ON Semiconductor®

FDZ451PZ

P-Channel 1.5 V Specified PowerTrench® Thin WL-CSP MOSFET
-20 V, -2.6 A, 140 mΩ

Features

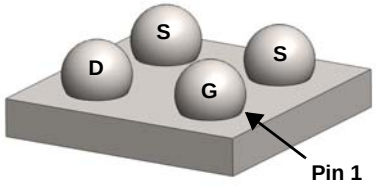
- Max $r_{DS(on)}$ = 140 mΩ at V_{GS} = -4.5 V, I_D = -2 A
- Max $r_{DS(on)}$ = 182 mΩ at V_{GS} = -2.5 V, I_D = -1.5 A
- Max $r_{DS(on)}$ = 231 mΩ at V_{GS} = -1.8 V, I_D = -1 A
- Max $r_{DS(on)}$ = 315 mΩ at V_{GS} = -1.5 V, I_D = -1 A
- Occupies only 0.64 mm^2 of PCB area. Less than 16% of the area of 2 x 2 BGA
- Ultra-thin package: less than 0.4 mm height when mounted to PCB
- HBM ESD protection level > 2 kV (Note3)
- RoHS Compliant

General Description

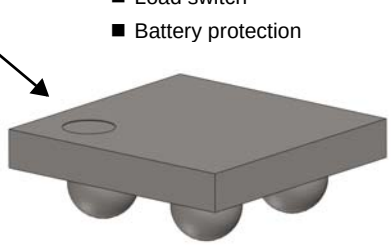
Designed on ON Semiconductor advanced 1.5 V PowerTrench® process with state of the art "fine pitch" Thin WLCSP packaging process,
the FDZ451PZ minimizes both PCB space and $r_{DS(on)}$. This advanced WLCSP MOSFET embodies a breakthrough in packaging technology which enables the device to combine excellent thermal transfer characteristics, ultra-low profile (0.4
mm) and small (0.8x0.8 mm^2) packaging, low gate charge, and low $r_{DS(on)}$.

Applications

- Battery management
- Load switch
- Battery protection



BOTTOM



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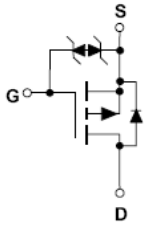


WL-CSP 0.8X0.8 Thin

MOSFET Maximum Ratings T_A = 25 °C unless otherwise noted

Symbol	Parameter			Ratings	Units
V_{DS}	Drain to Source Voltage			-20	V
V_{GS}	Gate to Source Voltage			±8	V
I_D	-Continuous	T_A = 25°C	(Note 1a)	-2.6	A
	-Pulsed			-10	
P_D	Power Dissipation	T_A = 25°C	(Note 1a)	1.3	W
	Power Dissipation	T_A = 25°C	(Note 1b)	0.4	
T_J, T_{STG}	Operating and Storage Junction Temperature Range			-55 to +150	°C

Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	(Note 1a)	93	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	(Note 1b)	311	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
EH	FDZ451PZ	WL-CSP 0.8X0.8 **Thin**	7 ”	8 mm	5000 units

