

## 4-BIT SINGLE CHIP OTP MICRO CONTROLLER

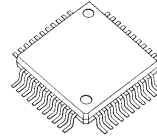
### ■ GENERAL DESCRIPTION

The **NJU3555** is the C-MOS 4-bit Single Chip OTP type Micro Controller with programmable Flash Memory.

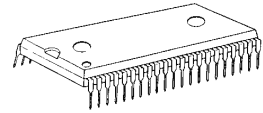
It is completely compatible with the **NJU3505** in function and the pin configuration. Therefore, the **NJU3555** is suitable for the final evaluation before **NJU3505** mask generation, the small quantity production and short lead-time.

\* In this data sheet, only OTP programming and the difference between **NJU3555** and **NJU3505** are mentioned mainly. Therefore the detail function and specification should be referred on the **NJU3505** data sheet.

### ■ PACKAGE OUTLINE



NJU3555FA1



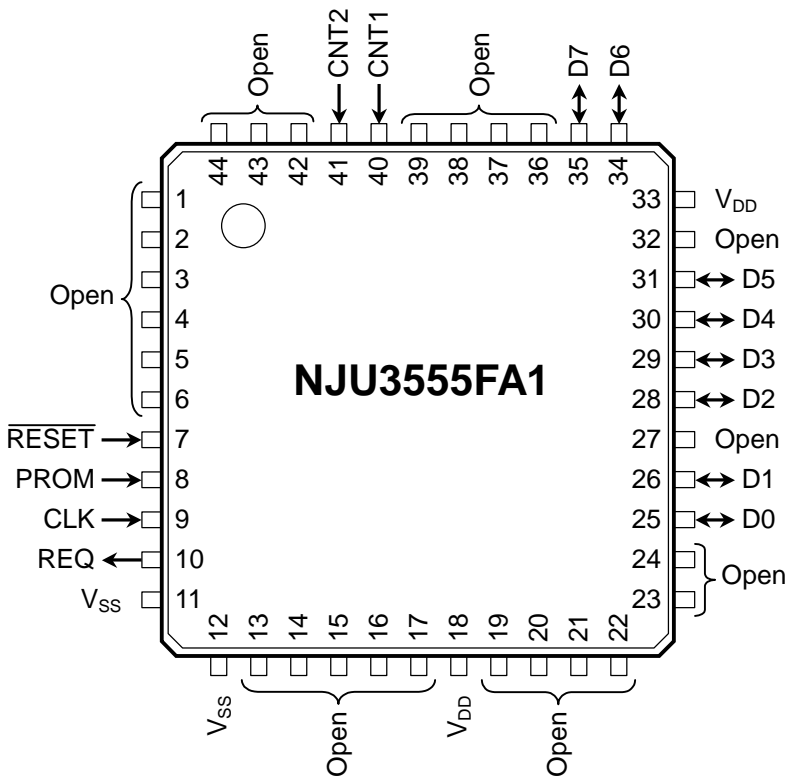
NJU3555L

### ■ FEATURES

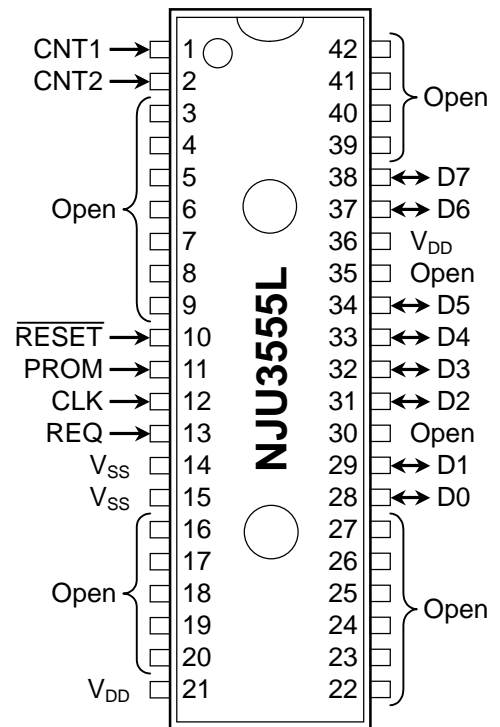
- Internal One Time Programmable ROM 8,192 X 8bits
  - ┌ 8,128 X 8bits (Program area)
  - └ 64 X 8bits (Option area)
- Internal Data RAM 256 X 4bits
- Wide operating voltage range 2.7V ~ 5.5V
- Package outline QFP44-A1 / SDIP42 (Compatible with **NJU3505**)
- ROM programmer "SUPERPRO/L" by XELTEK co.,

### ■ PIN CONFIGURATION IN OTP PROGRAMMING MODE

[ QFP44-A1 ]

