Texas Instruments 2010 revenue by segment

Total Revenue: $13.97B

- **Analog** $5.98B
  - High-Performance Analog
  - Power Management
  - High-Volume Analog & Logic

- **Wireless** $2.98B
  - Basebands
  - OMAP™ Processors
  - Connectivity

- **Embedded Processing** $2.07B
  - DSPs & Microcontrollers
  - Communications Infrastructure
  - Automotive

- **Other** $2.94B
  - DLP® Products
  - Calculators
  - Custom ASIC
  - Royalties
C2000 Strategy: Remains EE Focused

Renewable Energy
- Solar Power Inverters
- Wind Power Inverters

Digital Power
- Uninterruptable Power Supplies
- AC/DC Rectifiers
- Telecom / Server
- DC/DC Converters
- Hybrid Electric Vehicles
- Electric Power Steering
- Radar / Collision Avoidance

Motor Control
- White Goods
- Industrial Drives & Motion Control
- Pumps
- Auto HID
- LED Street Lighting
- Smart Metering
- Power Line Communication

Lighting
- LED TV Backlighting

Automotive
- E-bike

Smart Grid & PLC
- RF Communication
Building Upon These 3 Brands

**Piccolo™ MCUs**
- F2806x
- F2803x
- F2802x

**Performance:**
- 40-80MHz 28x CPU
- Floating Point Unit (optional)
- CLA Co-Processor (optional)
- VCU Accelerator (optional)

**Memory:**
- 16kB-128kB Flash
- 6kB-100kB SRAM

**Key Peripherals:**
- ADC, PWM, QEP, DMA, SPI, UART, I2C, CAN, USB

**Package:**
- 38 TSSOP, 48 QFP, 56 QFN, 64 QFP, 80 QFP, 100 QFP

**Delfino™ MCUs**
- C2834x
- F2833x

**Performance:**
- 100-300MHz 28x CPU
- Floating Point Unit

**Memory:**
- Up to 512kB Flash
- Up to 516 kB SRAM

**Key Peripherals:**
- ADC, PWM, QEP, DMA, SPI, UART, I2C, CAN, EMIF

**Package:**
- 176 QFP, 176 BGA, 179 u*BGA, 256 BGA

**Concerto™ MCUs**
- F28M35x

**Performance:**
- Dual Core
- Up to 150MHz 28x CPU
- Up to 100MHz ARM Cortex M3 CPU

**Floating Point Unit**
- VCU Accelerator

**Memory:**
- 256kB-1MB Flash
- Up to 132kB SRAM

**Key Peripherals:**
- ADC, PWM, QEP, DMA, EMIF, SPI, UART, I2C, CAN, USB, EMAC

**Package:**
- 144 QFP

150+ Devices, Software Compatibility
C2000 has a history of innovation

Innovation for Power Electronics Applications

1995
Motor Control Applications
Realize the Need of DSPs

F24x
16-bit DSP

1997
First Dedicated Device Aimed at Motor Control
20 MHz, 10-bit ADC
3PH PWM

1997
Motor Control Applications
Realize the Need of DSPs

F281x/F280x
32-bit MCU

2000
More Performance
40 MHz, 10-bit ADC, 3PH PWM

2000
More Performance
40 MHz, 10-bit ADC, 3PH PWM

2005
MCU Architecture
Unified Memory
150 MIPS
12.5 MSPS 12-bit ADC
High Res PWM,

2005
MCU Architecture
Unified Memory
150 MIPS
12.5 MSPS 12-bit ADC
High Res PWM,

Delfino™
32-bit FP MCU

2007
Highest Performance
400-600 MFLOPS,
Floating Pt.

2007
Highest Performance
400-600 MFLOPS,
Floating Pt.

2009
Lowest Cost!
Low pin count!
Differentiated Performance w/ CLA
Vreg, BOR, POR, 3.3V,
4.6 MSPS 12-bit ADC

Piccolo™
32-bit MCU

LF240x
16-bit DSP
Connecting seamlessly to controlSUITE!

Motor Control
- 3-phase Brushless Motor Control
- HV Motor & PFC Kit
- Multi-Axis & PFC Kit

Digital Power
- HV AC/DC Bridgeless PFC Kit
- HV AC/DC PFC Kit
- HV DC/DC Phase Shifted Full Bridge Kit
- HV DC/DC Resonant LLC Kit

Energy & Lighting
- Renewable Energy Kit
- DC/DC Multi-string LED Kit
- Multi-DC/DC Multi-string Color LED Kit

And more….

