TS-RX72M-COM
User's Manual
(RX72M Communication Board)

Issued: October 25,2019(Version 1.0)

TESSERA TECHNOLOGY INC.

TS-TUM08445

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Revision history

Version	Date	Description
Ver. 1.0	Oct. 25, 2019	Initial version

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1. Overview

1.1 Overview

This application note describes the usage of the communications evaluation board for the RX72M, which allows you to evaluate LSI RX72M without requiring proprietary hardware on the user side.

This board includes the interfaces listed below for use in evaluating communications by the RX72M.

- EtherCAT®
- 10Base-T / 100Base-TX
- USB
- I2C (No connector installed)
- SPI (No connector installed)
- RS-485(No connector installed)
- CAN(No connector installed)
- JTAG
- General-purpose ports
- Others

1.2 Overall Block Diagram

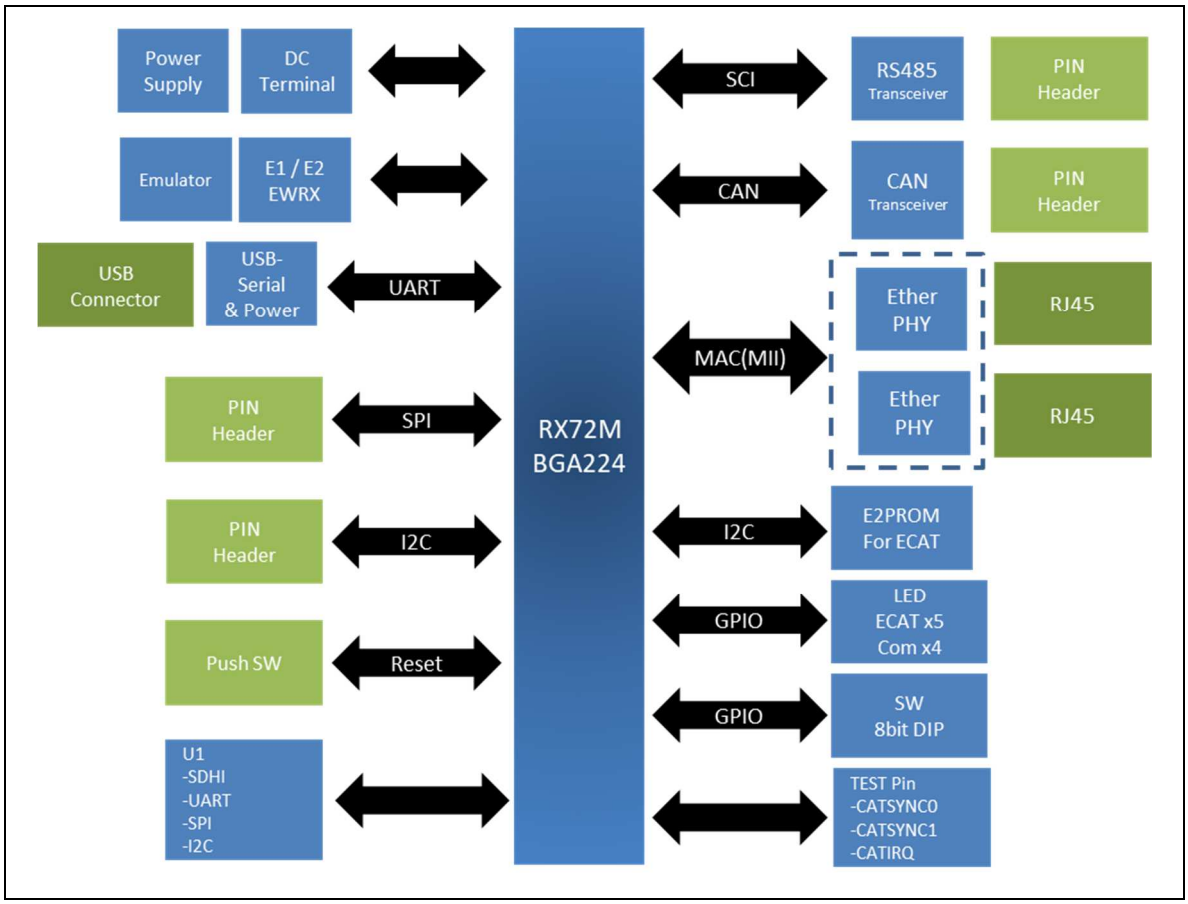


Figure 1.1 Overall Block Diagram

2. General Specifications

2.1 Electrical Specifications

This section gives the electrical and other specifications of this product in a set of tables.

Item		Specifications
Power supply	Rated voltage	DC 5 V
	Range of voltage tolerance	DC 4.75 V to 5.25 V
	Current drawn internally	100 mA or less
	Status LED (POWER)	Green

2.2 Environmental Specifications and Mass

Item		Specifications
Physical environment	Ambient temperature for operation	0 to 55□C
	Ambient temperature for storage	-25 to 70□C
	Ambient humidity for operation	30 to 90% RH (no condensation)
	Ambient humidity for storage	30 to 90% RH (no condensation)
	Atmosphere for operation	No corrosive gas
Mass	—	Approximately 150 g
Board dimensions	—	90 (W) × 52 (H) (not including protrusions)

2.3 Communications Specifications

Item	Specifications
Communications protocols	EtherCAT
Communications control IC	RX72M
EtherCAT PHY	KSZ8081 from Microchip
Communications method	IEEE 802.3u (100Base-TX)
Form of isolation	Pulse-transformer isolation
Status LEDs	RUN (green), ERR (red) L/A IN (green), L/A OUT (green) STAT (green/read)
External interfaces	RJ-45 × 2

3. Names and Functions of Parts

3.1 Clock

The RX72M system clock (24 MHz) is supplied by this board.

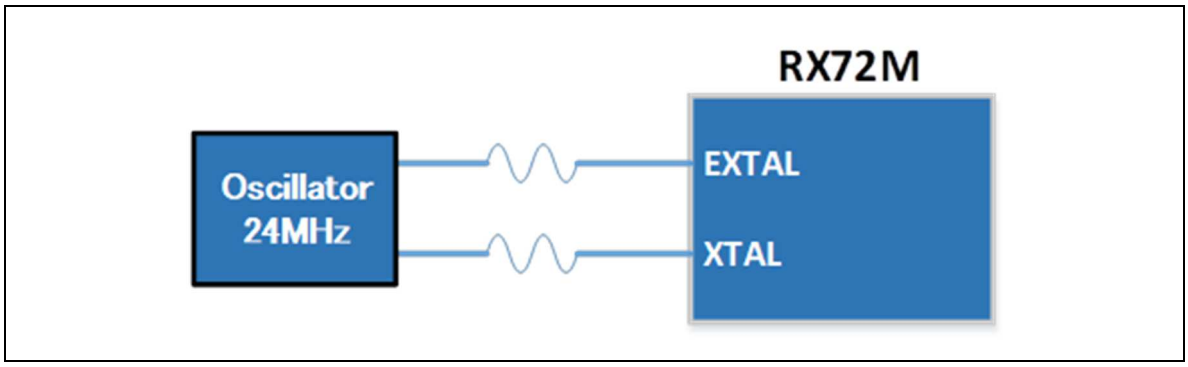


Figure 3.1 System clock supply

3.2 Communications Section

This communication board has a standard R-J45 connector, and possible to EtherCAT and Ethernet communication using this connector.

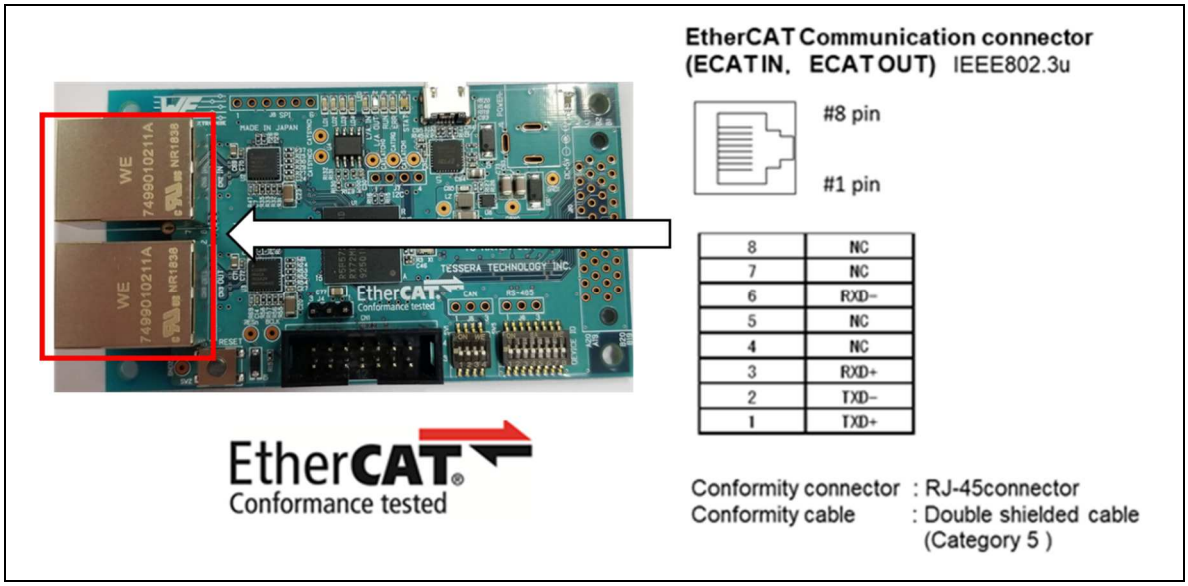


Figure 3.2 EtherCAT Communications Connectors

3.3 Power Supply and Peripheral Pins

5V DC power supply can be input through the USB to power the RX72M.