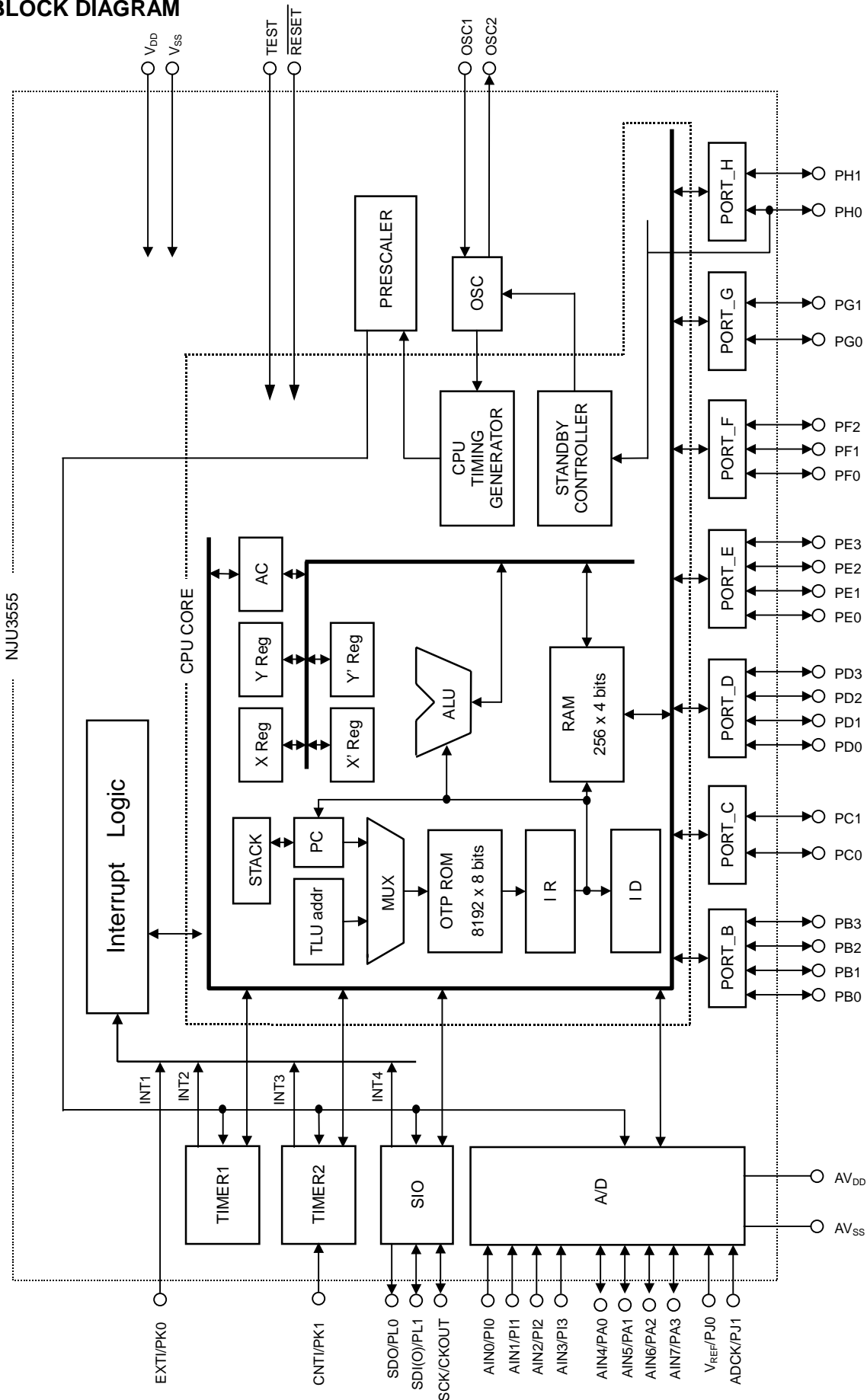


[ SDIP42 ]



Note) The pin configuration in Normal operating mode is the same as **NJU3505**.

## ■ BLOCK DIAGRAM



\* Refer [INPUT OUTPUT TERMINAL TYPE]

## ■ TERMINAL DESCRIPTION IN OTP PROGRAMMING MODE

No.		SYMBOL	INPUT / OUTPUT	FUNCTION
NJU 3555F	NJU 3555L			
7	10	$\overline{\text{RESET}}$	INPUT	RESET terminal. When the low-level input-signal, the system is initialized.
25, 26, 28-31, 34, 35	28, 29, 31-34, 37, 38	D0 - D7	INPUT/OUTPUT	Data bus
1	40,	CNT1	INPUT	OTP control input terminal
2	41	CNT2	INPUT	
10	13	REQ	OUTPUT	Request output terminal
9	12	CLK	INPUT	Clock input terminal
8	11	PROM	INPUT	OTP programming enable terminal
18, 33	21, 36	V <sub>DD</sub>	-	Power Source (5V)
11, 12	14, 15	V <sub>SS</sub>	-	Power Source (0V)

- Note 1) Use at V<sub>DD</sub>=5V in OTP programming mode.  
 2) Non connect anything to the other terminals.

# NJU3555

## ■ Difference between NJU3555 (OTP version) and NJU3505 (MASK version)

### ● Operating mode

**NJU3555** has two operating modes. One is "Normal operating mode" and the other is "OTP programming mode".

#### • Normal operating mode

The "TEST" terminal is set to low level. (The terminal is recommended to connect to GND.)  
Operating voltage range; 2.7V ~ 5.5V.

#### • OTP Programming mode

User program is read out from or written into the OTP by the universal programmer "SUPERPRO/L" and converting adapter made by XELTEK co.,(USA).

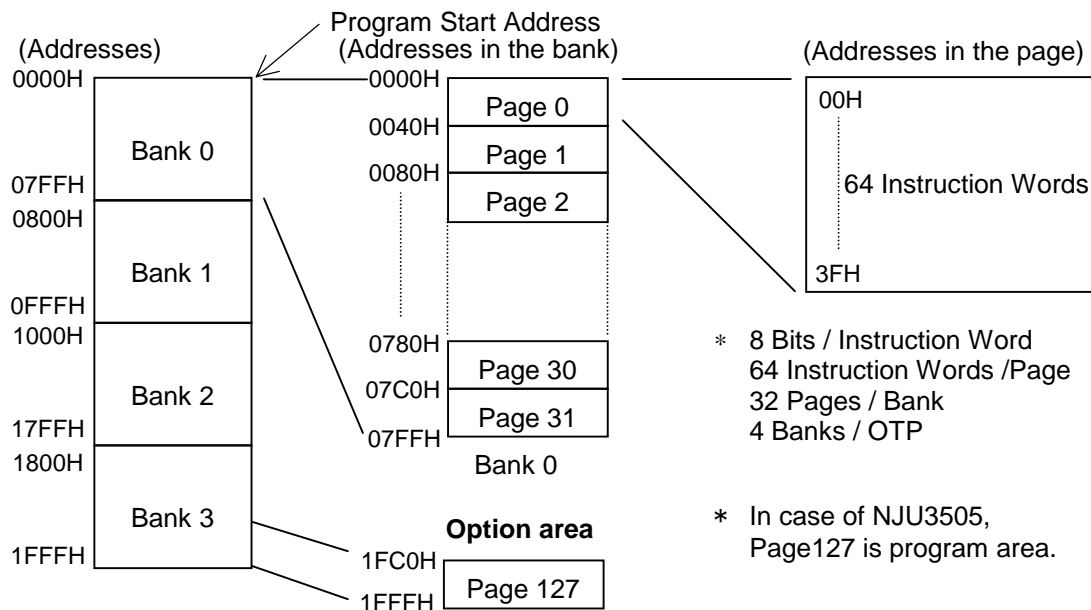
### ● Programming memory (OTP)

The address location of programming memory (OTP) of **NJU3555** is compatible with the masked ROM of **NJU3505**, excepting the option area.

The option area is located in page 127(64bytes) in the following.

