

32-bit Microcontrollers

# Kinetis K1x MCU Family

## Low-power, mixed-signal MCUs

### Target Applications

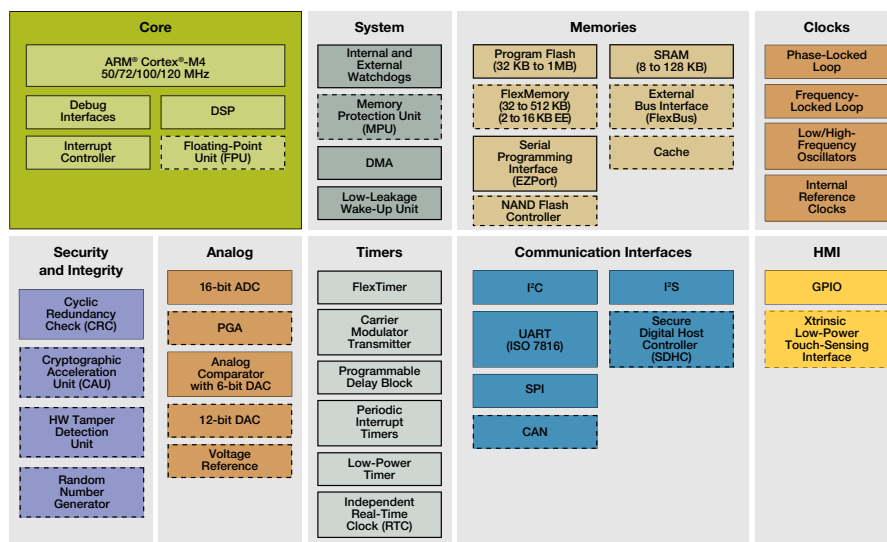
- Electronic point of sales (EPOS)
- Flow meters
- Gaming controllers
- HVAC systems
- Remote sensors

### Overview

The Kinetis MCU portfolio consists of multiple pin-, peripheral- and software-compatible MCU families based on the ARM® Cortex®-M4 core. 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 K1x MCU family is the entry point into the Kinetis MCU portfolio. Devices start from 32 KB of flash in a small-footprint 5x5 mm 32 QFN package, extending up to 1 MB in a 144 MAPBGA package with a rich suite of analog, communication, timing and control peripherals. Additionally, pin compatibility, flexible low-power capabilities and innovative FlexMemory help to solve many of the major pain points for system implementation.

### Kinetis K1x MCU Family



Standard Feature     Optional Feature





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

Freescale Tower System hardware development environment:

- Integrated development environments
  - Eclipse-based CodeWarrior V10.x IDE and Processor Expert
  - IAR Embedded Workbench®
  - MDK®
  - Mentor Graphics Sourcery™ CodeBench
- Runtime software and RTOS
  - Math, DSP and encryption libraries
  - Motor control libraries
  - Complimentary bootloaders (e.g., USB, Ethernet, RF, serial)
  - Complimentary Freescale embedded GUI
  - Complimentary Freescale MQX™
  - Cost-effective Nano™ SSL/Nano™ SSH for Freescale MQX RTOS
  - Micrium µC/OS-III
  - Express Logic ThreadX
  - SEGGER embOS
  - freeRTOS
  - Mocana (security)
- Full ARM ecosystem

### Features

- Cortex-M4 core with DSP instruction support and optional single-precision floating-point unit
- Up to 32-channel DMA. Up to 16 KB of cache. Crossbar switch.
- 32 KB–1 MB flash. Up to 128 KB of SRAM.
- 32–512 KB FlexMemory
- 10 ultra-low-power modes with flash programming and analog operation down to 1.71 V
- Low-power timer, low-power RTC, low-leakage wake-up unit
- High-speed 16-bit ADCs. Programmable gain amplifiers
- 12-bit DAC. High-speed comparators
- On-chip voltage reference
- Cryptographic acceleration unit (CAU)
- HW tamper detection unit
- Random number generator
- Low-power capacitive touch-sensing interface
- Up to six UARTs with IrDA support. One UART with ISO 7816 support.
- I<sup>2</sup>S interface, up to two CAN modules, up to three DSPI interfaces, up to two I<sup>2</sup>C interfaces

