




# FDMA1032CZ

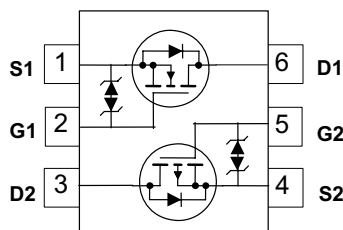
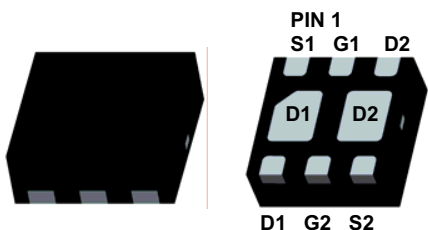
## 20V Complementary PowerTrench<sup>®</sup> MOSFET

### General Description

This device is designed specifically as a single package solution for a DC/DC 'Switching' MOSFET in cellular handset and other ultra-portable applications. It features an independent N-Channel & P-Channel MOSFET with low on-state resistance for minimum conduction losses. The gate charge of each MOSFET is also minimized to allow high frequency switching directly from the controlling device. The MicroFET 2x2 package offers exceptional thermal performance for its physical size and is well suited to switching applications.

### Features

- Q1: N-Channel  
3.7 A, 20V.  $R_{DS(ON)} = 68\text{ m}\Omega @ V_{GS} = 4.5\text{V}$   
 $R_{DS(ON)} = 86\text{ m}\Omega @ V_{GS} = 2.5\text{V}$
- Q2: P-Channel  
-3.1 A, -20V.  $R_{DS(ON)} = 95\text{ m}\Omega @ V_{GS} = -4.5\text{V}$   
 $R_{DS(ON)} = 141\text{ m}\Omega @ V_{GS} = -2.5\text{V}$
- Low profile – 0.8 mm maximum – in the new package MicroFET 2x2 mm
- HBM ESD protection level > 2 kV (Note 3) 
- RoHS Compliant
- Free from halogenated compounds and antimony oxides



### MicroFET 2x2

### Absolute Maximum Ratings T<sub>A</sub>=25°C unless otherwise noted

| Symbol                            | Parameter                                                     | Q1          | Q2   | Units |
|-----------------------------------|---------------------------------------------------------------|-------------|------|-------|
| V <sub>DS</sub>                   | Drain-Source Voltage                                          | 20          | -20  | V     |
| V <sub>GS</sub>                   | Gate-Source Voltage                                           | ±12         | ±12  | V     |
| I <sub>D</sub>                    | Drain Current – Continuous (Note 1a)                          | 3.7         | -3.1 | A     |
|                                   | – Pulsed                                                      | 6           | -6   |       |
| P <sub>D</sub>                    | Power Dissipation for Single Operation (Note 1a)<br>(Note 1b) | 1.4         |      | W     |
|                                   |                                                               | 0.7         |      |       |
| T <sub>J</sub> , T <sub>STG</sub> | Operating and Storage Junction Temperature Range              | -55 to +150 |      | °C    |

### Thermal Characteristics

| R <sub>θJA</sub> | Thermal Resistance, Junction-to-Ambient | (Note 1a) | 86 (Single Operation)  | °C/W |
|------------------|-----------------------------------------|-----------|------------------------|------|
| R <sub>θJA</sub> | Thermal Resistance, Junction-to-Ambient | (Note 1b) | 173 (Single Operation) |      |
| R <sub>θJA</sub> | Thermal Resistance, Junction-to-Ambient | (Note 1c) | 69 (Dual Operation)    |      |
| R <sub>θJA</sub> | Thermal Resistance, Junction-to-Ambient | (Note 1d) | 151 (Dual Operation)   |      |

### Package Marking and Ordering Information

| Device Marking | Device     | Reel Size | Tape width | Quantity   |
|----------------|------------|-----------|------------|------------|
| 032            | FDMA1032CZ | 7"        | 8mm        | 3000 units |