Brushed and Stepper Motor Control
Concerto Family
28x + ARM Cortex M3
Concerto™ MCUs eliminate compromise

**Standard MCU Challenge**

- Compromise between ideal host and control capability

**Dedicated MCU Challenge**

- Additional complexity
- Dual developments plus interface challenges / latency

**Concerto Solution**

**No Compromises**

- Real-time Control: F28x w/ Floating-point unit
- Host Subsystem: ARM® Cortex™-M3
Control + Connectivity. No compromise.

Real-Time Control
F28x w/Floating-point unit

Precision Control
- Industry Leading Computational Performance
- New Accelerator HW
- Flexible Precision PWMs
- Lowest latency control loops
- Robust control SW Support
- High Speed Precision Analog
- Fine-tuned Control Architecture

Host
ARM® Cortex™-M3

Ecosystem of Developers
- Operating Systems
- Middleware
- Software Infrastructure

Robust Communication
- Ethernet
- USB
- CAN
- Serial
- Wireless
- Fieldbus Support
No compromise means greener technologies

Industrial drives & automation
- Control: Multiple motors, Torque & speed control, Precision sensing
- Host: OS / RTOS, Communication Bridge, Motion Profile, System management

Solar
- Control: Max power point tracking, DC/DC boost, DC/AC conversion
- Host: OS / RTOS, Communication Bridge, Supervisor, System management

Server
- Control: Power conversion, Multiple rails and loads, Driving efficient topologies, Power Protection
- Host: System management, Load balancing, Diagnostics
Concerto Safety Features

**Error detection and correction**
- Up to 1MB of 65nm Flash & 132K RAM with error correction (ECC)
- Parity on CAN and interrupt registers
- Cyclic Redundancy Checking (CRC)
- Comparators for over-current & over-voltage protection

**Redundancy for functions**
- Two cores allow each core to check on the other to ensure accurate execution
- Two ADCs give ability to reliably monitor input measurements
- Two clocks for backup
- Multiple system watch dogs

**Security**
- Lock protection on GPIO and registers
- Memory protection for software IP safeguarding
- Permanently disable JTAG for anti-theft protection
Concerto™ ecosystem: controlSUITE™

28x Real-time while debugging M3

Breakpoints on one can cause break event on the other (cross-triggering)
Piccolo Family
## Piccolo™ – Ever Increasing Differentiation

<table>
<thead>
<tr>
<th>Model</th>
<th>Category</th>
<th>Features</th>
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</thead>
<tbody>
<tr>
<td>F2807x</td>
<td>Enhanced Math</td>
<td>Trigonometric Math Unit, Delta Sigma Modulators</td>
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<tr>
<td></td>
<td>Enhanced Control</td>
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<tr>
<td>F2806x</td>
<td>Floating Point &amp; Communication</td>
<td>Hi-Res PWMs (all channels), More Compare Registers, Advanced Topology Support</td>
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<td></td>
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<tr>
<td>F2804x</td>
<td>Digital Power</td>
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<tr>
<td></td>
<td>Enhancements</td>
<td></td>
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<tr>
<td>F2805x</td>
<td>Motor Control</td>
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<tr>
<td></td>
<td>Enhancements</td>
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<tr>
<td>F2803x</td>
<td>Co-Processor</td>
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<tr>
<td>F2802x</td>
<td>Finer Control</td>
<td>Hi-Res PWMs @ 150-ps, PWM Resolution (select channels), Peak Current Control Mode</td>
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<td></td>
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</tr>
<tr>
<td>F2802x0</td>
<td>Piccolo Entry Line</td>
<td>28x DSP Core + Analog Integration + MCU Peripherals</td>
</tr>
</tbody>
</table>

**Performance, Memory, & Communications**

- 12-bit ADC
- CMP
- High Res PWM
- CLA

**Digital Power Enhancements**

- Hi-Res PWMs (all channels)
- More Compare Registers
- Advanced Topology Support

**Motor Control Enhancements**

- Op-Amps
- Motor IP (Insta-Spin)
- Window Comparators
- Quadrature Encoder

**Co-Processor**

- CLA – Control Law Accelerator
- Adds Performance

**Finer Control**

- Hi-Res PWMs @ 150-ps
- PWM Resolution (select channels)
- Peak Current Control Mode
Development Tools
C2000 Software Tools

**IDEs (compilers & debuggers)**

**Code Composer Studio™**
Eclipse-based Code Composer Studio™
IDE supports all TI embedded processors
  - Unlimited with XDS100 emulator, else 32KB limit

**controlSUITE™**
Comprehensive. Intuitive. Optimized. Real world software for real-time control. This cohesive set of software infrastructure and software tools is designed to minimize software development time. controlSUITE™ provides a centralized portal for all C2000 software, tools, documentation, and support.

