

CMOS 4-Bit Microcontroller

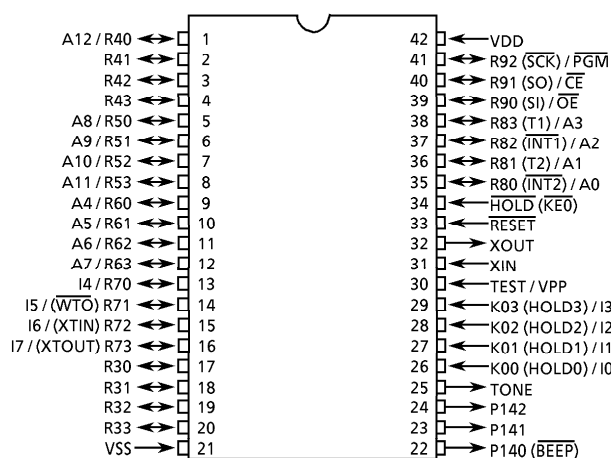
TMP47P857VN TMP47P857VF

The TMP47P857V is the OTP microcontroller with 64 kbits PROM. For program operation, the programming is achieved by using with EPROM programmer (TMM2764AD type) and adapter socket (BM1120, BM1121). AC/DC characteristics are equivalent to Mask-programed ROM device.

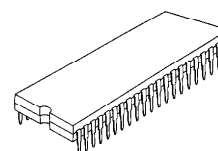
Part No.	ROM	RAM	Package	Adapter Socket
TMP47P857VN	OTP	1024 × 4-bit	P-SDIP42-600-1.78	BM1120
TMP47P857VF	8192 × 8-bit		P-QFP44-1414-0.80D	BM1121

Pin Assignment (Top View)

P-SDIP42-600-1.78



P-SDIP42-600-1.78



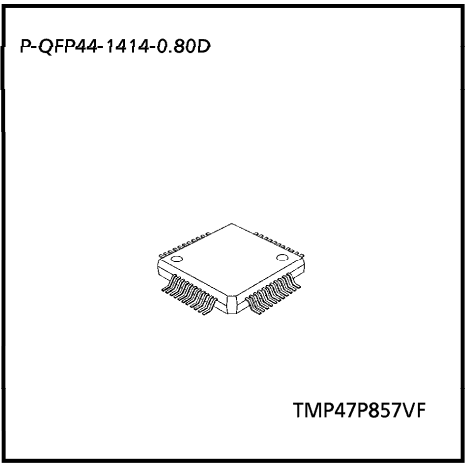
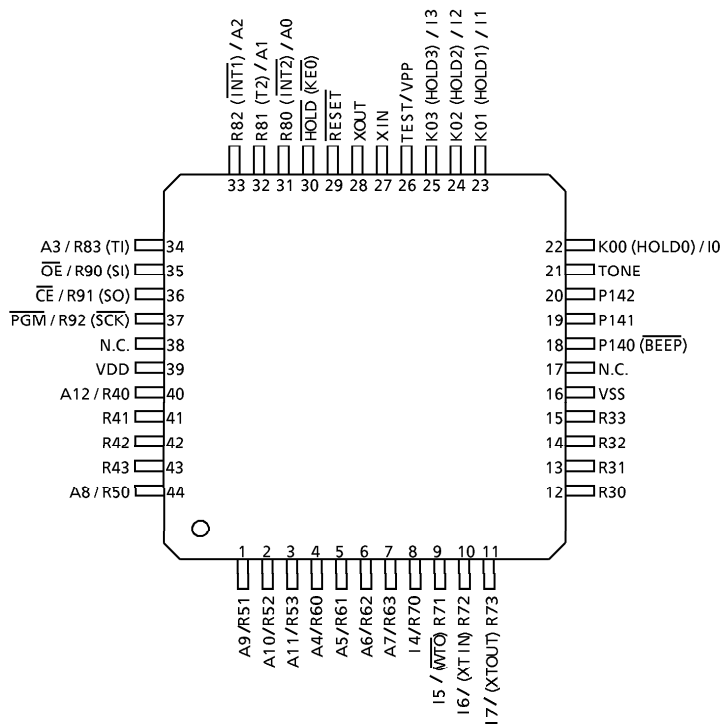
TMP47P857VN

000707EBA1

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Pin Assignment (Top View)

P-QFP44-1414-0.80D



Pin Function

The TMP47P857V has MCU mode and PROM mode.

