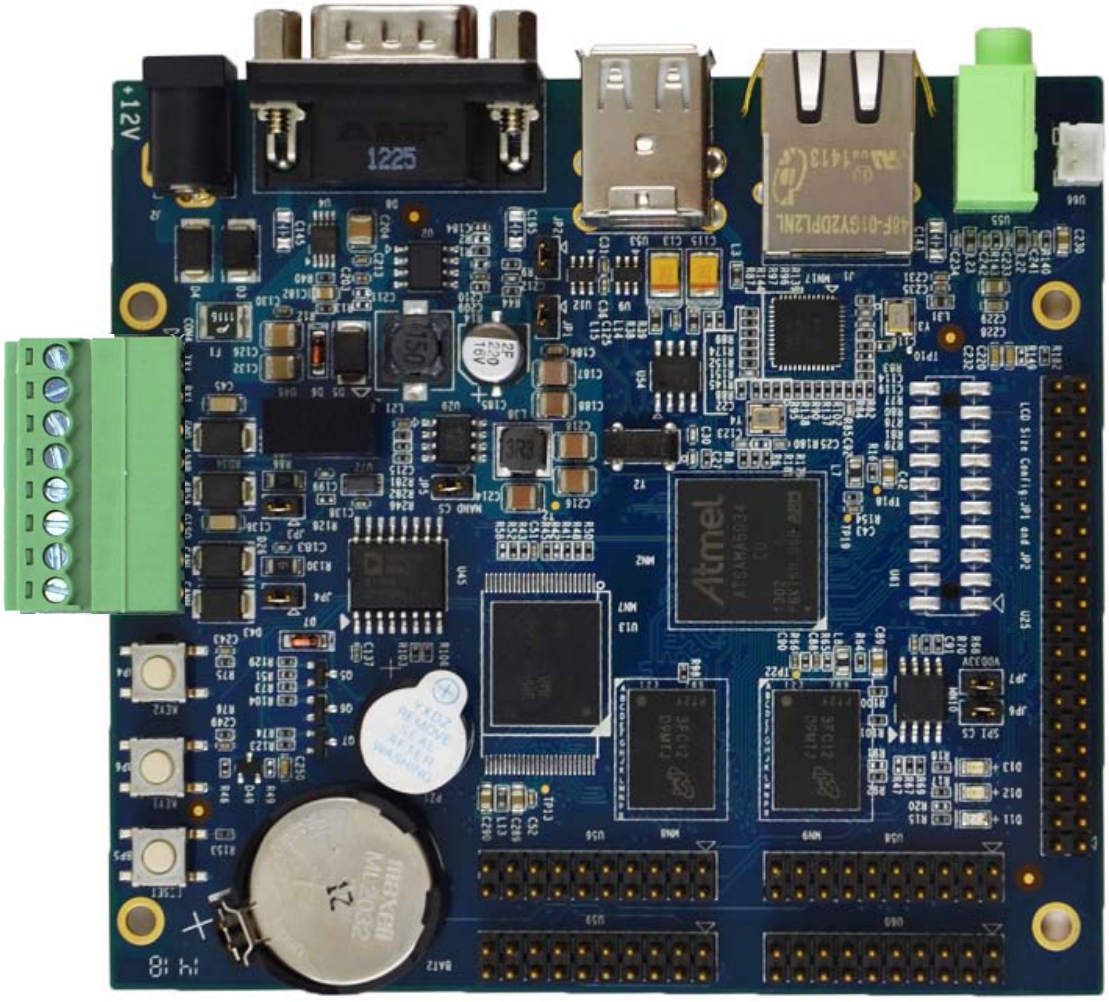
SBC60A6
Single Board Computer



Hardware Manual

Version 1.0 – Jul. 11th, 2014

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Revision History:

Version	Date	Description
1.0	2014-7-11	Original Version

Table of Contents

Chapter 1 Product Overview

1.1 About Product

SBC60A5 is an ARM-based embedded single board computer built on Atmel ATSAMA5D34 (integrates ARM Cortex-A5 core, 32KB data buffer and 32KB instruction buffer) industrial processor by Embest Technology.

1.2 Product Features

- **General Features**
  - Operating Temperature: -25 ℃ ~ 85 ℃ (-45 ℃ ~ 85 ℃ for custom model）
  - Storage Temperature: -45 ℃ ~ 85 ℃
  - Operating Humidity: 0% ~ 90% (Non-condensing)
  - Power Supply: 12V/2A
  - Total Power Consumption: 12V/0.15A (without any external device attached)
  - Voltages Available on Product: +1.2V, +1.8V, +2.5V, +3.3V, +5V, +12V
  - Electric Standards: CE, FCC, CCC
  - Product Dimensions: 106.5mm x 97.99mm
- **Devices/Interfaces**
  - 512MB DDR2, 4GB eMMC, 4MB Data Flash
  - Multiple communication methods such as Ethernet, USB, RS485, RS232 and CAN bus
  - Extended interfaces for 1 SPI, 1 TWI, 1 USB, 2-channel 12-bit ADC
  - Supports multiple LCD screen sizes; The CPU can support a max resolution of 2048X2048; Embest offers 4.3”, 5.6”, 7” and 10.4” LCDs for customers
- **Software Features**
  - Pre-installed with Linux-3.10.0; The source code is available for free
  - Provides explanation for the drivers of all the peripherals and instructions to

