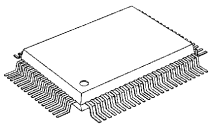
CMOS 4-Bit Microcontroller

TMP47P820VDF

The TMP47P820V is the system evaluation LSI of TMP47C620/820 with 32 Kbits one-time PROM. The TMP47P820V programs / verifies using an adapter socket to connect with PROM programmer, as it is in TMM2764AD.
In addition, the TMP47P820V and the TMP47C620/820 are pin compatible. The TMP47P820V operates as the same as TMP47C620/820 by programming to the internal PROM.

Part No.	ROM	RAM	Package	Adapter Socket
TMP47P820VDF	OTP 8192 × 8-bit	512 × 4-bit	P-QFP80-1420-0.80B	BM1162

P-QFP80-1420-0.80B

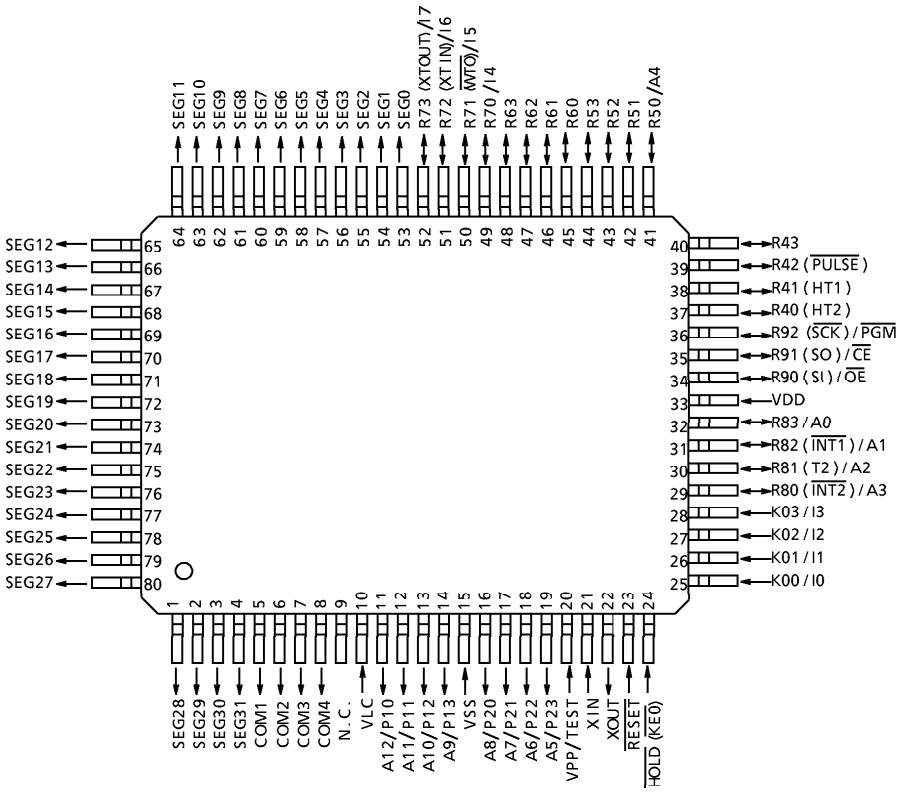


TMP47P820VDF

000707EBA1

Pin Assignment (Top View)

P-QFP80-1420-0.80B



Pin Function

The TMP47P820V has MCU mode and PROM mode.

(1) MCU mode

The TMP47C820 and the TMP47P820V 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)
A12 to A9	Input	Address inputs	P10 to P13
A8 to A5			P20 to P23
A4			R50
A3 to A0			R80 to R83
I7 to I4	I/O	Data inputs / outputs	R73 to R70
I3 to I0			K03 to K00
$\overline{PGM}$	Input	Program control input	R92
$\overline{CE}$		Chip Enable input	R91
$\overline{OE}$		Output Enable input	R90
VPP	Power supply	+ 12.5 V / 6 V (Program supply voltage)	TEST
VCC		+ 5 V	VDD
VSS		0 V	VSS
SEG31 to SEG0	Output	Open	
COM4 to COM1			
VLC	Power supply		
N.C.			
R53 to R51	I/O	Be fixed to low level	
R63 to R60			
R43 to R42			
R41 to R40		PROM mode setting pins. Be fixed to low level.	
$\overline{RESET}$	Input		
$\overline{HOLD}$	Input		
XIN	Input	Resonator connecting pins	
XOUT	Output		

Operational Description

The following is an explanation of hardware configuration and operation in relation to the TMP47P820V. The TMP47P820V is the same as the TMP47C620/820 except that an OTP is used instead of a Mask ROM.

