

The S-1810CF/1820CF is a CMOS 8-bit microcomputer, which integrates an 8K-byte ROM, a 4K-byte (S-1810CF) or 2.3K-byte (S-1820CF) RAM, a 14-bit counter, a 16-bit timer, general-purpose I/O ports, and an 8-bit serial interface on one chip. The S-1810/1820CF is ideal for high-performance remote controller.

## ■ Features

### *Characteristics*

- Power supply voltage : 2.2 to 6.0 V
- Current consumption :
  - Running : 1 mA typ., 3 mA max. at 4 MHz, 3 V operation
  - Standby : 0.1  $\mu$ A typ., 10  $\mu$ A max.
- Operating frequency : 4 MHz
- Instruction execution time : 2.0  $\mu$ s

### *Hardware functions*

- ROM : 8K  $\times$  8 bits
- RAM : 4K  $\times$  8 bits (S-1810CF)  
2.3K  $\times$  8 bits (S-1820CF)
- 32 I/O lines (4 of which have LED drivers)
- 8-bit serial port  $\times$  1 channel
- Timer/counter : 14-bit counter, 16-bit timer
- Watchdog timer
- Amplifier and waveshaping circuit for receiving signal
- Carrier generation circuit
- Low voltage detection circuit (detection voltage is regulated with external resistor)
- Interrupt function: External (two), internal (seven)
- Oscillation circuit : 4-MHz ceramic oscillator is built in
- Standby function : Stops oscillation clock at standby mode

### *Software*

- Instruction: 68 basic instruction sets (210 if addressing modes are included)
- 32-level subroutine nesting

### *Package*

- 54-pin QFP (terminal distance: 1.0 mm)