FDMA1032CZ 20V Complementary PowerTrench<sup>®</sup> MOSFET

### Electrical Characteristics

$T_A = 25^\circ\text{C}$  unless otherwise noted

| Symbol                                    | Parameter                                      | Test Conditions                                                                                                                                                          | Type     | Min         | Typ            | Max              | Units                |
|-------------------------------------------|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------------|----------------|------------------|----------------------|
| <b>Off Characteristics</b>                |                                                |                                                                                                                                                                          |          |             |                |                  |                      |
| $BV_{DSS}$                                | Drain-Source Breakdown Voltage                 | $V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$<br>$V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$                                                                          | Q1<br>Q2 | 20<br>-20   |                |                  | V                    |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$      | Breakdown Voltage Temperature Coefficient      | $I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$<br>$I_D = -250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$                                              | Q1<br>Q2 |             | 15<br>-12      |                  | mV/ $^\circ\text{C}$ |
| $I_{DSS}$                                 | Zero Gate Voltage Drain Current                | $V_{DS} = 16\text{ V}, V_{GS} = 0\text{ V}$<br>$V_{DS} = -16\text{ V}, V_{GS} = 0\text{ V}$                                                                              | Q1<br>Q2 |             |                | 1<br>-1          | $\mu\text{A}$        |
| $I_{GSS}$                                 | Gate-Body Leakage                              | $V_{GS} = \pm 12\text{ V}, V_{DS} = 0\text{ V}$                                                                                                                          | All      |             |                | $\pm 10$         | $\mu\text{A}$        |
| <b>On Characteristics (Note 2)</b>        |                                                |                                                                                                                                                                          |          |             |                |                  |                      |
| $V_{GS(th)}$                              | Gate Threshold Voltage                         | $V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$<br>$V_{DS} = V_{GS}, I_D = -250\ \mu\text{A}$                                                                                  | Q1<br>Q2 | 0.6<br>-0.6 | 1.0<br>-1.0    | 1.5<br>-1.5      | V                    |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$    | Gate Threshold Voltage Temperature Coefficient | $I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$<br>$I_D = -250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$                                              | Q1<br>Q2 |             | -4<br>4        |                  | mV/ $^\circ\text{C}$ |
| $R_{DS(on)}$                              | Static Drain-Source On-Resistance              | $V_{GS} = 4.5\text{ V}, I_D = 3.7\text{ A}$<br>$V_{GS} = 2.5\text{ V}, I_D = 3.3\text{ A}$<br>$V_{GS} = 4.5\text{ V}, I_D = 3.7\text{ A}, T_J = 125^\circ\text{C}$       | Q1       |             | 37<br>50<br>53 | 68<br>86<br>90   | m $\Omega$           |
|                                           |                                                | $V_{GS} = -4.5\text{ V}, I_D = -3.1\text{ A}$<br>$V_{GS} = -2.5\text{ V}, I_D = -2.5\text{ A}$<br>$V_{GS} = -4.5\text{ V}, I_D = -3.1\text{ A}, T_J = 125^\circ\text{C}$ | Q2       |             | 60<br>88<br>87 | 95<br>141<br>140 |                      |
| $g_{FS}$                                  | Forward Transconductance                       | $V_{DS} = 10\text{ V}, I_D = 3.7\text{ A}$<br>$V_{DS} = -10\text{ V}, I_D = -3.1\text{ A}$                                                                               | Q1<br>Q2 |             | 16<br>-11      |                  | S                    |
| <b>Dynamic Characteristics</b>            |                                                |                                                                                                                                                                          |          |             |                |                  |                      |
| $C_{iss}$                                 | Input Capacitance                              | $V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$                                                                                                          | Q1<br>Q2 |             | 340<br>540     |                  | pF                   |
| $C_{oss}$                                 | Output Capacitance                             |                                                                                                                                                                          | Q1<br>Q2 |             | 80<br>120      |                  | pF                   |
| $C_{rss}$                                 | Reverse Transfer Capacitance                   | $V_{DS} = -10\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$                                                                                                         | Q1<br>Q2 |             | 60<br>100      |                  | pF                   |
| <b>Switching Characteristics (Note 2)</b> |                                                |                                                                                                                                                                          |          |             |                |                  |                      |
| $t_{d(on)}$                               | Turn-On Delay Time                             | $V_{DD} = 10\text{ V}, I_D = 1\text{ A}, V_{GS} = 4.5\text{ V}, R_{GEN} = 6\ \Omega$                                                                                     | Q1<br>Q2 |             | 8<br>13        | 16<br>24         | ns                   |
| $t_r$                                     | Turn-On Rise Time                              |                                                                                                                                                                          | Q1<br>Q2 |             | 8<br>11        | 16<br>20         |                      |
| $t_{d(off)}$                              | Turn-Off Delay Time                            | $V_{DD} = -10\text{ V}, I_D = -1\text{ A}, V_{GS} = -4.5\text{ V}, R_{GEN} = 6\ \Omega$                                                                                  | Q1<br>Q2 |             | 14<br>37       | 26<br>59         | ns                   |
| $t_f$                                     | Turn-Off Fall Time                             |                                                                                                                                                                          | Q1<br>Q2 |             | 3<br>36        | 6<br>58          |                      |
| $Q_g$                                     | Total Gate Charge                              | $V_{DS} = 10\text{ V}, I_D = 3.7\text{ A}, V_{GS} = 4.5\text{ V}$                                                                                                        | Q1<br>Q2 |             | 4<br>7         | 6<br>10          | nC                   |
| $Q_{gs}$                                  | Gate-Source Charge                             |                                                                                                                                                                          | Q1<br>Q2 |             | 0.7<br>1.1     |                  |                      |
| $Q_{gd}$                                  | Gate-Drain Charge                              | $V_{DS} = -10\text{ V}, I_D = -3.1\text{ A}, V_{GS} = -4.5\text{ V}$                                                                                                     | Q1<br>Q2 |             | 1.1<br>2.4     |                  | nC                   |

