

**180KHz 60V 4A Switching Current Boost LED Constant Current Driver****XL6005****Features**

- Wide 3.6V to 32V Input Voltage Range
- 0.22V FB adjustable LED drive current
- Directly drive 11 Series 1W LED at  $V_{IN} \geq 12V$
- Fixed 180KHz Switching Frequency
- Max. 4A Switching Current Capability
- Up to 94% efficiency
- Excellent line and load regulation
- EN PIN TTL shutdown capability & With PWM Dimming Function
- Internal Optimize Power MOSFET
- Built in Soft-Start Function
- Built in Frequency Compensation
- Built in Thermal Shutdown Function
- Built in Current Limit Function
- Available in TO252-5L package

**General Description**

The XL6005 regulator is fixed frequency PWM Boost (step-up) LED constant current driver, capable of driving Series 1W/3W/5W LED units with excellent line and load regulation. The regulator is simple to use because it includes internal frequency compensation and a fixed-frequency oscillator so that it requires a minimum number of external components to work.

The XL6005 could directly drive 11 Series 1W LED units at  $V_{IN} > 12V$ .

The PWM control circuit is able to adjust the duty ratio linearly from 0 to 95%. An enable function, an over current protection function is built inside. An internal compensation block is built in to minimize external component count.

**Applications**

- LED Lighting
- Boost constant current driver
- Monitor LED Backlighting
- 7' to 15' LCD Panels



Figure1. Package Type of XL6005

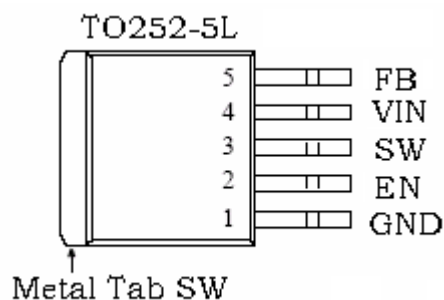
**180KHz 60V 4A Switching Current Boost LED Constant Current Driver****XL6005****Pin Configurations**

Figure2. Pin Configuration of XL6005 (Top View)

Table 1 Pin Description

Pin Number	Pin Name	Description
1	GND	Ground Pin.
2	EN	Enable Pin. Drive EN pin low to turn off the device, drive it high to turn it on. Floating is default high.
3	SW	Power Switch Output Pin (SW).
4	VIN	Supply Voltage Input Pin. XL6005 operates from a 3.6V to 32V DC voltage. Bypass Vin to GND with a suitably large capacitor to eliminate noise on the input.
5	FB	Feedback Pin (FB). The feedback threshold voltage is 0.22V.

## XL6005

The block diagram illustrates the internal architecture of a power management IC. Key components and their connections include:

- Inputs:** VIN (input voltage), EN (enable), FB (feedback), and SW (switch node).
- Regulation and Reference:** A 2.5V Regulator and a 0.22V Reference are connected to VIN. The 0.22V reference is connected to the non-inverting input (+) of the Error Amplifier (EA).
- Control Logic:** The EA output is connected to the inverting input (-) of the Comparator (COMP). The COMP output is connected to the RS Latch.
- Protection and Monitoring:** UVLO (Under Voltage Lockout) is connected to EN. OVP (Over Voltage Protection) and Thermal Shutdown are connected to the SW node. The RS Latch is connected to the Driver and the OCP (Over Current Protection) block.
- Compensation and Timing:** A Phase Compensation block is connected to the EA. An 180KHz Oscillator is connected to the Slop Compensation block, which in turn is connected to the COMP.
- Output Stage:** The Driver is connected to the SW node, which is also connected to the NDMOS transistor. The NDMOS is connected to GND (Ground).

The diagram shows a boost converter circuit. The input voltage is +12V, connected to the VIN pin of the XL6005 IC through a 47uF/16V capacitor (C\_IN). The inductor L (47uh/3A) is connected between VIN and the SW pin. The SW pin is connected to the anode of the diode D1 (SK36). The cathode of D1 is connected to the output capacitor C\_OUT (47uF/50V) and the positive terminal of the LED. The LED is labeled "Series 11 1W LED" and has a current of 350mA. The feedback pin (FB) is connected to the junction between the LED and the output capacitor. The EN pin is shown in an ON state. The formula  $I_{LED} = 0.22 / R_S$  is provided at the bottom right.

