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November 2013

# **FQP33N10**

# N-Channel QFET<sup>®</sup> MOSFET 100 V, 33 A, 52 m $\Omega$

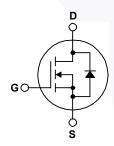
## **Description**

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		FQP33N10	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	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>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 Rang	е	-55 to +175	°C
T <sub>L</sub>	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 seconds		300	°C

# **Thermal Characteristics**

Symbol	Parameter	FQP33N10	Unit	
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	1.18	°C/W	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	62.5	°C/W	

# **Package Marking and Ordering Information**

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FQP33N10	FQP33N10	TO-220	Tube	N/A	N/A	50 units

# **Electrical Characteristics**

 $T_C = 25$ °C unless otherwise noted.

Symbol	Parameter Test Conditions		Min	Тур	Max	Uni
Off Cha	aracteristics					
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 <sub>D</sub> = 250 μA, Referenced to 25°C		0.11		V/°C
I <sub>DSS</sub>	Zero Coto Valtorio Duoin Cumunt	V <sub>DS</sub> = 100 V, V <sub>GS</sub> = 0 V			1	μΑ
	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 80 V, T <sub>C</sub> = 150°C			10	μΑ
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 <sub>GS(th)</sub>	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 <sub>GS</sub> = 10 V, I <sub>D</sub> = 16.5 A		0.040	0.052	Ω
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 40 V, I <sub>D</sub> = 16.5 A	\	22		S
Dynam	ic Characteristics					
C <sub>iss</sub>	Input Capacitance	$V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V},$		1150	1500	pF
C <sub>oss</sub>	Output Capacitance	f = 1.0 MHz		320	420	pF
C <sub>rss</sub>	Reverse Transfer Capacitance			62	80	pF
Switch	ing Characteristics					
$t_{d(on)}$	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	Rise Time $R_G = 25 \Omega$		195	400	ns
$t_{d(off)}$	Turn-Off Delay Time			80	170	ns
t <sub>f</sub>	Turn-Off Fall Time	(Note 4)	/	110	230	ns
Qg	Total Gate Charge	$V_{DS} = 80 \text{ V}, I_{D} = 33 \text{ A},$		38	51	nC
Q <sub>gs</sub>	Gate-Source Charge	V <sub>GS</sub> = 10 V	/	7.5		nC
Q <sub>ad</sub>	Gate-Drain Charge	(Note 4)		18		nC

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

I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current				33	Α
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode F	orward 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 <sub>GS</sub> = 0 V, I <sub>S</sub> = 33 A,		80		ns
Q <sub>rr</sub>	Reverse Recovery Charge	$dI_F / dt = 100 A/\mu s$		0.22	/	μC

- Notes: Notes: Notes: Notes: A Repetitive Rating: Pulse width limited by maximum junction temperature. 
  2. L = 0.6 mH, I<sub>AS</sub> = 33 A, V<sub>DD</sub> = 25 V, R<sub>G</sub> = 25  $\Omega$ , starting T<sub>J</sub> = 25°C. 
  3. I<sub>SD</sub>  $\leq$  33 A, di/dt  $\leq$  300 A/µs, V<sub>DD</sub>  $\leq$  BV<sub>DSS</sub>, starting T<sub>J</sub> = 25°C. 
  4. Essentially Independent of Operating Temperature.

# **Typical Characteristics**

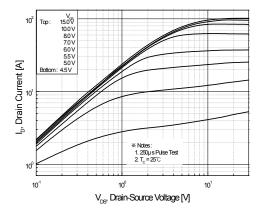


Figure 1. On-Region Characteristics

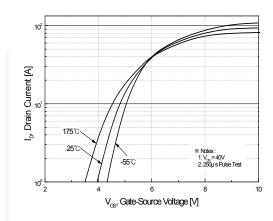


Figure 2. Transfer Characteristics

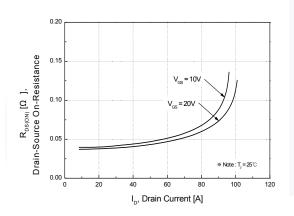


Figure 3. On-Resistance Variation vs.

Drain Current and Gate Voltage

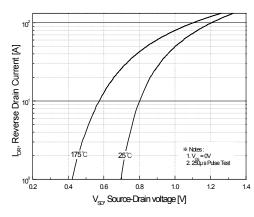


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

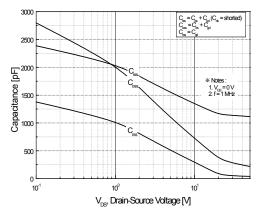


Figure 5. Capacitance Characteristics

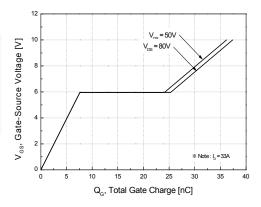
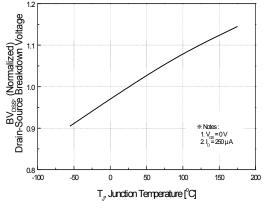


Figure 6. Gate Charge Characteristics

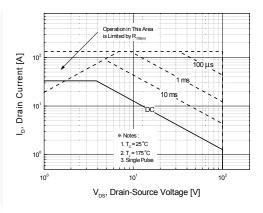
# Typical Characteristics (continued)



30 25 (Dezignation Temperature [°C]