### Electrical Characteristics

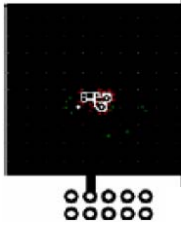
$T_A = 25^\circ\text{C}$  unless otherwise noted

| Symbol                                                        | Parameter                                             | Test Conditions                                                                                           | Type     | Min | Typ         | Max         | Units |
|---------------------------------------------------------------|-------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|----------|-----|-------------|-------------|-------|
| <b>Drain–Source Diode Characteristics and Maximum Ratings</b> |                                                       |                                                                                                           |          |     |             |             |       |
| $I_S$                                                         | Maximum Continuous Source-Drain Diode Forward Current |                                                                                                           | Q1<br>Q2 |     |             | 1.1<br>-1.1 | A     |
| $V_{SD}$                                                      | Source-Drain Diode Forward Voltage                    | $V_{GS} = 0\text{ V}, I_S = 1.1\text{ A}$ (Note 2)<br>$V_{GS} = 0\text{ V}, I_S = -1.1\text{ A}$ (Note 2) | Q1<br>Q2 |     | 0.7<br>-0.8 | 1.2<br>-1.2 | V     |
| $t_{rr}$                                                      | Diode Reverse Recovery Time                           | Q1<br>$I_F = 3.7\text{ A}, dI_F/dt = 100\text{ A}/\mu\text{s}$                                            | Q1<br>Q2 |     | 11<br>25    |             | ns    |
| $Q_{rr}$                                                      | Diode Reverse Recovery Charge                         | Q2<br>$I_F = -3.1\text{ A}, dI_F/dt = 100\text{ A}/\mu\text{s}$                                           | Q1<br>Q2 |     | 2<br>9      |             | nC    |

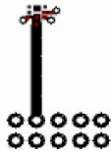
**Notes:**

1.  $R_{\theta JA}$  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.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta JA}$  is determined by the user's board design.

- (a)  $R_{\theta JA} = 86^\circ\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper, 1.5 " x 1.5 " x 0.062 " thick PCB. For single operation.
- (b)  $R_{\theta JA} = 173^\circ\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper. For single operation.
- (c)  $R_{\theta JA} = 69^\circ\text{C}/\text{W}$  when mounted on a 1 in<sup>2</sup> pad of 2 oz copper, 1.5 " x 1.5 " x 0.062 " thick PCB. For dual operation.
- (d)  $R_{\theta JA} = 151^\circ\text{C}/\text{W}$  when mounted on a minimum pad of 2 oz copper. For dual operation.



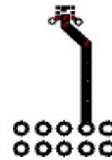
a) 86 °C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.



b) 173 °C/W when mounted on a minimum pad of 2 oz copper.



c) 69 °C/W when mounted on a 1 in<sup>2</sup> pad of 2 oz copper.



d) 151 °C/W when mounted on a minimum pad of 2 oz copper.

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

3. The diode connected between the gate and source serves only as protection against ESD. No gate overvoltage rating is implied.

### Typical Characteristics Q1 (N-Channel)

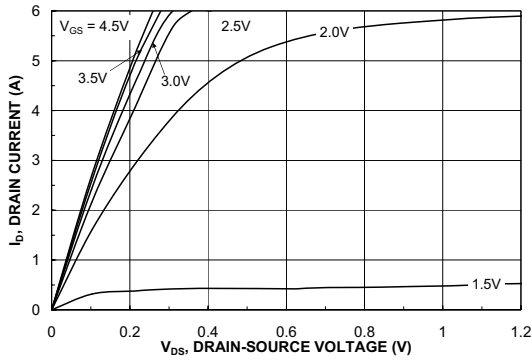


Figure 1. On-Region Characteristics.

