

# FQU20N06L

## N-Channel QFET® MOSFET

60 V, 17.2 A, 42 mΩ

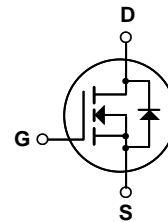
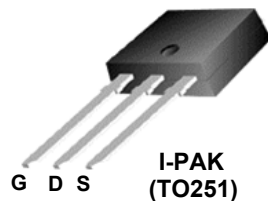


### Description

This N-Channel enhancement mode power MOSFET is produced using Fairchild Semiconductor®'s proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state resistance, and to provide superior switching performance and high avalanche energy strength. These devices are suitable for switched mode power supplies, audio amplifier, DC motor control, and variable switching power applications.

### Features

- 17.2 A, 60 V,  $R_{DS(on)}=42\text{ m}\Omega(\text{Max.})@V_{GS}=10\text{ V}, I_D=8.6\text{ A}$
- Low Gate Charge (Typ. 9.5 nC)
- Low  $C_{rss}$  (Typ. 35 pF)
- 100% Avalanche Tested
- 175°C Maximum Junction Temperature Rating



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

Symbol	Parameter	FQU20N06L	Unit
$V_{DSS}$	Drain-Source Voltage	60	V
$I_D$	Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ ) - Continuous ( $T_C = 100^\circ\text{C}$ )	17.2	A
		10.9	A
$I_{DM}$	Drain Current - Pulsed (Note 1)	68.8	A
$V_{GSS}$	Gate-Source Voltage	$\pm 20$	V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	170	mJ
$I_{AR}$	Avalanche Current (Note 1)	17.2	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	3.8	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	7.0	V/ns
$P_D$	Power Dissipation ( $T_A = 25^\circ\text{C}$ ) *	2.5	W
	Power Dissipation ( $T_C = 25^\circ\text{C}$ ) - Derate above $25^\circ\text{C}$	38	W
		0.30	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	FQU20N06L	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	3.28	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max. *	50	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	110	$^\circ\text{C}/\text{W}$

\* 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	Unit
<b>Off Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\ \mu\text{A}$	60	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$	--	0.06	--	V/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$	--	--	1	$\mu\text{A}$
		$V_{DS} = 48\text{ V}, T_C = 125^\circ\text{C}$	--	--	10	$\mu\text{A}$
$I_{GSSF}$	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	--	2.5	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 8.6\text{ A}$	--	0.046	0.06	$\Omega$
		$V_{GS} = 5\text{ V}, I_D = 8.6\text{ A}$	--	0.057	0.075	
$g_{FS}$	Forward Transconductance	$V_{DS} = 25\text{ V}, I_D = 8.6\text{ A}$	--	11	--	S

**Dynamic Characteristics**

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	480	630	pF
$C_{oss}$	Output Capacitance		--	175	230	pF
$C_{rss}$	Reverse Transfer Capacitance		--	35	45	pF

**Switching Characteristics**

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 30\text{ V}, I_D = 10.5\text{ A},$ $R_G = 25\ \Omega$	--	10	30	ns
$t_r$	Turn-On Rise Time		--	165	340	ns
$t_{d(off)}$	Turn-Off Delay Time		--	35	80	ns
$t_f$	Turn-Off Fall Time		(Note 4)	--	70	150
$Q_g$	Total Gate Charge	$V_{DS} = 48\text{ V}, I_D = 21\text{ A},$ $V_{GS} = 5\text{ V}$	--	9.5	13	nC
$Q_{gs}$	Gate-Source Charge		--	2.5	--	nC
$Q_{gd}$	Gate-Drain Charge		(Note 4)	--	5.5	--

**Drain-Source Diode Characteristics and Maximum Ratings**

$I_S$	Maximum Continuous Drain-Source Diode Forward Current	--	--	17.2	A	
$I_{SM}$	Maximum Pulsed Drain-Source Diode Forward Current	--	--	68.8	A	
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}, I_S = 17.2\text{ A}$	--	--	1.5	V
$t_{rr}$	Reverse Recovery Time	$V_{GS} = 0\text{ V}, I_F = 21\text{ A},$ $di_F / dt = 100\text{ A}/\mu\text{s}$	--	54	--	ns
$Q_{rr}$	Reverse Recovery Charge		--	75	--	nC

