

# MOSFET – Dual, N-Channel, POWER TRENCH®

40 V, 87 A, 2.6 mΩ

## FDMD8440L

### General Description

This package integrates two N-Channel devices connected internally in common-source configuration. This enables very low package parasitics and optimized thermal path to the common source pad on the bottom. It provides a very small footprint (3.3 x 5 mm) for higher power density.

### Features

- Max  $r_{DS(on)}$  = 2.6 mΩ at  $V_{GS} = 10$  V,  $I_D = 21$  A
- Max  $r_{DS(on)}$  = 3.8 mΩ at  $V_{GS} = 4.5$  V,  $I_D = 17$  A
- Ideal for Flexible Layout in Secondary Side Synchronous Rectification
- 100% UIL Tested
- This Device is Pb-Free, Halide Free and is RoHS Compliant

### Applications

- Isolated DC-DC Synchronous Rectifiers
- Common Ground Load Switches

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

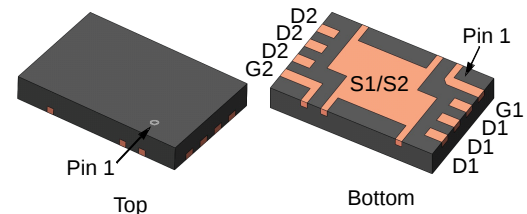
| Symbol         | Parameter                                                                                                                                                                                  | Ratings               | Unit             |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------------------|
| $V_{DS}$       | Drain to Source Voltage                                                                                                                                                                    | 40                    | V                |
| $V_{GS}$       | Gate to Source Voltage                                                                                                                                                                     | $\pm 20$              | V                |
| $I_D$          | Drain Current<br>– Continuous $T_C = 25^\circ\text{C}$ (Note 5)<br>– Continuous $T_C = 100^\circ\text{C}$ (Note 5)<br>– Continuous $T_A = 25^\circ\text{C}$ (Note 1a)<br>– Pulsed (Note 4) | 87<br>55<br>21<br>521 | A                |
| $E_{AS}$       | Single Pulse Avalanche Energy (Note 3)                                                                                                                                                     | 265                   | mJ               |
| $P_D$          | Power Dissipation<br>$T_C = 25^\circ\text{C}$<br>$T_A = 25^\circ\text{C}$ (Note 1a)                                                                                                        | 33<br>2.1             | W                |
| $T_J, T_{STG}$ | Operating and Storage Junction Temperature Range                                                                                                                                           | $-55$ to $+150$       | $^\circ\text{C}$ |

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

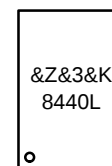
| Symbol          | Parameter                                         | Ratings | Unit               |
|-----------------|---------------------------------------------------|---------|--------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case              | 3.8     | $^\circ\text{C/W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1a) | 60      |                    |

| $V_{DS}$ | $r_{DS(on)}$ MAX | $I_D$ MAX |
|----------|------------------|-----------|
| 40 V     | 2.6 mΩ @ 10 V    | 87 A      |
|          | 3.8 mΩ @ 4.5 V   |           |



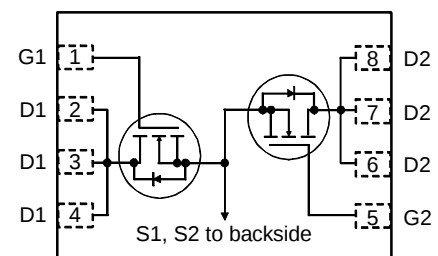
PQFN8 3.3X5, 0.65P  
(Power 3.3 x 5)  
CASE 483AU

### MARKING DIAGRAM



&Z = Assembly Plant Code  
&3 = 3-Digit Date Code  
&K = 2-Digits Lot Run Traceability Code  
8440L = Device Code

