FAIRCHILD™

Is Now Part of

ON Semiconductor®

To learn more about ON Semiconductor, please visit our website at
www.onsemi.com

Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

FAIRCHILD

SEMICONDUCTOR®

November 2013

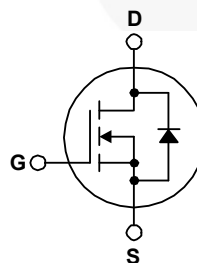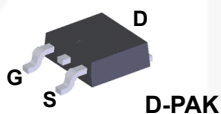# FQD2N80

N-Channel QFET® MOSFET

800 V, 1.8 A, 6.3 Ω

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

- 1.8 A, 800 V, $R_{DS(on)}$ = 6.3 Ω (Max.) @ V_{GS} = 10 V, I_D = 0.9 A
- Low Gate Charge (Typ. 12 nC)
- Low Crss (Typ. 5.5 pF)
- 100% Avalanche Tested
- RoHS Compliant

D-PAK

Absolute Maximum Ratings T_C = 25°C unless otherwise noted.

Symbol	Parameter			FQD2N80TM	Unit
V_{DSS}	Drain-Source Voltage			800	V
I_D	Drain Current	- Continuous (T_C = 25°C)		1.8	A
		- Continuous (T_C = 100°C)		1.14	A
I_{DM}	Drain Current	- Pulsed	(Note 1)	7.2	A
V_{GSS}	Gate-Source Voltage			± 30	V
E_{AS}	Single Pulsed Avalanche Energy		(Note 2)	180	mJ
I_{AR}	Avalanche Current		(Note 1)	1.8	A
E_{AR}	Repetitive Avalanche Energy		(Note 1)	5.0	mJ
dv/dt	Peak Diode Recovery dv/dt		(Note 3)	4.0	V/ns
P_D	Power Dissipation (T_A = 25°C) *			2.5	W
	Power Dissipation (T_C = 25°C)			50	W
	- Derate above 25°C			0.4	W/°C
T_J, T_{STG}	Operating and Storage Temperature Range			-55 to +150	°C
T_L	Maximum lead temperature for soldering, 1/8" from case for 5 seconds			300	°C

Thermal Characteristics

Symbol	Parameter	FQD2N80TM	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	2.5	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Minimum Pad of 2-oz Copper), Max.	110	
	Thermal Resistance, Junction to Ambient (*1 in² Pad of 2-oz Copper), Max.	50	

www.fairchildsemi.com

Package Marking and Ordering Information

Part Number	Top Mark	Package	Packing Method	Reel Size	Tape Width	Quantity
FQD2N80TM	FQD2N80	DPAK	Tape and Reel	330 mm	16 mm	2500 units

Electrical Characteristics T_C = 25°C unless otherwise noted.

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA	800	--	--	V
ΔBV_{DSS} / ΔT_J	Breakdown Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	--	0.9	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 800 V, V_{GS} = 0 V	--	--	10	μA
		V_{DS} = 640 V, T_C = 125°C	--	--	100	μA
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 Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 μA	3.0	--	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10 V, I_D = 0.9 A	--	4.9	6.3	Ω
g_{FS}	Forward Transconductance	V_{DS} = 50 V, I_D = 0.9 A	--	2.4	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25 V, V_{GS} = 0 V, f = 1.0 MHz	--	425	550	pF
C_{oss}	Output Capacitance		--	45	60	pF
C_{rss}	Reverse Transfer Capacitance		--	5.5	7.0	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 400 V, I_D = 2.4 A, R_G = 25 Ω	--	12	35	ns
t_r	Turn-On Rise Time		--	30	70	ns
$t_{d(off)}$	Turn-Off Delay Time		--	25	60	ns
t_f	Turn-Off Fall Time	(Note 4)	--	28	65	ns
Q_g	Total Gate Charge	V_{DS} = 640 V, I_D = 2.4 A, V_{GS} = 10 V	--	12	15	nC
Q_{gs}	Gate-Source Charge		--	2.6	--	nC
Q_{gd}	Gate-Drain Charge	(Note 4)	--	6.0	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	1.8	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	7.2	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 1.8 A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0 V, I_S = 2.4 A, dI_F / dt = 100 A/μs	--	480	--	ns
Q_{rr}	Reverse Recovery Charge		--	2.0	--	μC

