CMOS 8-Bit Microcontroller

TMP88PS43F

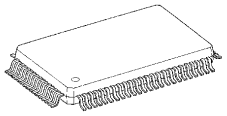
The TMP88PS43F is a high-speed, high-function 8-bit single-chip microcomputer incorporating 64-Kbyte one-time PROM. This microcomputer is pin compatible with the TMP88CS43, the mask ROM product. Once a program is written into its internal PROM, this microcomputer operates the same way as the TMP88CS43. By using an adapter socket, the TMP88PS43 can be programmed and verified with a general-purpose PROM programmer in the same way as for the TC571000D/AD.

Product No.	ROM	RAM	Package	Adapter Socket
TMP88PS43F	64 Kbytes	4 K + 128 bytes	P-LQFP80-1420-0.80B	BM11180A

Note : TMP88CS43 RAM size is 2 K + 128 bytes

External view of the package

P-QFP80-1420-0.80B

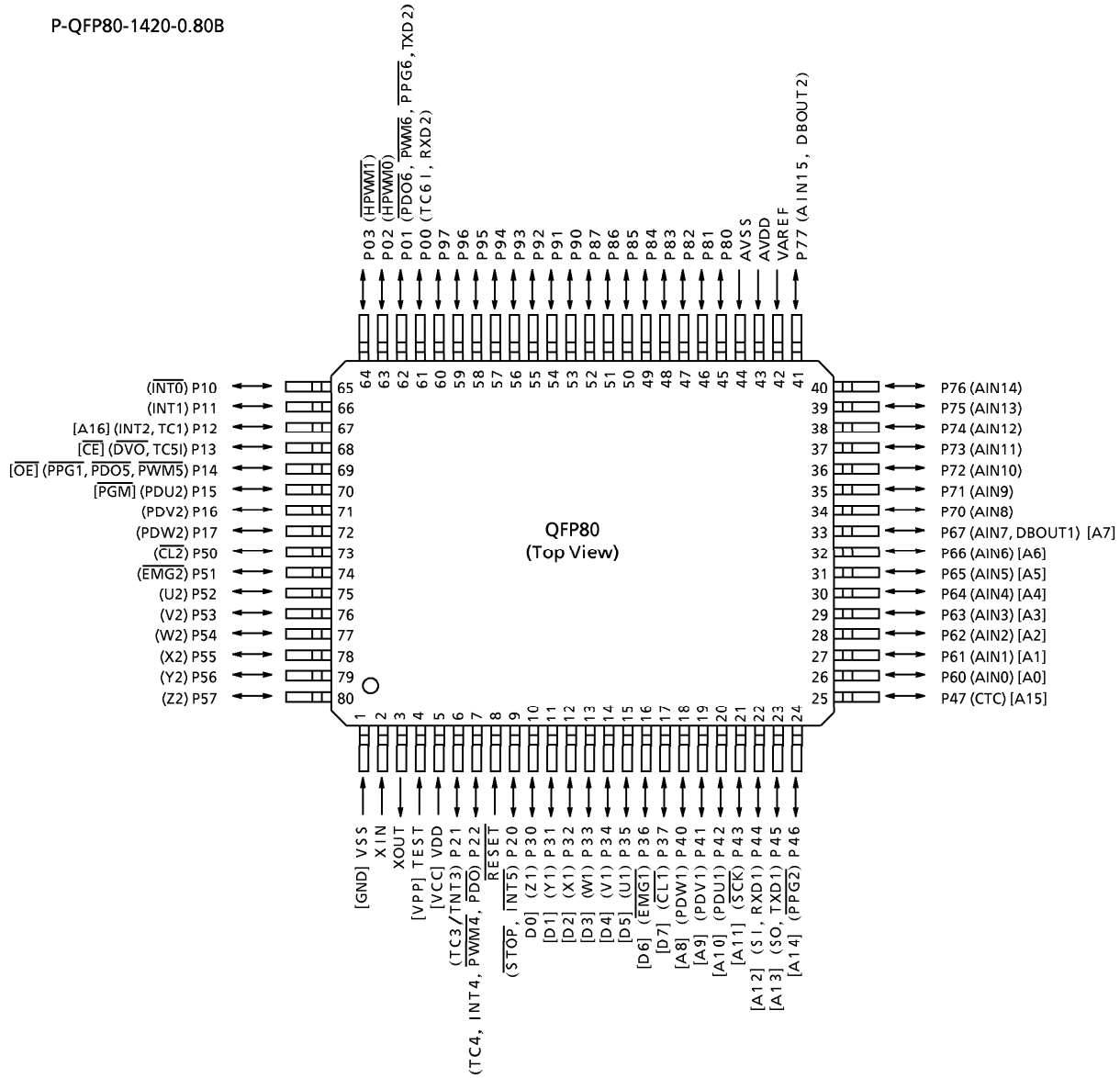


TMP88PS43F

000707EBP1

Pin Assignment (Top View)

P-QFP80-1420-0.80B



Pin Functions

The TMP88PS43 has MCU and PROM modes.

(1) MCU mode

Pin compatible with the TMP88CS43 (always makes sure the TEST pin is fixed low).

(2) PROM mode

Pin Name (during PROM Mode)	I/O	Functions	Pin Name (during MCU Mode)
A16	Input	Program memory address input	P12
A15 to A8			P47 to P40
A7 to A0			P67 to P60
D7 to D0	Input/output	Program memory data input/output	P37 to P30
$\overline{CE}$	Input	Chip enable signal input	P13
$\overline{OE}$		Output enable signal input	P14
$\overline{PGM}$		Program mode signal input	P15
VPP	Power supply	+ 12.75 V/5 V (Programming power supply)	TEST
