

SS0408 3 1/2 DIGIT CLINICAL THERMOMETER

1. General Descriptions

SS0408 is a CMOS digital clinical thermometer IC for measuring body temperature in Centigrade(°C) or Fahrenheit(°F) mode by its bonding option. It also provides alarm and auto power off functions. The other electronic components are LCD display, thermistor, 1.5V battery, ON/OFF switch, buzzer, resistors and capacitors.

2. Features

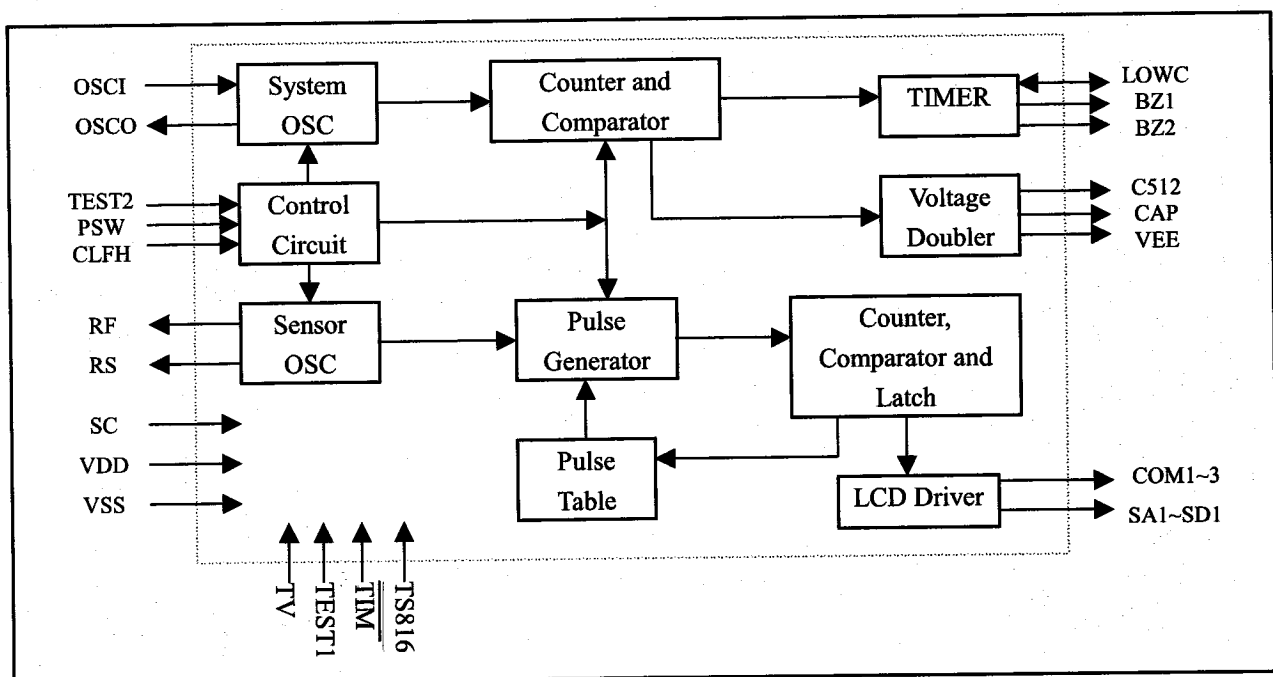
- ◆ Single 1.5V battery operation.
- ◆ Single-chip CMOS construction.
- ◆ Bonding option for Centigrade/ Fahrenheit measurement.
- ◆ Measurement range: +32.0~+42.0°C(+90.0~+108.0°F).

Resolution: 0.1°C(0.1°F).

Measurement accuracy: $\pm 0.1^{\circ}\text{C}(\pm 0.2^{\circ}\text{F})$.

- ◆ One-key input switch for ON/OFF.
- ◆ Alarm warning for fever.
- ◆ Highest temperature hold.
- ◆ Auto power off after 8 min 40 sec.
- ◆ Displays last time measured temperature.

