

# FAN5602

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## Universal (Step-Up/Step-Down) Charge Pump Regulated DC/DC Converter

### Description

The FAN5602 is a universal switched capacitor DC/DC converter capable of step-up or step-down operation. Due to its unique adaptive fractional switching topology, the device achieves high efficiency over a wider input/ output voltage range than any of its predecessors. The FAN5602 utilizes resistance-modulated loop control, which produces lower switching noise than other topologies. Depending upon actual load conditions, the device automatically switches between constant-frequency and pulse-skipping modes of operation to extend battery life.

The FAN5602 produces a fixed regulated output within the range of 2.7 V to 5.5 V from any type of voltage source. High efficiency is achieved under various input/ output voltage conditions because an internal logic circuit automatically reconfigures the system to the best possible topology. Only two 1  $\mu$ F bucket capacitors and one 10  $\mu$ F output capacitor are needed. During power on, soft-start circuitry prevents excessive current drawn from the supply. The device is protected against short-circuit and over-temperature conditions.

The FAN5602 is available with 4.5 V and 5.0 V output voltages in a 3x3 mm WDFN8 package.

### Features

- Low-Noise, Constant-Frequency Operation at Heavy Load

# FAN5602

## ORDERING INFORMATION

Part Number	Output Voltage, $N_{V_{OM}}$	Package	Packing Method†
FAN5602MP45X	4.5 V	WDFN8 3x3, 0.65P (Pb-Free)	3000 / Tape & Reel
FAN5602MP5X	5.0 V	WDFN8 3x3, 0.65P (Pb-Free)	3000 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D

