FAIRCHILD

SEMICONDUCTOR®

October 2008

QFET®

FQB8N60C / FQI8N60C

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 switched mode power supplies, active power factor correction, electronic lamp ballasts based on half bridge topology.

Features

- 7.5A, 600V, $R_{DS(on)} = 1.2\Omega$ @$V_{GS} = 10$ V
- Low gate charge (typical 28 nC)
- Low Crss (typical 12 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability
- RoHS Compliant

100% LEAD-FREE IMPLEMENTATION

D²-PAK
FQB Series
G   S

I²-PAK
FQI Series
G D S

D

G

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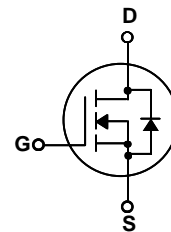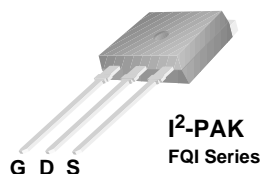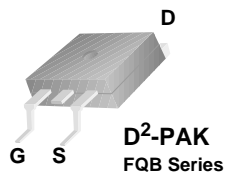
Absolute Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Parameter			FQB8N60C / FQI8N60C	Units
V_{DSS}	Drain-Source Voltage			600	V
I_D	Drain Current	- Continuous ($T_C = 25$°C)		7.5	A
		- Continuous ($T_C = 100$°C)		4.6	A
I_{DM}	Drain Current	- Pulsed	(Note 1)	30	A
V_{GSS}	Gate-Source Voltage			± 30	V
E_{AS}	Single Pulsed Avalanche Energy		(Note 2)	230	mJ
I_{AR}	Avalanche Current		(Note 1)	7.5	A
E_{AR}	Repetitive Avalanche Energy		(Note 1)	14.7	mJ
dv/dt	Peak Diode Recovery dv/dt		(Note 3)	4.5	V/ns
P_D	Power Dissipation ($T_A = 25$°C)*			3.13	W
	Power Dissipation ($T_C = 25$°C)			147	W
	- Derate above 25°C			1.18	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	--	0.85	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient*	--	40	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	62.5	°C/W

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

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Electrical Characteristics $T_C = 25°C$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0$ V, $I_D = 250$ µA	600	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	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	µA
		$V_{DS} = 480$ V, $T_C = 125°C$	--	--	10	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	2.0	--	4.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10$ V, $I_D = 3.75$ A	--	1.0	1.2	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 40$ V, $I_D = 3.75$ A (Note 4)	--	8.7	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = 25$ V, $V_{GS} = 0$ V, f = 1.0 MHz	--	965	1255	pF
C_{oss}	Output Capacitance		--	105	135	pF
C_{rss}	Reverse Transfer Capacitance		--	12	16	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 300$ V, $I_D = 7.5$A, $R_G = 25$ Ω	--	16.5	45	ns
t_r	Turn-On Rise Time		--	60.5	130	ns
$t_{d(off)}$	Turn-Off Delay Time		--	81	170	ns
t_f	Turn-Off Fall Time	(Note 4, 5)	--	64.5	140	ns
Q_g	Total Gate Charge	$V_{DS} = 480$ V, $I_D = 7.5$A, $V_{GS} = 10$ V	--	28	36	nC
Q_{gs}	Gate-Source Charge		--	4.5	--	nC
Q_{gd}	Gate-Drain Charge	(Note 4, 5)	--	12	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	7.5	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	30	A
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0$ V, $I_S = 7.5$ A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0$ V, $I_S = 7.5$ A,	--	365	--	ns
Q_{rr}	Reverse Recovery Charge	$dI_F / dt = 100$ A/µs (Note 4)	--	3.4	--	µC

Notes:
1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 7.3mH, I_{AS} = 7.5 A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C
3. $I_{SD} \leq 7.5A$, di/dt ≤ 200A/µs, $V_{DD} \leq BV_{DSS}$, Starting T_J = 25°C
4. Pulse Test : Pulse width ≤ 300µs, Duty cycle ≤ 2%
5. Essentially independent of operating temperature

