AC ON/OFF Adjusting Color Temperature Controller for LED Lighting

Features

- Integrated 400V/1A Power MOSFET
- Very few external components, no detecting AC Input
- Excellent system synchronization performance
- Built-in limiting voltage circuit for wider operation range
- Isolated and Non-isolated Applications

Description

The WS9911 is an AC ON/OFF adjusting color temperature controller for LED Lighting. It integrates 400V/1A Power MOSFET and simplifies the external circuit structure. It also ensures the logical consistency in multiple power applications at the same time.

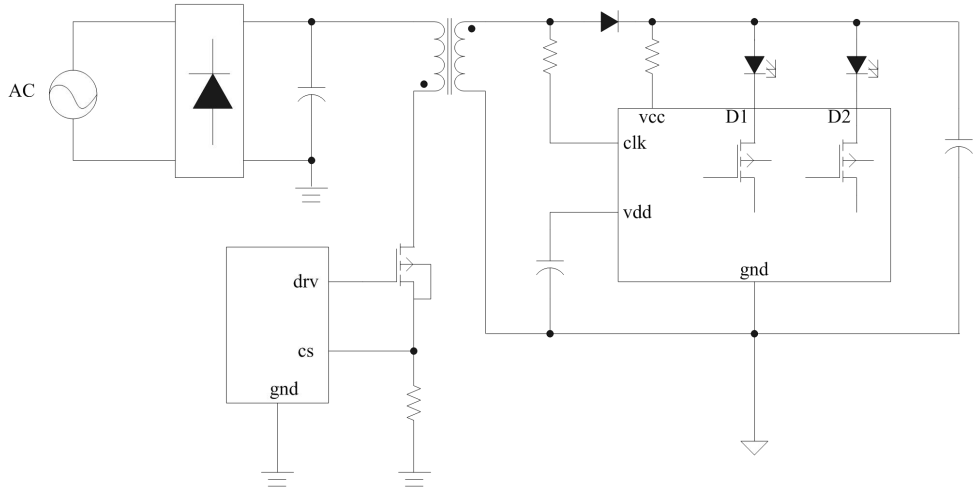
In order to expand the application field, the WS9911 can be used in the isolated flyback, Buck or Buck-Boost structure to facilitate the power supply design.

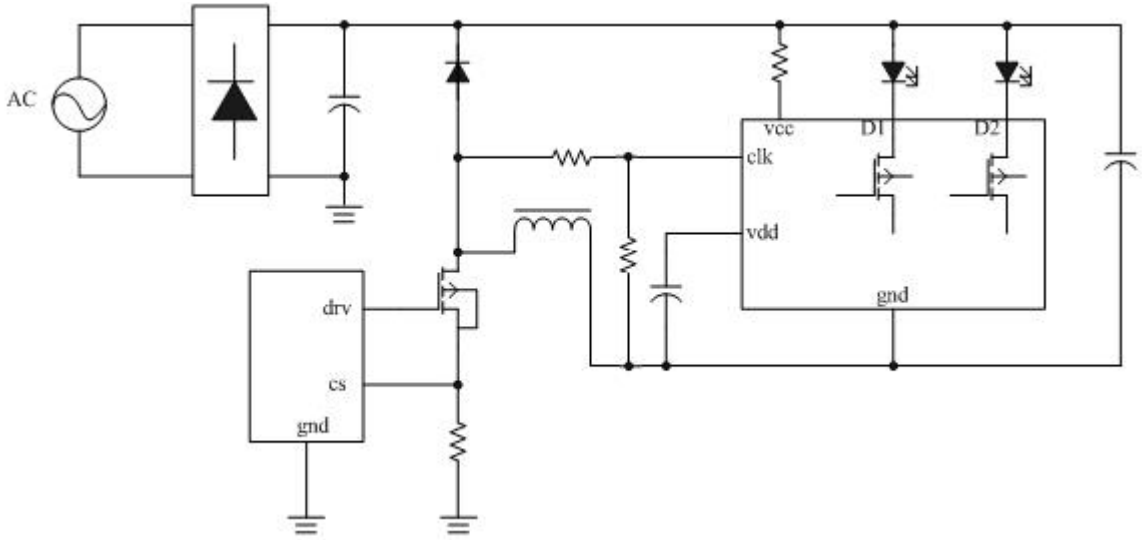
The WS9911 is available in SOP8 Package.

