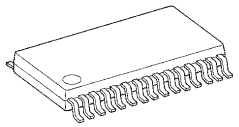
CMOS 8-Bit Microcontroller

TMP86P808DM

The TMP86P808 is a high-speed, high-performance 8-bit single chip microcomputer, which has 8 Kbytes One-Time PROM. The TMP86P808 is pin compatible with the TMP86C408/808. The operations possible with the TMP86C408/808 can be performed by writing programs to PROM. The TMP86P808 can write and verify in the same way as the TC571000D/AD using an adapter socket and a general-purpose PROM programmer.

Product No.	ROM	RAM	Package	Adapter socket
TMP86P808DM	8 K × 8 bits	256 × 8 bits	P-SSOP30-56-0.65	BM11183

P-SSOP30-56-0.65

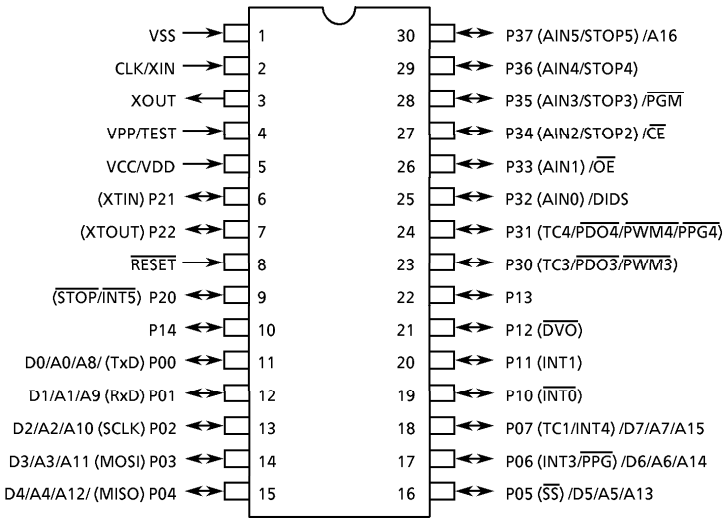


TMP86P808DM

000707EBP1

Pin Assignments (Top View)

P-SSOP30-56-0.65



Pin Functions

The TMP86P808 has two modes: MCU and PROM.

(1) MCU mode

In this mode, the TMP86P808 is pin compatible with the TMP86C408/808 (fix the TEST pin at low level).

(2) PROM mode

Pin Name (PROM mode)	Input/Output	Functions	Pin name (MCU mode)
A16	Input	Program memory address inputs	P37
A15 to A8			P07 to P00
A7 to A0			P07 to P00
D7 to D0	I/O	Program memory data input/outputs	P07 to P00
$\overline{CE}$	Input	Chip enable signal input	P34
$\overline{OE}$		Output enable signal input	P33
$\overline{PGM}$		Program mode signal input	P35
DIDS		PROM	P32
VPP	Power supply	+ 12.75 V/5 V (Program supply voltage)	TEST
VCC		+ 6.25 V/5 V	VDD
GND		0 V	VSS
P11, P21	I/O	PROM mode setting pins. Be fixed at high level.	
P10, P12, P20, P22, P36		PROM mode setting pins. Be fixed at low level.	
$\overline{RESET}$			
CLK	Input	Input a clock from the outside.	XIN
XOUT	Output	Open	

Operational Description

The configuration and function of the TMP86P808 are the same as those of the TMP86C408/808, except in that a one-time PROM is used instead of an on-chip mask ROM.

1. Operating Mode

The TMP86P808 has two modes: MCU and PROM.

1.1 MCU Mode

The MCU mode is activated by fixing the TEST/VPP pin at low level.
In the MCU mode, operation is the same as with the TMP86C408/808 (TEST/VPP pin cannot be used open because it has no built in pull-down resistance.)

1.1.1 Program Memory

The TMP86P808 have an 8 Kbytes (addresses E000 to $FFFF_H$ in the MCU mode, addresses 0000 to $1FFF_H$ in the PROM mode) one-time PROM.
When the TMP86P808 is used as a system evaluation of the TMP86C408/808, the data is written to the program storage area shown in Figure 1-1.