August-2017, Rev.3

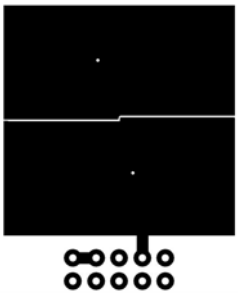
Publication Order Number:
FDZ451PZ/D

Electrical Characteristics T_J = 25 °C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = -250 μA, V_{GS} = 0 V	-20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = -250 μA, referenced to 25 °C		-13		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = -16 V, V_{GS} = 0 V			-1	μA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±8 V, V_{DS} = 0 V			±10	μA
On Characteristics						
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{GS} = V_{DS}, I_D = -250 μA	-0.3	-0.7	-1.2	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I_D = -250 μA, referenced to 25 °C		2.5		mV/°C
$r_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = -4.5 V, I_D = -2 A		108	140	mΩ
		V_{GS} = -2.5 V, I_D = -1.5 A		129	182	
		V_{GS} = -1.8 V, I_D = -1 A		159	231	
		V_{GS} = -1.5 V, I_D = -1 A		201	315	
		V_{GS} = -4.5 V, I_D = -2 A, T_J =125°C		143	204	
g_{FS}	Forward Transconductance	V_{DD} = -5 V, I_D = -2 A		7.8		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = -10 V, V_{GS} = 0 V, f = 1 MHz		416	555	pF
C_{oss}	Output Capacitance			61	80	pF
C_{rss}	Reverse Transfer Capacitance			53	70	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = -10 V, I_D = -2.5 A, V_{GS} = -4.5 V, R_{GEN} = 6 Ω		4.9	10	ns
t_r	Rise Time			6.3	13	ns
$t_{d(off)}$	Turn-Off Delay Time			68	108	ns
t_f	Fall Time			33	52	ns
Q_g	Total Gate Charge	V_{GS} = -4.5 V, V_{DD} = -10 V, I_D = -2.5 A		6.3	8.8	nC
Q_{gs}	Gate to Source Charge			0.6		nC
Q_{gd}	Gate to Drain “Miller” Charge			1.7		nC
Drain-Source Diode Characteristics						
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0 V, I_S = -1.4 A (Note 2)		-0.9	-1.2	V
t_{rr}	Reverse Recovery Time	I_F = -2.5 A, di/dt = 100 A/μs		29	46	ns
Q_{rr}	Reverse Recovery Charge			10	18	nC

Notes:

1. $R_{\theta JA}$ is determined with the device mounted on a 1 in^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. 93 °C/W when mounted on a 1 in^2 pad of 2 oz copper.

b. 311 °C/W when mounted on a minimum pad of 2 oz copper.

