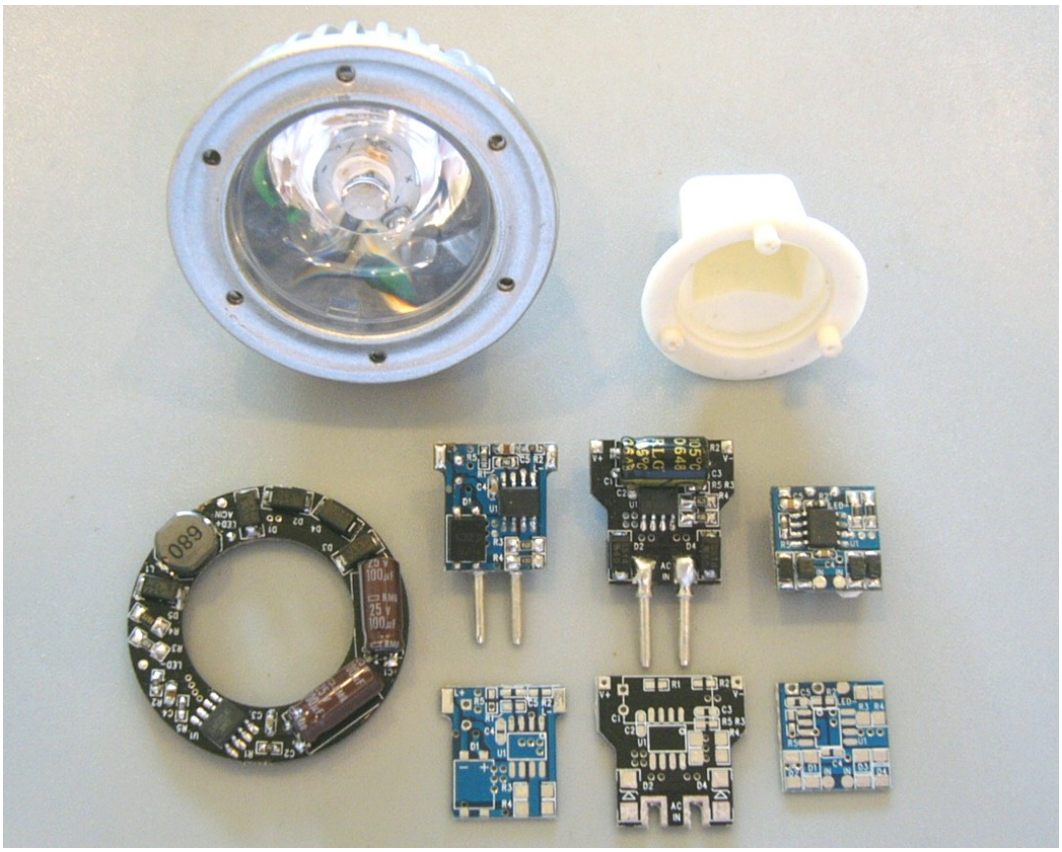
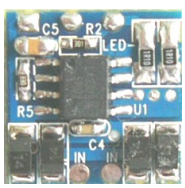
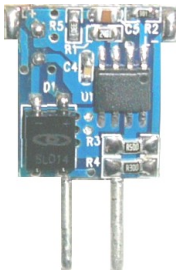
v LA8303 Features

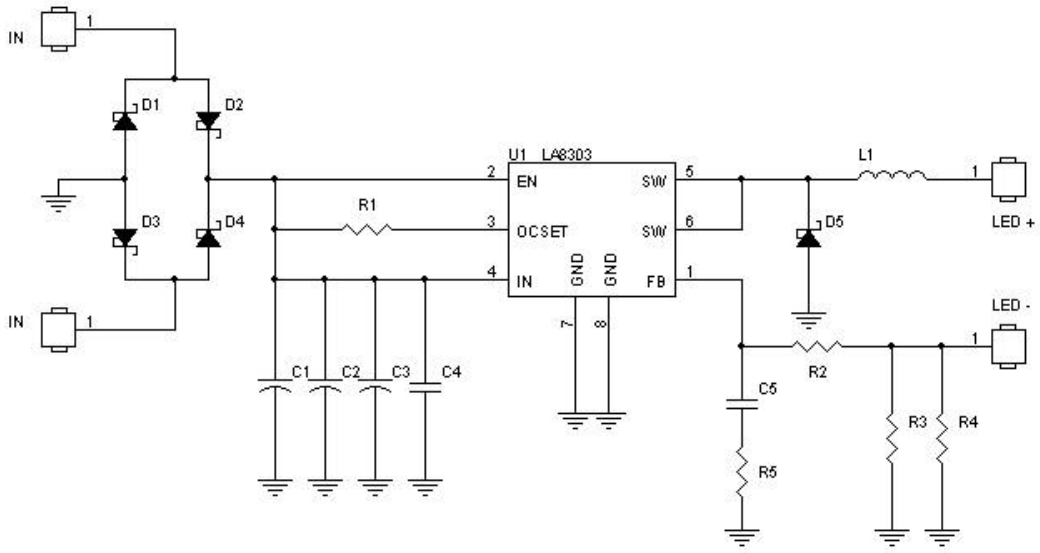
- Low Feedback Voltage 0.21V
- Up to 96% Efficiency
- Wide Operation Voltage from 3.6V to 23V
- Great Output Capability: 2A
- Oscillation Frequency: 300KHz
- Built-in P-channel MOSFET
- 0%~100% Duty Cycle
- External ON/OFF Control Function
- Over Current & Temperature Protection
- SOP-8L Package

