

**1. DESCRIPTION**

The DL9221 is a single-chip application of 4-bit microcontroller fabricated in CMOS technology, with built-in ROM, RAM, and 12 I/O pin, buzzer and common, segment driver output.

This digital 7-function watch integrated with timer and chronograph, designed to for a 13-digit triplexed liquid crystal display. The countdown timer can be set within a range of 1 min to 24 hours. The chronograph lets measure elapsed time as split time. The range of stopwatch is 23 hours, 59 min, 59 seconds. The DL9221 generates alarm, chime and touch-tone signals on the BZ, BZN outputs to direct drive a buzzer and provides special signal on the ALB output to initiate a melody chip

**1.1 FUNCTIONS**

- 7 functions: Month, Date, Day-of-week, Hour, Minute, Second, Dual Time
- 6-digit Chronograph with Split function
- Countdown Timer to 24 hours
- User selectable 12-hour/24-hour format
- 4-year calendar
- Chime on every hour
- Alarm function

**1.2 FEATURES**

- Single-chip CMOS construction
- Drives 13-digit triplexed LCD
- 32,768Hz crystal frequency
- Single 3V battery operation
- Low power dissipation
- 3-switch sequential operation
- Touch-tone signal

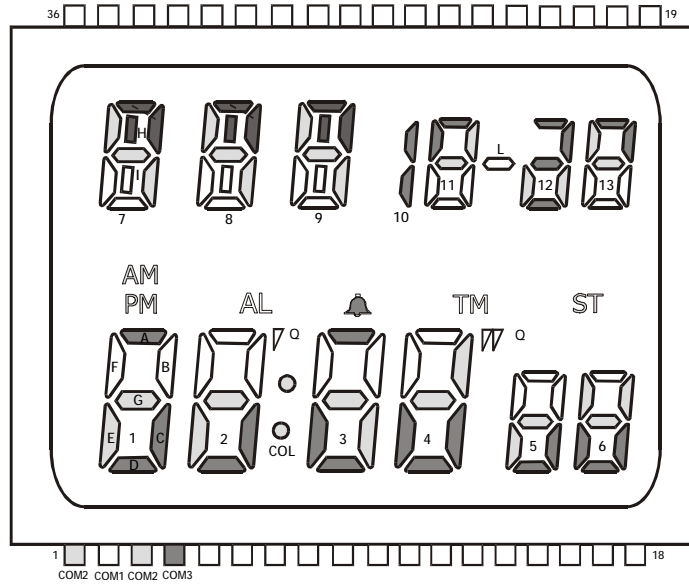
**2. ABSOLUTE MAXIMUM RATINGS**

Characteristic	Symbol	Value	Unit
Supply Voltage	V <sub>CC</sub>	- 0.3 ~ + 2.0	V
Display Voltage	V <sub>DD</sub>	- 0.3 ~ + 6.0	V
Operating Temperature	T <sub>opr</sub>	- 20 ~ + 70	°C
Storage Temperature	T <sub>stg</sub>	- 55 ~ + 125	°C

**3. ELECTRICAL CHARACTERISTICS** (T<sub>a</sub> = 25°C, V<sub>SS</sub> = 0V, V<sub>CC</sub> = 3V unless otherwise specified)

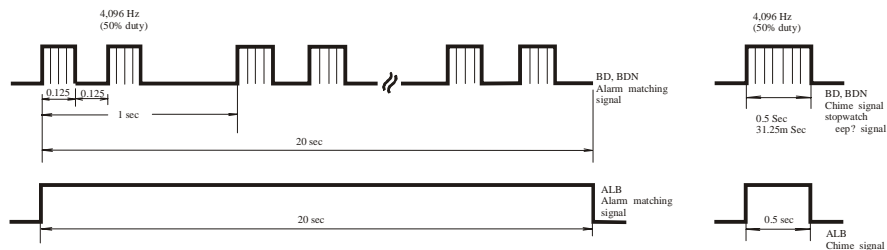
Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Operating Voltage	V <sub>CC</sub>		2.4	3.0	3.6	V
Display Voltage	V <sub>DD</sub>		3.6	4.5	5.4	V
Supply Current	I <sub>CC</sub>	Without load		1.2	2.5	μA
Oscillator Start Voltage	V <sub>OSC</sub>				2.7	V
Alarm Drive Current	I <sub>BZ</sub> , I <sub>BZN</sub>	V <sub>sat</sub> = 0.5V (Both Direction)	1	2		mA
	I <sub>ALB</sub>		10	20		μA
Oscillator Input and Output Capacitor	C <sub>IN</sub> , C <sub>OUT</sub>			20		pF

