C2000™ Piccolo™ TMS320F2806x Microcontroller Series

Texas Instruments

Overview

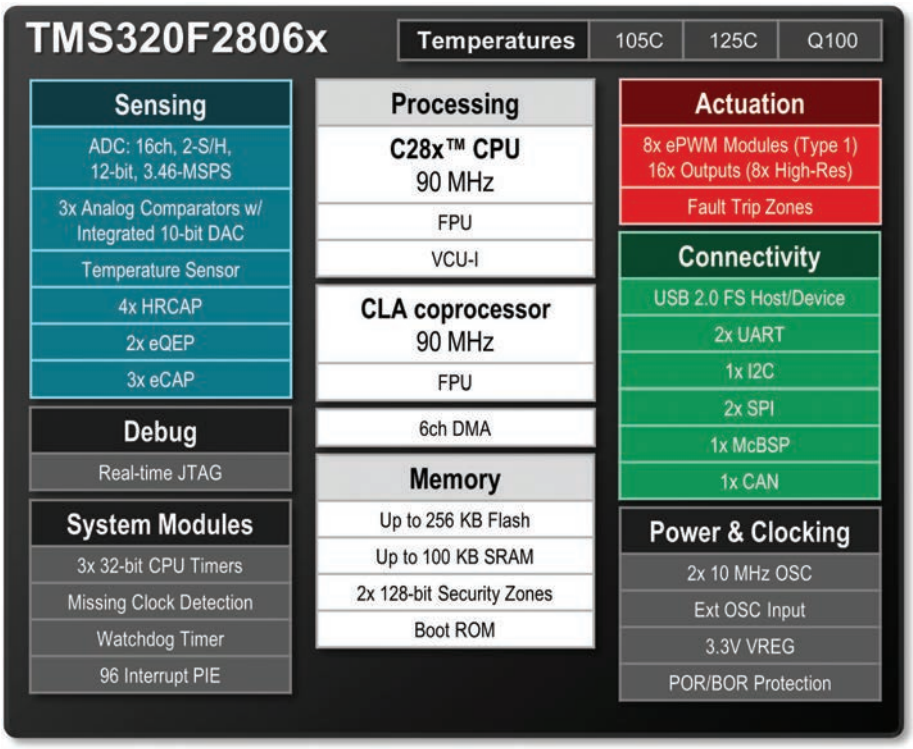
The Piccolo™ TMS320F2806x microcontroller series is a member of the **C2000™ family of real-time microcontrollers**. This microcontroller series features all-around performance for a wide variety of closed-loop control applications, including motor control, solar power, power supplies, appliances, automotive and more.

Get Started with TMS320F2806x MCUs

Learn more about Piccolo ’F2806x MCUs >	View technical documents >	Download software >
Purchase a development kit >	Select a TMS320F2806x MCU >	Compare ’F2806x to other Piccolo MCUs >

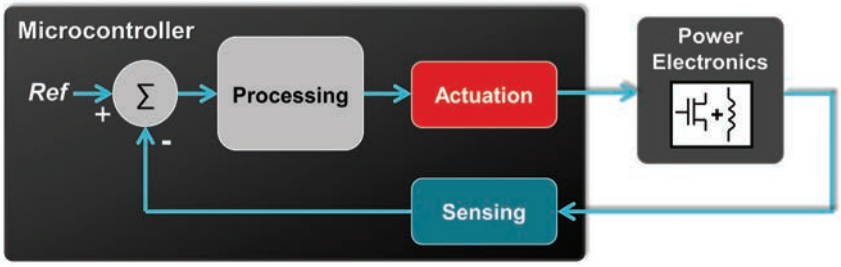
C2000™ Piccolo™ TMS230F2806x Microcontroller Series

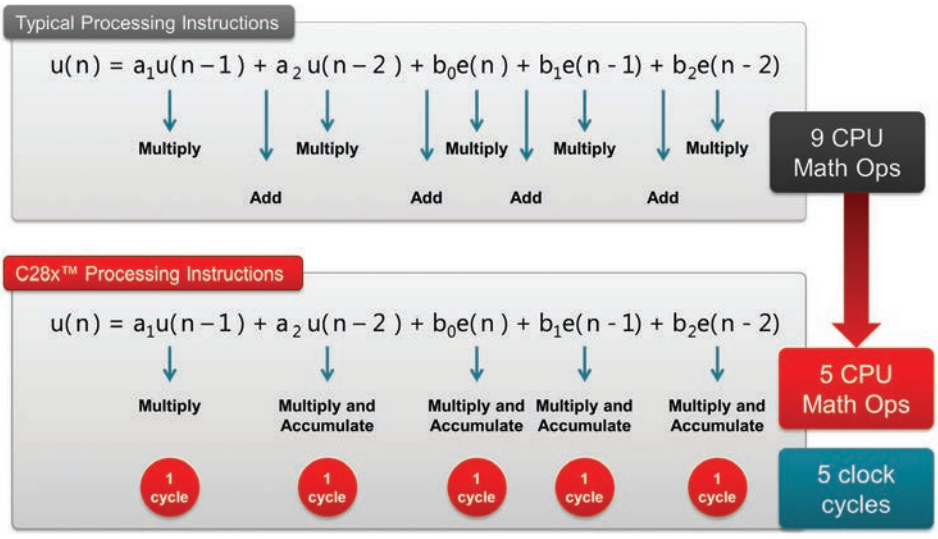
Feature Guide



Built for Closed-Loop Control

C2000™ microcontrollers are built with an optimized architecture for processing, sensing and actuation to increase closed-loop performance in real-time systems.





Powerful C28x™ DSP Processing

Built around the 32-bit C28x™ DSP processing core and CLA co-processor, F2806x MCUs can process up to 180 MIPS with low interrupt response time, including single-cycle execution of common control law operations.

See the **TMS320C28x DSP CPU and Instruction Set User Guide** to learn more.

