

4-BIT SINGLE CHIP OTP TINY CONTROLLER

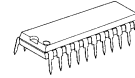
■ GENERAL DESCRIPTION

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

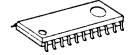
It is completely compatible with the **NJU3102** in function and the pin configuration. Therefore, the **NJU3152** is suitable for the final evaluation before **NJU3102** mask generation, the small quantity production and short lead-time.

* 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

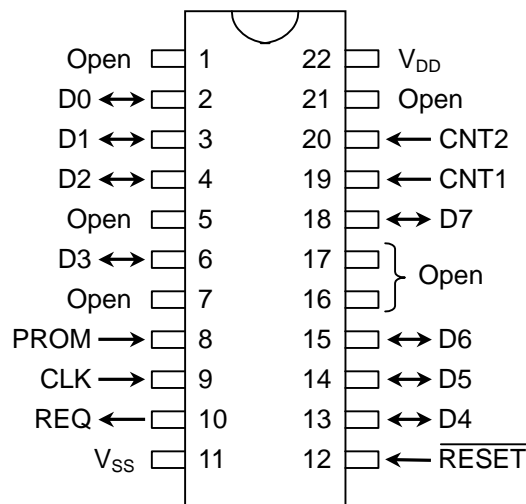


NJU3152G

■ FEATURES

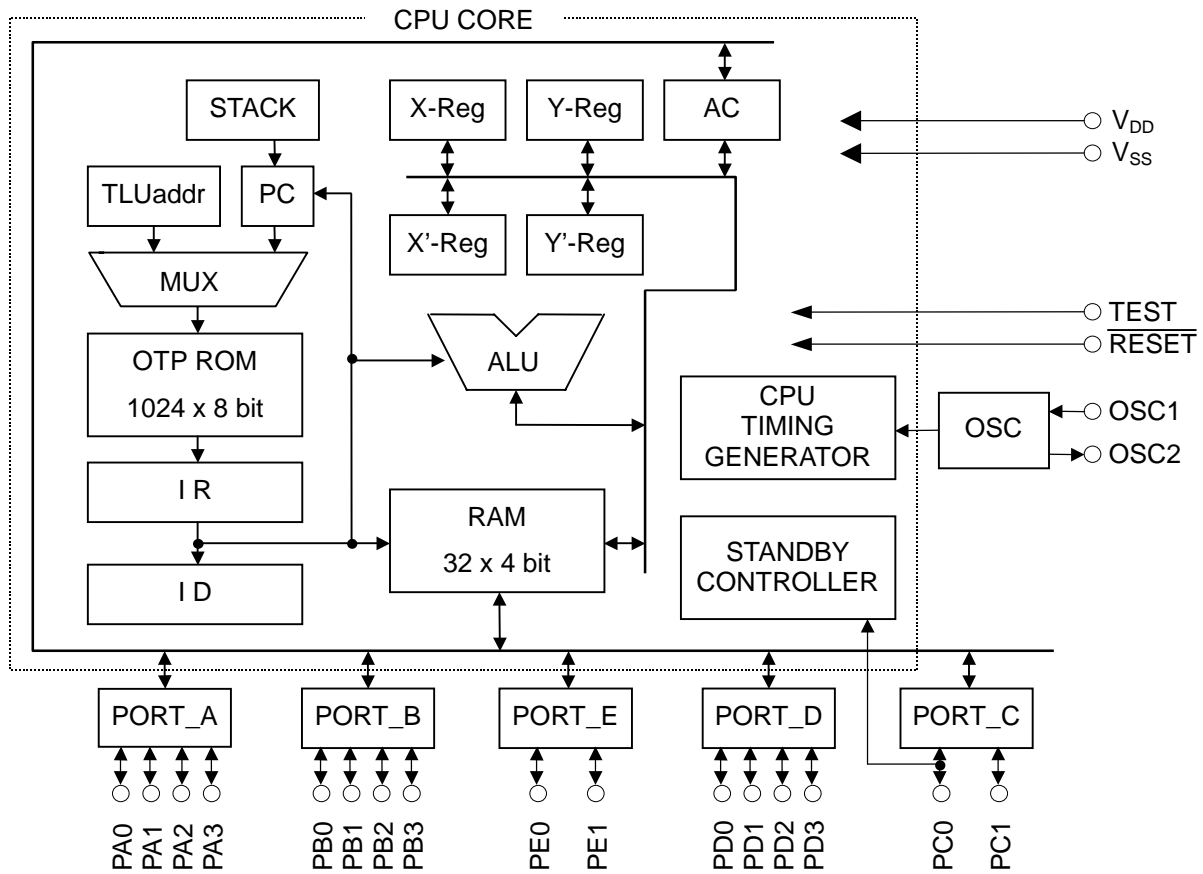
- Internal One Time Programmable ROM 1,024 X 8bits
- Internal Data RAM 32 X 4bits
- Wide operating voltage range 2.7V ~ 5.5V
- Package outline SDIP22 / SOP22
- ROM programmer "SUPERPRO/L" by XELTEK co.,

