## Silan
Semiconductors

SC83702

ALL IN ONE MOUSE CONTROLLER

DESCRIPTION

The SC83702 Mouse Controller is specially designed to control mouse device. This single chip can interface three key-switches and four photo-couple direct to RS-232C. The SC83702 does not need any external power supply, so the mouse can go without a power line. It is versatile with both microsoft and mouse system. Debouncing circuit were provided to prevent false entry and to improve the accuracy. In 1200 baud rate non-auto speed with 200 DPI wheels and photo-couples, the scanning is 650mm/sec without missing a dot in microsoft mode, and the scanning speed can up to 770mm/sec in mouse system mode.

FEATURES

*Built-in two zener diode between VDD and VSS, RTS and VDD

*Built-in noise immunity circuit

*CMOS DIP 16 pins package&SOP 16 pins package

*Low power dissipation

*Use 32.768KHz crystal or 3.58MHz resonator

*Oscillator circuits on-chip

*Serial output in 1200 baud rate

*Can be powered directly from RS-232C

*Can drive directly to RS-232C

*Three key-switches and four photo-couples inputs
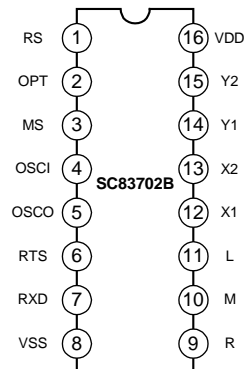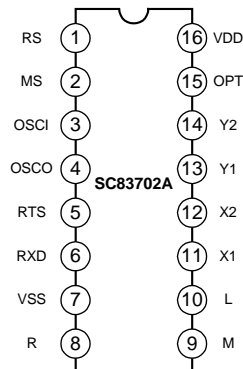
*Both key-in and key-release debounce interval 13ms

SOP-16

DIP-16
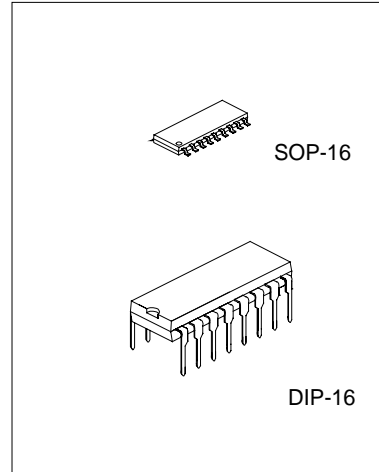
*Through three key-switches input, SC83702 can exert seven different output
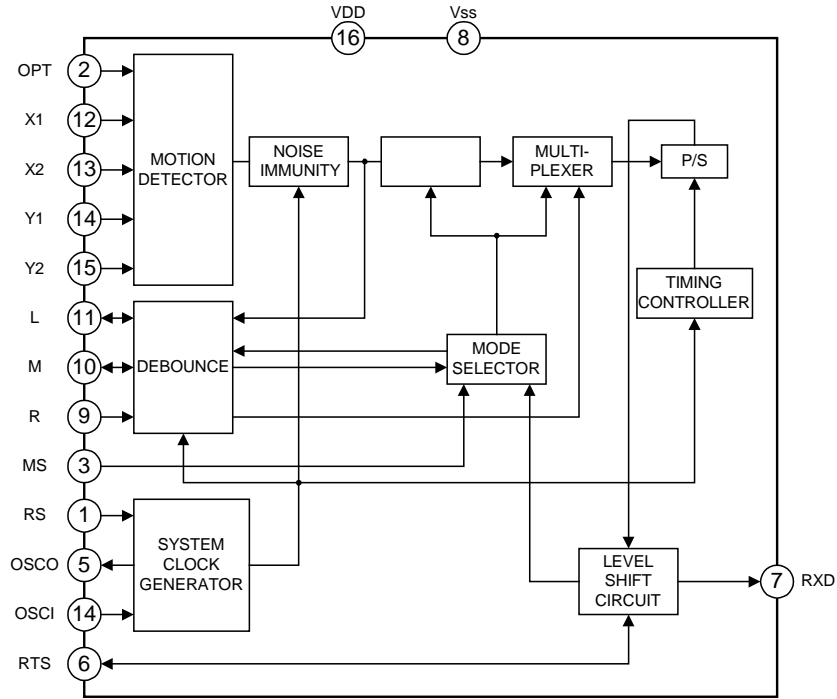
*The sampling rate of motion detector is 65KHz

