Five-function CMOS IC for 3.5-Digit watch with LCD and EL-backlight

Performed functions

- Five functions of the time counting and calendar with indications of hours, minutes, seconds, month, date.

Features

- Built-in crystal oscillator elements with operating frequency of 32768 Hz, capacity, resistor;
  - Single 3.0V battery operation, low consumption power;
  - schemes of suppression of a contact chatter on inputs of buttons;
  - Protection against a static electricity;
  - EL(Electroluminicent)- backlight

Table 1 - Absolute maximum ratings and recommended operating mode

Symbol	Parameter	Recommended operating mode		Absolute maximum rating		Unit
		Min	**Max**	**Min**	**Max**	
U_{DD}	Supply voltage	2.4	3.6	-0.3	4.0	V
U_{IH}	High level input voltage	U_{DD}-0.3	U_{DD}	-	U_{DD}+0.3	V
U_{IL}	High level input voltage	0	0.3	-0.3	-	V
Tamb	Operating Temperature	-20	75	-	-	^{o}C
Tstg	Storage Temperature	-	-	-60	125	^{o}C

Table 2 – Electric parameters (Tamb = 25 °C)

Parameter	Symbol	Norm		Mode of measurement	Unit
		Min	Max		
Comsumption current	I_{DD}	-	2.8	U_{DD}=3.6 V	uA
Dynamic comsumption current	I_{DDO}	-	3.0	No load U_{DD}=3.0 V	uA
		-	5.0	No load U_{DD}=3.6 V	
IND pin low level output current	I_{OL1}	10.0	-	U_{DD} =3.0 V U_{OL}=0.8 V	mA
		5.0	-	U_{DD} =2.4 V U_{OL}=0.8 V	
EL pin low level output current	I_{OL2}	1.0	-	U_{DD} =3.0 V U_{OL}=0.8 V	mA
		0.5	-	U_{DD} =2.4 V U_{OL}=0.8 V	
IND pin high level output current	I_{OH1}	-1.2	-	U_{DD} =3.0 V U_{OH}=0.8 V	mA
		-0.6	-	U_{DD} =2.4 V U_{OH}=0.8 V	
EL pin high level output current	I_{OH2}	-0.35	-	U_{DD} =3.0 V U_{OH}=0.8 V	mA
		-0.17	-	U_{DD} =2.4 V U_{OH}=0.8 V	
Oscillator start voltage	U_{OSC}	-	2.4	t≤5 sec	V
Oscillator upset voltage	U_{OSP}	-	2.4	-	V

Notes

1 Dynamic comsumption current is measured without load

2 nominal values of built in capacitors on OSCI and OSCO pins(Oscilator input and output) are 20 and 20 pF.

3 "Minus" indicate current direction only.

