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November 2013

## FQD10N20C / FQU10N20C

# N-Channel QFET<sup>®</sup> MOSFET 200 V, 7.8 A, 360 m $\Omega$

#### **Features**

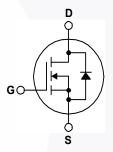
- 7.8 A, 200 V,  $R_{DS(on)}$  = 360 m $\Omega$  (Max.) @  $V_{GS}$  = 10 V,  $I_D$  = 3.9 A
- Low Gate Charge (Typ. 20 nC)
- Low Crss (Typ. 40.5 pF)
- · 100% Avalanche Tested

#### 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.







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

Symbol	Parameter		FQD10N20CTM / FQU10N20CTU	Unit
V <sub>DSS</sub>	Drain-Source Voltage		200	V
	Drain Current - Continuous (T <sub>C</sub> = 25°C)		7.8	Α
ID	- Continuous (T <sub>C</sub> = 100°C)		5.0	Α
I <sub>DM</sub>	Drain Current - Pulsed	(Note 1)	31.2	Α
V <sub>GSS</sub>	Gate-Source Voltage		± 30	V
E <sub>AS</sub>	Single Pulsed Avalanche Energy (Note 2)		210	mJ
I <sub>AR</sub>	Avalanche Current		7.8	Α
E <sub>AR</sub>	Repetitive Avalanche Energy (N		5.0	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)		5.5	V/ns
D_	Power Dissipation (T <sub>C</sub> = 25°C)		50	W
$P_{D}$	- Derate above 25°C		0.4	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 purposes, 1/8" from case for 5 seconds		300	°C

### **Thermal Characteristics**

Symbol	Parameter	FQD10N20CTM / FQU10N20CTU	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max. 2.5		°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.		C/VV

# **Package Marking and Ordering Information**

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FQD10N20C	FQD10N20CTM	D-PAK	330 mm	16 mm	2500 units
FQU10N20C	FQU10N20CTU	I-PAK	Tube	N/A	70 units

## **Electrical Characteristics** $T_C = 25^{\circ}C$ unless otherwise noted.

Symbol	Parameter	Test Conditions	Min	Тур	Max	Unit
Off Cha	racteristics					
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$	200			V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250 μA, Referenced to 25°C	-	0.28		V/°C
	Zara Cata Valtana Dania Cumant	V <sub>DS</sub> = 200 V, V <sub>GS</sub> = 0 V	<b>/</b>		10	μΑ
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 160 V, T <sub>C</sub> = 125°C	-		100	μΑ
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 Cha	racteristics					
V <sub>GS(th)</sub>	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_{D} = 250 \mu\text{A}$	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> = 3.9 A		0.29	0.36	Ω
9 <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 40 V, I <sub>D</sub> = 3.9 A		5.6		S
	ic Characteristics					
C <sub>iss</sub>	Input Capacitance	$V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V},$		395	510	pF
C <sub>oss</sub>	Output Capacitance	f = 1.0 MHz		97	125	pF
C <sub>rss</sub>	Reverse Transfer Capacitance			40.5	53	pF
Switchi	ing Characteristics					
t <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> = 100 V, I <sub>D</sub> = 9.5 A,		11	30	ns
t <sub>r</sub>	Turn-On Rise Time	$R_G = 25 \Omega$		92	190	ns
t <sub>d(off)</sub>	Turn-Off Delay Time		//	70	150	ns
t <sub>f</sub>	Turn-Off Fall Time	(Note 4)	-	72	160	ns
Qg	Total Gate Charge	V <sub>DS</sub> = 160 V, I <sub>D</sub> = 9.5 A,		20	26	nC
Q <sub>gs</sub>	Gate-Source Charge	V <sub>GS</sub> = 10 V		3.1		nC
Q <sub>gd</sub>	Gate-Drain Charge	(Note 4)	-	10.5		nC
Drain-S	ource Diode Characteristics ar	nd Maximum Ratings				
I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current				7.8	Α
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode F	Forward Current			31.2	Α
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 7.8 A			1.5	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 9.5 A,		158		ns
Q <sub>rr</sub>	Reverse Recovery Charge	dl <sub>F</sub> / dt = 100 A/μs		0.97		μС

