

# MOSFET – Single N-Channel, POWERTRENCH®

60 V, 7.5 A, 23 mΩ

## FDMA86551L

### General Description

This device has been designed to provide maximum efficiency and thermal performance for synchronous buck converters. The low  $R_{DS(on)}$  and gate charge provide excellent switching performance.

### Features

- Max  $R_{DS(on)}$  = 23 mΩ @  $V_{GS} = 10$  V,  $I_D = 7.5$  A
- Max  $R_{DS(on)}$  = 35 mΩ @  $V_{GS} = 4.5$  V,  $I_D = 6$  A
- Low Profile – 0.8 mm Maximum in the New Package  
MicroFET™ 2x2 mm
- This Device is Pb-Free, Halide Free and RoHS Compliant

### Applications

- DC-DC Buck Converters

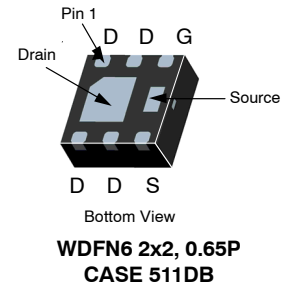
### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain to Source Voltage	60	V
$V_{GS}$	Gate to Source Voltage	±20	V
$I_D$	Drain Current – Continuous (Note 1a) $T_A = 25^\circ\text{C}$ – Pulsed (Note 4)	7.5 45	A
$E_{AS}$	Single Pulse Avalanche Energy (Note 3)	37	mJ
$P_D$	Power Dissipation (Note 1a) $T_A = 25^\circ\text{C}$ Power Dissipation (Note 1b) $T_A = 25^\circ\text{C}$	2.4 0.9	W
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	–55 to +150	°C

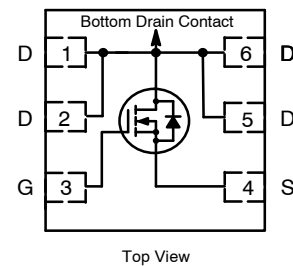
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

### THERMAL CHARACTERISTICS

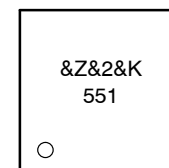
Symbol	Parameter	Ratings	Unit
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	52	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1b)	145	



### PIN CONNECTIONS

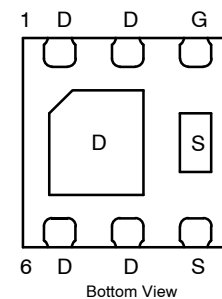


### MARKING DIAGRAM



- &Z = Assembly Plant Code
- &2 = Data Code (Year & Week)
- &K = Lot Run Code
- 551 = Specific Device Code

### PIN ASSIGNMENT



### ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

# FDMA86551L

**ELECTRICAL CHARACTERISTICS**  $T_A = 25^\circ\text{C}$  unless otherwise noted.

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

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = 250 \mu\text{A}, V_{GS} = 0 \text{ V}$	60	–	–	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , Referenced to $25^\circ\text{C}$	–	31	–	mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 48 \text{ V}, V_{GS} = 0 \text{ V}$	–	–	1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 20 \text{ V}, V_{DS} = 0 \text{ V}$	–	–	100	nA

**ON CHARACTERISTICS**

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250 \mu\text{A}$	1.0	1.8	3.0	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , Referenced to $25^\circ\text{C}$	–	–5	–	mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10 \text{ V}, I_D = 7.5 \text{ A}$	–	19	23	m $\Omega$
		$V_{GS} = 4.5 \text{ V}, I_D = 6 \text{ A}$	–	26	35	
		$V_{GS} = 10 \text{ V}, I_D = 7.5 \text{ A}, T_J = 125^\circ\text{C}$	–	28	33	
$g_{FS}$	Forward Transconductance	$V_{DD} = 5 \text{ V}, I_D = 7.5 \text{ A}$	–	21	–	S

