Product Overview

C2000 F280013x Real-Time Microcontrollers

Key Features and Benefits

- **Real-Time Processing**
  - 120-MHz C28x × 32-bit DSP CPU
  - Equivalent to 240-MHz Arm® Cortex®-M7* based device on real-time signal chain performance*
  - Floating Point Unit (FPU) for more precise mathematical calculations
  - Trigonometric Math Unit (TMU) speeds up algorithms key to real-time control systems

- **Memory**
  - Up to 256KB (128KW) of flash memory (ECC) and 36KB of SRAM (ECC, Parity)
  - New enhanced flash technology averages 92% efficiency for effective 110 MHz

- **Actuation**
  - Up to 14-PWM channels with 2-channel high-resolution PWMS enable accurate actuation and improved flexibility

- **Sensing**
  - Two 12-bit ADCs, 4 MSPS, up to 21-channels
  - Four windowed comparators with reference DACs

- **Connectivity**
  - CAN, 3 × UART, SPI, 2 × I2C

- **Clock and System**
  - Crystal oscillator or external clock
  - 10-MHz INTOSC, ±1% with precision resistor

- **Integrated Security and Safety**
  - AES tables, secure boot, JTAG lock, dual-code security module, unique ID, missing clock detection, dual-clock comparator

- **Packaging** $T_A = 125°C$
  - 48 (9 × 9) or 64 (12 × 12) LQFP
  - 32 (5 × 5) or 48 (7 × 7) QFN

The TMS320F280013x series is part of the Entry-Performance line of C2000 real-time microcontroller (MCU) family built for efficient control of power electronics. With an industry leading ultra-low latency (sensing-compute-control) and optimized price the devices offer a no-compromise answer for real-time control of industrial applications.

Key Applications

- Industrial 3-phase motor and digital power control
  - Appliances
  - Motor drives
  - Industrial power
  - Solar

Resources

- TMS320F2800137 Product Folder
- TMS320F2800137 LaunchPad Evaluation Module
- TMS320F2800137 controlCARD Evaluation Module
- HVAC Reference Design
- C2000WARE Software Development Kit
- C2000WARE-MOTORCONTROL-SDK
- C2000WARE-DIGITALPOWER-SDK
  - Performance Benchmark Application Note
  - C2000 Academy Training Workshops
  - SysConfig Graphical Device Configuration
  - Code Composer Studio Free IDE
Addition to the Generation 3 MCU Portfolio

The TMS320F280013x real-time microcontrollers are an extension of the Generation 3 C2000 MCU portfolio. All Generation 3 devices are compatible with C2000WARE software and pin-to-pin compatibility exists between many devices. Figure 1 illustrates the F280013x series in the portfolio and includes a new focus on application tailored series in the Entry-Performance line.

Figure 1. C2000 MCU Portfolio With New F280013x Entry-Performance Line

Pin and Packaging Options

Table 1 details the TMS320F280013x MCU series offers a broad set of memory and package options with industrial temperature range support.

Table 1. F280013x Packaging Options and Key Variant Differences

<table>
<thead>
<tr>
<th>Variants</th>
<th>Flash (KB)</th>
<th>MHz</th>
<th>Differences</th>
<th>Industrial −40°C to 125°C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>32-pin QFN 5 × 5</td>
</tr>
<tr>
<td>F2800137</td>
<td>256</td>
<td>120</td>
<td>14 PWM, CAN</td>
<td>✓</td>
</tr>
<tr>
<td>F2800135</td>
<td>128</td>
<td>120</td>
<td>14 PWM, CAN</td>
<td>✓</td>
</tr>
<tr>
<td>F2800133</td>
<td>64</td>
<td>120</td>
<td>14 PWM, CAN</td>
<td>✓</td>
</tr>
<tr>
<td>F2800132</td>
<td>64</td>
<td>100</td>
<td>6 PWM, no CAN</td>
<td>✓</td>
</tr>
</tbody>
</table>
The C2000 MCU SysConfig offers:

- Full peripheral configuration and application-specific calculators
- Integrated tool support: PinMux, Security (DCSM)
- Dependency detection across modules
- **NEW** One-click setup and initialization of C2000 MCU libraries
- **NEW** Memory configuration support
- **NEW** Board component support for easier migration, faster development
- **NEW** ePWM support
- **NEW** FreeRTOS configuration

**New C2000 Developer Experience**

C2000 MCU Academy offers all your training needs in one place including getting started resources, interactive classes, advanced workshops, and videos.

- **NEW** restructured navigation and new lab content
- **NEW** videos: 5-minute Ecosystem overview, migrating in < 10 m, CCS Getting Started, EPWM overview, and ADC
Comparison of Device Features

The F280013x series enables real-time control capability for industrial applications. Compared to the F28002x series, the F280013x series offers increased performance, flash and RAM memories, additional security features, and new small QFN package options at substantially lower prices. Pin-to-pin compatibility is offered in the QFP packages. Table 2 provides an overview of feature differences between the two.

Table 2. Comparison Between F280013x and F28002x Series

<table>
<thead>
<tr>
<th>Feature</th>
<th>F280013x</th>
<th>F28002x</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIPS</td>
<td>120 MHz maximum</td>
<td>100 MHz maximum</td>
</tr>
<tr>
<td>Flash</td>
<td>256KB (1 bank)</td>
<td>128KB (1 bank)</td>
</tr>
<tr>
<td>RAM</td>
<td>36KB</td>
<td>24KB</td>
</tr>
<tr>
<td>ADC</td>
<td>2 × 12b</td>
<td>2 × 12b</td>
</tr>
<tr>
<td>CMPSS</td>
<td>3 × CMPSS_LITE, 1 × 12b DAC</td>
<td>4 × 12b DAC</td>
</tr>
<tr>
<td>CLB</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>HWBIST</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>PWM</td>
<td>14 × ePWM (2 HRPWM)</td>
<td>14 × ePWM (8 HRPWM)</td>
</tr>
<tr>
<td>QEP, CAP</td>
<td>1 eQEP, 2 eCAP</td>
<td>2 eQEP, 3 eCAP, 1 HRCAP</td>
</tr>
<tr>
<td>Comms</td>
<td>3 UART, 1 SPI, 2 I2C, 1 CAN</td>
<td>3 UART, 2 SPI, 1 I2C, 1 CAN</td>
</tr>
<tr>
<td>Safety level</td>
<td>Functional Safety Quality Managed</td>
<td>Functional Safety Quality Managed</td>
</tr>
<tr>
<td>ERAD</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Security</td>
<td>DCSM, Secure Boot, JTAG Lock, AES Tables</td>
<td>DCSM</td>
</tr>
<tr>
<td>Packages</td>
<td>32</td>
<td>48 QFN; 48</td>
</tr>
<tr>
<td>Starting Price (1 ku)</td>
<td>$0.79</td>
<td>$1.43</td>
</tr>
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