3.5-DIGIT 12/24 - HOUR FORMAT WATCH

JC1201

FEATURES

- 5 functions: month, date, hour, minute and second
- Selective alternation of time-date display mode
- One-touch correction of time error within ± 30 seconds
- 4-year calendar
- 2-switch sequential operation
- LCD test
- Selectable 12/24-hour format

FUNCTIONS

- Single-chip CMOS constructions
- Drives 4 - digit duplexed LCD
- Low power consumption
- Colon display
- 32,768Hz crystal controlled operation
- Single 1.5V battery operation
- On-chip capacitive voltage
- Debounce circuiry on switch inputs
- Protection against static discharge
- Built-in crystal oscillator input and output capacitors

DESCRIPTION

The JC1201 is low threshold voltage, ion implanted poli-Si gate CMOS integrated circuit which provides all signals to drive
a duplexed 4 - digit liquid crystal display with colon (Fig. 1).
32.768Hz frequency from a crystal controlled oscillator is divided to provide second, minute, hour, date, and month information.
12-hour or 24-hour format can be selected.
Phase controlled segment outputs and two-phase controlled back plane outputs are provided for direct drive of the duplexed LCD.

ABSOLUTE MAXIMUM RATINGS ($T_a = 25^oC$)

Characteristic	Symbol	Value	Unit
Supply Voltage (V_{DD1} - V_{SS})	V_{DS1}	- 0.3 ~ + 2.0	V
Supply Voltage (V_{DD2} - V_{SS})	V_{DS2}	- 0.3 ~ + 4.0	V
Operating Temperature	T_{opr}	- 20 ~ + 75	^oC
Storage Temperature	T_{stg}	- 55 ~ + 125	^oC

ELECTRICAL CHARACTERISTICS ($T_a = 25^oC$, $V_{SS} = 0V$, $V_{DD} = 1.5V$; unless otherwise specified)

Characteristic	Symbol	Test Condition	Min	Typ	Max	Unit
Operating Voltage	V_{DD1}		1.2	1.5	1.8	V
Operating Voltage	V_{DD2}		2.4	3.0	3.4	V
Supply Current	I_{DD}	Without Load		0.8	1.5	μA
Input Low Voltage	V_{IL}		V_{SS}		V_{SS}+0.3	V
Input High Voltage	V_{IH}		V_{DD} -0.3		V_{DD}	V
Switch Activation Current	I_{SW}	$V_{IN} = V_{DD}$	0.1	0.5	3	μA
Oscillator Start Voltage	V_{OSC}	Within 5 sec			1.45	V
Oscillator Stop Voltage	V_{OSP}				1.25	V
Oscillator Input Capacitor	CI			20		pF
Oscillator Output Capacitor	CO			20		pF
Oscillator Frequency	F_{OSC}			32,768		Hz
DC - DC Conversion Frequency	V_{CON}	C1 = C2 = 0.1μF		512		Hz
LCD Frequency	FD			32		Hz
Switch Debouncing Time	TD				62.5	mS

APPLICATION

- Two switch (D and S) are required to control all display and setting of function. This inputs are pulled down by internal resistors.
- The voltage doubler circuit is formed by connecting 0.05μF to 0.1μF capacitor from AP' PAD to '1KO' PAD and from $_{DD2}$' PAD to $_{SS}$' PAD.
- The oscillator circuit is formed by connecting crystal from I' PAD to O' PAD.
- The circuit substrate is electrically connected to V_{SS}, the most negative voltage. The preferred assembly method is to connect die area to V_{SS} using a conductive die attach.