### PIN ASSIGNMENT



### ORDERING INFORMATION

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

# FDMD8440L

## ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C unless otherwise noted)

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

### OFF CHARACTERISTICS

|                                      |                                           |                                                |    |    |      |       |
|--------------------------------------|-------------------------------------------|------------------------------------------------|----|----|------|-------|
| BV <sub>DSS</sub>                    | Drain to Source Breakdown Voltage         | I <sub>D</sub> = 250 μA, V <sub>GS</sub> = 0 V | 40 | –  | –    | V     |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | I <sub>D</sub> = 250 μA, referenced to 25°C    | –  | 22 | –    | mV/°C |
| I <sub>DSS</sub>                     | Zero Gate Voltage Drain Current           | V <sub>DS</sub> = 32 V, V <sub>GS</sub> = 0 V  | –  | –  | 1    | μA    |
| I <sub>GSS</sub>                     | Gate to Source Leakage Current            | V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V | –  | –  | ±100 | nA    |

### ON CHARACTERISTICS

|                                        |                                                          |                                                                       |     |     |     |       |
|----------------------------------------|----------------------------------------------------------|-----------------------------------------------------------------------|-----|-----|-----|-------|
| V <sub>GS(th)</sub>                    | Gate to Source Threshold Voltage                         | V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250 μA           | 1.0 | 1.7 | 3.0 | V     |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | I <sub>D</sub> = 250 μA, referenced to 25°C                           | –   | –6  | –   | mV/°C |
| r <sub>DS(on)</sub>                    | Static Drain to Source On Resistance                     | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 21 A                         | –   | 1.8 | 2.6 | mΩ    |
|                                        |                                                          | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 17 A                        | –   | 2.6 | 3.8 |       |
|                                        |                                                          | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 21 A, T <sub>J</sub> = 125°C | –   | 2.8 | 4.1 |       |
| g <sub>FS</sub>                        | Forward Transconductance                                 | V <sub>DD</sub> = 5 V, I <sub>D</sub> = 21 A                          | –   | 111 | –   | S     |

### DYNAMIC CHARACTERISTICS

|                  |                              |                                                          |     |      |      |    |
|------------------|------------------------------|----------------------------------------------------------|-----|------|------|----|
| C <sub>iss</sub> | Input Capacitance            | V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V, f = 1 MHz | –   | 2965 | 4150 | pF |
| C <sub>oss</sub> | Output Capacitance           |                                                          | –   | 875  | 1225 | pF |
| C <sub>rss</sub> | Reverse Transfer Capacitance |                                                          | –   | 40   | 70   | pF |
| R <sub>g</sub>   | Gate Resistance              |                                                          | 0.1 | 1.6  | 3.2  | Ω  |

### SWITCHING CHARACTERISTICS

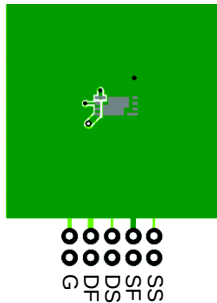
|                     |                               |                                                                                               |   |    |    |    |
|---------------------|-------------------------------|-----------------------------------------------------------------------------------------------|---|----|----|----|
| t <sub>d(on)</sub>  | Turn-On Delay Time            | V <sub>DD</sub> = 20 V, I <sub>D</sub> = 21 A, V <sub>GS</sub> = 10 V, R <sub>GEN</sub> = 6 Ω | – | 12 | 21 | ns |
| t <sub>r</sub>      | Rise Time                     |                                                                                               | – | 7  | 14 | ns |
| t <sub>d(off)</sub> | Turn-Off Delay Time           |                                                                                               | – | 34 | 54 | ns |
| t <sub>f</sub>      | Fall Time                     |                                                                                               | – | 7  | 14 | ns |
| Q <sub>g(TOT)</sub> | Total Gate Charge             | V <sub>GS</sub> = 0 V to 10 V, V <sub>DD</sub> = 20 V, I <sub>D</sub> = 21 A                  | – | 44 | 62 | nC |
|                     | Total Gate Charge             | V <sub>GS</sub> = 0 V to 4.5 V, V <sub>DD</sub> = 20 V, I <sub>D</sub> = 21 A                 | – | 21 | 35 | nC |
| Q <sub>gs</sub>     | Gate to Source Charge         | V <sub>DD</sub> = 20 V, I <sub>D</sub> = 21 A                                                 | – | 9  | –  | nC |
| Q <sub>gd</sub>     | Gate to Drain "Miller" Charge |                                                                                               | – | 7  | –  | nC |

