

CCPF-SK Hardware specification  
Rev.1.11

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Shimafuji Electric Incorporated

**Revision History**

Implementation Date	Revision	Chapter	Contents

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## 1. Introduction

CCPF Starter Kit is an extension board for R-Car Starter Kit Premier(H3) and R-Car Starter Kit Pro(M3) that made by Renesas Electronics Corporation. It uses Starter Kit Premier(H3) / R-Car Starter Kit Pro(M3) as the main control device and is controlled via COMEXPRESS. It is equipped with expansion interfaces such as M.2 PCI M-Key socket 2ch (compatible with SSD Socket type 2 and 3), USB3.0 1ch, USB2.0 1ch, CAN 2ch, Display 1ch, MIPI CSI 4-Lane 1ch and MIPI CSI 2-Lane 1ch.

### 1.1. Notation

In this manual, the notation of numbers is as shown in the table below. When the number of digits in hexadecimal or binary notation is too many to read, "-" (hyphen) is inserted every four digits.

**Table 1-1 Number notation rules**

Base numbers	Notation rules	Example
Decimal number	Only numbers are shown.	"10" indicates "10" in decimal.
Hexadecimal number	"H" is written at the end of each number. Numbers are preceded by 0x.	"10H" indicates "16" in decimal. "0x10" indicates "16" in decimal.
Binary number	"B" is written at the end of each number.	"10B" indicates "2" in decimal.

## 2. Basic specifications

### 2.1. Specifications

**Table 2-1 Specifications**

Connector	<ul style="list-style-type: none"><li>• CN1 COM Express type connector 440pin</li><li>• CN2 M.2 PCIe M-key SSD Card Socket ch0</li><li>• CN3 M.2 PCIe M-key SSD Card Socket ch1</li><li>• CN4 Display1 connector (Support with R-Car Starter Kit Premier(H3))</li><li>• CN5 USB 3.0</li><li>• CN6 USB 2.0</li><li>• CN7 CAN0/CAN1</li><li>• CN8 GPIO</li><li>• CN9 Main Power Supply input (12VDC or 24VDC)</li><li>• CN10 DEBUG SERIAL(for User)</li><li>• CN11 DEBUG SERIAL(for R-Car Starter Kit Premier(H3) and R-Car Starter Kit Pro(M3))</li><li>• CN12 Camera0 (MIPI CSI-2 4-Lane FPC connector)</li><li>• CN13 Camera1 (MIPI CSI-2 2-Lane FPC connector)</li><li>• CN14 RL78 DEBUG connector</li><li>• CN15 FAN connector</li><li>• CN16 PWRM Ext. switch input</li></ul>
Switch	<ul style="list-style-type: none"><li>• SW1 CAN0 Termination ON/OFF</li><li>• SW2 CAN1 Termination ON/OFF</li><li>• SW3 Power supply ON/OFF toggle switch</li><li>• SW4 PWRM Power ON push switch</li><li>• SW5 PWRM Power OFF push switch</li><li>• SW6 PWRM Suspend to RAM push switch</li><li>• SW7 RL78 MODE dip switch</li></ul>
Board Specification	<ul style="list-style-type: none"><li>• Dimensions: 120mm × 97mm</li><li>• Board thickness: 1.6mm</li><li>• External power supply 12V/5A or 24V/2.5A</li><li>• Operating ambient temperature . Free Air room temperature 25deg ave.</li><li>• DCIN (+6~+30V)</li></ul>

### 3. Configuration and appearance

#### 3.1. Block diagram

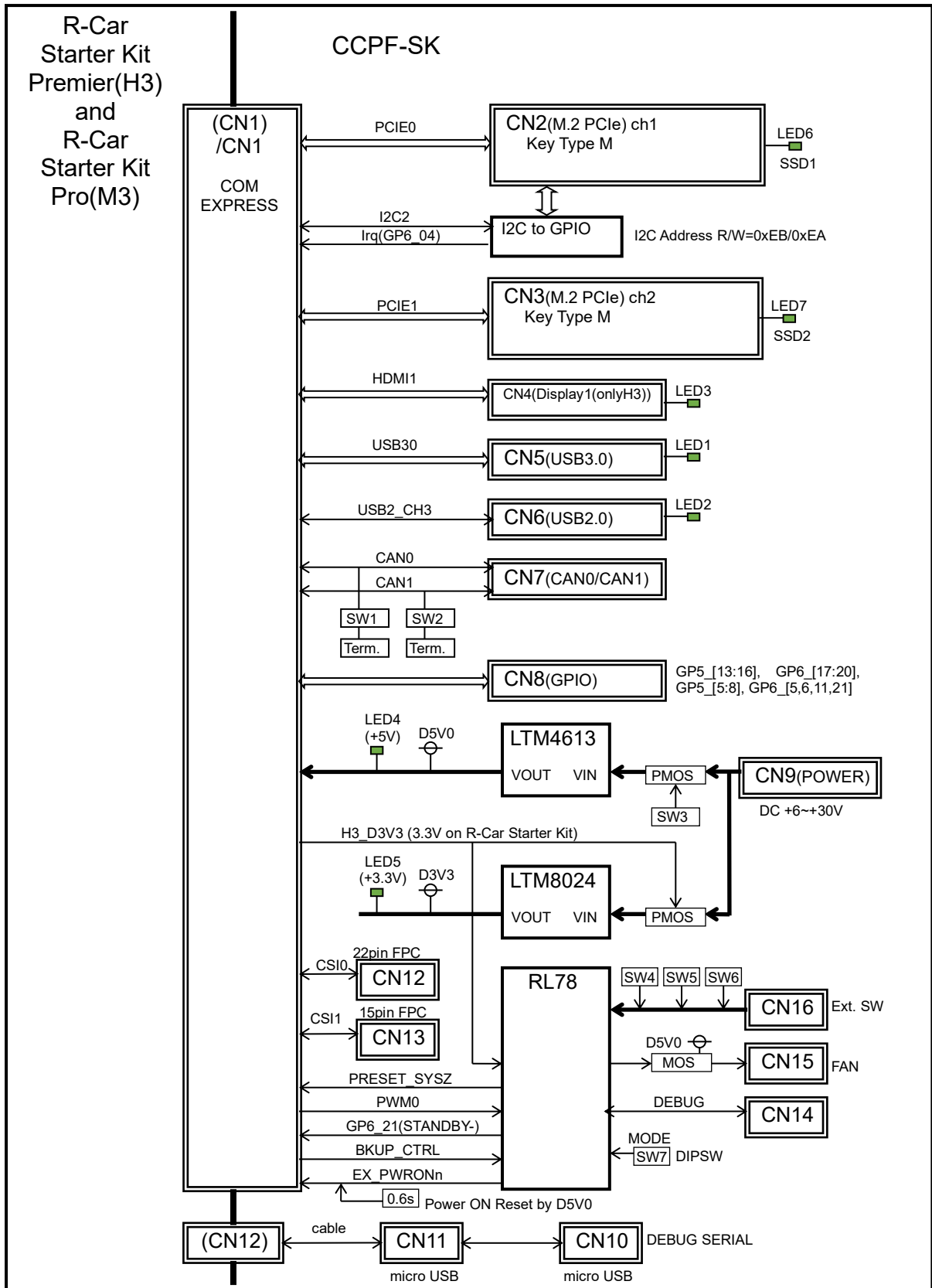


Figure 3-1 Block diagram

### 3.2. Board appearance

The following figures show the board appearance.

