

CMOS 4-Bit Microcontroller

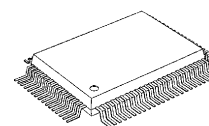
TMP47P847VF

The TMP47P847V is the system evaluation LSI of TMP47C647/847 with 64 Kbits one-time PROM. The TMP47P847V programs / verifies using an adapter socket to connect with PROM programmer, as it is in TMM2764AD.

In addition, the TMP47P847V and the TMP47C647/847 are pin compatible. The TMP47P847V operates as the same as TMP47C647/847 by programming to the internal PROM.

Part No.	ROM	RAM	Package	Adapter Socket
TMP47P847VF	OTP 8192 × 8-bit	512 × 4-bit	P-QFP80-1420-0.80B	BM1135

P-QFP80-1420-0.80B



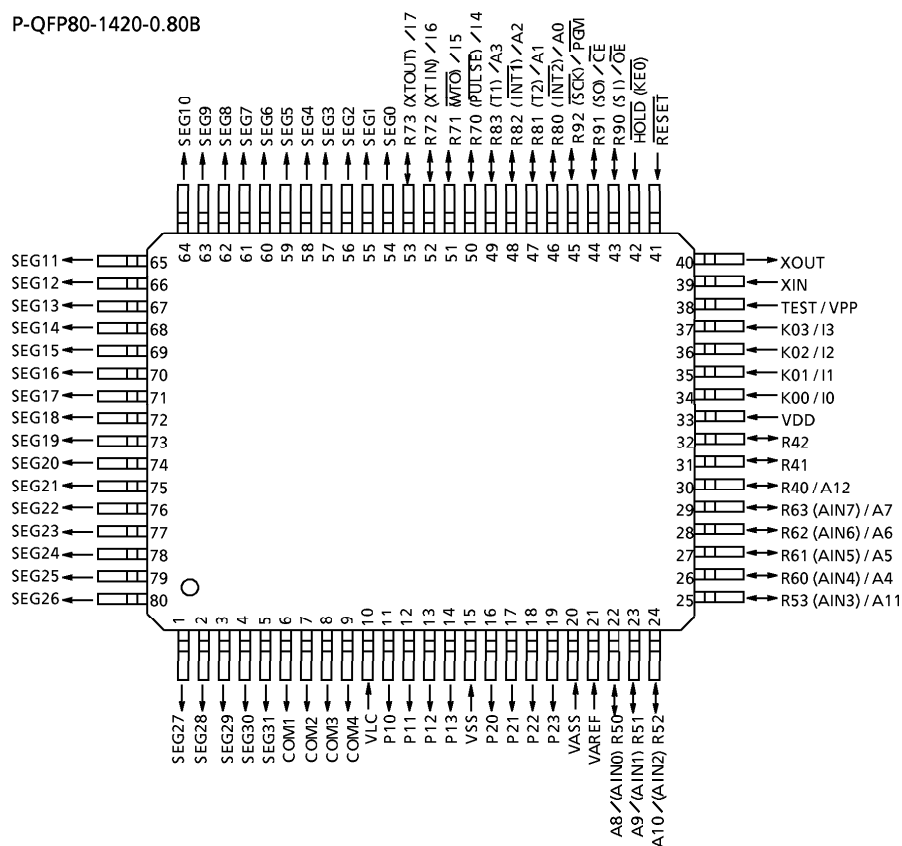
TMP47P847VF

000707EBA1

- For a discussion of how the reliability of microcontrollers can be predicted, please refer to Section 1.3 of the chapter entitled Quality and Reliability Assurance / Handling Precautions.
- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property.
In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the "Handling Guide for Semiconductor Devices," or "TOSHIBA Semiconductor Reliability Handbook" etc..
- The TOSHIBA products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These TOSHIBA products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury ("Unintended Usage"). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc.. Unintended Usage of TOSHIBA products listed in this document shall be made at the customer's own risk.
- The products described in this document are subject to the foreign exchange and foreign trade laws.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.

Pin Assignment (Top View)

P-QFP80-1420-0.80B



Pin Function

The TMP47P847V has MCU mode and PROM mode.

