

μPD17P202A is a model of μPD17202A which is equipped with a one-time PROM in place of the μPD17202A internal mask ROM.

Since the user can write the program to μPD17P202A, the microcomputer is suitable for experimental or small-scale production of μPD17202A systems.

It is recommended that you also read the documents related to μPD17202A, in addition to this data sheet.

FEATURES

- Compatible with μPD17202A
- Internal one-time PROM: 2,048 x 16 bits
- Operating voltage range: 2.2 to 5.5 V

ORDERING INFORMATION

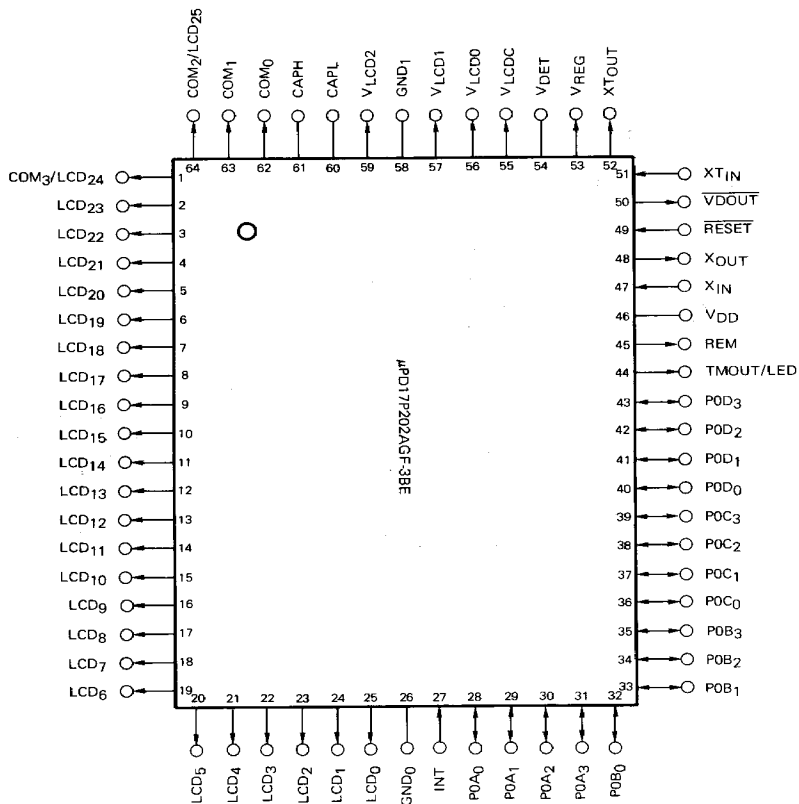
Order Code	Package	Quality Grade
μPD17P202AGF-001-3BE	64-pin plastic QFP (14 x 20 mm)	Standard
μPD17P202AGF-002-3BE	64-pin plastic QFP (14 x 20 mm)	Standard
μPD17P202AGF-003-3BE	64-pin plastic QFP (14 x 20 mm)	Standard

Note: Table below indicates differences in these products:

Item Part number	Pull-up resistor for RESET pin	Pull-up resistors for POA, POB pins	Main clock generator used/unused	Subclock generator used/unused
μPD17P202AGF-001-3BE	Provided	Provided	Used	Used
μPD17P202AGF-002-3BE	Not provided	Provided	Used	Unused
μPD17P202AGF-003-3BE	Not provided	Not provided	Unused	Used

PIN CONFIGURATION (Top View)

