Smart Home :

In the age of AI era we focusing how to make things surrounding us controlled smartly, Which start from your room.

Project Block:

Smart Home:

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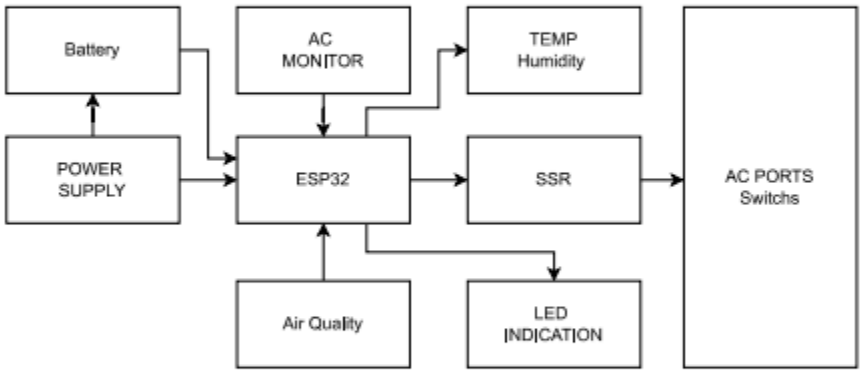
Date: 30-12-2024



MCU: ESP32 WROOM32 E 8MB

Temp Sensor: BME688

power supply: HLK 20M05 5V/20W

SSR:G3MB-202P

Use Case:

- Monitor energy usage of appliances and adjust settings to optimize efficiency.
- Control devices hands-free for individuals with disabilities.
- Control lighting based on occupancy and time of day, reducing energy consumption.

Block Description:

POWER SUPPLY:

Power Supply sections are contains below modules.

A. **SMPS:** Supplying the power for this circuit from a 220V AC Supply We are using Hi-Link product - HLK-20M05 5V/20W which comes compact form factor and with UL & CE safety certification.
This AC-DC converter can supply 5 volt DC with a power rating of 20 Watt.

B. **Boost Converter:** In our circuit there is two Input supply to drive the Voltage regulator one is 5V which is comes from SMPS module Another is direct battery supply voltage (3.7~4.2). Which is not good enough to drive the Voltage regulator, to solve this problem we are using Aerosemi's Boost converter MT3608. Which have wide range of input voltage and can deliver upto 4Amps of current. For our case Output voltage is set for 6.6Volt approx. The feedback resistors value are selected by Fig - 1.0 calculation. For reference circuit see the Fig - 2.0

$$V_{OUT} = V_{REF} \times (1 + \frac{R_1}{R_2})$$

Fig - 1.0

TYPICAL APPLICATION

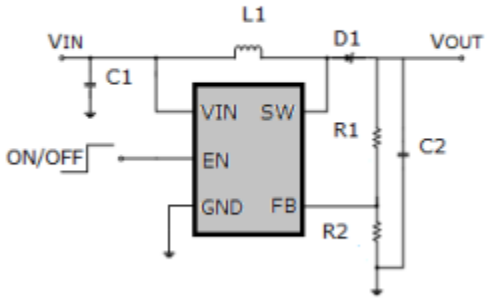


Figure 1. Basic Application Circuit

Fig - 2.0

C. **Voltage Regulator:** After Generating of 6.6V we need a very Low noise supply of 3.3V to drive wireless soc and sensors.for this purpose We are using Advance Monolithic Systems Product- AMS1117-3.3V Which can drive 3.3volt and upto 1100mAmp. Thich part has a junction Temperature of 15C/W.

D. **Battery Charger:**In case of power outage we are using a additional power Source i.e. a single lithium-ion cell. To charge that cell we are using a single Cell constant voltage trickle charging ic from Nanjing Top Power ASIC corp. - TP4056. For understanding it's charing method follow the Fig-3.0

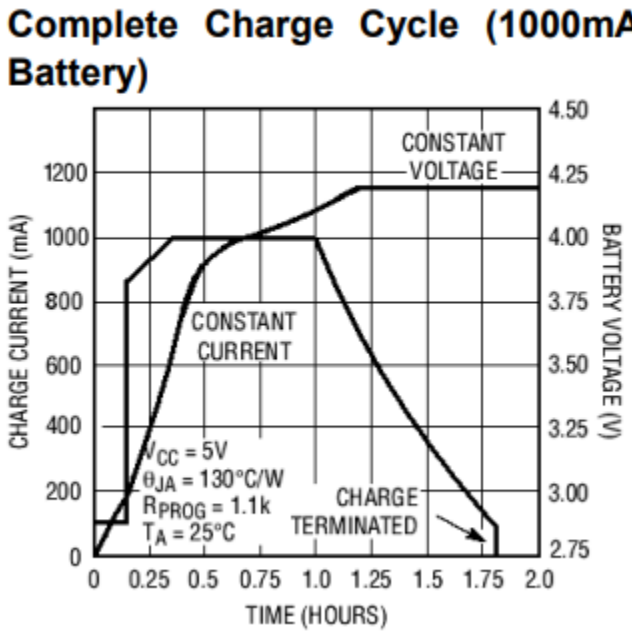


Fig-3.0

For selecting the Battery charging current range we are using 2K ohm @prog (pin-2) i.e. 580mAh. To select battery follow the Fig-4.0

Rprog Current Setting

R_{PROG} (k)	I_{BAT} (mA)
10	130
5	250
4	300
3	400
2	580
1.66	690
1.5	780
1.33	900
1.2	1000

Fig-4.0

For charing indication there is two indication.