### *OTP version*

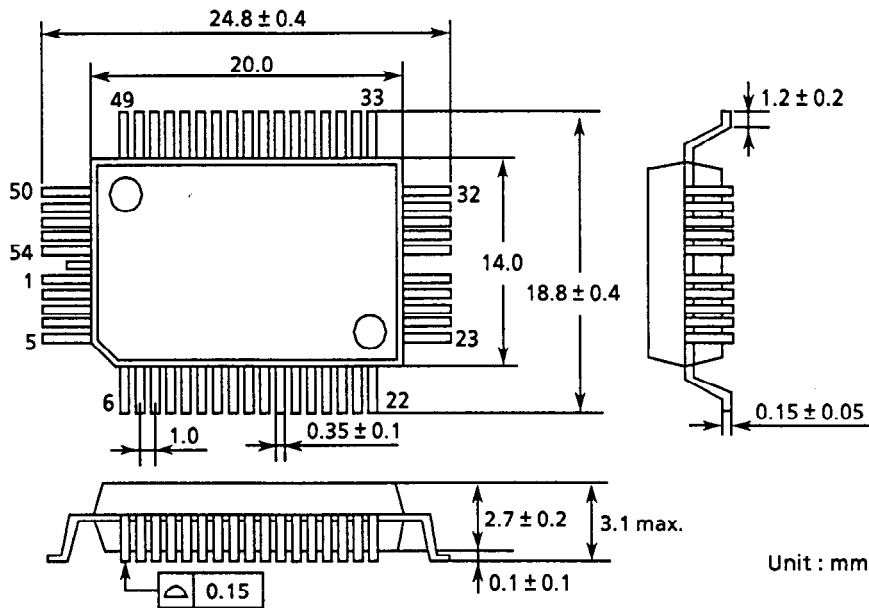
- S-18P10BF

## ■ Applications

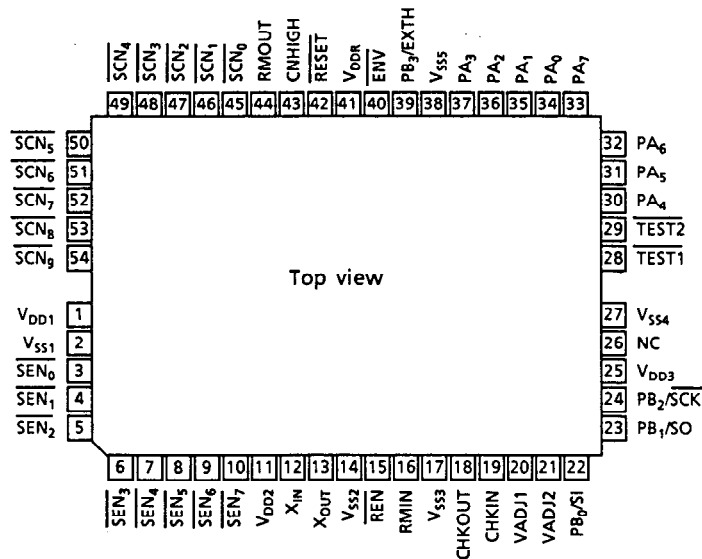
- Universal remote controller, others

# CMOS 8-bit 1-chip MICROCOMPUTER S-1810CF/1820CF

## ■ Dimensions (54-pin QFP)



## ■ Pin Assignments



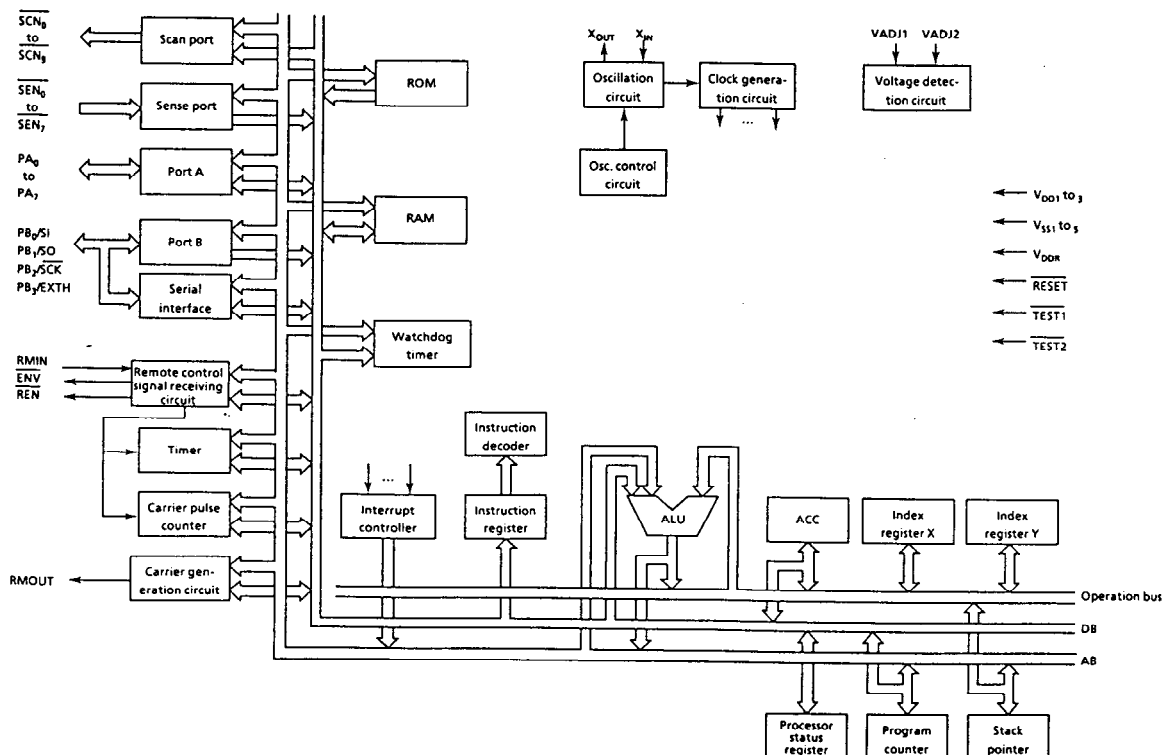
Note : It is recommended that power is supplied from all power terminals ( $V_{DD1}$  to  $V_{DD3}$ ,  $V_{SS1}$  to  $V_{SS5}$ ,  $V_{DDR}$ ). Even if all power terminals cannot be connected,  $V_{DDR}$ ,  $V_{DD2}$ ,  $V_{DD3}$ ,  $V_{SS2}$ , and  $V_{SS5}$  must be connected. Do not supply any power from terminal, that power is not supplied, to an external peripheral