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**180KHz 60V 4A Switching Current Boost LED Constant Current Driver****XL6005****Ordering Information**

Order Information	Marking ID	Package Type	Packing Type Supplied As
XL6005E1	XL6005E1	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 <sub>in</sub>	-0.3 to 36	V
Feedback Pin Voltage	V <sub>FB</sub>	-0.3 to V <sub>in</sub>	V
EN Pin Voltage	V <sub>EN</sub>	-0.3 to V <sub>in</sub>	V
Output Switch Pin Voltage	V <sub>Output</sub>	-0.3 to 60	V
Power Dissipation	P <sub>D</sub>	Internally limited	mW
Thermal Resistance (TO252-5L) (Junction to Ambient, No Heatsink, Free Air)	R <sub>JA</sub>	50	°C/W
Operating Junction Temperature	T <sub>J</sub>	-40 to 125	°C
Storage Temperature	T <sub>STG</sub>	-65 to 150	°C
Lead Temperature (Soldering, 10 sec)	T <sub>LEAD</sub>	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.

**180KHz 60V 4A Switching Current Boost LED Constant Current Driver**
**XL6005**
**XL6005 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>						
VFB	Feedback Voltage	$V_{in} = 5V \text{ to } 12V, V_{out}=24V$ $I_{load}=100mA$	209	220	231	mV
Efficiency	$\eta$	$V_{in}=12V, V_{out}=24V$ $I_{out}=1A$	-	92	-	%

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

Parameters	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Input operation voltage	$V_{in}$		3.6		32	V
Shutdown Supply Current	$I_{STBY}$	$V_{EN}=0V$		70	100	uA
Quiescent Supply Current	$I_q$	$V_{EN}=2V,$ $V_{FB}=V_{in}$		2.5	5	mA
Oscillator Frequency	$F_{osc}$		144	180	216	Khz
Switch Current Limit	$I_L$	$V_{FB}=0$		4		A
Output Power NMOS	$R_{dson}$	$V_{in}=12V,$ $I_{SW}=4A$		110	120	mohm
EN Pin Threshold	$V_{EN}$	High (Regulator ON) Low (Regulator OFF)		1.4 0.8		V
EN Pin Input Leakage Current	$I_H$	$V_{EN}=2V$ (ON)		3	10	uA
	$I_L$	$V_{EN}=0V$ (OFF)		3	10	uA
Max. Duty Cycle	$D_{MAX}$	$V_{FB}=0V$		90		%

**180KHz 60V 4A Switching Current Boost LED Constant Current Driver**

**XL6005**

**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	

**Typical System Application for VIN=12V to driver 11 x 1W series LED units**

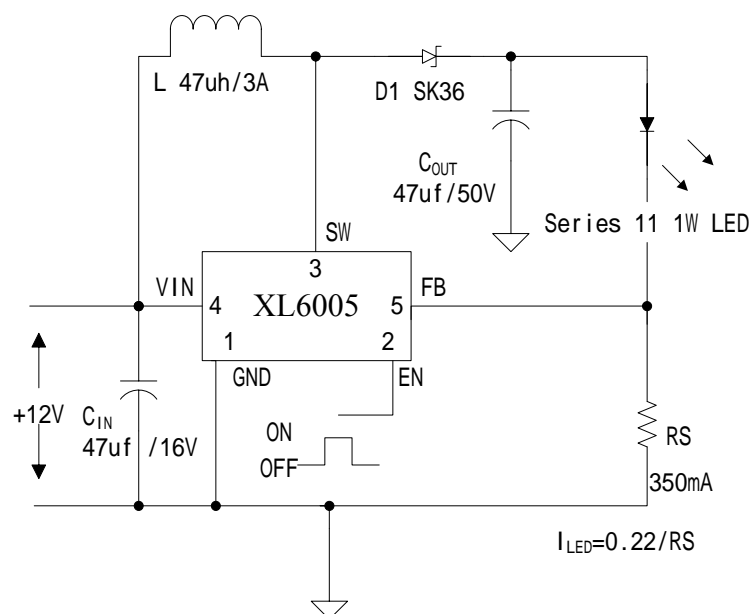


Figure5. XL6005 System Parameters Test Circuit (12V ~11 x 1W LED)

