MITSUBISHI ELECTRIC

Open Field Network
CC-Link Compatible Product Development
Reference Manual

CC-Link Remote I/O Station Communication LSI MFP2N

-A6GA-CCMFP2NN60FN
-A6GA-CCMFP2NN300FN

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CONTENTS

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

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

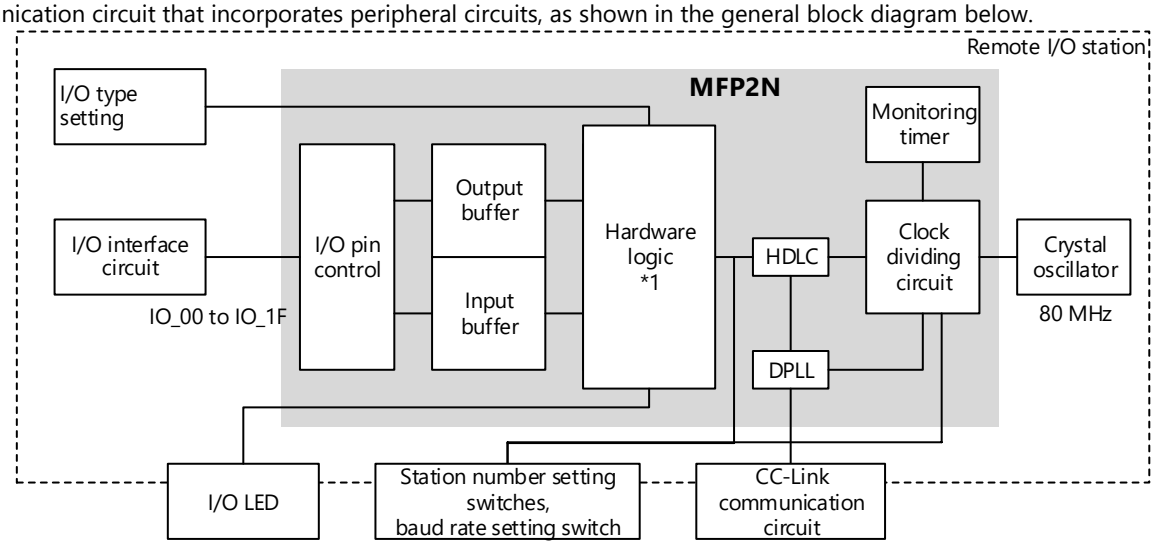
To request materials published by the CC-Link Partner Association and for conformance test details, please contact the following:
TEL: +81-52-919-1588
FAX: +81-52-916-8655
E-mail: info@cc-link.org
Web: http://www.cc-link.org/

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 (MFP2N)" 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 (MFP2N) and a CC-Link communication circuit that incorporates peripheral circuits, as shown in the general block diagram below.



General Block Diagram

*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 MFP2N, 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) 8 points
2	Output	Remote output (RY) 8 points
3	Input	Remote input (RX) 16 points
4	Output	Remote output (RY) 16 points
5	I/O combined	Remote input (RX) 8 points + Remote output (RY) 8 points
6	Input	Remote input (RX) 32 points
7	Output	Remote output (RY) 32 points
8	I/O combined	Remote input (RX) 16 points + Remote output (RY) 16 points

*: Combinations other than above cannot be set.

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.

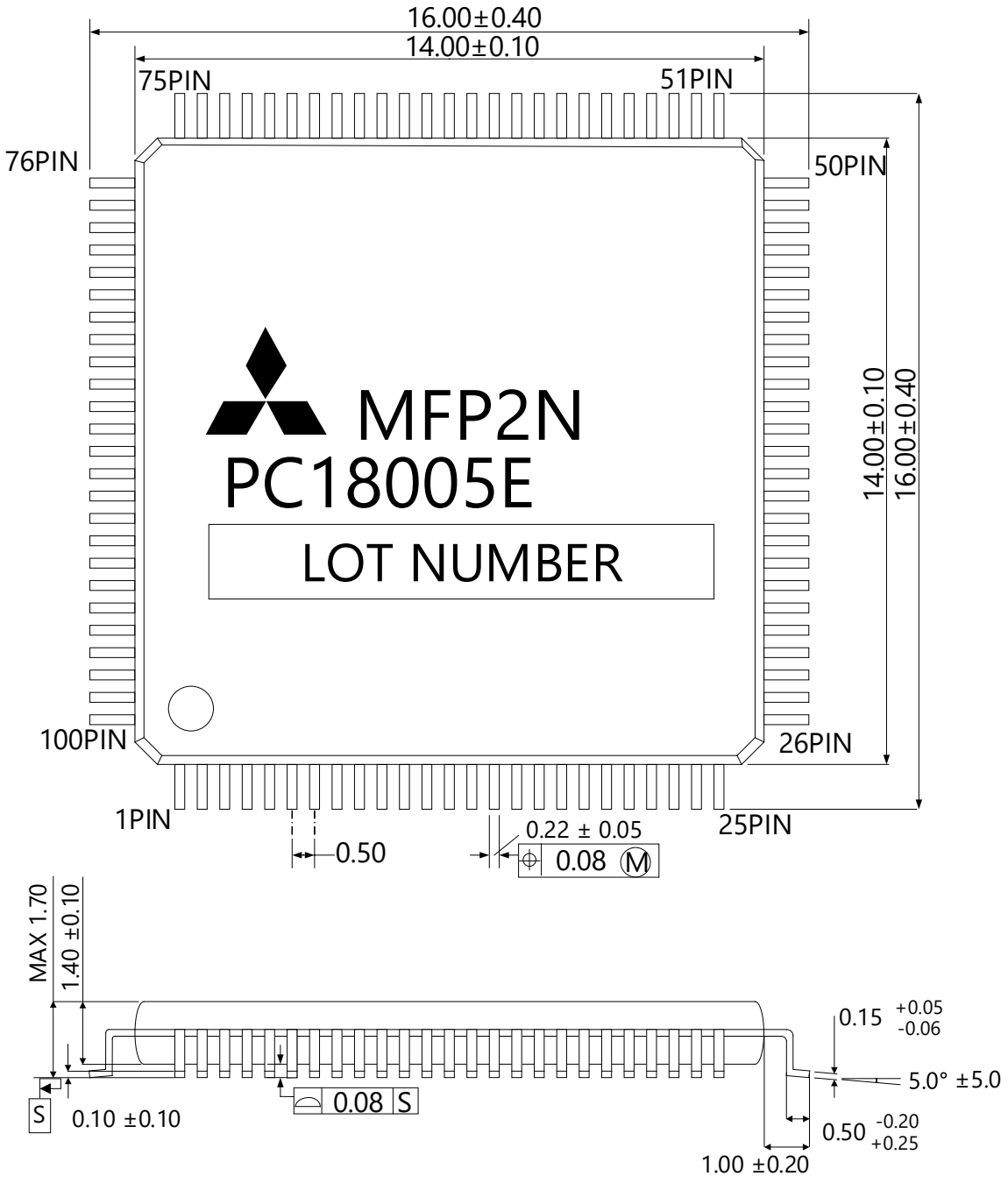
2. Function List

Function	Description
Number of I/O points, I/O type setting	Sets the number of I/O points and I/O type for MFP2N. 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 combined, 32-bit input, 32-bit output, 16-bit combined (Pin name for the number of I/O points: IOP0, IOP1) (Pin name for the I/O type: IOS0, IOS1)
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: ・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.

3.1 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 Pin List

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	VDD	-	26	GND	-	51	VDD	-	76	GND	-
2	IO_04	I/O	27	IO_19	I/O	52	CLK	I	77	FUSEL	I
3	IO_05	I/O	28	IO_1A	I/O	53	RSV53	-	78	RD1	I
4	IO_06	I/O	29	IO_1B	I/O	54	RSV54	-	79	RSV79	-
5	IO_07	I/O	30	IO_1C	I/O	55	RSV55	-	80	SD	O
6	IO_08	I/O	31	IO_1D	I/O	56	RSV56	-	81	SDGATEON	O
7	IO_09	I/O	32	IO_1E	I/O	57	RST	I	82	LEDX0	O
8	IO_0A	I/O	33	IO_1F	I/O	58	RSV58	-	83	LEDX1	O
9	IO_0B	I/O	34	GND	-	59	IOP0	I	84	LEDX2	O
10	GND	-	35	SW1	I	60	IOP1	I	85	LEDX3	O
11	IO_0C	I/O	36	SW2	I	61	IOS0	I	86	LEDX4	O
12	IO_0D	I/O	37	SW4	I	62	IOS1	I	87	LEDY0	O
13	IO_0E	I/O	38	SW8	I	63	TRE	I	88	LEDY1	O
14	IO_0F	I/O	39	SW10	I	64	RSV64	-	89	LEDY2	O
15	IO_10	I/O	40	SW20	I	65	RSV65	-	90	LEDY3	O
16	IO_11	I/O	41	SW40	I	66	RSV66	-	91	LEDY4	O
17	IO_12	I/O	42	SW80	I	67	MO0	O	92	LEDY5	O
18	IO_13	I/O	43	BS1	I	68	MO1	O	93	LEDY6	O
19	GND	-	44	BS2	I	69	MO2	O	94	LEDY7	O
20	IO_14	I/O	45	BS4	I	70	RSV70	-	95	GND	-
21	IO_15	I/O	46	BS8	I	71	RSV71	-	96	IO_00	I/O
22	IO_16	I/O	47	IDT	-	72	RDNRZ	O	97	IO_01	I/O
23	IO_17	I/O	48	RSV48	-	73	SDNRZ	O	98	IO_02	I/O
24	IO_18	I/O	49	RSV49	-	74	SCLK	O	99	IO_03	I/O
25	VDD	-	50	GND	-	75	VDD	-	100	GND	-

