

CMOS 8-Bit Microcontroller

**TMPA8700PSN, TMPA8700PSF**

The A8700PS is a One-Time PROM microcontroller with low-power 498 Kbits (a 60 Kbytes program memory and a 256 characters OSD font memory) electrically programmable read only memory for the A8700CH / CK / CM / CP / CS and A8701CH / CK / CM system evaluation. The A8700PS is pin compatible with the A8700CH / CK / CM / CP / CS and A8701CH / CK / CM. The operations possible with the A8700CH / CK / CM / CP / CS and A8701CH / CK / CM can be performed by writing programs and OSD font data to PROM. The A8700PS can write and verify in the same way as the TC571000 using an adaptor socket BMA1101 / BMA1102 and an EPROM programmer.

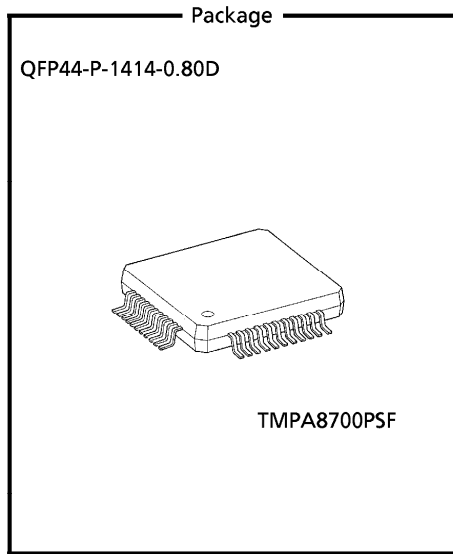
Part No.	OTP	RAM	Package	Adaptor Socket
TMPA8700PSN	60 Kbytes + 8 × 9 × 256 bits	2 Kbytes	SDIP42-P-600-1.78	BMA1101
TMPA8700PSF			QFP44-P-1414-0.80D	BMA1102

980910EBP1

- 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 the 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 observe standards of safety, and to avoid situations in which a malfunction or failure of a TOSHIBA product 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 products specifications. Also, please keep in mind the precautions and conditions set forth in the TOSHIBA Semiconductor Reliability Handbook.
- 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.

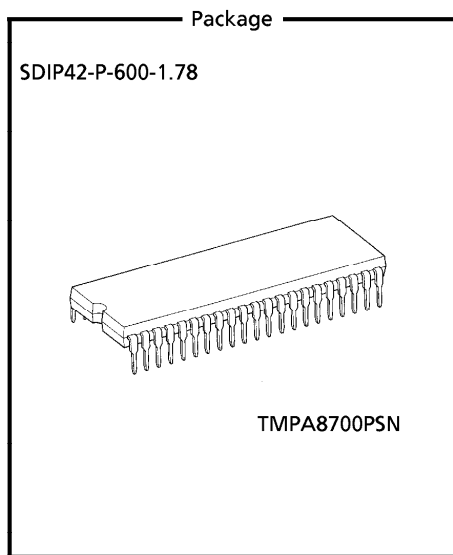
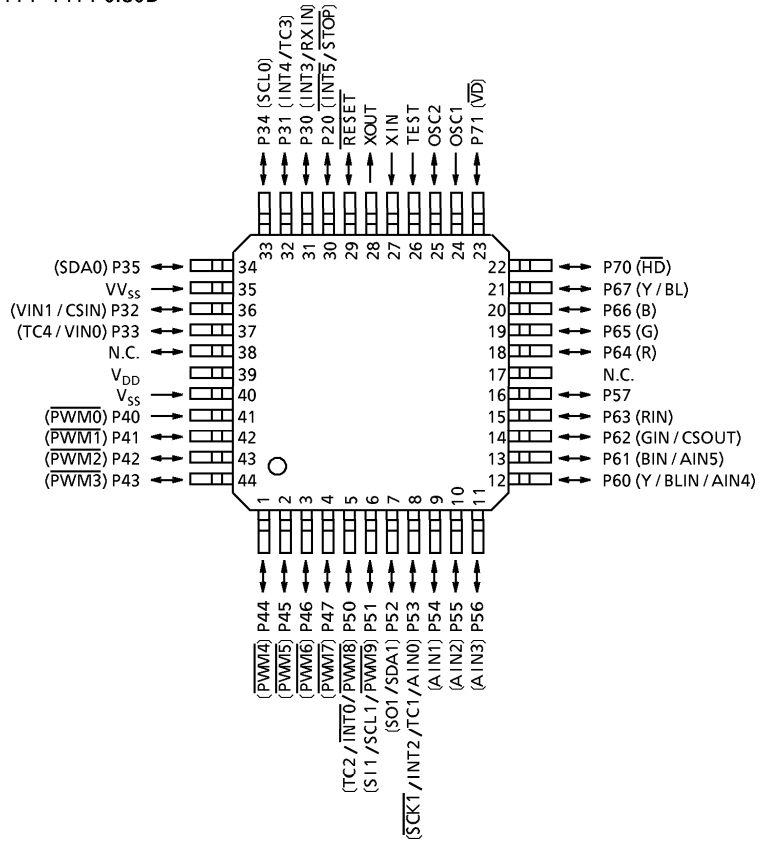


