



Open Field Network
CC-Link Compatible Product Development
Reference Manual

CC-Link Remote I/O Station Communication LSI MFP2AN

-A6GA-CCMFP2ANN60FN
-A6GA-CCMFP2ANN300FN

Notice for Safety Design

(Read before using this product.)

- Mitsubishi Electric Corporation (Mitsubishi) puts the maximum effort into making its products better and more reliable, but there is always the possibility that product failure or malfunction may occur. Failure or malfunction of Mitsubishi products may lead to personal injury, fire, and/or property damage. Remember to give due consideration to safety when making your designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of non-flammable material, or (iii) prevention against any malfunction or mishap.

Notes Regarding This Manual

(Read before using this product.)

- This manual is intended as a reference to assist our customers in the development of CC-Link family products best suited to the customer's application; it does not convey any license under any intellectual property rights, or any other rights, belonging to Mitsubishi in relation to the technical information described herein.
- When using any or all of the information contained in this manual, including product data, technical information in diagrams and charts, programs, and algorithms, please be sure to evaluate all information not only in terms of the technical details, programs, or algorithms, but as a total system before making a final decision on the applicability of the information and products. Mitsubishi assumes no responsibility for inapplicability.
- Mitsubishi assumes no responsibility for any damage, or infringement of any third-party's rights, originating in the use of any product data, diagrams, charts, programs, algorithms, or circuit application examples contained in this manual.
- The precautions given in this manual are concerned with this product only. For the safety precautions of the system, refer to the user's manuals for the products used.
- The model names of each components described in this manual are subject to change at the discretion of each manufacturer.
- All information contained in this manual, including product data, diagrams, charts, programs, and algorithms, represents information on products at the time of publication of this manual; the items and specifications described herein are subject to change by Mitsubishi without notice. Please consult your local Mitsubishi Electric representative for the latest product information before purchasing a Mitsubishi product.
- When disposing of a product that uses this product, treat it as industrial waste.
- The prior written approval of Mitsubishi is necessary to reprint or reproduce this manual in whole or in part.
- If you have any questions or concerns regarding the details described in this manual, consult your local Mitsubishi Electric representative.

Security Precautions

- To maintain the security (confidentiality, integrity, and availability) of the system against unauthorized access, denial-of-service (DoS) attacks, computer viruses, and other cyberattacks from external devices via the network, take appropriate measures such as firewalls, virtual private networks (VPNs), and antivirus solutions.

Conditions of Use for the Product

- (1) Mitsubishi dedicated LSI ("the PRODUCT") shall be used in conditions;
 - i) where any problem, fault or failure occurring in the PRODUCT, if any, shall not lead to any major or serious accident; and
 - ii) where the backup and fail-safe function are systematically or automatically provided outside of the PRODUCT for the case of any problem, fault or failure occurring in the PRODUCT.

- (2) The PRODUCT has been designed and manufactured for the purpose of being used in general industries. MITSUBISHI SHALL HAVE NO RESPONSIBILITY OR LIABILITY (INCLUDING, BUT NOT LIMITED TO ANY AND ALL RESPONSIBILITY OR LIABILITY BASED ON CONTRACT, WARRANTY, TORT, PRODUCT LIABILITY) FOR ANY INJURY OR DEATH TO PERSONS OR LOSS OR DAMAGE TO PROPERTY CAUSED BY the PRODUCT THAT ARE OPERATED OR USED IN APPLICATION NOT INTENDED OR EXCLUDED BY INSTRUCTIONS, PRECAUTIONS, OR WARNING CONTAINED IN MITSUBISHI'S USER, INSTRUCTION AND/OR SAFETY MANUALS, TECHNICAL BULLETINS AND GUIDELINES FOR the PRODUCT.
("Prohibited Application")
Prohibited Applications include, but not limited to, the use of the PRODUCT in;
 - Nuclear Power Plants and any other power plants operated by Power companies, and/or any other cases in which the public could be affected if any problem or fault occurs in the PRODUCT.
 - Railway companies or Public service purposes, and/or any other cases in which establishment of a special quality assurance system is required by the Purchaser or End User.
 - Aircraft or Aerospace, Medical applications, Train equipment, transport equipment such as Elevator and Escalator, Incineration and Fuel devices, Vehicles, Manned transportation, Equipment for Recreation and Amusement, and Safety devices, handling of Nuclear or Hazardous Materials or Chemicals, Mining and Drilling, and/or other applications where there is a significant risk of injury to the public or property.Notwithstanding the above restrictions, Mitsubishi may in its sole discretion, authorize use of the PRODUCT in one or more of the Prohibited Applications, provided that the usage of the PRODUCT is limited only for the specific applications agreed to by Mitsubishi and provided further that no special quality assurance or fail-safe, redundant or other safety features which exceed the general specifications of the PRODUCTS are required. For details, please contact the Mitsubishi representative in your region.

- (3) Mitsubishi shall have no responsibility or liability for any problems involving system trouble caused by DoS attacks, unauthorized access, computer viruses, and other cyberattacks.

CONTENTS

Notice for Safety Design.....	1
Notes Regarding This Manual.....	1
Security Precautions.....	1
Conditions of Use for the Product.....	2
Relevant Manuals.....	5
Terms.....	5
Usage Precautions.....	5
Address Notation.....	5
Radix Notation.....	5
CC-Link Partner Association.....	6
1. OVERVIEW.....	7
1.1 Development Features.....	7
2. FUNCTION LIST.....	8
3. MFP2AN SPECIFICATIONS.....	9
3.1 External Appearance.....	9
3.2 Pins.....	10
3.3 Pin Functions.....	11
3.3.1 Lists of pin functions.....	11
3.3.2 Buffer types.....	13
3.3.3 Reserved pin handling.....	13
3.3.4 Ratings for the input buffer type ($T_A = -40$ to $+110^\circ\text{C}$, $V_{DD} = 5\text{ V}\pm 10\%$).....	14
3.3.5 Ratings for the output buffer type ($T_A = -40$ to $+110^\circ\text{C}$, $V_{DD} = 5\text{ V}\pm 10\%$).....	15
3.3.6 Ratings for the I/O buffer type ($T_A = -40$ to $+110^\circ\text{C}$, $V_{DD} = 5\text{ V}\pm 10\%$).....	16
3.4 Block Diagram.....	17
3.5 Electrical Characteristics.....	18
3.5.1 Absolute maximum ratings (Unless specified $T_A = 25^\circ\text{C}$).....	18
3.5.2 Recommended operating conditions.....	18
3.5.3 DC characteristics ($T_A = -40$ to $+110^\circ\text{C}$, $V_{DD} = 5\text{ V}\pm 10\%$).....	19
3.5.4 AC characteristics ($T_A = -40$ to $+110^\circ\text{C}$, $V_{DD} = 5\text{ V}\pm 10\%$).....	19
3.5.5 I/O capacitance ($T_A = +25^\circ\text{C}$, $V_{DD} = 0\text{ V}$).....	19
4. RESET TIMING.....	20
5. REMOTE I/O STATION CIRCUIT DIAGRAM EXAMPLES.....	21
5.1 Remote I/O Station Circuit Examples.....	22
5.2 CC-Link Communication Circuit Examples.....	23
5.2.1 CC-Link communication circuit diagrams (isolated types).....	23
5.2.2 CC-Link communication circuit diagram (non-isolated type).....	24
5.2.3 Precautions for CC-Link communication circuit.....	24
5.3 Precautions for Printed Circuit Board Design.....	24
6. SPECIFIED/RECOMMENDED COMPONENTS.....	25
6.1 Mitsubishi Electric Specified Components.....	25
6.2 CC-Link Partner Association Recommended Components.....	25
6.3 MFP2AN.....	25
7. SETTING DETAILS.....	26
7.1 I/O Type and Number of I/O Points Settings.....	26
7.2 Station Number and Baud Rate Settings.....	27
7.3 Other Settings.....	27
8. LED ON/OFF CONDITIONS.....	28
9. MONITOR PINS.....	30
10. HANDLING PRECAUTIONS.....	31
10.1 Recommended Infrared Reflow Soldering Conditions (Including Hot Air Reflow and Infrared + Hot Air Reflow).....	31
10.2 Precautions When Opening the Package.....	32
APPENDICES.....	33
Appendix 1 MFP2AN Previous Specifications.....	33
Appendix 1.1 External appearance (before March 2020).....	33
Appendix 1.2 External appearance (before September 2014).....	34
Appendix 2 Differences between PC97007N and PC18006E.....	35
Appendix 2.1 Model names.....	35
Appendix 2.2 External appearance.....	36
Appendix 2.3 Electrical characteristics.....	37
Appendix 2.4 Specified components (crystal oscillator).....	39
Appendix 2.5 Handling precautions.....	40
Revisions.....	41

Warranty.....	42
Trademarks.....	42

Relevant Manuals

This manual does not describe the details on terms and functions of CC-Link.

For the details, please refer to the following manuals.

Manual name [manual number]	Description
MELSEC-Q CC-Link System Master/Local Module User's Manual [SH-080394E]	System configuration, performance specifications, functions, handling, wiring, and troubleshooting of the MELSEC Q series master/local module

Terms

Unless otherwise specified, this manual uses the following terms.

Term	Description
Cyclic transmission	A function by which data are periodically exchanged among stations on the same system using link devices (RX, RY, RWr, and RWw)
Master station	A station that controls the entire system. This station can perform cyclic transmission and transient transmission with all stations. Only one master station can be used in a system.
Remote I/O station	A station that exchanges I/O signals (bit data) by cyclic transmission. This station cannot perform transient transmission.
Remote output (RY)	Bit data output from the master station to a device station
Remote input (RX)	Bit data input from a device station to the master station
Disconnection	A process of stopping data link if a data link error occurs
Return	A process of restarting data link when a station recovers from an error

Usage Precautions

The intellectual property rights of the information provided in this manual belong to Mitsubishi Electric. Reprinting the information without the consent of Mitsubishi Electric and reproduction of the information for any purpose other than the development of a remote I/O station for CC-Link is prohibited.

Address Notation

This manual uses byte addresses, unless otherwise specified.

Radix Notation

This manual uses the following radix notation, unless otherwise specified.

Radix	Description	Example
Binary	"b" is added at the end of the number to indicate bit.	0b
Decimal	Nothing is added at the end of the number.	0
Hexadecimal	"H" is added at the end of the number to indicate hexadecimal.	10BAH

CC-Link Partner Association

(1) Specifications

The materials related to this manual include the specifications published by the CC-Link Partner Association below.

For CC-Link details, download and refer to the following specifications from the CC-Link Partner Association website.

Document title	Document No.
CC-Link Specification (Overview/Protocol)	BAP-C2001ENG-001
CC-Link Specification (Implementation)	BAP-C2001ENG-002
CC-Link Specification (Profile)	BAP-C2001ENG-003

(2) Conformance test

When a product is developed based on the information in this manual, the product must undergo a conformance test implemented by the CC-Link Partner Association. For conformance test details, download and refer to the following document from the CC-Link Partner Association website.

Document title	Document No.
CC-Link Remote I/O Station Conformance Test Specifications (Ver.1.1)	BAP-C0401ENG-015

(3) Creating a Control & Communication System Profile (CSP+)

The conformance test includes verification of CSP+. CSP+ files must be created in advance.

For CSP+ details, download and refer to the following documents from the CC-Link Partner Association website.

From the same website, other relevant documents and tool that help users create CSP+ files can also be download.

Document title, related tool	Document No.
Control & Communication System Profile Specification	BAP-C2008ENG-001
Control & Communication System Profile Creation Guidelines	-
CSP+ profile creation support tool	-
Sample CSP+ Files	-
CSP+ Templates	-

(4) Inquiries

To request materials published by the CC-Link Partner Association and for conformance test details, please contact the following:

TEL: +81-52-919-1588

FAX: +81-52-916-8655

E-mail: info@cc-link.org

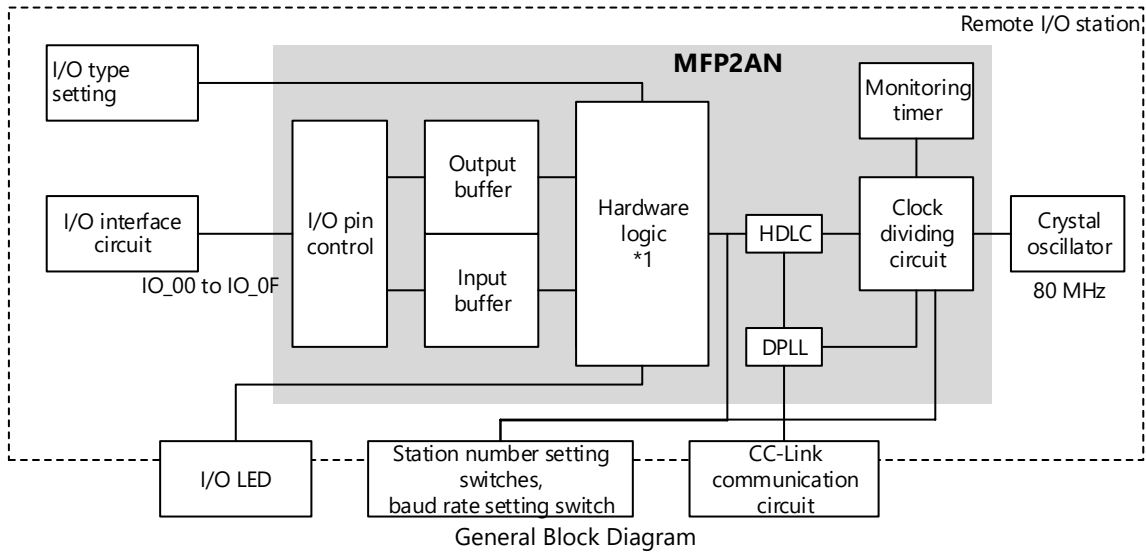
Web: <http://www.cc-link.org/>

1. OVERVIEW

This document describes how to develop a remote I/O station for CC-Link using "CC-Link remote I/O station communication LSI (MFP2AN)" provided by Mitsubishi Electric.

1.1 Development Features

The remote I/O station to be developed comprises CC-Link remote I/O station communication LSI (MFP2AN) and a CC-Link communication circuit that incorporates peripheral circuits, as shown in the general block diagram below.



