

Features

- n Operate from a rectified 85V~265V AC mains supply.
- n 0.2V current sense voltage reference.
- n Directly drive 3~7 series 1W LED.
- n Excellent line and load regulation.
- n Internal optimize power HV-MOSFET.
- n Built in thermal shutdown function.
- n Built in UVLO function.
- n Built in current limiting function.
- n Built in LED open & short protection.
- n Built in soft-start circuit.
- n Support without electrolytic capacitor System solution.
- n Available in SOIC-8 package.
- n PF > 0.9 (Power Factor) with suitable External components.

General Description

The XL5003 is a monolithic high voltage switching regulator with PFM that is specifically designed to operate from a rectified 85V~265V AC mains supply.

The XL5003 is a high efficiency LED driver switching regulator. The LED string is driven at DC constant current rather than constant voltage, thus providing constant current output and enhanced reliability.

Applications

- n E27, GU10, GU5.3, B22 lamp device
- n LED daylight lamp
- n LED Lighting & LED LAMP
- n General purpose lighting



SOIC-8

Figure1. Package Type of XL5003

600V 0.5A Switching Current Buck PFM LED Constant Current Driver	XL5003
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Pin Configurations

DIMM	1	8	VSS
VDD	2	7	VSS
XL5003			
IS	3	6	VIN
SW	4	5	VIN

Figure2. Pin Configuration of XL5003 (Top View)

Table 1 Pin Description

Pin Number	Pin Name	Description
1	DIMM	Linear & PWM Dimming Pin.
2	VDD	The chip supply voltage.
3	IS	Current Sense Pin. (The current sense voltage is 0.2V)
4	SW	Output Switching Pin
5, 6	VIN	Input high voltage Pin. (Operation voltage 100V~400V)
7, 8	VSS	The chip reference ground.

