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FQP4N90C / FQPF4N90C

N-Channel QFET® MOSFET

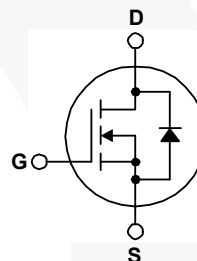
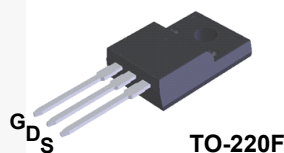
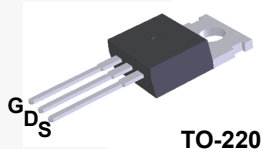
900 V, 4.0 A, 4.2 Ω

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.

Features

- 4.0 A, 900 V, $R_{DS(on)} = 4.2 \Omega$ (Max.) @ $V_{GS} = 10 V$, $I_D = 2.0 A$
- Low Gate Charge (Typ. 17 nC)
- Low Crss (Typ. 5.6 pF)
- 100% Avalanche Tested



Absolute Maximum Ratings $T_C = 25^\circ C$ unless otherwise noted.

Symbol	Parameter	FQP4N90C	FQPF4N90C	Unit
V_{DSS}	Drain-Source Voltage	900		V
I_D	Drain Current - Continuous ($T_C = 25^\circ C$) - Continuous ($T_C = 100^\circ C$)	4	4 *	A
		2.3	2.3 *	A
I_{DM}	Drain Current - Pulsed (Note 1)	16	16 *	A
V_{GSS}	Gate-Source Voltage	± 30		V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	570		mJ
I_{AR}	Avalanche Current (Note 1)	4		A
E_{AR}	Repetitive Avalanche Energy (Note 1)	14		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5		V/ns
P_D	Power Dissipation ($T_C = 25^\circ C$) - Derate above $25^\circ C$	140	47	W
		1.12	0.38	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

*Drain current limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	FQP4N90C	FQPF4N90C	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	0.89	2.66	°C/W
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink Typ, Max.	0.5	--	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	62.5	°C/W

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FQP4N90C	FQP4N90C	TO-220	Tube	N/A	N/A	50 units
FQPF4N90C	FQPF4N90C	TO-220F	Tube	N/A	N/A	50 units

Electrical Characteristics

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
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Off Characteristics

BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	900	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, Referenced to 25°C	--	1.05	--	$\text{V}/^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 900\text{ V}, V_{GS} = 0\text{ V}$	--	--	10	μA
		$V_{DS} = 720\text{ V}, T_C = 125^\circ\text{C}$	--	--	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	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	3.0	--	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 2\text{ A}$	--	3.5	4.2	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 50\text{ V}, I_D = 2\text{ A}$	--	5	--	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	740	960	pF
C_{oss}	Output Capacitance		--	65	85	pF
C_{riss}	Reverse Transfer Capacitance		--	5.6	7.3	pF

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 450\text{ V}, I_D = 4\text{ A},$ $R_G = 25\ \Omega$	--	25	60	ns	
t_r	Turn-On Rise Time		--	50	110	ns	
$t_{d(off)}$	Turn-Off Delay Time		(Note 4)	--	40	90	ns
t_f	Turn-Off Fall Time		(Note 4)	--	35	80	ns
Q_g	Total Gate Charge	$V_{DS} = 720\text{ V}, I_D = 4\text{ A},$ $V_{GS} = 10\text{ V}$	--	17	22	nC	
Q_{gs}	Gate-Source Charge		(Note 4)	--	4.5	--	nC
Q_{gd}	Gate-Drain Charge		(Note 4)	--	7.5	--	nC

Drain-Source Diode Characteristics and Maximum Ratings

I_S	Maximum Continuous Drain-Source Diode Forward Current	--	--	4	A	
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current	--	--	16	A	
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 4\text{ A}$	--	--	1.4	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_S = 4\text{ A},$ $di_F / dt = 100\text{ A}/\mu\text{s}$	--	450	--	ns
Q_{rr}	Reverse Recovery Charge		--	3.5	--	μC

Notes:

1. Repetitive rating : pulse-width limited by maximum junction temperature.
2. $L = 67\text{ mH}, I_{AS} = 4\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\ \Omega$, starting $T_J = 25^\circ\text{C}$.
3. $I_{SD} \leq 4\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$, starting $T_J = 25^\circ\text{C}$.
4. Essentially independent of operating temperature.

