TEC103+TEC110A Solar Power Pack

Li-Ion Power Pack with very high efficiency USB output & Solar charging

Features

- **Very high power conversion efficiency, up to 96%, from Li-Ion cell to USB output**
- **Highest power conversion efficiency, up to 85%, from a single solar PV cell (~0.45v) to Li-Ion cell**
- MiniUSB input for Li-Ion charging
- Very low standby consumption of 200uA enables very long storage time without on/off switch
- Photo voltaic cell is used at or close to the optimal power-point
- LEDs indications of solar charging, standard charging, discharging & battery level
- Solar charging is robust to partial shading

Description

The TEC103+TEC110A Solar Power Pack is a complete charger application that is designed to work with Li-Ion/Li-Pol cell.

It incorporates 2 charging sources - standard miniUSB input & High efficiency solar charging for full power autonomy

The Solar Power Pack utilizes Techtium's TEC110A IC for getting up-to 96% conversion efficiency from the Li-Ion cell to the USB output.
This enables reducing the Li-Ion battery by up-to 50% and still getting the same output capacity like other solutions, resulting with major cost, size & weight reductions.

Techtium's TEC103 Solar IC is used to get up-to 85% conversion efficiency from a single PV cell to the Li-Ion cell. This introduces charging rates that are x2 higher than other solutions in full sun and up-to x10 higher at partial shadings.

