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April 1st, 2010
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User's Manual

SH7286 CPU board M3A-HS87

User's Manual

Renesas 32-Bit RISC Microcomputers
SuperH™ RISC engine Family / SH7286 Group

Renesas Electronics
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Table of Contents

Chapter 1
Overview

1.1 Introduction

The M3A-HS87 is a CPU board designed for users to evaluate the feature and performance of SH7286 group of Renesas Technology original microcomputer (MCU), as well as develop and evaluate the application software for the microcomputers described above. All the pins of SH7286 data bus, address bus and on-chip peripheral function are connected to the extension connector to allow user to evaluate the timing with peripheral devices using measurement instruments or develop extension boards according to the use. Furthermore, the on-chip E10A-USB emulator, (Renesas Technology) can be connected.

1.2 System Configuration

Figure 1.2.1 shows an example of system configuration using M3A-HS87.

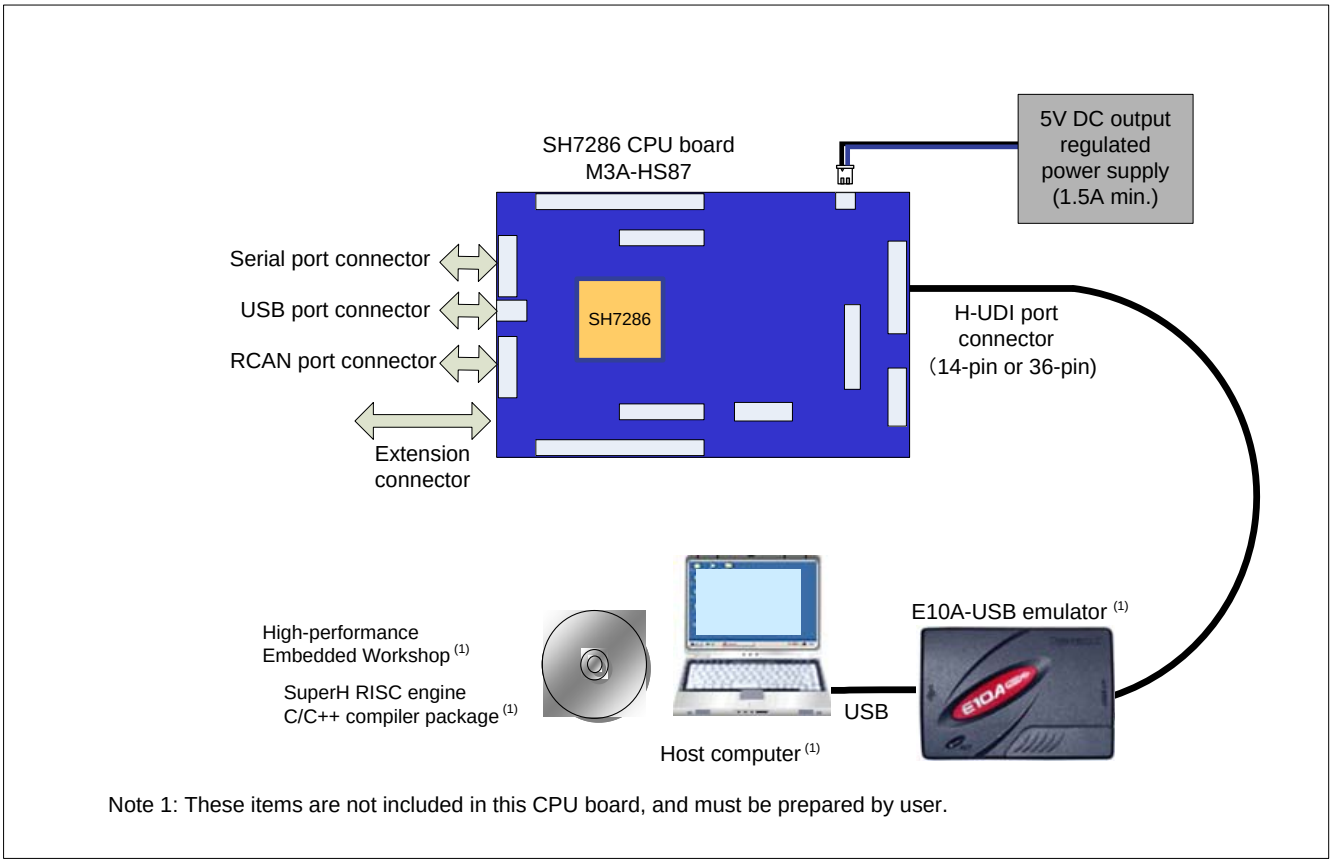

Figure 1.2.1 M3A-HS87 System Configuration Example

1.3 Board Specifications

Table 1.3.1 lists the M3A-HS87 board specifications.

Table 1.3.1 Board Specifications

No.	Item	Description
1	CPU	SH7286 - Input (XIN) clock: 12.5 MHz - CPU clock: 100 MHz max. - Bus clock: 50 MHz max. - On-chip memory - Flash memory: 1024 KB - RAM: 32 KB
2	External memory	- SDRAM: 16 MB (16-bit bus x 2), optional Notes: 1. SDRAM can be mounted only when SH7286 is used in 3.3 V 2. Bus width can be switched for 16-bit and 32-bit. -EEPROM: 128 kbit, optional HN58X24128FPIE: 1 (I^2C bus connection)
3	Connectors	- Extension connectors (Bus, I/O, VCC, GND) - USB port connector (Series-B receptacle) - Serial port connector (D-sub 9-pin) - RCAN port connector (D-sub 9-pin) - H-UDI port connector (14-pin) - H-UDI port connector (36-pin)
4	LEDs	- Power supply LED: 1 - User LEDs: 6
5	Switches	- Reset switch : 1 - NMI switch :1 - IRQ1 switch: 1 *1 - System setting DIP switches: 5/package - User DIP switches: 4/package
6	Board specification	- Dimensions: 100 mm x 160 mm - Mounting form: 4 layers, double-sided - Number of board: 1

Note 1: Silk screen for this switch is printed as IRQ0.

1.4 Exterior

Figure 1.4.1 shows the M3A-HS87 exterior.

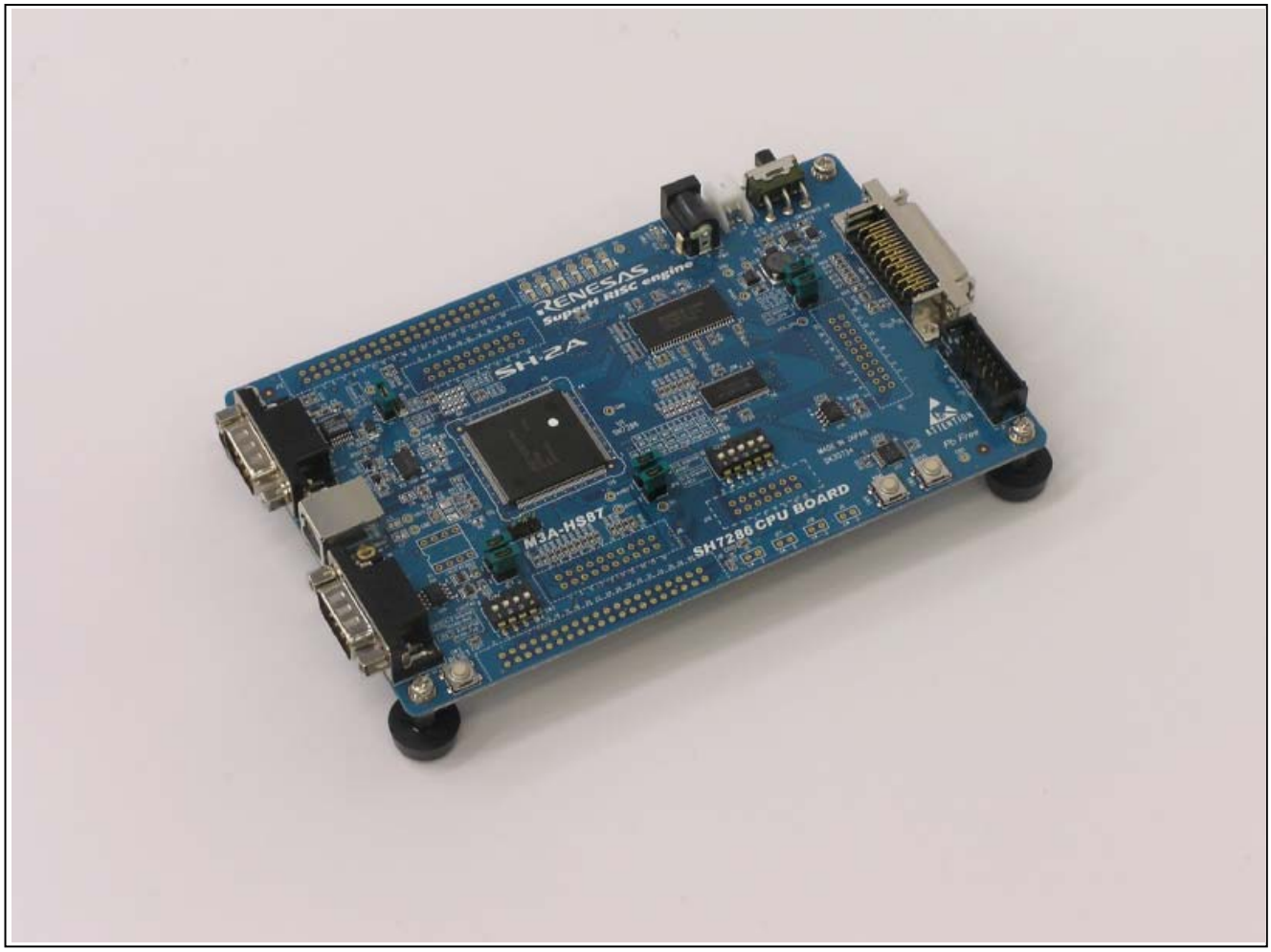

Figure 1.4.1 M3A-HS87 Exterior

1.5 Block Diagram

Figure 1.5.1 shows the M3A-HS87 block diagram.

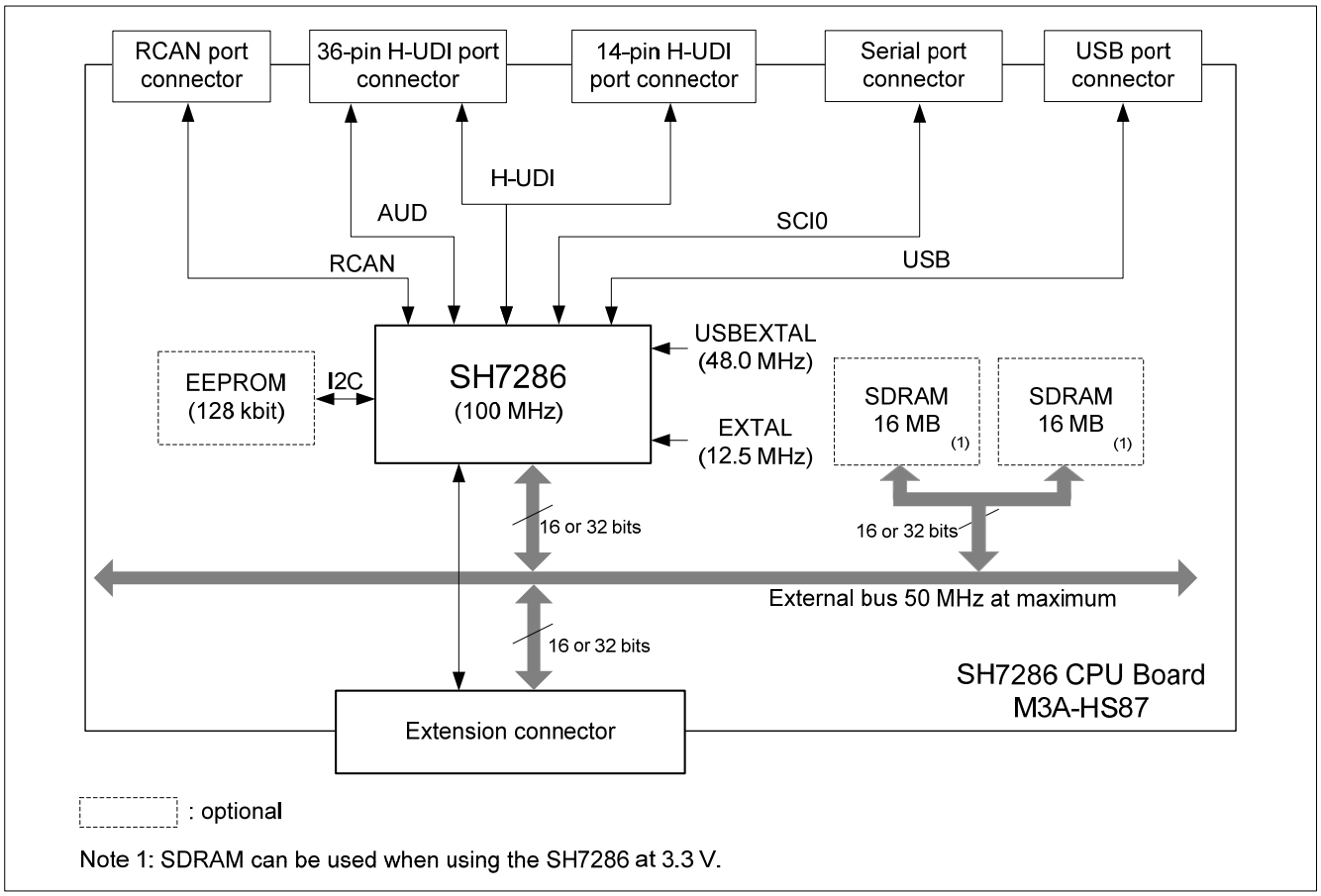

Figure 1.5.1 M3A-HS87 Block Diagram

1.6 Major Components

Figure 1.6.1 and Figure 1.6.2 show the M3A-HS87 major components.

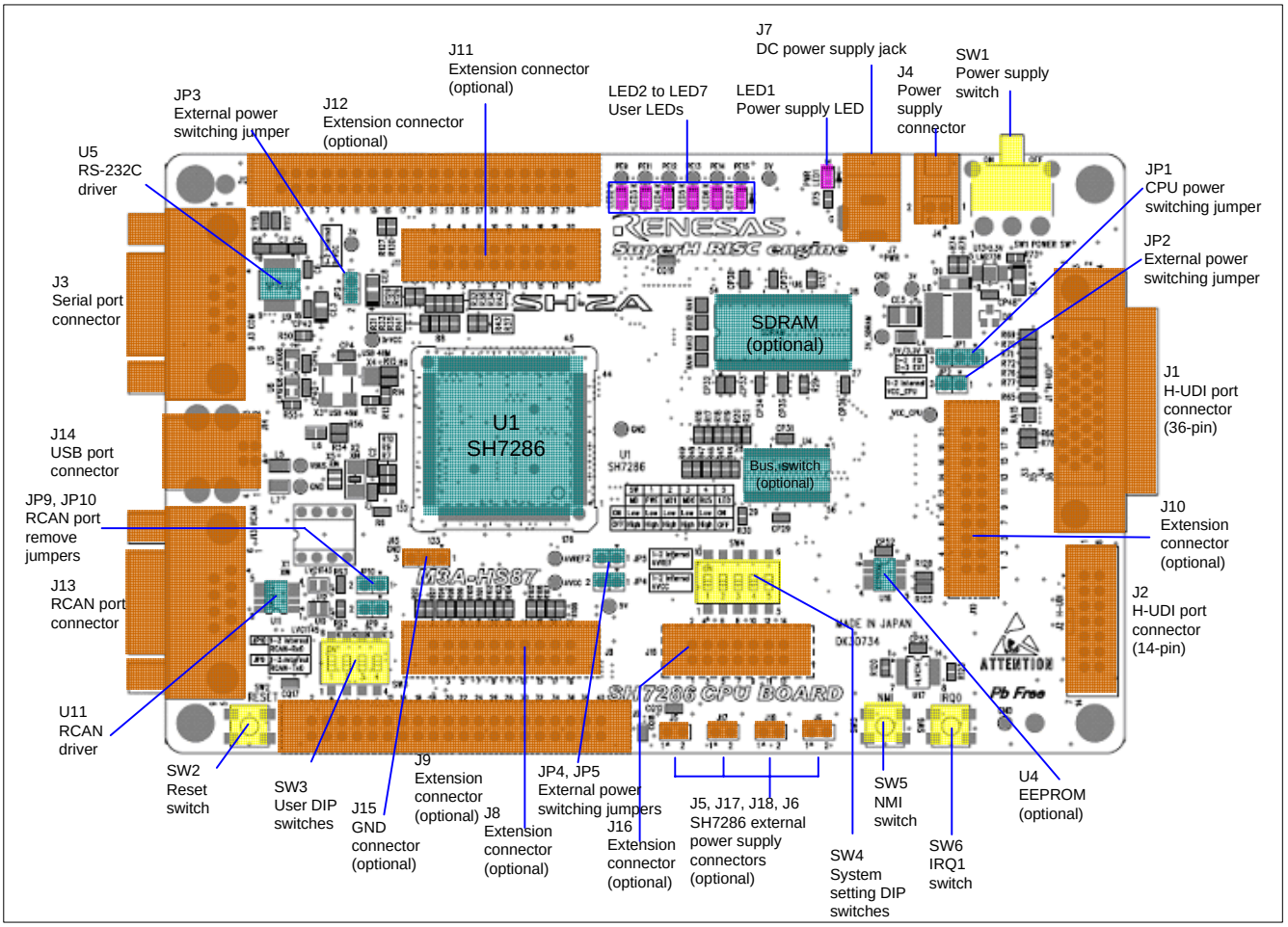

Figure 1.6.1 M3A-HS87 Major Components (Top View of the Component Side)

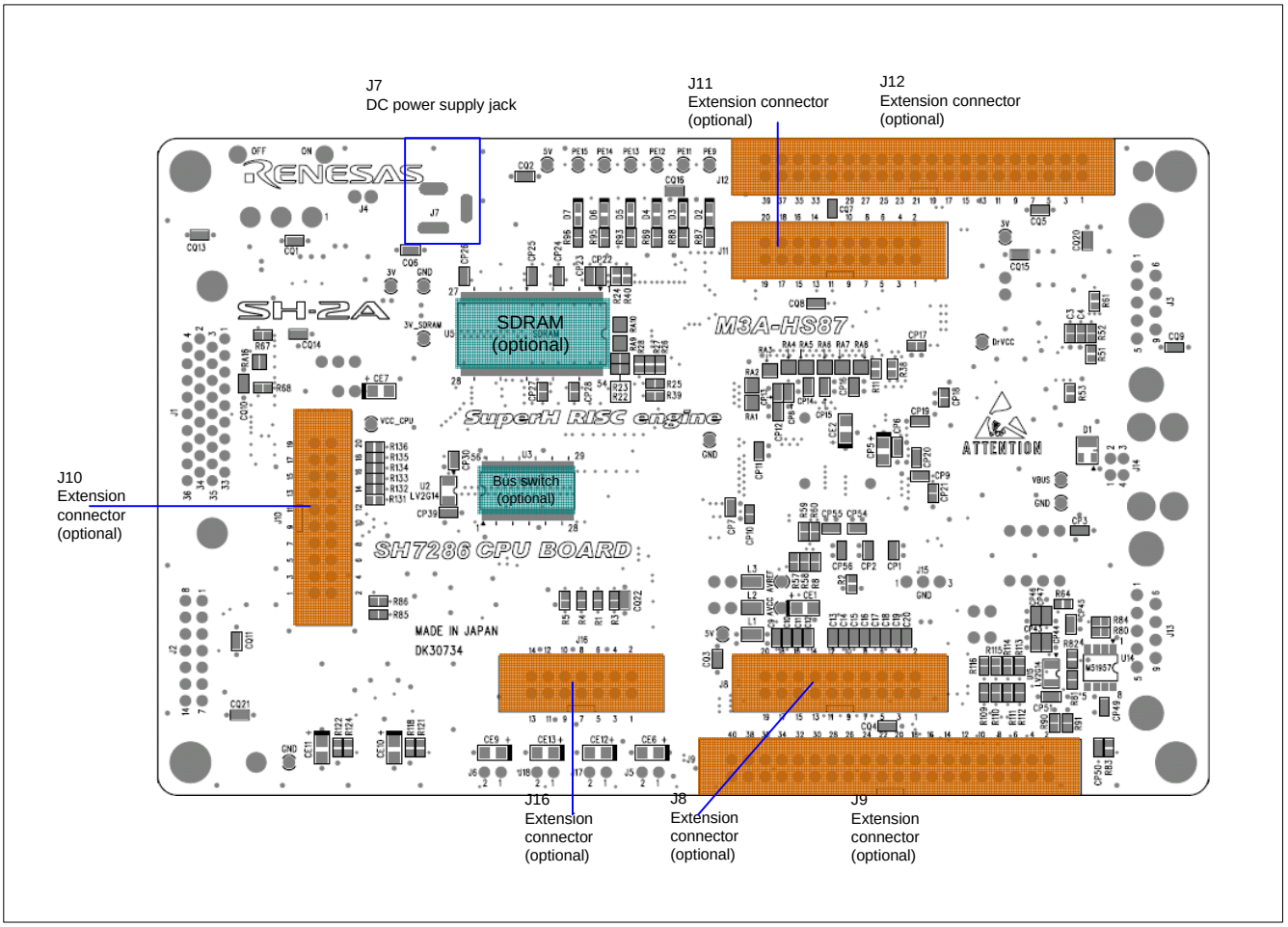

Figure 1.6.2 M3A-HS87 Major Components (Top View of the Solder Side)

Table 1.6.1 lists the major components on the M3A-HS87.

Table 1.6.1 Major Components on the M3A-HS87

No.	Name	Part Number	Manufacturer Name	Remarks
U1	CPU	SH7286	Renesas	
U3, U4	Bus switches	SN74CBTLV16211	TI	Optional
U5, U6	SDRAMs	EDS1216AATA-75E	ELPIDA	Optional
U16	EEPROM	HN58X24128FPIE	Renesas	Optional
U9	RS-232C driver	SP3232ECA	Sipex	
U11	RCAN transceiver	HA13721RPJE	Renesas	
U13	3.3 V regulator	LM2738-YMY 550KHz	N.S.	
U14	Reset IC	M51957BFP	Renesas	
X1	Oscillator	SG8002DC_12.5MHz	Epson	Optional
X1	Oscillator socket	110-83-308-41-001101	PRECI-DIP	Optional
X2	Crystal Units	CX5032GB 12500	KYOCERA KINSEKI	Optional
X3	Oscillator	SG8002JF_48MHz	Epson	Optional
X4	Resonator (Ceralock)	CSTCZ48M0X11R	Murata	
X5	Resonator (Ceralock)	CSTCE12M5G52R0	Murata	
J1	36-pin H-UDI port connector	DX10M-36SE	Hirose	
J2	14-pin H-UDI port connector	7614-6002BL	3M	
J3	Serial port connector	XM2C-0942-132L	OMRON	
J4	Power supply connector	S2B-XH-A	J.S.T. Mfg	
J5, J6, J17, J18	SH7286 external power supply connectors	A2-2PA-2.54DSA	Hirose	Optional
J7	DC power supply jack	HEC0470-01-630	HOSIDEN	
J8, J10, J11	20-pin extension connectors	XG4C-2031	OMRON	Optional
J9,J12	40-pin extension connectors	XG4C-4031	OMRON	Optional
J16	14-pin extension connector	XG4C-1431	OMRON	Optional
J14	USB port connector	UBB-4R-D14T-4D(LF)(SN)	J.S.T. Mfg	
J13	RCAN port connector	XM2C-0942-132L	OMRON	
LED1	Power supply LED	blue		
LED2 to 7	User LEDs	green		
SW1	Power supply switch	MS-12AAH1	Nikkai	
SW2	Reset switch	B3SN-3012	OMRON	
SW3	User DIP switches	A6S-4104	OMRON	
SW4	System setting DIP switches	A6S-5104	OMRON	
SW5	NMI switch	B3SN-3012	OMRON	
SW6	IRQ1 switch	B3SN-3012	OMRON	

1.7 Memory Maps

Figure 1.7.1 and Figure 1.7.2 show the memory map examples of SH7137 on the M3A-HS87.

