FAIRCHILD SEMICONDUCTOR®

November 2012

# FDMC2523P
# P-Channel QFET®
**-150V, -3A, 1.5Ω**

## Features

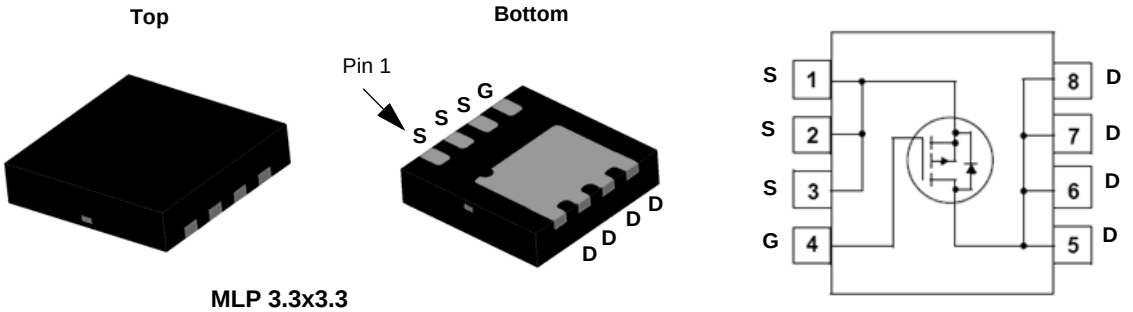
- Max $r_{DS(on)}$ = 1.5Ω at $V_{GS}$ = -10V, $I_D$ = -1.5A
- Low Crss ( typical 10pF)
- Fast Switching
- Low gate charge ( typical 6.2 nC )
- Improved dv / dt capability
- RoHS Compliant

## General Description

These P-Channel MOSFET enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for low voltage applications such as audio amplifier, high efficiency switching DC/DC converters, and DC motor control.

## Application

- Active Clamp Switch




**MLP 3.3x3.3**

## MOSFET Maximum Ratings $T_A$ = 25°C unless otherwise noted

| Symbol | Parameter | Ratings | Units |
|---|---|---|---|
| $V_{DS}$ | Drain to Source Voltage | -150 | V |
| $V_{GS}$ | Gate to Source Voltage | ±30 | V |
| $I_D$ | Drain Current -Continuous $T_C$ = 25°C | -3 | A |
| | -Continuous $T_C$ = 100°C | -1.8 | |
| | -Pulsed | -12 | |
| $P_D$ | Power Dissipation (Steady State) $T_C$ = 25°C | 42 | W |
| $E_{AS}$ | Single Pulse Avalanche Energy (Note 5) | 3.3 | mJ |
| $T_J$, $T_{STG}$ | Operating and Storage Junction Temperature Range | -55 to +150 | °C |
| $T_L$ | Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds | 300 | °C |
| dv/dt | Peak Diode Recovery dv/dt (Note 2) | -5 | V/ns |

### Thermal Characteristics

| | | | |
|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case (Note 1) | 3.0 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1a) | 60 | |

### Package Marking and Ordering Information

| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|---|---|---|---|---|---|
| FDMC2523P | FDMC2523P | MLP 3.3x3.3 | 13 " | 12 mm | 3000 units |

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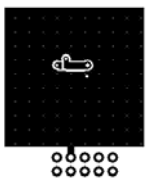
## Electrical Characteristics $T_J$ = 25°C unless otherwise noted

