

November 2013

FQD5N60C / FQU5N60C

N-Channel QFET[®] MOSFET 600 V, 2.8 A, 2.5 Ω

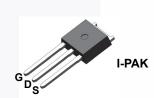
Features

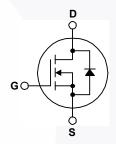
- 2.8 A, 600 V, $R_{DS(on)}$ = 2.5 Ω (Max.) @ V_{GS} = 10 V, I_D = 1.4 A
- Low Gate Charge (Typ. 15 nC)
- Low Crss (Typ. 6.5 pF)
- · 100% Avalanche Tested
- · RoHS compliant

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_C = 25°C unless otherwise noted.

Symbol	Parameter		FQD5N60CTM / FQU5N60CTU	Unit	
V_{DSS}	Drain-Source Voltage		600	V	
I _D	Drain Current - Continuous (T _C = 25°C)		2.8	Α	
	- Continuous (T _C = 100°C)		1.8	Α	
I _{DM}	Drain Current - Pulsed	(Note 1)	11.2	Α	
V_{GSS}	Gate-Source Voltage		± 30	V	
E _{AS}	Single Pulsed Avalanche Energy	(Note 2)	210	mJ	
I _{AR}	Avalanche Current (Note		2.8	Α	
E _{AR}	Repetitive Avalanche Energy (Note 1)		4.9	mJ	
dv/dt	Peak Diode Recovery dv/dt (Note 3)		4.5	V/ns	
	Power Dissipation (T _A = 25°C)*		2.5	W	
P_{D}	Power Dissipation (T _C = 25°C)		49	W	
	- Derate above 25°C		0.39	W/°C	
T _J , T _{STG}	Operating and Storage Temperature Range		-55 to +150	°C	
T _L	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds		300	°C	

Thermal Characteristics

Symbol	Parameter	FQD5N60CTM / FQU5N60CTU	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max. 2.56		
В	Thermal Resistance, Junction-to-Ambient (minimum pad of 2 oz copper), Max.	110	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (* 1 in² pad of 2 oz copper), Max.	50	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FQD5N60C	FQD5N60CTM	D-PAK	330 mm	16 mm	2500 units
FQU5N60C	FQU5N60CTU	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	aracteristics					
BV _{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0 \text{ V}, I_D = 250 \mu\text{A}$	600			V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250 μA, Referenced to 25°C		0.6		V/°C
1	Zero Gate Voltage Drain Current	V _{DS} = 600 V, V _{GS} = 0 V			1	μΑ
I _{DSS}		V _{DS} = 480 V, T _C = 125°C			10	μΑ
I _{GSSF}	Gate-Body Leakage Current, Forward	V _{GS} = 30 V, V _{DS} = 0 V			100	nA
I _{GSSR}	Gate-Body Leakage Current, Reverse	V _{GS} = -30 V, V _{DS} = 0 V			-100	nA
On Cha	racteristics					
V _{GS(th)}	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_{D} = 250 \mu\text{A}$	2.0		4.0	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} = 10 V, I _D = 1.4 A		2.0	2.5	Ω
g _{FS}	Forward Transconductance	V _{DS} = 40 V, I _D = 1.4 A		4.7		S
	ic Characteristics		1			1
C _{iss}	Input Capacitance	$V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V},$		515	670	pF
C _{oss}	Output Capacitance	f = 1.0 MHz		55	72	pF
C _{rss}	Reverse Transfer Capacitance			6.5	8.5	pF
Switchi	ing Characteristics					
t _{d(on)}	Turn-On Delay Time	V _{DD} = 300 V, I _D = 4.5A,		10	30	ns
t _r	Turn-On Rise Time	$R_{G} = 25 \Omega$		42	90	ns
t _{d(off)}	Turn-Off Delay Time	- 1.G 20 22		38	85	ns
t _f	Turn-Off Fall Time	(Note 4)	/	46	100	ns
Qg	Total Gate Charge	V _{DS} = 480 V, I _D = 4.5A,		15	19	nC
Q _{gs}	Gate-Source Charge	V _{GS} = 10 V		2.5		nC
Q _{gd}	Gate-Drain Charge	(Note 4)		6.6		nC
Drain-S	Source Diode Characteristics a	nd Maximum Ratings				
I _S	Source Diode Characteristics and Maximum Ratings Maximum Continuous Drain-Source Diode Forward Current				2.8	Α
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current				11.2	Α
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 2.8 A			1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _S = 4.5 A,		300		ns
Q _{rr}	Reverse Recovery Charge	dI _F / dt = 100 A/μs		2.2		μС

