FAIRCHILD SEMICONDUCTOR®

February 2006

FDZ206P
P-Channel 2.5V Specified PowerTrench® BGA MOSFET

General Description

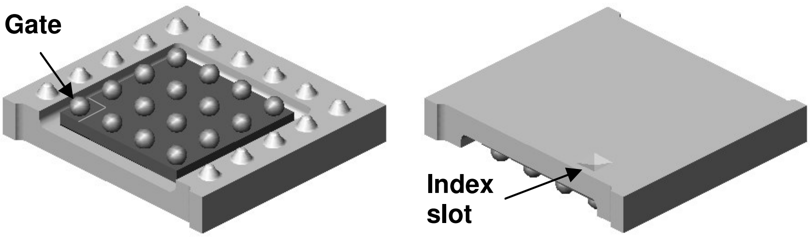
Combining Fairchild's advanced 2.5V specified PowerTrench process with state of the art BGA packaging, the FDZ206P minimizes both PCB space and $r_{DS(on)}$. This BGA MOSFET embodies a breakthrough in packaging technology which enables the device to combine excellent thermal transfer characteristics, high current handling capability, ultra-low profile packaging, low gate charge, and low $r_{DS(on)}$.

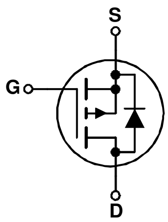
Applications

- Battery management
- Load switch
- Battery protection

Features

- –13 A, –20 V. $r_{DS(on)}$ = 9.5 mΩ @ V_{GS} = –4.5 V
  $r_{DS(on)}$ = 14.5 mΩ @ V_{GS} = –2.5 V
- Occupies only 14 mm^2 of PCB area.
  Only 42% of the area of SO-8
- Ultra-thin package: less than 0.80 mm height when mounted to PCB
- 0.65 mm ball pitch
- 3.5 x 4 mm^2 footprint
- High power and current handling capability





Absolute Maximum Ratings
T_A=25°C unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DSS}	Drain-Source Voltage		–20	V
V_{GS}	Gate-Source Voltage		±12	V
I_D	Drain Current – Continuous	(Note 1a)	–13	A
	– Pulsed		–60	
P_D	Power Dissipation (Steady State)	(Note 1a)	2.2	W
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)	56	°C/W
$R_{\theta JB}$	Thermal Resistance, Junction-to-Ball	(Note 1)	4.5	
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	(Note 1)	0.6	

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
206P	FDZ206P	13"	12mm	4000

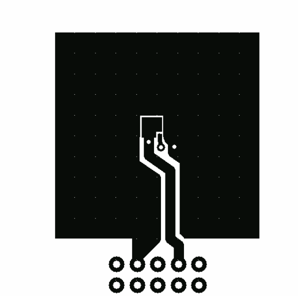
Electrical Characteristics

T_A = 25°C unless otherwise noted

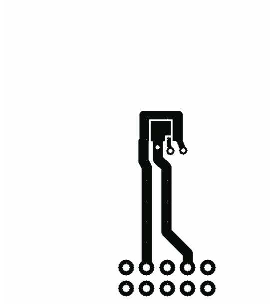
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain–Source Breakdown Voltage	V_{GS} = 0 V, I_D = –250 μA	–20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = –250 μA, Referenced to 25°C		–13		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = –16 V, V_{GS} = 0 V			–1	μA
I_{GSSF}	Gate–Body Forward Leakage	V_{GS} = –12 V, V_{DS} = 0 V			–100	nA
I_{GSSR}	Gate–Body Reverse Leakage	V_{GS} = 12 V, V_{DS} = 0 V			100	nA
On Characteristics (Note 2)						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = –250 μA	–0.6	–0.9	–1.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I_D = –250 μA, Referenced to 25°C		3.3		mV/°C
$r_{DS(on)}$	Static Drain–Source On–Resistance	V_{GS} = – 4.5 V, I_D = –13 A V_{GS} = –2.5 V, I_D = –10.5 A V_{GS} = –4.5 V, I_D = –13 A, T_J=125°C		7 10 9	9.5 14.5 13	mΩ
$I_{D(on)}$	On–State Drain Current	V_{GS} = –4.5 V, V_{DS} = –5 V	–60			A
g_{FS}	Forward Transconductance	V_{DS} = –5 V, I_D = –13 A		58		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = –10 V, V_{GS} = 0 V, f = 1.0 MHz		4280		pF
C_{oss}	Output Capacitance			873		pF
C_{rss}	Reverse Transfer Capacitance			400		pF
Switching Characteristics (Note 2)						
$t_{d(on)}$	Turn–On Delay Time	V_{DD} = –10 V, I_D = –1 A, V_{GS} = –4.5 V, R_{GEN} = 6 Ω		17	31	ns
t_r	Turn–On Rise Time			11	20	ns
$t_{d(off)}$	Turn–Off Delay Time			115	184	ns
t_f	Turn–Off Fall Time			60	96	ns
Q_g	Total Gate Charge	V_{DS} = –10 V, I_D = –13 A, V_{GS} = –4.5 V		38	53	nC
Q_{gs}	Gate–Source Charge			7		nC
Q_{gd}	Gate–Drain Charge			10		nC
Drain–Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain–Source Diode Forward Current				–1.8	A
V_{SD}	Drain–Source Diode Forward Voltage	V_{GS} = 0 V, I_S = –1.8 A (Note 2)		–0.7	–1.2	V
t_{rr}	Diode Reverse Recovery Time	I_F = –13A, d_{iF}/d_t = 100 A/µs		34		nS
Q_{rr}	Diode Reverse Recovery Charge			38		nC

