

### General Description

The SY59103P is a linear AC/DC driver with integrated 350V MOSFET for LED lighting. It's compatible with Leading/Trailing edge dimmer. The patented technique results in high efficiency and power factor.

### Ordering Information

SY59103 □ (□ □) □  
 └─── Temperature Code  
 └─── Package Code  
 └─── Optional Spec Code

Ordering Number	Package type	Note
SY59103PFCC	SO8E	----

### Features

- Compatible with Leading/Trailing Edge Dimmer
- Integrated 350V MOSFET
- Power Factor >0.9
- SMT Assembly
- Eliminate Magnetic Components
- Compact Package: SO8E

### Applications

- LED Lighting
- Down Light/Bulb/Spot Lamp

### Typical Applications

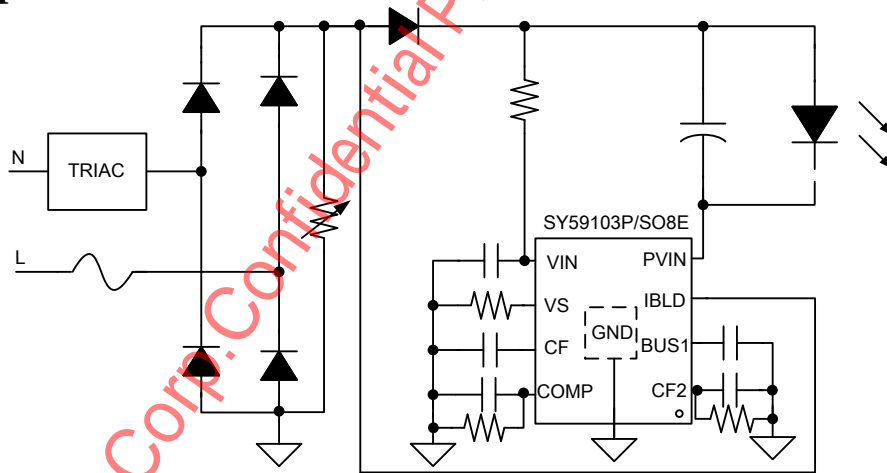
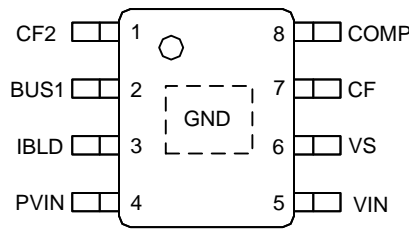


Fig1. Typical application

## Pinout (top view)



(SO8E)

Top Mark: BTJxyz (device code: BTJ, x=year code, y=week code, z=lot number code)

Pin	Name	Description
1	CF2	TRIAC or Non TRIAC mode detection.
2	BUS1	Connect a 2.2nF to GND.
3	IBLD	Bleeding current from BUS to achieve good compatibility.
4	PVIN	Drain of integrated power MOSFET.
5	VIN	IC power supply.
6	VS	Source of integrated power MOSFET integrate, sense output current.
7	CF	TRIAC angle detection.
8	COMP	Loop compensation Pin.
Bottom	GND	GND of IC.

## Block Diagram

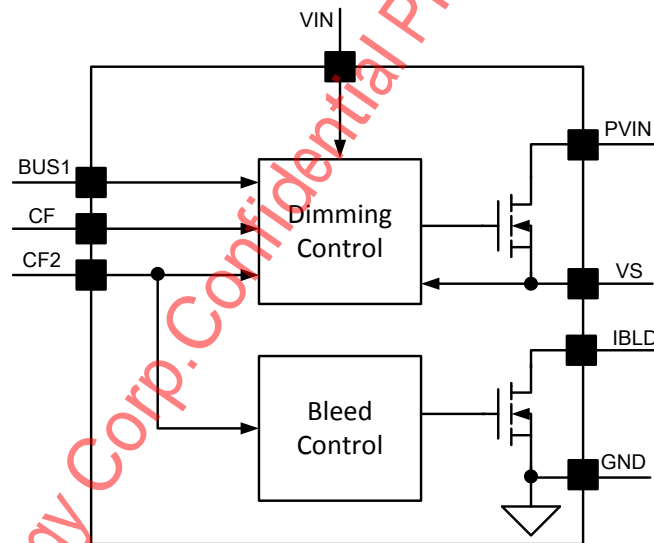


Fig2. IC block diagram

**Absolute Maximum Ratings** (Note 1)

PVIN-----	-0.3V to 350V
IBLD-----	-0.3V to 600V
COMP, BUS1 -----	-0.3V to 25V
CF, CF2, VS-----	-0.3V to 3.6V
VIN-----	-0.3V to 21V
Supply current I <sub>VIN</sub> -----	10mA
Power Dissipation, @ T <sub>A</sub> = 25°C SO8E-----	3.3W
Package Thermal Resistance (Note 2)	
SO8E,θ <sub>JA</sub> -----	30°C/W
SO8E,θ <sub>JC</sub> -----	10°C/W
Temperature Range -----	-40°C to 150°C
Lead Temperature (Soldering, 10 sec.) -----	260°C
Storage Temperature Range -----	-65°C to 150°C

