

THine

High Speed Interface Evaluation Kit

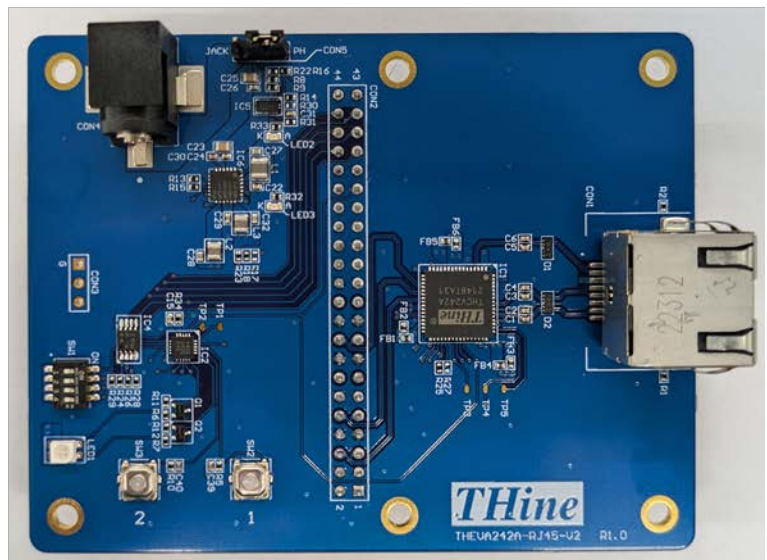


THEVA24-RJ45-SET-V2 Hardware Manual

THEVA241A-RJ45-V2



THEVA242A-RJ45-V2





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1. Purpose of This Document

The purpose of this document is to provide the hardware information of Camera SerDes Starter Kit System shown in Figure 1 so that a user can evaluate long-distance data transmission from a MIPI CSI-2 camera module. Tx board has THCV241A-P. Rx board has THCV242A-P. This document provides the way to set up the kit, and the information on two boards functions, schematics, and parts locations.

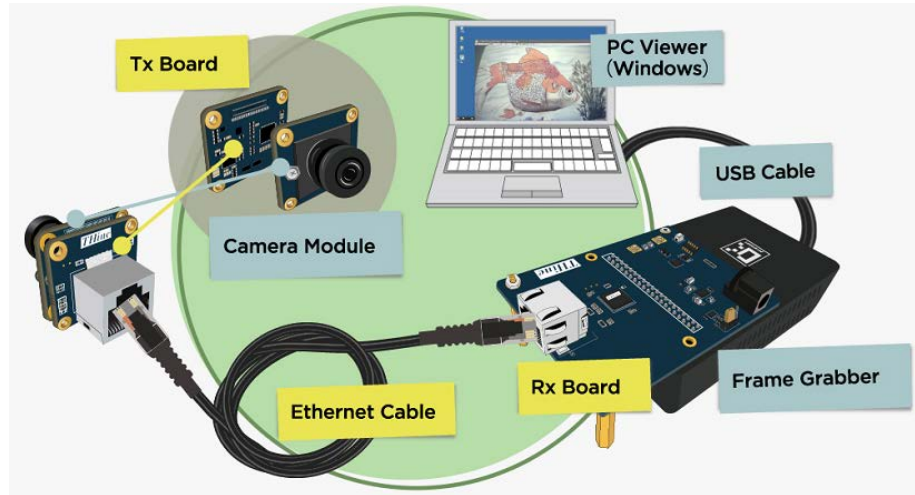


Figure 1 System Configuration

THEVA24-RJ45-SET-V2 does not include a Camera Module, Frame Grabber, USB Cable, and PC in Figure 1.

2. Contents in the Kit

THEVA24-RJ45-SET-V2 has the items listed in Table 1 in the box.

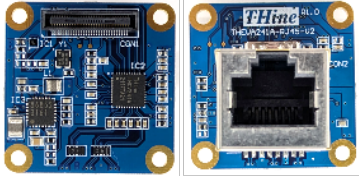
No.	Item	Qty.	Description
1	THEVA241A-RJ45-V2	1	Tx Board THCV241A-P is on the board to convert MIPI® CSI-2 to V-by-One® HS. 
2	THEVA242A-RJ45-V2	1	Rx Board THCV242A-P is on the board to convert V-by-One® HS to MIPI® CSI-2. 
3	Cable	1	2-meter Ethernet Cable (Cat5e / Straight Cable) 
4	Spacer	6	M2 4 mm x 4 pcs / M3 30 mm x 2 pcs 
5	Screw	10	M2 9 mm x 4 pcs / M3 4 mm x 2 pcs / M3 8 mm x 4 pcs 
6	Nut	4	M2 x 4 pcs 
7	Document	1	-

Table 1 Items in the Box

3. System Block Diagram

Figure 1 shows the block diagram to evaluate the MIPI CSI-2 long-distance transmission with this kit.

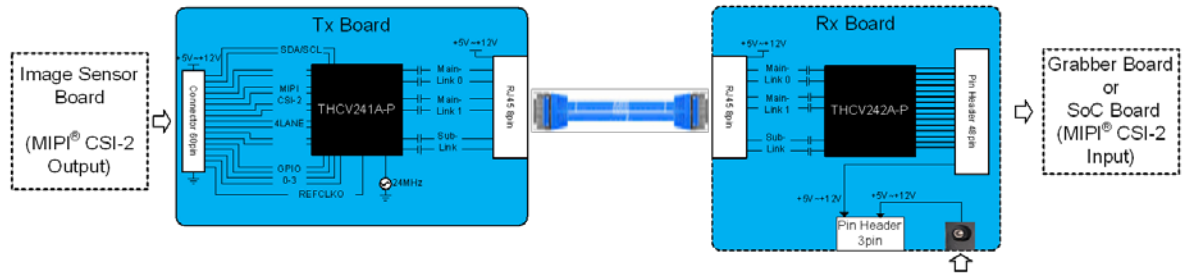


Figure 2 System Block Diagram for Evaluation

The following items in Figure 1 are not in this kit.

