# BUCK BOOST PFC CONTROLLER FOR LED DRIVER

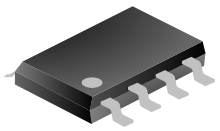
## DESCRIPTION

The SD6910A is a buck boost power factor correction (PFC) controller, specially designed for LED driver.

The Device adopts constant on time operation to achieve high power factor.

The SD6910A provides accurate constant current control and operates in boundary conduction mode (BCM) with high efficiency.

The SD6910A provides completed protections such as short LED protection, open LED protection and over temperature protection, etc.



SOP-8-225-1.27

## FEATURES

- Buck boost topology
- Boundary Conduction Mode
- Low start current
- Leading edge blanking
- Constant on-time control
- VCC over voltage protection
- VCC under voltage lockout
- Over temperature protection
- Cycle by cycle current limiting
- Peak current compensation
- Short LED protection and Open LED protection

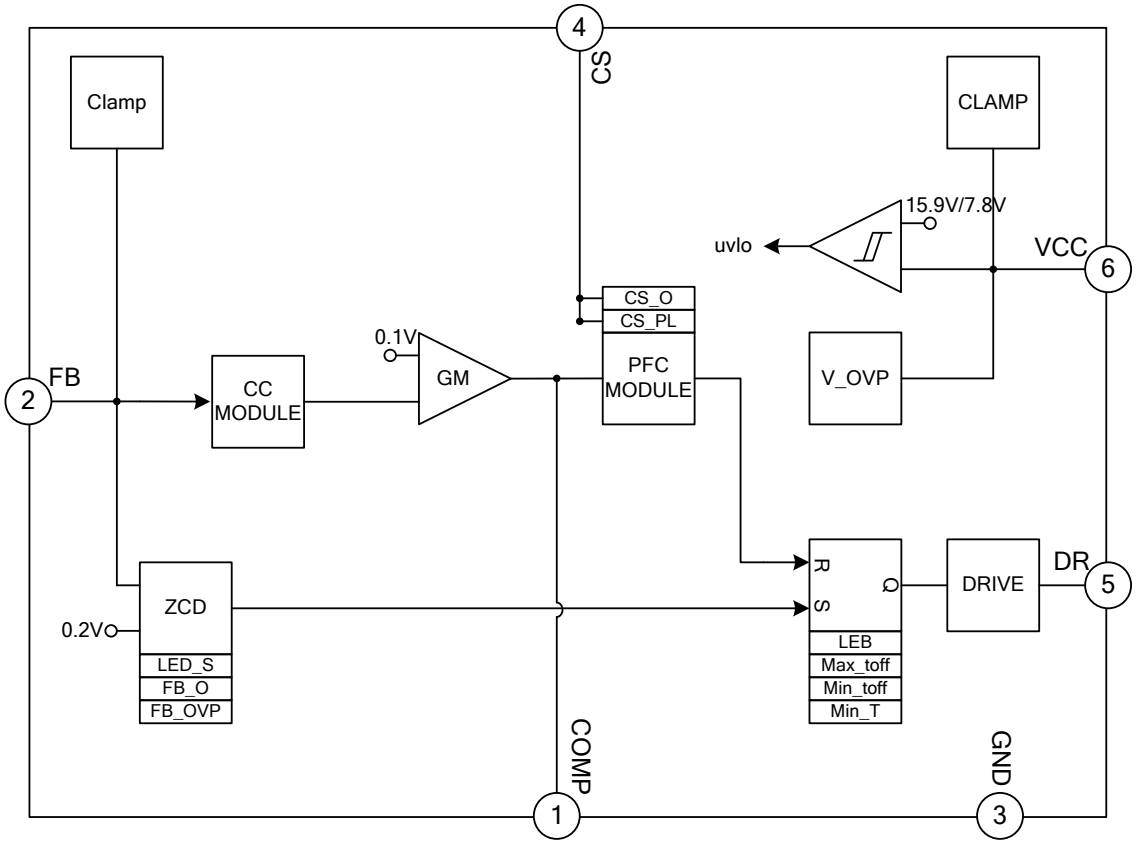
## APPLICATIONS

- LED lamp
- LED illumination with AC input

## ORDERING INFORMATION

| Part No. | Package | Material | Packing |
|---|---|---|---|
| SD6910A | SOP-8-225-1.27 | Halogen free | Tube |
| SD6910ATR | SOP-8-225-1.27 | Halogen free | Tape & reel |

