

4A 220KHz 36V Buck LED Constant Current Driver**XL3003****Features**

- Wide 8V to 36V Input Voltage Range
- Output Current Sense Voltage is 0.21V
- Maximum Duty Cycle 100%
- Minimum Drop Out 0.3V
- Fixed 220KHz Switching Frequency
- 4A Constant Output Current Capability
- Internal Optimize Power MOSFET
- High efficiency
- Excellent line and load regulation
- Built in thermal shutdown function
- Built in current limit function
- Built in output short protection function
- Available in TO-252 package

Applications

- Buck constant current driver
- Monitor LED Backlighting
- General purpose LED lighting

General Description

The XL3003 is a 220 KHz fixed frequency PWM buck (step-down) LED constant current driver, capable of driving a 4A load with high efficiency, low ripple and excellent line and load regulation. Requiring a minimum number of external components, the regulator is simple to use and include internal frequency compensation and a fixed-frequency oscillator.

The PWM control circuit is able to adjust the duty ratio linearly from 0 to 100%. An over current protection function is built inside. When short protection function happens, the operation frequency will be reduced from 220KHz to 60KHz. An internal compensation block is built in to minimize external component count.



Figure1. Package Type of XL3003

4A 220KHz 36V Buck LED Constant Current Driver

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Pin Configurations

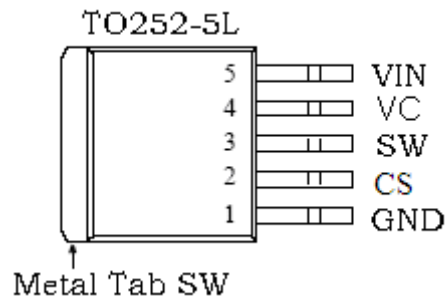


Figure2. Pin Configuration of XL3003 (Top View)

Table 1 Pin Description

Pin Number	Pin Name	Description
1	GND	Ground Pin. Care must be taken in layout. This pin should be placed outside of the Schottky Diode to output capacitor ground path to prevent switching current spikes from inducing voltage noise into XL3003.
2	CS	Output constant current sense Pin (CS). The CS reference voltage is 0.21V.
3	SW	Power Switch Output Pin (SW). SW is the switch node that supplies power to the output.
4	VC	Internal Voltage Regulator Bypass Capacity. In typical system application, The VC pin connect a 1uf capacity to VIN.
5	VIN	Supply Voltage Input Pin. XL3003 operates from a 8V to 36V DC voltage. Bypass Vin to GND with a suitably large capacitor to eliminate noise on the input.

