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S1C63653

CMOS 4-bit Single Chip Microcontroller

- **High Performance 4-bit Core CPU S1C63000**
- **LCD Driver (32 SEG × 6 COM)**
- **R/f Converter to Measure Temperature and Humidity**
- **Low Current Consumption**
- **Low Voltage Operation**

■ DESCRIPTIONS

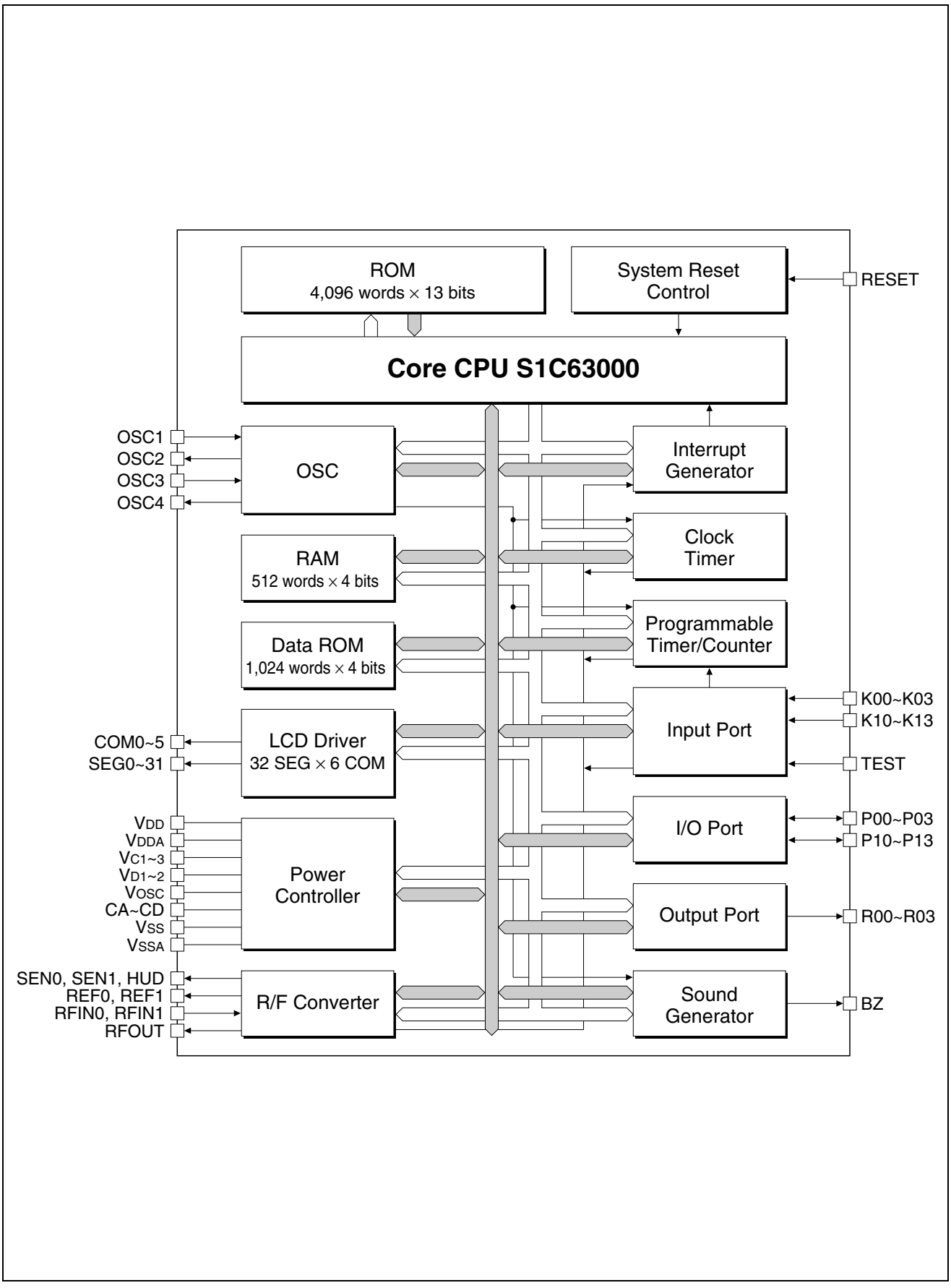
The S1C63653 is a microcomputer which has a high-performance 4-bit CPU S1C63000 as the core CPU, ROM (4,096 words × 13 bits), RAM (512 words × 4 bits), watchdog timer, programmable timer, time base counter, an LCD driver that can drive a maximum 32 segments × 6 commons, sound generator and R/f converter built-in. The S1C63653 features low current consumption, this makes it suitable for battery driven portable equipment with R/f converter.

