APPLICATION NOTE

ESP32-C3-WIZ2012 for RGB + TW (Tunable White) LED Lamp

REVISION HISTORY

Version	Revision Date	Editor	Revision summary
1.0	2021-06-08	Jacky	Initial release
1.1	2021-06-17	Jacky	Update operating current, Bluetooth protocols version, thermal consideration and remove the under voltage reset
1.2	2021-07-22	Jacky	Update Bluetooth protocols version
1.3	2022-03-03	Jacky	Add Power up and Reset Timing

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1. OVERVIEW

ESP32-C3-WIZ2012 is an embedded Dual mode (Wi-Fi + BT) module with a built-in SMD chip antenna. The core of the module is an ESP32-C3 chip. The WiZ firmware embedded inside the module enabled smart lighting control via WiZ system. ESP32-C3-WIZ2012 module provides five PWM output channels for LED control and one auxiliary GPIO.

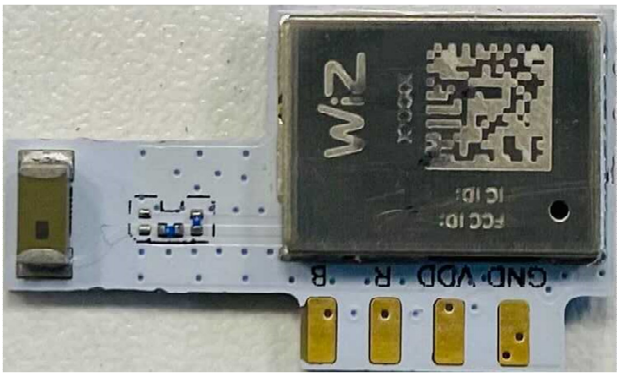


Fig. 1: Wi-Fi Module appearance

2. SPECIFICATIONS

Categories	Items	Specifications
Hardware	Operating Voltage	Min. 3.0VDC, Max. 3.6VDC
	Operating Current	Avg. 84mA, Max. 500mA
	Operating Temperature	-40°C ~ 105°C
	Size	20 x 12 x 3.4mm
	Interfaces	5 x PWM, 1 x GPIO
	Dimming Control	PWM @ 200Hz, Logic level
Wi-Fi	Protocols	802.11 b/g/n, WPA2
	Frequency	2.4 GHz
Bluetooth	Protocols	Bluetooth LE: Bluetooth 5, Bluetooth mesh (under development)
Software	Encryption	Wi-Fi: WPA2 TCP: TLS1.2
	Network protocols	IPv4, TCP/UDP, HTTPS, MQTT
	Upgrade	Automated and transparent, from Cloud
	User control	Smart application, cloud control, Wi-Fi remote, motion sensors, voice control (Amazon Alexa, Google Home, etc)

3. DESCRIPTION

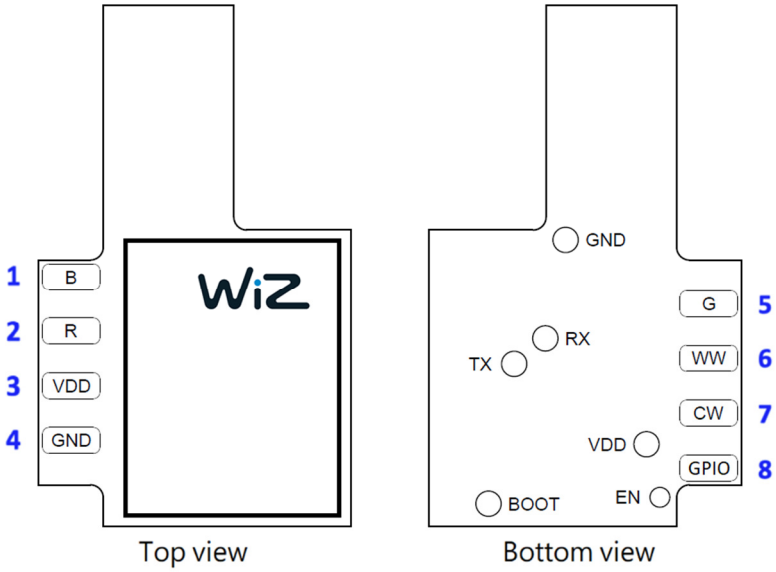


Fig. 2: Pins layout

Pin Number	Pin Name	Function Description – RGB + TW configuration	
		RGB + TW (CCT/DIM) (ref.: ESP24_SHRGBC_01)	RGB + TW (CW/WW) (ref.: ESP24_SHRGB_01)
1	B (IO5)	PWM output for Blue LED	
2	R (IO6)	PWM output for Red LED	
3	VDD	Power input for the module 3.3V	
4	GND	Power Ground	
5	G (IO4)	PWM output for Green LED	
6	WW (IO7)	PWM output for CCT control	PWM output for WW LED
7	CW (IO10)	PWM output for DIM control	PWM output for CW LED
8	GPIO (IO18)	Auxiliary GPIO	

