

## RT4532 Evaluation Board

### ***Purpose***

The RT4532 is a high-efficiency LED driver for backlight applications with an internal schottky diode and current source driver.

It supports linear mappings with 256 steps to setup the brightness of backlight LEDs. It also supports PWM dimming to adjust the brightness. This document explains the function and use of the RT4532 evaluation board (EVB) and provides information to enable operation and modification of the evaluation board and circuit to suit individual requirements.

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## Introduction

### General Product Information

The RT4532 is a high-efficiency LED driver for backlight applications. An asynchronous boost converter with an internal Schottky diode and a current source driver are designed to support 6LED/channel with wide input voltage range from 2.5V to 5.5V.

This document explains the function and use of the RT4532 evaluation board (EVB) and provides information to enable operation and modification of the evaluation board and circuit to suit individual requirements.

### Product Feature

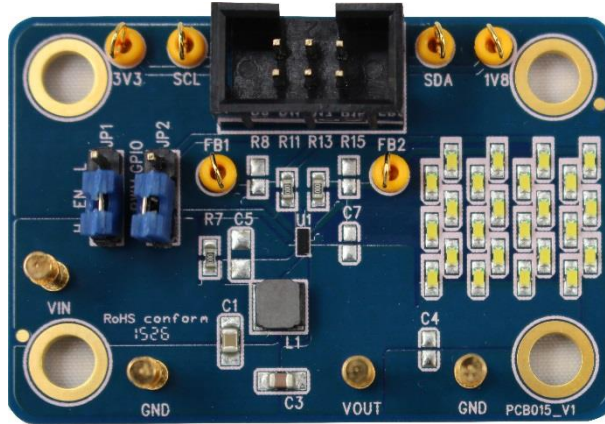
- Input Voltage Range : 2.5V to 5.5V
- Internal Schottky Diode
- Fast-speed mode I<sup>2</sup>C Compatible Interface
- Drive Up to 6 WLEDs in 4 String
- External PWM Brightness Control
- 550k/1.1MHz Switching Frequency
- Built-in Internal Soft-Start
- I<sup>2</sup>C Programmable 256 Steps Linear Current Regulation
- Up to 85% Efficiency with Small Magnetics
- Programmable 16V/24V OVP
- Current Accuracy  $\pm 5\%$  and Current Balance  $\pm 3\%$
- UVLO, OVP, OCP, OTP Protection
- Shutdown Current :  $< 1\mu\text{A}$
- Temperature Range :  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$

### Key Performance Summary Table

Key Features		Evaluation Board Number: PCB015_V1
Default Input Voltage	2.5V~5.5V	
Max Output Current	20mA/40mA	
Default Output Voltage	17V	
Default Marking & Package Type	RT4532	
Operation Frequency	Steady 1.1MHz at all loads	
Protection	UVLO OVP OCP Thermal Shutdown	

## Bench Test Setup Conditions

### Headers Description and Placement



Please carefully inspect the EVB IC and external components, comparing them to the following Bill of Materials, to ensure that all components are installed and undamaged. If any components are missing or damaged during transportation, please contact the distributor or send e-mail to [evb\\_service@richtek.com](mailto:evb_service@richtek.com)

### Test Points

The EVB is provided with the test points and pin names listed in the table below.

Pin No.	Pin Name	Comment (expected waveforms or voltage levels on test points)
<b>A2</b>	GND	Ground.
<b>B1</b>	VOUT	Power Output of the Asynchronous Boost Converter for Backlight LEDs. Connect a 1 $\mu$ F or larger ceramic capacitor from VOUT to ground.
<b>B2</b>	VIN	Power Input. Connect this pin to the input power supply voltage. Connect a 10 $\mu$ F or larger ceramic capacitor from the VIN to ground.
<b>C1</b>	PWM	PWM Dimming Input for Backlight LED.
<b>C2</b>	EN	Enable Control Input (Active High). The chip is in shutdown mode when the EN pin is low.
<b>D1</b>	SDA	I <sup>2</sup> C Serial Data Input/Output. An external pull-up resistor is required.
<b>D2</b>	SCL	I <sup>2</sup> C Serial Data Input/Output. An external pull-up resistor is required.
<b>E1</b>	FB2	Single Output 2 for Backlight LED.
<b>E2</b>	FB1	Single Output 1 for Backlight LED.

