



Description

D8044A is a high-precision primary side feedback LED constant current control IC. Built-in power switch which withstand voltage is more than 650V, suitable for fly back isolation LED constant current which the power of high precision constant current is less than 18W.

D8044A use primary feedback mode, without secondary feedback circuit and compensate circuit, internal integrated high withstand voltage power tube, be conducive to the external components of the system, and greatly reduce the system cost and volume.

D8044A built-in line voltage compensation with high precision current sampling, without increasing the current compensation circuit can meet the current accuracy of full input voltage range ($\pm 3\%$). The IC can easily meet the demand of EPA2.0 energy efficiency with very low start-up current.

The D8044A also integrates several protection features for increasing the stability of system: under voltage lockout LEB, LED open circuit protection, over current protection, loop open-circuit protection, LED short circuit protection. Adopt DIP-8 package. Economize the system volume, very suitable for the high volume and cost requirement of bulb lighting.

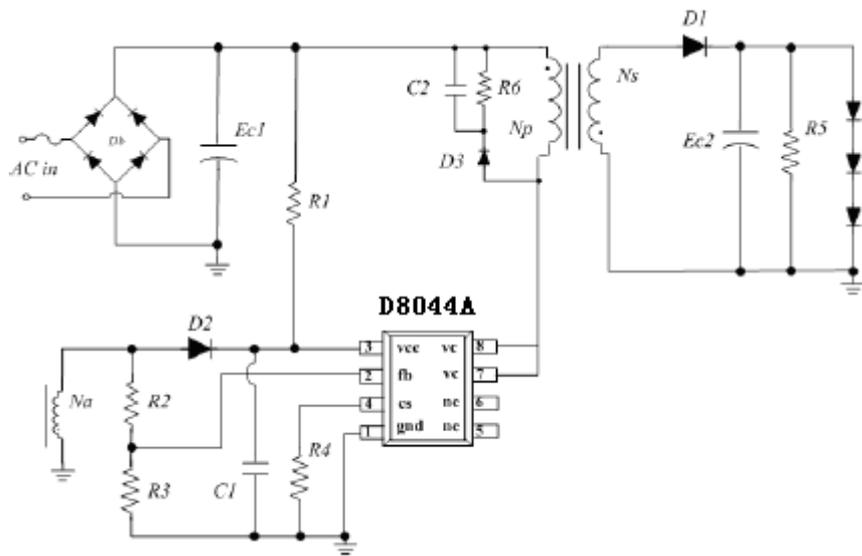
Feature

- Primary feedback constant current control, without opt coupler and 431 components
- Internal integrated 650V high withstand voltage MOS power tube
- $\pm 3\%$ constant current precision, single chip $\pm 1\%$ precision
- Very low start-up current (15uA)
- Built-in soft start-up
- Built-in line voltage compensation, wide input voltage
- Built-in cycle-by-cycle current limit and LEB
- LED open/short circuit protection
- LED over voltage protection
- FB feedback loop circuit
- Without any loop circuit compensation

Application

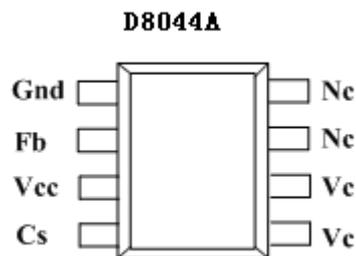
- LED bulb light, down light, PAR light
- The other LED light

Typical Application



Picture 1 D8044A Application diagram

Pin Package



Picture 2 Pin figure

Pin Description

Pin No.	Pin Name	Description
1	G _{ND}	The ground of Signal and power
2	F _B	The feedback feet of output voltage
3	V _{CC}	The IC power port
4	C _S	Primary current detection feet
5, 6	V _C	The high voltage input of internal power
7, 8	N _C	No connect



Order Information

Module	Print	Package type
D8044A	D8044A	Tube 50pcs/Tube

Application Limiting Parameter (Note1)

Parameter	Range
VCC – GND	-0.3V ~ 30V
FB - GND	-0.3V ~ 9V
V _C - GND	0.3V ~ 650V
CS - GND	0.3V ~ 9V
Operating temperature range	-40°C to +125°C
Junction temperature range	-40°C to +150°C
Storage temperature range	-60°C to +150°C
Electronic protect human mode	2000V (Note2)
Electronic protect machine mode	500V

Note1: The maximum limit value is beyond the scope of the application, will be most likely to cause permanent damage to the chip. The above application limit value expressed stress value chip can withstand, but it is not recommended to chip working in this limit conditions or beyond the "recommended operating conditions". Chips working at maximum rated condition a long time, it will affect the reliability of chip.

