

SB-PWM - Sandbox PWM

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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:

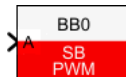
- [FPGA-based direct torque control using Vivado HLS \(TN133\)](#)
- [FPGA-based hysteresis current control \(TN120\)](#)

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)

PWM activation

Show "Activate" input

PWM (1/2) PWM (2/2)

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

<input checked="" type="checkbox"/> CH0 / LN0 LN1	Dual (PWM_H + PWM)	<input type="text" value="1e-6"/>
<input checked="" type="checkbox"/> CH1 / LN2 LN3	Dual (PWM_H + PWM)	<input type="text" value="1e-6"/>
<input checked="" type="checkbox"/> CH2 / LN4 LN5	Dual (PWM_H + PWM)	<input type="text" value="1e-6"/>
<input type="checkbox"/> CH3 / LN6 LN7	Dual (PWM_H + PWM)	<input type="text" value="1e-6"/>
<input type="checkbox"/> CH4 / LN8 LN9	Dual (PWM_H + PWM)	<input type="text" value="1e-6"/>
<input type="checkbox"/> CH5 / LN10 LN11	Dual (PWM_H + PWM)	<input type="text" value="1e-6"/>
<input type="checkbox"/> CH6 / LN12 LN13	Dual (PWM_H + PWM)	<input type="text" value="1e-6"/>
<input type="checkbox"/> CH7 / LN14 LN15	Dual (PWM_H + PWM)	<input type="text" value="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)

PWM activation

Show "Activate" input

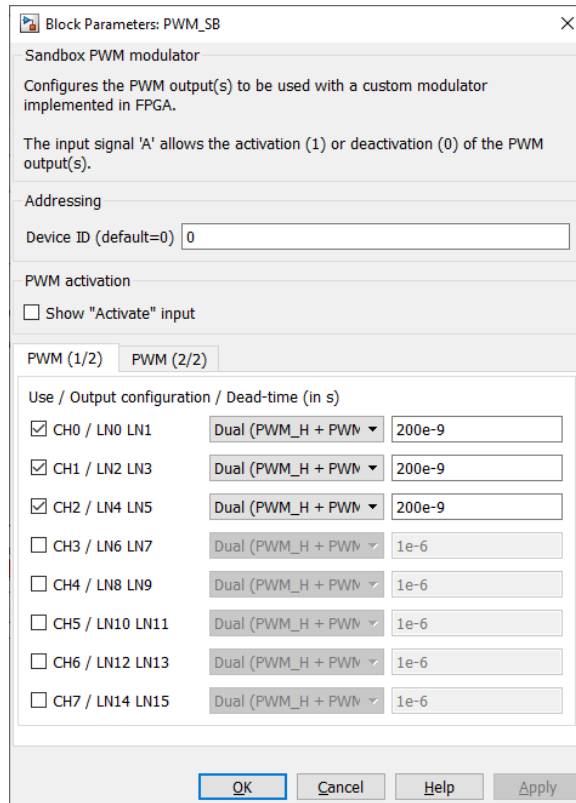
PWM (1/2) PWM (2/2)

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

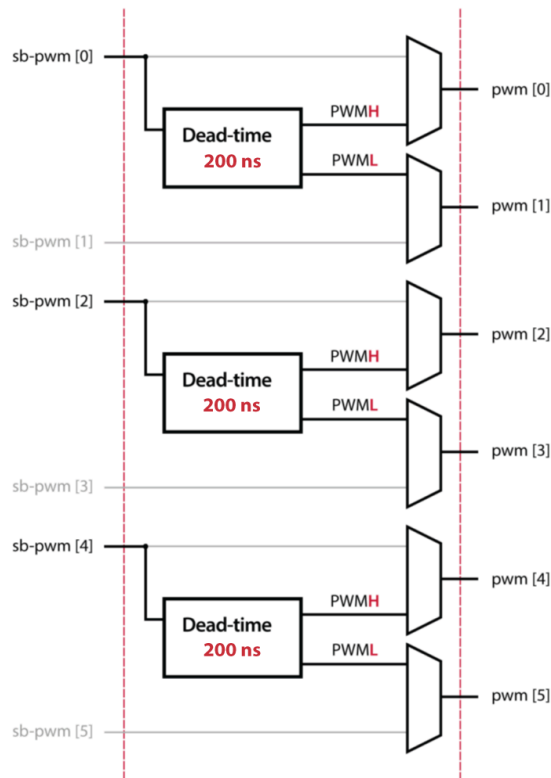
<input type="checkbox"/> CH8 / LN16 LN17	Dual (PWM_H + PWM)	<input type="text" value="1e-6"/>
<input type="checkbox"/> CH9 / LN18 LN19	Dual (PWM_H + PWM)	<input type="text" value="1e-6"/>
<input type="checkbox"/> CH10 / LN20 LN21	Dual (PWM_H + PWM)	<input type="text" value="1e-6"/>
<input type="checkbox"/> CH11 / LN22 LN23	Dual (PWM_H + PWM)	<input type="text" value="1e-6"/>
<input type="checkbox"/> CH12 / LN24 LN25	Dual (PWM_H + PWM)	<input type="text" value="1e-6"/>
<input type="checkbox"/> CH13 / LN26 LN27	Dual (PWM_H + PWM)	<input type="text" value="1e-6"/>
<input type="checkbox"/> CH14 / LN28 LN29	Dual (PWM_H + PWM)	<input type="text" value="1e-6"/>
<input type="checkbox"/> CH15 / LN30 LN31	Dual (PWM_H + PWM)	<input type="text" value="1e-6"/>

OK Cancel Help Apply

Example of SB PWM configuration



Configuration of the SB-PWM block in Simulink

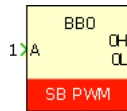


Mapping between sb_pwm and pwm ports of the imperix IP in Vivado

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 PWM output mode

```
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.

Can only 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 ID of the addressed device (optional, used in multi-device configuration only)

`SbPwm_ConfigureDeadTime` — Configure the dead time

```
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*.

Can only 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 ID of the addressed device (optional, used in multi-device configuration only)

`SbPwm_Activate` — Activate the PWM outputs

```
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.

Can be called in `UserInit()` or in the interrupt routine.

Parameters

- `output`: the PWM channel or lane to address
- `device`: the ID of the addressed device (optional, used in multi-device configuration only)

`SbPwm_Deactivate` — Deactivate the PWM outputs

```
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.

Can be called in `UserInit()` or in the interrupt routine.

Parameters

- `output`: the PWM channel or lane to address
- `device`: the ID of the addressed device (optional, used in multi-device configuration only)