FQB8N60C / FQI8N60C

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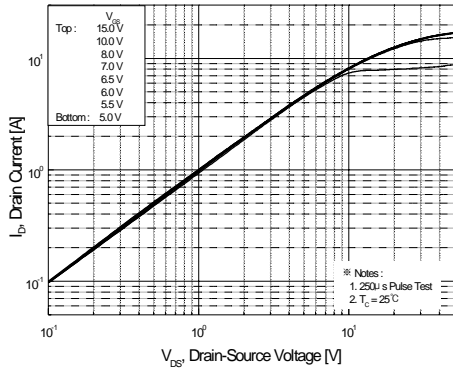
Typical Characteristics

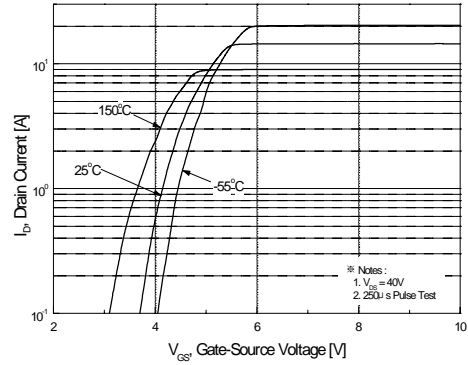**Figure 1. On-Region Characteristics**
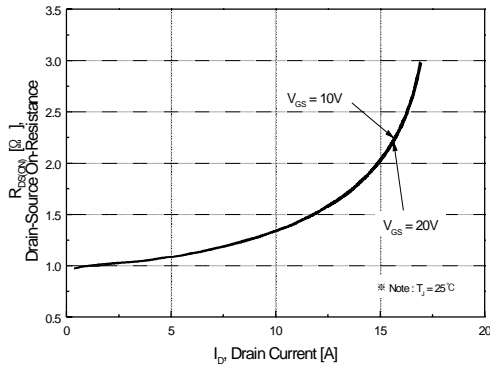

Figure 2. Transfer Characteristics

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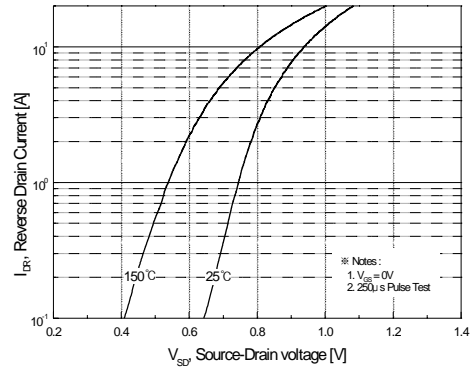

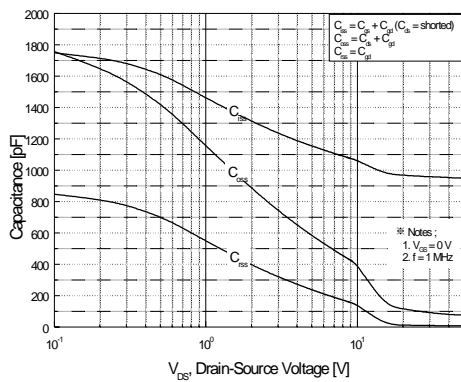**Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature**

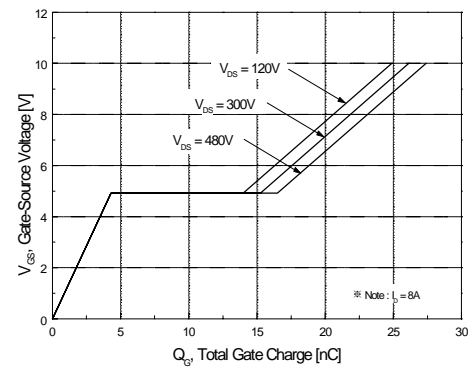**Figure 5. Capacitance Characteristics**

