

MOSFET – N-Channel, POWERTRENCH®

30 V, 20 A, 6.1 mΩ

FDMC8651

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

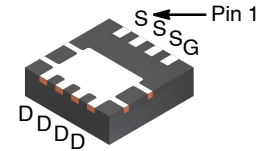
ABSOLUTE MAXIMUM RATINGS (T_A = 25°C unless otherwise noted.)

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

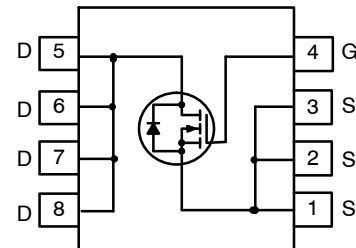
THERMAL CHARACTERISTICS (T_A = 25°C unless otherwise noted.)

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



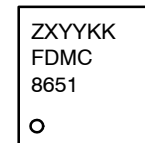
PQFN8 3.3 × 3.3, 0.65P
(Power 33)
CASE 483AK

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

BV_{DSS}	Drain–Source Breakdown Voltage	$I_D = 250\ \mu\text{A}$, $V_{GS} = 0\ \text{V}$	30	–	–	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, Referenced to 25°C	–	27.5	–	mV/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 24\ \text{V}$, $V_{GS} = 0\ \text{V}$	–	–	1	μA
I_{GSS}	Gate to Source Leakage Current	$V_{GS} = \pm 12\ \text{V}$, $V_{DS} = 0\ \text{V}$	–	–	± 100	nA

ON CHARACTERISTICS

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 250\ \mu\text{A}$	0.8	1.1	1.5	V
$\Delta V_{GS(th)} / \Delta T_J$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, Referenced to 25°C	–	–4.4	–	mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain–Source On–Resistance	$V_{GS} = 4.5\ \text{V}$, $I_D = 15\ \text{A}$ $V_{GS} = 2.5\ \text{V}$, $I_D = 12\ \text{A}$ $V_{GS} = 4.5\ \text{V}$, $I_D = 15\ \text{A}$, $T_J = 125^\circ\text{C}$	–	4.3 6.2 6.3	6.1 9.3 9.0	m Ω
g_{FS}	Forward Transconductance	$V_{DS} = 5\ \text{V}$, $I_D = 15\ \text{A}$	–	91	–	S

DYNAMIC CHARACTERISTICS

C_{iss}	Input Capacitance	$V_{DS} = 15\ \text{V}$, $V_{GS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	–	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	$V_{DD} = 15\ \text{V}$, $I_D = 15\ \text{A}$, $V_{GS} = 4.5\ \text{V}$, $R_{GEN} = 6\ \Omega$	–	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	$V_{DD} = 15\ \text{V}$, $I_D = 15\ \text{A}$	–	19.4	27.2	nC
Q_{gs}	Total Gate Charge		–	4.8	–	nC
Q_{gd}	Gate to Drain “Miller” Charge		–	4.2	–	nC

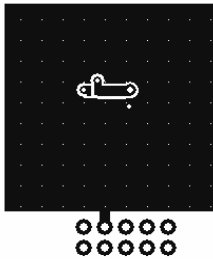
DRAIN–SOURCE DIODE CHARACTERISTICS

V_{SD}	Source to Drain Diode Forward Voltage	$V_{GS} = 0\ \text{V}$, $I_S = 15\ \text{A}$ (Note 2)	–	0.8	1.3	V
		$V_{GS} = 0\ \text{V}$, $I_S = 1.7\ \text{A}$ (Note 2)	–	0.7	1.2	
t_{rr}	Reverse Recovery Time	$I_F = 15\ \text{A}$, $di/dt = 100\ \text{A}/\mu\text{s}$	–	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:

- $R_{\theta JA}$ is determined with the device mounted on a 1 in² 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) $53^\circ\text{C}/\text{W}$ when mounted on a 1 in² 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 μs , Duty Cycle < 2.0%.
- Starting $T_J = 25^\circ\text{C}$; N–ch: $L = 1\ \text{mH}$, $I_{AS} = 16\ \text{A}$, $V_{DD} = 27\ \text{V}$, $V_{GS} = 10\ \text{V}$.

