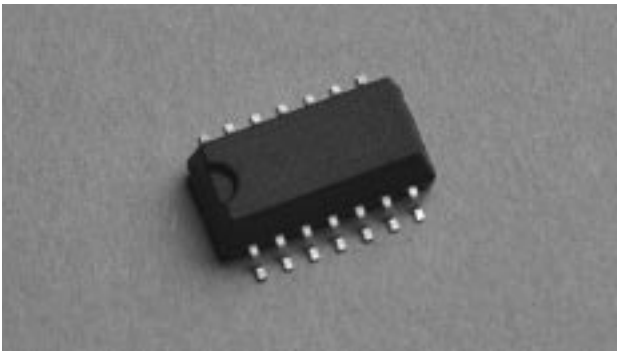


# Real Time Clock Modules - Seiko Epson

## RTC-8583/RTC-8593/RTC-8593SB



## Features

- **The Built-in Quartz Crystal. thus Adjustment Free with 10pF Gate capacitor**
- **Package (SOP-14 Pin) Worlds smallest**
- **Three mode operations: internal crystal oscillation, external 50Hz clock and event counter**
- **I<sup>2</sup>C-Bus Interface Compatible**
- **Built-in 240 x 8 bit S-RAM is Available (RTC8583)**
- **Alarm and Timer Functions are Available**
- **Wide Operating Voltage Range 2.5V to 6.0V**
- **Wide Data Hold Voltage Range 1.0V to 6.0V**
- **Low current consumption (RTC8593, 1.0µA Typical)**
- **Full Application Notes available**

## Specifications

### Absolute Maximum Rating

Item	Symbol	Condition	MIN.	MAX.	Unit
Supply voltage	V <sub>DD</sub>	V <sub>DD</sub> -GND	-0.8	+7.0	V
Data Holding Voltage	V <sub>IN</sub>		GND-0.8	V <sub>DD</sub> +0.8	V
Input current	I <sub>I</sub>			10	mA
Output current	I <sub>O</sub>			10	mA
Storage temperature	T <sub>STG</sub>		-55	+125	°C

### Operating Range

Item	Symbol	MIN.	MAX.	Unit
Operating voltage	V <sub>DD</sub>	2.5	6.0	V
Data Holding Voltage	V <sub>CLK</sub>	1.0	6.0	V
Operating temperature	T <sub>OPR</sub>	-30	+70	°C
External capacitor	C <sub>q</sub>	10 ± 5%		pF

### DC Characteristics

Item	Symbol	Condition	MIN	TYP.	MAX.	Unit	
"H" input voltage	SDA	V <sub>IH</sub>		0.7V <sub>DD</sub>	V <sub>DD</sub> +0.8	V	
"L" input voltage	SDA	V <sub>IL</sub>		-0.8	0.3	V	
"L" output current	SDA	I <sub>OL</sub>	V <sub>CL</sub> =0.4V	3		mA	
Input leak current	SDA	I <sub>L</sub>	V <sub>IN</sub> =V <sub>DD</sub> or GND	1		µA	
Leak current	AO RESET OSC1	I <sub>L</sub>	V <sub>IN</sub> =V <sub>DD</sub> or GND		250	µA	
Output current	INT	I <sub>OL</sub>	V <sub>CL</sub> =0.4V	1		mA	
Leak current	INT SCL	I <sub>L</sub>	V <sub>IN</sub> =V <sub>DD</sub> or GND		1	µA	
Source current (access)		I <sub>DDO</sub>	f <sub>SCL</sub> =100Hz		200	µA	
Current	8583	1	I <sub>DD1</sub>	V <sub>DD</sub> =5V, f <sub>SCL</sub> =0Hz	10	50	µA
		2	I <sub>DD2</sub>	V <sub>DD</sub> =3V, f <sub>SCL</sub> =0Hz	3.5	15	µA
		3	I <sub>DD3</sub>	V <sub>DD</sub> =2V, f <sub>SCL</sub> =0Hz	2.0	10	µA
Consumption (Non access)	8593	1	I <sub>DD1</sub>	V <sub>DD</sub> =5V, f <sub>SCL</sub> =0Hz	3.0	15	µA
		2	I <sub>DD2</sub>	V <sub>DD</sub> =3V, f <sub>SCL</sub> =0Hz	1.2	10	µA
		3	I <sub>DD3</sub>	V <sub>DD</sub> =2V, f <sub>SCL</sub> =0Hz	1.0	8	µA

### Frequency Characteristics

Item	Symbol	Condition	MAX.	Unit
Frequency tolerance	Δf/fo	T <sub>a</sub> =25°C, V <sub>DD</sub> =5V	A: 5±20 B: 5±50	ppm
Frequency temperature characteristics	top	T <sub>a</sub> =-10 to 70°C, V <sub>DD</sub> =5V	+10 -120	ppm
Frequency voltage characteristics	fv	T <sub>a</sub> =25°C, V <sub>DD</sub> =2.0 to 6.0V	±3	ppm
Start-up time	t <sub>STA</sub>	T <sub>a</sub> =25°C, V <sub>DD</sub> =5V	3	sec
Aging	fa	T <sub>a</sub> =25°C, V <sub>DD</sub> =5V first year	±5	ppm/ year

