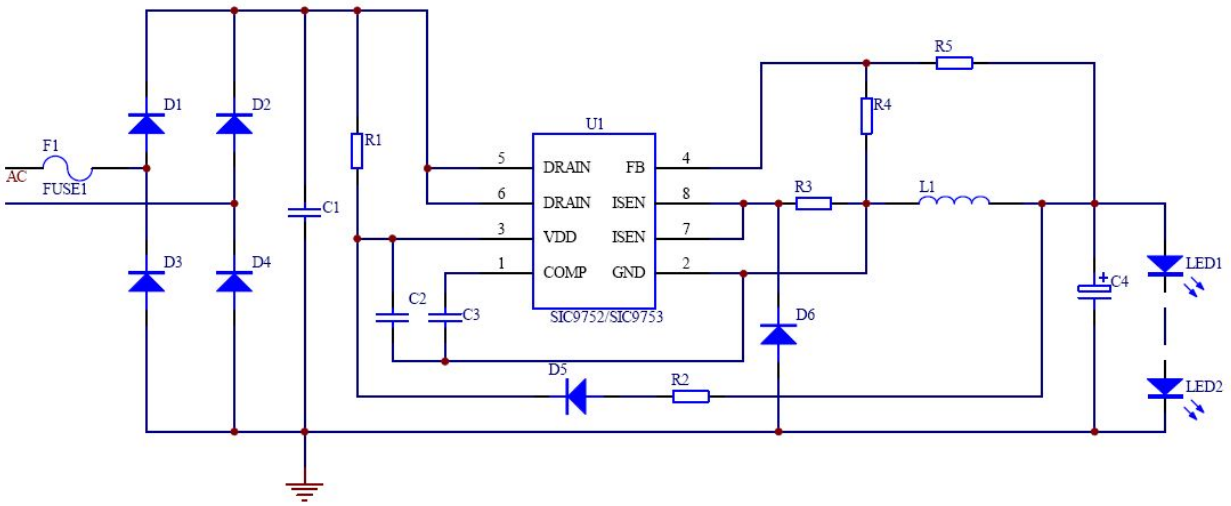
General Description

The SIC9752/SIC9753 are constant current LED regulators with high current accuracy which applies to single stage step-down power factor corrected LED drivers. 600V power MOSFET is integrated, which can significantly simplify the design of LED lighting system.
High accuracy of output current is achieved by sampling the output current directly. Critical conduction mode operation reduces the switching losses and largely increases the efficiency.
The SIC9752/SIC9753 is supplied from the output directly, and auxiliary winding is not needed.The SIC9752/SIC9753 has multi-protection functions which largely enhance the safety and reliability of the system, including V_{DD} over-voltage protection, V_{DD} UVLO, short-circuit protection, LED open protection, cycle-by-cycle current limit and over-temperature protection.
The SIC9752/SIC9753 available in SOP-8 & DIP-7 packages.

Features

·Active PFC for High power factor and low THD
·No auxiliary winding
·600V high voltage MOSFET integrated
·±3% LED output current accuracy
·Excellent line and load regulation
·Critical conduction mode
·System efficiency up to 95%
·Ultra low start up & operating current
·Cycle-by-cycle current limit
·LED short protection
·LED open protection
·Over-temperature protection

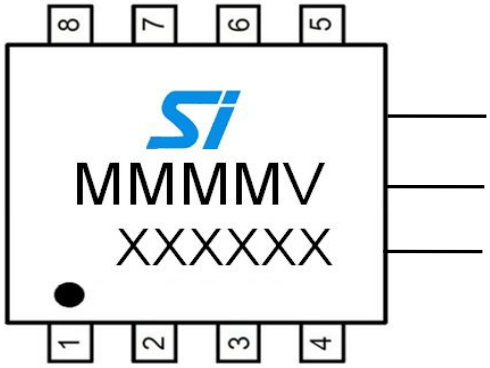
Typical Application



Ordering Information

Part Number	Package	Package Method	Marking
SIC9752（SOP-8）	SOP-8	Tape 3,000pcs/Roll	Si 9752 XXXXXX
SIC9753（SOP-8）	SOP-8	Tape 3,000pcs/Roll	Si 9753 XXXXXX
SIC9753（DIP-7）	DIP-7	Tube 50pcs/Tube	Si SIC9753 XXXXXX