v MR-16 Circuit Board Views



EVB_A Top View	EVB_A Bottom View	EVB_A Bottom View	EVB_B Top View	EVB_B Bottom View
				

v MR-16 Evaluation Board Circuit



Ø D1~D4 form a bridge rectifier to make sure the correct electrode into the system, whether the power source is alternating current (AC) or direct current (DC). The best solution is Schottky Diode because the low forward voltage. The package of SOD-123 or SOD-323 is suggestion. If the PCB size is sufficient, the low cost SMA package is also suitable for MR16 application.

The other solution about the bridge rectifier is Schottky Bridge such as D1 of EVB_B. It includes four Schottky Diodes, and suitable for space-saving MR16 application because the smaller dimension.

Ø C1~C3 are the input filter capacitors those transfer the pulsating DC to stabilized DC. The C1 and C2 are reserved for 7.3x4.3mm tantalum capacitors; C3 is reserved for Φ5 or Φ6.3 electrolytic capacitor.

Do not mount both tantalum capacitor and electrolytic capacitor at the same time, either one is suggested for this board.

The input capacitance is very important especially for ACIN. Because the smaller capacitance maybe causes the minimum input voltage lower than the LED forward voltage. It will reduce the LED average current and illumination.

The following capacitances are suggestion to attain the expectative LED current:

LED String	1W x 1	1W x 2	1W x 3	3W x 1	3W x 2	5W x 1
Cap. (Min.)	100uF	200uF	470uF	200uF	300uF	300uF

The tantalum capacitors are suitable for space-saving MR16 application because the smaller dimension and the larger capacitance. But the unit price is more expensive than the electrolytic capacitors.

The electrolytic capacitor's operating temperature and rating ripple current are important. Choose the electrolytic capacitor with 105°C operating temperature, and the rating ripple current higher than LED average current x 50% to extend the life time.

The other key parameter is the capacitor's rating voltage. Choose the tantalum capacitor with 20V rating voltage, or electrolytic capacitor with 25V rating voltage is recommended.

- C4 is the filter capacitor that by-pass the high frequency noise. Choose a ceramic capacitor with 0.1uF / 25V / X5R, and keep it as close as possible to U1.

- R1 is the current limit setting resistor that can be calculated by the following formula:
  I_{LIMIT} = R1 x 0.0005

- C5, R2, and R5 form the feedback compensation network. Please see the Bill of Materials as below to choose the suitable value.

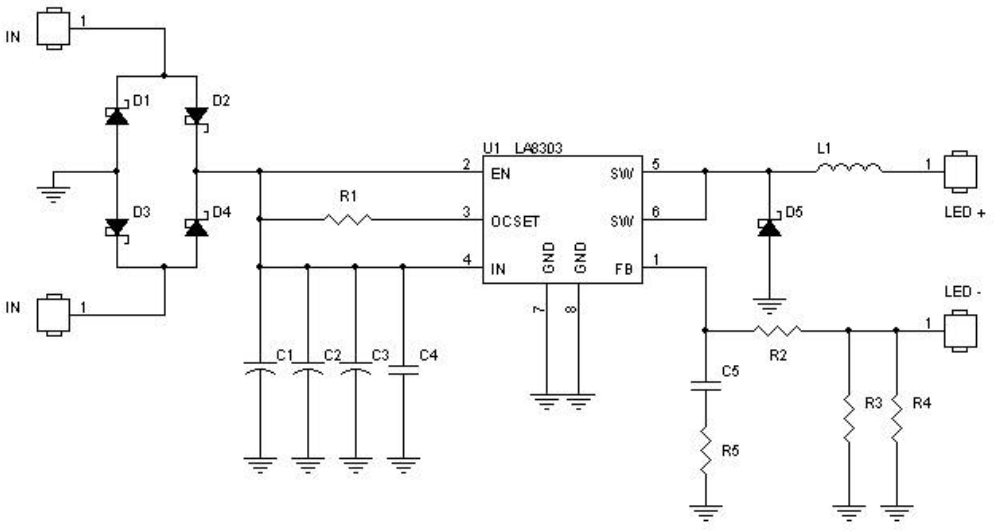
- D5 is the rectifier diode that provides a current path for the inductor current when the internal power switch of the converter turns off. The best solution is Schottky Diode because the low forward voltage and the fast reverse recovery time. The package of SOD-123 or SOD-323 is suggestion. If the PCB size is sufficient, the low cost SMA package is also suitable for MR16 application.
  (The designation of this part on the EVB_B is D2.)