## Application Diagram

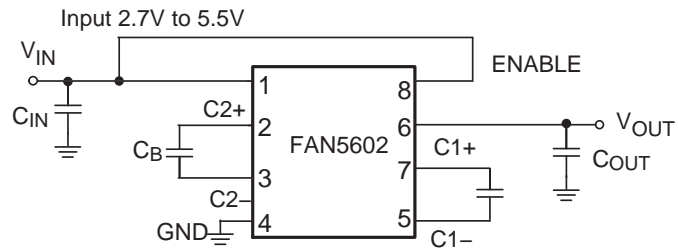


Figure 1. Typical Application Diagram

## Block Diagram

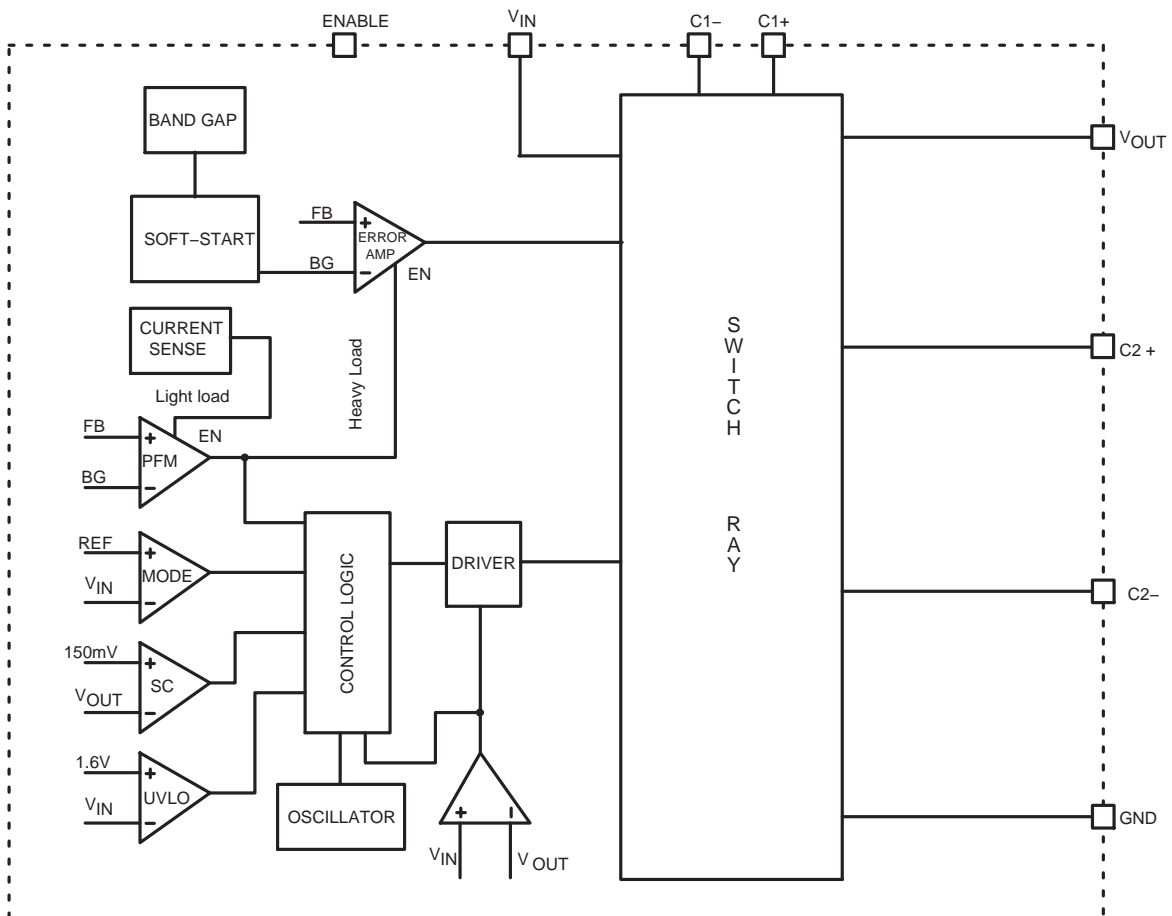


Figure 2. Block Diagram



# FAN5602

**Table 4. DC ELECTRICAL CHARACTERISTICS**

$V_{IN} = 2.7\text{ V to } 5.5\text{ V}$ ,  $C_1 = C_2 = 1\ \mu\text{F}$ ,  $C_{IN} = C_{OUT} = 10\ \mu\text{F}$ ,  $\text{ENABLE} = V_{IN}$ ,  $T_A = -40^\circ\text{C to } +85^\circ\text{C}$  unless otherwise noted. Typical values are at  $T_A = 25^\circ\text{C}$ .

Symbol	Parameter	Condition	Min	Typ	Max	Unit
$V_{UVLO}$						



Figure 10. Output Voltage vs. Input Voltage

TYPICAL PERFORMANCE CHARACTERISTICS (Continued)

$T_A = 25^\circ\text{C}$ ,  $C_{IN} = C_{OUT} = 10\ \mu\text{F}$ ,  $C_B = 1\ \mu\text{F}$ ,  $V_{OUT} = 4.5\ \text{V}$  unless otherwise noted.

