



April 2000

QFET™

FQA12N60

600V N-Channel MOSFET

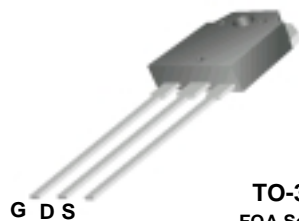
General Description

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

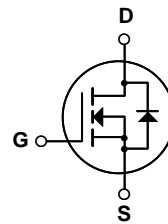
This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switch mode power supply.

Features

- 12A, 600V, $R_{DS(on)} = 0.7 \Omega$ @ $V_{GS} = 10 V$
- Low gate charge (typical 42 nC)
- Low Crss (typical 25 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability



TO-3P
FQA Series



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

Symbol	Parameter	FQA12N60	Units
V_{DSS}	Drain-Source Voltage	600	V
I_D	Drain Current - Continuous ($T_C = 25^\circ\text{C}$) - Continuous ($T_C = 100^\circ\text{C}$)	12	A
		7.6	A
I_{DM}	Drain Current - Pulsed (Note 1)	48	A
V_{GSS}	Gate-Source Voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	790	mJ
I_{AR}	Avalanche Current (Note 1)	12	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	24	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	4.5	V/ns
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$) - Derate above 25°C	240	W
		1.92	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	Typ	Max	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	0.52	°C/W
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink	0.24	--	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	40	°C/W

Electrical CharacteristicsT_C = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0 V, I _D = 250μA	600	--	--	V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250 μA, Referenced to 25°C	--	0.71	--	V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 600 V, V _{GS} = 0 V	--	--	10	μA
		V _{DS} = 480 V, T _C = 125°C	--	--	100	μA
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 Characteristics

V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 250 μA	3.0	--	5.0	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} = 10 V, I _D = 6.0 A	--	0.55	0.7	Ω
g _{FS}	Forward Transconductance	V _{DS} = 50 V, I _D = 6.0 A (Note 4)	--	11	--	S

Dynamic Characteristics

C _{iss}	Input Capacitance	V _{DS} = 25 V, V _{GS} = 0 V, f = 1.0 MHz	--	1480	1900	pF
C _{oss}	Output Capacitance		--	200	270	pF
C _{rss}	Reverse Transfer Capacitance		--	25	35	pF

Switching Characteristics

t _{d(on)}	Turn-On Delay Time	V _{DD} = 300 V, I _D = 12 A, R _G = 25 Ω (Note 4, 5)	--	30	70	ns
t _r	Turn-On Rise Time		--	115	240	ns
t _{d(off)}	Turn-Off Delay Time		--	95	200	ns
t _f	Turn-Off Fall Time		--	85	180	ns
Q _g	Total Gate Charge	V _{DS} = 480 V, I _D = 12 A, V _{GS} = 10 V (Note 4, 5)	--	42	54	nC
Q _{gs}	Gate-Source Charge		--	8.6	--	nC
Q _{gd}	Gate-Drain Charge		--	21	--	nC

Drain-Source Diode Characteristics and Maximum Ratings

I _S	Maximum Continuous Drain-Source Diode Forward Current	--	--	12	A	
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current	--	--	48	A	
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 12 A	--	--	1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _S = 12 A, di _F / dt = 100 A/μs (Note 4)	--	380	--	ns
Q _{rr}	Reverse Recovery Charge		--	3.5	--	μC

Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 10mH, I_{AS} = 12A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C
3. I_{SD} ≤ 12A, 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

