



1.General Descriptions

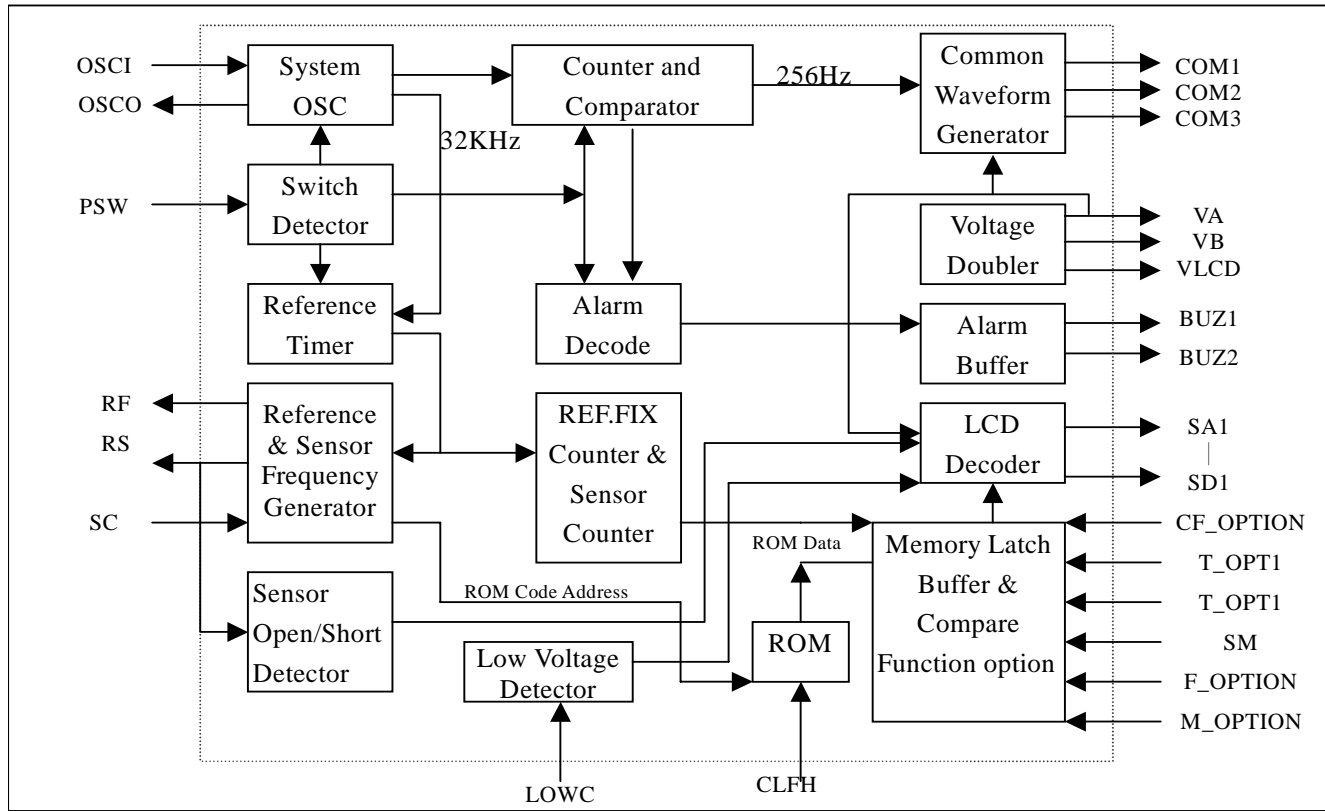
DL7017 is a CMOS digital clinical thermometer IC for measuring body temperature in Centigrade($^{\circ}\text{C}$) or Fahrenheit($^{\circ}\text{F}$) mode by its bonding option or by switch option. It also provides alarm and auto power off functions. The other electronic components are LCD display, thermistor, 1.5V battery, ON/OFF switch, buzzer, resistors and capacitors.

2.Features

- ◆ Single 1.5V battery operation.
- ◆ Single-chip CMOS construction.
- ◆ Centigrade or Fahrenheit measurement can be selected by bonding option or switch option.
- ◆ Measurement range:
While DL7017-1 / DL7017-2/DL7017-4, $+32.0 \sim +41.9^{\circ}\text{C}$ ($+90 \sim +107.9^{\circ}\text{F}$)
While DL7017-3, $+32.0 \sim +43.9^{\circ}\text{C}$ ($+90 \sim +111.9^{\circ}\text{F}$)
- ◆ 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 power ON/OFF.
- ◆ Highest temperature held.
- ◆ Auto power off after 8 min 40 sec (DL7017-1) or 10 min (DL7017-2/-3/-4).
- ◆ Display the last measured temperature.



