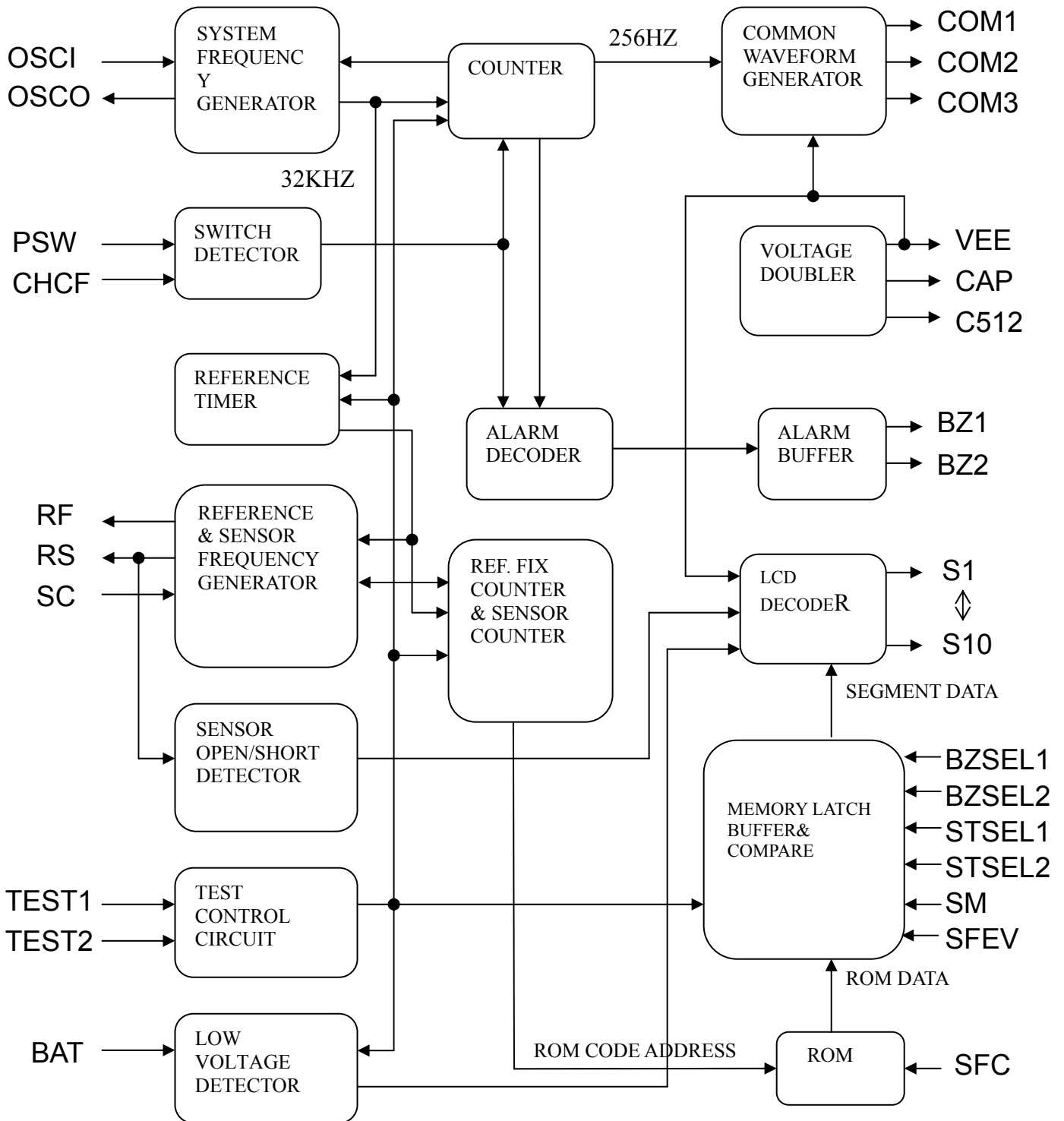# THERMOMETER SPECIFICATION

CONTENTS:

.General Description:

The TTP301 is an one-decimal electronic clinical thermometer IC. It can push switch to select the ℃/℉ mode.

