

# FDZ192NZ

## Power MOSFET, N-Channel, Trench<sup>®</sup>, 1.5 V Specified Thin WLCSP

20 V, 5.3 A, 39 mΩ

### General Description

Designed on advanced 1.5 V PowerTrench<sup>®</sup> process with state of the art “fine pitch” WLCSP packaging process, the FDZ192NZ minimizes both PCB space and  $r_{DS(on)}$ . This advanced WLCSP MOSFET embodies a breakthrough in packaging technology which enables the device to combine excellent thermal transfer characteristics, ultra-low profile packaging, low gate charge, and low  $r_{DS(on)}$ .

### Features

- Max  $r_{DS(on)}$  = 39 mΩ at  $V_{GS} = 4.5$  V,  $I_D = 2.0$  A
- Max  $r_{DS(on)}$  = 43 mΩ at  $V_{GS} = 2.5$  V,  $I_D = 2.0$  A
- Max  $r_{DS(on)}$  = 49 mΩ at  $V_{GS} = 1.8$  V,  $I_D = 1.0$  A
- Max  $r_{DS(on)}$  = 55 mΩ at  $V_{GS} = 1.5$  V,  $I_D = 1.0$  A
- Occupies only 1.5 mm<sup>2</sup> of PCB Area. Less than 50% of the Area of 2 x 2 BGA
- Ultra-thin Package: Less than 0.65 mm Height when Mounted to PCB
- HBM ESD Protection Level > 2200 V (Note 3)
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

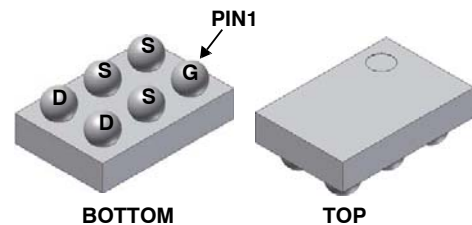
### Applications

- Battery Management
- Load Switch
- Battery Protection



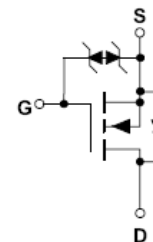
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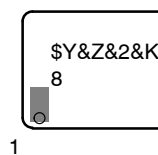


WLCSP6 1.5x1x0.6  
CASE 567PW

### SCHEMATIC



### MARKING DIAGRAM



\$Y	= ON Semiconductor Logo
&Z	= Assembly Plant Code
&2	= Numeric Date Code
&K	= Lot Code
8	= Specific Device Code

### ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

# FDZ192NZ

## ORDERING INFORMATION

Part Number	Device Marking	Package	Shipping <sup>†</sup>
FDZ192NZ	8	WLCSP6 1.5x1x0.6 (Pb-Free / Halogen Free)	5000 Units / 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.

## ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C unless otherwise noted)

Symbol	Parameter	Value	Unit
V <sub>DS</sub>	Drain to Source Voltage	20	V
V <sub>GS</sub>	Gate to Source Voltage	±8	V
I <sub>D</sub>	Drain Current Continuous, T <sub>A</sub> = 25°C (Note 1a)	5.3	A
	Drain Current Pulsed	15	
P <sub>D</sub>	Power Dissipation, T <sub>A</sub> = 25°C (Note 1a)	1.9	W
	Power Dissipation, T <sub>A</sub> = 25°C (Note 1b)	0.9	
T <sub>J</sub> , T <sub>STG</sub>	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

Symbol	Parameter	Value	Unit
R <sub>θJA</sub>	Thermal Resistance, Junction to Ambient (Note 1a)	65	°C/W
R <sub>θJA</sub>	Thermal Resistance, Junction to Ambient (Note 1b)	133	°C/W

## 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

BV <sub>DSS</sub>	Drain to Source Breakdown Voltage	I <sub>D</sub> = 250 μA, V <sub>GS</sub> = 0 V	20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250 μA, referenced to 25°C		10		mV/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 16 V, V <sub>GS</sub> = 0 V			1	μA
I <sub>GSS</sub>	Gate to Source Leakage Current	V <sub>GS</sub> = ±8 V, V <sub>DS</sub> = 0 V			±10	μA

