TM4C Microcontrollers

Texas Instruments

www.ti.com/tm4c

2014

TM4C123x Microcontrollers

Introduction

The **TM4C123x MCUs** provide a broad portfolio of connected Cortex®-M4 microcontrollers. Designers who migrate to the TM4C123x MCUs benefit from a balance between the floating-point performance needed to create highly responsive mixed-signal applications and the low-power architecture required to enable increasingly aggressive power budgets. TM4C123x MCUs are supported by TivaWare™ for C Series software, designed specifically for those customers who want to get started easily, write production-ready code quickly, and minimize their overall cost of software ownership.

Key highlights

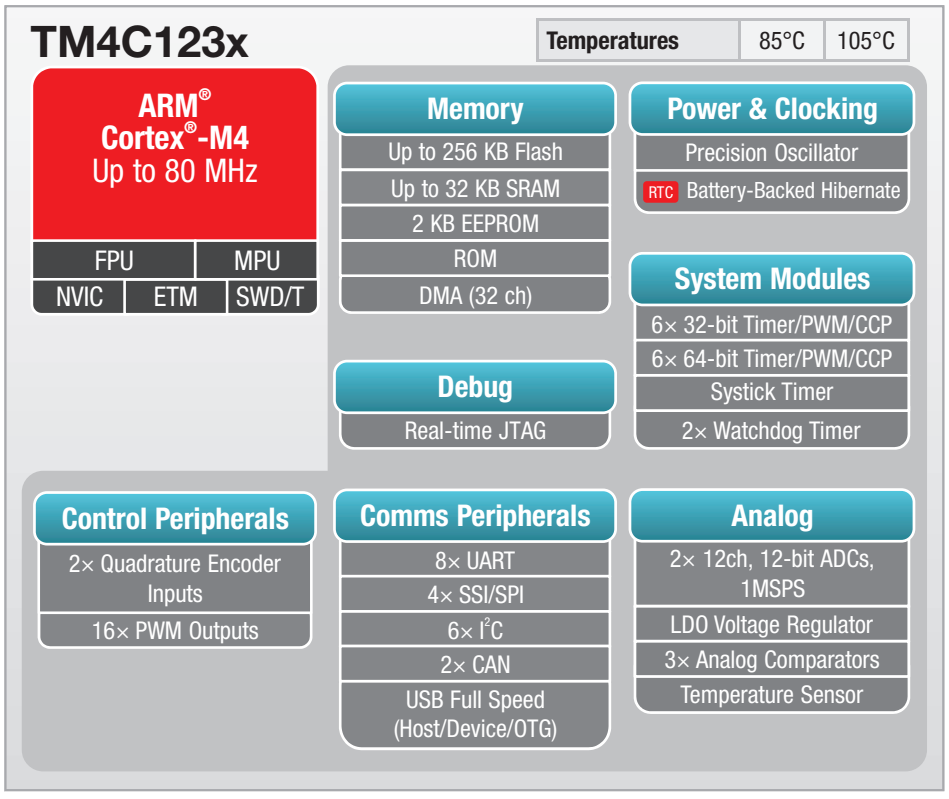
- ARM Cortex-M4 core with floating point
- CPU speed up to 80 MHz
- Up to 256-KB Flash
- Up to 32-KB single-cycle SRAM and 2-KB EEPROM
- Two high-speed 12-bit ADCs up to 1 MSPS
- Up to two CAN 2.0 A/B controllers
- Optional full-speed USB 2.0 OTG/Host/Device
- Up to 40 PWM outputs
- Serial communication with up to:
  - 8 UARTs, 6 I^2Cs, 4 SPI/SSI
- Intelligent low-power design power consumption as low as 1.6 µA

Benefits

- 12-bit ADC accuracy achievable at the full 1 MSPS rating without any hardware averaging, eliminating performance tradeoffs
- First ARM Cortex-M MCU in advanced 65-nm process technology provides the right balance between higher performance and low power consumption
- ARM Cortex-M4 with floating point accelerates math-intensive operations and simplifies digital signal processing implementations
- Range of pin-compatible memory and package configurations enables optimal selection of devices

