

# **S1C17801**

## **8-bit Timer (T8)**

### **Application Note**

When using the commands, follow the instructions of NOTICE\_Application Notes Sample Programs.pdf being included in the downloaded compressed file.

## NOTICE

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## OVERVIEW

This document is a reference to use the 8-bit timer function of S1C17801.

## OPERATING ENVIRONMENT

- S5U1C17801T1100 (hereafter SVT17801:Software eValuation Tool for S1C17801)  
SVT17801 CPU board and SVT17 ICD board
- USB miniB cable
- PC  
The GNU17 development tool has been installed.  
The USB driver for the SVT17 ICD board has been installed.

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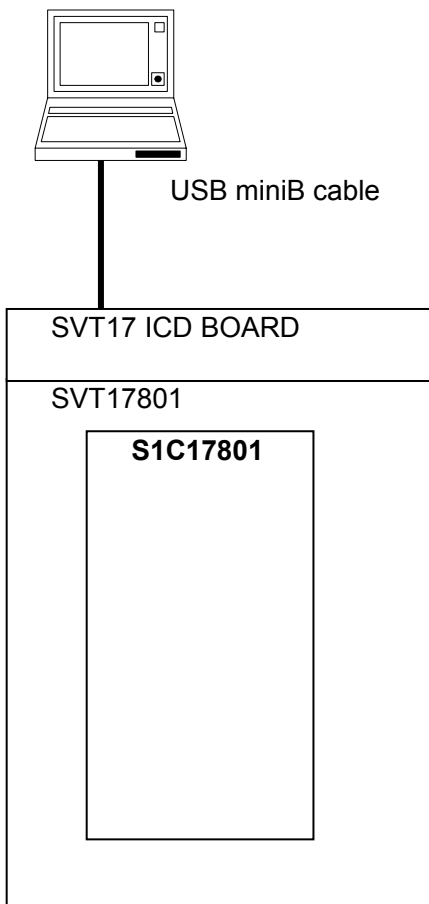
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### 1. SPECIFICATIONS

Start the 8-bit timer, generate a timer interrupt, and display it on the simulated I/O.

The following illustrates the standard cable layout.

PC (having the GNU17 development tool)



## 2. DESCRIPTIONS OF FUNCTIONS USED

## 2. DESCRIPTIONS OF FUNCTIONS USED

**Operation clock** The 8-bit programmable timer uses prescaler output clocks for counting. The prescaler generates 13 clocks by dividing the PT8\_CLK clock into 1/1 to 1/4096. This sample software uses the 1/256 division clock.

**Interrupts** The vector number and address of 8-bit timer interrupt are as follows:

Timer 0

Vector number: 21 (0x15)

Vector address: 0x900054

Timer 1

Vector number: 22 (0x16)

Vector address: 0x900058

Timer 2

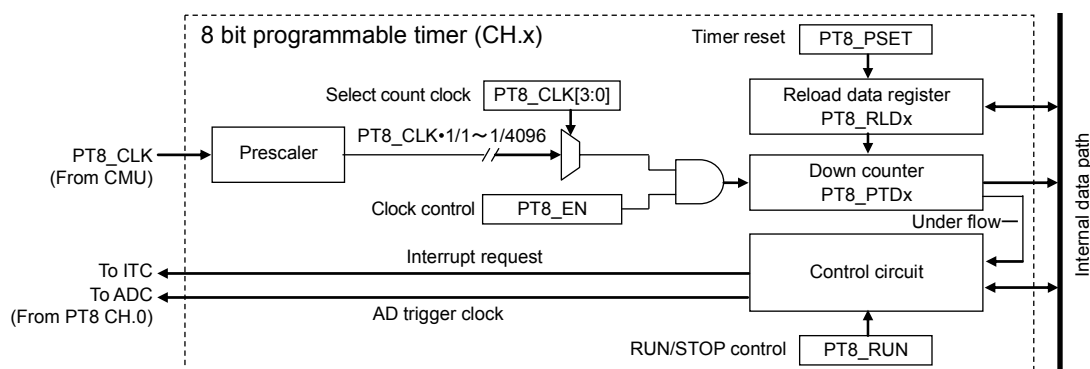
Vector number: 23 (0x17)

