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November 2013

FQP10N60C / FQPF10N60C N-Channel QFET® MOSFET 600 V, 9.5 A, 730 mΩ

Description

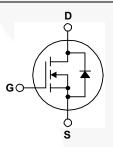
These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology. This advanced technology has been especially tailored to mini-mize on-state resistance, provide superior switching perfor-mance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high effi-ciency switched mode power supplies, active power factor correction, electronic lamp ballasts based on half bridge topology.

Features

- 9.5 A, 600 V, $R_{DS(on)}$ = 730 m Ω (Max.) @ V_{GS} = 10 V, I_D = 4.75 A
- · Low Gate Charge (Typ. 44 nC)
- · Low Crss (Typ. 18 pF)
- 100% Avalanche Tested







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

Symbol	Parameter		FQP10N60C	FQPF10N60C	Unit
V _{DSS}	Drain-Source Voltage		600		V
I _D	Drain Current - Continuous (T _C = 25°C	- Continuous (T _C = 25°C)		9.5 *	Α
	- Continuous (T _C = 100°C)		5.7	5.7 *	Α
I _{DM}	Drain Current - Pulsed	(Note 1)	38	38 *	Α
V _{GSS}	Gate-Source Voltage		± 30		V
E _{AS}	Single Pulsed Avalanche Energy (Note		700		mJ
I _{AR}	Avalanche Current	(Note 1)	9.5		Α
E _{AR}	Repetitive Avalanche Energy (Note 1)		15.6		mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)		4.5		V/ns
P_{D}	Power Dissipation (T _C = 25°C)		156	50	W
	- Derate above 25°C		1.25	0.4	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	FQP10N60C	FQPF10N60C	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	0.8	2.5	°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	62.5	°C/W

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FQP10N60C	FQP10N60C	TO-220	Tube	N/A	N/A	50 units
FQPF10N60C	FQPF10N60C	TO-220F	Tube	N/A	N/A	50 units
FQPF10N60CT	FQPF10N60CT	TO-220F	Tube	N/A	N/A	50 units
FQPF10N60C_F105	FQPF10N60C	TO-220F	Tube	N/A	N/A	50 units

Electrical Characteristics T_C = 25°C unless otherwise noted.

Symbol	Parameter	Test Conditions	Min	Тур	Max	Unit
Off Characte	ristics					
BV _{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$	600			V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250 μA, Referenced to 25°C		0.7		V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 600 V, V _{GS} = 0 V	/		1	μΑ
		V _{DS} = 480 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 Characte	ristics					
V _{GS(th)}	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_{D} = 250 \mu A$	2.0		4.0	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} = 10 V, I _D = 4.75 A		0.6	0.73	Ω
9 _{FS}	Forward Transconductance	V _{DS} = 40 V, I _D = 4.75 A		8.0		S
Dynamic Ch	aracteristics					
C _{iss}	Input Capacitance	$V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V},$		1570	2040	pF
C _{oss}	Output Capacitance	f = 1.0 MHz		166	215	pF
C _{rss}	Reverse Transfer Capacitance			18	24	pF
Switching Cl	haracteristics					
t _{d(on)}	Turn-On Delay Time	V _{DD} = 300 V, I _D = 9.5A,		23	55	ns
t _r	Turn-On Rise Time	$R_G = 25 \Omega$	/	69	150	ns
$t_{d(off)}$	Turn-Off Delay Time		/- -	144	300	ns
t _f	Turn-Off Fall Time	(Note 4)		77	165	ns
Q _g	Total Gate Charge	V _{DS} = 480 V, I _D = 9.5A,		44	57	nC
Q _{gs}	Gate-Source Charge	V _{GS} = 10 V		6.7		nC
Q _{gd}	Gate-Drain Charge	(Note 4)		18.5		nC
Drain-Source	e Diode Characteristics and Maximum	Ratings				Б
I _S	Maximum Continuous Drain-Source Diode Forward Current				9.5	Α
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current				38	Α
V _{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0 \text{ V}, I_{S} = 9.5 \text{ A}$			1.4	V
t _{rr}	Reverse Recovery Time	$V_{GS} = 0 \text{ V}, I_S = 9.5 \text{ A},$		420		ns
Q _{rr}	Reverse Recovery Charge	dI _F / dt = 100 A/μs		4.2		μС

NOTES:

- 1. Repetitive rating: pulse-width limited by maximum junction temperature.
- 2. L = 14.2 mH, I $_{AS}$ = 9.5 A, V $_{DD}$ = 50 V, R $_{G}$ = 25 $\Omega,$ starting T $_{J}$ = 25°C.
- $3.\,I_{SD} \leq 9.5\;\text{A, di/dt} \leq 200\;\text{A/}\mu\text{s, V}_{DD} \leq \text{BV}_{DSS},\;\text{starting}\;\text{T}_{J} = 25^{\circ}\text{C}.$
- 4. Essentially independent of operating temperature typical characteristics.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

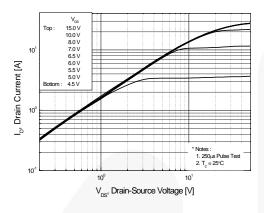


Figure 3. On-Resistance Variation vs.

