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February 2006

FDZ206P

P-Channel 2.5V Specified PowerTrench® BGA MOSFET

General Description

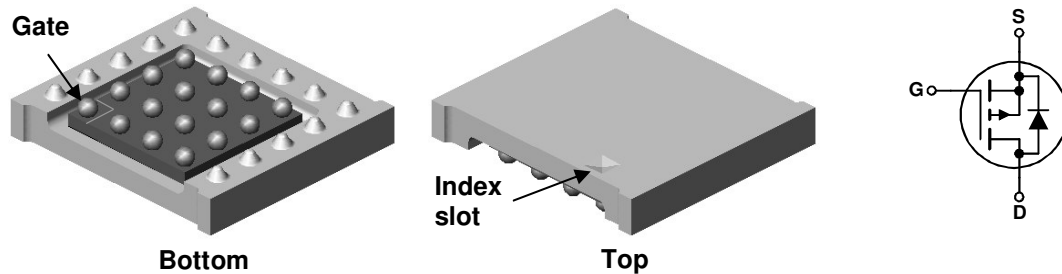
Combining Fairchild's advanced 2.5V specified PowerTrench process with state of the art BGA packaging, the FDZ206P minimizes both PCB space and $r_{DS(on)}$. This BGA MOSFET embodies a breakthrough in packaging technology which enables the device to combine excellent thermal transfer characteristics, 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. $r_{DS(on)} = 9.5 \text{ m}\Omega @ V_{GS} = -4.5 \text{ V}$
 $r_{DS(on)} = 14.5 \text{ m}\Omega @ V_{GS} = -2.5 \text{ V}$
- Occupies only 14 mm² 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 mm² 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 |
| | | -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 _{θJA} | Thermal Resistance, Junction-to-Ambient (Note 1a) | 56 | °C/W |
| R _{θJB} | Thermal Resistance, Junction-to-Ball (Note 1) | 4.5 | |
| R _{θJC} | Thermal Resistance, Junction-to-Case (Note 1) | 0.6 | |

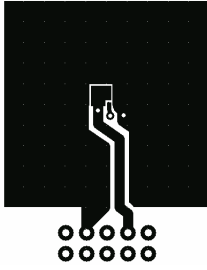
Package Marking and Ordering Information

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

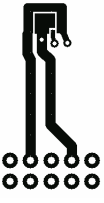
| Electrical Characteristics | | | | | | |
|---|---|---|------|--------------|-------------------|----------------------|
| $T_A = 25^\circ\text{C}$ unless otherwise noted | | | | | | |
| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
| Off Characteristics | | | | | | |
| BV_{DSS} |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

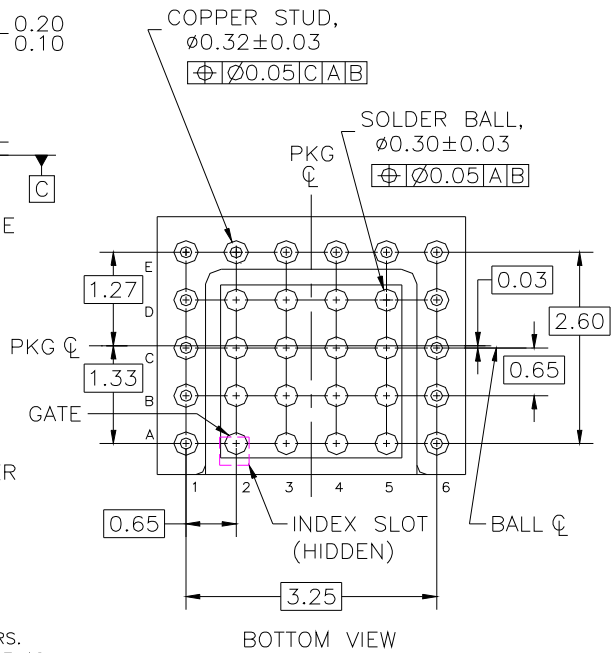
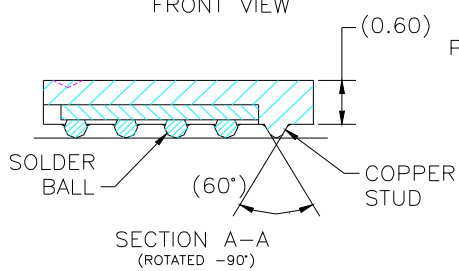
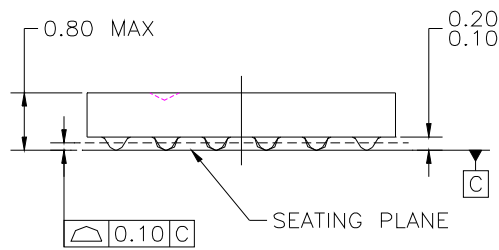
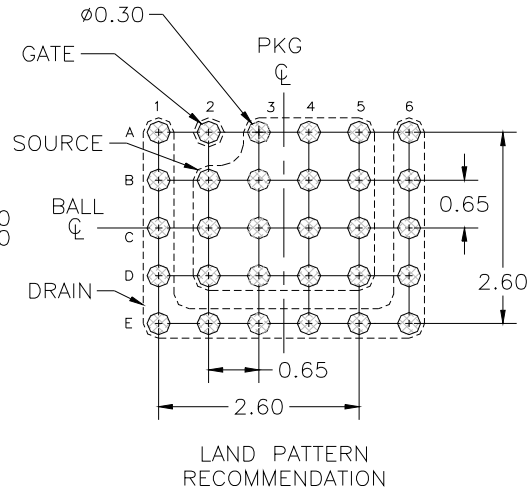
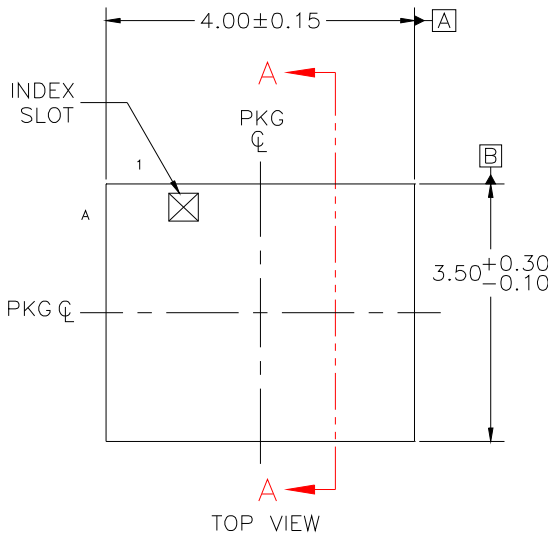