#### NOTES:

- ${\bf 1.}\ {\bf Repetitive}\ {\bf Rating: Pulse\ width\ limited\ by\ maximum\ junction\ temperature.}$
- 2. L = 5.2 mH, I $_{AS}$  = 7.8 A, V $_{DD}$  = 50 V, R $_{G}$  = 25  $\Omega$ , starting T $_{J}$  = 25°C.
- 3.  $I_{SD} \le 9.5$  A, di/dt  $\le 300$  A/ $\mu$ s,  $V_{DD} \le BV_{DSS}$ , starting  $T_J$  = 25°C.
- ${\bf 4.} \ {\bf Essentially \ independent \ of \ operating \ temperature}.$

## **Typical Characteristics**

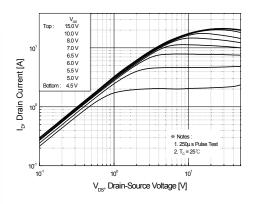


Figure 1. On-Region Characteristics

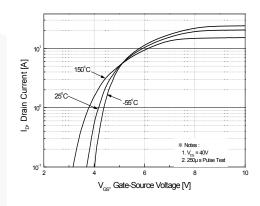


Figure 2. Transfer Characteristics

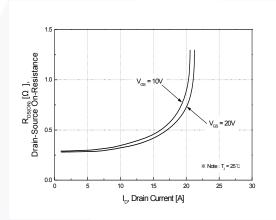


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

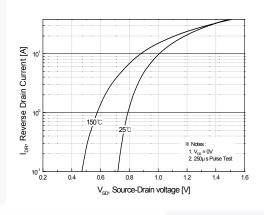


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

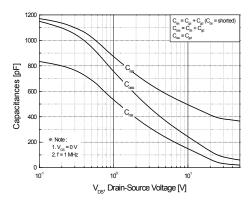


Figure 5. Capacitance Characteristics

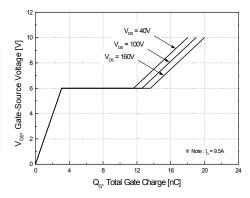
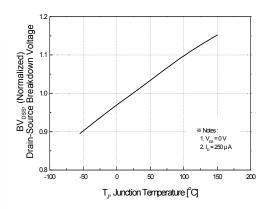


Figure 6. Gate Charge Characteristics

#### Typical Characteristics (Continued)



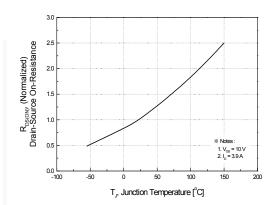
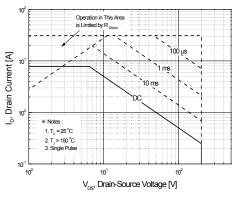


Figure 7. Breakdown Voltage Variation



Figure 8. On-Resistance Variation vs Temperature



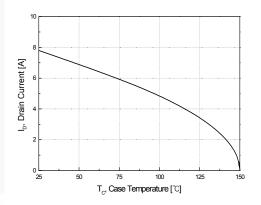


Figure 9. Maximum Safe Operating Area

Figure 10. Maximum Drain Current vs Case Temperature

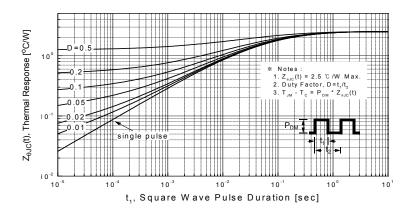


Figure 11. Transient Thermal Response Curve

Figure 12. Gate Charge Test Circuit & Waveform

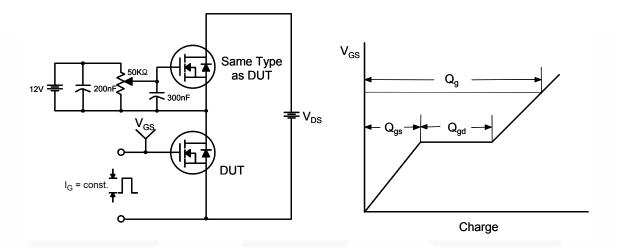


Figure 13. Resistive Switching Test Circuit & Waveforms

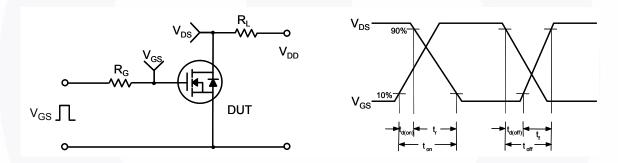
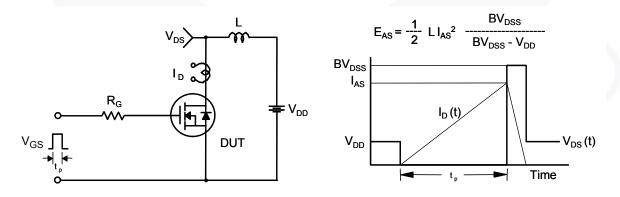


