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CMOS 4-bit
1-chip MICROCOMPUTER

S-13P48A

The S-13P48A 4-bit microcomputer integrates 8-bit programmable timer, watch dog timer, carry output circuit, etc., on one chip. As it can be driven by batteries, this microcomputer is ideal for various compact portable equipment.

■ Feature

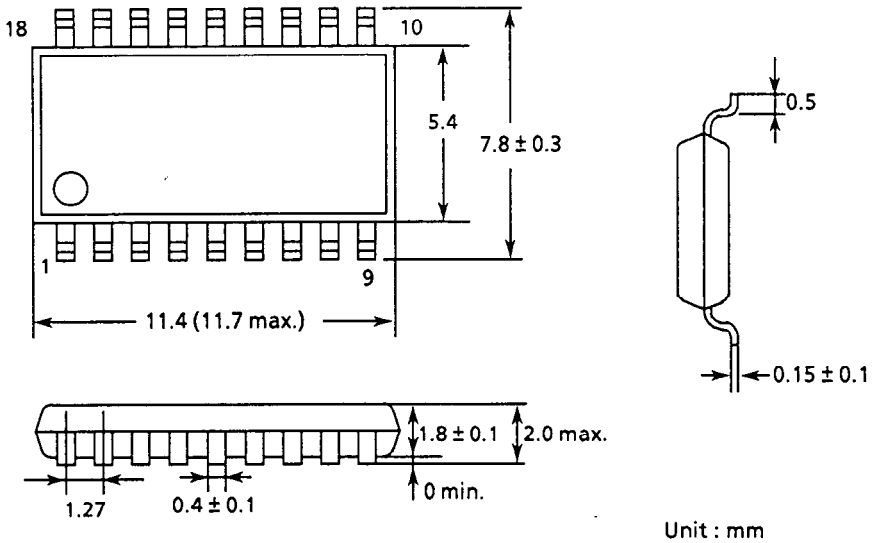
- Si gate CMOS process
- Low power consumption
- Single power supply : 1.8 V min.(600 KHz)
- High-speed operation : 600 KHz max.
- EPROM: 512×8 bits
- RAM: 16×4 bits
- 5 input lines , 6 output lines and a remote control signal output line
- 2 timers: 8-bit programmable timer and delay timer
- Watch dog timer
- Interrupt function
- Standby function (STOP, HALT)
- Instruction execution time: 8μ SEC /Inst min. (at 500 KHz)
- Instructions: 79 types (114 including addressing modes) 5-level subroutine nesting
- S-13P48AFE: 18-pin SOP (terminal distance:1.27mm)
- S-13P48AFS: 20-pin SSOP (terminal distance:0.65mm)

■ Applications

- Security system (Car, Home etc.)
- Toys
- Infrared remote controller
- Compact portable equipment, others

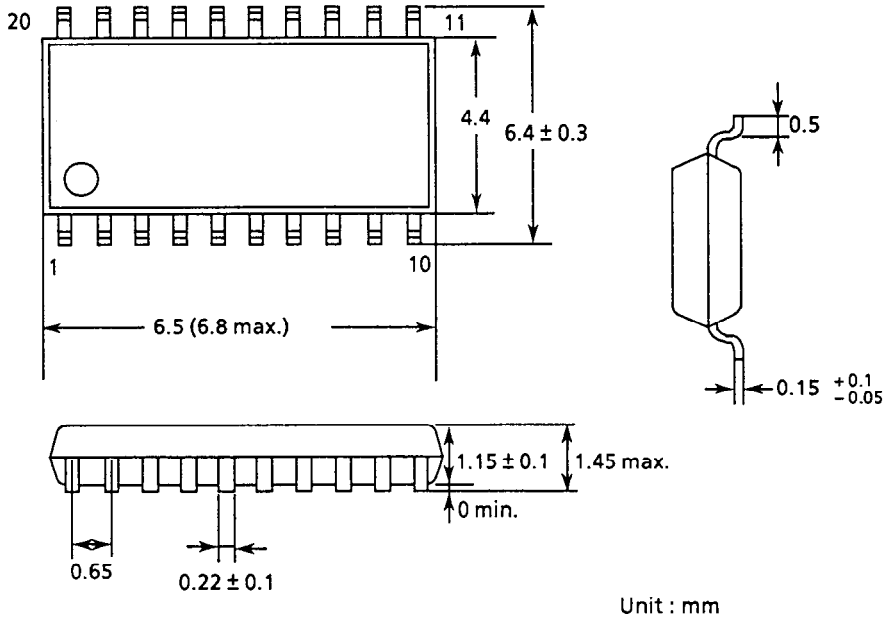
■ Dimensions (18-pin SOP, 20-pin SSOP)

