

FQP4N20L

N-Channel QFET® MOSFET

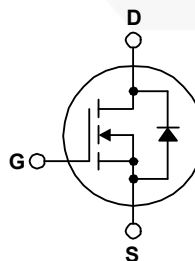
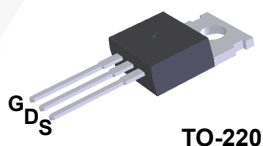
200 V, 3.8 A, 1.35 Ω

Description

These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology. This advanced technology is especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation modes. These devices are well suited for high efficiency switching DC/DC converters, switch mode power supplies, and motor control.

Features

- 3.8 A, 200 V, $R_{DS(on)} = 1.35 \Omega$ (Max.) @ $V_{GS} = 10 \text{ V}$, $I_D = 1.9 \text{ A}$
- Low Gate Charge (Typ. 4.0 nC)
- Low C_{rss} (Typ. 6.0 pF)
- 100% Avalanche Tested



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

Symbol	Parameter	FQP4N20L	Unit
V_{DSS}	Drain-Source Voltage	200	V
I_D	Drain Current - Continuous ($T_C = 25^\circ\text{C}$)	3.8	A
	- Continuous ($T_C = 100^\circ\text{C}$)	2.4	A
I_{DM}	Drain Current - Pulsed (Note 1)	15.2	A
V_{GSS}	Gate-Source Voltage	± 20	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	52	mJ
I_{AR}	Avalanche Current (Note 1)	3.8	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	4.5	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	5.5	V/ns
P_D	Power Dissipation ($T_C = 25^\circ\text{C}$)	45	W
	- Derate above 25°C	0.36	W/ $^\circ\text{C}$
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$
T_L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300	$^\circ\text{C}$

Thermal Characteristics

Symbol	Parameter	FQP4N20L	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	2.78	$^\circ\text{C}/\text{W}$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink, Typ.	0.5	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	$^\circ\text{C}/\text{W}$

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FQP4N20L	FQP4N20L	TO-220	Tube	N/A	N/A	50 units

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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Off Characteristics

BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	200	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, Referenced to 25°C	--	0.16	--	V/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 200\text{ V}, V_{GS} = 0\text{ V}$	--	--	1	μA
		$V_{DS} = 160\text{ V}, T_C = 125^\circ\text{C}$	--	--	10	μA
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{GS} = -20\text{ V}, V_{DS} = 0\text{ V}$	--	--	-100	nA

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\ \mu\text{A}$	1.0	--	2.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 1.9\text{ A}$	--	1.10	1.35	Ω
		$V_{GS} = 5\text{ V}, I_D = 1.9\text{ A}$	--	1.13	1.40	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 25\text{ V}, I_D = 1.9\text{ A}$	--	3.2	--	S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	240	310	pF
C_{oss}	Output Capacitance		--	36	45	pF
C_{rss}	Reverse Transfer Capacitance		--	6	8	pF

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 100\text{ V}, I_D = 3.8\text{ A},$ $R_G = 25\ \Omega$	--	7	25	ns	
t_r	Turn-On Rise Time		--	70	150	ns	
$t_{d(off)}$	Turn-Off Delay Time		(Note 4)	--	15	40	ns
t_f	Turn-Off Fall Time		(Note 4)	--	40	90	ns
Q_g	Total Gate Charge	$V_{DS} = 160\text{ V}, I_D = 3.8\text{ A},$ $V_{GS} = 5\text{ V}$	--	4.0	5.2	nC	
Q_{gs}	Gate-Source Charge		(Note 4)	--	1.0	--	nC
Q_{gd}	Gate-Drain Charge		(Note 4)	--	1.9	--	nC

Drain-Source Diode Characteristics and Maximum Ratings

I_S	Maximum Continuous Drain-Source Diode Forward Current	--	--	3.8	A	
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current	--	--	15.2	A	
V_{SD}	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 3.8\text{ A}$	--	--	1.5	V
t_{rr}	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_S = 3.8\text{ A},$ $di_F / dt = 100\text{ A}/\mu\text{s}$	--	90	--	ns
Q_{rr}	Reverse Recovery Charge		--	0.25	--	μC

Notes:

1. Repetitive rating : pulse-width limited by maximum junction temperature.
2. $L = 5.4\text{ mH}, I_{AS} = 3.8\text{ A}, V_{DD} = 50\text{ V}, R_G = 25\ \Omega,$ starting $T_J = 25^\circ\text{C}$.
3. $I_{SD} \leq 3.8\text{ A}, di/dt \leq 300\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS},$ starting $T_J = 25^\circ\text{C}$.
4. Essentially independent of operating temperature.

