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iCE40 Ultra™ Mobile Development Platform User Guide

EB90 Version 1.1, June 2015

Introduction

This platform is designed to develop and demonstrate various mobile applications using the iCE40 Ultra device. The board is in the form factor of a bar phone featuring various sensors and connectivity to external mobile software development platforms.

Kit Contents

The following items are included in the development kit:

- **Main Board** – The main board is mounted in lower plastic enclosures.
- **Key Set** – The key set includes keys A, B, C, and Custom. Key A is installed on the main unit by default.
- **DragonBoard Interface Module**
- **Interconnecting Cables** – The cables include USB mini-B cable, DragonBoard interface ribbon cable, and +5 V supply flywire.

Variants

The unit is built in two variants with different sets of RGB LED and IR LED parts.

Variant A includes the following parts on the board:

- RGB LED used at D12: AEBMT-RGBZ by Advanced Optoelectronics Technology
- IR LED used at D7: SFH 4645 by Osram Opto Semiconductors

Variant B includes the following parts on the board:

- RGB LED used at D13: APTF1616SEEZGQBDC by Kingbright
- IR LED used at D7: VSMB2948SL by Vishay Semiconductor

The variants can be distinguished through the populated status of D12 and D13.

- Variant A: D12 is populated and D13 is not populated
- Variant B: D12 is not populated and D13 is populated

Demo Board Architecture

Figure 1 shows the demo board architecture. The different I2C sensors are split up and wired on two separate I2C buses as Pool A and Pool B. The other sensors that are not I2C are either wired separately or are connected instead of Pool B and other resources on the board. Changes to connectivity are user controllable and achieved by means of changing the keys – a method to replace using multiple jumpers to re-route wiring to different resources.

Figure 1. Block Diagram

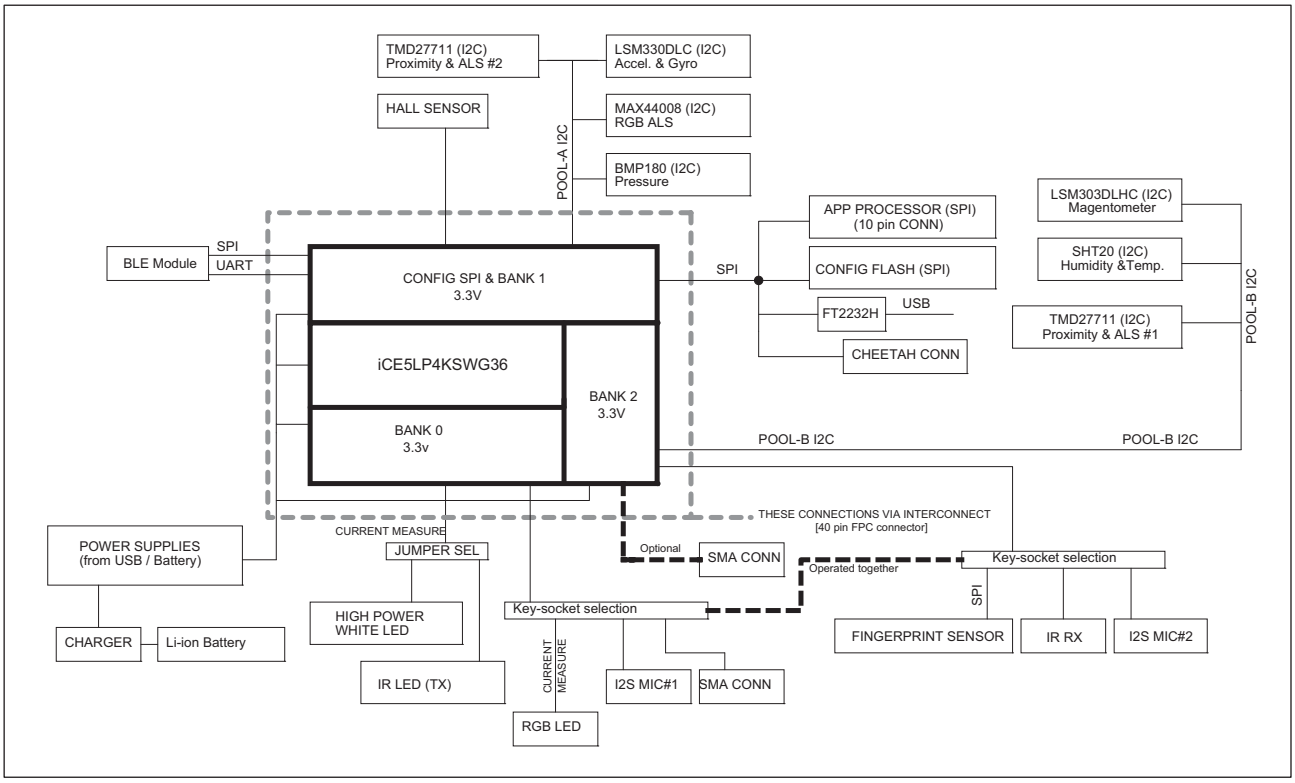


Figure 2. Top View of Main Unit

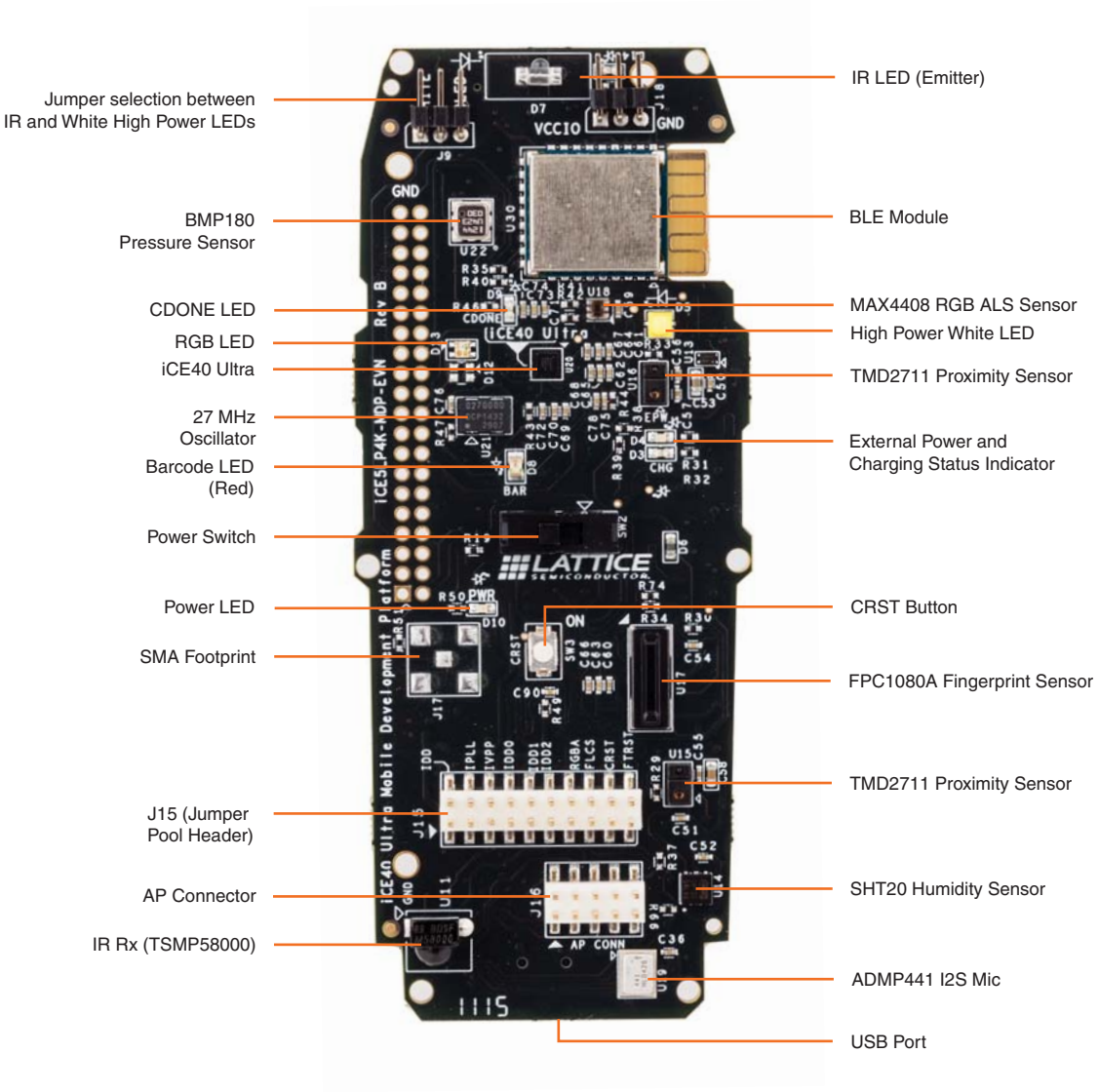
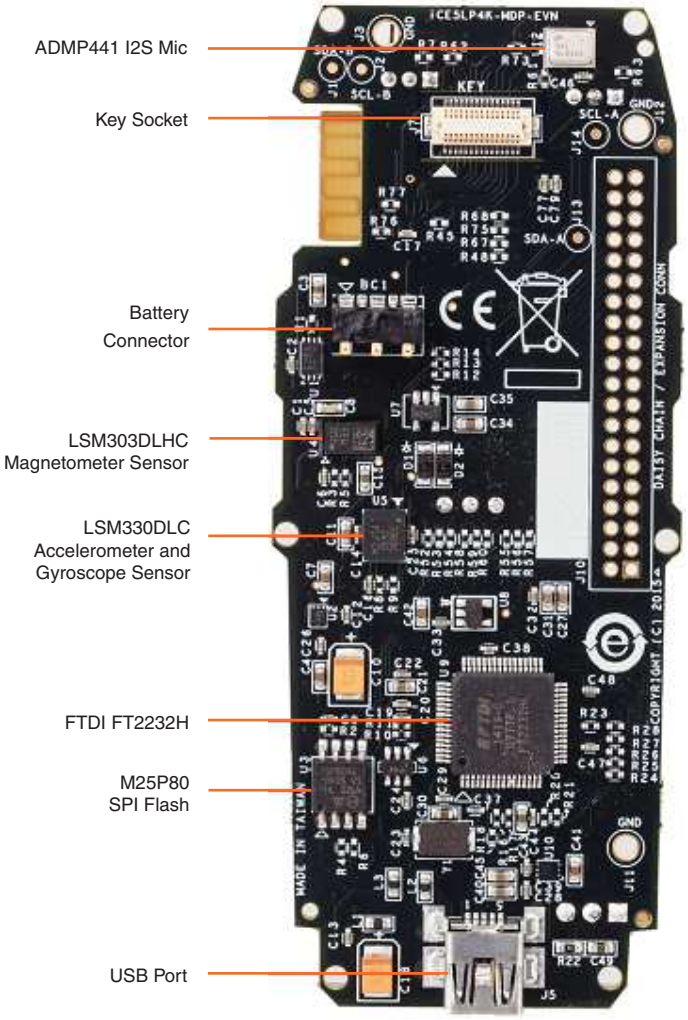


Figure 3. Bottom View of Main Unit



Features

- Supports BLE (Bluetooth Low Energy) module
- Supports OTA (Over-The-Air) configuration of FPGA
- Form factor similar to mobile phone

Sensor list

The following table lists the different sensors used on the board.