Pin Number	Pin Name	Function Description – TW & DW configuration		
		TW (CCT/DIM) (ref.: ESP24_SHTWC_01)	TW (CW/WW) (ref.: ESP24_SHTW_01)	DW (ref.: ESP24_SHDW_01)
1	B (IO5)	Not used		
2	R (IO6)	Not used		
3	VDD	Power input for the module 3.3V		
4	GND	Power Ground		
5	G (IO4)	Not used		
6	WW (IO7)	PWM output for CCT control	PWM output for WW LED	Not used
7	CW (IO10)	PWM output for DIM control	PWM output for CW LED	PWM output for LED
8	GPIO (IO18)	Auxiliary GPIO		

4. FUNCTIONAL DESCRIPTION

4.1 Hardware construction

The RGB+TW LED Lamp consist of 4 main components, AC/DC Power Supply, Wi-Fi module, LED Driver and LED Array. The AC/DC power source should provide DC high voltage for the supply of LED driver and LED arrays, and DC 3.3V for supply the Wi-Fi module. The Wi-Fi module is required supply 3.3V and the maximum current is 500mA. The AC/DC power supply should be enough current supply to the Wi-Fi module. LED Driver should provide the power to the LED arrays and accept the PWM signal to control the LED dimming. LED arrays are included CW, WW and RGB LED, in general the LEDs should be mounted on the metal PCB to increase the heat dissipation. The block diagram below shows the construction of RGB+TW LED Lamp. For the reference schematic, please see section 9.

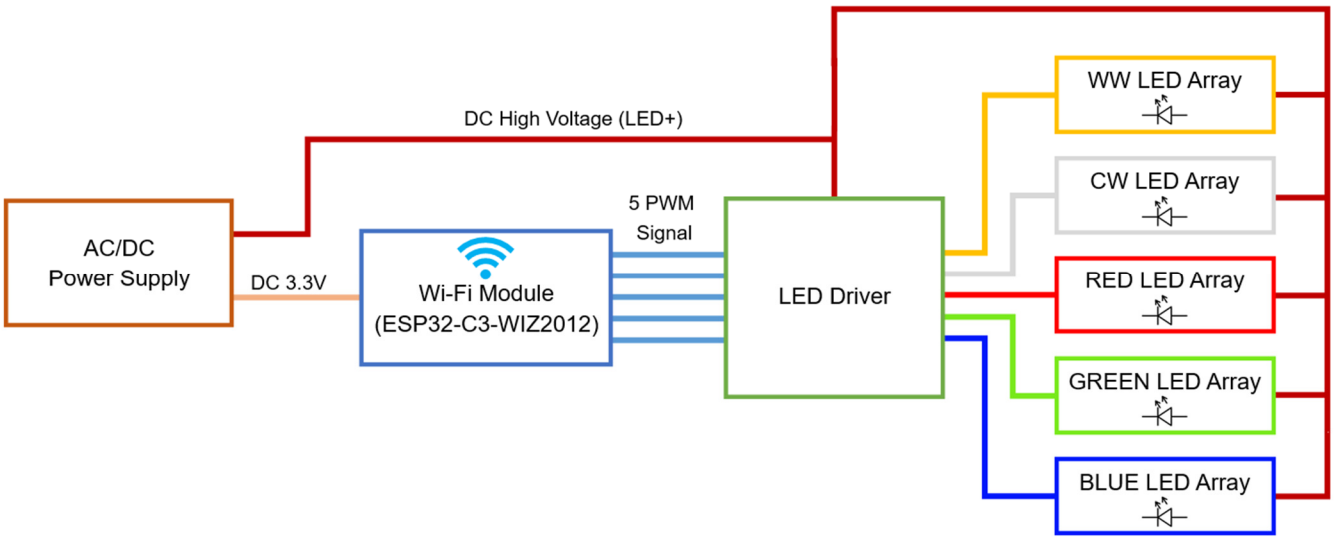


Fig. 3: Block diagram of RGB+TW LED Lamp with ESP32-C3-WIZ2012

4.2 WiZclick function

ESP32-C3-WIZ2012 module is built-in the hardware WiZclick circuit. The WiZclick feature is to make any existing hardware switch smarter, the favorite light modes 1 and 2 magically available with your existing switches.