Typical Characteristics

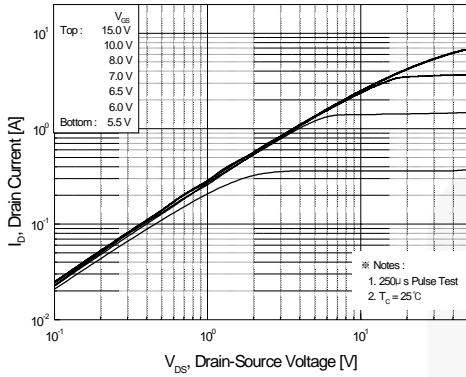


Figure 1. On-Region Characteristics

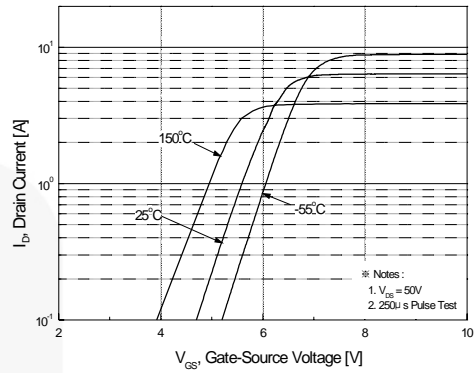


Figure 2. Transfer Characteristics

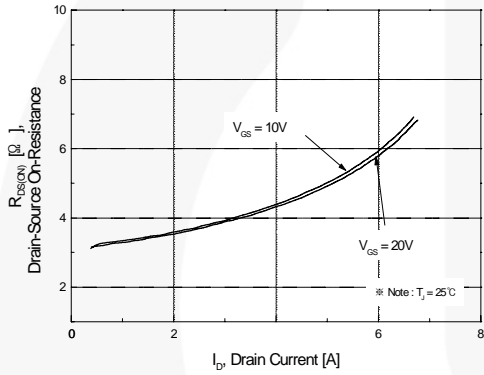


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

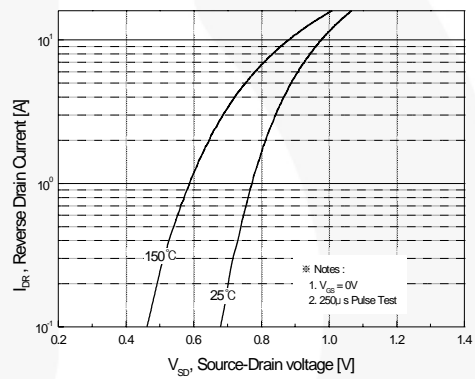


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

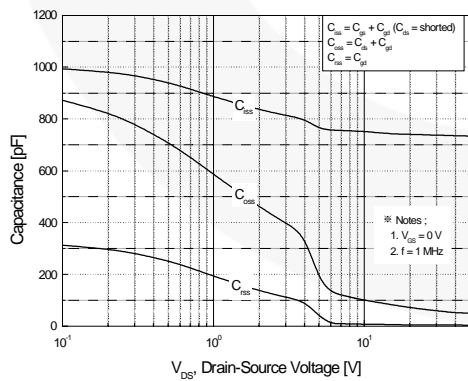


Figure 5. Capacitance Characteristics

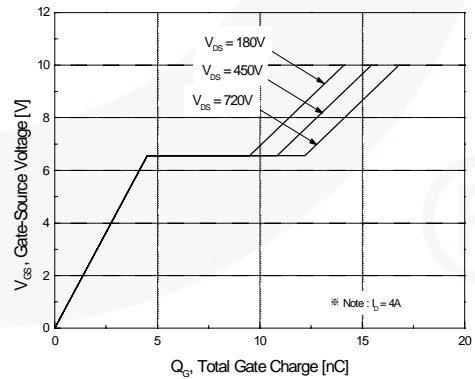


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

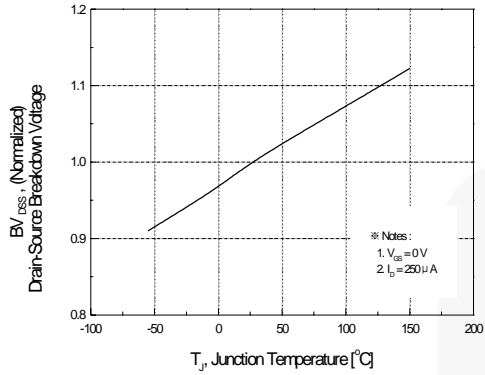


Figure 7. Breakdown Voltage Variation vs Temperature

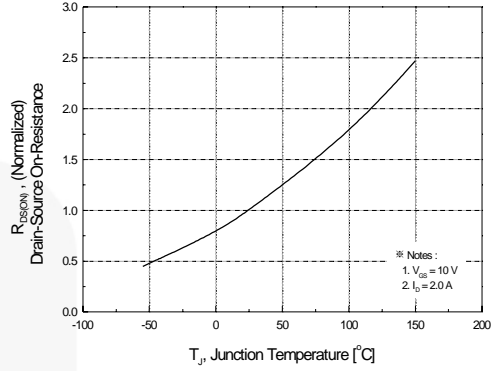


Figure 8. On-Resistance Variation vs Temperature

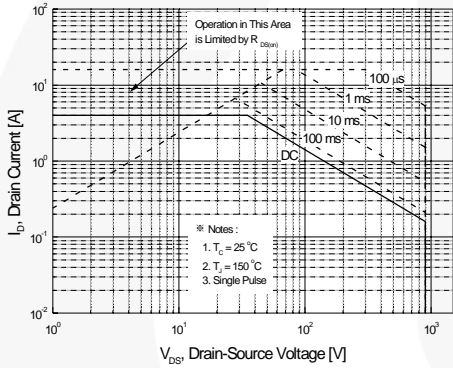


Figure 9-1. Maximum Safe Operating Area for FQP4N90C

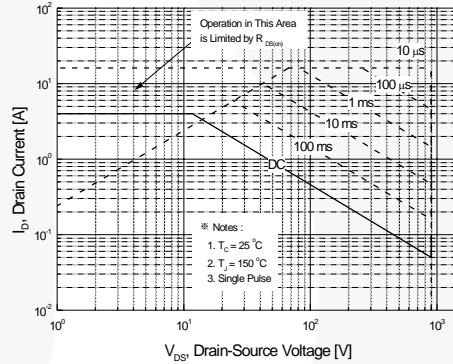


Figure 9-2. Maximum Safe Operating Area for FQPF4N90C

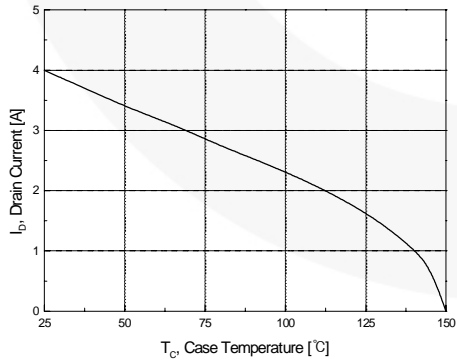


Figure 10. Maximum Drain Current vs Case Temperature

Typical Characteristics (Continued)