Applications

- Connectivity
- Sensor aggregation
- Security and access control
- Home and building automation
- Industrial automation
- Human machine interface
- Lighting control
- Energy
- Data acquisition
- System management



TM4C129x Microcontrollers

Introduction

The **TM4C129x** product line will allow designers to develop a new class of highly connected products using the first ARM® Cortex®-M4 MCU with integrated Ethernet MAC+PHY, along with on-chip communication peripherals. Engineers will have the ability to enhance product features and communicate to industrial and HMI applications with integrated data protection, robust memory and LCD controller. They can further control and differentiate products with TivaWare™, including 50+ software application examples, along with TI's strong development ecosystem.

Key highlights

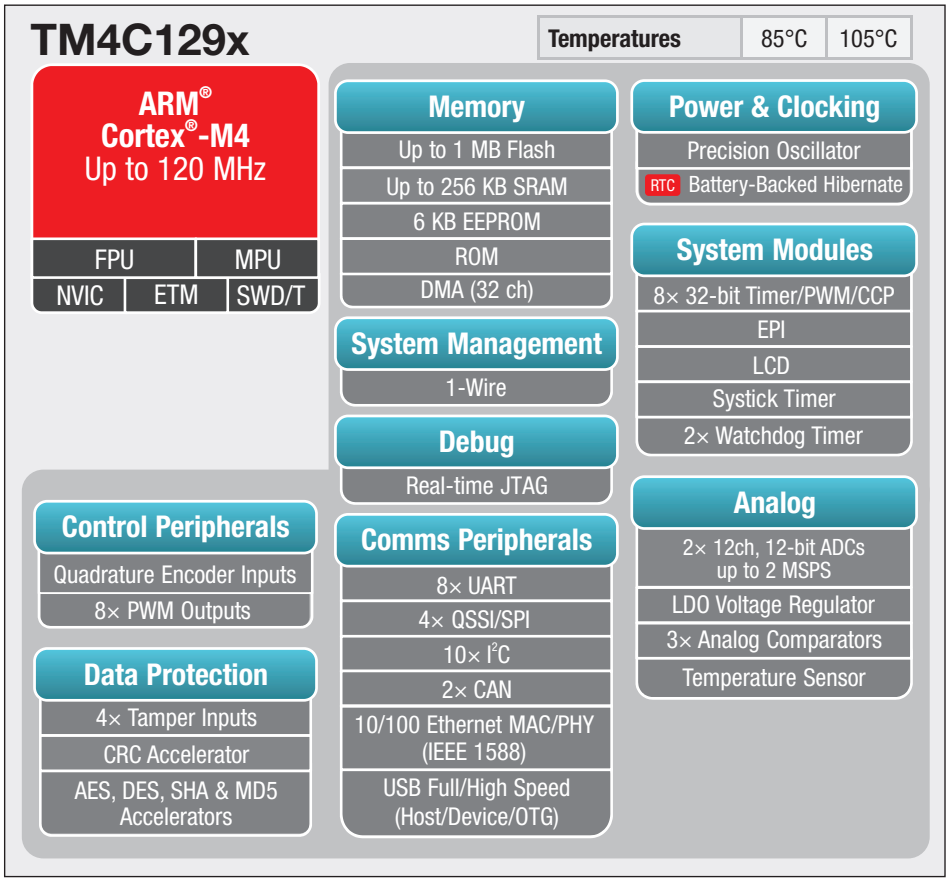
- ARM Cortex-M4 core with floating point
- CPU speed up to 120 MHz
- Up to 1-MB Flash
- 256-KB SRAM and 6-KB EEPROM
- 10/100 Ethernet with embedded MAC and PHY
- LCD controller
- AES, DES, SHA/MD5 and CRC hardware acceleration
- Four tamper inputs
- Two 12-bit ADCs up to 2 MSPS
- Two CAN 2.0 A/B controllers
- Full-speed USB 2.0 OTG/Host/Device and high-speed USB ULPI interface
- Serial communication with up to:
  - 8 UARTs, 10 I^2Cs, 4 QSPI/SSI, 1-Wire master interface

