

## 4-BIT SINGLE CHIP OTP TINY CONTROLLER

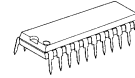
### ■ GENERAL DESCRIPTION

The **NJU3152** is the C-MOS 4-bit Single Chip OTP type Micro Controller with programmable Flash Memory.

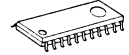
It is completely compatible with the **NJU3102** in function and the pin configuration. Therefore, the **NJU3152** is suitable for the final evaluation before **NJU3102** mask generation, the small quantity production and short lead-time.

\* In this data sheet, only OTP programming and the difference between **NJU3152** and **NJU3102** are mentioned mainly. Therefore the detail function and specification should be referred on the **NJU3102** data sheet.

### ■ PACKAGE OUTLINE



NJU3152L

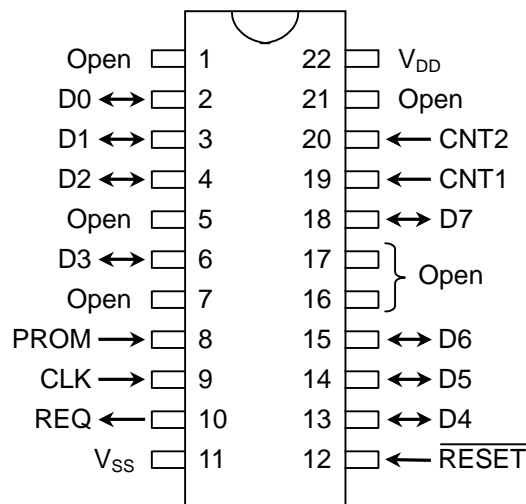


NJU3152G

### ■ FEATURES

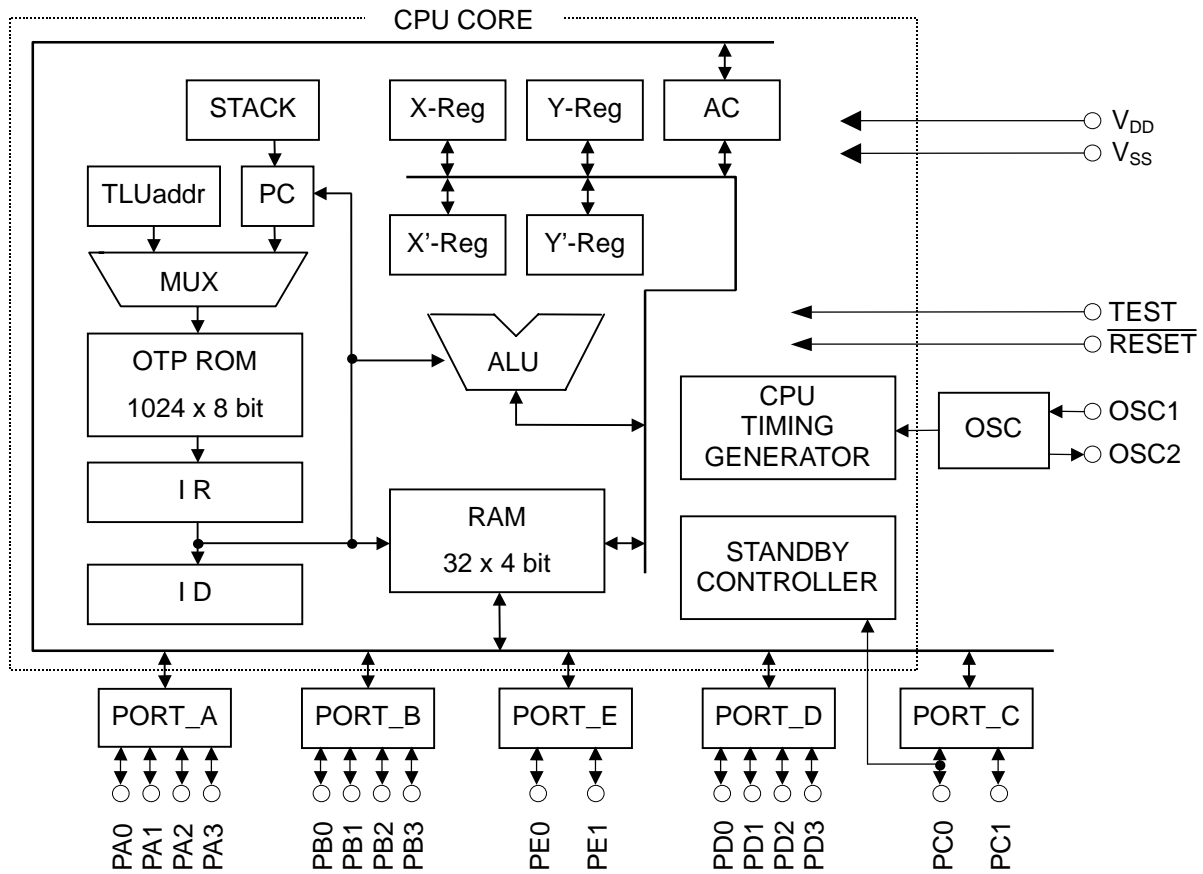
- Internal One Time Programmable ROM 1,024 X 8bits
- Internal Data RAM 32 X 4bits
- Wide operating voltage range 2.7V ~ 5.5V
- Package outline SDIP22 / SOP22
- ROM programmer "SUPERPRO/L" by XELTEK co.,