Notes:

1. Repetitive rating : pulse-width limited by maximum junction temperature.
2. L = 105 mH, I_{AS} = 1.8 A, V_{DD} = 50 V, R_G = 25 Ω, starting T_J = 25°C.
3. $I_{SD} \leq$ 2.4 A, di/dt $\leq$ 200 A/μs, $V_{DD} \leq BV_{DSS}$, starting T_J = 25°C.
4. Essentially independent of operating temperature.
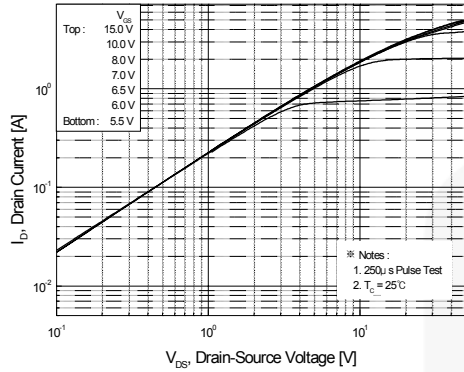
Typical Characteristics
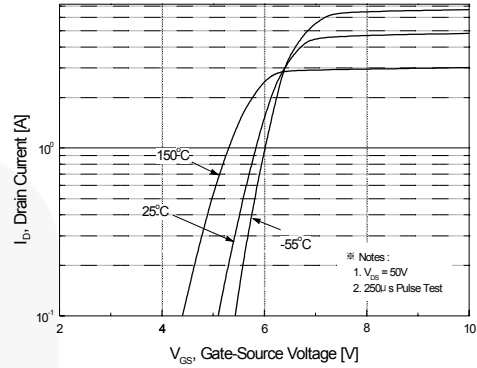
Figure 1. On-Region Characteristics
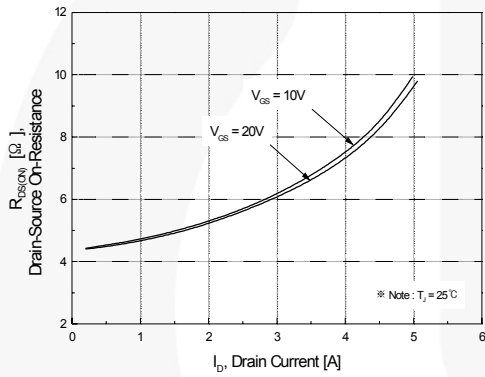

Figure 2. Transfer Characteristics

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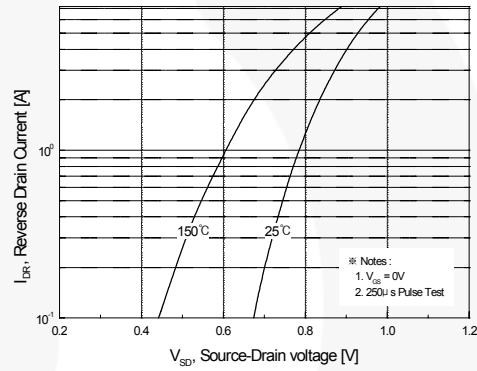Drain Current and Gate Voltage

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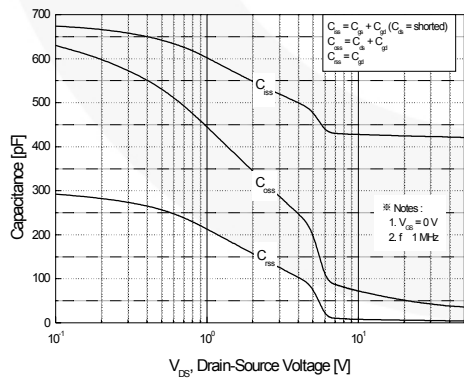Variation with Source Current
and Temperature