Notes:

1. $R_{\theta JA}$ is determined with the device mounted on a 1 in² 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) 56°C/W when mounted on a 1in² pad of 2 oz copper

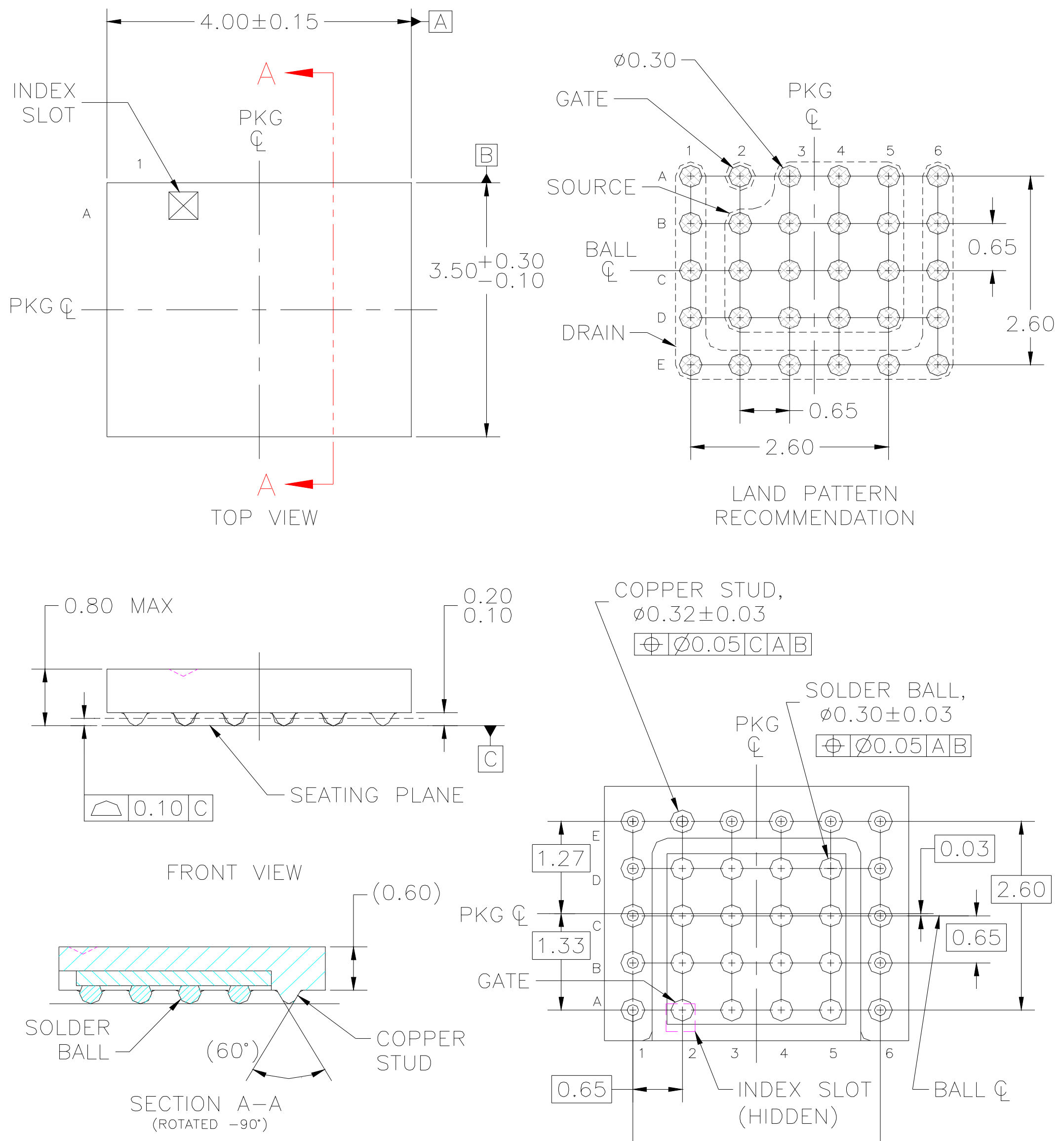


b) 119°C/W when mounted on a minimum pad of 2 oz copper

Scale 1 : 1 on letter size paper

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

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) TERMINAL CONFIGURATION TABLE

POSITION	DESIGNATION	TYPE
A1,B1,C1,D1,E1, E2,E3,E4,E5,E6, D6,C6,B6,A6	DRAIN	COPPER STUD
A2	GATE	SOLDER BALL