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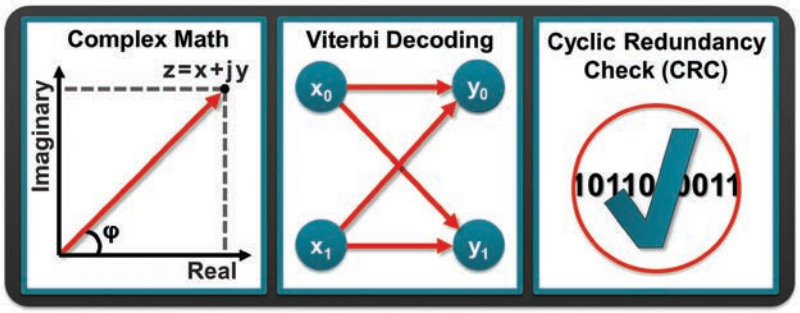
Viterbi, Complex Math and CRC

Accelerate communication and signal processing algorithms with the VCU processing extension to the C28x core. With the VCU, communications and signal processing algorithms can run up to 8× faster. The VCU includes instruction support for complex math, Viterbi and cyclic redundancy check (CRC) operations.



See page 138 of the **TMS320C28x Extended Instruction Set Technical Reference Manual** to learn more.

Floating-Point Support

Ease of floating-point programming with support of IEEE single-precision floating-point operations.

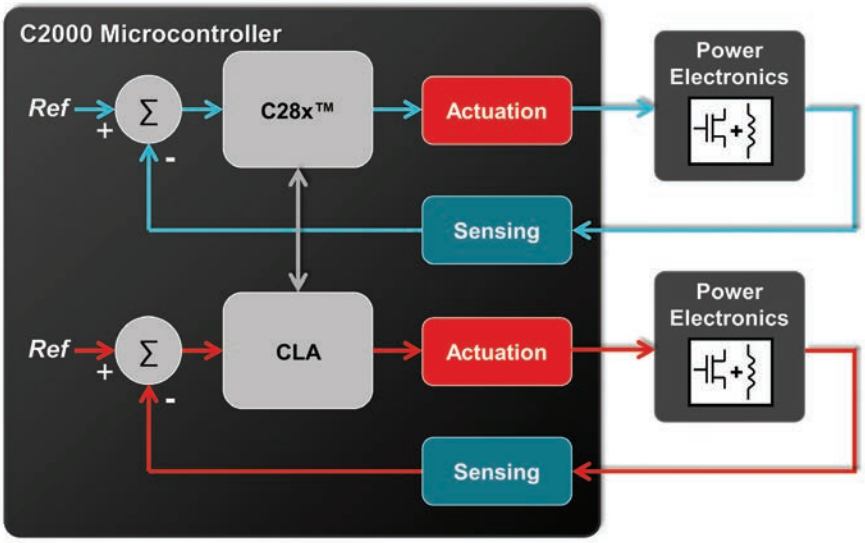
For code compatibility with devices without FPU support, C2000 offers IQMath libraries, providing all the benefits of floating-point programming and code portability on fixed-point devices.

See page 7 of the **TMS320C28x Extended Instruction Set Technical Reference Manual** to learn more.

Parallel Processing with the CLA

Run multiple control loops independently with the power of the 90-MIPS CLA Real-Time coprocessor. The CLA is an optimized floating-point math processor based on the C28x core. With the CLA and C28x processors, multiple control functions can be implemented with a single MCU.

See page 530 of the **TMS320F2806x Technical Reference Manual** to learn more.



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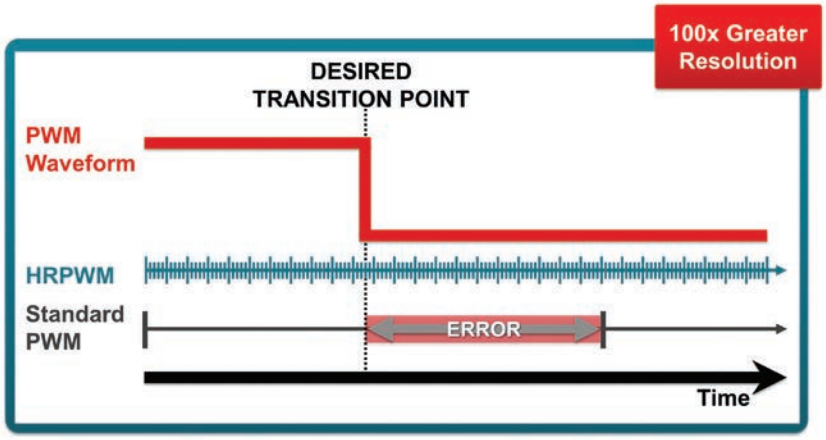


High-Resolution PWM Waveforms

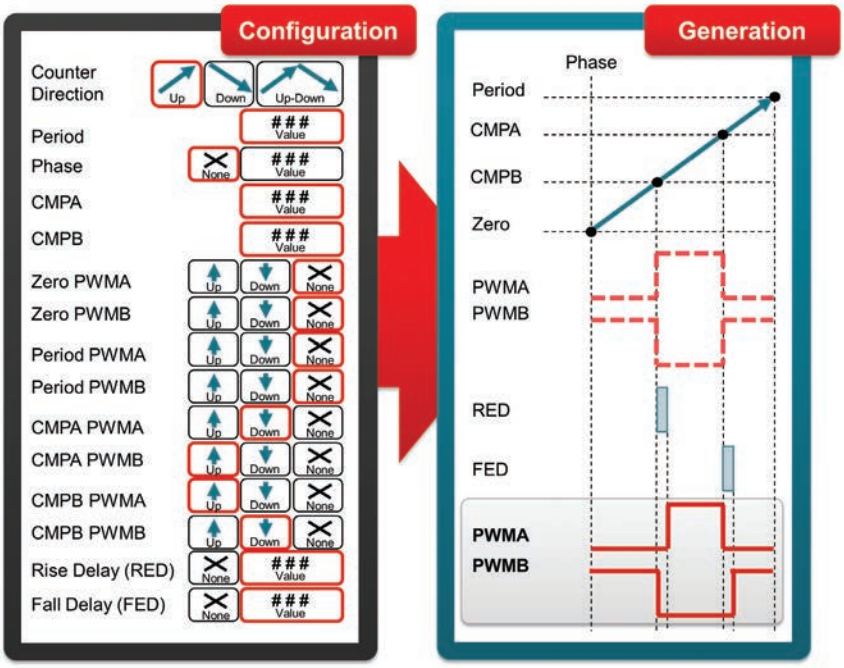
With over 100× greater resolution than a standard PWM generators, high-resolution PWM generation with Micro Edge Positioning (MEP) technology enables higher performing systems. HRPWMs support high timing resolution for duty cycle, period and phase offset settings during PWM generation, providing unparalleled performance for the range of PWM generation and synchronization techniques required in power electronics applications.

