



Ultra-low-power,
entry-level MCUs

Kinetis KL1x MCU Family

The Kinetis KL1x family of MCUs based on the ARM® Cortex®-M0+ core combine ultra-low-power performance with a rich suite of analog, communication, timing and control peripherals.

TARGET APPLICATIONS

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

Family members start from 32 KB of flash in a small 3.5 x 3.5 mm² 36XFBGA package, extending up to 256 KB in an 80 LQFP package. The KL1x MCU family is compatible with the ARM Cortex-M4 based Kinetis K10 MCU family, offering a migration path to higher performance and feature integration.

FEATURES

Ultra-Low-Power

- ▶ Next-generation 32-bit ARM Cortex-M0+ core. Two times more CoreMark®/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 new compute mode that reduces dynamic power by placing peripherals in an asynchronous stop mode
- ▶ LPUART, SPI, I²C, Flex™ I/O, 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
- ▶ Up to 16 KB ROM with integrated bootloader

- ▶ Security circuitry to prevent unauthorized access to RAM and flash contents

Performance

- ▶ ARM 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
- ▶ Thumb® instruction set combines high code density with 32-bit performance
- ▶ Up to 4-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

- ▶ Up to 16-bit ADC with configurable resolution, sample time and conversion speed/power. Integrated temperature sensor. Single or differential input mode operation for improved noise rejection.
- ▶ High-speed comparator with internal 6-bit DAC



- ▶ 12-bit DAC with DMA support
- ▶ 1.2 V high-accuracy internal voltage reference

Timing and Control

- ▶ One 6-channel and two 2-channel, 16-bit low-power timer PWM modules with DMA support
- ▶ 2-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 for VLLS0
- ▶ Real-time clock

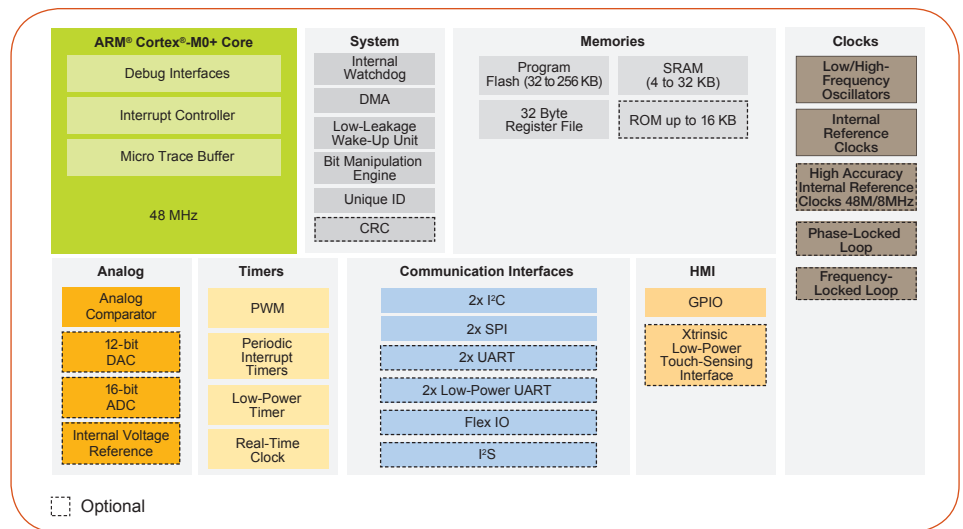
HMI

- ▶ 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

- ▶ I²C with DMA support, up to 1Mb/s and compatible with SMBus V2 features
- ▶ Three UART with up to two LPUART, and DMA support

KINETIS KL1x MCU FAMILY BLOCK DIAGRAM



- ▶ Two SPIs with DMA support
- ▶ I²S module for audio applications
- ▶ Flex I/O with capability of emulating multiple serial interface, such as IrDA, UART, SPI, I²C, etc.
- ▶ Integrated development environment (IDE)
 - Kinetis Design Studio IDE
 - CodeWarrior for Microcontrollers V10.x (Eclipse) IDE with Processor Expert software modeling tool
 - IAR Embedded Workbench®, Keil® MDK, Atollic® TrueSTUDIO®
- ▶ Runtime software and RTOS
 - MQX™ Lite, FreeRTOS, CodeSourcery G++ (GNU)
- ▶ Full ARM ecosystem support

Software and Tools

- ▶ Freedom Development Platforms and Tower System modules
- ▶ Kinetis Software Development Kit (SDK)

KINETIS KL1x MCU FAMILY OPTIONS

Sub-Family	Part Number	CPU (MHz)	Memory		Features											Package								
			Flash (KB)	SRAM (KB)	DMA	Low-Power UART	UART	UART w/ ISO7816	SPI	I ² C	TSI	I ² S	Flex I/O	RTC	12-bit DAC	16-bit ADC w/ DP Ch.	12-bit ADC	Total I/Os	FM 32 QFN (5 x 5, 0.5 mm)	DA 36X FBGA (3.5 x 3.5, 0.5 mm)	AD 35 WLCSP (2.5 x 3.0, 0.4 mm)	FT 48 QFN (7 x 7, 0.5 mm)	LH 64 LOFP (10 x 10, 0.5 mm)	LK 80 LOFP (12 x 12, 0.5 mm)
KL13	MKL13Z32xxx4	48 MHz	32	4	√	2	1	1	2	2		√	√	√	√		28-70	*			*	√	√	
	MKL13Z64xxx4	48 MHz	64	8	√	2	1	1	2	2		√	√	√	√		28-70	*			*	√	√	
KL14	MKL14Z32xxx4	48 MHz	32	4	√	1	2		2	2			√			√	28-70	√			√	√	√	
	MKL14Z64xxx4	48 MHz	64	8	√	1	2		2	2			√			√	28-70	√			√	√	√	
KL15	MKL15Z32xxx4	48 MHz	32	4	√	1	2		2	2	√		√	√	√		28-70	√			√	√	√	
	MKL15Z64xxx4	48 MHz	64	8	√	1	2		2	2	√		√	√	√		28-70	√			√	√	√	
	MKL15Z128xxx4	48 MHz	128	16	√	1	2		2	2	√		√	√	√		28-70	√	√		√	√	√	
KL16	MKL16Z32xxx4	48 MHz	32	4	√	1	2		2	2	√	√		√	√	√	28-54	√			√	√		
	MKL16Z64xxx4	48 MHz	64	8	√	1	2		2	2	√	√		√	√	√	28-54	√			√	√		
	MKL16Z128xxx4	48 MHz	128	16	√	1	2		2	2	√	√		√	√	√	28-54	√			√	√		
	MKL16Z256xxx4	48 MHz	256	32	√	1	2		2	2	√	√		√	√	√	54				√			√
KL17	MKL17Z128xxx4	48 MHz	128	32	√	2	1	1	2	2		√	√	√	√	√	28-54	√			√	√		√
	MKL17Z256xxx4	48 MHz	256	32	√	2	1	1	2	2		√	√	√	√	√	28-54	√			√	√		√
	MKL17Z32xxx4	48MHz	32	8	√	2	1	1	2	2		√	√	√	√		28-54	*	√		*	√		*
	MKL17Z64xxx4	48MHz	64	16	√	2	1	1	2	2		√	√	√	√		28-54	*	√		*	√		*

* This package is included in a Package Your Way program for Kinetis MCUs. Please visit www.nxp.com/KPYW for more detail.