APPLICATIONS

*Optical mouse or pen-mouse

*Mechanical mouse or pen-mouse

*Optomechanical mouse or pen-mouse

*Mechanical track ball

*Optomechanical track ball

PIN CONFIGURATIONS

SC83702A

RS	1		16	VDD
MS	2		15	OPT
OSCI	3		14	Y2
OSCO	4		13	Y1
RTS	5		12	X2
RXD	6		11	X1
VSS	7		10	L
R	8		9	M

SC83702B

RS	1		16	VDD
OPT	2		15	Y2
MS	3		14	Y1
OSCI	4		13	X2
OSCO	5		12	X1
RTS	6		11	L
RXD	7		10	M
VSS	8		9	R

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BLOCK DIAGRAM

NOTE: The pin numbers refer to SC83702B.

ABSOLUTE MAXIMUM RATINGS (Tamb=25°C, unless otherwise specified)

Characteristic		Value	Unit
Supply Voltage	V_{DD}- Vss	-0.3~+7.0	V
	RTS-Vss	-0.3~+14	V
Temperature Under Bias		0~70	°C
Storage Temperature		-65~+150	°C
Power Dissipation		600	mW

DC ELECTRICAL CHARACTERISTICS (Tamb=25~70°C, VDD=5.6V)

Parameter	Symbol	Min	Typ	Max	Unit
Operating Voltage	VDD	--	--	6.5	V
	VRTS	--	--	13	V
Operating Current (VDD=5.4V, RTS=VDD, 32.768kHz, No Load)	Iop	--	--	0.6	mA
Operating Current (VDD=6.2V, RTS=VDD, 32.768kHz, No Load)	Iop	3	--	--	mA
Operating Current (VDD=5.4V, RTS=VDD, 3.58MHz, No Load)	Iop	--	--	1.6	mA
Operating Current (VDD=6.2V, RTS=VDD, 3.58MHz, No Load)	Iop	4	--	--	mA
RTS Operating Current (VDD=5.6V, RTS=11V)	IRTS	--	--	0.6	mA
RTS Operating Current (VDD=5.6V, RTS=11.8V)	IRTS	3	--	--	mA
RXD High Output Current (Vrh=Vrts-2.6V)	Irh	2.0	--	--	mA
RXD Low Output Current (Vrl=Vss+2.6V)	Irl	--	--	-2.0	mA
X1,X2,Y1,Y2 Low Input Voltage	Vpl	--	--	0.7	V
X1,X2,Y1,Y2 High Input Voltage	Vph	1.3	--	--	V
X1,X2,Y1,Y2 Input Current (Pull Low Resistor, Vds=1.0V)	Ipi	57	--	104	μA
RTS High Input Voltage	Vth	9.6	--	--	V
RTS Low Input Voltage	Vtl	--	--	6.8	V
Low Input Voltage, Other Pins	Vail	--	--	1.5	V
High Input Voltage, Other Pins	Vaih	3.5	--	--	V
L,M,R,OPT Input Current (Pull Low Resistor, Vds=5.6V)	Imi	18.6	--	56	μA
Rs,Osc-In,L,M,R,X1,X2,Y2,Y2,Opt Input Leakage Current (Vin=0V)	Iil	0	--	1.0	μA
RS, OSC-IN Input Leakage Current (Vin=5.6V)	Iih	-1.0	--	0	μA

NOTE: *All voltages in above table are compared with VSS.

