SB-PWM - Sandbox PWM

SD012 | Posted on April 2, 2021 | Updated on May 27, 2025

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The FPGA sandbox PWM block allows driving the PWM output from a user-made modulator from within the FPGA.

Information on FPGA edition is available on Editing the FPGA firmware (sandbox) (PN116)

Usage examples of the FPGA sandbox PWM block are available on:

- FPGA-based direct torque control using Vivado HLS (TN133)
- FPGA-based hysteresis current control (TN120)

Because the user-generated FPGA signals still go through the PWM output chain, it supports **dead time generation** and can be **activated or deactivated**. More information is available on the PWM page.

Simulink block

Signal specification

The input A allows the activation (>0) or deactivation (<=0) of the PWM output(s).
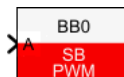
Parameters

- `Device ID`: selects which device to address when used in a multi-device configuration.
- `Show "activate" input`: makes the A signal input visible. If not checked, the CB-PWM block is active by default.
- Output configuration:
  - `use` checkbox: selects which PWM outputs are driven from the FPGA sandbox
  - `output configuration`: selects between a single PWM signal or complementary signals with a deadtime.
  - `dead-time`: configures the dead-time duration if the `Output mode` is set at *Dual (PWM_H + PWM_L)*.

The parameters `output mode`, `addressed PWM`, `dead-time` and `show "activate" input` are common to all PWM blocks and are further documented on the PWM page.

Block Parameters: PWM_SB ✕

Sandbox PWM modulator

Configures the PWM output(s) to be used with a custom modulator implemented in FPGA.

The input signal 'A' allows the activation (1) or deactivation (0) of the PWM output(s).

Addressing

Device ID (default=0) | 0 |

PWM activation

☑ Show "Activate" input

| **PWM (1/2)** | PWM (2/2) |

Use / Output configuration / Dead-time (in s)

☑ CH0 / LN0 LN1	Dual (PWM_H + PWM ▾	1e-6
☑ CH1 / LN2 LN3	Dual (PWM_H + PWM ▾	1e-6
☑ CH2 / LN4 LN5	Dual (PWM_H + PWM ▾	1e-6
☐ CH3 / LN6 LN7	Dual (PWM_H + PWM ▾	1e-6
☐ CH4 / LN8 LN9	Dual (PWM_H + PWM ▾	1e-6
☐ CH5 / LN10 LN11	Dual (PWM_H + PWM ▾	1e-6
☐ CH6 / LN12 LN13	Dual (PWM_H + PWM ▾	1e-6
☐ CH7 / LN14 LN15	Dual (PWM_H + PWM ▾	1e-6

| OK | Cancel | Help | Apply |

Block Parameters: PWM_SB ✕

Sandbox PWM modulator

Configures the PWM output(s) to be used with a custom modulator implemented in FPGA.

The input signal 'A' allows the activation (1) or deactivation (0) of the PWM output(s).

Addressing

Device ID (default=0) | 0 |

PWM activation

☑ Show "Activate" input

| PWM (1/2) | **PWM (2/2)** |

Use / Output configuration / Dead-time (in s)

☐ CH8 / LN16 LN17	Dual (PWM_H + PWM ▾	1e-6
☐ CH9 / LN18 LN19	Dual (PWM_H + PWM ▾	1e-6
☐ CH10 / LN20 LN21	Dual (PWM_H + PWM ▾	1e-6
☐ CH11 / LN22 LN23	Dual (PWM_H + PWM ▾	1e-6
☐ CH12 / LN24 LN25	Dual (PWM_H + PWM ▾	1e-6
☐ CH13 / LN26 LN27	Dual (PWM_H + PWM ▾	1e-6
☐ CH14 / LN28 LN29	Dual (PWM_H + PWM ▾	1e-6
☐ CH15 / LN30 LN31	Dual (PWM_H + PWM ▾	1e-6