- ✓ The Image Sensor Board as the MIPI CSI-2 Signal Source
- ✓ The Grabber Board (e.g. UC930 with PC) or SoC Board to Receive MIPI CSI-2 , Process, Display and Control the System

The power source(+5 V~ +12 V) for the kit is selectable from the 44-pin header connected to the Grabber board or DC jack. The Rx board supplies the power for the Tx board and the image sensor board via the Ethernet cable.

4. Tx Board Functions

4.1 Connectors

The Tx board has CON1 and CON2 connectors to interface the image sensor board and Rx board as Figure 3. CON1 is the board-to-board connector for the image sensor board. Table 2 shows the pin mapping in case user design user's image sensor board. CON2 is the RJ45 connector for the Ethernet cable to interface the Rx board. Table 3 shows the pin mapping of CON2.

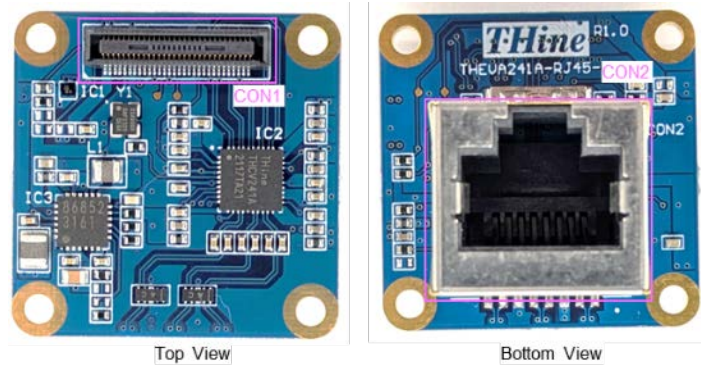


Figure 3 Tx Board Top View and Bottom View

Pin No.	Node Name	Type ^{*1}	Description	Pin No.	Node Name	Type ^{*1}	Description
1	NC	P	+5V Power Supply	31	NC	-	Not Connected
2	NC	P	+3.3V Power Supply	32	NC	-	Not Connected
3	NC	P	+5V Power Supply	33	NC	-	Not Connected
4	NC	P	+3.3V Power Supply	34	NC	-	Not Connected
5	T2V9	P	+2.9V Power Supply	35	SLAMODE	PD	Select Slave Address
6	T1V2	P	+1.2V Power Supply	36	GND	G	Ground
7	T2V9	P	+2.9V Power Supply	37	GND	G	Ground
8	T1V2	P	+1.2V Power Supply	38	GND	G	Ground
9	T1V8	P	+1.8V Power Supply	39	REFCLKO	O	Master Clock Output
10	NC	-	Not Connected	40	NC	-	Not Connected
11	GND	G	Ground	41	NC	-	Not Connected
12	GND	G	Ground	42	NC	-	Not Connected
13	GND	G	Ground	43	GND	G	Ground
14	GND	G	Ground	44	GND	G	Ground
15	XCLR	B	Sensor Clear	45	NC	-	Not Connected
16	NC	-	Not Connected	46	TCAM_D3_P	MI	MIPI® Positive Data Input Lane3
17	NC	-	Not Connected	47	NC	-	Not Connected
18	NC	-	Not Connected	48	TCAM_D3_N	MI	MIPI® Negative Data Input Lane3
19	GND	G	Ground	49	GND	G	Ground
20	NC	-	Not Connected	50	GND	G	Ground
21	CAM_SCL	B	2-Wire Serial I/F SCL	51	TCAM_D0_N	MI	MIPI® Negative Data Input Lane0
22	NC	-	Not Connected	52	TCAM_D1_N	MI	MIPI® Negative Data Input Lane1
23	XCE	-	I2C Enable for only IMX327	53	TCAM_D0_P	MI	MIPI® Positive Data Input Lane0
24	GPIO1	B	General Purpose I/O	54	TCAM_D1_P	MI	MIPI® Positive Data Input Lane1
25	XVS	TP	Vertical Sync Signal of IMX Sensor(TP3)	55	GND	G	Ground

26	GPIO2	B	General Purpose I/O	56	GND	G	Ground
27	CAM_SDA	B	2-Wire Serial I/F SDA	57	TCAM_D2_P	MI	MIPI® Positive Data Input Lane2
28	GPIO3	B	General Purpose I/O	58	TCAM_C_P	MI	MIPI® Positive Clock Input
29	XHS	TP	Horizontal Sync Signal of IMX Sensor(TP5)	59	TCAM_D2_N	MI	MIPI® Negative Data Input Lane2
30	NC	-	Not Connected	60	TCAM_C_N	MI	MIPI® Negative Clock Input