*1: This logic reads the bit data (RY) addressed to the own station from the receive data and stores the data in the output buffer.

The logic also reads the input information from the input buffer and sends the data (bit data (RX)) to the master station.

- (1) Since the CC-Link protocol is implemented in MFP2AN, a remote I/O station can be developed only with the hardware. (No additional MPU or software is required.)
- (2) I/O type and number of I/O points
The number of occupied stations of the remote I/O station is fixed to one.
The following table lists the combinations of the I/O type and the number of I/O points.

No.	I/O type	Number of I/O points
1	Input	Remote input (RX) 16 points
2	Output	Remote output (RY) 16 points
3	I/O combined	Remote input (RX) 8 points + Remote output (RY) 8 points

*: A device with less than 16 I/O bits can be developed by setting the I/O pins to "Not used".
(The master station recognizes this type of device as a 16-bit device.)

Point
The I/O combined type can perform both input and output using different device numbers. (Example: RX00 to RX07, RY08 to RY0F)
In some cases, the I/O combined type performs both input and output using the same device numbers. (Example: RX00 to RX0F, RY00 to RY0F (all the same numbers); or RX00 to RX1F, RY00 to RY0F (partially the same numbers))
For details, refer to Section 7.1.

2. FUNCTION LIST

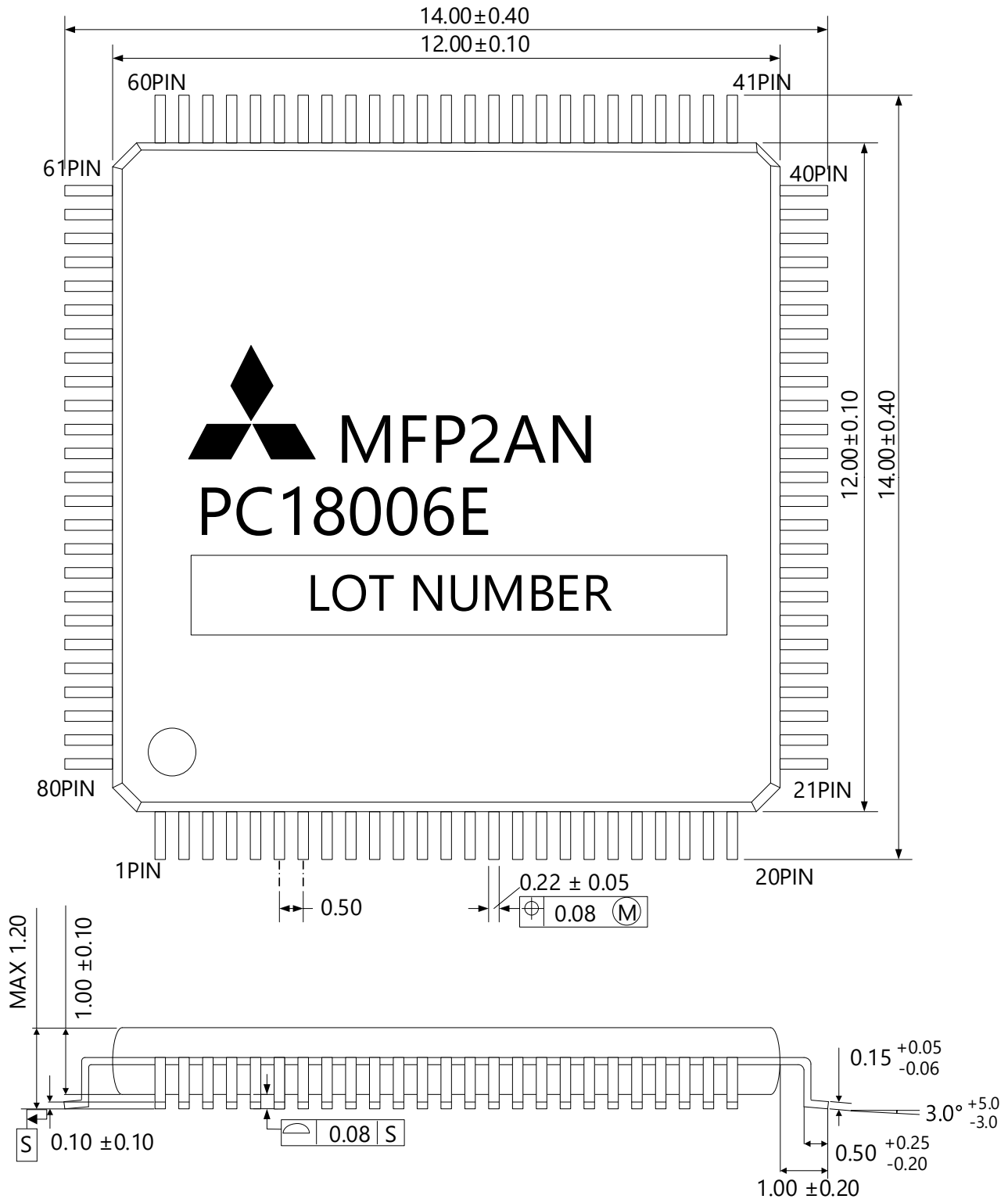
Function	Description
Number of I/O points, I/O type setting	Sets the number of I/O points and I/O type for MFP2AN. Note that the same device numbers cannot be set for the input and output of the I/O combined type. 8-bit input, 8-bit output, 16-bit input, 16-bit output, 8-bit input/8-bit output combined A device with less than 16 I/O bits can be developed by setting the I/O pins to "Not used". (The master station recognizes this type of device as a 16-bit device.)
Timeout monitoring time setting	Determines the timeout time for each baud rate. (Fixed)
Fuse blown detection function (only for the output type and combined type)	Sends the fuse status to the master station when the fuse has blown. (A fuse is mounted to the output module.) (The fuse status can be indicated by the LED.)
Output hold/clear function (only for the output type and combined type)	Sets whether to hold or clear output (RY) when an error occurs. (Pin name: TRE) The applicable errors include the following: <ul style="list-style-type: none"> • Disconnection • Timeout • Master station application error or programmable controller CPU error for users who use the Mitsubishi Electric programmable controller
Baud rate setting function	Sets the baud rate, 10 Mbps, 5 Mbps, 2.5 Mbps, 625 Kbps, or 156 Kbps.
Baud rate/station number setting error detection function	Detects an error of the baud rate or station number setting. The L ERR. LED turns on.
Baud rate/station number change detection function	Detects a change of the baud rate or station number setting from start-up. The L ERR. LED flashes at intervals of 0.4 s.

3. MFP2AN SPECIFICATIONS

3.1 External Appearance

The following is the external appearance of MFP2N as of April 2020. For the previous external appearance, refer to Appendix 1.

Unit: mm



3.2 Pins

Pin No.	Pin name	I/O	Pin No.	Pin name	I/O	Pin No.	Pin name	I/O	Pin No.	Pin name	I/O
1	GND	-	21	VDD	-	41	GND	-	61	VDD	-
2	RSV02	-	22	IO_00	I/O	42	LEDY7	O	62	SW1	I
3	RSV03	-	23	IO_01	I/O	43	LEDY6	O	63	SW2	I
4	IOS0	I	24	IO_02	I/O	44	LEDY5	O	64	SW4	I
5	IOS1	I	25	IO_03	I/O	45	LEDY4	O	65	SW8	I
6	TRE	I	26	IO_04	I/O	46	GND	-	66	SW10	I
7	RSV07	-	27	IO_05	I/O	47	VDD	-	67	SW20	I
8	RSV08	-	28	IO_06	I/O	48	LEDY3	O	68	SW40	I
9	RSV09	-	29	IO_07	I/O	49	LEDY2	O	69	RSV69	-
10	RDNZR	O	30	GND	-	50	LEDY1	O	70	CLK	I
11	SDNRZ	O	31	VDD	-	51	LEDY0	O	71	GND	-
12	RSV12	-	32	IO_08	I/O	52	GND	-	72	SCLK	O
13	FUSEL	I	33	IO_09	I/O	53	LEDX2	O	73	RSV73	-
14	RD1	I	34	IO_0A	I/O	54	LEDX1	O	74	MO0	O
15	RSV15	-	35	IO_0B	I/O	55	LEDX0	O	75	MO1	O
16	RSV16	-	36	IO_0C	I/O	56	RSV56	-	76	MO2	O
17	SD	O	37	IO_0D	I/O	57	BS1	I	77	RSV77	-
18	SDGATEON	O	38	IO_0E	I/O	58	BS2	I	78	RSV78	-
19	IDT	O	39	IO_0F	I/O	59	BS4	I	79	RST	I
20	GND	-	40	VDD	-	60	GND	-	80	VDD	-

3.3 Pin Functions

3.3.1 Lists of pin functions

(1) Clock reset

Pin No.	Pin name	I/O	Buffer type	Application	Remarks
70	CLK	I	IBT_SP1	Clock input	Input the crystal oscillator output (80 MHz).
79	RST	I	IBHP3_SP2	Reset input	Reset range = All I/O buffer bits, transmission section, switch setting section, HDLC section Active "H"

(2) Serial interface

Pin No.	Pin name	I/O	Buffer type	Application	Output level after reset	Remarks
14	RD1	I	IBS_SP1	RECEIVE DATA	-	
17	SD	O	OB3BT_SP1	SEND DATA	H	
18	SDGATEON	O	OB3BT_SP1	Send gate control signal	H	Active "H"

(3) Communication settings

Pin No.	Pin name	I/O	Buffer type	Application	Remarks
35	SW1	I	IBCP3_SP1	Station number setting switch input 1	Active "L"
36	SW2	I	IBCP3_SP1	Station number setting switch input 2	
37	SW4	I	IBCP3_SP1	Station number setting switch input 4	
38	SW8	I	IBCP3_SP1	Station number setting switch input 8	
39	SW10	I	IBCP3_SP1	Station number setting switch input 10	
40	SW20	I	IBCP3_SP1	Station number setting switch input 20	
41	SW40	I	IBCP3_SP1	Station number setting switch input 40	
42	SW80	I	IBCP3_SP1	Station number setting switch input 80	
43	BS1	I	IBCP3_SP1	Baud rate setting switch input 1	
44	BS2	I	IBCP3_SP1	Baud rate setting switch input 2	
45	BS4	I	IBCP3_SP1	Baud rate setting switch input 4	
46	BS8	I	IBCP3_SP1	Baud rate setting switch input 8	

For the setting method, refer to Section 7.2 "Station Number and Baud Rate Settings".

(4) Bit data I/O interface

Pin No.	Pin name	I/O	Buffer type	Application	Processing when not in use	Output level after reset	Remarks
22	IO_00	I/O	BH4BT_SP2	Bit data I/O 0	When the I/O type is input: GND	H	When the I/O type is input: Active "H"
23	IO_01	I/O	BH4BT_SP2	Bit data I/O 1			
24	IO_02	I/O	BH4BT_SP2	Bit data I/O 2			
25	IO_03	I/O	BH4BT_SP2	Bit data I/O 3			
26	IO_04	I/O	BH4BT_SP2	Bit data I/O 4			
27	IO_05	I/O	BH4BT_SP2	Bit data I/O 5			
28	IO_06	I/O	BH4BT_SP2	Bit data I/O 6			
29	IO_07	I/O	BH4BT_SP2	Bit data I/O 7			
32	IO_08	I/O	BH4BT_SP2	Bit data I/O 8	When the I/O type is output: OPEN	H	When the I/O type is output: Active "L"
33	IO_09	I/O	BH4BT_SP2	Bit data I/O 9			
34	IO_0A	I/O	BH4BT_SP2	Bit data I/O A			
35	IO_0B	I/O	BH4BT_SP2	Bit data I/O B			
36	IO_0C	I/O	BH4BT_SP2	Bit data I/O C			
37	IO_0D	I/O	BH4BT_SP2	Bit data I/O D			
38	IO_0E	I/O	BH4BT_SP2	Bit data I/O E			
39	IO_0F	I/O	BH4BT_SP2	Bit data I/O F			

For the relationship between the I/O type and the number of I/O points, refer to Section 7.1 "I/O Type and Number of I/O Points Settings".

(5) LED

Pin No.	Pin name	I/O	Buffer type	Application	Processing when not in use	Output level after reset	Remarks
55	LEDX0	O	OB2T_SP2	LED dynamic output (RX0)	-	H	*1
54	LEDX1	O	OB2T_SP2	LED dynamic output (X1)	-		
53	LEDX2	O	OB2T_SP2	LED dynamic output (X2)	OPEN		
51	LEDY0	O	OD3T_SP1	LED dynamic output (Y0)	-	H	*1 *2 Active "L"
50	LEDY1	O	OD3T_SP1	LED dynamic output (Y1)			
49	LEDY2	O	OD3T_SP1	LED dynamic output (Y2)			
48	LEDY3	O	OD3T_SP1	LED dynamic output (Y3)			
45	LEDY4	O	OD3T_SP1	LED dynamic output (Y4)			
44	LEDY5	O	OD3T_SP1	LED dynamic output (Y5)			
43	LEDY6	O	OD3T_SP1	LED dynamic output (Y6)			
42	LEDY7	O	OD3T_SP1	LED dynamic output (Y7)			

*1: Refer to Chapter 8 "LED ON/OFF CONDITIONS".

*2: Refer to Section 7.1 "I/O Type and Number of I/O Points Settings".

(6) I/O settings

Pin No.	Pin name	I/O	Buffer type	Application	Processing when not in use	Remarks
4	IOS0	I	IBC_SP1	I/O type setting pin	-	*1
5	IOS1	I	IBC_SP1	I/O type setting pin	-	
6	TRE	I	IBCP3_SP1	Output hold when a timeout occurs	OPEN	Output is held with "L". Output is cleared with "H".

*1: For the setting method, refer to Section 7.1 "I/O Type and Number of I/O Points Settings".

(7) Status input

Pin No.	Pin name	I/O	Buffer type	Application	Processing when not in use	Remarks
13	FUSEL	I	IBH_SP1	Fuse blown signal input	V _{DD}	Active "L"*1

*1: The I/O type is set to the remote output (RY) and the power is supplied externally.