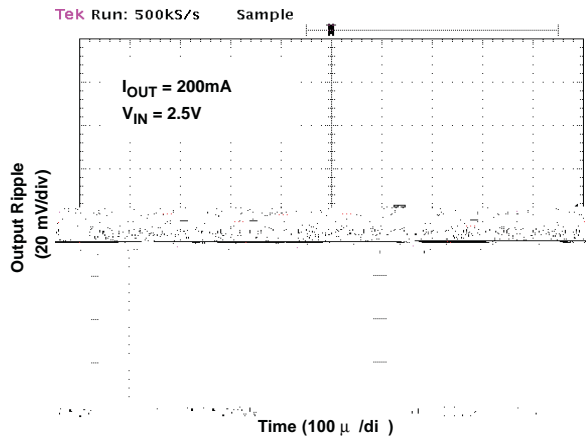


Figure 15. Output Ripple

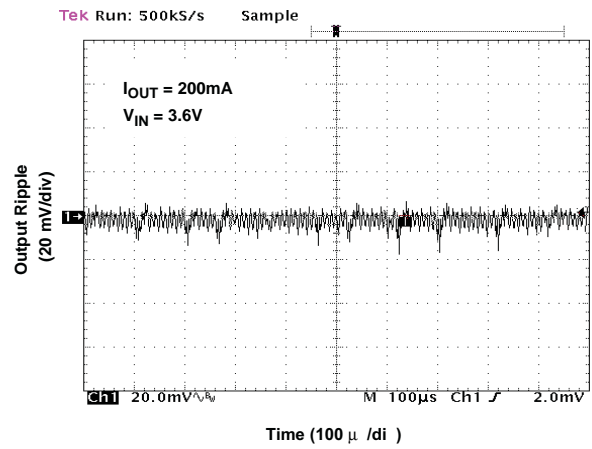


Figure 16. Output Ripple

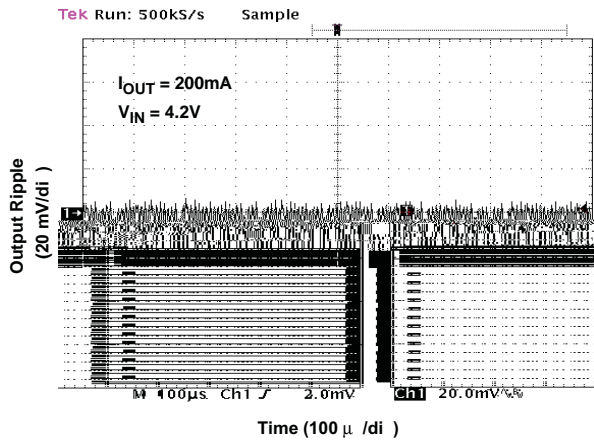


Figure 17. Output Ripple

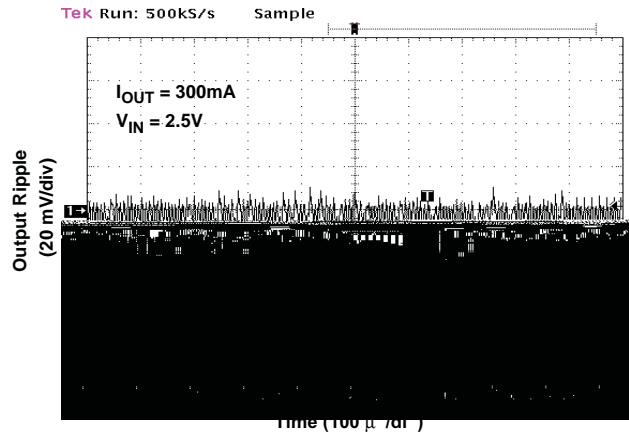


Figure 18. Output Ripple

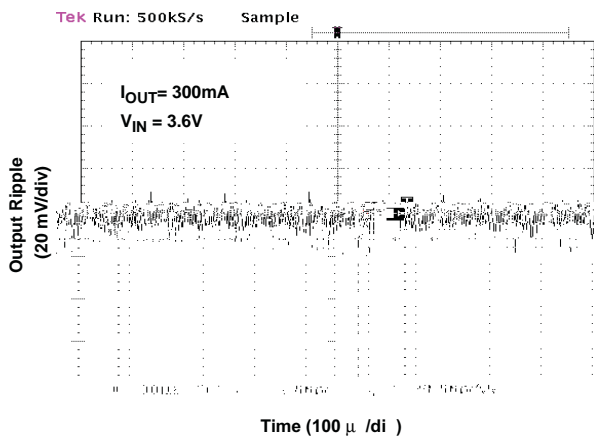


Figure 19. Output Ripple

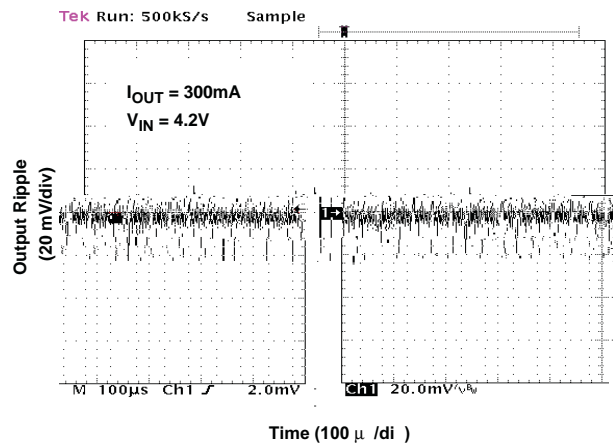


Figure 20. Output Ripple

# FAN5602

## FUNCTIONAL DESCRIPTION



Switch Array Modes

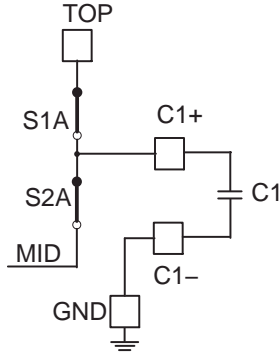


Figure 21. Mode 1 (1:1)