Purchase of TOSHIBA I<sup>2</sup>C components conveys a license under the Philips I<sup>2</sup>C Patent Rights to use these components in an I<sup>2</sup>C system, provided that the system conforms to the I<sup>2</sup>C Standard Specification as defined by Philips.



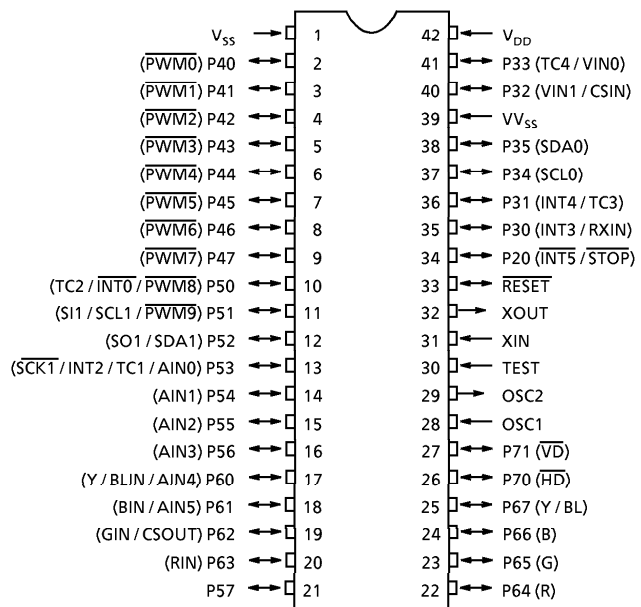
Pin Assignments (Top View)

QFP44-P-1414-0.80D



Pin Assignments (Top View)

SDIP42-P-600-1.78



**Pin Function**

The A8700PS has two modes : MCU and PROM.

(1) MCU mode

In this mode, the A8700PS is pin compatible with the A8700CH / CK / CM / CP / CS and A8701CH / CK / CM (fix the TEST pin at low level).

(2) PROM mode

Pin Name (PROM Mode)	Input / Output	Functions	Pin Name (MCU Mode)
A <sub>16</sub>	Input	PROM address inputs	OSC1
A <sub>15</sub> to A <sub>12</sub>			P35, P34, P31, P30
A <sub>11</sub> to A <sub>8</sub>			P67 to P64
A <sub>7</sub> to A <sub>0</sub>			P57 to P50
D <sub>7</sub> to D <sub>0</sub>	I / O	PROM data input / outputs	P47 to P40
$\overline{CE}$	Input	Chip enable signal input (active low)	P33
$\overline{OE}$		Output enable signal input (active low)	P32
$\overline{PGM}$	Input	Program mode signal input (active low)	OSC2
V <sub>PP</sub>	Power supply	+ 12.75 V / 5 V (Program supply voltage)	TEST
V <sub>CC</sub>		+ 6.25 V / 5 V	V <sub>DD</sub>
GND		0 V	V <sub>SS</sub> , V <sub>VSS</sub>
P61	Input	PROM mode setting pin. Be fixed at high level.	
P70			
P20			
P63, P62, P60		PROM mode setting pin. Be fixed at low level.	
P71			
$\overline{RESET}$			
XIN	Input	Connect an 8 MHz oscillator to stabilize the internal state.	
XOUT	Output		

**Operational Description**

The following explains the A8700PS hardware configuration and operation. The configuration and functions of the A8700PS are the same as those of the A8700CS, except in that a one-time PROM is used instead of an on-chip mask ROM.

