

# FDZ2554P

## Monolithic Common Drain P-Channel 2.5V Specified Power Trench® BGA MOSFET -20V, -6.5A, 28mΩ

### Features

- Max  $r_{DS(on)}$  = 28mΩ at  $V_{GS} = -4.5V$ ,  $I_D = -6.5A$
- Max  $r_{DS(on)}$  = 45mΩ at  $V_{GS} = -2.5V$ ,  $I_D = -5A$
- Occupies only 0.10 cm<sup>2</sup> of PCB area: 1/3 the area of SO-8
- Ultra-thin package: less than 0.80 mm height when mounted to PCB
- Outstanding thermal transfer characteristics: significantly better than SO-8
- Ultra-low  $Q_g \times r_{DS(on)}$  figure-of-merit
- High power and current handling capability
- RoHS Compliant



### General Description

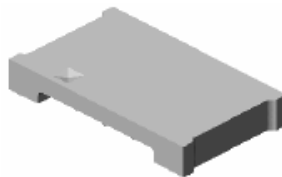
Combining Fairchild's advanced 2.5V specified PowerTrench process with state-of-the-art BGA packaging, the FDZ2554P minimizes both PCB space and  $r_{DS(on)}$ . This monolithic common drain BGA MOSFET embodies a breakthrough in packaging technology which enables the device to combine excellent thermal transfer characteristics, high current handling capability, ultra-low profile packaging, low gate charge, and low  $r_{DS(on)}$ .

### Applications

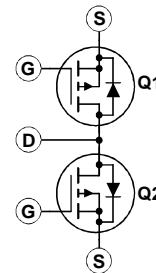
- Battery management
- Load Switch
- Battery protection



Bottom



Top



### MOSFET Maximum Ratings $T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Rated	Units
$V_{DS}$	Drain to Source Voltage	-20	V
$V_{GS}$	Gate to Source Voltage	$\pm 12$	V
$I_D$	Drain Current -Continuous (Note 1a)	-6.5	A
	-Pulsed	-20	
$P_D$	Power Dissipation (Steady State) (Note 1a)	2.1	W
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ\text{C}$

### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case (Note 1)	0.6	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	60	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1b)	108	
$R_{\theta JB}$	Thermal Resistance, Junction to Ball (Note 1)	6.3	

### Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
2554P	FDZ2554P	BGA 2.5X4.0	7"	12 mm	3000 units

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

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

$BV_{DSS}$	Drain to Source Breakdown Voltage	$I_D = -250\mu\text{A}, V_{GS} = 0\text{V}$	-20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\mu\text{A}$ , referenced to $25^\circ\text{C}$		-13		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	$V_{GS} = \pm 12\text{V}, V_{DS} = 0\text{V}$			$\pm 100$	nA

### On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = -250\mu\text{A}$	-0.6	-0.8	-1.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = -250\mu\text{A}$ , referenced to $25^\circ\text{C}$		3		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = -4.5\text{V}, I_D = -6.5\text{A}$		21	28	m $\Omega$
		$V_{GS} = -2.5\text{V}, I_D = -5\text{A}$		36	45	
		$V_{GS} = -4.5\text{V}, I_D = -6.5\text{A}, T_J = 125^\circ\text{C}$		30	43	
$g_{FS}$	Forward Transconductance	$V_{DD} = -5\text{V}, I_D = -6.5\text{A}$		24		S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = -10\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$		1430	1900	pF
$C_{oss}$	Output Capacitance			319	425	pF
$C_{rss}$	Reverse Transfer Capacitance			164	245	pF
$R_g$	Gate Resistance	$V_{GS} = 15\text{mV}, f = 1\text{MHz}$		9.2		$\Omega$