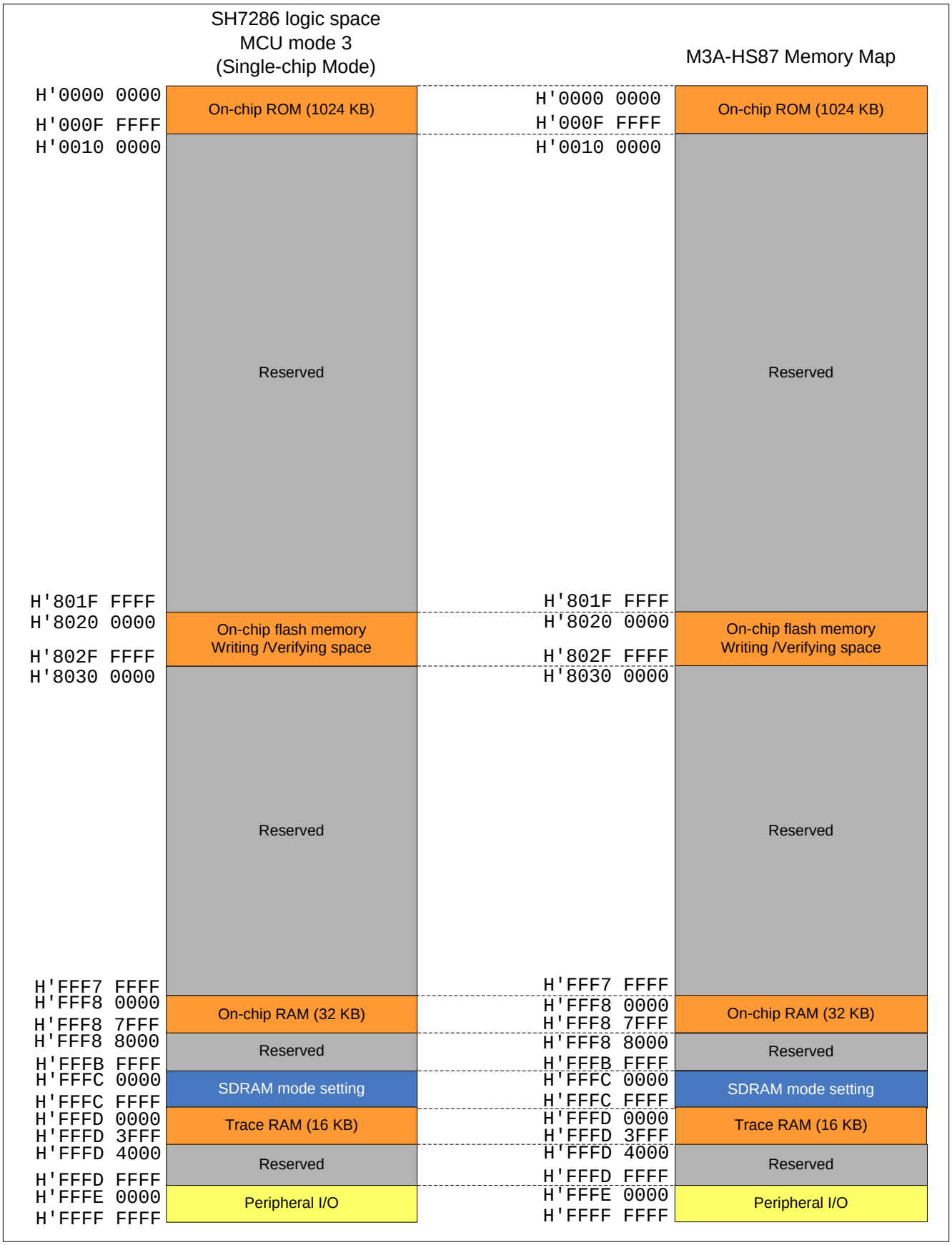

Figure 1.7.1 SH7286 memory mapping example (MCU mode 3)

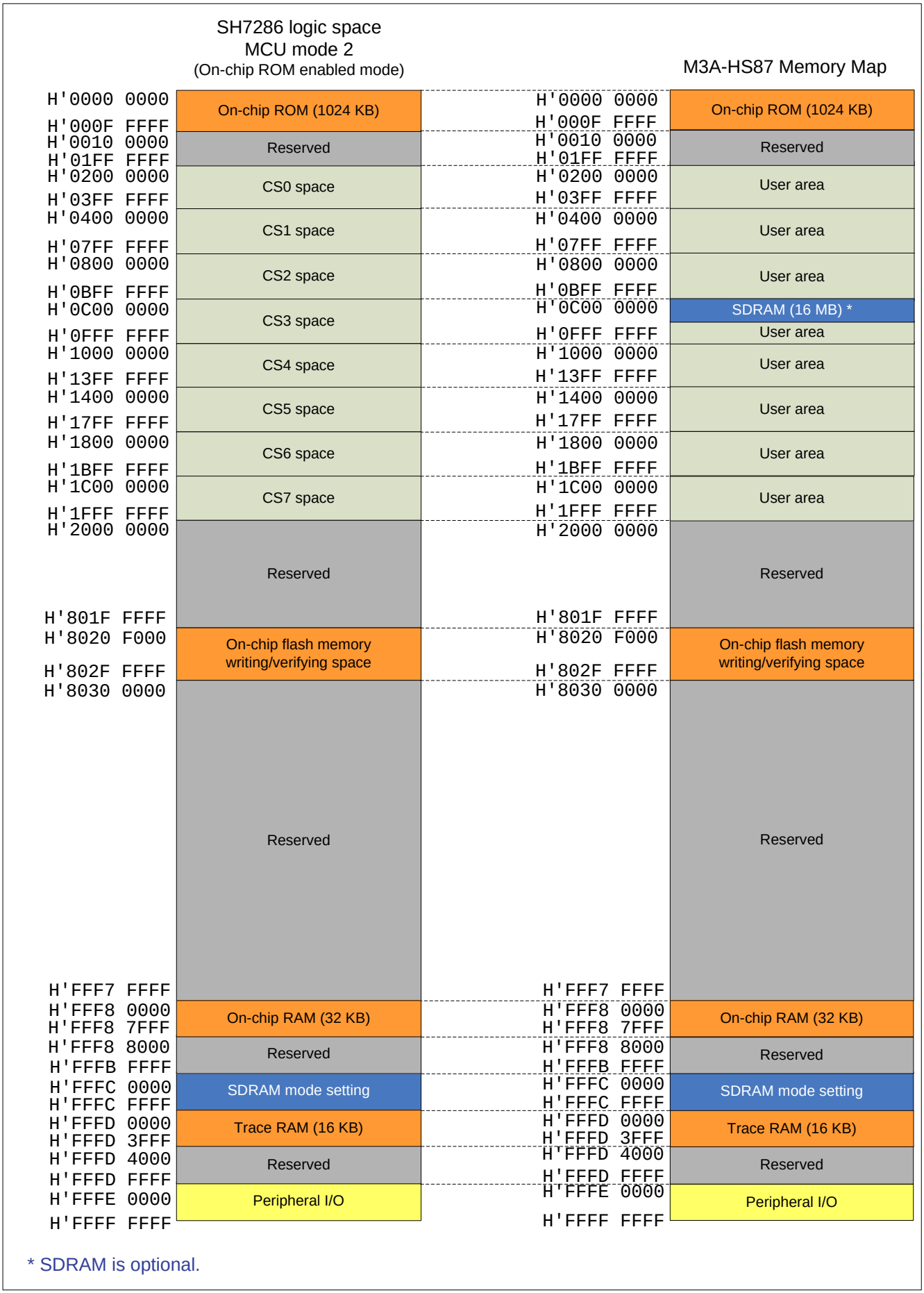

Figure 1.7.2 SH7286 memory mapping example (MCU mode 2)

1.8 Absolute Maximum Ratings

Table 1.8.1 lists the absolute maximum ratings of the M3A-HS87.

Table 1.8.1 M3A-HS87 Absolute Maximum Ratings

Symbol	Item	Value	Remarks
5VCC	5 V system power supply voltage	- 0.3 to 6.0 V	VSS
Topr	Operating temperature	0°C to 50°C	Do not expose to condensation or corrosive gas
Tstr	Storage temperature	-10°C to 60°C	Do not expose to condensation or corrosive gas

Temperature refers to the air temperature in the vicinity of the board.

1.9 Operating Conditions

Table 1.9.1 lists the operating conditions of the M3A-HS87.

Table 1.9.1 M3A-HS87 Operating Conditions

Symbol	Item	Value	Remarks
5VCC	5 V system power supply voltage	4.75 to 5.25 V	Reference voltage: VSS
-	Maximum current consumption	1.5 A max.	
Topr	Operating temperature	0°C to 50°C	Do not expose to condensation or corrosive gas

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Chapter 2
Functions

2.1 Overview of Functions

The M3A-HS87 is the SH7286 CPU board that has functional modules listed in Table 2.1.1.

Table 2.1.1 M3A-HS87 Functional Modules

Sections	Features	Description
2.2	CPU	SH7286 - Input (XIN) clock: 12.5 MHz - CPU clock: 100 MHz max. - Bus clock: 50 MHz max. - On-chip memory - Flash memory: 1024 KB - RAM: 32 KB
2.3	Memory	- SDRAM: 16 MB (16 bit bus width x 2), optional * SDRAM can be used only when SH7286 is used at 3.3 V. * Bus width can be switched for 16-bit and 32-bit. - EEPROM: 128 kbit (optional) HN58X24128FPIE :1 (I^2C bus connection)
2.4	Serial Port Interface	Connects the SH7286 SCI0 pin to the serial port connector
2.5	I/O Ports	Connect to the SH7286 I/O ports
2.6	Power Supply Module	Controls the M3A-HS87 system power supply
2.7	USB Port Interface	Connects the SH7286 USB pin to the USB port connector
2.8	RCAN Port Interface	Connects the SH7286 RCAN pin to RCAN port connector via RCAN transceiver
2.9	Clock Module	Controls the system clock
2.10	Reset Module	Resets the devices mounted on the M3A-HS87
2.11	Interrupt Switches	Connects to NMI pin and IRQ1 pin
2.12	E10A-USB Interface	SH7286 H-UDI/AUD Interface
-	Operating specifications	Connectors, switches, LEDs - SH7286 extension connectors - Switches, LEDs - H-UDI port connectors Refer to Chapter 3 for details.

2.2 CPU

The M3A-HS87 includes SH7286, the 32-bit RISC microcomputer operates with a maximum frequency of 100 MHz. SH7286 is the microcomputer that has a 1024 KB flash memory and 32 KB on-chip RAM to support various application such as data processing and device control.

SH7286 can be operated at 100 MHz of CPU clock frequency (50 MHz at maximum of external bus) when the input clock on the M3A-HS87 is at 12.5 MHz. Figure 2.2.1 shows the SH7286 block diagram on the M3A-HS87.

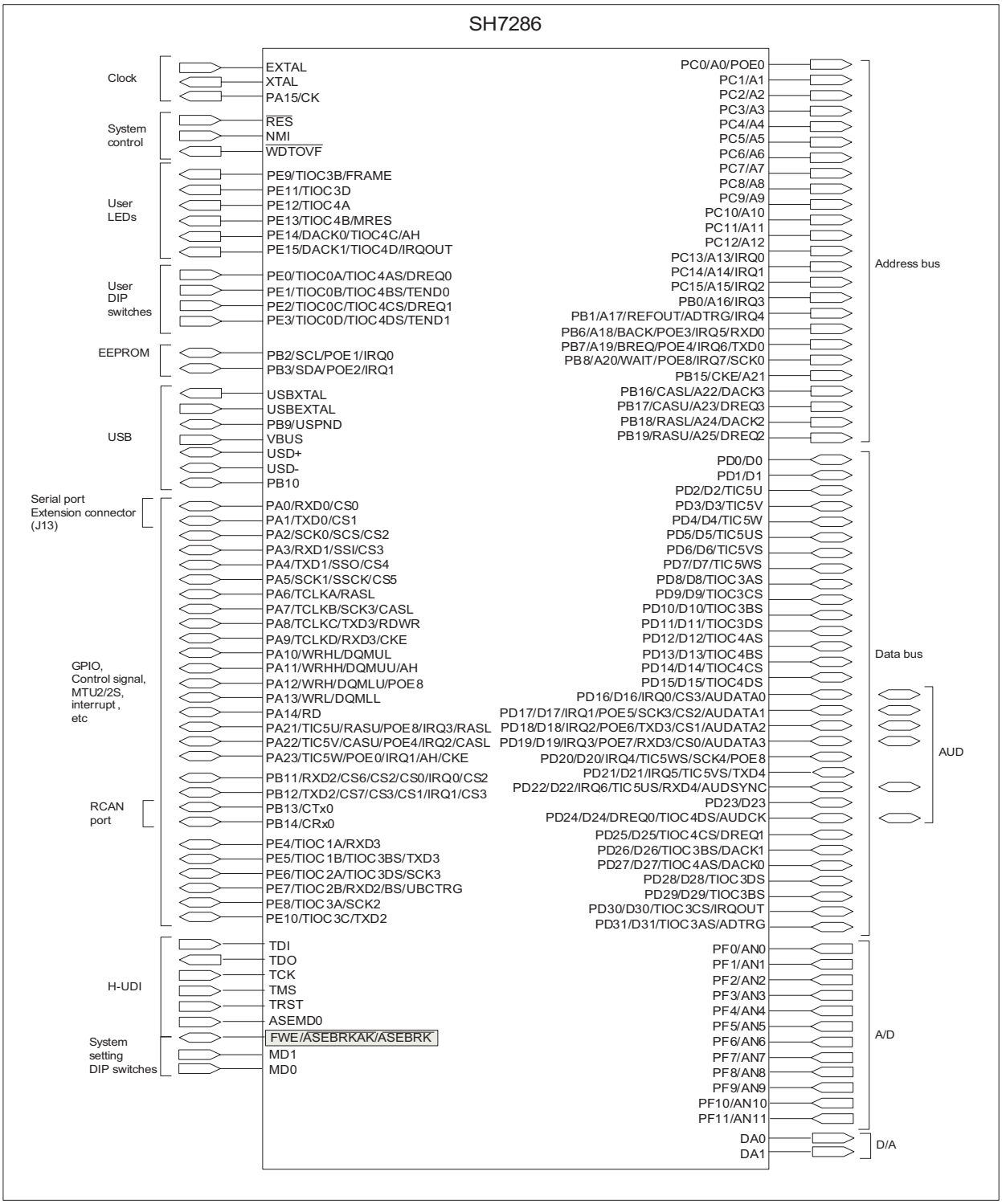


Figure 2.2.1 SH7286 Block Diagram

2.3 Memory

2.3.1 SH7286 On-chip memory

The SH7286 MCU includes a 1024 KB flash memory and a 32 KB RAM.

2.3.2 SDRAM

Two of 16 MB SDRAMs can be mounted on the M3A-HS87 (optional). As 3.3 V power is supplied to SDRAM on the M3A-HS87, use the SH7286 MCU at 3.3 V when using SDRAM. (Set the CPU power switching jumper JP1 as "2-3".) SDRAM is controlled by the SH7286 on-chip bus state controller.
Specify the bus width to 16-bit when accessing one SDRAM. To access two SDRAMs, specify the bus width to 32-bit.
When mounting SDRAM, mount two bus switches (PI3C16211A), a peripheral logic (HD74LV2G14A), resistors and capacitors. Also remove 0 Ω resistors, R44 to R49.

Example A: To mount two SDRAMs of 16MB (for 8, 16 and 32-bit access)
- Mount R5, R16 to R43, RA9 to RA14, CP22 to CP39, L4, and U2 to U6
- Remove R44 to R49

Example B: To mount one SDRAM of 16MB (for 8 and 16-bit access)
- Mount R5, R16 to R21, R26 to R33, R38 to R43, RA11 to RA14, CP30 to CP39, L4, U2, U4 and U6
- Remove R44 to R49

Table 2.3.1 shows the summary of SDRAM specifications. Figure 2.3.1 shows the circuit diagram between SH7286 and SDRAM.

Table 2.3.1 SDRAM specifications

Item	Description
Configuration	2 M words x 16 bits x 4 banks: 2
Capacity	32 MB (8 M words/32 bits)
Access time	5.4 ns
CAS Latency	2 (at 50 MHz bus clock)
Refresh interval	4096 cycles every 64 ms
Row address	A11 to A0
Column address	A8 to A0
Number of banks	4 (controlled by BA0 and BA1)

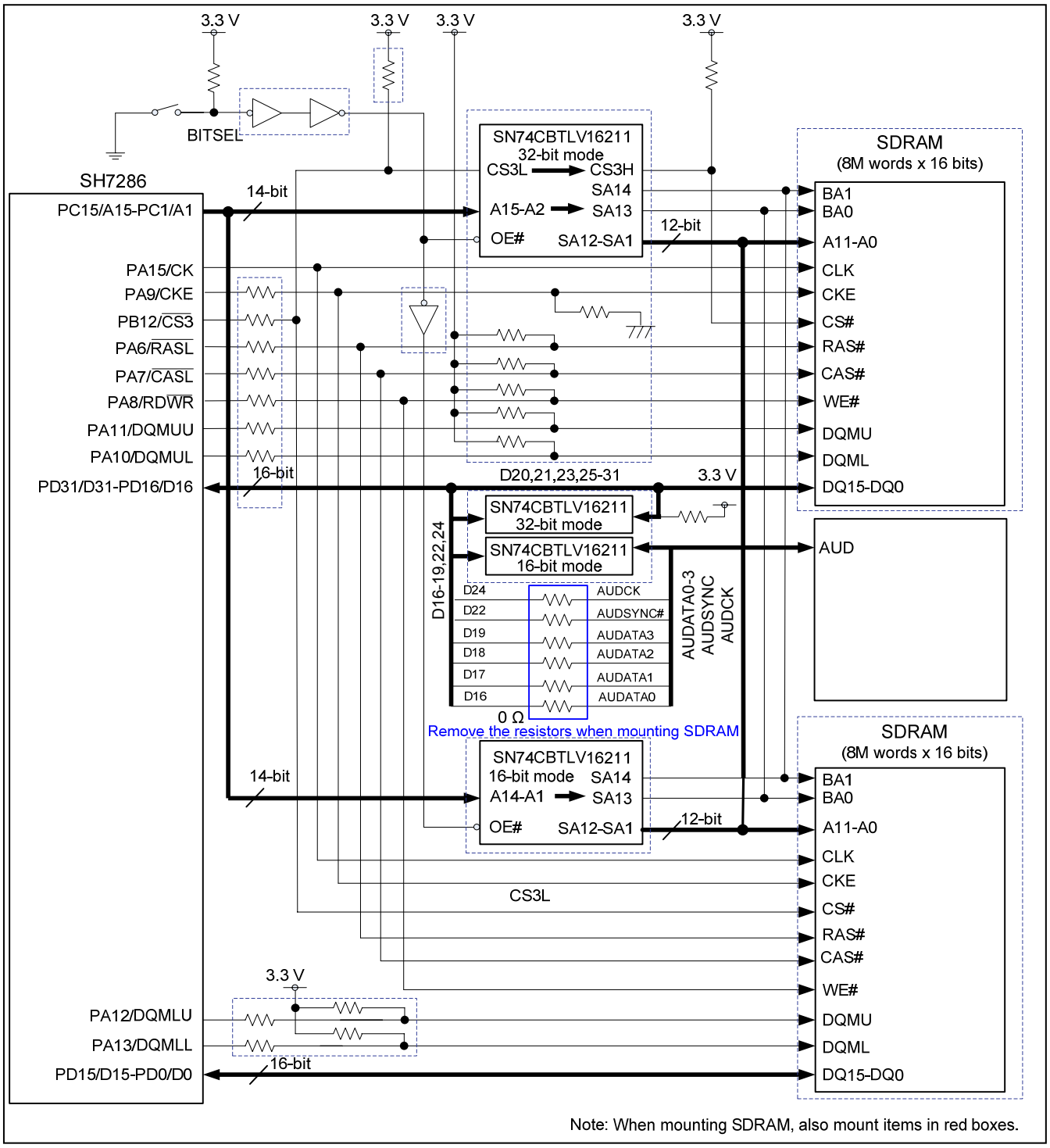


Figure 2.3.1 SH7286-SDRAM Circuit Diagram

2.3.3 EEPROM

A 128kbit EEPROM can be mounted on the M3A-HS87 (optional). EEPROM is controlled by the SH7286 on-chip I^{2}C-bus interface. Table 2.3.2 lists the summary of EEPROM specifications.
Figure 2.3.2 shows the circuit diagram between SH7286 and EEPROM.

Table 2.3.2 EEPROM specifications

Part number	Interface	Capacity	Package
HN58X24128FPIE	I^{2}C-bus interface (note)	128 kbit (16k words x 8 bits)	8-pin, SOP

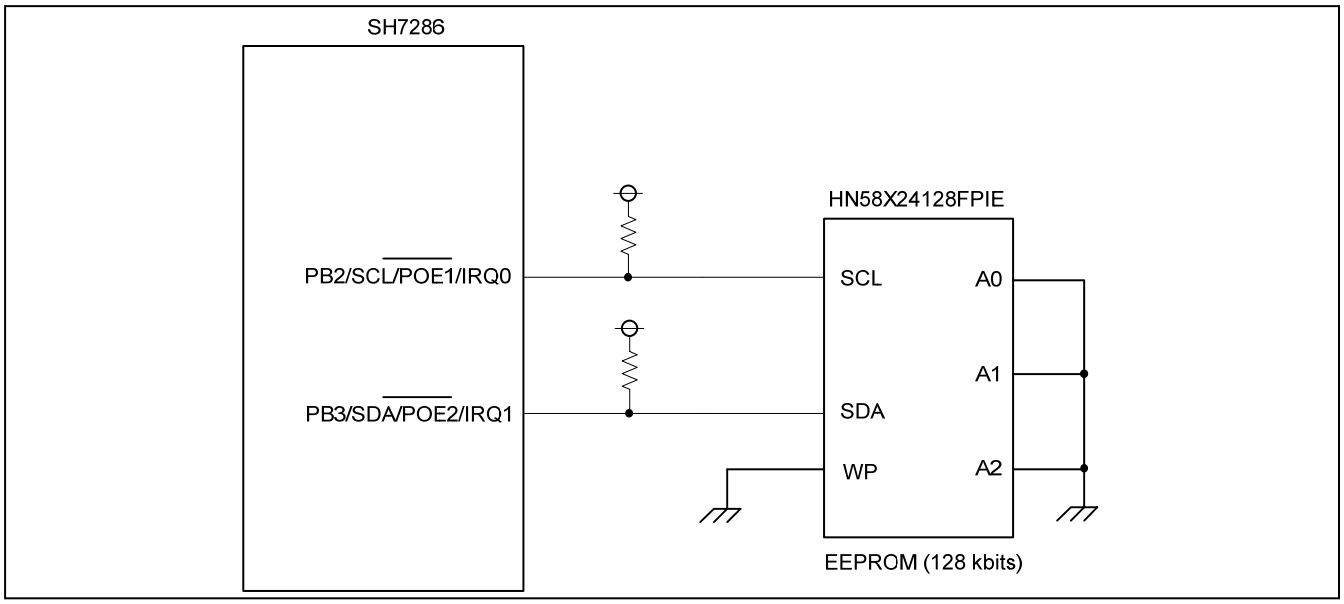


Figure 2.3.2 SH7211-EEPROM Circuit Diagram

Note: I^{2}C is the trademark of Philips semiconductors.

2.4 Serial Port Interface

On the M3A-HS87, SH7286 SCI channel 0 is connected to the serial port connector. Also, SH7286 SCI channel 0 is connected to the extension connector (J12). When using SH7286 SCI channel 0 as a serial port, do not connect it to the extension connector. Figure 2.4.1 shows the serial port block diagram on the M3A-HS87.

