

# **TM57 Series**

## **TM57PE11A DEMO CODE FOR TM57PE11A BASIC FUNCTIONS SAMPLE**

### **Application Note**

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**AMENDMENT HISTORY**

<b>Version</b>	<b>Date</b>	<b>Description</b>
V1.0	May, 2011	New release

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**PRODUCT NAME**

TM57 Series IC

**TITLE**

TM57PE11A\_timer0 Application Sample  
TM57PE11A\_wakeup Application Sample  
TM57PE11A\_key\_AP Application Sample  
TM57PE11A\_WDT Application Sample

**APPLICATION NOTE**

EV2793 supports TM57PA10 and TM57PE11A ICs. In using TM57PE11A simulation, please avoid using TM57PA10 unique resources; it can still be used in EV board, however, these resources don't exist in the real IC.

Note: In writing TM57PE11A subroutine, TM57PE11A has improvement from TM57PE11 basic, as shown below

	TM57PE11	TM57PE11A
Fast Internal Clock Frequency	4 MHz	4/8 MHz
PA pull high resistance status after reset (except PA7)	Enable	Disable
Whether WKT / WDT can stop oscillating under SLEEP mode	No	Yes
LVR voltage	2.2V/3.2V	2.0V/2.9V

## 1. TM57PE11A\_timer0 Application Sample

### 1-1. Details of DEMO program, please refer to TM57PE11A\_timer0.asm

### 1-2. Sample description

TIMER0 is an 8-bit non-auto reload periodic counter, every time interrupt occurs, TIMER0 initial value must be reconfigured. The counter clock source selection is SELT0I; SELT0I=0, means the clock source is fosc/2, while SELT0I =1 means the clock source is input from T0I pin.

### 1-3. Configuration steps:

1. Set TIMER0 initial value (F-plane 01h.7~0)
2. Set Timer0 frequency division (bit0-3 in TM0PSC, R-plane 02h.3~0)
3. Set Timer clock source (SELT0I, R-plane 02h.4)
4. Enable counter interrupt (when TM0IE = 1, the timer starts countdown to interrupt, F-plane 08h.4)

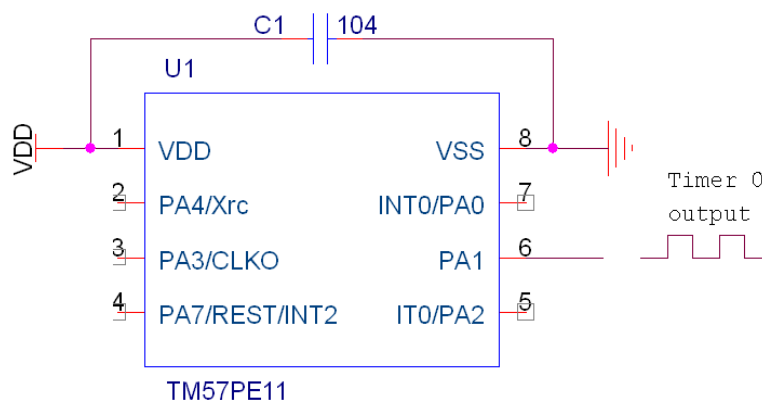
### 1-4. Counter time calculation:

$$1/f_{osc} * 2 * \text{Timer0 Pre-Scale} * (256 - \text{TIMER0}) = \text{time}$$

$$\text{or } 1/F_{t0i} * \text{Timer0 Pre-Scale} * (256 - \text{TIMER0}) = \text{time} \quad (F_{t0i} \text{ is input frequency for T0I pin})$$

Using this sample in DEMO program, the configuration value is:  $1/4M * 2 * 8 * (256 - 131) = 500 \mu s$

### 1-5. Circuit Diagram



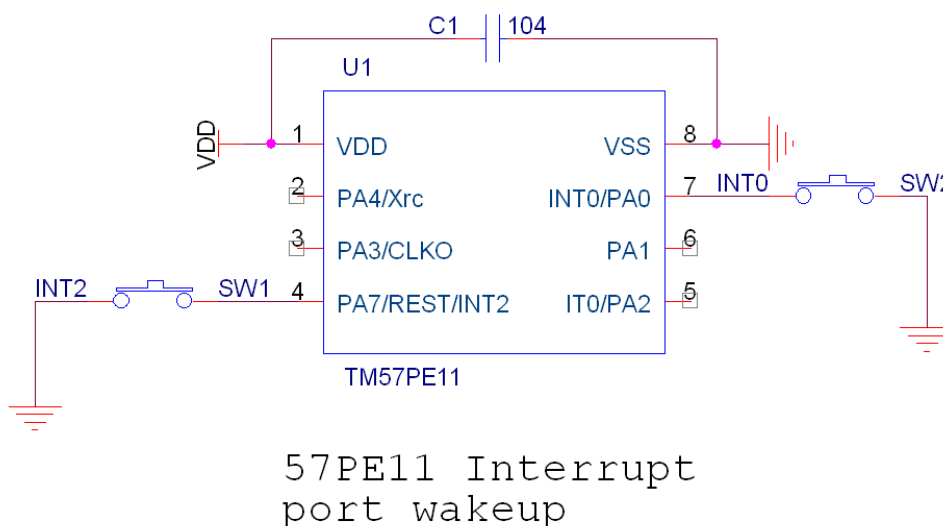
## 2. TM57PE11A\_wakeup Application Sample