(8) Monitor output

Pin No.	Pin name	I/O	Buffer type	Application	Processing when not in use	Output level after reset	Remarks
19	IDT	O	OB1T_SP2	Input monitor pin	OPEN	-	*1 Active "H"
74	MO0	O	OB1T_SP2	Receive data address monitor pin	OPEN	H	*2
75	MO1	O	OB1T_SP2	Receive data address monitor pin		-	
76	MO2	O	OB1T_SP2	Receive data address monitor pin		-	
10	RDNRZ	O	OB1T_SP2	Monitor pin for receive data after demodulation	OPEN	H	For monitoring (RDNRZ)
11	SDNRZ	O		Monitor pin for send data before modulation		H	For monitoring (SDNRZ)
72	SCLK	O	OB1T_SP2	Send clock		L	For monitoring (Frequency determined by the baud rate)

*1: A monitor pin for measuring delay of MFP2AN external process I/O circuits

*2: For the code details, refer to Chapter 9 "MONITOR PINS".

3.3.2 Buffer types

The following table lists the buffer types of each pin.

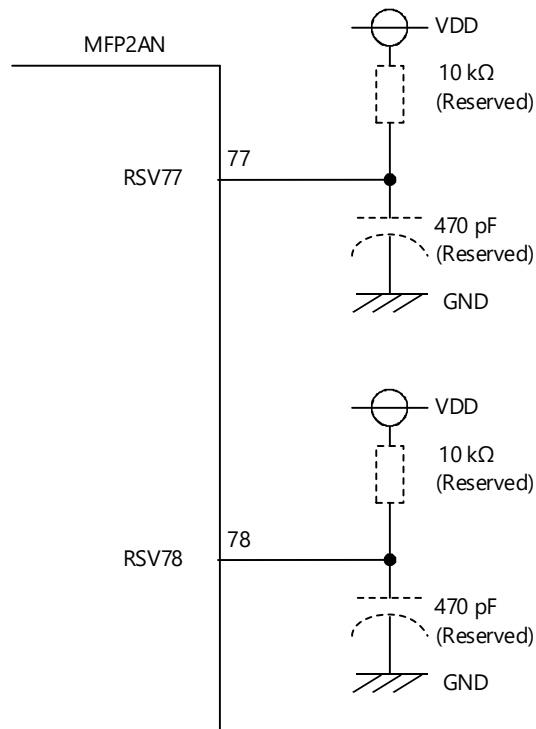
Buffer type	I/O	Function
IBC_SP1	I	Input Buffer (CMOS in)
IBCP3_SP1	I	Input Buffer (CMOS in) with Pull-Up Resistor 5 kΩ
IBH_SP1	I	Input Buffer (CMOS Schmitt in)
IBHP3_SP2	I	Input Buffer (CMOS Schmitt in) with Pull-Up Resistor 5 kΩ
IBS_SP1	I	Input Buffer (TTL Schmitt in)
IBT_SP1	I	Input Buffer (TTL in)
OB1T_SP2	O	Output Buffer (CMOS out: $I_{OL} = 4 \text{ mA}$)
OB2T_SP2	O	Output Buffer (CMOS out: $I_{OL} = 8 \text{ mA}$)
OB3BT_SP1	O	Output Buffer (CMOS out: $I_{OL} = 12 \text{ mA}$)
OD3T_SP1	O	Output Buffer (N-Ch Open Drain: $I_{OL} = 12 \text{ mA}$)
BH4BT_SP2	I/O	I/O Buffer (CMOS Schmitt in: CMOS 3-state out: $I_{OL} = 24 \text{ mA}$) (Low Noise)

3.3.3 Reserved pin handling

Design the circuit (pattern and pad) so that the components shown in the figure below can be implemented to the pin number 77 "RSV77" and pin number 78 "RSV78" external.

Resistors: 1/10 W or more, 10 kΩ

Capacitors: 50 V or higher, 470 pF



3.3.4 Ratings for the input buffer type ($T_A = -40$ to $+110^\circ\text{C}$, $V_{DD} = 5\text{ V} \pm 10\%$)

The sign indicates the polarity, and the direction of the current flowing into the pin is indicated by the positive sign.

(1) IBH_SP1

Item	Condition	Min.	Typ.	Max.	Unit
V_{IL}	CMOS Level	0	-	1.65	V
V_{IH}	CMOS Level	3.5	-	$V_{DD} + 0.3$	V
R_{PU}	-	-	-	-	k Ω
I_I	$V_I = V_{DD}$ or GND (normal input) input leak current	-	-	± 5	μA
V_P	-	2.55	-	3.75	V
V_N	-	1.15	-	2.05	V
V_H	-	1.1	-	-	V

(2) IBCP3_SP1

Item	Condition	Min.	Typ.	Max.	Unit
V_{IL}	CMOS Level	0	-	1.65	V
V_{IH}	CMOS Level	3.5	-	$V_{DD} + 0.3$	V
R_{PU}	Pull-up resistance 5 k Ω	2.5	5.0	12.9	k Ω
I_I	$V_I = \text{GND}$ input leak current	-0.35	-	-2.2	mA
V_P	-	-	-	-	V
V_N	-	-	-	-	V
V_H	-	-	-	-	V

(3) IBC_SP1

Item	Condition	Min.	Typ.	Max.	Unit
V_{IL}	CMOS Level	0	-	1.65	V
V_{IH}	CMOS Level	3.5	-	$V_{DD} + 0.3$	V
R_{PU}	Pull-up resistance 5 k Ω	-	-	-	k Ω
I_I	$V_I = V_{DD}$ or GND (normal input) input leak current	-	-	± 5	μA
V_P	-	-	-	-	V
V_N	-	-	-	-	V
V_H	-	-	-	-	V

(4) IBT_SP1

Item	Condition	Min.	Typ.	Max.	Unit
V_{IL}	TTL Level	0	-	0.77	V
V_{IH}	TTL Level	2.29	-	V_{DD}	V
R_{PU}	-	-	-	-	k Ω
I_I	$V_I = V_{DD}$ or GND (normal input) input leak current	-	-	± 5	μA
V_P	-	-	-	-	V
V_N	-	-	-	-	V
V_H	-	-	-	-	V

(5) IBHP3_SP1

Item	Condition	Min.	Typ.	Max.	Unit
V_{IL}	CMOS Level (Schmitt)	0	-	1.65	V
V_{IH}	CMOS Level (Schmitt)	3.5	-	$V_{DD} + 0.3$	V
R_{PU}	Pull-up resistance 5 k Ω	2.5	5.0	12.9	k Ω
I_I	$V_I = \text{GND}$ input leak current	-0.35	-	-2.2	mA
V_P	-	1.80	-	4.00	V
V_N	-	0.60	-	3.10	V
V_H	-	0.30	-	-	V

(6) IBS_SP1

Item	Condition	Min.	Typ.	Max.	Unit
V _{IL}	TTL Level (Schmitt)	0	-	0.77	V
V _{IH}	TTL Level (Schmitt)	2.29	-	V _{DD}	V
R _{PU}	-	-	-	-	kΩ
I _I	V _I = V _{DD} or GND (normal input) input leak current	-	-	±5	μA
V _P	-	1.38	-	2.55	V
V _N	-	0.64	-	1.33	V
V _H	-	0.64	-	-	V

3.3.5 Ratings for the output buffer type (T_A = -40 to +110°C, V_{DD} = 5 V±10%)

The sign indicates the polarity, and the direction of the current flowing into the pin is indicated by the positive sign.

(1) OB1T_SP2

Item	Condition	Min.	Typ.	Max.	Unit
I _{OL}	CMOS Level output (V _{OL} = 0.4 V)	4.0	-	-	mA
I _{OH}	CMOS Level output (V _{OH} = V _{DD} - 0.4 V)	-2.0	-	-	mA
I _{OZ}	V _O = V _{DD} or GND	-	-	±5	μA
V _{OL}	I _{OL} = 0 mA	-	-	0.4	V
V _{OH}	I _{OH} = 0 mA	V _{DD} - 0.4	-	-	V

(2) OB2T_SP2

Item	Condition	Min.	Typ.	Max.	Unit
I _{OL}	CMOS Level output (V _{OL} = 0.4 V)	8	-	-	mA
I _{OH}	CMOS Level output (V _{OH} = V _{DD} - 0.4 V)	-4	-	-	mA
I _{OZ}	V _O = V _{DD} or GND	-	-	±5	μA
V _{OL}	I _{OL} = 0 mA	-	-	0.4	V
V _{OH}	I _{OH} = 0 mA	V _{DD} - 0.4	-	-	V

(3) OB3BT_SP1

Item	Condition	Min.	Typ.	Max.	Unit
I _{OL}	CMOS Level output (V _{OL} = 0.4 V)	12.0	-	-	mA
I _{OH}	CMOS Level output (V _{OH} = V _{DD} - 0.4 V)	-12	-	-	mA
I _{OZ}	V _O = V _{DD} or GND	-	-	±5	μA
V _{OL}	I _{OL} = 0 mA	-	-	0.4	V
V _{OH}	I _{OH} = 0 mA	V _{DD} - 0.4	-	-	V

(4) OD3T_SP1

Item	Condition	Min.	Typ.	Max.	Unit
I _{OL}	CMOS Level output (V _{OL} = 0.4 V)	18.0	-	-	mA
I _{OH}	CMOS Level output (V _{OH} = V _{DD} - 0.4 V)	-9.0	-	-	mA
I _{OZ}	V _O = V _{DD} or GND	-	-	±5	μA
V _{OL}	I _{OL} = 0 mA	-	-	0.4	V
V _{OH}	I _{OH} = 0 mA	V _{DD} - 0.4	-	-	V

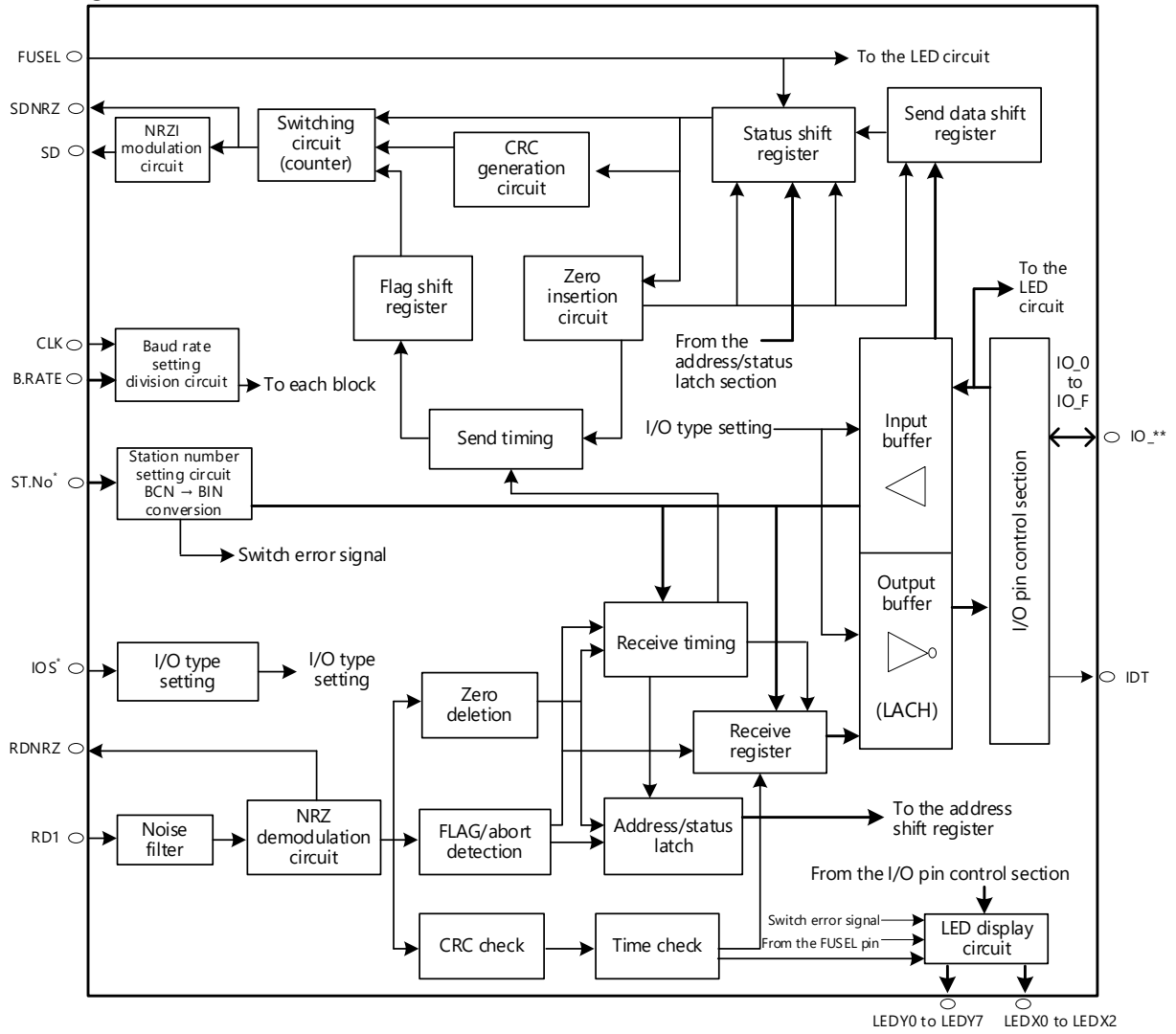
3.3.6 Ratings for the I/O buffer type ($T_A = -40$ to $+110^\circ\text{C}$, $V_{DD} = 5\text{ V} \pm 10\%$)

The sign indicates the polarity, and the direction of the current flowing into the pin is indicated by the positive sign.