5. DESIGN CONSIDERATION FOR INTERGRATING THE Wi-Fi MODULE

5.1 Stable power supply for the Wi-Fi Module

The module is sensitive to the power input, and care needs to be taken to ensure there is a stable power source. The module consumes a peak current of 500mA. Therefore, the power supply to the module must has minimum of 500mA output. The module will be permanently damaged if the supply voltage exceeds 3.6V.

In addition, the power off decay timing will affect the WiZclick operation. For the WiZclick to work correctly, it is required the power supply for the module should have a short decay time when power off. Recommended timing is less than 0.1 second when voltage of module's power goes below 0.6V.

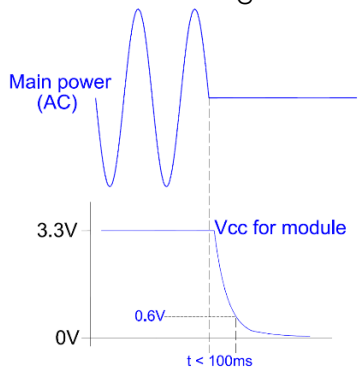


Fig. 4: Recommended power off decay timing for module

5.2 Pull down resistor for PWM output

It is recommended to add pull down resistor for the module PWM output of each channel, using a 4.7KΩ-10KΩ resistor, to avoid the LED drivers to pick up some floating/residual current and turn on those channels before the modules has booted. The resistor value is depending on the LED Driver input.

5.3 Wi-Fi module thermal consideration

The operating temperature of ESP32-C3-WIZ2012 Wi-Fi module is -40°C ~ 105°C. This temperature is measured on the surface of the module. It is suggested to have a good heat dissipation for the module to maintain the module within the operation temperature range.

5.4 Power up and Reset Timing

The time between power up the Vcc rails and EN pin t_0, it must greater than 50μs, the ESP32-C3-WIZ2012 module is built-in the RC circuit for the EN pin. The EN pin can use as the reset pin function, duration of EN signal level less than V_{IL_nRST} (-0.3V - 0.25xVcc) and t_1 greater than 50μs, it should be reset the chip.

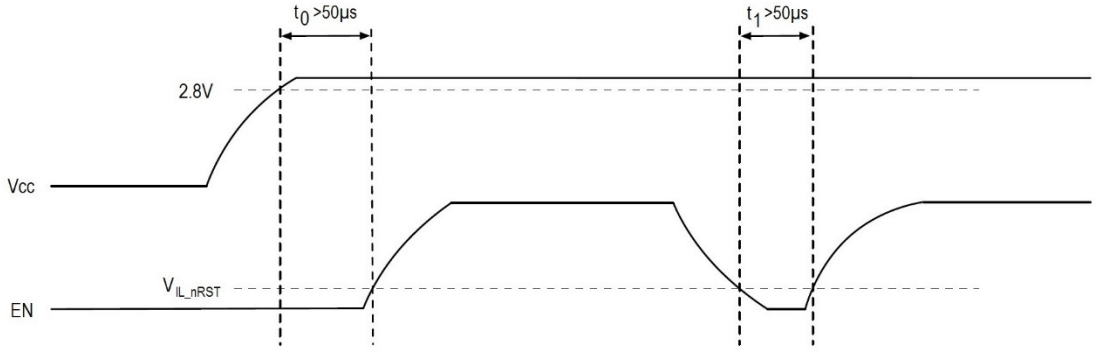


Fig. 5: Power up and reset timing

6. PCB LAYOUT CONSIDERATION

6.1 General layout

In general, the application and most part of circuit is not sensitive to PCB layout except the ANT pad of the Wi-Fi module. The signal frequency is not high and not sensitive to noise. Therefore, the general PCB layout rule can be used for the PCB design.

6.2 Wi-Fi antenna

The ESP32-C3-WIZ2012 is using an onboard SMD chip antenna. The placement and surrounding copper or components will affect the RF performance. To avoid the antenna interference, it is recommended at least 10mm distances between the antenna and the metal parts.

7. TESTING TOOL FOR MASS PRODUCTION

The WiZ Web Based Local Testing Tool (LTT) is a small device which can connect WiZ's device locally. The tool can help to control all type of WiZ lamps on the local network by the web service running on a local PC over the Wi-Fi network. For detail, please refer to the LTT user manual.