3.3 Pin Functions

3.3.1 Lists of pin functions

(1) Clock reset

Pin No.	Pin name	I/O	Buffer type	Application	Remarks
52	CLK	I	IBT_SP1	Clock input	Input the crystal oscillator output (80 MHz).
57	RST	I	IBHP3_SP1	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
78	RD1	I	IBS_SP1	RECEIVE DATA	-	
80	SD	O	OB3BT_SP1	SEND DATA	H	
81	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
96	IO_00	I/O	BH3BT_SP1	Bit data I/O 0	-	H	When the I/O type is input: Active "H" When the I/O type is output: Active "L"
97	IO_01	I/O	BH3BT_SP1	Bit data I/O 1			
98	IO_02	I/O	BH3BT_SP1	Bit data I/O 2			
99	IO_03	I/O	BH3BT_SP1	Bit data I/O 3			
2	IO_04	I/O	BH3BT_SP1	Bit data I/O 4			
3	IO_05	I/O	BH3BT_SP1	Bit data I/O 5			
4	IO_06	I/O	BH3BT_SP1	Bit data I/O 6			
5	IO_07	I/O	BH3BT_SP1	Bit data I/O 7			
6	IO_08	I/O	BH3BT_SP1	Bit data I/O 8	When the I/O type is input: GND When the I/O type is output: OPEN		
7	IO_09	I/O	BH3BT_SP1	Bit data I/O 9			
8	IO_0A	I/O	BH3BT_SP1	Bit data I/O A			
9	IO_0B	I/O	BH3BT_SP1	Bit data I/O B			
11	IO_0C	I/O	BH3BT_SP1	Bit data I/O C			
12	IO_0D	I/O	BH3BT_SP1	Bit data I/O D			
13	IO_0E	I/O	BH3BT_SP1	Bit data I/O E			
14	IO_0F	I/O	BH3BT_SP1	Bit data I/O F			
15	IO_10	I/O	BH3BT_SP1	Bit data I/O 10			
16	IO_11	I/O	BH3BT_SP1	Bit data I/O 11			
17	IO_12	I/O	BH3BT_SP1	Bit data I/O 12			
18	IO_13	I/O	BH3BT_SP1	Bit data I/O 13			
20	IO_14	I/O	BH3BT_SP1	Bit data I/O 14			
21	IO_15	I/O	BH3BT_SP1	Bit data I/O 15			
22	IO_16	I/O	BH3BT_SP1	Bit data I/O 16			
23	IO_17	I/O	BH3BT_SP1	Bit data I/O 17			
24	IO_18	I/O	BH3BT_SP1	Bit data I/O 18			
27	IO_19	I/O	BH3BT_SP1	Bit data I/O 19			
28	IO_1A	I/O	BH3BT_SP1	Bit data I/O 1A			
29	IO_1B	I/O	BH3BT_SP1	Bit data I/O 1B			
30	IO_1C	I/O	BH3BT_SP1	Bit data I/O 1C			
31	IO_1D	I/O	BH3BT_SP1	Bit data I/O 1D			
32	IO_1E	I/O	BH3BT_SP1	Bit data I/O 1E			
33	IO_1F	I/O	BH3BT_SP1	Bit data I/O 1F			

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
82	LEDX0	O	OB1BT_SP1	LED dynamic output (X0)	-	H	*1
83	LEDX1	O	OB1BT_SP1	LED dynamic output (X1)	-		
84	LEDX2	O	OB1BT_SP1	LED dynamic output (X2)	OPEN		
85	LEDX3	O	OB1BT_SP1	LED dynamic output (X3)	OPEN		
86	LEDX4	O	OB1BT_SP1	LED dynamic output (X4)	OPEN		
87	LEDY0	O	OD3T_SP1	LED dynamic output (Y0)	-	H	*1 *2 Active "L"
88	LEDY1	O	OD3T_SP1	LED dynamic output (Y1)			
89	LEDY2	O	OD3T_SP1	LED dynamic output (Y2)			
90	LEDY3	O	OD3T_SP1	LED dynamic output (Y3)			
91	LEDY4	O	OD3T_SP1	LED dynamic output (Y4)			
92	LEDY5	O	OD3T_SP1	LED dynamic output (Y5)			
93	LEDY6	O	OD3T_SP1	LED dynamic output (Y6)			
94	LEDY7	O	OD3T_SP1	LED dynamic output (Y7)			

*1: Refer to Chapter 8 "LIST OF LED ON 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	BUFFRE TYPE	Application	Processing when not in use	Remarks
59	IOP0	I	IBC_SP1	Number of I/O points setting pin	-	*1
60	IOP1	I	IBC_SP1	Number of I/O points setting pin		
61	IOS0	I	IBC_SP1	I/O type setting pin	-	
62	IOS1	I	IBC_SP1	I/O type setting pin		
63	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
77	FUSEL	I	IBH_SP1	Fuse blown signal input	VDD	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
47	IDT	O	OB1T	Input monitor pin	OPEN	-	*1 Active "H"
67	MO0	O	OB1T	Receive data address monitor pin	OPEN	H	*2
68	MO1	O	OB1T	Receive data address monitor pin		-	
69	MO2	O	OB1T	Receive data address monitor pin		-	
72	RDNRZ	O	OB1T	Monitor pin for receive data after demodulation	OPEN	H	For monitoring (RDNRZ)
73	SDNRZ	O	OB1T	Monitor pin for send data before modulation		H	For monitoring (SDNRZ)
74	SCLK	O	OB1T	Send clock		L	For monitoring (Frequency determined by the baud rate)

*1: A monitor pin for measuring delay of MFP2N 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.

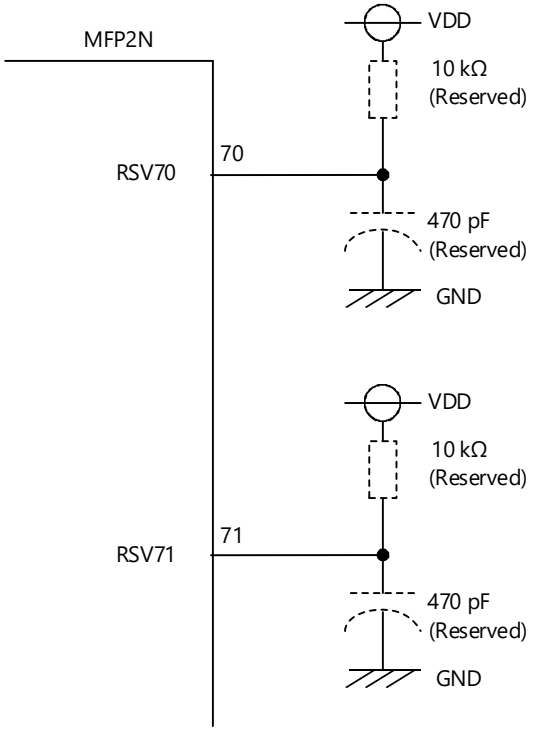
Buffer type	I/O	Function
IBC_SP1	I	Input Buffer (CMOS Level in)
IBCP3_SP1	I	Input Buffer (CMOS Level in) with Pull-Up Resistor 5 kΩ
IBH_SP1	I	Input Buffer (CMOS-Schmitt in)
IBHP3_SP1	I	Input Buffer (CMOS-Schmitt in) with Pull-Up Resistor 5 kΩ
IBS_SP1	I	Input Buffer (TTL Schmitt in)
IBT_SP1	I	Input Buffer (TTL Level in)
OB1BT_SP1	O	Output Buffer (CMOS Level out: I_{OL} = 6 mA)
OB1T	O	Output Buffer (CMOS Level out: I_{OL} = 3 mA)
OB3BT_SP1	O	Output Buffer (CMOS Level out: I_{OL} = 12 mA)
OD3T_SP1	O	N-Ch Open Drain Output Buffer (I_{OL} = 18 mA)
BH3BT_SP1	I/O	Low Noise Schmitt I/O Buffer (CMOS in: CMOS 3-state out: I_{OL} = 18 mA)

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 70 "RSV70" and pin number 71 "RSV71" 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°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) 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}	-	-	-	-	kΩ
I_I	V_I = V_{DD} or GND (normal input) input leak current	-	-	±5	μA
V_P	-	-	-	-	V
V_N	-	-	-	-	V
V_H	-	-	-	-	V

(2) 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}	-	-	-	-	kΩ
I_I	V_I = V_{DD} or GND (normal input) input leak current	-	-	±5	μA
V_P	-	-	-	-	V
V_N	-	-	-	-	V
V_H	-	-	-	-	V

(3) 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 kΩ	2.5	5.0	12.9	kΩ
I_I	V_I = GND input leak current	0.348	1.00	2.2	mA
V_P	-	2.55	-	3.75	V
V_N	-	1.15	-	2.05	V
V_H	-	1.10	-	-	V

(4) 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

(5) IBH_SP1

Item	Condition	Min.	Typ.	Max.	Unit
V_{IL}	CMOS Level (Schmitt in)	0	-	1.65	V
V_{IH}	CMOS Level (Schmitt in)	3.5	-	V_{DD} + 0.3	V
R_{PU}	-	-	-	-	kΩ
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	-	1.10	-	-	V

