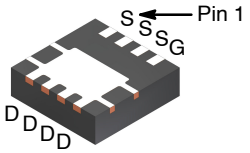
# MOSFET – N-Channel, POWERTRENCH®

## 30 V, 20 A, 6.1 mΩ

# FDMC8651




**PQFN8 3.3 × 3.3, 0.65P**
**(Power 33)**
**CASE 483AK**

### 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.

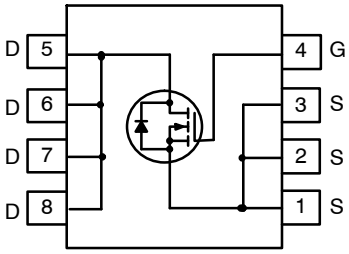
### Features

- Max $r_{DS(on)}$ = 6.1 mΩ at $V_{GS}$ = 4.5 V, $I_D$ = 15 A
  Max $r_{DS(on)}$ = 9.3 mΩ at $V_{GS}$ = 2.5 V, $I_D$ = 12 A
- Low Profile − 1 mm Max in Power 33
- 100% UIL Tested
- Pb−Free, Halide Free and RoHS Compliant

### Applications

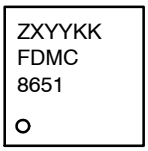
- Synchronous Rectifier
- 3.3 V Input Synchronous Buck Switch

### ELECTRICAL CONNECTION




**N−Channel MOSFET**

### MARKING DIAGRAM




| | |
|---|---|
| Z | = Assembly Plant Code |
| XYY | = 3−Digit Date Code Format |
| KK | = 2−Alphanumeric Lot Run Traceability Code |
| FDMC8651 | = Specific Device Code |

### ABSOLUTE MAXIMUM RATINGS ($T_A$ = 25°C unless otherwise noted.)

| Symbol | Parameter | | Value | Unit |
|---|---|---|---|---|
| $V_{DS}$ | Drain−Source Voltage | | 30 | V |
| $V_{GS}$ | Gate−Source Voltage | | ±12 | V |
| $I_D$ | Drain Current<br>− Continuous (Package Limited)<br>− Continuous (Silicon Limited)<br>− Continuous (Note 1a)<br>− Pulsed | <br>$T_C$ = 25°C<br>$T_C$ = 25°C<br>$T_A$ = 25°C<br> | <br>20<br>64<br>15<br>60 | A |
| $E_{AS}$ | Single Pulse Avalanche Energy (Note 3) | | 128 | mJ |
| $P_D$ | Power Dissipation<br>Power Dissipation (Note 1a) | $T_C$ = 25°C<br>$T_A$ = 25°C | 41<br>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.

### THERMAL CHARACTERISTICS ($T_A$ = 25°C unless otherwise noted.)

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | 3 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1a) | 53 | °C/W |

### ORDERING INFORMATION

| Device | Package | Shipping† |
|---|---|---|
| FDMC8651 | PQFN8 (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.

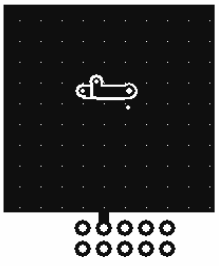
**ELECTRICAL CHARACTERISTICS** ($T_J$ = 25°C unless otherwise noted.)

