June 2015

FDZ1416NZ

Common Drain N-Channel 2.5 V PowerTrench® WL-CSP MOSFET

24 V, 7 A, 23 mΩ

Features

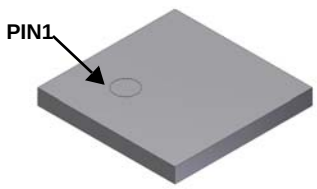
- Max $r_{S1S2(on)}$ = 23 mΩ at V_{GS} = 4.5 V, I_{S1S2} = 1 A
- Max $r_{S1S2(on)}$ = 25 mΩ at V_{GS} = 4 V, I_{S1S2} = 1 A
- Max $r_{S1S2(on)}$ = 28 mΩ at V_{GS} = 3.1 V, I_{S1S2} = 1 A
- Max $r_{S1S2(on)}$ = 33 mΩ at V_{GS} = 2.5 V, I_{S1S2} = 1 A
- Occupies only 2.2 mm^2 of PCB area
- Ultra-thin package: less than 0.35 mm height when mounted to PCB
- High power and current handling capability
- HBM ESD protection level > 3.2 kV (Note 3)
- RoHS Compliant

General Description

This device is designed specifically as a single package solution for Li-Ion battery pack protection circuit and other ultra-portable applications. It features two common drain N-channel MOSFETs, which enables bidirectional current flow, on Fairchild's advanced PowerTrench® process with state of the art "low pitch" WLCSP packaging process, the FDZ1416NZ minimizes both PCB space and $r_{S1S2(on)}$. 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 $r_{S1S2(on)}$.

Applications

- Battery management
- Load switch
- Battery protection



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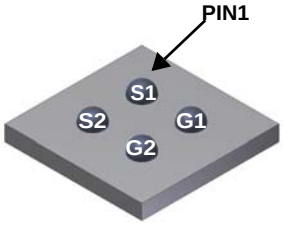

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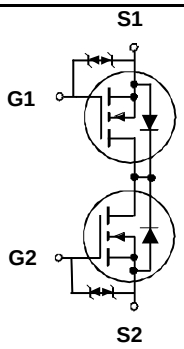


WL-CSP 1.4X1.6

MOSFET Maximum Ratings T_A = 25°C unless otherwise noted

Symbol	Parameter			Ratings	Units
V_{S1S2}	Source1 to Source2 Voltage			24	V
V_{GS}	Gate to Source Voltage			±12	V
I_{S1S2}	Source1 to Source2 Current -Continuous	T_A = 25°C	(Note 1a)	7	A
	-Pulsed			30	
P_D	Power Dissipation	T_A = 25°C	(Note 1a)	1.7	W
	Power Dissipation	T_A = 25°C	(Note 1b)	0.5	
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)	74	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	(Note 1b)	230	

Package Marking and Ordering Information

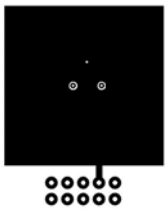
Device Marking	Device	Package	Reel Size	Tape Width	Quantity
EN	FDZ1416NZ	WL-CSP 1.4X1.6	7 ”	8 mm	5000 units