(1) MCU mode

The TMP47C857V and the TMP47P857V 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	Input	Address inputs	R40
A11 to A8			R53 to R50
A7 to A4			R63 to R60
A3 to A0			R83 to R80
I7 to I4	I/O	Data inputs / outputs	R73 to R70
I3 to I0			K03 to K00
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
TONE	Output	Open	
R33 to R30	I/O	Be fixed to low level	
R43 to R41			
P142 to P140	Output	Open	
$\overline{\text{RESET}}$	Input	PROM mode setting pins. Be fixed to low level.	
$\overline{\text{HOLD}}$	Input		
XIN	Input	External clock input (to keep the internal state stable)	
XOUT	Output	Open	

Operational Description

The following is an explanation of hardware configuration and operation in relation to the TMP47P857V. The TMP47P857V is the same as the TMP47C457/857 except that an OTP is used instead of a Mask ROM.

1. Operation Mode

The TMP47P857V 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 TMP47C457/857, 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 TMP47C857. Data conversion tables must be set in two locations when using the TMP47P857V to check TMP47C457 operation.

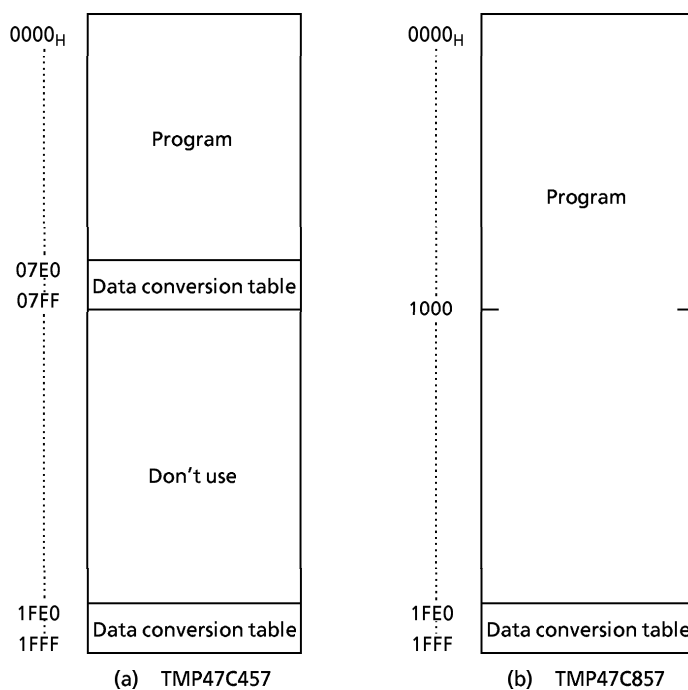


Figure 1-1. Program area

1.1.2 Data Memory

The TMP47P857V has 1024 × 4-bit data memory.

When using the TMP47P857V as a TMP47C457 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 TMP47C457/857 except that there is no built-in pull-down resistance for the TEST pin.

(2) I/O Ports

The input/output circuit of the TMP47P857V is the same as I/O code WB of the TMP47C457/857.

External resistance, for example, is required when using as evaluator of other I/O codes (WE, WH) (Refer to Figure 1-2).