test programs

1.3 Interfaces/Buttons

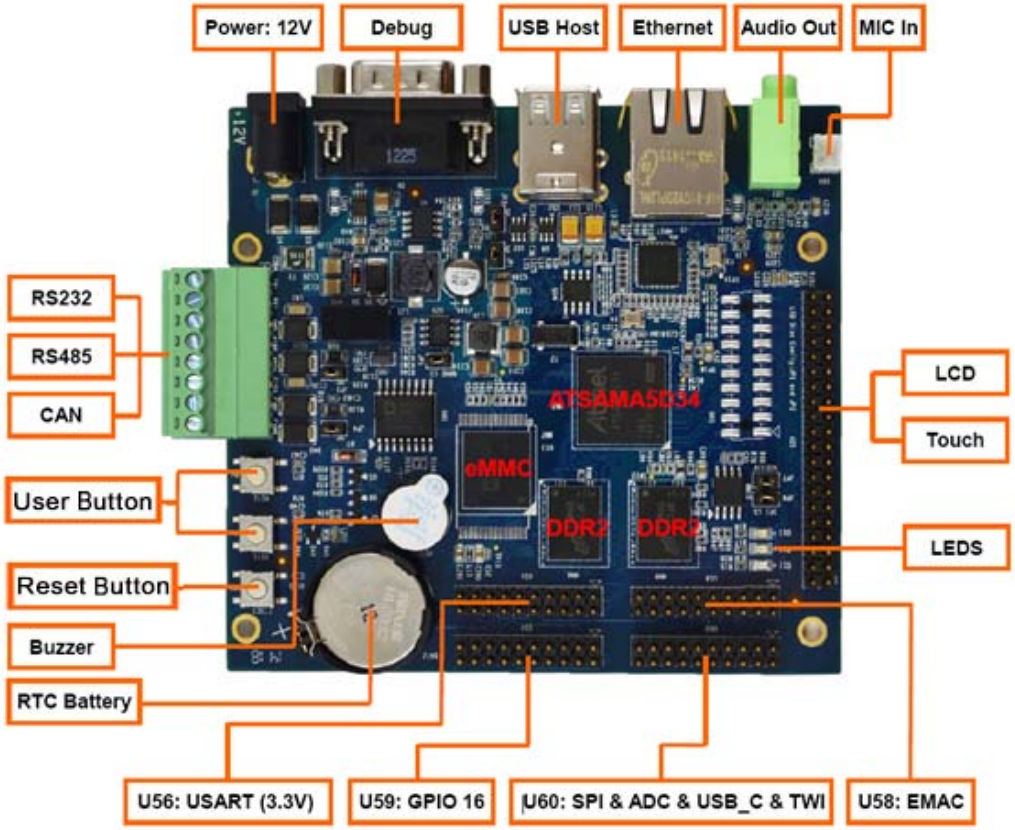


Figure 1-1 Interfaces/buttons on top side

Note:

The coin battery for RTC shown in the figure above is not provided along with SBC60A5 by default.

