PWM TIMER OPERATION

PRESCALER & DIVIDER

An 8-bit prescaler and an independent 4-bit divider make the following output frequencies:

4-bit divider settings	minimum resolution (prescaler = 1)	maximum resolution (prescaler = 255)	maximum interval (TCNTBn = 65535)
1/2 (MCLK = 66 MHz)	0.030 us (33.0 MHz)	7.75 us (58.6 KHz)	0.50 sec
1/4 (MCLK = 66 MHz)	0.060 us (16.5 MHz)	15.5 us (58.6 KHz)	1.02 sec
1/8 (MCLK = 66 MHz)	0.121 us (8.25 MHz)	31.0 us (29.3 KHz)	2.03 sec
1/16 (MCLK = 66 MHz)	0.242 us (4.13 MHz)	62.1 us (14.6 KHz)	4.07 sec
1/32 (MCLK = 66 MHz)	0.485 us (2.06 MHz)	125 us (7.32 KHz)	8.13 sec

BASIC TIMER OPERATION

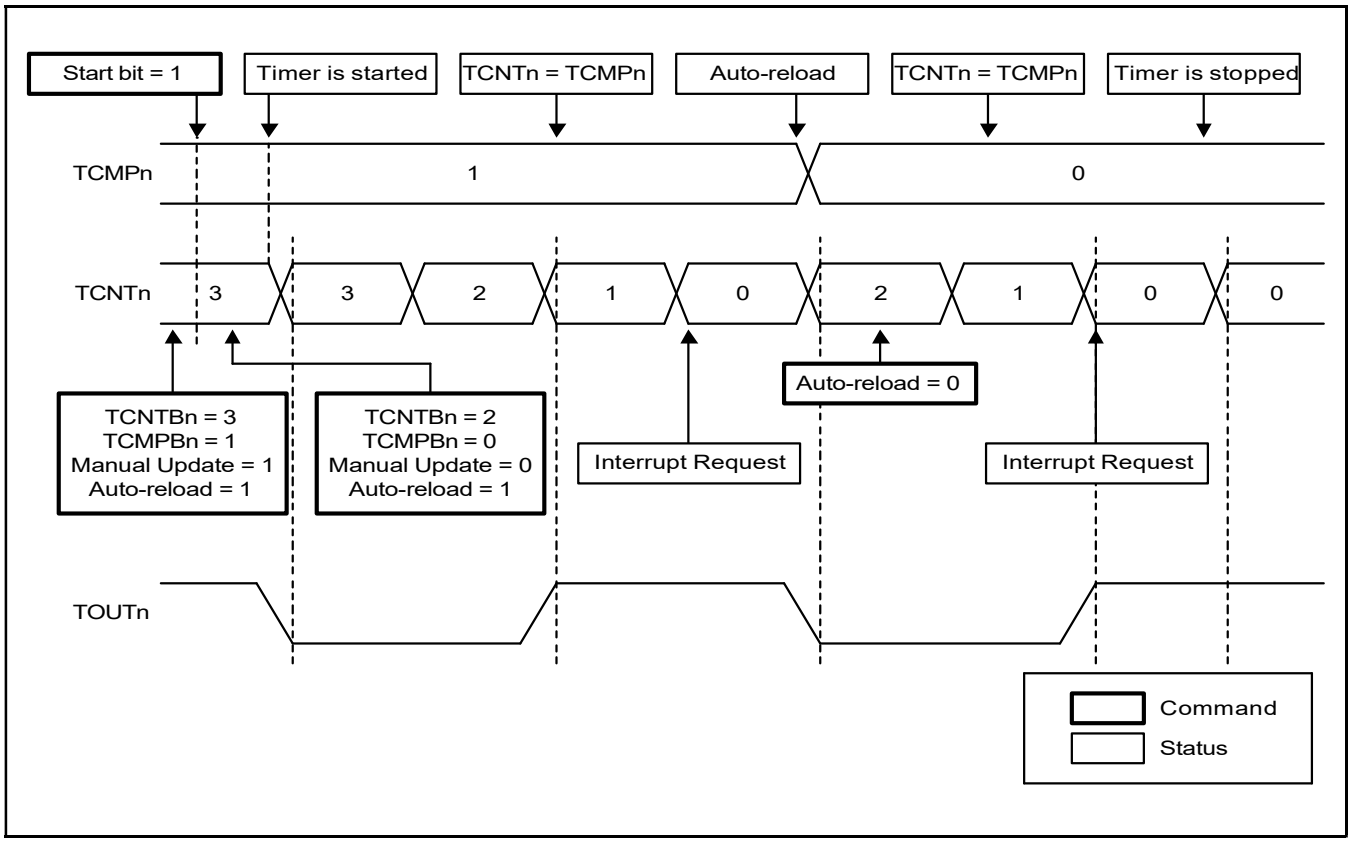

Figure 9-2. Timer operations

A timer (except the timer ch-5) has TCNTBn, TCNTn, TCMPBn and TCMPn. TCNTBn and TCMPBn are loaded into TCNTn and TCMPn when the timer reaches 0. When TCNTn reaches 0, the interrupt request will occur if the interrupt is enabled. (TCNTn and TCMPn are the names of the internal registers. The TCNTn register can be read from the TCNTOn register)

PWM TIMER CONTROL REGISTERS

TIMER CONFIGURATION REGISTER0 (TCFG0)

Timer input clock Frequency = MCLK / {prescaler value + 1} / {divider value}
{prescaler value} = 0-255
{divider value} = 2, 4, 8, 16, 32

Register	Address	R/W	Description	Reset Value
TCFG0	0x01D50000	R/W	Configures the three 8-bit prescalers	0x00000000

TCFG0	Bit	Description	Initial State
