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S1C17701

CMOS 16-bit Single Chip Microcontroller

- **Low Power MCU (operating voltage 1.8 V, 1 µA/SLEEP, 2.6 µA/HALT)**
- **S1C17 High Performance 16-bit RISC CPU Core with C Optimized Compact Code and Serial ICE Support**
- **High Quality and Stable Display LCD Driver with Voltage Booster (56 SEG × 32 COM, supports grayscale)**
- **Infrared Remote Controller with Carrier Generator**
- **64K-Byte Flash Memory and 4K-Byte RAM**

■ DESCRIPTIONS

The S1C17701 is a 16-bit MCU that features high-speed operation, low power consumption, small size, large address space, and on-chip ICE. The S1C17701 consists of an S1C17 CPU Core, a 64K-byte Flash memory, a 4K-byte RAM, serial interface modules (UART that supports high bit rate and IrDA 1.0, SPI and I^2C) for connecting various sensor modules, 8-bit timers, 16-bit timers, a PWM & capture timer, a clock timer, a stopwatch timer, a watchdog timer, 28 GPIO ports, an LCD driver with 56-segment × 32-common outputs and a voltage booster, a supply voltage detector, 32 kHz (typ.) and 8.2 MHz (max.) oscillators, and a voltage regulator for generating the 1.8 V internal voltage. The S1C17701 is capable of high-speed operation (8.2 MHz) with low operating voltage (1.8 V). Its 16-bit RISC processor executes one instruction in 1.5 clock cycles. The S1C17701 also provides an on-chip ICE function that allows on-board erasing/programming of the embedded Flash memory, on-board debugging and evaluating the program by connecting the S1C17701 to the serial ICD Mini (S5U1C17001H) with only three wires.

The S1C17701 is suitable for battery driven applications with sensor interfaces and up to 56 × 32-dot LCD display, such as remote controllers and sports watches.

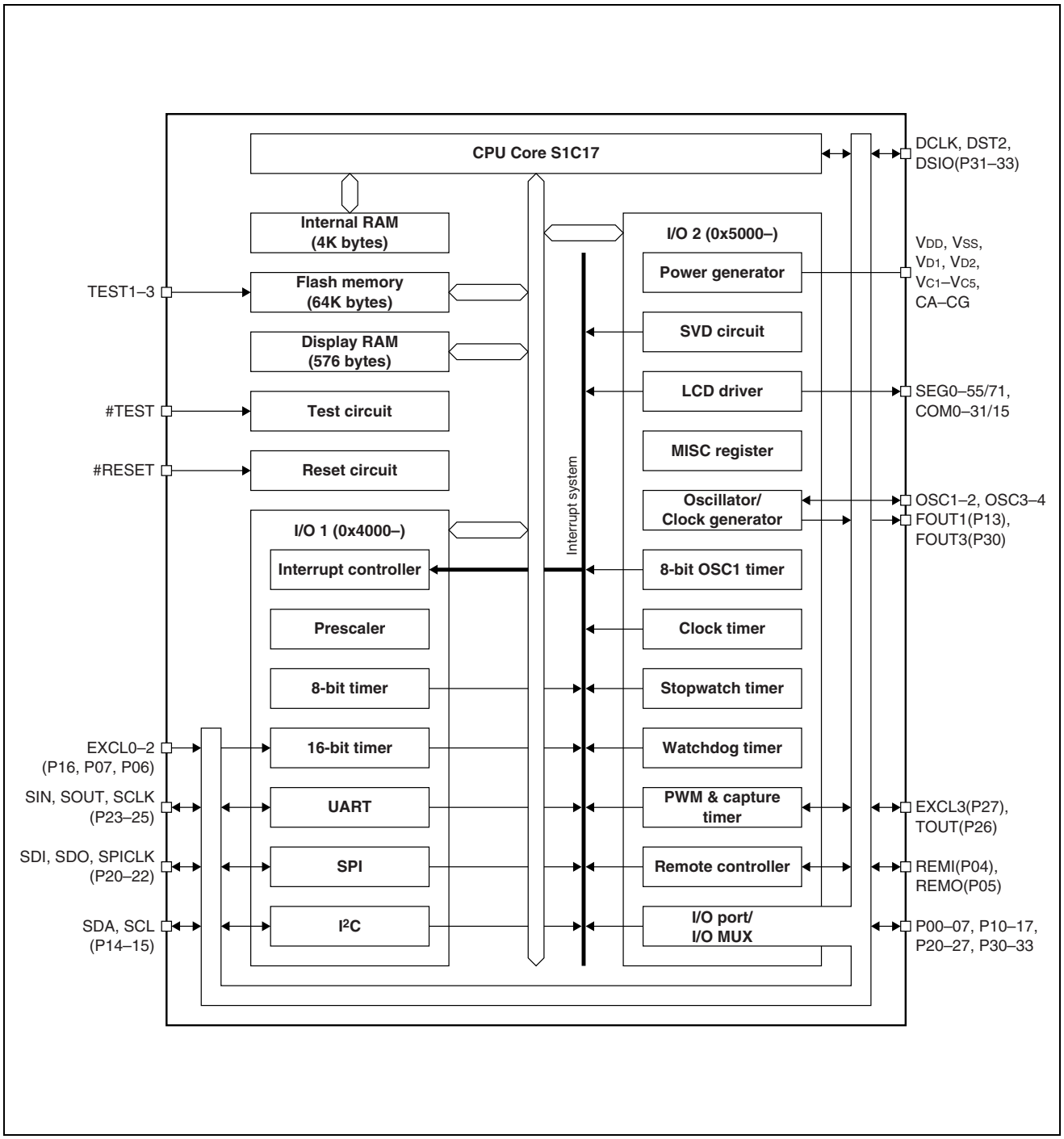
This product uses SuperFlash® Technology licensed from Silicon Storage Technology, Inc.