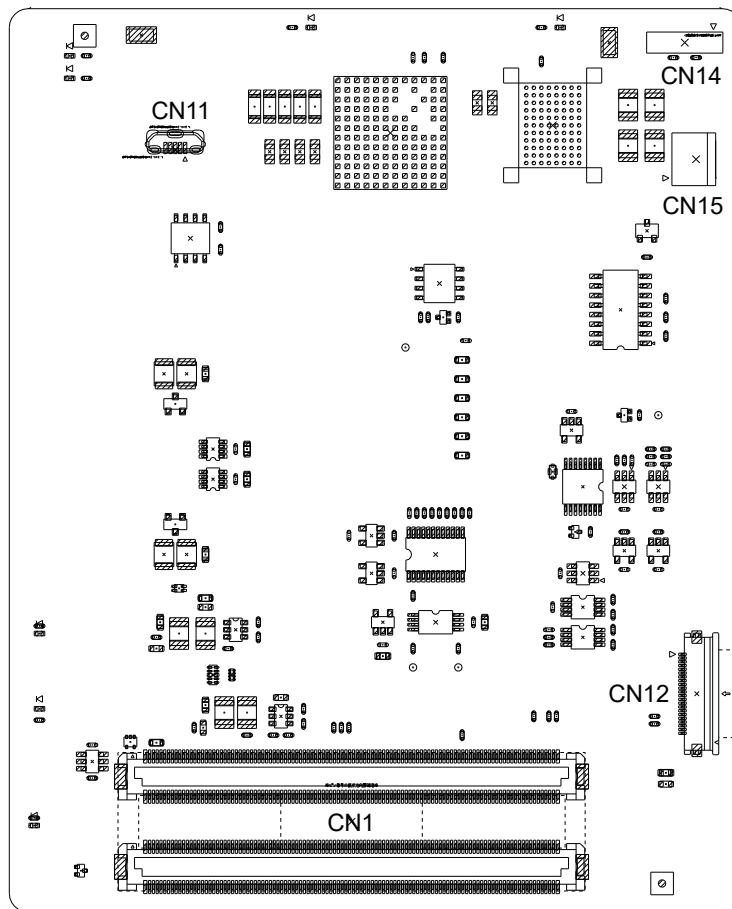


Figure 3-2 Top view

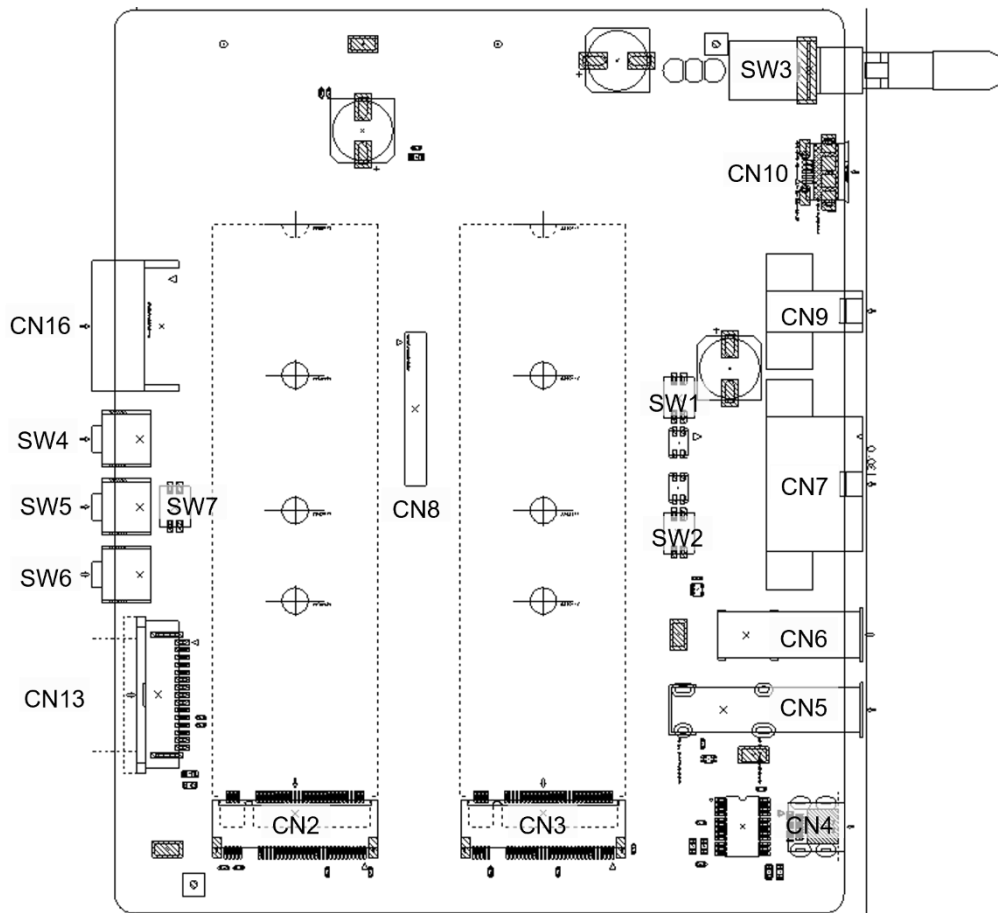


Figure 3-3 Bottom view



## 4. Board description

### 4.1. Switch

#### 4.1.1. SW1, SW2

This is a switch to enable the CAN terminating resistor by turning them on. Please operate 2 bits together.

#### 4.1.2. SW3

This is a power supply switch. The power supply for the board is turned on and off by toggle operation.

#### 4.1.3. SW4, SW5, SW6

These are the on-board switches for power management. The request to RL78 by pressing each SW is shown. (Please refer to [6.2 Power management.](#))

**Table 4-1 Switch functions**

SW No.	Name	Function description	RL78 Pin
SW4	PWR_ON_REQ	request for power return from STANDBY	P00(Input)
SW5	PWR_OFF_REQ	STANDBY transition request	P01(Input)
SW6	STANDBY_REQ	Suspend to RAM request	P02(Input)

#### 4.1.4. SW7

This is a dip switch for RL78 operation mode setting.

**Table 4-2 Dip switch functions**

Pin No.	Name	Function description	RL78 Pin	Initial Setting
1	PWRM_EN	ON (= L): Enable	P121(Input)	OFF
2	Reserved	Please always keep ON	P122(Input)	ON

### 4.2. LED

**Table 4-3 LED functions**

LED No.	Name	Function description	LED color
LED1	USB3.0	lighting when connected	yellow green
LED2	USB2.0	lighting when connected	yellow green
LED3	HDMI1	lighting when connected	yellow green
LED4	+5V	lighting when On Board power (D5V0) is ON	yellow green
LED5	+3.3V	lighting when On Board power (D3V3) is ON	yellow green
LED6	SSD1	lighting with SSD access of M.2 PCIe ch1	yellow green
LED7	SSD2	lighting with SSD access of M.2 PCIe ch2	yellow green

### 4.3. Connector

This section describes the specifications of each connector. Input/output (I/O) in the table is the direction on this board.

#### 4.3.1. COM Express connector (CN1)

This is a 440-pin connector of COM Express. Assignment of signal is based on R-Car Starter Kit Premier(H3) and R-Car Starter Kit Pro(M3).

Manufacturer : TYCO ELECTRONICS  
Model Number : 3-1827231-6  
Mating Connector : 3-5353652-6

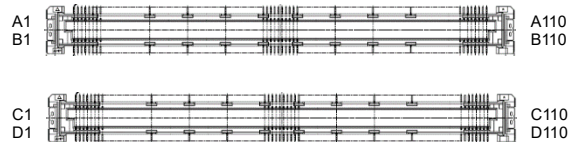


Figure 4-1 COM Express connector

#### 4.3.2. M.2 PCIe connector Key Type M (CN2, CN3)

This is card edge connector of M.2 PCIe Key Type M. Allowable insertion angle is max 20°, it supports card sizes of 30x30mm, 30x42mm, 22x60mm and 22x80mm.

Manufacturer : JAE  
Model Number : SM3ZS067U410AMR1000



Figure 4-2 M.2 PCIe connector

For pin assignment, please refer to Key Type M of Socket 2 and 3 of PCI Express M.2 Specification.

#### 4.3.3. Display1 connector (CN4)

This is a display connector that connects to Display1 on the R-Car Starter Kit Premier(H3).

Manufacturer : Molex  
Model Number : 46765-0301

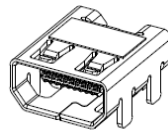


Figure 4-3 Display connector

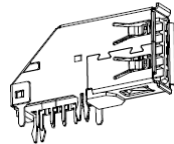
**Table 4-4 Display pin name**

1	HPD	13	GND_CLK(GND)
2	Utility(N.C.)	14	CLKM
3	DATA2+	15	CEC
4	GND_DATA2(GND)	16	GND_DDC_CEC(GND)
5	DATA2-	17	DDC_SCL
6	DATA1+	18	DDC_SDA
7	GND_DATA1(GND)	19	VCC(+5V)
8	DATA1-	G1	SHELL0(GND)
9	DATA0+	G2	SHELL1(GND)
10	GND_DATA0(GND)	G3	SHELL2(GND)
11	DATA0-	G4	SHELL3(GND)
12	CLKP		

**4.3.4. USB3.0 connector (CN5)**

This is a USB3.0 specification connector that connects to USB3\_ch0(USB30) of the R-Car Starter Kit Premier(H3) and R-Car Starter Kit Pro(M3).

