Pulse Width Modulator Utilising TRAC

Kambiz Pourhady

The TRAC family of totally reconfigurable Field Programmable Analog Devices offers an integrated path from signal processing problems to working silicon solutions - in minutes!

Introducing a Top-Down, Structured design discipline, TRAC enables rapid implementation, prototyping and product release. Rather than designing at the component level, TRAC champions a Computational Approach. Using eight simple mathematical building-blocks, any transfer function or mathematical equation can be implemented on TRAC, and more besides!

With a combination of programmable silicon and design software, TRAC brings a truly Integrated Route to signal processing problem solving, providing designers with benefits formerly associated only with programmable digital devices, and offering a path to Custom Silicon for higher volume users.

Introduction

The process of varying a high frequency carrier characteristic proportional to a lower frequency signal is called modulation. The parameter being modulated may be frequency, amplitude, or pulse width.

Pulse Width Modulators, commonly referred to as PWM, have many applications as sub-circuits, the most popular being as control element within switching regulator circuits. This application note demonstrates the design and implementation of a simple pulse width modulator which may be considered as the foundation for further discussions and design scope.

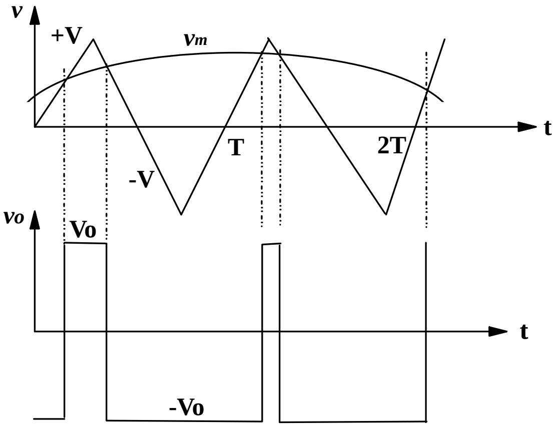

Figure 1
Pulse Width Modulator

Theory of Application

If a triangular waveform v(t) is applied to a comparator whose reference voltage V_R is not constant but say is an audio signal v_m (t), a succession of pulses will be obtained. The width of produced pulses will convey the audio information. The principle action of a pulse width modulator is outlined in Figure 1.

The block diagram shown in figure 2, outlines the basic design for a pulse width modulator utilising TRAC. The Integrating Oscillator (please refer to AN18 for detailed discussion on integrating oscillator design utilising TRAC) of Figure 1 forms the basis of the pulse width modulator system. Positive and negative polarities of the triangular oscillation are fed into two adders. The other input of these adders is the control voltage as shown in Figure 1.

The output of the adders is fed to two log cells. The ADD/LOG serial combination provides a comparator function which enables an output pulse to be produced when the control signal and the triangular wave are of equal amplitude.

The output signals are two interleaved pulses of magnitude $\pm V_{BE}$ and width proportional to the control voltage between the extremes of zero and half of the integrating oscillator period.

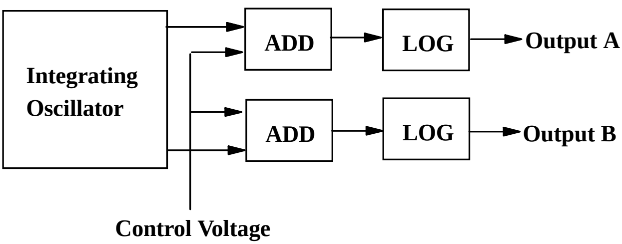

Figure 2
Block Diagram of the Pulse Width Modulator Utilising TRAC

Software

Adopting the "computational approach", the TRAC software and simulator enables the designer to use the required functions and operators, in this case an integrating oscillator and comparators (combination of ADD and LOG) to form a pulse width modulator. The interleaved outputs appear on I/O15 and I/O21.

The simple nature of the design shown in Figure 3, demonstrates the power and versatility of TRAC in a variety of complex applications.

Simulating the design (taking only few seconds!) will outline the successful implementation of TRAC for this rather generic and potentially complex design.

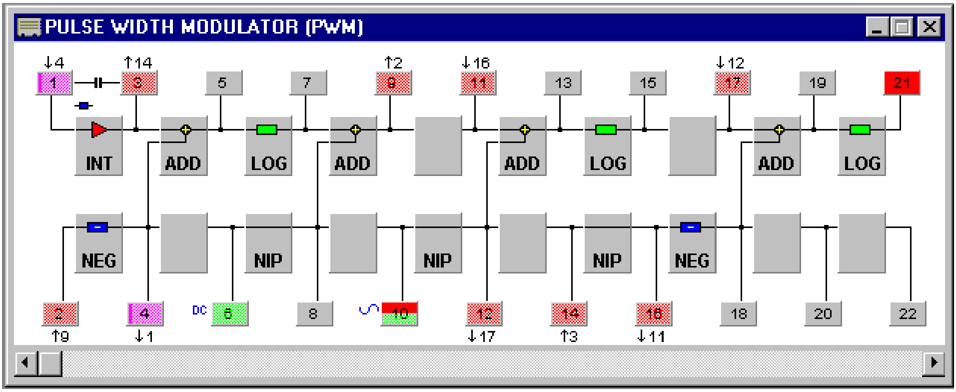

Figure 3
TRAC design of a PWM

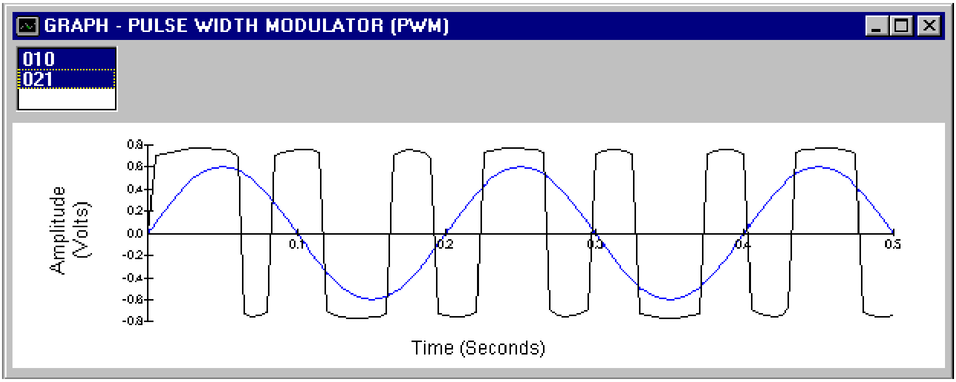

Figure 4
Simulation result for the PWM design

Fast Analog Solutions Ltd.
Fields New Road, Chadderton, Oldham, OL9 8NP, United Kingdom.
Tel: (+44) (0) 161 622 4567 Fax: (+44) (0) 161 622 4568
e-mail: trac@fas.co.uk Internet: http://www.fas.co.uk

TRAC products are supported by agents and distributors in many countries of the world. Details can be found on our web site.

A ZETEX GROUP COMPANY