

# FQPF47P06

## 60V P-Channel MOSFET

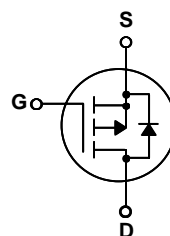
### General Description

These P-Channel 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 a high energy pulse in the avalanche and commutation modes. These devices are well suited for low voltage applications such as automotive, DC/DC converters, and high efficiency switching for power management in portable and battery operated products.

### Features

- -30A, -60V,  $R_{DS(on)} = 0.026\Omega @ V_{GS} = -10V$
- Low gate charge ( typical 84 nC)
- Low Crss ( typical 320 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability
- 175°C maximum junction temperature rating



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

| Symbol                            | Parameter   | FQPF47P06   | Units |
|-----------------------------------|---|-------------|-------|
| V <sub>DSS</sub>                  | Drain-Source Voltage  | -60         | V     |
| I <sub>D</sub>                    | Drain Current - Continuous (T <sub>C</sub> = 25°C)<br>- Continuous (T <sub>C</sub> = 100°C) | -30         | A     |
|                                   |   | -21.2       | A     |
| I <sub>DM</sub>                   | Drain Current - Pulsed (Note 1)   | -120        | A     |
| V <sub>GSS</sub>                  | Gate-Source Voltage   | ± 25        | V     |
| E <sub>AS</sub>                   | Single Pulsed Avalanche Energy (Note 2)   | 820         | mJ    |
| I <sub>AR</sub>                   | Avalanche Current (Note 1)  | -30         | A     |
| E <sub>AR</sub>                   | Repetitive Avalanche Energy (Note 1)  | 6.2         | mJ    |
| dv/dt                             | Peak Diode Recovery dv/dt (Note 3)  | -7.0        | V/ns  |
| P <sub>D</sub>                    | Power Dissipation (T <sub>C</sub> = 25°C)<br>- Derate above 25°C                            | 62          | W     |
|                                   |   | 0.41        | W/°C  |
| T <sub>J</sub> , T <sub>STG</sub> | Operating and Storage Temperature Range   | -55 to +175 | °C    |
| T <sub>L</sub>                    | Maximum lead temperature for soldering purposes,<br>1/8" from case for 5 seconds            | 300         | °C    |

### Thermal Characteristics

| Symbol           | Parameter                               | Typ | Max  | Units |
|------------------|---|-----|------|-------|
| R <sub>θJC</sub> | Thermal Resistance, Junction-to-Case    | --  | 2.42 | °C/W  |
| R <sub>θJA</sub> | Thermal Resistance, Junction-to-Ambient | --  | 62.5 | °C/W  |

## Elerical Characteristics

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

| Symbol                         | Parameter                                 | Test Conditions  | Min | Typ   | Max  | Units                     |
|--------------------------------|---|--|-----|-------|------|---------------------------|
| <b>Off Characteristics</b>     |   |  |     |       |      |                           |
| $BV_{DSS}$                     | Drain-Source Breakdown Voltage            | $V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$               | -60 | --    | --   | V                         |
| $\Delta BV_{DSS} / \Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D = -250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$ | --  | -0.06 | --   | $\text{V}/^\circ\text{C}$ |
| $I_{DSS}$                      | Zero Gate Voltage Drain Current           | $V_{DS} = -60\text{ V}, V_{GS} = 0\text{ V}$                 | --  | --    | -1   | $\mu\text{A}$             |
|                                |   | $V_{DS} = -48\text{ V}, T_C = 150^\circ\text{C}$             | --  | --    | -10  | $\mu\text{A}$             |
| $I_{GSSF}$                     | Gate-Body Leakage Current, Forward        | $V_{GS} = -25\text{ V}, V_{DS} = 0\text{ V}$                 | --  | --    | -100 | nA                        |
| $I_{GSSR}$                     | Gate-Body Leakage Current, Reverse        | $V_{GS} = 25\text{ V}, V_{DS} = 0\text{ V}$                  | --  | --    | 100  | nA                        |