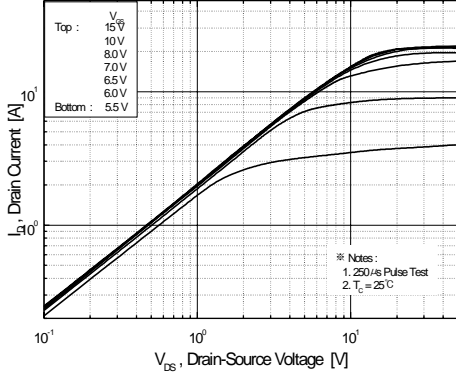


Figure 1. On-Region Characteristics

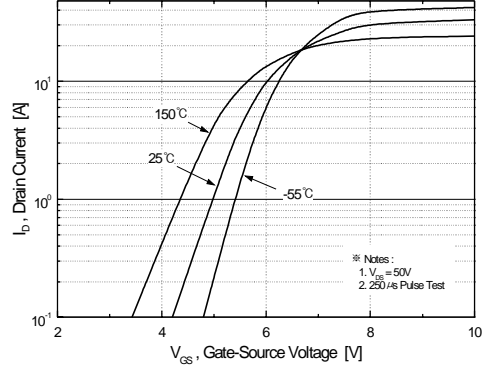


Figure 2. Transfer Characteristics

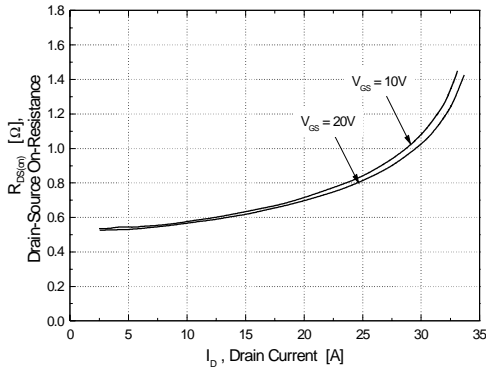


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

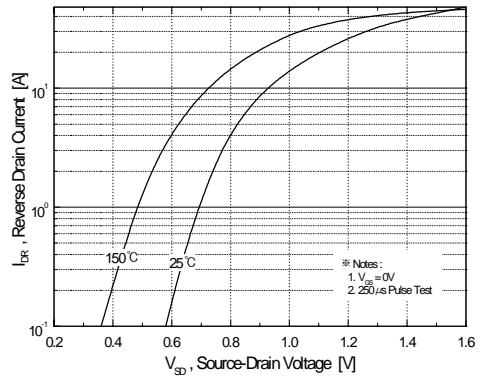


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

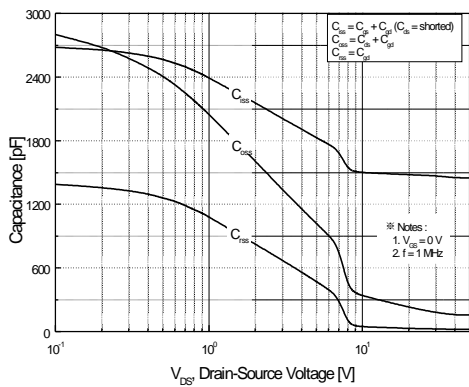


Figure 5. Capacitance Characteristics

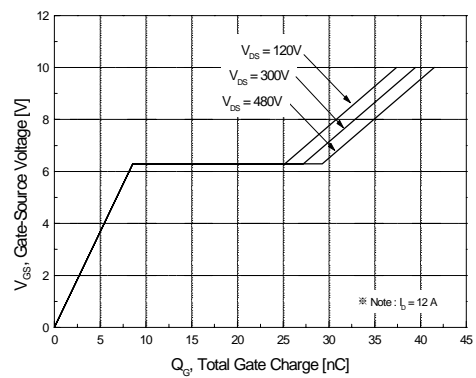


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

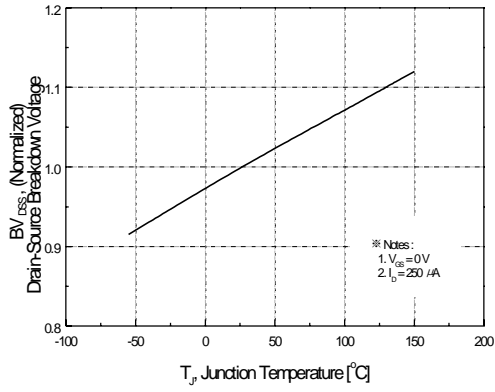


Figure 7. Breakdown Voltage Variation vs. Temperature

