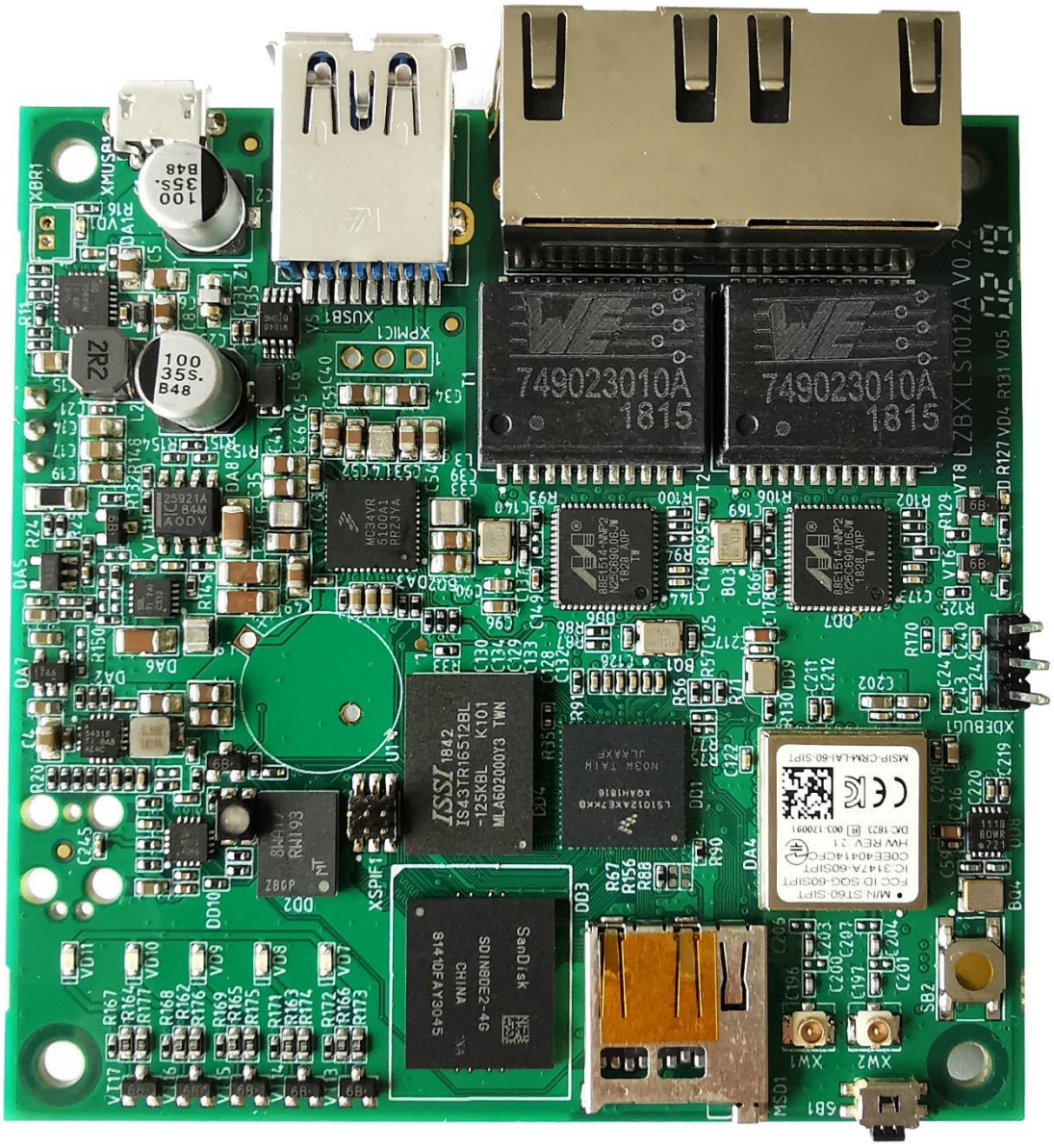
DAB-EMBEDDED



DAB-OWRT-A64

Industrial network router

Contents

Overview 3
Interfaces 4
Details 7
SerDes configuration 7
Wired network 7
Wireless network 7
SDHC/eMMC interface 8
USB 3.0 SS host interface 8
MicroUSB charger port 8
Supervisor MCU 9
Status LEDs 10
Boot procedure 10
Bootloader recover procedure 10
JTAG for LS1012A SoC 11
References 14
Legal 15