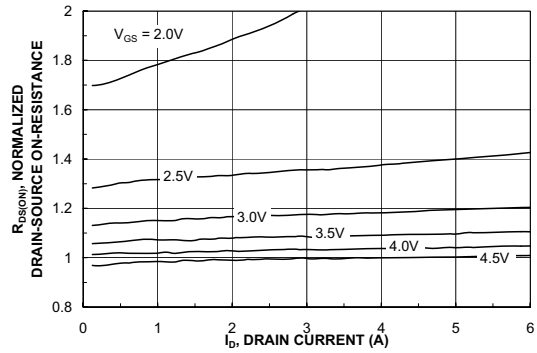


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

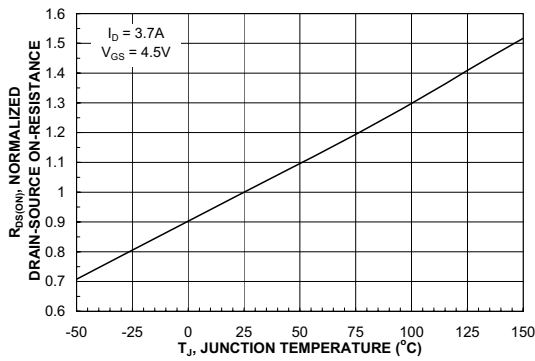


Figure 3. On-Resistance Variation with Temperature.

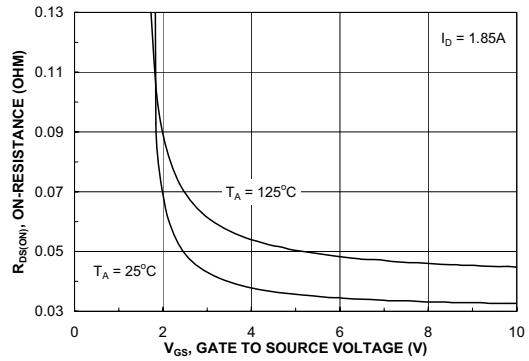


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

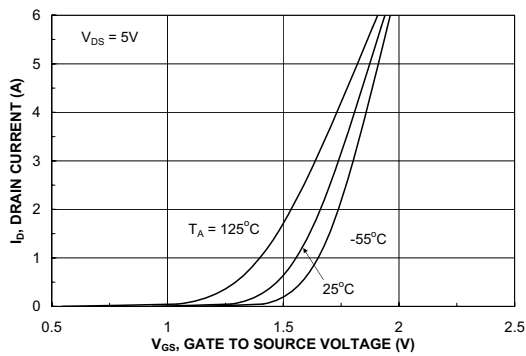


Figure 5. Transfer Characteristics.

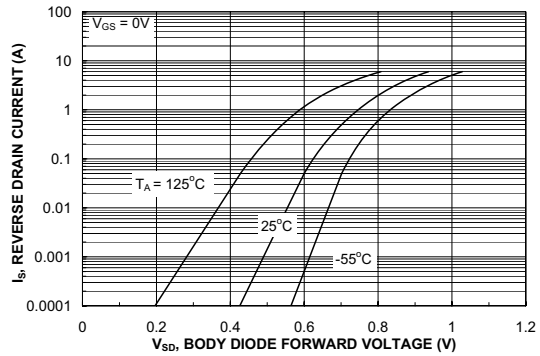


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

### Typical Characteristics Q1 (N-Channel)

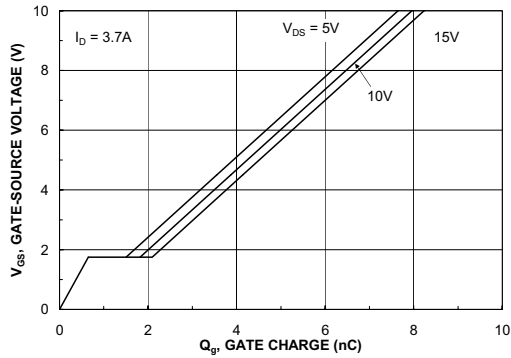


Figure 7. Gate Charge Characteristics.

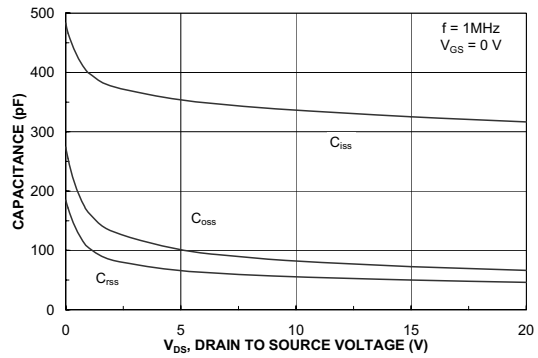


Figure 8. Capacitance Characteristics.