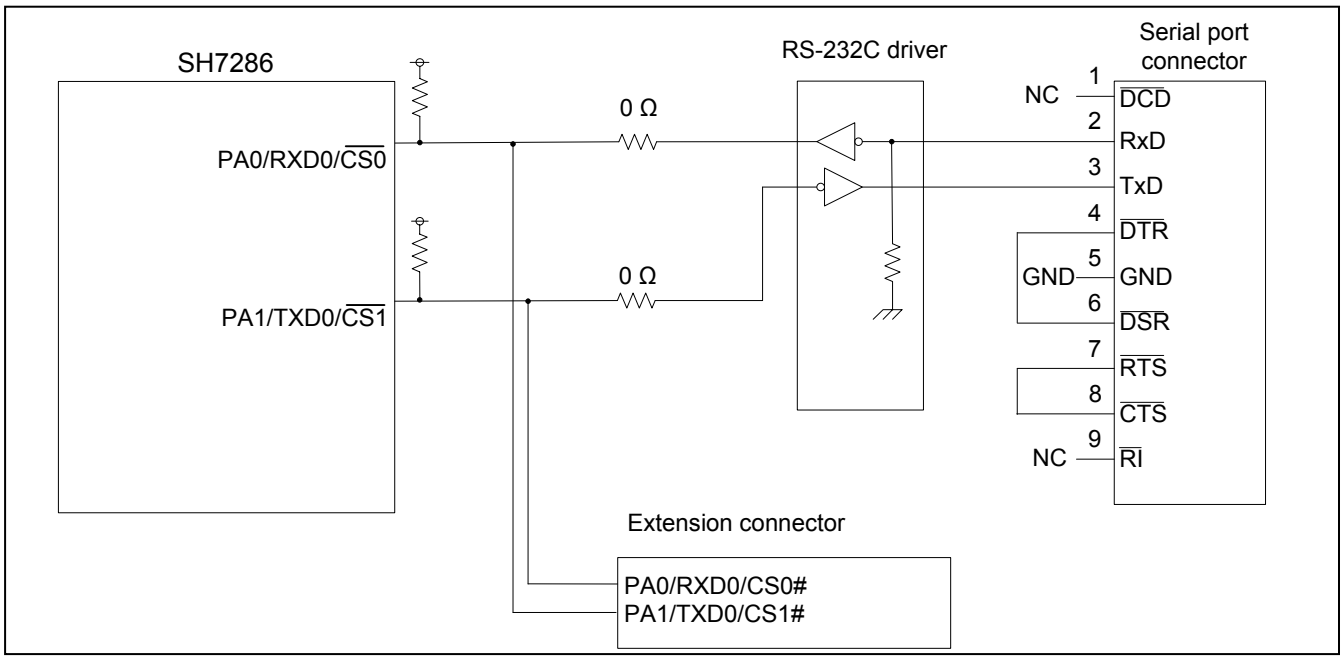


Figure 2.4.1 Serial Port Block Diagram

2.5 I/O Ports

SH7286 I/O ports are connected to the extension connector on the M3A-HS87.

Some I/O ports are also connected to DIP switches and LEDs, and can be used at the user's discretion.

Figure 2.5.1 shows the connection diagram of LEDs and DIP switches.

Table 2.5.1 lists functions of the I/O ports.

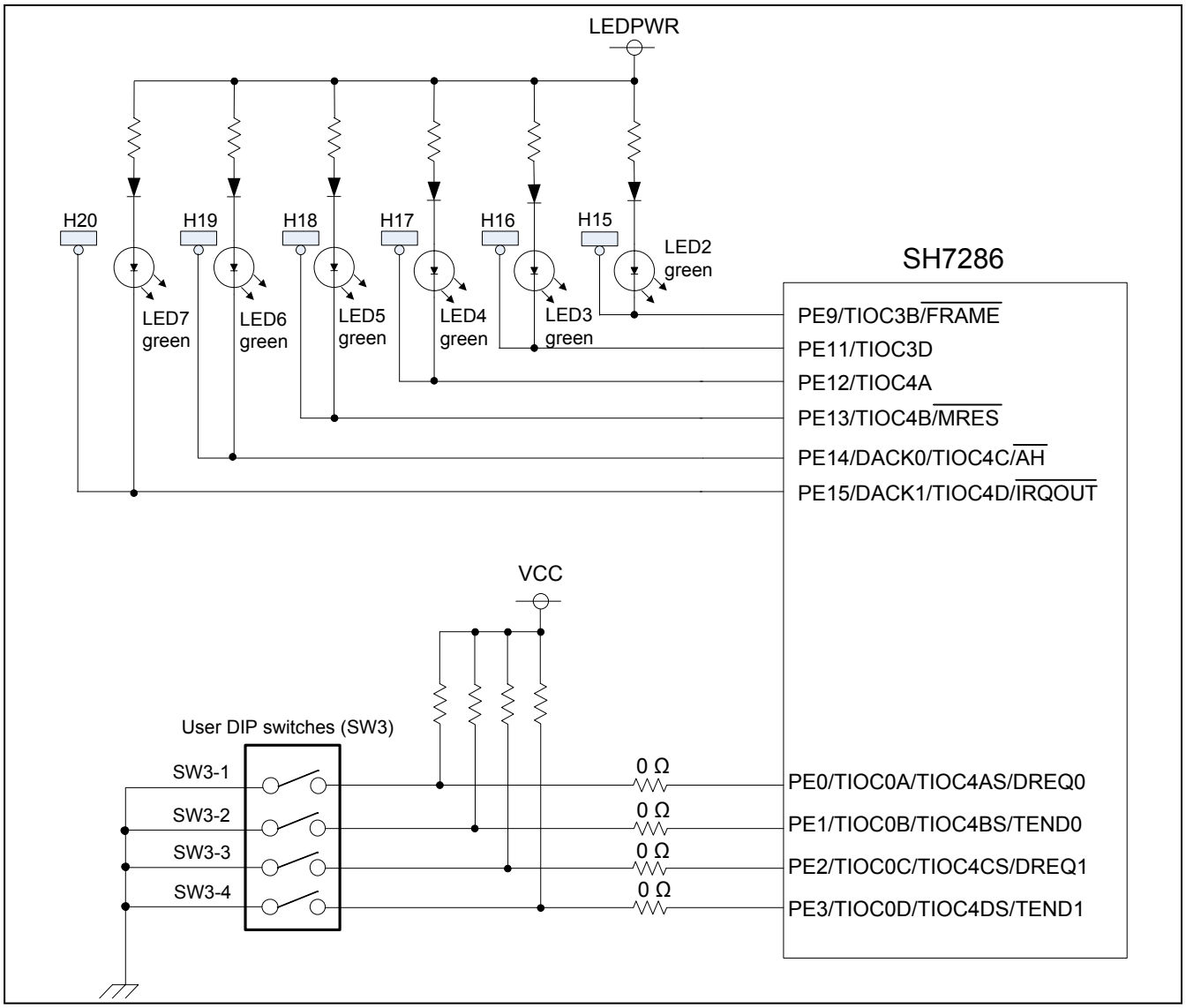


Figure 2.5.1 Connection Diagram of LEDs and DIP Switches

Table 2.5.1 I/O Ports Functions

SH7286		Extension Connectors						Remarks
No	Pin Name	J8	J9	J10	J11	J12	J16	
1	PE14/DACK0/TIOC4C/AH					✓		LED
2	PE15/DACK1/TIOC4D/IRQOUT					✓		LED
6	PA23/TIC5W/POE0/IRQ1/AH/CKE					✓		IRQ1 switch
7	PA22/TIC5V/CASU/POE4/IRQ2/CASL					✓		
8	PA21/TIC5U/RASU/POE8/IRQ3/RASL					✓		
9	PC0/A0/POE0		✓					
10	PC1/A1		✓					
11	PC2/A2		✓					
12	PC3/A3		✓					
13	PC4/A4		✓					
14	PC5/A5		✓					
15	PC6/A6		✓					
16	PC7/A7		✓					
17	PC8/A8		✓					
18	PC9/A9		✓					
19	PC10/A10		✓					
20	PC11/A11		✓					
21	PC12/A12		✓					
24	PC13/A13/IRQ0		✓					
25	PC14/A14/IRQ1		✓					
26	PC15/A15/IRQ2		✓					
27	PB0/A16/IRQ3		✓					
28	PB1/A17/REFOUT/ADTRG/IRQ4		✓					
29	PB2/SCL/POE1/IRQ0			♦				EEPROM
30	PB3/SDA/POE2/IRQ1			♦				EEPROM
31	PB6/A18/BACK/POE3/IRQ5/RXD0		✓					
32	PB7/A19/BREQ/POE4/IRQ6/TXD0		✓					
33	PB8/A20/WAIT/POE8/IRQ7/SCK0		✓					
36	PD0/D0				✓	✓		
37	PD1/D1				✓	✓		
38	PD2/D2/TIC5U				✓	✓		
39	PD3/D3/TIC5V				✓	✓		
40	PD4/D4/TIC5W				✓	✓		
41	PD5/D5/TIC5US				✓	✓		
42	PD6/D6/TIC5VS				✓	✓		
43	PD7/D7/TIC5WS				✓	✓		
46	PD8/D8/TIOC3AS				✓	✓		
47	PD9/D9/TIOC3CS				✓	✓		
48	PD10/D10/TIOC3BS				✓	✓		
49	PD11/D11/TIOC3DS				✓	✓		
50	PD12/D12/TIOC4AS				✓	✓		
51	PD13/D13/TIOC4BS				✓	✓		
52	PD14/D14/TIOC4CS				✓	✓		
53	PD15/D15/TIOC4DS				✓	✓		
57	PD16/D16/IRQ0/CS3/AUDATA0			♦				
58	PD17/D17/IRQ1/POE5/SCK3/CS2/AUDATA1			♦				
59	PD18/D18/IRQ2/POE6/TXD3/CS1/AUDATA2			♦				
60	PD19/D19/IRQ3/POE7/RXD3/CS0/AUDATA3			♦				
61	PD20/D20/IRQ4/TIC5WS/SCK4/POE8		✓					
62	PD21/D21/IRQ5/TIC5VS/TXD4		✓					
63	PD22/D22/IRQ6/TIC5US/RXD4/AUDSYNC			♦				
64	PD23/D22					✓		
65	PD24/D24/DREQ0/TIOC4DS/AUDCK			♦				
68	PD25/D25/TIOC4CS/DREQ1					✓		
69	PD26/D26/TIOC4BS/DACK1					✓		
70	PD27/D27/TIOC4AS/DACK0					✓		
71	PD28/D28/TIOC3DS				♦			
72	PD29/D29/TIOC3BS				♦			
73	PD30/D30/TIOC3CS/IRQOUT		✓					
74	PD31/D31/TIOC3AS/ADTRG			✓				

Legend:

✓: The pin can be connected to the extension connector specified at the top of this table.

♦: The pin can only be connected to the extension connector specified at the top of this table when a 0 Ω resistor is mounted.

Table 2.5.2 I/O Ports Functions

SH7286		Extension Connectors						Remarks
No	Pin Name	J8	J9	J10	J11	J12	J16	
77	PA15/CK		✓					
78	PA14/RD				✓	✓		
79	PA13/WRL/DQMLL			✓				
80	PA12/WRH/DQMLU/POE8			✓				
81	PA11/WRHH/DQMUU/AH						✓	
82	PA10/WRHL/DQMUL						✓	
83	PA9/TCLKD/RXD3/CKE			✓				
84	PA8/TCLKC/TXD3/RDWR			✓				
85	PA7/TCLKB/SCK3/CASL			✓				
86	PA6/TCLKA/RASL			✓				
96	PB15/CKE/A21						✓	
97	PB16/CASL/A22/DACK3						✓	
98	PB17/CASU/A23/DREQ3						✓	
99	PB18/RASL/A24/DACK2						✓	
100	PB19/RASU/A25/DREQ2						✓	
105	PB9/USPND					✓		
111	PB10					✓		
120	PE0/TIOC0A/TIOC4AS/DREQ0		✓					User DIP switches
121	PE1/TIOC0B/TIOC4BS/TEND0		✓					User DIP switches
122	PE2/TIOC0C/TIOC4CS/DREQ1		✓					User DIP switches
123	PE3/TIOC0D/TIOC4DS/TEND1		✓					User DIP switches
124	PE4/TIOC1A/RXD3		✓					
125	PE5/TIOC1B/TIOC3BS/TXD3		✓					
126	PE6/TIOC2A/TIOC3DS/SCK3	✓	✓					
129	PB11/RXD2/CS6/CS2/CS0/IRQ0/CS2		✓					
130	PB12/TXD2/CS7/CS3/CS1/IRQ1/CS3			✓				
131	PB13/CTx0						✓	RCAN output pin
132	PB14/CRx0						✓	RCAN input pin
133	RESET		✓					RESET
138	PF0/AN0	♦						Analog input pin
139	PF1/AN1	♦						Analog input pin
140	PF2/AN2	♦						Analog input pin
141	PF3/AN3	♦						Analog input pin
142	PF4/AN4	♦						Analog input pin
143	PF5/AN5	♦						Analog input pin
144	PF6/AN6	♦						Analog input pin
145	PF7/AN7	♦						Analog input pin
150	PF8/AN8	♦						Analog input pin
151	PF9/AN9	♦						Analog input pin
152	PF10/AN10	♦						Analog input pin
153	PF11/AN11	♦						Analog input pin
158	DA0						✓	Analog input pin
159	DA1						✓	Analog input pin
162	WDTOVF		✓					
163	PA0/RXD0/CS0					♦		J3
164	PA1/TXD0/CS1					♦		J3
165	PA2/SCK0/SCS/CS2			✓				
166	PA3/RXD1/SSI/CS3			✓				
167	PA4/TXD1/SSO/CS4			✓				
168	PA5/SCK1/SSCK/CS5		✓					
169	PE7/TIOC2B/RXD2/BS/UBCTRG					✓		
171	PE8/TIOC3A/SCK2					✓		
172	PE10/TIOC3C/TXD2					✓		
173	PE9/TIOC3B/FRAME					✓		LED
174	PE11/TIOC3D					✓		LED
175	PE12/TIOC4A					✓		LED
176	PE13/TIOC4B/MRES					✓		LED

Legend:

✓: The pin can be connected to the extension connector specified at the top of this table.

♦: The pin can only be connected to the extension connector specified at the top of this table when a 0 Ω resistor is mounted.

2.6 Power Supply Module

A 5 V DC is input to the M3A-HS87, and the generator on the M3A-HS87 generates 3.3 V DC. As it is a step down DC-DC switching regulator, the desired voltage can be generated by changing resistance value. 5 V DC power supply can be supplied from both DC regulated power supply (via J4 power connector) and AC adaptor (via J7 DC power supply jack)

System power of SH7286 (VCC) can be switched back and forth between 3.3 V and 5 V by power switching jumper (JP1). The default setting is at 5 V. When switching the VCC, follow the notes described below.

Note: When mounting SDRAM with 5 V DC setting, voltages beyond the maximum ratings may be supplied from the address bus, data bus and control bus and it may cause malfunction in device. Pay close attention for the setting.

The SH7286 system power (VCC), A/D power supply (AVCC), AVREF power supply and USB power supply (DrVCC) can be supplied from external power supply separately using the jumper settings.

Figure 2.6.1 shows the M3A-HS87 power supply circuit diagram.

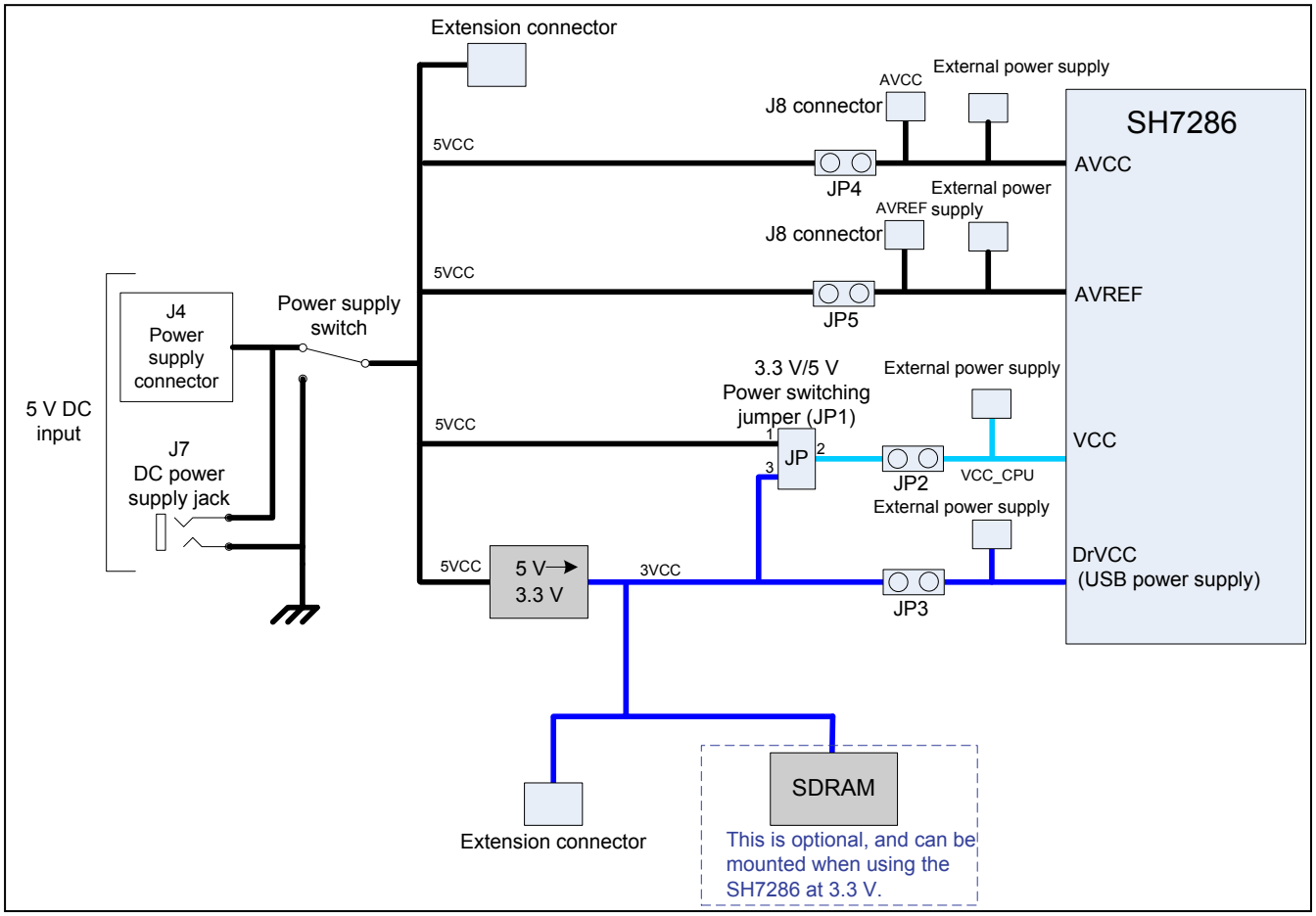
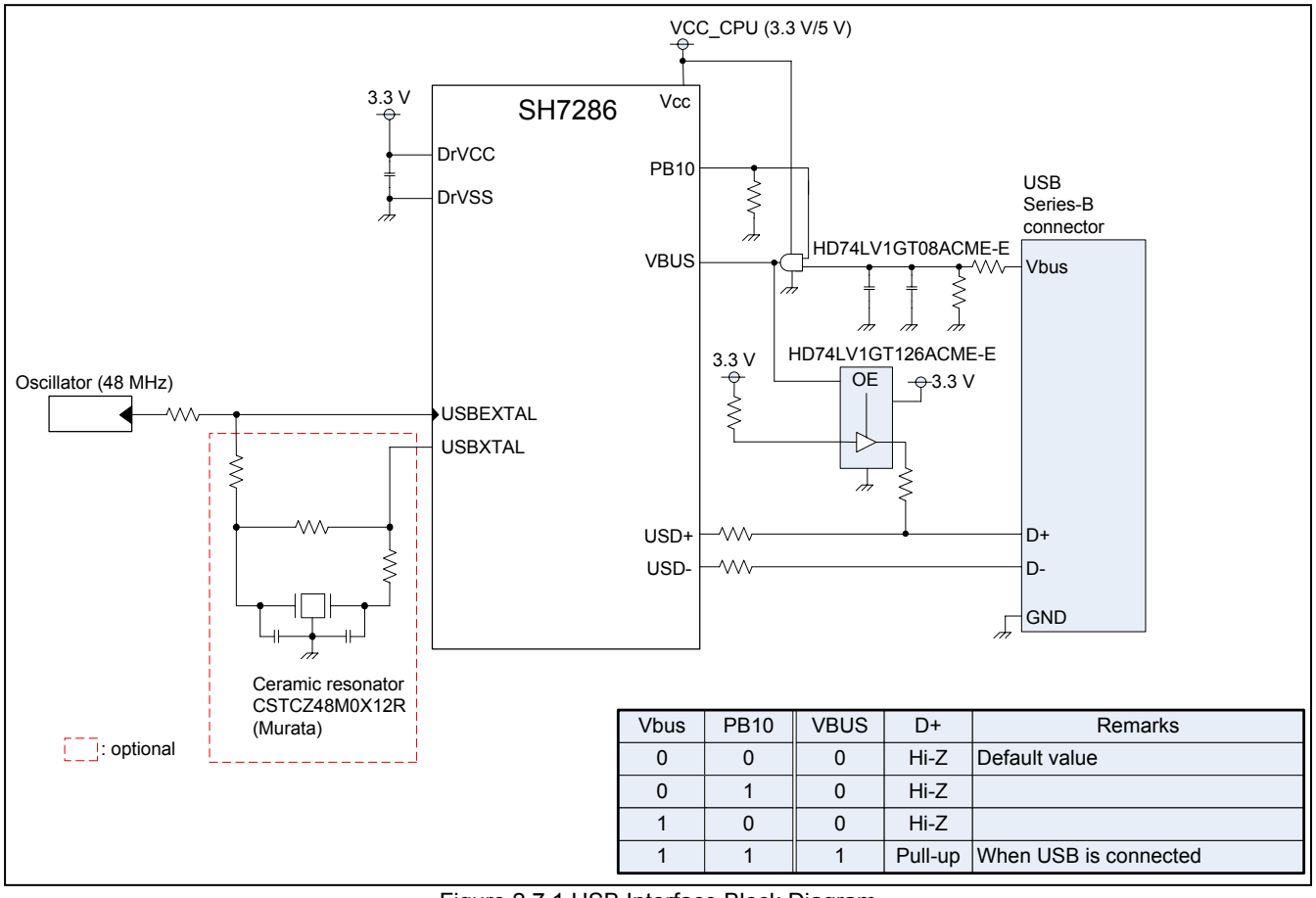


Figure 2.6.1 Power supply Block Diagram

2.7 USB Port Interface

The M3A-HS87 includes a USB port connector (Series-B receptacle). Use the SH7286 PB10 pin to control the USB line. Set the PB10 pin to a low level to disable the VBUS input and USD+ pull-up when delaying the connection notification (such as in high-priority processing or initialization) to a USB host or hub.

When the PB10 pin is set to a high level and the VBUS power is supplied from the USB port connector, the SH7286 VBUS input and USD+ pull-up are enabled. Then, the USB host or hub detects that a USB device has been connected.
When the VBUS pin is set to a low level, the SH7286 MCU retains its powered state regardless of the USD+ or USD- state.
When connecting a USB cable to a USB host or hub when this board is not ON, the USB host or hub supplies the voltage to the VBUS. Be sure to turn the CPU board ON before connecting the USB cable.
Figure 2.7.1 shows the M3A-HS87 USB interface block diagram.



Vbus	PB10	VBUS	D+	Remarks
0	0	0	Hi-Z	Default value
0	1	0	Hi-Z	
1	0	0	Hi-Z	
1	1	1	Pull-up	When USB is connected

Figure 2.7.1 USB Interface Block Diagram

2.8 RCAN Port Interface

The M3A-HS87 includes an RCAN port connector (D-Sub 9-pin connector).

Figure 2.8.1 shows the M3A-HS87 RCAN interface block diagram.

