



## General Description

AF5602 is a wide input voltage, high efficiency Active CC step-down DC/DC converter that operates in either CV (Constant Output Voltage) mode or CC (Constant Output Current) mode.

AF5602 provides up to 2.5A output current at 180kHz switching frequency. Current mode control provides fast transient response and cycle-by-cycle current limit.

An internal soft-start prevents inrush current at turn-on, This device, available in an SOP-8EP(Exposed Pad) package, provides a very compact solution with minimal external components.

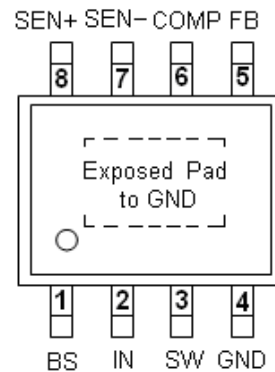
## Features

- Wide 8V to 38V Operating Input Range
- Integrated 140mΩ Power MOSFET Switches
- Output Adjustable from  $V_{FB}(1.0V)$  to 5.5V
- Up to 92% Efficiency
- Internal Soft-Start
- Stable with Low ESR Ceramic Output Capacitors
- Fixed 180KHz Frequency
- Cycle-by-Cycle Over Current Protection
- Input Under Voltage Lockout

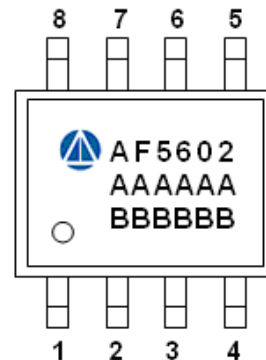
## Application

- LCD Monitor
- Graphic Card
- DVD-Video Player
- Telecom Equipment
- ADSL Modem
- Microprocessor core supply
- Networking power supply
- Car Charger