The POWER LED (green) lights up when 5.0V is being supplied.

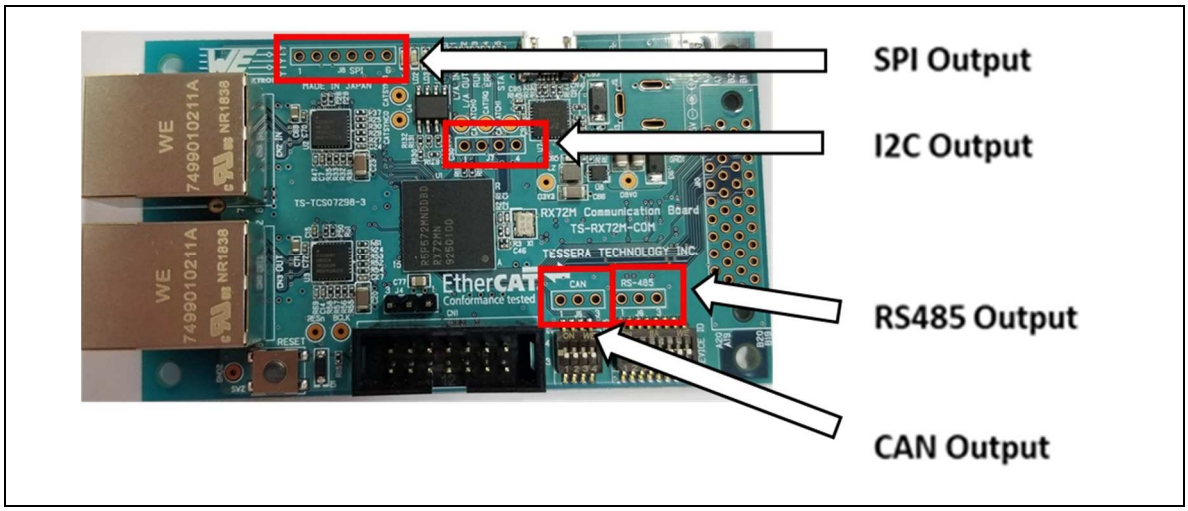


Figure 3.3 Power Supply and I/O Connectors

3.3.1 CAN I/F pins

These pins function as the pin headers for the CAN interface. Via the CAN Driver make the input and output of CANH/L.

Part No: WURTH 613 003 111 21(No connector installed)

Table 3.1 CAN I/F (J5)

Pin No.	I/O	Signal Name
1	I/O	CANH
2	I/O	CANL
3	—	GND

3.3.2 RS 485 I/F pins

These pins function as the pin headers for the RS-485 interface. Via the RS485 Driver make the input and output of Half duplex signals.

Part No: WURTH 613 003 111 21(No connector installed)

Table 3.2 RS485 I/F (J6)

Pin No.	I/O	Signal Name
1	Output	A
2	Output	B
3	—	GND

3.3.3 SPI I/F pins

These pins function as the pin headers for the SPI.

Part No: WURTH 613 006 111 21 (No connector installed)

Table 3.3 SPI I/F (J8)

Pin No.	I/O	Signal Name
1	—	+3.3V
2	Clocks	SPI_CLK
3	I/O	SPI_MOSI
4	I/O	SPI_MISO
5	I/O	SPI_SS_N
6	—	GND

3.3.4 I2C I/F pins

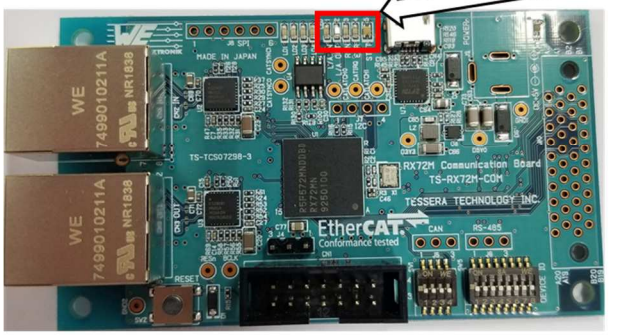
These pins function as the pin headers for the I^2C.

Part No: WURTH 613 004 111 21 (No connector installed)

Table 3.4 I^2C I/F (J7)

Pin No.	I/O	Signal Name
1	—	+3.3 V
2	SCL1	I2C_SDA
3	SDA1	I2C_SCL
4	—	GND

3.4 Status LEDs (EtherCAT)



Communication Status LED

RUN
Operation : Turn on

Safe Operation : Single flash
Pre Operation : Blinking
Initialization : Turn off

L/A IN
Link up operation : Flickering
Physical layer link up : Turn on
Physical layer non-link up : Turn off

L/A OUT
Link up operation : Flickering
Physical layer link up : Turn on
Physical layer non-link up : Turn off

ERR
WD Time Out : Double flash
Sync or Communication data are abnormal : Single flash
Communication setting is abnormal : Blinking
Normal operation : Turn off

STAT
Operation : Turn on
Sync or Communication data are abnormal : Single flash
Safe Operation : Single flash
Pre Operation : Blinking

Figure 3.4 Communications Status LEDs

The EtherCAT slave controller (ESC) controls lighting of the status LEDs

Table 3.5 EtherCAT Status LEDs

Signal Name	I/O	Pin No.
CATLINKACT0	Output	LED1
CATLINKACT1	Output	LED2
CATLEDRUN	Output	LED3
CATLEDERR	Output	LED4
CATLEDSTER	Output	LED5

3.5 Power supply, General-Purpose LEDs

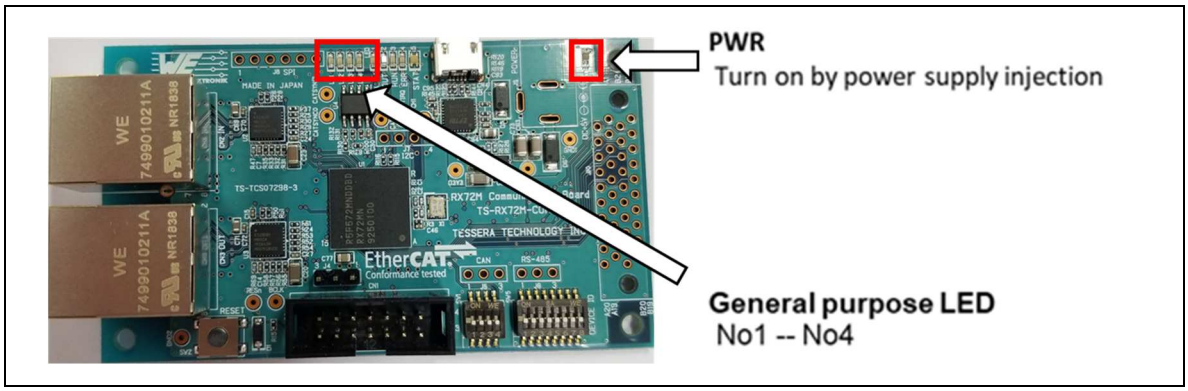


Figure 3.5 Power-Supply and General-Purpose LEDs

3.5.1 Power supply LEDs

The power for various devices is generated by the input of 5-V DC through a USB. When 5.0 V is supplied, the POWER_LED lights up in green.

