Ultra-low-power, entry-level MCUs

Kinetis® KL1x MCU Family

The Kinetis KL1x family of MCUs based on the ARM® Cortex®-M0+ core combines 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 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 Cortex-M0+ core
  – Two times more CoreMarks®/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) that reduce 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 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

‣ 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
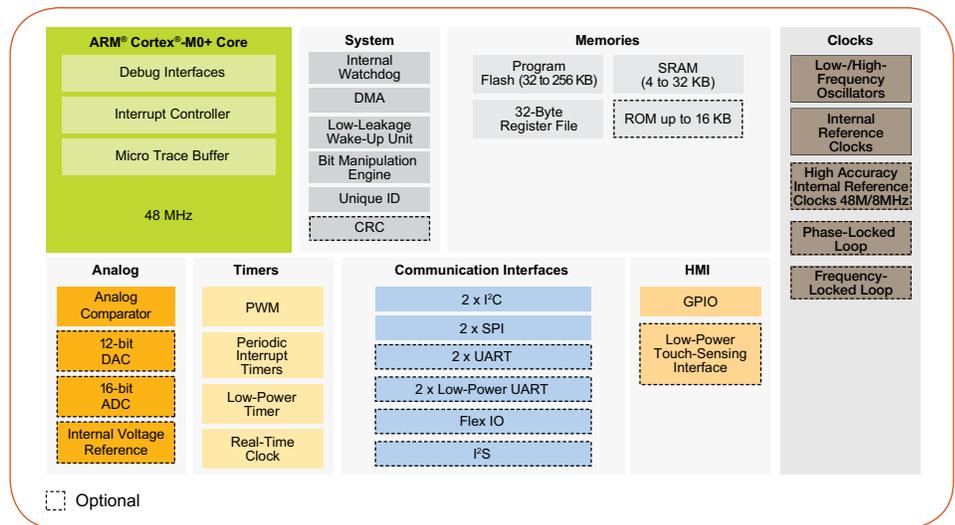- Low-power timer allows operation in all power modes except for VLLS0
- Real-time clock

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 1Mbit/s and compatible with SMBus V2 features

KINETIS KL1x MCU FAMILY BLOCK DIAGRAM

ARM® Cortex®-M0+ Core
- Debug Interfaces
- Interrupt Controller
- Micro Trace Buffer
- 48 MHz

System
- Internal Watchdog
- DMA
- Low-Leakage Wake-Up Unit
- Bit Manipulation Engine
- Unique ID
- CRC

Memories
- Program Flash (32 to 256 KB)
- SRAM (4 to 32 KB)
- 32-Byte Register File
- ROM up to 16 KB

Clocks
- Low-/High-Frequency Oscillators
- Internal Reference Clocks
- High Accuracy Internal Reference Clocks 48M/8MHz
- Phase-Locked Loop
- Frequency-Locked Loop

Analog
- Analog Comparator
- 12-bit DAC
- 16-bit ADC
- Internal Voltage Reference

Timers
- PWM
- Periodic Interrupt Timers
- Low-Power Timer
- Real-Time Clock

Communication Interfaces
- 2 x I²C
- 2 x SPI
- 2 x UART
- 2 x Low-Power UART
- Flex IO
- I²S

HMI
- GPIO
- Low-Power Touch-Sensing Interface

☐ Optional

- Three UART with up to two LPUART, and DMA support
- 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.

Software and tools

- Freedom development platforms and Tower System boards

- Kinetis Software Development Kit (SDK)
- 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
  - FreeRTOS™
- Full ARM ecosystem support

KINETIS KL1x MCU FAMILY OPTIONS

Sub-Family	Part Number	CPU (MHz)	Flash (KB)	SRAM (KB)	DMA	Low-Power UART	UART	UART w/ ISO7816	SPI	I²C	TSI	I²S	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 LQFP (10 x 10, 0.5 mm)	LK 80 LQFP (12 x 12, 0.5 mm)	MP 64 MAPBGA (5 x 5, 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.

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