### 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	0.4	0.7	1.0	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		-3		mV/°C
r <sub>DS(on)</sub>	Static Drain to Source On Resistance	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 2.0 A		26	39	mΩ
		V <sub>GS</sub> = 2.5 V, I <sub>D</sub> = 2.0 A		29	43	
		V <sub>GS</sub> = 1.8 V, I <sub>D</sub> = 1.0 A		33	49	
		V <sub>GS</sub> = 1.5 V, I <sub>D</sub> = 1.0 A		38	55	
		V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 2.0 A, T <sub>J</sub> = 125°C		31	47	
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 5 V, I <sub>D</sub> = 5.3 A		36		s

### Dynamic Characteristics

C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 0 V, f = 1 MHz		915	1220	pF
C <sub>oss</sub>	Output Capacitance			145	195	pF
C <sub>rss</sub>	Reverse Transfer Capacitance			100	150	pF

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 10\text{ V}$ , $I_D = 5.3\text{ A}$ , $V_{GS} = 4.5\text{ V}$ , $R_{GEN} = 6\ \Omega$		6.5	13	ns
$t_r$	Rise Time			4	10	ns
$t_{d(off)}$	Turn-Off Delay Time			50	80	ns
$t_f$	Fall Time			20	32	ns
$Q_g$	Total Gate Charge	$V_{GS} = 0\text{ V to }4.5\text{ V}$		12	17	nC
		$V_{DD} = 10\text{ V}$ , $I_D = 5.3\text{ A}$				
$Q_{gs}$	Gate to Source Charge			1.3		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			2.3		nC

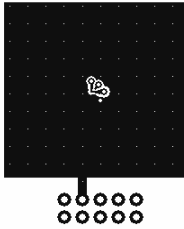
### Drain-Source Diode Characteristics

$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}$ , $I_S = 1.1\text{ A}$ (Note 2)		0.6	1.2	V
$t_{rr}$	Reverse Recovery Time	$I_F = 5.3\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$		18	32	ns
$Q_{rr}$	Reverse Recovery Charge			4.6	10	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 in<sup>2</sup> 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.)  $65^\circ\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper



b.)  $133^\circ\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper

- Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty cycle < 2.0%.
- The diode connected between the gate and source serves only as protection against ESD. No gate overvoltage rating is implied.

