## Contents

CMOS 4-bit
1-chip MICROCOMPUTER

# S-1462AF/14L62AF

The S-1462AF/14L62AF 4-bit microcomputer integrates 10-bit programmable counter, watchdog timer, and 8-bit programmable timer on one chip. Driven by batteries, this microcomputer is ideal for compact portable equipment.
S-14L62AF is low voltage operating version of S-1462AF.

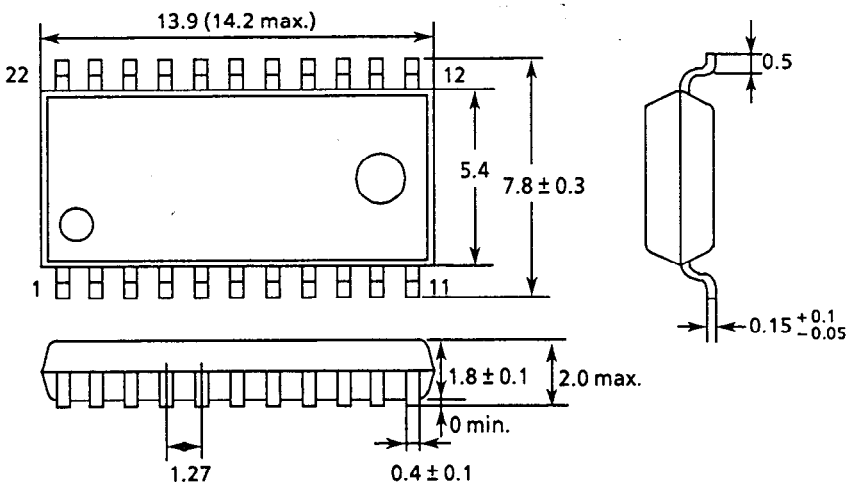
## ■ Feature

- Si gate CMOS process
- Low power consumption
- Single power supply: 2.2 V min.(for S-1462AF) , 1.2 V min.(for S-14L62AF)
- High-speed operation: 1 MHz max.
- ROM: 2 K×16 bits
- RAM: 128×4 bits
- 14 I/O lines
- 2 timers: timer, programmable countar
- Built-in watchdog timer
- Interrupt function: Two (internal)
- Standby function
- Instruction execution time: 4.0 $\mu$s /1 MHz
- Instruction: 35 basic instruction sets (166 if addressing modes are included)
  16-level subroutine nesting
- 22-pin SOP (terminal distance: 1.27 mm)

## ■ Applications

- Presettable remote controller
- Compact portable equipment, others

## ■ Dimensions (22-pin SOP)




Unit : mm

Figure 1

## ■ Pin Assignments

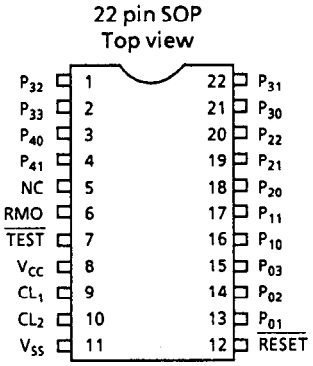



Figure 2

## ■ Terminal Functions

Table 1

| Name | I/O | Functions |
|---|---|---|
| $V_{SS}$ | — | GND potential terminal |
| $V_{CC}$ | — | Positive power supply |
| $\overline{TEST}$ | Input | Test input terminal (built-in pull-up resirtor) |
| $\overline{RESET}$ | Input | Reset input terminal (built-in pull-up resistor) |
| $CL_1$ | — | Ceramic oscillator connection terminal for system clock oscillation, external clock input |
| $CL_2$ | — | Ceramia osaillator connection terminal for system clock oscillation |
| RMO | Output | Remote control signal output terminal |
| $P_{01}$ to $P_{03}$ | I/O | Port 0 input/output pins, whose directions are selected in bit units (pull-up resistor or Nch opendrain can be selected by mask option) |
| $P_{10}$, $P_{11}$ | Input | Port 1 input pins (built-in pull-up resistor) |
| $P_{20}$ to $P_{22}$ | Input | Port 2 input pins (built-in pull-up resistor) |
| $P_{30}$ to $P_{33}$ | Output | Port 3 output pins (Nch opendrain output can be selected by mask option) |
| $P_{40}$, $P_{41}$ | Output | Port 4 output pins (Nch opendrain output can be selected by mask option) |