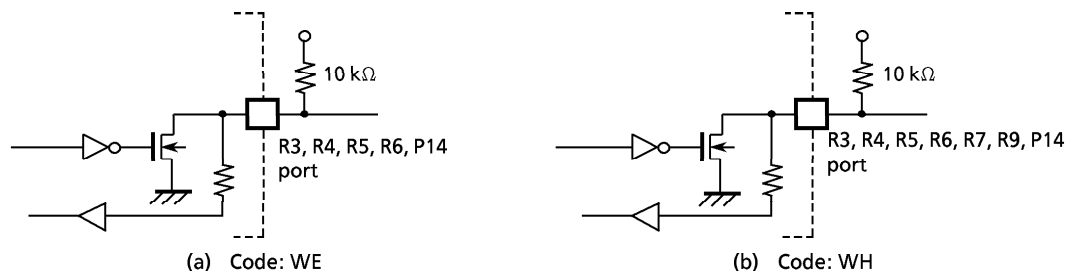


Figure 1-2. I/O code and external circuitry

1.2 PROM Mode

The PROM mode is set by setting the $\overline{\text{RESET}}$, $\overline{\text{HOLD}}$ 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).

An adapter socket (part No. BM1120/BM1121) is available for connecting a PROM writer.

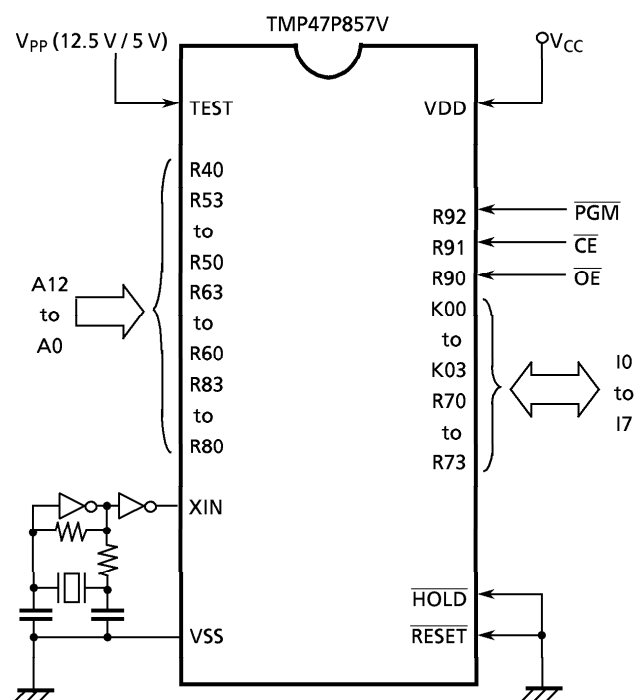


Figure 1-3. Setting for PROM mode

For more information on pins refer to the section on pin function.

Adapter socket	
Name	Applicable products
• BM1120	TMP47P452VN TMP47P453VN TMP47P407VN TMP47P853VN TMP47P857VN
• BM1121	TMP47P452VF TMP47P453VF TMP47P407VF TMP47P853VF TMP47P857VF

1.2.1 Writing

Set the PROM writer ROM to TMM2764AD (64 kbit), or equivalent.

1.2.2 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 $\overline{\text{PGM}} = V_{\text{IH4}}$. 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 ms is applied and then programmed data is verified. This should be repeated until the program operates correctly (max 15 times). After correctly programming the selected address, one additional program pulse with pulse width 4 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.