TYPICAL CHARACTERISTICS

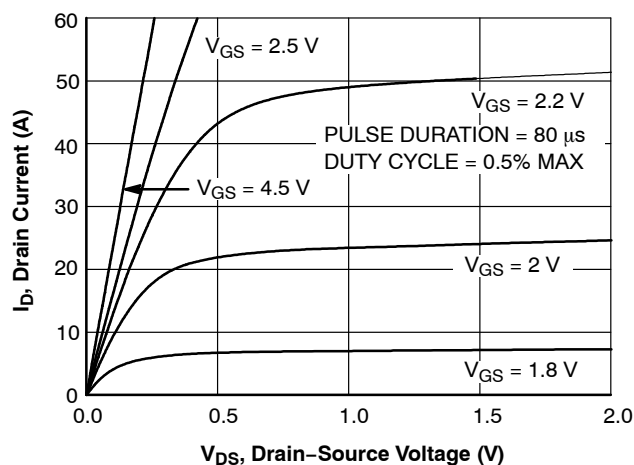
(T_J = 25°C unless otherwise noted)

Figure 1. On-Region Characteristics

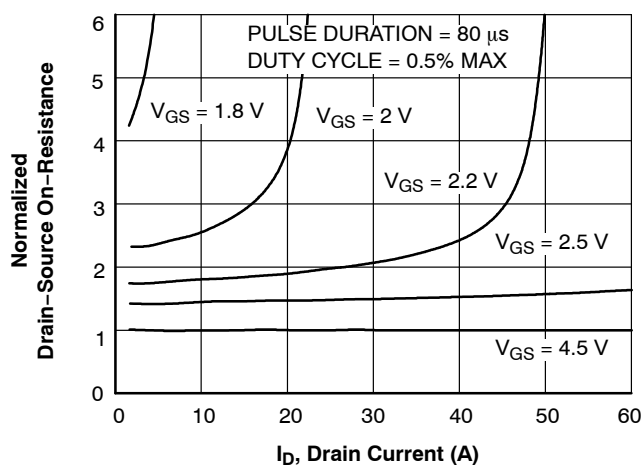


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

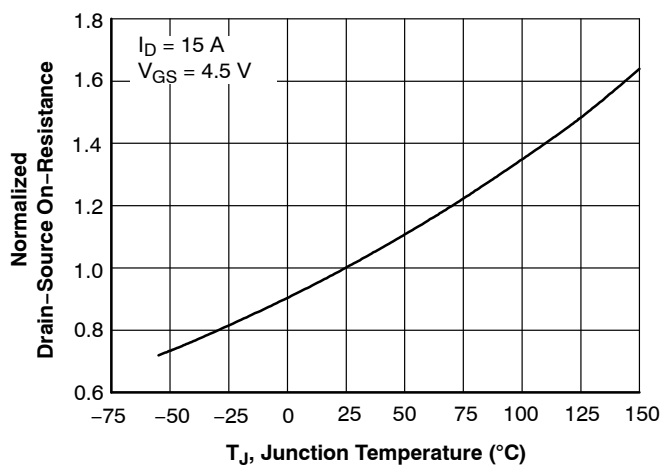


Figure 3. Normalized On-Resistance vs. Junction Temperature

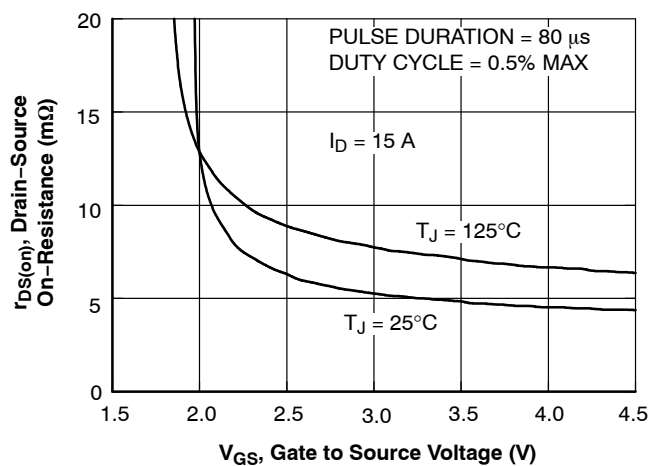


