

LTC3553EPD: Micropower USB Power Manager with Li-Ion Charger, Buck DC/DC, and LDO Regulator

DESCRIPTION

Demonstration Circuit DC1550A is a Micropower USB Power Manager with Li-Ion Charger, Buck DC/DC, and LDO Regulator featuring the LTC[®]3553.

PERFORMANCE SUMMARY

Specifications are at $T_A = 25^\circ\text{C}$

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
VBUS	Bus Input Voltage Range		4.35		6	V
V(BAT)	Battery Float Voltage	Constant Voltage Mode	4.15		4.23	V
I(BAT)	Battery Charge Current	Constant Current Mode, $R_{PRG} = 1.87k$	420		500	mA
VLDO	LDO Output Voltage	$I(VLDO) \leq 200\text{mA}$	3.25		3.35	V
VBUCK	Buck Regulator Output Voltage	$I(VBUCK) \leq 200\text{mA}$	1.15		1.25	V

QUICK START PROCEDURE

Refer to Figure 1 for the proper measurement equipment setup and jumper settings and follow the procedure below.

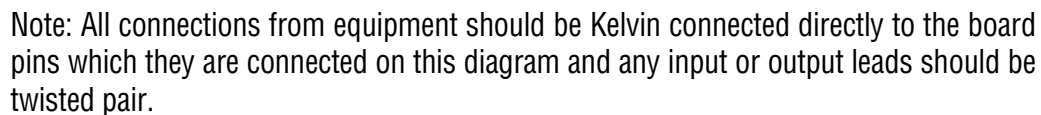
NOTE. When measuring the input or output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the input or output voltage ripple by touching the probe tip directly across the VBUS or VOUT(x) and GND terminals. See Figure 2 for proper scope probe technique.

- Set PS1 = 0V, PS2 = 3.6V. Press "ON" button for > 0.5s. Observe I(BAT) (AM2), VBUCK (VM5) and VLDO (VM6).
The LTC3553 is in STBY which reduces the battery current to less than 15 μA , even with both regulators running. In STBY the maximum current from regulators is reduced to as low as 10mA
- Set STBY (JP6) to "OFF", PS1 to 5V. Observe I(VBUS) (AM1), I(BAT) (AM2) and VPROG (VM2).

The LTC3553 is now operating in normal mode drawing more current from the battery. However the regulators are now capable of delivering over 200mA each. Also, since VBUS is now available, the battery charger is operating, but charge current is limited by the input current limit to 100mA.

- Set HPWR (JP2) to "500mA". Observe I(VBUS) (AM1), I(BAT) (AM2) and VPROG (VM2).
The input current limit is now 500mA, so the battery charger is delivering ~420mA to the battery.
- Set LD2 to 200mA, LD3 to 200mA. Observe VBUCK (VM5), VLDO (VM6) and I(BAT) (AM2).
Each regulator is supplying 200mA, and since the efficiency is ~90%, drawing ~225mA. So, the battery charger is only delivering approximately 50mA. This is because the input current limit is $500\text{mA} - 225\text{mA} - 225\text{mA} = 50\text{mA}$.

5. Set LD2 to 0A, LD3 to 0A. Press “OFF” button.
Observe VBUCK (VM5) and VLDO (VM6).
The regulators are now off and therefore supplying 0 current. The battery charger is once again supplying ~ 420mA to the battery.
6. Reset the Jumpers to their default position.



Note: All connections from equipment should be Kelvin connected directly to the board pins which they are connected on this diagram and any input or output leads should be twisted pair.

