



## Ultra-low- power MCUs

# Kinetis® KL0x MCU Family

The Kinetis KL0x MCU family is the entry point into the Kinetis L series of MCUs built on the ARM® Cortex®-M0+ core.

### TARGET APPLICATIONS

- ▶ Battery-operated applications
- ▶ Consumer applications
- ▶ Low-power applications
- ▶ USB peripherals

The Kinetis KL0x MCU family provides a bridge for 8-bit customers migrating into the Kinetis MCU portfolio, and is software and tool compatible with all other Kinetis L series families. Devices start from 8 KB of flash and a small footprint of 1.6 mm x 2.0 mm 20WLCSP package, extending up to 32 KB in a 48 LQFP package. Each family member combines ultra-low-power performance with a rich suite of analog, communication, timing and control peripherals.

### FEATURES

#### Ultra-Low Power

- ▶ Next-generation 32-bit Cortex-M0+ core with two times more CoreMarks®/mA than the closest 8-/16-bit architecture
- ▶ Multiple flexible low-power modes, including a new compute mode that 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 32 KB flash with 64-byte flash cache, up to 4 KB RAM
- ▶ Security circuitry to prevent unauthorized access to RAM and flash contents
- ▶ 8 KB ROM bootloader for easy flash upgrade

#### Performance

- ▶ Cortex-M0+ core, 48 MHz core frequency over full voltage and temperature range (–40 °C to +105 °C), except CSP (–40 °C to +85 °C)
- ▶ Single-cycle fast I/O access port facilitates bit banging and software protocol emulation, maintaining an 8-bit 'look and feel'
- ▶ Bit manipulation engine for improved bit handling of peripheral modules
- ▶ Thumb® instruction set combines high code density with 32-bit performance
- ▶ Up to four-channel DMA for peripheral and memory servicing with reduced CPU loading and faster system throughput
- ▶ Independent-clocked COP guards against clock skew or code runaway for fail-safe applications



## Mixed Signal

- ▶ 12-bit ADC with configurable resolution, sample time and conversion speed/power; integrated temperature sensor
- ▶ High-speed comparator with internal 6-bit DAC
- ▶ 12-bit DAC with DMA support
- ▶ Integrated 1.2 V reference

## Timing and control

- ▶ One six-channel and one two-channel, 16-bit low-power timer PWM modules with DMA support
- ▶ Two-channel, 32-bit periodic interrupt timer provides time base for RTOS task schedule or trigger source for ADC conversion
- ▶ Low-power timer allows operation in all power modes except VLLS0
- ▶ Real-time clock with calendar

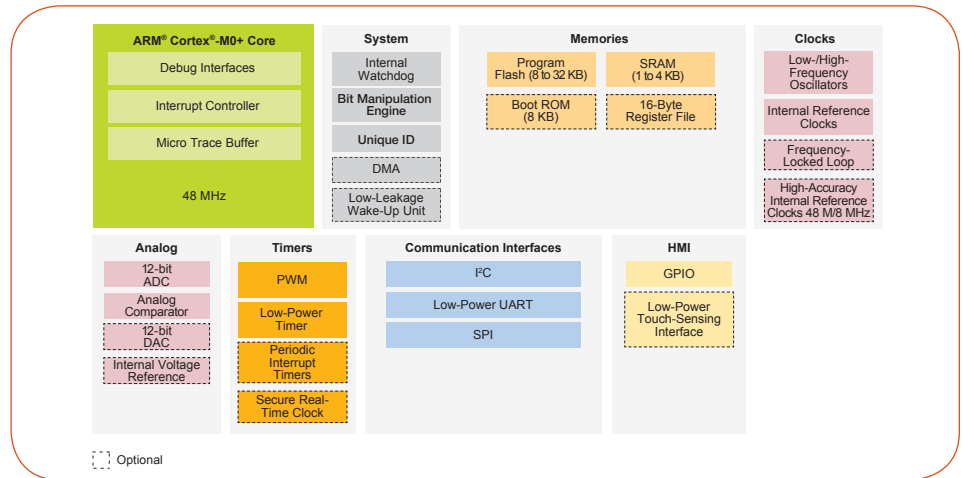
## HMI

- ▶ Capacitive touch sense interface supports up to 16 external electrodes and DMA data transfer
- ▶ GPIO with pin interrupt support, DMA request capability and other pin control options