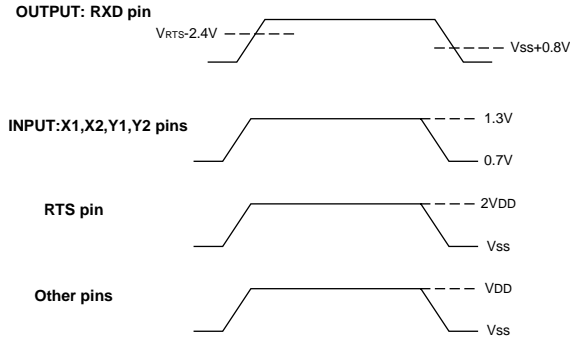　　　*All parameters in above table are tested under VDD=5.6V

AC ELECTRICAL CHARACTERISTICS (Tamb=25~70°C)

Parameter		Symbol	Min	Typ	Max	Unit
Key debounce		Tkd	--	13	--	ms
Transmission time	mouse(1200)	Tms	--	41.1	--	ms
Transmission time	microsoft(1200)	Tmx	--	24.7	--	ms
Start bit time	(1200)	Ts	--	0.85	--	ms
Data bit time	(1200)	Td	--	0.82	--	ms
Stop bit time	(1200)	Tp	--	0.82	--	ms
Mode code delay time	(1200)	Trd	11.9	--	14	ms
Rising edge crossed width		Tr	15	--	--	μs
Falling edge crossed width		Tf	15	--	--	μs

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AC TIMING TEST POINT

OUTPUT: RXD pin

V$_{RTS}$-2.4V

Vss+0.8V

INPUT:X1,X2,Y1,Y2 pins

1.3V

0.7V

RTS pin

2VDD

Vss

Other pins

VDD

Vss

X1,X2,Y1,Y2 INPUT IMPEDANCE

UNIT:KΩ

MAX.

17.0
16.0
15.0
14.0 TYP.
13.0
12.0
11.0 MIN.
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0

0   1.0   2.0   3.0   4.0   5.0

INPUT VOLTAGE
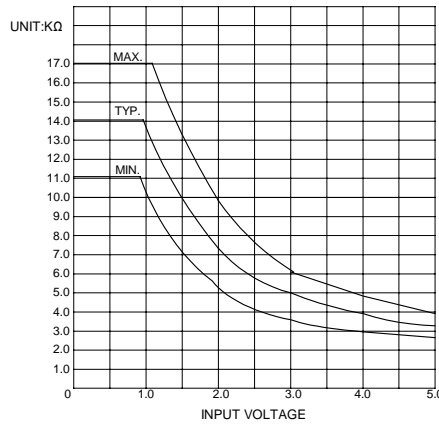
PIN DESCRIPTION

Pin Name	I/O	Description
RS	I	Crystal type select: "0" or floating. select 32.768KHz crystal. "1" select 3.58MHz resonator.
RXD	O	There are 8 or 7 bits in each data byte. Using parallel-in and serial-out components, the data bytes are shifted out from bit 0 through the high bits. SC83702 will transmit the data while the status of three key switches or the state of the horizontal counter or vertical counter is changed.

(to be continued)

(continued)

Pin Name	I/O	Description
MS	I	When this pin is connected to V_{DD}, then SC83702 is assigned to operate under the microsoft mode only. If the pin is connected to Vss, then SC83702 will operate under the mouse system mode. However if this pin is "floating", then SC83702 is on the "power on initiation" situation and if any one of three buttons is chosen, then SC83702 will operate under the mouse mode. And while the whole system is on "power on initiation", no key is chosen then operation will be under microsoft mode.
OSC.IN	I	A built-in inverter provides oscillation with 32.768KHz crystal or 3.58MHz resonator. Several counters used to decrease the frequency of oscillation and create 1200 baud rate, key-switches debounce and photo-couple sensor scanning clock, etc.
OSC.OUT	O	
RTS	I	Positive power input. The signal is sent by mouse driver from computer to the mouse to select a mode. During the reset time, SC83702 echoes the selected mode to the RXD line after the reset pulse signal of the RTS line. RXD will send out CD (H) code if it is under the microsoft mode. RXD will send out two-byte C8 (H) code if it is under the mouse system mode in SC83702.
Vss	--	Negative power input.
R	I	Three key-switches exert seven different combinations totally. Both key-pressed and key-released signals will be sent accompanied with horizontal and vertical state. The status of the key-switches will be preserved, whenever the value of horizontal or vertical counters will present at RXD. And the debounce interval for both key-press and key-release is 13ms.
M	I/O	
L	I/O	In testing mode, L and M are the outputs of motion detector. Using R key can select the two outputs X1, X2 or Y1, Y2. This feature can help manufacturer to adjust the phase of four photo-couples for improving the yield.
X1	I	Four photo-couple signals denote UP, DOWN, LEFT and RIGHT state. If SC83702 is in 1200 baud rate on non-auto speed mode, the system provides 40 transmission cycles per second in microsoft mode to the utmost. In mouse system mode, the cycles are 24 maximum. During the scanning period, as long as the photo couples change their states, the value of vertical or horizontal counter will increase or decrease accordingly.
X2		
Y1		
Y2		
OPT	I	Whenever OPT is connected to VDD, the chip will enter testing mode.
VDD	--	Power

