



# FQD17P06 / FQU17P06 P-Channel QFET® MOSFET

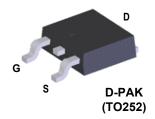
- 60 V, - 12 A, 135 m $\Omega$ 

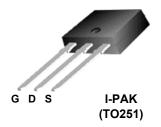
#### **Description**

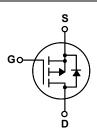
This P-Channel enhancement mode power MOSFET is produced using Fairchild Semiconductor®'s proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state resistance, and to provide superior switching performance and high avalanche energy strength. These devices are suitable for switched mode power supplies, audio amplifier, DC motor control, and variable switching power applications.

#### **Features**

- -12 A, -60 V,  $R_{DS(on)}$  = 135 m $\Omega$  (Max.) @  $V_{GS}$  = -10 V
- Low Gate Charge (Typ. 21 nC)
- · Low Crss (Typ. 80 pF)
- · 100% Avalanche Tested
- 175°C Maximum Junction Temperature Rating







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

Symbol	Parameter		FQD17P06 / FQU17P06	Unit	
V <sub>DSS</sub>	Drain-Source Voltage		-60	V	
I <sub>D</sub>	Drain Current	- Continuous (T <sub>C</sub> = 25°C)		-12	А
		- Continuous (T <sub>C</sub> = 100	)°C)	-7.6	Α
I <sub>DM</sub>	Drain Current	- Pulsed	(Note 1)	-48	А
V <sub>GSS</sub>	Gate-Source Voltage			± 25	V
E <sub>AS</sub>	Single Pulsed Avalanche Energy		(Note 2)	300	mJ
I <sub>AR</sub>	Avalanche Current		(Note 1)	-12	Α
E <sub>AR</sub>	Repetitive Avalanche Energy		(Note 1)	4.4	mJ
dv/dt	Peak Diode Recovery dv/dt		(Note 3)	-7.0	V/ns
$P_{D}$	Power Dissipation (T <sub>A</sub> = 25°C) *		2.5	W	
_	Power Dissipation (T <sub>C</sub> = 25°C)			44	W
	- Derate above 25°C			0.35	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	FQD17P06 / FQU17P06	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case, Max.	2.85	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient *, Typ.	50	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient, Max.	110	1

<sup>\*</sup> When mounted on the minimum pad size recommended (PCB Mount)

## **Elerical Characteristics**

T<sub>C</sub> = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Тур	Max	Unit
Off Cha	ıracteristics					
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	$V_{GS} = 0 \text{ V}, I_D = -250 \mu\text{A}$	-60			V
$\Delta BV_{DSS}$ / $\Delta T_{J}$	Breakdown Voltage Temperature Coefficient	$I_D$ = -250 μA, Referenced to 25°C		-0.06		V/°C
I <sub>DSS</sub>	7 0 1 1/1 5 1 0 1	V <sub>DS</sub> = -60 V, V <sub>GS</sub> = 0 V			-1	μА
Z	Zero Gate Voltage Drain Current	V <sub>DS</sub> = -48 V, T <sub>C</sub> = 125°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 <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 $V_{GS} = -10 \text{ V}, I_D = -6.0 \text{ A}$			0.11	0.135	Ω
9 <sub>FS</sub>	Forward Transconductance	$V_{DS} = -30 \text{ V}, I_{D} = -6.0 \text{ A}$		8.7		S
	ic Characteristics			600	000	
Ciss	Input Capacitance	$V_{DS} = -25 \text{ V}, V_{GS} = 0 \text{ V},$ f = 1.0  MHz		690	900	pF
Coss	Output Capacitance			325	420	pF
C <sub>rss</sub>	Reverse Transfer Capacitance			80	105	pF
Switchi	ng Characteristics					
t <sub>d(on)</sub>	Turn-On Delay Time	$V_{DD} = -30 \text{ V}, I_{D} = -8.5 \text{ A},$ $R_{G} = 25 \Omega$		13	35	ns
t <sub>r</sub>	Turn-On Rise Time			100	210	ns
t <sub>d(off)</sub>	Turn-Off Delay Time			22	55	ns
t <sub>f</sub>	Turn-Off Fall Time	(Note 4)		60	130	ns
Qg	Total Gate Charge	V <sub>DS</sub> = -48 V, I <sub>D</sub> = -17 A,		21	27	nC
Q <sub>gs</sub>	Gate-Source Charge	V <sub>GS</sub> = -10 V (Note 4)		4.2		nC
$Q_{gd}$	Gate-Drain Charge			10		nC
Drain-S	ource Diode Characteristics and Ma	aximum Ratings				
I <sub>S</sub>	Maximum Continuous Drain-Source Diode Forward Current				-12	Α
I <sub>SM</sub>	Maximum Pulsed Drain-Source Diode Forward Current				-48	Α
V <sub>SD</sub>	Drain-Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>S</sub> = -12 A			-4.0	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0 V, I <sub>S</sub> = -17 A,		92		ns
		dI <sub>F</sub> / dt = 100 A/μs		i e		

