

DL927 4-DIGIT COUNTDOWN/UP TIMER

1. General Descriptions

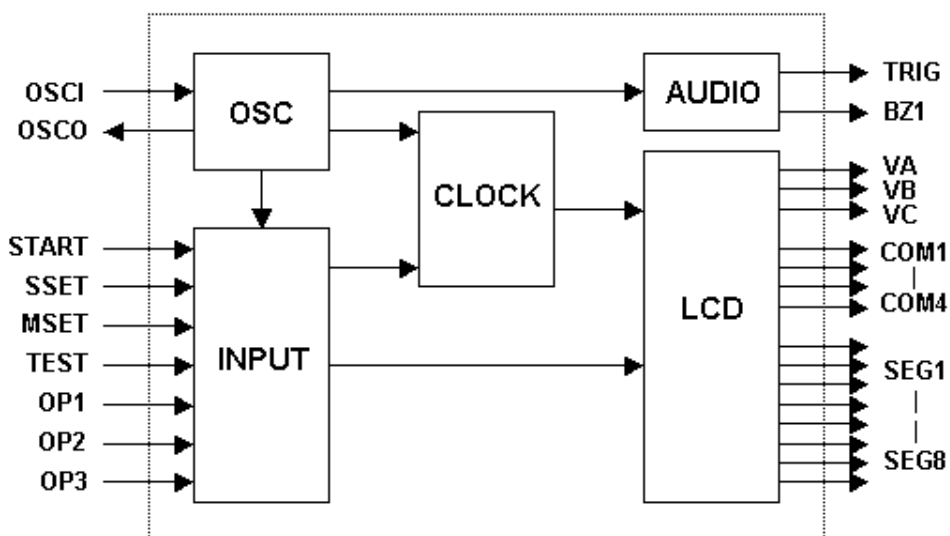
DL927 is an UP/DOWN timer IC. It can directly drive a standard 4 digit 1/4 duty cycle

LCD. Maximum countdown time is 59:59 or 99:59. Count up cycle time is 60 or 100 minutes by bonding option. Also bonding option is for alarm time 32 or 64 seconds, 2kHz, and up/down or just down function. Feasible input options and universal functions give this chip many uses such as parking alarm timer, pillbox timer, kitchen timer, etc.

2. Features

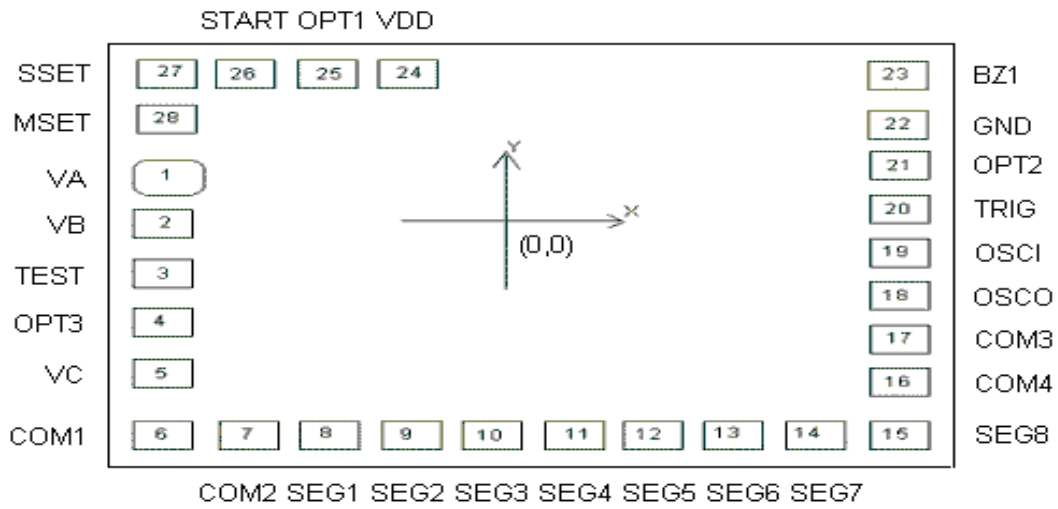
- ◆ Special alarm trigger output for switch control or for driving another melody IC
- ◆ Internal voltage doubler
- ◆ 32,768Hz quartz crystal time base
- ◆ Single 1.5V battery operation
- ◆ Direct drive buzzer
- ◆ 4 digit LCD display
- ◆ Maximum count 59:59 min or 99:59 min (bonding option)
- ◆ Just count-down timer repeat function by bonding option
- ◆ Minutes and Seconds set independently
- ◆ Timer reset when depressing MSET and SSET simultaneously
- ◆ Alarm sound 2kHz, 32 or 64 seconds (bonding option)