### Benefits

- Up to 120 MHz core supporting a broad range of processing bandwidth needs
- Peripheral and memory servicing with reduced CPU loading. Optimized bus bandwidth and flash execution performance. Concurrent multi-master bus accesses for increased bus bandwidth.
- High reliability, fast access program memory with 4-level security protection. Independent flash banks allow concurrent code execution and firmware updating.
- FlexMemory provides 32 byte–16 KB of user-segmentable byte write/erase EEPROM. In addition, FlexNVM from 32–512 KB for extra program code, data or EEPROM backup.
- Peripheral activity and wake-up times can be optimized to suit application requirements, enabling extended battery life (Stop currents of <500 nA, run currents of <200 µA/MHz, 4 µs wake-up from Stop)
- Continual device operation in reduced power states with flexible wake-up options
- Fast, accurate signal conditioning capability with support for single or differential operation for improved noise rejection
- Support for small amplitude signal processing
- Analog signal generation for audio applications
- Fast, accurate motor overcurrent protection
- Eliminates need for external voltage reference reducing overall system cost
- Secure data transfer and storage. Faster than software implementations and with minimal CPU loading. Supports a wide variety of algorithms: DES, 3DES, AES, MD5, SHA-1, SHA-256.
- Secure key storage with internal/external tamper detect for unsecured flash, temperature/clock/supply voltage variations and physical attack
- Provides a modern upgrade from mechanical to touch keypad, rotary and slider user interfaces and operates in all low-power modes with minimal current added. Supports up to 16 inputs.
- Variety of data size, format and transmission/reception settings supported for multiple industrial communication protocols
- Multiple communication interfaces for simple and efficient data exchange, industrial network bridging and audio system interfacing