Figure 4. On-Resistance vs. Gate to Source Voltage

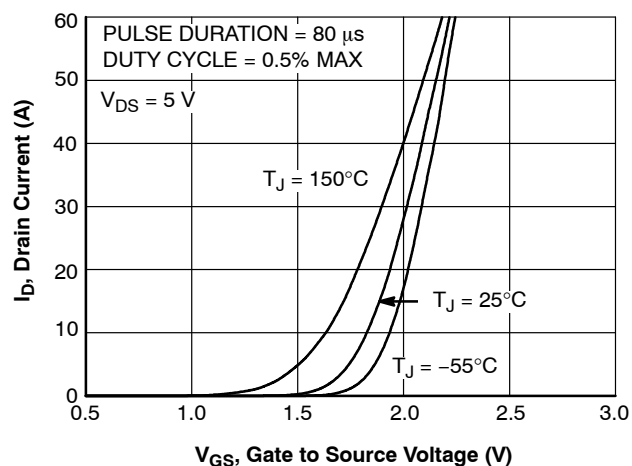


Figure 5. Transfer Characteristics

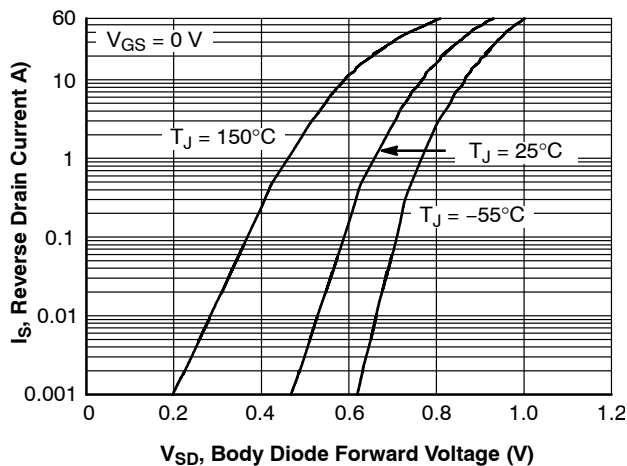


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

TYPICAL CHARACTERISTICS (continued)

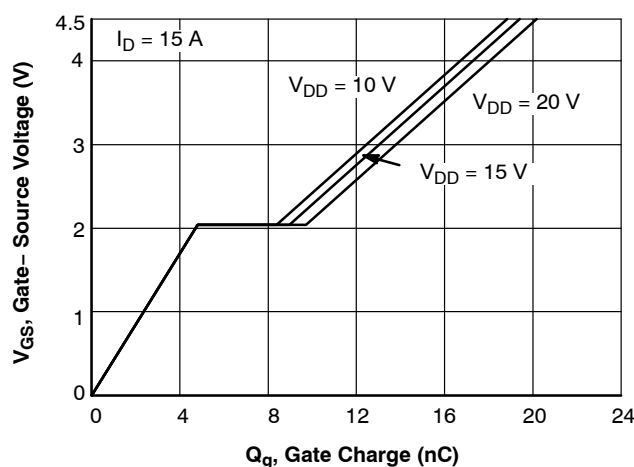
(T_J = 25°C unless otherwise noted)