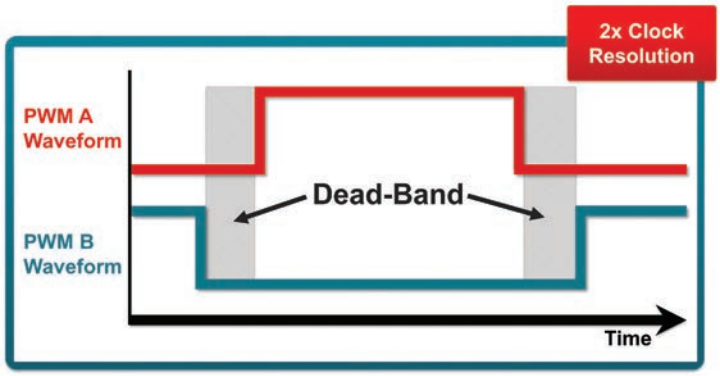
See page 370 of the **TMS320F2806x Technical Reference Manual** to learn more.

Ultra-Configurable PWM Waveforms

A multitude of configuration options enables generation of advanced PWM waveforms. PWM duty cycle can be configured according to zero, period, CMPA and CMPB timer events. Independent rising and falling edge deadband prevents energy losses. Phase relationships between PWM waveforms are supported. From buck converter control to LLC resonant converter control, C2000 PWMs have what it takes.

See page 241 of the **TMS320F2806x Technical Reference Manual** to learn more.





Deadband Protection

Minimize power losses from shoot through currents in FET switches with programmable dead band. TMS320F2806x MCU deadband has precision at double the clock rate of the MCU to further optimize efficiency.

See page 281 of the **TMS320F2806x Technical Reference Manual** to learn more.

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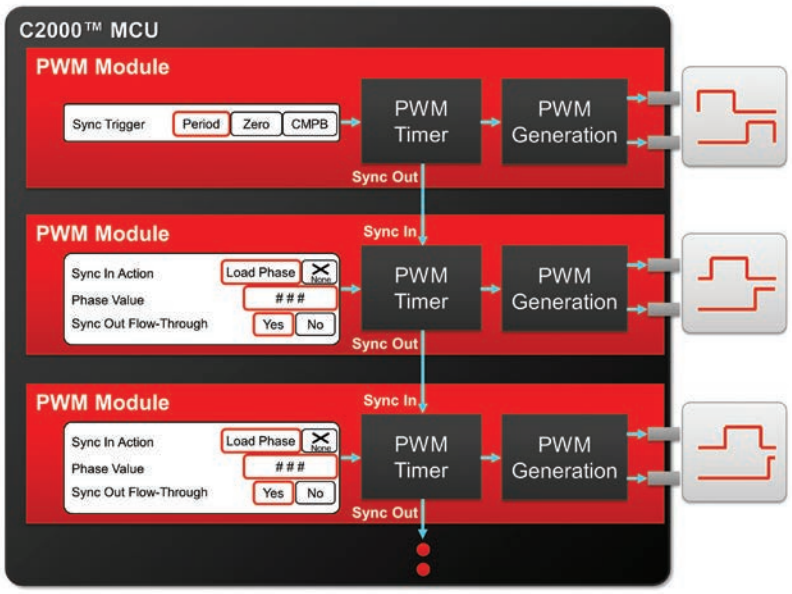
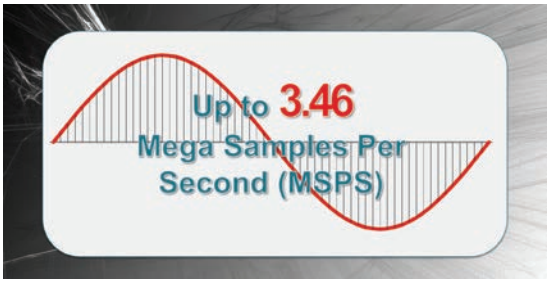
PWM Phase Synchronization

C2000 PWM modules support configurable phase offset and time synchronization between PWMs. This enables control of advanced power stages where phase relationships between PWM waveforms are needed, such as multi-phase DC/DC converters. Likewise, phase-shifted full-bridge and zero-voltage switched full-bridge power converters can be implemented with cycle-by-cycle modification of the phase value.

See page 320 of the **TMS320F2806x Technical Reference Manual** to learn more.





High-Performance ADC Sensing

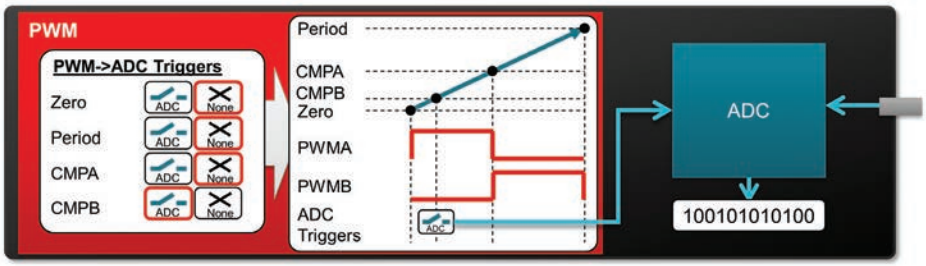
Get higher performance from your system. F2806x ADCs support conversion rates up to 3.46 mega samples per second with dual simultaneous sampling, perfect for motor control and power supply applications.

See page 486 of the **TMS320F2806x Technical Reference Manual** to learn more.

On-Time ADC Triggering

Sensing and actuation that work in harmony. C2000 MCUs support on-time feedback sampling through automated triggering from PWM modules.

See page 487 of the **TMS320F2806x Technical Reference Manual** to learn more.