**DYNAMIC CHARACTERISTICS**

$C_{iss}$	Input Capacitance	$V_{DS} = 30 \text{ V}, V_{GS} = 0 \text{ V}$ , $f = 1.0 \text{ MHz}$	–	881	1235	pF
$C_{oss}$	Output Capacitance		–	182	255	
$C_{rss}$	Reverse Transfer Capacitance		–	6.1	15	
$R_G$	Gate Resistance		0.1	0.5	1.5	

**SWITCHING CHARACTERISTICS**

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 30 \text{ V}, I_D = 7.5 \text{ A}$ , $V_{GS} = 10 \text{ V}, R_{GEN} = 6 \Omega$	–	7.3	15	ns
$t_r$	Rise Time		–	1.7	10	
$t_{d(off)}$	Turn-Off Delay Time		–	16	29	
$t_f$	Fall Time		–	1.4	10	
$Q_{g(TOT)}$	Total Gate Charge	$V_{GS} = 0 \text{ V to } 10 \text{ V}$ , $V_{DD} = 30 \text{ V}, I_D = 7.5 \text{ A}$	–	12	17	nC
		$V_{GS} = 0 \text{ V to } 4.5 \text{ V}$ , $V_{DD} = 30 \text{ V}, I_D = 7.5 \text{ A}$	–	5.8	8.1	
$Q_{gs}$	Gate to Source Charge	$V_{DD} = 30 \text{ V}, I_D = 7.5 \text{ A}$	–	2.7	3.8	
$Q_{gd}$	Gate to Drain "Miller" Charge		–	1.4	2.0	

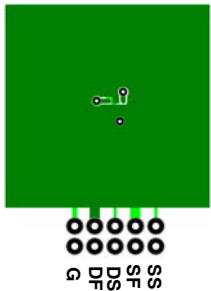
**DRAIN-SOURCE DIODE CHARACTERISTICS**

$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0 \text{ V}, I_S = 2 \text{ A}$ (Note 2)	–	0.8	1.2	V
		$V_{GS} = 0 \text{ V}, I_S = 7.5 \text{ A}$ (Note 2)	–	0.9	1.2	
$t_{rr}$	Reverse Recovery Time	$I_F = 7.5 \text{ A}, di/dt = 100 \text{ A}/\mu\text{s}$	–	23	37	ns
$Q_{rr}$	Reverse Recovery Charge		–	9.7	19	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  $R_{\theta JA}$  is determined by the user's board design.



a.  $52^\circ\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper



b.  $145^\circ\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper.

- Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty Cycle < 2.0%
- $E_{AS}$  of 37 mJ is based on starting  $T_J = 25^\circ\text{C}$ ,  $L = 3 \text{ mH}$ ,  $I_{AS} = 5 \text{ A}$ ,  $V_{DD} = 60 \text{ V}$ ,  $V_{GS} = 10 \text{ V}$ . 100% test at  $L = 0.1 \text{ mH}$ ,  $I_{AS} = 16 \text{ A}$ .
- Pulsed  $I_d$  measured at  $t_d \leq 250 \mu\text{s}$ , refer to Figure 11 SOA graph for more details.