.Features:

✧ Single 1.5V battery power supply
✧ Automatic power off function
✧ Provide low voltage detector function
✧ Measurement range: 32.0℃~42.9℃(90.0℉~109.9℉)
✧ Measurement accuracy: ±0.1℃(±0.2℉)
✧ Resolution: 0.1℃(0.1℉)
✧ Highest temperature hold
✧ Provide fever alarm function, enable or disable by bonding option
✧ Bonding option for memory function
✧ Bonding option for stable time selection: 4s/8s/16s/32s
✧ Bonding option for buzzer alarm frequency 4K/5.3K/6.4K/8KHz
✧ Bonding option for ℃ and ℉
✧ Bonding option for ℃/℉ changeable or not change mode by pushing switch
✧ When ℃/℉ changeable mode, push ON/OFF button to select ℃/℉ and bonding option ℃ or ℉ when power on initial

.Block Diagram:

Preliminary

.Pad Description:

Pad No.	Pad Name	I/O	Description
1~10	S1~S10	O	LCD segment driver, connect to LCD
11	VEE	O	Generated 3V voltage
12	CAP	O	For positive voltage pumping
13	C512	O	For positive voltage pumping
14	TEST1	I	Test pad, for IC test only

15	SFC	I	Bonding option for ℃ or ℉ mode
			  SFC= VDD or Open: ℃ (When ℃/℉ change mode, power on is ℃)
			  SFC= VSS: ℉ (When ℃/℉ change mode, power on is ℉)

16	CHCF	I	Bonding option for ℃/℉ changeable or not changeable mode
			  CHCF= VDD or Open: ℃/℉ not changeable mode
			  CHCF= VSS: ℃/℉ changeable mode

17	BAT	I/O	For the low voltage detector
18	VSS	P	Negative power supply
19	SC	I/O	Reference and sensor frequency pad.
20	RF	O	Connect to reference resistor
21	RS	O	Connect to sensor resistor
22	VDD	P	Positive power supply
23	PSW	I	Pull high input pad, push switch to power on or power off

24	TEST2	I	Pull high input pad, for the test of production
			  TEST2= VDD or Open: LCD display the highest value
			  TEST2= VSS: LCD display the real time value

25 26	BZSEL1 BZSEL2	I I	Pull high input pad, bonding option for buzzer output frequency

BZ FREQ.	BZSEL1	BZSEL2
8.0KHz	VDD or Open	VDD or Open
6.4KHz	VSS	VDD or Open
5.3KHz	VDD or Open	VSS
4.0KHz	VSS	VSS

| 27
28 | STSEL1
STSEL2 | I
I | Pull high input pad, bonding option for stable time |

Stable time	STSEL1	STSEL2
16 sec	VDD or Open	VDD or Open
4 sec	VSS	VDD or Open
8 sec	VDD or Open	VSS
32 sec	VSS	VSS

Pad No.	Pad Name	I/O	Description

29	SM	I	Pull high input pad, bonding option for memory function
			  SM= VDD or Open: non-memory function
			  SM= VSS: With memory function. After LCD full display, display
			    the last measuring temperature.

30	SFEV	I	Pull high input pad, bonding option for fever alarm function
			  SFEV= VDD or Open: With fever function
			  SFEV= VSS: non-fever function

31	OSCI	I	System oscillator input pad
32	OSCO	O	System oscillator output pad
33	BZ1	O	Buzzer output pad 1
34	BZ2	O	Buzzer output pad 2
35~37	COM1~COM3	O	LCD common driver, connect to LCD

Preliminary

.Electrical Parameter:

Description		Max.	Typical	Min.
1. Operating Voltage:		1.65V	1.5V	1.25V
2. Operating Average Current:		50uA	20uA	
3. Input Voltage:	VIL	Vss+0.3V		
	VIH			Vdd-0.3V
4. Output Voltage:	VOL	Vss+0.1V		
	VOH			Vdd-0.1V
5. Buzzer Driving Current :(Vds=1/2 Vdd)				1mA
6. Buzzer Sinking Current:(Vds=1/2 Vdd)				1mA
7. Pull-high Resistor: PSW Pad			250KΩ	
8. Pull-high Resistor: TEST2, SFC, CHCF, BZSEL1, BZSEL2, STSEL1, STSEL2, SM, SFEV Pad			25KΩ	

.Function Description:

<1> Power SW: Push PSW switch to power on or power off.

<2> When power on: push the switch, a "BI" sound for 0.125 sec will be generated.

   A. The LCD display ($\boxed{188.8}$ for B-1; $\boxed{188.8}$ or $\boxed{188.8}$ for B-2) about 2 sec. If non-memory function the "M" mark will not display.

