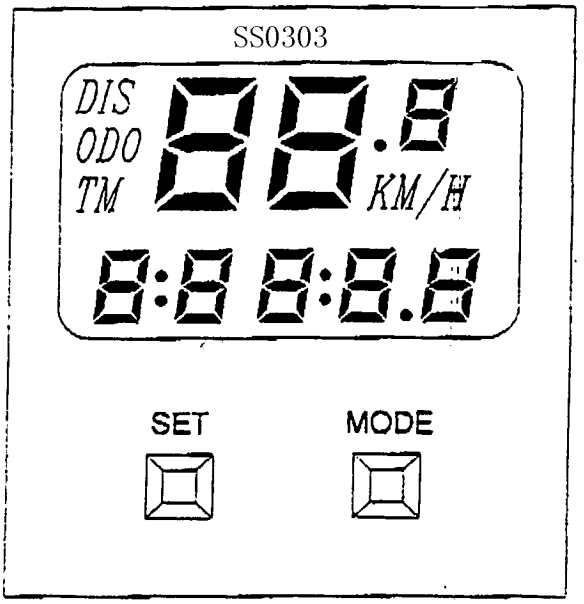
SS0303

CYCLOCOMPUTER
0.0 ~99.9 KM/H (MILE/H)



Features:

1. 1.5 Volts operating voltage
2. Dual-line display
3. Current speed in Kilometer per Hour (KM/H) or Mile per Hour (M/H)
4. Speedometer (0.0 to 99.9 km/h or mile/h) with a resolution of 0.5 km/h or mile/h
5. Tripmeter (0.00 to 999.99 km or mile) measuring elapsed distance
6. Odometer (0.0 to 9999.9 km or mile) measuring cumulated elapsed distance
7. Timer (0:00:00 to 9:59:59) started/stopped automatically by the wheel rotation or manually by pressing 'Set' key
8. Wheel size selection (in circumference ranging from 0 to 2999 mm) with a default value of 2124 mm at system reset
9. Blank display (power saving function) if no key pressed or wheel rotation for longer than 4 minutes

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I. General Description

The SS0303 is a low-power CMOS single chip microcontroller specially programmed to be used in a cyclometer, which requires low power operation. There are totally four functions available on this chip, speedometer for measuring the current speed of a bicycle, tripmeter for measuring elapsed distance, odometer for cumulatively measuring the total distance travelled since the last system reset and timer for measuring the elapsed time (Stopwatch) or the riding time when the bicycle being in motion (Auto-timer). The speedometer has a range of 0.0 to 99.9 km/h or mile/h with a resolution up to 0.5 km/h or mile/h. The SS0303 displays two functions simultaneously -- one is the real-time speedometer while the other one is selected by the 'mode' toggle input state.

II. Key Functions

Key	Terminal	Level	Functions
Mode	S2 & S4	Toggle	• Confirm unit setting • Confirm timer operating mode setting • Confirm individual digit setting of wheel size and switch to the next higher significant digit if any; otherwise confirm wheel size setting • Change mode 
Set	S1 & S3	Toggle	• Held for 3 seconds to reset timer in TM mode • Held for 3 seconds to reset distance in DIS mode • Held for 3 seconds to enter unit, timer operating mode and wheel size settings in ODO mode • Alternate display of flashing 'KM/H' or 'M/H' in unit setting • Alternate display of 'AUTO' or blank in timer operating mode setting • Advance flashing digit in wheel size setting • Held for automatically advance flashing digit in wheel size setting • Start/Stop timer in manual mode (Stopwatch)

Hold both the keys down for 3 seconds at any time to enter the initial setting mode that prompts inputs of unit setting, timer operating mode setting and wheel size setting, as that occurs after initial power up.

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III. Functional Description

3.1 Initial Setting Mode (System Reset)

When the system is first powered or both 'Set' and 'Mode' keys are held down for 3 seconds, the initial setting mode is entered. In this mode, all LCD segments are first turned on for a second and then turned off. Then, the system enters [1]unit setting (with 'M/H' displayed), followed by [2]timer operating mode setting (with 'AUTO' displayed) and [3]wheel size setting (with '2124' displayed). After all settings have been completed, the speedometer starts and the odometer mode is initially entered. In addition, the values of all functions are reset to zero.

