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November 2013

FQP13N50

N-Channel QFET® MOSFET

500 V, 12.5 A, 430 $m\Omega$

Description

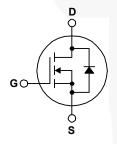
This N-Channel enhancement mode power MOSFET is • 12.5 A, 500 V, $R_{DS(on)}$ = 430 m Ω (Max.) @ V_{GS} = 10 V, produced using Fairchild Semiconductor's proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state

• Low Gate Charge (Typ. 45 nC) resistance, and to provide superior switching performance • Low Crss (Typ. 25 pF) and high avalanche energy strength. These devices are suitable for switched mode power supplies, active power • 100% Avalanche Tested factor correction (PFC), and electronic lamp ballasts.

Features

- $I_D = 6.25 A$





Absolute Maximum Ratings T_C = 25°C unless otherwise noted.

Symbol	Parameter		FQP13N50	Unit
V _{DSS}	Drain-Source Voltage		500	V
I _D	Drain Current - Continuous (T _C = 25°C)		12.5	Α
	- Continuous (T _C = 100°C)		7.9	Α
I _{DM}	Drain Current - Pulsed	(Note 1)	50	Α
V_{GSS}	Gate-Source Voltage		± 30	V
E _{AS}	Single Pulsed Avalanche Energy	(Note 2)	810	mJ
I _{AR}	Avalanche Current	(Note 1)	12.5	Α
E _{AR}	Repetitive Avalanche Energy (Note 1)		17	mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	4.5	V/ns
P _D	Power Dissipation (T _C = 25°C)		170	W
	- Derate above 25°C		1.35	W/°C
T _J , T _{STG}	Operating and Storage Temperature Range		-55 to +150	°C
T _L	Maximum lead temperature for soldering, 1/8" from case for 5 seconds		300	°C

Thermal Characteristics

Symbol	Parameter	FQP13N50	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	0.74	°C/W
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink, Max.	0.5	°C/W

Package warking and Ordering Information							
Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity	
FQP13N50 FQP13N50		TO-220	Tube	N/A	N/A	50 units	
Flectrical Cha	ractoristics	T = 25°C unless ath	anuina natad				

Symbol	Parameter	Test Conditions	Min.	Тур.	Max.	Unit
Off Cha	racteristics					
BV _{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$	500			V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250 μA, Referenced to 25°C		0.48		V/°C
I _{DSS} Zero	Zero Gate Voltage Drain Current	V _{DS} = 500 V, V _{GS} = 0 V			1	μА
		V _{DS} = 400 V, T _C = 125°C			10	μΑ
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 Cha	racteristics					
V _{GS(th)}	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_{D} = 250 \mu A$	3.0		5.0	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} =10 V, I _D =6.25 A		0.33	0.43	Ω
9 _{FS}	Forward Transconductance	V _{DS} = 50 V, I _D = 6.25 A		10		S

Dynamic Characteristics

C _{iss}	Input Capacitance	$V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V},$	 1800	2300	pF
Coss	Output Capacitance	f = 1.0 MHz	 245	320	pF
C _{rss}	Reverse Transfer Capacitance		 25	35	pF

Switching Characteristics

$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		9						
	t _{d(on)}	Turn-On Delay Time	V _{DD} = 250 V I _D = 13.4 A			40	90	ns
	t _r	Turn-On Rise Time				140	290	ns
	t _{d(off)}	Turn-Off Delay Time				100	210	ns
Q_{gs} Gate-Source Charge $V_{GS} = 10 \text{ V}$ 11 nC	t _f	Turn-Off Fall Time	(I	(Note 4)		85	180	ns
Q_{gs} Gate-Source Charge $V_{GS} = 10 \text{ V}$ 11 nC	Q_g	Total Gate Charge	V _{DS} = 400 V, I _D = 13.4 A,			45	60	nC
Q _{gd} Gate-Drain Charge (Note 4) 22 nC	Q_{gs}	Gate-Source Charge	V _{GS} = 10 V	•		11		nC
	Q _{gd}	Gate-Drain Charge	(1)	(Note 4)	/	22		nC