### ■ PIN CONFIGURATION IN OTP PROGRAMMING MODE



Note) The pin configuration in Normal operating mode is the same as **NJU3102**.

## ■ BLOCK DIAGRAM



## ■ TERMINAL DESCRIPTION IN OTP PROGRAMMING MODE

No.	SYMBOL	INPUT/OUTPUT	FUNCTION
12	$\overline{\text{RESET}}$	INPUT	RESET terminal. When the low-level input-signal, the system is initialized.
2 - 4, 6, 13 - 15, 18	D0 - D7	INPUT/OUTPUT	Data bus
19, 20	CNT1 CNT2	INPUT INPUT	OTP control input terminal
10	REQ	OUTPUT	Request output terminal
9	CLK	INPUT	Clock input terminal
8	PROM	INPUT	OTP programming enable terminal
22	$V_{DD}$	-	Power Source (5V)
11	$V_{SS}$	-	Power Source (0V)

- Note 1) Use at  $V_{DD}=5V$  in OTP programming mode.  
 2) Non connect anything to the other terminals.

## ■ Difference between NJU3152 (OTP version) and NJU3102 (MASK version)

### ● Operating mode

**NJU3152** 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.

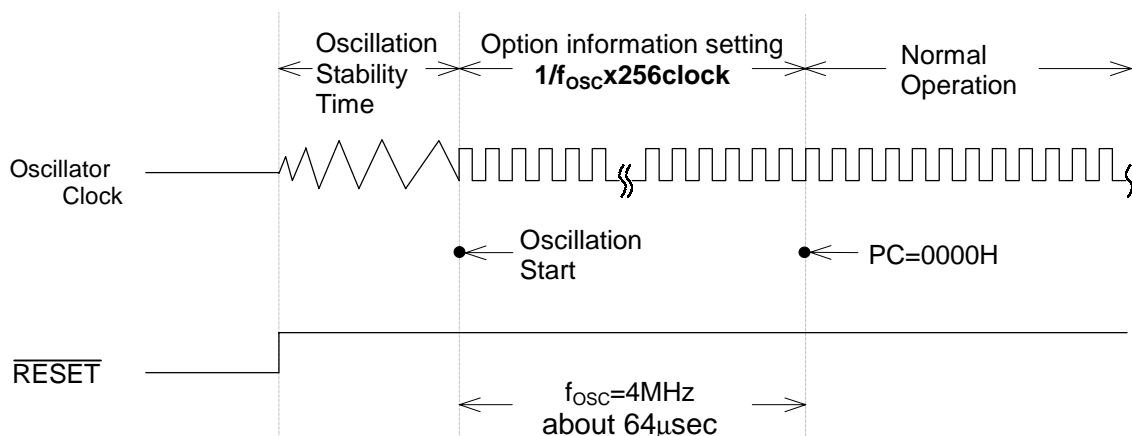
#### • OTP Programming mode

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).