3.Function Block Diagram



4.Function Descriptions

4.1 While DL7017-1

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

<2> when power on:

- A. The LCD display 188.8°C (or 188.8°F) about 2 sec.
- B. After A, show the temperature of last measured about 2 sec.
- C. After B, Show L $^{\circ}\text{C}$ (or $^{\circ}\text{F}$) about 1 sec.
- D. After C, when it is measuring. The $^{\circ}\text{C}$ (or $^{\circ}\text{F}$) will flash at the speed of 1 Hz.
- E. If the temperature $< 32.0^{\circ}\text{C}$ (90°F), then display L $^{\circ}\text{C}$ ($^{\circ}\text{F}$).
- F. If the temperature $> \text{or} = 42.0^{\circ}\text{C}$ (108°F), then display H $^{\circ}\text{C}$ ($^{\circ}\text{F}$).
- G. When measuring, the LCD will always display the highest temperature.
- H. If the first measured temperature doesn't rise again, the measurement will not be over and it will auto power off in 3 minutes; Or from the



second time's measurement, if the temperature is not changed more than 4 or 8 or 16 seconds, the measurement is over and mark °C(°F) stop flashing.

I. When measurement is over, if the temperature > 37.4 °C(99.4 °F), the buzzer alarms "Bi-Bi-Bi—— Bi-Bi-Bi——" for 4 sec, as follows:

Bi———Bi———Bi———
 0.125S 0.125S 0.125S 0.125S 0.125S 0.375S

If the temperature ≤ 37.4 °C(99.4 °F), the buzzer alarms

"Bi-Bi-Bi-Bi-" for 4 sec, as follows:

Bi———
 0 5S 0.5S

J. It will auto power off when measurement is over than 8 minutes 40 seconds.

K. When measurement is over, if the temperature rises within 8 minutes 40 seconds, then remeasure the temperature, but the °C (°F) mark will not flash again. When remeasurement is over, the buzzer will not alarm again.

<3> When push switch, buzzer will alarm "Bi" about 0.125 sec.

<4> When power off: the stand-by current ≤ 0.5uA.

<5> The frequency of the buzzer is 5.3khz.

<6> After <2>-C, if detect low voltage(1.35 ±0.05 V):

The battery mark " ■ " flashes at the speed of 1Hz and the measurement maybe not accurate, which means thermometer's battery must be changed.

<7> When TEST2 pin is floating, the LCD displays the highest value, not the real time value, in order to adjust the reference resistance R3 during the process of producing. When connected to VDD, the LCD displays the real time value.

<8> °C/°F(CLFH Pad) function is used by bonding option.

	CONNECTED TO VSS	NO CONNECT
CLFH	°C	°F

<9> Thermometer others charter is as follows:

Temperature range	32.0°C ~41.9°C	90°F ~ 107.9°F
Accuracy	±0.1 °C	±0.2 °F
Resolution	0.1 °C	0.1 °F

4.2 While DL7017-2



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

<2> When power on:

A. The LCD display 188.8°E When (T_OPT1=NC) or 188.8°M When (T_OPT1=0) about 2 sec.

B. After A, show the temperature of the last measured (and "M" When T_OPT1=0) about 2 sec.

C. After B, Show L $^{\circ}\text{C}$ (or $^{\circ}\text{F}$) about 1 sec.

D. After C, when it is measuring. The $^{\circ}\text{C}$ (or $^{\circ}\text{F}$) will flash at the speed of 1 Hz.

E. If the temperature $< 32.0^{\circ}\text{C}$ (90°F), then display L $^{\circ}\text{C}$ ($^{\circ}\text{F}$).

F. If the temperature $> \text{or} = 42.0^{\circ}\text{C}$ (108°F), then display H $^{\circ}\text{C}$ ($^{\circ}\text{F}$).

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

H. If the measured temperature is not changed more than 16 sec, the measurement is over and mark $^{\circ}\text{C}$ ($^{\circ}\text{F}$) stop flashing.

I. When measurement is over, if the temperature $> 37.4^{\circ}\text{C}$ (99.3°F), the buzzer alarms "Bi-Bi-Bi—— Bi-Bi-Bi——" for 4 sec, as follows:

Bi———Bi———Bi———

0.125S 0.125S 0.125S 0.125S 0.125S 0.375S

If the temperature $< 37.5^{\circ}\text{C}$ (99.5°F), the buzzer alarms

"Bi-Bi-Bi-Bi-" for 4 sec, as follows:

Bi———

0.5S 0.5S

J. It will auto power off when measurement is over than 10 minutes.

L. When measurement is over, if the temperature rises within 10 min, the $^{\circ}\text{C}$ ($^{\circ}\text{F}$) mark will flash again (repeat from the step of <2>-D).

<3> When push switch, buzzer will alarm "Bi" about 0.165 sec.

<4> When power off: the stand-by current $\leq 0.5 \mu\text{A}$.

<5>The frequency of the buzzer is 5.3khz,

<6> After <2>-C, if detect low voltage($1.35 \pm 0.05 \text{V}$):

A: When T_OPT1=NC:

The battery mark " \blacksquare " flashes at the speed of 1Hz and the measurement maybe not accurate, means thermometer's battery must be changed.