Figure 5. Capacitance Characteristics
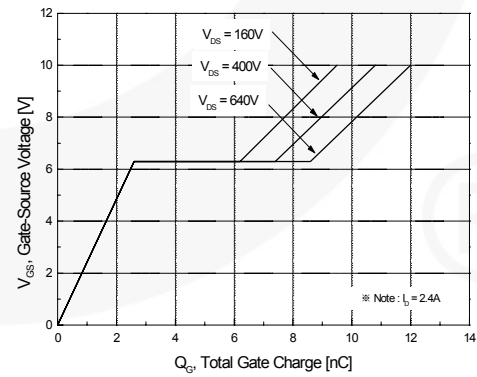
Figure 6. Gate Charge Characteristics

www.fairchildsemi.com

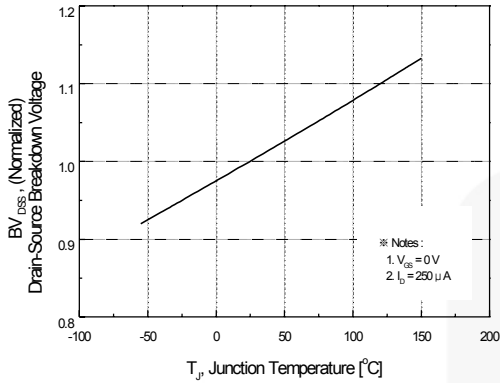## Typical Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs Temperature
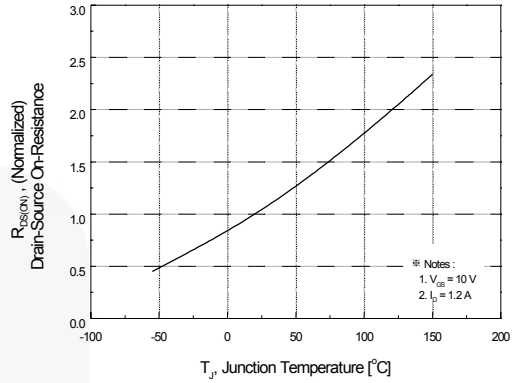
Figure 8. On-Resistance Variation vs Temperature

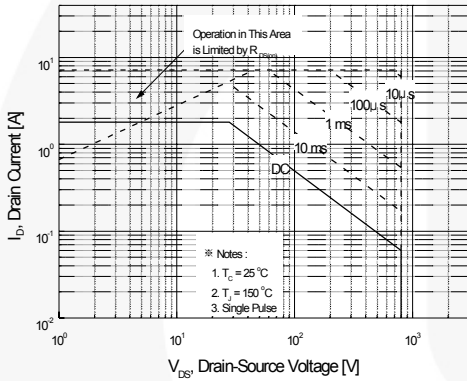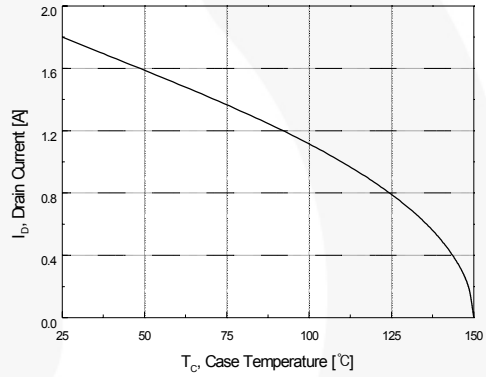**Figure 9. Maximum Safe Operating Area**