**Program Area** : Addresses 0000H ~ 1FBFH : 8,128bytes  
**Option Area** : Addresses 1FC0H ~ 1FFFH : 64bytes

### [ PROGRAM MEMORY AREA ]



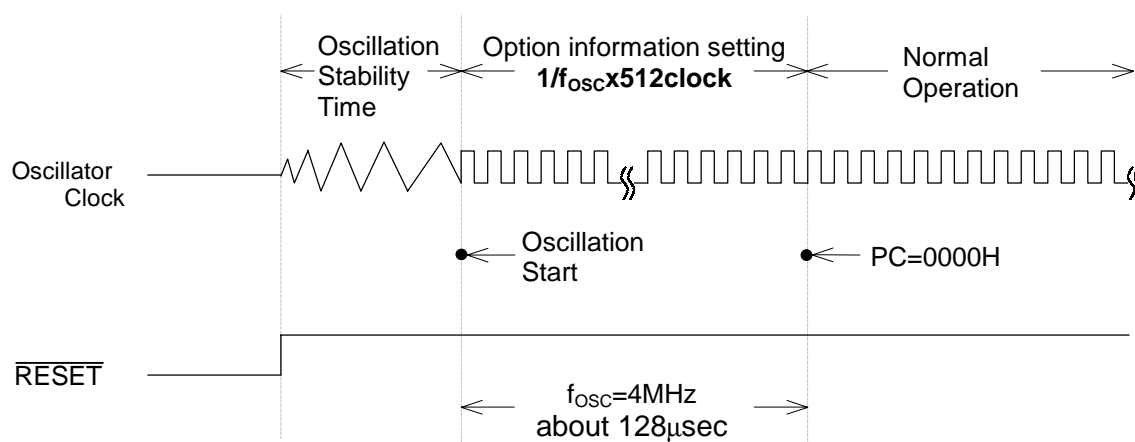
- Reset Terminal Type

	NJU3555	NJU3505
Internal Pull-up Resistance	With Pull-up	Without Pull-up

- Option information set in the initialization

When the initialization is performed ( $\overline{\text{RESET}}$  terminal is "L"), the operation information stored in option area is set as shown in the following timing chart. The option information is set in the term of  $1 / f_{\text{osc}} \times 512\text{clock}$  after RESET releasing and oscillation stability time. After information set, the program counter is set to 0000H and the NJU3555 operates in normal.

[ TIMING CHART ]



# NJU3555

## ■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)			
PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V <sub>DD</sub>	-0.3 ~ +7.0	V
Input Voltage	V <sub>IN</sub>	-0.3 ~ V <sub>DD</sub> + 0.3	V
Output Voltage	V <sub>OUT</sub>	-0.3 ~ V <sub>DD</sub> + 0.3	V
Analog Supply Voltage	AV <sub>DD</sub>	-0.3 ~ V <sub>DD</sub> + 0.3	V
Analog Reference Voltage	V <sub>REF</sub>	-0.3 ~ AV <sub>DD</sub> + 0.3	V
Analog Input Voltage	AIN0 ~ AIN7	-0.3 ~ AV <sub>DD</sub> + 0.3	V
Operating Temperature	T <sub>opr</sub>	-20 ~ +75	°C
Storage Temperature	T <sub>stg</sub>	-55 ~ +125	°C

Note)

The difference of electrical characteristics between **NJU3555** (OTP version) and **NJU3505** (MASK version)

	<b>NJU3505</b>	→	<b>NJU3555</b>
•Supply Voltage (V <sub>DD</sub> ) MIN.	2.4V	→	2.7V
•Supply Current			
5V (I <sub>DD1</sub> ) Max.	1.2mA	→	30mA
(I <sub>DD2</sub> ) Max.	1.2mA	→	30mA
(I <sub>DD3</sub> ) Max.	1.6mA	→	30mA
(I <sub>DD4</sub> ) Max.	4.0mA	→	30mA
(I <sub>DD5</sub> ) Max.	4.0μA	→	20μA
3V (I <sub>DD1</sub> ) Max.	0.5mA	→	20mA
(I <sub>DD2</sub> ) Max.	0.5mA	→	20mA
(I <sub>DD3</sub> ) Max.	0.6mA	→	20mA
(I <sub>DD4</sub> ) Max.	1.0mA	→	20mA
(I <sub>DD5</sub> ) Max.	2.0μA	→	20μA

## ■ ELECTRICAL CHARACTERISTICS    DC CHARACTERISTICS    1-1

( $V_{DD}=3.6\sim 5.5V$ ,  $V_{SS}=0V$ ,  $T_a=-20\sim 75^{\circ}C$ )

PARAMETER	SYM BOL	CONDITIONS	MIN	TYP	MAX	UNIT	NOTE
Supply Voltage	$V_{DD}$	$V_{DD}$	3.6		5.5	V	
Supply Current	$I_{DD1}$	$V_{DD}$ $V_{DD}=5V$ , $f_{OSC}=2MHz$ X'tal Oscillation in Reset			30	mA	*3
	$I_{DD2}$	$V_{DD}$ $V_{DD}=5V$ , $f_{OSC}=2MHz$ Ceramic Oscillation in Reset			30	mA	*3
	$I_{DD3}$	$V_{DD}$ $V_{DD}=5V$ , $f_{OSC}=2MHz$ CR Oscillation in Reset			30	mA	*3
	$I_{DD4}$	$V_{DD}$ $V_{DD}=5V$ , $f_{OSC}=4MHz$ Operating (Except ADC)			30	mA	*3
	$I_{DD5}$	$V_{DD}$ $V_{DD}=5V$ , STANDBY Mode			20	$\mu A$	*3
	$I_{ADD}$	$AV_{DD}$ $AV_{DD}=V_{DD}=5V$ , $ADCK=225kHz$			3.0	5.0	mA
High-Level Input Voltage	$V_{IH1}$	AIN4/PA0~AIN7/PA3, PB0~PB3, PC0, PC1, PD0~PD3, PE0~PE3, AIN0/PI0~AIN3/PI3, SDI(O)/PL1, SCK/CKOUT	$0.7V_{DD}$		$V_{DD}$	V	*1
	$V_{IH2}$	PF0~PF2, PG0, PG1, PH0, PH1, $V_{REF}/PJ0$ , $ADCK/PJ1$ , $EXTI/PK0$ , CNTI/PK1, $\overline{RESET}$	$0.8V_{DD}$		$V_{DD}$	V	*1
	$V_{IH3}$	OSC1	$V_{DD}-1.0$		$V_{DD}$	V	
Low-level Input Voltage	$V_{IL1}$	AIN4/PA0~AIN7/PA3, PB0~PB3, PC0, PC1, PD0~PD3, PE0~PE3, AIN0/PI0~AIN3/PI3, SDI(O)/PL1, SCK/CKOUT	0		$0.3V_{DD}$	V	*1
	$V_{IL2}$	PF0~PF2, PG0, PG1, PH0, PH1, $V_{REF}/PJ0$ , $ADCK/PJ1$ , $EXTI/PK0$ , CNTI/PK1, $\overline{RESET}$	0		$0.2V_{DD}$	V	*1
	$V_{IL3}$	OSC1	0		1.0	V	

\*1 Input/output port is set as an Input terminal.