B: When T_OPT1=0:



The LCD display flashes at the speed of 1Hz and the measurement maybe not accurate, means thermometer's battery must be changed.

<7> When TEST2 pin is floating, the LCD displays the highest value, not the real time value, in order to adjust the reference resistance RF during the process of producing. When connected to VDD, the LCD displays the real time value.

<8> °C/°F (CLFH Pad) function is used by pad option.

	CONNECTED TO VSS	NO CONNECT
CLFH	°F	°C

<9> Thermometer's other charter is as follows:

Temperature range	32.0°C ~41.9°C	90°F ~ 107.9°F
Accuracy	±0.1 °C	±0.2 °F
Resolution	0.1 °C	0.1 °F

4.3 While DL7017-3

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

<2> when power on:

- A. The LCD display 100.0°C (or 100.0°F) about 2 sec. If non-memory function the "M" will not display.
- B. After A, with memory function push switch more than 2 sec, LCD will display the stable-temperature of last measure, and "M" will display.
- C. After B, LCD displays 36.5°C (97.7°F) about 1 sec.
- D. After C, when it is measuring. The °C (or °F) will flash at the speed of 1HZ.
- E. With memory function, the stable-temperature time will be counted after releasing switch for 8 sec. Without memory function, the stable-temperature time will be counted after turning on for 8sec.
- F. If the temperature < 32.0°C (90°F), then display L °C (°F).
- G. If the temperature > or = 44.0°C (112°F), then display H °C (°F).
- H. When measuring, the LCD will always display the highest temperature.
- I. If the measured temperature is not changed more than 16 or 32 sec, the measurement is over and the mark °C (°F) stops flashing.
- J. When measurement is over, if the temperature > 37.5°C (99.5°F), The buzzer alarms "Bi-Bi-Bi——Bi-Bi-Bi——" for 4 sec, as follows:
Bi———Bi———Bi———



0.125S 0.125S 0.125S 0.125S 0.125S 0.375S

If the temperature ≤ 37.5 °C (99.5 °F), the buzzer alarms "Bi-Bi-Bi-Bi-" for 4 sec, as follows:

Bi—————
0.5S 0.5S

K. It will auto power off when measurement is over than 10 minutes.

L. When measurement is over, if the temperature rises within 10 minutes, then remeasure the temperature, but the °C (°F) mark will not flash again. When remeasurement is over, the buzzer will not alarm again.

<3> When push switch, buzzer will alarm "Bi" about 0.125 sec.

<4> When power off: the stand-by current ≤ 0.5 uA.

<5> The frequency of the buzzer is 5.3khz.

<6> After <2>-C, if detect low voltage (1.35 \pm 0.05 V), the LCD will only display battery mark" ■ " and the measurement maybe not accurate, means thermometer must be changed battery.

<7> When sensor circuit detect error, LCD only display "E", it will not measure normally until the error status is cancelled.

<8> When TEST2 pin is floating, the LCD displays the highest value, not the real time value, in order to adjust the reference resistance RF during the process of producing. When connected to VDD, the LCD displays the real time value.

<9> Memory (SM Pad) and °C/°F(CLFH Pad) function is used by pad option.

	CONNECTED TO VSS	NO CONNECT
CLFH	°F	°C
SM	NO MEMORY FUNCTION	MEMORY FUNCTION

<10> THERMOMETER'S OTHER CHARTER IS AS FOLLOWS:

TEMPERATURE RANGE	32.0°C ~43.9°C	90°F ~ 111.9°F
ACCURANCY	± 0.1 °C	± 0.2 °F
RESOLUTION	0.1 °C	0.1 °F

4.4 While DL7017-4

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

<2> When power on:



- A. The LCD display $\overline{\text{100.0}}^{\text{E}}$ When (T_OPT1=NC) or $\overline{\text{100.0}}^{\text{E}}_{\text{M}}$ When (T_OPT1=0) about 2 sec.
- B. After A, show the temperature of the last measured (and "M" When T_OPT1=0) about 2 sec.
- C. After B, Show 37.0°C (or 98.6 °F) about 1 sec.
- D. After C, when it is measuring. The °C (or °F) will flash at the speed of 1 Hz.
- E. If the temperature < 32.0 °C (90 °F), then display L0 °C (°F).
- F. If the temperature >or = 42.0 °C (108 °F), then display H I°C (°F).
- G. When measuring, the LCD will always display the highest temperature.
- H. If the measured temperature is not changed more than 16, the measurement is over and mark °C (°F) stop flashing.
- I. When measurement is over, if the temperature > 37.5 °C (99.5 °F), the buzzer alarms "Bi-Bi-Bi—— Bi-Bi-Bi——" for 4 sec, as follows:

Bi—————Bi—————Bi—————
0.125S 0.125S 0.125S 0.125S 0.125S 0.375S
If the temperature ≤ 37.5 °C (99.5 °F), the buzzer alarms
"Bi-Bi-Bi-Bi-" for 4 sec, as follows:
Bi—————
0.5S 0.5S