Notes: 1. Repetitive Rating : Pulse width limited by maximum junction temperature 2. L = 2.4mH, I<sub>AS</sub> = -12A, V<sub>DD</sub> = -25V, R<sub>G</sub> = 25  $\Omega$ , Starting T<sub>J</sub> = 25°C 3. I<sub>SD</sub>  $\leq$  -17 A, di/dt  $\leq$  300A/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**

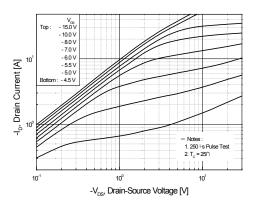


Figure 1. On-Region Characteristics

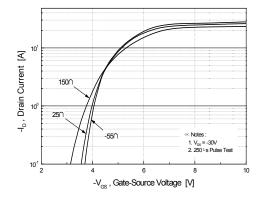


Figure 2. Transfer Characteristics

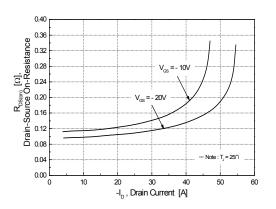


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

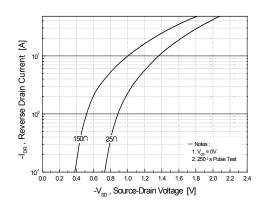


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

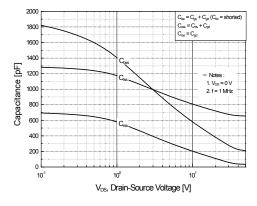


Figure 5. Capacitance Characteristics

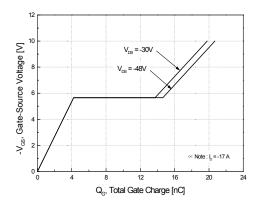
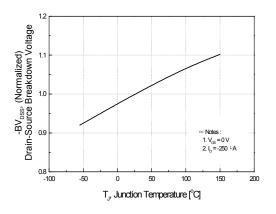


Figure 6. Gate Charge Characteristics

## Typical Characteristics (Continued)



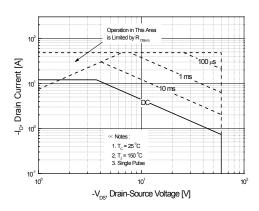
25

Out 10

Ou

Figure 7. Breakdown Voltage Variation vs. Temperature

Figure 8. On-Resistance Variation vs. Temperature



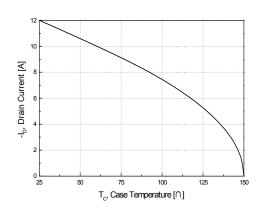


Figure 9. Maximum Safe Operating Area

Figure 10. Maximum Drain Current vs. Case Temperature

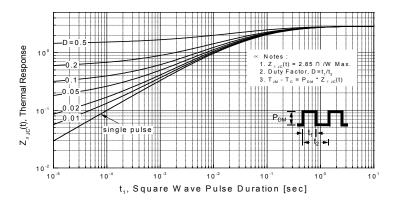
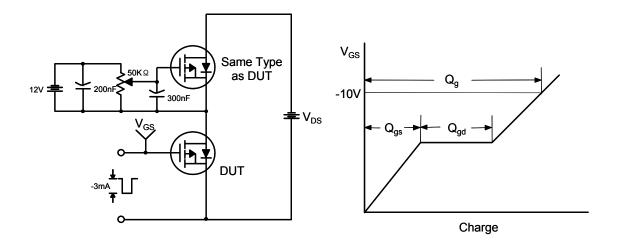
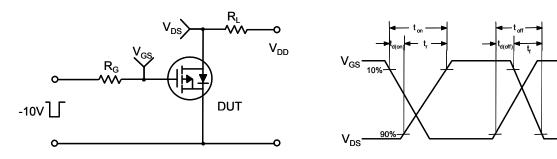


Figure 11. Transient Thermal Response Curve

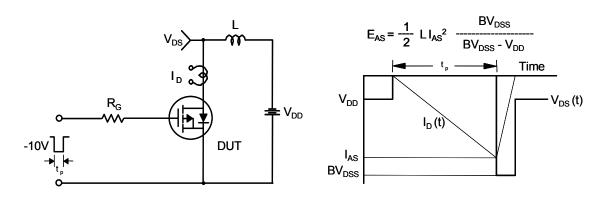
#### **Gate Charge Test Circuit & Waveform**



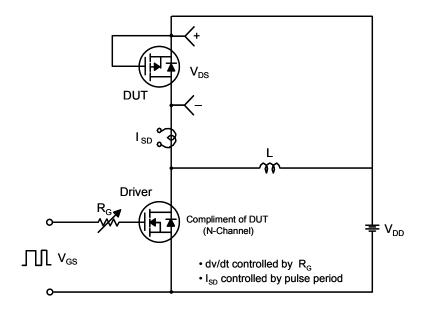
## **Resistive Switching Test Circuit & Waveforms**