- L1 is the power inductor. Choose the larger inductance will reduce the LED peak-peak current to extend LED life time. The SMD 0503/0504 power inductor is suggestion. If the LED average current more than 700mA, choose the SMD 0703/0705 power inductor to dissipate the heat. Make sure the inductor rating current higher than the LED peak current to prevent the saturation. More inductor selection, please see the Bill of Materials as below.

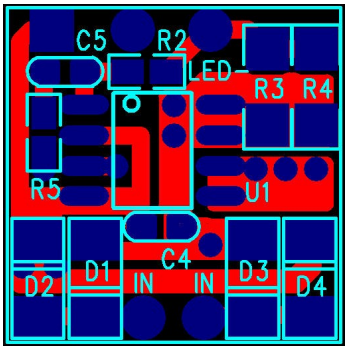
- R3 is the LED current setting resistor. R4 is reserved for share power dissipation with R3. The LED average current can be calculated by the following formula:
  I_{LED}=0.21V / (R3//R4)
  Choose 1% resistor to attain the best current accuracy.

V Bill of Materials

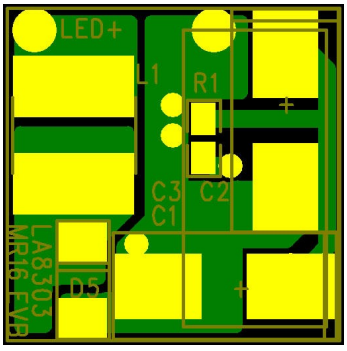
LED / Item	1W x 1	1W x 2	1W x 3	3W x 1	3W x 2	5W x 1
U1	LA8303 Step-Down LED Driver					
L1	SMD 0503 L ≥ 100uH I_{SAT} ≥ 0.4A	SMD 0503 L ≥ 47uH I_{SAT} ≥ 0.4A	SMD 0503 L ≥ 47uH I_{SAT} ≥ 0.4A	SMD 0705 L ≥ 68uH I_{SAT} ≥ 0.8A	SMD 0705 L ≥ 47uH I_{SAT} ≥ 0.8A	SMD 0705 L ≥ 33uH I_{SAT} ≥ 1.1A
D1~D5	(EVB_A) 1A 40V Schottky Diode, SOD-123 (M-Type) or SOD-323 (N-Type) (EVB_B) D1: 1A 40V Schottky Bridge Diode D2: 1A 40V Schottky Diode					
C1	NC	NC	Tantalum Cap 150uF / 20V	NC	Tantalum Cap 150uF / 20V	Tantalum Cap 150uF / 20V
C2	NC	NC	Tantalum Cap 150uF / 20V	NC	Tantalum Cap 150uF / 20V	Tantalum Cap 150uF / 20V
C3	Electrolytic Cap. 100uF / 25V	Electrolytic Cap. 220uF / 25V	NC	Electrolytic Cap. 220uF / 25V	NC	NC
C4	SMD Capacitor 0.1uF 0603 X5R					
C5	SMD Capacitor 150nF 0603 X5R	SMD Capacitor 220nF 0603 X5R				
R1	SMD Resistor 2.4KΩ 0603 5%					
R2	SMD Resistor 220Ω 0603 1%	SMD Resistor 300Ω 0603 1%				
R3	SMD Resistor 0.6Ω 0805 1%			SMD Resistor 0.3Ω 1206 1%		SMD Resistor 0.4Ω 1206 1%
R4	NC	NC	NC	NC	NC	SMD Resistor 0.4Ω 1206 1%
R5	SMD Resistor 27Ω 0603 1%	SMD Resistor 33Ω 0603 1%				



v MR-16 Evaluation Board Layout

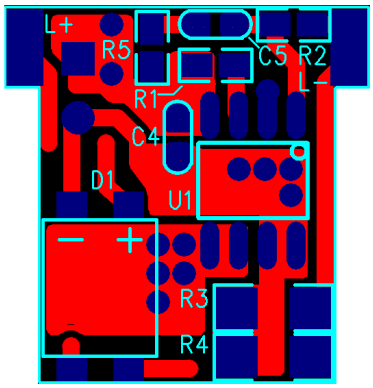


EVB_A
(Top View)

