EPSON

S1C88848

8-bit Single Chip Microcomputer

Low Voltage Operation Products

- ● Original Architecture Core CPU
- ● Remote-control Carrier Output
- ● Dot-matrix LCD Driver
  ($51\times32/66\times17/67\times16$, 8 dots)

■ DESCRIPTION

The S1C88848 microcomputer features the S1C88 (Model 3) CMOS 8-bit core CPU along with ROM, RAM, a remote-control carrier output, a dot-matrix LCD controller/driver that allows driving of up to 1,632 pixels, three different timers and a serial interface with optional asynchronization or clock synchronization. The S1C88848 is fully operable over a wide range of voltages, and can perform stable operations even at low voltage (1.8 V Min.). Like all the devices in the S1C Family, this microcomputer has low current consumption (1.7 µA at standby mode). The S1C88848 also contains the SVD circuit for detecting drop of battery voltage, and is most suitable for remote controllers for home electric appliances.

■ FEATURES

- ● Core CPU .... S1C88 (MODEL3) CMOS 8-bit core CPU
- ● Main (OSC3) oscillation circuit .... Crystal oscillation circuit/ceramic oscillation circuit/CR oscillation circuit 8.2MHz (Max.) [1] (start clock source)
- ● Sub (OSC1) oscillation circuit .... Crystal oscillation circuit/CR oscillation circuit 32.768kHz (Typ.) [1]
- ● Instruction set .... 608 types (usable for multiplication and division instructions)
- ● Min. instruction execution time 0.244µsec/8.2MHz (2-clock)
- ● Internal ROM capacity .... 48K bytes
- ● Internal RAM capacity .... RAM: 1.5K bytes
  Display memory: 402 bytes
- ● Input port .... 10 bits (2 bits can be configured for event counter external clock inputs)
  Internal pull-up resistors are available [1]
- ● Output port .... 5 bits (can be configured for buzzer[2], TOUT[2], FOUT[2] and infrared remote-control carrier[1] outputs)
  SEG40–SEG50 are usable as DC output ports [1]
- ● I/O port .... 8 bits (4 bits can be configured for serial interface inputs/outputs [2])
  Internal pull-up resistors are available [1]
- ● LCD driver .... Dot matrix type
  51 segments $\times$ 32 commons [1, 2]
  66 segments $\times$ 17 commons [1]
  67 segments $\times$ 16 commons [1, 2]
  67 segments $\times$ 8 commons [1]
  Built-in LCD power supply circuit (booster type, 5 or 4 potentials)
- ● Remote controller .... Infrared remote-control carrier output or DC output
- ● Serial interface .... 1 ch. (optional clock synchronous system or asynchronous system [2])
- ● Programmable timer .... 16-bit $\times$ 2 ch. or 8-bit $\times$ 4 ch.[2], with event counter function
- ● Clock timer .... 8-bit $\times$ 1 ch.
- ● Stopwatch timer .... 8-bit $\times$ 1 ch.