### 2-1. Details of DEMO program, please refer to TM57PE11A\_wakeup.asm

### 2-2. Sample description

- 1) After the subroutine executes Sleep command to enter sleep mode, TM57PA11A can use two ways to wake up. Such as the interrupt, i.e. via 2 external interrupt ports level variation and watch dog timer overflow.
- 2) External interrupt wakeup configuration steps:
  1. At first, set INT0(PA0), INT2(PA7) ports as inputs and enable pull high, set the I/O port data register to 1.
  2. Enable the related external interrupt (F-plane 08h.2 , F-plane 08h.0)
  3. When entering sleep mode, interrupt port level from high to low condition will cause interrupt, at this moment, subroutine will enter interrupt, and sleep mode will be waken up.
- 3) WKT wakeup function steps:
  1. At first, from the config selection, select Disable WDT Reset, Enable WKT timer.
  2. Select Watch Dog timer overflow time (0-1 bit of WKTPSC, R-plane 0bh.1~0).
  3. Enable watch dog interrupt WKTIE (when watch dog timer overflows, subroutine will be interrupted; sleep mode will be waken up, F-plane 08h.3).

### 2-3. Circuit Diagram



**Note:** When using INT0, INT2 ports for sleep wakeup, the data register port must be set to 1.

INT0 (PA0) , F-plane 05h.0

INT2 (PA2) , F-plane 05h.7

### 3. TM57PE11A\_key\_AP Application Sample

#### 3-1. Details of DEMO program, please refer to TM57PE11A\_key\_AP.asm

#### 3-2. Sample description

- 1) Subroutine uses PA4, PA3, PA7 as key input ports, PA0, PA1, PA2 as LED output port. Simple operating instruction of key and I/O port: power on, all LED lights are turned ON, press key once, the correspondent LED turns over once; when LED turns over, subroutine uses macro instruction.

```

negb_ macro f_flag,ll
    btfss f_flag,ll      ; test whether the current bit is 0 or 1
    goto $+3             ;PC register+3
    bcf f_flag,ll        ;Delete a particular bit
    goto $+2             ;PC register +2
    bsf f_flag,ll        ;Set a particular bit
endm

```

- 2) Initialization steps are as follows:

1. Set key ports PA3, PA4, PA7 and LED port PA0, PA1, PA2 port data to 1.

```

movlw    11111111b
movwf    PAD

```

2. Set key ports PA3, PA4, PA7 as input, set LED ports PA0, PA1, PA2 as output.

```

movlw    00000111b
movwr    PAE

```

3. Enable key ports PA3, PA4, PA7 pull up, disable the LED ports PA0, PA1, PA2 pull up (please note that after TM57PE11 power on reset, PA port pull up is enabled, however, after TM57PE11A power on reset, the PA port pull up is disabled).

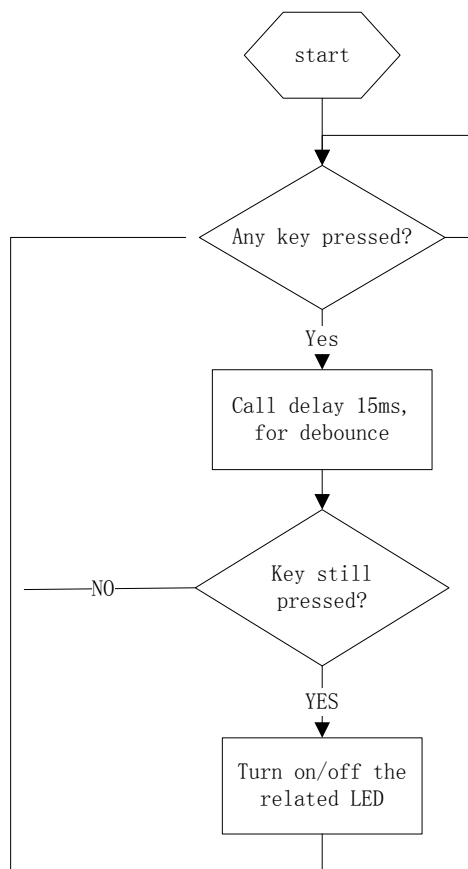
```

movlw    00000111b
movwr    PAPU

```

- 3) Key scanning subroutine basic procedure is after any key pressed is scanned, delay 15 ms to debounce, then scan key, if the key is remain pressed, then LED control procedure will be executed.

