

## FQPF3N30

### 300V N-Channel MOSFET

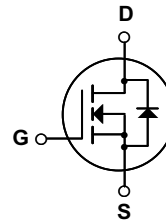
#### General Description

These N-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 high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switching DC/DC converters, switch mode power supply.

#### Features

- 1.95A, 300V,  $R_{DS(on)} = 2.2\Omega @ V_{GS} = 10V$
- Low gate charge ( typical 5.5 nC)
- Low  $C_{rss}$  ( typical 6.0 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability



#### Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted

| Symbol         | Parameter   | FQPF3N30    | Units               |
|----------------|---|-------------|---------------------|
| $V_{DSS}$      | Drain-Source Voltage  | 300         | V                   |
| $I_D$          | Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ )<br>- Continuous ( $T_C = 100^\circ\text{C}$ ) | 1.95        | A                   |
|                |   | 1.23        | A                   |
| $I_{DM}$       | Drain Current - Pulsed (Note 1)   | 7.8         | A                   |
| $V_{GSS}$      | Gate-Source Voltage   | $\pm 30$    | V                   |
| $E_{AS}$       | Single Pulsed Avalanche Energy (Note 2)   | 140         | mJ                  |
| $I_{AR}$       | Avalanche Current (Note 1)  | 1.95        | A                   |
| $E_{AR}$       | Repetitive Avalanche Energy (Note 1)  | 2.0         | mJ                  |
| dv/dt          | Peak Diode Recovery dv/dt (Note 3)  | 4.5         | V/ns                |
| $P_D$          | Power Dissipation ( $T_C = 25^\circ\text{C}$ )<br>- Derate above $25^\circ\text{C}$                   | 20          | W                   |
|                |   | 0.16        | W/ $^\circ\text{C}$ |
| $T_J, T_{STG}$ | Operating and Storage Temperature Range   | -55 to +150 | $^\circ\text{C}$    |
| $T_L$          | Maximum lead temperature for soldering purposes,<br>1/8" from case for 5 seconds                      | 300         | $^\circ\text{C}$    |

#### Thermal Characteristics

| Symbol          | Parameter                               | Typ | Max  | Units                     |
|-----------------|---|-----|------|---------------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction-to-Case    | --  | 6.25 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | --  | 62.5 | $^\circ\text{C}/\text{W}$ |

## Electrical Characteristics T<sub>C</sub> = 25°C unless otherwise noted

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|--------|-----------|-----------------|-----|-----|-----|-------|
|--------|-----------|-----------------|-----|-----|-----|-------|

### Off Characteristics

|                                      |   |   |     |      |      |      |
|--------------------------------------|---|---|-----|------|------|------|
| BV <sub>DSS</sub>                    | Drain-Source Breakdown Voltage            | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA  | 300 | --   | --   | V    |
| ΔBV <sub>DSS</sub> / ΔT <sub>J</sub> | Breakdown Voltage Temperature Coefficient | I <sub>D</sub> = 250 μA, Referenced to 25°C     | --  | 0.35 | --   | V/°C |
| I <sub>DSS</sub>                     | Zero Gate Voltage Drain Current           | V <sub>DS</sub> = 300 V, V <sub>GS</sub> = 0 V  | --  | --   | 1    | μA   |
|                                      |   | V <sub>DS</sub> = 240 V, T <sub>C</sub> = 125°C | --  | --   | 10   | μA   |
| I <sub>GSSF</sub>                    | Gate-Body Leakage Current, Forward        | V <sub>GS</sub> = 30 V, V <sub>DS</sub> = 0 V   | --  | --   | 100  | nA   |
| I <sub>GSSR</sub>                    | Gate-Body Leakage Current, Reverse        | V <sub>GS</sub> = -30 V, V <sub>DS</sub> = 0 V  | --  | --   | -100 | nA   |

### On Characteristics

|                     |                                   |   |     |      |     |   |
|---------------------|-----------------------------------|---|-----|------|-----|---|
| V <sub>GS(th)</sub> | Gate Threshold Voltage            | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA | 3.0 | --   | 5.0 | V |
| R <sub>DS(on)</sub> | Static Drain-Source On-Resistance | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 0.98 A             | --  | 1.65 | 2.2 | Ω |
| g <sub>FS</sub>     | Forward Transconductance          | V <sub>DS</sub> = 50 V, I <sub>D</sub> = 0.98 A (Note 4)    | --  | 1.45 | --  | S |