Pin Assignment

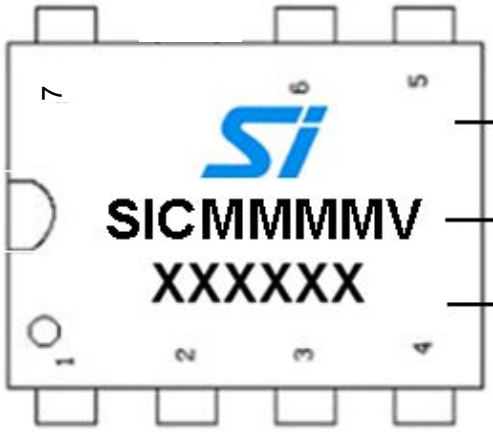


SOP-8 Products

"Si"-Logo of SI Semiconductors

MMMM--Part Number (4 digits)； V： Version(1 digit, optional)

XXXXXX--Date Code (6 digits)



DIP-7 Products

"Si"-Logo of SI Semiconductors

MMMM--Part Number (4 digits)； V： Version(1 digit, optional)

XXXXXX--Date Code (6 digits)

Pin Description

Pin	Pin Name	Description
1	COMP	Compensation Pin for Internal Error Amplifier. Connect a capacitor between the pin and GND to compensate the internal feedback loop.
2	GND	Ground.
3	VDD	Power Supply Pin. This pin supplies current to the internal start-up circuit. This pin must be bypassed with a capacitor nearby.
4	FB	Voltage Loop Feedback Pin. FB is used to detect LED open by sampling the output voltage.
5/6	DRAIN	DRAIN of the MOSFET.
7/8	ISEN	Output Current Sense Pin. The pin is used for output current control.

Recommended Operation Conditions

Products	Symbol	Range	Unit
SIC9752	$I_{LED}1$	<225 @V_{OUT}=80V	mA
	$I_{LED}2$	<330 @V_{OUT}=36V	
SIC9753	$I_{LED}1$	<280 @V_{OUT}=80V	mA
	$I_{LED}2$	<400 @V_{OUT}=36V	

Absolute Maximum Ratings

Parameter	Symbol	Parameter Range	Unit
Voltage On DRAIN Pin	VDRN	-0.3～600	V
Voltage On ISEN Pin	VISEN	-0.3～6	V
Voltage On COMP Pin	Vcomp	-0.3～6	V
Voltage On FB Pin	VFB	-0.3～6	V
Maximum Operation Current	IDDMAX	10	mA
Maximum Power Dissipation (Ta=25°C)	P_{tot}	0.45@ SOP-8	W
		0.90@ DIP-7	
Thermal Resistance Junction-ambient	Rthj-a	145@ SOP-8	℃/W
		80@ DIP-7	
Operating Junction Temperature	TJ	-40～150	℃
Storage Temperature Range	TSTG	-55～150	℃
ESD		2,000	V

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Exposure to Absolute Maximum Rating conditions for extended periods may affect device reliability。

