

November 2013

### **FQB19N20C**

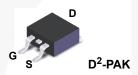
# N-Channel QFET $^{\rm @}$ MOSFET 200 V, 19 A, 170 m $\Omega$

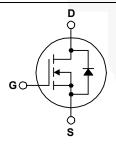
### **Description**

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, active power factor correction (PFC), and electronic lamp ballasts.

#### **Features**

- 19.0 A, 200 V,  $R_{DS(on)}$  = 170 m $\Omega$  (Max.) @  $V_{GS}$  = 10 V,  $I_D$  = 9.5 A
- · Low Gate Charge (Typ. 40.5 nC)
- Low C<sub>rss</sub> (Typ. 85 pF)
- · 100% Avalanche Tested
- · RoHS Compliant





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

Symbol	Parameter	FQB19N20CTM	Unit
V <sub>DSS</sub>	Drain-Source Voltage	200	V
I <sub>D</sub>	Drain Current - Continuous (T <sub>C</sub> = 25°C)	19.0	Α
	- Continuous (T <sub>C</sub> = 100°C)	12.1	Α
I <sub>DM</sub>	Drain Current - Pulsed (Note 1)	76.0	Α
V <sub>GSS</sub>	Gate-Source voltage	± 30	V
E <sub>AS</sub>	Single Pulsed Avalanche Energy (Note 2)	433	mJ
I <sub>AR</sub>	Avalanche Current (Note 1)	19.0	Α
E <sub>AR</sub>	Repetitive Avalanche Energy (Note 1)	13.9	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	5.5	V/ns
P <sub>D</sub>	Power Dissipation (T <sub>A</sub> = 25°C)*	3.13	W
	Power Dissipation (T <sub>C</sub> = 25°C)	139	W
	- Derate above 25°C	1.11	W/°C
T <sub>J,</sub> T <sub>STG</sub>	Operating and Storage Temperature Range	-55 to +150	°C
T <sub>L</sub>	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds		

#### **Thermal Characteristics**

Symbol	Parameter	FQB19N20CTM	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.9	
D	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
FQB19N20C	FQB19N20CTM	D <sup>2</sup> -PAK	330 mm	24 mm	800 units

### Electrical Characteristics T<sub>C</sub> = 25°C unless otherwise noted.

Symbol	Parameter	Conditions	Min	Тур	Max	Unit
Off Charac	teristics				•	
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$	200			V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250 μA, Referenced to 25°C		0.24		V/ºC
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 200 V, V <sub>GS</sub> = 0 V			10	μΑ
		V <sub>DS</sub> = 160 V, T <sub>C</sub> = 125°C			100	μА
I <sub>GSSF</sub>	Gate-Body Leakage Current, Forward	V <sub>GS</sub> = 30 V, V <sub>DS</sub> = 0 V			100	nA
I <sub>GSSR</sub>	Gate-Body Leakage Current, Reverse	V <sub>GS</sub> = -30 V, V <sub>DS</sub> = 0 V			-100	nA
On Charac	teristics					
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> = 9.5 A		0.14	0.17	Ω
9 <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 40 V, I <sub>D</sub> = 9.5 A		10.8		S
Dynamic C	Characteristics					
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V,		830	1080	pF
C <sub>oss</sub>	Output Capacitance	f = 1.0 MHz	\	195	255	pF
C <sub>rss</sub>	Reverse Transfer Capacitance			85	110	pF
Switching	Characteristics				1	
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 100 V, I <sub>D</sub> = 19.0 A		10	40	ns
t <sub>r</sub>	Turn-On Rise Time	$R_G = 25 \Omega$		150	310	ns
t <sub>d(off)</sub>	Turn-Off Delay Time			135	280	ns
t <sub>f</sub>	Turn-Off Fall Time	(Note 4)		115	240	ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> = 160 V, I <sub>D</sub> = 19.0 A		40.5	53	nC
Q <sub>gs</sub>	Gate-Source Charge	V <sub>GS</sub> = 10 V		6.0		nC
Q <sub>gd</sub>	Gate-Drain Charge	(Note 4)	/	22.5		nC
Drain-Soul	rce Diode Characteristics and Maximu	m Ratings				
I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current		<b>/-</b>		19.0	Α
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode F	Diode Forward Current			76.0	Α
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 19.0 A			1.5	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 19.0 A		208	/	ns
Q <sub>rr</sub>	Reverse Recovery Charge	dI <sub>F</sub> /dt =100 A/μs		1.63		μС

#### Notes

<sup>1.</sup> Repetitive rating: pulse-width limited by maximum junction temperature.

