

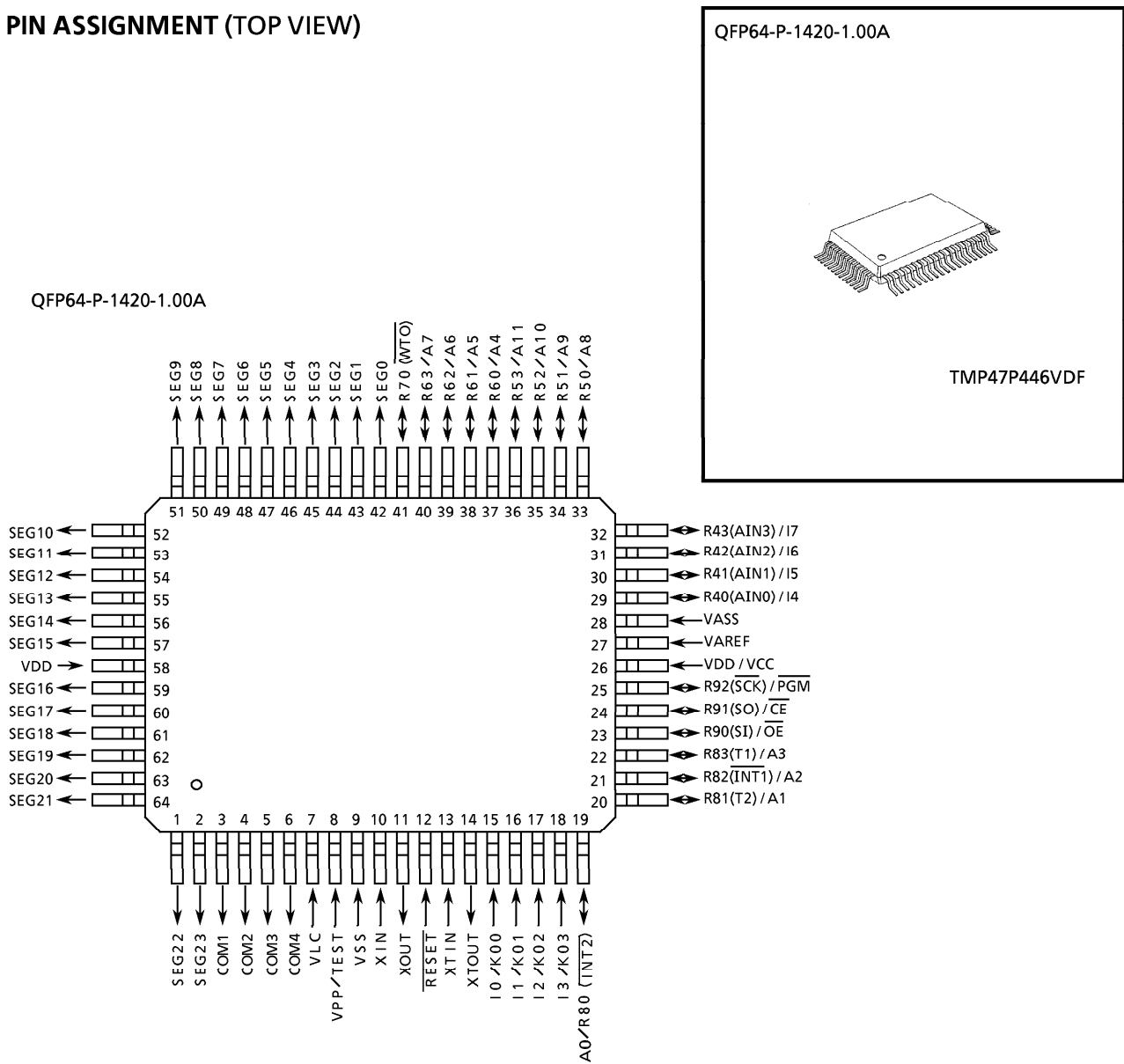
CMOS 4-BIT MICROCONTROLLER

TMP47P446VDF

The 47P446V is the system evaluation LSI of 47C446A with 32K bits one-time PROM. The 47P446V programs / verifies using an adapter socket to connect with PROM programmer, as it is in TMM2764AD. In addition, the 47P446V and the 47C446A are pin compatible. The 47P446V operates as the same as the 47C446A by programming to the internal PROM.