3.2 Speedometer Function

This function is displayed at any time after the wheel size setting is completed. The speed of the bicycle is shown on the upper line of the display. The displayed value has a range of 0.0 to 99.9 km/h or mile/h with a resolution of 0.5 km/h or mile/h. The measurable range depends on the wheel size selected. For the default wheel size of 2124 mm, it is ranging from 4 to 80 km/h (or 2.5 to 50 mile/h). The speedometer is activated by the wheel rotation automatically and cannot be disabled or reset manually by the user.

3.3 Odometer Mode (ODO)

Odometer mode is indicated by 'ODO' icon. In this mode, the cyclometer accumulates the distance travelled in each trip since the last system reset. The value is shown on the lower line of the display. It can only be reset after system reset. When 'Set' key is held down for 3 seconds, [2]timer operating mode setting (with the current mode displayed) and [3]wheel size setting (with the current size displayed) will be entered. The values of other functions are retained before entering these settings. The maximum cumulated value is limited to 9999.9 km or mile. Once if this value is exceeded, the odometer will be restarted from zero.

3.4 Timer Mode (TM)

Timer mode is indicated by 'TM' icon. There are two operations (auto-timer and stopwatch) with the timer, which have exclusively been selected in timer operating mode setting. When the timer functions as an auto-timer, it is started/stopped automatically by the wheel rotation. When the timer functions as a stop watch, it can be started/stopped manually by pressing the 'Set' key. By holding down the 'Set' key for 3 seconds, the timer and the tripmeter will both be reset to zero. At system reset, the timer is intrinsically reset to zero. The range of the timer in either operation is from 0:00:00 to 9:59:59. Once if the upper bound is exceeded, the timer will be restarted from 0:00:00.

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3.5 Tripmeter Mode (DIS)

Tripmeter mode is indicated by 'DIS' icon. In this mode, the distance elapsed by the bicycle is recorded. By holding down the 'Set' key for 3 seconds, the tripmeter and the timer will both be reset to zero. At system reset, the tripmeter is intrinsically reset to zero. The distance measurement starts only when the timer is running in either operating mode. When the timer is stopped, the distance measurement will also be stopped with the last measured distance retained. The range of displayed value is from 0.00 to 999.99 km or mile. Once if the upper bound is exceeded, the tripmeter will be restarted from zero.

3.6 Blank Display Mode (Power Saving Function)

Blank display mode is entered automatically when there is no key pressed or wheel rotation for longer than 4 minutes. At this time, all the display segments are turned off and the CPU enters halt mode for power saving purpose. At the same time, the values of all functions are retained. Press any button or spin the wheel to release from this mode. Then, the retained values are restored and the odometer mode is initially entered.

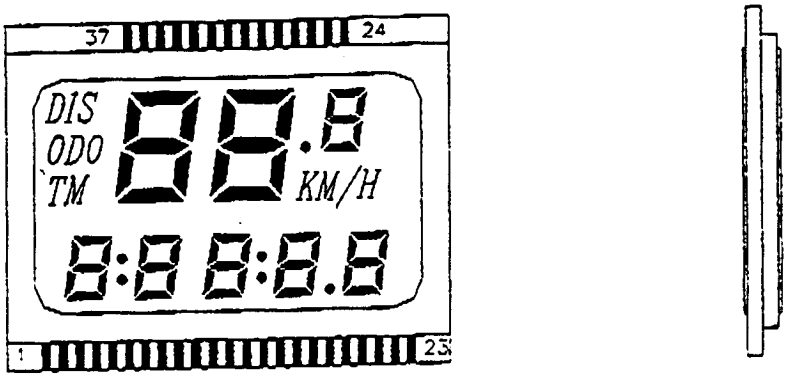
The 'M/H' or 'KM/H' icon indicates the unit used in the whole speed measurement. Press the 'Set' key to toggle blinking of either 'M/H' or 'KM/H'. Press the 'Mode' key to confirm the selection and exit the setting. The selected icon will be constantly shown on the display.

