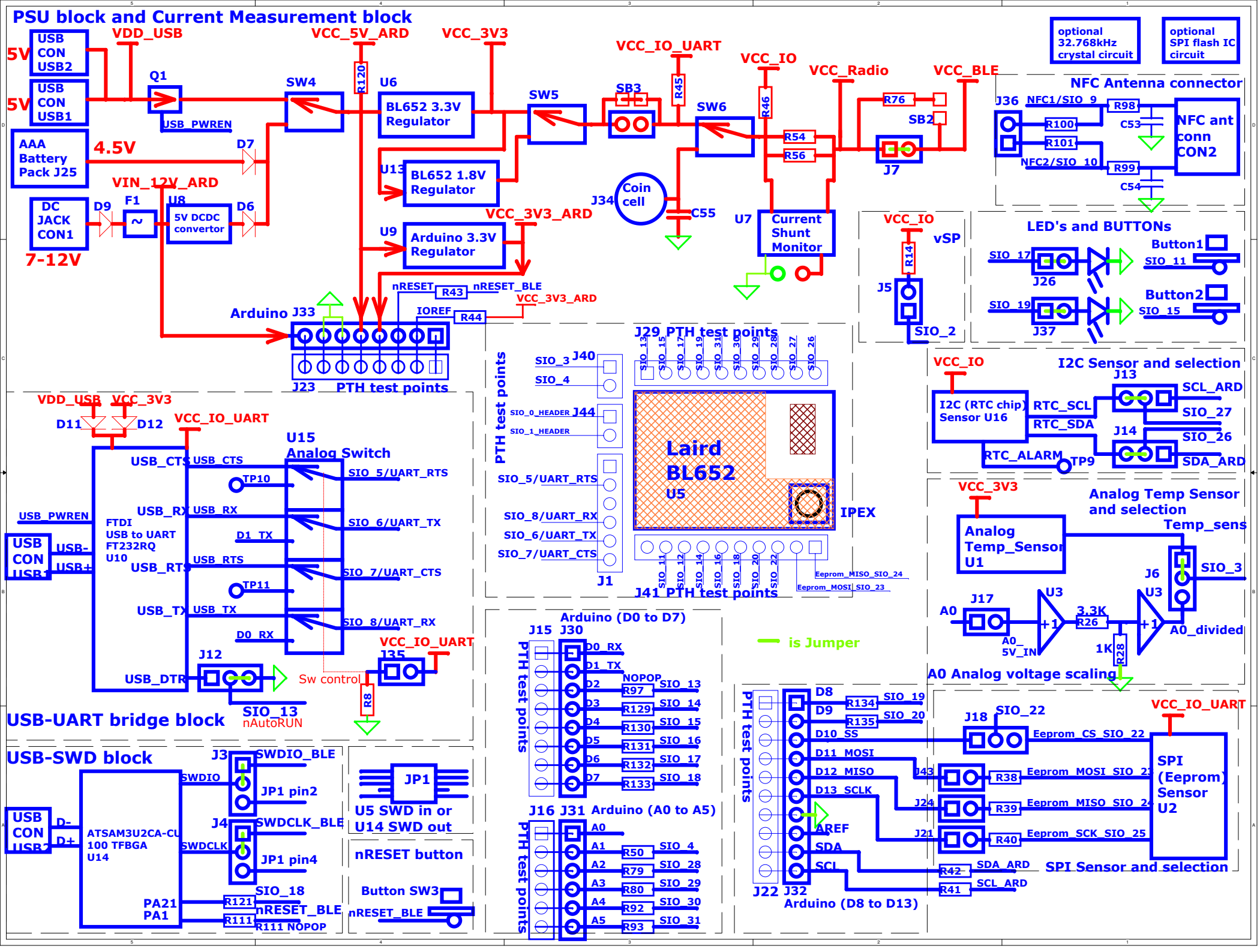
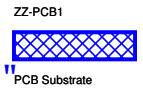

