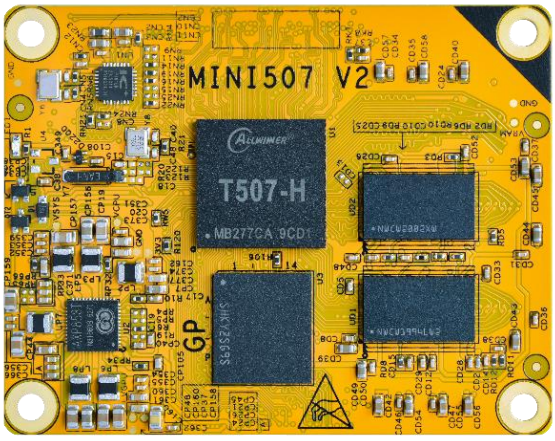
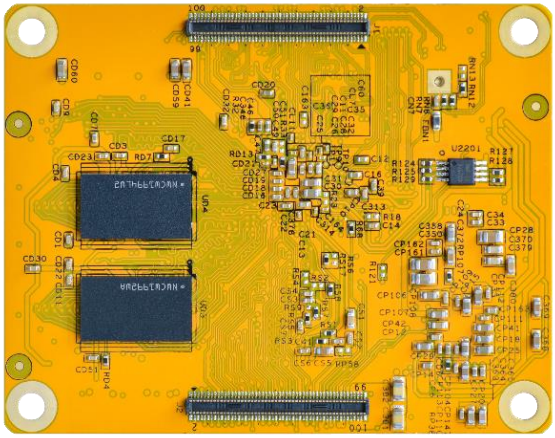
MINI507 Reference User Manual

V2.202610





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 MINI507 Introduction

1.1 Summary

The MINI507 system-on-module is equipped with Allwinner's T507, which features a quad-core Cortex-A53 CPU and a G31 MP2 GPU. It is designed specifically for smart devices such as industrial controllers, IoT devices, digital clusters, and automotive devices. The high-performance, low-power solution can help customers introduce new technologies more quickly and improve overall solution efficiency.
In particular, the T507 is AEC-Q100 qualified.

1.2 Features

- **Microprocessor**
  - Quad-core Cortex-A53 up to 1.5G
  - 32KB I-cache, 32KB D-cache, 512KB L2 cache

  Memory Organization
  - DDR4 RAM up to 4GB
  - EMMC up to 64GB
- **Boot ROM**
  - Supports system code download through USB OTG
- **Security ID**
  - Size up to 2Kbit for security chip ID
- **Video Decoder/Encoder**
  - Supports video decoding up to 4K@30fps
  - Supports H.264 encode
  - H.264 HP encoding up to 4K@25fps
  - Picture size up t0 4096x4096
- **Display Subsystem**
  - **Video Output**

  Supports HDMI 2.0 transmitter with HDCP 1.4, up to 4K@30fps (T507H option)
  Supports Serial RGB interface up to 800x640@60fps
  Supports LVDS interface Dual link up to 1920x1080@60fps and Single link up to 1366x768@60fps
  Supports RGB interface up to 1920x1080@60fps
  Supports BT656 interface up to 1920x1080@30fps
  Supports 1ch TV output with plug detecting
  - **Image in**

  Supports MIPI CSI input up to 8M@30fps or 4x1080P@25fps
  Supports parallel interfaces up to 1080P@30fps
  Supports BT656/BT1120
- **Analog audio**
  - One stereo headphone output
- **I2S/PCM/ AC97**