### DRAIN-SOURCE CHARACTERISTICS

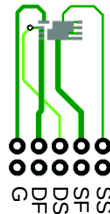
|                 |                                       |                                                       |   |     |     |    |
|-----------------|---------------------------------------|-------------------------------------------------------|---|-----|-----|----|
| V <sub>SD</sub> | Source to Drain Diode Forward Voltage | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 21 A (Note 2) | – | 0.8 | 1.2 | V  |
| t <sub>rr</sub> | Reverse Recovery Time                 | I <sub>F</sub> = 21 A, di/dt = 100 A/μs               | – | 41  | 66  | ns |
| Q <sub>rr</sub> | Reverse Recovery Charge               |                                                       | – | 22  | 35  | 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.

1. R<sub>θJA</sub> 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<sub>θJC</sub> is guaranteed by design while R<sub>θCA</sub> is determined by the user's board design.



- a. 60°C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz copper



- b. 160°C/W when mounted on a minimum pad of 2 oz copper

2. Pulse Test: Pulse Width < 300 μs, Duty cycle < 2.0%.
3. E<sub>AS</sub> of 216 mJ is based on starting T<sub>J</sub> = 25°C, L = 3 mH, I<sub>AS</sub> = 12 A, V<sub>DD</sub> = 40 V, V<sub>GS</sub> = 10 V. 100% tested at L = 0.1 mH, I<sub>AS</sub> = 40 A.
4. Pulse Id refers to Figure 11. Forward Bias Safe Operation Area.
5. 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)