4 Parameters are controlled with quartz resonator, providing series resonance frequency 32768 Hz
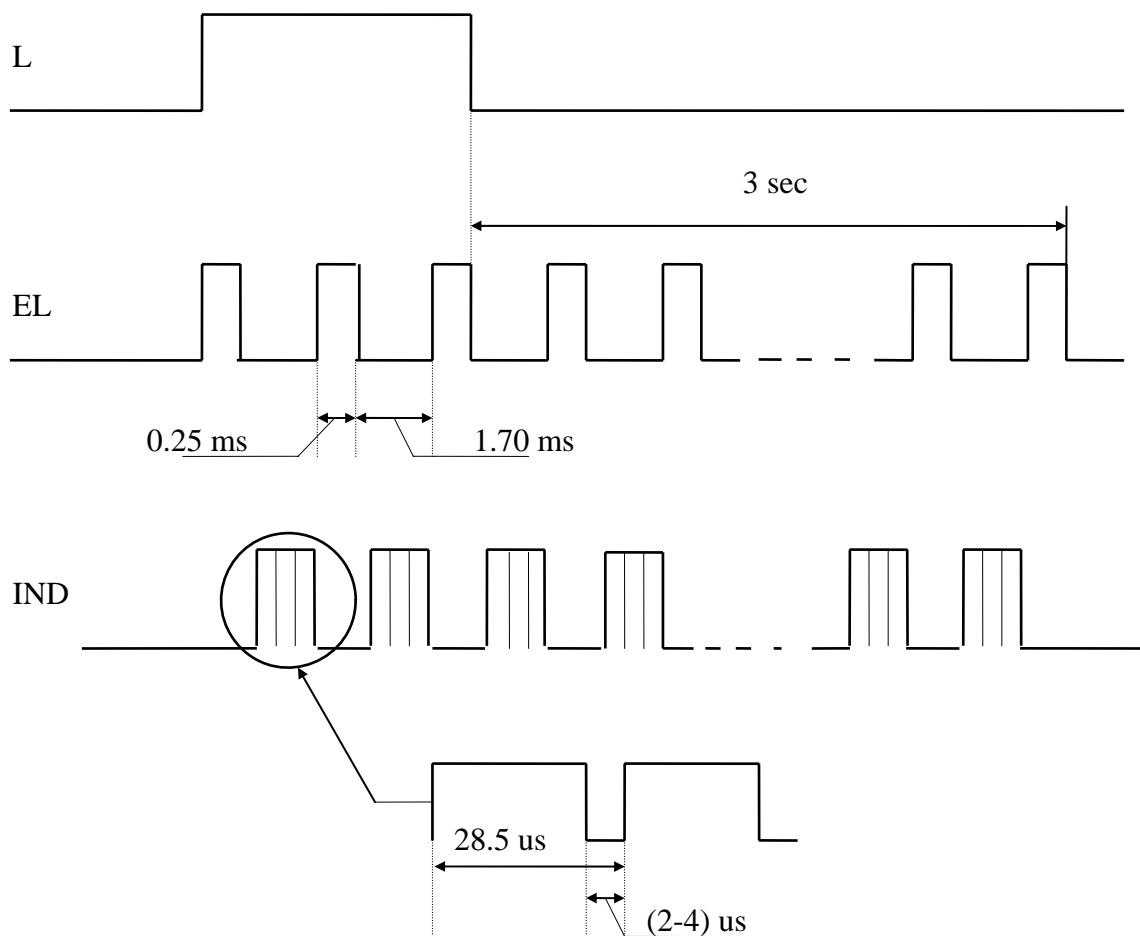
Fig.1 – Signal time diagram

