Built-In System Protection for Industrial Drives

Kenneth W. Schachter and Brian A. Fortman   *Industrial Drives and Automation C2000 Micrcontrollers*

ABSTRACT

Eight windowed comparators are integrated into the Delfino F2837xD MCU architecture, providing "trip points," and operate independently from the CPU so there is no additional CPU loading. The comparators are also fast acting (50 ns reaction to trip!) and CPU independent to minimize latency with trip signals so the system can react quickly to any abnormal events or over/under limit conditions. The comparator trip events can be configured to help provide a full shut down action in the case of a catastrophic event, making the system more resilient in industrial drive and servo systems.

The on-chip X-BARs provide a flexible means for interconnecting multiple inputs, outputs, and internal resources in various configurations. The F2837xD contains three X-BARs: the Input X-BAR, the Output X-BAR, and the ePWM X-BAR. These resource are helpful in many ways to the system developer but are particularly helpful in routing the many potential on-chip and off-chip sources to the PWM Trip Zones, thus, providing the designer with many flexible approaches for protection without requiring external logic and creating better utilization of the microcontrollers I/O.

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1　Comparator Subsystem (CMPSS)

The F2837xD includes eight independent Comparator Subsystem (CMPSS) modules that are useful for supporting applications such as peak current mode control, switched-mode power, power factor correction, and voltage trip monitoring. Each CMPSS module is designed around a pair of analog comparators which generates a digital output indicating if the voltage on the positive input is greater than the voltage on the negative input. The positive input to the comparator is always driven from an external pin. The negative input can be driven by either an external pin or an internal programmable 12-bit digital-to-analog (DAC) as a reference voltage. Values written to the DAC can take effect immediately or be synchronized with ePWM events. A falling-ramp generator is optionally available to the control the internal DAC reference value for one comparator in the module. Each comparator output is feed through a programmable digital filter that can remove spurious trip signals. The output of the CMPSS generates trip signals to the ePWM event trigger submodule and GPIO structure.
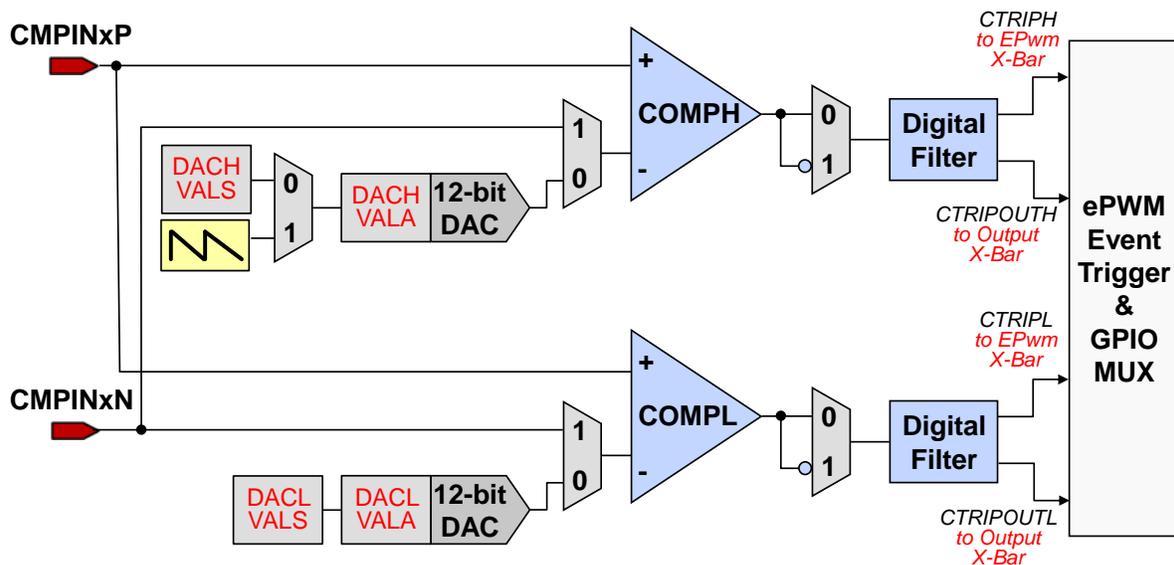

Figure 1. Comparator Subsystem (CMPSS) Block Diagram

2   Crossbars (X-BAR)

The X-BARs provide a flexible means for interconnecting multiple inputs, outputs, and internal resources in various configurations. The F2837xD contains three X-BARs: the Input X-BAR, the Output X-BAR, and the ePWM X-BAR.