- Three I2S/PCM interface
- Support up to 8-CH DMIC
- One SPDIF input and output

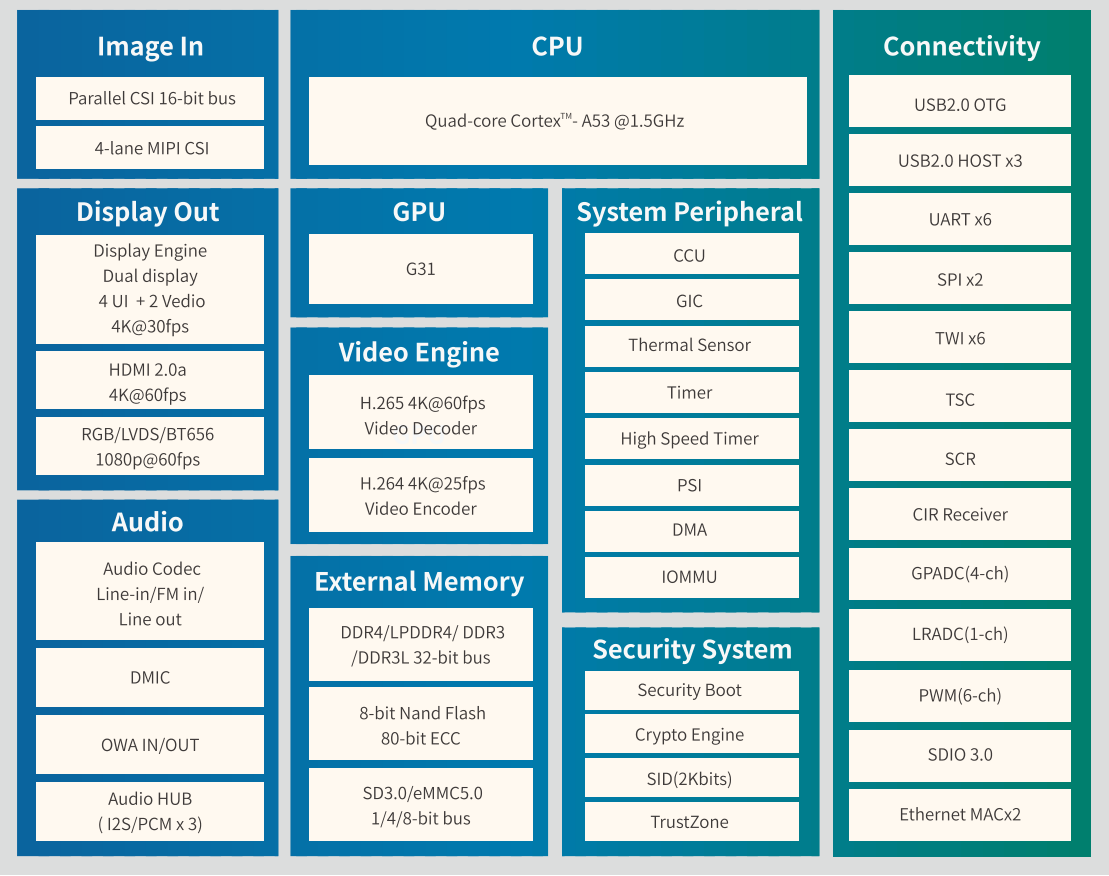
- **USB**
  - Four USB 2.0 interfaces
  - One USB 2.0 OTG, and three USB hosts
- **Ethernet**
  - Support two Ethernet interface
  - One 10/100M PHY on CPU Board
  - One GMAC/EMAC interface
- **I2C**
  - Up to five I2Cs
  - Support standard mode and fast mode(up to 400kbit/s)
- **Smart Card Reader**
  - Support ISO/IEC 7816-3 and EMV2000(4.0) specifications
  - Support synchronous and any other non-ISO 7816 and non-EMVcards
- **SPI**
  - Two SPI controllers, each SPI controller with two CS signals
  - Full-duplex synchronous serial interface
  - 3 or 4-wire mode
- **UART**
  - Up to 6 UART controllers
  - UART0/5 with 2 wires
  - UART1/2/3/4 each with 4 wires
  - UART0 default for debug
  - Compatible with industry-standard 16550 UARTs
  - Support RS485 mode on 4 wires UARTs
- **CIR**
  - One CIR controllers
  - Flexible receiver for consumer IR remote control
- **TSC**
  - Support multiple transport stream format
  - Support DVB-CSA V1.1/2.1 Descrambler
- **ADC**
  - Four ADC input
  - 12-bit resolution
  - Voltage input range between 0V to 1.8V
- **KEYADC**
  - One ADC channel for key application
  - 6-bit resolution
  - Voltage input range between 0V to 1.8V
  - Support ingle, normal and continuous mode
- **PWM**
  - 6 PWMs (**3** PWM pairs) with interrupt-based operation

- up to 24/100MHz output frequency
- Minimum resolution is 1/65536

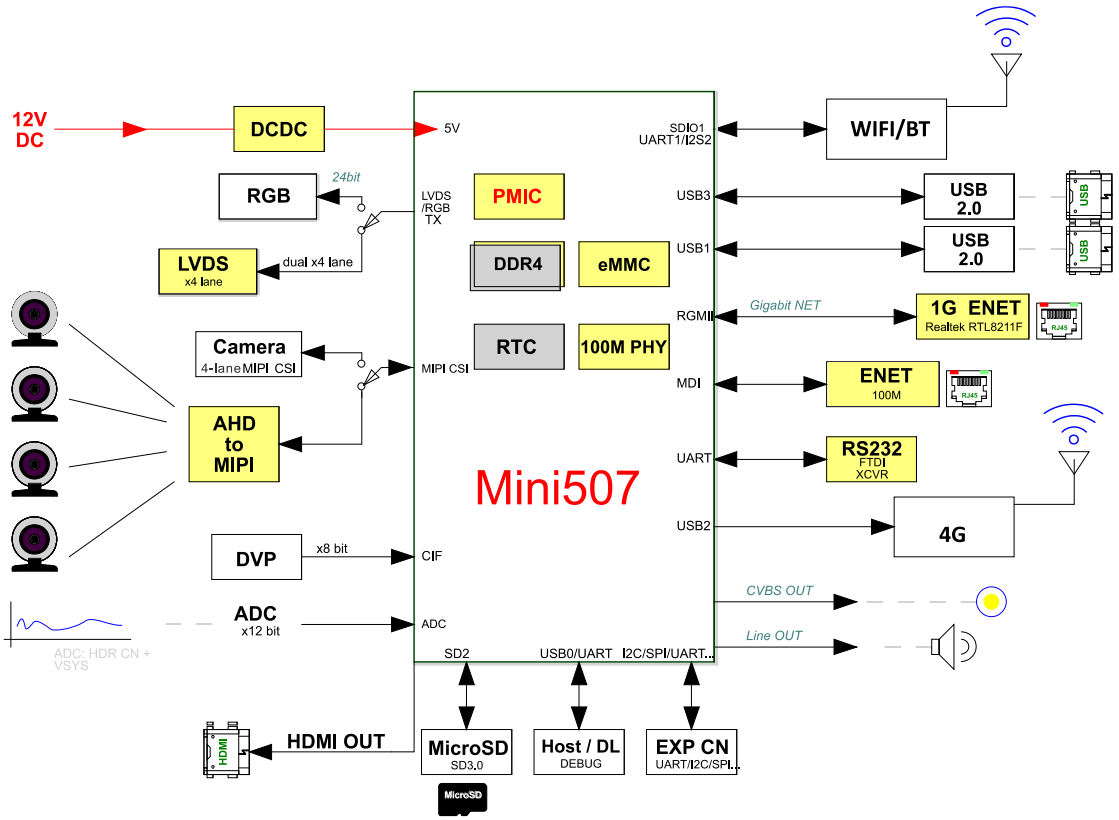
- **Interrupt Controller**
  - Support **28** interrupts
- **3D Graphics Engine**
  - ARM G31 MP2 supply
  - Support OpenGL ES 3.2/2.0/1.1, Vulkan1.1, Open CL 2.0 standard
- **Power unit**
  - AXP853T on board
  - OVP/UVP/OTP/OCP protections
  - DCDC6 0.5~3.4V@1A output
  - DCDC1 3.3V@300mA output for Carry board GPIO
  - ALDO5 0.5~3.3V@300mA output
  - BLDO5 0.5~3.3V@500mA output
  - Ext-RTC IC on board (option)
  - Very low RTC consume current, less 5uA at 3V button Cell (option)