FUNCTION DESCRIPTIONS

1.OPERATING MODE

A) Mouse System Mode

Anytime the mouse changes its state, including the key-switches and the photo-couple sensors, SC83702 will detect the result and transmit to RS-232C. Mouse system transmits the result with five bytes in 1200 baud rate. Each byte contains 10 bits, one start bit, one stop bit and eight data bits. The first byte represents the key-switches status. The second byte denotes the number counted by the horizontal counter. The third byte conveys the number accumulated by the vertical counter. If the mouse is moved faster, the photo-couple sensors detect the "change state" and output the record, excessive horizontal counter will be transported through the fourth byte and vertical counter through the fifth byte. Otherwise, the fourth and fifth byte are zero. Output bytes arrange:

Bit No.	7	6	5	4	3	2	1	0
1st Byte	1	0	0	0	0	L'*	M'*	R'*
2nd Byte	H7	H6	H5	H4	H3	H2	H1	H0
3rd Byte	V7	V6	V5	V4	V3	V2	V1	V0
4th Byte	H7	H6	H5	H4	H3	H2	H1	H0
5th Byte	V7	V6	V5	V4	V3	V2	V1	V0

*: " ' " denotes complement

B) Microsoft Mode

In microsoft mode, the transmission cycle consists of three bytes. Each byte is divided into one start bit, seven data bits and two stop bits. The first byte contains "L", "R" switch status and four bits of the two most significant bits in horizontal counter and vertical counter. The next byte represents the value accumulated by horizontal counter, the last byte is the data of the vertical counter. Notice that "M" key-switch is not active in the microsoft mode and the vertical data is transmitted in 2's complement.

Bit No.	6	5	4	3	2	1	0
1st Byte	1	L	R	V7'	V6'	H7	H6
2nd Byte	0	H5	H4	H3	H2	H1	H0
3rd Byte	0	V5'	V4'	V3'	V2'	V1'	V0'

2.TESTING MODE

Whenever OPT is connected to V$_{DD}$, the chip will enter buyer's testing mode. The X direction output signal generators will present to L and M pin. Pressing "R" key can toggle the output from X direction to "Y" direction.
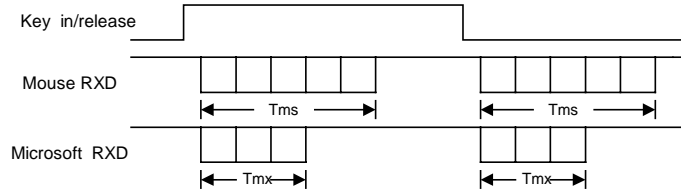
3.ECHO MODE

RXD will send out CD (H) code when RTS rise from low to high under microsoft mode. Under mouse system mode, when RTS rise from low to high, the RXD pin SC83702 will send out two byte C8 (H) code.
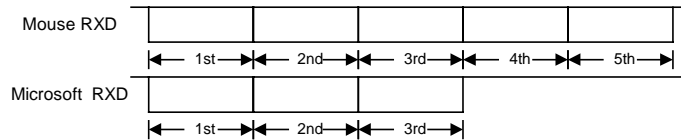
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TIMING DIAGRAM