■ 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.

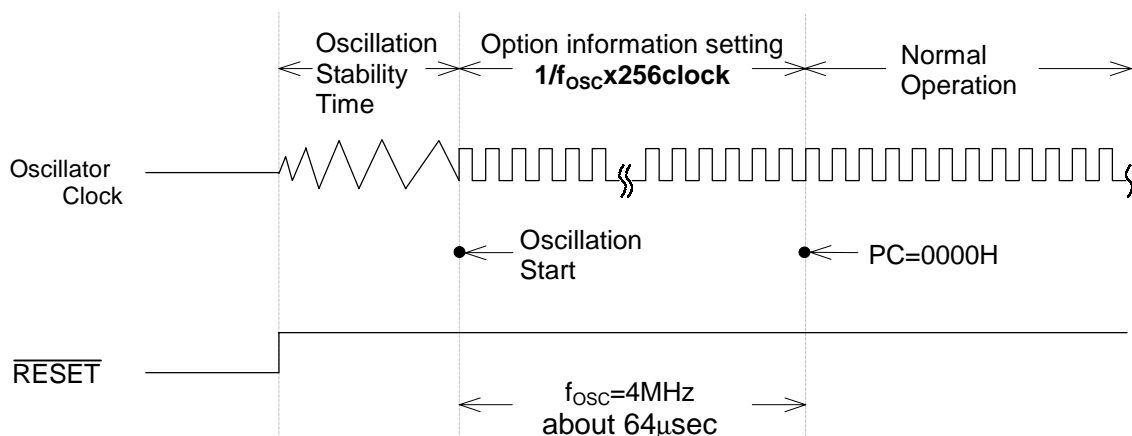
• OTP Programming mode

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 _{DD}	-0.3 ~ +7.0	V
Input Voltage	V _{IN}	-0.3 ~ V _{DD} + 0.3	V
Output Voltage	V _{OUT}	-0.3 ~ V _{DD} + 0.3	V
Operating Temperature	T _{opr}	-20 ~ +75	°C
Storage Temperature	T _{stg}	-55 ~ +125	°C

Note)

The difference of electrical characteristics between **NJU3152** (OTP version) and **NJU3102** (MASK version)

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

■ ELECTRICAL CHARACTERISTICS DC CHARACTERISTICS 1

(V_{DD}=3.6~5.5V, V_{SS}=0V, Ta=-20~75°C)

