC
t_{rr}	Reverse Recovery Time	$I_F = 10\text{ A}, di/dt = 1000\text{ A}/\mu\text{s}$	–	21	34	ns
Q_{rr}	Reverse Recovery Time		–	96	154	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.

- $R_{\theta JA}$ is determined with the device mounted on a 1 in² oz. copper pad on a 1.5 x 1.5 in. board of FR-4 material $R_{\theta CA}$ 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 us, Duty Cycle < 2.0%
- E_{AS} of 121 mJ is based on starting $T_J = 25^\circ\text{C}$; N-ch: $L = 3\text{ mH}$, $I_{AS} = 9\text{ A}$, $V_{DD} = 100\text{ V}$, $V_{GS} = 10\text{ V}$. 100% test at $L = 0.3\text{ mH}$, $I_{AS} = 21\text{ A}$.
- Pulsed I_d please refer to Figure 11 SOA graph for more details.
- Computed continuous current limited to Max Junction Temperature only, actual continuous current will be limited by thermal & electro-mechanical application board design.

TYPICAL CHARACTERISTICS

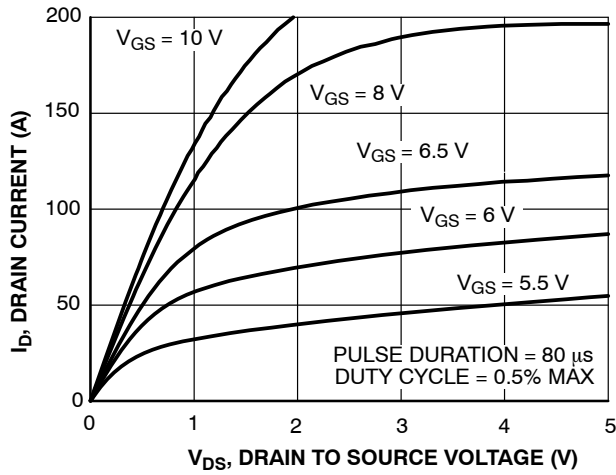


Figure 1. On-Region Characteristics

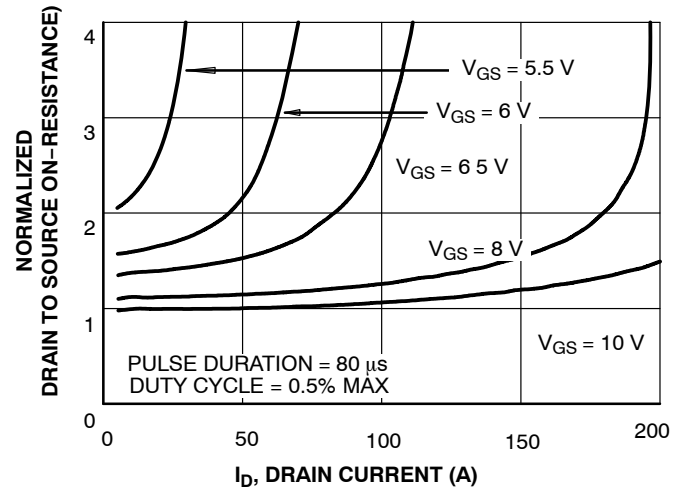


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

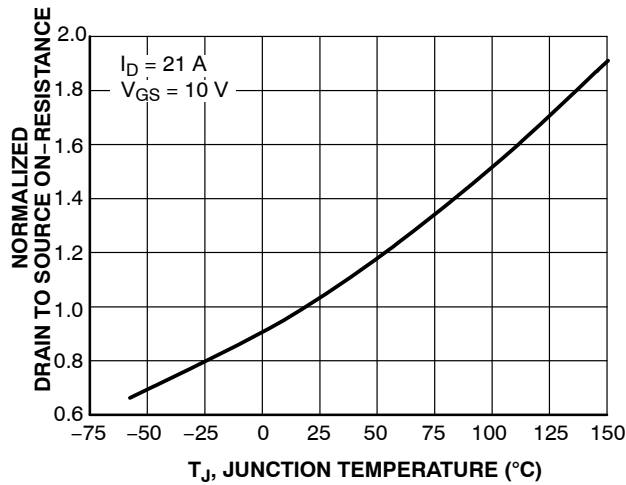


Figure 3. Normalized On-Resistance vs. Junction Temperature

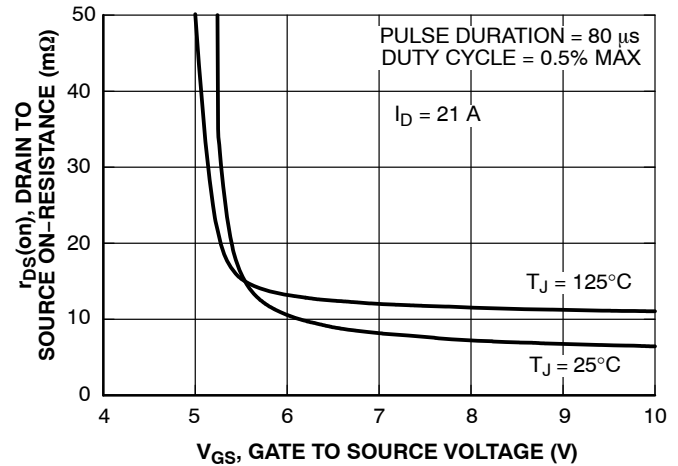


Figure 4. On-Resistance vs. Gate to Source Voltage

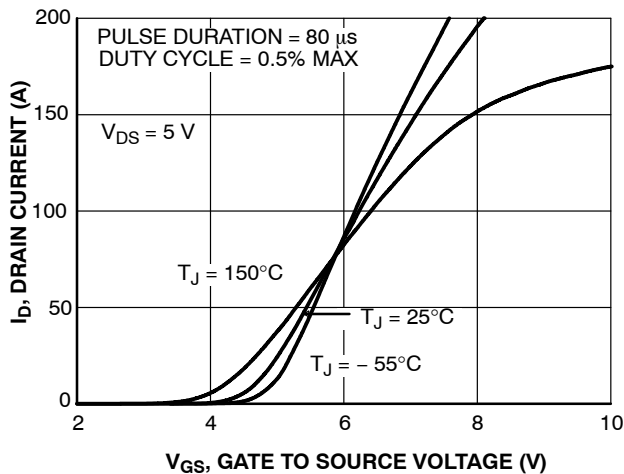


Figure 5. Transfer Characteristics

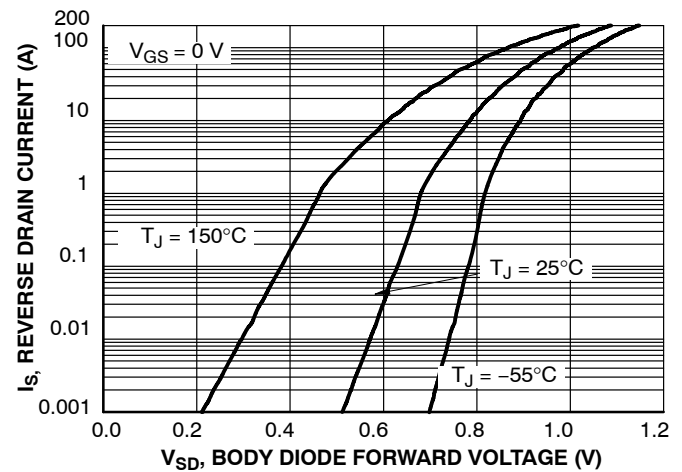


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

TYPICAL CHARACTERISTICS (CONTINUED)