### Switching Characteristics

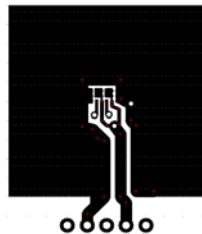
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -10\text{V}, I_D = -1\text{A}, V_{GS} = -4.5\text{V}, R_{GEN} = 6\Omega$		12	22	ns
$t_r$	Rise Time			9	18	ns
$t_{d(off)}$	Turn-Off Delay Time			62	100	ns
$t_f$	Fall Time			37	60	ns
$Q_g$	Total Gate Charge	$V_{GS} = -4.5\text{V}, V_{DD} = -10\text{V}$		14	20	nC
$Q_{gs}$	Gate to Source Charge	$I_D = -6.5\text{A}$		3		nC
$Q_{gd}$	Gate to Drain "Miller" Charge			4		nC

### Drain-Source Diode Characteristics

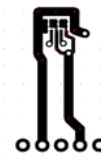
$I_S$	Maximum Continuous Drain-Source Diode Forward Current			-1.75	A
$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{V}, I_S = -1.75\text{A}$ (Note 2)	-0.7	-1.2	V
$t_{rr}$	Reverse Recovery Time	$I_F = -6.5\text{A}, di/dt = 100\text{A}/\mu\text{s}$	25	40	ns
$Q_{rr}$	Reverse Recovery Charge		20	32	nC

#### NOTES:

- $R_{\theta JA}$  is determined with the device mounted on a 1 in<sup>2</sup> oz. copper pad on a 1.5 x 1.5 in. board of FR-4 material. The thermal resistance from the junction to the circuit board side of the solder ball,  $R_{\theta JB}$ , is defined for reference. For  $R_{\theta JC}$ , the thermal reference point for the case is defined as the top surface of the copper chip carrier.  $R_{\theta JC}$  and  $R_{\theta JB}$  are guaranteed by design while  $R_{\theta JA}$  is determined by the user's board design.



a. 60°C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.



b. 108°C/W when mounted on a minimum pad of 2 oz copper.

