Product Bulletin

Digital Signal Controllers

for Advanced Sensing and Measurement Applications

Key Features

- High-performance CPU capable of single-cycle 32-bit MAC operations
- PWM generation for system stimulation and control
- Ultra-fast, multi-channel 12-bit ADC to measure system parameters and system response
- Fast interrupt response supporting multiple system-level interrupts
- Capture inputs, QEP inputs and additional GPIO to support system stimulation and measurement

Advanced Sensing

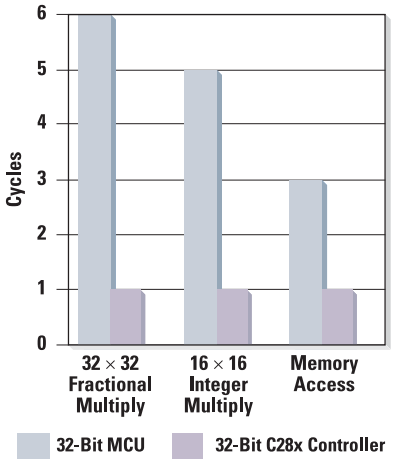
Advanced sensing and measurement applications using Texas Instruments' (TI) TMS320C2000™ digital signal controllers can:

- Monitor system parameters
- Compare the state of the system to the desired state
- Stimulate an output to control the state

TMS320C28x™ Controllers

C28x™ controller generation is a member of the C2000™ controller platform of embedded processors that combine the high-performance math and algorithmic capabilities of a DSP with the peripheral, memory integration and ease-of-use of traditional microcontrollers (MCUs).

32-Bit C28x™ Controller vs. 32-Bit MCU



Advanced Sensing and Measurement Applications Using TMS320C2000™ Digital Signal Controllers

Industrial Measurement	Consumer / Retail
Flow meters	RFID detection and deactivation
Water/Air quality	Bar code scanners
Utilities metering	Touch screen controls
Light and color sensing	Audio feedback control
Capacitive/Piesoresistive sensing	Noise cancellation
Temperature and current control	Musical effects
Medical Instrumentation	**Automotive**
Muscle stimulators	Collision avoidance (radar)
Cytometry: Blood analysis	Valves, spark, throttle
Oxygen sensor	Fuel sensor
Dental radiography	Pressure sensor
	Torque / Inertial sensor
	Knock and noise cancellation

