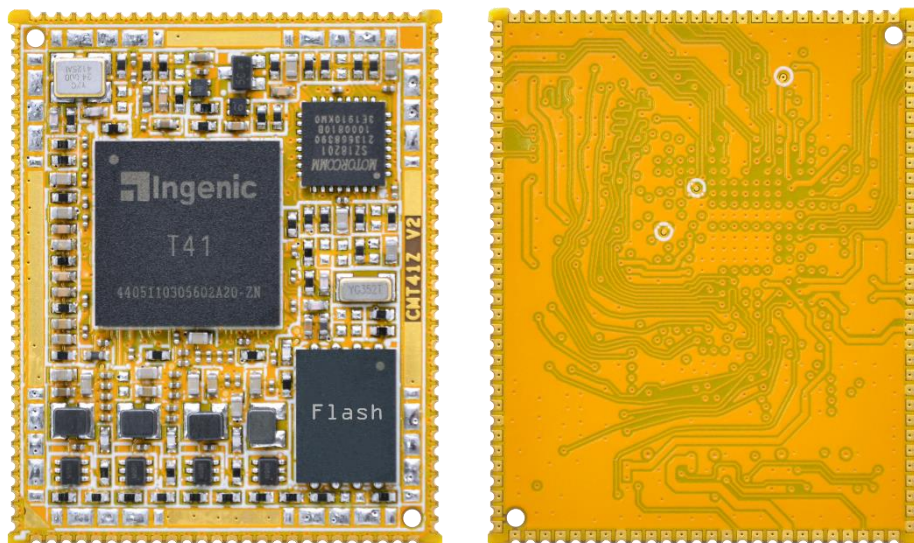


CMT41Z Reference User Manual

V2.202609



Boardcon Embedded Design

www.armdesigner.com

1. Introduction

1.1. About this Manual

This manual is intended to provide the user with an overview of the board and benefits, complete features specifications, and set up procedures. It contains important safety information as well.

1.2. Feedback and Update to this Manual

To help our customers make the most of our products, we are continually making additional and updated resources available on the Boardcon website (www.boardcon.com , www.armdesigner.com).

These include manuals, application notes, programming examples, and updated software and hardware. Check in periodically to see what's new!

When we are prioritizing work on these updated resources, feedback from customers is the number one influence, If you have questions, comments, or concerns about your product or project, please no hesitate to contact us at support@armdesigner.com.

1.3. Limited Warranty

Boardcon warrants this product to be free of defects in material and workmanship for a period of one year from date of buy. During this warranty period Boardcon will repair or replace the defective unit in accordance with the following process:

A copy of the original invoice must be included when returning the defective unit to Boardcon. This limited warranty does not cover damages resulting from lighting or other power surges, misuse, abuse, abnormal conditions of operation, or attempts to alter or modify the function of the product.

This warranty is limited to the repair or replacement of the defective unit. In no event shall Boardcon be liable or responsible for any loss or damages, including but not limited to any lost profits, incidental or consequential damages, loss of business, or anticipatory profits arising from the use or inability to use this product.

Repairs make after the expiration of the warranty period are subject to a repair charge and the cost of return shipping. Please contact Boardcon to arrange for any repair service and to obtain repair charge information.



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1 CMT41Z Introduction

1.1 Summary

The CMT41Z system-on-module is equipped with Ingenic's T41Z, which features an XBurst2 dual-core MIPS32 ISA R5 and a 700 MHz RISC-V MCU.

The T41Z is a new-generation professional smart video application processor targeting video devices such as mobile cameras, security surveillance, video calling, and video analytics. It integrates a new-generation 4K-resolution ISP and the latest H.264/H.265/JPEG combined video compression encoder, delivering industry-leading image quality and low bitrate.

The T41Z also integrates a low-power, high-performance AI engine with a typical performance of 1.2 TOPS at INT8. It also supports 2N-bit widths, such as 2/4/6/8/10/12/14/16 bits, which are optionally configurable. The T41Z can operate in low-power-consumption mode for extended periods.

1.2 Features

- **Microprocessor**
 - XBurst2 Dual-core 1.0GHz ~1.4GHz, MIPS32 ISA R5
 - 32K L1 D-cache + 32K L1 I-cache, 128KByte L2 cache
 - 1.2Tops@int8, 4.8Tops@int4
 - 700M RISC-V MCU
 - Fast Boot(200ms)
 - Max 3840x2160@20fps ISP

Memory Organization

- SIP IN 512Mbit DDR2/DDR2L (up to 2Gbit)
- SPI Nor/NAND Flash

- **Video Encoder**
 - H264/H265/JPEG Comb-Video Compression Encoder

- **Display Subsystem**
 - **Video Output**
Supports Smart LCD (MCU LCD)
 - **Video in**
Input interface: MIPI/DVP/BT656/BT1120 (serial)