■ FEATURES

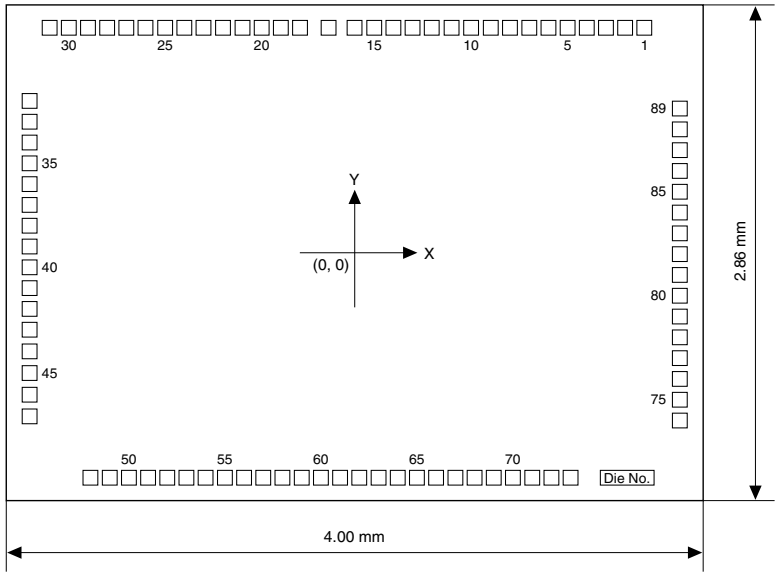
- Core CPU: 4-bit CMOS core CPU S1C63000
- OSC1 oscillation circuit: 32.768 kHz (Typ.) crystal oscillation circuit
- OSC3 oscillation circuit: 4 MHz (Max.) ceramic (2 MHz Max. when OSC3 is used as the R/f converter operating clock) or 1.1 MHz (Typ.) CR oscillation circuit (∗1)
- Instruction set: Basic instruction: 46 types (411 instructions with all)
  Addressing mode: 8 types
- Instruction execution time: During operation at 32.768 kHz: 61 µsec 122 µsec 183 µsec
  During operation at 4 MHz: 0.5 µsec 1.0 µsec 1.5 µsec
- ROM capacity: Code ROM: 4,096 words × 13 bits
  Data ROM: 1,024 words × 4 bits
- RAM capacity: Data memory: 512 words × 4 bits
  Display memory: 48 words × 4 bits
- Input port: 8 bits (Pull-down resistors may be supplemented ∗1)
- Output port: 4 bits (It is possible to switch the 2 bits to special output ∗2)
- I/O port: 8 bits
- LCD driver: 32 segments × 6, 5, 4 or 3 commons (∗2)
- Time base counter: Clock timer
- Programmable timer: 16-bit PWM × 1 ch. or 8-bit PWM × 2 ch. (∗2)
- Watchdog timer: Built-in
- Sound generator: With envelope and 1-shot output functions
- R/f converter: 2 channels, CR oscillation type, 20-bit counter
  Supports resistive humidity sensors.
- External interrupt: Input port interrupt: 2 systems
- Internal interrupt: Clock timer interrupt: 4 systems
  Programmable timer interrupt: 4 systems
  R/f converter interrupt: 2 systems
- Power supply voltage: 2.4 to 3.6 V: Max. 4 MHz operation in normal mode
  2.4 to 3.6 V: 32 kHz operation in halver mode
  1.8 to 3.6 V: 32 kHz operation in normal mode
- Operating temperature range: -20 to 70°C
- Current consumption (Typ.): Low-speed operation (OSC1 = 32 kHz crystal oscillation):
  During HALT 3.0 V (LCD ON, halver mode) 0.65 µA
  During operation 3.0 V (LCD ON, halver mode) 2.5 µA
  High-speed operation (OSC3 = 4 MHz ceramic oscillation):
  During operation 3.0 V (LCD ON) 800 µA
- Shipping form: Chip (no polyimide)