4. LCD FORMAT

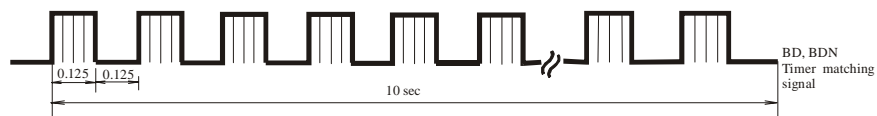


Pad No.	Pin No.	Pad Name	COM1	COM2	COM3	Pad No.	Pin No.	Pad Name	COM1	COM2	COM3
54	1	COM2		COM2		38	19	SEG15	C13	G13	B13
1	2	COM1	COM1			37	20	SEG16	E13	F13	A13
54	3	COM2		COM2		36	21	SEG17	D11	C12	B12
53	4	COM3			COM3	35	22	SEG18	C11	E12	A12/D12/G12
52	5	SEG1	F1	E1	A1/D1	34	23	SEG19	L	B11	A11
51	6	SEG2	B1	G1	C1	33	24	SEG20	E11	G11	F11
50	7	SEG3	F2	E2	D2	32	25	SEG21	Q	ST	BC10
49	8	SEG4	A2	G2	C2	31	26	SEG22	I9	C9	B9
48	9	SEG5	B2	COL	E3	30	27	SEG23	D9	G9	A9
47	10	SEG6	F3	G3	A3/D3	29	28	SEG24	E9	F9	H9
46	11	SEG7	B3	C3	E4	28	29	SEG25	I8	C8	B8
45	12	SEG8	F4	G4	D4	27	30	SEG26	D8	G8	A8
44	13	SEG9	A4	B4	C4	26	31	SEG27	E8	F8	H8
43	14	SEG10	F5	E5	D5	25	32	SEG28	I7	C7	B7
42	15	SEG11	A5	G5	C5	24	33	SEG29	D7	G7	A7
41	16	SEG12	B5	F6	E6	23	34	SEG30	E7	F7	H7
40	17	SEG13	A6	G6	D6	22	35	SEG31	-	AM	TIMER
39	18	SEG14	D13	B6	C6	21	36	SEG32	AL	PM	CHIME

