ESP32 Universal IoT Dev Kit - Actuating Mini

IoT Actuator Kit - Mini

Abstract

This is an ESP-32 based dev kit/IoT unit mainly designed for connecting actuators to IoT based systems such as home automation systems. It is ideal for researchers, engineers, and hobbyists in IoT and embedded system development. It is versatile enough to be used in R&D and perfect for long-running applications and systems. This document explains the components available in the module and their utilization. The users are advised to go through this booklet before using a board.

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Contents

1: Introduction

This unit is an ESP32-based dev kit/IoT unit mainly designed to connect actuators to IoT-based systems. It has an integrated relay switch to control a device and has a range of I/O pins for connecting sensors or actuators according to user requirements. Further it has two onboard push buttons for input. The unit can be programmed and employed using Arduino IDE, MicroPython and other Espressif chips compatible platforms such as ESP IDF. This module is ideal for researchers, engineers, and hobbyists in IoT and embedded system development. It is versatile enough to be used in R&D and perfect for long-running applications and systems. The block diagram of the module is shown below.

2: Block Diagram

Figure 1 shows the overall system design and other options available on the IoT dev kit for actuating - Mini.

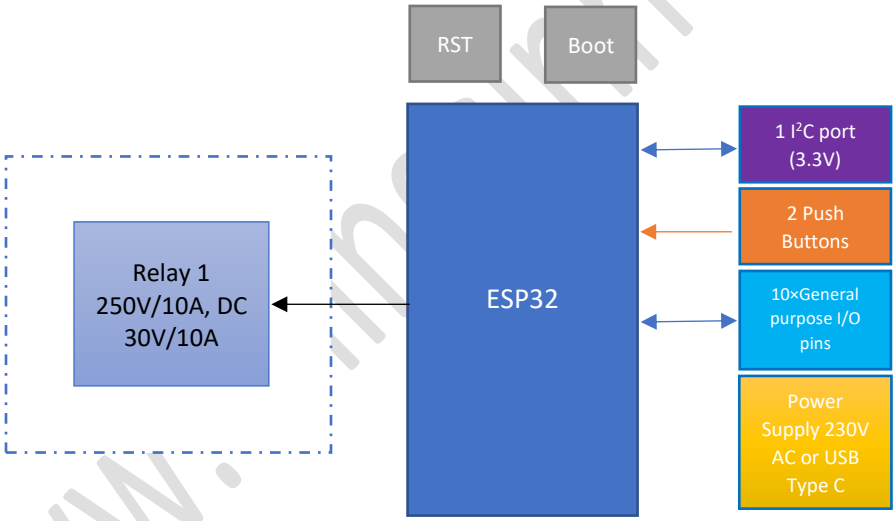


Figure 1: Block diagram of the module

3: IoT Module Components

This section explains the MCU, relays, expanded I/O pins and other modules available on the IoT dev kit.

3.1: Microcontroller Unit (MCU)

This board is based on the ESP-32 microcontroller, which is integrated with Wi-Fi and Bluetooth capabilities. Hence, it is one of the ideal microcontrollers for IoT applications. Further, ES-P32 is a robust, reliable, and low-power device that could be employed in both R&D and industrial applications.

3.2: Relay and Push Buttons

The IoT dev kit has an onboard relay for driving a device and two push buttons for Input. The relay module is 250V/10A, DC 30V/10A. The MCU is protected from back emf using TVS diodes. More information about the placement of the relay and pushbuttons available on the board is shown below.

SN#	Device	I/O Pins in MCU		Comment
		Label	Pin	
1	Relay	RLY1	GPIO25	Active High
2	Pushbutton 1	S1	GPIO34	Active Low
3	Pushbutton 2	S2	GPIO35	Active Low

Table 1: Relay and pushbuttons

3.3: USB-to-UART Bridge

CP2102 USB chip from Silicon Labs has been employed in this board to enable auto switching between ESP-32 boot modes.

3.4: Input Pushbuttons

There are four pushbuttons available on the dev kit, one for Rest, one for ESP-32 Boot and another two for standard Input. More information (I/O pins) about the Input pushbuttons is available in Table 1.

3.5: LED

Two LED indicators are available on the board. LD1 is the power indicator and LD2 can be used for user defined indications such as status of the Wi-Fi connectivity. LD2 connected to GPIO2 of the ESP-32, and active High.

3.6: Expanded I/O Pins and Specifications

The board has a series of I/O pin headers for connecting any extra sensors or actuators according to the user requirements. The specifications of the available I/O and power supply pin headers are shown in Table 2.