Drain-Source Diode Characteristics and Maximum Ratings

I _S	Maximum Continuous Drain-Source Diode Forward Current		 	12.5	Α
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		 	50	Α
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 12.5 A	 	1.4	V
t _{rr}	Reverse Recovery Time	$V_{GS} = 0 \text{ V, } I_{S} = 13.4 \text{ A,}$	 290		ns
Q _{rr}	Reverse Recovery Charge	dI _F / dt = 100 A/μs	 2.6	//	μС

Repetitive rating: pulse-width limited by maximum junction temperature. 2. L = 9.3 mH, I_{AS} = 12.5 A, V_{DD} = 50 V, R_G = 25 Ω , starting T_J = 25°C. 3. I_{SD} \leq 13.4 A, di/dt \leq 200 A/ μ s, V_{DD} \leq BV_{DSS}, starting T_J = 25°C. 4. Essentially independent of operating temperature.

Typical Characteristics

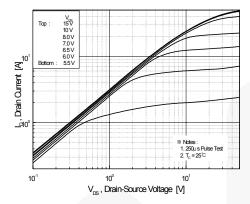


Figure 1. On-Region Characteristics

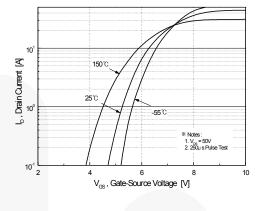


Figure 2. Transfer Characteristics

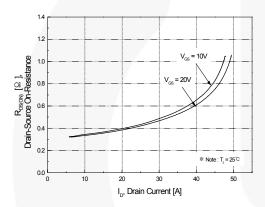


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

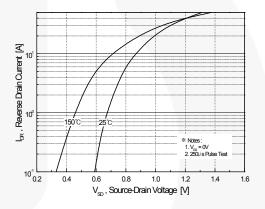


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

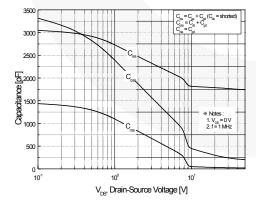


Figure 5. Capacitance Characteristics

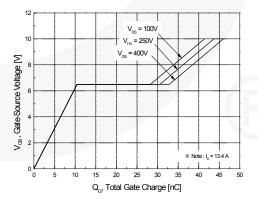


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

T_J, Junction Temperature [°C]

