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 μA typ., 10 μA max.

· Operating frequency : 4 MHz

· Instruction execution time : 2.0 μs

Hardware functions

· ROM : 8K × 8 bits

· RAM : 4K × 8 bits (S-1810CF)
         2.3K × 8 bits (S-1820CF)

· 32 I/O lines (4 of which have LED drivers)

· 8-bit serial port × 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
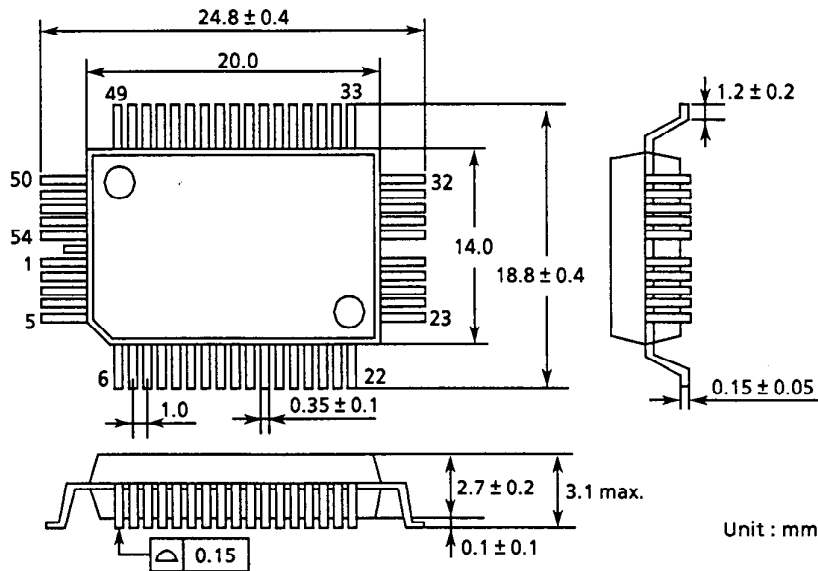
· 54-pin QFP (terminal distance: 1.0 mm)

OTP version

· S-18P10BF

■ **Applications**

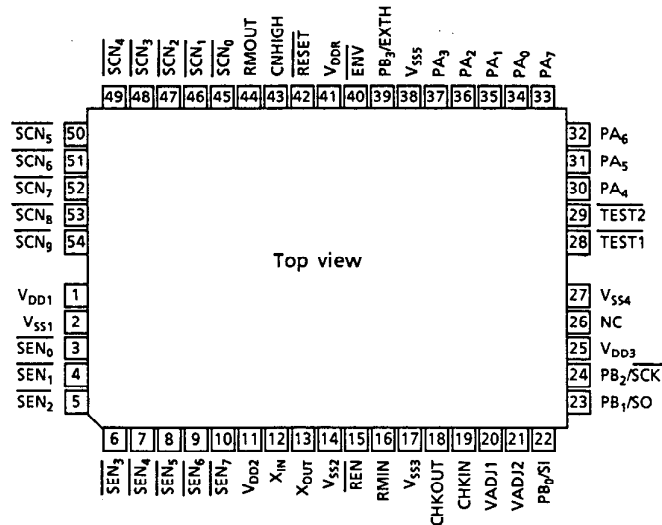· Universal remote controller, others

■ **Dimensions (54-pin QFP)**

Unit : mm

■ **Pin Assignments**

Note : It is recommended that power is supplied from all power teminals (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

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■ **Terminal Functions**

Name	I/O	Functions
V_{DD1} to V_{DD3}	—	Positive power supply
V_{SS1} to V_{SS5}	—	GND potential terminals
V_{DDR}	—	Power supply terminal for built-in SRAM
X_{IN}	—	Oscillation circuit input or external clock input terminal, used by connecting ceramic oscillator between X_{OUT} and X_{IN}
X_{OUT}	—	Oscillation circuit output, used by connecting ceramic oscillator between X_{OUT} and X_{IN}. Open during external clock input.
$\overline{RESET}$	Input	Reset input terminal
$\overline{TEST1}$ to $\overline{TEST2}$	Input	Test input terminals
VADJ1	Input	Resistor connection terminal for 1st detection voltage adjustment
VADJ2	Input	Resistor connection terminal for 2nd detection voltage adjustment
$\overline{SCN_0}$ to $\overline{SCN_9}$	Output	Scan output terminals of key matrix
$\overline{SEN_0}$ to $\overline{SEN_7}$	Input	Sense input terminals of key matrix
$\overline{REN}$	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
$\overline{ENV}$	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_0 to PA_3	I/O	I/O ports (LED drive available)
PA_4 to PA_7	I/O	I/O ports
PB_0/SI	Input	Input port and serial data input terminal
PB_1/SO	I/O	Input port and serial data output terminal
$PB_2/\overline{SCK}$	I/O	Input port and serial clock input/output terminal
$PB_3/EXTH$	Input	Input port and external interrupt input terminal
CNHIGH	—	Connect to V_{DD} level