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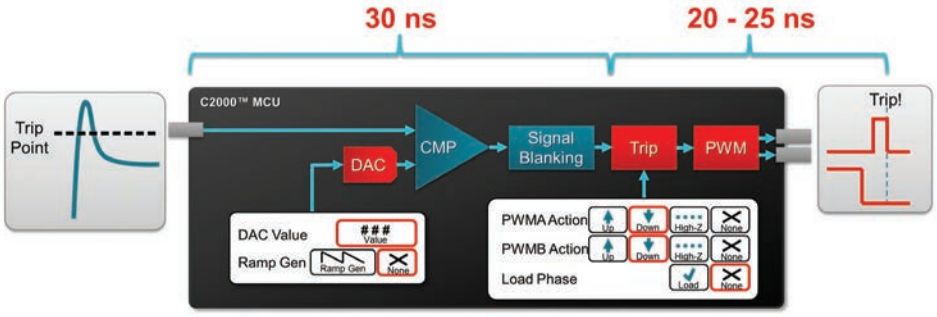
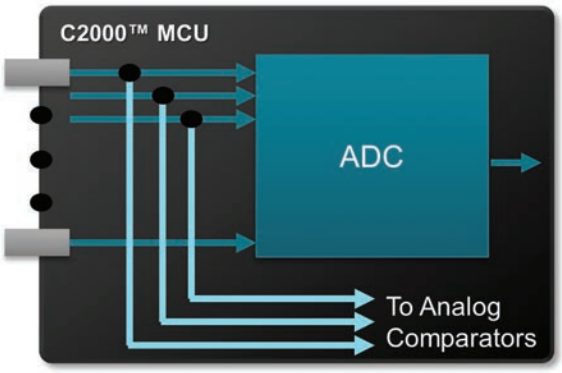
Feature Guide

Robust System Protection and Control

Integrated analog comparators are tied to ADC inputs and provide overcurrent or overvoltage system protection, asynchronously shutting down (i.e., fault trip) PWM outputs in as little as 50 ns. Furthermore, with included ramp generation logic, advanced power stage control—like peak current mode control—can be implemented for power supply applications.



See page 521 of the **TMS320F2806x Technical Reference Manual** to learn more.



Ready-to-Use Analog Comparators

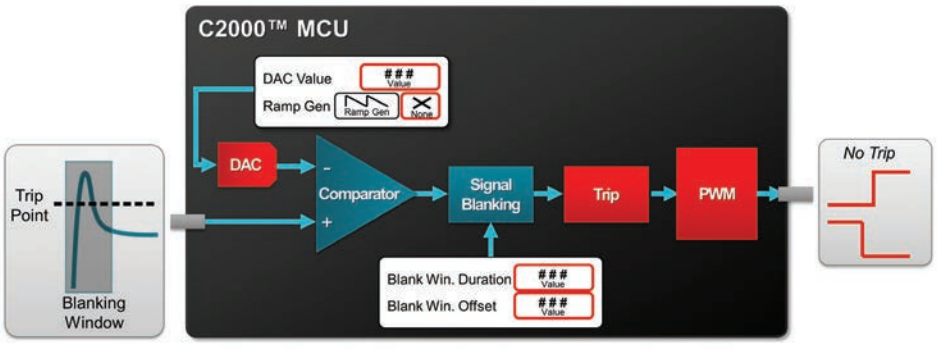
Analog comparators on C2000 MCUs come ready-to-use. The analog comparators are tied internally to the ADC input pins, which means they require no external routing or additional pin utilization. This saves board routing space, frees up MCU pins for other functions, reduces latency and makes it easy for designers to implement system protection.

See pages 84 and 95 of the **TMS320F2806x Data Sheet** to learn more.

Tripping When You Want It

Analog comparators on C2000 MCUs also include blanking window and filtering features, allowing removal of noise and unwanted PWM trip triggering.

See page 303 of the **TMS320F2806x Technical Reference Manual** to learn more.



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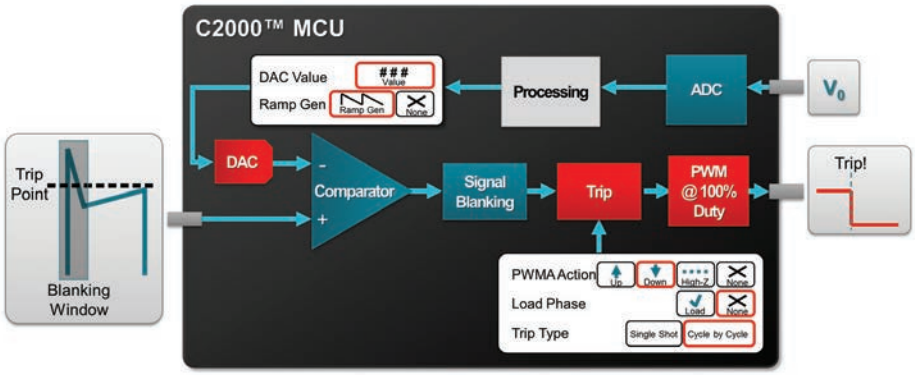
Feature Guide



Peak Current-Mode Control Capable

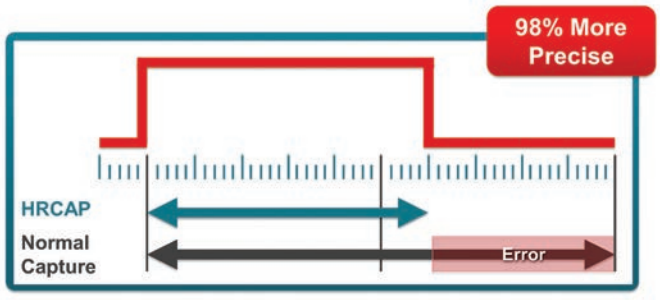
C2000 MCUs bring the benefits of digital control to even the more complex control methodologies like peak current-mode control. Designers can build high-performance digital power supplies controlled by peak current-mode control with slope compensation support.

See page 328 of the **TMS320F2806x Technical Reference Manual** to learn more.

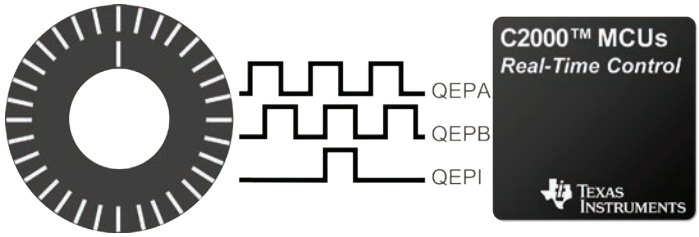
High-Resolution Signal Detection

With high-resolution captures (HRCAP), you can detect input signal edges at a clock resolution of 300 ps versus 16,667 ps for a normal capture interface. This introduces less error into your system when you need to detect high-frequency digital signals from external sensors and other interfaces.