Note2: Human mode, 00PF capacitor discharge through the 15K ohm resistance.

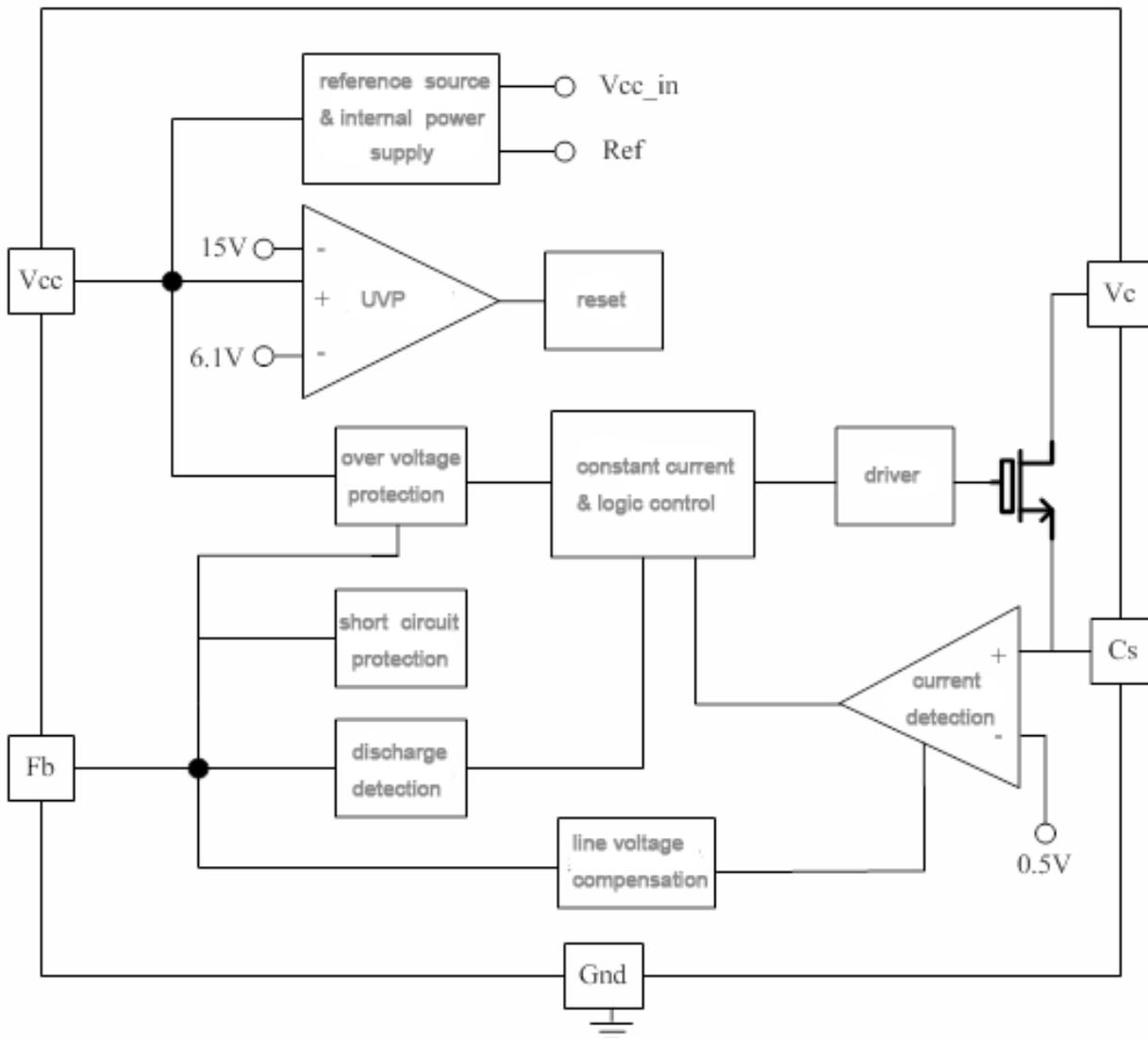
Electrical Characteristics

(VCC=12V, Ta=25°C, unless the other notes)