## Ordering Information

ACT Stock No.	ACT Stock No.
RTC8583A (20ppm)	RTC8593A (20ppm)
RTC8583B (50ppm)	RTC8593B (50ppm)

# Real Time Clock Modules - Seiko Epson

## RTC-8583/RTC-8593/RTC-8593SB Series Continued

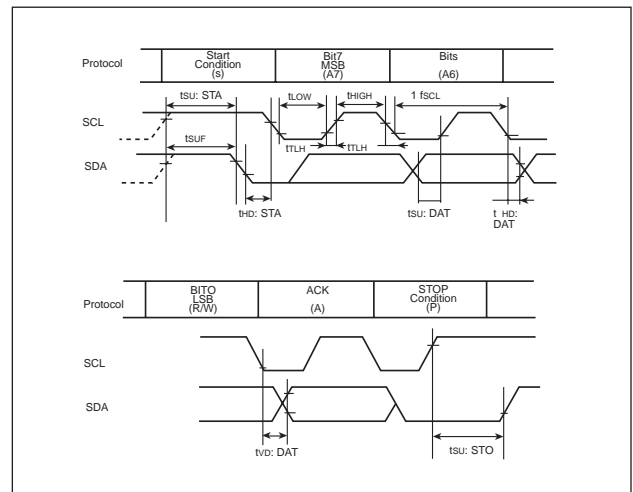
**Register Table**

Address	Register name	count	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
00	CNT		STOP	HOLD	MODE1	MODE2	MASK	ALM	AF	TF
01	1/00SEC	0 to 99	8/10	4/10	2/10	1/10	8/100	4/100	2/100	1/100
02	SEC	0 to 59	10S8	10S4	10S2	10S1	S8	S4	S2	S1
03	MIN	0 to 59	10MIN8	10MIN4	10MIN2	10MIN1	MIN8	MIN4	MIN2	MIN1
04	HOUR	0 to 23	12/24	AM/PM	10HOUR2	10HOUR1	HOUR8	HOUR4	HOUR2	HOUR1
05	DAY	0 to 31	YEAR2	YEAR1	10DAY2	10DAY1	DAY8	DAY4	DAY2	DAY1
06	MONTH	0 to 12	W4	W2	W1	10MONTH1	MONTH8	MONTH4	MONTH2	MONTH1
07	TIMER	0 to 99	10TIMER8	10TIMER4	10TIMER2	10TIMER1	TIMER8	TIMER4	TIMER2	TIMER1
08	ALARM		AIE	TAIE	AS1	AS0	TIE	TCP2	TCP1	TCPO
09	A-1/100	0 to 99	A-8/10	A-4/10	A-2/10	A-1/10	A-8/100	A-4/100	A-2/100	A-1/100
0A	A-SEC	0 to 59	10A-SEC8	10A-SEC4	10A-SEC2	10A-SEC1	10A-SEC8	10A-SEC4	10A-SEC2	10A-SEC1
0B	A-MIN	0 to 59	10A-MIN8	10A-MIN4	10A-MIN2	10A-MIN1	10A-MIN8	10A-MIN4	10A-MIN2	10A-MIN1
0C	A-HR	0 to 23	A-12/24	A-AM/PM	10A-HR2	10A-HR1	A-HR8	A-HR4	A-HR2	A-HR1
0D	A-DAY	0 to 31	-	-	A-DAY2	A-DAY1	A-DAY8	A-DAY4	A-DAY2	A-DAY1
0E	A-MON	0 to 12	-	-	-	10A-MON1	10A-MON8	10A-MON4	10A-MON2	10A-MON1
0F	A-TIM	0 to 99	10A-TIM8	10A-TIM4	10A-TIM2	10A-TIM1	10A-TIM8	10A-TIM4	10A-TIM2	10A-TIM1
10 to FF		0 to FF	User's RAM (RTC-8583 is available)							