(1) MCU mode

The TMP47C847 and the TMP47P847V 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
$\overline{\text{PGM}}$	Input	Program control input	R92
$\overline{\text{CE}}$		Chip Enable input	R91
$\overline{\text{OE}}$		Output Enable input	R90
VPP	Power supply	+ 12.5V / 5V (Program supply voltage)	TEST
VCC		+ 5V	VDD
VSS		0V	VSS
SEG31 to SEG0	Output	Open	
COM4 to COM1			
VLC	Power supply		
P13 to P10	I/O	Be fixed to low level	
P23 to P20			
R42, R41			
$\overline{\text{RESET}}$	Input	PROM mode setting pins. Be fixed to low level.	
$\overline{\text{HOLD}}$	Input		
XIN	Input	Resonator connecting pins	
XOUT	Output		
VAREF	Power supply	Be fixed to VSS level	
VASS			

Operational Description

The following is an explanation of hardware configuration and operation in relation to the TMP47P847V. The TMP47P847V is the same as the TMP47C647/847 except that an EPROM or OTP is used instead of a Mask ROM.

1. Operation Mode

The TMP47P847V 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 TMP47C647/847, 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 TMP47C847. Data conversion tables must be set in two locations when using the TMP47P847V to check TMP47C647 operation.

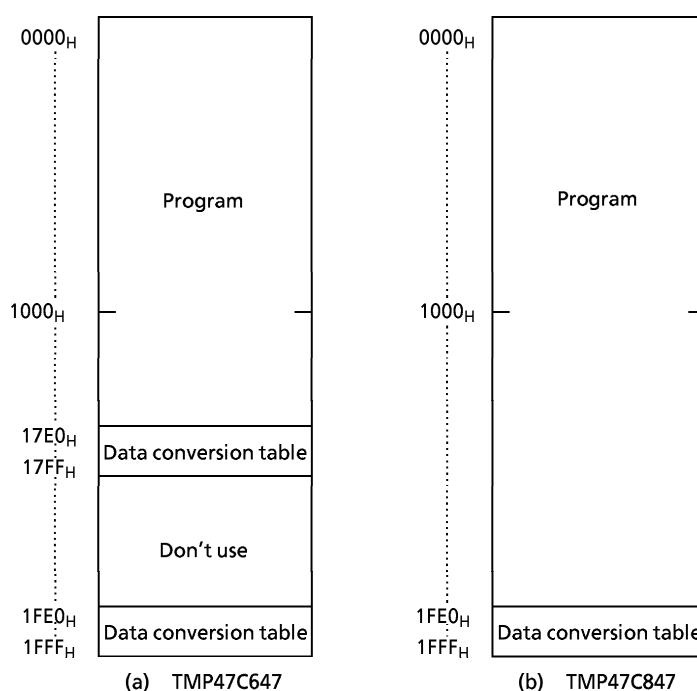


Figure 1-1. Program area

1.1.2 Data memory

The TMP47P847V has 512x4-bit data memory banks (RAM).

When using the TMP47P847V as a TMP47C647 evaluator, do not write data to address 80_H and following, even though the bank1 addresses are 00 to FF_H. There is no necessary to take into consideration a special function Shared area because one is built in bank0.

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 13.0	V
Input Voltage	V _{IN}		– 0.3 to V _{DD} + 0.3	V
Output Voltage	V _{OUT1}	R4, R5, R7, Push-pull ports	– 0.3 to V _{DD} + 0.3	V
	V _{OUT2}	P1, P2, R6, R8, R9 ports	– 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)	Σ I _{OUT}	Ports P1, P2	60	mA
Power Dissipation [Topr = 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 Operating 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 SLEEP mode			
			In the HOLD mode	2.0		
Input High Voltage	V _{IH1}	Except Hysteresis Input	V _{DD} ≥ 4.5V	V _{DD} × 0.7	V _{DD}	V
	V _{IH2}	Hysteresis Input		V _{DD} × 0.75		
	V _{IH3}		V _{DD} < 4.5V	V _{DD} × 0.9		
Input Low Voltage	V _{IL1}	Except Hysteresis Input	V _{DD} ≥ 4.5V	0	V _{DD} × 0.3	V
	V _{IL2}	Hysteresis Input			V _{DD} × 0.25	
	V _{IL3}		V _{DD} < 4.5V		V _{DD} × 0.1	
Clock Frequency	f _c	XIN, XOUT		0.4	6.0	MHz
	f _s	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, $\overline{\text{RESET}}$, $\overline{\text{HOLD}}$	V _{DD} = 5.5V, V _{IN} = 5.5V / 0V	—	—	± 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 Registance	R _{IN2}	$\overline{\text{RESET}}$		100	220	450	kΩ
Output Leakage Current	I _{LO}	Open drain ports P, R	V _{DD} = 5.5 V, V _{OUT} = 5.5 V	—	—	2	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
Segment Output Low Registance	R _{OC1}	COM pin					
Common Output High Registance	R _{OS2}	SEG pin		—	200	—	
Common Output High Registance	R _{OC2}	COM pin					
Segment/Common Output Registance	V _{O2/3}	SEG / COM pin					3.8
	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, f _c = 4 MHz	—	3	6	mA
Supply Current (in the SLOW mode)	I _{DDS}		V _{DD} = 3.0 V, f _s = 32.768 kHz	—	30	60	μA
Supply Current (in the SLEEP mode)	I _{DDL}			—	15	30	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}, I_{DDH} ; V_{IN} = 5.3 V / 0.2 V