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| $BV_{DSS}$ | Drain to Source Breakdown Voltage | $I_D$ = -250μA, $V_{GS}$ = 0V | -150 | | | V |
| $\frac{\Delta BV_{DSS}}{\Delta T_J}$ | Breakdown Voltage Temperature Coefficient | $I_D$ = -250μA, referenced to 25°C | | -138 | | mV/°C |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = -150V, $V_{GS}$ = 0V | | | -1 | μA |
| | | $T_J$ = 125°C | | | -10 | |
| $I_{GSS}$ | Gate to Source Leakage Current | $V_{GS}$ = ±30V, $V_{DS}$ = 0V | | | ±100 | nA |
| **On Characteristics** | | | | | | |
| $V_{GS(th)}$ | Gate to Source Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = -250μA | -3 | -3.8 | -5 | V |
| $\frac{\Delta V_{GS(th)}}{\Delta T_J}$ | Gate to Source Threshold Voltage Temperature Coefficient | $I_D$ = -250μA, referenced to 25°C | | 6 | | mV/°C |
| $r_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS}$ = -10V, $I_D$ = -1.5A | | 1.1 | 1.5 | Ω |
| | | $V_{GS}$ = -10V, $I_D$ = -1.5A , $T_J$ = 125°C | | 2.0 | 3.6 | |
| $g_{FS}$ | Forward Transconductance | $V_{DS}$ = -40V, $I_D$ = -1.5A (Note 4) | | 1.4 | | S |
| **Dynamic Characteristics** | | | | | | |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = -25V, $V_{GS}$ = 0V, f = 1MHz | | 200 | 270 | pF |
| $C_{oss}$ | Output Capacitance | | | 60 | 80 | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 10 | 15 | pF |
| $R_g$ | Gate Resistance | f = 1MHz | 0.1 | 7.5 | 15 | Ω |
| **Switching Characteristics** | | | | | | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD}$ = -75V, $I_D$ = -3A, $V_{GS}$ = -10V, $R_{GEN}$ = 25Ω (Note 3,4) | | 15 | 27 | ns |
| $t_r$ | Rise Time | | | 11 | 20 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 19 | 35 | ns |
| $t_f$ | Fall Time | | | 13 | 24 | ns |
| $Q_g$ | Total Gate Charge | $V_{GS}$ = -10V, $V_{DD}$ = -75V, $I_D$ = -3A (Note 3,4) | | 6.2 | 9 | nC |
| $Q_{gs}$ | Gate to Source Gate Charge | | | 1.4 | | nC |
| $Q_{gd}$ | Gate to Drain “Miller” Charge | | | 3.3 | | nC |
| **Drain-Source Diode Characteristics** | | | | | | |
| $I_S$ | Maximum continuous Drain - Source Diode Forward Current | | | | -3 | A |
| $I_{SM}$ | Maximum Pulse Drain - Source Doide Forward Current | | | | -12 | A |
| $V_{SD}$ | Source to Drain Diode Forward Voltage | $V_{GS}$ = 0V, $I_S$ = -3.0A | | -1.8 | -5 | V |
| $t_{rr}$ | Reverse Recovery Time | $I_F$ = -3.0A, di/dt = 100A/μs (Note 3) | | 93 | | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | | 0.27 | | nC |

**Notes:**

**1:** $R_{\theta JA}$ is the sum of the junction-to-case and case-to- ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ 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.135°C/W when mounted on a minimum pad of 2 oz copper

**2:** $I_{SD}$ ≤ -3A, dI/dt ≤ 300A/us, $V_{DD}$ ≤ $B_{VDSS}$, Starting $T_J$ = 25°C

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

**4:** Essentially independent of operating temperature.

**5:** $E_{AS}$ of 3.3 mJ is based on starting $T_J$ = 25 °C; P-ch: L = 3 mH, $I_{AS}$ = -1.5 A, $V_{DD}$ = -150 V, $V_{GS}$ = -10 V.