V_{DD}		+ 6.25 V/5 V	VDD
GND		0 V	VSS
P03 to P00	Input/output	Leave these pins open.	
P17 to P16			
P57 to P50			
P77 to P70			
P87 to P80			
P97 to P90			
P21		PROM mode setup pins. Fix these pins high.	
P11 to P10		PROM mode setup pins. Fix these pins low.	
P22, P20			
$\overline{RESET}$			
XIN	Input	Attach a resonator (20 MHz) to these pins for self-oscillation.	
XOUT	Output		
AVDD	Power supply	5 V	
VAREF		0 V (GND)	
VASS			

Functional Description

The TMP88PS43 is a one-time PROM version of the TMP88CS43 with its internal mask ROM replaced with one-time PROM. All other configurations and functions are the same as those of the TMP88CS43. (TMP88CS43 RAM size is 2 K + 128 bytes.) Immediately after a reset, the TMP88PS43 is in single-clock mode.

1. Operation Modes

The TMP88PS43 has MCU and PROM modes.

1.1 MCU Mode

The microcomputer is placed in MCU mode by fixing the TEST and VPP pins low.
In this mode, the microcomputer operates the same way as the TMP88CS43 (because the TEST and VPP pins do not have internal pulldown resistors, they cannot be left open while in use).

1.1.1 Program Memory

The TMP88PS43 contains a 64-Kbyte one-time PROM (located at addresses 04000 to $13EFF_H$ or addresses FFF00 to $FFFFF_H$ during MCU mode and addresses 00000 to $0FFFF_H$ during PROM mode). When using this microcomputer for the purpose of evaluating the system constructed with the TMP88CS43, write a program into the program storage area shown in Figure 1-1.

