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Amethyst

Overview



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History

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0.9.9	October 2007	CS032702	Amethyst overview pre-release
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1 - Introduction

1.1 System description

For what concerns hardware organization, the Amethyst system core resembles the ZefeerDZB module (processors, boot flash memory, SDRAM memory).

The software environment is directly derived from the Zefeer Embedded Linux Kit (ZELK) 1.5.0. Thus it is assumed reader has already read references [1] and [2]. Note that every reference to [1] and [2] from this document, is implicitly connected to the ZefeerDZB module and the version 1.5.0 of the ZELK.

Amethyst is the complete solution dedicated to industrial application based on linux operative system. The board provides several interfaces (ethernet, serial, usb, analog and digital input) so the system can connect to and control a lot of external devices.

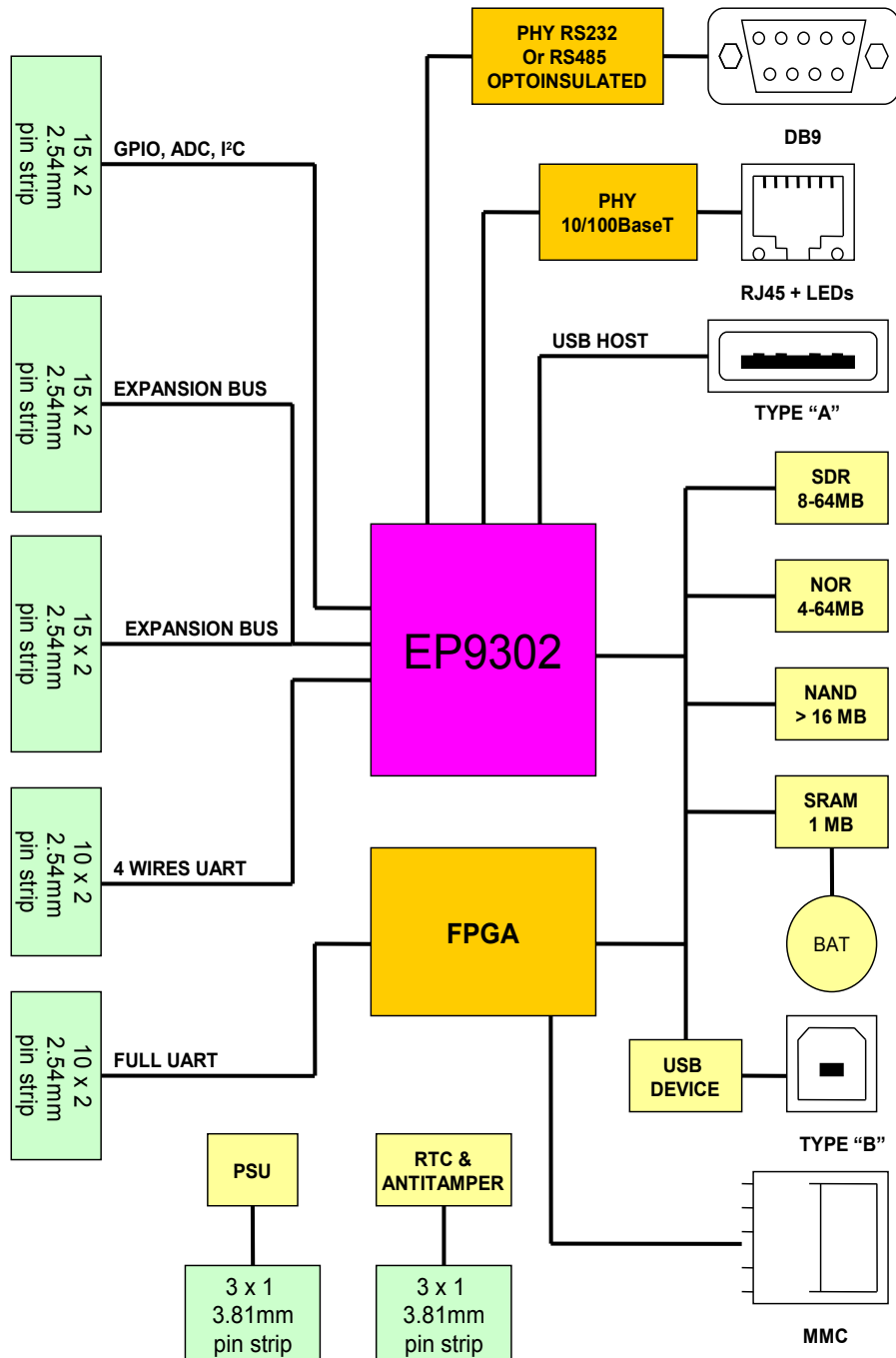


1.2 Features Table

CPU	EP9302 ARM9 (920T core) @180 Mhz with MMU
Cache	16K cache for instructions +16K cache for data
Memory	
SDRAM	16MBytes expandable up to 64 MBytes
Flash NOR	4 MBytes expandable up to 64 MBytes
Flash NAND	128 Mbytes
