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June 2014

FQPF13N50CF

N-Channel QFET[®] FRFET[®] MOSFET

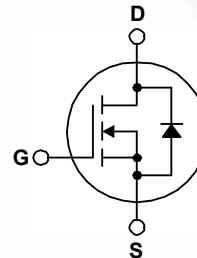
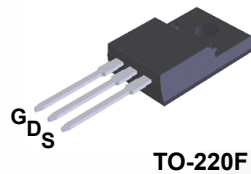
500 V, 13 A, 540 mΩ

Features

- 13 A, 500 V, $R_{DS(on)} = 540 \text{ m}\Omega$ (Max.) @ $V_{GS} = 10 \text{ V}$, $I_D = 6.5 \text{ A}$
- Low Gate Charge (Typ. 43 nC)
- Low C_{rss} (Typ. 20 pF)
- 100% Avalanche Tested
- Fast Recovery Body Diode (Typ. 100 ns)

Description

This N-Channel enhancement mode power MOSFET is produced using Fairchild Semiconductor's proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state resistance, and to provide superior switching performance and high avalanche energy strength. These devices are suitable for switched mode power supplies, active power factor correction (PFC), and electronic lamp ballasts.



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

Symbol	Parameter	FQPF13N50CF	Unit
V_{DSS}	Drain to Source Voltage	500	V
I_D	Drain Current	- Continuous ($T_C = 25^\circ\text{C}$)	13
		- Continuous ($T_C = 100^\circ\text{C}$)	8
I_{DM}	Drain Current - Pulsed (Note 1)	52	A
V_{GSS}	Gate to Source Voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	530	mJ
I_{AR}	Avalanche Current (Note 1)	13	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	19.5	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5	V/ns
P_D	Power Dissipation	($T_C = 25^\circ\text{C}$)	48
		- Derate above 25°C	0.39
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds	300	$^\circ\text{C}$

*Drain current limited by maximum junction temperature

Thermal Characteristics

Symbol	Parameter	FQPF13N50CF	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	2.58	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FQPF13N50CF	FQPF13N50CF	TO-220F	Tube	N/A	50 units

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	500	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, Referenced to 25°C	--	0.5	--	$\text{V}/^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$	--	--	10	μA
		$V_{DS} = 400\text{ V}, T_C = 125^\circ\text{C}$	--	--	100	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$	--	--	-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	$V_{GS} = 10\text{ V}, I_D = 6.5\text{ A}$	--	0.43	0.54	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 40\text{ V}, I_D = 6.5\text{ A}$	--	15	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$	--	1580	2055	pF
C_{oss}	Output Capacitance		--	180	235	pF
C_{riss}	Reverse Transfer Capacitance		--	20	25	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 250\text{ V}, I_D = 13\text{ A}, R_G = 25\ \Omega$	--	25	60	ns
t_r	Turn-On Rise Time		--	100	210	ns
$t_{d(off)}$	Turn-Off Delay Time		--	130	270	ns
t_f	Turn-Off Fall Time		(Note 4)	--	100	210
Q_g	Total Gate Charge	$V_{DS} = 400\text{ V}, I_D = 13\text{ A}, V_{GS} = 10\text{ V}$	--	43	56	nC
Q_{gs}	Gate-Source Charge		--	7.5	--	nC
Q_{gd}	Gate-Drain Charge		(Note 4)	--	18.5	--
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	13	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	52	A
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 13\text{ A}$	--	--	1.4	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_S = 13\text{ A}, di_F / dt = 100\text{ A}/\mu\text{s}$	--	100	160	ns
Q_{rr}	Reverse Recovery Charge		--	0.35	--	μC

Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature.
2. $L = 5.6\text{ mH}, I_{AS} = 13\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\ \Omega$, starting $T_J = 25^\circ\text{C}$.
3. $I_{SD} \leq 13\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$, starting $T_J = 25^\circ\text{C}$.
4. Essentially independent of operating temperature.