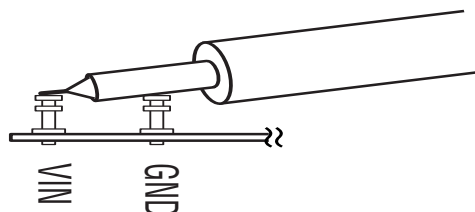


Figure 2. Measuring Input or Output Ripple

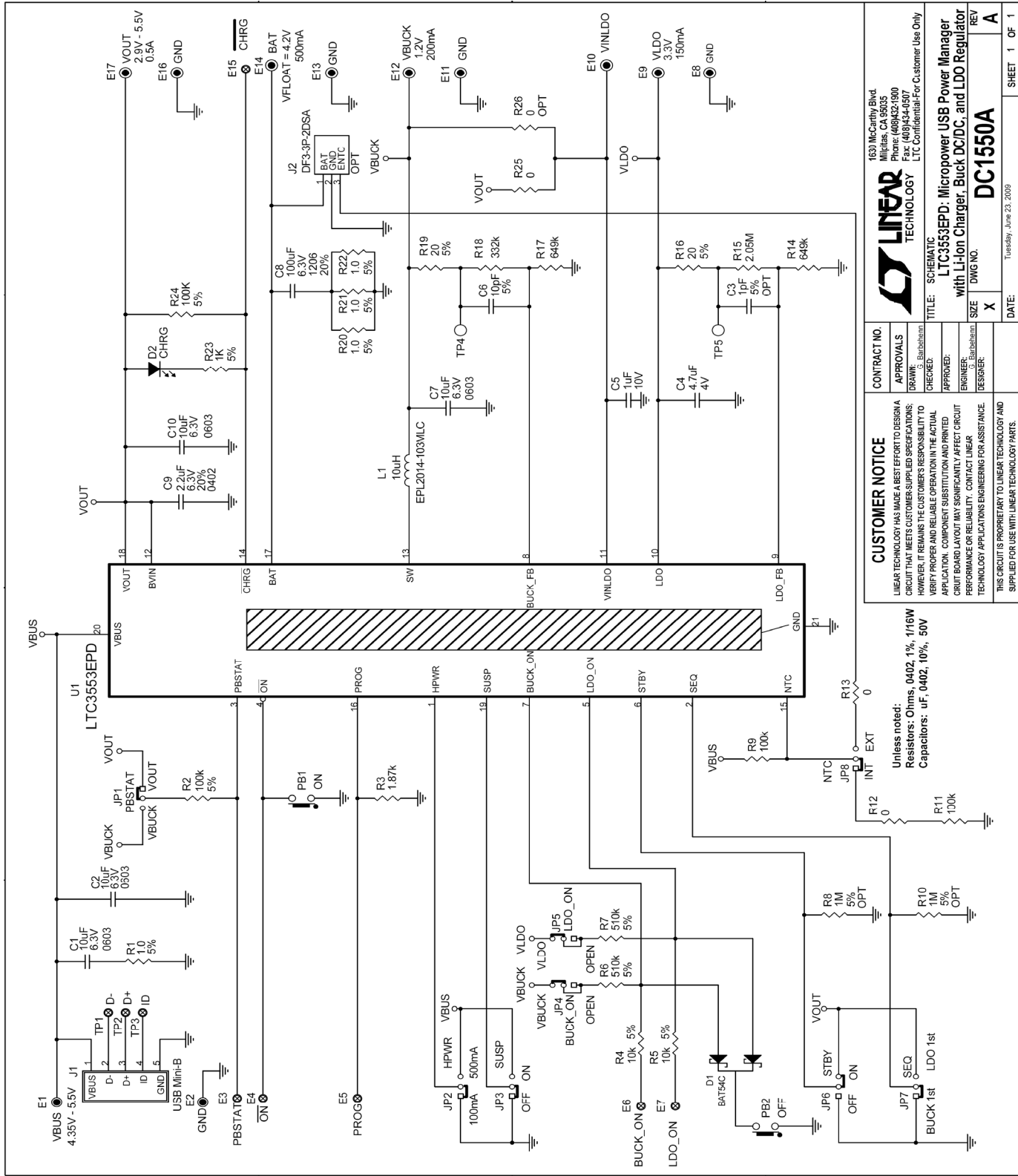


Figure 3. Circuit Schematic

CONTRACT NO.		APPROVALS	
DRAWN: (G. Baderheim)		CHECKED: (G. Baderheim)	
APPROVED: (G. Baderheim)		DESIGNED: (G. Baderheim)	
TITLE: SCHEMATIC		DATE: Tuesday, June 23, 2009	
LTC3553EPD: Micropower USB Power Manager with Li-Ion Charger, Buck DC/DC, and LDO Regulator		SHEET 1 OF 1	
SIZE X		REV A	
DWG NO. DC1550A			

Unless noted:
Resistors: Ohms, 0402, 1%, 1/16W
Capacitors: uF, 0402, 10%, 50V

CUSTOMER NOTICE
LINEAR TECHNOLOGY HAS MADE A BEST EFFORT TO DESIGN A CIRCUIT THAT MEETS CUSTOMER-SUPPLIED SPECIFICATIONS. HOWEVER, IT REMAINS THE CUSTOMER'S RESPONSIBILITY TO VERIFY PROPER AND RELIABLE OPERATION IN THE ACTUAL APPLICATION. COMPONENT SUBSTITUTION AND PRINTED CIRCUIT BOARD LAYOUT MAY SIGNIFICANTLY AFFECT CIRCUIT PERFORMANCE OR RELIABILITY. CONTACT LINEAR TECHNOLOGY APPLICATIONS ENGINEERING FOR ASSISTANCE.

THIS CIRCUIT IS PROPRIETARY TO LINEAR TECHNOLOGY AND SUPPLIED FOR USE WITH LINEAR TECHNOLOGY PARTS.