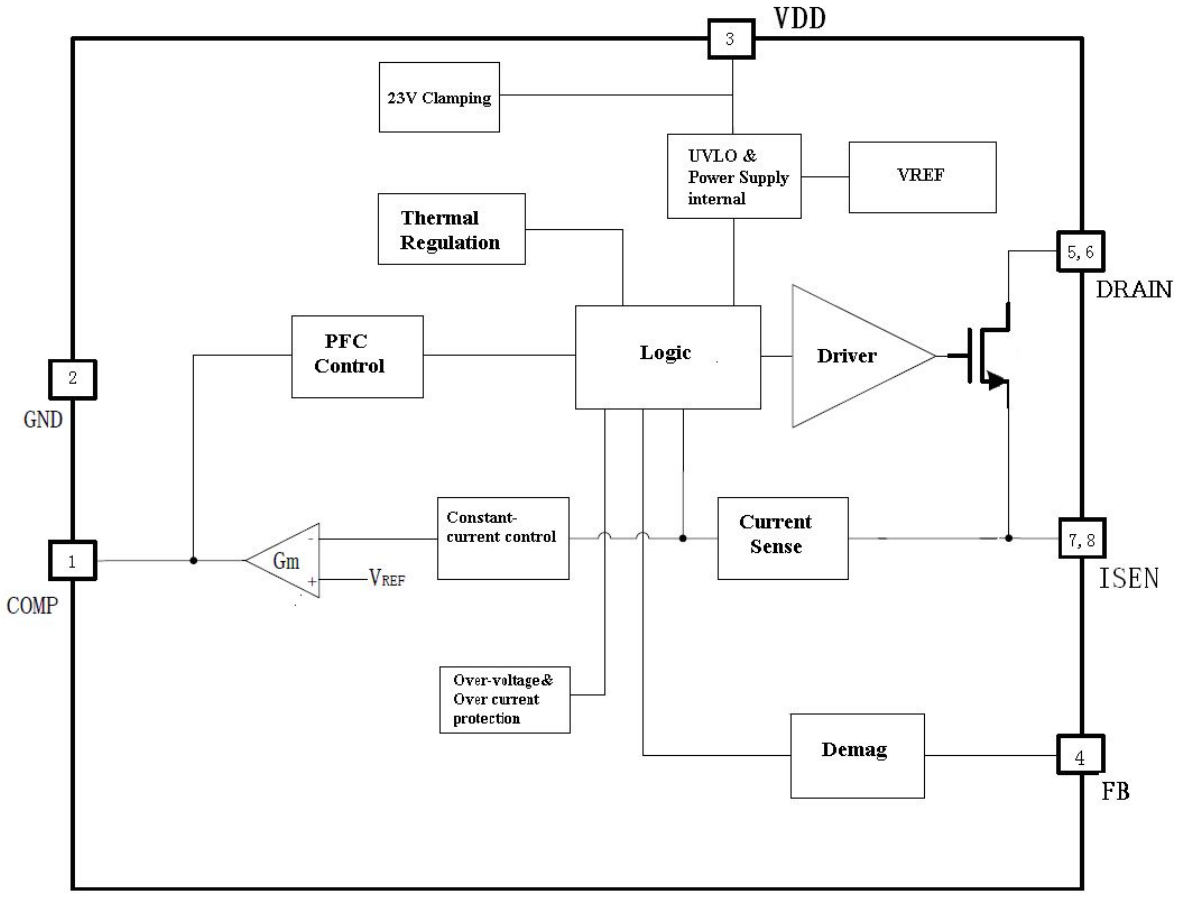
Electronic Characteristics

T_C=25°C,V_{DD} = 20V,unless otherwise specified

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
VDD Turn On Threshold Voltage	V_{DD_ON}	VDD Rising		16.9		V
VDD Turn Off Threshold Voltage	V_{DD_UVLO}	VDD Falling		7.8		V
VDD Start Up Current	I_{ST}	VDD= V_{DD_ON}-1V		33	50	uA
VDD Operating Current	I_{OP}	F =10KHZ		300	500	uA
VDD Clamp Voltage	V_{DD_CLAMP}	1mA		20		V
FB Falling Edge Threshold Voltage	V_{FB_FALL}	FB Falling		0.2		V
FB Hysteresis Voltage	V_{FB_HYS}	FB Rising		0.15		V
FB Over Voltage Protection Threshold	V_{FB_OVP}			1.6		V
Minimum Degaussing time	T_{OFF_MIN}			3		us