3. Function Block Diagram

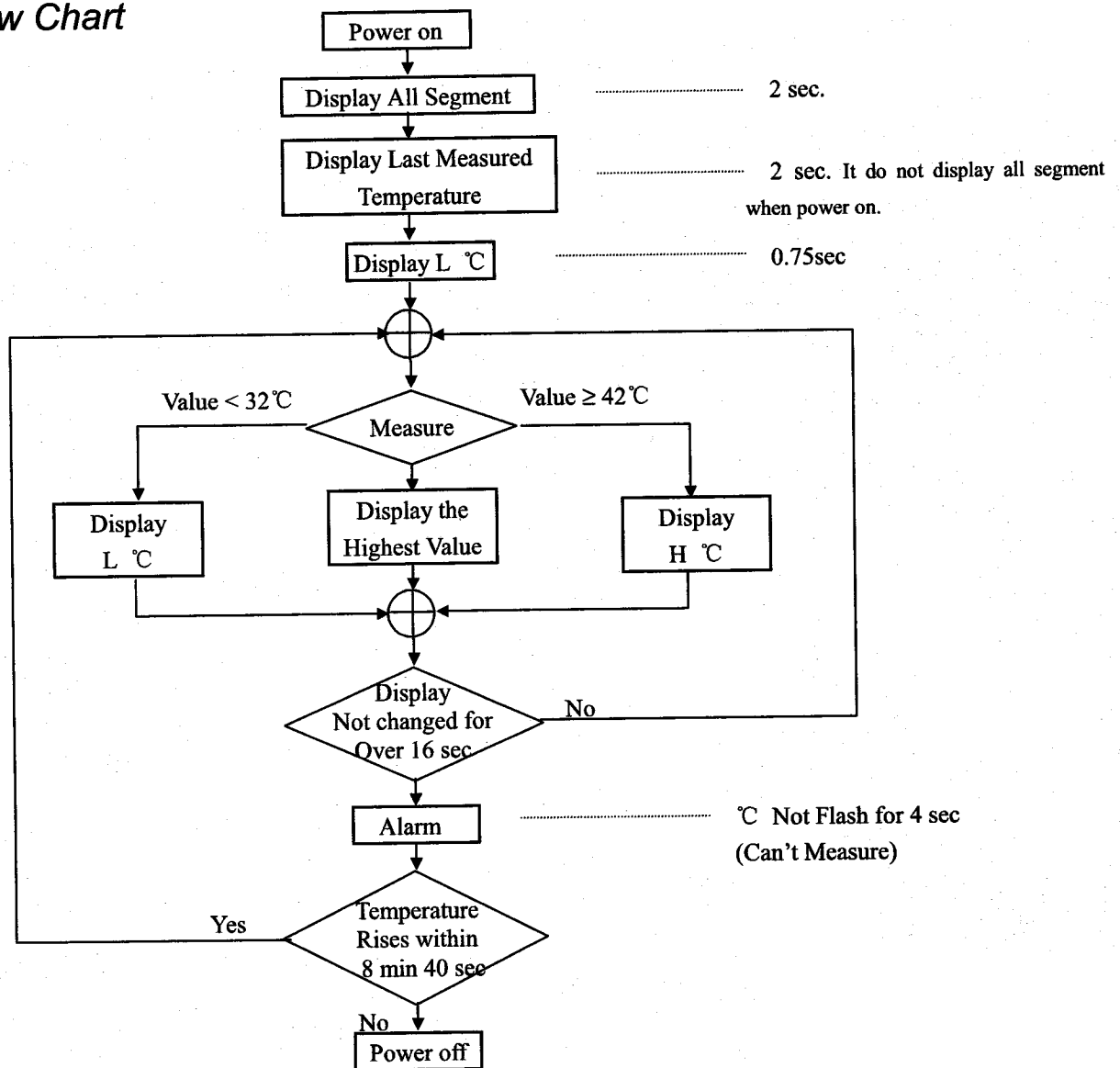


BI -----

0.5S 0.5S

- j. It will automatically turn the power off when measurement is over for 8 min 40 sec.
- k. When measurement is over, but if the temperature rises within 8 min 40 sec, the °C(or°F) mark will flash again (repeat from step d.), and starts to count 8 min 40 sec again.
- l. When beep sound is on for 4 sec, the temperature is not measured.
- When power off: the standby current $\leq 1\mu\text{A}$.
- The frequency of the buzzer is 5.3KHz
- Bonding option °C or °F
- Measurement to 0.1 degree in either °C or °F
- Sensor use 503ET
- Reference resistor is the value (sensor in 37.0°C)
- When battery voltage is low, the battery mark "V" flashes at the speed of 1 Hz and the measurement may not be accurate. The low voltage detects: $1.35\text{V} \pm 0.05\text{V}$.
- During the process of mass production, in order to adjust the reference resistance (RF), let test 2 be floating, the measured temperature will be the actual temperature of the measured environment. It can be up or down, not always the higher one.

6. Flow Chart



4. Pin Descriptions

Pin	Name	I/O	Function
1	LOWC	I/O	For the supply voltage detector, open the pin when not in use
2	VSS	I	Power supply GND
3	SC	I/O	Common point, NMOS open drain
4	RF	O	Connect reference resistor, PMOS open drain
5	RS	O	Connect sensor resistor, PMOS open drain
6	VDD		Positive power supply
7	PSW	I	Pull-low input pin, push switch to turn power on or off
8	TEST2	I	Pull-low test pin, for production test, floating LCD displays the real time value, when connected to VDD, LCD displays the highest value.
9	CLFH	I	Floating for $^{\circ}\text{C}$, connect to VDD for $^{\circ}\text{F}$
10	OSCI	I	For system oscillator in
11	OSCO	O	For system oscillator out
12	BZ1	O	Buzzer output 1
13	BZ2	O	Buzzer output 2
14~16	COM1~COM3	O	LCD backplane drive, 3-level voltage out
17~19	SA1~SA3	O	LCD segment drive