Typical Characteristics

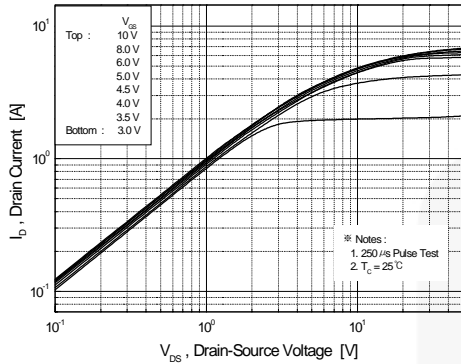


Figure 1. On-Region Characteristics

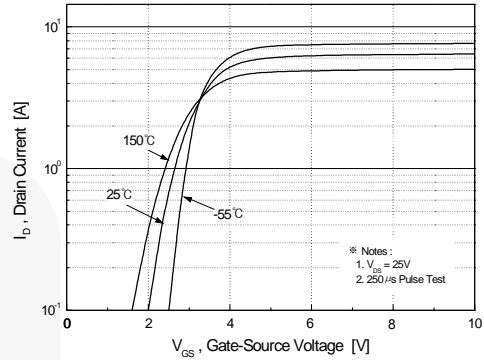


Figure 2. Transfer Characteristics

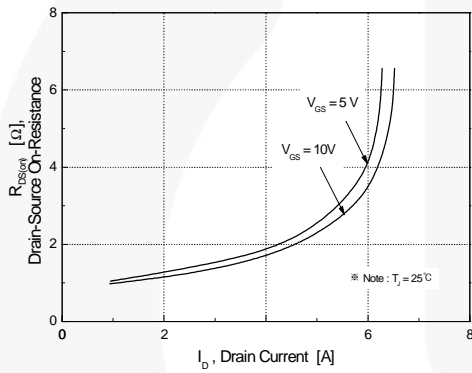


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

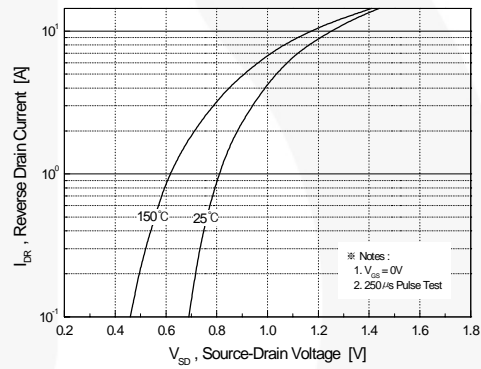


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

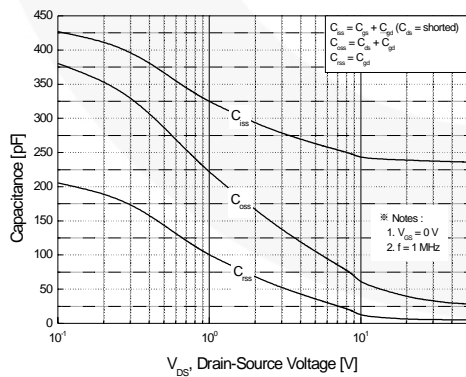


Figure 5. Capacitance Characteristics