### Power-up & Measurement Procedure

1. Apply 3.6V nominal input power supply ( $2.5V < V_{IN} < 5.5V$ ) to the VIN and GND terminals.
2. The EN voltage is pulled to logic high by internal circuit to enable operation. Drive EN high ( $>1.05V$ ) to enable operation or low ( $<0.4V$ ) to disable operation. Pull EN pin to High pin that make EN voltage equal to VIN.
3. There is a 2-pin header JP2 "EN" for enable control. To use a jumper at "H" option to tie EN test pin to input power VIN for enabling the device. Inversely, to use a jumper at "L" option to tie EN test pin and ground GND for disabling the device.
4. The JP4 is the I<sup>2</sup>C control pin that includ SDA, SCL, GND pin, and it need to connect to Richtek WrenBoard when use the RT4532 I<sup>2</sup>C dimming.
5. The I<sub>LED</sub> setting supports I<sup>2</sup>C dimming and PWM dimming as below.

## Output I<sub>LED</sub> Setting

### 1. Linear Brightness Dimming

The chip is built-in an I<sup>2</sup>C 8-bit resolution brightness control with maximum 20mA/40mA selection. Reg0x02 <3> corresponds to full-scale LED current control. Reg0x04 <7:0> sets 8bits resolution brightness dimming control.

$$I_{LED} = \frac{\text{Code}}{255} \times I_{LED, Full}$$

Where

I<sub>LED, Full</sub> : the full-scale LED current set by Reg0x02 <3>.

Code : the 8bit brightness code Reg0x04 <7:0> programmed by I<sup>2</sup>C interface.

