



## Wide Range Synchronous Buck Controller

### General Description

The LP6496 is a synchronous step down regulator with CC control from a high voltage input supply. Operating with an input voltage 8V~40V, the LP6496 achieves 5A continuous output current with excellent load and line regulation. Current mode operation provides fast transient response and eases loop stabilization.

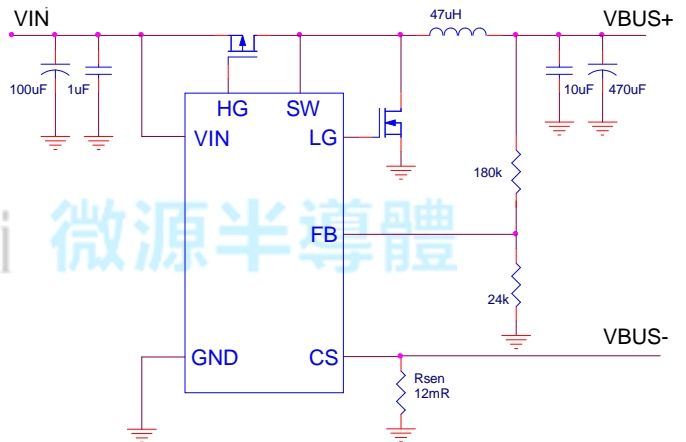
The LP6496 requires a minimum number of readily available standard external components. Other features include cable compensation, programmable current limit and thermal shutdown.

The LP6496 converters are available in the industry standard SOP8 packages.

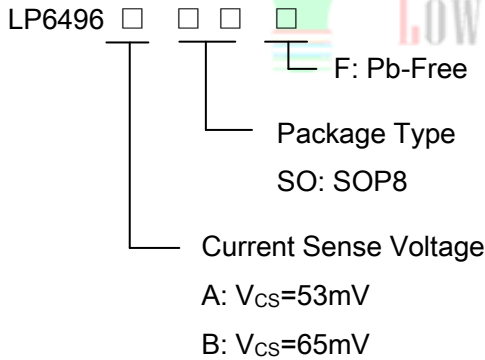
### Features

- ◆ Wide Input Voltage Range: 8V ~ 40V
- ◆ Up to 94% Efficiency
- ◆ No Loop Compensation Required
- ◆ CC/CV control
- ◆ Programmable CC Current
- ◆ Thermal Shutdown
- ◆ Available in SOP8 Package

### Typical Application Circuit



### Order Information



### Applications

- ✧ Car Charger / Adaptor
- ✧ LED Driver
- ✧ Pre-Regulator for Linear Regulators
- ✧ Distributed Power Systems
- ✧ Battery Charger

### Marking Information

| Device  | Marking | Package | Shipping  |
|---|---------|---------|-----------|
| LP6496A   | LPS     | SOP8    | 2.5K/REEL |
| LP6496B   | XXX     |         |           |
| Marking indication:<br>Y:Production year W:Production week X:Production batch |         |         |           |



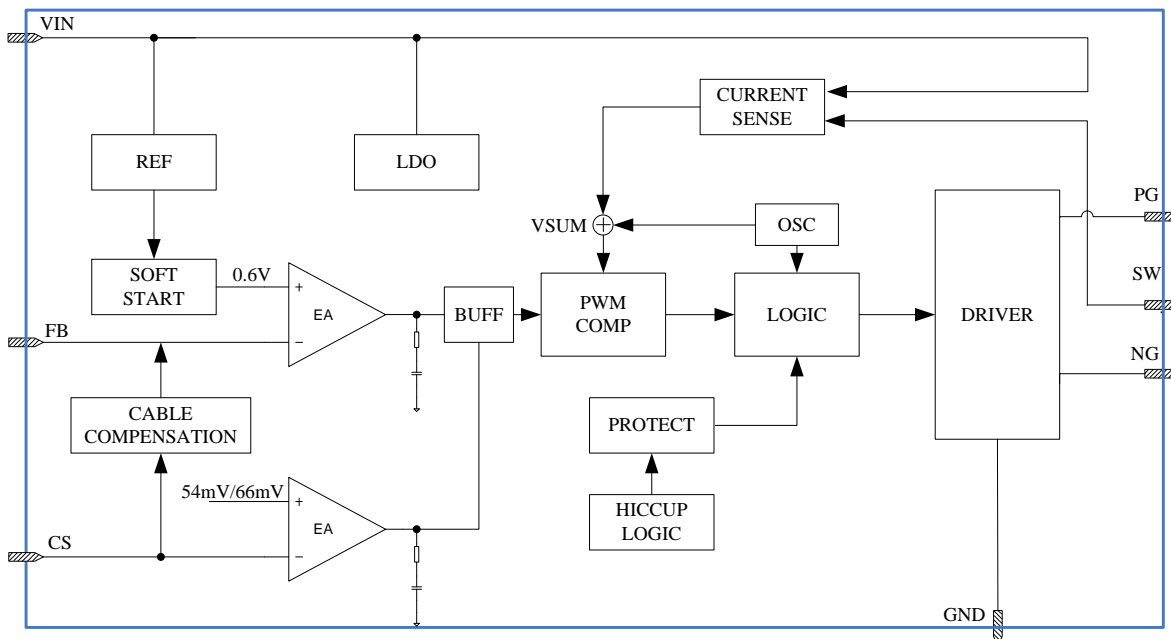
## Functional Pin Description

| Package Type | Pin Configurations |
|--------------|--------------------|
| SOP8         |                    |