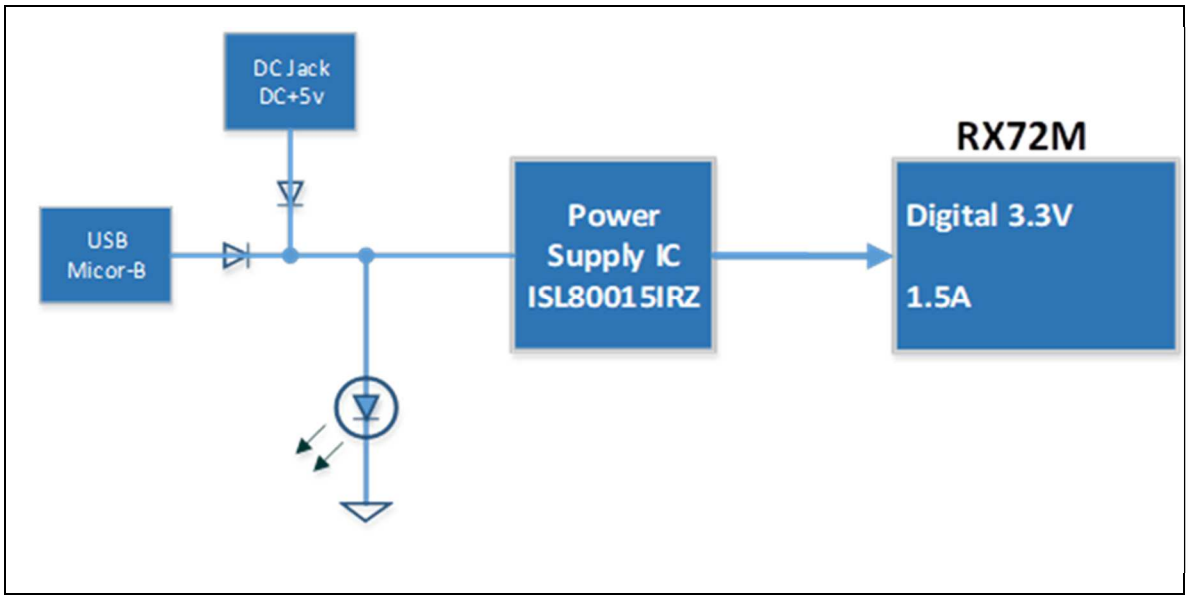


Figure 3.6 Power-Supply Connection

3.5.2 General-Purpose LEDs

It is an LED terminal that the user can arbitrarily use.

According to the protocol standard, green and red LEDs can be used.

Table 3.6 General-Purpose LEDs

Signal Name	I/O	Pin No.
P71	Output	LD1 (Green)
PH0	Output	LD2 (Red)
PN4	Output	LD3 (Green)
P85	Output	LD4 (Red)

3.6 DIP Switch Block

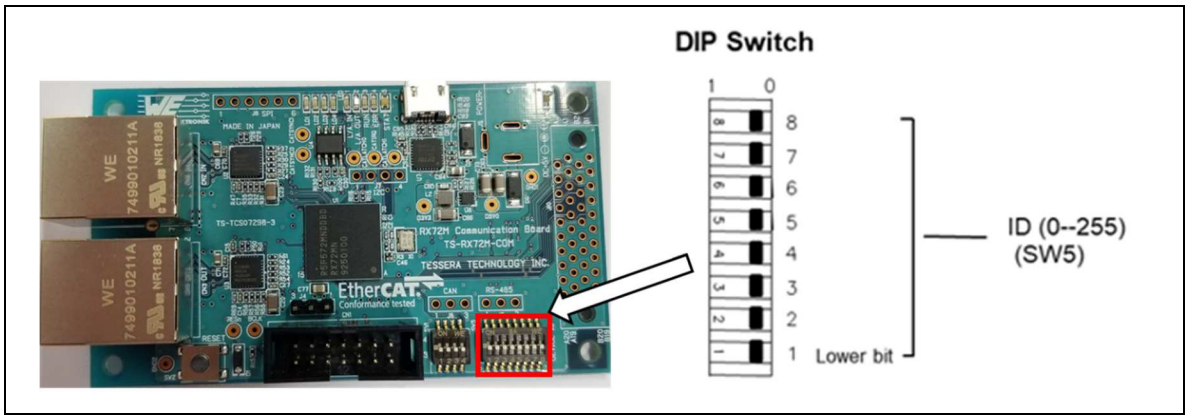


Figure 3.7 DIP Switch Block

The DIP switches of SW5 are used to set the node ID (0 to 255).

Table 3.7 DIP Switches (SW5)

Switch No.	Name of RX72M Signal	Function
SW5-1	PH2	ID SW0
SW5-2	P46	ID SW1
SW5-3	PQ3	ID SW2
SW5-4	P05	ID SW3
SW5-5	P72	ID SW4
SW5-6	P47	ID SW5
SW5-7	PC1	ID SW6
SW5-8	PN5	ID SW7

3.7 Connector for Debugging and Reset Switch

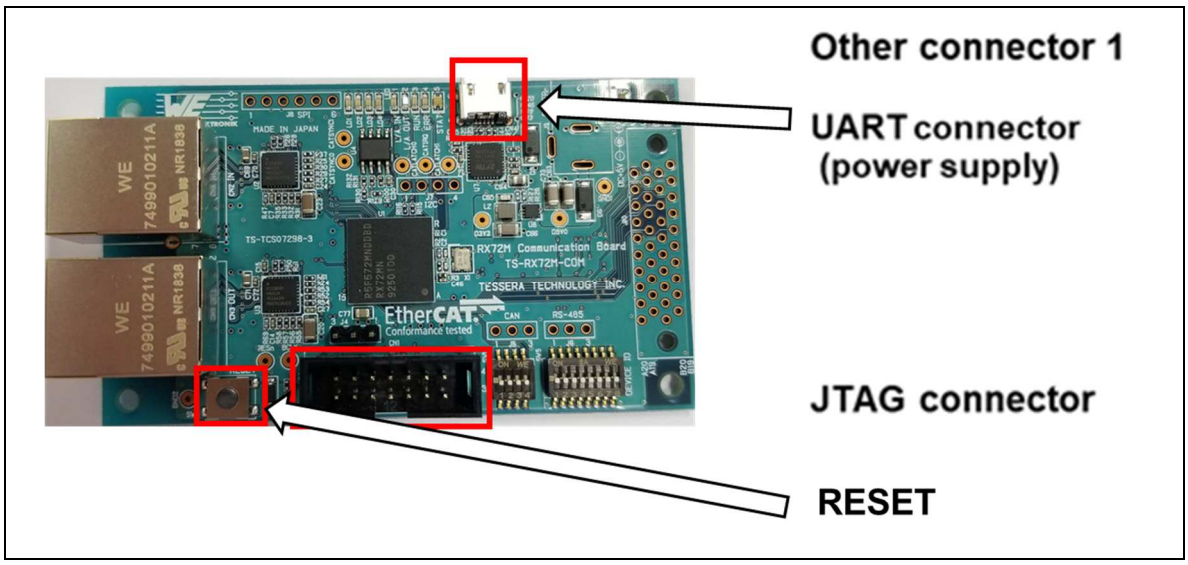


Figure 3.8 Push Switch and Other Connectors on the Board

3.7.1 Reset switch (SW2)

This push switch generates a reset of the RX72M and its I/O pins.

3.7.2 JTAG connector (CN1)

This is a inch-pitch connector having JTAG-14 pins for debugging.
Part No: WURTH 612 014 216 21 (Not mounted)

Table 3.8 JTAG (CN1)

Pin No.	Name of RX72M Signal	Pin No.	Name of RX72M Signal
1	TCK/FINEC	2	VSS
3	TRSTn	4	EMLE
5	TDO	6	-
7	MD/FINED	8	VCC
9	TMS	10	UB
11	TDI	12	VSS
13	RESn	14	VSS

3.7.3 UART connector (CN4)

This is a USB micro B type connector for the USB interface to be used as a UART. UART to USB conversion LSI (FT 232 RQ) is mounted on the communication board. The RX72M performs asynchronous communication with a PC by connecting a USB connector.

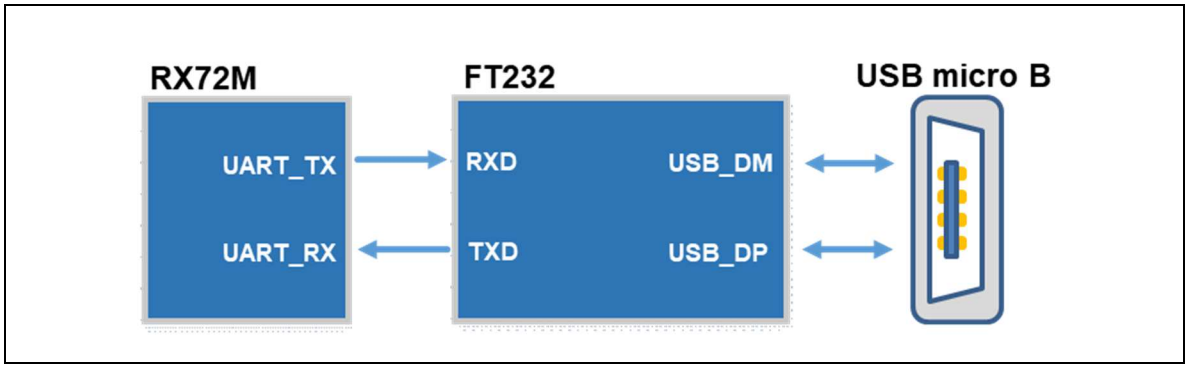


Figure 3.9 UART

Table 3.9 UART (CN4)

Pin No.	Signal Name
1	VBUS
2	-D
3	+D
4	ID
5	GND

3.8 Jumper Blocks (J4)

This jumper sets JATG Configuration mode.
Usually it is used at 2-3 short of jumper pin. To use the hot plug-in function, change it to 1-2 short and use it.