(A) P/S Output

Key in/release
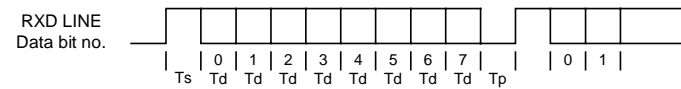
Mouse RXD

    Tms   Tms

Microsoft RXD

    Tmx   Tmx

(B) Bytes Structure

Mouse RXD

  1st   2nd   3rd   4th   5th

Microsoft RXD

  1st   2nd   3rd

(C) Bits Structure

(1) Mouse   RXD LINE
Data bit no.

  | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | 0 | 1 |
Ts Td Td Td Td Td Td Td Td Tp

(2) Microsoft   RXD LINE
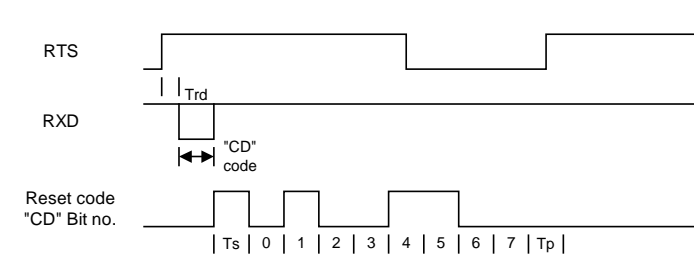Data bit no.

  | 0 | 1 | 2 | 3 | 4 | 5 | 6 | | 0 | 1 |
Ts Td Td Td Td Td Td Td Tp Tp
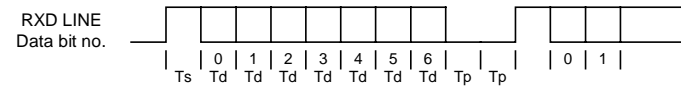
(D) Mode Select Timing

(1) Mouse system
RTS

|Trd|

RXD   two byte
"C8" code

Reset code
"C8" Bit no.

 | Ts | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Tp |

(2) Microsoft

RTS

| |Trd

RXD

"CD"
code

Reset code
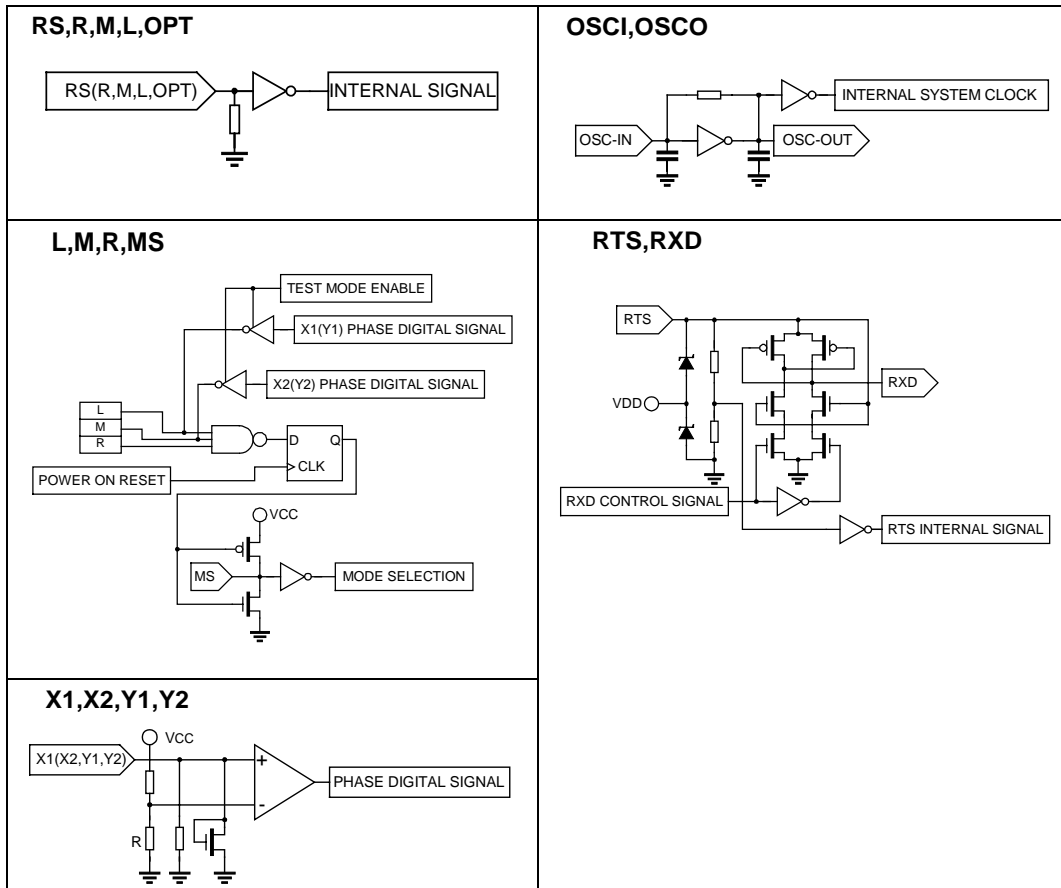"CD" Bit no.