■ FEATURES

- CPU ..... • Seiko Epson original 16-bit RISC CPU core S1C17
- Main (OSC3) oscillator • Crystal/ceramic oscillator 8.2 MHz (max.) or CR oscillator 2.2 MHz (max.)
- Sub (OSC1) oscillator ..... • Crystal oscillator 32.768 kHz (typ.)
- On-chip Flash memory ..... • 64K bytes (for instructions and data)
  - 1,000 erase/program cycles
  - Read/program protection
  - On-board programming by a debugging tool such as ICD Mini (S5U1C17701H) and self-programming by software control
- On-chip RAM ..... • 4K bytes
- On-chip display RAM ..... • 576 bytes
- I/O ports ..... • Max. 28 general-purpose I/O ports (Pins are shared with the peripheral I/O.)
- Serial interfaces ..... • SPI (master/slave) 1 ch.
  - I^2C (master) 1 ch.
  - UART (115200 bps, IrDA 1.0) 1 ch.
  - Remote controller (REMC) 1 ch.
- Timers ..... • 8-bit timer (T8F) 1 ch.
  - 16-bit timer (T16) 3 ch.
  - PWM & capture timer (T16E) 1 ch.
  - Clock timer (CT) 1 ch.
  - Stopwatch timer (SWT) 1 ch.
  - Watchdog timer (WDT) 1 ch.
  - 8-bit OSC1 timer (T8OSC1) 1 ch.
- LCD driver ..... • 56 SEG × 32 COM or 72 SEG × 16 COM (1/5 bias)
  - Built-in voltage booster
- Supply voltage detector (SVD) ..... • 13 programmable detection levels (1.8 V to 2.7 V)
- Interrupts ..... • Reset
  - NMI
  - 16 programmable interrupts (8 levels)

