

## General Description

The AS5422A is a wide input range, high-efficiency, DC-DC step-down switching regulator, capable of delivering up to 2A of output current. Current mode PWM control allows the use of small external components, such as ceramic input and output caps, as well as small inductors, while still providing low output ripples. On top of the integrated internal synchronous rectifier that eliminates external Schottky diode, AS5422A also employs a proprietary control scheme that switches the device into a power save mode during light load, thereby extending the range of high efficiency operation. Therefore, AS5422A is a much superior solution in comparison to other competitions in terms of efficiency and cost. Cycle-by-cycle current limit provides output short-circuit protection and an input OVP function guards AS5422A against possible input voltage surge. Overall, AS5422A is a highly efficient and robust solution for DC-DC step-down applications that requires wide input ranges. AS5422A is housed in a SOP8 Package.

## Features

- ◆ Wide Input Operating Range from 4.5V to 18V
- ◆ High Efficiency:
  - Up to 90% at Light Load
  - Up to 95% at Heavy Load
- ◆ Capable of Delivering 2A
- ◆ Input OVP at 20V
- ◆ No External Schottky Diode Needed
- ◆ Current Mode control
- ◆ 0.923V Reference for Low Output voltages
- ◆ Logic Control Shutdown
- ◆ Thermal shutdown and UVLO

## Applications

- ◆ LCD TVs
- ◆ Notebook computer
- ◆ Constant Current Source
- ◆ LED drivers
- ◆ FPGA power supplies

## Typical Application

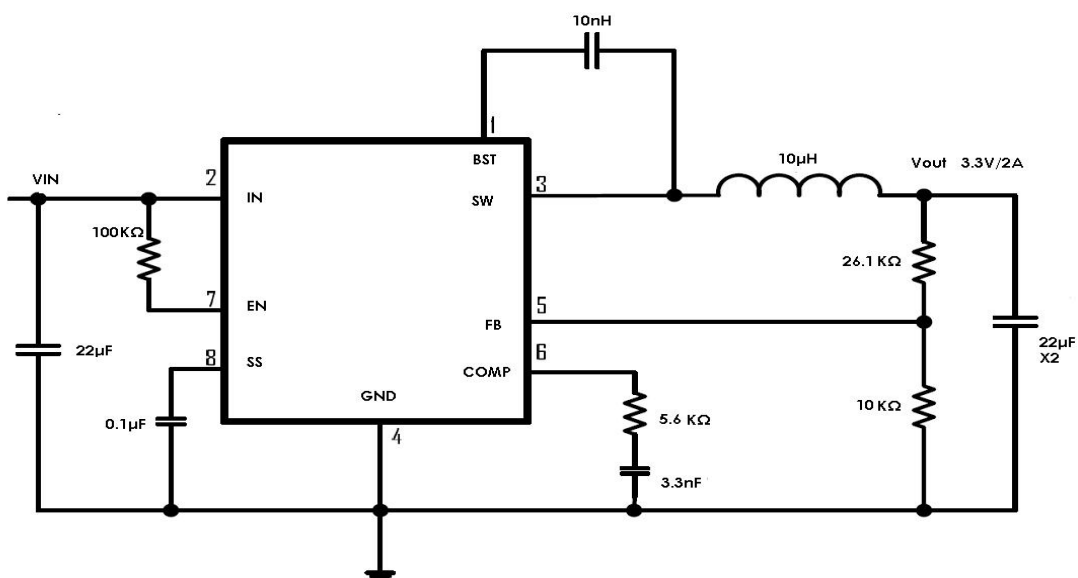
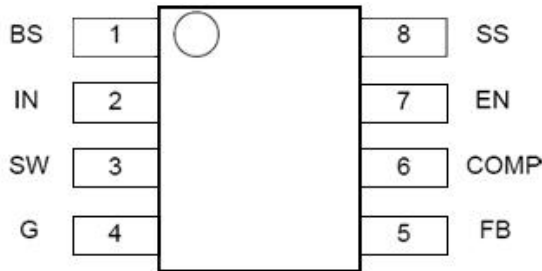


Figure1. Typical Application Circuit

### Package Configuration



### Order Information

| Part Number    | Package | Packing                 | Remark  |
|----------------|---------|-------------------------|---------|
| AS5422AD/TR-LF | SOP8    | Tape & Reel<br>MPQ=2.5k | Pb Free |