Overview

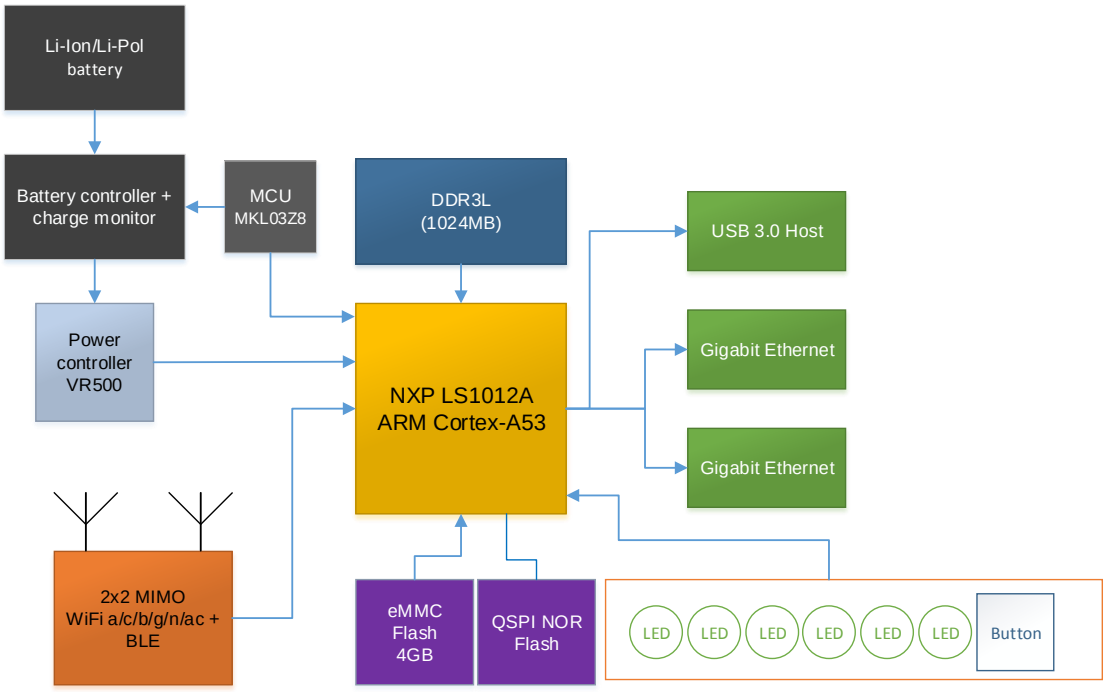
The DAB-OWT-A64 by DAB-Embedded, also known as the Lizardbox™, is a secure networking communication device with a small (80x80 mm) form factor with Ethernet, USB 3.0, and Wi-Fi (supports various standards: IEEE 802.11a, 802.11b, 802.11d*, 802.11e, 802.11g, 802.11h, 802.11i, 802.11k*, 802.11n, 802.11r, 802.11v*, 802.11ac; * with specific WiFi firmware) connections for high-performance networking.

Device brings Trust Architecture of higher-end QorlQ LS device, allowing scalable, secure applications on a common platform.

The DAB-OWT-A64 board based on NXP QorlQ LS1012A 1GHz single-core processor with crypto extensions, 1 GB of DDR3L memory, 4 GB of eMMC disk, 64MB of QSPI Flash and slot for microSD memory. This makes DAB-OWT-A64 board suitable for industrial, home and business needs, and can be used as business router, media gateway and industrial access point.

Additional WiFi firmware (Summit Stack from Laird) brings reliable wireless to the applications and environments that need it most, where connectivity is a must.

Board ships with OpenWRT software package supports all hardware blocks on board.