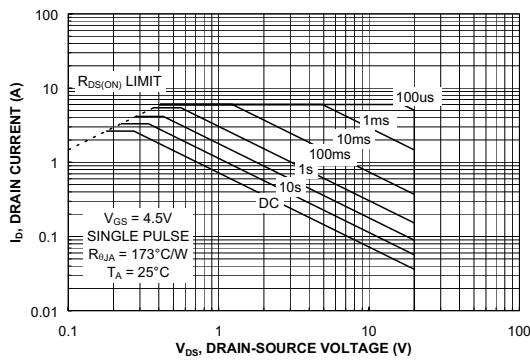


Figure 9. Maximum Safe Operating Area.

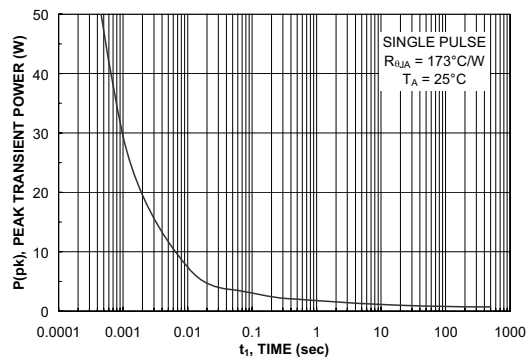


Figure 10. Single Pulse Maximum Power Dissipation.

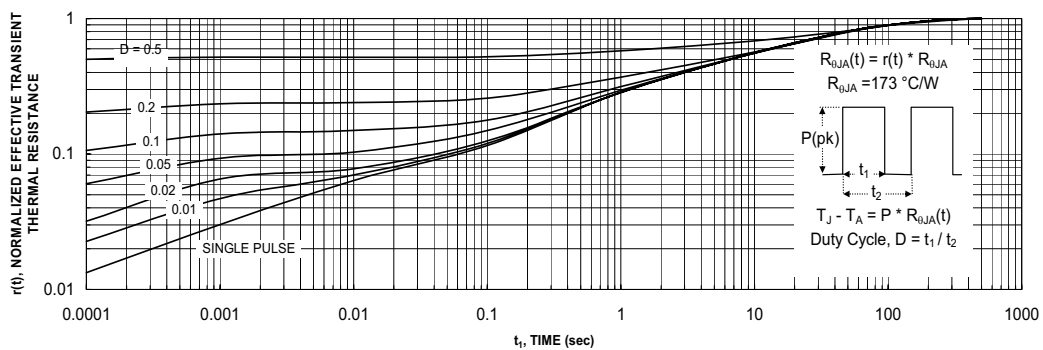


Figure 11. Transient Thermal Response Curve.

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

### Typical Characteristics: Q2 (P-Channel)

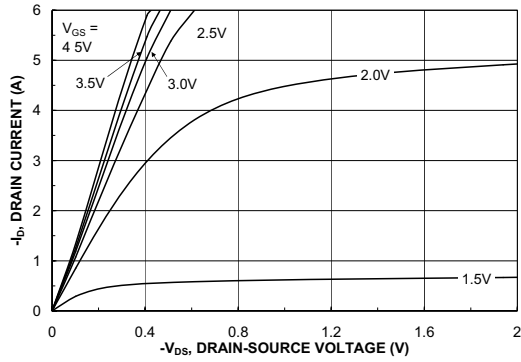


Figure 12. On-Region Characteristics.

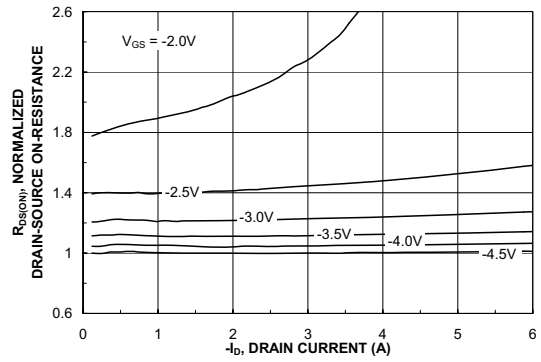


Figure 13. On-Resistance Variation with Drain Current and Gate Voltage.