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| $BV_{DSS}$ | Drain–Source Breakdown Voltage | $I_D$ = 250 μA, $V_{GS}$ = 0 V | 30 | – | – | V |
| $\Delta BV_{DSS}$ / $\Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D$ = 250 μA, Referenced to 25°C | – | 27.5 | – | mV/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = 24 V, $V_{GS}$ = 0 V | – | – | 1 | μA |
| $I_{GSS}$ | Gate to Source Leakage Current | $V_{GS}$ = ±12 V, $V_{DS}$ = 0 V | – | – | ±100 | nA |
| **ON CHARACTERISTICS** | | | | | | |
| $V_{GS(th)}$ | Gate to Source Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 250 μA | 0.8 | 1.1 | 1.5 | V |
| $\Delta V_{GS(th)}$ / $\Delta T_J$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D$ = 250 μA, Referenced to 25°C | – | –4.4 | – | mV/°C |
| $r_{DS(on)}$ | Static Drain–Source On–Resistance | $V_{GS}$ = 4.5 V, $I_D$ = 15 A<br>$V_{GS}$ = 2.5 V, $I_D$ = 12 A<br>$V_{GS}$ = 4.5 V, $I_D$ = 15 A, $T_J$ = 125°C | –<br>–<br>– | 4.3<br>6.2<br>6.3 | 6.1<br>9.3<br>9.0 | mΩ |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = 5 V, $I_D$ = 15 A | – | 91 | – | S |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 15 V, $V_{GS}$ = 0 V, f = 1 MHz | – | 2530 | 3365 | pF |
| $C_{oss}$ | Output Capacitance | | – | 865 | 1150 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | – | 140 | 205 | pF |
| $R_g$ | Gate Resistance | | – | 0.8 | – | Ω |
| **SWITCHING CHARACTERISTICS** | | | | | | |
| $t_{d(on)}$ | Turn–On Delay Time | $V_{DD}$ = 15 V, $I_D$ = 15 A, $V_{GS}$ = 4.5 V, $R_{GEN}$ = 6 Ω | – | 18 | 31 | ns |
| $t_r$ | Rise Time | | – | 9 | 18 | ns |
| $t_{d(off)}$ | Turn–Off Delay Time | | – | 35 | 56 | ns |
| $t_f$ | Fall Time | | – | 6 | 12 | ns |
| $Q_{g(TOT)}$ | Total Gate Charge at 4.5 V | $V_{DD}$ = 15 V, $I_D$ = 15 A | – | 19.4 | 27.2 | nC |
| $Q_{gs}$ | Total Gate Charge | | – | 4.8 | – | nC |
| $Q_{gd}$ | Gate to Drain “Miller” Charge | | – | 4.2 | – | nC |
| **DRAIN–SOURCE DIODE CHARACTERISTICS** | | | | | | |
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS}$ = 0 V, $I_S$ = 15 A (Note 2) | – | 0.8 | 1.3 | V |
| | | $V_{GS}$ = 0 V, $I_S$ = 1.7 A (Note 2) | – | 0.7 | 1.2 | |
| $t_{rr}$ | Reverse Recovery Time | $I_F$ = 15 A, di/dt = 100 A/μs | – | 35 | 55 | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | – | 17 | 30 | nC |

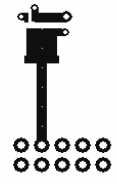
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

NOTES:

1. $R_{\theta JA}$ is determined with the device mounted on a 1in$^2$ 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°C/W when mounted on a 1 in$^2$ pad of 2 oz. copper.



b) 125°C/W when mounted on a minimum pad of 2 oz. copper.

2. Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2.0%.
3. Starting $T_J$ = 25°C; N–ch: L = 1 mH, $I_{AS}$ = 16 A, $V_{DD}$ = 27 V, $V_{GS}$ = 10 V.

## TYPICAL CHARACTERISTICS

($T_J$ = 25°C unless otherwise noted)