Block diagram

Main components:

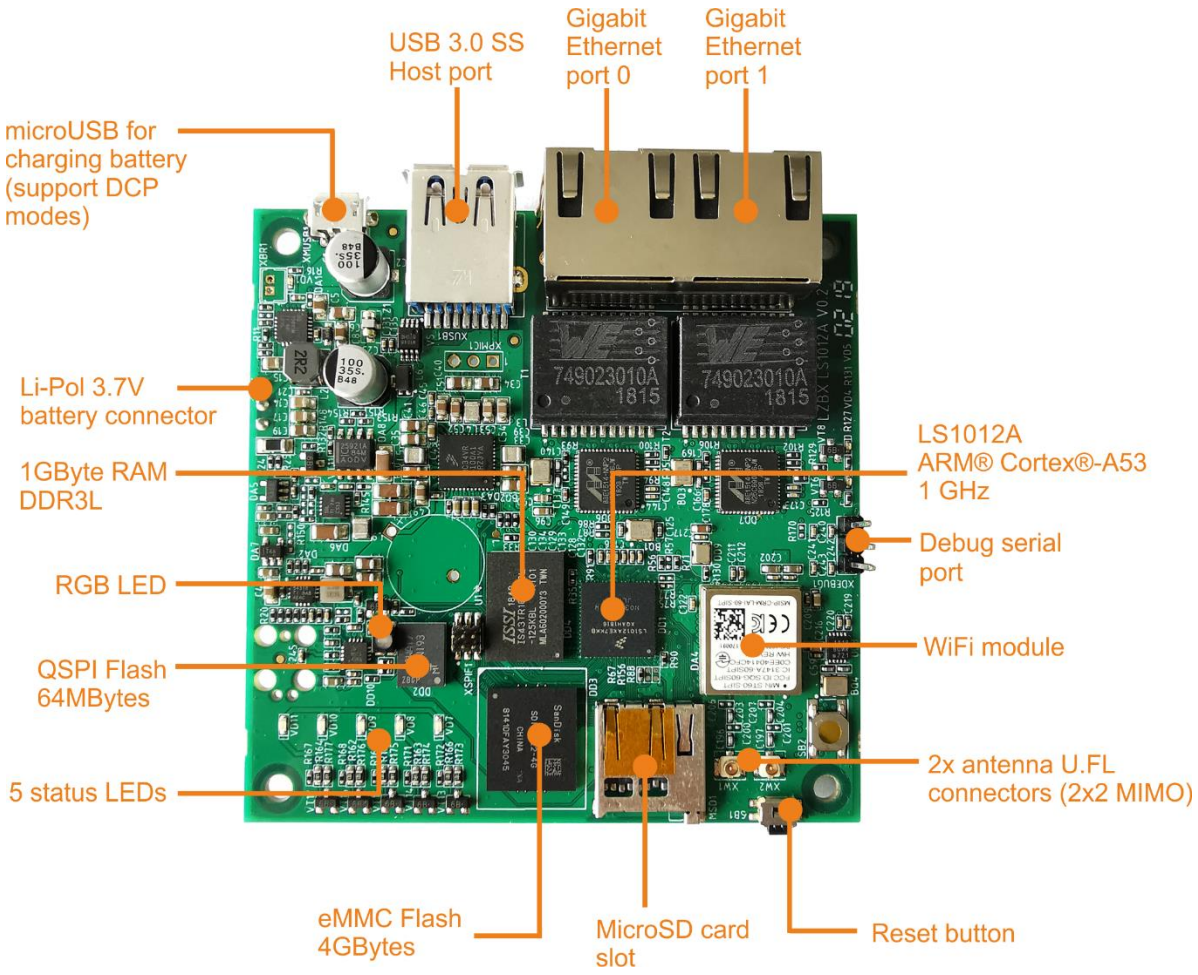
- NXP® QorlQ LS1012A 1GHz Processor with Security extension;
- DDR3L up to 1GByte;
- eMMC Flash drive up to 64GBytes;