Pin Label	Description	Corresponding ESP32 Pin	
CN1	10×ESP32 GPIO pins for Input and Output	4,5,13,15,16,17,18,19,23,27	
I2C	3.3V I^2C pin header. Users can connect a 3.3V I^2C module using this header	SDA	GPIO21
		SCL	GPIO22
3V3	3.3V/100mA voltage output pin		
5V	5V/100mA voltage output pin		

Table 2: Expanded I/O Pins and Specifications

3.7: USB

There is a USB Type-C port available on board. It can be used to program the ESP-32 MCU and can be used to power up the module.

3.8: Power Supply

The primary input voltage for the board is 230V AC, and power can be directly provided to the board through the TE2 terminal. It's crucial to exercise caution when working with high voltages. In addition to the AC power source, the board can also be powered through the USB Type-C port, particularly during programming and in low voltage scenarios. The power supply can be switched using the power mode selector jumper (JP1).

3.9: Fuse

A 3.15A fuse is used in the circuit to protect the IoT unit from excessive current flow. Its primary purpose is to limit the amount of current passing through the circuit to a safe level.

3.10: Power Mode Selector Jumper (JP1)

This jumper helps to switch the power supply between USB Type-C (USB Mode) and External power source 230V AC (EXT Mode).

4: Printed Circuit Board (PCB) Design

The dual-layer PCB has been printed using cutting-edge technologies and assembled using high-quality electronic components. A relay is available on the board for driving a device, and a set of I/O pins for connecting other sensors and actuators according to the user preference.

