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331 DSP Controller Board

This board is designed around the ADMC331 DSP motor controller from ANALOG DEVICES and offers a low cost yet powerful solution for a wide variety of power conversion applications such as motor drives (induction motor, brushless, DC or AC), power factor correction, active filters, single or three phase inverters, converters (AC/DC, DC/AC, AC/AC, DC/DC), SCR controlled converters and others.

PWM SECTION

The board has 6 main PWM channels (16 bits with 38.5nsec edge resolution), with options for 5 or 15 volt logic and two secondary PWM channels (8 bits) with 5 volt logic.

The main PWM channels have software programmable dead time and narrow pulse deletion. The minimum switching frequency can be as low as 198 Hz. Each of the 6 PWM pulses can be individually enabled or disabled. Additionally, there is a special crossover function suitable for driving brushless DC motors. An external PWMTRIP pin (active low) enables fast shutdown of all 6 PWM pulses in the event of a fault. The 331 DSP CONTROLLER BOARD can accept three open collector type input signals that are internally OR-ed into a general fault signal that activates the PWMTRIP feature of the ADMC331. High frequency chopping mode for transformer coupled gate drives enables the user to modulate the PWM pulses with a very high frequency that is software programmable.

Double or single duty cycle update mode control permits the generation of symmetrical or asymmetrical PWM pulses .

The two auxiliary PWM pulses can be used for the switching of other circuits in a typical motor control drive (for example power factor correction) and their frequency can be programmed between 50.8 kHz and 13MHz. The two channels can be programmed to work in two different modes: 1) independent mode , where the switching frequencies and duty cycles can be controlled independently for each channel , or 2) offset mode where the switching frequency is the same on both channels but there is an offset time between the rising edge of the PWM pulses from the two channels .

ANALOG TO DIGITAL SECTION

The 331DSP CONTROLLER BOARD utilizes all seven analog to digital channels of the ADMC331 processor. In order to be able to address a wide variety of applications the A/D section of the board has been separated into two sections that are briefly described below:

HIGH VOLTAGE SECTION: Three A/D channels are dedicated to interface with the high voltage side of the power converter (motor drive or PFC for example). Three on board isolated DC-DC converters together with three isolation amplifiers provide the necessary isolation to measure three analog signals from the power circuit, for example, two currents and the dc-link voltage in a motor drive. Additionally, a precise programmable voltage reference (1.2 to 32 volts) is used to provide the level shifting required when negative and positive are to be measured, as in the case with the motor or line currents. When the voltage shifting is not needed, a jumper on each of the three channels can disable it. Voltages up to 500VDC/AC can be measured as the board has provisions for voltage divider resistors.

LOW VOLTAGE SECTION: The remaining four A/D channels are grouped into a low voltage section as follows: two channels are directly connected to the A/D pins of the DSP chip and two channels can be configured either as differential or single ended signals through high performance operational amplifiers. Both of the latter two channels have the option of using the voltage level shift described above, and the gain can be adjusted through resistors.

The two A/D channels that are connected directly to the DSP chip have only a one pole anti-aliasing filter, whose corner frequency can be adjusted, while the other five channels have the options of using a one or two pole anti–aliasing filter and their cut-off frequencies can also be modified.

In this way, the user can accommodate virtually any kind of analog signal: high voltage, low voltage, differential or single ended, DC or AC.

DIGITAL I/O SECTION :

The ADMC331 DSP chip has 24 digital I/O; twelve of them can be used on the 331 DSP CONTROLLER BOARD. There are six digital inputs and six digital outputs, each isolated by optocouplers. The six digital inputs are all referenced to a common isolated power supply ground included on the board; the RS232/485 section of the board also uses the ground.

The six isolated digital outputs have the open collector type optocoupler rated for 80V and 50mA per channel. There is absolutely no connection between the output sections of the optocouplers, so the user can have the freedom of using them independently or, for example, the isolated power supply mentioned above can also be used. All the optocouplers have an isolation voltage of 2500VAC .

RS 232/485 SECTION

The ADMC331 DSP chip has two serial ports and both are used for RS232 (serial port 1) and for RS485 (serial port 0). Both serial ports are isolated through high-speed digital optocouplers and an on board isolated DC-DC converter. The RS232 is particularly important as it can be used during the initial stage of the design for debugging and testing with a PC (the board has also a standard 9 pin connector for interfacing with the serial port of a computer) and it can be used, for example, with ANALOG DEVICES's MOTION CONTROL DEBUGGER software. Once the software is completed, the serial port 1 can be used to download the code from a serial EEPROM at power–up.

A hardware reset push-button and a power supply monitor chip are also included on the board.

The 331 DSP CONTROLLER BOARD has separate analog and digital grounds (it is a four layer board) and the two grounds are connected in only one point, close to the connector that brings all the voltages for the boards. The board accepts +5V (for the digital section) and +/- 5V to +/-15V for the analog section. For maximum noise immunization, all the above voltages have high performance EMI-FILTERS made of ferrite beads and ceramic capacitor capable of suppressing unwanted radiation from other sources making the board ideal for operating in a very noisy environment. All the five DC-DC converters present on the board have an isolation voltage of 1000VDC.

SPECIAL OPTION FOR PHASE CONTROLLED RECTIFIERS

The ADMC331 has only high frequency center based PWM channels; therefore, these channels cannot be used for an application such as a phase controlled rectifier where the pulses must be synchronized with an external signal and the frequency is lower than 198Hz (minimum switching frequency of the PWM section). However, PCTI has developed the software that will enable the use of the ADMC331 in phase controlled applications by using six of the digital I/O's as dedicated PWM outputs for SCR triggering. This new board, soon to be released, will also have all the functions described above covering virtually any power electronics topology.

For more information about the ADMC331 DSP controller chip you can visit ANALOG DEVICE's website at www.analog.com.

For more information about how can you use the 331 DSP CONTROLLER BOARD for your application, you can visit our website at www.gopcti.com, or contact us at 724 452-5787, fax 724 452 4791.