TYPICAL CHARACTERISTICS

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

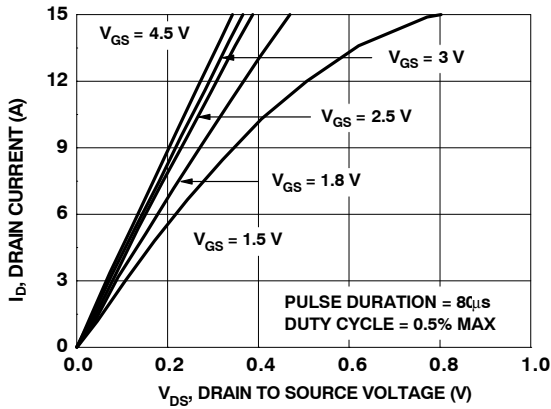


Figure 1. On-Region Characteristics

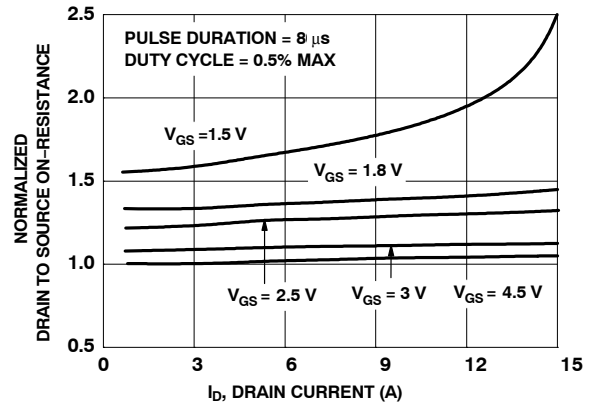


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

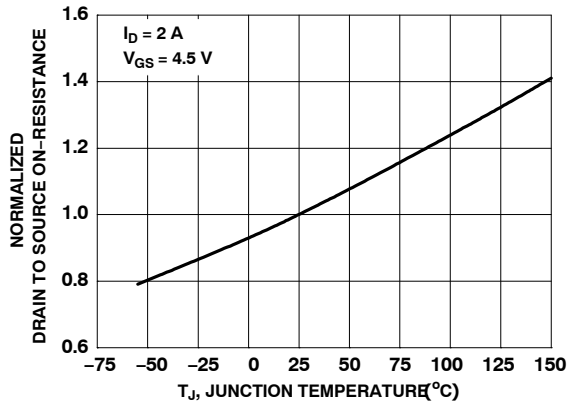


Figure 3. Normalized On-Resistance vs Junction Temperature

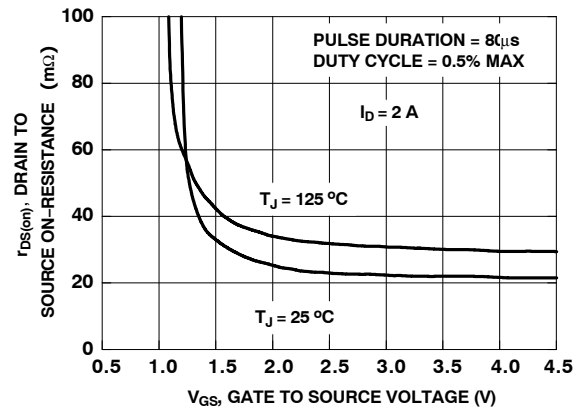


Figure 4. On-Resistance vs Gate to Source Voltage

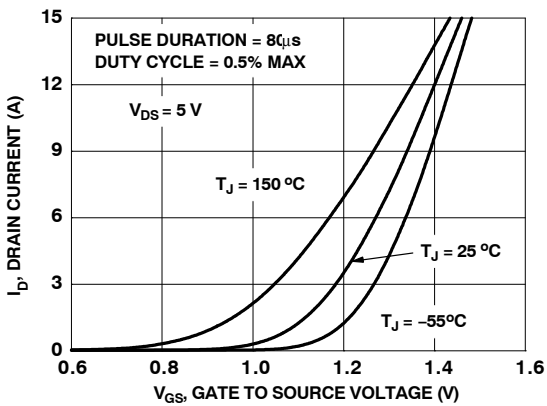


Figure 5. Transfer Characteristics

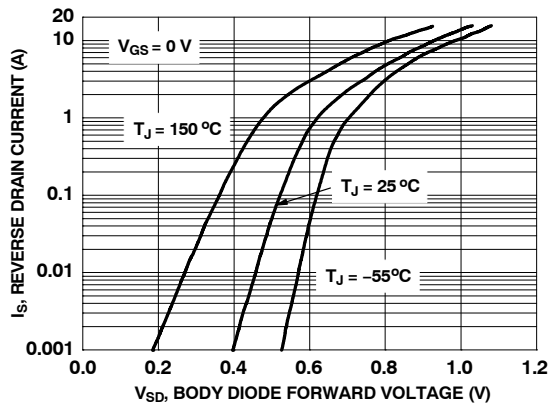


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

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## TYPICAL CHARACTERISTICS

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