- J. It will auto power off when measurement is over than 10 minutes.
- L. When measurement is over, if the temperature rises within 10 min, the °C (°F) mark will flash again (repeat from the step of <2>-D).
- <3> When push switch, buzzer will alarm "Bi" about 0.125 sec.
- <4> When power off: the stand-by current ≤ 0.5 uA.
- <5> The frequency of the buzzer is 5.3khz.
- <6> After <2>-C, if detect low voltage(1.35 ±0.05 V):

A: When T_OPT1=NC:

The battery mark "▲" flashes at the speed of 1Hz and the measurement maybe not accurate, means thermometer's battery must be changed.

B: When T_OPT1=0:

The LCD display flashes at the speed of 1Hz and the measurement maybe not accurate, means thermometer's battery must be changed.

<7> When TEST2 pin is floating, the LCD displays the highest value, not the real time value, in order to adjust the reference resistance RF during the process of producing.

When connected to VDD, the LCD displays the real time value.

<8> °C/°F (CLFH Pad) function is used by pad option.

	CONNECTED TO VSS	NO CONNECT
CLFH	°F	°C

<9> Thermometer's other charter is as follows:

Temperature range	32.0°C ~41.9°C	90°F ~ 107.9°F
Accuracy	±0.1 °C	±0.2 °F
Resolution	0.1 °C	0.1 °F



5.Pin Descriptions

Pin	Name	I/O	Function
1	SC	I	Reference and sensor frequency input pad. The reference & sensor frequency generator consists of pad 1,3,4.
2	RF	O	PMOS open drain, connected to the reference resistance.
3	RS	O	PMOS open drain, connected to the sensor.
4	M_OPTION	I	Listed as tables above.
5	TEST1	I	Test pad, for IC internal test only.
6	OSCI	I	System frequency input pad.
7	OSCO	O	System frequency output pad.
8	BUZ1	O	Output pad, the buffer of buzzer.
9	BUZ2	O	Output pad, the buffer of buzzer.
10~12	COM1~COM3	O	LCD backplane drive, 3-level voltage out
13~15	SA1~SA3	O	LCD segment drive



16~18	SB1~SB3	O	LCD segment drive
19~21	SC1~SC3	O	LCD segment drive
22	SD1	O	LCD segment drive
23	VA	O	Doublers voltage 3V capacitor connects.
24	VB	O	Doublers voltage 3V capacitor connects.
25	VLCD	O	The voltage is 3V.
26	VDD	I	1.5V
27	CF_OPTION	I	Listed as tables above.
28	TEST2	I	Pull-low test pad, for the test of production. When floating, LCD displays the highest value; When connected to VDD, the LCD displays the real-time value (not the highest value).
29	PSW		Pull-low input pad, push switch to power on or power off.
30	T_OPT1	I	While DL7017-1, stable time option function with T_OPT2 While DL7017-2/-4 No connect: No connect: While detecting low voltage, the battery mark will blink at the speed of 1Hz; Connected to GND: While detecting low voltage, LCD displays will blink at the speed of 1Hz. While DL7017-3, don't care.



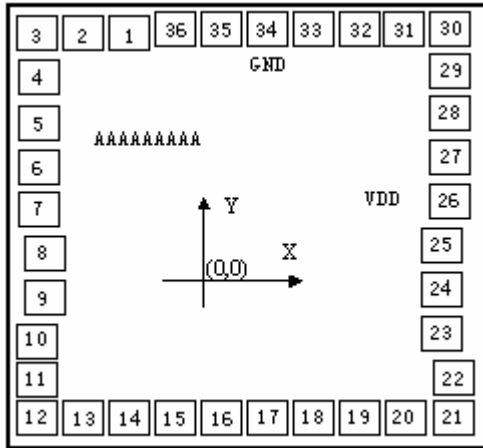
31	T_OPT2	I	While DL7017-1, stable time option function with T_OPT1.												
			<table border="1"> <tr> <td>T_OPT1</td> <td>T_OPT2</td> <td>Stable Time</td> </tr> <tr> <td>Floating</td> <td>Floating</td> <td>16s</td> </tr> <tr> <td>GND</td> <td>Floating</td> <td>8s</td> </tr> <tr> <td>Floating</td> <td>GND</td> <td>4s</td> </tr> </table>	T_OPT1	T_OPT2	Stable Time	Floating	Floating	16s	GND	Floating	8s	Floating	GND	4s
			T_OPT1	T_OPT2	Stable Time										
			Floating	Floating	16s										
GND	Floating	8s													
Floating	GND	4s													
While DL7017-2/-3/-4, don't care.															
32	LOWC	I	For the low voltage detecting.												
33	SM	I/O	While DL7017-1 &DL7017-2&DL7017-4, don't care. While DL7017-3, Connected to VDD: memory function; Connected to VSS: no memory function.												
34	GND	I	Power supply GND												
35	CLFH	I	While DL7017-1 and CF_OPTION Floating, No connect: show °F; Connected to VSS: show °C. While DL7017-2/-3/-4 No connect: show °C; Connected to VSS: show °F.												
36	F_OPTION	I	Listed as tables above.												

