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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 μ A typ., 10 μ A max.
- Operating frequency : 4 MHz
- Instruction execution time : 2.0 μ 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

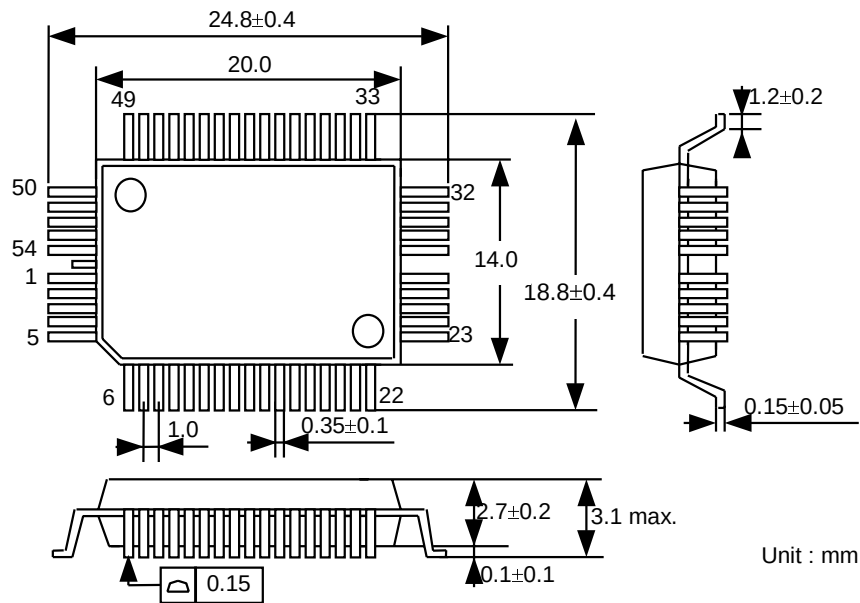
- S-18P10BF

■ Applications

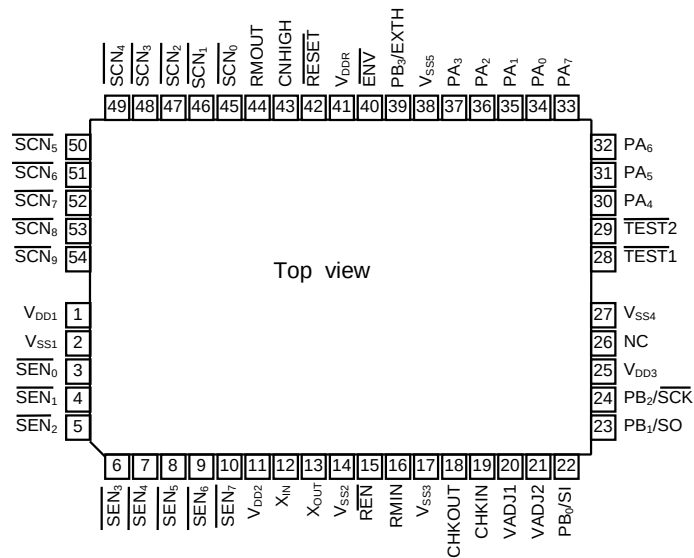
- Universal remote controller, others

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 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 devices.

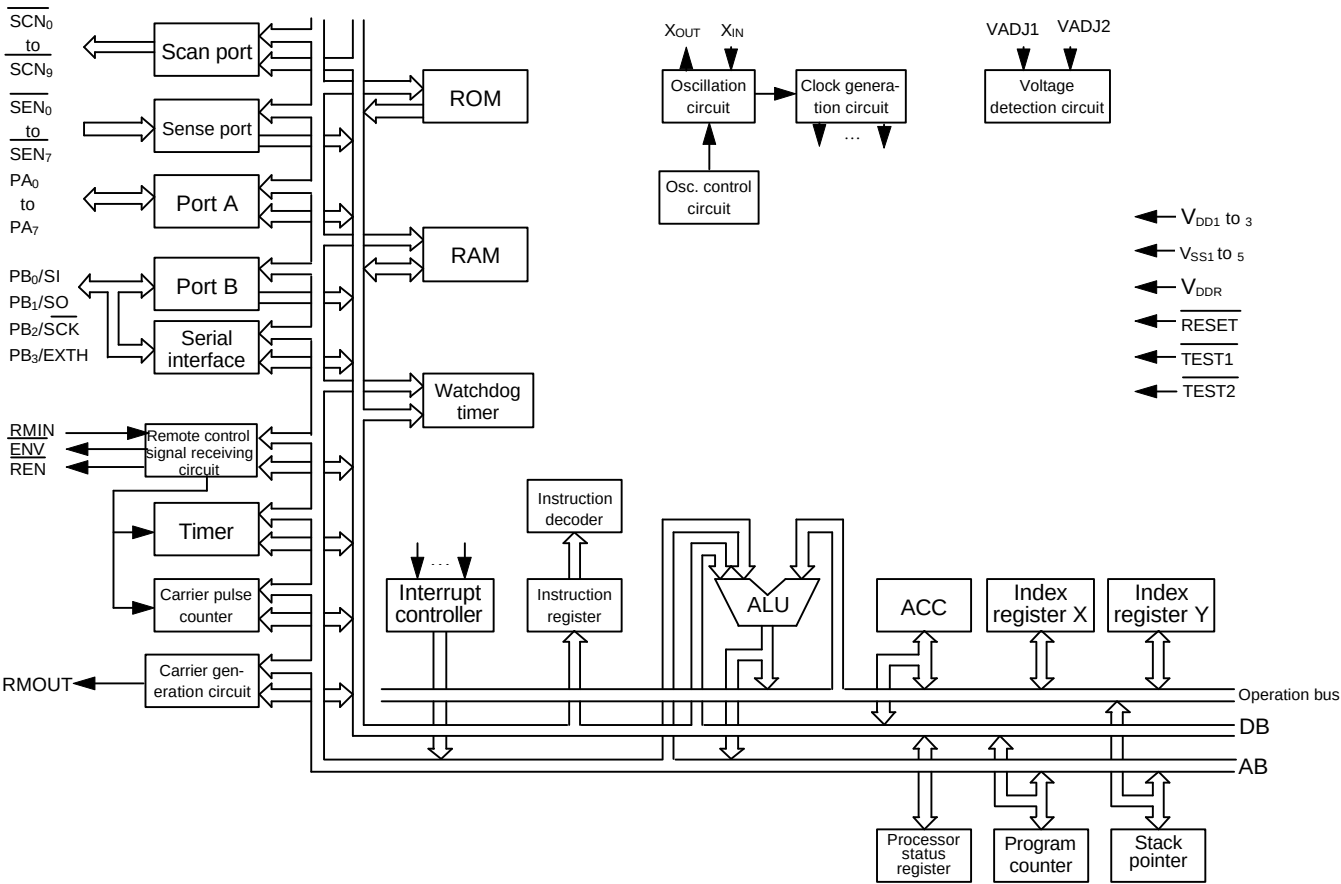
■ Terminal Functions

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/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

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■ Block Diagram

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



■ 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×V _{DD}	V
High level input voltage	V _{IH}	All input pins	0.8×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 current1	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}	R _{MIN}	12	25	50	kΩ
Amplifier gain	G _V	R _{MIN} , 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 : 1Total : 68 basic instructions

■ Application Example (Universal Remote Controller)