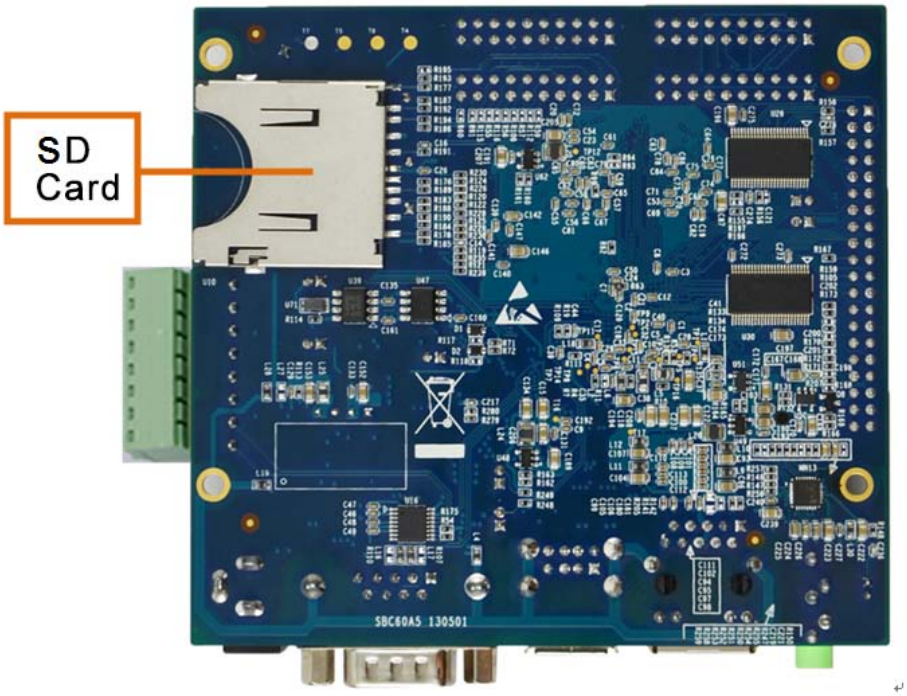


Figure 1-2 Interface on back side

1.4 System Block Diagram

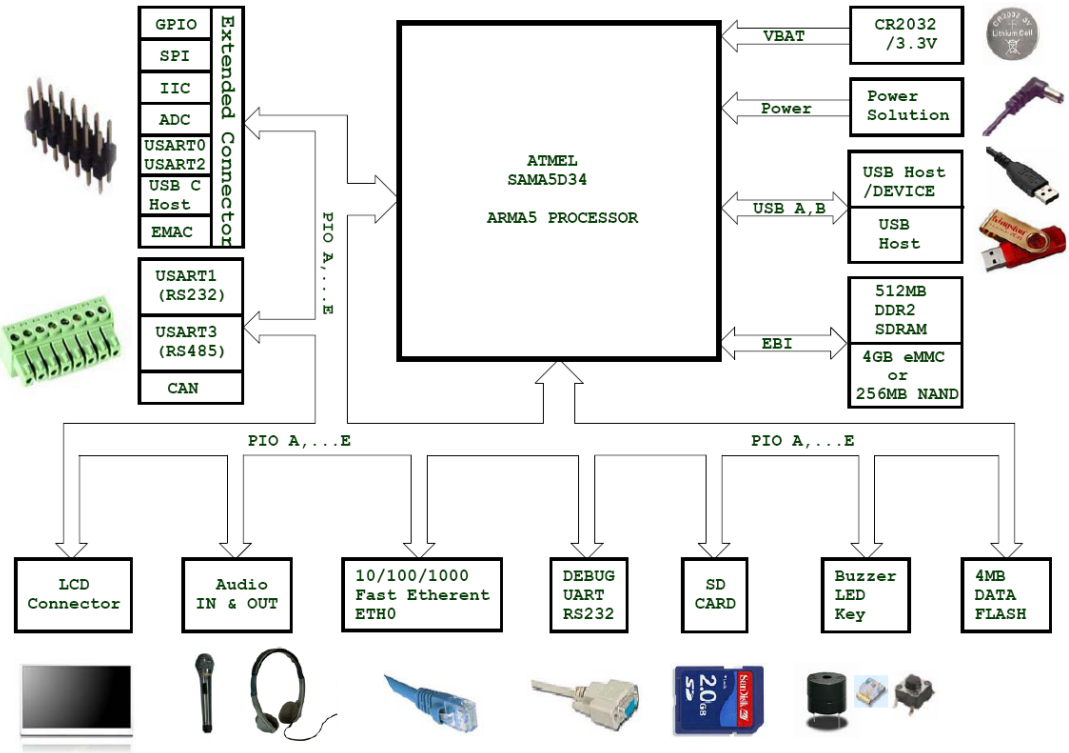


Figure 1-3 System block diagram

1.5 Product Dimensions

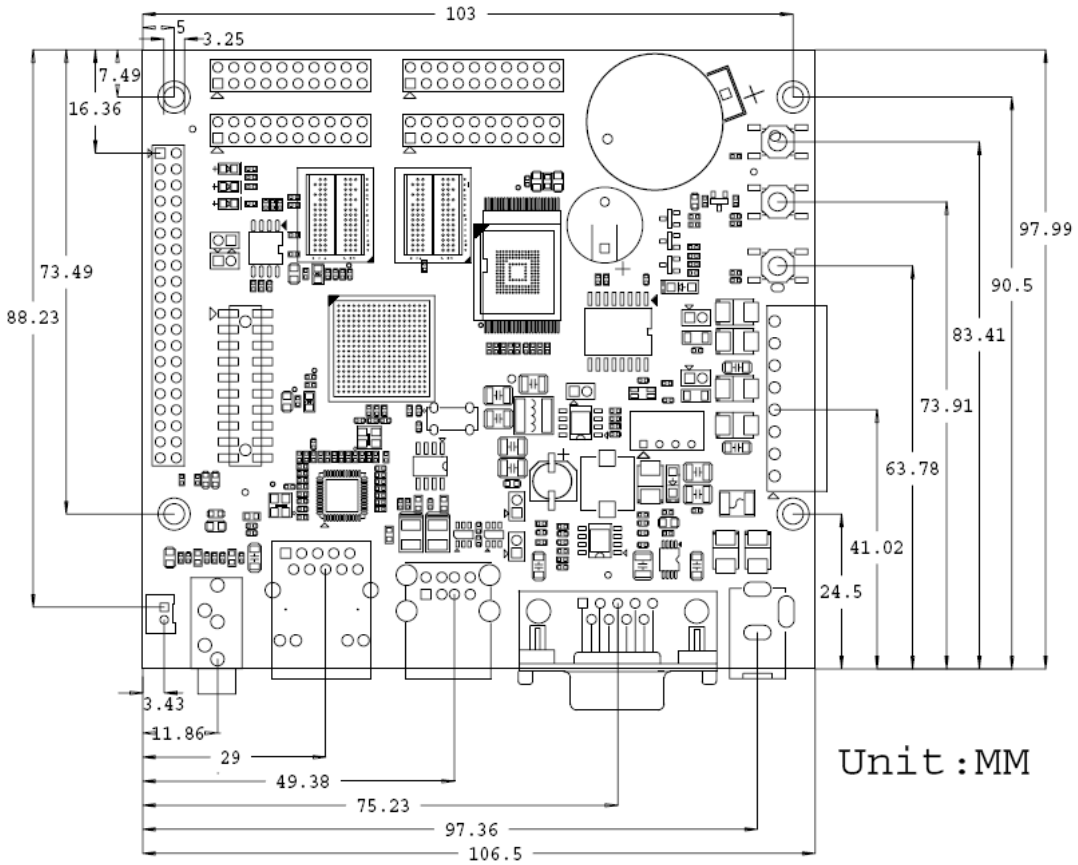


Figure 1-4 Product dimensions

1.6 Devices/Interfaces

Table 1-1 Devices/Interfaces

Categories	Names	Descriptions
Processor	CPU	Atmel ATSAMA5D34 Cortex-A5 536Mhz
Memory	DDR2	512MB
	eMMC	4GB
	DataFlash	4MB
	SD card	High-speed SD interface supports hot plugging
Comm.	Serial Interface	DEBUG：3-wire RS232
		USART0：5-wire TTL
		USART1：3-wire RS232
		USART2：5-wire TTL
		USART3：RS485 (isolated)
	Ethernet	10/100/1000Mbps with LED indicator

Categories	Names	Descriptions
Interface	USB HOST	2 USB2.0 Host interfaces support USB keypad/mouse, and hot plugging. One of the interfaces can be set to USB Device mode.
	CAN	1 CAN Bus 2.0 with isolation
Display Interface	LCD	Supports TFT LCD under 16-bit RGB mode. CPU supports up to 2048X2048. Linux driver supports 4.3-inch (480x272), 5.6-inch (640x480), 7-inch (800x480) and 10.4-inch (800x600) LCDs
Input/Output Interface	Touch Screen	4-wire resistive touch screen
	Buzzer	1 buzzer
	Audio Out	Supports MP3 playback
	Audio In	Supports MIC recording
	GPIO	16 GPIOs
General Interface	LED Indicators	1 power supply indicator, 2 working status indicator
	Reset Button	RESET
	IO Buttons	2 IO buttons
Expansion Interface	SPI	1 SPI bus for users' function expansion
	TWI	1 TWI bus for users' function expansion
	USB Host	Can be extended for function of USB Host
	ADC	2 12-bit ADCs
	EMAC	Can implement 10/100Mbps Ethernet by working together with an external physical-layer transceiver
Others	Real-Time Clock (RTC)	Independent real-time clock module with backup battery holder (battery is not provided by default)
	WatchDog	Controller is integrated in CPU
	System Power	DC-in 12V

1.7 Optional Modules

- 4.3" 480*272 LCD module
- 5.6" 640*480 LCD module
- 7" 800*480 LCD module
- 10.4" 800*600 LCD module

Chapter 2 Introduction to Devices/Interfaces