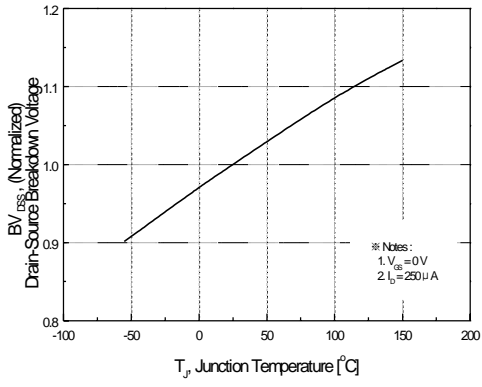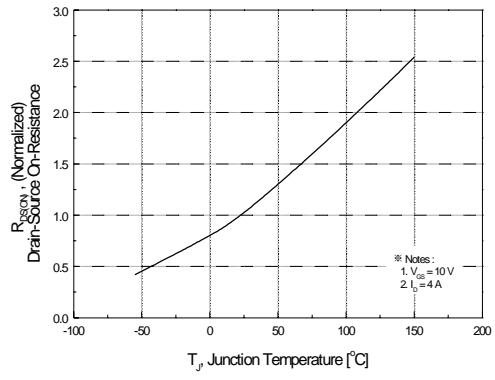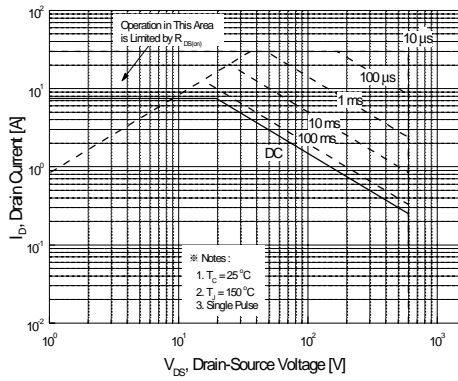**Figure 6. Gate Charge Characteristics**

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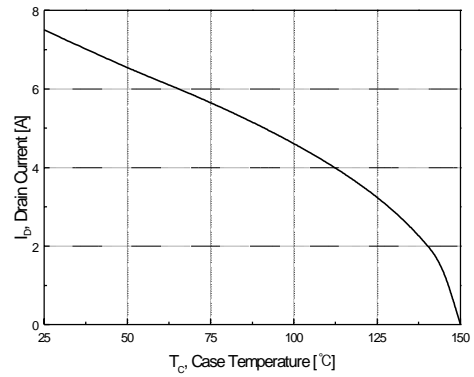
Typical Characteristics (Continued)

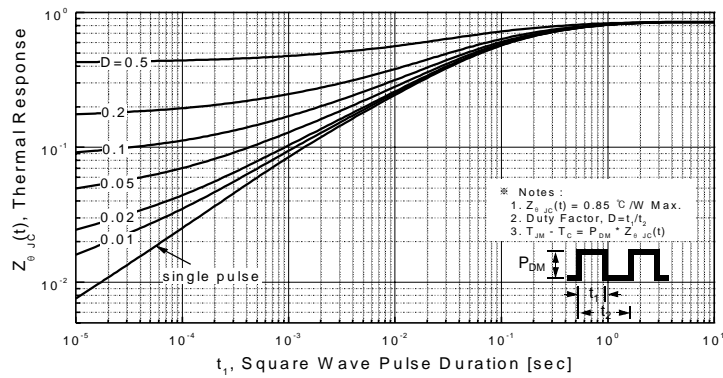**Figure 7. Breakdown Voltage Variation
vs Temperature**