\*2 Input/output port is set as an Output terminal.

\*3 Except the current through Pull-up resistor.

## ■ ELECTRICAL CHARACTERISTICS DC CHARACTERISTICS 1-2

( $V_{DD}=3.6\sim 5.5V$ ,  $V_{SS}=0V$ ,  $T_a=-20\sim 75^{\circ}C$ )

PARAMETER	SYM BOL	CONDITIONS	MIN	TYP	MAX	UNIT	NOTE
High-Level Input Current	$I_{IH}$	$V_{DD}=5.5V$ , $V_{IN}=5.5V$ AIN4/PA0~AIN7/PA3, PB0~PB3, PC0, PC1, PD0~PD3, PE0~PE3, PF0~PF2, PG0, PG1, PH0, PH1, AIN0/PI0~AIN3/PI3, $V_{REF}/PJ0$ , ADCK/PJ1, EXTI/PK0, CNTI/PK1, SDI(O)/PL1, RESET, SCK/CKOUT			10	$\mu A$	*1
Low-Level Input Current	$I_{IL1}$	$V_{DD}=5.5V$ , $V_{IN}=0V$ Without pull-up resistance AIN4/PA0~AIN7/PA3, PB0~PB3, PC0, PC1, PD0~PD3, PE0~PE3, PF0~PF2, PG0, PG1, PH0, PH1, AIN0/PI0~AIN3/PI3, $V_{REF}/PJ0$ , ADCK/PJ1, EXTI/PK0, CNTI/PK1, SDI(O)/PL1, SCK/CKOUT			-10	$\mu A$	*1
	$I_{IL2}$	$V_{DD}=5.5V$ , $V_{IN}=0V$ With pull-up resistance AIN4/PA0~AIN7/PA3, PB0~PB3, PC0, PC1, PD0~PD3, PE0~PE3, PF0~PF2, PG0, PG1, PH0, PH1, AIN0/PI0~AIN3/PI3, $V_{REF}/PJ0$ , ADCK/PJ1, EXTI/PK0, CNTI/PK1, SDI(O)/PL1, RESET, SCK/CKOUT			-100	$\mu A$	*1
High-Level Output Voltage	$V_{OH}$	$I_{OH}=-100\mu A$ PD0~PD3, PE0~PE3, PF0~PF2, PG0, PG1, PH0, PH1, SDO/PL0, SDI(O)/PL1, SCK/CKOUT	$V_{DD}-0.5$			V	*2
Low-Level Output Voltage	$V_{OL1}$	$I_{OL1}=400\mu A$ PD0~PD3, PE0~PE3, PF0~PF2, PG0, PG1, PH0, PH1, SDO/PL0, SDI(O)/PL1, SCK/CKOUT			0.5	V	*2
	$V_{OL2}$	$I_{OL2}=15mA$ AIN4/PA0~AIN7/PA3, PB0~PB3, PC0, PC1			2.0	V	*2
Output Leakage Current	$I_{OD}$	$V_{DD}=5.5V$ , $V_{OH}=5.5V$ AIN4/PA0~AIN7/PA3, PB0~PB3, PC0, PC1			10	$\mu A$	*2
Input Capacitance	$C_{IN}$	Except $V_{DD}$ , $V_{SS}$ terminals $f_{OSC}=1MHz$ Other terminals : 0V		10	20	pF	

\*1 Input/output port is set as an Input terminal.

\*2 Input/output port is set as an Output terminal.

\*3 Except the current through Pull-up resistor.



## ■ ELECTRICAL CHARACTERISTICS    DC CHARACTERISTICS    2-1

( $V_{DD}=2.7\sim 3.6V$ ,  $V_{SS}=0V$ ,  $T_a=-20\sim 75^\circ C$ )

PARAMETER	SYM BOL	CON DITIONS	MIN	TYP	MAX	UNIT	NOTE
Supply Voltage	$V_{DD}$	$V_{DD}$	2.7		3.6	V	
Supply Current	$I_{DD1}$	$V_{DD}$ $V_{DD}=3V$ , $f_{OSC}=1MHz$ X'tal Oscillation in Reset			20	mA	*3
	$I_{DD2}$	$V_{DD}$ $V_{DD}=3V$ , $f_{OSC}=1MHz$ Ceramic Oscillation in Reset			20	mA	*3
	$I_{DD3}$	$V_{DD}$ $V_{DD}=3V$ , $f_{OSC}=1MHz$ CR Oscillation in Reset			20	mA	*3
	$I_{DD4}$	$V_{DD}$ $V_{DD}=3V$ , $f_{OSC}=2MHz$ Operating (Except ADC)			20	mA	*3
	$I_{DD5}$	$V_{DD}$ $V_{DD}=3V$ , STANDBY Mode			20	$\mu A$	*3
	$I_{ADD}$	$AV_{DD}$ $AV_{DD}=V_{DD}=3V$ , $ADCK=225kHz$		2.5	3.5	mA	*3
High-Level Input Current	$V_{IH1}$	AIN4/PA0~AIN7/PA3, PB0~PB3, PC0, PC1, PD0~PD3, PE0~PE3, AIN0/PI0~AIN3/PI3, SDI(O)/PL1, SCK/CKOUT	$0.8V_{DD}$		$V_{DD}$	V	*1
	$V_{IH2}$	PF0~PF2, PG0, PG1, PH0, PH1, $V_{REF}/PJ0$ , $ADCK/PJ1$ , $EXTI/PK0$ , CNTI/PK1, $\overline{RESET}$	$0.85V_{DD}$		$V_{DD}$	V	*1
	$V_{IH3}$	OSC1	$V_{DD}-0.3$		$V_{DD}$	V	
Low-Level Input Voltage	$V_{IL1}$	AIN4/PA0~AIN7/PA3, PB0~PB3, PC0, PC1, PD0~PD3, PE0~PE3, AIN0/PI0~AIN3/PI3, SDI(O)/PL1, SCK/CKOUT	0		$0.2V_{DD}$	V	*1
	$V_{IL2}$	PF0~PF2, PG0, PG1, PH0, PH1, $V_{REF}/PJ0$ , $ADCK/PJ1$ , $EXTI/PK0$ , CNTI/PK1, $\overline{RESET}$	0		$0.15V_{DD}$	V	*1
	$V_{IL3}$	OSC1	0		0.3	V	

\*1 Input/output port is set as an Input terminal.