This chapter will give you detailed information of part of interfaces on SBC60A5 as well as different on-board peripherals such as LED, RTC, buzzer and buttons.

2.1 Power Jack (J2)

SBC60A5 uses a standard 2.1mm DC power jack with an input voltage at DC 12V. The interface works with 2.2A upper current limit that is ensured by a fuse providing over-current protection automatically. The following table lists the pin definitions of the interface.

Table 2-1 Power jack (J2)

Interface	Pins	Definitions
Power（J2）	1	GND
	2	GND
	3	VDD 12V

2.2 Debugging Interface (D8/U56)

The debugging interface on SBC60A5 has been extended with two physical connectors, a DB9 male connector (named D8 on silkscreen layer) and a standard 2.54mm-pitch pin header (named U56 on silkscreen layer), of which the former one provides RS232 voltage level and the latter TTL level (pin 17 and 19, use PB30 and PB31 of the processor). The connector and output level to be used is determined by whether to solder a MAX3232 chip and resistors on the board. Please refer to schematics for detailed information. This debugging interface is implemented with a 3-wire mechanism working at 115200bps baudrate without flow control. The following two tables list the pin definitions and processor resources for the physical interfaces.

Table 2-2 U56 connector

Connector	CPU Resources	Definitions
U56	PB30	DRRXD
	PB31	DRTXD

Table 2-3 DB9 connector (D8)

Connector	Pins	Definitions
D8	1	NC
	2	DRRXD
	3	DRTXD
	4	NC
	5	GND
	6	NC
	7	NC
	8	NC
	9	NC

2.3 USB Interface (U53)

The USB interface is implemented with a standard type A dual-port USB connector (using HHSDMA, HHSDPA, HHSDMB and HHSDPB of the processor) and compliant with high-speed USB 2.0 protocol. A dedicated current-limiting chip is applied to the interface, ensuring 500mA power supply on each USB port. The higher port can only work under USB Host mode; the lower one can be set to either Host or Device mode by different configurations as well as used to update system images. Please refer to the software manual for the details of system update.