Block Diagram

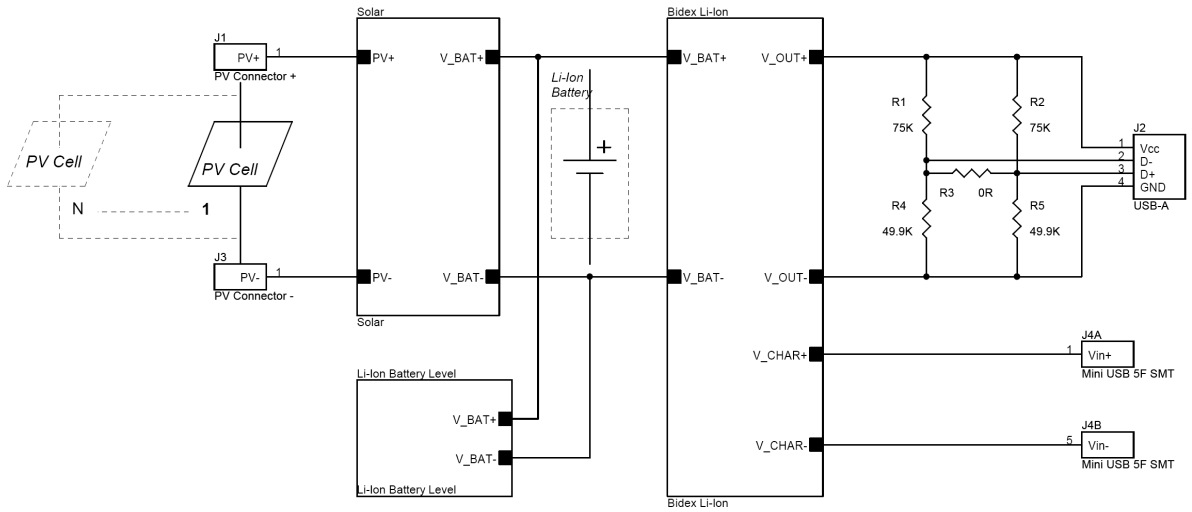


***Fig 1**: TEC103+TEC110A Solar Power Pack block diagram*

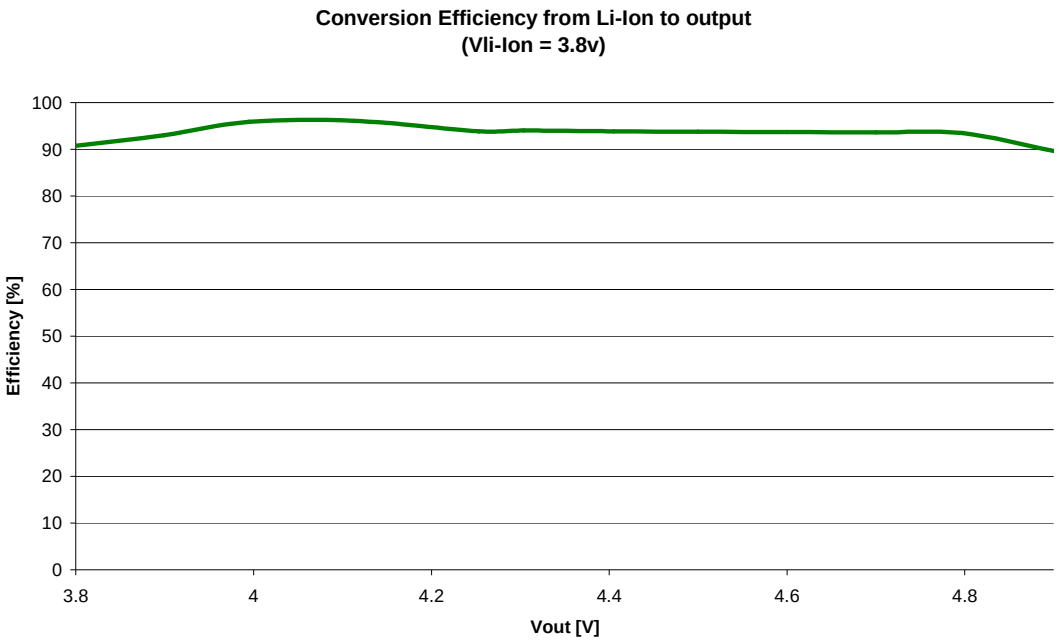
Technical Specification

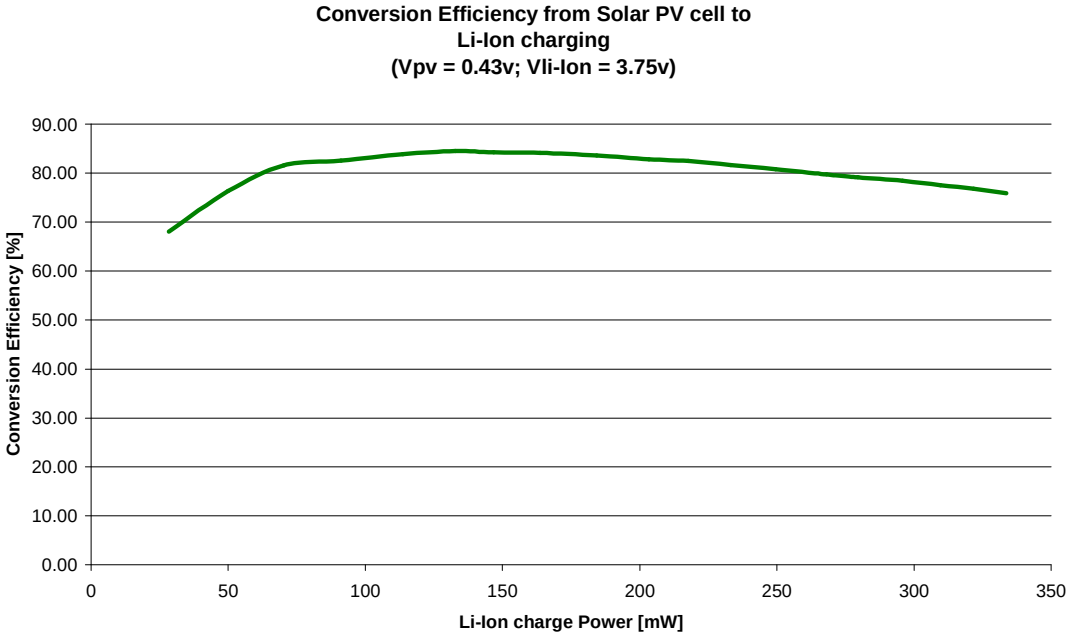
Parameter	NOTE	Test Conditions	Limits			Units
			Min	Typ.	Max	
PV input voltage	4			430		mV
Solar output voltage (to Li-Ion cell)	2,4		2.6		4.2	V
Solar output power (to Li-Ion cell)	1,4		0		400	mW
Solar active current consumption		Vli-Ion = 3.9v		3		mA
Conversion efficiency				80	85	%
Solar Auto-start conditions	4	PV voltage above		520		mV
		VLi-Ion Above		2.6		V
		Vli-Ion Below		4.1		V
		Input Power Above		13		mW
Solar Auto-stop conditions	4	Output Current below		4		mA
Solar Maximum output voltage				4.1		V
Output voltage				5.0		V
Output current					650	mA
Input voltage (miniUSB input)			4.3	5.0	10	V
Li-Ion Maximum charging voltage (from miniUSB input)	2,3		4.175	4.2	4.225	V
Charging current (miniUSB input)			414	450	486	mA
Standby current consumption (whole circuit)		Vli-Ion = 3.9v		200		uA