Function Block

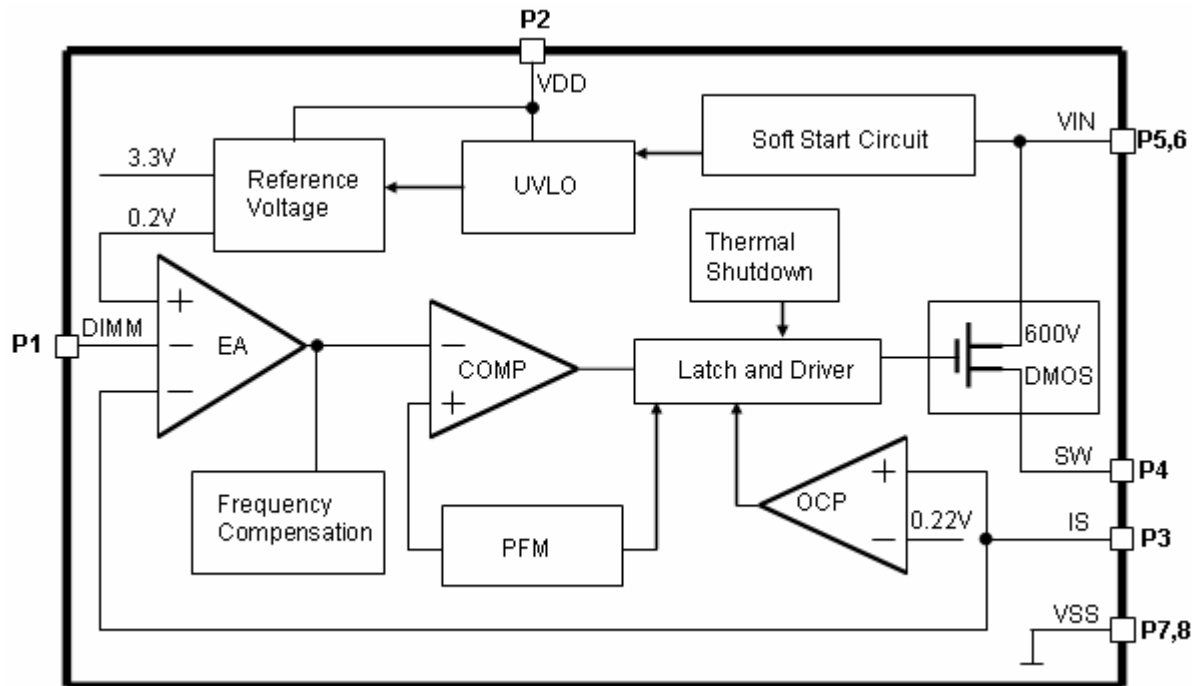
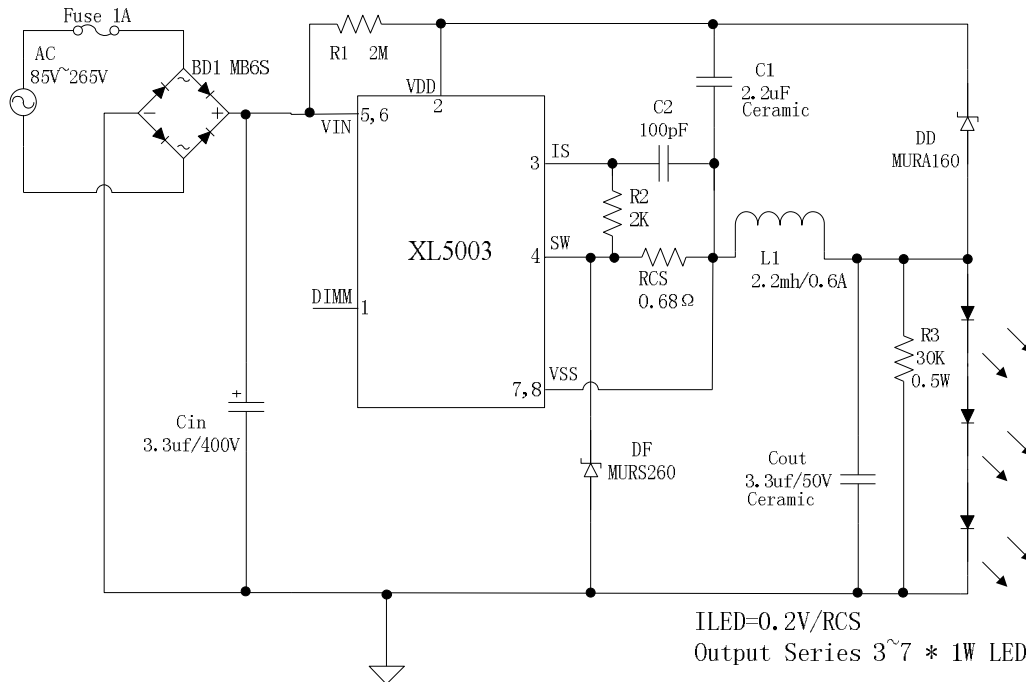


Figure3. Function Block Diagram of XL5003

600V 0.5A Switching Current Buck PFM LED Constant Current Driver XL5003

Typical application circuit

RCS For Output LED Constant Current & LED Short Protection
 DD C1 For XL5003 Bootstrap Supply



- [1] Input AC 85V~265V Mains Supply.
- [2] Output Constant Current Drive Series 3~7 * 1W LED.
- [3] Support Output LED Open & Short Protection.

Figure4. XL5003 Typical Application (Mains supply 3W~7W LED saving energy lamp)

600V 0.5A Switching Current Buck PFM LED Constant Current Driver

XL5003

Ordering Information

Package	Temperature Range	Part Number	Marking ID	Packing Type
		Lead Free	Lead Free	
		XL5003E1	XL5003E1	Tube
		XL5003TRE1	XL5003E1	Tape & Reel

XLSEMI Pb-free products, as designated with “E1” suffix in the par number, are RoHS compliant.