**Recommended Operating Conditions** (Note 3)

VIN-----	12V~18V
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## Electrical Characteristics

( $V_{IN} = 15V$  (Note 3),  $T_A = 25^\circ C$  unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>Power Supply Section</b>						
VIN Turn-on Threshold	$V_{VIN\_ON}$		15	17.5	20	V
VIN Turn-off Threshold	$V_{VIN\_OFF}$		9.5	11.5	13.5	V
Quiescent Current	$I_Q$		210	255	320	$\mu A$
Internal Reference Voltage	$V_{REF}$		274	281	288	mV
BV of Integrated MOSFET	$V_{Drain}$		350			V
<b>Thermal Section</b>						
Thermal Fold Back Temperature	$T_{FB}$			150		$^\circ C$
Thermal Shutdown Temperature	$T_{SD}$			160		$^\circ C$

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

**Note 2:**  $\theta_{JA}$  is measured in the natural convection at  $T_A = 25^\circ C$  on a low effective single layer thermal conductivity test board of JEDEC 51-3 thermal measurement standard. Test condition: Device mounted on 2” x 2” FR-4 substrate PCB, 2oz copper, with minimum recommended pad on top layer and thermal vias to bottom layer ground plane.

**Note 3:** Increase VIN pin voltage gradually higher than  $V_{VIN\_ON}$  voltage then turn down to 15V.

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## Operation

The SY59103P is a dimmable linear AC/DC driver with integrated 350V MOSFET for LED lighting.

It's compatible with Leading/Trailing edge dimmer.

With the constant current control, SY59103P can achieve good line regulation and load regulation.

The patented technique leads to high power efficiency and PF (>0.9).

SY59103P provides reliable protections such as over temperature protection (Thermal fold-back), etc.

SY59103P is available with SO8E package.

## Applications Information

### Start Up and IC Power Supply

After AC supply is powered on,  $C_{VIN}$  is charged up by BUS voltage through a start up resistor  $R_{ST}$ . Once  $V_{VIN}$  exceeds  $V_{VIN\_ON}$ , IC starts to work and  $R_{ST}$  supplies IC operation current.

The startup procedure is shown in Fig.3.

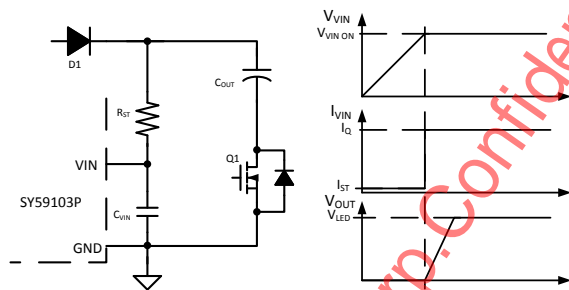


Fig.3 Start up

### Shut Down

After AC supply is powered off, the energy stored in the output capacitor will be discharged. When  $V_{VIN}$  is below  $V_{VIN\_UVLO}$ , the IC will stop working and  $V_{COMP}$  will be discharged to zero.

### Constant-Current Control

The output current  $I_{OUT}$  can be represented by

$$I_{OUT} = \frac{V_{REF}}{R_S}$$

Where  $V_{REF}$  is the internal reference voltage;  $R_S$  is the current sense resistor.

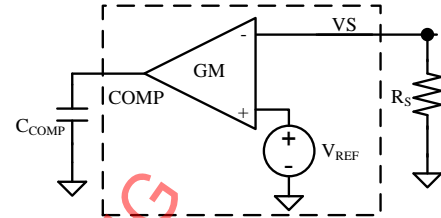


Fig.4 Closed loop

Output capacitor  $C_{COMP}$  need to be big enough to keep average output current is equal to  $V_{REF}$ .

### Special Design for Current Compensation

To have a better efficiency, special design is integrated in SY59103P.