**1. Operating Mode**

The A8700PS has two modes : MCU and PROM.

**1.1 MCU Mode**

The MCU mode is activated by fixing the TEST / V<sub>PP</sub> pin at low level.

In the MCU mode, operation is the same as with the A8700CH / CK / CM / CP / CS (the TEST / V<sub>PP</sub> pin cannot be used open because it has no built-in pull-down resistance).

Also, without the program corrective function, D / A converted (pulse width modulation) output, remote control signal processor, and RAM addresses 340<sub>H</sub> to 83F<sub>H</sub>, the chip operates in the same way as the A8701CH / CK / CM.

Moreover, when using the chip to evaluate the A8701CH / CK / CM, do not set the registers used for these functions.

**1.1.1 Program Memory and OSD Character Font Memory**

The A8700PS has a 60 Kbytes (addresses 1100<sub>H</sub> to FFFF<sub>H</sub> in the MCU mode, address 11100<sub>H</sub> to 1FFFF<sub>H</sub> in the PROM mode) of program memory and a 8×9×256 bits (addresses 4000<sub>H</sub> to 4FFF<sub>H</sub> in the PROM mode) of OSD character font memory.

## Electrical Characteristics

Absolute Maximum Ratings

(V<sub>SS</sub> = 0 V)

Characteristic	Symbol	Pins	Rating	Unit
Supply Voltage	V <sub>DD</sub>	—	– 0.3 to 6.5	V
Programmable Voltage	V <sub>PP</sub>	TEST / V <sub>PP</sub> pin	– 0.3 to 13.0	V
Input Voltage	V <sub>IN</sub>	—	– 0.3 to V <sub>DD</sub> + 0.3	V
Output Voltage	V <sub>OUT1</sub>	—	– 0.3 to V <sub>DD</sub> + 0.3	V
Output Current (Per 1 pin)	I <sub>OUT1</sub>	Ports P2, P3, P4, P5, P64 to P67, P7	3.2	mA
	I <sub>OUT2</sub>	Ports P60 to P63	30	
Output Current (Total)	ΣI <sub>OUT1</sub>	Ports P2, P3, P4, P5, P64 to P67, P7	120	mA
	ΣI <sub>OUT2</sub>	Ports P60 to P63	120	
Power Dissipation	P <sub>D</sub>	—	600	mW
Soldering Temperature (time)	T <sub>sld</sub>	—	260 (10 s)	°C
Storage Temperature	T <sub>stg</sub>	—	– 55 to 125	°C
Operating Temperature	T <sub>opr</sub>	—	– 30 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	( $V_{SS} = 0\text{ V}$ , $T_{opr} = -30\text{ to }70^{\circ}\text{C}$ )
----------------------------------	--

Characteristic	Symbol	Pins	Test Condition	Min	Max	Unit
Supply Voltage	$V_{DD}$	—	NORMAL mode	4.5	5.5	V
			IDLE mode			
			STOP mode	2.0		
Input High Voltage	$V_{IH1}$	Except hysteresis input	—	$V_{DD} \times 0.70$	$V_{DD}$	V
	$V_{IH2}$	Hysteresis input		$V_{DD} \times 0.75$		
Input Low Voltage	$V_{IL1}$	Except hysteresis input	—	0	$V_{DD} \times 0.30$	V
	$V_{IL2}$	Hysteresis input			$V_{DD} \times 0.25$	
Clock Frequency	$f_c$ (Note)	XIN, XOUT	—	1	8.0	MHz
	$f_{osc}$	OSC1, OSC2	Normal frequency mode (FORS = 0)	2	12	
			Double frequency mode (FORS = 1)	2	6	

*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: Clock frequency  $f_c$  : Supply voltage range is specified in NORMAL1 / 2 mode and IDLE1 / 2 mode.*

*Furthermore, since the CPU clock serves dual purposes as a clock for the CCD slicer, always be sure to use an 8 MHz oscillator.*

## D.C. Characteristics

(V<sub>SS</sub> = 0 V, T<sub>opr</sub> = -30 to 70°C)