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Function Block

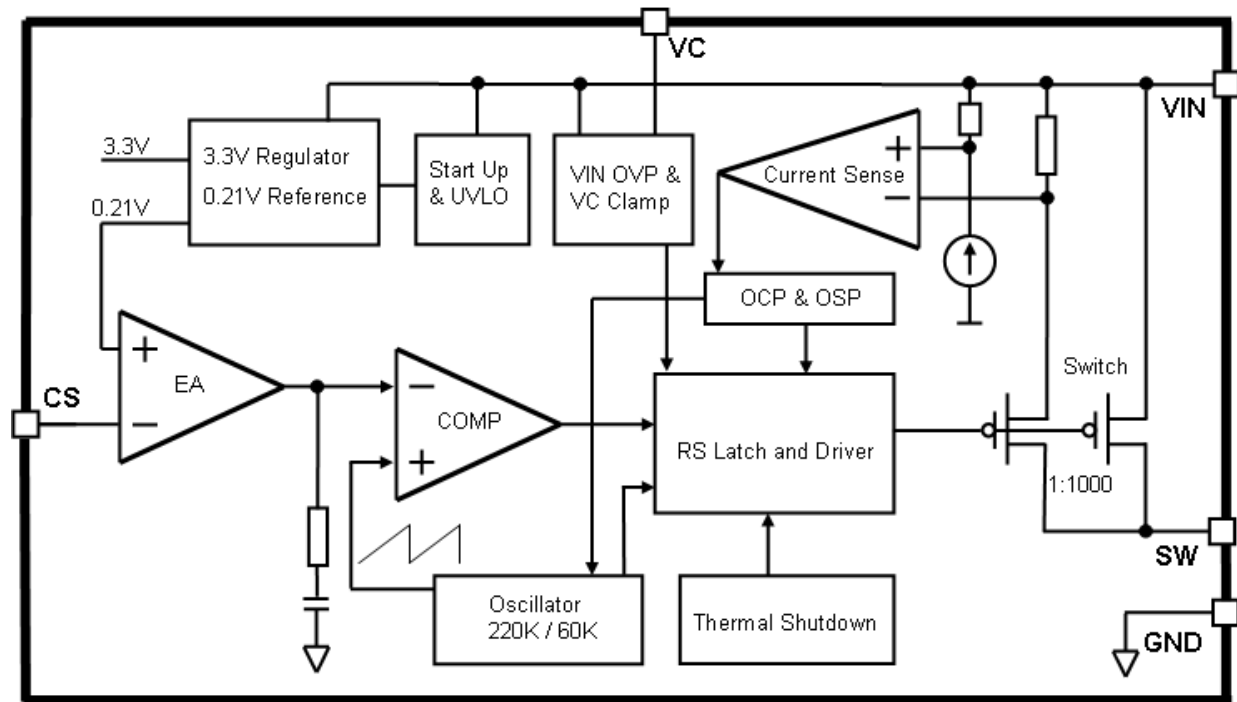


Figure3. Function Block Diagram of XL3003

Typical Application Circuit

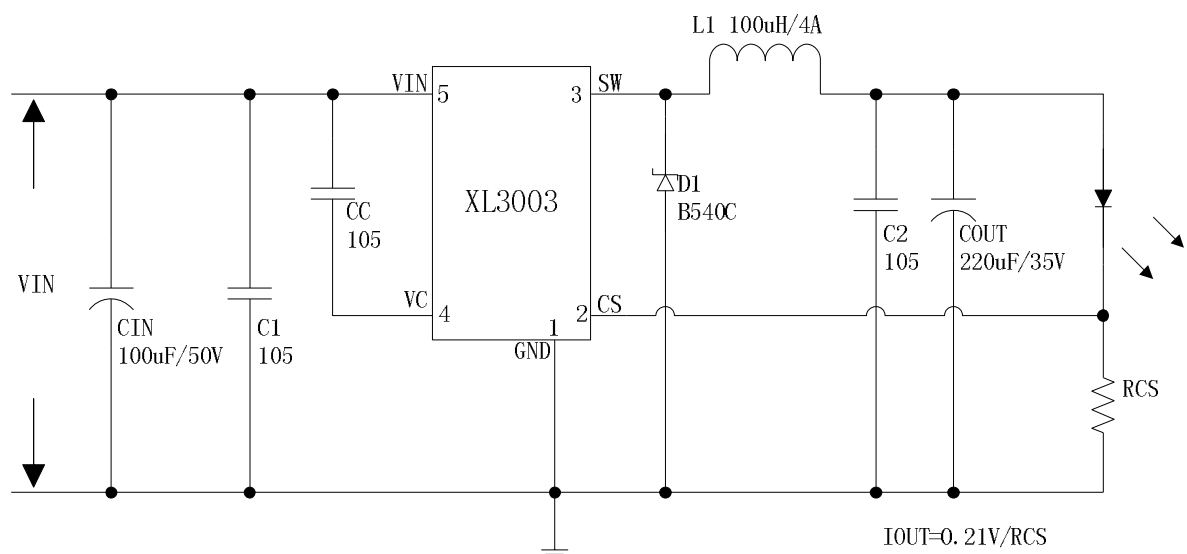


Figure4. XL3003 Typical Application Circuit

4A 220KHz 36V Buck LED Constant Current Driver
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Ordering Information

Order Information	Marking ID	Package Type	Packing Type Supplied As
XL3003E1	XL3003E1	TO252-5L	2500 Units on 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 40	V
CS Pin Voltage	V _{CS}	-0.3 to V _{in}	V
Output Switch Pin Voltage	V _{Output}	-0.3 to V _{in}	V
Power Dissipation	P _D	Internally limited	mW
Thermal Resistance (TO252) (Junction to Ambient, No Heatsink, Free Air)	R _{JA}	50	°C/W
Maximum Junction Temperature	T _J	-40 to 150	°C
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)		>2000	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.

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XL3003 Electrical Characteristics
 $T_a = 25^{\circ}\text{C}$; unless otherwise specified.

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
<i>System parameters test circuit figure4</i>						
VCS	Current Sense Voltage	$V_{in} = 8\text{V to } 36\text{V}, V_{out}=6.4\text{V}$ $I_{load}=0.1\text{A to } 3\text{A}$	203.7	210	216.3	mV
η	Efficiency	$V_{in}=12\text{V}, V_{out}=10\text{V}$ $I_{out}=0.3\text{A}$	-	95	-	%
η	Efficiency	$V_{in}=24\text{V}, V_{out}=16\text{V}$ $I_{out}=1\text{A}$	-	96	-	%
η	Efficiency	$V_{in}=36\text{V}, V_{out}=19\text{V}$ $I_{out}=1\text{A}$	-	95	-	%

Electrical Characteristics (DC Parameters)
 $V_{in} = 12\text{V}$, $GND=0\text{V}$, V_{in} & GND parallel connect a 100uf/50V capacitor; $I_{out}=500\text{mA}$, $T_a = 25^{\circ}\text{C}$; the others floating unless otherwise specified.