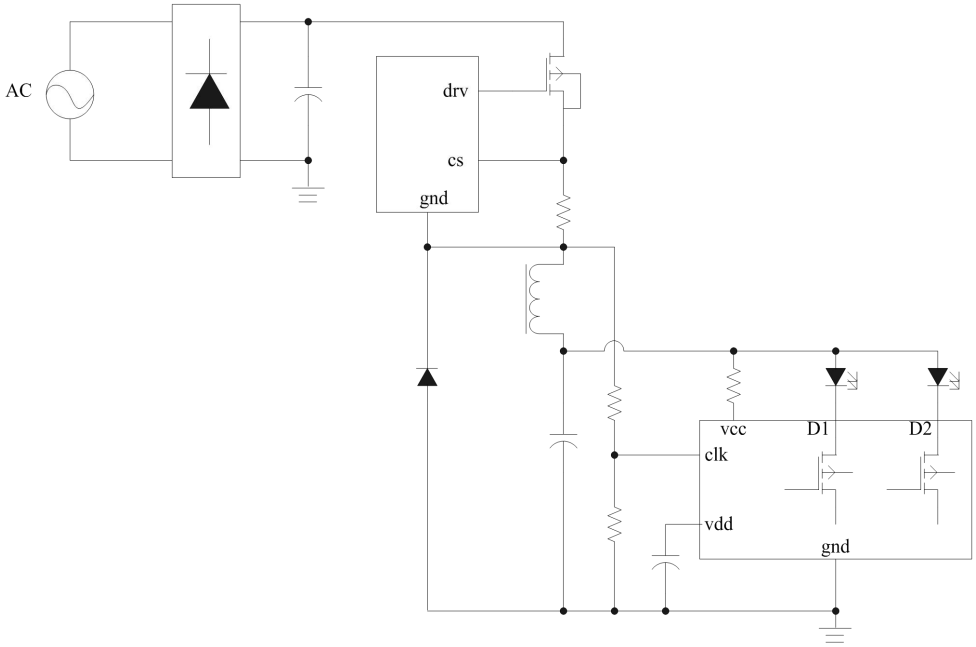
Typical Appliction

- AC ON/OFF adjusting color temperature controller for LED Lighting

Typical Application Circuit




AC
vcc
D1
D2
clk
vdd
gnd
drv
cs
gnd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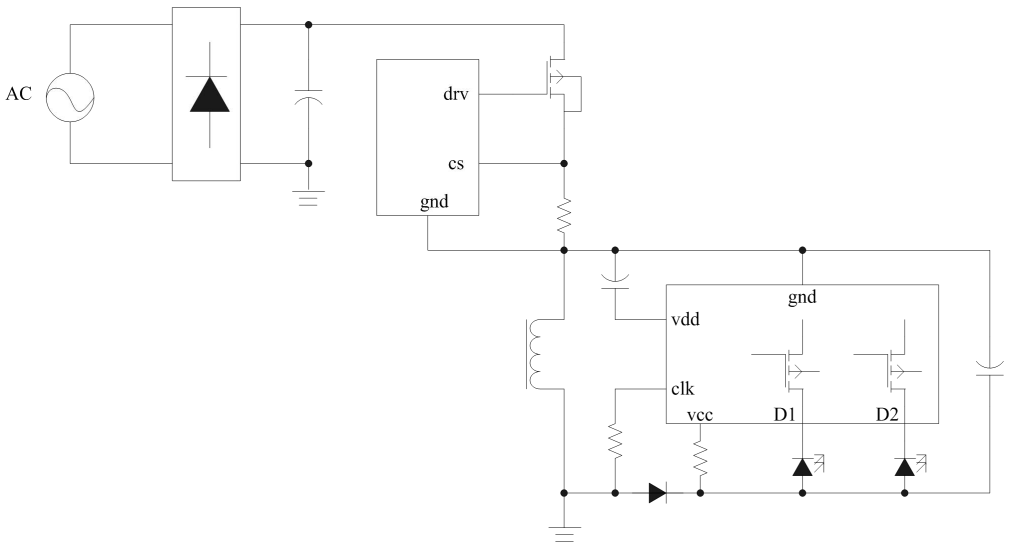
AC
drv
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clk
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D1
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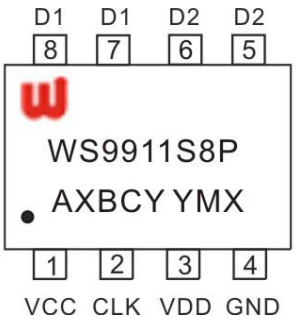
Pin Definition and Device Marking