BH4BT_SP2

Item	Condition	Min.	Typ.	Max.	Unit
V_{IL}	CMOS Level	0	-	1.65	V
V_{IH}	CMOS Level	3.5	-	$V_{DD} + 0.3$	V
R_{PU}	-	-	-	-	$k\Omega$
I_I	$V_I = V_{DD}$ or GND (normal input) input leak current	-	-	± 5	μA
V_P	-	2.30	-	4.05	V
V_N	-	0.9	-	1.92	V
V_H	-	1.1	-	-	V
I_{OL}	CMOS Level output ($V_{OL} = 0.4\text{ V}$)	24	-	-	mA
I_{OH}	CMOS Level output ($V_{OH} = V_{DD} - 0.4\text{ V}$)	-12	-	-	mA
I_{OZ}	$V_O = V_{DD}$ or GND	-5	-	± 5	μA
V_{OL}	$I_{OL} = 0\text{ mA}$	-	-	0.4	V
V_{OH}	$I_{OH} = 0\text{ mA}$	$V_{DD} - 0.4$	-	-	V

3.4 Block Diagram



3.5 Electrical Characteristics

3.5.1 Absolute maximum ratings (Unless specified $T_A = 25^\circ\text{C}$)

Symbol	Item	Condition	Rated value	Unit
V_{DD}	Power supply voltage	-	$V_{SS} - 0.5$ to $+7.0$	V
V_I/V_O	I/O voltage	-	$V_{SS} - 0.5$ to $+7.0$	V
I_O	Output current	$I_{OL} = 4$ mA type	± 30	mA
		$I_{OL} = 8$ mA type	± 30	mA
		$I_{OL} = 12$ mA type	± 30	mA
		$I_{OL} = 24$ mA type (BH4BT_SP2)	± 50	mA
T_A	Operating ambient temperature	-	-40 to $+110$	$^\circ\text{C}$
T_{stg}	Storage temperature	-	-65 to $+150$	$^\circ\text{C}$
-	Maximum current consumption	$V_{DD} = 5$ V	56	mA

3.5.2 Recommended operating conditions

Symbol	Item	Condition*	Specification value			Unit
			Min.	Typ.	Max.	
V_{DD}	Power supply voltage	-	4.5	5.0	5.5	V
T_A	Ambient temperature	-	-40	25	110	$^\circ\text{C}$
V_{IH}	"H" input voltage	CMOS type	3.5	-	$V_{DD} + 0.3$	V
		TTL type	2.29	-	V_{DD}	V
V_{IL}	"L" input voltage	CMOS type	0	-	1.65	V
		TTL type	0	-	0.77	V
V_P	Positive trigger voltage	CMOS Schmitt type	1.80	-	4.00	V
		CMOS Schmitt type (IBH_SP1)	2.55	-	3.75	V
		CMOS Schmitt type (BH4BT_SP2)	2.3	-	4.05	V
		TTL Schmitt type	1.38	-	2.55	V
V_N	Negative trigger voltage	CMOS Schmitt type	0.60	-	3.10	V
		CMOS Schmitt type (IBH_SP1)	1.15	-	2.05	V
		CMOS Schmitt type (BH4BT_SP2)	0.9	-	1.92	V
		TTL Schmitt type	0.64	-	1.33	V
V_H	Hysteresis voltage	CMOS Schmitt type	0.30	-	-	V
		CMOS Schmitt type (IBH_SP1, BH4BT_SP2)	1.10	-	-	V
		TTL Schmitt type	0.64	-	-	V
t_{ri}	Input rising time	Schmitt input type	0	-	10	ms
		Other than the Schmitt input type	0	-	200	ns
t_{fi}	Input falling time	Schmitt input type	0	-	10	ms
		Other than the Schmitt input type	0	-	200	ns
f	External clock input frequency	-	-	80	-	MHz

*: For buffer types such as CMOS and TTL, refer to Section 3.3.1 "Lists of pin functions" and Section 3.3.2 "Buffer types".

3.5.3 DC characteristics ($T_A = -40$ to $+110^\circ\text{C}$, $V_{DD} = 5\text{ V} \pm 10\%$)

Symbol	Item	Condition	Specification value ^{*2}			Unit
			Min.	Typ.	Max.	
I_{OZ}	Off-state output current	$V_O = V_{DD}$ or GND	-	-	± 5	μA
I_I	Input leak current	$V_I = V_{DD}$ or GND (Normal input)	-	-	± 5	μA
		$V_I = \text{GND}$ (Pull-up 50 k Ω)	45	131.6	366.7	μA
		$V_I = \text{GND}$ (Pull-up 5 k Ω)	0.348	1.0	2.2	mA
R_{PU}	Pull-up resistance	50 k Ω	15	38	100	k Ω
		5 k Ω	2.5	5.0	12.9	k Ω
I_{OL}	"L" output current	$V_{OL} = 0.4\text{ V}$ ($I_{OL} = 4\text{ mA}$ type)	4.0	-	-	mA
		$V_{OL} = 0.4\text{ V}$ ($I_{OL} = 8\text{ mA}$ type)	8.0	-	-	mA
		$V_{OL} = 0.4\text{ V}$ ($I_{OL} = 12\text{ mA}$ type)	12.0	-	-	mA
		$V_{OL} = 0.6\text{ V}$ ($I_{OL} = 12\text{ mA}$ type) ^{*1}	18.0	-	-	mA
		$V_{OL} = 0.4\text{ V}$ ($I_{OL} = 24\text{ mA}$ type: BH4BT_SP2)	24.0	-	-	mA
I_{OH}	"H" output current	$V_{OH} = V_{DD} - 0.4\text{ V}$ ($I_{OL} = 4\text{ mA}$ type)	-2.0	-	-	mA
		$V_{OH} = V_{DD} - 0.4\text{ V}$ ($I_{OL} = 8\text{ mA}$ type)	-4.0	-	-	mA
		$V_{OH} = V_{DD} - 0.4\text{ V}$ ($I_{OL} = 12\text{ mA}$ type)	-12.0	-	-	mA
		$V_{OH} = V_{DD} - 0.4\text{ V}$ ($I_{OL} = 24\text{ mA}$ type: BH4BT_SP2)	-12.0	-	-	mA
V_{OL}	"L" output voltage	$I_{OL} = 0\text{ mA}$	-	-	$V_{SS} + 0.4$	V
V_{OH}	"H" output voltage	$I_{OH} = 0\text{ mA}$	$V_{DD} - 0.4$	-	-	V

*1: Only for the buffer type, OD3T_SP1.

*2: The + and - signs of the current values in the table indicate the direction of the current. Current flowing into a device is indicated by +, and current flowing out of a device is indicated by -. The Min. and Max. columns show the comparison results with the absolute values.

3.5.4 AC characteristics ($T_A = -40$ to $+110^\circ\text{C}$, $V_{DD} = 5\text{ V} \pm 10\%$)

Symbol	Item	Condition	Specification value			Unit
			Min.	Typ.	Max.	
t_r	Output rising time	$C_L = 15\text{ pF}$, $I_{OL} = 3\text{ mA}$	-	2.5	-	ns
t_f	Output falling time	$C_L = 15\text{ pF}$, $I_{OH} = -3\text{ mA}$	-	2.5	-	ns

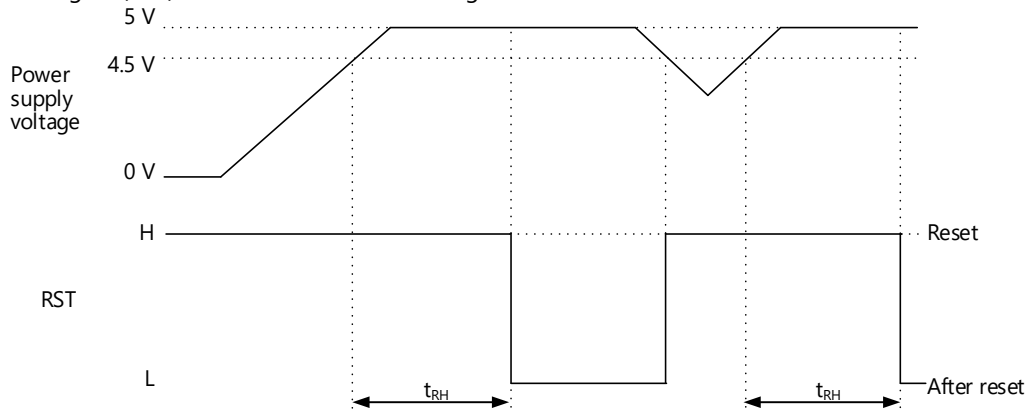
3.5.5 I/O capacitance ($T_A = +25^\circ\text{C}$, $V_{DD} = 0\text{ V}$)

Symbol	Item	Condition	Specification value			Unit
			Min.	Typ.	Max.	
C_{IN}	Input capacitance	$f = 1\text{ MHz}$	-	-	10	pF
C_{OUT}	Output capacitance	0 V at pins other than the measured pin	-	-	10	pF
$C_{I/O}$	I/O capacitance		-	-	10	pF

4. RESET TIMING

Symbol	Item	Condition	Specification value			Unit
			Min.	Typ.	Max.	
t_{RH}	Reset pulse width	Clock normal	3.3	-	-	ms

Design the reset signal (RST) so that it satisfies the timing below.



[Restrictions]

The reset signal (RST) must be held at "H" for 3.3 ms or longer after the power supply voltage reaches 4.5 V or higher.

5. REMOTE I/O STATION CIRCUIT DIAGRAM EXAMPLES

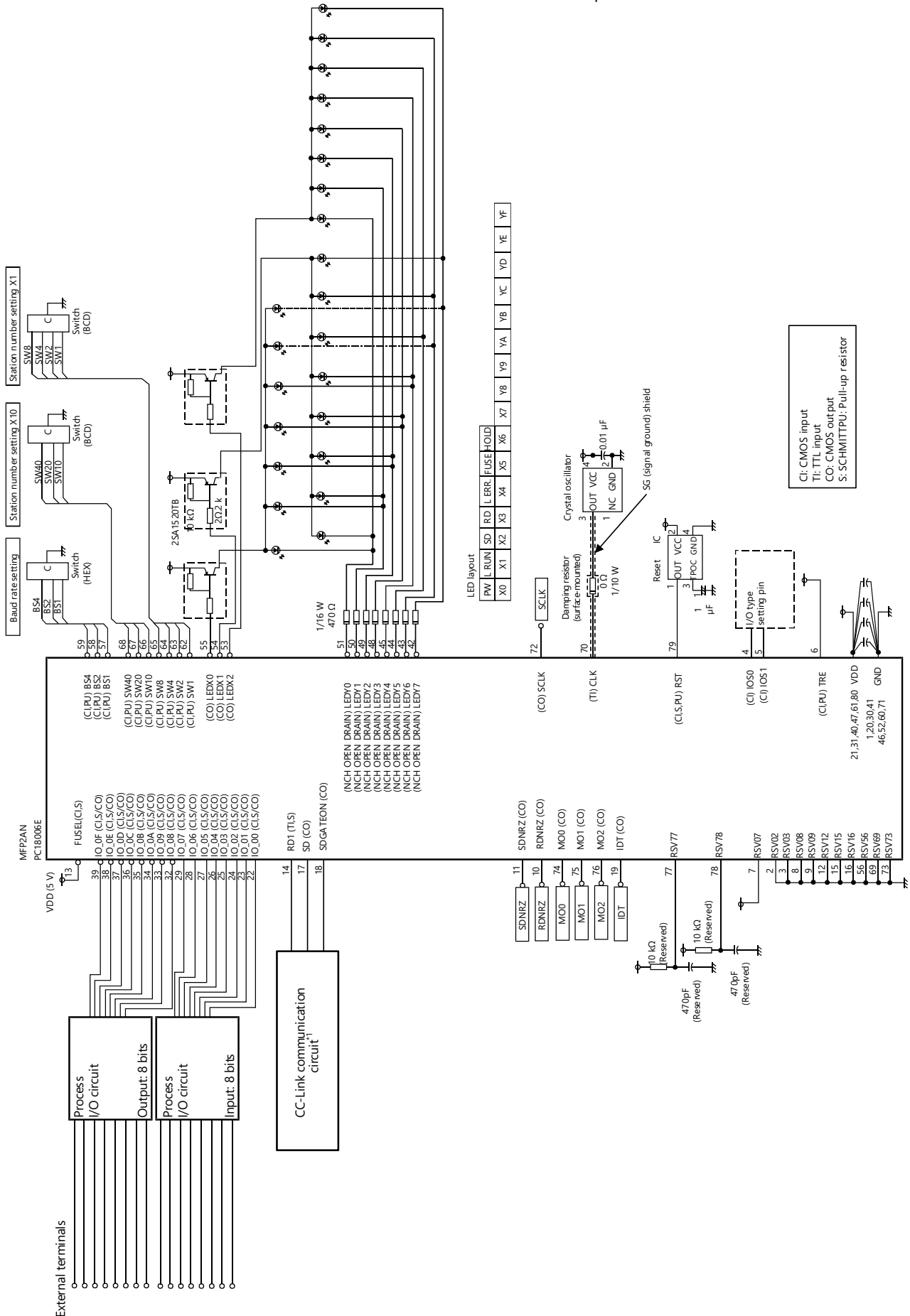
This chapter provides remote I/O station circuit diagram examples.

For measures to reduce noise, read the precautions described in Section 5.2 "CC-Link Communication Circuit Examples".

5.1 Remote I/O Station Circuit Examples

The following is a circuit example of the 8-point I/O combined type.

To improve the noise immunity, isolate the CC-Link communication circuit. (Recommended) For details on the CC-Link communication circuit, refer to Section 5.2 "CC-Link Communication Circuit Examples".



*1: For the CC-link communication circuit, refer to Section 5.2 "CC-Link Communication Circuit Examples".

