Technical Article **Real-time Controllers Get New Connectivity Capabilities**

TEXAS INSTRUMENTS

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In the current industrial landscape, there are multiple solutions and architectures available for a wide variety of motor drive, factory automation and high-power grid applications. Many of these offer solid performance and connectivity but at a price – they can be complex, costly and often multiple chips are required to meet system needs. In an ever-evolving market place, design differentiation is important, but efficiencies and performance are vital to the life cycle and ultimately the long-term sustainability of a business.

You may be asking yourself, "How can I compete?" or "What's the right choice to help sustain my business and propel me to the future?" The heart of the matter is integrated functionality where real-time control meets real-time connectivity.

A new series of C2000[™] real-time controllers, F2838x, offers enhanced connectivity options and increases control performance while enabling system-level flexibility in industrial and high-power-grid applications. The easiest way to describe the new series (Figure 1) is that it is an F2837x device with performance enhancements and a new connectivity manager, an Arm® Cortex®-M4-based subsystem, which offloads processing-intensive communications and optimizes connectivity.

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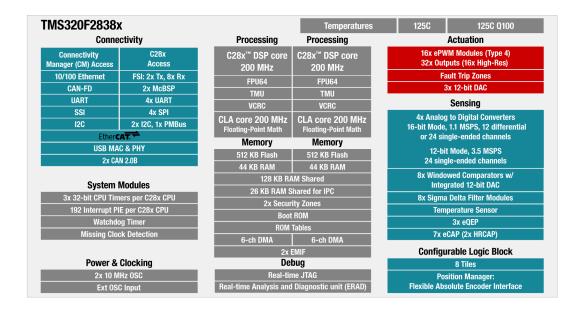


Figure 1. TMS320F28388D Block Diagram

By enabling functionality typically performed by an FPGA/complex programmable logic device, applicationspecific integrated circuit, and communications microcontroller (MCU)/microprocessor, the F2838x enables a near single-chip solution for connected servo drives, AC drives, factory automation and industrial power equipment.

Real-time communications are enabled by a dedicated Arm® Cortex-M4 based Connectivity Manager. With EtherCAT capability integrated there is no need for an external ASIC. 10/100 Ethernet, CAN FD, USB and various high-speed serial ports are also supported. Additionally, the fast serial interface (FSI) enables up to 200 Mbps communication and a low cost path across an isolation barrier

Typical FPGA/CPLD functions are addressed by multiple F2838x capabilities. The Configurable Logic Block (CLB) allows for:

- · Creation of absolute encoder interfaces,
- Specialized pulse train logic
- · Customized timers, serial interfaces and inverter protection schemes.

Fast Current Loop (FCL) technology can process the critical servo drive field oriented control loop in less than 500ns. Also included are Sigma Delta Filter modules that allow interface to popular isolated Delta Sigma converters, more class-leading high-resolution PWMs (up to 32 ePWM channels) and a premium comparator sub-system for inverter protection and flexible timer synchronization.

High-performance loop control is made possible by:

- Class leading C28x[™] DSPs cores enhanced with the Trigonometric Math Unit (TMU) to accelerate critical arctan, sin and cos functions;
- · New fast integer division hardware for efficient calculations;
- 64-bit floating-point unit for extended precision in servo motion control.

Control Law Accelerators (CLA) are available for added parallel control or signal processing. Four independent 16-bit precision analog to digital converters with post processing hardware are available with a new single-ended mode which doubles available channels. Off-loading of host and communication tasks to the Connectivity Manager frees cycles to dedicate to real-time control.

Once in full production, the F2838x series will be available in six configurations (Figure 2). All of the devices include the connectivity manager and Ethernet as standard. Options include single (1.0-MB flash) or dual (1.5-MB flash) C28x-plus-control law accelerator (CLA) sub-systems, configurable logic block access and EtherCAT

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functionality. The F2838x is available in a 16-mm-by-16-mm 337-ball fine pitch ball grid array package with a -40°C to 125°C junction temperature rating.

F2838x MCU	Connectivity	C28x CPUs/million	Control law	Flash	Ethernet	EtherCAT	Configurable
	manager	instructions per	accelerator	memory			logic block
		second (MIPS)	coprocessors/MIPS				
TMS320F28388D	1/125 MIPS	2 400 MIPS	2/400 MIPS	1.5 MB	Yes	Yes	Yes
TMS320F28388S	1/125 MIPS	1/200 MIPS	1/200 MIPS	1.0 MB	Yes	Yes	Yes
TMS320F28386D	1/125 MIPS	2/400 MIPS	2/400 MIPS	1.5 MB	Yes	-	Yes
TMS320F28386S	1/125 MIPS	1/200 MIPS	1/200 MIPS	1.0 MB	Yes	-	Yes
TMS320F28384D	1/125 MIPS	2/400 MIPS	2/400 MIPS	1.5 MB	Yes	-	-
TMS320F28384S	1/125 MIPS	1/200 MIPS	1/200 MIPS	1.0 MB	Yes	-	-

Figure 2. F2838x Configurations

Additional Resources

- For more information about the CAN FD device driver compatible with the F2838x family of MCUs, please visit Simma Software.
- Check out the TMS320F28388D product folder with data sheet, technical reference manual and samples.
- Explore the latest tools in the TMDSCNCD28388D tool folder.
- Learn more about C2000Ware for C200 MCUs.
- · Download these development kits:
 - DigitalPower software development kit for C2000 MCUs.
 - MotorControl software development kit for C2000 MCUs.
 - C2000 DesignDRIVE development kit for industrial motor control.

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