- **I2S**
 - One I2S interface

- **DMIC**
 - One DMIC interface
 - Support 4 channel digital MIC

- **USB**
 - One USB 2.0 OTG

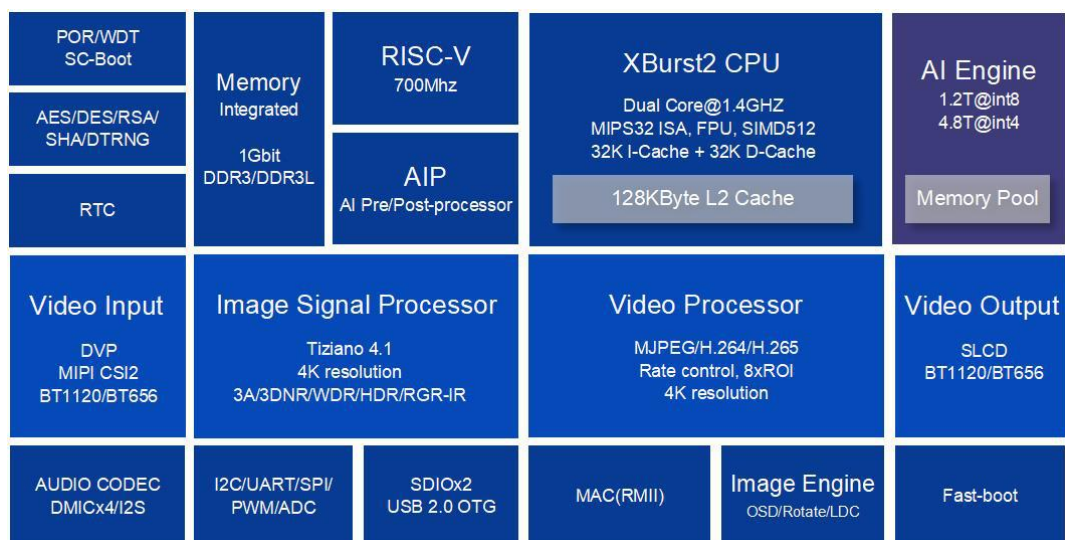
- **Ethernet**
 - SZ18201 PHY onboard



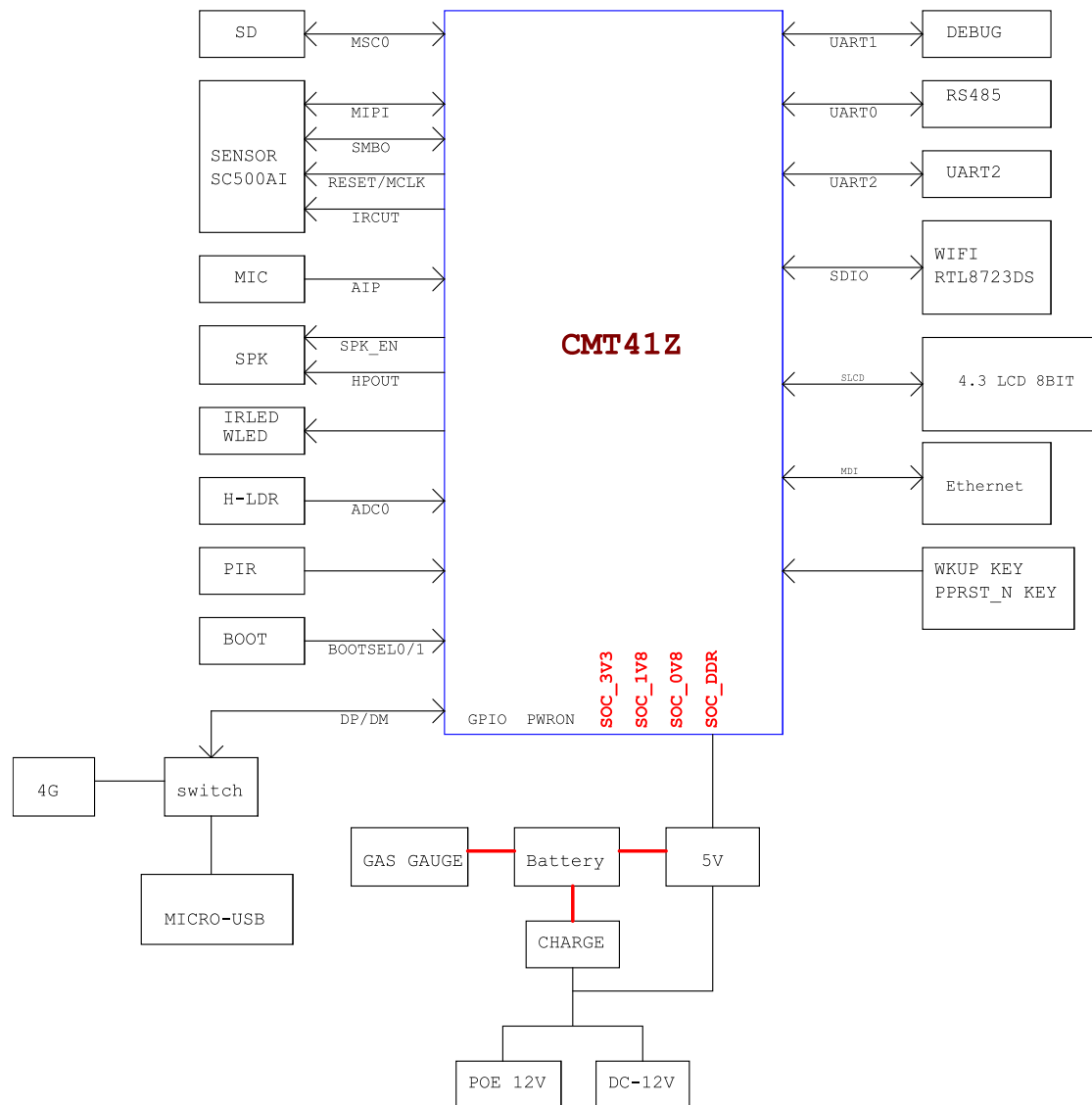
- Support 10/100M
- **I2C**
 - Up to three I2Cs
 - Support standard mode (100kbit/s) and fast mode(400kbit/s)
- **SDIO**
 - Support 2CH SDIO 2.0 protocol
- **SPI**
 - three SPI controllers,
 - Full-duplex synchronous serial interface
 - two SPI Master, one SPI Slave
- **UART**
 - Support up to 6 UARTs
 - Support Full-duplex transfer
 - UART1 with 2 wires for debug tools
 - UART0 and UART2 Support auto flow control mode
- **ADC**
 - four ADC channels
 - 12-bit resolution
 - Up to 2MS/s sampling rate
 - Voltage input range between 0V to 1.8V
- **PWM**
 - 8 on-chip PWMs, each channel can work independently
- **Power unit**
 - 3.3~5.5V input and RTC power input

