



Integrated  
measurement  
engine, Ethernet  
and LCD

## Kinetis K50 Family

The Kinetis MCU portfolio consists of multiple pin-, peripheral and software-compatible MCU families based on the ARM® Cortex®-M4 core.

### TARGET APPLICATIONS

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

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.

### ONE-STOP ENABLEMENT OFFERING: MCU + IDE + RTOS

Tower® System hardware development environment:

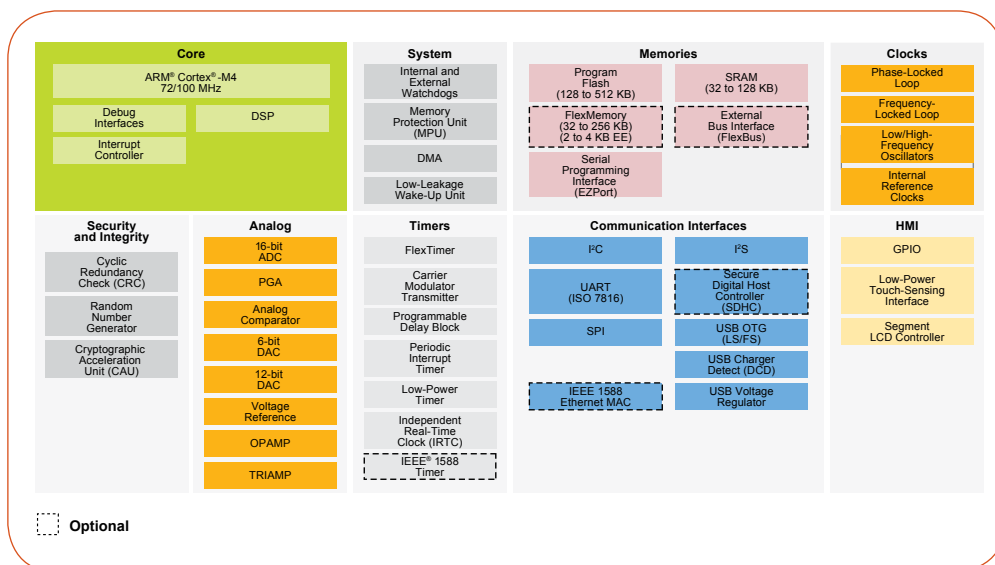
- ▶ TWR-K53N512-KIT (\$179)
  - Includes TWR-SER, TWR-ELEV and TWR-K53N512 modules
- ▶ TWR-K53N512 (\$109)
  - Includes TWR-K53N512 and TWRPI-SLCD daughter card
- ▶ Integrated development environments (IDEs)
  - Eclipse-based CodeWarrior IDE and Processor Expert
  - IAR Embedded Workbench®
  - ARM Keil® MCU development tool
  - 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 embedded GUI
- ▶ Complimentary proprietary MQX™ RTOS
- ▶ Cost-effective Nano™ SSL/Nano™ SSH for proprietary MQX RTOS
- ▶ Micrium μC/OS-III
- ▶ Express Logic ThreadX
- ▶ SEGGER embOS
- ▶ FreeRTOS
- ▶ Green Hills μ-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

## KINETIS K50 FAMILY



| 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 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>   |



## KINETIS K50 MCU FAMILY OPTIONS

| Part Number     | CPU (MHz) | Memory     |                |          |                         | Feature Options |       |     |          |     |     | Packages                   |                            |                             |                          |                             |
|-----------------|-----------|------------|----------------|----------|-------------------------|-----------------|-------|-----|----------|-----|-----|----------------------------|----------------------------|-----------------------------|--------------------------|-----------------------------|
|                 |           | FLASH (KB) | FlexMemory(KB) | SRAM(KB) | EEPROM/<br>FlexRAM (KB) | TRIAMP          | Opamp | DAC | ETHERNET | LCD | ADC | 64 LQFP<br>(10 x 10 mm) LH | 80 LQFP<br>(12 x 12 mm) LK | 100 LQFP<br>(14 x 14 mm) LL | 121 BGA<br>(8 x 8 mm) MC | 144 LQFP<br>(20 x 20 mm) LQ |
| 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