Parameters	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Input operation voltage	V_{in}		8		36	V
VIN UVLO	V_{in_uvlo}			5		V
Quiescent Supply Current	I_q	$V_{CS}=V_{in}$		2.1	5	mA
Oscillator Frequency	F_{osc}		187	220	253	KHz
Output Short Frequency	F_{osp}		48	60	72	KHz
Switch Current Limit	I_L	$V_{CS}=0$		6		A
Max. Duty Cycle	D_{MAX}	$V_{CS}=0\text{V}$		100		%
Output Power PMOS	R_{dson}	$V_{CS}=0\text{V}, V_{in}=12\text{V},$ $I_{SW}=4\text{A}$		60	80	mohm

Typical System Application (Recommend output voltage safe work range)

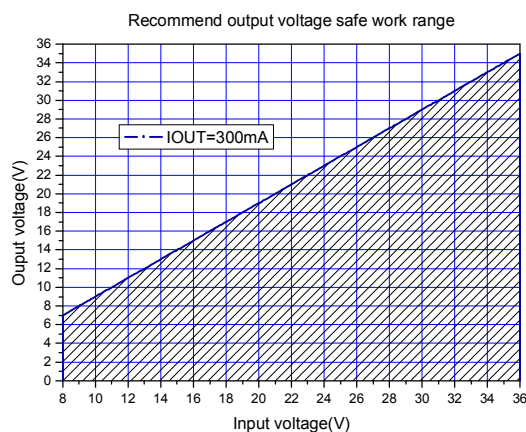


Figure5.Max output voltage(IOUT=300mA)

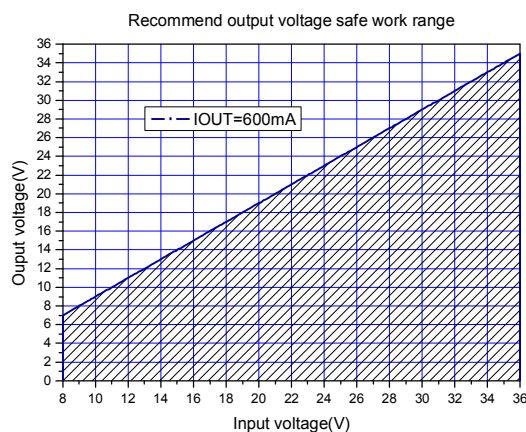


Figure6.Max output voltage(IOUT=600mA)

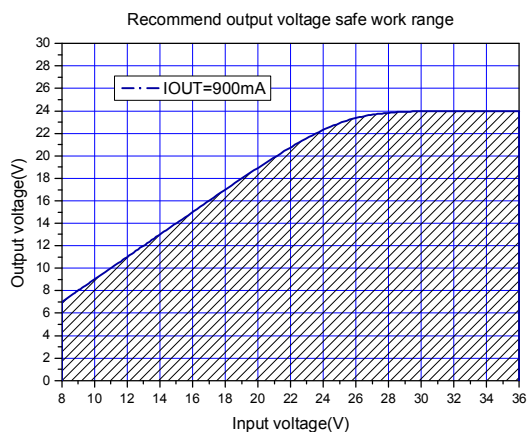


Figure7.Max output voltage(IOUT=900mA)

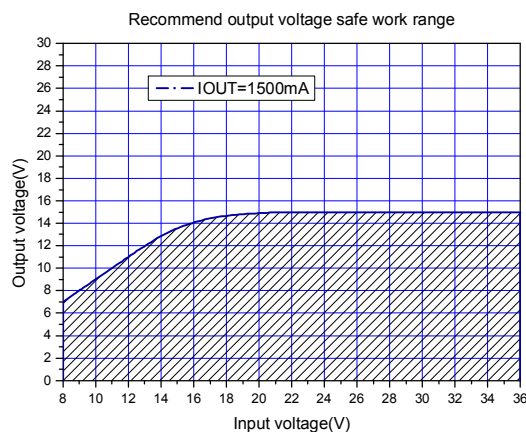


Figure8.Max output voltage(IOUT=1500mA)

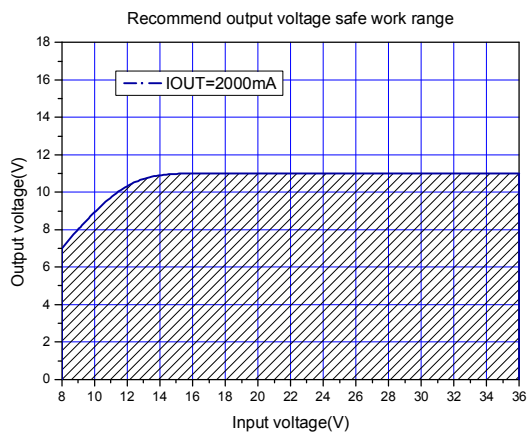


Figure9.Max output voltage(IOUT=2000mA)

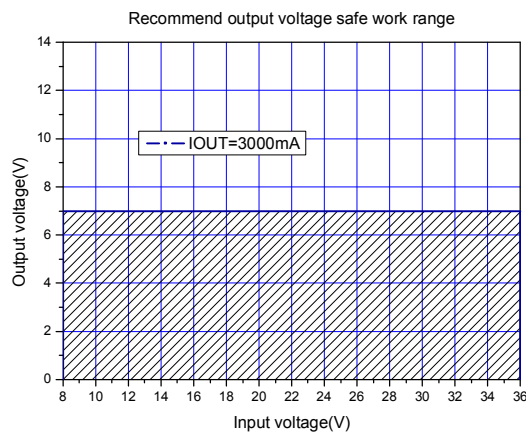


Figure10.Max output voltage(IOUT=3000mA)