18-pin SOP



Unit : mm

20-pin SSOP

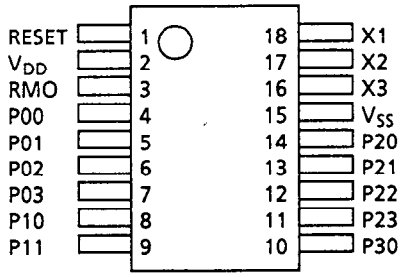


Unit : mm

Figure 1

■ Pin Assignments

S-13P48AFE
18-pin SOP



S-13P48AFS
20-pin SSOP
(Packing form : Reel only)

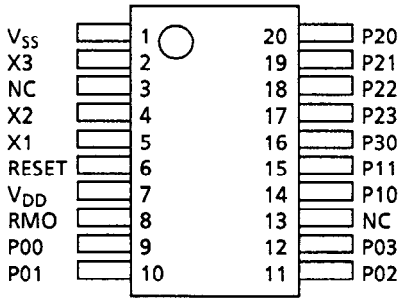


Figure 2

■ Terminal Functions

Table 1

Name	Normal operation		PROM programming mode	
	I/O	Function	I/O	Function
V_{DD}	—	Positive power supply	—	Positive power supply
V_{SS}	—	GND potential terminal	—	GND potential terminal
RESET	Input	Active high/reset input terminal (built-in Schmitt input, pull-down resistor)	Input	PROM write power supply (12.5 V) or V_{DD}
X1	Input	Condenser and register connect terminal for oscillation circuit X1-X2:C X1-X3:R	Input	Address clock input
X2	Output		Output	(OPEN)
X3	Output		Output	(OPEN)
RMO	Output	Carrier wave output	Input	Mode selection
P_{00}	Output	Output port (Nch open drain output/CMOS output selection available through software)	Input/ Output	PROM data (D0)
P_{01}				PROM data (D1)
P_{02}				PROM data (D2)
P_{03}				PROM data (D3)
P_{10}	Output		Output	(OPEN)
P_{11}				(OPEN)
P_{20}	Input	Input port (Pullup resistance inclusion available through software)	Input	PROM data (D4)
P_{21}				PROM data (D5)
P_{22}				PROM data (D6)
P_{23}				PROM data (D7)
P_{30}	Input		Input/ Output	10 KΩ resistance pull-down

■ Block Diagram

S-13P48A is connected by 4-bit data bus (DB), 12-bit address bus (AB), control signals, etc., and controls the memories (EPROM, RAM), registers, I/O ports, logic circuits (ALU), timers, etc.