Absolute Maximum Ratings (Note1)

Parameter	Symbol	Value	Unit
Input Voltage	V_{in}	-0.3 to 600	V
Power Dissipation	P_D	Internally limited	mW
Thermal Resistance (SOP-8L) (Junction to Ambient, No Heatsink, Free Air)	R_{JA}	100	°C/W
Operating Junction Temperature	T_J	-40 to 125	°C
Storage Temperature	T_{STG}	-65 to 150	°C
Lead Temperature (Soldering, 10 sec)	T_{LEAD}	260	°C
ESD (HBM)		3000	V

Note1: Stresses greater than those listed under Maximum Ratings may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operation is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

600V 0.5A Switching Current Buck PFM LED Constant Current Driver	XL5003
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XL5003 Electrical Characteristics

T_a = 25°C; unless otherwise specified. Reference test circuit figure4

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
VIS	IS Voltage	VAC = 85V to 265V, Iled=0.3A, Pout=3W	190	200	210	mV
Efficiency	η	VAC=110V, Iled=0.3A, Pout=6W	-	78.28	-	%
Efficiency	η	VAC=220V, Iled=0.3A, Pout=6W	-	80.69	-	%

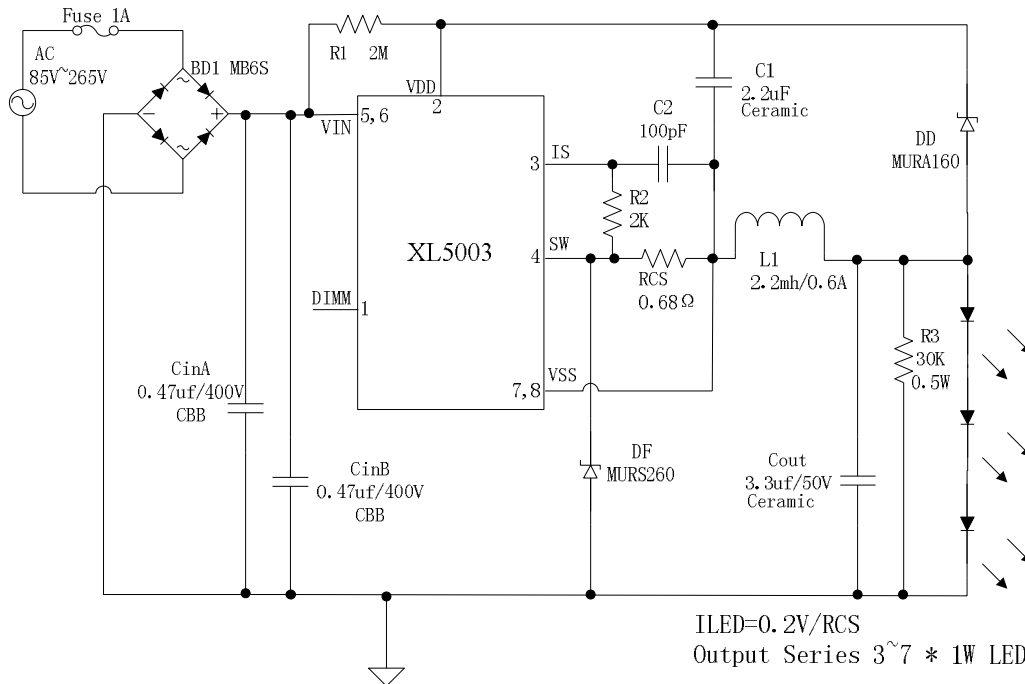
Electrical Characteristics (DC Parameters)

Parameters	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Input operation voltage	VIN		100		400	V
Quiescent Supply Current	I _q	Figure4, VAC=220V Iled=0		0.15	0.3	mA
Switching Frequency	Fosc	Figure4 (6*1W) VAC=220V	29.4	36.8	44.2	KHz
Max. Duty Cycle	D _{MAX}			50		%
VDMOS Drain-Source Breakdown Voltage	V _{BRDS}	V _{GS} =0V, I _{DS} =250uA	600			V
VDMOS Drain-Source on resistor	R _{DS(on)}	I _{DS} =0.5A, V _{GS} =10V		8	10	Ohm
Thermal Shutdown	OTP	T _j		165		°C
Thermal Shutdown Window				25		°C

600V 0.5A Switching Current Buck PFM LED Constant Current Driver XL5003

[1] Typical application circuit without electrolytic capacitor (3W ~ 7W)

RCS For Output LED Constant Current & LED Short Protection
 DD C1 For XL5003 Bootstrap Supply



- [1] Input AC 85V~265V Mains Supply.
- [2] Output Constant Current Drive Series 3~7 * 1W LED.
- [3] Support Output LED Open & Short Protection.
- [4] Support Without Electrolytic Capacitor Solution
 For High Reliability & High Performance.

