LTC3553EUD-2
Micropower USB Power Manager with Li-Ion Charger, Always-On LDO and Buck Regulator

DESCRIPTION

Demonstration circuit DC1920A is a micropower USB power manager with Li-ion charger, buck DC/DC, and always-on LDO regulator featuring the LTC®3553EUD-2.

Design files for this circuit board are available at http://www.linear.com/demo

PERFORMANCE SUMMARY (T_A = 25°C)

SYMBOL	PARAMETER	CONDITIONS	MIN	MAX	UNITS
VBUS	Bus Input Voltage Range		4.35	5.5	V
V(BAT)	Battery Float Voltage	Constant Voltage Mode	4.15	4.23	V
I(BAT)	Battery Charge Current	Constant Current Mode, RPROG = 1.87k	380	420	mA
VLDO	LDO Output Voltage	I(VLDO) ≤ 150mA	3.25	3.35	V
VBUCK	Buck Regulator Output Voltage	I(VBUCK) ≤ 200mA	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.

1. Set PS1 = 0V, PS2 = 3.6V. Application of power to BAT (PS2), causes a POR. As shown in Figure 5 of the data sheet, the POR causes the LTC3553EUD-2 to enter the PDN1 state. In the PDN1 state VLDO is on, and VBUCK is off. After 1s, the LTC355EUD-2 transitions to the Hard Reset (HR) state. In HR VLDO is off, and total current draw from the battery is less than 1µA.

2. Press "REGS ON" button for > 0.5 seconds. Observe I(BAT) (AM2), VBUCK (VM5) and VLDO (VM6). Pressing the "REGS ON" button for > 0.5 seconds causes the LTC3553EUD-2 to enter the PUP1 state. In the PUP1 state both regulators are on. After 5 seconds, the LTC3553EUD-2 enters the PON state. Observe VLDO (VM6). VLDO is always-on, and is 3.3V. The LTC3553EUD-2 is in standby mode which reduces the battery current to less than 15µA, even with both regulators running. In standby mode the maximum current from the buck regulator is reduced to 10mA. Since BUCK_ON (pin 7) on the LTC3553EUD-2 is pulled up by the buck output, the buck regulator will remain on, and at 1.2V.

QUICK START PROCEDURE

3. Set STBY (JP6) to "OFF", and observe I(BAT) (AM2) and VPROG (VM2). The LTC3553EUD-2 is now operating in normal mode drawing more current from the battery. However the buck regulator is now capable of delivering up to 200mA, VLDO can deliver 150mA in either standby or normal mode.
4. Set PS1 to 5V. Observe I(VBUS) (AM1), I(BAT) (AM2) and VPROG (VM2). Since VBUS is now available, the battery charger is operating, but charge current is limited by the input current limit to 100mA (max.).
5. Set HPWR (JP2) to "500mA". Observe I(VBUS) (AM1), I(BAT) (AM2) and VPROG (VM2). The input current limit is now 500mA (max.) so the battery charger is delivering the full programmed charge current of ~400mA to the battery.
6. Set LD2 to 200mA, LD3 to 150mA. Observe VBUCK (VM5), VLDO (VM6) and I(BAT) (AM2). The buck regulator is supplying 200mA, and the always-on LDO is supplying 150mA. At ~90% efficiency the buck regulator is drawing ~50mA and the LDO is drawing 150mA from the VBUS supply. So, the battery charger is delivering approximately 250mA. This is because the input current limit is 450mA – 150mA – 50mA = 250mA.
7. Set LD2 to 0A, LD3 to 0A and PS1 to 0V. Press "Buck OFF" button. Observe VBUCK (VM5) and VLDO (VM6). The buck regulator is now off. To turn off the LDO hold down the $\overline{\text{ON}}$ button for at least 14 seconds. This puts the LTC3553EUD-2 in "Hard Reset" and shuts off the LDO.
8. 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 (Figure 1) and any input or output leads should be twisted pair.