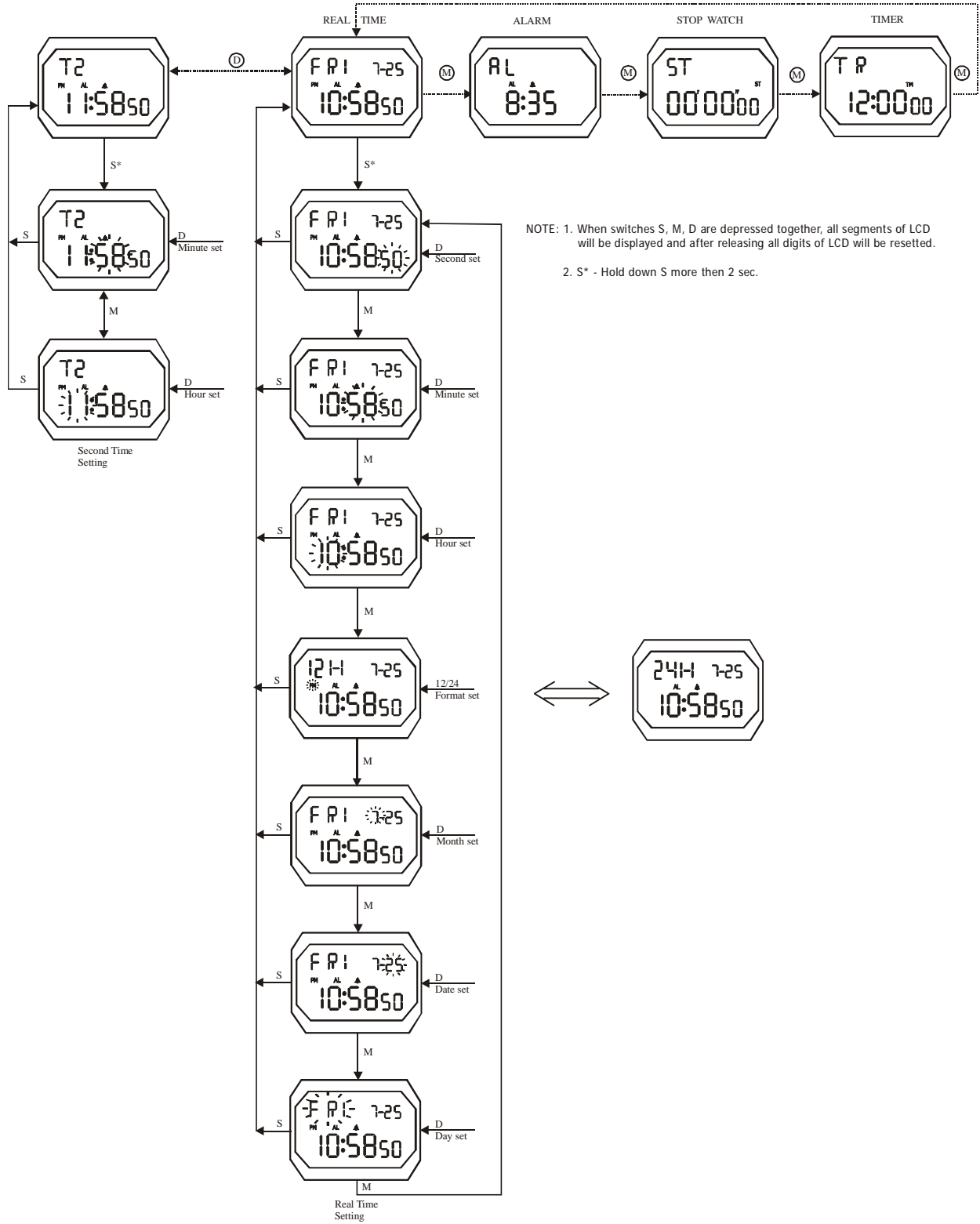
5. ALARM OUTPUT WAVEFORM



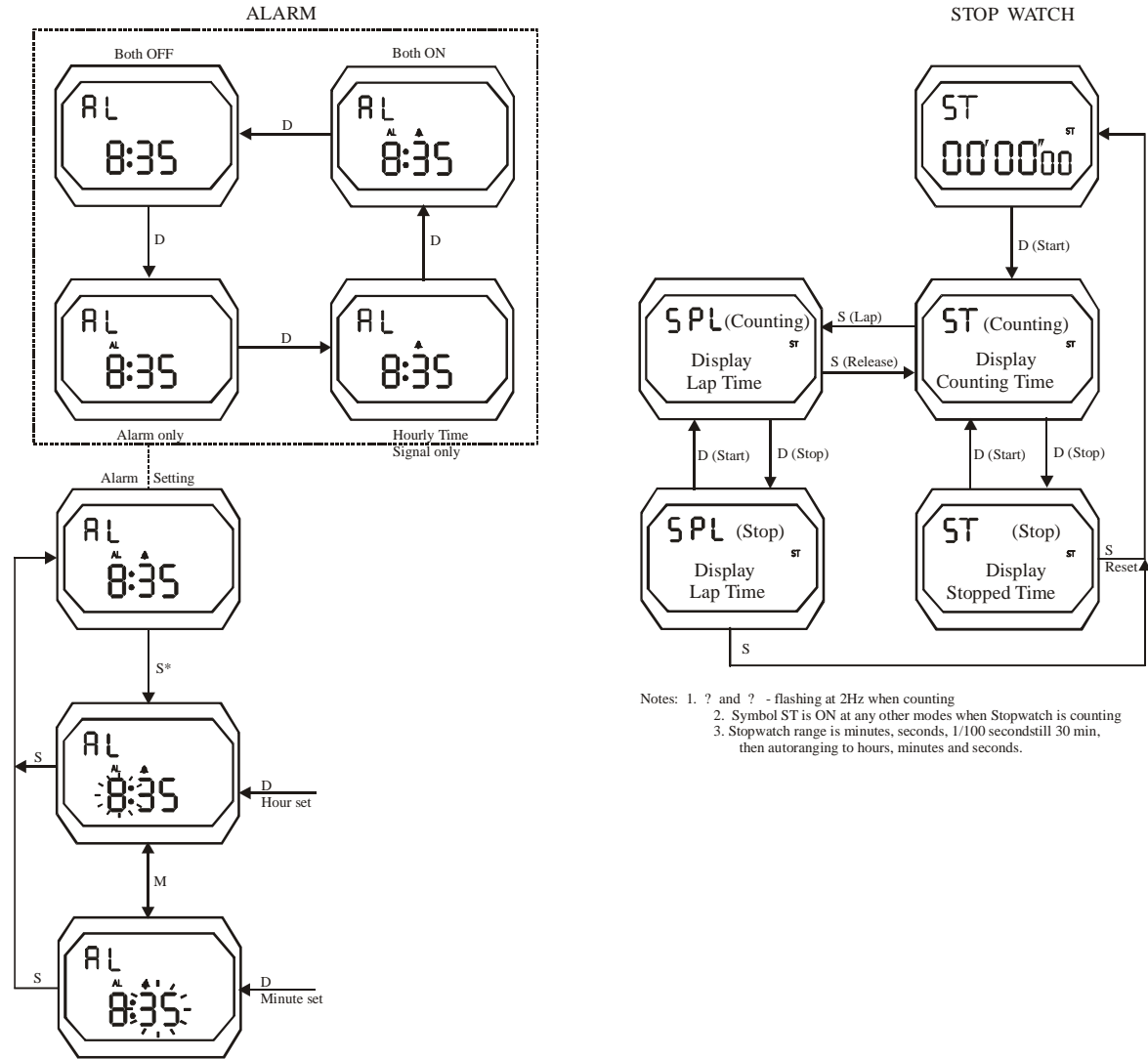
6. TIMER OUTPUT WAVEFORM



7. SETTING SEQUENCE AND SWITCH OPERATION