1.3 Block Diagram

1.3.1 T507 Block Diagram



1.3.2 Development board (EMT507) Block Diagram

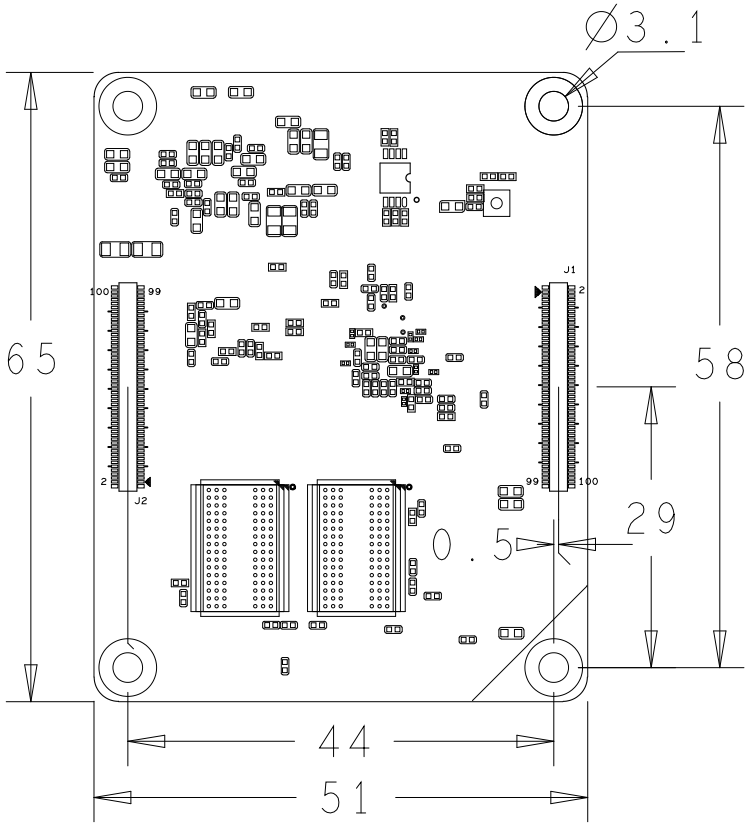


1.4 MINI507 specifications

Feature	Specifications
CPU	Quad-core Cortex-A53
DDR	2GB DDR4 (up to 4GB)
eMMC FLASH	8GB (up to 64GB)
Power	DC 5V
LVDS	Dual CH up to 4-Lane
I2S	3-CH
MIPI_CSI	1-CH
TSC	1-CH
HDMI out	1-CH(option)
Camera	1-CH(DVP)
USB	3-CH (USB HOST2.0), 1-CH(OTG 2.0)
Ethernet	1000M GMAC And 100M PHY
SDMMC	2-CH
SPDIF RX/TX	1-CH

I2C	5-CH
SPI	2-CH
UART	5-CH, 1-CH(DEBUG)
PWM	6-CH
ADC IN	4-CH
Board Dimension	51 x 65 mm

1.5 MINI507 PCB Dimension



--Top View--

1.6 MINI507 Pin Definition

J1	Signal	Description	Alternate functions	IO Voltage
1	MDI-RN	100M PHY MDI		1.8V
2	MDI-TN	100M PHY MDI		1.8V
3	MDI-RP	100M PHY MDI		1.8V
4	MDI-TP	100M PHY MDI		1.8V
5	LED0/PHYAD0	100M PHY Link LED-		3.3V
6	LED3/PHYAD3	100M PHY Speed LED+		3.3V
7	GND	Ground		0V

J1	Signal	Description	Alternate functions	IO Voltage
8	GND	Ground		0V
9	LVDS0-CLKN/LCD-D7	LVDS or RGB display interface	PD7/EINT7/TS0-D3	3.3V
10	LVDS0-D3N/LCD-D9	LVDS or RGB display interface	PD9/EINT9/TS0-D5	3.3V
11	LVDS0-CLKP/LCD-D6	LVDS or RGB display interface	PD6/EINT6/TS0-D2	3.3V
12	LVDS0-D3P/LCD-D8	LVDS or RGB display interface	PD8/EINT8/TS0-D4	3.3V
13	LVDS0-D2P/LCD-D4	LVDS or RGB display interface	PD4/EINT4/TS0-D0	3.3V
14	LVDS0-D1N/LCD-D3	LVDS or RGB display interface	PD3/EINT3/TS0-DVLD	3.3V
15	LVDS0-D2N/LCD-D5	LVDS or RGB display interface	PD5/EINT5/TS0-D1	3.3V
16	LVDS0-D1P/LCD-D2	LVDS or RGB display interface	PD2/EINT2/TS0-SYNC	3.3V
17	LVDS1-D3N/LCD-D19	LVDS or RGB display interface	PD19/EINT19	3.3V
18	LVDS0-D0N/LCD-D1	LVDS or RGB display interface	PD1/EINT1/TS0-EER	3.3V
19	LVDS1-D3P/LCD-D18	LVDS or RGB display interface	PD18/EINT18/SIM0-DET	3.3V
20	LVDS0-D0P/LCD-D0	LVDS or RGB display interface	PD0/EINT0/TS0-CLK	3.3V
21	LVDS1-D2N/LCD-D15	LVDS or RGB display interface	PD15/EINT15/SIM0-CLK	3.3V
22	LVDS1-CLKN/LCD-D17	LVDS or RGB display interface	PD17/EINT17/SIM0-RST	3.3V
23	LVDS1-D2P/LCD-D14	LVDS or RGB display interface	PD14/EINT14/SIM0-PWREN	3.3V
24	LVDS1-CLKP/LCD-D16	LVDS or RGB display interface	PD16/EINT16/SIM0-DATA	3.3V
25	LVDS1-D1N/LCD-D13	LVDS or RGB display interface	PD13/EINT13/SIM0-VPPPP	3.3V
26	LVDS1-D0N/LCD-D11	LVDS or RGB display interface	PD11/EINT11/TS0-D7	3.3V
27	LVDS1-D1P/LCD-D12	LVDS or RGB display interface	PD12/EINT12/SIM0-VPPEN	3.3V
28	LVDS1-D0P/LCD-D10	LVDS or RGB display interface	PD10/EINT10/TS0-D6	3.3V
29	LCD-D20	RGB display interface	PD20/EINT20	3.3V

