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November 2013

# **FQP11P06**

# P-Channel QFET® MOSFET

-60 V, -11.4 A, 175 mΩ

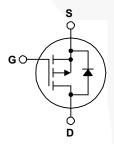
### **Description**

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 onstate 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**

- -11.4 A, -60 V,  $R_{DS(on)}$  = 175 m $\Omega$  (Max.) @  $V_{GS}$  = -10 V,  $I_D$  = -5.7 A
- Low Gate Charge (Typ. 13 nC)
- · Low Crss (Typ. 45 pF)
- 100% Avalanche Tested
- 175°C Maximum Junction Temperature Rating





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

Symbol	Parameter		FQP11P06	Unit
$V_{DSS}$	Drain-Source Voltage		-60	V
I <sub>D</sub>	Drain Current - Continuous (T <sub>C</sub> = 25°C	C)	-11.4	Α
	- Continuous (T <sub>C</sub> = 100°C)		-8.05	Α
I <sub>DM</sub>	Drain Current - Pulsed	(Note 1)	-45.6	А
V <sub>GSS</sub>	Gate-Source Voltage		± 25	V
E <sub>AS</sub>	Single Pulsed Avalanche Energy	(Note 2)	160	mJ
I <sub>AR</sub>	Avalanche Current	(Note 1)	-11.4	Α
E <sub>AR</sub>	Repetitive Avalanche Energy	(Note 1)	5.3	mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	-7.0	V/ns
$P_{D}$	Power Dissipation (T <sub>C</sub> = 25°C)		53	W
	- Derate above 25°C		0.35	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, 1/8" from case for 5 seconds		300	°C

### **Thermal Characteristics**

Symbol	Parameter	FQP11P06	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	2.85	°C/W
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink, Typ.	0.5	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	°C/W

# **Package Marking and Ordering Information**

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FQP11P06	FQP11P06	TO-220	Tube	N/A	N/A	50 units

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

Symbol	Parameter	Test Conditions	Min	Тур	Max	Unit
Off Cha	racteristics					
BV <sub>DSS</sub>	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 <sub>D</sub> = -250 μA, Referenced to 25°C		-0.07		V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = -60 V, V <sub>GS</sub> = 0 V			-1	μΑ
		V <sub>DS</sub> = -48 V, T <sub>C</sub> = 150°C			-10	μΑ
I <sub>GSSF</sub>	Gate-Body Leakage Current, Forward	$V_{GS} = -25 \text{ V}, V_{DS} = 0 \text{ V}$			-100	nA
I <sub>GSSR</sub>	Gate-Body Leakage Current, Reverse	V <sub>GS</sub> = 25 V, V <sub>DS</sub> = 0 V			100	nA
On Cha	racteristics					
V <sub>GS(th)</sub>	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_{D} = -250 \mu\text{A}$	-2.0		-4.0	V
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = -10 V, I <sub>D</sub> = -5.7 A		0.14	0.175	Ω
9 <sub>FS</sub>	Forward Transconductance	$V_{DS} = -30 \text{ V}, I_{D} = -5.7 \text{ A}$		5.1		S
	ic Characteristics			\ <u></u>		
C <sub>iss</sub>	Input Capacitance	$V_{DS} = -25 \text{ V}, V_{GS} = 0 \text{ V},$		420	550	pF
C <sub>oss</sub>	Output Capacitance	f = 1.0 MHz		195	250	pF
C <sub>rss</sub>	Reverse Transfer Capacitance			45	60	pF
Switchi	ing Characteristics					
t <sub>d(on)</sub>	Turn-On Delay Time	$V_{DD} = -30 \text{ V}, I_D = -5.7 \text{ A},$		6.5	25	ns
t <sub>r</sub>	Turn-On Rise Time	$R_{G} = 25 \Omega$		40	90	ns
t <sub>d(off)</sub>	Turn-Off Delay Time	- 1.6 _ 1.1		15	40	ns
t <sub>f</sub>	Turn-Off Fall Time	(Note 4)		45	100	ns
Qg	Total Gate Charge	V <sub>DS</sub> = -48 V, I <sub>D</sub> = -11.4 A,		13	17	nC
Q <sub>gs</sub>	Gate-Source Charge	V <sub>GS</sub> = -10 V	/	2.0		nC
Q <sub>gd</sub>	Gate-Drain Charge	(Note 4)		6.3		nC
Drain-S	ource Diode Characteristics a	nd Maximum Ratings				
I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current				-11.4	Α
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode Forward Current				-45.6	Α
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	$V_{GS} = 0 \text{ V, } I_{S} = -11.4 \text{ A}$			-4.0	V
t <sub>rr</sub>	Reverse Recovery Time	$V_{GS} = 0 \text{ V}, I_{S} = -11.4 \text{ A},$		83	//	ns
$Q_{rr}$	Reverse Recovery Charge	$dI_F / dt = 100 A/\mu s$		0.26		μC