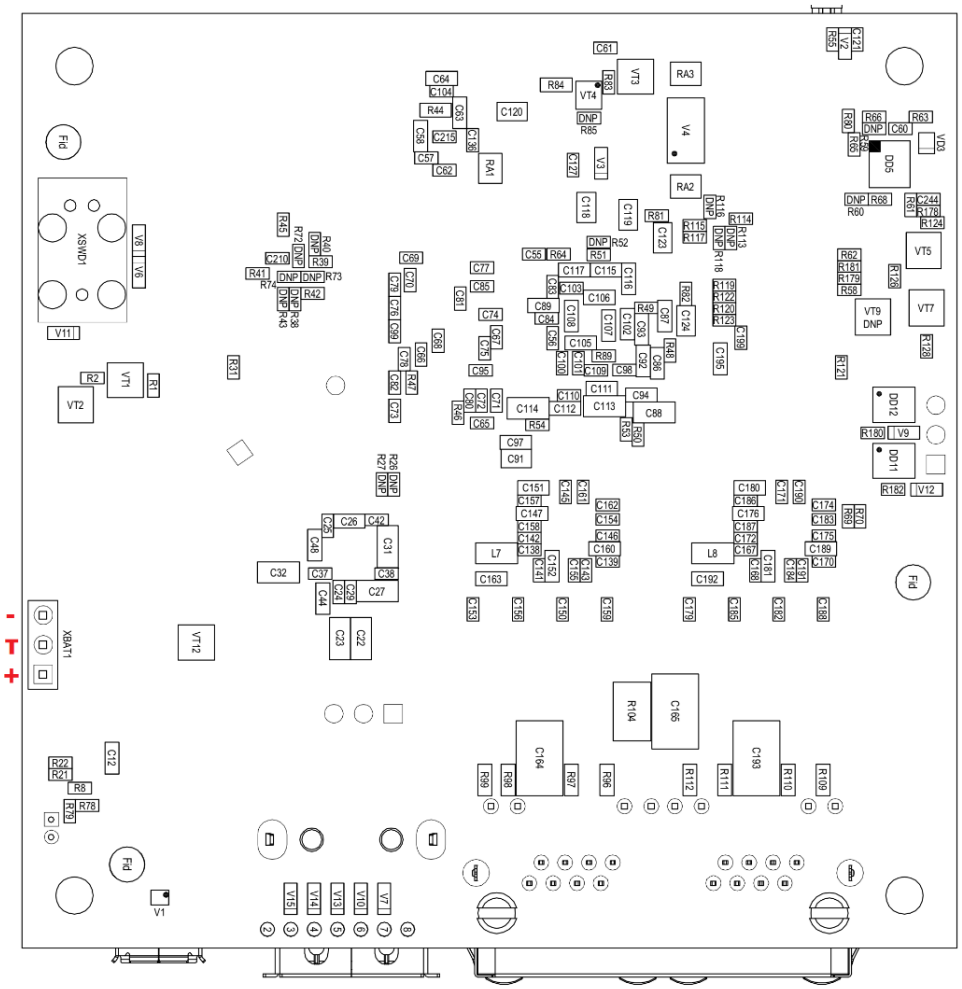
- Bootable QSPI Flash up to 128Mbit;
- 2x Gigabit Ethernet interfaces;
- 2.4GHz/5GHz WiFi 2x2 MU-MIMO module with speed up to 866.7Mbps (Laird ST60-SIPT);
- Li-ion/-pol battery charger (TI BQ25895);
- MicroSD card slot.

Interfaces

DAB-OWT-A64 board has rich number of interfaces:

- 2x 100Mbit/1Gbit Ethernet;
- USB 3.0 SS Host;
- 2.4GHz/5GHz WiFi 2x2 MIMO;
- microSD slot;
- UART (Linux console);
- Li-ion/-pol battery connector (single cell 3.7V);
- microUSB port for charging battery.





