IS31LT3352 MR16 DEMO Board Guide

Description

The IS31LT3352 is a continuous mode inductive step-down converter, designed to efficiently drive a single or multiple LEDs connected in series from a voltage source higher than the total LED voltage. The device can operate with an input voltage of 6V to 40V and generate an output current of up to 750mA for a total of 30W.

The IS31LT3352 includes an integrated output switch and a high-side output current sensing circuit. An external resistor is used to set the output current. It also integrates a temperature compensation function in order to maintain stable and reliable operation of the LEDs'. The IS31LT3352 monitors the ambient temperature near the LEDs with an external Negative Temperature Coefficient (NTC) thermistor mounted close to LEDs. The output current is automatically reduced if the ambient temperature exceeds the resistance threshold value set at RTH pin. The current will return to the set value once the ambient temperature goes below the threshold.

The IS31LT3352 can be connected in a serial chain all using the same temperature compensation percentage. In this chain, the device ADJO output pin will drive the next IS31LT3352's ADJI input pin with the temperature compensation information. For this configuration a single thermistor is required.

The IS31LT3352 MR16 DEMO board is designed for an MR16 lamp.

Features

- ✓ Simple low parts count
- ✓ Internal 40V power switch
- ✓ Wide input voltage range: 6V to 40V
- ✓ Up to 750mA output current
- ✓ High efficiency (up to 95%)
- ✓ 1200:1 dimming rate
- ✓ Typical 5% output current accuracy
- ✓ Single pin on/off and brightness control using DC voltage or PWM
- ✓ Up to 1MHz switching frequency
- ✓ Inherent open-circuit LED protection
- ✓ Thermal shutdown to protect IC itself
- ✓ Temperature compensation to protect LEDs

Quick Start

Recommended Equipment

- ✓ 30VDC Power supply
- ✓ LED panel (1W LED, 3 LEDs in series)
- ✓ Multi-meter

Recommended Input and Output Ratings

- ✓ Input: 12-24VDC or 12VAC
- ✓ Output: 1-3 LEDs in series/333mA

Note: The input voltage must be at least 2V higher than the output voltage (total Vf).

Absolute Maximum Ratings

- ✓ Input voltage ≤ 25VDC

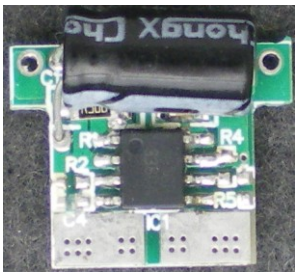
Caution: Do not exceed the conditions listed above, otherwise the board will be damaged.

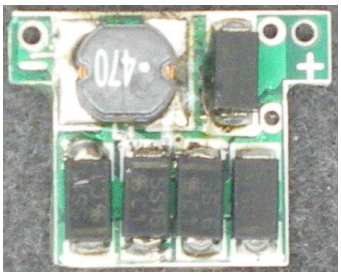
Procedure

The IS31LT3352 DEMO Board is fully assembled and tested. Follow the steps listed below to verify board operation.

Caution: Do not turn on the power supply until all connections are completed.

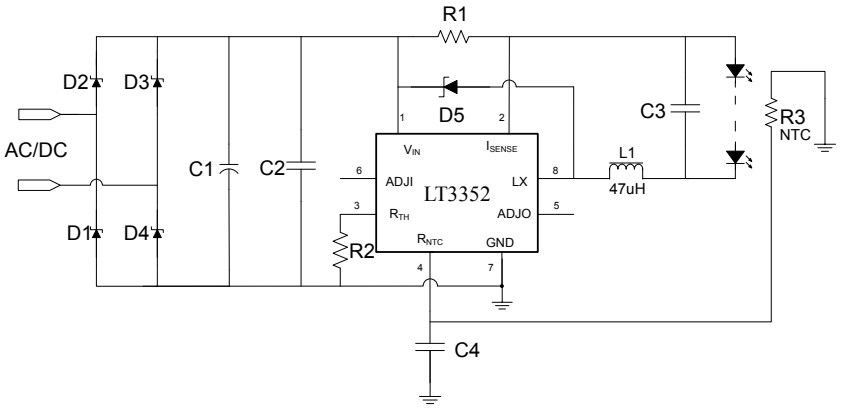
1) Connect the terminals of the power supply to the AC1 and AC2 pin.
2) Connect the Cathode (-) of the LED panel (LED arrays) to the EVB (-) terminal.
3) Connect the Anode (+) of the LED panel (LED arrays) to the EVB (+) terminal.
4) Turn on the power supply and the LED panel (LED arrays) will light.