## ■ Block Diagram

The S-1462/L62AF blocks connect with a 4-bit data bus (DB), 4-bit address bus (AB), 4-bit RAM address bus (RA), and 12-bit operation bus (OB).

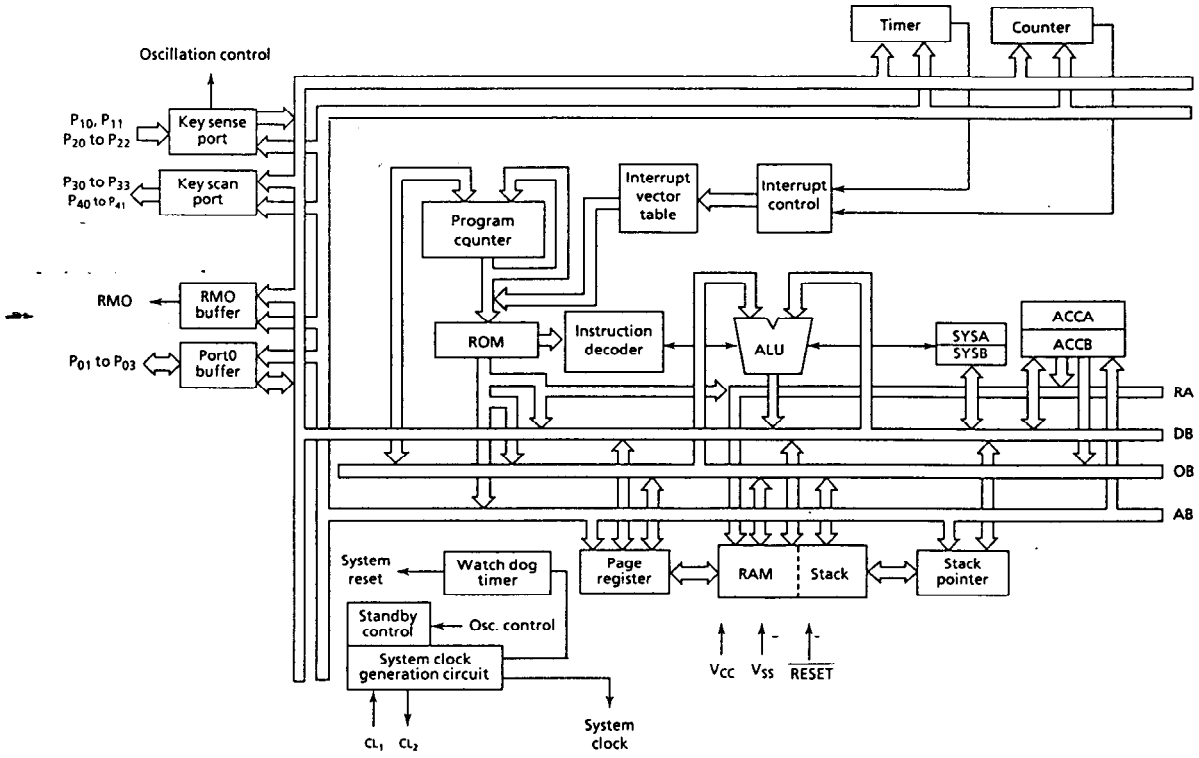



Figure 3

## ■ Absolute Maximum Ratings

Table 2

| Item | Symbol | Conditions | Rating | Unit |
|---|---|---|---|---|
| Storage temperature | $T_{stg}$ | | -40 to + 125 | °C |
| Operating temperature | $T_{opr}$ | | -10 to + 70 | °C |
| Power supply voltage | $V_{CC}$ | Ta = 25°C S-1462AF | -0.3 to + 7.0 | V |
| Power supply voltage | $V_{CC}$ | Ta = 25°C S-14L62AF | -0.3 to + 4.0 | V |
| Input voltage | $V_{IN}$ | Ta = 25°C | $V_{SS}$-0.3 to $V_{CC}$ + 0.3 | V |
| Output voltage | $V_{OUT}$ | Ta = 25°C | $V_{SS}$ to $V_{CC}$ | V |
| Power consumption | $P_d$ | Ta = 25°C | 300 | mW |

## ■ Recommended Operating Conditions

Table 3

(Ta = -10 °C to + 70 °C)

| Item | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Power supply voltage | $V_{CC}$ | System clock: 1 MHz for S-1462AF | 2.2 | — | 6.0 | V |
| Power supply voltage | $V_{CC}$ | System clock: 1 MHz for S-14L62AF | 1.2 | — | 3.6 | V |
| Input voltage | $V_{IN}$ | | 0 | — | $V_{CC}$ | V |
| System clock frequency | $f_{sys}$ | $V_{CC}$ = 2.2 to 6.0 V for S-1462AF | 0.2 | — | 1.0 | MHz |
| System clock frequency | $f_{sys}$ | $V_{CC}$ = 1.2 to 3.6 V for S-14L62AF | 0.2 | — | 1.0 | MHz |

## ■ DC Characteristics

1. S-1462AF ($V_{CC}$ = 3V)

**Table 4**

($Ta$ = -10 °C to + 70 °C, $V_{CC}$ = 3 V)

| Item | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Operating current consumption | $I_{CCO}$ | $f_O$ = 1 MHz, No load | — | 0.25 | 0.7 | mA |