## Pin Description

| Pin | Name | Description                                     |
|-----|------|---|
| 1   | HG   | PMOS Gate Drive.                                |
| 2   | LG   | NMOS Gate Drive.                                |
| 3   | SW   | Switch PIN.                                     |
| 4   | GND  | Power Ground.                                   |
| 5   | FB   | Voltage Feedback. The feedback voltage is 0.6V. |
| 6   | CS   | Output Current Sense.                           |
| 7   | GND  | Ground  |
| 8   | VIN  | Input Supply Voltage.                           |

## Function Diagram





### Absolute Maximum Ratings <sup>Note 1</sup>

- ◇ VIN to GND----- -0.3V to +43V
- ◇ SW to GND----- -0.3V to +43V
- ◇ HG to GND-----  $V_{IN}-6V$  to  $V_{IN}$
- ◇ All other pin to GND----- -0.3V to +6V
- ◇ Storage temperature range----- -55°C to +150°C
- ◇ Maximum Operating Junction temperature ----- 150°C
- ◇ Maximum Soldering Temperature (at leads, 10 sec)----- 260°C

**Note 1.** Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

### Thermal Information

- ◇ Maximum Power Dissipation (  $P_D, T_A=25^\circ C$  ) ----- 1.5W
- ◇ Thermal Resistance ( $\theta_{JA}$ ) ----- 80°C/W

### ESD Susceptibility

- ◇ HBM(Human Body Mode) ----- 2KV
- ◇ MM(Machine Mode) ----- 200V

### Recommended Operating Conditions

- ◇ Operating Junction Temperature Range (TJ) ----- -40°C to 150°C
- ◇ Ambient Temperature Range ----- -40°C to 85°C



## Electrical Characteristics

$V_{IN}=12V$  ,  $T_A=25^{\circ}C$ , unless otherwise noted

| Parameter                                      | Symbol         | Condition                    | Min   | Typ   | Max   | Units       |
|--|----------------|------------------------------|-------|-------|-------|-------------|
| Supply Current                                 | $I_Q$          | No switching , $V_{FB}=0.8V$ |       | 0.73  | 1     | mA          |
|  | $I_{SW}$       | Switching , $I_{load}=0A$    |       | 10    | 20    | mA          |
| VIN Under Voltage Lockout Threshold Rising     | $V_{IN\_UVLO}$ | $V_{IN}$ rising              | 6.6   | 7.3   | 8     | V           |
| VIN Under Voltage Lockout Threshold Hysteresis | $V_{IN\_HYS}$  |                              |       | 1     |       | V           |
| VIN OVP Voltage Lockout Threshold Rising       | $V_{IN\_OVP}$  | $V_{IN}$ rising              | 40    | 41    | 42    | V           |
| VIN OVP Voltage Lockout Threshold Hysteresis   | $V_{IN\_HYS1}$ |                              |       | 2.7   |       | V           |
| Oscillator Frequency                           | $F_{SW}$       | $V_{FB}=0.6V$                |       | 180   |       | KHz         |
| Maximum Duty Cycle                             | $D_{MAX}$      |                              |       |       | 98    | %           |
| FB Voltage Reference                           | $V_{REF}$      |                              | 0.588 | 0.6   | 0.612 | V           |
| OVP Voltage Reference                          | $V_{OVP}$      |                              |       | 0.706 |       | V           |
| SCP voltage Reference                          | $V_{REF\_SCP}$ |                              |       | 0.395 |       | V           |
| CS Voltage Reference                           | $V_{CS}$       | LP6496A                      | 48    | 53    | 58    | mV          |
|  |                | LP6496B                      | 58    | 65    | 72    | mV          |
| Line Compensation Current                      | $I_{FB}$       |                              |       | 1.5   |       | uA          |
| SCP Frequency                                  | $F_{SW1}$      |                              |       | 61    |       | KHz         |
| Current Limit                                  | $I_{LIMIT}$    | $R_{PMOS}=60m$ , Duty=50%    |       | 4.7   |       | A           |
|  |                | $R_{PMOS}=30m$ , Duty=50%    |       | 9.3   |       | A           |
| Thermal Shutdown                               | $T_{OTP}$      | Temp rising                  |       | 150   |       | $^{\circ}C$ |
| Thermal Shutdown Hysteresis                    | $T_{OTP\_HYS}$ |                              |       | 15    |       | $^{\circ}C$ |
| Hiccup Time                                    | $t_{HICCUP}$   |                              |       | 260   |       | ms          |
| Soft-start Time                                | $t_{SS}$       |                              |       | 2.7   |       | ms          |



## Application Information

The LP6496 operates by a constant frequency, current mode architecture. The output voltage is set by an external divider returned to the FB pin. An error amplifier compares the divided output voltage with a reference voltage of 0.6V and adjusts the peak inductor current accordingly.

