

# FQB30N06L / FQI30N06L

## 60V LOGIC N-Channel MOSFET

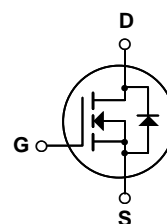
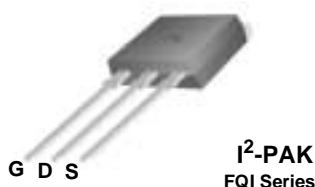
### General Description

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

This advanced technology 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 low voltage applications such as automotive, DC/DC converters, and high efficiency switching for power management in portable and battery operated products.

### Features

- 32A, 60V,  $R_{DS(on)} = 0.035\Omega$  @  $V_{GS} = 10V$
- Low gate charge ( typical 15 nC)
- Low  $C_{rss}$  ( typical 50 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability
- 175°C maximum junction temperature rating
- RoHS Compliant



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

Symbol	Parameter	FQB30N06L / FQI30N06L	Units
$V_{DSS}$	Drain-Source Voltage	60	V
$I_D$	Drain Current - Continuous ( $T_C = 25^\circ\text{C}$ )	32	A
	- Continuous ( $T_C = 100^\circ\text{C}$ )	22.6	A
$I_{DM}$	Drain Current - Pulsed (Note 1)	128	A
$V_{GSS}$	Gate-Source Voltage	$\pm 20$	V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	350	mJ
$I_{AR}$	Avalanche Current (Note 1)	32	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	7.9	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	7.0	V/ns
$P_D$	Power Dissipation ( $T_A = 25^\circ\text{C}$ ) *	3.75	W
	Power Dissipation ( $T_C = 25^\circ\text{C}$ )	79	W
	- Derate above $25^\circ\text{C}$	0.53	W/ $^\circ\text{C}$
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +175	$^\circ\text{C}$
$T_L$	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	--	1.90	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient *	--	40	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	62.5	$^\circ\text{C/W}$

\* 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	Units
<b>Off Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	60	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$ , 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	$\mu\text{A}$
		$V_{DS} = 48\text{ V}, T_C = 150^\circ\text{C}$	--	--	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	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	1.0	--	2.5	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 16\text{ A}$	--	0.027	0.035	$\Omega$
		$V_{GS} = 5\text{ V}, I_D = 16\text{ A}$	--	0.035	0.045	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 25\text{ V}, I_D = 16\text{ A}$ (Note 4)	--	24	--	S

## Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$	--	800	1040	pF
$C_{oss}$	Output Capacitance		--	270	350	pF
$C_{rss}$	Reverse Transfer Capacitance		--	50	65	pF

## Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 30\text{ V}, I_D = 16\text{ A},$ $R_G = 25\text{ }\Omega$  (Note 4, 5)	--	15	40	ns
$t_r$	Turn-On Rise Time		--	210	430	ns
$t_{d(off)}$	Turn-Off Delay Time		--	60	130	ns
$t_f$	Turn-Off Fall Time		--	110	230	ns
$Q_g$	Total Gate Charge	$V_{DS} = 48\text{ V}, I_D = 32\text{ A},$ $V_{GS} = 5\text{ V}$  (Note 4, 5)	--	15	20	nC
$Q_{gs}$	Gate-Source Charge		--	3.5	--	nC
$Q_{gd}$	Gate-Drain Charge		--	8.5	--	nC

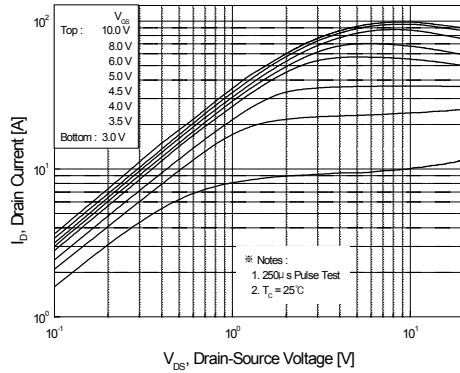
## Drain-Source Diode Characteristics and Maximum Ratings

I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current		--	--	32	A
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode Forward Current		--	--	128	A
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 32 A	--	--	1.5	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 32 A,	--	60	--	ns
Q <sub>rr</sub>	Reverse Recovery Charge	dI <sub>F</sub> / dt = 100 A/μs (Note 4)	--	90	--	nC

