Non-isolated Buck Type LED Driver

Description

D8075B is a high-precision buck type LED constant current IC, with the active power factor correction, which can be applied to 85Vac-265Vac universal input voltage non-isolated bulk type LED constant current power. D8075B integrate active power factor correct circuit, can achieve very high power factor and very low total harmonic distortion. Due to it operates in critical continuous mode of inductor current, the MOSFET is at zero current turn on station, the switch loss reduce, while the utilization rate of inductance is also higher.

D8075B use the patent of GND floating frame, and it's sampling for inductor current in full cycle, to achieve high precision output constant current control, and excellent line voltage regulation and load regulation.

D8075B integrated multiple protection function to strengthen system reliability, including LED open circuit protection, LED short circuit protection, chip supply power under voltage protection, current sampling resistor open circuit protection and cycle by cycle current limited, and so on. All the protection station is with automatic reboot function. And, D8075B is with over heat regulation function, to reduce the output current when the driver power is too hot, to improve the reliability of the system.

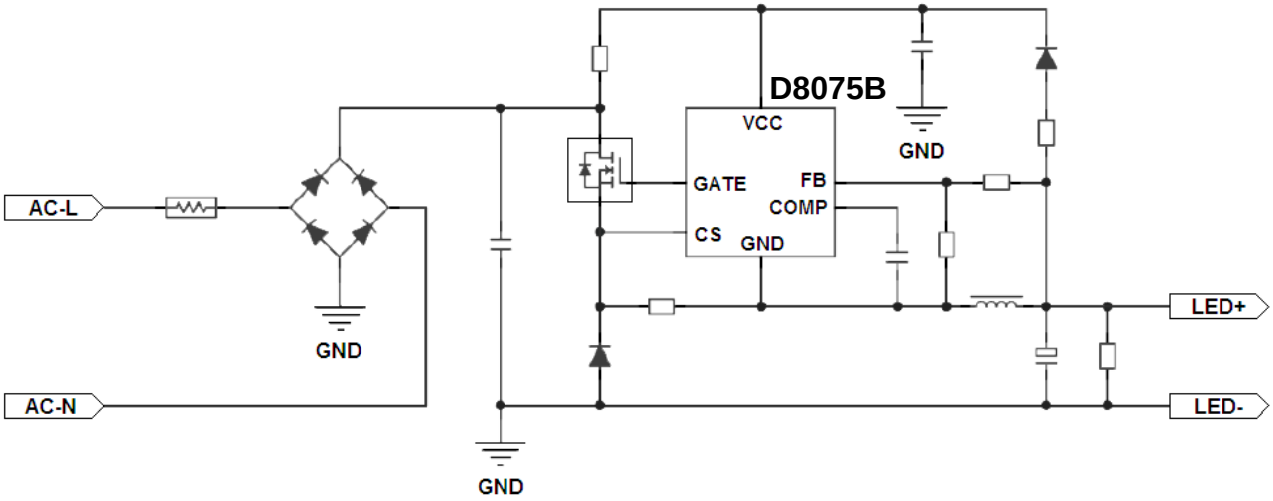
Feature

- Active power factor correct, high PF, low THD
- System efficiency of up to 95%
- ±3% LED output current precision
- Excellent line voltage regulation rate and loading regulation rate
- Critical continuous mode of inductor current
- Ultra low (33uA) start-up current
- Ultra low (300uA) operating current
- LED open circuit / short circuit protection
- Open circuit protection for current sampling resistor
- Cycle by cycle current limiting
- Chip supply under voltage protection
- Automatic reboot function
- Overheat regulation function
- Available in SOT23-6 package

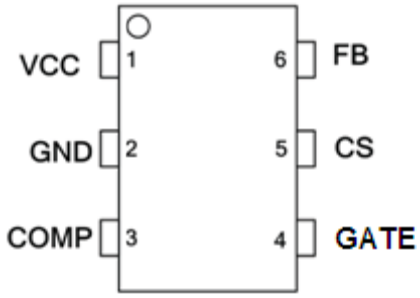
Application

- GU10/E27 LED bulb lamp, spot light
- LED PAR30, PAR38 lamp
- LED tube light
- Other LED lighting

Typical Application



PIN Configuration



Pin Definition

Pin No.	Name	Description
1	V_{CC}	Power supply.
2	GND	Ground of chip signal and chip power.
3	COMP	Loop compensation point.
4	GATE	External MOSFEF GATE drive.
5	CS	Current Sense Pin. Connect sampling resistor to
6	FB	Feedback signal for sampling Pin.

