GPS

locate, communicate, accelerate

EVK-6

u-blox Evaluation Kits

User Guide

Abstract

This document describes the components and usage of the EVK-6 Evaluation Kits and guides through the evaluation and testing of u-blox 6 GPS Technology.

1 Product description

EVK-6 Evaluation Kits make evaluating the high performance of u-blox 6 GPS modules simple. The built-in USB interface provides both power supply and high-speed data transfer, and eliminates the need for an external power supply. u-blox 6 Evaluation Kits are compact, and their user friendly interface and power supply make them ideally suited for use in laboratories, vehicles and outdoor locations. Furthermore, they can be used with a PDA or a notebook PC, making them the perfect companion through all stages of design-in projects.

Evaluation Kit	Suitable for
EVK-6A: u-blox 6 Evaluation Kit for AMY-6M	AMY-6M
EVK-6H: u-blox 6 Evaluation Kit with TCXO	LEA-6H, LEA-6S, NEO-6G, NEO-6Q, MAX-6G, MAX-6Q, u-blox 6 GPS chips with TCXO
EVK-6N: u-blox 6 GPS/ GLONASS/ QZSS Evaluation Kit with TCXO	LEA-6N, u-blox 6 GPS chips with TCXO and Flash FW1.00
EVK-6P: u-blox 6 Evaluation Kit with Crystal	LEA-6A, NEO-6M, u-blox 6 GPS chips with Crystal
EVK-6T: u-blox 6 Evaluation Kit with Precision Timing	LEA-6T
EVK-6R: u-blox 6 Evaluation Kit with Automotive Dead Reckoning (hardware sensor interface)	LEA-6R, ADR GWT Products
EVK-6V: u-blox 6 Evaluation Kit with Automotive Dead Reckoning (software sensor interface)	ADR DWT Products
EVK-6PPP: u-blox 6 Evaluation Kit with Precise Point Positioning	NEO-6P

Table 1: List of available EVK-6 u-blox 6 Evaluation Kits

☞ For additional information and documentation for the EVK-6V, contact the u-blox sales representative nearest you.

1.1 Kit includes

	Evaluation unit	USB cable	Active GPS antenna, 5 m cable	Active GPS/GLONASS antenna, 3m cable	CD with tools, drivers & documentation	MMCX to BNC female pigtail adapter	Serial interface cable with RJ45 connectors	Serial adapter: RJ45 to D89	Power supply adapter
EVK-6A/H/P/V/PPP	•	•	•		•				
EVK-6T	•	•	•		•	•			
EVK-6R	•	•	•		•		•	•	•
EVK-6N	•	•		•	•				

1.2 u-center GPS evaluation software

EVK-6 evaluation kits include u-center, an interactive tool for configuration, testing, visualization and data analysis of GPS receivers. It provides useful assistance during all phases of a system integration project.

1.3 System requirements

- PC with USB interface
- Operating system: Microsoft® Windows 7, Windows Vista or Windows XP
- USB drivers are provided in the evaluation kit CD

2 Getting Started

2.1 Software installation

☞ Installation of the EVK-6X software and documentation requires Internet access.

- Insert the CD-ROM with u-blox EvalKit software in your personal computer. The installation software will automatically start and guide you through the installation process. The installer requires Internet access to ensure that the most up-to-date components are installed on your system; these will be placed under the "u-blox" folder in the Start->Programs menu.

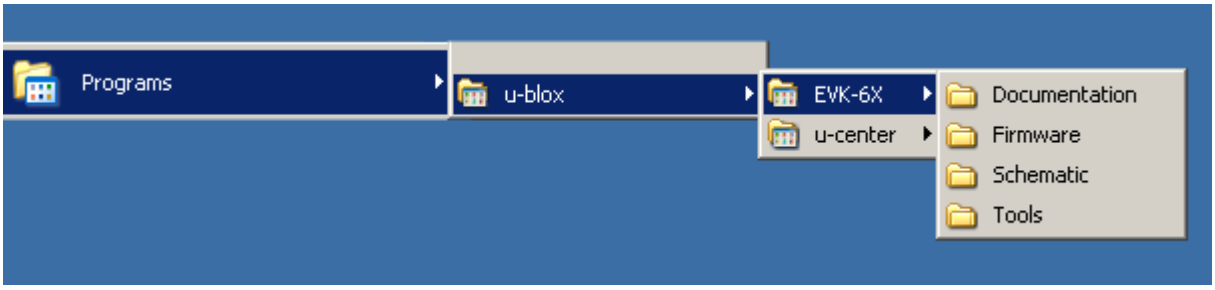


Figure 1: Location of EVK components on start menu

2.2 Hardware installation (EVK-6A/H/N/P/T/V/PPP)

1. Connect the USB port of the evaluation box to a PC running Microsoft Windows. An additional RS232 port is available on the back of the EVK unit. When communicating via this port the device must still be powered via USB.
2. Connect the GPS antenna to the evaluation unit and place the antenna in a location with good sky view.
3. Start the u-center GPS Evaluation Software and select corresponding COM port and baud rate (refer to the *u-center User Guide* [9] for more information).

2.3 Hardware installation (EVK-6R)

1. Connect the power adapter to the evaluation box and a power rail.
2. Connect one of the serial interface cables to port 1 or USB of the evaluation box and a PC running Microsoft Windows.
3. Connect the GPS antenna to the evaluation unit and place the antenna in a location for optimal ADR performance i.e. above the middle of the rear (unsteered) axle [7].
4. Connect odometer signal and the forward-backward signal (optional) to the evaluation box.
5. Power up the evaluation box.
6. Start the u-center GPS Evaluation Software and synchronize COM port and baud rate (refer to the *u-center User Guide* [9] for more information).

2.4 Serial port default configuration

Parameter	Description	Remark
UART Port 1, Input	UBX and NMEA protocol at 9'600 Baud	
UART Port 1, Output	UBX and NMEA protocol at 9'600 Baud	Only NMEA messages are activated
USB, Input	UBX and NMEA protocol	
USB, Output	UBX and NMEA protocol	Only NMEA messages are activated

Table 2: Default configuration

3 Device description

3.1 Active antenna

The EVK-6 Evaluation Kit comes either with a u-blox ANN-MS active GPS antenna with 5 m of cable (see the *ANN-MS Product Summary* [1] for more information) or with a GPS/ GLONASS antenna with 3 m of cable (EVK-6N). It is possible to connect various active and passive GPS antennas with SMA connector to the Evaluation Box. The maximum antenna supply current for active antennas is 30 mA.

3.2 EVK-6A/H/N/P/T/V/PPP Evaluation Box

Figure 2 shows the front and the rear sides of the EVK-6A/H/N/P/T/V/PPP Evaluation Box, showing connectors.

Front panel **Rear panel**

Figure 2: EVK-6A/H/N/P/T/V/PPP Evaluation Box - front and rear panels

3.2.1 Antenna connector

An SMA female jack is available on the front side (see Figure 2) of the Evaluation Box for connecting an active or passive antenna. DC voltage at the RF input is 3.0 V and the current is limited to 30 mA.

The connector is only to be used with a GPS/GNSS antenna or simulator. Do not connect this equipment to cable distribution systems.

3.2.2 Backup battery

With the EVK-6A/H/N/P/T/V/PPP a backup battery is connected to the u-blox 6 module to supply the backup part. This is necessary for storing orbital information between operations and enables faster start-up. The battery is a 1.55 V silver oxide type SR1154W (SR44), with a capacity of 190 mA. This should last for approximately 1 year.

CAUTION! RISK OF EXPLOSION IF BATTERY IS REPLACED BY AN INCORRECT TYPE. DISPOSE OF USED BATTERIES ACCORDING TO THE INSTRUCTIONS!

CAUTION! IN THE UNLIKELY EVENT OF A FAILURE IN THE INTERNAL PROTECTION CIRCUITRY THERE IS A RISK OF AN EXPLOSION WHEN CHARGING FULLY OR PARTIALLY DISCHARGED BATTERIES. REPLACE THE BATTERY IF IT NO LONGER HAS SUFFICIENT CHARGE FOR UNIT OPERATION. CONTROL THE BATTERY BEFORE USING IF THE DEVICE HAS NOT BEEN OPERATED FOR AN EXTENDED PERIOD OF TIME.

3.2.3 LEDs

On the front panel of the Evaluation Box there is a single LED to indicate operation of the 1PPS Timepulse signal.

3.2.4 GNSS Configuration (EVK-6N)

Besides GPS the EVK-6N also supports QZSS and GLONASS. For more information on how to configure the GNSS used, refer to the *u-center User Guide* [9], the *u-blox 6 Receiver Description including Protocol Specification* [8], and the *u-blox 6 GLONASS FW 1.00 Release Note* [12]. When testing GLONASS mode, be sure to use an LNA in front of the RF connection.

3.2.5 UART

The Evaluation Box includes an RS232 port for serial communication that is compatible with PC serial ports. Connect using a straight RS232 serial cable with male and female connectors to the port on your PC. If you are using a USB to RS232 adaptor cable you can connect it directly to the evaluation kit RS232 port.

The 9 pin D-SUB female connector is assigned as listed in Table 3:

Pin Nr.	Assignment
1	GPS time pulse output
2	TXD, GPS Transmit Data, serial data to DTE
3	RXD, GPS Receive Data, serial data from DTE
4	GPS ExtInt input
5	GND
6	GPS time pulse output
7-9	not connected

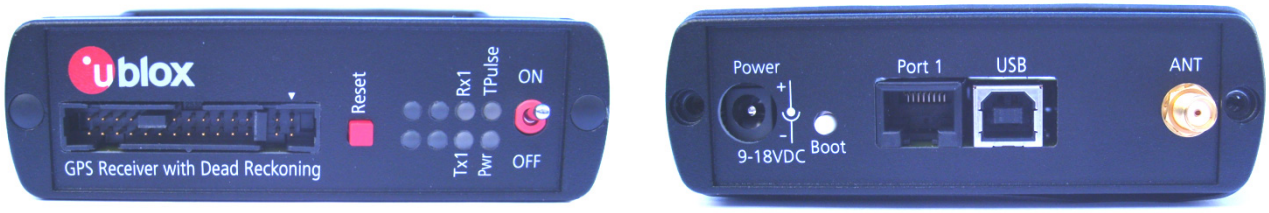
Table 3: Connector pin description EVK-6A/H/P/T/V/PPP

3.2.6 USB

A USB V2.0 compatible serial port is featured for data communication and power supply.

3.3 EVK-6R Evaluation Box

Figure 3 shows the front and the rear sides of the EVK-6R Evaluation Box, showing connectors.



Front panel **Rear panel**

Figure 3: EVK-6R Evaluation Box - front and rear panels

3.3.1 Antenna connector

An SMA female jack is available on the back side (see Figure 3) of the Evaluation Box for connecting an active or passive antenna.

The connector is only to be used with a GPS/GNSS antenna or simulator. Do not connect this equipment to cable distribution systems.

3.3.2 Backup battery

With the EVK-6R the backup battery in the Evaluation Box is a 3V lithium battery of the type 2450N. This battery has a capacity of 540 mAh, which should last for approximately 1 year for storing GPS and calibration sensor data in the EVK-6R Evaluation Kit.

CAUTION! RISK OF EXPLOSION IF BATTERY IS REPLACED BY AN INCORRECT TYPE. DISPOSE OF USED BATTERIES ACCORDING TO THE INSTRUCTIONS!

CAUTION! IN THE UNLIKELY EVENT OF A FAILURE IN THE INTERNAL PROTECTION CIRCUITRY THERE IS A RISK OF AN EXPLOSION WHEN CHARGING FULLY OR PARTIALLY DISCHARGED BATTERIES. REPLACE THE BATTERY IF IT NO LONGER HAS SUFFICIENT CHARGE FOR UNIT OPERATION. CONTROL THE BATTERY BEFORE USING IF THE DEVICE HAS NOT BEEN OPERATED FOR AN EXTENDED PERIOD OF TIME.