Benefits

- Connect to and communicate with products and services with 10/100 Ethernet MAC+PHY with advanced line diagnostics. Integrated CAN and USB provide high-speed connectivity, allowing the creation of seamless gateway solutions.
- Control outputs and manage multiple events with 10 I^2C ports, dual 12-bit ADCs, three on-chip comparators, and the external peripheral interface
- Address varying application memory needs with pin-for-pin compatibility across the TM4C129x portfolio. With 256 KB of integrated SRAM and 6-KB EEPROM along with a scalable 512 KB to 1 MB Flash memory with 100,000 program cycle endurance for extended in-field updates and reliable operation.
- Save board space and design smaller products with integrated Ethernet MAC+PHY, USB and LCD controller.
- Add data protection to applications and reduce processing overhead with the hardware acceleration of key encryption/decryption

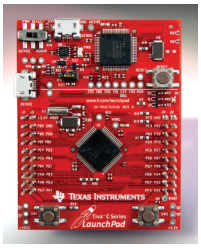
Applications

- Solar inverters
- Industrial sensors
- Industrial automation
- Security access systems
- Industrial motor control
- Communications adapters/concentrators
- Networked industrial meters/controllers
- Industrial HMI control panels/displays
- Networked residential/SoHo systems
- Vending machines



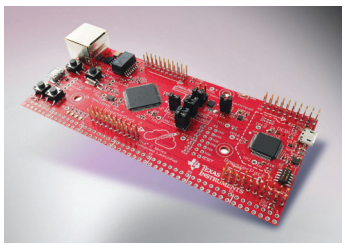
TM4C Kits

Evaluation kits



EK-TM4C123GXL LaunchPad is the perfect kit to get started with a TM4C microcontroller (MCU) at just $12.99.

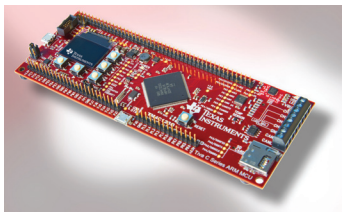
EK-TM4C1294XL Connected LaunchPad is the industry's lowest-priced Cortex®-M4 evaluation kit with one-of-a-kind out-of-the-box connectivity options, starting at $19.99.



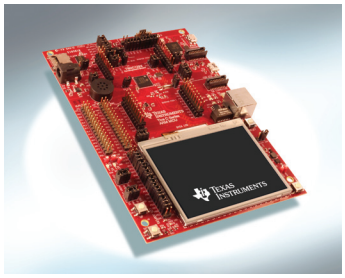
www.ti.com/launchpad

Development kits

TM4C123G Development Kit is a compact and versatile evaluation platform for the TM4C123G ARM® Cortex-M4-based microcontroller (MCU). The development kit design highlights the TM4C123G MCU integrated USB 2.0 On-the-Go/Host/Device interface, CAN, precision analog, sensor hub, and low-power capabilities. The development kit features a TM4C123GH6PGE microcontroller in a 144-LQFP package, a color OLED display, USB OTG connector, a microSD card slot, a coin-cell battery for the low-power Hibernate mode, a CAN transceiver, a temperature sensor, a nine-axis sensor for motion tracking and easy-access through-holes to all of the available device signals.

