

Contents

Features.....	1
Applications.....	1
Dimensions (28-pin SOP).....	2
Pin Assignment	2
Terminal Functions.....	2
Block Diagram.....	3
Absolute Maximum Ratings.....	3
Recommended Operating Conditions	3
DC Electrical Characteristics	4
Instructions	6
Application Example (S-1460CF)	6

The S-1460CF/14L60CF is a CMOS 4-bit microcomputer, which integrates ROM, RAM, a timer and I/O ports on a single chip. Since the S-1460BF/14L60BF has a 4K×16-bit ROM, a special terminal for remote control signal output and key-on wake-up functions, it is ideal for infrared remote controller.

Due to its low operating voltage range (1.2V to 3.6V), the S-14L60BF is suitable for single-battery powered devices.

■ Features

Characteristics

- Power supply voltage : 1.8 to 3.6 V (S-1460CF)
1.2 to 3.6 V (S-14L60CF)
- Current consumption
 - S-1460CF : Running : 1.0 mA max. at 1MHz, 3 V operation
Standby : 1.0 μ A typ., 10 μ A max.
 - S-14L60CF : Running : 0.3 mA max. at 1MHz, 1.5 V operation
Standby : 10 μ A max.
- Operating frequency : 1 MHz
- Instruction execution time : 4.0 μ s at 1 MHz oscillation

Hardware functions

- ROM : 4K×16 bits
- RAM : 128×4 bits
- Port : 8-bit input, 8-bit output, 4-bit I/O
- Remote control signal output
- Standby counter
- Timer / Counter : 10-bit counter, 8-bit timer
- Watchdog timer
- Key-on wake-up
- Interrupt function: Internal (two)
- Oscillation circuit : for Ceramic oscillator
- Standby status : Stops oscillation, holds internal status
- Internal low-voltage detector (only for the S-1460CF)

Software

- Instruction: 35 basic instruction sets (166 if addressing modes are included)
- 16-level subroutine nesting

Package

- 28-pin SOP

OTP version

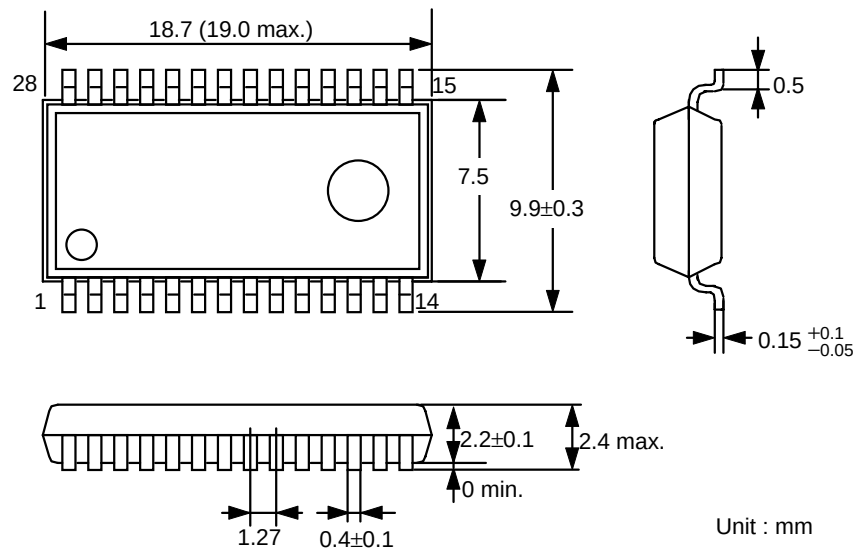
- S-1460CF : S-14P60AF
- S-14L60CF : For software evaluation, use the S-14P60AF

■ Applications

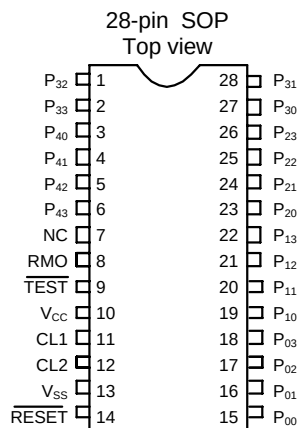
- Remote controller
- Other small-sized control equipment

CMOS 4-bit 1-chip MICROCOMPUTER
S-1460CF/14L60CF

■ Dimensions (28-pin SOP)