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

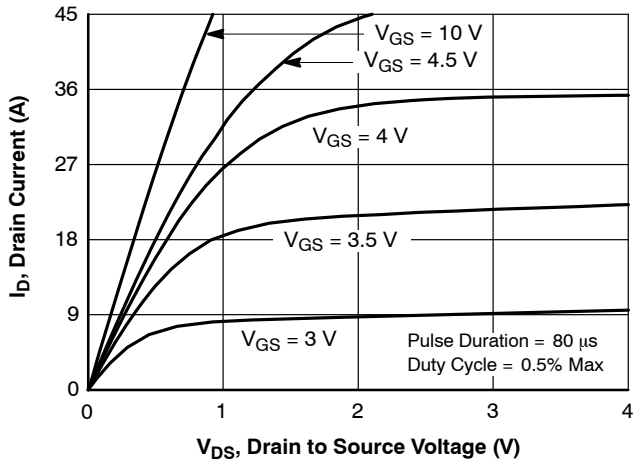


Figure 1. On-Region Characteristics

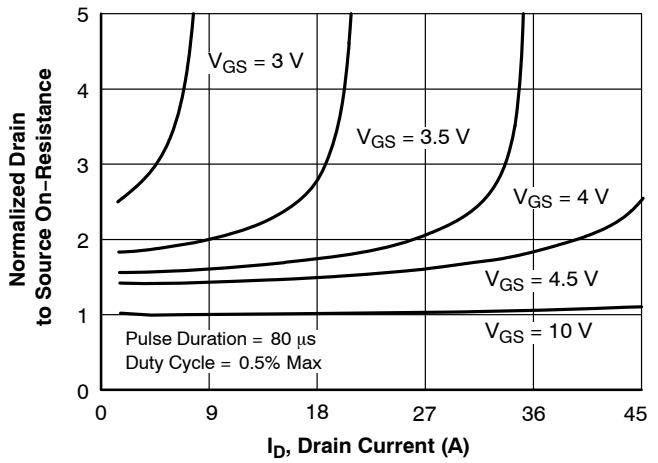


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

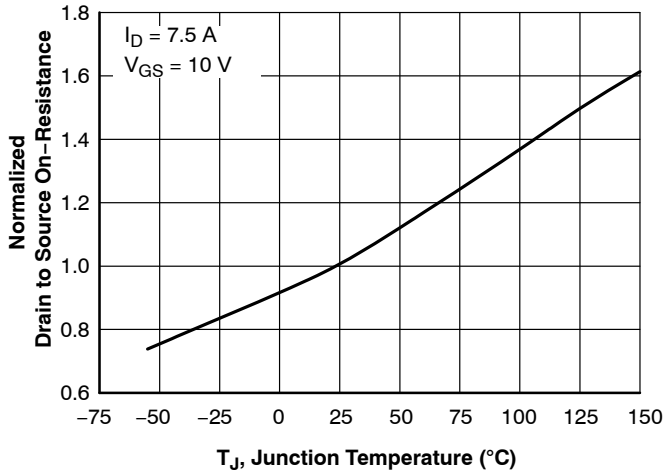


Figure 3. Normalized On-Resistance vs. Junction Temperature

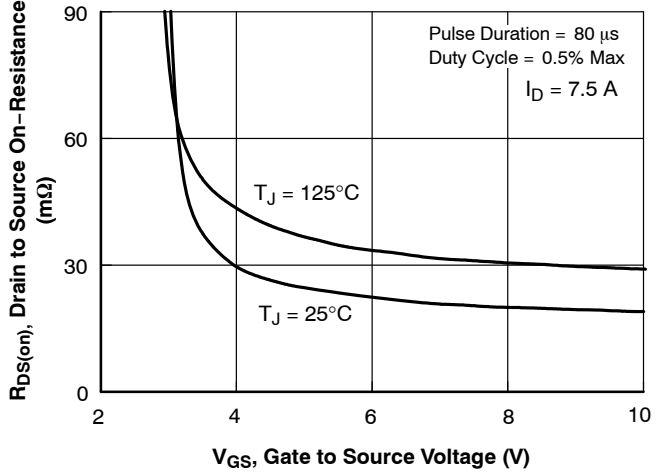


Figure 4. On-Resistance vs. Gate to Source Voltage

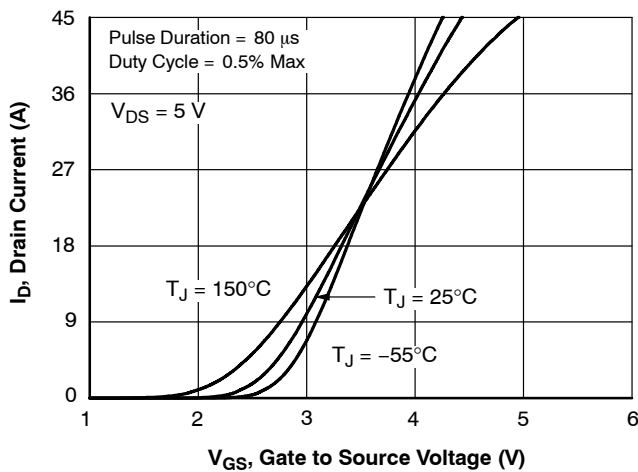