■ **Block Diagram**

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

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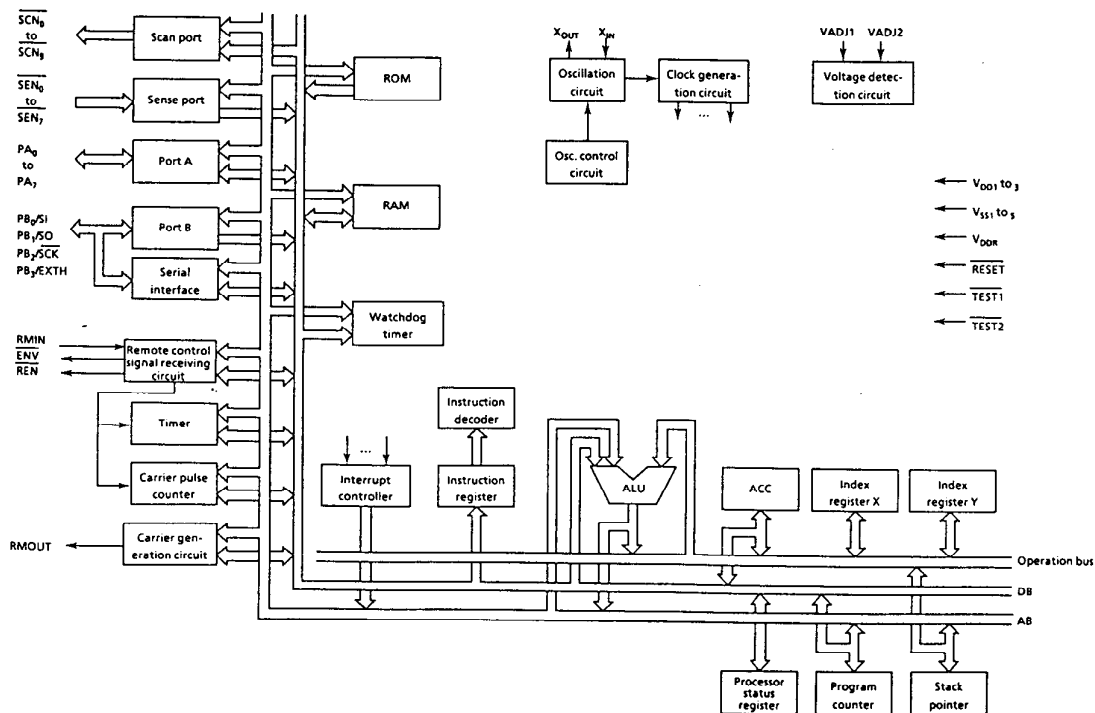
■ Absolute Maximum Ratings

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}	Ta = 25°C	-0.3 to +7.0	V
Input voltage	V_{IN}	Ta = 25°C	-0.3 to V_{DD} + 0.3	V
Output voltage	V_{OUT}	Ta = 25°C	-0.3 to V_{DD} + 0.3	V
Power dissipation	P_D	Ta = 25°C	500	mW

■ Recommended Operating Conditions

(Ta = -10°C to +70°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

(Ta = -10°C to 70°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	μA
Standby current consumption	I_{DDS}	V_{DD}, V_{DDR}, Ta = 25°C	—	0.1	1	μA
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	μA
Low level input leakage current	I_{LL}	Input pins without pull-up resistor, V_{IN} = V_{SS}	-1	—	—	μA
High level input leakage current	I_{LH}	All input pins, V_{IN} = V_{DD}	—	—	1	μA
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}	RMOUT, 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 RMOUT and CHKOUT V_{OUT} = V_{DD}-0.4 V	—	—	-0.4	mA
Input impedance	R_{IN}	RMIN	12	25	50	kΩ
Amplifier gain	G_V	RMIN, f = 40 kHz	—	20	—	dB

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■ 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
Flug setting instruction : 7
Bit operation instruction : 2
Branch instruction : 15
Interrupt instruction : 1
Others : 1
Total : 68 basic instructions

■ **Application Example (Universal Remote Controller)**