■ Pin Assignment

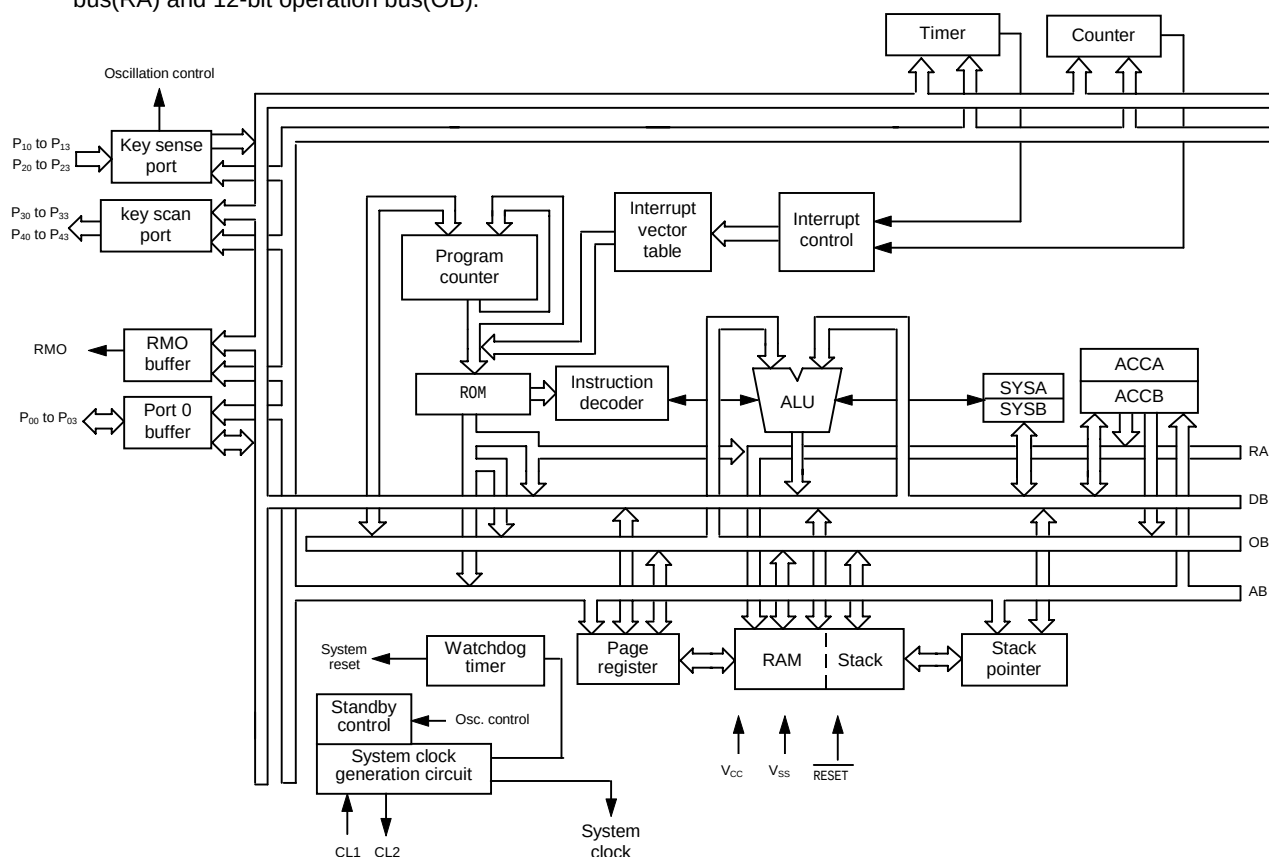


■ Terminal Functions

Name	I/O	Functions
V _{CC}	—	Positive power supply
V _{SS}	—	GND potential terminal
CL1	Input	Oscillation circuit input terminal
CL2	Output	Oscillation circuit output terminal
RESET	Input	Reset input terminal (pull-up resistor is built in)
TEST	Input	Test input terminal (pull-up resistor is built in)
RMO	Output	Remote control signal output terminal
P ₀₀ to P ₀₃	I/O	I/O ports, selectable in bit unit. Built-in pull-up resistor and Nch opendrain output are available in mask option.
P ₁₀ to P ₁₃ P ₂₀ to P ₂₃	Input	Input ports, also used as sense input of key matrix. Standby status is released by inputting low level in standby status. Pull-up resistor is built in.
P ₃₀ to P ₃₃ P ₄₀ to P ₄₃	Output	Output ports, also used as scan output of key matrix. Nch opendrain output is also available in mask option.

■ Block Diagram

The S-1460CF/14L60CF 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).