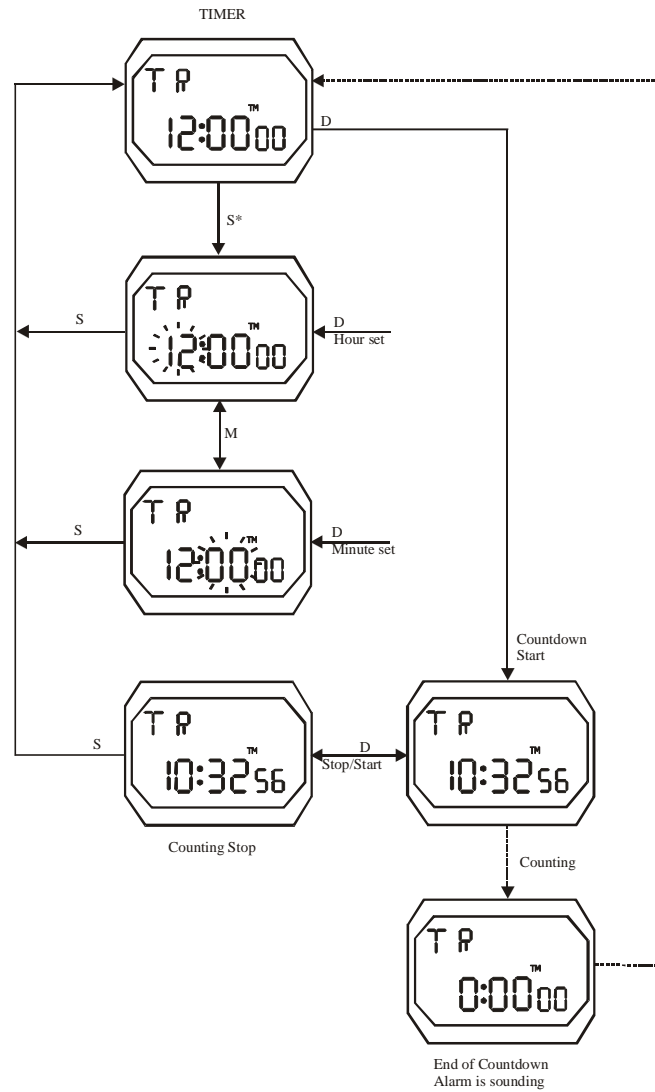


8. ALARM SETTING and STOP WATCH OPERATION



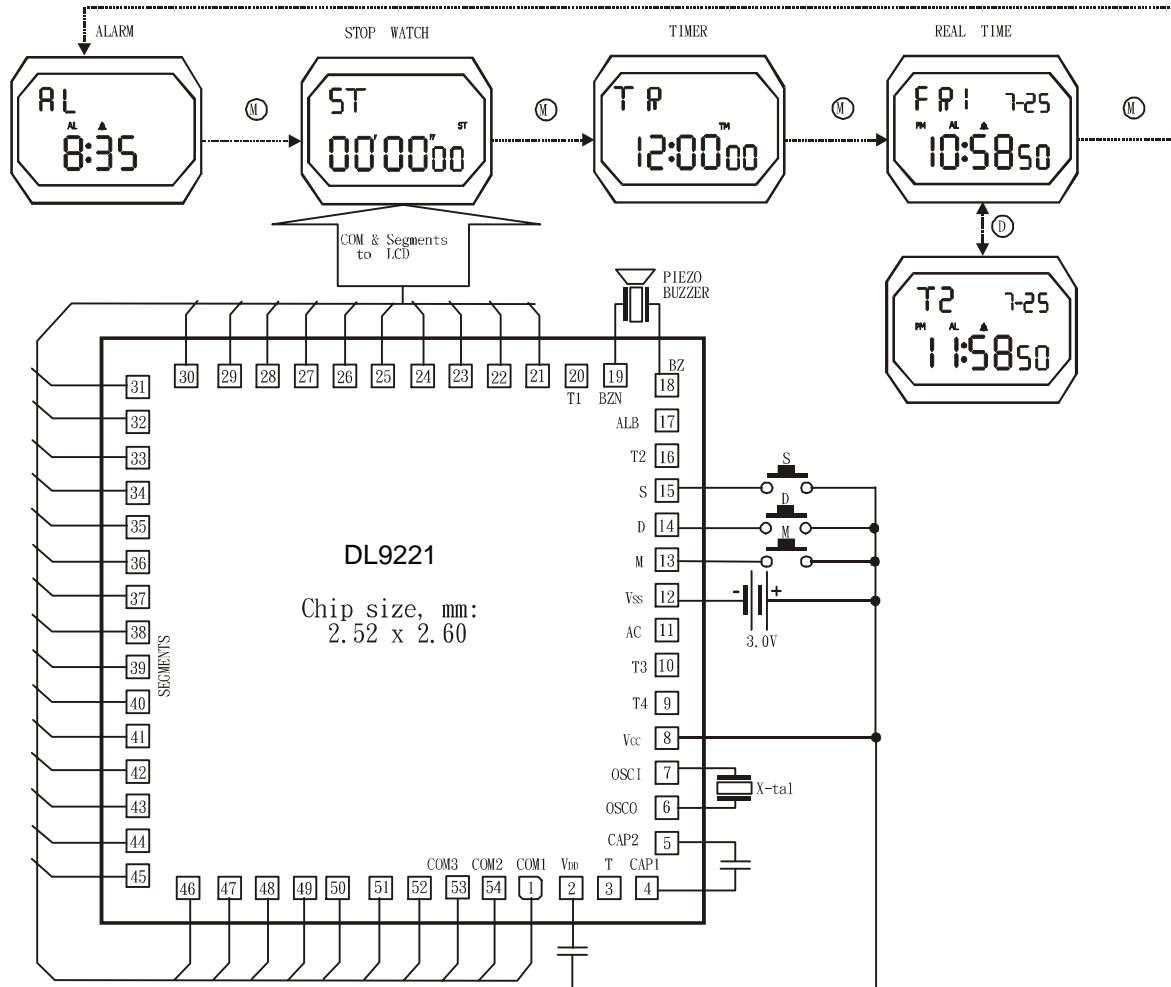
- Notes:
1. ? and ? - flashing at 2Hz when counting
  2. Symbol ST is ON at any other modes when Stopwatch is counting
  3. Stopwatch range is minutes, seconds, 1/100 second still 30 min, then autoranging to hours, minutes and seconds.

