Contents

Features 1
Applications 1
Dimensions (80-pin QFP) 2
Pin Assignment 2
Terminal Functions 3
Block Diagram 4
Absolute Maximum Ratings 4
Recommended Operating Conditions 4
Characteristics 5
Instructions 6
Application Example 6

CMOS 4-bit
1-chip MICROCOMPUTER

S-1400CF

The S-1400CF 4-bit microcomputer integrates 8-bit programmable timer, 15-bit time base timer, key-in input, 8-bit serial input/output, and 4-level detection circuit, etc., on one chip. Driven by batteries, this microcomputer is ideal for compact portable equipment.

■ Feature

- Si gate CMOS process
- Low power consumption
- Single power supply (2.2 V min.)
- High-speed operation (1 MHz max.)
- ROM: 4 K×16 bits
- RAM: 512×4 bits
- 28 I/O lines
- 8-bit serial interface
- Two timers: Time base timer, programmable timer
- Interrupt function: External (four), internal (three)
- Standby function
- Built-in LCD driver that drives the LCD directly
- Built-in LCD driver power supply (constant-voltage circuit, dual booster circuit, triple booster circuit)
- Instruction execution time: 4.0 μs/1 MHz
  122 μs/32,768 Hz
- Instructions: 37 basic instruction sets (168 if addressing modes are included)
  16-level subroutine nesting
- 80-pin QFP (pin spacing: 0.65 mm)
- Piggyback: S-1408B

■ Applications

- VTR, TV, cassette deck, portable CD
- Office equipment, copier, medical equipment
- Toys
- Pager, security system

■ Dimensions (80-pin QFP)