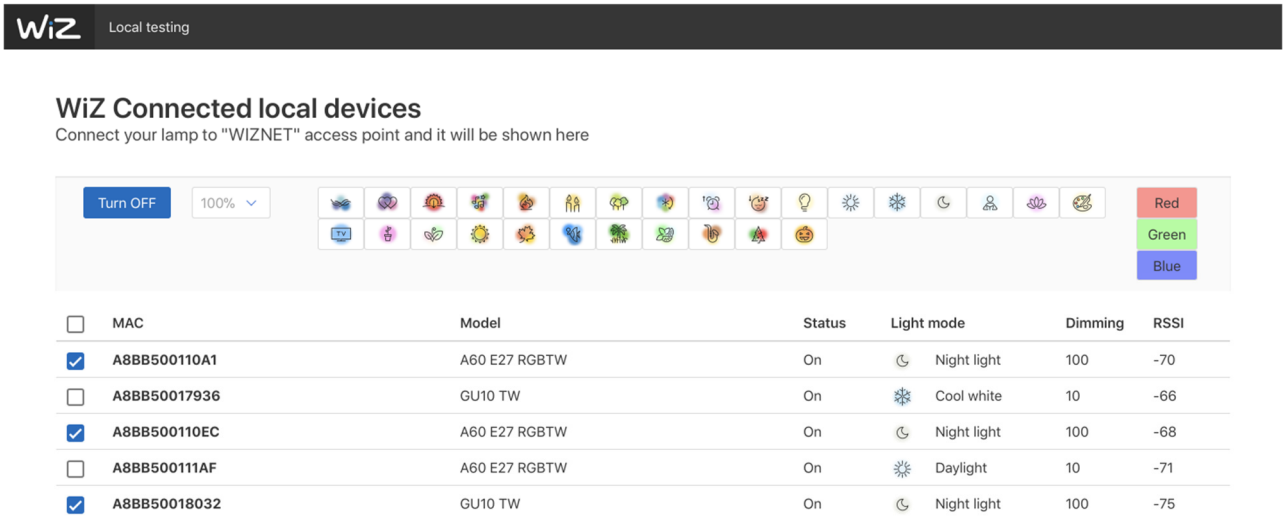


Fig. 6: Local Testing Tool

8. DIMENSIONS

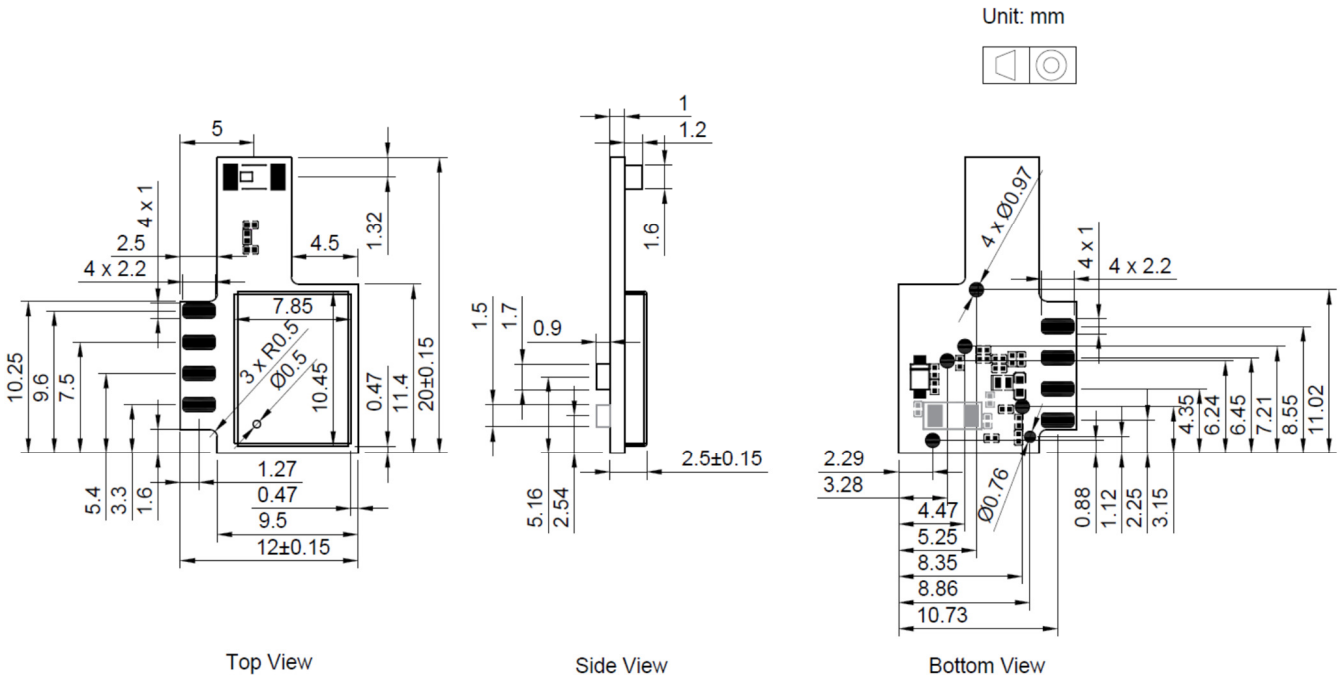
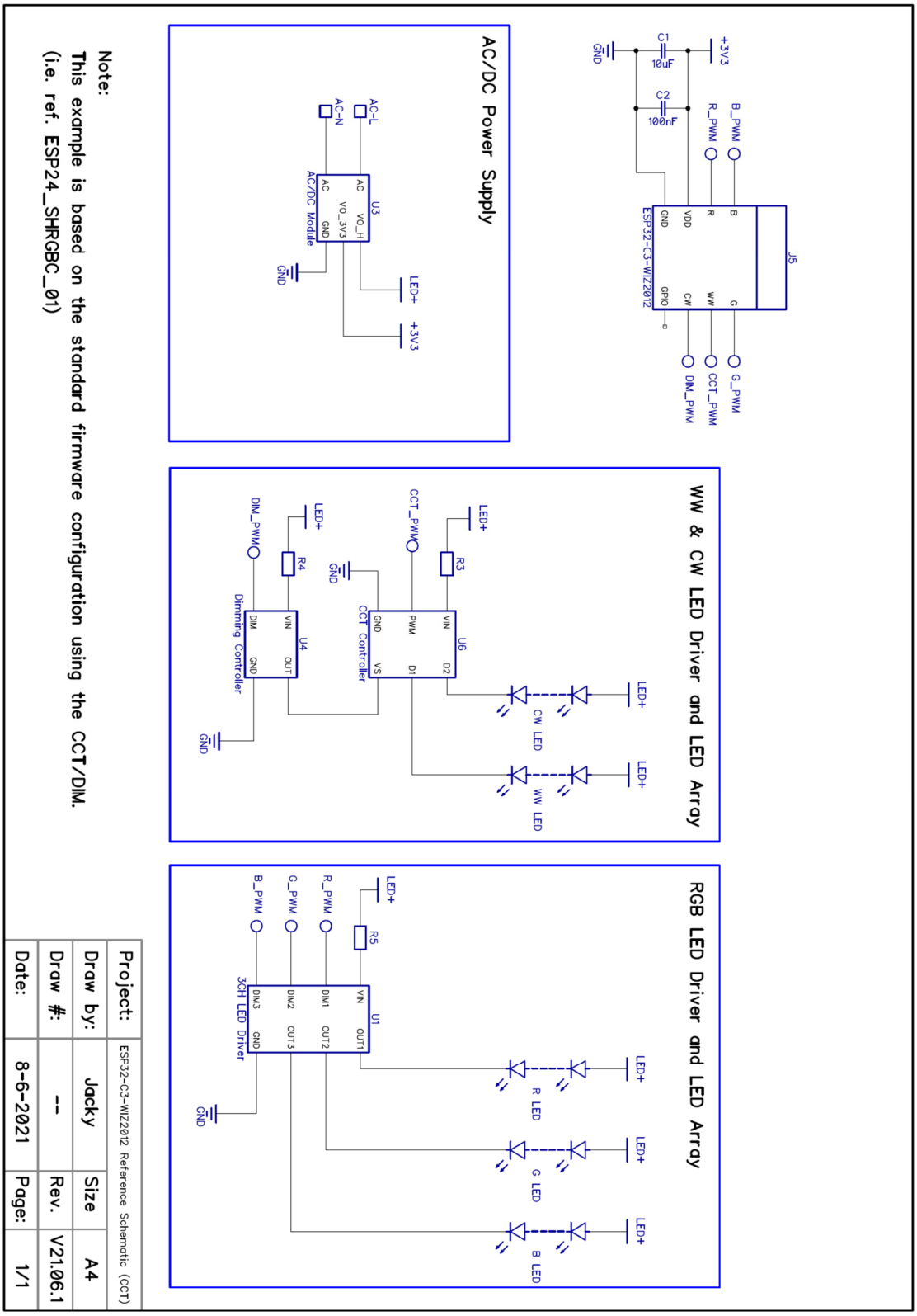


Fig. 7: ESP32-C3-WIZ2012 Dimensions

9. APPLICATION REFERENCE

9.1 Application example for the RGB+TW LED Lamp (TW driving by CCT)



9.2 Application example for the RGB+TW LED Lamp (TW driving by PWM)