



Description

D8043A is a high-precision primary side feedback LED constant current control IC. Built-in power switch which withstand voltage is more than 700V, suitable for fly back isolation LED constant current which the power of high precision constant current is less than 5W.

D8043A 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.

D8043A 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 D8043A 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 and spot light.

Feature

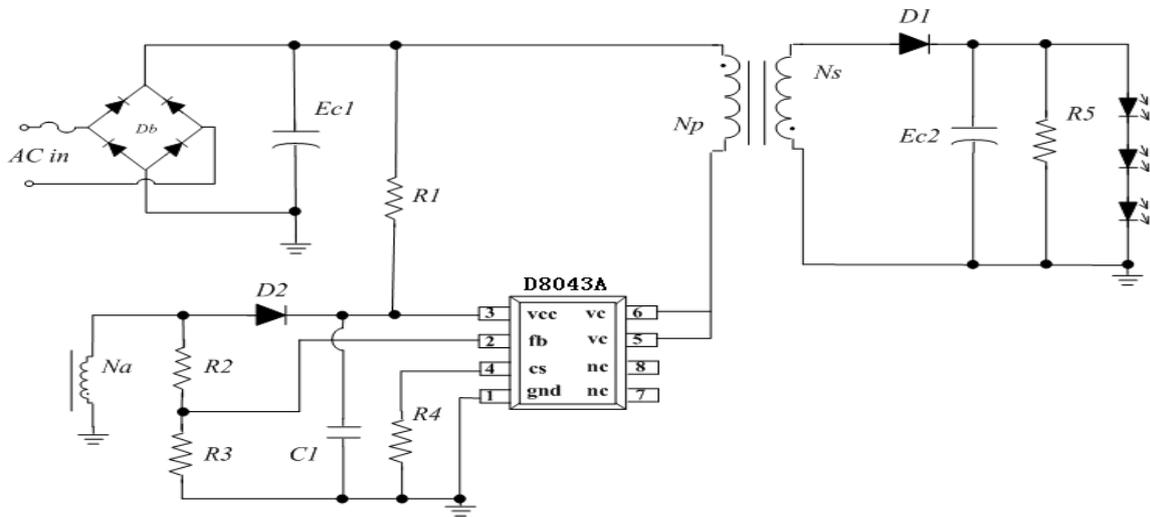
- Primary feedback constant current control, without opt coupler and 431 components
- Internal integrated 700V high withstand voltage MOS power tube
- $\pm 3\%$ constant current accuracy, single chip $\pm 1\%$ accuracy
- Very low start-up current (15uA)
- Built-in soft start-up
- Built-in cable compensation, width 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, spot light
- The other LED light

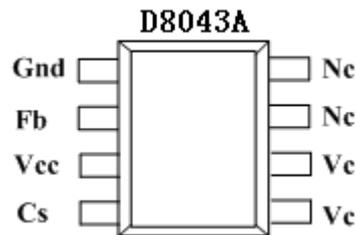


Typical Application



Picture 1 D8043A Application schematic

Pin Package



Pin Description

Pin No.	Pin Name	Description
1	GND	The ground of Signal and power
2	FB	The feedback Pin of output voltage
3	VCC	IC power Pin
4	CS	Primary current sense Pin
5 , 6	VC	The high voltage input of internal power tube
7 , 8	NC	Without connect

Order Information



Part number	Print	Package type
D8043A	D8043A XXYY	Tape 50pcs/ Tape

Application Limiting Parameter (Note1)

Parameter	Range
VCC – GND	-0.3V ~ 30V
FB - GND	-0.3V ~ 9V
VC- GND	0.3V ~ 700V
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: Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

Note2: Human mode, 100PF capacitor discharge through the 15K ohm resistor.