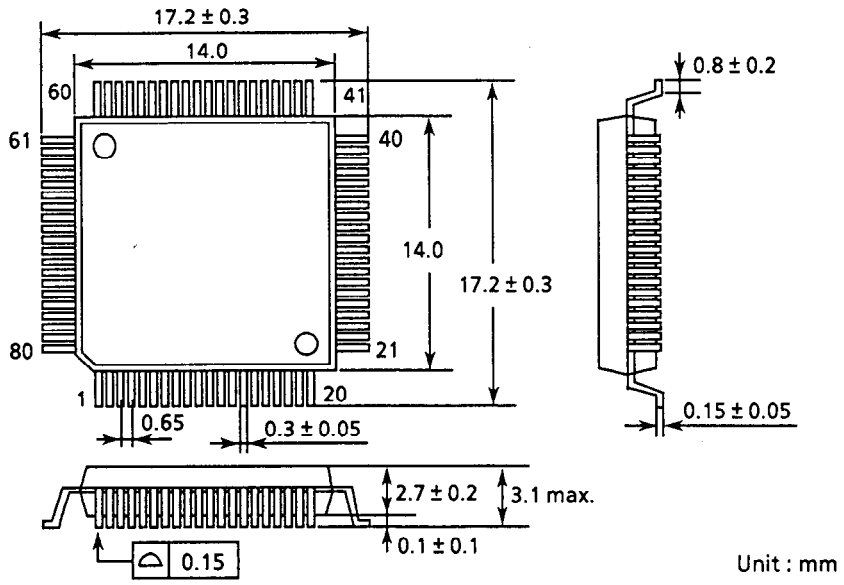

Figure 1

■ Pin Assignments

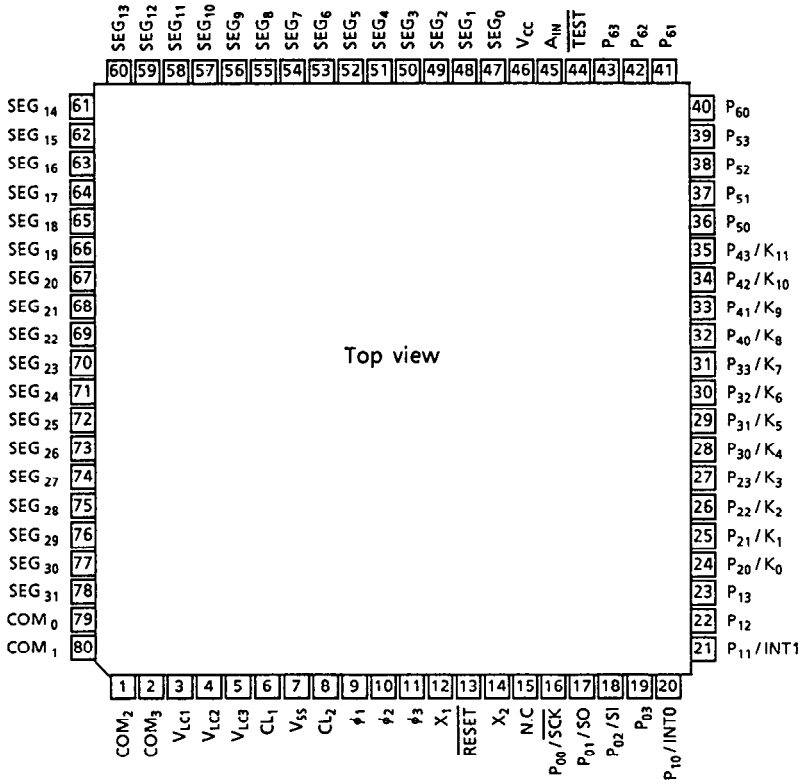

Figure 2

■ Terminal Functions

Table 1

Name	I/O	Functions
V_{SS}	—	GND potential terminal
V_{CC}	—	Positive power supply
V_{LC1} V_{LC2} V_{LC3}	—	LCD power supply (constant valtage) C = 0.1 μF LCD power supply (dual booster) C = 0.1 μF LCD power supply (triple booster) C = 0.1 μF
$\overline{TEST}$	Input	Test input terminal
$\overline{RESET}$	Input	Reset input terminal
CL_1	—	CR connection terminal for system clock oscillation (Ceramic resonator also connectable by mask option)
CL_2	—	CR connection terminal for system clock oscillation (Ceramic resonator also connectable by mask option)
X_1	—	Crystal connection terminal for count clock oscillation
X_2	—	Crystal connection terminal for count clock oscillation
$Ø_1$ to $Ø_3$	—	LCD booster capacitor connection terminal
A_{IN}	Input	4-level detection input terminal
COM_0 to COM_3	Output	LCD common signal output terminal
SEG_0 to SEG_{31}	Output	LCD segment signal output terminal
P_{00} / $\overline{SCK}$ P_{01} / SO P_{02} / SI P_{03}	I/O I/O Input Input	Port 0 input and serial clock input/output terminal Port 0 input and serial data output terminal Port 0 input and serial data input terminal Port 0 input terminal
P_{10} / INT0 P_{11} / INT1 P_{12} P_{13}	Input Input Input Input	Port 1 input and external interrupt input INT0 Port 1 input and external interrupt input INT1 Port 1 input terminal Port 1 input terminal
P_{20} / K_0 P_{21} / K_1 P_{22} / K_2 P_{23} / K_3	Input Input Input Input	Port 2 input and key-in input
P_{30} / K_4 P_{31} / K_5 P_{32} / K_6 P_{33} / K_7	Input Input Input Input	Port 3 input and key-in input
P_{40} / K_8 P_{41} / K_9 P_{42} / K_{10} P_{43} / K_{11}	Input Input Input Input	Port 4 input and key-in input
P_{50} to P_{53}	I/O	Port 5 input/output terminal
P_{60} to P_{61}	I/O	Port 6 input/output terminal
P_{62} to P_{63}	I/O	Port 6 input/output terminal

■ Block Diagram

The S-1400CF 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).