### Dynamic Characteristics

|                  |                              |   |    |     |     |    |
|------------------|------------------------------|---|----|-----|-----|----|
| C <sub>iss</sub> | Input Capacitance            | V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V,<br>f = 1.0 MHz | -- | 175 | 230 | pF |
| C <sub>oss</sub> | Output Capacitance           |   | -- | 40  | 50  | pF |
| C <sub>rss</sub> | Reverse Transfer Capacitance |   | -- | 6   | 8   | pF |

### Switching Characteristics

|                     |                     |   |    |     |     |    |
|---------------------|---------------------|---|----|-----|-----|----|
| t <sub>d(on)</sub>  | Turn-On Delay Time  | V <sub>DD</sub> = 150 V, I <sub>D</sub> = 3.2 A,<br>R <sub>G</sub> = 25 Ω<br><br>(Note 4, 5)  | -- | 10  | 30  | ns |
| t <sub>r</sub>      | Turn-On Rise Time   |   | -- | 40  | 90  | ns |
| t <sub>d(off)</sub> | Turn-Off Delay Time |   | -- | 10  | 30  | ns |
| t <sub>f</sub>      | Turn-Off Fall Time  |   | -- | 25  | 60  | ns |
| Q <sub>g</sub>      | Total Gate Charge   | V <sub>DS</sub> = 240 V, I <sub>D</sub> = 3.2 A,<br>V <sub>GS</sub> = 10 V<br><br>(Note 4, 5) | -- | 5.5 | 7.0 | nC |
| Q <sub>gs</sub>     | Gate-Source Charge  |   | -- | 1.5 | --  | nC |
| Q <sub>gd</sub>     | Gate-Drain Charge   |   | -- | 2.5 | --  | nC |

### Drain-Source Diode Characteristics and Maximum Ratings

|                 |   |  |    |      |     |    |
|-----------------|---|--|----|------|-----|----|
| I <sub>S</sub>  | Maximum Continuous Drain-Source Diode Forward Current | --   | -- | 1.95 | A   |    |
| I <sub>SM</sub> | Maximum Pulsed Drain-Source Diode Forward Current     | --   | -- | 7.8  | A   |    |
| V <sub>SD</sub> | Drain-Source Diode Forward Voltage                    | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 1.95 A   | -- | --   | 1.5 | V  |
| t <sub>rr</sub> | Reverse Recovery Time                                 | V <sub>GS</sub> = 0 V, I <sub>S</sub> = 3.2 A,<br>dI <sub>F</sub> / dt = 100 A/μs (Note 4) | -- | 120  | --  | ns |
| Q <sub>rr</sub> | Reverse Recovery Charge                               |  | -- | 0.4  | --  | μC |

#### Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 61.4mH, I<sub>AS</sub> = 1.95A, V<sub>DD</sub> = 50V, R<sub>G</sub> = 25 Ω, Starting T<sub>J</sub> = 25°C
3. I<sub>SD</sub> ≤ 3.2A, di/dt ≤ 200A/μs, V<sub>DD</sub> ≤ BV<sub>DSS</sub>, Starting T<sub>J</sub> = 25°C
4. Pulse Test : Pulse width ≤ 300μs, Duty cycle ≤ 2%
5. Essentially independent of operating temperature

