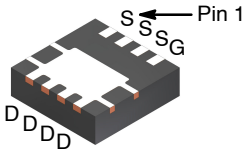
MOSFET – N-Channel, POWERTRENCH®

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.

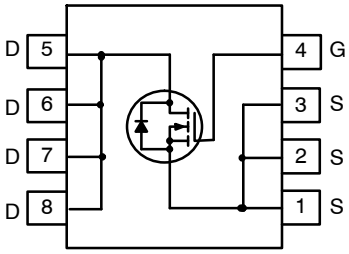
Features

- 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

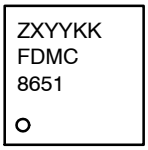
- Synchronous Rectifier
- 3.3 V Input Synchronous Buck Switch

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 − Continuous (Package Limited) − Continuous (Silicon Limited) − Continuous (Note 1a) − Pulsed	 T_C = 25°C T_C = 25°C T_A = 25°C 	 20 64 15 60	A
E_{AS}	Single Pulse Avalanche Energy (Note 3)		128	mJ
P_D	Power Dissipation Power Dissipation (Note 1a)	T_C = 25°C T_A = 25°C	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

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.

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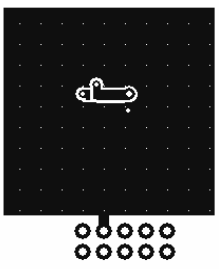
ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted.)

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
ΔBV_{DSS} / ΔT_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
$\Delta V_{GS(th)}$ / ΔT_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 V_{GS} = 2.5 V, I_D = 12 A V_{GS} = 4.5 V, I_D = 15 A, T_J = 125°C	– – –	4.3 6.2 6.3	6.1 9.3 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

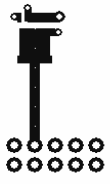
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

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)

