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PV198 – One-chip Controllers

Timers

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2. What is it used for
3. How does it work
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What is Timer

- Timer / Counter
- Timer – measure time intervals
- Counter – count events

What is it used for

- Using Timer vs Delay
- examples

How does it work

- PIT – Periodic Interrupt Timer

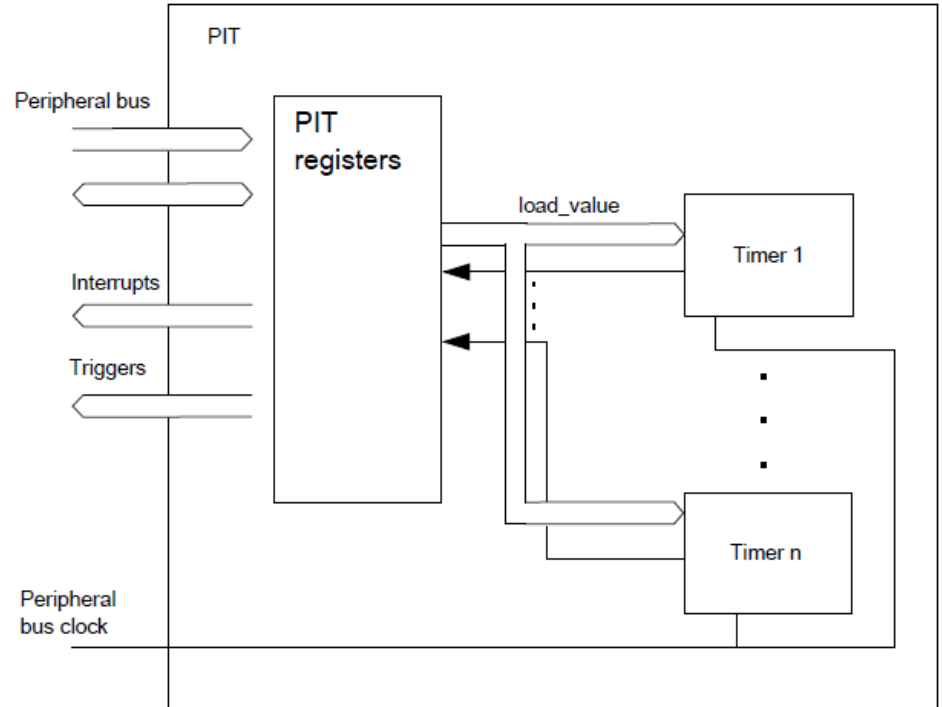


Figure 46-1. Block diagram of the PIT

<https://www.nxp.com/docs/en/reference-manual/K66P144M180SF5RMV2.pdf>

FRDM-K66F Timers

- Programmable delay block (PDB)
- Flexible timer modules (FTM)
- Low Power TPM (TPM)
- Periodic interrupt timers (PIT)
- Low-power timer (LPTimer)
- Carrier modulator timer (CMT)
- Real-time clock (RTC)
- IEEE 1588 timers

Periodic interrupt timers (PIT) – Features

- 4 timers
- Ability of timers to generate DMA trigger pulses
- Ability of timers to generate interrupts
- Independent timeout periods for each timer
- Chaining of timers

Periodic interrupt timers (PIT)

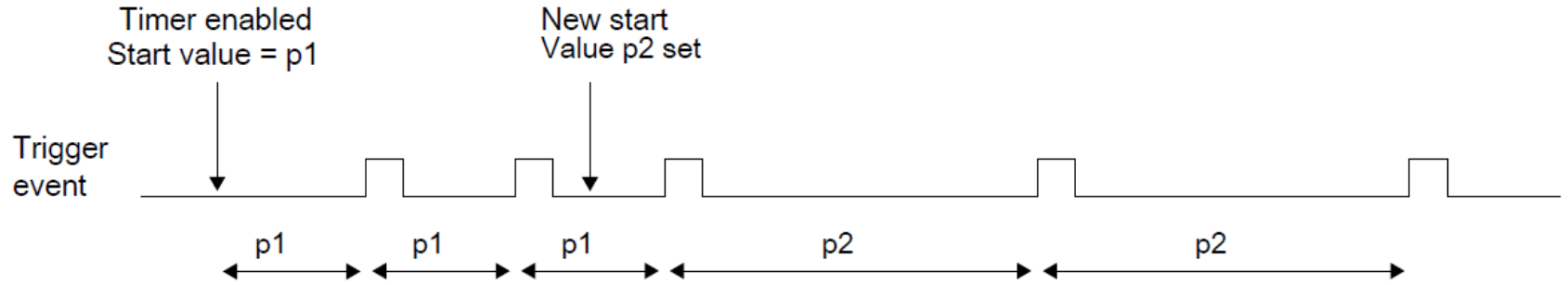


Figure 46-4. Dynamically setting a new load value

Periodic interrupt timers (PIT)

- Set value to a timer register
Timer Load Value Register (PIT_LDVALn)
- The timer will count down until it reaches 0, then it will generate an interrupt and load this register value again

Periodic interrupt timers (PIT)

- Which value to set?
- Example:
 - Interrupt every 0.5 seconds
 - Bus clock: 60 MHz \rightarrow clock period = 16.67 ns
 - LDVAL trigger = $(\text{period} / \text{clock period}) - 1$
 - $0.5 \text{ s} / 16.67 \text{ ns} = 30\,000\,000 - 1 = 29\,999\,999$ cycles

Code

```
void PIT_1_init(void) {
    /* Initialize the PIT. */
    PIT_Init(PIT_1_PERIPHERAL, &PIT_1_config);
    /* Set channel 0 period to 3 s (18000000 ticks). */
    PIT_SetTimerPeriod(PIT_1_PERIPHERAL, kPIT_Chnl_0, PIT_1_0_TICKS);
    /* Enable interrupts from channel 0. */
    PIT_EnableInterrupts(PIT_1_PERIPHERAL, kPIT_Chnl_0, kPIT_TimerInterruptEnable);
    /* Enable interrupt PIT_1_0_IRQN request in the NVIC */
    EnableIRQ(PIT_1_0_IRQN);
    /* Start channel 0. */
    PIT_StartTimer(PIT_1_PERIPHERAL, kPIT_Chnl_0);
}
```

Application

Goal:

- Write an application that prints text to console every 1 second
- Update it to toggle LED every 0.5 seconds

Homework

Write interrupt base button debouncing.

- Use GPIO interrupt to detect first edge
- When GPIO is triggered start Timer and wait for constant time
- When Timer interrupt triggers, check GPIO value.
- Add Green LED toggle when debounced button press signal is accepted.