SRAM	512 KBytes Static RAM powered by RTC battery
Available Interfaces	
Ethernet PHY	10/100Mbps with leds (RJ45 connector)
UART	4 Wire asynchronous serial port; RS232/RS485 port with optoelectronic insulation in RS485 mode (DB9 male connector);
	full UART serial port
SPI	1 channel
I ² C	1 master channel
GPIO	10 GPIO signals
Input Signals	5 Analog Measurement Inputs and 2 Digital Inputs
Expansion Bus	2 expansion buses, 16 bit, 26 lines for addresses, GPIO, direct chip selects
USB	1 Host Port (Type A Connector) 1 Device port (Type B Connector)
MMC	1 Multimedia Card slot
Other features	
RTC, Watchdog	ST M41ST87 On Board, I2C connected, 3V lithium battery
Anti Tamper	2 Antitameper inputs, with log capabilities (ST M41ST87)
FPGA On Board	FPGA implementation of several board functions
Mechanical	
Physical	120mm height x100mm width x 25mm depth
PCB Thickness	1.6 mm
Temperature	-45+85 °C operational temperature (Industrial Range)
PSU	
Single 5V± 5%	Through Phoenix 3 poles connector
Consumption	Around 1A worst case
Software	
Multitasking OS	Linux 2.6.XX (ZELK)
Bootloader	U-boot
Features/Packages	TCP/IP USB Stack
Agency approvals	
CE Mark	CE Mark (EN 55022, EN 61000-4-3, EN 61000-4-4, EN 61000-4-6)



1.3 Block Diagram





2 - Hardware overview

2.1 Host board mechanical and layout

The following pictures show host board mechanical, layout and connectors identifiers.

