



FAN5904

Multi-Mode Buck Converter for GSM/EDGE, 3G/3.5G and 4G PAs

Features

- 2.7V to 5.5V Input Voltage Range
- V_{OUT} Range from 0.40V to 3.50V (or V_{IN})
- Single 470nH Small Form Factor Inductor
- 35mΩ Integrated Bypass FET
- 100% Duty Cycle for Low Dropout Operation
- Input Under-Voltage Lockout / Thermal Shutdown
- 1.71mm x 1.71mm, 16-Bump, 0.40mm Pitch WLCSP
- **High Power PWM Mode**
 - Up to 95% Efficient Synchronous Operation in High P_{OUT} Conditions
 - Output current up to 2.3A
 - 10μs Output Voltage Step Response for Early GSM Tx Power-Loop Settling
 - 3MHz PWM Mode
- **Low Power Auto Mode**
 - Up to 95% Efficient Synchronous Operation at Higher P_{OUT} Conditions
 - Output Current up to 1.2A
 - 10μs Output Voltage Step Response for Early Tx Power-Loop Settling
 - 6MHz PWM Operation at High Power and PFM Operation at Low Power
- **Bypass Mode**
 - Up to 3A Load Current

Applications

- Dynamic Supply Bias for Polar or Linear GSM/EDGE PAs and 3G/3.5G and 4G PAs
- Dynamic Supply Bias for GSM/EDGE Quad Band Amplifiers for Mobile Handsets and Data Cards

Description

The FAN5904 is a high-efficiency, low-noise, synchronous, step-down, DC-DC converter optimized for powering Radio Frequency (RF) Power Amplifiers (PAs) in handsets and other mobile applications. In High-Power Mode, GSM Tx power is enabled. In Low-Power Mode, up to 3.0W is supported, enabling up to 29dBm output power for 3G/3.5G and 4G platforms.

The output voltage may be dynamically adjusted from 0.40V to 3.50V, proportional to an analog input voltage V_{CON} ranging from 0.16V to 1.40V, optimizing power-added efficiency. Fast transition times of less than 10μs are achieved, allowing excellent inter-slot settling.

An integrated bypass FET is automatically enabled when the battery voltage and voltage drop across the DC-DC PMOS device are within a set voltage range of the desired output voltage ($V_{OUT} = V_{BAT} - V_{PMOS} - V_{BP_TH}$). This dynamic bypass feature enables the FAN5904 to support heavy load currents under the most stringent VSWR conditions while maintaining high efficiency and superior spectral performance. The bypass FET may also be enabled by providing a V_{CON} voltage nominally greater than or equal to 1.5V or by driving $BPEN$ high.

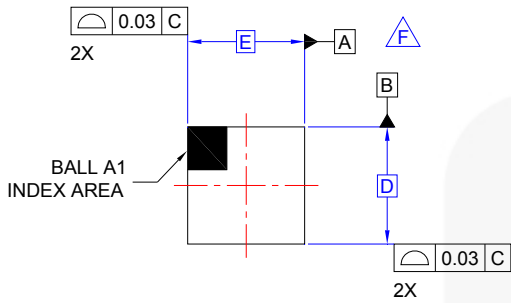
The FAN5904 operates in PWM Mode with a 6MHz switching frequency in Low-Power Mode and at 3MHz in High-Power Mode, which limits high-frequency spur levels. It uses a single, small form factor inductor of 470nH. In addition, PFM operation is allowed in Low-Power Mode to improve efficiency at low load currents.

The FAN5904UC00X option allows PFM Mode only when V_{OUT} is less than 1V, while the FAN5904UC01X permits PFM Mode at higher voltages for applications that can tolerate larger output ripple and that demand optimal low-to-moderate load current efficiency.

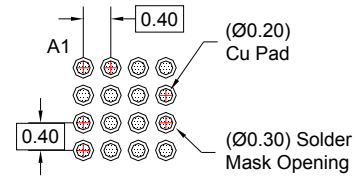
Ordering Information

Part Number	LPM Mode PFM	Output Voltage	Temperature Range	Package	Packing
FAN5904UC00X	$V_{OUT} < 1V$	0.4V to PV_{IN}	-40°C to +85°C	1.71mm x 1.71mm, 16-Bump 0.4mm Pitch, Wafer-Level Chip-Scale Package (WLCSP)	Tape and Reel
FAN5904UC01X	All V_{OUT}				

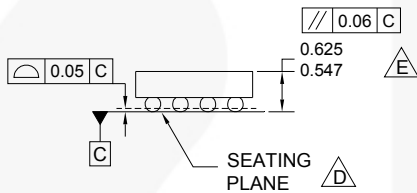
Physical Dimensions



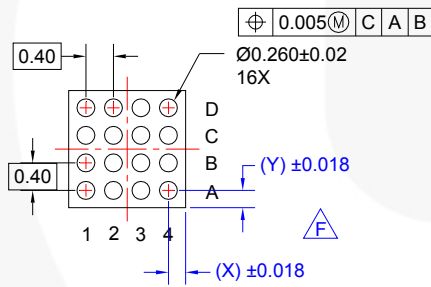
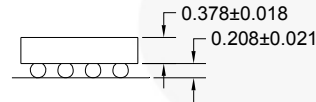
TOP VIEW



RECOMMENDED LAND PATTERN (NSMD PAD TYPE)



SIDE VIEWS



BOTTOM VIEW

NOTES:

- A. NO JEDEC REGISTRATION APPLIES.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCE PER ASME Y14.5M, 1994.
- D. DATUM C IS DEFINED BY THE SPHERICAL CROWNS OF THE BALLS.
- E. PACKAGE NOMINAL HEIGHT IS 586 MICRONS ±39 MICRONS (547-625 MICRONS).
- F. FOR DIMENSIONS D, E, X, AND Y SEE PRODUCT DATASHEET.
- G. DRAWING FILNAME: MKT-UC016AArev2.

Product	D	E	X	Y	Unit
FAN5904UC00X	1.710 ±0.030	1.710 ±0.030	0.255	0.255	mm
FAN5904UC01X	1.710 ±0.030	1.710 ±0.030	0.255	0.255	mm

Figure 60. 1.71x1.71mm Square, 16 Bumps, 0.4mm Pitch, WLCSP




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