## Pin Define ( SOP-8EP )

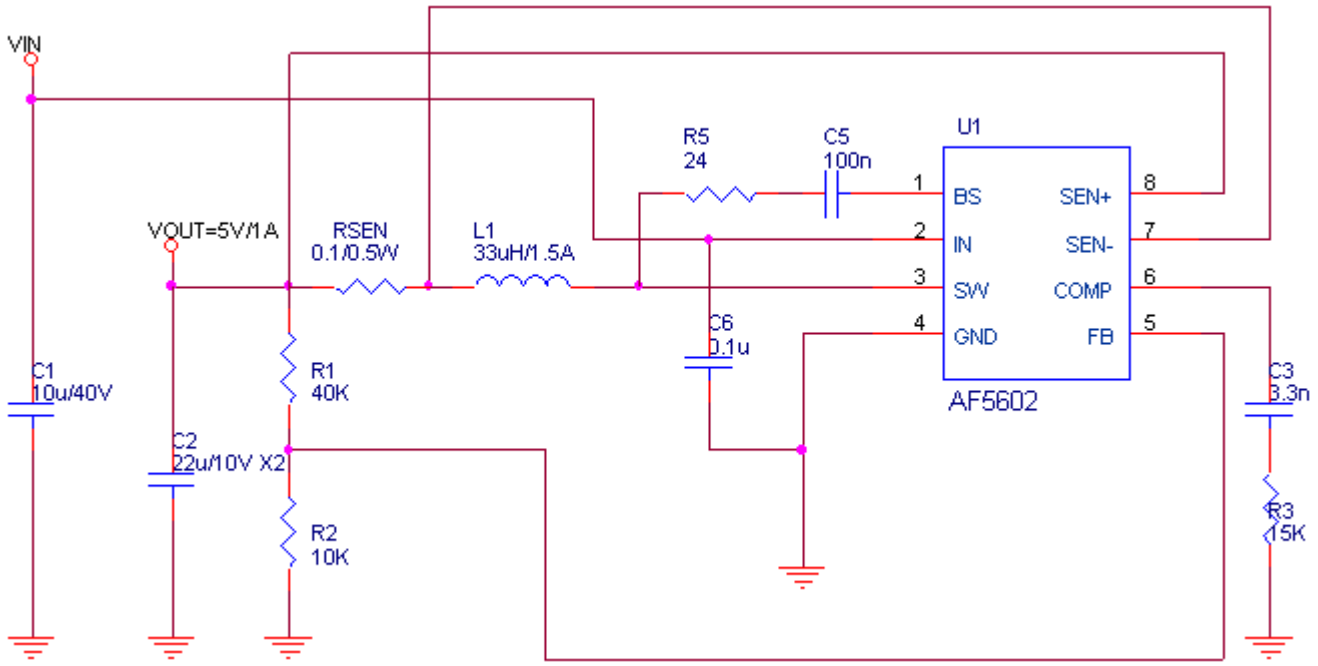


## Marking Information

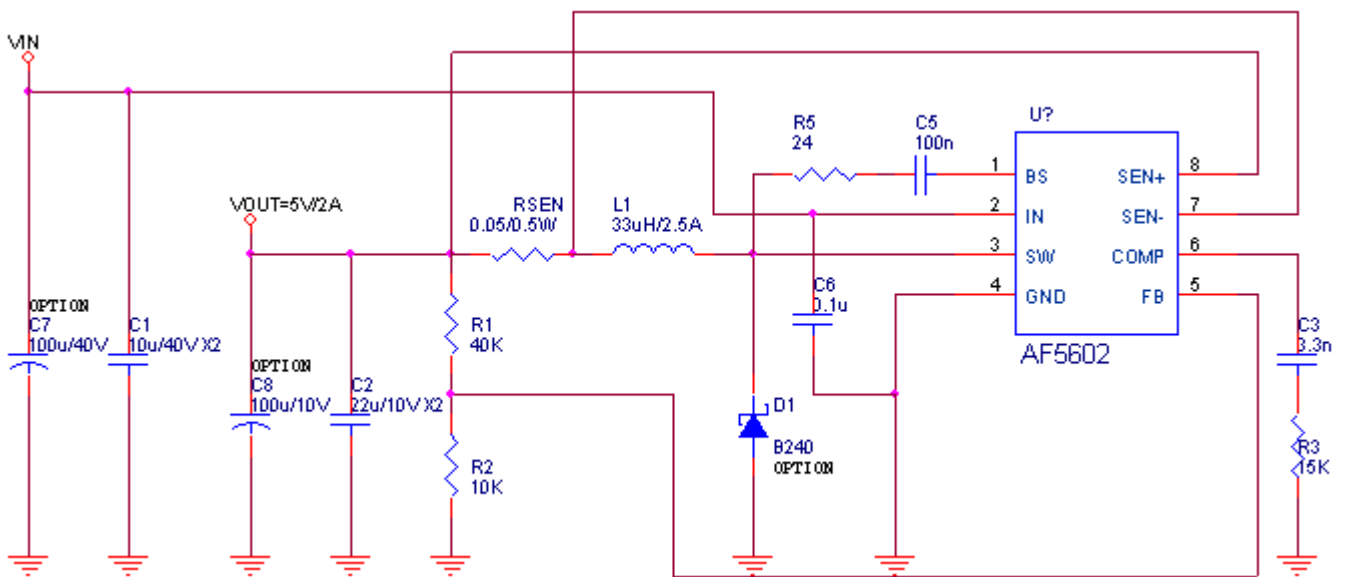




**Typical Application Circuit ( For 1A )**



**Typical Application Circuit ( For 2A )**





**Pin Description**

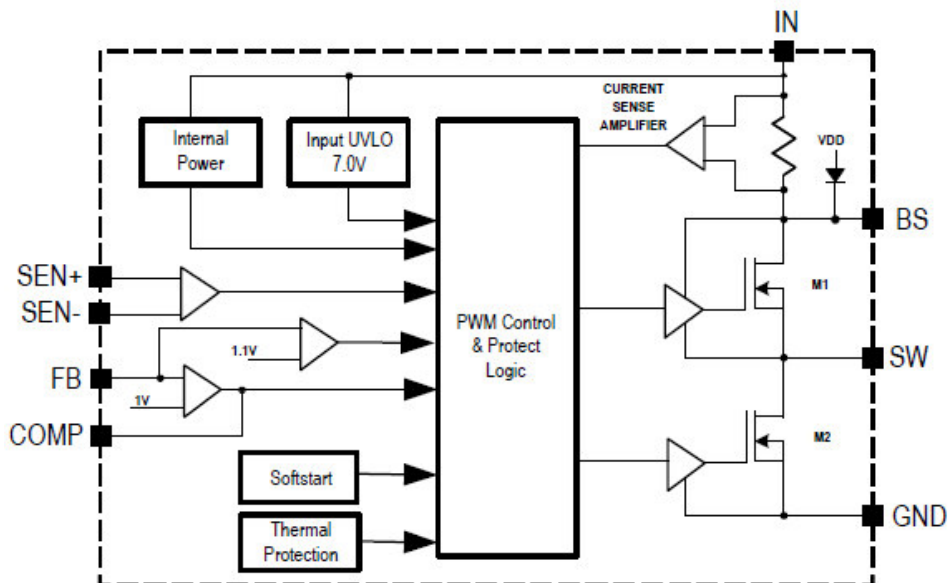
Pin	Symbol	Description
1	BS	Boot-Strap Pin. Supply high side gate driver. Decouple this pin to LX pin with 24ohm + 0.1uF ceramic cap.
2	IN	Power Input. IN supplies the power to the IC, as well as the step-down converter switches. Drive IN with a 8V to 38V power source. Bypass IN to GND with a suitably large capacitor to eliminate noise on the input to the IC. See Input Capacitor.
3	SW	Power Switching Output. SW is the switching node that supplies power to the output. Connect the output LC filter from SW to the output load.
4	GND	Ground.
5	FB	Feedback Input. FB senses the output voltage to regulate that voltage. Drive FB with a resistive voltage divider from the output voltage.
6	COMP	Compensation Node. COMP is used to compensate the regulation control loop. Connect a series RC network from COMP to GND to compensate the regulation control loop.
7	SEN+	The Current Sense Input (+) pin.
8	SEN-	The Current Sense Input (-) pin.