■ Absolute Maximum Ratings

Parameter	Symbol	Conditions	Ratings	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-1460CF	-0.3 to +7.0	V
Power supply voltage	V _{CC}	Ta=25°C S-14L60CF	-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 dissipation	P _D	Ta=25°C	300	mW

■ Recommended Operating Conditions

(Ta=-10°C to +70°C)						
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Power supply voltage	V _{CC}	f _{OSC} =1 MHz S-1460CF	1.8	—	3.6	V
Power supply voltage	V _{CC}	f _{OSC} =1 MHz S-14L60CF	1.2	—	3.6	V
Input voltage	V _{IN}		0	—	V _{CC}	V
System clock frequency	f _{OSC}	V _{CC} =1.8 to 3.6 V (S-1460CF) V _{CC} =1.2 to 3.6 V (S-14L60CF)	0.2	—	1.0	MHz

CMOS 4-bit 1-chip MICROCOMPUTER

S-1460CF/14L60CF

■ DC Electrical Characteristics

1. S-1460CF

- $V_{CC}=3\text{ V}$

($T_a=-10^{\circ}\text{C}$ to $+70^{\circ}\text{C}$)

Parameter	Symbol	Conditions(applicable terminals)	Min.	Typ.	Max.	Unit
Operating current consumption	I_{CCO}	$f_{OSC}=1\text{ MHz}$, no load	—	0.4	1.0	mA
Standby current consumption	I_{CCS}	OFF mode (When low voltage detection is used)	—	1.0	10	μA
Standby current consumption	I_{CCS}	OFF mode (When low voltage detection is not used)	—	0.1	9	μA
High level input voltage	V_{IH}		$0.8 \times V_{CC}$	—	—	V
Low level input voltage	V_{IL}		—	—	$0.2 \times V_{CC}$	V
High level input leakage current	I_{LH}	All input pins* $V_{IN}=V_{CC}$	—	—	1	μA
Low level input leakage current	I_{LL}	Without pull-up resistor P_{00} to P_{03} , $V_{IN}=V_{SS}$	-1	—	—	μA
High level input current	I_{IH}	$\overline{\text{RESET}}$, $V_{IN}=V_{CC}-0.3\text{V}$	-8	-5	-2	μA
Low level input current 1	I_{IL1}	With pull-up resistor, P_{00} to P_{03} , P_{10} to P_{13} , P_{20} to P_{23} , $V_{IN}=V_{SS}$	-120	-50	-20	μA
Low level input current 2	I_{IL2}	$\overline{\text{RESET}}$, $V_{IN}=V_{SS}$	-10	-4	-1.5	μA
Low level input current 3	I_{IL3}	$\overline{\text{TEST}}$, $V_{IN}=V_{SS}$	-30	-10	-3	μA
High level output current 1	I_{OH1}	RMO, $V_{OUT}=2.1\text{ V}$	—	-10	-5.0	mA
High level output current 2	I_{OH2}	P_{00} to P_{03} $V_{OUT}=2.1\text{ V}$	—	-3	-1.5	mA
High level output current 3	I_{OH3}	P_{30} to P_{33} , P_{40} to P_{43} $V_{OUT}=2.6\text{ V}$	—	-450	-200	μA
Low level output current 1	I_{OL1}	RMO, $V_{OUT}=0.4\text{ V}$	400	1000	—	μA
Low level output current 2	I_{OL2}	P_{00} to P_{03} $V_{OUT}=0.9\text{ V}$	1.0	1.5	—	mA
Low level output current 3	I_{OL3}	P_{30} to P_{33} , P_{40} to P_{43} $V_{OUT}=0.4\text{ V}$	1.0	1.5	—	mA
Schmitt hysteresis width	V_{WD}		—	1.0	—	V

* $\overline{\text{TEST}}$, $\overline{\text{RESET}}$, P_{00} to P_{03} , P_{10} to P_{13} , P_{20} to P_{23}

2. S-14L60CF

- $V_{CC}=1.5\text{ V}$

(Ta=-10°C to +70°C)