F_OPTION	CF_OPTION	M_OPTION	Function
Floating	Don't care	Floating	DL7017-1
GND	Floating	Floating	DL7017-2
	VDD	Floating	DL7017-3
GND	Don't care	GND	DL7017-4

F_OPTION	CF_OPTION	
Floating	Floating	Opts °C or °F by CLFH
GND	Don't care	Opts °C or °F by CLFH



6. Pad Diagram



Chip Size: (1160 μ m *1220 μ m)

Note: The substrate must be connected to VSS or floating

PAD LOCATION

PROJECT:	CH2115S	TOPCELL:	CH2115S
NO.	PADNAME	X	Y
1	SC	-283	510
2	RF	-395	510
3	RS	-505	510
4	CHG	-505	380
5	TEST1	-505	270
6	OSCI	-505	160
7	OSCO	-505	50
8	BUZ1	-462	-75
9	BUZ2	-462	-192
10	COM1	-505	-309
11	COM2	-505	-422
12	COM3	-505	-535
13	SA1	-376	-535

PROCESS:	CSMC0.5	DATE:	2008/09/04
NO.	PADNAME	X	Y
19	SC1	284	-535
20	SC2	395	-535
21	SC3	505	-535
22	SD1	505	-410
23	VA	484	-257
24	VB	488	-130
25	VLCD	488	-20
26	VDD	505	95
27	CF_OPTION	505	205
28	TEST2	505	315
29	PSW	505	425
30	T_OPT1	505	535
31	T_OPT2	380	535



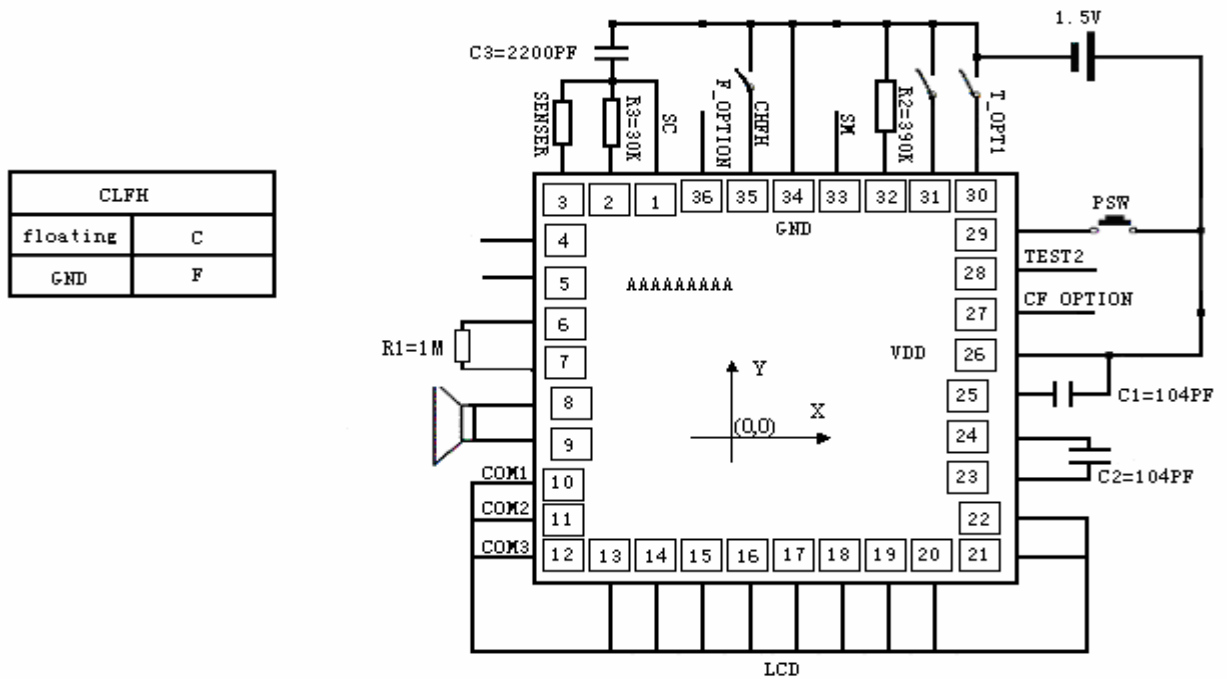
14	SA2	-266	-535
15	SA3	-156	-535
16	SB1	-46	-535
17	SB2	65	-535
18	SB3	175	-535

32	LOWC	270	535
33	SM	160	535
34	GND	50	535
35	CLFH	-60	535
36	F_OPTION	-170	535

7.Application Circuit

7.1 Application 1(DL7017-1)

1). Option °C or °F measurement by bonding option CLFH(°C bond to GND & °F floating)