Part No: WURTH 613 003 111 21 (No connector installed)

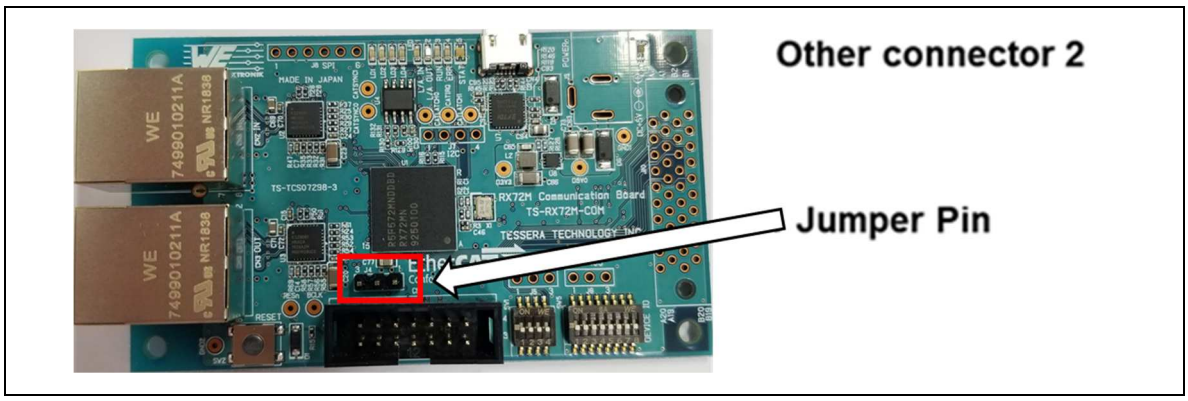


Figure 3.10 Jumper Blocks

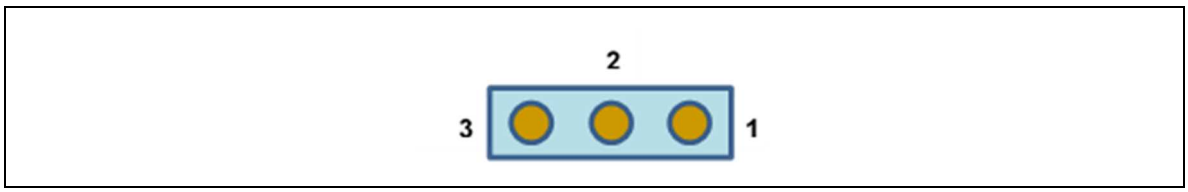


Figure 3.11 Jumper Pin Assignment

Table 3.10 Jumper (J4)

Jumper Pin	Function
1-2	E2 debugging with Hot plug-in
2-3	E2 normal debugging Microcontroller single operation ※Default
open	Do not set

3.9 Combination Connector (J10)

The combination connector is used to connect an external device to the RX72M communications board.

Part No: HIROSE FX2-40P-1.27DSL (71) (Not mounted)

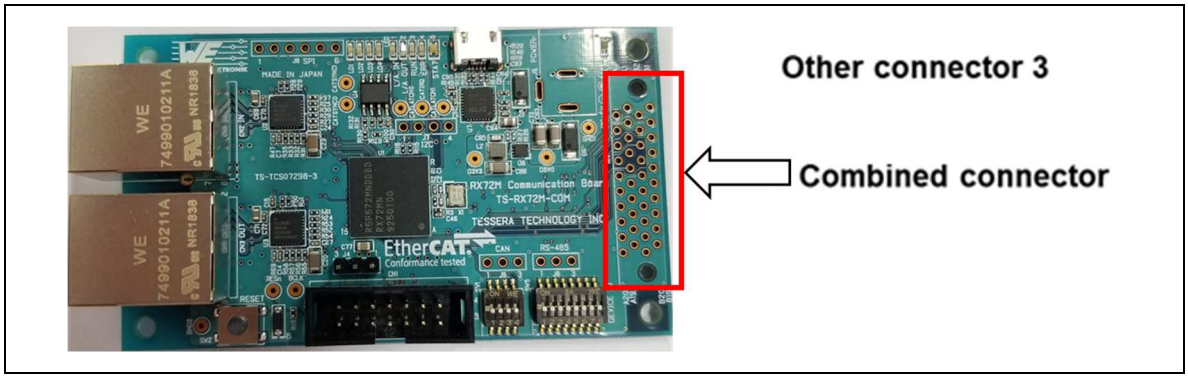


Figure 3.11 Combination Connector

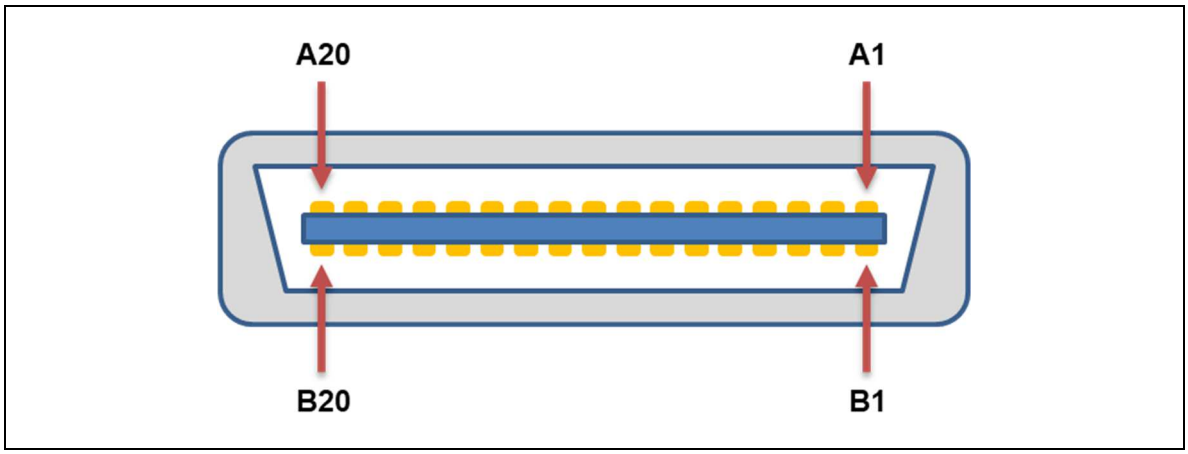


Figure 3.12 Combination Connector Assignment

Table 3.11 Combination connector arrangement (J10)

Pin No.	Name of RX72M Signal	Function	Pin No.	Name of RX72M Signal	Function
A1	-	D5V	B1	-	D3.3V
A2	-	D5V	B2	-	D3.3V
A3	P76	PMOD_SCL	B3	P77	PMOD_SDA
A4	P93	FIFO_SPI_SS_N	B4	P91	FIFO_SPI_CLK
A5	P90	FIFO_SPI_MOSI	B5	P92	FIFO_SPI_MISO
A6	PD0	FIFO_SPI_INT	B6	PD2	FIFO_SPI_RST
A7	PB7	PMOD_UART_TX	B7	PB6	PMOD_UART_RX
A8	PB4	PMOD_UART_CTS	B8	PB5	PMOD_UART_RTS
A9	PD1	PMOD_UART_INT	B9	PD4	PMOD_UART_RST
A10	P54	PMOD_SPI_SS_N	B10	P51	PMOD_SPI_CLK
A11	P50	PMOD_SPI_MOSI	B11	P52	PMOD_SPI_MISO
A12	P30	PMOD_IO0	B12	P02	PMOD_IO1
A13	PJ1	PMOD_IO2	B13	PL1	PMOD_IO3
A14	P41	SDHI_FLT	B14	P83	SDHI_PW_EN
A15	P87	SDHI_D2	B15	P17	SDHI_D3
A16	P22	SDHI_D0	B16	P23	SDHI_D1
A17	P25	SDHI_CD	B17	P24	SDHI_WP
A18	P21	SDHI_CLK	B18	P20	SDHI_CMD
A19	-	GND	B19	-	GND
A20	-	GND	B20	-	GND

3.10 Test Pins

This is a list of pins connected to the pads from the RX72M on this board. The pads are 0.8mm through holes.