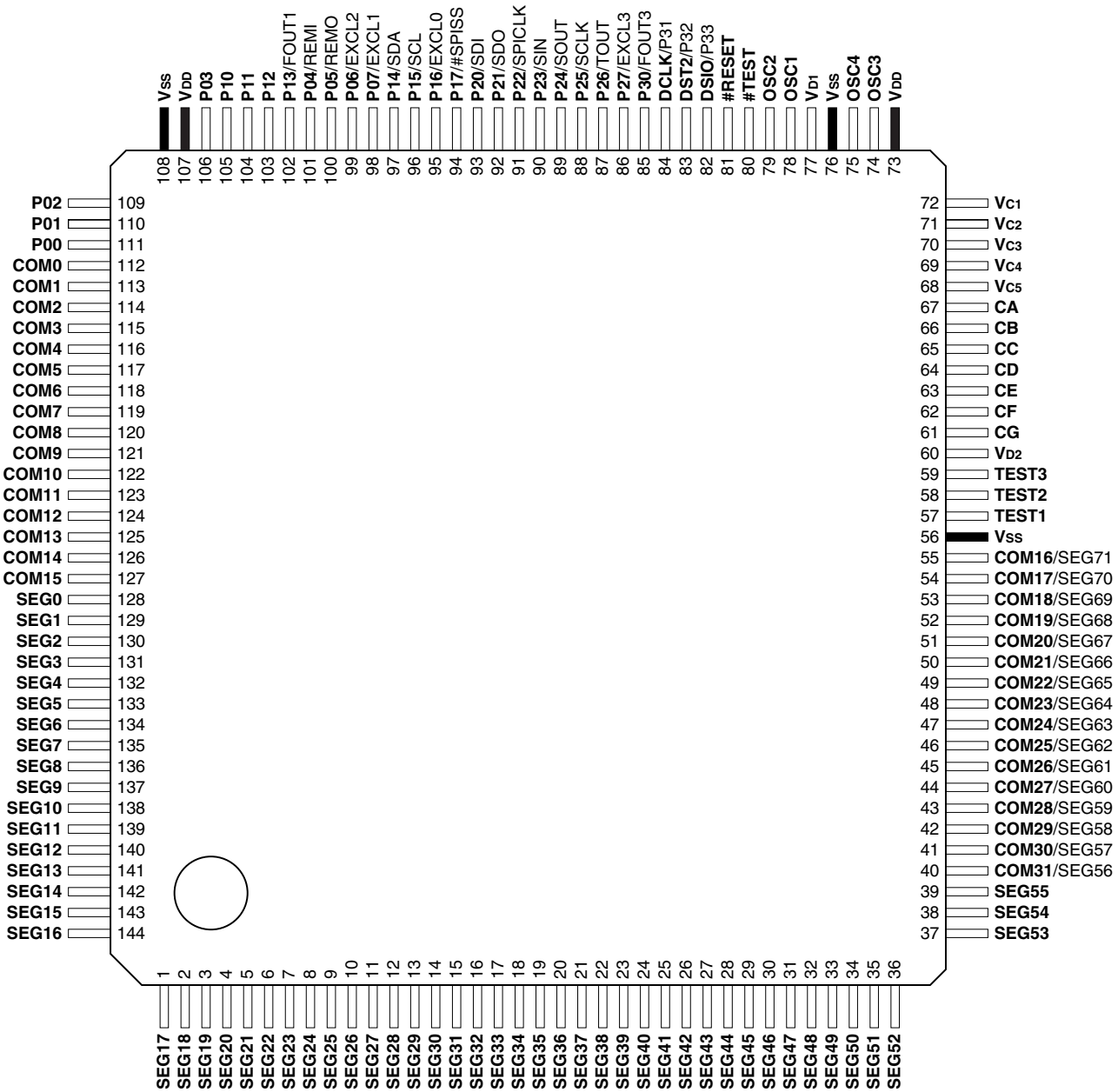
- Power supply voltage.....• 1.8 V to 3.6 V (for normal (low-power) operation with the 1.8 V internal voltage)
  • 2.7 V to 3.6 V (for Flash erasing/programming with the 2.5 V internal voltage)
- Operating temperature.....• -20°C to 70°C
- Current consumption (typ.) .....• SLEEP state: 1 µA
  • HALT state: 2.6 µA (32 kHz OSC1 crystal oscillator, LCD off)
  • Run state: 14 µA (32 kHz OSC1 crystal oscillator, LCD off)
  1800 µA (8 MHz OSC3 ceramic oscillator, LCD off)
- Shipping form.....• TQFP24-144pin plastic package (16 mm × 16 mm × 1.0 mm, lead pitch: 0.4 mm)
  • Chip

