

DIO8950

Single Stage Boost & PFC Controller

Without Auxiliary Winding For LED Lighting

Features

- Internal HV JFET
- Without auxiliary winding
- Excellent Line and Load regulation
- Power factor >0.95 @230VAC
- Meet the criterion of IEC61000-3-2
- CCM operation to achieve lower switching losses and high efficiency
- Multiple protection features:
 - ✧ Reliable LED open protection
 - ✧ Reliable freewheeling diode open protection
 - ✧ Reliable thermal compensation
- Package: SOIC-8 package

Descriptions

The DIO8950 is a single stage Boost and PFC controller targeting at LED lighting applications.

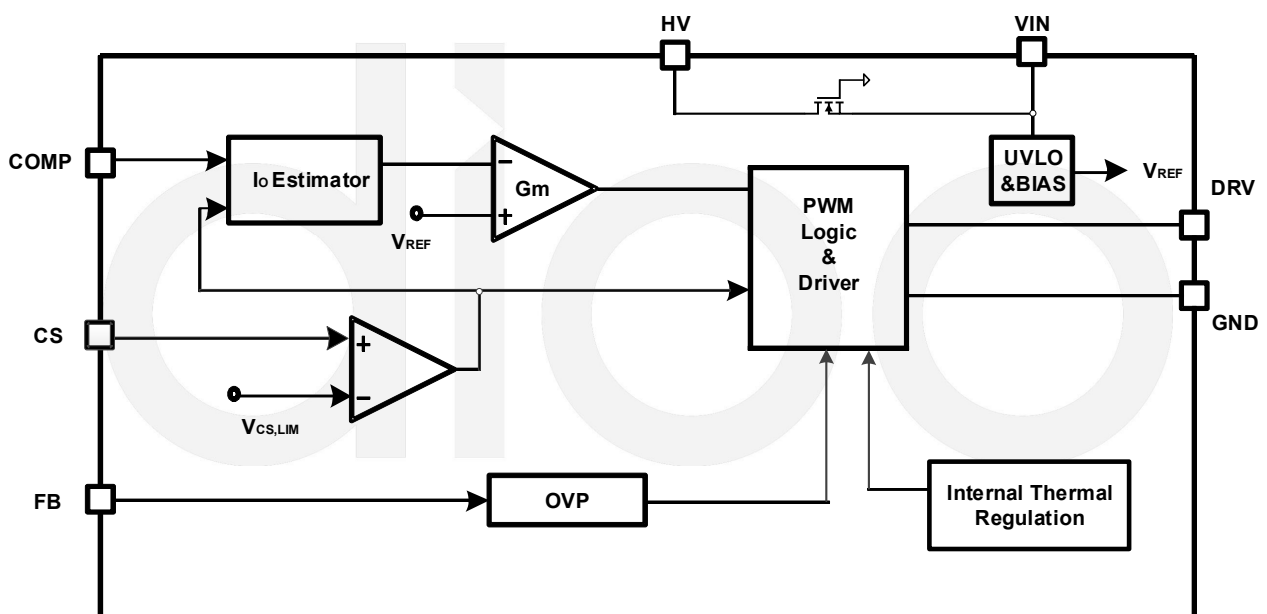
The DIO8950 is single stage Boost controller which integrates HV JFET and without auxiliary winding for low cost, and drives the Boost converter in CCM mode to achieve higher efficiency.

The DIO8950 integrates full protection features, including reliable LED open protection, freewheeling diode open protection, thermal compensation, ect., to ensure the system safe and reliable.