Figure 5. Transfer Characteristics

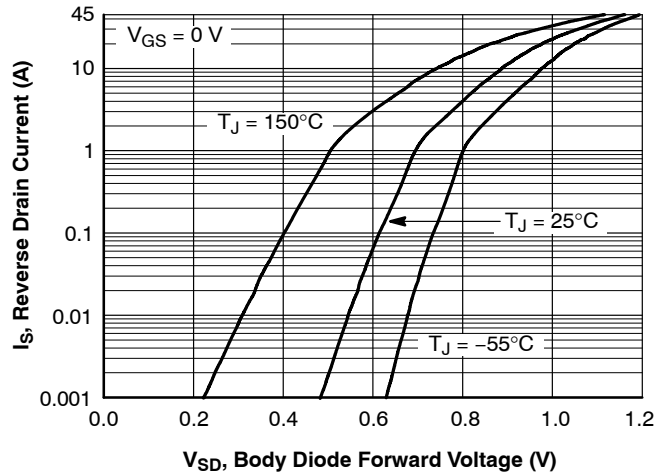


Figure 6. Source to Drain Diode Forward Voltage vs. Source Current

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

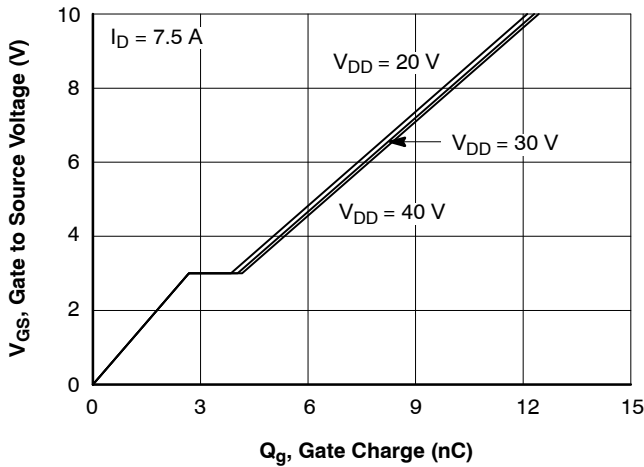


Figure 7. Gate Charge Characteristics

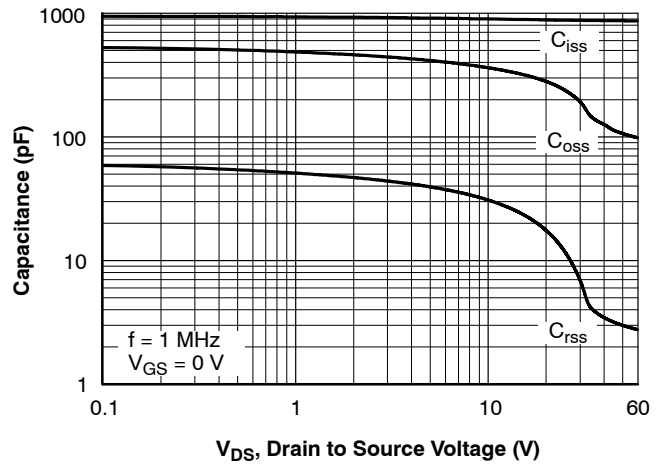


Figure 8. Capacitance vs. Drain to Source Voltage

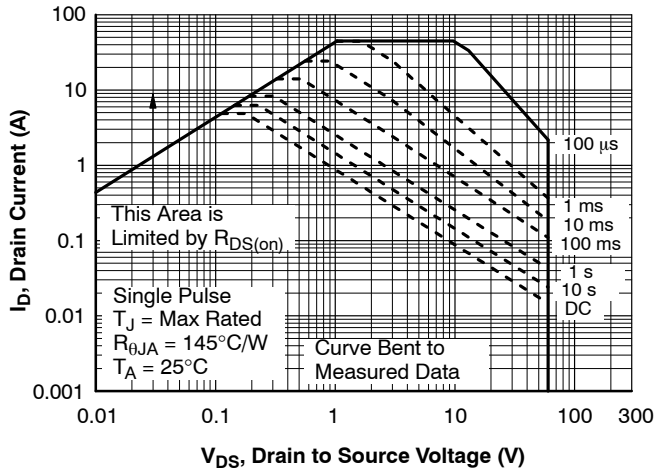


Figure 9. Forward Bias Safe Operating Area