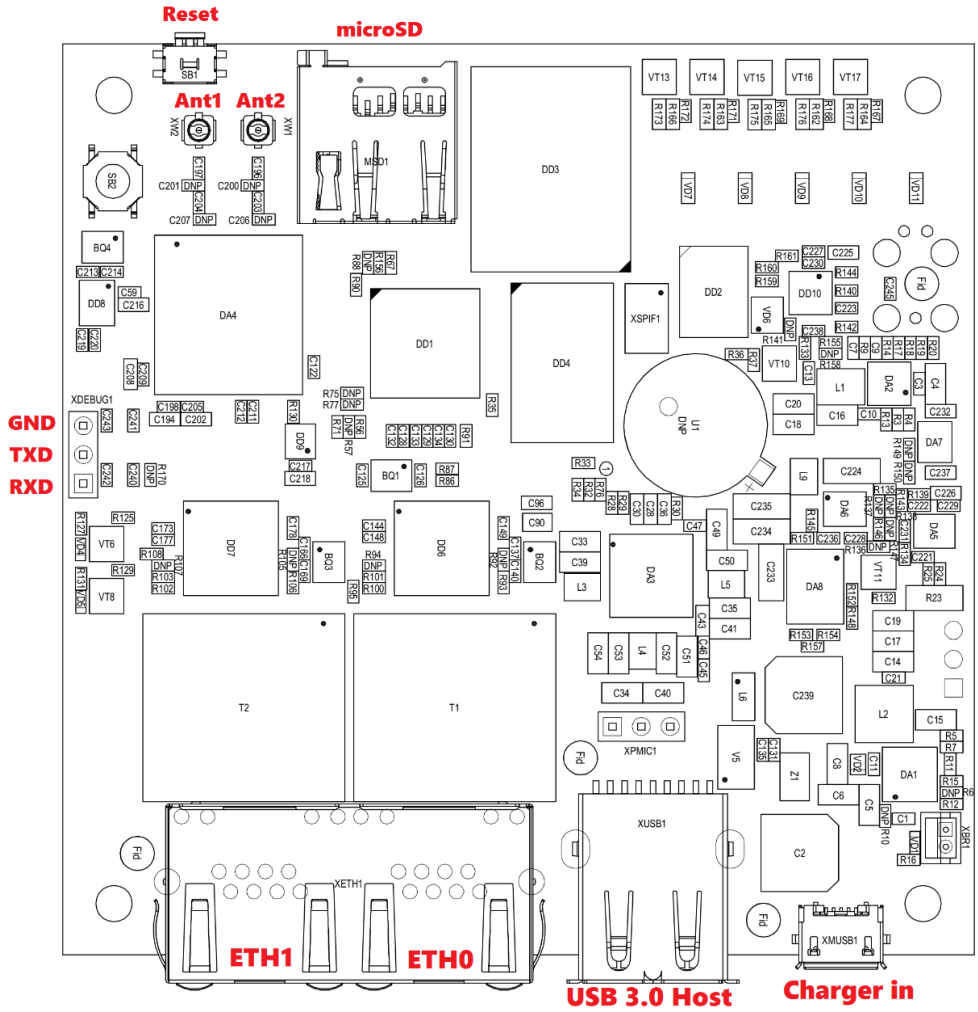
XBAT1 – connector for single cell 3.7V (up to 4.3V) Li-Ion battery.

Pin	Description
+	Positive contact of Li-Ion battery
T	Battery's thermal sensor
-	Negative contact of Li-Ion battery

Test results using Li-Ion/Pol batteries:

Battery P/N	Time of active operation
BAK 18650CA-1S-3J (2250 mAh)	4h 16m
Cameron Simo CS-HPS120SL (9500 mAh)	16h 22m

- "Active operation" condition means 1x Ethernet port active (1Gbit link), board connected to 5GHz-WiFi network, CPU runs at 1GHz and board running OpenWRT Linux (CPU load ~20%).



XDEBUG1 connector (debug serial port):

Pin	Description
RXD	UART RX contact (3.3V TTL)
TXD	UART TX contact (3.3V TTL)
GND	Ground

Default settings (for Uboot & Linux): 115200 bps, 8 bits, no parity, 1 stop bit

Additional connectors:

- Ant1, Ant2 – Connectors for WiFi antennas (2x2 MIMO).
- Reset – button for system reset.
- microSD – connector for microSD card.
- ETH0, ETH1 – Ethernet connectors (up to 1Gbit/s).
- USB 3.0 Host – USB 3.0 SS host connector (able to provide power);
- Charger in – microUSB connector for powering board on and charging battery.