Applications

- T-tube LED Lighting
- Ceiling Lamp

Block Diagram



Ordering Information

Order Part Number	Top Marking		T _A	Package	
DIO8950SO8	DIO8950	Green	-40 to 85°C	SOIC-8	Tape & Reel, 2500

Pin Assignments

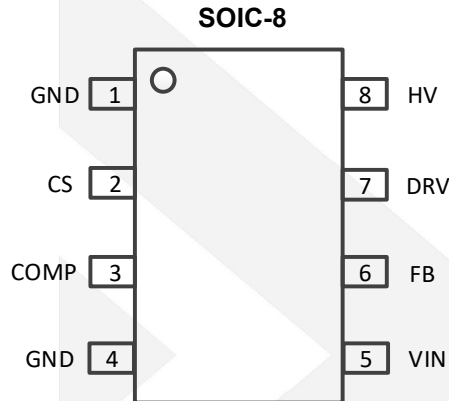


Figure 1 Pin Assignment (Top View)

Pin Definitions

Pin Name	Description
GND	Ground pin.
CS	Current sense pin. Connect the sense resistor across the LEDN and the GND pin.
COMP	Loop compensation pin. Compensation for internal error amplifier. Connect a capacitor between the pin and GND to compensate the internal feedback loop.
HV	Power supply pin. This pin supplies current to the internal circuit and must be locally bypassed with a capacitor.
FB	Output Voltage feedback pin. FB is used to detect LED open or output over voltage.
DRV	Gate driver pin. Connect this pin to the gate of primary MOSFET.
HV	HV JFET pin.

Absolute Maximum Ratings

Stresses beyond those listed under “Absolute Maximum Rating” may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other condition 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.

Parameter		Rating	Unit
HV Voltage		700	V
VIN Voltage		30	V
DRV Voltage		20	V
CS, COMP,FB		-0.3 to 5	V
Thermal Performance	Θ_{JA}	100	°C/W
	Θ_{JC}	50	
Junction Temperature		150	°C
Lead Temperature		260	°C
Storage Temperature		-65 to 150	°C

Recommend Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended Operating conditions are specified to ensure optimal performance to the datasheet specifications. DIOO does not Recommend exceeding them or designing to Absolute Maximum Ratings.

Parameter	Rating	Unit
HV Voltage	30 to 600	V
VIN Voltage	10 to 13.6	°C
Operating Junction Temperature (T _J)	-40 to 125	°C

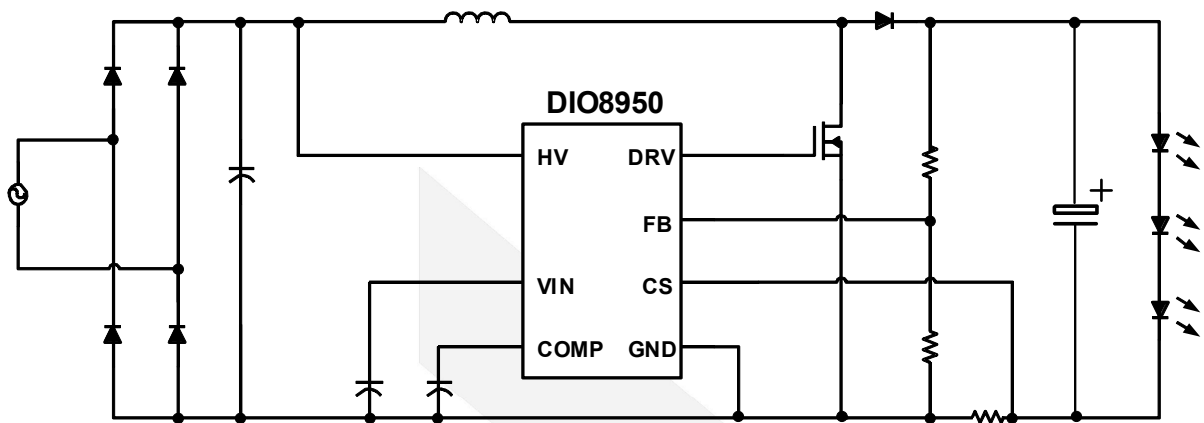
Electrical Characteristics

HV = 20V, T_A = 25°C, unless otherwise specified.