Typical Characteristics

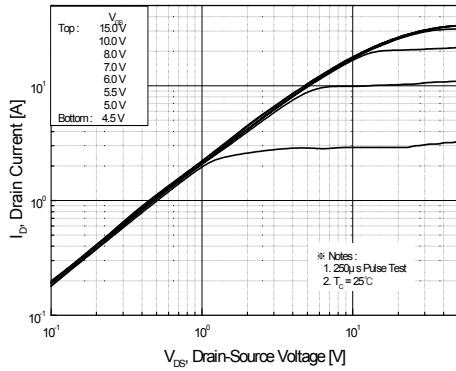


Figure 1. On-Region Characteristics

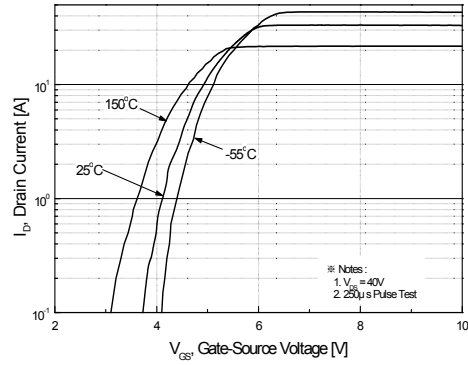


Figure 2. Transfer Characteristics

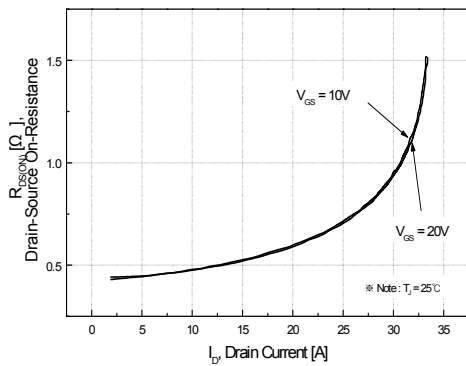


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

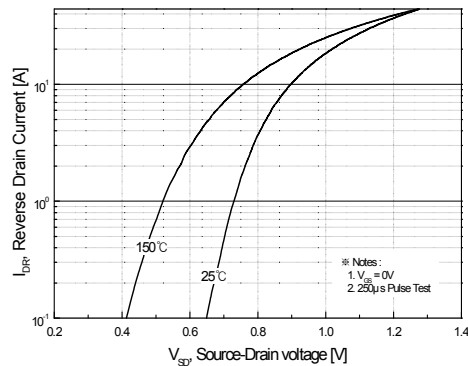


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

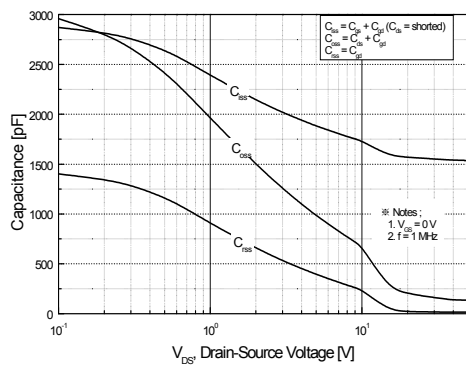


Figure 5. Capacitance Characteristics

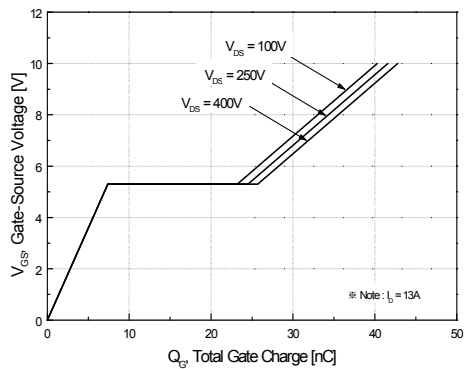


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

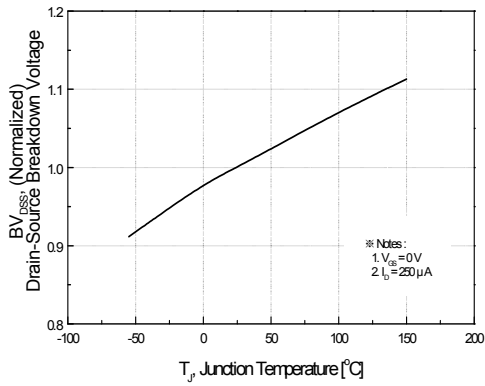