## BLOCK DIAGRAM




## ABSOLUTE MAXIMUM RATING

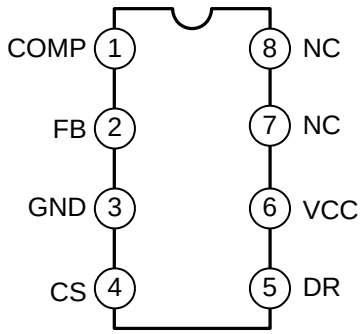
| Characteristics | Symbol | Rating | Unit |
|---|---|---|---|
| Supply voltage | $V_{CC}$ | -0.3 ~ 26.5 | V |
| Analog pin voltage | - | -0.3 ~ 5.5 | V |
| Junction temperature | $T_j$ | -40~+150 | °C |
| Storage temperature Range | $T_{stg}$ | -55~+150 | °C |

## ELECTRICAL CHARACTERISTICS (unless otherwise specified, $V_{CC}$=18V, $T_{amb}$=25°C)

| Characteristics | Symbol | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **Supply voltage** | | | | | | |
| Operating voltage | $V_{CC}$ | After IC starts | 8.6 | -- | 24.8 | V |
| Turn-on threshold | $V_{CCON}$ | | 14.3 | 15.9 | 17.5 | V |
| Turn-off voltage | $V_{CCOFF}$ | | 7.0 | 7.8 | 8.6 | V |
| Clamp voltage | $V_Z$ | $I_{CC}$=10mA | -- | 34.5 | -- | V |
| VCC over voltage threshold | $V_{CCOVP}$ | | 24.8 | 26.5 | 27.8 | V |
| Start-up current | $I_{start}$ | $V_{CC}$=14V | 0 | 3 | 10 | μA |
| Operating current | $I_{op}$ | | 300 | 500 | 800 | μA |
| **FB Feedback** | | | | | | |

| Characteristics | Symbol | Test conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| OVP threshold value | $V_{FBOVP}$ | | 1.38 | 1.46 | 1.54 | V |
| Short-circuit detect voltage | $V_{SHT}$ | | -- | 0.29 | -- | V |
| Zero-crossing detection | $V_{zcs}$ | | -- | 0.2 | -- | V |
| **Dynamitic characteristic** | | | | | | |
| Leading-edge blanking time | $T_{LEB}$ | | 0.53 | 0.68 | 0.83 | μs |
| Max. on time | $T_{onmax}$ | COMP connected to 4V via 20K | 24 | 33 | 42 | μs |
| Max. off time | $T_{offmax}$ | | 25 | 34 | 43 | μs |
| Min. off time | $T_{offmin}$ | | 3.2 | 4.2 | 5.2 | μs |
| Min. period | $T_{min}$ | | 6.3 | 8.3 | 10.3 | μs |
| Current limit | | | | | | |
| CS peak limit | $V_{CSPL}$ | | 0.49 | 0.60 | 0.71 | V |
| **Gm amplifier** | | | | | | |
| CS CC compare point | $V_{cscc}$ | | 0.097 | 0.100 | 0.103 | V |
| **Drive** | | | | | | |
| DR rising time | $T_R$ | C=1nF | 100 | 200 | 400 | ns |
| DR falling time | $T_F$ | C=1nF | 60 | 100 | 120 | ns |
| DR high clamp voltage | $V_{DRC}$ | | 16 | 17.5 | 19 | V |
| Peak drive source current | $I_{srcpk}$ | C=1nF | 0.2 | -- | -- | A |
| Peak drive sink current | $I_{snkpk}$ | C=1nF | 0.45 | -- | -- | A |
| DR high level | $V_{DRH}$ | Isource=25mA | 14.0 | 15.6 | -- | V |
| DR low level | $V_{DRL}$ | Isink=20mA | -- | 0.5 | 0.8 | V |
| **Over Temperature Protection** | | | | | | |
| Over temperature detection | $T_{sd}$ | | -- | 150 | -- | °C |
| Over temperature hysteresis | $T_{sdhys}$ | | -- | 10 | -- | °C |

## PIN CONFIGURATION



## PIN DESCRIPTION

| Pin No. | Pin Name | I/O | Function description |
|---|---|---|---|
| 1 | COMP | I/O | RC loop compensation pin, output of transconductance amplifier |
| 2 | FB | I | Feedback voltage input pin |
| 3 | GND | I/O | Ground |
| 4 | CS | I | Current sense pin |
| 5 | DR | O | Drive pin |
| 6 | VCC | I/O | Power supply |
| 7 | NC | -- | NC |
| 8 | NC | -- | NC |