Vector address: 0x90005c

Timer 3

Vector number: 24 (0x18)

Vector address: 0x900060



### 3. SOFTWARE DESCRIPTION

#### 3.1 File Configuration

File name	Function
boot.c	Startup module
main.c	Main function
inthdlr.c	Interrupt handler function
vector.c	Vector table settings
header¥reg_801.h	Register definitions
header¥vector.h	Vector table definitions
t8_drv¥t8_drv.c	T8 driver API group
t8_drv¥t8_api.h	T8 driver API definitions
t8_gnu17IDE.lids	Linker script file
t8_gnu17IDE.cmd	GDB command file
t8_gnu17IDE.par	Parameter configuration file
t8_gnu17IDE.mak	Make file
.cdtproject	Project file
.gnu17project	Project file
.project	Project file
GDB17 Launch for t8.launch	Project startup file

#### 3.2 Module Description

File name: main.c

Function name	Function
Main	Sets up the 8-bit timer and operates channels 0 to 3.
ExecuteT8Ch0	Starts channel 0 of the 8-bit timer and displays it on the simulated I/O.
ExecuteT8Ch1	Starts channel 1 of the 8-bit timer and displays it on the simulated I/O.
ExecuteT8Ch2	Starts channel 2 of the 8-bit timer and displays it on the simulated I/O.
ExecuteT8Ch3	Starts channel 3 of the 8-bit timer and displays it on the simulated I/O.
t8ch0_int	Interrupts channel 0 of the 8-bit timer (and counts the interrupts).
t8ch1_int	Interrupts channel 1 of the 8-bit timer (and counts the interrupts).
t8ch2_int	Interrupts channel 2 of the 8-bit timer (and counts the interrupts).
t8ch3_int	Interrupts channel 3 of the 8-bit timer (and counts the interrupts).

#### 3.3 Global Variables

The following shows the global variables used in the sample program.

Variable name	Type	Function
g_TimCnt0	unsigned short	Stores the interrupt occurrence bits.
g_TimCnt1	unsigned short	Stores the interrupt occurrence bits.
g_TimCnt2	unsigned short	Stores the interrupt occurrence bits.
g_TimCnt3	unsigned short	Stores the interrupt occurrence bits.

### 3. SOFTWARE DESCRIPTION

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#### 3.4 Structure

The following describes the structure used in the sample program.

Definition name		
T_T8_CFG config		
Members		
ReloadData	unsigned short	Sets the reload data.
PclkDiv	unsigned char	Sets the prescaler output clock.
intFunc	void * (void)	Sets the T8 interrupt function.
Remarks		
T8 initial value setup structure		

#### 3.5 Operation Procedure

##### Import the project

- (1) Start the IDE and import the “t8” project.
  - \* For the import procedure, refer to Section 3 “Software Development Procedure” of the S5U1C17001C Manual.
  - \* Copy the required drivers from the “driver” folder.

##### Build

- (1) Build the “t8” project using the IDE.

##### Cabling and power-on

- (1) Connect the SVT17801, USB miniB port and PC using their cables.
- (2) Reset the SVT17 ICD board.

##### Execution

- (1) Execute the “t8” project using the IDE.

#### 3.6 Outline of the sample program operation

Generate 8-bit timer interrupts 1,000 times.

When interrupts occurred 1,000 times, display the following message on the simulated I/O.