## Typical Characteristics $T_J$ = 25°C unless otherwise noted

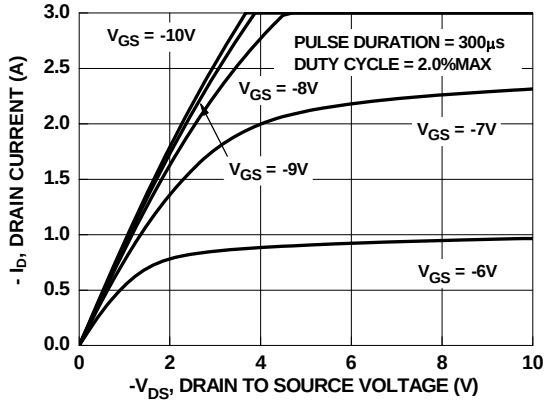



**Figure 1. On-Region Characteristics**

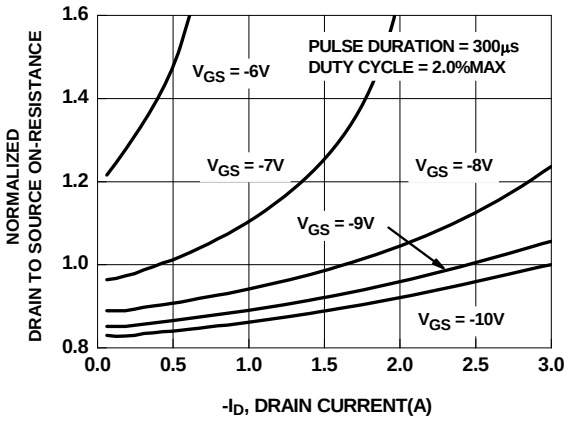



**Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage**

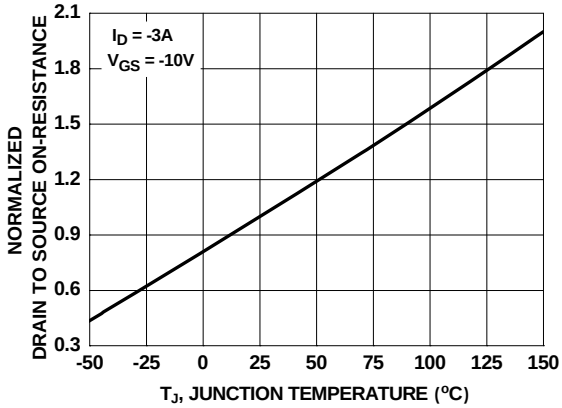



**Figure 3. Normalized On-Resistance vs Junction Temperature**

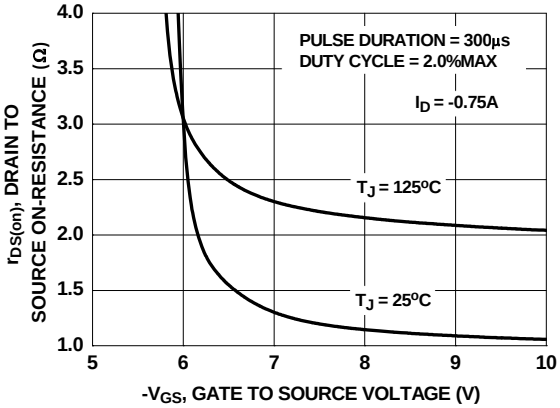



**Figure 4. On-Resistance vs Gate to Source Voltage**

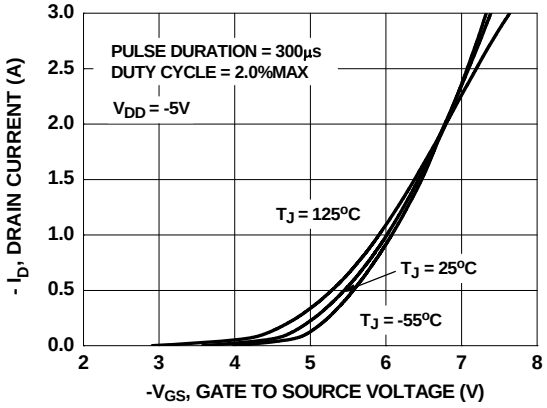