5.2 CC-Link Communication Circuit Examples

Isolate the CC-Link communication circuits. (Recommended)

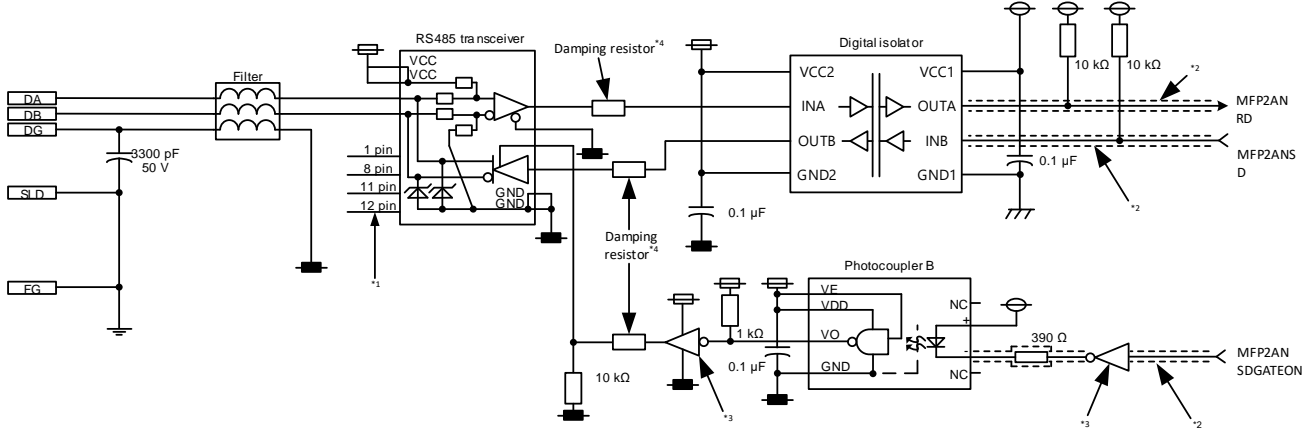
For the CC-Link communication circuits, refer to the following examples of the CC-Link communication circuit diagrams.

For the components to be used in the CC-Link communication circuits, refer to the CC-Link Specification (Implementation).

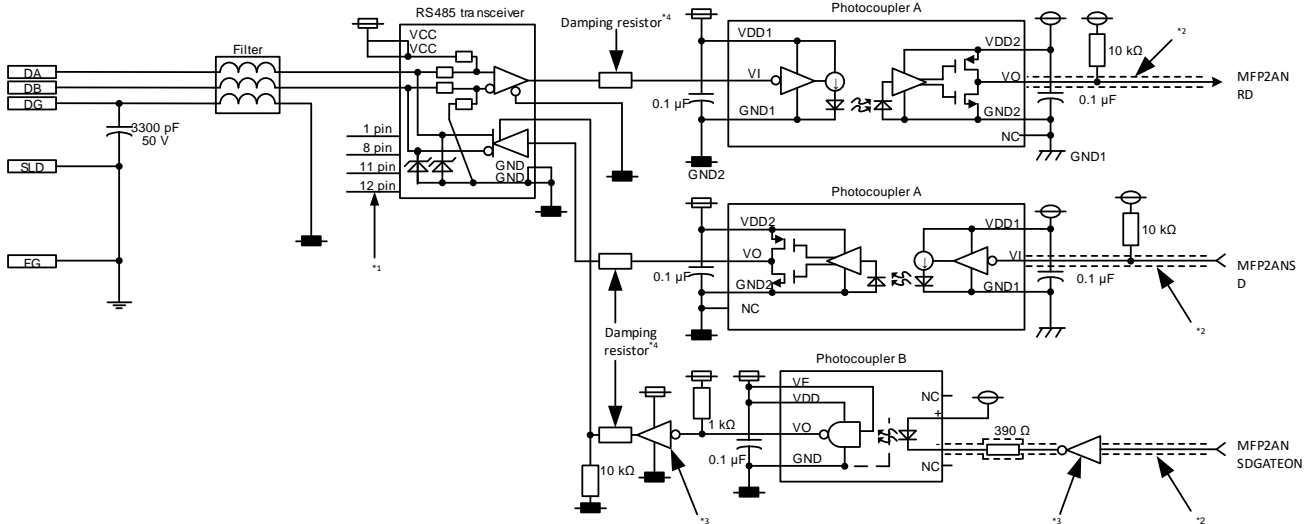
5.2.1 CC-Link communication circuit diagrams (isolated types)

The following diagrams are the examples of the isolated CC-Link communication circuits.

When a digital isolator is used



When photocouplers are used



*1: Do not connect 1 pin, 8 pin, 11 pin, and 12 pin of the RS485 transceiver.

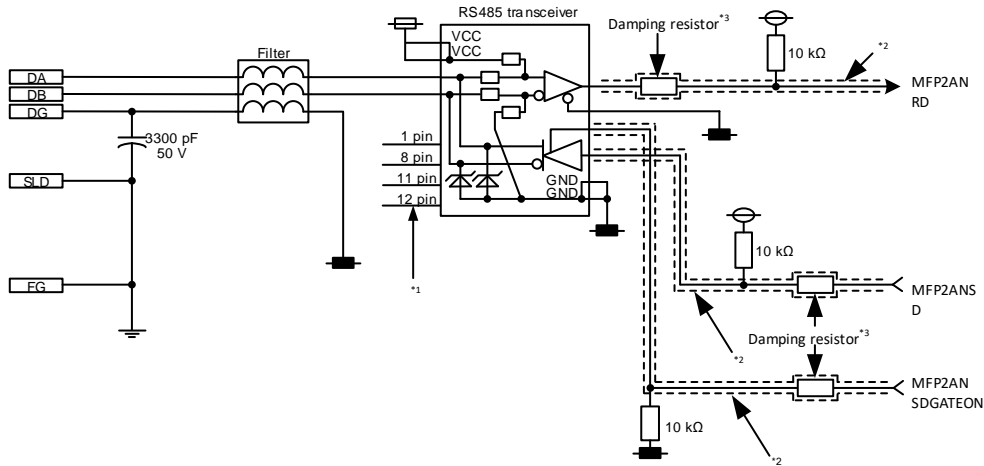
*2: Make the traces between the "SD", "RD", and "SDGATEON" and the photocoupler or digital isolator as short as possible, and shield them with signal ground (SG) lines.

*3: Place inverters on both the primary and secondary sides of the photocoupler B of the RS485 transceiver. (Example: LV04A)

*4: Mounting damping resistors may be helpful depending on the layout of the printed circuit board.

5.2.2 CC-Link communication circuit diagram (non-isolated type)

The following diagram is the example of the non-isolated CC-Link communication circuits.



*1: Do not connect 1 pin, 8 pin, 11 pin, and 12 pin of the RS485 transceiver.

*2: Shield "RD", "SD", and "SDGATEON" between MFP2AN and the RS485 transceiver with signal ground (SG) lines.

*3: Mounting damping resistors may be helpful depending on the layout of the printed circuit board.

5.2.3 Precautions for CC-Link communication circuit

- (1) Form wide traces for "SD", "RD", and "SDGATEON" between MFP2AN and the RS485 transceiver.
- (2) Note the following so that the stray capacitance (capacitor component) of the transmission path connection terminal block (between DA and DB) becomes 20 pF or less. If the stray capacitance is large, the waveform of the transmission path may be distorted and the communication performance may not be fully demonstrated.
 - Shorten the trace between the transmission path connection terminal block and the RS485 transceiver, and eliminate any internal layer patterns in that area.
 - Keep as much distance between DA trace and DB trace, and position them far away from other traces.
- (3) Implement the following as measures to reduce noise:
 - Connect SLD and FG near the external input/output terminal.
 - Wire the FG trace so that it does not intersect the input/output traces on the front/back of the printed circuit board.
 - Isolate the CC-Link communication circuit. (Recommended)
- (4) Isolate power supply and device inputs and outputs. For the insulation of the I/O device parts, refer to the CC-Link Specification (Implementation). (Recommended)

5.3 Precautions for Printed Circuit Board Design

- (1) Precautions for remote I/O station circuit
 - (a) Make the traces between the crystal oscillator and MFP2AN as short as possible so that a damping resistor can be surface mounted.
 - (b) Keep as much distance between the crystal oscillator trace and other signal traces.
 - (c) Design a ground plane for the crystal oscillator.
 - (d) Use a four-layered printed circuit board as the board for mounting MFP2AN. (Recommended)

6. SPECIFIED/RECOMMENDED COMPONENTS

This chapter describes the specified/recommended components of the remote I/O station circuit.

6.1 Mitsubishi Electric Specified Components

The following table lists the components specified by Mitsubishi Electric for using CC-Link remote I/O station communication LSI (MFP2AN).

Use a crystal oscillator having a frequency deviation within ± 100 ppm.

Component	Model	Size (unit: mm)	Manufacturer
Crystal oscillator	DSO751SBM 80MHz	7.3 × 4.9	DAISHINKU CORP.
	KC7050B80.0000C5ZBRZ (The production will be discontinued from March 2022.)	7.0 × 5.0	KYOCERA Corporation
	DSO321SBN 80MHZ	3.2 × 2.5	DAISHINKU CORP.

Note

For the latest information of the specified components, check the technical bulletins.
For the production status, contact each manufacturer.

6.2 CC-Link Partner Association Recommended Components

The components to be used in the CC-Link communication circuit are the CC-Link Partner Association recommended components.

For the model, manufacturer, and specifications of each component, refer to the CC-Link Specification (Implementation).

6.3 MFP2AN

MFP2AN can be purchased from your Mitsubishi Electric dealer network. For prices, please ask your dealer. MFP2AN is the lead-free/RoHS Directive compliant product.

Product	Model	Package unit	Manufacturer
MFP2AN (PC18006E)	A6GA-CCMFP2ANN60FN	60 pieces	Mitsubishi Electric Corporation
	A6GA-CCMFP2ANN300FN	300 pieces	

7. SETTING DETAILS

7.1 I/O Type and Number of I/O Points Settings

I/O type setting pin name		Combination	I/O pin (Pin name = IO_**)		LED (Pin name = LED**)	
IOS1	IOS0		0 to 7	8 to F	0 to 7	8 to F
L	L	(Cannot be set.)	-	-	-	-
L	H	Input 16 points	○	○	○	○
H	L	Output 16 points	○	○	○	○
H	H	Input 8 points, output 8 points (combined)	○	○	○	○

○ = Connectable

- (1) The same device numbers cannot be set for input and output of the I/O combined type.
- (2) Combinations other than above cannot be set.
- (3) The I/O type cannot be changed during operation. (The I/O type must be determined in advance and fixed on the printed circuit board.)
- (4) The LEDs are turned on using the dynamic scanning method.

I/O assignment

The following are the data areas to be used by MFP2AN within the data area (RX/RX: 32 bits) of one station.

I/O type Number of I/O points	Input type				Output type				I/O combined type				
	RX00	RX0F to RX00	RY00	Not used	RX00	Not used	RY00	RY0F to RY00	RX00	RX07 to RX00	RY00	Not used	RY0F to RY08
16 points	RX0F	Not used	RY0F	Not used	RX0F	Not used	RY0F	Not used	RX0F	Not used	RY0F	Not used	RY0F
	RX1F	Not used	RY1F	Not used	RX1F	Not used	RY1F	Not used	RX1F	Not used	RY1F	Not used	Not used

[Development of devices other than 16-bit type]

A remote I/O station other than the input 16-bit, output 16-bit, and 8-bit I/O combined types (a remote I/O station with less than 16 bits) can be developed by setting I/O pins to "Not used".

Connect unused pins of the input device to GND, and connect unused pins of the output device to OPEN. Connect an unused LED pin to OPEN.

(Refer to the table below.)

(Note 1) Even if an I/O device with less than 16 bits is developed, the master station recognizes this type of device as a 16-bit device.

(Note 2) When an I/O combined type device is developed, the number of input or output points cannot exceed 8 bits. (Example: An I/O combined type device with 12-bit input and 4-bit output cannot be developed.)

(Example: An I/O combined type device with 8-bit input and 8-bit output)

I/O type setting pin name		I/O type	I/O pin (Pin name = IO_**)		LED (Pin name = LED**)	
IOS1	IOS0		0 to 7	8 to F	0 to 7	8 to F
L	H	Input 8 bits	○	GND	○	OPEN
H	L	Output 8 bits	○	OPEN	○	OPEN

I/O type Number of I/O points	Input type				Output type			
	RY0	Not used	RX0	b7 to b0	RY0	b7 to b0	RX0	Not used
8 points	RY0F	Not used	RX0F	Not used	RY0F	Not used	RX0F	Not used
	RY1F	Not used	RX1F	Not used	RY1F	Not used	RX1F	Not used

7.2 Station Number and Baud Rate Settings

The station number and baud rate settings are set at active "L" as shown in the table below. The settings are latched after reset (at the falling edge of RST).

(1) Station number setting value

1 to 64: Station number (normal)

0, 65 or higher: A station number switch setting error occurs. The L ERR. LED turns on.

Station number (tens place) Pin	00	10	20	30	40	50	60	70 ^{*1}	80 ^{*1}	90 ^{*1}
SW80	H	H	H	H	H	H	H	H	L	L
SW40	H	H	H	H	L	L	L	L	H	H
SW20	H	H	L	L	H	H	L	L	H	H
SW10	H	L	H	L	H	L	H	L	H	L

*1: The settings result in an error.

Station number (ones place) Pin	0	1	2	3	4	5	6	7	8	9
SW8	H	H	H	H	H	H	H	H	L	L
SW4	H	H	H	H	L	L	L	L	H	H
SW2	H	H	L	L	H	H	L	L	H	H
SW1	H	L	H	L	H	L	H	L	H	L

(2) Baud rate setting value

0: 156 Kbps 1: 625 Kbps

2: 2.5 Mbps

3: 5 Mbps

4: 10 Mbps

5 to 7: A baud rate switch setting error occurs. The L ERR. LED turns on.

Baud rate Pin	0 (156 Kbps)	1 (625 Kbps)	2 (2.5 Mbps)	3 (5 Mbps)	4 (10 Mbps)	5 ^{*1}	6 ^{*1}	7 ^{*1}	8 ^{*1}	9 ^{*1}
BS8	H	H	H	H	H	H	H	H	L	L
BS4	H	H	H	H	L	L	L	L	H	H
BS2	H	H	L	L	H	H	L	L	H	H
BS1	H	L	H	L	H	L	H	L	H	L

*1: The settings result in an error.

7.3 Other Settings

Output hold/clear setting

"TRE" pin setting	Description
H	Clears the received data (RY).
L	Holds the last data (RY) received normally.

8. LED ON/OFF CONDITIONS

POWER: Turns on when the internal 5 V is normal.

L RUN: Turns on while the refresh data is being received normally, and turns off when data refresh is not performed for a certain period of time. (Y outputs are turned off at the same time.)

L ERR.: Turns on when the data addressed to the own station has a CRC error or when an abort error occurs.