**Ordering Information**

Part Ordering No.	Part Marking	Package	Unit	Quantity
AF5602S8EPRG	AF5602	SOP-8EP ( Exposed Pad )	Tape & Reel	2500 EA

- ※ A Lot code
- ※ B Date code
- ※ AF5602S8EPRG : 13" Tape & Reel ; Pb- Free ; Halogen- Free

**Block Diagram**





### Absolute Maximum Ratings (T<sub>A</sub>=25°C Unless otherwise noted)

The following ratings designate persistent limits beyond which damage to the device may occur.

Symbol	Parameter	Value	Unit
V <sub>IN</sub>	Supply Voltage	-0.3 to +42	V
V <sub>SW</sub>	Switch Voltage	- 0.3 to V <sub>IN</sub> + 0.3	V
V <sub>BS</sub>	Bootstrap Voltage	V <sub>SW</sub> -0.3 to V <sub>SW</sub> + 6.0	V
V <sub>ALL</sub>	All Other Pins	- 0.3 to + 6.0	V
J <sub>T</sub>	Junction Temperature	150	°C
L <sub>T</sub>	Lead Temperature	260	°C
θ <sub>JA</sub>	Thermal Resistance	40	°C/W
θ <sub>JC</sub>	Thermal Resistance	15	°C/W
T <sub>OPR</sub>	Operating Temperature Range	- 40 to + 85	°C
T <sub>STG</sub>	Storage Temperature Range	- 65 to + 150	°C

### Caution:

The absolute maximum ratings are rated values exceeding which the product could suffer physical damage. These values must therefore not be exceeded under any conditions.

### Electrical Characteristics

(T<sub>A</sub>=25°C, V<sub>IN</sub>=12V, unless otherwise specified.)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V <sub>IN</sub>	Input Voltage		8		38	V
I <sub>CCQ</sub>	Quiescent Current	V <sub>FB</sub> = 1.05V		1.0	1.5	mA
V <sub>FB</sub>	Feedback Voltage	8V ≤ V <sub>IN</sub> ≤ 38V	0.98	1.00	1.02	V
OVP(FB)	Feedback Overvoltage Threshold			1.1X		V <sub>FB</sub>
R <sub>DS(ON)1</sub>	High-Side Switch On Resistance			150		mΩ
R <sub>DS(ON)2</sub>	Low -Side Switch On Resistance			140		mΩ
I <sub>GND OFF</sub>	High-Side Switch Leakage Current	V <sub>FB</sub> = 1.05V, V <sub>SW</sub> = 0V			10	μA
I <sub>CL-U</sub>	Upper Current Limit	Minimum Duty Cycle	2.9	3.5		A
I <sub>CL-L</sub>	Lower Current Limit	From Drain to Source		0.9		A
F <sub>OSC1</sub>	Oscillation Frequency			160		KHz
F <sub>OSC2</sub>	Short Circuit Oscillation Frequency	V <sub>FB</sub> ≤ 0.5V		60		KHz
D <sub>MAX</sub>	Maximum Duty Cycle			90		%
T <sub>ON(min)</sub>	Minimum On Time			220		ns
ΔV <sub>SEN</sub>	Sense Voltage	V <sub>(SEN+)</sub> - V <sub>(SEN-)</sub>	114	120	126	mV
V <sub>OVP(F)</sub>	V <sub>IN</sub> OVP Turn-Off Voltage	Input Voltage Rising		40		V
V <sub>OVP(H)</sub>	V <sub>IN</sub> OVP Hysteresis	Input Voltage Falling		5		V
UVLO(HYS)	Input Under Voltage Lockout Threshold	V <sub>IN</sub> Rising		0.8		V
P <sub>SS</sub>	Soft-Start Period			3		ms
T <sub>SD</sub>	Thermal Shutdown			150		°C
T <sub>SH</sub>	Thermal Shutdown Hysteresis			130		°C



## Function Description

The AF5602 is a synchronous rectified, current-mode, step-down regulator. It regulates input voltages from 8V to 38V down to an output voltage as low as  $V_{FB}$ , and supplies up to 2.5A of load current.