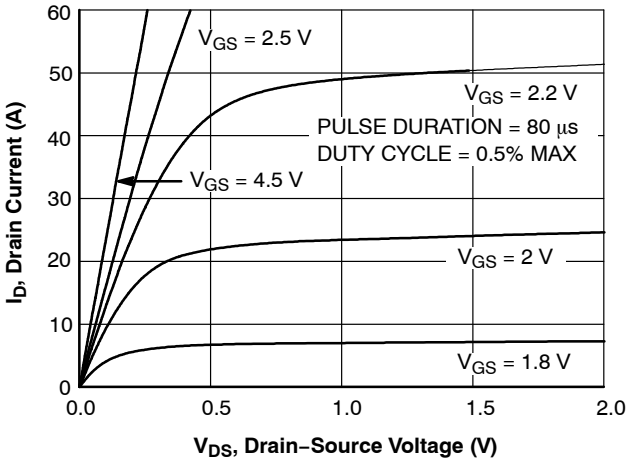


Figure 1. On−Region Characteristics

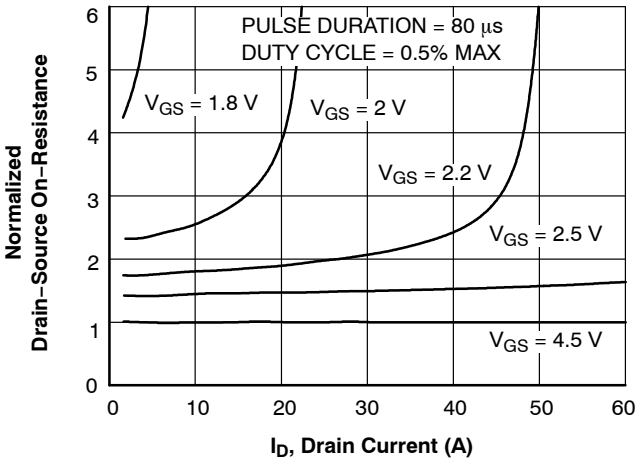


Figure 2. Normalized On−Resistance vs. Drain Current and Gate Voltage

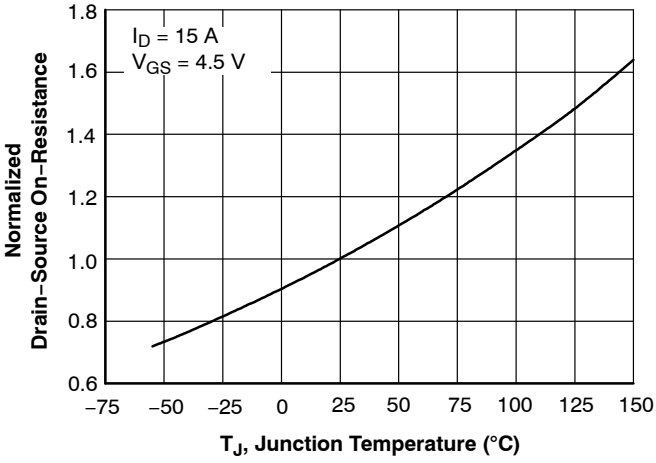


Figure 3. Normalized On−Resistance vs. Junction Temperature

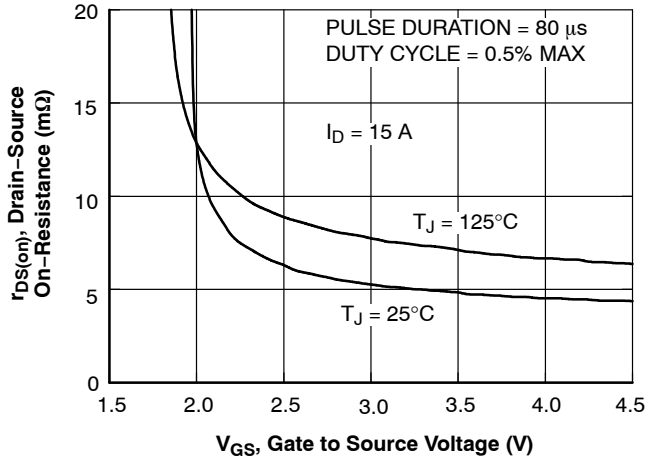


Figure 4. On−Resistance vs. Gate to Source Voltage

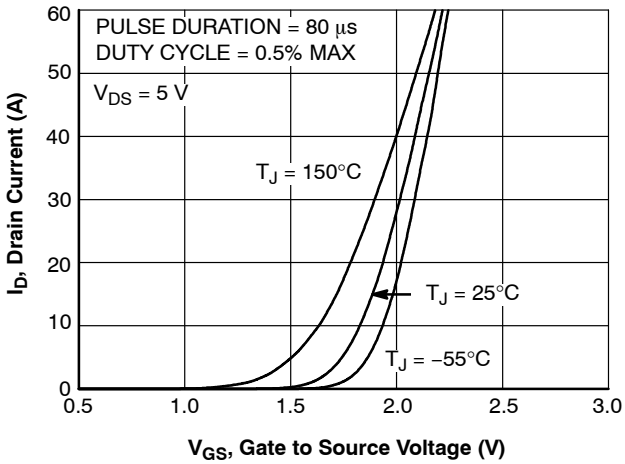


Figure 5. Transfer Characteristics

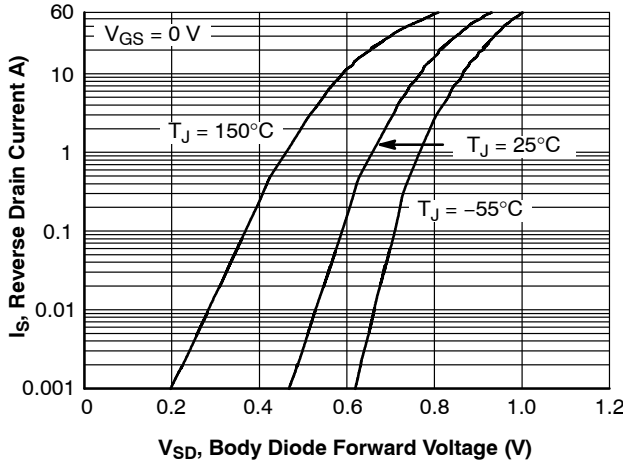


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

TYPICAL CHARACTERISTICS (continued)

(T_J = 25°C unless otherwise noted)