PART No.	ROM	RAM	PACKAGE	ADAPTER SOCKET
TMP47P446VDF	OTP 4096 × 8-bit	256 × 4-bit	QFP64-P-1420-1.00A	BM1127A

PIN ASSIGNMENT (TOP VIEW)



PIN FUNCTION

The 47P446V has MCU mode and PROM mode.

(1) MCU mode

The 47C446A and the 47P446V are pin compatible.

(TEST pin for out-going test. Be fixed to low level.)

(2) PROM mode

PIN NAME	Input/Output	FUNCTIONS	PIN NAME (MCU MODE)
A11 to A8	Input	Address inputs	R53 to R50
A7 to A4			R63 to R60
A3 to A0			R83 to R80
I7 to I4	I/O	Data inputs / outputs	R43 to R40
I3 to I0			K03 to K00
$\overline{\text{PGM}}$	Input	Program control input	R92
$\overline{\text{CE}}$		Chip Enable input	R91
$\overline{\text{OE}}$		Output Enable input	R90
VPP	Power supply	+ 12.5 V / 5 V (Program supply voltage)	TEST
VCC		+ 5 V	VDD
VSS		0 V	VSS
SEG23 to SEG0	Output	Open	
COM4 to COM1			
$\overline{\text{RESET}}$	Input	PROM mode setting pins. Be fixed to low level.	
R70			
XIN	Input	Resonator connecting pins	
XOUT	Output		
VAREF	Power supply	Be fixed to low level	
VASS			
VLC	Power supply	Be fixed to low level	

OPERATIONAL DESCRIPTION

The following is an explanation of hardware configuration and operation in relation to the 47P446V. The 47P446V is the same as the 47C446A except that an OTP is used instead of a built-in mask ROM.

1. OPERATION mode

The 47P446V has an MCU mode and a PROM mode.

1.1 MCU mode

The MCU mode is set by fixing the TEST / VPP pin at the "L" level. Operation in the MCU mode is the same as for the 47C446A, except that the TEST / VPP pin does not have built in pull-down resistor and cannot be used open.

1.1.1 Program Memory

The program storage area is the same as for the 47C446A.

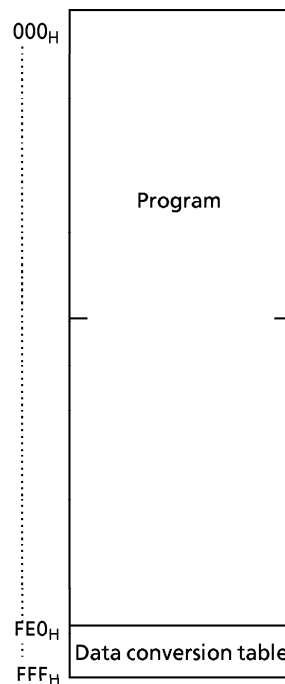


Figure 1-1. Program area

1.1.2 Data Memory

The 47P446V contains 256 × 4-bit (equivalent to 47C446A) data memory.

1.1.3 Input / Output Circuitry

(1) Control pins

This is the same as for the 47C446A except that there is no built-in pull-down resistance for the TEST pin.

(2) I/O Ports

The input / output circuit of the 47P446V is the same as I/O code 1A of the 47C446A.

External resistance, for example, is required when using as evaluator of other I/O codes (SB to SF), (Refer to Figure 1.2)