### ● 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  **$1/f_{osc} \times 256\text{clock}$**  after RESET releasing and oscillation stability time. After information set, the program counter is set to 0000H and the **NJU3152** operates in normal.

### [ TIMING CHART ]



# NJU3152

## ■ 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
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 **NJU3152** (OTP version) and **NJU3102** (MASK version)

	<b>NJU3102</b>		<b>NJU3152</b>
•Supply Voltage (V <sub>DD</sub> ) MIN.	2.4V	→	2.7V
•Supply Current			
5V (I <sub>DD1</sub> ) Max.	4.5mA	→	30mA
(I <sub>DD2</sub> ) Max.	4.5mA	→	30mA
(I <sub>DD3</sub> ) Max.	4.3mA	→	30mA
(I <sub>DD4</sub> ) Max.	5.0μA		20μA
3V (I <sub>DD1</sub> ) Max.	2.3mA	→	20mA
(I <sub>DD2</sub> ) Max.	2.3mA	→	20mA
(I <sub>DD3</sub> ) Max.	2.1mA		20mA
(I <sub>DD4</sub> ) Max.	3.0μA	→	20μA

## ■ ELECTRICAL CHARACTERISTICS    DC CHARACTERISTICS    1

(V<sub>DD</sub>=3.6~5.5V, V<sub>SS</sub>=0V, Ta=-20~75°C)

PARAMETER	SYM BOL	CONDITIONS	MIN	TYP	MAX	UNIT	NOTE
Supply Voltage	V <sub>DD</sub>	V <sub>DD</sub>	3.6		5.5	V	
Supply Current	I <sub>DD1</sub>	V <sub>DD</sub> V <sub>DD</sub> =5V, f <sub>OSC</sub> =2MHz X'tal Oscillation in Reset			30	mA	*3
	I <sub>DD2</sub>	V <sub>DD</sub> V <sub>DD</sub> =5V, f <sub>OSC</sub> =2MHz Ceramic Oscillation in Reset			30	mA	*3
	I <sub>DD3</sub>	V <sub>DD</sub> V <sub>DD</sub> =5V, f <sub>OSC</sub> =2MHz CR Oscillation in Reset			30	mA	*3
	I <sub>DD4</sub>	V <sub>DD</sub> V <sub>DD</sub> =5V, STANDBY Mode			20	μA	*3
	I <sub>DD5</sub>	V <sub>DD</sub> V <sub>DD</sub> =5V, f <sub>OSC</sub> =4MHz, Operating			30	mA	*3
High-Level Input Voltage	V <sub>IH1</sub>	PA0~PA3, PB0~PB3, PC0, PC1, PD0~PD3	0.7V <sub>DD</sub>		V <sub>DD</sub>	V	*1
	V <sub>IH2</sub>	PE0, PE1, RESET	0.8V <sub>DD</sub>		V <sub>DD</sub>	V	*1
	V <sub>IH3</sub>	OSC1	V <sub>DD</sub> -1.0		V <sub>DD</sub>	V	
Low-level Input Voltage	V <sub>IL1</sub>	PA0~PA3, PB0~PB3, PC0, PC1, PD0~PD3	0		0.3V <sub>DD</sub>	V	*1
	V <sub>IL2</sub>	PE0, PE1, RESET	0		0.2V <sub>DD</sub>	V	*1
	V <sub>IL3</sub>	OSC1	0		1.0	V	
High-Level Input Current	I <sub>IH</sub>	V <sub>DD</sub> =5.5V, V <sub>IN</sub> =5.5V PA0~PA3, PB0~PB3, PC0, PC1, PD0~PD3, PE0, PE1, RESET			10	μA	*1
Low-Level Input Current	I <sub>IL1</sub>	V <sub>DD</sub> =5.5V, V <sub>IN</sub> =0V Without pull-up resistance PA0~PA3, PB0~PB3, PC0, PC1, PD0~PD3, PE0, PE1, RESET			-10	μA	*1
	I <sub>IL2</sub>	V <sub>DD</sub> =5.5V, V <sub>IN</sub> =0V With pull-up resistance PA0~PA3, PB0~PB3, PC0, PC1, PD0~PD3, PE0, PE1			-100	μA	*1
High-Level Output Voltage	V <sub>OH</sub>	I <sub>OH</sub> =-100μA PA0~PA3, PB0~PB3, PC0, PC1, PD0~PD3, PE0, PE1	V <sub>DD</sub> -0.5			V	*2
Low-Level Output Voltage	V <sub>OL1</sub>	I <sub>OL1</sub> =400μA PA0~PA3, PB0~PB3, PC0, PC1, PE0, PE1			0.5	V	*2
	V <sub>OL2</sub>	I <sub>OL2</sub> =15mA PD0~PD3			2.0	V	*2
Output Leakage Current	I <sub>OD</sub>	V <sub>DD</sub> =5.5V, V <sub>OH</sub> =5.5V PD0~PD3			10	μA	*2
Input Capacitance	C <sub>IN</sub>	Except V <sub>DD</sub> , V <sub>SS</sub> terminals f <sub>OSC</sub> =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