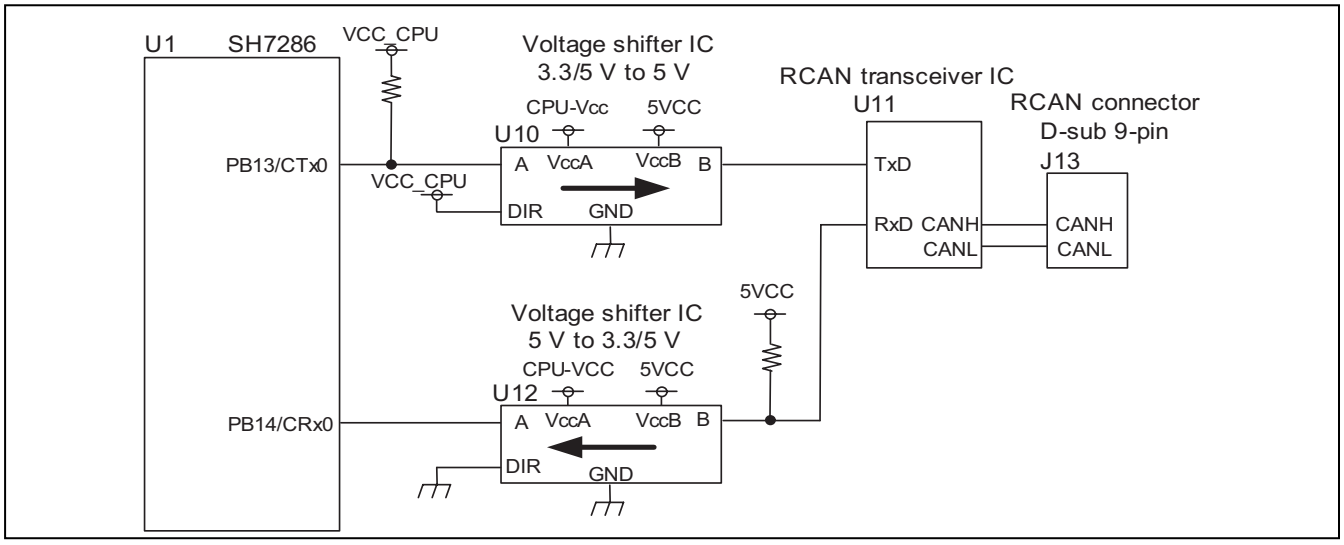


Figure 2.8.1 RCAN Interface Block Diagram

2.9 Clock Module

The M3A-HS87 clock module is composed of two blocks. One block connects an output from an oscillator to the SH7286 EXTAL, and another block connects a crystal units or a ceramic resonator (Ceralock) to EXTAL and XTAL.

M3A-HS87 comes standard with a 12.5 MHz ceramic resonator (Ceralock).

Remove R7, R9, and R10 when using an oscillator. Mount an oscillator to the CPU board via an 8-pin IC socket.

Figure 2.9.1 shows Clock module block diagram.

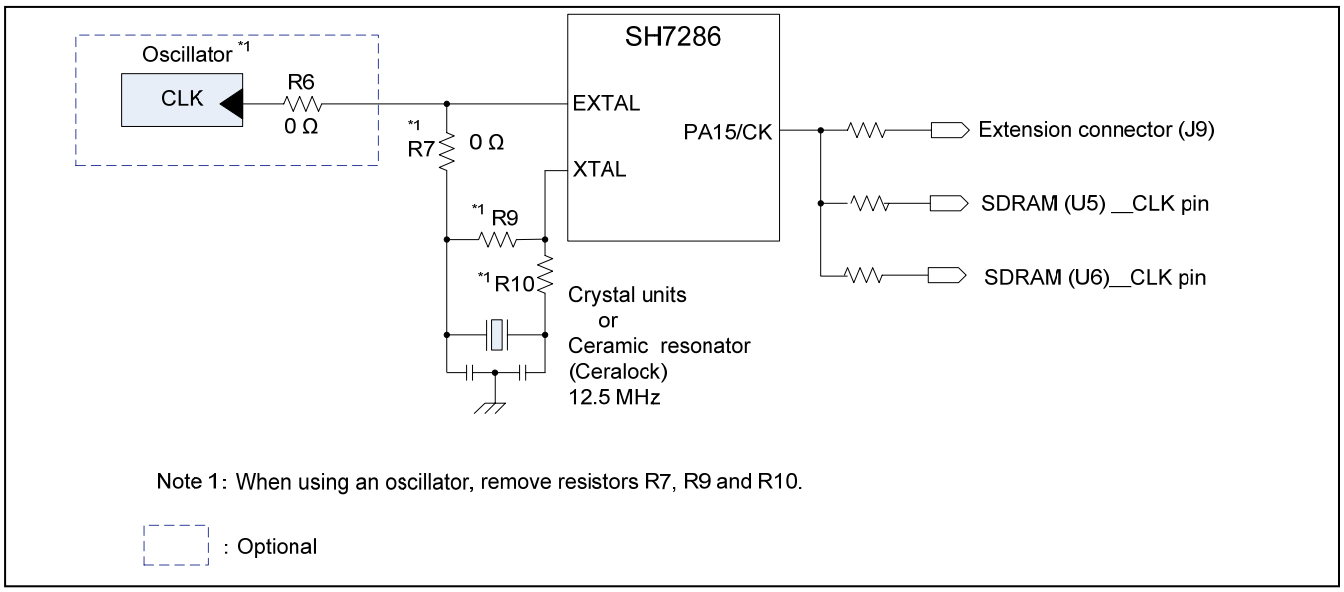


Figure 2.9.1 Clock Module Block Diagram

2.10 Reset Module

The reset module controls the reset signals of the SH7286 mounted on the M3A-HS87.

Figure 2.10.1 shows the M3A-HS87 reset circuit block diagram.

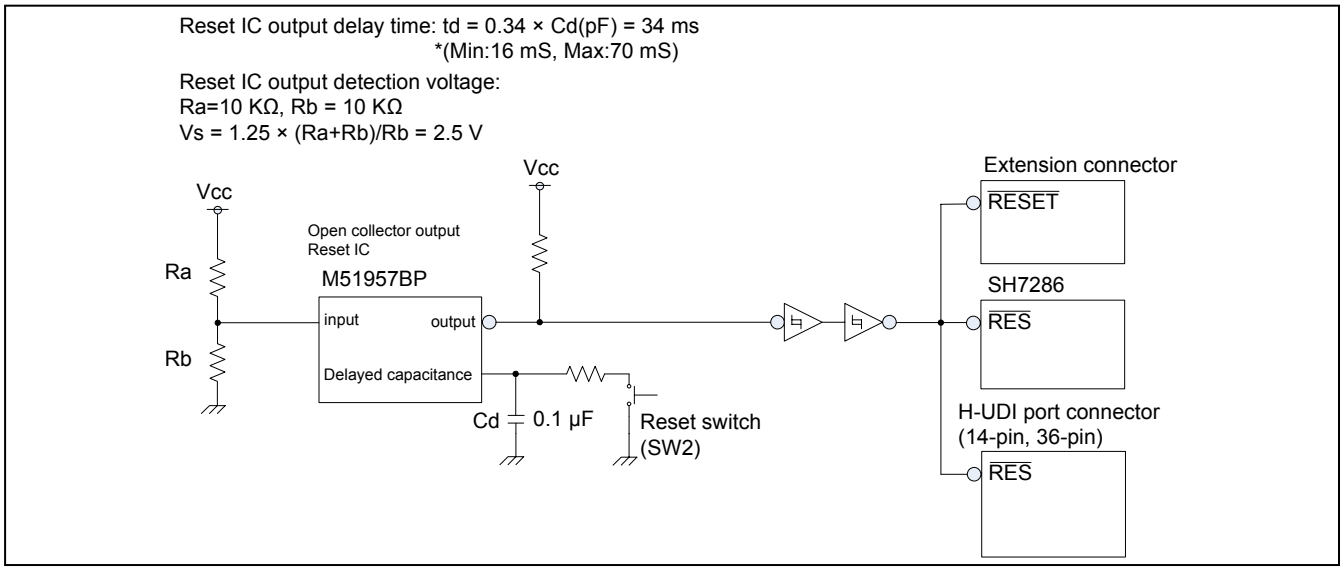


Figure 2.10.1 Reset Circuit Block Diagram

2.11 Interrupt Switches

The SH7286 NMI and IRQ1 pins are connected to push-button switches on the M3A-HS87.Figure 2.11.1 shows the interrupt switch block diagram.

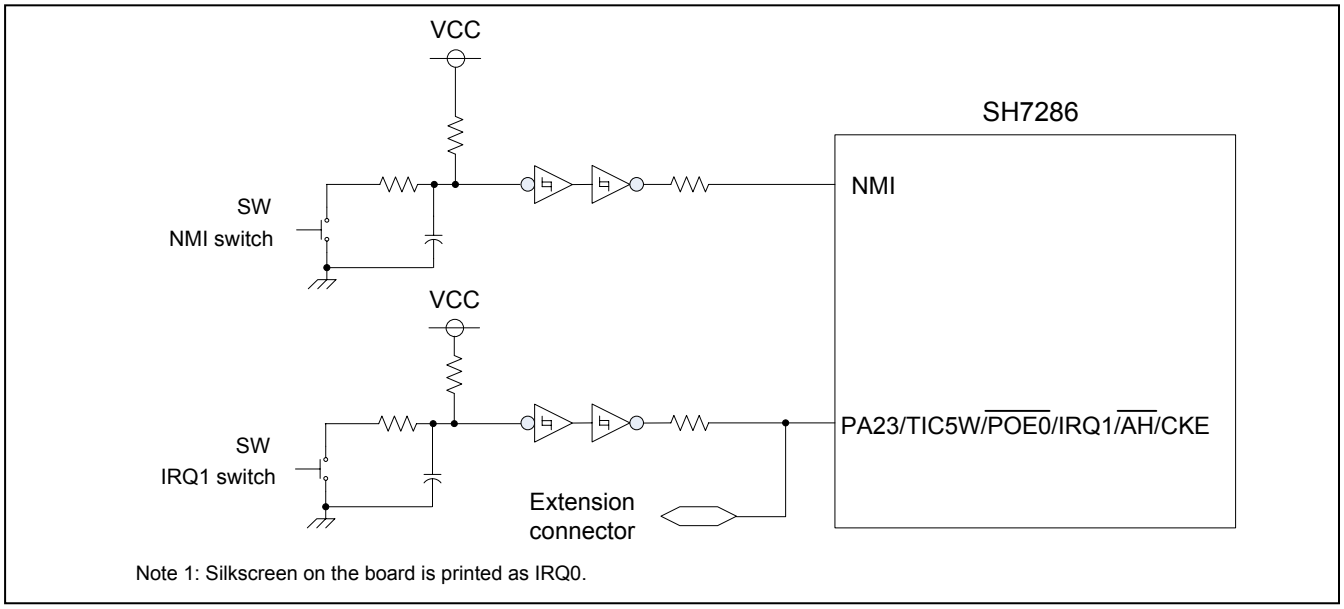


Figure 2.11.1 Interrupt Switch Block Diagram

2.12 E10A-USB Interface

The M3A-HS87 includes two H-UDI port connectors (J1 and J2) to connect to the E10A-USB emulator.

The SH7286 $\overline{\text{ASEBRKAK}}$/$\overline{\text{ASEBRK}}$/FWE pins are connected to the System setting DIP switches (SW4-1). Turn SW4-1 OFF to connect the M3A-HS87 to the E10A-USB emulator. If SW4-1 is ON, the M3A-HS87 cannot be debugged correctly. Do not use the AUD pin when accessing SDRAM in 32-bit.

Figure 2.12.1 shows the E10A-USB interface block diagram.

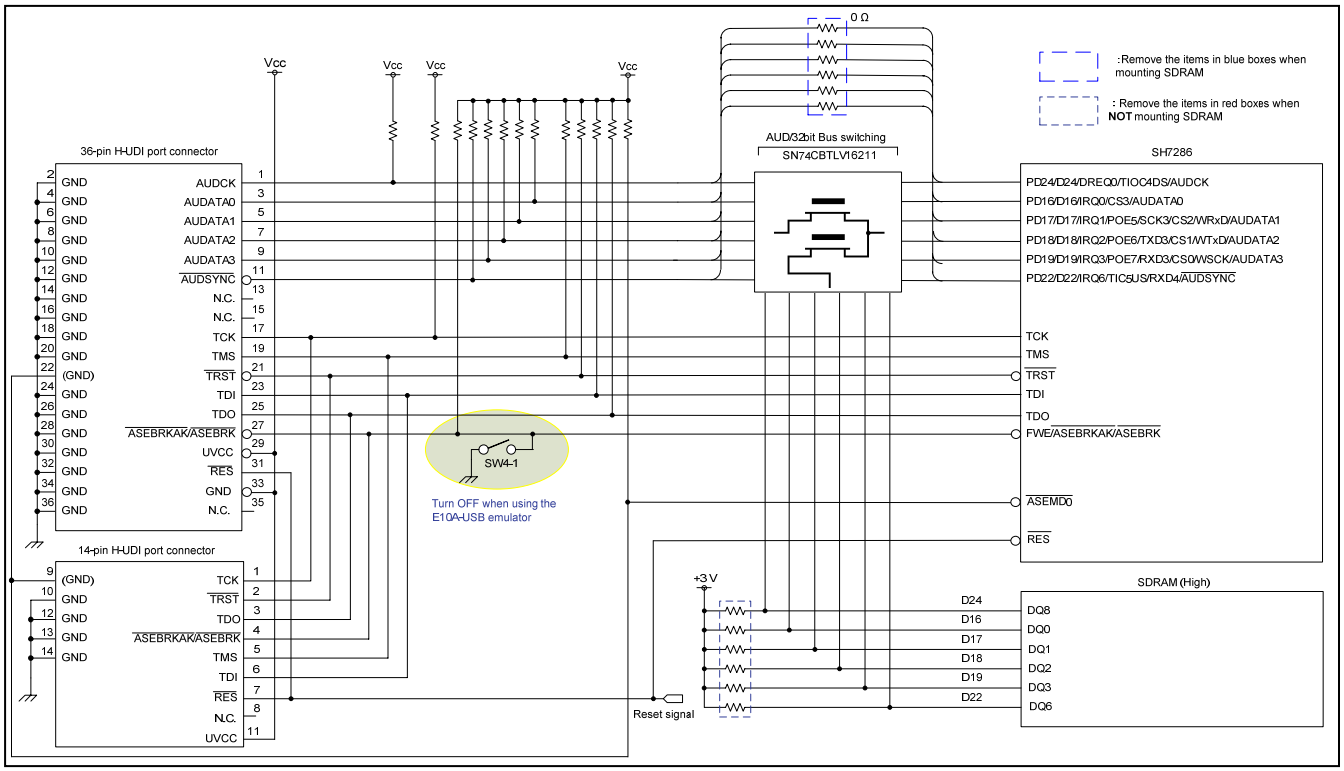


Figure 2.12.1 E10A-USB Interface Block Diagram

Note: The $\overline{\text{TRST}}$ signal is pulled up on the M3A-HS87 schematics.

When mounting the SH7286 in the user's system, pull down the $\overline{\text{TRST}}$ signal with a 1 KΩ resistor as described in the E10A-USB emulator User's manual.

Chapter 3
Operating Specifications

3.1 Connectors

Figure 3.1.1 and Figure 3.1.2 show the connector assignments for the M3A-HS87.

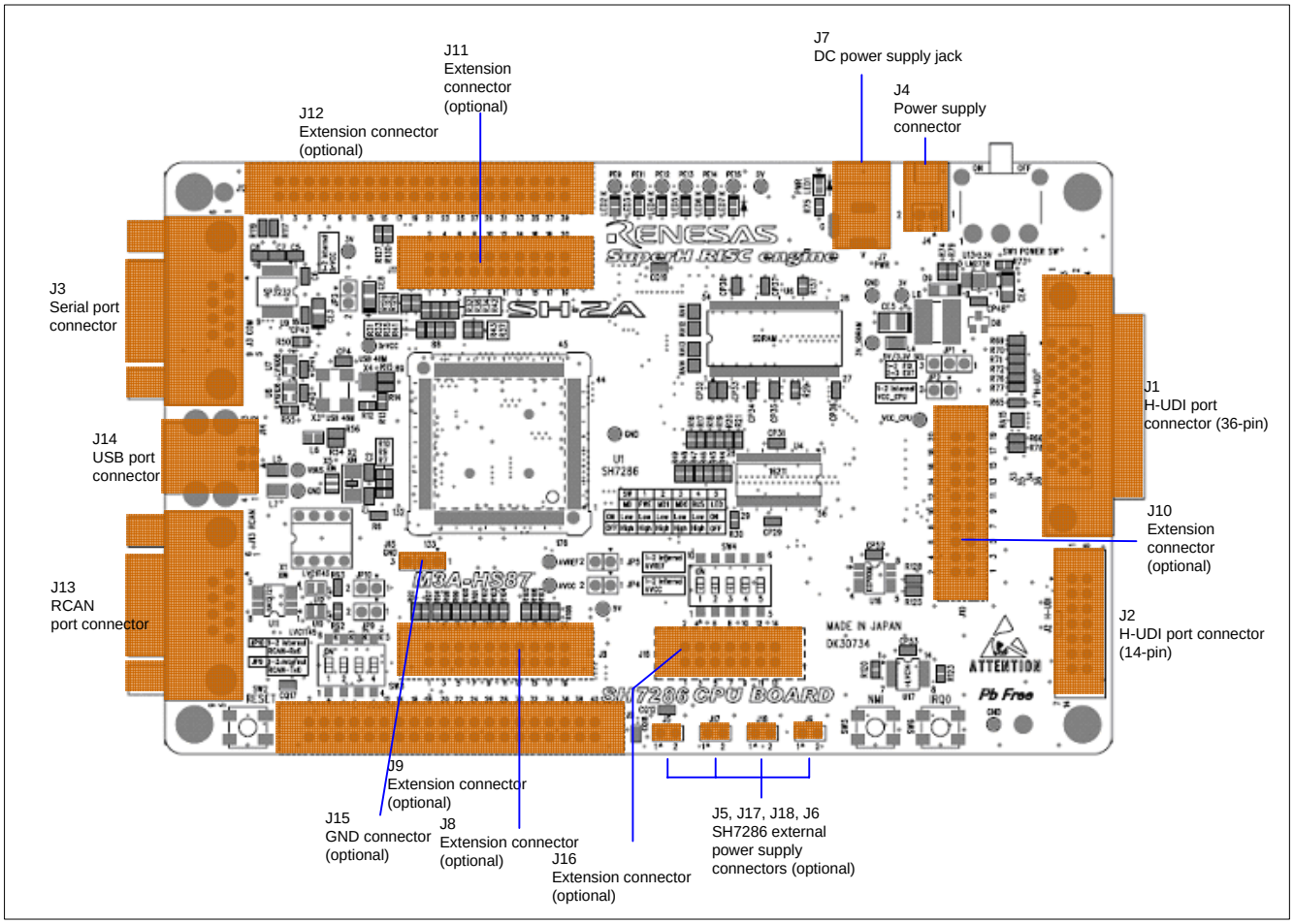


Figure 3.1.1 Connector Assignments (Top View of the Component Side)

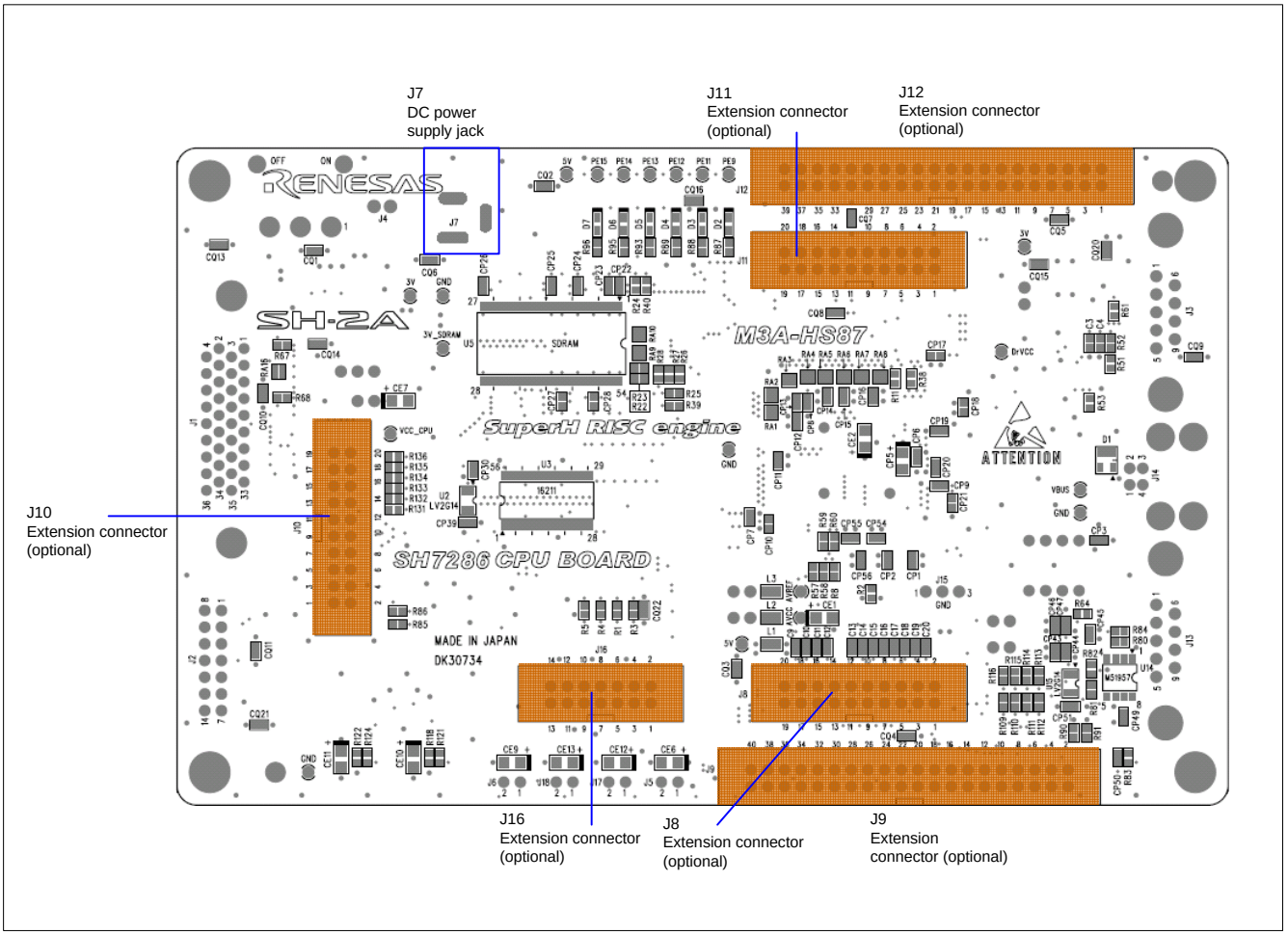


Figure 3.1.2 Connector Assignments (Top View of the Solder Side)

3.1.1 H-UDI Port Connectors (J1 and J2)

The M3A-HS87 includes two 36-pin (J1) and 14-pin (J2) H-UDI port connectors to connect the board to an E10A-USB emulator. Figure 3.1.3 shows pin assignments for the H-UDI port connector (J1).

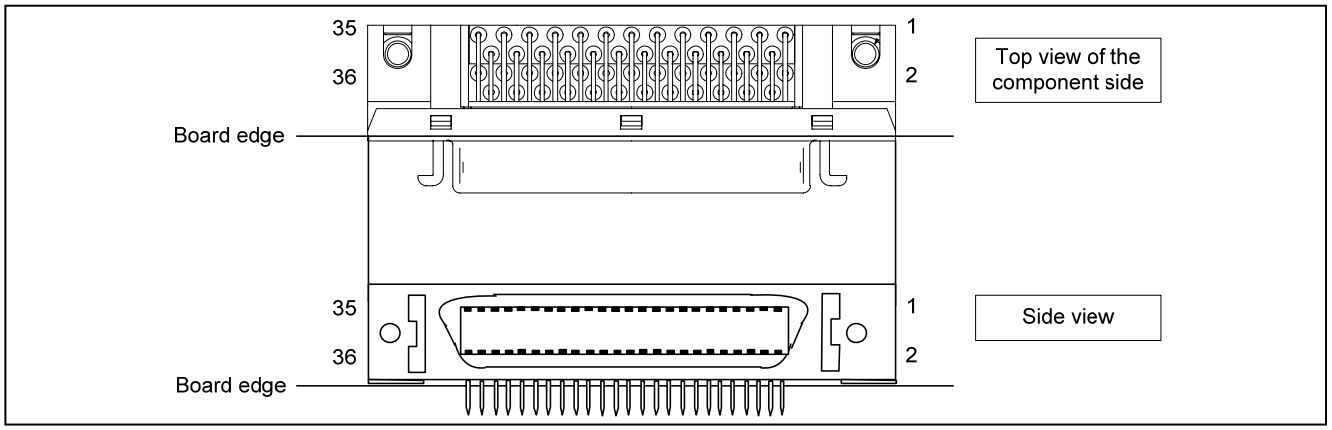


Figure 3.1.3 H-UDI Port Connector (J1) Pin Assignments

Table 3.1.1 lists the H-UDI port connector (J1) pin descriptions.