2.4 Gigabit Ethernet Interface (J1)

The gigabit Ethernet interface relies on the controller integrated in the processor and an external physical-layer transceiver (KSZ9021) to transfer data at 10/100/1000Mbps with support to RGMII mode. The interface is implemented with a RJ45 connector which has a working status indictor. The following table lists the processor resources used by the interface.

Table 2-4 Gigabit Ethernet interface (J1)

Interface	CPU Resources	Definitions
J1	PB1	GTX0
	PB2	GTX1
	PB3	GTX2
	PB4	GTX3
	PB5	GRX0
	PB6	GRX1
	PB7	GRX2
	PB8	GRX3
	PB9	GTXCK
	PB11	GTXEN
	PB13	GRXCK
	PB16	GRXER
	PB17	GMDC
	PB18	GMDIO
	PB25	G125CK

2.5 Audio Output Interface (U55)

SBC60A5 provide a dual-channel stereo audio output interface that is implemented physically with a standard 3.5mm audio jack.

2.6 Audio Input Interface (U56)

SBC60A5 has reserved a soldering position for 2.0mm pin headers which would be used for, if necessary, implementing an audio input interface that is not mounted on the board by default.

2.7 LCD Interface (U25)

LCD interface (U25) is realized by using a standard 40-pin (2*20) 2.54mm pin header to provide TTL output level. The driving capability of the interface is enhanced by the use of a drive buffer. The following table lists pin definitions and processor resources for U25 interface.

Table 2-5 LCD Interface (U25)

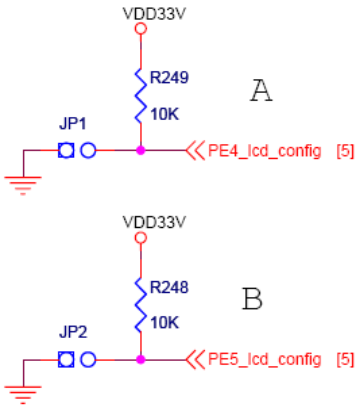
Interface	Pins	CPU Resources	Definitions
U25	1		GND
	2	PA28	DCLK
	3	PA27	HSYNC
	4	PA26	VSYNC
	5		GND
	6	PC31	IO
	7	PC11	R3
	8	PC10	R4
	9	PC15	R5
	10	PE27	R6
	11	PE28	R7
	12		GND
	13	PA10	G2
	14	PA11	G3
	15	PA12	G4
	16	PA13	G5
	17	PA14	G6
	18	PA15	G7
	19		GND
	20	PE2	TWI0_INT
	21	PA3	B3
	22	PA4	B4
	23	PA5	B5
	24	PA6	B6
	25	PA7	B7
	26		GND
	27	PA29	LCDDEN
	28		VDD33V
	29		VDD33V
	30	PA31	TWCK0
	31	PA30	TWD0
	32	PD22	Y+
	33	PD21	X-
	34	PD23	Y-
	35	PD20	X+
	36	PA25	PWREN
	37		VDD5V
	38	PA24	PWM
	39		VDD5V
	40		VDD12V

The following table lists all the signals of a TFT LCD display and the descriptions.

Table 2-6 Signals of TFT LCD

Signals	Descriptions
R	Red wire for data transfer
G	Green wire for data transfer
B	Blue wire for data transfer
VSYNC	Vertical synchronous signal
HSYNC	Horizontal synchronous signal
DCLK	Image data acquisition clock
PWREN	Back-light enable signal
LCDDEN	LCD enable signal
PWM	Back-light brightness control
GND	Ground

The jumpers JP1 and JP2 on the board can be used to select LCD screen size and corresponding driver easily when using LCD products from Embest and images contained in the CD-ROM. Please set the jumpers according to the configurations shown in the following figure.



LCD Config

JP OPEN:PE4/5=1				
JP CLOSE:PE4/5=0				
JP1	JP2	PE4	PE5	LCD
CLOSE	CLOSE	0	0	4.3'
OPEN	CLOSE	1	0	5.6'
CLOSE	OPEN	0	1	7.0'
OPEN	OPEN	1	1	10.4'

Figure 2-1 Jumper settings

As shown in the left part of the figure above, the I/O pin presents a high voltage level when the jumpers are closed, and low level when opened. The processor will read the voltage level on PE4 and PE5 when system is booting to determine the LCD driver to be loaded.

2.8 LED Indicators

The three LEDs on SBC60A5 work as a power indicator, a system status indicator and a programmable indicator respectively. The last one can be controlled through GPIO. These indictors include one red and two green LEDs, among which the red LED D11 is used to indicate power status and the green LEDs D12 and D13 are used as system satus indicator and programmable indicator respectively. The following table lists processor resources used by these LEDs as well as their descriptions.

Table 2-7 LED Indicators

Device	Names	CPU Resources	Descriptions
LED	D11	None	VDD33V power indicator
	D12	PE6	System status indicator
	D13	PE7	User defined indicator

2.9 Expansion Interfaces (U56, U58, U59, U60）

SBC60A5 provides a rich set of expansion interfaces which draw out most of the non-standardized interfaces of the processor. There are four sets of 20-pin 2.54mm pin headers in total mounted on the board for users to expand functions. This section will give you detailed information on these interfaces.