PSU block and Current Measurement block
5V
USB CON USB2
5V
USB CON USB1
VDD_USB
Q1
USB_PWREN
SW4
VCC_5V_ARD
R120
U6
BL652 3.3V Regulator
VCC_3V3
SW5
SB3
VCC_IO_UART
R45
SW6
R46
VCC_IO
VCC_Radio
VCC_BLE
R76
SB2
J7
R54
R56
AAA Battery Pack J25
4.5V
D7
VIN_12V_ARD
DC JACK CON1
7-12V
D9
F1
U8
5V DCDC convertor
D6
U13
BL652 1.8V Regulator
J34
Coin cell
C55
U7
Current Shunt Monitor
VCC_3V3_ARD
U9
Arduino 3.3V Regulator
nRESET
R43
nRESET_BLE
IOREF
R44
Arduino J33
J23 PTH test points
optional 32.768kHz crystal circuit
optional SPI flash IC circuit
NFC Antenna connector
J36
NFC1/SIO_9
NFC2/SIO_10
R98
R100
R101
R99
C53
C54
NFC ant conn CON2
VCC_IO
R14
vSP
J5
SIO_2
LED's and BUTTONs
SIO_17
J26
Button1
SIO_11
SIO_19
J37
Button2
SIO_15
VDD_USB
VCC_3V3
D11
D12
VCC_IO_UART
U15
Analog Switch
USB_CTS
TP10
USB_RX
D1_TX
USB_RTS
TP11
USB_TX
D0_RX
SIO_5/UART_RTS
SIO_6/UART_TX
SIO_7/UART_CTS
SIO_8/UART_RX
USB_PWREN
USB CON USB1
USB-
USB+
FTDI USB to UART FT232RQ U10
J12
USB_DTR
Sw control
R8
VCC_IO_UART
J35
SIO_13
nAutoRUN
USB-UART bridge block
PTH test points
SIO_3
SIO_4
J40
SIO_0_HEADER
SIO_1_HEADER
J44
SIO_5/UART_RTS
SIO_8/UART_RX
SIO_6/UART_TX
SIO_7/UART_CTS
J1
J29 PTH test points
SIO_13
SIO_15
SIO_17
SIO_19
SIO_31
SIO_30
SIO_29
SIO_28
SIO_27
SIO_26
Laird BL652 U5
IPEX
J41 PTH test points
SIO_11
SIO_12
SIO_14
SIO_16
SIO_18
SIO_20
SIO_22
Eeprom_MISO_SIO_24
Eeprom_MOSI_SIO_23
VCC_IO
I2C Sensor and selection
I2C (RTC chip) Sensor U16
RTC_SCL
RTC_SDA
RTC_ALARM
TP9
J13
SCL_ARD
SIO_27
J14
SIO_26
SDA_ARD
VCC_3V3
Analog Temp Sensor and selection
Analog Temp_Sensor U1
Temp_sens
J6
SIO_3
J17
A0
A0_5V_IN
U3
+1
3.3K
R26
1K
R28
A0_divided
A0 Analog voltage scaling
USB-SWD block
USB CON USB2
D-
D+
ATSAM3U2CA-CU 100 TFBGA U14
SWDIO
SWDCLK
PA21
PA1
J3
SWDIO_BLE
JP1 pin2
J4
SWDCLK_BLE
JP1 pin4
SIO_18
R121
nRESET_BLE
R111
R111 NOPOP
JP1
U5 SWD in or U14 SWD out
nRESET button
Button SW3
nRESET_BLE
Arduino (D0 to D7)
J15 J30
D0_RX
D1_TX
D2
D3
D4
D5
D6
D7
NOPOP
R97
R129
R130
R131
R132
R133
SIO_13
SIO_14
SIO_15
SIO_16
SIO_17
SIO_18
PTH test points
J16 J31 Arduino (A0 to A5)
A0
A1
A2
A3
A4
A5
R50
R79
R80
R92
R93
SIO_4
SIO_28
SIO_29
SIO_30
SIO_31
is Jumper
D8
D9
D10_SS
D11_MOSI
D12_MISO
D13_SCLK
AREF
SDA
SCL
R134
R135
SIO_19
SIO_20
J22 J32
Arduino (D8 to D13)
J18
SIO_22
Eeprom_CS_SIO_22
J43
R38
Eeprom_MOSI_SIO_23
J24
R39
Eeprom_MISO_SIO_24
J21
R40
Eeprom_SCK_SIO_25
R42
SDA_ARD
R41
SCL_ARD
VCC_IO_UART
SPI (Eeprom) Sensor U2
SPI Sensor and selection