<sup>2.</sup> L = 1.8 mH, I $_{AS}$  = 19.0 A, V $_{DD}$  = 50 V, R $_{G}$  = 25  $\Omega$ , starting T $_{J}$  = 25°C.

<sup>3.</sup> I  $_{SD} \leq$  19.0 A, di/dt  $\leq$  300 A/µs, V  $_{DD} \leq$  BV  $_{DSS,}$  starting  $\,$  T  $_{J}$  = 25°C.

<sup>4.</sup> Essentially independent of operating temperature.

### **Typical Characteristics**

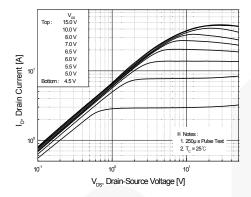


Figure 1. On-Region Characteristics

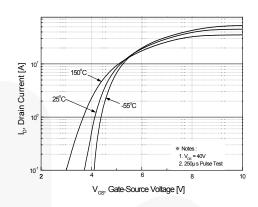


Figure 2. Transfer Characteristics

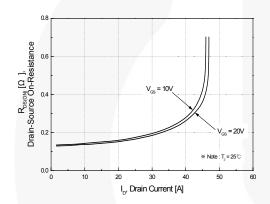


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

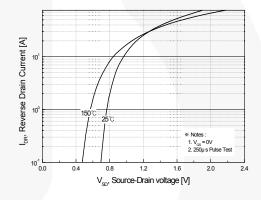


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

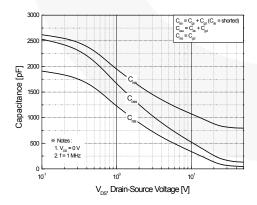


Figure 5. Capacitance Characteristics

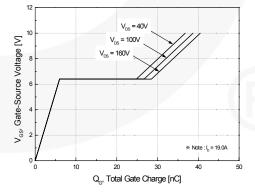


Figure 6. Gate Charge Characteristics

### Typical Characteristics (Continued)

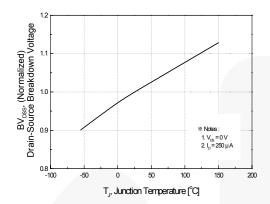


