

# MOSFET – N-Channel, Shielded Gate, POWER trench®

100 V, 43 A, 14 mΩ

## FDMC86160ET100

### General Description

This N-Channel MOSFET is produced using onsemi's advanced POWER trench process that incorporates Shielded Gate technology. This process has been optimized for the on-state resistance. This device is well suited for applications where ultra low  $r_{DS(on)}$  is required in small spaces such as High performance VRM, POL and orring functions.

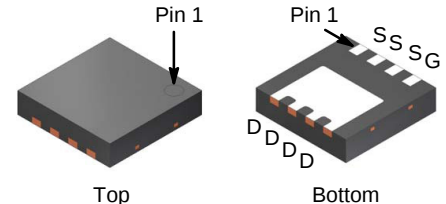
### Features

- Extended  $T_J$  Rating to 175°C
- Shielded Gate MOSFET Technology
- Max  $r_{DS(on)}$  = 14 mΩ at  $V_{GS} = 10$  V,  $I_D = 9$  A
- Max  $r_{DS(on)}$  = 23 mΩ at  $V_{GS} = 6$  V,  $I_D = 7$  A
- High Performance Technology for Extremely Low  $r_{DS(on)}$
- Termination is Lead-free and RoHS Compliant

### Applications

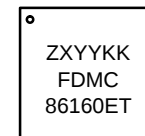
- Bridge Topologies
- Synchronous Rectifier

| $V_{DS}$ | $r_{DS(on)}$ MAX | $I_D$ MAX |
|----------|------------------|-----------|
| 100 V    | 14 mΩ @ 10 V     | 43 A      |
|          | 23 mΩ @ 6 V      |           |



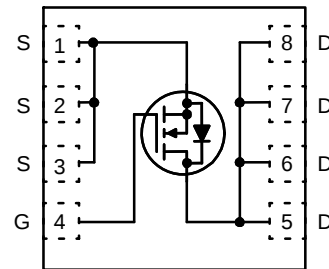
WDFN8 3.3x3.3, 0.65P  
(Power 33)  
CASE 483 AW

### MARKING DIAGRAM



Z = Assembly Plant Code  
XYX = 3-Digit Date Code Format  
KK = 2-Alphanumeric Lot Run Traceability Code  
FDMC86160ET = Device Code

### PIN ASSIGNMENT



### ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

# FDMC86160ET100

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

| Symbol         | Parameter                                                    | Ratings         | Unit             |
|----------------|--------------------------------------------------------------|-----------------|------------------|
| $V_{DS}$       | Drain to Source Voltage                                      | 100             | V                |
| $V_{GS}$       | Gate to Source Voltage                                       | $\pm 20$        | V                |
| $I_D$          | Drain Current – Continuous $T_C = 25^\circ\text{C}$ (Note 5) | 43              | A                |
|                | – Continuous $T_C = 100^\circ\text{C}$ (Note 5)              | 31              |                  |
|                | – Continuous $T_A = 25^\circ\text{C}$ (Note 1a)              | 9               | A                |
|                | – Pulsed (Note 4)                                            | 204             | A                |
| $E_{AS}$       | Single Pulse Avalanche Energy (Note 3)                       | 181             | mJ               |
| $P_D$          | Power Dissipation $T_C = 25^\circ\text{C}$                   | 65              | W                |
|                | Power Dissipation $T_A = 25^\circ\text{C}$ (Note 1a)         | 2.8             |                  |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range             | $-55$ to $+175$ | $^\circ\text{C}$ |

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.

