Circuit for electron pedometer - ergmeter

Short characteristics

Functions performed:

- 5 functions for counting time and calendar with indication of hours, minutes, seconds, month, date ,
- count the quantity of steps by means of evaluation and counting pulses from external sensor ;
- count and indication of steps, calories, kilometers , miles during current day and night (mode «DAILY STEPS COUNTER»);
- summing up at changing 24 hours, steps , calories, kilometers , miles with values stored previous (mode «TOTAL STEPS COUNTER»).

Features:

- imbed in chip element of quartz generator with operating frequency of 32768 Hz, capacity, resistor, and voltage doubler;
- operation from one battery with the voltage of 1.5V, low consumption power;
- availability of circuits of contacts bracing suppression on buttons inputs;
- frequency of registered pulses from external sensor at counting steps is no more than 6Hz at duration of time between the end of previous and beginning of counted pulse no less than 100 ms;
- conversion of quantity of steps into calories , kilometres and miles according to the following ratios:
  (10 steps = 0.24 calorie
  = 0.0073 klm
  = 0.0045 mile ;
  1000 steps = 24 calorie
  = 0.73 klm
  = 0.456 mile);
- indication of distance in miles and kilometers starting from 0.001, calories, starting from 0.1.

Operating temperatures range

operating temperatures range from -0 to +70°C.

Table 1 - Limiting and extreme modes

Symbol in letters	Name of parameter, mode , unit of measurement	Extreme mode		Limiting mode	
		min	max	min	max
U_{CC1}	Primary supply voltage from the source of voltage, V	1,2	1,8	-0,3	2,0
U_{CC2}	Secondary supply voltage, V	$2U_{CC1}$-0,3	$2U_{CC1}$	-0,3	4,0
U_{IH}	Input voltage of high level, V	U_{CC1}-0,3	U_{CC1}	-0,3	U_{CC1}+0,3
U_{IL}	Input voltage of low level, V	Uss	Uss+0,3	-0,3	U_{CC1}+0,3

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

Name of the parameter	in letters	Standard		mode of measurement	unit of measurement
		min	max		
Consumption current in primary supply voltage chain from voltage source	I_{CC1}	-	0.6	U_{CC1}=1.8 V	μA
Consumption current in secondary supply voltage chain	I_{CC2}	-	1.2	U_{CC1}=1.8 V	μA
dynamic consumption current	I_{CCO}	-	3.0	without load U_{CC1}=1.65 V	μA
Input current of low level on inputs S, M, D, COUNT	I_{IL}	-	5	U_{CC1}=1.65 V U_{IL}=0.3 V	μA
		-	8	U_{CC1}=1.8 V U_{IL}=0.3 V	
Voltage of quartz generator start	U_{OSC}	-	1.45	t≤5 c	V
voltage of quartz generator break-down	U_{OSP}	-	1.2	-	V