**Notes:**

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $L = 670\ \mu\text{H}, I_{AS} = 17.2\text{ A}, V_{DD} = 25\text{ V}, R_G = 25\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 21\text{ A}, di/dt \leq 300\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$
4. Essentially independent of operating temperature

## Typical Characteristics

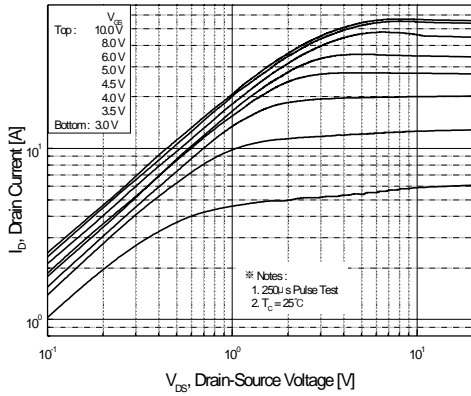


Figure 1. On-Region Characteristics

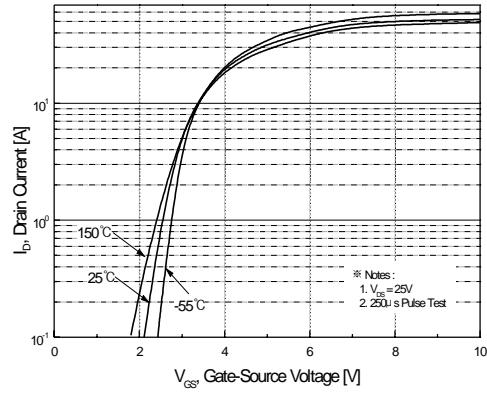


Figure 2. Transfer Characteristics

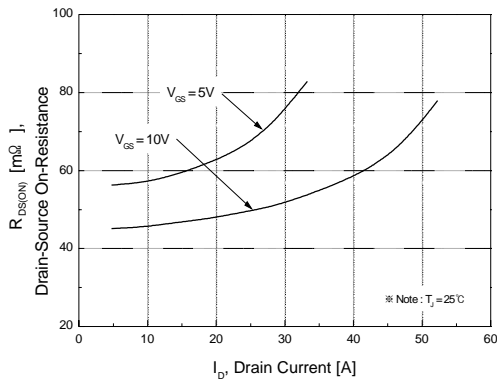


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