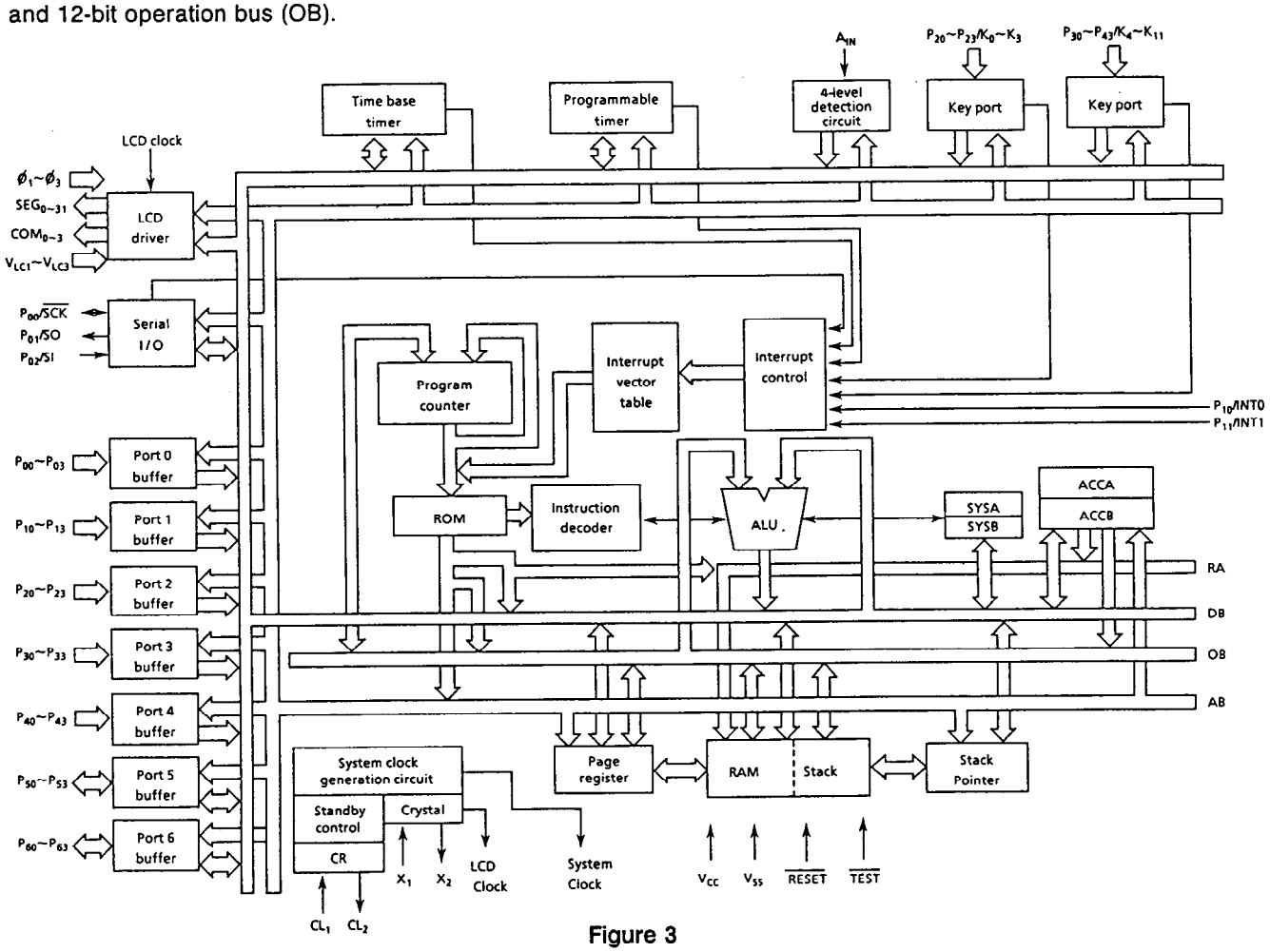

Figure 3

■ 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	-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

Table 3

(Ta = -10 °C to +70 °C)

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Power supply voltage	V_{CC}		2.2	—	3.6	V
Input voltage	V_{IN}		0	—	V_{CC}	V
Sub-clock oscillation frequency	f_{SUB}	V_{CC} = 2.0 to 3.6 V	—	32,768	—	Hz
Main clock oscillation frequency	f_{main}	V_{CC} = 2.2 to 3.6 V, CR oscillation	0.2	0.6	1.0	MHz