With the HRCAP, systems can achieve greater accuracy of measurements like speed and distance, or realize greater sensitivity for short-pulse applications like capacitive touch.



See page 402 of the **TMS320F2806x Technical Reference Manual** to learn more.



Encoder Motor Feedback

With the Quadrature Encoder Pulse Module (QEP), you can interface with linear or rotary incremental encoders, providing position, direction and speed measurements in motion-control systems. Benefits include flexible interfacing to support a variety of encoders, support for low-speed measurements, and motor stall detection.

See page 451 of the **TMS320F2806x Technical Reference Manual** to learn more.

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USB 2.0 Connectivity

Provide external connectivity to your MCU-based system with industry-standard USB 2.0 connectivity.

See page 1107 of the **TMS320F2806x Technical Reference Manual** to learn more.

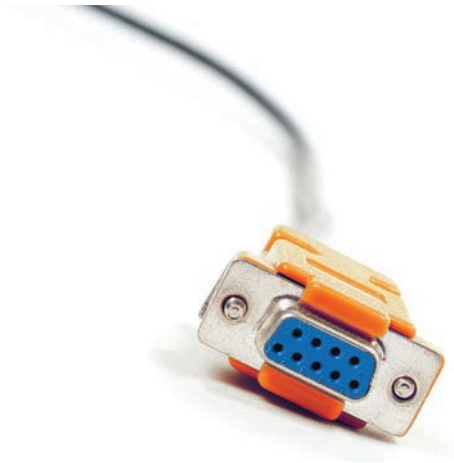
CAN 2.0B Connectivity

TMS320F2806x MCUs include a complete CAN controller compatible with the CAN 2.0B standard. This enables communication with other microcontrollers and logic in automotive applications.

See page 1039 of the **TMS320F2806x Technical Reference Manual** to learn more.

Serial Connectivity

Expand system functionality with robust serial connectivity. The TMS320F2806x series features various serial connectivity options, including SPI, UART, I^2C and McBSP.

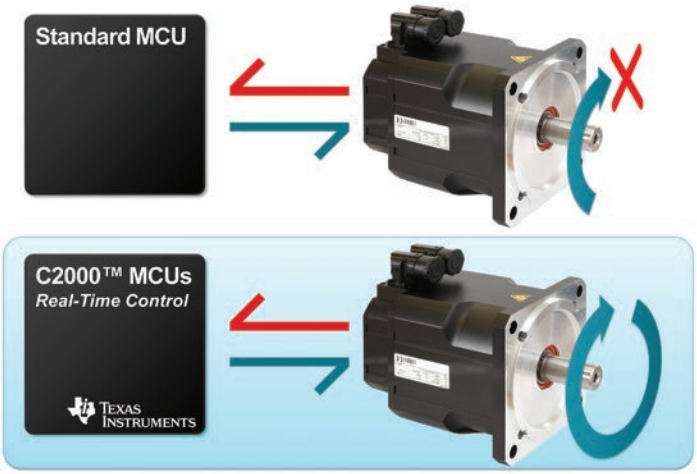


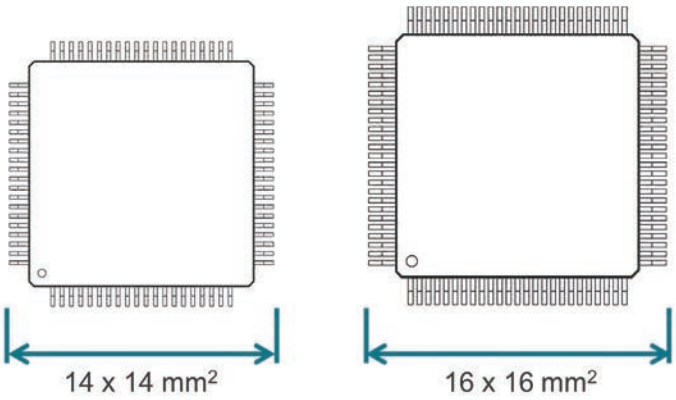
See pages 837, 870, 898 and 927 of the **TMS320F2806x Technical Reference Manual** to learn more.

Real-Time Debugging

C2000™ MCUs feature real-time debugging, enabling designers to debug their systems while keeping them in action. Where traditional MCUs stop all threads or prevent interrupts from being handled, C2000 MCUs allow time-critical interrupts to be serviced while background program execution is suspended. This functionality gives designers real-time, non-intrusive debugging of their system, making it easier to understand and adjust how the system performs.

See page 477 of the **C28x™ CPU and Instruction Set Reference Guide** to learn more.





80- and 100-Pin QFP Packages

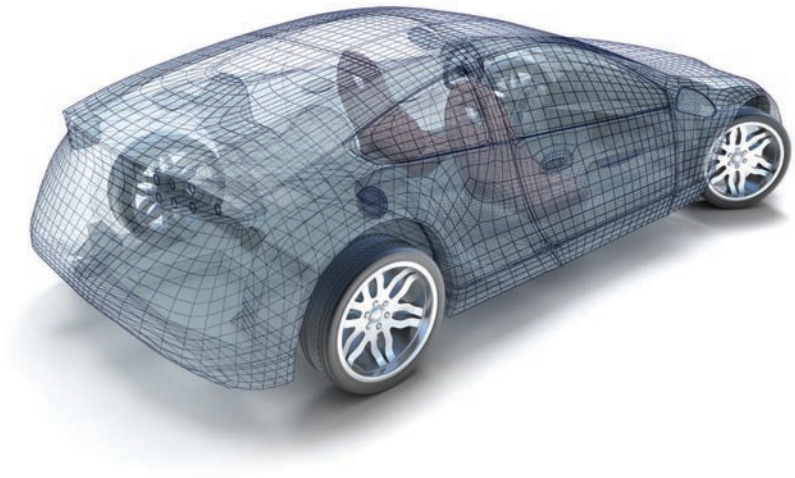
Choose between 80- and 100-pin packages, with package sizes from 14×14 mm^2 to 16×16mm^2.

See page 163 of the **TMS320F2806x Data Sheet** to view all package options.