Figure 10. Maximum Drain Current vs Case Temperature
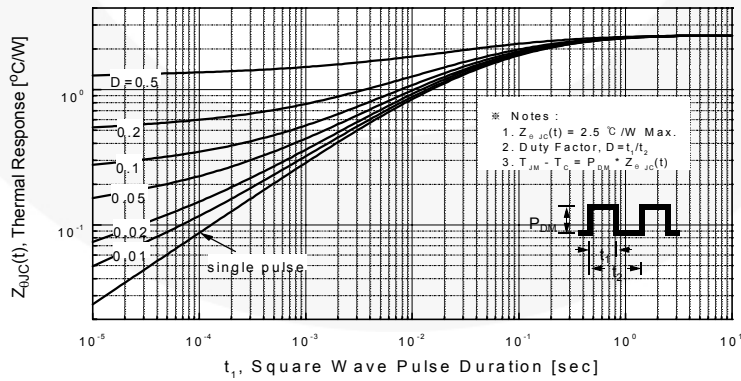
Figure 11. Transient Thermal Response Curve
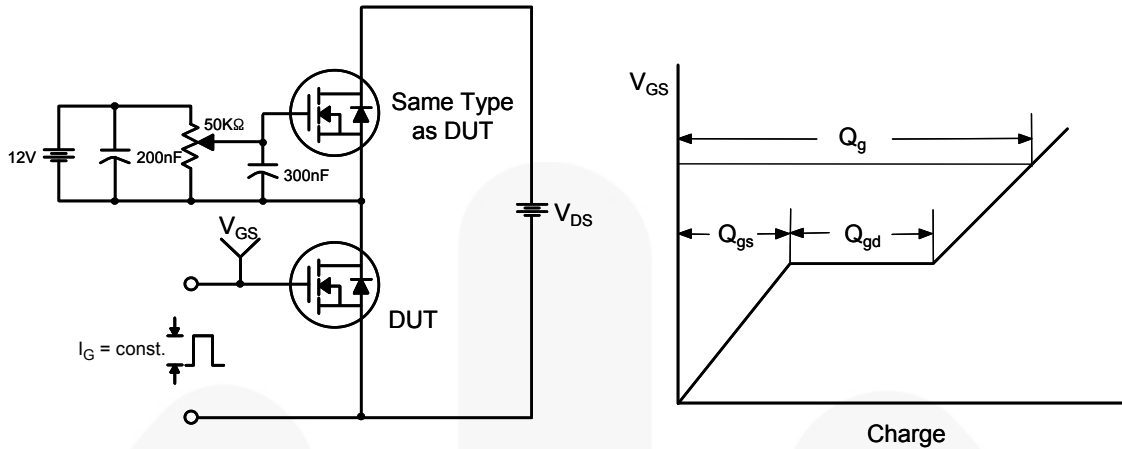
Figure 12. Gate Charge Test Circuit & Waveform
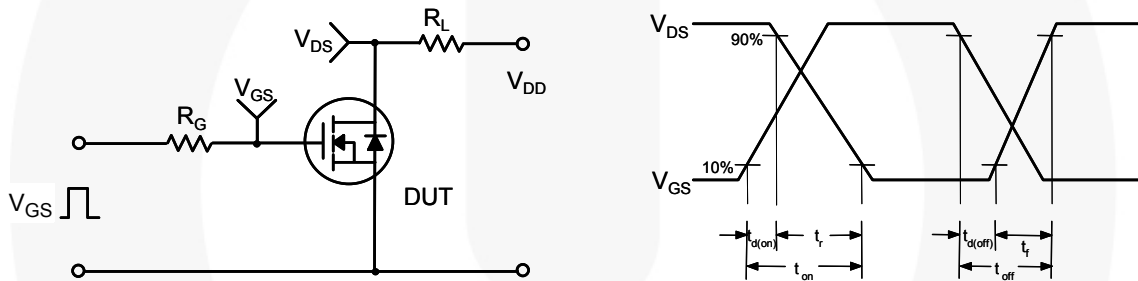
Figure 13. Resistive Switching Test Circuit & Waveforms

$$E_{AS} = \frac{1}{2} L I_{AS}^2 \frac{BV_{DSS}}{BV_{DSS} - V_{DD}}$$

Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

DUT

V_{DS}

I_{SD}

L

Driver

R_G

Same Type
as DUT

V_{DD}

V_{GS}

• dv/dt controlled by R_G
• I_{SD} controlled by pulse period

V_{GS}
(Driver)

