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November 2013

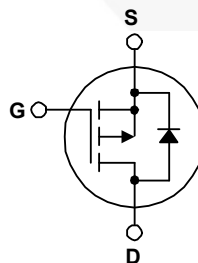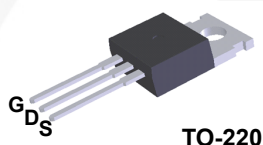# FQP12P10

P-Channel QFET® MOSFET

-100 V, -11.5 A, 290 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 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.

Features

- -11.5 A, -100 V, $R_{DS(on)}$ = 290 mΩ (Max.) @ V_{GS} = -10 V, I_D = -5.75 A
- Low Gate Charge (Typ. 21 nC)
- Low Crss (Typ. 65 pF)
- 100% Avalanche Tested
- 175ºC Maximum Junction Temperature Rating

TO-220

S

G

D

Absolute Maximum Ratings $T_C = 25^{o}C$ unless otherwise noted.

Symbol	Parameter			FQP12P10	Unit
V_{DSS}	Drain-Source Voltage			-100	V
I_D	Drain Current	- Continuous (T_C = 25°C)		-11.5	A
		- Continuous (T_C = 100°C)		-8.1	A
I_{DM}	Drain Current	- Pulsed	(Note 1)	-46	A
V_{GSS}	Gate-Source Voltage			± 30	V
E_{AS}	Single Pulsed Avalanche Energy		(Note 2)	370	mJ
I_{AR}	Avalanche Current		(Note 1)	-11.5	A
E_{AR}	Repetitive Avalanche Energy		(Note 1)	7.5	mJ
dv/dt	Peak Diode Recovery dv/dt		(Note 3)	-6.0	V/ns
P_D	Power Dissipation (T_C = 25°C)			75	W
		- Derate above 25°C		0.5	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range			-55 to +175	°C
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds			300	°C

Thermal Characteristics

Symbol	Parameter	FQP12P10	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	2.0	°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
FQP12P10	FQP12P10	TO-220	Tube	N/A	N/A	50 units

Electrical Characteristics $T_C = 25^{\circ}C$ unless otherwise noted.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0$ V, $I_D = -250$ µA	-100	--	--	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	$I_D = -250$ µA, Referenced to 25°C	--	-0.1	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = -100$ V, $V_{GS} = 0$ V	--	--	-1	µA
		$V_{DS} = -80$ V, $T_C = 150°C$	--	--	-10	µA
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{GS} = -30$ V, $V_{DS} = 0$ V	--	--	-100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{GS} = 30$ V, $V_{DS} = 0$ V	--	--	100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = -250$ µA	-2.0	--	-4.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = -10$ V, $I_D = -5.75$ A	--	0.24	0.29	Ω
g_{FS}	Forward Transconductance	$V_{DS} = -40$ V, $I_D = -5.75$ A	--	6.7	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = -25$ V, $V_{GS} = 0$ V, f = 1.0 MHz	--	620	800	pF
C_{oss}	Output Capacitance		--	220	290	pF
C_{rss}	Reverse Transfer Capacitance		--	65	85	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -50$ V, $I_D = -11.5$ A, $R_G = 25$ Ω	--	15	40	ns
t_r	Turn-On Rise Time		--	160	330	ns
$t_{d(off)}$	Turn-Off Delay Time		--	35	80	ns
t_f	Turn-Off Fall Time	(Note 4)	--	60	130	ns
Q_g	Total Gate Charge	$V_{DS} = -80$ V, $I_D = -11.5$ A, $V_{GS} = -10$ V	--	21	27	nC
Q_{gs}	Gate-Source Charge		--	4.6	--	nC
Q_{gd}	Gate-Drain Charge	(Note 4)	--	11.5	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	-11.5	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	-46	A
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0$ V, $I_S = -11.5$ A	--	--	-4.0	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0$ V, $I_S = -11.5$ A, $dI_F / dt = 100$ A/µs	--	110	--	ns
Q_{rr}	Reverse Recovery Charge		--	0.47	--	µC

Notes:
1. Repetitive rating: pulse-width limited by maximum junction temperature.
2. L = 4.2 mH, $I_{AS} = -11.5$ A, $V_{DD} = -25$ V, $R_G = 25$ Ω, starting $T_J = 25°C$.
3. $I_{SD} \leq -11.5$ A, di/dt ≤ 300 A/µs, $V_{DD} \leq BV_{DSS}$, starting $T_J = 25°C$.
4. Essentially independent of operating temperature.