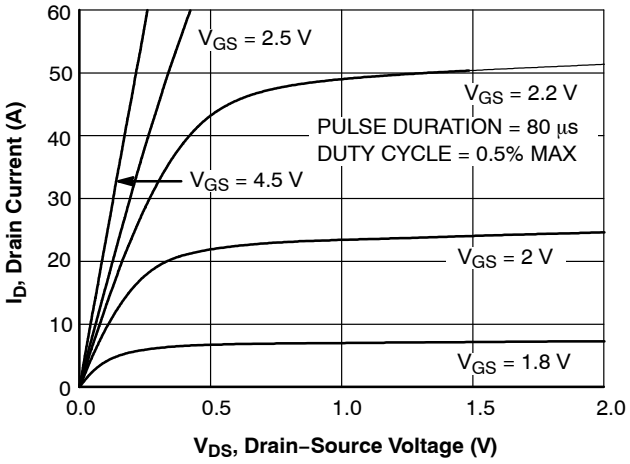



**Figure 1. On−Region Characteristics**

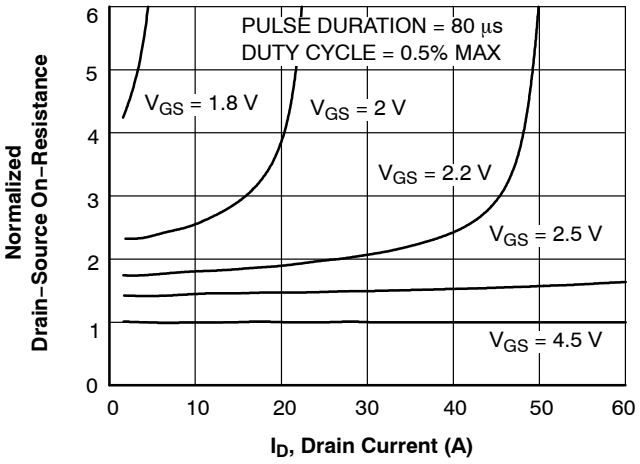



**Figure 2. Normalized On−Resistance vs. Drain Current and Gate Voltage**

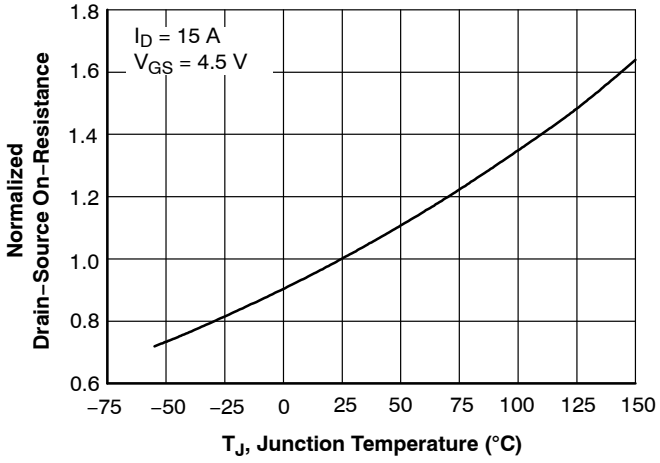



**Figure 3. Normalized On−Resistance vs. Junction Temperature**

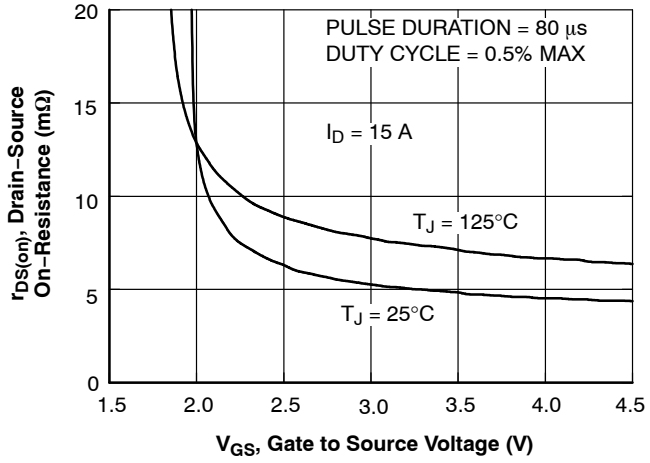



**Figure 4. On−Resistance vs. Gate to Source Voltage**

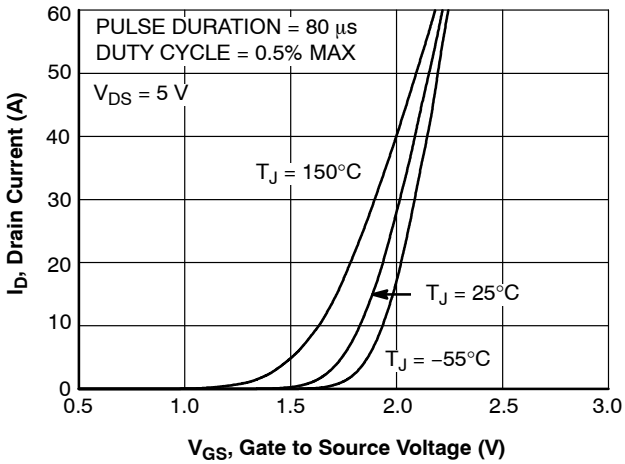



**Figure 5. Transfer Characteristics**

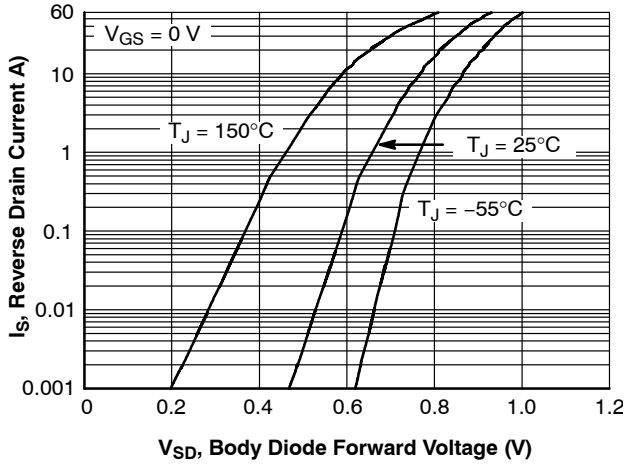



**Figure 6. Source to Drain Diode Forward Voltage vs. Source Current**

## TYPICAL CHARACTERISTICS (continued)

($T_J$ = 25°C unless otherwise noted)