3. Function Block Diagram



4. Pad Diagram

(Unit:um)



Chip Size (1370*1690)

Notice: The substrate must be connected to VDD

No.	Name	X	Y	No.	Name	X	Y
1	VA	-587	285	15	SEG8	587	-748
2	VB	-587	86	16	COM4	587	-505
3	TEST	-587	-104	17	COM3	587	-375
4	OPT3	-587	-234	18	OSCO	587	-228
5	VC	-587	-423	19	OSCI	587	-98
6	COM1	-583	-748	20	TRIG	587	95
7	COM2	-453	-748	21	OPT2	587	295
8	SEG1	-323	-748	22	GND	587	486
9	SEG2	-193	-748	23	BZ1	587	746
10	SEG3	-63	-748	24	VDD	-137	742
11	SEG4	67	-748	25	OPT1	-267	742
12	SEG5	197	-748	26	STRART	-457	746
13	SEG6	327	-748	27	SSET	-587	746
14	SEG7	457	-748	28	MSET	-587	536

5. Pin Descriptions

NO.	Name	I/O	Function
1	VDD	P	Power pins for positive power supply
2	OSCI	I	Oscillator Input
3	OSCO	O	Oscillator Output
4	GND	P	Ground
5	VC	O	voltage doubler supply for LCD driving
6	SSET	I	Second Setting Input
7	MSET	I	Minute Setting Input
8	START/STOP	I	Start or Stop Input
9	BZ1	O	Alarm Output
10	TRIG	O	Trigger Output
11	VA & VB	O	Voltage Doubler Capacitor
12	SEG1 – SEG8	O	LCD Segments Driving Pins
13	COM1 – COM4	O	LCD Backplane Pins
14	TEST	I	Test Input Pins
15	OPT1	I	Bonding option for alarm time
16	OPT2	I	Bonding option for up/down or input down
17	OPT3	I	Bonding option for maximum count

6. Functional Description

6.1 Countdown Timer Mode

6.1.1 After power-on, LCD will display 00:00.

6.1.2 Time is set by the SSET and MSET pins. Time setting is only effective in this mode and the timer must be in the stop or reset state. Each depression of these pins will make the timer count advance one digit and if it is depressed more than one second, the timer will count one digit for every 1/8 second. The second and minute setting are independent. Colon will be on but not flash during the setting.

6.1.3 The timer will reset to 00:00, if SSET and MSET are depressed simultaneously.

6.1.4 After the time has been set, triggering the START/STOP pin will start the timer and colon will begin to flash (0.5 sec on, 0.5 sec off).

6.1.5 When the timer is counting, it will be stopped by triggering off any key pin. When the timer is stopped by pressing MSET or SSET key, the preset time will be the time of last pressing one of this keys. In this stop state, the colon will be on, but not flash. The timer can also be set during this state. An additional trigger to START/STOP will terminate this state and start to count from the time which it displays.

6.1.6 When countdown time is reached, the LCD displays 00:00 and the colon will be on but not flash. At this moment, BZ1 will send out a 2048 x 8 x 1Hz signal for 32 second (or 64 sec by

bonding option). During this alarm period, depress any pin will stop the output.

6.1.7 When the countdown timer reaches zero and the alarm signal ends (32 or 64 sec), the LCD will be returned to preset time. If alarm signal is stopped by depressing START/STOP, the LCD will be returned to preset time. If alarm is stopped by the SSET or MSET pin, the LCD displays 00:00 and then depressing START/STOP pin will be returned the LCD to preset time.

6.2 Countup Timer Mode

6.2.1 The count-up timer will be triggering START/STOP start only when the chip has been reset and powered on without a set time. The countup timer will start by triggering Start/Stop after reset.