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

PARAMETER	SYM BOL	CONDITIONS	MIN	TYP	MAX	UNIT	NOTE
Supply Voltage	$V_{DD}$	$V_{DD}$	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
	$I_{DD4}$	$V_{DD}$ $V_{DD}=3V$ , STANDBY Mode			20	$\mu A$	*3
	$I_{DD5}$	$V_{DD}$ $V_{DD}=3V$ , $f_{OSC}=4MHz$ , Operating			20	mA	*3
High-Level Input Voltage	$V_{IH1}$	PA0~PA3, PB0~PB3, PC0, PC1, PD0~PD3	$0.8V_{DD}$		$V_{DD}$	V	*1
	$V_{IH2}$	PE0, PE1, RESET	$0.85V_{DD}$		$V_{DD}$	V	*1
	$V_{IH3}$	OSC1	$V_{DD}-0.3$		$V_{DD}$	V	
Low-level Input Voltage	$V_{IL1}$	PA0~PA3, PB0~PB3, PC0, PC1, PD0~PD3	0		$0.2V_{DD}$	V	*1
	$V_{IL2}$	PE0, PE1, RESET	0		$0.15V_{DD}$	V	*1
	$V_{IL3}$	OSC1	0		0.3	V	
High-Level Input Current	$I_{IH}$	$V_{DD}=3.6V$ , $V_{IN}=3.6V$ PA0~PA3, PB0~PB3, PC0, PC1, PD0~PD3, PE0, PE1, RESET			10	$\mu A$	*1
Low-Level Input Current	$I_{IL1}$	$V_{DD}=3.6V$ , $V_{IN}=0V$ Without pull-up resistance PA0~PA3, PB0~PB3, PC0, PC1, PD0~PD3, PE0, PE1, RESET			-10	$\mu A$	*1
	$I_{IL2}$	$V_{DD}=3.6V$ , $V_{IN}=0V$ With pull-up resistance PA0~PA3, PB0~PB3, PC0, PC1, PD0~PD3, PE0, PE1			-100	$\mu A$	*1
High-Level Output Voltage	$V_{OH}$	$I_{OH}=-80\mu A$ PA0~PA3, PB0~PB3, PC0, PC1, PD0~PD3, PE0, PE1	$V_{DD}-0.5$			V	*2
Low-Level Output Voltage	$V_{OL1}$	$I_{OL1}=350\mu A$ PA0~PA3, PB0~PB3, PC0, PC1, PE0, PE1			0.5	V	*2
	$V_{OL2}$	$I_{OL2}=5mA$ PD0~PD3			1.0	V	*2
Output Leakage Current	$I_{OD}$	$V_{DD}=3.6V$ , $V_{OH}=3.6V$ PD0~PD3			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.