The presence or absence of an 'AUTO' icon indicates the timer functioning as auto-timer or stopwatch respectively. Press the 'Set' key to alternate the display of this icon. Press the 'Mode' key to confirm the selection and exit the setting.

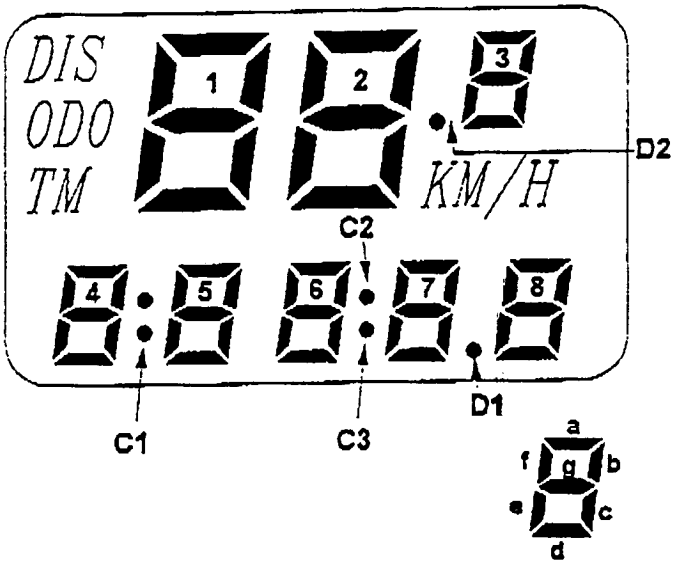
The value with the least significant digit blinking indicates the wheel circumference in mm. Press the 'Set' key to advance the blinking digit or hold it down for advancing the digit automatically. The ranges for the lower three digits are from 0 to 9 while that for the upper one is from 0 to 2. Press the 'Mode' key to confirm the digit setting and switch to the setting of the next higher significant digit if any; otherwise confirm the set value and exit the setting.

IV. LCD Information

4.1 LCD Pin Assignment



4.2 LCD Segment Assignment



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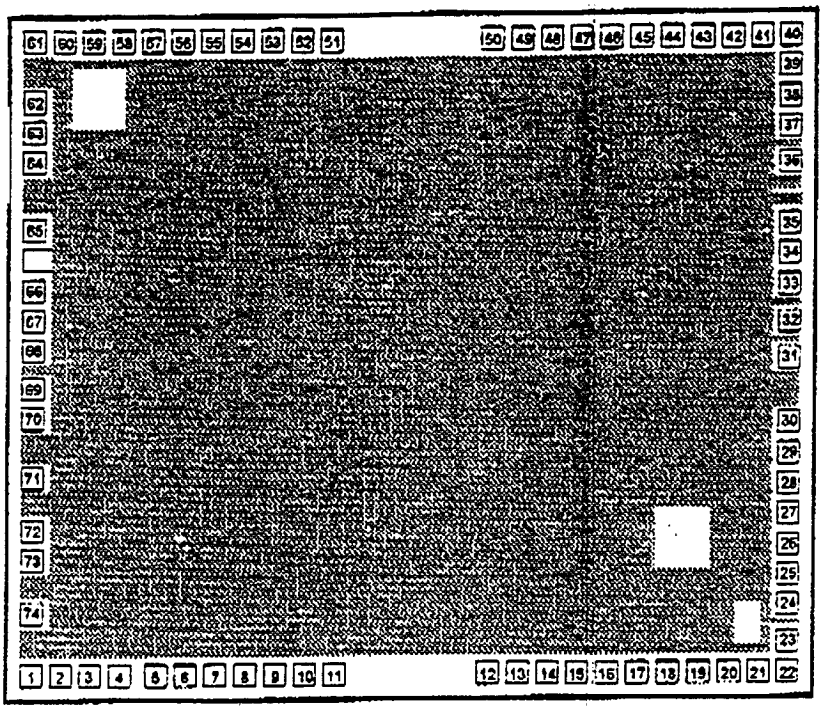
4.3 LCD Segment Assignment Table