Drain Current and Gate Voltage

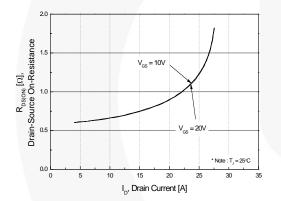


Figure 2. Transfer Characteristics

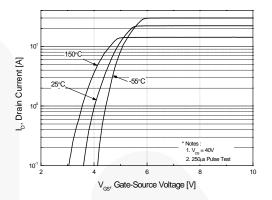


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

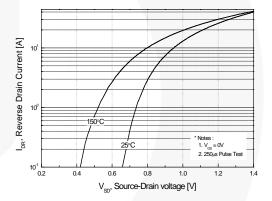


Figure 5. Capacitance Characteristics

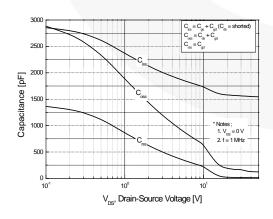
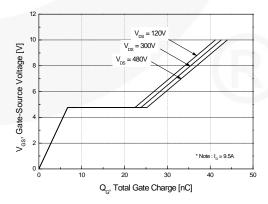


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

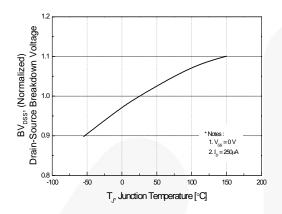


Figure 8. On-Resistance Variation vs. Temperature

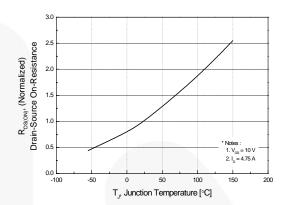


Figure 9-1. Maximum Safe Operating Area for FQP10N60C

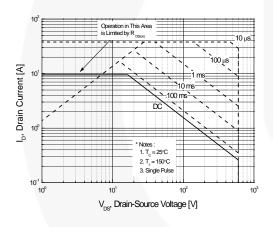


Figure 9-2. Maximum Safe Operating Area for FQPF10N60C

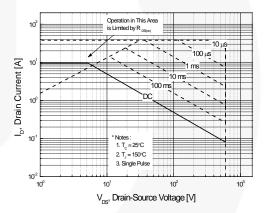
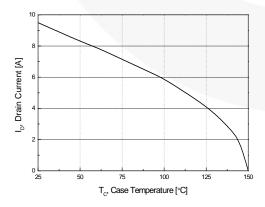


Figure 10. Maximum Drain Current vs. Case Temperature



Typical Performance Characteristics (Continued)

Figure 11-1. Transient Thermal Response Curve for FQP10N60C

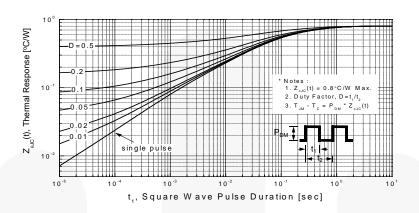
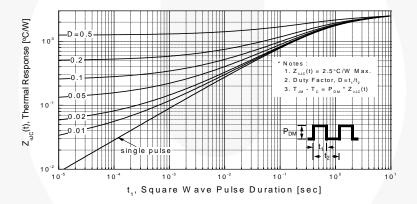