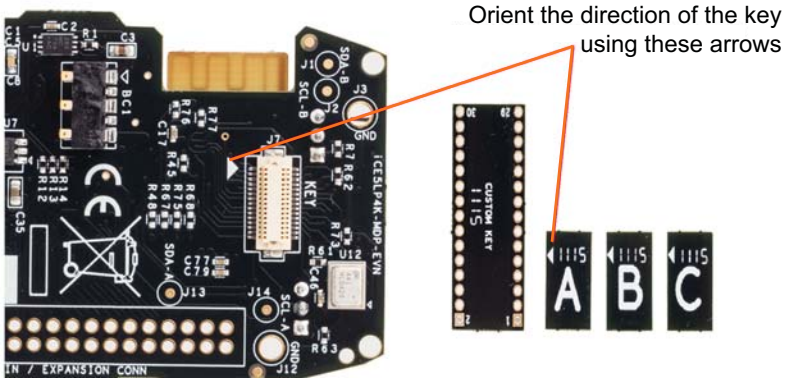
Table 1. Sensor List

Number	Sensor Function	Interface	Sensor Part Number	Manufacturer
1	RGB LED (Variant 1)	Direct	AEBMT-RGBZ	AOT
2	RGB LED (Variant 2)	Direct	APTF1616SEEZGQBDC	Kingbright
3	High Current IR Tx LED (Variant A)	Direct	SFH4645	Osram Opto
4	High Current IR Tx LED (Variant B)	Direct	VSMB2948SL	Vishay Semiconductor
5	High Current Visible LED	Direct	XBDA WT-00-0000-00000LCE3	Cree Inc.
6	IR Rx	Direct	TSMP58000	Vishay Semiconductor
7	Proximity Sensor (Two numbers)	I2C	TMD27711	A MS-TA OS USA Inc
8	RGB Light Sensor	I2C	MAX44008	Maxim-IC
9	Temperature Sensor	I2C	BMP180 (integrated)	Bosch
10	Barometric Pressure	I2C	BMP180	Bosch
11	Accelerometer	I2C	LSM330DLC	ST Micro
12	Gyroscope	I2C		
13	Magnetometer	I2C	LSM303DLHC	ST Micro
14	Humidity	I2C	SHT20	Sensirion
15	Hall	Direct	BU52051NV X-TR	Rohm Semiconductor
16	Fingerprint	SPI	FPC1080A	Fingerprints
17	MEMS Mic (Two numbers)	I2S	ADMP441	Invensense

Key-socket Arrangement

Three predefined keys and one user defined key is provided to allow the user to change the wiring of the board between different sensor sets as described in Table 2. The table also denotes pin assignments to the iCE40 Ultra FPGA on the board. While selecting and inserting a particular key of choice, ensure that you align the aligning arrow on the key and on the main PCB. The keys are mechanically delicate, and hence, you must be careful while inserting and removing the keys. Figure 4 shows the four keys and socket on the main board.

Figure 4. Key-socket Arrangement



Pin assignments iCE40 Ultra FPGA

Table 2 lists the complete pin assignments for the iCE40 Ultra FPGA for the different keys and other hard wired peripherals on the board

Table 2. Pin Assignment

Pin Number	Pin Name	Bank	Pin Assignment for Default Key A	Pin Assignment for Key B	Pin Assignment for Key C
A4	VCCIO_0	Bank 0	3V3	3V3	3V3
B5	IOT_46B_G0	Bank 0	Not used / Optional ext SMA clock	Not used / Optional ext SMA clock	I2S_WS1 (Microphone 1 (DP R51))
A6	RGB2	Bank 0	BLED (RGB LED)	BLED (RGB LED)	I2S_CE1 (Microphone 1)
B6	RGB1	Bank 0	GLED (RGB LED)	GLED (RGB LED)	I2S_SCK1 (Microphone 1)
C6	RGB0	Bank 0	RLED (RGB LED)	RLED (RGB LED)	I2S_SD1 (Microphone 1)
A2	IRLED	Bank 0	HPLED (IRLED or VLED)	HPLED (IRLED or VLED	HPLED (IRLED or VLED
A1	VSSIO_LED	Bank 0	GND	GND	GND
C3	SPI_VCCIO1	Bank 1	3V3	3V3	3V3
D1	IOB_33B_SI_MOSI_SPI1	Bank 1	ICE_SI/FLSH_MOSI	ICE_SI/FLSH_MOSI	ICE_SI/FLSH_MOSI
F2	IOB_32A_SO_MISO_SPI1	Bank 1	ICE_SO/FLSH_MISO	ICE_SO/FLSH_MISO	ICE_SO/FLSH_MISO
E1	IOB_34A_SCK_SCK_SPI1	Bank 1	FLSH_SCLK	FLSH_SCLK	FLSH_SCLK
F1	IOB_35B_SS_MCSNO_SPI1	Bank 1	FLSH_CS	FLSH_CS	FLSH_CS
E4	IOB_12A_G4_CDONE	Bank 1	CDONE	CDONE	CDONE
D3	CRESET_B	Bank 1	CRESET	CRESET	CRESET
B2	IOB_31B	Bank 1	HALL_OUT/BMP_XCLR	HALL_OUT/BMP_XCLR	HALL_OUT/BMP_XCLR
C1	IOB_30A	Bank 1	PoolA_Sensor_SDA	PoolA_Sensor_SDA	PoolA_Sensor_SDA
E2	IOB_29B	Bank 1	Pool_Sensor_SCL	Pool_Sensor_SCL	Pool_Sensor_SCL
D2	IOB_27B	Bank 1	CLK_STNDBY# (Osc. Standby)	CLK_STNDBY# (Osc. Standby)	CLK_STNDBY# (Osc. Standby)
B1	IOB_26A	Bank 1	FP_RSTn (Fingerprint reset)	FP_RSTn (Fingerprint reset)	FP_RSTn (Fingerprint reset)
E3	IOB_20A	Bank 1	UART_TX (BLE)	UART_TX (BLE)	UART_TX (BLE)

Pin Number	Pin Name	Bank	Pin Assignment for Default Key A	Pin Assignment for Key B	Pin Assignment for Key C
F3	IOB_16A	Bank 1	UART_RX (BLE)	UART_RX (BLE)	UART_RX (BLE)
B4	IOB_10A	Bank 1	PROC_INTR	PROC_INTR	PROC_INTR
C2	IOB_25B_G3	Bank 1	PROC_CS	PROC_CS	PROC_CS
F4	IOB_11B_G5	Bank 1	CLK (27 MHz)	CLK (27 MHz)	CLK (27 MHz)
C4	VCCIO_2	Bank 2	3V3	3V3	3V3
E5	IOB_7B	Bank 2	BAR_LED	FP_INTR (Fingerprint)	S_LR2 (Microphone 2)
F5	IOB_6A	Bank 2	IR_IN (IR Rx)	IR_IN (IR Rx)	I2S_LR1 (Microphone 1)
D5	IOB_5B_MCSN 0_SPI2	Bank 2	Spare GPIO on Exp Header p.16	FP_CS (Fingerprint)	I2S_WS2 (Microphone 2)
D6	IOB_4A_SCK_ SPI2	Bank 2	PoolB_Sensor_SCL	FP_SCK (Fingerprint)	I2S_SD2 (Microphone 2)
E6	IOB_3B_G6_M OSI_SPI2	Bank 2	PoolB_Sensor_SDA	FP_MOSI (Fingerprint)	ISS_SCK2 (Microphone 2)
F6	IOB_2A_MISO_ SPI2	Bank 2	Spare GPIO on Exp Header p.20	FP_MISO (Fingerprint)	I2S_CE2 (Microphone 2)
D4	VPP_2V5	Power	2V5	2V5	2V5
B3	VCCPLL	Power	1V2	1V2	1V2
A5	VCC	Power	1V2	1V2	1V2
C5	GND1	Power	GND	GND	GND
A3	GND2	Power	GND	GND	GND

External Interfacing

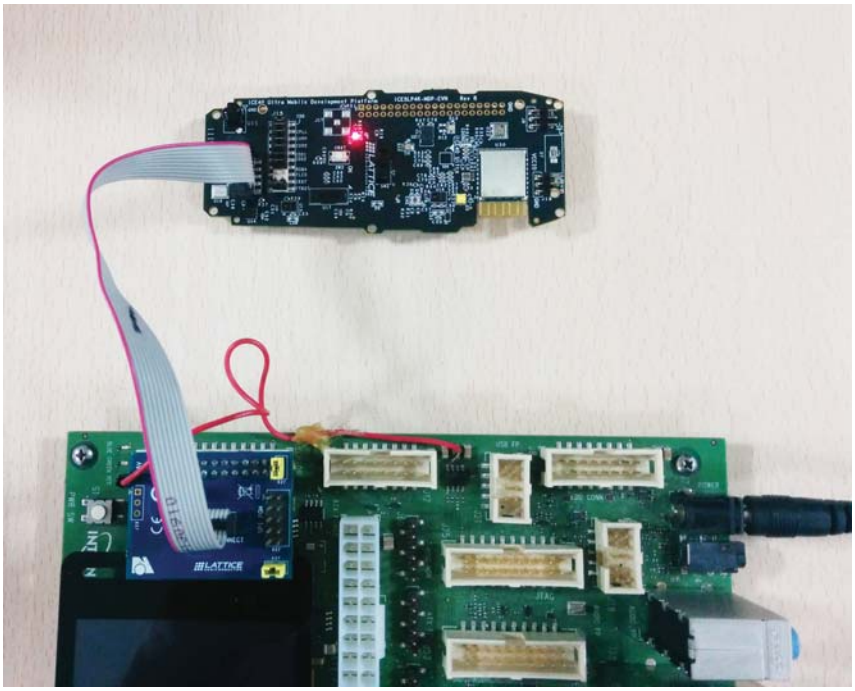
The board can be interface to external systems by one of two methods:

- SPI based application processor interface via J16 (AP Conn)
- BLE wireless module

For DragonBoard based SPI based application processor interfacing, a DragonBoard interfacing module and a connecting ribbon cable are required (provided). Figure 5 shows the interfacing module, connecting cable, and method to power the module from the DragonBoard.