3.3.3 Boot button

The Boot button on the rear panel is non-functional on the EVK-6R.

3.3.4 LEDs

On the front panel of the EVK-6R Evaluation Box there are 4 LEDs to monitor status (see Figure 3).

LED Name	Description
Tx1	Indicates data transmission on Tx1 (transmission to the host)
Rx1	Indicates data reception on Rx1 (reception from the host)
Pwr	Indicates if power is supplied to the GPS Evaluation Box
TPulse	Timepulse Signal (pin P28 of LEA-6R)

Table 4: Description of the LEDs on the EVK-6R Evaluation Box

3.3.5 On/Off switch

The power switch is located on the right side of the front panel of the EVK-6R Evaluation Box (see Figure 3).

3.3.6 Power supply

The Power supply delivered is a standard 12V/0.8A DC external device with a detachable power cord, which is available with power plugs for specific countries. The input range of the power supply is from 100 to 240 V AC within a range of 50 to 60 Hz.

3.3.7 Reset button

The red button on the front panel of the EVK-6R GPS Evaluation Box (see Figure 3) is the reset button.

3.3.8 Serial interface connector: RJ45/DB9

An RS232 port is also available on the EVK-6R Evaluation Box. The pin assignment of the RJ45 connector is in accordance to the EIA/TIA 561 standard for RS-232D.

RJ45	DB9	Name	Description	I/O	RJ45 connector pin order
1	**9**	**RI**	Ring Indicator	Output	
2	**1**	**DCD**	Data Carrier Detect	Output	Pin 1
3	**4**	**DSR**	DSR; for future use	Input	
4	**5**	**GND**	Signal ground – there is no cable shield!		
5	**2**	**TxD**	Transmission Data to the host computer	Output	
6	**3**	**RxD**	Receiving Data from the host computer	Input	
7	**8**	**NC**	Not connected		
8	**7**	**NC**	Not connected		

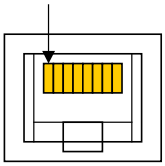


Table 5: Pin assignment of the serial interface connector (EVK-6R)

3.3.9 Serial interface cable

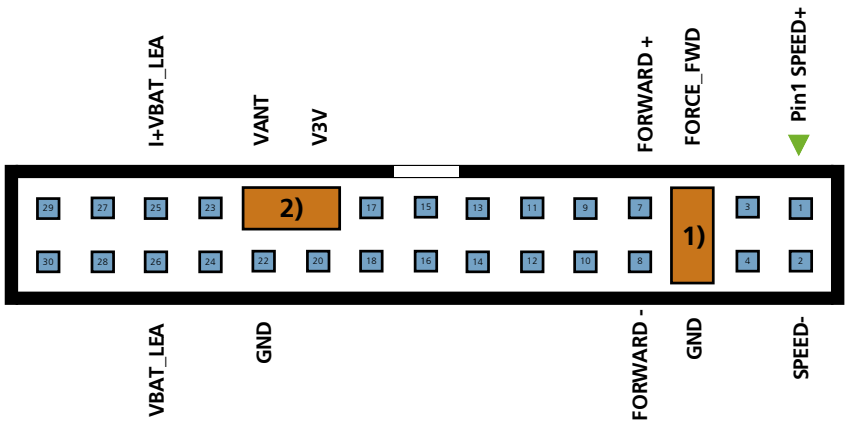
The EVK-6R comes with one 8-pole "1:1" serial interface cable with RJ45 plugs at both ends. The maximal length of the cable depends on the quality of the cable and on the speed of the cable. Therefore a recommendation is given that the cable should not exceed 3m connected directly to the host PC.

3.3.10 Service connector

The 30-pin connector with a pitch of 2.54 mm on the front panel of the EVK-6R Evaluation Box gives access to the most important signals from the Evaluation Kit. Extension boards or other interface electronics can be connected to this connector.

The power output of this connector is limited. In case of longer cable lengths for signals coming out of this connector, signals might have to be repeated or amplified. For further details refer to the electronic schematics in section 3.4.1.

To use the EVK-6R Evaluation Kit the jumpers have to be set according to Figure 4, which shows the Service connector, including the pin assignment and jumper settings.



1) PIN5 - PIN6: Set direction to 'forward' if no direction signal available
2) PIN19-PIN21: Connect VANT with 3V to supply the active antenna

Figure 4: Service connector and pin assignment (front view)

Pin Nr.	Signal Name	Description	Signal Direction
1	SPEED+	Speedpulse Signal	Input
2	SPEED-	Speedpulse Signal	Input
3	N.C.	Not Connect	
4	N.C.	Not Connect	
5	FORCE_FWD	Forces Direction Signal to forward	Output
6	GND	Ground	
7	FORWARD+	Forward/ Backward Signal	Input
8	FORWARD-	Forward/ Backward Signal	Input
9 : 18	N.C.	Not Connect	
19	V3V	3V DC	
20	N.C.	Not Connect	
21	VANT	Bias voltage for active antenna	Input
22	GND	Ground	
23	N.C.	Not Connect	
24	N.C.	Not Connect	
25	I+VBAT_LEA	Service Pin to measure the Backup Battery Current	Output
26	VBAT_LEA	Backup Battery Voltage	Output
27	N.C.	Not Connect	
28	N.C.	Not Connect	
29	N.C.	Not Connect	Output
30	N.C.	Not Connect	Output

Table 6: Pin assignment of the "Service" connector

3.3.11 USB

A USB V2.0 compatible serial port is featured for data communication. Powering through the USB is not supported with the EVK-6R.

3.4 USB cable

EVK-6 Evaluation Kits come with one USB cable to connect the Evaluation Box to a PC.

4 Specifications

Parameter	Evaluation Kit	Specification
Serial Interfaces	All	1 RS-232, 1 USB V2.0
Dimensions	EVK-6A/H/N/P/T/V/PPP EVK-6R	74 x 54 x 24 mm 87[1] x 110 x 36 mm
Speed Pulses + FWD/BACKWD Signal	EVK-6R	Voltage range: 4.5 to 12 V Galvanic decoupling circuit inside
Power Supply	EVK-6R	9 to 24V[2]
Temperature range with battery	EVK-6A/H/N/P/T/V/PPP	0 to 60 degrees Celsius
Temperature range without battery	EVK-6A/H/N/P/T/V/PPP	-20 to 65 degrees Celsius

Table 7: EVK-6 specifications

5 Measuring tracking current

To measure the tracking current with EVK-6H/P/T/V/PPP, follow these steps:

1. Remove jumper at J13
2. Connect a true rms multimeter across J13
3. Wait 12 minutes to download all GPS orbital data, or download all the Aiding Data via the AssistNow Online service
4. Read voltage (and average if necessary) at multimeter and convert to current (1 mV equals 1 mA)
5. Perform the test with good signals and clear sky view to ensure that the receiver can acquire the satellite signals.
6. Place the jumper on **J13** after the measurement.

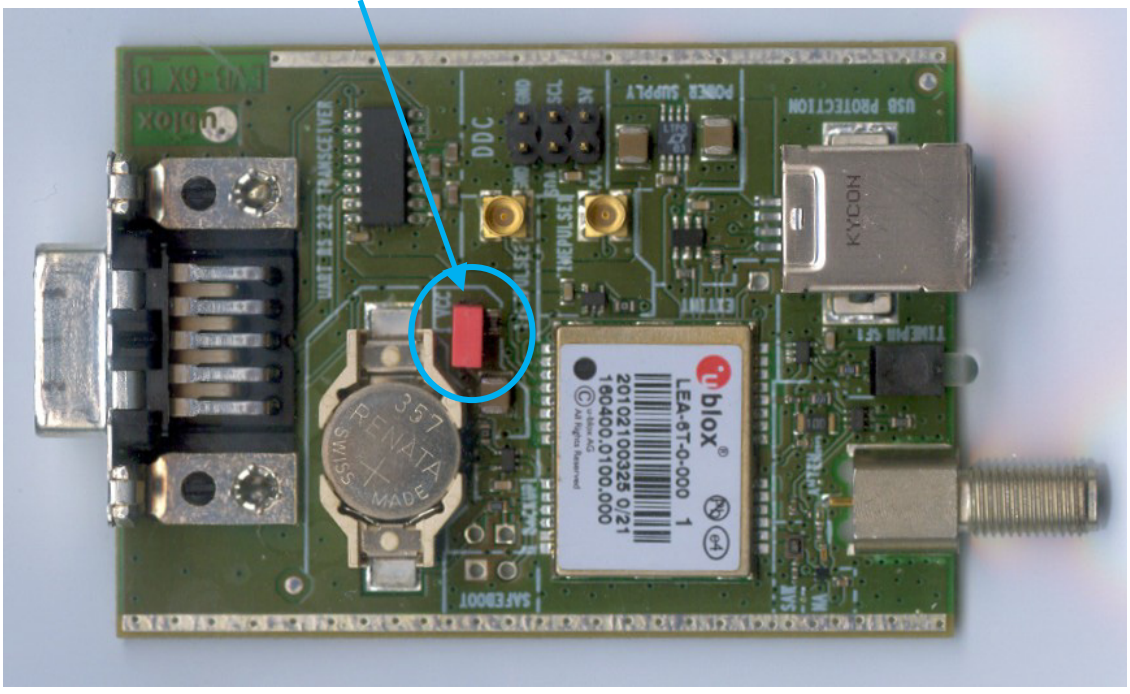


Figure 5: jumper J13 for current measurement

[1] Excl. ON/OFF switch.
[2] Powering through the USB is not supported.

6 Testing Power Save Mode

When testing Power Save Mode with EVK-6A/H/P/N, observe the following points:

- When configuring Power Save Mode you must setup the parameters using the CFG-PM message first and then enable Power Save Mode using CFG-RXM. The Configuration view or Messages View of the u-center evaluation software can be used to do this. When enabling the mode using CFG-RXM, always save the configuration by checking the "save configuration" box in u-center otherwise the configuration will be lost.
- When you want to alter the Power Save Mode configuration, you must first disable the mode using CFG-RXM first (remember to enable "save configuration" again), before changing the CFG-PM parameters. You can then re-enable Power Save Mode using CFG-PM.
- Communications to the evaluation kit must be via the RS232 (not USB) for FW6.02.
- The evaluation kit may only be supplied over the USB connector. This can be done by either connecting a USB cable from the evaluation kit to a supplied USB hub, or by using a USB power connector (see Figure 6). Do not connect the USB cable to the PC!
- When configuring Power Save Mode set the parameters using the CFG-PM message first and then enable Power Save Mode using CFG-RXM. The Configuration view or Messages View of the u-center evaluation software can be used to do this. When enabling the mode using CFG-RXM, always save the configuration by checking the "save configuration" box in u-center otherwise the configuration will be lost.
- When altering the Power Save Mode configuration, first disable the mode using CFG- RXM first (remember to enable "save configuration" again), before changing the CFG-PM parameters. Then re-enable Power Save Mode using CFG-PM.

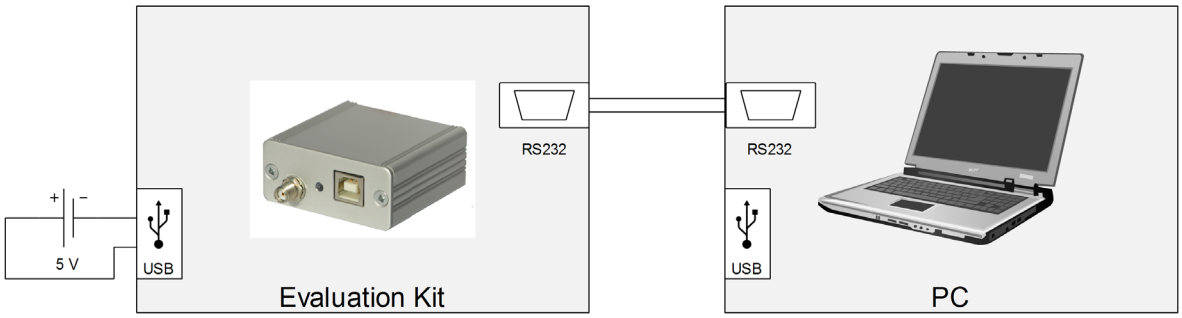


Figure 6: Connecting EVK for supply and communications when testing Power Save Mode

7 EVK-6T Precision GPS Timepulse output

The LEA-6T GPS synchronized **Timepulse 1** output has a high accuracy output (see *LEA-6 Data Sheet* [3] for details). The current design of the EVK-6T uses a MAX3232 driver for the D-SUB connector, which adds a delay of typically 0.15 µs.