DISPLAY CONTROL

- **Standard Display**

   Normal DL1201 displays HOUR in digit 1, 2 and MINUTE in digit 3 and 4. In this state colon flashes at 1Hz rate.
   Depression of the D switch in normal display state will cause month to be displayed in Digits 1 and 2, date in Digits 3 and 4, with colon off. Month and date will continue to be displayed for 2 seconds after the D switch is released. Then hour and minute are displayed again.
   Two momentary depressions of D switch within 2 seconds in the normal display state will cause second to be displayed in Digits 3, 4 and the Digit 1 and 2 are blanked with colon not flashing. Depressing the S swich in this state resets and holds the second counter until S switch is released and minute counter is either advanced or remains unchanged, depending upon whether the second counter is greater or less than 30 seconds.
   Depressing the D switch in this state returns the display to hr: min state.

- **Alternating display**

   This mode is selected by activating the set switch (S) in the normal display mode. In this mode, hr: min is automatically displayed alternately with month date. Each is displayed for two seconds.
   The S input must be activated five times to return to the normal display mode and depressing the D switch in this alternating mode will cause the second display mode to appear.
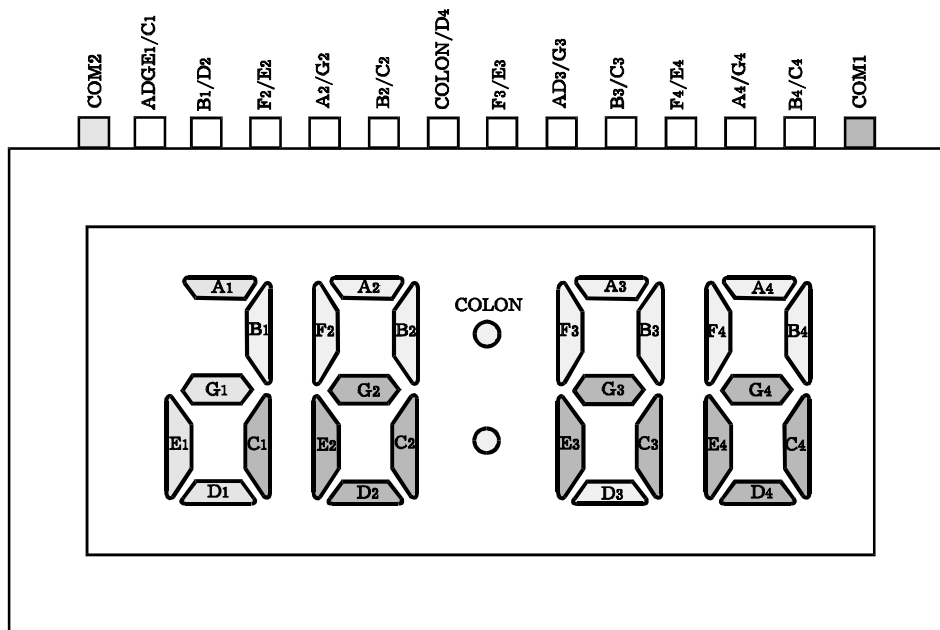
3.5-DIGIT LCD FORMAT

Fig. 1

SETTING PROCEDURE (Fig. 2)

Time/calendar setting is accomplished by using the 6 switch to enter and return form the setting state. The D switch is used to advance the function at a 2Hz rate.

The function to be set is displayed the only one while setting state.

The detailed setting procedure is as follows.

a. Alternating display state

Depressing the S switch in normal display state calls MONTH set state and the display shows MONTH in the digit1 date)

b. Month

Depressing the S switch in the alternating display state calls up the month set state and the display shows month in the Digits 1 and 2. The month counter can be advanced at a 2Hz rate by depressing the D switch.

c. Date

The next depression of the S switch will select date set state the display shows date in Digits 3 and 4. The date can be advanced in Fig. 2.

d. Hour

The next depression of the S switch will select hour set state and the display shows hour in Digits 1 and 2 and A(AM)/P(PM) in Digits 4.