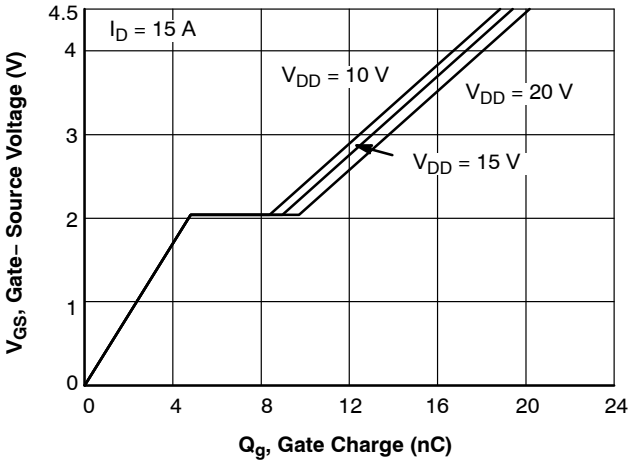



**Figure 7. Gate Charge Characteristics**

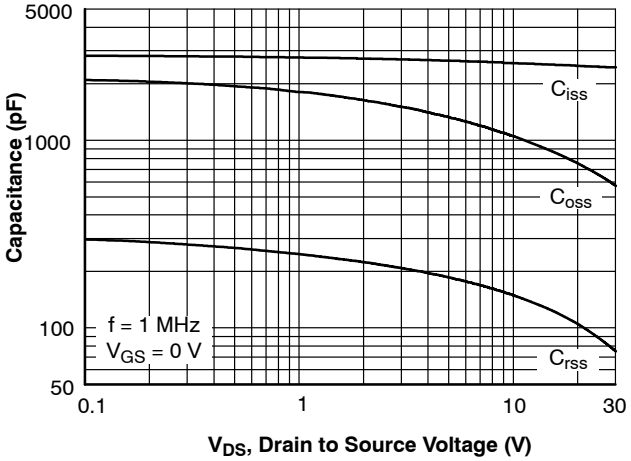



**Figure 8. Capacitance vs. Drain to Source Voltage**

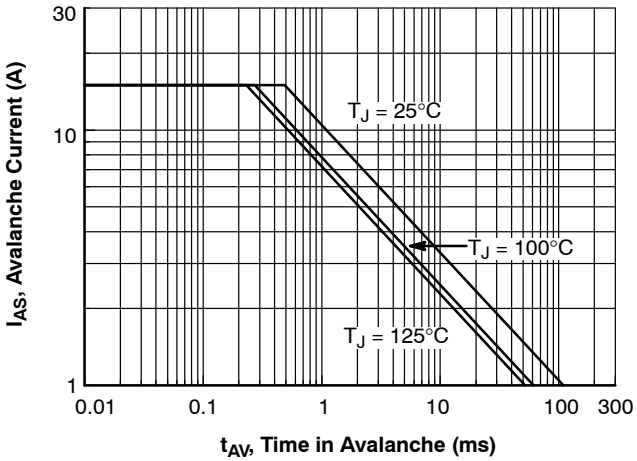



**Figure 9. Unclamped Inductive Switching Capability**

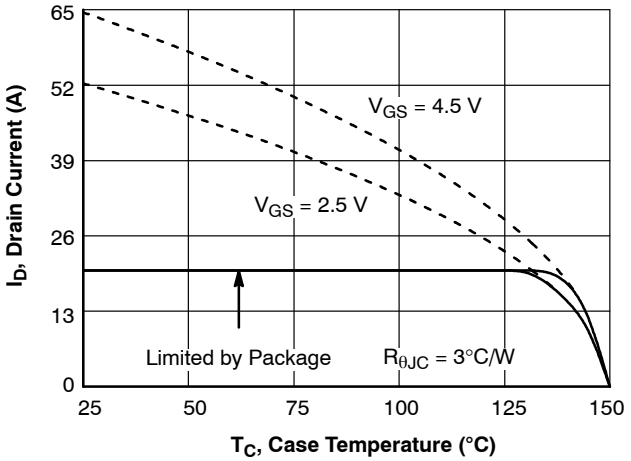