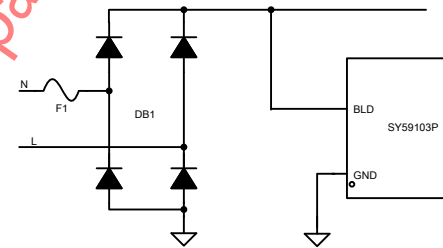


Fig.5 The patented technology of compensation

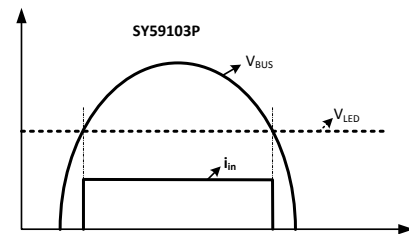


Fig.6 Shape of Input current for high PF

Input current of SY59103P is constant when  $V_{BUS}$  higher than  $V_{LED}$ , set  $V_{LED}$  about 115V, it is just right for the requirement PF>0.9.

## TRIAC Dimming

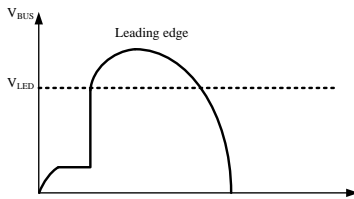


Fig.7 BUS voltage with TRIAC

When cooperate with dimmer, IC will provide enough latching current and holding to keep dimmer working normally.

## Thermal Fold-back Function

SY59103P have thermal fold-back function.

## Design Guide:

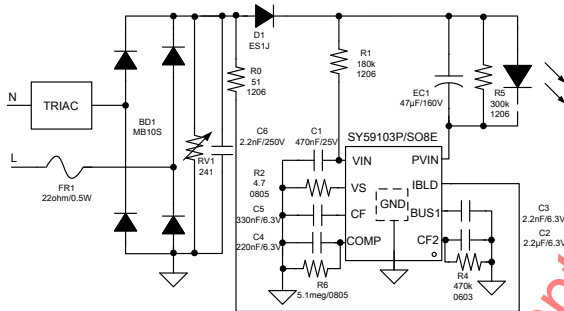


Fig.8 Schematic

### 1: Power Supply Module:

R1 and C1 is start up and power supply module:

(a) Power supply of SY59103P is from R<sub>1</sub> (by D1 and EC1), and maximum operation current is I<sub>Q\_MAX</sub>. Consider of operating condition and power loss, 180KΩ is recommended.

$$R_S < \frac{V_{OUT\_MIN} - V_{VIN\_UVLO}}{I_{Q\_MAX}} = \frac{80V - 11.5V}{320\mu A} = 214K$$

(b) Consider ripple on C<sub>VIN</sub> and IC supply voltage is about 18V, C<sub>VIN</sub> is recommended 470nF/25V.

### 2: Sense Resistor

Inter Ref is 281mV, R<sub>S</sub>=281mV/I<sub>OUT</sub>. As connect a 5.1meg resistor between COMP and GND, R<sub>S</sub> need to relect around the result calculated.

### 3: Output Electrolytic Capacitor

According to output current ripple requirement, usually, when select 47μF electrolytic capacitor, output ripple is around ± 25% I<sub>OUT</sub>, when select 22μF electrolytic capacitor, output ripple is around ± 45% I<sub>OUT</sub>.

### 4: C<sub>COMP</sub> Selection

Consider of PF and loop response speed, C<sub>COMP</sub> is suggested 220~330nF (If PF is not requested higher than 0.9, then C<sub>COMP</sub> can chose 68nF~100nF).

### 5: C<sub>CF</sub> Selection

CF is use for TRIAC angle detection, on other way, the duty V<sub>S</sub>>V<sub>S\_LOW</sub>, by filtering the angle and change reference inter according to V<sub>CF</sub>. C<sub>CF</sub> is suggested 220nF~470nF.

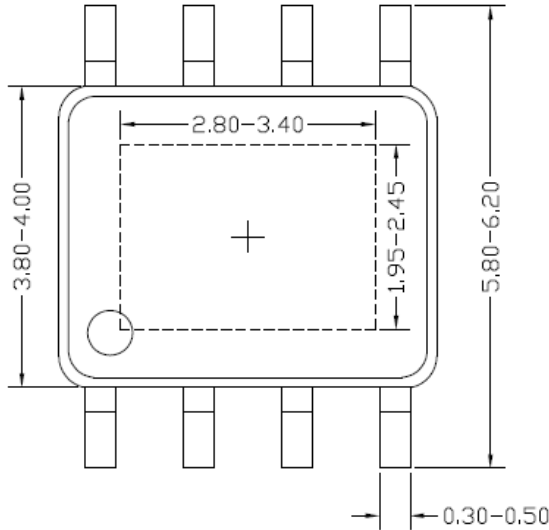
### 6: C<sub>CF2</sub> Selection

CF2 is use for TRIAC or non TRIAC detection, 2.2μF is recommended for C<sub>CF2</sub>, usually a resistor is paralleled between CF2 and GND.