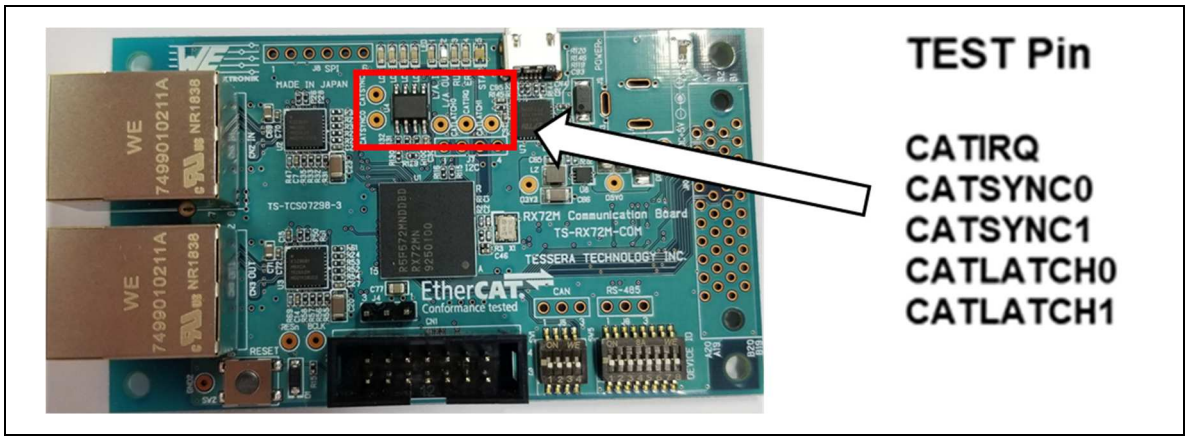


Figure 3.13 Test Pins

Table 3.12 List of Pins

Pin Name	Pad Name	Handling of Pins Connected to the Pads
PJ5	CATSYNC0	-
P11	CATSYNC1	-
P27	CATIRQ	-
PH5	CATLATCH0	-
PH6	CATLATCH1	-
D3.3V	D3V3	-
D5V	D5V0	-
RESn	RESn	-
GND	GND	-

4. Board Dimensions

This section describes the dimensions of the RX72M communications board.

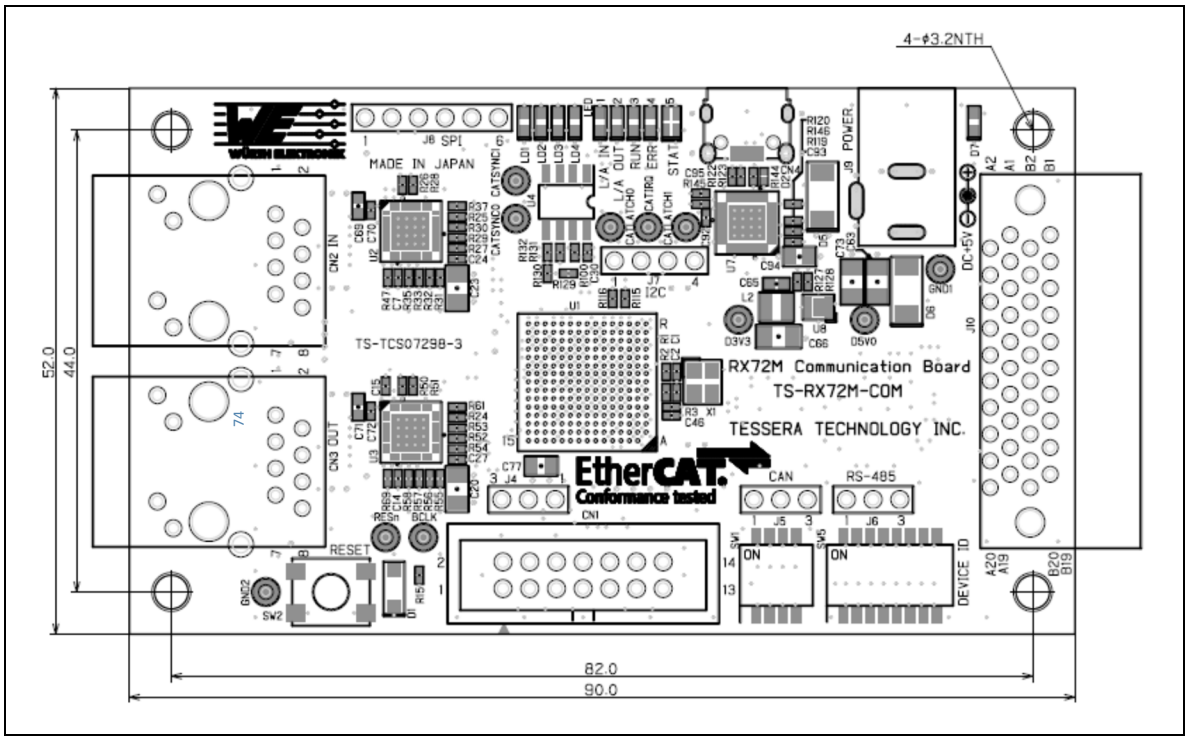


Figure 4.1 External Dimensions of the Board

5. Component List

The board's components are listed below.

No.	quantity	mounted reference	unmounted reference	Classification	Name of parts	Makers
1	0		GND1,CATSYNC1,CATLATCH1,	TPD08	ST-1-2	MAC8
			GND2,D3V3,D5V0,RESn,			
			CATSYNC0,CATLATCH0,			
			CATIRQ,BCLK			
2	1	CN1		612 014 216 21	61201421621	WURTH
3	2	CN2,CN3		749 901 021 1A	7499010211A	WURTH
4	1	CN4		629 105 150 521	629105150521	WURTH
5	2	C1,C2		10pF/50V	NP00402100J050DFCT10000	WURTH
6	3	C39,C43,C49	C4,C6,C10,C12	1uF/16V	X7R0603105K016DFCT10000	WURTH
7	2	C7,C14		100pF/50V	X7R0402101K050DFCT10000	WURTH
8	33	C8,C9,C16,C17,C24,C25,	C3,C5,C11,C13	0.1uF	X7R0402104K016DFCT10000	WURTH
		C27,C28,C30,C32,C33,C38,				
		C42,C45,C48,C52,C53,C54,				
		C55,C56,C57,C58,C59,C60,				
		C61,C62,C70,C72,C75,				
		C78,C92,C93,C95				
9	1	C15		1.5nF	X7R0402102K050DFCT10000	WURTH
10	8	C18,C20,C21,C23,C31,C63,		22uF/16V	X5R1206226M016DFCT10000	WURTH
		C66,C73				
11	6	C40,C44,C50,C51,C76,C77		10uF/16V	X5R0805106M016DFCT10000	WURTH
12	1	C46		0.22uF	X5R0402224M016DFCT10000	WURTH
13	1	C65		22pF/50V	NP00603220J050DFCT10000	WURTH
14	2	C69,C71		2.2uF	X5R0603225M016DFCT10000	WURTH
15	1	C94		4.7uF/16V	X7R0805475K016DFCT10000	WURTH
16	1	D1		1N4148W	1N4148W	Vishay
17	5	D2,D3,D4,D8,D9		823 07 050 029	82307050029	WURTH
18	2	D5,D6		CMS03	CMS03	TOSHIBA
19	6	LED1,LD1,LED2,LED3,		SML-D12P8W	SML-D12P8W	ROHM
		LD3,D7				
20	1	J4	J5,J6	613 003 111 21	61300311121	WURTH
21	0		J7	613 004 111 21	61300411121	WURTH
22	0		J8	613 006 111 21	61300611121	WURTH
23	0		J9	694 106 301 002	694106301002	WURTH
24	0		J10	FX2-40P-1.27DSL(71)	FX2-40P-1.27DSL(71)	HRS
25	3	LED4,LD4,LD2		SML-D12U8W	SML-D12U8W	ROHM
26	1	LED5		SML-522MU8W	SML-522MU8W	ROHM
27	1	L1		BLM21PG300SN1D	74279206	WURTH
28	1	L2		MAKK2520H1R5M	74438324015	WURTH