**Figure 10. Maximum Continuous Drain Current vs. Case Temperature**

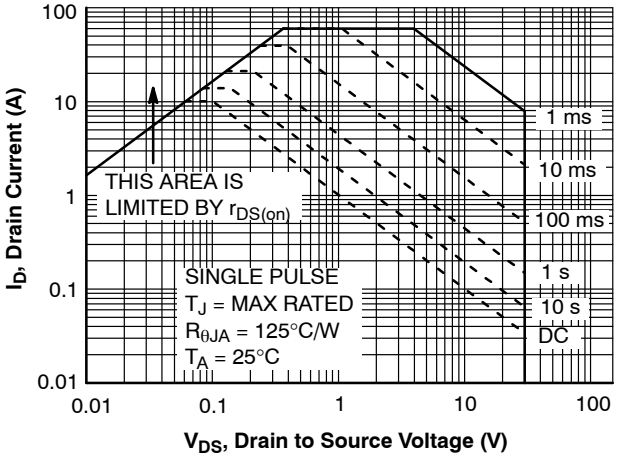



**Figure 11. Forward Bias Safe Operating Area**

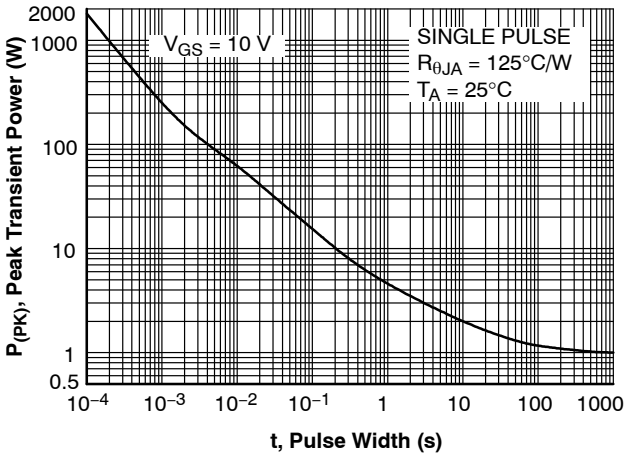



**Figure 12. Single Pulse Maximum Power Dissipation**

## TYPICAL CHARACTERISTICS (continued)

($T_J$ = 25°C unless otherwise noted)

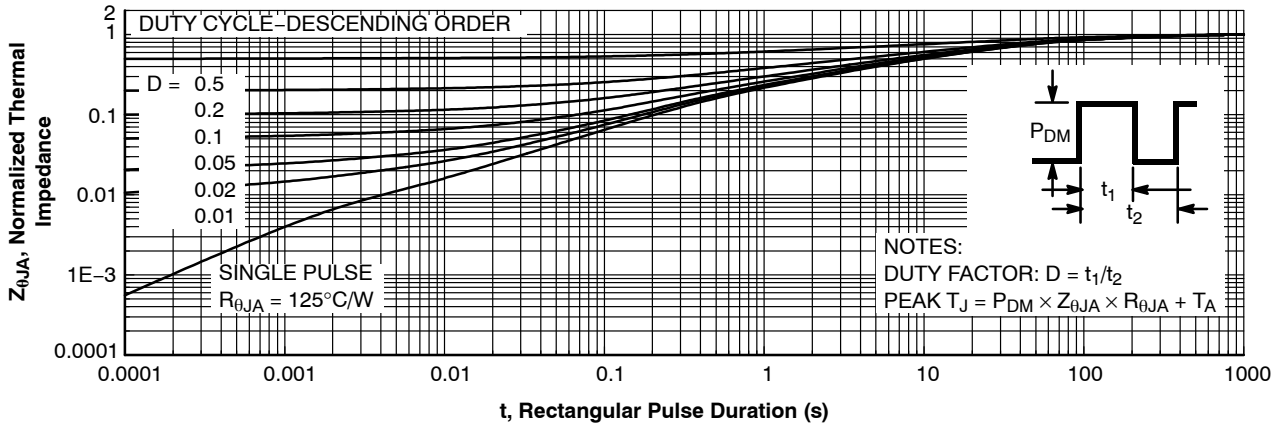
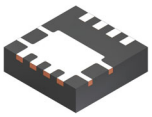