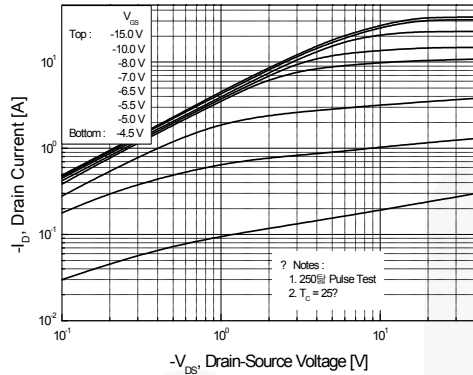## Typical Characteristics

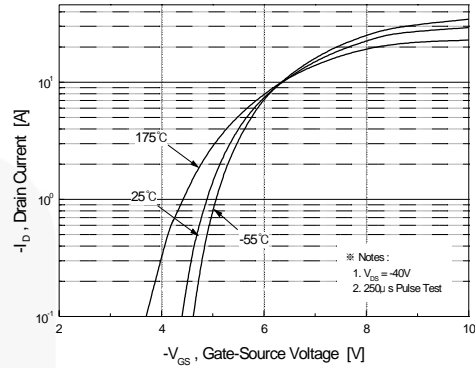**Figure 1. On-Region Characteristics**

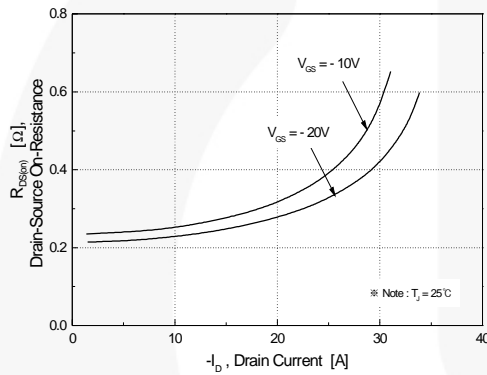**Figure 2. Transfer Characteristics**

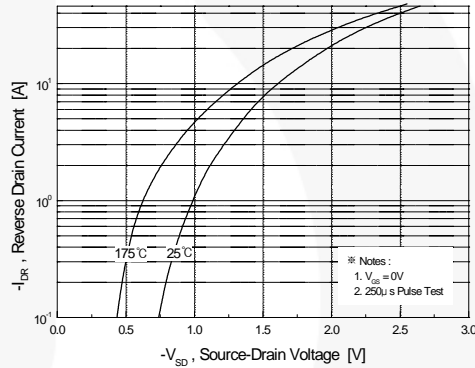**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**

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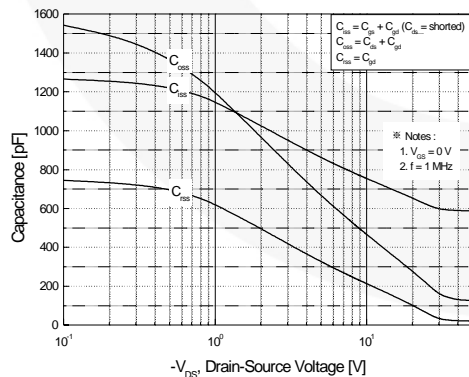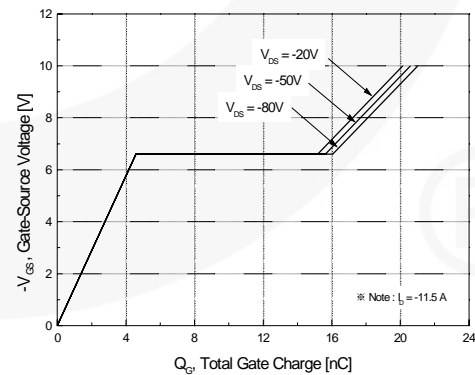