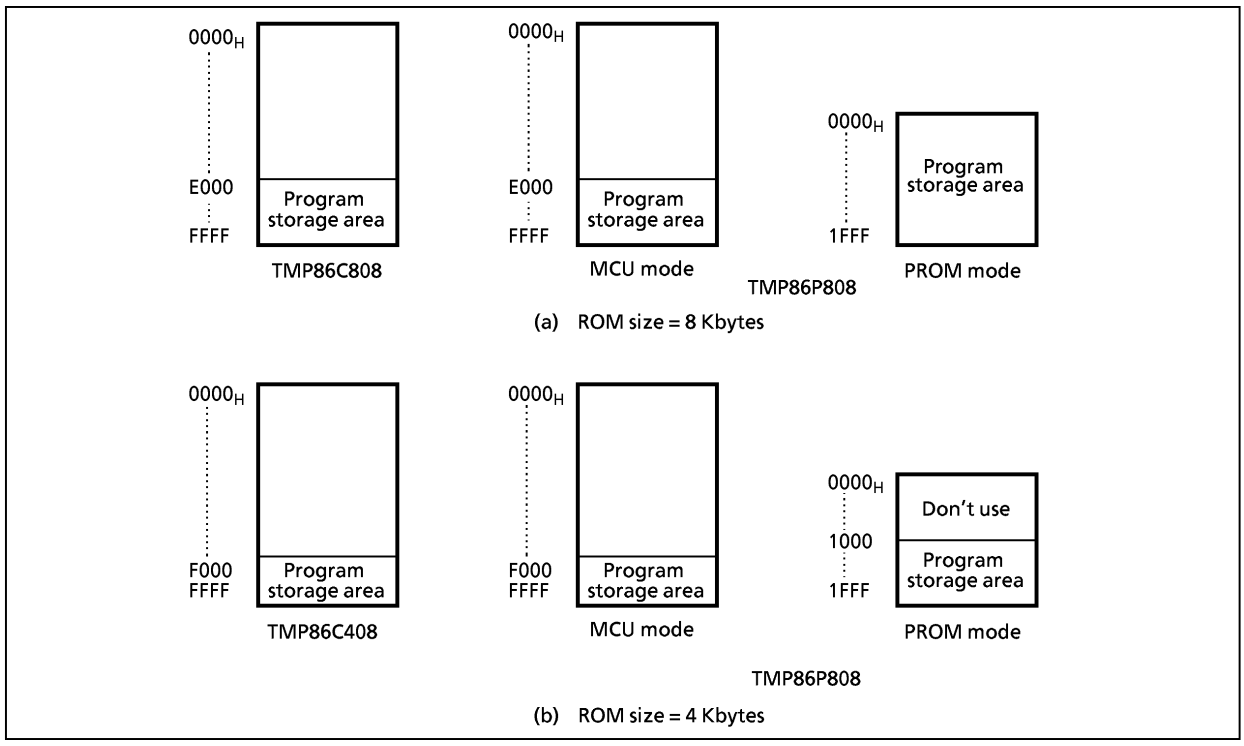


Figure 1-1. Program Memory Area

Note: Either write the data FF_H to the unused area or set the general-purpose PROM programmer to access only the program storage area

Electrical Characteristics

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

Parameter	Symbol	Pins	Rating	Unit
Supply Voltage	V_{DD}		– 0.3 to 6.5	V
Input Voltage	V_{IN}		– 0.3 to V_{DD} + 0.3	
Output Voltage	V_{OUT1}	P21, P22, $\overline{RESET}$, Tri-state Port	– 0.3 to V_{DD} + 0.3	
	V_{OUT2}	P20, Sink Open Drain Port	– 0.3 to 5.5	
Output Current (Per 1 pin)	I_{OUT1} I_{OH}	P0, P1, P3 Port	– 1.8	mA
	I_{OUT2} I_{OL}	P1, P2, P3 Port	3.2	
	I_{OUT3} I_{OL}	P0 Port	30	
Output Current (Total)	ΣI_{OUT1}	P0, P1, P3 Port	– 30	
	ΣI_{OUT2}	P1, P2, P3 Port	60	
	ΣI_{OUT3}	P0 Port	80	
Power Dissipation [T_{opr} = 85°C]	PD		145	mW
Soldering Temperature (time)	Tsld		260 (10 s)	°C
Storage Temperature	Tstg		– 55 to 150	
Operating Temperature	Topr		– 40 to 85	