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Fig 2 – LCD format

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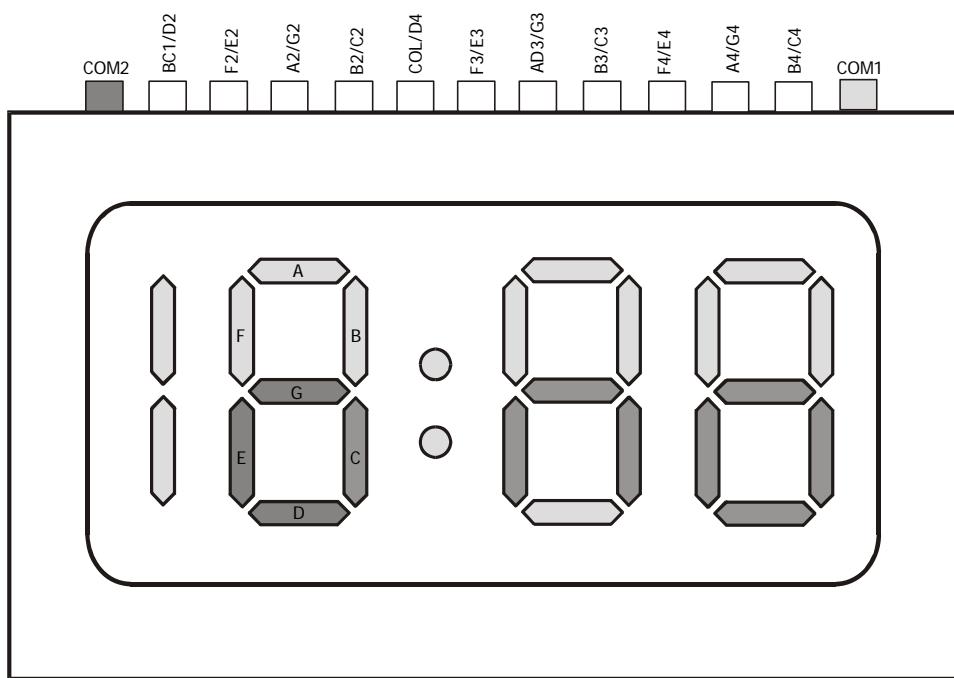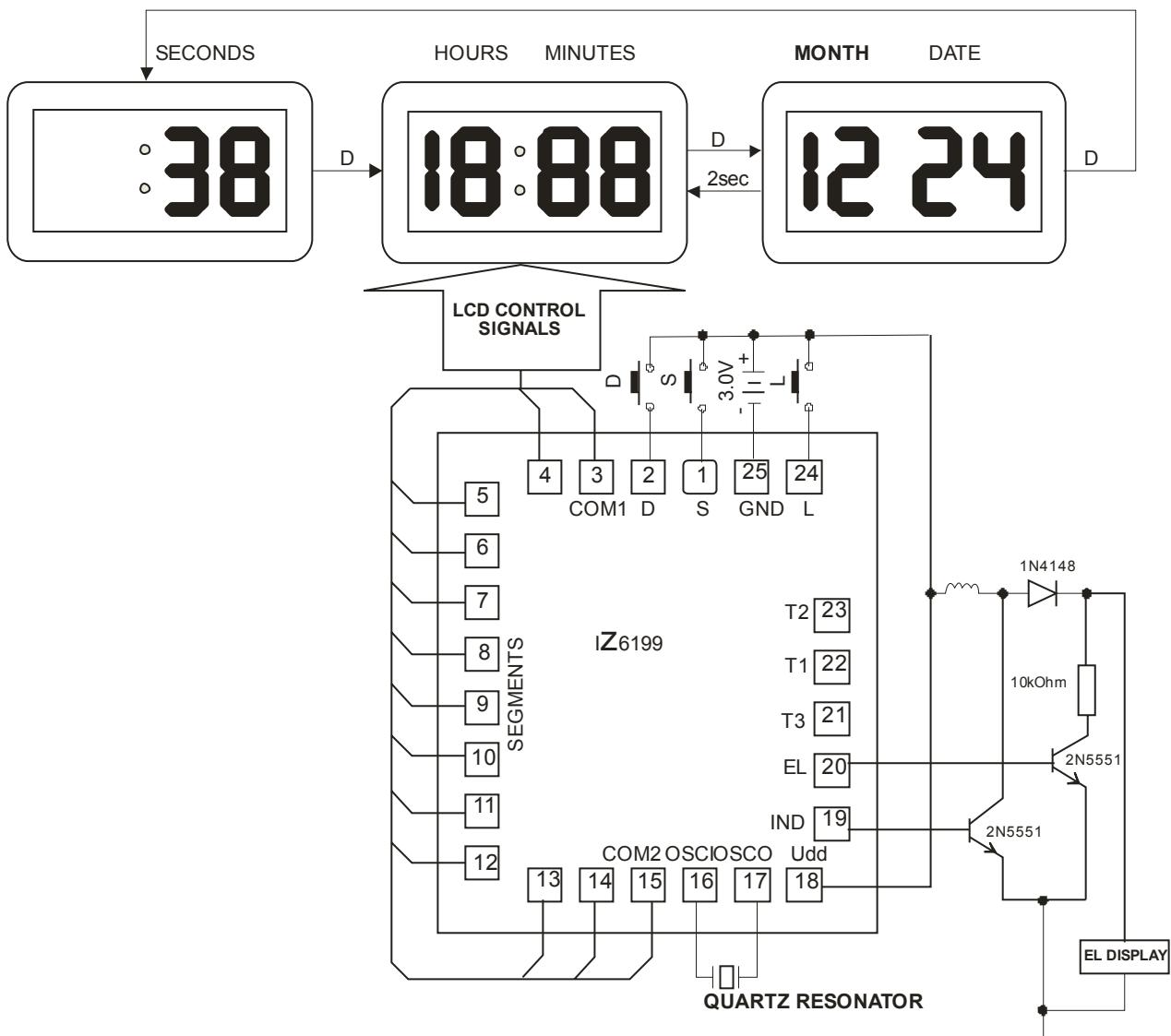
Quartz oscillator parameters
Fp = 32768 Hz, C_L = 10.0 pF, $C_1 \leq 0.004$ pF,
$C_O \leq 2.5$ pF, Rs ≤ 35 kOhm, Q ≥ 35000

