

# 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

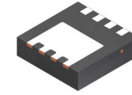
### Typical Applications or Applications

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

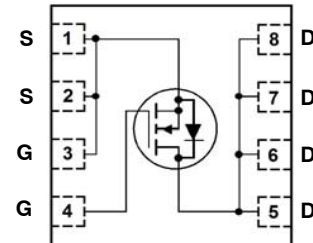
### MOSFET MAXIMUM RATINGS $T_A$ = 25°C unless otherwise noted

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 $25^{\circ}\text{C}$	–	59	–	$\text{mV}/^{\circ}\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 80\ \text{V}$ , $V_{GS} = 0\ \text{V}$	–	–	1	$\mu\text{A}$
$I_{GSS}$	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 $25^{\circ}\text{C}$	–	–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 $\Omega$
		$V_{GS} = 6\ \text{V}$ , $I_D = 10\ \text{A}$	–	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	$\Omega$

## Switching Characteristics

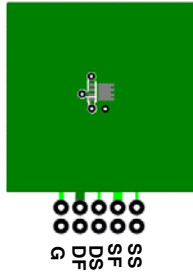
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 50\ \text{V}$ , $I_D = 21\ \text{A}$ , $V_{GS} = 10\ \text{V}$ , $R_{GEN} = 6\ \Omega$	–	12	22	ns
$t_r$	Rise Time		–	4	10	ns
$t_{d(off)}$	Turn-Off Delay Time		–	17	31	ns
$t_f$	Fall Time		–	4	10	ns
$Q_g$	Total Gate Charge	$V_{GS} = 0\ \text{V}$ to $10\ \text{V}$ , $V_{DD} = 50\ \text{V}$ , $I_D = 21\ \text{A}$	–	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
<b>Drain–Source Diode Characteristics</b>						
$V_{SD}$	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 in<sup>2</sup> 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 in<sup>2</sup> 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  $\mu\text{s}$ , 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