Absolute Maximum Ratings(Note1)

Symbol	Parameter	Range	Units
I_{CC_MAX}	Vcc pin maximum clamp current	10	mA
COMP	Compensation pin of loop circuit	-0.3~6	V
FB	Feedback pin of auxiliary winding	-0.3~6	V
CS	Current sense pin	-0.3~6	V
GATE	External MOSFET Gate driver pin voltage	-0.3~22	V
P_{DMAX}	Maximum power dissipation (Note2)	0.3	W
R_{JA}	Thermal resistance of PN junction to ambient	240	℃/W
T_J	Operating junction temperature	-40 to +150	℃
T_{STG}	Storage temperature range	-55 to +150	℃
ESD	Electrostatic discharge (Note3)	2	KV

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. The electrical characteristics table defines the operation range of the device, the “electrical characteristics” is assured on DC and AC voltage by test program. For the parameters without minimum and maximum value in the EC table, the typical value defines the operation range, the accuracy is not guaranteed by spec.

Note 2: The maximum power dissipation decrease if temperature rise, it is decided by T_{JMAX}, R_{JA}, and environment temperature T_A. The maximum power dissipation is the lower one between $P_{DMAX} = (T_{JMAX} - T_A)/ R_{JA}$ and the number listed in the minimum table.

Note 3: Human Body mode, 100pF capacitor discharge on 1.5KΩ resistor.

Recommended operating conditions

Symbol	Parameter	Range	Unit
V_{CC}	Chip power supply voltage	8.5 ~ 20	V

Electrical Characteristics (Note 4, 5) （Unless otherwise specified, V_{CC} =17V, T_A =25 ℃）

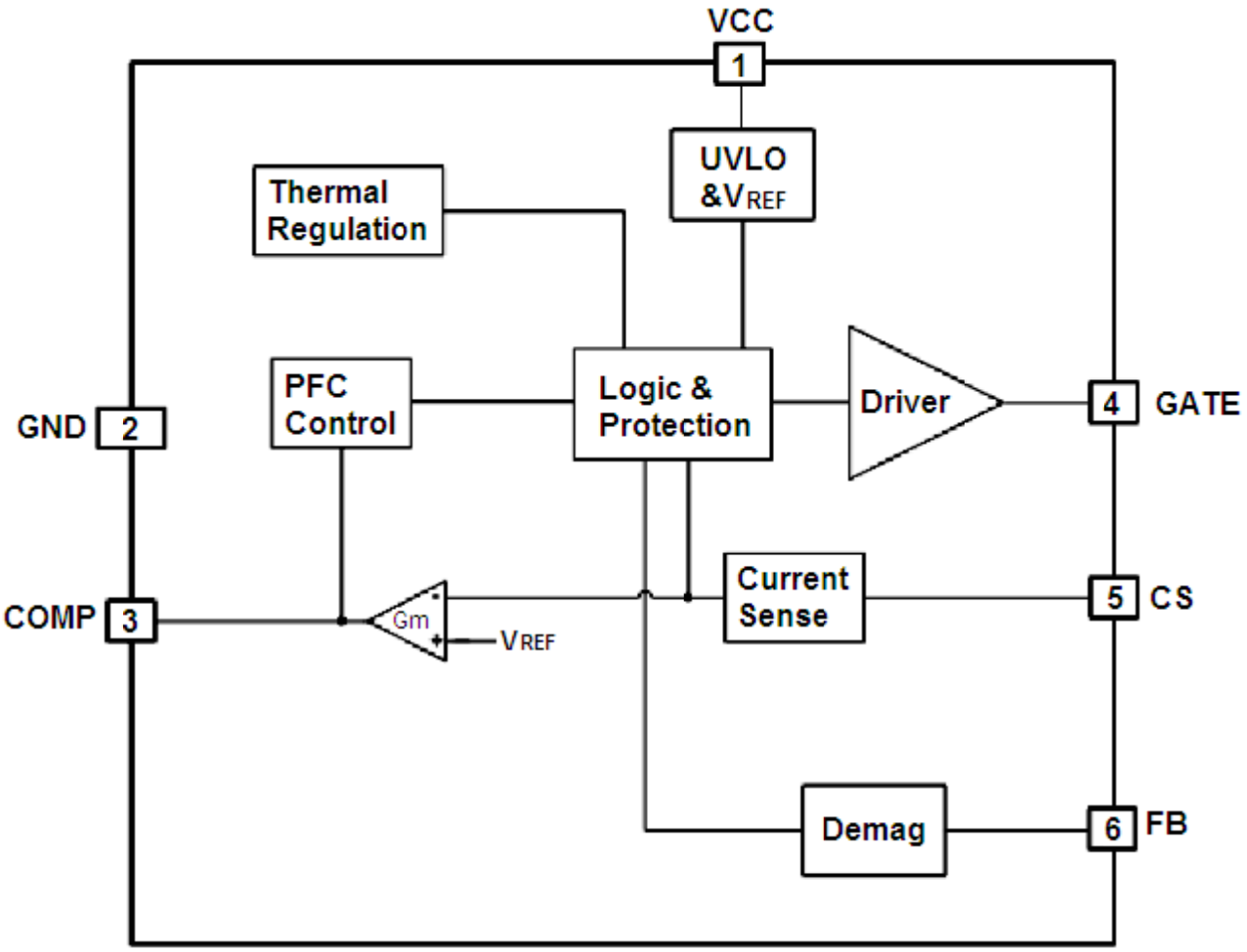
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Supply Voltage Section						
V_{CC-ON}	V_{CC} startup voltage	V_{CC} rise		17		V
$V_{CC-UVLO}$	V_{CC} under voltage protection threshold	V_{CC} drop		7.8		V
$V_{CC-CLAMP}$	V_{CC} Clamp voltage			20		V
$I_{CC-UVLO}$	V_{CC} turn-off current	Vcc rise, V_{CC} =V_{CC_ON} – 1V		33	50	uA
I_{CC}	V_{CC} operating current	F =10KHz Load=100pF		300	500	uA
Feedback Section						
V_{FB_FALL}	FB falling threshold voltage	FB drop		0.2		V
V_{FB_HYS}	FB hysteresis voltage	FB rise		0.15		V
V_{FB_OVP}	FB over voltage protection threshold			1.6		V
T_{ON_MAX}	Maximum turn on time			20		uS
T_{OFF_MIN}	Minimum turn off time			3		uS
T_{OFF_MAX}	Maximum turn off time			100		uS
Current Sense						
V_{CS_LMIT}	CS peak voltage limit			1.5		V
T_{LEB}	Current sampling leading edge blanking time			350		nS
T_{DELAY}	Chip turn off delay			200		nS
Loop circuit compensation Section						
V_{REF}	Internal reference voltage		0.194	0.200	0.206	V
V_{COMP_LO}	Lower voltage of clamp			1.5		V
V_{COMP}	Linear operate range of COMP		1.5		3.9	V
V_{COMP_HI}	Higher voltage of clamp			4.0		V
Driver Section						