- Notes. 1. Repetitive rating: pulse-width limited by maximum junction temperature. 2. L = 1.44 mH,  $I_{AS}$  = -11.4 A,  $V_{DD}$  = -25 V,  $R_G$  = 25  $\Omega$ , starting  $T_J$  = 25°C. 3.  $I_{SD}$  ≤ -11.4 A, di/dt ≤ 300 A/ $\mu$ s,  $V_{DD}$  ≤ BV $_{DSS}$ , starting  $T_J$  = 25°C. 4. Essentially independent of operating temperature.

# **Typical Characteristics**

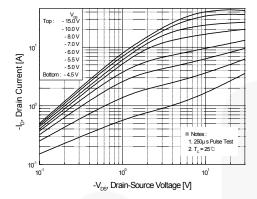


Figure 1. On-Region Characteristics

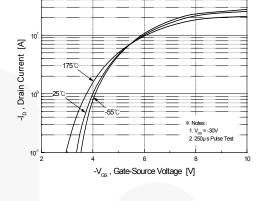


Figure 2. Transfer Characteristics

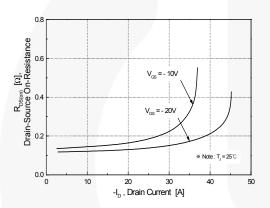


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

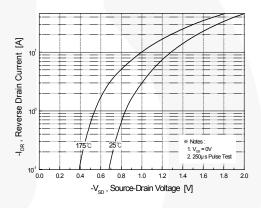


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

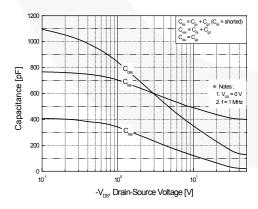


Figure 5. Capacitance Characteristics

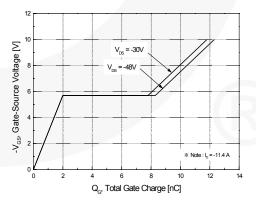


Figure 6. Gate Charge Characteristics

# Typical Characteristics (Continued)

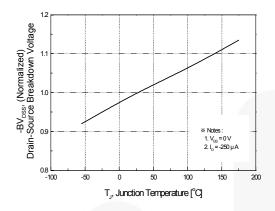
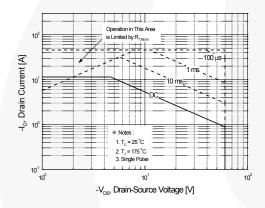


