FAIRCHILD

SEMICONDUCTOR ™

April 2000

$QFET^{TM}$

FQP7N80

800V 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

- 6.6A, 800V, $R_{DS(on)}$ = 1.5Ω @V_{GS} = 10 V
- Low gate charge (typical 40 nC)
- Low Crss (typical 19 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability

D

G

S

TO-220
FQP Series

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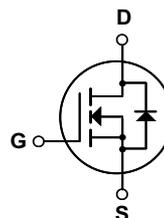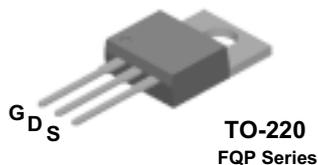
Absolute Maximum Ratings T_C = 25°C unless otherwise noted

Symbol	Parameter			FQP7N80	Units
V_{DSS}	Drain-Source Voltage			800	V
I_D	Drain Current	- Continuous (T_C = 25°C)		6.6	A
		- Continuous (T_C = 100°C)		4.2	A
I_{DM}	Drain Current	- Pulsed	(Note 1)	26.4	A
V_{GSS}	Gate-Source Voltage			± 30	V
E_{AS}	Single Pulsed Avalanche Energy		(Note 2)	580	mJ
I_{AR}	Avalanche Current		(Note 1)	6.6	A
E_{AR}	Repetitive Avalanche Energy		(Note 1)	16.7	mJ
dv/dt	Peak Diode Recovery dv/dt		(Note 3)	4.0	V/ns
P_D	Power Dissipation (T_C = 25°C)			167	W
		- Derate above 25°C		1.34	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	--	0.75	°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

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	800	--	--	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	--	0.77	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 800 V, V_{GS} = 0 V	--	--	10	μA
		V_{DS} = 640 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 = 3.3 A	--	1.2	1.5	Ω
g_{FS}	Forward Transconductance	V_{DS} = 50 V, I_D = 3.3 A (Note 4)	--	5	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	--	1420	1850	pF
C_{oss}	Output Capacitance		--	150	195	pF
C_{rss}	Reverse Transfer Capacitance		--	19	25	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 400 V, I_D = 6.6 A, R_G = 25 Ω	--	35	80	ns
t_r	Turn-On Rise Time		--	80	170	ns
$t_{d(off)}$	Turn-Off Delay Time		--	95	200	ns
t_f	Turn-Off Fall Time	(Note 4, 5)	--	55	120	ns
Q_g	Total Gate Charge	V_{DS} = 640 V, I_D = 6.6 A, V_{GS} = 10 V	--	40	52	nC
Q_{gs}	Gate-Source Charge		--	8.5	--	nC
Q_{gd}	Gate-Drain Charge	(Note 4, 5)	--	20	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	6.6	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	26.4	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 6.6 A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 6.6 A, dI_F / dt = 100 A/μs (Note 4)	--	400	--	ns
Q_{rr}	Reverse Recovery Charge		--	4.3	--	μC

Notes:
1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 25mH, I_{AS} = 6.6A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C
3. $I_{SD} \leq$ 6.6A, di/dt $\leq$ 400A/μs, $V_{DD} \leq BV_{DSS}$, Starting T_J = 25°C
4. Pulse Test : Pulse width $\leq$ 300μs, Duty cycle $\leq$ 2%
5. Essentially independent of operating temperature

