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# FDZ663P

## P-Channel 1.5 V Specified PowerTrench® Thin WL-CSP MOSFET -20 V, -2.7 A, 134 mΩ

### Features

- Max  $r_{DS(on)}$  = 134 mΩ at  $V_{GS} = -4.5$  V,  $I_D = -2$  A
- Max  $r_{DS(on)}$  = 171 mΩ at  $V_{GS} = -2.5$  V,  $I_D = -1.5$  A
- Max  $r_{DS(on)}$  = 216 mΩ at  $V_{GS} = -1.8$  V,  $I_D = -1$  A
- Max  $r_{DS(on)}$  = 288 mΩ at  $V_{GS} = -1.5$  V,  $I_D = -1$  A
- Occupies only 0.64 mm<sup>2</sup> 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
- RoHS Compliant

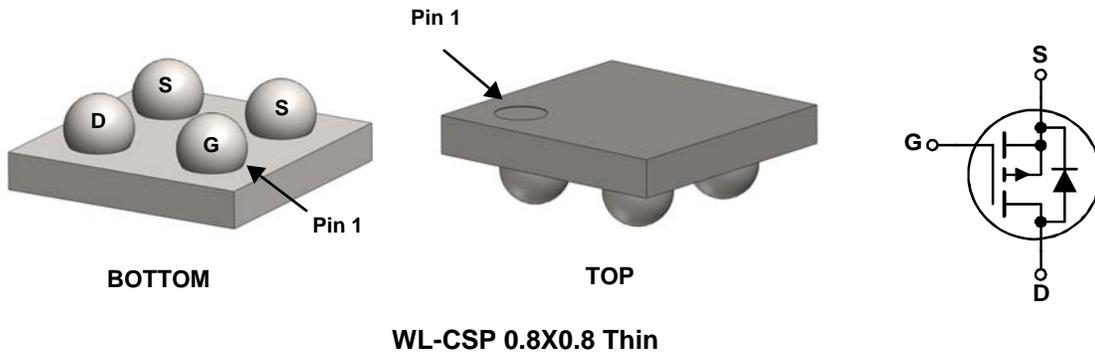


### General Description

Designed on Fairchild's advanced 1.5 V PowerTrench® process with state of the art "fine pitch" Thin WLCSP packaging process, the FDZ663P 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<sup>2</sup>) packaging, low gate charge, and low  $r_{DS(on)}$ .

### Applications

- Battery management
- Load switch
- Battery protection



WL-CSP 0.8X0.8 Thin

### MOSFET Maximum Ratings $T_A = 25$ °C unless otherwise noted

Symbol	Parameter	Rated Value	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)	-2.7	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

Symbol	Parameter	Rated Value	Units
$R_{\theta JA}$	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
EJ	FDZ663P	WL-CSP 0.8X0.8 Thin	7"	8 mm	5000 units

## Electrical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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### Off Characteristics

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = -250\text{ }\mu\text{A}$ , $V_{GS} = 0\text{ V}$	-20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$		-14		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -16\text{ V}$ , $V_{GS} = 0\text{ V}$			-1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 8\text{ V}$ , $V_{DS} = 0\text{ V}$			$\pm 60$	nA

### On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$ , $I_D = -250\text{ }\mu\text{A}$	-0.3	-0.7	-1.2	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = -250\text{ }\mu\text{A}$ , referenced to $25\text{ }^\circ\text{C}$		2.4		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = -4.5\text{ V}$ , $I_D = -2\text{ A}$		103	134	m $\Omega$
		$V_{GS} = -2.5\text{ V}$ , $I_D = -1.5\text{ A}$		122	171	
		$V_{GS} = -1.8\text{ V}$ , $I_D = -1\text{ A}$		149	216	
		$V_{GS} = -1.5\text{ V}$ , $I_D = -1\text{ A}$		186	288	
		$V_{GS} = -4.5\text{ V}$ , $I_D = -2\text{ A}$ , $T_J = 125\text{ }^\circ\text{C}$		137	198	
$g_{FS}$	Forward Transconductance	$V_{DD} = -5\text{ V}$ , $I_D = -2\text{ A}$		8		S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = -10\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1\text{ MHz}$		394	525	pF
$C_{oss}$	Output Capacitance			62	85	pF
$C_{rss}$	Reverse Transfer Capacitance			53	80	pF