## On Characteristics

|              |                                   |  |      |       |       |          |
|--------------|-----------------------------------|--|------|-------|-------|----------|
| $V_{GS(th)}$ | Gate Threshold Voltage            | $V_{DS} = V_{GS}, I_D = -250\ \mu\text{A}$           | -2.0 | --    | -4.0  | V        |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance | $V_{GS} = -10\text{ V}, I_D = -15\text{ A}$          | --   | 0.021 | 0.026 | $\Omega$ |
| $g_{FS}$     | Forward Transconductance          | $V_{DS} = -30\text{ V}, I_D = -15\text{ A}$ (Note 4) | --   | 19    | --    | S        |

## Dynamic Characteristics

|            |                              |   |    |      |      |    |
|------------|------------------------------|---|----|------|------|----|
| $C_{iss}$  | Input Capacitance            | $V_{DS} = -25\text{ V}, V_{GS} = 0\text{ V},$<br>$f = 1.0\text{ MHz}$ | -- | 2800 | 3600 | pF |
| $C_{oss}$  | Output Capacitance           |   | -- | 1300 | 1700 | pF |
| $C_{riss}$ | Reverse Transfer Capacitance |   | -- | 320  | 420  | pF |

## Switching Characteristics

|              |                     |   |             |     |     |     |
|--------------|---------------------|---|-------------|-----|-----|-----|
| $t_{d(on)}$  | Turn-On Delay Time  | $V_{DD} = -30\text{ V}, I_D = -23.5\text{ A},$<br>$R_G = 25\ \Omega$    | --          | 50  | 110 | ns  |
| $t_r$        | Turn-On Rise Time   |   | --          | 450 | 910 | ns  |
| $t_{d(off)}$ | Turn-Off Delay Time |   | --          | 100 | 210 | ns  |
| $t_f$        | Turn-Off Fall Time  |   | (Note 4, 5) | --  | 195 | 400 |
| $Q_g$        | Total Gate Charge   | $V_{DS} = -48\text{ V}, I_D = -47\text{ A},$<br>$V_{GS} = -10\text{ V}$ | --          | 84  | 110 | nC  |
| $Q_{gs}$     | Gate-Source Charge  |   | --          | 18  | --  | nC  |
| $Q_{gd}$     | Gate-Drain Charge   |   | (Note 4, 5) | --  | 44  | --  |

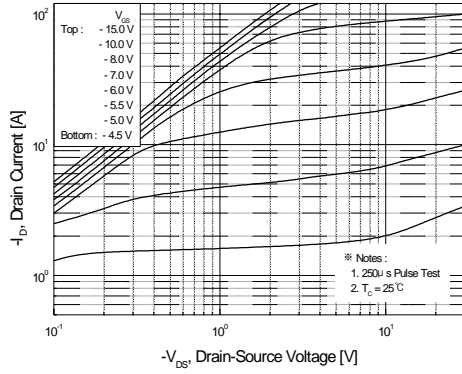
## Drain-Source Diode Characteristics and Maximum Ratings

|          |   |   |    |      |      |               |
|----------|---|---|----|------|------|---------------|
| $I_S$    | Maximum Continuous Drain-Source Diode Forward Current | --  | -- | -30  | A    |               |
| $I_{SM}$ | Maximum Pulsed Drain-Source Diode Forward Current     | --  | -- | -120 | A    |               |
| $V_{SD}$ | Drain-Source Diode Forward Voltage                    | $V_{GS} = 0\text{ V}, I_S = -30\text{ A}$       | -- | --   | -4.0 | V             |
| $t_{rr}$ | Reverse Recovery Time                                 | $V_{GS} = 0\text{ V}, I_S = -47\text{ A},$      | -- | 130  | --   | ns            |
| $Q_{rr}$ | Reverse Recovery Charge                               | $di_F / dt = 100\text{ A}/\mu\text{s}$ (Note 4) | -- | 0.55 | --   | $\mu\text{C}$ |