NOTES:

^{1.} Repetitive Rating : Pulse width limited by maximum junction temperature.

^{2.} L = 18.9mH, I_{AS} = 4.5 A, V_{DD} = 50V, R_G = 25 Ω , starting T_J = 25°C.

 $^{3.~}I_{SD} \leq 4.5 A,~di/dt \leq 200 A/\mu s,~V_{DD} \leq BV_{DSS,}~starting~~T_J = 25^{\circ}C.$

^{4.} Essentially independent of operating temperature.

Typical Characteristics

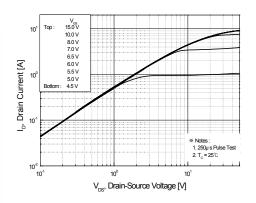


Figure 1. On-Region Characteristics

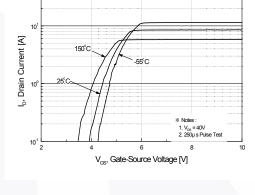


Figure 2. Transfer Characteristics

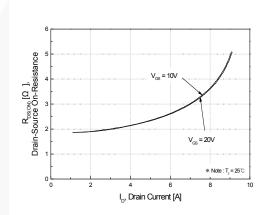


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

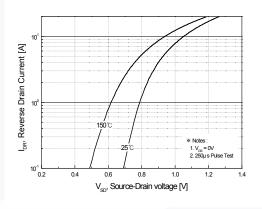


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

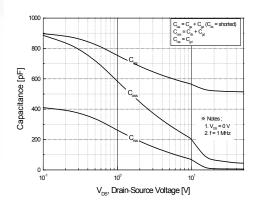


Figure 5. Capacitance Characteristics

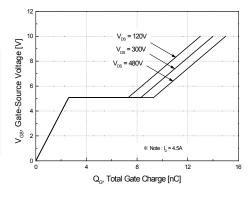


Figure 6. Gate Charge Characteristics

Typical Characteristics (Continued)