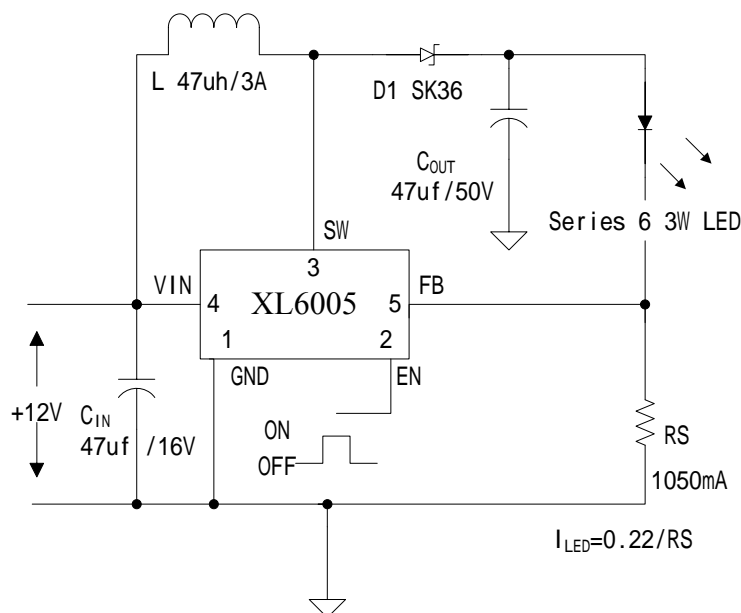
**180KHz 60V 4A Switching Current Boost LED Constant Current Driver****XL6005****Typical System Application for  $V_{IN} \geq 12V$  to driver 6 x 3W series LED units**

Figure6. XL6005 System Parameters Test Circuit (12V ~ 6 x 3W LED)

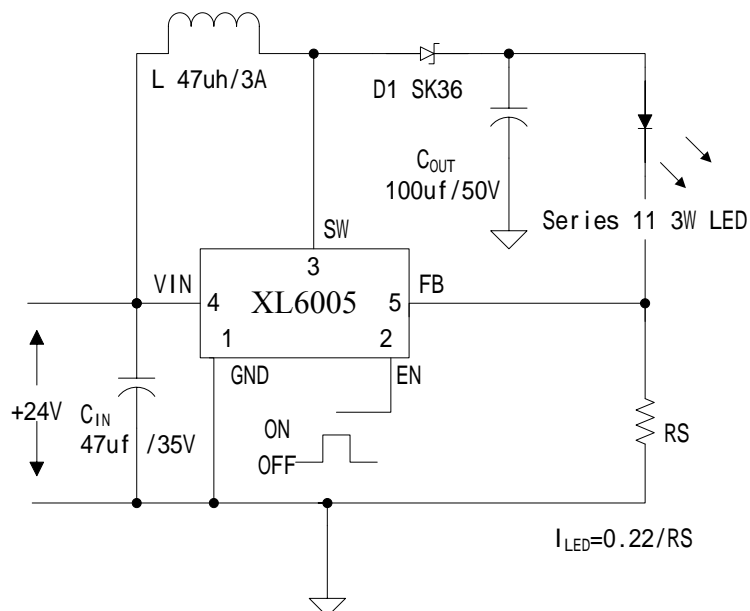
**Typical System Application for  $V_{IN} \geq 24V$  to driver 11 x 3W series LED units**

Figure7. XL6005 System Parameters Test Circuit (24V ~ 11 x 3W LED)