■ BLOCK DIAGRAM



■ PIN LAYOUT DIAGRAM

TQFP24-144pin



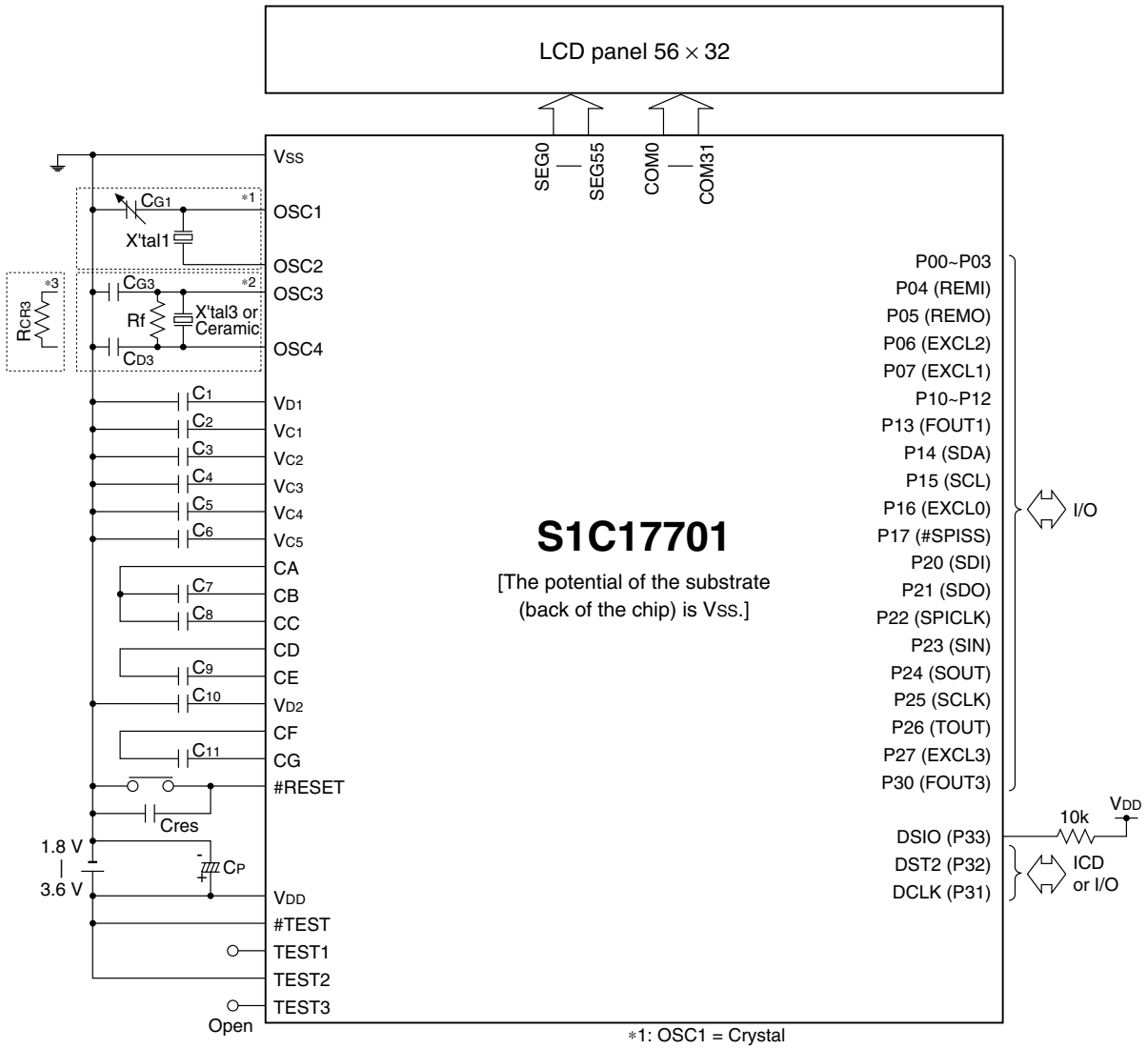
■ PIN DESCRIPTION

Pin No.	Pin name	I/O	Initial	Function
1–39	**SEG17–55**	O	O (L)	LCD segment output pins
40–55	**COM31–16**/ SEG56–71	O	O (L)	LCD common output pins* or LCD segment output pins
56	**VSS**	–	–	Power supply pin (GND)
57	**TEST1**	–	–	Test pin (open during normal operation)
58	**TEST2**	–	–	Test pin (fix at high during normal operation)
59	**TEST3**	–	–	Test pin (open during normal operation)
60	**VD2**	–	–	LCD power voltage booster output pin
61	**CG**	–	–	Power voltage boosting capacitor connect pin
62	**CF**	–	–	Power voltage boosting capacitor connect pin
63	**CE**	–	–	LCD voltage boosting capacitor connect pin
64	**CD**	–	–	LCD voltage boosting capacitor connect pin
65	**CC**	–	–	LCD voltage boosting capacitor connect pin
66	**CB**	–	–	LCD voltage boosting capacitor connect pin
67	**CA**	–	–	LCD voltage boosting capacitor connect pin
68	**VC5**	–	–	LCD drive voltage output pin
69	**VC4**	–	–	LCD drive voltage output pin
70	**VC3**	–	–	LCD drive voltage output pin
71	**VC2**	–	–	LCD drive voltage output pin
72	**VC1**	–	–	LCD drive voltage output pin
73	**VDD**	–	–	Power supply pin (+)
74	**OSC3**	I	I	OSC3 oscillation input pin
75	**OSC4**	O	O	OSC3 oscillation output pin
76	**VSS**	–	–	Power supply pin (GND)
77	**VD1**	–	–	Internal logic and oscillation system voltage regulator output pin
78	**OSC1**	I	I	OSC1 oscillation input pin
79	**OSC2**	O	O	OSC1 oscillation output pin
80	**#TEST**	I	I (Pull-up)	Test pin (fix at high during normal operation)
81	**#RESET**	I	I (Pull-up)	Initial reset input pin
82	**DSIO**/P33	I/O	I (Pull-up)	On-chip debugger data I/O pin* or I/O port pin
83	**DST2**/P32	I/O	O (L)	On-chip debugger status output pin* or I/O port pin
84	**DCLK**/P31	I/O	O (L)	On-chip debugger clock output pin* or I/O port pin
85	**P30**/FOUT3	I/O	I (Pull-up)	I/O port pin* or OSC3 divider clock output pin
86	**P27**/EXCL3	I/O	I (Pull-up)	I/O port pin* or T16E external clock input pin
87	**P26**/TOUT	I/O	I (Pull-up)	I/O port pin* or T16E PWM signal output pin
88	**P25**/SCLK	I/O	I (Pull-up)	I/O port pin* or UART clock input pin
89	**P24**/SOUT	I/O	I (Pull-up)	I/O port pin* or UART data output pin
90	**P23**/SIN	I/O	I (Pull-up)	I/O port pin* or UART data input pin
91	**P22**/SPICLK	I/O	I (Pull-up)	I/O port pin* or SPI clock I/O pin
92	**P21**/SDO	I/O	I (Pull-up)	I/O port pin* or SPI data output pin
93	**P20**/SDI	I/O	I (Pull-up)	I/O port pin* or SPI data input pin