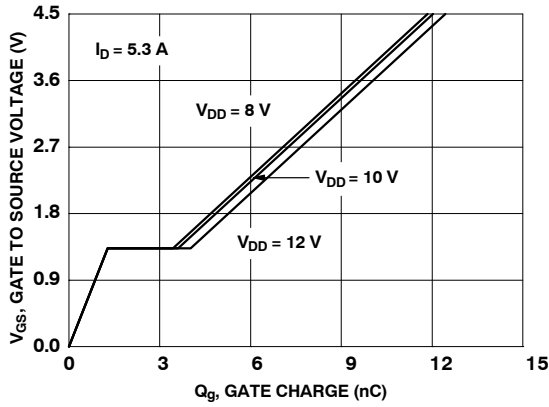


Figure 7. Gate Charge Characteristics

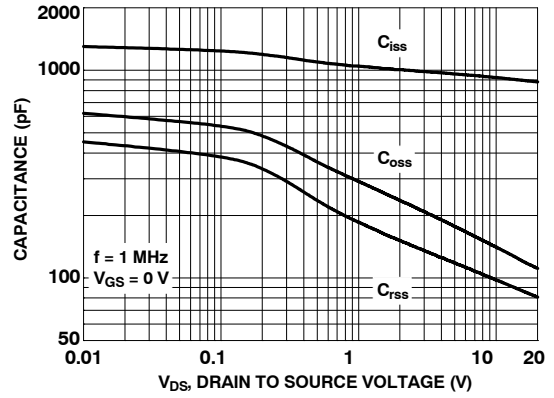


Figure 8. Capacitance vs Drain to Source Voltage

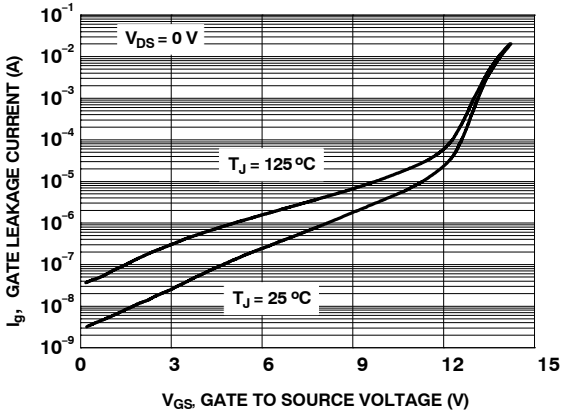


Figure 9. Gate Leakage Current vs Gate to Source Voltage

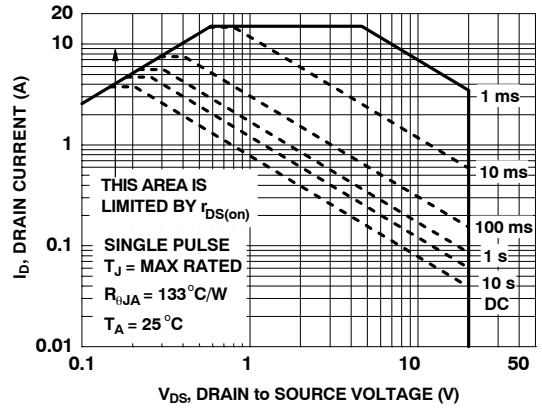


Figure 10. Forward Bias Safe Operating Area

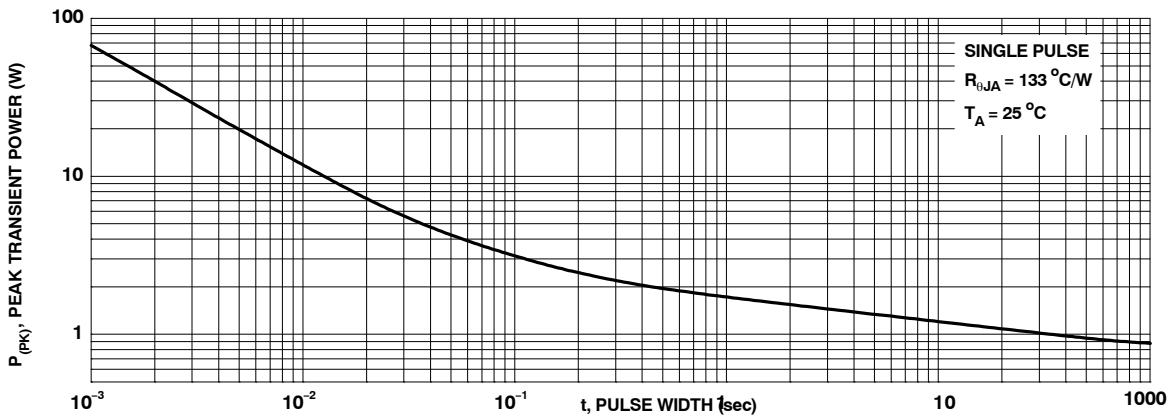


Figure 11. Single Pulse Maximum Power Dissipation

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## TYPICAL CHARACTERISTICS

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

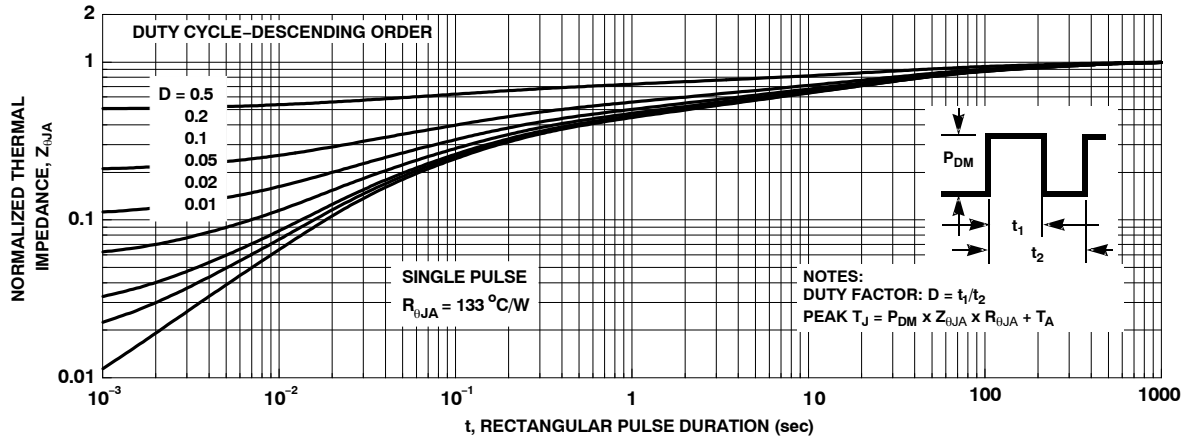


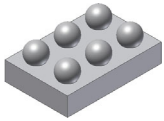
Figure 12. Junction-to-Ambient Transient Thermal Response Curve

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# MECHANICAL CASE OUTLINE

