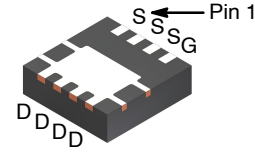


# MOSFET – N-Channel, POWERTRENCH®

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

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

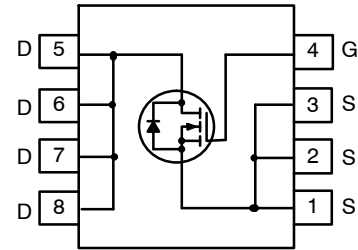
Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-Source Voltage	30	V
$V_{GS}$	Gate-Source Voltage	±12	V
$I_D$	Drain Current		A
	– Continuous (Package Limited) $T_C = 25^\circ\text{C}$	20	
	– Continuous (Silicon Limited) $T_C = 25^\circ\text{C}$	64	
	– Continuous (Note 1a) $T_A = 25^\circ\text{C}$	15	
	– Pulsed	60	
$E_{AS}$	Single Pulse Avalanche Energy (Note 3)	128	mJ
$P_D$	Power Dissipation $T_C = 25^\circ\text{C}$	41	W
	Power Dissipation (Note 1a) $T_A = 25^\circ\text{C}$	2.3	
$T_J, T_{STG}$	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.)

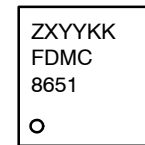
Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case	3	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	53	$^\circ\text{C}/\text{W}$

### 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

### ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
FDMC8651	PQFN8 (Pb-Free/ Halide Free)	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 Specification Brochure, [BRD8011/D](#).

# FDMC8651

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

B <sub>V</sub> DSS	Drain–Source Breakdown Voltage	I <sub>D</sub> = 250 μA, V <sub>GS</sub> = 0 V	30	–	–	V
ΔB <sub>V</sub> DSS / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250 μA, Referenced to 25°C	–	27.5	–	mV/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 24 V, V <sub>GS</sub> = 0 V	–	–	1	μA
I <sub>GSS</sub>	Gate to Source Leakage Current	V <sub>GS</sub> = ±12 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	0.8	1.1	1.5	V
ΔV <sub>GS(th)</sub> / ΔT <sub>J</sub>	Gate to Source Threshold Voltage Temperature Coefficient	I <sub>D</sub> = 250 μA, Referenced to 25°C	–	–4.4	–	mV/°C
r <sub>DS(on)</sub>	Static Drain–Source On–Resistance	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 15 A V <sub>GS</sub> = 2.5 V, I <sub>D</sub> = 12 A V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 15 A, T <sub>J</sub> = 125°C	–	4.3 6.2 6.3	6.1 9.3 9.0	mΩ
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 5 V, I <sub>D</sub> = 15 A	–	91	–	S

### DYNAMIC CHARACTERISTICS

C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 0 V, f = 1 MHz	–	2530	3365	pF
C <sub>oss</sub>	Output Capacitance		–	865	1150	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		–	140	205	pF
R <sub>g</sub>	Gate Resistance		–	0.8	–	Ω

### SWITCHING CHARACTERISTICS

t <sub>d(on)</sub>	Turn–On Delay Time	V <sub>DD</sub> = 15 V, I <sub>D</sub> = 15 A, V <sub>GS</sub> = 4.5 V, R <sub>GEN</sub> = 6 Ω	–	18	31	ns
t <sub>r</sub>	Rise Time		–	9	18	ns
t <sub>d(off)</sub>	Turn–Off Delay Time		–	35	56	ns
t <sub>f</sub>	Fall Time		–	6	12	ns
Q <sub>g(TOT)</sub>	Total Gate Charge at 4.5 V	V <sub>DD</sub> = 15 V, I <sub>D</sub> = 15 A	–	19.4	27.2	nC
Q <sub>gs</sub>	Total Gate Charge		–	4.8	–	nC
Q <sub>gd</sub>	Gate to Drain “Miller” Charge		–	4.2	–	nC

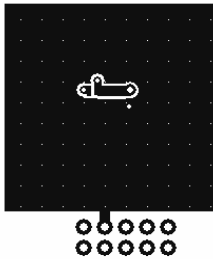
### DRAIN–SOURCE DIODE CHARACTERISTICS

V <sub>SD</sub>	Source to Drain Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 15 A (Note 2)	–	0.8	1.3	V
		V <sub>GS</sub> = 0 V, I <sub>S</sub> = 1.7 A (Note 2)	–	0.7	1.2	
t <sub>rr</sub>	Reverse Recovery Time	I <sub>F</sub> = 15 A, di/dt = 100 A/μs	–	35	55	ns
Q <sub>rr</sub>	Reverse Recovery Charge		–	17	30	nC

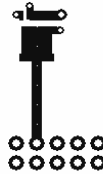
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

### NOTES:

- R<sub>θJA</sub> is determined with the device mounted on a 1in<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) 53°C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz. copper.