Table 2 Tx Board CON1 Pin Mapping for Image Sensor Board

Pin No.	Node Name	Type ^{*1}	Description
1	TCM_C_P	CB	CML Bi-directional Positive Input/Output (Sub-Link)
2	TCM_C_N	CB	CML Bi-directional Negative Input/Output (Sub-Link)
3	VIN_TX	P	Power Supply (+5 V~+12 V)
4	TX1_C_P	CO	V-by-One® HS Lane1 High-speed CML Positive Signal Output
5	TX1_C_N	CO	V-by-One® HS Lane1 High-speed CML Negative Signal Output
6	GND	G	Ground
7	TX0_C_P	CO	V-by-One® HS Lane0 High-speed CML Positive Signal Output
8	TX0_C_N	CO	V-by-One® HS Lane0 High-speed CML Negative Signal Output

Table 3 Tx Board CON2 Pin Mapping

*1 Abbreviation Note

MI: MIPI input, CO: CML Output

MO: MIPI output, CI: CML Input

CB: CML Bi-directional Input/Output

B: 1.8V LVCMOS Bi-directional Input/Output

O: LVCMOS Output

P: Power, G: Ground

TP: Test Point, PD: Pull Down(External circuit)

4.2 Clock for Image Sensor Board

There is a 24MHz oscillator to supply clock for THC241A-P CKI pin and the image sensor board. User should remove the R7 resistor in Figure 4 to cut the clock line to the image sensor board if the image sensor board outputs a signal (e.g. a clock signal) from REFCLKO.



Figure 4 R7 Resistor to Supply Clock to Image Sensor Board

5. Rx Board Functions

5.1 Connectors

Rx board has CON1 and CON2 connectors to interface the Grabber board(e.g. UC930), or an SoC board and the Tx board as Figure 5. CON1 is the RJ45 connector to interface Tx board via the Ethernet cable. Table 4 shows the pin mapping of CON1. CON2 is the 44-pin header to interface the Grabber board. The CON2 pin mapping is shown in Table 5. User can connect the CON2 with the UC930 Grabber board without any modification to use the kit.

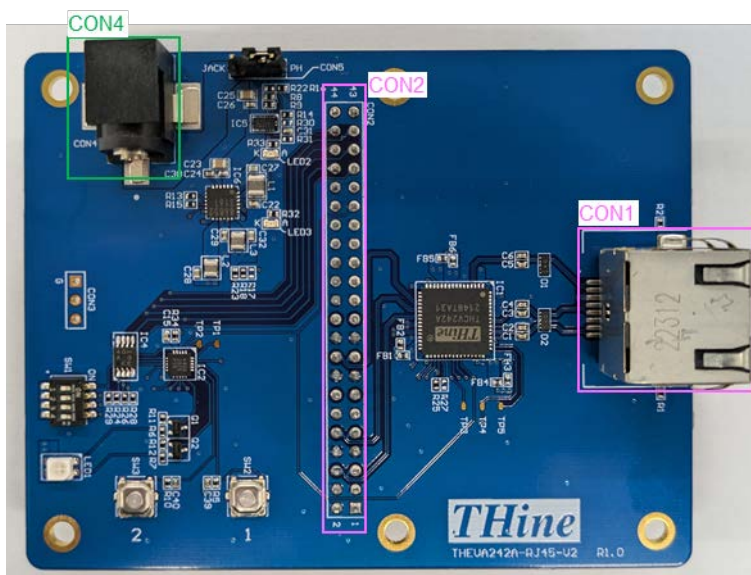


Figure 5 Rx Board Top View

Pin No.	Node Name	Type ¹	Description
1	RCM_C_P	CB	CML Bi-directional Positive Input/Output (Sub-Link)
2	RCM_C_N	CB	CML Bi-directional Negative Input/Output (Sub-Link)
3	VOUT	P	Power Supply (+5 V~+12 V)
4	RX1_C_P	CI	V-by-One [®] HS Lane1 High-speed CML Positive Signal Input
5	RX1_C_N	CI	V-by-One [®] HS Lane1 High-speed CML Negative Signal Input
6	GND	G	Ground
7	RX0_C_P	CI	V-by-One [®] HS Lane0 High-speed CML Positive Signal Input
8	RX0_C_N	CI	V-by-One [®] HS Lane0 High-speed CML Negative Signal Input

Table 4 Rx Board CON1 Pin Mapping

Pin No.	Node Name	Type ^{*1}	Description	Pin No.	Node Name	Type ^{*1}	Description
1	OISVDD	NC	Not Connected	23	GRB_VPP2	NC	Not Connected
2	OISVDD	NC	Not Connected	24	GRB_VPP2	NC	Not Connected
3	NC	-	Not Connected	25	AVDD	NC	Not Connected
4	NC	-	Not Connected	26	AVDD	NC	Not Connected
5	MTXC_N	MO	MIPI® Negative Clock Output	27	DOVDD	NC	Not Connected
6	MTXC_P	MO	MIPI® Positive Clock Output	28	DOVDD	NC	Not Connected
7	GND	G	Ground	29	DVDD	NC	Not Connected
8	GND	G	Ground	30	DVDD	NC	Not Connected
9	MTX0_N	MO	MIPI® Negative Data Output Lane0	31	AFVCC	NC	Not Connected
10	MTX0_P	MO	MIPI® Positive Data Output Lane0	32	AFVCC	NC	Not Connected
11	NC	-	Not Connected	33	CV242_GPIO 2	B	General Purpose I/O
12	NC	-	Not Connected	34	MCLK	NC	Not Connected
13	MTX1_N	MO	MIPI® Negative Data Output Lane1	35	GRB_PWDN	-	Power Supply Enable (IC5)
14	MTX1_P	MO	MIPI® Positive Data Output Lane1	36	GRB_RST	-	THCV242A PDN Pin Control(option)
15	GND	G	Ground	37	CV242_SCL	B	2-wire Serial I/F Clock
16	GND	G	Ground	38	CV242_SDA	B	2-wire Serial I/F Data
17	MTX2_N	MO	MIPI® Negative Data Output Lane2	39	CV242_ERR0	O	Internal Error/Status Signal Monitoring
18	MTX2_P	MO	MIPI® Positive Data Output Lane2	40	CV242_GPIO 1	B	General Purpose I/O
19	GND	G	Ground	41	CV242_GPIO 0	B	General Purpose I/O
20	GND	G	Ground	42	CV242_INT0	O	Interrupt Signal Output