Electrical Characteristics T_J = 25 °C unless otherwise noted

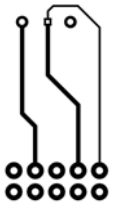
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
I_{S1S2}	Zero Gate Voltage Source1 to Source2 Current	V_{S1S2} = 19 V, V_{GS} = 0 V			1	μA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±12 V, V_{S1S2} = 0 V			±10	μA
On Characteristics						
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{GS} = V_{S1S2}, I_{S1S2} = 250 μA	0.4	0.9	1.3	V
$r_{S1S2(on)}$	Static Source1 to Source2 On Resistance	V_{GS} = 4.5 V, I_{S1S2} = 1 A	9	16	23	mΩ
		V_{GS} = 4 V, I_{S1S2} = 1 A	10	17	25	
		V_{GS} = 3.1 V, I_{S1S2} = 1 A	11	19	28	
		V_{GS} = 2.5 V, I_{S1S2} = 1 A	12	22	33	
		V_{GS} = 4.5 V, I_{S1S2} = 1 A,T_J = 125 °C		24	36	
g_{FS}	Forward Transconductance	V_{S1S2} = 5 V, I_{S1S2} = 1 A		4.5		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{S1S2} = 12 V, V_{GS} = 0 V, f = 1 MHz		1140	1515	pF
C_{oss}	Output Capacitance			136	220	pF
C_{rss}	Reverse Transfer Capacitance			129	205	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{S1S2} = 12 V, I_{S1S2} = 1 A, V_{GS} = 4.5 V, R_{GEN} = 6 Ω		9.5	19	ns
t_r	Rise Time			12	22	ns
$t_{d(off)}$	Turn-Off Delay Time			37	59	ns
t_f	Fall Time			16	33	ns
Q_g	Total Gate Charge	V_{S1S2} = 12 V, I_{S1S2} = 1 A, V_{G1S1} = 4.5 V, V_{G2S2} = 0 V		12	17	nC
Q_{gs}	Gate to Source1 Gate Charge			1.6		nC
Q_{gd}	Gate to Source2 “Miller” Charge			3.7		nC
Source1 to Source2 Diode Characteristics						
I_{fss}	Maximum Continuous Source1 to Source2 Diode Forward Current				1	A
V_{fss}	Source1 to Source2 Diode Forward Voltage	V_{G1S1} = 0 V, V_{G2S2} = 4.5 V, I_{fss} = 1 A (Note 2)		0.7	1.2	V

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. 74 °C/W when mounted on a 1 in^2 pad of 2 oz copper



b. 230 °C/W when mounted on a minimum pad of 2 oz copper

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

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

Typical Characteristics T_J = 25°C unless otherwise noted

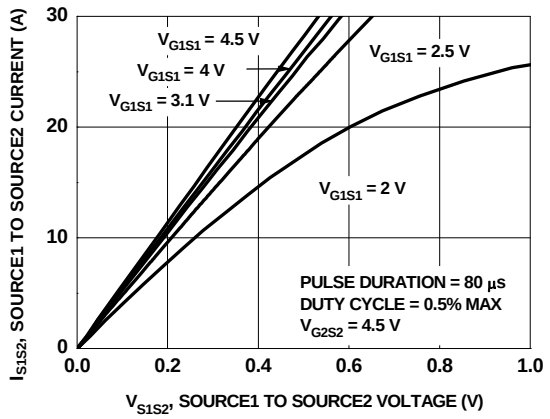


Figure 1. On-Region Characteristics

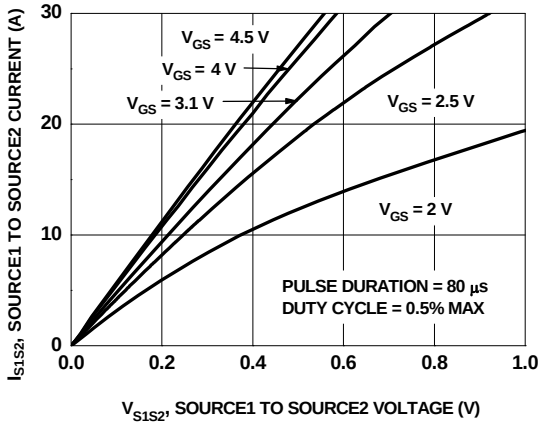


Figure 2. On-Region Characteristics

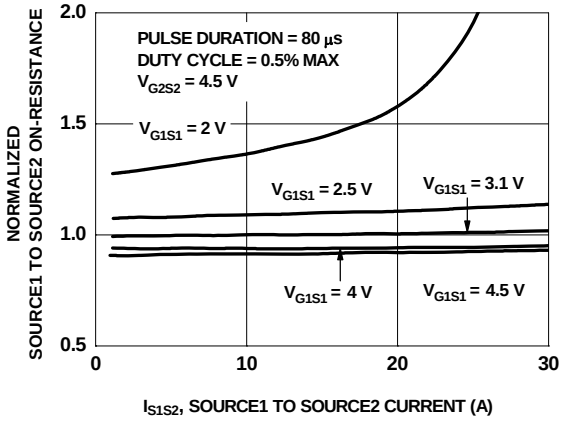


Figure 3. Normalized On-Resistance vs Source1 to Source2 Current and Gate Voltage

