

November 2013

# FDB38N30U

# N-Channel UniFET<sup>TM</sup> Ultra FRFET<sup>TM</sup> MOSFET 300 V, 38 A, 120 m $\Omega$

#### **Features**

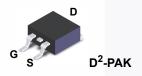
- •R  $_{\mathrm{DS(on)}}$  = 120 m $\Omega$  (Max.) @  $\mathrm{V_{GS}}$  = 10 V,  $\mathrm{I_{D}}$  = 19 A
- Low Gate Charge (Typ. 56 nC)
- •L ow C<sub>rss</sub> (Typ. 55 pF)
- · 100% Avalanche Tested
- •R oHS Compliant

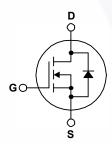
# **Applications**

- · Uninterruptible Power Supply
- LCD/LED/PDP TV
- · AC-DC Power Supply

# Description

UniFET<sup>TM</sup> MOSFET is Fairchild Semicondu ctor's high voltage MOSFET family based on planar stripe and DMOS technology. This MOSFET is tailored to r educe on-state r esistance, and to provide be tter switching performance and higher avalanche energy streng th. UniFET Ultra F RFET<sup>TM</sup> MOSFET has much superior body diode reverse recovery performance. Its trr is less than 50nsec and the r everse dv/dt immunity is 20V/nsec while normal planar MOSF ETs have over 200 nsec and 4 .5V/nsec respectively. Ther efore UniFET Ultra FRFET MO SFET can remove additional component and improve system r eliability in certain applications that require performance improvement of the MOSFET's bo dy diode. The is device family is suitable for switching power converter applications such as power factor correction (PFC), flat panel display (FPD) TV power, ATX and electronic lamp ballasts.





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

Symbol		Parameter		FDB38N30U	Unit	
V <sub>DSS</sub>	Drain to Source Voltage			300	V	
V <sub>GSS</sub>	Gate to Source Voltage			±30	V	
	Drain Orrent	- Continuous (T <sub>C</sub> = 25°C)		38	^	
ID	Diam when	- Continuous (T <sub>C</sub> = 100°C)		22.8	A	
I <sub>DM</sub>	Drain Current	- Pulsed	(Note 1)	152	Α	
E <sub>AS</sub>	Single Pulsed Avalanche	Energy	(Note 2)	722	mJ	
I <sub>AR</sub>	Avalanche Current		(Note 1)	38	Α	
E <sub>AR</sub>	Repetitive Avalanche En	ergy	(Note 1)	31.3	mJ	
dv/dt	Peak Diode Recovery dv	r/dt	(Note 3)	20	V/ns	
D	Dawer Dissination	(T <sub>C</sub> = 25°C)		313	W	
$P_{D}$	Power Dissipation	- Derate Above 25°C2		.5	W/°C	
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage T	emperature Range		-55 to +150	°C	
T <sub>L</sub>	Maximum Lead Tempera	ture for Soldering, 1/8" from Case for 5 S	Seconds	300	°C	

## **Thermal Characteristics**

Symbol	Parameter	FDB38N30U	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	0.4	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	62.5	- 0/00

Unit

# **Package Marking and Ordering Information**

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FDB38N30U	FDB38N30U	D <sup>2</sup> -PAK	Tape and Reel	330 mm	24 mm	800 units

**Test Conditions** 

Min.

Тур.

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

Off Chara	acteristics					
BV <sub>DSS</sub>	Drain to Source Breakdown Voltage	$I_D = 250 \mu A, V_{GS} = 0 V, T_J = 25^{\circ}C3$	00	-	-	V
ΔBV <sub>DSS</sub> / ΔT <sub>J</sub>	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250 μA, Referenced to 25°C	-	0.33	-	V/°C
1	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 300 V, V <sub>GS</sub> = 0 V	-	-	25	^
IDSS	Zero Gate Voltage Drain Current	$V_{DS} = 240 \text{ V}, T_{C} = 125^{\circ}\text{C}$	-	-	250	μΑ
I <sub>GSS</sub>	Gate to Body Leakage Current	$V_{GS} = \pm 30 \text{ V}, V_{DS} = 0 \text{ V}$	-	-	±100	nA

#### **On Characteristics**

Symbol

V <sub>GS(th)</sub>	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_{D} = 250 \mu\text{A}$	3.0	-	5.0	V
R <sub>DS(on)</sub>	Static Drain to Source On Resistance	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 19 A	-	0.103	0.120	Ω
9 <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 20 V, I <sub>D</sub> = 19 A	-	30	-	S

# **Dynamic Characteristics**

C <sub>iss</sub>	Input Capacitance	V 05 V V 0 V		-	2510	3340	pF
Coss	Output Capacitance	$V_{DS} = 25 \text{ V}, V_{GS} = 0 \text{ V},$ f = 1  MHz		-	470	625	pF
C <sub>rss</sub>	Reverse Transfer Capacitance	1 - 1 1/11/12		-\	55	85	pF
Q <sub>g(tot)</sub>	Total Gate Charge at 10V	V <sub>DS</sub> = 240 V, I <sub>D</sub> = 38 A		-5	6	73	nC
$Q_{gs}$	Gate to Source Gate Charge	V <sub>GS</sub> = 10 V		-	14	-	nC
$Q_{gd}$	Gate to Drain "Miller" Charge		(Note 4)	-	24	-	nC