| DATE | REVISION NUMBER | INITIALS | Initial Release |
|---|---|---|---|
| 10Jan2016 | A0 ( EVT1 ) | RK | SCH reviewed draft.<br>Added R122, R111, R123, C59, C49, C68, R124, TP21. Make JP1 and J20 NOPOP. Re-wire J29. Add C53 and C54 300pF MPN.<br>Add J34 coincell holder Vendor2 MPN. Added C69. Some wiring changes. Make C63 NOPOP.<br>Add sheet in BOM for Jumpers to be Fitted and SW4, SW5 and SW6 switch setting positions. |
| 16May2016 | A1 ( EVT2 ) | RK | Change U5 BL652-SX-A0 31 pin module (using WLCSP nRF52832-CHAA) to BL652-SX-A1 39 module (using QFN nRF52832-QFAA-xx).<br>Hence many wiring changes.<br>Change R59 30K 1% to 33K 1% (to generate 5V at D6pin2).<br>Changed U3 Dual OpAmp PCB footprint from SOP8 to SOIC-8.<br>Make Coulomb counter IC U4 a NOPOP hence, U4,C7(0.1uF), R30(3R3), Do Not Fit. Fit jumper in J7(default).<br>Change JP1 from NOPOP to Fit.<br>Update ZZ-PCB1 Description (DVK-BL652-A1)<br>Add Jumpers fitted list sheet. Fit Test Hook (black) into TP14 (GND).<br>Make the added DAC IC U17 a NOPOP hence, U17, C69(0.1uF), R110(0R), R109(0R) Do Not Fit.<br>Add SPI flash IC U18 and associated C5(0.1uF), R125(10K), R126(10K), SB4, SB5, SB6, SB7.<br>Add Y3 32.76kHz crystal and associated C71(15pF), C70(15pF), SB8, SB9, R127(0R), R128(0R).<br>Change J40 from 2pin header to 3pin header but still a NOPOP.<br>Add J44 2pin header but is a NOPOP<br>Change J29 from 6pin header to 10pin header but still a NOPOP.<br>Change J41 from 8pin header to 10pin header but still a NOPOP.<br>Add series 560R resistors R95, R96, R97, R129, R130, R131, R132, R133 in series with Arduino connector J30 (which carries signals D2 to D7).<br>Make R97 560R a NOPOP.<br>Add series 560R resistors R134, R135, R136 in series with Arduino connector J32 3 signals D8, D9, AREF).<br>Add series 560R resistors R93, R92, R80, R79, R50 in series with Arduino connector J31 five signals A5, A4, A3, A2, A1).<br>Change R123(0R) from a NOPOP to Fit on PB3(U14 ball J5).<br>Add C72(0.1uF) to GND on PB2(U14 ball G2) and wire to VCC_IO_UART.<br>Connect PB1 (U14 ball F1) to GND.<br>Delete from design R95, R96 560R. Add U5 PCB footprint name "MODULE_BL652Q_39P_SMD".<br>Change U17 PCB footprint from SOT23-6 to SOT23_6.<br>Change U13 from UPI uP0111AMA5-00 to RT9187BGB.<br>Change U8 symbol from 8-pin to 9-pin.<br>Change J40 from 3pin header to 2pin header but still a NOPOP.<br>Remove R7(0R) and move R14 (560R) to R7 location. |
| 23June2016 | B0 | RK | Change C70 from 15pF to 10pF.<br>Change C71 from 15pF to 12pF.<br>Change J8 to NOPOP.<br>Change Q1 MPN from Secos SST2623J to Fairchild FDC6310P.<br>Change U8 PCB footprint from PSOP_8_PGA to PSOP_8_PG (to match PCB layout).<br>Change ZZ-PCB1 description, i.e. size 120x85x1mm and name of PCB (DVK-BL652-B0).<br>Add secondary source 19-217/BHC-ZL1M2RY/3T to D1, D2, D3.<br>Add Chern-Yi 43-1P battery holder as secondary source for J34.<br>Added Mag. Layers MCM-9070M-301 as secondary source for CMF1.<br>Add U6 and U9 secondary source RT9187GSP. |
| 15Aug2016 | 1.0 | RK | Release.<br>Change R25 from 10K to NOPOP. Change PCB decription from DVK-BL652-B0 to DVK-BL652-1.0.<br>Add Block Diagram.<br>Move jumper from J12pin2-1 to J12pin2-3 (so default is nAutoRUN mode). Add jumper on J6pin2-1 (connect temperature sensor to BL652).<br>Make R111 0R a NOPOP. |