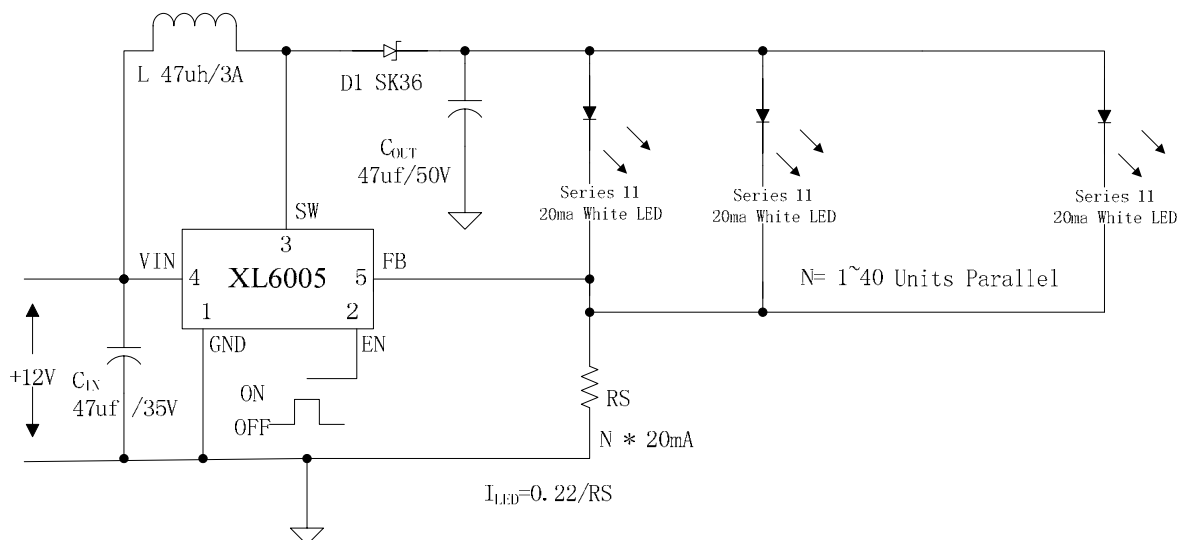
**180KHz 60V 4A Switching Current Boost LED Constant Current Driver**
**XL6005**
**Typical System Application for VIN≥12V to driver 11 series x 40 parallel White LED Array**


Figure8. XL6005 System Parameters Test Circuit (12V ~ 11 x 40 White LED)