Fig. 3 – Application diagram

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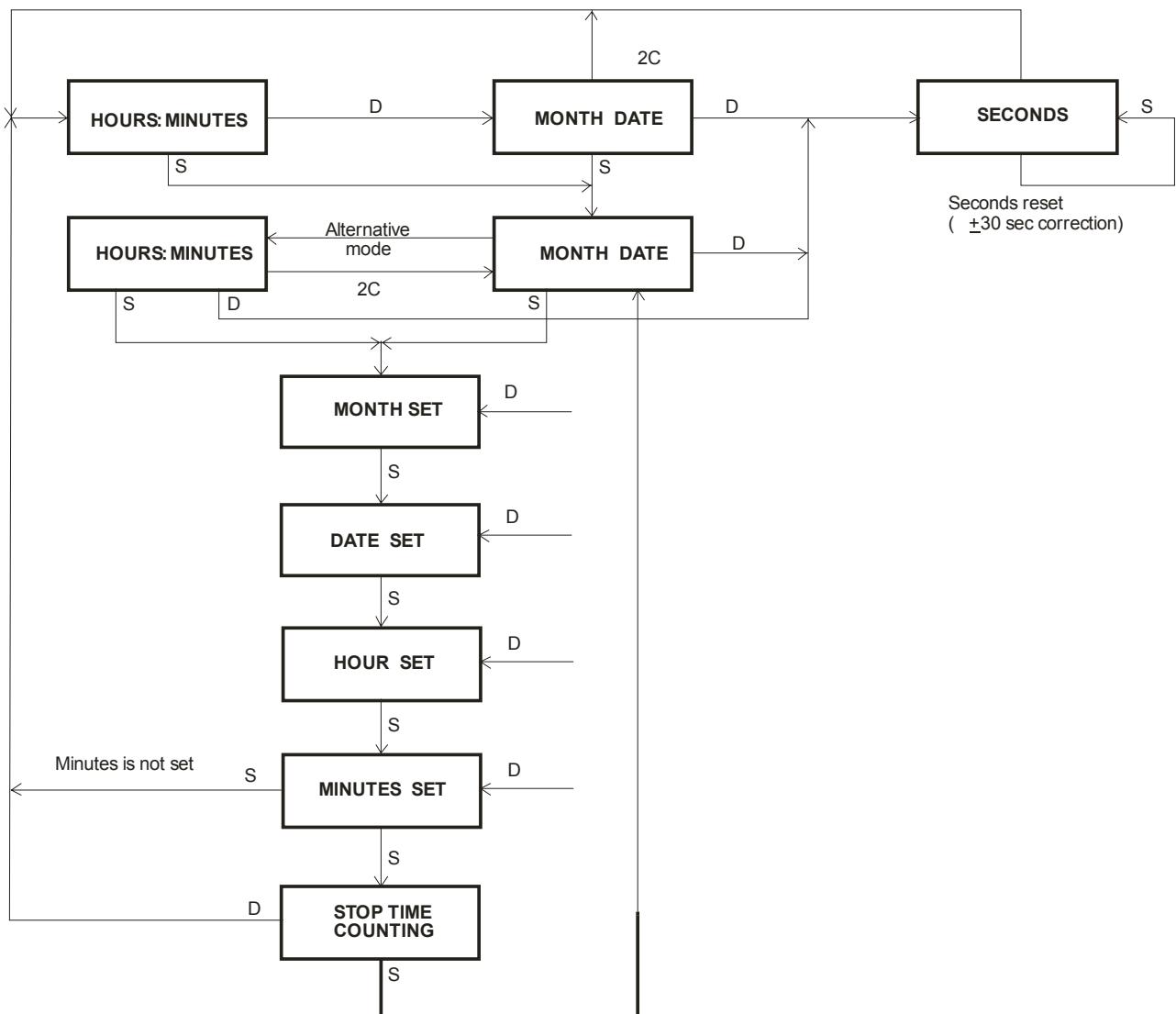
Fig 4 – Algorithm of control

Table 3 – Contact pad description

Contact pad number	Symbol	Description
01	S	Button control input
02	D	Button control input
03	COM1	1st common electrode control output
04	B4/C4	Segment control output
05	A4/G4	Segment control output
06	F4/E4	Segment control output
07	B3/C3	Segment control output
08	AD3/G3	Segment control output
09	F3/E3	Segment control output
10	COL/D4	Segment control output
11	B2/C2	Segment control output
12	A2/G2	Segment control output
13	F2/E2	Segment control output
14	BC1/D2	Segment control output
15	COM2	2nd common electrode control output
16	OSCI	Oscilator input
17	OSCO	Oscilator output
18	U$_{DD}$	Supply voltage input
19	IND	EL backlight driver control output
20	EL	EL backlight driver control output
21	T3	Express control input
22	T1	Express control input
23	T2	Express control input
24	L	Button control input
25	GND	Common (Ground)