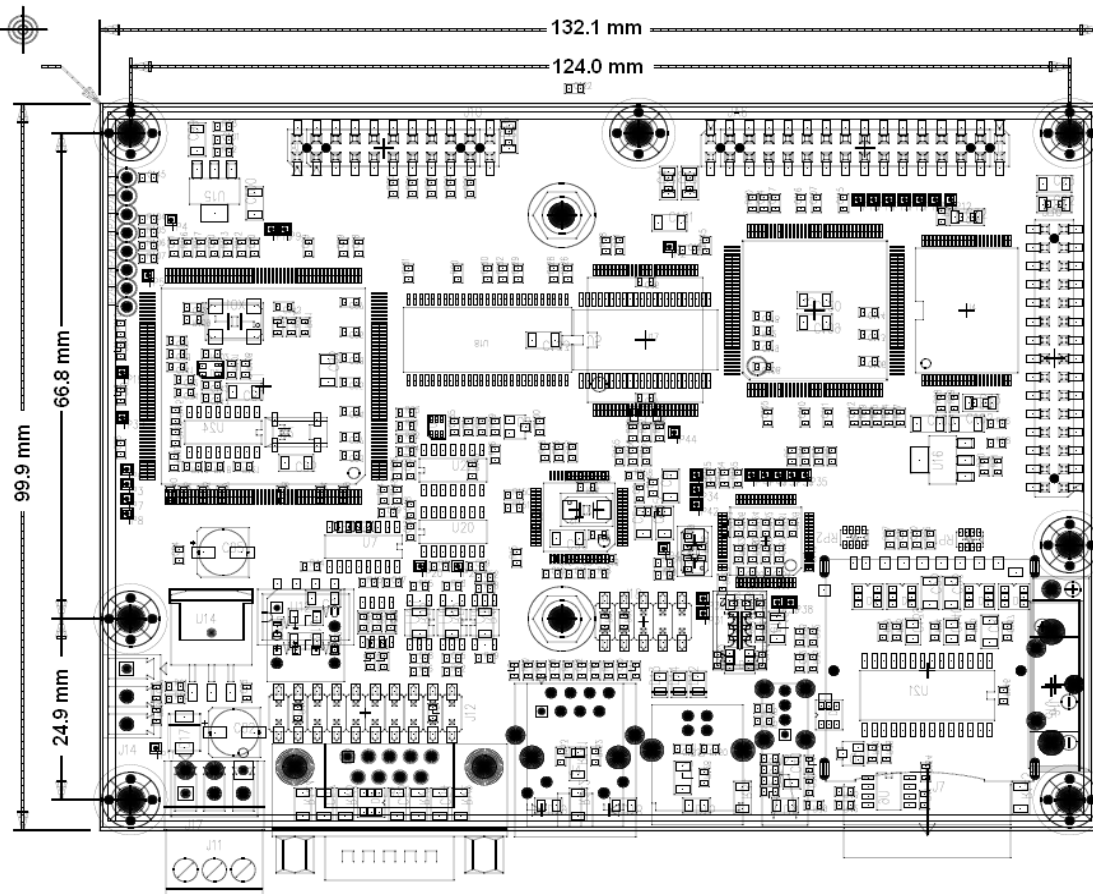


Fig. 1: Host board mechanical

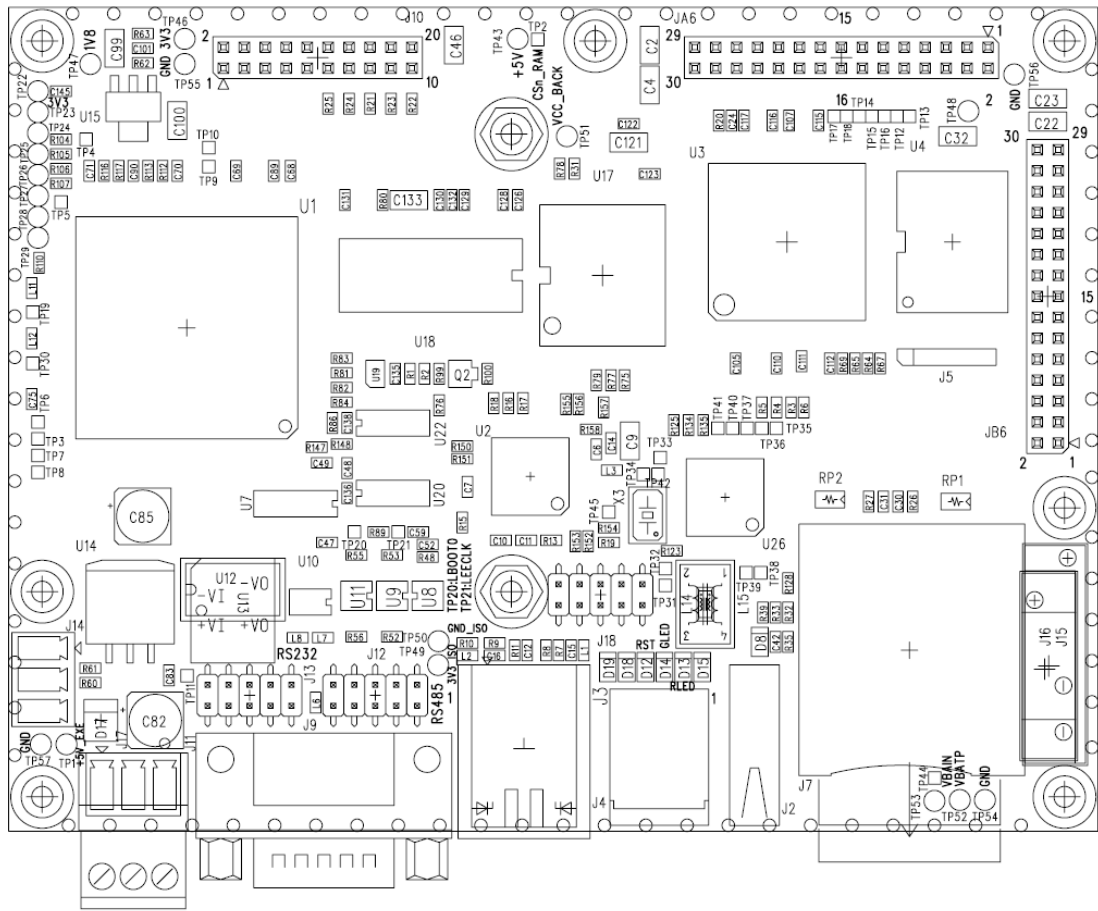


Fig. 2: Host board layout (TOP)

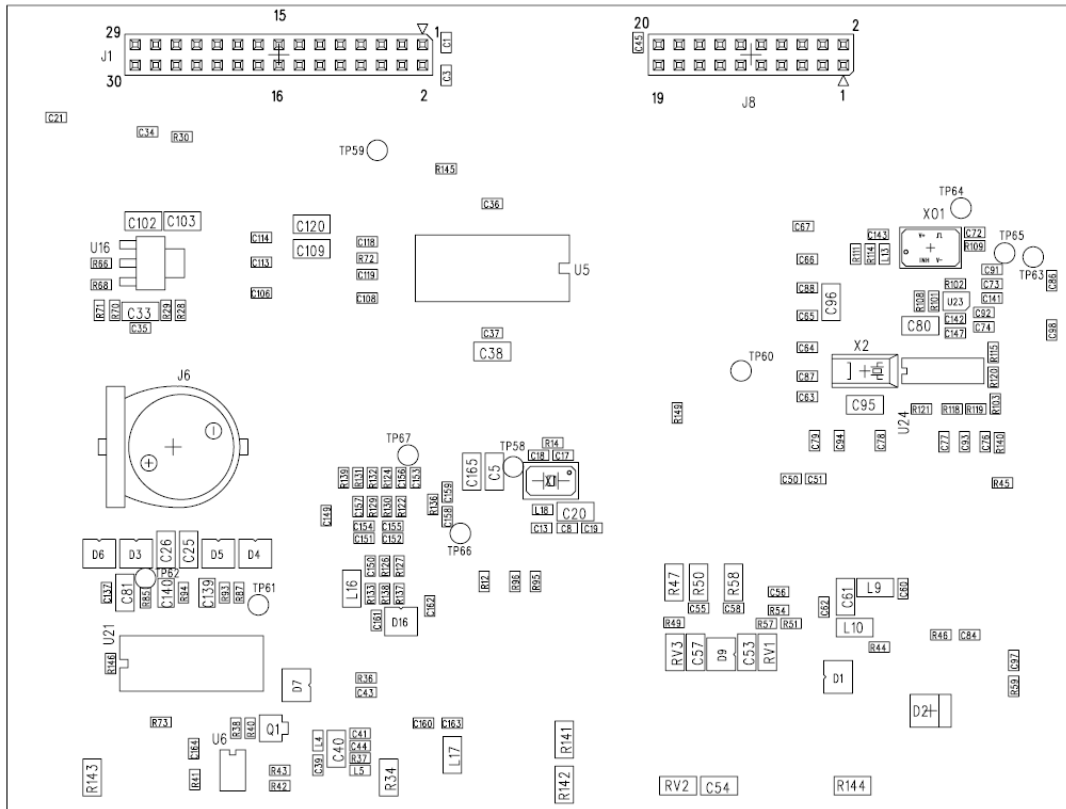


Fig. 3: Host board layout (BOTTOM)



2.2 Connectors

2.2.1 Power – J17

J17 Power Supply Connector, is a Phoenix MCV 1,5/3-G-3,81, placed near to DB9 connector.