### Switching Characteristics

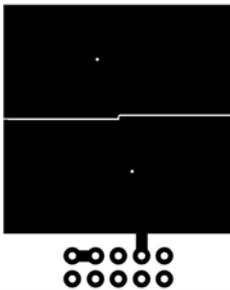
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -10\text{ V}$ , $I_D = -2.5\text{ A}$ , $V_{GS} = -4.5\text{ V}$ , $R_{GEN} = 6\text{ }\Omega$		4.8	10	ns
$t_r$	Rise Time			6.2	12	ns
$t_{d(off)}$	Turn-Off Delay Time			67	107	ns
$t_f$	Fall Time			32	52	ns
$Q_g$	Total Gate Charge		$V_{GS} = -4.5\text{ V}$ , $V_{DD} = -10\text{ V}$ , $I_D = -2.5\text{ A}$		5.9	8.2
$Q_{gs}$	Gate to Source Charge			0.6		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			1.6		nC

### Drain-Source Diode Characteristics

$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{ V}$ , $I_S = -1.4\text{ A}$ (Note 2)		-0.8	-1.2	V
$t_{rr}$	Reverse Recovery Time	$I_F = -2.5\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$		30	48	ns
$Q_{rr}$	Reverse Recovery Charge			10	18	nC

#### Notes:

1.  $R_{\theta JA}$  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. 93  $^\circ\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.



b. 311  $^\circ\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper.