∗1: Can be selected with mask option ∗2: Can be selected with software

■ BLOCK DIAGRAM



■ PAD DIAGRAM



Chip thickness: 400 µm
Pad opening: 90 × 90 µm

■ PAD COORDINATES

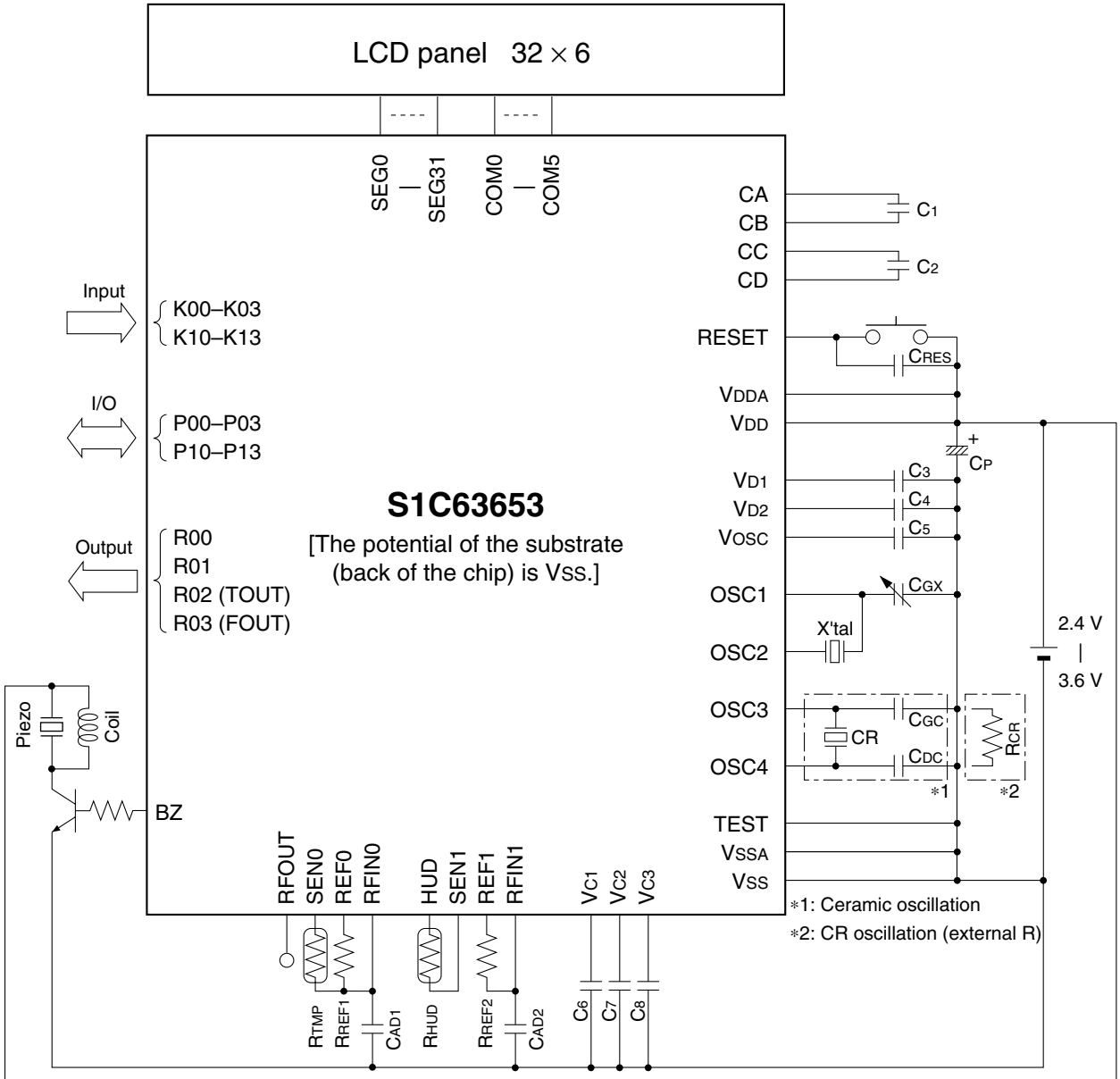
Unit: mm

No.	Pad name	X	Y	No.	Pad name	X	Y	No.	Pad name	X	Y
1	COM0	1.662	1.298	31	RESET	-1.751	1.298	61	P01	-0.084	-1.298
2	COM1	1.552	1.298	32	SEG16	-1.866	0.876	62	P02	0.026	-1.298
3	COM2	1.442	1.298	33	SEG17	-1.866	0.756	63	P03	0.137	-1.298
4	CA	1.332	1.298	34	SEG18	-1.866	0.636	64	P10	0.247	-1.298
5	CB	1.222	1.298	35	SEG19	-1.866	0.516	65	P11	0.357	-1.298
6	V_{C1}	1.112	1.298	36	SEG20	-1.866	0.396	66	P12	0.467	-1.298
7	V_{C2}	1.002	1.298	37	SEG21	-1.866	0.276	67	P13	0.578	-1.298
8	V_{C3}	0.891	1.298	38	SEG22	-1.866	0.156	68	R00	0.688	-1.298
9	V_{SSA}	0.781	1.298	39	SEG23	-1.866	0.036	69	R01	0.798	-1.298
10	RFOUT	0.668	1.298	40	SEG24	-1.866	-0.084	70	R02	0.908	-1.298
11	RFIN0	0.556	1.298	41	SEG25	-1.866	-0.204	71	R03	1.019	-1.298
12	RFIN1	0.442	1.298	42	SEG26	-1.866	-0.324	72	BZ	1.129	-1.298
13	REF0	0.332	1.298	43	SEG27	-1.866	-0.444	73	V_{SS}	1.239	-1.298