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

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

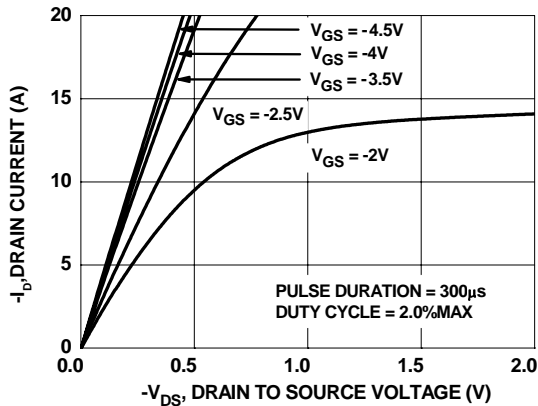


Figure 1. On-Region Characteristics

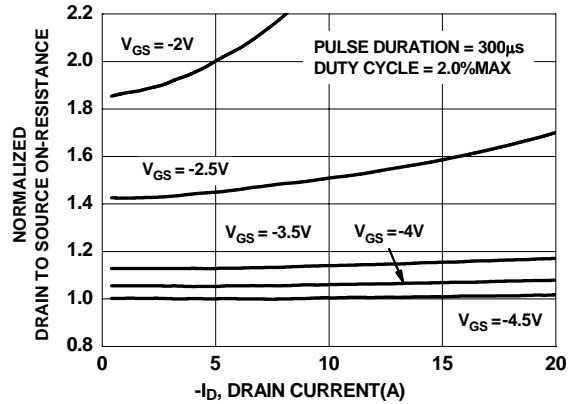


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

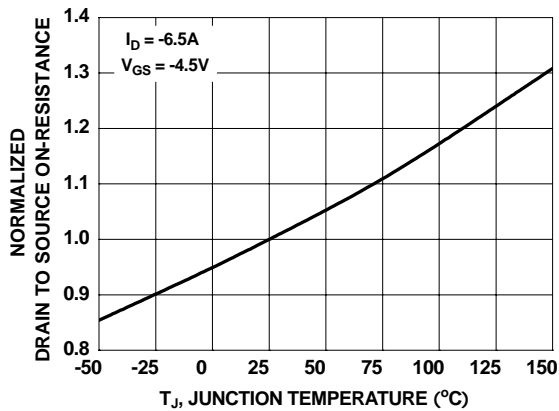


Figure 3. Normalized On-Resistance vs Junction Temperature

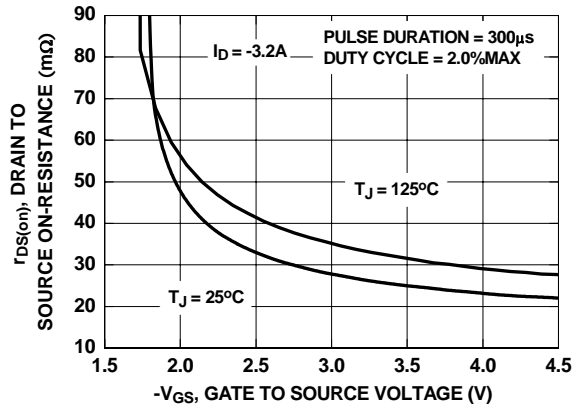


Figure 4. On-Resistance vs Gate to Source Voltage

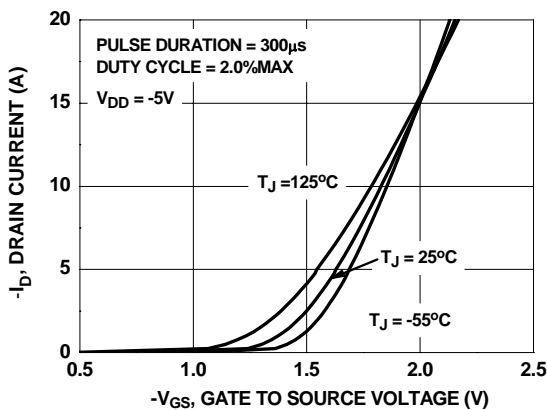


Figure 5. Transfer Characteristics

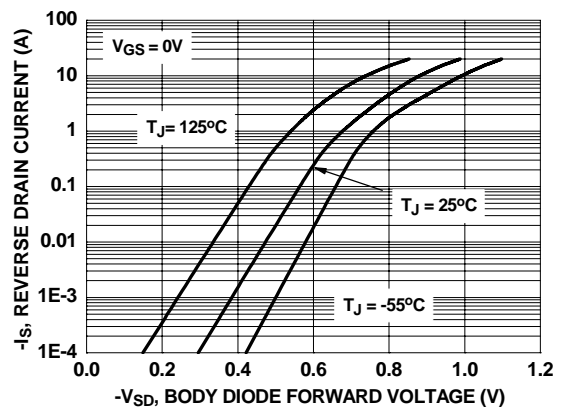
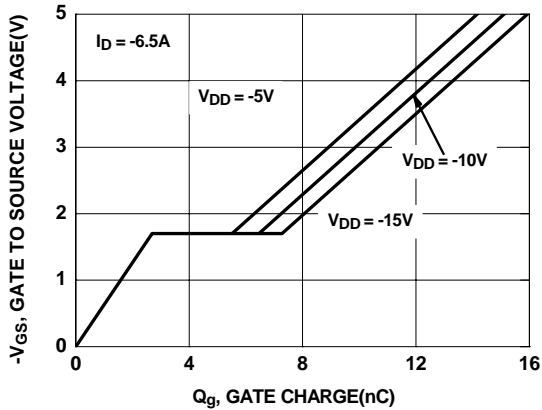
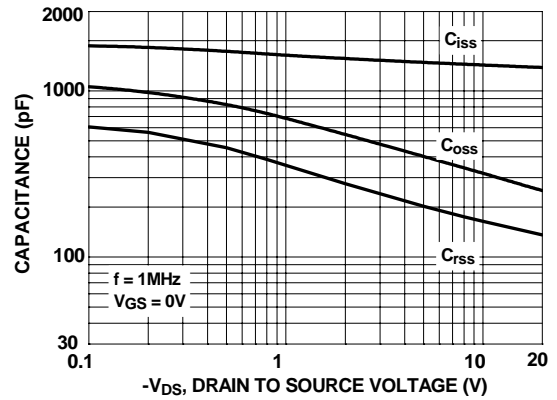