Typical Characteristics
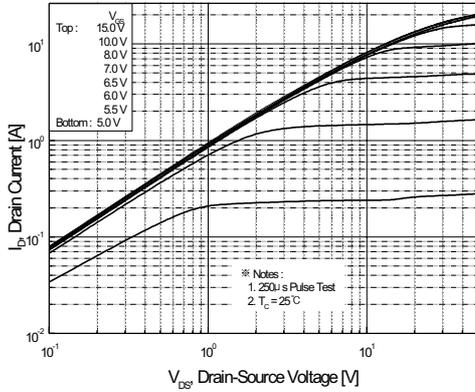
Figure 1. On-Region Characteristics
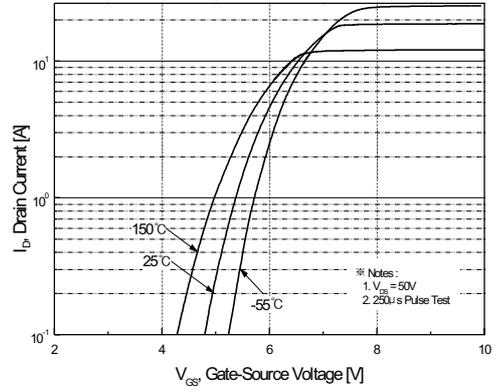
Figure 2. Transfer Characteristics
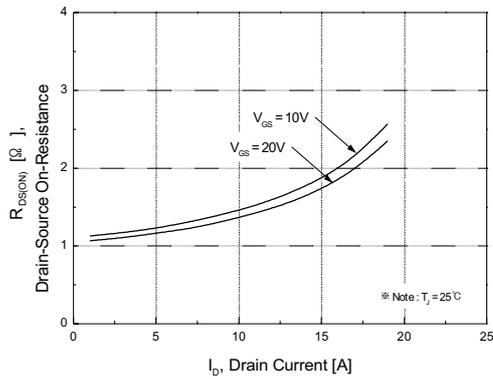
Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage
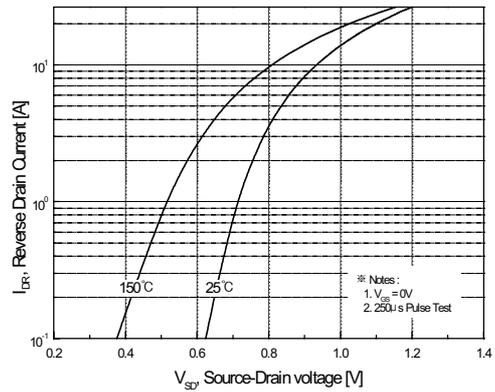
Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature
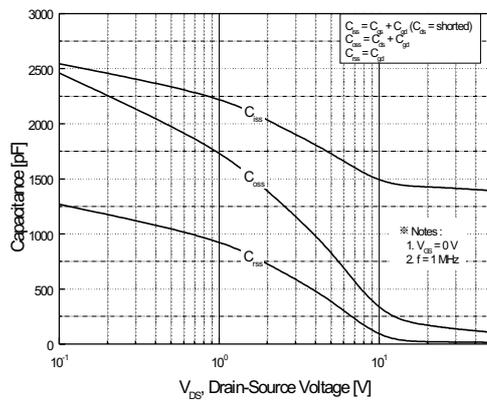
Figure 5. Capacitance Characteristics
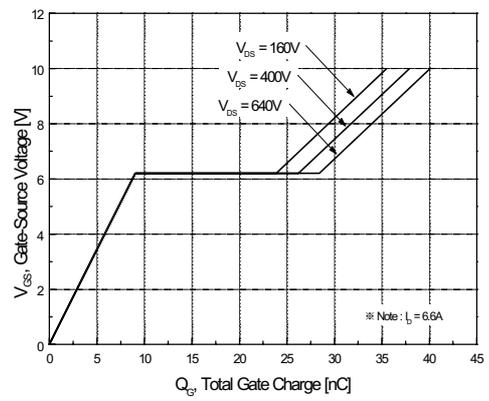
Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)
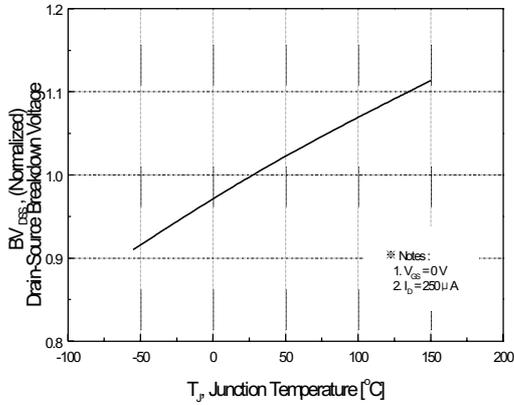
Figure 7. Breakdown Voltage Variation vs. Temperature.
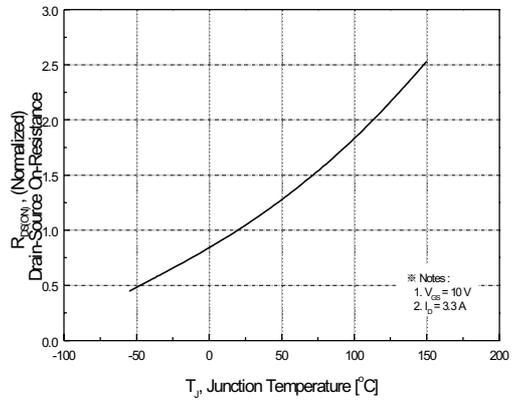
Figure 8. On-Resistance Variation vs. Temperature
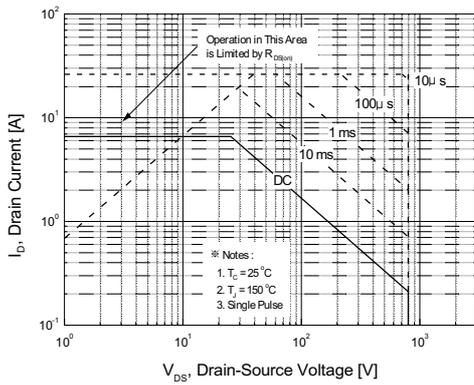
Figure 9. Maximum Safe Operating Area
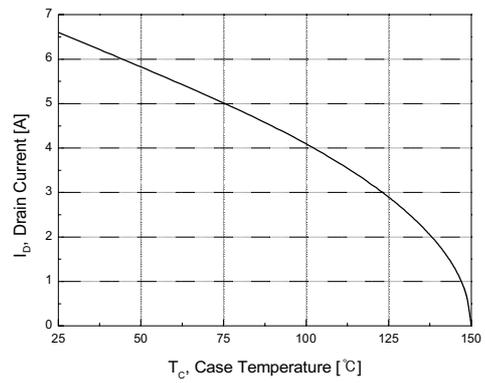
Figure 10. Maximum Drain Current vs. Case Temperature
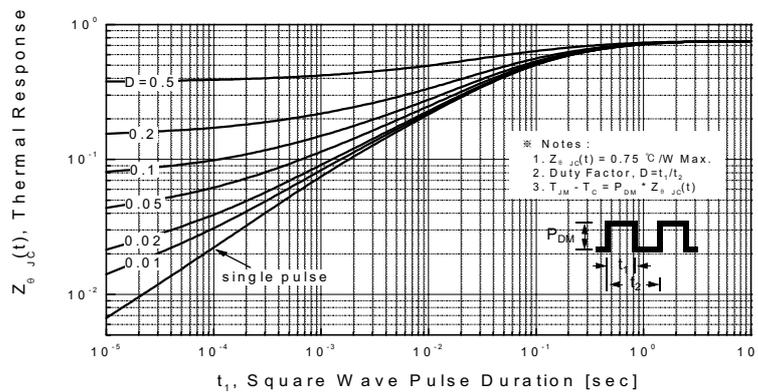
Figure 11. Transient Thermal Response Curve