(6) 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 kΩ	2.5	5.0	12.9	kΩ
I_I	V_I = GND input leak current	0.348	1.00	2.2	mA
V_P	-	-	-	-	V
V_N	-	-	-	-	V
V_H	-	-	-	-	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) OD3T_SP1

Item	Condition	Min.	Typ.	Max.	Unit
I_{OL}	CMOS Level output (V_{OL} = 0.4 V, I_{OL} = 18.0 mA type)	18.0	-	-	mA
I_{OH}	CMOS Level output (V_{OH} = V_{DD} - 0.4 V, I_{OL} = 18.0 mA type)	-	-	-	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) OB3BT_SP1

Item	Condition	Min.	Typ.	Max.	Unit
I_{OL}	CMOS Level output (V_{OL} = 0.4 V, I_{OL} = 12.0 mA type)	12.0	-	-	mA
I_{OH}	CMOS Level output (V_{OH} = V_{DD} - 0.4 V, I_{OL} = 12.0 mA type)	-12.0	-	-	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) OB1BT_SP1

Item	Condition	Min.	Typ.	Max.	Unit
I_{OL}	CMOS Level output (V_{OL} = 0.4 V, I_{OL} = 6.0 mA type)	6.0	-	-	mA
I_{OH}	CMOS Level output (V_{OH} = V_{DD} - 0.4 V, I_{OL} = 6.0 mA type)	-6.0	-	-	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

(4) OB1T

Item	Condition	Min.	Typ.	Max.	Unit
I_{OL}	CMOS Level output (V_{OL} = 0.4 V, I_{OL} = 3.0 mA type)	3.0	-	-	mA
I_{OH}	CMOS Level output (V_{OH} = V_{DD} - 0.4 V, I_{OL} = 3.0 mA type)	-3.0	-	-	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

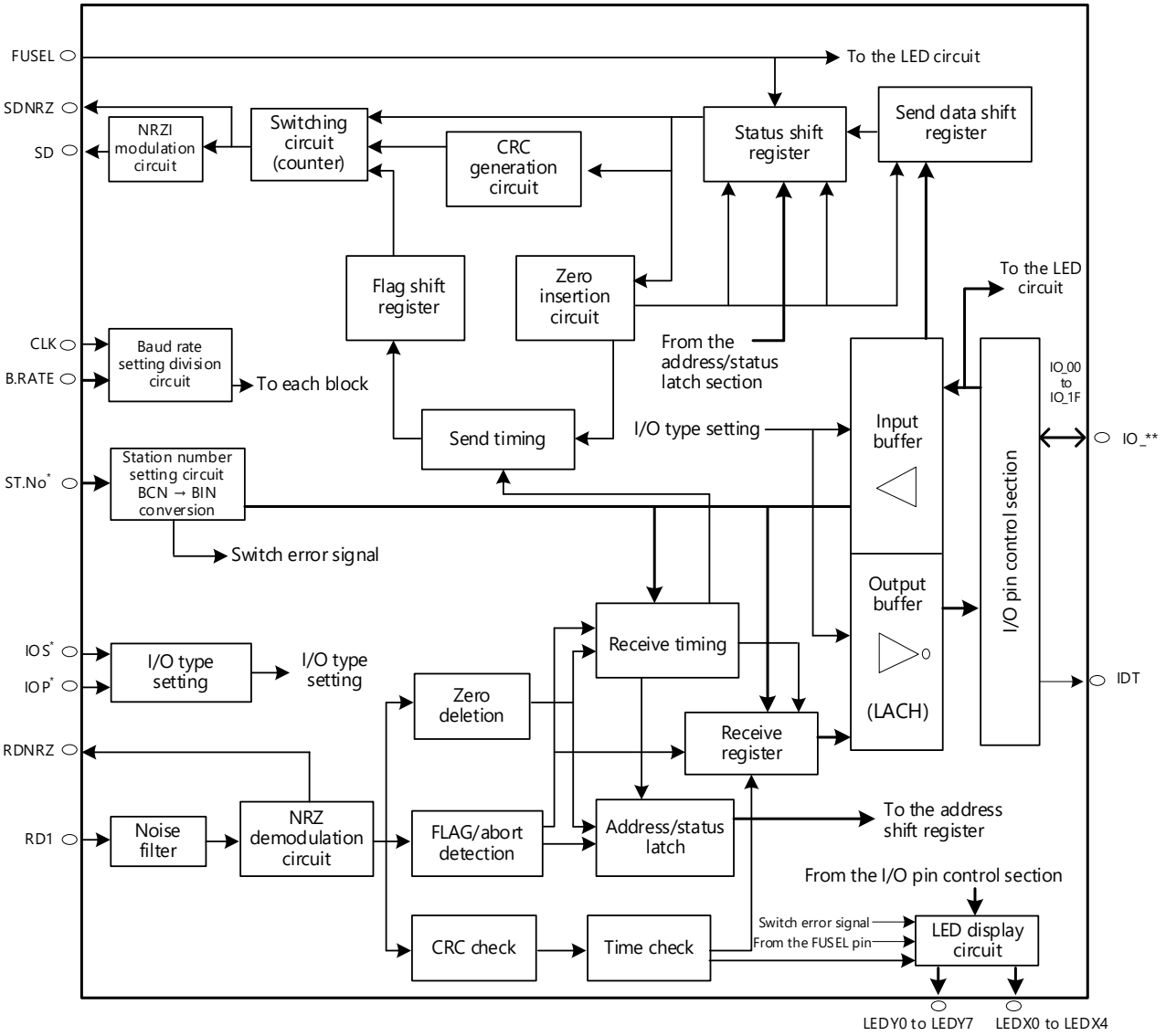
3.3.6 Ratings for the I/O buffer type (T_A = -40 to +110°C, V_{DD} = 5 V±10%)

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

BH3BT_SP1

Item	Condition	Min.	Typ.	Max.	Unit
V_{IL}	CMOS Level (Schmitt in)	0	-	1.65	V
V_{IH}	CMOS Level (Schmitt in)	3.5	-	V_{DD} + 0.3	V
R_{PU}	-	-	-	-	kΩ
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	-	1.10	-	-	V
I_{OL}	CMOS Level output (V_{OL} = 0.4 V, I_{OL} = 18.0 mA type)	18.0	-	-	mA
I_{OH}	CMOS Level output (V_{OH} = V_{DD} - 0.4 V, I_{OL} = 18.0 mA type)	-18.0	-	-	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

3.4 Block Diagram



3.5 Electrical Characteristics

3.5.1 Absolute maximum ratings (Unless specified T_A = 25°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 V_{DD} + 0.5	V
I_O	Output current	I_{OL} = 3 mA type buffer	±30	mA
		I_{OL} = 6 mA type buffer	±30	mA
		I_{OL} = 12 mA type buffer	±30	mA
		I_{OL} = 18 mA type buffer	±40	mA
T_{opt}	Operating temperature	-	-40 to +110	°C
T_{stg}	Storage temperature	-	-65 to +150	°C
-	Maximum current consumption	V_{DD} = 5 V	72	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	°C
V_I	Input voltage	-	-0.3	-	V_{DD} + 0.3	V
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 type	2.55	-	3.75	V
		TTL type	1.38	-	2.55	V
V_N	Negative trigger voltage	CMOS type	1.15	-	2.05	V
		TTL type	0.64	-	1.33	V
V_H	Hysteresis voltage	CMOS type	1.10	-	-	V
		TTL 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 "List of pin functions" and Section 3.3.2 "Buffer types".

3.5.3 DC characteristics (T_A = -40 to +110°C, V_{DD} = 5 V±10%)

Symbol	Item	Condition	Specification value[*3]			Unit
			Min.	Typ.	Max.	
I_{DSS}	Static supply current[*1]	V_I = V_{DD} or GND	-	-	240	µA
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 = GND (Pull-up 50 kΩ)	45	131.6	366.7	µA
		V_I = GND (Pull-up 5 kΩ)	0.348	1.0	2.2	mA
R_{PU}	Pull-up resistance[*2]	50 kΩ	15	38	100.0	kΩ
		5 kΩ	2.5	5	12.9	kΩ
I_{OL}	"L" output current	V_L = 0.4 V (CMOS 3.0 mA type)	3.00	-	-	mA
		V_{OL} = 0.4 V (CMOS 6.0 mA type)	6.00	-	-	mA
		V_{OL} = 0.4 V (CMOS 12.0 mA type)	12.00	-	-	mA
		V_{OL} = 0.4 V (CMOS 18.0 mA type)	18.00	-	-	mA
I_{OH}	"H" output current	V_{OL} = V_{DD} - 0.4 V (CMOS 3.0 mA type)	-3.00	-	-	mA
		V_{OL} = V_{DD} - 0.4 V (CMOS 6.0 mA type)	-6.00	-	-	mA
		V_{OL} = V_{DD} - 0.4 V (CMOS 12.0 mA type)	-12.00	-	-	mA
		V_{OL} = V_{DD} - 0.4 V (CMOS 18.0 mA type)	-18.00	-	-	mA
V_{OL}	"L" output voltage	I_{OL} = 0 mA	-	-	V_{SS} + 0.4	V
V_{OH}	"H" output voltage	I_{OH} = 0 mA	V_{DD} - 0.4	-	-	V

*1: The static supply current (IDSS) does not include the current that flows into the resistor in the resistor built-in block (pull-up/pull-down resistors, oscillation circuit).