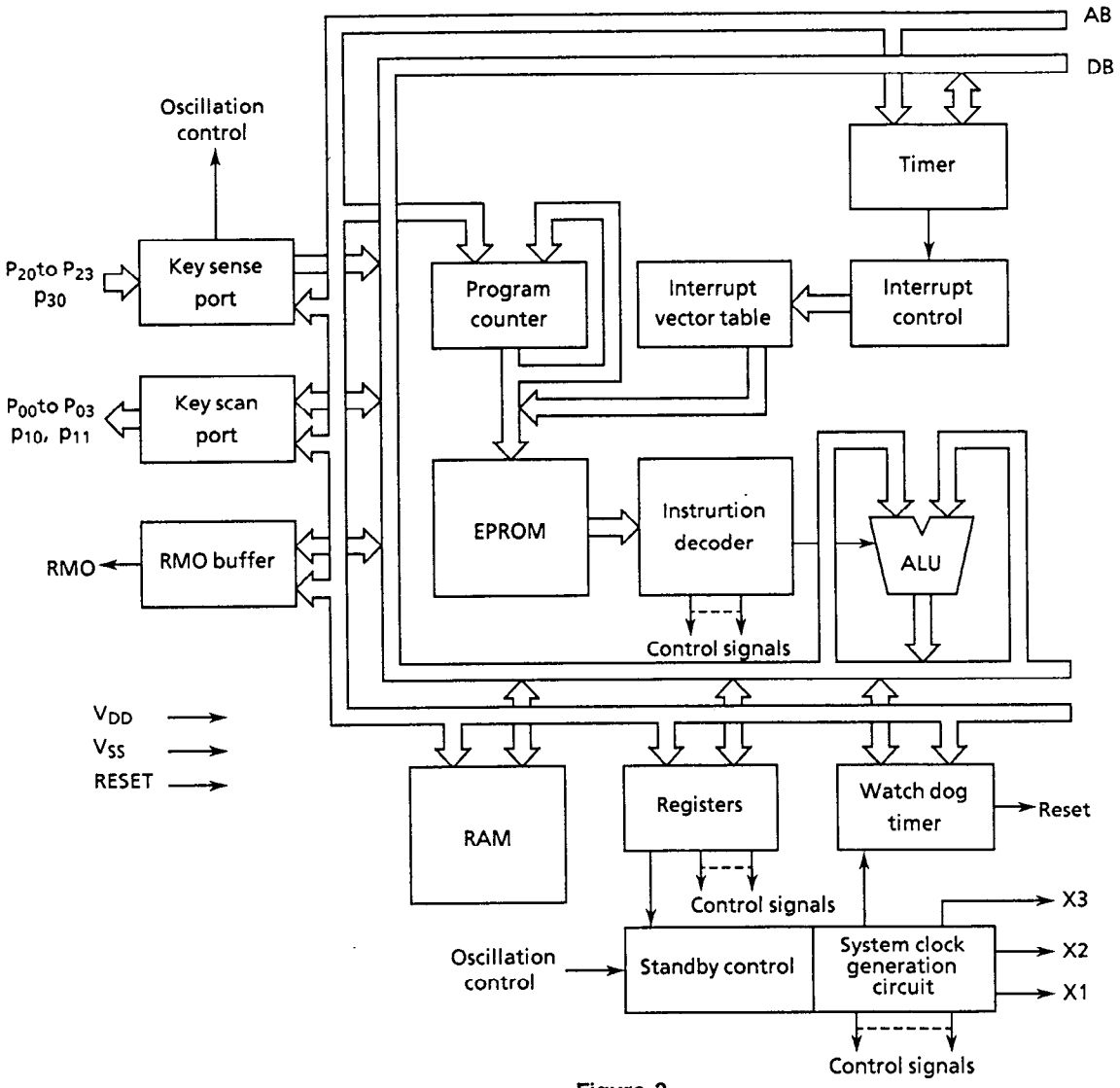


Figure 3

■ Absolute Maximum Ratings

Table 2

Item	Symbol	Conditions	Rating	Unit
Storage temperature	Tstg		-40 to + 125	°C
Operating temperature	Topr		-20 to + 70	°C
Power supply voltage	V_{DD}	Ta = 25°C	-0.3 to 7.0	V
Input voltage	V_{IN}	Ta = 25°C	V_{SS}-0.3 to V_{DD} + 0.3	V
Output voltage	V_{OUT}	Ta = 25°C	V_{SS} to V_{DD}	V
Power dissipation	Pd	Ta = 25°C	300	mW

■ Recommended Operating Conditions

Table 3

(Ta = -20 °C to + 70 °C)

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Power supply voltage	V_{DD}	System clock : 600 KHz	1.8		5.5	V
Input voltage	V_{IN}		0		V_{DD}	V
System clock frequency	fsys	V_{DD} = 1.8 to 5.5V	200		600	KHz

■ DC Characteristics

Table 4 DC Characteristics (I)

($Ta = -20\,°C$ to $+70\,°C$, $V_{DD} = 3.0\,V$)

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Operating current consumption	I_{CCO}	System clock : 455 KHz	—	0.4	0.7	mA
Standby current consumption	I_{CCS}	At STOP mode	—	0.01	1	μA
High level input voltage	V_{IH}		$0.8 \times V_{DD}$	—	—	V
Low level input voltage	V_{IL}		—	—	$0.2 \times V_{DD}$	V
High level input leakage current	I_{IH}	All input terminals $V_{IN} = V_{DD}$	—	—	1	μA
Low level input leakage current	I_{IL}	Without pull-up resistor $V_{IN} = V_{SS}$	-1	—	—	μA
High level input current	I_{IH}	RESET terminal $V_{IN} = V_{DD}$	0.6	2	6	μA
Low level input current 1	I_{IL1}	With pull-up resistor $V_{IN} = V_{SS}$	-90	-30	-10	μA
Low level input current 2	I_{IL2}	RESET terminal $V_{IN} = V_{SS} + 0.3\,V$	0.9	3	9	μA
High level output current 1	I_{OH1}	RMO terminal, $V_{OUT} = 2.1\,V$	—	—	-5.0	mA
High level output current 2	I_{OH2}	P00 to P03 terminal $V_{OUT} = 2.1\,V$	—	—	-2.0	mA
High level output current 3	I_{OH3}	P10, P11 terminal $V_{OUT} = 2.6\,V$	—	—	-100	μA
Low level output current 1	I_{OL1}	RMO terminal, $V_{OUT} = 0.4\,V$	250	—	—	μA
Low level output current 2	I_{OL2}	P00 to P03 terminal $V_{OUT} = 0.9\,V$	5	—	—	mA
Low level output current 3	I_{OL3}	Output port, $V_{OUT} = 0.4\,V$	1.0	—	—	mA
Schmitt hysteresis width	V_{WD}		—	0.7	—	V

Table 5 DC Characteristics (II)

($Ta = -20\,°C$ to $+70\,°C$, $V_{DD} = 5.0\,V$)