To avoid this delay on the **Timepulse** signal, connect the timing output directly to the internal MMCX connector on the EVK-6T PCB board.

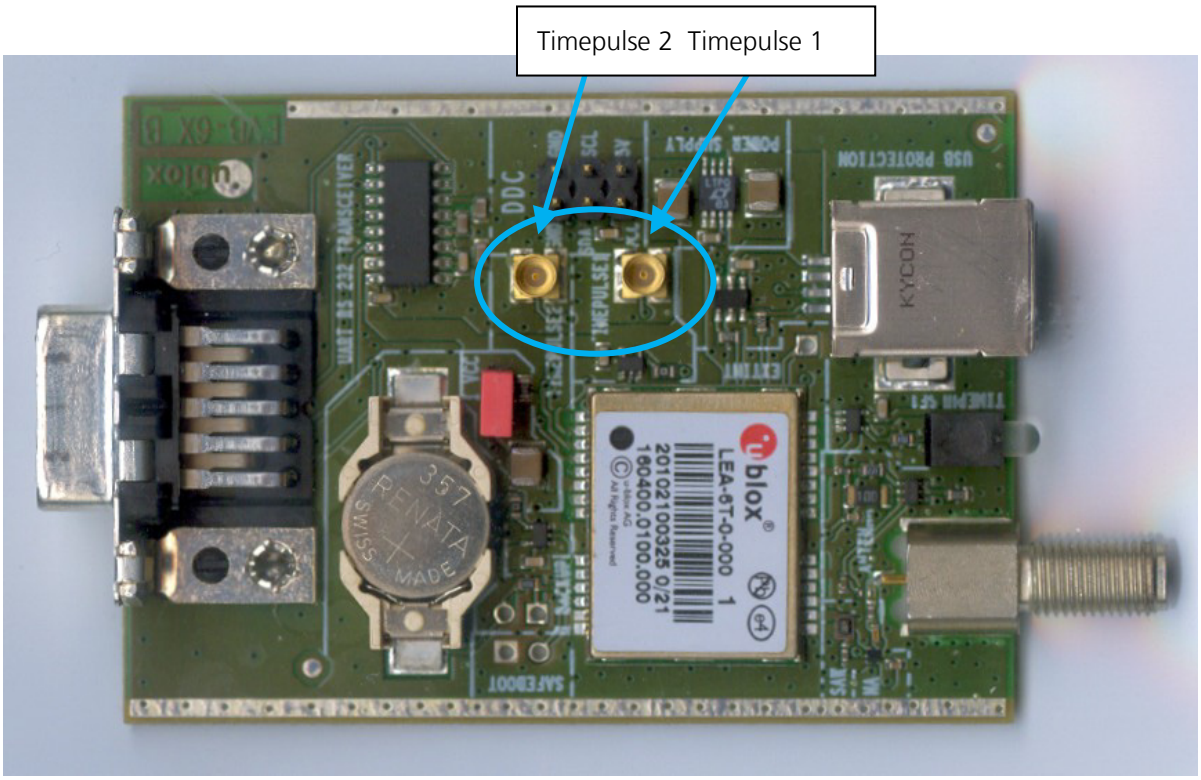


Figure 7: Timepulse connector position

☞ For more information on evaluating Timepulse see the *GPS-based Timing Application Note* [10].

8 Block diagrams

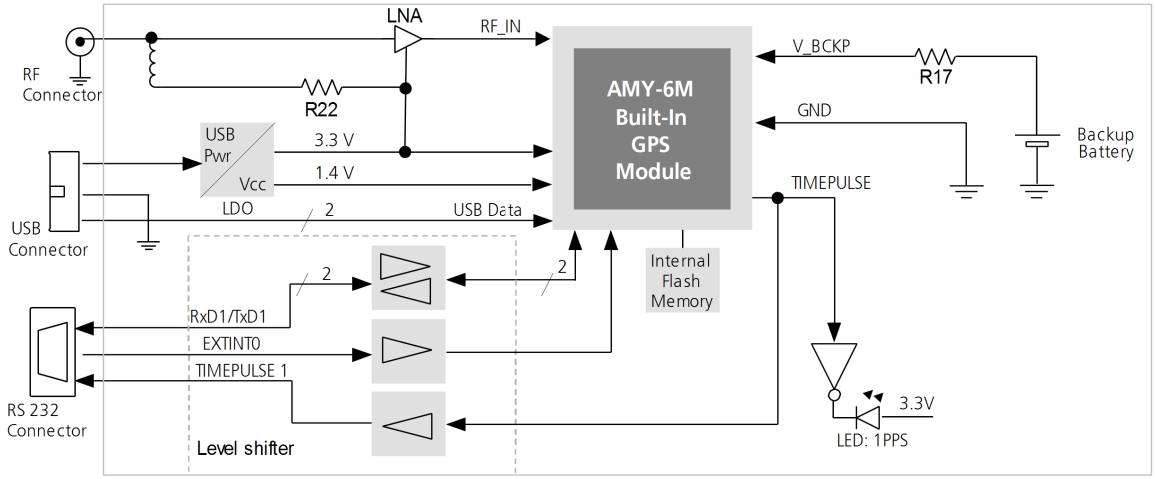


Figure 8: EVK-6A block diagram

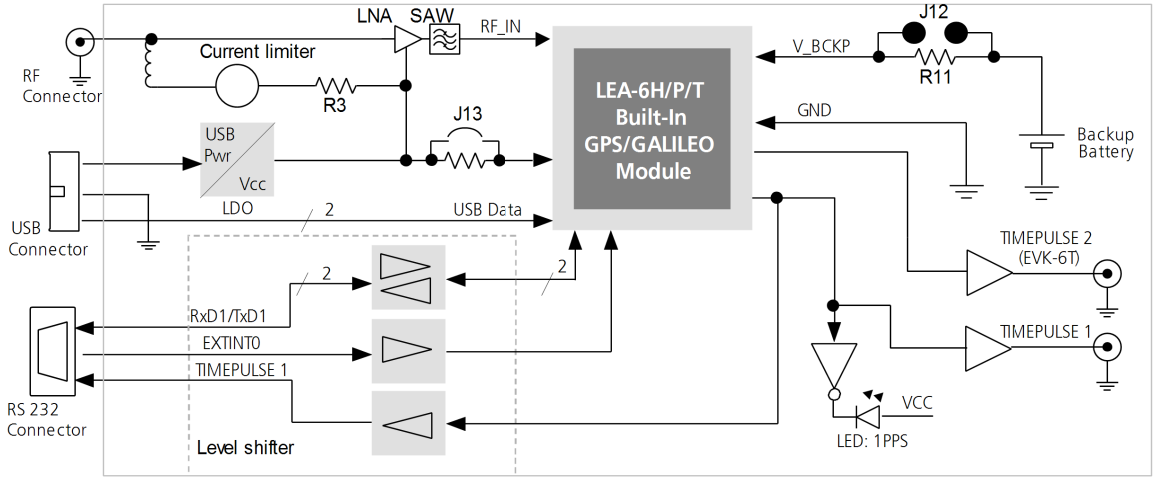


Figure 9: EVK-6H/P/T/V/PPP block diagram

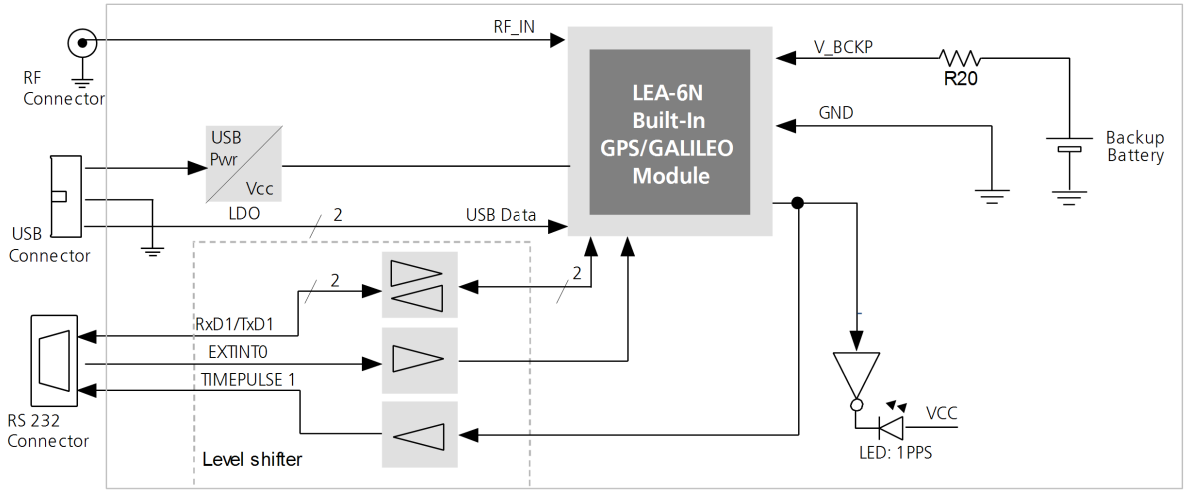


Figure 10: EVK-6N block diagram

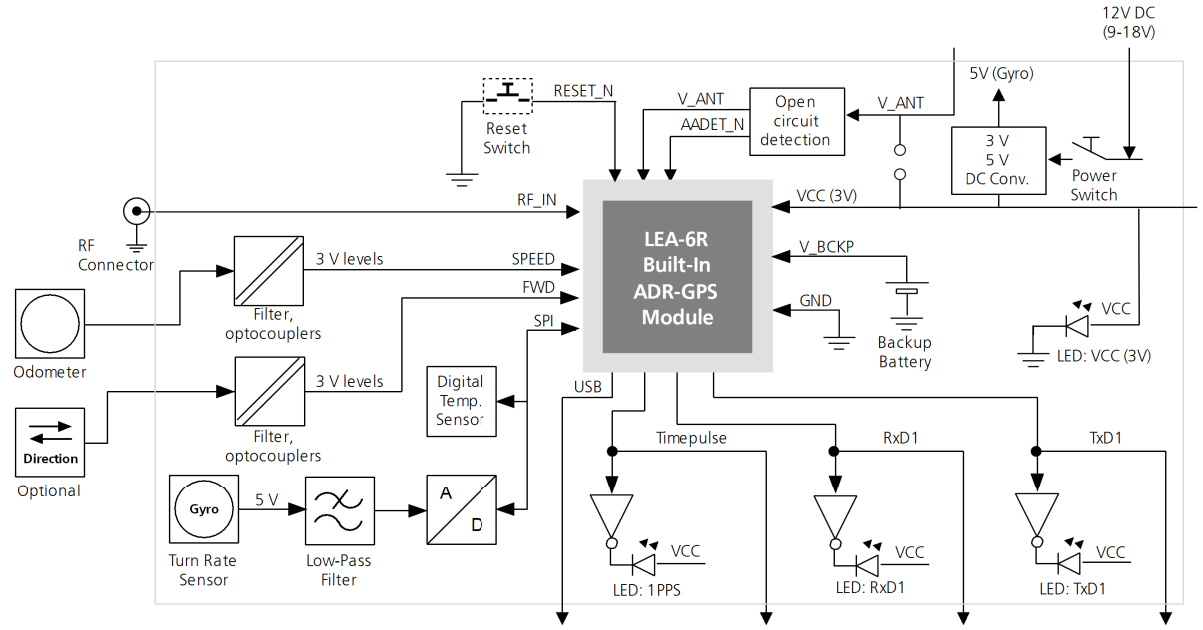


Figure 11: EVK-6R block diagram

9 Board layout

9.1 EVK-6A board layout

Figure 12 shows the EVK board layout. See Table 8 for the component list of the EVB-6A.

