



**THE DATASHEET OF  
MKL16Z32VLH4**





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 mm<sup>2</sup> 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, I<sup>2</sup>C, 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

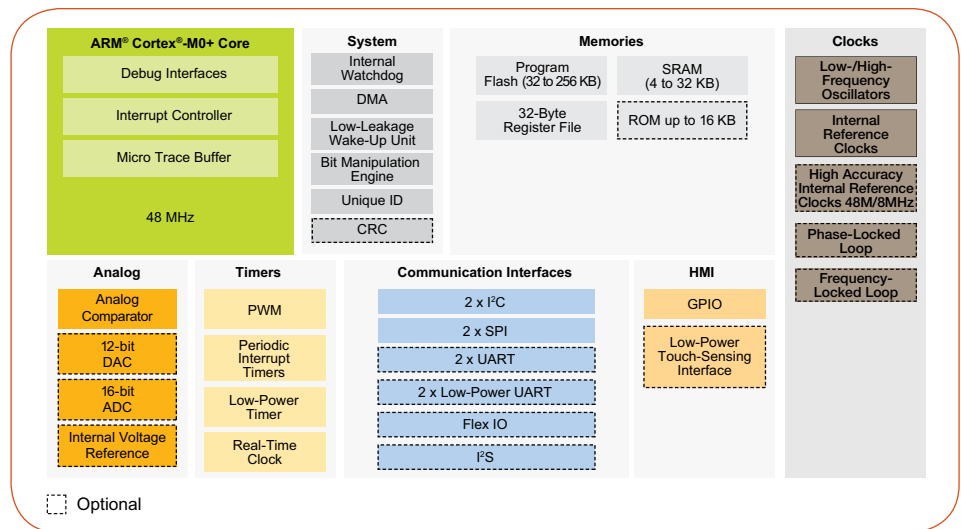
### HMI

- ▶ 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

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

## KINETIS KL1x MCU FAMILY BLOCK DIAGRAM



- ▶ Three UART with up to two LPUART, and DMA support
- ▶ Two SPIs with DMA support
- ▶ I<sup>2</sup>S module for audio applications
- ▶ Flex I/O with capability of emulating multiple serial interface, such as IrDA, UART, SPI, I<sup>2</sup>C, etc.
- ▶ 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

### Software and tools

- ▶ Freedom development platforms and Tower System boards

## 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 <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	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							√	√			√	√	√	
	MKL14Z64xxx4	48 MHz	64	8	√	1	2		2	2							√	√			√	√	√	
KL15	MKL15Z32xxx4	48 MHz	32	4	√	1	2		2	2	√			√	√	√	√	√			√	√	√	√
	MKL15Z64xxx4	48 MHz	64	8	√	1	2		2	2	√			√	√	√	√	√			√	√	√	√
	MKL15Z128xxx4	48 MHz	128	16	√	1	2		2	2	√			√	√	√	√	√	√		√	√	√	√
KL16	MKL16Z32xxx4	48 MHz	32	4	√	1	2		2	2	√	√		√	√	√	√	√			√	√	√	
	MKL16Z64xxx4	48 MHz	64	8	√	1	2		2	2	√	√		√	√	√	√	√			√	√	√	
	MKL16Z128xxx4	48 MHz	128	16	√	1	2		2	2	√	√		√	√	√	√	√			√	√	√	
	MKL16Z256xxx4	48 MHz	256	32	√	1	2		2	2	√	√		√	√	√	√	√			√	√	√	√
KL17	MKL17Z128xxx4	48 MHz	128	32	√	2	1	1	2	2	√	√	√	√	√	√	√	√			√	√	√	√
	MKL17Z256xxx4	48 MHz	256	32	√	2	1	1	2	2	√	√	√	√	√	√	√	√			√	√	√	√
	MKL17Z32xxx4	48MHz	32	8	√	2	1	1	2	2		√	√		√	√	√	√			*	√		*
	MKL17Z64xxx4	48MHz	64	16	√	2	1	1	2	2		√	√		√	√	√	√			*	√		*

\* This package is included in a Package Your Way program for Kinetis MCUs. Please visit [www.nxp.com/KPYW](http://www.nxp.com/KPYW) for more detail.

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

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