2.9.1 USART Interface (U56)

This interface contains all the UART resources of the SAMA5D34 processor. It includes 4 groups of USARTs with flow control and 1 group of serial debugging interface which all work on TTL voltage level. USART0 and USART2 are extened directly from the processor and can be used immediately; USART1 and USART3 are multiplexed with each other. By default the former one is set to RS232 voltage level while the latter is RS485 voltage level. Both of them are extened through CON4 interface. To obtain a TTL level, the chips U16 and U45 should be removed and the series resistor 27R needs to be soldered, and then a pin header could be used for extension (please refer to the schematics for details). RS232

level is the default setting on serial debugging interface which is extended through D8 interface. It can also be set to TTL level by using the same method. The following figure shows pin definitions of this interface.

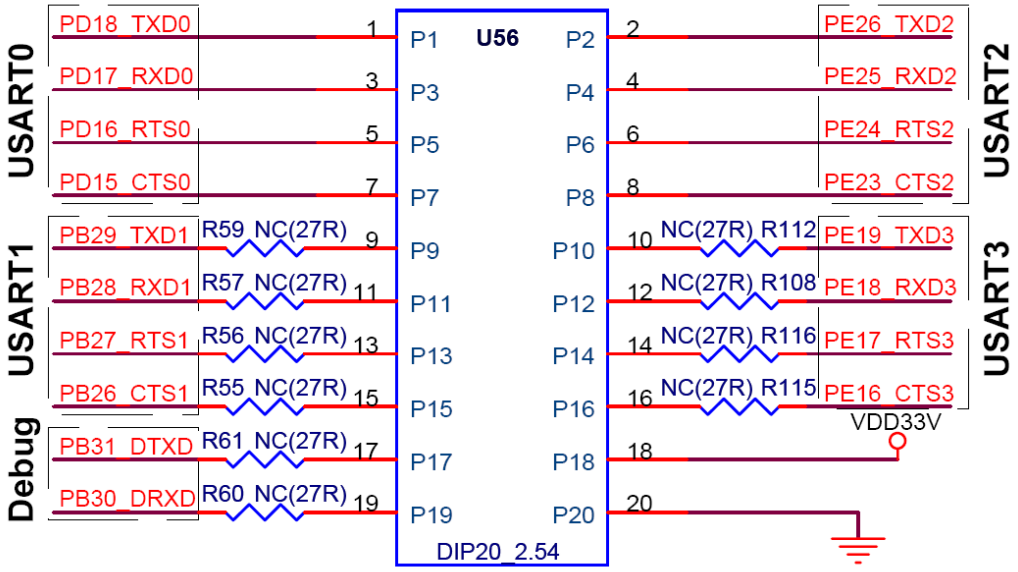


Figure 2-2 USART interface

2.9.2 EMAC Interface (U58)

The SAMA5D34 processor integrates two sets of Ethernet resources. One is a 10/100/1000 Mbps GMAC that has been configured as a standard Ethernet interface and implemented physically with a RJ45 connecor; the other is a 10/100 Mbps EMAC which is reserved for expansion and can be working either as a 10/100Mbps Ethernet interface by connecting an external physical-layer transceiver chip such as KSZ8081 or as a general I/O. The following figure shows pin definitions of EMAC interface.

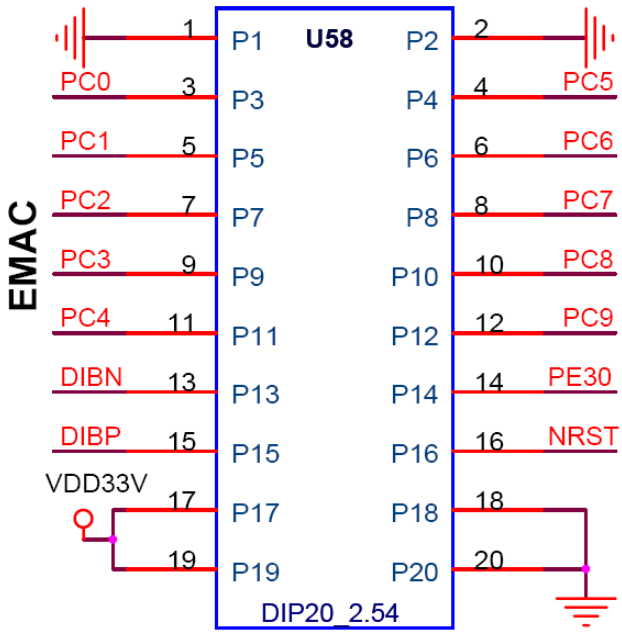


Figure 2-3 EMAC interface

2.9.3 SPI/TWI/USB/ADC Interface (U60)

This interface draws out a SPI bus (with 1 chip-selecting and 1 interrupt signal), a TWI bus (with 1 interrupt signal), an USB bus and two ADC signals. The USB bus goes directly out of the processor and is associated to USB C. It can work as a USB Host interface. The two ADC signals are also coming directly from the processor with 12-bit resolution, 1MHz max conversion rate and 3.3V max sampling voltage.Please note never connect the signals to peripherals working at voltages higher than 3.3V. The following figure and talbe contain pin definitions and processor resources for the interface.