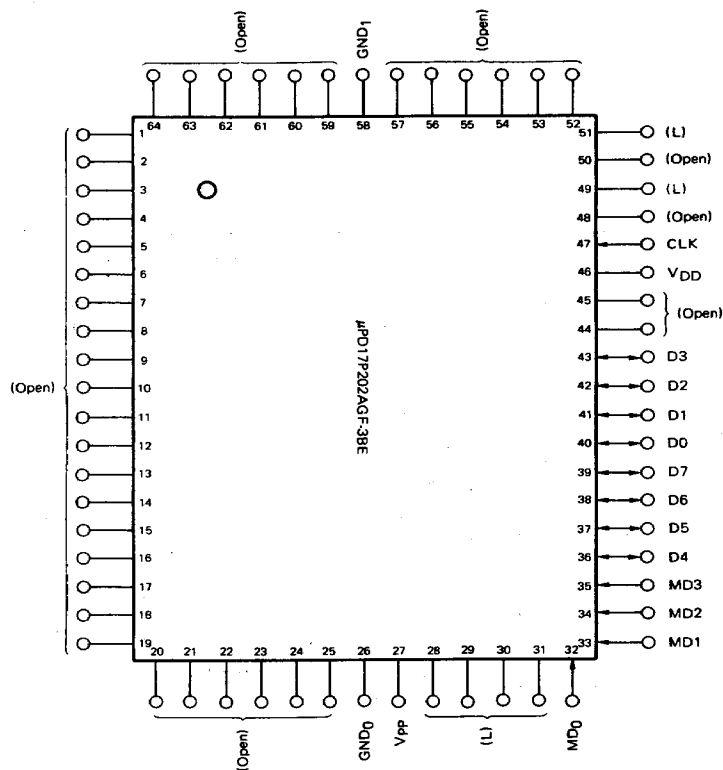
(1) Ordinary operation



POA₀-POA₃ : Input/output port
 POB₀-POB₃ : Input/output port
 POC₀-POC₃ : Input/output port
 POD₀-POD₃ : Input/output port
 VREG : Voltage regulator output
 VDET : Voltage detector detection voltage adjustment
 VLDCD : LCD drive reference voltage adjustment
 VLCD₀-VLCD₂ : LCD drive voltage outputs
 LCD₀-LCD₃₅ : LCD segment signal output
 COM₀-COM₃ : LCD common signal output
 TMOUT : 8-bit timer output
 LED : Remote control transmission indication output

REM : Remote control transmission output
 INT : External interrupt request signal input
 RESET : Reset input
 VDOUT : Low voltage detection circuit output
 XIN, XOUT : Main clock oscillator circuit
 XTIN, XTOUT : Subclock oscillator circuit
 CAPH, CAPL : Booster capacitor connection pins
 CLK : PROM clock input
 MD₀-MD₃ : PROM mode selection input
 D₀-D₇ : PROM data input/output
 Vpp : PROM write voltage power supply pin
 VDD : Power supply pin
 GND₀, GND₁ : GND