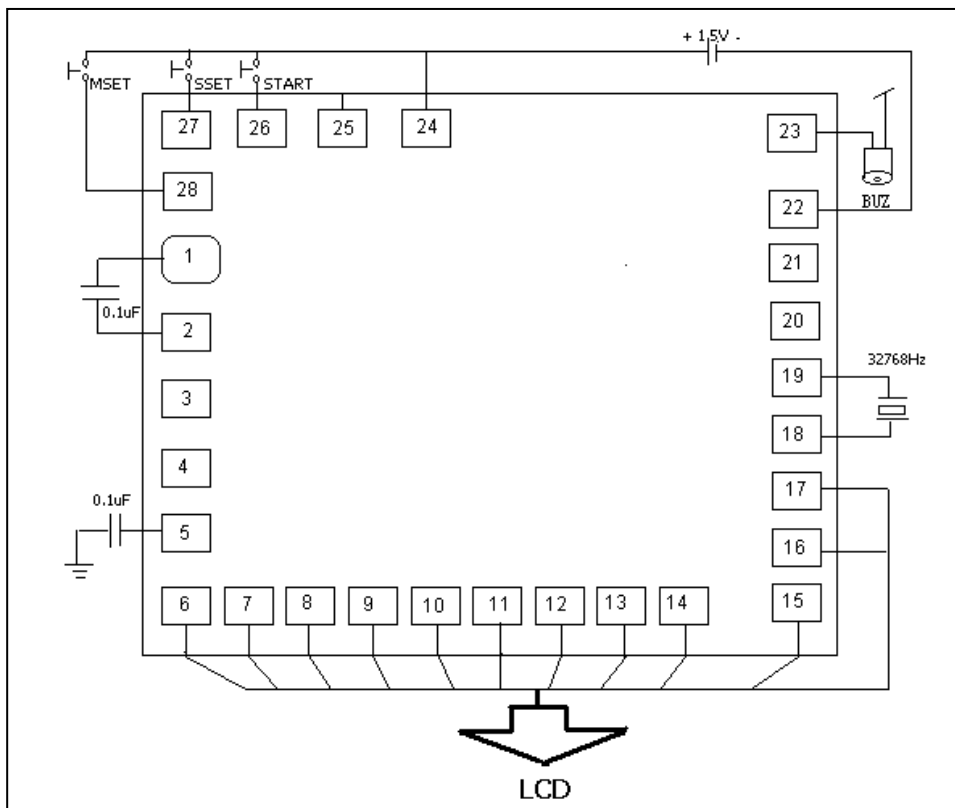
6.2.2 The countup timer has a cyclical count of 59 minutes (or 99 minutes by bonding option) after being started.

6.2.3 While the countup timer is counting, depressing the any key will stop it. Another trigger of START/STOP will start the timer continuously counting.

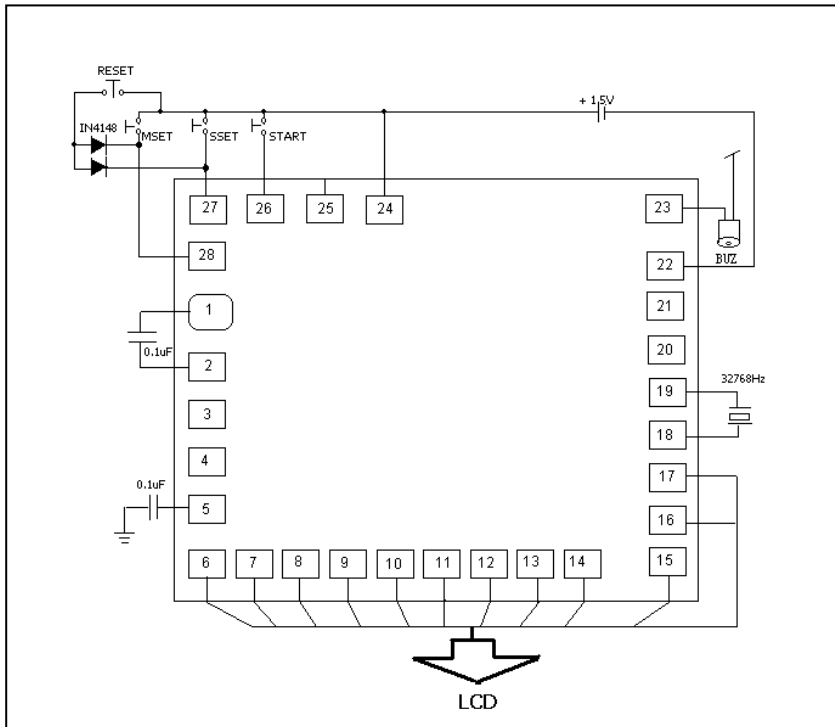
6.2.4 When the chip is in count up timer mode, the chip can change to count down timer mode after the countup timer is stopped by any key and then preset by MSET and SSET.