「T8(Ch.0) Interrupt ! : *n* times」

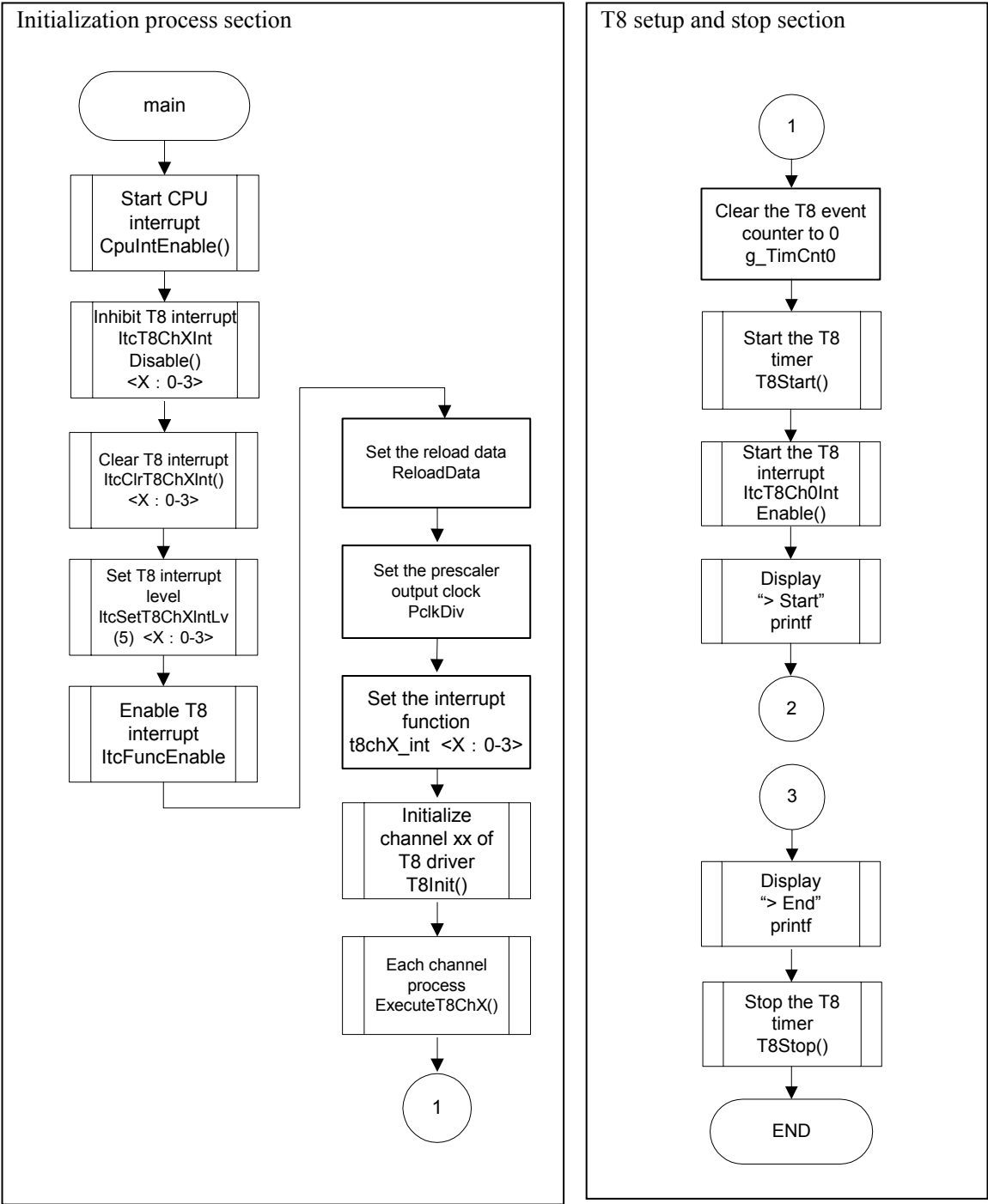
Display the message 1 time for 1,000 interrupts, and repeat the display 10 times.

Repeat these operations in the similar way for channels 1 to 3.