2. Pulse Test: Pulse Width < 300μs, Duty cycle < 2.0%.

3. The diode connected between the gate and source serves only as protection ESD. No gate overvoltage rating is implied.

Typical Characteristics T_J = 25 °C unless otherwise noted

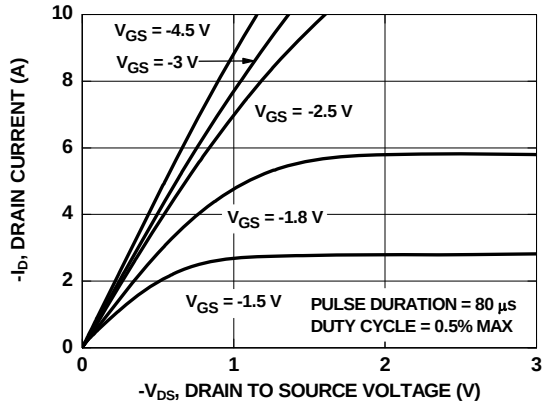


Figure 1. On-Region Characteristics

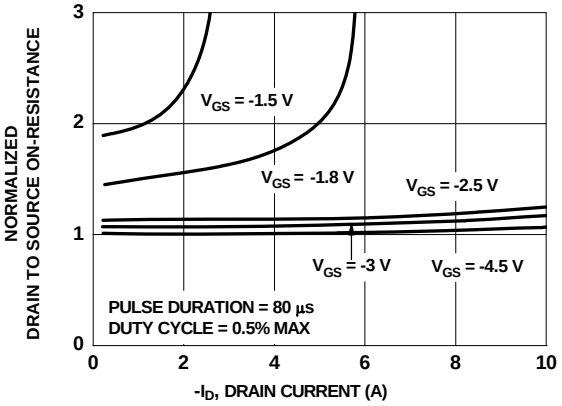


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

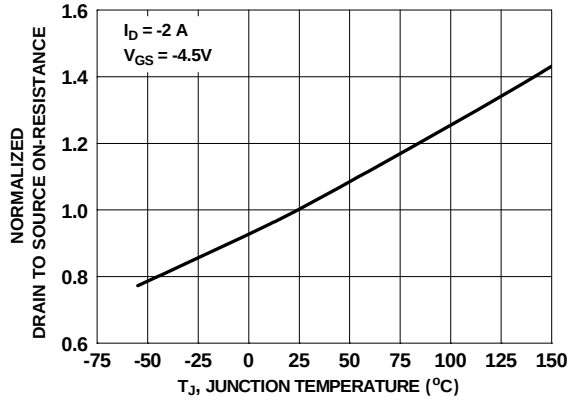


Figure 3. Normalized On-Resistance vs Junction Temperature

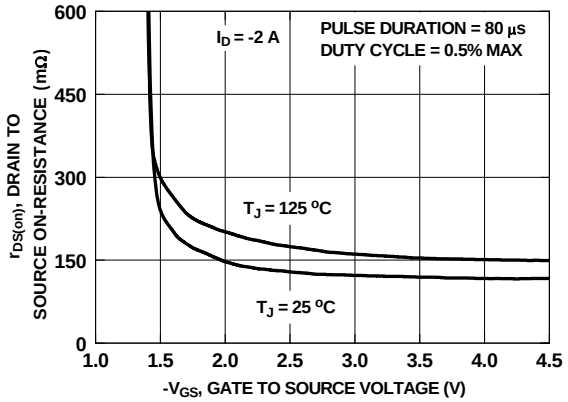


Figure 4. On-Resistance vs Gate to Source Voltage

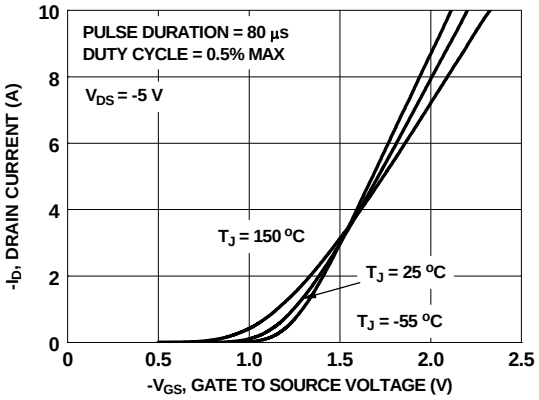


Figure 5. Transfer Characteristics

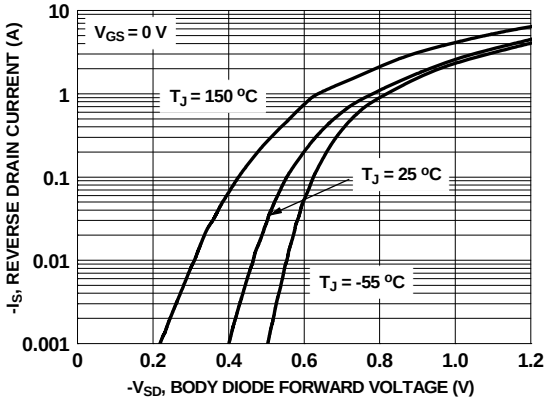


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics T_J = 25 °C unless otherwise noted