**Figure 8. On-Resistance Variation
vs Temperature**

Figure 9. Maximum Safe Operating Area

**Figure 10. Maximum Drain Current
vs Case Temperature**

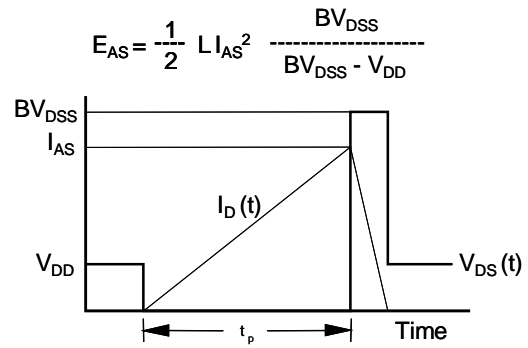
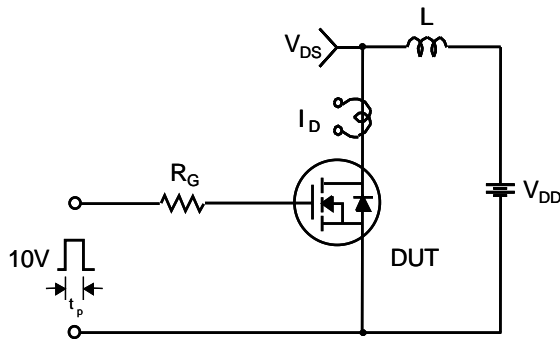**Figure 11. Transient Thermal Response Curve**
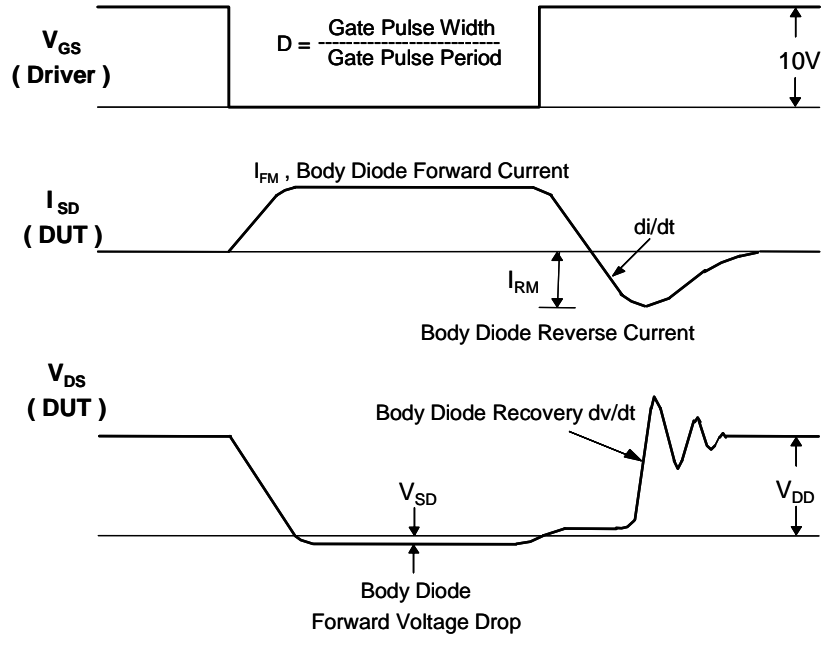
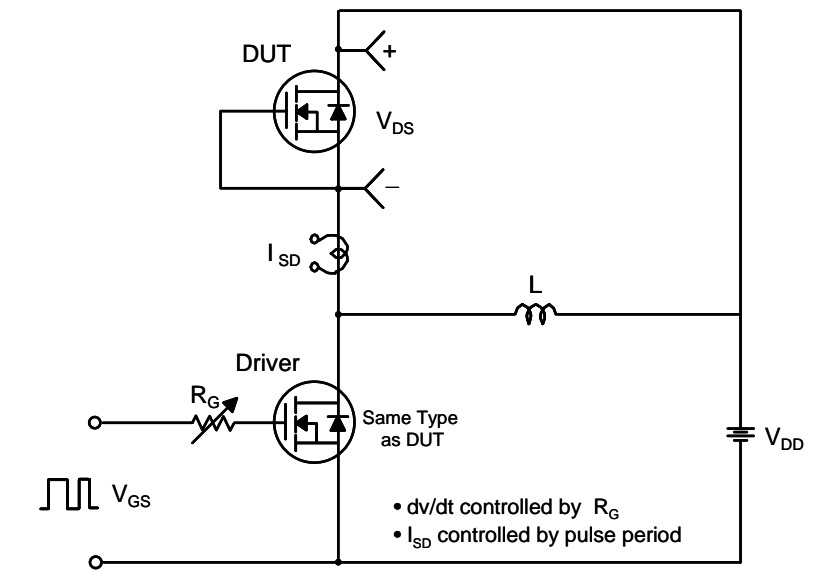**Gate Charge Test Circuit & Waveform**