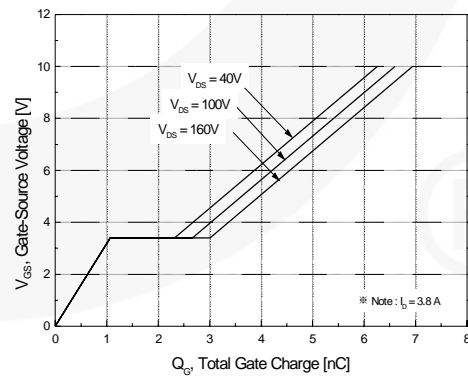


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

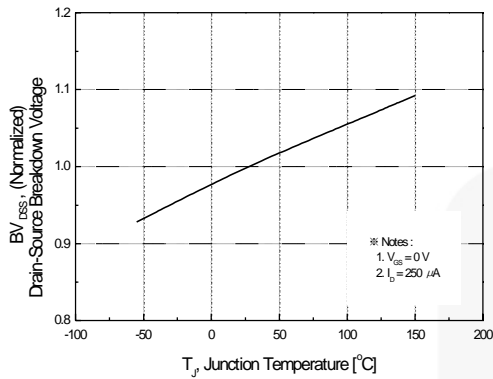


Figure 7. Breakdown Voltage Variation vs. Temperature

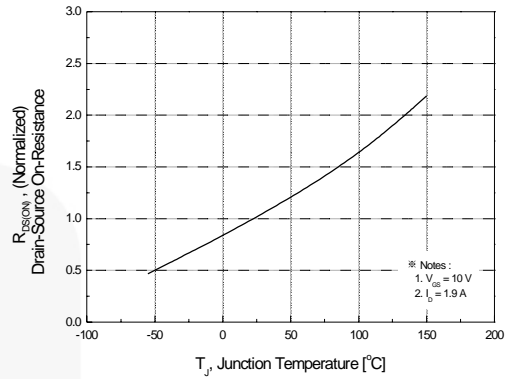


Figure 8. On-Resistance Variation vs. Temperature

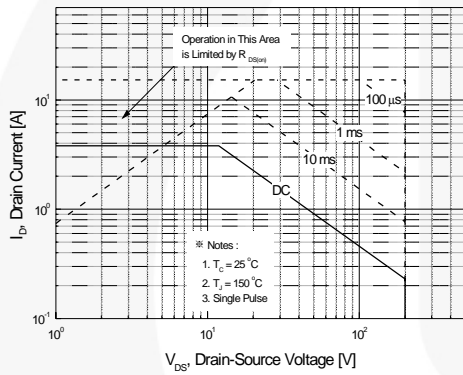


Figure 9. Maximum Safe Operating Area

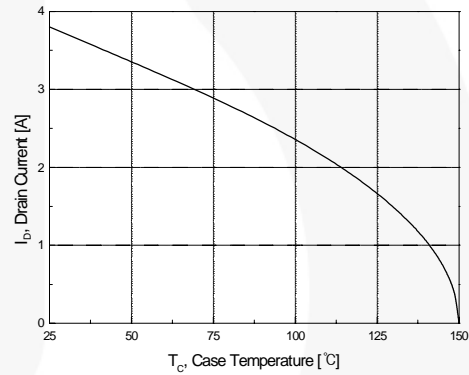


Figure 10. Maximum Drain Current vs. Case Temperature

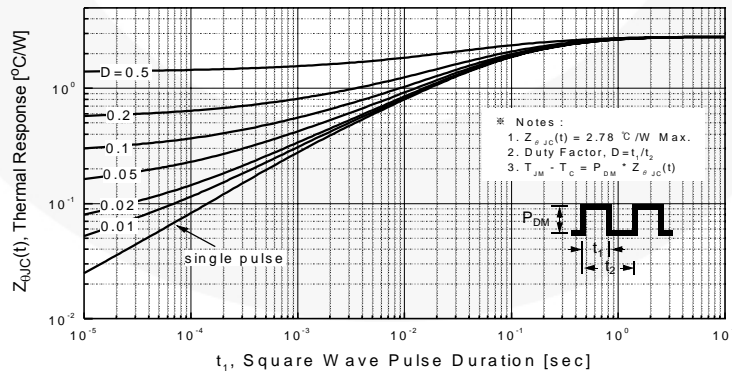