<i>Pin #</i>	<i>Pin name</i>	<i>Function</i>	<i>Note</i>
1	+5V +/-5%		
2	GND		
3	Earth		

2.2.2 Ethernet – J4

This is a standard RJ45 Fast Ethernet, 10/100 Mbps connector. For MAC Address configuration, see Section

2.2.3 USB Host Port – J2

This is a standard USB 2.0 HOST type-A connector. Current to the device is limited to 1.2A

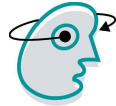
2.2.4 USB Device Port – J3

This is a standard USB 2.0 Device type-B connector.

2.2.5 RS232 and RS485 Serial ports

The following table report all Serial ports.

<i>Connector name</i>	<i>Conn type</i>	<i>Interface Type</i>	<i>Device</i>
J10	10x2x2.54 SMT	UART LVTTTL (4 wire)	/dev/ttyAM0
J9	DB9 male	RS232/485	/dev/ttyAM1
J8	10x2x2.54 SMT	UART LVTTTL	/dev/ttyS0



2.2.6 J10 – UART0 /dev/ttyAM0

All signals are LVTTL (3V3) . Input signals are not 5V tolerant.

<i>Pin #</i>	<i>Pin name and function</i>	<i>Function</i>	<i>Note</i>
1, 2	GND	Ground	
3	TX	Transmit data	
4	RX	Receive data	
5	RTS		
6	CTS		
7, 8	+5V	VCC	
9..20	GND	Ground	

2.2.7 JP9 – UART1-(RS232/1KV-ISO-RS485) - /dev/ttyAM1

<i>Pin #</i>	<i>Pin name</i>	<i>Function</i>	<i>Note</i>
1	N.C.		
2	RX	receive data (RS232) / D- (RS485)	
3	TX	transmit data (RS232) / D+ (RS485)	
4	N.C.		
5	GND	Ground	
6..9	N.C.		

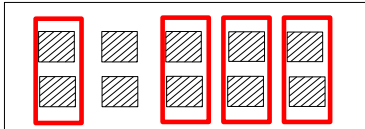
RS485 is 1KV isolated.

Jumper on J13 and J12 (5x2x2.54mm pin strip connectors) allow to select RS232 or RS485 function mode for UART1.

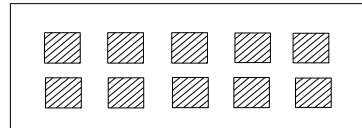


2.2.7.1 RS232 mode selection

J13 and J12 are located near to the J10 - DB9 connector.
Please insert jumper as in the following pictures:



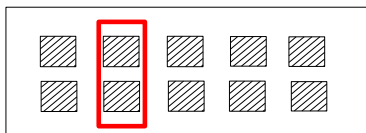
*J13 – Jumpers for RS232 mode
(TOP view)*



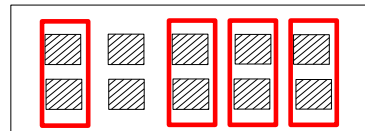
*J12 – Jumpers for RS232 mode
(TOP view)*

2.2.7.2 1KV Isolated RS485 mode selection

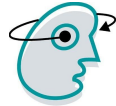
J13 and J12 are located near to the J10 - DB9 connector.
Please insert jumper as in the following pictures:



*J13 – Jumpers for RS485 mode
(TOP view)*



*J12 – Jumpers for RS485 mode
(TOP view)*



2.2.8 JP8 – UART3 - /dev/ttyS0

All signals are LVTTTL (3V3) . Input signals are not 5V tolerant.