*2: The pull-up and pull-down resistance values change according to the input voltage and output voltage.

*3: 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°C, V_{DD} = 5 V±10%)

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

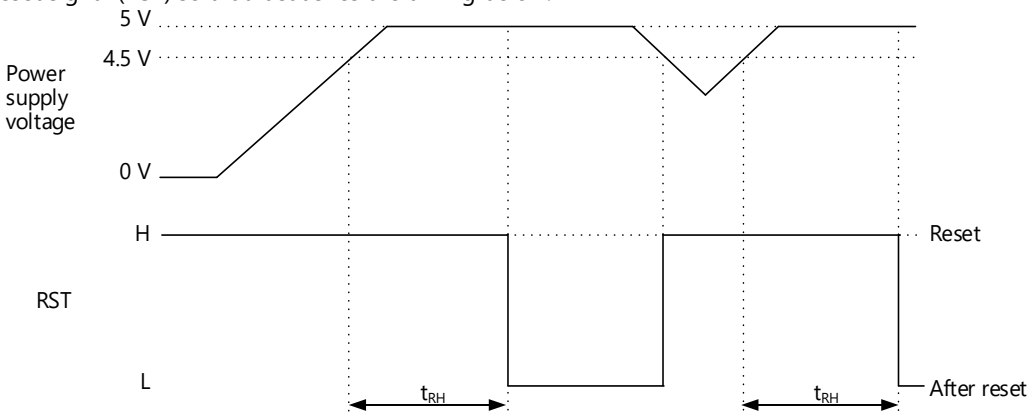
3.5.5 I/O capacitance (T_A = +25°C, V_{DD} = 0 V)

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

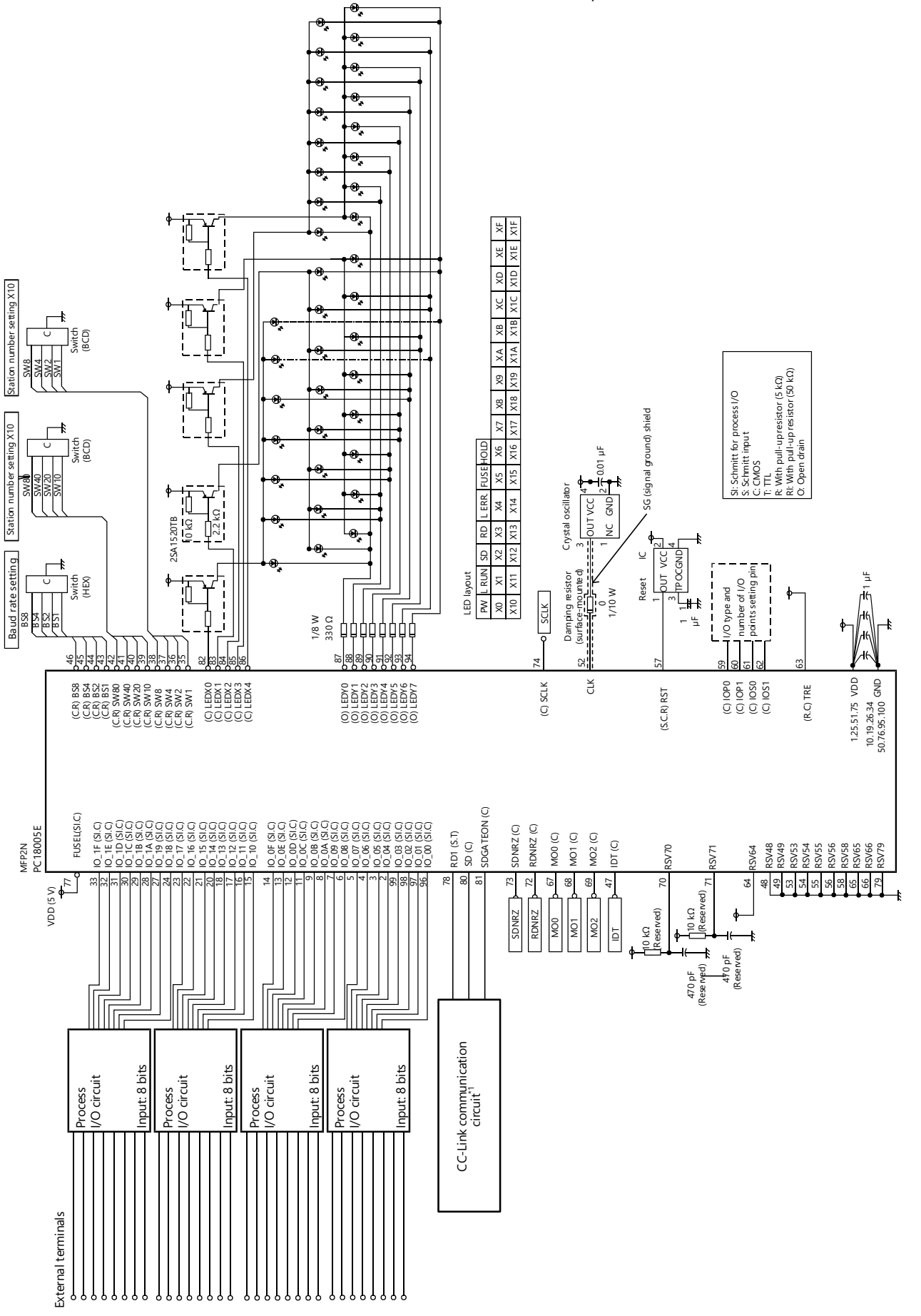
5. REMOTE I/O STATION CIRCUIT DIAGRAM EXAMPLES

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 input 32-point 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)

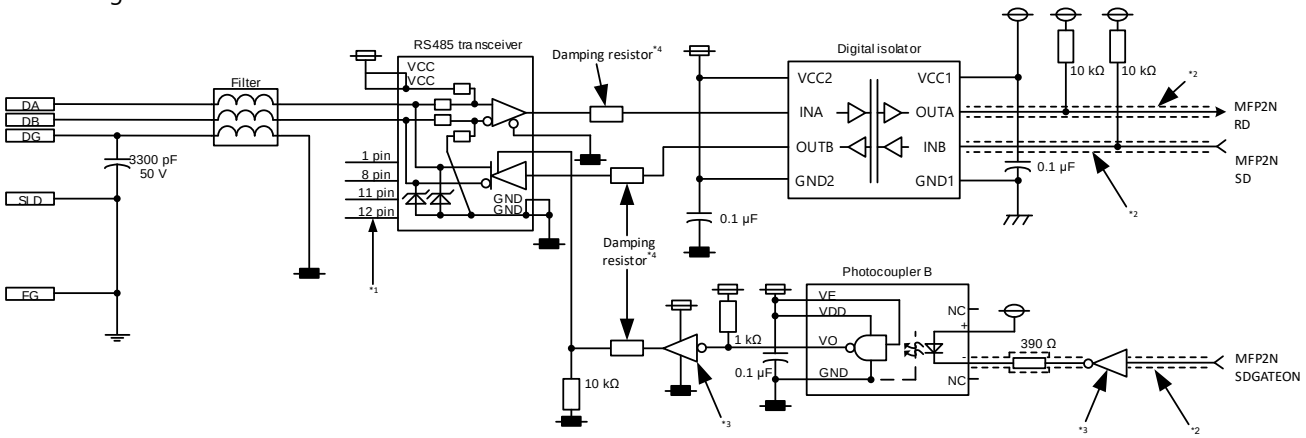
For the CC-Link communication circuits, refer to the following examples of the CC-Link communication circuit diagrams.

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

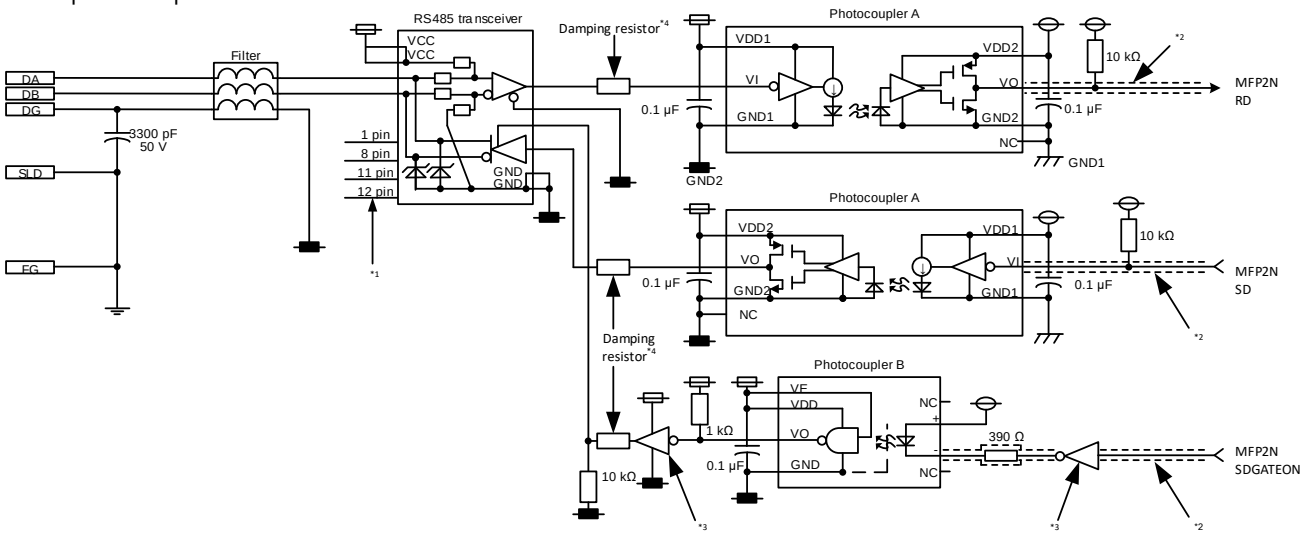
5.2.1 CC-Link communication circuit diagrams (isolated types)

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.