100

150

200

0.8 L -100

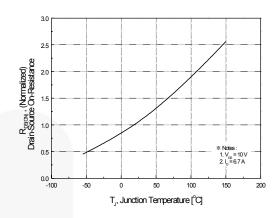


Figure 8. On-Resistance Variation vs. Temperature

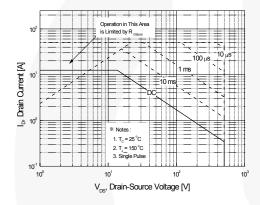


Figure 9. Maximum Safe Operating Area

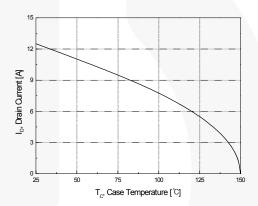


Figure 10. Maximum Drain Current vs. Case Temperature

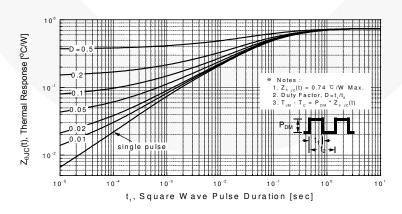


Figure 11. Transient Thermal Response Curve

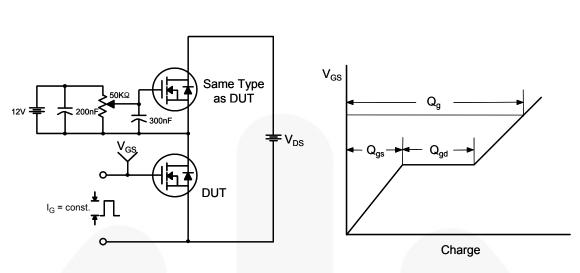


Figure 12. Gate Charge Test Circuit & Waveform

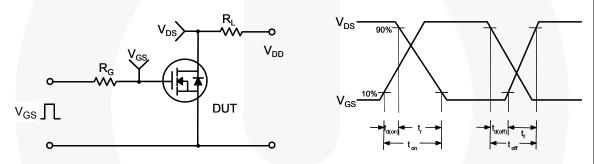


Figure 13. Resistive Switching Test Circuit & Waveforms

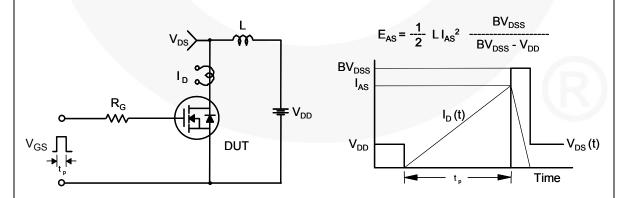
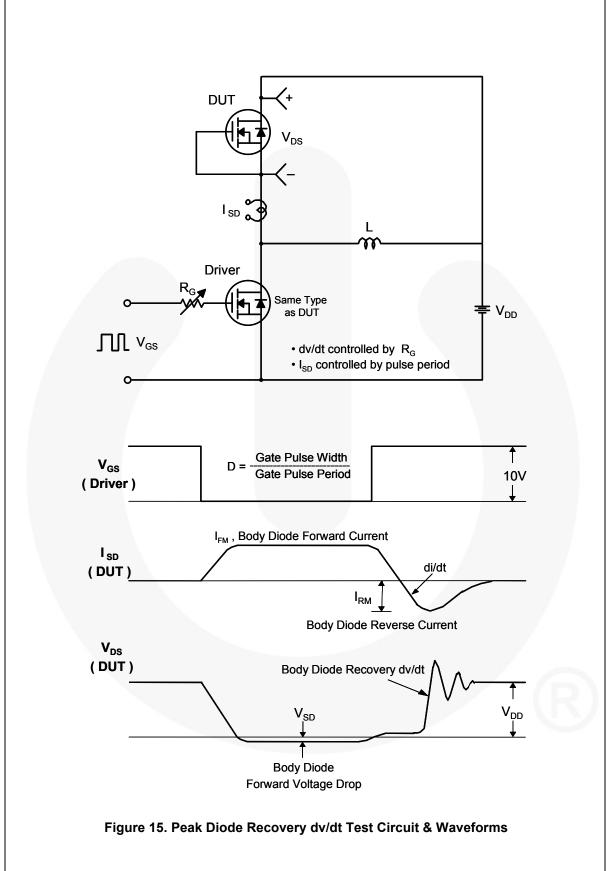
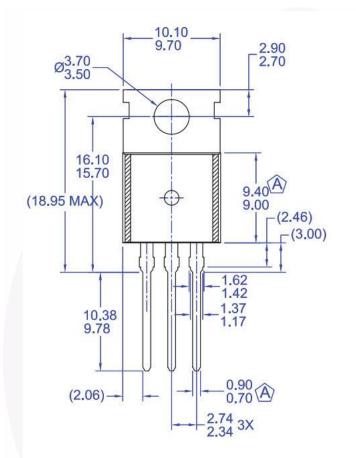
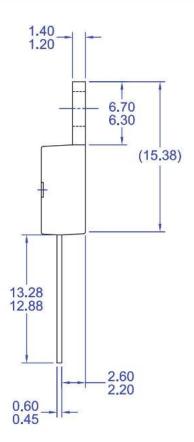


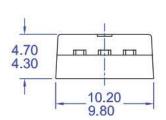
Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms



Mechanical Dimensions







NOTES:

- (A) 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

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

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