**Figure 5. Transfer Characteristics**

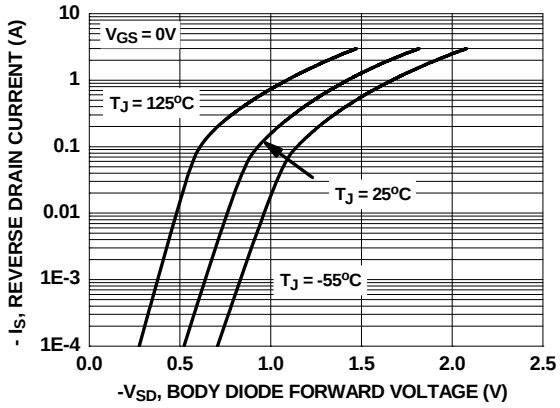



**Figure 6. Source to Drain Diode Forward Voltage vs Source Current**

## Typical Characteristics $T_J$ = 25°C unless otherwise noted

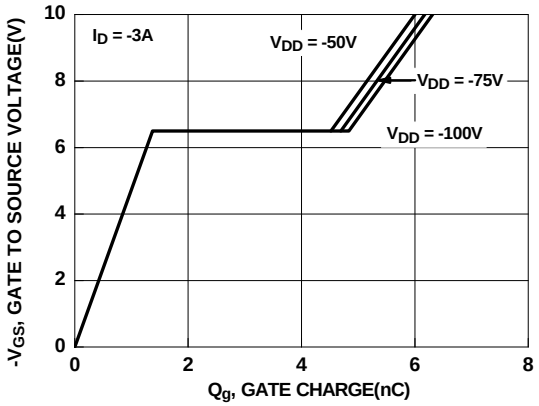



**Figure 7. Gate Charge Characteristics**

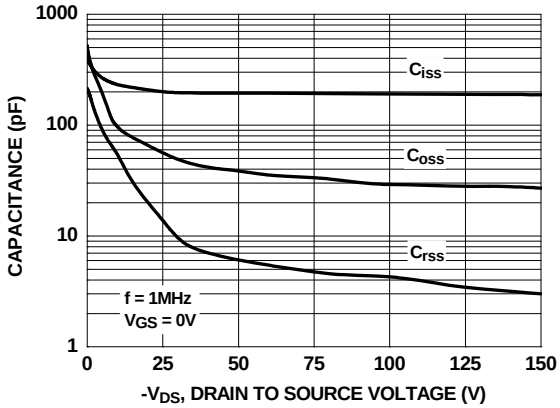



**Figure 8. Capacitance vs Drain to Source Voltage**

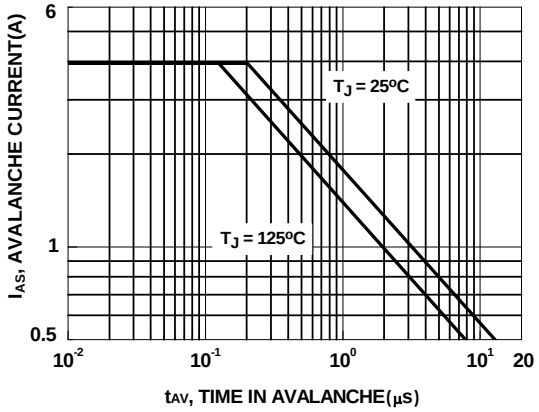