I_{SOURCE_MAX}	Maximum drive pull-up Current			200		mA
I_{SINK_MAX}	Maximum drive pull-down Current			500		mA
Thermal Regulation Section						
T_{REG}	Overheating temperature regulation			150		℃

Note 4: The typical parameters values is tested under typical parameters, in 25 ℃.

Note 5: Specifications, the maximum / minimum specification range ensure by testing, typical value ensure by design, test and statistical analysis.

Internal structure diagram



Application information

D8075B is an active power factor correction LED constant current control chip, suitable for non-isolated buck circuit, the system operates in the inductor current critical continuous mode, the chip can achieve high power factor and low total harmonic distortion, and high efficiency.

Start-up

In power system, the bus voltage through the startup resistor to charge the capacitor at the V_{CC} pin, when the voltage rises to start threshold voltage, the chip operate to start internal control circuit, COMP voltage is quickly pulled up to 1.5V. Then D8075B started the pulse signal output voltage, system begin to operate at 10KHZ switch frequency, COMP began to rise from the 1.5V, the inductor peak current increased following it, so as to realize the soft start-up of LED current output, prevents the output current overshoot effectively. When the output voltage is established, the V_{CC} voltage is supplied by the output voltage through a diode, thereby reducing the power consumption of the system.

Constant current control, output current settings

D8075B adopts GND floating frame, the inductor current is sampling in complete period, operating in the inductor current critical continuous mode, can achieve high precision output constant current control.

Calculation method of LED output current:

$$I_{OUT} \approx \frac{V_{REF}}{R_{CS}}$$

V_{REF} is the internal reference voltage

R_{CS} is a current sampling resistor value

Feedback Network

D8075B detects the output current zero state through the FB, FB the threshold voltage is set at 0.2V, and the hysteresis voltage is 0.15V, the FB pin can also be used to detect output over voltage protection (OVP), the threshold is 1.6V.

FB proportional of upper and lower divider resistance can be set:

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

R_{FBL} is the feedback lower divider resistance

R_{FBH} is the feedback upper divider resistance

V_{OVP} is the set point of protection of output voltage over voltage

Recommended V_{OVP} be set about 30% higher than maximum loading voltage. Recommended FB lower divider resistor is in about 2KΩ-5KΩ, connect an about 100pF capacitor in parallel, to prevent to wrong trigger OVP by the switch noise.

Overheat regulation

D8075B has the function of overheat regulation, the output current is gradually reduced when the driving power is over heat, to control the output power and temperature rising, to keep the power temperature being at the setting value, so as to improve the system reliability. Chip internal setting temperature at 150℃.