Manufacturer : Molex  
Model Number : 48404-0003



**Figure 4-4 USB3.0 connector**

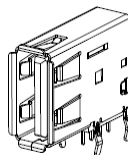
**Table 4-5 USB3.0 connector pin name**

1	VBUS
2	D-
3	D+
4	GND
5	STDA_SSRX-
6	STDA_SSRX+
7	GND
8	STDA_SSTX-
9	STDA_SSTX+
G1	SHELL0(GND)
G2	SHELL1(GND)
G3	SHELL2(GND)
G4	SHELL3(GND)

**4.3.5. USB2.0 connector (CN6)**

This is a USB2.0 specification connector that connects to USB2\_ch0(USB20) of the R-Car Starter Kit Premier(H3) and R-Car Starter Kit Pro(M3).

Manufacturer : Molex  
Model Number : 48204-0001



**Figure 4-5 USB2.0 connector**

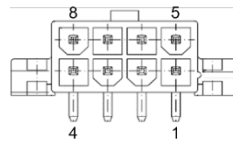
**Table 4-6 USB2.0 connector pin name**

1	VBUS
2	D-
3	D+
4	GND
G1	SHELL0(GND)
G2	SHELL1(GND)
G3	SHELL2(GND)
G4	SHELL3(GND)

**4.3.6. CAN connector (CN7)**

This is a connector for CAN that connects to CAN\_ch0(CAN0) and CAN\_ch1(CAN1) of the R-Car Starter Kit Premier(H3) and R-Car Starter Kit Pro(M3).

Manufacturer : Molex  
Model Number : 39291088



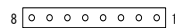
**Figure 4-6 CAN connector**

**Table 4-7 CAN pin name**

1	GND	5	GND
2	CANH0	6	CANH1
3	CANL0	7	CANL1
4	GND	8	GND

**4.3.7. GPIO connector (CN8)**

This is a GPIO signal directly connected to the R-Car Starter Kit premier(H3) and R-Car Starter Kit Pro(M3). This level is 3.3V. Please don't apply a signal with a level exceeding this voltage. Also, please don't apply a voltage level exceeding  $\pm 0.3V$  when the board is powered off. It may cause board failure.



**Figure 4-7 GPIO connector**

**Table 4-8 GPIO pin name**

1	3.3V
2	GP5_13/HRX0
3	GP5_14/HTX0
4	GP5_15/HCTS0#
5	GP5_16/HRTS0#
6	GP6_17
7	GP6_18
8	GND

#### 4.3.8. Power supply connector (CN9)

This is a connector for power supply. It inputs DC12V or DC24V.  
 Manufacturer : Molex  
 Model Number : 39291028

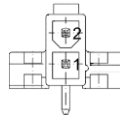


Figure 4-8 Power supply connector

Table 4-9 Power supply pin name

1	DC 12V/24V
2	GND

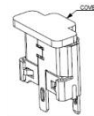
#### 4.3.9. DEBUG serial connector (CN10, CN11)

CN10 is a serial connector for the console. Also, CN11 is connected by a cable to the connector (CN12) on the R-Car Starter Kit Premier(H3) / R-Car Starter Kit Pro(M3).

CN10  
 Manufacturer : Hirose  
 Model Number : ZX62D-AB-5P8(30)  
 CN11  
 Manufacturer : Molex  
 Model Number : 1051330011



CN10



CN11

Figure 4-9 DEBUG serial connector

Table 4-10 DEBUG serial pin name

1	VBUS
2	D-
3	D+
4	ID(N.C.)
5	GND
G1	FG1
G2	FG2
G3	FG3
G4	FG4

#### 4.3.10. Camera connector (CN12, CN13)

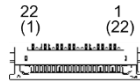
This is a MIPI camera serial interface FPC connector. The pin number of below figure CN12 is circuit pin number of FPC. The number in parentheses is the pin number of connector component. The pin number of CN13 matches the pin number both FPC and connector parts.

CN12

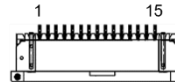
Manufacturer : Molex  
Model Number : 54548-2271

CN13

Manufacturer : FCI  
Model Number : SFW15R-1STE1LF



(CN12)



(CN13)

Figure 4-10 Camera connector

Table 4-11 Camera pin name

Pin No.	Pin Name
1(22)	GND
2(21)	CAM_D0_N
3(20)	CAM_D0_P
4(19)	GND
5(18)	CAM_D1_N
6(17)	CAM_D1_P
7(16)	GND
8(15)	CAM_CK_N
9(14)	CAM_CK_P
10(13)	GND
11(12)	CAM_D2_N
12(11)	CAM_D2_P
13(10)	GND
14(9)	CAM_D3_N
15(8)	CAM_D3_P
16(7)	GND
17(6)	CAM_IO0
18(5)	CAM_IO1
19(4)	GND
20(3)	CAM_SCL
21(2)	CAM_SDA
22(1)	CAM_3V3

Pin No.	Pin Name
1	GND
2	CAM_D0_N
3	CAM_D0_P
4	GND
5	CAM_D1_N
6	CAM_D1_P
7	GND
8	CAM_CK_N
9	CAM_CK_P
10	GND
11	CAM_IO0
12	CAM_IO1
13	CAM_SCL
14	CAM_SDA
15	CAM_3V3

#### 4.3.11. RL78 DEBUG connector (CN14)

This is a connector for RL78 DEBUGGER connection.

Manufacturer : OMRON  
 Model Number : XG8V-0431



Figure 4-11 RL78 DEBUG connector

Table 4-12 RL78 DEBUG pin name

1	5V
2	RESET
3	TOOL
4	GND

#### 4.3.12. FAN connector (CN15)

This connects the FAN of the R-Car Starter Kit Premier(H3) and R-Car Starter Kit Pro(M3). It controls FAN power supply using RL78.

Manufacturer : Molex  
 Model Number : 22-04-1031



Figure 4-12 FAN connector

Table 4-13 FAN pin name

1	GND
2	PWM(+5V)
3	N.C.

#### 4.3.13. EXT\_SW connector (CN16)

This is an external switch input connector. It requests the power management processing of RL78 wired with SW4, SW5 and SW6 on the board. Please refer to [6.2.2 Power state transition request switch](#).

Manufacturer : JST  
 Model Number : S6B-XH-A

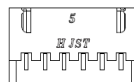


Figure 4-13 EXT\_SW connector

Table 4-14 EXT\_SW pin name

1	EX_SW4
2	EX_SW5
3	EX_SW6
4	5VIN
5	5VOUT
6	GND

## 5. Functions

In this chapter, the circuit configuration is explained by functional block.

### 5.1. M.2 PCIe card slot

#### 5.1.1. M.2 PCIe ch1

The connector for PCIe ch1 (CN2) can be accessed to the port from I2C ch2 (I2C2). Please refer to [5.9 General purpose port](#) about the pins.