21	MTX3_N	MO	MIPI® Negative Data Output Lane3	43	NC	-	Not Connected
22	MTX3_P	MO	MIPI® Positive Data Output Lane3	44	AVDD2	NC	Not Connected

Table 5 Rx Board CON2 Pin Mapping for Grabber Board

*1 Abbreviation Note

MI: MIPI input, CO: CML Output

MO: MIPI output, CI: CML Input

CB: CML Bi-directional Input/Output

B: 1.8V LVCMOS Bi-directional Input/Output

O: LVCMOS Output

P: Power, G: Ground

TP: Test Point, PD: Pull Down(External circuit)

[Optional] Rx board also has a CON4 connector to supply power with an AC adapter(12 V) in case there is no power in the mated connector of CON2. User can select the power supply connector CON2 or CON4 with CON5 shown with the pink rectangle in Figure 6.

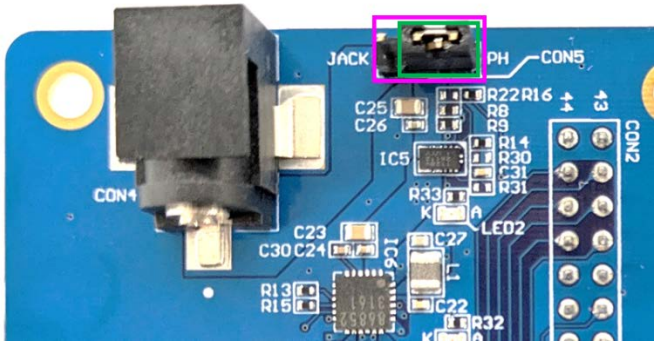


Figure 6 CON5 3-Pin Header to Switch the Power Source Connector

The CON5 center pin(No. 2) is shorted to the pin of the PH silk side (No. 3) in the factory as the green rectangle in Figure 6. The factory setup is to use power supply pin of CON2. User should change the pin socket to short CON5 center pin(No. 2) with JACK silk side pin(No. 1) if user supplies power from CON4.

5.2 Power Indicator LEDs for 5 V and 3.3 V

The LED2 and LED3 indicate whether the 3.3 V and 5 V power regulators are working or not as shown in Figure 7.

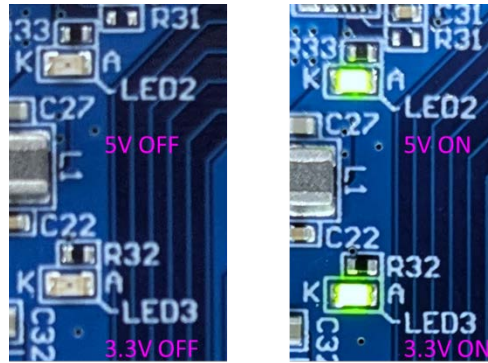


Figure 7 5V LED (LED2) and 3.3V LED (LED3)

5.3 THCV242A-P I2C Target Address

The THCV242A-P I2C target address is set to 0x65(7bit) in the factory.

[Optional] User can change the I2C target address to 0x34(7bit) if user mount a 0 ohm resistor on the R27 and remove R25. The setting files in the download page assume that the THCV242A-P I2C target address is 0x65(7bit). The R25 and R27 lands are green rectangles in Figure 7.



Figure 8 THCV242A-P I2C Target Address Setting Resistors

5.4 [Optional] Power Switch Enable Pull-up Resistor

User can add the R22 pull-up resistor in between the enable of the power switch and the power supply (+5V ~ +12 V). The R22 lands are the green rectangle in Figure 7. This pull-up resistor is not mounted in the factory because the signal from CON2 can control the power switch.