1.3 CMT41Z Block Diagram

1.3.1 T41Z Block Diagram



1.3.2 Development board (Idea T41) Block Diagram



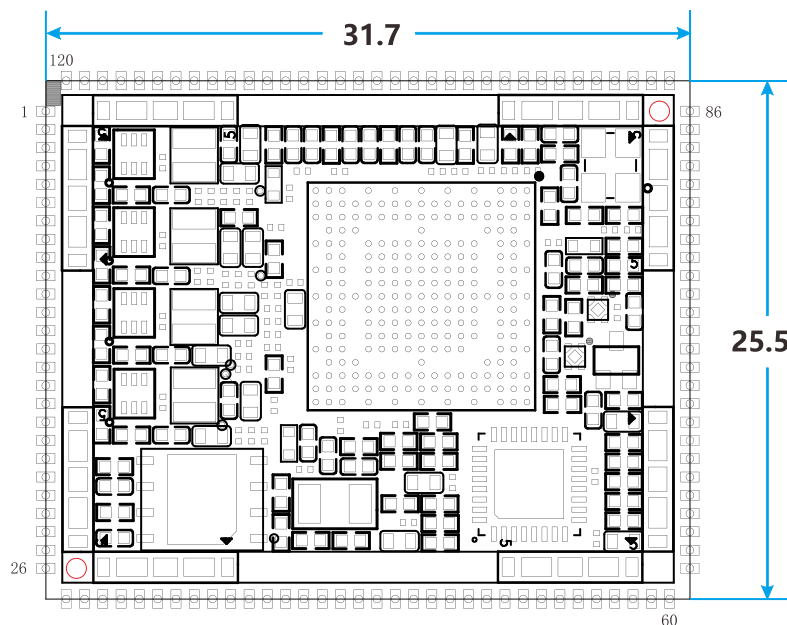
1.4 CMT41Z Specifications

Feature	Specifications
CPU	XBurst2 Dual-core 1.0GHz ~ 1.4GHz, MIPS32 ISA R5
DDR	DDR2/DDR3/DDR3L/LPDDR2/LPDDR3 SIP 512Mb/1Gb/2Gb
SPI NOR/NAND FLASH	32MB/64MB/128MB/256MB
Power	DC 3.3~5.5V
I2S	1-CH
MIPI CSI	1-CH 2-Lane
DVP	1-CH (10bit)
LCD	MCU LCD (8bit)



USB	1-CH (USB 2.0 OTG)
Ethernet	10/100M
SDIO2.0	2-CH
I2C	3-CH
SPI	3-CH
UART	6-CH, 1-CH(DEBUG)
PWM	8-CH
ADC IN	4-CH
Board Dimension	31.7 x 25.5mm

1.5 CMT41Z PCB Dimension



1.6 CMT41Z Pin Definition

Pin	Signal	Description or functions	GPIO serial	IO Voltage
1	VCC_5V	Main Power input		3.3~5.5V
2	VCC_5V	Main Power input		3.3~5.5V
3	PWEN	power on/off control of main power		3.3V
4	GND	Ground		0V
5	GND	Ground		0V
6	GND	Ground		0V
7	3V3	3V3 Output (Max 500ma)		3.3V
8	1V8	1V8 Output (Max 500ma)		1.8V
9	PPRST_N	power on reset and RESET-KEY reset input		1.8V



Pin	Signal	Description or functions	GPIO serial	IO Voltage
10	PWRENO	power on/off control of main power		1.8V
11	WKUP	WKUP_PD31	PD31	1.8V
12	GND	Ground		0V
13	SADC_VIN3	SADC_VIN3		1.8V
14	SADC_VIN0	SADC_VIN0		1.8V
15	SADC_VIN2	SADC_VIN2		1.8V
16	SADC_VIN1	SADC_VIN1		1.8V
17	UART1_RXD	UART1_RXD/TDI/PB24	PB24	3.3V
18	UART1_TXD	UART1_TXD/TDO/PB23	PB23	3.3V
19	GND	Ground		0V
20	MSC0_D3	MSC0_D3/PB03	PB03	3.3V
21	MSC0_D2	MSC0_D2/PB02	PB02	3.3V
22	MSC0_D1	MSC0_D1/PB01	PB01	3.3V
23	MSC0_D0	MSC0_D0/PB00	PB00	3.3V
24	MSC0_CMD	MSC0_CMD/PB05	PB05	3.3V
25	MSC0_CLK	MSC0_CLK/PB04	PB04	3.3V
26	GND	Ground		0V
27	GND	Ground		0V
28	MSC1_CLK/UART0_CTS/PB20	MSC1_CLK/UART0_CTS/PB20/TCK	PB20	3.3V
29	MSC1_D0/PWM0/PB17	MSC1_D0/PWM0/PB17	PB17	3.3V
30	MSC1_D1/PWM1/PB18	MSC1_D1/PWM1/PB18	PB18	3.3V
31	MSC1_D2/UART0_RTS/PB21	MSC1_D2/UART0_RTS/PB21/TMS	PB21	3.3V
32	MSC1_D3/UART0_TXD/PB22	MSC1_D3/UART0_TXD/PB22	PB22	3.3V
33	MSC1_CMD/UART0_RXD/PB19	MSC1_CMD/UART0_RXD/PB19	PB19	3.3V
34	GND	Ground		0V
35	SLCD_BT656_D7/SLCD_D7/SMB1_SCK/PD07	BT656_D7/SLCD_D7/SMB1_SCK/PD07	PD07	3.3V
36	SLCD_BT656_D6/SLCD_D6/SMB1_SDA/PD06	BT656_D6/SLCD_D6/SMB1_SDA/PD06	PD06	3.3V
37	SLCD_BT656_D5/SLCD_D5/UART5_RXD/PD05	BT656_D5/SLCD_D5/UART5_RXD/PD05	PD05	3.3V
38	SLCD_BT656_D4/SLCD_D4/UART5_TXD/PD04	BT656_D4/SLCD_D4/UART5_TXD/PD04	PD04	3.3V