Figure 7. Breakdown Voltage Variation vs. Temperature

Figure 8. On-Resistance Variation vs. Temperature



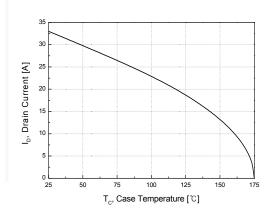


Figure 9. Maximum Safe Operating Area

Figure 10. Maximum Drain Current vs. Case Temperature

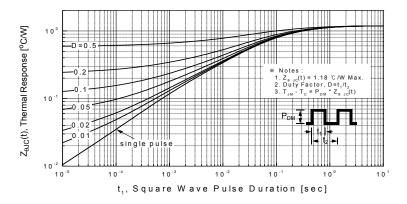


Figure 11. Transient Thermal Response Curve

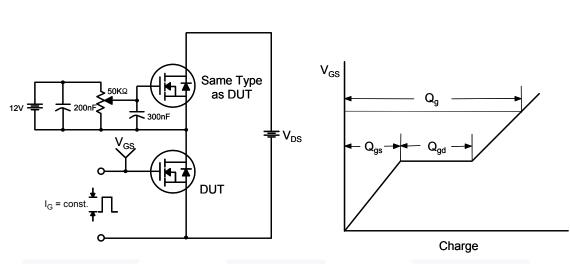


Figure 12. Gate Charge Test Circuit & Waveform

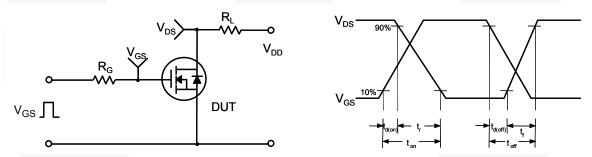


Figure 13. Resistive Switching Test Circuit & Waveforms

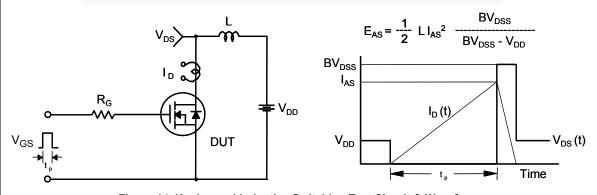
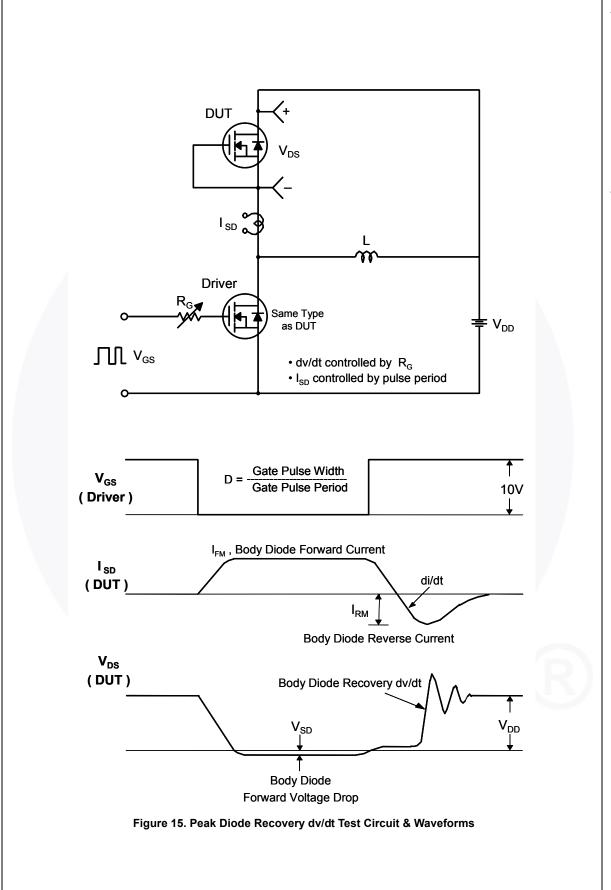


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms



# **Mechanical Dimensions**

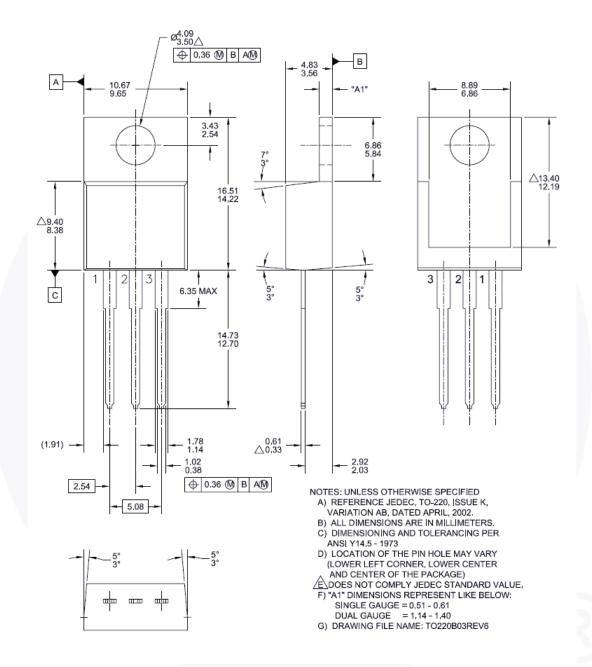


Figure 16. TO-220, Molded, 3-Lead, Jedec Variation AB

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