1. Operation Mode

The TMP47P820V 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 TMP47C620/820, except that the TEST / VPP pin does not have pull-down resistor and cannot be used open.

1.1.1 Program memory

The program storage area is the same as for the TMP47C820. Data conversion tables must be set in two locations when using the TMP47P820V to check TMP47C620 operation.

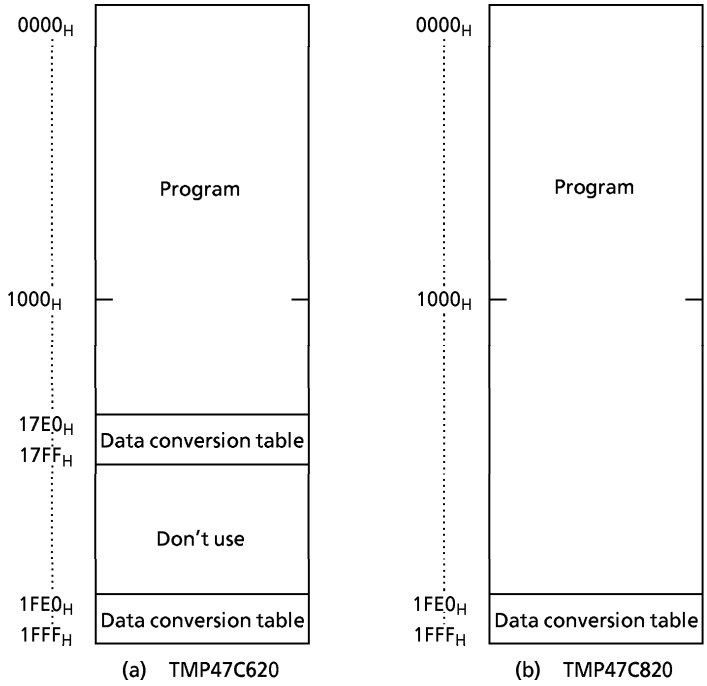


Figure 1-1. Program area

1.1.2 Data memory

The TMP47P820V has 512 × 4-bit data memory bank (RAM).

When using the TMP47P820V as a TMP47C620 evaluator, do not write data to address 80_H and following, even though the DMB1 addresses are 00-FF_H. There is no necessary to take into consideration a special function Shared area because one is built in DMB0.

1.1.3 Input / Output circuitry

(1) Control pins

This is the same as for the TMP47C620/820 except that there is no built-in pull-down resistance for the TEST pin.

(2) I/O Ports

The input / output circuit of the TMP47P820V is the same as I/O code GA of the TMP47C620/820. External resistance, for example, is required when using as evaluator of other I/O codes (GB to GF) (Refer to Figure 1-2).