Extended Temperature Options and AEC-Q100 Automotive Qualification

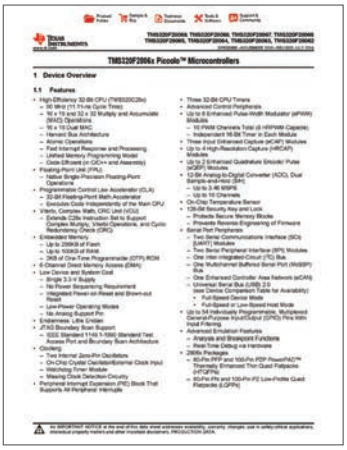
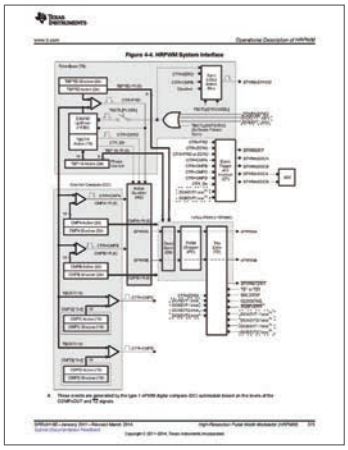
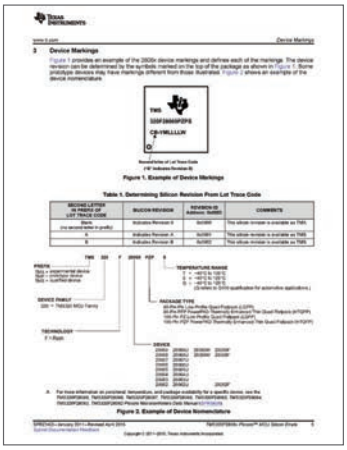
Choose from three operating temperature options:

- –40 to 105°C
- –40 to 125°C
- –40 to 125°C AEC-Q100 qualified



C2000™ Piccolo™ TMS230F2806x Microcontroller Series

TMS320F2806x Technical Documentation and Resources

Product Data Sheet	Technical Reference Manual	Silicon Errata
		
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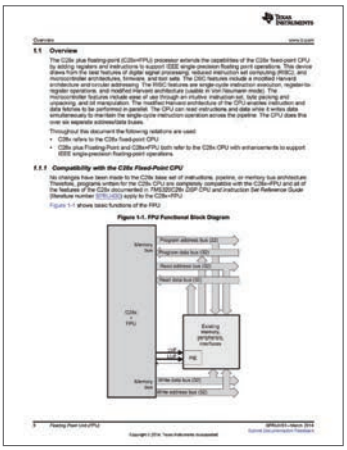
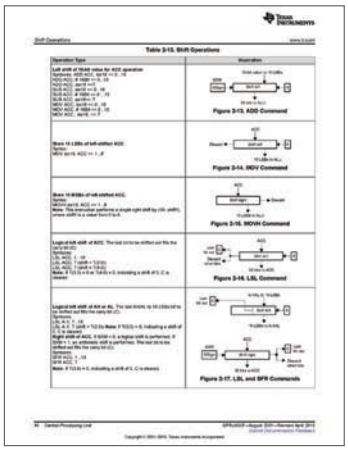
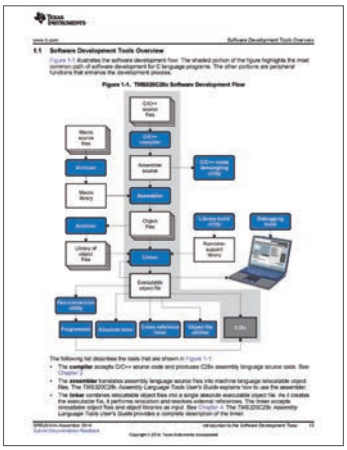
TMS320C28x Extended Instruction Set Technical Reference Manual	**TMS320C28x DSP CPU and Instruction Set**	**TMS320C28x Optimizing C/C++ Compiler**
		
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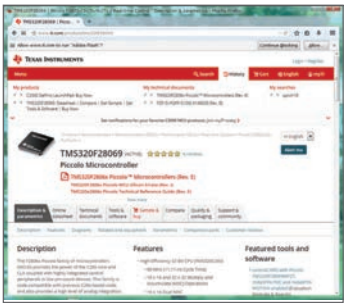
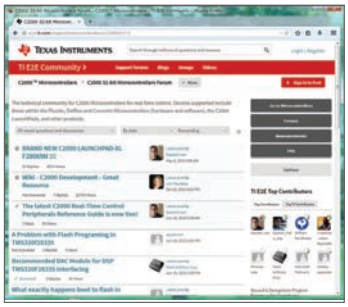
Product Web Page	**E2E™ Support Forums**	**Application Solutions**
		
View	View	View

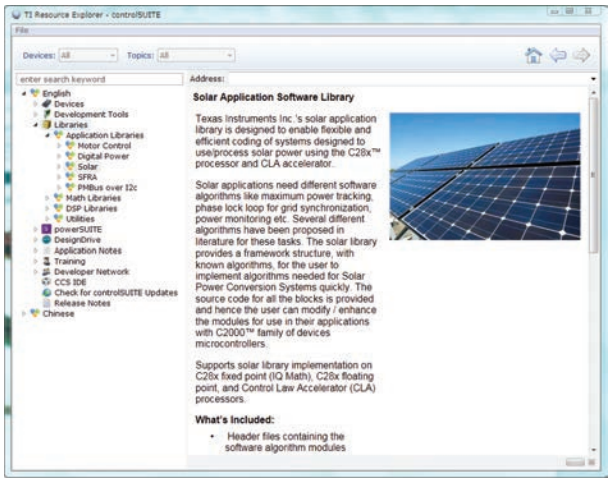
C2000™ Piccolo™ TMS230F2806x Microcontroller Series

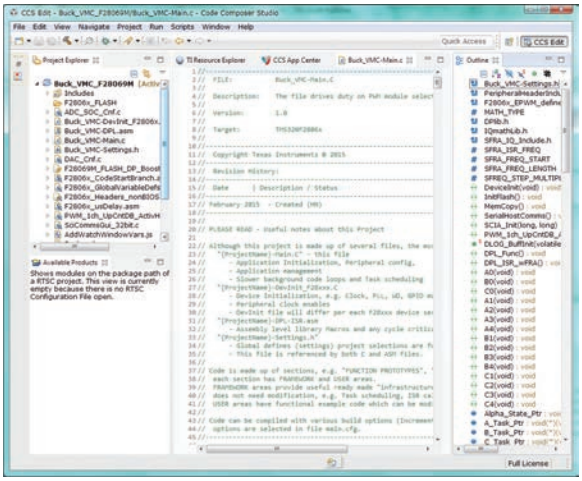
Software and Tools

controlSUITE™ Software

One place for all C2000 microcontroller software. controlSUITE includes: device support libraries, DSP and math libraries, application libraries, example projects, MCU documentation, development kit software and hardware source, technical application guides, training and more.