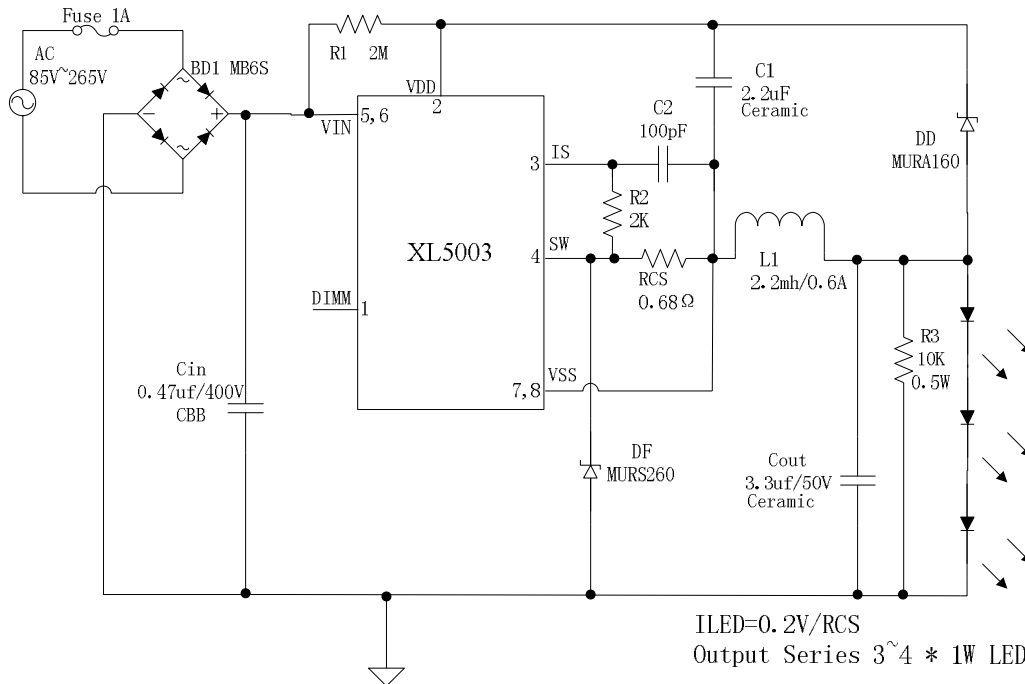
Figure5. XL5003 System Application for AC LED LAMP (3W ~ 7W)

VIN=110Vac						
1W LED Series	Pin(W)	PF	Vout (V)	Iout (mA)	Fosc (KHz)	EF (%)
3	3.9	0.458	9.74	288	26.32	71.93
4	4.8	0.516	12.82	284	32.47	75.85
5	5.7	0.564	15.90	279	37.88	77.83
6	6.5	0.607	18.97	274	43.10	79.97
7	7.2	0.637	21.95	269	47.17	82.01
VIN=220Vac						
1W LED Series	Pin(W)	PF	Vout (V)	Iout (mA)	Fosc (KHz)	EF (%)
3	4.4	0.628	9.90	335	22.73	75.38
4	5.7	0.647	13.21	333	27.78	77.17
5	6.8	0.647	16.36	329	32.89	79.15
6	7.9	0.622	19.54	325	42.37	80.39
7	9.1	0.582	22.60	321	46.10	79.72

600V 0.5A Switching Current Buck PFM LED Constant Current Driver XL5003

[2] Typical application circuit without electrolytic capacitor (3W ~ 4W)