Electrical Characteristics

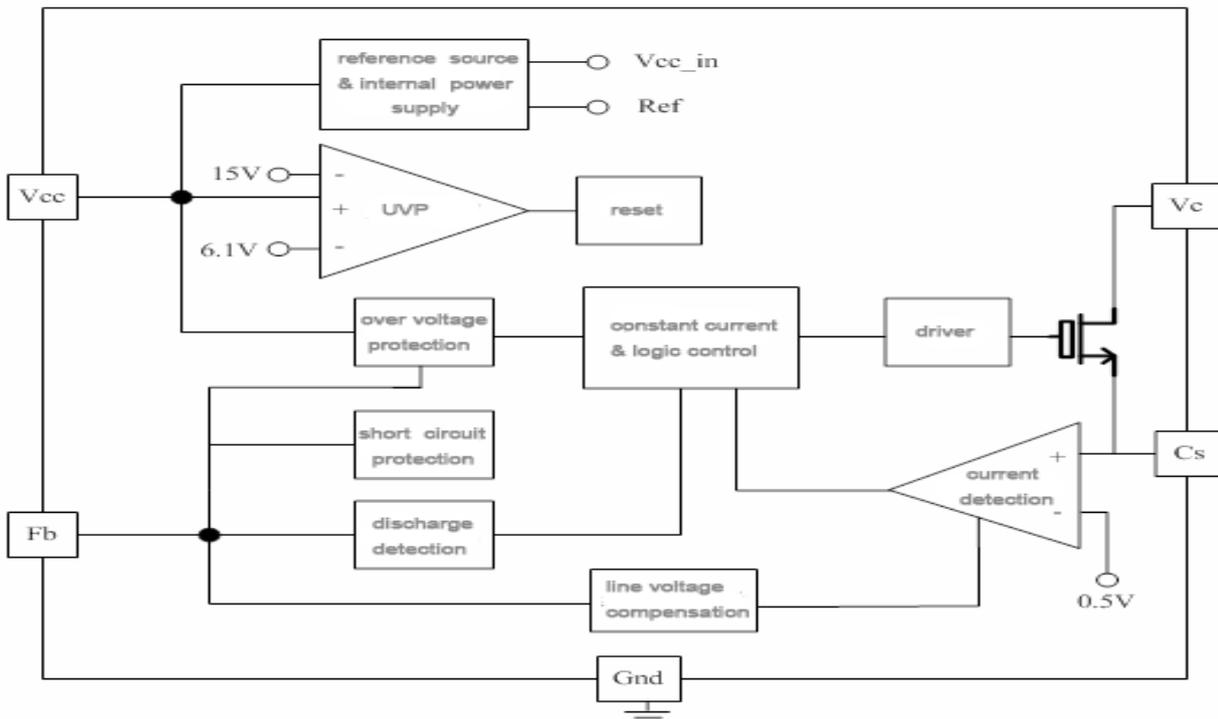
(VCC=12V, Ta=25°C, unless otherwise specified.)

Description	Symbol	Min.	Typ.	Max.	Unit
FB pin					
FB over voltage protection	FB_ovp	3	3.15	3.3	V
FB Maximum output current	IFB_max		5		mA
FB Minimum output current	IFB_min		25		uA
CS pin					
Over current limit voltage	VCS	0.445	0.450	0.455	V
Leading edge blanking time	LEB		570		nS
VCC pin					



Sart-up current	Istart		15	35	uA
VCC start-up voltage	VCC(on)	14	15	16	V
VCC turn-off voltage	VCC(off)	5.5	6.1	6.6	V
VCC static operating current	Iccq		0.45		mA
VCC over voltage protection	VCC(ovp)	22	24.5	26.5	V
VCC recommended operating range	Vcc_op	6.8		21	V
Power tube					
Maximum continuous conduction current	Icc		1.5		A
(Ic=1mA) C-B breakdown voltage	BVcbo	700			V
(Ic=10mA) C-E breakdown voltage	BVceo	400			V
(Ic=1mA) E-B breakdown voltage	BVebo	9			V
saturation voltage (Ic=200mA , Ib=40mA)	Vcesat1			0.3	V
saturation voltage(Ic=750mA , Ib=250mA)	Vcesat2			0.5	V

Functional Block Diagram



Picture 2 D8043A internal Structure Diagram

D8043A is a constant current switch chip, is dedicated to LED lighting, use primary feedback topology structure controller, can achieve higher precision constant current without optocoupler and 431. Built-in cable compensation, lower system cost, can achieve excellent constant current index with little periphery



component. Built-in high withstand voltage power tube for reduce the system cost, suitable for less than 5W LED light.

1. Start-up circuit

When start the system, as the picture 4, the input voltage V_{cap} to charge C_1 through the start-up resistance R_1 . 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.

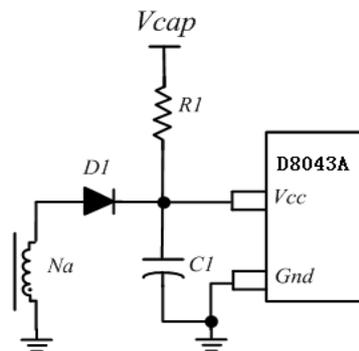
The delay time of power start-up (T_{sd}) is given by:

$$T_{sd} = R_1 \times C_1 \times L_n (1 - V_{CC (on)} / (V_{cap} - I_{start} \times R_1))$$

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

I_{start} is starting current

V_{cap} is commutating voltage of AC

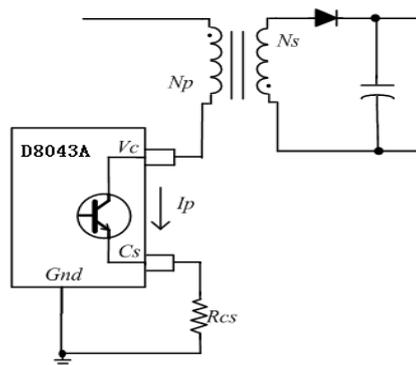


Picture 3 start-up schematic

Because the starting- current is very small (less than 30uA), the start-up resistance R_1 can be made large. Calculate with R_1 values is 1 M, V_{CC} capacitor C_1 value is 4.7uF; it can start within 1 seconds at AC 90V input.