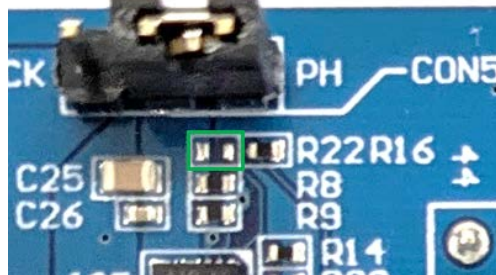
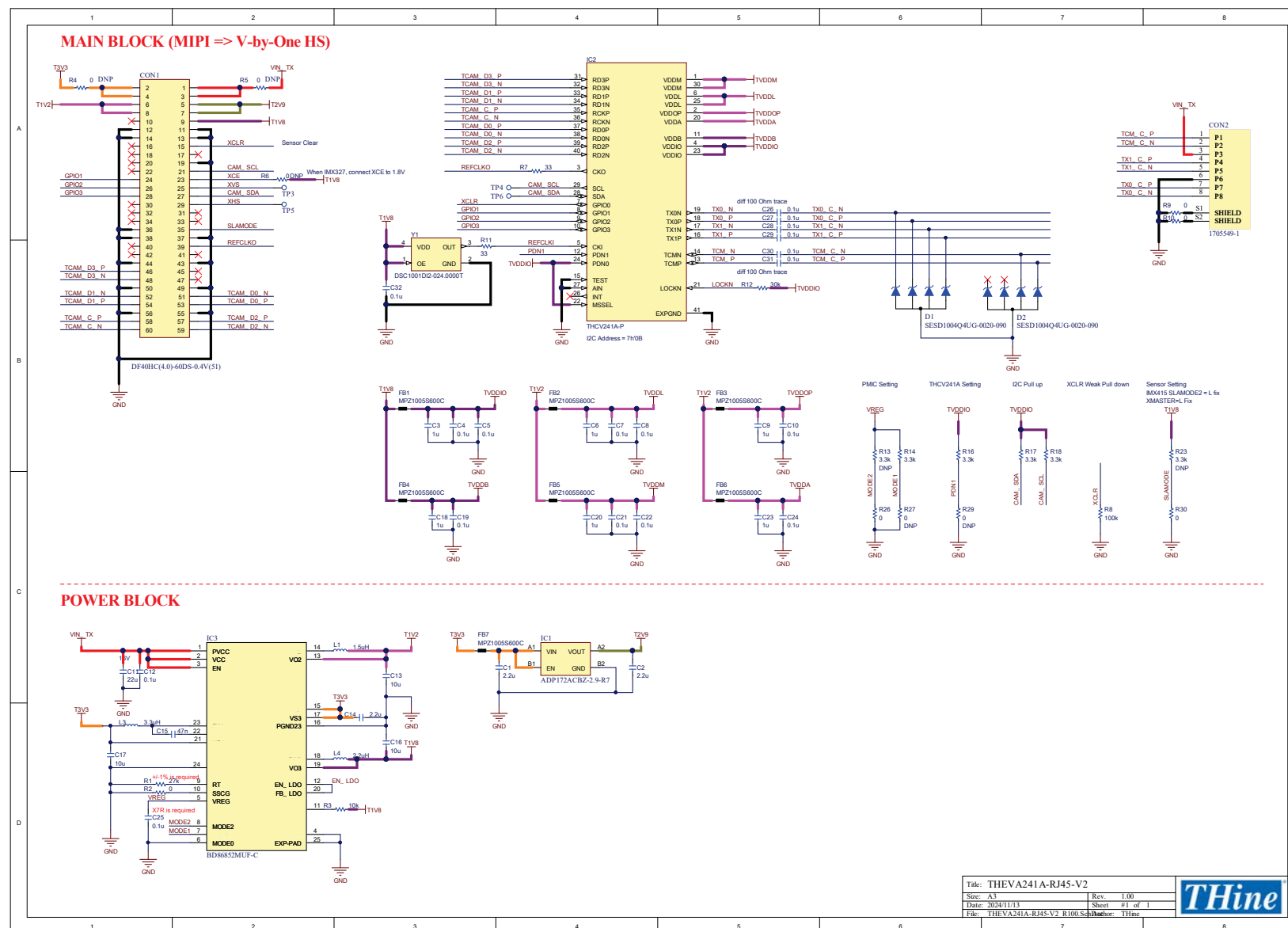
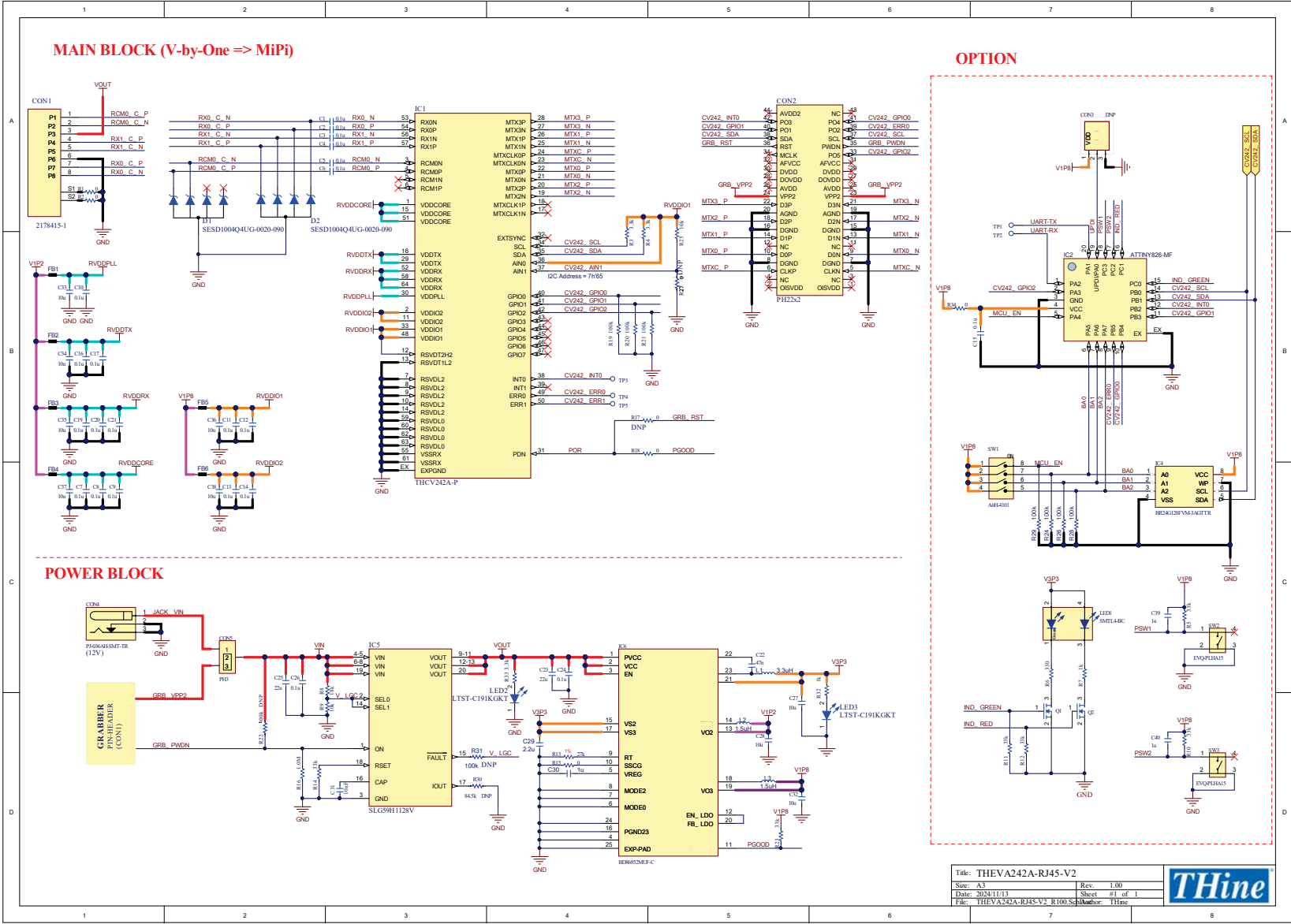