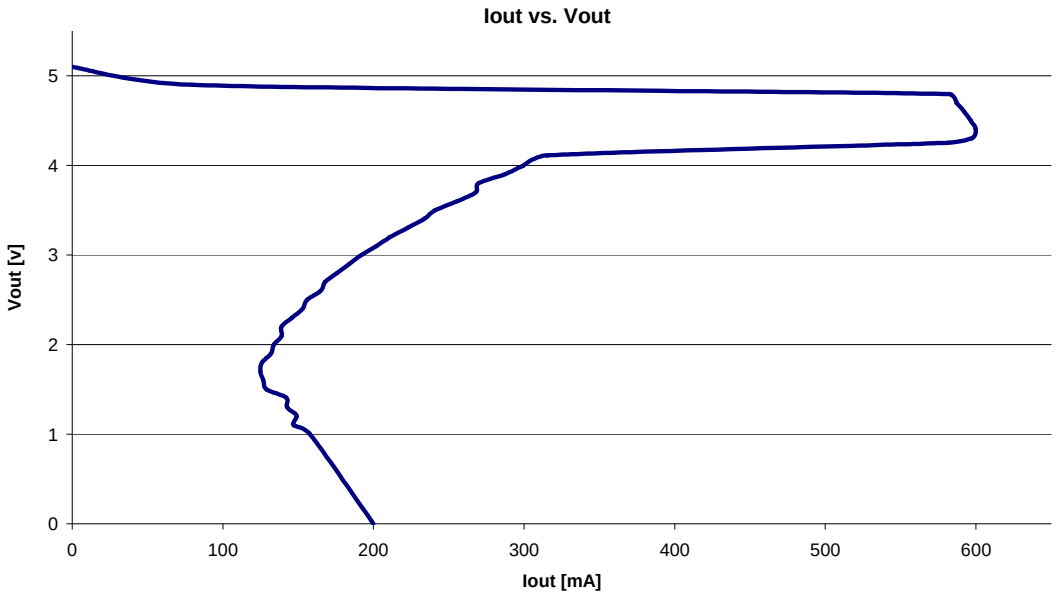
Notes:

1) Maximum solar output power is defined by the selected components, it is possible to reach even 5W output with different components – please contact Techtium if such is required
2) Output designed for proper Li-Ion voltage & current charging
3) Accurate End of Charge by Li-Ion voltage and current according to battery manufacturer recommendations.
4) Can be adjusted by component choice