| Standby current consumption | $I_{CCS}$ | At OFF mode | — | 0.1 | 2.0 | μA |
| High level input voltage | $V_{IH}$ | | 0.8 × $V_{CC}$ | — | — | V |
| Low level input voltage | $V_{IL}$ | | — | — | 0.2 × $V_{CC}$ | V |
| High level input leakage current | $I_{LH}$ | All input terminals* $V_{IN}$ = $V_{CC}$ | — | — | 1 | μA |
| Low level input leakage current | $I_{LL}$ | Without pull-up resistor, $P_{01}$ to $P_{03}$, $V_{IN}$ = $V_{SS}$ | -1 | — | — | μA |
| High level input current | $I_{IH}$ | $\overline{RESET}$, $V_{IN}$ = $V_{CC}$-0.3 V | -9 | — | -0.9 | μA |
| Low level input current 1 | $I_{IL1}$ | With pull-up resistor, $P_{01}$ to $P_{03}$, $P_{10}$, $P_{11}$, $P_{20}$ to $P_{22}$, $V_{IN}$ = $V_{SS}$ | -90 | -30 | -10 | μA |
| Low level input current 2 | $I_{IL2}$ | $\overline{RESET}$, $V_{IN}$ = $V_{SS}$ | -6 | -2 | -0.6 | μA |
| Low level input current 3 | $I_{IL3}$ | $\overline{TEST}$, $V_{IN}$ = $V_{SS}$ | -30 | -10 | -3 | μA |
| High level output current 1 | $I_{OH1}$ | RMO, $V_{OUT}$ = 2.1 V | — | — | -5.0 | mA |
| High level output current 2 | $I_{OH2}$ | $P_{01}$ to $P_{03}$, $P_{30}$ to $P_{33}$, $P_{40}$, $P_{41}$, $V_{OUT}$ = 2.6 V | — | — | -100 | μA |
| Low level output current 1 | $I_{OL1}$ | RMO, $V_{OUT}$ = 0.4 V | 250 | — | — | μA |
| Low level output current 2 | $I_{OL2}$ | $P_{01}$ to $P_{03}$, $P_{30}$ to $P_{33}$, $P_{40}$, $P_{41}$, $V_{OUT}$ = 0.4 V | 1.0 | — | — | mA |
| Schmitt hysteresis width | $V_{WD}$ | | — | 1.0 | — | V |