Details

SerDes configuration

SERDES configuration used: 3305

SERDES	Interface	Device
A	SGMII (1G)	Ethernet PHY0
B	SGMII (1G)	Ethernet PHY1
D	PCIe (x1)	WiFi module

Wired network

ETH0 is Gigabit Ethernet interface using Marvell 88E151x PHY connected to Serdes A (Ethernet port 0).
ETH1 is Gigabit Ethernet interface using Marvell 88E151x PHY connected to Serdes B (Ethernet port 1).

Both PHYs supports additional feature: 802.3az-2010 (Energy efficient Ethernet - EEE).

Wireless network

Wireless network based on Laird 60-SIPT module which connected to PCIe xx1 port of LS1012A SoC.

The 60-SIPT series SiP modules are an integrated, small form factor 2x2 MIMO 802.11a/b/g/n/ac WLAN. The integration of all WLAN functionality in a single package supports low cost and simple implementation along with flexibility for platform-specific customization.

This device is pre-calibrated and integrates the complete transmit/receive RF paths including band pass filter, diplexer, switches, reference crystal oscillator, and power manage units (PMU).

The 60-SIPT series device supports IEEE 802.11 ac (wave 2) 2X2 receive multi-user MIMO (MU-MIMO) spatial stream multiplexing with data rates up to MCS9 (866.7 Mbps).

Next features available:

- Wi-Fi Media Access Protocol:
  - Carrier sense multiple access with collision avoidance (CSMA/CA) A-MPDU Rx (De-aggregation) and Tx (aggregation) (802.11ac single-MPDU A MPDU);
- Wi-Fi Media:

    - Direct Sequence-Spread Spectrum (DSSS),
      Complementary Code Keying (CCK),
      Orthogonal Frequency Divisional Multiplexing (OFDM);
- Network Architecture Types:
    - Infrastructure and ad-hoc;
- WiFi-standards supported:
    - IEEE 802.11a, 802.11b, 802.11d*, 802.11e, 802.11g, 802.11h, 802.11i, 802.11k*, 802.11n, 802.11r, 802.11v*, 802.11ac;
      * Summit software version only (special order);
- Wi-Fi Data Rates Supported:
    - Support 802.11 ac/a/b/g/n 2X2 MIMO,
      802.11b (DSSS, CCK) 1, 2, 5.5, 11 Mbps.
      802.11a/g (OFDM) 6, 9, 12, 18, 24, 36, 48, 54 Mbps.
      802.11n (OFDM, HT20/HT40, MCS 0-15).
      802.11ac (OFDM, HT20, MCS0-8; OFDM HT40/HT80, MCS 0-9);
- Modulation Table:
    - BPSK, QPSK, CCK, 16-QAM, 64-QAM, and 256-QAM.

SDHC/eMMC interface

eSDHC1 interface connected to microSD card slot and has next features:

- 4bits data bus width;
- card detect pin available;
- no WP option;
- 3.3V and 1.8V cards supported;
- SDIO mode supported;
- SDR and DDR modes supported;

eSDHC2 interface connected to eMMC chip and has next features:

- eMMC has 4GBytes size by default (can be up to 64GBytes on special order);
- 4bits data bus width;
- SDR, DDR and HS200 modes supported.

USB 3.0 SS host interface

USB 3.0 SS host port connected directly to LS1012A SoC and supports SuperSpeed (SS), HighSpeed (HS), FullSpeed (FS) and LowSpeed (LS) modes.

MicroUSB charger port

Charger schematic based on Texas Instruments BQ25895M IC that follows the USB Battery Charging Specification 1.2 (BC1.2) and to detect input source (SDP/CDP/DCP) and non-standard adapter through USB D+/D- lines (from microUSB port).