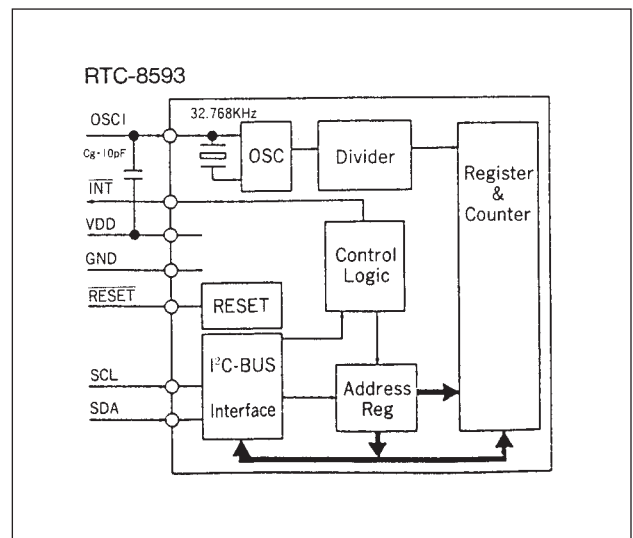
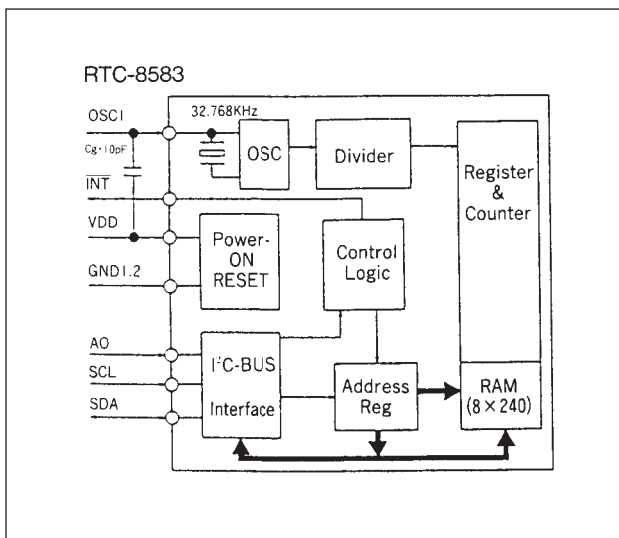
### Switching Characteristics

Item	Symbol	MIN.	MAX.	Unit
SCL clock frequency	$f_{SCL}$		100	kHz
Spike tolerance on bus	$t_{SW}$		100	$\mu$ S
Bus free time	$t_{BUF}$	4.7		$\mu$ S
Start condition set-up time	$t_{SU, STA}$	4.7		$\mu$ S
Hold time	$t_{HD, STA}$	4.0		$\mu$ S
SCL "L" time	$t_{LOW}$	4.7		$\mu$ S
SCL "H" time	$t_{HIGH}$	4.0		$\mu$ S
SCL, SDA rise time	$t_{TLH}$		1.0	$\mu$ S
SCL, SDA fall time	$t_{TFL}$		0.3	$\mu$ S
Date set-up	$t_{SU, DAT}$	250		$\mu$ S
Date hold time	$t_{HD, DAT}$	0		$\mu$ S
SCL low to data out valid	$t_{VD, DAT}$		3.4	$\mu$ S
Stop condition set-up time	$t_{SU, STO}$	4.0		$\mu$ S
Invent counter frequency	$f_i$		1.0	MHz

### Timing Chart



### Block Diagram



# Real Time Clock Modules - Seiko Epson

## RTC-8583/RTC-8593/RTC-8593SB Series Continued

### Dimensions and Pin Out - RTC-8593SB

Technical drawing of the R8593SB 5436A module. The top view shows a rectangular module with dimensions 11.4±0.2 mm width and 7.8±0.2 mm height. Pin numbers #1 to #18 are indicated. The side view shows a height of 5.4 mm and a lead thickness of 0.6±0.2 mm. The pinout view shows 18 pins with labels: 1-7 (N.C.), 8 (Reset), 9 (VSS), 10 (SDA), 11 (SCL), 12 (Int), 13 (VDD), 14 (OSC1), and 15-18 (N.C.). Specific pin dimensions include 0.76 mm for SCL, 2.0 mm for SDA, and 1.27 mm for VSS and RESET. A 10pf capacitor is shown connected to the VDD pin.

No.	8593SB
1-7	N.C.
8	Reset
9	VSS
10	SDA
11	SCL
12	Int
13	VDD
14	OSC1
15-18	N.C.

This part is incompatible with Philips PCF8593. Unit: mm

### Dimensions and Pin Out - RTC-8583 and RTC-8593

Technical drawing of the R8583B 447 6A module. The top view shows a rectangular module with dimensions 10.1±0.2 mm width and 7.4±0.2 mm height. Pin numbers 1 to 14 are indicated. The side view shows a height of 5.0 mm and a lead thickness of 0.6 mm. The pinout view shows 14 pins with labels: 1 (GND1), 2 (SCL), 3 (SDA), 4 (N.C.), 5 (GND2), 6 (N.C.), 7 (RESET), 8 (OSC1), 9 (N.C.), 10 (N.C.), 11 (VDD), 12 (N.C.), 13 (N.C.), and 14 (INT). Specific pin dimensions include 0.15 mm for the lead width and 0.05 mm minimum for the lead thickness.

No.	8583	No.	8593
1	GND1	1	N.C.
2	SCL	2	SCL
3	SDA	3	SDA
4	N.C.	4	N.C.
5	GND2	5	GND
6	N.C.	6	N.C.
7	A0	7	RESET
8	OSC1	8	OSC1
9	N.C.	9	N.C.
10	N.C.	10	N.C.
11	VDD	11	VDD
12	N.C.	12	N.C.
13	N.C.	13	N.C.
14	INT	14	INT

Unit: mm