J1	Signal	Description	Alternate functions	IO Voltage
30	LCD-D22	RGB display interface	PD22/EINT22	3.3V
31	LCD-D21	RGB display interface	PD21/EINT21	3.3V
32	LCD-D23	RGB display interface	PD23/EINT23	3.3V
33	LCD-PWM	PWM0	PD28/EINT28	3.3V
34	LCD-HSYNC	RGB display interface	PD26/EINT26	3.3V
35	GND	Ground		0V
36	LCD-VSYNC	RGB display interface	PD27/EINT27	3.3V
37	LCD-CLK	RGB display interface	PD24/EINT24	3.3V
38	LCD-DE	RGB display interface	PD25/EINT25	3.3V
39	GND	Ground		0V
40	GND	Ground		0V
41	USB3-DM	USB3 data -		3.3V
42	HTX2N	HDMI output data2-		1.8V
43	USB3-DP	USB3 data +		3.3V
44	HTX2P	HDMI output data2+		1.8V
45	USB2-DM	USB2 data -		3.3V
46	HTX1N	HDMI output data1-		1.8V
47	USB2-DP	USB2 data +		3.3V
48	HTX1P	HDMI output data1+		1.8V
49	USB1-DM	USB1 data -		3.3V
50	HTX0N	HDMI output data0-		1.8V
51	USB1-DP	USB1 data +		3.3V
52	HTX0P	HDMI output data0+		1.8V
53	USB0-DM	USB0 data -		3.3V
54	HTXCN	HDMI Clock -		1.8V
55	USB0-DP	USB0 data +		3.3V
56	HTXCP	HDMI Clock +		1.8V
57	GND	Ground		0V
58	HSDA	HDMI serial data	Need Pull up 5V	5V
59	UART0-TX	Debug Uart	PH0/EINT0/PWM3	3.3V
60	HSCL	HDMI serial CLK	Need Pull up 5V	5V
61	UART0-RX	Debug Uart	PH1/EINT1/PWM4	3.3V
62	HHPD	HDMI hot plug detect		5V
63	PH4	GPIO or SPDIF output	I2C3_SCL/PH-EINT4	3.3V
64	HCEC	HDMI consumer electronics control		3.3V
65	GND	Ground		0V
66	GND	Ground		0V
67	MCSI-D3N	MIPI CSI differential data 3N		1.8V
68	MCSI-D2N	MIPI CSI differential data 2N		1.8V
69	MCSI-D3P	MIPI CSI differential data 3P		1.8V
70	MCSI-D2P	MIPI CSI differential data 2P		1.8V

J1	Signal	Description	Alternate functions	IO Voltage
71	MCSI-CLKN	MIPI CSI differential clock N		1.8V
72	MCSI-D1N	MIPI CSI differential data 1N		1.8V
73	MCSI-CLKP	MIPI CSI differential clock P		1.8V
74	MCSI-D1P	MIPI CSI differential data 1P		1.8V
75	GND	Ground		0V
76	MCSI-D0N	MIPI CSI differential data 0N		1.8V
77	UART5-RX	UART5 or SPDIF in or I2C2SDA	PH3/EINT3/PWM1	3.3V
78	MCSI-D0P	MIPI CSI differential data 0P		1.8V
79	UART5-TX	UART5 or SPDIF CLK or I2C2SCL	PH2/EINT2/PWM2	3.3V
80	PH-I2S3-DOUT0	I2S-D0 or DIN1/SPI1-MISO	PH8/EINT8/CTS2	3.3V
81	LINEOUTR	Audio Analog R line output	Need Coupling CAP	1.8V
82	PH-I2S3-MCLK	I2S-CLK/SPI1-CS0/UART2-TX	PH5/EINT5/I2C3SDA	3.3V
83	LINEOUTL	Audio Analog L line output	Need Coupling CAP	1.8V
84	PH-I2S3-DIN0	I2S-D1 or DIN0/SPI1-CS1	PH9/EINT9	3.3V
85	AGND	Audio Ground		0V
86	PH-I2S3-LRLK	I2S-CLK/SPI1MOSI/UART2RTS	PH7/EINT7/I2C4SDA	3.3V
87	PC3	Boot-SEL1/SPI0-CS0	PC-EINT3	1.8V
88	PH-I2S3-BCLK	I2S-CLK/SPI1-CLK/UART2-RX	PH6/EINT6/I2C4SCL	3.3V
89	PC4	Boot-SEL2/SPI0-MISO	PC-EINT4	1.8V
90	LRADC	Key 6bit ADC input		1.8V
91	GPADC3	General 12bit ADC3 in		1.8V
92	GPADC1	General 12bit ADC1 in		1.8V
93	GPADC0	General 12bit ADC0 in		1.8V
94	GPADC2	General 12bit ADC2 in		1.8V
95	TV-OUT	CVBS output		1.0V
96	PA/TWI3-SDA		PA11/EINT11	3.3V
97	IR-RX	IR input	PH10/EINT10	3.3V
98	PA/TWI3-SCK		PA10/EINT10	3.3V
99	PC7	SPI0-CS1	PC-EINT7	1.8V
100	GND	Ground		0V
J2	**Signal**	**Description**	**Alternate functions**	**IO Voltage**
1	PE13	CSI0-D9	PE13/EINT14	3.3V
2	GND	Ground		0V
3	PE14	CSI0-D10	PE14/EINT15	3.3V
4	SPI0_CLK_1V8		PC0/EINT0	1.8V
5	PE15	CSI0-D11	PE-EINT16	3.3V
6	PE12	CSI0-D8	PE-EINT13	3.3V
7	PE0	CSI0-PCLK	PE-EINT1	3.3V
8	PE18	CSI0-D14	PE-EINT19	3.3V
9	PE16	CSI0-D12	PE-EINT17	3.3V
10	PE19	CSI0-D15	PE-EINT20	3.3V