A BLE module provides a feature on the board for wireless interfacing using Bluetooth Low energy version 4.

Figure 5. Data and 5 V Wiring from DragonBoard to DB Interface Module



Clocking

The board features an onboard 27 MHz oscillator. When an external clock is required, the SMA footprint can be populated with a suitable SMA SMD connector (such as Molex part # 732511350). You must depopulate R51 on the board.

Daisy Chain Interconnect / Expansion Connector

Daisy chain interconnect to the iCE FPGA by means of a connecting cable between two boards is possible via J10 on the main board. Refer to the schematics for the pin assignments of J10. All the pins of the FPGA are accessible on this connector – and hence also forms a convenient way to tap into, or expand from any pin on the FPGA.

Basic Usage Procedures

Powering the Board

The board may be powered using one of three following methods:

- USB cable: USB A to mini B cable (supplied) connected to a PC may be used to power the board
- +5 V supplied to the DragonBoard interface module used to power the board through the provided ribbon cable. The +5 V can be tapped from the DragonBoard as indicated in the Figure 5.
- Internal rechargeable battery not supplied with the kit. It must be procured separately. An example is the Nokia BL-5C Lithium-ion battery shown in Figure 7.

Charging the Battery

The battery is charged when USB power is applied. Glowing of the green LED D3 (CHG) indicates the charging of the battery. Glowing of the green LED D4 (EPW) indicates that an external charging power (USB) is applied. Glowing D3 indicates that charging is in progress. If D3 does not glow and D4 (EPW) glows, it means that charging is complete.

Figure 6. USB Socket Located on the Lower Side

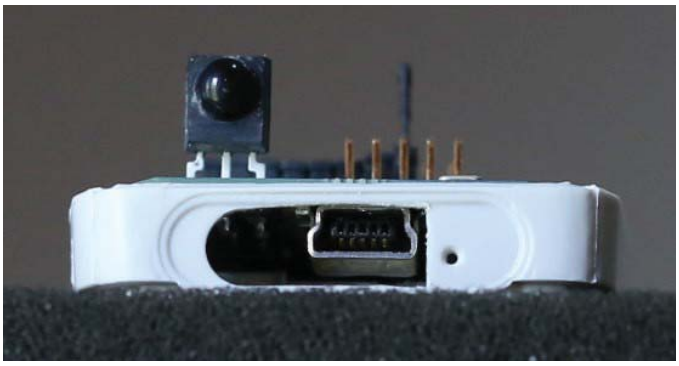


Figure 7. Nokia BL-5C Li-ion Battery Mounted Inside Back-cover of the Main Unit

Configuring the FPGA

The iCE40 Ultra can be configured using one of two methods:

- By programming the on-board SPI Flash U3 (ST Micro's M25P80)
- By directly configuring the FPGA using a processor to configure via iCE40 Ultra's SPI

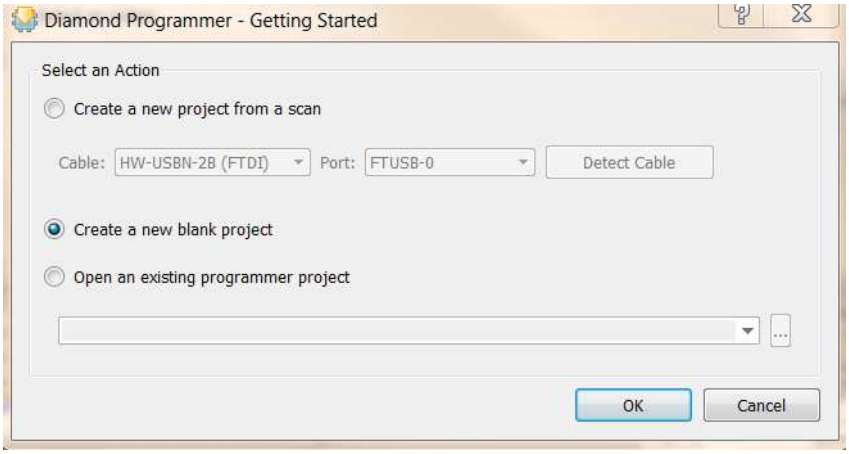
Configuration by Programming SPI Flash

The SPI Flash (M25P80) can be programmed using the on-board FTDI's FT2232H (USB-SPI FIFO) via USB and Lattice Diamond® Programmer.

To program the SPI Flash via USB and Lattice Diamond Programmer:

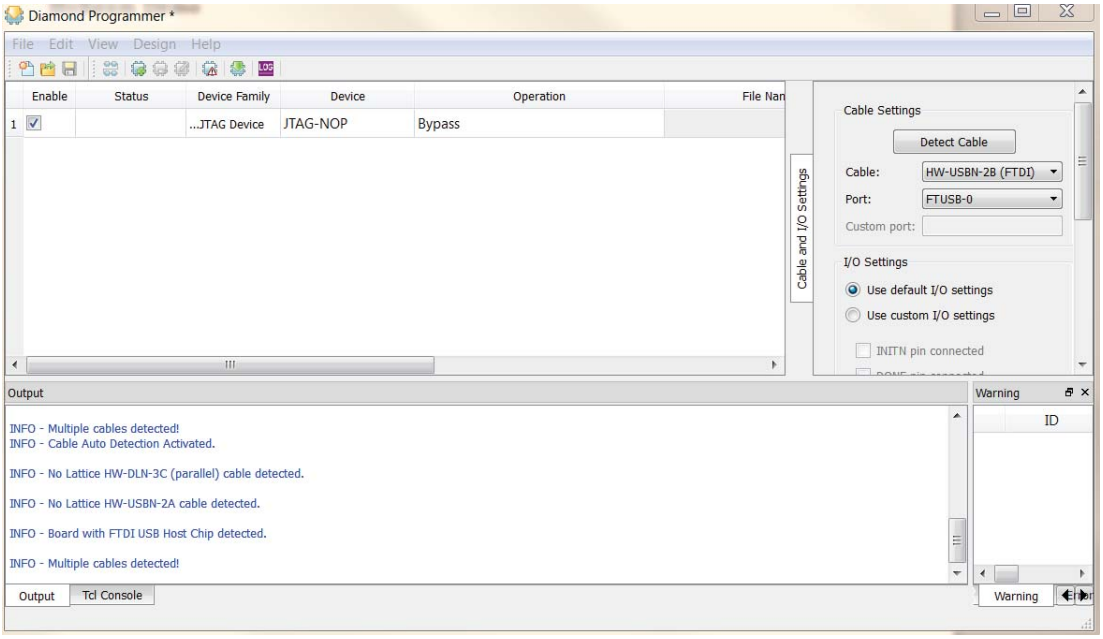
1. Apply a jumper to FLCS on jumper pool header J15.
2. Connect the USB cable to the demo board.
3. Download the bitstream in SPI Flash (M25P80) using Lattice Diamond Programmer. To download the bitstream:
    a. Open Diamond Programmer version 3.2 or above and select **Create a new blank project** as shown in Figure 8.

Figure 8. Diamond Programmer Getting Started Dialog Box



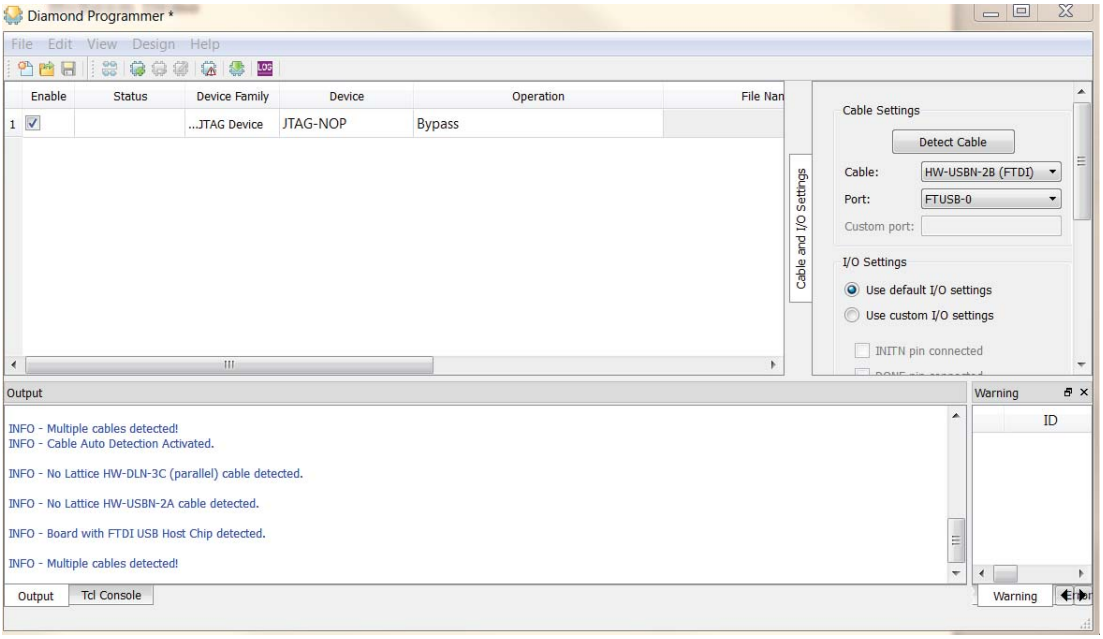
b. The Diamond Programmer main interface opens, as shown in Figure 9.

Figure 9. Diamond Programmer Main Interface



c. Select **iCE5LP** in Device Family and **iCE5LP4K** in Device, as shown in Figure 10.

