



June 2000

QFET™

FQB44N10 / FQI44N10

100V N-Channel MOSFET

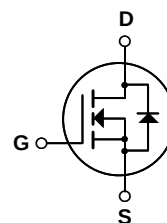
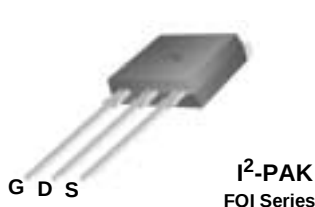
General Description

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 low voltage applications such as audio amplifier, high efficiency switching DC/DC converters, and DC motor control.

Features

- 43.5A, 100V, $R_{DS(on)} = 0.039\Omega$ @ $V_{GS} = 10V$
- Low gate charge (typical 48 nC)
- Low C_{rss} (typical 85 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability
- 175°C maximum junction temperature rating



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

Symbol	Parameter	FQB44N10 / FQI44N10	Units
V_{DSS}	Drain-Source Voltage	100	V
I_D	Drain Current - Continuous ($T_C = 25^\circ\text{C}$)	43.5	A
	- Continuous ($T_C = 100^\circ\text{C}$)	30.8	A
I_{DM}	Drain Current - Pulsed (Note 1)	174	A
V_{GSS}	Gate-Source Voltage	± 25	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	530	mJ
I_{AR}	Avalanche Current (Note 1)	43.5	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	14.6	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	6.0	V/ns
P_D	Power Dissipation ($T_A = 25^\circ\text{C}$) *	3.75	W
	Power Dissipation ($T_C = 25^\circ\text{C}$)	146	W
	- Derate above 25°C	0.97	W/ $^\circ\text{C}$
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +175	$^\circ\text{C}$
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300	$^\circ\text{C}$

Thermal Characteristics

Symbol	Parameter	Typ	Max	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	1.03	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient *	--	40	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	62.5	$^\circ\text{C/W}$

* When mounted on the minimum pad size recommended (PCB Mount)

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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Off Characteristics

BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	100	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$, Referenced to 25°C	--	0.1	--	V/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 100\text{ V}, V_{GS} = 0\text{ V}$	--	--	1	μA
		$V_{DS} = 80\text{ V}, T_C = 150^\circ\text{C}$	--	--	10	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{GS} = 25\text{ V}, V_{DS} = 0\text{ V}$	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{GS} = -25\text{ V}, V_{DS} = 0\text{ V}$	--	--	-100	nA

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	2.0	--	4.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 21.75\text{ A}$	--	0.03	0.039	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 40\text{ V}, I_D = 21.75\text{ A}$ (Note 4)	--	30	--	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	1400	1800	pF
C_{oss}	Output Capacitance		--	425	550	pF
C_{rss}	Reverse Transfer Capacitance		--	85	110	pF

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 50\text{ V}, I_D = 43.5\text{ A},$ $R_G = 25\text{ }\Omega$ (Note 4, 5)	--	19	45	ns
t_r	Turn-On Rise Time		--	190	390	ns
$t_{d(off)}$	Turn-Off Delay Time		--	90	190	ns
t_f	Turn-Off Fall Time		--	100	210	ns
Q_g	Total Gate Charge	$V_{DS} = 80\text{ V}, I_D = 43.5\text{ A},$ $V_{GS} = 10\text{ V}$ (Note 4, 5)	--	48	62	nC
Q_{gs}	Gate-Source Charge		--	9.0	--	nC
Q_{gd}	Gate-Drain Charge		--	24	--	nC

Drain-Source Diode Characteristics and Maximum Ratings

I _S	Maximum Continuous Drain-Source Diode Forward Current		--	--	43.5	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	174	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 43.5 A	--	--	1.5	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _S = 43.5 A,	--	98	--	ns
Q _{rr}	Reverse Recovery Charge	dI _F / dt = 100 A/μs (Note 4)	--	360	--	nC

Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. $L = 0.42\text{ mH}$, $I_{AS} = 43.5\text{ A}$, $V_{DD} = 25\text{ V}$, $R_G = 25\text{ }\Omega$, Starting $T_J = 25^\circ\text{C}$
3. $I_{SD} \leq 43.5\text{ A}$, $di/dt \leq 300\text{ A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$
4. Pulse Test : Pulse width $\leq 300\mu\text{s}$, Duty cycle $\leq 2\%$
5. Essentially independent of operating temperature