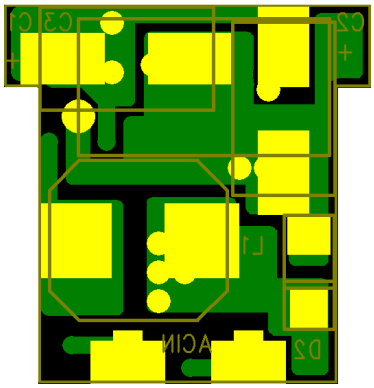


EVB_A
(Bottom View)

Board Size
1.4cm x 1.4cm



EVB_B
(Top View)



EVB_B
(Bottom View)

Board Size
1.6cm x 1.6cm

- The feedback path that consists of LED (-), R3 (and R4), R2, C5, R5, and the pin1 of U1 should be kept noisy traces away; also keep it separate using grounded copper to prevent noise interference.

- The power charge and discharge path those consists of D1~D5, C1~C3, U1, R3 (and R4), and L1 should be kept wide and as short as possible. Use 1oz / 30mil copper or more is suggestion.

- Due to the limited space of MR16 and LED is next to the board, the heat dissipation will be a key factor to consider when design in. The pin 5~8 of U1 must be coppered on double side and make sure the copper area is big enough to dissipate the heat. Thermal via can be used when it is a necessary. Choose several 12mil vias to connect in parallel is suggestion.

- The location of the (-) plates of D5(EVB_A) and D2(EVB_B) must be close to the (-) plates of C1~C3 to reduce ground bounce and EMI.

v Performance

Ø The LED average current, efficiency and IC temperature are recommended for different applications as below:

LED String	1W x 1 C_{IN}=100uF	1W x 2 C_{IN}=200uF	1W x 3 C_{IN}=300uF	3W x 1 C_{IN}=200uF	3W x 2 C_{IN}=300uF	5W x 1 C_{IN}=300uF
LED Current at DC12V_{IN} (DC Power Source)	354mA	350mA	344mA	701mA	698mA	995mA
LED Current at AC12V_{IN} (AC Power Source)	354mA	349mA	347mA	700mA	700mA	997mA
LED Current at AC12V_{IN} (Electronic Transformer)	348mA	335mA	245mA	698mA	630mA	966mA
Efficiency	81%	87%	91%	81%	86%	81%
IC Temperature (T_A=26˚C)	50˚C	51˚C	52˚C	56˚C	58˚C	73˚C

Ø When the electronic transformer is inputted at AC12V, the LED average current will be declined depends on varied input capacitance as below:

LED String	1W x 1 I_{LED}=350mA	1W x 2 I_{LED}=350mA	1W x 3 I_{LED}=350mA	3W x 1 I_{LED}=700mA	3W x 2 I_{LED}=700mA	5W x 1 I_{LED}=1A
C_{IN}=47uF	10%~15%	35%~40%	55%~60%	15%~20%	40%~45%	20%~25%
C_{IN}=100uF	<1%	20%~25%	45%~50%	10%~15%	30%~35%	15%~20%
C_{IN}=150uF	<1%	10%~15%	35%~40%	<5%	20%~25%	10%~15%
C_{IN}=200uF	<1%	<5%	30%~35%	<1%	15%~20%	5%~10%
C_{IN}=300uF	<1%	<1%	25%~30%	<1%	5%~10%	<5%
C_{IN}=470uF	<1%	<1%	<5%	<1%	<1%	<1%

v Key Component Supplier

Item	Manufacturer	Website	Manufacturer	Website
Inductor	Chilisin	www.chilisin.com.tw	WE	www.we-online.com
Schottky Diode	Formosa	www.formosams.com	Gulf	www.gulfsemi.com
Tantalum Capacitor	Kemet	www.kemet.com		
Electrolytic Capacitor	NCC	www.chemi-con.co.jp	Jamicon	www.jamicon.com.tw
SMD Capacitor	Yageo	www.yageo.com	Taiyo Yuden	www.yuden.co.jp
SMD Resistor	Yageo	www.yageo.com		

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