Figure 9 R22 Pull-up Resistor Location

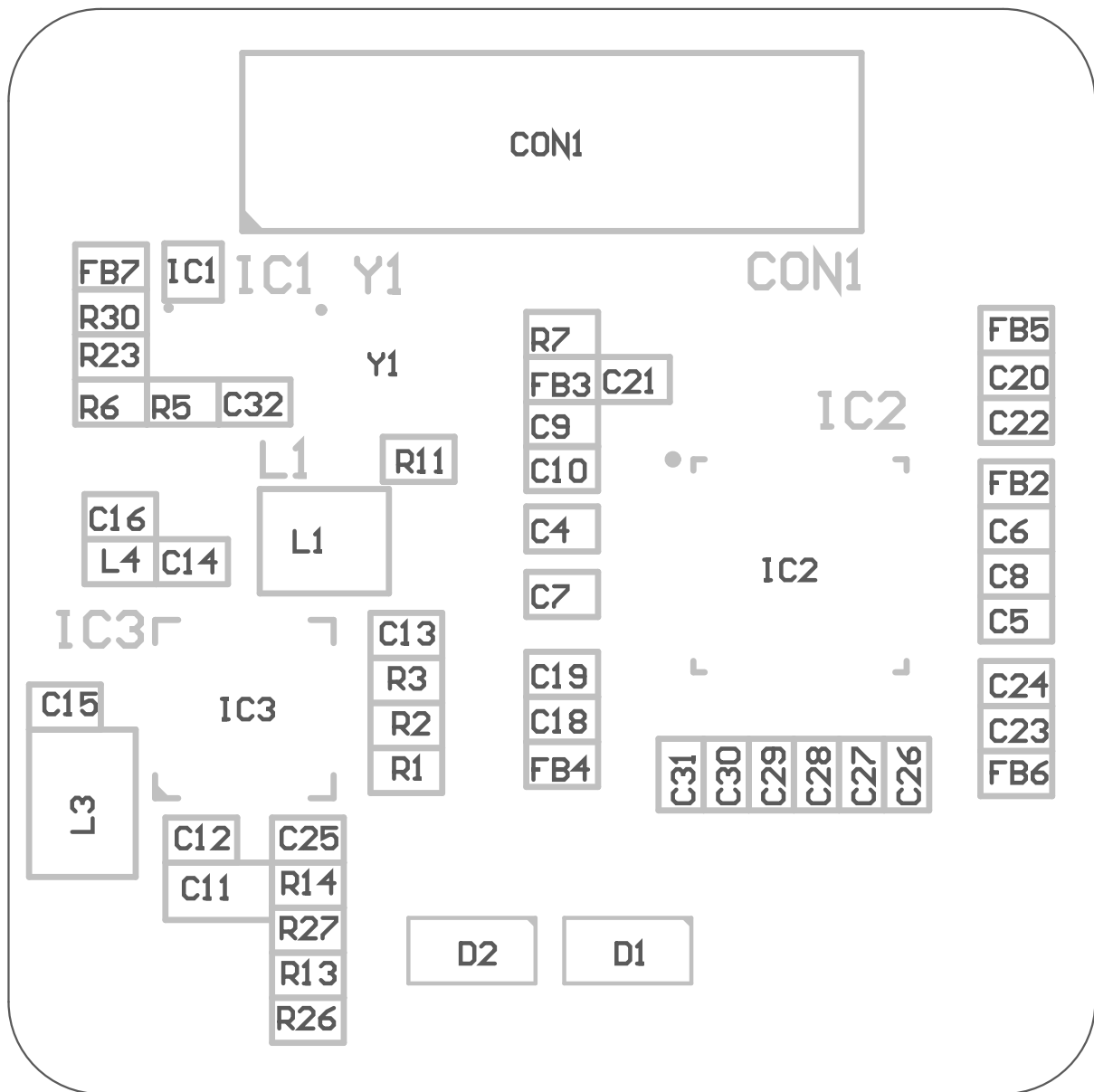
6. Tx Board Schematic



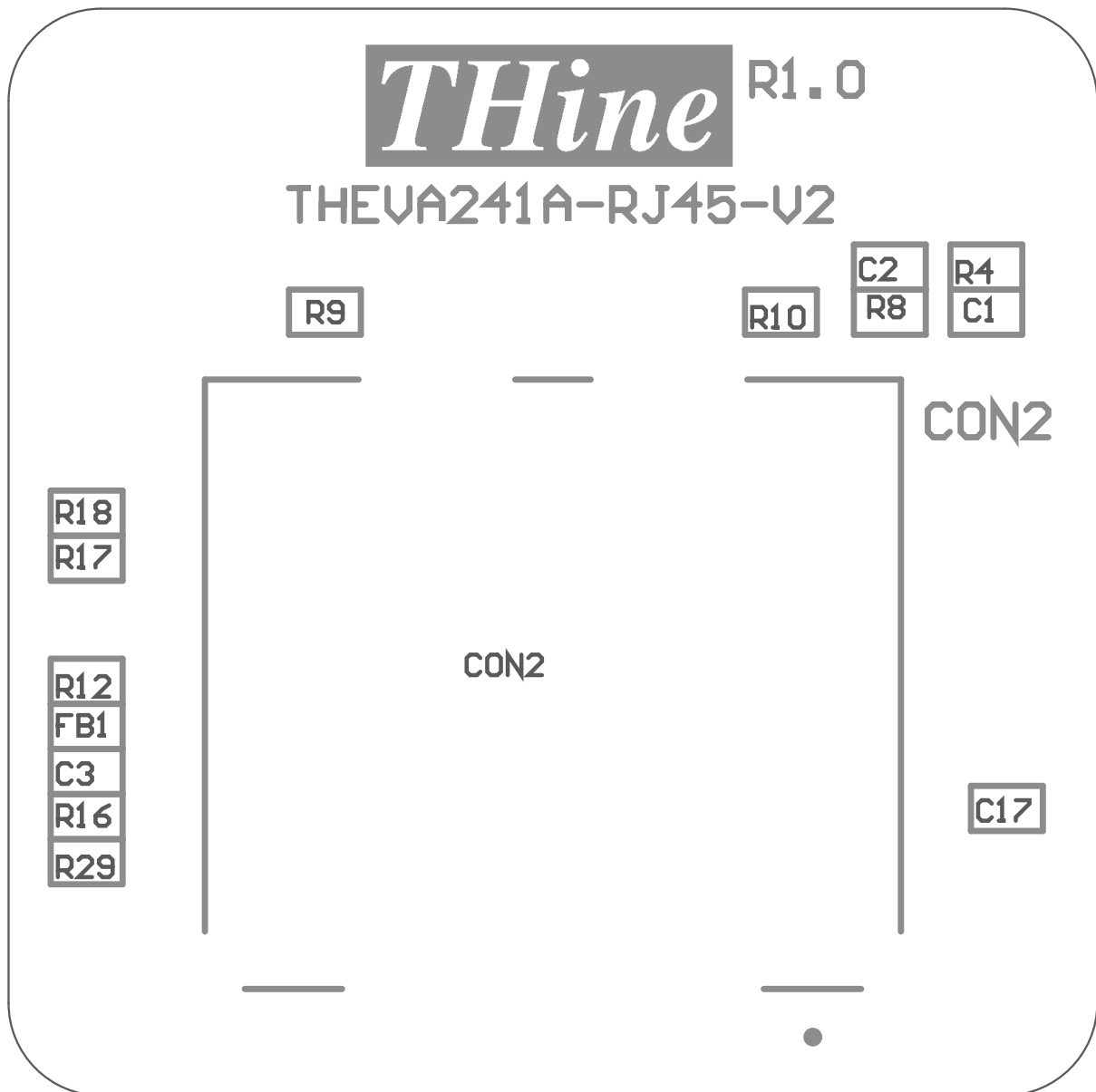
7. Rx Board Schematic



8. Tx Board Parts Location on Top Side



9. Tx Board Part Location Bottom Side



PCB layout of the THEVA242A-RJ45-V2 module. The layout shows a central IC1 (THEVA242A) connected to various components including resistors (R1-R34), capacitors (C1-C39), LEDs (LED1, LED2, LED3), and switches (SW1, SW2, SW3). The module has a PH connector, a JACK, and three CON connectors (CON1, CON2, CON3). The layout is labeled with component values and pin numbers.