Pin	Signal	Description or functions	GPIO serial	IO Voltage
	TXD/PD04			
39	SLCD_BT656_D3/ SLCD_D3/UART4_ RXD/PD03	BT656_D3/SLCD_D3/UART4_RXD/PD03	PD03	3.3V
40	SLCD_BT656_D2/ SLCD_D2/UART4_ TXD/PD02	BT656_D2/SLCD_D2/UART4_TXD/PD02	PD02	3.3V
41	SLCD_BT656_D1/ SLCD_D1/UART3_ RXD/PD01	BT656_D1/SLCD_D1/UART3_RXD/PD01	PD01	3.3V
42	SLCD_BT656_D0/ SLCD_D0/UART3_ TXD/PD00	BT656_D0/SLCD_D0/UART3_TXD/PD00	PD00	3.3V
43	BT656_PCLK/SLCD_ D_WR/PD08	BT656_PCLK/SLCD_WR/PD08	PD08	3.3V
44	SLCD_TE/PWM4/P D09	SLCD_TE/PWM4/PD09/UART2_CTS	PD09	3.3V
45	SLCD_CS/PWM5/P D10	SLCD_CS/PWM5/PD10/UART2_RTS	PD10	3.3V
46	SLCD_DC/PWM6/ PD11	SLCD_DC/PWM6/PD11/UART2_TXD	PD11	3.3V
47	SLCD_RDY/PWM7/ PD12	SLCD_RDY/PWM7/PD12/UART2_RXD	PD12	3.3V
48	PHY_LED1	LED 1, Link 100Mbps On, Active blink. PHY address 1 selection		3.3V
49	PHY_LED0	LED 0, Link 10Mbps On, Active blink. PHY address 0 selection		3.3V
50	GND	Ground		0V
51	TX_P0	ETH TX_P0		3.3V
52	TX_N0	ETH TX_N0		3.3V
53	RX_P1	ETH TX_P1		3.3V
54	RX_N1	ETH RX_N1		3.3V
55	GND	Ground		0V
56	KEY1_PB30	DMIC_DAT1/UART4_RXD/PB30/SSI1_ CE0	PB30	3.3V
57	RTC_IRQ_N_PB29	DMIC_DAT0/UART4_TXD/PB29/SSI1_ DR	PB29	3.3V
58	SD0_CD_N_PB27	DRV_VBUS/SMB2_SDA/PB27/SSI1_D T	PB27	3.3V
59	I2C1_SDA/UART3_ TXD/PB25	SMB1_SDA/UART3_TXD/PB25/SSI1_C E1	PB25	3.3V



Pin	Signal	Description or functions	GPIO serial	IO Voltage
60	I2C1_SCK/UART3_RXD/PB26	SMB1_SCK/UART3_RXD/PB26/SSI1_GPC	PB26	3.3V
61	BT_UART0_CTS_PC11	UART0_CTS/PC11/I2S_DAC_MCLK	PC11	default:3.3V
62	OU_PWR_EN_PC18	SSI_SLV_DR/I2S_SDTI/PWM3/PC18	PC18	default:3.3V
63	BT_UART0_RTS_PC12	UART0_RTS/PC12/I2S_ADC_MCLK	PC12	default:3.3V
64	SOC_BT_RST_PC17	SSI_SLV_DT/I2S_SDTI/PWM2/PC17	PC17	default:3.3V
65	SOC_WIFI_OOB_PC15	SSI_SLV_CLK/I2S_DAC_BCLK/PWM0/EXCLK/PC15	PC15	default:3.3V
66	PWR_ON_PC16	SSI_SLV_CE0/I2S_DAC_LRCK/PWM1/RTC32K/PC16	PC16	default:3.3V
67	SPEAK_EN	GPIO_PB31	PB31	3.3V
68	PC20	UART2_RTS/SMB1_SCK/PC20	PC20	default:3.3V
69	PC19	UART2_CTS/SMB1_SDA/PC19	PC19	default:3.3V
70	VBUCK	RTC power supply		3.3~5.5V
71	UART2_TXD_PC13	UART2_TXD/PC13/I2S_ADC_BCLK	PC13	default:3.3V
72	UART2_RXD_PC14	UART2_RXD/PC14/I2S_ADC_LRCK	PC14	default:3.3V
73	BT_UART0_TXD_PC08	UART0_TXD/PC08/SMB2_SDA	PC08	default:3.3V
74	BT_UART0_RXD_PC09	UART0_RXD/PC09/SMB2_SCK	PC09	default:3.3V
75	BOOTSEL0	BOOT_SEL0/PC00	PC00	3.3V
76	GND	Ground		0V
77	WIFI_MSC1_CLK_PC02	MSC1_CLK/SSI0_CLK/PC02	PC02	default:3.3V
78	WIFI_MSC1_D0_PC04	MSC1_D0/SSI0_DT/PC04	PC04	default:3.3V
79	WIFI_MSC1_D1_PC05	MSC1_D1/SSI0_DR/PC05	PC05	default:3.3V
80	WIFI_MSC1_D2_PC06	MSC1_D2/SSI0_GPC/PC06	PC06	default:3.3V
81	WIFI_MSC1_D3_PC07	MSC1_D3/SSI0_CE1/PC07	PC07	default:3.3V
82	WIFI_MSC1_CMD_PC03	MSC1_CMD/SSI0_CE0/PC03	PC03	default:3.3V
83	GND	Ground		0V
84	MIPI_DVP_RESET	SA2/PA18	PA18	1.8V