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Operating current consumption	I_{CCO}	System clock : 455 KHz	—	1.2	2.0	mA
Standby current consumption	I_{CCS}	At STOP mode	—	0.1	5	μA
High level input voltage	V_{IH}		$0.8 \times V_{DD}$	—	—	V
Low level input voltage	V_{IL}		—	—	$0.2 \times V_{DD}$	V
High level input leakage current	I_{IH}	All input terminals $V_{IN} = V_{DD}$	—	—	1	μA
Low level input leakage current	I_{IL}	Without pull-up resistor $V_{IN} = V_{SS}$	-1	—	—	μA
High level input current	I_{IH}	RESET terminal $V_{IN} = V_{DD}$	3	9	27	μA
Low level input current 1	I_{IL1}	With pull-up resistor $V_{IN} = V_{SS}$	-270	-90	-30	μA
Low level input current 2	I_{IL2}	RESET terminal $V_{IN} = V_{SS} + 0.3\,V$	3	9	27	μA
High level output current 1	I_{OH1}	RMO terminal, $V_{OUT} = 2.1\,V$	—	—	-8.0	mA
High level output current 2	I_{OH2}	P00 to P03 terminal $V_{OUT} = 4.1\,V$	—	—	-3.0	mA
High level output current 3	I_{OH3}	P10, P11 terminal $V_{OUT} = 4.6\,V$	—	—	-250	μA
Low level output current 1	I_{OL1}	RMO terminal, $V_{OUT} = 0.4\,V$	500	—	—	μA
Low level output current 2	I_{OL2}	P00 to P03 terminal $V_{OUT} = 0.9\,V$	6.0	—	—	mA
Low level output current 3	I_{OL3}	Output port, $V_{OUT} = 0.4\,V$	2.0	—	—	mA
Schmitt hysteresis width	V_{WD}		—	1.3	—	V

■ Instructions

Table 6

	Basic	Including addressing modes
Transfer instruction	13	27
Arithmetic operation instruction	34	47
Logical operation instruction	7	13
Branch instruction	21	21
Shift instruction	2	4
Special instruction	2	2
Total	79	114

■ Application Example

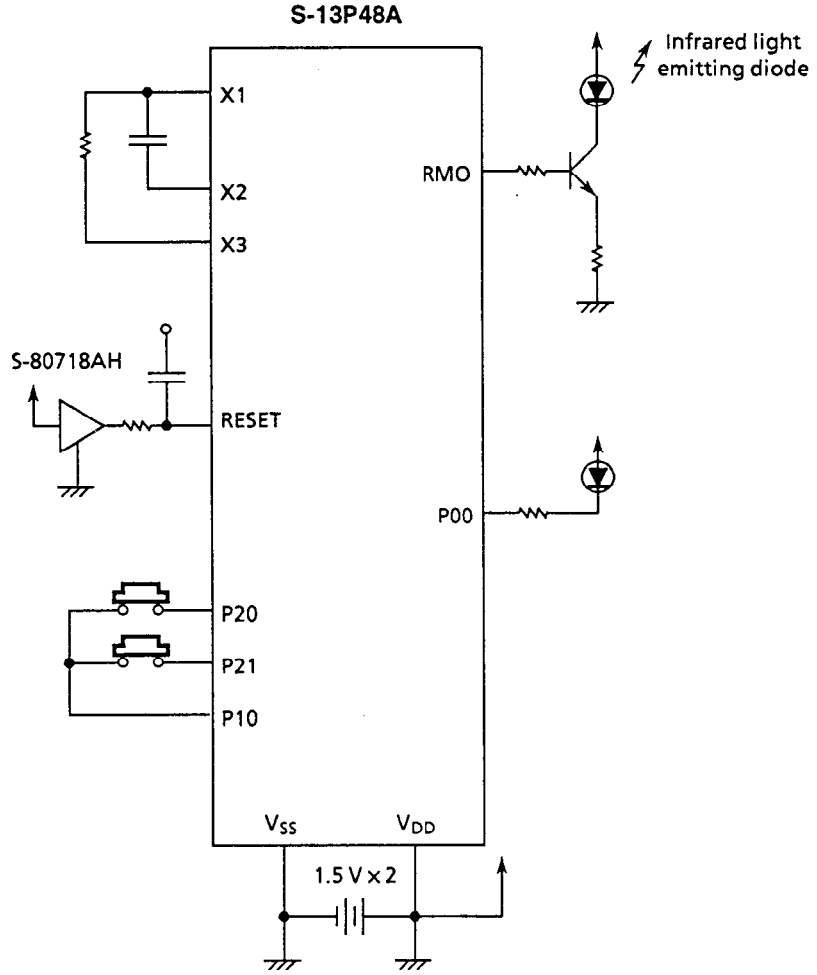


Figure 4