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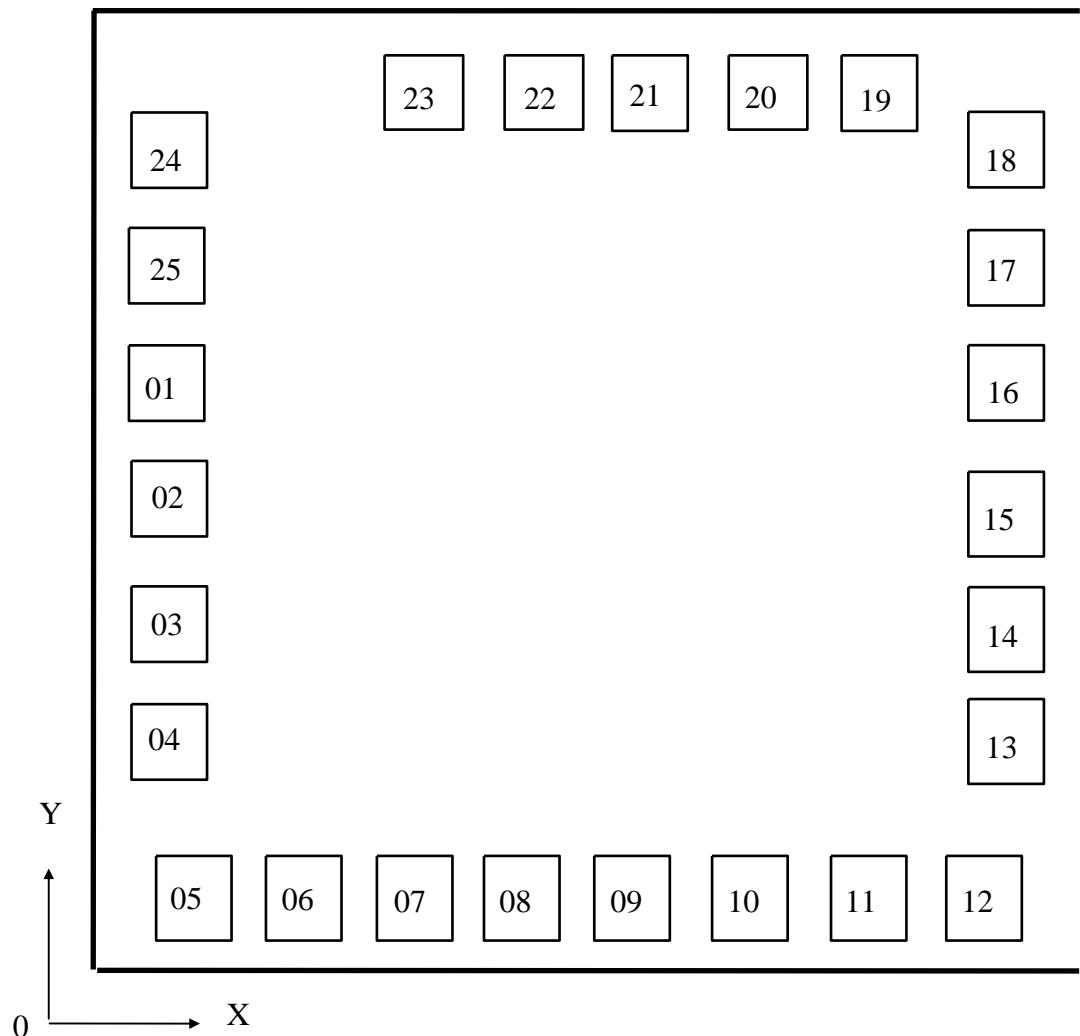
Die dimension (1440±30) x (1270±30) um.
Die thicness (460±20) um.

Fig. 5- Pad layout diagramm

Table 4 – Contact pad coordinates

Contact pad number	Symbol	Coordinates (um)		Contact pad number	Symbol	Coordinates (um)	
		X	Y			X	Y
01	S	80	710	14	BC1/D2	1260	410
02	D	80	560	15	COM2	1260	560
03	COM1	80	410	16	OSCI	1260	710
04	B4/C4	80	260	17	OSCO	1260	860
05	A4/G4	145	80	18	U_{DD}	1260	1010
06	F4/E4	295	80	19	IND	1080	1090
07	B3/C3	445	80	20	EL	930	1090
08	AD3/G3	595	80	21	T3	780	1090
09	F3/E3	745	80	22	T1	630	1090
10	COL/D4	895	80	23	T2	480	1090
11	B2/C2	1045	80	24	L	80	1010
12	A2/G2	1195	80	25	GND	80	860
13	F2/E2	1260	260				