The Input X-BAR is used to route external GPIO signals into the device. It has access to every GPIO pin, where each signal can be routed to any or multiple destinations which include the ADCs, eCAPs, ePWMs, Output X-BAR, and external interrupts. This provides additional flexibility above the multiplexing scheme used by the GPIO structure. Since the GPIO does not affect the Input X-BAR, it is possible to route the output of one peripheral to another, such as measuring the output of an ePWM with an eCAP for frequency testing.
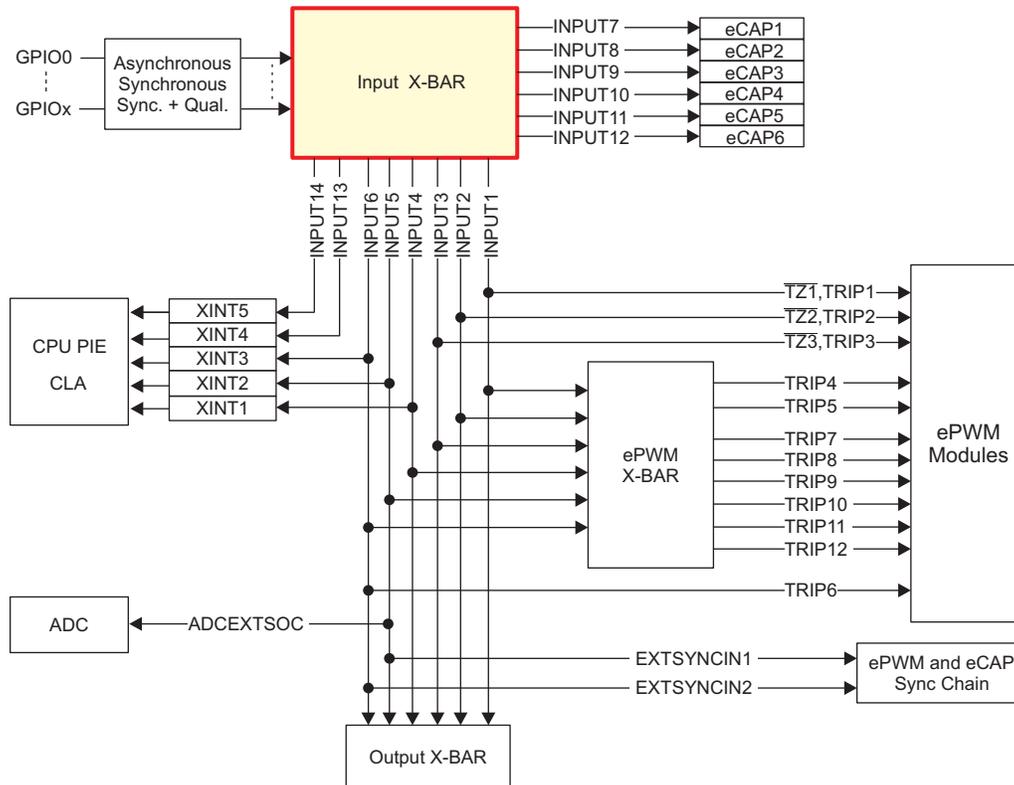
Figure 2. Input X-BAR