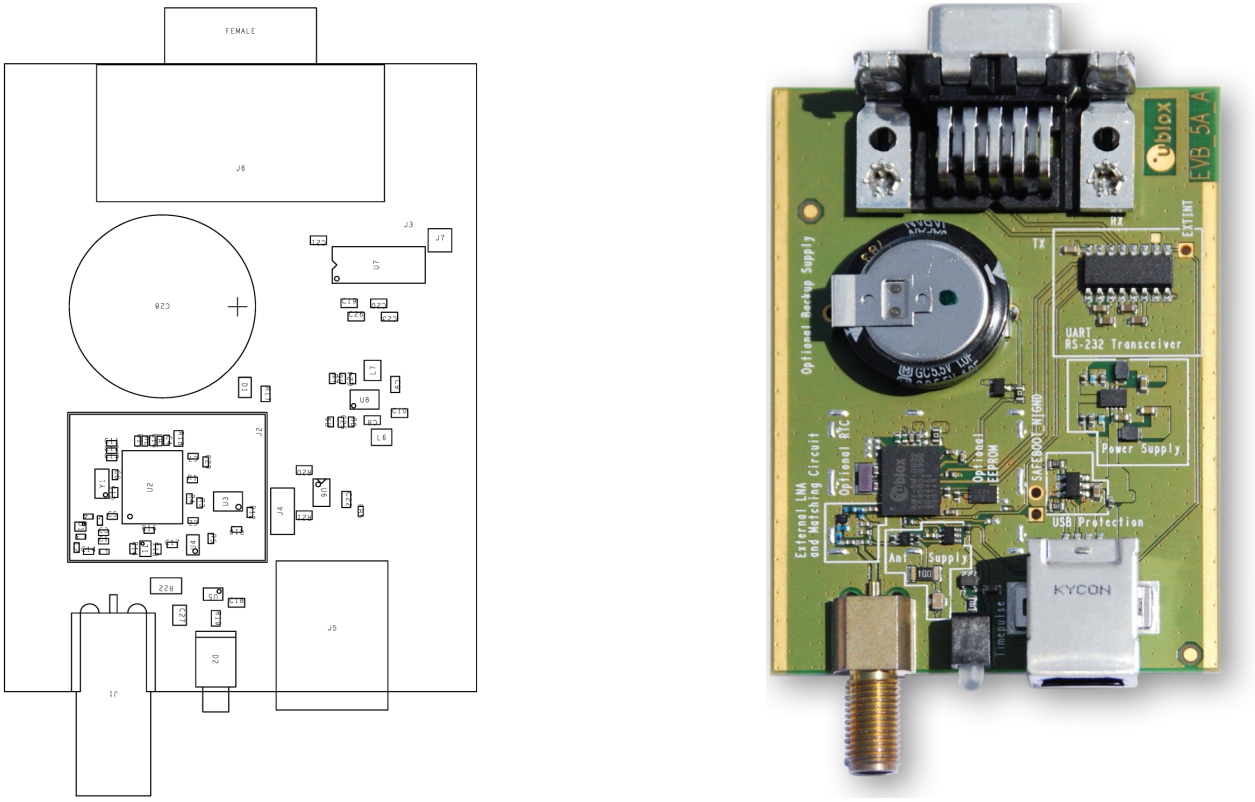


Figure 12: EVK-6A board layout

Part number	Description	Remarks
C1 C17	CAP CER X5R 0402 100N 10% 10V	
C10 C8 C9	CAP CER X5R 0603 10U 20% 6.3V	
C14	CAP CER COG 0402 47P 5% 25V	
C15 C6	CAP CER COG 0402 12P 5% 25V	
C18 C19 C21 C22	CAP CER X7R 0603 100N 10% 10V	
C20 C23 C26	CAP CER X5R 0603 1U0 10% 6.3V	
C24 C25	CAP CER COG 0402 22P 5% 25V	
C27	CAP FEEDTHRU 0805 MURATA NFM21 470P 20% 50V 0.3A	
C28	CAP ELECTRIC DOUBLE LAYER THT PANASONIC SERIES SG 1F 30% 5.5V	
C29	CAP CER X5R 0402 1U0 10% 6.3V	
C3	CAP CER X7R 0402 1N0 10% 16V	
C5	CAP CER COG 0402 1P5 +/-0.1P 25V	
D1	DIODE SCHOTTKY INFINEON BAS70-04W 70V 0.07A	
D2	LED 3MM DIALIGHT 591-2301 GREEN 0.01A	
FB1	FERRITE BEAD MURATA BLM15HD 0402 1000R@100MHZ	
FB5	FERRITE BEAD MURATA BLM15HD 0402 10R@100MHZ	
J1	CON SMA SMD STRAIGHT JACK 11.4MM HEIGHT WITH WASHER AND NUT	
J5	CON USB RECEPTACLE B TYPE SMD	
J6	SUB-D CONNECTOR FEMALE	

Part number	Description	Remarks
L1	IND MURATA LQG15H 0402 27N 5% 0.3A	
L2	IND MURATA LQW15A 0402 10N 2% 0.5A	
L3	IND MURATA LQW15A 0402 15N 3% 0.46A	
L4	IND MURATA LQW15A 0402 22N 3% 0.31A	
L5	IND MURATA LQW15A 0402 6N8 3% 0.7A	
L6 L7	IND MURATA LQH2MC0806 2U2 20% 0.425A	
R11 R2	RES THICK FILM CHIP 0402 0R 0 0.1W	
R14 R15	RES THICK FILM CHIP 0402 100K 5% 0.1W	
R17 R18	RES THICK FILM CHIP 0603 0R 0 0.1W	
R19	RES THICK FILM CHIP 0603 100R 5% 0.1W	
R20 R21	RES THICK FILM CHIP 0603 27R 5% 0.1W	
R22	RES THICK FILM CHIP 1206 10R 5% 0.25W	
R3 R4	RES THICK FILM CHIP 0402 10K 5% 0.1W	
R6 R8	RES THICK FILM CHIP 0402 270K 1% 0.1W	
R7	RES THICK FILM CHIP 0402 200K 1% 0.1W	
R9	RES THICK FILM CHIP 0402 60K4 1% 0.063W	
T1	COMPLEMENTARY N- AND P-CHANNEL 20V (D-S) MOSFET VISHAY Si1016 SC89-6	
U1	LOW NOISE AMPLIFIER 1.5-2.4GHZ JRC NJG1117 USB6-A8	
U2	GPS RECEIVER U-BLOX AMY-6M-0 ROM6.02 -40/+85C	
U3	EEPROM SERIAL I2C 32KBIT 1.8-5.5V UFDFPN8 -40/+85C	
U4	TINY LOGIC UHS DUAL BUFFER OPEN DRAIN OUTPUTS FAIRCHILD NC7WZ07 SC70	
U5	TINY LOGIC UHS BUFFER OE_N ACTIVE LOW FAIRCHILD NC7SZ125 SC70	
U6	USB DATA LINE PROTECTION ST USBLC6-2SC6 SOT23-6	
U7	RS-232 TRANSCEIVER MAXIM MAX3232 SO16 -40/+85C	
U8	DUAL SYNCHRONOUS STEP DOWN REGULATOR LINEAR LTC3547B DDB8 ADJ -40/+85C	
Y1	CRYSTAL CL=9PF MICRO CRYSTAL CC7 GOLD TERMINATION 32.768KHZ 100PPM	

Figure 13: EVB-6A component list

9.2 EVK-6H/P/T/V/PPP board layout

Figure 14 shows the EVK board layout. See Table 8 for the component list of the EVB-6H.

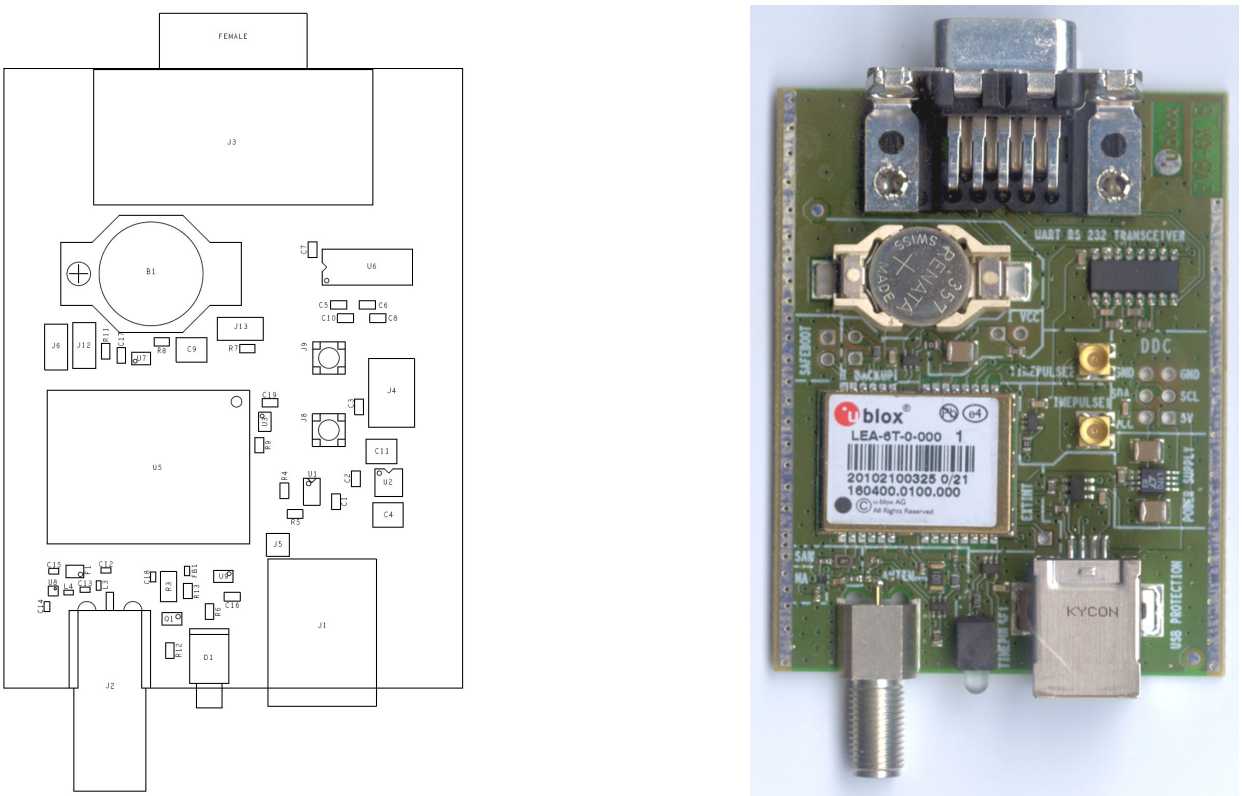


Figure 14: EVK-6H/P/T/V/PPP board layout

Part number	Description	Remarks
B1	BATTERY HOLDER + BATTERY, RENATA SMTU357 1V55	
C1 C16 C17 C19 C3 C5 C7	CAP CER X7R 0603 100N 10% 10V	
C10 C6 C8	CAP CER X5R 0603 1U0 10% 6.3V	
C11 C4 C9	CAP CER X5R 1210 10U 10% 10V	
C12 C14	CAP CER X5R 0402 100N 10% 10V	
C13 C15	CAP CER COG 0402 8P2 +/-0.5P 25V	
C18	CAP CER X5R 0402 1U0 10% 6.3V	
C2	CAP CER X7R 0603 10N 10% 10V	
D1	LED 3MM DIALIGHT 591-2301 GREEN 0.01A	
F1	SAW FILTER FOR GPS EPCOS B7839	
FB1	FERRITE BEAD MURATA BLM15HD 0402 1000R@100MHZ	
J1	CON USB RECEPTACLE B TYPE SMD	
J13	CON 1-ROW THT 100MIL GRID 2PINS 0.64MM SQUARE 6.1MM HEIGHT	
J2	CON SMA SMD STRAIGHT JACK 11.4MM HEIGHT WITH WASHER AND NUT	
J3	SUB-D CONNECTOR FEMALE	
J4	CON 2-ROWS THT 100MIL GRID 6PINS 0.64MM SQUARE 6.1MM HEIGHT	
J8 J9	SMT MMCX 50 OHMS JACK VERTICAL CONNECTOR -55/+125C	J9 only populated on EVK-6T
L3	IND MURATA LQG15H 0402 27N 5% 0.3A	
L4	IND MURATA LQP15M 0402 9N1 +/-0.1N 0.1A -40/+85C	
Q1	MBT3906DW1T1G DUAL GENERAL PURPOSE TRANSISTOR 0.2A 0.15W -40/+125C	
R11 R6	RES THICK FILM CHIP 0603 100R 5% 0.1W	
R12	RES THICK FILM CHIP 0603 2K2 5% 0.1W	
R13	RES THICK FILM CHIP 0603 220R 5% 0.1W	