Figure 7. Breakdown Voltage Variation vs. Temperature

Figure 8. On-Resistance Variation vs. Temperature



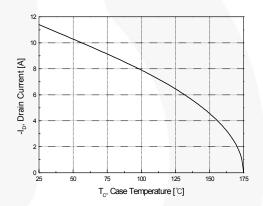


Figure 9. Maximum Safe Operating Area

Figure 10. Maximum Drain Current vs. Case Temperature

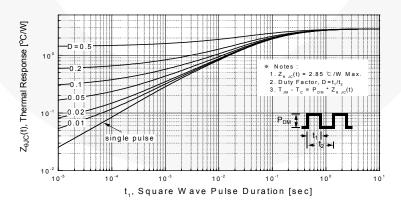


Figure 11. Transient Thermal Response Curve

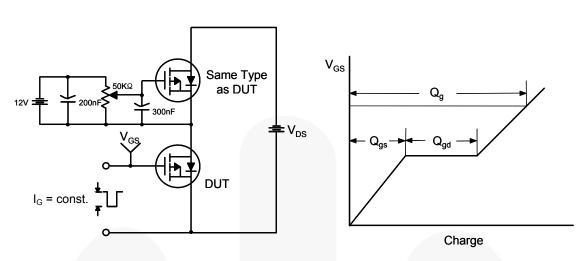


Figure 12. Gate Charge Test Circuit & Waveform

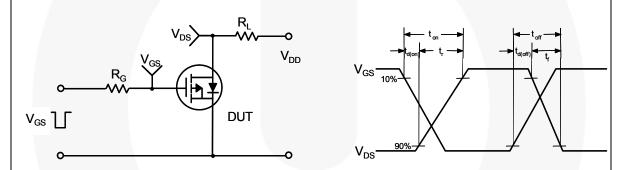


Figure 13. Resistive Switching Test Circuit & Waveforms

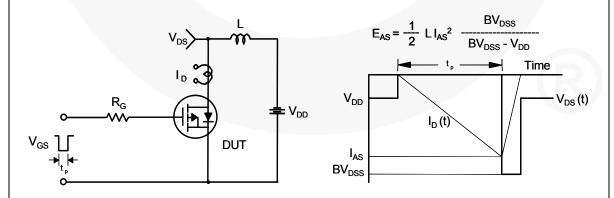
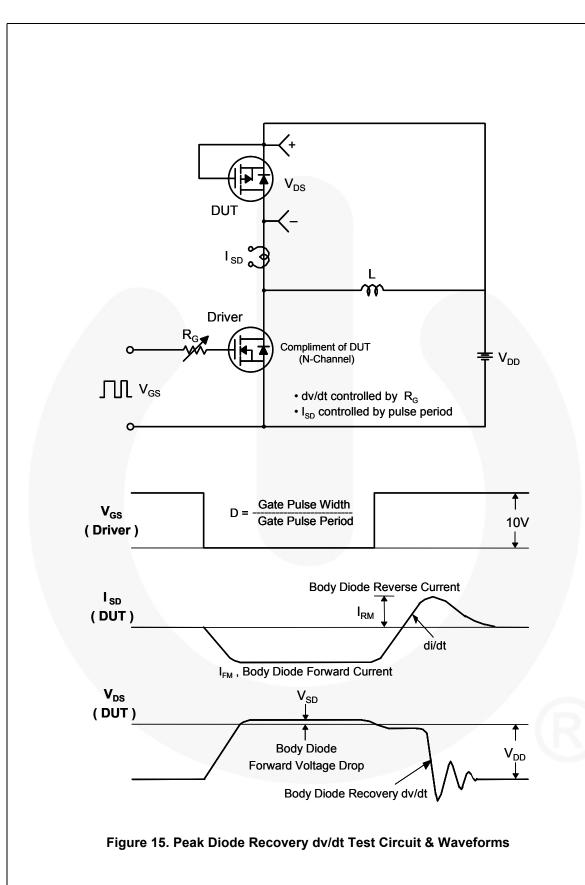


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms



### **Mechanical Dimensions**

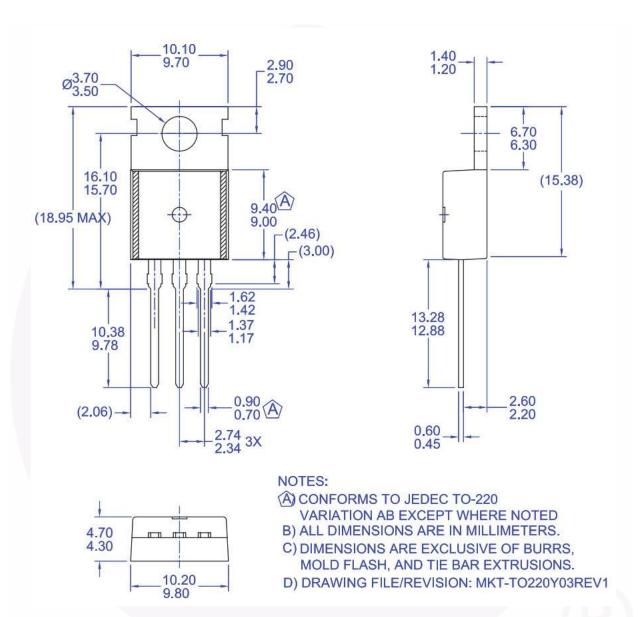


Figure 16. TO220, Molded, 3-Lead, Jedec Variation AB

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