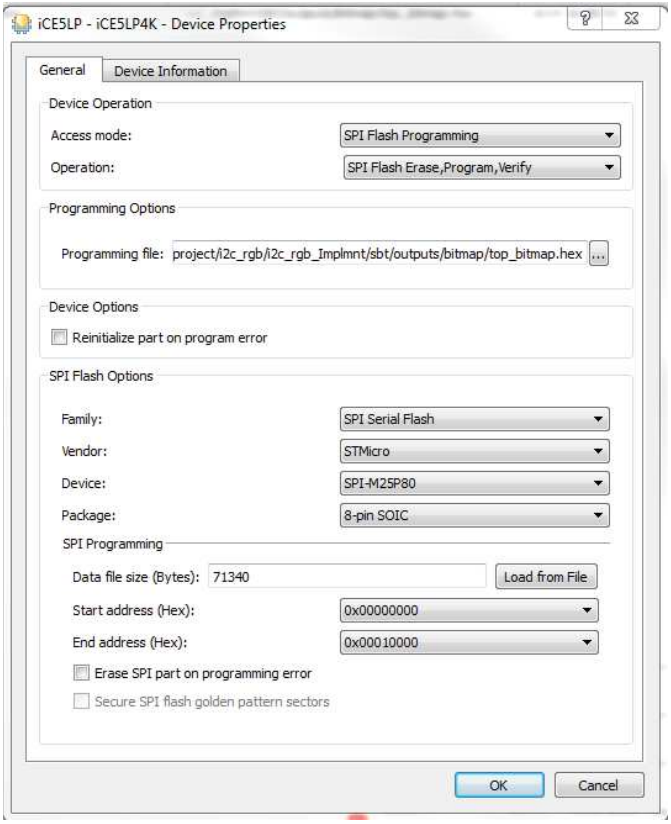
Figure 10. Device Selection



d. Double-click **Fast Program** and choose the desired *.bin file.

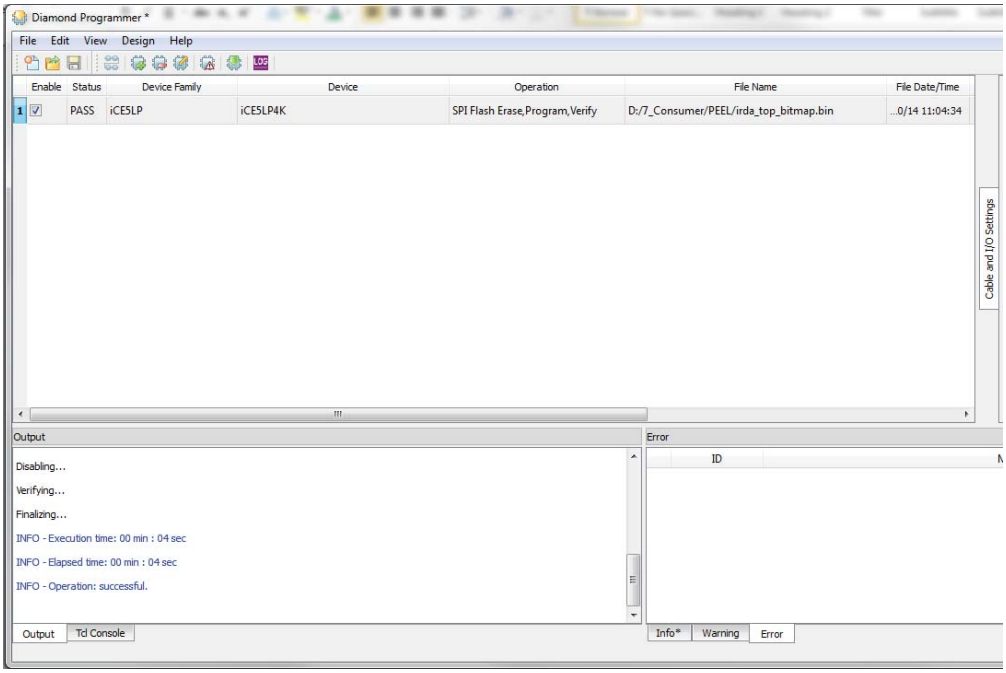
e. In the Device properties dialog box, select the program to be used in programming the device and click **OK**, as shown in Figure 11.

Figure 11. Device Properties Dialog Box



e. Verify that the operation is completed successfully. In the main interface, *INFO: Operation: successful* is displayed in the Output pane.

Figure 12. Verifying Operation



Alternatively, the SPI Flash can be programmed using Totalphase's Aardvark or Cheetah. *Flash Center GUI* flash programming utility can be hooked up to the J29 (SPI PGM) header on the DragonBoard interfacing module.

To program the SPI Flash using Aardvark/Cheetah:

1. Apply a jumper on FLCS located on jumper pool header J15.
2. Ensure that the ribbon cable is connected between J16 (AP CONN) on main board and J26 (AP Interconnect) on the DragonBoard interfacing module.
3. Remove shunt on J20 (PGM) header on the DragonBoard interfacing module.
4. Connect Aardvark / Cheetah to the J29 (SPI PGM) header on the DragonBoard interfacing module and its USB to the PC/Laptop running the Flash Center GUI utility.
5. While operating the CRST button or applying the jumper on CRST of J15 (on the main board), use the Flash Center GUI and appropriate bitmap to program the M25P80 SPI Flash.
6. After programming, remove the shunts on CRST and PGM.

Direct Configuration by a Processor (Processor Configuration)

The iCE40 Ultra FPGA can be configured directly without using an external SPI Flash. This can be done by the application processor interfacing with the iCE40 Ultra SPI lines. While using this method appropriate software and Android Application is required.

To configure the hardware:

1. Remove the jumper shunt on FLCS located on J15 (jumper pool header).
2. Apply a jumper shunt on FTRST located on J15 (jumper pool header).
3. Remove the jumper shunt on CRST located on J15 (jumper shunt header).

4. Using the ribbon cable provided, connect the main PCB and the DragonBoard through the DragonBoard interfacing module.
5. Run the appropriate software / application to configure iCE40 Ultra directly from the DragonBoard processor.

Current Measurements

FPGA currents are measured by inserting ammeters in series with the respective current paths. This is achieved by means of removing the jumper shunts on the pooled jumper header J15, and replacing those by ammeters. Note the legends printed across each of the jumpers on the PCB and the corresponding wiring in the schematics around region of J15 to make the desired measurements. Current measurements for the high power LED (IR or white) can be done at J9 (LED selecting 3 pin jumper). Note that RGB LED current measurements on J15 (jumper pool header) is for the common Anode limb of the LED and not individual RGB circuits; Thus appropriate drive must be made to measure individual RG

Technical Support Assistance

Submit a technical support case via www.latticesemi.com/techsupport

Revision History

Date	Version	Change Summary
June 2015	1.1	General update in multiple sections.
		Updated Appendix A. Schematic Diagrams section.
		Added Appendix B. Bill of Materials section.
June 2014	01.0	Initial release.