Continued from previous page

No.	quantity	mounted reference	unmounted reference	Classification	Name of parts	Makers
29	1	R1		1M/1%	RK73H1ETTP1004F	KOA
30	1	R2		470	RK73B1ETTP471J	KOA
31	7	R3,R5,R114,R115,R116,	R101,R102,R103,R104,R105,	10k	RK73B1ETTP103J	KOA
		R145,R146	R106,R107,R108			
32	6	R4,R10,R11,R49,R73,R137		0(1608)	RK73Z1JTTD	KOA
33	15	R6,R7,R8,R9,R12,R13,R14,	R75,R76,R78,R79,R82,R83,	4.7k	RK73B1ETTP472J	KOA
		R15,R17,R97,R118,R119,	R85,R90,R92,R93,R94,R96,			
		R120,R134,R144	R99			
34	12	R16,R23,R24,R25,R80,R95,	R84	1k	RK73B1ETTP102J	KOA
		R98,R109,R110,R111,R112,				
		R125				
35	3	R19,R20,R100		22k	RK73B1ETTP223J	KOA
36	1	R22		68k	RK73B1ETTP683J	KOA
37	31	R26,R27,R28,R29,R30,R31,	R89	22	RK73B1ETTP220J	KOA
		R32,R33,R35,R37,R38,R39,				
		R40,R42,R44,R46,R50,R51,				
		R52,R53,R54,R55,R56,R57,				
		R58,R61,R62,R63,R64,R65,				
		R67				
38	0		R34,R36,R41,R43,R59,R60,	49.9/1%	RK73H1ETTP49R9F	KOA
			R66,R68			
39	5	R45,R48,R70,R71,R133		220	RK73B1ETTP221J	KOA
40	2	R47,R69		6.49k/1%	RK73H1ETTP6491F	KOA
41	6	R72,R74,R77,R81,R86,R87		1.5k	RK73B1ETTP152J	KOA
42	2	R88,R91		2.2k	RK73B1ETTP222J	KOA
43	1	R113		120/1%	RK73H1ETTP1200F	KOA
44	2	R122,R123		27	RK73B1ETTP270J	KOA
45	1	R127		453k/1%	RK73H1ETTP4533F	KOA
46	1	R128		100k/1%	RK73H1ETTP1003F	KOA
47	4	R129,R130,R131,R132		100	RK73B1ETTP101J	KOA
48	2	R135,R136		390	RK73B1ETTP391J	KOA
49	1	SW1		416 131 160 804	416131160804	WURTH
50	1	SW2		430 483 031 816	430483031816	WURTH
51	1	SW5		416 131 160 808	416131160808	WURTH
52	1	U1		RX72M	R5F572MNDDBD	RENESAS
53	2	U2,U3		KSZ8081MNXCA	KSZ8081MNXCA	MicroChip
54	1	U4		M24C16-RMN6TP	M24C16-RMN6TP	STMicro
55	1	U5		R2A25416SP	R2A25416SP	RENESAS
56	1	U6		ISL32740EIAZ	ISL32740EIAZ	RENESAS
57	1	U7		FT232RQ	FT232RQ	FTDI
58	1	U8		ISL80015IRZ-T	ISL80015IRZ-T	RENESAS
59	1	X1		NX3225SA-24.000MHZ	NX3225SA-24.000MHZ-STD-CSR-1	NDK

6. Circuit Diagram

The evaluation board's circuit diagrams are provided below.

RX72M Communication Board

Contents

P01 TOP (This page.)
P02 Global
P03 Ether
P04 Ext I/F
P05 Power (RX72M)
P06 Power

Revision History

Date	Rev	Description
2019.09.12	V1.0	*First edition

Power types

Board silk

Board Name	TS-RX72M-COM
PCB No.	TS-TCS07298-3
Company logo	TESSERA TECHNOLOGY INC.
Country of production	RX72M Communication Board
Display 1	MADE IN JAPAN
Display 2	RoHS compliant
Display 3	UL mark
Display 4	
Version	
Sirial No.	

Product Planning & Development Section Sales Division		**Approval**	
TESSERA TECHNOLOGY INC.		**Check**	
Revision	V1.0	**Creation**	
Date	Septemberr 12, 2019		

TESSERA TECHNOLOGY INC.

Title: RX72M Communication Board
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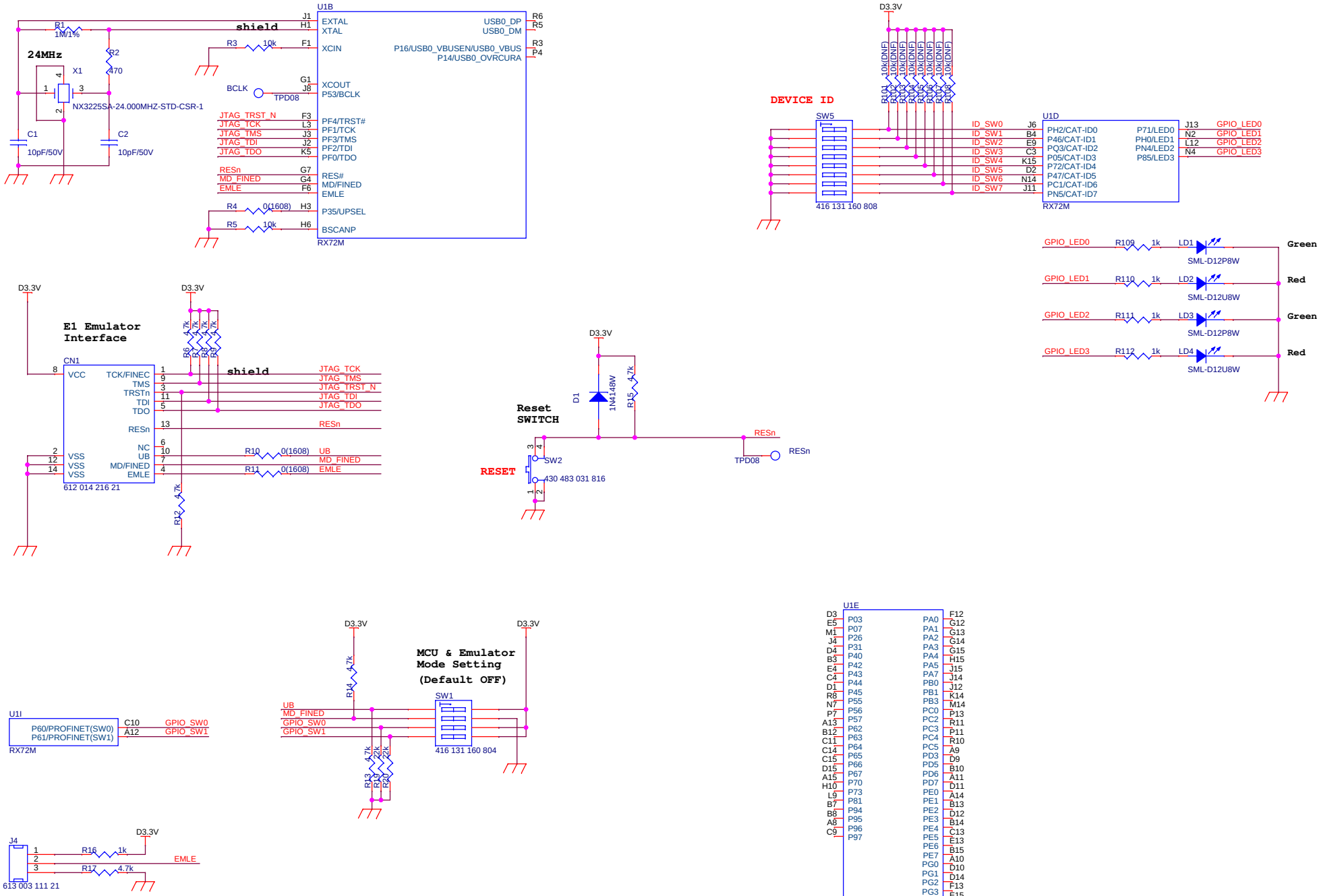

J4	Emulator Configuration
Shorted Pin1-2	E1 debugging with Hot plug-in
Shorted Pin2-3	E1 normal debugging Microcontroller single operation (without E1/E20)
all open	DO NOT SET

TESSERA TECHNOLOGY INC.