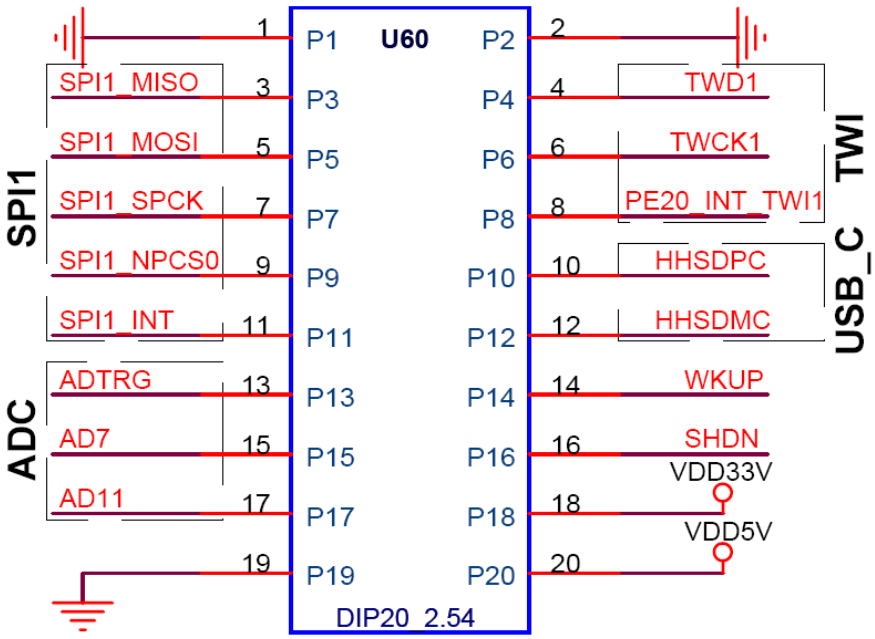


Figure 2-4 SPI/TWI/USB/ADC interface

Table 2-8 SPI/TWI/USB/ADC interface

Pins	CPU Resources	Definitions
1		GND
2		GND
3	PC22	SPI1_MISO
4	PC26	TWD1
5	PC23	SPI1_MOSI
6	PC27	TWCK1
7	PC24	SPI1_SPCK
8	PE20	PE20_INT_IIC1
9	PC25	SPI1_NPCS0
10	HHSDPC	HHSDPC
11	PC28	SPI1_INT
12	HHSDMC	HHSDMC
13	PD19	ADTRG
14	WKUP	WKUP
15	PD27	AD7
16	SHDN	SHDN
17	PD31	AD11
18		VDD33V
19		GND
20		VDD5V

2.9.4 GPIO Interface (U59)

The GPIO interface is composed of 16 IOs fanning out directly from the processor. Please refer to the datasheet of SAMA5D3 to learn about the electrical specifications of the interface. The following figure shows pin definitions of the GPIO interface.

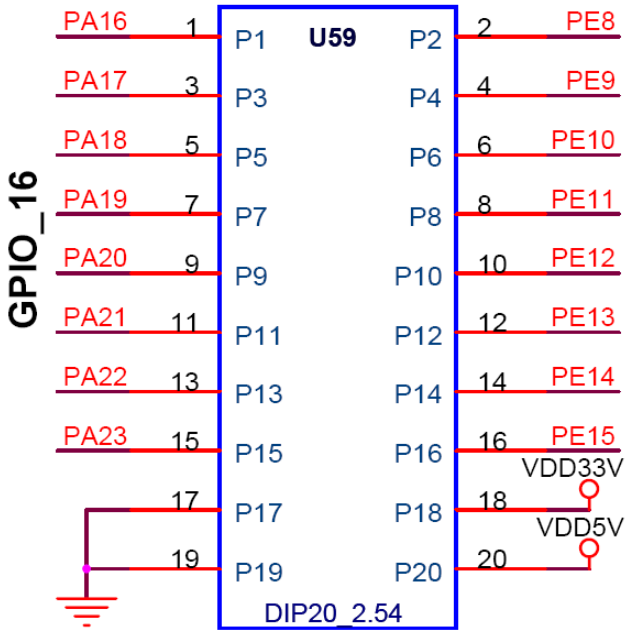


Figure 2-5 GPIO interface

2.9.5 RTC

The processor has a built-in RTC circuit which can be driven by either the 3.3V power of SBC60A5 or a 3V coin battery. When these power sources are both available, the 3.3V power will be adopted automatically by the system with a purpose to save the power of coin battery. The system clock can be sustained by the use of a coin battery when 3.3V power fails. SBC60A5 is not installed with a coin battery when it is shipped. The battery needs to be purchased separately if necessary and CR2032 is recommended.

2.9.6 Buzzer (PZ1)

SBC60A5 is equipped with a positive DC buzzer on the board. This buzzer can be switched on or off by software via PE29. When a low voltage level is detected on PE29, the buzzer will make a continuous sound, while a high voltage level will silences the

buzzer.