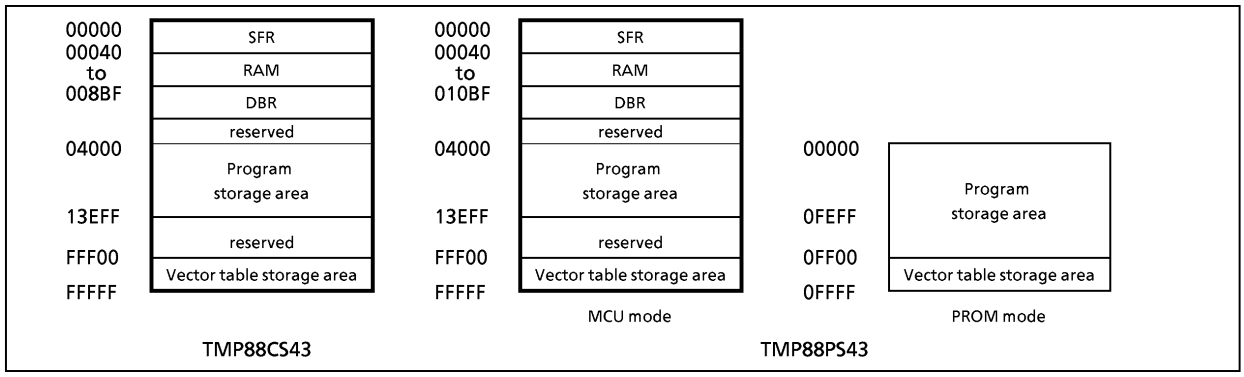


Figure 1-1. Program Storage Area

Note: Fill the unused area with data FF_H, or set up the general-purpose PROM programmer so that only the program storage area will be accessed.

1.1.2 Data Memory

The TMP88PS43 contains 4 K + 128-byte data memory (static RAM).

Note: TMP88CS43 contains 2K + 128 bytes.

1.1.3 Input/Output Circuits of the Pins

(1) Control pins

The control pins are the same as those of the TMP88CS43, except that the TEST pin does not have an internal pulldown resistor.

(2) Input/output ports

The input/output circuits of the TMP88PS43 input/output ports are the same as those of the TMP88CS43.

Electrical Characteristics

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

Parameter	Symbol	Pin	Standard	Unit	Remark
Power Supply Voltage	V_{DD}		– 0.3 to 6.5	V	
Program Voltage	V_{PP}	TEST/VPP	– 0.3 to 13.0		
Input Voltage	V_{IN}		– 0.3 to V_{DD} + 0.3		
Output Voltage	V_{OUT}		– 0.3 to V_{DD} + 0.3		
Output Current	I_{OH}	P0, 1, 3, 4, 5, 6, 7, 8, 9	– 1.8	mA	
	I_{OL1}	P0, 1, 2, 6, 7, 8, 9	3.2		
	I_{OL2}	P3, P4, P5	30		
Mean Output Current	ΣI_{OUT1}	P0, 1, 2, 6, 7, 8, 9	60		Total of all ports except large-current ports
	ΣI_{OUT2}	P3	60		Total of 8 pins of large-current ports P30 to 7
	ΣI_{OUT3}	P4	60		Total of 8 pins of large-current ports P40 to 7
	ΣI_{OUT4}	P5	60		Total of 8 pins of large-current ports P50 to 7
Power Dissipation	PD		350	mW	QFP
Operating Temperature	Topr		– 40 to 85	°C	
Soldering Temperature (time)	Tsld		260 (10 s)		
Storage Temperature	Tstg		– 55 to 125		

Note: The Absolute Maximum Ratings stipulate the standards, any parameter of which cannot be exceeded even in an instant. If the device is used under conditions exceeding the Absolute Maximum Ratings, it may break down or degrade, causing injury due to rupture or burning. Therefore, always make sure the Absolute Maximum Ratings will not be exceeded when designing your application equipment.

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

Parameter	Symbol	Pin	Condition		Min	Max	Unit
Power Supply Voltage	V_{DD}		fc = 20 MHz	NORMAL/IDLE/ STOP	4.5	5.5	V
High Level Input Voltage	V_{IH1}	Normal (P6, P7, P8, P9)	$V_{DD} \geqq 4.5$ V		$V_{DD} \times 0.70$	V_{DD}	
	V_{IH2}	Hysteresis (P0, P1, P2, P3, P4, P5)			$V_{DD} \times 0.75$		
Low Level Input Voltage	V_{IL1}	Normal (P6, P7, P8, P9)	$V_{DD} \geqq 4.5$ V		0	$V_{DD} \times 0.30$	
	V_{IL2}	Hysteresis (P0, P1, P2, P3, P4, P5)				$V_{DD} \times 0.25$	
Clock Frequency	fc	XIN, XOUT	V_{DD} = 4.5 V to 5.5 V		8	20	MHz

Note: The Recommended Operating Conditions show the conditions under which we recommend the device be used in order for it to operate normally while maintaining its quality. If the device is used outside the range of Recommended Operating Conditions (power supply voltage, operating temperature range, or AC/DC rated values), it may operate erratically. Therefore, when designing your application equipment, always make sure its intended working conditions will not exceed the range of Recommended Operating Conditions.