\*2 Input/output port is set as an Output terminal.

\*3 Except the current through Pull-up resistor.

## ■ ELECTRICAL CHARACTERISTICS DC CHARACTERISTICS 2-2

( $V_{DD}=2.7\sim 3.6V$ ,  $V_{SS}=0V$ ,  $T_a=-20\sim 75^{\circ}C$ )

PARAMETER	SYM BOL	COND ITIONS	MIN	TYP	MAX	UNIT	NOTE
High-Level Input Current	$I_{IH}$	$V_{DD}=3.6V$ , $V_{IN}=3.6V$ AIN4/PA0~AIN7/PA3, PB0~PB3, PC0, PC1, PD0~PD3, PE0~PE3, PF0~PF2, PG0, PG1, PH0, PH1, AIN0/PI0~AIN3/PI3, $V_{REF}/PJ0$ , ADCK/PJ1, EXTI/PK0, CNTI/PK1, SDI(O)/PL1, RESET, SCK/CKOUT			10	$\mu A$	*1
Low-Level Input Current	$I_{IL1}$	$V_{DD}=3.6V$ , $V_{IN}=0V$ Without pull-up resistance AIN4/PA0~AIN7/PA3, PB0~PB3, PC0, PC1, PD0~PD3, PE0~PE3, PF0~PF2, PG0, PG1, PH0, PH1, AIN0/PI0~AIN3/PI3, $V_{REF}/PJ0$ , ADCK/PJ1, EXTI/PK0, CNTI/PK1, SDI(O)/PL1, SCK/CKOUT			-10	$\mu A$	*1
	$I_{IL2}$	$V_{DD}=3.6V$ , $V_{IN}=0V$ With pull-up resistance AIN4/PA0~AIN7/PA3, PB0~PB3, PC0, PC1, PD0~PD3, PE0~PE3, PF0~PF2, PG0, PG1, PH0, PH1, AIN0/PI0~AIN3/PI3, $V_{REF}/PJ0$ , ADCK/PJ1, EXTI/PK0, CNTI/PK1, SDI(O)/PL1, RESET, SCK/CKOUT			-100	$\mu A$	*1
High-Level Output Voltage	$V_{OH}$	$I_{OH}=-80\mu A$ PD0~PD3, PE0~PE3, PF0~PF2, PG0, PG1, PH0, PH1, SDO/PL0, SDI(O)/PL1, SCK/CKOUT	$V_{DD}-0.5$			V	*2
Low-Level Output Voltage	$V_{OL1}$	$I_{OL1}=350\mu A$ PD0~PD3, PE0~PE3, PF0~PF2, PG0, PG1, PH0, PH1, SDO/PL0, SDI(O)/PL1, SCK/CKOUT			0.5	V	*2
	$V_{OL2}$	$I_{OL2}=5mA$ AIN4/PA0~AIN7/PA3, PB0~PB3, PC0, PC1			1.0	V	*2
Output Leakage Current	$I_{OD}$	$V_{DD}=3.6V$ , $V_{OH}=3.6V$ AIN4/PA0~AIN7/PA3, PB0~PB3, PC0, PC1			10	$\mu A$	*2
Input Capacitance	$C_{IN}$	Except $V_{DD}$ , $V_{SS}$ terminals $f_{OSC}=1MHz$ Other terminals : 0V		10	20	pF	

\*1 Input/output port is set as an Input terminal.

\*2 Input/output port is set as an Output terminal.

\*3 Except the current through Pull-up resistor.

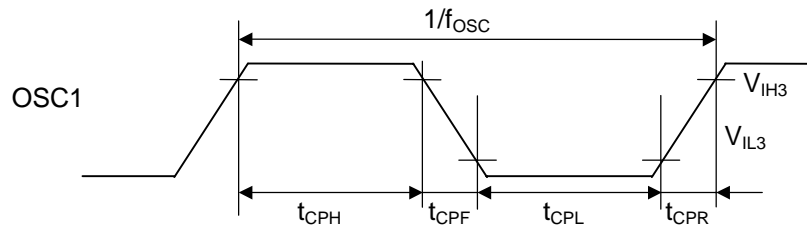
## ■ ELECTRICAL CHARACTERISTICS    AC CHARACTERISTICS    1

(V<sub>SS</sub>=0V, T<sub>a</sub>= -20~75°C)