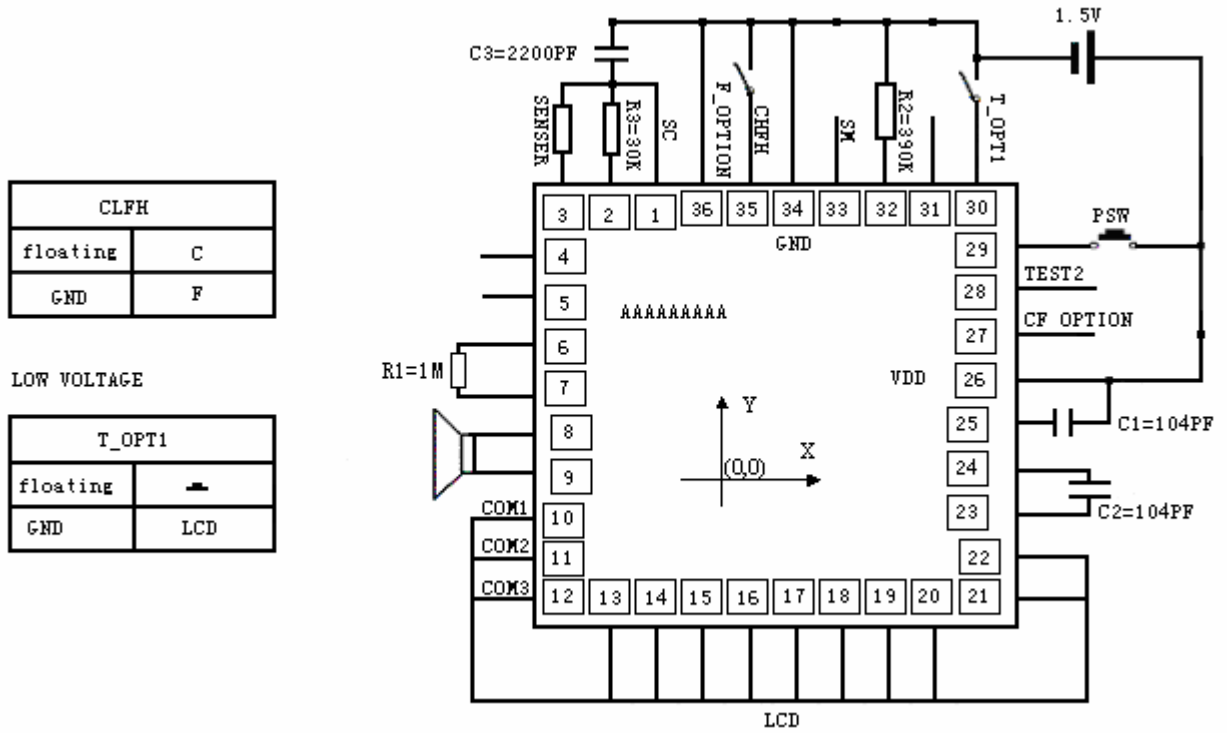


Note: The value of R1, R2, C1 C2 is allowed the tolerance of ±5%.

The value of RF=30kΩ, which is allowed the tolerance E of ±1%.

The RS is Sensor (503ET).