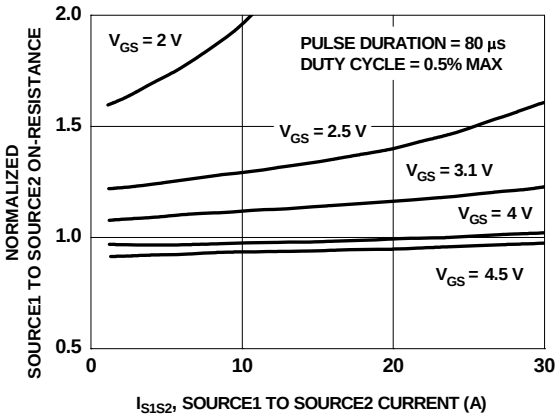


Figure 4. Normalized On-Resistance vs Source1 to Source2 Current and Gate Voltage

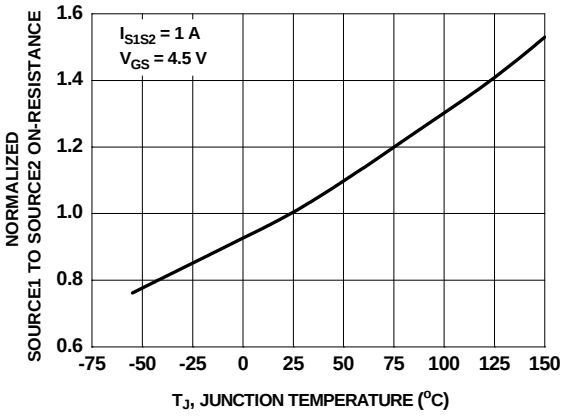


Figure 5. Normalized On Resistance vs Junction Temperature

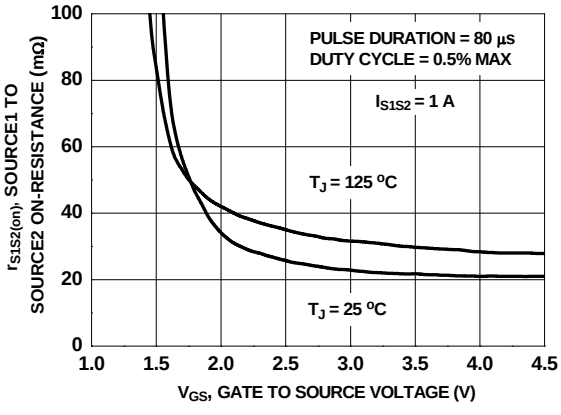


Figure 6. On Resistance vs Gate to Source Voltage

Typical Characteristics T_J = 25°C unless otherwise noted

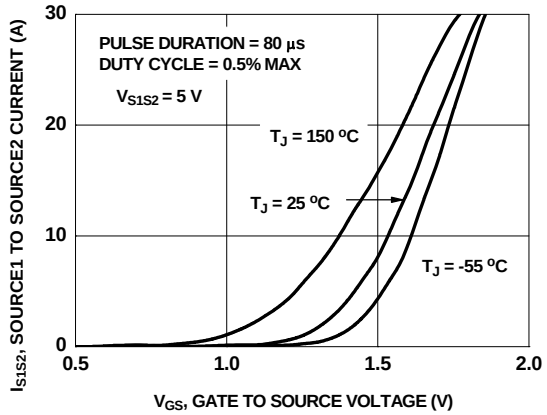


Figure 7. Transfer Characteristics

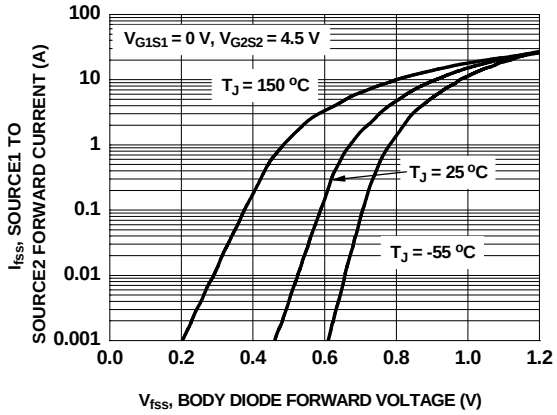