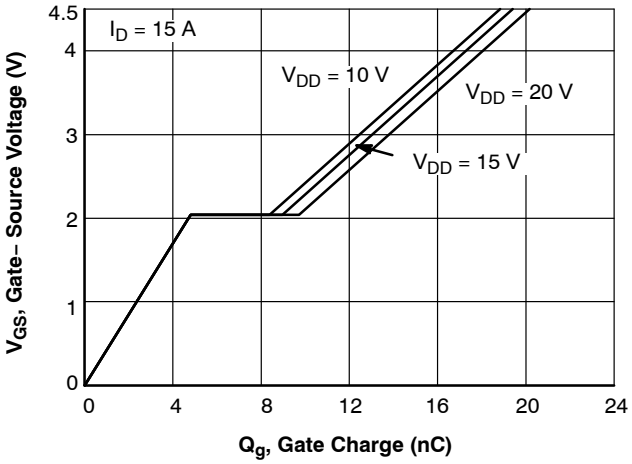


Figure 7. Gate Charge Characteristics

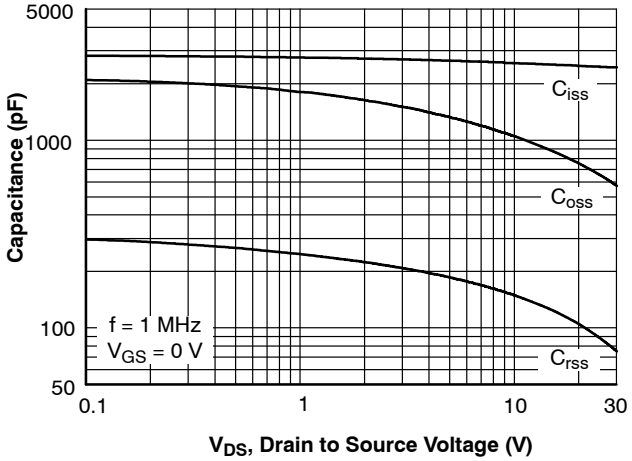


Figure 8. Capacitance vs. Drain to Source Voltage

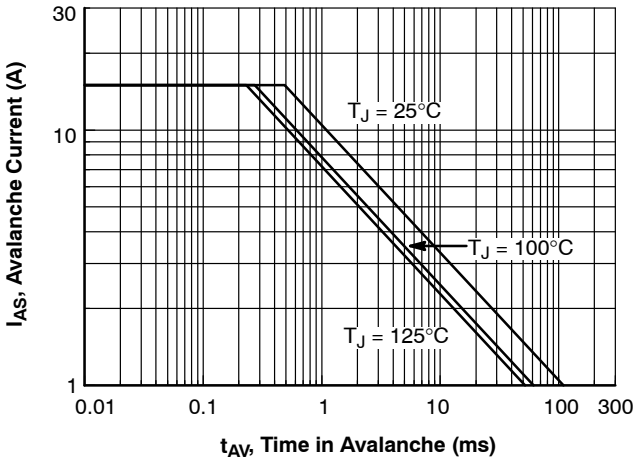


Figure 9. Unclamped Inductive Switching Capability

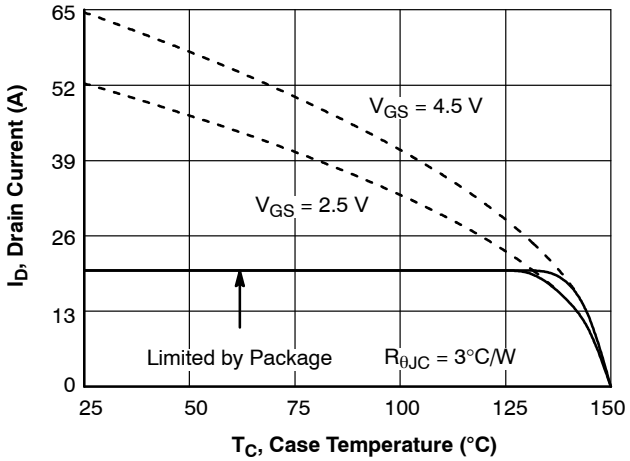


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

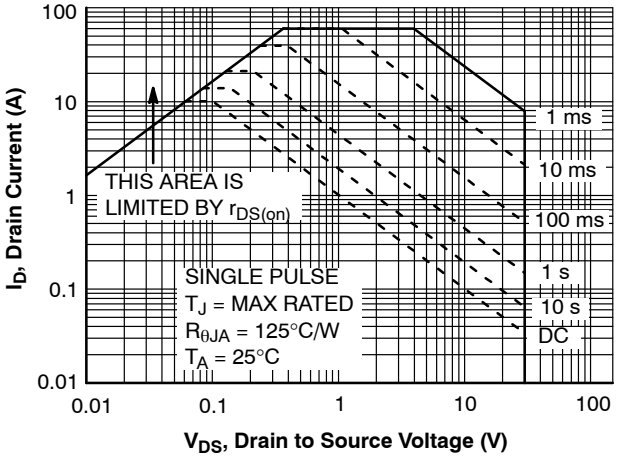


Figure 11. Forward Bias Safe Operating Area

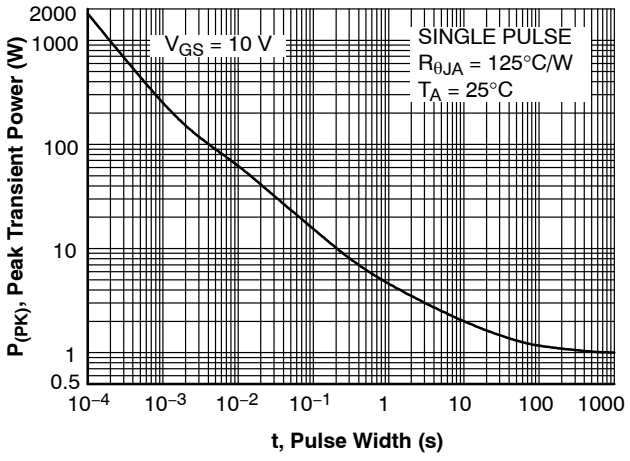


Figure 12. Single Pulse Maximum Power Dissipation

TYPICAL CHARACTERISTICS (continued)

