FAIRCHILD

SEMICONDUCTOR®

December 2011

FAN5903
Buck Converter with Bypass Mode for 3G/3.5G/4G PAs

Features

- 2.7V to 5.5V Input Voltage Range
- V_{OUT} Range from 0.4V to 3.50V (or V_{IN})
- Small Form Factor Inductor
  - o 2012 470nH or 540nH for Minimal PCB Area
  - o 2020 1.0µH for Higher Efficiency
- Bypass Dropout at 500mA, 60mV Typical
- 100% Duty Cycle for Low Dropout Operation
- Input Under-Voltage Lockout / Thermal Shutdown
- 1.34mm x 1.29mm, 9-Bump, 0.4mm-Pitch WLCSP
- 3MHz / 6MHz Selectable Switching Frequency to Facilitate System Optimization
- High-Efficiency PFM Operation at Low Power
- Sleep Mode for Very Low I_Q Operation
- Up to 96% Efficient Synchronous Operation at High-Power Conditions
- 10µs Output Voltage Step Response for Early Power Loop Settling

Applications

- Dynamic Supply Bias for 3G/3.5G and 4G PAs
- Power Supply for WCDMA/LTE PAs

Resources

For more information or a full copy of this datasheet, please contact a Fairchild representative.

Description

FAN5903 is a high-efficiency, low-noise, synchronous, step-down, DC-DC converter designed for powering 3G/3.5G/4G RF Power Amplifiers (PAs) in handsets and other mobile applications.

The output voltage may be dynamically varied from 0.40V to 3.50V, proportional to an analog input V_{CON}, ranging from 0.16V to 1.40V provided by an external DAC. This allows the PA to be supplied with the voltage that enables maximum power-added efficiency.

An integrated bypass FET automatically switches on when battery voltage drops close to the desired output voltage ($V_{OUT}=V_{BAT}-200mV$). The DC-DC switches back to Synchronous Mode when the voltage dropout exceeds 375mV. The integrated bypass FET is also enabled when V_{CON} is nominally greater than to 1.5V.

The FAN5903 offers fast transition times, enabling changes to the output voltage in less than 10µs for power transitions. Moreover, a Current-Mode control loop with fast transient response ensures excellent line and load regulation.

Light-load efficiency is optimized by operating in PFM Mode for load currents typically less than 100mA.
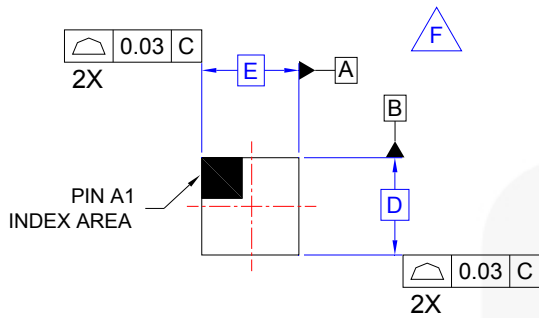
The switching frequency may be set to 3MHz or 6MHz, enabling further optimization of system performance. The FAN5903 typically uses a single, small-form-factor inductor of 540nH. Efficiency may be further optimized using a 1.0µH inductor when running at 3MHz.

When output regulation is not required, the FAN5903 may be placed in Sleep Mode by setting V_{CON} nominally to 100mV. This ensures a very low I_Q (<70µA) while enabling a fast return to output regulation. The FAN5903 enables significant current reduction and increased talk time and is available in a 1.34mm x 1.29mm, 9-bump, 0.40mm-pitch, WLCSP package.
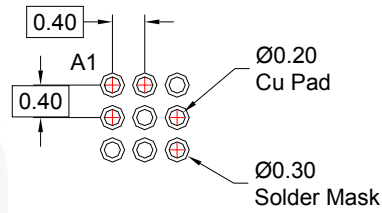
Ordering Information

Part Number	Operating Temperature Range	Package	Packing Method
FAN5903UCX	-40 to +85°C	1.34mm x 1.29mm, 9-bump, 0.4mm Pitch, Wafer-Level Chip-Scale Package (WLCSP)	Tape and Reel

Physical Dimensions
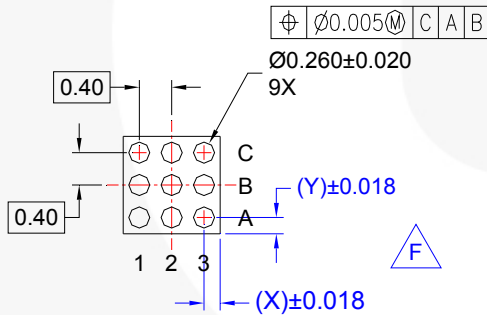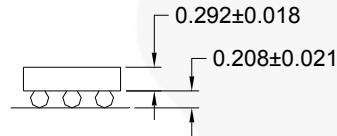
TOP VIEW

PIN A1
INDEX AREA

2X

2X

0.03 | C

0.03 | C

E

A

B

D

F

LAND PATTERN RECOMMENDATION
(NSMD PAD TYPE)

0.40

0.40

A1

Ø0.20
Cu Pad

Ø0.30
Solder Mask

// | 0.06 | C

0.539
0.461

E

0.05 | C

C

SEATING PLANE

D

SIDE VIEWS

0.292±0.018

0.208±0.021

Ø0.005 Ⓜ | C | A | B

Ø0.260±0.020
9X

0.40

0.40

C
B
A

1 2 3

(Y)±0.018

(X)±0.018

F
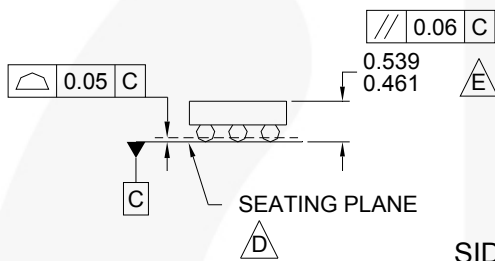
BOTTOM VIEW

NOTES:

A. NO JEDEC REGISTRATION APPLIES.

B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS AND TOLERANCE
   PER ASMEY14.5M, 1994.

D. DATUM C IS DEFINED BY THE SPHERICAL
   CROWNS OF THE BALLS.

E. PACKAGE NOMINAL HEIGHT IS 500 MICRONS
   ±39 MICRONS (461-539 MICRONS).

F. FOR DIMENSIONS D, E, X, AND Y SEE
   PRODUCT DATASHEET.

G. DRAWING FILNAME: MKT-UC009AErev1

Product	D	E	X	Y	Unit
FAN5903UCX	1.292 ± 0.030	1.342 ± 0.030	0.271	0.246	mm

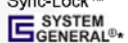**Figure 42. 1.34 x 1.29mm, 9-Bump, 0.4mm-Pitch WLCSP**

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/packaging/.

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

* 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 herein:

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 manufacturers 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 applications, 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 handling 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 any 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. I61