**Figure 9. Unclamped Inductive Switching Capability**

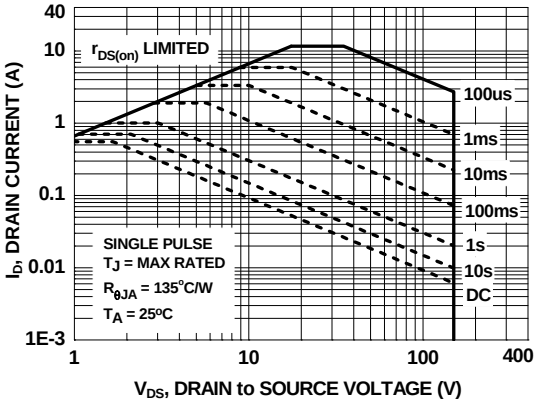



**Figure 10. Forward Bias Safe Operating Area**

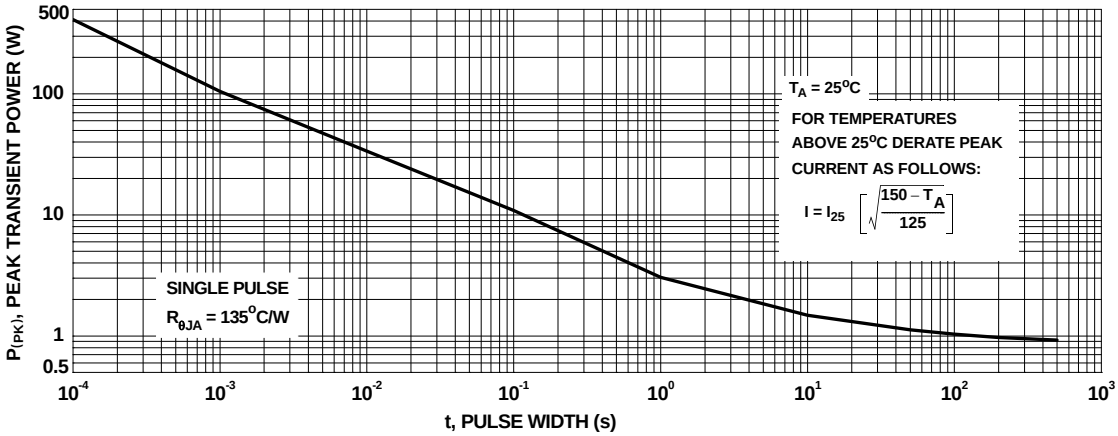



**Figure 11. Single Pulse Maximum Power Dissipation**

## Typical Characteristics $T_J$ = 25°C unless otherwise noted

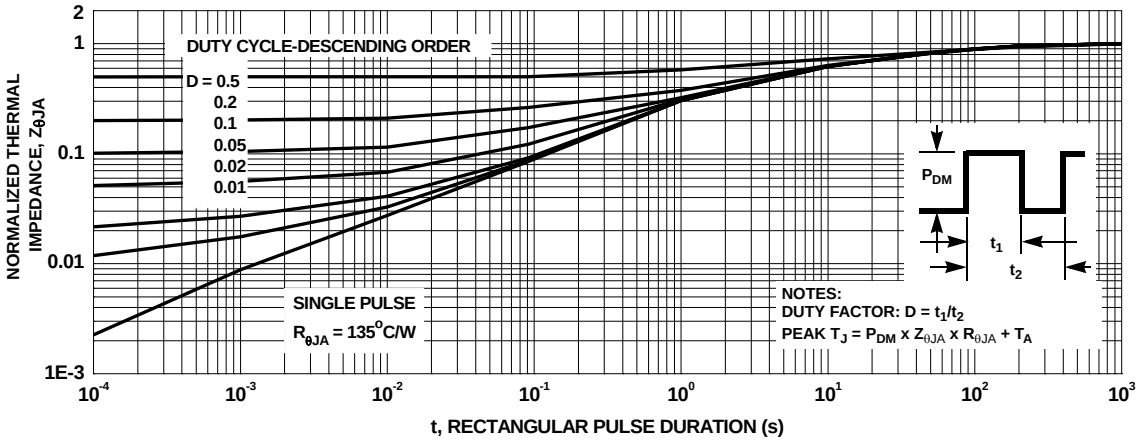
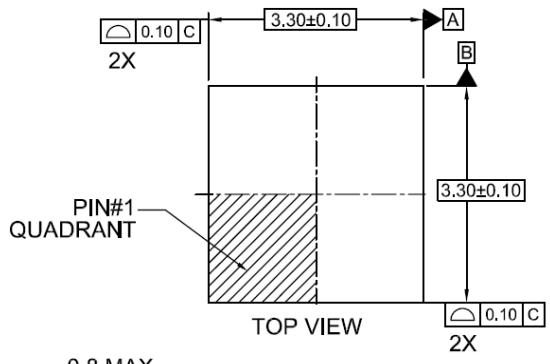
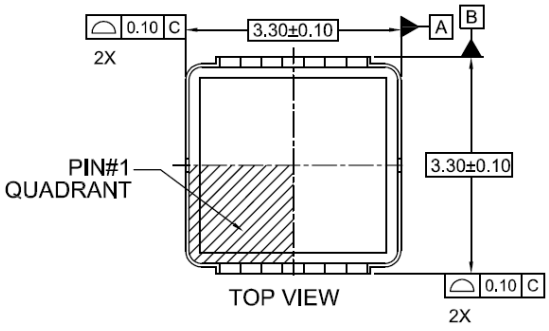
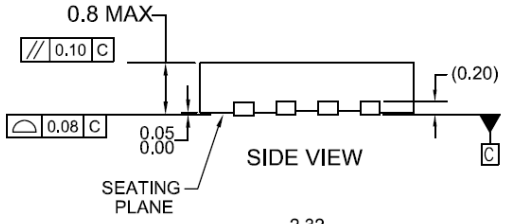