Appendix A. Schematic Diagrams

Figure 13. Pool-A I2C Sensors

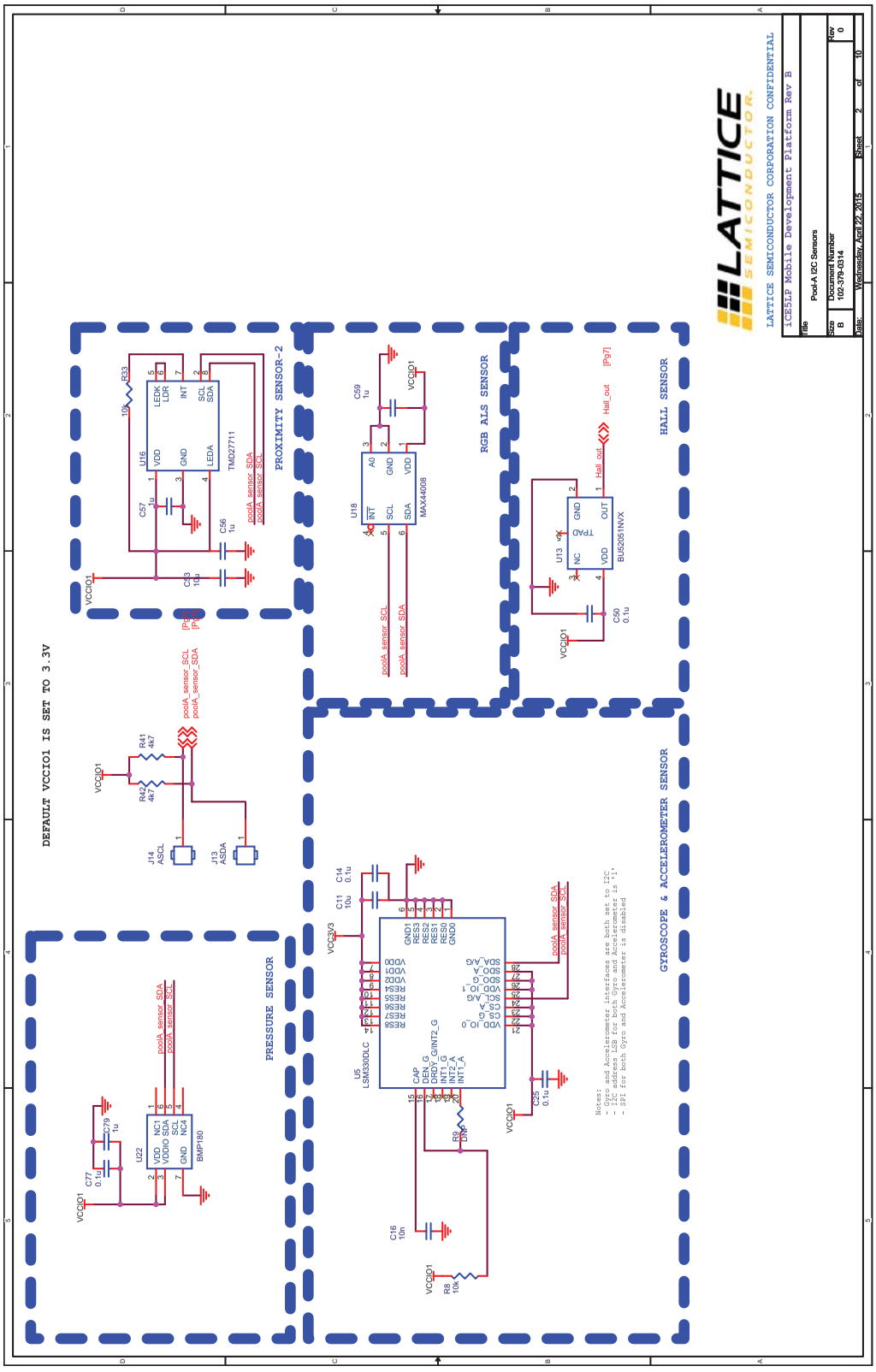


Figure 14. Pool-B I2C Sensors, IR Rx and Clocking

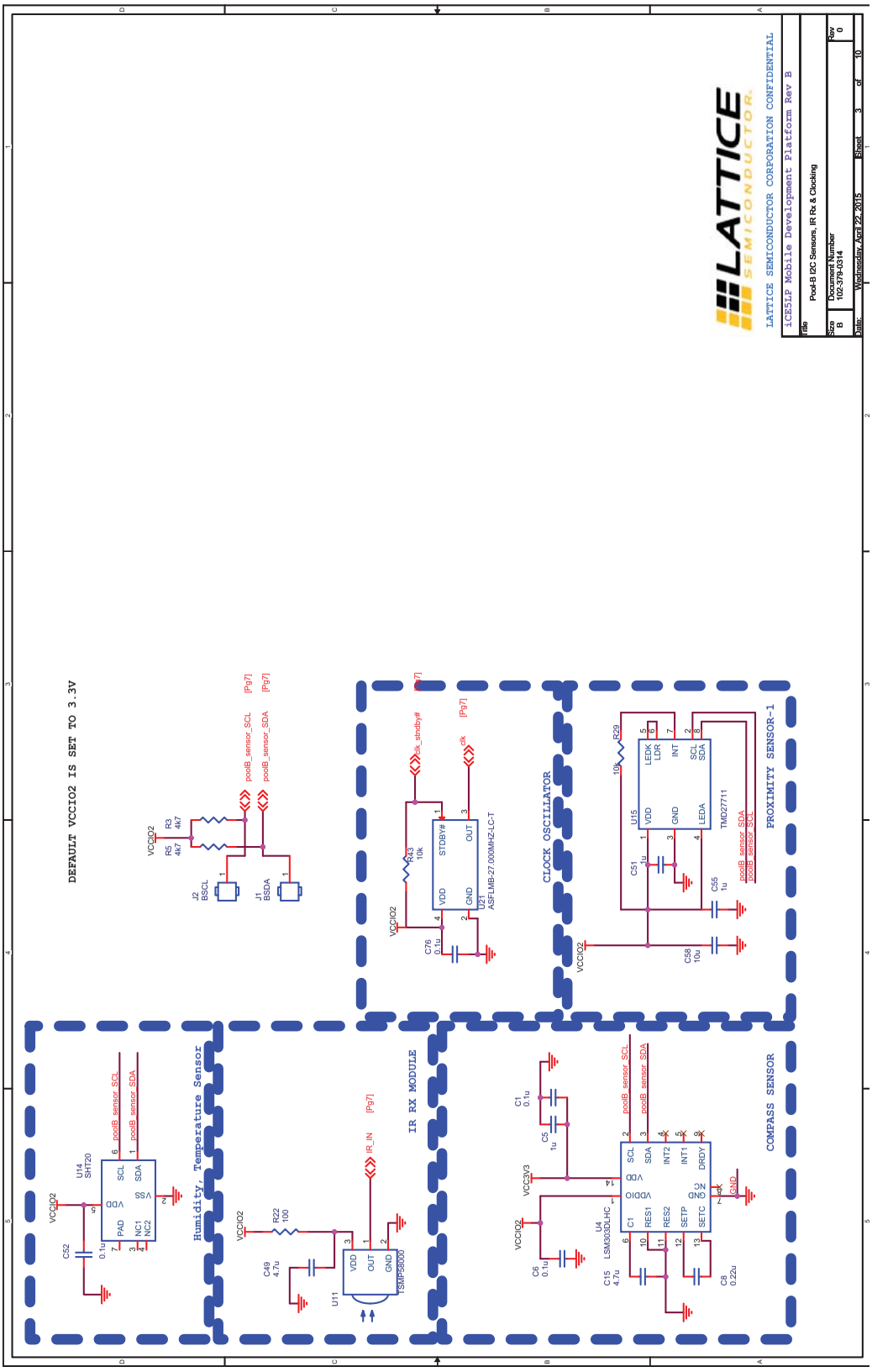


Figure 15. Interconnects

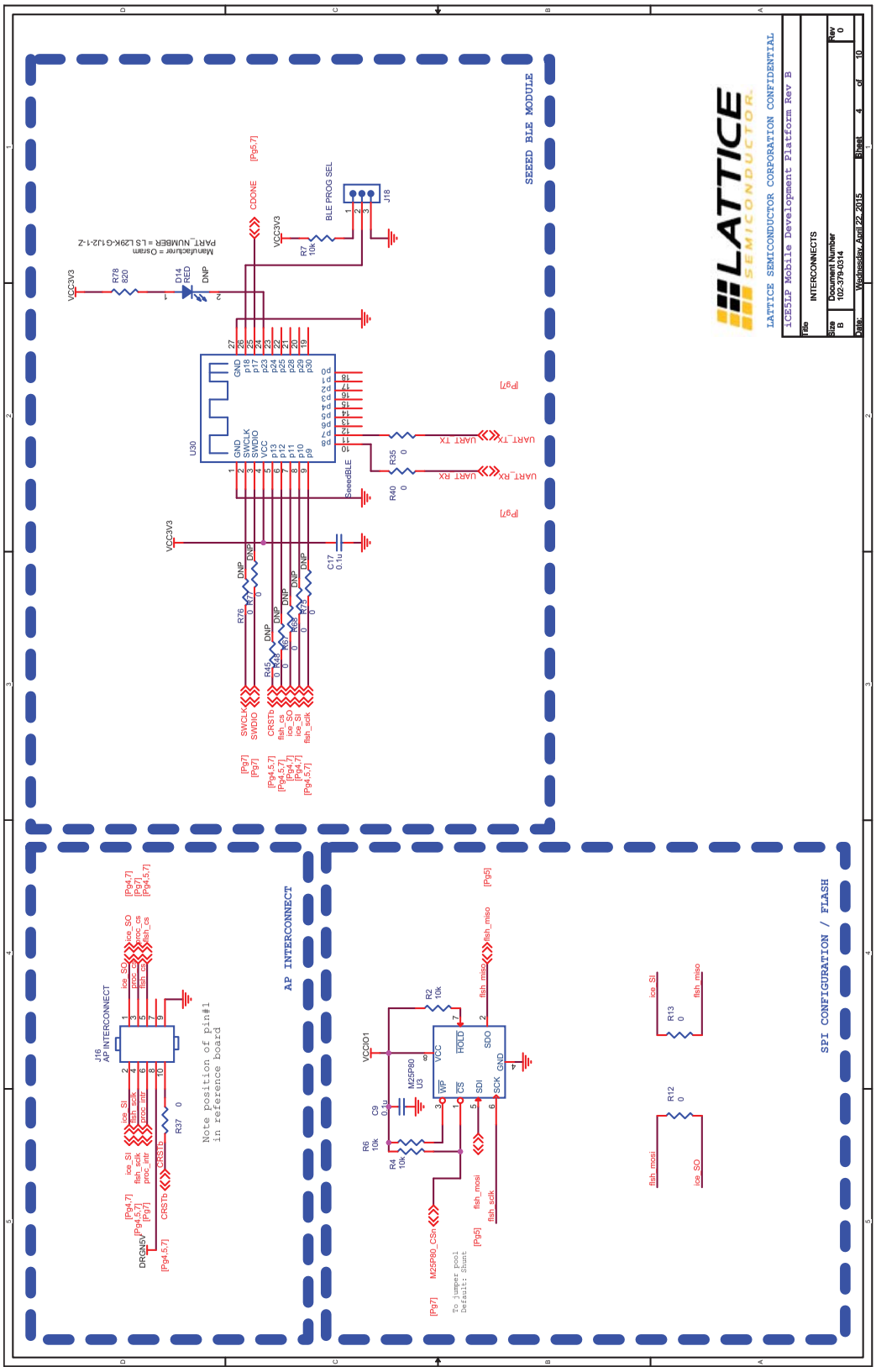


Figure 16. USB Programming and Power