■ Terminal Functions

Name	I/O	Functions
V <sub>DD1</sub> to V <sub>DD3</sub>	—	Positive power supply
V <sub>SS1</sub> to V <sub>SS5</sub>	—	GND potential terminals
V <sub>DDR</sub>	—	Power supply terminal for built-in SRAM
X <sub>IN</sub>	—	Oscillation circuit input or external clock input terminal, used by connecting ceramic oscillator between X <sub>OUT</sub> and X <sub>IN</sub>
X <sub>OUT</sub>	—	Oscillation circuit output, used by connecting ceramic oscillator between X <sub>OUT</sub> and X <sub>IN</sub> . Open during external clock input.
RESET	Input	Reset input terminal
TEST1 to TEST2	Input	Test input terminals
VADJ1	Input	Resistor connection terminal for 1st detection voltage adjustment
VADJ2	Input	Resistor connection terminal for 2nd detection voltage adjustment
SCN <sub>0</sub> to SCN <sub>9</sub>	Output	Scan output terminals of key matrix
SEN <sub>0</sub> to SEN <sub>7</sub>	Input	Sense input terminals of key matrix
REN	Output	Power control terminal of remote control signal receiving circuit
RMIN	Input	Input terminal of remote control receiving signal
RMOUT	Output	Output terminal of remote control transmitting signal
ENV	Output	Output terminal of waveshaping circuit of remote control receiving signal
CHKOUT	Output	Output terminal of amplification circuit of remote control receiving signal
CHKIN	Input	Input terminal of waveshaping circuit of remote control receiving signal
PA <sub>0</sub> to PA <sub>3</sub>	I/O	I/O ports (LED drive available)
PA <sub>4</sub> to PA <sub>7</sub>	I/O	I/O ports
PB <sub>0</sub> /SI	Input	Input port and serial data input terminal
PB <sub>1</sub> /SO	I/O	Input port and serial data output terminal
PB <sub>2</sub> /SCK	I/O	Input port and serial clock input/output terminal
PB <sub>3</sub> /EXTH	Input	Input port and external interrupt input terminal
CNHIGH	—	Connect to V <sub>DD</sub> level

■ Block Diagram

The S-1810CF/1820CF blocks connect with an 8-bit data bus (DB) and 16-bit address bus (AB).



**CMOS 8-bit 1-chip MICROCOMPUTER**  
**S-1810CF/1820CF**

■ **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	$V_{DD}$	$T_a = 25^\circ\text{C}$	-0.3 to +7.0	V
Input voltage	$V_{IN}$	$T_a = 25^\circ\text{C}$	-0.3 to $V_{DD} + 0.3$	V
Output voltage	$V_{OUT}$	$T_a = 25^\circ\text{C}$	-0.3 to $V_{DD} + 0.3$	V
Power dissipation	$P_D$	$T_a = 25^\circ\text{C}$	500	mW

■ **Recommended Operating Conditions**

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Power supply voltage	$V_{DD}$		2.2	—	6.0	V
Input voltage	$V_{IN}$		0	—	$V_{DD}$	V
Oscillation frequency	$f_{OSC}$	$V_{DD} = 2.2$ to $6.0$ V	—	4	—	MHz

■ **DC Electrical Characteristics**

( $T_a = -10^\circ\text{C}$  to  $70^\circ\text{C}$ ,  $V_{DD} = 3.0$  V,  $V_{DDR} = 3.0$  V)