Dead zone length	[31:24]	These 8 bits determine the dead zone length. The 1 unit time of the dead zone length is equal to the 1 unit time of timer 0.	0x00
Prescaler 2	[23:16]	These 8 bits determine prescaler value for Timer 4 & 5	0x00
Prescaler 1	[15:8]	These 8 bits determine prescaler value for Timer 2 & 3	0x00
Prescaler 0	[7:0]	These 8 bits determine prescaler value for Timer 0 & 1	0x00

TIMER CONFIGURATION REGISTER1 (TCFG1)

Register	Address	R/W	Description	Reset Value
TCFG1	0x01D50004	R/W	6-MUX & DMA mode selecton register	0x00000000

TCFG1	Bit	Description	Initial State
DMA mode	[27:24]	Select DMA request channel 0000 = No select (all interrupt) 0001 = Timer0 0010 = Timer1 0011 = Timer2 0100 = Timer3 0101 = Timer4 0110 = Timer5 0111 = Reserved	000
MUX 5	[23:20]	Select MUX input for PWM Timer5. 0000 = 1/2 0001 = 1/4 0010 = 1/8 0011 = 1/16 01xx = EXTCLK	000
MUX 4	[19:16]	Select MUX input for PWM Timer4. 0000 = 1/2 0001 = 1/4 0010 = 1/8 0011 = 1/16 01xx = TCLK	000
MUX 3	[15:12]	Select MUX input for PWM Timer3. 0000 = 1/2 0001 = 1/4 0010 = 1/8 0011 = 1/16 01xx = 1/32	000
MUX 2	[11:8]	Select MUX input for PWM Timer2. 0000 = 1/2 0001 = 1/4 0010 = 1/8 0011 = 1/16 01xx = 1/32	000
MUX 1	[7:4]	Select MUX input for PWM Timer1. 0000 = 1/2 0001 = 1/4 0010 = 1/8 0011 = 1/16 01xx = 1/32	000
MUX 0	[3:0]	Select MUX input for PWM Timer0. 0000 = 1/2 0001 = 1/4 0010 = 1/8 0011 = 1/16 01xx = 1/32	000

TIMER CONTROL REGISTER (TCON)

Register	Address	R/W	Description	Reset Value
TCON	0x01D50008	R/W	Timer control register	0x00000000