SEIKO EPSON CORPORATION

- Sound generator .... Envelope function, equipped with volume control
- Watchdog timer .... Built-in
- Supply voltage detection (SVD) circuit .... 16 value programmable (1.8V to 4.35V) [*2]
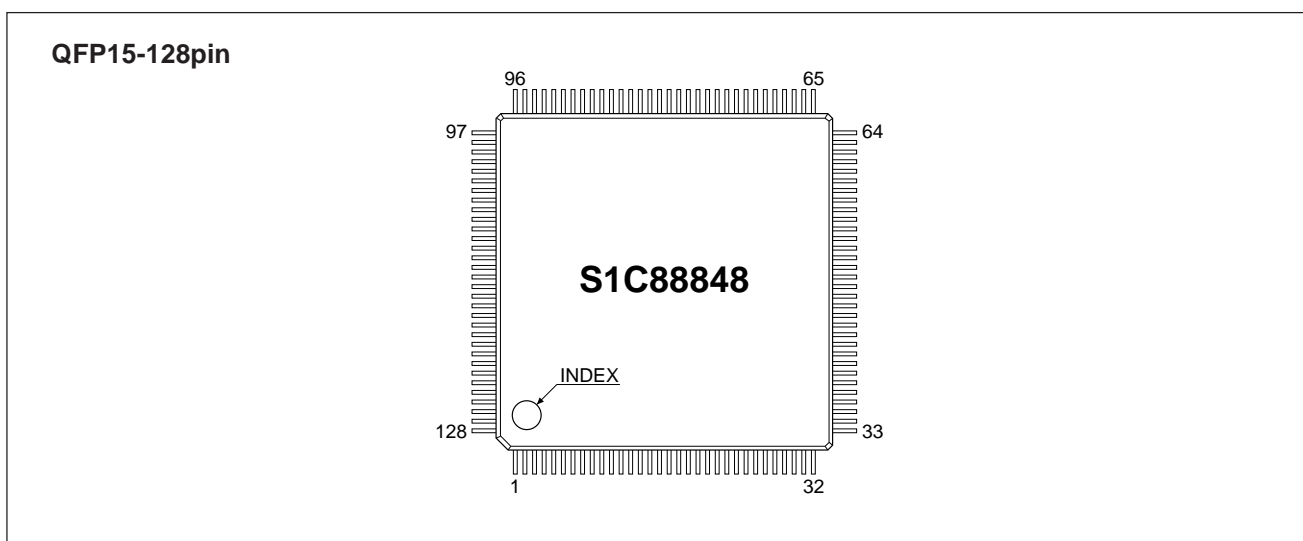- Interrupt .... External interrupt: Input port interrupt   2 systems (3 types)

	Internal interrupt:	Clock timer interrupt	1 system	(4 types)
		Stopwatch timer interrupt	1 system	(3 types)
		Programmable timer interrupt	2 systems	(4 types)
		Serial interface interrupt	1 system	(3 types)