RCS For Output LED Constant Current & LED Short Protection
 DD C1 For XL5003 Bootstrap Supply



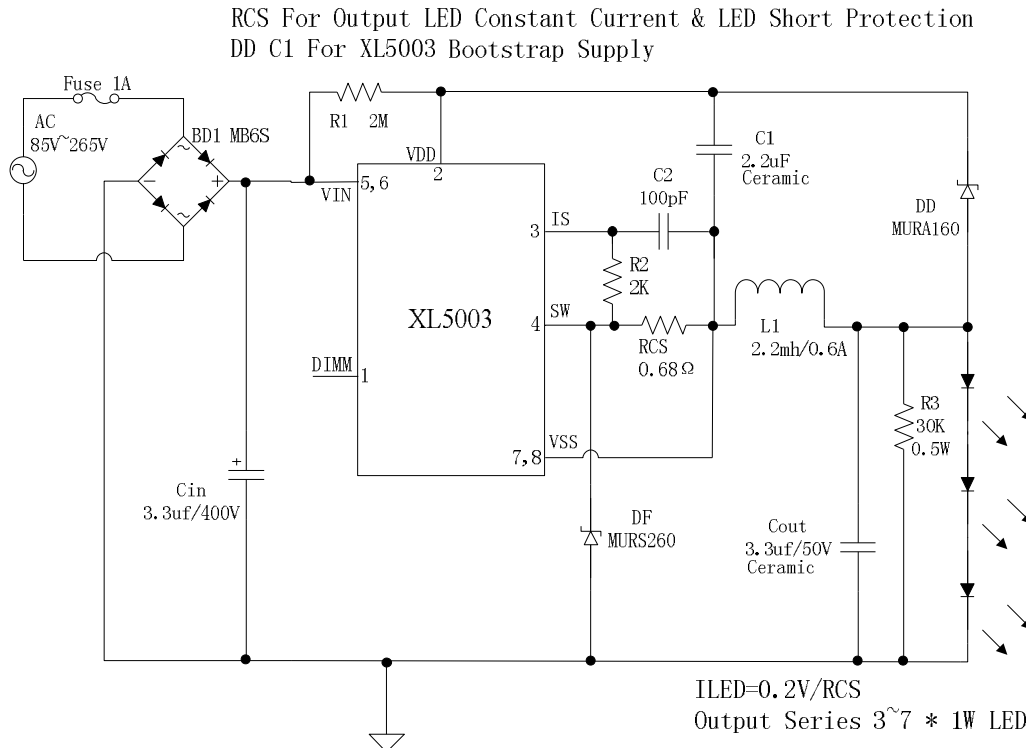
- [1] Input AC 85V~265V Mains Supply.
- [2] Output Constant Current Drive Series 3~4 * 1W LED.
- [3] Support Output LED Open & Short Protection.
- [4] Support Without Electrolytic Capacitor Solution For High Reliability & High Performance.

Figure6. XL5003 System Application for AC LED LAMP (3W ~ 4W)

VIN=110Vac						
1W LED Series	Pin(W)	PF	Vout(V)	Iout(mA)	Fosc(KHz)	EF(%)
3	3.8	0.475	9.93	289	28.09	75.52
4	4.8	0.539	13.26	284	32.89	78.46
VIN=220Vac						
1W LED Series	Pin(W)	PF	Vout(V)	Iout(mA)	Fosc(KHz)	EF(%)
3	4.5	0.592	10.08	326	24.27	73.02
4	5.7	0.448	13.35	308	29.76	72.14

600V 0.5A Switching Current Buck PFM LED Constant Current Driver XL5003

[3] Typical application circuit with electrolytic capacitor (3W ~ 7W)



- [1] Input AC 85V~265V Mains Supply.
- [2] Output Constant Current Drive Series 3~7 * 1W LED.
- [3] Support Output LED Open & Short Protection.