## PCB design specification

1. Substrate: FR4 ROHS compliant, High TG 140 degree.
2. Solder mask, color=BLUE, Silkscreen color=WHITE
3. Surface finish to be Immersion Nickel/Gold (ENIG) with 1-2 u"
4. Start with 1/2 oz. copper on all layers.

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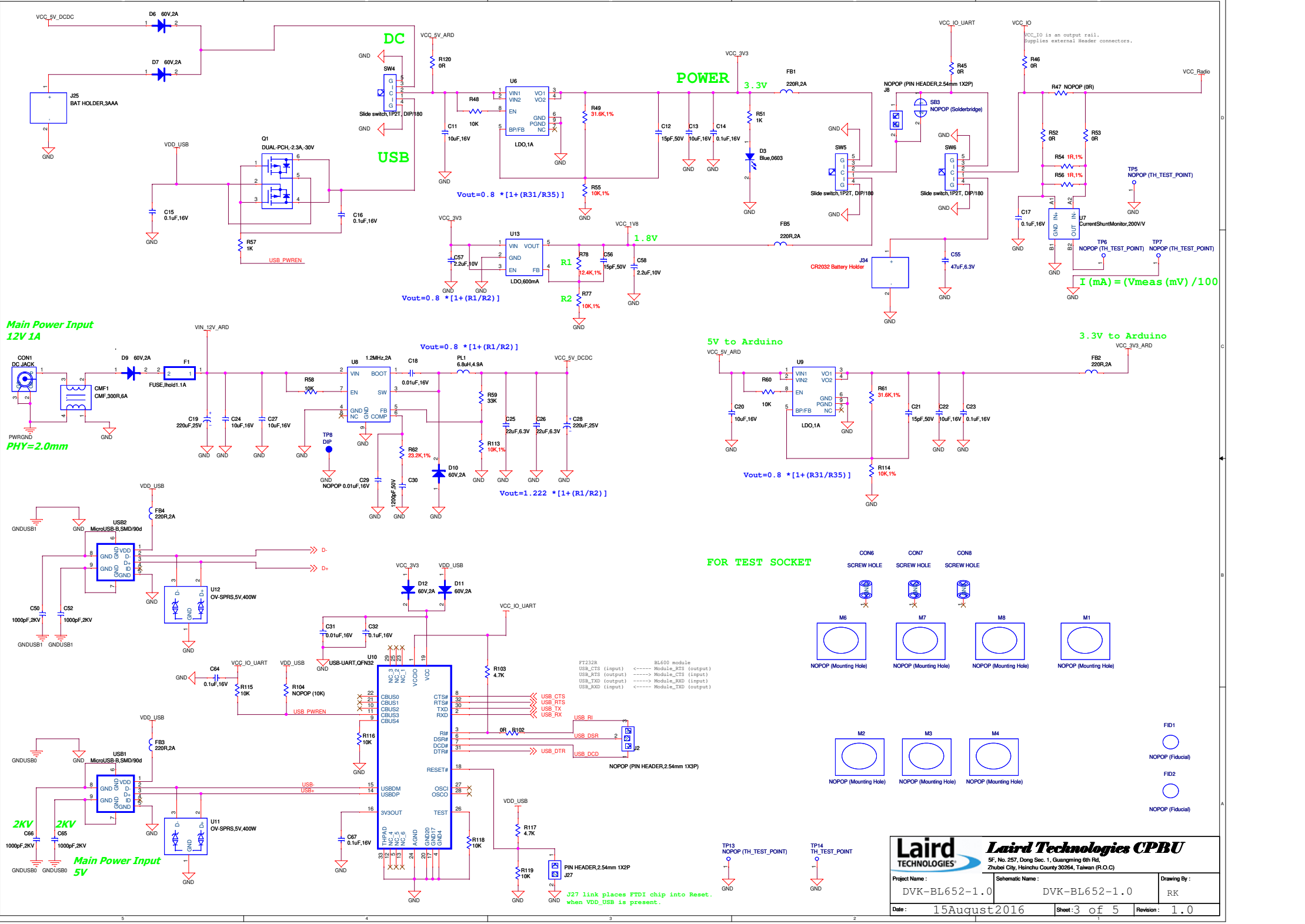
| Project Name : | Sehematic Name : | Drawing By : |
|---|---|---|
| DVK-BL652-1.0 | DVK-BL652-1.0 | RK |
| Date : 15August2016 | Sheet : 2 of 5 | Revision : 1.0 |