LCD Pin No.	Chip Pin Name	COM1 Group	COM2 Group
1	COM2	—	COM2
2	SEG1	TM	—
3	SEG2	4e	4f
4	SEG3	4d	4g
5	SEG4	4c	4b
6	SEG5	C1	4a
7	SEG6	5e	5f
8	SEG7	5d	5g
9	SEG8	5c	5b
10	SEG9	DIS	5a
11	SEG10	ODO	6a
12	SEG11	6e	6f
13	SEG12	6d	6g
14	SEG13	6c	6b
15	SEG14	C3	C2
16	SEG15	7e	7f
17	SEG16	7d	7g
18	SEG17	7c	7b
19	SEG18	D1	7a
20	SEG19	8e	8f
21	SEG20	8d	8g
22	SEG21	8c	8b
23	SEG22	—	8a
24	SEG23	M/H	K
25	SEG24	3b	3c
26	SEG25	3a	3g
27	SEG26	3f	3e
28	SEG27	D2	3d
29	SEG28	2b	2c
30	SEG29	2a	2g
31	SEG30	2f	2e
32	SEG31	—	2d
33	SEG32	1b	1c
34	SEG33	1a	1g
35	SEG34	1f	1e
36	SEG35	—	1d
37	COM1	COM1	—

V. Chip Pad Information

5.1 Pad Lavout



5.2 Pad Coordinates

PAD	SIGNAL	X-POS.	Y-POS.
1	COM2	-2190	-1965
2	SEG1	-2010	-1965
3	SEG2	-1830	-1965
4	SEG3	-1650	-1965
5	SEG4	-1436	-1965
6	SEG5	-1256	-1965
7	SEG6	-1075	-1965
8	SEG7	-896	-1965
9	SEG8	-716	-1965
10	SEG9	-536	-1965
11	SEG10	-356	-1965
12	SEG11	390	-1965
13	SEG12	570	-1965
14	SEG13	750	-1965
15	SEG14	930	-1965
16	SEG15	1110	-1965
17	SEG16	1290	-1965
18	SEG17	1470	-1965
19	SEG18	1650	-1965
20	SEG19	1830	-1965
21	SEG20	2010	-1965
22	SEG21	2190	-1965
23	SEG22	2190	-1763
24	N.C.	2190	-1535
25	N.C.	2190	-1335
26	N.C.	2190	-1175
27	N.C.	2190	-995
28	N.C.	2190	-815
29	N.C.	2190	-635
30	AC	2190	-455
31	N.C.	2190	-67
32	N.C.	2190	209
33	VSS1	2190	457
34	S4	2190	637
35	S1	2190	817
36	VCM	2190	1169
37	VCP	2190	1407