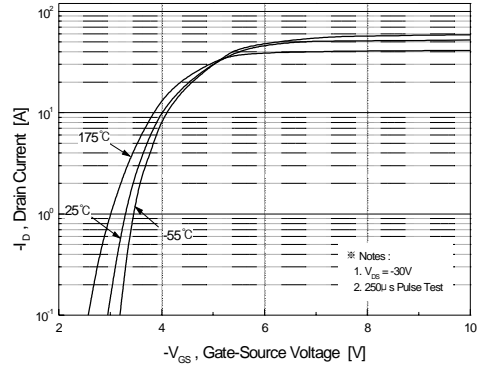
### Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $L = 1.06\text{mH}, I_{AS} = -30\text{ A}, V_{DD} = -25\text{ V}, R_G = 25\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq -47\text{ A}, di/dt \leq 300\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$
4. Pulse Test : Pulse width  $\leq 300\ \mu\text{s}$ , Duty cycle  $\leq 2\%$
5. Essentially independent of operating temperature

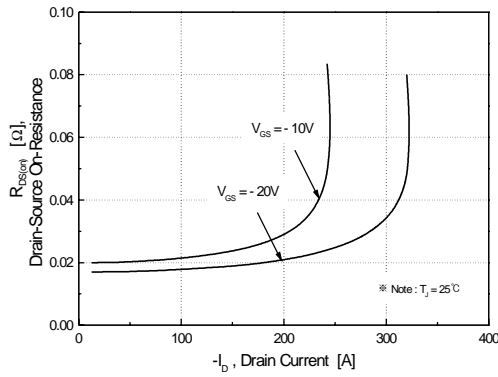
## Typical Characteristics



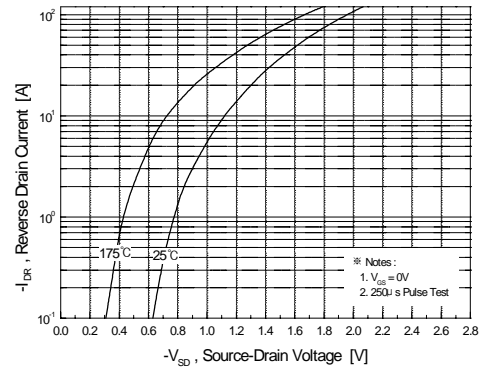
**Figure 1. On-Region Characteristics**



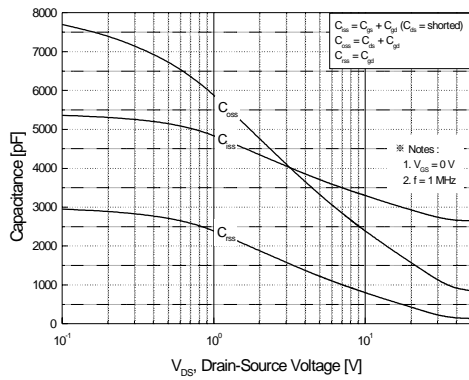
**Figure 2. Transfer Characteristics**



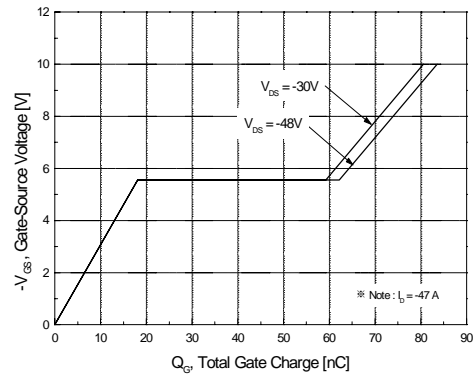
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



**Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature**

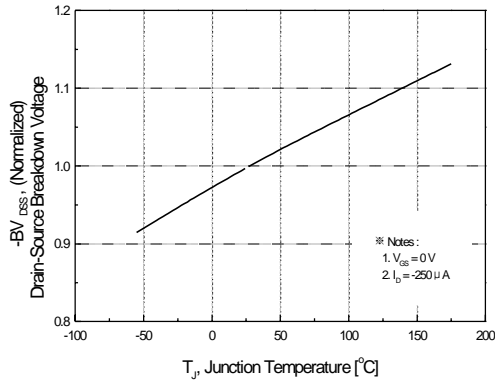


**Figure 5. Capacitance Characteristics**

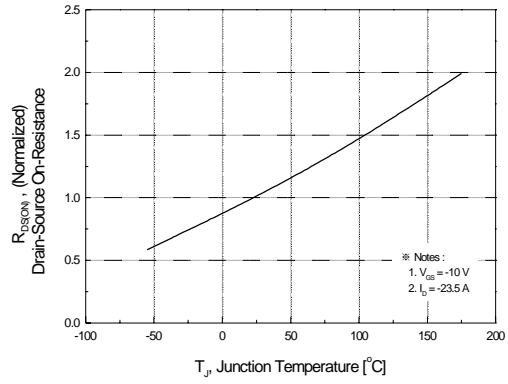


**Figure 6. Gate Charge Characteristics**

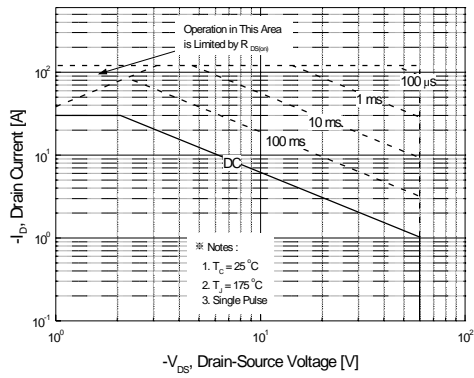
**Typical Characteristics** (Continued)



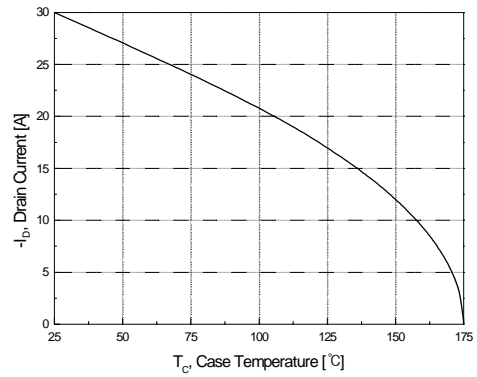
**Figure 7. Breakdown Voltage Variation vs. Temperature**



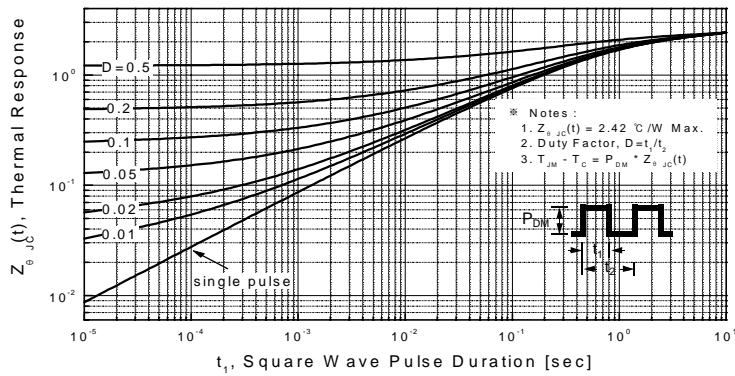
**Figure 8. On-Resistance Variation vs. Temperature**