The WS9911 is available in SOP-8 package：

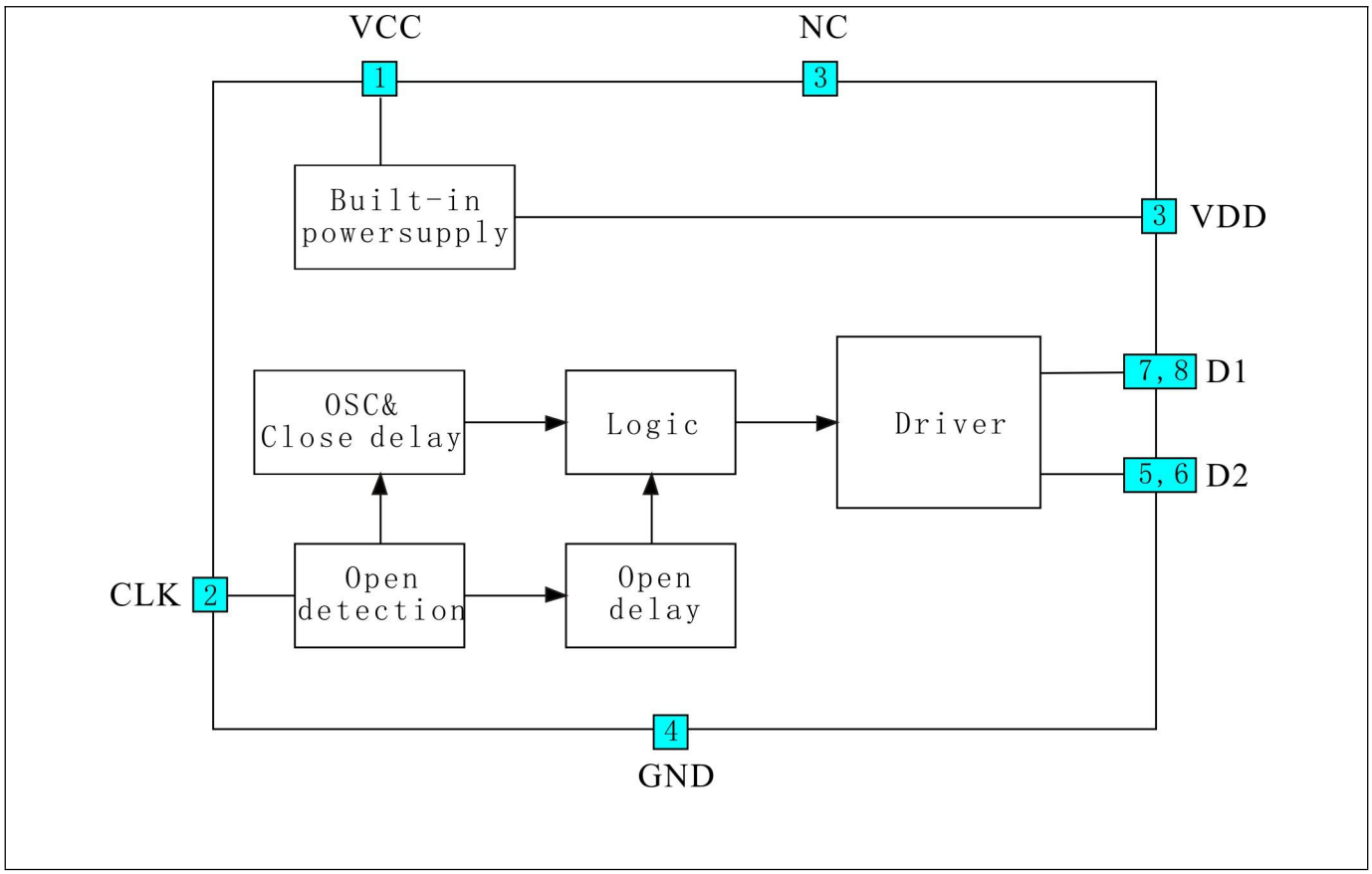


WS9911S8P：Product Code
A：Product Code
X：Internal Code
BCY：Internal QC Code
YMX：D/C

