

# **FQP4N20L**

## **200V LOGIC N-Channel MOSFET**

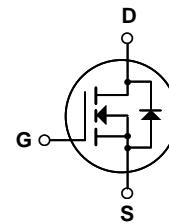
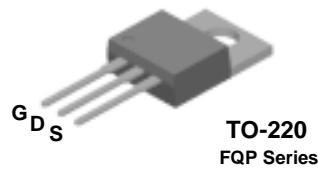
### **General Description**

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

This advanced technology 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**

- 3.8A, 200V,  $R_{DS(on)} = 1.35\Omega$  @  $V_{GS} = 10$  V
- Low gate charge ( typical 4.0 nC)
- Low  $C_{rss}$  ( typical 6.0 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability
- Low level gate drive requirement allowing direct operation from logic drivers



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

Symbol	Parameter	FQP4N20L	Units
$V_{DSS}$	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)	A
$V_{GSS}$	Gate-Source Voltage	$\pm 20$	V
$E_{AS}$	Single Pulsed Avalanche Energy	(Note 2)	mJ
$I_{AR}$	Avalanche Current	(Note 1)	A
$E_{AR}$	Repetitive Avalanche Energy	(Note 1)	mJ
$dv/dt$	Peak Diode Recovery $dv/dt$	(Note 3)	V/ns
$P_D$	Power Dissipation ( $T_C = 25^\circ\text{C}$ )	45	W
	- Derate above $25^\circ\text{C}$	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	Typ	Max	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	2.78	$^\circ\text{C}/\text{W}$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink	0.5	--	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	62.5	$^\circ\text{C}/\text{W}$

## Electrical Characteristics

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>Off Characteristics</b>						
$\text{BV}_{\text{DSS}}$	Drain-Source Breakdown Voltage	$V_{\text{GS}} = 0 \text{ V}$ , $I_D = 250 \mu\text{A}$	200	--	--	V
$\Delta \text{BV}_{\text{DSS}} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250 \mu\text{A}$ , Referenced to $25^\circ\text{C}$	--	0.16	--	$\text{V}/^\circ\text{C}$
$I_{\text{DSS}}$	Zero Gate Voltage Drain Current	$V_{\text{DS}} = 200 \text{ V}$ , $V_{\text{GS}} = 0 \text{ V}$	--	--	1	$\mu\text{A}$
		$V_{\text{DS}} = 160 \text{ V}$ , $T_C = 125^\circ\text{C}$	--	--	10	$\mu\text{A}$
$I_{\text{GSSF}}$	Gate-Body Leakage Current, Forward	$V_{\text{GS}} = 20 \text{ V}$ , $V_{\text{DS}} = 0 \text{ V}$	--	--	100	nA
$I_{\text{GSSR}}$	Gate-Body Leakage Current, Reverse	$V_{\text{GS}} = -20 \text{ V}$ , $V_{\text{DS}} = 0 \text{ V}$	--	--	-100	nA

## On Characteristics

$V_{\text{GS(th)}}$	Gate Threshold Voltage	$V_{\text{DS}} = V_{\text{GS}}$ , $I_D = 250 \mu\text{A}$	1.0	--	2.0	V
$R_{\text{DS(on)}}$	Static Drain-Source On-Resistance	$V_{\text{GS}} = 10 \text{ V}$ , $I_D = 1.9 \text{ A}$ $V_{\text{GS}} = 5 \text{ V}$ , $I_D = 1.9 \text{ A}$	--	1.10 1.13	1.35 1.40	$\Omega$
$g_{\text{FS}}$	Forward Transconductance	$V_{\text{DS}} = 25 \text{ V}$ , $I_D = 1.9 \text{ A}$ (Note 4)	--	3.2	--	S