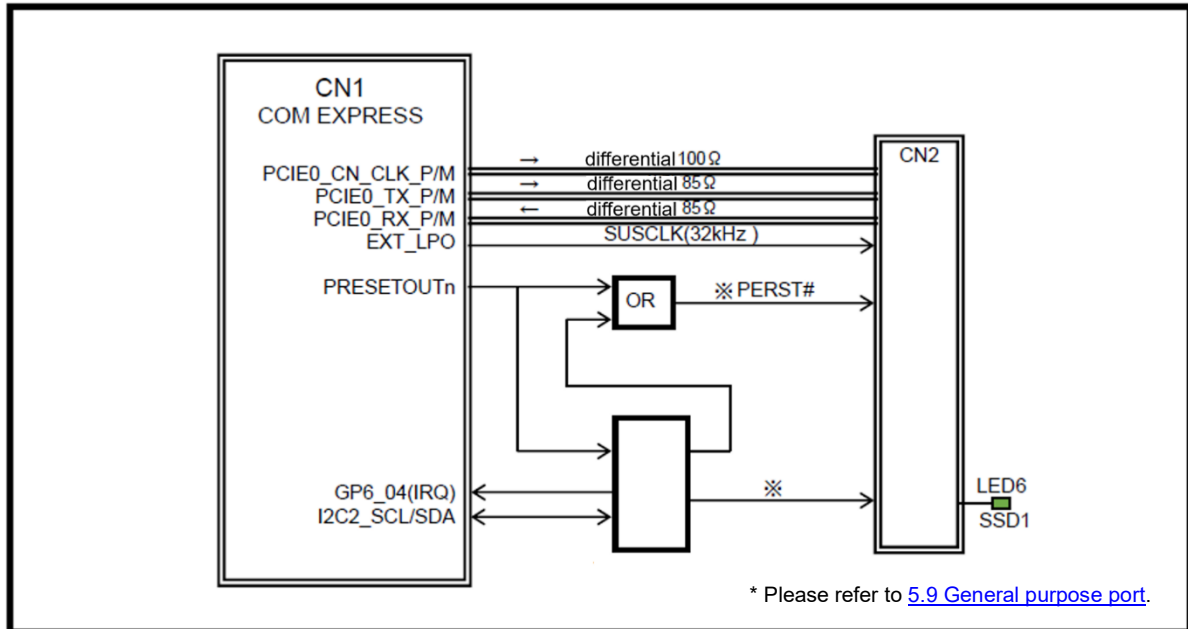


Figure 5-1 M.2 PCIe ch1 function diagram

#### 5.1.2. M.2 PCIe ch2

The connector for PCIe ch2 (CN3) is prepared for SSD. Although there is no port for control lines like ch1, CN3-21 can be read.

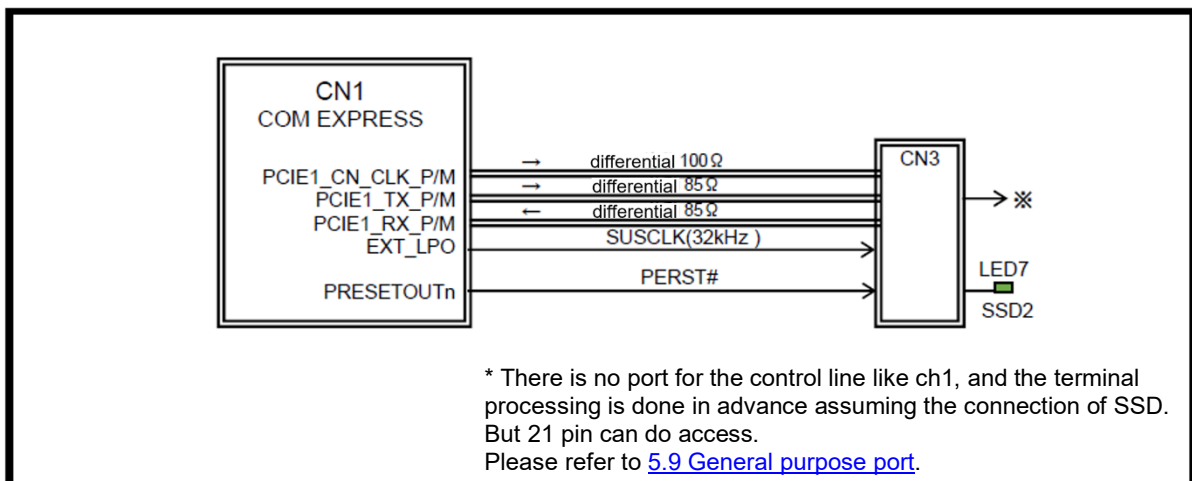


Figure 5-2 M.2 PCIe ch2 function diagram



## 5.2. Display

HDMI1 on the R-Car Starter Kit Premier(H3) connects to CN4 as shown in the figure below.

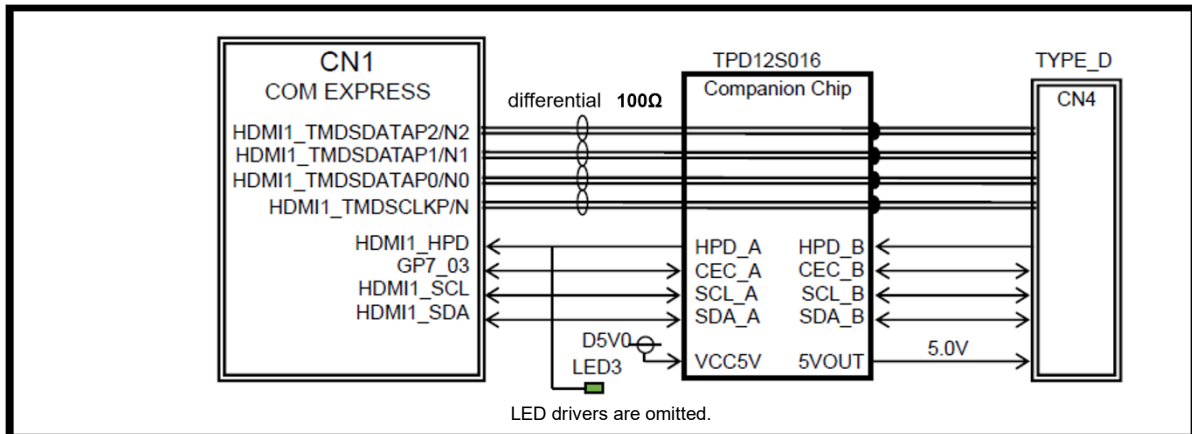


Figure 5-3 Display function diagram

## 5.3. USB

### 5.3.1. USB3.0

USB3.0 ch0 on the R-Car Starter Kit Premier(H3) / R-Car Starter Kit Pro(M3) is connected to CN5 as shown in the figure below.

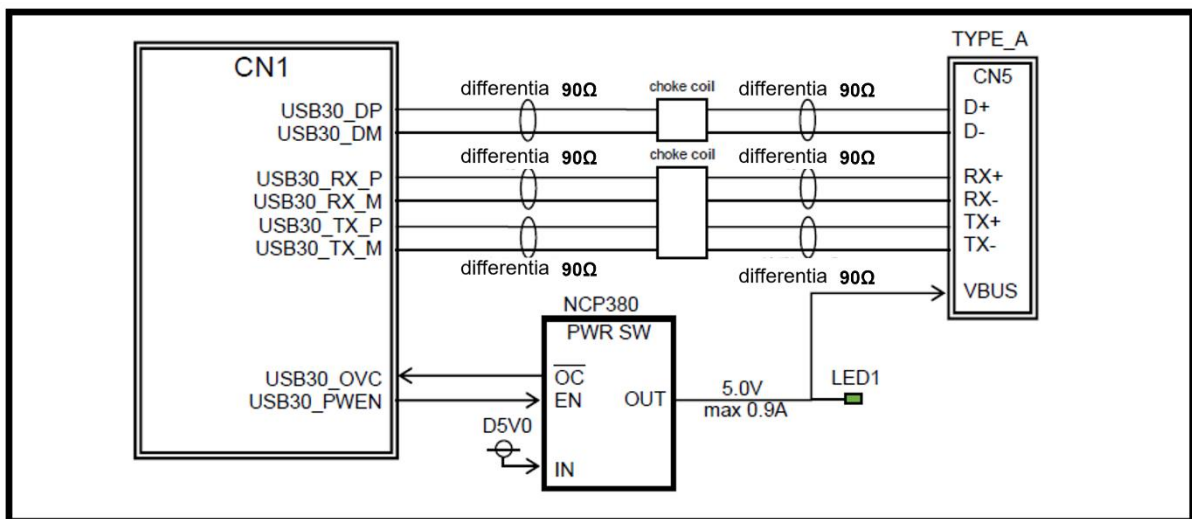


Figure 5-4 USB3.0 function diagram

### 5.3.2. USB2.0

USB2.0 ch0 on the R-Car Starter Kit Premier(H3) / R-Car Starter Kit Pro(M3) is connected to CN6 as shown in the figure below.