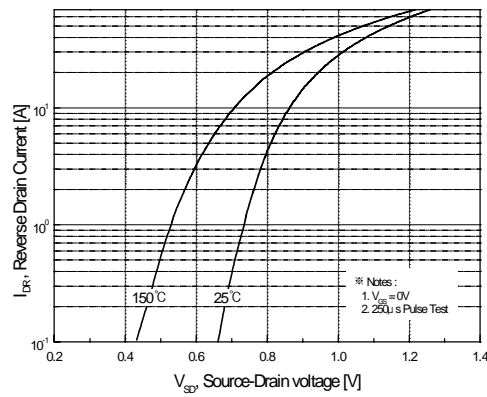


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

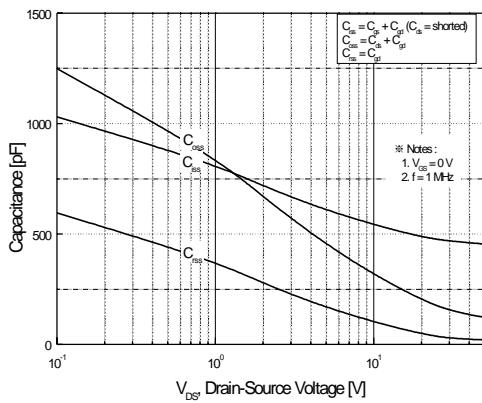


Figure 5. Capacitance Characteristics

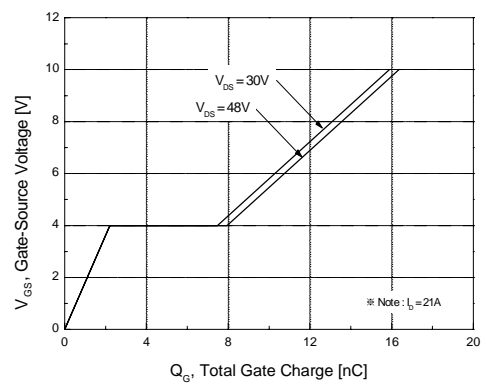
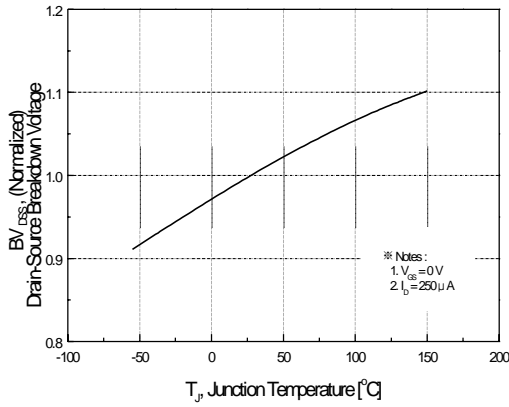
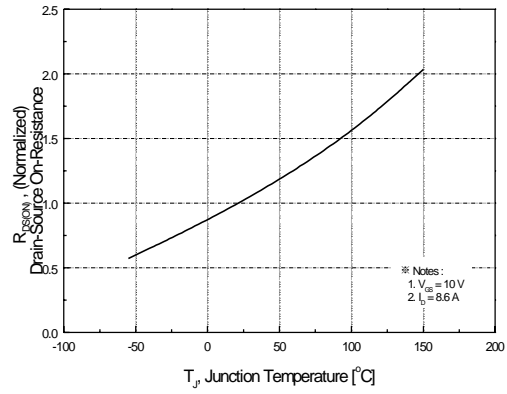


Figure 6. Gate Charge Characteristics

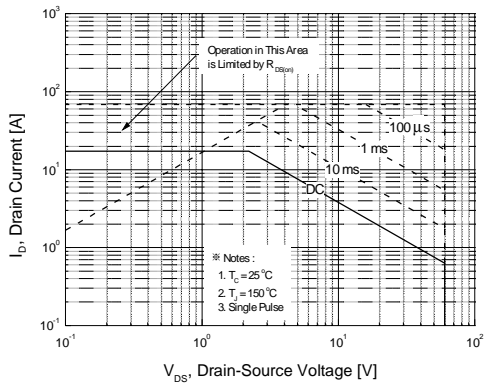
**Typical Characteristics** (Continued)



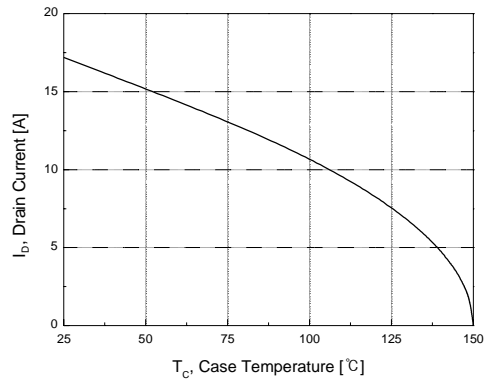
**Figure 7. Breakdown Voltage Variation vs. Temperature**



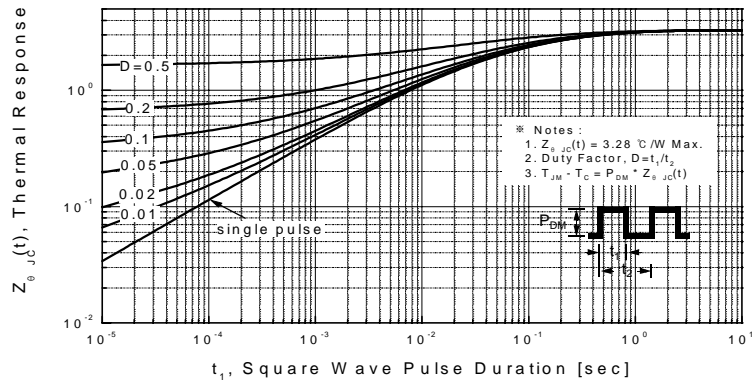
**Figure 8. On-Resistance Variation vs. Temperature**