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

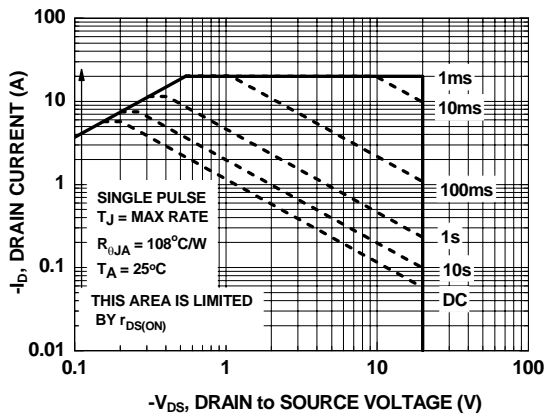
**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted



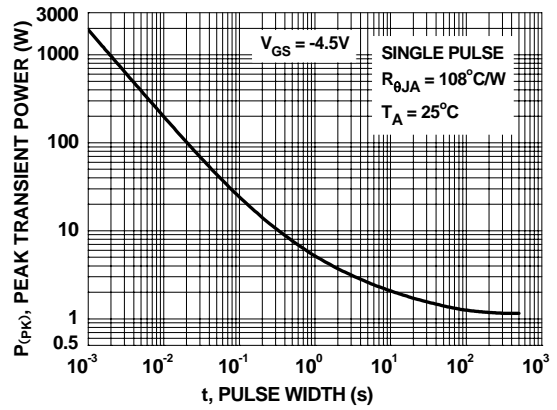
**Figure 7. Gate Charge Characteristics**



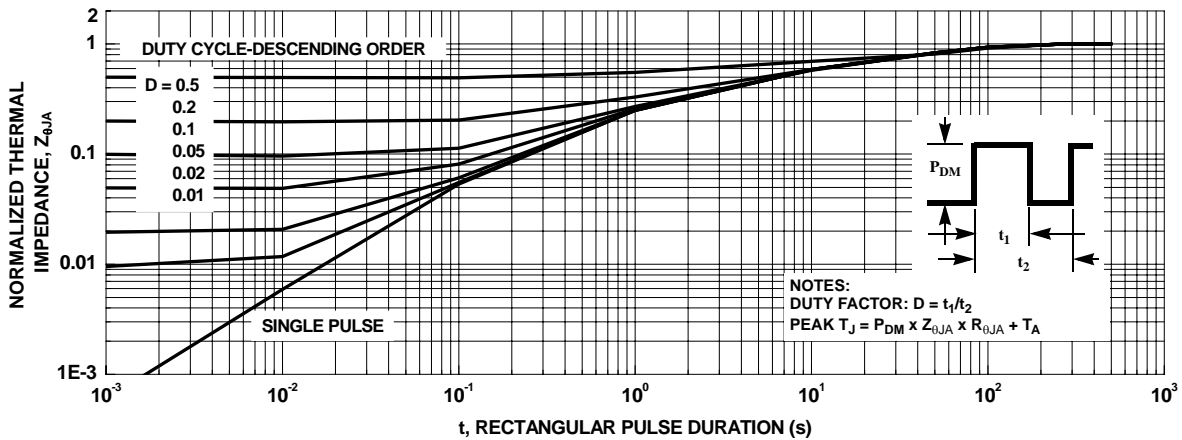
**Figure 8. Capacitance vs Drain to Source Voltage**