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

Parameter	Symbol	Pin	Condition	Min	Typ.	Max	Unit
Input Current	I_{IN1}	TEST	V_{DD} = 5.5 V V_{IN} = 5.5 V/0 V	–	–	± 2	μA
	I_{IN2}	Sink OD, Tri-state					
	I_{IN3}	$\overline{RESET}$, $\overline{STOP}$					
Input Resistance	R_{IN}	$\overline{RESET}$		90	220	510	kΩ
Output Leakage Current	I_{LO}	Sink OD, Tri-state	V_{DD} = 5.5 V, V_{IN} = 5.5 V/0 V	–	–	± 2	μA
High Level Output Voltage	V_{OH}	Tri-state port	V_{DD} = 4.5 V, I_{OH} = – 0.7 mA	4.1	–	–	V
Low Level Output Current	I_{OL1}	P0, 1, 2, 6, 7, 8, 9	V_{DD} = 4.5 V, V_{OL} = 0.4 V	1.6	–	–	mA
	I_{OL2}	P3, P5, P4	V_{DD} = 4.5 V, V_{OL} = 1.0 V	–	20	–	
Power Supply Current	I_{DDO}		V_{DD} = 5.5 V, V_{IN} = 5.3 V/0.2 V fc = 20 MHz	–	18	25	
	I_{DDL}			–	16	23	
	I_{DDH}			–	2	100	μA

AD Conversion Characteristics (Topr = – 40 to 85°C)

Parameter	Symbol	Pin	Min	Typ.	Max		Unit
					8 bits	10 bits	
Analog Reference Voltage	VA_{REF}	V_{SS} = 0 V, V_{DD} = AV_{DD}	V_{DD} – 1.0	–	V_{DD}		V
Analog Input Voltage Range	VA_{IN}		V_{ASS}	–	V_{AREF}		
Analog Reference Power Supply Current	I_{REF}	V_{DD} = AV_{DD} = VA_{REF} = 5.0 V V_{SS} = AV_{SS} = 0 V	–	0.5	1.0		mA
Nonlinearity Error		V_{DD} = 5 V, V_{SS} = 0 V AV_{DD} = VA_{REF} = 5 V AV_{SS} = 0 V	–	–	± 1	± 2	LSB
Zero Error			–	–	± 1	± 2	
Full Scale Error			–	–	± 1	± 2	
Overall Error			–	–	± 2	± 4	

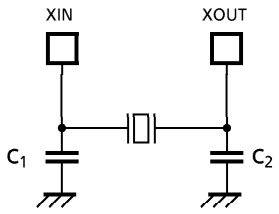
AC Characteristics (V_{SS} = 0 V, V_{DD} = 4.5 to 5.5 V, Topr = – 40 to 85°C)

Parameter	Symbol	Pin	Min	Typ.	Max	Unit
Machine Cycle Time	tcy	During NORMAL1 mode	0.2	–	0.5	μs
		During IDLE mode				
High Level Clock Pulse Width	t_{WCH}	When operating with external clock (XIN input) fc = 20 MHz	25	–	–	ns
Low Level Clock Pulse Width	t_{WCL}					

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

Parameter	Resonator	Oscillation Frequency	Recommended Resonator	Recommended Constant	
				C_1	C_2
High-frequency oscillation	Ceramic resonator	16 MHz	CSTLS16MOX51-B0 made by Murata Mfg. Co.	(5 pF)	(5 pF)
		20 MHz	CSTLS20MOX51-B0 made by Murata Mfg. Co.	(5 pF)	(5 pF)

(C1, C2 built-in type)



High-frequency oscillation

Note 1: When using the device in places exposed to high electric fields as in cathode-ray tubes, we recommend electrically shielding the package in order to maintain the device in normal working condition.