$D = \dfrac{\text{Gate Pulse Width}}{\text{Gate Pulse Period}}$

10V

I_{SD}
(DUT)

I_{FM} , Body Diode Forward Current

di/dt

I_{RM}

Body Diode Reverse Current

V_{DS}
(DUT)

Body Diode Recovery dv/dt

V_{SD}

V_{DD}

Body Diode
Forward Voltage Drop

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

Mechanical Dimensions

6.73 / 6.35

5.46 / 5.21

A

1.27 / 0.89

6.22 / 5.97

1.02 MAX

C

1   2   3

(0.59)

0.89 / 0.64

1.14 / 0.76

2.29

4.57

⊕ 0.25 Ⓜ A Ⓜ C

6.00 MIN

6.50 MIN

6.25

4

3.00 MIN

1   3

1.40 MIN

2.30

4.60

LAND PATTERN RECOMMENDATION

SEE NOTE D

4.32 MIN

4

5.21 MIN

3   2   1

B

2.39 / 2.18

0.58 / 0.46

10.41 / 9.40

SEE DETAIL A

⌒ 0.10 B

GAGE PLANE

0.61 / 0.46

10° / 0°

0.51

(1.54)

1.78 / 1.40

0.127 MAX

SEATING PLANE

(2.90)

DETAIL A
(ROTATED −90°)
SCALE: 12X

NOTES: UNLESS OTHERWISE SPECIFIED
A) THIS PACKAGE CONFORMS TO JEDEC, TO−252, ISSUE C, VARIATION AA.
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSIONING AND TOLERANCING PER ASME Y14.5M−1994.
D) HEAT SINK TOP EDGE COULD BE IN CHAMFERED CORNERS OR EDGE PROTRUSION.
E) PRESENCE OF TRIMMED CENTER LEAD IS OPTIONAL.
F) DIMENSIONS ARE EXCLUSIVE OF BURSS, MOLD FLASH AND TIE BAR EXTRUSIONS.
G) LAND PATTERN RECOMENDATION IS BASED ON IPC7351A STD TO220P1003X238−3N.
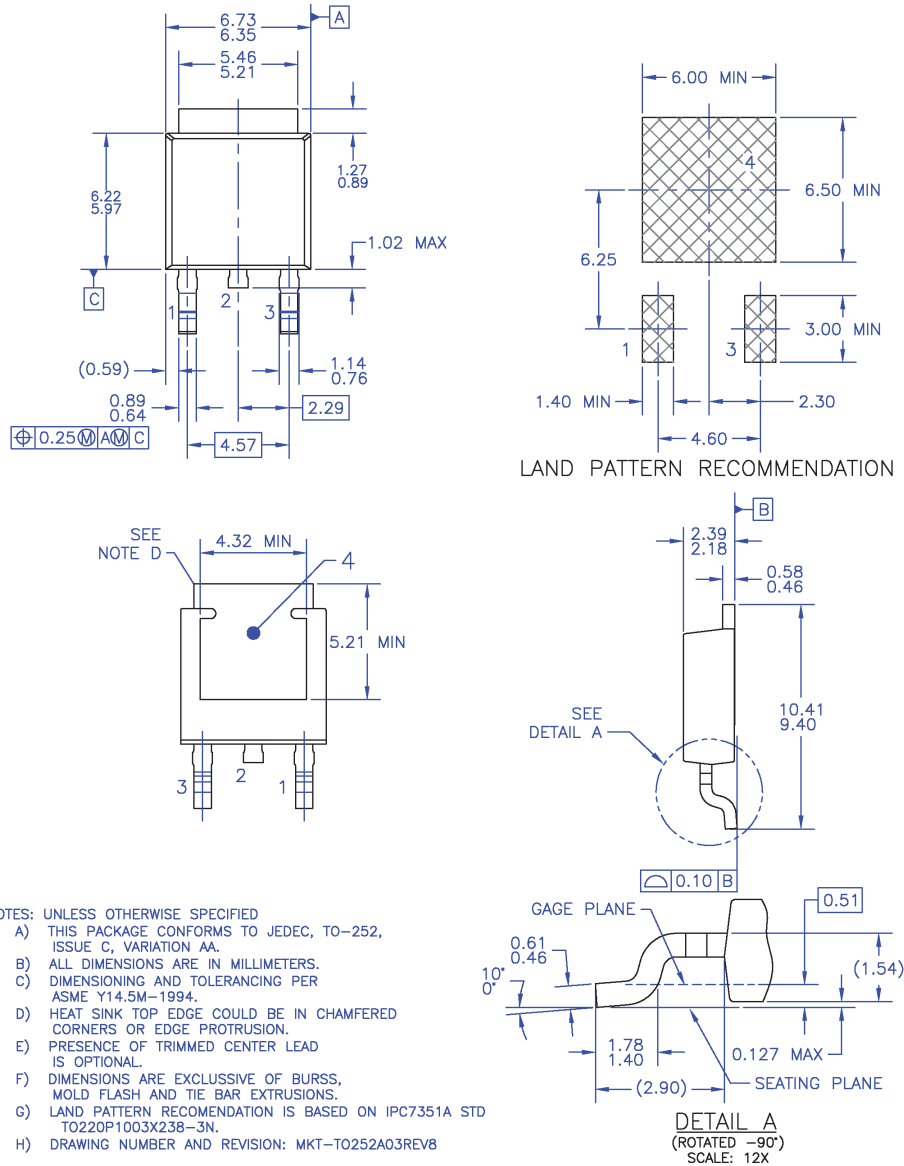H) DRAWING NUMBER AND REVISION: MKT−TO252A03REV8