Part number	Description	Remarks
R3	RES THICK FILM CHIP 1206 10R 5% 0.25W	
R4 R5	RES THICK FILM CHIP 0603 22R 5% 0.1W -55/+125C	
R7	RES THICK FILM CHIP 0603 1R0 5% 0.1W	
R8 R9	RES THICK FILM CHIP 0603 51R 1% 0.063W	R8 only populated on EVK-6T
U1	USB DATA LINE PROTECTION ST USBLC6-2SC6 SOT23-6	
U2	LOW DROPOUT REGULATOR LINEAR LT1962 MS8 3.0V 0.3A	
U3 U7 U9	TINY LOGIC UHS BUFFER OE_N ACTIVE LOW FAIRCHILD NC7SZ125 SC70	U7 only populated on EVK-6T
U5	GPS RECEIVER U-BLOX LEA-6x 3.6V -40/+85C	
U6	RS-232 TRANSCEIVER MAXIM MAX3232 SO16 -40/+85C	
U8	LOW NOISE AMPLIFIER GAAS MMIC 1.575 GHZ 1.5V-3.6V JRC EPFFP6-A2 3.6V -40/+85C	

Table 8: EVB-6H/P/T/V/PPP component list

9.3 EVK-6N board layout

Figure 14 shows the EVK board layout. See Table 8 for the component list of the EVB-6N.

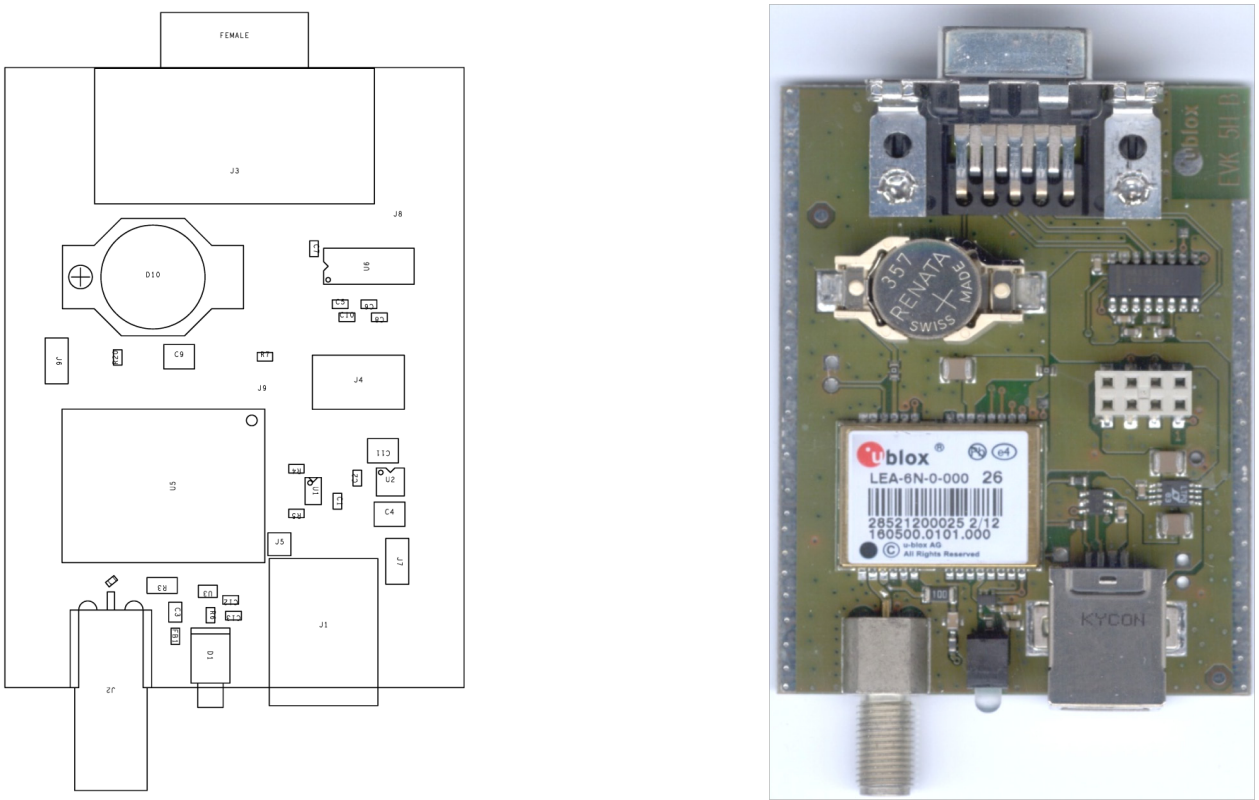


Figure 15: EVK-6N board layout

Part number	Description	Remarks
C1 C12 C13 C5 C7	CAP CER X7R 0603 100N 10% 10V	
C10 C6 C8	CAP CER X5R 0603 1U0 10% 6.3V	
C11 C4 C9	CAP CER X5R 1210 10U 10% 10V	
C2	CAP CER X7R 0603 10N 10% 10V	
C3	CAP FEEDTHRU 0805 MURATA NFM21 470P 20% 50V 0.3A	
D1	LED 3MM DIALIGHT 591-2301 GREEN 0.01A	
D10	BATTERY HOLDER + BATTERY, RENATA SMTU357 1V55	
FB1	FERRITE BEAD MURATA BLM18HD 0603 600R@100MHZ	
J1	CON USB RECEPTACLE B TYPE SMD	

Part number	Description	Remarks
J2	CON SMA SMD STRAIGHT JACK 11.4MM HEIGHT WITH WASHER & NUT	
J3	SUB-D CONNECTOR FEMALE	
J4	2-ROWS SMD-PCB SOCKET 100MIL GRID 8PINS 7.0MM	
R20 R7	RES THICK FILM CHIP 0603 0R 0 0.1W	
R3	RES THICK FILM CHIP 1206 10R 5% 0.25W	
R4 R5	RES THICK FILM CHIP 0603 27R 5% 0.1W	
R6	RES THICK FILM CHIP 0603 100R 5% 0.1W	
U1	USB DATA LINE PROTECTION ST USBLC6-2SC6 SOT23-6	
U2	LOW DROPOUT REGULATOR LINEAR LT1962 MS8 3.0V 0.3A	
U3	TINY LOGIC UHS BUFFER OE_N ACTIVE LOW FAIRCHILD NC7SZ125 SC70	
U5	GPS RECEIVER U-BLOX LEA-6N-0 -40/+85C	
U6	RS-232 TRANSCEIVER MAXIM MAX3232 SO16 -40/+85C	

Table 9: EVB-6N component list

9.4 EVK-6R board layout

Figure 16 shows the EVK board layout. See Table 10 for the component list of the EVB-6H.

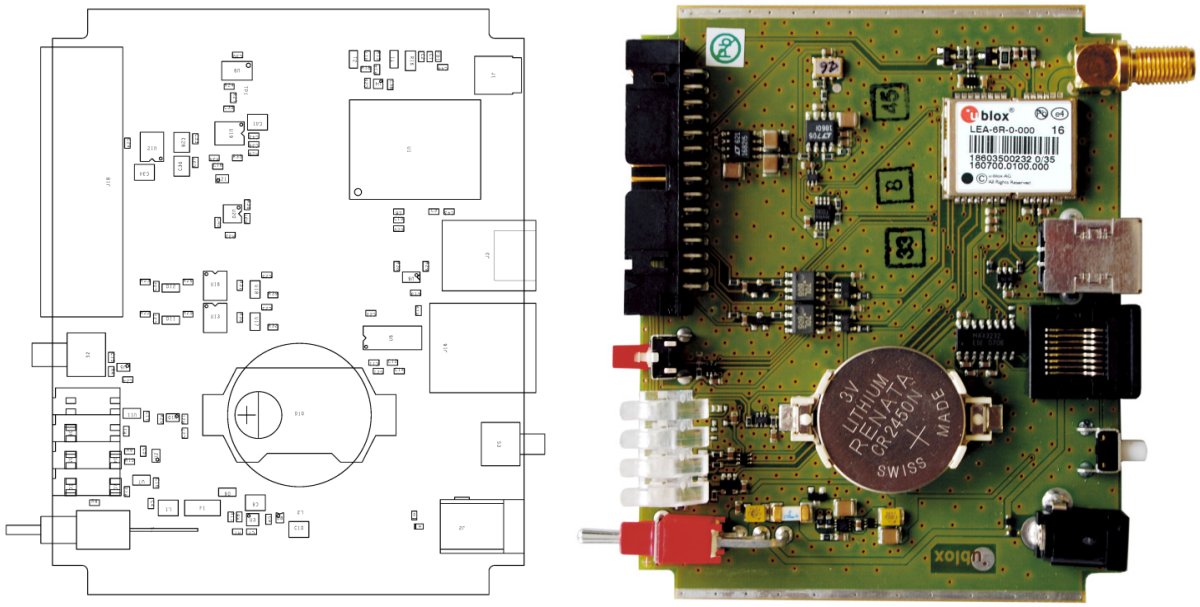


Figure 16: EVK-6R board layout

Part number	Description	Remarks
C1 C2	CAP CER X5R 0603 1U0 10% 6.3V	
C10 C28 C34 C36 C41 C6	CAP CER X5R 1210 10U 10% 25V	
C11 C12 C13 C15 C16 C17 C18 C19 C20 C22 C23 C24 C25 C27 C30 C39 C4 C40 C42 C43 C44 C5 C7 C8 C9	CAP CER X7R 0603 100N 10% 50V	
C14 C21 C29 C35	CAP CER X7R 0603 220N 10% 10V	
C26 C38	CAP CER X7R 0603 2U2 10% 25V	
C3	CAP CER X7R 0603 10N 10% 25V	
C31 C32	CAP CER X7R 0603 33N 10% 25V	
C33 C37	CAP CER X7R 0603 1N0 10% 25V	
D1	LED DIALIGHT 597-3111 RED 0.025A	
D10	BATTERY HOLDER + BATTERY, RENATA CR2450N 3V	
D11 D12	VOLTAGE REGULATOR DIODE FAIRCHILD BZX84 SOT23 6V2 0.2A	

