Department of Electronics & Telecommunication Engineering

University of Moratuwa

EN3023 – Electronic Design Realization

SolarBank

PRODUCTION DOCUMENT

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THIS REPORT IS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE MODULE EN3023 – ELECTRONIC DESIGN REALIZATION

05TH OF JUNE 2022

1. GENERAL INFORMATION

1.1. OVERVIEW

SolarBank is a portable mobile charger that can be used to charge mobile phones, power banks, MP3 players etc. This charger can be charged using two ways. The main method of powering the charger is using the solar cells. Alternatively, AC voltage can be used to charge the product in the absence of sunlight. The product can be installed in public places such as railway stations, bus stands, markets etc. and can be carried out while hiking.

1.2. FUNCTIONALITY

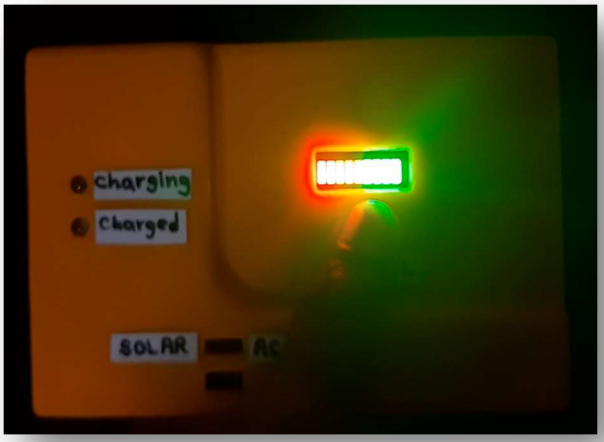
Battery Charging Circuit, Mobile Charging Circuit, and Battery Status Indicator are the three main sections in our overall circuit. A user can charge up to two mobile phones at a time.

- **Battery Charging**

  Red LED is used to indicate whether the batteries are being charged and green LED is used to indicating once the batteries are charged. There are two modes in our Battery Charging circuit. They are constant current mode and constant voltage mode.

- **Battery Level Indicator**

  For indicating battery levels, we have used four colors. Red indicates the battery level is low, yellow, and green colors indicate the level is moderate and blue color shows that the battery level is full.



- **Mobile Charging**

  There are two ports to connect USB cables for charging mobile phones.