### Pin Description

| Pin# | Name | Description   |
|------|------|---|
| 1    | BST  | Bootstrap pin. Connect a 10nF capacitor from this pin to SW   |
| 2    | IN   | Supply Voltage. Bypass with a 22μF ceramic capacitor to GND   |
| 3    | SW   | Inductor Connection. Connect an inductor Between SW and the regulator output.                       |
| 4    | GND  | Ground  |
| 5    | FB   | Feedback Input. Connect an external resistor divider from the output to FB and GND to set $V_{OUT}$ |
| 6    | COMP | Regulator Compensation. Connect series RC network to GND.   |
| 7    | EN   | Enable pin for the IC. Drive this pin to high to enable the part, low to disable.                   |
| 8    | SS   | Soft start pin. Connect a 0.1 uF capacitor from this pin to GND                                     |

### Absolute Maximum Ratings

| Parameter                   | Value                  |
|-----------------------------|------------------------|
| Max Input Voltage           | -0.3V to 20V           |
| SW, EN Voltage              | -0.3V to $V_{IN}+0.3V$ |
| BST Voltage                 | - 0.3V to $SW+6V$      |
| FB Voltage                  | - 0.3V to 6V           |
| SW to ground current        | Internally limited     |
| Operating Temperature Range | - 40°C to 85°C         |
| Storage Temperature Range   | - 55°C to 150°C        |

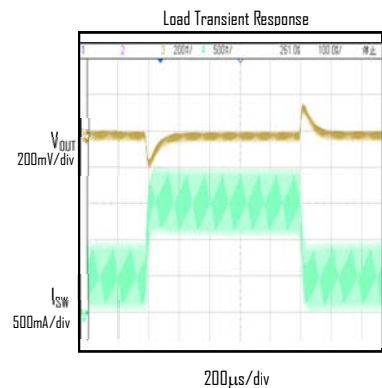
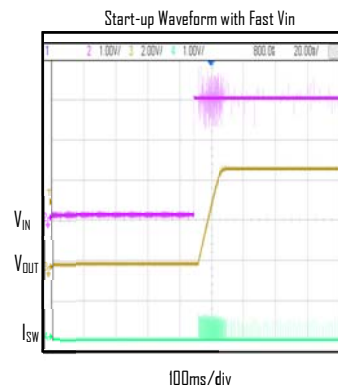
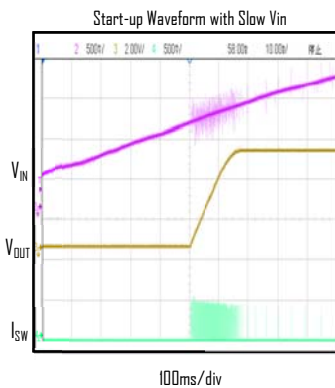
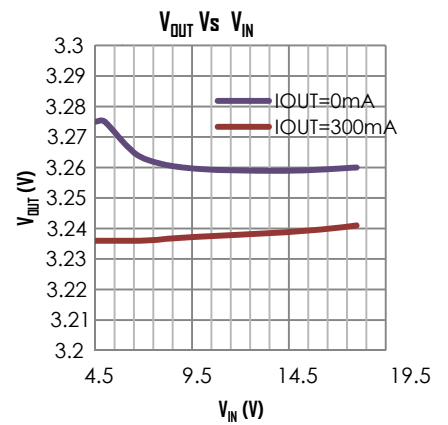
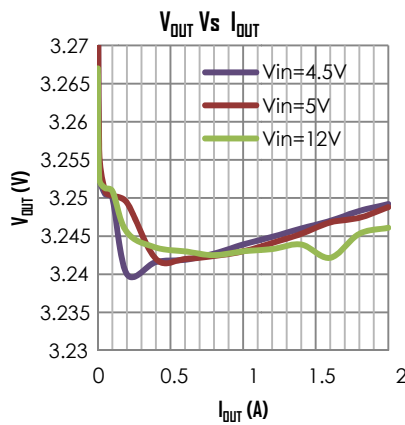
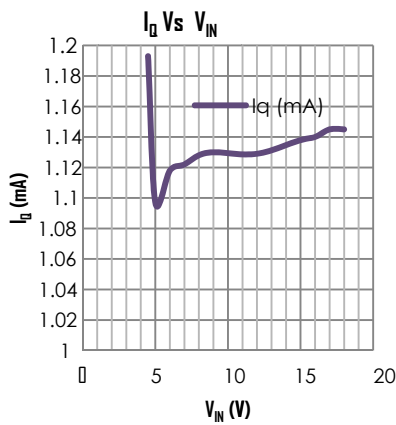
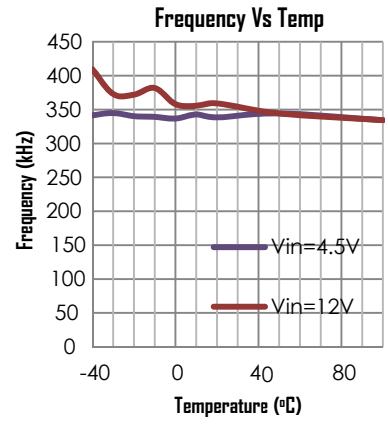
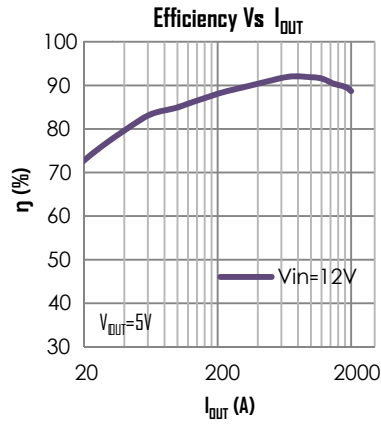
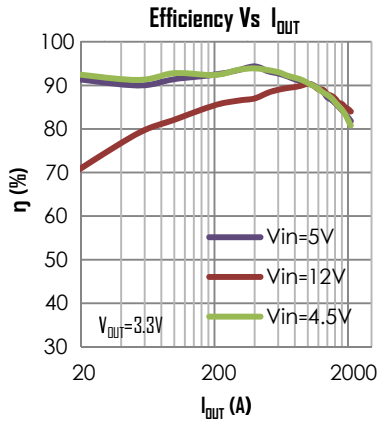
(Note: Exceeding these limits may damage the device. Exposure to absolute maximum rating conditions for long periods may affect device reliability.)