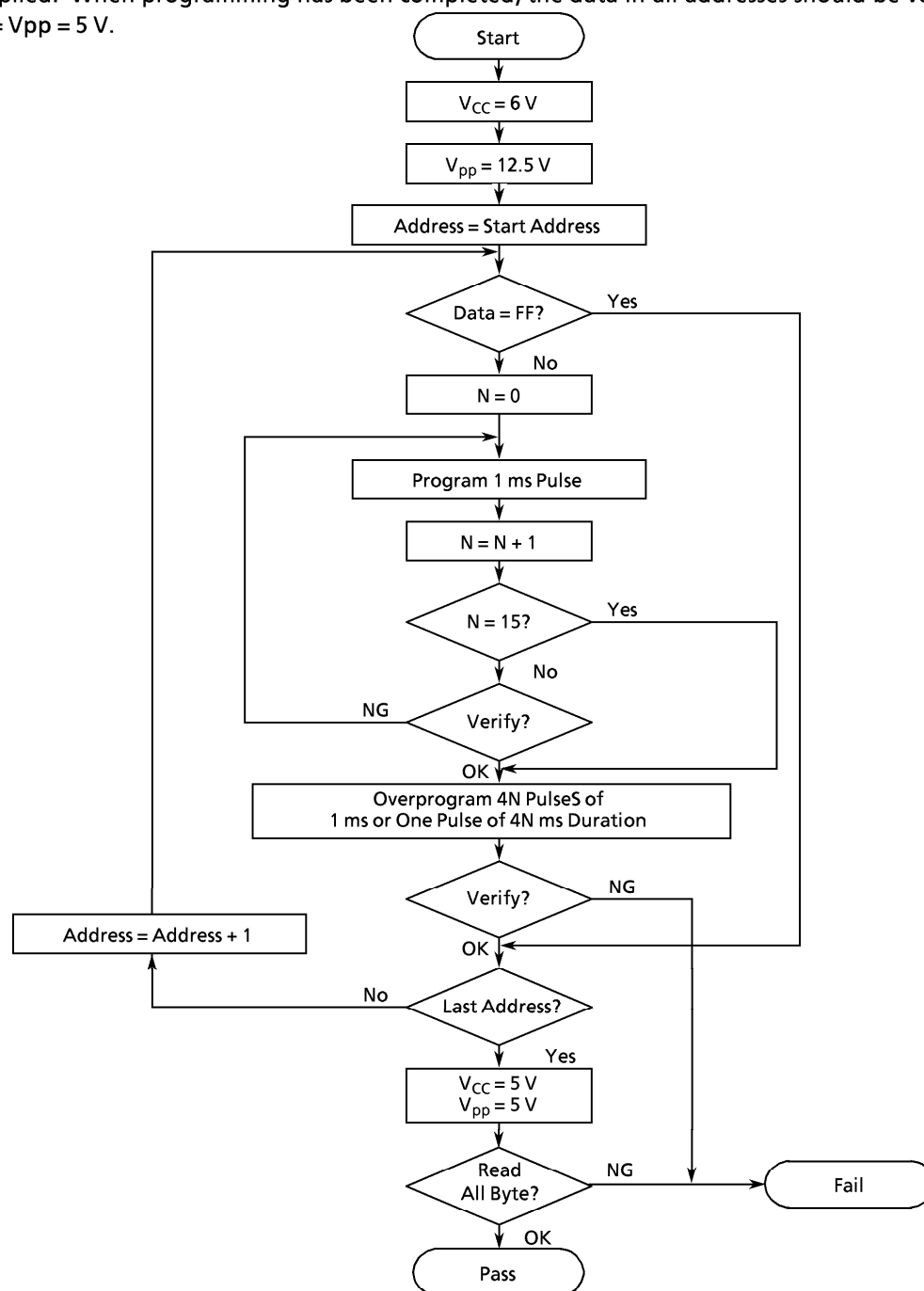


Figure 1-4. Flowchart

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/VPP pin	– 0.3 to 14.0	V
Input Voltage	V _{IN}		– 0.3 to V _{DD} + 0.3	V
Output Voltage	V _{OUT1}	Except sink open drain pin	– 0.3 to V _{DD} + 0.3	V
	V _{OUT2}	Sink open drain pin	– 0.3 to 10	
Output Current (per 1 pin)	I _{OUT}		3.2	mA
Power Dissipation (T _{opr} = 60°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 60	°C

Note 1: 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.