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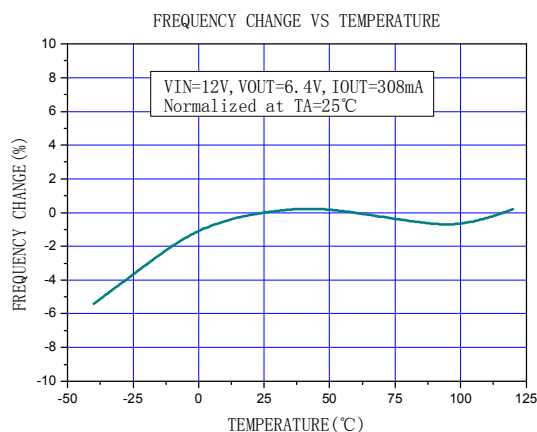


Figure11. Frequency change Curve

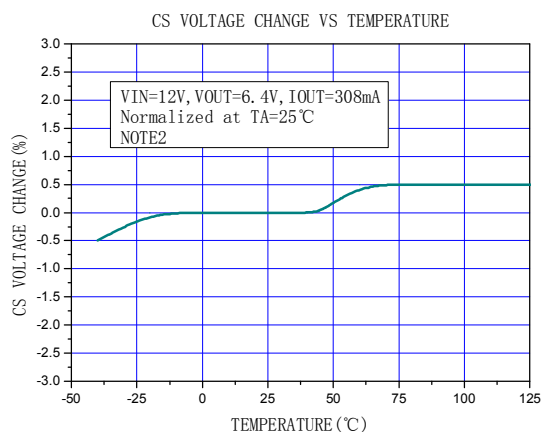


Figure12. CS Voltage change Curve

Note2: Internal temperature compensation circuitry is provided to compensation the PCB and external line loss in system application. When the junction temperature or the output power rise, the CS voltage will be compensated. This function is provided to compensation the PCB and external line loss in system application.

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Typical System Application (VIN=8V~36V, IOU=308mA)

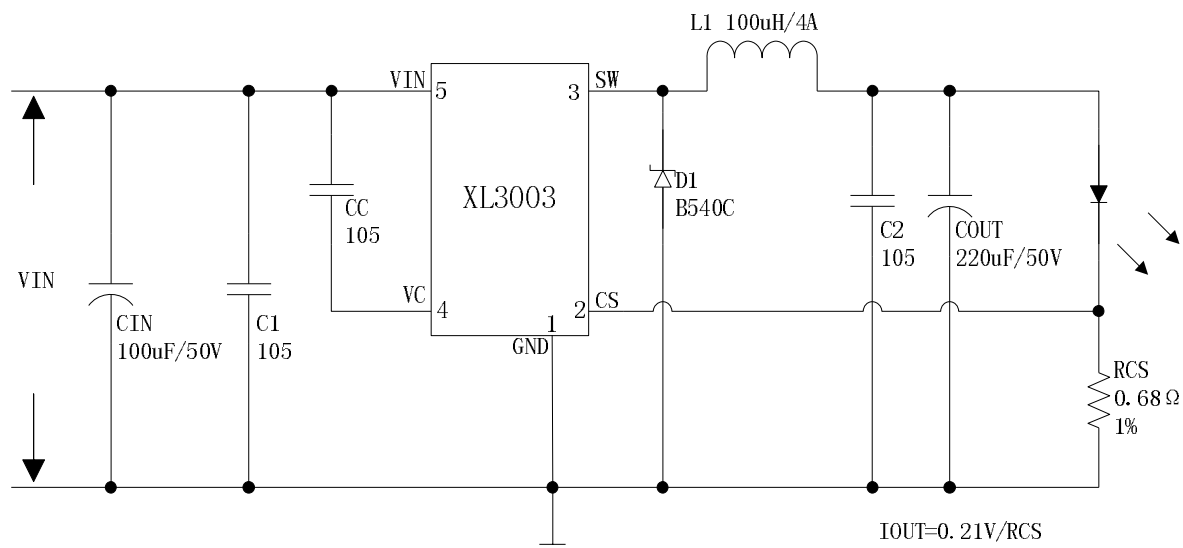


Figure13. XL3003 System Parameters Test Circuit ($V_{IN}=8V\sim36V$, $I_{OUT}=308mA$)