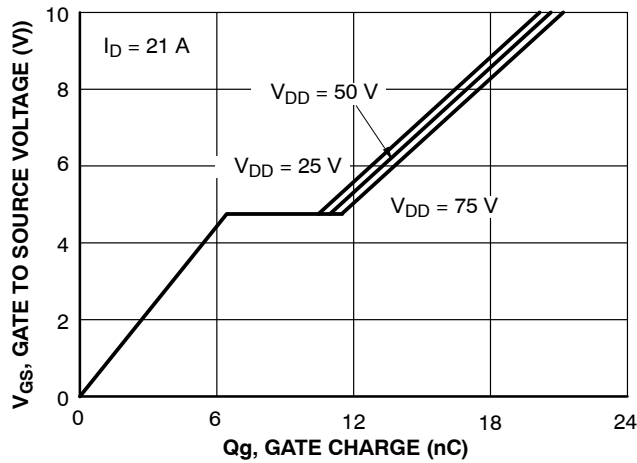


Figure 7. Gate Charge Characteristics

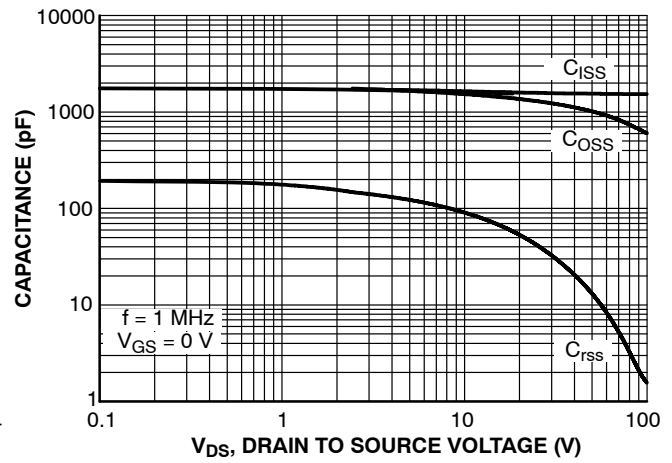


Figure 8. Capacitance vs. Drain to Source Voltage

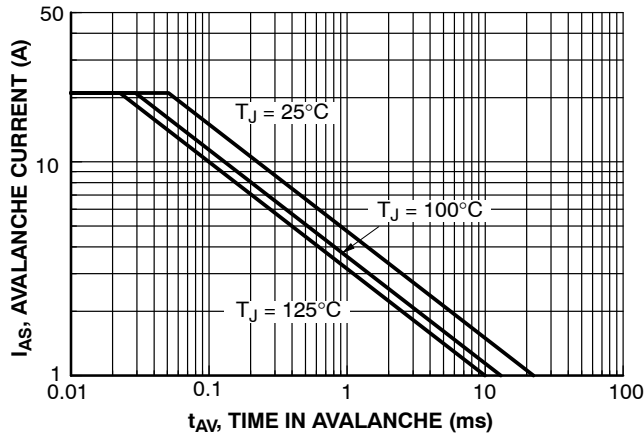


Figure 9. Unclamped Inductive Switching Capability

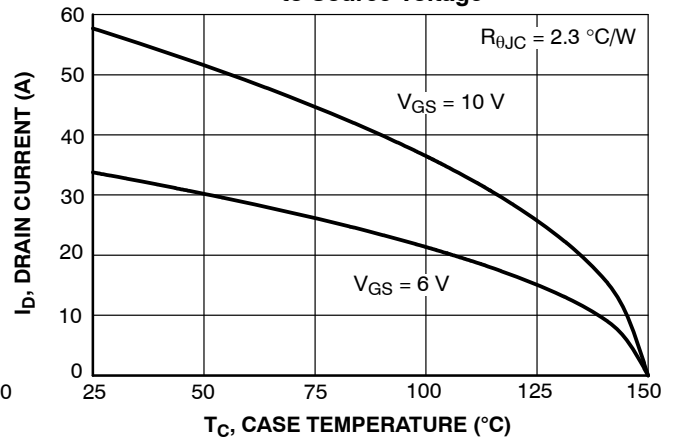


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

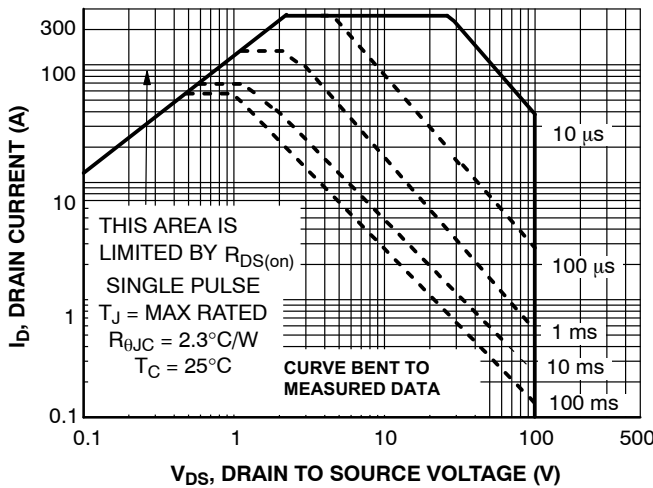


Figure 11. Forward Bias Safe Operating Area

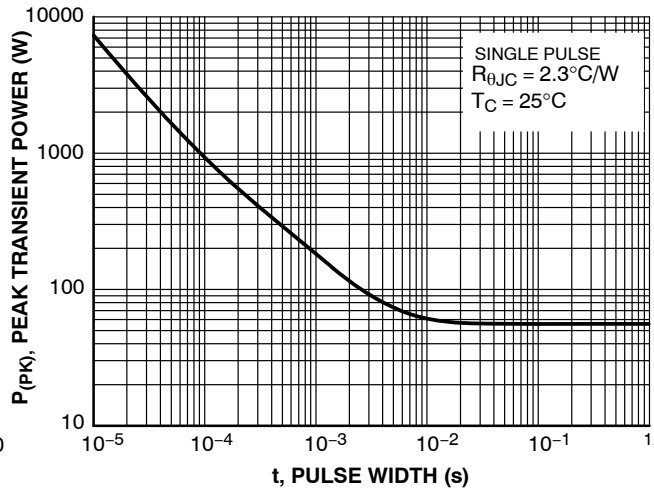


Figure 12. Single Pulse Maximum Power Dissipation

TYPICAL CHARACTERISTICS (CONTINUED)