### Thermal Protection

The total power dissipation in LP6496 is limited by a thermal protection circuit. When the device temperature rises to approximately 150°C, this circuit turns off the output, allowing the IC to cool. The thermal protection circuit can protect the device from being damaged by overheating in the event of fault conditions. Continuously running the LP6496 into thermal shutdown degrades device reliability.

### Current Limit

The Current limit is set by outside resistance ( $R_{SEN}$ ). When the CS voltage larger than 53mV/65mV, the current limit is happened that driver can be turned off. The current limit set according to the following equation:

$$I_{OUT} = V_{CS} / R_{SEN}$$

### Setting Output Voltage

The output voltage is set with a resistor divider from the output node to the FB pin. It is recommended to use divider resistors with 1% tolerance or better. To improve efficiency at very light loads consider using larger value resistors. If the values are too high the regulator is more susceptible to noise and voltage errors from the FB input current are noticeable. For most applications, a resistor in the 10kΩ to 1MΩ range is suggested for  $R_{UP}$  and  $R_{DN}$ . The output voltage is established by the following equations

$$V_{OUT} = 0.6V \cdot ( 1 + R_{UP} / R_{DN} )$$

Where  $V_{REF}$  is 0.6V.

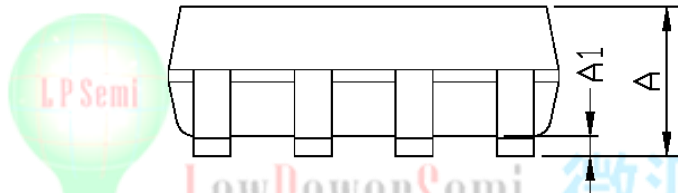
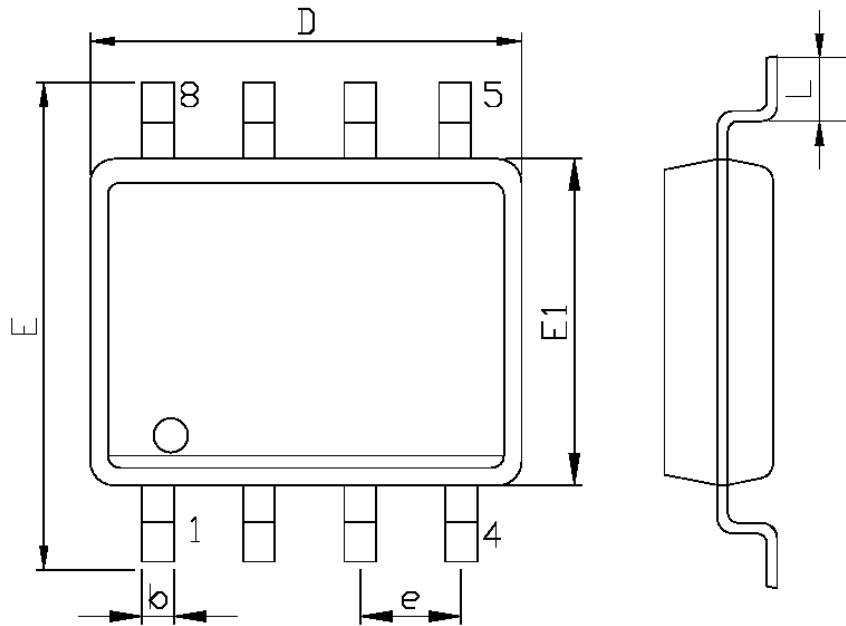
### Output Cable Resistance Compensation

To compensate for resistive voltage drop across the charger's output cable, the LP6496 integrates a simple, user-programmable cable voltage drop compensation using the impedance at the FB pin. The delta  $V_{OUT}$  rises when the feedback resistance  $R_{SEN}$  value rises, use the equation below:

$$\Delta V_{OUT}(V) = I_{OUT}(A) \cdot R_{SEN}(m\Omega) \cdot R_{UP}(K\Omega) / 40 K\Omega$$



### Packaging Information



| SYMBOLS | MILLIMETERS |      | INCHES |       |
|---------|-------------|------|--------|-------|
|         | MIN.        | MAX. | MIN.   | MAX.  |
| A       | 1.35        | 1.75 | 0.053  | 0.069 |
| A1      | 0.10        | 0.25 | 0.004  | 0.010 |
| D       | 4.90        |      | 0.193  |       |
| E       | 5.80        | 6.20 | 0.228  | 0.244 |
| E1      | 3.90        |      | 0.153  |       |
| L       | 0.40        | 1.27 | 0.016  | 0.050 |
| b       | 0.31        | 0.51 | 0.012  | 0.020 |
| e       | 1.27        |      | 0.050  |       |