■ Characteristics

Table 4

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

Item	Symbol	Conditions	Min.	Typ.	Max.	Unit
Operating current consumption1	I_{CCO1}	During FAST mode System clock : 1 MHz	—	0.5	1	mA
Operating current consumption2	I_{CCO2}	During SUB mode System clock : 32 KHz	—	18	35	μA
Standby current consumption	I_{CCS}	During STOP mode, C_G = 15 pF	—	10	18	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, All input terminals*, V_{IN} = V_{SS}	-1	—	—	μA
Low level input current 1	I_{IL1}	With pull-up resistor, P_{62}, P_{63}, V_{IN} = V_{SS}	-15	—	-2	μA
Low level input current 2	I_{IL2}	With pull-up resistor, $\overline{TEST}$, V_{IN} = V_{SS}	-30	—	-5	μA
Low level input current 3	I_{IL3}	With pull-up resistor, All input terminals, but P_{62}, P_{63} $\overline{TEST}$, V_{IN} = V_{SS}	-5	—	-0.35	μA
Low level input current 4	I_{IL4}	With pull-up resistor, P_{20} to $_{23}$, P_{30} to $_{33}$, P_{40} to $_{43}$, V_{IN} = V_{CC}-0.6 V	-30	—	-5	μA
High level output current	I_{OH}	P_{00}, P_{01}, P_{50} to $_{53}$, P_{60} to $_{63}$, V_{OUT} = Vcc – 0.5 V	—	—	-100	μA
Low level output current	I_{OL}	P_{00}, P_{01}, P_{50} to $_{53}$, P_{60} to $_{63}$, V_{OUT} = 0.5 V	250	—	—	μA
LCD drive output	R_{LCD}	COM_0 to COM_3, SEG_0 to SEG_{31}	—	—	17	kΩ
Schmitt hysteresis width	V_{WD}		—	0.7	—	V
Constant voltage for LCD drive	V_{LC1}		1.45	1.55	1.65	V
Constant voltage for 4-level detection	V_{REG}		1.45	1.55	1.65	V
4-level detection voltage	$V_{REF(n)}$	$V_{REF}(n)$ = V_{CC}-(n)/4 × V_{REG} n = 1, 2, 3	$V_{REF}(n)$ -0.1	$V_{REF}(n)$	$V_{REF}(n)$ + 0.1	V

* All input terminals: P_{00} to P_{03}, P_{10} to P_{13}, P_{20} to P_{23}, P_{30} to P_{33}, P_{40} to P_{43}, P_{50} to P_{53}, P_{60} to P_{63}
$\overline{TEST}$, $\overline{RESET}$, A_{IN}

■ Instructions

1. Instructions are 16-bit length, and executed in a single instruction cycle (4 clocks).
2. The S-1400CF 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 5

	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	5	5
Total	37	168

■ Application Example

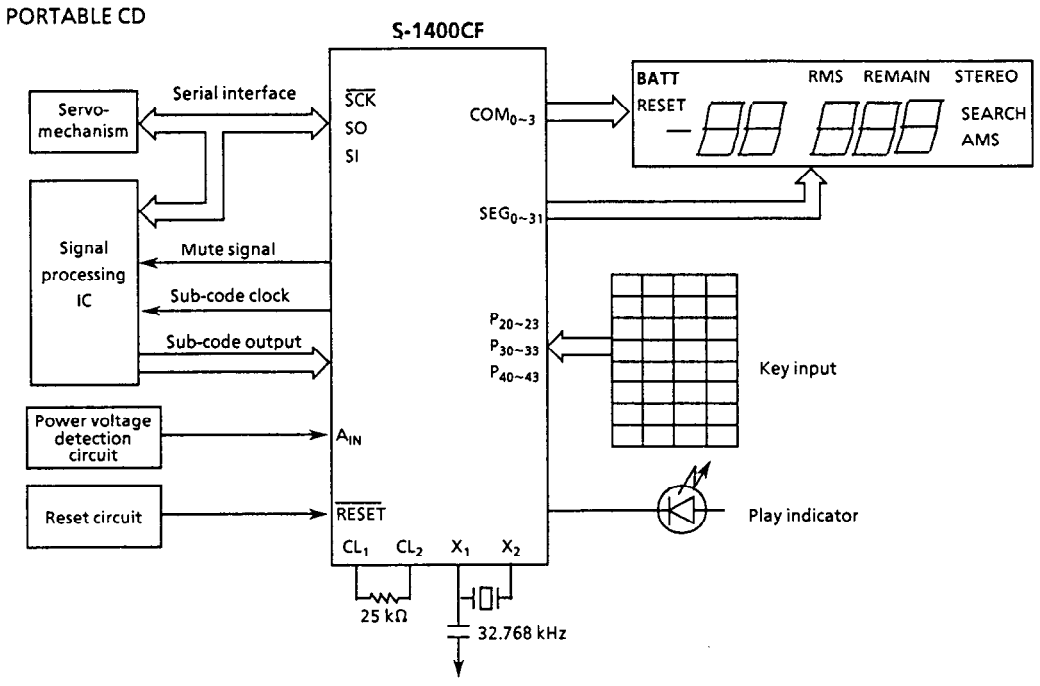

Figure 4