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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

CMOS 4-bit 1-chip MICROCOMPUTER

S-1400CF

■ Dimensions (80-pin QFP)

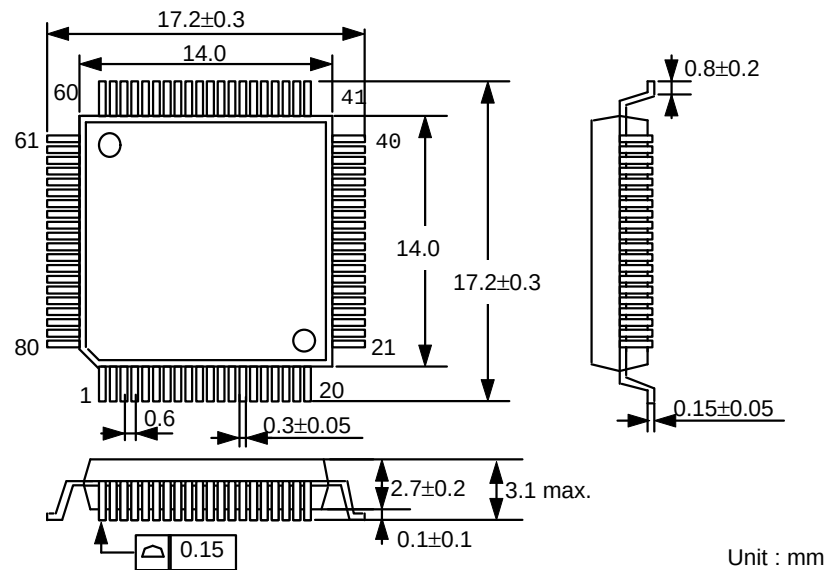


Figure 1

■ Pin Assignments

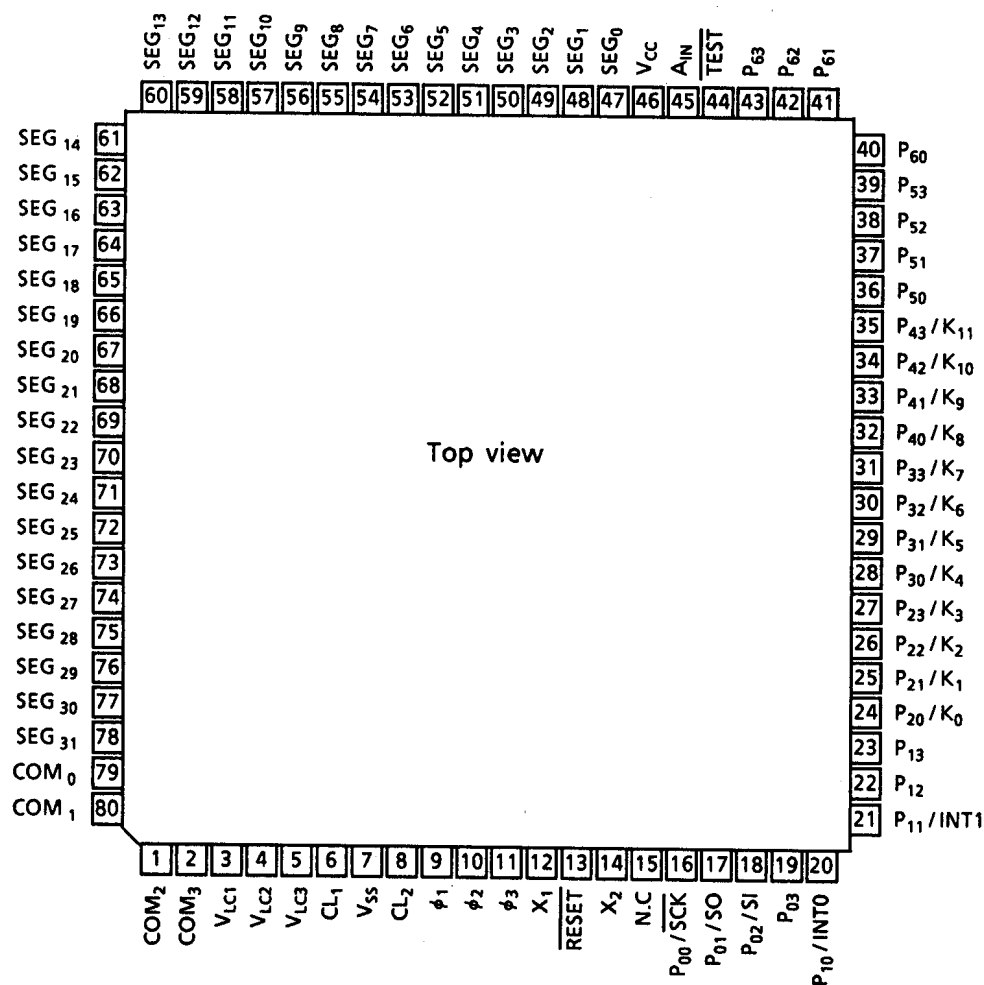


Figure 2

■ 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 μ F LCD power supply (dual booster) C=0.1 μ F LCD power supply (triple booster) C=0.1 μ F
$\overline{TEST}$	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
Φ_1 to Φ_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} / $\overline{SO}$ P_{02} / $\overline{SI}$ 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} / $\overline{INT0}$ P_{11} / $\overline{INT1}$ P_{12} P_{13}	Input Input Input Input	Port 1 input and external interrupt input $\overline{INT0}$ Port 1 input and external interrupt input $\overline{INT1}$ 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

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■ 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).