2. Pulse Test: Pulse Width < 300  $\mu\text{s}$ , Duty cycle < 2.0%.

**Typical Characteristics**  $T_J = 25\text{ }^\circ\text{C}$  unless otherwise noted

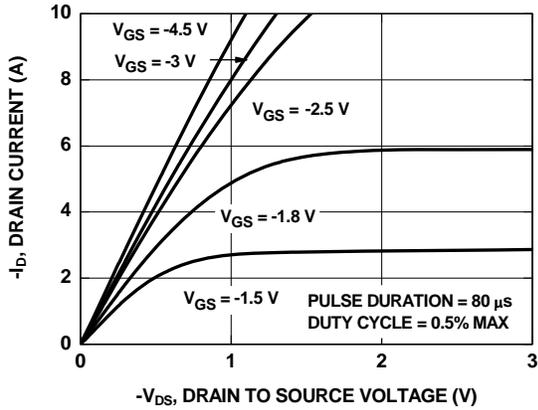


Figure 1. On-Region Characteristics

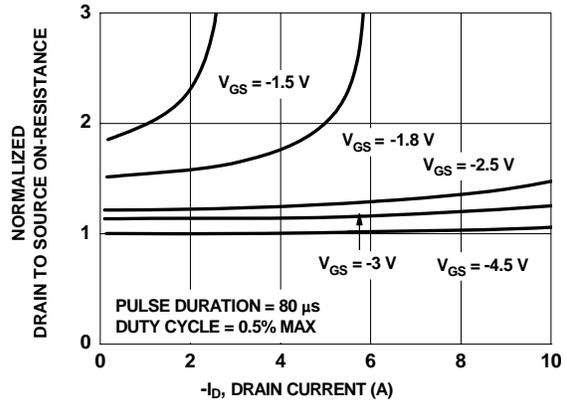


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

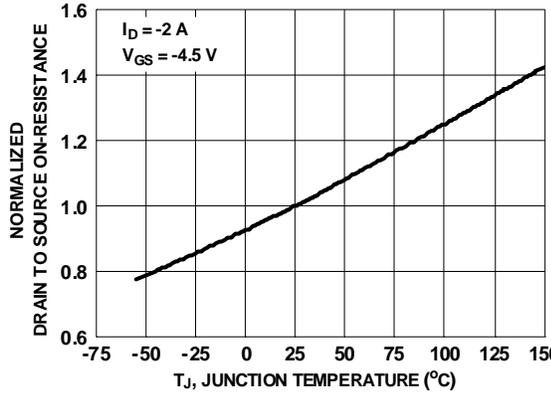


Figure 3. Normalized On-Resistance vs Junction Temperature

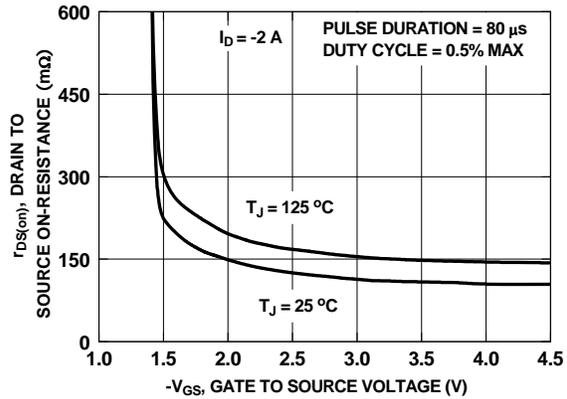


Figure 4. On-Resistance vs Gate to Source Voltage

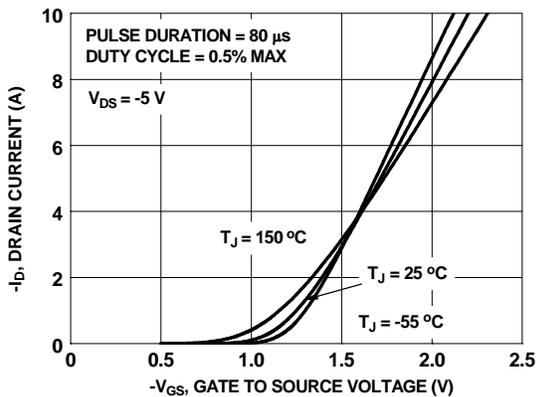


Figure 5. Transfer Characteristics

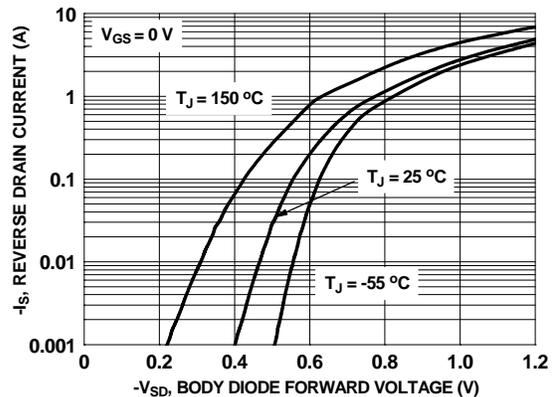
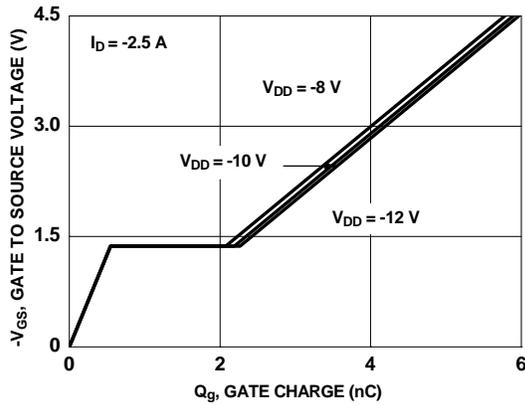
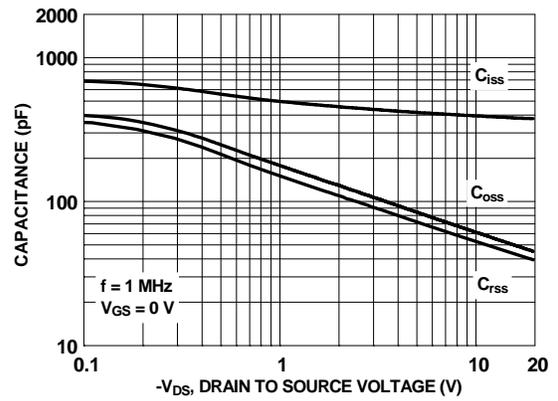