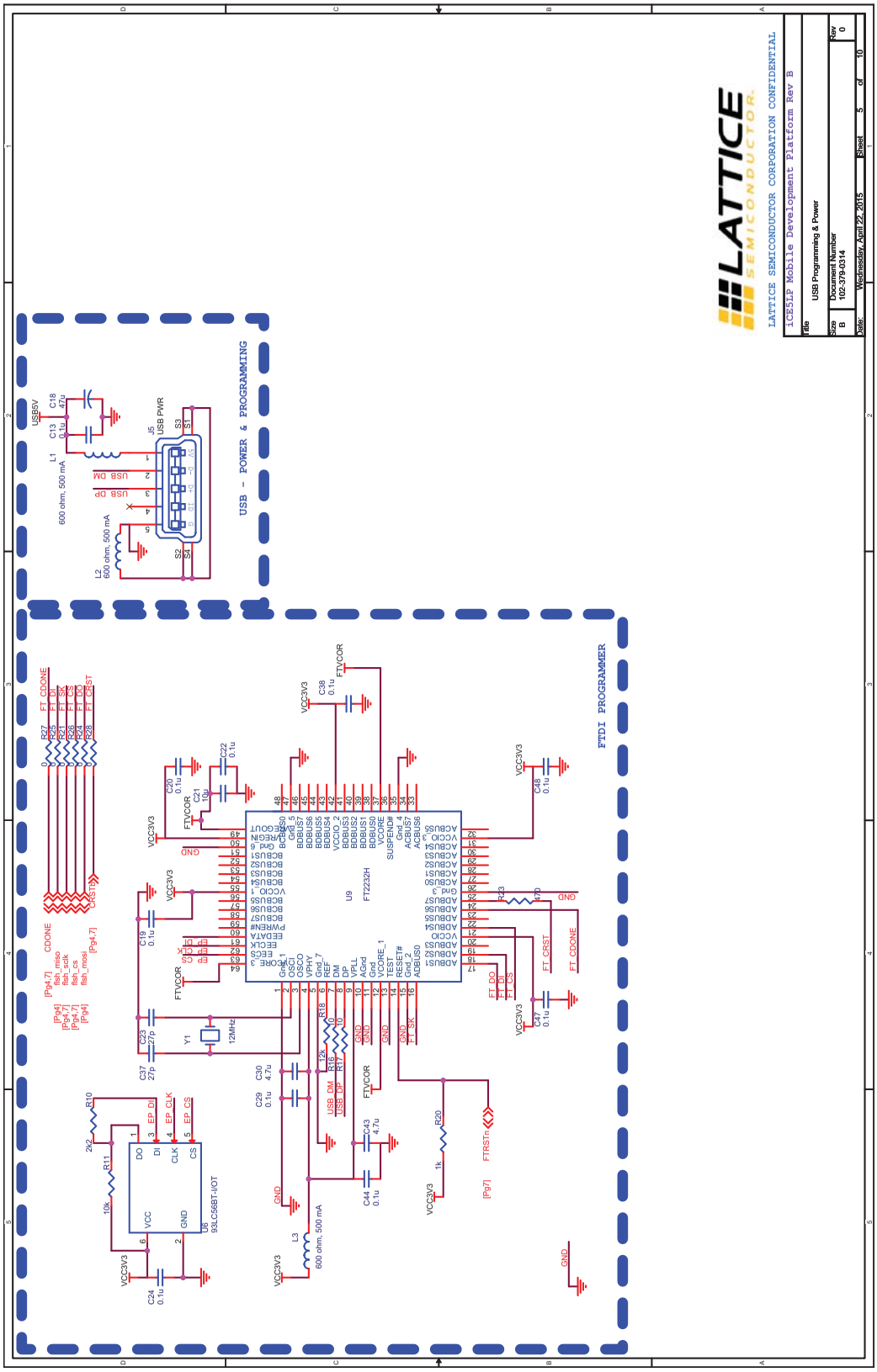


Figure 17. I2S MIC, Fingerprint Sensors and Micro SD

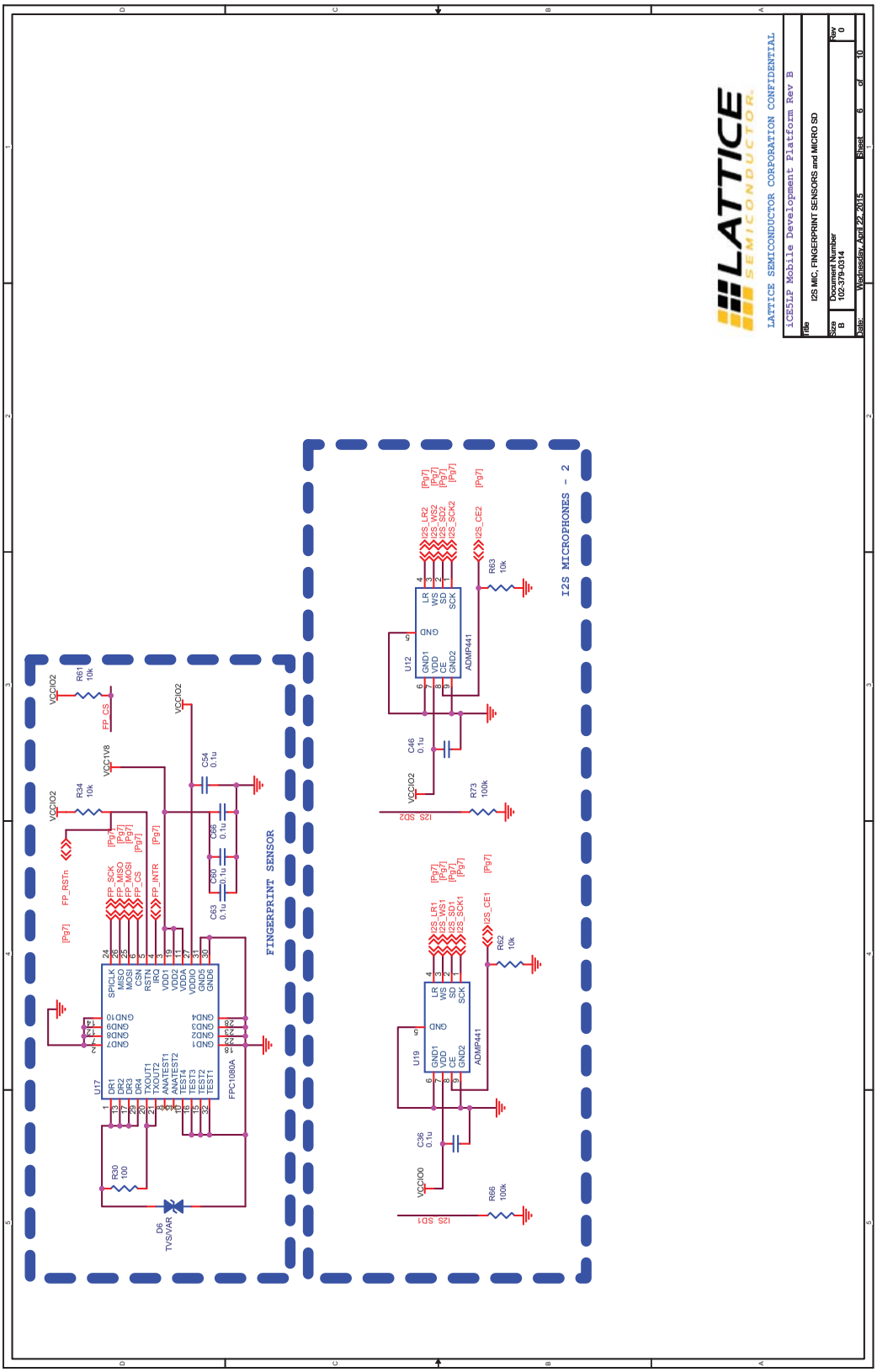


Figure 18. iCE5LP4KSWG36 FPGA and LEDs

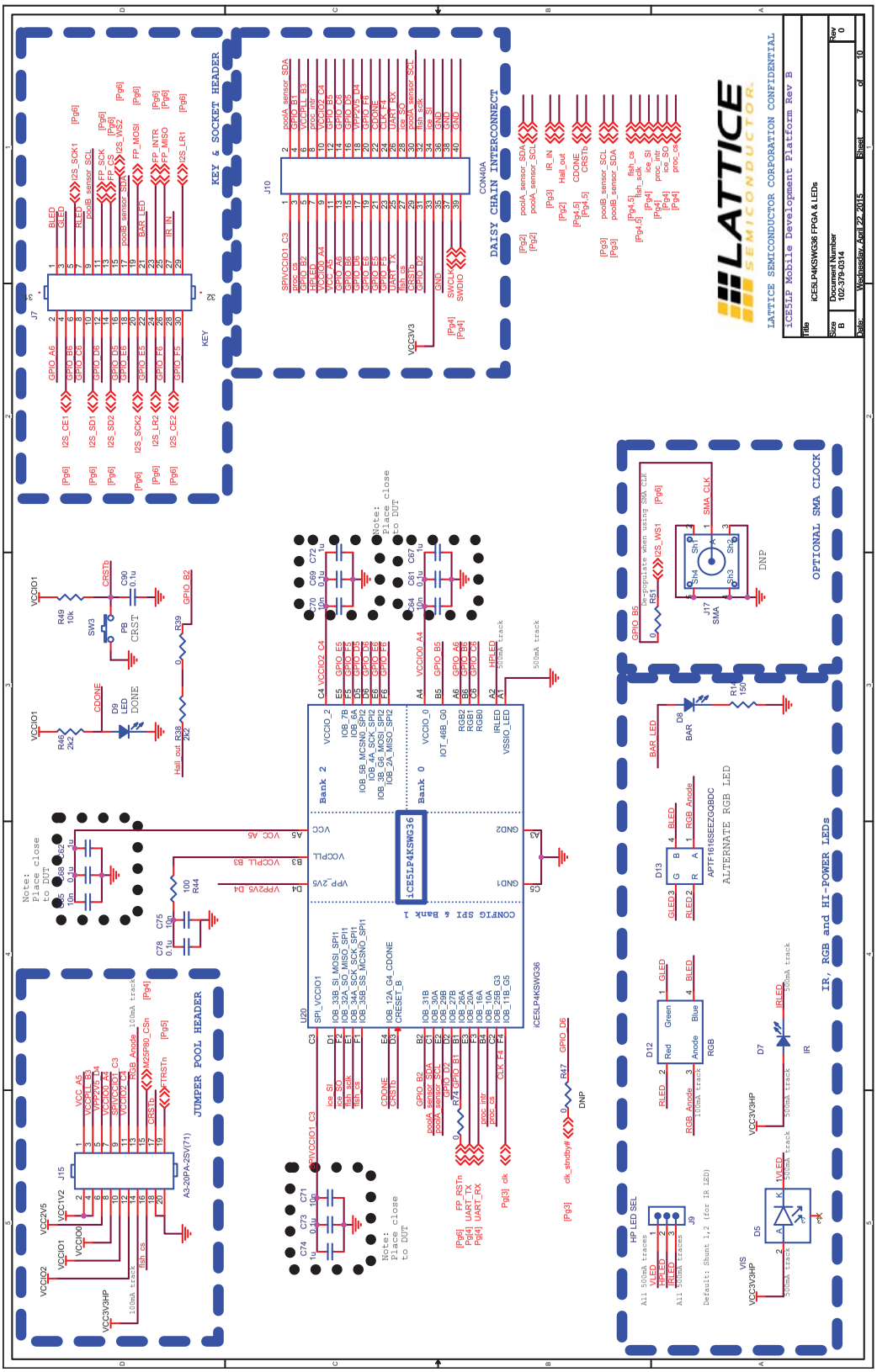


Figure 19. Power Supplies

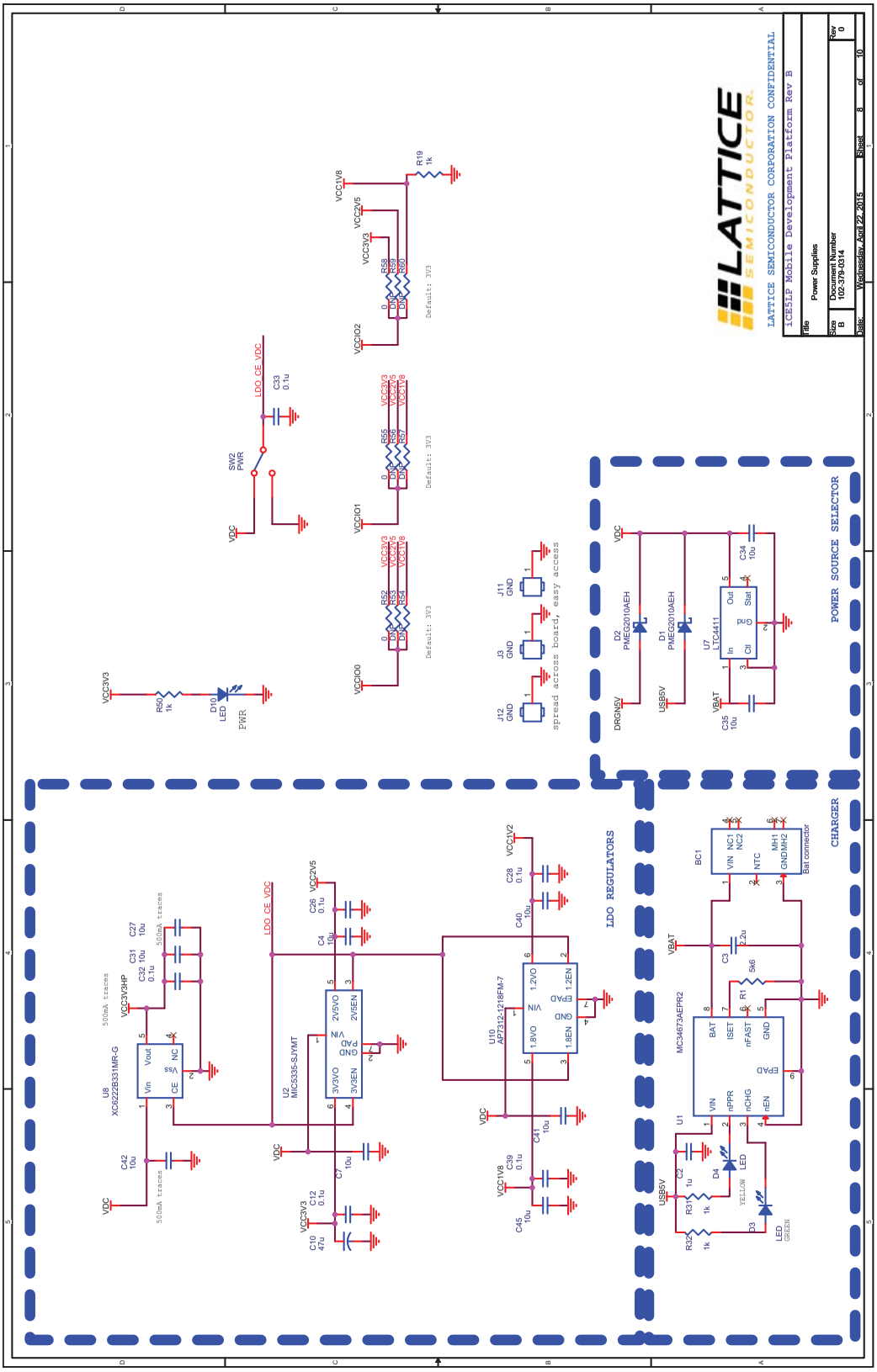


Figure 20. Keys (4 Different PCB Modules)