Figure 8. Source1 to Source2 Diode Forward Voltage vs Source Current

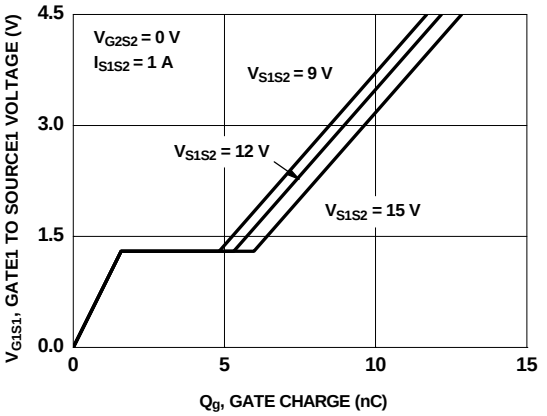


Figure 9. Gate Charge Characteristics

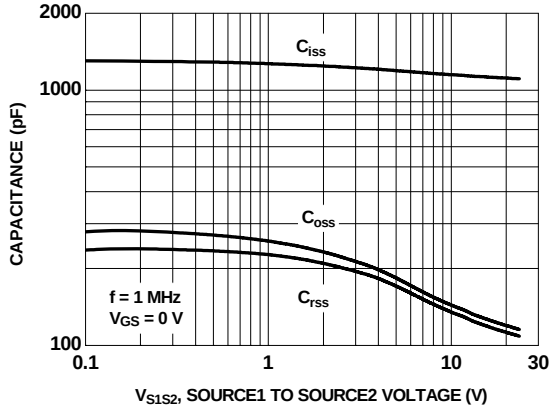


Figure 10. Capacitance vs Source1 to Source2 Voltage

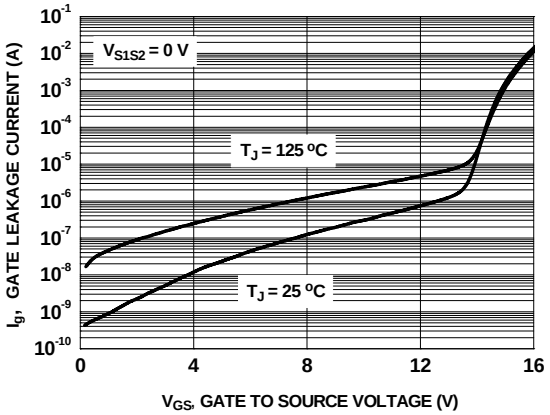


Figure 11. Gate Leakage Current vs Gate to Source Voltage

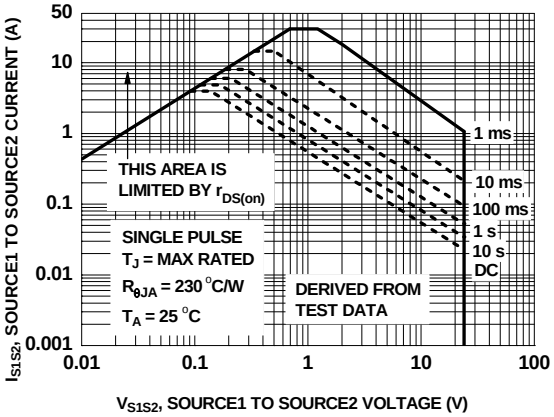


Figure 12. Forward Bias Safe Operating Area

Typical Characteristics T_J = 25°C unless otherwise noted

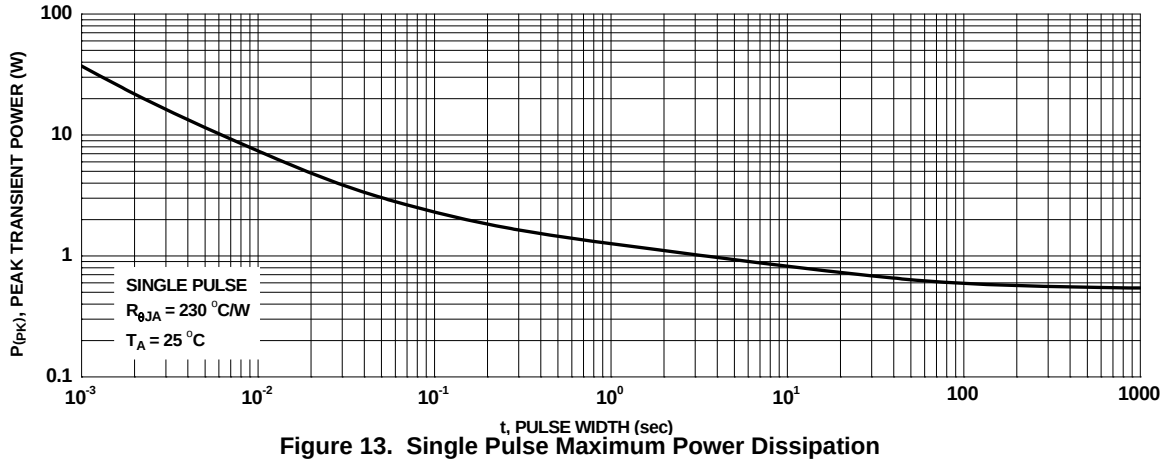