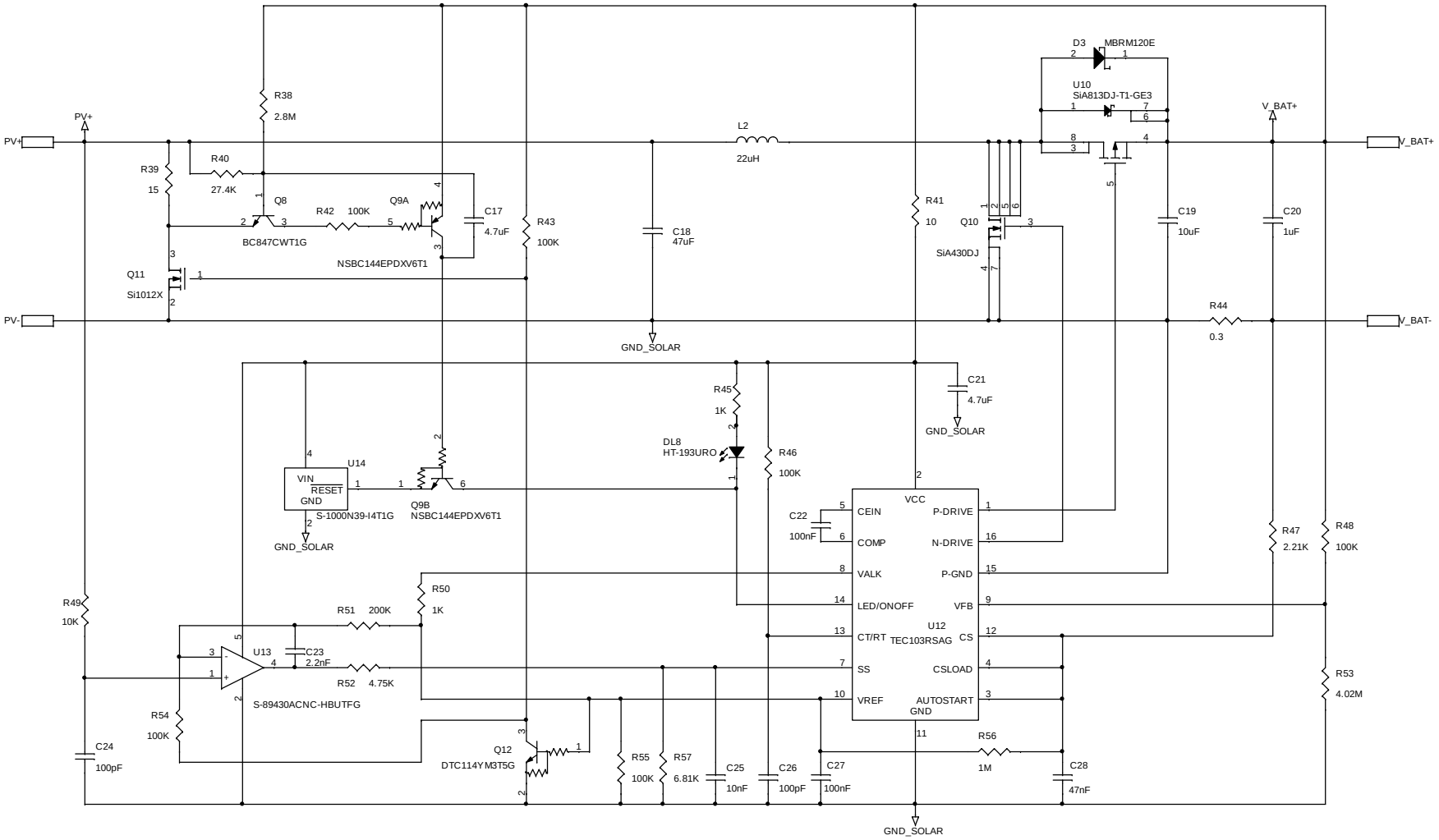
Typical Performance



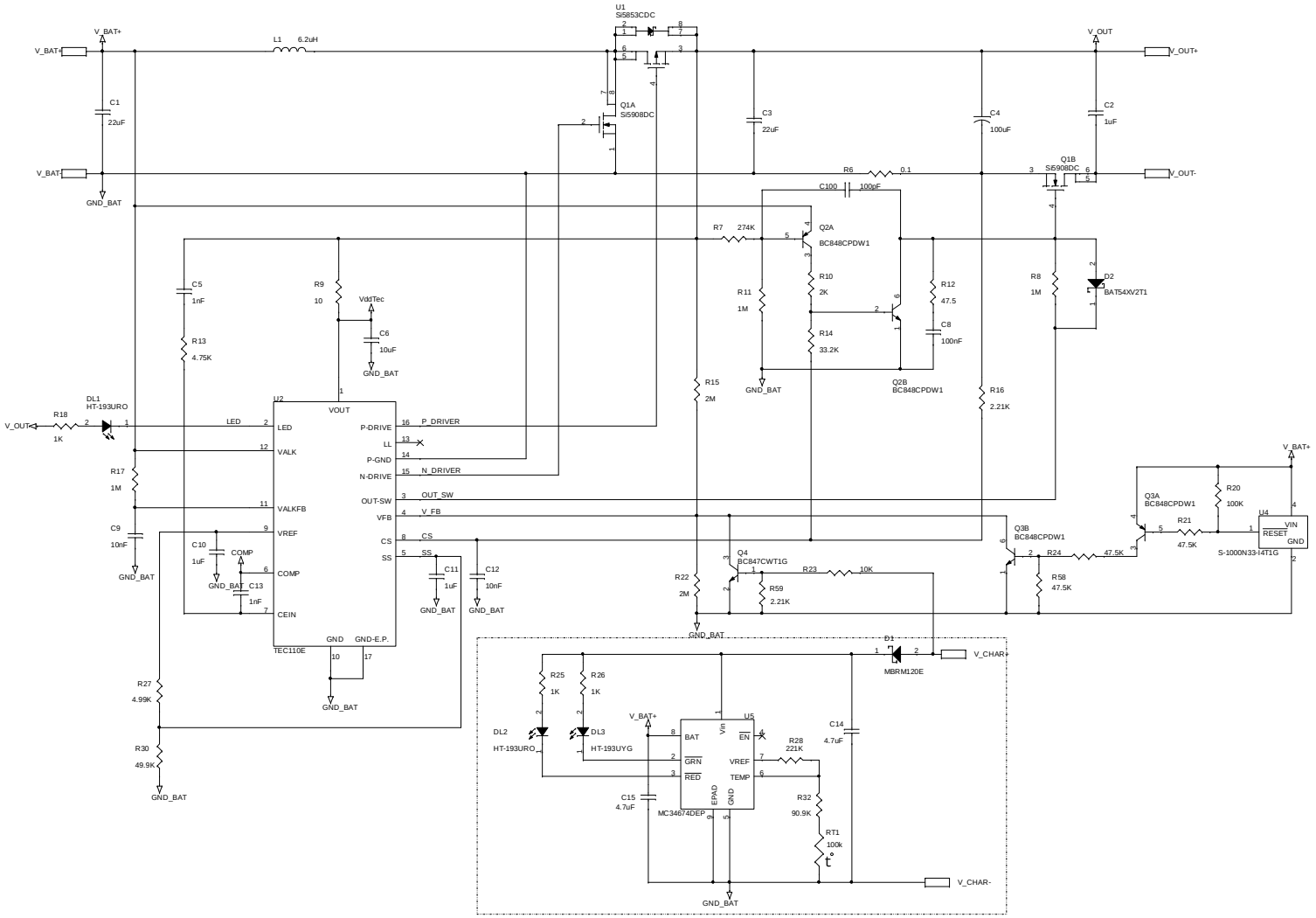



Iout vs. Vout