Details of the flow diagram are shown as below:





### 3-3. Delay subroutine

Subroutine uses 4 MHz internal oscillator, to debounce delay time about 15 ms,  $15\text{ ms} = 15000\text{ us} = 30000\text{ instruction cycle}$ . Lower bit of the subroutine circulates every 4 instruction cycles, when using DECFSZ instruction, it needs 2 instruction cycles to jump over, otherwise it needs 1 instruction cycle for not jump instruction, delay\_count\_l register initial value is 250, the instruction cycle for every lower bit to circulate is  $250 \times 4 = 1000$ . Key scanning initial value for high bit is 30, low bit initial value is 250, the initialization procedure is shown as below:

```
movlw 30
movwf delay_count_h           ;High initial delivery delay count
movlw 250
movwf delay_count_l           ;Low initial delivery delay count
```

After initialization, procedure enters lower bit 250 times circulation.

Lower bit circulation detail procedure is shown as below:

delay\_loop:

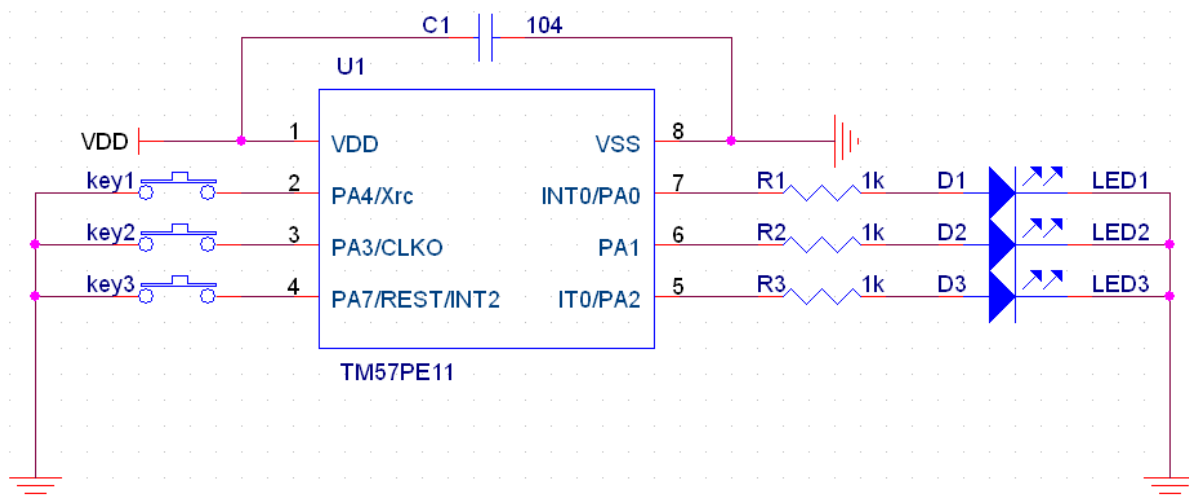
```
nop
decfsz delay_count_l,1
goto delay_loop
```

After lower bit 250 times circulation is done, subroutine will enter high bit circulation once, then once lower bit circulation, until 29 times of high bit circulations is finished.

High bit circulation details procedure is shown below:

```
movlw 250
movwf delay_count_l           ;Low initial delivery delay count
decfsz delay_count_h,1
goto delay_loop
```

### 3-4. Application Circuit:



#### 4. TM57PE11A\_WKT Application Sample

TM57PE11A Watchdog circuit consists of an internal independent RC oscillator circuit and a timer. Regarding to power save reason, this independent RC oscillator circuit can be switched OFF, as shown as below table, and once the oscillator is in suspend condition, timer overflow will not happen, it means, the further reset (WDT) or interrupt (WKT) will not happen.

Mode	WDTE	WKTIE	Watch Dog Oscillator Circuit
Operating	0	0	Stop
	0	1	Operating
	1	0	
	1	1	
Sleep	0	0	Stop
	0	1	Operating
	1	0	Stop
	1	1	Operating

**Note:** WDTE is the bit6 of CONFIG

WKTIE is enable bit of WKT interrupt (f\_plane, 08h.3)

##### 4-1. Details of DEMO program, please refer to TM57PE11A\_WKT.asm

##### 4-2. Sample description

- 1) This DEMO program is mainly to show how to use WDT in SLEEP mode to finish RESET function, the key point of the program is before entering SLEEP mode, set WDTE, WKTIE to '1', to make sure when enabling watch dog circuit, the oscillator circuit in SLEEP mode also keeps operating, so that when watch dog timer overflows, reset will occur.
- 2) Please note that WKTIE needs to be set to 0 if user hopes TM57PE11A spends the least power consumption in SLEEP mode when the watch dog oscillator circuit is closed.
- 3) Different with TM57PE11A, oscillator circuit in TM57PE11 under SLEEP mode cannot be disabled.