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 Condition (V_{SS} = 0 V, Topr = – 40 to 85°C)

Parameter	Symbol	Pins	Condition		Min	Max	Unit
Supply Voltage	V_{DD}		fc = 16 MHz	NORMAL1, 2 mode	4.5	5.5	V
				IDLE0, 1, 2 mode			
			fc = 8 MHz	NORMAL1, 2 mode	2.7		
				IDLE0, 1, 2 mode			
			fs = 32.768 kHz	SLOW1, 2 mode			
				SLEEP0, 1, 2 mode			
				STOP mode			
Input high Level	V_{IH1}	Except Hysteresis input	$V_{DD} \geqq$ 4.5 V		$V_{DD} \times 0.70$	V_{DD}	
	V_{IH2}	Hysteresis input			$V_{DD} \times 0.75$		
	V_{IH3}		$V_{DD} <$ 4.5 V		$V_{DD} \times 0.90$		
Input low Level	V_{IL1}	Except Hysteresis input	$V_{DD} \geqq$ 4.5 V		0	$V_{DD} \times 0.30$	
	V_{IL2}	Hysteresis input				$V_{DD} \times 0.25$	
	V_{IL3}		$V_{DD} <$ 4.5 V			$V_{DD} \times 0.10$	
Clock Frequency	fc	XIN, XOUT	V_{DD} = 2.7 to 5.5 V		1.0	8.0	MHz
			V_{DD} = 4.5 to 5.5 V			16.0	
	fs	XTIN, XTOUT	V_{DD} = 2.7 to 5.5 V		30.0	34.0	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 Standard

DC Characteristics (V_{SS} = 0 V, Topr = – 40 to 85°C)

Parameter	Symbol	Pins	Condition	Min	Typ.	Max	Unit
Hysteresis Voltage	V_{HS}	Hysteresis input		–	0.9	–	V
Input Current	I_{IN1}	TEST	V_{DD} = 5.5 V, V_{IN} = 5.5 V/0 V	–	–	± 2	μA
	I_{IN2}	Sink Open Drain, Tri-state Port					
	I_{IN3}	$\overline{RESET}$, $\overline{STOP}$					
Input Resistance	R_{IN}	$\overline{RESET}$ Pull-Up		100	220	450	kΩ
Output Leakage Current	I_{LO}	Sink Open Drain, Tri-state Port	V_{DD} = 5.5 V, V_{OUT} = 5.5 V/0 V	–	–	± 2	μA
Output High Voltage	V_{OH}	P0, P1, P3 Port	V_{DD} = 4.5 V, I_{OH} = – 0.7 mA	4.1	–	–	V
Output Low Voltage	V_{OL}	P1, P2, P3 Port	V_{DD} = 4.5 V, I_{OL} = 1.6 mA	–	–	0.4	
Output Low Current	I_{OL}	High Current Port (P0 Port)	V_{DD} = 4.5 V, V_{OL} = 1.0 V	–	20	–	mA
Supply Current in NORMAL 1, 2 mode	I_{DD}		V_{DD} = 5.5 V V_{IN} = 5.3/0.2 V fc = 16.0 MHz fs = 32.768 kHz	–	7.5	9.0	
Supply Current in IDLE 0, 1, 2 mode				–	5.5	6.5	
Supply Current in SLOW 1 mode			V_{DD} = 3.0 V V_{IN} = 2.8 V/0.2 V fs = 32.768 kHz	–	14.0	25.0	μA
Supply Current in SLEEP 1 mode				–	7.0	15.0	
Supply Current in SLEEP 0 mode				–	6.0	15.0	
Supply Current in STOP mode			V_{DD} = 5.5 V V_{IN} = 5.3 V/0.2 V	–	0.5	10.0	