		Remote-control output interrupt	1 system	(1 type)

- Supply voltage .... 1.8V to 5.5V [*3]
- Current consumption (Typ.) ....

SLEEP mode:	1µA
HALT mode (32kHz crystal oscillation):	1.7µA
HALT mode (8.2MHz ceramic oscillation):	100µA
Run (32kHz crystal oscillation):	4µA
Run (8.2MHz ceramic oscillation):	700µA

- Supply form .... QFP15-128pin or chip

     ∗1 Mask option   ∗2 Software selection
     ∗3 A supply voltage of less than 2.4 V affects the LCD contrast.
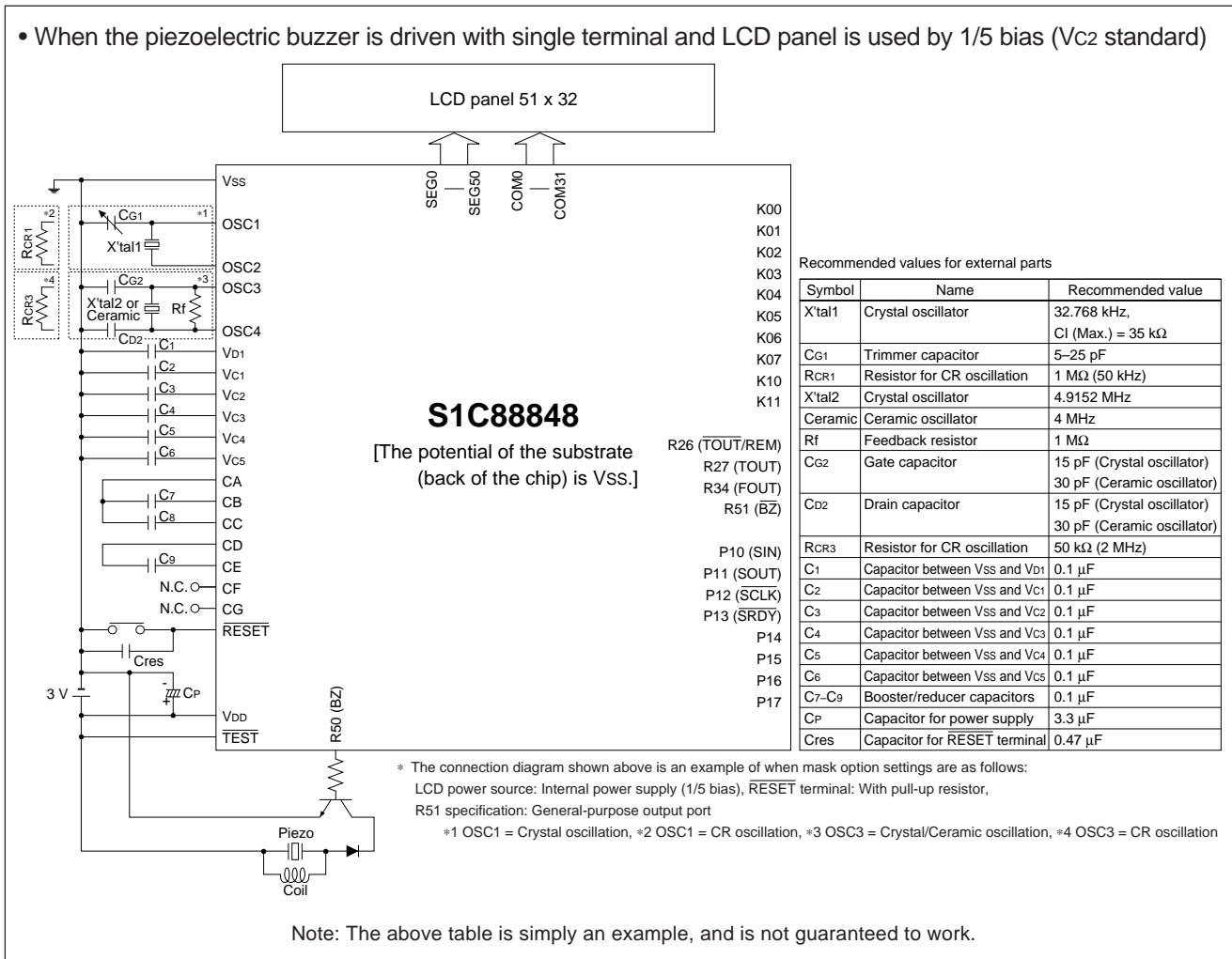
■ BLOCK DIAGRAM