## Connectivity and communications

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

## KINETIS KL0x MCU FAMILY BLOCK DIAGRAM



## SOFTWARE AND TOOLS

- ▶ Kinetis Design Studio Integrated Development Environment (IDE)
- ▶ CodeWarrior® for MCUs V10.x (Eclipse) IDE with Processor Expert® software configuration tool
- ▶ IAR Embedded Workbench®, ARM Keil® MDX, Atollic®, GCC
- ▶ FreeRTOS™
- ▶ Full ARM ecosystem support
- ▶ Online enablement with ARM mbed™ development platform



## Freedom development platform

The Freedom development platform is a small, low-power, cost-effective evaluation

and development system perfect for quick application prototyping and demonstration of Kinetis MCU families. The platform offers an easy-to-use mass-storage device mode flash programmer, a virtual serial port and classic programming and run control capabilities.

- ▶ Low cost (<\$20 USD MSRP)
- ▶ Designed in an industry-standard compact form factor
- ▶ Easy access to the MCU I/O pins
- ▶ Integrated open standard serial and debug interface (OpenSDA)
- ▶ Compatible with a rich set of third-party expansion boards

Learn more at [www.nxp.com/Freedom](http://www.nxp.com/Freedom).

## KINETIS KL0x MCU FAMILY OPTIONS

Sub-Family	Part Number	CPU (MHz)	Memory			Features										Package						Freedom Hardware				
			Flash (KB)	SRAM (KB)	Boot ROM (KB)	DMA	UART	SPI	I <sup>2</sup> C	TSI	RTC	LLWU	12-bit DAC	12-bit ADC	VREF	Total I/Os	Other	16 QFN (3 x 3, 0.5 mm)	20 WLCSP (< 2 x 2, 0.4 mm)	24 QFN (4 x 4, 0.5 mm)	32 LQFP (7 x 7, 0.8 mm)		32 QFN (5 x 5, 0.5 mm)	48 LQFP (7 x 7, 0.5 mm)		
KL02	MKL02Z8xxx4	48 MHz	8	1			1	1	2							√	14~28		√							FRDM-KL02Z
	MKL02Z16xxx4	48 MHz	16	2			1	1	2							√	14~28		√				√			FRDM-KL02Z
	MKL02Z32xxx4	48 MHz	32	4			1	1	2							√	14~28		√	√			√			FRDM-KL02Z
KL03	MKL03Z8xxx4	48 MHz	8	2	8		1	1	1		√	√*		√	√		14~22		√		√					FRDM-KL03Z
	MKL03Z16xxx4	48 MHz	16	2	8		1	1	1		√	√*		√	√		14~22		√		√					FRDM-KL03Z
	MKL03Z32xxx4	48 MHz	32	2	8		1	1	1		√	√*		√	√		14~22		√	√	√					FRDM-KL03Z
KL04	MKL04Z8xxx4	48 MHz	8	1		√	1	1	1		√	√		√			22~28				√	√				FRDM-KL05Z
	MKL04Z16xxx4	48 MHz	16	2		√	1	1	1		√	√		√			22~41				√	√	√	√		FRDM-KL05Z
	MKL04Z32xxx4	48 MHz	32	4		√	1	1	1		√	√		√			22~41				√	√	√	√		FRDM-KL05Z
KL05	MKL05Z8xxx4	48 MHz	8	1		√	1	1	1		√	√	√	√			22~28				√	√	√			FRDM-KL05Z
	MKL05Z16xxx4	48 MHz	16	2		√	1	1	1		√	√	√	√			22~41				√	√	√	√		FRDM-KL05Z
	MKL05Z32xxx4	48 MHz	32	4		√	1	1	1		√	√	√	√			22~41				√	√	√	√		FRDM-KL05Z

\*Low-power wakeup pin only