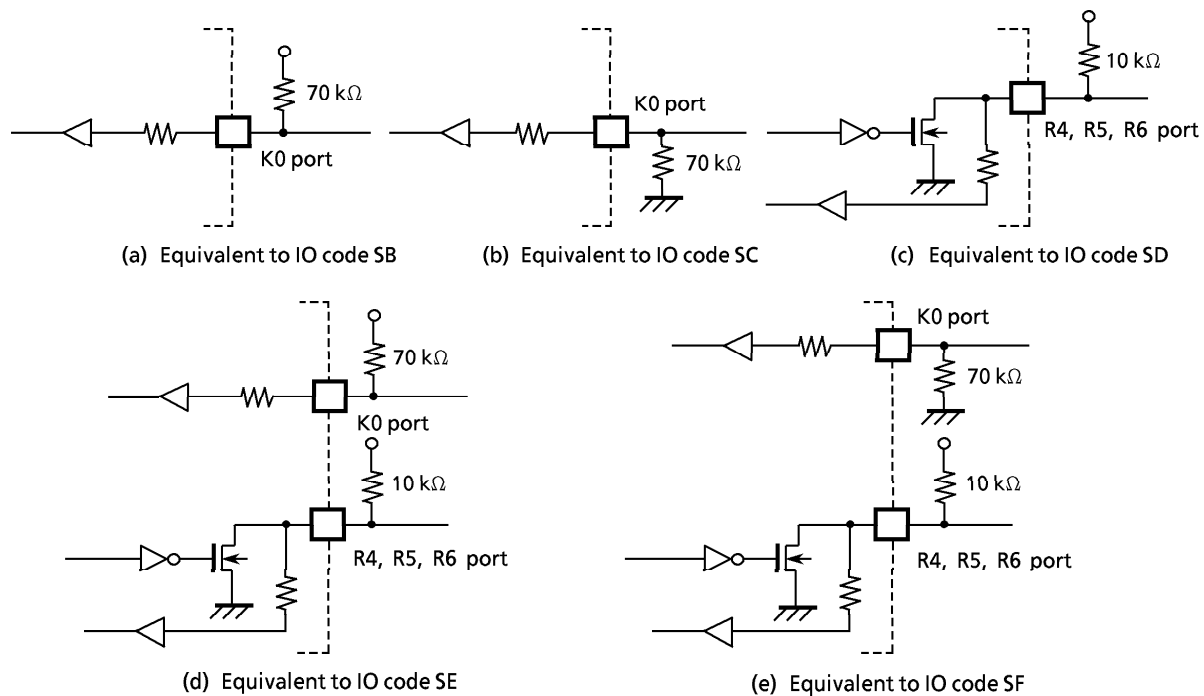


Figure 1-2. I/O code and external circuitry

1.2 PROM mode

The PROM mode is set by setting the $\overline{\text{RESET}}$ and R70 pins to the "L" level. The PROM mode can be used as a general-purpose PROM writer for program and an adapter socket to connect with PROM programmer writing and verification.