2.9.7 Buttons

SBC60A5 provides 3 buttons, one of which is reset button and the rest two are general buttons that can be programmed. The following talbe list all the buttons as well as their processor resources and descriptions.

Table 2-9 Buttons

Device	Names	CPU Resource	Descriptions
Button	RESET	NRST	Reset the system
	KEY1	PE1	Defined by users
	KEY2	PE0	Defined by users

2.9.8 Bus Interface （CON4）

SBC60A5 has a standard 3.5mm Phoenix connector which contains 1 RS232, 1 RS485 and 1 CAN bus. The following table lists pin definitions of the interface.

Table 2-10 Bus interface (CON4)

Pins	Names	CPU Resources		Descriptions
1	TX1	PB29	USART1	RS232 bus
2	RX1	PB28		
3	GND	GND	GND	System ground
4	485B	PE17	USART3	RS485 bus
5	485A	PE18 PE19		
6	GISO	GND_ISO	GND_ISO	Isolated ground
7	CANL	PB14	CAN1	CAN bus
8	CANH	PB15		

- **RS232 interface:** This interface is implemented with a 3-wire mechanism and a max baudrate 115200bps without flow control. The baudrate can be changed by software. The RS232 interface uses USART1 of the processor and delivers RS232 voltage level by default though Pin1 and Pin2 of CON4. It can also provide TTL level though an expansion pin header by changing its configurations. Please refer to the schematics for the detailed information.

- **RS485 interface:** This interface features an isolated power supply and a digital signal isolator. It uses 2-wire mechanism and can work at a baudrate of up to 115200bps that is adjustable by using software. RS485 interface uses USART3 of the processor and delivers RS485 voltage level by default though Pin4 and Pin5 of CON4. It can also provide TTL level though an expansion pin header by changing its configurations. Please refer to the schematics for the detailed information. SBC60A5 has a 120R terminal resistor soldered on the board which can be connected to the circuitry when the jumper JP3 is shorted or removed from the circuitry when JP3 is opened.

- **CAN bus interface:** This interface features an isolated power supply and a digital signal isolator. It is a standard CAN 2.0 communication interface working at a data transfer rate of up to 1Mbit/s. SBC60A5 has a 120R terminal resistor soldered on the board which can be connected to the circuitry when the jumper JP4 is shorted or removed from the circuitry when JP4 is opened.

2.9.9 SD Card Interface (U10)

This is a high-speed SD card interface supporting up to 32GB memory space. It uses a 4-bit parallel bus to transfer data and can be working as an approach by which system boots up. Moreover, the SD card interface can be used to update system images. The following table lists processor resourcs used by the SD card interface.

Table 2-11 SD card interface (U10)

Interface	CPU Resources	Definitions
U10	PE3	SW_1
	PB12	SW_2
	PD1	DAT0
	PD2	DAT1
	PD3	DAT2
	PD4	DAT3
	PD0	DCMD
	PD9	CLK

Technical Support and Warranty

Technical Support

Embest Technology provides its product with one-year free technical support including:

- Providing software and hardware resources related to the embedded products of Embest Technology;
- Helping customers properly compile and run the source code provided by Embest Technology;
- Providing technical support service if the embedded hardware products do not function properly under the circumstances that customers operate according to the instructions in the documents provided by Embest Technology;
- Helping customers troubleshoot the products.

The following conditions will not be covered by our technical support service. We will take appropriate measures accordingly:

- Customers encounter issues related to software or hardware during their development process;
- Customers encounter issues caused by any unauthorized alter to the embedded operating system;
- Customers encounter issues related to their own applications;
- Customers encounter issues caused by any unauthorized alter to the source code provided by Embest Technology;

Warranty Conditions

1） 12-month free warranty on the PCB under normal conditions of use since the sales of the product;

2） The following conditions are not covered by free services; Embest Technology will charge accordingly:

- Customers fail to provide valid purchase vouchers or the product identification tag is damaged, unreadable, altered or inconsistent with the products.
- Products are damaged caused by operations inconsistent with the user manual;
- Products are damaged in appearance or function caused by natural disasters (flood, fire, earthquake, lightning strike or typhoon) or natural aging of components or other force majeure;
- Products are damaged in appearance or function caused by power failure, external forces, water, animals or foreign materials;
- Products malfunction caused by disassembly or alter of components by customers or, products disassembled or repaired by persons or organizations unauthorized by Embest Technology, or altered in factory specifications, or configured or expanded with the components that are not provided or recognized by Embest Technology and the resulted damage in appearance or function;
- Product failures caused by the software or system installed by customers or inappropriate settings of software or computer viruses;
- Products purchased from unauthorized sales;
- Warranty (including verbal and written) that is not made by Embest Technology and not included in the scope of our warranty should be fulfilled by the party who committed. Embest Technology has no any responsibility;

3） Within the period of warranty, the freight for sending products from customers to Embest Technology should be paid by customers; the freight from Embest to customers should be paid by us. The freight in any direction occurs after warranty period should be paid by customers.

4） Please contact technical support if there is any repair request.

Note:

📖 Embest Technology will not take any responsibility on the products sent back without the permission of the company.

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