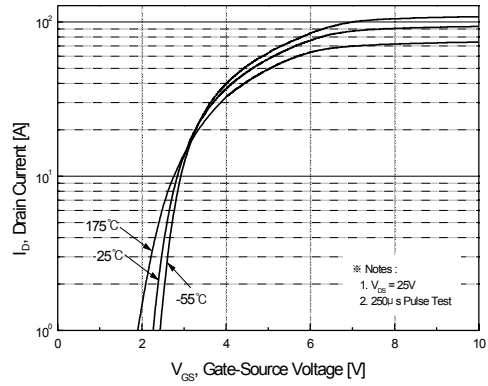
### Notes:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2.  $L = 400\text{ }\mu\text{H}, I_{AS} = 32\text{ A}, V_{DD} = 25\text{ V}, R_G = 25\text{ }\Omega$ , Starting  $T_J = 25^\circ\text{C}$
3.  $I_{SD} \leq 32\text{ A}, di/dt \leq 300\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$
4. Pulse Test : Pulse width  $\leq 300\text{ }\mu\text{s}$ , Duty cycle  $\leq 2\%$
5. Essentially independent of operating temperature

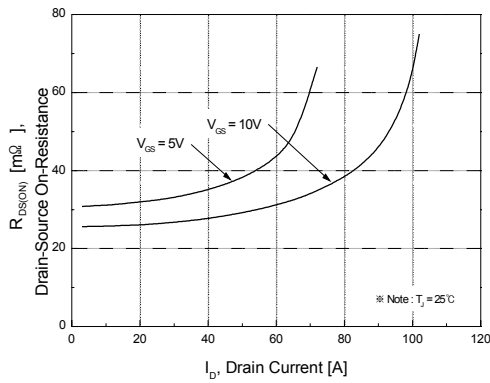
# Typical Characteristics



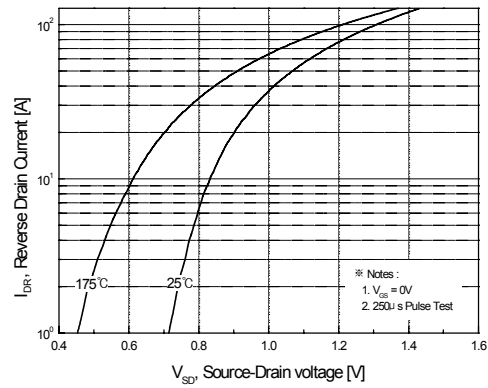
**Figure 1. On-Region Characteristics**



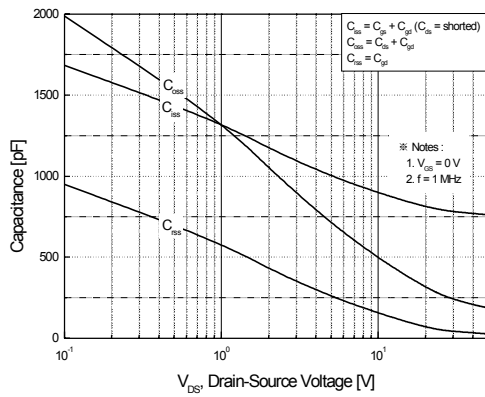
**Figure 2. Transfer Characteristics**



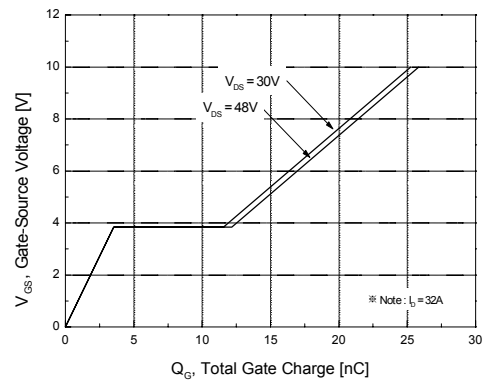
**Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage**