(2) PROM programming mode

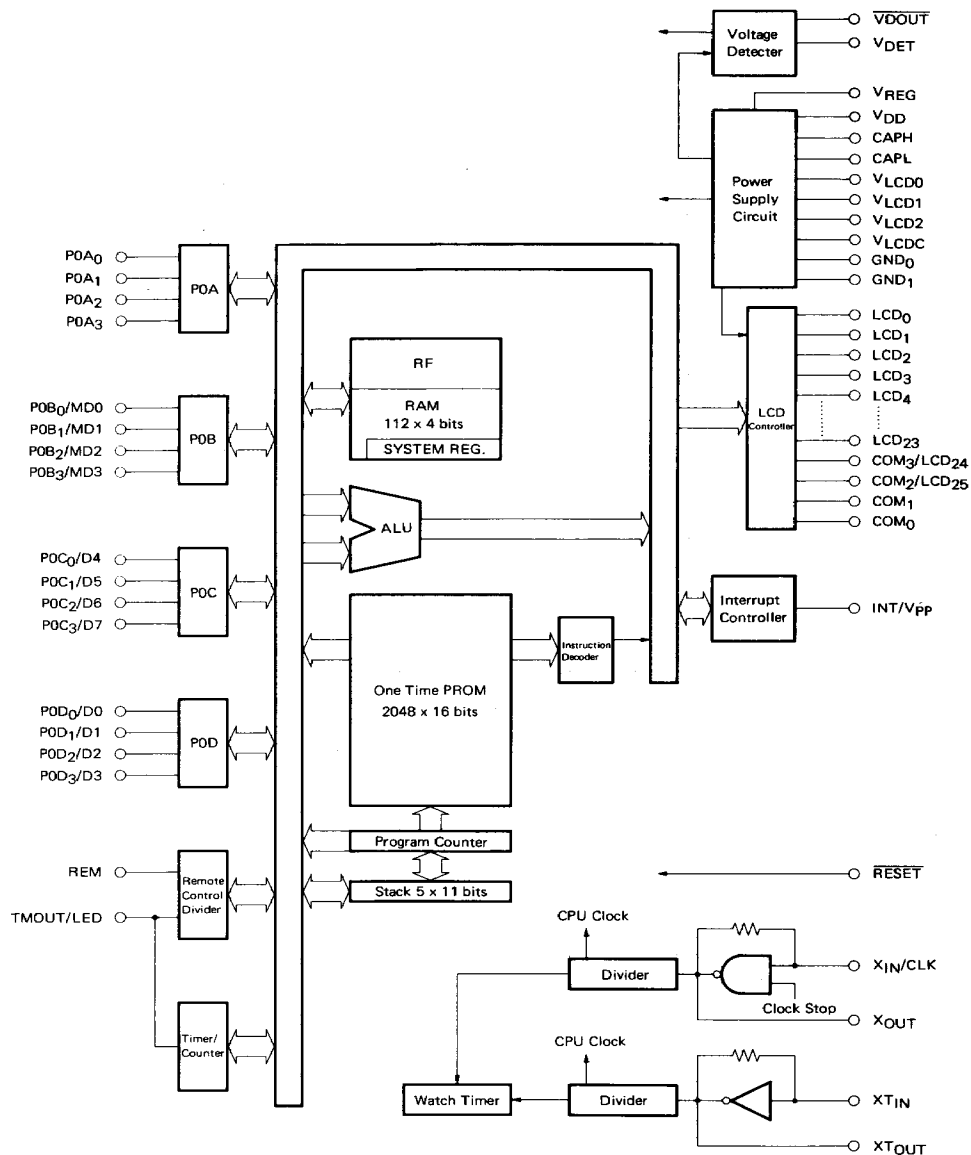


Note: () Indicates processing for pins not used in the PROM programming mode.

L : Ground each of these pins through a 470 Ω resistor.

Open : Do not connect these pins.

BLOCK DIAGRAM



1. PIN FUNCTIONS

1.1 ORDINARY OPERATION MODE

PIN No.	SYMBOL	FUNCTION	OUTPUT TYPE	POWER ON RESET
62 63 64 1 2 25	COM ₀ COM ₁ LCD ₂₅ /COM ₂ LCD ₂₄ /COM ₃ LCD ₂₃ LCD ₀	LCD controller/driver segment signal outputs and LCD controller/driver common signal outputs. • LCD₂₅ to LCD₀ • LCD controller/driver segment signal outputs • COM₀ to COM₃ • LCD controller/driver common signal outputs	CMOS	—
28	GND ₀	GND	—	—
27	INT	Inputs external interrupt request signal. Either the rising edge or the falling edge can be specified as the interrupt request effective edge.	—	Input
28 31	POA ₀ POA ₃	4-bit CMOS input/output port. This port can be specified for input/output in 4-bit units. In the input mode, these pins become CMOS inputs, and can be used as key return inputs for key matrix. See Note.	CMOS push-pull	Input
32 35	POB ₀ POB ₃	4-bit CMOS input/output port. This port can be specified for input/output in 4-bit units. In the input mode, these pins become CMOS inputs, and can be used as key return inputs for key matrix. See Note.	CMOS push-pull	Input
36 39	POC ₀ POC ₃	4-bit CMOS input/output port. This port can be specified for input/output in 4-bit units. In the output mode, these pins become N-ch open-drain output, and can be used for key source output for key matrix.	N-ch open-drain	Input
40 43	POD ₀ POD ₃	4-bit CMOS input/output port. This port can be specified for input/output in 4-bit units. In the output mode, these pins become N-ch open-drain output, and can be used for key source output for key matrix.	N-ch open-drain	Input
44	TMOUT/LED	This pin outputs NRZ signal (LED) synchronized with infrared remote control signal and 8-bit timer (TMOUT). • TMOUT • 8-bit timer output • LED • Remote control transmission indication output	CMOS push-pull	High level output

Note: Pull-up resistors are provided only in the μPD17P202A-001 and μPD17P202A-002.

PIN No.	SYMBOL	FUNCTION	OUTPUT TYPE	POWER ON RESET
45	REM	Infrared remote control signal output.	CMOS push-pull	High level output
46	V _{DD}	Positive voltage power supply pin. 2.2 to 5.5 V is applied in the normal operation mode.	—	—
47 48	X _{IN} X _{OUT}	Main clock oscillation circuit is connected across these pins. Connect a 4 MHz ceramic resonator or crystal resonator across these pins.	—	—
49	RESET	Reset signal input.	—	Input
50	$\overline{\text{VDOUT}}$	Internal low voltage detection circuit output.	CMOS push-pull	—
51 52	XT _{IN} XT _{OUT}	Subclock oscillation circuit is connected across these pins. Connect a 32 kHz crystal resonator across these pins.	—	—
53	V _{REG}	Voltage regulator output for subclock generator.	—	—
54	V _{DET}	A resistor for adjusting the voltage detector detection level is connected to this pin.	—	—
55	V _{LCD0}	Adjusts LCD drive reference voltage.	—	—
56 57	V _{LCD0} V _{LCD1}	Outputs a voltage boosted from LCD drive reference voltage.	—	—
58	GND ₁	GND	—	—
59	V _{LCD2}	Outputs a voltage boosted from LCD drive reference voltage.	—	—
60 61	CAPL CAPH	Voltage boosting capacitor is connected across these pins.	—	—

