## C2000" F28003x <br> Real-Time Microcontrollers

## - Tin Texas Instruments

## Key features and benefits

- Real-time control performance
- 120-MHz C28x DSP core with 240 MIPS processing capability enables motor control precision and high switching speeds
- Integrated CLA co-processor offloads additional tasks
- 384 KB flash across three flash banks and 69 kB SRAM enables fast control loops
- 16 PWM channels with highresolution PWMs enable precise actuation and increased flexibility
- High number of IOs within a small package reduces system cost
- Integrated analog peripherals
- Three 12-bit ADCs, 4 MSPS with post-processing and threshold actions
- Eight Sigma-Delta demodulation channels
- Eight windowed comparators and two 12-bit output DACs
- Variety of digital peripheral options
- Integrated communications with CAN-FD and SCI instances
- Configurable logic block (CLB) tiles augment existing peripheral capability
- High-speed communication with other TI devices using fast-serial interface (FSI)
- Functional safety-compliant MCUs
- Support up to ASIL B functional safety requirements
o Hardware built-in self-test (HWBIST) enabling permanent fault coverage of $90 \%$ for CPU
- Integrated security
- AES, JTAG Lock and Secure boot

The TMS320F28003x microcontroller (MCU) family enables high-efficiency real-time control while reducing system costs. The F28003x MCUs are the next step in expanding the C2000 ${ }^{\text {TM }}$ real-time MCU portfolio, helping you push the boundaries of real-time control in EV/HEV systems and industrial motor control and digital power applications.


Key applications

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- Industrial
    Telecom & server power
    - Solar energy
    - HVAC motor control
    - Industrial robots
    Servo drives
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- Automotive
- On-board charger
- DC/DC converter
- Traction inverters
- HVAC compressor module
- Engine fan
- Pumps
- e-turbo charger
- Headlight

| Resources: Getting started |
| :--- |
| TMS320F280039C product page |
| C2000WARE |
| C2000WARE-DIGITALPOWER-SDK |
| C2000WARE-MOTORCONTROL-SDK |
| TMS320F280039C controlCARD evaluation module product page |
| Training workshop |

Table 1. Getting started with TMS320F28003x MCUs.

## Growing the Generation 3 MCU portfolio

The TMS320F28003x real-time microcontrollers is an extension of the Generation 3 C2000 real-time MCU portfolio, designed to enable higher performance and more affordable real-time control systems. The Generation 3 product portfolio provides pin-topin compatibility between devices and common software solutions. Figure 1 illustrates how the new F28003x is expanding the family of mid-performance Generation 3 MCUs.


Figure 1. Illustrates how the new F28003x is expanding the family of mid-performance Generation 3 real-time MCUs.

## Pin and packaging options and feature comparison

The TMS320F28003x MCU offers a variety of pin count, memory and packaging options along with integrated communication, functional safety and security features to meet a variety industrial and automotive needs. A comparison of devices is shown in Table 2.


Table 2. F28003x pin packaging options and key features.

## A scalable device platform

The TMS320F28003x MCU family enables the broadest range of real-time control capabilities for industrial and automotive applications. Compared to other Generation 3 devices, it offers increased performance over the F28002x, and a lower web price than the F28004x family. The F28003x is pin compatible with all F28002x and F28004x devices. Table 3 provides an overview of the different features in each device family to help you choose the right device for your application needs.

| Feature | F28004x | F28002x | F28003x |
| :---: | :---: | :---: | :---: |
| CPU (MHz) | 100 | 100 | 120 |
| FPU32 | Yes | Yes + FastDIV | YES + FastDIV |
| TMU32 | Type 0 | Type 1 | Type 1 |
| CLA | Yes | No | Yes |
| DMA | Yes | Yes | Yes |
| CLB | 4 tiles | 2 tiles | 4 tiles |
| Flash (KB) | 256 | 128 | 384 |
| JTAG Lock | No | No | Yes |
| RAM (KB) | 100.5 | 24 | 69 |
| ADC | $3 \times 12$-bit | $2 \times 12$-bit | $3 \times 12$-bit |
| ADC channels (Max) | 21 | 16 | 23 |
| CMPSS | 7 | 4 | 4 |
| CAN (DCAN)-Type 0 | 2 | 1 | 1 |
| CANFD (MCAN)-Type 2 | 0 | 0 | 1 |
| FSI | 1 (1 RX and 1 TX) | 1 (1 RX and 1 TX) | 1 (1 RX and 1 TX) |
| ${ }^{12} \mathrm{C}$ Type 1 | 1 | 2 | 2 |
| LIN Type 1 | 1 | 2 | 2 |
| HIC | 0 | Type $0^{*}$ | Type ${ }^{*}$ |
| SCI | 2 | 1 | 2 |
| eCAP/HRCAP modules | 7 (2 with HRCAP capability) - Type 1* | 3 (1 with HRCAP capability) - Type $2^{*}$ | 3 (1 with HRCAP capability) Type 3* |
| ePWM/HRPWM Type 4 | 16 (16 with HRPWM) | 14 (8 with HRPWM) | 16 (8 with HRPWM) |

*A type represents a major functional feature difference in a peripheral module, please refer to the C2000 Real-Time Control MCU Peripherals Reference Guide for more information.
Table 3. Feature comparison between closest Generation 3 devices.

Table 4 illustrates the migration options for various devices. For more details about migration, download the migration guides for F28002x to F28003x and F28004x to F28003x.

| Pin-to-pin migration | From F28002x to F28003x | From F28003x to F28002x | From F28002x to F28004x | From F28004x to F28002x | From F28003x to F28004x | From F28004x to F28003x | Key |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 48-pin | 3 | 3 | 5 | 5 | 5 | 5 |  |  |
| 64-pin "S" | 1 | 1 | 3 | 3 | 3 | 3 | 2 | $Y(\mathrm{w} /$ minor migration path $)$ |
| 64 -pin " Q " | 2 | 2 | 3 | 3 | 3 | 3 | 3 | $\mathrm{Y}(\mathrm{w} /$ migration path $)$ |
| 80-pin | 3 | 3 | 5 | 5 | 5 | 5 | 4 | N (w/ major migration path) |
| 100-pin | 5 | 5 | 5 | 5 | 4 | 4 | 5 | NA |

Table 4. Migrating between the F28002x, F28003x and F28004x device families.

## A common software ecosystem

F28003x has three main software development packages: C2000Ware, the Digital Power Software Development Kit and the Motor Control Software Development Kit. C2000Ware includes peripherals, coding examples, drivers and libraries (Math, DSP and Control). The software development kits include firmware that can be run in various evaluation modules and reference designs that represent specific system use cases. All software is shared across high-, mid- and entry-performance C2000 MCUs. Learn more about the C2000 real-time MCU portfolio and supported software in the C2000 Software Guide.

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