Table 3.1.1 H-UDI Port Connector (J1) Pin Descriptions

Pin Number	Signal Name	Pin Number	Signal Name
1	AUDCK	19	TMS
2	GND	20	GND
3	AUDATA0	21	$\overline{\text{TRST}}$
4	GND	22	(GND)
5	AUDATA1	23	TDI
6	GND	24	GND
7	AUDATA2	25	TDO
8	GND	26	GND
9	AUDATA3	27	$\overline{\text{ASEBRKAK/ASEBRK}}$
10	GND	28	GND
11	$\overline{\text{AUDSYNC}}$	29	UVCC
12	GND	30	GND
13	NC	31	$\overline{\text{RES}}$
14	GND	32	GND
15	NC	33	GND
16	GND	34	GND
17	TCK	35	NC
18	GND	36	GND

Figure 3.1.4 shows pin assignments for the H-UDI port connector (J2).

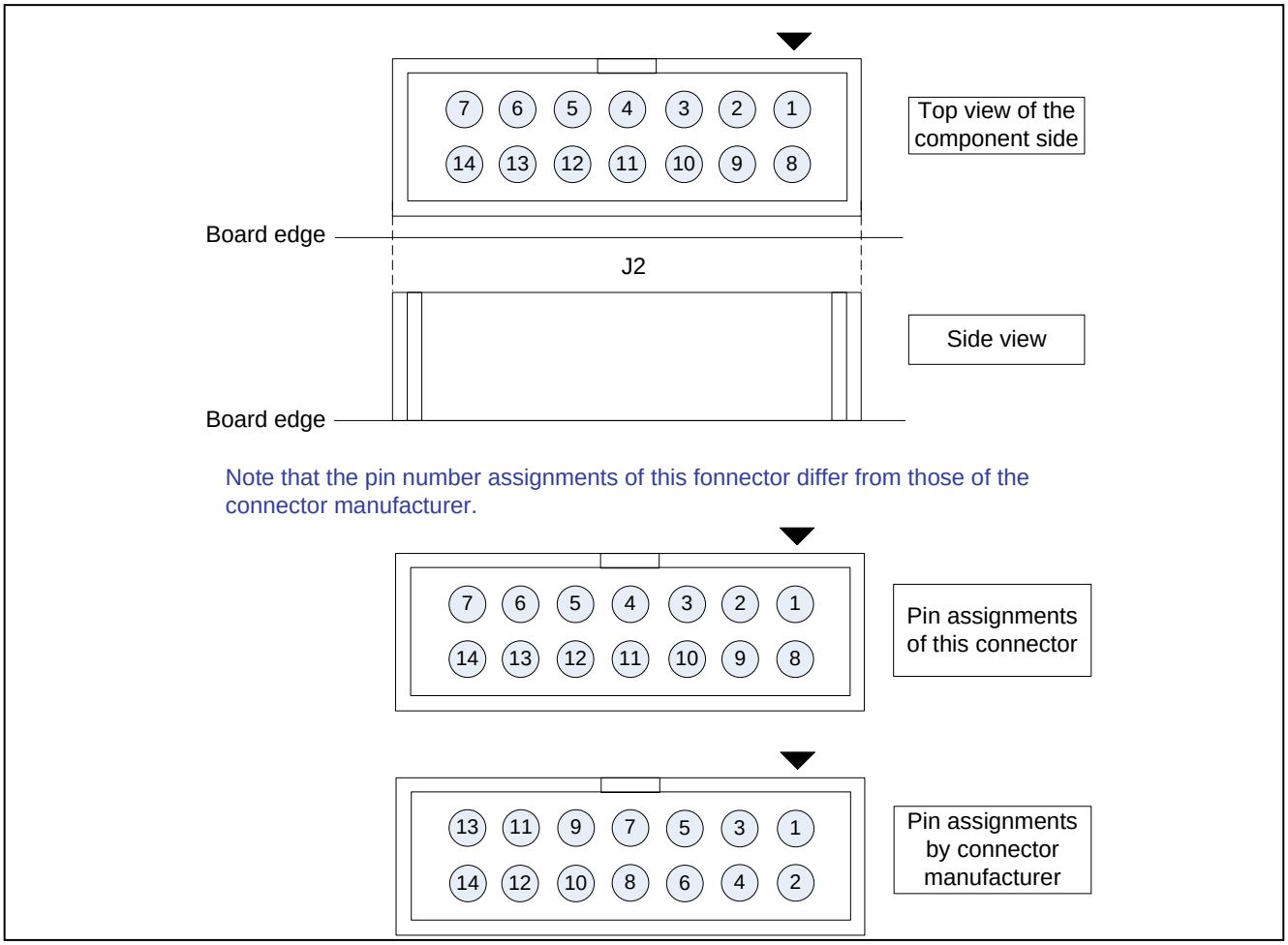


Figure 3.1.4 H-UDI Port Connector (J2) Pin Assignments

Table 3.1.2 lists the H-UDI port connector (J2) pin descriptions.

Table 3.1.2 H-UDI Port Connector (J2) Pin Descriptions

Pin Number	Signal Name	Pin Number	Signal Name
1	TCK	8	NC
2	$\overline{\text{TRST}}$	9	(GND)
3	TDO	10	GND
4	$\overline{\text{ASEBRKAK}}$/$\overline{\text{ASEBRK}}$	11	UVCC
5	TMS	12	GND
6	TDI	13	GND
7	$\overline{\text{RES}}$	14	GND

3.1.2 Serial Port Connector (J3)

The M3A-HS87 includes a serial port connector (J3).

Figure 3.1.5 shows pin assignments for the serial port connector.

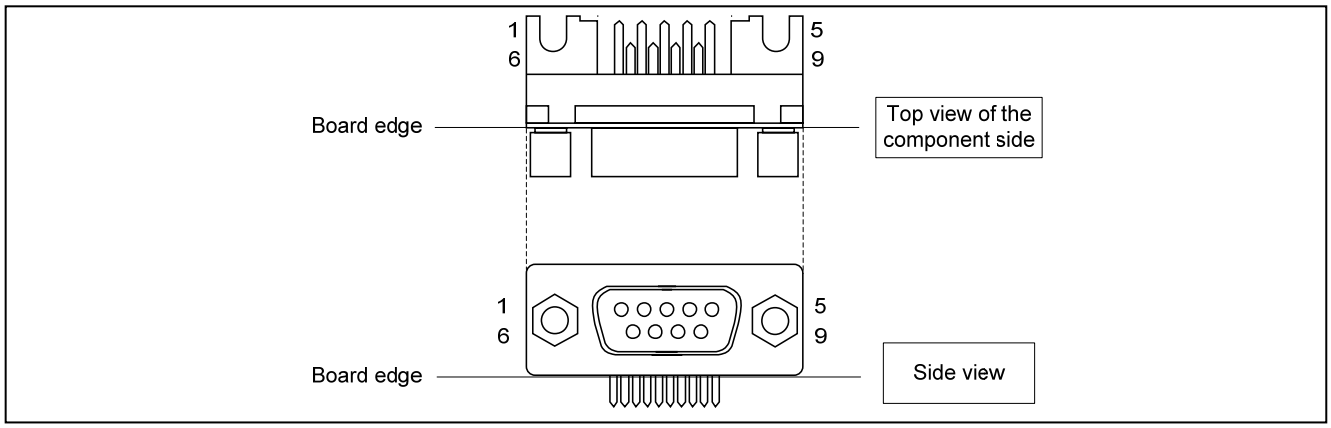


Figure 3.1.5 Serial Port Connector (J3) Pin Assignments

Table 3.1.3 lists the serial port connector pin descriptions.

Table 3.1.3 Serial Port Connector (J3) Pin Descriptions

Pin Number	Signal Name	Pin Number	Signal Name
1	NC	6	$\overline{\text{DSR}}$
2	RXD	7	$\overline{\text{RTS}}$
3	TXD	8	$\overline{\text{CTS}}$
4	$\overline{\text{DTR}}$	9	NC
5	GND		

Pins 4 to 6, and 7 to 8 are loopback-connected.

3.1.3 Power Supply Connector (J4)

The M3A-HS87 includes a power supply connector (J4).

Figure 3.1.6 shows pin assignments for the power supply connector.

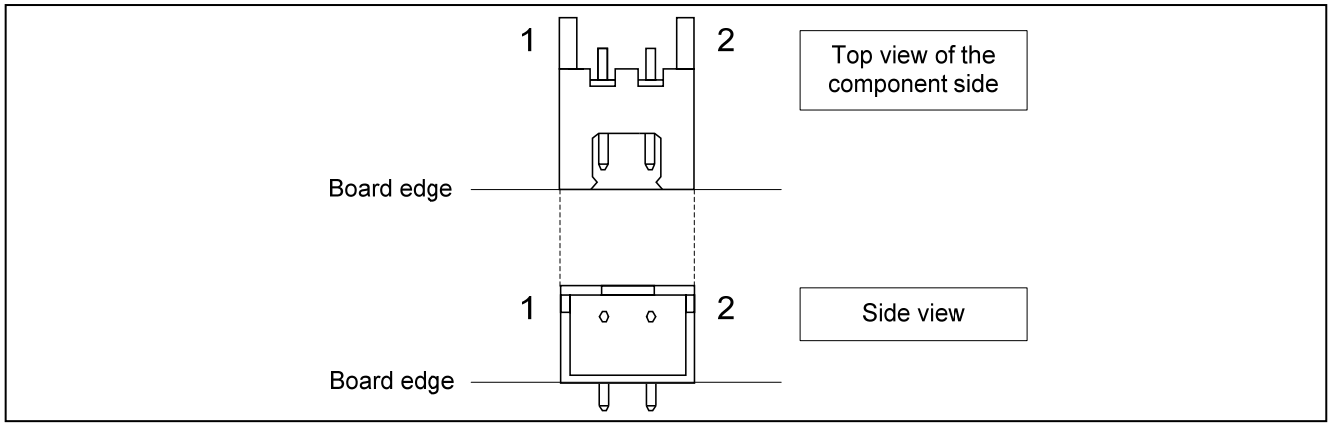


Figure 3.1.6 Power Supply Connector (J4) Pin Assignments

Table 3.1.4 lists the power supply connector pin descriptions.

Table 3.1.4 Power Supply Connector (J4) Pin Descriptions

Pin Number	Signal Name	Pin Number	Signal Name
1	5.0 V	2	GND

3.1.4 SH7286 External Power Supply Connectors (J5, J6, J17 and J18)

External power supply connectors for CPU power, USB power, and analog power can be mounted on the M3A-HS87.

To supply power using these connectors, remove the receptacles of the external power switching jumpers (JP2, JP3, JP4 and JP5) to leave them open.

Figure 3.1.7 shows pin assignments for the external power supply connector.

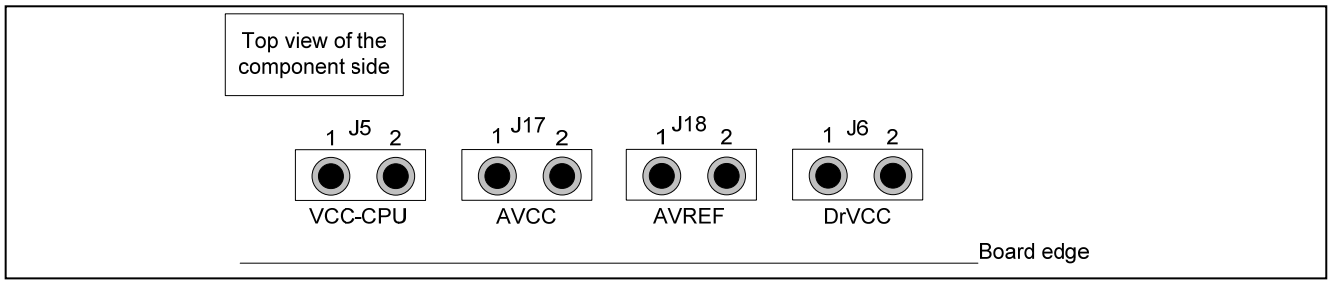


Figure 3.1.7 SH7286 External Power Supply Connectors (J5, J6, J17 and J18) Pin Assignments

Table 3.1.5 shows the CPU external power supply connector (J5) pin descriptions.

Table 3.1.5 CPU External Power Supply Connector (J5) Pin Descriptions

Pin Number	Signal Name	Pin Number	Signal Name
1	VCC-CPU	2	GND

Table 3.1.6 shows the USB external power supply connector (J6) pin descriptions.

Table 3.1.6 USB External Power Supply Connector (J6) Pin Descriptions

Pin Number	Signal Name	Pin Number	Signal Name
1	DrVCC	2	GND

Table 3.1.7 shows the analog (AVCC) external power supply connector (J17) pin descriptions.

Table 3.1.7 Analog (AVCC) External Power Supply Connector (J17) Pin Descriptions

Pin Number	Signal Name	Pin Number	Signal Name
1	AVCC	2	AGND

Table 3.1.8 shows the analog (AVREF) external power supply connector (J18) pin descriptions.

Table 3.1.8 Analog (AVREF) External Power Supply Connector (J18) Pin Descriptions

Pin Number	Signal Name	Pin Number	Signal Name
1	AVREF	2	AVREFVSS

3.1.5 DC Power Supply Jack (J7)

The M3A-HS87 includes a DC power supply jack (J7). Figure 3.1.8 shows the DC power supply jack pin assignments. Table 3.1.9 lists pin descriptions for the DC power supply jack.

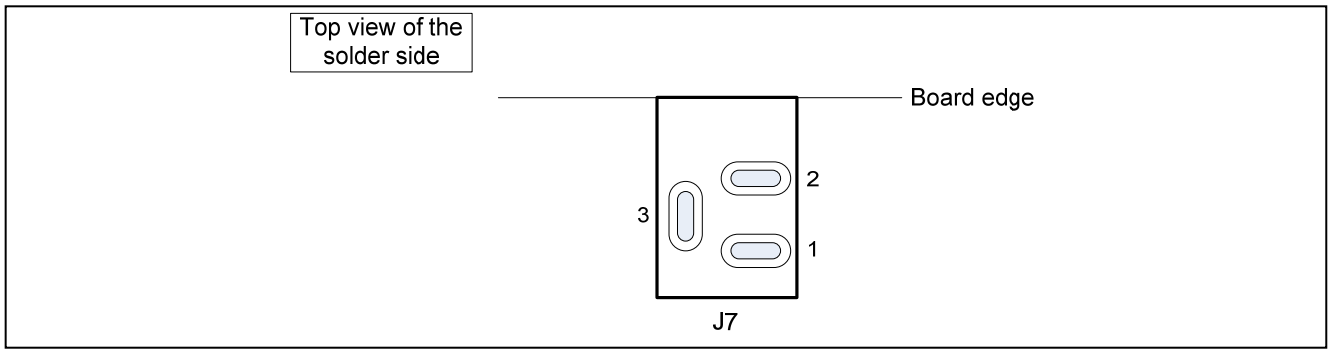


Figure 3.1.8 DC Power Supply Jack Pin Assignments (J7)

Table 3.1.9 DC Power Supply Jack Pin Descriptions (J7)

Pin Number	Signal Name
1	5.0 V
2	GND
3	GND

3.1.6 Extension Connectors (J8 to J12, J16)

The M3A-HS87 includes through-holes for mounting extension connectors. The SH7286 I/O pins are connected to the through-holes. The standard MIL connector can be connected to the through-holes (J8 to J12) to connect the expansion board or monitor the SH7286 bus signals.

Figure 3.1.9 and Figure 3.1.10 show pin assignments for the extension connectors.

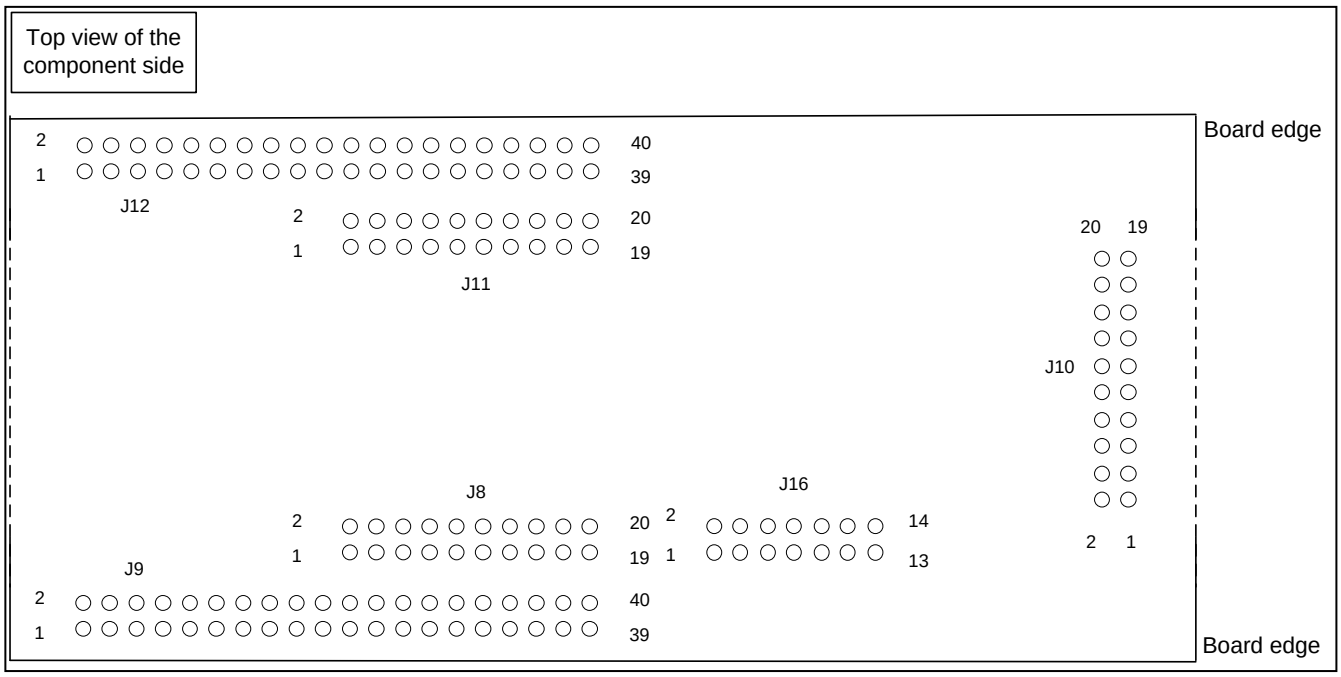


Figure 3.1.9 Extension Connector Pin Assignments (Top View of the Component Side)

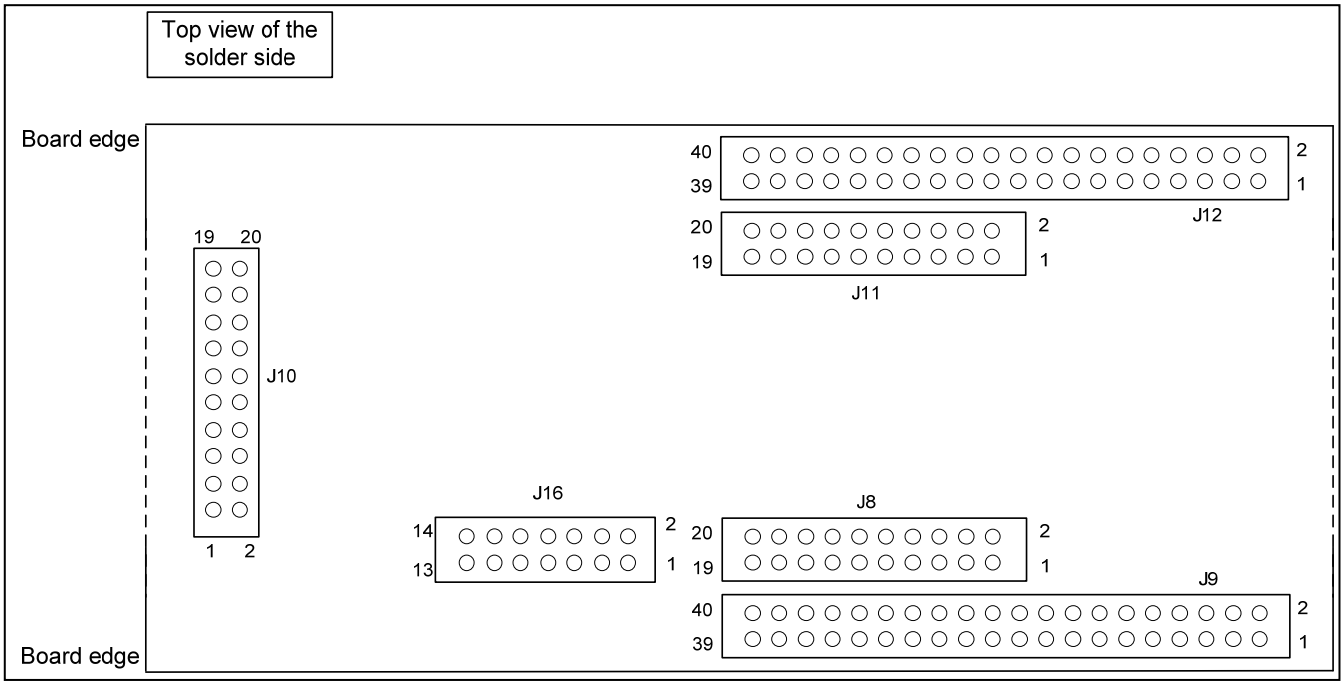


Figure 3.1.10 Extension Connector Pin Assignments (Top View of the Solder Side)

Note: Pin assignments on the CPU board are based on the assumption that the extension connectors are mounted on the component side. If the expansion connectors are mounted on the solder side, these pin assignments do not apply.

Table 3.1.10 lists the extension connector (J8) pin descriptions.

Table 3.1.10 Extension Connector (J8) Pin Descriptions

Pin Number	Signal Name	Other Connections
1	AVCC	-
2	AVCC	-
3	AVREF	-
4	PF0/AN0	-
5	PF1/AN1	-
6	PF2/AN2	-
7	PF3/AN3	-
8	PF4/AN4	-
9	PF5/AN5	-
10	PF6/AN6	-
11	PF7/AN7	-
12	GND(AVREFVSS)	-
13	PE6/TIOC2A/TIOC3DS/SCK3	Extension connector (J9)
14	AGND	-
15	AGND	-
16	PF8/AN8	-
17	PF9/AN9	-
18	PF10/AN10	-
19	PF11/AN11	-
20	GND	-

Table 3.1.11 lists the extension connector (J9) pin descriptions.

Table 3.1.11 Extension Connector (J9) Pin Descriptions

Pin Number	Signal Name	Other Connections
1	5VCC	-
2	5VCC	-
3	WDTOVF	-
4	PE6/TIOC2A/TIOC3DS/SCK3	-
5	PE5/TIOC1B/TIOC3BS/TXD3	-
6	PE4/TIOC1A/RXD3	-
7	PE3/TIOC0D/TIOC4DS/TEND1	User DIP switches (SW3)
8	PE2/TIOC0C/TIOC4CS/DREQ1	User DIP switches (SW3)
9	PB8/A20/WAIT/POE8/IRQ7/SCK0	-
10	PB7/A19/BREQ/POE4/IRQ6/TXD0	-
11	PB6/A18/BACK/POE3/IRQ5/RXD0	-
12	PB1/A17/REFOUT/ADTRG/IRQ4	-
13	PB0/A16/IRQ3	-
14	PC15/A15/IRQ2	Bus switch (U3) (1)
15	PC14/A14/IRQ1	Bus switch (U3) (U4) (1)
16	PC13/A13/IRQ0	Bus switch (U3) (U4) (1)
17	PC12/A12	Bus switch (U3) (U4) (1)
18	PC11/A11	Bus switch (U3) (U4) (1)
19	PC10/A10	Bus switch (U3) (U4) (1)
20	GND	-
21	PE1/TIOC0B/TIOC4BS/TEND0	User DIP switches (SW3)
22	PE0/TIOC0A/TIOC4AS/DREQ0	User DIP switches (SW3)
23	PA15/CK	SDRAM (U5) (U6) (1)
24	PC9/A9	Bus switch (U3) (U4) (1)
25	PC8/A8	Bus switch (U3) (U4) (1)
26	PC7/A7	Bus switch (U3) (U4) (1)
27	PC6/A6	Bus switch (U3) (U4) (1)
28	PC5/A5	Bus switch (U3) (U4) (1)
29	PC4/A4	Bus switch (U3) (U4) (1)
30	PC3/A3	Bus switch (U3) (U4) (1)
31	PC2/A2	Bus switch (U3) (U4) (1)
32	PC1/A1	Bus switch (U4) (1)
33	PC0/A0/POE0	-
34	PB11/RXD2/CS6/CS0/IRQ0/CS2	-
35	PA5/SCK1/SSCK/CS5	-
36	PD20/D20/IRQ4/TIC5WS/SCK4//POE8	SDRAM (U5) (1)
37	PD21/D21/IRQ5/TIC5VS/TXD4	SDRAM (U5) (1)
38	PD30/D30/TIOC3CS/IRQOUT	SDRAM (U5) (1)
39	RESET	Reset module
40	GND	-

Note 1: These pins can be connected to SDRAM or bus switch only when SDRAM or bus switch is mounted on the board.