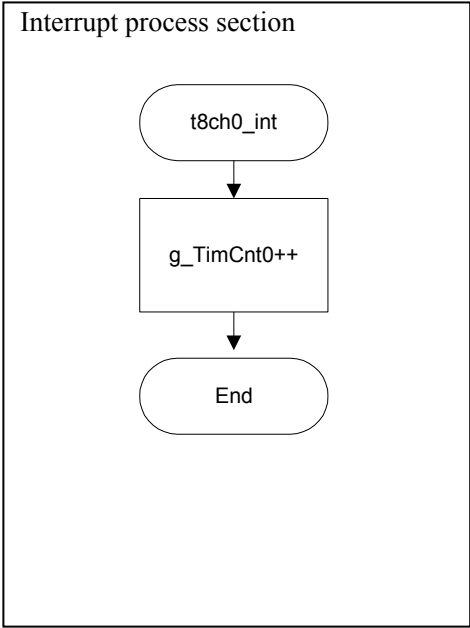
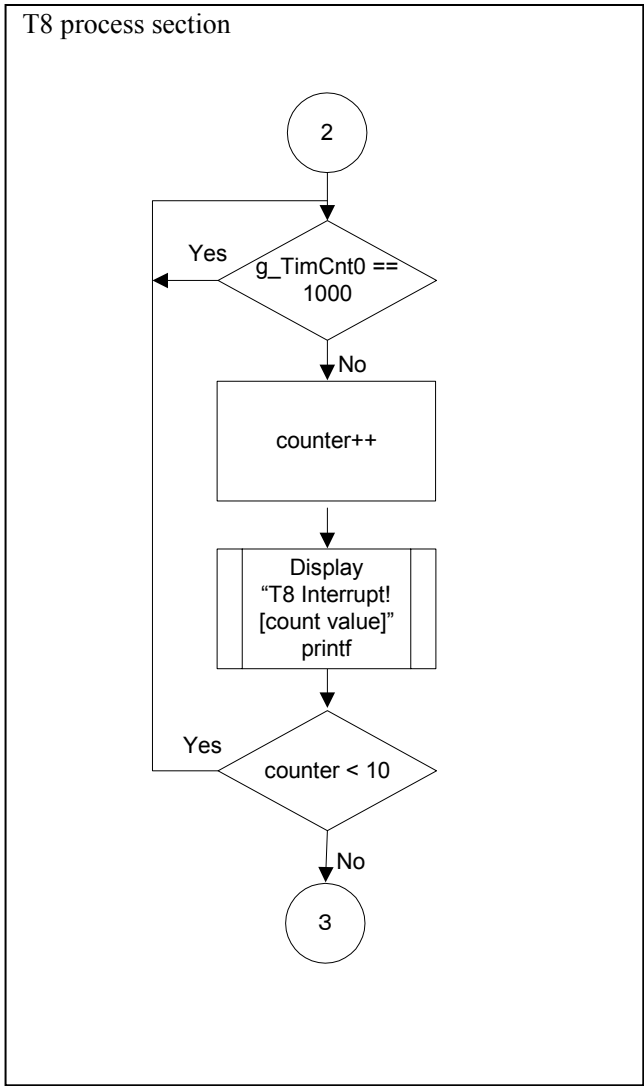


3.7 Flowcharts

The following shows a flowchart of main routine and interrupt functions.



### 3. SOFTWARE DESCRIPTION



This chart shows the process for T8 channel 0 only.  
The same process is repeated for channels 1 to 3.

### 3.8 Detailed Explanation of T8 Driver

The following describes the functions written in the “t8\_drv.c” and “t8\_api.h” files.

#### T8 initialization process

<b>Format</b>	<b>void T8Init(unsigned char chNo, T_T8_CFG *pConfig)</b>
<b>Function</b>	Initializes the T8 driver
<b>Arguments</b>	ChNo     -in       Channel number *pConfig -in       T8 initialization information
<b>Return value</b>	None
(Process description) Execute the following process for each channel number. (1) Set the prescaler output clock. (2) Set the reload data. (3) Set the interrupt function.	