Part number	Description	Remarks
D2 D3	DIODE HIGH SPEED SWITCHING BAS516 SOD523 75V 0.5A	
D4 D5 D7	LED DIALIGHT 597-3401 YELLOW 0.025A	
D6	VOLTAGE REGULATOR DIODE FAIRCHILD BZX84 SOT23 20V 0.2A	
D8	DIODE SCHOTTKY NXP PMEG4005AEV SOT666 40V 0.5A -55/+125C	
F1	NANO FUSE VERY FAST ACTING 125V 0.2A SUBMINIATUTE PACKAGE 125V 0.2A -55/+125C	
FB1	FERRITE BEAD MURATA BLM18HD 0603 600R@100MHZ	
J1	CON SMA THT RIGHT ANGLE JACK 10.8MM HEIGHT	
J16	RJ45 THT RIGHT ANGLE JACK	
J18	2-ROWS TH-PCB CONNECTOR 100MIL GRID 30PINS RIGHT ANGLE 10.2MM	
J2	POWER CONNECTOR 2.1MM	
J3	CON USB RECEPTACLE B TYPE THT	
L1	IND EPCOS SIMID B82422?H 1210 4U7 5% 0.7A	
L2	IND EPCOS SIMID B82422?H 1210 6U8 5% 0.57A	
R10 R12 R9	RES THICK FILM CHIP 0603 220R 5% 0.1W	
R11 R14	RES THICK FILM CHIP 0603 18K 5% 0.1W	
R15 R17 R36	RES THICK FILM CHIP 0603 5K6 5% 0.1W	
R16	RES THICK FILM CHIP 1206 10R 5% 0.25W	
R18	RES THICK FILM CHIP 0603 56R 5% 0.1W	
R20 R32 R39	RES THICK FILM CHIP 0603 0R 0 0.1W	
R21	RES THICK FILM CHIP 0603 100R 5% 0.1W	
R22 R23 R25 R26	RES THICK FILM CHIP 0603 2K2 5% 0.1W	
R24 R37	RES THICK FILM CHIP 0603 100K 5% 0.1W	
R27	RES THICK FILM CHIP 0603 22K 5% 0.1W	
R28	RES THICK FILM CHIP 0603 10R 5% 0.1W	
R29 R38	RES THICK FILM CHIP 0603 27R 5% 0.1W	
R30 R31 R4 R6	RES THICK FILM CHIP 0603 1K0 5% 0.1W	
R33 R34 R35	RES THICK FILM CHIP 0603 10K 5% 0.1W	
R7 R8	RES THICK FILM CHIP 0603 51K 5% 0.1W -55/+125C	
S1	SWITCH ON ON	
S2	SWITCH SPST ON 1POL VERTICAL OMRON	
S3	SWITCH SPST ON 1POL TYCO	
T1 T2	PNP SILICON TRANSISTOR PHILIPS BC856B SOT23	
U1	GPS RECEIVER U-BLOX LEA-6R-0 3.6V -40/+85C	
U10	TINY LOGIC UHS D-FLIP-FLOP ASYNCH. CLEAR FAIRCHILD NC7SZ175	
U12	VOLTAGE DOUBLER CHARGE PUMP WITH LDO LINEAR LTC1682 SO8 5V - 40/+85C	
U13 U16	OPTOCOUPLER LVTTL/LVCMOS COMPATIBLE AVAGO HCPL-070L-000E SO8	
U17 U18	TINY LOGIC UHS INVERTER WITH SCHMITT TRIGGER FAIRCHILD NC7SZ14 SOT23-5	
U19	12 BIT A/D-CONVERTER LINEAR LTC1860 SO8 -40/+85C	
U2 U21 U5	TINY LOGIC UHS DUAL BUFFER OPEN DRAIN OUTPUTS FAIRCHILD NC7WZ07 SC70	
U20	DIGITAL TEMPERATURE SENSOR 10BIT NATIONAL LM70 5V MSOP8	
U3	STEP DOWN REGULATOR LINEAR LT3502A DFN8 40V 0.5A -40/+125C	
U4	LOW DROPOUT REGULATOR SEIKO S1112B SNT-6A 3.0V 0.15A	
U6	RS-232 TRANSCEIVER MAXIM MAX3232 SO16 -40/+85C	
U7	TINY LOGIC UHS BUFFER OE ACTIVE HIGH FAIRCHILD NC7SZ126 SOT23-5	
U8	USB DATA LINE PROTECTION ST USBLC6-2SC6 SOT23-6	
U9	GYRO SENSOR EPSON XV-8000CB 5.25V -40/+85C	

Table 10: EVB-6R component list

10 Schematic

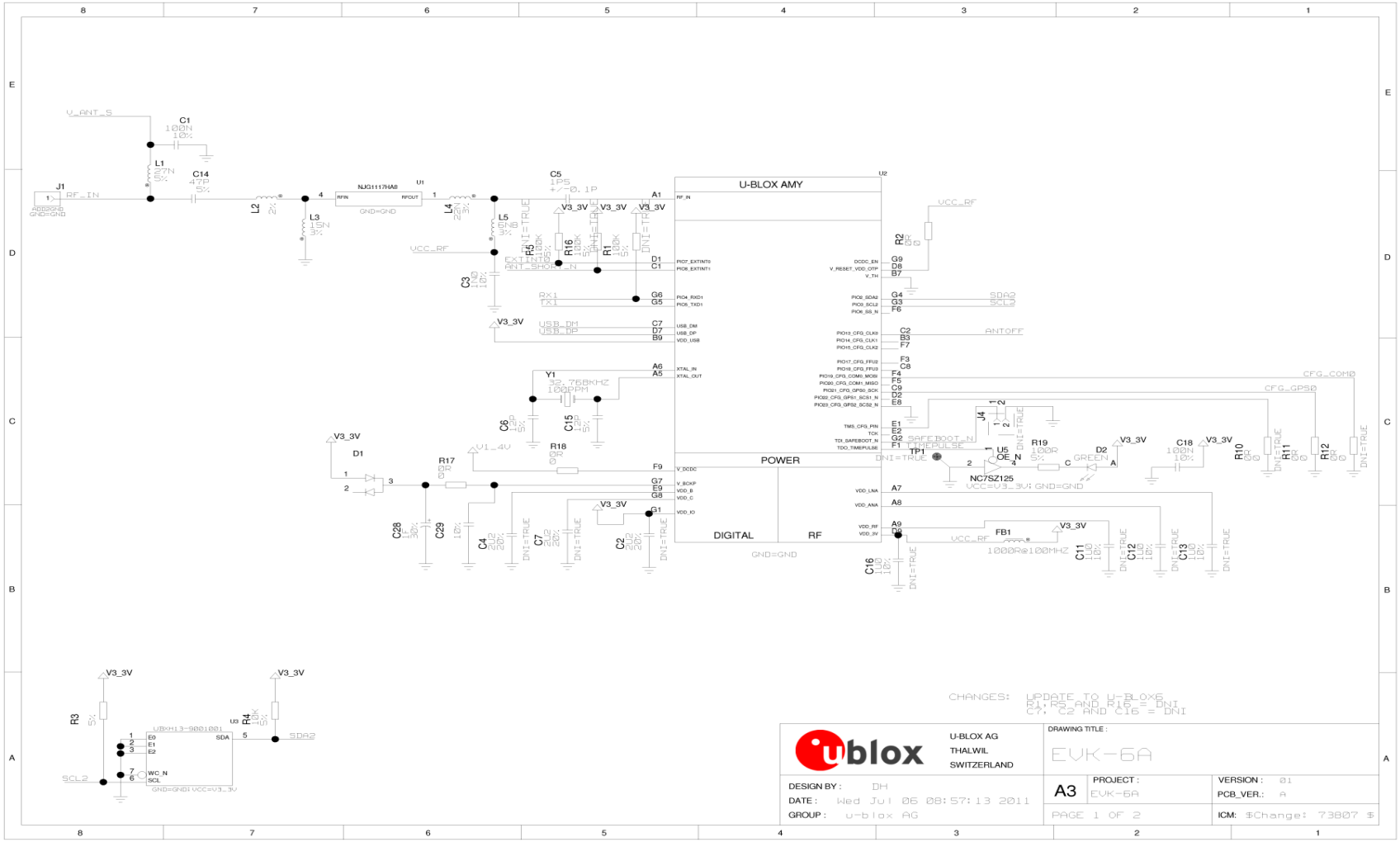


Figure 17: Schematic EVK-6A (page 1): DNI=TRUE in the schematic means: DO NOT INSTALL.

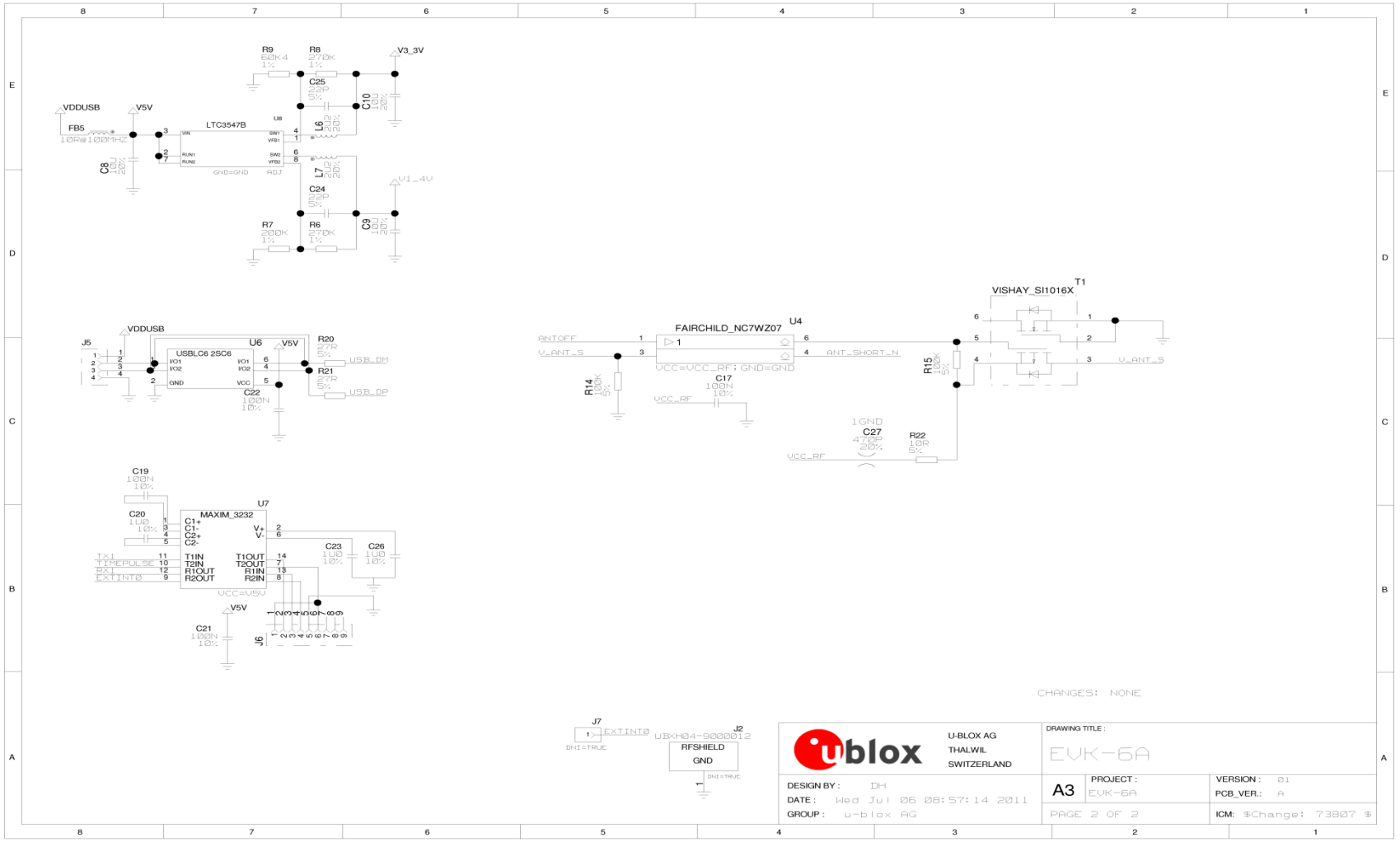


Figure 18: Schematic EVK-6A (page 2): DNI=TRUE in the schematic means: DO NOT INSTALL.