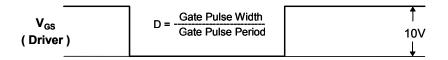


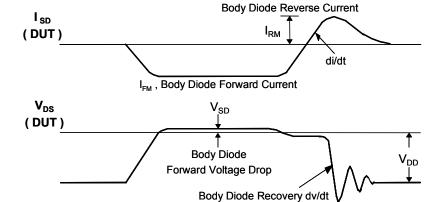
#### **Unclamped Inductive Switching Test Circuit & Waveforms**



#### Peak Diode Recovery dv/dt Test Circuit & Waveforms

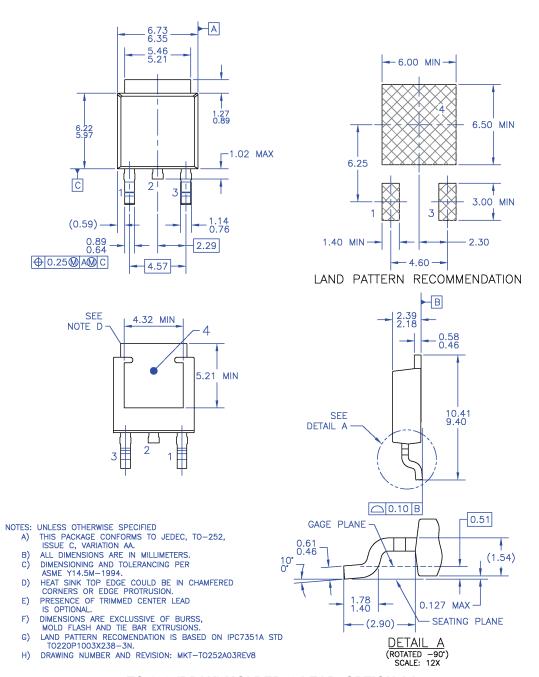






#### **Mechanical Dimensions**

# **D-PAK**



## TO-252 (DPAK) MOLDED, 3 LEAD, OPTION AA

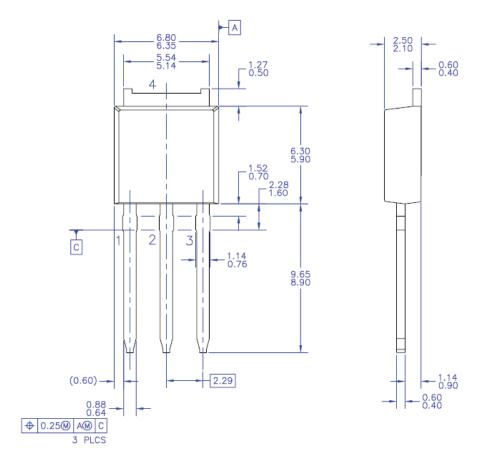
Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications 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

**Dimensions in Millimeters** 

## **Mechanical Dimensions**

# I-PAK





NOTES: UNLESS OTHERWISE SPECIFIED

- A) ALL DIMENSIONS ARE IN MILLIMETERS.
- B) THIS PACKAGE CONFORMS TO JEDEC, TO-251, ISSUE C, VARIATION AA, DATED SEP 1988.
- C) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.

## TO-251 (IPAK) MOLDED, 3LEAD, OPTION AA

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\_TT251-003

**Dimensions 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.

2Cool™ FPS™ AccuPower™ F-PFS™ AX-CAP® FRFET® Global Power Resource<sup>SM</sup> BitSiC™

Build it Now™ Green Bridge™ CorePLUS™ Green FPS™ Green FPS™ e-Series™

Gmax™

CorePOWER™  $CROSSVOLT^{TM}$ CTL™

GTO™ Current Transfer Logic™ IntelliMAX™ DEUXPEED® ISOPLANAR™

Dual Cool™ Marking Small Speakers Sound Louder EcoSPARK® MegaBuck™ EfficentMax™

ESBC™ MICROCOUPLER™ MicroFET™ MicroPak™ MicroPak2™ Fairchild®

MillerDrive™ Fairchild Semiconductor® MotionMax™ FACT Quiet Series™ mWSaver™ FACT<sup>®</sup> FAST® OptoHiT™ OPTOLOGIC® FastvCore™ OPTOPLANAR® FETBench™

(1)<sub>®</sub> 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®

SyncFET™

Sync-Lock™

SYSTEM®' TinvBoost<sup>1</sup> TinyBuck™ TinyCalc™ TinyLogic® TINYOPTO™ TinyPower™ TinyPWM™ TinyWire™ TranSiC® TriFault Detect™ TRUECURRENT®\*

**UHC®** Ultra FRFET™ UniFET™ VCX<sup>TM</sup> VisualMax™ VoltagePlus™ XS™

uSerDes™

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

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.

- 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

#### 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 without 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. 164