Resistive Switching Test Circuit & Waveforms

Unclamped Inductive Switching Test Circuit & Waveforms
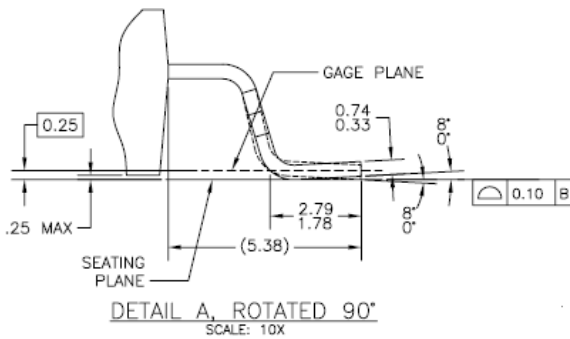
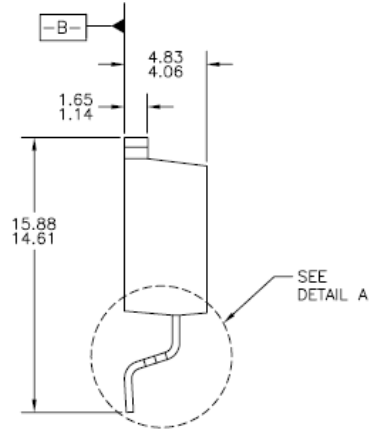$$E_{AS} = \frac{1}{2} L I_{AS}^2 \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$

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Peak Diode Recovery dv/dt Test Circuit & Waveforms

DUT

V_{DS}

+

−

I_{SD}

L

Driver

R_G

Same Type as DUT

V_{DD}

V_{GS}

• dv/dt controlled by R_G
• I_{SD} controlled by pulse period

V_{GS}
(Driver)

$D = \dfrac{\text{Gate Pulse Width}}{\text{Gate Pulse Period}}$

10V

I_{SD}
(DUT)

I_{FM} , Body Diode Forward Current

di/dt

I_{RM}

Body Diode Reverse Current

V_{DS}
(DUT)

Body Diode Recovery dv/dt

V_{SD}

V_{DD}

Body Diode
Forward Voltage Drop

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Mechanical Dimensions

D^2 - PAK

LAND PATTERN RECOMMENDATION

SEE DETAIL A

GAGE PLANE

SEATING PLANE

DETAIL A, ROTATED 90°
SCALE: 10X

Dimensions in Millimeters

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Mechanical Dimensions

I² - PAK

10.29 / 9.65 A

8.33 / 6.22

1.40 / 1.00

7.88 / 6.86

9.65 / 8.64

1 2 3

B 3.96 / 2.80

(2.13)

14.73 / 12.70

B 1.78 / 1.14

2.54

B 0.90 / 0.64

5.08

⊕ 0.254 A Ⓜ B

4.83 / 4.06 B

1.40 / 1.14

7°

5° 5°

2.79 / 2.03

B 0.64 / 0.33

Dimensions in Millimeters

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