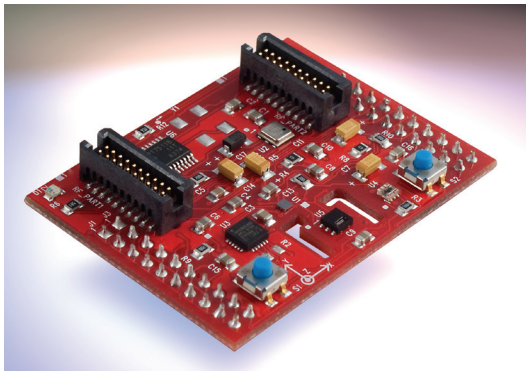


TM4C129x Connected Development Kit (DK-TM4C129X) is a versatile and feature-rich engineering platform highlighting the 120-MHz TM4C129XNCZAD ARM Cortex-M4-based microcontroller that includes an integrated 10/100 Ethernet MAC+PHY plus many other key features. Beyond the industry-leading Ethernet integration, this kit and its associated MCU, the TM4C129XNCZADI, also showcase integrated functions such as a color LCD interface, USB 2.0 OTG/Host/Device port, TI wireless EM connection, BoosterPack and BoosterPack XL interfaces, a Quad SSI-supported 512-Mbit Flash memory, microSD slot, plus expansion headers providing easy access for interfacing to the MCU's high-speed USB ULPI port, Ethernet RMII/MII ports, and its external peripheral interface, which supports memories, parallel peripherals and other system functions.



BoosterPacks

Sensor Hub BoosterPack. Unlock a world of possibilities with TI's new Sensor Hub BoosterPack featuring 9-axis MEMS motion sensors, pressure sensor, ambient light sensor and IR temperature sensor.



Plug-in BoosterPacks for the TM4C123x LaunchPad and TM4C129x Connected Development Kit make it simple and fun to explore various applications by expanding the functionality of the TM4C MCUs.

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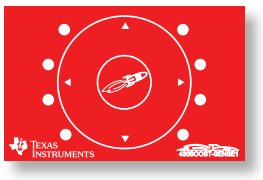
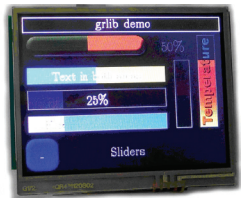