Parameter		Symbol	Test Conditions	Min	Typ	Max	Unit
Maximum Degaussing time		T_{OFF_MAX}			100		us
Maximum On time		T_{ON_MAX}			20		us
ISEN Peak Voltage Limitation		V_{ISEN_LMIT}			1		V
Leading Edge Blanking Time for Current Sense		T_{LEB}			350		ns
Switch off Delay Time		T_{DELAY}			200		ns
Internal Reference Voltage		V_{REF}		194	200	206	mV
COMP Low Clamp Voltage		V_{COMP_L0}			1.5		
COMP Linear Operating Voltage Range		V_{COMP}		1.5		3.9	V
COMP High Clamp Voltage		V_{COMP_OVP}			4		V
SIC9752	MOSFET	$R_{DS(ON)}$	V_{GS}=15V/ I_{DS}=0.5A		6.5	7.0	Ω
SIC9753	$R_{DS(ON)}$				3.5	4.0	
Breakdown Voltage		BV_{DSS}	V_{GS} =0/ I_{DS} =250uA	600			V
Drain Leakage Current		I_{DSS}	V_{GS} =0/ V_{DS} =600V			1	uA
Over-temperature Protection		T_{REG}			150		℃

Functional Block Diagram



Applications Information

Functional Description

The SIC9752/SIC9753 is a constant current LED regulator which applies to non-isolation step-down LED system with power factor correction. 600V power MOSFET is integrated, which can significantly simplify the design of LED lighting system. SIC9752/SIC9753 works in the critical conduction mode can achieve excellent line and load regulation, high efficiency and low BOM cost.

Start Up

When system turn on, the capacitor connected to VDD pin is charged up, while the VDD up to threshold voltage, the internal circuits start working. The COMP pin voltage is pulled up to 1.5V quickly, then the system starts switching. The system works at 10kHz frequency at the beginning, the COMP voltage rises up gradually, and the inductor peak current also rises up. The LED current hence achieves a soft start without overshoot. After the output voltage is built up, the VCC power is supplied by the output voltage through a diode to save the consumption of the system.

Constant Current Control

The SIC9752/SIC9753 controls the output current from the information of the current sensing resistor. The output LED mean current can be calculated as:

$$I_{LED} = \frac{V_{ISEN}}{R_{ISEN}}(A)$$

Where

V_{ISEN} –200mV typically;

RI_{SEN} – The sensing resistor connected between ISEN and GND.

Feedback Network

The SIC9752/SIC9753 senses the output current zero crossing information through the feedback network, the FB falling threshold voltage is set to 0.2V with 0.15V hysteresis. The FB pin is also used to detect output OVP, the threshold voltage is 1.6V. The ratio of FB upper resistor to lower resistor can be set as: ：

$$\frac{R_{FBL}}{R_{FBL}+R_{FBH}} = \frac{1.6V}{V_{OVP}}$$

Where,

RFBL: The lower resistor of the feedback network

RFBH: The upper resistor of the feedback network

VOVP: Output over voltage setting point

It is recommended that the FB lower resistor set to 2KΩ-5KΩ.

Loop Compensation

When the output is short circuit or the inductor is saturated, the ISEN peak voltage will be relatively high. When VISEN reaches the internal limitation (1V), the power MOSFET will be turned off instantaneously. This cycle by cycle current limitation can help protecting the power MOSFET, the inductor and the output diode.

LED Over Temperature Protection

When SIC9752/SIC9753's temperature are too high the output current will be decrease. The output power and thermal dissipation are also reduced. The system temperature is regulated and the system reliability is improved. The thermal regulation temperature is set to 150℃ internally.

LED Open Protection

The output voltage can be detected by the FB pin. When the FB voltage is higher than 1.6V, the LED open protection is triggered and the power MOSFET gate driver stops switching. After several seconds, the gate driver starts switching again.