DC
USB
POWER
3.3V
1.8V
Vout=0.8 *[1+(R31/R35)]
Vout=0.8 *[1+(R1/R2)]
Vout=1.222 *[1+(R1/R2)]
I (mA) = (Vmeas (mV) /100
Main Power Input
12V 1A
PHY=2.0mm
5V to Arduino
3.3V to Arduino
FOR TEST SOCKET
Main Power Input
5V
2KV
2KV
VCC_IO is an output rail.
Supplies external Header connectors.
J25 BAT HOLDER,3AAA
CR2032 Battery Holder
Slide switch,1P2T, DIP/180
LDO,1A
LDO,600mA
USB-UART,QFN32
OV-SPRS,5V,400W
NOPOP (PIN HEADER,2.54mm 1X2P)
NOPOP (PIN HEADER,2.54mm 1X3P)
PIN HEADER,2.54mm 1X2P
NOPOP (Mounting Hole)
NOPOP (Fiducial)
J27 link places FTDI chip into Reset. when VDD_USB is present.
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Project Name : DVK-BL652-1.0
Schematic Name : DVK-BL652-1.0
Drawing By : RK
Date : 15August2016
Sheet : 3 of 5
Revision : 1.0

BL652 UART routed to FTDI chip: J35 No Jumper in J35 (default).
routed to Arduino(J30): Fit Jumper in J35.

TP1 NOPOP (TH_TEST_POINT)

FTDI (USB to TTL 232 Cable)

Module pin BL652 UART Data Flow
SIO_6 Module_TX Output
SIO_8 Module_RX Input
SIO_5 Module_RTS Output
SIO_7 Module_CTS Input

VSP on SIO_2

Develop: Jumper J12 pin2-1
nAUTORUN: Jumper J12 pin2-3 (default)

n_Autorun / module_DSR

J7 jumper fitted (Default)

Digital to Analog Convertor
VDD 2.7V-5.5V

Coulomb Counter
V+ 2.7V-3.6V

J13pin2-3 jumper fitted (Default).
J14pin2-3 jumper fitted (Default).

Arduino Connectors
J30, J31, J32, J33

Analog output temp sensor
V+ 2.4V-3.6V

Vo(mV) = (-11.67mV/degC x T) + 1858.3V
For temperature range -40degC to +85degC.
Refer to LM20BIM7 datasheet.

| Temperature(T) | Typ Vo |
|---|---|
| +40degC | 1391mV |
| +30degC | 1509mV |
| +20degC | 1625mV |

Temp Sensor: Jumper J6 pin2-1 (default)

SPI sensor (Eeprom 256kb)
VDD 1.7V-5.5V

J26 jumper fitted (Default).
J37 jumper fitted (Default).

Analog 5V to 1.2V level translator

Test points for BL652

Test points for BL652

Test points for BL652

Module pin BL652 UART Data Flow
SIO_6 Module_TX Output
SIO_8 Module_RX Input
SIO_5 Module_RTS Output
SIO_7 Module_CTS Input

J3pin2-1 jumper fitted (Default).
J4pin2-1 jumper fitted (Default).