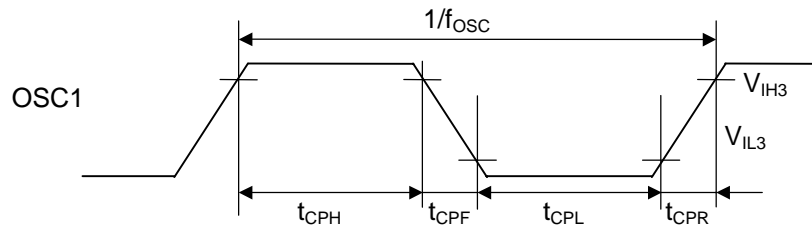
## ■ ELECTRICAL CHARACTERISTICS    AC CHARACTERISTICS    1

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

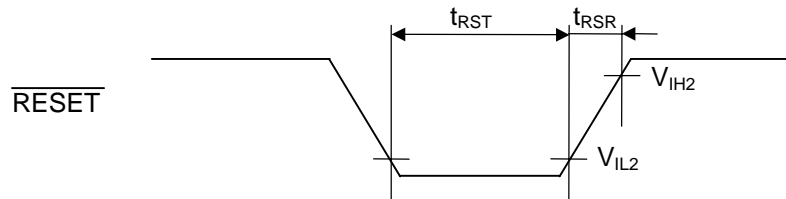
PARAMETER	SYM BOL	CONDITIONS		MIN	TYP	MAX	UNIT
Operating Frequency	$f_{OSC}$	$V_{DD}=2.7\sim 3.6V$	X'tal Resonator	0.03		2.0	MHz
			Ceramic Resonator	0.03		2.0	
			External Resistor Oscillation	0.03		1.0	
			External Clock	0.03		2.0	
		$V_{DD}=3.6\sim 5.5V$	X'tal Resonator	0.03		4.0	
			Ceramic Resonator	0.03		4.0	
			External Resistor Oscillation	0.03		2.0	
			External Clock	0.03		4.0	
Instruction Cycle Time	$t_c$			$6/f_{OSC}$		s	
External Clock Pulse Width	$t_{CPH}$	$V_{DD}=2.7\sim 3.6V$	250		16600	ns	
	$t_{CPL}$	$V_{DD}=3.6\sim 5.5V$	125		16600		
External Clock Rise Time Fall Time	$t_{CPR}$	$V_{DD}=2.7\sim 5.5V$			20	ns	
	$t_{CPF}$						
RESET Low-Level Width	$t_{RST}$	$V_{DD}=2.7\sim 5.5V$	$4/f_{OSC}$			s	
RESET Rise Time	$t_{RSR}$	$V_{DD}=2.7\sim 5.5V$			20	ms	
Port Input Level Width	$t_{PIN}$	$V_{DD}=2.7\sim 5.5V$	$6/f_{OSC}$			s	
Edge Detection (PC1) Rise Time Fall Time	$t_{EDR}$	$V_{DD}=2.7\sim 5.5V$			200	ns	
	$t_{EDF}$						
Restart Signal (PC0) Rise Time	$t_{STR}$	$V_{DD}=2.7\sim 5.5V$			200	ns	