### 2. PWM Brightness Dimming

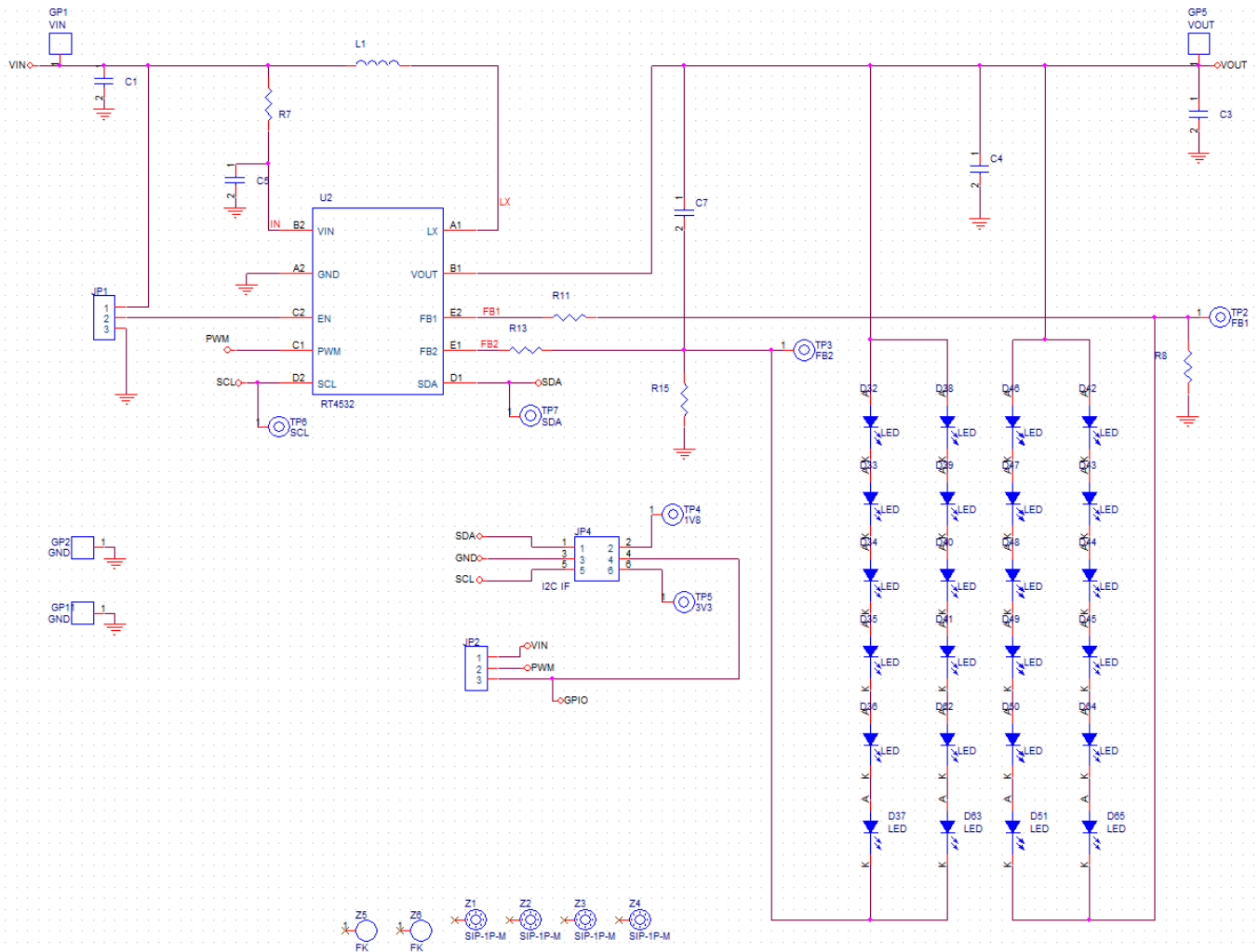
Besides programmable built-in I<sup>2</sup>C backlight LED current control, the RT4532 features a built-in PWM dimming current control by setting Reg0x02 <6> to 1, offering a linear current dimming by external clock source. In order to guarantee the PWM dimming resolution (7 bit at > 15kHz application), recommending dimming frequency have to be operated at range of 400Hz to 20kHz.

### 3. LED Short Protection

LED short protection prevents abnormal connection to cause IC damage avoiding FB1/FB2 connecting power supply. And, If unbalanced LEDs series (cause FB1 or FB2 > 9.6V) is different between channel1 and channel2, IC will also occur LED short event. As LED short event occur more than deglitch time 2ms, IC will shut-down latch until IC is reset by EN pin.