**Electrical Characteristics** ( $V_{IN} = 12V$ , unless otherwise specified. Typical values are at  $T_A = 25^\circ C$ )

| Parameter                      | Test Conditions                               | Min   | Typ   | Max   | Units      |
|--------------------------------|---|-------|-------|-------|------------|
| Input Voltage Range            |   | 5     |       | 18    | V          |
| Input UVLO                     | Rising,<br>Hysteresis=100mV                   |       | 4.75  |       | V          |
| Input Over voltage lockout     |   | 18.5  | 20    | 22    | V          |
| Input Supply Current           | $V_{FB}=0.85V$                                |       | 1     |       | mA         |
| Input Shutdown Current         |   |       | 6     |       | $\mu A$    |
| FB Feedback Voltage            |   | 0.904 | 0.923 | 0.942 | V          |
| FB Input Current               |   |       | 0.01  |       | $\mu A$    |
| Error Amp Transconductance     |   |       | 800   |       | $\mu S$    |
| Current Sense Transresistance  |   |       | 0.2   |       | $\Omega$   |
| Switching Frequency            |   |       | 340   |       | KHz        |
| High side Switch On Resistance | $I_{sw} = 200mA$                              |       | 130   |       | $m\Omega$  |
| Low side Switch On Resistance  | $I_{sw} = 200mA$                              |       | 110   |       | $m\Omega$  |
| High side Switch Current Limit |   | 25    | 3     |       | A          |
| SW Leakage Current             | $V_{IN}=12V, V_{sw}=0$ or $12V,$<br>$EN= GND$ |       |       | 10    | $\mu A$    |
| EN Input Current               |   |       |       | 1     | $\mu A$    |
| EN Input Low Voltage           |   | 1     | 1.5   | 3     | V          |
| Thermal Shutdown               | Hysteresis=40°C                               |       | 150   |       | $^\circ C$ |

## Typical Performance Characteristics

(Typical values are at TA = 25° C unless otherwise specified.)



## Functional Descriptions

### *Loop Operation*

The AS5422A is a wide input range, high-efficiency, DC-to-DC step-down switching regulator, capable of delivering up to 2A of output current, integrated with a 110m $\Omega$  synchronous MOSFET, eliminating the need for external diode. It uses a PWM current-mode control scheme. An error amplifier integrates error between the FB signal and the internal reference voltage. The output of the integrator is then compared to the sum of a current-sense signal and the slope compensation ramp. This operation generates a PWM signal that modulates the duty cycle of the power MOSFETs to achieve regulation for output voltage.

### *Current Limit*

There is a cycle-by-cycle current limit on the high-side MOSFET of 3A(typ). When the current flowing out of SW exceeds this limit, the high-side MOSFET turns off and the synchronous rectifier turns on. Unlike the traditional method of current limiting by limiting the voltage at the compensation pin, which usually has large variation due to duty cycle variance, this type of peak current limiting scheme provides a relatively more accurate limit for output current, thereby lowering the requirements for system design.

### *Light Load Operation*

Traditionally, a fixed constant frequency PWM DC-DC regulator always switches even when the output load is small. When energy is shuffling back and forth through the power MOSFETs, power is lost due to the finite RDSONs of the MOSFETs and parasitic capacitances. At light load, this loss is prominent and efficiency is therefore very low. AS5422A employs a proprietary control scheme that improves efficiency in this situation by enabling the device into a power save mode during light load, thereby extending the range of high efficiency operation.