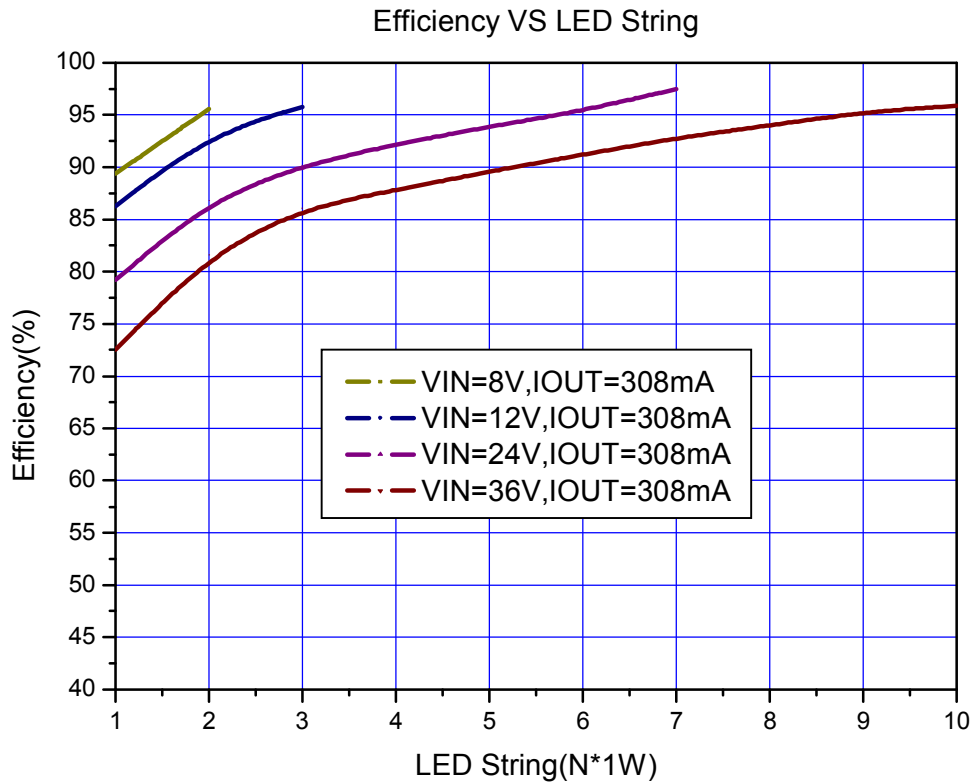


Figure14. XL3003 System Efficiency Curve

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Typical System Application (VIN=8V~36V, IOU=615mA)

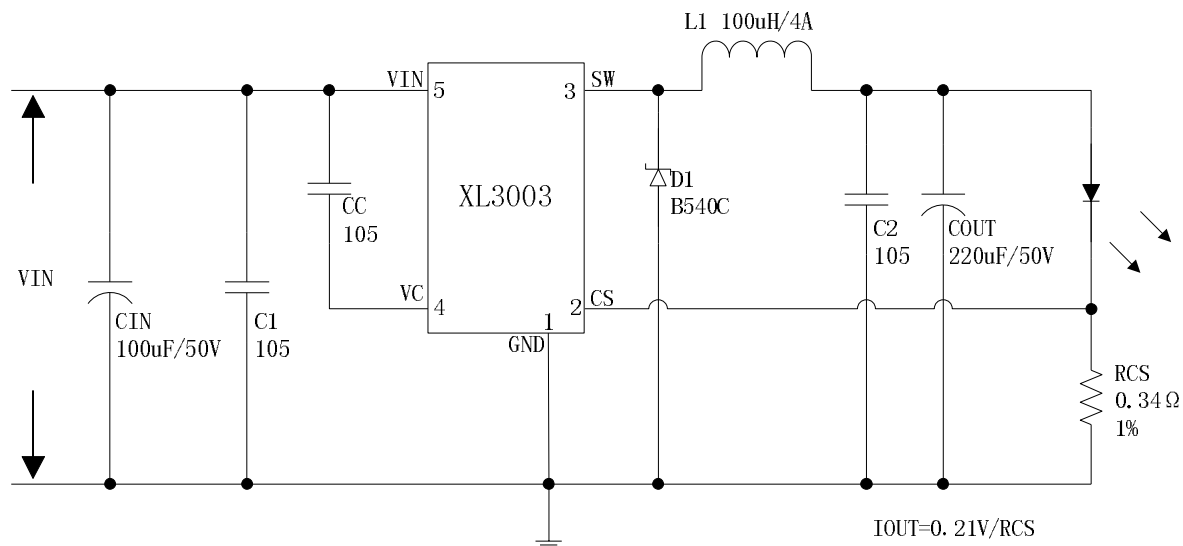


Figure15. XL3003 System Parameters Test Circuit (VIN=8V~36V, IOU=615mA)