Table 3.1.12 lists the extension connector (J10) pin descriptions.

Table 3.1.12 Extension Connector (J10) Pin Descriptions

Pin	Signal Name	Other Connections
1	PB3/SDA/POE2/IRQ1	EEPROM (U16) (2)
2	PB2/SCL/POE1/IRQ0	EEPROM (U16) (2)
3	PB12/TXD2/CS7/CS1/IRQ1/CS3	Bus switch (U3), SDRAM (U6) (1)
4	PA8/TCLKC/TXD3/RDWR	SDRAM (U5) (U6) (1)
5	PA13/WRL/DQMLL	SDRAM (U6) (1)
6	PA12/WRH/DQMLU/POE8	SDRAM (U6) (1)
7	PD31/D31/TIOC3AS/ADTRG	SDRAM (U6) (1)
8	PA4/TXD1/SSO/CS4	-
9	PA9/TCLKD/RXD3/CKE	SDRAM (U5) (U6) (1)
10	PA6/TCLKA/RASL	SDRAM (U5) (U6) (1)
11	PA7/TCLKB/SCK3/CASL	SDRAM (U5) (U6) (1)
12	PA2/SCK0/SCS/CS2	-
13	PA3/RXD1/SSI/CS3	-
14	PD16/D16/IRQ0/CS3/AUDATA0	Bus switch (U3) (U4) (1)
15	PD17/D17/IRQ1/POE5/SCK3/CS2/WRxD/AUDATA1	Bus switch (U3) (U4) (1)
16	PD18/D18/IRQ2/POE6/TXD3/CS1/WTxD/AUDATA2	Bus switch (U3) (U4) (1)
17	PD19/D19/IRQ3/POE7/RXD3/CS0/WSCK/AUDATA3	Bus switch (U3) (U4) (1)
18	PD22/D22/IRQ6/TIC5US/RXD4/AUDSYNC	Bus switch (U3) (U4) (1)
19	PD24/D24/DREQ0/TIOC4DS/AUDCK	Bus switch (U3) (U4) (1)
20	GND	-

Notes:

(1) These pins can be connected to SDRAM or bus switch only when SDRAM or bus switch is mounted on the board.

(2) These pins can be connected to EEPROM only when EEPROM is mounted on the board.

Table 3.1.13 lists the extension connector (J11) pin descriptions.

Table 3.1.13 Extension Connector (J11) Pin Descriptions

Pin Number	Signal Name	Other Connections
1	PD28/D28/TIOC3DS	SDRAM (U5) (1)
2	PD29/D29/TIOC3BS	SDRAM (U5) (1)
3	PA14/RD	-
4	PD15/D15/TIOC4DS	SDRAM (U6) (1),Extension connector (J12)
5	PD14/D14/TIOC4CS	SDRAM (U6) (1), Extension connector (J12)
6	PD13/D13/TIOC4BS	SDRAM (U6) (1), Extension connector (J12)
7	PD12/D12/TIOC4AS	SDRAM (U6) (1), Extension connector (J12)
8	PD11/D11/TIOC3DS	SDRAM (U6) (1), Extension connector (J12)
9	PD10/D10/TIOC3BS	SDRAM (U6) (1), Extension connector (J12)
10	PD9/D9/TIOC3CS	SDRAM (U6) (1), Extension connector (J12)
11	PD8/D8/TIOC3AS	SDRAM (U6) (1), Extension connector (J12)
12	PD7/D7/TIC5WS	SDRAM (U6) (1), Extension connector (J12)
13	PD6/D6/TIC5VS	SDRAM (U6) (1), Extension connector (J12)
14	PD5/D5/TIC5US	SDRAM (U6) (1), Extension connector (J12)
15	PD4/D4/TIC5W	SDRAM (U6) (1), Extension connector (J12)
16	PD3/D3/TIC5V	SDRAM (U6) (1), Extension connector (J12)
17	PD2/D2/TIC5U	SDRAM (U6) (1), Extension connector (J12)
18	PD1/D1	SDRAM (U6) (1), Extension connector (J12)
19	PD0/D0	SDRAM (U6) (1), Extension connector (J12)
20	GND	-

Note 1: These pins can be connected to SDRAM only when SDRAM is mounted on the board.

Table 3.1.14 lists the extension connector (J12) pin descriptions.

Table 3.1.14 Extension Connector (J12) Pin Descriptions

Pin Number	Signal Name	Other Connections
1	3VCC	-
2	3VCC	-
3	PA21/TIC5U/RASU/POE8/IRQ3/RASL	-
4	PA22/TIC5V/CASU/POE4/IRQ2/CASL	-
5	PA23/TIC5W/POE0/IRQ1/AH/CKE	IRQ1 Switch (SW6)
6	PB9/USPND	-
7	PB10	USB module
8	PD25/D25/TIOC4CS/DREQ1	SDRAM (U5) (1)
9	PD26/D26/TIOC4BS/DACK1	SDRAM (U5) (1)
10	PD27/D27/TIOC4AS/DACK0	SDRAM (U5) (1)
11	PE7/TIOC2B/RXD2/BS/UBCTRG	-
12	PE8/TIOC3A/SCK2	-
13	PE9/TIOC3B/FRAME	User LED
14	PE10/TIOC3C/TXD2	-
15	PE11/TIOC3D	User LED
16	PE12/TIOC4A	User LED
17	PE13/TIOC4B/MRES	User LED
18	PE14/DACK0/TIOC4C/AH	User LED
19	PE15/DACK1/TIOC4D/IRQOUT	User LED
20	GND	-
21	PA0/RXD0/CS0	RS-232C driver (U9)
22	PA1/TXD0/CS1	RS-232C driver (U9)
23	PA14/RD	-
24	PD15/D15/TIOC4DS	SDRAM (U6) (1), Extension connector (J11)
25	PD14/D14/TIOC4CS	SDRAM (U6) (1), Extension connector (J11)
26	PD13/D13/TIOC4BS	SDRAM (U6) (1), Extension connector (J11)
27	PD12/D12/TIOC4AS	SDRAM (U6) (1), Extension connector (J11)
28	PD11/D11/TIOC3DS	SDRAM (U6) (1), Extension connector (J11)
29	PD10/D10/TIOC3BS	SDRAM (U6) (1), Extension connector (J11)
30	PD9/D9/TIOC3CS	SDRAM (U6) (1), Extension connector (J11)
31	PD8/D8/TIOC3AS	SDRAM (U6) (1), Extension connector (J11)
32	PD7/D7/TIC5WS	SDRAM (U6) (1), Extension connector (J11)
33	PD6/D6/TIC5VS	SDRAM (U6) (1), Extension connector (J11)
34	PD5/D5/TIC5US	SDRAM (U6) (1), Extension connector (J11)
35	PD4/D4/TIC5W	SDRAM (U6) (1), Extension connector (J11)
36	PD3/D3/TIC5V	SDRAM (U6) (1), Extension connector (J11)
37	PD2/D2/TIC5U	SDRAM (U6) (1), Extension connector (J11)
38	PD1/D1	SDRAM (U6) (1), Extension connector (J11)
39	PD0/D0	SDRAM (U6) (1), Extension connector (J11)
40	GND	-

Note 1: These pins can be connected to SDRAM only when SDRAM is mounted on the board.

Table 3.1.15 lists the extension connector (J16) pin descriptions.

Table 3.1.15 Extension Connector (J16) Pin Descriptions

Pin Number	Signal Name	Other Connections
1	PA10/WRHL/DQMUL	SDRAM (U5) (1)
2	PA11/WRHH/DQMUU/AH	SDRAM (U5) (1)
3	PB13/CTx0	RCAN (U10)
4	PB14/CRx0	RCAN (U12)
5	PB15/CKE/A21	-
6	PB16/CASL/A22/DACK3	-
7	PB17/CASU/A23/DREQ3	-
8	PB18/RASL/A24/DACK2	-
9	PB19/RASU/A25/DREQ2	-
10	PD23/D23	SDRAM (U5) (1)
11	GND	-
12	DA0	-
13	DA1	-
14	GND(AVREFVSS)	-

Note 1: These pins can be connected to SDRAM only when SDRAM is mounted on the board.

3.1.7 RCAN Port Connector (J13)

The M3A-HS87 supports RCAN transmission and reception.

Figure 3.1.11 shows pin assignments for the RCAN port connector (J13).

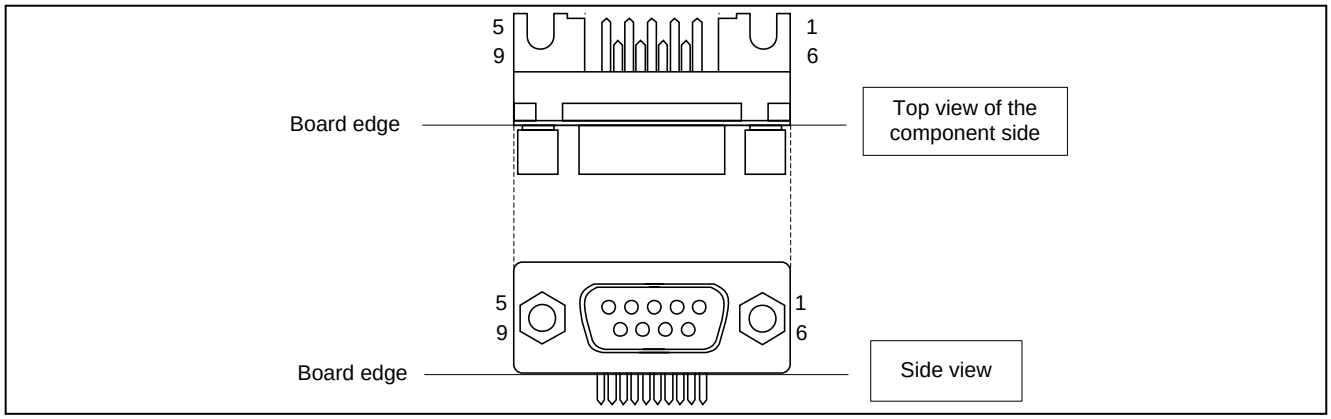


Figure 3.1.11 RCAN Port Connector (J13) Pin Assignments

Table 3.1.16 lists the RCAN port connector (J13) pin descriptions.

Table 3.1.16 RCAN Port Connector (J13) Pin Descriptions

Pin Number	Signal Name	Pin Number	Signal Name
1	NC	6	NC
2	CANL (U12)	7	CANH (U12)
3	GND	8	NC
4	NC	9	NC
5	NC		

3.1.8 USB Port Connector (J14)

The M3A-HS87 includes a USB port connector (Series-B receptacle).

Figure 3.1.12 shows pin assignments for the USB port connector (J14). Table 3.1.17 lists the USB port connector (J14) pin descriptions.

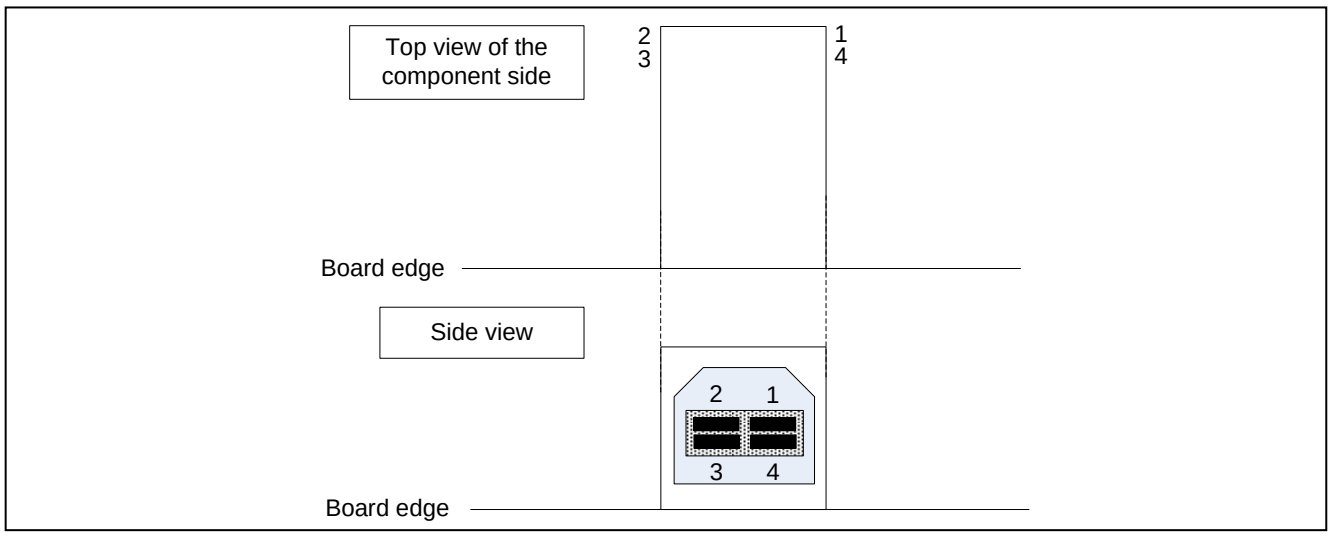


Figure 3.1.12 USB Port Connector (J14) Pin Assignments

Table 3.1.17 USB Port Connector (J14) Pin Descriptions

Pin Number	Signal Name
1	Vbus
2	D-
3	D+
4	GND

3.1.9 GND connector (J15)

The M3A-HS87 includes the GND connector (J15).

Figure 3.1.13 shows pin assignments for the GND connector. Table 3.1.18 lists the GND connector pin descriptions.

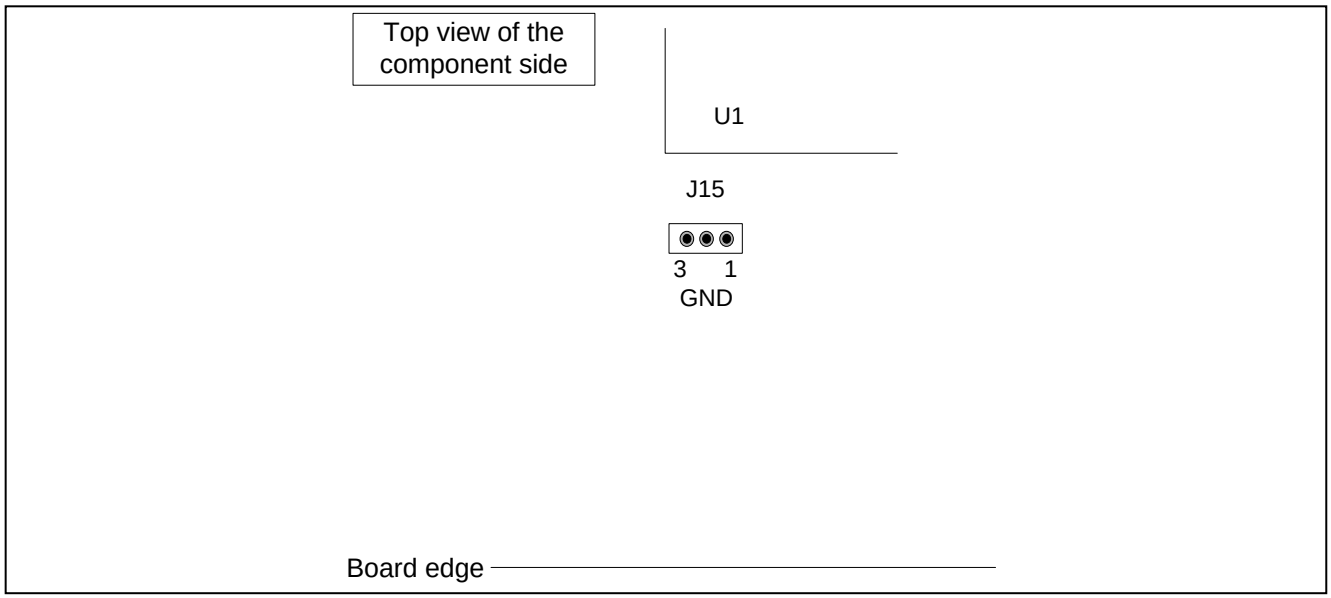


Figure 3.1.13 GND Connector (J15) Pin Assignments

Table 3.1.18 GND Connector (J15) Pin Descriptions

Pin Number	Signal Name
1	GND
2	GND
3	GND

3.2 Switches and LEDs

The M3A-HS87 includes switches and LEDs as the operating components.

Figure 3.2.1 shows the M3A-HS87 operating components assignments.

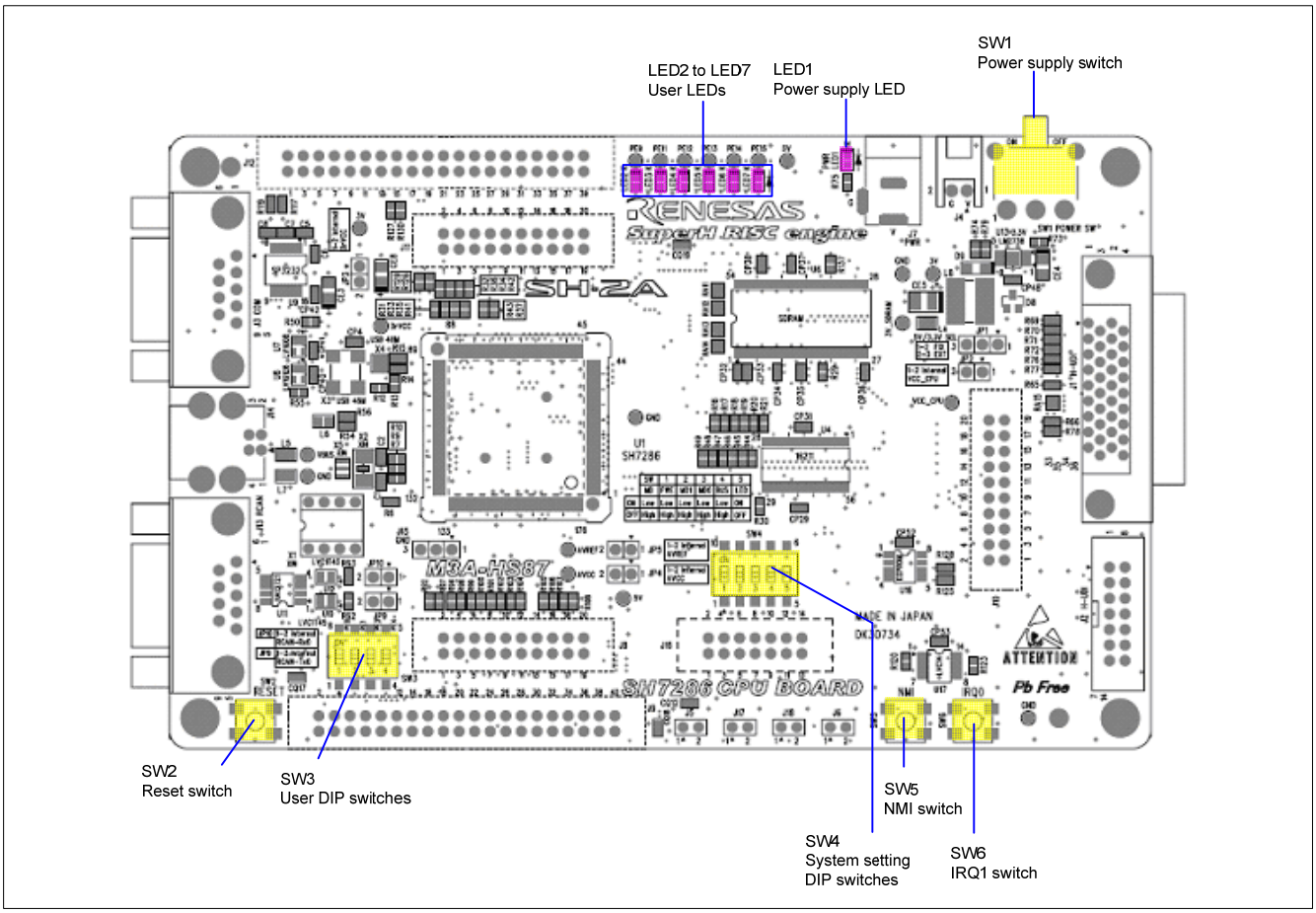


Figure 3.2.1 M3A-HS87 Operational Component Assignments (Top View of the Component Side)

3.2.1 CPU Power Switching Jumper (JP1)

Set the JP1 to switch the power supply and voltage to the SH7286 between 3.3 V and 5.0 V. This setting is applicable only for the SH7286 MCU (U1), and does not effect on other components such as the external memory.

Figure 3.2.2 shows the CPU power switching jumper (JP1) assignments. Table 3.2.1 lists the CPU power switching jumper (JP1) setting.

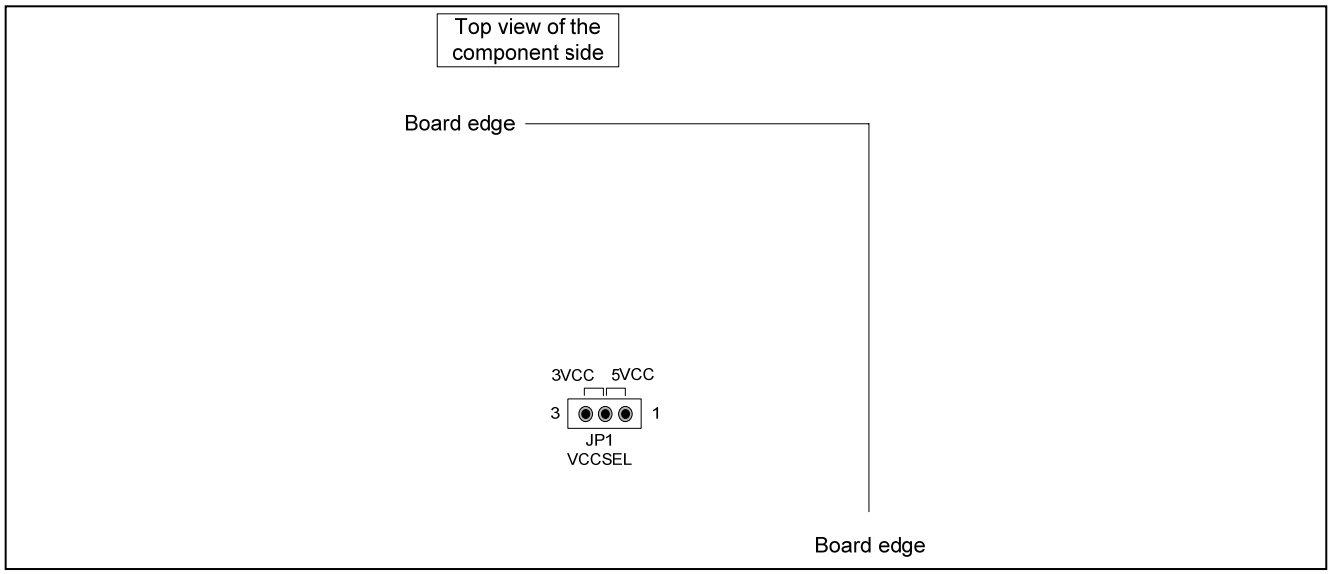


Figure 3.2.2 CPU Power Switching Jumper (JP1) Assignments

Table 3.2.1 CPU Power Switching Jumper (JP1) Setting

Number	Setting	Description
JP1 VCCSEL	1-2	Supplies 5 V DC to VCC_CPU
	2-3	Supplies 3.3 V DC to VCC_CPU (1)

Notes:

(1) Default setting

(2) Do not change the jumper settings while the board is ON. Be sure to turn the power OFF before changing the settings.

3.2.2 External Power Switching Jumpers (JP2 to JP5)

Set JP2 to JP5 to switch the source of the power supply voltage to the SH7286 system power supply (VCC), USB power supply (DrVCC), analog power supply (AVCC) and A/D reference power supply (AVREF).

Figure 3.2.3 shows the external power switching jumpers assignments. Table 3.2.2 lists the external power switching jumpers setting.