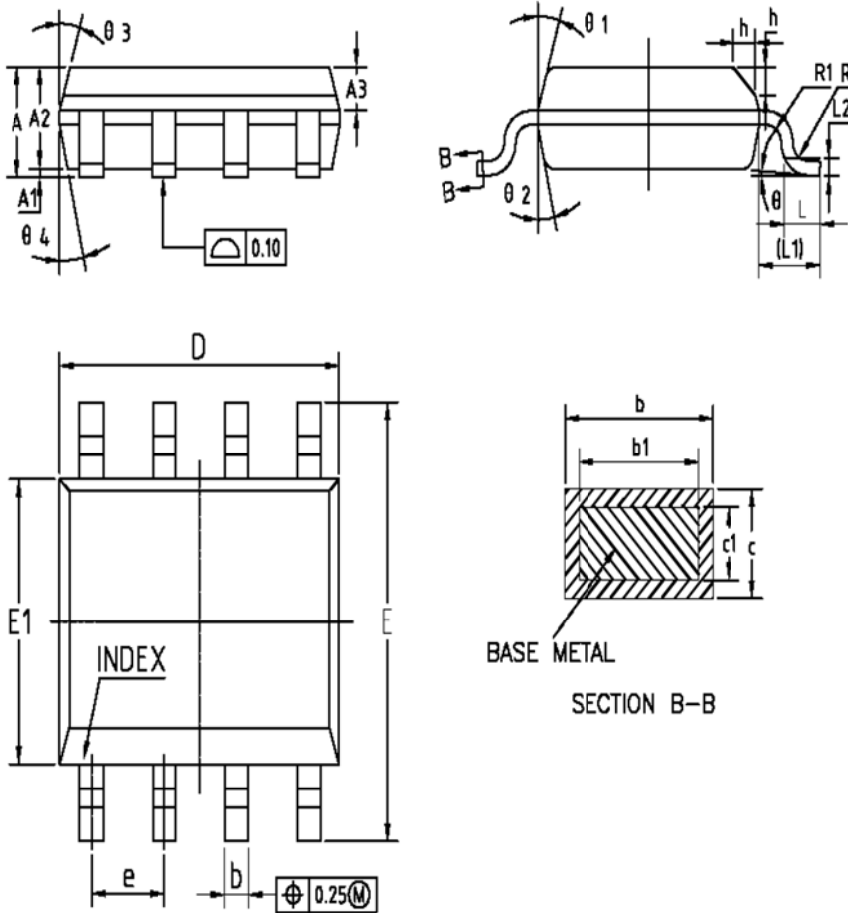
## Application Information

### Components Selection

| V <sub>OUT</sub> (V) | C <sub>OUT</sub> ( $\mu$ F) | L ( $\mu$ H) |
|----------------------|-----------------------------|--------------|
| 8                    | 22x2                        | 22           |
| 5                    | 22x2                        | 15           |
| 3.3                  | 22x2                        | 10           |
| 2.5                  | 22x2                        | 6.8          |
| 1.8                  | 22x2                        | 4.7          |
| 1.2                  | 22x2                        | 3.3          |

## Package Information

SOP8



| Symbol | Min     | Nom  | Max  |
|--------|---------|------|------|
| A      | 1.35    | 1.55 | 1.75 |
| A1     | 0.10    | 0.15 | 0.25 |
| A2     | 1.25    | 1.40 | 1.65 |
| A3     | 0.50    | 0.60 | 0.70 |
| b      | 0.38    | -    | 0.51 |
| b1     | 0.37    | 0.42 | 0.47 |
| c      | 0.17    | 0.20 | 0.23 |
| c1     | 0.17    | -    | 0.25 |
| D      | 4.80    | 4.90 | 5.00 |
| E      | 5.80    | 6.00 | 6.20 |
| E1     | 3.80    | 3.90 | 4.00 |
| e      | 1.27BSC |      |      |
| L      | 0.45    | 0.60 | 0.80 |
| L1     | 1.04REF |      |      |
| L2     | 0.25BSC |      |      |
| R      | 0.07    | -    | -    |
| R1     | 0.07    | -    | -    |
| h      | 0.30    | 0.40 | 0.50 |
| θ      | 0°      | -    | 8°   |
| θ 1    | 15°     | 17°  | 19°  |
| θ 2    | 11°     | 13°  | 15°  |
| θ 3    | 15°     | 17°  | 19°  |
| θ 4    | 11°     | 13°  | 15°  |

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