**Schematic, Bill of Materials & Board Layout**

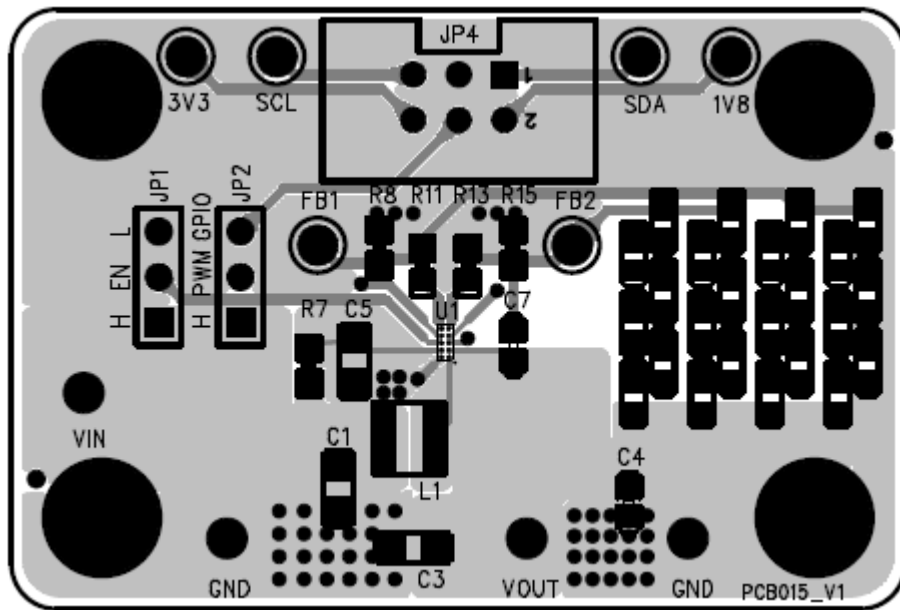
**EVB Schematic Diagram**



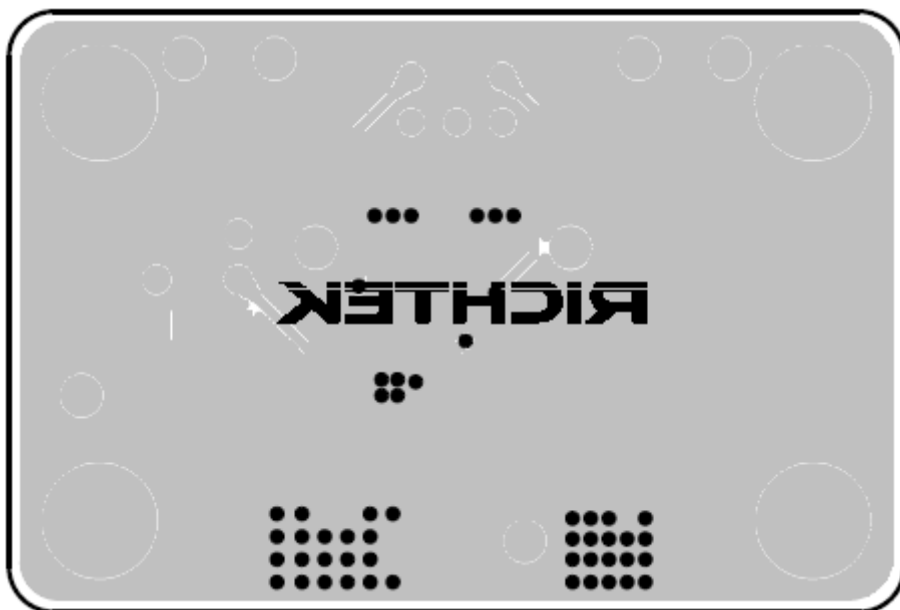
**Bill of Materials**

Reference	Qty	Part Number	Description	Package	Manufacture
<b>U2</b>	1	RT4532	DC-DC Converter	CSP-10B 0.87x2.07	RICHTEK
<b>L1</b>	1	NR4018T100M	10 $\mu$ H/1.2A/ $\pm$ 20%, DCR = 0.18 $\Omega$ , Inductor	4mm x 4mm x 1.8mm	TAIYO YUDEN
<b>C1</b>	1	0603X106M6R3	10 $\mu$ F/ $\pm$ 20%/ 6.3V/X5R Ceramic Capacitor	0603	WALSIN
<b>C3</b>	1	C2012X7R1H105KT	1 $\mu$ F/ $\pm$ 10%/50V/X7R Ceramic Capacitor	0805	TDK
<b>R7</b>	1		Short		
<b>R11</b>	1		Short		
<b>R13</b>	1		Short		
<b>D32, D34, D36, D33, D35, D37, D38, D40, D62, D39, D41, D63, D46, D48, D50, D47, D49, D51, D42, D44, D64, D43, D45, D65</b>	24		LED		
<b>TP</b>	6	3V3, SCL, SDA, 1V8, FB1, FB2	Test Pin		
<b>GP</b>	4	VIN, GND, GND, VOUT	Golden Pin		
<b>JP</b>	3	JP1, JP2, JP4			

**EVB Layout**



PCB Layout—Top View



PCB Layout—Bottom Side

### ***More Information***

For more information, please find the related datasheet or application notes from Richtek website <http://www.richtek.com>.

### ***Important Notice for Richtek Evaluation Board***

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