# Typical Characteristics

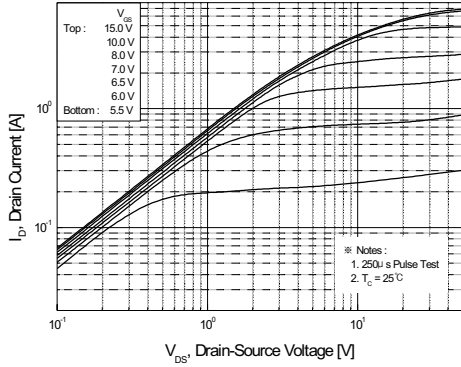


Figure 1. On-Region Characteristics

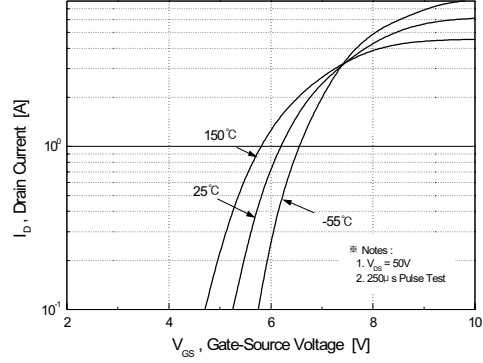


Figure 2. Transfer Characteristics

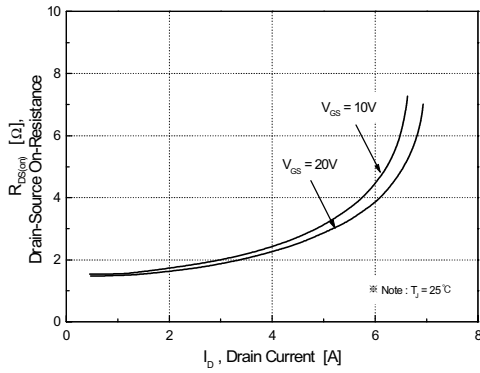


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

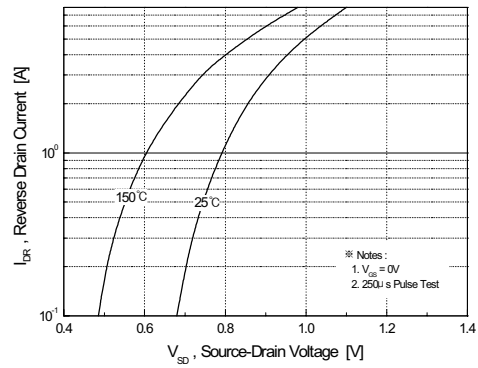


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

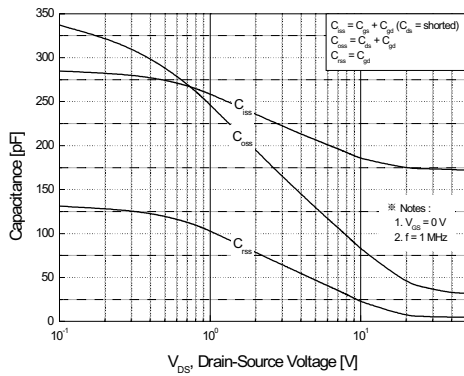


Figure 5. Capacitance Characteristics

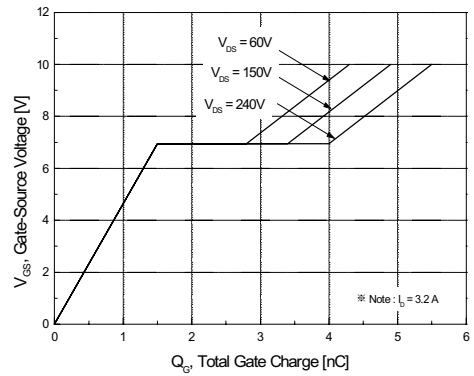
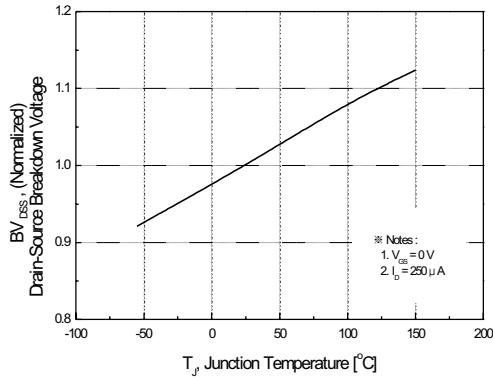
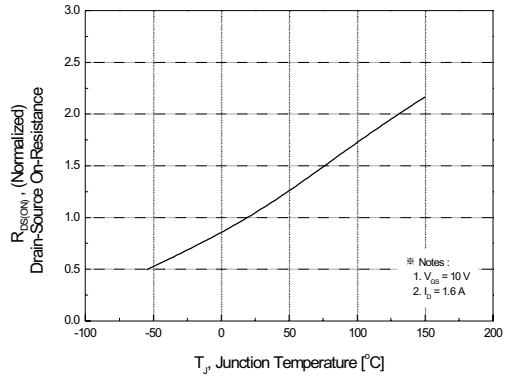


Figure 6. Gate Charge Characteristics

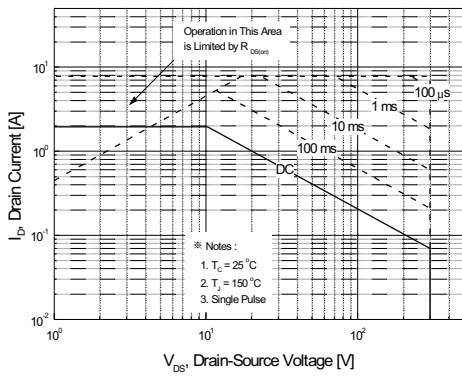
**Typical Characteristics** (Continued)