Note 1: Typical values show those at Topr = 25°C, V_{DD} = 5 V
Note 2: Input current (I_{IN1}, I_{IN3}); The current through pull-up or pull-down resistor is not included.
Note 3: I_{DD} does not include I_{REF} current.
Note 4: The power supply current in STOP2 and SLEEP2 modes each are the same as in IDLE0, 1, and 2 modes.

AD Conversion Characteristics (V_{SS} = 0.0 V, 4.5 V ≦ V_{DD} ≦ 5.5 V, Topr = – 40 to 85°C)

Parameter	Symbol	Condition	Min	Typ.	Max	Unit
Analog Input Voltage	V_{AIN}		V_{SS}	–	V_{DD}	V
Power Supply Current of Analog Reference Voltage	I_{REF}	V_{DD} = 5.5 V V_{SS} = 0.0 V	–	0.6	1.0	mA
Non linearity Error		V_{DD} = 5.0 V, V_{SS} = 0.0 V	–	–	± 1	LSB
Zero Point Error			–	–	± 1	
Full Scale Error			–	–	± 1	
Total Error			–	–	± 2	

(V_{SS} = 0.0 V, 2.7 V ≦ V_{DD} < 4.5 V, Topr = – 40 to 85°C)

Parameter	Symbol	Condition	Min	Typ.	Max	Unit
Analog Input Voltage	V_{AIN}		V_{SS}	–	V_{DD}	V
Power Supply Current of Analog Reference Voltage	I_{REF}	V_{DD} = 4.5 V V_{SS} = 0.0 V	–	0.5	0.8	mA
Non linearity Error		V_{DD} = 2.7 V, V_{SS} = 0.0 V	–	–	± 1	LSB
Zero Point Error			–	–	± 1	
Full Scale Error			–	–	± 1	
Total Error			–	–	± 2	

Note 1: The total error includes all errors except a quantization error, and is defined as a maximum deviation from the ideal conversion line.
Note 2: Conversion time is different in recommended value by power supply voltage.
About conversion time, please refer to "2.10.2 Register Configuration".
Note 3: Please use input voltage to AIN input Pin in limit of V_{DD} - V_{SS}.
When voltage of range outside is input, conversion value becomes unsettled and gives affect to other channel conversion value.
Note 4: The relevant pin for I_{REF} is V_{DD}, so that the current flowing into V_{DD} is the power supply current I_{DD} + I_{REF}.

SEI Operating Conditions (Slave mode) (V_{SS} = 0.0 V, 2.7 V ≦ V_{DD} ≦ 5.5 V, Topr = – 40 to 85°C)

Parameter	Symbol	Condition	Min	Typ.	Max	Unit
Transfer Rate			15.625 k	–	fc/4	bps

AC Characteristics (V_{SS} = 0 V, V_{DD} = 4.5 to 5.5 V, Topr = – 40 to 85°C)

Parameter	Symbol	Condition	Min	Typ.	Max	Unit
Machine Cycle Time	tcy	NORMAL 1, 2 mode	0.25	–	4	μs
		IDLE 0, 1, 2 mode				
		SLOW 1, 2 mode	117.6	–	133.3	
		SLEEP 0, 1, 2 mode				
High Level Clock Pulse Width	twcH	For external clock operation (XIN input) fc = 16 MHz	25	–	–	ns
Low Level Clock Pulse Width	twcL					
High Level Clock Pulse Width	twcH	For external clock operation (XTIN input) fs = 32.768 kHz	14.7	–	–	μs
Low Level Clock Pulse Width	twcL					

(V_{SS} = 0 V, V_{DD} = 2.7 to 4.5 V, Topr = – 40 to 85°C)