20~22	SB1~SB3	O	LCD segment drive
23~25	SC1~SC3	O	LCD segment drive
26	SD1	O	LCD segment drive
27	VEE	O	Generate negative voltage (-1.5V)
28	CAP	O	For negative voltage, NMOS output
29	C512	O	For negative voltage, inverter output
30	TV	I/O	Test pin for IC
31	TEST1	I	Test pin for IC
32	$\overline{\text{TIM}}$	I	Test pin for IC
33	TS816	I	Test pin for IC

5. Function Descriptions

- Power sw: push switch to power on or power off.
- When power on: push the switch, then it will generate a "beep" sound for 0.125 sec.
 - a. First displays all the segments on for 2 sec and tests itself at the same time, if it tests unsuccessfully, the LCD displays "Err", and it will restore the normal state after obstruction are obviated. If it tests successfully, it will skip to b..
 - b. After a. as described above, if it tests successfully, then shows the last time measured temperature for 2 sec.
 - c. After b., shows $^{\circ}\text{C}$ or $^{\circ}\text{F}$ for 0.75 sec.
 - d. After c., displays the measured temperature, then $^{\circ}\text{C}$ or $^{\circ}\text{F}$ mark will flash at a speed of 1Hz.
 - e. If the temperature is $<32^{\circ}\text{C}$ (or 90°F), the display shows $^{\circ}\text{C}$ (or $^{\circ}\text{F}$).
 - f. If the temperature $\geq 42^{\circ}\text{C}$ (or 108°F), the display shows $^{\circ}\text{H}$ (or $^{\circ}\text{F}$).
 - g. The display always shows the higher temperature during the temperature measurement.
 - h. If the measured temperature does not change for more than 16 sec, the measurement is over and the $^{\circ}\text{C}$ (or $^{\circ}\text{F}$) mark flash stops.
 - i. When measurement is over, if the temperature $>37.5^{\circ}\text{C}$ (or 99.5°F) the buzzer alarms "beep-beep-beep-beep-beep-beep-" for 4 sec, as follows:
 BI ----- BI ----- BI -----
 0.125S 0.125S 0.125S 0.125S 0.125S 0.125S 0.375S
 If the temperature $\leq 37.5^{\circ}\text{C}$ (or 99.5°F), the buzzer alarms "beep-beep-beep-beep-" for 4 sec, as follows:

7. Absolute Maximum Ratings

(All voltage referenced to GND)

Item	Symbol	Rating	Unit
Supply Voltage	V_{DD}	0 ~ 2.0	V
Input / Output Voltage	V_I/V_O	GND-0.5 ~ $V_{DD}+0.5$	V
Operating Temperature	T_{DD}	-2 ~ +75	°C
Storage Temperature	T_{ST}	-55 ~ +125	°C

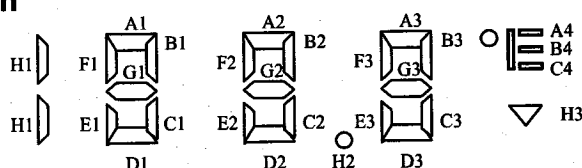
Note: These are stress ratings only. Stresses exceeding the range specified under "Absolute Maximum Ratings" may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

8. Electrical Characteristics

(All voltage referenced to GND, Ambient temperature=25 °C)

Parameters	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Voltage	V_{DD}		1.3	1.5	1.65	V
Operating Current	I_{DD}	$V_{DD}=1.5V$, No load	--	60	100	μA
Stand-by Current	I_{STB}	$V_{DD}=1.5V$	--	--	1.0	μA
Oscillating Frequency	F_{OSC}	$V_{DD}=1.5V$ $R_{OSC}=520K\Omega$	28	30	32	KHz
Temperature Measurement Accuracy at Range 35°C~39°C	$R^{\circ}C$	--	-0.1	--	0.1	°C
Temperature Measurement Accuracy at Range 95°F~102°F	$R^{\circ}F$		-0.2	--	0.2	°F