The AF5602 uses current-mode control to regulate the output voltage. The output voltage is measured at FB through a resistive voltage divider and amplified through the internal Transconductance error amplifier.

The converter uses internal N-Channel MOSFET switches to step-down the input voltage to the regulated output voltage. Since the high side MOSFET requires a gate voltage greater than the input voltage, a boost capacitor connected between SW and BS is needed to drive the high side gate. The boost capacitor is charged from the internal 5V rail when SW is low.

When the AF5602 FB pin exceeds 10% of the nominal regulation voltage of  $V_{FB}$ , the over voltage comparator is tripped and the COMP pin is discharged to GND, forcing the high-side switch off.

## Application Information

### Setting the Output Voltage

The output voltage is set using a resistive voltage divider from the output voltage to FB pin. The voltage divider divides the output voltage down to the feedback voltage by the ratio. Thus the output voltage is:

$$V_{OUT} = V_{FB} \times \frac{R1 + R2}{R2}$$

For example,  $V_{FB} = 1.00V$  for a 5.0V output voltage,  $R2$  is 10k $\Omega$ , and  $R1$  is 40k $\Omega$ .

### Inductor Selection

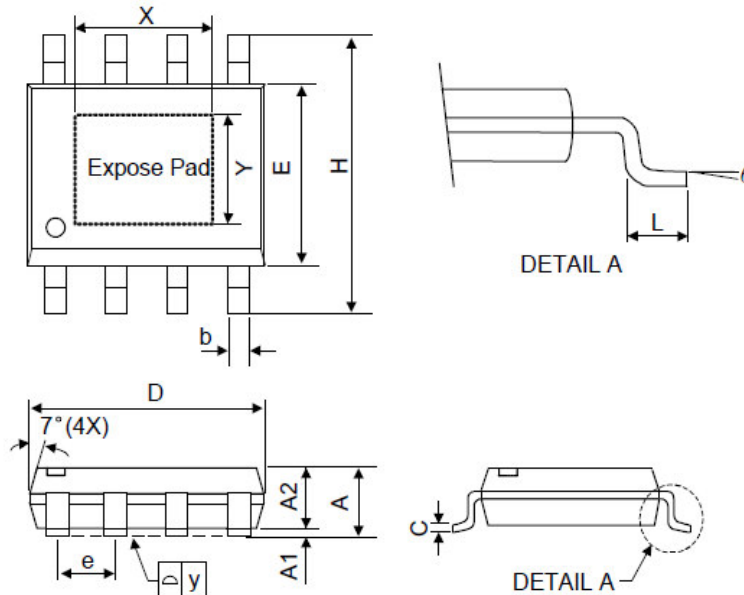
The inductor is required to supply constant current to the output load while being driven by the switched input voltage. A larger value inductor will result in less ripple current that will result in lower output ripple voltage. However, the larger value inductor will have a larger physical size, higher series resistance, and/or lower saturation current. A good rule for determining the inductance to use is to allow the peak-to-peak ripple current in the inductor to be approximately 30% of the maximum switch current limit.

<b>VIN</b>	<24V	<28V	<34V
<b>Inductor</b>	47uH	33uH	22uH

The choice of which style inductor to use mainly depends on the price vs. size requirements and any EMI requirements.



**Package Information ( SOP-8EP )**



Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	-	-	1.75	-	-	0.069
A1	0	-	0.15	0	-	0.06
A2	1.25	-	-	0.049	-	-
C	0.1	0.2	0.25	0.0075	0.008	0.01
D	4.7	4.9	5.1	0.185	0.193	0.2
E	3.7	3.9	4.1	0.146	0.154	0.161
H	5.8	6	6.2	0.228	0.236	0.244
L	0.4	-	1.27	0.015	-	0.05
b	0.31	0.41	0.51	0.012	0.016	0.02
e	1.27 BSC			0.050 BSC		
y	-	-	0.1	-	-	0.004
X	-	2.34	3.33	-	0.092	0.131
Y	-	2.34	2.54	-	0.092	0.10
θ	0°	-	8°	0°	-	8°

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