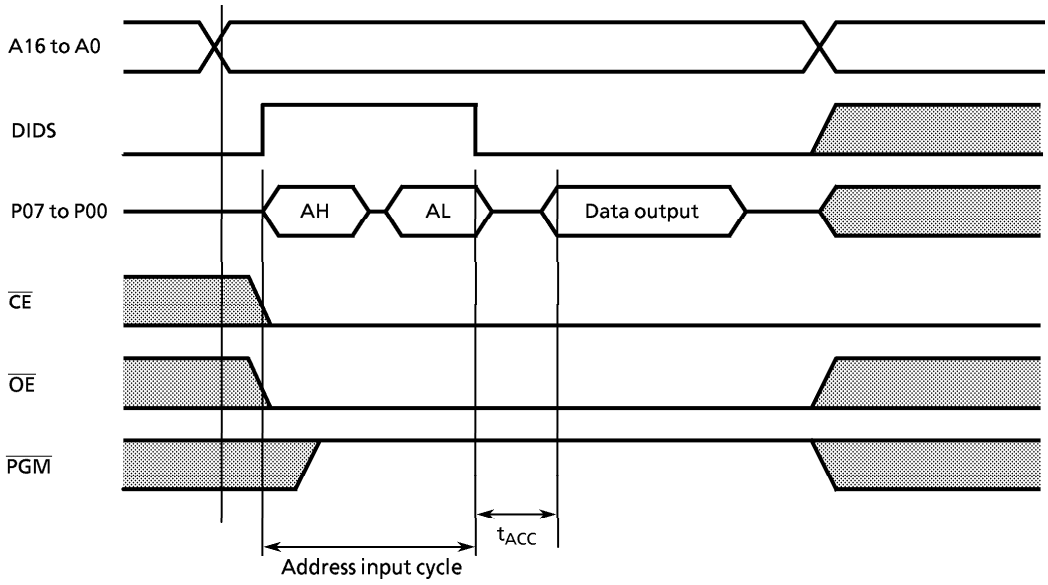
Parameter	Symbol	Condition	Min	Typ.	Max	Unit
Machine Cycle Time	tcy	NORMAL 1, 2 mode	0.5	–	4	μs
		IDLE 0, 1, 2 mode				
		SLOW 1, 2 mode	117.6	–	133.3	
		SLEEP 0, 1, 2 mode				
High Level Clock Pulse Width	twcH	For external clock operation (XIN input) fc = 8 MHz	50	–	–	ns
Low Level Clock Pulse Width	twcL					
High Level Clock Pulse Width	twcH	For external clock operation (XTIN input) fs = 32.768 kHz	14.7	–	–	μs
Low Level Clock Pulse Width	twcL					

DC Characteristics, AC Characteristics (PROM mode) (V_{SS} = 0 V, Topr = – 40 to 85°C)

(1) Read operation in PROM mode

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
High level input voltage	V_{IH4}		$V_{CC} \times 0.75$	–	V_{CC}	V
Low leve input voltage	V_{IL4}		0	–	$V_{CC} \times 0.25$	V
Power supply	V_{CC}		4.75	5.0	5.25	V
Power supply of program	V_{PP}					
Address access time	t_{ACC}	V_{CC} = 5.0 ± 0.25 V	–	–	1.5tcyc + 300	ns
Address input cycle	–		–	tcyc	–	ns