TM4C Product Selector

TM4C123x/TM4C129x Microcontrollers

Part Number	Memory			Core		External I/Fs		Serial Interfaces											Timers					Analog				Data Protection					Low Pwr		
								Ethernet				USB		UART		SSI/SPI																			
	Flash (KB)	SRAM (KB)	EEPROM (Bytes)	ARM® Cortex® CPU	Max Speed (MHz)	External Peripheral I/F	LCD Controller Module	10/100 MAC+PHY	10/100 MAC with MII I/F	IEEE 1588	CAN MAC	USB D, H, or O	HS USB PHY I/F (ULPI)	UART	I²C	Units	Quad-Capable	General-Purpose (Total)	Real-Time Clock (RTC)	Watchdog	PWM Outputs	QEI Channels	Resolution (bits)	Channels	Speed (samples/sec)	Analog/Digital Comparators	Tamper Signals	CRC	AES	DES	SHA/MD5	Battery-Backed Hibernation	Temperature Range (°C)	Pin/Package
TM4C123x MCUs																																		
TM4C1230E6PM	128	32	2K	M4	80	0	0	0	0	0	1	–	0	8	6	4	0	12	1	2	0	0	12	12	1M	2/16	0	0	0	0	0	0	–40 to 85	64 LQFP
TM4C1230H6PM	256	32	2K	M4	80	0	0	0	0	0	1	–	0	8	6	4	0	12	1	2	0	0	12	12	1M	2/16	0	0	0	0	0	0	–40 to 85	64 LQFP
TM4C1231E6PM	128	32	2K	M4	80	0	0	0	0	0	1	–	0	8	4	4	0	12	1	2	0	0	12	12	1M	2/16	0	0	0	0	0	1	–40 to 85	64 LQFP
TM4C1231E6PZ	128	32	2K	M4	80	0	0	0	0	0	1	–	0	8	6	4	0	12	1	2	0	0	12	22	1M	3/16	0	0	0	0	0	1	–40 to 85	100 LQFP
TM4C1231H6PGE	256	32	2K	M4	80	0	0	0	0	0	1	–	0	8	6	4	0	12	1	2	0	0	12	24	1M	3/16	0	0	0	0	0	1	–40 to 85	144 LQFP
TM4C1231H6PM	256	32	2K	M4	80	0	0	0	0	0	1	–	0	8	4	4	0	12	1	2	0	0	12	12	1M	2/16	0	0	0	0	0	1	–40 to 85	64 LQFP
TM4C1231H6PZ	256	32	2K	M4	80	0	0	0	0	0	1	–	0	8	6	4	0	12	1	2	0	0	12	22	1M	3/16	0	0	0	0	0	1	–40 to 85	100 LQFP
TM4C1232E6PM	128	32	2K	M4	80	0	0	0	0	0	1	D	0	8	6	4	0	12	1	2	0	0	12	12	1M	2/16	0	0	0	0	0	0	–40 to 85	64 LQFP
TM4C1232H6PM	256	32	2K	M4	80	0	0	0	0	0	1	D	0	8	6	4	0	12	1	2	0	0	12	12	1M	2/16	0	0	0	0	0	0	–40 to 85	64 LQFP
TM4C1233E6PM	128	32	2K	M4	80	0	0	0	0	0	1	D	0	8	4	4	0	12	1	2	0	0	12	12	1M	2/16	0	0	0	0	0	1	–40 to 85	64 LQFP
TM4C1233E6PZ	128	32	2K	M4	80	0	0	0	0	0	1	D	0	8	6	4	0	12	1	2	0	0	12	22	1M	3/16	0	0	0	0	0	1	–40 to 85	100 LQFP
TM4C1233H6PGE	256	32	2K	M4	80	0	0	0	0	0	1	D	0	8	6	4	0	12	1	2	0	0	12	24	1M	3/16	0	0	0	0	0	1	–40 to 85	144 LQFP
TM4C1233H6PM	256	32	2K	M4	80	0	0	0	0	0	1	D	0	8	4	4	0	12	1	2	0	0	12	12	1M	2/16	0	0	0	0	0	1	–40 to 85	64 LQFP
TM4C1233H6PZ	256	32	2K	M4	80	0	0	0	0	0	1	D	0	8	6	4	0	12	1	2	0	0	12	22	1M	3/16	0	0	0	0	0	1	–40 to 85	100 LQFP
TM4C1236E6PM	128	32	2K	M4	80	0	0	0	0	0	1	O	0	8	6	4	0	12	1	2	0	0	12	12	1M	2/16	0	0	0	0	0	0	–40 to 85	64 LQFP