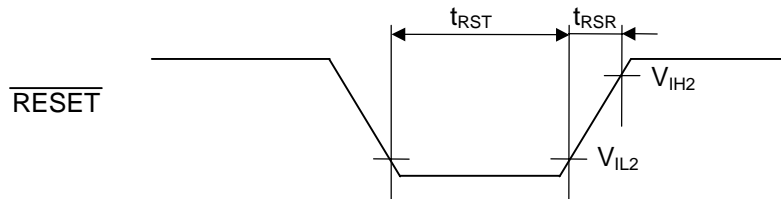
PARAMETER	SYM BOL	CONDITIONS		MIN	TYP	MAX	UNIT
Operating Frequency	f <sub>OSC</sub>	V <sub>DD</sub> =2.7~3.6V	X'tal Resonator	0.03		2.0	MHz
			Ceramic Resonator	0.03		2.0	
			External Resistor Oscillation	0.03		1.0	
				External Clock	0.03		
		V <sub>DD</sub> =3.6~5.5V	X'tal Resonator	0.03		4.0	
			Ceramic Resonator	0.03		4.0	
			External Resistor Oscillation	0.03		2.0	
				External Clock	0.03		
Instruction Cycle Time	t <sub>C</sub>			6/f <sub>OSC</sub>		s	
External Clock Pulse Width	t <sub>CPH</sub>	V <sub>DD</sub> =2.7~3.6V		250		16600	ns
	t <sub>CPL</sub>	V <sub>DD</sub> =3.6~5.5V		125		16600	
External Clock Rise Time Fall Time	t <sub>CPR</sub>	V <sub>DD</sub> =2.7~5.5V				20	ns
	t <sub>CPF</sub>						
RESET Low-Level Width	t <sub>RST</sub>	V <sub>DD</sub> =2.7~5.5V		4/f <sub>OSC</sub>			s
RESET Rise Time	t <sub>RSR</sub>	V <sub>DD</sub> =2.7~5.5V				20	ms
Port Input Level Width	t <sub>PIN</sub>	V <sub>DD</sub> =2.7~5.5V		6/f <sub>OSC</sub>			s
Edge Detection (PH1) Rise Time Fall Time	t <sub>EDR</sub>	V <sub>DD</sub> =2.7~5.5V				200	ns
	t <sub>EDF</sub>						
Restart Signal (PH0) Rise Time	t <sub>STR</sub>	V <sub>DD</sub> =2.7~5.5V				200	ns
External interrupt input (EXTI) Rise Time Fall Time	t <sub>EXR</sub>	V <sub>DD</sub> =2.7~5.5V				200	ns
	t <sub>EXF</sub>						
CNTI Clock Frequency	f <sub>CT</sub>	V <sub>DD</sub> =2.7~5.5V				f <sub>OSC</sub> /64	Hz
CNTI High-Level Width	t <sub>CT</sub>	V <sub>DD</sub> =2.7~5.5V		6/f <sub>OSC</sub>			s
CNTI Rise Time Fall Time	t <sub>CTR</sub>	V <sub>DD</sub> =2.7~5.5V				200	ns
	t <sub>CTF</sub>						