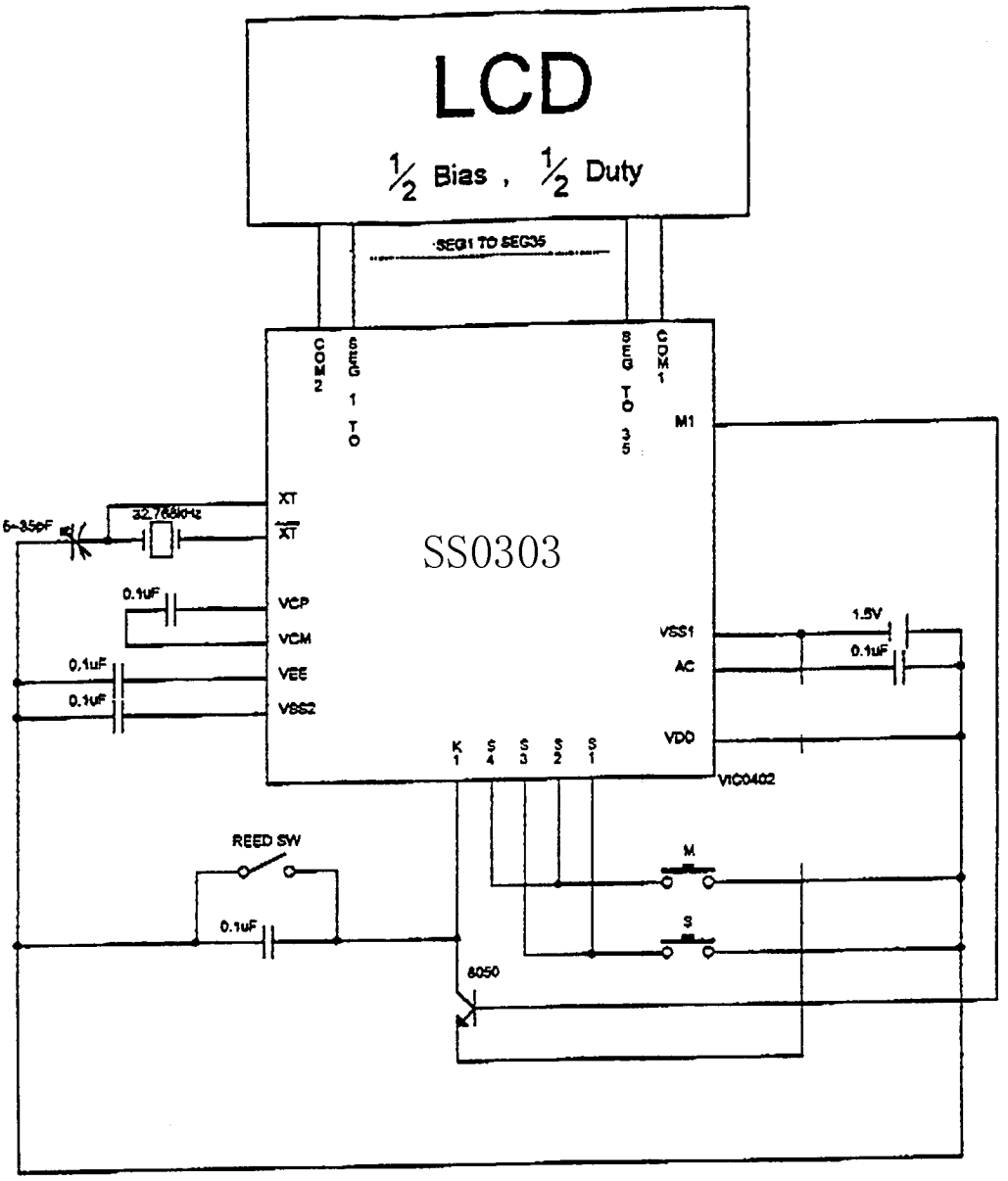
PAD	SIGNAL	X-POS.	Y-POS.
38	VSS2	2190	1587
39	SEG23	2190	1767
40	SEG24	2190	1965
41	SEG25	2010	1965
42	SEG26	1830	1965
43	SEG27	1650	1965
44	SEG28	1470	1965
45	SEG29	1290	1965
46	SEG30	1110	1965
47	SEG31	930	1965
48	SEG32	750	1965
49	SEG33	570	1965
50	SEG34	390	1965
51	SEG35	-390	1965
52	N.C.	-570	1965
53	N.C.	-750	1965
54	N.C.	-930	1965
55	N.C.	-1110	1965
56	N.C.	-1290	1965
57	N.C.	-1470	1965
58	N.C.	-1650	1965
59	N.C.	-1830	1965
60	N.C.	-2010	1965
61	COM1	-2190	1965
62	N.C.	-2190	1565
63	VDD	-2190	1385
64	XT	-2190	1205
65	$\overline{XT}$	-2190	857
66	S2	-2190	489
67	S3	-2190	309
68	VEE	-2190	129
69	K1	-2190	-131
70	N.C.	-2190	-311
71	M1	-2190	-721
72	N.C.	-2190	-1057
73	N.C.	-2190	-1237
74	N.C.	-2190	-1537