Figure 11-2. Transient Thermal Response Curve for FQPF10N60C



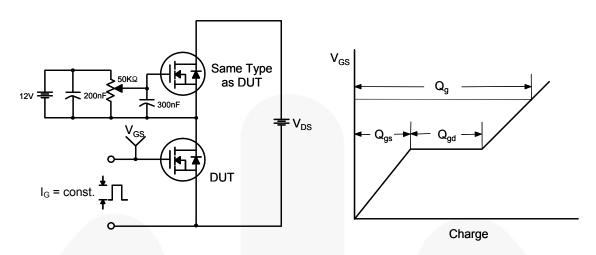


Figure 12. Gate Charge Test Circuit & Waveform

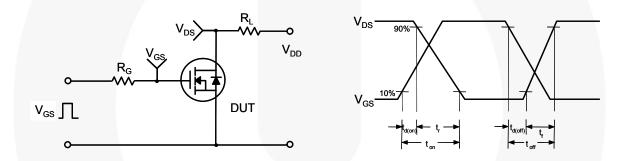


Figure 13. Resistive Switching Test Circuit & Waveforms

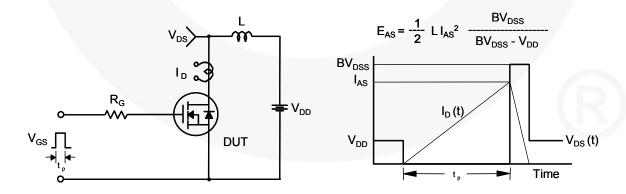


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

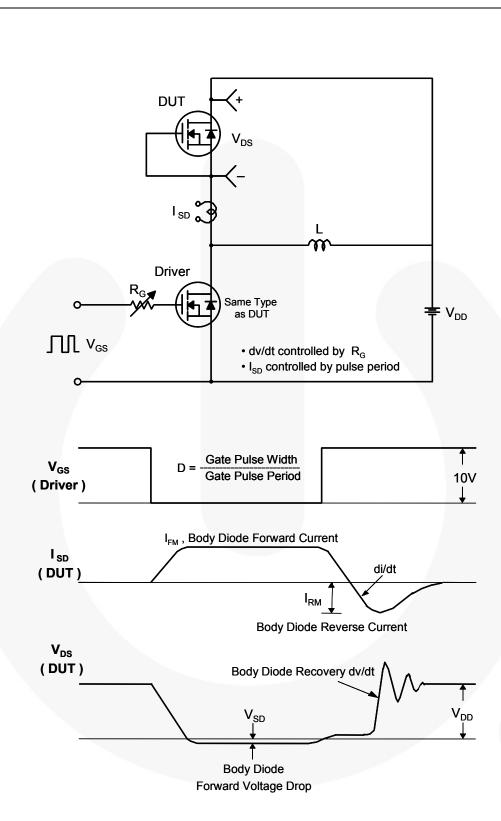


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions

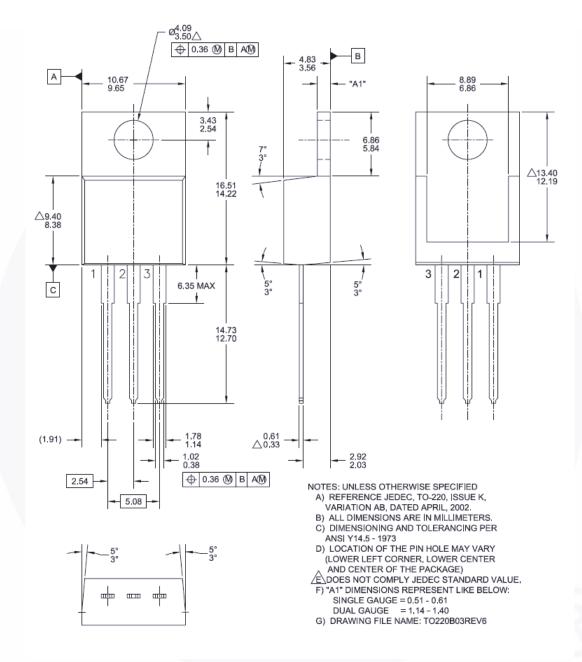


Figure 16. TO-220, Molded, 3-Lead, Jedec Variation AB

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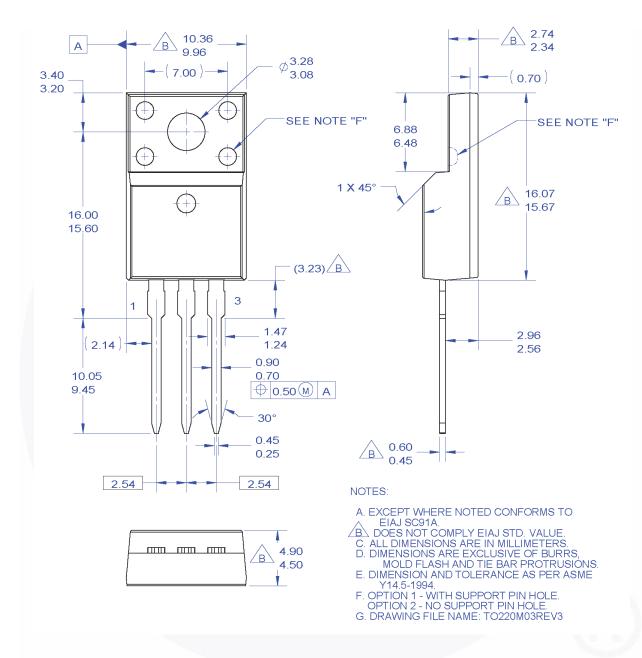


Figure 17. TO220, Molded, 3-Lead, Full Pack, EIAJ SC91, Straight Lead

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