FAIRCHILD SEMICONDUCTOR®

June 2007

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^2 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 Qg x $r_{DS(on)}$ figure-of-merit
- High power and current handling capability
- RoHS Compliant

General Description

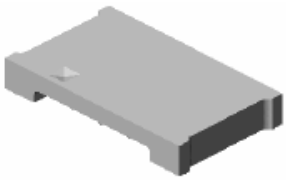
Combining Fairchild's advanced 2.5V specified PowerTrench process with state-of-the-art BGA packaging, the FDZ2554P minimizes both PCB space and $r_{DS(on)}$. This monolithic common drain BGA MOSFET embodies a breakthrough in packaging technology which enables the device to combine excellent thermal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

Applications

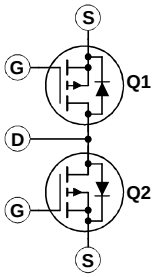
- Battery management
- Load Switch
- Battery protection



Bottom



Top



MOSFET Maximum Ratings T_A = 25°C unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DS}	Drain to Source Voltage		-20	V
V_{GS}	Gate to Source Voltage		±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	°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	(Note 1)	0.6	°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

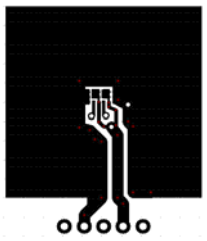
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Electrical Characteristics T_J= 25°C unless otherwise noted

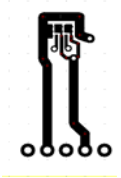
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = -250μA, V_{GS} = 0V	-20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = -250μA, referenced to 25°C		-13		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = -16V, V_{GS} = 0V			-1	μA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±12V, V_{DS} = 0V			±100	nA
On Characteristics						
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{GS} = V_{DS}, I_D = -250μA	-0.6	-0.8	-1.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I_D = -250μA, referenced to 25°C		3		mV/°C
$r_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = -4.5V, I_D = -6.5A		21	28	mΩ
		V_{GS} = -2.5V, I_D = -5A		36	45	
		V_{GS} = -4.5V, I_D = -6.5A, T_J = 125°C		30	43	
g_{FS}	Forward Transconductance	V_{DD} = -5V, I_D = -6.5A		24		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = -10V, V_{GS} = 0V, f = 1MHz		1430	1900	pF
C_{oss}	Output Capacitance			319	425	pF
C_{rss}	Reverse Transfer Capacitance			164	245	pF
R_g	Gate Resistance	V_{GS} = 15mV, f = 1MHz		9.2		Ω
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = -10V, I_D =-1A, V_{GS} = -4.5V, R_{GEN} = 6Ω		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} = -4.5V , V_{DD} =-10V I_D = -6.5A		14	20	nC
Q_{gs}	Gate to Source Charge			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} = 0V, I_S = -1.75A (Note 2)		-0.7	-1.2	V
t_{rr}	Reverse Recovery Time	I_F = -6.5A, di/dt = 100A/μs		25	40	ns
Q_{rr}	Reverse Recovery Charge			20	32	nC

NOTES:

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



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

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

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Typical Characteristics T_J = 25°C unless otherwise noted