**Figure 9. Maximum Safe Operating Area**

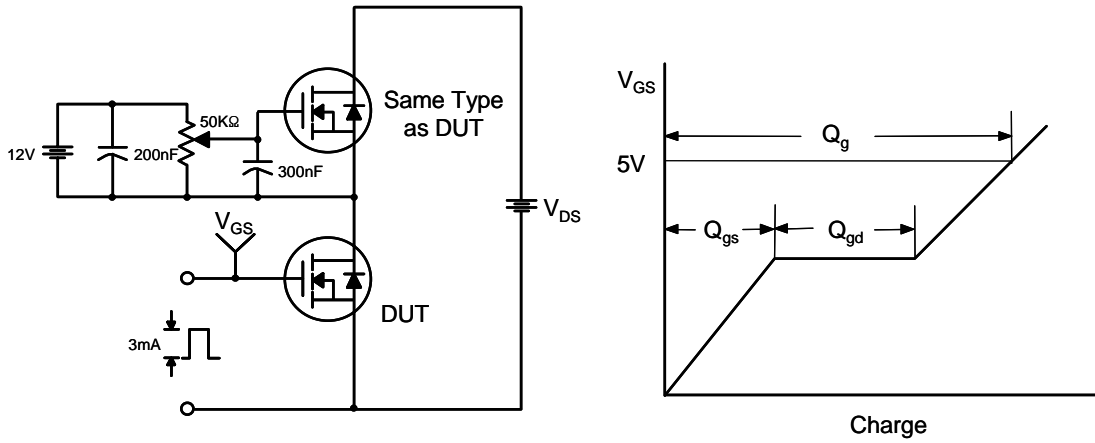


**Figure 10. Maximum Drain Current vs. Case Temperature**

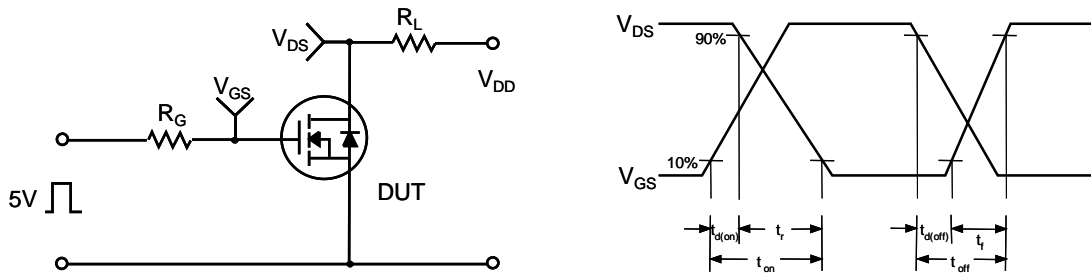


**Figure 11. Transient Thermal Response Curve**

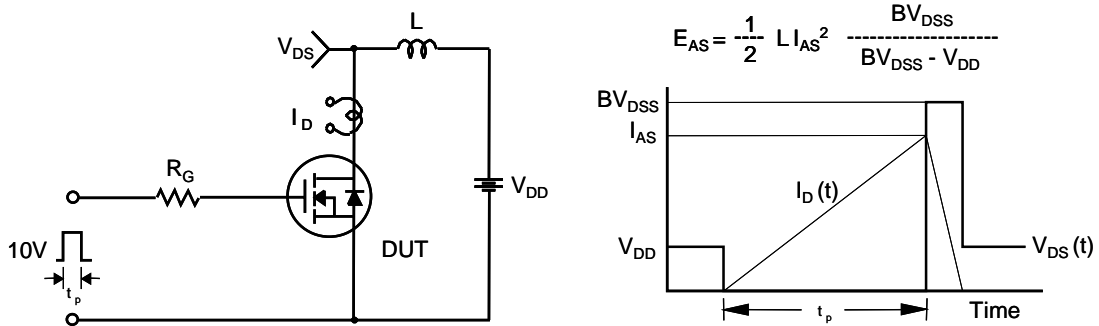
**Gate Charge Test Circuit & Waveform**



**Resistive Switching Test Circuit & Waveforms**



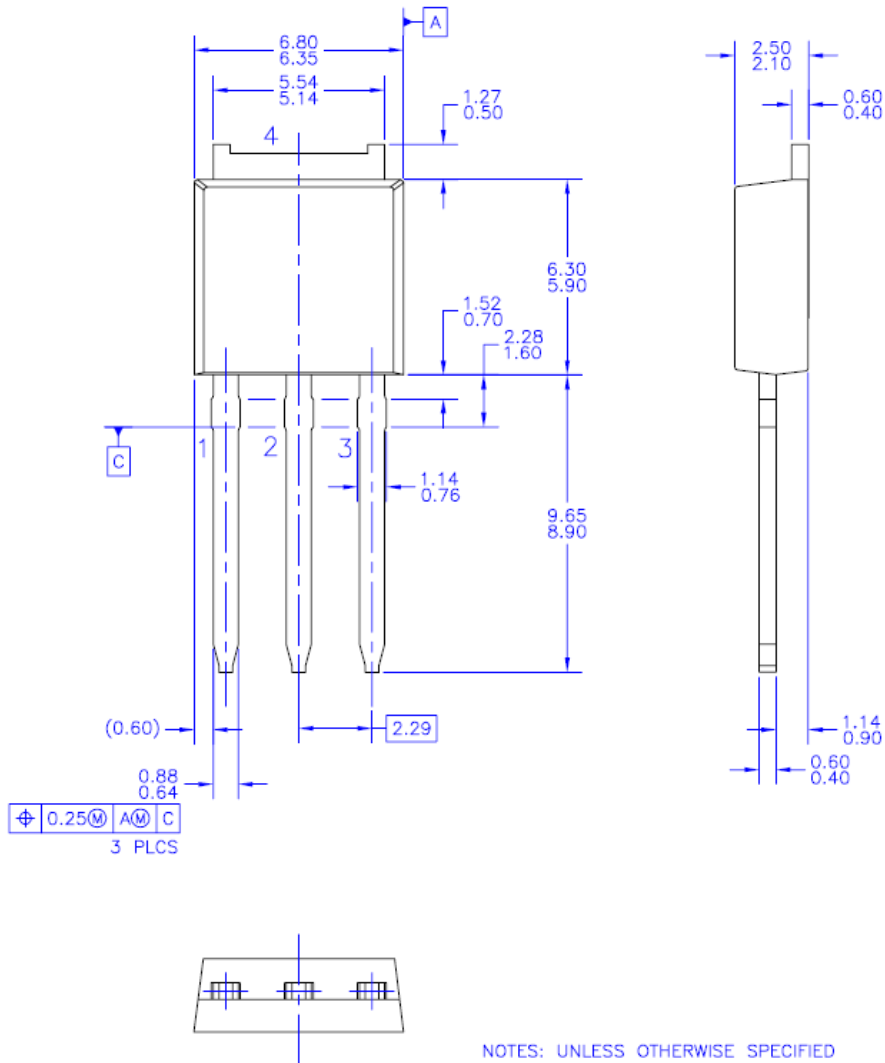
**Unclamped Inductive Switching Test Circuit & Waveforms**





**Package Dimensions (Continued)**

**IPAK**



- NOTES: UNLESS OTHERWISE SPECIFIED
- A) ALL DIMENSIONS ARE IN MILLIMETERS.
  - B) THIS PACKAGE CONFORMS TO JEDEC, TO-251, ISSUE C, VARIATION AA, DATED SEP 1988.
  - C) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.

**TO-251 (IPAK) MOLDED, 3LEAD, OPTION AA**

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[http://www.fairchildsemi.com/package/packageDetails.html?id=PN\\_TT251-003](http://www.fairchildsemi.com/package/packageDetails.html?id=PN_TT251-003)

Dimensions in Millimeters