Vout [v]
0
1
2
3
4
5
0
100
200
300
400
500
600
Iout [mA]

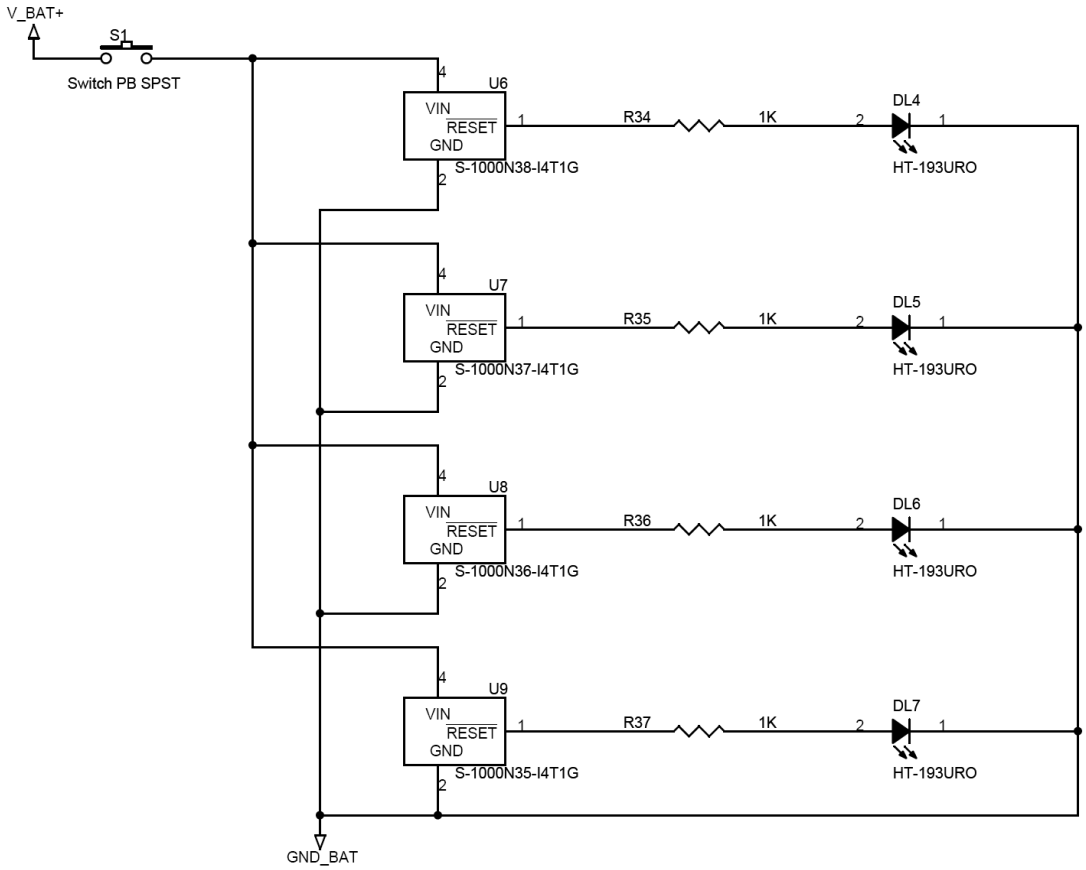
Schematic (Solar)