Parameter	Symbol	Conditions(applicable terminals)	Min.	Typ.	Max.	Unit
Operating current consumption	I_{CCO}	$f_{OSC}=1\text{ MHz}$, no load	—	0.15	0.3	mA
Standby current consumption	I_{CCS}	OFF mode	—	1	10	μA
High level input voltage	V_{IH}		$0.8 \times V_{CC}$	—	—	V
Low level input voltage	V_{IL}		—	—	$0.2 \times V_{CC}$	V
High level input leakage current	I_{LH}	All input pins* $V_{IN}=V_{CC}$	—	—	1	μA
Low level input leakage current	I_{LL}	Without pull-up resistor P_{00} to P_{03} , $V_{IN}=V_{SS}$	-1	—	—	μA
High level input current	I_{IH}	$\overline{\text{RESET}}$, $V_{IN}=V_{CC}-0.3\text{ V}$	-4	-2	-1	μA
Low level input current 1	I_{IL1}	With pull-up resistor, P_{00} to P_{03} , P_{10} to P_{13} , P_{20} to P_{23} , $V_{IN}=V_{SS}$	-30	-10	-3	μA
Low level input current 2	I_{IL2}	$\overline{\text{RESET}}$, $V_{IN}=V_{SS}$	-2	-0.6	-0.2	μA
Low level input current 3	I_{IL3}	$\overline{\text{TEST}}$, $V_{IN}=V_{SS}$	-8	-2	-0.5	μA
High level output current 1	I_{OH1}	RMO, $V_{OUT}=1.1\text{ V}$	—	-3.6	-2	mA
High level output current 2	I_{OH2}	P_{00} to P_{03} $V_{OUT}=1.1\text{ V}$	—	-0.6	-0.3	μA
High level output current 3	I_{OH3}	P_{30} to P_{33} , P_{40} to P_{43} $V_{OUT}=1.1\text{ V}$	—	-150	-100	μA
Low level output current 1	I_{OL1}	RMO, $V_{OUT}=0.4\text{ V}$	200	450	—	μA
Low level output current 2	I_{OL2}	P_{00} to P_{03} $V_{OUT}=0.4\text{ V}$	2.0	3.5	—	mA
Low level output current 3	I_{OL3}	P_{30} to P_{33} , P_{40} to P_{43} $V_{OUT}=0.4\text{ V}$	0.5	0.8	—	mA
Schmitt hysteresis width	V_{WD}		—	0.4	—	V

* $\overline{\text{TEST}}$, $\overline{\text{RESET}}$, P_{00} to P_{03} , P_{10} to P_{13} , P_{20} to P_{23}

- $V_{CC}=3\text{ V}$

(Ta=-10°C to +70°C)

Parameter	Symbol	Conditions(applicable terminals)	Min.	Typ.	Max.	Unit
Operating current consumption	I_{CCO}	$f_{OSC}=1\text{ MHz}$, no load	—	0.4	1.0	mA
Standby current consumption	I_{CCS}	OFF mode	—	1	10	μA
High level input voltage	V_{IH}		$0.8 \times V_{CC}$	—	—	V
Low level input voltage	V_{IL}		—	—	$0.2 \times V_{CC}$	V
High level input leakage current	I_{LH}	All input pins* $V_{IN}=V_{CC}$	—	—	1	μA
Low level input leakage current	I_{LL}	Without pull-up resistor P_{00} to P_{03} , $V_{IN}=V_{SS}$	-1	—	—	μA
High level input current	I_{IH}	$\overline{\text{RESET}}$, $V_{IN}=V_{CC}-0.3\text{ V}$	-8	-5	-2	μA
Low level input current 1	I_{IL1}	With pull-up resistor, P_{00} to P_{03} , P_{10} to P_{13} , P_{20} to P_{23} , $V_{IN}=V_{SS}$	-120	-50	-20	μA
Low level input current 2	I_{IL2}	$\overline{\text{RESET}}$, $V_{IN}=V_{SS}$	-10	-4	-1.5	μA
Low level input current 3	I_{IL3}	$\overline{\text{TEST}}$, $V_{IN}=V_{SS}$	-40	-16	-6	μA
High level output current 1	I_{OH1}	RMO, $V_{OUT}=2.6\text{ V}$	—	-6.5	-3	mA
High level output current 2	I_{OH2}	P_{00} to P_{03} $V_{OUT}=2.6\text{ V}$	—	-3	-1.5	mA
High level output current 3	I_{OH3}	P_{30} to P_{33} , P_{40} to P_{43} $V_{OUT}=2.6\text{ V}$	—	-450	-200	μA
Low level output current 1	I_{OL1}	RMO, $V_{OUT}=0.4\text{ V}$	400	1000	—	μA
Low level output current 2	I_{OL2}	P_{00} to P_{03} $V_{OUT}=0.9\text{ V}$	5	15	—	mA
Low level output current 3	I_{OL3}	P_{30} to P_{33} , P_{40} to P_{43} $V_{OUT}=0.4\text{ V}$	1.0	1.5	—	mA
Schmitt hysteresis width	V_{WD}		—	1.0	—	V

* $\overline{\text{TEST}}$, $\overline{\text{RESET}}$, P_{00} to P_{03} , P_{10} to P_{13} , P_{20} to P_{23}

CMOS 4-bit 1-chip MICROCOMPUTER
S-1460CF/14L60CF

■ Instructions

- 1 . Instructions are 16-bit length, and executed in a single instruction cycle(4 clocks).
- 2 . The S-1460CF/14L60CF has 6 addressing modes.
 - 1) Direct addressing modes
 - 2) Relative addressing modes
 - 3) Immediate addressing modes
 - 4) Register addressing modes
 - 5) Accumulator indirect addressing modes
 - 6) Accumulator indexed addressing modes
- 3 . Number of instructions

	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-1460CF)