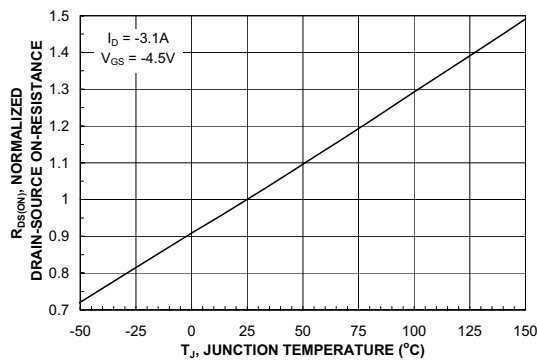


Figure 14. On-Resistance Variation with Temperature.

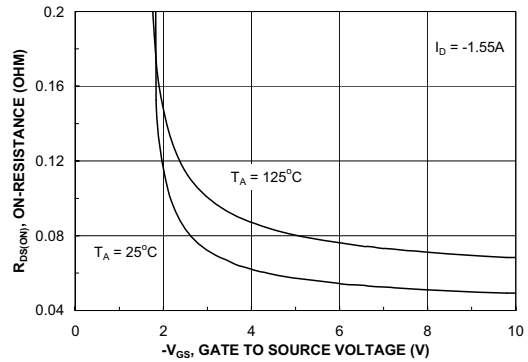


Figure 15. On-Resistance Variation with Gate-to-Source Voltage.

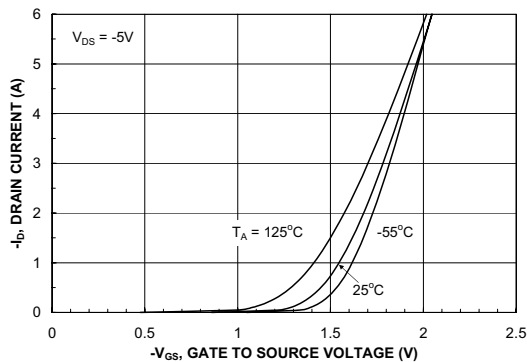


Figure 16. Transfer Characteristics.

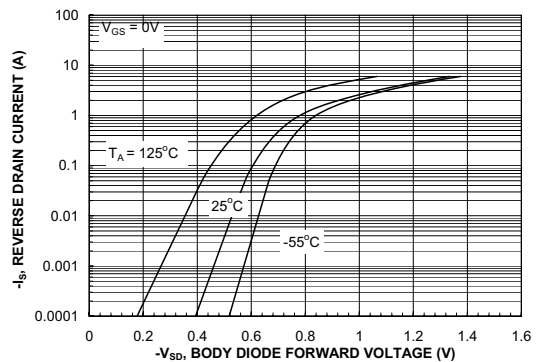


Figure 17. Body Diode Forward Voltage Variation with Source Current and Temperature.

### Typical Characteristics: Q2 (P-Channel)

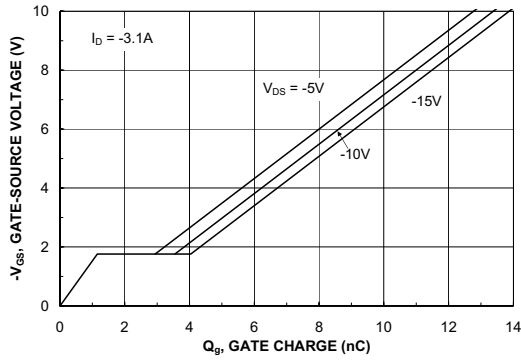


Figure 18. Gate Charge Characteristics.

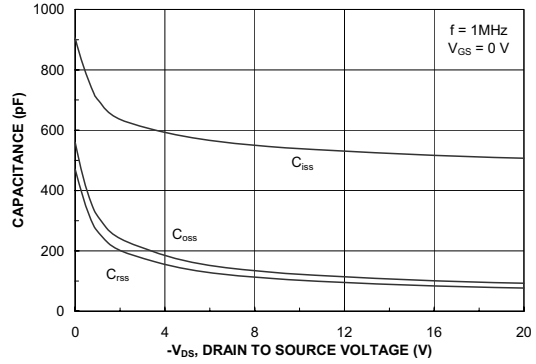


Figure 19. Capacitance Characteristics.

