

To our customers,

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April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

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# **78K0R/Kx3 Microcontroller**

## **Sample Program**

### **Operation Manual**

#### **(Multiple PWM Output (Timer Array Unit), ASM Source)**

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This software is for reference only and NEC Electronics does not guarantee its operation.  
Thoroughly evaluate this software on your set prior to use.

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January, 2008

1st Product Solution Group, Multipurpose Microcomputer Systems Division,  
Microcomputer Operations Unit  
NEC Electronics Corporation

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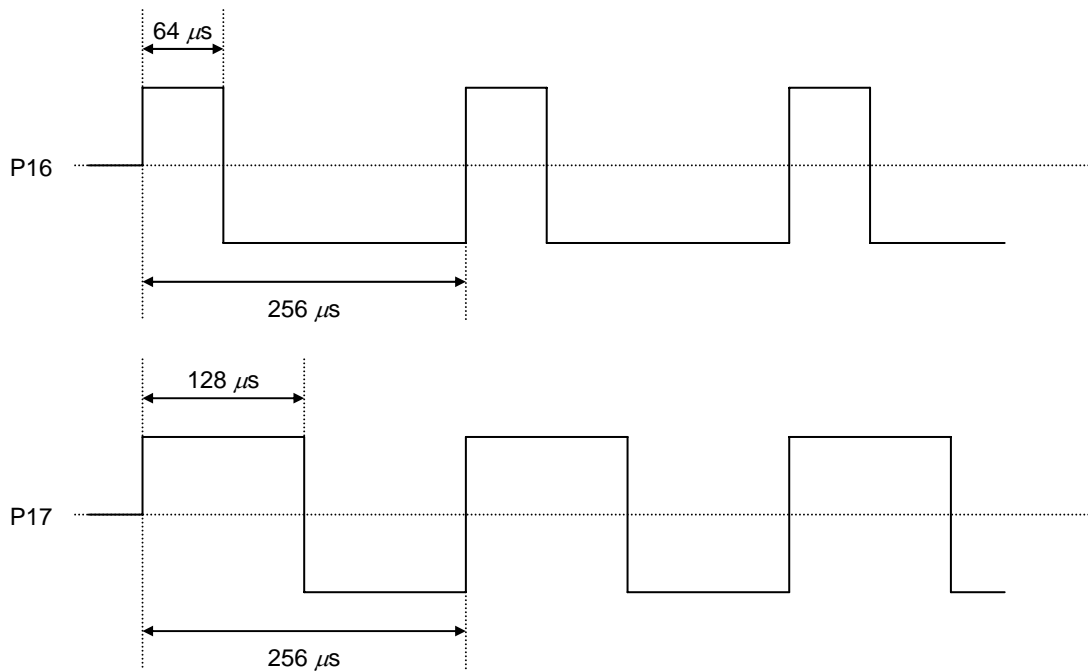
## 1. OVERVIEW

This manual explains the sample program functions of multiple PWM output for the 78K0R/Kx3 microcontroller.

In this sample program, timer channels 0, 1, and 2 are used and multiple PWM signals are output.

Channel 0 is used as the master, and channels 1 and 2 are used as the slaves.

The output pins are P16 and P17. P16 outputs a signal with a pulse cycle of  $256 \mu\text{s}$  and a duty factor of 25%. P17 outputs a signal with a pulse cycle of  $256 \mu\text{s}$  and a duty factor of 50%.