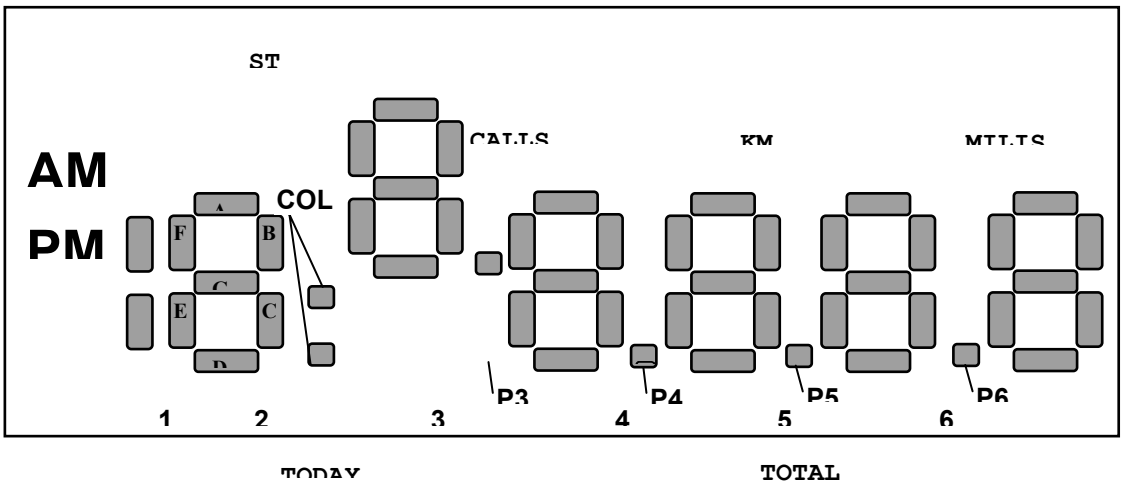


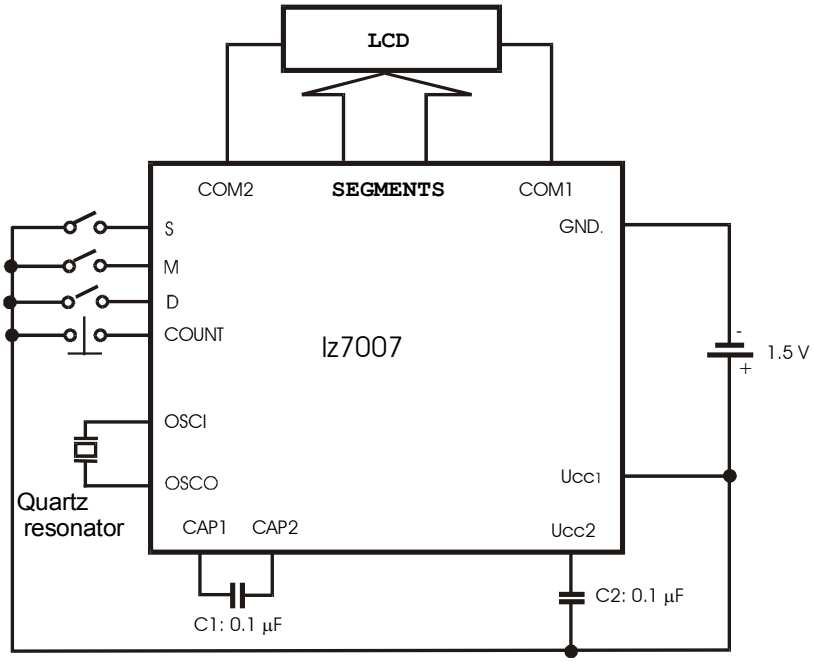
Figure1 - Format LCD

Table 3 – LCD segments State

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Segment	COM1	COM2
SEG28	*AM*	*PM*
SEG27	BC1	E2
SEG26	*ST*	F2
SEG25	A2	G2
SEG24	B2	C2
SEG23	*COL*	D2
SEG22	F3	E3
SEG21	*CALLS*	A3
SEG20	B3	G3
SEG19	C3	D3
SEG18	P3	*TODAY*
SEG17	F4	E4
SEG16	A4	G4
SEG15	B4	C4

Segment	COM1	COM2
SEG14	P4	D4
SEG13	*KM*	E5
SEG12	A5	F5
SEG11	B5	G5
SEG10	C5	D5
SEG9	F6	P5
SEG8	A6	E6
SEG7	B6	G6
SEG6	C6	D6
SEG5	P6	*TOTAL*
SEG4	*MILIS*	E7
SEG3	A7	F7
SEG2	B7	G7
SEG1	C7	D7