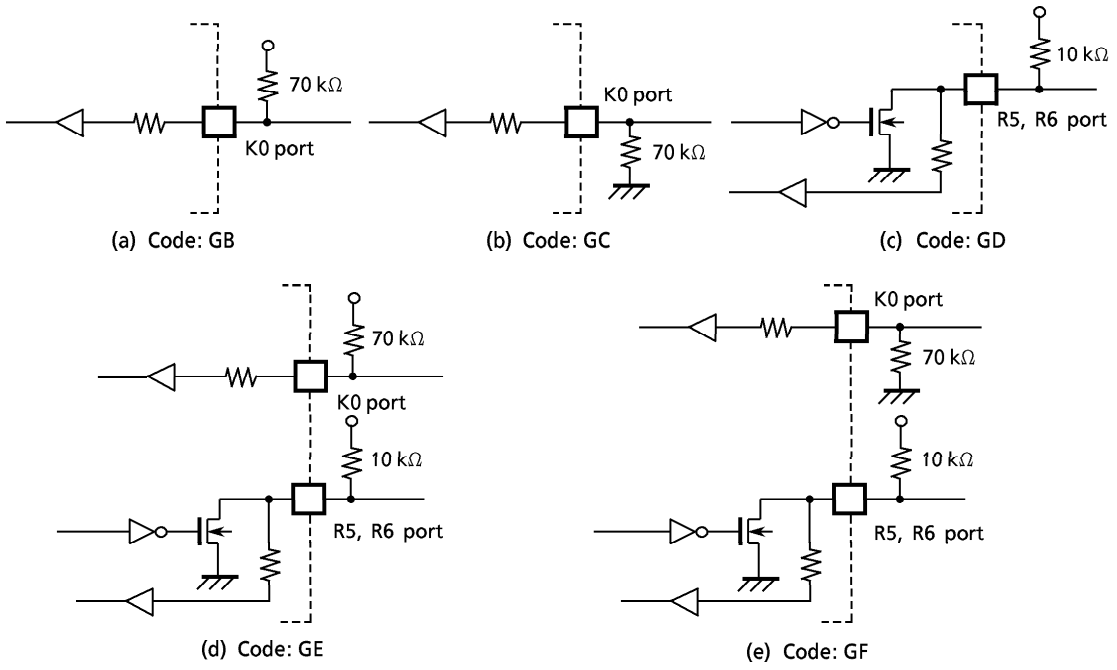


Figure 1-2. I/O code and external circuitry

1.2 PROM mode

The PROM mode is set by setting the $\overline{\text{RESET}}$, $\overline{\text{HOLD}}$, K00 and K01 pins to the "L" level. The PROM mode can be used as a general-purpose PROM writer for program writing and verification (A high-speed program mode is used set the ROM type the same as for the TMM2764AD).

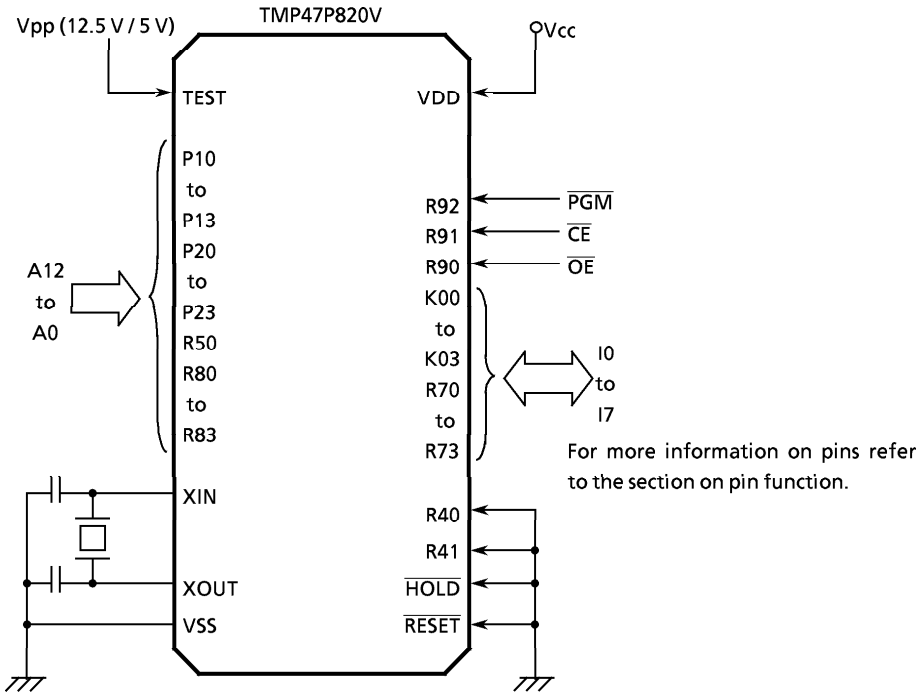


Figure 1-3. Setting for PROM mode

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 Vpp terminal with Vcc = 6 V and $\overline{PGM}$ = V_{IH4}. The programming is achieved by applying a Single TTL low level 1 ms, pulse the $\overline{PGM}$ 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 ms 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 Vcc = Vpp = 5 V.