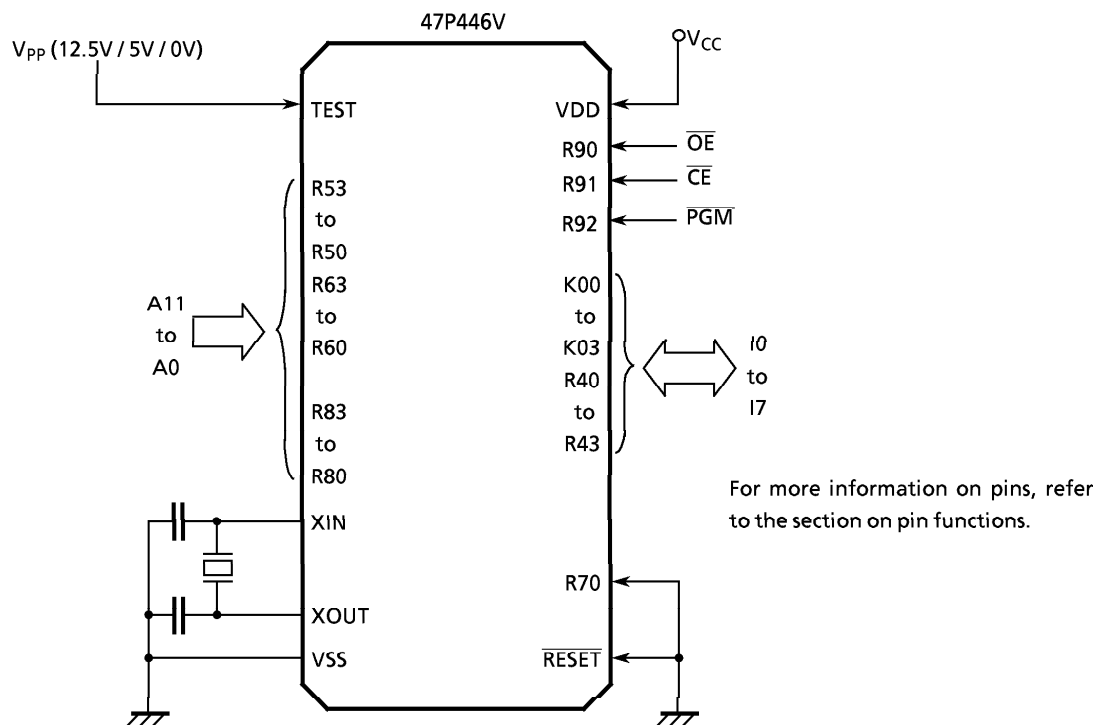


Figure 1-3. Setting for PROM mode

1.2.1 High Speed Programming Mode

The device is set up in the high speed programming mode when the programming voltage (12.5 V) is applied to the V_{pp} terminal with $V_{cc} = 6$ V and $\overline{\text{PGM}} = V_{IH4}$. The programming is achieved by applying a Single TTL low level 1 ms, pulse the $\overline{\text{PGM}}$ input after addresses and data are stable. Then the programmed data is verified by using program Verify Mode. If the programmed data is not correct, another program pulse of 1 msec is applied and then programmed data is verified. This should be repeated until the program operates correctly (max. 25 times). After correctly programming the selected address, one additional program pulse with pulse width 3 times that needed for programming is applied. When programming has been completed, the data in all addresses should be verified with $V_{cc} = V_{pp} = 5$ V.