**Figure 9. Maximum Safe Operating Area**

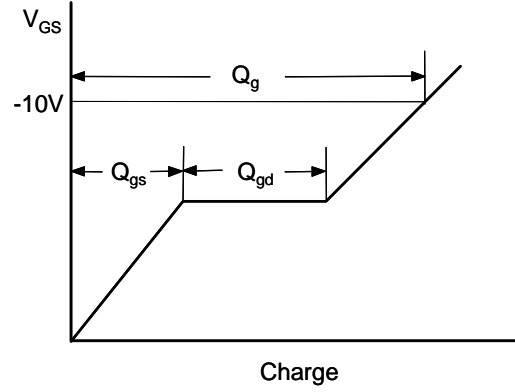


**Figure 10. Maximum Drain Current vs. Case Temperature**



**Figure 11. Transient Thermal Response Curve**

**Gate Charge Test Circuit & Waveform**



**Resistive Switching Test Circuit & Waveforms**



**Unclamped Inductive Switching Test Circuit & Waveforms**



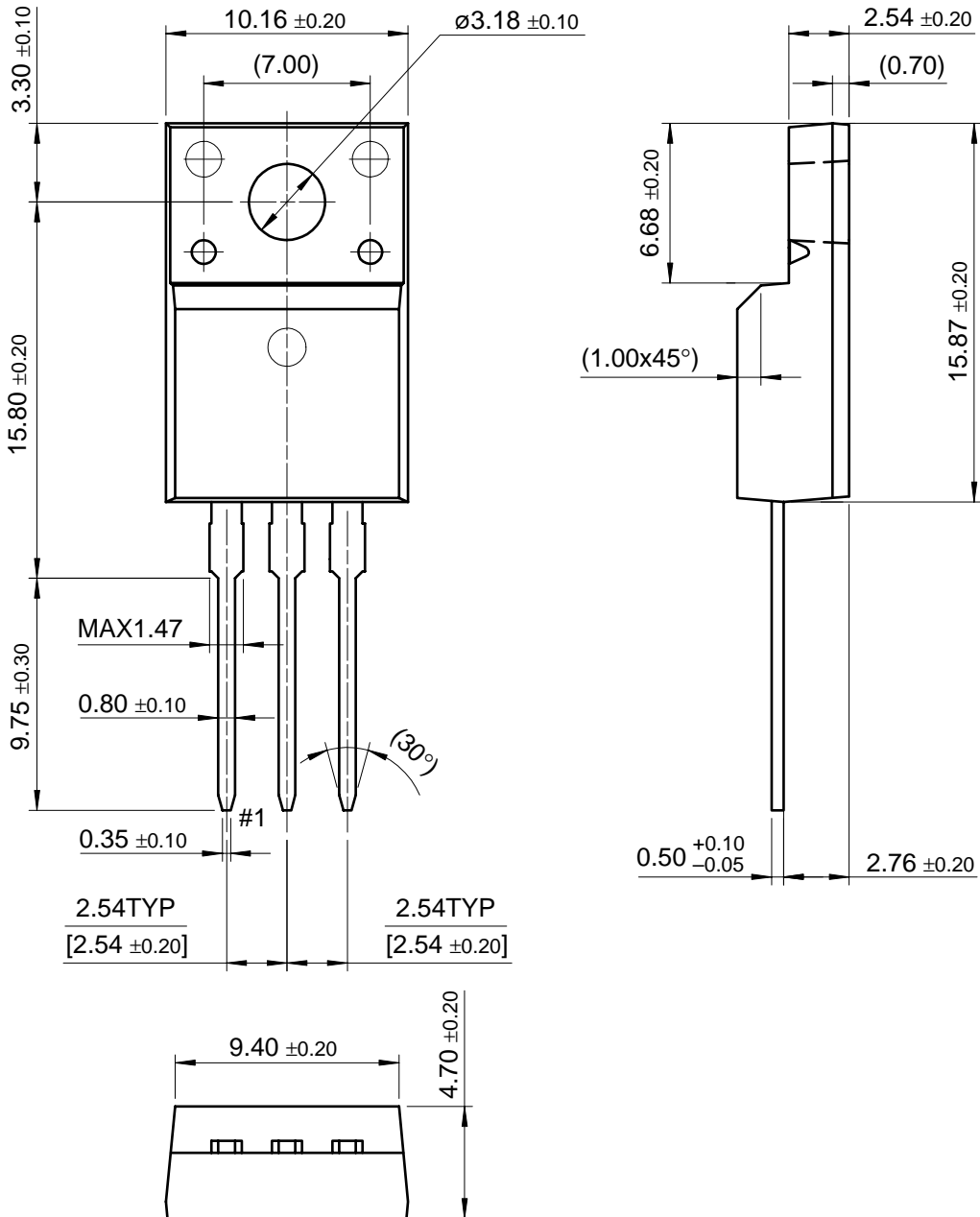
Peak Diode Recovery dv/dt Test Circuit & Waveforms



Package Dimensions

FQPF47P06

TO-220F



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