TM4C1236H6PM	256	32	2K	M4	80	0	0	0	0	0	1	O	0	8	6	4	0	12	1	2	0	0	12	12	1M	2/16	0	0	0	0	0	0	–40 to 85	64 LQFP
TM4C1237E6PM	128	32	2K	M4	80	0	0	0	0	0	1	O	0	8	4	4	0	12	1	2	0	0	12	12	1M	2/16	0	0	0	0	0	1	–40 to 85	64 LQFP
TM4C1237E6PZ	128	32	2K	M4	80	0	0	0	0	0	1	O	0	8	6	4	0	12	1	2	0	0	12	22	1M	3/16	0	0	0	0	0	1	–40 to 85	100 LQFP
TM4C1237H6PGE	256	32	2K	M4	80	0	0	0	0	0	1	O	0	8	6	4	0	12	1	2	0	0	12	24	1M	3/16	0	0	0	0	0	1	–40 to 85	144 LQFP
TM4C1237H6PM	256	32	2K	M4	80	0	0	0	0	0	1	O	0	8	4	4	0	12	1	2	0	0	12	12	1M	2/16	0	0	0	0	0	1	–40 to 85	64 LQFP
TM4C1237H6PZ	256	32	2K	M4	80	0	0	0	0	0	1	O	0	8	6	4	0	12	1	2	0	0	12	22	1M	3/16	0	0	0	0	0	1	–40 to 85	100 LQFP
TM4C123AE6PM	128	32	2K	M4	80	0	0	0	0	0	2	–	0	8	6	4	0	12	1	2	16	2	12	12	1M	2/16	0	0	0	0	0	0	–40 to 85	64 LQFP
TM4C123AH6PM	256	32	2K	M4	80	0	0	0	0	0	2	–	0	8	6	4	0	12	1	2	16	2	12	12	1M	2/16	0	0	0	0	0	0	–40 to 85	64 LQFP
TM4C123BE6PM	128	32	2K	M4	80	0	0	0	0	0	2	–	0	8	4	4	0	12	1	2	16	2	12	12	1M	2/16	0	0	0	0	0	1	–40 to 85	64 LQFP
TM4C123BE6PZ	128	32	2K	M4	80	0	0	0	0	0	2	–	0	8	6	4	0	12	1	2	16	2	12	22	1M	3/16	0	0	0	0	0	1	–40 to 85	100 LQFP
TM4C123BH6PGE	256	32	2K	M4	80	0	0	0	0	0	2	–	0	8	6	4	0	12	1	2	16	2	12	24	1M	3/16	0	0	0	0	0	1	–40 to 85	144 LQFP
TM4C123BH6PM	256	32	2K	M4	80	0	0	0	0	0	2	–	0	8	4	4	0	12	1	2	16	2	12	12	1M	2/16	0	0	0	0	0	1	–40 to 85	64 LQFP
TM4C123BH6PZ	256	32	2K	M4	80	0	0	0	0	0	2	–	0	8	6	4	0	12	1	2	16	2	12	22	1M	3/16	0	0	0	0	0	1	–40 to 85	100 LQFP
TM4C123BH6ZRB	256	32	2K	M4	80	0	0	0	0	0	2	–	0	8	6	4	0	12	1	2	16	2	12	24	1M	3/16	0	0	0	0	0	1	–40 to 85	157 BGA
TM4C123FE6PM	128	32	2K	M4	80	0	0	0	0	0	2	O	0	8	6	4	0	12	1	2	16	2	12	12	1M	2/16	0	0	0	0	0	0	–40 to 85	64 LQFP
TM4C123FH6PM	256	32	2K	M4	80	0	0	0	0	0	2	O	0	8	6	4	0	12	1	2	16	2	12	12	1M	2/16	0	0	0	0	0	0	–40 to 105	64 LQFP
TM4C123GE6PM	128	32	2K	M4	80	0	0	0	0	0	2	O	0	8	4	4	0	12	1	2	16	2	12	12	1M	2/16	0	0	0	0	0	1	–40 to 85	64 LQFP
TM4C123GE6PZ	128	32	2K	M4	80	0	0	0	0	0	2	O	0	8	6	4	0	12	1	2	16	2	12	22	1M	3/16	0	0	0	0	0	1	–40 to 105	100 LQFP
TM4C123GH6PGE	256	32	2K	M4	80	0	0	0	0	0	2	O	0	8	6	4	0	12	1	2	16	2	12	24	1M	3/16	0	0	0	0	0	1	–40 to 105	144 LQFP
TM4C123GH6PM	256	32	2K	M4	80	0	0	0	0	0	2	O	0	8	4	4	0	12	1	2	16	2	12	12	1M	2/16	0	0	0	0	0	1	–40 to 105	64 LQFP
TM4C123GH6PZ	256	32	2K	M4	80	0	0	0	0	0	2	O	0	8	6	4	0	12	1	2	16	2	12	22	1M	3/16	0	0	0	0	0	1	–40 to 105	100 LQFP
TM4C123GH6ZRB	256	32	2K	M4	80	0	0	0	0	0	2	O	0	8	6	4	0	12	1	2	16	2	12	24	1M	3/16	0	0	0	0	0	1	–40 to 105	157 BGA