SOP8 Package Pin Definition

Pin name	Pin No.	Description
1	VCC	IC Supply Voltage input
2	CLK	IC detecting PIN
3	VDD	Built-in powersupply and connecting a capacitor to acheieve holding time
4	GND	IC Ground
5,6	D2	Led2 negative electrode
7,8	D1	Led1 negative electrode

Block Diagram



Ordering Information

Package	Marking	Part Number
8-Pin SOP8, Pb-free	WS9911S8P	WS9911S8P

Absolute Maximum Ratings

Symbol	Parameter	Limit	Unit
VCC	Supply Voltage	-0.3~25	V
Vdd	Built-in power supply	-0.3~6	V
CLK	IC detecting PIN	-0.3~6	V
D1,D2	LED negative electrode	-0.3~400	V
Tjo	Operating Temperature Range	-40~150	℃
TSTG	Minimum/Maximum storage temperature	-55~150	℃

Note 1：Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. Under “recommended operating conditions” the device operation is assured, but some particular parameter may not be achieved.

Electrical Characteristics

Conditions： VCC=13V，TA=25℃.(Unless otherwise specified)

Symbol	Parameter	Test condition	Min	Typ	Max	Unit
VCC_CLAMP	VCC Clamping Voltage	Ivcc=2mA	12	13	14	V
Iop	Operating current	Vcc=12		1		mA
VDD	Internal Power Supply Voltage		5.3	5.8	6.3	V
Vth_clk	Detection threshold voltage		1.5	1.8	2.2	V
Ivdd_hold	Internal operational current in state holding				1	uA
Td(on)	the delay time of the switch in on state	Fsw=60khz （1）		13		ms
Td(off)	the delay time of the switch in off state			15		ms

Note: (1) Fsw is the switching frequency of constant-current source.

Function Description

The WS9911 is an AC ON/OFF adjusting color temperature controller for LED Lighting. It integrates 400V/1A Power MOSFET and simplifies the external circuit structure.

Power Supply

The WS9911 is powered by the VCC pin, which connects the VCC pin to the positive terminal of the power supply output via a current limiting resistor in application. As the IC current is about 2mA, and the temperature changes can affect the operating current, the design must ensure that the IC supply current is greater than 1mA.

The maximum value of the current limiting resistor of the power supply pin can be given by:

$$R_{MAX} = \frac{V_o - 13}{1}(Kohm) \quad (1)$$

The VCC pin integrates clamp circuit, and the maximum clamp current is 5mA. So the minimum current limiting resistor of the power supply pin can be given by:

$$R_{MIN} = \frac{V_o - 13}{5}(Kohm) \quad (2)$$

Detection

The WS9911's detection pin is CLK. In the application, the CLK pin is connected to one end of the constant current supply inductor via a detection resistor, as shown in the typical application diagram. The WS9911 determines whether the input switch is closed or open by the CLK pin. When the input switch is closed, the CLK pin detects the square wave signal; when the input switch is off, the square wave signal disappears. In order to filter out the noise and avoid causing false trigger, the WS9911 is designed with $T_d(on)$ and $T_d(off)$. $T_d(on)$ is the delay time of the switch in closed state and $T_d(off)$ is the delay time of the switch in off state.

The selection of the detection resistor must ensure that the current of the resistor must be less than 2mA when the negative pressure occurs at the other end of the resistor.

Driver

The WS9911 integrates two 400V1A power MOSFETs, which greatly simplified peripheral application circuits.

State Duration

To maintain the desired time when the input switch is open, the internal operational current of the WS9911 can be up to 1uA. The desired time can be achieved by adjusting the capacitor which is connected to the VDD pin. The larger the capacitor is, the longer the state duration is.

PCB Layout

The following rules should be followed in WS9911

PCB layout:

The bypass capacitor of VDD shall be close to the VDD pin and the GND pin.

The distance between the drive pin and the MOSFET should be as short as possible.

