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October 2013

# **FQB33N10**

# N-Channel QFET® MOSFET

**100 V, 33 A, 52 m**Ω

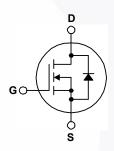
# **Description**

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**

- 33 A, 100 V,  $R_{DS(on)}$  = 52 m $\Omega$  (Max) @ $V_{GS}$  = 10 V,  $I_D$  = 16.5 A
- Low Gate Charge (Typ. 38 nC)
- · Low Crss (Typ. 62 pF)
- · 100% Avalanche Tested
- · 175°C Maximum Junction Temperature Rating





# Absolute Maximum Ratings T<sub>C</sub> = 25°C unless otherwise noted

Symbol	Parameter		FQB33N10TM	Unit
V <sub>DSS</sub>	Drain-Source Voltage		100	V
I <sub>D</sub>	Drain Current - Continuous (T <sub>C</sub> = 25°	C)	33	Α
	- Continuous (T <sub>C</sub> = 100	)°C)	23	Α
I <sub>DM</sub>	Drain Current - Pulsed	(Note 1)	132	Α
V <sub>GSS</sub>	Gate-Source Voltage		± 25	V
E <sub>AS</sub>	Single Pulsed Avalanche Energy	(Note 2)	435	mJ
I <sub>AR</sub>	Avalanche Current	(Note 1)	33	Α
E <sub>AR</sub>	Repetitive Avalanche Energy	(Note 1)	12.7	mJ
dv/dt	Peak Diode Recovery dv/dt	(Note 3)	6.0	V/ns
$P_{D}$	Power Dissipation (T <sub>A</sub> = 25°C) *		3.75	W
_	Power Dissipation (T <sub>C</sub> = 25°C)		127	W
	- Derate above 25°C		0.85	W/°C
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range		-55 to +175	°C
T <sub>L</sub>	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds		300	°C

## **Thermal Characteristics**

Symbol	Parameter	FQB33N10TM	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.		
В	Thermal Resistance, Junction to Ambient (minimum pad of 2 oz copper), Max.	62.5	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (* 1 in² pad of 2 oz copper), Max.	40	

# **Package Marking and Ordering Information**

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FQB33N10	FQB33N10TM	D2-PAK	330mm	24mm	800

# **Electrical Characteristics**

 $T_C$  = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Тур	Max	Unit
Off Cha	racteristics					
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$	100			V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	$I_D$ = 250 $\mu$ A, Referenced to 25°C		0.11		V/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 100 V, V <sub>GS</sub> = 0 V			1	μА
	Zelo Gale Voltage Dialii Current	V <sub>DS</sub> = 80 V, T <sub>C</sub> = 150°C			10	μА
I <sub>GSSF</sub>	Gate-Body Leakage Current, Forward	V <sub>GS</sub> = 25 V, V <sub>DS</sub> = 0 V			100	nA
I <sub>GSSR</sub>	Gate-Body Leakage Current, Reverse	V <sub>GS</sub> = -25 V, V <sub>DS</sub> = 0 V			-100	nA
On Cha	racteristics					

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_{D} = 250 \mu A$	2.0		4.0	V
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	$V_{GS} = 10 \text{ V}, I_D = 16.5 \text{ A}$		0.040	0.052	Ω
9 <sub>FS</sub>	Forward Transconductance	$V_{DS} = 40 \text{ V}, I_{D} = 16.5 \text{ A}$		22		S

## **Dynamic Characteristics**

C <sub>iss</sub>	Input Capacitance	$V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V},$		1150	1500	pF
Coss	Output Capacitance	f = 1.0 MHz	-	320	420	pF
C <sub>rss</sub>	Reverse Transfer Capacitance		-	62	80	pF

# **Switching Characteristics**

t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 50 V, I <sub>D</sub> = 33 A,		15	40	ns
t <sub>r</sub>	Turn-On Rise Time	$R_G = 25 \Omega$		195	400	ns
t <sub>d(off)</sub>	Turn-Off Delay Time			80	170	ns
t <sub>f</sub>	Turn-Off Fall Time	(Note 4)	/	110	230	ns
$Q_g$	Total Gate Charge	V <sub>DS</sub> = 80 V, I <sub>D</sub> = 33 A,	-	38	51	nC
$Q_{gs}$	Gate-Source Charge	V <sub>GS</sub> = 10 V	/	7.5		nC
Q <sub>gd</sub>	Gate-Drain Charge	(Note 4)		18		nC