1.2 PROM PROGRAMMING MODE

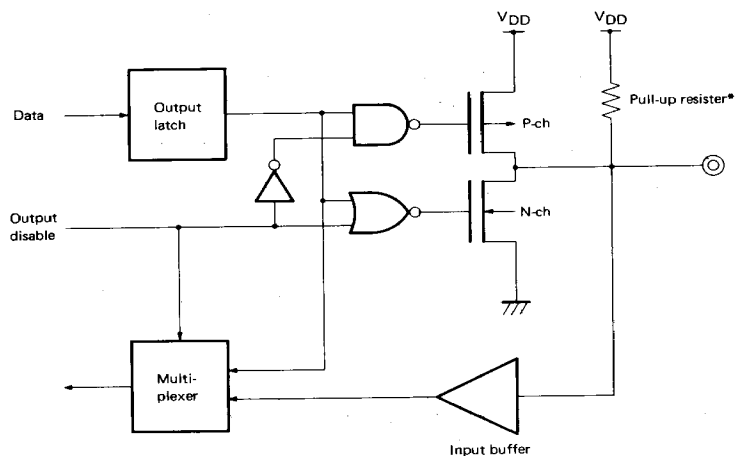
PIN No.	SYMBOL	FUNCTION	OUTPUT TYPE	POWER ON RESET
26	GND ₀	GND	—	—
27	V _{PP}	Positive power supply pin for PROM programming. 12.5 V is applied to this pin when programming, reading, or verifying the program memory.	—	—
32 35	MD3 MD0	Operation mode selection inputs for PROM programming.	—	Input
36 39 40 43	D4 D7 D0 D3	8-bit data input/output for PROM programming.	CMOS push-pull	Input
46	V _{DD}	Positive power supply pin. 6 V is applied to this pin when programming, reading, or verifying the program memory.	—	—
47	CLK	Clock input for PROM programming.	—	—
48	GND ₁	GND	—	—

Remarks: Pins other than listed above are not used in the PROM programming mode. Refer to "Pin Connection Diagram (2) PROM Programming Mode" for recommended conditions for unused pins.

1.3 PIN EQUIVALENT CIRCUITS

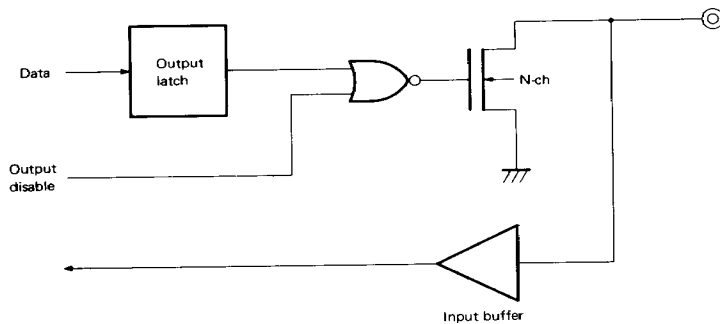
The simplified pin equivalent circuits schematic views for μ PD17P202A's pins are presented below.

(1) P0A₀ through P0A₃, P0B₀/MD0 through P0B₃/MD3

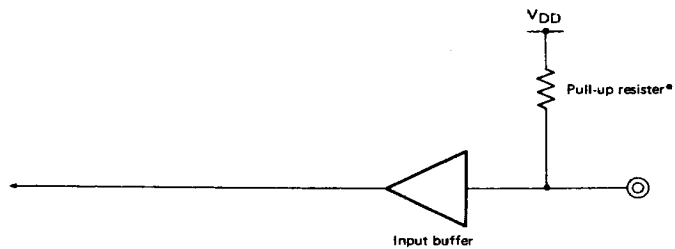


*: Only μ PD17P202A-001 and μ PD17P202A-002

(2) P0C₀/D4 through P0C₃/D7, P0D₀/D0 through P0D₃/D3



(3) $\overline{\text{RESET}}$



*: Only μPD17P202A-001

2. WRITING, READING, AND VERIFYING ONE-TIME PROM (PROGRAM MEMORY)

When the PROM is to be written, read, or verified, μ PD17P201A is set in the PROM mode, and the pins shown in Table 2-1 are used. No address has to be input. Instead, the address is incremented by the clock input from the CLK pin.