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
VIN Section						
V _{VIN,ON}	VIN turn-on threshold		12.8	13.8	14.8	V
V _{VIN,OFF}	VIN turn-off threshold		8	8.8	9.6	V
V _{VIN,OVP}	VIN OVP voltage		16.4	18.2	20	V
I _Q	Quiescent Current	VIN=6V		130	150	μA
I _{VIN}	Operation current	VIN=15.5V,FB=2V		350	400	μA
I _{VIN,OVP}	Shunt current in OVP mode	VIN= V _{VIN,OVP} -0.5V	3	5	8	mA
Error Amplifier Section						
V _{REF}	Internal Reference Voltage		146	153	160	mV
Current Regulation Section						
T _{ON,MAX}	Max on time			35		μs
I _{COMP}	COMP Pull Up Current	1.2V<COMP<2.4V, CS=0V	6	7	8	μA
f _{MAX}	Maximum switching frequency	COMP<1.2V		130		kHz
V _{CS_LIMIT}	CS Maximum Voltage		3.6	3.8	4	V
FB Section						
V _{FB,H}	FB High Voltage Threshold		1.5	1.6	1.7	V
V _{FB,L}	FB Low Voltage Threshold		255	300	345	mV
T _{LEB}	OVP Blanking Time			1		μs
Gate Driver						
T _{RISING}	Rising time from 10% to 90%	C _{LOAD} =1nF		100		ns
T _{FALLING}	Falling time from 90% to 10%	C _{LOAD} =1nF		50		ns
Thermal Section						
T _{COMP}	Thermal compensation Threshold			145		°C

Specifications subject to change without notice.

Typical Application



Functional Description

The DIO8950 is a single stage Boost and PFC controller targeting at LED lighting applications. The DIO8950 integrates HV JFET and without auxiliary winding for low cost, and drives the Boost converter in CCM mode to achieve higher efficiency.

Start up

After AC or DC supply is powered on, the capacitor C_{VIN} across VIN and GND pin is charged up by BUS voltage through a HV JFET. Once V_{VIN} rises up to $V_{VIN,ON}$, the internal blocks start to work and PWM output is enabled. An internal clamp is attached to the VIN pin to prevent VIN from being too high. Once VIN exceeds $V_{VIN,OVP}$, system shut down and VIN is charged to $V_{VIN,ON}$ again after it's pulled down to $V_{VIN,OFF}$. After 7 times, then system restarts.

Shut down

After AC supply or DC BUS is powered off, the energy stored in the BUS capacitor will be discharged. When the BUS can't supply enough energy to VIN pin, V_{VIN} will drop down. Once V_{VIN} is below $V_{VIN,OFF}$, the IC will stop working and V_{COMP} will be discharged to zero.

Loop Compensation

An error amplifier is applied to the output current feedback loop with a capacitor connected to the COMP pin. For offline applications, the crossover frequency should be set much less than the line frequency. A capacitor of $1\mu F$ connected to COMP pin is recommended to ensure the excellent PFC performance.

Constant Current Control

The DIO8950 controls the output current from the information of the current sensing resistor voltage. The output LED mean current can be calculated as:

$$I_{LED} = V_{REF} / R_S$$

Where

V_{REF} —The internal reference voltage;

R_S —The sensing resistor connected between CS and GND.

Critical Conduction Mode Operation

DIO8950 works in the Critical conduction mode. When the power MOSFET is turned on, the inductor current begins to increase from zero. When the power MOSFET is turned off, the inductor current begins to decrease. The power MOSFET turns on again when the inductor current is zero.

Thermal compensation Regulation

As the driver temperature is higher than the threshold temperature, it reduces the output current and then a balance is achieved between output power and temperature, thereby improve system reliability.

LED Open Protection

The output voltage can be detected by the FB pin. When the FB voltage is higher than $V_{FB,H}$, the power MOSFET shutdown, and the HV power source is disconnected until VIN decreases to $V_{VIN,OFF}$. When VIN is charged to $V_{VIN,ON}$ for 7 times, system restarts.

PCB Design

1. The VIN pin must be locally bypassed with a capacitor.
2. Make the area of the power loop as small as possible in order to reduce the EMI radiation.
3. The chip should be far away from the heating element, such as inductor and the freewheel diode.



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