2. Constant current set

The chip adopts the cycle sense the peak current of inductance; CS is connected to the input point of peak current comparator, compared to internal reference voltage, thus control the power switch.



Picture 4 set constant current schematic

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

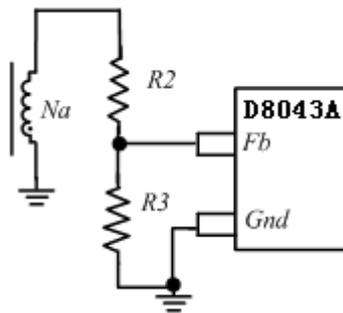
R_{cs} is current sense resistance value

N_{PS} is the turns ratio of primary and secondary winding

The output current can be set according to the current sampling resistor. No relation with the inductance.

3. Output over voltage protection and open circuit protection

As the picture 6, the chip normal 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 start.



Picture 5 feedback circuit schematic

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 start.

4. Feedback

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

5. Chip Driver

D8043A uses a characteristic multistage driving circuit, ensure the switch power dissipation is not too large, and not influence the system EMI. D8043A integrated 700V HV voltage MOSFET, efficiency low the system cost.

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:

$$F_{req} = N_p^2 * V_{OUT}/8 * N_s^2 * L_p * I_{OUT}$$

L_p is primary inductance

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

7. D8043A Design Tactic

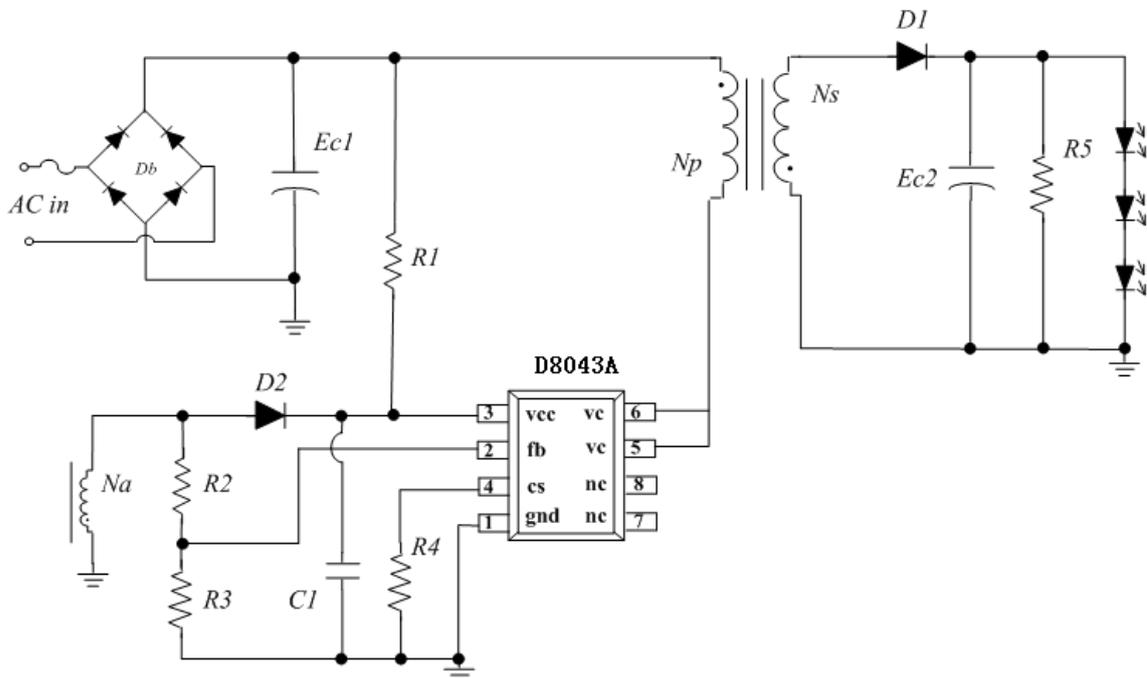
When design the PCB board, please take care as bellow:

VCC bypass capacitors should be as close to the chip VCC and GND pin, the GND Pin can't be hang.