## THERMAL CHARACTERISTICS

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

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

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|--------|-----------|-----------------|-----|-----|-----|------|
|--------|-----------|-----------------|-----|-----|-----|------|

### 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 $25^\circ\text{C}$ | –   | 73 | –         | $\text{mV}/^\circ\text{C}$ |
| $I_{DSS}$                            | 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            | $V_{GS} = \pm 20\ \text{V}, V_{DS} = 0\ \text{V}$           | –   | –  | $\pm 100$ | nA                         |

### ON CHARACTERISTICS

|                                        |                                                          |                                                                     |   |      |    |                            |
|----------------------------------------|----------------------------------------------------------|---------------------------------------------------------------------|---|------|----|----------------------------|
| $V_{GS(th)}$                           | Gate to Source Threshold Voltage                         | $V_{GS} = V_{DS}, I_D = 250\ \mu\text{A}$                           | 2 | 2.9  | 4  | V                          |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D = 250\ \mu\text{A}$ , referenced to $25^\circ\text{C}$         | – | –9   | –  | $\text{mV}/^\circ\text{C}$ |
| $r_{DS(on)}$                           | Static Drain to Source On Resistance                     | $V_{GS} = 10\ \text{V}, I_D = 9\ \text{A}$                          | – | 11.2 | 14 | m $\Omega$                 |
|                                        |                                                          | $V_{GS} = 6\ \text{V}, I_D = 7\ \text{A}$                           | – | 16   | 23 |                            |
|                                        |                                                          | $V_{GS} = 10\ \text{V}, I_D = 9\ \text{A}, T_J = 125^\circ\text{C}$ | – | 21   | 26 |                            |
| $g_{FS}$                               | Forward Transconductance                                 | $V_{DD} = 10\ \text{V}, I_D = 9\ \text{A}$                          | – | 43   | –  | S                          |

### DYNAMIC CHARACTERISTICS

|           |                              |                                                                  |     |     |      |          |
|-----------|------------------------------|------------------------------------------------------------------|-----|-----|------|----------|
| $C_{iss}$ | Input Capacitance            | $V_{DS} = 50\ \text{V}, V_{GS} = 0\ \text{V}, f = 1\ \text{MHz}$ | –   | 968 | 1290 | pF       |
| $C_{oss}$ | Output Capacitance           |                                                                  | –   | 241 | 320  | pF       |
| $C_{rss}$ | Reverse Transfer Capacitance |                                                                  | –   | 11  | 20   | pF       |
| $R_g$     | Gate Resistance              |                                                                  | 0.1 | 0.6 | 2.5  | $\Omega$ |

### SWITCHING CHARACTERISTICS

|              |                     |                                                                                        |   |     |    |    |
|--------------|---------------------|----------------------------------------------------------------------------------------|---|-----|----|----|
| $t_{d(on)}$  | Turn-On Delay Time  | $V_{DD} = 50\ \text{V}, I_D = 9\ \text{A}, V_{GS} = 10\ \text{V}, R_{GEN} = 6\ \Omega$ | – | 9.7 | 19 | ns |
| $t_r$        | Rise Time           |                                                                                        | – | 3.6 | 10 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time |                                                                                        | – | 16  | 30 | ns |
| $t_f$        | Fall Time           |                                                                                        | – | 3.4 | 10 | ns |

# FDMC86160ET100

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

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|--------|-----------|-----------------|-----|-----|-----|------|
|--------|-----------|-----------------|-----|-----|-----|------|

### SWITCHING CHARACTERISTICS

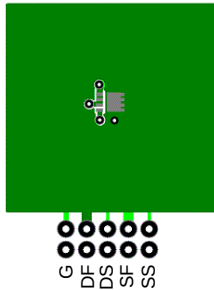
|              |                               |                                                                                    |   |     |    |    |
|--------------|-------------------------------|------------------------------------------------------------------------------------|---|-----|----|----|
| $Q_{g(TOT)}$ | Total Gate Charge             | $V_{GS} = 0\text{ V to }10\text{ V}$ , $V_{DD} = 50\text{ V}$ , $I_D = 9\text{ A}$ | – | 15  | 22 | nC |
| $Q_{g(TOT)}$ | Total Gate Charge             | $V_{GS} = 0\text{ V to }6\text{ V}$ , $V_{DD} = 50\text{ V}$ , $I_D = 9\text{ A}$  | – | 9.8 | 15 | nC |
| $Q_{gs}$     | Total Gate Charge             | $V_{DD} = 50\text{ V}$ , $I_D = 9\text{ A}$                                        | – | 4.4 | –  | nC |
| $Q_{gd}$     | Gate to Drain “Miller” Charge |                                                                                    | – | 3.5 | –  | nC |