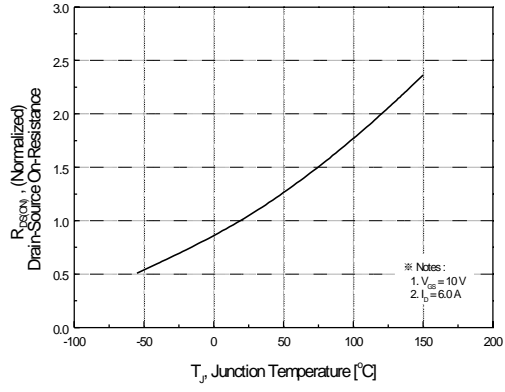


Figure 8. On-Resistance Variation vs. Temperature

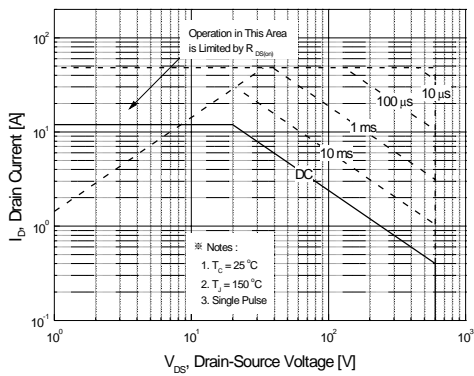


Figure 9. Maximum Safe Operating Area

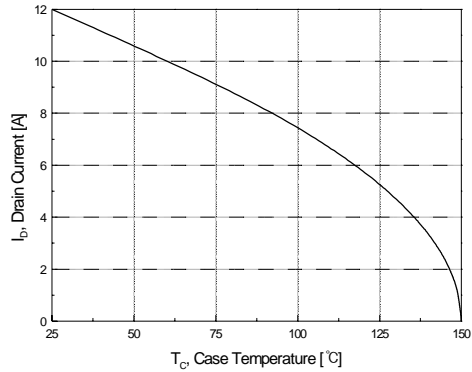


Figure 10. Maximum Drain Current vs. Case Temperature

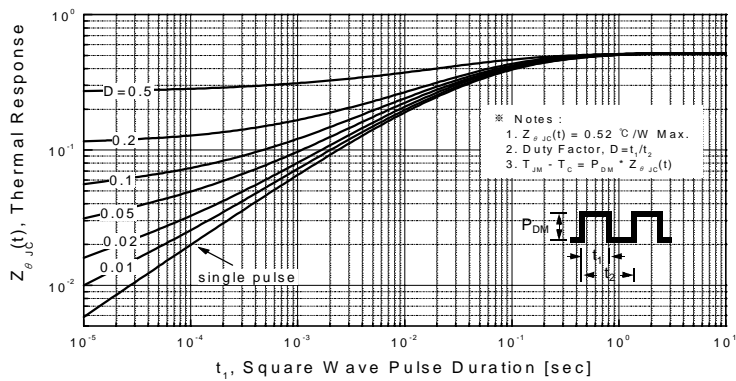
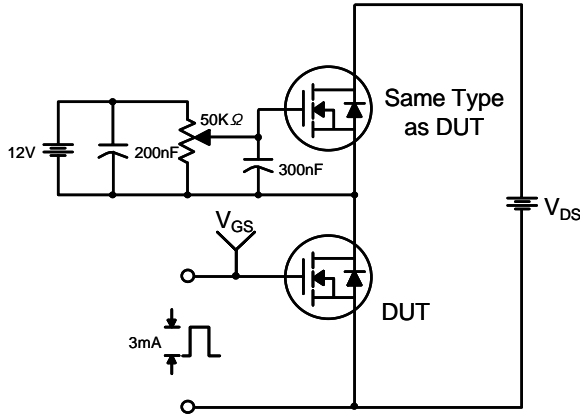
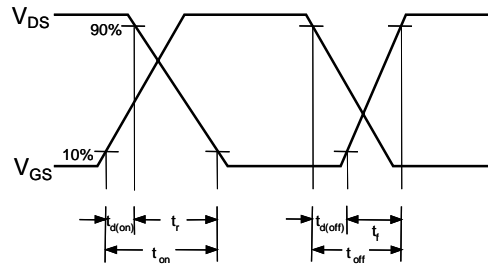


Figure 11. Transient Thermal Response Curve

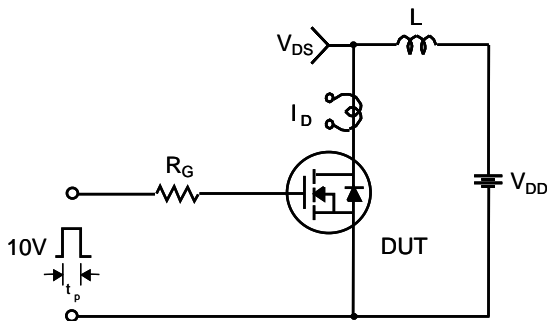
Gate Charge Test Circuit & Waveform



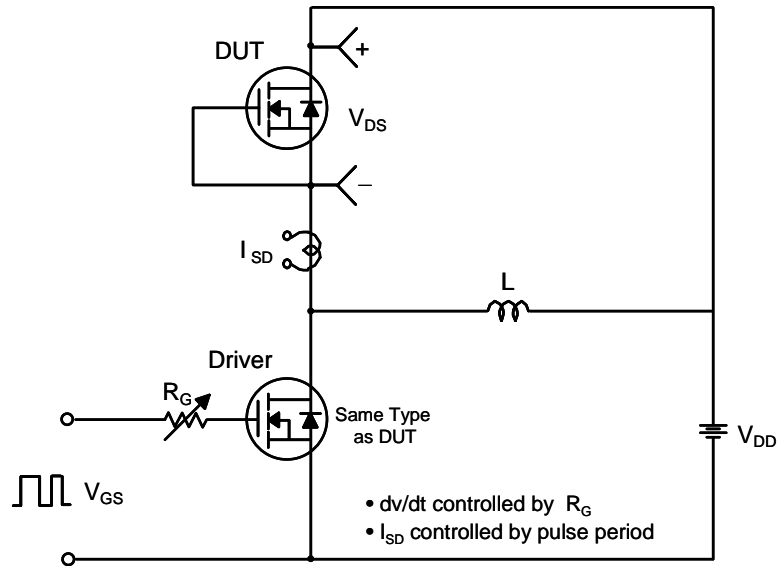
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