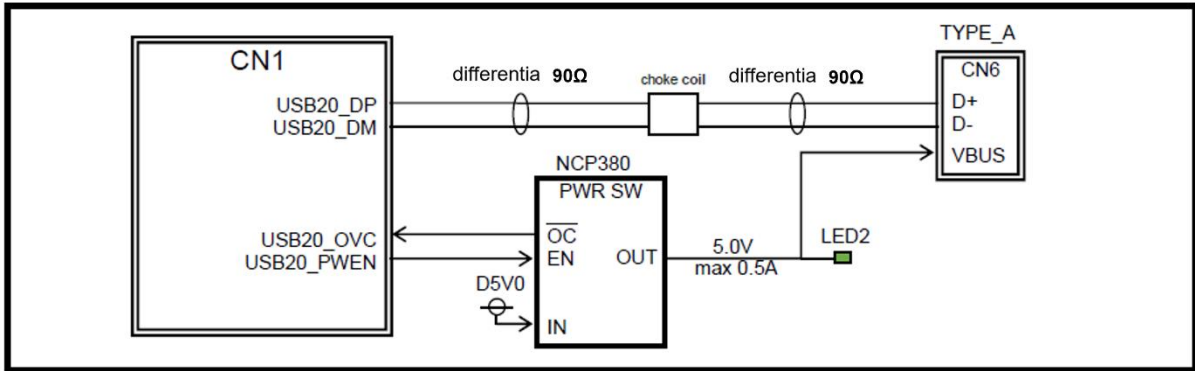


Figure 5-5 USB2.0 function diagram

### 5.4. CAN

#### 5.4.1. CAN ch0

CAN ch0 on the R-Car Starter Kit Premier(H3) / R-Car Starter Kit Pro(M3) is connected to CN7A.

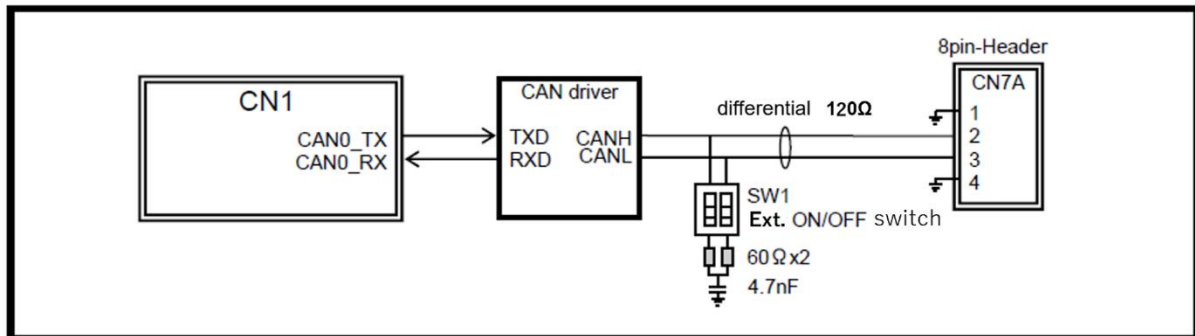


Figure 5-6 CAN ch0 function diagram

#### 5.4.2. CAN ch1

CAN ch1 on the R-Car Starter Kit Premier(H3) / R-Car Starter Kit Pro(M3) is connected to CN7B.

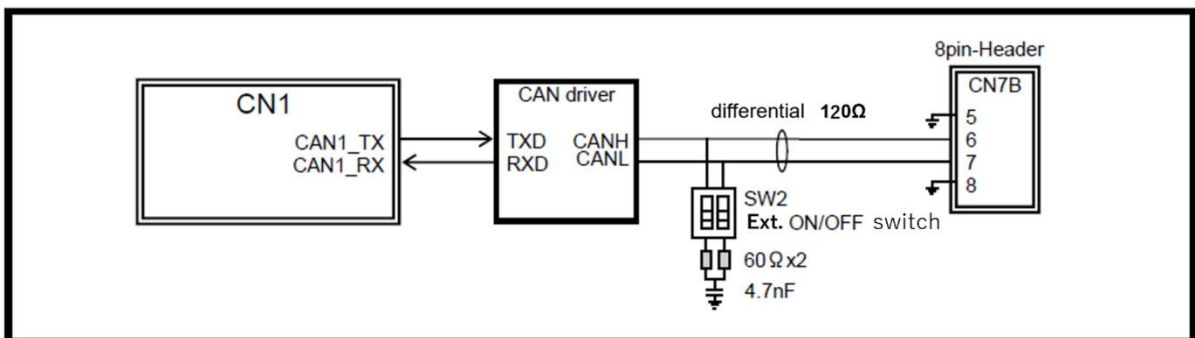


Figure 5-7 CAN ch1 function diagram

## 5.5. GPIO

GPIO is directly connected to CN8 via 100 ohm for testing. This level is 3.3V. Please don't apply a voltage level exceeding  $\pm 0.3V$  when the board is powered off. It may cause the board failure.

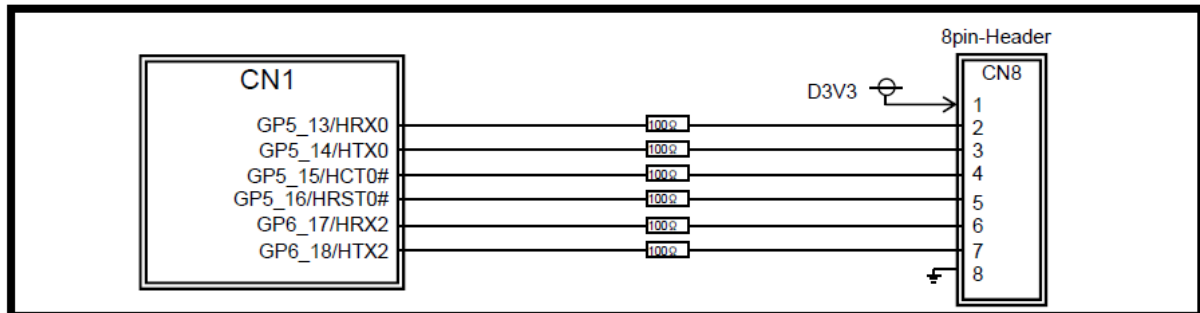


Figure 5-8 GPIO function diagram

## 5.6. Power supply

+5V(8A) and +3.3V(6A) are generated from DC +6V-+30V as input power supply. +5V(D5V0) is supplied for on-board and for input power supply of the R-Car Starter Kit Premier(H3) / R-Car Starter Kit Pro(M3).

+3.3V(D3V3) is supplied by turning PMOS on after supplying +3.3V on the R-Car Starter Kit Premier(H3) / R-Car Starter Kit Pro(M3). Also, the D3V3 is only used this board. RSTBMODE of R-Car Starter Kit Premier(H3) and R-Car Starter Kit Pro(M3) power management (PMIC) sets LOW (= Level mode). Please refer to user's manual of the R-Car Starter Kit Premier(H3) / R-Car Starter Kit Pro(M3) about detail of these PMIC.

Also, it has power management function (PWRM). Microcontroller RL78 controls according to each event. Please refer to [6.2 Power management](#).