### DRAIN-SOURCE DIODE CHARACTERISTICS

|          |                                       |                                                         |   |      |     |    |
|----------|---------------------------------------|---------------------------------------------------------|---|------|-----|----|
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS} = 0\text{ V}$ , $I_S = 9\text{ A}$ (Note 2)     | – | 0.79 | 1.3 | V  |
|          |                                       | $V_{GS} = 0\text{ V}$ , $I_S = 1.9\text{ A}$ (Note 2)   | – | 0.72 | 1.2 |    |
| $t_{rr}$ | Reverse Recovery Time                 | $I_F = 9\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ | – | 47   | 75  | ns |
| $Q_{rr}$ | Reverse Recovery Charge               |                                                         | – | 45   | 73  | 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> pad 2 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 181 mJ is based on starting  $T_J = 25^\circ\text{C}$ ,  $L = 3\text{ mH}$ ,  $I_{AS} = 11\text{ A}$ ,  $V_{DD} = 100\text{ V}$ ,  $V_{GS} = 10\text{ V}$ . 100% test at  $L = 0.1\text{ mH}$ ,  $I_{AS} = 35\text{ A}$ .
- 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 ( $T_J = 25^\circ\text{C}$  unless otherwise noted)

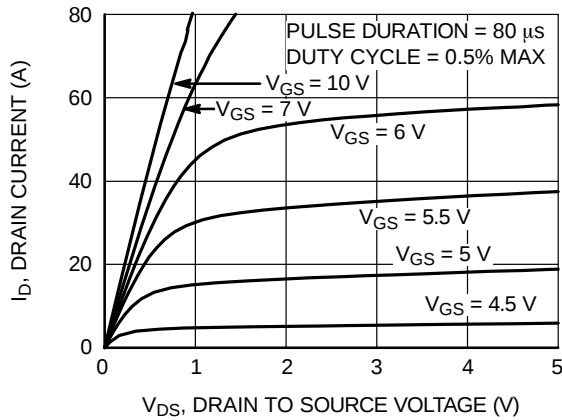


Figure 1. On-Region Characteristics

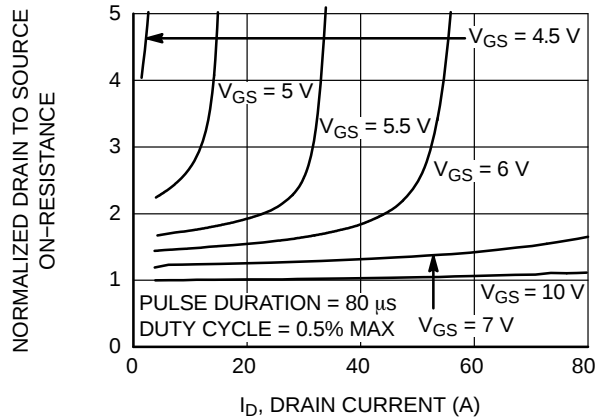


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

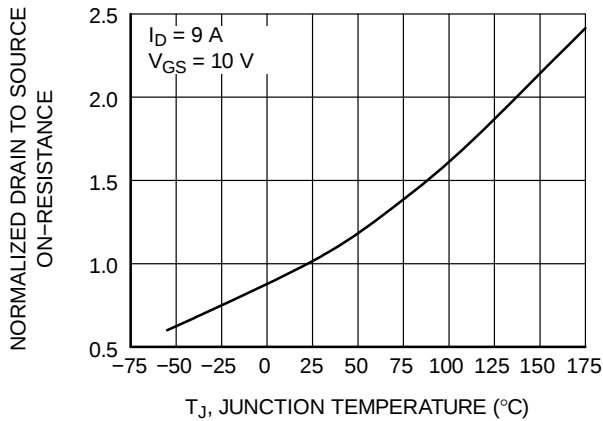


Figure 3. Normalized On-Resistance vs. Junction Temperature

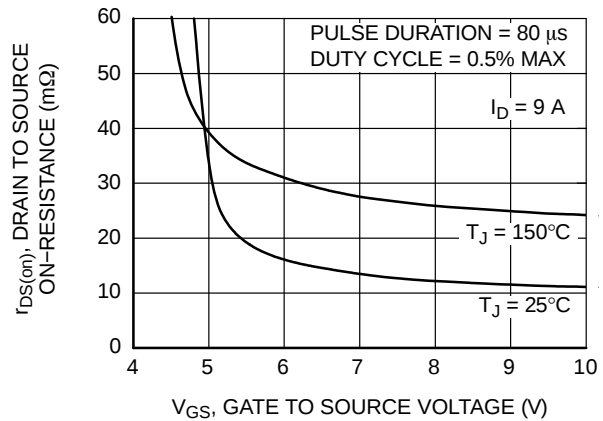


Figure 4. On-Resistance vs. Gate to Source Voltage

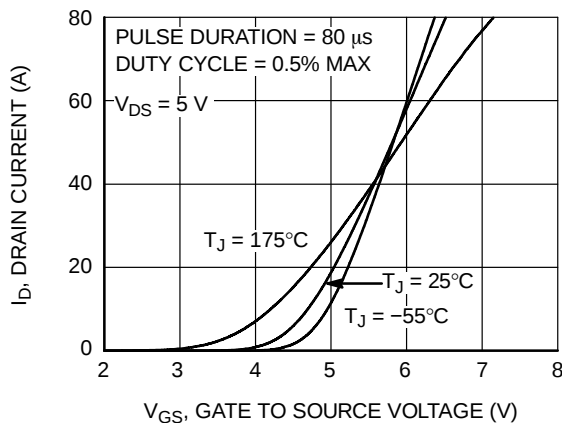


Figure 5. Transfer Characteristics

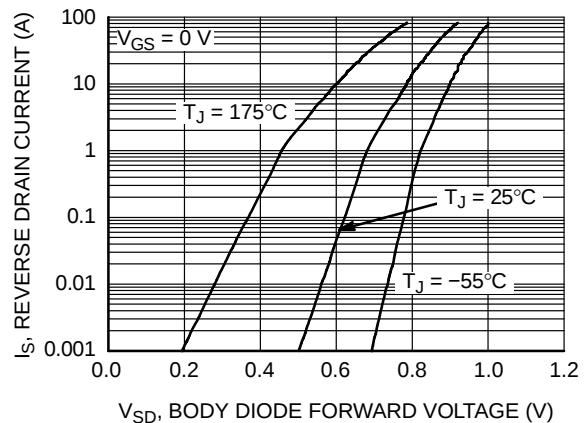


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

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