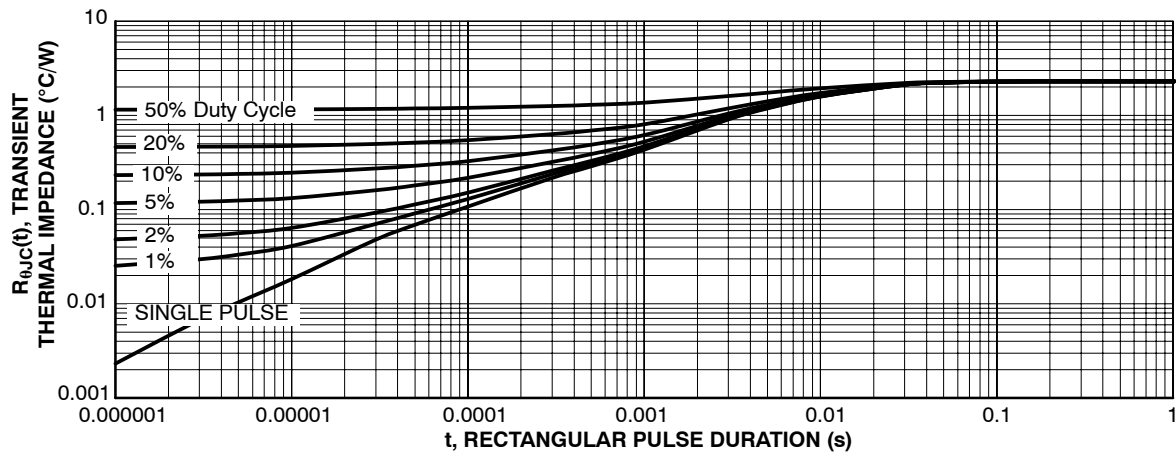
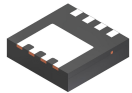


Figure 13. Junction-to-Case Transient Thermal Response Curve

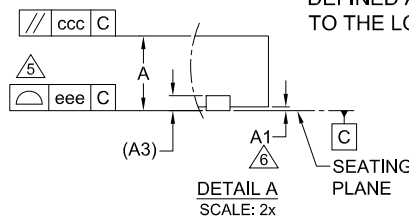
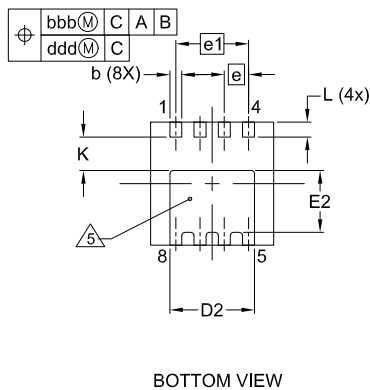
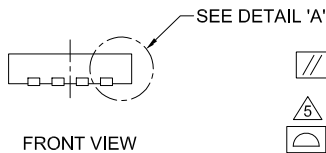
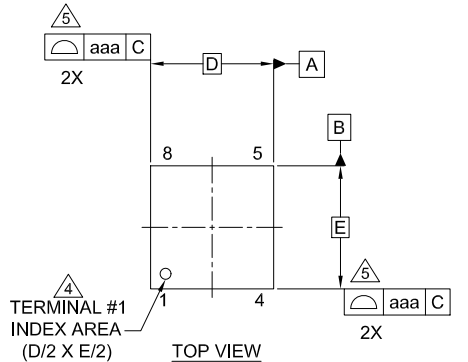
MECHANICAL CASE OUTLINE

PACKAGE DIMENSIONS

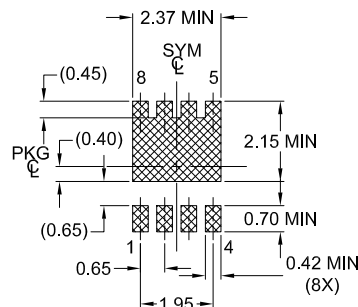


WDFN8 3.30x3.30x0.75, 0.65P
CASE 483AW
ISSUE B

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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