Figure 7. Gate Charge Characteristics

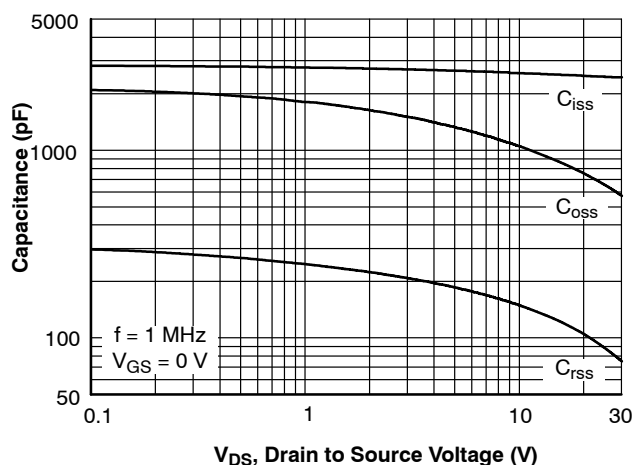


Figure 8. Capacitance vs. Drain to Source Voltage

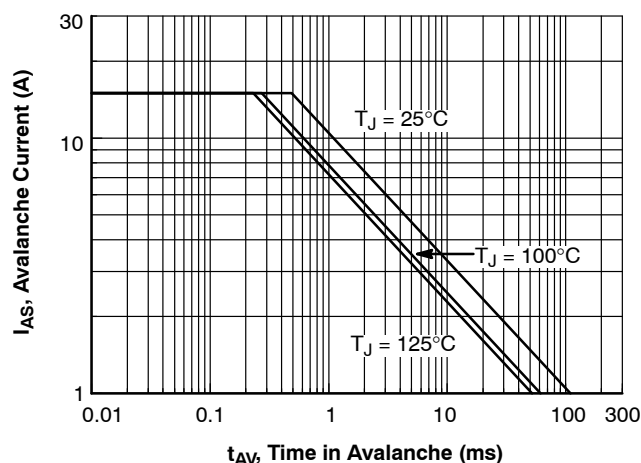


Figure 9. Unclamped Inductive Switching Capability

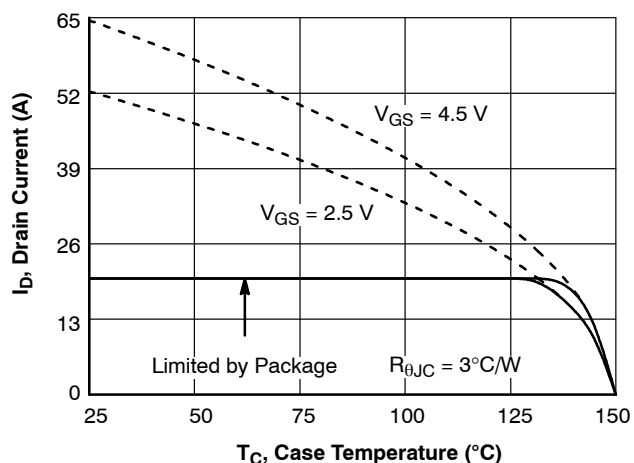


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

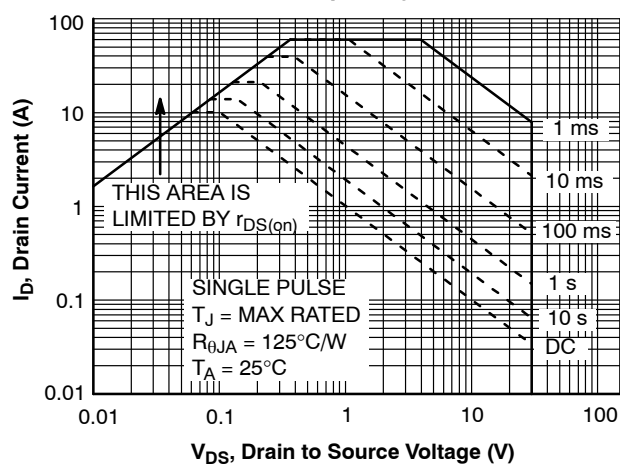


Figure 11. Forward Bias Safe Operating Area

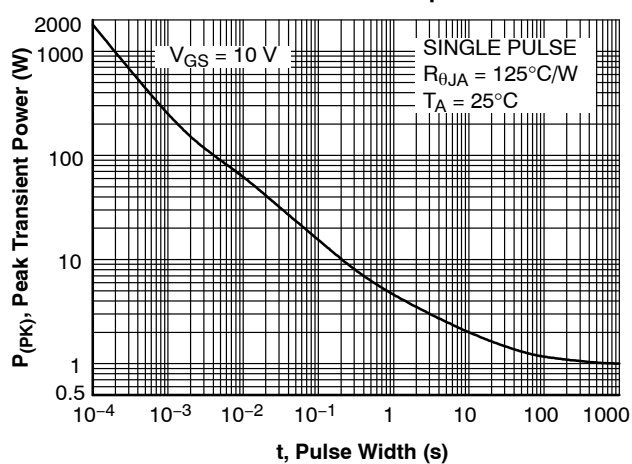


Figure 12. Single Pulse Maximum Power Dissipation

TYPICAL CHARACTERISTICS (continued)