SD: Turns on when the send data (before modulation) is "0". (A one-shot circuit is not allowed.)

RD: Turns on when the receive data carrier is detected.

LED ○: On, ●: Off, ⚡: Flashing					Operation	Y output
POWER	L RUN	L ERR.	SD	RD		
○	○	⚡	⚡	○	Data communications are performed normally, but a CRC error has often been detected due to noise.	Output
○	○	⚡	⚡	○	Data communications are performed normally, but the baud rate or station number setting switch is faulty. The L ERR. LED flashes at intervals of approximately 0.5 s.	Output
○	○	⚡	⚡	●	-	Output
○	○	⚡	●	○	The station cannot respond because the receive data has a CRC error.	Output
○	○	⚡	●	●	-	Output
○	○	●	⚡	○	Data communications are performed normally.	Output
○	○	●	⚡	●	-	Output
○	○	●	●	○	Data addressed to the own station cannot be received.	Output
○	○	●	●	●	-	Output
○	●	⚡	⚡	○	Polling response is performed, but the refresh receive data has a CRC error.	OFF
○	●	⚡	⚡	●	-	OFF
○	●	⚡	●	○	Data addressed to the own station has a CRC error.	OFF
○	●	⚡	●	●	-	OFF
○	●	●	⚡	○	Data link has not been started.	OFF
○	●	●	⚡	●	-	OFF
○	●	●	●	○	No data is addressed to the own station or data addressed to the own station cannot be received due to noise. (Amount of data sent from the master station is insufficient.)	OFF
○	●	●	●	●	Data cannot be received due to disconnection.	OFF
○	●	○	●	○	Baud rate or station number setting error	OFF
●	●	●	●	●	Power-off or remote station power supply failure	OFF

Other LEDs

HOLD: Indicates the output data hold setting status when a timeout error or a programmable controller CPU error has occurred.
(Off: Output reset, On: Output held)

FUSE: Indicates the fuse blown detection status. (Only for the output type and combined type)
(Off: Normal operation, On: Fuse blown detected)

Point

Implement the above LEDs to the device to be developed because they are useful for troubleshooting. (Recommended)

(1) I/O status LEDs

MFP2AN outputs the I/O status for the number of I/O points (16 points maximum) to the LEDs using the dynamic scanning method.

	LEDX0	LEDX1	LEDX2
LEDY0	"PW"	L0	L8
LEDY1	"L RUN"	L1	L9
LEDY2	"SD"	L2	LA
LEDY3	"RD"	L3	LB
LEDY4	"L ERR."	L4	LC
LEDY5	(Reserved)	L5	LD
LEDY6	"FUUSE"	L6	LE
LEDY7	"HOLD"	L7	LF

Do not connect an LED to the LED (reserved) indicating the I/O status (L* = IO_*).

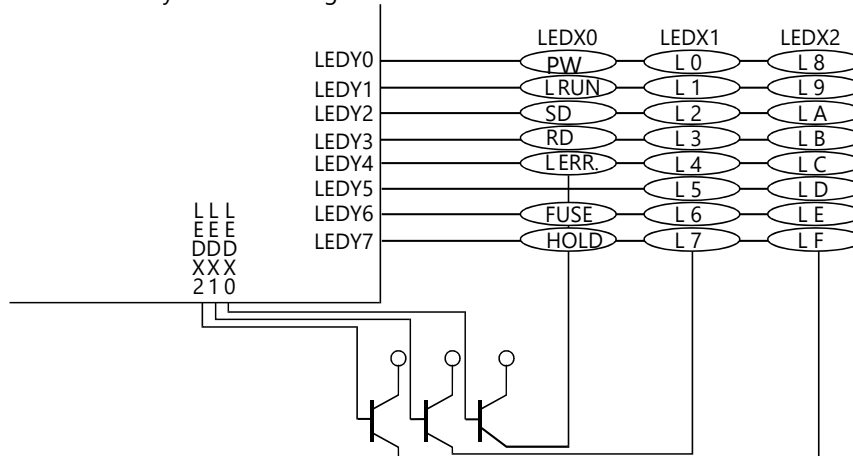
The on/off status of LEDs is automatically controlled by the MFP2AN internal circuit.

[Example]

- For the input 16-bit type: The input status is output to L0 to LF.
- For the input 8-bit and output 8-bit combined type: The input status is output to L0 to L7.
The output status is output to L8 to LF.

(2) Example of LED connections

LED indication uses the 8 × 5 dynamic scanning method.



LEDY0 to LEDY7 drive directly, and LEDX0 to LEDX2 drive indirectly via externally attached Tr.

9. MONITOR PINS

MFP2AN has the following monitor pins.

- SDNRZ : For send data before modulation
- RDNRZ : For receive data after demodulation
- IDT : For bit data I/O circuit (MFP2AN external) delay
- SCLK : For transmission clock (= frequency based on the baud rate setting)
- MO0 : }
· MO1 : } For receive address (A2)
· MO2 : }

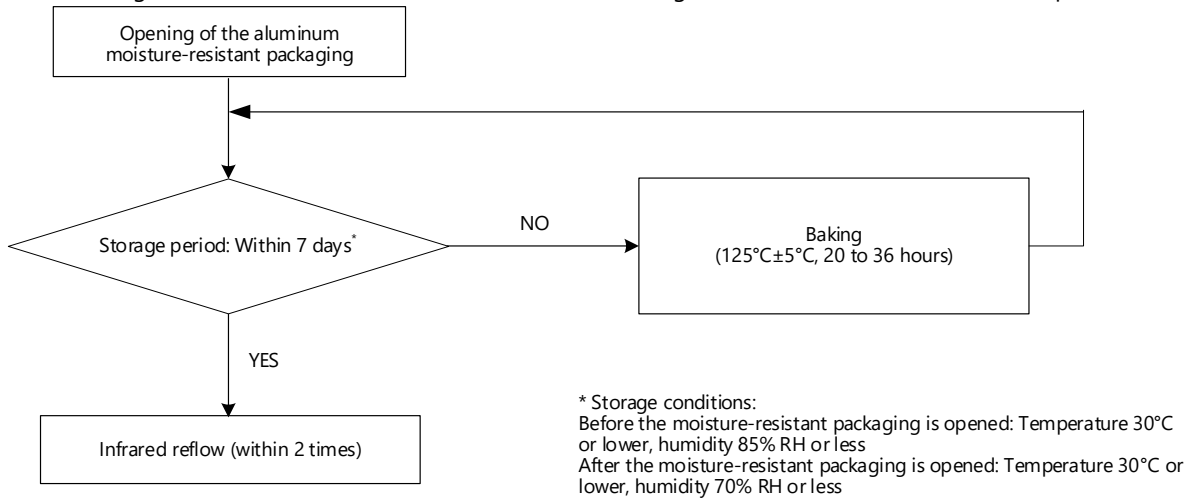
MO0	MO1	MO2	Receive address
L	H	H	FFH (Refresh and polling)
H	L	H	FEH (Polling)
L	L	H	FDH (Test refresh and polling)
H	H	L	FCH (Test polling)

(Note) The destination A2 (own station or another station) of the received refresh cannot be distinguished.

10. HANDLING PRECAUTIONS

10.1 Recommended Infrared Reflow Soldering Conditions (Including Hot Air Reflow and Infrared + Hot Air Reflow)

The following shows the recommended infrared reflow soldering conditions (for the moisture absorption control product).



Mount the product by the infrared reflow method, hot air reflow method, or infrared + hot air reflow method. Perform reflow within the above-indicated storage period. The maximum number of reflows is 2 times or less. The nitrogen atmosphere reflow is recommended to prevent oxidation and improve solder wettability.

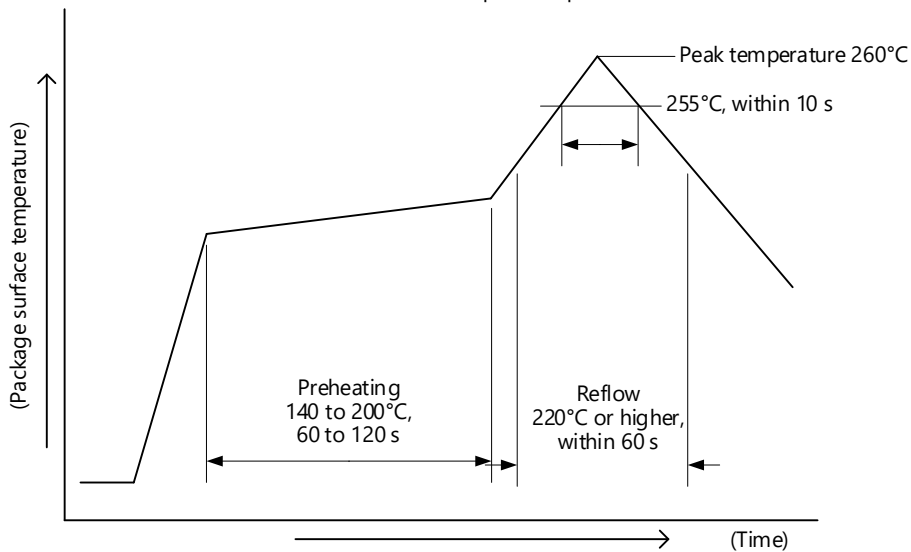
*: When performing manual soldering, be careful that the soldering iron does not come in contact with anything other than the package leads.

<Conditions> Iron tip temperature: 350°C or less, Time: 5 s or less, Number of reflows: 2 times or less

<Recommended soldering conditions>

Peak temperature (package surface temperature)	260°C or lower
Duration at maximum temperature	Within 10 s
Duration at 220°C or higher	Within 60 s
Duration at preheat temperature (140 to 200°C)	60 to 120 s
Maximum number of reflows	2 times or less
Storage limitation after unpacking drypack	Within 7 days

<Infrared reflow temperature profile>



10.2 Precautions When Opening the Package

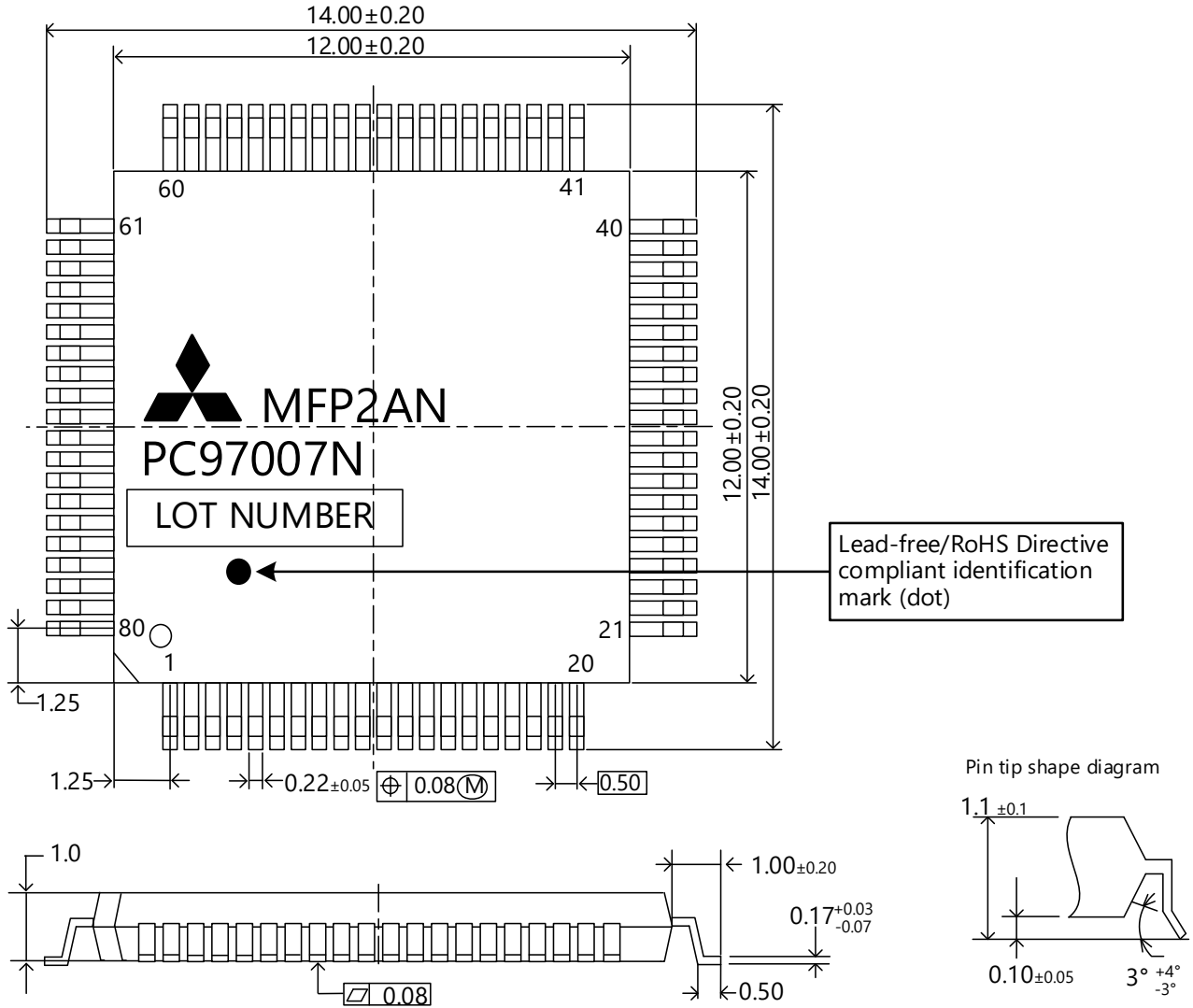
- (1) Open the package immediately before soldering.
- (2) Use the product within the moisture-resistant packaging storage period (within 12 months after sealing).
- (3) This product requires moisture control. After opening, store the product in a moisture-proof environment (temperature: 30°C or lower, humidity: 70% RH or less), and mount the product within 7 days.
- (4) If the product cannot be used within the periods stated in (2) and (3) above, put it in a heatproof tray and bake it for at least 20 hours at 125°C (Typ.) before mounting.