LTC3553 Product Options (for Reference only)

Part Number	LDO	PGOOD	Hard Reset Time
LTC3553	On/Off Control	No	5 Seconds
LTC3553-2	Always On	Yes	14 Seconds

QUICK START PROCEDURE

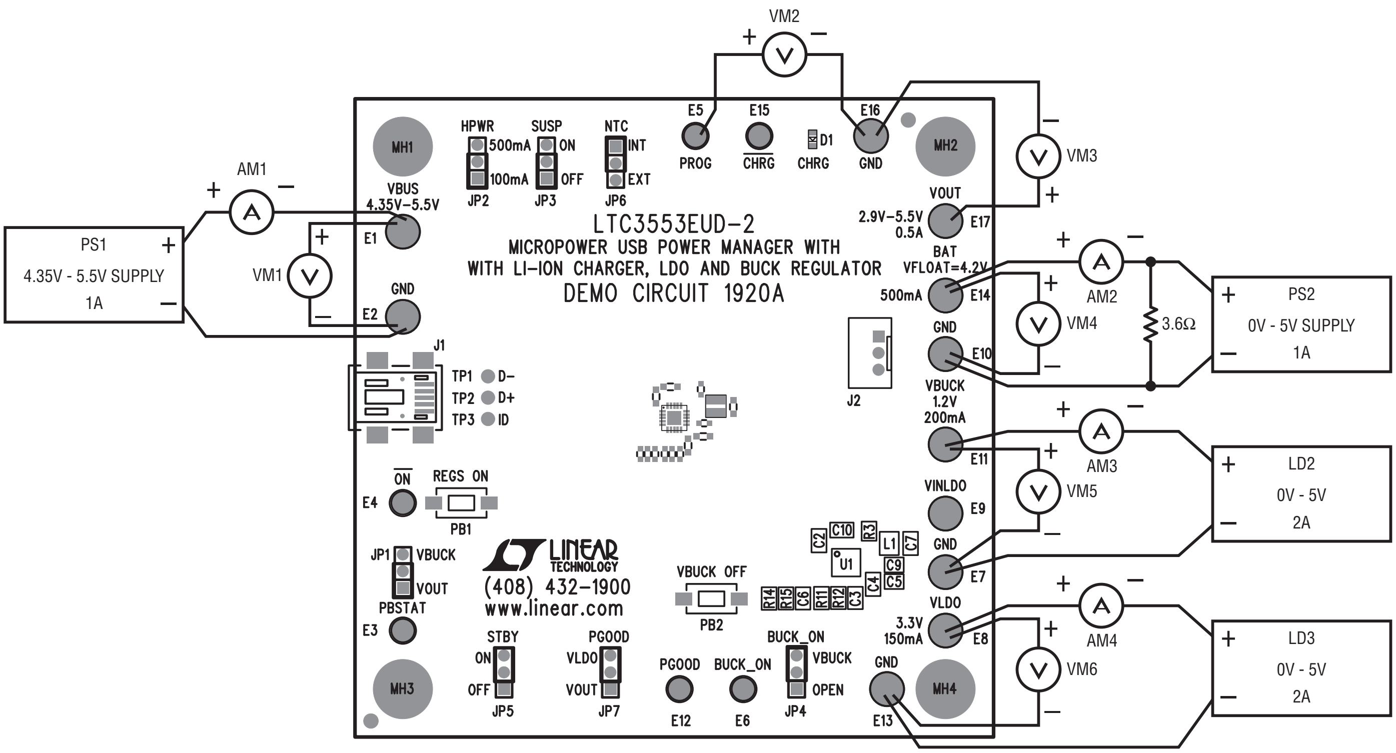


Figure 1. Proper Measurement Equipment Setup for DC1920A

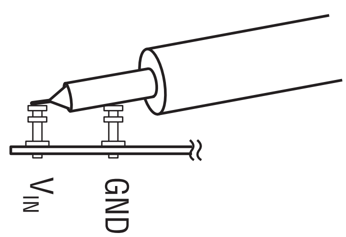
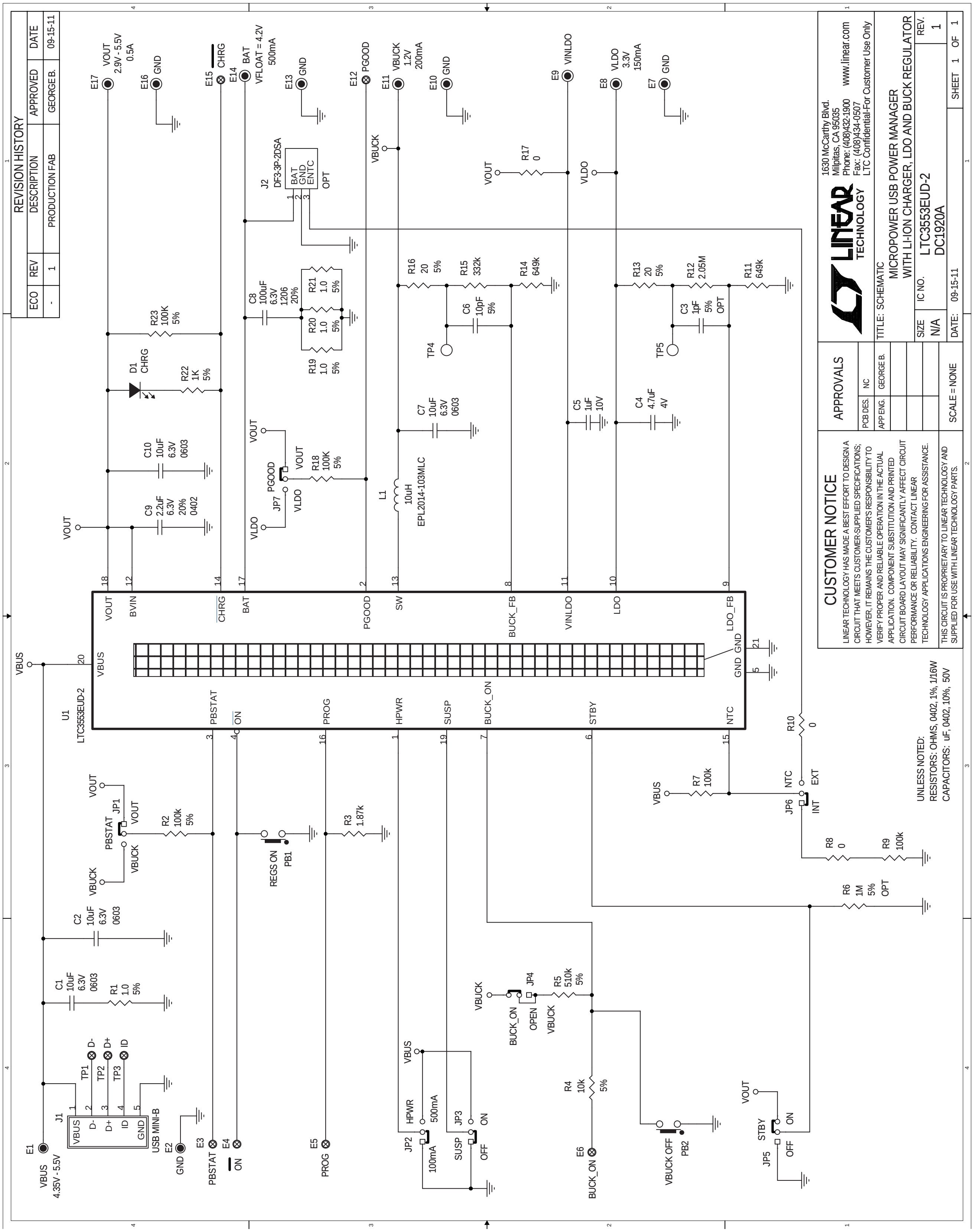