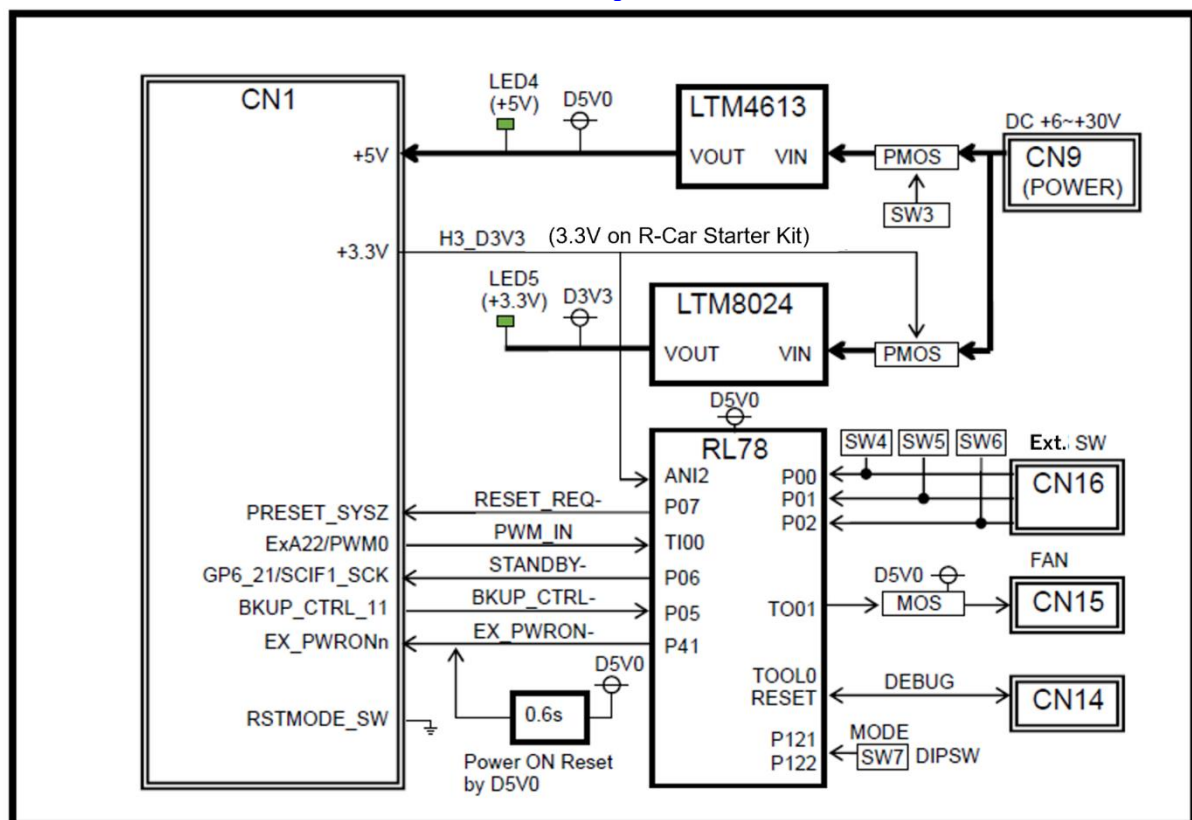


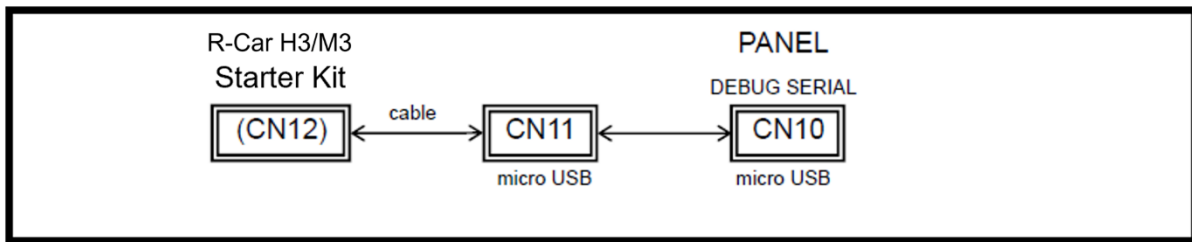
Figure 5-9 Power supply function diagram

**Table 5-1 Power supply pin function**

Pin No.	Pin Name (IO)	Signal Name	Pin Handling	Function
1	P41 (O)	PWRON-	PU	H3/M3 power ON/OFF. L=ON
2	TOOL0 (IO)	DEBUG_DATA	PU	DEBUGGER data and commands
3	RESET (I)	DEBUG_RESET	PU	DEBUGGER reset
4	TI00 (I)	PWM_IN		FAN control input. H3/M3 PWM0 (Pulse)
5	P122 (I)	N.A.	(GND)	SW7-2 (Reserved)
6	P121 (I)	PWRM_EN-	PU	SW7-1 power management enable (Active L)
7	VSS	GND		power supply ground
8	VDD	D5V0		power supply +5V
9	P00 (I)	SW_PWR_ON		SW4 power ON (Active H)
10	P01 (I)	SW_PWR_OFF		SW5 power OFF (Active H)
11	P02 (I)	SW_STANDBY_ON		SW6 Suspend to RAM request (Active H)
12	ANI2 (I)	H3_D3V3ON		H3/M3 3.3V power supply
13	TO01 (O)	PWM_OUT		FAN control output (PWM). (Pulse)
14	P05 (I)	BKUP_CTRL-	PU	backup request
15	P06 (O)	STANDBY-	PU	standby request. H3/M3 GP6_21 (Active L)
16	P07 (O)	RESET_REQ-	PU	system reset (PRESET_SYSZ) (Active L)

### 5.7. DEBUG connector

This is a serial connector for the console. Also, CN11 is connected by a cable to the connector (CN12) on the R-Car Starter Kit Premier(H3) / R-Car Starter Kit Pro(M3).



**Figure 5-10 DEBUG connector function diagram**

### 5.8. Camera0, Camera1

This is the interface for MIPI CSI-2 camera. MIPI CSI-2 4-Lane (CSI0) is connected to CN12 and MIPI CSI-2 2-Lane (CSI1) is connected to CN13. I2C4 is connected to I2C on CN12 and CN13, and is controlled by switching buffers. The control IO is accessed via the general purpose port.

Please refer to [5.9 General purpose port](#) about switching control and IO port.

In addition, the following I2C addresses are used in this board, and cameras with I2C addresses other than these can be connected.

I2C4 Slave Address(R/W) = (0xD1/0xD0), (0xD5/0xD4)

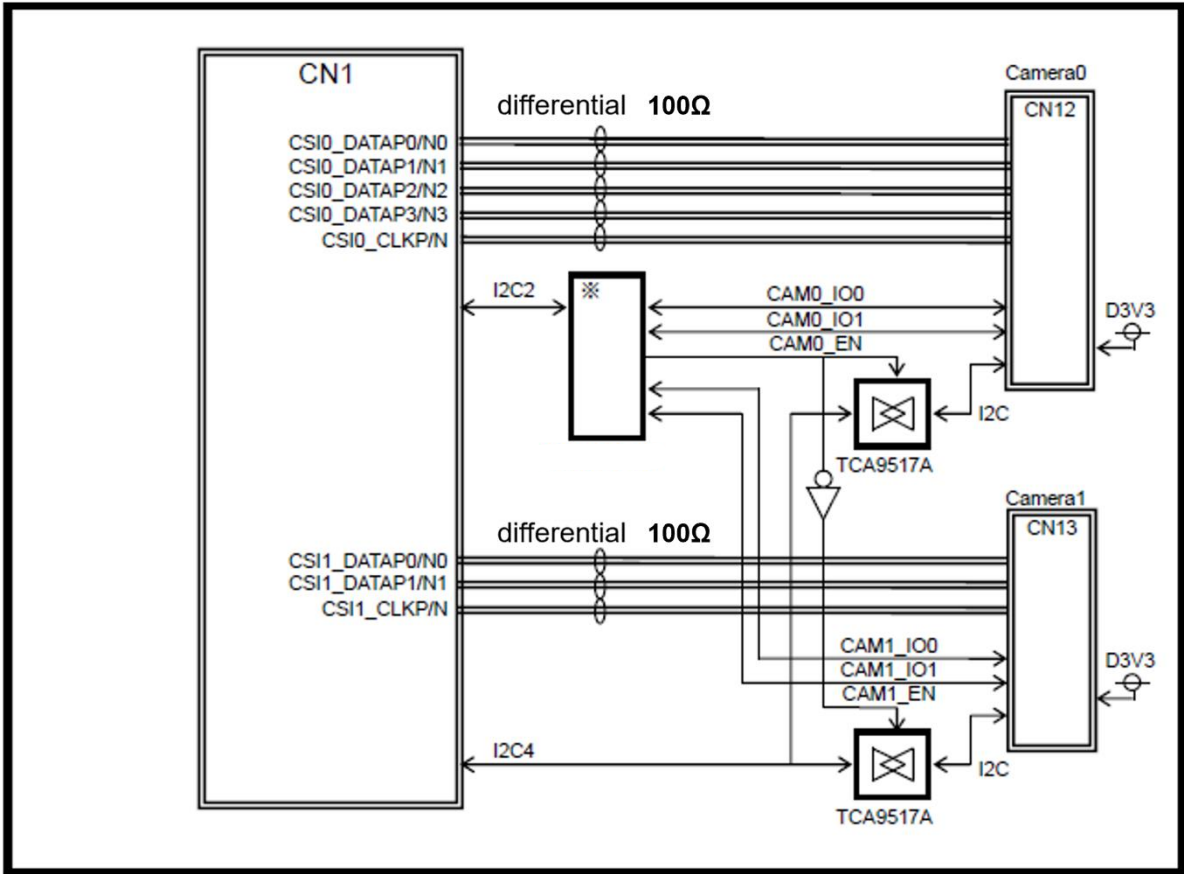


Figure 5-11 Camera function diagram

## 5.9. General purpose port

The board has general purpose port via I2C ch2 (I2C2).