Bill of Materials

No.	Name	Description	Ref Des.	Qty.	Mfr
1	AL Capacitor	220uF±10%,25V	C1	1	
2	SMD Capacitor	100nF±20%,50V,0805	C2,C4	2	
3	SMD Capacitor	1uF±10%,50V,0805	C3	1	
4	SMD Resistor	0.3Ω±1%,0805	R1	1	
5	SMD Resistor	75KΩ±1%,0603	R2	1	
6	NTC Resistor	NTC,100K,B=4050	R3	1	
7	SMD Resistor	NC	R4,R5	2	
8	Schottky Diode	SS16,1A,60V,SMA	D1-D5	5	
9	SMD Inductor	47uH,Isat≥600mA	L1	1	
10	IC1	IS31LT3352,SOP8	U1	1	ISSI



R2	temperature compensation point
75KΩ	31ºC
33KΩ	51ºC
20KΩ	65ºC

Figure 1 IS31LT3352 MR16 DEMO Board Schematic

Detailed Description

LED Current Control

The LED(s) output current is determined by the value of the external current sense resistor (R1) connected between V_{IN} and I_{SENSE} and is calculated by:

$$I_{OUT\ nom} = 0.1/R1\ [for\ R1>0.13\Omega]$$

The table below lists examples of output current values for various current set resistors (R1):

R1 (Ω)	Output current (mA)
0.13	769
0.15	667
0.27	370
0.3	333

The above values assume the ADJ pin is left floating at a nominal voltage of V_{REF} =1.2V.
Note that R1=0.13Ω is the minimum allowed value of sense resistor in order to maintain the switch current below the maximum allowable current.

Inductor selection

Recommended inductor values are in the range of 47μH to 220μH. The higher inductor values are recommended for higher supply voltages and low output currents in order to minimize variation in output current over the supply voltage range. Higher inductance values also minimize errors due to switching delays, which cause increased ripple and lower efficiency. The inductor should be mounted as close to LX pin as possible.

Temperature compensation of output current

High luminance LEDs often need to be supplied with a temperature compensated current in order to maintain stable and reliable operation at all drive levels. The LEDs are usually mounted remotely from the chip. If output current compensation is required, it is possible to use an external temperature sensing network - normally using Negative Temperature Coefficient (NTC) thermistors and/or diodes, mounted very close to the LED(s). The output of the sensing network can reduce output current as the monitored LED temperature increases.
As shown in Figure 2, temperature compensation is decided by NTC thermistor R3 and resistor R2. When the LED(s) temperature increases, thermistor resistance of R3 starts to decrease. The temperature compensation function is enabled once the NTC (R3) resistance decreases to the point that the total resistance (R3 + R4) equals the resistance of R2.
The equation for Iout current with temperature compensation is:

In the case that 0.3< VADJI <1.2V:

$$I_{OUTdc} = 0.083*V_{ADJI}(R3+R4)/R3*R2$$

In the case that VADJI >1.2V:

$$I_{OUTdc} = 0.1*(R3+R4)/R2*R1$$

R3 and R4 decide the temperature compensation slope, if R4 is 0Ω, the slope is decided by thermistor R3's parameter B-constant. A larger R4 resistance helps to smooth out the slope.
Large R3 and R4 resistor values will require a larger R2 to match and vice versa. Too large resistance value for R2 will make the Rth pin more sensitive to noise, too small R4 resistance will increase IC current consumption. An R2 resistance value of between 1K to 100K is recommended.

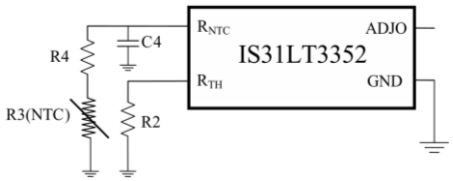


Figure 2 IS31LT3352 Temperature Compensation

An IS31LT3352 calculator is available from the ISSI to assist with temperature compensation design.