J2	Signal	Description	Alternate functions	IO Voltage
11	PE17	CSI0-D13	PE-EINT18	3.3V
12	PE8	CSI0-D4	PE-EINT9	3.3V
13	SDC0-DET	SD card detection	PF6/EINT6	3.3V
14	PE3	CSI0-VSYNC	PE-EINT4	3.3V
15	GND	Ground		0V
16	PE2	CSI0-HSYNC	PE-EINT3	3.3V
17	SDC0-D0	SD Data0	PF1/EINT1	3.3V
18	PE1	CSI0-MCLK	PE-EINT2	3.3V
19	SDC0-D1	SD Data1	PF0/EINT0	3.3V
20	SPI0_MOSI_1V8		PC2/EINT2	1.8V
21	SDC0-D2	SD Data2	PF5/EINT5	0V
22	PE4	CSI0-D0	PE-EINT5	3.3V
23	SDC0-D3	SD Data3	PF4/EINT4/	3.3V
24	PE5	CSI0-D1	PE-EINT6	3.3V
25	SDC0-CMD	SD Command Signal	PF3/EINT3	3.3V
26	PE7	CSI0-D3	PE-EINT8	3.3V
27	SDC0-CLK	SD Clock output	PF2/EINT2	3.3V
28	PE6	CSI0-D2	PE-EINT7	3.3V
29	GND	Ground		0V
30	PE9	CSI0-D5	PE-EINT10	3.3V
31	EPHY-CLK-25M	UART4CTS/CLK-Fanout1	PI16/EINT16/TS0-D7	3.3V
32	PE10	CSI0-D6	PE-EINT11	3.3V
33	RGMII-MDIO	UART4RTS/CLK-Fanout0	PI15/EINT15/TS0-D6	3.3V
34	PE11	CSI0-D7	PE-EINT12	3.3V
35	RGMII-MDC	UART4-RX/PWM4	PI14/EINT14/TS0-D5	3.3V
36	CK32KO	I2S2-MCLK/AC-MCLK	PG10/EINT10	1.8V
37	RGMII-RXCK	H-I2S0-DIN0/DO1	PI4/EINT4/DMIC-D3	3.3V
38	GND	Ground		0V
39	RGMII-RXD3	H-I2S0-MCLK	PI0/EINT0/DMICCLK	3.3V
40	PG-MCSI-SCK	I2C3-SCL/UART2-RTS	PG17/EINT17	1.8V
41	RGMII-RXD2	H-I2S0-BCLK	PI1/EINT1/DMIC-D0	3.3V
42	PG-MCSI-SDA	I2C3-SDA/UART2-CTS	PG18/EINT18	1.8V
43	RGMII-RXD1	RMII-RXD1/H-I2S0-LRCK	PI2/EINT2/DMIC-D1	3.3V
44	PE-TWI2-SCK	CSI0-SCK	PE20-EINT21	3.3V
45	RGMII-RXD0	RMII-RXD0/H-I2S0-DO0/DIN1	PI1/EINT1/DMIC-D2	3.3V
46	PE-TWI2-SDA	CSI0-SDA	PE21-EINT22	3.3V
47	RGMII-RXCTL	RMII-CRS/UART2TX/I2C0SCL	PI5/EINT5/TS0-CLK	3.3V
48	BT-PCM-CLK	H-I2S2-BCLK/AC-SYNC	PG11/EINT11	1.8V
49	GND	Ground		0V
50	BT-PCM-SYNC	H-I2S2-LRCLK/AC-ADCL	PG12/EINT12	1.8V
51	RGMII-TXCK	RMII-TXCK/UART3RTS/PWM1	PI11/EINT11/TS0-D2	3.3V
52	BT-PCM-DOUT	H-I2S2-DO0/DIN1/AC-ADCR	PG13/EINT13	1.8V