Schematic (Bidex Li-Ion)



Schematic (Li-Ion battery level)



Component List

Reference	Qty	Description	Package	Part Number	Vendor
Ceramic Capacitors					
C1,C3	2	Capacitor 22uF 10v X5R 20%	0805	LMK212BJ226MG-T	Taiyo-Yuden
C2,C10, C11,C20	4	Capacitor 1uF 10V X5R 20%	0402	LMK105BJ105MV-F	Taiyo-Yuden
C4	1	100uF 10V 20% 75mOhm(ESR) Tantalum Capacitor	CASE_C	TPSC107M010R0075	AVX
C5,C13	2	Capacitor 1nF 10V X5R 20%	0402	LMK042BJ102MC-F	Taiyo-Yuden
C6,C19	2	Capacitor 10uF 10V X5R 20%	0805	LMK212BJ106MG-T	Taiyo-Yuden
C9,C12,C25	3	Capacitor 10nF 10V X5R 20%	0402	LMK105BJ103MV-T	Taiyo-Yuden
C14,C15,C17,C21	4	Capacitor 4.7uF 10V X5R 20%	0603	LMK107BJ475MA-T	Taiyo-Yuden
C18	1	Capacitor 47uF 6.3V X5R 20%	0805	JMK212BJ476MG-T	Taiyo-Yuden
C8,C22,C27	3	Capacitor 100nF 10V X5R 20%	0402	LMK105BJ104MV-F	Taiyo-Yuden
C23	1	Capacitor 2.2nF 10V X5R 20%	0402		
C24,C26,C100	3	Capacitor 100pF 10V X5R 20%	0402	LMK0402BJ101MC-F	Taiyo-Yuden
C28	1	Capacitor 47nF 10V X5R 20%	0402	LMK105BJ473MV-T	Taiyo-Yuden
Diodes					
DL1,DL2, DL4,DL5, L6,DL7,DL8	7	SMD Red LED 0603	0603	HT-193URO	Harvatek
DL3	1	SMD Green LED 0603	0603	HT-193UYG	Harvatek
D1,D3	2	Surface Mount Schottky Power Rectifier	case457	MBRM120E	On
D2	1	Small Signal Schottky Diode	SOD523	BAT54XV2T1	On
Inductor					
J2	1	USB-A T.H. connector	USB_A_F_TH_PS	A0-062-08079	FM
J3	1	PV connector -	PAD2		
Connectors					
L1	1	INDUCTOR 6.2 µH , 29.1 mOhm	D63CB	A916CY-6R2M=P3	Toko
L2	1	INDUCTOR 22 µH, CORE 58240, N=20T,WIRE=0.315mm		58240	Magnetics
Resistors					
RT1	1	NTC	0402	NCP 15WF 1004F03RC	Murata
R1,R2	2	Resistor 75K Ohm 1%	0402		
R3	1	Resistor 0 Ohm	0402		Vishay
R4,R5,R30	3	Resistor 49.9K Ohm 1%	0402		
R6	1	Resistor 0.1 1%	0805	WSL0805 0.1 1% RT1	Vishay
R7	1	Resistor 274K Ohm 1%	0402		
R8,R11, R17,R56	4	Resistor 1M Ohm 1%	0402		
R9,R41	2	Resistor 10 Ohm 1%	0402		
R10	1	Resistor 2K Ohm 1%	0402		
R12	1	Resistor 47.5 Ohm 1%	0402		
R13,R52	2	Resistor 4.75K Ohm 1%	0402		
R14	1	Resistor 33.2K Ohm 1%	0402		
R15,R22	2	Resistor 2M Ohm 1%	0402		
R16,R47, R59	3	Resistor 2.21K Ohm 1%	0402		
R18,R25,	9	Resistor 1K Ohm 1%	0402		