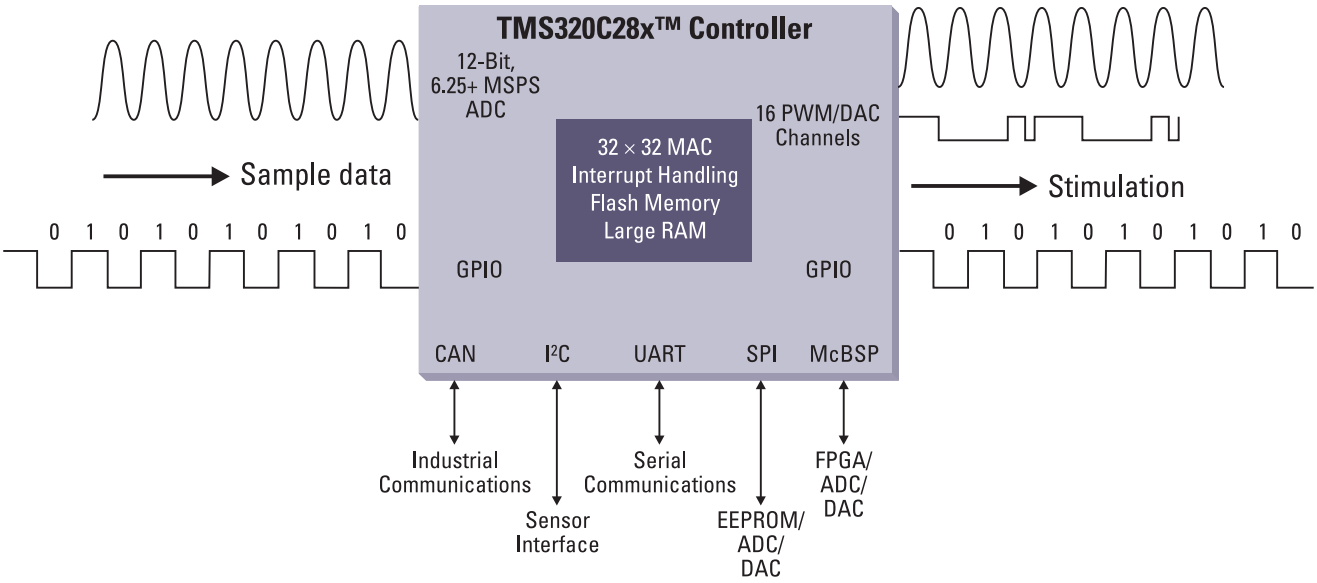
TMS320C28x as a 32-Bit DSP

- Ability to perform math-intensive algorithms that cannot practically be done using an MCU thanks to dedicated single-cycle multiplication hardware, better memory configuration, and a deeper pipeline
- Ability to perform more or better calculations in a single loop
- Math is done faster on C2000 controllers vs. MCU so there are cycles left over for more math or additional functionality
- Reduce quantization, rounding, truncation, overflow and underflow errors due to 32-bit single-cycle accuracy

TMS320C28x as a Controller

The C28x controller was specifically designed to be control friendly like an MCU.

- 13-cycle interrupt response time with auto context save of six 32-bit registers in parallel
- Full context save-restore of 32 cycles (vs. 40 for ARM7TDMI®)
- Dual pre-fetch mechanism to improve the efficiency in control code
- C28x controllers have 80% 16-bit and 20% 32-bit op-code to provide better code density as well as high-quality MIPS
- Most functions will have smaller code size with C28x controllers vs. MCU



Application Example – Flow Metering

Flow metering technologies are coming under increasing pressure to adapt to growing environmental concerns, demands for greater accuracy and reduced maintenance costs. Modern flow metering solutions have adopted ultrasonic techniques using microcontroller (MCU) based systems, but are still hampered by the lack of processing power to provide highly accurate and fast response measurements.

Chronotek has replaced an MCU with a C28x™ controller in their ultrasonic flow sensor to increase calculation rates from three to four per second to 300 per second.

Using the integrated, on-chip 12-bit ADC and high-resolution PWM generator the controller sends and captures ultrasonic signals for processing. The single-cycle multiply/accumulate (MAC) instruction of the C28x controller calculates the differential time-of-flight with a resolution of a few picoseconds. These increased calculation rates reduce errors due to contaminants, unstable flow rates, pulsing flows, and short distance transients.

The high integration offered by the C28x controller allowed Chronotek to reduce the physical size of their meter by 85%.

What customers are saying about the C28x™ controller for sensing and measurement applications:

"The ultrasonic flow meter system is an excellent example of the innovation that can be achieved with the C28x controller. We were able to redesign the ultrasonic flow meter to make it faster, more precise, smaller and less costly. Developers in the sensor and measurement space will be able to pursue innovative products by leveraging the powerful combination of processing performance, integration, small footprint, and low cost of the C28x digital signal controller."

David Tigwell, President, Chronotek

"The F2812 digital signal controller gave us the best combination of price, integration and size as well as the ease of configuration and programming with TI's eXpressDSP™ software and development tools. The F2812 controller allowed us to leverage our automotive-based MEMS rate sensor technology into high-performance aerospace and defense applications and make the MMQ-50 one of the smallest and lowest cost IMUs (Inertial Measurement Units) available on the market today."