J2	Signal	Description	Alternate functions	IO Voltage
53	RGMII-TXCTL	RMII-TXEN/UART3CTS/PWM2	PI12/EINT12/TS0-D3	3.3V
54	BT-PCM-DIN	H-I2S2-DO1/DIN0/AC-ADCX	PG14/EINT14	1.8V
55	RGMII-TXD3	UART2-RTS/I2C1-SCL	PI7/EINT7/TS0SYNC	3.3V
56	BT-UART-RTS	UART1-RTS/PLL-LOCK-DBG	PG8/EINT8	1.8V
57	RGMII-TXD2	UART2-CTS/I2C1-SDA	PI8/EINT8/TS0DVLD	3.3V
58	BT-UART-CTS	UART1-CTS/AC-ADCY	PG9/EINT9	1.8V
59	RGMII-TXD1	RMII-TXD1/UART3TX/I2C2SCL	PI9/EINT9/TS0-D0	3.3V
60	BT-UART-RX	UART1-RX	PG7/EINT7	1.8V
61	RGMII-TXD0	RMII-TXD0/UART3RX/I2C2SDA	PI10/EINT10/TS0-D1	3.3V
62	BT-UART-TX	UART1-TX	PG6/EINT6	1.8V
63	GND	Ground		0V
64	GND	Ground		0V
65	RGMII-CLKIN-125M	UART4-TX/PWM3	PI13/EINT13/TS0-D4	3.3V
66	WL-SDIO-D0	SDC1-D0	PG2/EINT2	1.8V
67	PHYRSTB	RMII-RXER/UART2-RX/I2C0-SDA	PI6/EINT6/TS0-EER	3.3V
68	WL-SDIO-D1	SDC1-D1	PG3/EINT3	1.8V
69	GND	Ground		0V
70	WL-SDIO-D2	SDC1-D2	PG4/EINT4	1.8V
71	MCSI-MCLK	PWM1	PG19/EINT19	1.8V
72	WL-SDIO-D3	SDC1-D3	PG5/EINT5	1.8V
73	GND	Ground		0V
74	WL-SDIO-CMD	SDC1-CMD	PG1/EINT1	1.8V
75	PG-TWI4-SCK	I2C4-SCL/UART2-TX	PG15/EINT15	1.8V
76	WL-SDIO-CLK	SDC1-CLK	PG0/EINT0	1.8V
77	PG-TWI4-SDA	I2C4-SDA/UART2-RX	PG16/EINT16	1.8V
78	GND	Ground		0V
79	FEL	Boot mode select: Low: download from USB, High: fast boot		3.3V
80	ALDO5	PMU ALDO5 default 1.8V output	Max:300mA	1.8V
81	EXT-IRQ	External IRQ input		OD
82	BLDO5	PMU ALDO5 default 1.2V output	Max:500mA	1.2V
83	PMU-PWRON	Connect to Power Key		1.8V
84	GND	Ground		0V
85	RTC-BAT	RTC battery input		1.8-3.3V
86	VSYS_3V3	System 3.3V output	Max: 300mA	3.3V
87	GND	Ground		0V
88	DCDC6	PMU DCDC6 out(default 3V3)	Max: 2000mA	3.3V
89	SOC-RESET	System Reset output	Connect to RST key	1.8V
90	DCDC6	PMU DCDC6 out(default 3V3)	Max: 2000mA	3.3V
91	GND	Ground		0V

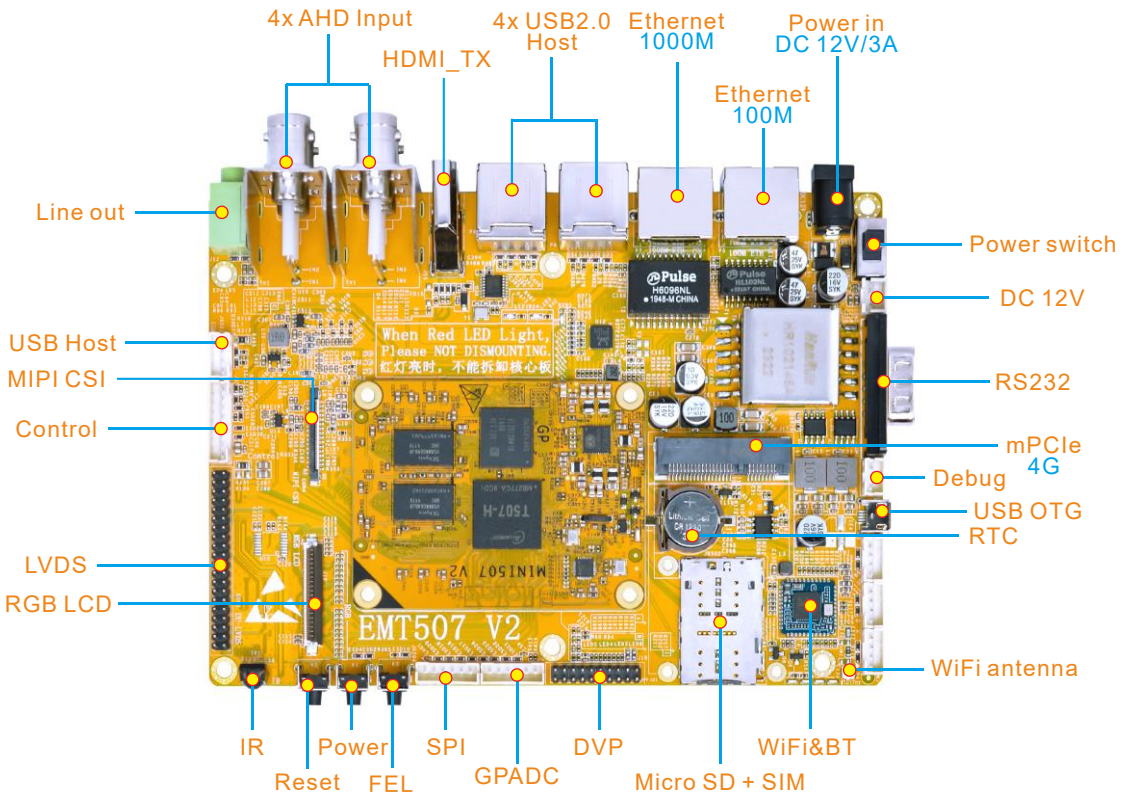
J2	Signal	Description	Alternate functions	IO Voltage
92	GND	Ground		0V
93	DCIN	Main Power input		3.4V-5.5V
94	DCIN	Main Power input		3.4V-5.5V
95	DCIN	Main Power input		3.4V-5.5V
96	DCIN	Main Power input		3.4V-5.5V
97	DCIN	Main Power input		3.4V-5.5V
98	DCIN	Main Power input		3.4V-5.5V
99	DCIN	Main Power input		3.4V-5.5V
100	DCIN	Main Power input		3.4V-5.5V