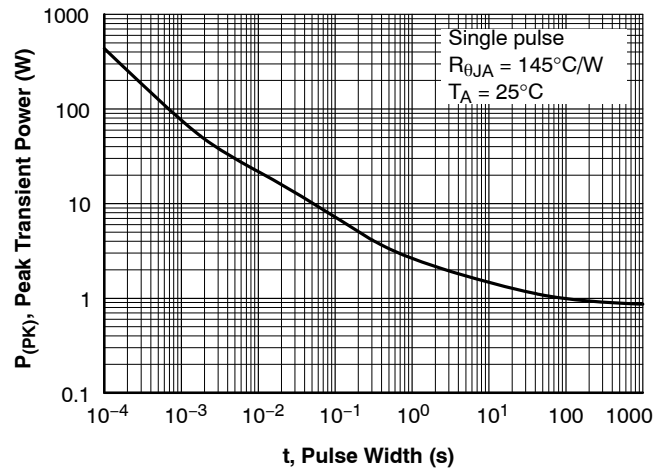


Figure 10. Single Pulse Maximum Power Dissipation

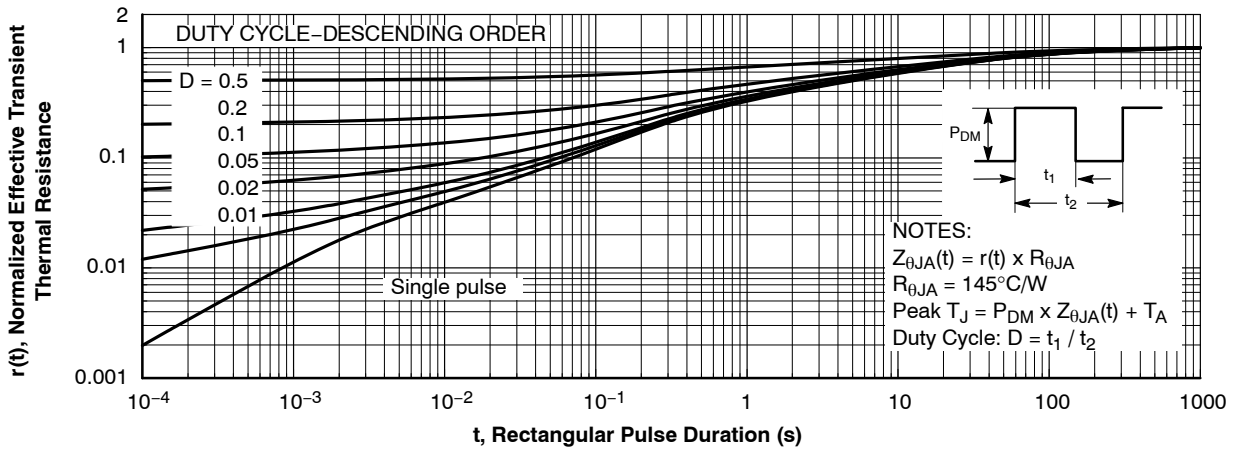


Figure 11. Junction-to-Ambient Transient Thermal Response Curve

# FDMA86551L

## ORDERING INFORMATION

Device	Device Marking	Package Type	Reel Size	Tape Width	Shipping <sup>†</sup>
FDMA86551L	551	WDFN6 2x2, 0.65P (Pb-Free/Halide Free)	7"	8 mm	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 Specifications Brochure, [BRD8011/D](#).