■ PIN LAYOUT DIAGRAM

QFP15-128pin

S1C88848

INDEX
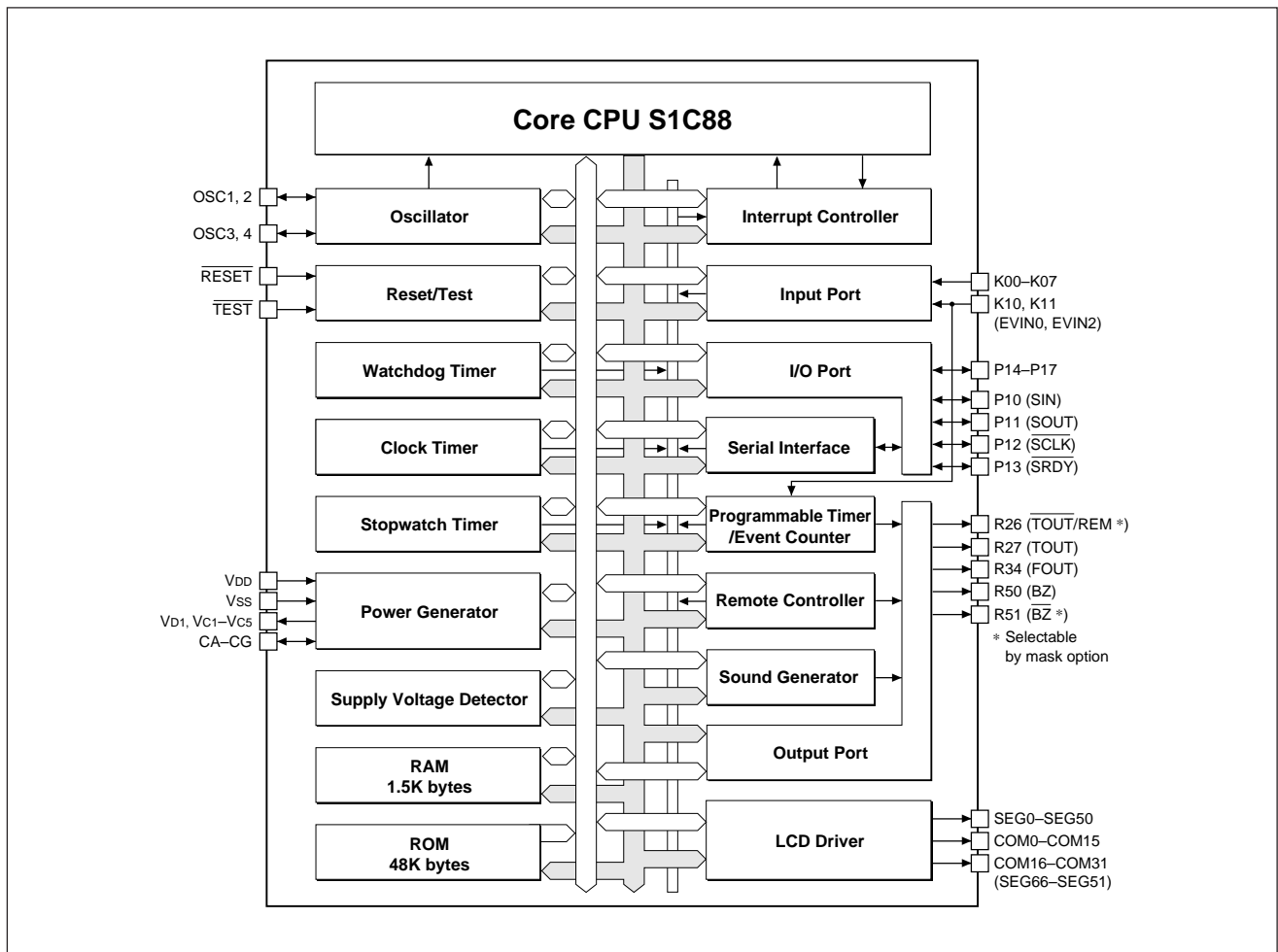
■ PIN DESCRIPTION

Pin name	Pin No.	In/out	Function
V_{DD}	71	–	Power supply (+) terminal
V_{SS}	72	–	Power supply (GND) terminal
V_{D1}	70	–	Internal operating voltage output terminal
V_{C1}–V_{C5}	67–63	O	LCD drive voltage output terminals
CA–CG	62–58, 95, 96	–	LCD voltage boost/reduce-capacitor connection terminals
OSC1	73	I	OSC1 oscillation input terminal (select crystal or CR oscillation by mask option)
OSC2	74	O	OSC1 oscillation output terminal
OSC3	68	I	OSC3 oscillation input terminal (select crystal, ceramic or CR oscillation by mask option)
OSC4	69	O	OSC3 oscillation output terminal
K00–K07	86–79	I	Input port terminals (K00–K07)
K10/EVIN0	78	I	Input port terminal (K10) or event counter external clock input terminal (EVIN0)
K11/EVIN2	77	I	Input port terminal (K11) or event counter external clock input terminal (EVIN2)
R26/$\overline{TOUT}$/REM	97	O	Output port terminal (R26), programmable timer underflow signal inverted output terminal ($\overline{TOUT}$) or remote-control carrier output terminal (REM) (selectable by mask option)
R27/TOUT	98	O	Output port terminal (R27) or programmable timer underflow signal output terminal (TOUT)
R34/FOUT	99	O	Output port terminal (R34) or clock output terminal (FOUT)
R50/BZ	100	O	Output port terminal (R50) or buzzer output terminal (BZ)
R51/$\overline{BZ}$	101	O	Output port terminal (R51) or buzzer inverted output terminal ($\overline{BZ}$) (selectable by mask option)
P10/SIN	94	I/O	I/O port terminal (P10) or serial I/F data input terminal (SIN)
P11/SOUT	93	I/O	I/O port terminal (P11) or serial I/F data output terminal (SOUT)
P12/$\overline{SCLK}$	92	I/O	I/O port terminal (P12) or serial I/F clock I/O terminal ($\overline{SCLK}$)
P13/$\overline{SRDY}$	91	I/O	I/O port terminal (P13) or serial I/F ready signal output terminal ($\overline{SRDY}$)
P14–P17	90–87	I/O	I/O port terminals (P14–P17)
COM0–COM15	102–117	O	LCD common output terminals
COM16–COM31 /SEG66–SEG51	56–41	O	LCD common output terminals or LCD segment output terminals COM16–COM31 (when 1/32 duty is selected) SEG66–SEG51 (when 1/16 or 1/8 duty is selected) COM16, SEG65–SEG51 (when 1/17 duty is selected)
SEG0–SEG39	118–128, 1–29	O	LCD segment output terminals
SEG40–SEG50	30–40	O	LCD segment output terminals or DC output terminals (selectable by mask option)
$\overline{RESET}$	76	I	Initial reset input terminal
$\overline{TEST}$ *1	75	I	Test input terminal