A3,A4,A5,B2,B3, B4,B5,C2,C3,C4, C5,D2,D3,D4,D5,	SOURCE	

BGA16AREVC

Typical Characteristics

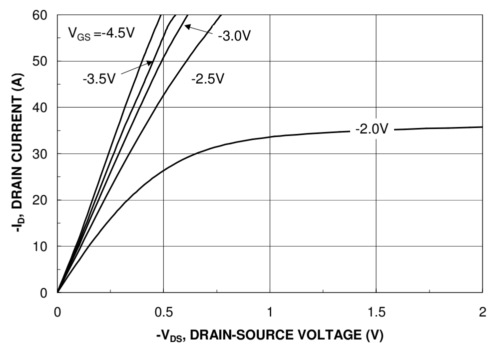


Figure 1. On-Region Characteristics.

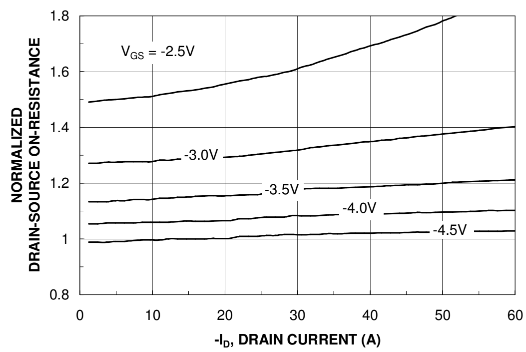


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

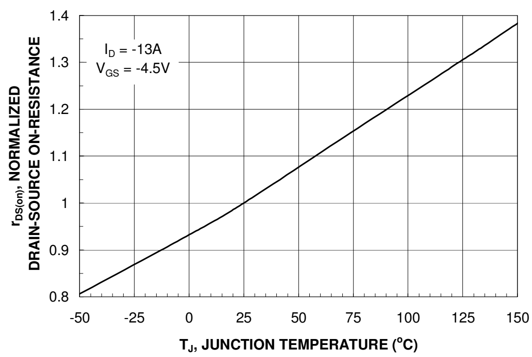


Figure 3. On-Resistance Variation with Temperature.

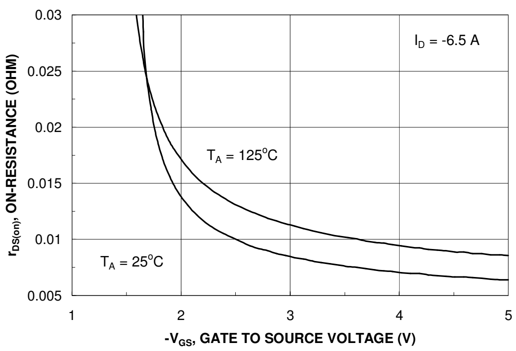


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

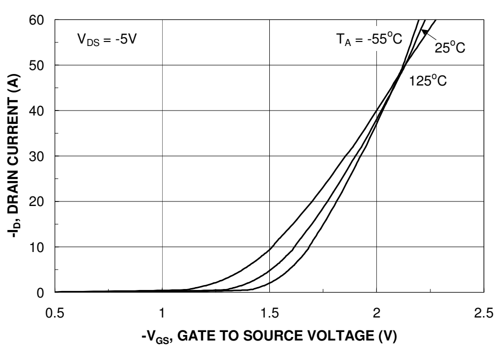


Figure 5. Transfer Characteristics.