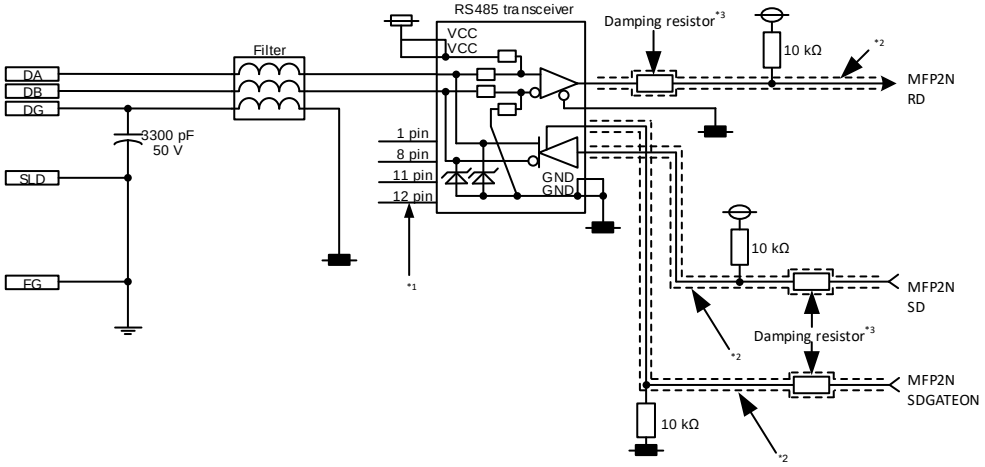
*2: Make the traces between the "SD", "RD", and "SDGATEON" and the photocoupler or digital isolator as short as possible, and shield them with signal ground (SG) lines.

*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 circuit.



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

*2: Shield "RD", "SD", and "SDGATEON" between MFP2N 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 MFP2N 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

(5) Precautions for remote I/O station circuit

(a) Make the traces between the crystal oscillator and MFP2N 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 MFP2N. (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 (MFP2N).

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

For the following components to be used in the CC-Link commnication circuit, use CC-Link Partner Association recommended components.

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

6.3 MFP2N

MFP2N can be purchased from your Mitsubishi Electric dealer network. For prices, please ask your dealer. MFP2N is the lead-free/RoHS Directive compliant product.

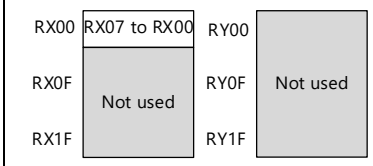
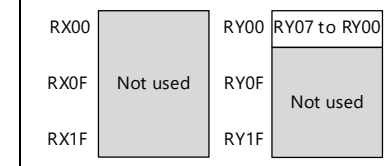
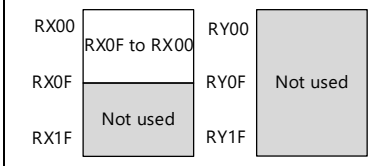
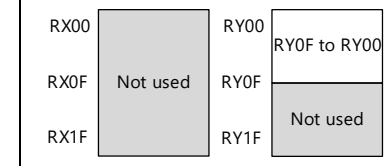
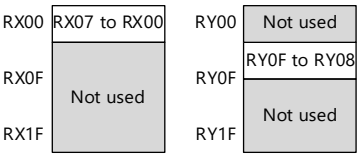
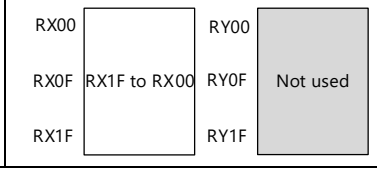
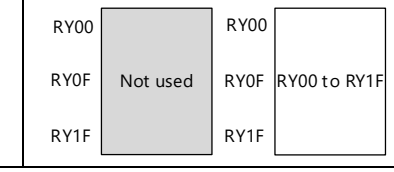
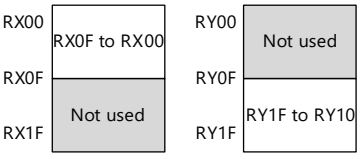
Product	Model	Package unit	Manufacturer
MFP2N (PC18005E)	A6GA-CCMFP2NN60FN	60 pieces	Mitsubishi Electric Corporation
	A6GA-CCMFP2NN300FN	300 pieces	

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

I/O type setting pin name		Number of I/O points setting pin name		Combination	I/O pin (Pin name = IO_**)				LED (Pin name = LED**)			
IOS1	IOS0	IOP1	IOP0		0 to 7	8 to F	10 to 17	18 to 1F	0 to 7	8 to F	10 to 17	18 to 1F
L	H	L	H	Input 8 points	○	GND	GND	GND	○	OPEN	OPEN	OPEN
H	L	L	H	Output 8 points	○	GND	GND	GND	○	OPEN	OPEN	OPEN
L	H	H	H	Input 16 points	○	○	GND	GND	○	○	OPEN	OPEN
H	L	H	H	Output 16 points	○	○	GND	GND	○	○	OPEN	OPEN
H	H	H	H	Input 8 points, output 8 points (combined)	○	○	GND	GND	○	○	OPEN	OPEN
L	H	H	L	Input 32 points	○	○	○	○	○	○	○	○
H	L	H	L	Output 32 points	○	○	○	○	○	○	○	○
H	H	H	L	Input 16 points, output 16 points (combined)	○	○	○	○	○	○	○	○

(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.
(5) When IOS1 is set to "L" and IOS0 is set to "L", all valid points specified by IOP1 and IOP0 will become bit inputs.
(6) When the I/O pins (IO_00 to IO_1F) set to valid using the I/O type setting pins and the number of I/O points setting pins are not used, connect the output to OPEN and the input to GND.
(7) The bit data of LED can be turned on only for the number of points set by IOP0 and IOP1.

I/O assignment
The following are the data areas to be used by MFP2N within the data area (RX/RY: 32 bits) of one station.

I/O type / Number of I/O points	Input type	Output type	I/O combined type
8 points			Cannot be set.
16 points			
32 points			

7.2 Station Number and Baud Rate Settings

The station number and baud rate settings are set at active "L". 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	
POWER	L RUN	L ERR.	SD	RD		Y output
○	○	☼	☼	○	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

MFP2N outputs the I/O status for the number of I/O points (32 points maximum) to the LEDs using the dynamic scanning method.

	LEDX0	LEDX1	LEDX2	LEDX3	LEDX4
LEDY0	"PW"	L0	L8	L10	L18
LEDY1	"L RUN"	L1	L9	L11	L19
LEDY2	"SD"	L2	LA	L12	L1A
LEDY3	"RD"	L3	LB	L13	L1B
LEDY4	"L ERR."	L4	LC	L14	L1C
LEDY5	(Reserved)	L5	LD	L15	L1D
LEDY6	"FUSE"	L6	LE	L16	L1E
LEDY7	"HOLD"	L7	LF	L17	L1F

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

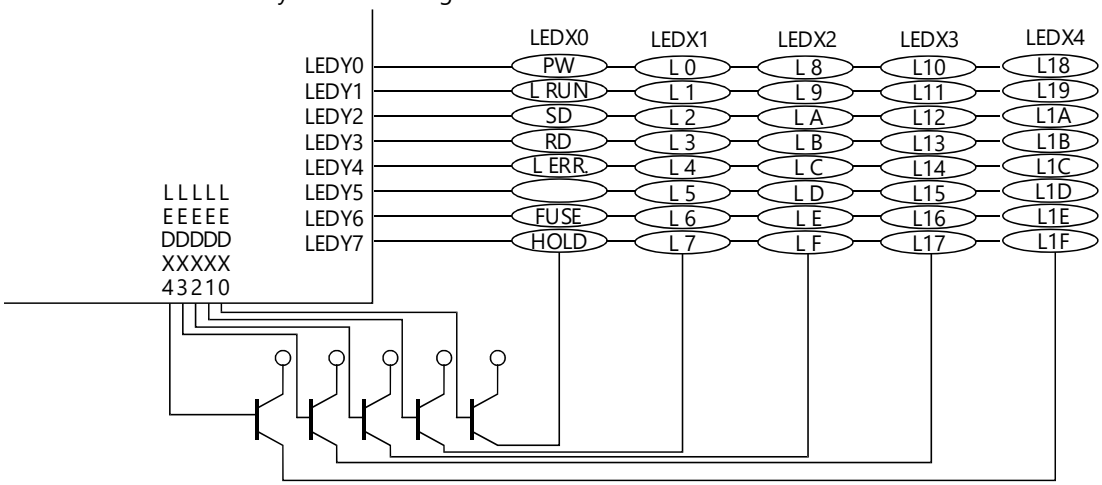
The on/off status of LEDs is automatically controlled by the MFP2N internal circuit.