14	SEN0	0.222	1.298	44	SEG28	-1.866	-0.569	74	SEG0	1.866	-0.968
15	REF1	0.112	1.298	45	SEG29	-1.866	-0.694	75	SEG1	1.866	-0.848
16	SEN1	-0.001	1.298	46	SEG30	-1.866	-0.819	76	SEG2	1.866	-0.728
17	HUD	-0.150	1.298	47	SEG31	-1.866	-0.944	77	SEG3	1.866	-0.608
18	V_{DDA}	-0.314	1.298	48	COM3	-1.517	-1.298	78	SEG4	1.866	-0.488
19	CC	-0.424	1.298	49	COM4	-1.406	-1.298	79	SEG5	1.866	-0.368
20	CD	-0.534	1.298	50	COM5	-1.296	-1.298	80	SEG6	1.866	-0.248
21	V_{D2}	-0.644	1.298	51	V_{DD}	-1.186	-1.298	81	SEG7	1.866	-0.128
22	V_{DD}	-0.756	1.298	52	K00	-1.076	-1.298	82	SEG8	1.866	-0.008
23	V_{OSC}	-0.868	1.298	53	K01	-0.966	-1.298	83	SEG9	1.866	0.112
24	OSC1	-0.978	1.298	54	K02	-0.856	-1.298	84	SEG10	1.866	0.232
25	OSC2	-1.088	1.298	55	K03	-0.745	-1.298	85	SEG11	1.866	0.352
26	V_{D1}	-1.201	1.298	56	K10	-0.635	-1.298	86	SEG12	1.866	0.472
27	OSC3	-1.311	1.298	57	K11	-0.525	-1.298	87	SEG13	1.866	0.592
28	OSC4	-1.421	1.298	58	K12	-0.415	-1.298	88	SEG14	1.866	0.712
29	V_{SS}	-1.531	1.298	59	K13	-0.304	-1.298	89	SEG15	1.866	0.832
30	TEST	-1.641	1.298	60	P00	-0.194	-1.298	–	–	–	–