Characteristic	Symbol	Pins	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Hysteresis Voltage	V <sub>HS</sub>	Hysteresis inputs	—	—	—	0.9	—	V
Input Current	I <sub>IN1</sub>	TEST	—	V <sub>DD</sub> = 5.5 V, V <sub>IN</sub> = 5.5 V / 0V	—	—	±2	μA
	I <sub>IN2</sub>	Open drain ports, Tri-state ports	—					
	I <sub>IN3</sub>	RESET, STOP	—					
Input Resistance	R <sub>IN2</sub>	RESET	—	—	100	220	450	kΩ
Output Leakage Current	I <sub>LO1</sub>	Sink open drain ports	—	V <sub>DD</sub> = 5.5 V, V <sub>OUT</sub> = 5.5 V / 0 V	—	—	±2	μA
	I <sub>LO2</sub>	Tri-state ports	—	V <sub>DD</sub> = 5.5 V, V <sub>OUT</sub> = 5.5 V / 0 V				
Output High Voltage	V <sub>OH2</sub>	Tri-state ports	—	V <sub>DD</sub> = 4.5 V, I <sub>OH</sub> = -0.7 mA	4.1	—	—	V
Output Low Voltage	V <sub>OL</sub>	Except XOUT, OSC2 and P63 to 60	—	V <sub>DD</sub> = 4.5 V, I <sub>OL</sub> = 1.6 mA	—	—	0.4	V
Output Low Current	I <sub>OL3</sub>	P63 to P60	—	V <sub>DD</sub> = 4.5 V, V <sub>OL</sub> = 1.0 V	—	20	—	mA
Supply Current in NORMAL Mode	I <sub>DD</sub>	—	—	V <sub>DD</sub> = 5.5 V f <sub>c</sub> = 8 MHz (Note 3) V <sub>IN</sub> = 5.3 V / 0.2 V	—	15	25	mA
Supply Current in IDLE Mode					—	10	18	
Supply Current in STOP Mode					—	0.5	10	μA

Note 1: Typ. values show those at T<sub>opr</sub> = 25°C, V<sub>DD</sub> = 5 V.

Note 2: Input Current I<sub>IN3</sub>; The current through resistor is not included.

Note 3: Supply Current I<sub>DD</sub>; The current (Typ. 0.5 mA) through ladder resistors of ADC is included in NORMAL mode and IDLE mode.

## A/D Conversion Characteristics

(T<sub>opr</sub> = -30 to 70°C)

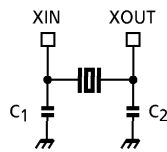
Characteristic	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Analog Reference Voltage	V <sub>AREF</sub>	—	Supplied from V <sub>DD</sub> pin	—	V <sub>DD</sub>	—	V
Analog Reference Voltage Range	V <sub>ASS</sub>	—	0 V, supplied from V <sub>SS</sub> pin	—	0	—	
	ΔV <sub>AREF</sub>	—	= V <sub>DD</sub> - V <sub>SS</sub>	—	V <sub>DD</sub>	—	
Analog Input Voltage	V <sub>AIN</sub>	—	—	V <sub>SS</sub>	—	V <sub>DD</sub>	LSB
Nonlinearity Error	—	—	V <sub>DD</sub> = 4.5 to 5.5 V	—	—	±1	
Zero Point Error	—			—	—	±2	
Full Scale Error	—			—	—	±2	
Total Error	—			—	—	±3	

**A.C. Characteristics** ( $V_{SS} = 0\text{ V}$ ,  $V_{DD} = 4.5\text{ to }5.5\text{ V}$ ,  $T_{opr} = -30\text{ to }70^\circ\text{C}$ )

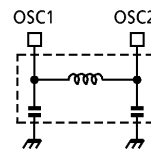
Characteristic	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Machine Cycle Time	t <sub>cy</sub>	—	In NORMAL mode	0.5	—	4	μs
			In IDLE mode				
High Level Clock Pulse Width	t <sub>WCH</sub>	—	For external clock operation (XIN input), f <sub>c</sub> = 8 MHz	62.5	—	—	ns
Low Level Clock Pulse Width	t <sub>WCL</sub>						