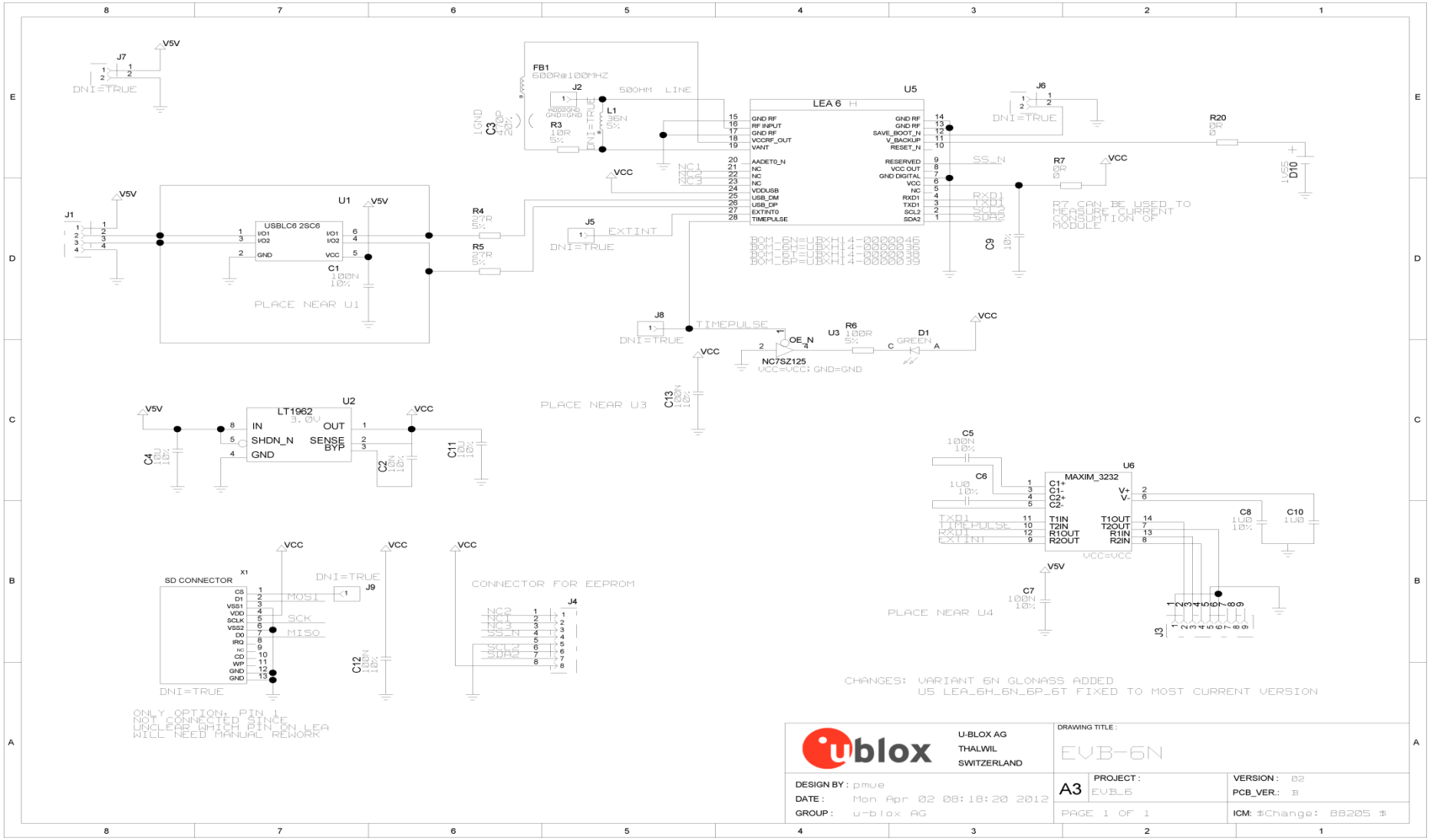


Figure 19: Schematic EVK-6N: DNI=TRUE in the schematic means: DO NOT INSTALL.

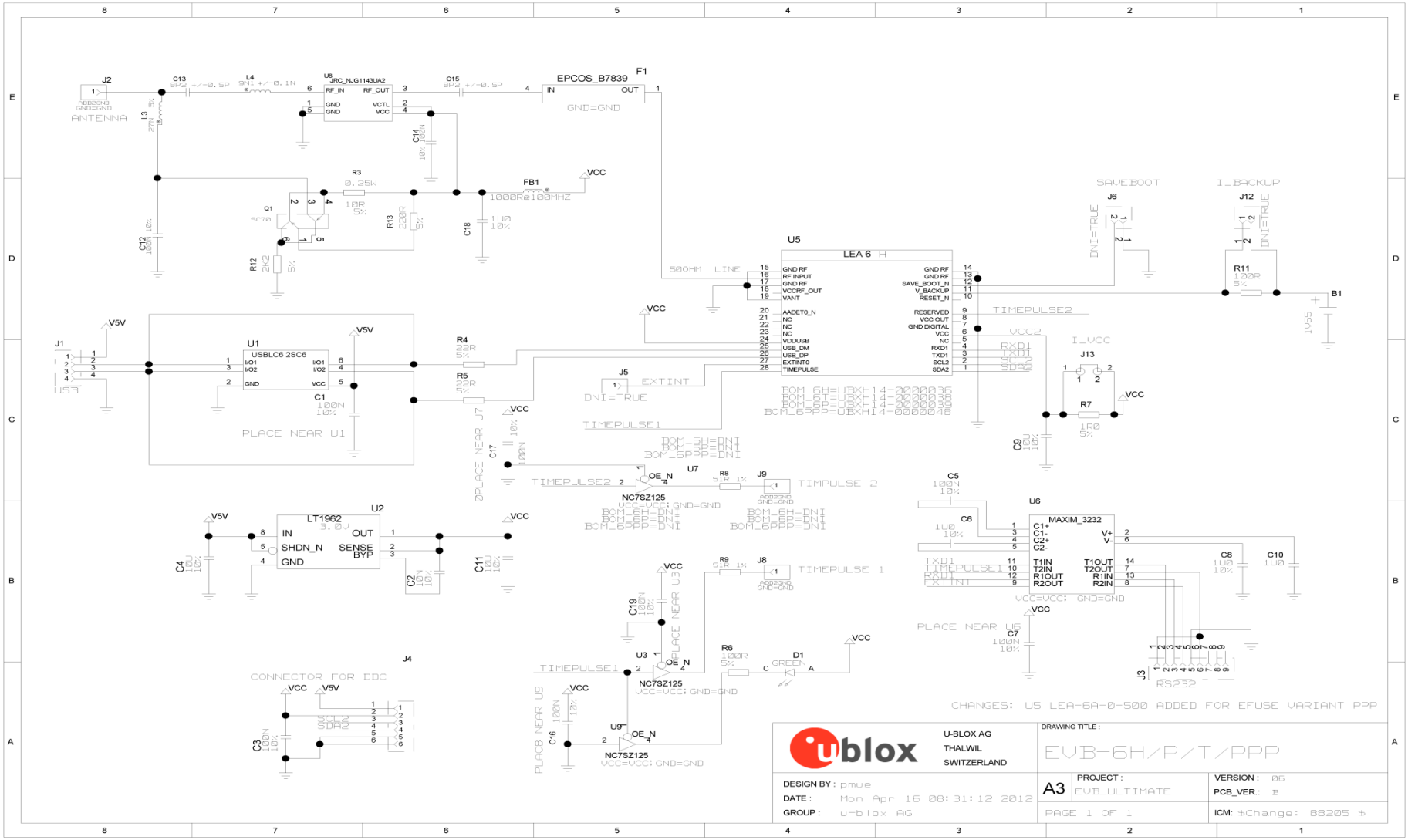


Figure 20: Schematic EVK-6H/P/T/V/PPP: DNI=TRUE in the schematic means: DO NOT INSTALL.

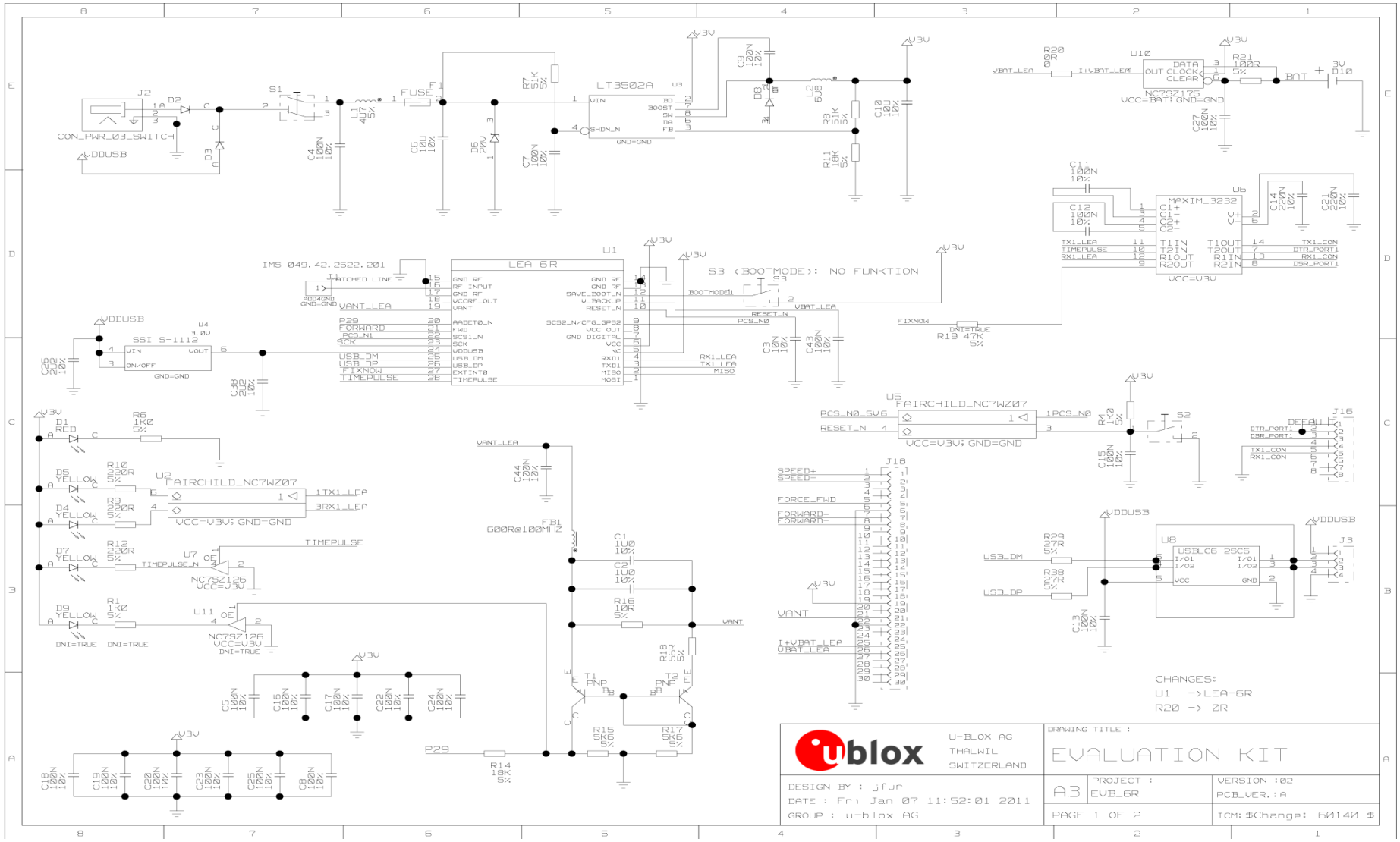


Figure 21: Schematic EVK-6R (page 1): DNI=TRUE in the schematic means: DO NOT INSTALL.