1. Charging : When the Battery is in charing mode then this pin will be pulled low.
2. STAND-BY: When the Battery charing get terminated then this pin will be pulled Low. other wise pull high.

For your example of the reference diagram follow the Fig-5.0

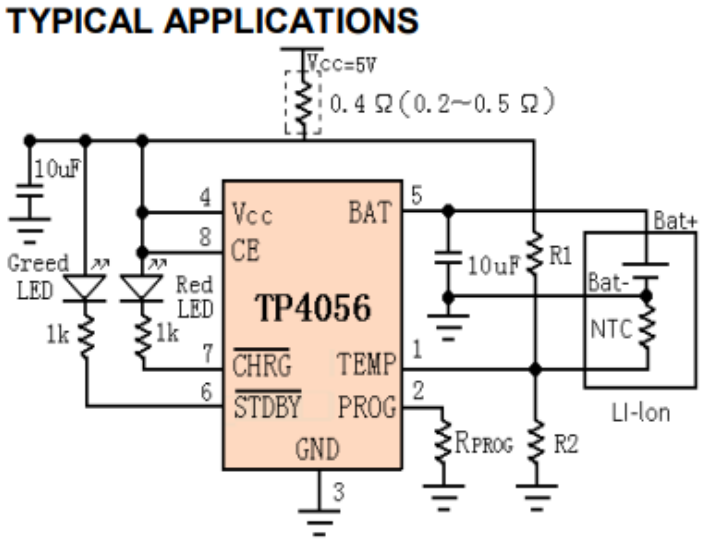


Fig-5.0

E. Battery Protection: In this application we are using one lithium-ion cell protection ic From Fortune semicon, having part number - FS312F-G. This BMS have a feature of

Over and under voltage protection also over current drain protection. For your reference Follow Fig-6.0

Overcharge Protection Voltage	FS312F-G	VOCP	4.225	4.25	4.275	V
Overcharge Release Voltage		VOCR	4.095	4.145	4.195	V
Overdischarge Protection Voltage		VODP	2.82	2.90	2.98	V
Overdischarge Release Voltage		VODR	2.92	3.00	3.08	V
Overcurrent Protection Voltage		VOIP (VOI1)	120	150	180	mV
Short Current Protection Voltage	VCC=3.6V	VSIP (VOI2)	1.00	1.35	1.70	V

Fig - 6.0

In our circuit we are switching the low of the supply to protect our battery.For your example of the reference diagram follow the Fig-7.0

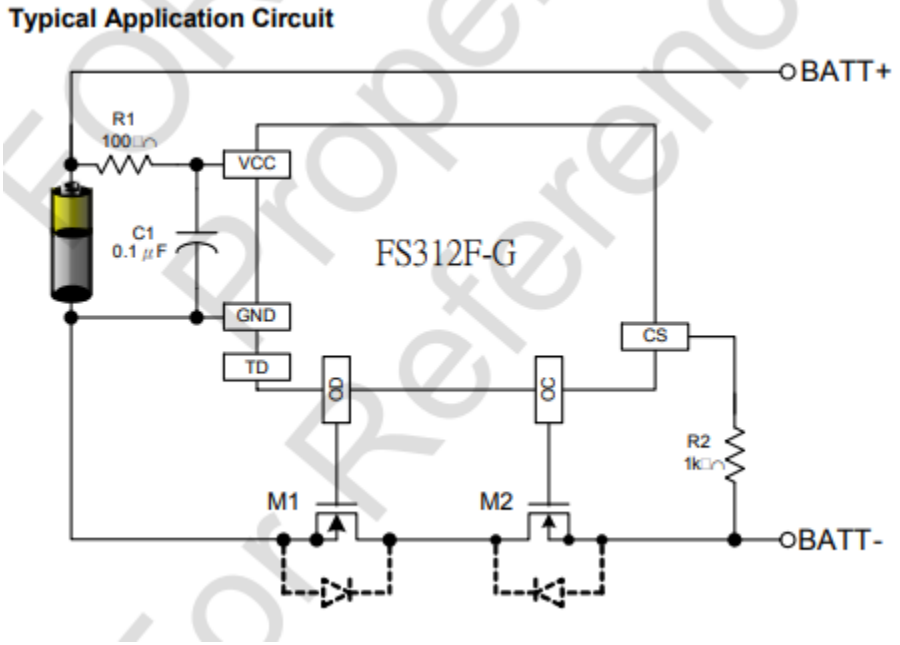


Fig-7.0

F. AC Voltage Measurement: On last segment of the Power Supply Block there is circuit for measuring of the Input AC Voltage.for that we are using a Comparator

circuit. To make calculation of the AC voltage we refer to follow EmonLib repo Which is based on arduino supported frame work. Reference circuit diagram is Taken from a open source forum Hackster.io also see the Fig - 8.0