Note

1. J1 Pin87/89(PC3/PC4) is Boot-SEL associated, please do not pull H or L.

2. PC/PG unit is 1.8V level default, but can change to 3.3V.

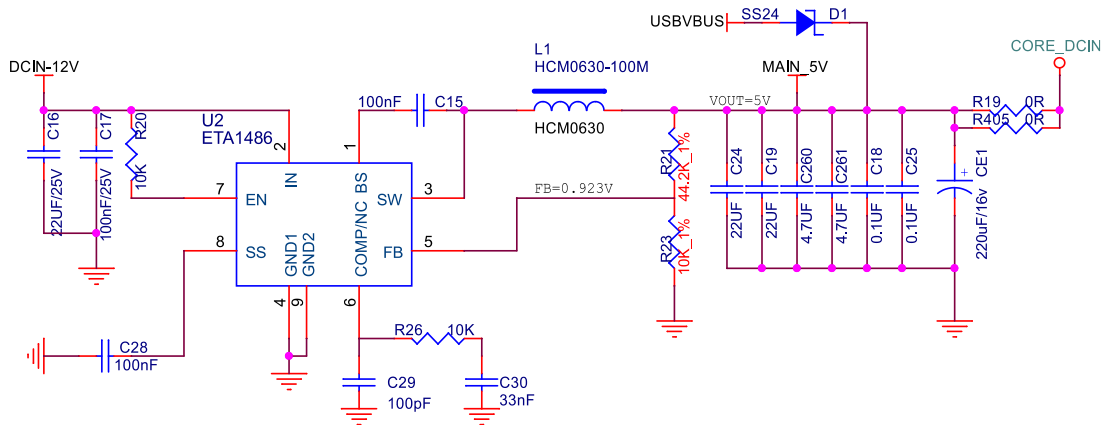
1.7 Development Kit (EMT507)