TCON	Bit	Description	initial state
Timer 5 auto reload on/off	[26]	This bit determines auto reload on/off for Timer 5. 0 = One-shot 1 = Interval mode (auto reload)	0
Timer 5 manual update (note)	[25]	This bit determines the manual update for Timer 5. 0 = No operation 1 = Update TCNTB5	0
Timer 5 start/stop	[24]	This bit determines start/stop for Timer 5. 0 = Stop 1 = Start for Timer 5	0
Timer 4 auto reload on/off	[23]	This bit determines auto reload on/off for Timer 4. 0 = One-shot 1 = Interval mode (auto reload)	0
Timer 4 output inverter on/off	[22]	This bit determines output inverter on/off for Timer4. 0 = Inverter off 1 = Inverter on for TOUT4	0
Timer 4 manual update (note)	[21]	This bit determines the manual update for Timer 4. 0 = No operation 1 = Update TCNTB4, TCMPB4	0
Timer 4 start/stop	[20]	This bit determines start/stop for Timer 4. 0 = Stop 1 = Start for Timer 4	0
Timer 3 auto reload on/off	[19]	This bit determines auto reload on/off for Timer 3. 0 = One-shot 1 = Interval mode (auto reload)	0
Timer 3 output inverter on/off	[18]	This bit determines output inverter on/off for Timer 3. 0 = Inverter off 1 = Inverter on for TOUT3	0
Timer 3 manual update (note)	[17]	This bit determine manual update for Timer 3. 0 = No operation 1 = Update TCNTB3, TCMPB3	0
Timer 3 start/stop	[16]	This bit determines start/stop for Timer 3. 0 = Stop 1 = Start for Timer 3	0
Timer 2 auto reload on/off	[15]	This bit determines auto reload on/off for Timer 2. 0 = One-shot 1 = Interval mode (auto reload)	0
Timer 2 output inverter on/off	[14]	This bit determines output inverter on/off for Timer 2. 0 = Inverter off 1 = Inverter on for TOUT2	0
Timer 2 manual update (note)	[13]	This bit determines the manual update for Timer 2. 0 = No operation 1 = Update TCNTB2, TCMPB2	0
Timer 2 start/stop	[12]	This bit determines start/stop for Timer 2. 0 = Stop 1 = Start for Timer 2	0

NOTE: This bit has to be cleared at next writing.

TIMER CONTROL REGISTER (TCON) (Continued)

TCON	Bit	Description	initial state
Timer 1 auto reload on/off	[11]	This bit determines the auto reload on/off for Timer1. 0 = One-shot 1 = Interval mode (auto reload)	0
Timer 1 output inverter on/off	[10]	This bit determines the output inverter on/off for Timer1. 0 = Inverter off 1 = Inverter on for TOUT1	0
Timer 1 manual update (note)	[9]	This bit determines the manual update for Timer 1. 0 = No operation 1 = Update TCNTB1, TCMPB1	0
Timer 1 start/stop	[8]	This bit determines start/stop for Timer 1. 0 = Stop 1 = Start for Timer 1	0
Dead zone enable	[4]	This bit determines the dead zone operation. 0 = Disable 1 = Enable	0
Timer 0 auto reload on/off	[3]	This bit determines auto reload on/off for Timer 0. 0 = One-shot 1 = Interval mode(auto reload)	0
Timer 0 output inverter on/off	[2]	This bit determines the output inverter on/off for Timer 0. 0 = Inverter off 1 = Inverter on for TOUT0	0
Timer 0 manual update (note)	[1]	This bit determines the manual update for Timer 0. 0 = No operation 1 = Update TCNTB0, TCMPB0	0
Timer 0 start/stop	[0]	This bit determines start/stop for Timer 0. 0 = Stop 1 = Start for Timer 0	0

NOTE: This bit has to be cleared at next writing.

TIMER 0 COUNT BUFFER REGISTER & COMPARE BUFFER REGISTER (TCNTB0, TCMPB0)

Register	Address	R/W	Description	Reset Value
TCNTB0	0x01D5000C	R/W	Timer 0 count buffer register	0x00000000
TCMPB0	0x01D50010	R/W	Timer 0 compare buffer register	0x00000000

TCMPB0	Bit	Description	Initial State
Timer 0 compare buffer register	[15:0]	Setting compare buffer value for Timer 0 **NOTE:** This value must be smaller than TCNTB0	0x00000000

TCNTB0	Bit	Description	Initial State
Timer 0 count buffer register	[15:0]	Setting count buffer value for Timer 0	0x00000000

TIMER 0 COUNT OBSERVATION REGISTER (TCNTO0)

Register	Address	R/W	Description	Reset Value
TCNTO0	0x01D50014	R	Timer 0 count observation register	0x00000000

TCNTO0	Bit	Description	Initial State
Timer 0 observation register	[15:0]	Setting count observation value for Timer 0	0x00000000

TIMER 1 COUNT BUFFER REGISTER & COMPARE BUFFER REGISTER (TCNTB1, TCMPB1)

Register	Address	R/W	Description	Reset Value
TCNTB1	0x01D50018	R/W	Timer 1 count buffer register	0x00000000
TCMPB1	0x01D5001C	R/W	Timer 1 campare buffer register	0x00000000

TCMPB1	Bit	Description	Initial State
Timer 1 compare buffer register	[15:0]	Setting compare buffer value for Timer 1 **NOTE:** This value must be smaller than TCNTB1	0x00000000