Table 2-1 Pins Used to Write/Read/Verify Program Memory

Pin name	Function
V _{PP}	Apply program voltage (12.5 V) to this pin.
CLK	Address incrementing clock input
MD0 to MD3	Operation mode selector
D0 to D7	8-bit data input/output
V _{DD}	Apply operating voltage (6 V) to this pin.

2.1 OPERATION MODES FOR PROGRAM MEMORY WRITE, READ, AND VERIFY

μ PD17P202A is set in the program memory write, read, or verify mode, when +6 V is applied to pin V_{DD}, and +12.5 V is applied to pin V_{PP}, after being placed in the reset status (V_{DD} = 5 V, RESET = low level) for a certain period of time.

The operation modes, selected by pins MD0 through MD3, are listed in Table 2-2.

Pins not used to write, read, or verify the program memory must be open, or grounded through pull-down resistors (470 Ω).

Table 2-2 Operation Modes for Program Memory Write, Read, and Verify

Operation mode selection						Operation mode
V _{PP}	V _{DD}	MD0	MD1	MD2	MD3	
+12.5 V	+6 V	H	L	H	L	Program memory address 0 clear
		L	H	H	H	Write mode
		L	L	H	H	Read, verify mode
		H	x	H	H	Program inhibit mode

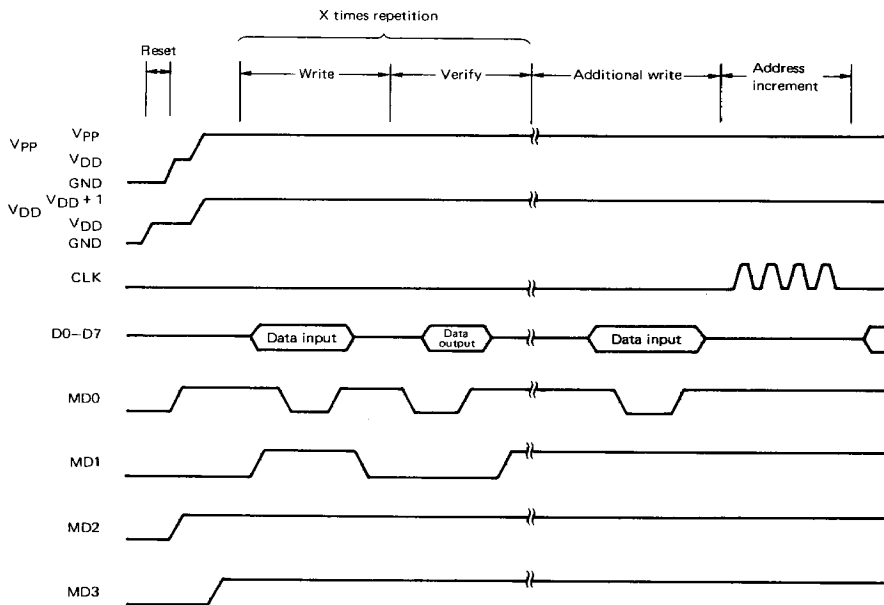
Remarks: x: L or H

2.2 PROGRAM MEMORY WRITING PROCEDURE

Write the program memory by following these steps. The program memory can be written at high speeds.

- (1) Pull down the unused pins to the ground potential through resistors. Make the pin CLK low.
- (2) Apply 5 V to pin V_{DD}. Make pin V_{PP} low.
- (3) Wait for 10 μs. Then, apply 5 V to pin V_{PP}.
- (4) Set the program memory address 0 clear mode by the mode selector pins.
- (5) Apply 6 V to pin V_{DD}, and 12.5 V to pin V_{PP}.
- (6) Program inhibit mode
- (7) Write data in the 1 ms write mode.
- (8) Program inhibit mode
- (9) Verify mode. Proceed to (10), if the memory has been written. If it has not been written, repeat (7) through (9).
- (10) Additional writing for (the number of times (7) through (9) are repeated: X) x 1 ms
- (11) Program inhibit mode
- (12) Input a pulse four times to pin CLK, in order to increment the program memory address (by one).
- (13) Repeat (7) through (12), until the last address is programmed.
- (14) Program memory address 0 clear mode
- (15) Decrease the voltages on pin V_{DD} and V_{PP} to 5 V.
- (16) Turn power off.