Protection function

D8075B built-in multiple protection functions, to ensure the reliability of the system.

When LED is open circuit, the output voltage rise gradually, the FB pin can detect output voltage when power MOSFET is shut off. When the FB is higher than threshold value, will trigger the logic protection and stop switch function.

When the LED short circuit, the system operates at 10KHZ frequency, due to the output voltage is very low, it cannot supply power to V_{CC} through the diode, so the V_{CC} voltage gradually decreased until under voltage protection threshold.

The system enters the protection state, V_{CC} voltage begins to drop, when V_{CC} reached the under voltage protection threshold, the system will reboot. At the same time, system state detection continuously, if trouble shooting, the system will restart to operate normally.

When the output short circuit or transformer saturation, CS peak voltage will be higher. When the CS voltage rises to internal limit value (1.5V), the switch cycle will stop. The cycle by cycle current limiting function can protect the power MOSFET, power inductor and an output fly-wheeling diode.

PCB Design

In the design of D8075B PCB, need to follow the guidelines:

Bypass capacitor

Bypass capacitor V_{CC} need to close to the chip V_{CC} and GND pins.

GND wire

The GND of power wire of current sampling resistor should be as thick as possible, and

be close to the chip GND wire (Pin2), in order to ensure the precision of the current sampling, or may affect the output current regulation rate. In addition, signal GND requires a separate connection to the chip to GND pin.

The power loop area

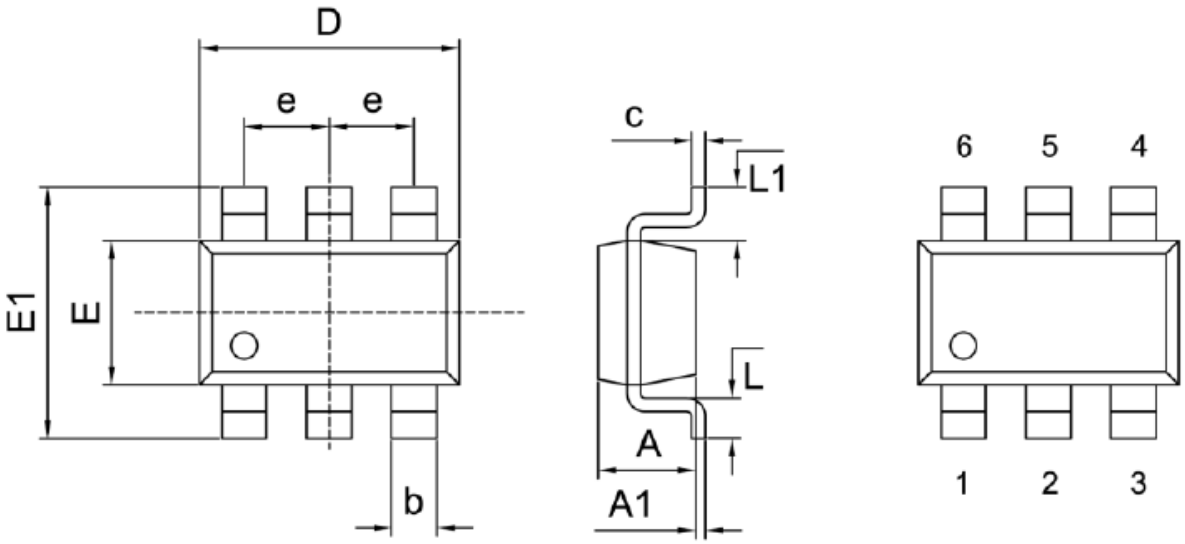
To reduce the large current loop area, such as power inductor, power MOSFET, the bus wire of capacitor loop area, and power inductor, fly-wheel diode, output capacitor loop area, in order to reduce the EMI radiation.

FB pin

Divider resistor connected to FB must be close to the FB pin, and the junction to be away from the transformer moving point, otherwise the system noise prone to false triggering FB OVP protection function.

Package Dimensions

SOT23-6



Symbol	Millimeters		Inches		Symbol	Millimeters		Inches	
	Min	Max	Min	Max		Min	Max	Min	Max
A	0.90	1.30	0.035	0.051	E	1.50	1.75	0.059	0.067
A1	0.00	0.15	0.000	0.006	E1	2.60	3.00	0.102	0.118
b	0.35	0.50	0.013	0.020	e	0.95 TYP		0.037 TYP	
c	0.08	0.20	0.003	0.008	L	0.35	0.60	0.013	0.024
D	2.80	3.20	0.110	0.126	L1	0.60 REF		0.024 REF	

日期 Date	版本 Version	说明 Description	排版 Typesetting	工程师 Engineer	状态 Status
2015-2-6	A0-J	/	Jasper	/	Cancel
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