* $\overline{TEST}$, $\overline{RESET}$, $P_{01}$ to $P_{03}$, $P_{10}$, $P_{11}$, $P_{20}$ to $P_{22}$

2. S-1462AF (VCC = 5V)

**Table 5**

($Ta$ = -10 °C to + 70 °C, $V_{CC}$ = 5 V)

| Item | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Operating current consumption | $I_{CCO}$ | $f_O$ = 1 MHz, No load | — | 0.6 | 1.2 | mA |
| Standby current consumption | $I_{CCS}$ | At OFF mode | — | 0.1 | 5.0 | μA |
| High level input voltage | $V_{IH}$ | | 0.8 × $V_{CC}$ | — | — | V |
| Low level input voltage | $V_{IL}$ | | — | — | 0.2 × $V_{CC}$ | V |
| High level input leakage current | $I_{LH}$ | All input terminals* $V_{IN}$ = $V_{CC}$ | — | — | 1 | μA |
| Low level input leakage current | $I_{LL}$ | Without pull-up resistor, $P_{01}$ to $P_{03}$, $V_{IN}$ = $V_{SS}$ | -1 | — | — | μA |
| High level input current | $I_{IH}$ | $\overline{RESET}$, $V_{IN}$ = $V_{CC}$-0.3 V | -15 | — | -1.5 | μA |
| Low level input current 1 | $I_{IL1}$ | With pull-up resistor, $P_{01}$ to $P_{03}$, $P_{10}$, $P_{11}$, $P_{20}$ to $P_{22}$, $V_{IN}$ = $V_{SS}$ | -230 | -90 | -30 | μA |
| Low level input current 2 | $I_{IL2}$ | $\overline{RESET}$, $V_{IN}$ = $V_{SS}$ | -15 | -6 | -2.4 | μA |
| Low level input current 3 | $I_{IL3}$ | $\overline{TEST}$, $V_{IN}$ = $V_{SS}$ | -75 | -30 | -12 | μA |
| High level output current 1 | $I_{OH1}$ | RMO, $V_{OUT}$ = 4.1 V | — | — | -7 | mA |
| High level output current 2 | $I_{OH2}$ | $P_{01}$ to $P_{03}$, $P_{30}$ to $P_{33}$, $P_{40}$, $P_{41}$, $V_{OUT}$ = 4.6 V | — | — | -250 | μA |
| Low level output current 1 | $I_{OL1}$ | RMO, $V_{OUT}$ = 0.4 V | 450 | — | — | μA |
| Low level output current 2 | $I_{OL2}$ | $P_{01}$ to $P_{03}$, $P_{30}$ to $P_{33}$, $P_{40}$, $P_{41}$, $V_{OUT}$ = 0.4 V | 1.5 | — | — | mA |
| Schmitt hysteresis width | $V_{WD}$ | | — | 2.2 | — | V |

* $\overline{TEST}$, $\overline{RESET}$, $P_{01}$ to $P_{03}$, $P_{10}$, $P_{11}$, $P_{20}$ to $P_{22}$

3. S-14L62AF ($V_{CC}$ = 1.5 V)

**Table 6**

($T_a$ = -10 °C to + 70 °C, $V_{CC}$ = 1.5 V)

