

32-bit MCUs

# Kinetis K50 Family

Integrated measurement engine, Ethernet and LCD

## Target Applications

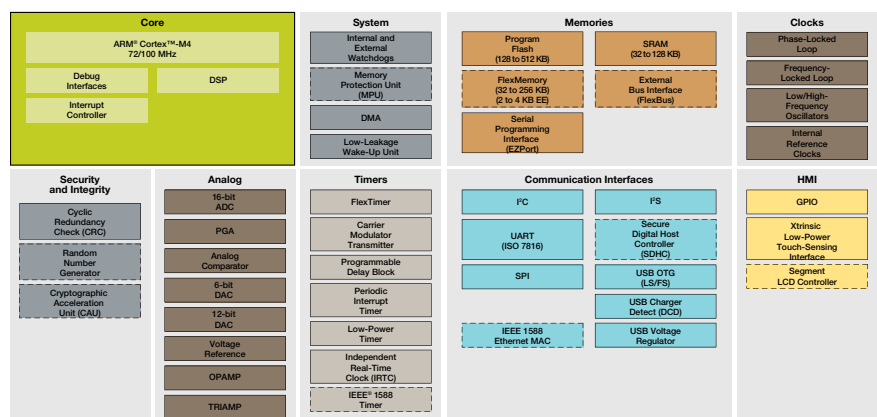
- Low-power portable medical devices
- Clinical and lab equipment
- Test/measurement equipment
- Instrumentation applications
- Monitor and telehealth applications

## Overview

The Kinetis MCU portfolio consists of multiple pin-, peripheral and software-compatible MCU families based on the ARM® Cortex™-M4 core. Kinetis MCU families are built from innovative 90 nm thin-film storage (TFS) flash technology with unique FlexMemory (EEPROM) capability and offer industry-leading low power and mixed signal analog integration.

The K50 MCU family provides designers with an analog measurement engine consisting of integrated operational and transimpedance amplifiers as well as high-resolution ADC and DAC modules. The family also features IEEE® 1588 Ethernet and hardware encryption, Full-Speed USB 2.0 On-The-Go with device charger detect capability and a flexible low-power segment LCD controller with support for up to 320 segments. Devices start from 128 KB of flash in 64 QFN packages extending up to 512 KB in a 144 MAPBGA package.

## Kinetis K50 Family



Standard  Optional



## One-Stop Enablement Offering: MCU + IDE + RTOS

Freescale Tower System hardware development environment:

- TWR-K53N512-KIT (\$179)
  - Includes TWR-SER, TWR-ELEV and TWR-K53N512 modules
- TWR-K53N512 (\$109)
  - Includes TWR-K53N512 and TWRPI-SLCD daughter card
- Integrated development environments
  - Eclipse-based CodeWarrior IDE and Processor Expert
  - IAR Embedded Workbench
  - Keil MDK
  - CodeSourcery Sourcery G++ (GNU)
- Portable medical applications demo software: EKG, pulse oximeter, blood pressure monitor, spirometer
- Math, DSP and encryption libraries
- Motor control libraries
- Complimentary bootloaders (USB, Ethernet, RF, serial)
- Complimentary Freescale embedded GUI
- Complimentary Freescale MQX™ RTOS
- Cost-effective Nano™ SSL/Nano™ SSH for Freescale MQX RTOS
- Micrium uC/OS-III

- Express Logic ThreadX
- SEGGER embOS
- FreeRTOS
- Green Hills  $\mu$ -velOSity
- Mocana (security)
- Full ARM ecosystem
- Reduces core interruption, increasing performance
- Design flexibility and system cost reduction
- Increases system safety by restricting access to key memory locations
- Provides scalability needed for key digital power and motor control applications