9. TIMER OPERATION



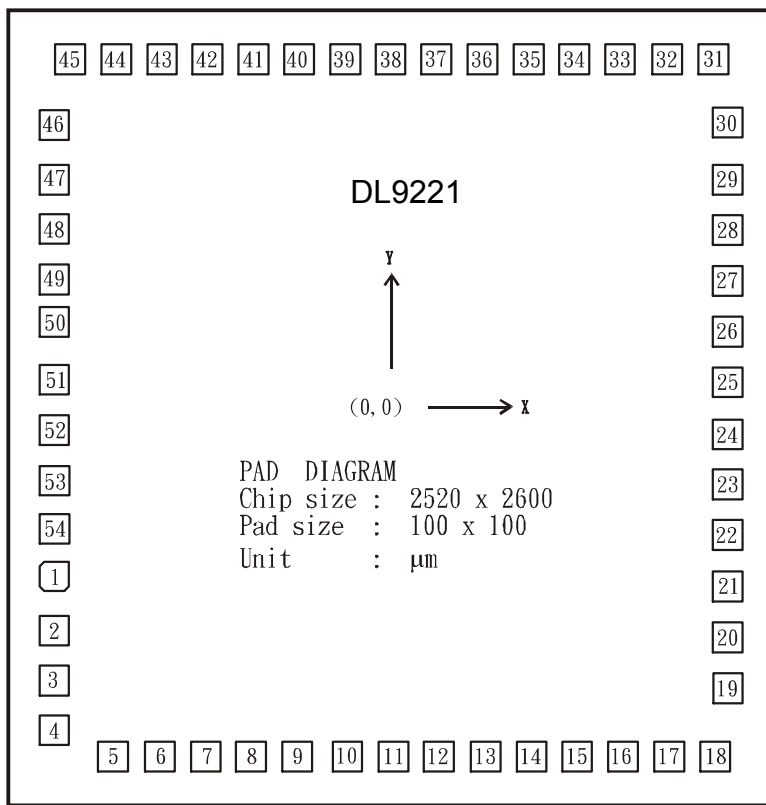
Note: The symbol TM is ON at any other modes when time is counting

10. APPLICATION CIRCUIT



**NOTE:** The die area should be isolated or connected to V<sub>SS</sub>

11. PAD DIAGRAM



Pad No.	Pad Name	X	Y	Pad No.	Pad Name	X	Y	Pad No.	Pad Name	X	Y
1	COM1	-1104	-554	19	BZN	1104	-918	37	SEG16	152	1139
2	V <sub>DD</sub>	-1104	-730	20	T1	1104	-752	38	SEG15	1	1139
3	T	-1104	-894	21	SEG32	1104	-586	39	SEG14	-149	1139
4	CAP1	-1104	-1058	22	SEG31	1104	-419	40	SEG13	-300	1139
5	CAP2	-910	-1250	23	SEG30	1104	-253	41	SEG12	-450	1139
6	OSCO	-759	-1250	24	SEG29	1104	-86	42	SEG11	-600	1139
7	OCSI	-609	-1250	25	SEG28	1104	80	43	SEG10	-751	1139
8	V <sub>CC</sub>	-458	-1250	26	SEG27	1104	248	44	SEG9	-901	1139
9	T4	-308	-1250	27	SEG26	1104	413	45	SEG8	-1052	1139
10	T3	-141	-1250	28	SEG25	1104	579	46	SEG7	-1104	922
11	AC	10	-1250	29	SEG24	1104	746	47	SEG6	-1104	746
12	V <sub>SS</sub>	160	-1250	30	SEG23	1104	932	48	SEG5	-1104	582
13	M	310	-1250	31	SEG22	1059	1139	49	SEG4	-1104	418
14	D	461	-1250	32	SEG21	908	1139	50	SEG3	-1104	254
15	S	611	-1250	33	SEG20	753	1139	51	SEG2	-1104	90
16	T2	762	-1250	34	SEG19	603	1139	52	SEG1	-1104	-74
17	ALB	912	-1250	35	SEG18	452	1139	53	COM3	-1104	-238
18	BZ	1062	-1250	36	SEG17	302	1139	54	COM2	-1104	-402