7. Application Circuit

7.1 Three Keys Application: MSET SSET START/STOP

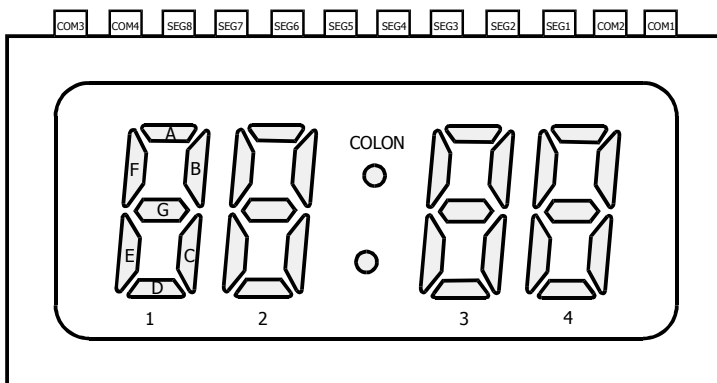


7.2 Four Keys Application: MSET SSET START/STOP RESET



NOTE: The chip substrate must be connected to VDD

8. LCD FORMAT



LCD Voltage: 3.0V, 1/2Bias, and 1/4Duty

	SEG8	SEG7	SEG6	SEG5	SEG4	SEG3	SEG2	SEG1
COM1	A1	B1	A2	B2	A3	B3	A4	B4
COM2	F1	G1	F2	G2	F3	G3	F4	G4
COM3	E1	C1	E2	C2	E3	C3	E4	C4
COM4	-	D1	-	D2	COLON	D3	-	D4

9. Electrical Characteristics

(Ta = 25°C, GND = 0V, VDD = -1.5V, F_{OSC} = 32768 Hz, unless otherwise specified)

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Operating Voltage	V _{DD}	--	1.25	1.5	1.70	V
Display Voltage	VC	--	2.4	3.0	3.4	V
Supply Current	I _{CC}	Without Load		3.0	5.0	μA
Output Drive Current (BZ, TRIG Output)	I _{OH}	V _{OH} = 1.35V (TRIG Output)	-500	--	--	μA
	I _{OL}	V _{OL} = 0.15V (TRIG Output)	500	--	--	
			V _{OL} = 0.5V (BZ Output)	5	10	
Frequency Stability	Δf/f	V _{CC} = 1.25V to 1.70V			10	ppm
Oscillator Built-in Capacitor	CD	--		10		pF
Alarm Output Frequency	F _{BZ}	--	2048 x 4 x 1	--	--	Hz
Oscillator Start up Time	T _{OS}	V _{CC} = 1.30V		--	2	sec

10. Absolute Maximum Ratings

Parameter	Symbol	Limits	Unit
Supply Voltage	V _{DD}	-0.3 ~ 5	V
Input Voltage	V _I	GND-0.3 ~ VDD+0.3	V
Output Voltage	V _O	GND-0.3 ~ VDD+0.3	V
Operating Temperature	T _{OPR}	0 ~ 70	°C
Storage Temperature	T _{STG}	-20 ~ 125	°C

11. Editions

Editions	Expression	Date
V1.0	DL927B	2004/4/6
V2.0	DL927C, The decode circuit of LCD use gate circuit in version 1.0, but replace with ROM decode circuit in version 2.0	2006/10/31

12. Notices

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