Parameter	Symbol	Conditions(applicable terminals)	Min.	Typ.	Max.	Unit
Operating supply voltage	$V_{DD}$	$V_{DD}$ , $V_{DDR}$ , $f_{OSC} = 4$ MHz	2.2	—	6.0	V
Memory operating voltage	$V_{OPM}$	$V_{DDR}$	2.0	—	6.0	V
Operating current consumption	$I_{DDO}$	$V_{DD}$ , $V_{DDR}$ , no load	—	1	3	mA
Standby current consumption	$I_{DDS}$	$V_{DD}$ , $V_{DDR}$	—	0.1	10	$\mu\text{A}$
Standby current consumption	$I_{DDS}$	$V_{DD}$ , $V_{DDR}$ , $T_a = 25^\circ\text{C}$	—	0.1	1	$\mu\text{A}$
Low level input voltage	$V_{IL}$	All input pins	—	—	$0.2 \times V_{DD}$	V
High level input voltage	$V_{IH}$	All input pins	$0.8 \times V_{DD}$	—	—	V
Low level input current	$I_{IL}$	Input pins with pull-up resistor, $V_{IN} = V_{SS}$	-100	-30	-10	$\mu\text{A}$
Low level input leakage current	$I_{LL}$	Input pins without pull-up resistor, $V_{IN} = V_{SS}$	-1	—	—	$\mu\text{A}$
High level input leakage current	$I_{LH}$	All input pins, $V_{IN} = V_{DD}$	—	—	1	$\mu\text{A}$
Low level output current 1	$I_{OL1}$	$PA_0$ to $PA_3$ , REN, $V_{OUT} = 0.4$ V	3.2	—	—	mA
Low level output current 2	$I_{OL2}$	CHKOUT, $V_{OUT} = 0.4$ V	0.4	—	—	mA
Low level output current 3	$I_{OL3}$	Pins except $PA_0$ to $PA_3$ , REN and CHKOUT, $V_{OUT} = 0.4$ V	0.8	—	—	mA
High level output current 1	$I_{OH1}$	RMOU, $V_{OUT} = V_{DD} - 0.4$ V	—	—	-3.2	mA
High level output current 2	$I_{OH2}$	CHKOUT, $V_{OUT} = V_{DD} - 0.4$ V	—	—	-0.2	mA
High level output current 3	$I_{OH3}$	Pins except RMOU and CHKOUT, $V_{OUT} = V_{DD} - 0.4$ V	—	—	-0.4	mA
Input impedance	$R_{IN}$	RMIN	12	25	50	k $\Omega$
Amplifier gain	$G_V$	RMIN, $f = 40$ kHz	—	20	—	dB

## ■ Instructions

- 1 . There are three kinds of instructions : 1-byte, 2-byte, and 3-byte instructions.  
Byte 1 is called "op code", which indicates kinds of instruction.  
Byte 2 and byte 3 are called "operand", which indicates object of instruction.  
Operand is not always necessary, and influences addressing mode.
- 2 . The S-1810CF/1820CF has 17 addressing modes, and executes memory access efficiently.

- 1) Accumulator addressing mode : ACC
- 2) Immediate addressing mode : IMM
- 3) Absolute addressing mode : ABS
- 4) Zero-page addressing mode : ZPG
- 5) Implied addressing mode : IMP
- 6) Zero-page indexed X addressing mode : ZPG, X
- 7) Zero-page indexed Y addressing mode : ZPG, Y
- 8) Absolute indexed X addressing mode : ABS, X
- 9) Absolute indexed Y addressing mode : ABS, Y
- 10) Relative addressing mode : REL
- 11) Zero-page indexed indirect addressing mode : (IND, X)
- 12) Zero-page indirect indexed addressing mode : (IND), Y
- 13) Zero-page indirect addressing mode : (IND)
- 14) Absolute indexed indirect addressing mode : (ABS, X)
- 15) Absolute indirect addressing mode : (ABS)
- 16) Zero-page bit-relative addressing mode : ZREL
- 17) Zero-page bit addressing mode : ZBIT

### 3 . Number of instructions

Operation instruction : 17  
Data transfer instruction : 21  
Rotate/shift instruction : 4  
Flag setting instruction : 7  
Bit operation instruction : 2  
Branch instruction : 15  
Interrupt instruction : 1  
Others : 1  
Total : 68 basic instructions

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■ Application Example (Universal Remote Controller)