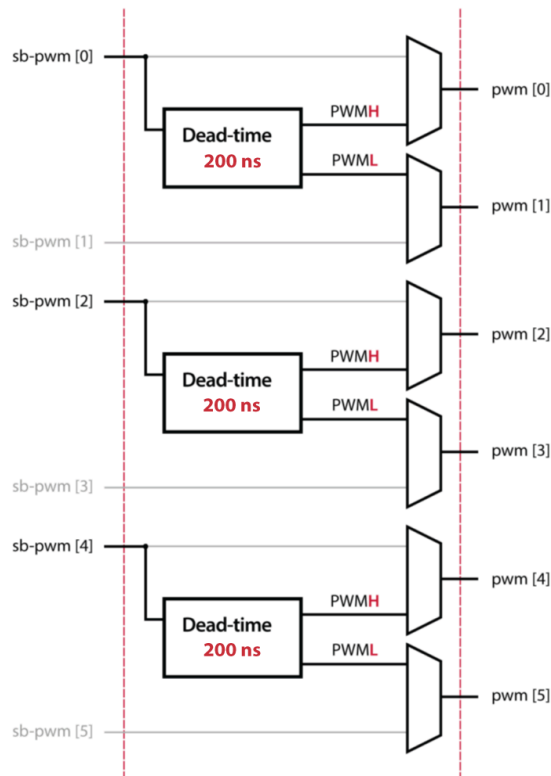| OK | Cancel | Help | Apply |

Example of SB PWM configuration

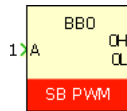Configuration of the SB-PWM block in Simulink

Mapping between sb_pwm and pwm ports of the imperix IP in Vivado

PLECS block

Signal specification

The input A allows the activation (>0) or deactivation (<=0) of the PWM output(s).

Parameters

- `Device ID` selects which device to address when used in a multi-device configuration.
- `Output mode` selects between a single PWM signal or complementary signals with a deadtime.
- `Output lane(s)` or `Output channel(s)`(vectorizable) selects which PWM outputs are driven from the FPGA sandbox.
- `PWM activation` makes the `A` signal input visible if the option *Use block input* is selected. If not, the CB-PWM block is activated by default.
- `Dead-time duration` configures the dead-time duration if the `Output mode` is set at *Dual (PWM_H + PWM_L)*.

The parameters `output mode`, `addressed PWM`, `dead time` and `PWM activation` are common to all PWM blocks and are further documented on the [PWM page](#).

C++ functions

Functions specific to the sandbox PWM

There is no function specific to the sandbox PWM. The function `SbPwm_ConfigureOutputMode()` must be used to select the PWM outputs to be driven from the FPGA sandbox.

Functions common to all PWM drivers

These functions are common to all PWM blocks. Further documentation is available on the [PWM page](#).

`SbPwm_ConfigureOutputMode` **— Select the P**WM **output mod**e

```cpp
void SbPwm_ConfigureOutputMode(tPwmOutput output, tPwmOutMode outMode, unsigned int device=0);
```
Code language: C++ (cpp)

Selects the PWM output mode.

If the output mode selected is *COMPLEMENTARY,* a dead-time must be configured using the `CbPwm_ConfigureDeadTime()` function.

It has to be called in `UserInit()`.

Parameters

- `output`: the PWM channel or lane to address
- `outMode`: the output mode to use (*COMPLEMENTARY, INDEPENDENT* or *PWMH_ACTIVE*)
- `device`: the B-Box/B-Board to address when used in a multi-device configuration

`SbPwm_ConfigureDeadTime` **— Configure the dead time**

```cpp
void SbPwm_ConfigureDeadTime(tPwmOutput output, float deadTime, unsigned int device=0);
```
Code language: C++ (cpp)

Configures the dead-time duration if the output mode is set as *COMPLEMENTARY.*

It has to be called in `UserInit()`.

Parameters

- `output`: the PWM channel or lane to address
- `outMode`: the output mode to use (*COMPLEMENTARY, INDEPENDENT* or *PWMH_ACTIVE*)
- `device`: the B-Box/B-Board to address when used in a multi-device configuration

`SbPwm_Activate` **— Activate the PWM outputs**

```cpp
void SbPwm_Activate(tPwmOutput output, unsigned int device=0);
```
Code language: C++ (cpp)

Activates the addressed PWM output(s). If the addressed PWM output has been set as *COMPLEMENTARY* or *PWMH_ACTIVE* this function acts on both outputs.

It can be called in `UserInit()` or in the control interrupt routine.

Parameters

- `output`: the PWM channel or lane to address
- `device`: the B-Box/B-Board to address when used in a multi-device configuration

`SbPwm_Deactivate` **— Deactivate the PWM outputs**

```cpp
void SbPwm_Deactivate(tPwmOutput output, unsigned int device=0);
```
Code language: C++ (cpp)

Deactivates the addressed PWM output(s). If the addressed PWM output has been set as *COMPLEMENTARY* or *PWMH_ACTIVE* this function acts on both outputs.

It can be called in `UserInit()` or in the control interrupt routine.

Parameters

- `output`: the PWM channel or lane to address
- `device`: the B-Box/B-Board to address when used in a multi-device configuration