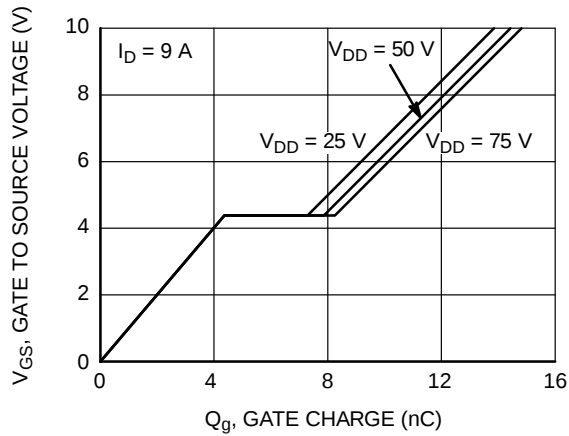


Figure 7. Gate Charge Characteristics

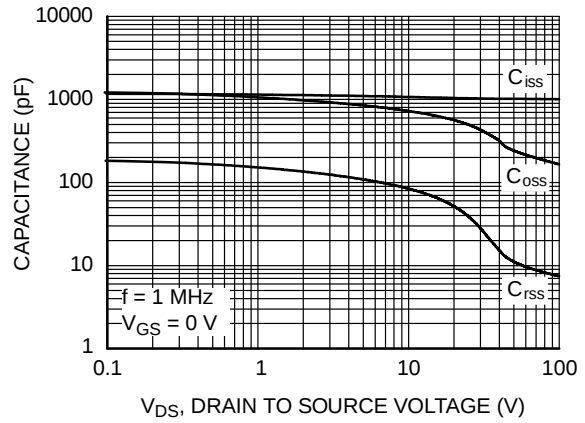


Figure 8. Capacitance vs. Drain to Source Voltage

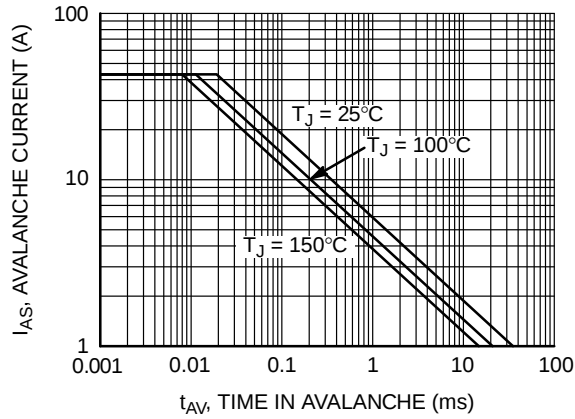


Figure 9. Unclamped Inductive Switching Capability

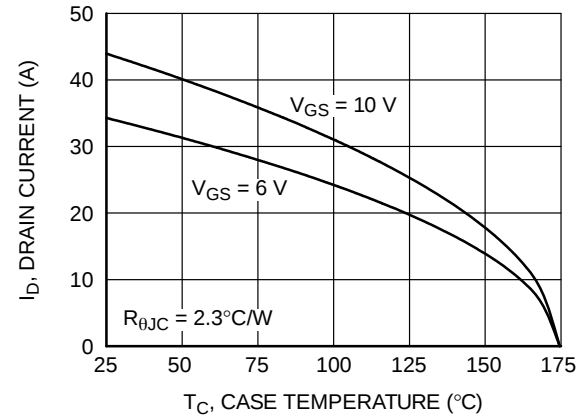


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

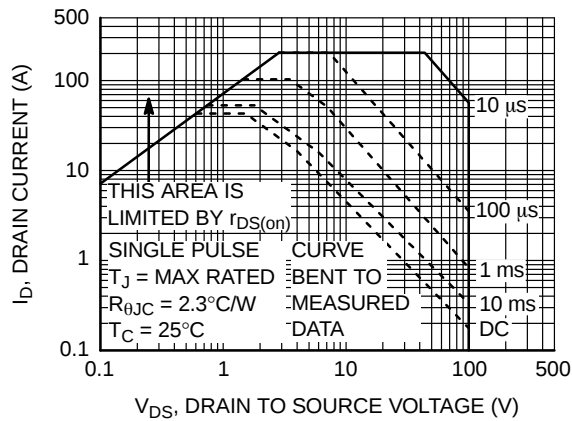


Figure 11. Forward Bias Safe Operating Area

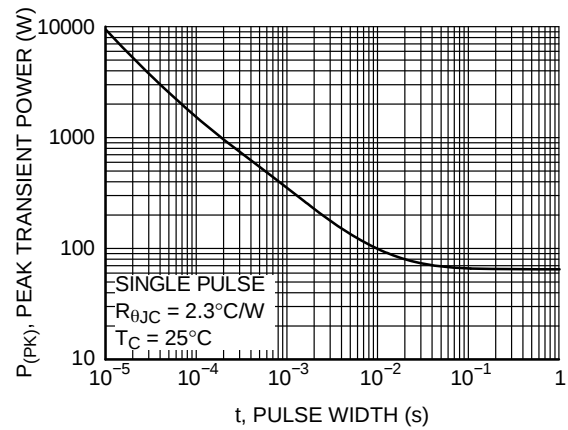


Figure 12. Single Pulse Maximum Power Dissipation

# FDMC86160ET100

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

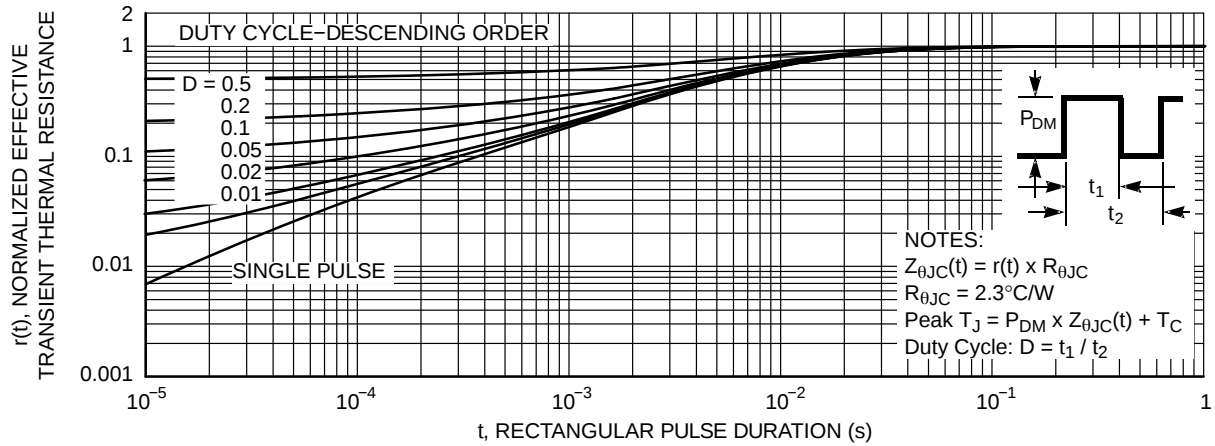


Figure 13. Junction-to-Ambient Transient Thermal Response Curve

### PACKAGE MARKING AND ORDERING INFORMATION

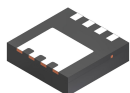
| Device         | Device Marking | Package Type                     | Reel Size | Tape Width | Shipping <sup>†</sup> |