TM4C Product Selector (continued)

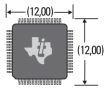
TM4C123x/TM4C129x Microcontrollers

Part Number	Memory			Core		External I/Fs		Serial Interfaces											Timers					Analog				Data Protection					Low Pwr		
								Ethernet				USB		UART		SSI/SPI																		
	Flash (KB)	SRAM (KB)	EEPROM (Bytes)	ARM® Cortex® CPU	Max Speed (MHz)	External Peripheral I/F	LCD Controller Module	10/100 MAC+PHY	10/100 MAC with MII I/F	IEEE 1588	CAN MAC	USB D, H, or O	HS USB PHY I/F (ULPI)	UART	I²C	Units	Quad-Capable	General-Purpose (Total)	Real-Time Clock (RTC)	Watchdog	PWM Outputs	QEI Channels	Resolution (bits)	Channels	Speed (samples/sec)	Analog/Digital Comparators	Tamper Signals	CRC	AES	DES	SHA/MD5	Battery-Backed Hibernation	Temperature Range (°C)	Pin/Package
TM4C129x MCUs																																	
TM4C1292NCPDT	1024	256	6K	M4	120	1	0	0	1	1	2	0	1	8	10	4	4	8	1	2	8	1	12	20	2M	3/16	4	1	0	0	0	1	–40 to 105	128 TQFP
TM4C1292NCZAD	1024	256	6K	M4	120	1	0	0	1	1	2	0	1	8	10	4	4	8	1	2	8	1	12	24	2M	3/16	4	1	0	0	0	1	–40 to 105	212 BGA
TM4C1294KCPDT	512	256	6K	M4	120	1	0	1	0	1	2	0	1	8	10	4	4	8	1	2	8	1	12	20	2M	3/16	4	1	0	0	0	1	–40 to 105	128 TQFP
TM4C1294NCPDT	1024	256	6K	M4	120	1	0	1	0	1	2	0	1	8	10	4	4	8	1	2	8	1	12	20	2M	3/16	4	1	0	0	0	1	–40 to 105	128 TQFP
TM4C1294NCZAD	1024	256	6K	M4	120	1	0	1	0	1	2	0	1	8	10	4	4	8	1	2	8	1	12	24	2M	3/16	4	1	0	0	0	1	–40 to 105	212 BGA
TM4C1299KCZAD	512	256	6K	M4	120	1	1	1	0	1	2	0	1	8	10	4	4	8	1	2	8	1	12	24	2M	3/16	4	1	0	0	0	1	–40 to 105	212 BGA
TM4C1299NCZAD	1024	256	6K	M4	120	1	1	1	0	1	2	0	1	8	10	4	4	8	1	2	8	1	12	24	2M	3/16	4	1	0	0	0	1	–40 to 105	212 BGA
TM4C129DNCPDT	1024	256	6K	M4	120	1	0	0	1	1	2	0	1	8	10	4	4	8	1	2	8	1	12	20	2M	3/16	4	1	1	1	1	1	–40 to 105	128 TQFP
TM4C129DNCZAD	1024	256	6K	M4	120	1	0	0	1	1	2	0	1	8	10	4	4	8	1	2	8	1	12	24	2M	3/16	4	1	1	1	1	1	–40 to 105	212 BGA
TM4C129EKCPDT	512	256	6K	M4	120	1	0	1	0	1	2	0	1	8	10	4	4	8	1	2	8	1	12	20	2M	3/16	4	1	1	1	1	1	–40 to 105	128 TQFP
TM4C129ENCPDT	1024	256	6K	M4	120	1	0	1	0	1	2	0	1	8	10	4	4	8	1	2	8	1	12	20	2M	3/16	4	1	1	1	1	1	–40 to 105	128 TQFP
TM4C129ENCZAD	1024	256	6K	M4	120	1	0	1	0	1	2	0	1	8	10	4	4	8	1	2	8	1	12	24	2M	3/16	4	1	1	1	1	1	–40 to 105	212 BGA
TM4C129LNCZAD	1024	256	6K	M4	120	1	1	1	0	1	2	0	1	8	10	4	4	8	1	2	8	1	12	24	2M	3/16	4	1	1	1	1	1	–40 to 105	212 BGA
TM4C129XKCZAD	512	256	6K	M4	120	1	1	1	1	1	2	0	1	8	10	4	4	8	1	2	8	1	12	24	2M	3/16	4	1	1	1	1	1	–40 to 105	212 BGA
TM4C129XNCZAD	1024	256	6K	M4	120	1	1	1	1	1	2	0	1	8	10	4	4	8	1	2	8	1	12	24	2M	3/16	4	1	1	1	1	1	–40 to 105	212 BGA