Features	Benefits
<ul style="list-style-type: none"> <li>• ARM® Cortex™-M4 core with DSP instruction support</li> <li>• Up to 16-channel DMA and crossbar switch</li> </ul>	<ul style="list-style-type: none"> <li>• Up to 100 MHz core supporting a broad range of processing bandwidth needs</li> <li>• Peripheral and memory servicing with reduced CPU loading. Concurrent multi-master bus accesses for increased bus bandwidth</li> </ul>
<ul style="list-style-type: none"> <li>• Up to 2 x 16-bit ADC with PGA</li> <li>• Up to 2 x 12-bit DAC</li> <li>• Programmable delay block</li> <li>• Operational and transimpedance amplifiers</li> <li>• Voltage reference (VREF)</li> </ul>	<ul style="list-style-type: none"> <li>• High-resolution and high-accuracy ADC provides accurate signal acquisition</li> <li>• Digital-to-analog converter with clock gating optimized for low-power usage</li> <li>• PDB precisely triggers ADC and DAC blocks to complete sensor biasing and measurement (i.e. glucometry strips)</li> <li>• OPAMPS allow signal filtering and amplification, TRIAMPS are optimized for converting current inputs into voltages that can be read by the ADC</li> <li>• VREF allows enhanced accuracy by supplying analog peripherals with fixed reference</li> </ul>
<ul style="list-style-type: none"> <li>• IEEE® 1588 Ethernet MAC with hardware time stamping</li> <li>• Hardware encryption coprocessor</li> </ul>	<ul style="list-style-type: none"> <li>• Precision clock synchronization for real-time networked industrial automation and control</li> <li>• Secure data transfer and storage. Faster than software implementations and with minimal CPU loading. Supports a wide variety of algorithms</li> </ul>
<ul style="list-style-type: none"> <li>• USB On-The-Go (Full-Speed) with device charger detect</li> </ul>	<ul style="list-style-type: none"> <li>• Optimized charging current/time for portable USB devices enabling longer battery life</li> <li>• USB low-voltage regulator supplies up to 120 mA off chip at 3.3 V to power external components from 5 V input</li> </ul>
<ul style="list-style-type: none"> <li>• Flexible, low-power LCD controller with support for up to 320 segments (40 x 8 or 44 x 4)</li> </ul>	<ul style="list-style-type: none"> <li>• LCD blink mode enables low average power while remaining in low-power mode</li> <li>• Segment fail detect guards against erroneous readouts and reduces LCD test costs</li> <li>• Frontplane/backplane reassignment provides pin-out flexibility easing PCB design and allows LCD configuration changes via firmware with no hardware re-work</li> <li>• Supports multiple 3 V and 5 V LCD panel sizes with fewer segments (pins) than competitive controllers and no external components</li> <li>• Unused LCD pins can be configured as other GPIO functions</li> </ul>
<ul style="list-style-type: none"> <li>• FlexBus external bus interface and secure digital host controller</li> </ul>	<ul style="list-style-type: none"> <li>• Enables the connection of external memories and peripherals (e.g., graphics displays)</li> <li>• Connection to SD, SDIO, MMC or CE-ATA cards for in-application software upgrades, file systems or adding Wi-Fi® or Bluetooth® support</li> </ul>
<ul style="list-style-type: none"> <li>• 128–512 KB flash. Up to 128 KB of SRAM</li> <li>• 32–256 KB FlexMemory</li> </ul>	<ul style="list-style-type: none"> <li>• High reliability, fast access program memory with 4-level security protection</li> <li>• Independent flash banks allow concurrent code execution and firmware updating</li> <li>• FlexMemory provides 2–4 KB of user-segmentable byte write/erase EEPROM. In addition, Flex NVM from 32–256 KB for extra program code, data or EEPROM backup</li> </ul>

## K50 Family Options

Part Number	CPU (MHz)	Memory				Feature Options							Packages				
		Flash (KB)	FlexMemory(KB)	SRAM(KB)	EEPROM/ FlexRAM (KB)	TRIAMP	Opamp	DAC	Ethernet	LCD	ADC	64 LQFP (10 x 10 mm) LH	80 LQFP (12 x 12 mm) LK	100 LQFP (14 x 14 mm) LL	121 BGA (8 x 8 mm) MC	144 LQFP (20 x 20 mm) LQ	144 BGA (13 x 13 mm) MD
MK50DX128Cyy7	72	128	32	32	2	✓	✓	✓			✓	✓		✓			
MK51DX128Cyy7	72	128	32	32	2	✓	✓	✓		✓	✓	✓			✓		
MK50DX256Cyy7	72	256	32	64	2	✓	✓	✓			✓	✓	✓	✓	✓		
MK51DX256Cyy7	72	256	32	64	2	✓	✓	✓		✓	✓	✓	✓	✓	✓		
MK51DN256ZCyy10	100	256	-	64		✓	✓	✓		✓	✓					✓	✓
MK50DX256ZCyy10	100	256	256	64	4	✓	✓	✓			✓	✓	✓	✓	✓		
MK51DX256ZCyy10	100	256	256	64	4	✓	✓	✓		✓	✓	✓	✓	✓	✓		
MK53DX256ZCyy10	100	256	256	128	4	✓	✓	✓	✓	✓	✓					✓	✓
MK50DN512ZCyy10	100	512	-	128		✓	✓	✓			✓			✓	✓	✓	✓
MK51DN512ZCyy10	100	512	-	128		✓	✓	✓		✓	✓			✓	✓	✓	✓
MK52DN512ZCyy10	100	512	-	128		✓	✓	✓	✓		✓					✓	✓
MK53DN512ZCyy10	100	512	-	128		✓	✓	✓	✓	✓	✓					✓	✓

yy = Package designator

For current information about Kinetis products and documentation, please visit [freescale.com/Kinetis](http://freescale.com/Kinetis)

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