7.2 Application 2(DL7017-2)

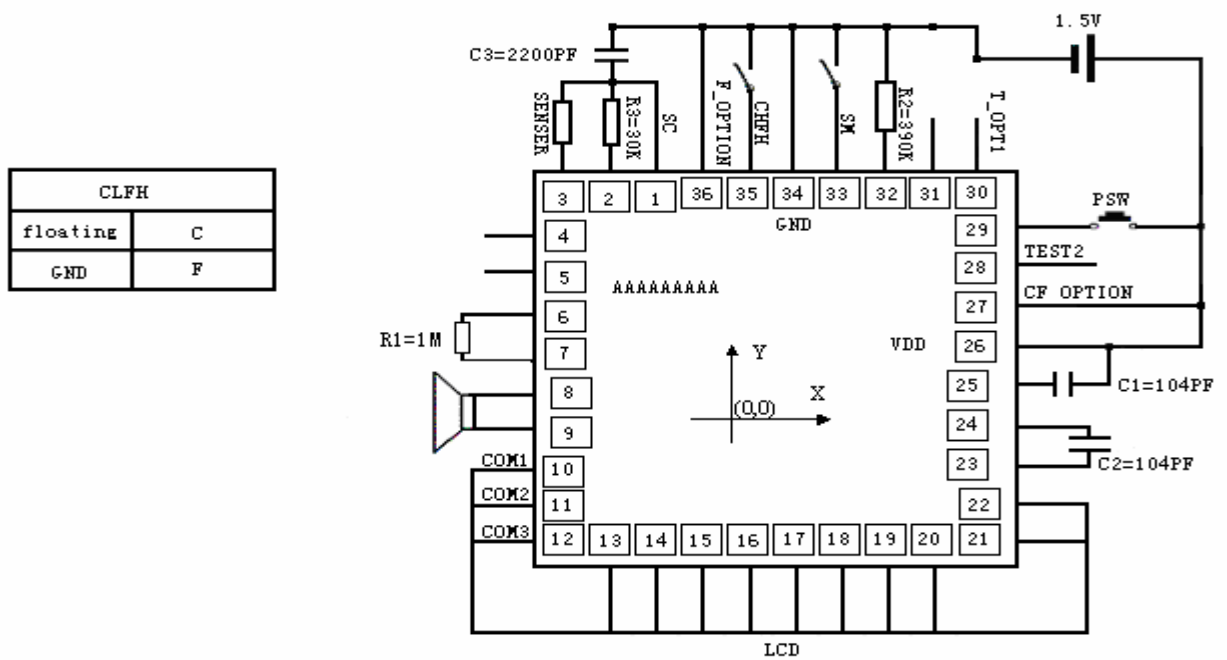


Note: The value of R1, R2, C1 C2 is allowed the tolerance of $\pm 5\%$.

The value of $R_F=30k\Omega$, which is allowed the tolerance E of $\pm 1\%$.

The RS is Sensor (503ET).

7.3 Application 2(DL7017-3)



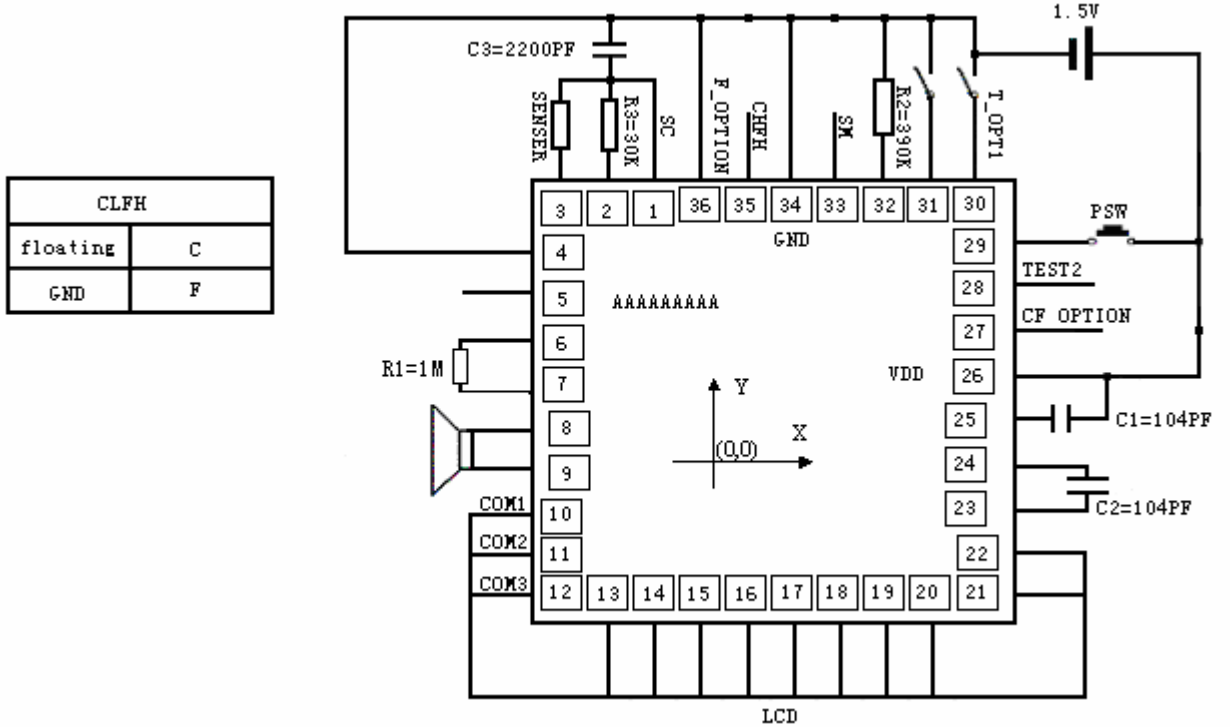
Note: The value of R1, R2, C1 C2 is allowed the tolerance of $\pm 5\%$.



The value of $R_F=30k\Omega$, which is allowed the tolerance E of $\pm 1\%$.

The RS is Sensor (503ET).