## AC CHARACTERISTICS 1 TIMING CHART

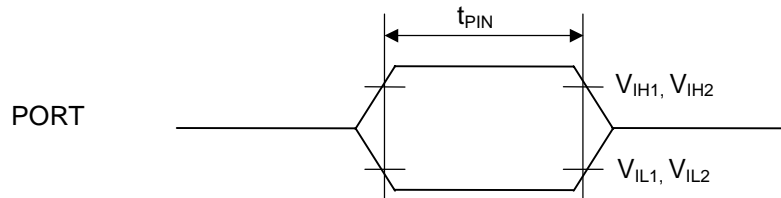
EXTERNAL CLOCK



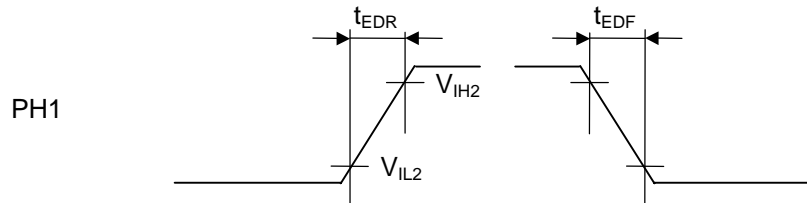
RESET INPUT



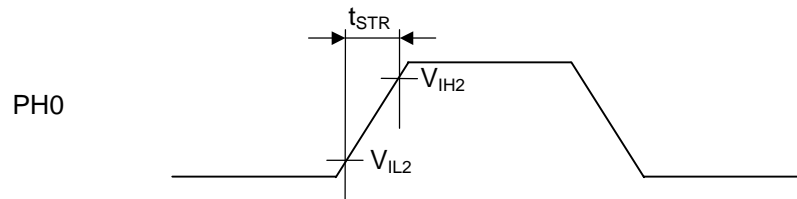
PORT INPUT



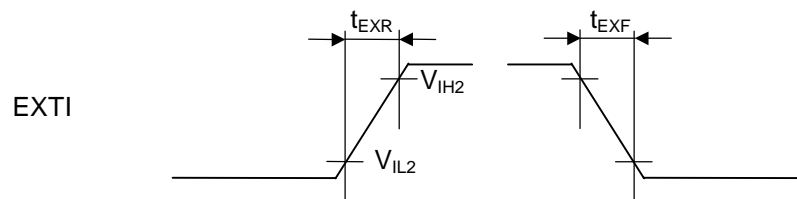
EDGE DETECTOR INPUT



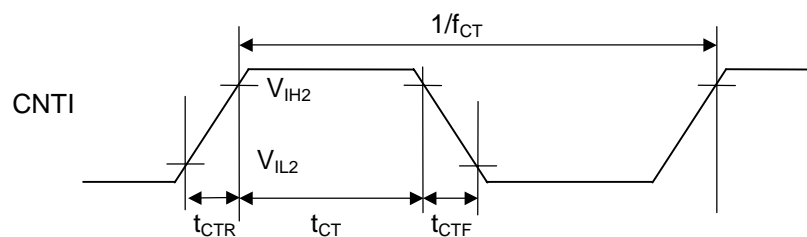
RESTART SIGNAL INPUT



EXTERNAL INTERRUPT



TIMER2 EXTERNAL CLOCK TIMING CHART



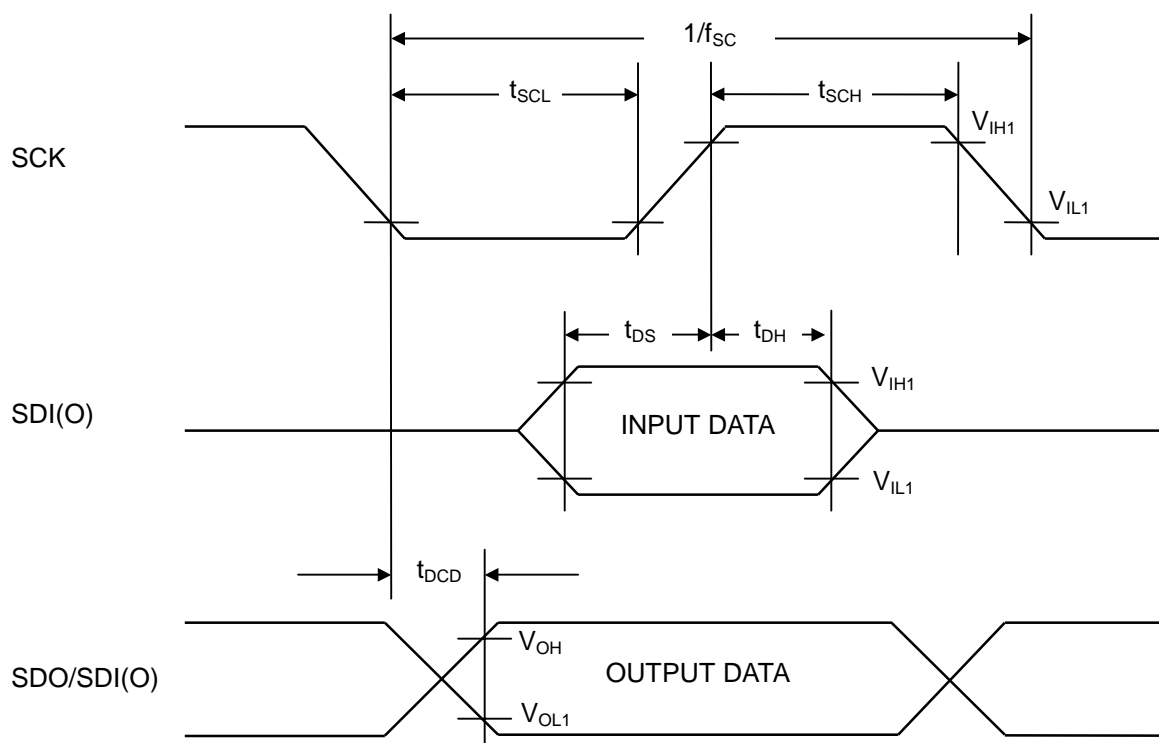
## ■ ELECTRICAL CHARACTERISTICS AC CHARACTERISTICS 2 SERIAL INTERFACE

(V<sub>SS</sub>=0V, V<sub>DD</sub>=2.7~5.5V, T<sub>a</sub>= -20~75°C)

PARAMETER	SYM BOL	CONDITIONS		MIN	TYP	MAX	UNIT
Serial Operating Frequency	f <sub>SC</sub>	Internal Clock				(1/12) × f <sub>OSC</sub> *	Hz
		External Clock				500k	
Clock Pulse Width Low-Level	t <sub>SCL</sub>	Internal Clock	V <sub>DD</sub> =2.7~3.6V f <sub>OSC</sub> =2MHz	3.0			μs
			V <sub>DD</sub> =3.6~5.5V f <sub>OSC</sub> =4MHz	1.5			
		External Clock		1.0			
Clock Pulse Width High-Level	t <sub>SCH</sub>	Internal Clock	V <sub>DD</sub> =2.7~3.6V f <sub>OSC</sub> =2MHz	3.0			μs
			V <sub>DD</sub> =3.6~5.5V f <sub>OSC</sub> =4MHz	1.5			
		External Clock		1.0			
SDI setup Time To SCK	t <sub>DS</sub>			0.5			μs
SDI Hold time To SCK	t <sub>DH</sub>			0.5			μs
SDO Data Fix Time To SCK	t <sub>DCD</sub>					0.5	μs

\* The dividing ratio of the internal clock is 1/2.

## ■ AC CHARACTERISTICS 2 SERIAL INTERFACE TIMING CHART



## ■ ELECTRICAL CHARACTERISTICS    A/D CONVERTER CHARACTERISTICS

( $V_{DD}=AV_{DD}=2.7\sim 5.5V$ ,  $V_{SS}=AV_{SS}=0V$ ,  $T_a=25^\circ C$ ,  $f_{OSC}=4MHz$ )

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Resolution	-		-	8	-	bits
Absolute Accuracy	-	$V_{DD}=5V$ , $AV_{DD}=5V$ , $V_{REF}=5V$			$\pm 2$	LSB
Conversion Time	$t_{CONV}$	$V_{DD}=5V$ , $AV_{DD}=5V$ , $V_{REF}=5V$	40			$\mu s$
Reference Voltage	$V_{REF}$		2.7		$AV_{DD}$	V
Analog Input Voltage	$V_{IA}$		$AV_{SS}$		$V_{REF}$	V
ADCK Frequency	$f_{ADCK}$				225	kHz

■ **OPTION as same as mask version (NJU3505)**

1) **INPUT OUTPUT Terminal Selection**

All of input-output terminals select a terminal type for each port from the following table1 and table2 by the mask option.

**[ CIRCUIT TYPE TABLE 1 ]**

SYMBOL	TERMINAL TYPES			EXTRA FUNCTION	REMARKS
	Input / Output Terminal*1				
	Port of Input	Port of Output	Programmable Input / Output		
AIN4 / PA0			IOP IO	AD : Analog input to ADC (AIN4)	
AIN5 / PA1			IOP IO	AD : Analog input to ADC (AIN5)	
AIN6 / PA2			IOP IO	AD : Analog input to ADC (AIN6)	
AIN7 / PA3			IOP IO	AD : Analog input to ADC (AIN7)	
PB0			IOP IO		
PB1			IOP IO		
PB2			IOP IO		
PB3			IOP IO		
PC0	ICP IC	ONP ON			
PC1	ICP IC	ONP ON			
PD0	ICP IC	OC			
PD1	ICP IC	OC			
PD2	ICP IC	OC			
PD3	ICP IC	OC			
PE0	ICP IC	OC			
PE1	ICP IC	OC			
PE2	ICP IC	OC			
PE3	ICP IC	OC			

Note) The symbol in the above table is the same as in mask option generator software.

\*1) The symbol and the detail circuits of INPUT OUTPUT TERMINAL are written in INPUT OUTPUT TERMINAL TYPE.