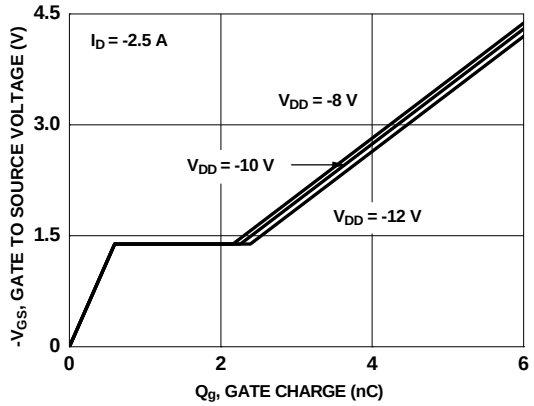


Figure 7. Gate Charge Characteristics

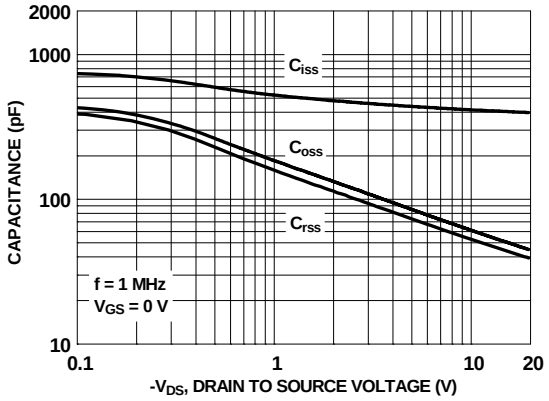


Figure 8. Capacitance vs Drain to Source Voltage

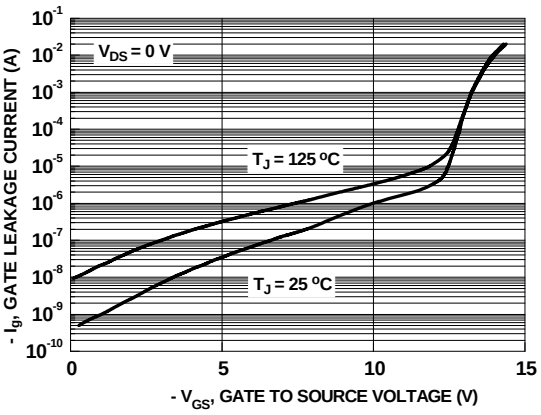


Figure 9. Gate Leakage Current vs Gate to Source Voltage

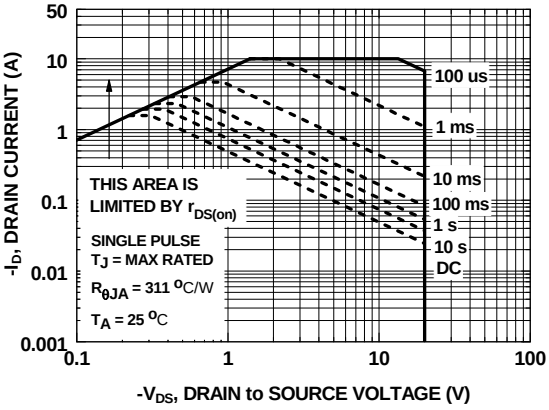


Figure 10. Forward Bias Safe Operating Area

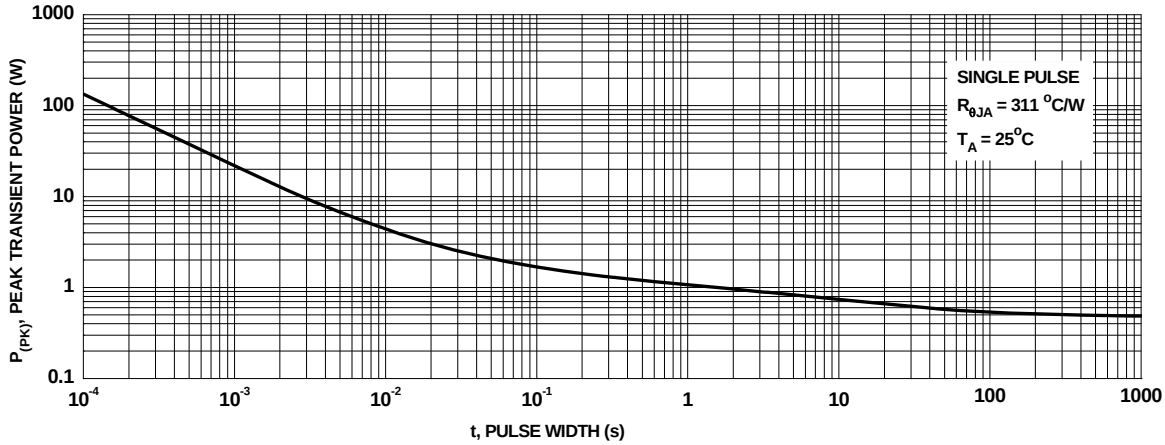


Figure 11. Single Pulse Maximum Power Dissipation

Typical Characteristics T_J = 25 °C unless otherwise noted

