

July 2005

## Important Notices

Thank you for your continued patronage of Toshiba microcontrollers.

This page gives you important information on using Toshiba microcontrollers. Please be sure to check each item for proper use of our products.

▶ **Restriction on Use of 8-bit Timers** (July 2005)

\*If your datasheet is dated 4 November 2003 or earlier, please download the latest datasheet or request it from your local Toshiba office.

▶ **Datasheet Modifications regarding I<sup>2</sup>C Bus Mode Control** (October 2004)

▶ **Datasheet Modifications: PWM Cycle of 8-bit Timers** (October 2004)

\*If your datasheet is dated 3 November 2003 or earlier, please download the latest datasheet or request it from your local Toshiba office.

**TOSHIBA Microcontrollers 900 Family**  
(TMP91CW12F) (TMP91PW12F) (TMP91CW12AF) (TMP91FY12AF) (TMP91C815F) (TMP91C016F)  
(TMP91CW18AF) (TMP91PW18AF) (TMP91C219F) (TMP91C820AF) (TMP91CY22F)  
(TMP91FY22F) (TMP91C824F) (TMP91C025F) (TMP91CK27U) (TMP91CP27U)  
(TMP91CP27RUG) (TMP91CU27U) (TMP91CU27RUG) (TMP91FY27U) (TMP91CW28FG)  
(TMP91CY28FG) (TMP91FY28FG) (TMP91C829F) (TMP91C630F)  
(TMP92C820FG) (TMP92CH21FG) (TMP92CM22FG) (TMP92CA25FG) (TMP92CM27FG)  
(TMP92CD54IF) (TMP92FD54AIF)  
(TMP94C241CF) (TMP94C251AF)

Dear Customer

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## Restriction on Use of 8-bit Timers

With regard to our TLCS-900/L1 Series and TLCS-900/H1 Series of 16-bit microcontrollers, we have found that the following problem may occur when 8-bit timers are used under certain conditions.

### [Problem]

If the timer register of an 8-bit timer is updated under the following conditions, the timer flip-flop may output an unexpected value.

### [Conditions]

This problem occurs if all the following conditions are met:

- When the 8-bit timer is used in PWM or PPG mode
- When the double buffer is enabled
- When the data in the register buffer is updated immediately before an overflow occurs in the up-counter

### [Workaround]

This problem can be avoided by software by using either of the following methods:

(1) Disable the double buffer.

(After reset the double buffer is initially disabled.)

(2) Observe the following timing requirement when writing new data to the register buffer:

a) In the case of using PWM mode

Write new data to the register buffer by six cycles before the next overflow occurs, using the interrupt routine to be activated by an overflow interrupt.

b) In the case of using PPG mode

Write new data to the register buffer by six cycles before the next cycle compare match occurs, using the interrupt routine to be activated by a cycle compare match interrupt (\*).

(\*) An interrupt that specifies when to transfer data from the register buffer to the timer register

**[Note]**

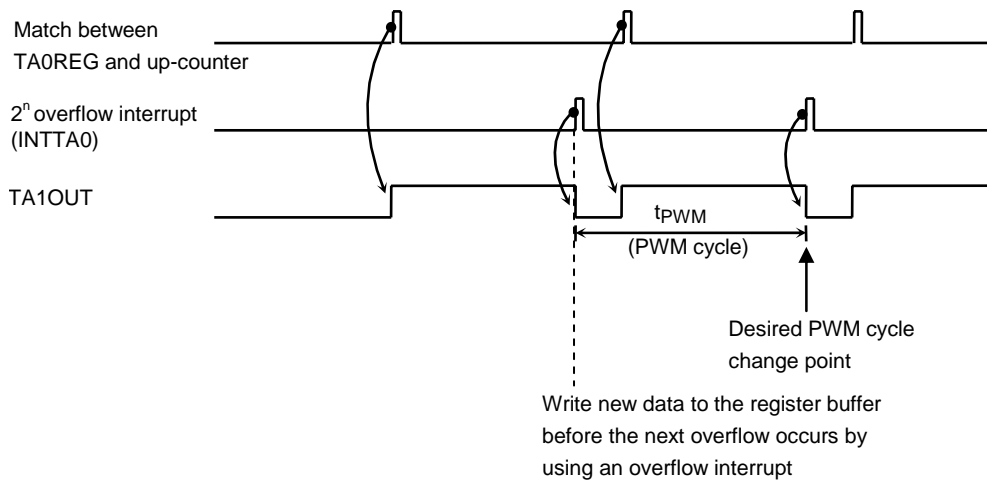
When the double buffer is enabled for an 8-bit timer in PWM or PPG mode, caution is required as explained below.

If new data is written to the register buffer immediately before an overflow occurs by a match between the timer register value and the up-counter value, the timer flip-flop may output an unexpected value.

For this reason, make sure that in PWM mode new data is written to the register buffer by six cycles ( $f_{sys} \times 6$ ) before the next overflow occurs by using an overflow interrupt.

In the case of using PPG mode, make sure that new data is written to the register buffer by six cycles before the next cycle compare match occurs by using a cycle compare match interrupt.

Example when using PWM mode



TOSHIBA Microcontrollers  
 900 Family  
 (TMP91CW12) (TMP91PW12) (TMP91CW12A) (TMP91FY12A)  
 (TMP91CY22) (TMP91FY22)  
 (TMP91CY23I)  
 (TMP91CP27) (TMP91FY27)  
 (TMP91C815) (TMP91C820A) (TMP91C824)

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## Datasheet Modifications: I<sup>2</sup>C Bus Mode Control

The following modifications (shown in red) will be made to the technical datasheets in the next revision.