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

$I_S$	Maximum Continuous Drain-Source Diode Forward Current				33	Α
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode Forward Current				132	Α
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 33 A			1.5	V
t <sub>rr</sub>	Reverse Recovery Time	$V_{GS} = 0 \text{ V, } I_{S} = 33 \text{ A,}$		80		ns
Q <sub>rr</sub>	Reverse Recovery Charge	$dI_F / dt = 100 A/\mu s$		0.22	-	μС

- 1. Repetitive Rating : Pulse width limited by maximum junction temperature 2. L = 0.6mH, I $_{AS}$  = 33A, V $_{DD}$  = 25V, R $_{G}$  = 25  $\Omega$ , Starting T $_{J}$  = 25°C 3. I $_{SD}$   $\leq$  33A, di/dt  $\leq$  300A/ $\mu$ s, V $_{DD}$   $\leq$  BV $_{DSS}$ , Starting T $_{J}$  = 25°C 4. Essentially independent of operating temperature

# **Typical Characteristics**

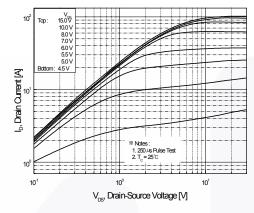


Figure 1. On-Region Characteristics

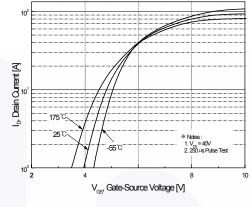


Figure 2. Transfer Characteristics

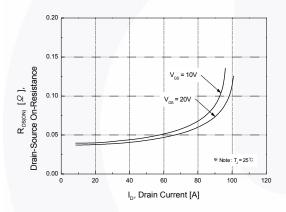


Figure 3. On-Resistance Variation vs.