Mark Chamberlain, Director of Marketing and Sales, Systron Donner

TMS320C28x™ Controller Generation

Device[§]	MIPS	Boot ROM	RAM	Flash/ ROM	Timers	CAP/ QEP	# PWM Channels	# HiRes PWM	12-Bit A/D Chs/ Conversion Time (ns)	EMIF	WD Timer	Comm Ports: Other	SPI	SCI	CAN	I/O Pins	Core Voltage (V)	Packaging	1 KU ($U.S.)[+]
Flash Devices																			
TMS320**F2801**-PZA/S/Q[§]	100	8 KB	12 KB	32 KB	9	2/1	6 + 2	3	16 ch/160	–	Y	I²C	2	1	1	32	1.8	100 LQFP	5.79[†]
TMS320**F2801**-GGMA/S/Q[§]	100	8 KB	12 KB	32 KB	9	2/1	6 + 2	3	16 ch/160	–	Y	I²C	2	1	1	32	1.8	100 BGA	5.79[†]
TMS320**F2806**-PZA/S/Q[§]	100	8 KB	20 KB	64 KB	15	4/2	12 + 4	4	16 ch/160	–	Y	I²C	4	2	1	32	1.8	100 LQFP	8.69[†]
TMS320**F2806**-GGMA/S/Q[§]	100	8 KB	20 KB	64 KB	15	4/2	12 + 4	4	16 ch/160	–	Y	I²C	4	2	1	32	1.8	100 BGA	8.69[†]
TMS320**F2808**-PZA/S/Q[§]	100	8 KB	36 KB	128 KB	15	4/2	12 + 4	4	16 ch/160	–	Y	I²C	4	2	2	32	1.8	100 LQFP	11.52[†]
TMS320**F2808**-GGMA/S/Q[§]	100	8 KB	36 KB	128 KB	15	4/2	12 + 4	4	16 ch/160	–	Y	I²C	4	2	2	32	1.8	100 BGA	11.52[†]
TMS320**F2810**-PBKA/S/Q[§]	150	8 KB	36 KB	128 KB	7	6/2	16	–	16 ch/80	–	Y	McBSP	1	2	1	56	1.9	128 LQFP	13.81
TMS320**F2811**-PBKA/S/Q[§]	150	8 KB	36 KB	256 KB	7	6/2	16	–	16 ch/80	–	Y	McBSP	1	2	1	56	1.9	128 LQFP	14.73
TMS320**F2812**-GHHA/S/Q[§]	150	8 KB	36 KB	256 KB	7	6/2	16	–	16 ch/80	Y	Y	McBSP	1	2	1	56	1.9	179 BGA	15.65
TMS320**F2812**-PGFA/S/Q[§]	150	8 KB	36 KB	256 KB	7	6/2	16	–	16 ch/80	Y	Y	McBSP	1	2	1	56	1.9	176 LQFP	15.65
RAM-Only Devices																			
TMS320**R2811**-PBKA/Q[§]	150	8 KB	40 KB	–	7	6/2	16	–	16 ch/80	–	Y	McBSP	1	2	1	56	1.9	128 LQFP	9.11
TMS320**R2812**-GHHA/Q[§]	150	8 KB	40 KB	–	7	6/2	16	–	16 ch/80	Y	Y	McBSP	1	2	1	56	1.9	179 BGA	10.63
TMS320**R2812**-PGFA/Q[§]	150	8 KB	40 KB	–	7	6/2	16	–	16 ch/80	Y	Y	McBSP	1	2	1	56	1.9	176 LQFP	10.63
ROM Devices																			
TMS320**C2810**-PBKA/Q[§]	150	8 KB	36 KB	128 KB	7	6/2	16	–	16 ch/80	–	Y	McBSP	1	2	1	56	1.9	128 LQFP	7.05[✦]
TMS320**C2811**-PBKA/Q[§]	150	8 KB	36 KB	256 KB	7	6/2	16	–	16 ch/80	–	Y	McBSP	1	2	1	56	1.9	128 LQFP	8.22[✦]
TMS320**C2812**-GHHA/Q[§]	150	8 KB	36 KB	256 KB	7	6/2	16	–	16 ch/80	Y	Y	McBSP	1	2	1	56	1.9	179 BGA	9.59[✦]
TMS320**C2812**-PGFA/Q[§]	150	8 KB	36 KB	256 KB	7	6/2	16	–	16 ch/80	Y	Y	McBSP	1	2	1	56	1.9	176 LQFP	9.59[✦]

[+] Prices are quoted per unit in U.S. dollars at 1 KU quantities. Prices represent year 2005 suggested resale pricing.
[§] A = –40° to 85°C; S = –40 to 125°C (10% adder over A); Q = –40 to 125°C, Q100 qualified (15% adder over S)
All devices are available in PB-Free Green packaging.
[✦] Minimum volumes for C281x devices are 10 KU with NRE of $11,000.
[†] Production scheduled for 3Q05.