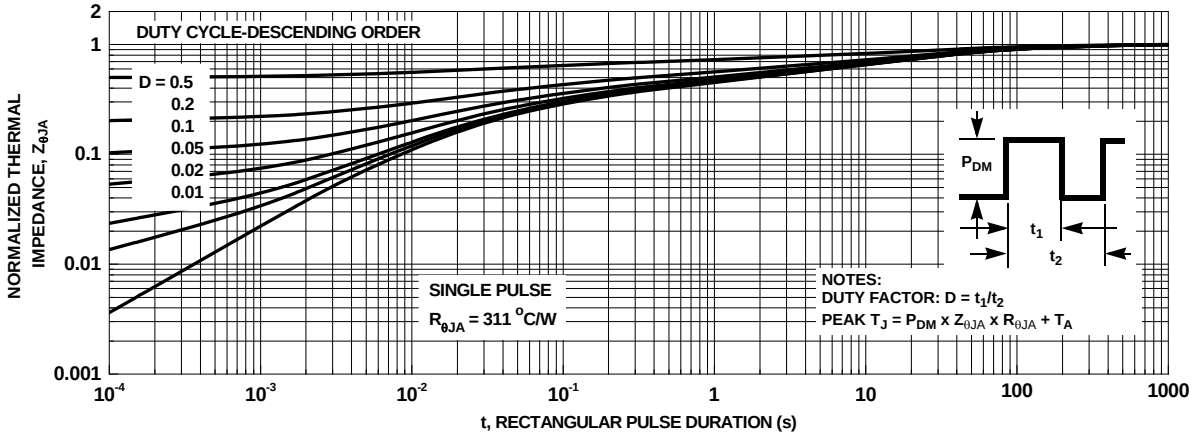
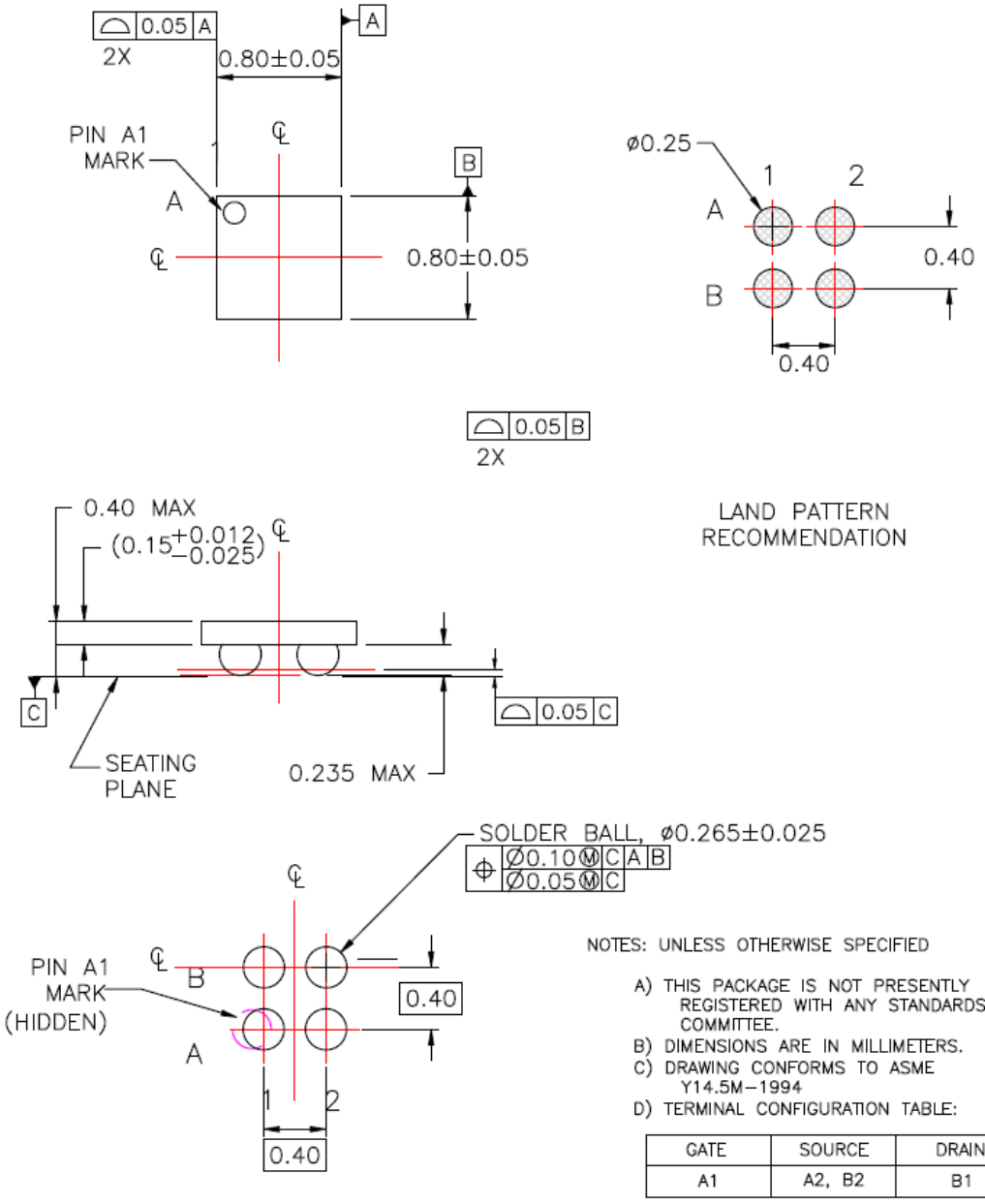


Figure 12. Junction-to-Ambient Transient Thermal Response Curve

Dimensional Outline and Pad Layout



NOTES: UNLESS OTHERWISE SPECIFIED

A) THIS PACKAGE IS NOT PRESENTLY REGISTERED WITH ANY STANDARDS COMMITTEE.
B) DIMENSIONS ARE IN MILLIMETERS.
C) DRAWING CONFORMS TO ASME Y14.5M–1994
D) TERMINAL CONFIGURATION TABLE:

GATE	SOURCE	DRAIN
A1	A2, B2	B1

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
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