| Item | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Operating current consumption | $I_{CCO}$ | $f_O$ = 1 MHz, No load | — | 0.1 | 0.3 | mA |
| Standby current consumption | $I_{CCS}$ | At OFF mode | — | 1 | 10 | μA |
| High level input voltage | $V_{IH}$ | | 0.8 × $V_{CC}$ | — | — | V |
| Low level input voltage | $V_{IL}$ | | — | — | 0.2 × $V_{CC}$ | V |
| High level input leakage current | $I_{LH}$ | All input terminals* $V_{IN}$ = $V_{CC}$ | — | — | 1 | μA |
| Low level input leakage current | $I_{LL}$ | Without pull-up resistor, $P_{01}$ to $P_{03}$, $V_{IN}$ = $V_{SS}$ | -1 | — | — | μA |
| High level input current | $I_{IH}$ | $\overline{RESET}$, $V_{IN}$ = $V_{CC}$-0.3 V | -4 | — | -1 | μA |
| Low level input current 1 | $I_{IL1}$ | With pull-up resistor, $P_{01}$ to $P_{03}$, $P_{10}$, $P_{11}$, $P_{20}$ to $P_{22}$, $V_{IN}$ = $V_{SS}$ | -30 | -10 | -3 | μA |
| Low level input current 2 | $I_{IL2}$ | $\overline{RESET}$, $V_{IN}$ = $V_{SS}$ | -2 | -0.6 | -0.2 | μA |
| Low level input current 3 | $I_{IL3}$ | $\overline{TEST}$, $V_{IN}$ = $V_{SS}$ | -8 | -2 | -0.5 | μA |
| High level output current 1 | $I_{OH1}$ | RMO, $V_{OUT}$ = 1.1 V | — | — | -2 | mA |
| High level output current 2 | $I_{OH2}$ | $P_{01}$ to $P_{03}$, $P_{30}$ to $P_{33}$, $P_{40}$, $P_{41}$, $V_{OUT}$ = 1.1 V | — | — | -100 | μA |
| Low level output current 1 | $I_{OL1}$ | RMO, $V_{OUT}$ = 0.4 V | 200 | — | — | μA |
| Low level output current 2 | $I_{OL2}$ | $P_{01}$ to $P_{03}$, $P_{30}$ to $P_{33}$, $P_{40}$, $P_{41}$, $V_{OUT}$ = 0.4 V | 0.5 | — | — | mA |
| Schmitt hysteresis width | $V_{WD}$ | | — | 0.4 | — | V |

* $\overline{TEST}$, $\overline{RESET}$, $P_{01}$ to $P_{03}$, $P_{10}$, $P_{11}$, $P_{20}$ to $P_{22}$

4. S-14L62AF ($V_{CC}$ = 3 V)

**Table 7**

($T_a$ = -10 °C to + 70 °C, $V_{CC}$ = 3 V)

| Item | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Operating current consumption | $I_{CCO}$ | $f_O$ = 1 MHz, No load | — | 0.5 | 1.0 | mA |
| Standby current consumption | $I_{CCS}$ | At OFF mode | — | 1 | 15 | μA |
| High level input voltage | $V_{IH}$ | | 0.8 × $V_{CC}$ | — | — | V |
| Low level input voltage | $V_{IL}$ | | — | — | 0.2 × $V_{CC}$ | V |
| High level input leakage current | $I_{LH}$ | All input terminals* $V_{IN}$ = $V_{CC}$ | — | — | 1 | μA |
| Low level input leakage current | $I_{LL}$ | Without pull-up resistor, $P_{01}$ to $P_{03}$, $V_{IN}$ = $V_{SS}$ | -1 | — | — | μA |
| High level input current | $I_{IH}$ | $\overline{RESET}$, $V_{IN}$ = $V_{CC}$-0.3 V | -8 | — | -2 | μA |
| Low level input current 1 | $I_{IL1}$ | With pull-up resistor, $P_{01}$ to $P_{03}$, $P_{10}$, $P_{11}$, $P_{20}$ to $P_{22}$, $V_{IN}$ = $V_{SS}$ | -120 | -50 | -20 | μA |
| Low level input current 2 | $I_{IL2}$ | $\overline{RESET}$, $V_{IN}$ = $V_{SS}$ | -10 | -4 | -1.5 | μA |
| Low level input current 3 | $I_{IL3}$ | $\overline{TEST}$, $V_{IN}$ = $V_{SS}$ | -40 | -16 | -6 | μA |
| High level output current 1 | $I_{OH1}$ | RMO, $V_{OUT}$ = 2.6 V | — | — | -3 | mA |
| High level output current 2 | $I_{OH2}$ | $P_{01}$ to $P_{03}$, $P_{30}$ to $P_{33}$, $P_{40}$, $P_{41}$, $V_{OUT}$ = 2.6 V | — | — | -200 | μA |
| Low level output current 1 | $I_{OL1}$ | RMO, $V_{OUT}$ = 0.4 V | 400 | — | — | μA |
| Low level output current 2 | $I_{OL2}$ | $P_{01}$ to $P_{03}$, $P_{30}$ to $P_{33}$, $P_{40}$, $P_{41}$, $V_{OUT}$ = 0.4 V | 1.0 | — | — | mA |
| Schmitt hysteresis width | $V_{WD}$ | | — | 1.0 | — | V |