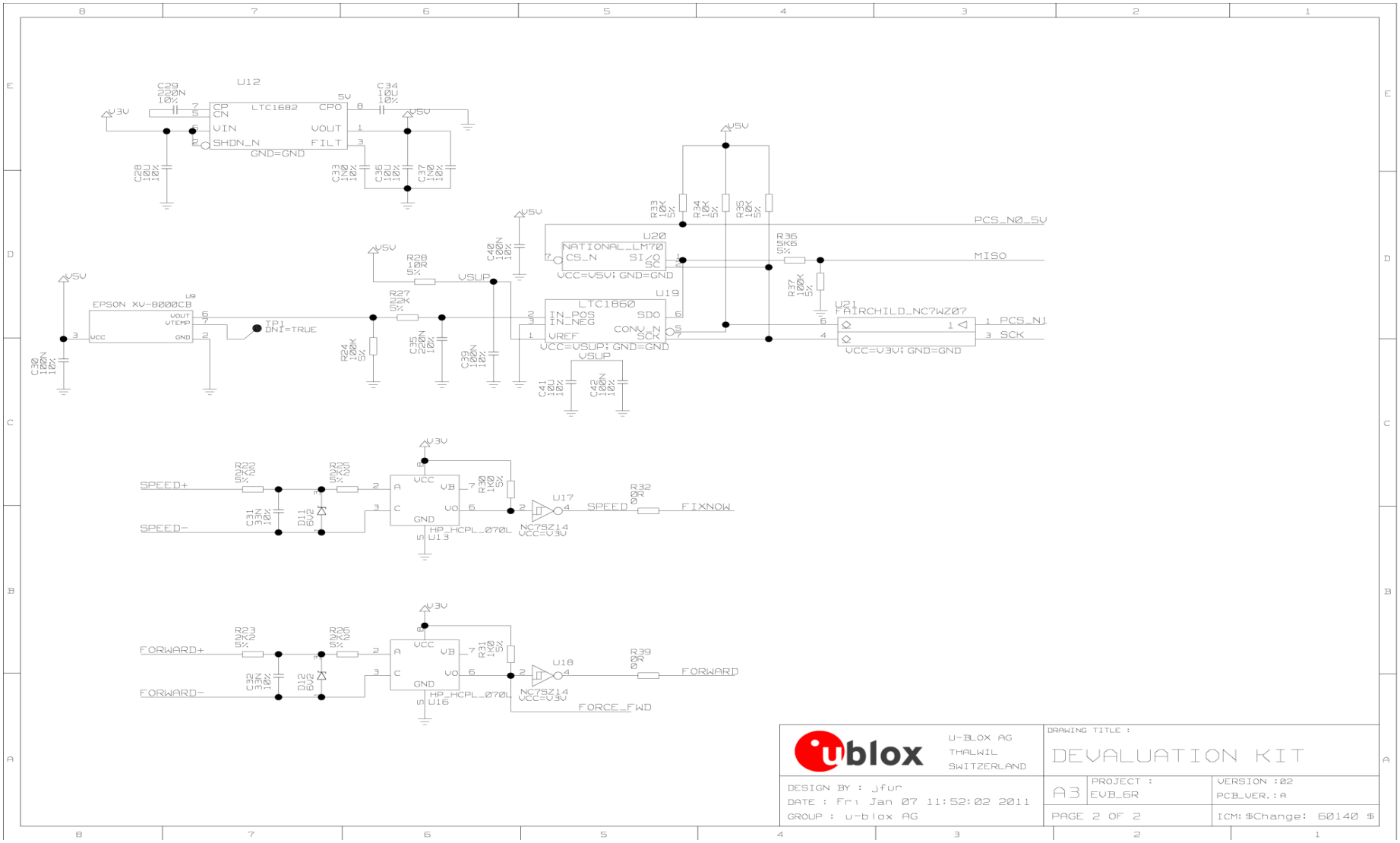


Figure 22: Schematic EVK-6R (page 2): DNI=TRUE in the schematic means: DO NOT INSTALL

11 Troubleshooting

My application (e.g. u-center) does not receive anything

Check if the green LED on the evaluation box lights up and make sure the USB cable is properly connected to the evaluation box and the PC. By default the evaluation box outputs NMEA protocol on Serial Port 1 at 9600 Baud, or on the USB.

My application (e.g. u-center) does not receive all messages

When using UART, make sure the baudrate is sufficient. If the baudrate is insufficient, GPS receivers based on u-blox 6 GPS Technology will skip excessive messages. Some serial port cards/adapters (i.e. USB to RS232 converter) frequently generate errors. If a communication error occurs while u-center receives a message, the message will be discarded.

My application (e.g. u-center) loses the connection to the GPS receiver

u-blox 6 GPS Technology and u-center have an autobauding feature. If frequent communication errors occur (i.e. due to problems with the serial port), the connection may be lost since u-center and the GPS receiver will autonomously try to adjust the baudrate. Do not enable the u-center autobauding feature if the GPS receiver has the autobauding flag enabled.

Some COM ports are not shown in the port list of my application (e.g. u-center)

Only the COM ports, that are available on your computer, will show up in the COM port drop down list. If a COM Port is gray, another application running on this computer is using it.

The position is off by a few dozen meters

u-blox 6 GPS Technology supports different datums. By default, it starts up with the WGS84 standard GPS datum. If your application expects a different datum, you'll most likely find the positions to be off by a few dozen meters. Find out what kind of datum your application requires and configure the EvalKit accordingly. And don't forget to check the calibration of u-center map files.

The position is off by hundreds of meters

Position drift may also occur when almanac navigation is enabled. The satellite orbit information retrieved from an almanac is much less accurate than the information retrieved from the ephemeris. With an almanac only solution the position will only have an accuracy of a few kilometers but it may startup faster or still navigate in areas with obscured visibility when the ephemeris from one or several satellites have not yet been received. The almanac information is NOT used for calculating a position, if valid ephemeris information is present, regardless of the setting of this flag.

In NMEA protocol, position solutions with high deviation (e.g. due to enabling almanac navigation) can be filtered with the Position Accuracy Mask. UBX protocol does not directly support this since it provides a position accuracy estimation, which allows the user to filter the position according to his requirements. However, the 'Position within Limits' flag of the UBX-NAV-STATUS message indicate whether the configured thresholds (i.e. P Accuracy Mask and PDOP) are exceeded.

At startup TTFF times are much longer than specified

At startup (after the first position fix) the GPS receiver performs an RTC calibration to have an accurate internal time source. A calibrated RTC is required to achieve minimal startup time.

Before shutting down the receiver externally, check the status in MON-HW in field 'Real Time Clock Status'. Don't shut down the receiver if the RTC is not calibrated.

The EVK-6 does not meet the TTFF specification

Make sure the antenna has a good sky view. Obstructed view leads to prolonged startup times. In a well-designed system, the average of the C/No ratio of high elevation satellites should be in the range of 44 dBHz to about 50 dBHz. With a standard off-the-shelf active antenna, 47 dBHz should easily be achieved. Low C/No values lead to a prolonged startup time.

EVK-6 does not preserve the configuration in case of reset

u-blox 6 GPS technology uses a slightly different concept than most of the other GPS receivers do. Settings are initially stored to volatile memory. In order to save them permanently, sending a second command is required. This allows testing the new settings and reverting to the old settings by resetting the receiver if the new settings aren't good. This provides safety, as it's no longer possible to accidentally program a bad configuration (e.g. disabling the main communication port).

The Battery Backup Current is much higher than specified in the Data Sheet

The battery backup current will be at an undefined level if the backup voltage is applied to the GPS receiver without having the GPS receiver turned on once to put the real-time-clock (RTC) into a known state. When using the GPS receiver with backup battery connected, turn the GPS receiver on for the first time to bring it into a known state.

Power Save Mode and USB (EVK-6A/H/P/T/V)

When operating the GPS in Power Save Mode the USB cannot be used. For communication in Power Save Mode use the RS232.

EVK-6N receives GPS but not GLONASS

Use u-center, version 6.3 or newer. The message UBX-CFG-GNSS has been added to allow switching on and switching off the supported GNSS.

EVK-6R with external power management, the TTFF times are much longer than specified

At startup (after the first position fix) the GPS receiver performs an RTC calibration to have an accurate internal time source. A calibrated RTC is required to achieve minimal startup time.

Before shutting down the receiver externally, check the status in MON-HW in field 'Real Time Clock Status'. Don't shut down the receiver if the RTC is not calibrated.

EVK-6R only reports 3D fixes

The internal sensor integrity check might reject sensor measurements due to gyro malfunction or missing speed pulses. Check the attached sensors (Gyro, Speed Signal), **reset all calibration data** in UBX-CFG-EKF and execute an initial calibration.

EVK-6R only reports a speed of 0km/h while driving

The EVK-6R may not recognize the speed pulses from the speed indicator. Check the speed signal attached (voltage level, signal type) and compare with the speed signal definitions. For more information consult the *LEA-6/NEO-6/MAX-6 System Integration Manual* [7].

12 Common evaluation pitfalls

- Parameter may have the same name but a different definition. GPS receivers may have a similar size, price and power consumption but can still have different functionalities (e.g. no support for passive antennas, different temperature range). Also, the definitions of Hot, Warm, Cold Start times may differ between suppliers.
- Verify design-critical parameters; do not base a decision on unconfirmed numbers from datasheets.
- Try to use identical or at least similar settings when comparing the GPS performance of different receivers.
- Data, which has not been recorded at the same time and the same place, should not be compared. The satellite constellation, the number of visible satellites and the sky view might have been different.
- Do not compare momentary measurements. GPS is a non-deterministic system. The satellite constellation changes constantly. Atmospheric effects (i.e. dawn and dusk) have an impact on signal travel time. The position of the GPS receiver is typically not the same between two tests. Comparative tests should therefore be conducted in parallel by using one antenna and a signal splitter; statistical tests shall be run for 24 hours.
- Monitor the Carrier-To-Noise-Ratio. The average C/No ratio of the high elevation satellites should be between 44 dBHz and about 50dBHz. A low C/No ratio will result in a prolonged TTFF and more position drift.

- When comparing receivers side by side, make sure that all receivers have the same signal levels. The best way to achieve this is by using a signal splitter. Comparing results measured with different antenna types (with different sensitivity) will lead to incorrect conclusions.
- Try to feed the same signal to all receivers in parallel (i.e. through a splitter); the receivers won't have the same sky view otherwise. Even small differences can have an impact on the accuracy. One additional satellite can lead to a lower DOP and less position drift.
- When doing reacquisition tests, cover the antenna in order to block the sky view. Do not unplug the antenna since the u-blox 6 GPS Technology continuously performs a noise calibration on idle channels.

13 Declaration of conformity

Hereby, u-blox AG declares that these EVK-6 -family products are in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC. A copy of the Declaration of Conformity can be found at http://www.u-blox.com/.

Related documents

[1] ANN-MS Product Summary, Docu. No GPS-X-02022
[2] AMY-6 Data Sheet, Docu. No GPS.G6-HW-10052
[3] LEA-6 Data Sheet, Docu. No GPS.G6-HW-09004
[4] NEO-6 Data Sheet, Docu. No GPS.G6-HW-09005
[5] MAX-6 Data Sheet, Docu. No GPS.G6-HW-10106
[6] AMY-6 Hardware Integration Manual, Docu. No GPS.G6-HW-10037
[7] LEA-6/NEO-6/MAX-6 Hardware Integration Manual, Docu. No GPS.G6-HW-09007
[8] u-blox 6 Receiver Description including Protocol Specification, Docu. No GPS.G6-SW-10018
[9] u-center – User Guide, Docu. No GPS-SW-08007
[10] GPS-based Timing Application Note, Docu. No GPS.G6-X-11007
[11] LEA-6N Data Sheet, Docu No GPS.G6-HW-12003
[12] u-blox 6 GLONASS FW 1.00 Release Note, Docu No GPS.G6-SW-12002

☞ For regular updates to u-blox documentation and to receive product change notifications please register on our homepage.

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