SEGGER J-Link Lite Cortex M-9 JTAG/SWD Emulator 10-pin connector. Top view.

| | |
|---|---|
| Project Name : | DVK-BL652-1.0 |
| Schematic Name : | DVK-BL652-1.0 |
| Drawing By : | RK |
| Date : | 15August2016 |
| Sheet : | 4 of 5 |
| Revision : | 1.0 |

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## JLINK

| Net | ATSAM3U2CA | BL652 module |
|---|---|---|
| SWDCLK | H4+K7+H8 | Pin6 |
| SWDIO | H7+G7 | Pin5 |
| nRESET_BLE | H9(PA1) | Pin7 |
| SIO.18 | J8(PA21) | Pin9 |

## Close to MCU

R68 DFSDM
D- / D+ — 39R,1% DHSDM / DHSDP
R69 DFSDP
39R,1%

TP16 NOPOP (TH_TEST_POINT) — R85 0R — TDIout / TDIin
TP17 NOPOP (TH_TEST_POINT) — R86 0R — TRSTin / TRSTout
TP18 NOPOP (TH_TEST_POINT) — R87 0R — TRESin / TRESout
TP19 NOPOP (TH_TEST_POINT) — RTCKin
TP20 NOPOP (TH_TEST_POINT) — TDOin

SIO_18 — 0R R121

Wire nRF52 P0.21 (nRESET_BLE) to ATSAM PA1.
Wire nRF52 P0.18 (SWO) to ATSAM PA21.

TO BL652

SWDCLK — R71 150R
SWDIO — R72 150R

R63 NOPOP (220R,1%) — GND
C72 0.1uF,16V — ENSPI — GND
R122 0R — GND
R67 6.8K — GND
C33 10pF,50V — GND
C59 0.1uF,16V — GND
R89 NOPOP (0R) — VCC_3V3
R90 0R — VCC_IO_UART
R124 NOPOP (0R)
R123 0R — RTCKin
EXT_SWO
TDIout
TDOin
ENSPI
TDIin

U14
ATSAM3U2CA-CU,96MHz

J2 K1 J1 H2 H3 H4 F2 G1 G2 F1 G3 G6 F5 G5 F4 E1 E3 F9 B2 C1 D1 B3 A1 D2 C2

CTS0/A1/AD3/PB8
RTS0/A0/NBS0/AD2/PB7
TIOB1/D15/AD1/PB6
TIOA1/A7/AD0/PB5
RD/PCK0/PA27
D4/PWMH0/PB13
D3/RI0/PB12
D2/DCD0/PB11
PWMH2/A4/PB2
PWMH1/A3/PB1
PWMH0/A2/PB0
GND
VDDIO
VDDCORE
RF/TIOB2/PA31
RK/PWMH1/PA29
TK/PWMH0/PA28
VDDCORE
GNDUTMI
DFSDP
DFSDM
VDDUTMI
VBG
DHSDM
DHSDP

K2 J3 K3 K4 H4 J4 J5 K5 B1 H5 K6 H6 J6 K7 F7 G7 H7 J7 K8 J8 K9 H1 H8 K10 J9

VDDANA
ADVREF
GNDANA
AD12BVREF
PA22/TXD2/RTS1/AD12B0
PA30/TF/TIOA2/AD12B1
PB3/PWMH3/A5/AD12BAB2
PB4/TCLK1/A6/AD12BAB3
VDDCORE
PA13/MISO
PA14/MOSI
PA15/SPCK/PWMH2
PA16/NPCS0/NCS1
PA17/SCK0/ADTRG
PB16/D7/PWMH3
PB15/D6/PWMH2
PA18/TXD0/PWMFI2
PA19/RXD0/NPCS3
PA20/TXD1/PWMH3
PA21/RXD1/PCK0
PA23/RXD2/CTS1
VDDCORE
PA24/TWD1/SCK1
PA25/TWCK1/SCK2
PA26/TD/TCLK2

XIN A2
XOUT A3
VDDPLL D3
GNDPLL C3
D0/DTR0/PB9 E4
D1/DSR0/PB10 B4
D5/PWMH1/PB14 C4
NANDOE/PWML0/PB17 A4
NANDWE/PWML1/PB18 B5
NRD/PWML2/PB19 C5
NCS0/PWML3/PB20 D5
A21(NANDALE/RTS2/PB21 A5
A22/NANDCLE/CTS2/PB22 C6
NWR0/NWE/PCK2/PB23 A6
GND F6
VDDIO F3
VDDCORE E7
NANDRDY/PCK1/PB24 B6
NRST B7
TCK A7
TMS C7
TDO B8
VDDIN A8
VDDOUT A9
TDI B9