Point

L** can be turned on only for the number of actual I/O points (the number of points set by IOP0 and IOP1).
[Example]
• For the input 8-bit type: The input status is output to L0 to L7.
L8 to L1F are always off (cannot be turned on).
• For the input 16-bit and output 16-bit combined type:
The input status is output to L0 to LF.
The output status is output to L10 to L1F.

(2) Example of LED connections

LED indication uses the 8 × 5 dynamic scanning method.



LEDY0 to LEDY7 drive directly, and LEDX0 to LEDX4 drive indirectly via externally attached Tr.

9. MONITOR PINS

MFP2N has the following monitor pins.

- SDNRZ : For send data before modulation
- RDNRZ : For receive data after demodulation
- IDT : For bit data I/O circuit (MFP2N external) delay
- SCLK : For transmission clock (= frequency based on the baud rate setting)
- MO0 :
- MO1 : } For receive address (A2)
- MO2 :

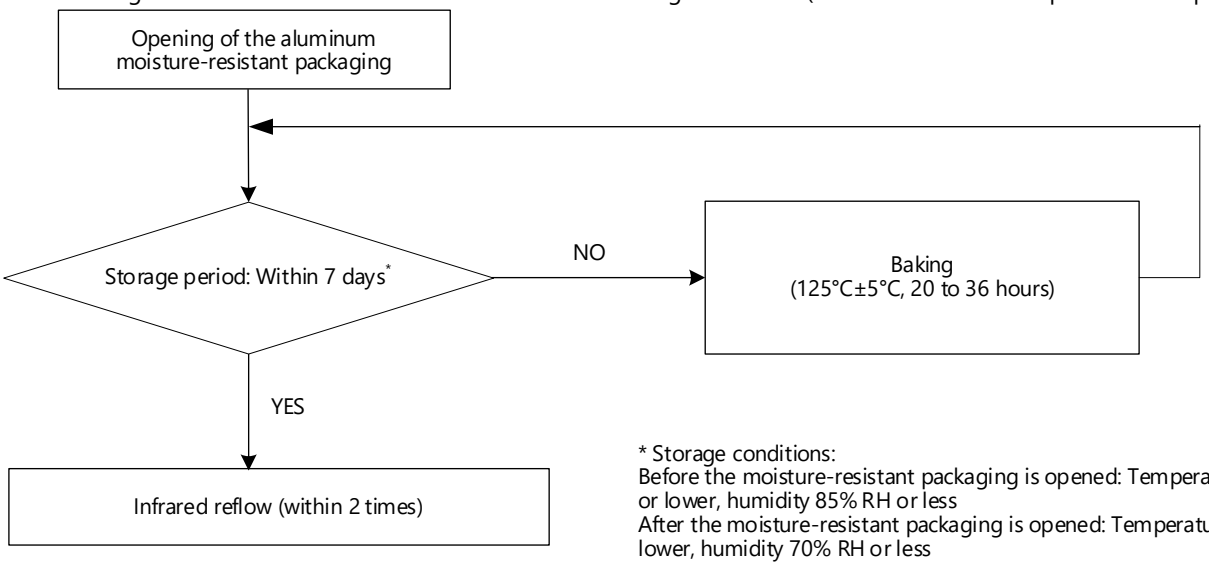
MO0	MO1	MO2	Receive address
L	H	H	FFH (Refresh and polling)
H	L	H	FEH (Polling)
L	L	H	FDH (Test refresh and polling)
H	H	L	FCH (Test polling)

(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).



* Storage conditions:
Before the moisture-resistant packaging is opened: Temperature 30°C or lower, humidity 85% RH or less
After the moisture-resistant packaging is opened: Temperature 30°C or lower, humidity 70% RH or less

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.

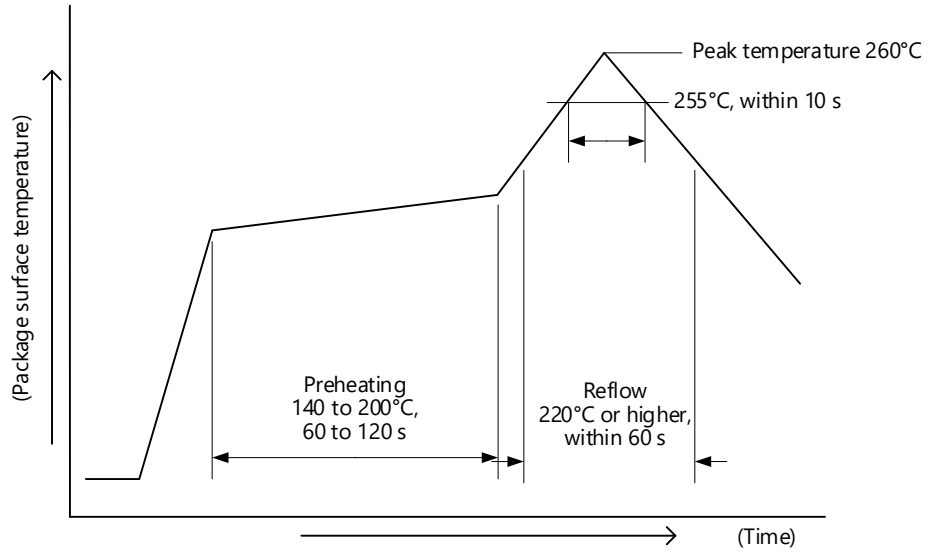
*: When performing manual soldering, be careful that the soldering iron does not come in contact with anything other than the package leads.

<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>



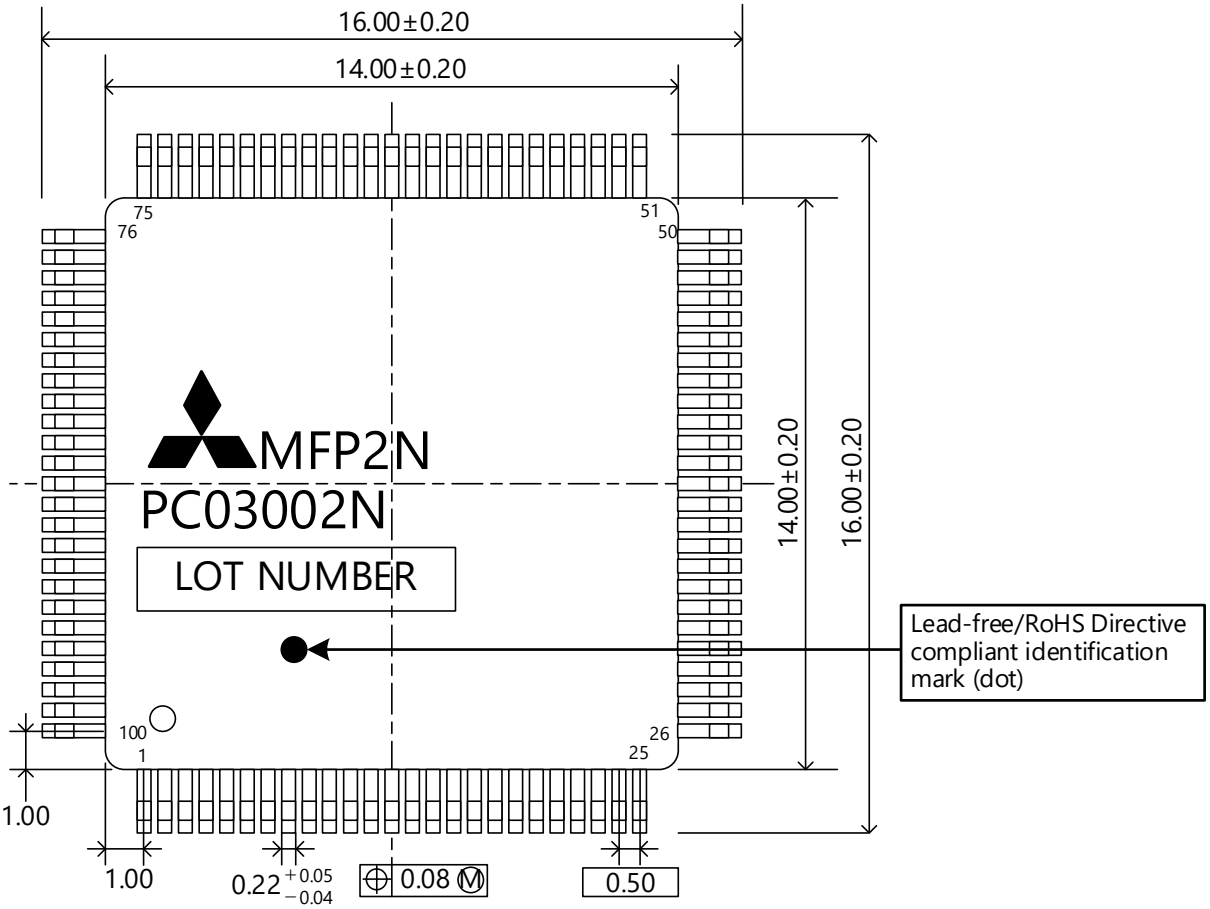
10.2 Precautions When Opening the Package

(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.