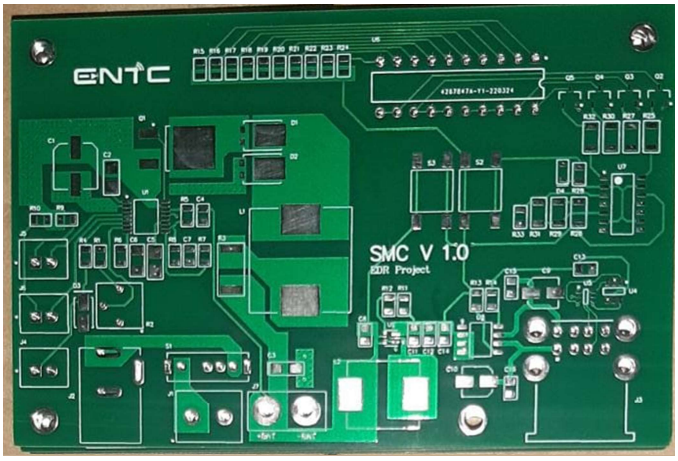
2. PRODUCTION PROCESS

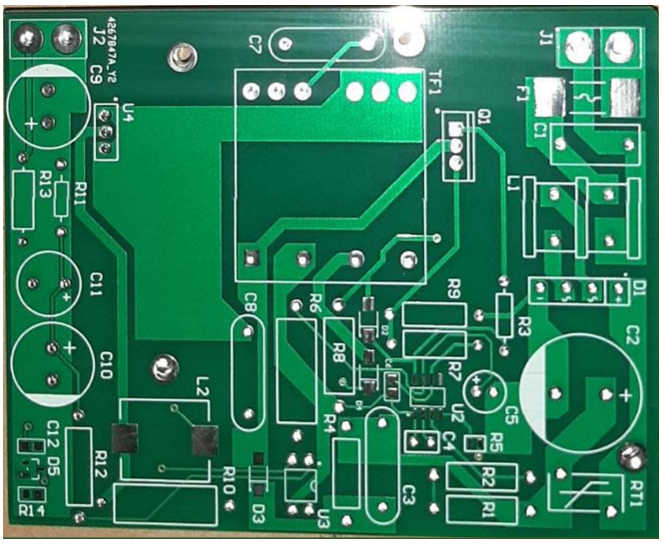
The following sections describe the PCB fabrication process, Soldering process, Enclosure manufacturing process. Several parts are outsourced due to low volume of manufacturing and lack of locally available facilities.

2.1. PCB FABRICATION

The double-sided printed circuit board of the portable solar charger is outsourced to a Chinese PCB manufacturing company due to the lack of facilities locally. It is designed using Altium and then prototyped and tested manually before manufacturing. PCB layouts and the details of the manufacturer are given below.