Typical Characteristics

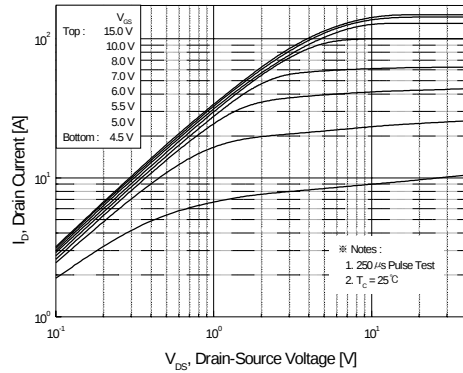


Figure 1. On-Region Characteristics

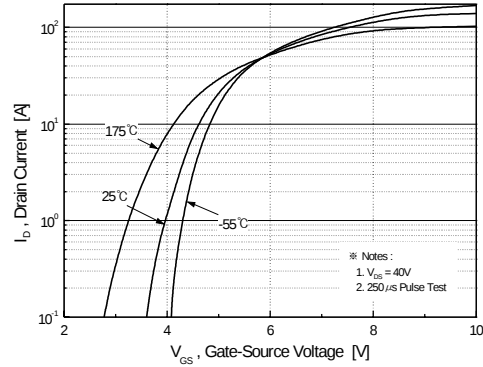


Figure 2. Transfer Characteristics

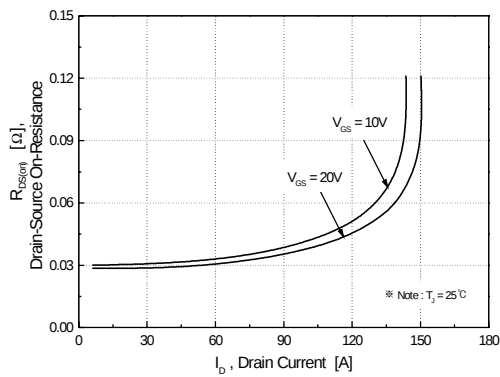


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

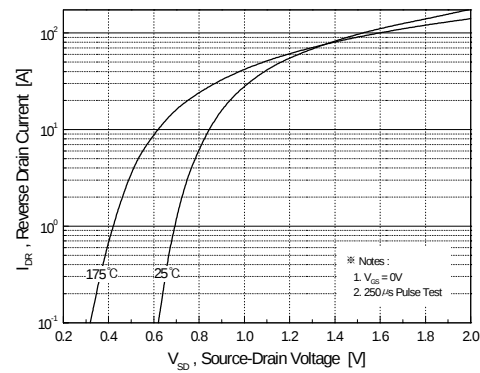


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

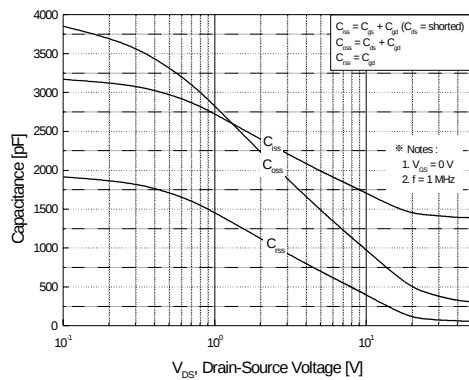


Figure 5. Capacitance Characteristics

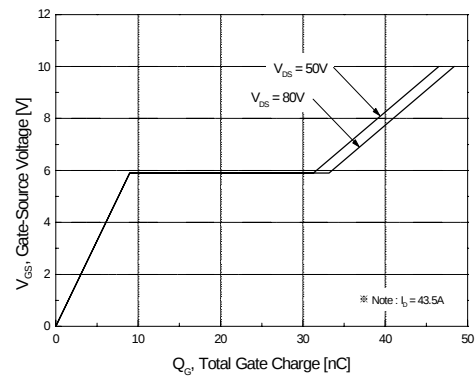


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

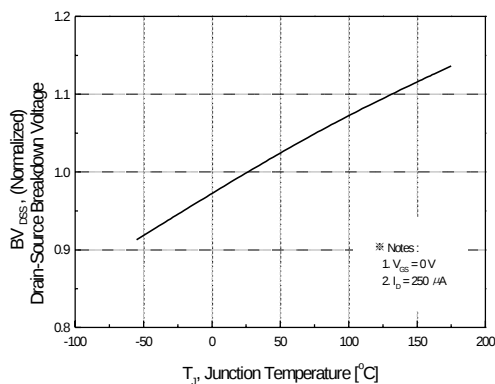


Figure 7. Breakdown Voltage Variation vs. Temperature

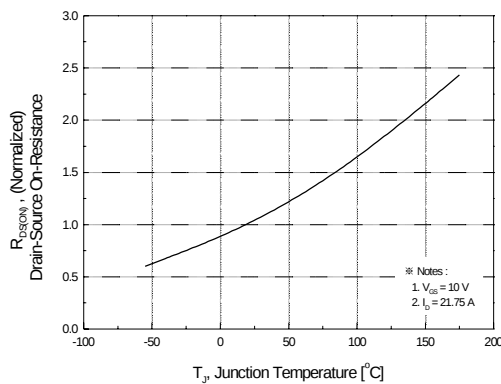


Figure 8. On-Resistance Variation vs. Temperature

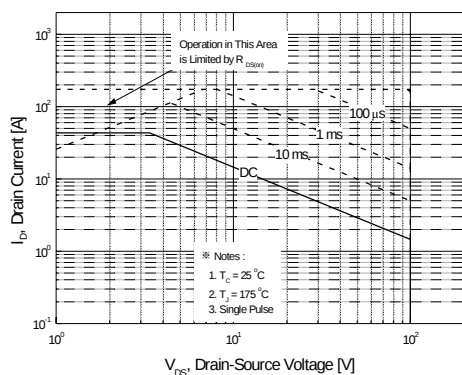


Figure 9. Maximum Safe Operating Area

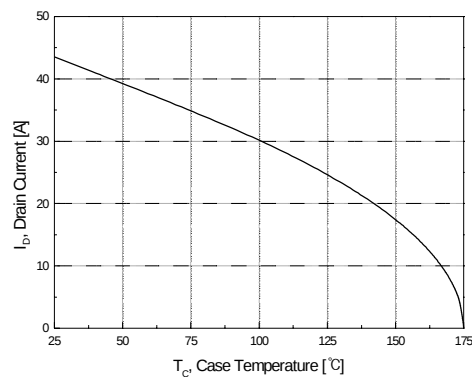


Figure 10. Maximum Drain Current vs. Case Temperature

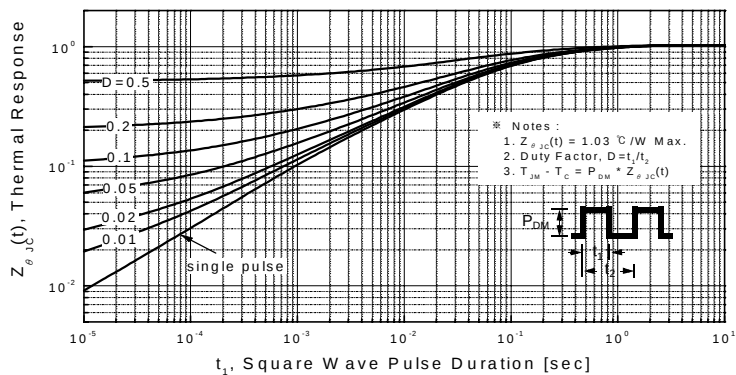


Figure 11. Transient Thermal Response Curve

Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms



Peak Diode Recovery dv/dt Test Circuit & Waveforms



Technical drawing of a 10-pin D-sub connector showing front, side, and top views with dimensions in millimeters.