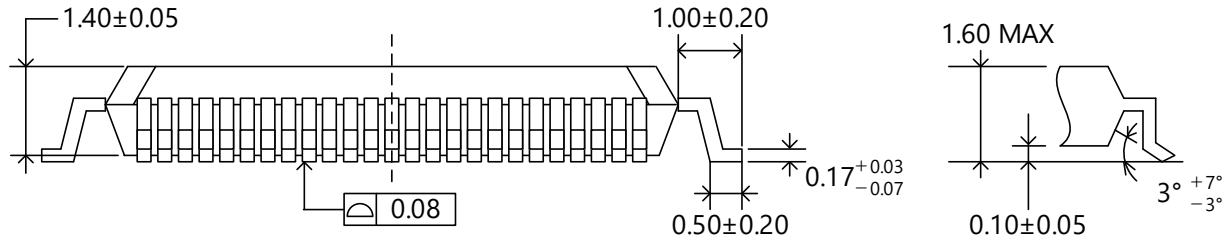
Appendix 1 MFP2N Previous Specifications

Appendix 1.1 External appearance (before March 2020)

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



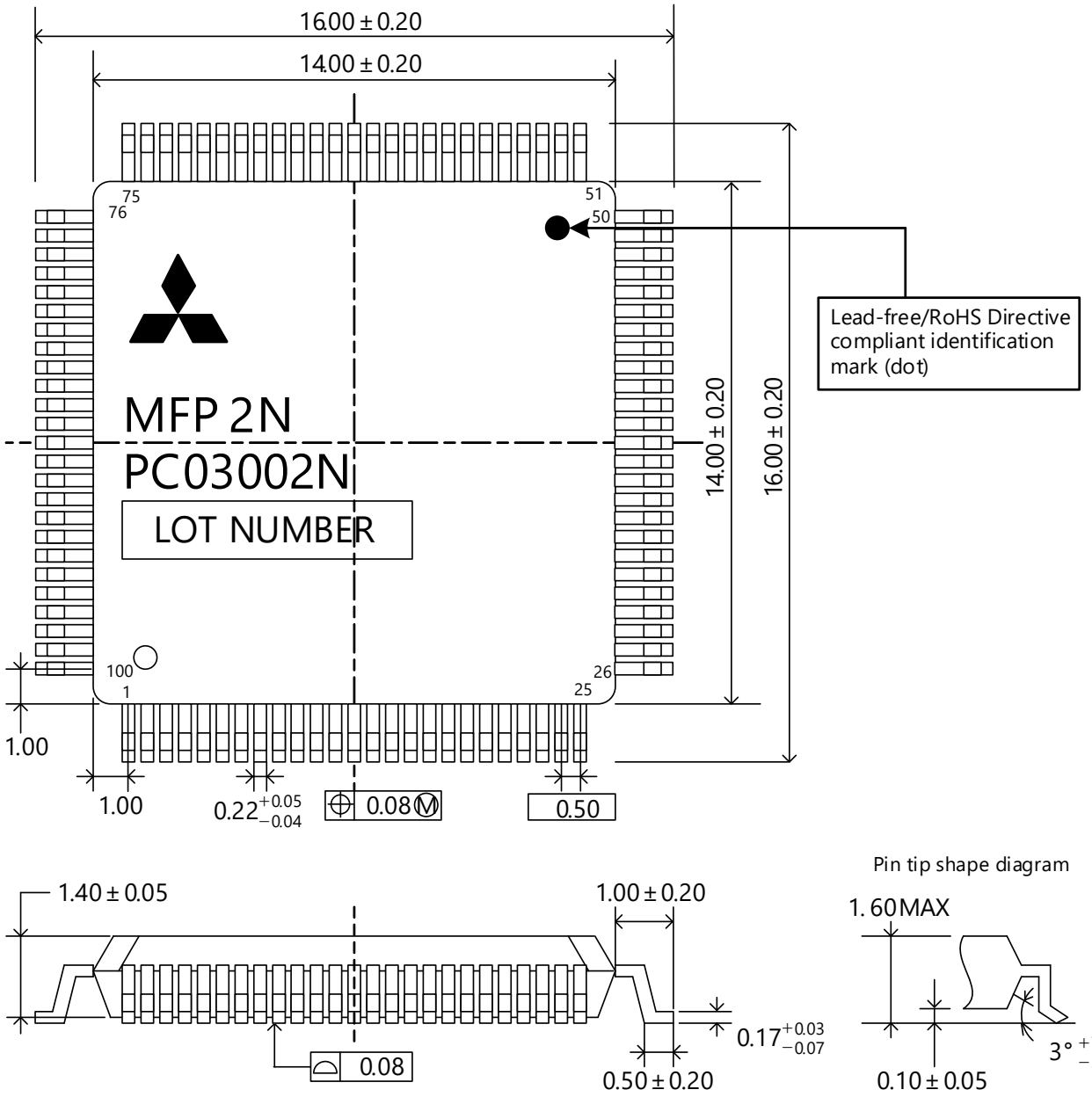
Pin tip shape diagram



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

Appendix 1.2 External appearance (before July 2014)

The following is the external appearance of MFP2N before July 2014.
Unit: mm



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

Appendix 2 Differences between PC03002N and PC18005E

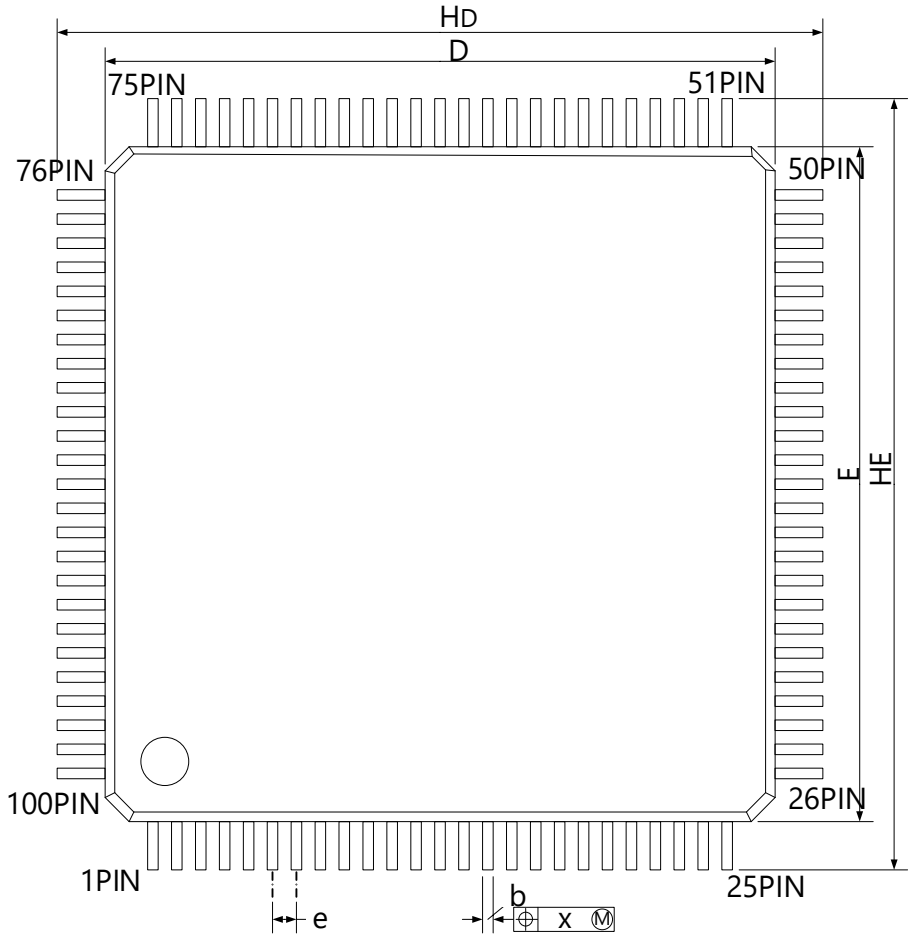
This section describes the differences between PC03002N and PC18005E.
Some specifications of PC18005E, such as electrical characteristics, have changed from the specifications of PC03002N.
Refer to this section when considering replacement.

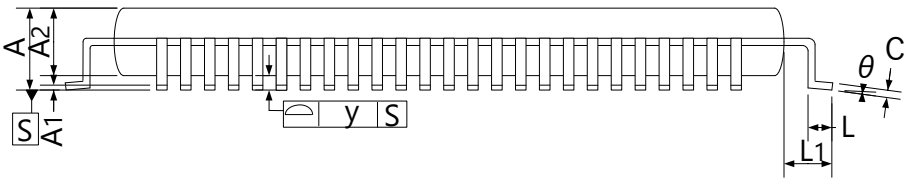
Appendix 2.1 Model names

Item	Discontinued model	Alternative model
Product	PC03002N	PC18005E
Model (package unit: 60 pieces)	A6GA-CCMFP2NN60F	A6GA-CCMFP2NN60FN
Model (package unit: 300 pieces)	A6GA-CCMFP2NN300F	A6GA-CCMFP2NN300FN
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	PC03002N			PC18005E		
	Min.	Nom.	Max.	Min.	Nom.	Max.
D	13.8	14.0	14.2	13.9	14.0	14.1
E	13.8	14.0	14.2	13.9	14.0	14.1
A	-	-	1.6	-	-	1.7
A1	0.095	0.1	0.105	0	0.1	0.2
A2	1.35	1.4	1.45	1.3	1.4	1.5
e	-	0.5	-	-	0.5	-
b	0.18	0.22	0.27	0.17	0.22	0.27
c	0.1	0.17	0.2	0.09	0.15	0.2
Θ	0°	3°	10°	0°	5°	10°
L	0.3	0.5	0.7	0.3	0.50	0.75
L1	0.8	1.0	1.2	0.8	1.0	1.2
HE	15.8	16.0	16.2	15.6	16.0	16.4
HD	15.8	16.0	16.2	15.6	16.0	16.4
x	-	-	0.08	-	-	0.08
y	-	-	0.08	-	-	0.08

Appendix 2.2.2 Print position specifications

For the print position of PC18005E, refer to Section 3.1 "External Appearance".
For the print position of PC03002N, refer to Appendix 1.1 "External appearance".