PARAMETER	SYM BOL	CON DITIONS	MIN	TYP	MAX	UNIT	NOT E
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, STANDBY Mode			20	μA	*3
	I _{DD5}	V _{DD} V _{DD} =5V, f _{OSC} =4MHz, Operating			30	mA	*3
High-Level Input Voltage	V _{IH1}	PA0~PA3, PB0~PB3, PC0, PC1, PD0~PD3	0.7V _{DD}		V _{DD}	V	*1
	V _{IH2}	PE0, PE1, RESET	0.8V _{DD}		V _{DD}	V	*1
	V _{IH3}	OSC1	V _{DD} -1.0		V _{DD}	V	
Low-level Input Voltage	V _{IL1}	PA0~PA3, PB0~PB3, PC0, PC1, PD0~PD3	0		0.3V _{DD}	V	*1
	V _{IL2}	PE0, PE1, RESET	0		0.2V _{DD}	V	*1
	V _{IL3}	OSC1	0		1.0	V	
High-Level Input Current	I _{IH}	V _{DD} =5.5V, V _{IN} =5.5V PA0~PA3, PB0~PB3, PC0, PC1, PD0~PD3, PE0, PE1, RESET			10	μA	*1
Low-Level Input Current	I _{IL1}	V _{DD} =5.5V, V _{IN} =0V Without pull-up resistance PA0~PA3, PB0~PB3, PC0, PC1, PD0~PD3, PE0, PE1, RESET			-10	μA	*1
	I _{IL2}	V _{DD} =5.5V, V _{IN} =0V With pull-up resistance PA0~PA3, PB0~PB3, PC0, PC1, PD0~PD3, PE0, PE1			-100	μA	*1
High-Level Output Voltage	V _{OH}	I _{OH} =-100μA PA0~PA3, PB0~PB3, PC0, PC1, PD0~PD3, PE0, PE1	V _{DD} -0.5			V	*2
Low-Level Output Voltage	V _{OL1}	I _{OL1} =400μA PA0~PA3, PB0~PB3, PC0, PC1, PE0, PE1			0.5	V	*2
	V _{OL2}	I _{OL2} =15mA PD0~PD3			2.0	V	*2
Output Leakage Current	I _{OD}	V _{DD} =5.5V, V _{OH} =5.5V PD0~PD3			10	μA	*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

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

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	μA	*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	μA	*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	μA	*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	μA	*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	μA	*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.

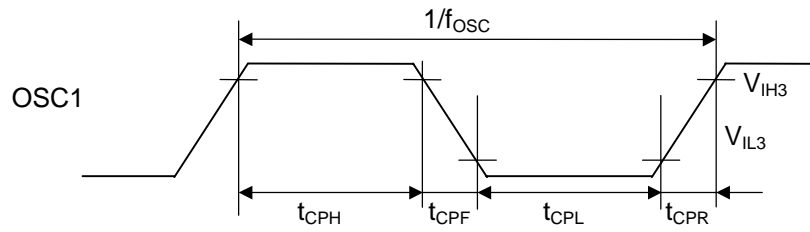
■ ELECTRICAL CHARACTERISTICS AC CHARACTERISTICS 1

(V_{SS}=0V, T_a= -20~75°C)