The colon flashes at a 1Hz rate. The hour can be advanced as Fig. 2. The 12-hour format or 24-hour format can be select alternately on every 24-hour cycle during hour advance.

e. Minute

The next depression of the S switch will select minute set state and the display shows minute in Digits 3 and 4 and the colon flashes at a 1Hz rate. Depressing the D switch advanced the minute at 2Hz flashing and the watch suspends it time-keeping function.

f. Hold mode

Then watch enters the hold state with the depressing of the S switch. In this state the display shows hour in Digits 1 and 2, minute in Digits 3 and 4 and non-flashing colon. (Normal display state).

NOTE

If minute is not changed in minute set state, the watch will not enter the hold state but will automatically revert to the normal display state.

The carry signal from any proceeding counter during operation is not accepted except for second reset.
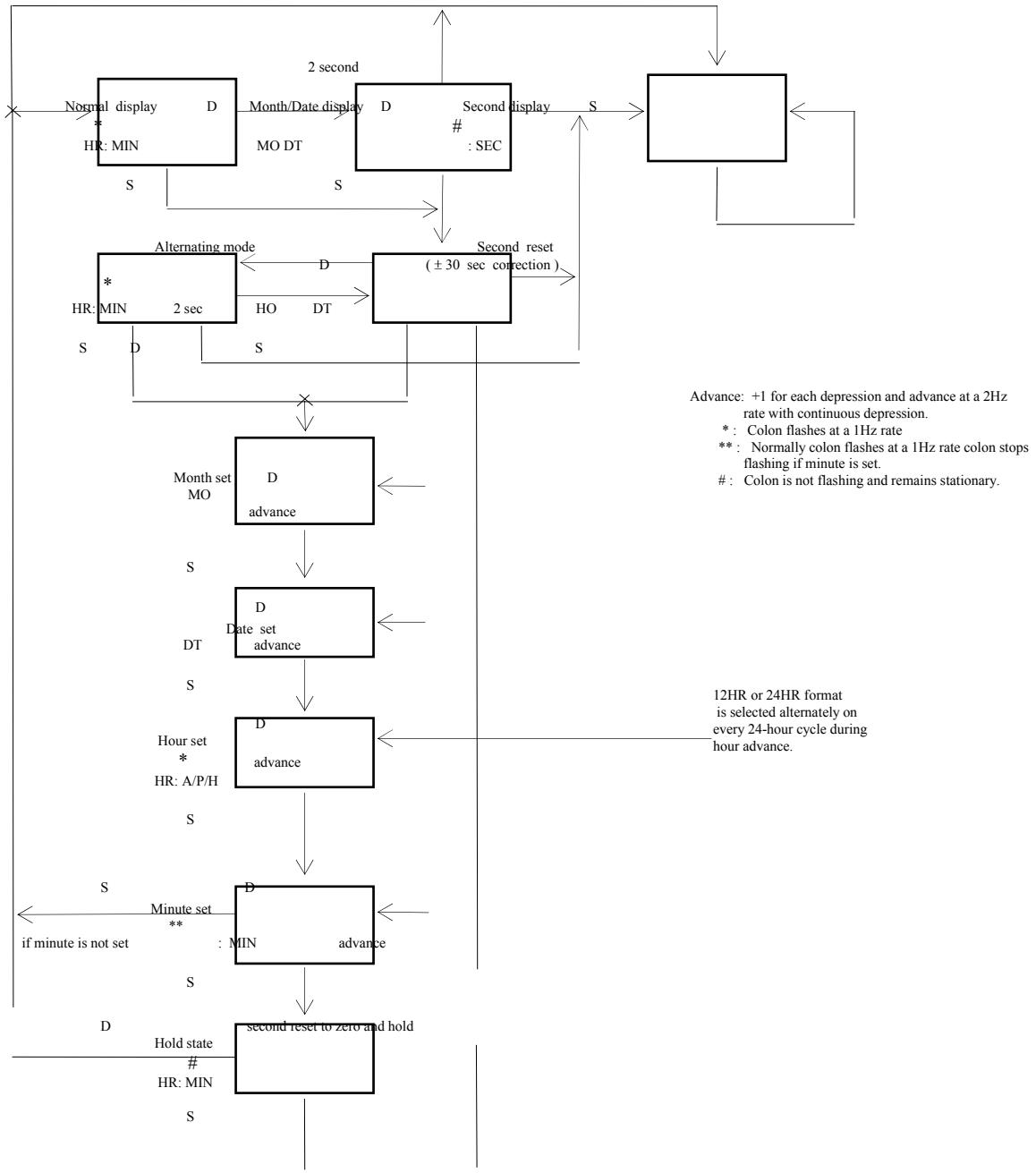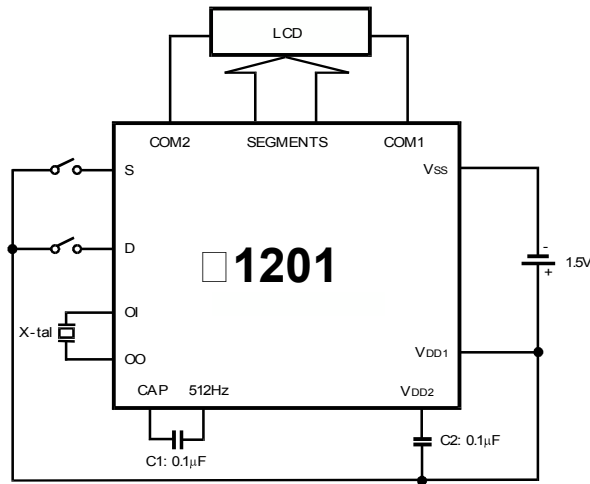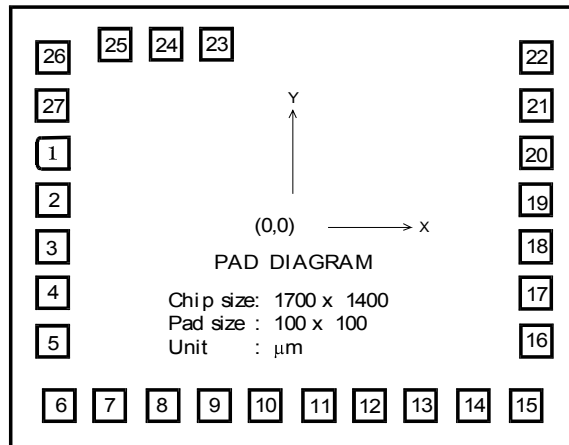
SETTING AND DISPLAY SEQUENCE