**Key Functional Areas**
- Device Support (Bit fields, API Drivers)
- Library Repository (Math Library, DSP Library, Application Libraries, Utilities)
- Development Kit Support (Hardware Packages, Software Examples, Complete System Frameworks, Graphical User Interfaces)
- Debug and Software Tools (IDE, RTOS, Emulation)

**Modules & Libraries**

<table>
<thead>
<tr>
<th>Code Libraries</th>
<th>Math Libraries – IQMath for floating-point</th>
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<tbody>
<tr>
<td></td>
<td>DSP Libraries – Filter and FFT algorithms</td>
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<td></td>
<td>Application Libraries – Digital Motor Control and Digital Power</td>
</tr>
<tr>
<td></td>
<td>Utilities – Flash API and Boot ROM Source Code</td>
</tr>
</tbody>
</table>

**Graphical Development & Code Gen. for C2000**
Configure and debug C2000 applications with TI 3rd parties’ GUI based code generation tools. Generated code from a graphical block diagram can be plugged-in for CCStudio ViSSim www.vissim.com/c2000
Embedded Target www.mathworks.com/products/tic2000

**TI Partners**
The C2000 development ecosystem features many other software tools, including Flash programming interfaces. Visit our partners page to see more:
TI Partners Page

**SW Tools and Development Network**

IDE: Integrated Development Environment

**Modular Code Examples**

controlSUITE™ provides modular software libraries for every design stage

Other resources: Technical Documents & User Guides

www.ti.com/plc
C2000 MCU Developer’s Kits

**controlCARD**
- Unique daughter card which allows quick experimentation with different C2000 MCUs in application development and device evaluation kits. controlCARDs are all pin compatible, allowing easy experimentation with different C2000 MCUs.

**Device Evaluation**
- **Experimenter’s Kits** - Docking station with access to controlCARD pins and prototyping area
- **Peripheral Explorer Kits** - Learning kit providing interaction with majority of C2000 device peripherals
- **USB controlSTICKs** - Quick and simple USB memory stick form factor device evaluation

**Application Development Kits**
- **Digital Power and Solar**
- **Digital Motor Control**
- **Lighting**

C2000 offers a variety of hardware development tools designed to accelerate and simplify the design process by providing real-world application examples.

**Kit Contents:**
- controlCARD + Base Board
- Eclipse-based CCStudio IDE
- Example Software with System Guides
- Power Supply and Cables

**Developer’ s Packages:**
- Schematics (source, .PDF files)
- Bill of materials (BOM)
- Gerber files to freely use or modify
- Pin-out table showing all key signals
- DIMM100 pin/socket mechanical details
- Available for free in controlSUITE™

**controlSUITE™**
- Centralized portal for C2000 device and development kit software, documentation, and support.
Experimenter’s Kits
Device Evaluation

Kits Include

- Docking Station
  - Prototyping Area
  - Access to most controlCARD signals
  - 5V and 3.3V rails
- controlCARD
  - F2808
  - F28335
  - F28027
  - F28035
  - F28069 NEW!
  - C28345
  - C28346
  - F28M35H52C1 NEW!
- Code Composer Studio V4
- Full hardware documentation
- Example projects

External JTAG emulator required

Includes onboard USB JTAG emulation

- F2808 TMDSDOCK2808 - $89
- Delfino F28335 TMDSDOCK28335 - $99
- Piccolo F28027 TMDSDOCK28027 - $79
- Piccolo F28035 TMDSDOCK28035 - $89
- Piccolo F28069 TMDSDOCK28035 - $99
- Delfino C28343 TMDSDOCK28343 - $159
- Delfino DIM168 C28346 TMDSDOCK28346-168 - $189
- Concerto F28M35 TMDSDOCKH52C1 - $139

NEW!
Concerto Development Tools

**H52C1 controlCARD - $99**

Plug-and-play with any existing DIM100 controlCARD-based development kit
- Includes Ethernet, microSD, and microUSB OTG ports
- JTAG emulation on-board via USB
- Orderable part number: TMDXCNCDH52C1

**H52C1 Experimenter Kit - $139**

controlCARD and prototyping area in one kit
- Includes the Concerto DIM100 controlCARD, docking station, and cables
- Orderable part number: TMDXDOCKH52C1
Application Development Kits

Motor Control
- HV Motor & PFC Kit
- Multi-Axis & PFC Kit
- Brushed and Stepper Motor Control
- 3-phase Brushless Motor Control

Digital Power
- HV AC/DC Bridgeless PFC Kit
- HV AC/DC PFC Kit
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