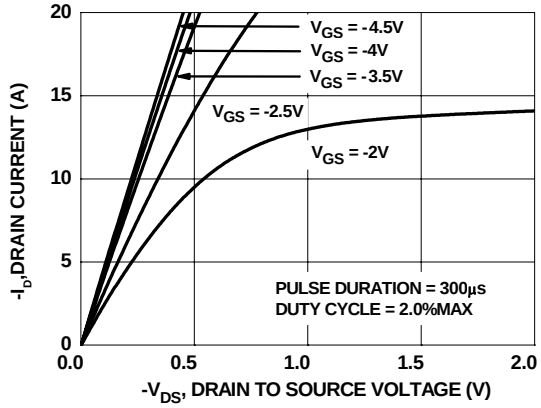


Figure 1. On-Region Characteristics

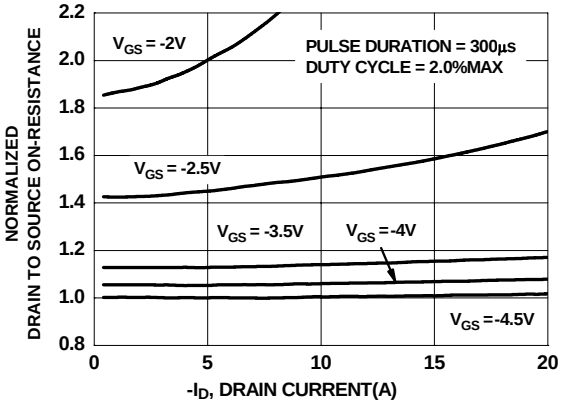


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

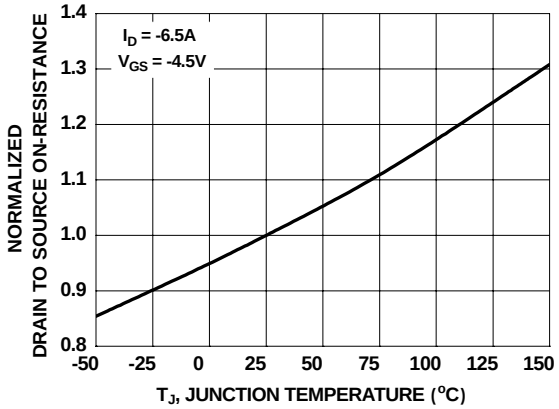


Figure 3. Normalized On-Resistance vs Junction Temperature

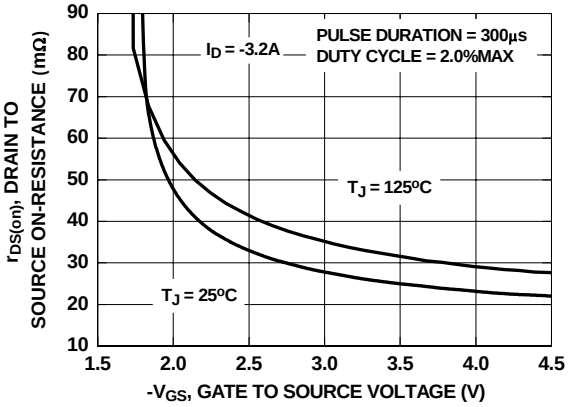


Figure 4. On-Resistance vs Gate to Source Voltage

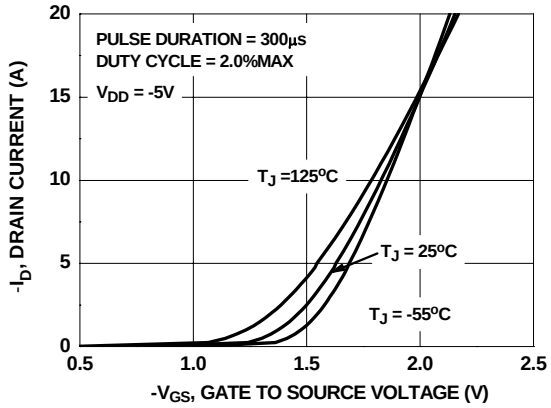


Figure 5. Transfer Characteristics

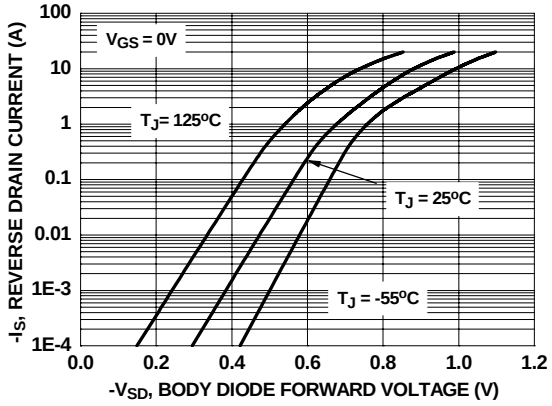


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics T_J = 25°C unless otherwise noted