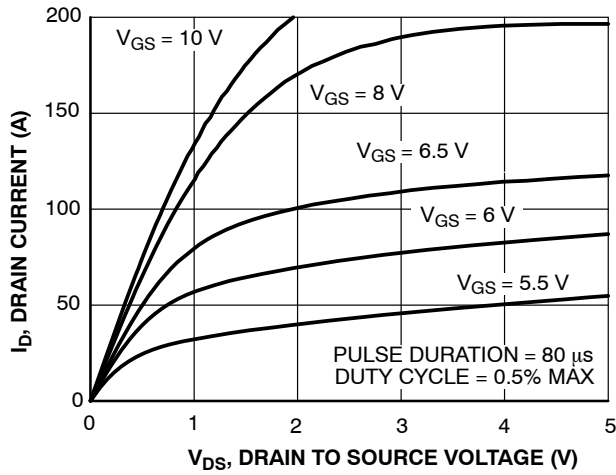


Figure 1. On-Region Characteristics

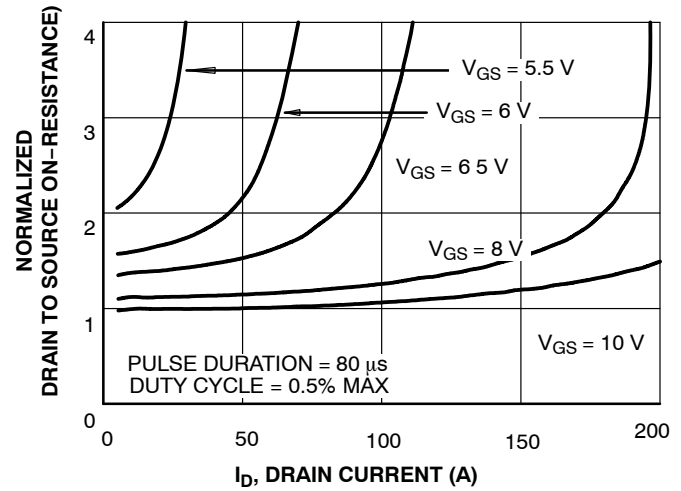


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

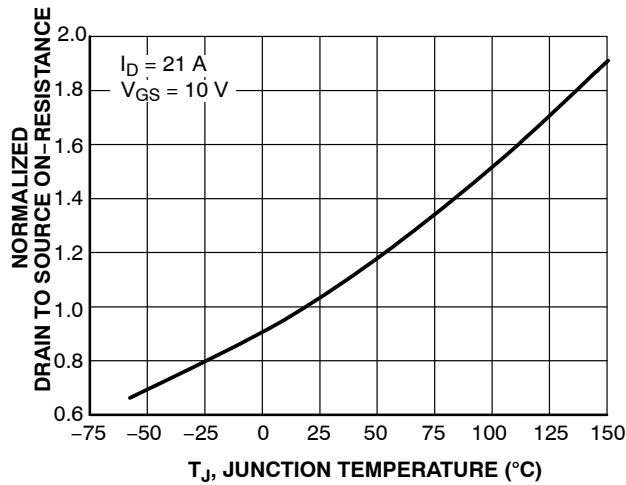


Figure 3. Normalized On-Resistance vs. Junction Temperature

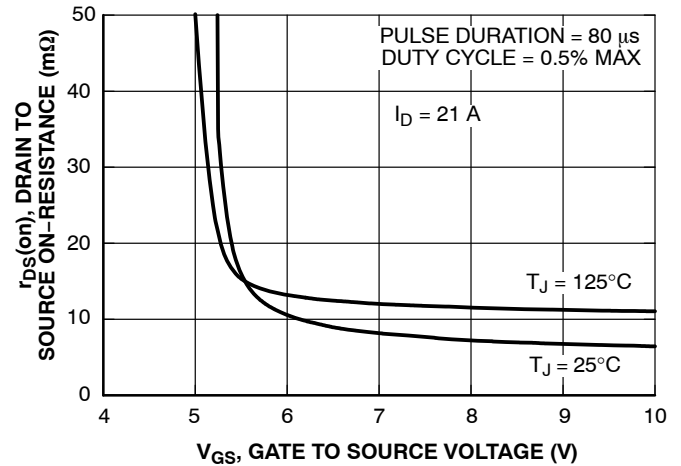


Figure 4. On-Resistance vs. Gate to Source Voltage

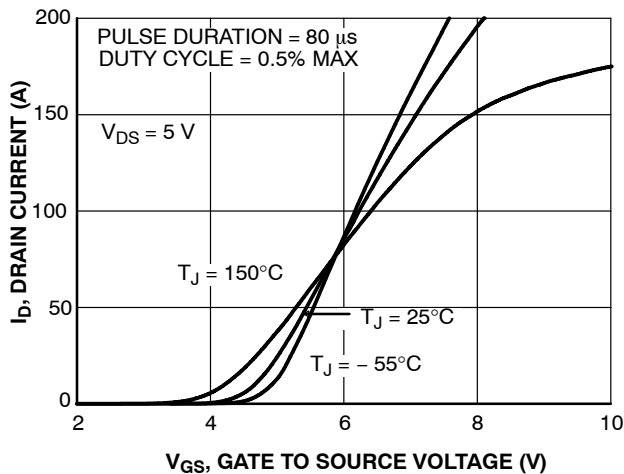


Figure 5. Transfer Characteristics

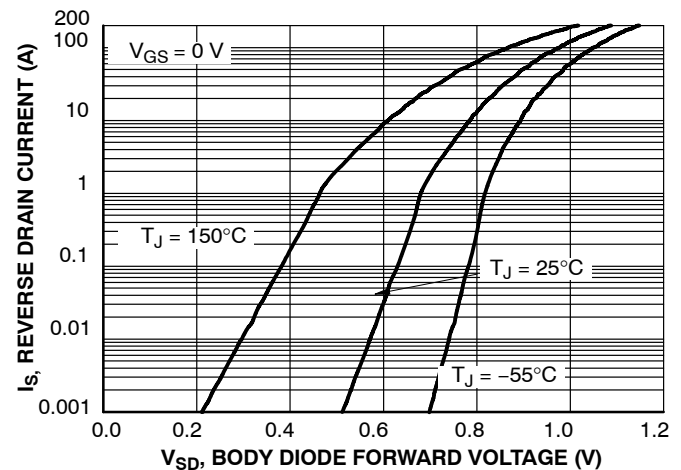


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

TYPICAL CHARACTERISTICS (CONTINUED)