Learn More





Code Composer Studio™ IDE

Code Composer Studio IDE is an integrated development environment (IDE) that supports TI's Microcontroller and Embedded Processors portfolio. Code Composer Studio IDE comprises a suite of tools used to develop and debug embedded applications. It includes an optimizing C/C++ compiler, source code editor, project build environment, debugger, profiler and many other features.

Learn More

TMS320F2806x Development Kits

F28069M LaunchPad™

The C2000™ Piccolo™ LAUNCHXL-F28069M LaunchPad™, is a complete low-cost development board for the Texas Instruments Piccolo F2806x devices and InstaSPIN™ technology. The LAUNCHXL-F28069M kit features all the hardware and software necessary to develop applications based on the TMS320F2806x microprocessor.

Learn More

F28069 Experimenter's Kit

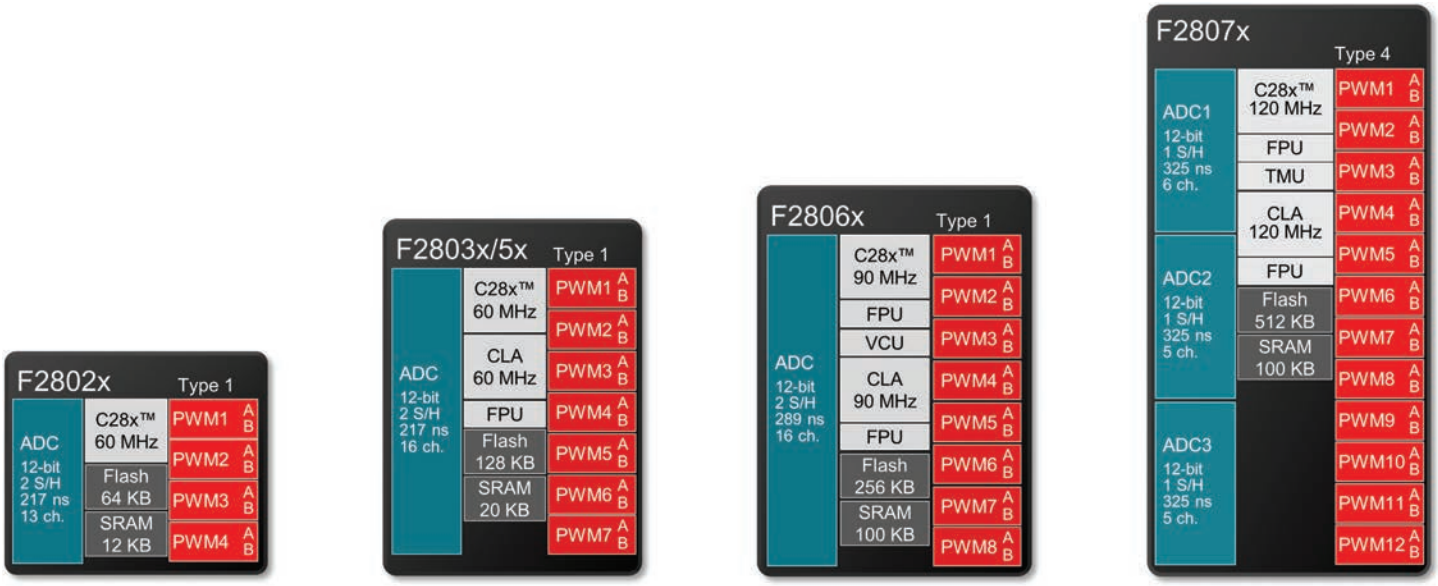
C2000™ MCU Experimenter's Kits provide a robust hardware prototyping platform for real-time, closed-loop control development with C2000 microcontrollers. This platform is a great tool to customize and prove out solutions for many common power electronics applications, including motor control, power supplies, solar inverters, digital LED lighting, precision sensing and more.

Learn More

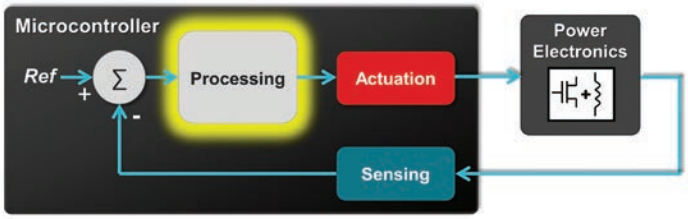
C2000™ Piccolo™ TMS230F2806x Microcontroller Series

Piccolo Family Comparison

Compare TMS320F2806x MCUs to the Rest of the Piccolo Family



Piccolo Family Processing Feature Comparison

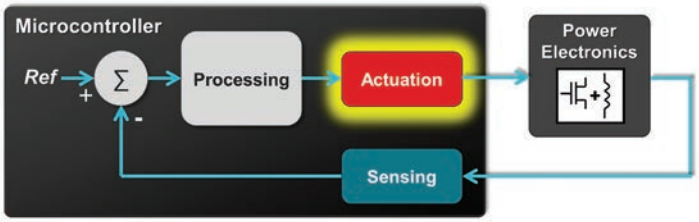


	TMS320F28075	TMS320F28069	TMS320F28055	TMS320F28035	TMS320F28027
Total processing	240 MIPS	180 MIPS	120 MIPS	120 MIPS	60 MIPS
C28x processor	120 MHz	90 MHz	60 MHz	60 MHz	60 MHz
C28x accelerators	FPU TMU	FPU VCU	–	–	–
CLA processor	120 MHz	90 MHz	60 MHz	60 MHz	–
CLA accelerators	FPU	FPU	FPU	FPU	–
DMA	6 ch.	6 ch.	–	–	–
Flash	512 KB	256 KB	128 KB	128 KB	64 KB
SRAM	100 KB	100 KB	20 KB	20 KB	12 KB
Learn more	View Product Web Page	View Product Web Page	View Product Web Page	View Product Web Page	View Product Web Page

