



Large flash  
memory with  
segment LCD  
and USB

## Kinetis<sup>®</sup> KL4x MCU Family

The Kinetis KL4x family of MCUs based on ARM<sup>®</sup> Cortex<sup>®</sup>-M0+ cores combine ultra-low-power performance with a rich suite of analog, communication, timing and control peripherals, including a USB 2.0 On-The-Go controller and low-power segment LCD controller with support for up to 376 segments.

### TARGET APPLICATIONS

- ▶ Electronic scales
- ▶ Flow meters
- ▶ Smart meters
- ▶ Thermostats

Family members start from 128 KB of flash in a 64 LQFP package, extending up to 256 KB in a 121 MBGA package. The KL4x MCU family is compatible with the Cortex-M4 based M4-based Kinetis K40 MCU family, offering a migration path to higher performance and feature integration.

### FEATURES

#### Ultra-low power

- ▶ Next-generation 32-bit Cortex-M0+ core
  - Two times more CoreMarks<sup>®</sup>/mA than the closest 8-/16-bit architecture
  - Single-cycle fast I/O access port facilitates bit banging and software protocol emulation, maintaining an 8-bit 'look and feel'
- ▶ Multiple flexible low-power modes, including a new compute mode which reduces dynamic power by placing peripherals in an asynchronous stop mode

- ▶ LPUART, SPI, I<sup>2</sup>C, ADC, DAC, LP timer and DMA support low-power mode operation without waking up the core

#### Memory

- ▶ Up to 256 KB flash with 64-byte flash cache, up to 32 KB RAM
- ▶ 16 KB ROM with integrated bootloader
- ▶ Security circuitry to prevent unauthorized access to RAM and flash contents

#### Performance

- ▶ Cortex-M0+ core, 48 MHz core frequency over full voltage and temperature range (–40° C +105° C)
- ▶ Bit manipulation engine for improved bit handling of peripheral modules
- ▶ Up to 4-channel DMA for peripheral and memory servicing with reduced CPU loading and faster system throughput

#### Mixed signal

- ▶ Up to 16-bit ADC
- ▶ High-speed comparator with internal 6-bit DAC
- ▶ 12-bit DAC with DMA support



## Timing and control

- ▶ One six-channel and two 2-channel, 16-bit low-power timer PWM modules
- ▶ 2-channel, 32-bit periodic interrupt timer
- ▶ Low-power timer allows operation in all power modes except VLLS0
- ▶ Real-time clock

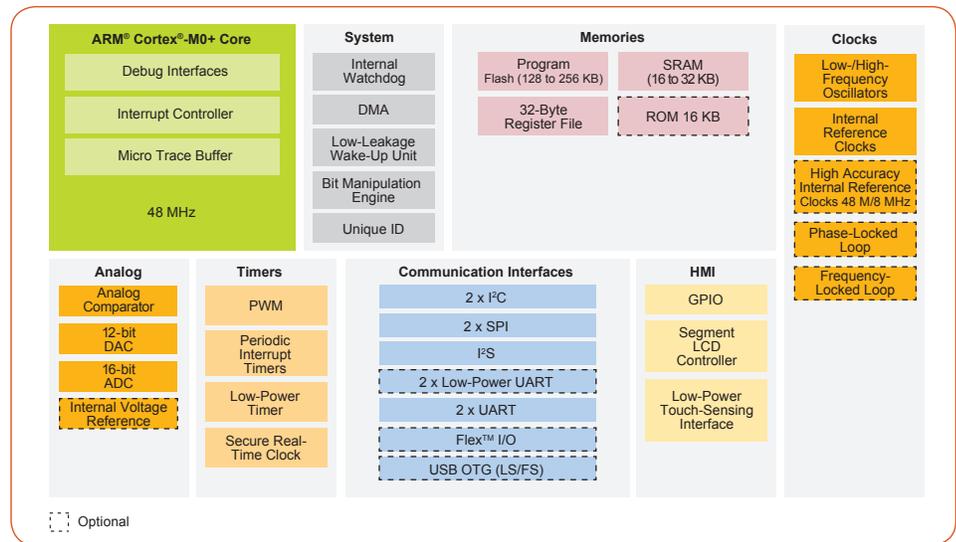
## HMI

- ▶ Flexible, low-power LCD controller with up to 376 segments (47 x 8 or 51 x 4)
- ▶ LCD blink mode enables low average power while remaining in low-power mode. Segment fail detect alerts the user to failures in the display, which helps avoid the possibility of an erroneous readout in medical applications. Front plane/backplane reassignment provides pin-out flexibility to ease PCB design and allow LCD configuration changes via firmware with no hardware rework. Unused LCD pins can be configured as other GPIO functions.
- ▶ Capacitive touch-sensing inputs

## Connectivity and communications

- ▶ USB 2.0 On-The-Go integrated USB low-voltage regulator supplies up to 120 mA off chip at 3.3 volts to power external components from 5-volt input

## KINETIS KL4x MCU FAMILY BLOCK DIAGRAM



- ▶ Two I<sup>2</sup>C with DMA support, up to 1 Mbit/s and compatible with SMBus V2 features
- ▶ One LPUART and two UART with DMA support
- ▶ Two SPI with DMA support

## Development tools and software

- ▶ Tower<sup>®</sup> System modules
- ▶ Freedom development platform

- ▶ Integrated development environment (IDE)
  - IAR Embedded Workbench<sup>®</sup>, ARM Keil<sup>®</sup> MDK, and Rowley Crossworks
  - CodeWarrior<sup>®</sup> for Microcontrollers v10.x (Eclipse) IDE with Processor Expert<sup>®</sup> software configuration tool
  - Kinetis Design Studio IDE
- ▶ Processor Expert software configuration tool

## KINETIS KL4x MCU FAMILY OPTIONS

Sub-Family	Part Number	CPU (MHz)	Memory		Features													√ Package				Development Hardware	
			Flash (KB)	SRAM (KB)	DMA	UART	Low-Power UART	SPI	I <sup>2</sup> C	TSI	I <sup>2</sup> S	Flex™ I/O	RTC	12-bit DAC	16-bit ADC w/DP CH.	12-bit ADC	Total I/Os	Other	LH	LL	MC		MP
																			64 LQFP (10 x 10, 0.5 mm)	100 LQFP (14 x 14, 0.5 mm)	121 MAPBGA (8 x 8, 0.65 mm)		64 MAPBGA (5 x 5, 0.5 mm)
KL43	MKL43Z128xxx4	48 MHz	128	16	√	1	2	2x 16b	2		√	√	√	√	√		50	USB 2.0 Device, with embedded OSC	√			√	FRDM-KL43Z: Freedom development platform
	MKL43Z256xxx4	48 MHz	256	32	√	1	2	2x 16b	2		√	√	√	√	√		50	USB 2.0 Device, with embedded OSC	√			√	TWR-KL43Z48M: Tower <sup>®</sup> System module
KL46	MKL46Z128xxx4	48 MHz	128	16	√	2	1	2	2	√	√		√	√	√		46~80	USB 2.0 OTG/Host/Device + Segment LCD	√	√	√	√	FRDM-KL46Z: Freedom development platform
	MKL46Z256xxx4	48 MHz	256	32	√	2	1	2	2	√	√		√	√	√		46~80	USB 2.0 OTG/Host/Device + Segment LCD	√	√	√	√	TWR-KL46Z48M: Tower System module

[www.nxp.com/Kinetis/Lseries](http://www.nxp.com/Kinetis/Lseries)

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