Figure 7. Breakdown Voltage Variation vs Temperature

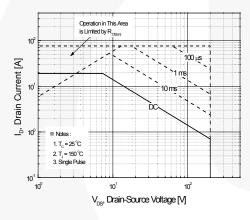


Figure 9. Maximum Safe Operating Area

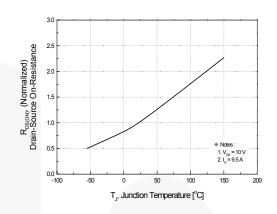


Figure 8. On-Resistance Variation vs Temperature

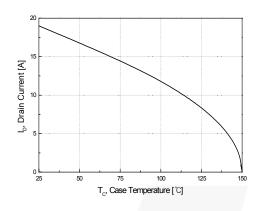


Figure 10. Maximum Drain Current vs Case Temperature

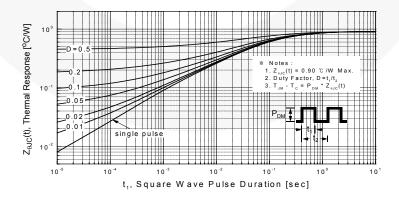


Figure 11. Transient Thermal Response Curve

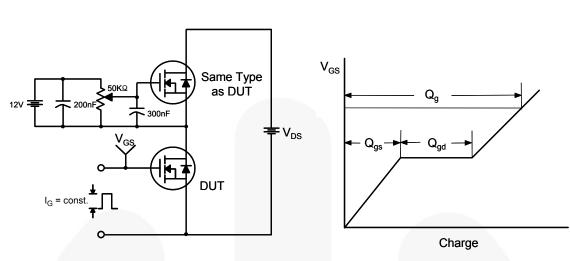


Figure 12. Gate Charge Test Circuit & Waveform

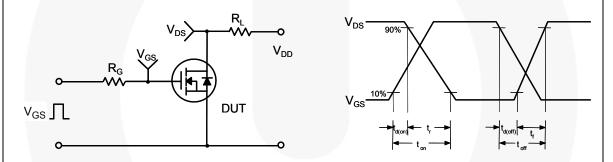


Figure 13. Resistive Switching Test Circuit & Waveforms

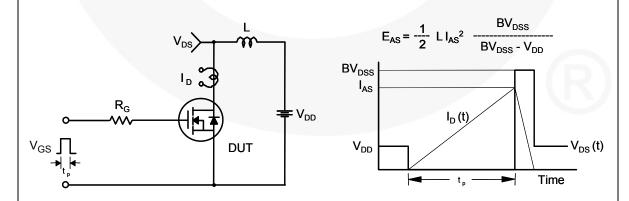
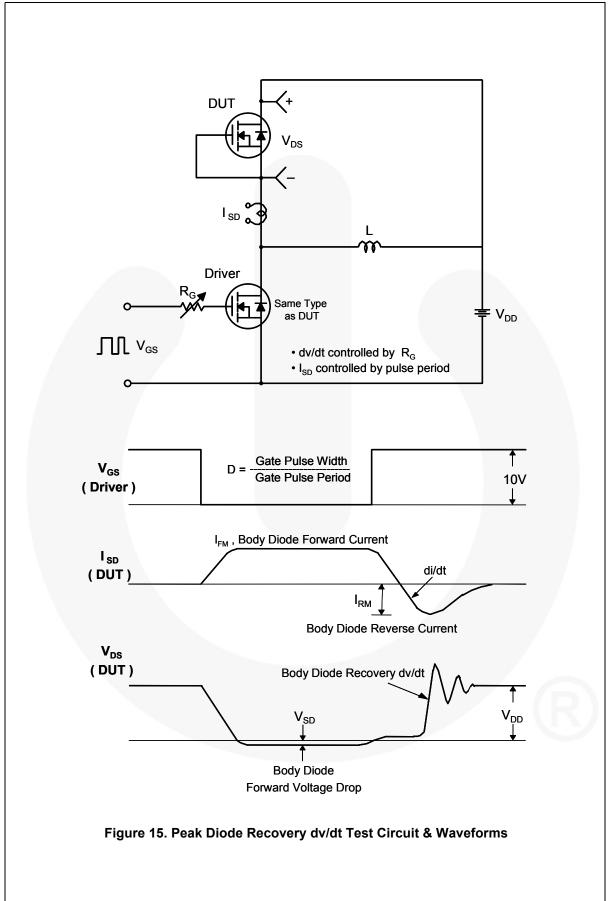


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms



#### **Mechanical Dimensions**

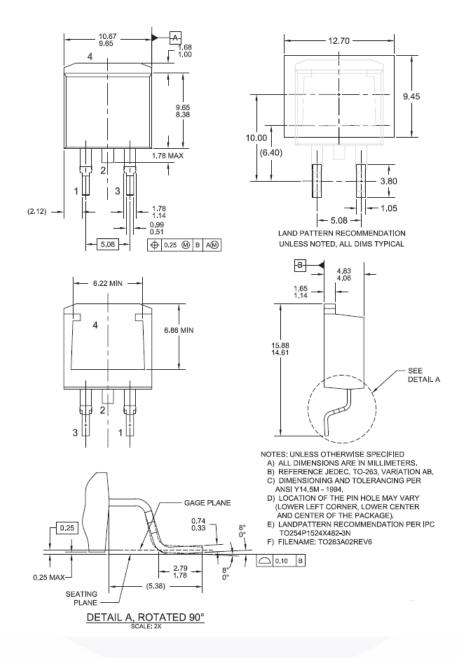


Figure 16. TO263 (D<sup>2</sup>PAK), Molded, 2-Lead, Surface Mount

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