**Recommended Oscillating Conditions** ( $V_{SS} = 0\text{ V}$ ,  $V_{DD} = 4.5\text{ to }5.5\text{ V}$ ,  $T_{opr} = -30\text{ to }70^\circ\text{C}$ )

Parameter	Oscillator	Frequency	Recommended Oscillator		Recommended Constant	
					C <sub>1</sub>	C <sub>2</sub>
High-Frequency Oscillation	Ceramic Resonator	8 MHz	KYOCERA	KBR8.0M	30 pF	30 pF
	Crystal Oscillator	8 MHz	TOYOCOM	210B 8.0000	20 pF	20 pF
OSD	LC Resonator	6 MHz	TOKO	A285HCIS-13319	—	—
		12 MHz	TOKO	TBEHCIS-13306		



(1) High-frequency Oscillation



(2) LC Resonator for OSD

*Note: To keep reliable operation, shield the device electrically with the metal plate on its package mold surface against the high electric field, for example, by CRT (Cathode Ray Tube).*

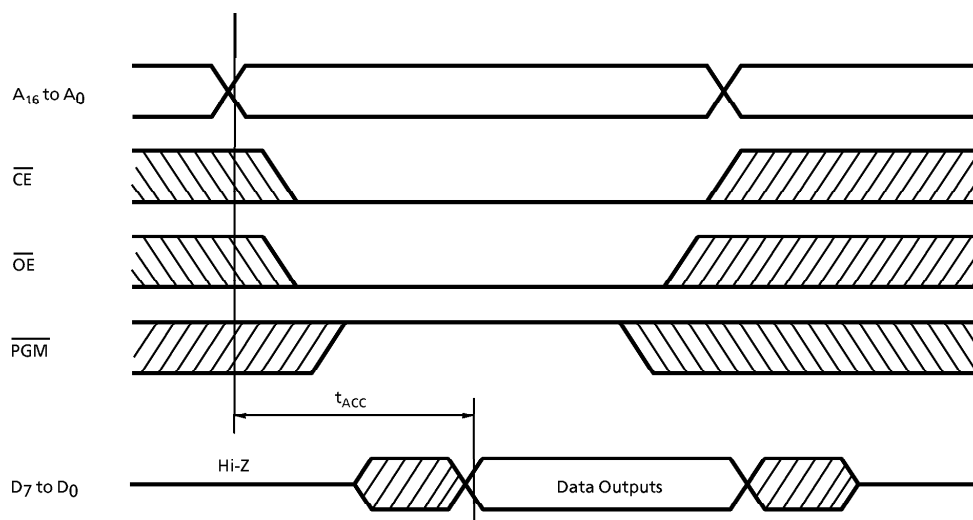


DC / AC Characteristics (PROM Mode) ( $V_{SS} = 0\text{ V}$ ,  $T_{opr} = -30\text{ to }70^\circ\text{C}$ )

(1) Read operation

Characteristic	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Input High Voltage	$V_{IH4}$	—	—	$V_{CC} \times 0.7$	—	$V_{CC}$	V
Input Low Voltage	$V_{IL4}$	—	—	0	—	$V_{CC} \times 0.12$	V
Power Supply Voltage	$V_{CC}$	—	—	4.75	5.0	5.25	V
Program Power Supply Voltage	$V_{PP}$	—					
Address Access Time	$t_{ACC}$	—	$V_{CC} = 5.0 \pm 0.25\text{ V}$	—	$1.5\text{ t}_{cyc} + 300$	—	ns

Note:  $t_{cyc} = 500\text{ ns}$  at 8 MHz



(2) High-speed programming operation ( $T_{opr} = 25 \pm 5^\circ\text{C}$ )

Characteristic	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Input High Voltage	$V_{IH4}$	—	—	$V_{CC} \times 0.7$	—	$V_{CC}$	V
Input Low Voltage	$V_{IL4}$	—	—	0	—	$V_{CC} \times 0.12$	V
Power Supply Voltage	$V_{CC}$	—	—	6.0	6.25	6.5	V
Program Power Supply Voltage	$V_{PP}$	—	—	12.5	12.75	13.0	V
Initial Program Pulse Width	$t_{PW}$	—	$V_{CC} = 6.0\text{ V}$	0.095	0.1	0.105	ms