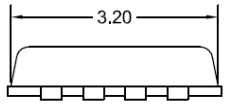

**Figure 12. Transient Thermal Response Curve**

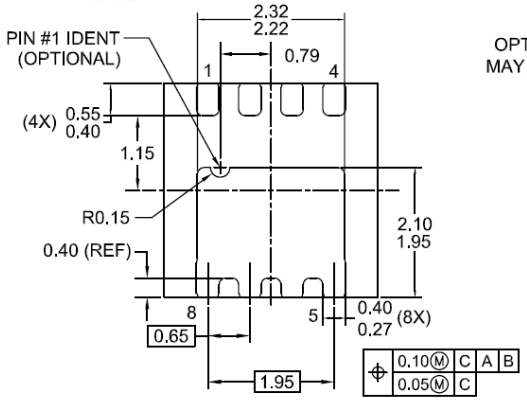
## Dimensional Outline and Pad Layout



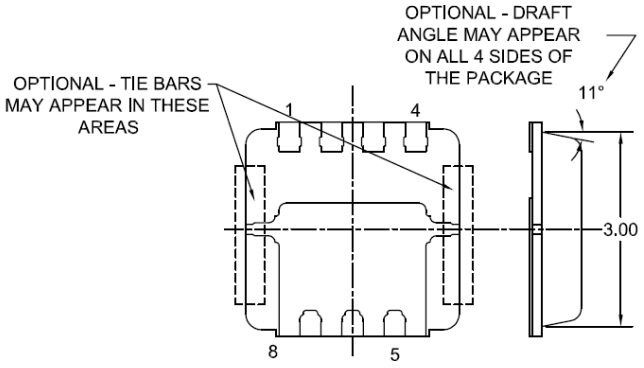



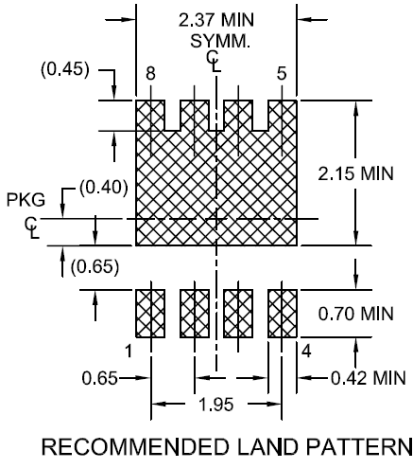




BOTTOM VIEW
(OPTION A)




ALL DIMENSIONS AS PER OPTION A
UNLESS SPECIFIED

BOTTOM VIEW
(OPTION B)

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