BQ25895M IC has next features:

- Support 3.9-V to 14-V Input Voltage Range (using microUSB port);
- Input Current Limit (100 mA to 3.25 A with 50-mA resolution) to support USB 2.0 standard and High Voltage Adapters;
- Auto Detect USB SDP, CDP, DCP, and Nonstandard Adapters;
- Supported charging modes:
    - SDP (USB500);
    - CDP (1.5A);
    - MaxCharge™ Adapters (1.5A);
    - DCP (3.25A).

BQ25895C IC connected to I2C1 bus of LS1012A and accessible using slave address 0x6A.

Supervisor MCU

Supervisor block based on NXP MKL03Z MCU with custom firmware. Supervisor MCU powered directly from Li-Ion/Pol battery input, also connected to I2C1 bus of LS1012A SoC and has next features:

- I2C slave address 0x3E;
- Build-in RTC (Real time clock);
- RGB LED controller (with brightness control for blue and green led);
- LS1012A SoC reset control;
- External watchdog functionality;

I2C register map (byte access):

Sub-Address	Register	Description
0x02	MCU_FW	MCU firmware verson (Read), SoC hardware reset: 0x55 (Write).
0x06	MCU_RED_LED_CTRL	Red LED control 0 – off, 1..255 - on
0x07	MCU_GREEN_LED_CTRL	Green LED intensity: 0 – off, 1..255 – intensity level
0x08	MCU_BLUE_LED_CTRL	Blue LED intensity: 0 – off, 1..255 – intensity level
0x09	MCU_RTC_HOURS	RTC: Hour value
0x0A	MCU_RTC_MINUTES	RTC: Minutes value
0x0B	MCU_RTC_SECONDS	RTC: Seconds value
0x0C	MCU_RTC_DATE	RTC: Date
0x0D	MCU_RTC_MONTH	RTC: Month
0x0E	MCU_RTC_YEAR_LOW	RTC: Year (low part)
0x0F	MCU_RTC_YEAR_HIGH	RTC: Year (high part)

Status LEDs

Board has 5x status green LEDs connected to regular LS1012A SoC GPIOs:

LED1 - GPIO2_12
LED2 - GPIO2_11
LED3 - GPIO2_10
LED4 - GPIO2_9
LED5 - GPIO2_13

Active state – High.

Boot procedure

Board has QSPI NOR Flash device (16Mbytes size) for booting LS1012A SoC chip. SoC requires to have RCW (Reset configuration word), pre-bootloader and bootloader itself (U-boot, by default) should be located at the beginning of QSPI NOR Flash.

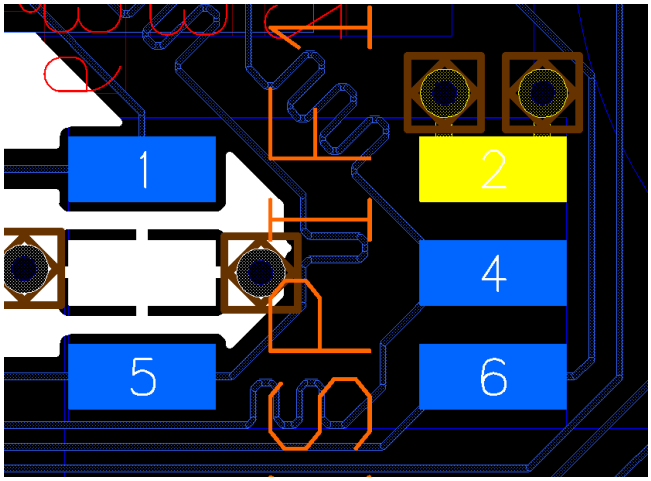
LS1012A technical reference manual [1] provides more information about boot procedure and RCW configuration block.

After U-boot is active any other boot source (USB, Ethernet, microSD card or eMMC drive can be used as boot source for OS boot).

Bootloader recover procedure

In case of damaged RCW, PBL (pre-bootloader) and Uboot bootloader – there easy way to recover the boot image.

Board has XSPIF1 connector (Sullins GRPB032VWQS-RC):



(Mature part for this connector: Sullins LPPB032xxxx-xx)

IMPORTANT: Interface is 1.8V tolerant only.