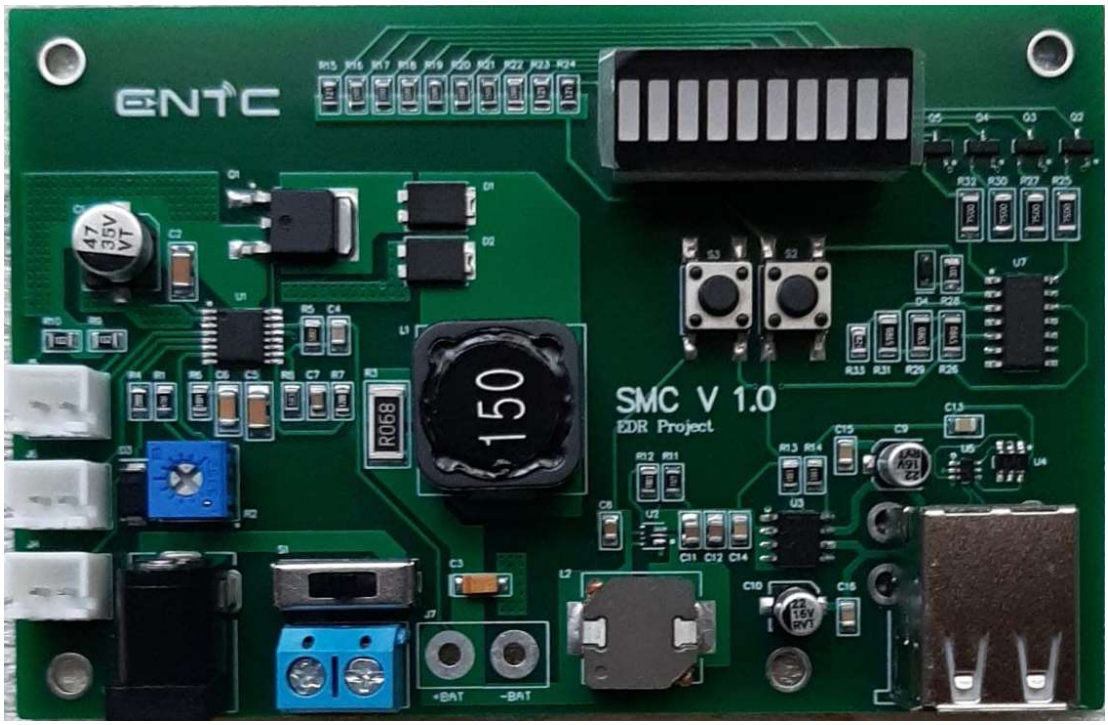
- JLCPCB – https://jlcpcb.com/

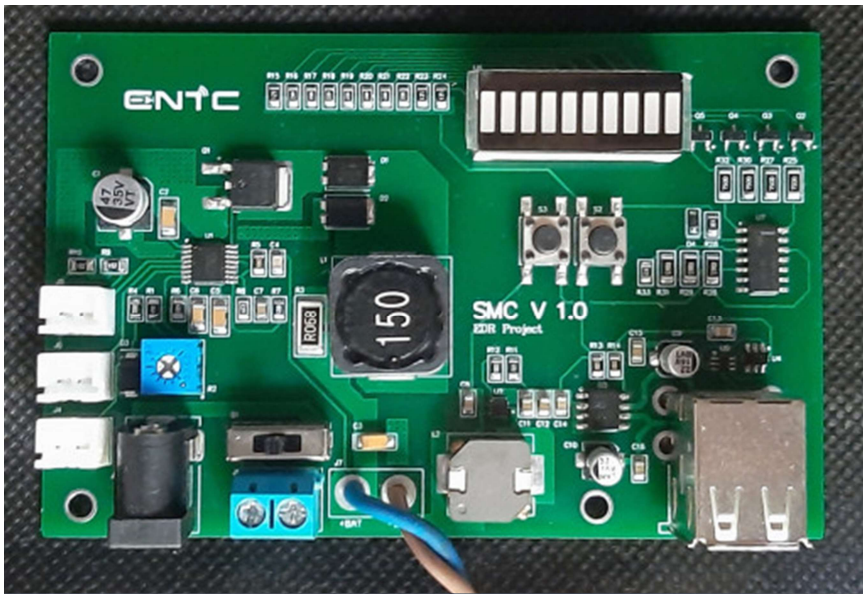




2.2. SOLDERING PROCESS

Due to the lower number of components per PCB and lower number of overall PCBs since this is a medium scale manufacturing process, hand soldering is done in-house by skilled technicians to reduce cost and to increase product quality. After growth in sales, attention would be paid to automatic soldering techniques, which will be costly unless there are large number of PCBs to solder.





2.3. ENCLOSURE MANUFACTURING PROCESS

The enclosure of Solar Bank consists of two main parts. The cover which contains PCB, ports, switches, LEDS and the base which contains battery holder. CAD software Solidworks 2021 is used to model the entire design. Although we have used 3D printing to manufacture the product, a proper analysis has been done in order to ensure that the design is fully moldable to use injection molding process for bulk production. PLA plastic is used to manufacture the product.

3. TESTING

Every PCB has been tested according to a proper and through testing processes that have to be executed before sending them to the market. The overall circuit has been divided into several sub circuits and then some inputs and desired test outputs have been used for testing. To ensure the enclosures are in high quality and are free of defects they have been passed through a quality control test that is done by members of quality control team.

4. ASSEMBLING

Items for assembling is selected after going through the testing and quality control procedures. Afterwards they have been assembled at the assembly division to produce the final product. The Bill of Materials and the list of suppliers of the components are provided in the Appendix.

5. PACKAGING

Device is packaged carefully inside a cardboard cubical box placed between a custom regiform fitting for shipping. Final package should include the following items;