b) 119°C/W when mounted on a minimum pad of 2 oz copper

Scale 1 : 1 on letter size paper

2. Pulse Test: Pulse Width < 300 μs , 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 | SOLDER BALL |

BGA16AREVC

Typical Characteristics

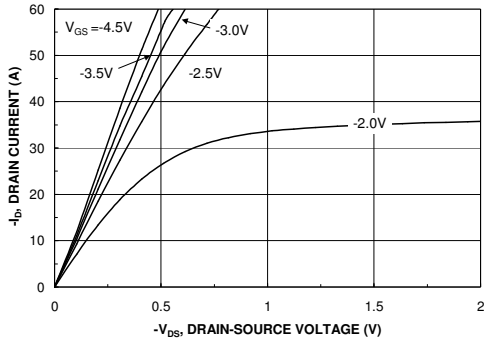


Figure 1. On-Region Characteristics.

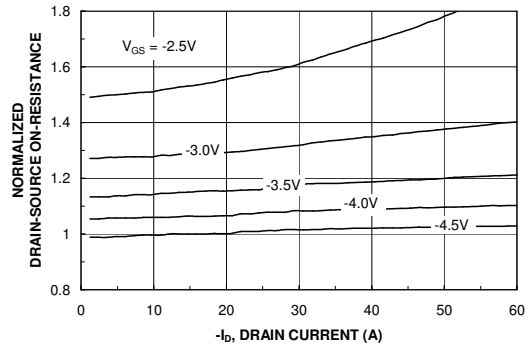


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

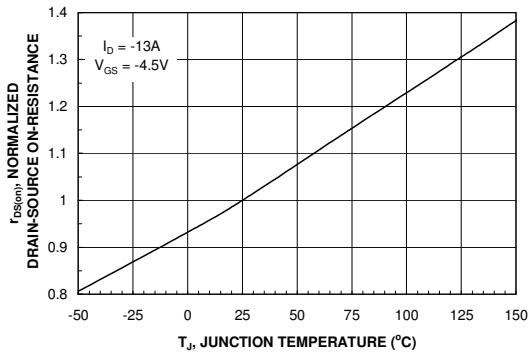


Figure 3. On-Resistance Variation with Temperature.

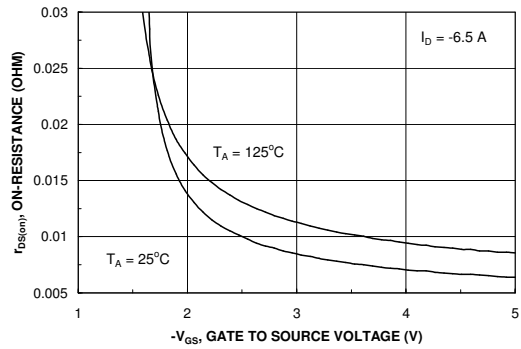


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

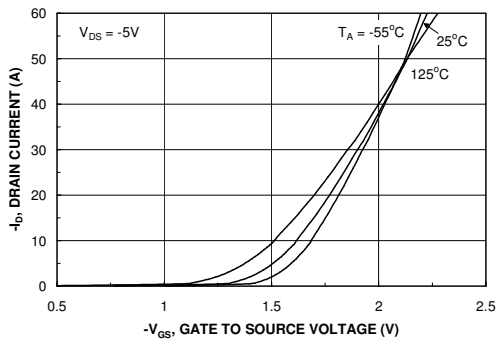


Figure 5. Transfer Characteristics.