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

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™	F-PFS™		Sync-Lock™
AX-CAP®*	FRFET®	®	SYSTEM GENERAL ®*
BitSiC™	Global Power Resource℠	PowerTrench®	
Build it Now™	GreenBridge™	PowerXS™	TinyBoost®
CorePLUS™	Green FPS™	Programmable Active Droop™	TinyBuck®
CorePOWER™	Green FPS™ e-Series™	QFET®	TinyCalc™
CROSSVOLT™	G*max*™	QS™	TinyLogic®
CTL™	GTO™	Quiet Series™	TINYOPTO™
Current Transfer Logic™	IntelliMAX™	RapidConfigure™	TinyPower™
DEUXPEED®	ISOPLANAR™	™	TinyPWM™
Dual Cool™	Marking Small Speakers Sound Louder		TinyWire™
EcoSPARK®	and Better™	Saving our world, 1mW/W/kW at a time™	TranSiC™
EfficentMax™	MegaBuck™	SignalWise™	TriFault Detect™
ESBC™	MICROCOUPLER™	SmartMax™	TRUECURRENT®*
	MicroFET™	SMART START™	μSerDes™
® Fairchild®	MicroPak™	Solutions for Your Success™	
Fairchild Semiconductor®	MicroPak2™	SPM®	μSerDes™
FACT Quiet Series™	MillerDrive™	STEALTH™	UHC®
FACT®	MotionMax™	SuperFET®	Ultra FRFET™
FAST®	mWSaver®	SuperSOT™-3	UniFET™
FastvCore™	OptoHiT™	SuperSOT™-6	VCX™
FETBench™	OPTOLOGIC®	SuperSOT™-8	VisualMax™
FPS™	OPTOPLANAR®	SupreMOS®	VoltagePlus™
		SyncFET™	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:

1. 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.

2. 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 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. I66

PUBLICATION ORDERING INFORMATION

© Semiconductor Components Industries, LLC

www.onsemi.com

Mouser Electronics

Authorized Distributor

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

[ON Semiconductor](#):
  [FQD2N80TM](#)