TMS320 DSP
DESIGNER'S NOTEBOOK

Configuring PWM Outputs of TMS320F240 with Dead Band for Different Power Devices

APPLICATION REPORT: SPRA289

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TEXAS INSTRUMENTS

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Contents

Figures

Tables

Configuring PWM Outputs of TMS320F240 with Dead Band for Different Power Devices

Abstract

The DSP controller TMS320F240 has a programmable dead band generator, to insert a dead band between two PWM outputs. The polarity of PWM channels (active high or active low) can be controlled using the ACTR register. The appropriate dead band between two PWM outputs can be inserted using the DBTCON register. This document discribes how to configure the PWM outputs with dead band for different power devices.

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Design Problem

How do I configure PWM outputs with dead band for different power devices?

Solution

The DSP controller TMS320F240 has a programmable dead band generator to insert a dead band between two PWM outputs (PWM1&2, PWM3&4, and PWM5&6). The polarity of PWM channels (active high or active low) can be controlled using the ACTR register. The appropriate dead band between two PWM outputs can be inserted using the DBTCON register. The dead band circuitry of the TMS320F240 reduces the active portion of the odd PWM channels (PWM1, PWM3, and PWM5) from the leading transition end. However, the dead band circuitry of TMS320F240 increases the active portion of the even PWM channels (PWM2, PWM4, and PWM6) from the lagging transition end. The following figures show different PWM waveform configurations with dead band. Figure 1 shows PWM1 (active high) and PWM2 (active low) without dead band. The counter is operating in continuous up/down mode and the transitions in PWM outputs occur at every compare match. The compare match event is shown by dotted lines in Figure 2 through Figure 5.

Figure 1. PWM1 & PWM2 without Dead Band: PWM1 (top) Active High and PWM2 (bottom) Active Low.

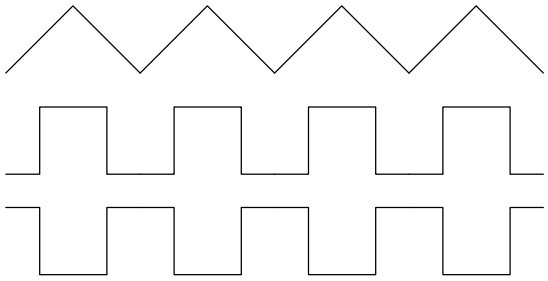


Figure 2 shows PWM1 and PWM2 configured as active high and active low respectively, with dead band.

Figure 2. PWM1 (Active High) and PWM2 (Active Low) Outputs with Dead Band.

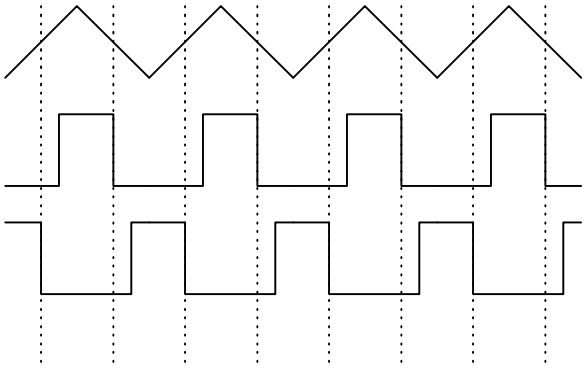


Figure 3 shows PWM1 and PWM2 configured as active low and active high respectively, with dead band.

Figure 3. PWM1 (Active Low) and PWM2 (Active High) Outputs with Dead Band.

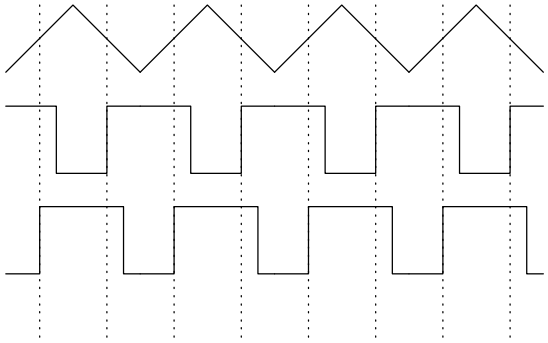


Figure 4 shows both PWM1 and PWM2 configured as active high with dead band.

Figure 4. Both PWM1 and PWM2 Configured Active High with Dead Band.

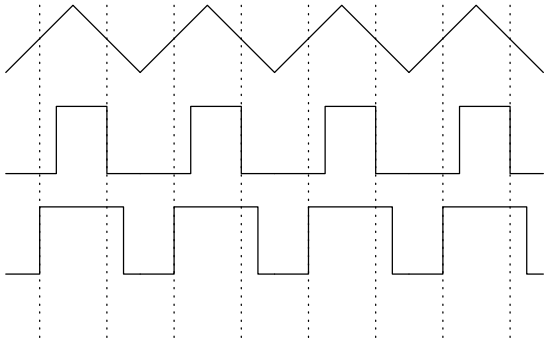
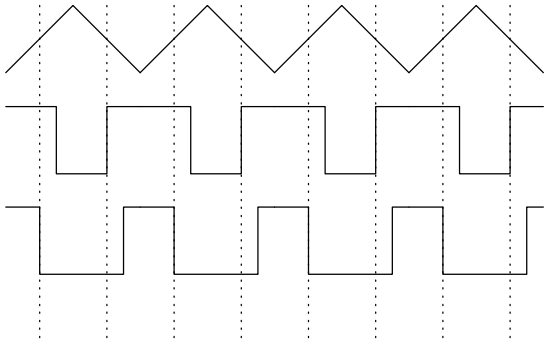


Figure 5 shows both PWM1 and PWM2 configured as active low with dead band.

Figure 5. Both PWM1 and PWM2 Configured As Active Low with Dead Band.

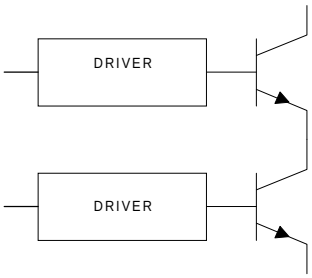


Note that in all the cases shown in Figure 2 through Figure 5, the active portion of PWM1 is reduced and the active portion of PWM2 is increased by the introduction of dead band.

Example

Figure 6 shows a phase of an inverter that needs dead band to prevent shoot through fault.

Figure 6. Inverter Phase with Two Power Devices Connected In Series.



Suppose that both power devices turn on when the driver gets high voltage, and turn off when the driver gets low voltage. In this case the PWM outputs with dead band should be configured as shown in Figure 2.

If both power devices turn on with low voltage and turn off with high voltage, then the PWM outputs with dead band should be configured as shown in Figure 3.

If the upper device needs high voltage to turn on and the lower device needs low voltage to turn on, then the PWM outputs with dead band should be configured as shown in Figure 4.

If the upper device needs low voltage to turn on and the lower device needs high voltage to turn, on then the PWM outputs with dead band should be configured as shown in Figure 5.

Table 1. The PWM Output Configurations with Dead Band for Various Power Devices

Power Devices Configurations				**PWM output configurations**			
In order to turn ON, upper switch needs - (V)		**In order to turn ON, lower switch needs - (V)**		**Polarity of PWMx x = 1,3, and 5**		**Polarity of PWMy y = 2,4, and 6**	
High	**Low**	**High**	**Low**	**Active Hi**	**Active Lo**	**Active Hi**	**Active Lo**
X		X		X			X
	X		X		X	X	
X			X	X		X	
	X	X			X		X