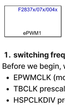
Eg. ePWM

The time settings of the ePWM block can be configured using either a **clock** or a **time value**, but it is recommended that professional users use the **clock** option to achieve precise control.



Each ePWM block corresponds to one module and can generate two PWM signals: ePWMA and ePWMB, which are typically used to control the upper and lower switches of the same bridge leg.

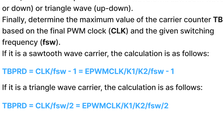
1. switching frequency fs

Before we begin, we need to understand a few configuration parameters:

- EPWMCLK (model configuration)
- TBCLK prescaler divider K1 (ePWM block configuration)
- HSPCLKDIV prescaler divider K2 (ePWM block configuration)

EPWMCLK is generated from the 200 MHz system clock, optionally divided by a prescaler. It serves as the base clock for all ePWM modules. By default, EPWMCLK = SYSCLKOUT/2 = 100 MHz.
K1 and **K2** are futher prescaler dividers to slow down EPWMCLK for the final clock **CLK**. By default they are both 1.

CLK = EPWMCLK/K1/K2



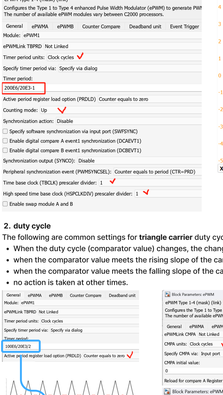
To correctly and accurately set the switching period **(fsw)** for the PWM, we first choose clock cycles as the unit of time.
Then, select the shape of the carrier waveform: sawtooth wave (up or down) or triangle wave (up-down).
Finally, determine the maximum value of the carrier counter **TBPRD** based on the final PWM clock **(CLK)** and the given switching frequency **(fsw)**.
If it is a sawtooth wave carrier, the calculation is as follows:

TBPRD = CLK/fsw - 1 = EPWMCLK/K1/K2/fsw - 1

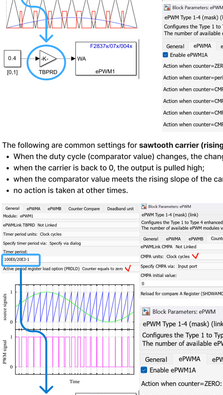
If it is a triangle wave carrier, the calculation is as follows:

TBPRD = CLK/fsw/2 = EPWMCLK/K1/K2/fsw/2

For example, if fsw = 20 kHz and a triangular wave is chosen as the carrier, the following settings can be applied:



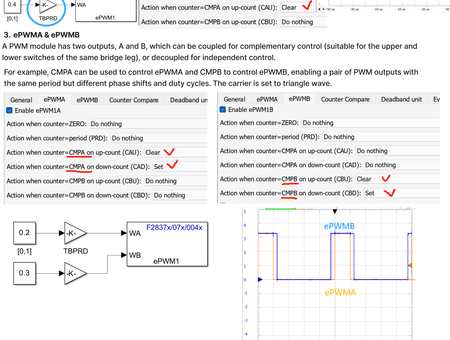
For example, if fsw = 20 kHz and a sawtooth wave is chosen as the carrier, the following settings can be applied:



2. duty cycle

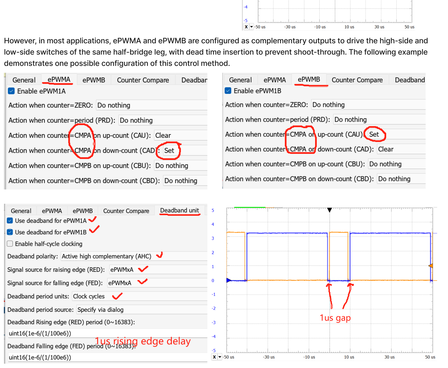
The following are common settings for **triangle carrier** duty cycle control:

- When the duty cycle (comparator value) changes, the change will be updated when the carrier is at zero;
- when the comparator value meets the rising slope of the carrier, the output is pulled low;
- when the comparator value meets the falling slope of the carrier, the output is pulled high;
- no action is taken at other times.



The following are common settings for **sawtooth carrier (rising)** duty cycle control:

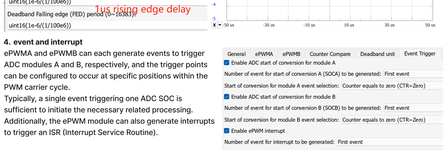
- When the duty cycle (comparator value) changes, the change will be updated when the carrier is at zero;
- when the carrier is back to 0, the output is pulled high;
- when the comparator value meets the rising slope of the carrier, the output is pulled low;
- no action is taken at other times.



3. ePWMA & ePWMB

A PWM module has two outputs, A and B, which can be coupled for complementary control (suitable for the upper and lower switches of the same bridge leg), or decoupled for independent control.

For example, CMPA can be used to control ePWMA and CMPB to control ePWMB, enabling a pair of PWM outputs with the same period but different phase shifts and duty cycles. The carrier is set to triangle wave.



However, in most applications, ePWMA and ePWMB are configured as complementary outputs to drive the high-side and low-side switches of the same half-bridge leg, with dead time insertion to prevent shoot-through. The following example demonstrates one possible configuration of this control method.

4. event and interrupt

ePWMA and ePWMB each can generate events to trigger ADC modules A and B, respectively, and the trigger points can be configured to occur at specific positions within the PWM carrier cycle.
Typically, a single event triggering one ADC SOC is sufficient to initiate the necessary related processing. Additionally, the ePWM module can also generate interrupts to trigger an ISR (Interrupt Service Routine).