* $\overline{TEST}$, $\overline{RESET}$, $P_{01}$ to $P_{03}$, $P_{10}$, $P_{11}$, $P_{20}$ to $P_{22}$

## ■ Instructions

1. Instructions are 16-bit length, and executed in a single instruction cycle (4 clocks).
2. The S-1462AF/14L62AF has 6 addressing modes.
   1) Direct addressing mode
   2) Relative addressing mode
   3) Immediate addressing mode
   4) Register addressing mode
   5) Accumulator indirect addressing mode
   6) Accumulator indexed addressing mode
3. Number of instructions

Table 8

| | Basic | Including addressing modes |
|---|---|---|
| Transfer instruction | 6 | 15 |
| Arithmetic operation instruction | 9 | 57 |
| Logical operation instruction | 8 | 66 |
| Branch instruction | 7 | 19 |
| Rotate/shift instruction | 2 | 6 |
| CPU control instruction | 3 | 3 |
| Total | 35 | 166 |

## ■ Application Example (S-1462AF)

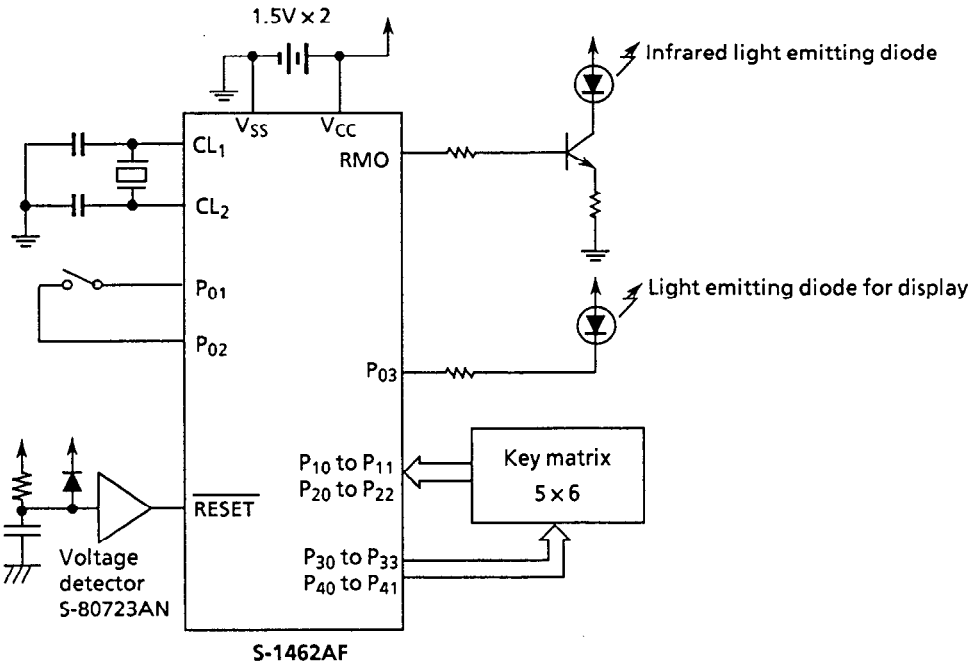



Figure 4