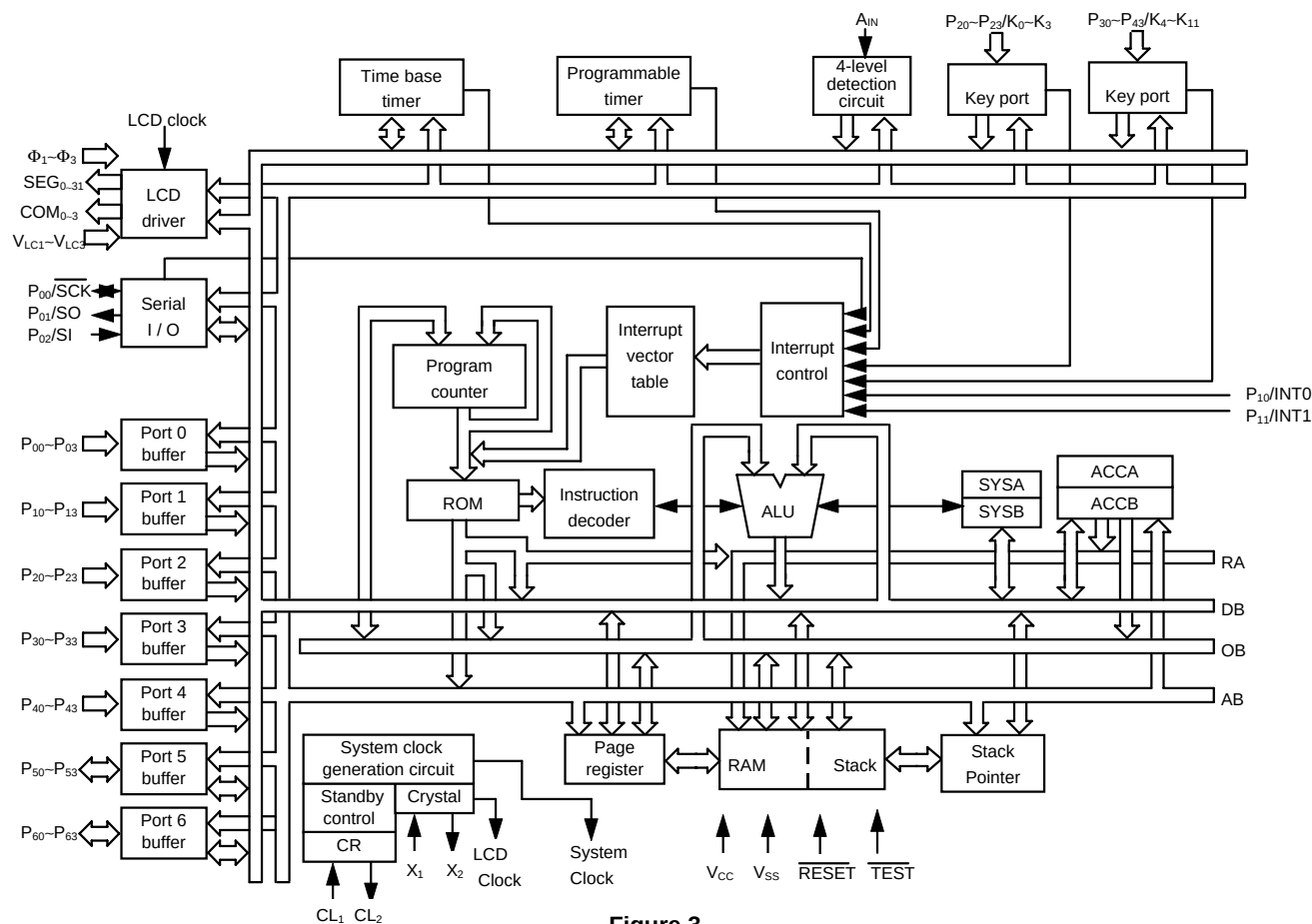


Figure 3

■ 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, 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 TEST, V _{IN} =V _{SS}	-5	—	-0.35	μA
Low level input current 4	I _{IL4}	With pull-up resistor, P ₂₀ to P ₂₃ , P ₃₀ to P ₃₃ , P ₄₀ to P ₄₃ , V _{IN} =V _{CC} -0.6 V	-30	—	-5	μA
High level output current	I _{OH}	P ₀₀ , P ₀₁ , P ₅₀ to P ₅₃ , P ₆₀ to P ₆₃ , V _{OUT} =V _{CC} -0.5 V	—	—	-100	μA