Figure 13. Single Pulse Maximum Power Dissipation

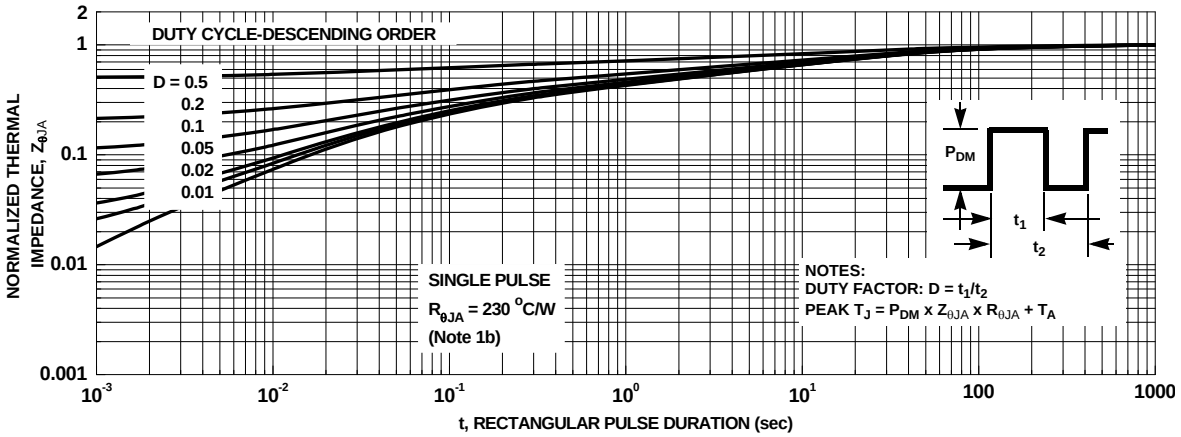


Figure 14. Junction-to-Ambient Transient Thermal Response Curve

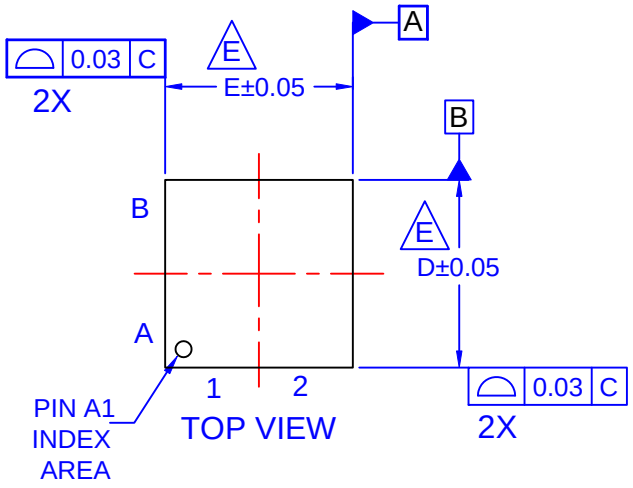
The following information applies to the WL-CSP package dimensions on the next page:

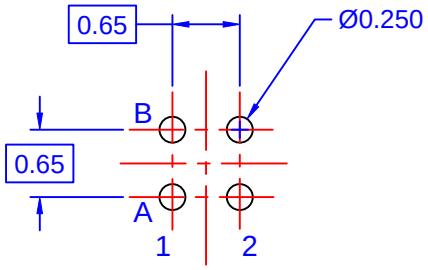
Pin Definitions:

Pin Name	G1	G2	S1	S2
Position	A2	B2	A1	B1

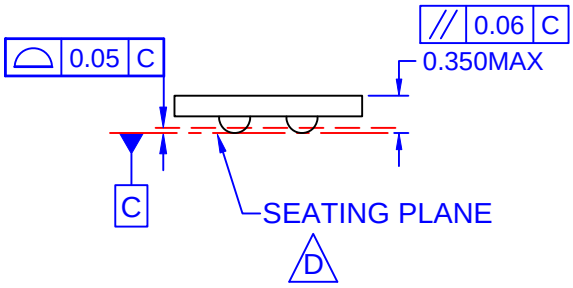
Product Specific Dimensions:

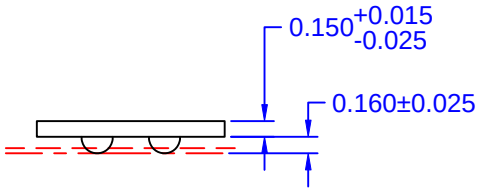
D	E	X	Y