Figure 7. Breakdown Voltage Variation vs Temperature

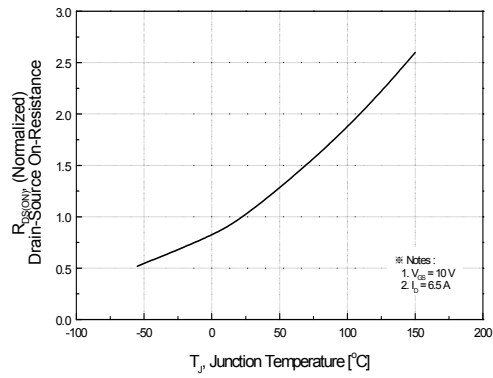


Figure 8. On-Resistance Variation vs Temperature

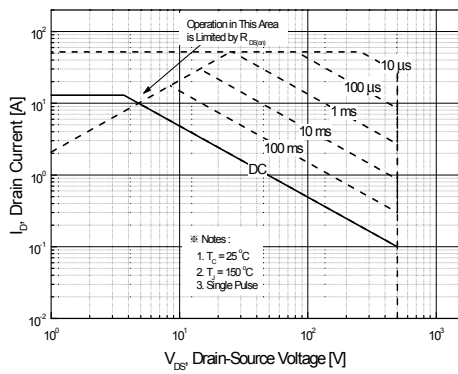


Figure 9. Maximum Safe Operating Area

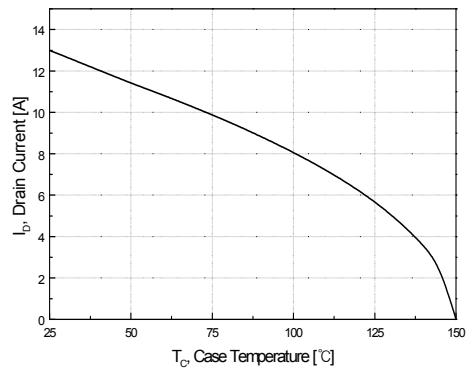


Figure 10. Maximum Drain Current vs Case Temperature

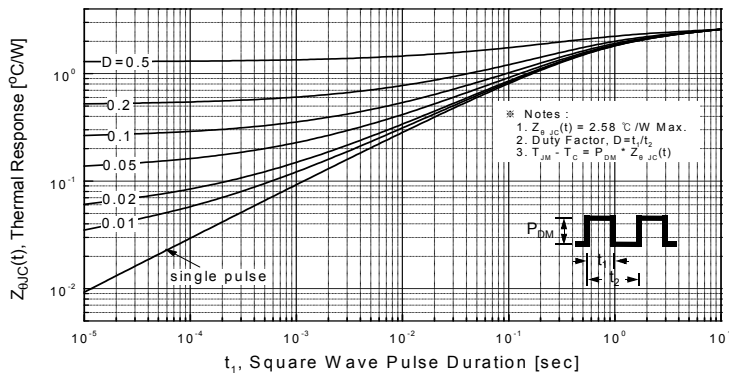


Figure 11. Transient Thermal Response Curve

Figure 12. Gate Charge Test Circuit & Waveform



Figure 13. Resistive Switching Test Circuit & Waveforms



Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

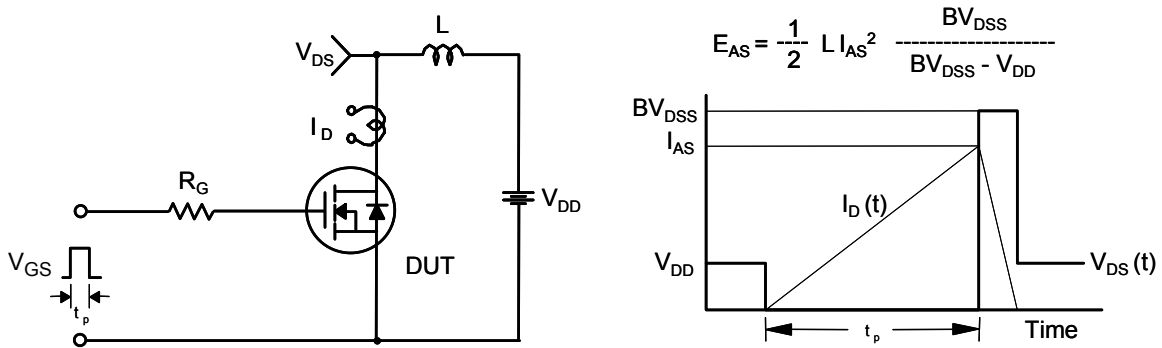