## Dynamic Characteristics

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

## Switching Characteristics

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

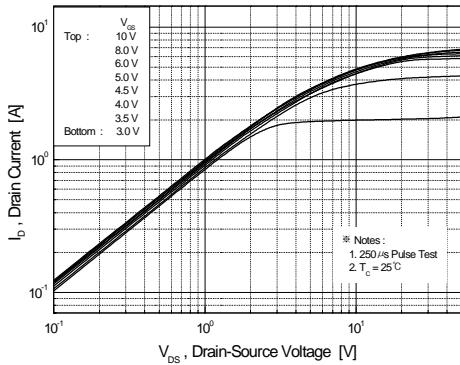
## Drain-Source Diode Characteristics and Maximum Ratings

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

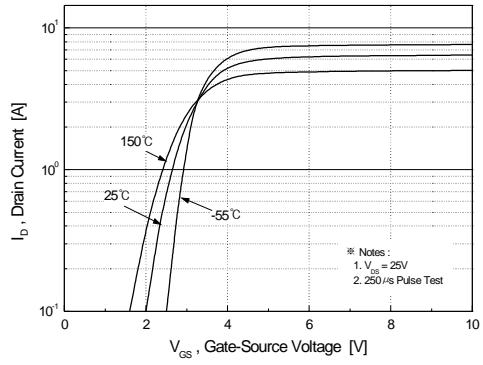
### Notes:

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.  $I_{SD} \leq 3.8\text{A}$ ,  $dV/dt \leq 300\text{A}/\mu\text{s}$ ,  $V_{DD} \leq \text{BV}_{\text{DSS}}$  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

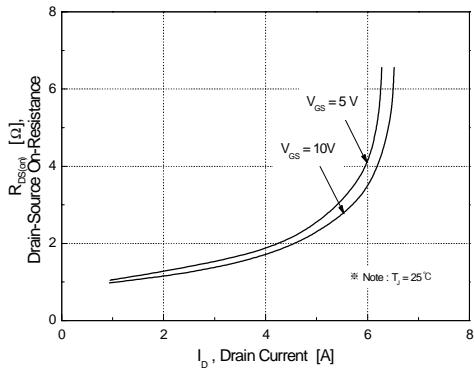
## Typical Characteristics



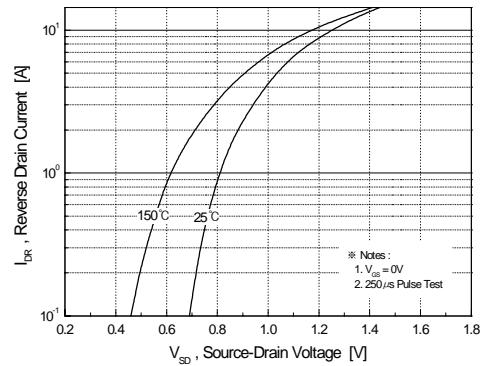
**Figure 1. On-Region Characteristics**



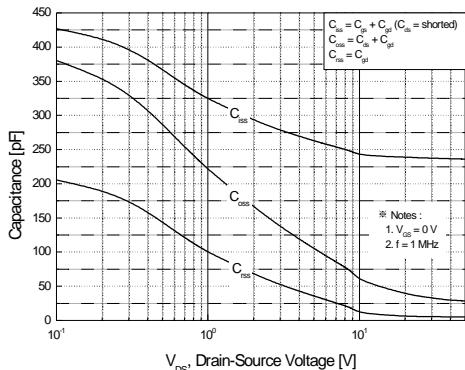
**Figure 2. Transfer Characteristics**



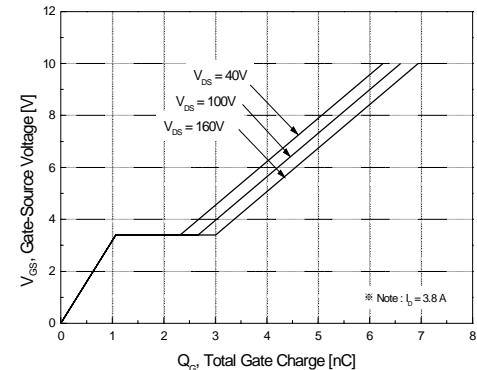
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



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



**Figure 5. Capacitance Characteristics**



**Figure 6. Gate Charge Characteristics**