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# MECHANICAL CASE OUTLINE

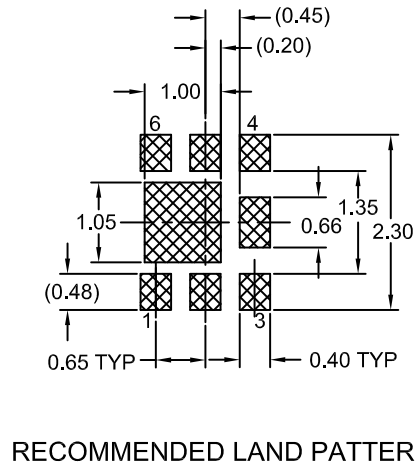
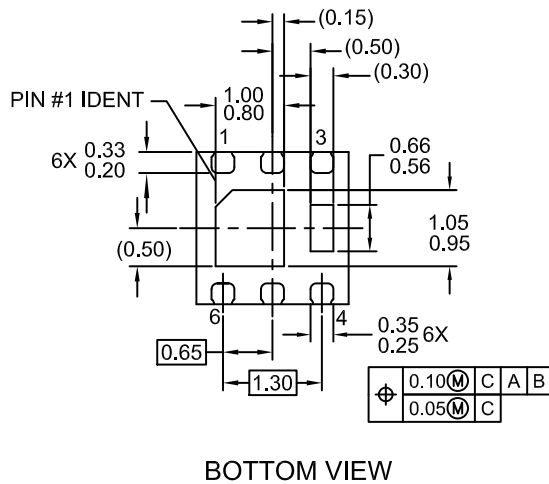
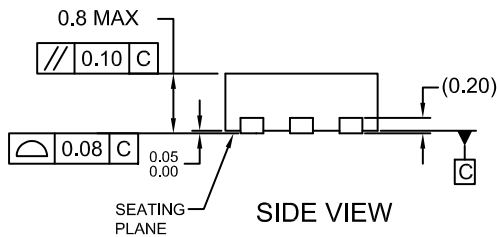
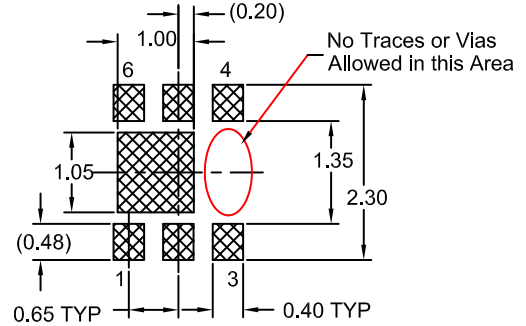
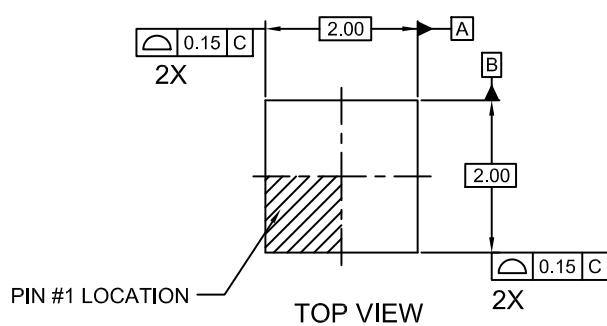
## PACKAGE DIMENSIONS

ON Semiconductor®



WDFN6 2x2, 0.65P  
CASE 511DB  
ISSUE O

DATE 31 AUG 2016



NOTES:

- A. DOES NOT FULLY CONFORM TO JEDEC REGISTRATION MO-229 DATED AUG/2003
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994

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