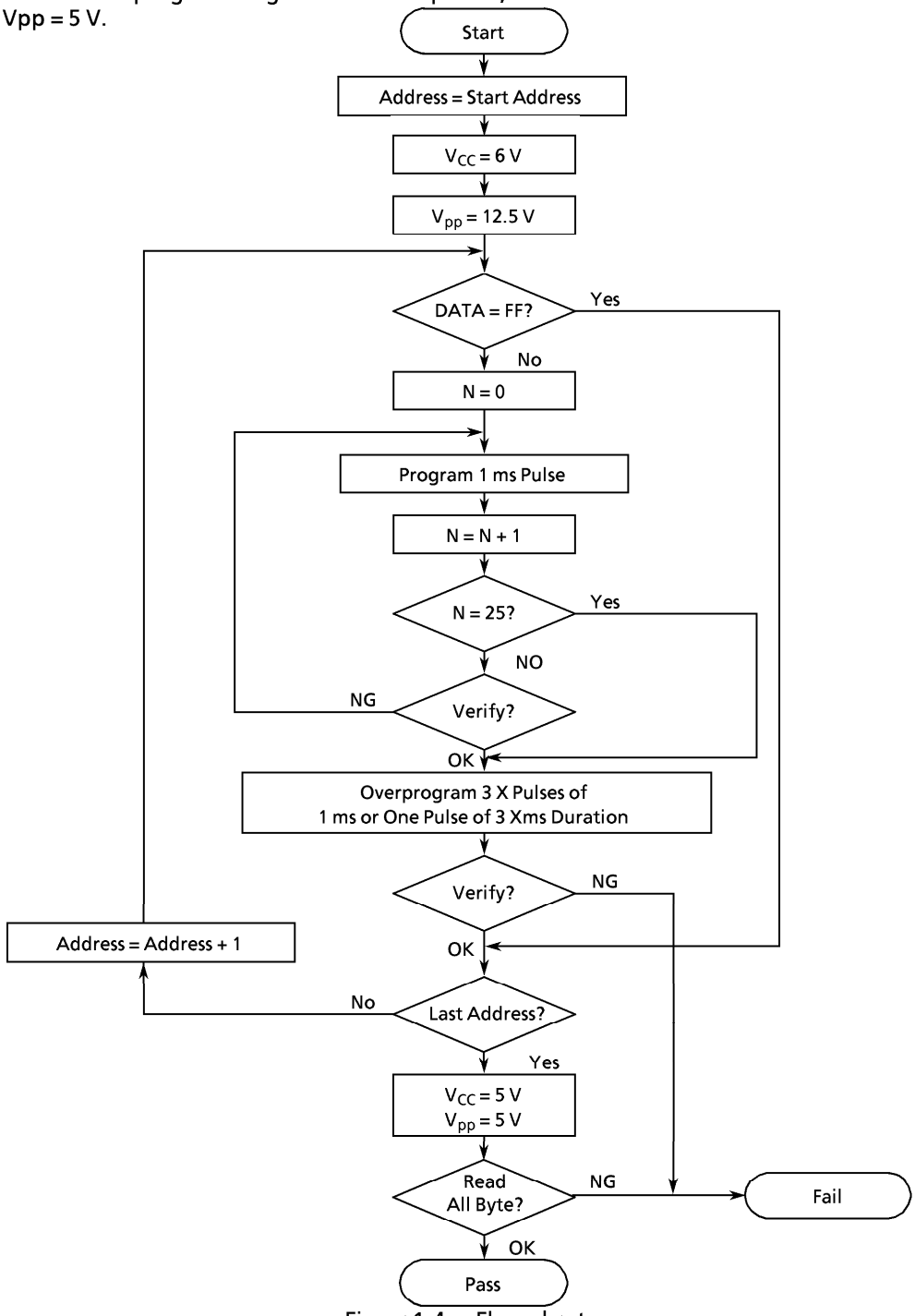


Figure1-4. Flow chart

Electrical Characteristics

Absolute Maximum Ratings (V_{SS} = 0 V)

Parameter	Symbol	Pins	Ratings	Unit
Supply Voltage	V_{DD}		– 0.3 to 7	V
Program Voltage	V_{PP}	TEST / V_{PP} Pin	– 0.3 to 13.0	V
Input Voltage	V_{IN}		– 0.3 to V_{DD} + 0.3	V
Output Voltage	V_{OUT1}	Ports R4, R5, R7, push-pull port	– 0.3 to V_{DD} + 0.3	V
	V_{OUT2}	Ports P1, P2, R6, R8, R9	– 0.3 to 10	
Output Current (Per 1 pin)	I_{OUT1}	Ports P1, P2	15	mA
	I_{OUT2}	Ports R4 to R9	3.2	
Output Current (Total)	ΣI_{OUT}	Ports P1, P2	60	mA
Power Dissipation [T_{opr} = 70°C]	PD		600	mW
Soldering Temperature (time)	Tsld		260 (10 s)	°C
Storage Temperature	Tstg		– 55 to 125	°C
Operating Temperature	Topr		– 40 to 70	°C

Note: The absolute maximum ratings are rated values which must not be exceeded during operation, even for an instant. Any one of the ratings must not be exceeded. If any absolute maximum rating is exceeded, a device may break down or its performance may be degraded, causing it to catch fire or explode resulting in injury to the user. Thus, when designing products which include this device, ensure that no absolute maximum rating value will ever be exceeded.