	Qty	Reference	Part Description	Manufacture / Part #
REQUIRED CIRCUIT COMPONENTS:				
1	3	C2, C7, C10	CAP, CHIP, X5R, 10 μ F, $\pm$ 10%, 6.3V, 0603	TDK, C1608X5R0J106K
2	1	C4	CAP, CHIP, X5R, 4.7 μ F, $\pm$ 20%, 4V, 0402	MURATA, GRM155R60G475M
3	1	C5	CAP, CHIP, X5R, 1 μ F, $\pm$ 10%, 10V, 0402	MURATA, GRM155R61A105KE15D
4	1	C6	CAP, CHIP, C0G, 10pF, $\pm$ 5%, 50V, 0402	MURATA, GRM1555C1H100JZ01D
5	1	C9	CAP, CHIP, X5R, 2.2 μ F, $\pm$ 20%, 6.3V, 0402	MURATA, GRM155R60J225ME15D
6	1	L1	IND, SMT, 10 μ H, 459m Ω , $\pm$ 20%, 0.631A, 2mmX2mm	COILCRAFT, EPL2014-103MLC
7	1	R3	RES, CHIP, 1.87k Ω , $\pm$ 1%, 1/16W, 0402	VISHAY, CRCW04021K87FKED
8	2	R9, R11	RES, CHIP, 100k Ω , $\pm$ 1%, 1/16W, 0402	VISHAY, CRCW0402100KFKED
9	3	R12, R13, R25, R26-OPT	RES, CHIP, 0 Ω jumper, 1/16W, 0402	VISHAY, CRCW04020000Z0ED
10	2	R14, R17	RES, CHIP, 649k Ω , $\pm$ 1%, 1/16W, 0402	VISHAY, CRCW0402649KFKED
11	1	R15	RES, CHIP, 2.05MEG Ω , $\pm$ 1%, 1/16W, 0402	VISHAY, CRCW04022M05FKED
12	1	R18	RES, CHIP, 332k Ω , $\pm$ 1%, 1/16W, 0402	VISHAY, CRCW0402332KFKED
13	1	U1	Micropower USB Power Manager with Li-Ion Charger, Buck DC/DC, and LDO Regulator	LINEAR TECH., LTC3553EPD
ADDITIONAL DEMO BOARD CIRCUIT COMPONENTS:				
1	1	C1	CAP, CHIP, X5R, 10 μ F, $\pm$ 10%, 6.3V, 0603	TDK, C1608X5R0J106K
2	0	C3-OPT	CAP, CHIP, C0G, 1pF, $\pm$ 5%, 50V, 0402	VISHAY, VJ0402A1R0JXAA
3	1	C8	CAP, CHIP, X5R, 100 μ F, $\pm$ 20%, 6.3V, 1206	MURATA, GRM31CR60J107ME39L
4	1	D1	DIODE, Dual Schottky, 30V, 200mA, SOT23	DIODES INC., BAT54C
5	1	D2	LED, GREEN, 0603	LITE-ON, LTST-C190KGKT
6	4	R1, R20, R21, R22	RES, CHIP, 1 Ω , $\pm$ 5%, 1/16W, 0402	VISHAY, CRCW04021R00JNED
7	2	R2, R24	RES, CHIP, 100k Ω , $\pm$ 5%, 1/16W, 0402	VISHAY, CRCW0402100KJNED
8	2	R4, R5	RES, CHIP, 10k Ω , $\pm$ 5%, 1/16W, 0402	VISHAY, CRCW040210K0JNED
9	2	R6, R7	RES, CHIP, 510k Ω , $\pm$ 5%, 1/16W, 0402	VISHAY, CRCW0402510KJNED
10	0	R8-OPT, R10-OPT	RES, CHIP, 1MEG Ω , $\pm$ 5%, 1/16W, 0402	VISHAY, CRCW04021M00JNED
11	2	R16, R19	RES, CHIP, 20 Ω , $\pm$ 5%, 1/16W, 0402	VISHAY, CRCW040220R0JNED
12	1	R23	RES, CHIP, 1k Ω , $\pm$ 5%, 1/10W, 0603	VISHAY, CRCW06031K00JNED
HARDWARE FOR DEMO BOARD ONLY:				
1	11	E1, E2, E8, E9, E10, E11, E12, E13, E14, E16, E17	TURRET, 0.09"	MILLMAX, 2501-2
2	6	E3, E4, E5, E6, E7, E15	TURRET, 0.061"	MILLMAX, 2308-2
3	1	J1	CONN, USB Mini-B	TYCO, 1734035-2
4	0	J2-OPT	CONN, 3 Pin Polarized	HIROSE, DF3-3P-2DSA
5	8	JP1, JP2, JP3, JP4, JP5, JP6, JP7, JP8	HEADER, 3 Pin, 2mm	SAMTEC, TMM-103-02-L-S
6	8	JP1, JP2, JP3, JP4, JP5, JP6, JP7, JP8	SHUNT, 2mm	SAMTEC, 2SN-BK-G
7	2	PB1, PB2	SWITCH, N.O. Momentary, 3.5mmx6mm SMT	PANASONIC, EVQPPFA25
8	4		STAND-OFF, NYLON, 0.375"	KEYSTONE, 8832
9	1		FAB, PRINTED CIRCUIT BOARD	DEMO CIRCUIT 1550A
10	1		STENCIL-TOP	STENCIL #1550-1-TOP
11	1		STENCIL-BOTTOM	STENCIL #1550-1-BOTTOM

Figure 4. Bill of Materials