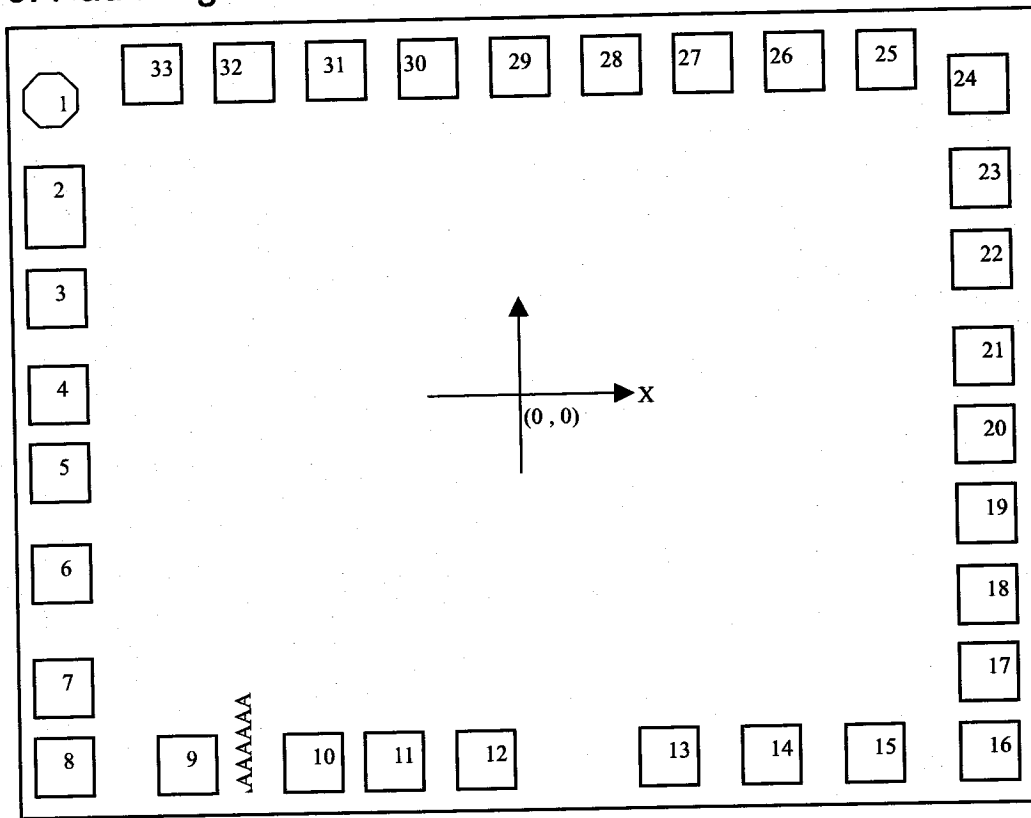
LCD Electrode Pattern



	SA1	SA2	SA3	SB1	SB2	SB3	SC1	SC2	SC3	SD1
COM1	F1	A1	B1	F2	A2	B2	F3	A3	B3	A4
COM2	E1	G1	C1	E2	G2	C2	E3	G3	C3	B4
COM3	H1	D1	---	---	D2	H2	---	D3	H3	C4

Note: 1/3 duty, 1/2 bias, (LCD uses 3V)

9. Pad Diagram

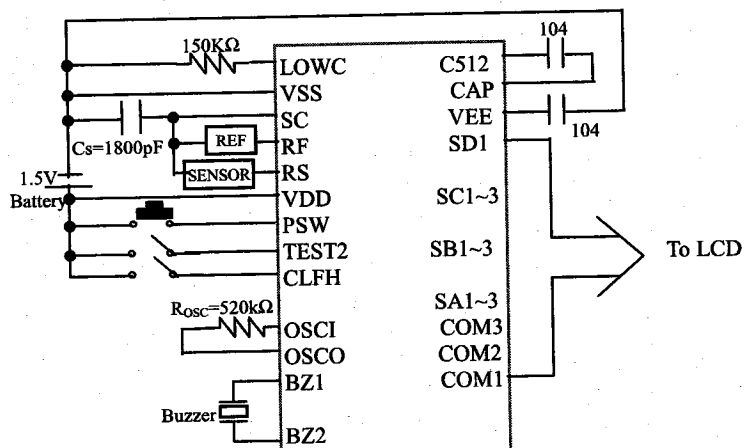


Chip Size: $(2380, 1830) \mu^2\text{m}$
 Note: The substrate must be connected to VDD.

PAD NO.	NAME	X	Y
1	LOWC	-1112	828
2	GND	-1112	448
3	SC	-1112	275
4	RF	-1112	-4
5	RS	-1112	-233
6	VDD	-1112	-413
7	PSW	-1112	-626
8	TEST2	-1112	-837
9	CLFH	-808	-837
10	OSCI	-583	-837
11	OSCO	-331	-837
12	BUZ1	-54	-837
13	BUZ2	416	-837
14	COM1	699	-837
15	COM2	966	-837
16	COM3	1112	-832
17	SA1	1112	-631

PAD NO.	NAME	X	Y
18	SA2	1112	-389
19	SA3	1112	-238
20	SB1	1112	11
21	SB2	1112	162
22	SB3	1112	411
23	SC1	1112	562
24	SC2	1112	806
25	SC3	975	837
26	SD1	731	837
27	VEE	587	826
28	CAP	395	826
29	C512	7	837
30	TV	-184	837
31	TEST1	-428	837
32	TIM	-574	837
33	TS816	-823	837

10. Application Circuit



The value of R_{osc} , C_s is allowed the range of $\pm 5\%$.

Note: Substrate connect to VDD

VEE, CAP, and C512 are externally connected to capacitors for stabilizing $V_{EE}(= -1.5V)$.

BZ1 and BZ2 are connected to an external buzzer to generate sounds.

LOWC is connected to an external resistor for adjusting the detector level of a low voltage detector.

Open the pin when not in use.

OSCI, OSCO are connected to an external resistor, and form an RC oscillator with a built-in capacitor for SYSTEM clock ($\approx 30KHz$).

RS, RF, SC constitute an alternating RC oscillator, which allows one oscillator, namely RS or RF, active at a time.

REF(reference resistor) is a resistor value equal to 503ET, sensor is value in $37.0^{\circ}C$ or $98.6^{\circ}F$.

SENSOR is a 503ET thermistor.

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