Description	Symbol	Min	Typ	Max	Unit
FB pin					
FB over voltage protect voltage	FB_ovp	3	3.15	3.3	V
Maximum output current	IFB_max		5		mA
minimum output current	IFB_min		25		uA
CS pin					
over current limit voltage	V _{cs}	0.465	0.470	0.475	V
Leading edge blanking time	LEB		570		nS
VCC pin					
start-up current	I _{start}		15	35	uA
VCC start-up voltage	V _{cc(on)}	14	15	16	V
VCC turn-off voltage	V _{cc(off)}	5.5	6.1	6.6	V
VCC static operating current	I _{ccq}		0.45		mA
VCC over voltage protect voltage	V _{cc(ovp)}	22	24.5	26.5	V
VCC recommended operating range	V _{cc_op}	6.8		21	V
Power tube					
On-resistance	R _{ds_on}			6	Ohm
breakdown voltage	BV _{d_SS}	650			V

Functional Block Diagram



Picture 3 D8044A internal Structure Diagram

D8044A is a constant current switch chip, is dedicated to LED lighting, use primary feedback topology structure controller, can achieve higher precision constant current without opt coupler and 431. Built-in line voltage compensation, lower system cost, only need little periphery component can achieve excellent constant current index. Built-in high withstand voltage power tube, to reduce the system cost, suitable for less than 18W LED light.

1. Start-up circuit

When start the system, as the picture 4, the input voltage V_{cap} to charge $C1$ through the start-up resistance $R1$. When the capacitor voltage V_{CC} achieve to startup voltage V_{cc} (on), the internal control circuit of chip begin to work. V_{CC} is supplied by the auxiliary winding after system start-up.



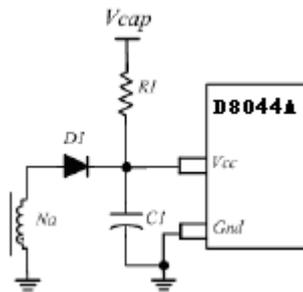
The delay time of power start-up(T_{sd}):

$$T_{sd} = R1 \times C1 \times \ln(1 - V_{CC(on)} / (V_{cap} - I_{start} \times R1))$$

$V_{CC(on)}$ is starting voltage

I_{start} is starting current

V_{cap} is commutating voltage of AC

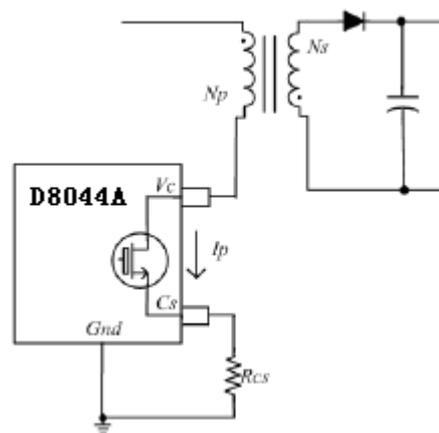


Picture 4 start-up diagram

Because the starting- current is very small (less than 30uA), the start-up resistance $R1$ can be made large. Calculate with $R1$ values is 1 M, V_{CC} capacitor $C1$ value is 4.7uF; it can start within 1 seconds in AC 90V input.

2. Constant current set

The chip adopts the cycle detection the peak current of inductance; Cs is connected to the input point of peak current comparator, compared to internal reference voltage, so as to control the power switch.



Picture 5 Constant current set-up diagram

Primary current is: $I_p = V_{cs} / R_{cs}$

LED output current is: $I_{OUT} = 1/4 \times I_p \times N_{ps}$

V_{cs} is the internal current chip comparison threshold value



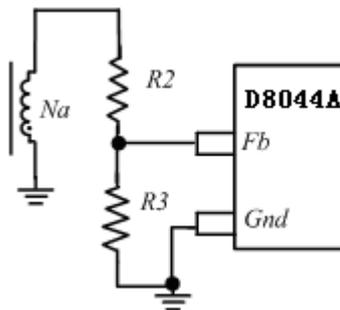
R_{cs} is current sense resistance value

NPS is the turn's ratio of primary and secondary winding

The output current can be set according to the current sampling resistor. And have nothing with the inductance.