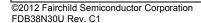
# **Switching Characteristics**

t <sub>d(on)</sub>	Turn-On Delay Time		-3	3	76	ns
t <sub>r</sub>	Turn-On Rise Time	$V_{DD} = 150 \text{ V}, I_D = 38 \text{ A},$	-	80	170	ns
t <sub>d(off)</sub>	Turn-Off Delay Time	$V_{GS}$ = 10 V, $R_G$ = 25 $\Omega$	-	133	276	ns
t <sub>f</sub>	Turn-Off Fall Time	(Note 4)	-	62	134	ns

## **Drain-Source Diode Characteristics**

Is	Maximum Continuous Drain to Source Diod	Maximum Continuous Drain to Source Diode Forward Current		-	38	Α
I <sub>SM</sub>	Maximum Pulsed Drain to Source Diode Forward Current		· -	-	152	Α
$V_{SD}$	Drain to Source Diode Forward Voltage	V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 38 A	-	-	1.4	V
t <sub>rr</sub>	Reverse Recovery Time	V <sub>GS</sub> = 0 V, I <sub>SD</sub> = 38 A,	-6	0	-	ns
Q <sub>rr</sub>	Reverse Recovery Charge	dI <sub>F</sub> /dt = 100 A/μs	-	0.097	_	μС

- ${\it 1:} \ \ {\it Repetitive\ rating: pulse-width\ limited\ by\ maximum\ junction\ temperature.}$
- 2: L = 1 mH,  $I_{AS}$  = 38 A,  $V_{DD}$  = 50 V,  $R_{G}$  = 25  $\Omega$ , starting  $T_{J}$  = 25°C.
- 3:  $I_{SD} \le 38$  A, di/dt  $\le 200$  A/µs,  $V_{DD} \le BV_{DSS}$ , starting  $T_J = 25^{\circ}C$ .
- 4: Essentially Independent of Operating Temperature Typical Characteristics.



# **Typical Performance Characteristics**

Figure 1. On-Region Characteristics 100 V<sub>GS</sub> = 15.0V 10.0V 8.0V 7.0V 6.5V Ip, Drain Current[A] 6.0V 1. 250µs Pulse Test 2.  $T_C = 25^{\circ}C$ 0.1 0.1 10 1 V<sub>DS</sub>, Drain-Source Voltage[V] 20

Figure 3. On-Resistance Variation vs.

Drain Current and Gate Voltage

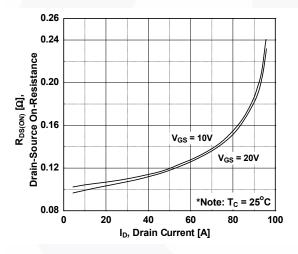


Figure 5. Capacitance Characteristics

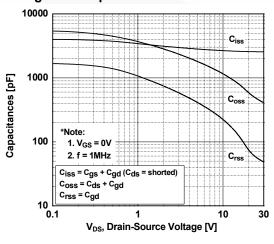


Figure 2. Transfer Characteristics

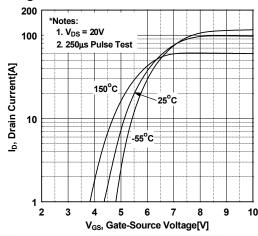


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

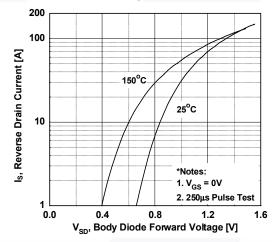
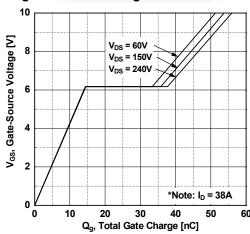


Figure 6. Gate Charge Characteristics



# **Typical Performance Characteristics** (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

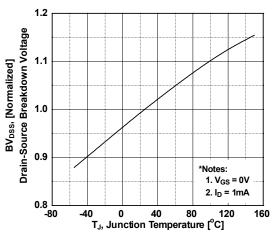


Figure 9. Maximum Drain Current vs. Case Temperature

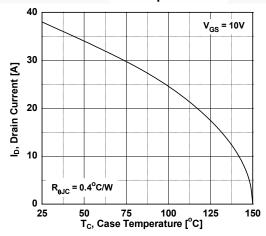


Figure 8. Maximum Safe Operating Area

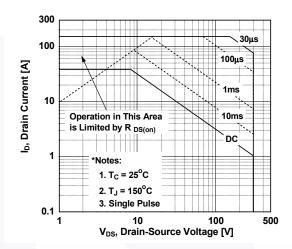


Figure 10. Unclamped Inductive Switching Capability

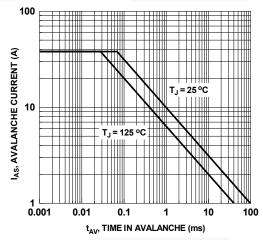
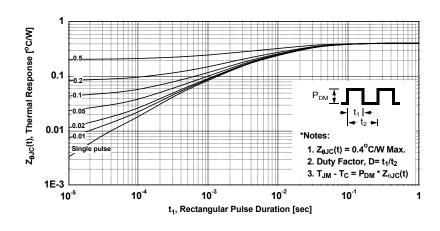