Figure 5. Capacitance Characteristics

Figure 6. Gate Charge Characteristics
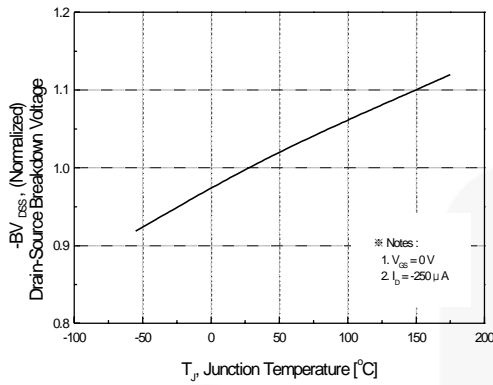
Typical Characteristics (Continued)
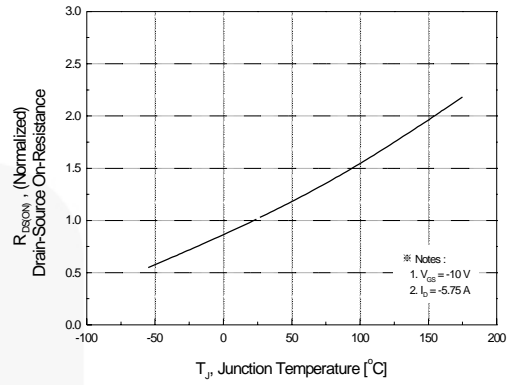

**Figure 7. Breakdown Voltage Variation
vs. Temperature**

**Figure 8. On-Resistance Variation
vs. Temperature**
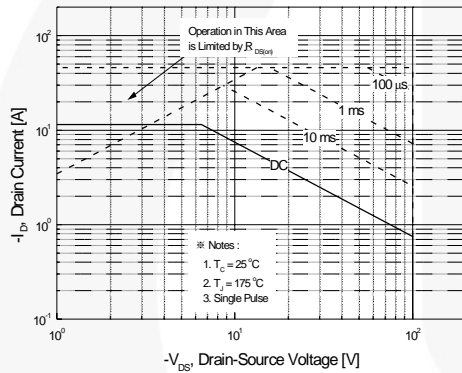
Figure 9. Maximum Safe Operating Area
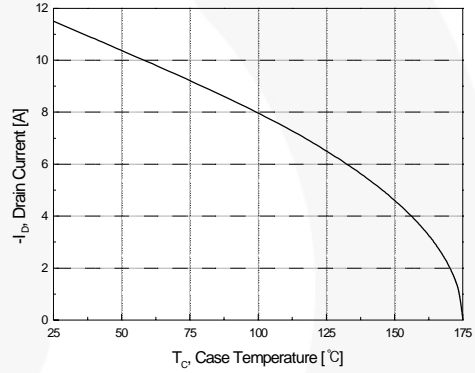
**Figure 10. Maximum Drain Current
vs. Case Temperature**
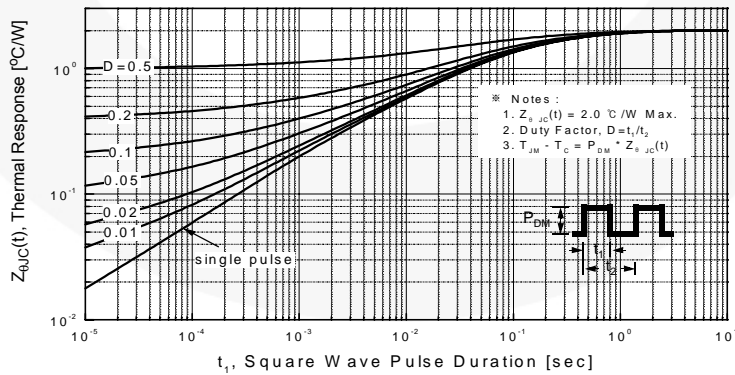
Figure 11. Transient Thermal Response Curve
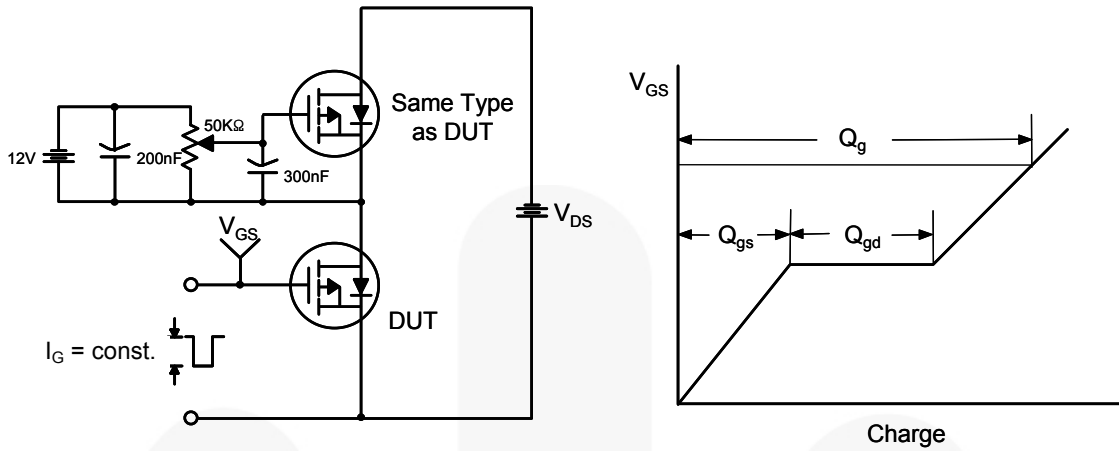
Figure 12. Gate Charge Test Circuit & Waveform
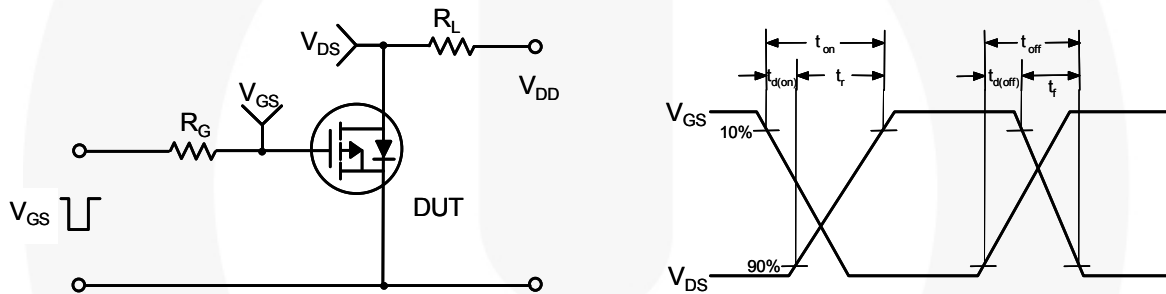
Figure 13. Resistive Switching Test Circuit & Waveforms