7.4 Application 2(DL7017-4)



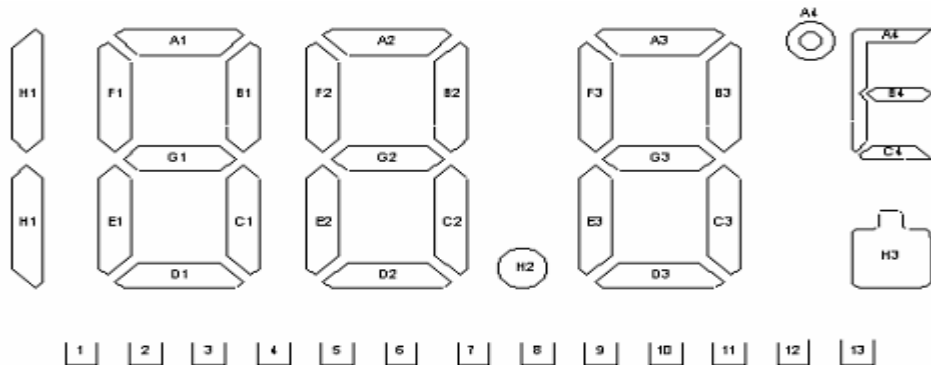
Note: The value of R_1, R_2, C_1, C_2 is allowed the tolerance of $\pm 5\%$.

The value of $R_F=30k\Omega$, which is allowed the tolerance E of $\pm 1\%$.

The RS is Sensor (503ET).

8.LCD Electrode Pattern

8.1 CH2115S-2/-4, T_OPT1 Pad: no connect (LCD-1)





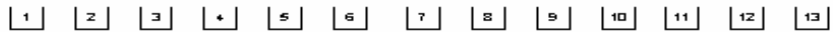
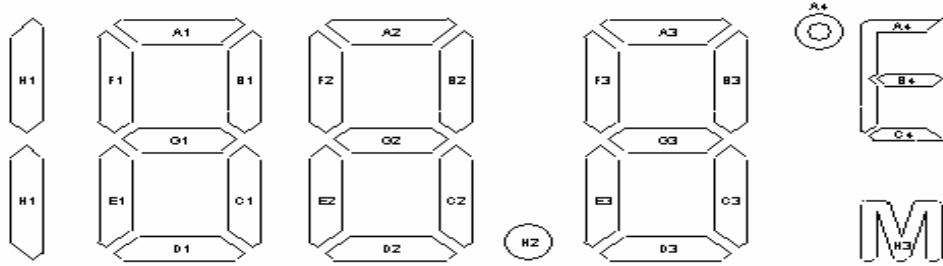
LCD SPEC:

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

B. VTN=1.5V

	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	I3	D3	H3	C4

8.2 DL7017-2/-4, T_OPT1 Pad: connected to VSS (LCD-2)



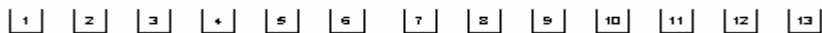
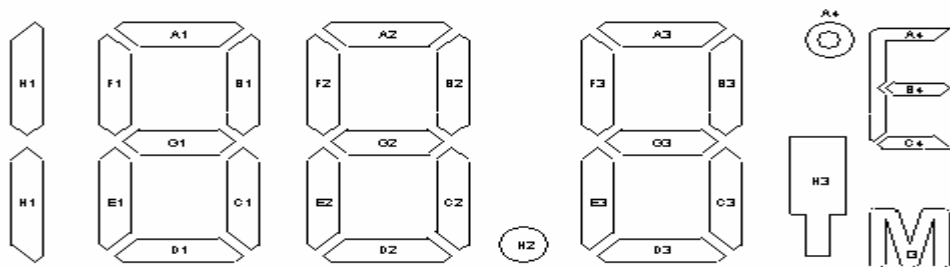
LCD SPEC:

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

B. VTN=1.5V

	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	I3	D3	H3	C4

8.3 DL7017-1/-3



LCD SPEC:



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

B. VTN=1.5V

	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	I3	D3	H3	C4

9. Absolute Maximum Ratings

(All voltage referenced to GND)

Item	Symbol	Rating	Unit
Supply Voltage	VDD	0~1.65	V
Input / Output Voltage	VI/VO	GND-0.3 ~ VDD+0.3	V
Operating Temperature	TDD	0 ~ +75	°C
Storage Temperature	TST	-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.

10. Electrical Characteristic

(All voltage referenced to GND, Ambient temperature=25°C, VDD=1.5V)

Parameters	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating Voltage	VDD		1.3	1.5	1.65	V
Operating Average Current	IDD	VDD=1.5V unload	--	45	60	μA
Stand-by Current	ISTB	VDD=1.65V	0	--	0.5	μA
Oscillation Frequency	FOSC	ROSC=1M	31	33	35	KHz
Input Voltage	VIL		VSS-0.3 V			V
	VIH				VDD+0.3 V	V



Output Voltage	VOL		VSS-0.1			V
	VOH				VDD+0.1	V
Buzzer Driving Current	IDRIVE	VDD=1.5V			4.5	mA
Buzzer Sinking Current	ISINK	VDD=1.5V			10	mA

12. Notices

1. The information contained herein could be changed without notice owing to product and /or technical improvements. Please make sure before using the product that the information you are referring to is up-to-date.

2. No responsibility is assumed by us for any consequence resulting from any wrong or improper operation, etc. of the product.