Low level output current	I _{OL}	P ₀₀ , P ₀₁ , P ₅₀ to P ₅₃ , P ₆₀ to P 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: P₀₀ to P₀₃, P₁₀ to P₁₃, P₂₀ to P₂₃, P₃₀ to P₃₃, P₄₀ to P₄₃, P₅₀ to P₅₃, P₆₀ to P₆₃
TEST, RESET, A_{IN}

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S-1400CF

■ 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

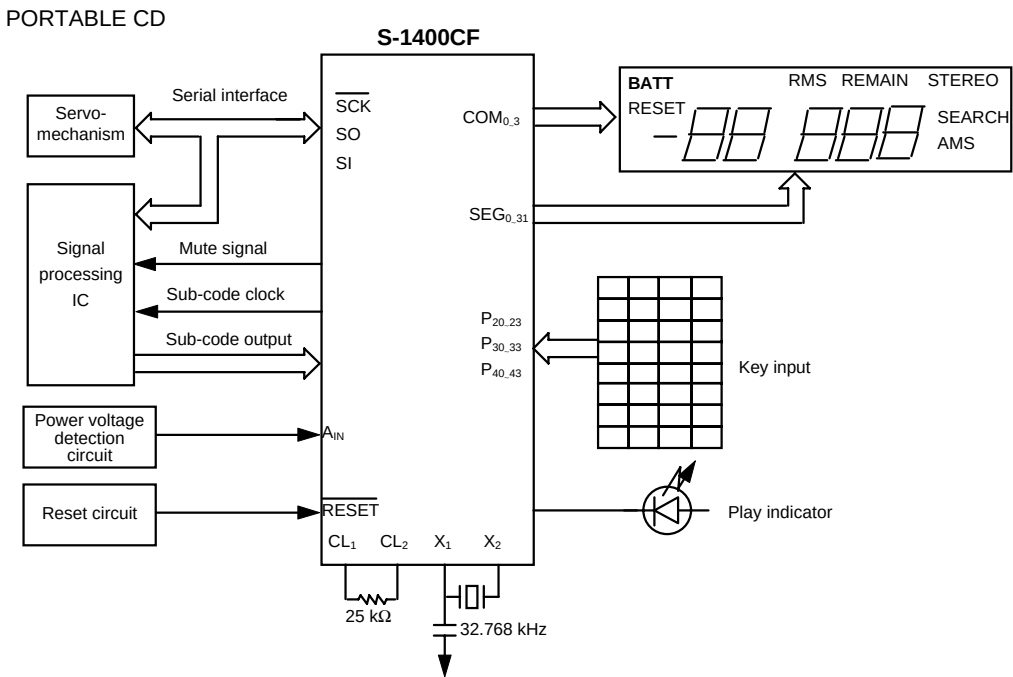


Figure 4