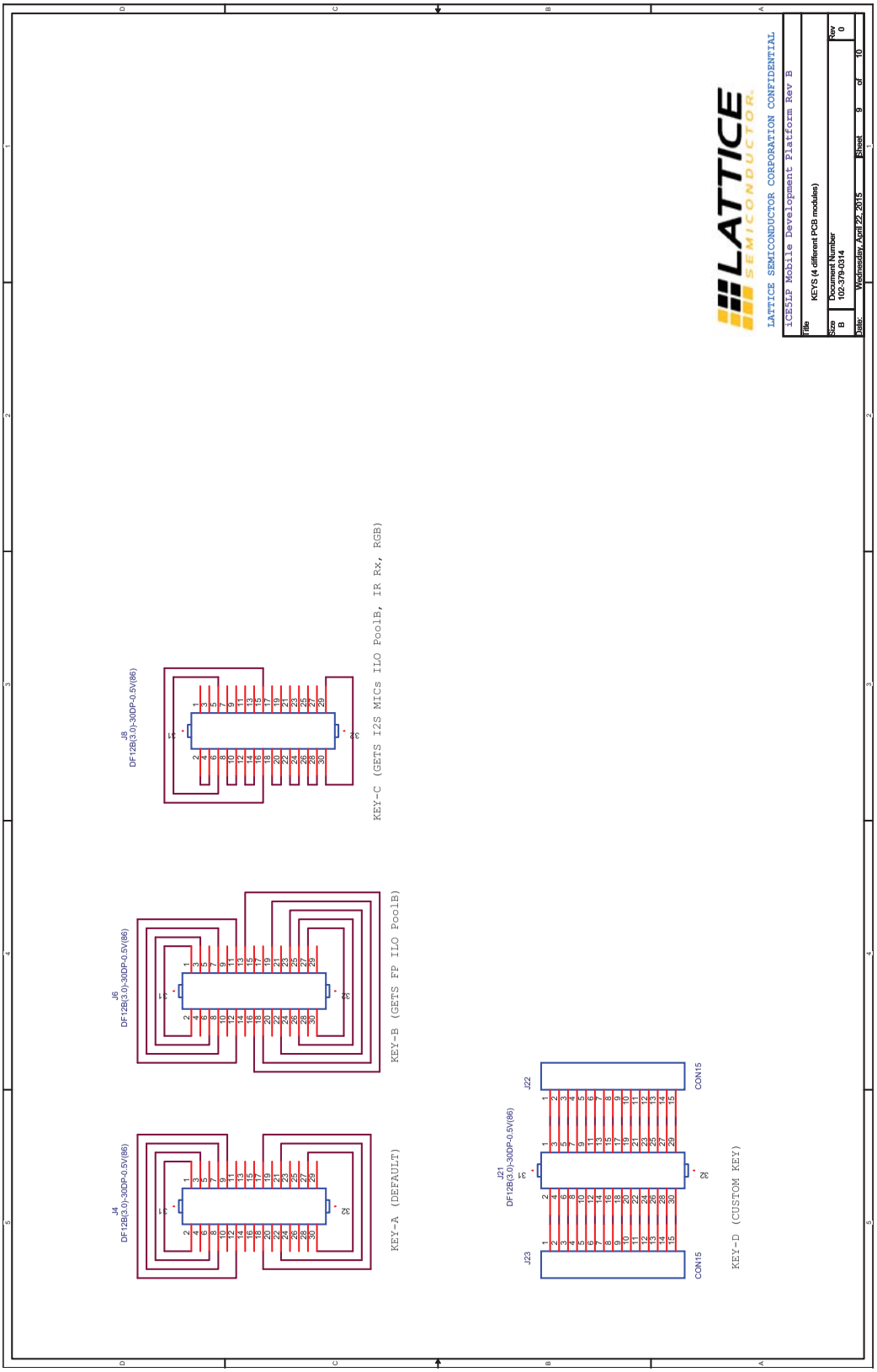
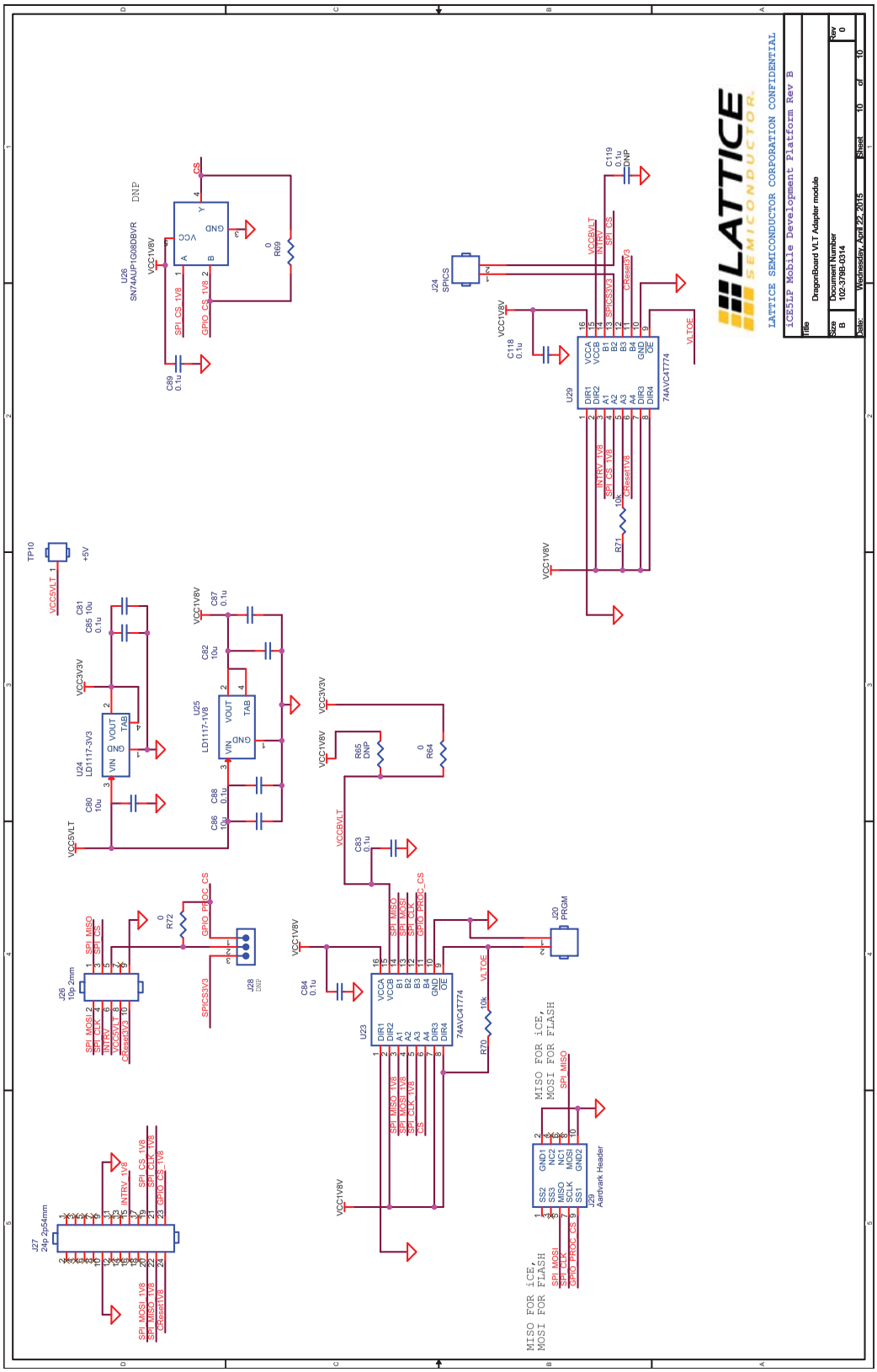