Gate Charge Test Circuit & Waveform

12V
200nF
50KΩ
300nF
Same Type as DUT
V_{DS}
V_{GS}
3mA
DUT

V_{GS}
10V
Q_g
Q_{gs}
Q_{gd}
Charge

Resistive Switching Test Circuit & Waveforms

V_{DS}
R_L
V_{DD}
V_{GS}
R_G
10V
DUT

V_{DS}
90%
V_{GS}
10%
$t_{d(on)}$
t_r
$t_{d(off)}$
t_f
t_{on}
t_{off}
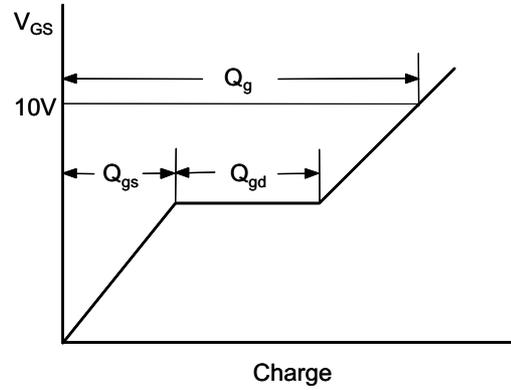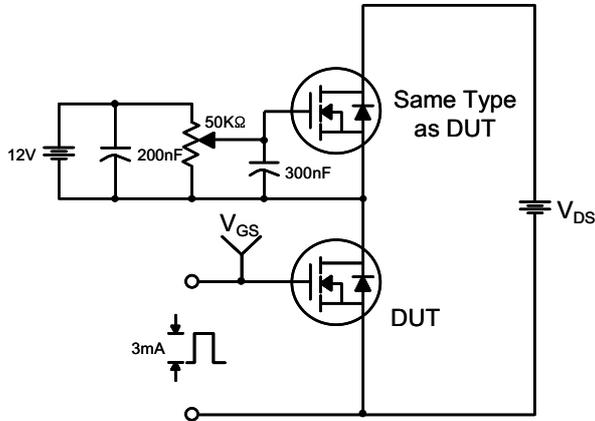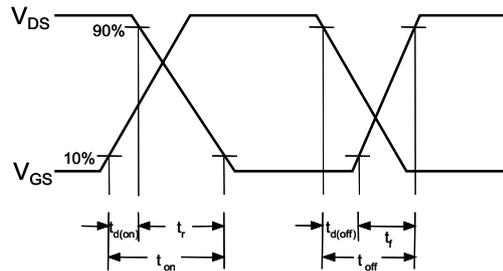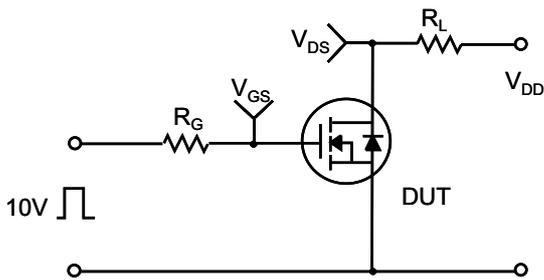
Unclamped Inductive Switching Test Circuit & Waveforms

V_{DS}
L
I_D
R_G
V_{DD}
10V
t_p
DUT

$$E_{AS} = \frac{1}{2} L I_{AS}^2 \; \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$

BV_{DSS}
I_{AS}
$I_D(t)$
V_{DD}
$V_{DS}(t)$
t_p
Time
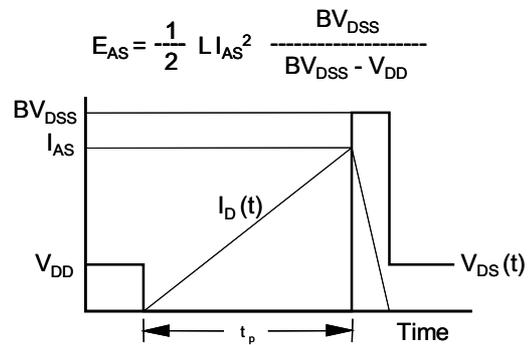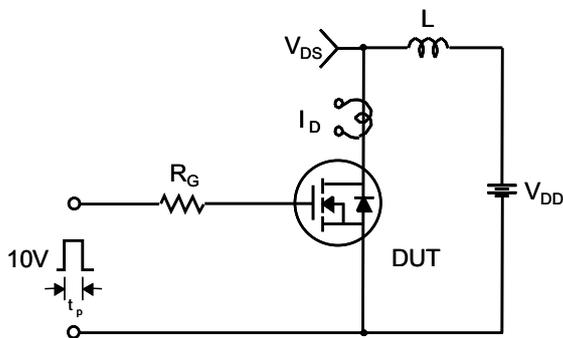
Peak Diode Recovery dv/dt Test Circuit & Waveforms