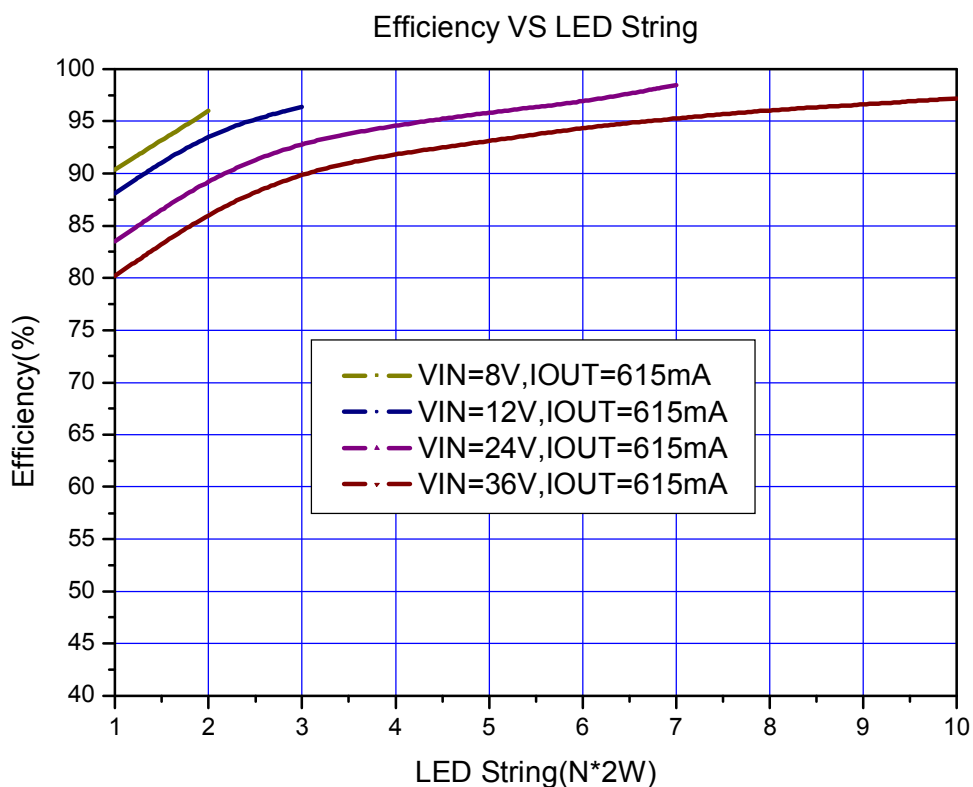


Figure16. XL3003 System Efficiency Curve

4A 220KHz 36V Buck LED Constant Current Driver

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Typical System Application (VIN=8V~36V, IOU=925mA)

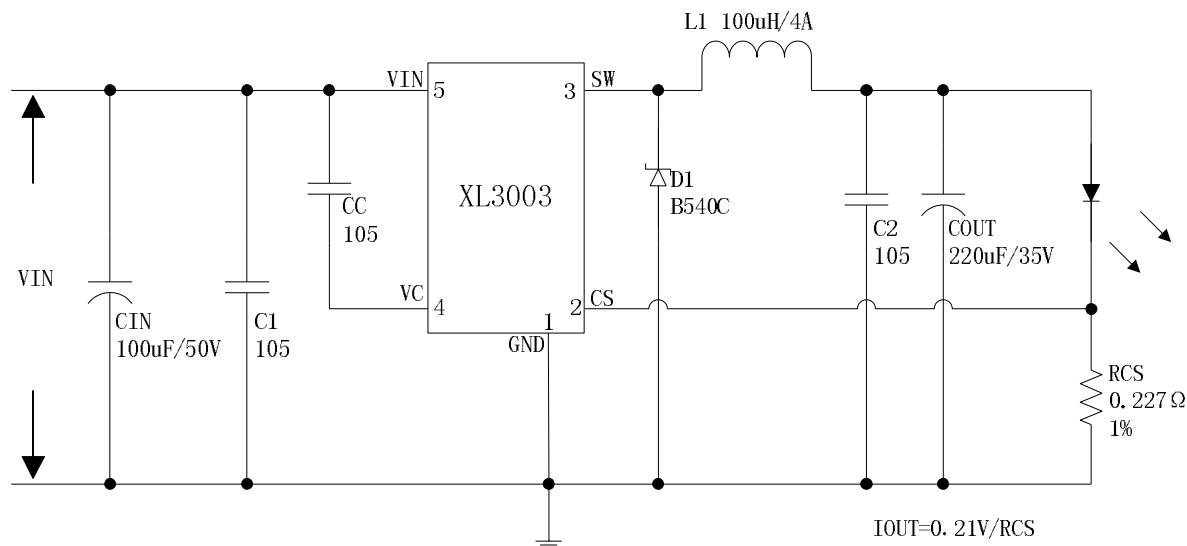


Figure17. XL3003 System Parameters Test Circuit (VIN=8V~36V, IOU=925mA)