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

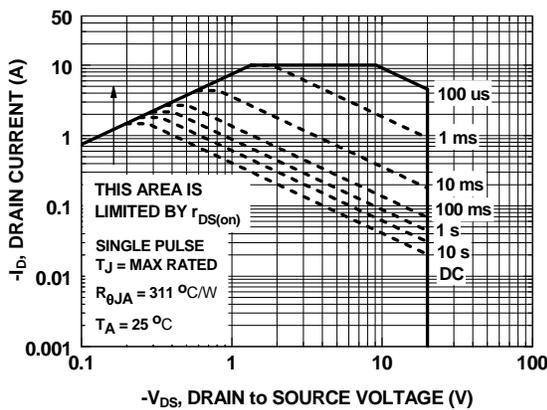
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



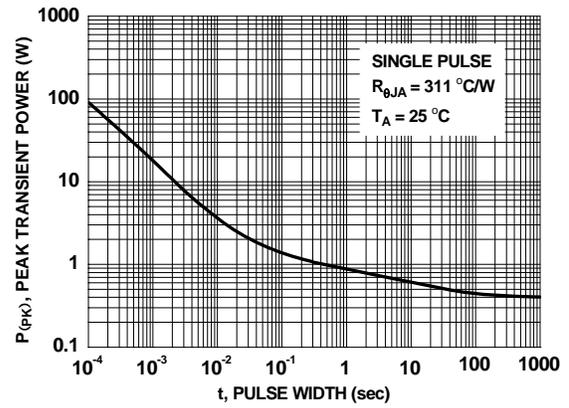
**Figure 7. Gate Charge Characteristics**



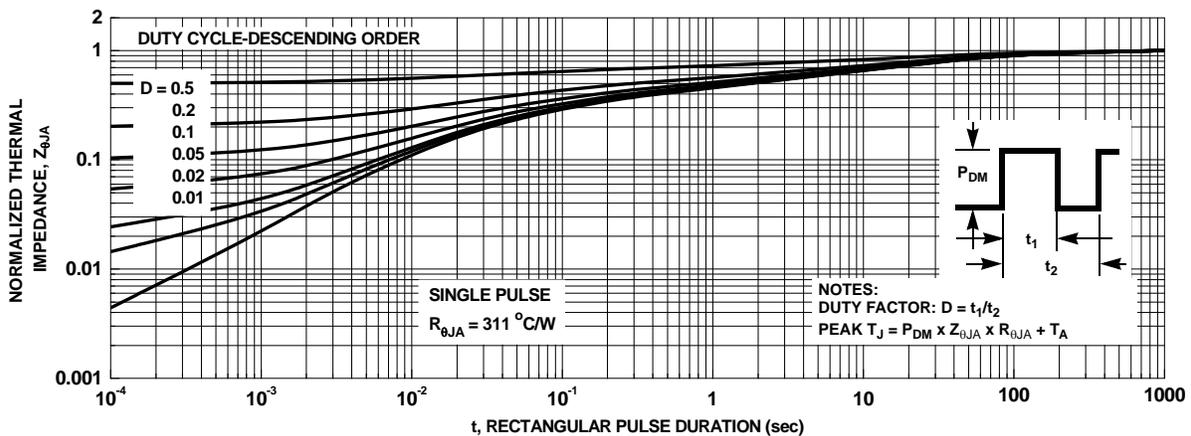
**Figure 8. Capacitance vs Drain to Source Voltage**