Note 2: Characteristic of R7 is different from TMP47C857

Recommended Operating Conditions (V_{SS} = 0 V, T_{opr} = – 30 to 60°C)

Parameter	Symbol	Pins	Conditions	Min	Max	Unit
Supply Voltage	V _{DD}		In the Normal mode	2.7	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} ≥ 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	f _c	XIN, XOUT		3.84 / 1.92		MHz
	f _s	XTIN, XTOUT		30	34	kHz

Note: 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.

DC Characteristics

(V_{SS} = 0 V, V_{DD} = 2.7 to 6.0 V, T_{opr} = -30 to 60°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, RESET, HOLD	V _{DD} = 5.5 V,	—	—	± 2	μA
	I _{IN2}	Port R (open drain)	V _{IN} = 5.5 V / 0 V				
Input Low Current	I _{IL}	Port R (push-pull)	V _{DD} = 5.5 V, V _{IN} = 0.4 V	—	—	-2	mA
Input Resistance	R _{IN1}	Port K0		30	70	150	kΩ
	R _{IN2}	RESET		100	220	450	
Output Leakage Current	I _{LO}	Ports P, R (open drain)	V _{DD} = 5.5 V, V _{OUT} = 5.5 V	—	—	2	μA
Output High Voltage	V _{OH}	Port 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
Supply Current (in the Normal mode)	I _{DD}		Except TONE generating V _{DD} = 5.5 V, f _c = 3.84 MHz	—	3	6	mA
	I _{DDT}		TONE generating V _{DD} = 5.5 V, f _c = 3.84 MHz	—	5	10	
Supply Current (in the SLOW mode)	I _{DDS}		V _{DD} = 3.0 V, V _{LC} = V _{SS} f _s = 32.768 kHz	—	30	60	μA
Supply Current (in the HOLD mode)	I _{DDH}		V _{DD} = 5.5 V	—	0.5	10	

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 pull-up / pull-down resistor is contained.

Note 3: Supply Current ; V_{IN} = 5.3 / 0.2 V

The K0 port is opened when the pull-up/pull-down resistor is contained.

The voltage applied to the R port is within the valid range V_{IL} or V_{IH}.

Note 4: Supply Current I_{DDS}; V_{IN} = 2.8 V / 0.2 V, low frequency clock is only oscillated
(connecting XTIN, XOUT).

Tone Output Characteristics

(V_{SS} = 0 V, V_{DD} = 2.7 to 6.0 V, T_{opr} = -30 to 60°C)

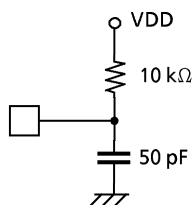
Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Tone Output Voltage (ROW)	V _{TONE}	RL ≥ 10 kΩ, V _{DD} = 3.0 V	135	200	260	mVrms
Tone Output Pre-Emphasis High Band	PEHB	PEHB = 20 log (COL/ROW)	1	2	3	dB
Tone Output Distortion	DIS		—	—	10	%
Tone Output Frequency Stability	Δf	Except error of osc. frequency	—	—	0.7	%

AC Characteristics

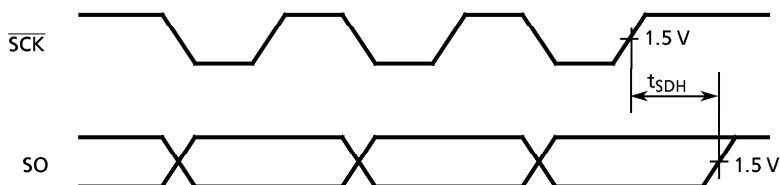
(V_{SS} = 0 V, V_{DD} = 2.7 to 6.0 V, T_{opr} = – 30 to 60°C)

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Instruction Cycle Time	t _{cy}	in the Normal operating mode	2.1 / 4.2			μs
		in the SLOW operating mode	235	–	267	
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}		0.5t _{cy} – 0.3	–	–	μs

Note: Shift Data Hold Time:

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

Serial port (completion of transmission)



Recommended Oscillating Conditions

(V_{SS} = 0 V, V_{DD} = 2.7 to 6.0 V, T_{opr} = – 30 to 60°C)