4.1: Image

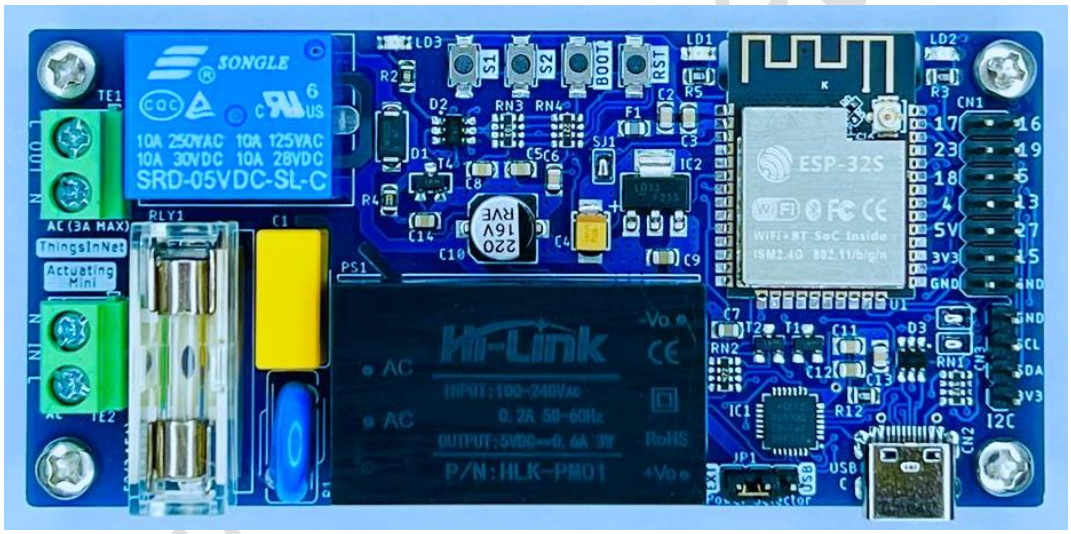


Figure 2: Image of the module

4.2: Layout

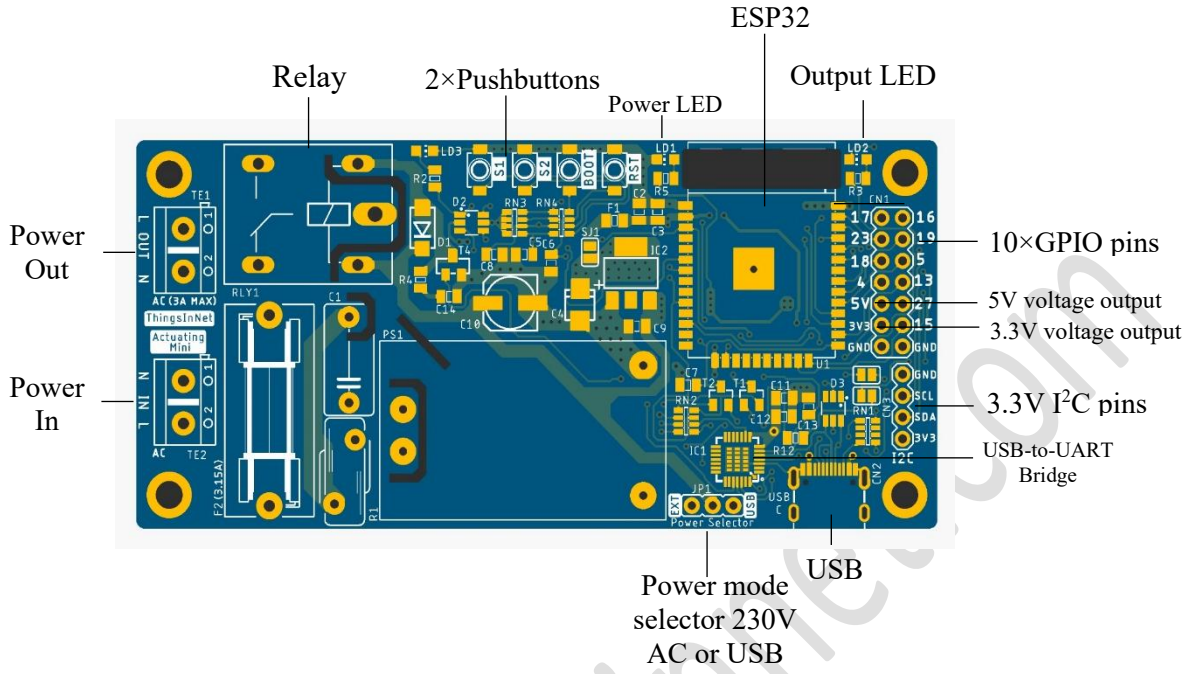


Figure 3: Layout of the module

4.3: Summary of the ESP-32 pin utilization and voltage output pins

SN#	Type	Component/Pin	Label	ESP-32 Pin	
1	Relay	Relay	RLY1	GPIO25	
2	Pushbuttons	Pushbutton 1	S1	GPIO34	
3		Pushbutton 2	S2	GPIO35	
4	Onboard output	LED 2	LD2	GPIO2	
5	Expanded I/O Pins	3.3V I²C pins	I2C	SDA	GPIO21
				SCL	GPIO22
6		ESP32 GPIO pins	10×GPIOs	4,5,13,15,16,17,18,19,23,27	
7	Voltage output	3.3V/100mA	3V3		
8		5V/100mA	5V		