3. Output over voltage protection and open circuit protection

As the picture 6, the chip regular work, through the auxiliary winding R1 and divided voltage resistance R3 feedback the output voltage to FB pin, the chip make a stable current output through adjust the turn-off time, if the output voltage is over voltage, the input voltage of FB reach 3.15V and keep enough time, is regarded as the circuit output over voltage, the chip will close the out pin until the next boot.



Picture 6 feedback circuit diagram

If the feedback circuit of R2 short circuit, the FB voltage quickly rushed up to output overvoltage condition, chips continue to restart, has been working in hiccup mode, R3 open circuit as the same as it; if the R2 open circuit (or auxiliary winding open circuit or short circuit) or R3 short circuit, FB voltage is 0, then the chip will close the OUT pin after start work in a period until the next boot.

4. Feedback

As shown in the diagram, chip through the auxiliary winding, resistance R2 and R3 feedback the output current state to the FB, FB detection current threshold voltage is 0.1V. LED protection voltage can be calculated according to the picture 6.

5. Chip Driver

D80213 uses a characteristic multistage driving circuit, ensure the switch power is not too large, and not influence the system EMI, The chip can drive power transistor which more cost-effective than other, also drive power MOS tube, satisfy the requirements which require higher efficiency or greater power system.

6. Working frequency

System operating in current and inductance critical conduction mode, without any loop compensation, the max duty cycle is 42%. Design the center working frequency of system is about 45Khz. suggested that the maximum operating frequency for 80Khz, the



minimum frequency for 20Khz. Calculation formulas of frequency as bellow:

$$\text{Freq} = N_p^2 * V_{\text{OUT}}/8 * N_s^2 * L_p * I_{\text{OUT}}$$

L_p is the peak current of inductance

N_p , N_s is the turns ratio of the primary and secondary winding

7. D8044A Design Tactic

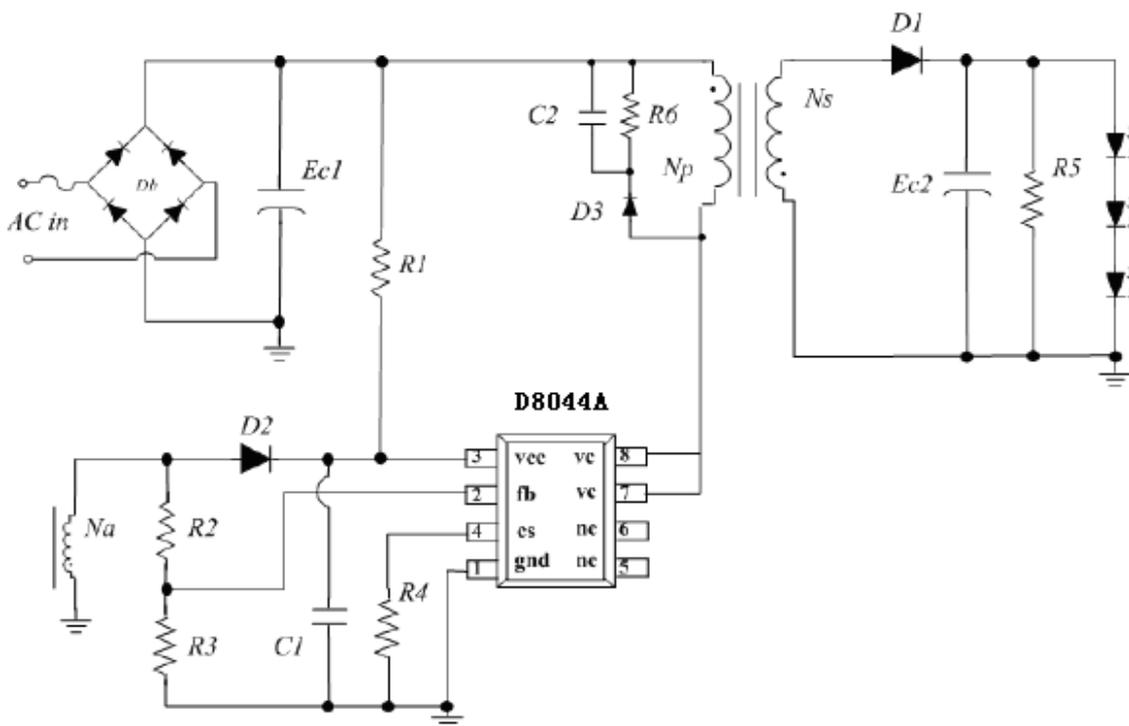
When design the PCB board, please take care as bellow:

VCC bypass capacitors should be as close to the chip VCC and GND pins.

Reduce power loop area, such as the transformer primary, power tube and the loop area between feedback resistances can effectively reduce the EMI radiation.

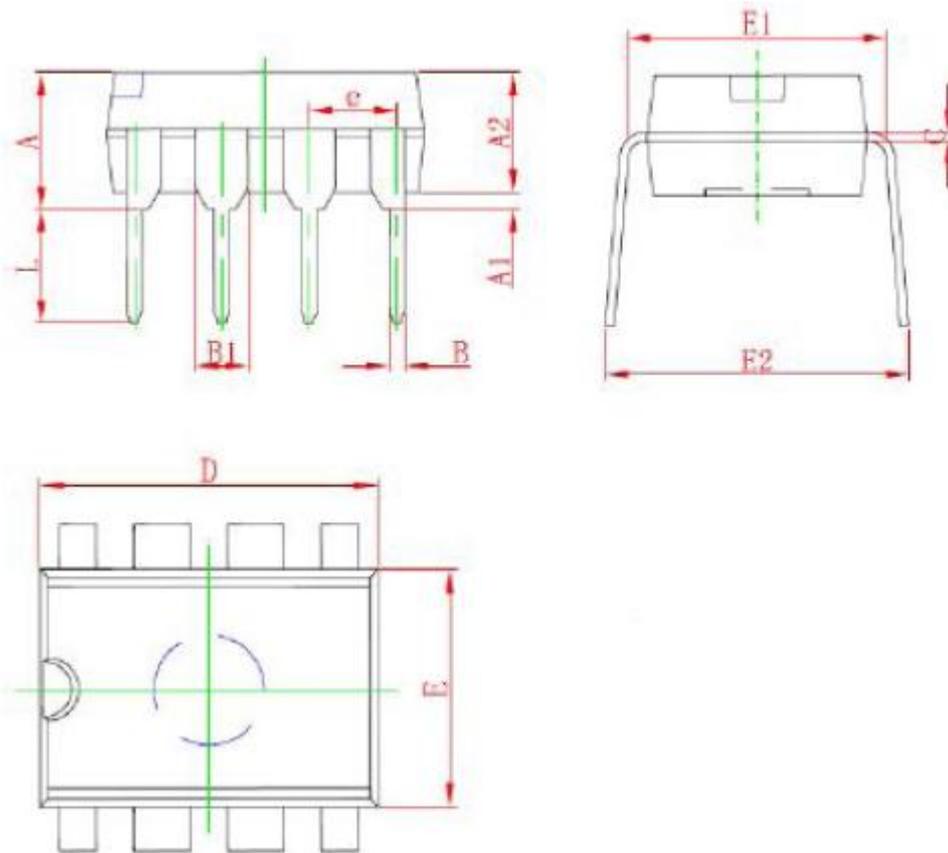
The ground of CS sampling resistance as close as possible to GND can effectively reduce the coupling noise, improve sampling accuracy.

Typical application solution



Picture 7 -18W Application diagram

Dip-8 Package Description



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	3.710	4.310	0.146	0.170
A1	0.510		0.020	
A2	3.200	3.600	0.126	0.142
B	0.380	0.570	0.015	0.022
B1	1.524 (BSC)		0.060 (BSC)	
C	0.204	0.360	0.008	0.014
D	9.000	9.400	0.354	0.370
E	6.200	6.600	0.244	0.260
E1	7.320	7.920	0.288	0.312
e	2.540 (BSC)		0.100 (BSC)	
L	3.000	3.600	0.118	0.142
E2	8.400	9.000	0.331	0.354