1. Portable solar charger
2. Solar panel with cables
3. Power Cable
4. User Manual
5. Warranty certificate

6. APPENDIX

6.1. BILL OF MATERIALS

No	LCSC Electronics Part Number	Manufacturer Part Number	Description
1	C90276	VT1V470M0605	47uF 35V SMD Aluminum Electrolytic Capacitors
2	C110253	1206B104K500NT	100nF 50V SMD Multilayer Ceramic Capacitors
3	C237220	1206B471K500CT	470pF 50V SMD Multilayer Ceramic Capacitors
4	C282753	TCC0805X7R224K500DT	220nF 50V SMD Multilayer Ceramic Capacitors
5	C110055	T491A106K016AT	10uF 16V Tantalum Capacitors
6	C2857996	0805CG110J500NT	11pF 50V SMD Multilayer Ceramic Capacitors
7	C100046	RC0805JR-071KL	1kΩ Chip Resistor - Surface Mount
8	C70913	MF11 103M	10kΩ 450Mw Thermistors
9	C81260	3362P-1-502LF	5kΩ Plugin Variable Resistors/Potentiometers
10	C114245	RC0805FR-07120RL	120Ω Chip Resistor - Surface Mount
11	C445663	ERA6AEB683V	68kΩ Chip Resistor - Surface Mount ROHS
12	C316211	AR05BTCW5002	50kΩ Chip Resistor - Surface Mount
13	C328397	AECR0805F47K0K9	47kΩ Chip Resistor - Surface Mount
14	C228604	AC0805FR-071ML	1MΩ Chip Resistor - Surface Mount
15	C144578	AC0805FR-07200RL	200Ω Chip Resistor - Surface Mount
16	C333703	RTT25R068FTE	0.068Ω Chip Resistor - Surface Mount
17	C113945	SB1045L	45V 10A TO-277 Schottky Barrier Diodes
18	C266552	SS24	40V 2A DO-214AC Schottky Barrier Diodes
19	C970540	YPRH1508-150M	8.5A 15uH ±20% 28mΩ SMD, Power Inductors
20	C474881	KF301-5.0-2P	5mm Screw terminal
21	C158012	B2B-XH-A(LF)(SN)	2.5mm Wire to Wire Connector
22	C144401	XHP-2	2.5mm Rectangular Connectors
23	C77905	CN3722	TSSOP-16 Battery Management IC
24	C296720	CL21A226KOQNNNE	22uF 16V SMD Multilayer Ceramic Capacitors
25	C17816	0805W8F7323T5E	732kΩ Chip Resistor - Surface Mount
26	C915088	TPS61022RWUR	VQFN-7 DC-DC Converters
27	C17024	CL21A106KPFNNNE	10uF 10V SMD Multilayer Ceramic Capacitors
28	C96346	RC0805FR-07100KL	100kΩ Chip Resistor - Surface Mount
29	C2048948	SPM10054T-1R0M-HZ	27.5A 1uH ±20% 2.4mΩ - SMD Inductors
30	C49678	CC0805KRX7R9BB104	100nF 50V SMD Multilayer Ceramic Capacitors
31	C44770	TPS2513DBVR	SOT-23-6 Battery Management IC
32	C217765	ARG05FTC1003	100kΩ Chip Resistor - Surface Mount
33	C130050	TPS2066DR	SOIC-8_150mil Power Distribution Switches
34	C72502	RVT1C220M0405	22uF 16V SMD Aluminum Electrolytic Capacitors
35	C2341	907-111A1012D10200	USB 2.0 2 8 Female Type-A Plugin USB Connectors
36	C194628	TPD4E1U06DCKR	6.5V Unidirectional SOT-363 ESD Protection Devices
37	C127469	SPEF220100	1A SMD Push Switches