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

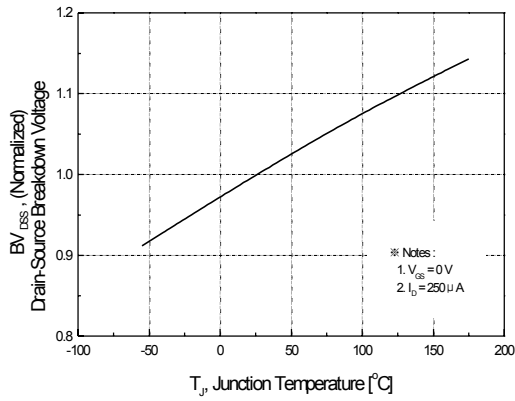


**Figure 5. Capacitance Characteristics**

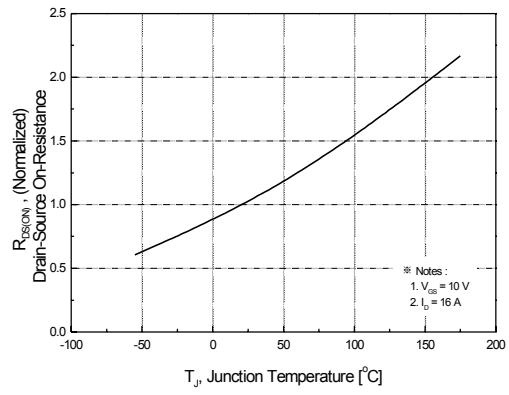


**Figure 6. Gate Charge Characteristics**

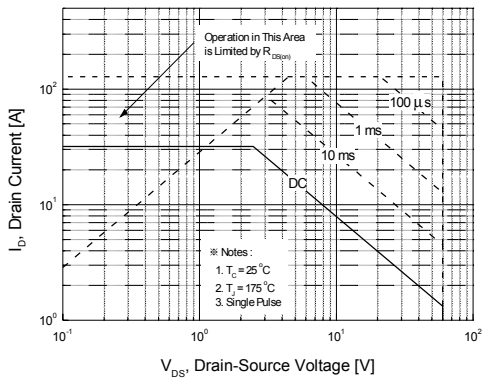
## Typical Characteristics (Continued)



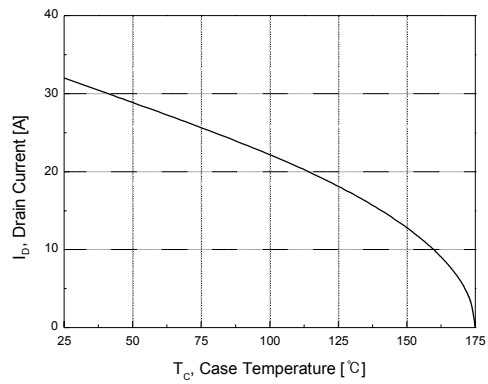
**Figure 7. Breakdown Voltage Variation vs. Temperature**



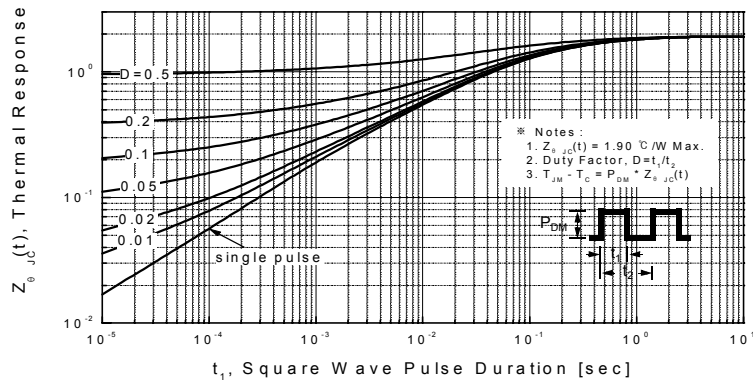
**Figure 8. On-Resistance Variation vs. Temperature**