Table 3: Summary of the ESP-32 pin utilization and voltage output pins

4.4: Schematic diagram

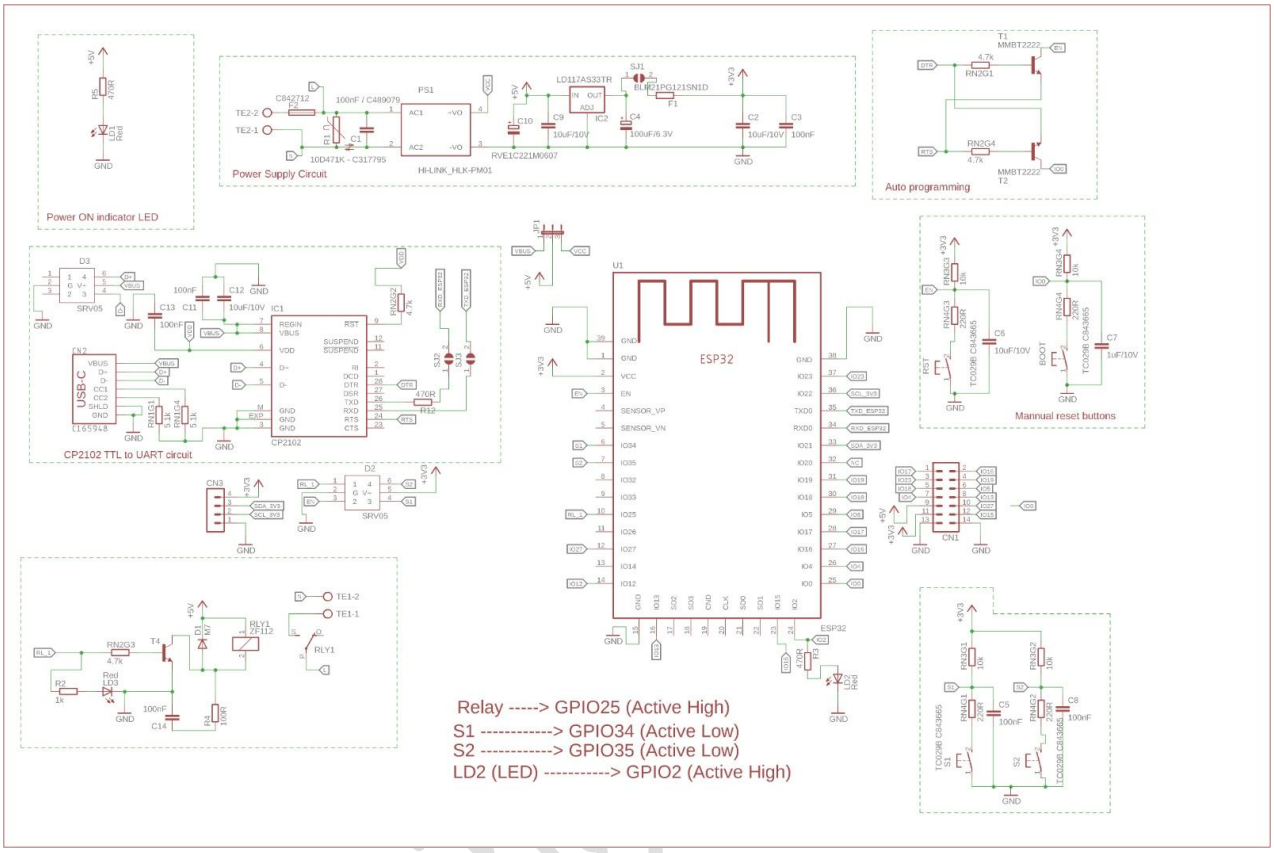


Figure 4: Schematic diagram of the module

5: Product Specifications

Name	Universal IoT Dev Kit for Actuating - Mini
MPN	GS3 ESP-32 IoT Unit for Actuating - Mini
Marketing status	Mass production
Temp (℃)	–40 ~ 85
Flash (MB)	4 MB
PSRAM (KB)	520 KB
Size (mm)	98×46
Antenna	PCB
Interfaces	I/O, I^2C, USB Type-C

Table 4: Product specifications

6: Applications of the Board

This board can be employed in a wide range of applications, from R&D to industrial applications where IoT and embedded systems are in place. Even though a set of application domains has been listed below, the module can also be utilized in many other fields.

1. Smart farming
2. Smart cities
3. Weather stations
4. Environmental monitoring systems
5. Autonomous robots
6. Security systems
7. Research
8. Teaching and learning

7: Special Notes

a. The voltage and current specifications and GPIO properties of the I/O pins available in this module follow the original ESP-32 specifications.
b. If there is any requirement to have Analog to Digital conversion with the Dev Kits, we strongly recommend using ADS1115 ADC module which can easily connect with I2C bus
c. Any sensor or component can be upgraded or removed as per client requests. If you want any customized versions of the IoT units e-mail contact@thingsinnet.com

8: Setup the board and tryout some samples

The contents, settings and programs in the third-party links below have been tested on the dev kit by the developer team (20/12/2022).

Step 1: Download and install the **USB drivers** here.
CP2102 USB-to-UART Bridge from Silicon Labs:
https://www.silabs.com/developers/usb-to-uart-bridge-vcp-drivers?tab=downloads

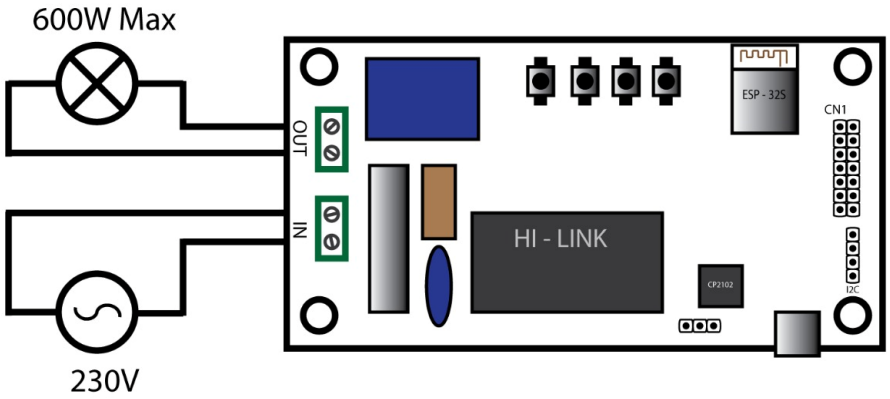
Step 2: Installing the ESP32 Board in Arduino IDE (Windows, Mac OS X, Linux)
https://randomnerdtutorials.com/installing-the-esp32-board-in-arduino-ide-windows-instructions/

Step 3: In the Arduino IDE select the **ESP32 Dev Module**

Step 4: You may visit ThingsInNetBlog for examples from the ThingsInNet team

Further, you may try out any simple examples available on the web and in the Arduino IDE. The development team will periodically update this section.

9: Sample wiring diagram



Note: If you want to connect an appliance with more than 600W do so through Contactor.

10: Copyright Notice

The content of this document, contents in the associated links and the dev kit layout and other options can be changed without prior notifications.

No warranty is provided for either hardware or software components.

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