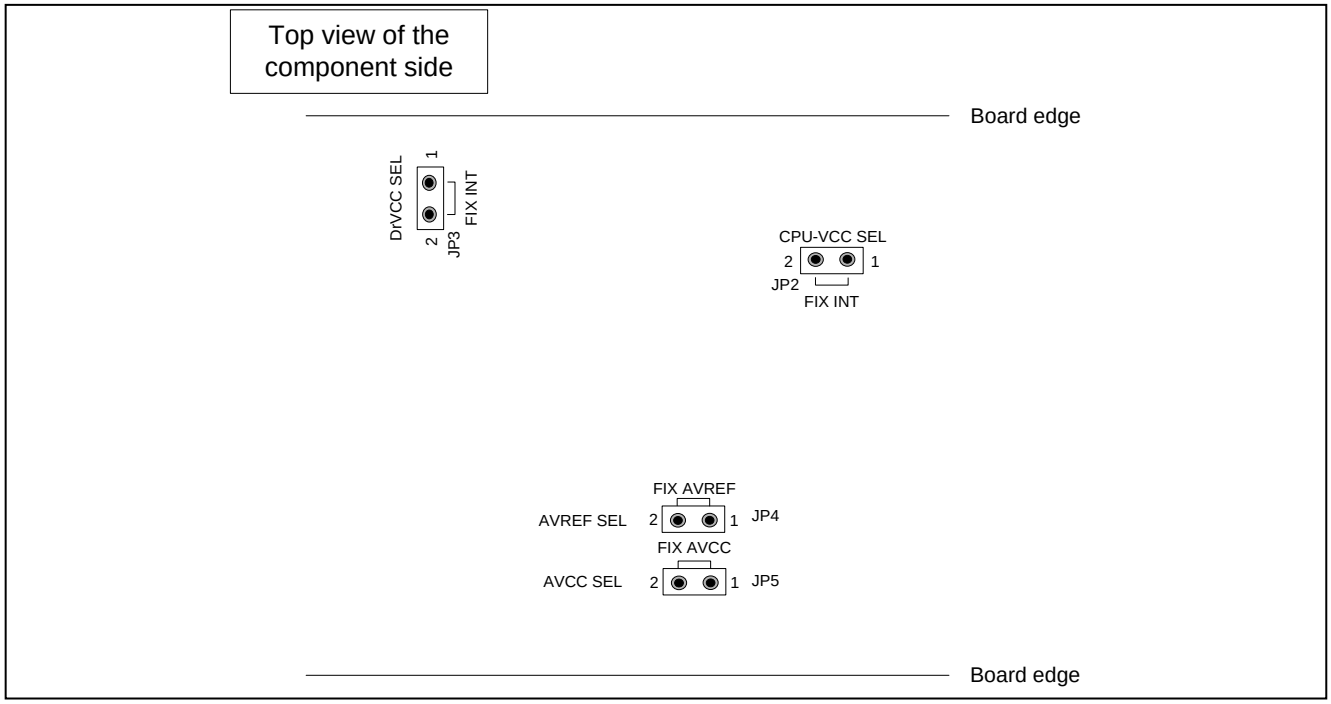


Figure 3.2.3 External Power Switching Jumper Assignments (JP2 to JP5)

Table 3.2.2 External Power Switching Jumper Settings (JP2 to JP5)

Number	Setting	Description
JP2 CPU-VCC SEL	1 - 2	Supplies the SH7286 power supply voltage (VCC) from J4 or J7 (1)
	Open	Uses the external power supply voltage (J5 or H13)
JP3 DrVCC SEL	1 - 2	Supplies the SH7286 USB power supply (DrVCC) from J4 or J7 (via a regulator) (1)
	Open	Uses the external power supply voltage (J6 or H14)
JP4 AVCCSEL	1 - 2	Connects the SH7286 AVCC to the 5 V fixed power supply voltage (1)
	Open	Uses the external power supply voltage (J17, J8 or H8)
JP5 AVREFSEL	1 - 2	Connects the SH7286 AVREF to 5 V fixed power supply voltage (1)
	Open	Uses the external power supply voltage (J18, J8 or H9)

Notes:

(1) Default setting

(2) Do not change the jumper settings while the board is ON. Be sure to turn the power OFF before changing the settings.

3.2.3 RCAN Port Remove Jumpers (JP9 and JP10)

Set the JP9 and JP10 to switch the SH7286 pins connected to the RCAN transceiver (U11).

U11 is connected to the SH7286 PB13/CTx0 and PB14/CRx0 pins via the level shifter as default.

When not using these pins via U11, remove JP9 and JP10.

Figure 3.2.4 shows the RCAN port remove jumper assignments. Table 3.2.3 lists RCAN port remove jumper settings.

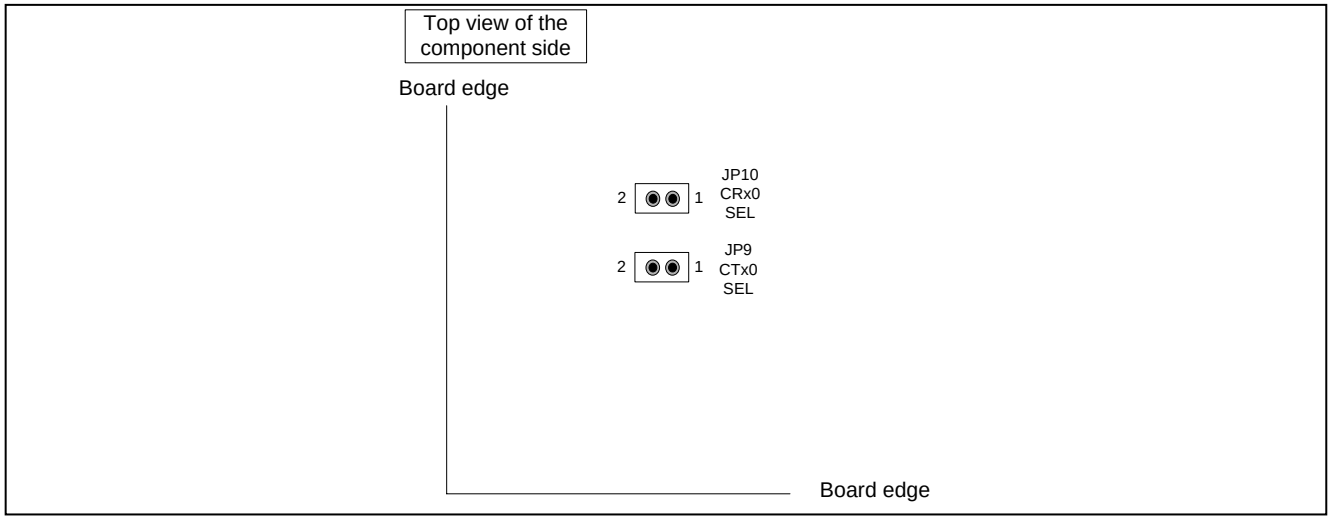


Figure 3.2.4 RCAN Port Remove Jumper Assignments (JP7 and JP8)

Table 3.2.3 RCAN Port Jumper Settings (JP7 and JP8)

Number	Setting	Description
JP9 TXDSEL	1-2	Connects the SH7286 PB13/CTx0 pin to the RCAN transceiver (U11) (1)
	Open	Removes the SH7286 PB13/CTx0 pin from the RCAN transceiver (U11)
JP10 RXD SEL	1-2	Connects the SH7286 PB14/CRx0 pin to the RCAN transceiver (U11) (1)
	Open	Removes the SH7286 PB14/CRx0 pin from the RCAN transceiver (U11)

Notes:

(1) Default setting

(2) Do not change the jumper settings while the board is ON. Be sure to turn the power OFF before changing the settings.

3.2.4 Switches and LEDs

The M3A-HS87 includes six switches and seven LEDs.

Table 3.2.4 lists the switches mounted on the board.

Table 3.2.4 Switches

Switch Number	Description	Remarks
SW1	System power ON-OFF switch	-
SW2	System reset input switch	Refer to Section 2.10 for details.
SW3	User DIP switches (4/package) SW3-1 OFF: PE0= high ON: PE0= low SW3-2 OFF: PE1= high ON: PE1= low SW3-3 OFF: PE2= high ON: PE2= low SW3-4 OFF: PE3= high ON: PE3= low	Pins PE0, PE1, PE2 and PE3 are pulled up. Refer to Section 2.5 for details.
SW4	System setting DIP switches (5/package)	Refer to Table 3.2.5 for functions.
SW5	NMI switch	Refer to Section 2.11 for details.
SW6	IRQ1 switch	Refer to Section 2.11 for details.

Table 3.2.5 lists the SW4 functions. Set the SH7286 operating mode using the FWE, MD0, and MD1 pins.

Table 3.2.6 lists SH7286 operating mode settings.

Note: The FWE pin is multiplexed to the $\overline{\text{ASEBRK}}$/$\overline{\text{ASEBRKAK}}$ signals. Turn OFF the SW4-1 (FWE) before using the E10A-USB emulator.

Table 3.2.5 Switch (SW4) Functions

Switch Number	Setting	Description	
SW4-1 FWE	OFF	FWE is high (on-chip flash memory is write/erase enabled) (1)	Operating mode setting
	ON	FWE is low (on-chip flash memory is write/erase protected)	
SW4-2 MD1	OFF	MD1 pin is fixed high (1)	
	ON	MD1 pin is fixed low	
SW4-3 MD0	OFF	MD0 pin is fixed high	
	ON	MD0 pin is fixed low (1)	
SW4-4 SDRAM	OFF	Accessing SDRAM in 16-bit (1)	
	ON	Accessing SDRAM in 32-bit	
SW4-5 LED	OFF	User LED is turned OFF	
	ON	User LED is turned ON (1)	

Notes:

(1) Default setting

(2) Do not change the SW4 settings while the M3A-HS87 is ON. Be sure to turn the power OFF before changing the settings.

Table 3.2.6 SH7286 Operating Mode Settings

SW4-1 (FWE) (1)	SW4-2 (MD1)	SW4-3 (MD0)	SH7286 Operating Mode	
			Number	Name
ON	ON	ON	Mode 0 (2)	MCU extension mode 0 (on-chip ROM is disabled, CS0 space: 32-bit bus)
ON	ON	OFF	Mode 1 (2)	MCU extension mode 1 (on-chip ROM is disabled,CS0 space:16-bit bus)
ON	OFF	ON	Mode 2	MCU extension mode 2 (on-chip ROM is enabled)
ON	OFF	OFF	Mode 3	Single-chip mode (on-chip ROM is enabled)
OFF	ON	ON	Mode 4 (1)	Boot mode (on-chip ROM is enabled)
OFF	ON	OFF	Mode 5 (2)	User boot mode (on-chip ROM is enabled)
OFF	OFF	ON	Mode 6 (1)	User program mode (on-chip ROM is enabled) (default setting)
OFF	OFF	OFF	Mode 7 (2)	USB boot mode (on-chip ROM is enabled)

Notes:

(1) Programming mode for the flash memory.

(2) This mode is not supported by the M3A-HS87.

(3) Do not change the SW4 settings while the M3A-HS87 is ON. Be sure to turn the power OFF before changing the settings.

Table 3.2.7 lists the LEDs on the M3A-HS87.

Table 3.2.7 LEDs

LED Number	Color	Description/Remarks
LED1	blue	Power supply LED (LED1 is illuminated when power and voltage is supplied)
LED2	green	User LED (LED 2 is illuminated when PE9 outputs a low-level signal)
LED3	green	User LED (LED 3 is illuminated when PE11 outputs a low-level signal)
LED4	green	User LED (LED 4 is illuminated when PE12 outputs a low-level signal)
LED5	green	User LED (LED 5 is illuminated when PE13 outputs a low-level signal)
LED6	green	User LED (LED 6 is illuminated when PE14 outputs a low-level signal)
LED7	green	User LED (LED 7 is illuminated when PE15 outputs a low-level signal)

Note: LED 2 to LED 7 are illuminated when switches SW 3 to SW5 (LEDPWR) are turned ON.

3.2.5 Jumper/Switch Setting when Using the Development Tools

As the SH7286 signals connected to the emulator (FWE/$\overline{\text{ASEBRKAK}}$/$\overline{\text{ASEBRK}}$, TDI, TDO pins) are multiplexed to the on-chip flash writing control pins, set the jumpers and switches as shown in Table 3.2.8 when using development tools such as the E10A-USB emulator or the Flash Development Toolkit (FDT).

Table 3.2.8 Jumper/Switch Setting

Development Tool	Connector	Setting (1)				Remarks
		SW4-1	SW4-2	SW4-3	SW4-4	
E10A-USB (14-pin)	H-UDI port connector (J2)	OFF	OFF	ON	OFF	SDRAM is 16-bit access.
		OFF	OFF	ON	ON	SDRAM is 32-bit access.
E10A-USB (36-pin)	H-UDI port connector (J1)	OFF	OFF	ON	OFF	SDRAM is 16-bit access. AUD can be used.
		OFF	OFF	ON	ON	SDRAM is 32-bit access AUD cannot be used.
FDT	Serial port connector (J3)	OFF	ON	ON	-	
	USB port connector (J14)	OFF	OFF	OFF	-	Mode 7 USB boot mode (2)

Notes:

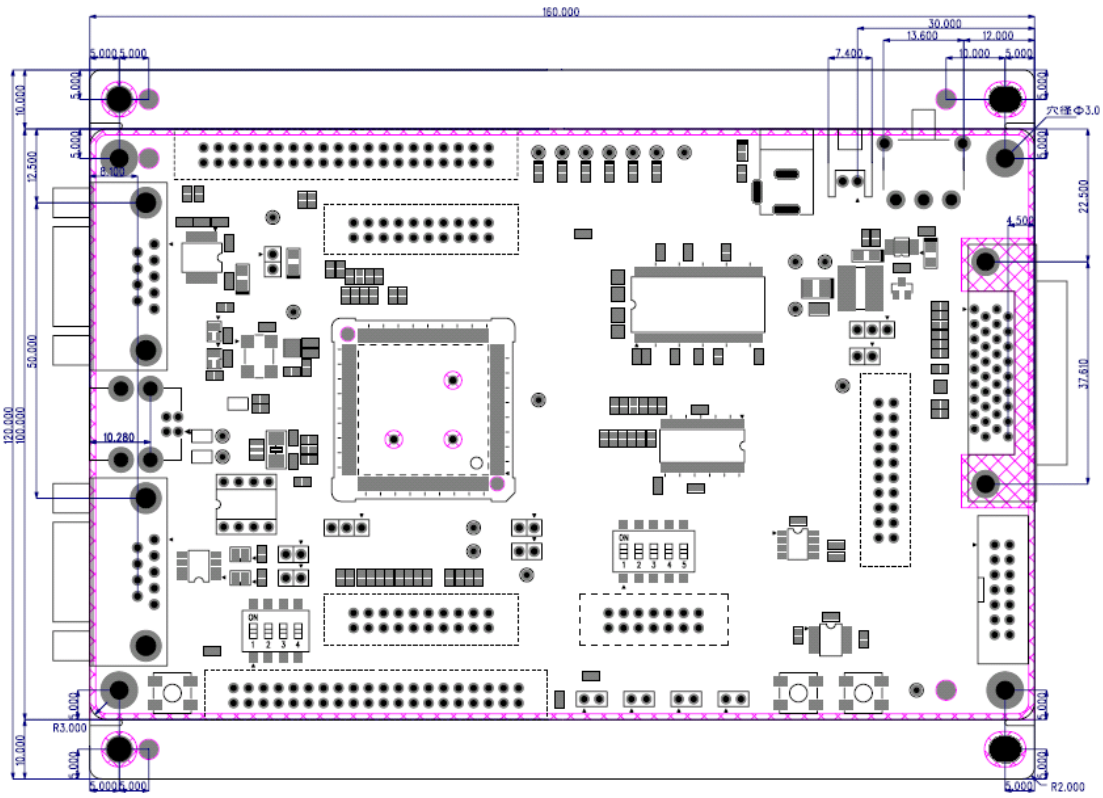
(1) Do not change the SW4 settings while the board is ON. Be sure to turn the power OFF before changing the settings.

(2) The M3A-HS87 does not support the USB boot mode, however, pull down PC0/A0/P0E0 pins to use that mode. We've mounted a 47 k ohm resistor between pins 33 and 40 of J9 connector on the M3A-HS87 to check its operation. For details, refer to "26.5.2 USB Boot Mode Notes on USB Boot Mode Execution" on the SH7280 Group Hardware Manual.

3.3 Dimensions

Figure 3.3.1 shows the CPU board dimensions.

Top view of the component side



Transparent view of the solder side

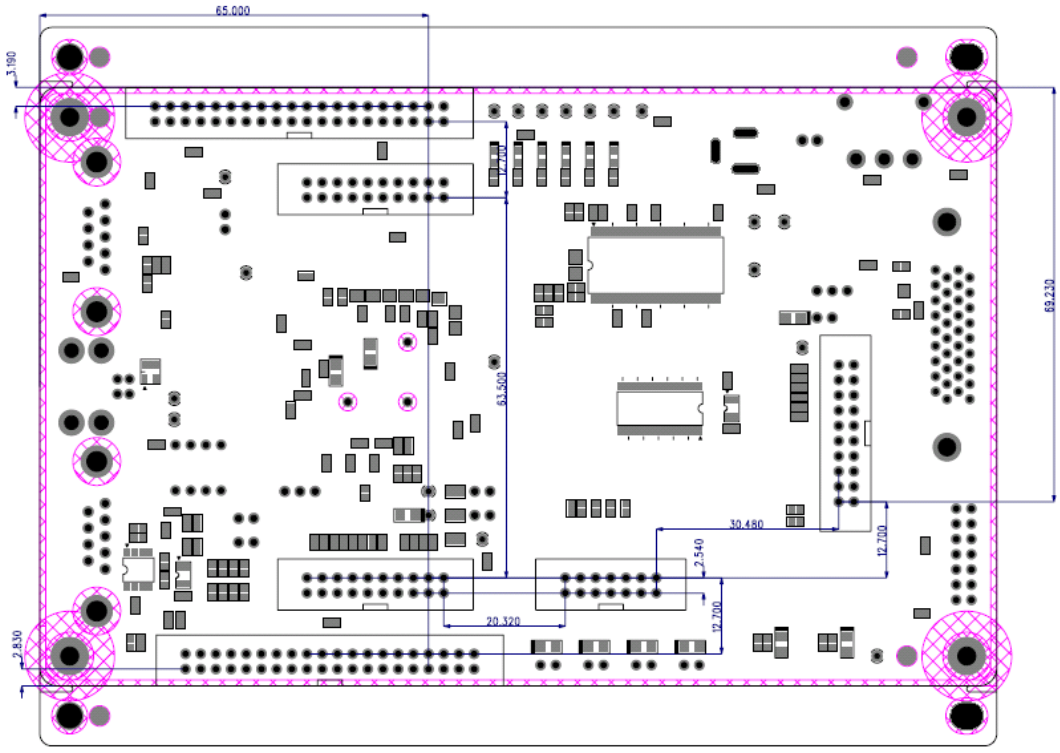


Figure 3.3.1 M3A-HS87 Board Dimensions

Appendix

M3A-HS87 SCHEMATICS

SH7286 CPU Board M3A-HS87 SCHEMATICS

Note:

5VCC = Digital 5V
3VCC = 3.3V
VCC_CPU = CPU 5V/3.3V
AVCC = CPU Analog 5V
DrVCC = USB 3.3V
3VCC_SDRAM = SDRAM 3.3V

R = Fixed Resistors
RA = Resister Array
C = Ceramic Caps
CE = Electrolytic Caps
CP = Decoupling Caps
CQ = Demitasse resonance Caps
L = Inductor

:not mounted

CHANGE							
Ver. 1.02 Change USB Clock to Ceramic resonator	SCALE		RENESAS SOLUTIONS CORPORATION				M3A-HS87
	DATE	08-09-03	DRAWN	CHECKED	DESIGNED	APPROVED	INDEX (1 / 6)
							DK30734C

Mode Switch 1-3
Bus Mode Switch 4
LED Power Switch 5

MODE	FWE	MD1	MD0
0	L	L	L
1	L	L	H
2	L	H	L
3	L	H	H
4	H	L	L
5	H	L	H
6	H	H	L
7	H	H	H

Bus Mode	
ON	32 Bit Mode
OFF	16 Bit Mode

LED Power	
ON	ON
OFF	OFF

SH7286

R5F72867D100FP

U1

GND-AGND

L1 L300

H1 AVCC

JP4 XG8S-0231 L2 L300 CE1 10µF/16V

JP5 XG8S-0231 L3 L300

AVREF H2

0.1µF CP1 CP54 CP55 CP2 CP56 R2 0Ω

5VCC VCC_CPU 3VCC_SDRAM

R3 4.7KΩ R1 4.7KΩ R4 4.7KΩ R5 4.7KΩ

This registor have to install when SDRAM installed.

SW4 A6S-5104 FWE MD1 MD0 Bus Mode LED Power

BITSEL [3] LEDPWR [6]