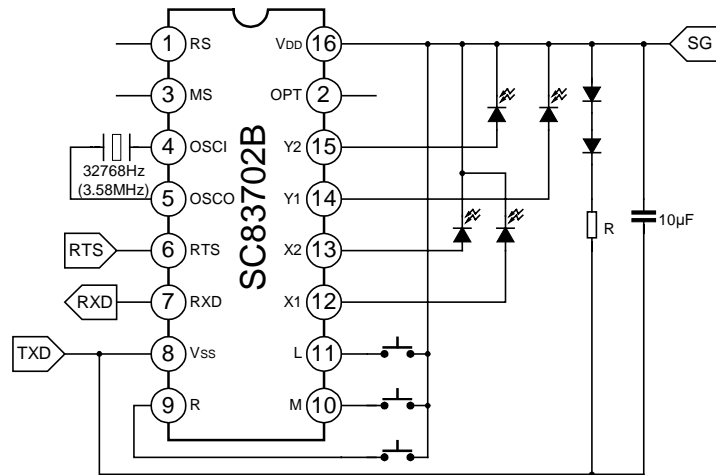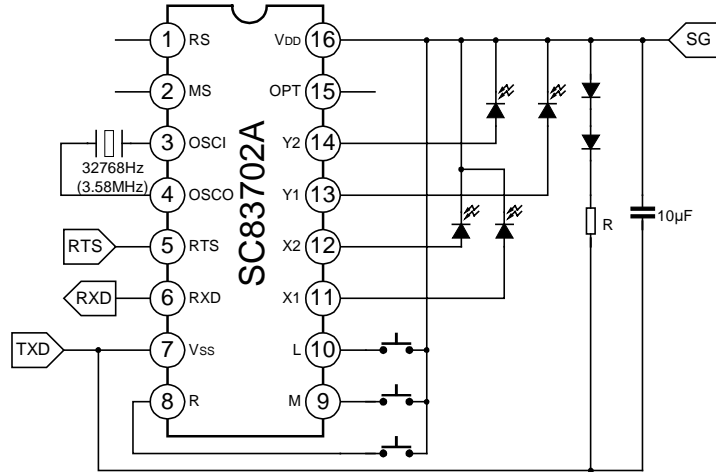 | Ts | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Tp |
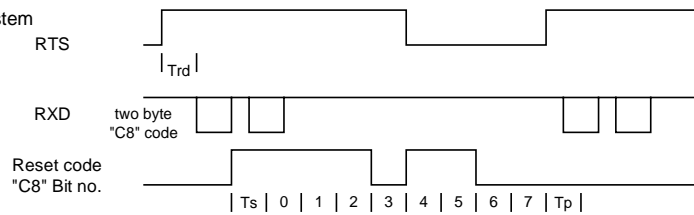
(E) Photo-couples pulse width
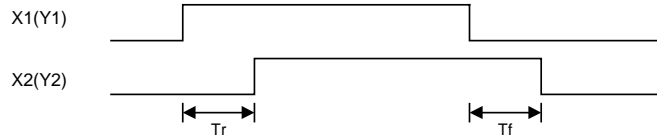
SC83702 I/O PIN EQUIVALENT CIRCUIT

OPTOMECHANICAL MOUSE APPLICATIONS

PACKAGE OUTLINE

DIP-16-300-2.54   UNIT:mm

SOP-16-225-1.27   UNIT:mm

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