Note: tcyc = 250 ns at f_{CLK} = 16 MHz



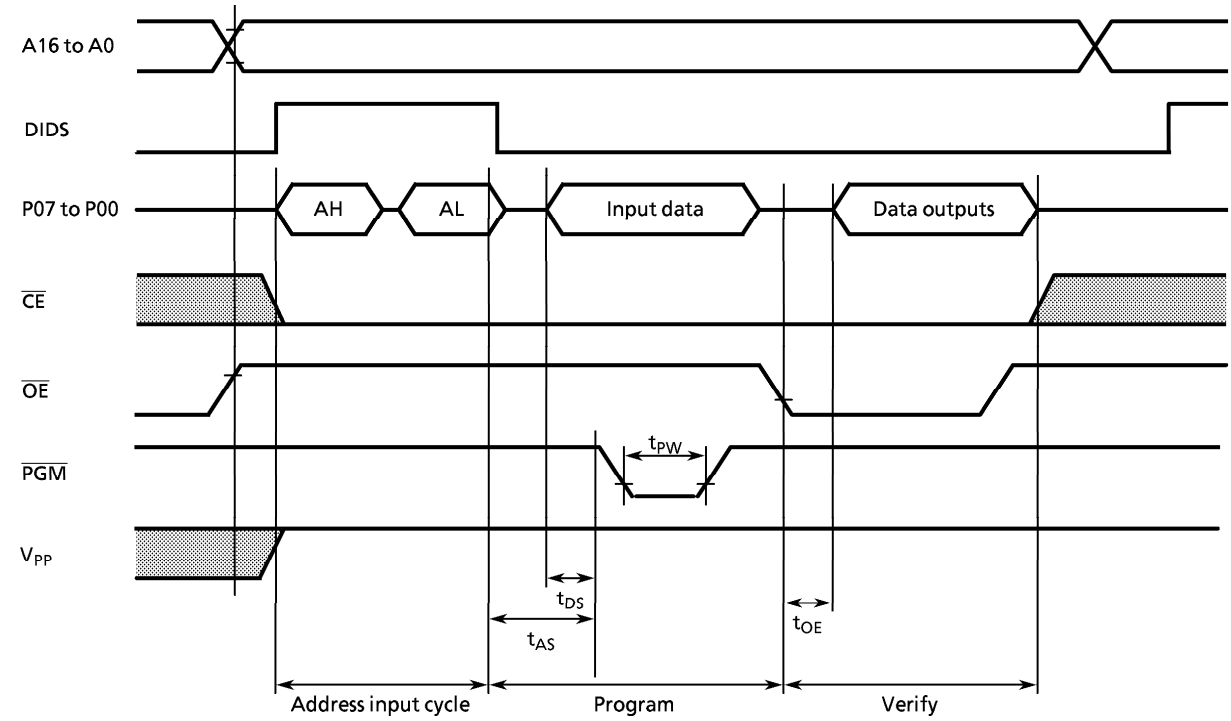
Note: DIDS and P07 to P00 are the signals for the TMP86P808.
All other signals are EPROM programmable.
AL: Address input (A0 to A7)
AH: Address input (A8 to A15)

(2) Program operation (High-speed) (Topr = 25 ± 5°C)

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
High level input voltage	V_{IH4}		$V_{CC} \times 0.75$	–	V_{CC}	V
Low leve input voltage	V_{IL4}		0	–	$V_{CC} \times 0.25$	V
Power supply	V_{CC}		6.0	6.25	6.5	V
Power supply of program	V_{PP}		12.5	12.75	13.0	V
Pulse width of initializing program	t_{PW}	V_{CC} = 6.0 V	0.095	0.1	0.105	ms
Address set up time	t_{AS}		0.5tcyc	–	–	ns
Address input cycle	–		–	tcyc	–	ns
Data set up time	t_{DS}		1.5tcyc	–	–	ns
$\overline{OE}$ to valid output data	t_{OE}		–	–	1.5tcyc + 300	ns

Note: tcyc = 250 ns at f_{CLK} = 16 MHz

High-speed program writing



Note: DIDS and P07 to P00 are the signals for the TMP86P808.
All other signals are EPROM programmable.
AL: Address input (A0 to A7)
AH: Address input (A8 to A15)

Note 1: The power supply of V_{PP} (12.75 V) must be set power-on at the same time or the later time for a power supply of V_{CC} and must be clear power-on at the same time or early time for a power supply of V_{CC}.
Note 2: The pulling up/down device on the condition of V_{PP} = 12.75 V ± 0.25 V causes a damage for the device. Do not pull up/down at programming.
Note 3: Use the recommended adapter (see 1.2.2 (1)) and mode (see 1.2.2 (3) i).
Using other than the above condition may cause the trouble of the writting.