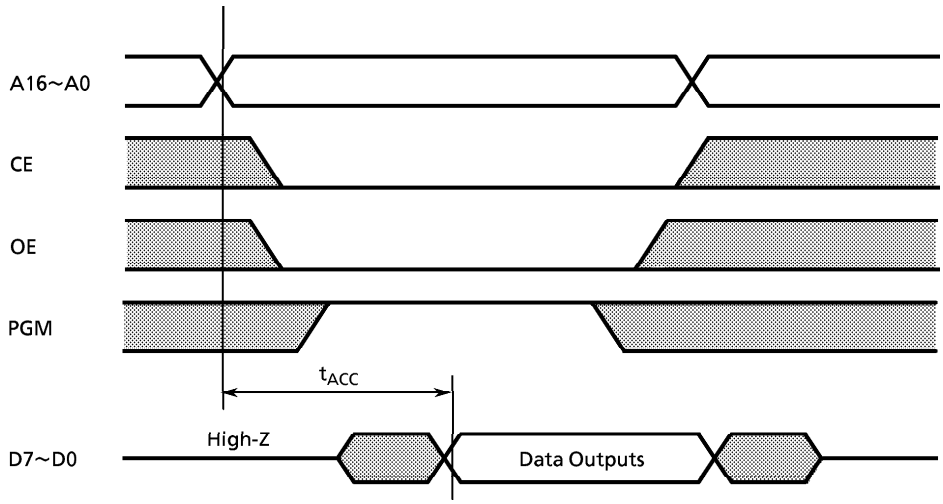
Note 2: These product numbers and the corresponding specifications are subject to change. For up-to-date information, please refer to the following URL;
http://www.murata.co.jp/search/index.html

DC/AC Characteristics (PROM mode) (V_{SS} = 0 V, Topr = 25 ± 5°C)

(1) Read Operation

Parameter	Symbol	Condition	Min	Typ.	Max	Unit
Input High Voltage	V_{IH4}		V_{CC} × 0.7	–	V_{CC}	V
Input Low Voltage	V_{IL4}		0	–	V_{CC} × 0.12	
Power Supply Voltage	V_{CC}		4.75	5.0	5.25	
Program Power Supply Voltage	V_{PP}					
Address Access Time	t_{ACC}	V_{CC} = 5.0 ± 0.25 V	–	1.5tcyc + 300	–	ns

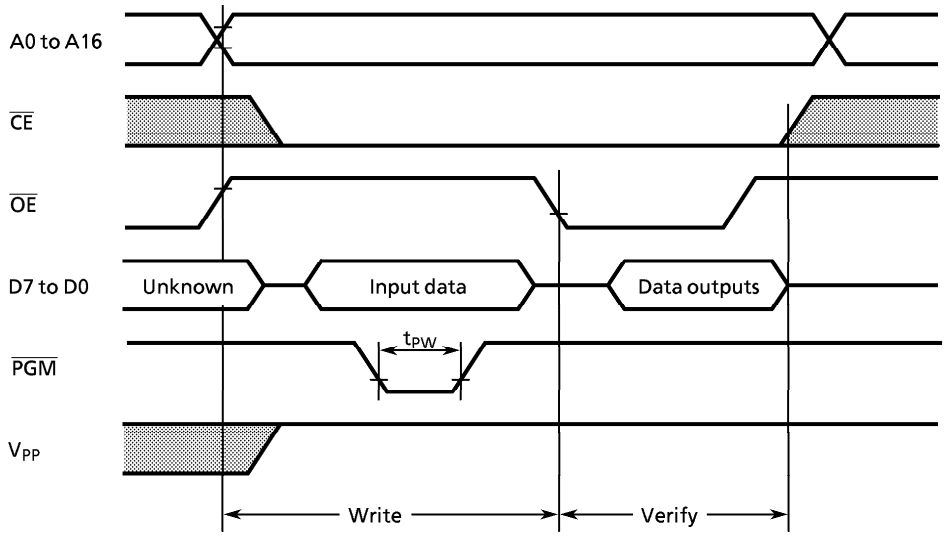
Note : tcyc = 250 ns at 16 MHz



(2) High-Speed Programming Operation (Topr = 25 ± 5°C)

Parameter	Symbol	Condition	Min	Typ.	Max	Unit
Input High Voltage	V_{IH4}		V_{CC} × 0.7	–	V_{CC}	V
Input Low Voltage	V_{IL4}		0	–	V_{CC} × 0.12	
Power Supply Voltage	V_{CC}		6.0	6.25	6.5	
Program Power Supply Voltage	V_{PP}		12.5	12.75	13.0	
Initial Program Pulse Width	t_{PW}	V_{CC} = 6.0 V	0.095	0.1	0.105	ms

High-speed program



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.