#### T8 start process

<b>Format</b>	<b>void T8Start(unsigned char chNo)</b>
<b>Function</b>	Starts the 8-bit timer
<b>Arguments</b>	ChNo     -in       Channel number
<b>Return value</b>	None
(Process description) Execute the following process for each channel number. (1) Stop the count clock sent to the counter. (2) Reset the timer. (3) Stop the timer.	

#### T8 stop process

<b>Format</b>	<b>void T8Stop(unsigned char chNo)</b>
<b>Function</b>	Stop the 8-bit timer
<b>Arguments</b>	ChNo     -in       Channel number
<b>Return value</b>	None
(Process description) Execute the following process for each channel number. (1) Stop the timer. (2) Stop the count clock sent to the counter.	

### 3. SOFTWARE DESCRIPTION

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#### T8 interrupt function (channel 0)

<b>Format</b>	<b>Void T8Ch0IntProc (void)</b>
<b>Function</b>	8-bit timer, channel-0 interrupt handler
<b>Arguments</b>	None
<b>Return value</b>	None
(Process description) Interrupt channel 0 of the 8-bit timer.	

#### T8 interrupt function (channel 1)

<b>Format</b>	<b>Void T8Ch1IntProc (void)</b>
<b>Function</b>	8-bit timer, channel-1 interrupt handler
<b>Arguments</b>	None
<b>Return value</b>	None
(Process description) Interrupt channel 1 of the 8-bit timer.	

#### T8 interrupt function (channel 2)

<b>Format</b>	<b>Void T8Ch2IntProc (void)</b>
<b>Function</b>	8-bit timer, channel-2 interrupt handler
<b>Arguments</b>	None
<b>Return value</b>	None
(Process description) Interrupt channel 2 of the 8-bit timer.	

#### T8 interrupt function (channel 3)

<b>Format</b>	<b>void T8Ch3IntProc (void)</b>
<b>Function</b>	8-bit timer, channel-3 interrupt handler
<b>Arguments</b>	None
<b>Return value</b>	None
(Process description) Interrupt channel 3 of the 8-bit timer.	

### 3.9 Header Definitions

The following lists the definitions used for the driver functions.

Definition name	Value	Description
T8_CH_0	0	Channel number 0
T8_CH_1	1	Channel number 1
T8_CH_2	2	Channel number 2
T8_CH_3	3	Channel number 3
T8_PCLK_1	0x00	Prescaler output clock; PT8_CLK-1/1
T8_PCLK_2	0x01	Prescaler output clock; PT8_CLK-1/2
T8_PCLK_4	0x02	Prescaler output clock; PT8_CLK-1/4
T8_PCLK_8	0x03	Prescaler output clock; PT8_CLK-1/8
T8_PCLK_16	0x04	Prescaler output clock; PT8_CLK-1/16
T8_PCLK_32	0x05	Prescaler output clock; PT8_CLK-1/32
T8_PCLK_64	0x06	Prescaler output clock; PT8_CLK-1/64
T8_PCLK_128	0x07	Prescaler output clock; PT8_CLK-1/128
T8_PCLK_256	0x08	Prescaler output clock; PT8_CLK-1/256
T8_PCLK_512	0x09	Prescaler output clock; PT8_CLK-1/512
T8_PCLK_1024	0x0A	Prescaler output clock; PT8_CLK-1/1024
T8_PCLK_2048	0x0B	Prescaler output clock; PT8_CLK-1/2048
T8_PCLK_4096	0x0C	Prescaler output clock; PT8_CLK-1/4096

## REVISION HISTORY

10	EPSON	S1C17801 8-bit Timer (T8) Application Note (Rev.1.0)
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