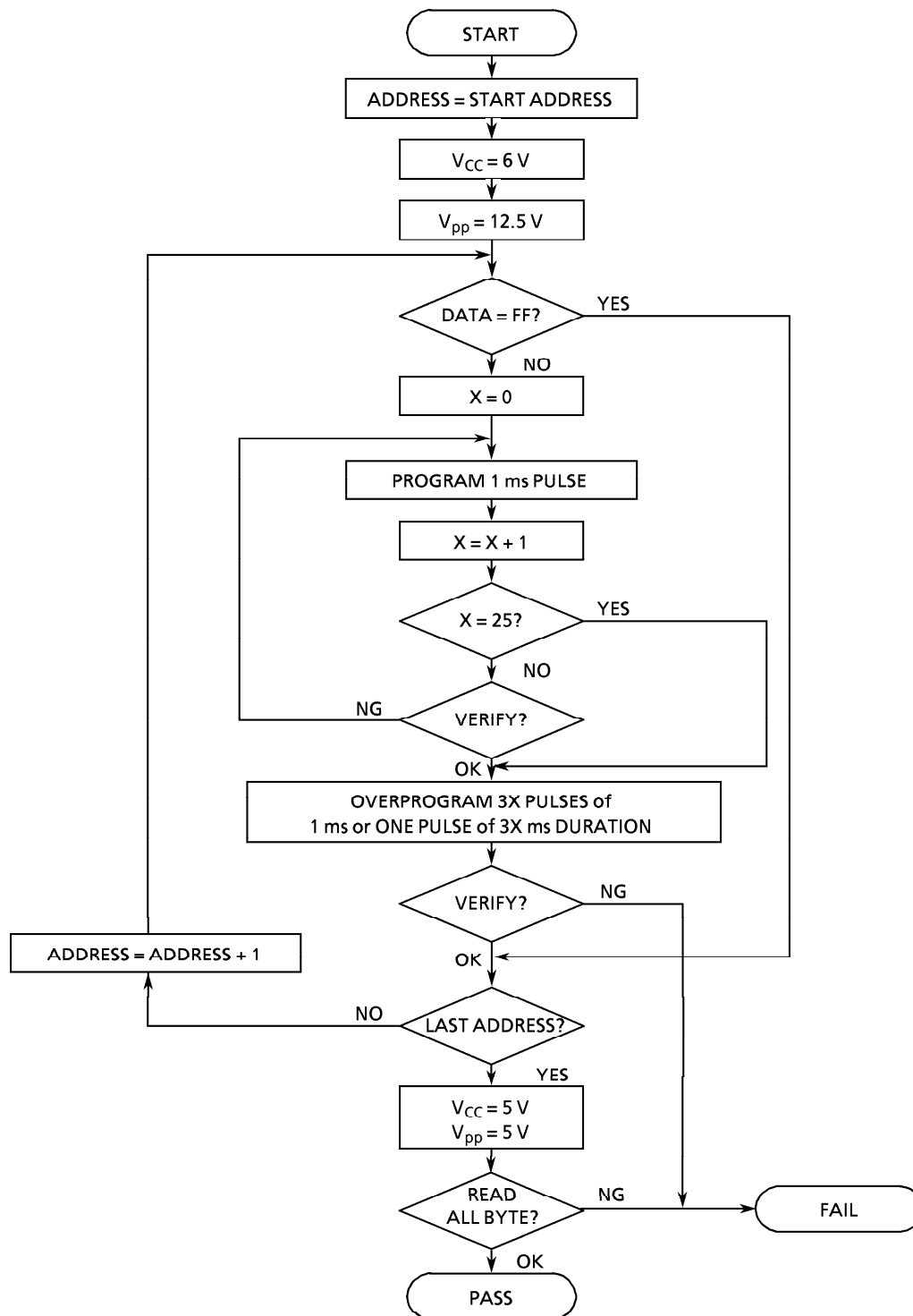


Figure1-4. Flow Chart

ELECTRICAL CHARACTERISTICS

ABSOLUTE MAXIMUM RATINGS

(V_{SS} = 0 V)

PARAMETER	SYMBOL	PINS	RATING	UNIT
Supply Voltage	V _{DD}		– 0.3 to 7	V
Program Voltage	V _{PP}	TEST / VPP pin	– 0.3 to 14.0	V
Supply Voltage (LCD drive)	V _{LC}		– 0.3 to V _{DD} + 0.3	V
Input Voltage	V _{IN}		– 0.3 to V _{DD} + 0.3	V
Output Voltage	V _{OUT1}	Except sink open drain pin, but include R7	– 0.3 to V _{DD} + 0.3	V
	V _{OUT2}	Sink open drain pin without port R7	– 0.3 to 10	
Output Current (per 1 pin)	I _{OUT}		3.2	mA
Power Dissipation [T _{opr} = 70 °C]	PD		600	mW
Soldering Temperature (time)	T _{sld}		260 (10 s)	°C
Storage Temperature	T _{stg}		– 55 to 125	°C
Operating Temperature	T _{opr}		– 30 to 70	°C

RECOMMENDED OPERATING CONDITIONS

(V_{SS} = 0 V, T_{opr} = – 30 to 70 °C)

PARAMETER	SYMBOL	PINS	CONDITIONS	Min.	Max.	UNIT
Supply Voltage	V _{DD}		In the Normal mode	4.5	6.0	V
			In the SLOW mode	2.7		
Input High Voltage	V _{IH1}	Except Hysteresis Input	V _{DD} ≥ 4.5 V	V _{DD} × 0.7	V _{DD}	V
	V _{IH2}	Hysteresis Input		V _{DD} × 0.75		
	V _{IH3}		V _{DD} < 4.5 V	V _{DD} × 0.9		
Input Low Voltage	V _{IL1}	Except Hysteresis Input	V _{DD} ≥ 4.5 V	0	V _{DD} × 0.3	V
	V _{IL2}	Hysteresis Input			V _{DD} × 0.25	
	V _{IL3}		V _{DD} < 4.5 V		V _{DD} × 0.1	
Clock Frequency (High freq.)	f _c	XIN, XOUT		0.4	4.2	MHz
Clock Frequency (Low freq.)	f _s	XTIN, XTOUT		30.0	34.0	kHz

Note 1. Input Voltage V_{IH3}, V_{IL3} : in the SLOW mode

D.C. CHARACTERISTICS

(V_{SS} = 0 V, T_{opr} = -30 to 70 °C)

