

April 2000

FQP4N60

600V N-Channel MOSFET

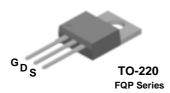
General Description

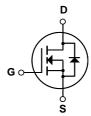
These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology.

This advanced technology has been especially tailored to 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 high efficiency switch mode power supply.

Features

- 4.4A, 600V, $R_{DS(on)}$ = 2.2 Ω @V_{GS} = 10 V Low gate charge (typical 15 nC)
- Low Crss (typical 8.0 pF)
- · Fast switching
- 100% avalanche tested
- · Improved dv/dt capability





Absolute Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Parameter		FQP4N60	Units	
V _{DSS}	Drain-Source Voltage		600	V	
I _D	Drain Current - Continuous (T _C = 25°C) - Continuous (T _C = 100°C)		4.4	Α	
			2.8	А	
I _{DM}	Drain Current - Pulsed	(Note 1)	17.6	Α	
V _{GSS}	Gate-Source Voltage		± 30	V	
E _{AS}	Single Pulsed Avalanche Energy	(Note 2)	260	mJ	
I _{AR}	Avalanche Current	(Note 1)	4.4	Α	
E _{AR}	Repetitive Avalanche Energy	(Note 1)	10.6	mJ	
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	4.5	V/ns	
P_{D}	Power Dissipation (T _C = 25°C) - Derate above 25°C		106	W	
			0.85	W/°C	
T _J , T _{STG}	Operating and Storage Temperature Range		-55 to +150	°C	
T _L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds		300	°C	

Thermal Characteristics

Symbol	Parameter	Тур	Max	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case		1.18	°C/W
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink	0.5		°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient		62.5	°C/W

Symbol	Parameter	Test Conditions	3	Min	Тур	Max	Units
Off Cha	aracteristics						
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		0.6		V/°C
I _{DSS}	Zana Cata Valta na Duain Commant	V _{DS} = 600 V, V _{GS} = 0 V				10	μΑ
	Zero Gate Voltage Drain Current	V _{DS} = 480 V, T _C = 125°C			-	100	μΑ
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 Cha	aracteristics						
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	$V_{GS} = 10 \text{ V}, I_D = 2.2 \text{ A}$			1.77	2.2	Ω
g _{FS}	Forward Transconductance	V _{DS} = 50 V, I _D = 2.2 A	(Note 4)		4.0		S
C _{oss}	Output Capacitance Reverse Transfer Capacitance	$V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V},$ f = 1.0 MHz			70 8	90 11	pF pF
C _{rss}	Reverse Transfer Capacitance				8	11	pF
Switch	ing Characteristics						
t _{d(on)}	Turn-On Delay Time	V_{DD} = 300 V, I_{D} = 4.4 A, R_{G} = 25 Ω			13	35	ns
t _r	Turn-On Rise Time				45	100	ns
t _{d(off)}	Turn-Off Delay Time				25	60	ns
t _f	Turn-Off Fall Time		(Note 4, 5)		35	80	ns
Q_g	Total Gate Charge	$V_{DS} = 480 \text{ V}, I_{D} = 4.4 \text{ A},$			15	20	nC
Q _{gs}	Gate-Source Charge	V _{GS} = 10 V (Note 4, 5)			3.4		nC
Q_{gd}	Gate-Drain Charge				7.1		nC
Drain-9	Source Diode Characteristics ar	nd Maximum Rating	s				
Dialii	Maximum Continuous Drain-Source Diode Forward Current					4.4	Α
	Maximum Continuous Drain-Source Dic		Maximum Pulsed Drain-Source Diode Forward Current				
I _S		Forward Current				17.6	Α
I _S		Forward Current V _{GS} = 0 V, I _S = 4.4 A				17.6	V
I _S	Maximum Pulsed Drain-Source Diode F				 250		

- **Notes:**1. Repetitive Rating : Pulse width limited by maximum junction temperature 2. L = 25mH, I_{AS} = 4.4A, V_{DD} = 50V, R_G = 25 Ω , Starting T_J = 25°C 3. I_{gD} ≤ 4.4A, di/dt ≤ 200A/µs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C 4. Pulse Test : Pulse width ≤ 300µs, Duty cycle ≤ 2% 5. Essentially independent of operating temperature

Typical Characteristics

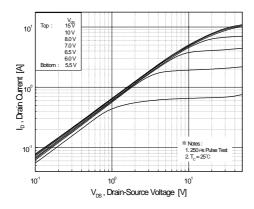


Figure 1. On-Region Characteristics

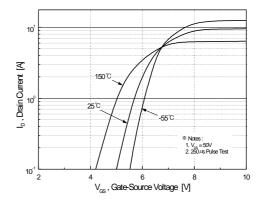


Figure 2. Transfer Characteristics

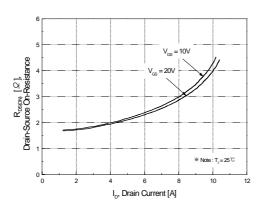


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

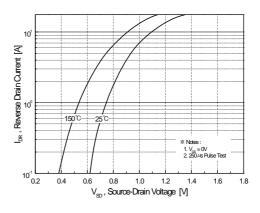


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

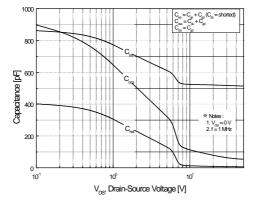


Figure 5. Capacitance Characteristics

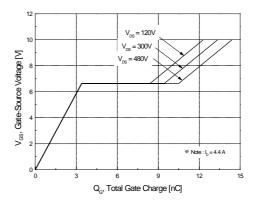


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

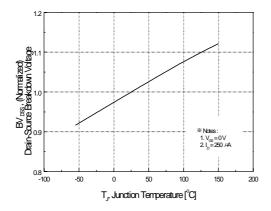
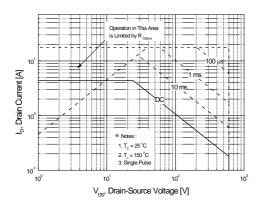