|----------------|----------------|----------------------------------|-----------|------------|-----------------------|
| FDMC86160ET100 | FDMC86160ET    | WDFN8 3.3x3.3, 0.65P<br>Power 33 | 13"       | 12 mm      | 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

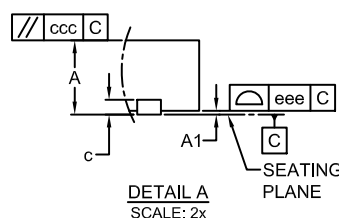
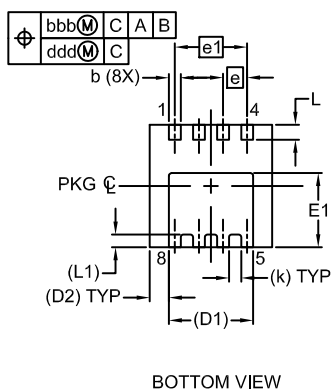
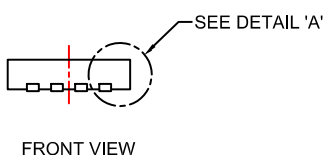
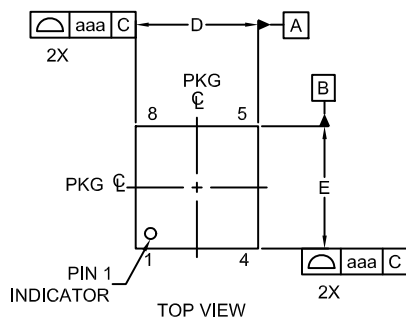
## PACKAGE DIMENSIONS

ON Semiconductor®

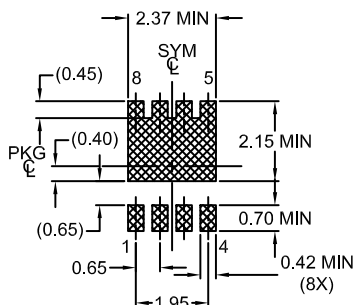


**WDFN8 3.3X3.3, 0.65P**  
CASE 483AW  
ISSUE A

DATE 10 SEP 2019



### 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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| <b>DESCRIPTION:</b>     | <b>WDFN8 3.3X3.3, 0.65P</b> | <b>PAGE 1 OF 1</b>                                                                                                                                                               |

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