PARAMETER	SYMBOL	PINS	CONDITIONS	Min.	Typ.	Max.	UNIT
Hysteresis Voltage	V _{HS}	Hysteresis Input		—	0.7	—	V
Input Current	I _{IN1}	Port K0, TEST, $\overline{\text{RESET}}$	V _{DD} = 5.5 V,	—	—	± 2	μA
	I _{IN2}	Ports R (open drain)	V _{IN} = 5.5 V / 0 V				
Low Input Current	I _{IL}	Ports R (push-pull)	V _{DD} = 5.5 V, V _{IN} = 0.4 V	—	—	− 2	mA
Input Resistance	R _{IN1}	Port K0 with pull-up/pull-down resistor		30	70	150	kΩ
	R _{IN2}	$\overline{\text{RESET}}$		100	220	450	
Output Leakage Current	I _{LO}	Ports R (open drain)	V _{DD} = 5.5 V, V _{OUT} = 5.5 V	—	—	2	μA
Output High Voltage	V _{OH}	Ports R (push-pull)	V _{DD} = 4.5 V, I _{OH} = − 200 μA	2.4	—	—	V
Output Low Voltage	V _{OL2}	Except XOUT	V _{DD} = 4.5 V, I _{OL} = 1.6 mA	—	—	0.4	V
Segment Output Low Resistance	R _{OS1}	SEG pin	V _{DD} = 5 V, V _{DD} − V _{LC} = 3 V	—	20	—	kΩ
Common Output Low Resistance	R _{OC1}	COM pin					
Segment Output High Resistance	R _{OS2}	SEG pin		—	200	—	
Common Output High Resistance	R _{OC2}	COM pin					
Segment / Common Output Voltage	V _{O2/3}	SEG / COM pin		3.8	4.0	4.2	V
	V _{O1/2}			3.3	3.5	3.7	
	V _{O1/3}		2.8	3.0	3.2		
Supply Current (in the Normal mode)	I _{DD}		V _{DD} = 5.5 V, V _{LC} = V _{SS} f _C = 4 MHz	—	3	6	mA
Supply Current (in the SLOW mode)	I _{DDs}		V _{DD} = 3 V, V _{LC} = V _{SS} f _s = 32 768 kHz	—	15	30	μA

Note 1. Typ. values shows those at T_{opr} = 25 °C, V_{DD} = 5 V.

Note 2. Input Current I_{IN1} : The current through resistor is not included, when the input resistor (pull-up/pull-down) is contained.

Note 3. Output Resistance R_{OS}, R_{OC} : Shows on-resistance at the level switching.

Note 4. V_{O2/3} : Shows 2/3 level output voltage, when the 1/4 or 1/3 duty LCD is used.

V_{O1/2} : Shows 1/2 level output voltage, when the 1/2 duty or static LCD is used.

V_{O1/3} : Shows 1/3 level output voltage, when the 1/4 or 1/3 duty LCD is used.

Note 5. Supply Current I_{DD} : V_{IN} = 5.3 V / 0.2 V

The Port K0 is open when the input resistor is contained.

The voltage applied to the Port R is within the valid range.

Note 6. Supply Current I_{DDs} : V_{IN} = 2.8 V / 0.2 V. Only low frequency clock is only osillated (connecting XTIN, XTOUT).

Note 7. When using LCD, it is necessary to consider values of R_{OS1/2} and R_{OC1/2}.

Note 8. Times for SEG / COM output resistance switching on :

R_{OS1}, R_{OC1} : 2/f_s (s)

R_{OS2}, R_{OC2} : 1/(n·f_F) (1/n : duty, f_F : frame frequency)

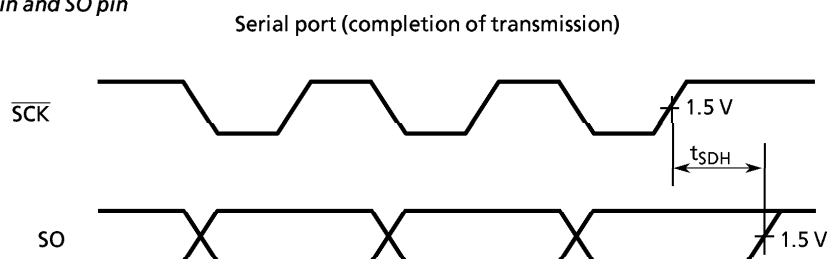
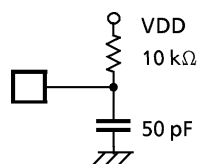
A / D CONVERSION CHARACTERISTICS (T_{opr} = -30 to 70 °C)

PARAMETER	SYMBOL	CONDITIONS	Min.	Typ.	Max.	UNIT
Analog Reference	V _{AREF}		V _{DD} - 1.5	—	V _{DD}	V
	V _{ASS}		V _{SS}	—	1.5	
Analog Reference Voltage Range	ΔV _{AREF}	V _{AREF} - V _{ASS}	2.5	—	—	V
Analog input Voltage	V _{AIN}		V _{ASS}	—	V _{AREF}	V
Analog Supply Current	I _{REF}		—	0.5	1.0	mA
Nonlinearity Error		V _{DD} = 5.0 V, V _{SS} = 0.0 V V _{AREF} = 5.000 V V _{ASS} = 0.000 V	—	—	± 1	LSB
Zero point Error			—	—	± 1	
Full scale Error			—	—	± 1	
Total Error			—	—	± 2	