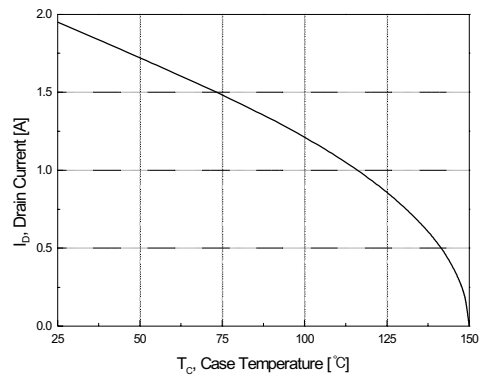
**Figure 7. Breakdown Voltage Variation vs. Temperature**



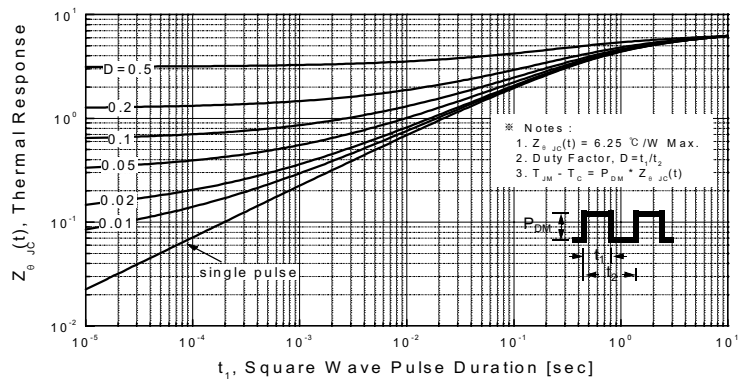
**Figure 8. On-Resistance Variation vs. Temperature**



**Figure 9. Maximum Safe Operating Area**

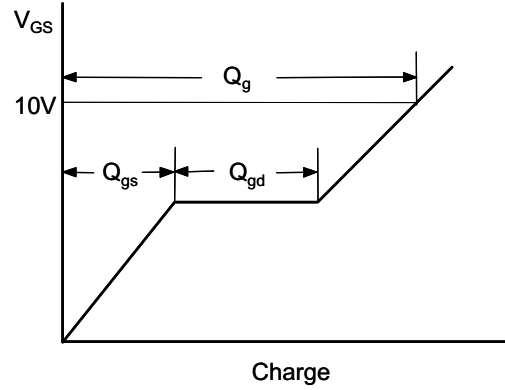


**Figure 10. Maximum Drain Current vs. Case Temperature**

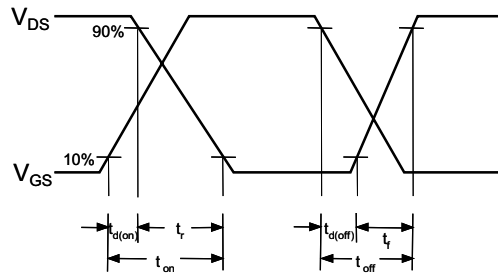
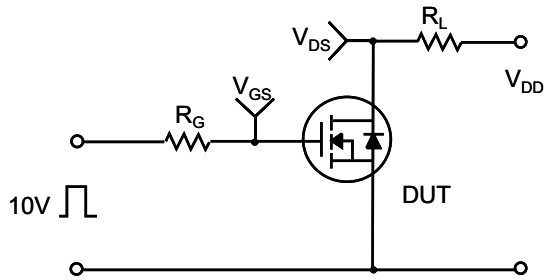


**Figure 11. Transient Thermal Response Curve**

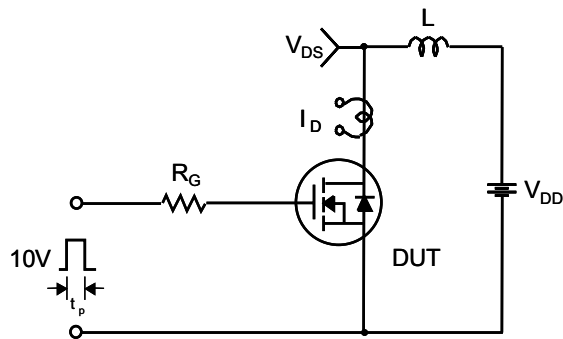
Gate Charge Test Circuit & Waveform



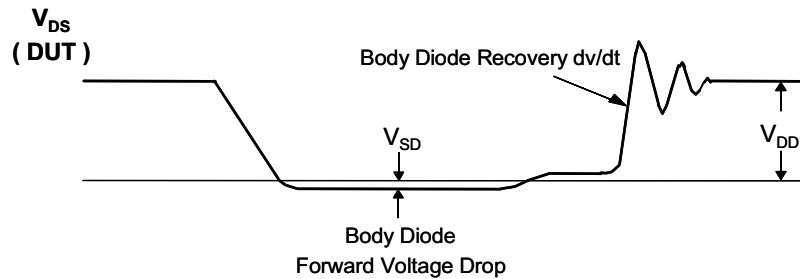
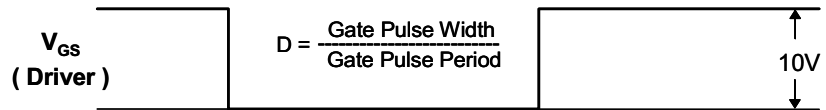
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