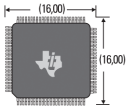
Package options

157-ball BGA

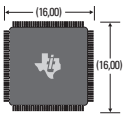
212-ball BGA



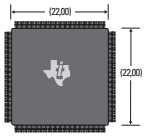
64-pin LQFP



100-pin LQFP



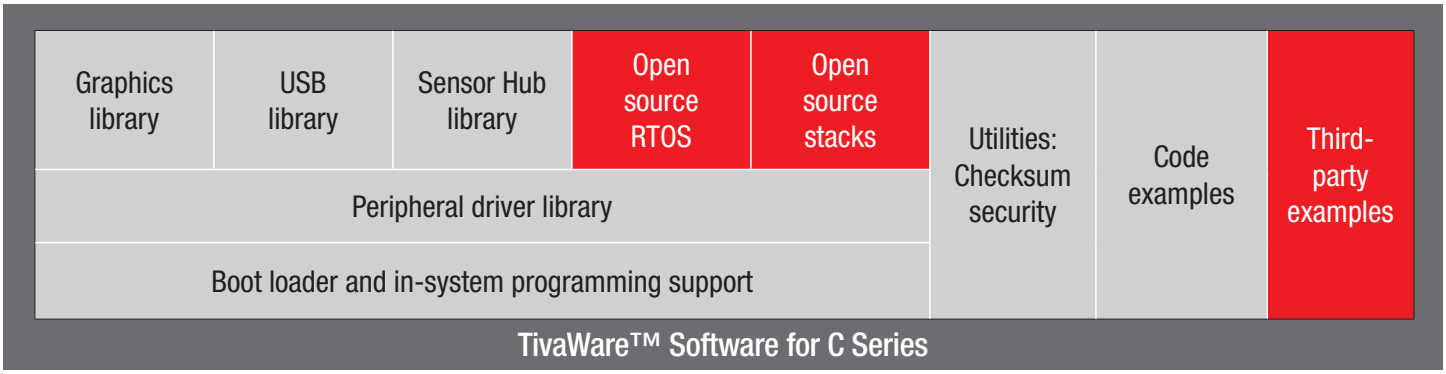
128-pin TQFP



144-pin LQFP

TivaWare™ Software for C Series

TivaWare™ Software for C Series provides free-license and royalty-free source code that customers can use to accelerate their time to market and reduce their total cost of software ownership.



Libraries and code examples

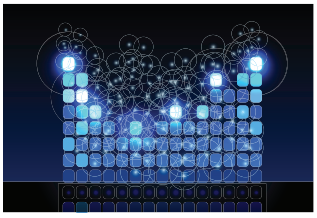
Use the TivaWare for C Series software libraries and start spending your time differentiating your solution!

Peripheral driver library

Set of BSD licensed functions for controlling TM4C peripherals.

USB library

TivaWare royalty-free USB stack is provided to enable efficient USB host, device, and on-the-go operations.



Graphics library

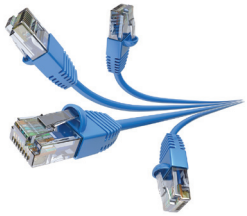
Royalty-free set of graphics primitives and widgets to create GUIs.

Sensor Hub library

TM4C Sensor Hub library offers an advanced sensor fusion algorithm and a broad range of sensor support.

CMSIS DSP library

Full support for ARM®'s Cortex® Microcontroller Software Interface Standard (CMSIS) libraries.



Ethernet

Integrated Ethernet MAC+PHY with support with lwIP, MuIP and TI's Networking Development Kit (NDK).

Interactive Development Environment (IDE)

TivaWare Software for C Series is pre-built using five different compilers.

Code Composer Studio™ IDE

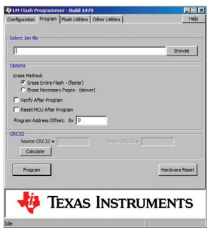
Code Composer Studio™ (CCStudio) is an integrated development environment (IDE) for all of Texas Instruments embedded processor families.

TM4C Software Ecosystem

PinMux Utility

- Easy-to-use tool for configuring the GPIOs
- Generates source code in C
- Automatically checks and solves pin conflicts
- Intuitive user interface
- Provided free of charge

In-System Programming Support



- Boot loaders available in on-chip ROM
- Boot loader customized in Flash memory
- Serial Flash loader

Download: www.ti.com/tool/lmflashprogrammer

Real-Time Operating System (RTOS)

TI-RTOS

FreeRTOS

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