Figure 2. Measuring Input or Output Ripple

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	3	C2, C7, C10	CAP, CHIP, X5R, 10µF, ±20%, 6.3V, 0603	TDK, C1608X5R0J106K
2	1	C4	CAP, CHIP, X5R, 4.7µF, ±20%, 4V, 0402	MURATA, GRM155R60G475M
3	1	C5	CAP, CHIP, X5R, 1µF, ±10%, 10V, 0402	MURATA, GRM155R61A105KE15D
4	1	C6	CAP, CHIP, C0G, 10pF, ±5%, 50V, 0402	MURATA, GRM1555C1H100JZ01D
5	1	C9	CAP, CHIP, X5R, 2.2µF, ±20%, 6.3V, 0402	MURATA, GRM155R60J225ME15D
6	1	L1	IND, SMT, 10µH, 459mΩ, ±20%, 0.631A, 2mm × 2mm	COILCRAFT, EPL2014-103MLC
7	1	R3	RES, CHIP, 1.87kΩ, ±1%, 1/16W, 0402	VISHAY, CRCW04021K87FKED
8	2	R7, R11	RES, CHIP, 100kΩ, ±1%, 1/16W, 0402	VISHAY, CRCW0402100KFKED
9	3	R8, R10, R17	RES, CHIP, 0Ω JUMPER, 1/16W, 0402	VISHAY, CRCW04020000Z0ED
10	2	R11, R14	RES, CHIP, 649kΩ, ±1%, 1/16W, 0402	VISHAY, CRCW0402649KFKED
11	1	R12	RES, CHIP, 2.05MΩ, ±1%, 1/16W, 0402	VISHAY, CRCW04022M05FKED
12	1	R15	RES, CHIP, 332kΩ, ±1%, 1/16W, 0402	VISHAY, CRCW0402332KFKED
13	1	U1	MICROPOWER USB POWER MANAGER WITH LI-ION CHARGER, LDO AND BUCK REGULATOR	LINEAR TECH., LTC3553EUD-2
Additional Demo Board Circuit Components				
1	1	C1	CAP, CHIP, X5R, 10µF, ±20%, 6.3V, 0603	TDK, C1608X5R0J106K
2	0	C3-OPT	CAP, CHIP, C0G, 1pF, ±5%, 50V, 0402	VISHAY, VJ0402A1R0JXAA
3	1	C8	CAP, CHIP, X5R, 100µF, ±20%, 6.3V, 1206	MURATA, GRM31CR60J107ME39L
4	1	D1	LED, GREEN, 0603	LITE-ON, LTST-C190KGKT
5	4	R1, R19-R21	RES, CHIP, 1Ω, ±5%, 1/16W, 0402	VISHAY, CRCW04021R00JNED
6	3	R2, R18, R23	RES, CHIP, 100kΩ, ±5%, 1/16W, 0402	VISHAY, CRCW0402100KJNED
7	1	R4	RES, CHIP, 10kΩ, ±5%, 1/16W, 0402	VISHAY, CRCW040210K0JNED
8	1	R5	RES, CHIP, 510kΩ, ±5%, 1/16W, 0402	VISHAY, CRCW0402510KJNED
9	0	R6	RES, CHIP, 1MΩ, ±5%, 1/16W, 0402	VISHAY, CRCW04021M00JNED
10	2	R13, R16	RES, CHIP, 20Ω, ±5%, 1/16W, 0402	VISHAY, CRCW040220R0JNED
11	1	R22	RES, CHIP, 1kΩ, ±5%, 1/10W, 0603	VISHAY, CRCW06031K00JNED
Hardware For Demo Board Only				
1	11	E1-E2, E7-E11, E13-E14, E16-E17	TURRET, 0.09 DIA	MILL-MAX, 2501-2-00-80-00-00-07-0
2	6	E3-E6, E12, E15	TURRET, 0.061”	MILL-MAX, 2308-2-00-80-00-00-07-0
3	1	J1	CONN, USB MINI-B	TYCO, 1734035-2
4	0	J2-OPT	CONN, 3 PIN POLARIZED	HIROSE, DF3-3P-2DSA
5	7	JP1-JP7	HEADER, 3 PIN, 2mm	SAMTEC, TMM-103-02-L-S
6	7	JP1-JP7	SHUNT, 2mm	SAMTEC, 2SN-BK-G
7	2	PB1, PB2	SWITCH, N.O. MOMENTARY, 3.5mm × 6mm SMT	PANASONIC, EVQPPFA25
8	4		STAND-OFF, NYLON, 0.375”	KEYSTONE, 8832

SCHEMATIC DIAGRAM



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