38	C173439	BZT52C3V3S	3.3V SOD-323 Zener Diodes
39	C134081	RC0805JR-07300RL	300Ω Chip Resistor - Surface Mount
40	C2933571	FRC0805J821 TS	820Ω Resistor - Surface Mount
41	C243023	MCWF12R59R0BTL	59Ω Chip Resistor - Surface Mount
42	C57473	LM2902DR2G	4 1MHz 3mA General Purpose SOIC-14_150mil Operational Amplifier
43	C351454	PTFR1206B750RP9	750Ω Chip Resistor - Surface Mount
44	C18536	2N3904S-RTK/PS	5mA NPN SOT-23 Bipolar Transistors
45	C114244	RC0805JR-07120RL	120Ω Chip Resistor - Surface Mount
46	C304819	RS-05K1500FT	150Ω Chip Resistor - Surface Mount
47	C100045	RC0805FR-070RL	0Ω Chip Resistor - Surface Mount
48	C2683746	MBR30100CT	100V 30A TO-220AB Schottky Barrier Diodes
49	C2933374	FRC0805F2321TS	2.32kΩ Chip Resistor - Surface Mount
50	C181890	EL817(C)-F	5000Vrms Transistor Optocouplers DIP-4 Optocouplers
51	C111578	TL431	Adjustable SOT-23 Voltage References
52	C20648	KBP307	3A 600V KBP Bridge Rectifiers
53	C433349	CR6841S	SOP-8 AC-DC Controllers & Regulators
54	C920725	K104K275VC3L12	100nF 275V 10mm Suppression Capacitors
55	C332361	5D-9	5Ω 3A NTC Thermistors
56	C2841135	HY2G820M180250CD288	400V 82uF Aluminum Electrolytic Capacitors
57	C377841	CC1H104ZA1FD3F6C1000	100nF 50V Ceramic Disc Capacitors
58	C122218	RI40-1W-820KΩ±2% T	820kΩ Through Hole Resistors
59	C122214	RI40-1W-100KΩ±5% T	100kΩ Through Hole Resistors
60	C1380302	FMP100FTF52-27R	27Ω Through Hole Resistors
61	C479229	KNP1WS-100Ω±5%-XT52	100Ω Through Hole Resistors
62	C176617	MFR3WSJT-73-5R6	5.6Ω Through Hole Resistors
63	C274866	RFS01JR330A520NH	330mΩ Through Hole Resistors
64	C714113	MF1W-10KΩ±1%T	10kΩ Through Hole Resistors
65	C601008	M01W-1K±5%-TT63	1kΩ Through Hole Resistors
66	C242154	ERG2SJ751A	750Ω Through Hole Resistors
67	C385349	RN1WS20KΩFT/BA1	20kΩ Through Hole Resistors
68	C489107	35ZL1000MEFCG412.5X25	1000uF 35V Aluminum Electrolytic Capacitors
69	C106604	ERM1HM330E11OT	33uF 50V Aluminum Electrolytic Capacitors
70	C2896151	DCH222Z30Y5VP6BL5A0	2.2nF 2kV Ceramic Disc Capacitors
71	C779292	MBR20200CT	200V 10A TO-220AB Schottky Barrier Diodes
72	C271452	HF20N60	600V 20A 120W N Channel TO-220F MOSFET
73	C2916149	RS1M	1A 1kV SMA Diodes – General Purpose
74	C968816	DCH472M30Y5VN6FJ5A0	4.7nF 1kV Ceramic Disc Capacitors
75	C2907311	FRC0805J243 TS	24kΩ Chip Resistor - Surface Mount
76	C116373	UU9.8-5mH	700mΩ 5mH @ 1kHz Through Hole Common Mode Filters
77	C59354	KF471M035G160A	470uF 35V Aluminum Electrolytic Capacitors
78	C1711	CL21B104KBCNNNC	100nF 50V SMD Multilayer Ceramic Capacitors

79	C351107	YSPI1040-220M	5A 22uH ±20% 73mΩ SMD Power Inductors
80	C519909	CC0805KRX7R7BB103	10nF 16V SMD Multilayer Ceramic Capacitors
81	C381116	DC-005-5A-2.0	5A 24V Plugin AC/DC Power Connectors
82	C480348	SS13D07L4B	50V 0.3A Plugin Slide Switches
83	C187586	046406.3DR	100A SMD Fuse 6.3A 300mV SMD Fuses
84	C879147	AOD4185	TO-252 MOSFETs
85	C2938490	JMTK440P04A	TO-252 MOSFETs
86	C2839011	13007	10μA 400V 2W 9A TO-220 Bipolar Transistors

6.2. LIST OF SUPPLIERS

- SHENZHEN LCSC ELECTRONICS TECHNOLOGY CO., LTD.