1.4 mm	1.6 mm	0.475 mm	0.375 mm

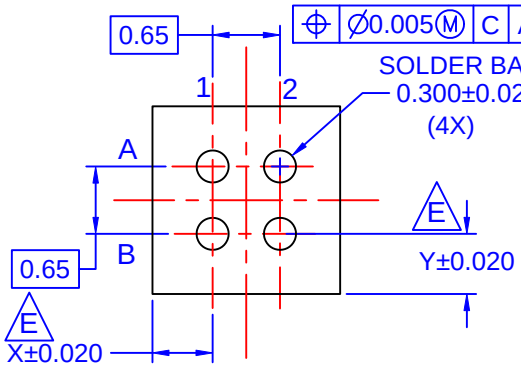




LAND PATTERN RECOMMENDATION







BOTTOM VIEW

NOTES:

A. NO JEDEC REGISTRATION APPLIES.
B. DIMENSIONS ARE IN MILLIMETERS.
C. DIMENSIONS AND TOLERANCE PER ASME Y14.5M, 1994.
D. DATUM C IS DEFINED BY THE SPHERICAL CROWNS OF THE BALLS.
E. FOR DIMENSIONS D,E,X AND Y SEE PRODUCT DATA SHEET.
F. FOR PIN-OUT ASSIGNMENT , REFER TO DATA SHEET.
G. DRAWING NAME: MKT-UC004AJREV2.

PUBLICATION ORDERING INFORMATION

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