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

- Pulse Test: Pulse Width < 300 μs, Duty Cycle < 2.0%.
- Starting T<sub>J</sub> = 25°C; N–ch: L = 1 mH, I<sub>AS</sub> = 16 A, V<sub>DD</sub> = 27 V, V<sub>GS</sub> = 10 V.

TYPICAL CHARACTERISTICS

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

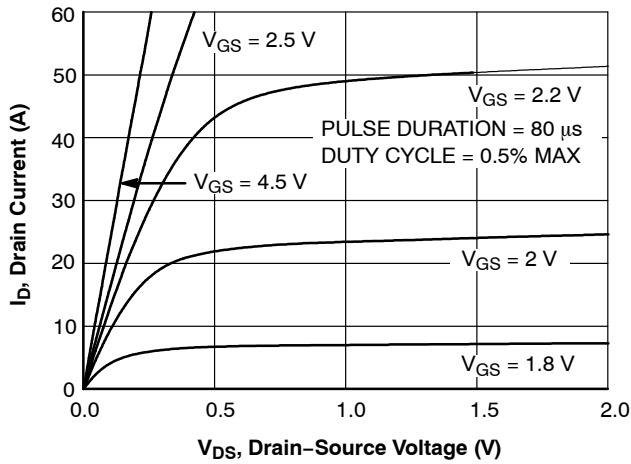


Figure 1. On-Region Characteristics

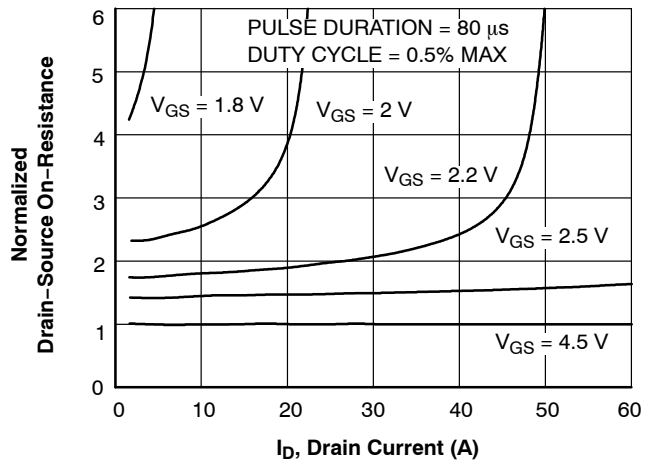