## 2. RESOURCES USED

Resource	Description	Remark
Main clock specification	Internal high-speed oscillator used (8 MHz (TYP.))	Supplied to CPU and peripheral hardware
	High-speed system clock used (20 MHz)	Oscillated by initial processing
Subclock	XT1 (32.768 kHz)	Oscillated by initial processing
Related hardware	Peripheral enable register 0 (PER0)	Controls the input clock of the timer array unit.
	Timer clock select register 0 (TPS0)	Operation clock: CK01 (1/2), 4 MHz (0.25 $\mu$ s)
	Timer mode register 00 (TMR00)	Operation clock: CK01, 8 MHz Master channel
	Timer mode registers 01, 02 (TMR01, TMR02)	Operation clock: CK01, 8 MHz Slave channels
	Timer data register 00 (TDR00)	Pulse cycle: 256 $\mu$ s
	Timer data register 01 (TDR01)	Duty factor: 25%
	Timer data register 02 (TDR02)	Duty factor: 50%
	Timer output mode register 0 (TOM0)	Channel 0: Toggle mode Channel 1: Combination operation mode with channel 0 Channel 2: Combination operation mode with channel 0
	Timer output level register 0 (TOL0)	Channels 1, 2 positive logic output (active high)
	Timer output register 0 (TO0)	Timer output values of channels 1 and 2 are "0".
	Timer output enable register 0 (TOE0)	Enables the operation of TO01 and TO02 by counting operation.
	Timer channel start register 0 (TS00)	
	Timer channel stop register 0 (TT0)	
	Port mode register (P1)	
Port register (P1)		
I/O	Output: TO01 (P16), TO02 (P17)	
Interrupt	Timer channels 0, 1, 2	
Others	Not used	

### 3. SOFTWARE CONFIGURATION

#### Files

File Name	Processing Outline
K0R_vct.asm	Vector processing
K0R_init.asm	Initialization processing
K0R_main.asm	Main processing
K0R_sfr_set.asm	Multiple PWM output



## 4. FUNCTION EXPLANATIONS

[File name]

K0R\_main.asm

Function

Function Name	Processing Outline	Argument	Return Value
MMA_STRT	Main routine	None	None

Function explanations

Function name	MMA_STRT
Processing	Main routine
Argument	–
Return value	–
Description	Executes initialization processing and then starts multiple PWM output main processing.
Remark	–

[File name]

K0R\_sfr\_set.asm

Functions

Function Name	Processing Outline	Argument	Return Value
STM_MINI	Initializes multiple PWM output.	None	None
STM_MSTT	Starts multiple PWM output operation.	None	None
STM_MSTP	Stops multiple PWM output operation.	None	None