■ PIN DESCRIPTION

Pin name	Pad No.	I/O	Function
V_{DD}	22, 51	–	Power (+) supply pin
V_{SS}	29, 73	–	Power (–) supply pin
V_{DDA}	18	–	Analog system power (+) supply pin (=V_{DD})
V_{SSA}	9	–	Analog system power (–) supply pin (=V_{SS})
V_{D1}	26	–	Internal logic system regulated voltage output pin
V_{D2}	21	–	1/2V_{DD} voltage halver output pin
V_{OSC}	23	–	Oscillation system regulated voltage output pin
V_{C1}~V_{C3}	6–85	–	LCD system power supply pin
CA, CB	4, 5	–	LCD system voltage booster capacitor connecting pin
CC, CD	19, 20	–	Voltage halver capacitor connecting pin
OSC1	24	I	Crystal oscillation input pin
OSC2	25	O	Crystal oscillation output pin
OSC3	27	I	Ceramic or CR oscillation input pin (selected by mask option)
OSC4	28	O	Ceramic or CR oscillation output pin (selected by mask option)
K00–K03	52–55	I	Input port pins
K10–K13	56–59	I	Input port pins
P00–P03	60–63	I/O	I/O port pins
P10–P13	64–67	I/O	I/O port pins
R00	68	O	Output port pin
R01	69	O	Output port pin
R02	70	O	Output port or TOUT output pin (selected by software)
R03	71	O	Output port or FOUT output pin (selected by software)
COM0–COM5	1–3, 48–50	O	LCD common output pin (1/3, 1/4, 1/5 or 1/6 duty is selectable by software)
SEG0–SEG31	74–89, 32–47	O	LCD segment output pin
SEN0	14	O	R/f converter Ch. 0 CR oscillation output pin
SEN1	16	O	R/f converter Ch. 1 CR oscillation output pin
REF0	13	O	R/f converter Ch. 0 reference resistor CR oscillation output pin
REF1	15	O	R/f converter Ch. 1 reference resistor CR oscillation output pin
HUD	17	O	R/f converter AC-bias oscillation output pin for humidity sensor
RFIN0	11	I	R/f converter Ch. 0 CR oscillation input pin
RFIN1	12	I	R/f converter Ch. 1 CR oscillation input pin
RFOUT	10	O	R/f converter oscillation frequency output pin
BZ	72	O	Sound output pin
RESET	31	I	Initial reset input pin
TEST	30	I	Testing input pin

■ BASIC EXTERNAL CONNECTION DIAGRAM



X'tal	Crystal oscillator	32.768 kHz, CI (Max.) = 34 kΩ
CGX	Trimmer capacitor	5–25 pF
CR	Ceramic oscillator	4 MHz (3.0 V)
CGC	Gate capacitor	30 pF
CDC	Drain capacitor	30 pF
RCR	Resistor for OSC3 CR oscillation	30 kΩ (2 MHz)
C1–C8	Capacitor	0.2 µF
CP	Capacitor	3.3 µF
CRES	RESET terminal capacitor	0.1 µF

Note: The above table is simply an example, and is not guaranteed to work.

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