Pin #	Pin name	Function	Note
1	CD:		
2	DSR		
3	RX	Receive data	
4	RTS		
5	TX	Send data	
6	CTS		
7	DTR		
8	RI		
9	GND		
10	ON/OFF: OUT	Output	Normally low (Internal Pull-down 1K)
11	PWRCTL: INPUT	Input	Voltage Level >2.4V is considered as logic "1"
12	RESET:OUT	Output	Normally low (Internal Pull-down 1K)
13	CONFIG1: INPUT	Input	Normally high (Internal Pull-up 10K to 3V3)
14	CONFIG2:INPUT	Input	Normally high (Internal Pull-up 10K to 3V3)
15	CONFIG3:INPUT	Input	Normally high (Internal Pull-up 10K to 3V3)
16,18,20	+5V	VCC	
17,19	GND	Ground	



2.2.9 J14: Anti-tamper inputs

<i>Pin #</i>	<i>Pin name</i>	<i>Function</i>	<i>Note</i>
1	Anti-tamper input 1	Anti-tamper	
2	GND	Ground	
3	Anti-tamper input 2	Anti-tamper	

2.2.10 J6 Expansion bus connectors

JA6 and JB6 are two expansion bus connectors that comes out all address and data bus signals plus control signals as chip selects, read and write signals.

<i>Connector Name</i>	<i>Connector Type</i>	<i>Functions</i>	<i>Interface</i>	<i>Note</i>
JA6	15x2x2.54 female SMT	Expansion Bus		All signals are LVTTTL (3V3) . Input signals are not 5V tolerant.
JB6	15x2x2.54 female SMT	Expansion Bus		All signals are LVTTTL (3V3) . Input signals are not 5V tolerant.

2.2.10.1 JA6: Expansion bus connector A

<i>Pin #</i>	<i>Pin name</i>	<i>Function</i>	<i>Note</i>
1..16	D0..D15	Data bus	
19	A9	Address bus line 9	
20	A11	Address bus line 11	
21	A1	Address bus line 1	
22	A10	Address bus line 10	
23	A3	Address bus line 3	
24	A2	Address bus line 2	
25	A5	Address bus line 5	



Pin #	Pin name	Function	Note
26	A4	Address bus line 4	
27	A7	Address bus line 7	
28	A6	Address bus line 6	
29	A0	Address bus line 0	
30	A8	Address bus line 8	
17,18	GND	GND	

2.2.10.2 JB6: Expansion bus connector B

Pin #	Pin name	Function	Note
1	A20	Address bus line 20	
2	A19	Address bus line 19	
3	A18	Address bus line 18	
4	A17	Address bus line 17	
5	A16	Address bus line 16	
6	A25	Address bus line 25	
7	A24	Address bus line 24	
8	A23	Address bus line 23	
9	A14	Address bus line 14	
10	A15	Address bus line 15	
11	A22	Address bus line 22	
12	A21	Address bus line 21	
13	A13	Address bus line 13	
14	A12	Address bus line 12	
15,16	GPIOD1, GPIOD0	GPIOs	GPIO
17	RD: read	Read	Active Low
19	WR: write	Write	Active Low
21	CS0: chip select 0	Chip select 0	Active Low
23	CS1: chip select 1		Active Low
25	CS2: chip select 2		Active Low
27	CS3: chip select 3		Active Low
29	CS4: chip select 4		Active Low
18,20,22	GND		
24,26,28,30	+5V		

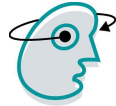


2.2.11 Multiple Interface Connector – J1

This connector comes out the SD card signals, some ADC channels, some digital I/Os and the I2C interface.