C34 18pF,50V — Y1 12MHz,10ppm,16pF — C35 18pF,50V — GND
C36 0.1uF,16V — VCORE — GND
C68 0.1uF,16V — VCC_IO_UART — GND
RESET
TCKS
TMSS
TDOS
TDIS
C43 10uF,16V — C44 0.1uF,16V — C45 10uF,16V — VCC_3V3 — VCORE — GND

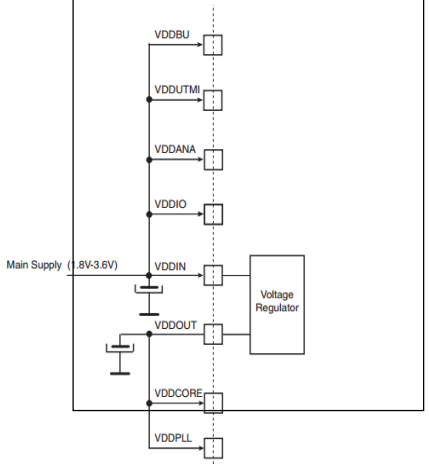
PA0/TIOB0/NPCS1
PA1/TIOA0/NPCS2
PA2/TCLK0/AD12BTRG
PA3/MCCK/PCK1
PA4/MCCDA/PWMH0
PA5/MCDA0/PWMH1
PA6/MCDA1/PWMH2
PA7/MCDA2/PWML0
VDDCORE
GND
VDDIO
PA8/MCDA3/PWML1
PA9/TWD0/PWML2
PA10/TWCK0/PWML3
PA11/URXD/PWMFI0
PA12/UTXD/PWMFI1
FWUP
ERASE
TEST
VDDBU
GNDBU
NRSTB
JTAGSEL
XOUT32
XIN32

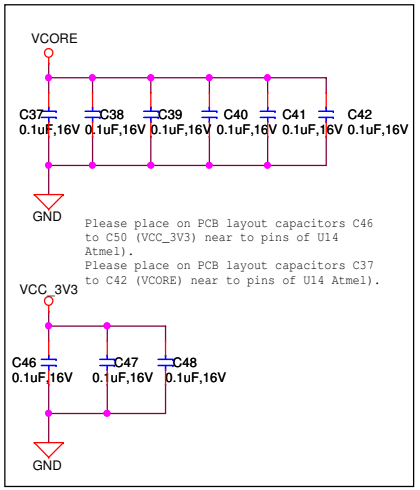
J10 H9 H10 G8 G10 G9 F8 F10 D4 E2 E6 E10 E9 E8 D9 D10 D8 D6 D7 C10 E5 C8 C9 B10 A10

R73 NOPOP (10K) — GND
R74 NOPOP (10K) — GND
TRSTin
TRSTout
TRESin
TRESout
nRESET_BLE — R111 NOPOP (0R)
TP21 NOPOP (TH_TEST_POINT) — EXT_SWO
C51 0.01uF,16V — VCC_3V3 — GND
C49 0.1uF,16V — VCC_IO_UART — GND
R84 NOPOP (10K)
R75 1K,1%
R88 100K — VCC_3V3
J19 NOPOP (HEADER-2.54mm-1x4-M-DIP-180d)

## JTAG

VCC_IO_UART — R64 4.7K — R65 4.7K — R66 4.7K — VDD_USB
J20 NOPOP (TC2050)
1 VCC_3V3
2 TMSS
3 GND
4 TCKS
5 VDD_USB
10 RESET
9 NC
8 TDIS
7 NC
6 TDOS
R70 4.7K — GND
R91 NOPOP (0R) — VCC_IO_UART — GND

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| Project Name : | Sehematic Name : | Drawing By : |
|---|---|---|
| DVK-BL652-1.0 | DVK-BL652-1.0 | RK |
| Date : 15August2016 | Sheet : 5 of 5 | Revision : 1.0 |