LOW POWER EMBEDDED DESIGN
PROJECT UPDATE #6

Team Name: WearTech

Team Mates:

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Executive Summary:

Part Selection

Battery	**GMB401215-45mAh**
PMU IC	**LT1965**
Processor	**EFR32BG13– f1024**
Inductive Charging IC	**BQ5103B**
Battery Charger IC	**BQ24040**
Sensor	**BMA280**

As discussed, our project requires 2 Blue Gecko dev kits to act as devices in the mesh network.

On Schedule: Yes

Accomplishments:

- We have completed 90% of the schematics.
- Read about Bluetooth Mesh.
- Worked on the ESD diode

Next week:

- Complete Schematics & get reviewed
- Complete the Layouts
- Start Firmware Development
- Test Inductive charging

I/O Ports:

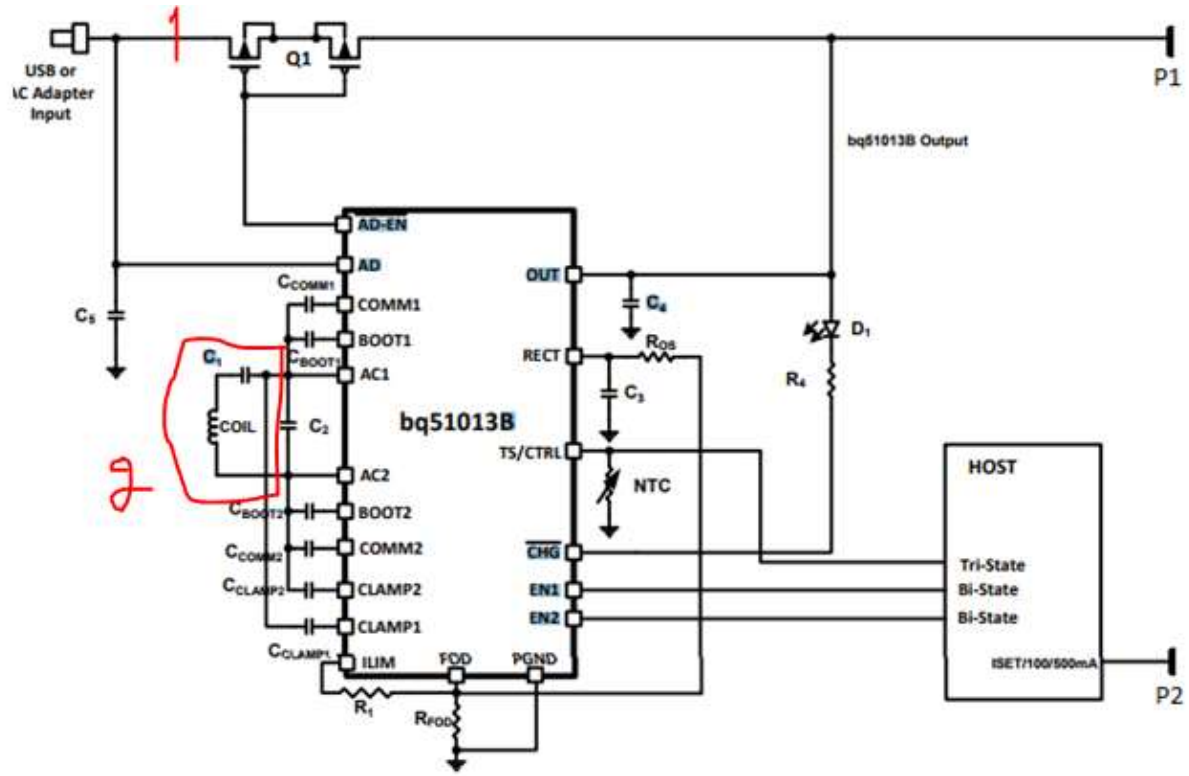
According to the Ckt Diagram:

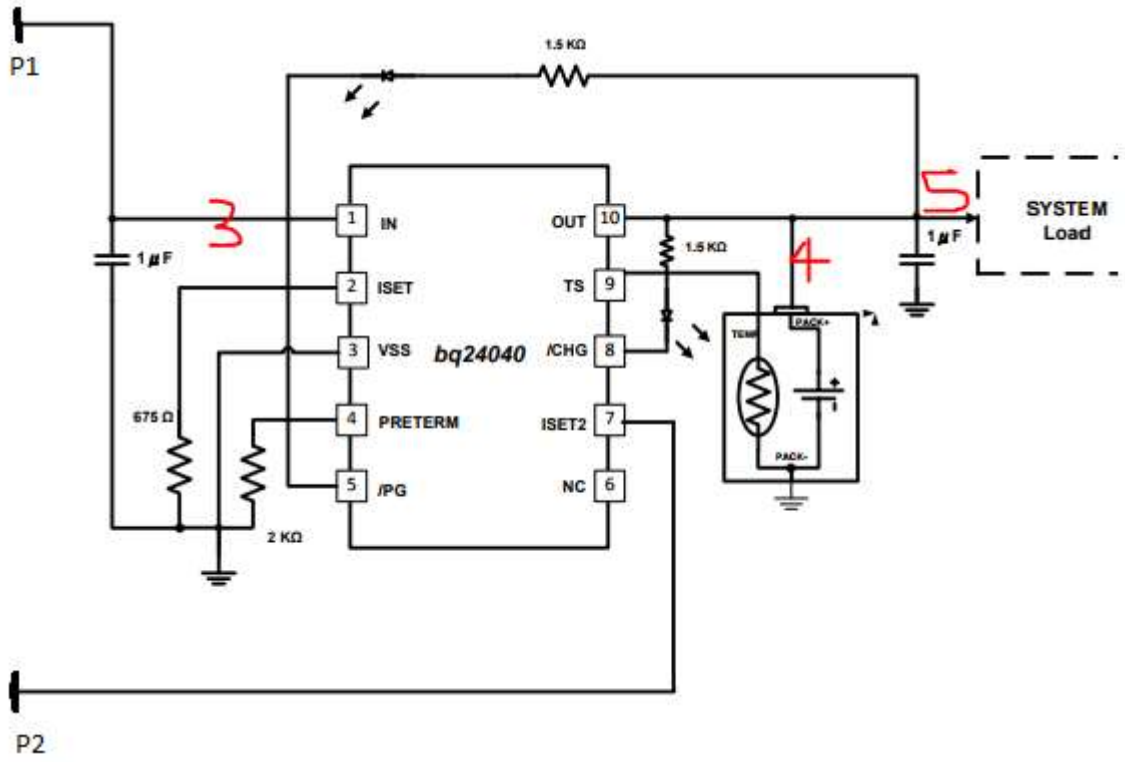
We have,

1. **USB** input and **Q1** Switch
2. Input from Inductive charging at **AC1, AC2**
3. **IN** pin BQ024040
4. **OUT** from pin BQ24040 to the Battery
5. **OUT** from pin BQ24040 to the MCU
6. **INPUT VCC** power to the BMA280 from the MCU
7. **SPI** BMA280

Is ESD protection required for I/O Ports?

Yes we need it for all the following points mentioned.We can ignore the debug pins since it already has the required ESD diodes.





ESD Diode for Power Plane:

We have chosen a Multilayer Varistor for power supply lines and data lines as given below:

Protection Technology	Data Rate Span	Peak/ Clamp (8kV)	ESD Level	Discrete Options	Array Options	Applications and Circuits	Key Advantages
Multilayer Varistor (MLVs)	< 125Mbps	Good	Good	0402 0603 0805 1206	1206	Keypad/switch, audio, analog video, USB1.1, RS232	Lowest cost; broad discrete offering

MULTILAYER VARISTORS (MLVS)

MLVs provide board level protection against ESD, EFT, and other transients that occur on power supply, data and control lines. Single line devices are available in popular industry standard formats, and for more efficient board space usage, four-line devices are also available. Some MLVs also offer low band-pass filtering characteristics that filter high frequency noise from the circuit.

	Part Number	Capacitance (pF)	Clamp Voltage (V)[2]	Operating Voltage (VDC)[2]	Leakage Current (Max nA)	Package	Lines	Input Polarity	ESD Protection Level[1]
MLA	V5.5MLA0402	220	19 at 1A	0–5.5	<5	0402	1	Bi-polar	8kV

Electrical Characteristics | Technical Resources | Environmental Info

Property (Mouseover for details)	Value
Lines Protected	1
ILMax	20
Itm1x	20
Moisture Sensitivity Level	
Typ Capacitance (pF)	220
Package Size	0402 (1005)
Max Clamp Voltage (Vc) (V)	19
VMAX AC (V)	4
Max Rated DC Voltage	5
VNDC MAX (V)	10.8
V_{NDC} MIN (V)	7.1
Wtm10x1000	0.05

http://www.littelfuse.com/~/media/electronics/datasheets/varistors/littelfuse_varistor_mla_datasheet.pdf.pdf

Reason: Max VDC is 5V which is within the acceptable range for LTC1965, BQ5103B, BQ24040 and Battery. The max operable voltage of the circuit is 5V.

ESD Communication Lines:

http://www.semtech.com/images/datasheet/lcdaxx.pdf

LCDA05						
Parameter	**Symbol**	**Conditions**	**Minimum**	**Typical**	**Maximum**	**Units**
Reverse Stand-Off Voltage	V_{RWM}				5	V
Reverse Breakdown Voltage	V_{BR}	I_t = 1mA	6			V
Reverse Leakage Current	I_R	V_{RWM} = 5V, T=25°C			20	µA
Clamping Voltage	V_C	I_{PP} = 1A, t_p = 8/20µs			9.8	V
Clamping Voltage	V_C	I_{PP} = 5A, t_p = 8/20µs			11	V
Maximum Peak Pulse Current	I_{PP}	t_p = 8/20µs			17	A
Junction Capacitance	C_J	Between I/O Pins and Ground V_R = 0V, f = 1MHz			5	pF

Reason:

The Capacitance is 5pF which is acceptable for data lines. The PMUs and the battery voltage supply is within 5V which matches with the Vrwm of 5V.

Update from the previous Report:

- Limiting the current: build a current limiting circuit or use the DC source that is there in the ESE lab or take a current limiting circuit from the market and use it.
  or we could build something like
  https://electronics.stackexchange.com/questions/165040/how-to-limit-current-precisely

- We have gone through the BlueGecko programming pdf from silicon labs for programming the board.