### Section: “I<sup>2</sup>C Bus Mode Control Register”

▪ In the explanation of the Serial Bus Interface Control Register 1

1. Delete the setting examples where the serial clock frequency exceeds 100 kHz.
2. Add the following note.

Internal serial clock selection <SCK2:0> @ write

|     |      |          |  |
|-----|------|----------|--|
| 000 | n=5  | - (Note) | $\left( \begin{array}{l} \text{System clock: } f_c \\ \text{Clock gear: } f_c/1 \\ f_c = 16 \text{ MHz} \\ \text{(Output to internal SCL)} \\ \text{Frequency} = \frac{f_c}{2^n + 8} \text{ [ Hz ]} \end{array} \right)$ |
| 001 | n=6  | - (Note) |  |
| 010 | n=7  | - (Note) |  |
| 011 | n=8  | 60.6 kHz |  |
| 100 | n=9  | 30.8 kHz |  |
| 101 | n=10 | 15.5 kHz |  |
| 110 | n=11 | 7.78 kHz |  |
| 111 |      | Reserved |  |

**Note:** This I<sup>2</sup>C bus circuit does not support the Fast mode. It supports the Standard mode only. Although the I<sup>2</sup>C bus circuit itself allows the setting of a baud rate over 100 kbps, the compliance with the I<sup>2</sup>C specification is not guaranteed in that case.

### Section: “Control in I<sup>2</sup>C Bus Mode”

▪ In “(3) Serial clock”

1. Add the following sentence about the communication baud rate.
2. Modify the equations as shown below.

a. Clock source

The SBIOCR1<SCK2:0> is used to select a maximum transfer frequency outputted on the SCL pin in master mode. **Set a communication baud rate that meets the I<sup>2</sup>C bus specification, such as the shortest pulse width of t<sub>LOW</sub>, based on the equations shown below.**

$$\begin{aligned}
 t_{\text{LOW}} &= 2^{n-1}/f_{\text{SBI}} \\
 t_{\text{HIGH}} &= 2^{n-1}/f_{\text{SBI}} + 8/f_{\text{SBI}} \\
 f_{\text{scl}} &= 1/(t_{\text{LOW}} + t_{\text{HIGH}}) \\
 &= \frac{f_{\text{SBI}}}{2^n + 8}
 \end{aligned}$$

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 (TMP91C820A) (TMP91CY22) (TMP91FY22) (TMP91CY23I) (TMP91C824) (TMP91C025)  
 (TMP91CP27) (TMP91FY27) (TMP91CW28) (TMP91CY28) (TMP91FY28)  
 (TMP91C829) (TMP91C630) (TMP91CP82T) (TMP91PP82T)  
 (TMP92C820) (TMP92CH21) (TMP92CM22)  
 (TMP92CW53I) (TMP92CW53AI) (TMP94FD53) (TMP92FD54AI) (TMP92CD54I)

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## Datasheet Modifications: PWM Cycle of 8-bit Timers

With regard to the TLCS-900/L1 and TLCS-900/H1 microcontrollers listed above, please be advised of the modifications to be made to the technical datasheets about the PWM cycle of 8-bit timers in PWM mode.

### [Modifications to be made]

In the datasheet the PWM cycle of 8-bit timers when used in PWM mode is described as " $2^{n-1}$ ". This should be corrected to " $2^n$ " as shown below.

TMRA01Mode Register

|                    |             | 7   | 6  | 5     | 4     | 3  | 2       | 1   | 0       |
|--------------------|-------------|---|--|-------|-------|--|---------|---|---------|
| TA01MOD<br>(xxxxH) | bit Symbol  | TA01M1  | TA01M0   | PWM01 | PWM00 | TA1CLK1  | TA1CLK0 | TA0CLK1   | TA0CLK0 |
|                    | Read/Write  | R/W   |  |       |       |  |         |   |         |
|                    | After reset | 0   | 0  | 0     | 0     | 0  | 0       | 0   | 0       |
|                    | Function    | Operation mode<br>00: 8-bit timer mode<br>01: 16-bit timer mode<br>10: 8-bit PPG<br>11: 8-bit PWM | PWM cycle<br>00: Reserved<br>01: $2^6-1$<br>10: $2^7-1$<br>11: $2^8-1$ |       |       | Source clock for TMRA1<br>00: TA0TRG<br>01: $\phi T1$<br>10: $\phi T16$<br>11: $\phi T256$ |         | Source clock for TMRA0<br>00: TA0IN pin<br>01: $\phi T1$<br>10: $\phi T4$<br>11: $\phi T16$ |         |

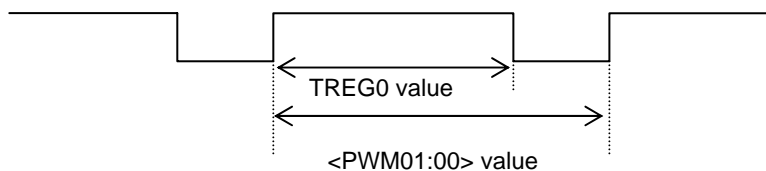
PWM cycle  
00: Reserved  
01:  $2^6$   
10:  $2^7$   
11:  $2^8$

Correct

(The mode register for 8-bit timer TMRA01 is shown here as an example.)

### [Operation]

Waveform in PWM mode (in the case of 8-bit timer TMRA01)



Datasheet PWM cycle:  $2^{n-1}$   $\rightleftharpoons$  Actual cycle  $2^n$