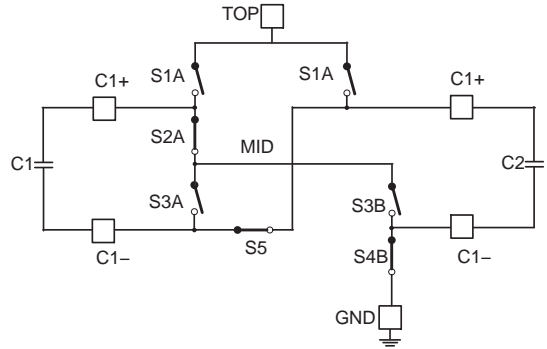


Figure 22. Mode 2 (2:3 or 3:2) All Switches Set for Phase 1 and Reverse State for Phase 2

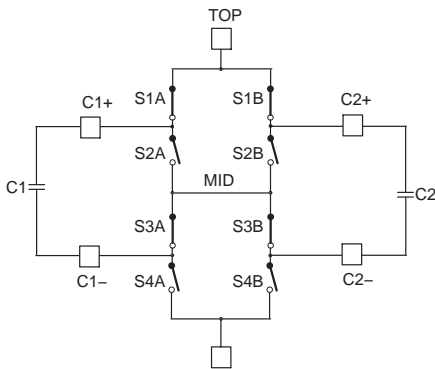


Figure 23. Mode 3 (1:2 or 2:1) All Switches Set for Phase 1 and Reverse State for Phase 2

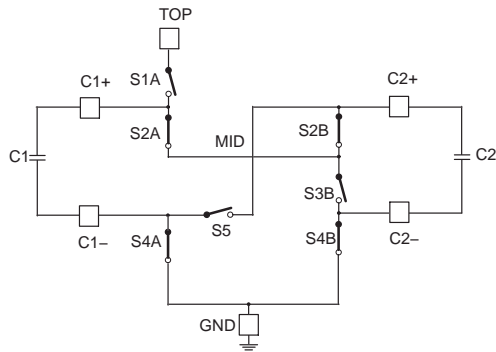


Figure 24. Mode 4 (1:3 or 3:1) All Switches Set for Phase 1 and Reverse State for Phase 2

Light-Load Operation

The power transistors used in the charge pump are very large in size. The dynamic loss from the switching the power transistors is not small and increases its proportion of the total power consumption as the load gets light. To save power, the FAN5602 switches, when the load is less than 10mA, from constant frequency to pulse-skip-ping mode (PFM) for modes 2:3(3:2), 1:2(2:1) and 1:3(3:1), except mode 1:1. In PFM mode, the linear loop is disabled and the error amplifier is turned off. A PFM comparator is used to setup an upper threshold and a lower threshold for the output. When the output is lower than the lower threshold, the oscillator is turned on and the charge pump starts working and keeps delivering charges from the input to the output until the output is higher than the upper threshold.

## FAN5602

### APPLICATION INFORMATION

#### Using the FAN5602 to Drive LCD Backlighting

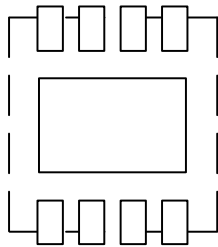
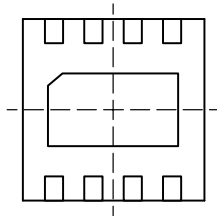
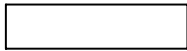
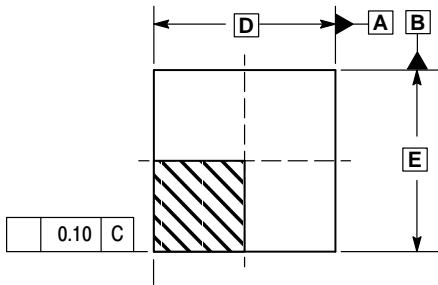
3%3

The FAN5602 4.5V option is ideal for driving the back-lighting and flash LEDs for portable devices. One FAN5602 device can supply the roughly 150mA needed to power both the backlight and the flash LEDs. Even though drawing this much current from the FAN5602 drives the part out of the

WDFN8 3x3, 0.65P  
CASE 511CD  
ISSUE O

SCALE 2:1

DATE 29 APR 2014



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION **b** APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 MM FROM TERMINAL TIP.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

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