Quartz resonator characteristics

Fp = 32768Hz
C_L = 10pF
C_1 = 0.004pF
C_O = 2.5pF
Rs = 35kOhm
Q = 35000

Figure 2 – application diagram

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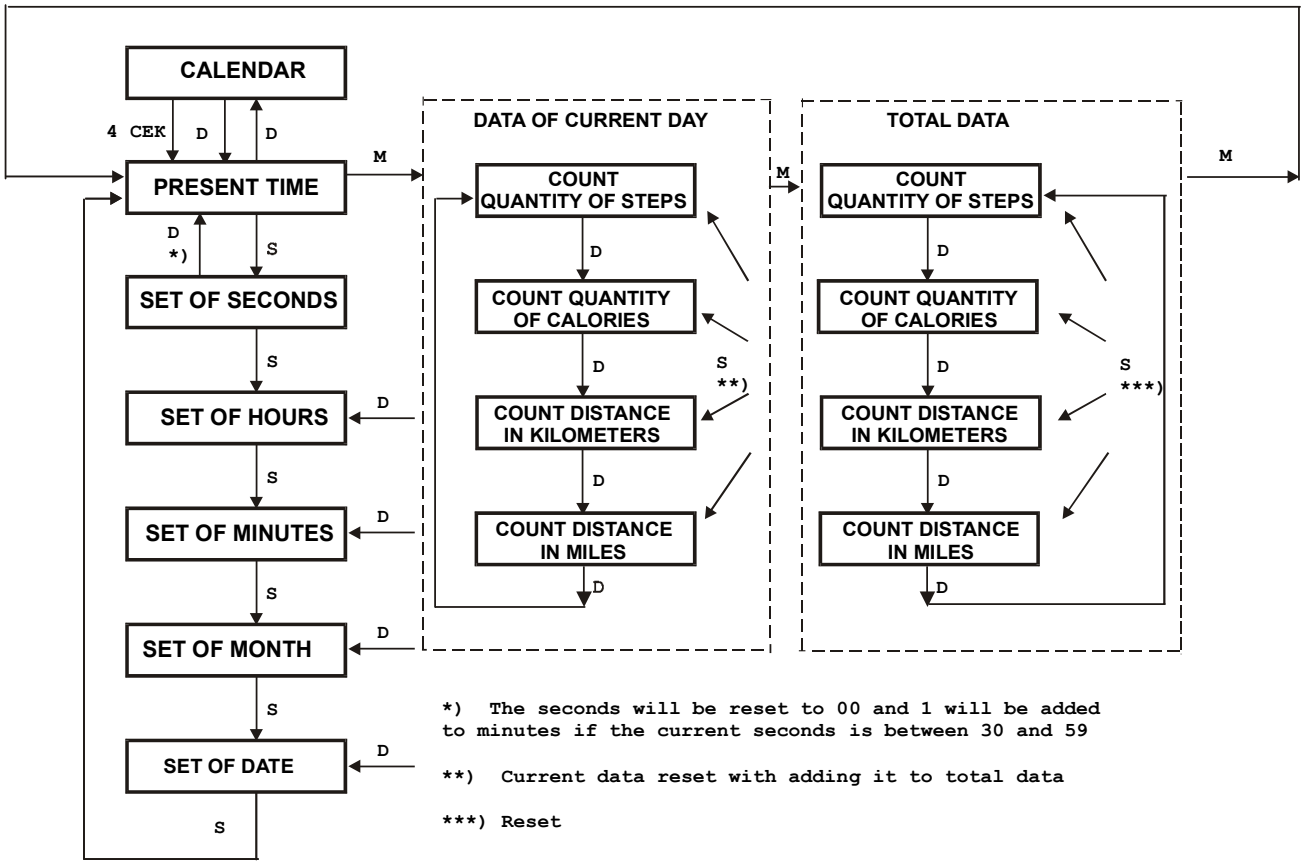
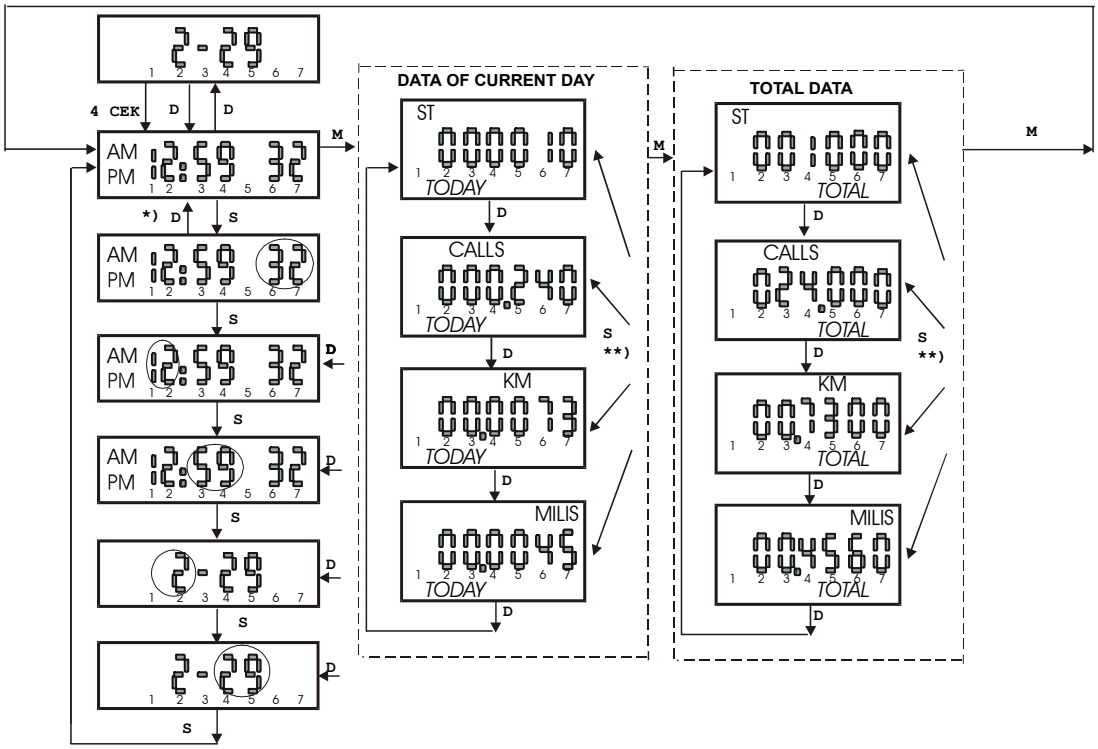