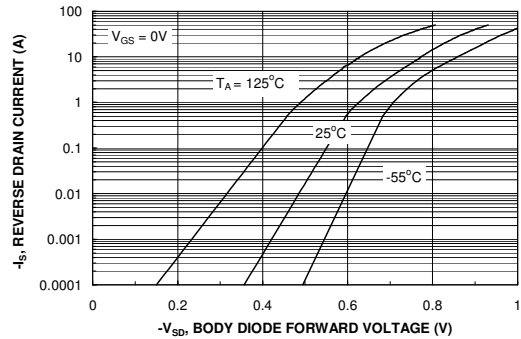


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics

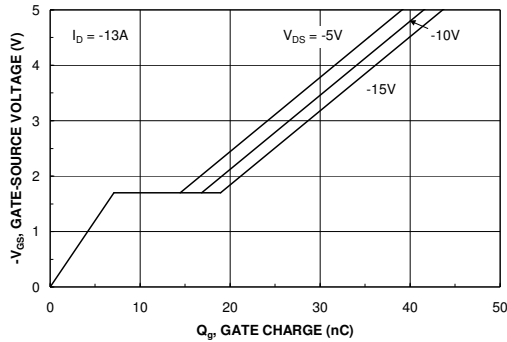


Figure 7. Gate Charge Characteristics.

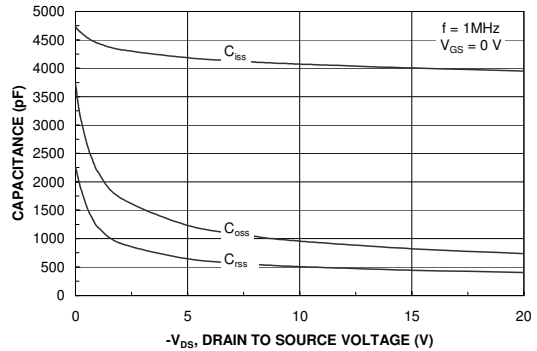


Figure 8. Capacitance Characteristics.

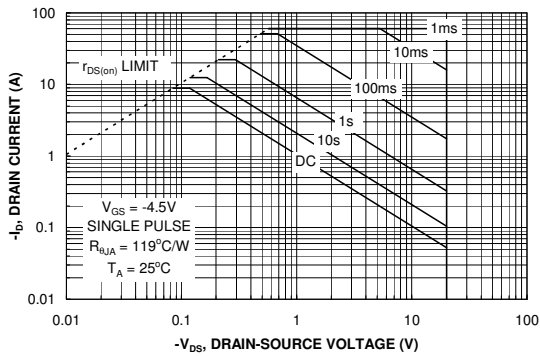


Figure 9. Maximum Safe Operating Area.

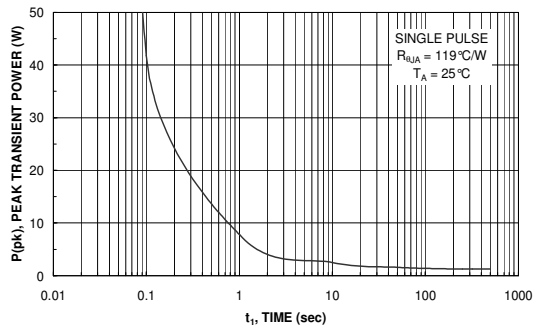


Figure 10. Single Pulse Maximum Power Dissipation.

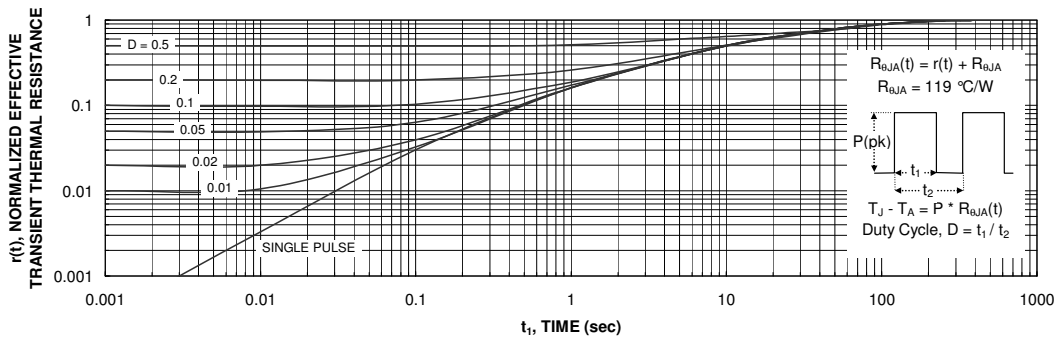


Figure 11. Transient Thermal Response Curve.

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