A.C. CHARACTERISTICS (V_{SS} = 0 V, V_{DD} = 4.5 to 6.0 V, T_{opr} = -30 to 70 °C)

PARAMETER	SYMBOL	CONDITION	Min.	Typ.	Max.	UNIT
Instruction Cycle Time	t _{cy}	in the Normal mode	1.9	—	20	μs
		in the SLOW mode	235	—	267	
High level Clock Pulse Width	t _{WCH}	For external clock operation	80	—	—	ns
Low level Clock Pulse Width	t _{WCL}					
A/D Conversion Sampling Time	t _{AIN}	f _c = 4 MHz	—	4	—	μs
Shift Data Hold Time	t _{SDH}		0.5 t _{cy} - 300	—	—	ns

Note. Shift data Hold Time:
External circuit for $\overline{\text{SCK}}$ pin and SO pin



RECOMMENDED OSCILLATING CONDITIONS

($V_{SS} = 0\text{ V}$, $V_{DD} = 4.5\text{ to }6.0\text{ V}$, $T_{opr} = -30\text{ to }70\text{ }^{\circ}\text{C}$)

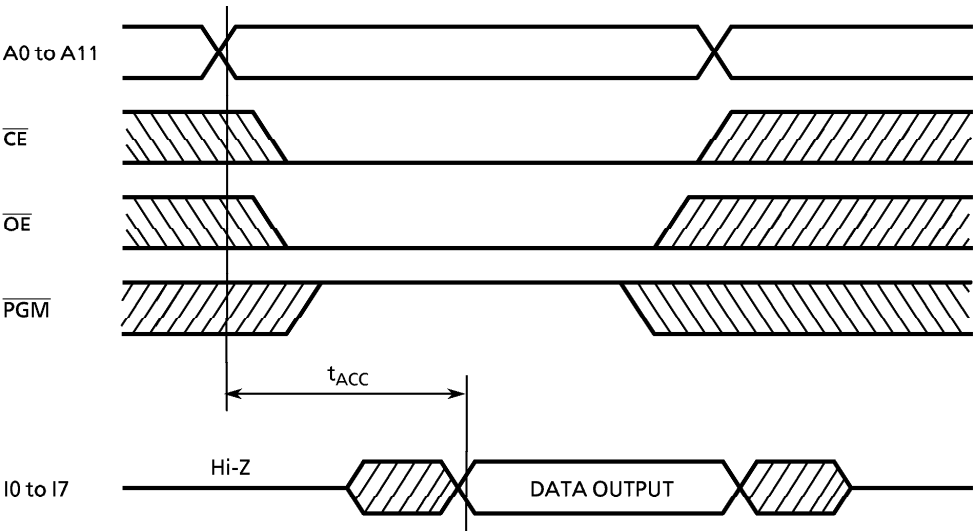
Recommended oscillating conditions of the 47P446V are equal to the 47C446A's.

DC/AC CHARACTERISTICS

($V_{SS} = 0\text{ V}$)

(1) Read Operation

PARAMETER	SYMBOL	CONDITION	Min.	Typ.	Max.	UNIT
Output Level High Voltage	V_{IH4}		$V_{CC} \times 0.7$	–	V_{CC}	V
Output Level Low Voltage	V_{IL4}		0	–	$V_{CC} \times 0.3$	V
Supply Voltage	V_{CC}		4.75	–	6.0	V
Programming Voltage	V_{PP}					
Address Access Time	t_{ACC}	$V_{CC} = 5.0 \pm 0.25\text{ V}$	0	–	350	ns



(2) High Speed Programming Operation

PARAMETER	SYMBOL	CONDITION	Min.	Typ.	Max.	UNIT
Input High Voltage	V_{IH4}		$V_{CC} \times 0.7$	–	V_{CC}	V
Input Low Voltage	V_{IL4}		0	–	$V_{CC} \times 0.3$	V
Supply Voltage	V_{CC}		4.75	–	6.0	V
V_{PP} Power Supply Voltage	V_{PP}		12.0	12.5	13.0	V
Programming Pulse Width	t_{PW}	$V_{CC} = 6.0 \pm 0.25$ V	0.95	1.0	1.05	ms