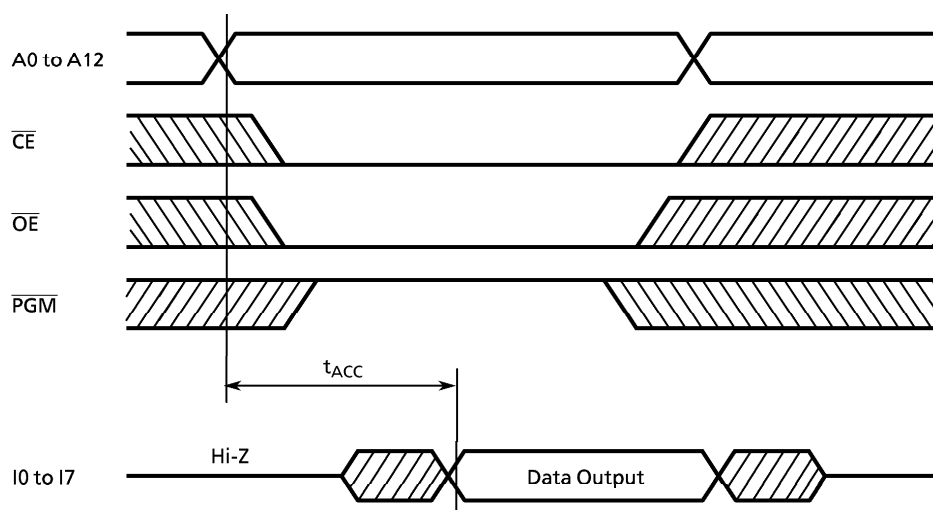
Recommended oscillating conditions of the TMP47P857V are equal to the TMP47C457/857.

DC/AC Characteristics

(V_{SS} = 0 V)

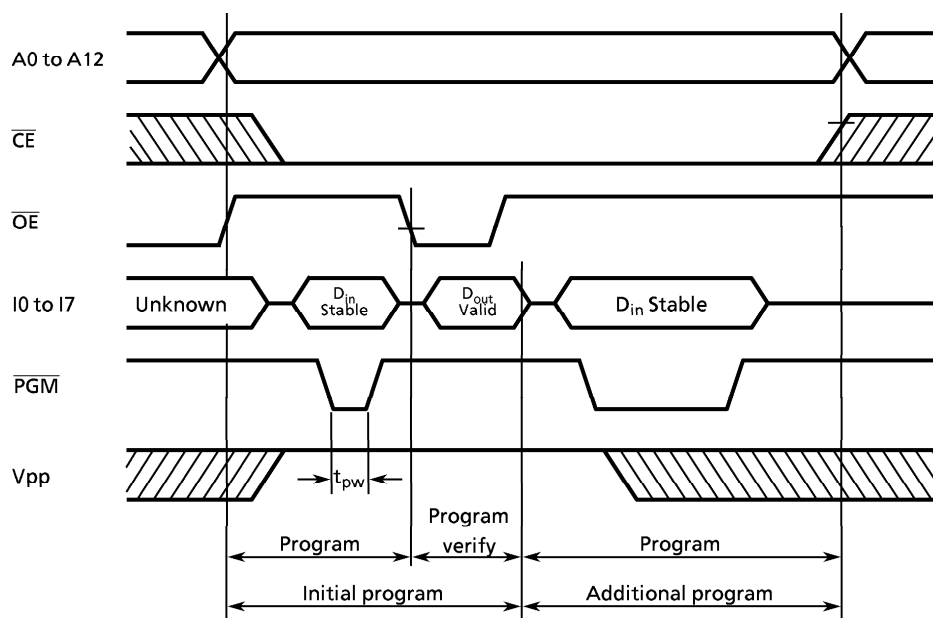
(1) Read Operation

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} × 0.3	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	–	–	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



Typical Characteristics