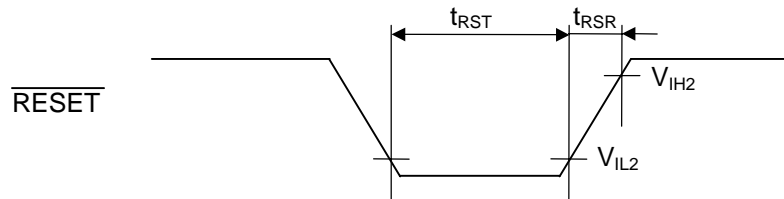
PARAMETER	SYM BOL	CONDITIONS		MIN	TYP	MAX	UNIT
Operating Frequency	f _{OSC}	V _{DD} =2.7~3.6V	X'tal Resonator	0.03		2.0	MHz
			Ceramic Resonator	0.03		2.0	
			External Resistor Oscillation	0.03		1.0	
			External Clock	0.03		2.0	
		V _{DD} =3.6~5.5V	X'tal Resonator	0.03		4.0	
			Ceramic Resonator	0.03		4.0	
			External Resistor Oscillation	0.03		2.0	
			External Clock	0.03		4.0	
Instruction Cycle Time	t _c			6/f _{OSC}		s	
External Clock Pulse Width	t _{CPH} t _{CPL}	V _{DD} =2.7~3.6V	250		16600	ns	
		V _{DD} =3.6~5.5V	125		16600		
External Clock Rise Time Fall Time	t _{CPR} t _{CPF}	V _{DD} =2.7~5.5V			20	ns	
RESET Low-Level Width	t _{RST}	V _{DD} =2.7~5.5V	4/f _{OSC}			s	
RESET Rise Time	t _{RSR}	V _{DD} =2.7~5.5V			20	ms	
Port Input Level Width	t _{PIN}	V _{DD} =2.7~5.5V	6/f _{OSC}			s	
Edge Detection (PC1) Rise Time Fall Time	t _{EDR} t _{EDF}	V _{DD} =2.7~5.5V			200	ns	
Restart Signal (PC0) Rise Time	t _{STR}	V _{DD} =2.7~5.5V			200	ns	

■ AC CHARACTERISTICS 1 TIMING CHART

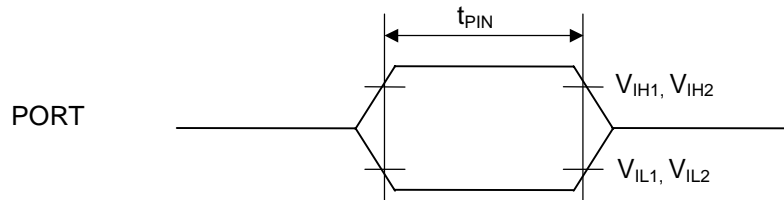
EXTERNAL CLOCK



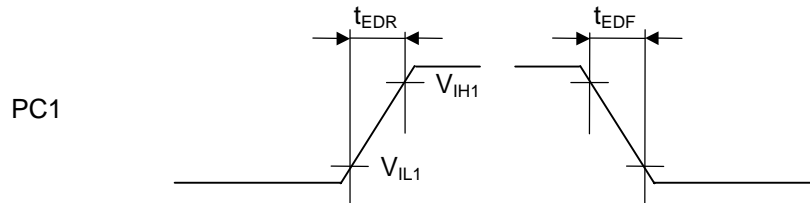
RESET INPUT



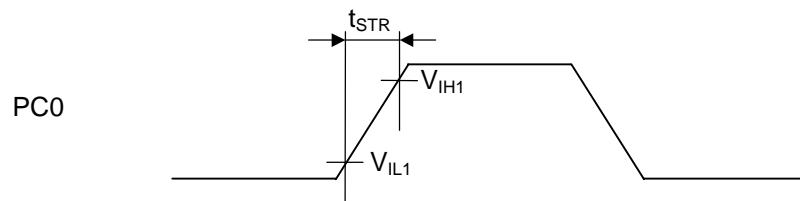
PORT INPUT



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 F	Rise edge detection 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.

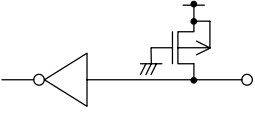
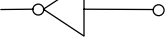
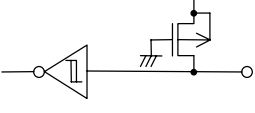
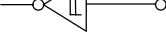
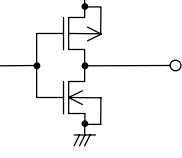
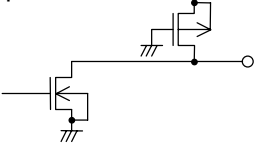
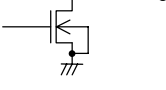
*1) The symbol and the detail circuits of INPUT OUTPUT TERMINAL are written in INPUT OUTPUT TERMINAL TYPE.

*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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