Front View (Top Left):

- Overall width: 9.90 ± 0.20
- Overall height: 15.30 ± 0.30
- Pin height: 4.90 ± 0.20
- Pin pitch: 2.54 TYP
- Pin diameter: 0.80 ± 0.10
- Pin length: 1.27 ± 0.10
- Top flange height: 1.40 ± 0.20
- Top flange thickness: 0.40
- Internal cavity height: 9.20 ± 0.20
- Internal cavity width: 1.20 ± 0.20

Side View (Top Right):

- Overall width: 4.50 ± 0.20
- Pin height: 2.54 ± 0.30
- Pin pitch: 2.54 TYP
- Pin diameter: 0.80 ± 0.10
- Pin length: 1.27 ± 0.10
- Pin diameter: $0.50^{+0.10}_{-0.05}$
- Pin angle: $0^\circ - 3^\circ$
- Pin length: 2.40 ± 0.20
- Pin length: 0.10 ± 0.15
- Pin length: $1.30^{+0.10}_{-0.05}$
- Pin length: 2.00 ± 0.10
- Pin length: 0.75

Top View (Bottom Left):

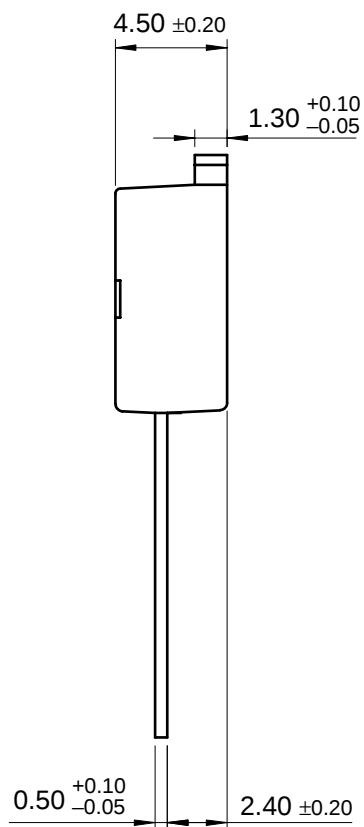
- Overall width: 10.00 ± 0.20

Bottom View (Bottom Right):

- Overall width: 10.00 ± 0.20
- Overall height: 15.30 ± 0.30
- Pin height: 4.90 ± 0.20
- Pin pitch: 2.54 TYP
- Pin diameter: 0.80 ± 0.10
- Pin length: 1.27 ± 0.10
- Pin diameter: $0.50^{+0.10}_{-0.05}$
- Pin angle: $0^\circ - 3^\circ$
- Pin length: 2.40 ± 0.20
- Pin length: 0.10 ± 0.15
- Pin length: $1.30^{+0.10}_{-0.05}$
- Pin length: 2.00 ± 0.10
- Pin length: 0.75

Package Dimensions (Continued)

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