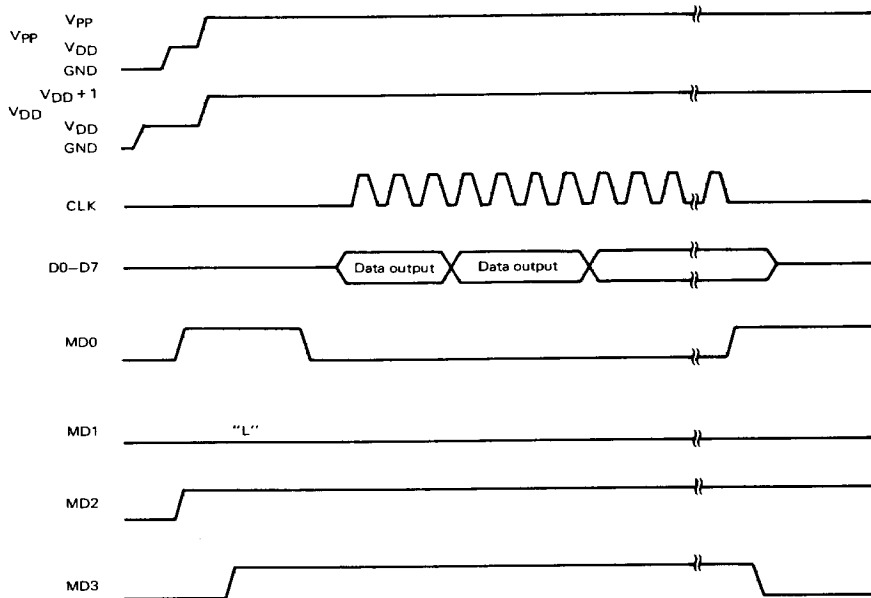
The following figure illustrates steps (2) through (12) above.



2.3 PROGRAM MEMORY READING PROCEDURE

- (1) Pull down the unused pins to the ground potential through resistors. Make the pin CLK low.
- (2) Apply 5 V to pin V_{DD} . Make pin V_{PP} low.
- (3) Wait for 10 μ s. Then, apply 5 V to pin V_{PP} .
- (4) Set the program memory address 0 clear mode by the mode selector pins.
- (5) Apply 6 V to pin V_{DD} , and 12.5 V to pin V_{PP} .
- (6) Program inhibit mode
- (7) Verify mode. The data for each address is output on a one-by-one basis in a cycle during which the clock pulse is input to pin CLK four times.
- (8) Program inhibit mode
- (9) Program memory address 0 clear mode
- (10) Decrease the voltages on pin V_{DD} and V_{PP} to 5 V.
- (11) Turn power off.

The following figure illustrates steps (2) through (9) above.



3. DIFFERENCES BETWEEN μPD17P202A AND μPD17202A

In the μPD17P202A, the internal mask ROM (program memory) for the μPD17202A is replaced by the PROM which can be programmed by the user. Therefore, the program memory and some mask options are the only differences between the μPD17P202A and μPD17202A, so the CPU functions and internal hardware are identical.

The table below summarizes the differences between the μPD17P202A and μPD17202A.

Refer to the μPD17202A data sheet for details on CPU functions and internal hardware.

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Device Item	μPD17P202A-001	μPD17P202A-002	μPD17P202A-003	μPD17202A
Program memory	• PROM • 0000H-07FFH • 2048 x 16 bits			• Mask ROM • 0000H-07FFH • 2048 x 16 bits
RESET pin pull-up resistor	Provided	None	None	(Mask option)
POA, POB pins pull-up resistors		Provided		
Main clock generator provided/not provided			None	
Subclock generator provided/not provided				
Pin connections	V _{pp} pin, PROM programming pin are provided.			V _{pp} pin, PROM programming pin not provided
Operating voltage range	2.2 to 5.5 V			
Package	64-pin plastic QFP (14 x 20 mm)			

4. ELECTRICAL CHARACTERISTICS**ABSOLUTE MAXIMUM RATINGS ($T_a = 25^\circ\text{C}$)**

Supply Voltage	V_{DD}	-0.3 to +7.0	V
Input Voltage	V_I	-0.3 to $V_{DD} + 0.3$	V
Operating Temperature	T_{opt}	-20 to +75	$^\circ\text{C}$
Storage Temperature	T_{stg}	-40 to +125	$^\circ\text{C}$

CAPACITANCE ($T_a = 25^\circ\text{C}$, $V_{DD} = 0\text{ V}$)