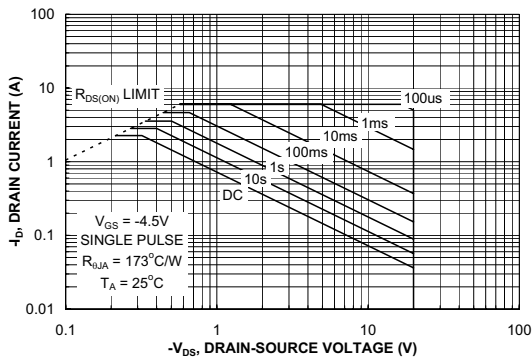


Figure 20. Maximum Safe Operating Area.

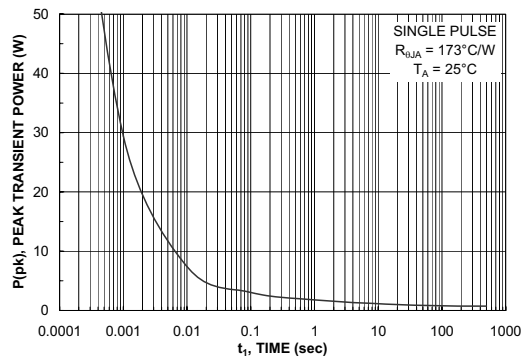


Figure 21. Single Pulse Maximum Power Dissipation.

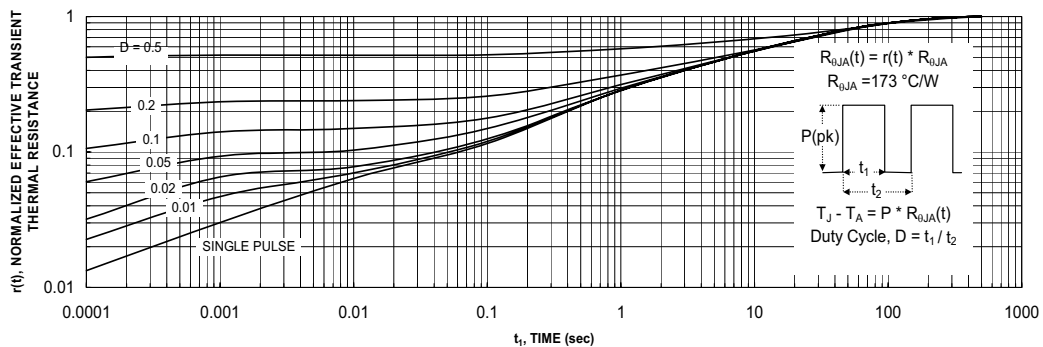
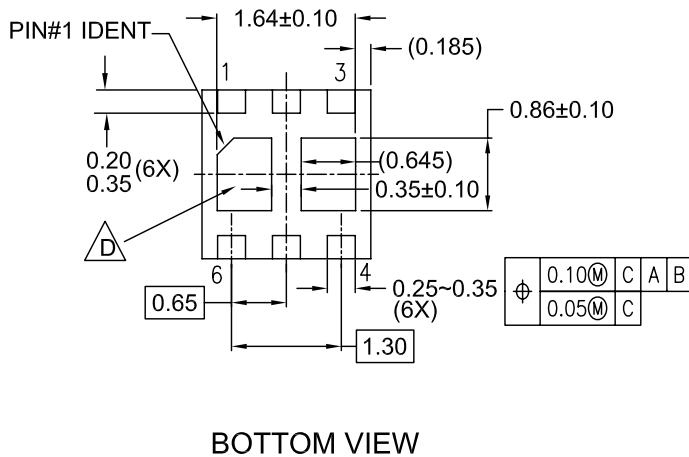
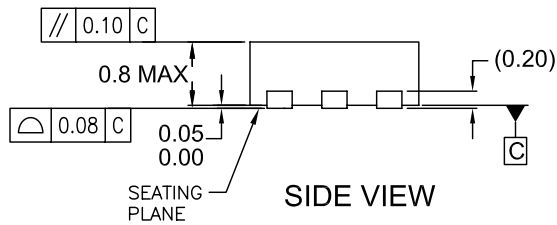
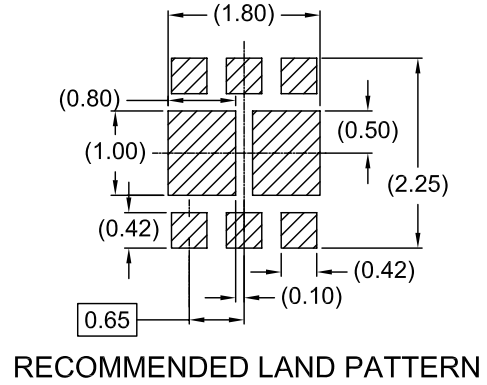
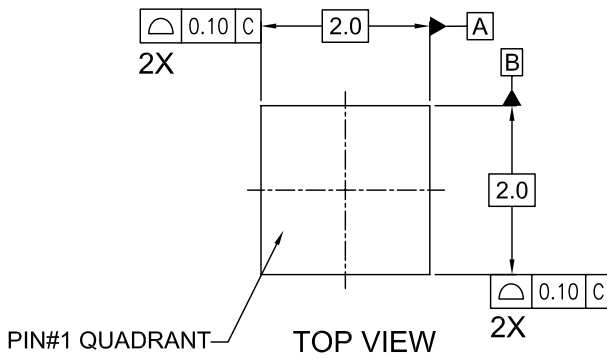