Figure 21. DragonBoard VLT Adapter Module



Appendix B. Bill of Materials

Item	Reference	Quantity	Part	PCB Footprint	Comments	Part Number	Manufacturer	Description
1	BC1	1	Bat connector	BATT_009155003301006	—	09155003301006	AVX	CONN BATTERY 3 POS RIGHT ANGLE
2	C1,C6,C9,C12,C13,C14,C17,C19,C20,C22,C24,C25,C26,C28,C29,C32,C33,C36,C38,C39,C44,C46,C47,C48,C50,C52,C54,C60,C61,C63,C66,C68,C69,C73,C76,C77,C78,C83,C84,C85,C87,C88,C89,C90,C118	45	0.1 u	C0402	—	CL05A104MP5NNNC	Samsung	CAP CER 0.1UF 10V 20% X5R 0402
3	C2,C5,C51,C55,C56,C57,C59,C62,C67,C72,C74,C79	12	1 u	C0402	—	CL05A105KP5NNNC	Samsung	CAP CER 1UF 10V 10% X5R 0402
4	C3	1	2.2 u	C0603	—	CC0603ZRY5V6BB225	Yageo	CAP CER 2.2UF 10V Y5V 0603
5	C4,C11,C21,C27,C31,C35,C40,C45,C53,C58,C81,C82	12	10 u	C0603	—	CL10A106MQ8NNNC	Samsung	CAP CER 10UF 6.3V 20% X5R 0603
6	C7,C34,C41,C42,C80,C86	6	10 u	C0603	—	CL10X106MP8NRNC	Samsung	CAP CER 10UF 10V 20% X6S 0603
7	C8	1	0.22 u	C0603	—	CL10B224KO8NNNC	Samsung	CAP CER 0.22UF 16V 10% X7R 0603
8	C10,C18	2	47 u	C3528	—	TCJB476M010R0070	AVX	CAP TANT 47UF 10V 20% 1210
9	C15,C30,C43,C49	4	4.7 u	C0603	—	CC0603KRX5R6BB475	Yageo	CAP CER 4.7UF 10V 10% X5R 0603
10	C16,C64,C65,C70,C71,C75	6	10 n	C0402	—	CL05B103KO5NCNC	Samsung	CAP CER 10000PF 16V 10% X7R 0402
11	C23,C37	2	27 p	C0402	—	CL05C270JB5NNNC	Samsung	CAP CER 27PF 50V 5% NP0 0402
12	C119	1	0.1 u	C0402	DNP	CL05A104MP5NNNC	Samsung	CAP CER 0.1UF 10V 20% X5R 0402
13	D1,D2	2	PMEG2010AEH	SOD123F	—	PMEG2010AEH,115	NXP Semiconductor	DIODE SCHOTTKY 20V 1A SOD123F
14	D3	1	LED	led0603	—	LG L29K-G2J1-24-Z	Osram Opto	LED SMARTLED GREEN 570NM 0603
15	D4	1	LED	led0603	—	LY Q976-P1S2-36	Osram Opto	LED CHIPLED 587NM YLW 0603 SMD
16	D5	1	VIS	XBDAWT	—	XBDAWT-00-0000-00000LCE3	Cree Inc	LED HIGH BRIGHTNESS
17	D6	1	TVS/VAR	R0603	—	VC060330A650DP	AVX	VARISTOR 36.9V 30A 0603
18	D7	1	IR	IRD	—	VSMB2948SL	Vishay	IR EMITTER HIGH SPEED 940NM SMD
19	D8	1	BAR	LED0805	—	APT2012SRCPRV	Kingbright Corp	LED 2X1.2MM 640NM RD WTR CLR SMD
20	D9	1	LED	led0603	—	LG L29K-G2J1-24-Z	Osram Opto	LED SMARTLED GREEN 570NM 0603
21	D10	1	LED	led0603	—	LS Q976-NR-1	Osram Opto	LED CHIPLED 633NM RED 0603 SMD
22	D12	1	RGB	RGBD	DNP	AEBMTRGBZ	Custom	—
23	D13	1	APTF1616SEEZGQBDC	RGBOPT2	—	APTF1616SEEZGQBDC	KingbrightCorp	LED RED/GREEN/BLUE WTR CLEAR SMD
24	D14	1	RED	LED0603	DNP	LS L29K-G1J2-1-Z	Osram	LED SMARTLED GREEN 570NM 0603
25	J1	1	BSDA	TP_TH_40_24_S	DNP	PCB	MDN	—
26	J2	1	BSCL	TP_TH_40_24_S	DNP	PCB	MDN	—
27	J3,J11,J12	3	GND	TUR_TH	DNP	1573-2	Keystone Electronics	TERMINAL TURRET DBL .082"L
28	J4,J6,J8,J21	4	DF12B(3.0)-30DP-0.5V(86)	HIROSE_DF12B_30_mirror	—	DF12B(3.0)-30DP-0.5V(86)	Hirose	CONN HEADER 30POS 3MM SMD 0.5MM
29	J5	1	USB PWR	CONN_S5P1RMINIUSBB_MOLEX	—	67503-1020	Molex	CONN RECEPT MINIUSB R/A 5POS SMD
30	J7	1	KEY	HIROSE_DF12B_30	—	DF12B(3.0)-30DS-0.5V(86)	Hirose	CONN RCPT 30POS 3MM SMD 0.5MM
31	J9	1	HP LED SEL	hdr1x3-40_2mm	—	NRPN031PARN-RC	Sullins Connector Solutions	CONN HEADER 2MM SINGLE R/A 3POS
32	J10	1	CON40A	hdr20x2_2mm	DNP	0877582016	Molex Inc	CONN HEADER 20POS 2MM VERT GOLD
33	J13	1	ASDA	TP_TH_40_24_S	DNP	PCB	MDN	—

Item	Reference	Quantity	Part	PCB Footprint	Comments	Part Number	Manufacturer	Description
34	J14	1	ASCL	TP_TH_40_24_S	DNP	PCB	MDN	—
35	J15	1	A3-20PA-2SV(71)	hirose_10x2_2mm	—	A3-20PA-2SV(71)	Hirose	CONN HEADER 20POS 2MM GOLD SMD
36	J16	1	AP INTERCONNECT	hirose_5x2_2mm	—	A3-10PA-2SV(71)	Hirose	CONN HEADER 10POS 2MM GOLD SMD
37	J17	1	SMA	molex_0732511350	DNP	732511350	Molex	CONN SMA JACK STR 50 Ohm SMD
38	J18	1	BLE PROG SEL	hdr1x3-40_2mm	—	NRPN031PARN-RC	Sullins Connector Solutions	CONN HEADER 2MM SINGLE R/A 3POS
39	J20	1	PRGM	HDR1X2-40	—	77311-801-02LF	FCI	CONN HEADER .100 SINGL STR 2POS
40	J22,J23	2	CON15	HDR1x15_2mm_TH	DNP	PCB	MDN	—
41	J24	1	SPICS	HDR1X2-40	—	77311-801-02LF	FCI	CONN HEADER .100 SINGL STR 2POS
42	J26	1	10p 2 mm	hdr_5x2_2mm	—	0877581016	Molex Inc	CONN HEADER 10POS 2MM VERT GOLD
43	J27	1	24p 2p 54 mm	hdr12x2_TH_2p54_mirror	—	M20-7831242	Harwin Inc	12+12 DIL VERT SOCKET L/FREE
44	J28	1	DNP	hdr1x3-40	DNP	77311-801-03LF	FCI	CONN HEADER .100 SINGL STR 3POS
45	J29	1	Aardvark Header	hdr5x2	—	77313-801-10LF	FCI	CONN HEADER .100 SINGL STR 10POS
46	L1,L2,L3	3	600 Ohm, 500 mA	L0603	—	MMZ1608R601A	TDK Corp	FERRITE CHIP 600 Ohm 500MA 0603
47	R1	1	5k6	R0402	—	RC1005F562CS	Samsung	RES 5.6 kOhm 1/16W 1% 0402
48	R2,R4,R6,R7,R8,R11,R29,R33,R34,R43,R49,R61,R62,R63,R70,R71	16	10k	R0402	—	RC1005J103CS	Samsung	RES 10 kOhm 1/16W 5% 0402
49	R3,R5,R41,R42	4	4k7	R0402	—	RC1005J472CS	Samsung	RES 4.7 kOhm 1/16W 5% 0402
50	R9	1	DNP	R0402	DNP	WR04X000PTL	Walsin	—
51	R10,R38,R46	3	2k2	R0402	—	RC1005J222CS	Samsung	RES 2.2 kOhm 1/16W 5% 0402
52	R12,R13,R35,R40	4	0	R0402	—	RC1005J000CS	Samsung	RES 0.0 Ohm 1/16W JUMP 0402
53	R14	1	150	R0402	—	RMCF0402JT150R	Stackpole Electronics	RES 150 Ohm 1/16W 5% 0402
54	R16,R17	2	10	R0402	—	RC1005J100CS	Samsung	RES 10 Ohm 1/16W 5% 0402
55	R18	1	12k	R0402	—	RC1005F123CS	Samsung	RES 12 kOhm 1/16W 1% 0402
56	R19,R20,R31,R32,R50	5	1k	R0402	—	RC1005J102CS	Samsung	RES 1 kOhm 1/16W 5% 0402
57	R21,R24,R25,R26,R27,R28,R37,R39,R51,R52,R55,R58,R64,R69,R72,R74	16	0	R0402	—	RC1005J000CS	Samsung	RES 0.0 Ohm 1/16W JUMP 0402
58	R22	1	100	R0603	—	RC1608J101CS	Samsung	RES 100 Ohm 1/10W 5% 0603
59	R23	1	470	R0402	—	RC1005J471CS	Samsung	RES 470 Ohm 1/16W 5% 0402
60	R30,R44	2	100	R0402	—	RC1005J101CS	Samsung	RES 100 Ohm 1/16W 5% 0402
61	R45,R47,R48,R67,R68,R75,R76,R77	8	0	R0402	DNP	RC1005J000CS	Samsung	RES 0.0 Ohm 1/16W JUMP 0402
62	R53,R54,R56,R57,R59,R60,R65	7	DNP	R0402	DNP	RC1005J000CS	Samsung	RES 0.0 Ohm 1/16W JUMP 0402
63	R66,R73	2	100k	R0402	—	RC1005J104CS	Samsung	RES 100 kOhm 1/16W 5% 0402
64	R78	1	820	R0402	—	RC1005F821CS	Samsung	RES SMD 820 Ohm 1% 1/16W 0402
65	SW2	1	PWR	EG1218O_switch	—	EG1218	E-Switch	SWITCH SLIDE SPDT 30V.2A PC MNT
66	SW3	1	PB	2psmd_eswitch	—	TL1015AF160QG	E-Switch	SWITCH TACTILE SPST-NO 0.05A 12V
67	TP10	1	+5 V	HDR1	—	77311-801-01LF	FCI	HEADER BERGSTIK
68	U1	1	MC34673AEPR2	8-UDFN	—	MC34673AEPR2	Freescale Semiconductor	IC SGL CELL BATTERY CHRGR 8-UDFN
69	U2	1	MIC5335-SJYMT	6TMLF	—	MIC5335-SJYMT	Micrel	IC REG LDO 3.3 V/2.5 V 0.3A 6TMLF
70	U3	1	M25P80	SOIC8-W	—	M25P80-VMW6G	Numonyx/ST Micro	IC FLASH 8MBIT 75MHZ 8SO
71	U4	1	LSM303DLHC	LGA14_LSM303	—	LSM303DLHC	ST Micro	ACCELEROMETER/MAGNETOMETER 14LGA
72	U5	1	LSM330DLC	LGA-28	—	LSM330DLC	ST Micro	ACCELEROMETER/MAGNETOMETER 28LGA
73	U6	1	93LC56BT-I/OT	SOT23-6	—	93LC56BT-I/OT	Microchip Technology	IC EEPROM 2KBIT 2MHZ SOT23-6