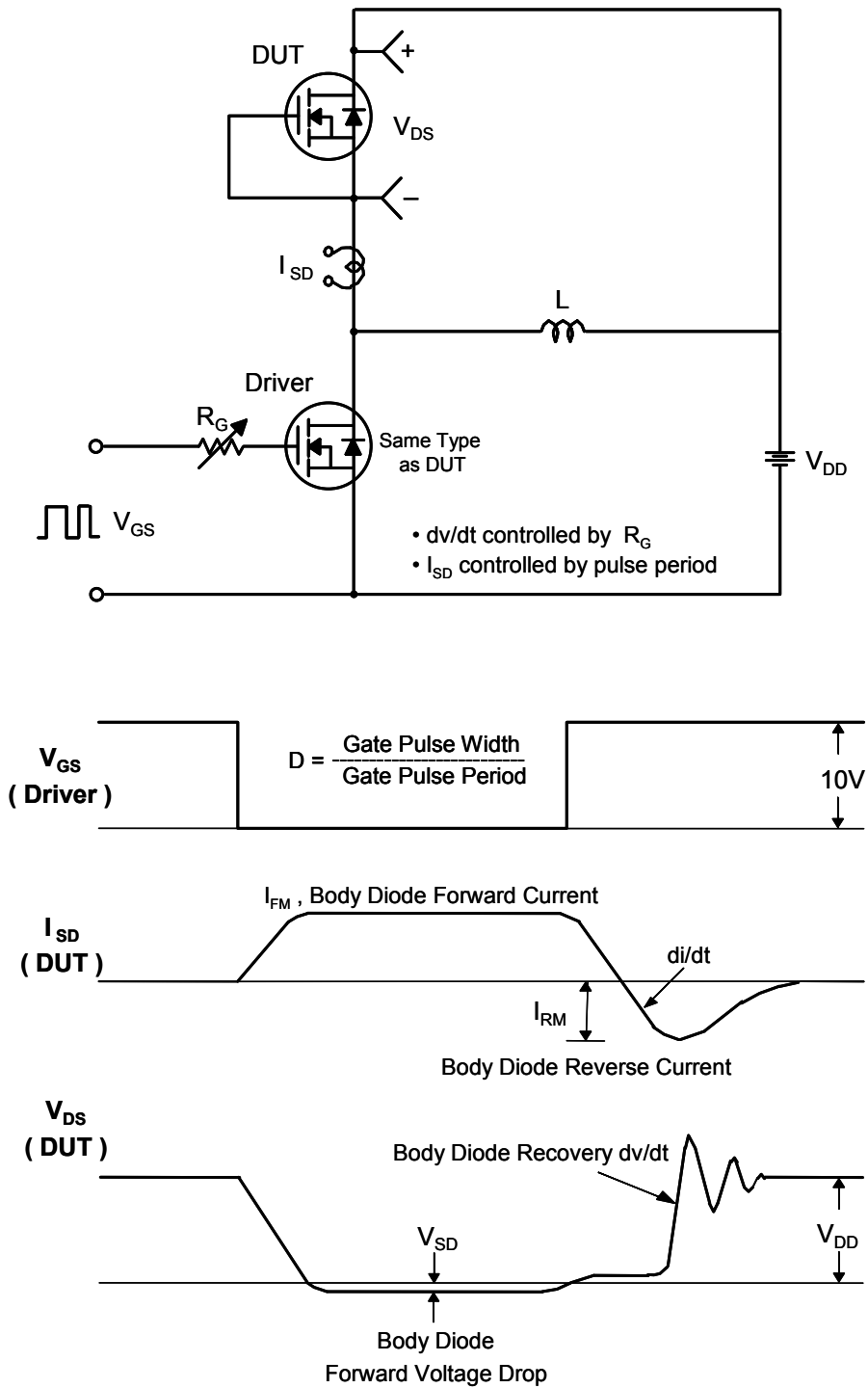


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions



NOTES:

- A. EXCEPT WHERE NOTED CONFORMS TO EIAJ SC91A.
- B. DOES NOT COMPLY EIAJ STD. VALUE.
- C. ALL DIMENSIONS ARE IN MILLIMETERS.
- D. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.
- E. DIMENSION AND TOLERANCE AS PER ASME Y14.5-1994.
- F. OPTION 1 - WITH SUPPORT PIN HOLE.
OPTION 2 - NO SUPPORT PIN HOLE.
- G. DRAWING FILE NAME: TO220M03REV3

Figure 16. TO220, Molded, 3-Lead, Full Pack, EIAJ SC91, Straight Lead

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