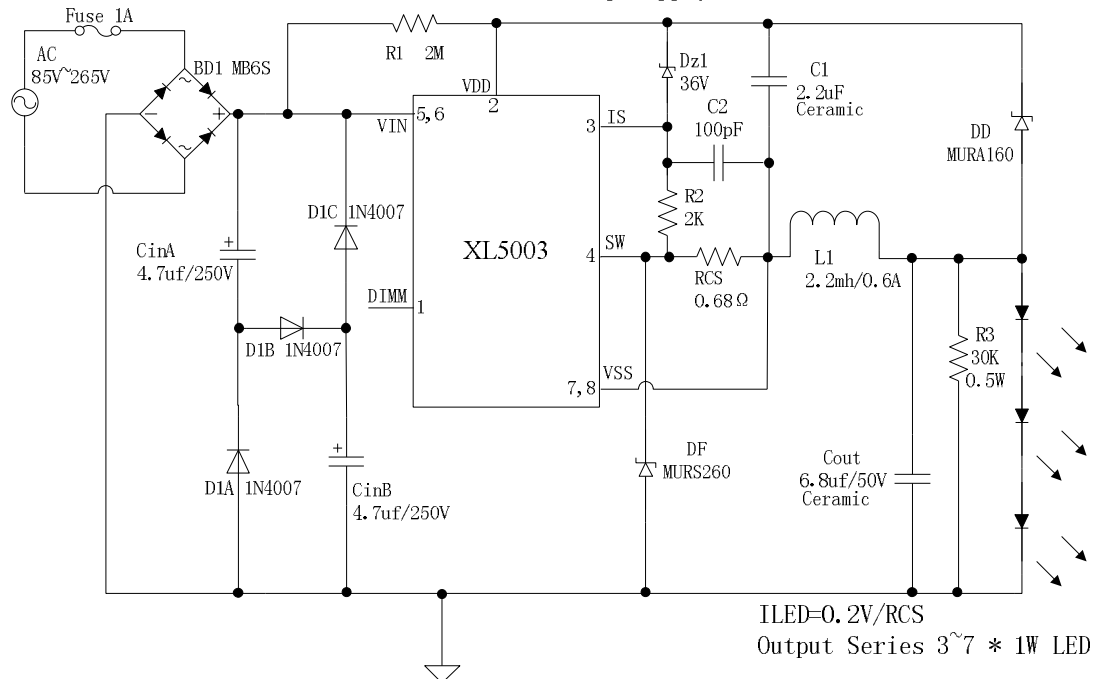
Figure7. XL5003 System Application for AC LED LAMP (3W ~ 7W)

VIN=110Vac						
1W LED Series	Pin(W)	PF	Vout(V)	Iout(mA)	Fosc(KHz)	EF(%)
3	4.1	0.621	9.82	312	26.60	74.73
4	5.3	0.638	12.95	310	31.65	75.75
5	6.4	0.521	16.10	308	37.31	77.48
6	7.5	0.572	19.25	305	43.10	78.28
7	8.4	0.551	22.23	294	47.17	77.81
VIN=220Vac						
1W LED Series	Pin(W)	PF	Vout(V)	Iout(mA)	Fosc(KHz)	EF(%)
3	4.5	0.500	9.89	343	21.55	75.38
4	5.8	0.542	13.05	341	27.17	76.73
5	6.8	0.544	16.22	338	31.65	80.62
6	8.0	0.563	19.27	335	36.76	80.69
7	9.0	0.575	22.27	332	43.10	82.15

600V 0.5A Switching Current Buck PFM LED Constant Current Driver XL5003

[4] Typical application circuit with PFC (3W ~ 7W)

CinA/B & D1A/B/C For Power Factor Correction (PFC)
 RCS For Output LED Constant Current & LED Short Protection
 DD C1 For XL5003 Bootstrap Supply



- [1] Input AC 85V~265V Mains Supply.
- [2] Output Constant Current Drive Series 3~7 * 1W LED.
- [3] Support Output LED Open & Short Protection.