Drain Current and Gate Voltage

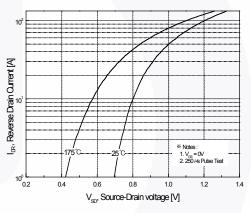


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

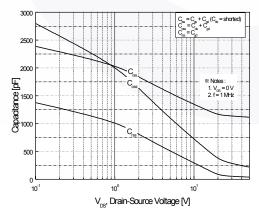


Figure 5. Capacitance Characteristics

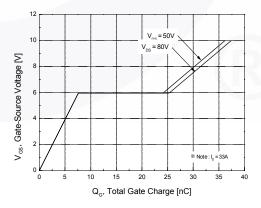


Figure 6. Gate Charge Characteristics

# Typical Characteristics (Continued)

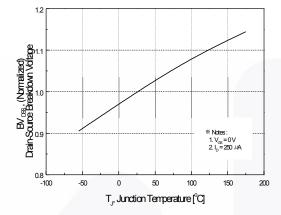


Figure 7. Breakdown Voltage Variation vs. Temperature

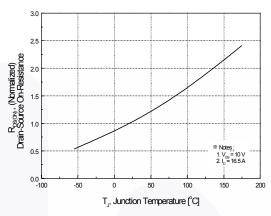


Figure 8. On-Resistance Variation vs. Temperature

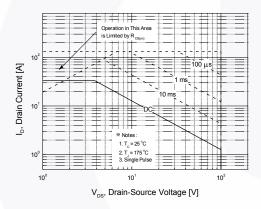


Figure 9. Maximum Safe Operating Area

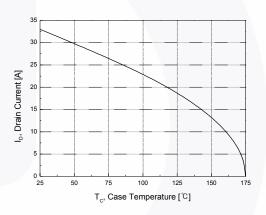


Figure 10. Maximum Drain Current vs. Case Temperature

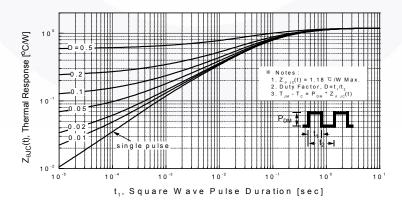


Figure 11. Transient Thermal Response Curve



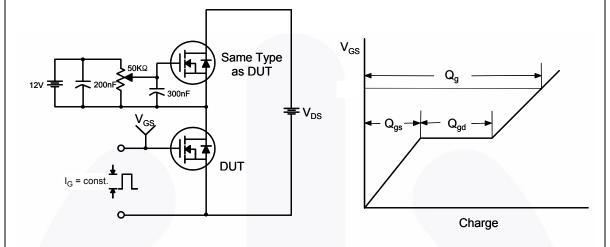


Figure 13. Resistive Switching Test Circuit & Waveforms

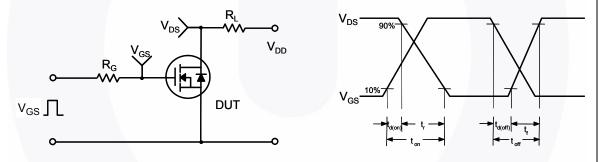
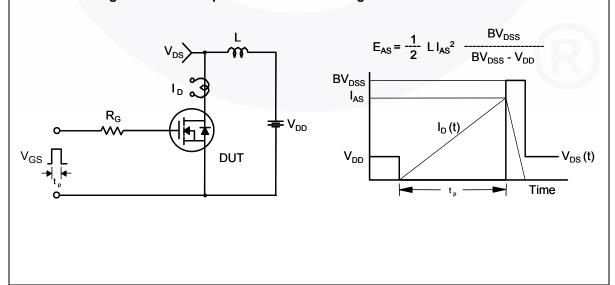
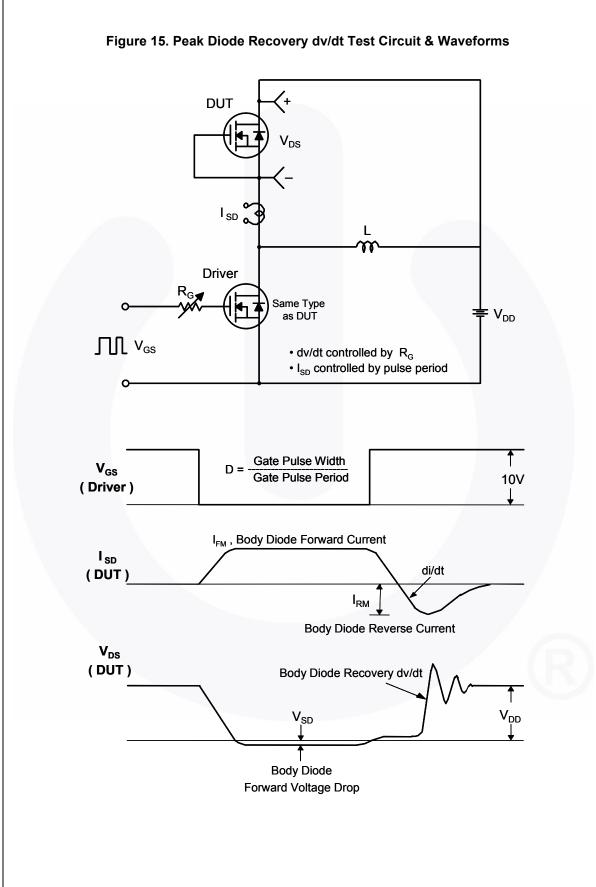


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms





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# **Mechanical Dimensions**

# TO-263 2L (D<sup>2</sup>PAK)

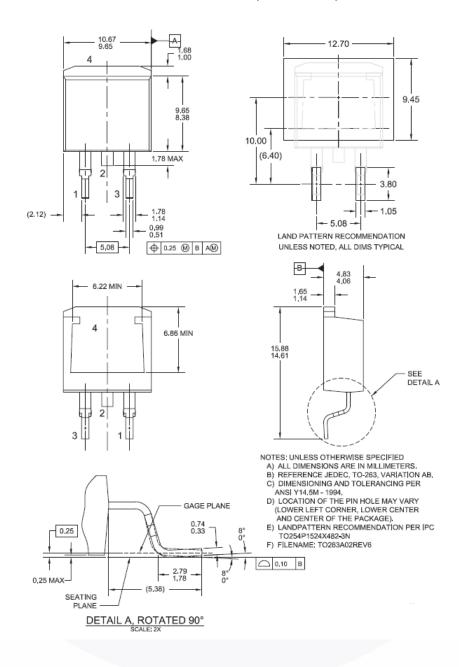


Figure 16. 2LD, TO263, Surface Mount

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Dimension in Millimeters





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