C2000™ Piccolo™ TMS230F2806x Microcontroller Series

Piccolo Family Comparison

Piccolo Family Actuation Feature Comparison

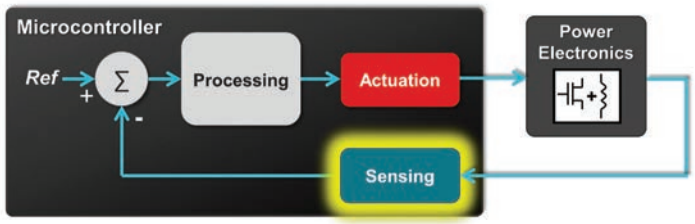


	TMS320F28075	TMS320F28069	TMS320F28055	TMS320F28035	TMS320F28027
PWM ch.	24 ch.	16 ch.	14 ch.	14 ch.	8 ch.
HRPWM ch.	16 ch.	8 ch.	–	7 ch.	4 ch.
HRPWM resolution	150 ps	150 ps	–	150 ps	150 ps
PWM timer comparators	4	2	2	2	2
PWM trip	✔	✔	✔	✔	✔
PWM pin-to-pin trip response	50 ns	50 ns	85 ns	50 ns	50 ns
PWM trip delay	✔	–	–	–	–
PWM deadband	✔	✔	✔	✔	✔
PWM deadband resolution	150 ps	5555 ps	5555 ps	5555 ps	5555 ps
PWM phase synchronization	✔	✔	✔	✔	✔
DAC outputs	1	–	–	–	–
DAC resolution	12-bit	–	–	–	–
Learn more	View Product Web Page	View Product Web Page	View Product Web Page	View Product Web Page	View Product Web Page

C2000™ Piccolo™ TMS230F2806x Microcontroller Series

Piccolo Family Comparison

Piccolo Family Sensing Feature Comparison

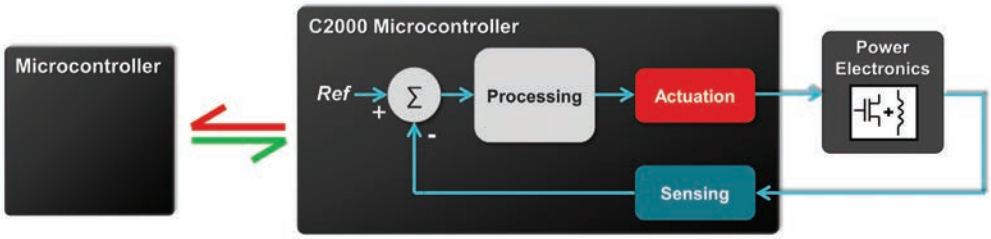


	TMS320F28075	TMS320F28069	TMS320F28055	TMS320F28035	TMS320F28027
# of ADCs	3	1	1	1	1
ADC ch.	17 ch.	16 ch.	16 ch.	16 ch.	13 ch.
ADC resolution	12-bit	12-bit	12-bit	12-bit	12-bit
Simultaneous samples	3	2	2	2	2
Conversion rate per ADC	3.1 MSPS	3.46 MSPS	3.75 MSPS	4.6 MSPS	4.6 MSPS
Cumulative ADC MSPS	9.3 MSPS	3.46 MSPS	3.75 MSPS	4.6 MSPS	4.6 MSPS
Analog comparator modules	8	3	7	3	2
Analog comparator module type	Window	Standard	Window	Standard	Standard
Analog comparator DAC references	12-bit	10-bit	6-bit	10-bit	10-bit
Analog comparator DAC ramp generator	✔	✔	–	✔	✔
Analog comparator signal blanking	✔	✔	✔	✔	✔
Programmable gain amplifiers (PGAs)	–	–	4	–	–
Sigma-delta filter modules	8	–	–	–	–
Signal capture ch.	6	3	1	1	1
HRCAP ch.	–	4	–	2	–
HRCAP resolution	–	300 ps	–	300 ps	–
QEP ch.	3	2	1	1	–
Learn more	View Product Web Page	View Product Web Page	View Product Web Page	View Product Web Page	View Product Web Page

C2000™ Piccolo™ TMS230F2806x Microcontroller Series

Piccolo Family Comparison

Piccolo Family Connectivity Feature Comparison



	TMS320F28075	TMS320F28069	TMS320F28055	TMS320F28035	TMS320F28027
	TMS320F28075	**TMS320F28069**	**TMS320F28055**	**TMS320F28035**	**TMS320F28027**
I^2C	2	1	1	1	1
UART	3	2	3	1	1
SPI	4	2	1	2	1
USB	1	1	–	–	–
CAN	2	1	1	1	–
LIN	–	–	–	1	–
McBSP	2	1	–	1	–
External Memory interface (EMIF)	1	–	–	–	–
GPIO	97	54	42	45	22
Learn more	View Product Web Page	View Product Web Page	View Product Web Page	View Product Web Page	View Product Web Page

See All That the C2000 Family Has to Offer!

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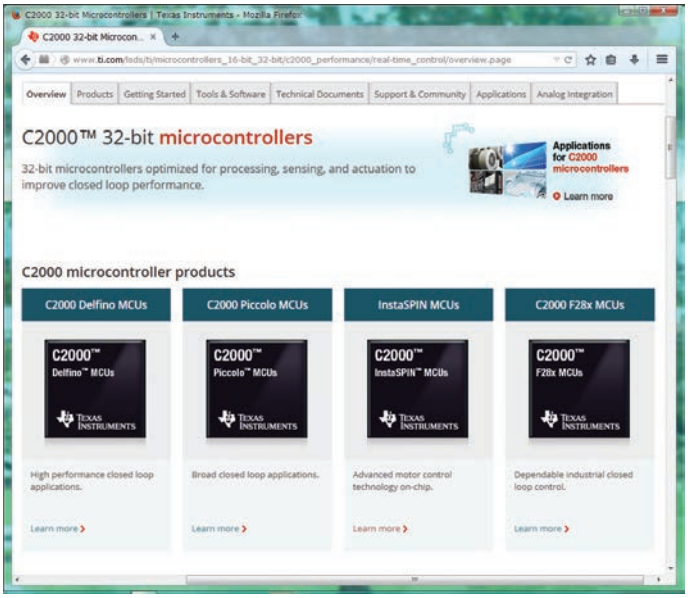

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International +86-21-23073444
Fax +86-21-23073686
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A021014

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