   B. After A,

   B-1. When **CHCF= VDD or Open(℃/℉ is not changeable mode by pushing switch)**:

   When the memory function is optioned (SM=VSS). The LCD displays the last measuring temperature and "M" mark about 2 sec.

   If it is selected non-memory function (SM=NC or VDD), then jump to the step C.

   B-2. When **CHCF= VSS(℃/℉ is changeable mode by pushing switch)**:

   If push switch over 2 sec, the ℃/℉ mode will be changed to another mode and only display ℃ (or ℉) until release switch. And then the LCD displays the Lo ℃ (or Lo ℉) and "M" mark about 2 sec, when the memory function is optioned (SM=VSS). Another that is selected non-memory function (SM=NC or VDD), and then jump to the step C.

   C. After B, LCD displays the self-test temperature (37.0℃/98.6℉) about 1 sec.
   The ℃/℉ mark will start to flash at the speed of 1Hz and starts to count the stable time .

   D. After C, it will start to measure temperature and the ℃/℉ mark flash at the speed of 1Hz. The LCD always displays the highest measuring temperature.

   E. If the temperature ＜ 32.0℃ (or 90.0℉), the LCD displays Lo ℃ (or Lo ℉).

   F. If the temperature ≧ 43.0℃ (or 110.0℉), the LCD displays Hi ℃ (or Hi ℉).

   G. When measuring, the LCD will always display the highest temperature.

   H. If the measure temperature does not change within the stable time, the measurement will be over and the ℃(℉) mark flash stop.

   I. When measurement is over and if the temperature ≧ 37.8 ℃ (100.0 ℉),
   the buzzer will alarm "BI—BI—BI———BI—BI—BI———" for 10 sec, as follows:
   BI—BI—BI———BI—
   BI: 0.125sec
   —: 0.125sec
   ———: 0.375sec
   If the temperature ＜ 37.8 ℃(100.0 ℉), the buzzer will alarms "BI—BI—BI—BI—" for 10 sec, as follows:
   BI—BI—
   BI: 0.5sec
   —: 0.5sec

   J. It will automatically power off after measurement is stable and the system is still on more than 8 min 40 sec (Fsys=32768Hz).

   K. When measurement is over and the beep sound is terminated, if the temperature rises within 8 min 40 sec, the measurement will start again, but the ℃ (℉) mark will not flash and the buzzer will not output also.

   L. During BI sound is on 10 sec and delay 2 sec, the temperature is not measurement.

<3> When power off: the stand-by current ≦ 1uA.

<4> Measurement to 0.1 degree at ℃ or ℉.

<5> Sensor use 503ET.

<6> Reference resistor is the value sensor in 37.0 ℃.

<7> When battery voltage is low, the battery mark "🔋" will flash at the speed of 1Hz.

And the measurement maybe not accurate, it means thermometer must be changed battery.

The low voltage detect: 1.35 ±0.05V.

<8> When TEST2 pin is connected to VSS, the LCD will display the real-time value not the highest value,

in order to adjust the reference resistance RF during the process of producing.

The LCD can be up or down changed, not always display the highest value.

<9> When sensor circuit detect error, LCD only display "Err", it will not measure normally until the error

status cancel.

<10> The frequency of buzzer is selected by BZSEL1 and BZSEL2 pads option.

Buzzer frequency	BZSEL1	BZSEL2
8.0KHz	VDD or Open	VDD or Open
6.4KHz	VSS	VDD or Open
5.3KHz	VDD or Open	VSS
4.0KHz	VSS	VSS

<11> The 4 kinds of stable time are 4 sec, 8 sec, 16 sec and 32 sec to be selected by STSEL1

and STSEL2 pads option.

Stable Time	STSEL1	STSEL2
16 sec	VDD or Open	VDD or Open
4 sec	VSS	VDD or Open
8 sec	VDD or Open	VSS
32 sec	VSS	VSS

<12> ℃/℉ power on initial function is used SFC pad option.

Mode	SFC
℃	VDD or Open
℉	VSS

<13> ℃/℉ changeable or not changeable mode is used CHCF pad option.

	CHCF
Not changeable mode	VDD or Open
Changeable mode	VSS

<14> Memory function is used SM pad option.

	SM
Non-memory function	VDD or Open
With memory function	VSS

<15> Fever function is used SFEV pad option.