∗1 $\overline{TEST}$ is the terminal used for shipping inspection of the IC. For normal operation be sure it is connected to V_{DD}.

S1C88848

■ BASIC EXTERNAL CONNECTION DIAGRAM

• When the piezoelectric buzzer is driven with single terminal and LCD panel is used by 1/5 bias (V$_{C2}$ standard)

LCD panel 51 x 32

SEG0 SEG50 COM0 COM31

V$_{SS}$
OSC1
OSC2
OSC3
OSC4
V$_{D1}$
V$_{C1}$
V$_{C2}$
V$_{C3}$
V$_{C4}$
V$_{C5}$
CA
CB
CC
CD
CE
CF   N.C.
CG   N.C.
$\overline{RESET}$
V$_{DD}$
$\overline{TEST}$

C$_{G1}$ *1
X'tal1
C$_{G2}$ *3
X'tal2 or Ceramic   Rf
R$_{CR1}$ *2
R$_{CR3}$ *4
C$_{D2}$ C$_1$
C$_2$
C$_3$
C$_4$
C$_5$
C$_6$
C$_7$
C$_8$
C$_9$
Cres
3 V   C$_P$
R50 (BZ)

S1C88848
[The potential of the substrate (back of the chip) is V$_{SS}$.]

K00
K01
K02
K03
K04
K05
K06
K07
K10
K11

R26 ($\overline{TOUT}$/REM)
R27 (TOUT)
R34 (FOUT)
R51 ($\overline{BZ}$)

P10 (SIN)
P11 (SOUT)
P12 ($\overline{SCLK}$)
P13 ($\overline{SRDY}$)
P14
P15
P16
P17

Piezo
Coil

Recommended values for external parts

Symbol	Name	Recommended value
X'tal1	Crystal oscillator	32.768 kHz, CI (Max.) = 35 kΩ
C$_{G1}$	Trimmer capacitor	5–25 pF
R$_{CR1}$	Resistor for CR oscillation	1 MΩ (50 kHz)
X'tal2	Crystal oscillator	4.9152 MHz
Ceramic	Ceramic oscillator	4 MHz
Rf	Feedback resistor	1 MΩ
C$_{G2}$	Gate capacitor	15 pF (Crystal oscillator) 30 pF (Ceramic oscillator)
C$_{D2}$	Drain capacitor	15 pF (Crystal oscillator) 30 pF (Ceramic oscillator)
R$_{CR3}$	Resistor for CR oscillation	50 kΩ (2 MHz)
C$_1$	Capacitor between V$_{SS}$ and V$_{D1}$	0.1 µF
C$_2$	Capacitor between V$_{SS}$ and V$_{C1}$	0.1 µF
C$_3$	Capacitor between V$_{SS}$ and V$_{C2}$	0.1 µF
C$_4$	Capacitor between V$_{SS}$ and V$_{C3}$	0.1 µF
C$_5$	Capacitor between V$_{SS}$ and V$_{C4}$	0.1 µF
C$_6$	Capacitor between V$_{SS}$ and V$_{C5}$	0.1 µF
C$_7$–C$_9$	Booster/reducer capacitors	0.1 µF
C$_P$	Capacitor for power supply	3.3 µF
Cres	Capacitor for $\overline{RESET}$ terminal	0.47 µF

∗ The connection diagram shown above is an example of when mask option settings are as follows:
LCD power source: Internal power supply (1/5 bias), $\overline{RESET}$ terminal: With pull-up resistor,
R51 specification: General-purpose output port
∗1 OSC1 = Crystal oscillation, ∗2 OSC1 = CR oscillation, ∗3 OSC3 = Crystal/Ceramic oscillation, ∗4 OSC3 = CR oscillation

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