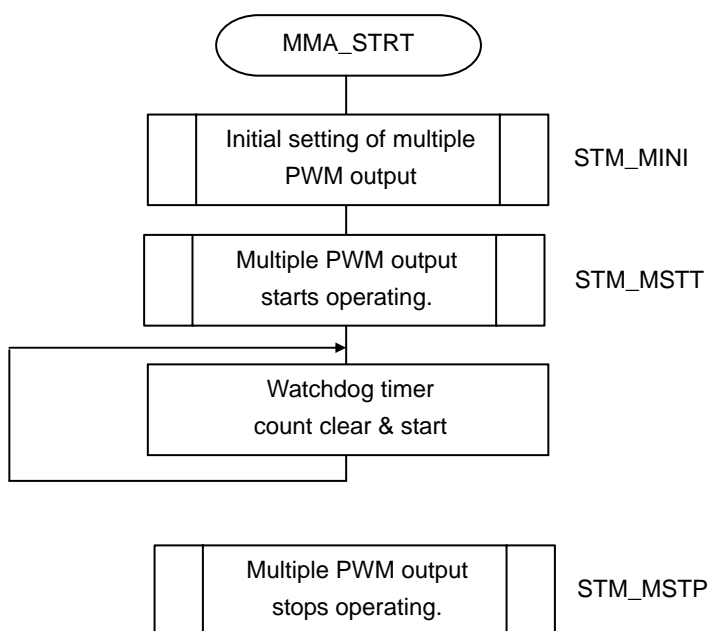
## Function explanations

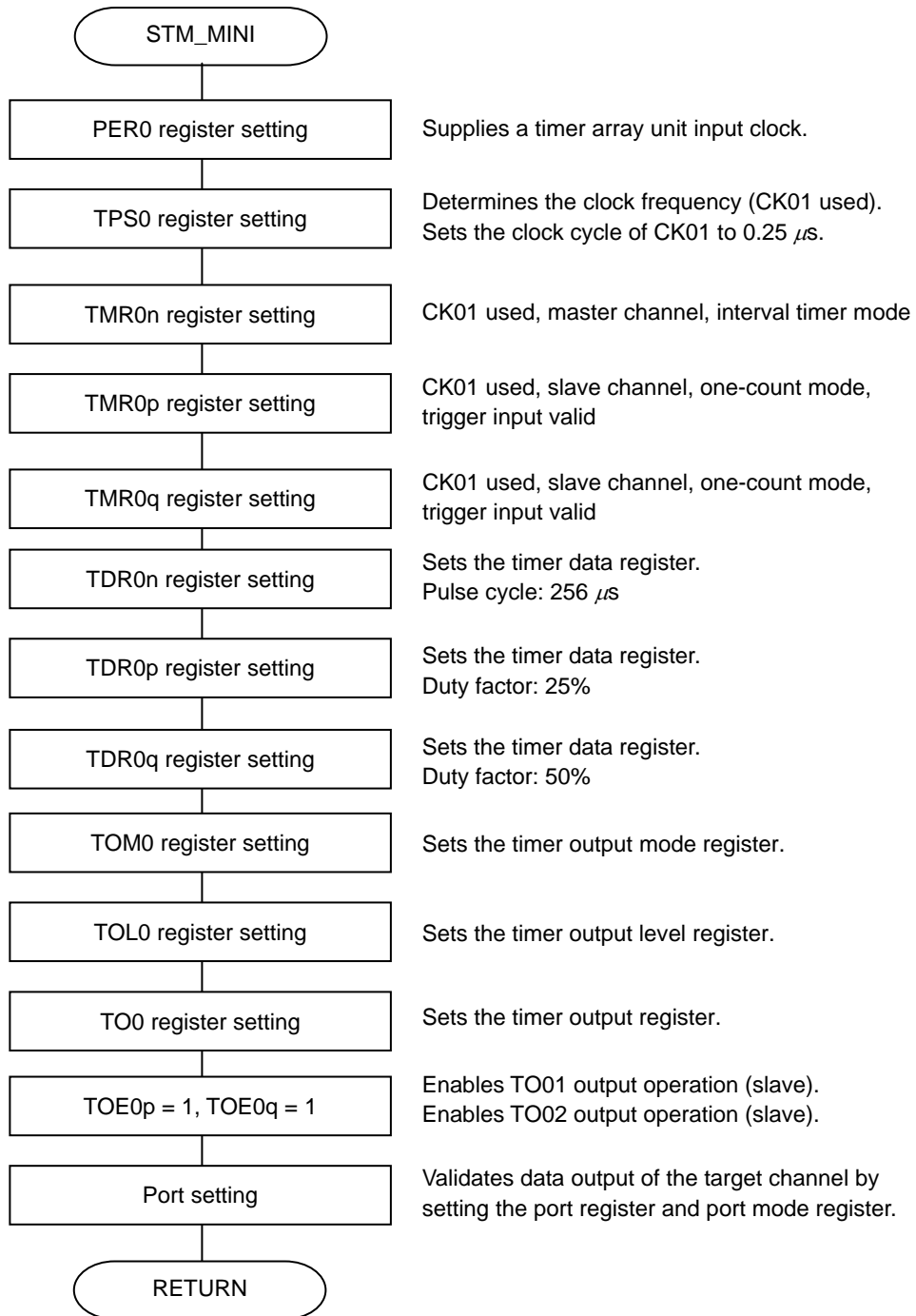
Function name	STM_MINI
Processing	Initializes multiple PWM output.
Argument	–
Return value	–
Description	<p>Initializes the timer array unit.</p> <ul style="list-style-type: none"> <li>• Supplies a timer array unit input clock.</li> <li>• Sets the clock frequency to 0.25 <math>\mu</math>S.</li> </ul> <p>Initializes timer channel 0 (master).</p> <ul style="list-style-type: none"> <li>• Operation mode: Operation clock CK01, master channel, interval timer mode</li> <li>• Output mode: Toggle operation mode</li> <li>• Sets the pulse cycle to 256 <math>\mu</math>S (0.25 <math>\mu</math>S <math>\times</math> 1,024).</li> </ul> <p>Initializes timer channel 1 (slave).</p> <ul style="list-style-type: none"> <li>• Operation mode: Operation clock CK01, slave channel, one-count mode</li> <li>• Output mode: Combination operation mode</li> <li>• Sets the duty factor to 25% ((256/1,024) <math>\times</math> 100).</li> <li>• Enables output.</li> </ul> <p>Initializes timer channel 2 (slave).</p> <ul style="list-style-type: none"> <li>• Operation mode: Operation clock CK01, slave channel, one-count mode</li> <li>• Output mode: Combination operation mode</li> <li>• Sets the duty factor to 50% ((512/1,024) <math>\times</math> 100).</li> <li>• Enables output.</li> </ul> <p>Sets P16 and P17 to the output mode.</p>
Remark	–