Periphery Parameter Design

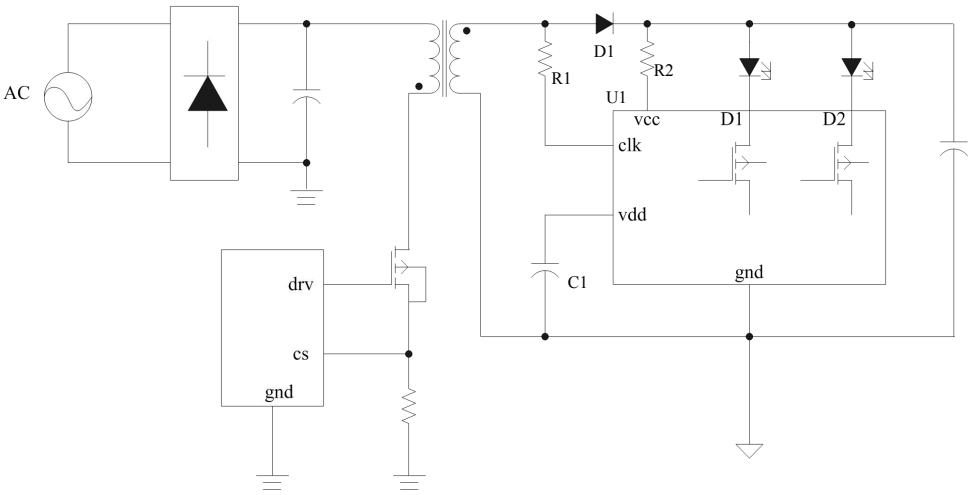
Design Process：

1.Based on the architecture of the constant current power supply

2.Define the periphery structure of the WS9911

3.Calculate the parameters of the external components based on the output voltage and current

Isolated flyback constant current structure：



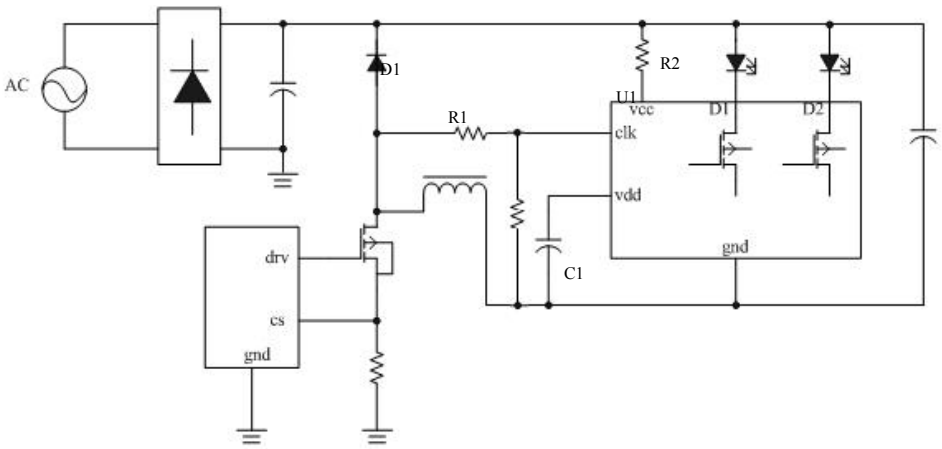
C1 determines the state duration. Generally, 1uF capacitor can be maintained for about 5S.

$$R_1 = 1Mohm$$

$$\frac{V_{O\_MAX} - 13}{5} \le R_2 \le \frac{V_{O\_MIN} - 13}{1}$$

Where, V_{O_MAX} is the maximum output load voltage, V_{O_MIN} is the minimum output load voltage.