CHIP SIZE - 4.68 X 4.23 [mm]
PAD SIZE - 110 X 110 [μm]
ORG. - X = 0, Y = 0
UNIT - μm

VI. Pin Description

Designation	Functior
V_{DD}	Circuit ground potential
V_{SS_1}	Power source (-1.5V)
V_{SS_2}	Power source for LCD driver (-3.0V) This terminal is connected to V_{DD} terminal through a 0.1μF capacitor.
V_{EE}	Power source for internal logic (-1.5 to -3.0V) This terminal is connected to V_{DD} terminal through a 0.1μF capacitor.
V_{CP}, V_{CM}	Booster capacitor connection terminals V_{CP} terminal is connected to V_{CM} terminal through a 0.1μF capacitor.
XT, XT	Input and output terminals of oscillator inverter, 32.768kHz crystal is connected to these terminals.
AC	Terminal to clear internal logic pulled down to V_{SS_1}. After power is turned on. the SS0303 must be reset by this terminal.

VII. Reference Circuit Diagram



VIII. Electrical Characteristics

8.1 Absolute Maximum Ratings

Parameter	Symbol	Conditions	Limits	Unit
Supply Voltage 1	$V_{DD} - V_{SS_1}$	Ta = 25°C	-0.3 to +2.0	V
Supply Voltage 2	$V_{DD} - V_{SS_2}$	Ta = 25°C	-0.3 to +4.0	V
Supply Voltage 3	$V_{DD} - V_{EE}$	Ta = 25°C	-0.3 to +4.0	V
Input Voltage	V_{IN_1}	Ta = 25°C	V_{SS_1} -0.3 to +0.3	V
Output Voltage 1	V_{OUT_1}	Ta = 25°C	V_{SS_1} -0.3 to +0.3	V
Output Voltage 2	V_{OUT_2}	Ta = 25°C	V_{SS_2} -0.3 to +0.3	V
Storage Temperature	T_{stg}	—	-55 to 125	°C

8.2 Operating Conditions

Parameter	Symbol	Limits	Unit
Operating Voltage	$V_{DD} - V_{SS_1}$	1.25 to 1.65	V
Operating Temperature	T_{opr}	-20 to 75	°C

8.3 DC Characteristics

(V_{DD} = 0V, V_{SS_1}, V_{EE} = −1.55V, V_{SS_2} = −3.0V, C_1 = 30kΩ, Ta=25°C are assumed)

Parameter	Symbol	Condition	Limits			Unit
			Min.	Typ.	Max.	
Power supply current	I_{DD}	—	—	3.0	—	μA
Oscillation start voltage	$-V_{OSC}$	Within 5 sec. V_{SS_1} terminal	1.45	—	—	V
Output current 1 (COM)	I_{OH_1}	V_{OH_1} = −0.2V	—	—	-4	μA
	I_{OM_1}	V_{OM_1} = V_{SS_1} ±0.2V	4	—	-4	
	I_{OL_1}	V_{OL_1} = −2.8V	4	—	—	
Output current 2 (SEGMENT)	I_{OH_2}	V_{OH_2} = −0.2V	—	—	-0.4	μA
	I_{OL_2}	V_{OL_2} = −2.8V	0.4	—	—	
Output current 3 (M_1)	I_{OH_3}	V_{OH_3} = −0.5V	—	—	-100	μA
	I_{OL_3}	V_{OL_3} = −1.0V	1.5	—	12.7	
Input current 1 (S_1 ~ S_4)	I_{IH_1}	V_{IH_1} = 0V	1	10	50	μA
	I_{IL_1}	V_{IL_1} = −1.55V	-0.2	—	—	
Input current 2 (K_1)	I_{IH_2}	V_{IH_2} = 0V	2.5	6	11.6	μA
	I_{IL_2}	V_{IL_2} = −1.55V	-0.2	—	—	
Oscillator built-in capacitor	CD	—	—	20	—	pF