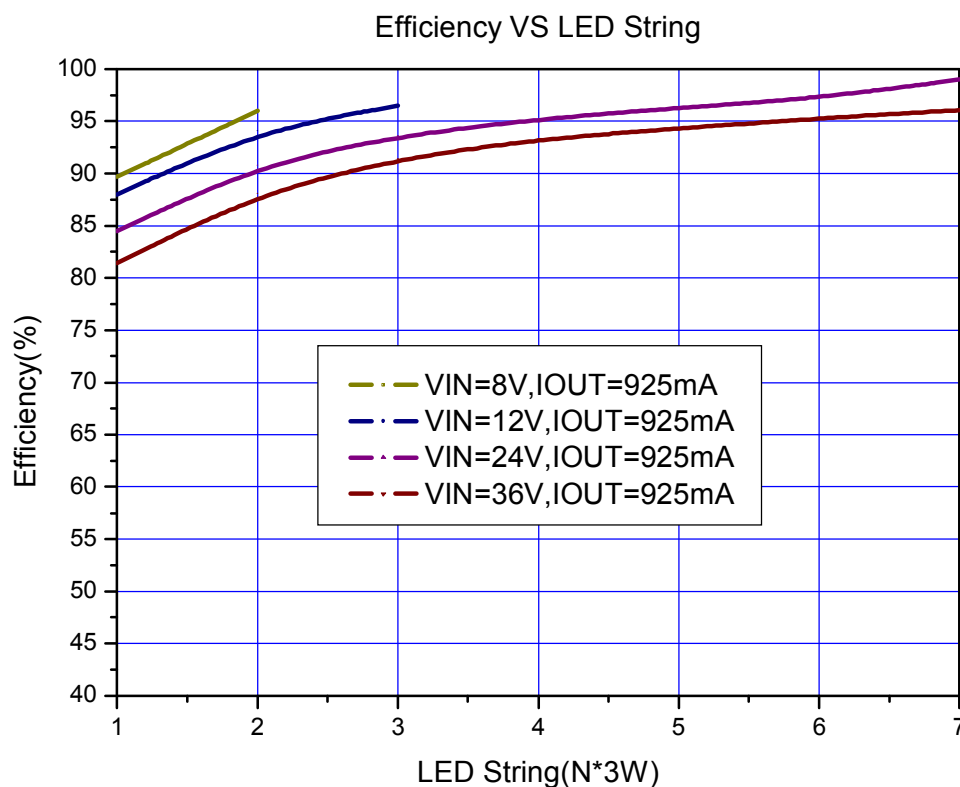


Figure18. XL3003 System Efficiency Curve

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Typical System Application (PWM DIMMING)

PWM dimming function can be used in typical system application with external components. Changing the duty cycle of PWM signal can get different LED current. The PWM signal high voltage above 3.3V(referenced to ground, lower than VIN), Low voltage below 0.2V(referenced to ground).

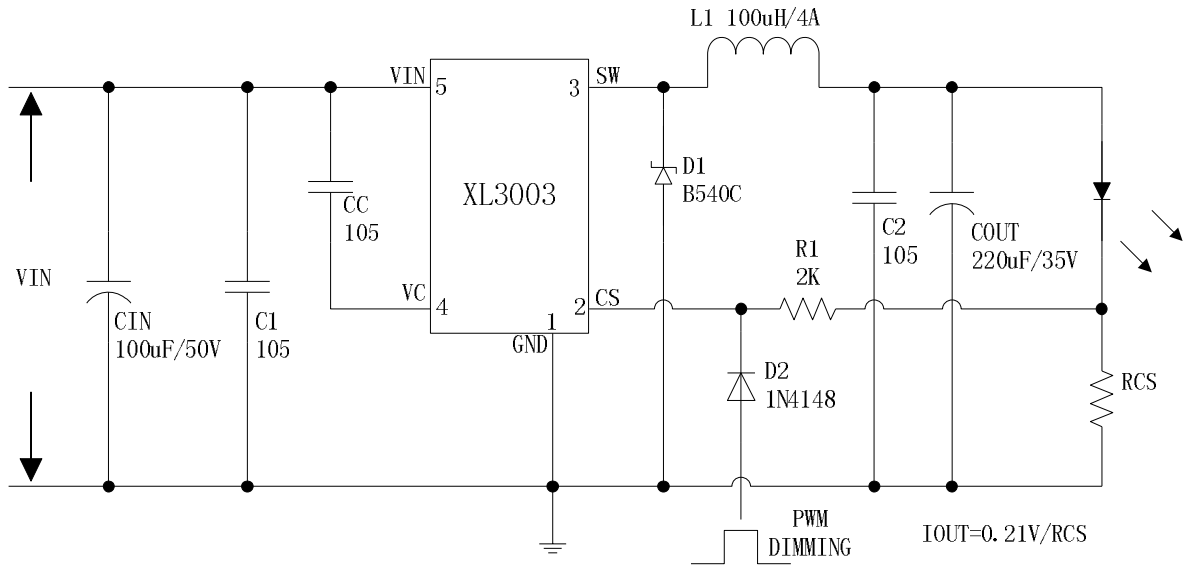


Figure19. XL3003 System Parameters Test Circuit (PWM DIMMING)

Typical System Application (LED OVP)

LED OVP function can be used in typical system application with external components. The output voltage can be limited in a suitable value by choose different zener diode when the output LED open. the zener diode voltage choosed by output led voltage's 1.3 times.