Non-isolated buck structure：



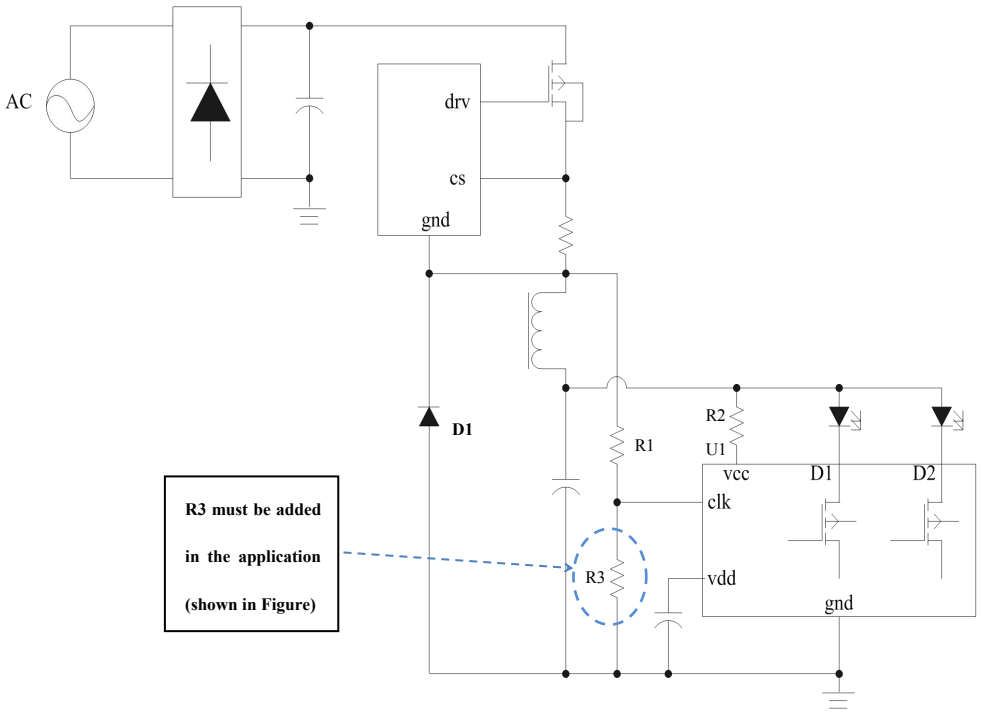
C1 determines the state duration. Generally, 1uF capacitor can be maintained for about 5S.

$$R_1 = 1Mohm$$

$$\frac{V_{O\_MAX} - 13}{5} \le R_2 \le \frac{V_{O\_MIN} - 13}{1}$$

Where, V_{O_MAX} is the maximum output load voltage, V_{O_MIN} is the minimum output load voltage.

Non-isolated buck floating structure：



C1 determines the state duration. Generally, 1uF capacitor can be maintained for about 5S.

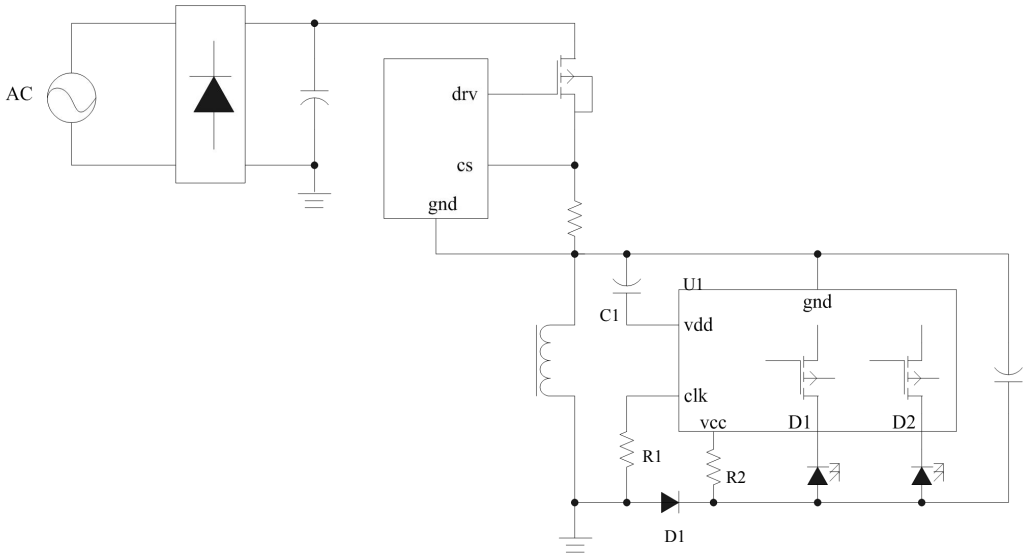
$R_1 = 1Mohm$

$R_3 = 10Kohm$

$$\frac{V_{O\_MAX} - 13}{5} \le R_2 \le \frac{V_{O\_MIN} - 13}{1}$$

Where, V_{O_MAX} is the maximum output load voltage, V_{O_MIN} is the minimum output load voltage.