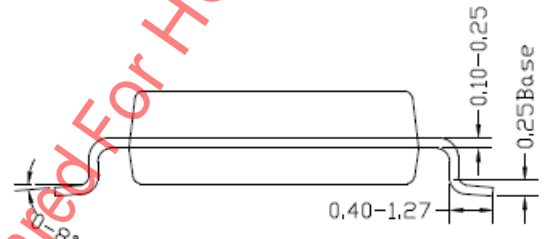
### 7: C<sub>BUS1</sub> Selection

BUS1 is an internal compensation PIN, a 2.2nF internal compensatory capacitor is recommended to connect between BUS1 and GND.

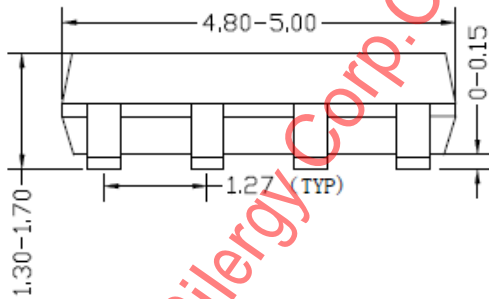
## SO8E Package Outline & PCB layout



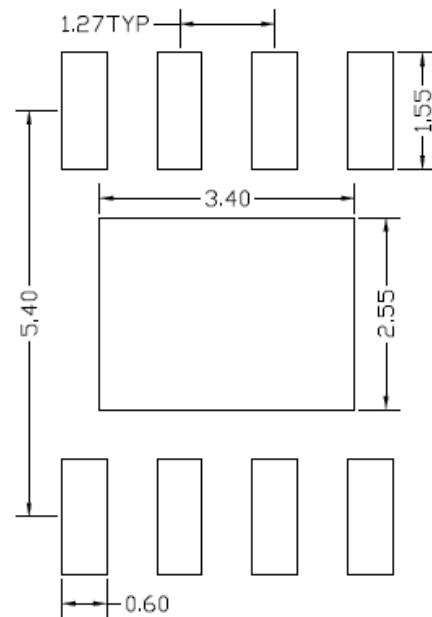
**Top view**



**Side view**



**Front view**



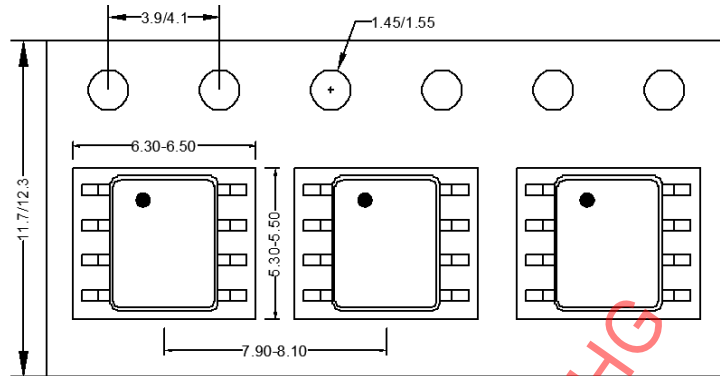
**Recommended PCB Layout  
(Reference Only)**

**Notes: All dimension in millimeter and exclude mold flash & metal burr.**

## Taping & Reel Specification

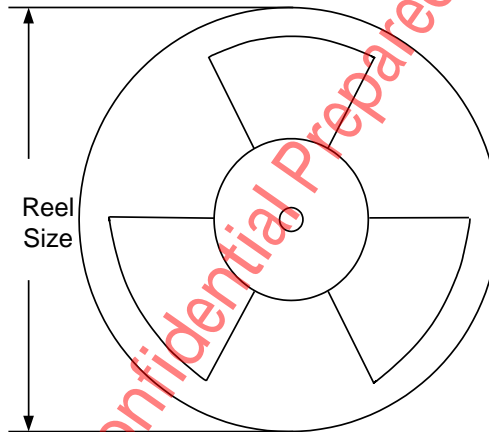
### 1. Taping orientation

SO8E



Feeding direction →

### 2. Carrier Tape & Reel specification for packages



Package types	Tape width (mm)	Pocket pitch(mm)	Reel size (Inch)	Trailer * length(mm)	Leader * length (mm)	Qty per reel (pcs)
SO8E	12	8	13"	400	400	2500

Others: NA



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