CHARACTERISTICS	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS
Input Capacitance	C_{IN}			10	pF	Pins INT, RESET
	C_{PIN}			10	pF	Other than pins INT, RESET

RECOMMENDED OPERATING RANGE

CHARACTERISTICS	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS
Supply Voltage	V_{DD1}	2.2	3.0	5.5	V	$f_X = 4\text{ MHz}$
	V_{DD2}	3.5	5.0	5.5	V	$f_X = 8\text{ MHz}$
Main Clock Oscillation Frequency	f_X	2.0	4.0	8.0	MHz	
Subclock Oscillation Frequency	f_{XT}		32.768		kHz	

DC CHARACTERISTICS ($V_{DD} = 3\text{ V}$, $T_a = -20\text{ to }+75\text{ }^{\circ}\text{C}$, $f_X = 4\text{ MHz}$, $f_{XT} = 32\text{ kHz}$)

CHARACTERISTICS	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS
LCD Output Voltage Variable Range	V_{LCD0}	0.8		1.8	V	
Doubler Output Voltage	V_{LCD1}	1.9 V_{LCD0}	2 V_{LCD0}		V	
Tripler Output Voltage	V_{LCD2}	2.85 V_{LCD0}	3 V_{LCD0}		V	
Low-voltage Detection Voltage	V_{DET}	1.3	2.0	2.9	V	VDET pin external resistance = $2\text{ M}\Omega$
High-Level Input Voltage	V_{IH1}	$0.8 V_{DD}$		V_{DD}	V	RESET pin and INT pin
	V_{IH2}	$0.7 V_{DD}$		V_{DD}	V	Other than RESET pin and INT pin
Low-Level Input Voltage	V_{IL1}	0		$0.2 V_{DD}$	V	RESET pin and INT pin
	V_{IL2}	0		$0.3 V_{DD}$	V	Other than RESET pin and INT pin
High-Level Input Current	I_{IH1}			0.2	μA	INT $V_{IH} = V_{DD}$
	I_{IH2}			0.2	μA	RESET $V_{IH} = V_{DD}$
	I_{IH3}			0.2	μA	P0A-P0D $V_{IH} = V_{DD}$
Low-Level Input Current	I_{IL1}			0.2	μA	INT $V_{IL} = 0\text{ V}$
	I_{IL2}			0.2	μA	RESET $V_{IL} = 0\text{ V}$, w/o pull-up resistor
	I_{IL3}	20	50	100	μA	
	I_{IL4}			0.2	μA	P0A, P0B $V_{IL} = 0\text{ V}$ w/o pull-up resistor
	I_{IL5}	6	12	20	μA	
	I_{IL6}			0.2	μA	P0C, P0D $V_{IL} = 0\text{ V}$
High-Level Output Current	I_{OH1}	-0.6	-2.0	-4.0	mA	P0A, P0B $V_{OH} =$ $V_{DD}-0.3\text{ V}$
	I_{OH2}	-7.0	-15.0	-25.0	mA	REM $V_{OH} =$ $V_{DD}-2\text{ V}$
	I_{OH3}	-0.3	-1.0	-2.0	mA	LED $V_{OH} =$ $V_{DD}-0.3\text{ V}$
	I_{OH4}	-0.3	-1.0	-2.0	mA	VDOU $V_{OH} =$ $V_{DD}-0.3\text{ V}$

CHARACTERISTICS	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS	
Low-Level Output Current	I _{OL1}	0.5	1.5	2.5	mA	P0A, P0B	V _{OL} = 0.3 V
	I _{OL2}	0.5	1.5	2.5	mA	P0C, P0D	V _{OL} = 0.3 V
	I _{OL3}	0.5	1.5	2.5	mA	REM	V _{OL} = 0.3 V
	I _{OL4}	0.5	1.5	2.5	mA	LED	V _{OL} = 0.3 V
	I _{OL5}	0.5	1.5	2.5	mA	V _{DOUT}	V _{OL} = 0.3 V
Common Output Current	I _{COM}	30			μA	Output voltage deviation = 0.2 V	
Segment Output Current	I _{LCD}	5			μA	Output voltage deviation = 0.2 V	
Supply Current	I _{DD1}		0.5	1.5	mA	Operation mode	Both XT and X oscillate
	I _{DD2}		15	30	μA		Only XT oscillates
	I _{DD3}		0.5	1.5	mA	HALT mode	Both XT and X oscillate
	I _{DD4}		10	15	μA	STOP mode	Only XT oscillates