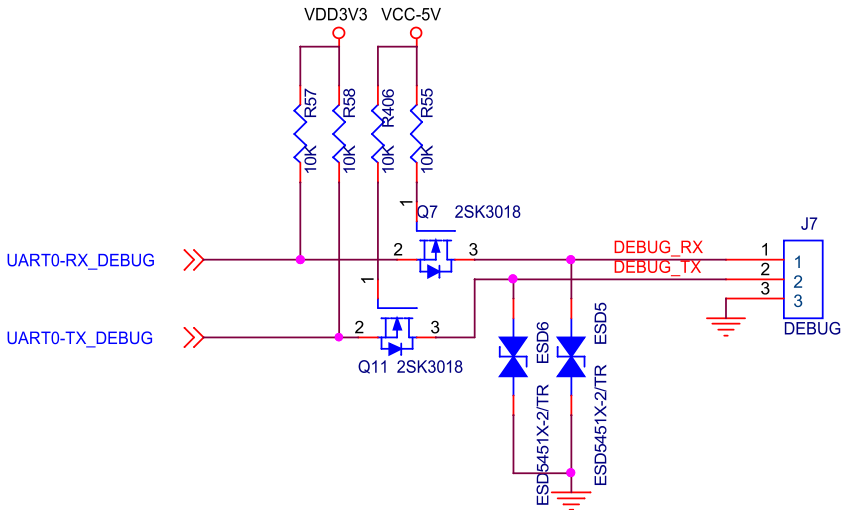
2 Hardware Design Guide

2.1 Peripheral Circuit Reference

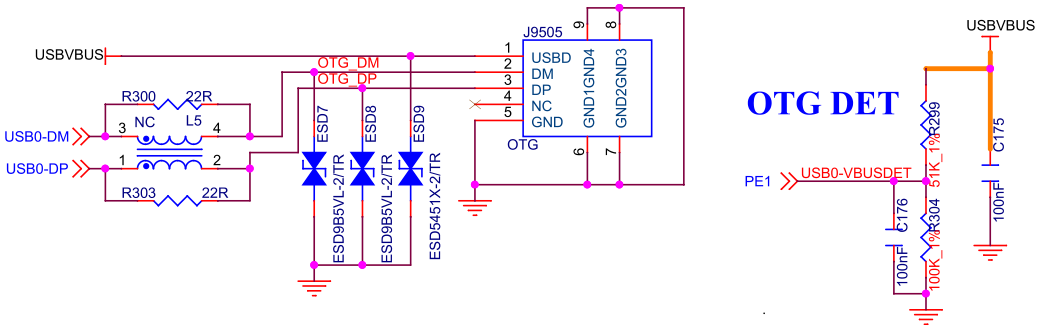
2.1.1 External Power



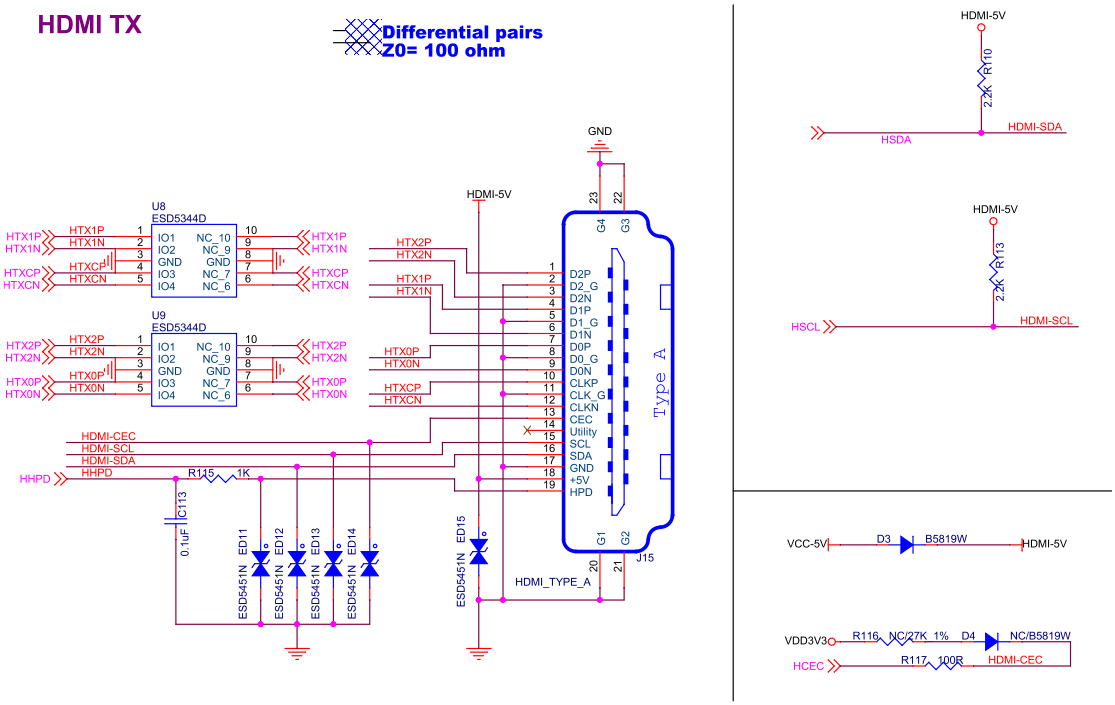
2.1.2 Debug Circuit



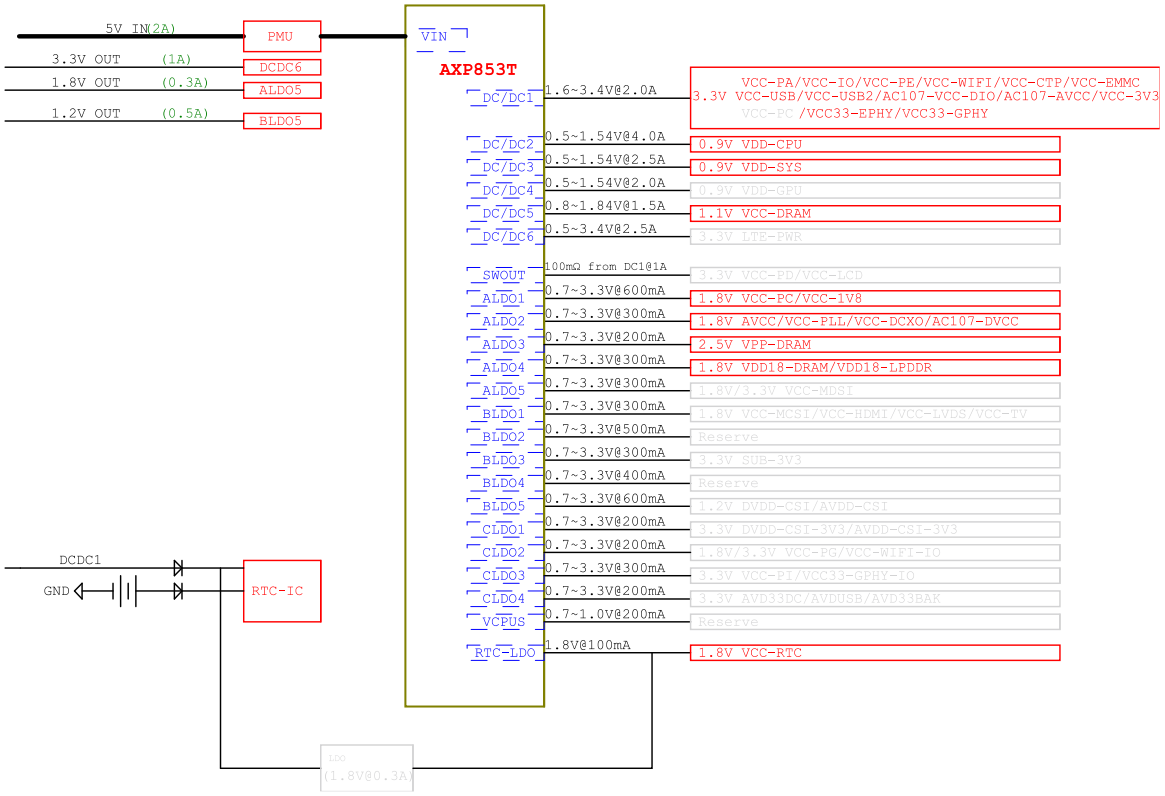
2.1.3 USB OTG Interface Circuit



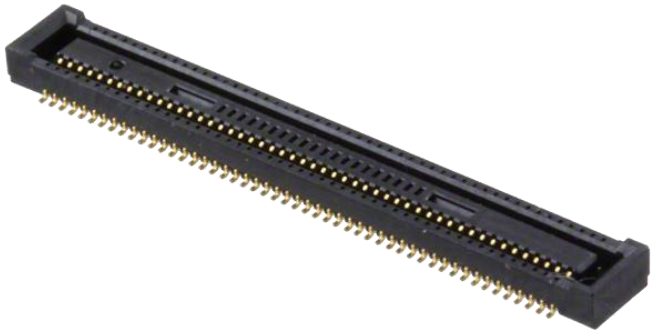
2.1.4 HDMI Interface Circuit



2.2 Power Tree



2.3 B2B connector for carrier board



DF40C-100DS-0.4V

3 Product Electrical Characteristics

3.1 Dissipation and Temperature

Symbol	Parameter		Min	Typ	Max	Unit
DCIN	System Voltage		3.4	5	5.5	V
VSYS_3V3	System IO Voltage		3.3-5%	3.3	3.3+5%	V
DCDC6_3V3	Peripheral Voltage		3.3-5%	3.3	3.3+5%	V
ALDO5	Camera IO Voltage		0.5	1.8	3.3	V
BLDO5	Camera Core Voltage		0.5	1.2	3.3	V
Idcin	DCIN input Current			500		mA
VCC_RTC	RTC Voltage		1.8	3	3.4	V
Iirtc	RTC input Current			TDB		uA
Ta	Operating Temperature	Commercial	0	NA	70	°C
		Industrial	-40	NA	85	°C
Tstg	Storage Temperature		-40		120	°C