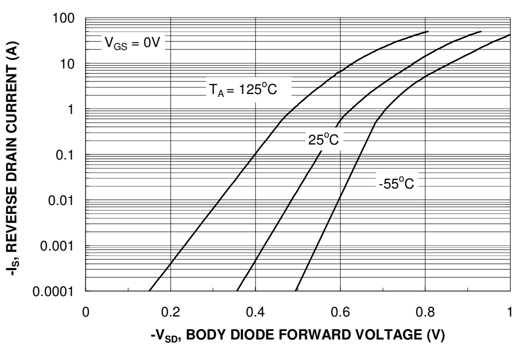


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics

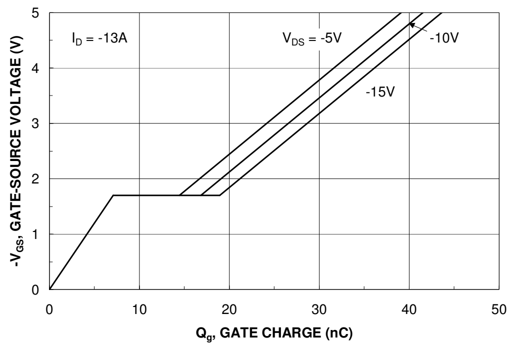


Figure 7. Gate Charge Characteristics.

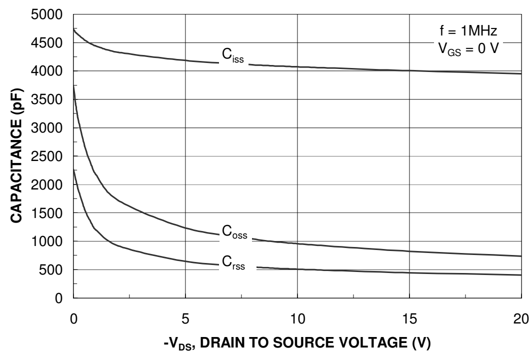


Figure 8. Capacitance Characteristics.

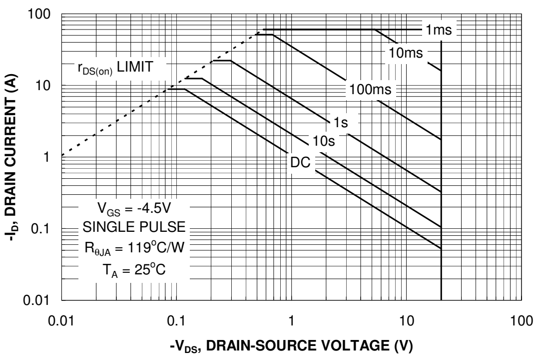


Figure 9. Maximum Safe Operating Area.

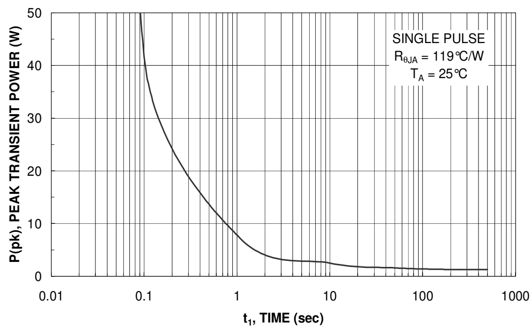


Figure 10. Single Pulse Maximum Power Dissipation.

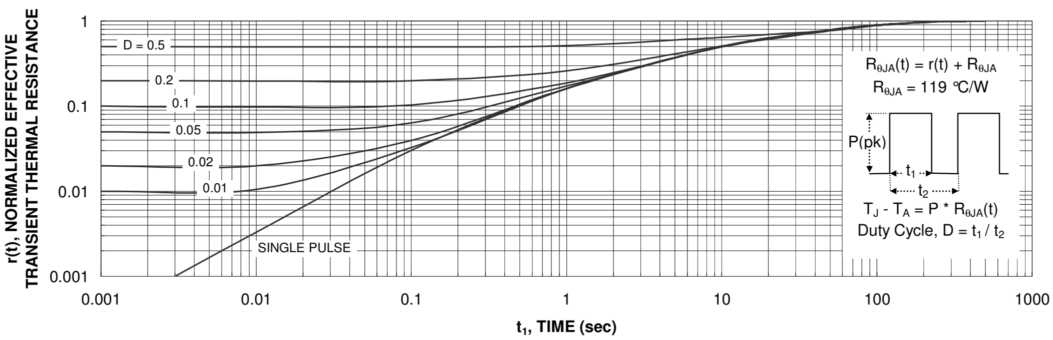


Figure 11. Transient Thermal Response Curve.

Thermal characterization performed using the conditions described in Note 1b.
Transient thermal response will change depending on the circuit board design.