**Figure 9. Maximum Safe Operating Area**

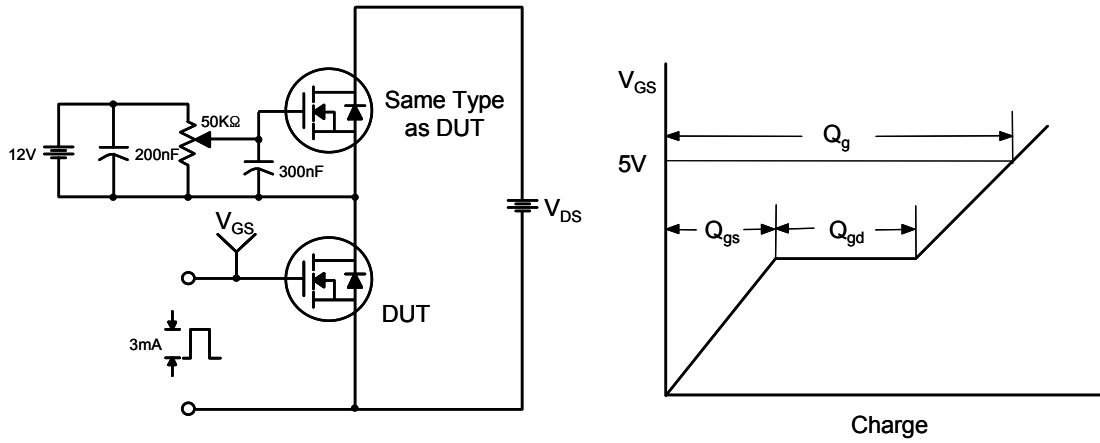


**Figure 10. Maximum Drain Current vs. Case Temperature**

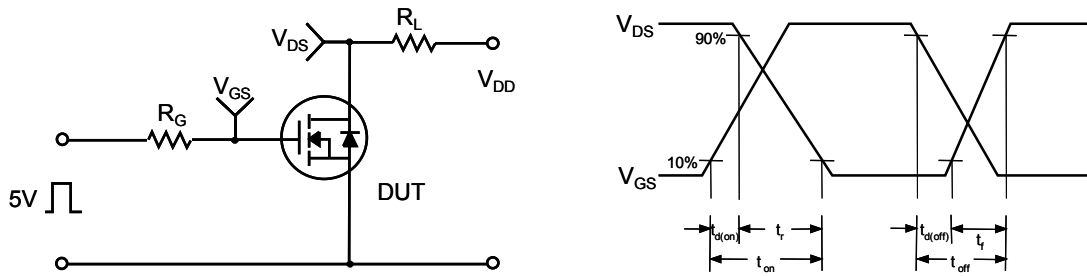


**Figure 11. Transient Thermal Response Curve**

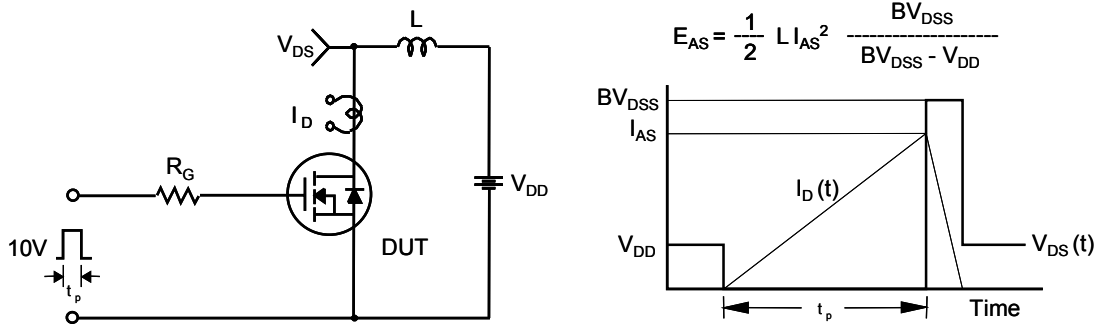
### Gate Charge Test Circuit & Waveform



### Resistive Switching Test Circuit & Waveforms



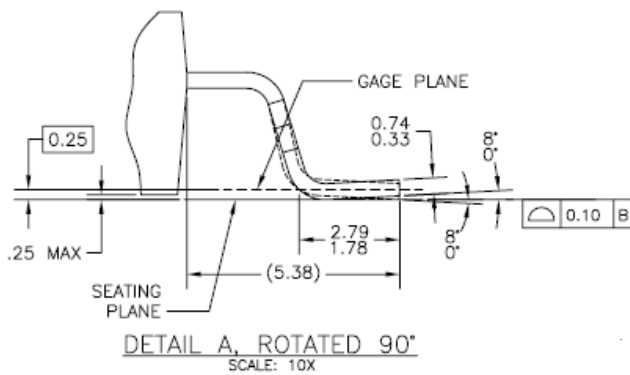
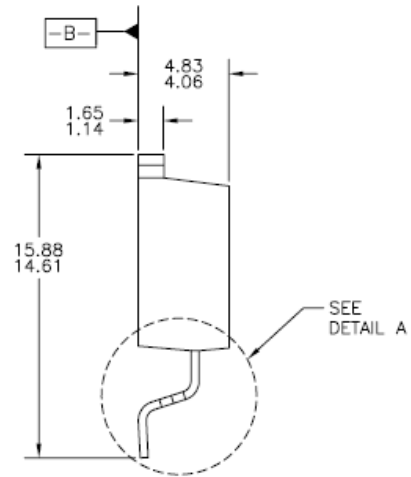
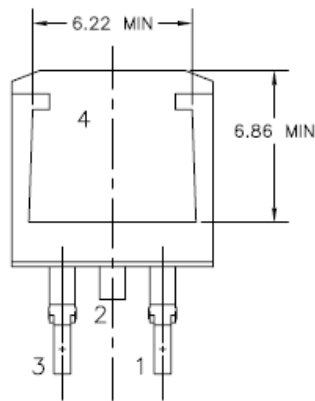
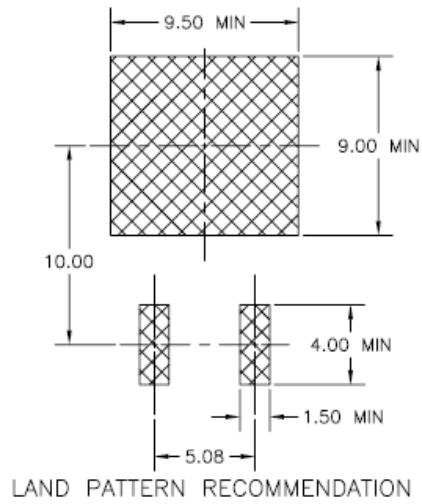
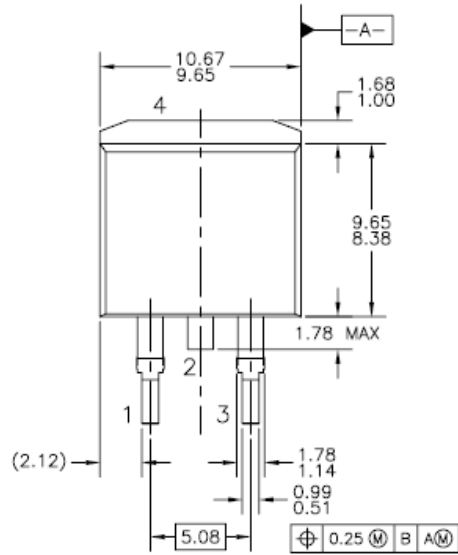
### Unclamped Inductive Switching Test Circuit & Waveform





Package Dimensions

D<sup>2</sup> - PAK



Dimensions in Millimeters

Technical drawing of a mechanical part, showing two views: a front view (left) and a side view (right).

**Front View (Left):**

- Overall width: 10.29, 9.65
- Internal width: 8.33, 6.22
- Height: 7.88, 6.86
- Feature A: 1.40, 1.00
- Feature B: 3.96, 2.80
- Feature 1: 2.13
- Feature 2: 2.54
- Feature 3: 5.08
- Feature 4: 1.78, 1.14
- Feature 5: 0.90, 0.64
- Feature 6: 14.73, 12.70
- Feature 7: 0.254, A(M), B

**Side View (Right):**

- Overall width: 4.83, 4.06
- Height: 1.40, 1.14
- Feature A: 1.40, 1.14
- Feature B: 0.64, 0.33
- Feature 1: 2.79, 2.03
- Feature 2: 0.64, 0.33
- Feature 3: 0.254, A(M), B

**Feature Details:**

- Feature 1: 2.13
- Feature 2: 2.54
- Feature 3: 5.08
- Feature 4: 1.78, 1.14
- Feature 5: 0.90, 0.64
- Feature 6: 14.73, 12.70
- Feature 7: 0.254, A(M), B

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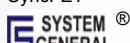
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