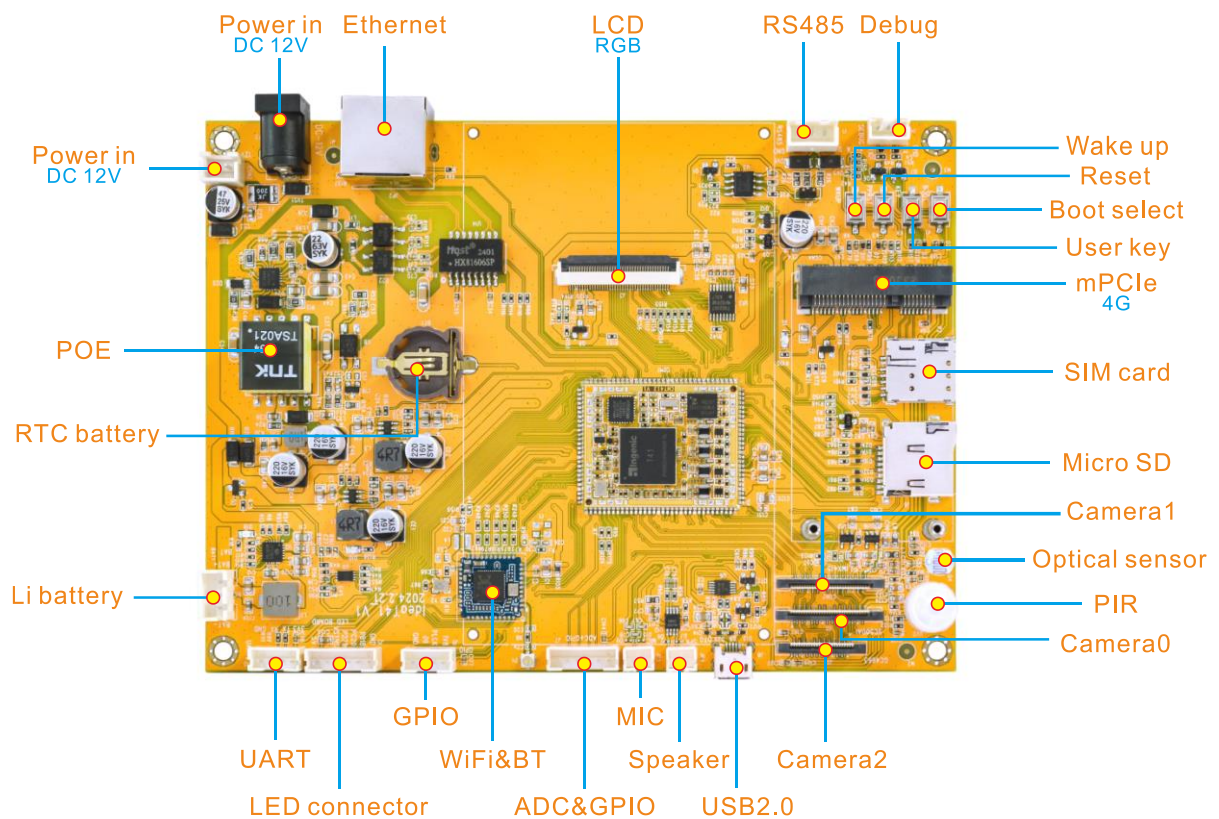
Pin	Signal	Description or functions	GPIO serial	IO Voltage
85	MIPI_DVP_PWDN_PA19	WAIT/PA19	PA19	1.8V
86	DVP_PCLK	SA0/DVP_PLCK/DMIC_CLK/PA14	PA14	1.8V
87	GND	Ground		0V
88	DVP_VSYNC	RD/DVP_VSYNC/DMIC_DAT1/PA17	PA17	1.8V
89	DVP_HSYNC	CS2/DVP_HSYNC/DMIC_DAT0/PA16	PA16	1.8V
90	I2C0_MIPI_DVP_SDA	SD6/SMB0_SDA/PA12	PA12	1.8V
91	I2C0_MIPI_DVP_SCK	SD7/SMB0_SCK/PA13	PA13	1.8V
92	DVP_D9	SD3/DVP_D9/SSI0_DR/PA09	PA09	1.8V
93	DVP_D8	SD2/DVP_D8/SSI0_DT/PA08	PA08	1.8V
94	DVP_D7	SD1/DVP_D7/SSI0_CE0/PA07	PA07	1.8V
95	DVP_D6	SD0/DVP_D6/SSI0_CLK/PA06	PA06	1.8V
96	MIPI_MCLK_PA15/ DVP_MCLK_PA15	SA1/DVP_MCLK/PA15	PA15	1.8V
97	MIPI_RX_2LANE_CLKP0/DVP_D5	CSI_CLKP/DVP_D5		1.8V
98	MIPI_RX_2LANE_CLKN0/DVP_D4	CSI_CLKN/DVP_D4		1.8V
99	MIPI_RX_2LANE_DP0/DVP_D1	CSI_DATAP0/DVP_D1		1.8V
100	MIPI_RX_2LANE_DN0/DVP_D0	CSI_DATAN0/DVP_D0		1.8V
101	MIPI_RX_2LANE_DP1/DVP_D3	CSI_DATAP1/DVP_D3		1.8V
102	MIPI_RX_2LANE_DN1/DVP_D2	CSI_DATAN1/DVP_D2		1.8V
103	GND	Ground		0V
104	MICPL	left ADC channel input		1.8V
105	MICNL	left ADC channel input		1.8V
106	AGND	AGND		0V
107	HPOUT	left DAC channel output P end		1.8V
108	GND	Ground		0V
109	USB_DP0	USB_DP0		3.3V
110	USB_DM0	USB_DM0		3.3V
111	GND	Ground		0V
112	USB0ID	USB0ID		1.8V
113	USB_VBUS	power supply for the device and other USB functions		3.3V
114	SFC1_SCLK_PA22	SSI1_CLK/SFC1_CLK/PA22	PA22	3.3V