**Figure 13. Junction−to−Ambient Transient Thermal Response Curve**

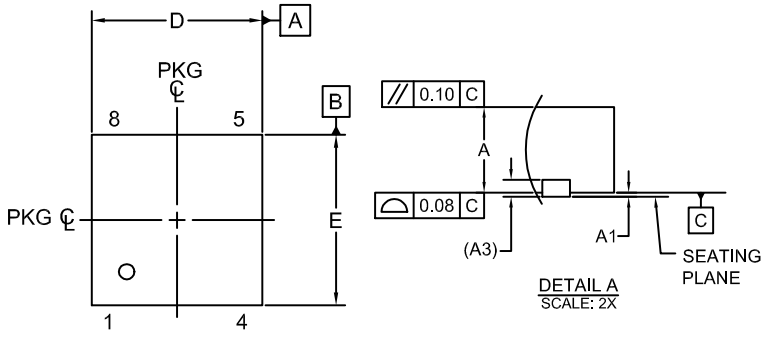
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# MECHANICAL CASE OUTLINE
## PACKAGE DIMENSIONS

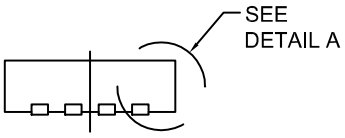


**PQFN8 3.3X3.3, 0.65P**
CASE 483AK
ISSUE B

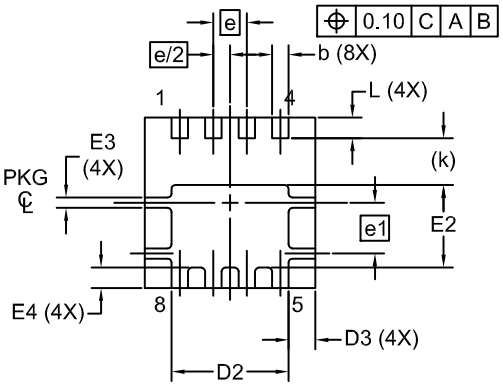
DATE 12 OCT 2021



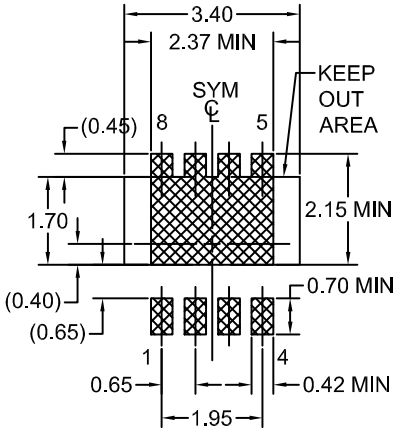

TOP VIEW




FRONT VIEW




BOTTOM VIEW




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 PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. COPLANARITY APPLIES TO THE EXPOSED PADS AS WELL AS THE TERMINALS.
4. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.
5. 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.
6. IT IS RECOMMENDED TO HAVE NO TRACES OR VIAS WITHIN THE KEEP OUT AREA.

| DIM | MILLIMETERS | | |
|---|---|---|---|
| | MIN. | NOM. | MAX. |
| A | 0.90 | 1.00 | 1.10 |
| A1 | 0.00 | - | 0.05 |
| A3 | 0.20 REF | | |
| b | 0.27 | 0.32 | 0.37 |
| D | 3.20 | 3.30 | 3.40 |
| D2 | 2.17 | 2.27 | 2.37 |
| D3 | 0.42 | 0.52 | 0.62 |
| E | 3.20 | 3.30 | 3.40 |
| E2 | 1.50 | 1.60 | 1.70 |
| E3 | 0.10 | 0.20 | 0.30 |
| E4 | 0.29 | 0.39 | 0.49 |
| e | 0.65 BSC | | |
| e/2 | 0.325 BSC | | |
| e1 | 0.98 BSC | | |
| k | 0.91 REF | | |
| L | 0.30 | 0.40 | 0.50 |