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

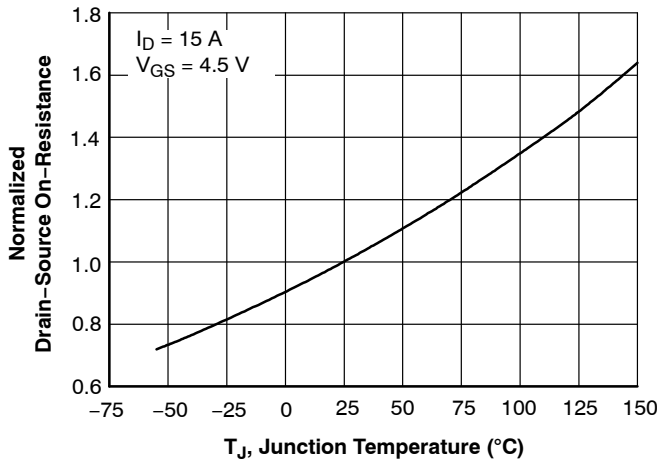


Figure 3. Normalized On-Resistance vs. Junction Temperature

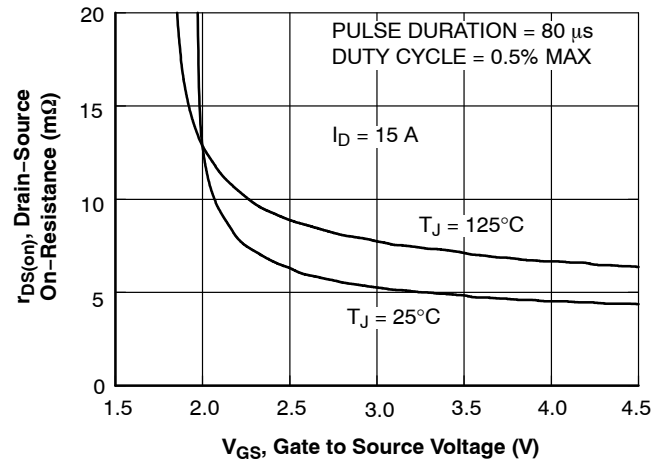


Figure 4. On-Resistance vs. Gate to Source Voltage

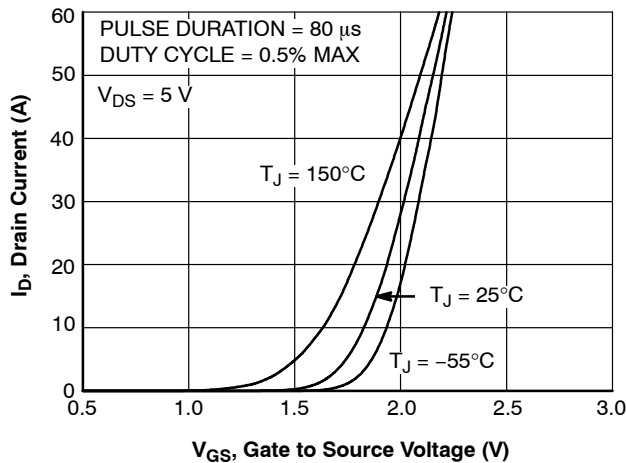


Figure 5. Transfer Characteristics

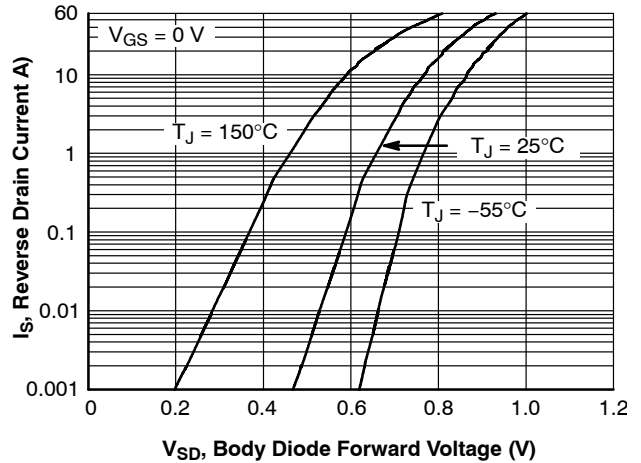


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

TYPICAL CHARACTERISTICS (continued)