Recommended Opeating Conditions (V_{SS} = 0 V, Topr = – 40 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		
			In the HOLD mode	2.0		
Input High Voltage	V_{IH1}	Except Hysteresis Input	$V_{DD} \geqq 4.5$ V	$V_{DD} \times 0.7$	V_{DD}	V
	V_{IH2}	Hysteresis Input		$V_{DD} \times 0.75$		
	V_{IH3}		$V_{DD} < 4.5$ V	$V_{DD} \times 0.9$		
Input Low Voltage	V_{IL1}	Except Hysteresis Input	$V_{DD} \geqq 4.5$ V	0	$V_{DD} \times 0.3$	V
	V_{IL2}	Hysteresis Input			$V_{DD} \times 0.25$	
	V_{IL3}		$V_{DD} < 4.5$ V		$V_{DD} \times 0.1$	
Clock Frequency	fc	XIN, XOUT		0.4	6.0	MHz
	fs	XTIN, XTOUT		30.0	34.0	kHz

Note 1: The recommended operating conditions for a device are operating conditions under which it can be guaranteed that the device will operate as specified. If the device is used under operating conditions other than the recommended operating conditions (supply voltage, operating temperature range, specified AC/DC values etc.), malfunction may occur. Thus, when designing products which include this device, ensure that the recommended operating conditions for the device are always adhered to.

Note 2: Input voltage V_{IH3}, V_{IL3}: In the SLOW or HOLD mode.

DC Characteristics (V_{SS} = 0 V, T_{opr} = – 40 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, $\overline{RESET}$, $\overline{HOLD}$	V_{DD} = 5.5 V, V_{IN} = 5.5 V / 0 V	–	–	± 2	μA
	I_{IN2}	Open drain R port					
Input Low Current	I_{IL}	Push-pull R port	V_{DD} = 5.5 V, V_{IN} = 0.4 V	–	–	–2	mA
Input Resistance	R_{IN}	$\overline{RESET}$		100	220	450	kΩ
Output Leakage Current	I_{LO}	Open drain ports P, R	V_{DD} = 5.5 V, V_{OUT} = 5.5 V	–	–	0.4	μA
Output High Voltage	V_{OH}	Push-pull R port	V_{DD} = 4.5 V, I_{OH} = –200 μA	2.4	–	–	V
Output Low Voltage	V_{OL2}	Except XOUT XTOUT and ports P1, P2	V_{DD} = 4.5 V, I_{OL} = 1.6 mA	–	–	0.4	V
Output Low Current	I_{OL1}	Ports P1, P2	V_{DD} = 4.5 V, V_{OL} = 1.0 V	–	10	–	mA
Segment Output Low Registance	R_{OS1}	SEG pin	V_{DD} = 5 V, V_{DD} – V_{LC} = 3 V	–	20	–	kΩ
Common Output Low Registance	R_{OC1}	COM pin					
Segment Output High Registance	R_{OS2}	SEG pin		–	200	–	
Common Output High Registance	R_{OS2}	COM pin					
Segment/Common Output Registance	$V_{O2/3}$	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, fc = 4 MHz	–	3	6	mA
Supply Current (in the SLOW mode)	I_{DDS}		V_{DD} = 3.0 V, fs = 32.768 kHz	–	30	60	μA
Supply Current (in the HOLD mode)	I_{DDH}		V_{DD} = 5.5 V	–	0.5	10	μA

Note 1: Typ. values show 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.

Note 5: $V_{O1/2}$; Shows 1/2 level output voltage, when the 1/2 duty or static LCD is used.

Note 6: $V_{O1/3}$; Shows 1/3 level output voltage, when the 1/4 or 1/3 duty LCD is used.

Note 7: Supply Current I_{DD} ; V_{IN} = 5.3 V / 0.2 V
The K0 port is open when the input resistor is contained.
The voltae applied to the R port is within the valid range.

Note 8: Supply Current I_{DDS} ; V_{IN} = 2.8 V / 0.2 V. Only low frequency clock is only osillated (connecting XTIN, XTOUT).

Note 9: When using LCD, it is necessary to consider values of $R_{OS1/2}$ and $R_{OC1/2}$.