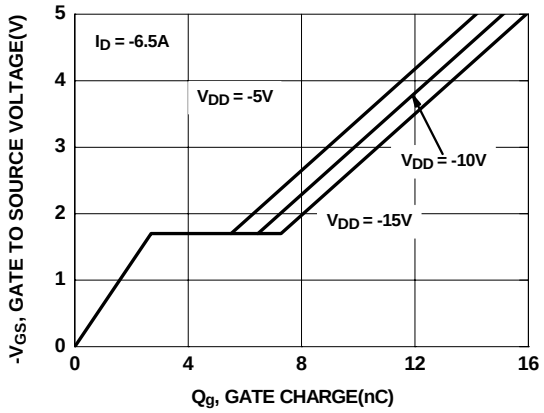


Figure 7. Gate Charge Characteristics

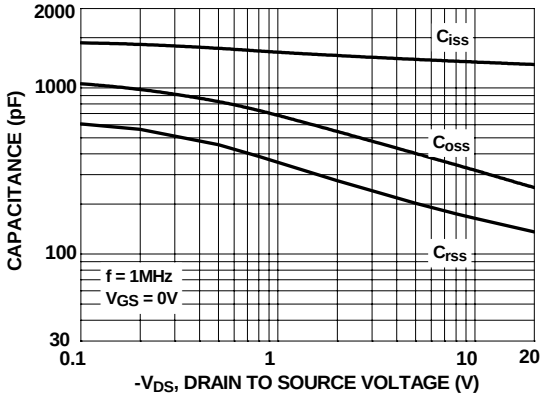


Figure 8. Capacitance vs Drain to Source Voltage

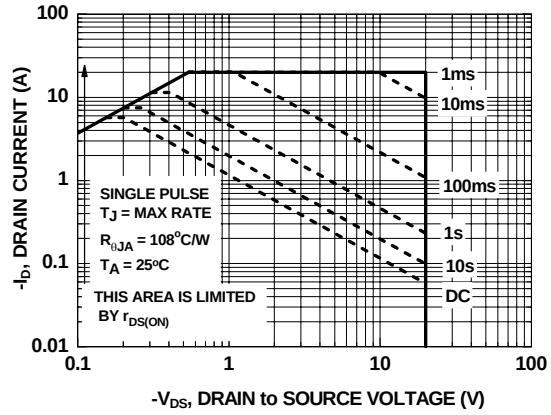


Figure 9. Forward Bias Safe Operating Area

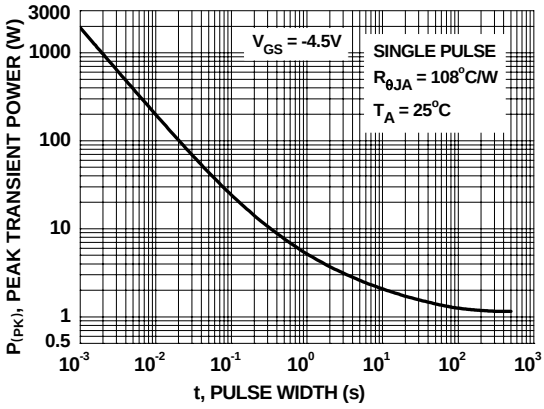


Figure 10. Single Pulse Maximum Power Dissipation

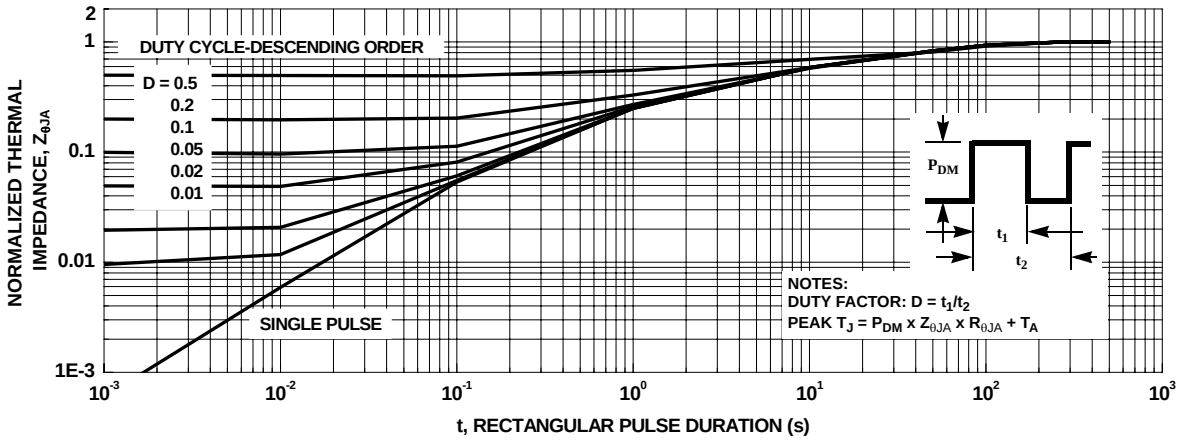
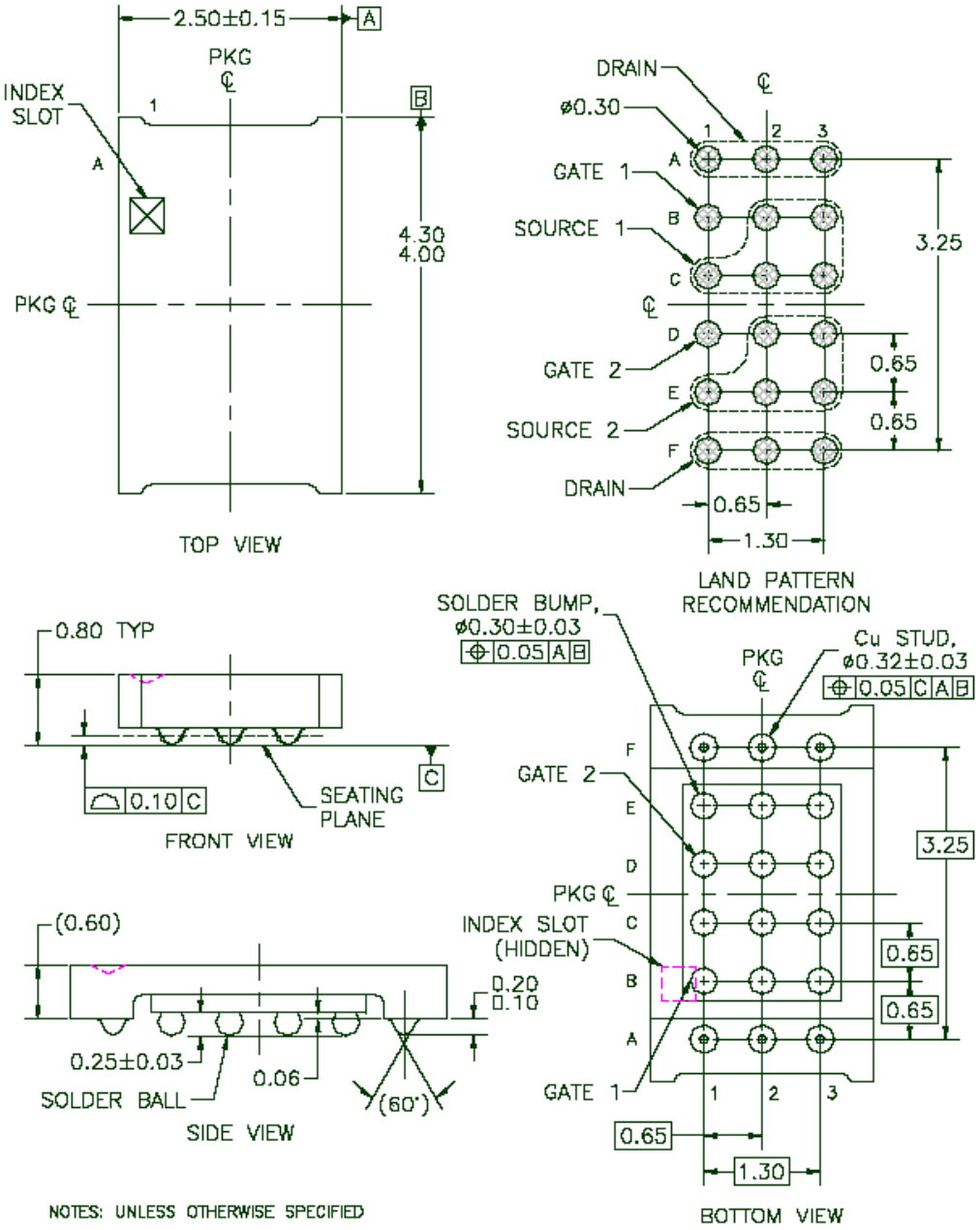


Figure 11. Transient Thermal Response Curve

Dimensional Outline and Pad Layout



NOTES: UNLESS OTHERWISE SPECIFIED

A) ALL DIMENSIONS ARE IN MILLIMETERS.
B) NO JEDEC REGISTRATION REFERENCE AS OF JULY 1999.
C) BALL CONFIGURATION TABLE

TERMINAL	DESIGNATION
A1,A2,A3,F1,F2,F3	DRAIN
B1	GATE 1
B2,B3,C1,C2,C3	SOURCE 1
D1	GATE 2
D2,D3,E1,E2,E3	SOURCE 2

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Global Power Resourse^{SM}	Power220®	SuperSOT™-3	UniFET™
Green FPS™	Power247®	SuperSOT™-6	VCX™

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Rev. I29

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