Fig. 2

APPLICATION CIRCUIT

* Quartz Cristal Parameter
Fp = 32,768Hz
CL = 12.5pF
C1 = 4 fF
CO = 2.5pF
Rs = 35KΩ
Q = 35,000

PAD DIAGRAM

PAD DIAGRAM

Chip size: 1700 x 1400
Pad size : 100 x 100
Unit   : μm

PAD LOCATION

Pad No.	Pad Name	X	Y	Pad No.	Pad Name	X	Y	Pad No.	Pad Name	X	Y
1	V_{DD1}	-720	240	10	F3/E3	-80	-570	19	OO	720	90
2	V_{DD2}	-720	90	11	COL/D4	75	-570	20	V_{DD1}	720	240
3	D	-720	-60	12	B2/C2	230	-570	21	512Hz	720	390
4	COM1	-720	-210	13	A2/G2	385	-570	22	CAP	720	540
5	B4/C4	-720	-360	14	F2/E2	540	-570	23	TEST	-215	586
6	A4/G4	-700	-570	15	B1/D2	695	-570	24	TEST	-370	586
7	F4/E4	-545	-570	16	ADEG1/C1	720	-360	25	TEST	-525	586
8	B3/C3	-390	-570	17	COM2	720	-210	26	GND	-720	540
9	AD3/G3	-235	-570	18	OI	720	-60	27	S	-720	390

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