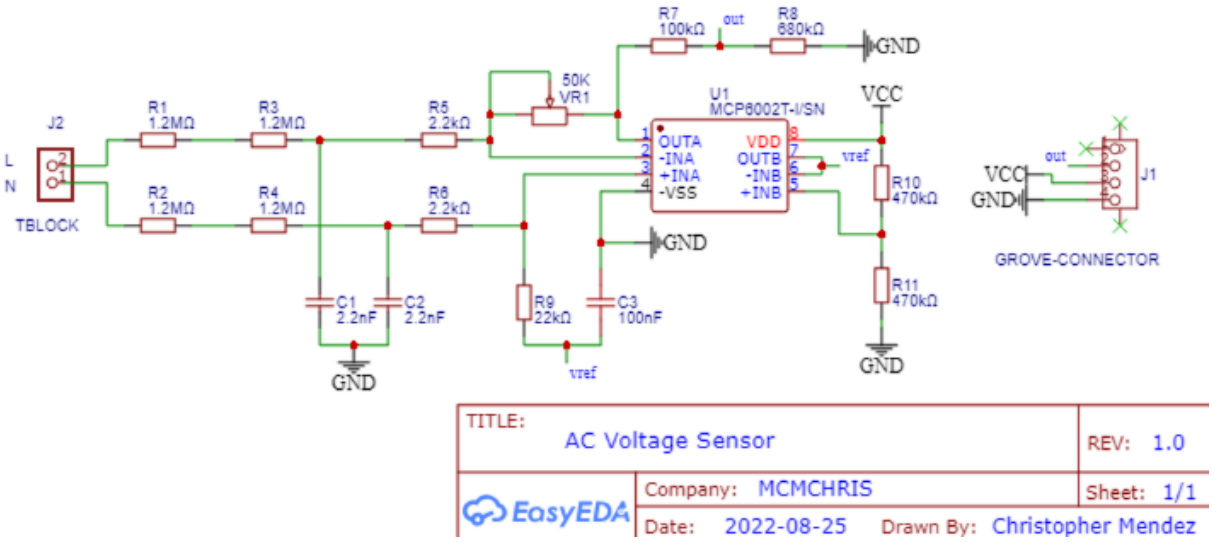


Fig - 8.0

PROCESSOR UNIT :

Processor sections are contains below modules.

A. Microcontroller unit : In our smart Home project main heart component is the Wireless MCU Module which is manufacture by Espressif it's self i.e. - ESP32 - Wroom - 32E. we can Control all the home appliances by over the Internet by this part it's self. ESP32 is a dual band (2.4 / 5 GhZ) Wifi-BLE soc Which come in market in budget friendly price. For our case we will be control our Application through STA mode.

B. IO Peripherals : In our Smart Home project we are using 4 AC Output control Channels which will be control further 4 different SSR.

C. Temp & Humidity Sensor : There is on board two different Temperaure and Humidity sensor. We can use one of them based on product variant.
For base variant we are using AOSONG DHT-11 which have a similar supply voltage like our MCU. This sensor can take data at sampling rate of 16bit/s.
The DHT-11 communicate with MCU through one wire protocol, Which requires One external pull up resistor for data line.

On the other Hand we have another sensor for measuring the Temperature and Humidity i.e. from Bosch BME688. It's a compact environmental sensor that measures temperature, humidity, pressure, and gas levels with high accuracy. High accuracy for temperature, humidity, pressure, and gas detection Compact size Low power consumption, AI-powered gas scanner for customized gas detection.
For communication with this sensor we can use I2C/SPI, In our case we are using I2C, which require two external pull up resistor value of 4.7K.

OUTPUT RELAY UNIT :

Solid State Relays : On our smart home project drive the output device We are using omron Part G3MB-202P DC5.Which has input drive voltage of 5V. See the load capacity chart at Fig - 9.0

SSR Type	Input voltage	Load type	Load ratings
G3MB-102P	5 to 24 VDC	General purpose	2 A, 120 VAC
		Tungsten	1 A, 120 VAC
		Motor	1.60 FLA/9.60 LRA, 120 VAC
G3MB-202P G3MB-202PL G3MB-202PEG G3MB-202PLEG		General purpose	2 A, 240 VAC
		Tungsten	1 A, 240 VAC
		Motor	1.60 FLA/9.60 LRA, 240 VAC

Fig - 9.0

For visualization of the PCB see the Below Images :

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