Figure 11. Transient Thermal Response Curve

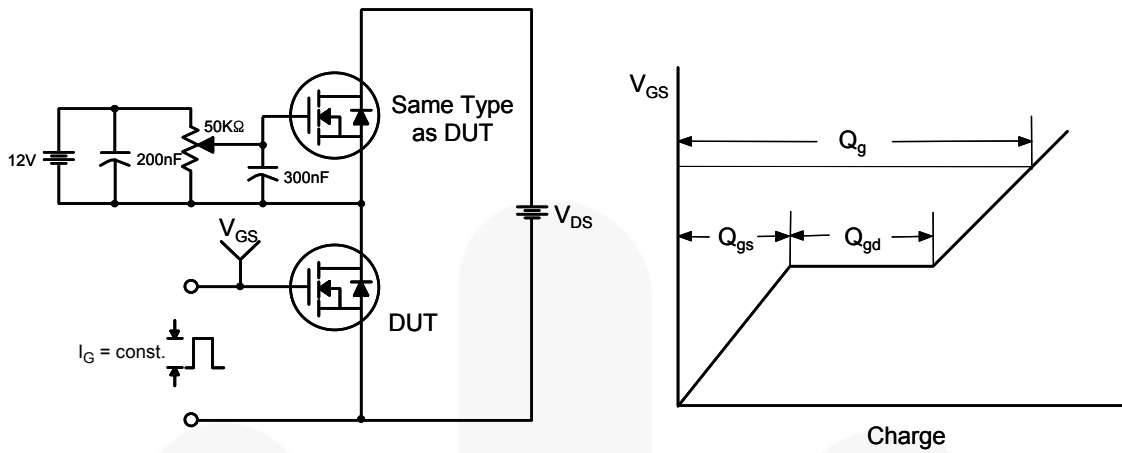


Figure 12. Gate Charge Test Circuit & Waveform



Figure 13. Resistive Switching Test Circuit & Waveforms



Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms



Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions

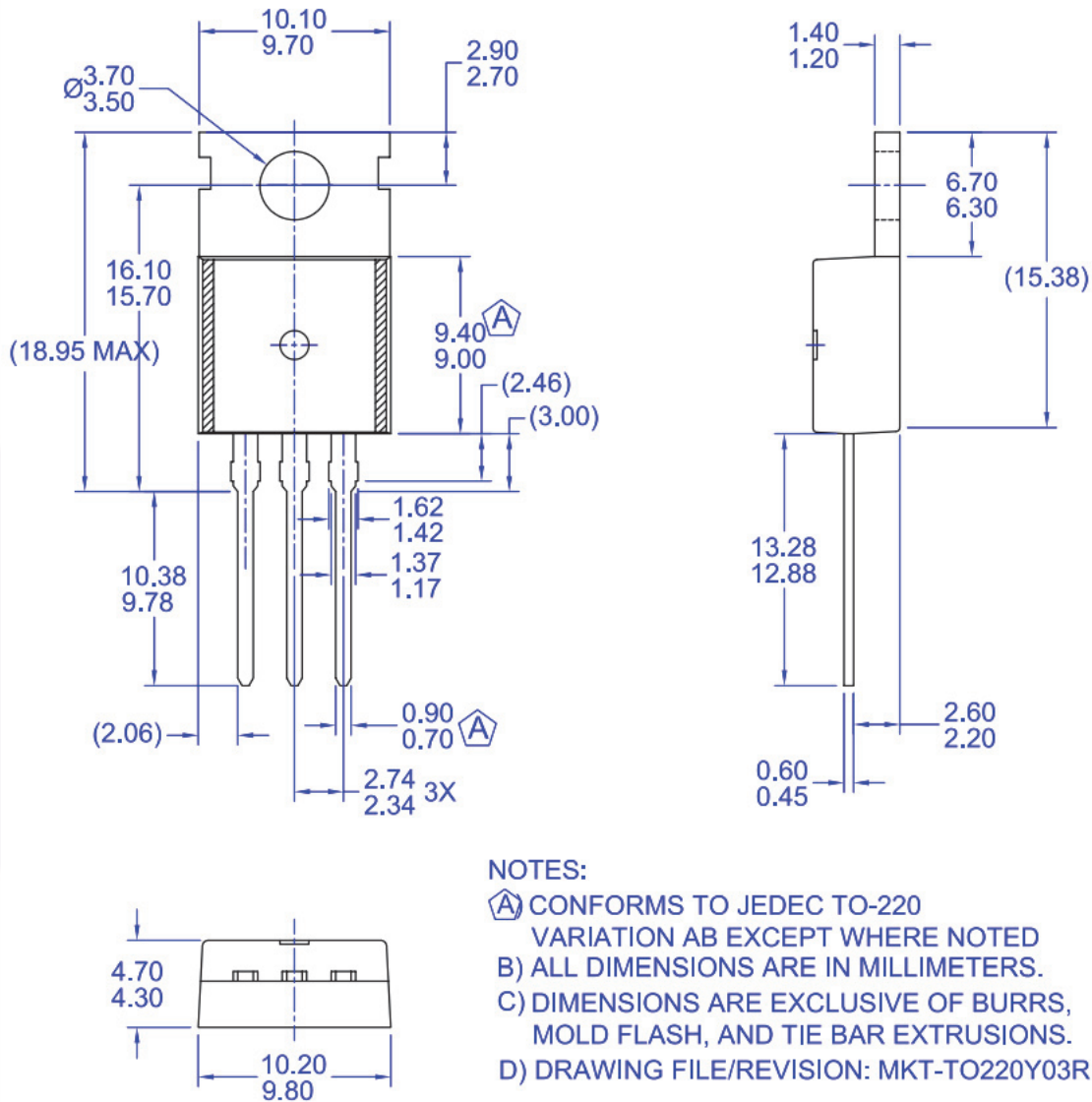


Figure 16. TO220, Molded, 3-Lead, Jedec Variation AB

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