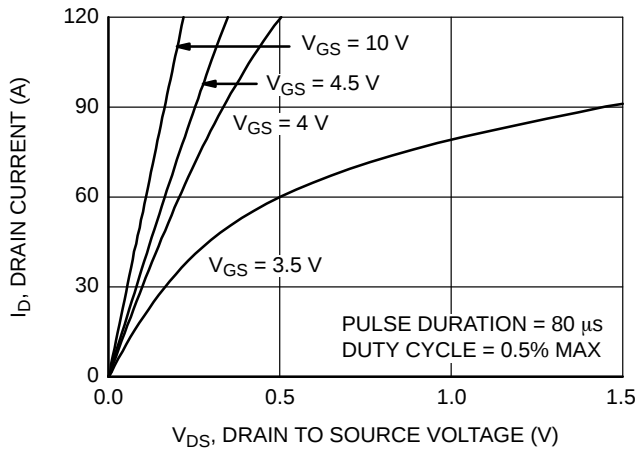


Figure 1. On-Region Characteristics

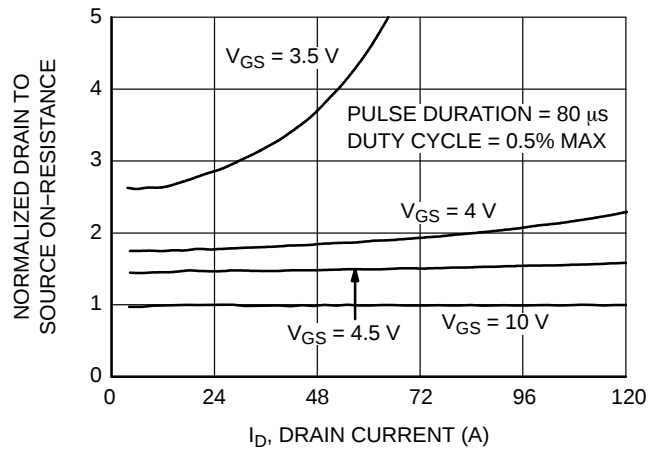


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

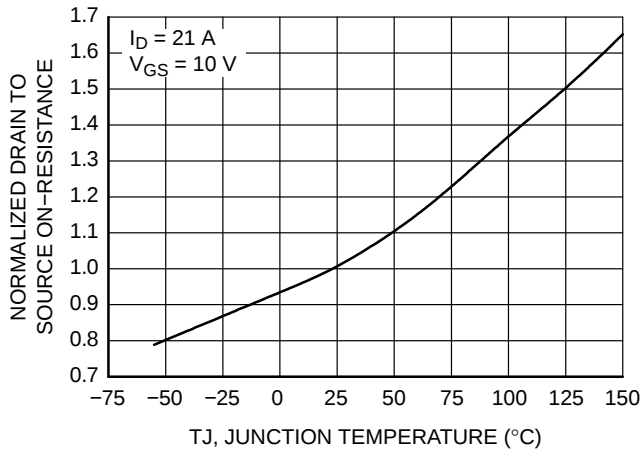


Figure 3. Normalized On Resistance vs. Junction Temperature

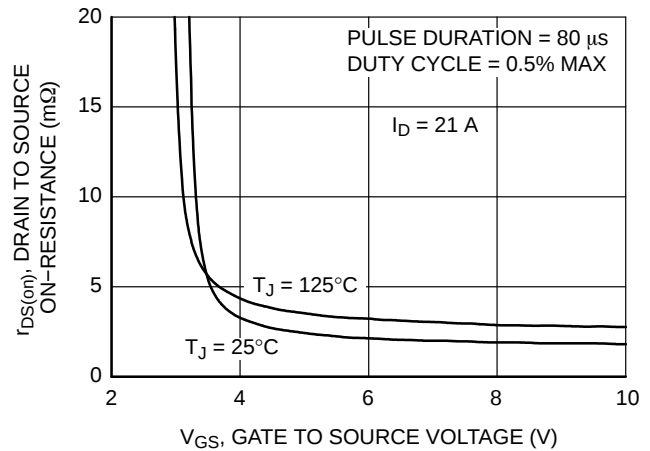


Figure 4. On Resistance vs. Gate to Source Voltage

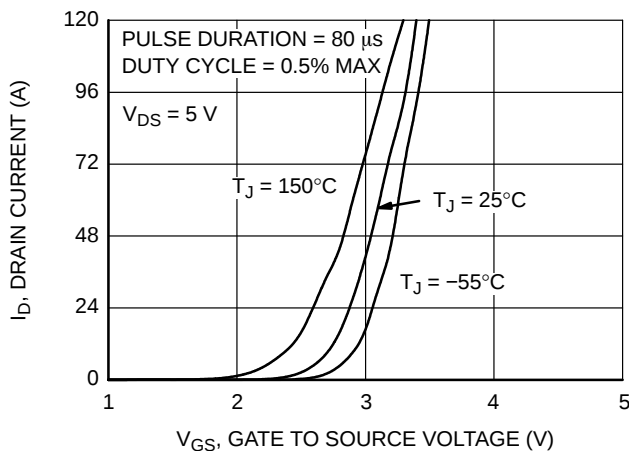


Figure 5. Transfer Characteristics

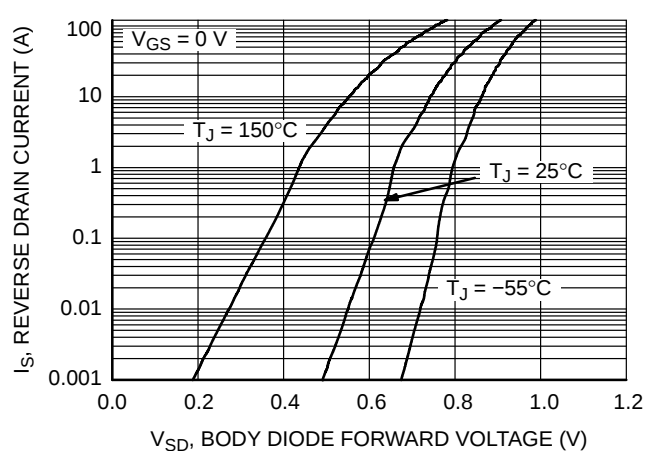


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

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