Figure 7. Breakdown Voltage Variation vs. Temperature

Figure 8. On-Resistance Variation vs. Temperature



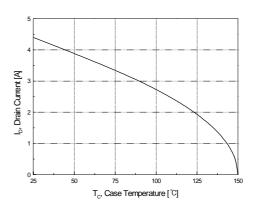


Figure 9. Maximum Safe Operating Area

Figure 10. Maximum Drain Current vs. Case Temperature

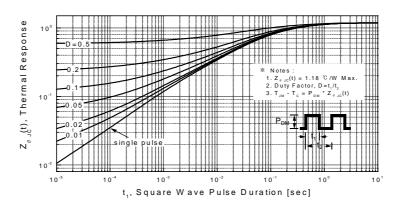
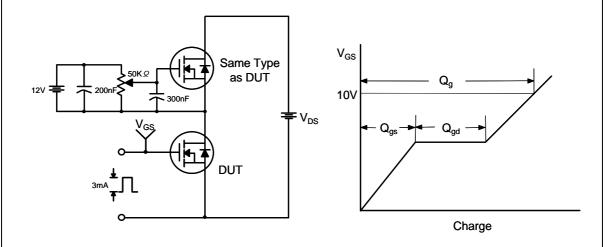


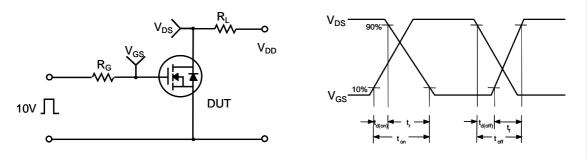
Figure 11. Transient Thermal Response Curve

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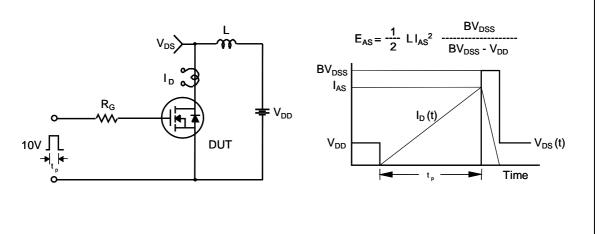
Gate Charge Test Circuit & Waveform



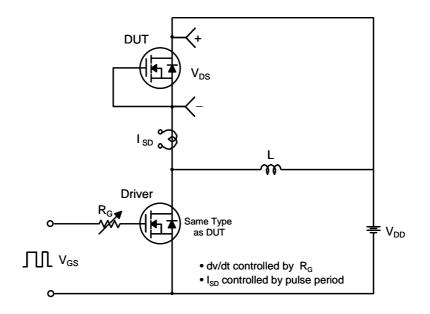
Resistive Switching Test Circuit & Waveforms

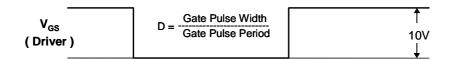


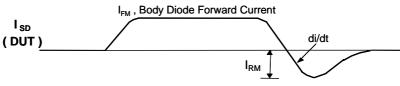
Unclamped Inductive Switching Test Circuit & Waveforms



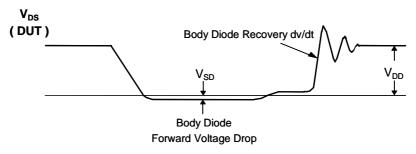
Peak Diode Recovery dv/dt Test Circuit & Waveforms



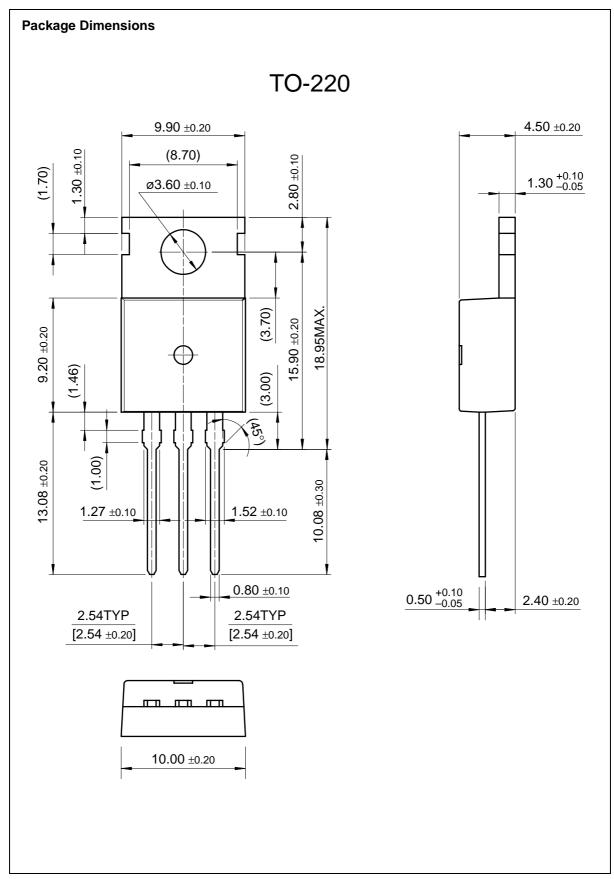




Body Diode Reverse Current



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