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

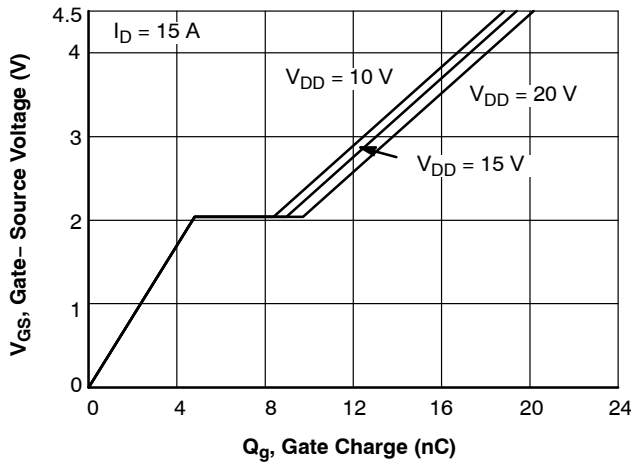


Figure 7. Gate Charge Characteristics

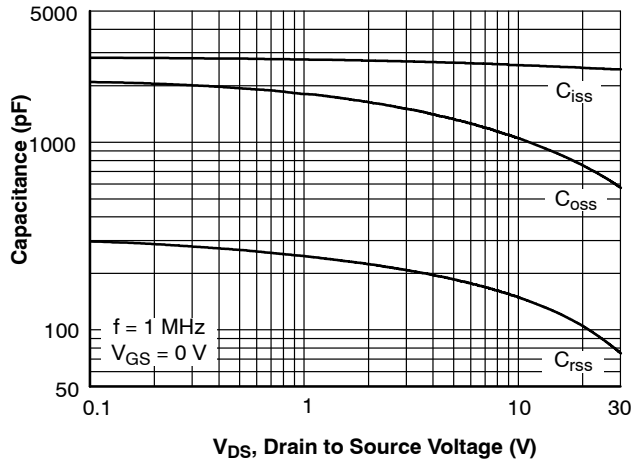


Figure 8. Capacitance vs. Drain to Source Voltage

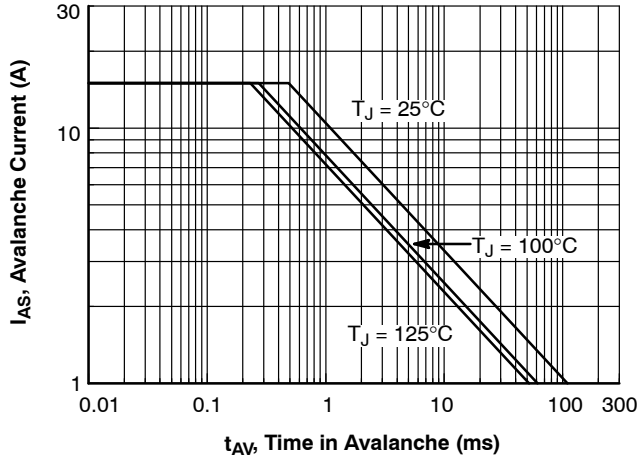


Figure 9. Unclamped Inductive Switching Capability

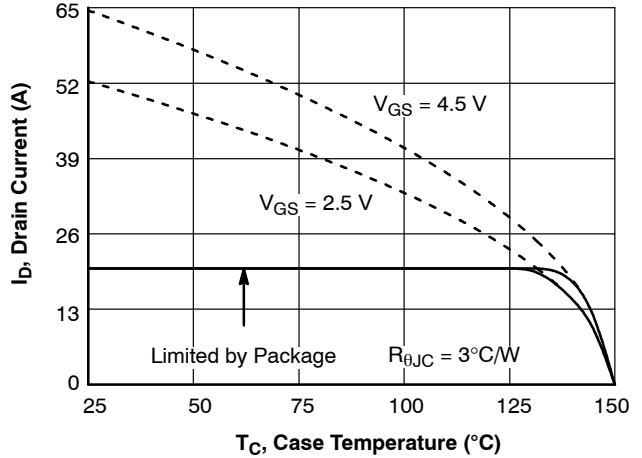


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

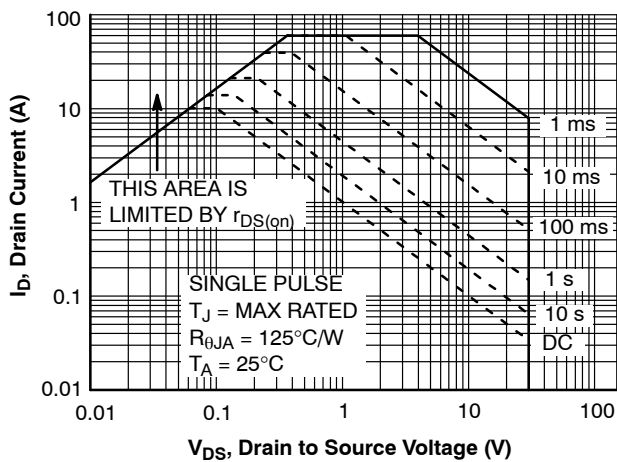


Figure 11. Forward Bias Safe Operating Area

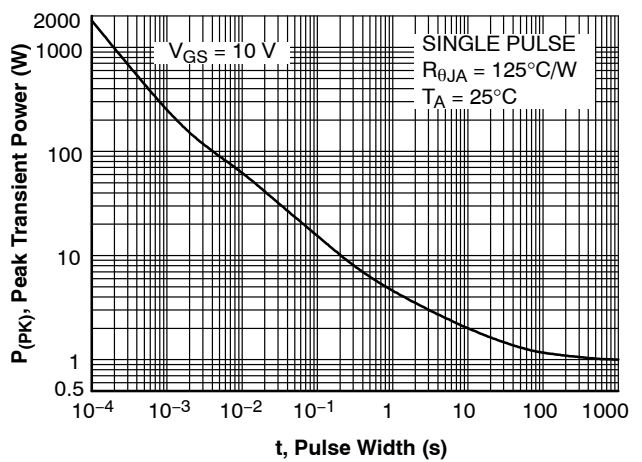


Figure 12. Single Pulse Maximum Power Dissipation

TYPICAL CHARACTERISTICS (continued)