## FUNCTION DESCRIPTION

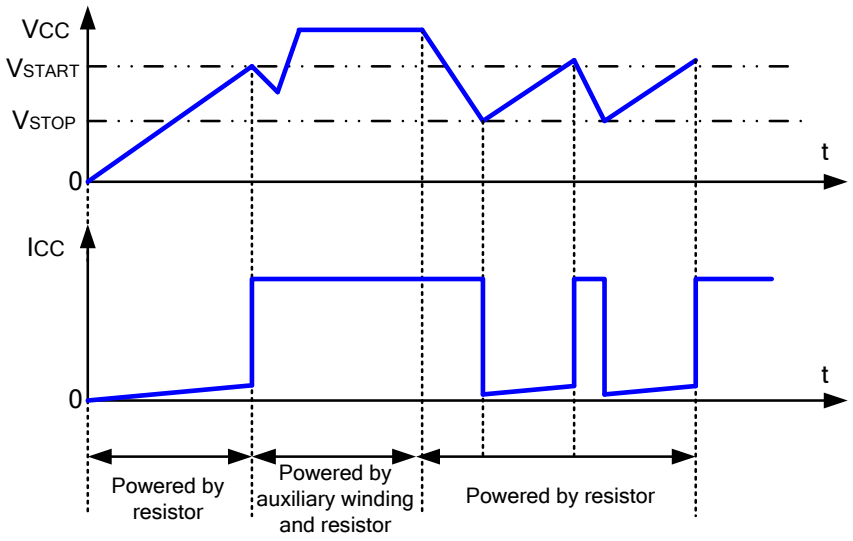
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The SD6910A provides completed protections such as short LED protection, open LED protection and over temperature protection, etc.

### 1. Start-up and under voltage lockout

After AC supply is powered on, the capacitor connected to pin VCC is charged by AC supply through a start resistor. Once VCC voltage rises up to 15.9V, the circuit starts to work. VCC voltage will be pulled down by internal consumption of IC until the auxiliary winding could supply enough energy to maintain VCC voltage above 7.8V. If the protection occurs, the output of circuit is off, VCC voltage starts to decrease. If VCC voltage is decreased to 7.8V, the capacitor connected to pin VCC is recharged through start resistor.



### 2. Drive circuit

Drive circuit is power by VCC. When DR＝1, MOSFET is on; When DR＝0, MOSFET is off. $T_{LEB}$＝0.75μs is set to avoid the burr which will cause error at the turn-on transient of MOSFET.

### 3. Peak current detection and sample holding

When MOSFET is on, the inductance current, which is detected by sense resistor, increases linearly. If this current exceeds the threshold value 0.6V, the current limit comparator acts to turn off MOSFET and DR＝0.
When it is normal, inductance peak current is $I_{pk}$, and the diode on time is $T_{off1}$, hence, the output current is given by:

$$I_{out} = 0.5 \cdot I_{pk} \cdot T_{off1} / T$$

$I_{pk} \cdot T_{off1} / T$ is calculated in integral mode, and $I_{pk} \cdot T_{off1} / T = V_{cscc} / R_{sen}$ is realized through loop control.
Where, $R_{sen}$ is the sense resistor.
That is,

$$I_{out} = 0.5 \cdot V_{cscc} / R_{sen}$$

The output of error amplifier COMP is used for control switch on time. When the on time is up, DR＝0, MOSFET is off.

### 4. Boundary Conduction Mode

The pin FB detects the voltage across the auxiliary winding by a resistor divider. When the inductance current turns to zero, FB voltage starts to decrease. If FB voltage is decreased to 0.2V, the MOSFET would be turned on.

### 5. VCC over voltage protection and Open LED protection

The output voltage is reflected by the auxiliary winding voltage, and both pin FB and pin VCC provide over voltage protection function. When VCC voltage exceeds 26.5V, or FB voltage exceeds 1.46V, the over voltage protection is triggered and the IC will discharge, VCC voltage start to decrease. If VCC voltage is decreased to 7.8V, the capacitor connected to pin VCC is recharged through start resistor. If the over voltage condition still exists, the system will operate in hiccup mode.