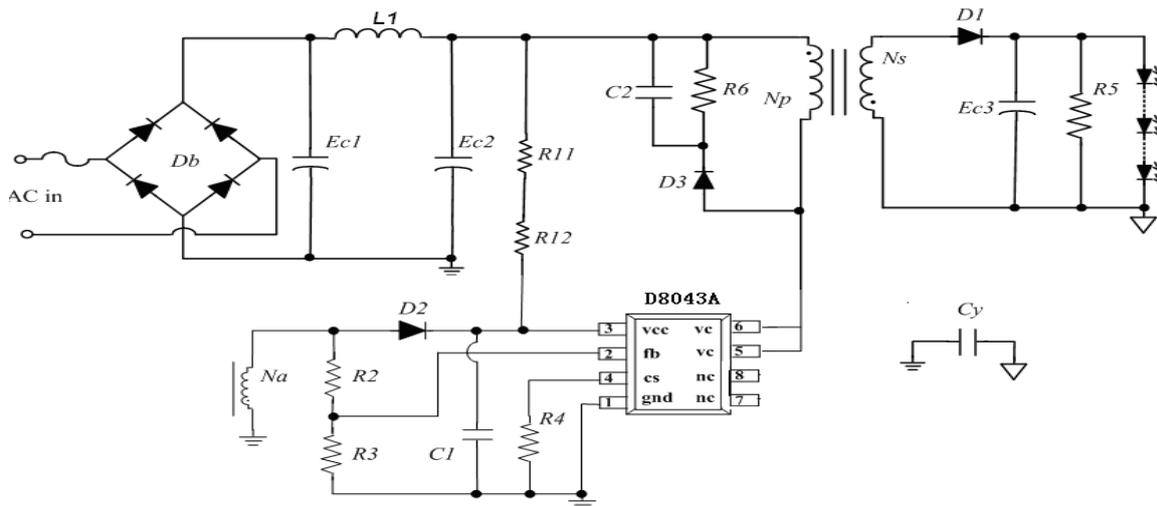
Reduce power loop area, such as the transformer primary, power tube and the loop area between feedback resistances can effectively reduce the EMI radiation.

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

Typical application solution

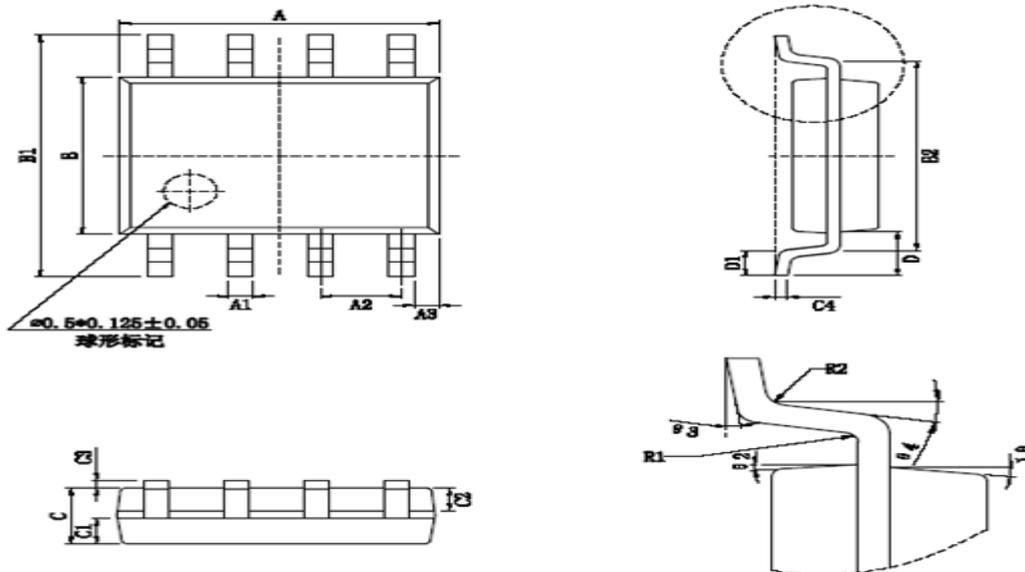


Picture 6- 5W common application schematic



Picture 8- 5W with CE application schematic

Dip-8 Package Description



标注	尺寸	最小(mm)	最大(mm)	标注	尺寸	最小(mm)	最大(mm)
A		4.80	5.00	C3		0.05	0.20
A1		0.35	0.45	C4		0.203TYP	
A2		1.27TYP		D		1.05TYP	
A3		0.345TYP		D1		0.40	0.60
B		3.80	4.00	R1		0.20TYP	
B1		5.80	6.20	R2		0.20TYP	
B2		5.00TYP		θ 1		17° TYP4	
C		1.30	1.50	θ 2		13° TYP4	
C1		0.55	0.65	θ 3		0° ~ 8°	
C2		0.55	0.65	θ 4		4° ~ 12°	