94	**P17**/#SPISS	I/O	I (Pull-up)	I/O port pin (with interrupt)* or SPI slave select input pin
95	**P16**/EXCL0	I/O	I (Pull-up)	I/O port pin (with interrupt)* or T16 Ch.0 external clock input pin
96	**P15**/SCL	I/O	I (Pull-up)	I/O port pin (with interrupt)* or I^2C clock output pin
97	**P14**/SDA	I/O	I (Pull-up)	I/O port pin (with interrupt)* or I^2C data I/O pin
98	**P07**/EXCL1	I/O	I (Pull-up)	I/O port pin (with interrupt)* or T16 Ch.1 external clock input pin
99	**P06**/EXCL2	I/O	I (Pull-up)	I/O port pin (with interrupt)* or T16 Ch.2 external clock input pin
100	**P05**/REMO	I/O	I (Pull-up)	I/O port pin (with interrupt)* or Remote control signal output pin
101	**P04**/REMI	I/O	I (Pull-up)	I/O port pin (with interrupt)* or Remote control signal input pin
102	**P13**/FOUT1	I/O	I (Pull-up)	I/O port pin (with interrupt)* or OSC1 clock output pin
103	**P12**	I/O	I (Pull-up)	I/O port pin (with interrupt)
104	**P11**	I/O	I (Pull-up)	I/O port pin (with interrupt)
105	**P10**	I/O	I (Pull-up)	I/O port pin (with interrupt)
106	**P03**	I/O	I (Pull-up)	I/O port pin (with interrupt)
107	**VDD**	–	–	Power supply pin (+)
108	**Vss**	–	–	Power supply pin (GND)

Pin No.	Pin name	I/O	Initial	Function
109	**P02**	I/O	I (Pull-up)	I/O port pin (with interrupt)
110	**P01**	I/O	I (Pull-up)	I/O port pin (with interrupt)
111	**P00**	I/O	I (Pull-up)	I/O port pin (with interrupt)
112–127	**COM0–15**	O	O (L)	LCD common output pins
128–144	**SEG0–16**	O	O (L)	LCD segment output pins

Note: The pin names described in boldface type and description with '*' are default settings.

■ BASIC EXTERNAL CONNECTION DIAGRAM



*1: OSC1 = Crystal
*2: OSC3 = Crystal or Ceramic (S1C17701F00B100)
*3: OSC3 = CR (S1C17701F00E100)

Recommended values for external parts

Symbol	Name	Recommended value
X'tal1	Crystal oscillator	32.768 kHz
C_{G1}	Trimmer capacitor	0–25 pF
X'tal3	Crystal oscillator	0.2–8 MHz
Ceramic	Ceramic oscillator	0.2–8 MHz
Rf	Feedback resistor	1 MΩ
C_{G3}	Gate capacitor	15 pF (crystal) 30 pF (ceramic)
C_{D3}	Drain capacitor	15 pF (crystal) 30 pF (ceramic)
R_{CR3}	Resistor for CR oscillation	30 kΩ

Symbol	Name	Recommended value
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 capacitors	0.1 µF
C_{10}	Capacitor between V_{SS} and V_{D2}	0.1 µF
C_{11}	Booster capacitor	0.1 µF
C_P	Capacitor for power supply	3.3 µF
Cres	Capacitor for #RESET terminal	0.47 µF

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

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