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

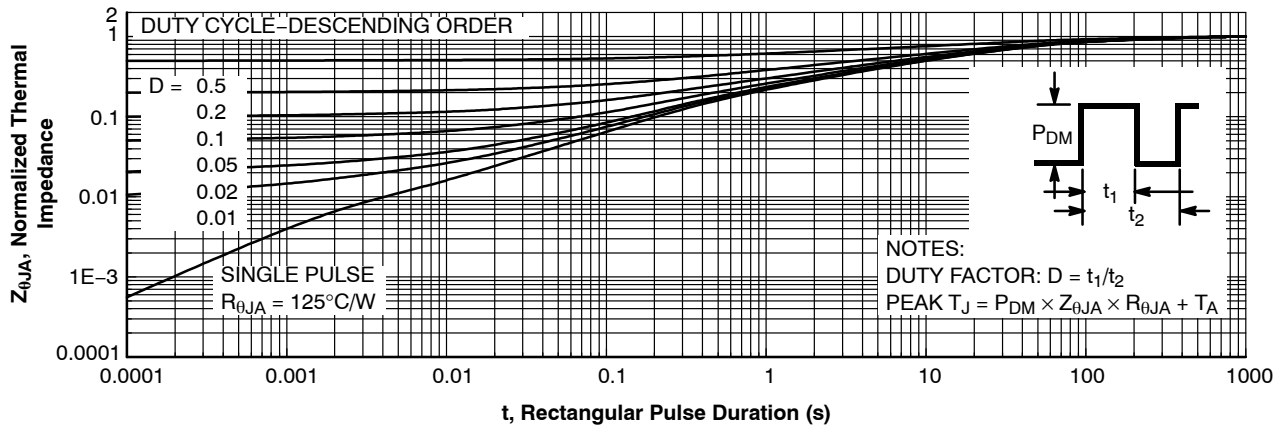
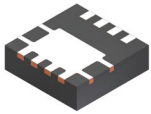
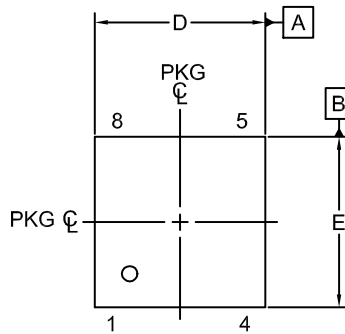


Figure 13. Junction-to-Ambient Transient Thermal Response Curve

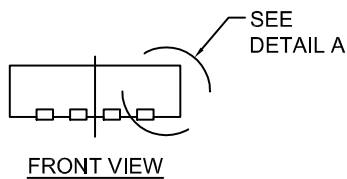


PQFN8 3.3X3.3, 0.65P
CASE 483AK
ISSUE B

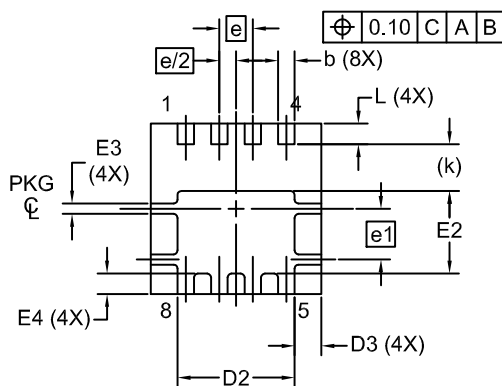
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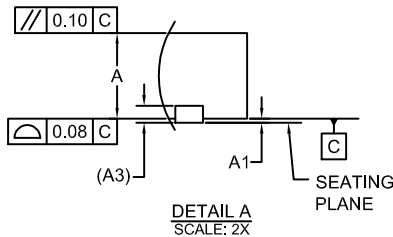
TOP VIEW



FRONT VIEW



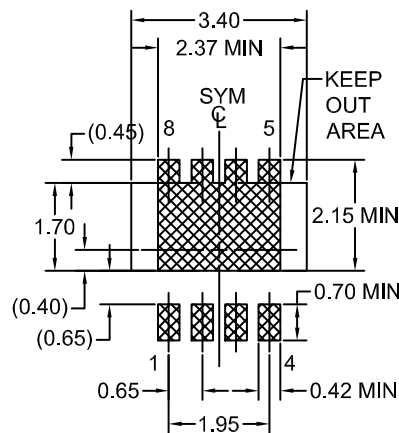
BOTTOM VIEW



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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