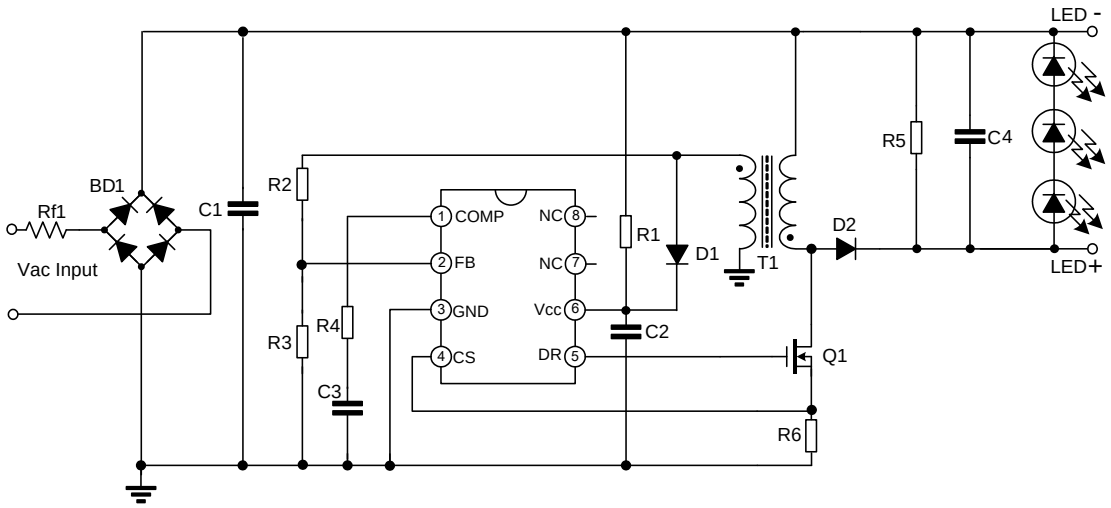
### 6. Over Temperature Protection

If the circuit is over temperature, the output is shut down to prevent the circuit from damage. The over temperature protection has the hysteresis characteristic. The temperature should be decreased lower than the threshold temperature by 10°C for normal operation. This is adopted to avoid frequently change between normal and protection modes.

### 7. LED Short-circuit protection

When LED is short-circuit and held for some time, the protection acts and the circuit restarts after the protection.

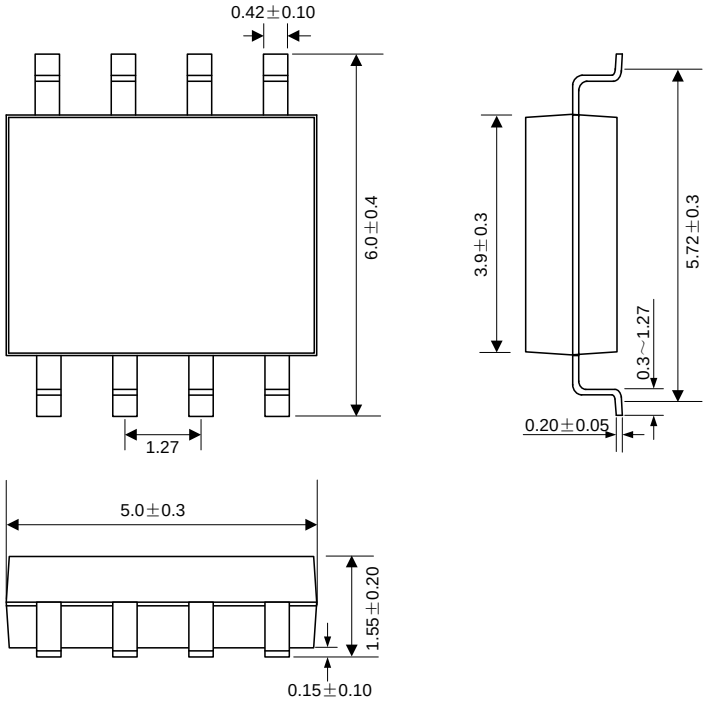
## TYPICAL APPLICATION CIRCUIT




**Note:** The circuit and parameters are for reference only; please set the parameters of the real application circuit based on the real test.

## PACKAGE OUTLINE

**SOP-8-225-1.27** **UNIT: mm**






**MOS DEVICES OPERATE NOTES:**

Electrostatic charges may exist in many things. Please take following preventive measures to prevent effectively the MOS electric circuit as a result of the damage which is caused by discharge:

- The operator must put on wrist strap which should be earthed to against electrostatic.
- Equipment cases should be earthed.
- All tools used during assembly, including soldering tools and solder baths, must be earthed.
- MOS devices should be packed in antistatic/conductive containers for transportation.

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| Rev.: | 1.0 | Author: | Tang Xianming |

Revision History:

1. First release