TMS320C2000™ DSP Platform Hardware and Software Development Tools

Description	Part #	$U.S.[+]
Development Boards		
F2812 eZdsp Starter Kit	TMDSEZD2812 (U.S. part number)	395
Includes parallel port cable, User's Guide, Code Composer Studio™ (CCStudio) IDE for eZdsp, power supply	TMDSEZD2812-0E (European part number)	
F2812 eZdsp Starter Kit (Socketed)	TMDSEZS2812 (U.S. part number)	495
Includes parallel port cable, User's Guide, CCStudio IDE for eZdsp, power supply	TMDSEZS2812-0E (European part number)	
F2808 eZdsp Starter Kit (Socketed)	TMDXEZS2808 (U.S. part number)	495
Includes USB cable, User's Guide, CCStudio IDE, power supply	TMDXEZS2808-0E (European part number)	
F2812 Development Bundle	TMDSEVP2812 (U.S. part number)	1,995
Includes eZdsp (socketed), CCStudio v 2.2, XDS510PP-Plus	TMDSEVP2812-0E (European part number)	
F2812 Development Bundle	TMDSEVU2812 (U.S. part number)	2,295
Includes eZdsp (socketed), CCStudio v 2.2, XDS510™ USB Emulator	TMDSEVU2812-0E (European part number)	
Software Development Tools		
C2000™ DSP Code Composer Studio Development Tools Bundled with Annual Software Subscription	TMDSCCS2000-1	495
Supports C24x™ and C28x™ DSP products		
C2000 Code Composer Studio Development Tools Annual Software Subscription	TMDSSUB2000	495
Essential Guide to Getting Started with DSP CD-ROM	SPRC119B	Free
Includes C2000™ Code Composer Studio 90-Day Free Evaluation Tools[‡]	**www.dspvillage.ti.com/freetools**	
TMS320C2000 Flash Programming Utilities	**www.ti.com/c2000flashtools**	Free
TMS320C2000 Application Software	**www.ti.com/c2000appsw**	Free
TMS320C2000 Signal Processing Libraries	**www.ti.com/c2000sigproclib**	Free

[+] Prices are quoted in U.S. dollars and represent year 2005 suggested resale pricing.
*[‡] Includes full-featured Code Composer Studio™ Development Tools, code generation tools (C/C++ compiler/assembler/linker), emulator and simulator configurations all limited to 90 days. Alternative Development Tools are available from third parties such as Spectrum Digital (**www.spectrumdigital.com**), Technosoft (**www.technosoft.ch**) and Softronics (**www.softronx.com**).*

F2808 eZdsp™ Starter Kit

The TMS320F2808 eZdsp Starter Kit (part number TMDXEZS2808) is a standalone module that is an excellent platform to develop, demonstrate and run software for the TMS320F2808 controller. The kit, which provides new performance-enhancing features such as an embedded IEEE 1149.1 JTAG controller with USB emulation, can be operated without additional development tools such as an emulator.

$495

Hardware Features

- TMS320F2808 controller @ 100 MHz, socketed
- 18K on-chip zero-wait-state SARAM
- 256K bit I^2C EEPROM
- 20-MHz input clock to TMS320F2808 controller
- Onboard embedded JTAG emulation with USB host connection
- Support for external emulator via standard JTAG header
- Two SCI ports with onboard transceivers, one port pinned out to standard 9-pin DSUB
- Two enhanced CAN ports with onboard transceivers, one port pinned out to standard 9-pin DSUB
- Boot mode selection switches

TMS320F2808 eZdsp Starter Kit

Software Features

- Code Composer Studio™ Integrated Development Environment for eZdsp
- F2808 eZdsp Diagnostics Utility
- Host and target source for Diagnostics, POST and EEPROM programming

Available for purchase at **www.ti-estore.com** or through one of your local TI authorized distributors.

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