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

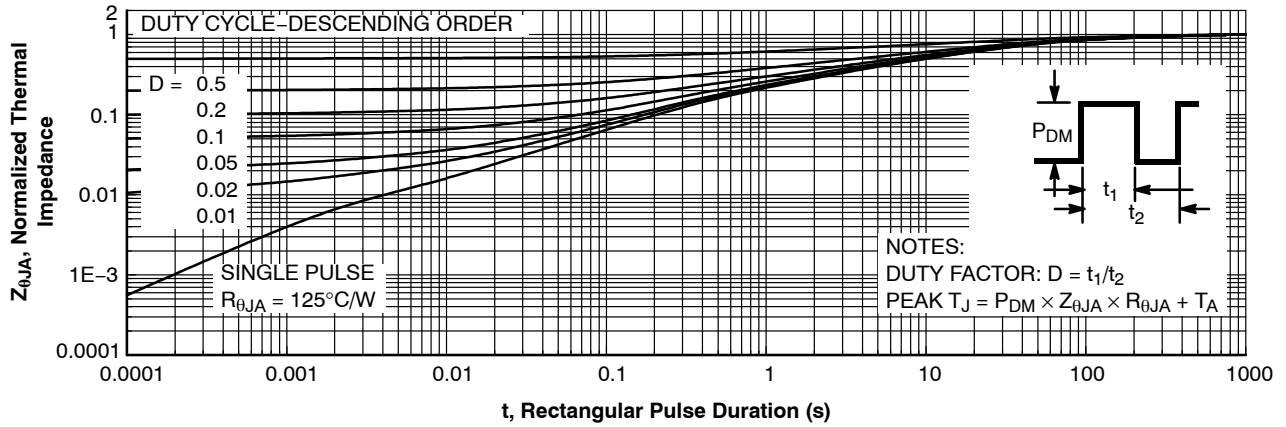
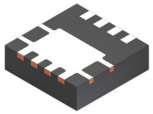


Figure 13. Junction-to-Ambient Transient Thermal Response Curve

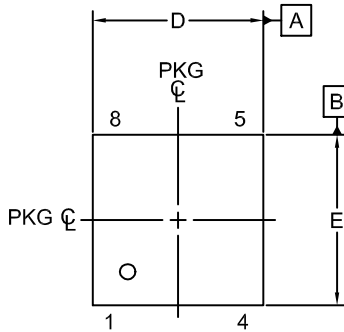
# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

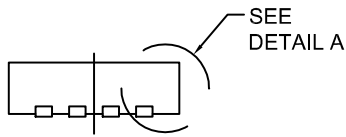


**PQFN8 3.3X3.3, 0.65P**  
**CASE 483AK**  
**ISSUE B**

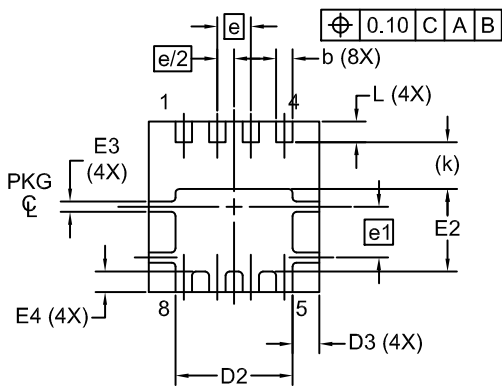
DATE 12 OCT 2021



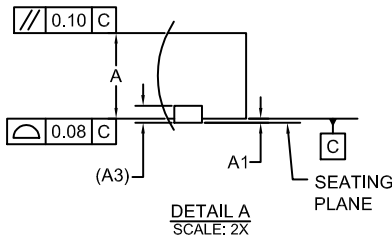
TOP VIEW



FRONT VIEW



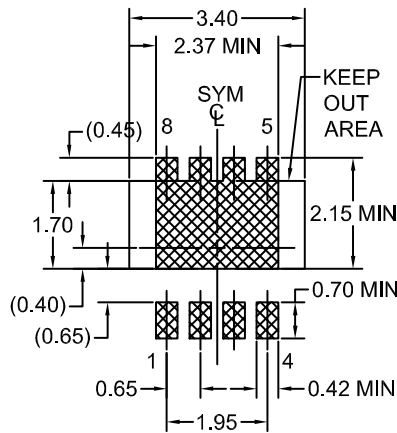
BOTTOM VIEW



DETAIL A  
SCALE: 2X

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.



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, SOLDERM/D.

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

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