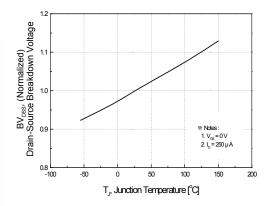


Figure 7. Breakdown Voltage Variation vs Temperature

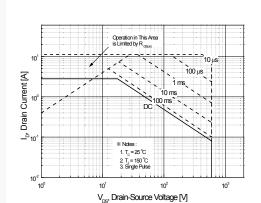


Figure 8. On-Resistance Variation vs Temperature

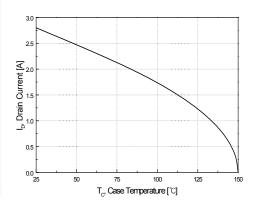


Figure 9. Maximum Safe Operating Area

Figure 10. Maximum Drain Current vs Case Temperature

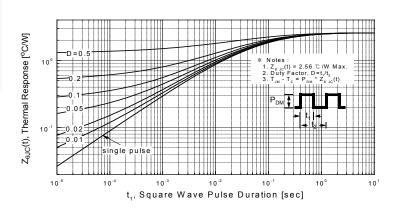


Figure 11. Transient Thermal Response Curve

Figure 12. Gate Charge Test Circuit & Waveform

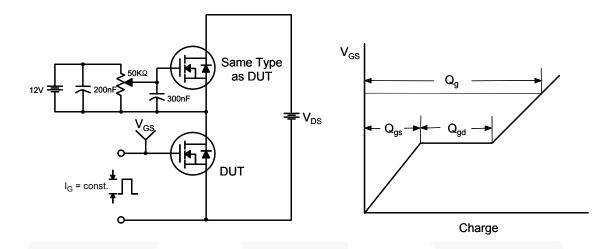


Figure 13. Resistive Switching Test Circuit & Waveforms

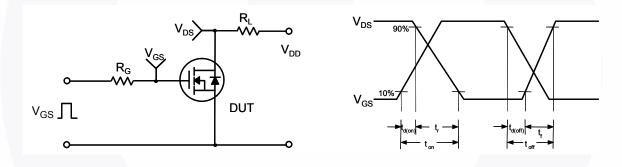
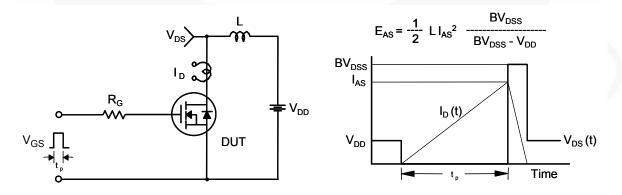


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms



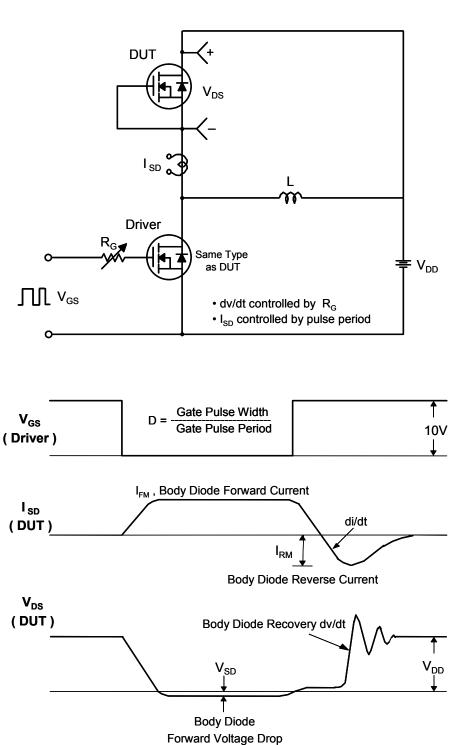


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

Mechanical Dimensions

TO-252 3L (DPAK)

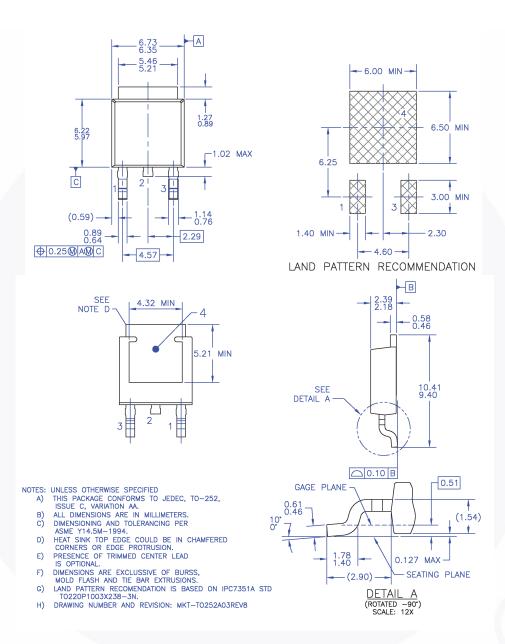


Figure 16. TO252 (D-PAK), Molded, 3 Lead, Option AA&AB

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:

http://www.fairchildsemi.com/package/packageDetails.html?id=PN_TT252-003

Dimension in Millimeters

Mechanical Dimensions

TO-251 3L (IPAK)