Figure 22. Transient Thermal Response Curve.

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

**Dimensional Outline and Pad Layout**



**NOTES:**







- A. CONFORMS TO JEDEC REGISTRATION MO-229, VARIATION VCCC EXCEPT AS NOTED.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994
- D. NON-JEDEC DUAL DAP
- E. DRAWING FILE NAME : MLP06J rev3





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- |                                                                                   |                                                                                   |                                                                                                     |                                                                                     |
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| Auto-SPM™                                                                         | F-PFS™                                                                            | PowerTrench®                                                                                        | The Power Franchise®                                                                |
| Build it Now™                                                                     | FRFET®                                                                            | PowerXS™                                                                                            | the power® franchise                                                                |
| CorePLUS™                                                                         | Global Power Resource <sup>SM</sup>                                               | Programmable Active Droop™                                                                          | TinyBoost™                                                                          |
| CorePOWER™                                                                        | Green FPS™                                                                        | QFET®                                                                                               | TinyBuck™                                                                           |
| CROSSVOLT™                                                                        | Green FPS™ e-Series™                                                              | QS™                                                                                                 | TinyLogic®                                                                          |
| CTL™                                                                              | Gmax™                                                                             | Quiet Series™                                                                                       | TINYOPTO™                                                                           |
| Current Transfer Logic™                                                           | GTO™                                                                              | RapidConfigure™                                                                                     | TinyPower™                                                                          |
| EcoSPARK®                                                                         | IntelliMAX™                                                                       |  ™                 | TinyPWM™                                                                            |
| EfficientMax™                                                                     | ISOPLANAR™                                                                        | Saving our world, 1mW /W /kW at a time™                                                             | TinyWire™                                                                           |
| EZSWITCH™ *                                                                       | MegaBuck™                                                                         | SmartMax™                                                                                           | TriFault Detect™                                                                    |
|  | MICROCOUPLER™                                                                     | SMART START™                                                                                        | TRUECURRENT™ *                                                                      |
|  | MicroFET™                                                                         | SPM®                                                                                                | μSerDes™                                                                            |
| Fairchild®                                                                        | MicroPak™                                                                         | STEALTH™                                                                                            |  |
| Fairchild Semiconductor®                                                          | MillerDrive™                                                                      | SuperFET™                                                                                           | UHC®                                                                                |
| FACT Quiet Series™                                                                | MotionMax™                                                                        | SuperSOT™-3                                                                                         | Ultra FRFET™                                                                        |
| FACT®                                                                             | Motion-SPM™                                                                       | SuperSOT™-6                                                                                         | UniFET™                                                                             |
| FAST®                                                                             | OPTOLOGIC®                                                                        | SuperSOT™-8                                                                                         | VCX™                                                                                |
| FastvCore™                                                                        | OPTOPLANAR®                                                                       | SupreMOS™                                                                                           | VisualMax™                                                                          |
| FETBench™                                                                         |  | SyncFET™                                                                                            | XS™                                                                                 |
| FlashWriter® *                                                                    | PDP SPM™                                                                          | Sync-Lock™                                                                                          |                                                                                     |
| FPS™                                                                              | Power-SPM™                                                                        |  SYSTEM GENERAL® * |                                                                                     |

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As used herein:

- Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
- A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

**ANTI-COUNTERFEITING POLICY**

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, [www.Fairchildsemi.com](http://www.Fairchildsemi.com), under Sales Support.

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufactures of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed application, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address and warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

**PRODUCT STATUS DEFINITIONS**

**Definition of Terms**

| Datasheet Identification | Product Status        | Definition                                                                                                                                                                                          |
|--------------------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Advance Information      | Formative / In Design | Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.                                                                       |
| Preliminary              | First Production      | Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design. |
| No Identification Needed | Full Production       | Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.                                               |
| Obsolete                 | Not In Production     | Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.                                                    |