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

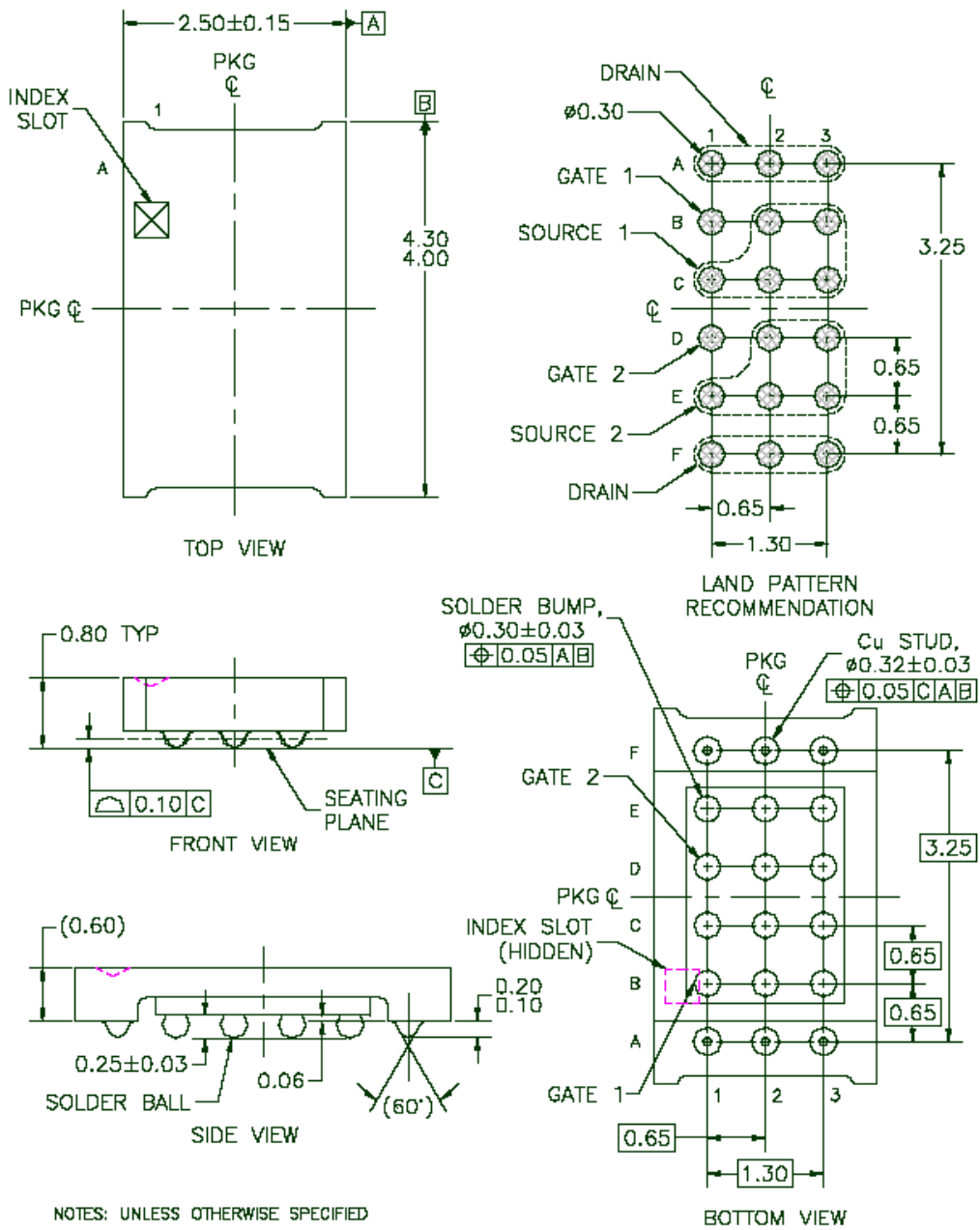


**Figure 10. Single Pulse Maximum Power Dissipation**



**Figure 11. Transient Thermal Response Curve**

## Dimensional Outline and Pad Layout





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