(T_J = 25°C unless otherwise noted)

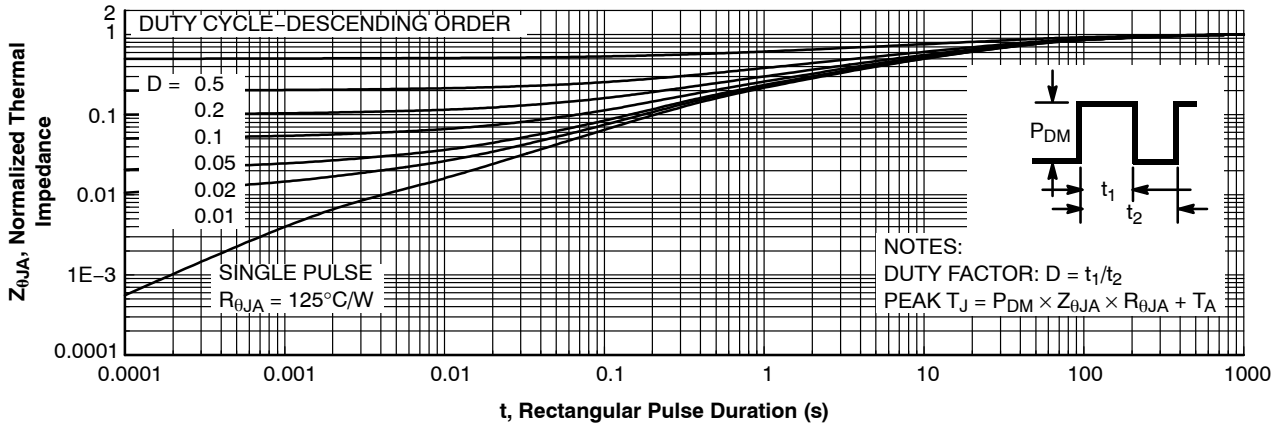


Figure 13. Junction−to−Ambient Transient Thermal Response Curve

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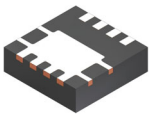
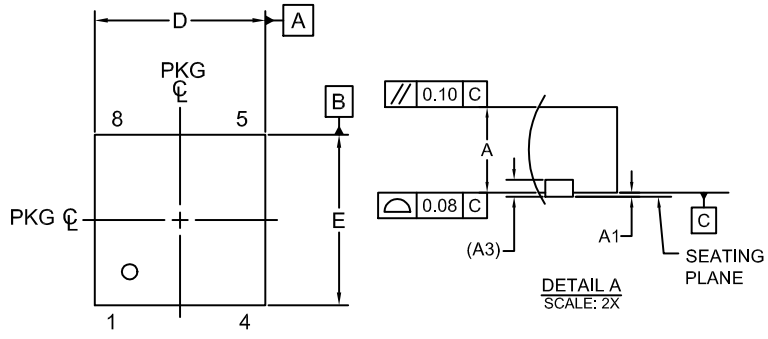
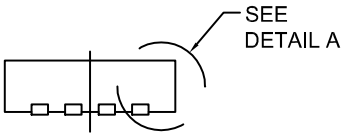


PQFN8 3.3X3.3, 0.65P
CASE 483AK
ISSUE B

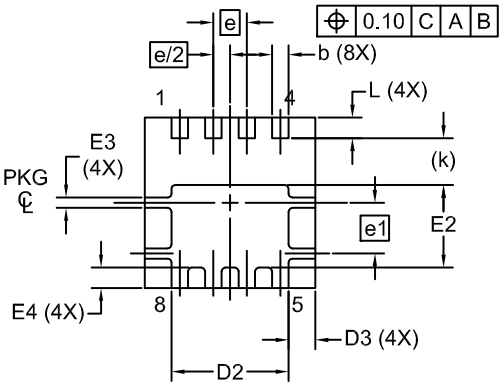
DATE 12 OCT 2021



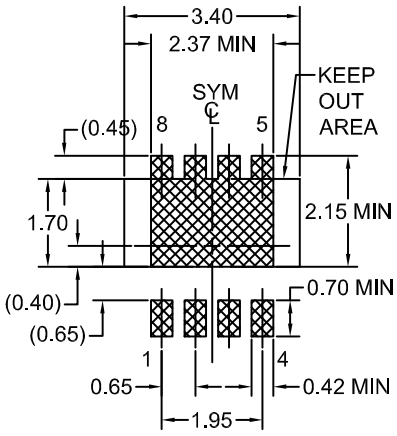
TOP VIEW



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

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