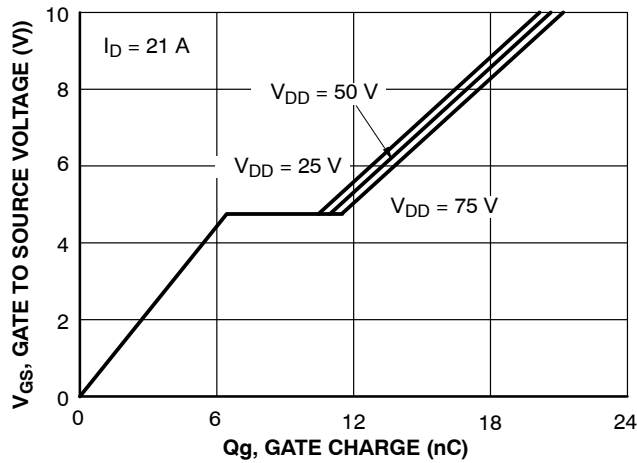


Figure 7. Gate Charge Characteristics

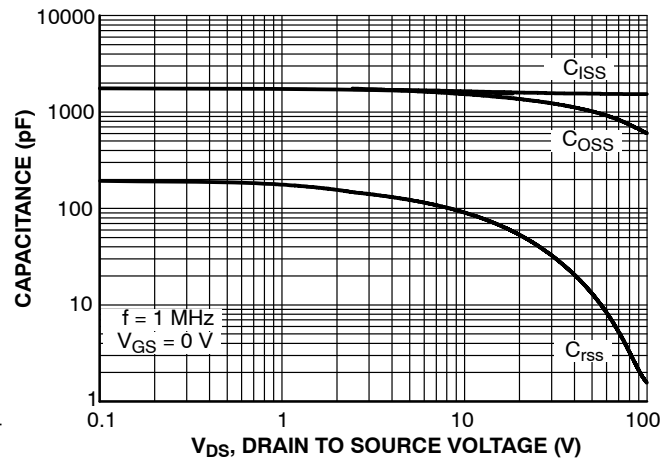


Figure 8. Capacitance vs. Drain to Source Voltage

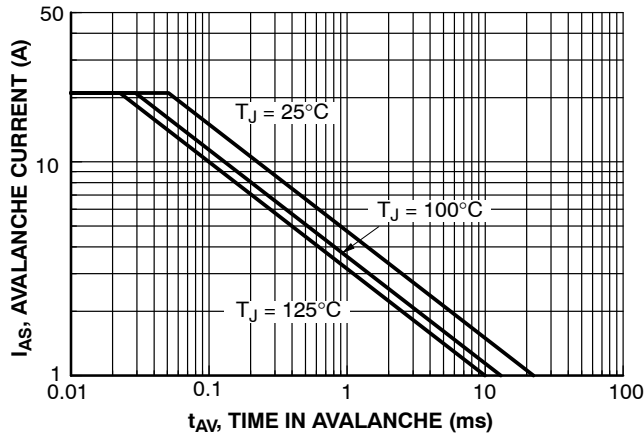


Figure 9. Unclamped Inductive Switching Capability

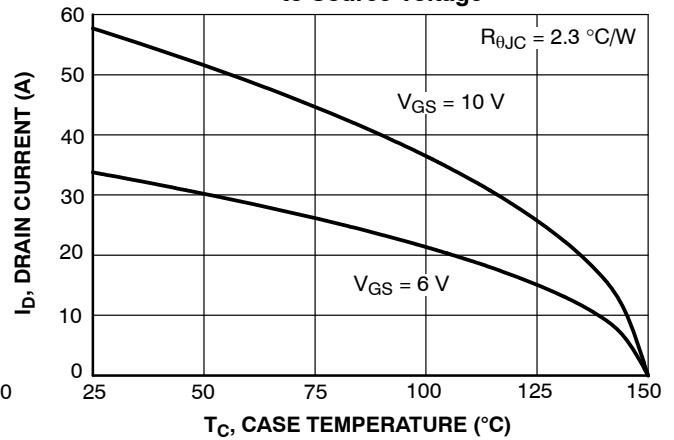


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

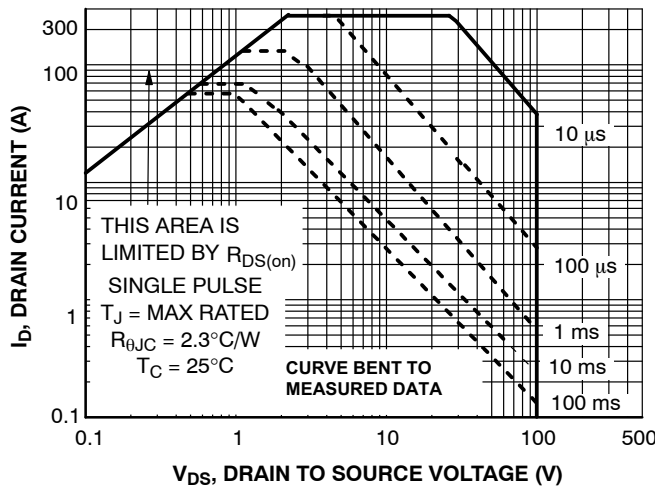


Figure 11. Forward Bias Safe Operating Area

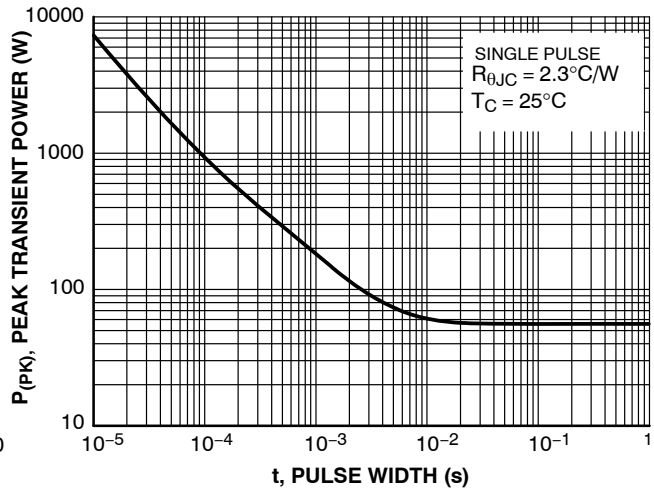


Figure 12. Single Pulse Maximum Power Dissipation

## TYPICAL CHARACTERISTICS (CONTINUED)

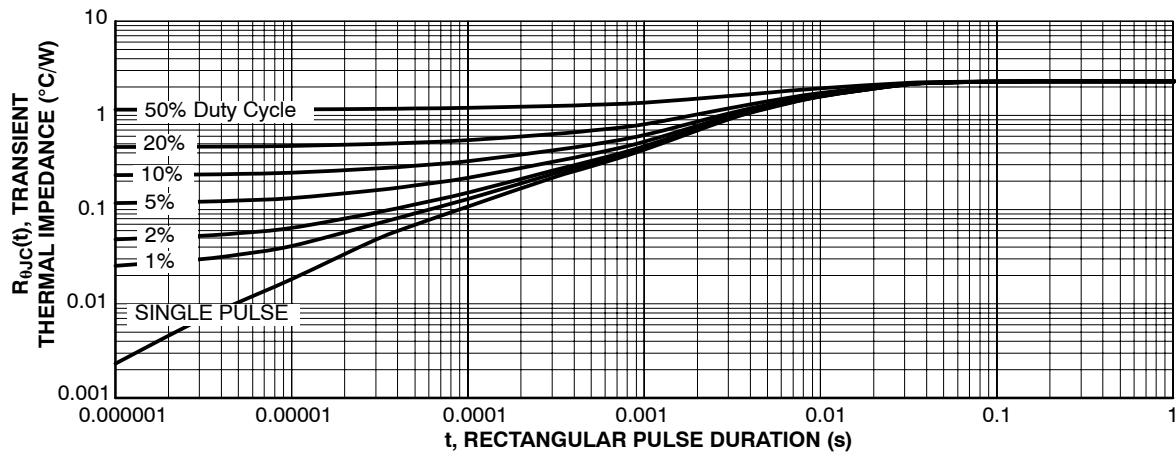