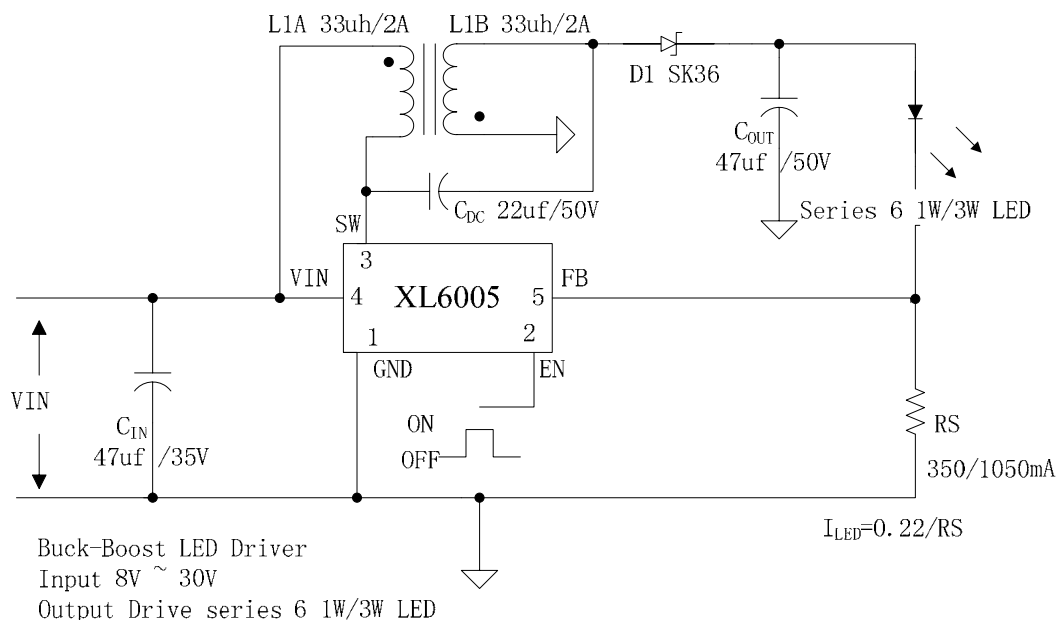
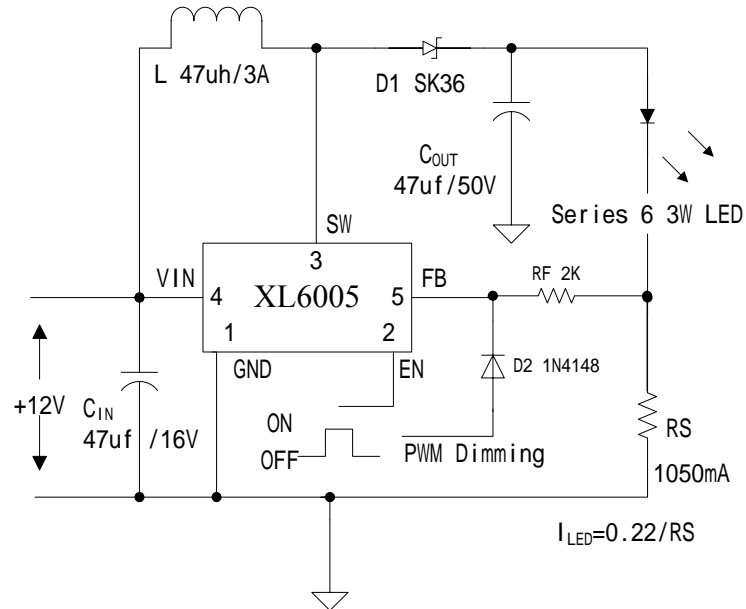
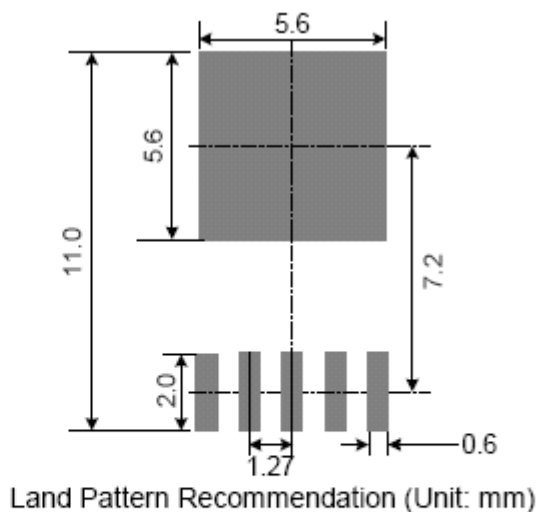
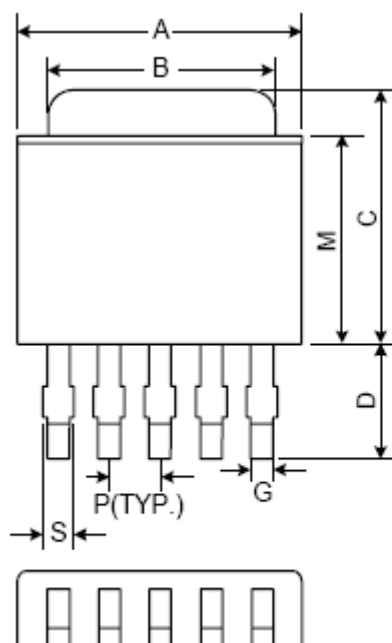
**Typical System Application for SEPIC Buck-Boost LED Driver**


Figure9. XL6005 System Parameters Test Circuit (Buck-Boost LED Driver)



**180KHz 60V 4A Switching Current Boost LED Constant Current Driver****XL6005****Typical System Application for  $V_{IN} \geq 12V$  to driver 6 x 3W series LED units With Dimming Function****Figure10. XL6005 System Parameters Test Circuit (12V ~ 6 x 3W LED with Dimming Function)**

**180KHz 60V 4A Switching Current Boost LED Constant Current Driver**
**XL6005**
**Package Information**
**TO252-5L**


Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	6.35	6.60	6.85	0.250	0.260	0.270
B	5.20	5.35	5.50	0.205	0.211	0.217
C	6.80	7.00	7.30	0.268	0.276	0.287
D	2.20	2.50	2.80	0.087	0.098	0.110
P	1.27 REF.			0.050 REF.		
S	0.50	0.65	0.80	0.020	0.026	0.031
G	0.40	0.50	0.63	0.016	0.020	0.025
H	2.20	2.30	2.40	0.087	0.091	0.094
J	0.45	0.52	0.58	0.018	0.020	0.023
K	0.00	0.08	0.15	0.000	0.003	0.006
L	0.90	1.20	1.63	0.035	0.047	0.064
M	5.40	5.80	6.20	0.213	0.228	0.244