Figure 11. Transient Thermal Response Curve



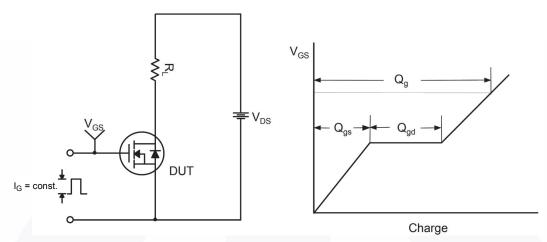


Figure 12. Gate Charge Test Circuit & Waveform

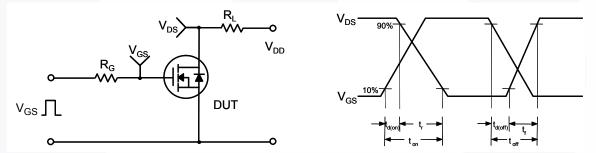


Figure 13. Resistive Switching Test Circuit & Waveforms

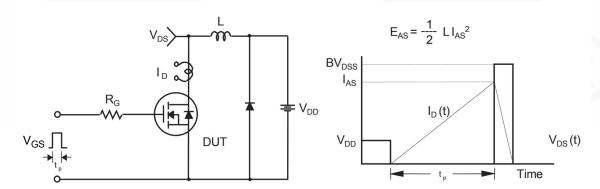


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

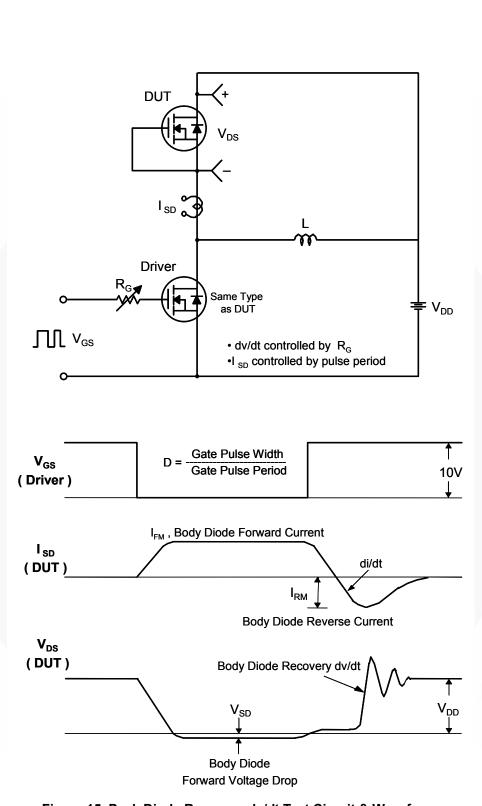


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

## **Mechanical Dimensions**

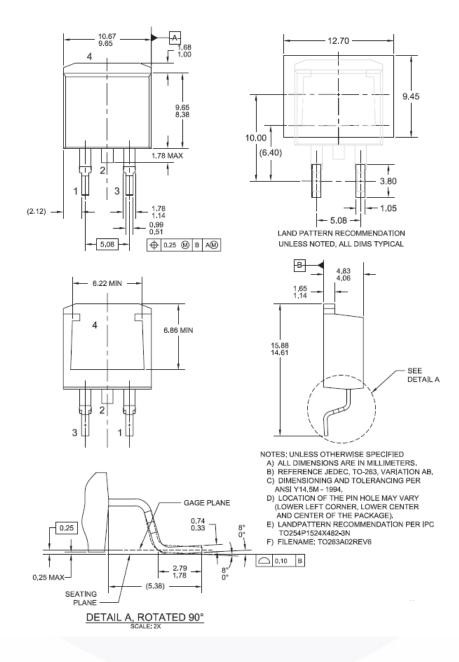


Figure 16. TO263 (D<sup>2</sup>PAK), Molded, 2-Lead, Surface Mount

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\_TT263-002





#### **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<sup>®</sup> Fairchild Semiconductor® FACT Quiet Series™ FACT<sup>®</sup>

FAST® FastvCore™ FETBench™ FPS™

F-PFS™ FRFET®

Global Power Resource<sup>SM</sup>

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<sup>0</sup> 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<sup>®</sup> TinyBuck<sup>®</sup> TinyCalc™ TinyLogic<sup>®</sup> TINYOPTO™ TinvPower™ TinyPWM™ TinyWire™ TranSiC™ TriFault Detect™ TRUECURRENT®\*

Sync-Lock™

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

μSerDes™

\*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 AR ISING 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 pro vided in t he label ing, can be reasonably expected to result in a significant injury of the user.
- A critical component in an y 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 Ant i-Counterfeiting Pol icy is also stated on our external websit e, 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 a re listed by coun try on our web page cited above. Products cust omers 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 warr anties 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 166