I2C Slave Address (R/W) = 0xEB/0xEA

P00-P03, P10 and P14 are for M.2 PCIe, P04-P07 and P17 are for Camera. CN of pin number shows below.

CN2 ; M.2 PCIe card ch1

CN3 ; M.2 PCIe card ch2

CN12 ; Camera0

CN13 ; Camera1

CAM0\_EN is enable control signal of I2C buffer for Camera.

**Table 5-2 General purpose port function**

Port No.	Pin No.	Pin Name	Signal Name	Attributes and External Processing	Function
P17	-	-	CAM0_EN	(OUT)PU	'H' to connect Camera0 to I2C4 'L' to connect Camera1 to I2C4
P16				(IN)PU	
P15				(IN)PU	
P14	CN2-50	PERST#	PERST1#	(OUT)PU	M.2 PCIe card ch1
P13				(IN)PU	
P12				(IN)PU	
P11				(IN)PU	
P10	CN2-69	PEDET	PESATA1	(IN)PU	M.2 PCIe card ch1
P7	CN13-18	-	CAM1_IO1	(IN/OUT)PU	Camera1 IO port 1
P6	CN13-17	-	CAM1_IO0	(IN/OUT)PU	Camera1 IO port 0
P5	CN12-18	-	CAM0_IO1	(IN/OUT)PU	Camera0 IO port 1
P4	CN12-17	-	CAM0_IO0	(IN/OUT)PU	Camera0 IO port 0
P3	CN3-21	GND[5]	SSDIND2	(IN)PU	M.2 PCIe card ch2
P2	CN2-52	CLKREQ#	CLKREQ1	(IN/OUT)PU	M.2 PCIe card ch1
P1	CN2-54	PEWAKE#	PEWAKE1	(OUT)PU	M.2 PCIe card ch1
P0	CN2-21	GND[5]	SSDIND1	(IN)PU	M.2 PCIe card ch1

## 6. APPENDIX

### 6.1. Product appearance

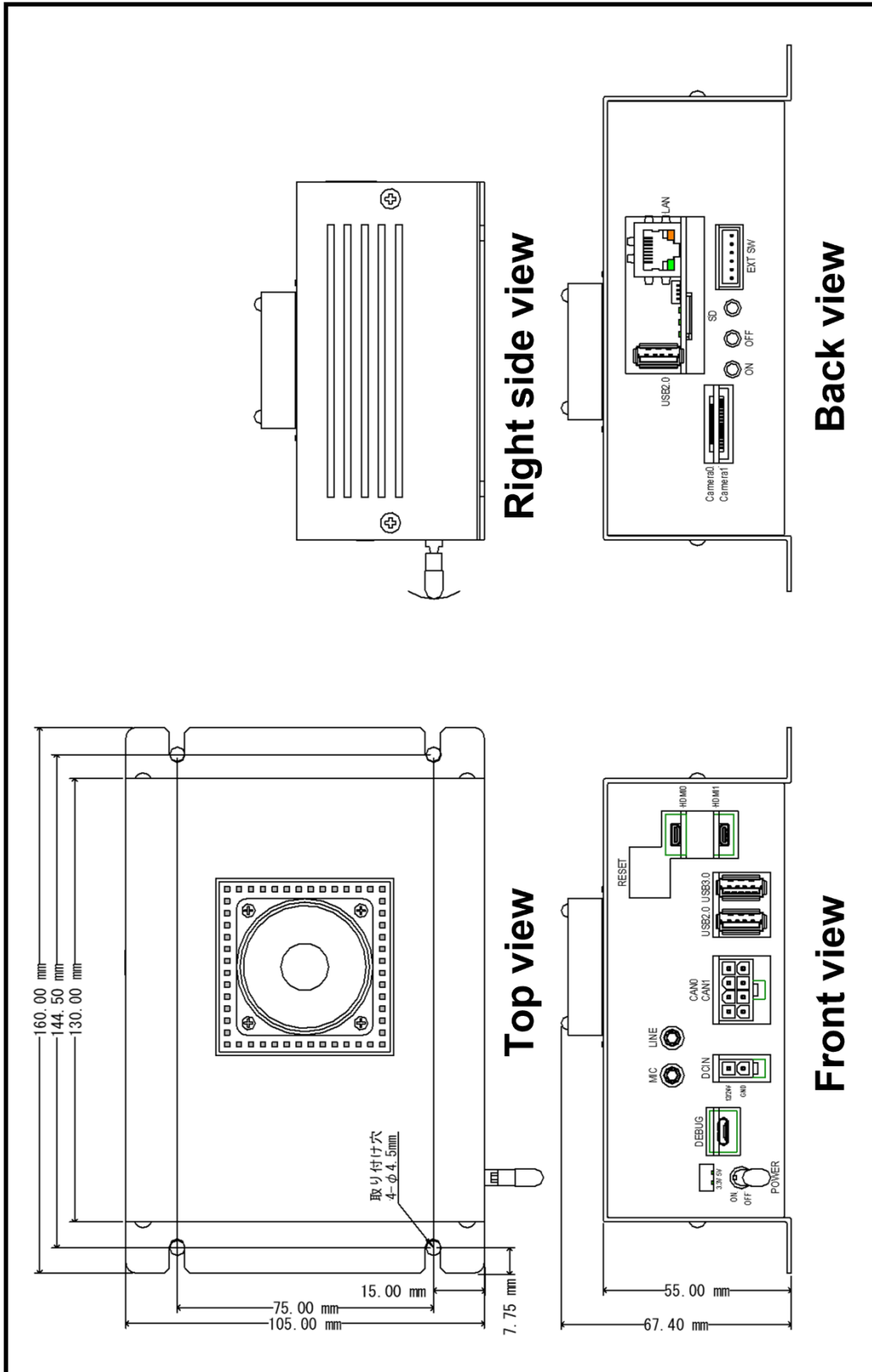
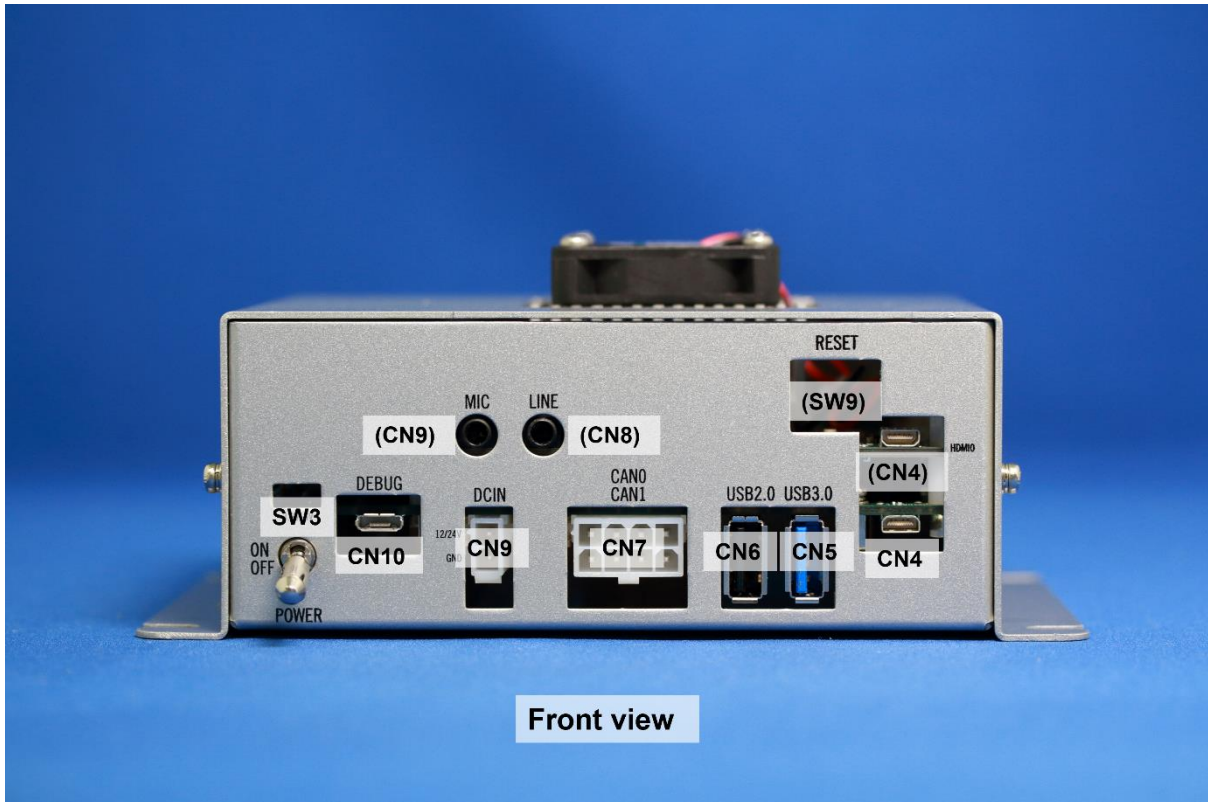