	SFEV
With fever function	VDD or Open
Non-fever function	VSS

<16> Thermometer others character is below:

temperature range	32.0℃ ~ 42.9℃	90.0℉ ~ 109.9℉
accuracy	±0.1 ℃	±0.2 ℉
resolution	0.1 ℃	0.1 ℉

.LCD pattern
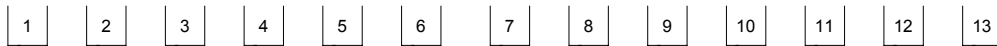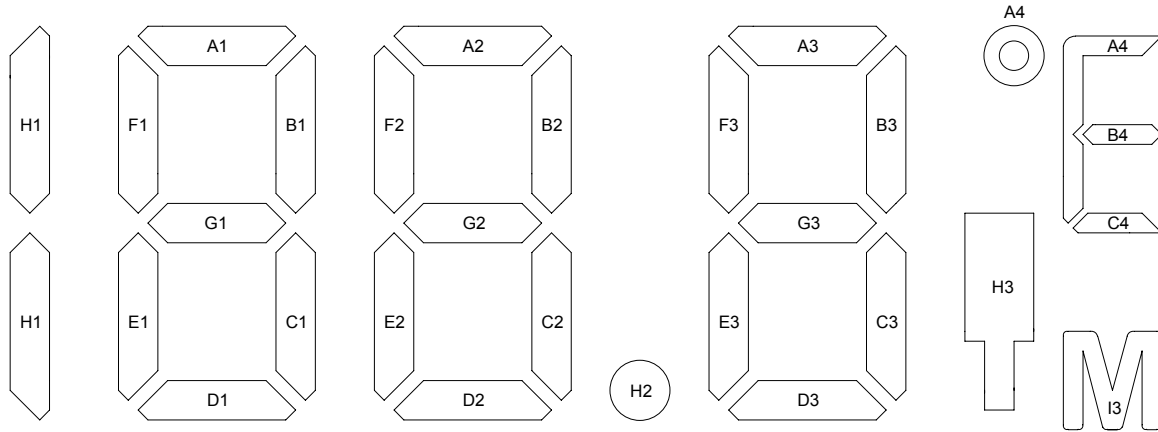
TTP301 PIN NAME	COM1	COM2	COM3	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
	1	2	3	4	5	6	7	8	9	10	11	12	13
COM1	COM1			F1	A1	B1	F2	A2	B2	F3	A3	B3	A4
COM2		COM2		E1	G1	C1	E2	G2	C2	E3	G3	C3	B4
COM3			COM3	H1	D1			D2	H2	I 3	D3	H3	C4

SPEC : A . 1/3 DUTY , 1/2 BIAS . (LCD USES 3 V)

　　　　　B . V_{TH} = 1.5 V

.Application Circuit

TTP301 APPLICATION CIRCUIT
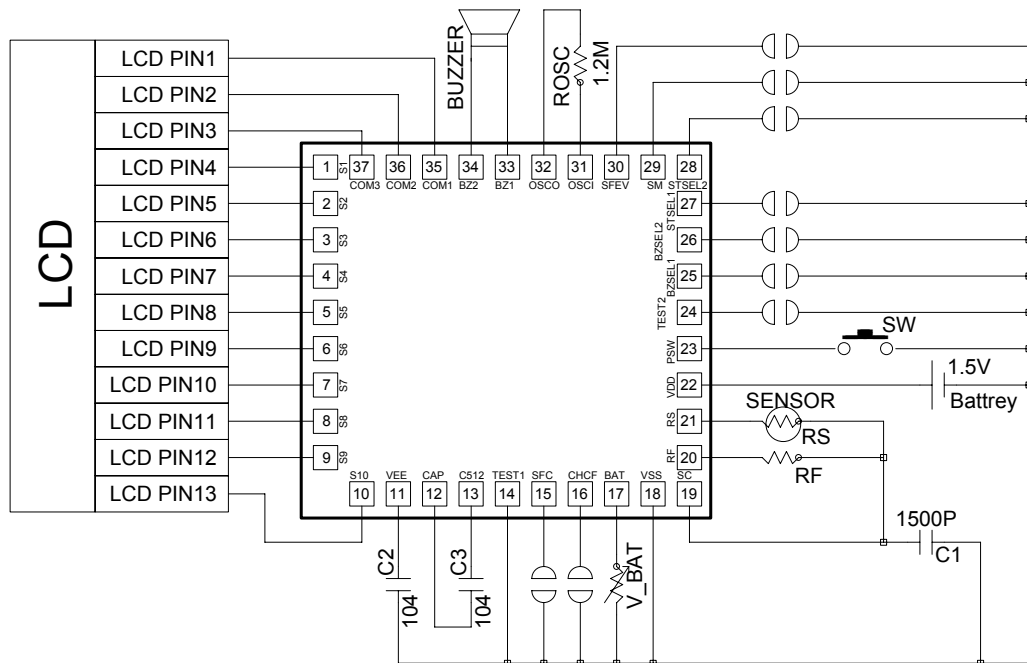
REMARK:

1. Sensor use ET-503 sensor.
2. RF is selected according to sensor type, RF resistor is the value of sensor ET-530 in 37.0℃.
3. About the PCB layout, recommends to do according to following methods.
   - 3-1 The ROSC device should be located near the TTP301 IC's OSCI and OSCO pins.
   - 3-2 The lines of SC,RF,RS do not parallel and near with the lines of OSCI,OSCO. The space between lines of SC,RF,RS and other lines must be large as far as.
4. Option table:

SFC PAD	℃/℉ MODE
VDD or Open	℃ Mode
VSS	℉ Mode

CHCF PAD	℃/℉ MODE
VDD or Open	Not Changeable Mode
VSS	Changeable Mode

BZSEL1 PAD	BZSEL2 PAD	Buzzer Frequency
VDD or Open	VDD or Open	8.0KHz
VSS	VDD or Open	6.4KHz
VDD or Open	VSS	5.3KHz
VSS	VSS	4.0KHz

STSEL1 PAD	STSEL2 PAD	Stable Time
VDD or Open	VDD or Open	16sec
VSS	VDD or Open	4sec
VDD or Open	VSS	8sec
VSS	VSS	32sec

SM PAD	VDD or Open	VSS
Function	Non-Memory	With Memory

SFEV PAD	VDD or Open	VSS
Function	With Fever	Non-Fevel

.PAD Location

TCP301 PAD'S DIAGRAM
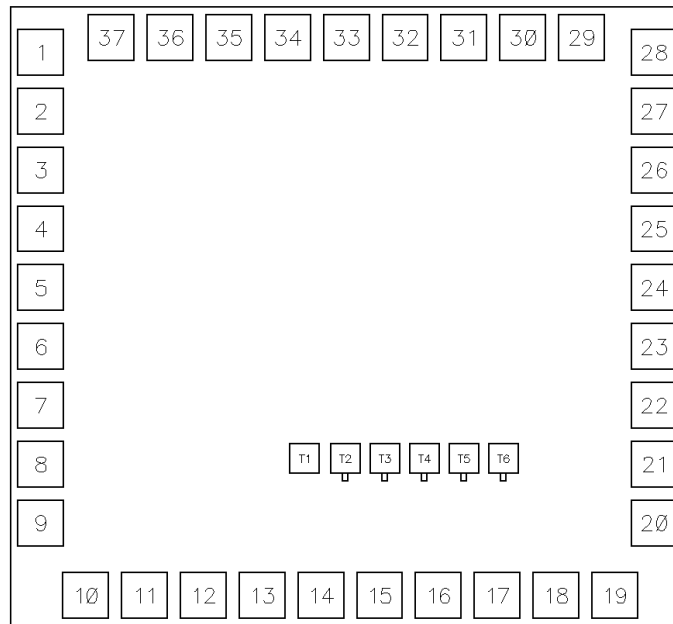
CHIP SIZE = 1410 X 1300 um^2
SUBSTRATE floating (recommend) or VSS

PAD'S COORDINATE

Pad No.	Pad Name	X	Y	Pad No.	Pad Name	X	Y
1	S1	-605.00	520.80	20	RF	605.00	-407.20
2	S2	-605.00	404.80	21	RS	605.00	-291.20
3	S3	-605.00	288.80	22	VDD	605.00	-175.20
4	S4	-605.00	172.80	23	PSW	605.00	-59.20
5	S5	-605.00	56.80	24	TEST2	605.00	56.80
6	S6	-605.00	-59.20	25	BZSEL1	605.00	172.80
7	S7	-605.00	-175.20	26	BZSEL2	605.00	288.80
8	S8	-605.00	-291.20	27	STSEL1	605.00	404.80
9	S9	-605.00	-407.20	28	STSEL2	605.00	520.80
10	S10	-516.60	-550.00	29	SM	462.05	550.00
11	VEE	-400.60	-550.00	30	SFEV	346.05	550.00
12	CAP	-284.60	-550.00	31	OSCI	230.05	550.00
13	C512	-168.60	-550.00	32	OSCO	114.05	550.00
14	TEST1	-52.60	-550.00	33	BZ1	-1.95	550.00
15	SFC	63.40	-550.00	34	BZ2	-117.95	550.00
16	CHCF	179.40	-550.00	35	COM1	-233.95	550.00
17	BAT	295.40	-550.00	36	COM2	-349.95	550.00
18	VSS	411.40	-550.00	37	COM3	-465.95	550.00
19	SC	527.40	-550.00				

