

### Power Supply and Battery Charging

## Battery Sensing

The diagram shows a battery sensing circuit. It features an operational amplifier (Q4, DMP2035) configured as a comparator. The non-inverting input (pin 3) is connected to a voltage divider consisting of resistor R11 (1M) and resistor R12 (1k). The inverting input (pin 2) is connected to the BATT-EN pin. The output of the op-amp (pin 1) is connected to the BATT pin. The BATT pin is also connected to a voltage divider consisting of resistor R9 (470k) and resistor R10 (1.6M). The output of this divider is connected to GND. The text below the diagram indicates a reading of 3.246V -> 4.2V.

### I/O Expansion

The diagram shows the I/O expansion circuit for the PCF8574APWR. The chip is connected to a 3V3 supply and ground. The I2C lines (SCL and SDA) are connected to pins 2 and 3 via 10k pull-up resistors (R19, R20). The chip's VDD (pin 5) is connected to 3V3 and GND (pin 15) is connected to ground. The chip's pins 10-17 are connected to LEDs (EPD\_EN, BATT\_EN, SD\_EN, EPD\_RES, SD\_CD) and pins 18-20 are connected to push-buttons (EXT\_GP100, EXT\_GP101, EXT\_GP102). The chip is labeled U5 PCF8574APWR.

**LED**

D5  
FM-B2020RGA-HG

FPC\_LED\_R  
FPC\_LED\_G  
FPC\_LED\_B

FPC\_3V3

**Note:** LED and capacitive buttons are on different PCB connected using FPC

## USB to UART Interface

**Note:** Cut JP1 for lower power consumption and then program through headers

**Auto Program**

DTR	RTS	IO0	IO2	EN
1	1	1	1	1
0	0	1	1	1
1	0	1	1	0
0	1	0	0	1

The diagram illustrates the pin configuration and component values for the ESP-WROOM-32 module. The module is labeled U6 and OLIMEX\_Cases\_ESP-WROOM-32. The pin connections are as follows:

- Pin 1:** +3V3
- Pin 2:** 3V3
- Pin 3:** EN
- Pin 4:** NC
- Pin 5:** GND
- Pin 6:** GND
- Pin 7:** GND
- Pin 8:** GND
- Pin 9:** GND
- Pin 10:** GND
- Pin 11:** GND
- Pin 12:** GND
- Pin 13:** GND
- Pin 14:** GND
- Pin 15:** GND
- Pin 16:** GND
- Pin 17:** GND
- Pin 18:** GND
- Pin 19:** GND
- Pin 20:** GND
- Pin 21:** GND
- Pin 22:** GND
- Pin 23:** GND
- Pin 24:** GND
- Pin 25:** GND
- Pin 26:** GND
- Pin 27:** GND
- Pin 28:** GND
- Pin 29:** GND
- Pin 30:** GND
- Pin 31:** GND
- Pin 32:** GND
- Pin 33:** GND
- Pin 34:** GND
- Pin 35:** GND
- Pin 36:** GND
- Pin 37:** GND
- Pin 38:** GND
- Pin 39:** GND
- Pin 40:** GND
- Pin 41:** GND
- Pin 42:** GND
- Pin 43:** GND
- Pin 44:** GND
- Pin 45:** GND
- Pin 46:** GND
- Pin 47:** GND
- Pin 48:** GND
- Pin 49:** GND
- Pin 50:** GND
- Pin 51:** GND
- Pin 52:** GND
- Pin 53:** GND
- Pin 54:** GND
- Pin 55:** GND
- Pin 56:** GND
- Pin 57:** GND
- Pin 58:** GND
- Pin 59:** GND
- Pin 60:** GND
- Pin 61:** GND
- Pin 62:** GND
- Pin 63:** GND
- Pin 64:** GND
- Pin 65:** GND
- Pin 66:** GND
- Pin 67:** GND
- Pin 68:** GND
- Pin 69:** GND
- Pin 70:** GND
- Pin 71:** GND
- Pin 72:** GND
- Pin 73:** GND
- Pin 74:** GND
- Pin 75:** GND
- Pin 76:** GND
- Pin 77:** GND
- Pin 78:** GND
- Pin 79:** GND
- Pin 80:** GND
- Pin 81:** GND
- Pin 82:** GND
- Pin 83:** GND
- Pin 84:** GND
- Pin 85:** GND
- Pin 86:** GND
- Pin 87:** GND
- Pin 88:** GND
- Pin 89:** GND
- Pin 90:** GND
- Pin 91:** GND
- Pin 92:** GND
- Pin 93:** GND
- Pin 94:** GND
- Pin 95:** GND
- Pin 96:** GND
- Pin 97:** GND
- Pin 98:** GND
- Pin 99:** GND
- Pin 100:** GND

The module includes the following components:

- GPIO0/ADC2\_CH1/TOUCH1/RTC\_GPIO11/CLK\_OUT1/EMAC\_TX\_CLK**
- GPIO1/U0TXD/CLK\_OUT3/EMAC\_RXD2**
- GPIO2/ADC2\_CH2/TOUCH2/RTC\_GPIO12/HSPWP/H52\_DATA0/SD\_DATA0**
- GPIO3/U0RXD/CLK\_OUT2**
- GPIO4/ADC2\_CH0/TOUCH0/RTC\_GPIO10/HSPHD/H52\_DATA1/SD\_DATA1/EMAC\_TX\_ER**
- GPIO5/VSPIC50/H51\_DATA6/EMAC\_RX\_CLK**
- GPIO6/SD\_CLK/SPICLK/H51\_CLK/U1CTS**
- GPIO7/SD\_DATA0/SPICLK/H51\_DATA0/U2CTS**
- GPIO8/SD\_DATA1/SPID/H51\_DATA1/U2CTS**
- GPIO9/SD\_DATA2/SPID/H51\_DATA2/U1RXD**
- GPIO10/SD\_DATA3/SPWP/H51\_DATA3/U1TXD**
- GPIO11/SD\_CMD/SPIC50/H51\_CMD/U1RTS**
- GPIO12/ADC2\_CH5/TOUCH5/RTC\_GPIO15/MTDI/H5PIQ/H52\_DATA2/SD\_DATA2/EMAC\_TXD3**
- GPIO13/ADC2\_CH4/TOUCH4/RTC\_GPIO14/MTCK/H5PID/H52\_DATA3/SD\_DATA3/EMAC\_RX\_ER**
- GPIO14/ADC2\_CH6/TOUCH6/RTC\_GPIO16/MTMS/HSPICLK/H52\_CLK/SD\_CLK/EMAC\_TXD2**
- GPIO15/ADC2\_CH3/TOUCH3/MTD0/HSPIC50/RTC\_GPIO13/H52\_CMD/SD\_CMD/EMAC\_RXD3**
- GPIO16/H51\_DATA4/U2RXD/EMAC\_CLK\_OUT**
- GPIO17/H51\_DATA5/U2TXD/EMAC\_CLK\_OUT\_180**
- GPIO18/VSPICLK/H51\_DATA7**
- GPIO19/VSPIC0/U0CTS/EMAC\_TXD0**
- GPIO21/VSPID/H51\_DATA7**
- GPIO22/VSPWP/U0RTS/EMAC\_TXD1**
- GPIO23/VSPID/H51\_STROBE**
- GPIO25/DAC\_1/ADC2\_CH8/RTC\_GPIO6/EMAC\_RXD0**
- GPIO26/DAC\_2/ADC2\_CH9/RTC\_GPIO7/EMAC\_RXD1**
- GPIO27/ADC2\_CH7/TOUCH7/RTC\_GPIO17/EMAC\_RX\_DV**
- GPIO32/XTAL\_32K\_P/ADC1\_CH4/TOUCH9/RTC\_GPIO9**
- GPIO33/XTAL\_32K\_N/ADC1\_CH5/TOUCH8/RTC\_GPIO8**
- GPIO34/ADC1\_CH6/RTC\_GPIO4**
- GPIO35/ADC1\_CH7/RTC\_GPIO5**
- GPIO36/SENSOR\_VP/ADC\_H/ADC1\_CH0/RTC\_GPIO0**
- GPIO39/SENSOR\_VN/ADC1\_CH3/ADC\_H/RTC\_GPIO3**

The module also includes the following components:

- GPIO\_0**
- GPIO\_2**
- LED\_G**
- UART\_TXD0**
- LED\_B**
- UART\_RXD0**
- CAPBTN\_1**
- LED\_R**
- Integrated Flash**
- JTAG\_TDI**
- JTAG\_TCK**
- JTAG\_TMS**
- JTAG\_TDO**
- I2C\_SDA**
- I2C\_SCL**
- SPL\_SCLK**
- SPL\_MISO**
- SD\_CS**
- EPD\_CS**
- SPL\_MOSI**
- BUTZ**
- EPD\_DC**
- CAPBTN\_2**
- xtal\_P**
- Y1**
- 32.768KHz**
- xtal\_N**
- BATTI**
- EPD\_BUSY**
- CHG**
- PCF\_INT**

The module is labeled **ESP-WROOM-32 MODULE**.

## External Header

Pinout diagram for the External Header (J4) of the ESP32. The header has 26 pins. Pins 1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, and 25 are connected to various pins on the ESP32. Pins 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, and 26 are connected to other pins on the ESP32. The diagram shows the connection of the external header to the ESP32 pins.

Header Pin	ESP32 Pin	Header Pin	ESP32 Pin
1	GND	13	EXT_GPIO1
2	+3V3	14	EXT_GPIO2
3	DTR	15	I2C_SDA
4	RTS	16	
5	UART_TXD0	17	JTAG_TMS
6	UART_RXD0	18	
7	SPI_MOSI	19	JTAG_TCK
8	SPI_SCLK	20	
9	SPI_MISO	21	JTAG_TDO
10		22	
11		23	JTAG_TDI
12		24	
13		25	ESP_EN
14		26	
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			

## TO-DO

- + Check e-paper display inductor requirement
- Battery charger resistor value
- + Battery Sense Resistors
- JST PH 2 pin for battery connector
- ? Reverse Polarity on the input – check in spice what would happen for existing circuit
- + ESD Protection
- + Add Auto-program circuit
- + Check if GPIO2 is required for the Auto-Program circuit
- Confirm Buzzer circuit with respect to Piezo/Magnetic
- Check Decoupling capacitors
- Check LED Resistors

NOTES:	B
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## References

SD Card: <https://www.alliedelec.com/m/4/04db416b291011446889dbd6129e2644.pdf>  
LED: <https://hackaday.com/2017/01/20/cheating-at-5v-ws2812-control-to-use-a-3-3v-data-line/>  
JTAG: [http://www.keil.com/support/man/docs/ulink2/ulink2\\_hw\\_connectors.htm](http://www.keil.com/support/man/docs/ulink2/ulink2_hw_connectors.htm)

Size: A3	Date: 2019-09-15	Rev: 1
KiCad E.D.A. kicad 5.99.0-unknown-c3175b4100ubuntu16.04.1		Id: 1/1