Figure 3 -Control algorithm

Figure 4 - Control algorithm and display of date



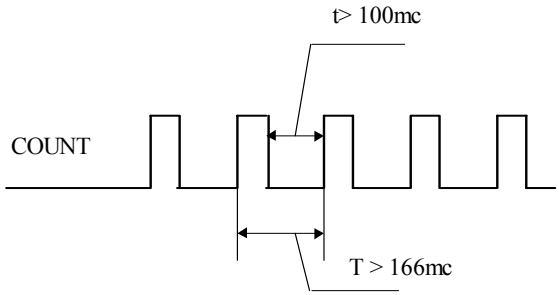


Figure 5 - Timing diagram

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Table 4 - Purpose of contact pads

№ of contact pad	Symbol	purpose
01	D	control input
02	M	control input
03	BD	is not used
04	BDN	is not used
05	U_{CC1}	Output of primary supply voltage from voltage source
06	U_{CC2}	pin of secondary supply voltage
07	EL	is not used
08	IND	is not used
09	GND	general output
10	CAP1	output of connecting of voltage converter capacity
11	CAP2	output of connecting of voltage converter capacity
12	OSCO	output for connection of quartz resonator
13	OSCI	input for connection of quartz resonator
14	TST	is not used
15	S	control input
16	COUNT	control input
17	COM1	LCD general electrode control output
18	SEG1	LCD sign electrode control output
19	SEG2	LCD sign electrode control output
20	SEG3	LCD sign electrode control output
21	SEG4	LCD sign electrode control output
22	SEG5	LCD sign electrode control output
23	SEG6	LCD sign electrode control output
24	SEG7	LCD sign electrode control output
25	SEG8	LCD sign electrode control output
26	SEG9	LCD sign electrode control output
27	SEG10	LCD sign electrode control output
28	SEG11	LCD sign electrode control output
29	SEG12	LCD sign electrode control output
30	SEG13	LCD sign electrode control output
31	SEG14	LCD sign electrode control output
32	SEG15	LCD sign electrode control output
33	SEG16	LCD sign electrode control output
34	SEG17	LCD sign electrode control output
35	SEG18	LCD sign electrode control output
36	SEG19	LCD sign electrode control output
37	SEG20	LCD sign electrode control output
38	SEG21	LCD sign electrode control output
39	SEG22	LCD sign electrode control output
40	SEG23	LCD sign electrode control output
41	SEG24	LCD sign electrode control output
42	SEG25	LCD sign electrode control output
43	SEG26	LCD sign electrode control output
44	SEG27	LCD sign electrode control output
45	SEG28	LCD sign electrode control output
46	SEG29	is not used
47	COM3	is not used
48	COM2	LCD General electrode control Output