[12.5MHz:CPU] DIP Type

X1 VCC OUT GND OE XIN125 R6 0Ω CP3 0.1µF _SG-8002DC_12.5MHz

[12.5MHz:CPU]CERALOCK Type

R7 0Ω R9 1MΩ X5 CSTCE12M5G52-R0 R10 0Ω

[12.5MHz:CPU]Xtal Type

X2 CX5032GB 12500 C1 _8pF C2 _8pF

[48MHz:USB]Osclator

X3 VCC OUT GND OE R12 0Ω CP4 0.1µF _SG-8002JF_48MHz_PCC

[48MHz:USB]CERALOCK Type

R13 0Ω R14 1MΩ X4 R15 0Ω CSTCZ48M0X11R**-B0

Decoupling Caps

CP10 CP11 CP12 CP13 CP14 CP15 CP16 CP17 CP18 CP19 CP20 CP21 0.1µF CE2 4.7µF

DrVCC 10µF/16V CP5 CP6 0.1µF CP7 CP8 CP9 0.1µF

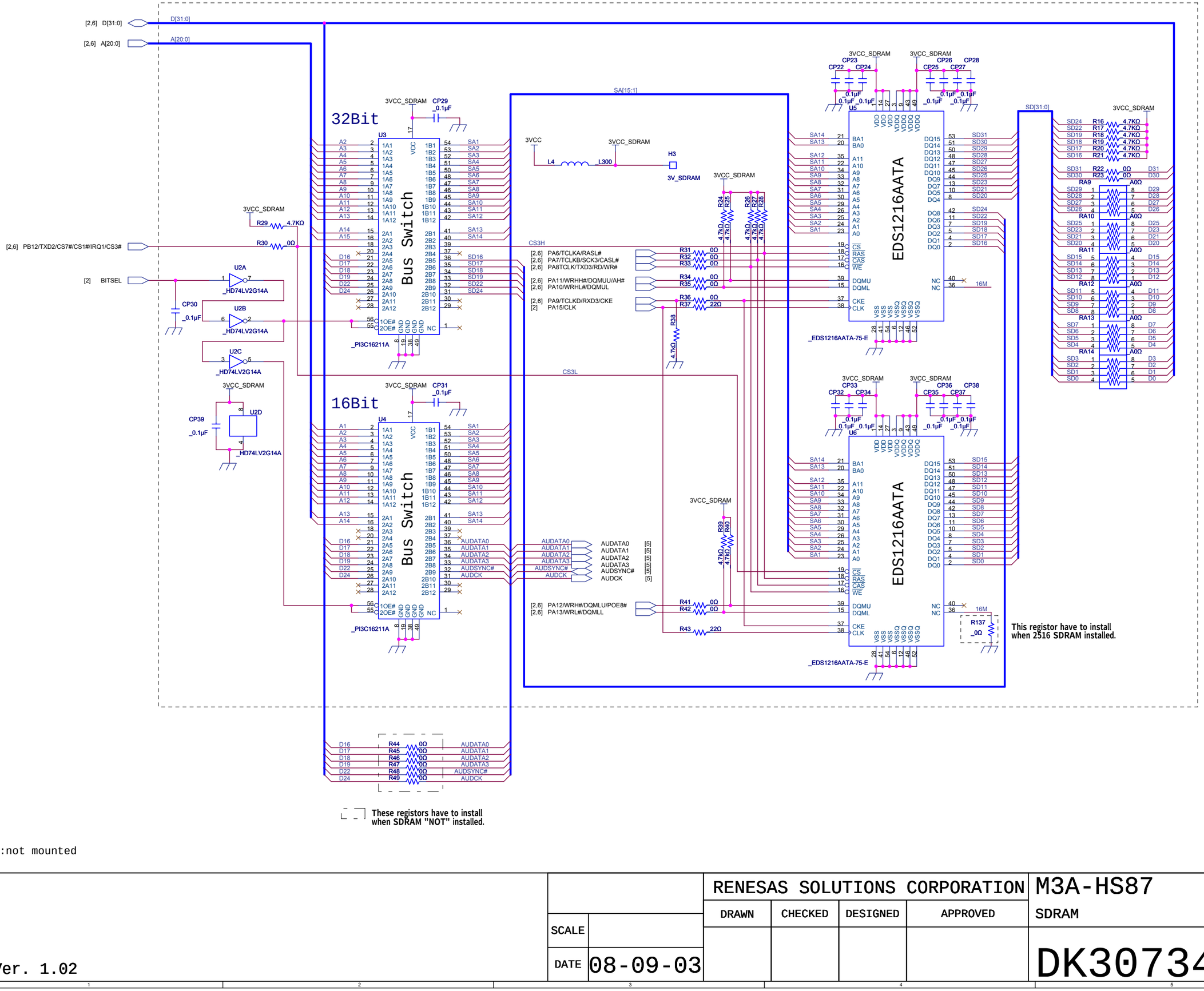
:not mounted

CHANGE		SCALE		DATE	08-09-03
Ver. 1.02 Change USB Clock to Ceramic resonator					

RENESAS SOLUTIONS CORPORATION

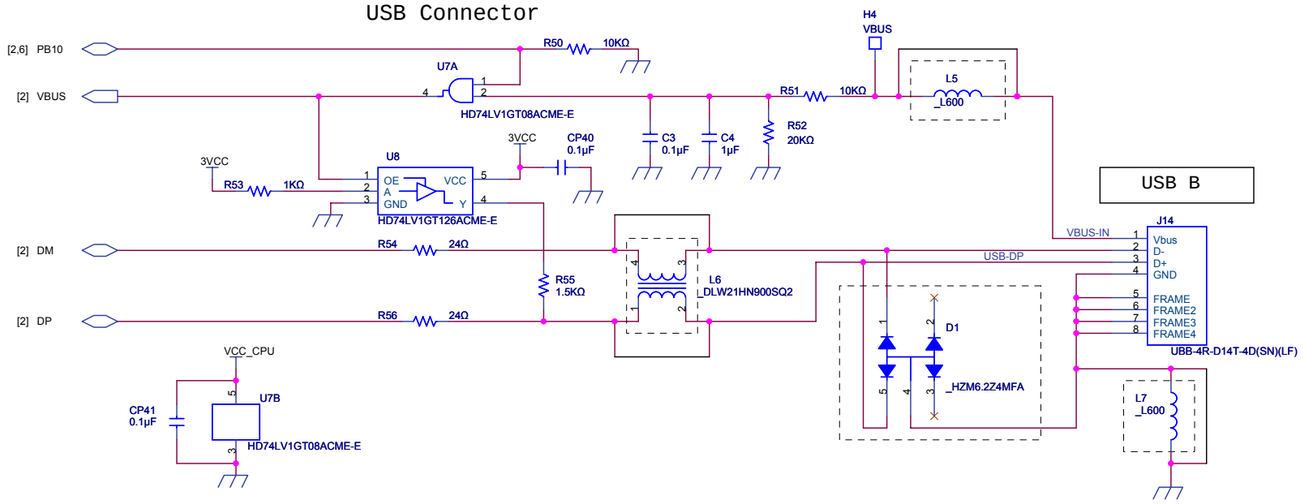
DRAWN	CHECKED	DESIGNED	APPROVED

M3A-HS87
CPU_SH7286 (2 / 6)
DK30734C

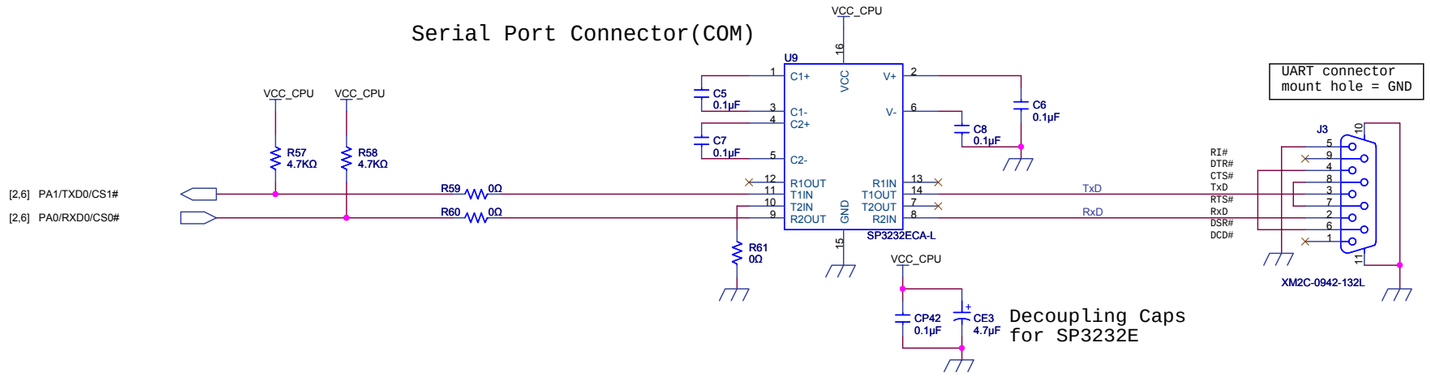


CHANGE	Ver. 1.02		RENESAS SOLUTIONS CORPORATION		M3A-HS87
			DRAWN / CHECKED / DESIGNED / APPROVED		SDRAM (3 / 6)
		SCALE			DK30734C
		DATE	08-09-03		

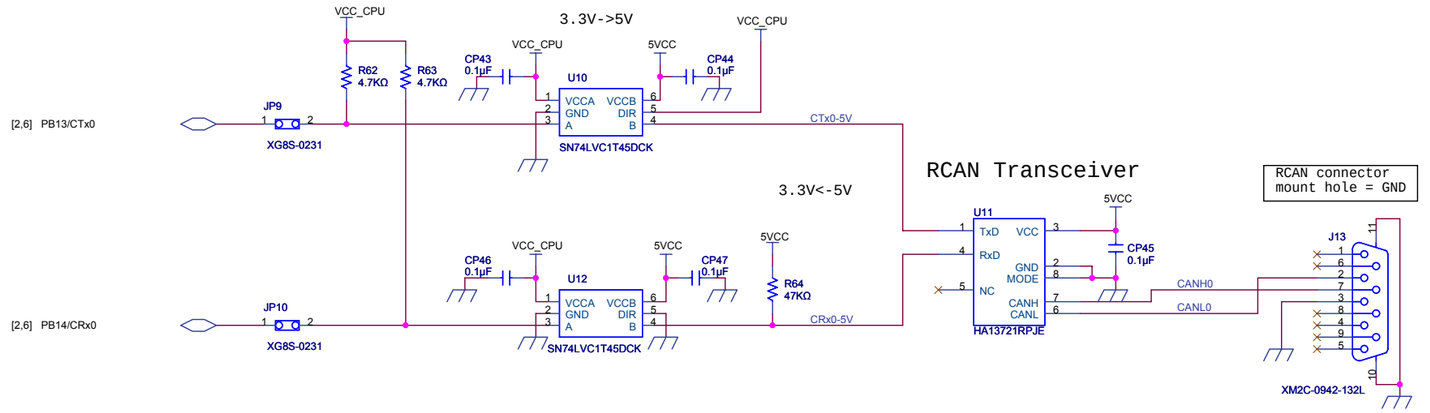
USB Connector



Serial Port Connector(COM)



Voltage Level Shifter 3.3V<->5V



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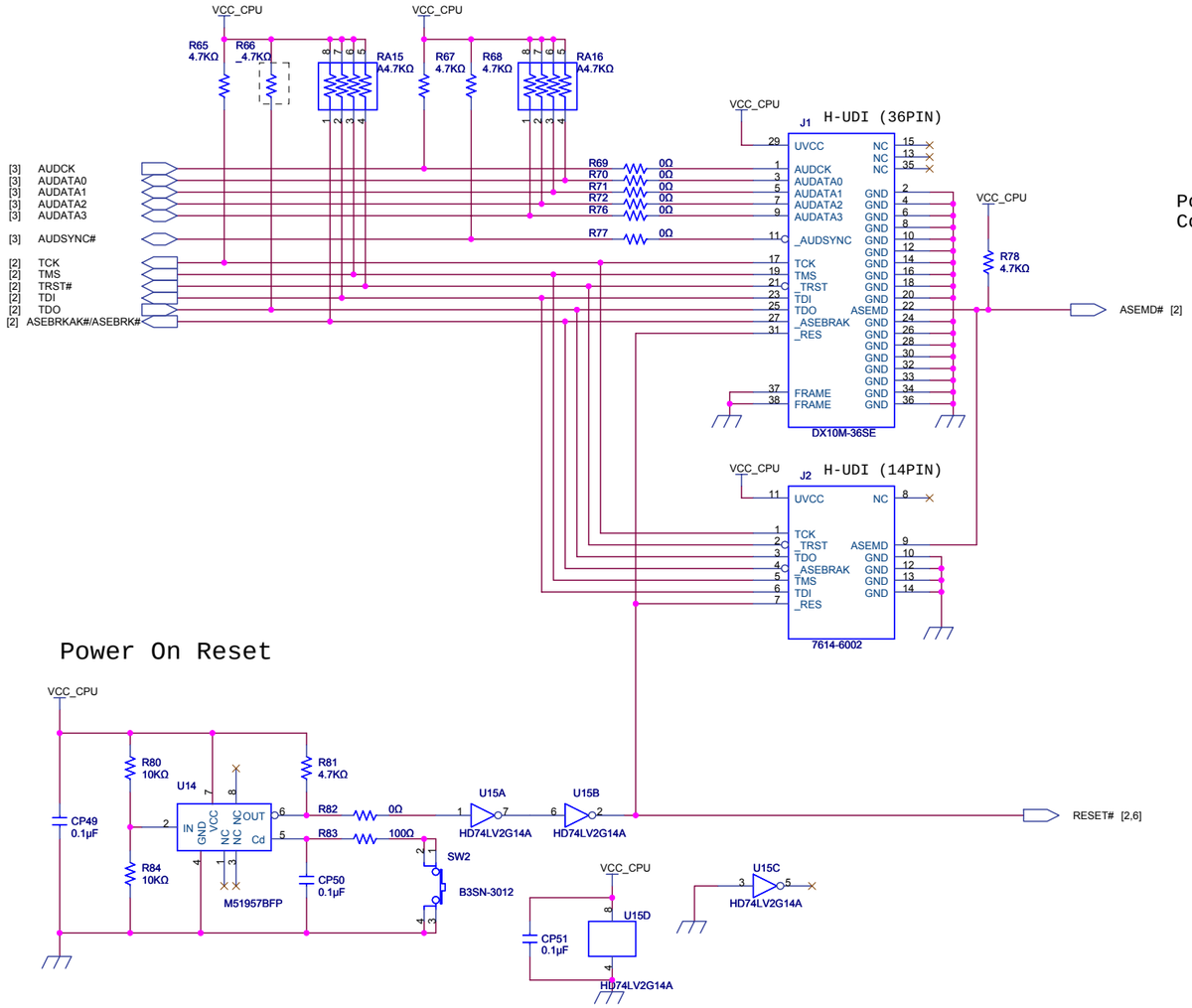
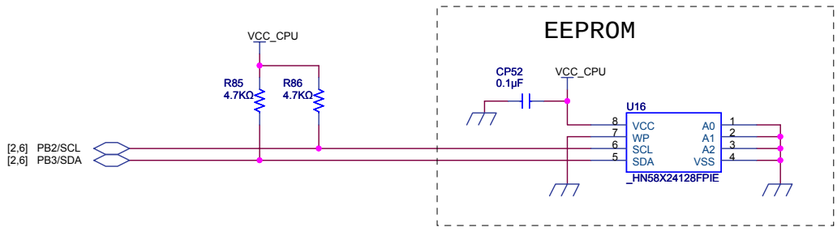
CHANGE			RENESAS SOLUTIONS CORPORATION				M3A-HS87
			DRAWN	CHECKED	DESIGNED	APPROVED	USB/SERIAL/RCAN Interface (4 / 6)
Ver. 1.02		SCALE					DK30734C
		DATE	08-09-03				

H-UDI Interface



Power On Reset

EEPROM



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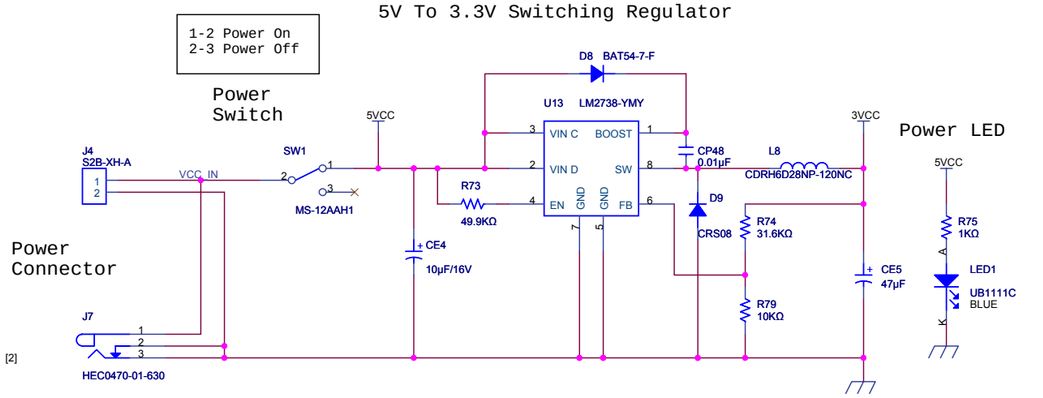
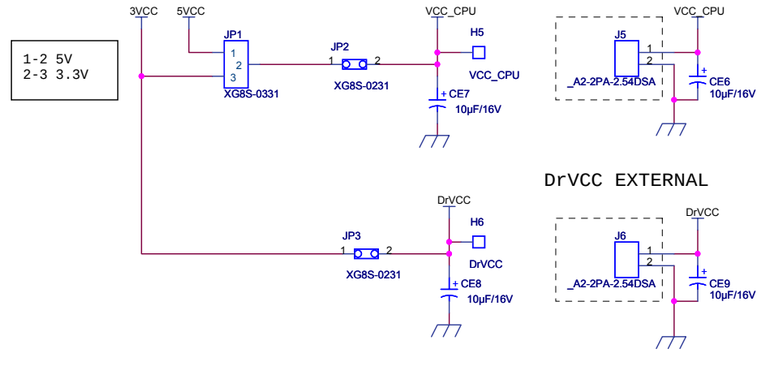
5V To 3.3V Switching Regulator

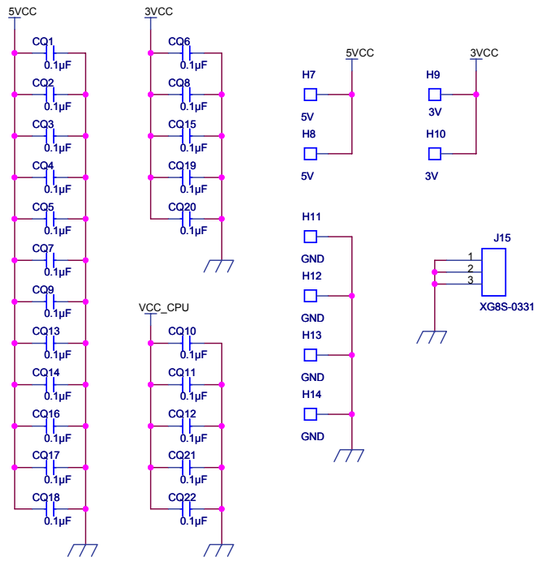


VCC_CPU EXTERNAL

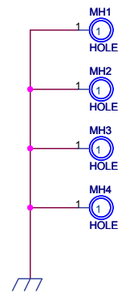


DrVCC EXTERNAL

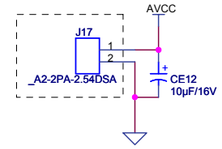
POWER TEST PIN



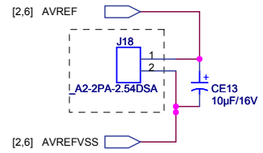
Board fixed hole.



AVCC EXTERNAL

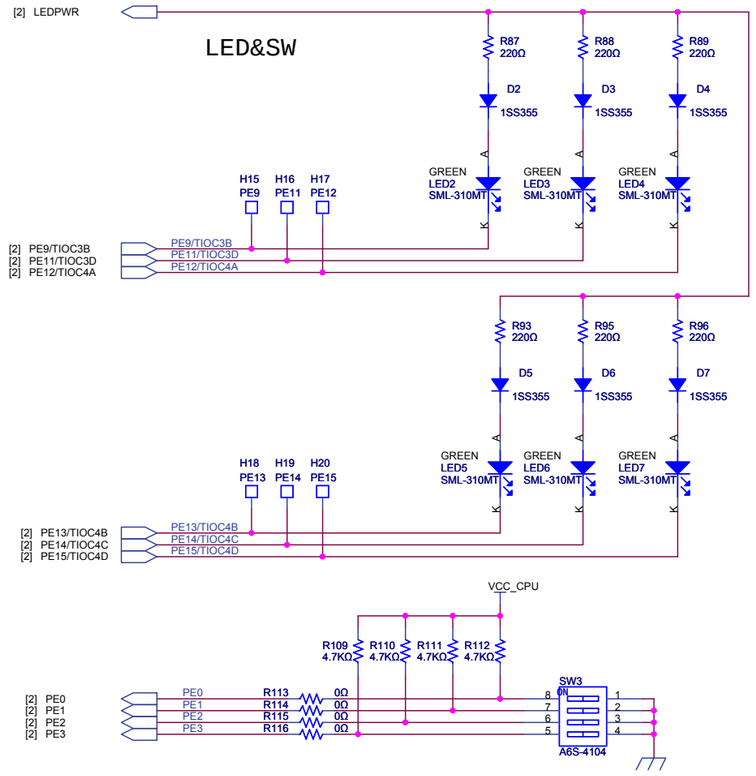


AVREF EXTERNAL

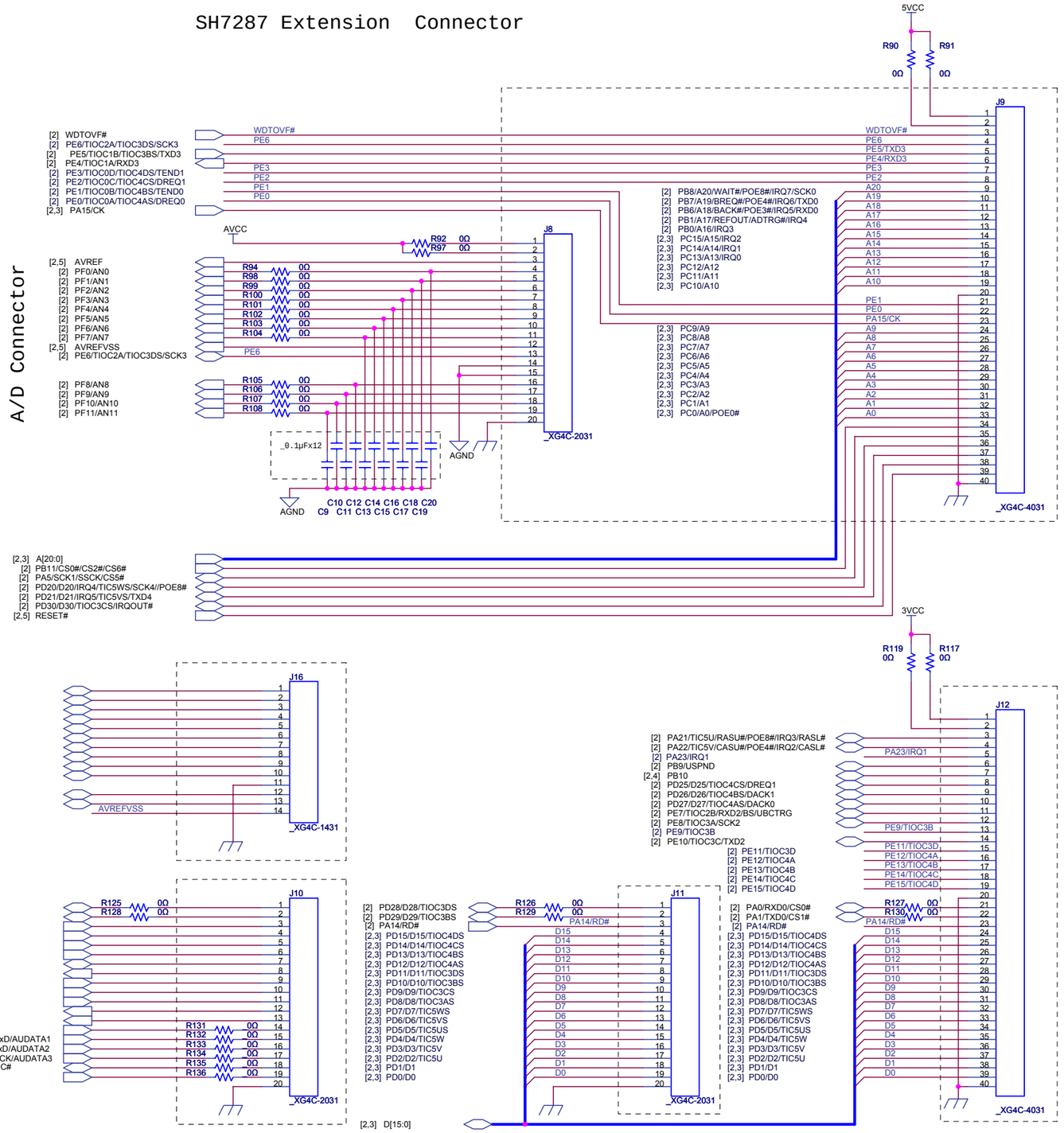


CHANGE			RENESAS SOLUTIONS CORPORATION				M3A-HS87
			DRAWN	CHECKED	DESIGNED	APPROVED	H-UDI,Power,Reset,EEPROM (5 / 6)
Ver. 1.02	SCALE						DK30734C
	DATE	08-09-03					

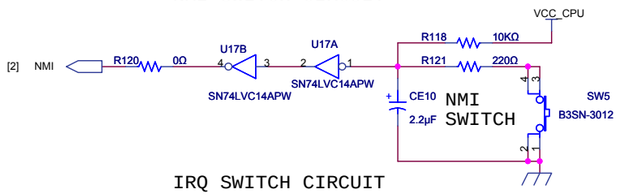
LED&SW



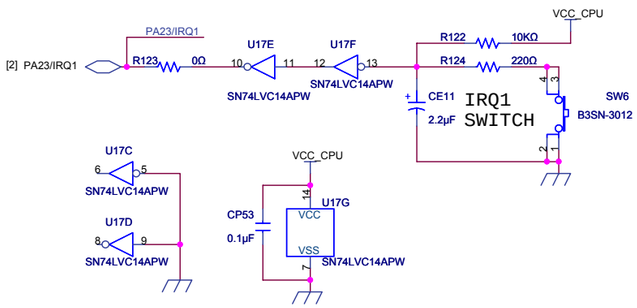
SH7287 Extension Connector



NMI SWITCH CIRCUIT



IRQ SWITCH CIRCUIT



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CHANGE			RENESAS SOLUTIONS CORPORATION		
			DRAWN	CHECKED	DESIGNED	APPROVED
Ver. 1.02	SCALE					
	DATE	08-09-03				

M3A-HS87
Connectors,PUSH/DIP_SW,LED
(6 / 6)

DK30734C

Revision History	SH7286 CPU board M3A-HS87 User's Manual

Rev.	Date	Description	
		Page	Summary
1.00	Apr. 23, 2009	–	First edition issued
1.01	Jun. 09, 2009	1-6,7	SRAM is corrected to SDRAM.
1.01	Jun. 09, 2009	1-11	Table1.8.1 and table 1.9.1 are corrected.
1.01	Jun. 09, 2009	3-26	The USB boot mode is corrected to the unsupport.
1.01	Jun. 09, 2009	3-27	Note(2) is corrected.

SH7286 CPU board
M3A-HS87
User's Manual

Publication Rev. 1.01
Date Jun. 09, 2009

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SH7286 CPU board
M3A-HS87
User's Manual

Renesas Electronics Corporation
1753, Shimonumabe, Nakahara-ku, Kawasaki-shi, Kanagawa 211-8668 Japan

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