APPENDICES

Appendix 1 MFP2AN Previous Specifications

Appendix 1.1 External appearance (before March 2020)

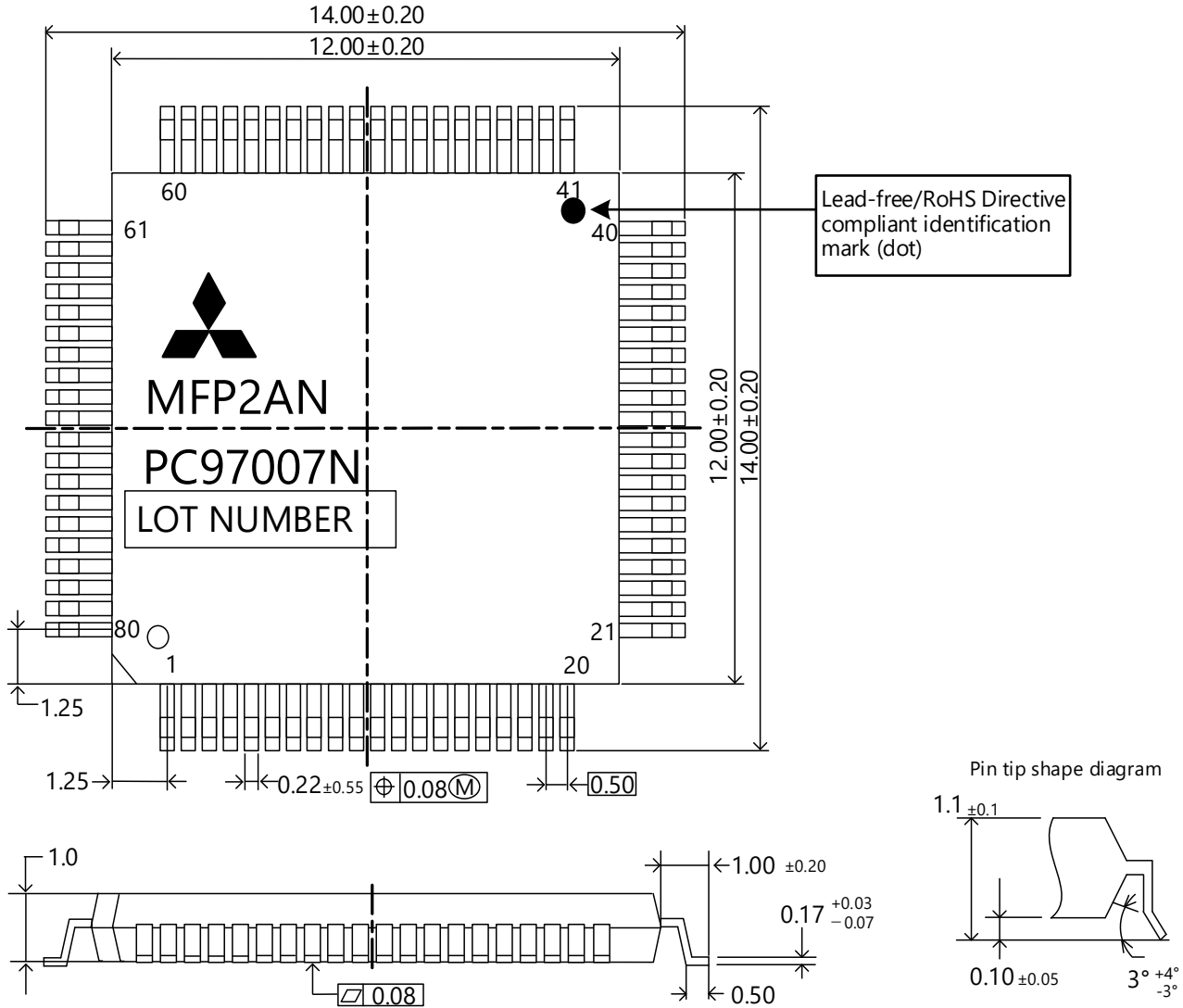
The following is the external appearance of MFP2N before March 2020.
Unit: mm



*: The position of dot may be different from the actual product.

Appendix 1.2 External appearance (before September 2014)

The following is the external appearance of MFP2AN before September 2014.
Unit: mm



*: The position of dot may be different from the actual product.

Appendix 2 Differences between PC97007N and PC18006E

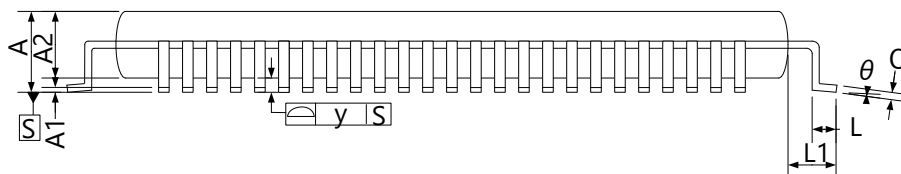
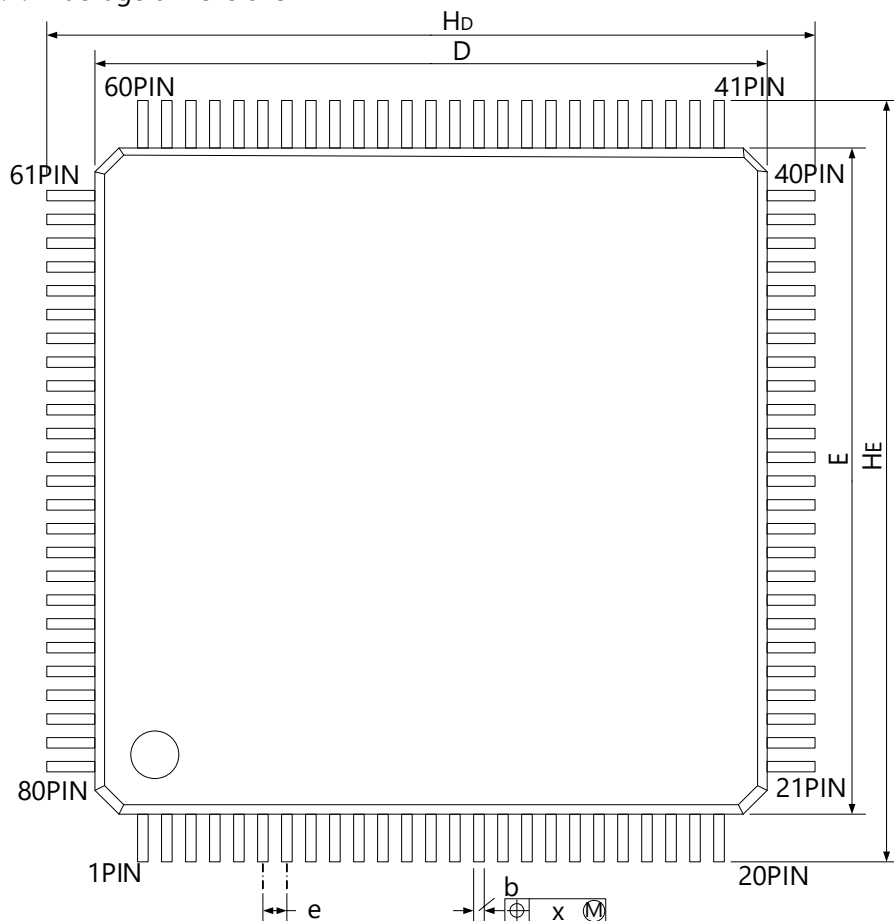
This section describes the differences between PC97007N and PC18006E.

Some specifications of PC18006E, such as electrical characteristics, have changed from the specifications of PC97007N. Refer to this section when considering replacement.

Appendix 2.1 Model names

Item	Discontinued model	Alternative model
Product	PC97007N	PC18006E
Model (package unit: 60 pieces)	A6GA-CCMFP2ANN60F	A6GA-CCMFP2ANN60FN
Model (package unit: 300 pieces)	A6GA-CCMFP2ANN300F	A6GA-CCMFP2ANN300FN
Manufacturer	Mitsubishi Electric Corporation	Mitsubishi Electric Corporation

Appendix 2.2 External appearance
 Appendix 2.2.1 Package dimensions



Detailed package dimensions
 [Unit: mm unless otherwise specified]

Symbol	PC97007N			PC18006E		
	Min.	Nom.	Max.	Min.	Nom.	Max.
D	11.80	12.00	12.20	11.90	12.00	12.10
E	11.80	12.00	12.20	11.90	12.00	12.10
A	1.00	1.10	1.20	-	-	1.20
A1	0.05	0.10	0.15	0.00	0.10	0.20
A2	-	-	1.00	0.90	1.00	1.10
e	-	0.50	-	-	0.50	-
b	0.17	0.22	0.27	0.17	0.22	0.27
c	0.10	0.17	0.20	0.09	0.15	0.20
θ	0°	3°	7°	0°	3°	8°
L	-	0.50	-	0.30	0.50	0.75
L1	0.80	1.00	1.20	0.80	1.00	1.20
HD	13.80	14.00	14.20	13.60	14.00	14.40
HE	13.80	14.00	14.20	13.60	14.00	14.40
x	-	-	0.08	-	-	0.08
y	-	-	0.08	-	-	0.08

Appendix 2.2.2 Print position specifications

For the print position of PC18006E, refer to Section 3.1 "External Appearance".

For the print position of PC97007N, refer to Appendix 1.1 "External appearance (before March 2020)".

Appendix 2.3 Electrical characteristics

Appendix 2.3.1 Buffer types

I/O	Buffer type	PC97007N	PC18006E
I	Input Buffer (CMOS in)	FI01	IBC_SP1
I	Input Buffer (TTL in)	FI02	IBT_SP1
I	Input Buffer (CMOS Schmitt in)	OFI7	IBH_SP1
I	Input Buffer (TTL Schmitt in)	FIS2	IBS_SP1
I	Input Buffer (CMOS in) with Pull-Up Resistor 5 k Ω	FIW1	IBCP3_SP1
I	Input Buffer (CMOS Schmitt in) with Pull-Up Resistor 5 k Ω	FWS1	IBHP3_SP2
O	Output Buffer (CMOS out: I _{OL} = 12 mA)	FO03	OB3BT_SP1
O	Output Buffer (CMOS out: I _{OL} = 8 mA)	FO02	OB2T_SP2
O	Output Buffer (CMOS out: I _{OL} = 4 mA)	FO01	OB1T_SP2
O	Output Buffer (N-Ch Open Drain: I _{OL} = 18 mA)	EXT5	OD3T_SP1
I/O	CMOS Schmitt in: CMOS 3-state out: I _{OL} = 24 mA (Low Noise)	OB32	BH4BT_SP2

Appendix 2.3.2 Absolute maximum ratings

Item	PC97007N			PC18006E			Unit	
	Symbol	Rated value		Symbol	Rated value			
		Min.	Max.		Min.	Max.		
Power supply voltage	V _{DD}	-0.5	6.0	V _{DD}	V _{SS} - 0.5	7.0	V	
Input voltage	V _I	-0.5	V _{DD} + 0.5	V _I	V _{SS} - 0.5	V _{DD} + 0.5	V	
Output voltage	V _O	-0.5	V _{DD} + 0.5	V _O	V _{SS} - 0.5	V _{DD} + 0.5	V	
Output current	I _{OL} = 4 mA type	I _{OUT}	-	±12	I _{OUT}	-	±30	mA
	I _{OL} = 8 mA type		-	±24		-	±30	mA
	I _{OL} = 12 mA type		-	±36		-	±40	mA
	I _{OL} = 18 mA type (N-Ch Open Drain only)		-	±48		-	±50	mA
	I _{OL} = 24 mA type		-	±48		-	±50	mA
Storage temperature	T _{stg}	-65	150	T _{stg}	-65	150	°C	
Maximum current consumption	V _{DD} = 5 V	-	56	-	-	56	mA	

Appendix 2.3.3 Recommended operating conditions

Item	PC97007N				PC18006E				Unit
	Symbol	Rated value			Symbol	Rated value			
		Min.	Typ.	Max.		Min.	Typ.	Max.	
Power supply voltage	V _{DD}	4.5	5.0	5.5	V _{DD}	4.5	5.0	5.5	V
Operating temperature	T _A	-40	-	85	T _A	-40	25	110	°C
Input rising time (normal input)	t _{r1}	0	-	200	t _{r1}	-	-	200	ns
Input falling time (normal input)	t _{f1}	0	-	200	t _{f1}	-	-	200	ns
Input rising time (Schmitt input)	t _{r2}	0	-	10	t _{r2}	-	-	10	ms
Input falling time (Schmitt input)	t _{f2}	0	-	10	t _{f2}	-	-	10	ms