12. Tx Board Bill of Material

Part Number	Designator	Value	Manufacturer	Description
CL05A225MP5NSNC	C1, C2, C14	2.2u	Samsung Electro-Mechanics	Capacitor
CL05A105KP5NNNC	C3, C6, C9, C18, C20, C23	1u	Samsung Electro-Mechanics	Capacitor
CL05B104KA5NNNC	C4, C5, C7, C8, C10, C12, C19, C21, C22, C24, C25, C26, C27, C28, C29, C30, C31, C32	0.1u	Samsung Electro-Mechanics	Capacitor
CL10A226MO7JZNC	C11	22u	Samsung Electro-Mechanics	Capacitor
CL05A106MP5NUNC	C13, C16, C17	10u	Samsung Electro-Mechanics	Capacitor
CL05B473KO5NNNC	C15	47n	Samsung Electro-Mechanics	Capacitor
DF40HC(4.0)-60DS-0.4V(51)	CON1		Hirose Electric Co Ltd	CONN RCPT 60POS SMD GOLD
1705549-1	CON2		TE Connectivity AMP Connectors	CONN MOD JACK 8P8C SHLD
SESD1004Q4UG-0020-090	D1, D2		Littelfuse Inc.	TVS DIODE 7VWM 9.2VC 1004/10DFN
MPZ1005S600C	FB1, FB2, FB3, FB4, FB5, FB6, FB7	MPZ1005S600C	TDK Corporation	FerriteBead
ADP172ACBZ-2.9-R7	IC1		Analog Devices Inc.	IC REG LINEAR 2.9V 300MA 4WLCSP
THCV241A-P	IC2		THine Electronics, Inc.	Mipi to V-by-One HS
BD86852MUF-C	IC3		Rohm Semiconductor	PMIC FOR AUTOMOTIVE CAMERA. BD86
TFM201610ALMA1R5MTAA	L1	1.5uH	TDK Corporation	FIXED IND 1.5UH 2.3A 110MOHM SMD
TFM252012ALMA3R3M	L3	3.3uH	TDK Corporation	FIXED IND 3.3UH 2A 140 MOHM SMD
MLZ1005M2R2WT000	L4	2.2uH	TDK Corporation	FIXED IND 2.2UH 350MA 550MOHM SM
RC0402FR-0727KL	R1	27k	Yageo	Resistor
RC0402JR-070RP	R2, R9, R10, R26, R30	0	Yageo	Resistor
RC0402JR-0710KL	R3	10k	Yageo	Resistor
RC0402JR-070RP	R4, R5, R6, R27, R29	0	Yageo	Resistor
RC0402FR-0733RL	R7, R11	33	Yageo	Resistor
RC0402FR-07100KL	R8	100k	Yageo	Resistor
RC0402FR-0730KL	R12	30k	Yageo	Resistor
RC0402JR-073K3L	R13, R23	3.3k	Yageo	Resistor
RC0402JR-073K3L	R14, R16, R17, R18	3.3k	Yageo	Resistor
DSC1001DI2-024.0000T	Y1	24.0MHz	Microchip Technology	MEMS OSC XO 24.0000MHZ CMOS SMD

13. Rx Board Bill of Material

Part Number	Designator	Value	Manufacturer	Description
CL05B104KA5NNNC	C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, C19, C20, C21, C24, C26	0.1u	Samsung Electro-Mechanics	Capacitor
CL05B473KO5NNNC	C22	47n	Samsung Electro-Mechanics	Capacitor
CL10A226MO7JZNC	C23, C25	22u	Samsung Electro-Mechanics	Capacitor
CL05A106MP5NUNC	C27, C28, C32, C33, C34, C35, C36, C37, C38	10u	Samsung Electro-Mechanics	Capacitor
CL05A225MP5NSNC	C29	2.2u	Samsung Electro-Mechanics	Capacitor
CL05A105KP5NNNC	C30, C39, C40	1u	Samsung Electro-Mechanics	Capacitor
CL05B103KO5NNNC	C31	10nF	Samsung Electro-Mechanics	Capacitor
2178415-1	CON1	Cat5e	TE Connectivity	RJ45 Connector
JTW-2522	CON2		Hirosugi	Pin header
JTS-2503	CON3		Hirosugi	Pin header
PJ-036AH-SMT-TR	CON4	-	CUI Devices	AC Adaptor
JTS-2503	CON5		Hirosugi	Pin header
SESD1004Q4UG-0020-090	D1, D2	-	Littelfuse Inc.	TVS Diode
MPZ1005S600C	FB1, FB2, FB3, FB4, FB5, FB6	MPZ1005S600C	TDK Corporation	Ferrite bead
THCV242A-P	IC1	-	THine Electronics, Inc.	VbyOne HS to MIPI
ATTINY826-MF	IC2	ATTINY826-MF	Microchip Technology	Micro controller
BR24G128FVM-3AGTTR	IC4	128kb	Rohm Semiconductor	EEPROM
SLG59H1128V	IC5		Renesas	Power switch
BD86852MUF-C	IC6	-	Rohm Semiconductor	PMIC
TFM252012ALMA3R3M	L1	3.3uH	TDK Corporation	Inductor
TFM201610ALMA1R5MTAA	L2, L3	1.5uH	TDK Corporation	Inductor
SMTL4-BC	LED1		Bivar	LED
LTST-C191KGKT	LED2, LED3		Lite-On Inc.	LED
DMN2004WK-7	Q1, Q2	-	Diodes Incorporated	NMOSFET
RC0402JR-070RP	R1, R2, R15, R18, R34	0	Yageo	Resistor
RC0402JR-073K3L	R3, R4, R33	3.3k	Yageo	Resistor
RC0402FR-0733KL	R5, R10, R11, R12, R14, R23	33k	Yageo	Resistor
RC0402FR-07330RL	R6	330	Yageo	Resistor
RC0402JR-071KL	R7, R32	1k	Yageo	Resistor
RC0402FR-0718KL	R8	18k	Yageo	Resistor
RC0402JR-0710KL	R9, R25	10k	Yageo	Resistor
RC0402FR-0727KL	R13	27k	Yageo	Resistor
RC0402JR-071ML	R16	1.0M	Yageo	Resistor
RC0402JR-070RP	R17, R27	0	Yageo	Resistor
RC0402FR-07100KL	R19, R20, R21, R24, R26, R28, R29	100k	Yageo	Resistor
RC0402FR-07100KL	R22, R31	100k	Yageo	Resistor
RC0402FR-0784K5L	R30	84.5k	Yageo	Resistor
A6H-4101	SW1	-	Omron Electronics Inc-EMC Div	Switch
EVQ-PLHA15	SW2, SW3	-	Panasonic Electronic Components	Push switch

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