**Figure 9. Forward Bias Safe Operating Area**

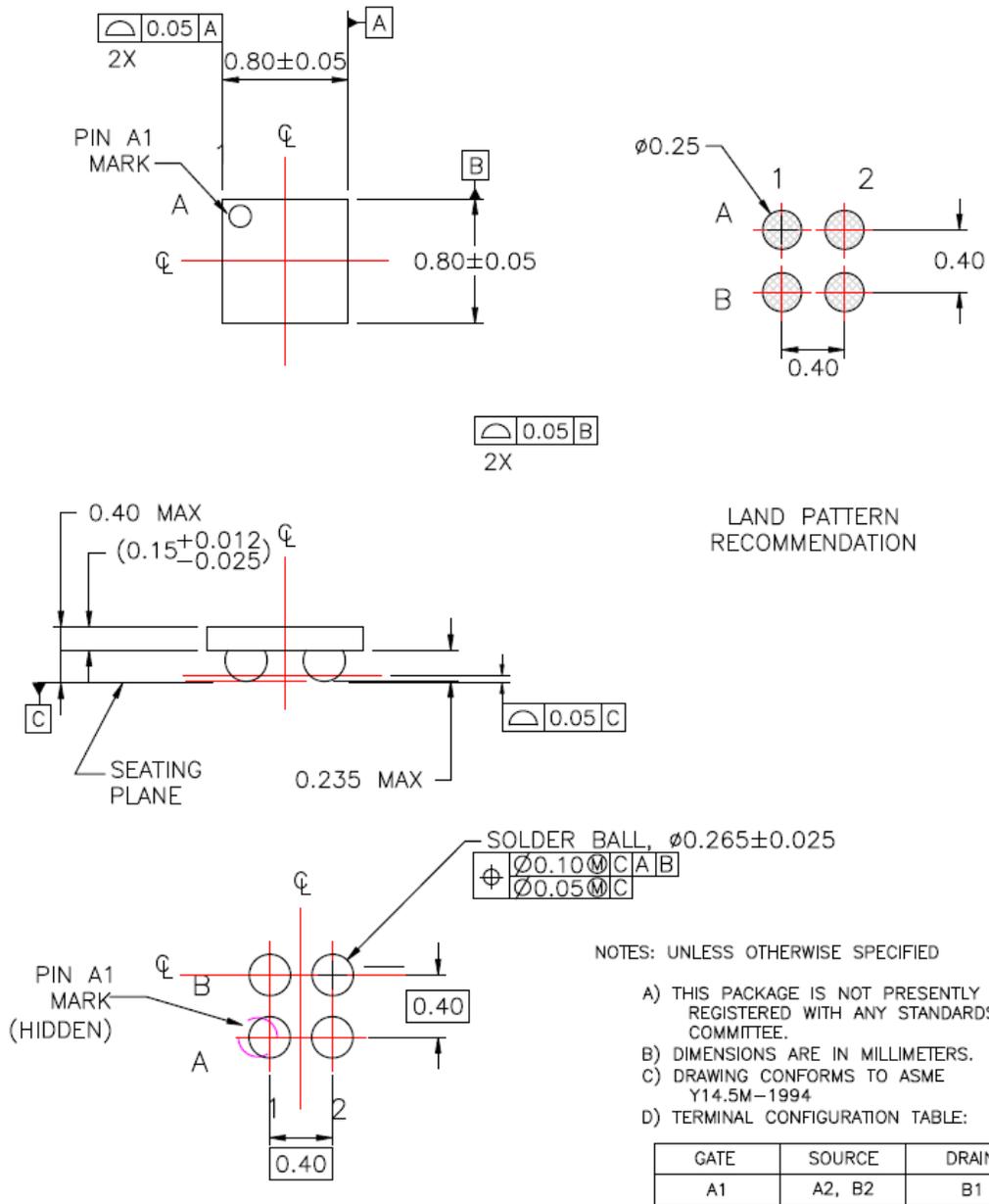


**Figure 10. Single Pulse Maximum Power Dissipation**



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

## Dimensional Outline and Pad Layout





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