## ■ AC CHARACTERISTICS 1 TIMING CHART

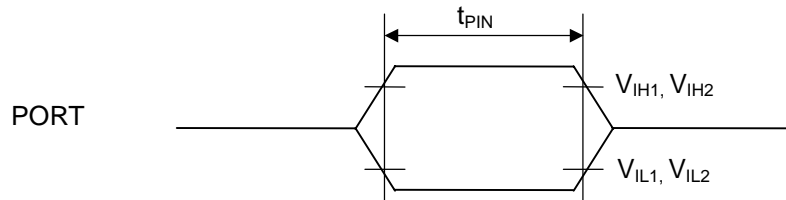
EXTERNAL CLOCK



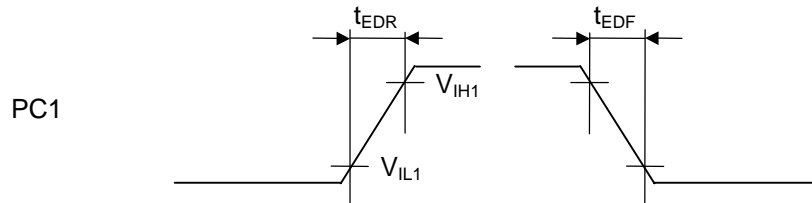
RESET INPUT



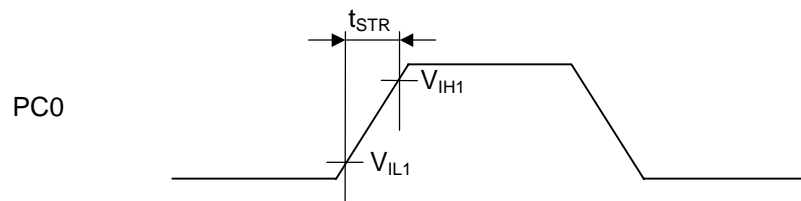
PORT INPUT



EDGE DETECTOR INPUT



RESTART SIGNAL INPUT





■ **OPTION as same as mask version (NJU3102)**

1) INPUT OUTPUT Terminal Selection

All of input-output terminals select a terminal type from the following table for each group as a PORT by the mask option.

[ CIRCUIT TYPE TABLE ]

SYMBOL	TERMINAL TYPES				REMARKS
	Input / Output Terminal*1		EXTRA FUNCTION		
	Port of Input	Port of Output			
Port A (PA0~PA3)	ICP IC	OC			
Port B (PB0~PB3)	ICP IC	OC			
Port C (PC0, PC1)	ICP IC	OC	Restart signal input *2		
			Edge detection *2		R Rise edge detection F Fall edge detection
Port D (PD0~PD3)	ICP IC	ONP ON			
Port E (PE0, PE1)	ISP IS	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.

\*2) When the PORTC(PHY3) is set as the input, the extra function are added for terminals.

[ MASK OPTION LIST ]

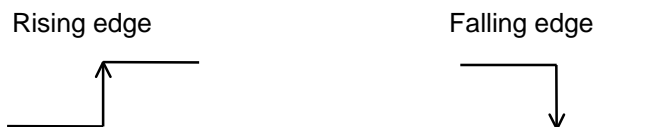
記号	機能
ICP	C-MOS input with pull-up resistance
ISP	C-MOS Schmitt trigger input with pull-up resistance
IC	C-MOS input
IS	C-MOS Schmitt trigger input
ONP	Nch-FET Open-Drain output with pull-up resistance
OC	C-MOS output
ON	Nch-FET Open-Drain output
R	Rise edge detection
F	Fall edge detection

[ INPUT OUTPUT TERMINAL TYPE ]

	Types	With Pull-up	Without Pull-up	Terminals	
INPUT TERMINAL	C-MOS	Type ICP 	Type IC 	PA0~PA3, PB0~PB3, PC0, PC1, PD0~PD3	
	SCHMITT TRIGGER	Type ISP 	Type IS 	PE0, PE1	
OUTPUT TERMINAL	C-MOS	/		Type ON 	PA0~PA3, PB0~PB3, PC0, PC1, PE0, PE1
	N-channel(Nch) OPEN DRAIN	Type ONP 	Type ON 	PD0~PD3	

2) Edge Detector Selection

PC1 terminal is added the "Edge detect function" by the mask option.



## MEMO

**[CAUTION]**

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