Pin	Signal	Description or functions	GPIO serial	IO Voltage
115	SFC1_CE_PA29	SSI1_CE0/SFC1_CE/PA29	PA29	3.3V
116	SFC1_DR_PA21	SSI1_DR/SFC1_DR_IO1/PA21	PA21	3.3V
117	SFC1_WP_PA30	SSI1_CE1/SFC1_WP_IO2/PA30	PA30	3.3V
118	SFC1_DT_PA20	SSI1_DT/SFC1_DT_IO0/PA20	PA20	3.3V
119	SFC1_HOLD_PA31	SSI1_GPC/SFC1_HOLD_IO3/PA31	PA21	3.3V
120	GND	Ground		0V

Note:

- Most GPIO voltage is 3.3V, but some pins marked 1.8V.
- The default GPIO is marked as 3.3V. If you want to change it to 1.8V, you can do so by modifying the hardware.

1.7 Development Kit (IdeaT41)

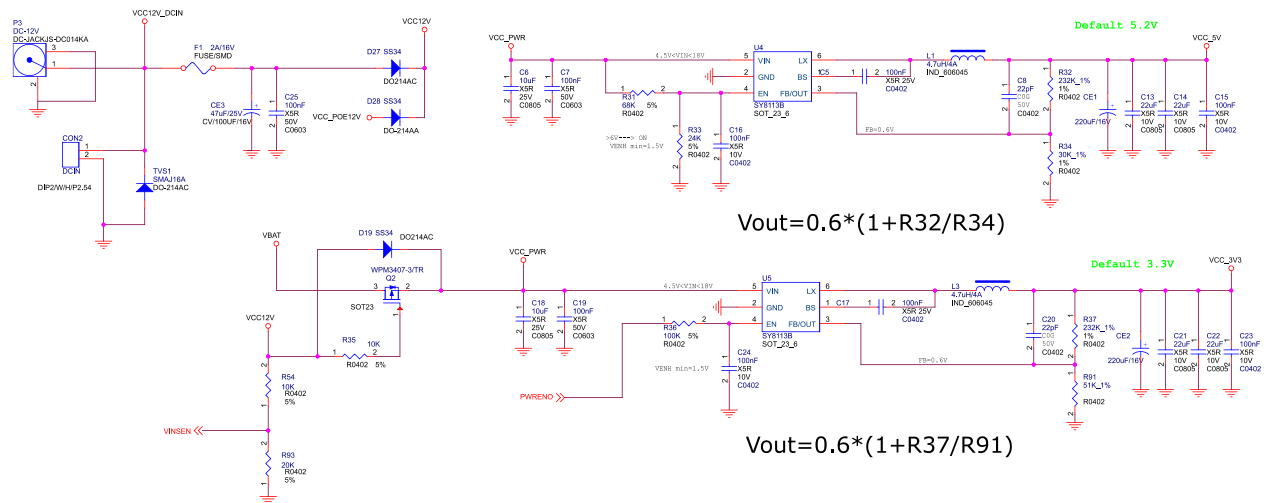




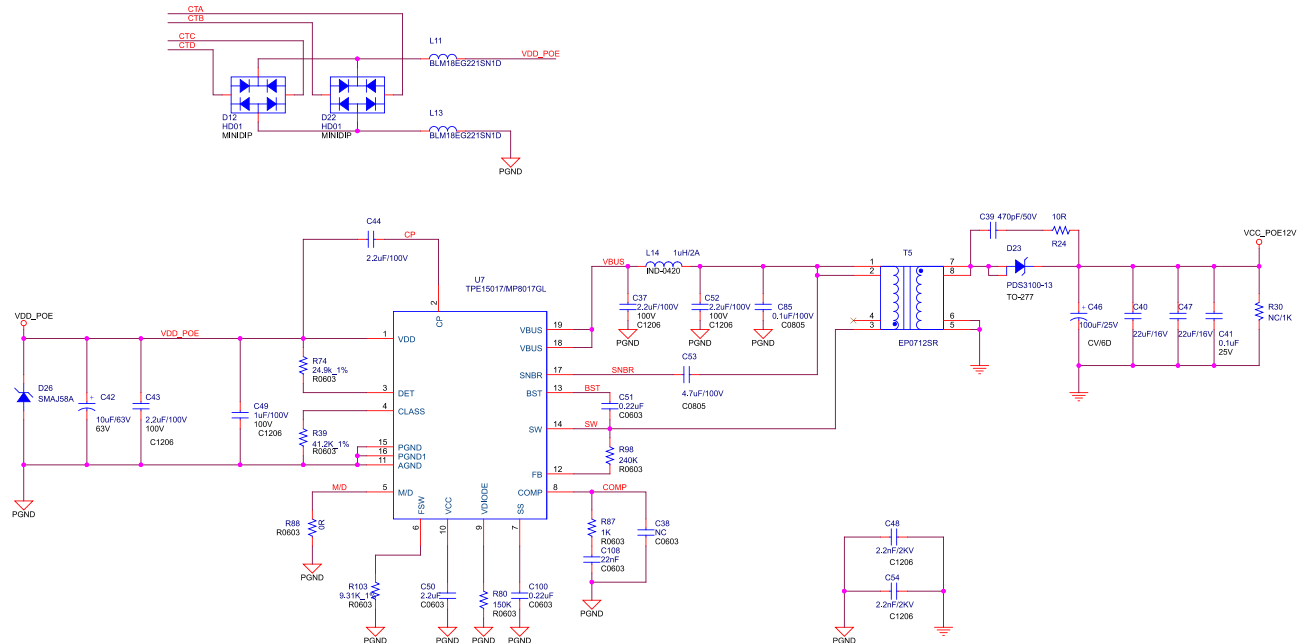
2 Hardware Design Guide

2.1 Peripheral Circuit Reference

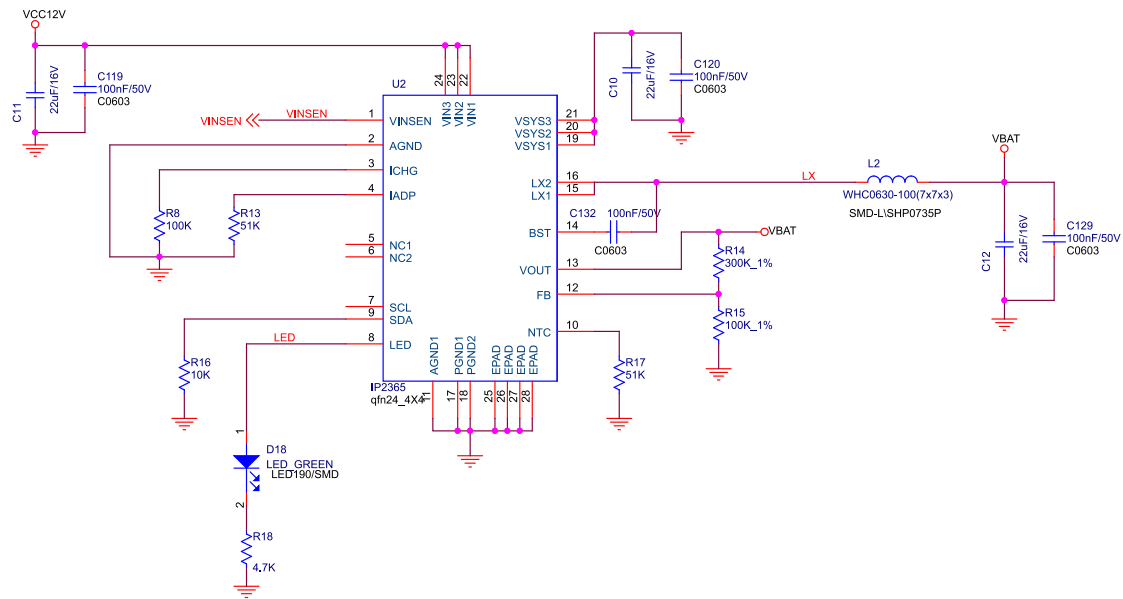
2.1.1 Power Circuit



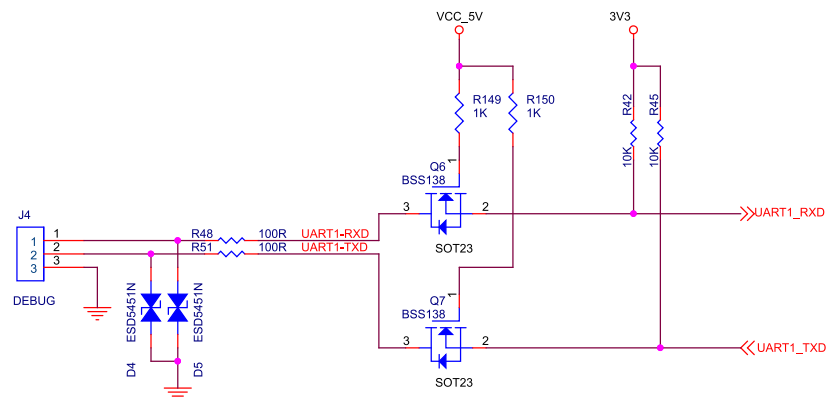
2.1.2 POE Circuit



2.1.3 Battery Charge Circuit

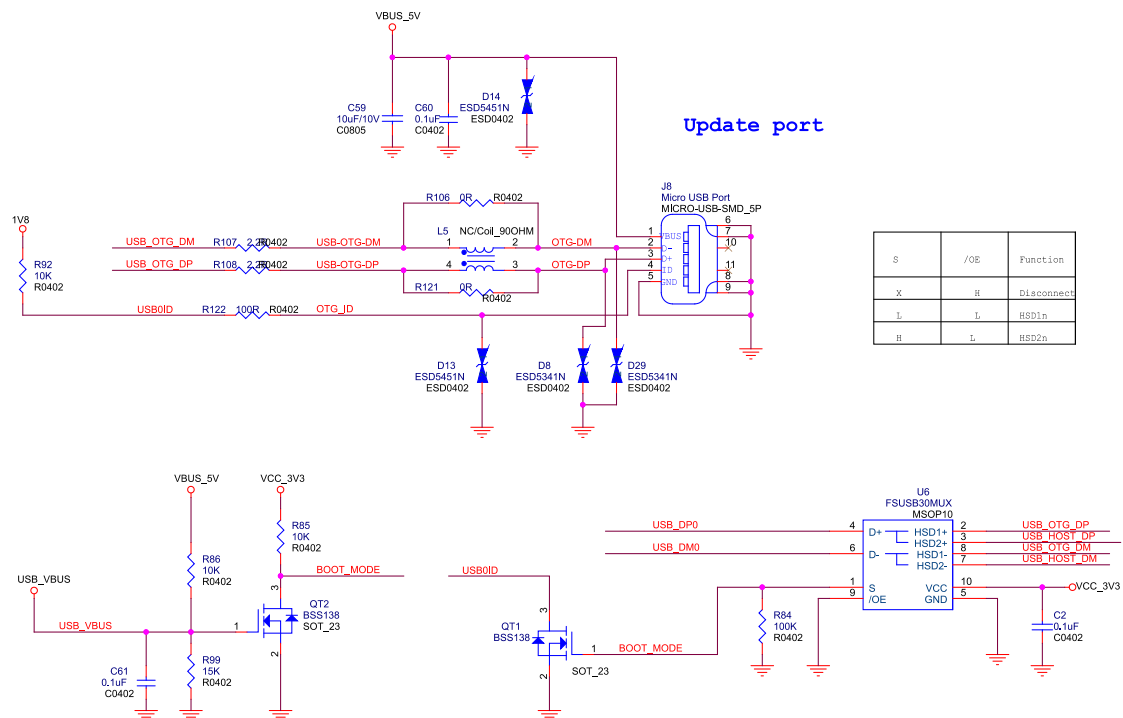


2.1.4 Debug Circuit

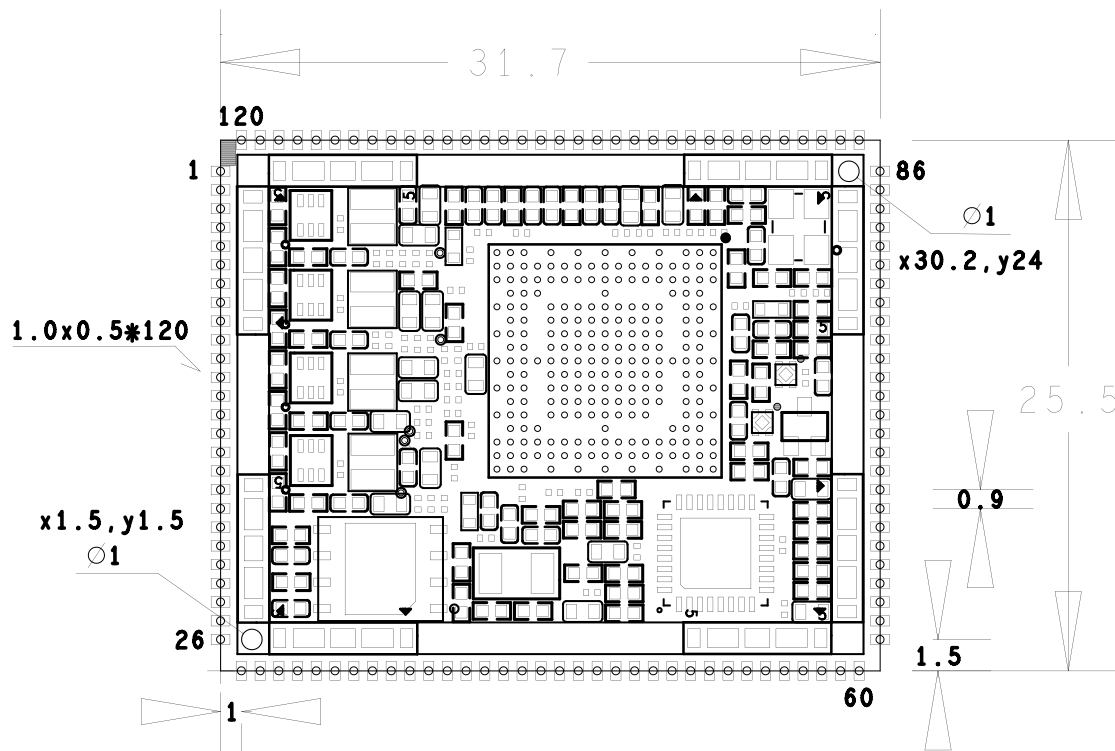




2.1.5 USB OTG Circuit



2.2 PCB Footprint



3 Product Electrical Characteristics

3.1 Dissipation and Temperature

Symbol	Parameter	Min	Typ	Max	Unit
VCC_SOC	System Voltage	3.3	5	5.5	V
VCC_SOC	VCC_SOC input Current		280		mA
VCC_RTC	RTC Voltage	3	3.3	5	V
Ta	Operating Temperature	-20		70	°C
Tstg	Storage Temperature	-40		85	°C

3.2 Reliability of Test

High Temperature Operating Test		
Contents	Operating 8h in high temperature	
Result	TBD	

Operating Life Test		
Contents	Operating in room	
Result	TBD	