$$E_{AS} = \frac{1}{2} L I_{AS}^2 \ \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$
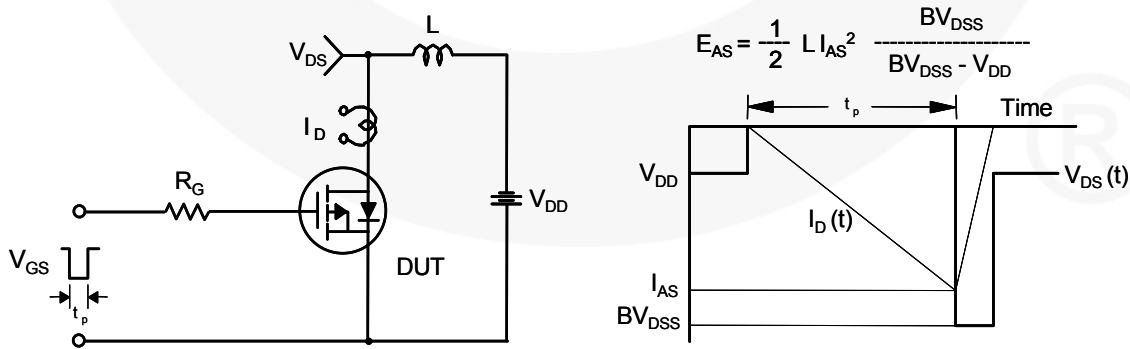
Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