.Function Flow Chart:

```
                        ┌─────────────────┐
                        │    Power On      │ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─  Push PSW Switch
                        └─────────────────┘
                                 │
                        ┌─────────────────────┐
                        │ Display All Segments │ ─ ─ ─ ─ ─ ─ ─ ─   2 SEC
                        └─────────────────────┘
                                 │
                        ╱─────────────────────╲
              YES      ╱   Is change mode enable? ╲
        ┌─────────────     And, is it push PSW
        │             ╲   switch over 2sec?      ╱
        │              ╲─────────────────────── ╱
        │                        │ NO
  ┌──────────────────────┐
  │ ℃/℉ Mode change and  │      ╱─────────────────╲        NO
  │ only Display ℃/℉ mark│     ╱  Has it memory     ╲ ─────────────┐
  └──────────────────────┘     ╲  function?        ╱              │
        Release PSW Switch ──────╲─────────────────╱               │
                                        │ YES                      │
                        ┌─────────────────────────┐                │
                        │ Display Memory value     │ ─ ─ ─ ─ ─ ─ ─  2 SEC
                        │ and "M" mark             │                │
                        └─────────────────────────┘                │
                                        │←───────────────────────────┘
                        ┌─────────────────────────┐
                        │ Display 37.0℃/98.6℉ and │ ─ ─ ─ ─ ─ ─ ─  1 SEC
                        │ ℃/℉ mark start to flash 1Hz│
                        └─────────────────────────┘
                                        │←──────────────────────────────┐
   Value<32.0℃(90.0℉)       ╱─────────────────────╲   Value≧43.0℃(110.0℉) │
        ┌──────────────────╱  Measure Temperature.  ╲──────────────────┐  │
        │                  ╲  The ℃/℉ mark flashes   ╱                  │  │
        │                  ╲  1Hz before first stable.╱                  │  │
        │                   ╲─────────────────────╱                     │  │
        ▼                            ▼                                   ▼  │
  ┌──────────────┐      ┌─────────────────────────┐      ┌──────────────┐  │
  │ Display Lo ℃/℉│      │ Display the Highest Value │      │ Display Hi ℃/℉│  │
  └──────────────┘      └─────────────────────────┘      └──────────────┘  │
        └────────────────────────│────────────────────────────┘            │
                        ╱─────────────────────╲                            │
                       ╱  Display Temperature    ╲        NO                 │
                       ╲  not Change more than    ╱ ─────────────────────────┘
                       ╲  the stable-time?       ╱
                        ╲─────────────────────╱
                                 │ YES
                        ┌─────────────────────────┐
                        │ Alarm 10sec              │
                        │ And ℃/℉ mark stops flash │
                        └─────────────────────────┘
                                 │
                        ┌──────────────────────────────┐
                        │ Start to count the Auto-Off-Time 8m│
                        │ 40s. If temperature rises within time,│←──┐
                        │ then it updates the LCD display │       │
                        └──────────────────────────────┘        │
                                 │                               │
                        ╱─────────────────╲          NO           │
                       ╱   Time is over?    ╲ ─────────────────────┘
                        ╲─────────────────╱
                                 │ YES
                        ┌─────────────────┐
                        │   Power Off      │ ─ ─ ─ ─ ─ ─  Or Push PSW Switch Again
                        └─────────────────┘
```

.Order Information

    a. Package form: No support
    b. Chip form: TCP301
    c. Wafer base: TDP301

.Revise History

1. 2010/09/15
   -Original version：V_1.0
2. 2011/09/19 => V_1.1
   -Change the page 7, describes as follows：
   A. The LCD display (100.0℃M for B-1; 100.0℃M or 100.0℉M for B-2) about 2 sec. If non-memory function
   the 〝M〞mark will not display.
3. 2014/06/05 => V_1.2
   -Change the page 10 remark describes.