Appendix 2.3 Electrical characteristics

Appendix 2.3.1 Buffer types

I/O	Buffer type	PC03002N	PC18005E
I	Input Buffer (CMOS Level in)	FI01	IBC_SP1
I	Input Buffer (TTL Level in)	FI02	IBT_SP1
I	Input Buffer (CMOS-Schmitt in)	FIS1W	IBH_SP1
I	Input Buffer (TTL Schmitt in)	FIS2W	IBS_SP1
I	Input Buffer (CMOS Level in) with Pull-Up Resistor 5 kΩ	FIW1	IBCP3_SP1
I	Input Buffer (CMOS-Schmitt in) with Pull-Up Resistor 5 kΩ	FWS1W	IBHP3_SP1
O	N-Ch Open Drain Output Buffer (I_{OL} = 18 mA)	EXT5	OD3T_SP1
O	Output Buffer (CMOS Level out: I_{OL} = 12 mA)	FO02	OB3BT_SP1
O	Output Buffer (CMOS Level out: I_{OL} = 6 mA)	FO04	OB1BT_SP1
O	Output Buffer (CMOS Level out: I_{OL} = 3 mA)	FO09	OB1T
I/O	Low Noise Schmitt I/O Buffer (CMOS in: CMOS 3-state out: I_{OL} = 18 mA)	BF15W	BH3BT_SP1

Appendix 2.3.2 Absolute maximum ratings

Item		PC03002N			PC18005E			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} = 3 mA type	I_{OUT}	-	±10	I_{OUT}	-	±30	mA
	I_{OL} = 6 mA type		-	±15				mA
	I_{OL} = 12 mA type		-	±30				mA
	I_{OL} = 18 mA type		-	±40		-	±40	mA
Storage temperature		T_{stg}	-65	150	T_{stg}	-65	150	°C
Maximum current consumption	V_{DD} = 5 V	-	-	72	-	-	72	mA

Appendix 2.3.3 Recommended operating conditions

Item	PC03002N				PC18005E				Unit
	Symbol	Rated value			Symbol				
		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		PC03002N				PC18005E				Unit
		Symbol	Rated value			Symbol	Rated value			
			Min.	Typ.	Max.		Min.	Typ.	Max.	
"H" input voltage	CMOS	V_{IH1}	$0.7V_{DD}$	-	V_{DD}	V_{IH1}	3.5	-	V_{DD} + 0.3	V
	TTL	V_{IH2}	2.29	-	V_{DD}	V_{IH2}	2.29	-	V_{DD}	V
"L" input voltage	CMOS	V_{IL1}	0	-	0.3 V_{DD}	V_{IL1}	0	-	1.65	V
	TTL	V_{IL2}	0	-	0.77	V_{IL2}	0	-	0.77	V
Positive trigger voltage	CMOS	V_{T1+}	2.85	-	3.75	V_{T1+}	2.55	-	3.75	V
	TTL	V_{T2+}	1.68	-	2.55	V_{T2+}	1.38	-	2.55	V
Negative trigger voltage	CMOS	V_{T1-}	1.15	-	1.75	V_{T1-}	1.15	-	2.05	V
	TTL	V_{T2-}	0.64	-	1.33	V_{T2-}	0.64	-	1.33	V
Hysteresis voltage	CMOS	ΔV	1.3	-	2.07	ΔV	1.1	-	-	V
	TTL	V_{H2}	0.83	-	1.44	V_{H2}	0.64	-	-	V
Input leak current		I_{L1}	-10	$\pm10^{-5}$	10	I_{L1}	-5	-	5	μA
Output leak current		I_{OZ}	-10	-	10	I_{OZ}	-5	-	5	μA
Pull-up resistance 50 kΩ		R_{PU}	17.2	38.2	100	R_{PD}	15	38	100	kΩ
Pull-up resistance 5 kΩ		R_{PU}	2.5	5.0	12.9	R_{PU}	2.5	5.0	12.9	kΩ
"L" output current	I_{OL} = 3 mA type	I_{OL}	3.0	-	-	I_{OL}	3.0	-	-	mA
	I_{OL} = 6 mA type		6.0	-	-		6.0	-	-	mA
	I_{OL} = 12 mA type		12.0	-	-		12.0	-	-	mA
	I_{OL} = 18 mA type		18.0	-	-		18.0	-	-	mA
"H" output current	I_{OL} = 3 mA type	I_{OH}	-3.0	-	-	I_{OH}	-3.0	-	-	mA
	I_{OL} = 6 mA type		-6.0	-	-		-6.0	-	-	mA
	I_{OL} = 12 mA type		-12.0	-	-		-12.0	-	-	mA
	I_{OL} = 18 mA type		-18.0	-	-		-18.0	-	-	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}	-	-	0.4	V
Static supply current (T_A = -40 to 85°C)		I_{DDS}	-	-	100	I_{DDS}	-	-	100	μA

Appendix 2.3.5 AC characteristics

Item	Condition	PC03002N				PC18005E				Unit
		Symbol	Rated value			Symbol	Rated value			
			Min.	Typ.	Max.		Min.	Typ.	Max.	
Output rising time	C_L = 15 pF	t_r	-	1.23	-	t_r	-	2.5	-	ns
Output falling time		t_f	-	1.62	-	t_f	-	2.5	-	ns

Appendix 2.3.6 I/O capacitance

Item	Condition	PC03002N				PC18005E				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.

PC03002N			PC18005E		
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

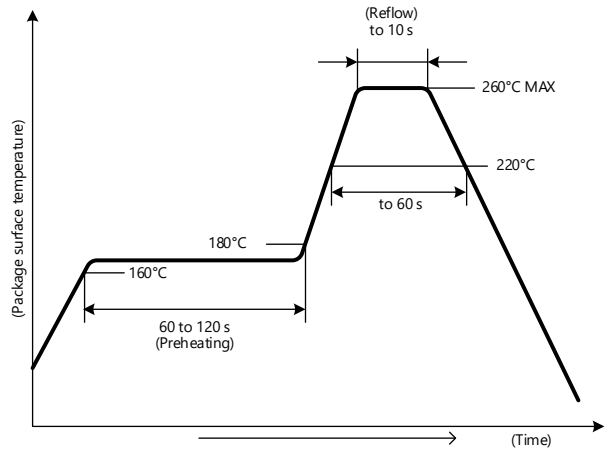
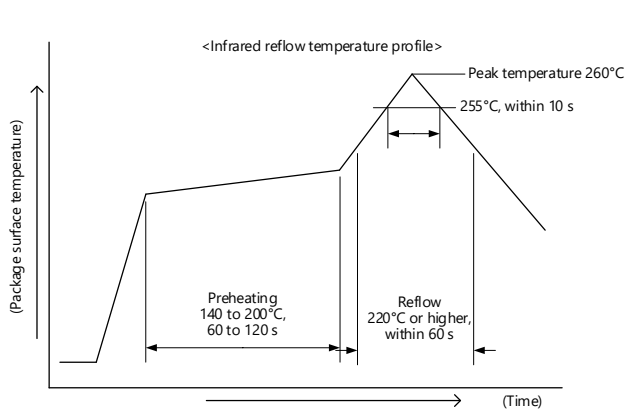
For the latest information of the specified components, check the technical bulletins.
For the production status, contact each manufacturer.

Appendix 2.5 Handling precautions

Appendix 2.5.1 Recommended conditions

Item	PC03002N	PC18005E
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

PC03002N	PC18005E
	

Revisions

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

Print date	*Manual number	Revision
December 2005	SH(NA)-080622ENG-A	First edition
June 2006	SH(NA)-080622ENG-B	Modified Section 6.1
November 2006	SH(NA)-080622ENG-C	Modified Section 5.1, 5.2
January 2010	SH(NA)-080622ENG-D	Added Section 3.3.2, 3.3.3 Modified Related Materials: Section 3.5.2, 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)-080622ENG-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)-080622ENG-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, Section 7.1, Chapter 8, Chapter 10 Added CC-Link Partner Association (CLPA), Trademarks, APPENDIX Deleted RELATED MATERIALS
May 2020	SH(NA)-080622ENG-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 to 3.3.6, Sections 3.5.1 to 3.5.5, Sections 6.1 to 6.3, Section 7.2, Section 10.1, Appendix 1 Added Relevant Manual, Terms, Appendix 2 Deleted INTRODUCTION
August 2021	SH(NA)-080622ENG-H	Modified Back cover, Notes Regarding This Manual, Chapter1, Sections 3.2, 6.1, 7.2, Appendix 2.4, Warranty Added Usage Precautions, Address Notation, Radix Notation
March 2022	SH(NA)-080622ENG-J	Added/Modified Section 6.1, Appendix 2.4
February 2024	SH(NA)-080622ENG-K	Modified Security Precautions, Conditions of Use for the Product, Sections 1.1, 5.1, 5.2, 6.2

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

SH(NA)-080622ENG-K(2402)MEE
MODEL: CC-LINK-MFP2N-R-E
MODEL CODE: 13JV13

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