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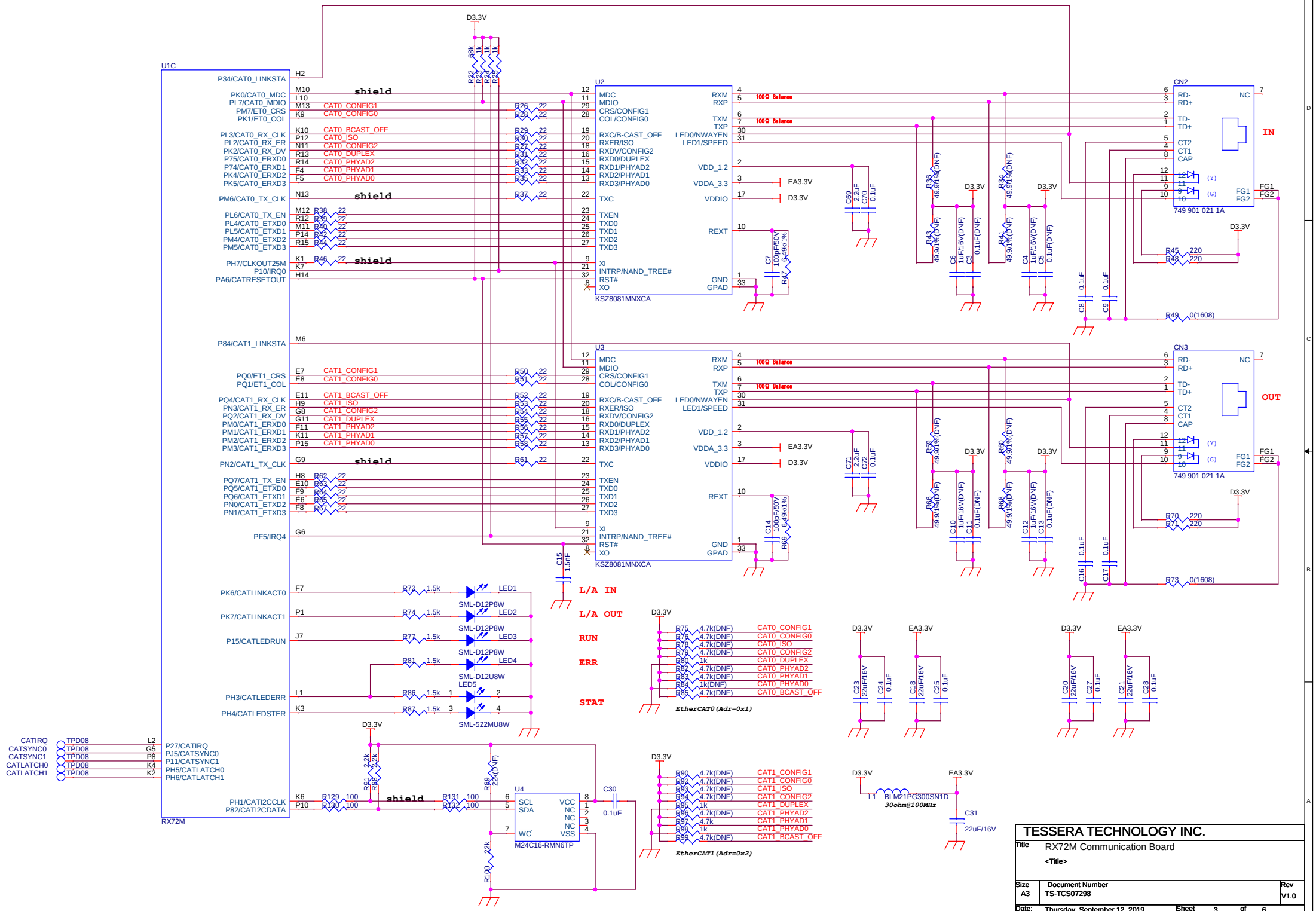
U1C
RX72M
P34/CAT0_LINKSTA
PK0/CAT0_MDC
PL7/CAT0_MDIO
PM7/ET0_CRS
PK1/ET0_COL
PL3/CAT0_RX_CLK
PL2/CAT0_RX_ER
PK2/CAT0_RX_DV
P75/CAT0_ERXD0
P74/CAT0_ERXD1
PK4/CAT0_ERXD2
PK5/CAT0_ERXD3
PM6/CAT0_TX_CLK
PL6/CAT0_TX_EN
PL4/CAT0_ETXD0
PL5/CAT0_ETXD1
PM4/CAT0_ETXD2
PM5/CAT0_ETXD3
PH7/CLKOUT25M
P10/IRQ0
PA6/CATRESETOUT
CAT0_CONFIG1
CAT0_CONFIG0
CAT0_BCAST_OFF
CAT0_ISO
CAT0_CONFIG2
CAT0_DUPLEX
CAT0_PHYAD2
CAT0_PHYAD1
CAT0_PHYAD0
shield
U2
KSZ8081MNXCA
MDC
MDIO
CRS/CONFIG1
COL/CONFIG0
RXC/B-CAST_OFF
RXER/ISO
RXDV/CONFIG2
RXD0/DUPLEX
RXD1/PHYAD2
RXD2/PHYAD1
RXD3/PHYAD0
TXC
TXEN
TXD0
TXD1
TXD2
TXD3
XI
INTRP/NAND_TREE#
RST#
XO
RXM
RXP
TXM
TXP
LED0/NWAYEN
LED1/SPEED
VDD_1.2
VDDA_3.3
VDDIO
REXT
GND
GPAD
100Ω Balance
EA3.3V
D3.3V
CN2
IN
RD-
RD+
TD-
TD+
CT2
CT1
CAP
NC
FG1
FG2
749 901 021 1A
P84/CAT1_LINKSTA
CAT1_CONFIG1
CAT1_CONFIG0
CAT1_BCAST_OFF
CAT1_ISO
CAT1_CONFIG2
CAT1_DUPLEX
CAT1_PHYAD2
CAT1_PHYAD1
CAT1_PHYAD0
U3
CN3
OUT
PF5/IRQ4
L/A IN
L/A OUT
RUN
ERR
STAT
LED1
LED2
LED3
LED4
LED5
SML-D12P8W
SML-D12U8W
SML-522MU8W
PK6/CATLINKACT0
PK7/CATLINKACT1
P15/CATLEDRUN
PH3/CATLEDERR
PH4/CATLEDSTER
CATIRQ
CATSYNC0
CATSYNC1
CATLATCH0
CATLATCH1
TPD08
P27/CATIRQ
PJ5/CATSYNC0
P11/CATSYNC1
PH5/CATLATCH0
PH6/CATLATCH1
PH1/CATI2CCLK
P82/CATI2CDATA
U4
M24C16-RMN6TP
SCL
SDA
WC
VCC
VSS
EtherCAT0(Adr=0x1)
EtherCAT1(Adr=0x2)
L1
BLM21PG300SN1D
30ohm@100MHz
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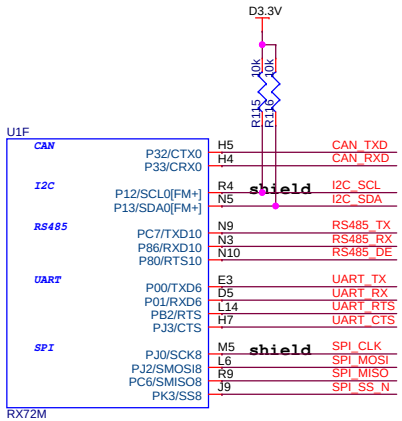
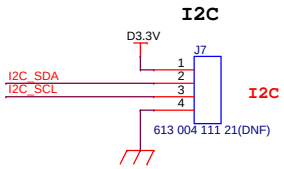
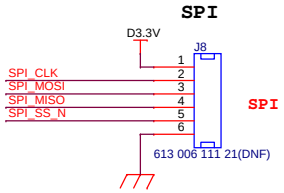
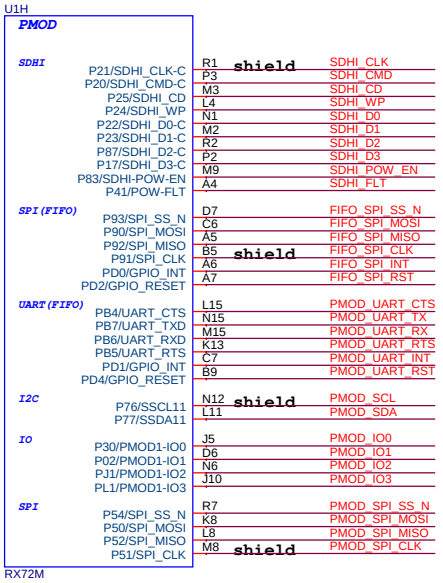
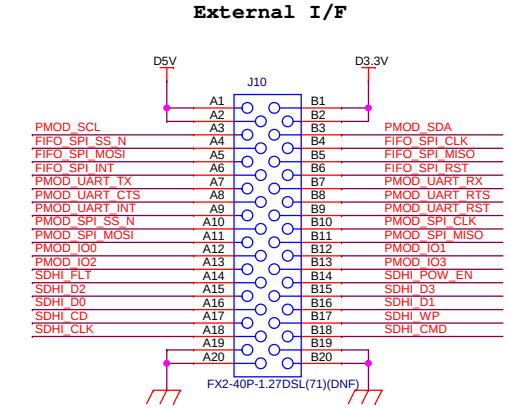
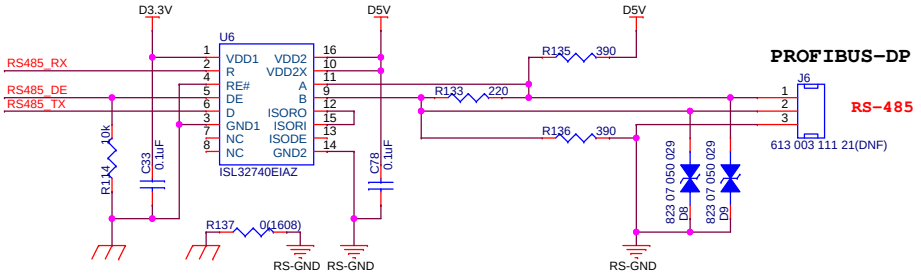