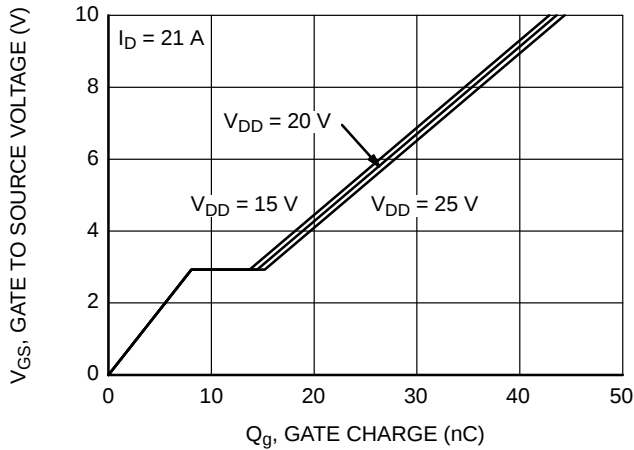


Figure 7. Gate Charge Characteristics

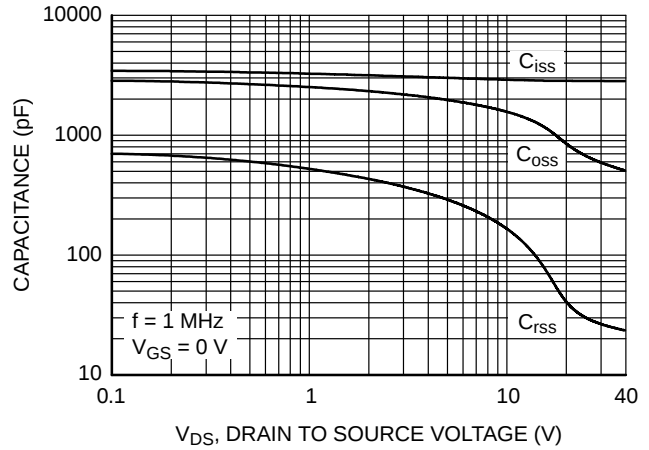


Figure 8. Capacitance vs. Drain to Source Voltage

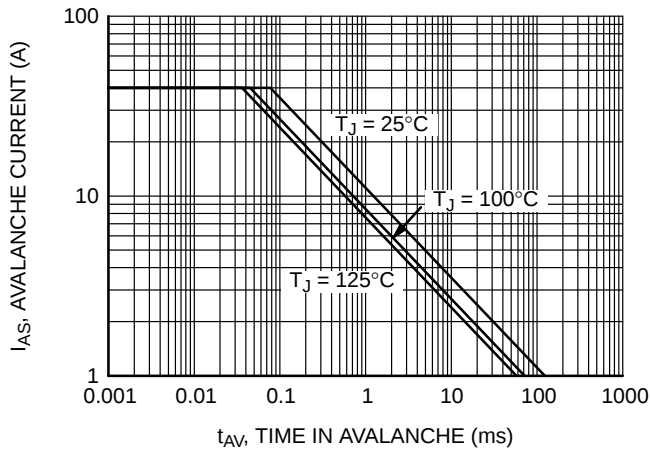


Figure 9. Unclamped Inductive Switching Capability

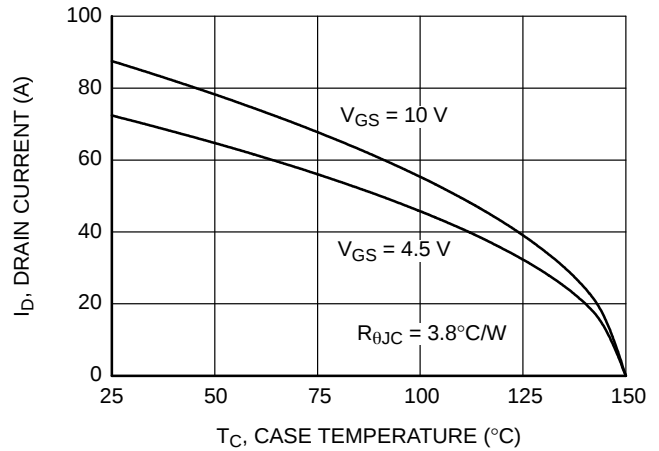


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

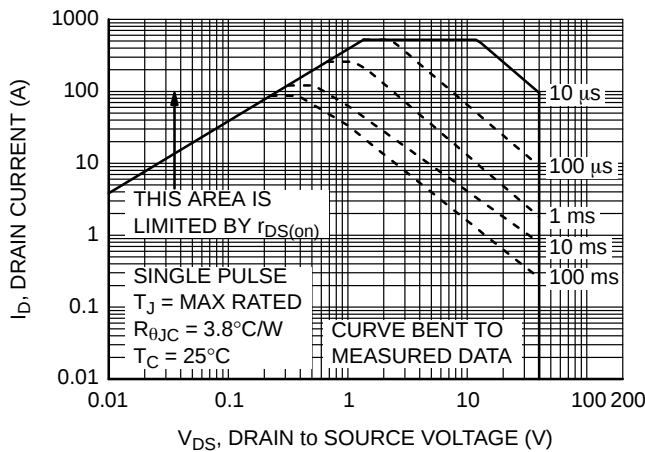


Figure 11. Forward Bias Safe Operating Area

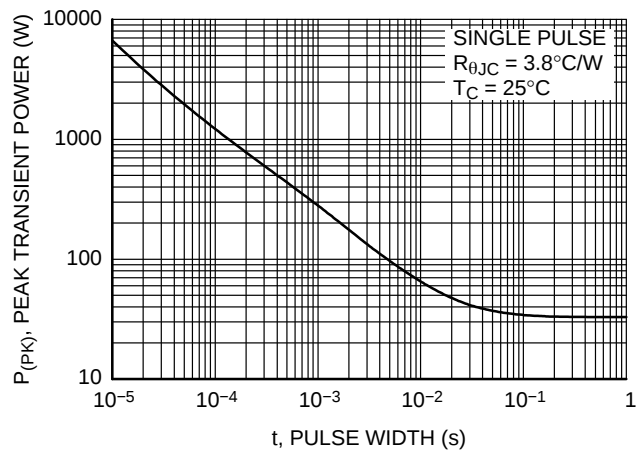


Figure 12. Single Pulse Maximum Power Dissipation

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

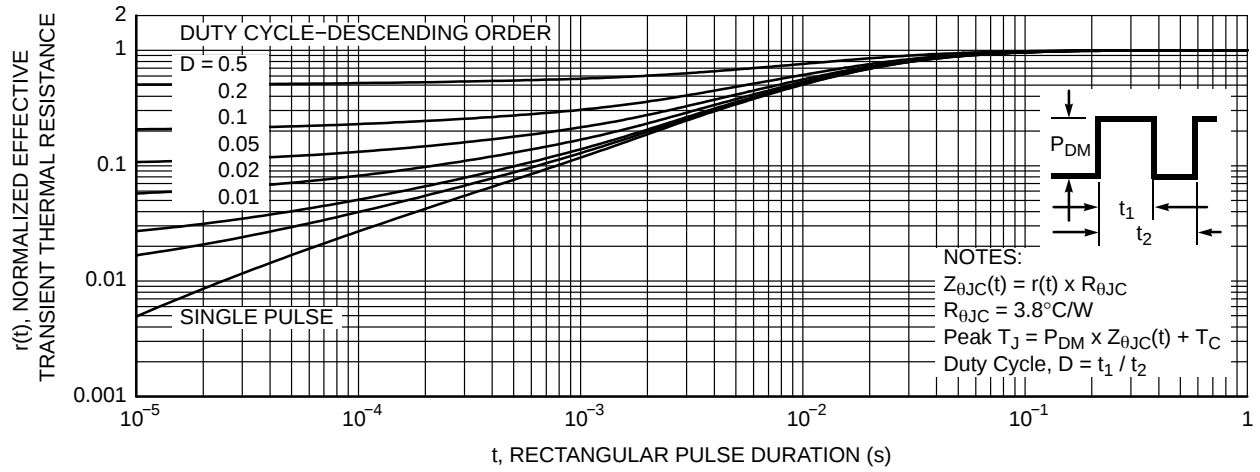
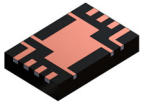


Figure 13. Junction-to-Case Transient Thermal Response Curve

PACKAGE MARKING AND ORDERING INFORMATION

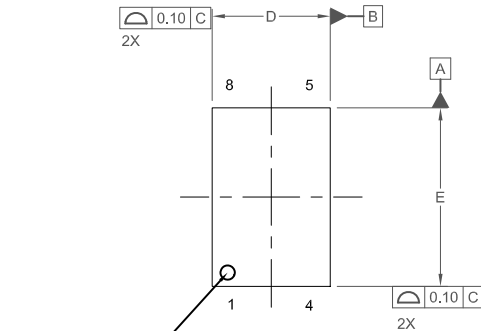
| Device    | Device Marking | Package                                                         | Reel Size | Tape Width | Shipping <sup>†</sup> |
|-----------|----------------|-----------------------------------------------------------------|-----------|------------|-----------------------|
| FDMD8440L | 8440L          | PQFN8 3.3X5, 0.65P<br>(Power 3.3 x 5)<br>(Pb-Free, Halide Free) | 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.