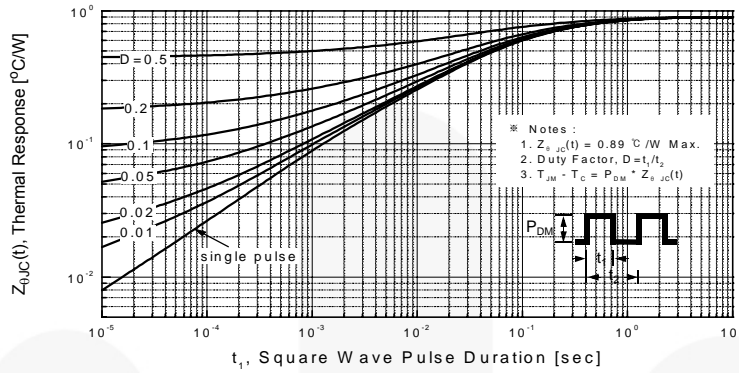


Figure 11-1. Transient Thermal Response Curve for FQP4N90C

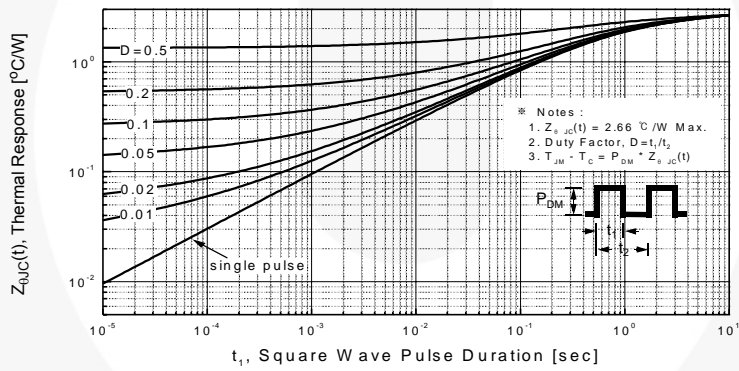


Figure 11-2. Transient Thermal Response Curve for FQPF4N90C



Figure 12. Gate Charge Test Circuit & Waveform

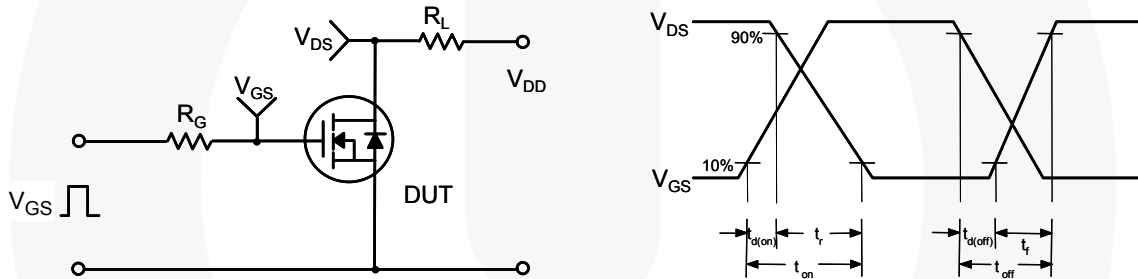


Figure 13. Resistive Switching Test Circuit & Waveforms



Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms



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

Mechanical Dimensions

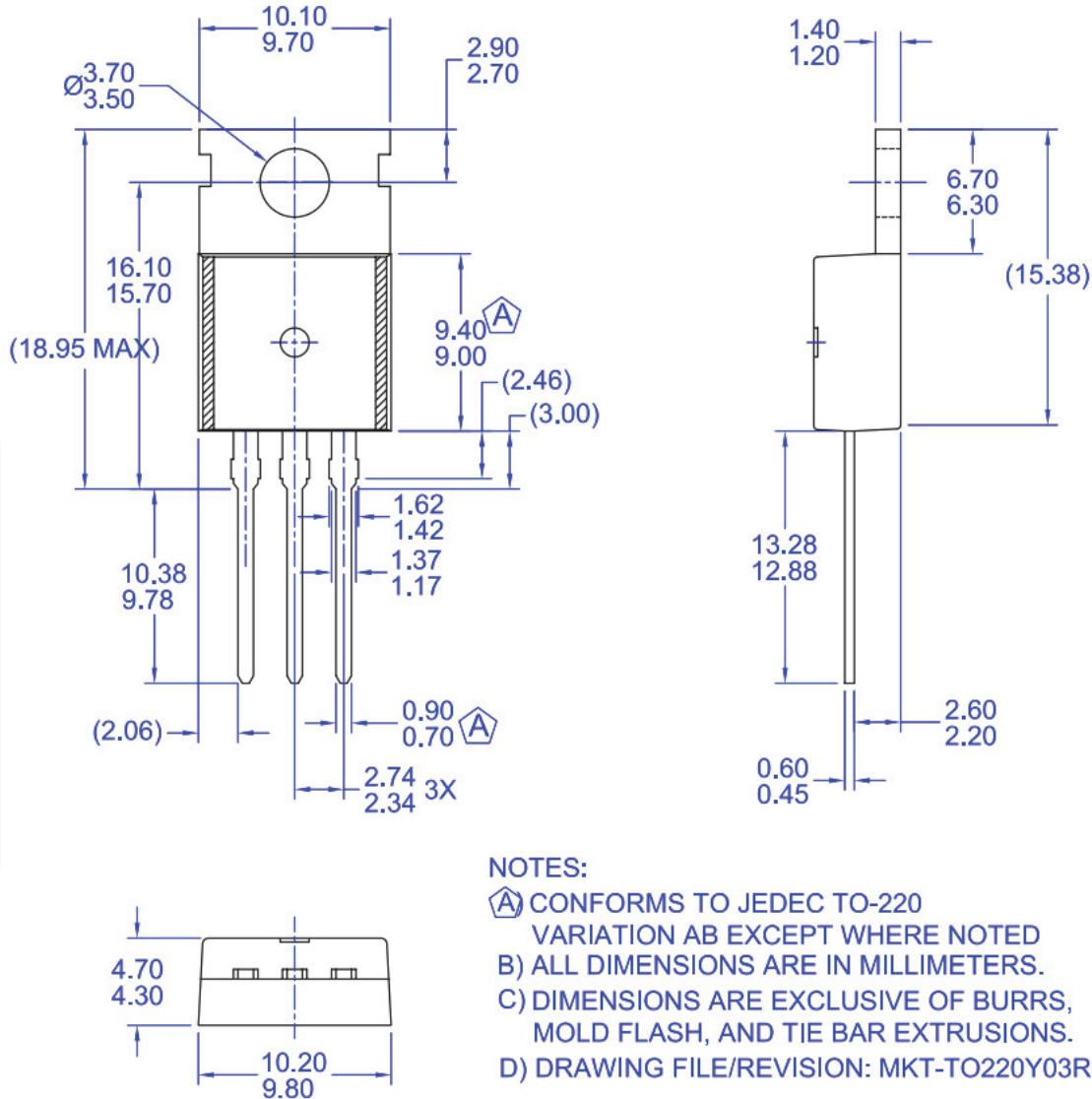


Figure 16. TO220, Molded, 3-Lead, Jedec Variation AB

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

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