[ CIRCUIT TYPE TABLE 2 ]

SYMBOL	TERMINAL TYPES			EXTRA FUNCTION	REMARKS
	Input / Output Terminal*1				
	Port of Input	Port of Output	Programmable Input / Output		
PF0	ISP IS	OC			
PF1	ISP IS	OC			
PF2	ISP IS	OC			
PG0	ISP IS	OC			
PG1	ISP IS	OC			
PH0	ISP IS	OC		Restart signal input	E With restart input D Without restart input
PH1	ISP IS	OC		Edge detection	R Rise edge detection F Fall edge detection D Without edge detection
AIN0 / PI0	ICP IC			AD Analog input to ADC (AIN0)	
AIN1 / PI1	ICP IC			AD Analog input to ADC (AIN1)	
AIN2 / PI2	ICP IC			AD Analog input to ADC (AIN2)	
AIN3 / PI3	ICP IC			AD Analog input to ADC (AIN3)	
V <sub>REF</sub> / PJ0	ISP IS			AD Reference input (V <sub>REF</sub> )	
ADCK / PJ1 *2	ISP IS			ACP External clock input (ADCK) AC	
EXTI / PK0 *2	ISP IS			IIP External interrupt input (EXTI) II	R Rise interrupt input F Fall interrupt input
CNTI / PK1 *2	ISP IS			IIP External clock of Timer 2 input (CNTI) II	
SDO / PL0		OC		SO Serial data output	MSB MSB first
SDI(O) / PL1 *2	ICP IC	OC		SDP Serial data input/output SD	LSB LSB first
SCK / CKOUT *2 *3				SCP Serial clock input/output SC - Output clock divide by pre-scaler	

Note) The symbol in the above table is the same as in mask option generator software.

\*1) The symbol and the detail circuits of INPUT OUTPUT TERMINAL are written in INPUT OUTPUT TERMINAL TYPE.

\*2) The pull-up resistance is added to the terminal selected as the extra function.

\*3) When Serial INPUT-OUTPUT is selected, "SCK" is selected automatically. When it is not selected, "CKOUT" is selected automatically.

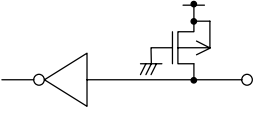
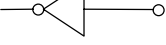
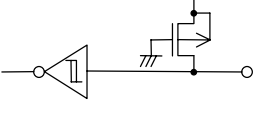
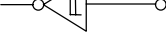
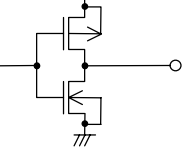
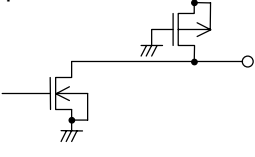
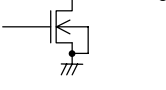
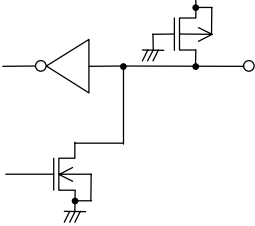
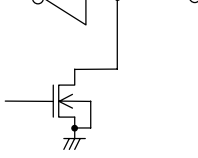


## [MASK OPTION LIST]

SYM BOL	FUNCTION
ICP	C-MOS input with pull-up resistance
ISP	C-MOS Schmitt trigger input with pull-up resistance
IC	C-MOS input
IS	C-MOS Schmitt trigger input
ONP	Nch-FET Open-Drain output with pull-up resistance
OC	C-MOS output
ON	Nch-FET Open-Drain output
IIP	External interrupt input with pull-up resistance
II	External interrupt input
SDP	Serial data input/output with pull-up resistance
SD	Serial data input/output
SO	Serial data output
SCP	Serial clock input/output with pull-up resistance
SC	Serial clock input/output
AD	A/D converter
ACP	External clock input with pull-up resistance for ADC
AC	External clock input for ADC
IOP	Programmable input/output with pull-up resistance
IO	Programmable input/output

SYM BOL	FUNCTION
R	Rise edge detection
F	Fall edge detection
D	Prohibition of edge detection
MSB	Serial data order MSB first
LSB	Serial data order LSB first
1	1/2
2	1/4
3	1/8
4	1/16
5	1/32
6	1/64
7	1/128
8	1/256
9	1/512
a	1/1024
b	1/2048
c	1/4096
E	permission
D	prohibit

## [ INPUT OUTPUT TERMINAL TYPE ]

	Types	With Pull-up	Without Pull-up	Terminals	
INPUT TERMINAL	C-MOS	Type ICP 	Type IC 	PC0, PC1, PD0~PD3, PE0~PE3, AIN0/PI0~ AIN3/PI3, SDI(O)/PL1	
	SCHMITT TRIGGER	Type ISP 	Type IS 	PF0~PF2, PG0, PG1, PH0, PH1, V <sub>REF</sub> /PJ0, ADCK/PJ1, EXTI/PK0, CNT1/PK1	
OUTPUT TERMINAL	C-MOS	/		Type ON 	PD0~PD3, PE0~PE3, PF0~PF2, PG0, PG1, PH0, PH1, SDO/PL0, SDI(O)/PL1
	N-channel(Nch) OPEN DRAIN	Type ONP 	Type ON 	PC0, PC1	
PROGRAMMABLE INPUT OUTPUT TERMINAL	C-MOS INPUT / Nch OPEN DRAIN OUTPUT	Type IOP 	Type IO 	AIN4/PA0~ AIN7/PA3, PB0~PB3	

## 2) Re-start signal Input Selection

PH0 terminal performs as the re-start terminal to return from "STANDBY" mode. It is selected by mask option.

The STANDBY mode is released by the rising edge of the input signal to PH0 terminal, and the CPU re-starts the execution from the last address before the STANDBY mode in.

## 3) Edge Detector Selection

PH1 terminal is added the "Edge detect function" by the mask option.



## 4) External Interrupt of the edge Selection

When the interrupt function is set by mask option. PK0 terminal performs as the interrupt input terminal. The polarity of the edge, rising as "low to high" or falling as "high to low", is selected by the mask option.



## 5) The data order (MSB, LSB) of the Serial Interface

The data order of the Serial Interface is selected select either MSB or LSB first by the mask option.

## 6) A/D Control Clock

A/D Control Clock is selected either the external clock from ADCK terminal or the internal clock from the prescaler by the mask option.

## 7) Dividing ration of the internal clock

Each dividing ration of the count clocks of Timer1 and Timer2, the Internal shift clock of the Serial Interface, the clock of the A/D control clock and the output clock through the SCK/CKOUT terminal is selected among the following by the mask option.

The frequency of each clock is determined by the dividing ration and the 1-instruction term ( $1/f_{OSC} \times 6$ ).

1/2, 1/4, 1/8, 1/16, 1/32, 1/64, 1/128, 1/256, 1/512, 1/1024, 1/2048, 1/4096

Note) As Timer2 clock, the external clock or the internal is selected by the program.

As the shift clock of the serial interface, the external clock or the internal is selected by the program.

**[CAUTION]**  
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