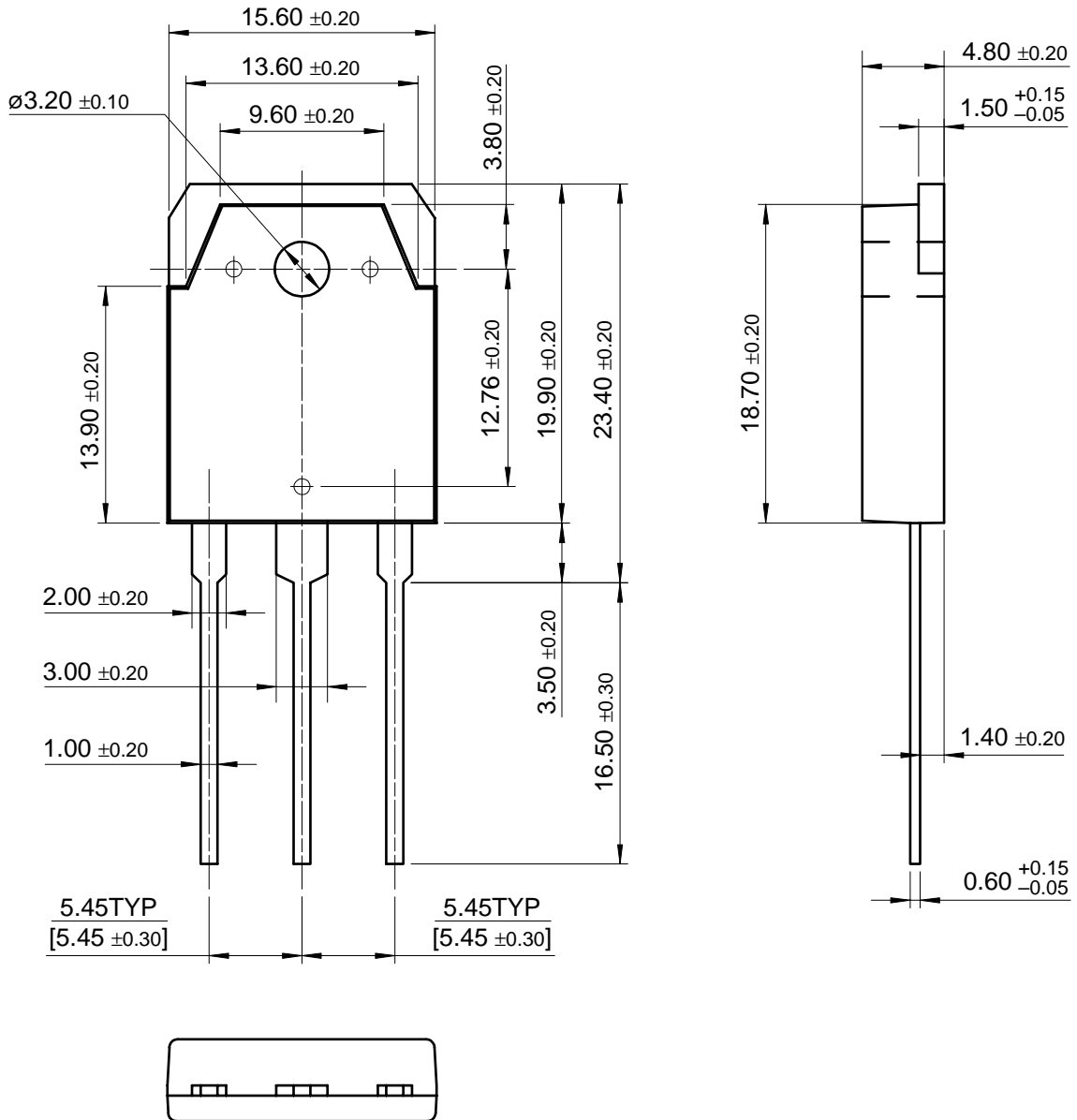


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Package Dimensions

TO-3P



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