XSPIF1 connector pinout:

Pin	Description	FT2232H-56Q pin	Segger J-Link PRO pin
1	SPI CLK	AD0	9
2	1.8V out	VIO	1
3	GND	GND	6
4	SPI MOSI	AD2	13
5	SPI NCS	AD3	7
6	SPI MISO	AD1	5

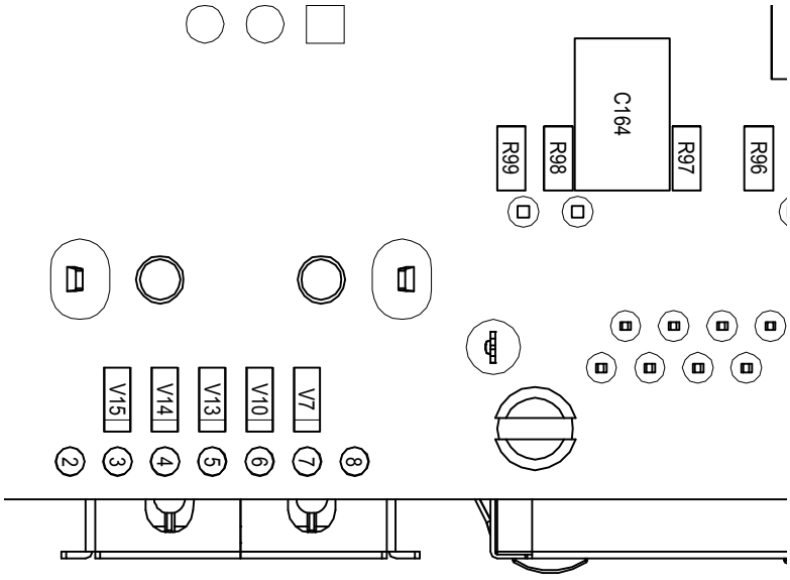
For boot image recovery in QSPI NOR Flash can be used 1.8V tolerant SPI Flash programmer, like:

- FT2232H-56Q mini module (https://www.ftdichip.com/Support/Documents/DataSheets/Modules/DS_FT2232H-56Q_Mini_Module.pdf , JP2 should be open);
    - FlashROM application can be used for programming [2];
- Segger J-link PRO (with J-Flash option).

For programming QSPI NOR Flash need to keep reset button pressed (to shutdown LS1012A SoC and release QSPI NOR Flash for programming).

JTAG for LS1012A SoC

Board has dedicated test points to use JTAG of LS1012A SoC.



Test points located under USB 3.0 SS host port and has next pinout:

Pin	Function
2	1.8V out
3	JTAG NTRST
4	JTAG TDI
5	JTAG TDO

6	JTAG TCK
7	JTAG TMS
8	GND

JTAG pins are connected to LS1012A SoC and WiFi module, therefore might be inaccessible after WiFi module initialization procedure.

Also, accessibility of JTAG pins depends on RCW configuration located in QSPI NOR Flash.

Regulatory

Board has radio module Laird® 60-SIPT. This module has US/FCC, Canada/IC and Korean certification and tested for EU regulation complicancy.

Board shipped with Laird® EFD2455A3S-10MHF1 Flexible PIFA antenna.

Regulatory IDs summary

Model	US/FCC	Canada/IC	Korea
60-SIPT series	SQG-SU60SIPT	3147A-SU60SIPT	MSIP-CRM-LAI-60-2230C

60-SIPT device passed tests according 2014/53/EU – Radio Equipment Directive (RED).

Contains IC: 3147A-60SIPT

Operating temperature

Board has 2 temperature grades: Commercial and Industrial.

Commercial temperature grade has operational temperature range: 0 °C .. +70 °C .

Industrial temperature grade has operational temperature range: -40 °C .. +85 °C .

Mechanics

Board dimensions is 80x80x20 mm

Weight

Board weight (without battery): 41 gramm.

Order codes

Board has 2 order options:

Order code	
DAB-001002-C	Commercial temperature grade
DAB-001002-I	Industrial temperature grade

GTIN: 05419980085412

References

[1] NXP LS1012A reference manual available on NXP website: www.nxp.com

[2] https://www.flashrom.org/Flashrom

Legal