TCNTB1	Bit	Description	Initial State
Timer 1 count buffer register	[15:0]	Setting count buffer value for Timer 1	0x00000000

TIMER 1 COUNT OBSERVATION REGISTER(TCNTO1)

Register	Address	R/W	Description	Reset Value
TCNTO1	0x01D50020	R	Timer 1 count observation register	0x00000000

TCNTO1	Bit	Description	initial state
Timer 1 observation register	[15:0]	Setting count observation value for Timer 1	0x00000000

TIMER 2 COUNT BUFFER REGISTER & COMPARE BUFFER REGISTER (TCNTB2, TCMPB2)

Register	Address	R/W	Description	Reset Value
TCNTB2	0x01D50024	R/W	Timer 2 count buffer register	0x00000000
TCMPB2	0x01D50028	R/W	Timer 2 campare buffer register	0x00000000

TCMPB2	Bit	Description	Initial State
Timer 2 compare buffer register	[15:0]	Setting compare buffer value for Timer 2 **NOTE:** This value must be smaller than TCNTB2	0x00000000

TCNTB2	Bit	Description	Initial State
Timer 2 count buffer register	[15:0]	Setting count buffer value for Timer 2	0x00000000

TIMER 2 COUNT OBSERVATION REGISTER (TCNTO2)

Register	Address	R/W	Description	Reset Value
TCNTO2	0x01D5002C	R	Timer 2 count observation register	0x00000000

TCNTO2	Bit	Description	Initial State
Timer 2 observation register	[15:0]	Setting count observation value for Timer 2	0x00000000

TIMER 3 COUNT BUFFER REGISTER & COMPARE BUFFER REGISTER (TCNTB3, TCMPB3)

Register	Address	R/W	Description	Reset Value
TCNTB3	0x01D50030	R/W	Timer 3 count buffer register	0x00000000
TCMPB3	0x01D50034	R/W	Timer 3 campare buffer register	0x00000000

TCMPB3	Bit	Description	Initial State
Timer 3 compare buffer register	[15:0]	Setting compare buffer value for Timer 3 **NOTE:** This value must be smaller than TCNTB3	0x00000000

TCNTB3	Bit	Description	Initial State
Timer 3 count buffer register	[15:0]	Setting count buffer value for Timer 3	0x00000000

TIMER 3 COUNT OBSERVATION REGISTER (TCNTO3)

Register	Address	R/W	Description	Reset Value
TCNTO3	0x01D50038	R	Timer 3 count observation register	0x00000000

TCNTO3	Bit	Description	Initial State
Timer 3 observation register	[15:0]	Setting count observation value for Timer 3	0x00000000

TIMER 4 COUNT BUFFER REGISTER & COMPARE BUFFER REGISTER (TCNTB4, TCMPB4)

Register	Address	R/W	Description	Reset Value
TCNTB4	0x01D5003C	R/W	Timer 4 count buffer register	0x00000000
TCMPB4	0x01D50040	R/W	Timer 4 campare buffer register	0x00000000

TCMPB4	Bit	Description	Initial State
Timer 4 compare buffer register	[15:0]	Setting compare buffer value for Timer 4 **NOTE:** This value must be smaller than TCNTB4	0x00000000

TCNTB4	Bit	Description	Initial State
Timer 4 count buffer register	[15:0]	Setting count buffer value for Timer 4	0x00000000

TIMER 4 COUNT OBSERVATION REGISTER (TCNTO4)

Register	Address	R/W	Description	Reset Value
TCNTO4	0x01D50044	R	Timer 4 count observation register	0x00000000

TCNTO4	Bit	Description	Initial State
Timer 4 observation register	[15:0]	Setting count observation value for Timer 4	0x00000000

TIMER 5 COUNT BUFFER REGISTER (TCNTB5)

Register	Address	R/W	Description	Reset Value
TCNTB5	0x01D50048	R/W	Timer 5 count buffer register	0x00000000

TCNTB5	Bit	Description	Initial State
Timer 5 count buffer register	[15:0]	Setting count buffer value for Timer 5	0x00000000

TIMER 5 COUNT OBSERVATION REGISTER (TCNTO5)

Register	Address	R/W	Description	Reset Value
TCNTO5	0x01D5004C	R	Timer 5 count observation register	0x00000000

TCNTO5	Bit	Description	Initial State
Timer 5 observation register	[15:0]	Setting count observation value for Timer 5	0x00000000