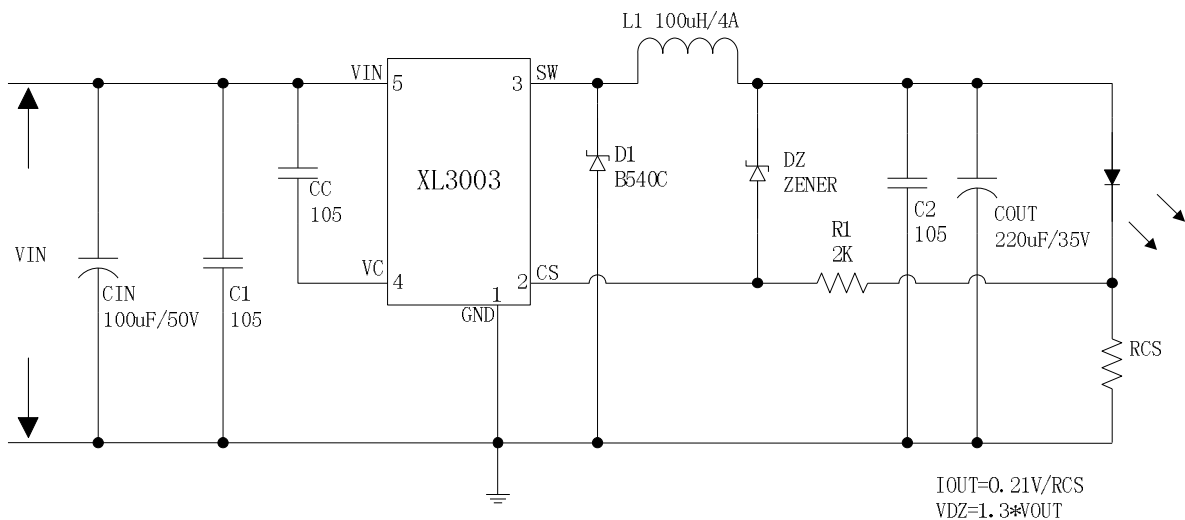


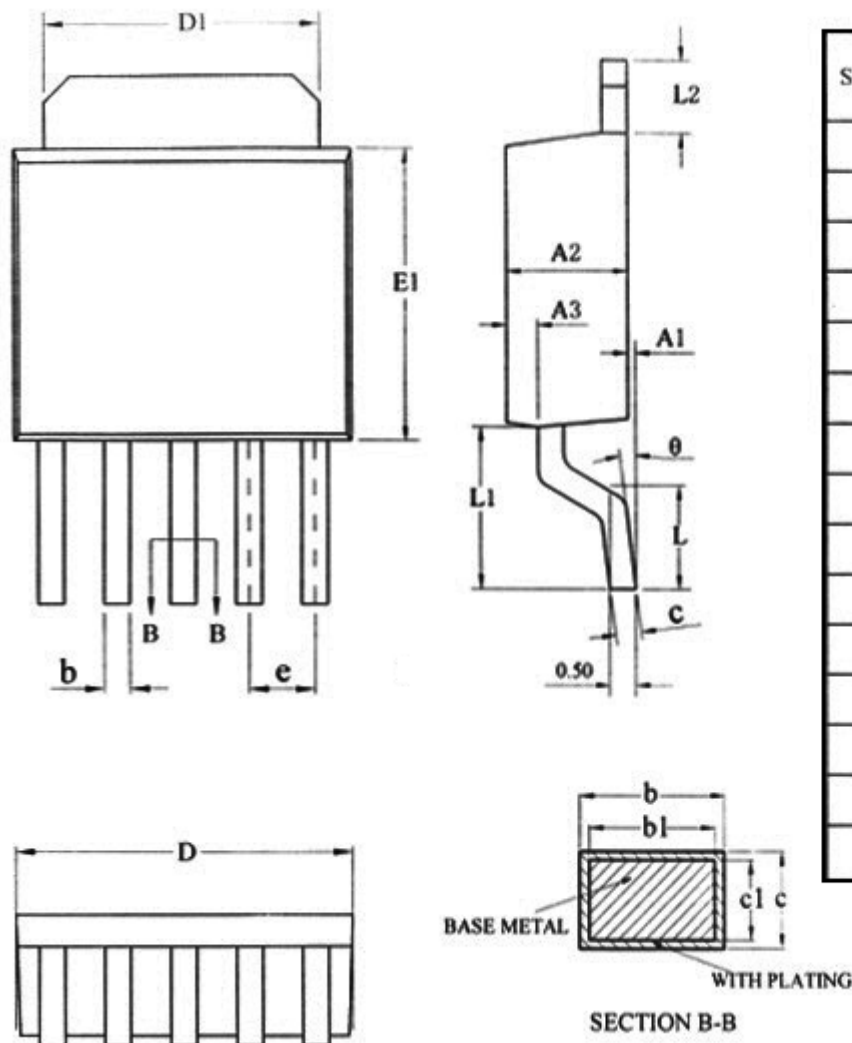
Figure19. XL3003 System Parameters Test Circuit (LED OVP)

4A 220KHz 36V Buck LED Constant Current Driver
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Schottky Diode Selection Table

Current	Surface Mount	Through Hole	VR (The same as system maximum input voltage)				
			20V	30V	40V	50V	60V
1A		✓	1N5817	1N5818	1N5819		
3A		✓	1N5820	1N5821	1N5822		
		✓	MBR320	MBR330	MBR340	MBR350	MBR360
	✓		SK32	SK33	SK34	SK35	SK36
	✓			30WQ03	30WQ04	30WQ05	
		✓		31DQ03	31DQ04	31DQ05	
		✓	SR302	SR303	SR304	SR305	SR306
5A		✓	1N5823	1N5824	1N5825		
		✓	SR502	SR503	SR504	SR505	SR506
		✓	SB520	SB530	SB540	SB550	SB560
	✓			50WQ03	50WQ04	50WQ05	
8A		✓	SR820	SR830	SR840	SR850	SR860

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Package Information
TO252-5L



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A1	0.05	0.15	0.25
A2	2.10	2.30	2.50
A3	0.50	0.60	0.70
b	0.46	—	0.60
b1	0.45	0.50	0.55
c	0.49	—	0.56
c1	0.48	0.50	0.52
D	6.30	6.50	6.70
D1	5.30REF		
E1	5.30	5.50	5.70
e	1.27BSC		
L	1.40	1.50	1.60
L1	3.00	3.10	3.30
L2	1.40BSC		
θ	0	—	8°

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