Note 10: Times for SEG / COM output switching on ; R_{OS1}, R_{OC1}: 2/fs (s)
R_{OS2}, R_{OC2}: 1/(n · f_F)
(1/n: duty, f_F: frame frequency)

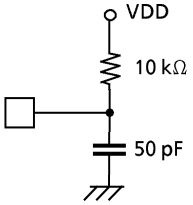
AC Characteristics

(V_{SS} = 0 V, V_{DD} = 4.5 to 6.0 V, T_{opr} = – 40 to 70°C)

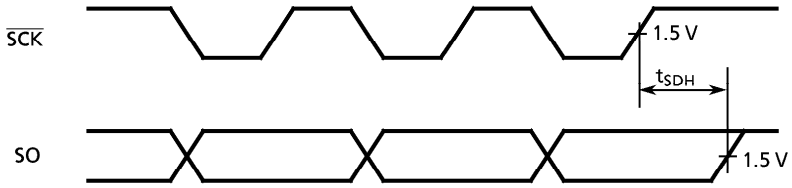
Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Instruction Cycle Time	tcy	In the Normal mode	1.3	—	20	μs
		In the SLOW mode	235	—	267	μs
High Level Clock Pulse Width	t_{WCH}	For external clock operation	80	—	—	ns
Low Level Clock Pulse Width	t_{WCL}					
Shift data Hold Time	t_{SDH}		0.5 tcy – 0.3	—	—	μs
High Speed Timer / Counter input frequency	f_{HT}		—	—	fc	MHz

Note: Shift data Hold time:

External circuit for $\overline{SCK}$ pin and SO pin



Serial port (completion of transmission)



Recommended Oscillating Conditions

(V_{SS} = 0 V, V_{DD} = 4.5 to 6.0 V, Topr = – 40 to 70°C)

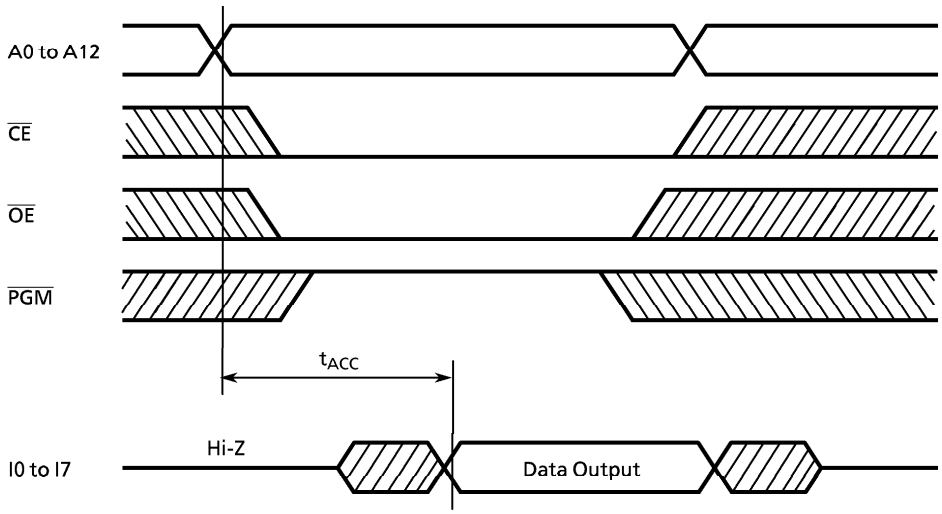
Recommended oscillating conditions of the TMP47P820V are equal to the TMP47C820's.

DC/AC Characteristics

(V_{SS} = 0 V)

(1) Read operation

Parameter	Symbol	Condition	Min	Typ.	Max	Unit
Output Level High Voltage	V_{IH4}		V_{CC} × 0.7	–	V_{CC}	V
Output Level Low Voltage	V_{IL4}		0	–	V_{CC} × 0.1	V
Supply Voltage	V_{CC}		4.75	–	6.0	V
Programming Voltage	V_{PP}					
Address Access Time	t_{ACC}	V_{CC} = 5.0 ± 0.25 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	–	$V_{CC} \times 0.1$	V
Supply Voltage	V_{CC}		4.75	–	6.0	V
V_{PP} Power Supply Voltage	V_{PP}		12.00	12.50	13.0	V
Programming Pulse Width	t_{PW}	$V_{CC} = 6.0 \pm 0.25$ V	0.95	1.0	1.05	ms