Abbreviations
LCD - liquid crystal display жидкокристалический индикатор

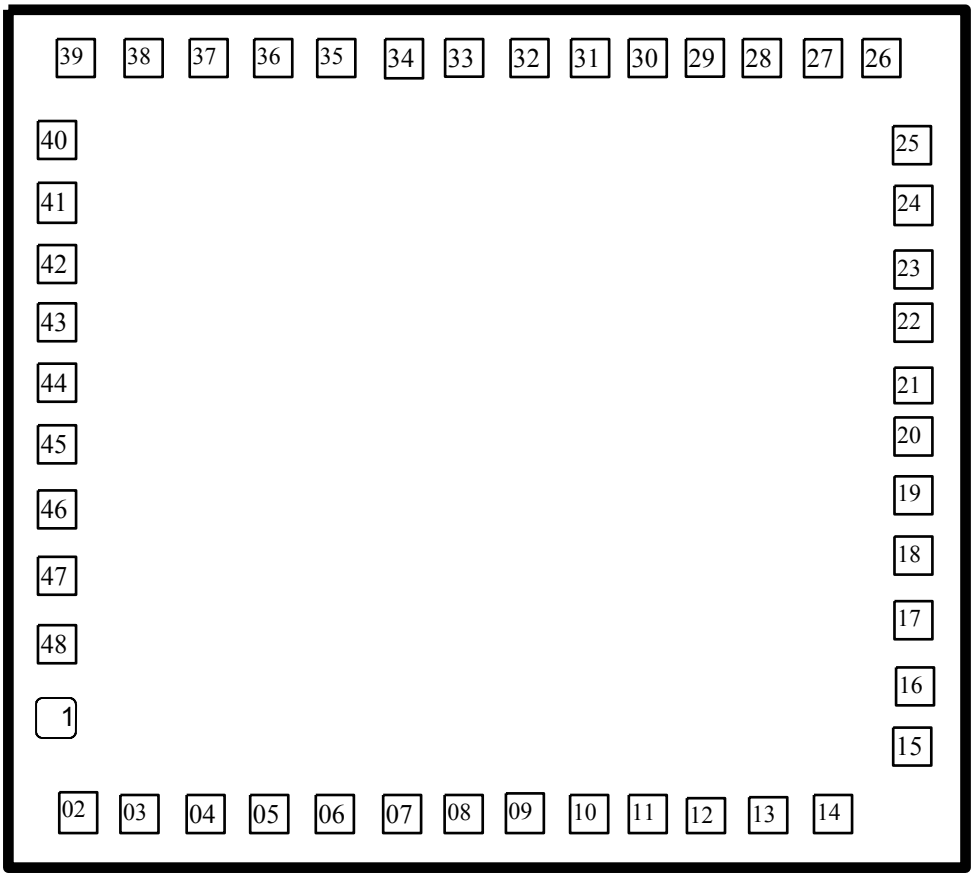


Figure 6 - Chip plane

Table 5 - Contact pads coordinates

Number of contact pad	symbol	Coordinates (μ)		Number of contact pad	symbol	Coordinates (μ)	
		X	Y			X	Y
01	D	106	314	25	SEG8	2146	1664
02	M	131	106	26	SEG9	2106	1864
03	BD	289	106	27	SEG10	1948	1864
04	BDN	440	106	28	SEG11	1798	1864
05	U_{CC1}	590	106	29	SEG12	1647	1864
06	U_{CC2}	740	106	30	SEG13	1497	1864
07	EL	891	106	31	SEG14	1346	1864
08	IND	1041	106	32	SEG15	1196	1864
09	GND	1192	106	33	SEG16	1046	1864
10	CAP1	1342	106	34	SEG17	895	1864
11	CAP2	1492	106	35	SEG18	745	1864
12	OSCO	1643	106	36	SEG19	594	1864
13	OSCI	1793	106	37	SEG20	444	1864
14	TST	1944	106	38	SEG21	294	1864
15	S	2146	165	39	SEG22	131	1864
16	COUNT	2146	311	40	SEG23	106	1655
17	COM1	2146	461	41	SEG24	106	1505
18	SEG1	2146	612	42	SEG25	106	1354
19	SEG2	2146	762	43	SEG26	106	1204
20	SEG3	2146	912	44	SEG27	106	1054
21	SEG4	2146	1063	45	SEG28	106	903
22	SEG5	2146	1213	46	SEG29	106	753
23	SEG6	2146	1364	47	COM3	106	603
24	SEG7	2146	1514	48	COM2	106	452

Chip size 2350±30 Ч 2070±30 μ.
Chip thickness: 460±20 μ.