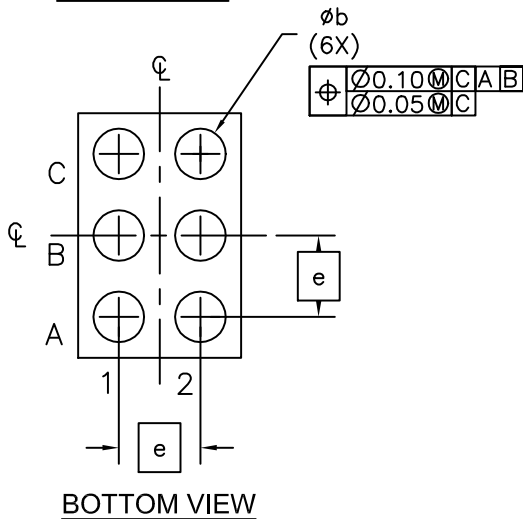
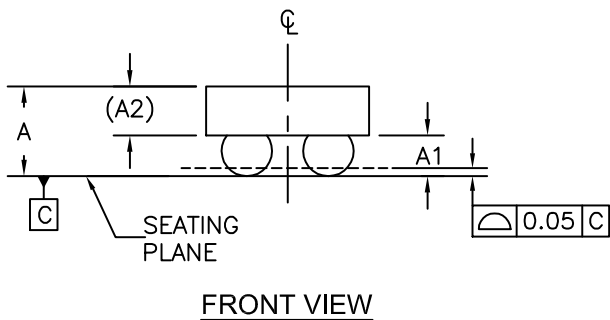
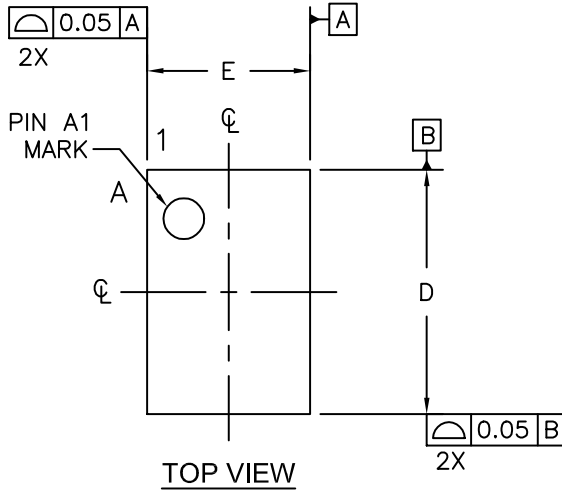
## PACKAGE DIMENSIONS

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**WLCSP6 1.5x1x0.6**  
CASE 567PW  
ISSUE A

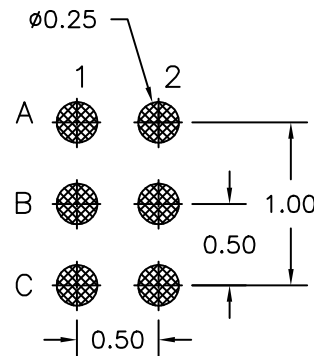
DATE 04 AUG 2021



NOTES: UNLESS OTHERWISE SPECIFIED

- A) ALL DIMENSIONS ARE IN MILLIMETERS.
- B) NO JEDEC REGISTRATION REFERENCE AS OF OCTOBER 2005.
- C) DRAWING CONFORMS TO ASME Y14.5M-2009

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	-	-	0.60
A1	0.22	0.25	0.28
A2	0.30 REF		
b	0.24	0.31	0.39
D	1.45	1.50	1.55
E	0.95	1.00	1.05
e	0.50 BSC		



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

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