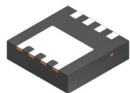
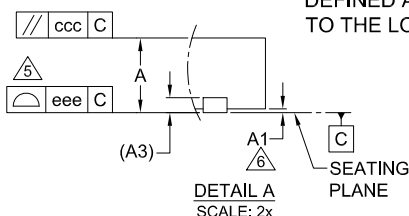
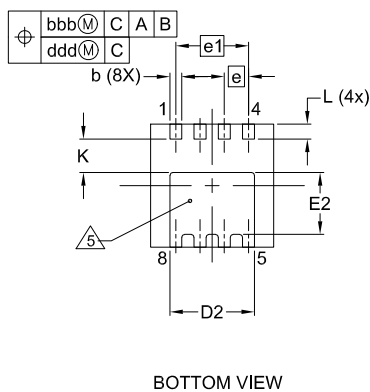
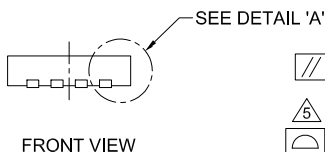
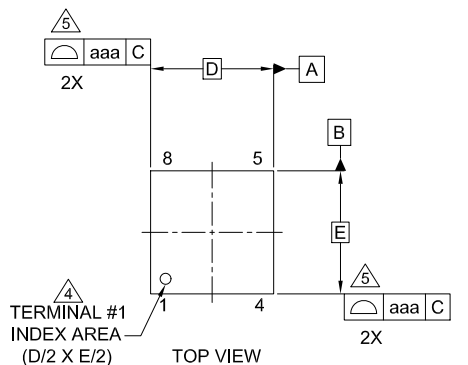
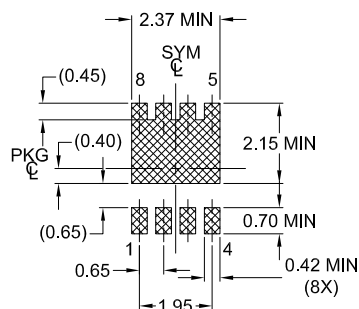


Figure 13. Junction-to-Case Transient Thermal Response Curve


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

DATE 22 MAR 2024


**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. 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		

**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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