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

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

Note 8: Supply Current I_{DDS}, I_{DDL} ; 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)

AD Conversion Characteristics

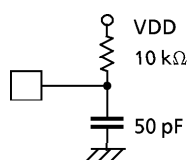
(T_{opr} = -40 to 70°C)

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} = 4.5 to 6.0 V, V _{SS} = 0.0 V V _{AREF} = V _{DD} ± 0.001 V V _{ASS} = 0.000 V	—	—	± 1	LSB
Zero point Error			—	—	± 1	
Full scale Error			—	—	± 1	
Total Error			—	—	± 2	

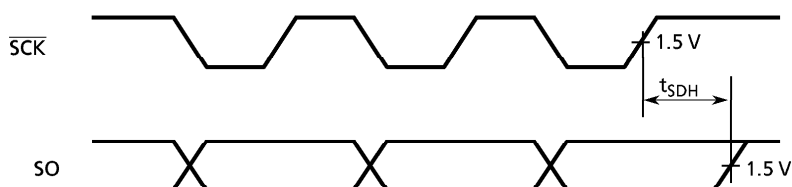
AC Characteristics

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

Parameter	Symbol	Condition	Min	Typ.	Max	Unit
Instruction Cycle Time	t _{cy}	In the Normal mode	1.3	—	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}					
AD Conversion Sampling Time	t _{AIN}	f _c = 4 MHz	—	4	—	μs
Shift Data Hold Time	t _{SDH}		0.5 t _{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

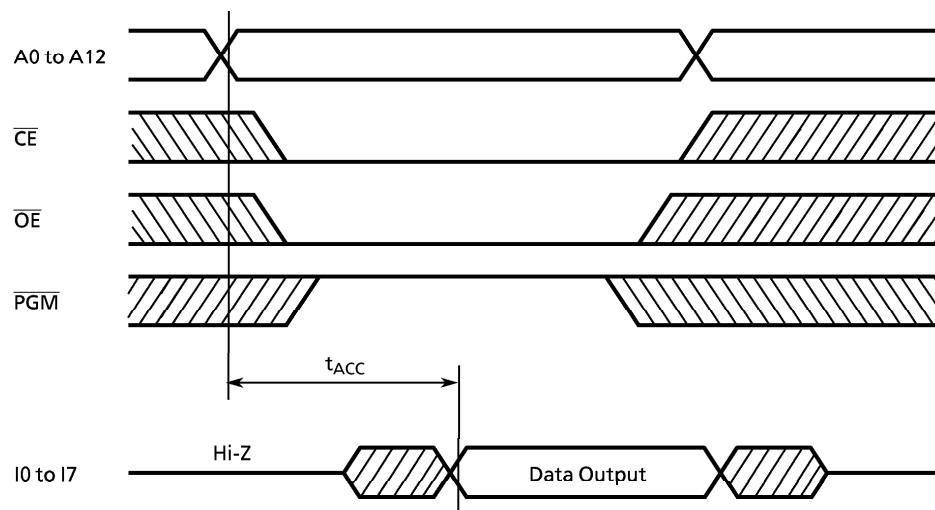
(V_{SS} = 0V, V_{DD} = 4.5 to 6.0 V, T_{opr} = -40 to 70°C)

Recommended oscillating conditions of the TMP47P847V are equal to the TMP47C847'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	13.00	V
Programming Pulse Width	t_{PW}	$V_{CC} = 6.0 \pm 0.25V$	0.95	1.0	1.05	ms