Appendix 2.3.4 DC characteristics

Item		PC97007N					PC18006E				Unit
		Symbol	Rated value			Symbol	Rated value				
			Min.	Typ.	Max.		Min.	Typ.	Max.		
CMOS	"H" input voltage	V _{IH1}	0.7V _{DD} (Min.: 3.15)	-	V _{DD}	V _{IH1}	3.5	-	V _{DD} + 0.3	V	
	"L" input voltage	V _{IL1}	0	-	0.3 V _{DD} (Max.: 1.65)	V _{IL1}	0	-	1.65	V	
TTL	"H" input voltage	V _{IH2}	2.2	-	V _{DD}	V _{IH2}	2.29	-	V _{DD}	V	
	"L" input voltage	V _{IL2}	0	-	0.8	V _{IL2}	0	-	0.77	V	
CMOS Schmitt trigger (I/O)	Positive trigger voltage	V _{T1+}	2.3	-	4.05	V _{T1+}	2.3	-	4.05	V	
	Negative trigger voltage	V _{T1-}	0.9	-	1.92	V _{T1-}	0.9	-	1.92	V	
	Hysteresis voltage	ΔV	1.1	-	2.35	ΔV	1.1	-	-	V	
CMOS Schmitt trigger (FUSEL)	Positive trigger voltage	V _{T1+}	2.3	-	4.05	V _{T1+}	2.55	-	3.75	V	
	Negative trigger voltage	V _{T1-}	0.9	-	1.92	V _{T1-}	1.15	-	2.05	V	
	Hysteresis voltage	ΔV	1.1	-	2.35	ΔV	1.1	-	-	V	
CMOS Schmitt trigger (RST)	Positive trigger voltage	V _{T1+}	1.8	-	4	V _{T1+}	1.8	-	4	V	
	Negative trigger voltage	V _{T1-}	0.6	-	3.1	V _{T1-}	0.6	-	3.1	V	
	Hysteresis voltage	ΔV	0.3	-	1.5	ΔV	0.3	-	-	V	
TTL Schmitt trigger	Positive trigger voltage	V _{T2+}	1.2	-	2.4	V _{T2+}	1.38	-	2.55	V	
	Negative trigger voltage	V _{T2-}	0.6	-	1.8	V _{T2-}	0.64	-	1.33	V	
	Hysteresis voltage	V _{H2}	0.3	-	1.5	V _{H2}	0.64	-	-	V	
Input leak current		I _{L1}	-10	±10 ⁻⁵	10	I _{L1}	-5	-	5	μA	
Output leak current		I _{OZ}	-10	-	10	I _{OZ}	-5	-	5	μA	
Pull-up resistance 50 kΩ		R _{PD}	25	50	100	R _{PU}	15	38	100	kΩ	
Pull-up resistance 5 kΩ		R _{PU}	2.5	5.0	10	R _{PU}	2.5	5.0	12.9	kΩ	
"L" output current	I _{OL} = 4 mA type	I _{OL}	4.0	-	-	I _{OL}	4.0	-	-	mA	
	I _{OL} = 8 mA type		8.0	-	-		8.0	-	-	mA	
	I _{OL} = 12 mA type		12.0	-	-		12.0	-	-	mA	
	I _{OL} = 18 mA type (N-Ch Open Drain only)		18.0 (V _{OL} = 0.6 V)	-	-		18.0	-	-	mA	
	I _{OL} = 24 mA type		24.0	-	-		24.0	-	-	mA	
"H" output current	I _{OL} = 4 mA type	I _{OH}	-2.0	-	-	I _{OH}	-2.0	-	-	mA	
	I _{OL} = 8 mA type		-4.0	-	-		-4.0	-	-	mA	
	I _{OL} = 12 mA type		-6.0	-	-		-12.0	-	-	mA	
	I _{OL} = 18 mA type (N-Ch Open Drain only)		-	-	-		-	-	-	mA	
	I _{OL} = 24 mA type		-12.0	-	-		-12.0	-	-	mA	
"H" output voltage (I _{OH} = current value of each specifications)		V _{OH}	V _{DD} - 0.4	-	-	V _{OH}	V _{DD} 0.4	-	-	V	
"L" output voltage (I _{OL} = current value of each specifications)		V _{OL}	-	-	0.4	V _{OL}	-	-	V _{SS} + 0.4	V	
Static supply current (T _A = -40 to 85°C)		I _{DD5}	-	-	Undefined	I _{DD5}	-	-	100	μA	

Appendix 2.3.5 AC characteristics

Item	Condition	PC97007N				PC18006E				Unit
		Symbol	Rated value			Symbol	Rated value			
			Min.	Typ.	Max.		Min.	Typ.	Max.	
Output rising time	C _L = 15 pF	t _r	-	3.6	-	t _r	-	2.5	-	ns
Output falling time		t _f	-	2.7	-	t _f	-	2.5	-	ns

Appendix 2.3.6 I/O capacitance

Item	Condition	PC97007N				PC18006E				Unit
		Symbol	Rated value			Symbol	Rated value			
			Min.	Typ.	Max.		Min.	Typ.	Max.	
Input capacitance	f = 1 MHz, V _{DD} = 0 V	C _I	-	10	20	C _I	-	-	10	pF
Output capacitance		C _O	-	10	20	C _O	-	-	10	pF
I/O capacitance		C _{IO}	-	10	20	C _{IO}	-	-	10	pF

Appendix 2.4 Specified components (crystal oscillator)

Use a crystal oscillator having a frequency deviation within ± 100 ppm.

PC97007N			PC18006E		
Size (unit: mm)	Model	Manufacturer	Size (unit: mm)	Model	Manufacturer
7.3 × 4.9	DSO751SBM 80MHz	DAISHINKU CORP.	7.3 × 4.9	DSO751SBM 80MHz	DAISHINKU CORP.
	DSO751SB 80MHz (discontinued product)			-	
7.0 × 5.0	KC7050B80.0000C5ZBRZ (The production will be discontinued from March 2022.)	KYOCERA Corporation	7.0 × 5.0	KC7050B80.0000C5ZBRZ (The production will be discontinued from March 2022.)	KYOCERA Corporation
	KC7050B80.0000C5ZBQZ (discontinued product) (FXO-37FNB 80MHz)			-	
3.2 × 2.5	DSO321SBN 80MHZ	DAISHINKU CORP.	3.2 × 2.5	DSO321SBN 80MHZ	DAISHINKU CORP.

Note

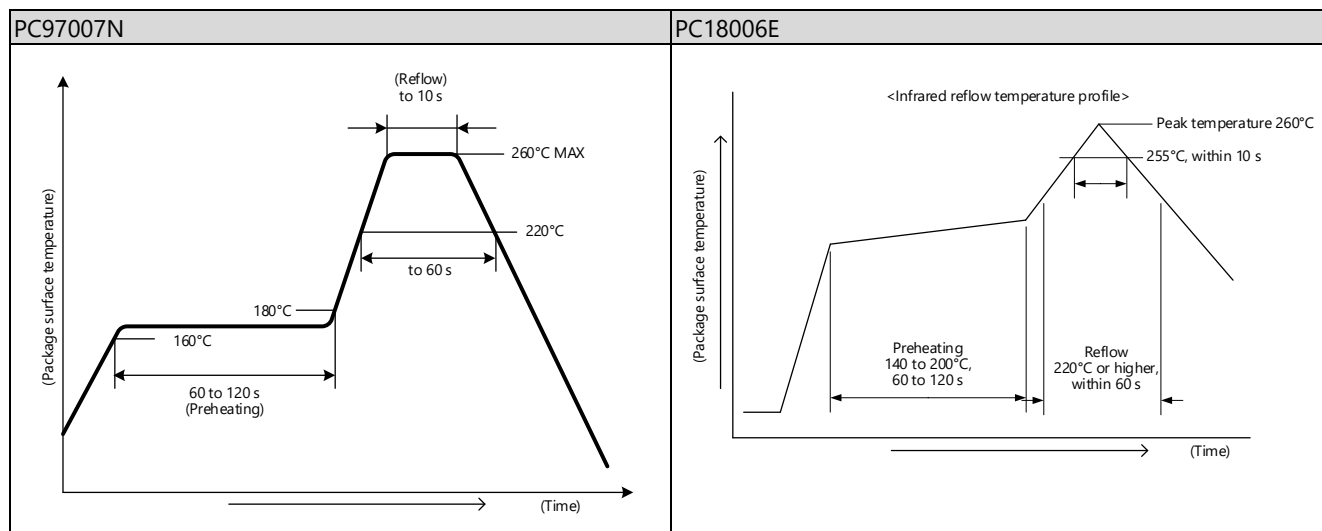
For the latest information of the specified components, check the technical bulletins.
For the production status, contact each manufacturer.

Appendix 2.5 Handling precautions

Appendix 2.5.1 Recommended conditions

Item	PC97007N	PC18006E
After package opening	Within 7 days	Within 7 days
Baking	125°C, 10 to 72 hours	125°C, 20 to 36 hours
Maximum temperature (package surface temperature)	260°C or lower	260°C or lower
Preheating time	160 to 180°C, 60 to 120 s	140 to 200°C, 60 to 120 s
Reflow time	220°C, within 60 s	220°C, within 60 s
Maximum number of reflows	3 times or less	2 times or less

Appendix 2.5.2 Allowable temperature profile conditions



Revisions

* The manual number is given on the bottom left of the back cover.

Print date	*Manual number	Revision
December 2005	SH(NA)-080623ENG-A	First edition
May 2006	SH(NA)-080623ENG-B	Partial correction
November 2006	SH(NA)-080623ENG-C	Modified Section 5.1, 5.2
January 2010	SH(NA)-080623ENG-D	Added Section 3.3.2, Section 3.3.3 Modified Related Materials, Section 3.5.2, Section 5.1, Section 5.2, Chapter 6, Sections 3.3.2 to 3.3.4 → Section 3.3.4 to Section 3.3.6
January 2012	SH(NA)-080623ENG-E	Modified Section 1.1, Chapter 2, Section 3.2, Section 3.3.1, Section 3.3.2, Section 3.3.3, Section 3.3.4, Section 3.3.6, Section 3.4, Section 3.5.2, Section 3.5.3, Section 3.5.4, Chapter 4, Chapter 5, Chapter 6, Section 7.1, Section 7.2, Chapter 8, Chapter 10
November 2017	SH(NA)-080623ENG-F	Modified Notice for Safe Designs, INTRODUCTION, Chapter 1, Section 1.1, Chapter 2, Section 3.1, Section 3.3.2, Chapter 5, Section 6.1, Section 6.2, Chapter 8, Chapter 10 Added CC-Link Partner Association (CLPA), Trademarks, APPENDIX Deleted RELATED MATERIALS
May 2020	SH(NA)-080623ENG-G	Modified Notice for Safety Design, Notes Regarding This Manual, Conditions of Use for the Product, Trademarks, Section 1.1, Chapter 2, Section 3.1, Sections 3.3.1, 3.3.2, 3.3.4, 3.3.5, Sections 3.5.1 to 3.5.5, Sections 6.1 to 6.3, Sections 7.1 to 7.3, Section 10.1, Appendix 1 Added Relevant Manual, Terms, Appendix 2 Deleted INTRODUCTION
August 2021	SH(NA)-080623ENG-H	Modified Back cover, Notes Regarding This Manual, Chapter 1, Sections 3.2, 3.3.4, 3.3.5, 3.5.3 to 3.5.5, 6.1, 7.1, 7.2, Appendix 2.4, Warranty Added Usage Precautions, Address Notation, Radix Notation
March 2022	SH(NA)-080623ENG-J	Added/Modified Section 6.1, Appendix 2.4
February 2024	SH(NA)-080623ENG-K	Modified Security Precautions, Conditions of Use for the Product, Sections 1.1, 5.1, 5.2, 6.2

This manual confers no industrial property rights or any rights of any other kind, nor does it confer any patent licenses. Mitsubishi Electric Corporation cannot be held responsible for any problems involving industrial property rights which may occur as a result of using the contents in this manual.

© 2005 MITSUBISHI ELECTRIC CORPORATION

Warranty

Please confirm the following product warranty details before using dedicated LSI.

1. Gratis Warranty Term and Gratis Warranty Range

If any faults or defects (hereinafter "Failure") found to be the responsibility of Mitsubishi occurs during use of the product within the gratis warranty term, the product shall be replaced at no cost via the sales representative or Mitsubishi Service Company.

[Gratis Warranty Term]

The gratis warranty term of the product shall be for one year after the date of purchase or delivery to a designated place. Note that after manufacture and shipment from Mitsubishi, the maximum distribution period shall be six (6) months, and the longest gratis warranty term after manufacturing shall be eighteen (18) months.

[Gratis Warranty Range]

- (1) The range shall be limited to normal use within the usage state, usage methods and usage environment, etc., which follow the conditions and precautions, etc., given in the instruction manual, user's manual and caution labels on the product.
- (2) Even within the gratis warranty term, a replacement fee shall be applied in the following cases.
 - [1] Failure occurring from inappropriate storage or handling, carelessness or negligence by the user. Failure caused by the user's hardware or software design.
 - [2] Failure caused by unapproved modifications, etc., to the product by the user.
 - [3] When the Mitsubishi product is assembled into a user's device, failure that could have been avoided if functions or structures, judged as necessary in the legal safety measures the user's device is subject to or as necessary by industry standards, had been provided.
 - [4] Failure caused by external irresistible forces such as fires or abnormal voltages, and failure caused by force majeure such as earthquakes, lightning, wind and water damage.
 - [5] Failure caused by reasons unpredictable by scientific technology standards at time of shipment from Mitsubishi.
 - [6] Any other failure found not to be the responsibility of Mitsubishi or that admitted not to be so by the user.

2. Handling after discontinuation of production

- (1) Discontinuation of production shall be notified with Mitsubishi Technical Bulletins, etc.
- (2) Product supply (including repair parts) is not available after production is discontinued.

3. Customer service

- (1) When the cause of failure requires an investigation, Mitsubishi shall conduct the investigation using the dedicated LSI unit only. Please bring the dedicated LSI removed from the product to which it was incorporated to Mitsubishi. Mitsubishi will not conduct business travel in connection with the investigation.
- (2) Overseas, replacements shall be provided by Mitsubishi's local FA Centers. Note that the conditions under which replacements are provided by each FA Center differ.

4. Exclusion of loss in opportunity and secondary loss from warranty liability

Regardless of the gratis warranty term, Mitsubishi shall not be liable for compensation to:

- (1) Damages caused by any cause found not to be the responsibility of Mitsubishi.
- (2) Loss in opportunity, lost profits incurred to the user by Failures of Mitsubishi products.
- (3) Special damages and secondary damages whether foreseeable or not, compensation for accidents, and compensation for damages to products other than Mitsubishi products.
- (4) Replacement by the user, maintenance of on-site equipment, start-up test run and other tasks.

5. Changes in product specifications

The specifications given in the catalogs, manuals, and technical documents are subject to change without prior notice.

Trademarks

The company names, system names and product names mentioned in this manual are either registered trademarks or trademarks of their respective companies. In some cases, trademark symbols such as '™' or '®' are not specified in this manual.

SH(NA)-080623ENG-K(2402)MEE

MODEL: CC-LINK-MFP2AN-R-E

MODEL CODE: 13JV14

MITSUBISHI ELECTRIC CORPORATION

HEAD OFFICE: TOKYO BLDG., 2-7-3, MARUNOUCHI, CHIYODA-KU, TOKYO 100-8310, JAPAN
NAGOYA WORKS: 1-14, YADA-MINAMI 5-CHOME, HIGASHI-KU, NAGOYA 461-8670, JAPAN

When exported from Japan, this manual does not require application to the
Ministry of Economy, Trade and Industry for service transaction permission.

Specifications subject to change without notice.