## Kinetis K1x MCU Family Options

| Part Number       | Memory    |            |               |           |            | Features                             |                   |     |                     |                       |                        |            | Other | Packages             |                  |                 |                |                 |                   |                   |                   |                    |                 |                    |                   |
|-------------------|-----------|------------|---------------|-----------|------------|--------------------------------------|-------------------|-----|---------------------|-----------------------|------------------------|------------|-------|----------------------|------------------|-----------------|----------------|-----------------|-------------------|-------------------|-------------------|--------------------|-----------------|--------------------|-------------------|
|                   | CPU (MHz) | Flash (KB) | Flex NVM (KB) | SRAM (KB) | Cache (KB) | Single-Precision Floating-Point Unit | Memory Protection | CAN | Secure Digital Host | NAND Flash Controller | External Bus Interface | 12-bit DAC |       | Prog. Gain Amplifier | 5 V Tolerant I/O | FM 32 QFN (6x6) | FT 48QFN (7x7) | LF 48LOFP (7x7) | MP 64MAPBGA (6x6) | LH 64LQFP (10x10) | LK 80LOFP (12x12) | LL 100LQFP (14x14) | MC 121BGA (8x8) | LQ 144LQFP (20x20) | MD 144BGA (13x13) |
| MK10DN32Vyy5      | 50        | 32         |               | 8         |            |                                      |                   |     |                     |                       |                        |            |       |                      | √                | √               | √              | √               | √                 |                   |                   |                    |                 |                    |                   |
| MK10DN64Vyy5      | 50        | 64         |               | 16        |            |                                      |                   |     |                     |                       |                        |            |       |                      | √                | √               | √              | √               | √                 |                   |                   |                    |                 |                    |                   |
| MK10DN128Vyy5     | 50        | 128        |               | 16        |            |                                      |                   |     |                     |                       |                        |            |       |                      | √                | √               | √              | √               | √                 |                   |                   |                    |                 |                    |                   |
| MK10DN512Vyy10    | 100       | 512        |               | 128       |            |                                      | √                 | √   | √                   |                       | √                      | √          | √     | √                    |                  |                 |                |                 |                   | √                 | √                 | √                  | √               | √                  | √                 |
| MK10FN1M0Vyy12    | 120       | 1 MB       |               | 128       | 16         | √                                    | √                 | √   | √                   | √                     | √                      | √          | √     | √                    |                  |                 |                |                 |                   |                   |                   |                    |                 | √                  | √                 |
| MK10DX32Vyy5      | 50        | 32v        | 32            | 8         |            |                                      |                   |     |                     |                       |                        |            |       |                      | √                | √               | √              | √               | √                 |                   |                   |                    |                 | √                  | √                 |
| MK10DX64Vyy5      | 50        | 64         | 32            | 16        |            |                                      |                   |     |                     |                       |                        |            |       |                      | √                | √               | √              | √               | √                 |                   |                   |                    |                 | √                  | √                 |
| MK10DX128Vyy5     | 50        | 128        | 32            | 16        |            |                                      |                   |     |                     |                       |                        |            |       |                      | √                | √               | √              | √               | √                 |                   |                   |                    |                 | √                  | √                 |
| MK10DX64Vyy7      | 72        | 64         | 32            | 16        |            |                                      | √                 |     |                     |                       | √                      | √          | √     | √                    |                  |                 |                |                 | √                 | √                 |                   |                    |                 | √                  | √                 |
| MK10DX128Vyy7     | 72        | 128        | 32            | 32        |            |                                      | √                 |     |                     |                       | √                      | √          | √     | √                    |                  |                 |                |                 | √                 | √                 |                   |                    |                 | √                  | √                 |
| MK10DX256Vyy7     | 72        | 256        | 32            | 64        |            |                                      | √                 |     |                     |                       | √                      | √          | √     | √                    |                  |                 |                |                 | √                 | √                 |                   |                    |                 | √                  | √                 |
| MK10DX128Vyy10    | 100       | 128        | 128           | 32        |            |                                      | √                 | √   | √                   |                       | √                      | √          | √     | √                    |                  |                 |                |                 | √                 | √                 |                   |                    |                 | √                  | √                 |
| MK10DX256Vyy10    | 100       | 256        | 256           | 64        |            |                                      | √                 | √   | √                   |                       | √                      | √          | √     | √                    |                  |                 |                |                 | √                 | √                 |                   |                    |                 | √                  | √                 |
| MK10FX512Vyy12    | 120       | 512        | 512           | 128       | 16         | √                                    | √                 | √   | √                   | √                     | √                      | √          | √     | √                    |                  |                 |                |                 |                   |                   |                   |                    |                 | √                  | √                 |
| MK11DX128AVyy5(R) | 50        | 128        | 64            | 32        |            |                                      |                   |     |                     |                       |                        | √          |       |                      |                  |                 |                |                 |                   | √                 |                   |                    |                 | √                  | √                 |
| MK11DX256AVyy5(R) | 50        | 256        | 64            | 32        |            |                                      |                   |     |                     |                       |                        | √          |       |                      |                  |                 |                |                 |                   | √                 |                   |                    |                 | √                  | √                 |
| MK11DN512AVyy5(R) | 50        | 512        |               | 64        |            |                                      |                   |     |                     |                       |                        | √          |       |                      |                  |                 |                |                 |                   | √                 |                   |                    |                 | √                  | √                 |
| MK12DX128Vyy5(R)  | 50        | 128        | 64            | 32        |            |                                      |                   |     |                     |                       |                        | √          |       |                      |                  |                 |                |                 | √                 | √                 |                   |                    |                 | √                  | √                 |
| MK12DX256Vyy5(R)  | 50        | 256        | 64            | 32        |            |                                      |                   |     |                     |                       |                        | √          |       |                      |                  |                 |                |                 | √                 | √                 |                   |                    |                 | √                  | √                 |
| MK12DN512Vyy5     | 50        | 512        |               | 64        |            |                                      |                   |     |                     |                       |                        | √          |       |                      |                  |                 |                |                 | √                 | √                 |                   |                    |                 | √                  | √                 |

yy = package designator

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

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