DC PROGRAMMING CHARACTERISTICS (T_a = 25 ± 5 °C, V_{DD} = 6.0 ± 0.25 V, V_{PP} = 12.5 ± 0.3 V)

CHARACTERISTICS	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS
High-Level Input Voltage	V _{IH1}	0.7 V _{DD}		V _{DD}	V	Other than CLK
	V _{IH2}	V _{DD} - 0.5		V _{DD}	V	CLK
Low-Level Input Voltage	V _{IL1}	0		0.3 V _{DD}	V	Other than CLK
	V _{IL2}	0		0.4	V	CLK
Input Leakage Current	I _{LI}			10	μA	V _{IN} = V _{IL} or V _{IH}
High-Level Output Voltage	V _{OH}	V _{DD} - 1.0			V	I _{OH} = -1 mA
Low-Level Output Voltage	V _{OL}			0.4	V	I _{OL} = 1.6 mA
V _{DD} Supply Current	I _{DD}			30	mA	
V _{PP} Supply Current	I _{PP}			30	mA	MD0 = V _{IL} , MD1 = V _{IH}

Note 1: Keep V_{pp} to below +13.5 V, including the overshoot.
 2: Apply V_{DD} before V_{pp}, and remove V_{DD} after V_{pp}.

AC PROGRAMMING CHARACTERISTICS ($T_a = 25 \pm 5^\circ\text{C}$, $V_{DD} = 6.0 \pm 0.25\text{ V}$,
 $V_{PP} = 12.5 \pm 0.3\text{ V}$)

CHARACTERISTICS	SYMBOL	*1	MIN.	TYP.	MAX.	UNIT	CONDITIONS
Address setup time*2 (vs. MD0 ↓)	t_{AS}	t_{AS}	2			μs	
MD1 setup time (vs. MD0 ↓)	t_{M1S}	t_{OES}	2			μs	
Data setup time (vs. MD0 ↓)	t_{DS}	t_{DS}	2			μs	
Address hold time*2 (vs. MD0 ↑)	t_{AH}	t_{AH}	2			μs	
Data hold time (vs. MD0 ↑)	t_{DH}	t_{DH}	2			μs	
MD0 ↑ → data output float delay time	t_{DF}	t_{DF}	0		130	ns	
V_{PP} setup time (vs. MD3 ↑)	t_{VPS}	t_{VPS}	2			μs	
V_{DD} setup time (vs. MD3 ↑)	t_{VDS}	t_{VCS}	2			μs	
Initial program pulse width	t_{PW}	t_{PW}	0.95	1.0	1.05	ms	
Additional program pulse width	t_{OPW}	t_{OPW}	0.95		21.0	ms	
MD0 setup time (vs. MD1 ↑)	t_{MOS}	t_{CES}	2			μs	
MD0 ↓ → data output delay time	t_{DV}	t_{DV}			1	μs	MD0=MD1= V_{IL}
MD1 hold time (vs. MD0 ↑)	t_{M1H}	$t_{OE H}$	2			μs	$t_{M1H} + t_{M1R}$ ≥ 50 μs
MD1 recovery time (vs. MD0 ↓)	t_{M1R}	t_{OR}	2			μs	
Program counter reset time	t_{PCR}	—	10			μs	
CLK input high-, low-level width	t_{XH} , t_{XL}	—	0.125			μs	
CLK Input Frequency	f_X	—			4.19	MHz	
Initial Mode Set Time	t_I	—	2			μs	
MD3 Setup Time (vs. MD1 ↑)	t_{M3S}	—	2			μs	
MD3 Hold Time (vs. MD1 ↓)	t_{M3H}	—	2			μs	
MD3 Setup Time (vs. MD0 ↓)	t_{M3SR}	—	2			μs	When program memory is read
Address*2 → Data Output Delay Time	t_{DAD}	t_{ACC}			2	μs	When program memory is read
Address*2 → Data Output Hold Time	t_{HAD}	t_{OH}	0		130	μs	When program memory is read
MD3 Hold Time (vs. MD0 ↑)	t_{M3HR}	—	2			μs	When program memory is read
MD3 ↓ → Data Output Float Delay Time	t_{DFR}	—	2			μs	When program memory is read
Reset Setup Time	t_{RES}		10			μs	

*1: Symbols for corresponding μPD27C256

*2: The internal address is incremented (+1) at the falling edge of third clock periods for the four CLK clock periods, which constitute one cycle. The internal address has no external pin connection.