PCB Layout

NOTE: Physical dimensions are (L x W x H): 18mm x 14mm x 10mm

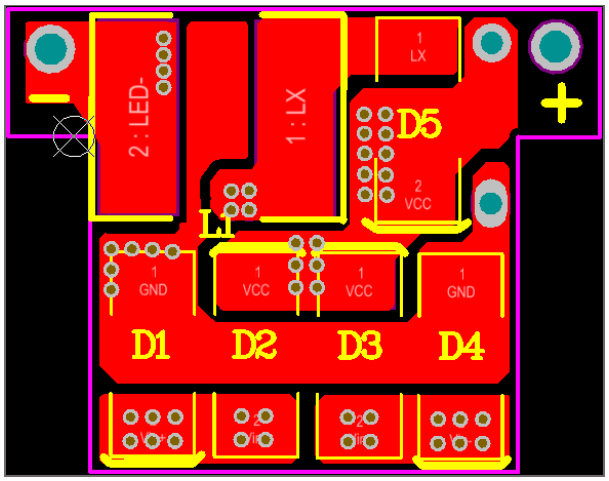


Figure 2 PCB Layout-Top Layer

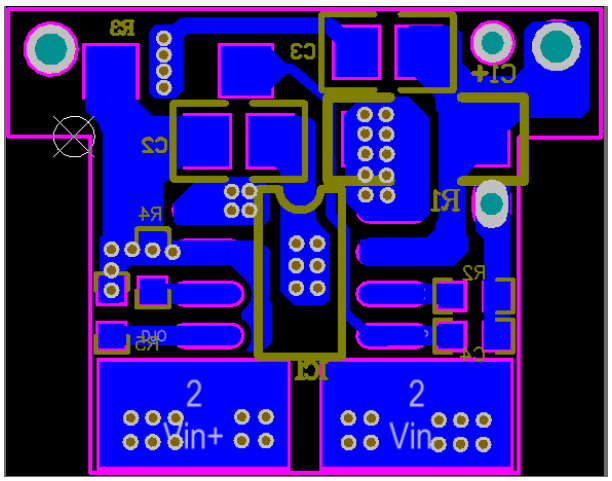


Figure 3 PCB Layout-Bottom Layer

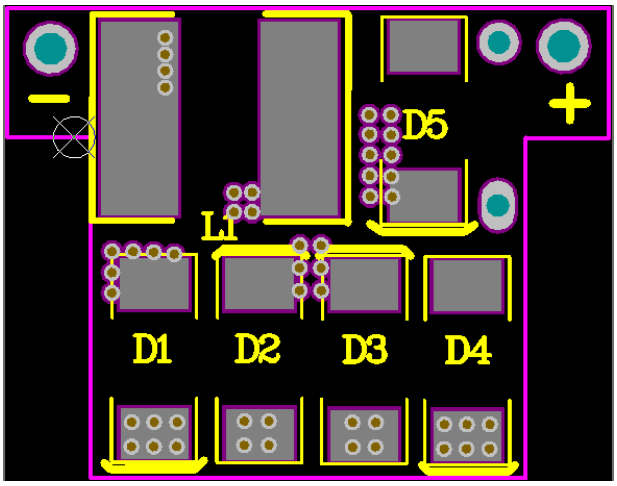


Figure 4 Component Placement Guide -Top Layer

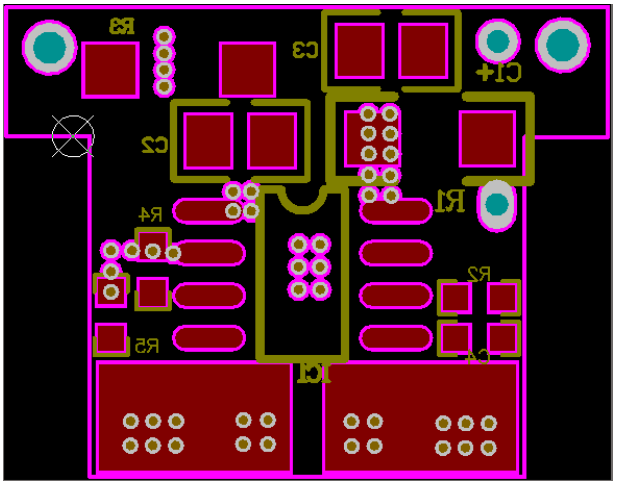


Figure 5 Component Placement Guide -Bottom Layer

Revision History

Date	Revision	Changes
2012.03.06	R1.0	Initial release
2012.04.12	R1.1	1. BOM: Add Cap tolerance value. 2. BOM: NTC B=3950 change to B=4050. 3. Change the temperature compensation point in the schematic table.