The Output X-BAR is used to route various internal signals out of the device. It contains eight outputs that are routed to the GPIO structure, where each output has one or multiple assigned pin positions, which are labeled as OUTPUTXBARx. Additionally, the Output X-BAR can select a single signal or logically OR up to 32 signals.
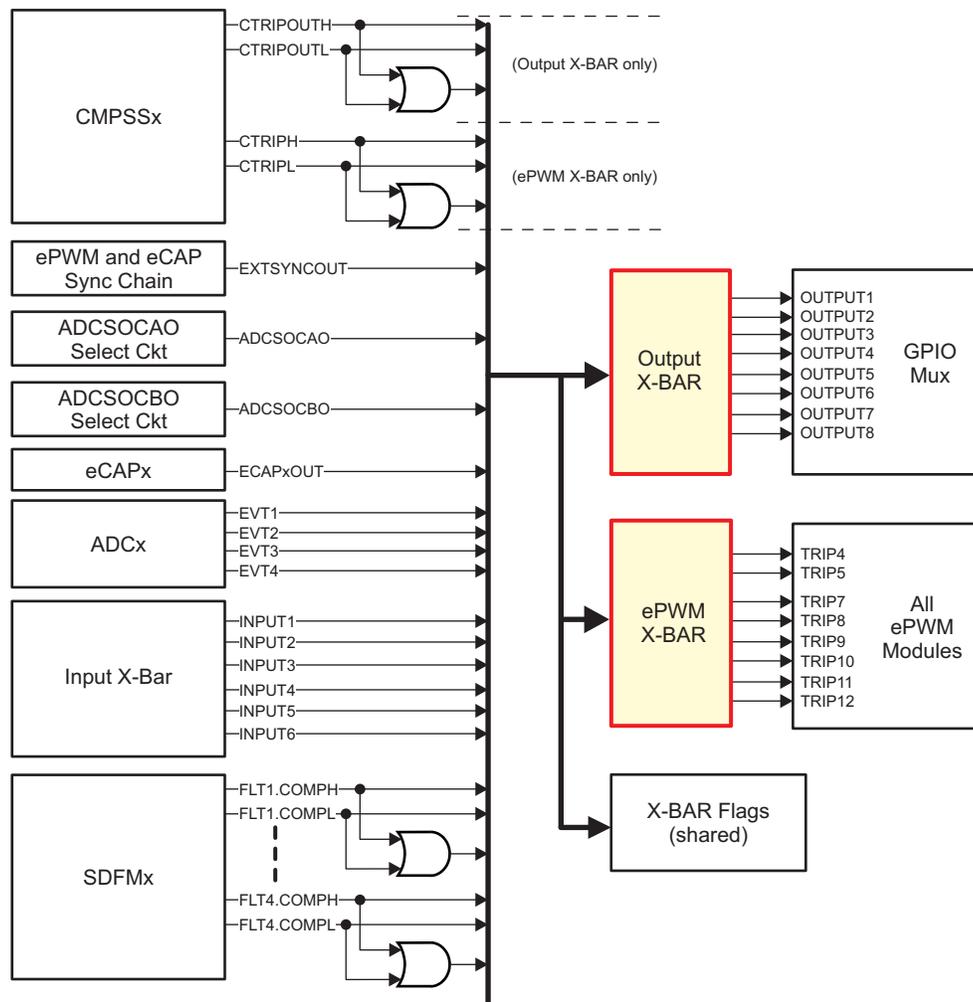
Figure 3. Output and ePWM X-BARs

The ePWM X-BAR is used to route signals to the ePWM Digital Compare submodules of each ePWM module for actions such as trip zones and synchronizing. It contains eight outputs that are routed as TRIPx signals to each ePWM module. Likewise, the ePWM X-Bar can select a single signal or logically OR up to 32 signals.

3   For More Information

- To learn more about DesignDRIVE software, tools and kits for industrial drives and servo control development, visit www.ti.com/tool/DesignDRIVE
- To learn even more on the sensing circuits included on the Delfino F2837x microcontrollers, see the device-specific product group and data sheet at: www.ti.com/delfino, the *TMS320F2837xD Dual-Core Delfino Microcontrollers Technical Reference Manual* (SPRUHM8) or the *TMS320F2837xS Delfino Microcontrollers Technical Reference Manual* (SPRUHX5).
- To view online training on how to use DesignDRIVE solutions, see DesignDRIVE training portal.
- For an introduction and general overview to the TMS320F2837xD microcontroller, see *The TMS320F2837xD Architecture: Achieving a New Level of High Performance Technical Brief* (SPRT720)

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