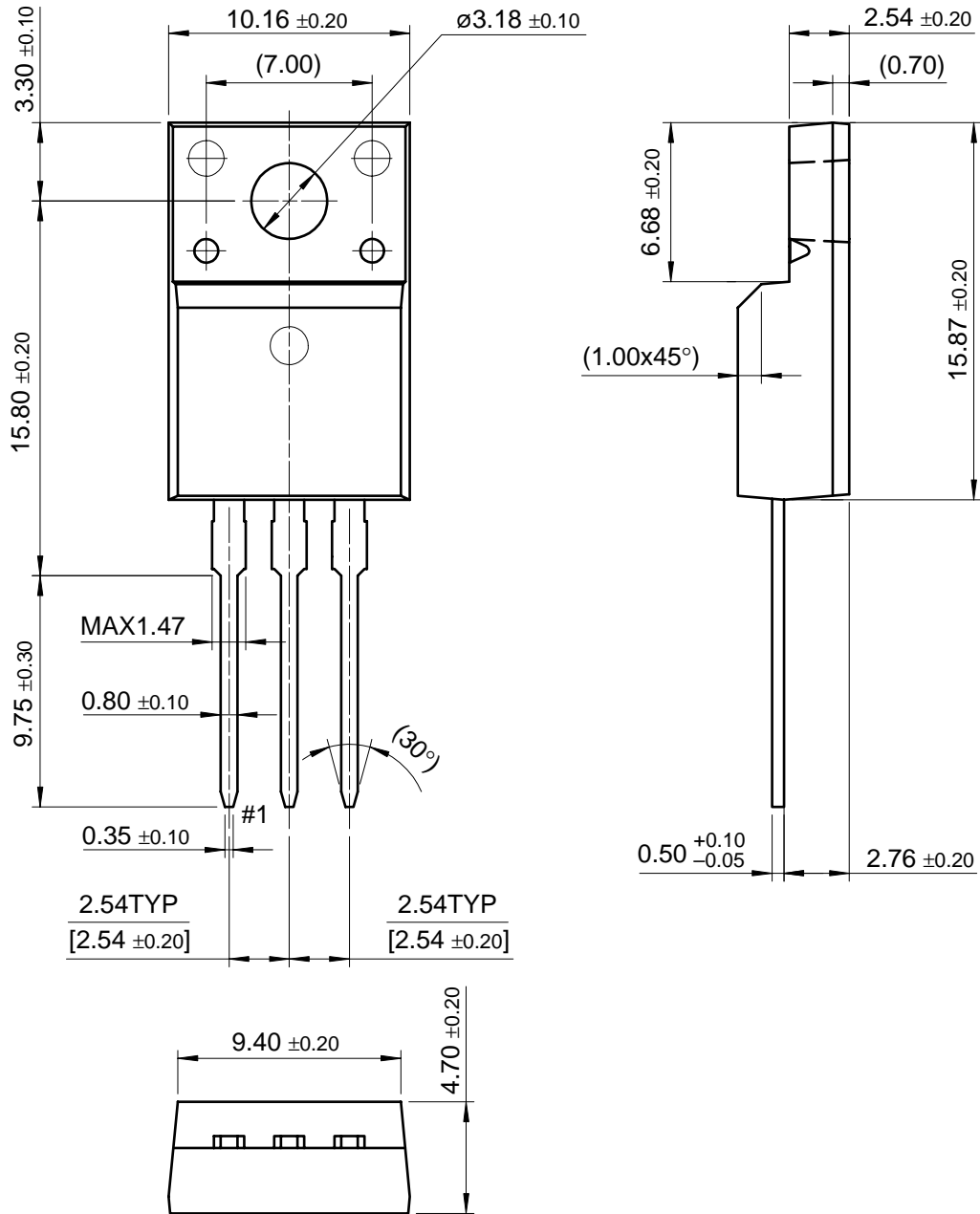


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Package Dimensions

TO-220F



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