Buck-Boost Structure：



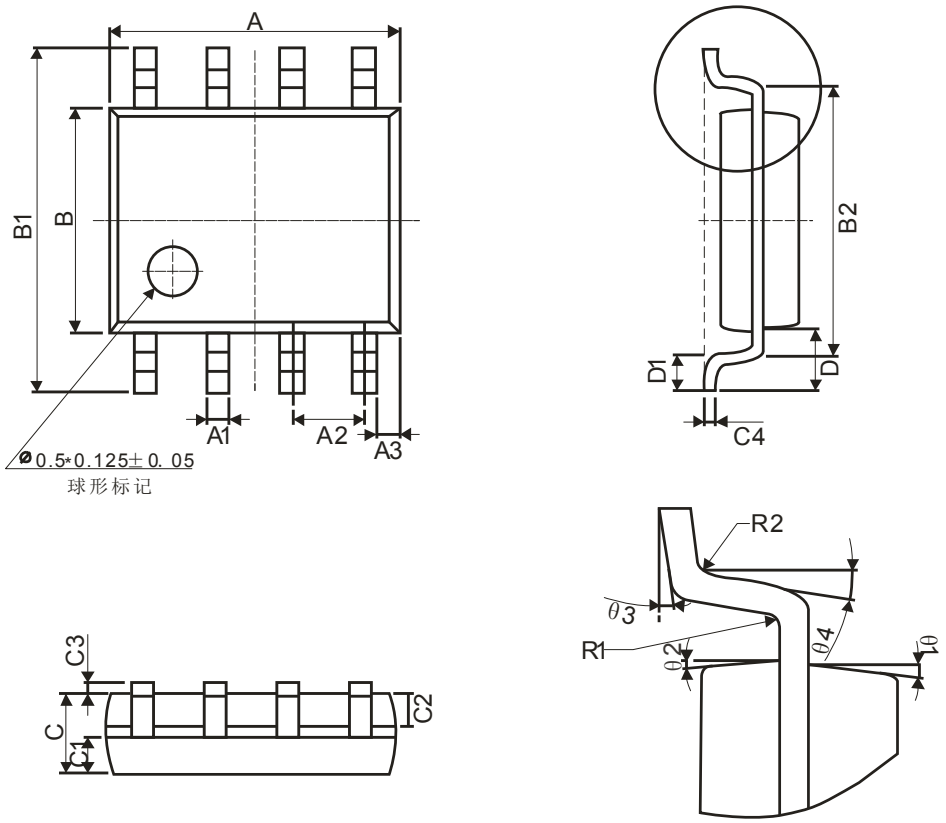
C1 determines the state duration. Generally, 1uF capacitor can be maintained for about 5S.

$R_1 = 1Mohm$

$$\frac{V_{O\_MAX} - 13}{5} \le R_2 \le \frac{V_{O\_MIN} - 13}{1}$$

Where, V_{O_MAX} is the maximum output load voltage, V_{O_MIN} is the minimum output load voltage.

SOP-8 Package Dimension



Symbol	Winsemi			
	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	4.70	5.10	0.185	0.201
B	3.70	4.10	0.146	0.161
C	1.30	1.50	0.051	0.059
A1	0.35	0.48	0.014	0.019
A2	1.27TYP		0.05TYP	
A3	0.345TYP		0.014TYP	
B1	5.80	6.20	0.228	0.244
B2	5.00TYP		0.197TYP	
C1	0.55	0.70	0.022	0.028
C2	0.55	0.70	0.022	0.028
C3	0.05	0.225	0.002	0.009
C4	0.203TYP		0.008TYP	
D	1.05TYP		0.041TYP	
D1	0.40	0.80	0.016	0.031

NOTE:

1.We strongly recommend customers check carefully on the trademark when buying our product, if there is any question, please don't be hesitate to contact us.

2.Please do not exceed the absolute maximum ratings of the device when circuit designing.

3.Winsemi Microelectronics Co., Ltd reserved the right to make changes in this specification sheet and is subject to change without prior notice.