Function name	STM_MSTT
Processing	Starts multiple PWM output operation.
Argument	–
Return value	–
Description	<p>Enables the output operation of timer channels 1 and 2 (slave).</p> <p>Starts operation of timer channels 0, 1, and 2.</p>
Remark	–

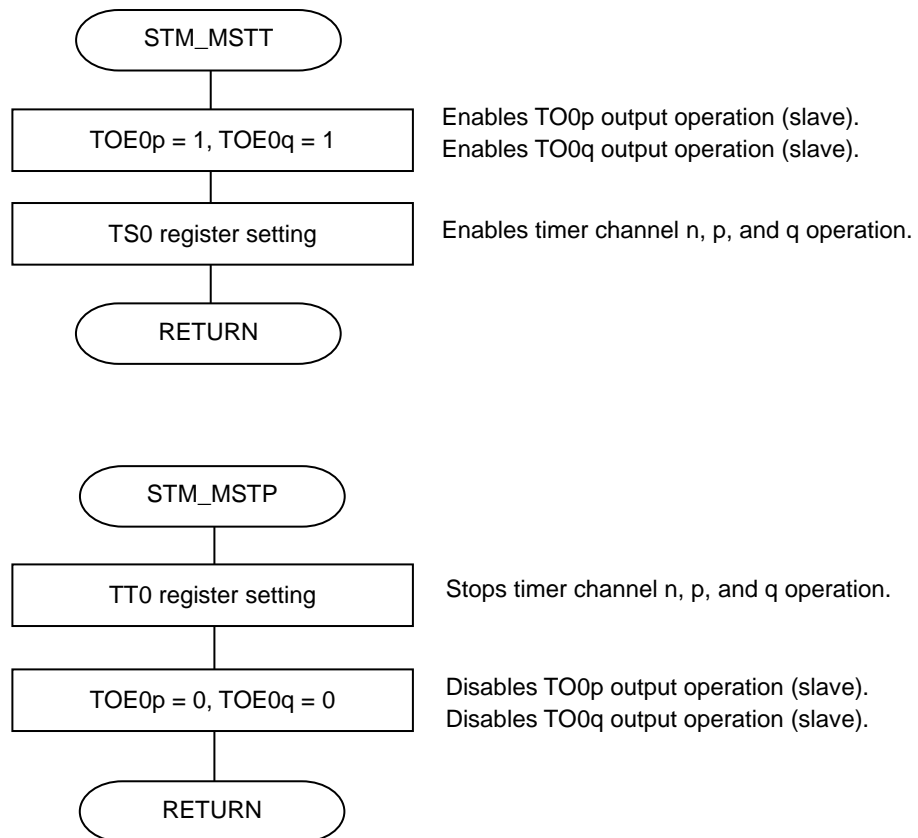
Function name	STM_MSTP
Processing	Stops multiple PWM output operation.
Argument	–
Return value	–
Description	Stops operation of timer channels 0, 1, and 2. Disables the output operation of timer channels 1 and 2 (slave).
Remark	–

5. FLOWCHARTS





**Remark** n = 0, 2, 4 can be set.  
 p = n + 1, q = n + 2  
 n = 0, p = 1, q = 2 for this sample program.



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