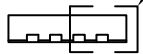


**PQFN8 3.30x5.00x0.75, 0.65P**  
CASE 483AU  
ISSUE B

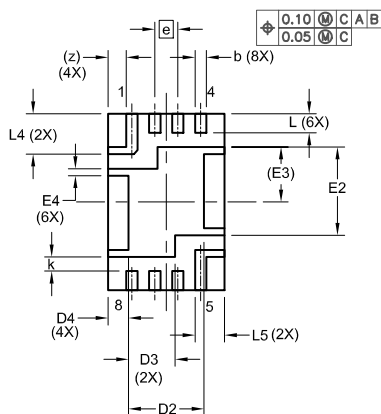
DATE 19 APR 2024



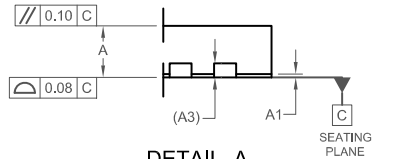
TOP VIEW



FRONT VIEW

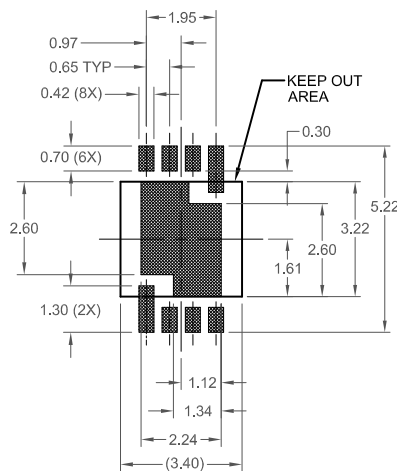


**BOTTOM VIEW**



DETAIL A

SCALE: 2X



RECOMMENDED LAND PAD

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

NOTES: UNLESS OTHERWISE SPECIFIED

- A) DOES NOT FULLY CONFORM TO JEDEC REGISTRATION, MO229 DATED 8/2012.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH. MOLD FLASH OR BURRS DOES NOT EXCEED 0.10MM.
- D) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
- E) IT IS RECOMMENDED TO HAVE NO TRACES OR VIAS WITHIN THE KEEP OUT AREA.

| DIM | MILLIMETERS |      |      |
|-----|-------------|------|------|
|     | MIN.        | NOM. | MAX. |
| A   | 0.70        | 0.75 | 0.80 |
| A1  | 0.00        | -    | 0.05 |
| A3  | 0.20 REF    |      |      |
| b   | 0.27        | 0.32 | 0.37 |
| D   | 3.20        | 3.30 | 3.40 |
| D2  | 2.04        | 2.14 | 2.24 |
| D3  | 1.22        | 1.32 | 1.42 |
| D4  | 0.48        | 0.58 | 0.68 |
| E   | 4.90        | 5.00 | 5.10 |
| E2  | 2.40        | 2.50 | 2.60 |
| E3  | 1.56 REF    |      |      |
| E4  | 0.10        | 0.20 | 0.30 |
| e   | 0.65 BSC    |      |      |
| k   | 0.30        | 0.40 | 0.50 |
| L   | 0.44        | 0.54 | 0.64 |
| L4  | 1.04        | 1.14 | 1.24 |
| L5  | 0.75        | 0.85 | 0.95 |
| z   | 0.51 REF    |      |      |

|                         |                                    |                                                                                                                                                                                     |
|-------------------------|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| <b>DESCRIPTION:</b>     | <b>PQFN8 3.30x5.00x0.75, 0.65P</b> | <b>PAGE 1 OF 1</b>                                                                                                                                                                  |

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