Figure 6-1 Product appearance



Front view

Figure 6-2 Front view



Back view

Figure 6-3 Back view

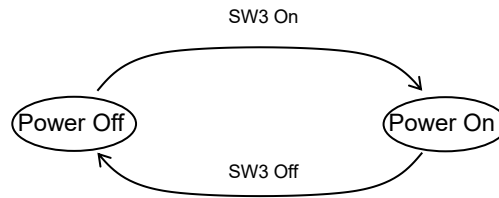
\* The number in parentheses is the part reference number of the R-Car Starter Kit Premier(H3) / R-Car Starter Kit Pro(M3).



## 6.2. Power management

### 6.2.1. RL78

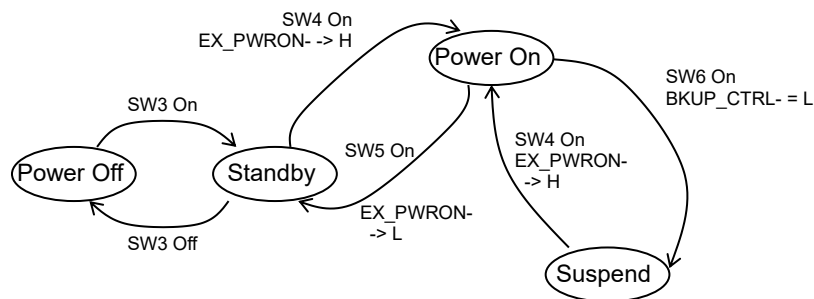
The following table shows the power supply status and transition diagram about power supply control by RL78.



**Figure 6-4 State transition diagram (SW7-1=Off)**

**Table 6-1 State transition table (SW7-1=Off)**

State / Event		Power OFF	Power On
		S1	S2
SW3 ON	E1	S2	-
		go to Power On	-
SW3 OFF	E5	-	S1
		-	go to Power Off



**Figure 6-5 State transition diagram (SW7-1=On)**

**Table 6-2 State transition table (SW7-1=On)**

State / Event		Power OFF	Standby	Power On	Suspend
		S1	S2	S3	S4
SW3 ON	E1	S2	-	-	-
		go to Standby	-	-	-
SW4 ON	E2	-	S3	-	S3
		-	go to Power On	-	go to Power On
SW5 ON	E3	-	-	S4	-
		-	-	go to Suspend	-
SW6 ON	E4	-	-	S2	-
		-	-	go to Standby	-
SW3 OFF	E5	-	S1	-	-
		-	go to Power Off	-	-

\* The signal level is the state on the RL78 pin.

### 6.2.2. Power state transition request switch

This board has the switches (SW4, SW5, SW6) in order to change the power status and also prepares the switches (EX\_SW4, EX\_SW5, EX\_SW6) for the external control. (Please refer to [4.1.3 SW4, SW5, SW6](#) and [4.3.13. EXT\\_SW connector \(CN16\)](#).)

The overall circuit and the external switch circuit (example) are described below. About the photo coupler (TLP291-4), refer to the following data sheet.

<https://toshiba.semicon-storage.com/jp/semiconductor/product/optoelectronics/detail.TLP291-4.html>

There are two types of corresponding circuits: TYPE (1), which uses 5V on the board as the LED power supply for the photo coupler, and TYPE (2), which uses the user power supply and completely isolates them from each other.

When using a user power supply, be careful not to exceed the absolute ratings of the above photocoupler specifications. In particular, don't exceed the allowable power consumption (62.5mW) of R111, R112 and R113 (390  $\Omega$ ), and include a resistor for current adjustment if necessary.

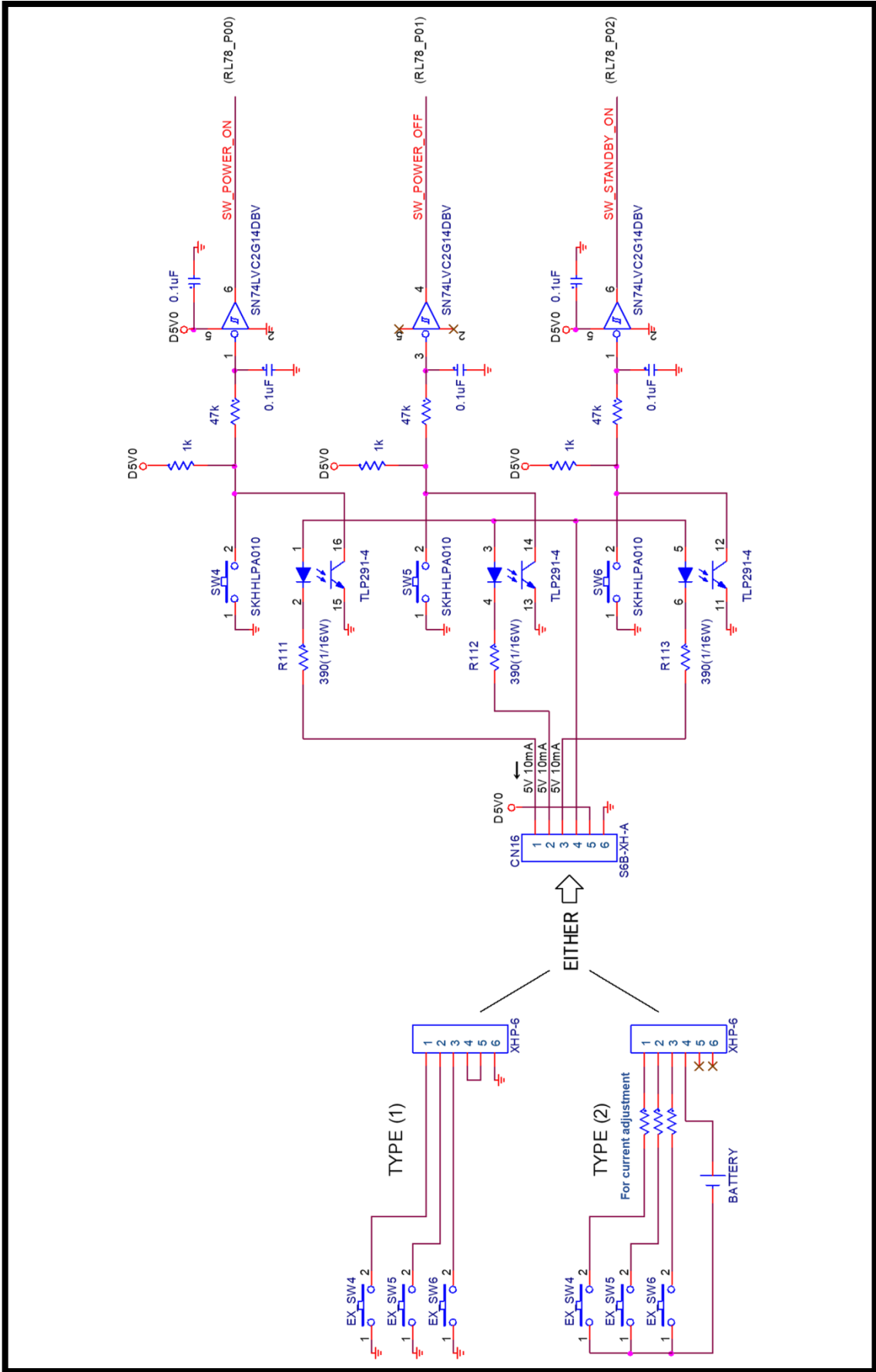


Figure 6-6 Power state transition request switch