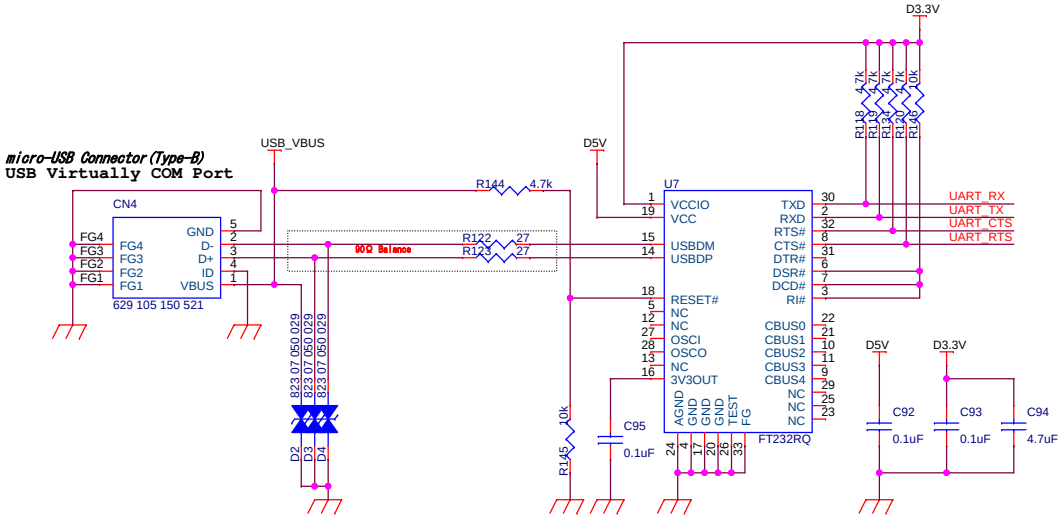


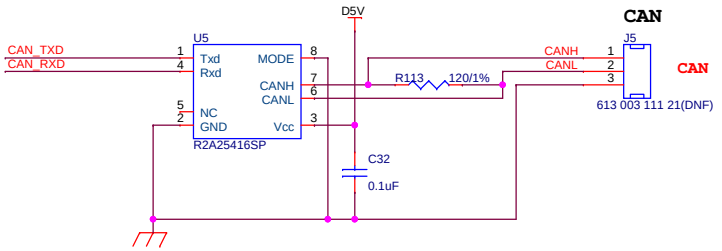






	R133	R135	R136
Line Termination for PROFIBUS-DP	220	390	390
Dual Fail-Safe Biasing for Long Data Links	127	1.09k	1.09k
Single Fail-Safe Biasing for Short Data Links	135	542	542





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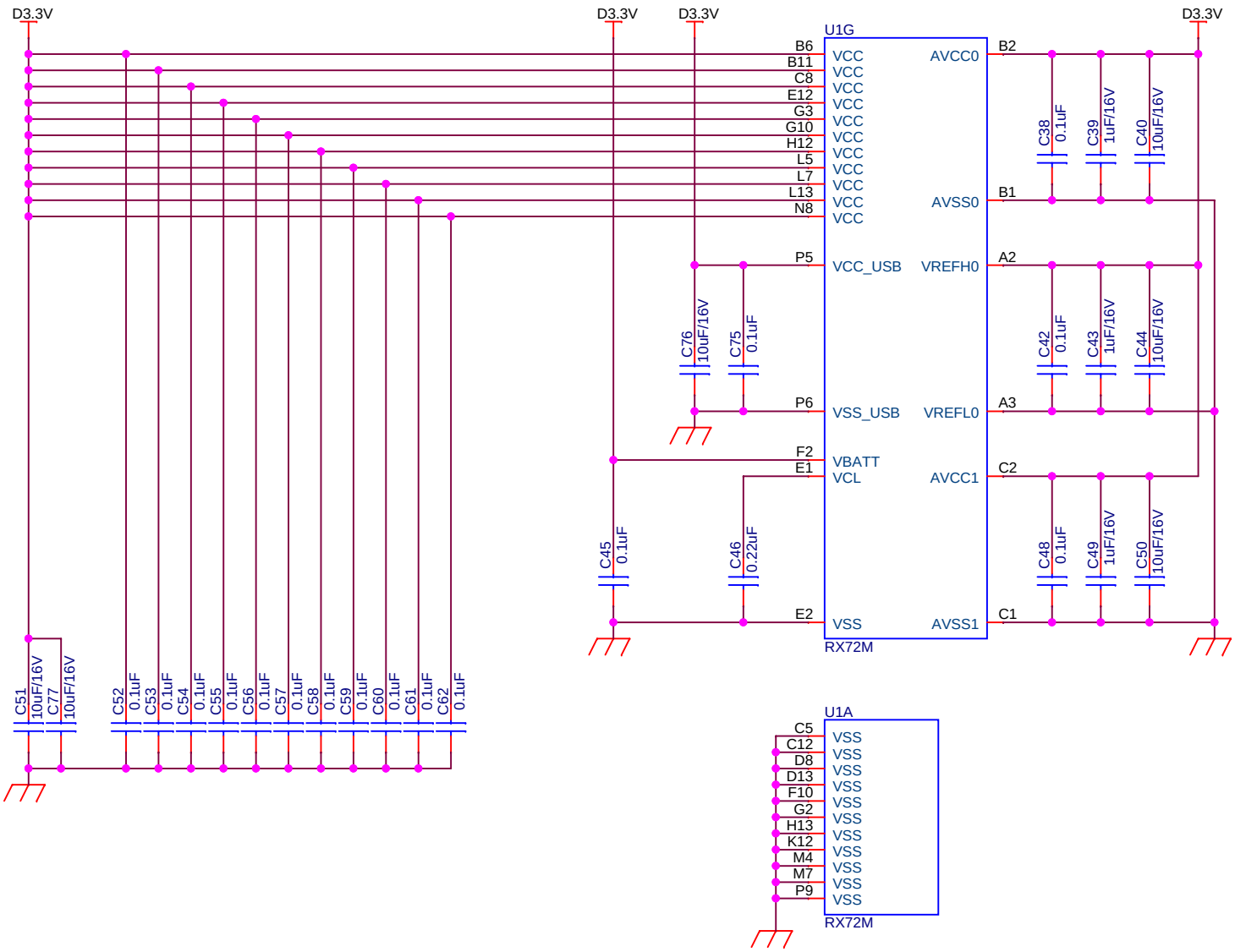

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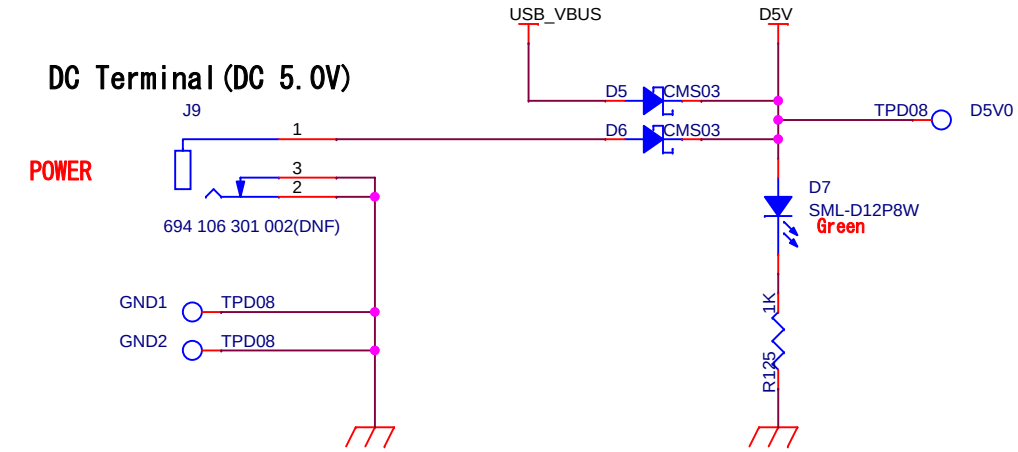

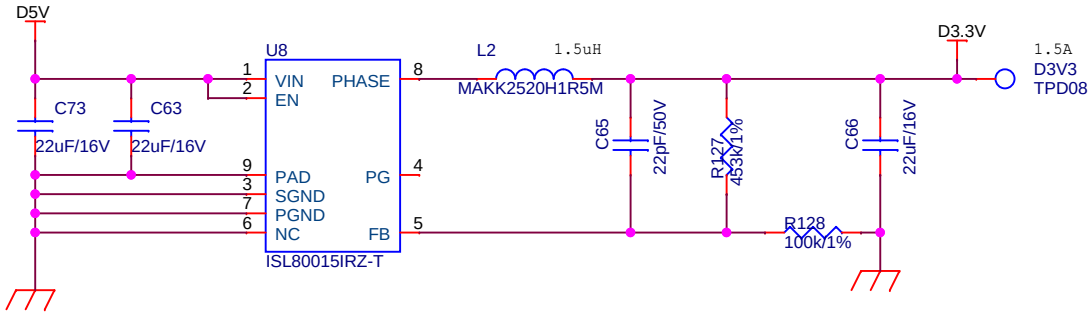

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