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms



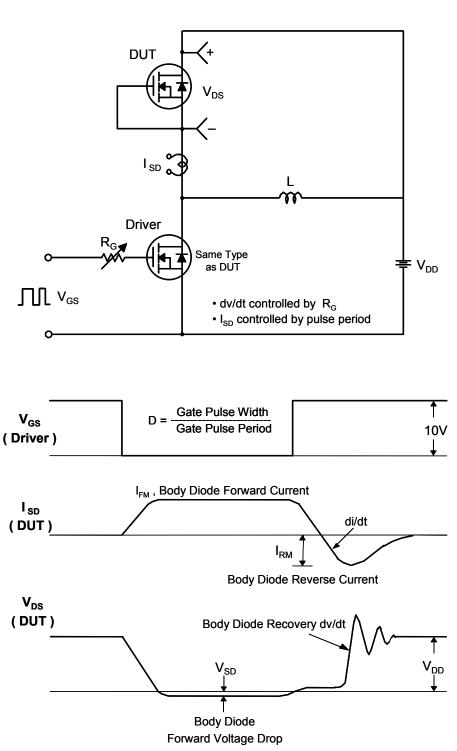


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

#### **Mechanical Dimensions**

# TO-252 3L (DPAK)

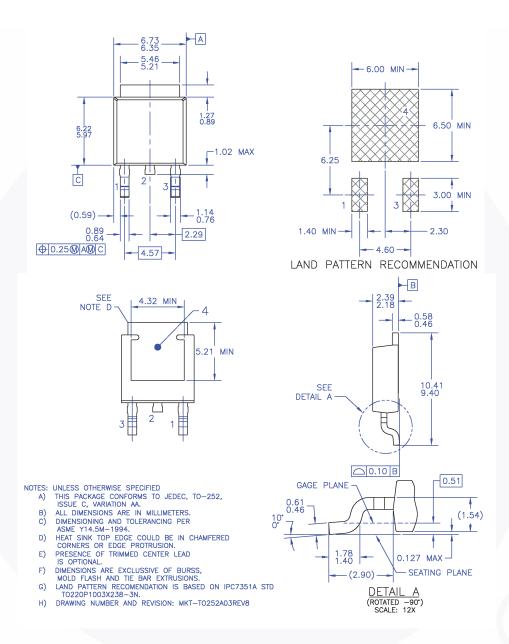


Figure 16. TO252 (D-PAK), Molded, 3 Lead, Option AA&AB

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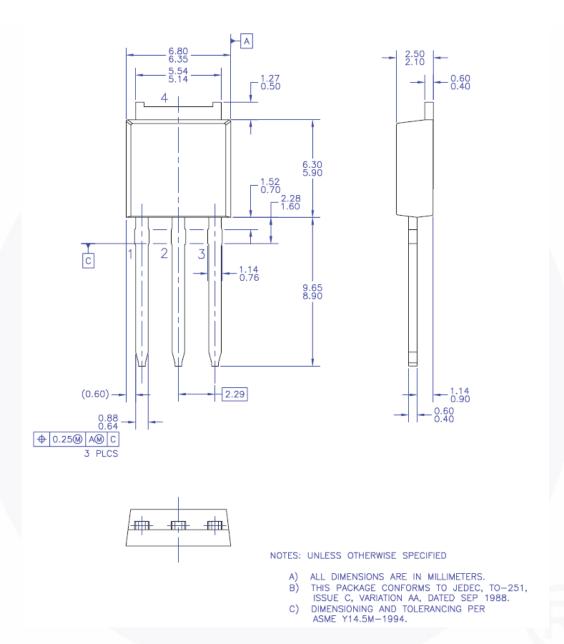
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Dimension in Millimeters

#### **Mechanical Dimensions**

# TO-251 3L (IPAK)



#### Figure 17. TO251 (IPAK) Molded 3 Lead

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Dimension in Millimeters





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