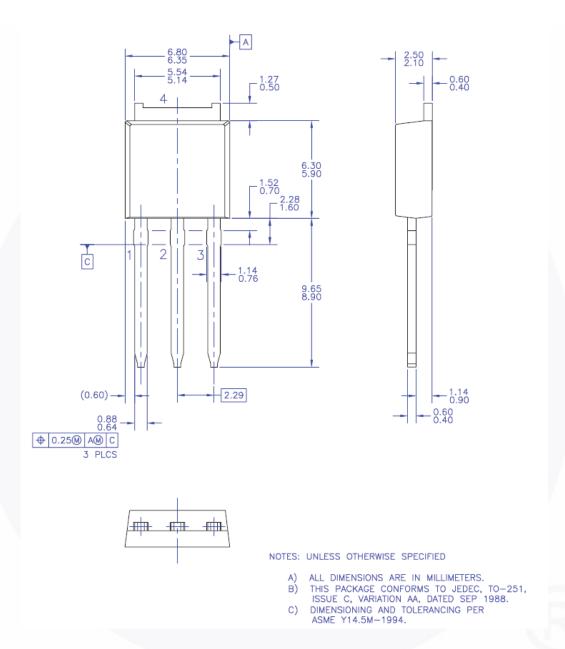


Figure 17. TO251 (IPAK) Molded 3 Lead

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:

http://www.fairchildsemi.com/package/packageDetails.html?id=PN_TO251-003

Dimension in Millimeters





TRADEMARKS

The following includes registered and unregistered trademarks and service marks, owned by Fairchild Semiconductor and/or its global subsidiaries, and is not intended to be an exhaustive list of all such trademarks.

AccuPower™ AX-CAP® BitSiC™ Build it Now™ CorePLUS™ CorePOWER™ $CROSSVOLT^{\text{TM}}$

CTI ™ Current Transfer Logic™ DEUXPEED® Dual Cool™

EcoSPARK® EfficentMax™ ESBC™

Fairchild[®] Fairchild Semiconductor® FACT Quiet Series™ FACT® FAST®

FastvCore™ FETBench™ FPS™

F-PFS™ FRFET®

Global Power ResourceSM GreenBridge™ Green FPS™

Green FPS™ e-Series™

G*max*™ GTO™ IntelliMAX™ ISOPLANAR™

Marking Small Speakers Sound Louder

and Better™ MegaBuck™ MICROCOUPLER™ MicroFET™

MicroPak™ MicroPak2™ MillerDrive™ MotionMax™ mWSaver® OptoHiT™ OPTOLOGIC® OPTOPLANAR® PowerTrench® PowerXS™

Programmable Active Droop™

QFET QS™ Quiet Series™ RapidConfigure™

Saving our world, 1mW/W/kW at a time™ SignalWise™

SmartMax™ SMART START™

Solutions for Your Success™

STEALTH™

SuperFET® SuperSOT™-3 SuperSOT™-6 SuperSOT™-8 SupreMOS® SvncFET™

SYSTEM ®* TinyBoost[®]

Sync-Lock™

TinyBuck[®] TinyCalc™ TinyLogic[®] TINYOPTO™ TinvPower™ TinyPWM™ TinyWire™ TranSiC™

TriFault Detect™ TRUECURRENT®* μSerDes™

UHC[®] Ultra FRFET™ UniFFT™ VCX™ VisualMax™ VoltagePlus™ XS™

*Trademarks of System General Corporation, used under license by Fairchild Semiconductor.

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

LIFE SUPPORT POLICY
FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE
EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used here in:

- Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
- A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

ANTI-COUNTERFEITING POLICY

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, www.Fairchildsemi.com, under Sales Support.

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufactures of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed application, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handing and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address and warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

PRODUCT STATUS DEFINITIONS Definition of Terms

Datasheet Identification	Product Status	Definition	
Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.	
Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time witho notice to improve design.	
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.	
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.	

Rev 166

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

Fairchild Semiconductor: FQD5N60CTM_F080