Connector Name	Connector Type	Functions	Interface	Note
J1	15x2x2.54 female SMT	Multiple Interface Connector		

Pin #	Pin name	Function	Note
1	DIG_IO0	IN/OUT DIGITAL I/O	LVC MOS (3V3, 12mA) – No 5V tol.
3	DIG_IO2	IN/OUT DIGITAL I/O	LVC MOS (3V3, 12mA) – No 5V tol.
4	DIG_IO1	IN/OUT DIGITAL I/O	LVC MOS (3V3, 12mA) – No 5V tol.
5	SD_CLK	SD Card Clock Output signal	LVC MOS (3V3, 12 mA)
6	DIG_IO3	IN/OUT DIGITAL I/O	LVC MOS (3V3, 12mA) – No 5V tol.
7	SD_D0_DOUT	SD Card Data IN/OUT	LVC MOS (3V3, 12 mA) – No 5V tol.
8	SD_CMD_DI	SD Card Data IN/OUT	LVC MOS (3V3, 12 mA) – No 5V tol.
10	SD_D1_IRQ	SD Card Data IN/OUT	LVC MOS (3V3, 12 mA) – No 5V tol.
11	DIG_IO4	IN/OUT DIGITAL I/O	LVC MOS (3V3, 12mA) – No 5V tol.
12	SD_D2_NC	SD Card Data IN/OUT	LVC MOS (3V3, 12mA) – No 5V tol.
13	DIG_IO5	IN/OUT DIGITAL I/O	LVC MOS (3V3, 12mA) – No 5V tol.
14	SD_D3_CS	SD Card Data IN/OUT / SD CARD CS	LVC MOS (3V3, 12mA) – No 5V tol.
17	SD_WP	SD CARD Write Protect signal Input	LOW: Card is Protect; LVC MOS (3V3) – No 5V tol.
18	SD_CD	SD CARD Detect Card Input	LOW: Card is present LVC MOS (3V3) – No 5V tol.
19	RFU	Reserved for Future Use	
20	RFU	Reserved for Future Use	
22	RFU	Reserved for Future Use	
16,24,26,28,30	ADC_IN0,ADC_IN1, ADC_IN2,ADC_IN3, ADC_IN4	Analog Input Channels	Connected directly to uP Vin range=(0-3.3V)



Pin #	Pin name	Function	Note
25	I2C_SDA	I2C DATA IN/OUT signa	10k pull-up resistor on board LVCMOS (3V3, 4 mA) – No 5V tol.
27	I2C_SCL	I2C CLOCK OUT signal	10k pull-up resistor on board LVCMOS (3V3, 4 mA)
29	RFU	Reserved for Future Use	
2,15	+5V	VCC	
9, 21, 23	GND	Ground	

2.3 System settings

2.3.1 Jumper for Settings – J18

Settings are performed via jumpers on J18 5x2x2.54mm pin strip connector whose pinout is described in functions are described in Tab. 1.

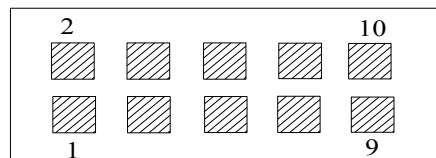


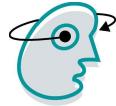
Fig. 4: J18-pinout (jumper for system settings) -TOP- view



Jumper insertion	Function	CLOSED	OPEN	DEFAULT
1-2	Serial Boot or Normal Boot for Zefeer Module	SERIAL	NORMAL	OPEN
3-4	External Boot or Internal Boot for Zefeer Module	INTERNAL	EXTERNAL	OPEN
5-6	Reset system	System in reset	NORMAL	OPEN
7-8	Battery Disconnection (during stockage)	Connected	Disconnected	CLOSED
9-10	SD CARD Slot Power	Power ON	Power OFF	CLOSED

Tab. 1: System settings

As shown above, SW 1 selects Serial Boot or Normal Boot option. SW 2 selects the boot from Internal BootROM (OFF) or from an external memory device. Default configuration sets NORMAL and EXTERNAL mode. SW3 is thought to start machine in a “SERVICE OPERATION“(This SW is connected to GPIO A.4 that can be read at machine bootstrapping). SW4 acts as battery disconnection to avoid battery discharge during stocking phase.



3 - Bibliography and useful links

- [1] DAVE Srl, Zefeer Hardware Manual
- [2] DAVE Srl, ZELK Software Manual