LED short protection

The SIC9752/SIC9753 judges LED short from the FB voltage. During a shorted LED condition, SIC9752/SIC9753 reduces the internal command current to a very low level and slows down the switching frequency to 10 kHz to decrease the output current. Meanwhile, the output voltage is low and the VDD pin cannot be charged up by the output voltage, so the VDD pin voltage will gradually decrease and finally reaches the UVLO threshold. After the system enters into fault condition, the VCC voltage will decrease until it reaches UVLO threshold. Then the system will re-start again. If the fault condition is removed, the system will resume normal operation.

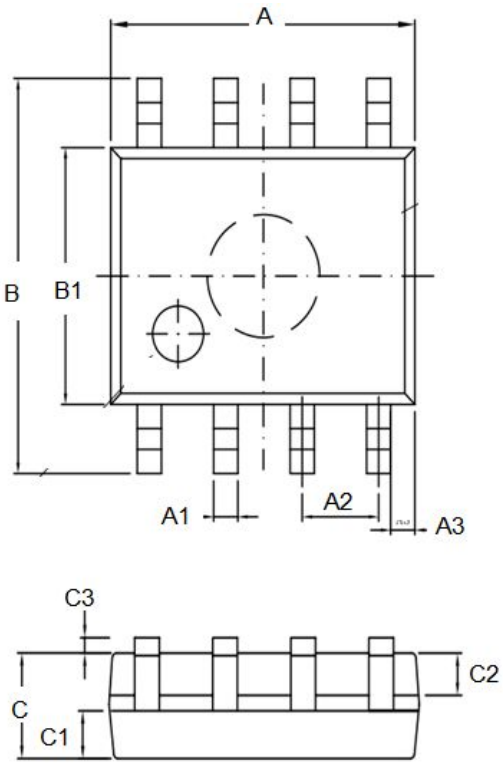
PCB Layout Guidelines:

Bypass Capacitor: The bypass capacitor on VDD pin should be as close as possible to the VDD and GND pins.
Ground Path: The power ground path for current sense resistor should be short and wide, and it should be as close as possible to the IC ground (pin 2) , otherwise the LED output current accuracy maybe affected. The IC signal ground for COMP and FB components should be connected to the IC GND pin with short traces and should be away from the power ground path.
The Area of Power Loop: The area of main current loop should be as small as possible to reduce EMI radiation.
FB Pin: The feedback resistor divider should be as close as possible to the FB pin, and the trace must keeps away from dynamic node of the inductor (DRAIN pin trace), otherwise the FB pin OVP function might have risk to be mis-triggered by the system noise.
DRAIN Pin：To increase the copper area of DRAIN pin for better thermal dissipation. However too large copper area may compromise EMI performance.

SOP8 封装机械尺寸
SOP8 MECHANICAL DATA

单位:毫米/UNIT：mm

符号 SYMBOL	最小值 min	典型值 nom	最大值 max	符号 SYMBOL	最小值 min	典型值 nom	最大值 max
A	4.80		5.00	C	1.30		1.50
A1	0.37		0.47	C1	0.55		0.75
A2		1.27 TYP		C2	0.55		0.65
A3		0.41 TYP		C3	0.05		0.20
B	5.80		6.20	C4	0.19	0.20TYP	0.23
B1	3.80		4.00	D		1.05TYP	
B2		5.0TYP		D1	0.40		0.62



DIP7 封装机械尺寸
DIP7 MECHANICAL DATA

单位:毫米/UNIT：mm

符号 SYMBOL	最小值 min	典型值 nom	最大值 max	符号 SYMBOL	最小值 min	典型值 nom	最大值 max
A	9.00		9.20	C2		0.50TYP	
A1	1.474		1.574	C3	3.20		3.40
A2	0.41		0.51	C4	1.47		1.57
A3	2.44		2.64	D	8.20		8.80
A4		0.51TYP		D1	0.244		0.264
A5		0.99TYP		D2	7.62		7.87
B	6.10		6.30	Θ1		17°TYP4	
C	3.20		3.40	Θ2		10°TYP4	
C1	7.10		7.30	Θ3		8°TYP