$$D = \frac{\text{Gate Pulse Width}}{\text{Gate Pulse Period}}$$
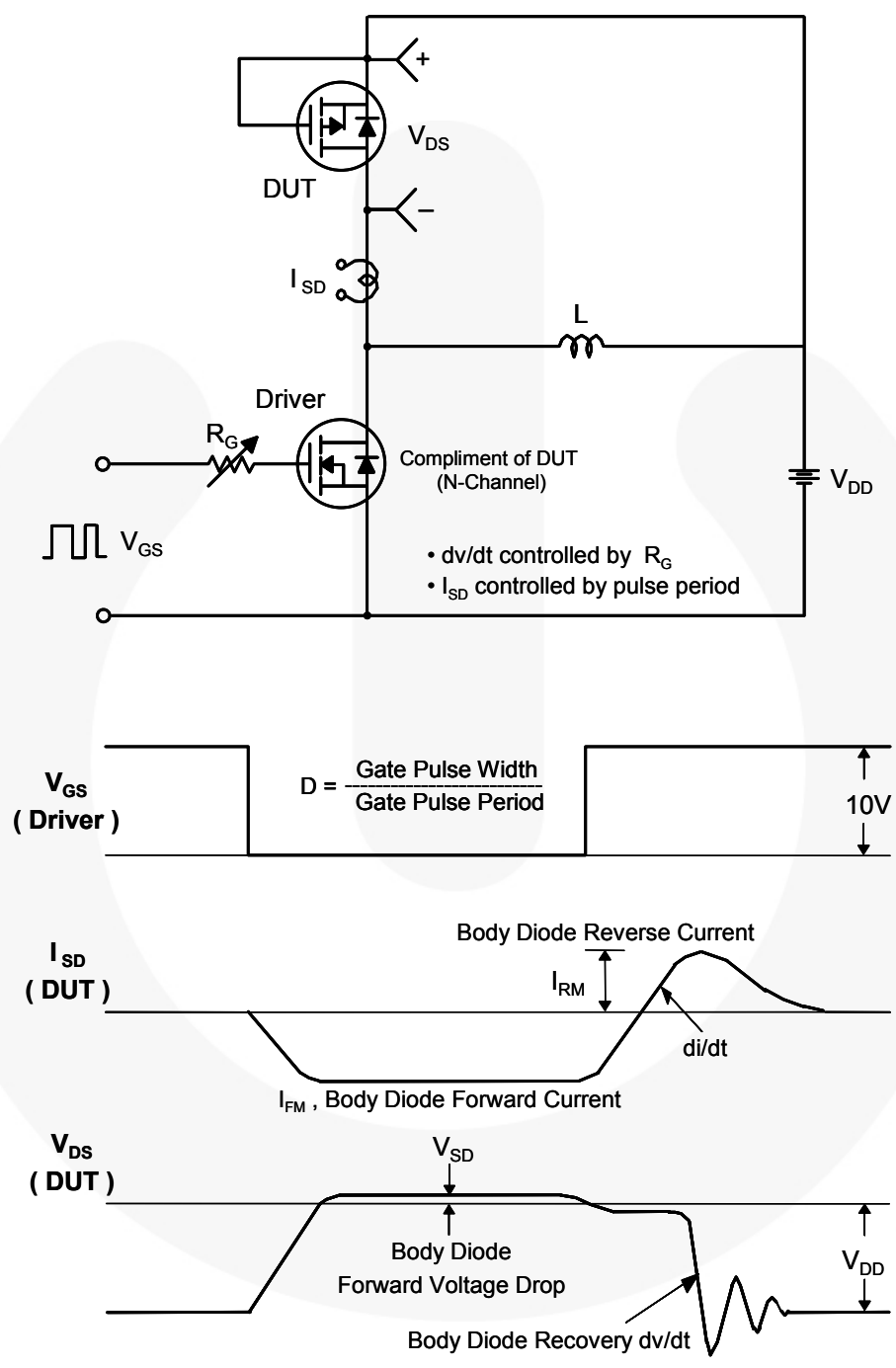
Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions

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

NOTES:

Ⓐ CONFORMS TO JEDEC TO-220 VARIATION AB EXCEPT WHERE NOTED
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
D) DRAWING FILE/REVISION: MKT-TO220Y03REV1

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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.
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