R26,R34,R35,R36,R37,R45,R50					
R20,R42,R43,R46,R48,R54,R55	7	Resistor 100K Ohm 1%	0402		
R21,R24,R58	3	Resistor 47.5K Ohm 1%	0402		
R27	1	Resistor 4.99K Ohm 1%	0402		
R28	1	Resistor 221K Ohm 1%	0402		
R32	1	Resistor 90.9K Ohm 1%	0402		
R38	1	Resistor 2.8M Ohm 1%	0402		
R39	1	Resistor 15 Ohm 1%	0402		
R40	1	Resistor 27.4K Ohm 1%	0402		
R44	1	Resistor 0.3 1%	0805	WSL0805 0.3 1% RT1	Vishay
R23,R49	2	Resistor 10K Ohm 1%	0402		
R51	1	Resistor 200K Ohm 1%	0402		
R53	1	Resistor 4.02M Ohm 1%	0402		
R57	1	Resistor 6.81K Ohm 1%	0402		
Transistors					
Q1	1	Dual N-Channel 20-V (D-S) MOSFET	1206-8	Si5908DC-T1-E3	Vishay
Q2,Q3	2	Dual Transistors NPN/PNP	SC70-6	BC848CPDW1	On
Q4,Q8	2	General Purpose NPN Transistor	SC70-3	BC847CWT1G	ON
Q9	1	Dual PNP, NPN transistors	SOT563-6	NSBC144EPDXV6T1	On
Q10	1	N-Channel 20-V (D-S) MOSFET	POWERPAK-SC70-6_S	SiA430DJ-T1-GE3	Vishay
Q11	1	N-Channel 1.8-V (G-S) MOSFET	SC89-3	Si1012X	Vishay
Q12	1	NPN digital transistor	SOT723-3	DTC114YM3T5G	On
Integrated Circuits					
U1	1	P-Channel 20-V (D-S) MOSFET with Schottky Diode	1206-8	Si5853CDC-TI-E3	Vishay
U2	1	Charge Controller	QFN-16_4x4mm	TEC110ARSAG	Techtium
U4	1	3.3V - Low Voltage Detector	SNT-4A	S-1000N33-I4T1G	Seiko Instruments
U5	1	Integrated Li-Ion Charger 450mA	UDFN-8	MC34674DEP	Freescale
U6	1	3.8V - Low Voltage Detector	SNT-4A	S-1000N38-I4T1G	Seiko Instruments
U7	1	3.7V - Low Voltage Detector	SNT-4A	S-1000N37-I4T1G	Seiko Instruments
U8	1	3.6V - Low Voltage Detector	SNT-4A	S-1000N36-I4T1G	Seiko Instruments
U9	1	3.5V - Low Voltage Detector	SNT-4A	S-1000N35-I4T1G	Seiko Instruments
U10	1	P-Channel 20-V (D-S) MOSFET with Schottky Diode	POWERPAK-SC70-6_P	SiA813DJ-T1-GE3	Vishay
U12	1	DCDC up converter	QFN-16_4x4mm	TEC103RSAG	Techtium
U13	1	RtoR op amplifier	SC88-5	S-89430ACNC-HBUTFG	Seiko Instruments
U14	1	3.9V - Low Voltage Detector	SNT-4A	S-1000N39-I4T1G	Seiko Instruments

Notes

The selected components provide best performance at input power range of up-to ~500mW.

For optimizing Techtium application circuit for higher input power please contact Techtium.

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