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

Package Dimensions

TO - 220

Dimensions in Millimeters
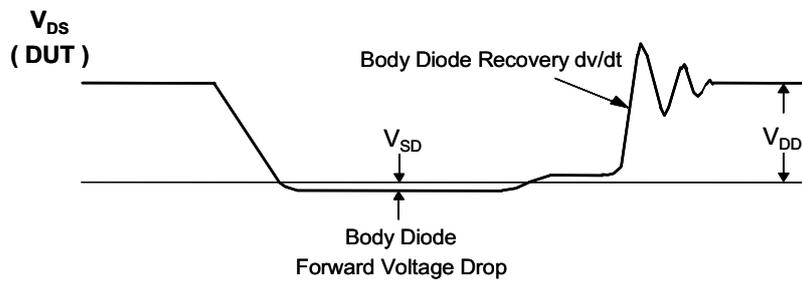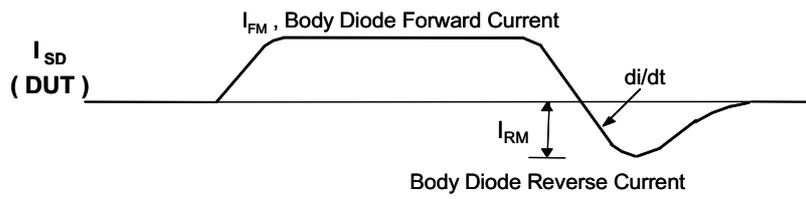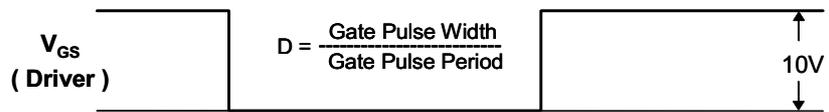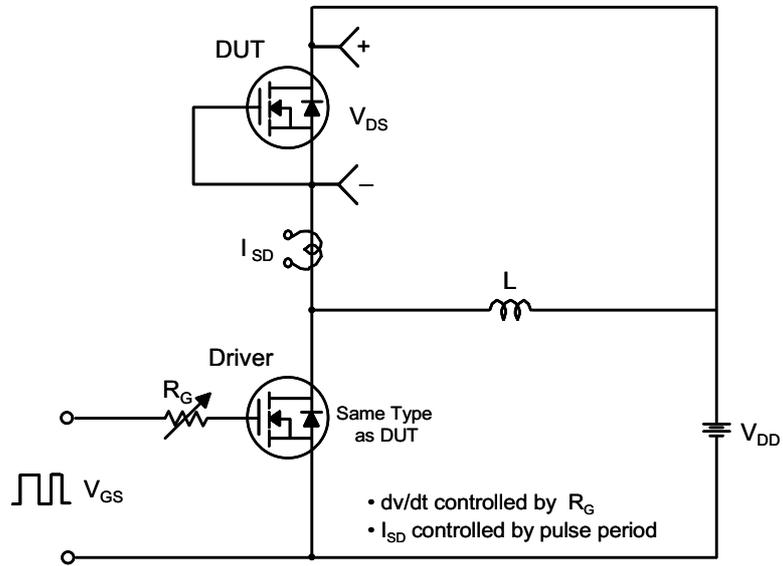
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