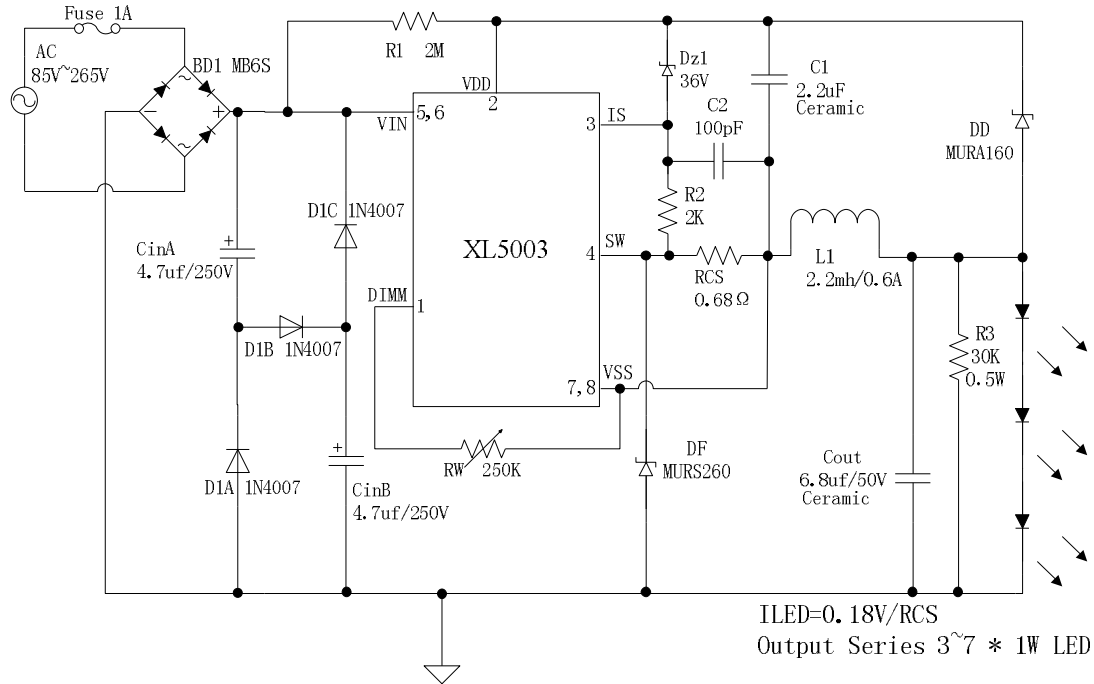
Figure8. XL5003 System Application for AC LED LAMP (3W ~ 7W)

VIN=110Vac						
1W LED Series	Pin(W)	PF	Vout(V)	Iout(mA)	Fosc(KHz)	EF(%)
3	3.8	0.904	9.50	307	26.60	76.75
4	4.8	0.905	12.62	305	31.65	80.19
5	5.9	0.895	15.76	303	37.88	80.94
6	6.9	0.862	18.91	302	42.37	82.77
7	8.0	0.851	22.00	300	47.17	82.50
VIN=220Vac						
1W LED Series	Pin(W)	PF	Vout(V)	Iout(mA)	Fosc(KHz)	EF(%)
3	4.2	0.875	9.59	329	23.81	75.12
4	5.3	0.898	12.75	328	27.78	78.91
5	6.5	0.902	15.92	326	36.76	79.84
6	7.4	0.891	19.09	324	39.68	83.58
7	8.5	0.885	22.18	322	46.30	84.02

600V 0.5A Switching Current Buck PFM LED Constant Current Driver XL5003

[5] Typical application circuit with PFC & with linear dimming (3W ~ 7W)

CinA/B & D1A/B/C For Power Factor Correction (PFC)
 RCS For Output LED Constant Current & LED Short Protection
 Dz1 & R2 For Output LED Open Protection
 DD C1 For XL5003 Bootstrap Supply
 RW For Linear Dimming Function



- [1] Input AC 85V~265V Mains Supply.
- [2] Output Constant Current Drive Series 3~7 * 1W LED.
- [3] Support Output LED Open & Short Protection.
- [4] Support LED Linear Dimming.

Figure9. XL5003 System Application for AC LED LAMP (3W ~7W)

