Kinetis KL3x – General-Purpose Ultra-Low-Power MCUs
Up to 256 KB Flash and 32 KB SRAM

1. Kinetis L family introduction

Kinetis L series microcontrollers (MCUs) combine the exceptional low-power performance with energy efficiency and ease of use of the new ARM® Cortex®-M0+ processor with the performance, peripheral sets, enablement, and scalability of the Kinetis 32-bit MCU portfolio.

The Kinetis ultra-low-power L series frees power-critical designs from 8- and 16-bit MCU limitations by combining excellent dynamic and stop currents with superior processing performance, a broad selection of on-chip Flash memory densities, and extensive analog, connectivity, and HMI peripheral options.

Kinetis ultra-low-power L series MCUs are also hardware- and software-compatible with the ARM Cortex-M4-based Kinetis K series, providing a scalable migration path for higher performance, memory, and feature integration.

Contents

2. Kinetis KL3x subfamily overview

The Kinetis KL3x ultra low power MCU family adds a segment LCD controller in addition to the Kinetis KL1x series. The Kinetis KL3x MCU family is also compatible with the Kinetis K30 MCU family (based on the ARM® Cortex®-M4 processor), and with all other Kinetis KL1x, KL2x, and KL4x series MCUs, providing a migration path to lower and higher performance and feature integration.

- KL33 – New member of KL3x, with up to 256KB flash and 32KB SRAM, featuring ROM boot loader, FlexIO, ISO7816 and, 16-bit ADC, 12-bit DAC,and high accuracy internal VREF.

- KL34 – General purpose MCU with segment LCD, featuring market leading ultra low power to provide developers an appropriate entry-level 32-bit solution.

- KL36 – Expansion from the KL34 with up to 256 KB Flash and 32 KB SRAM, with the addition of 16-bit ADC, 12-bit DAC, I2S, and TSI

3. Kinetis KL3x family key features

- Ultra-low-power 48 MHz devices supported with base line functions, up to 256 KB of Flash, and 32 KB of RAM.

- The asynchronous DMA allows for energy-saving peripherals; for example, ADC, UART, and Timer / PWM, to trigger asynchronous DMA request in the STOP / VLPS modes to perform DMA transfer and return to current power mode with no CPU intervention.

- Segment LCD controller is available under all power mode (except VLLS0).

- The LPUART supports asynchronous transmit and receive operations to the bus clock, supporting communication down to the STOP / VLPS modes. Configurable receiver baud rate oversampling ratio from $4\times$ to $32\times$, allowing for higher baud rates with lower clock sources.

- The SPI supports slave mode address match wakeup function and first message capture down to the STOP / VLPS modes.

- The I^{2}C supports multiple address match wakeup function down to the STOP / VLPS modes.

- The FlexIO is capable of emulating multiple serial interfaces, for example, UART, SPI, I^{2}C, IrDA, and is fully-functional under the STOP / VLPS modes.

- The LPTPM supports 16-bit timer input capture, output compare, and PWM functions, down to the STOP / VLPS modes.

- The LPTMR supports 16-bit timer and pulse counter functions in all power modes.

- The RTC supports 32-bit second counter with second interrupt and programmable alarm in all power modes with included temperature and voltage compensation.

- The ADC supports single conversions in multiple result registers down to the STOP / VLPS modes with hardware averaging and automatic compare modes.

- The CMP supports threshold crossing detection in all power modes (except VLLS0) along with a triggered compare mode for lower average power compares.

- The DAC and VREF support static reference in all power modes (except VLLS0).

- The TSI supports wake-on capacitive touch on single channel in all power modes.

- The LLWU supports eight wakeup pins, RESET and NMI wakeup pins, and energy-saving peripherals in the LLS and VLLSx modes.

- Outstanding low-power operation with core mark currents down to 100 μA / MHz, state retention stop mode down to 1.83 μA, with 7.5 μS wakeup time, and lowest power mode down to 95 nA.

- Highly reliable, fast-access Flash memory with four levels of protection for code security / protection.

- Faster time to market with comprehensive enablement solutions, including SDK (drivers, libraries, stacks), IDE, boot-loader, RTOS, online community, and more.

4. Kinetis KL3x family feature summary

Table 1.   Family feature summary

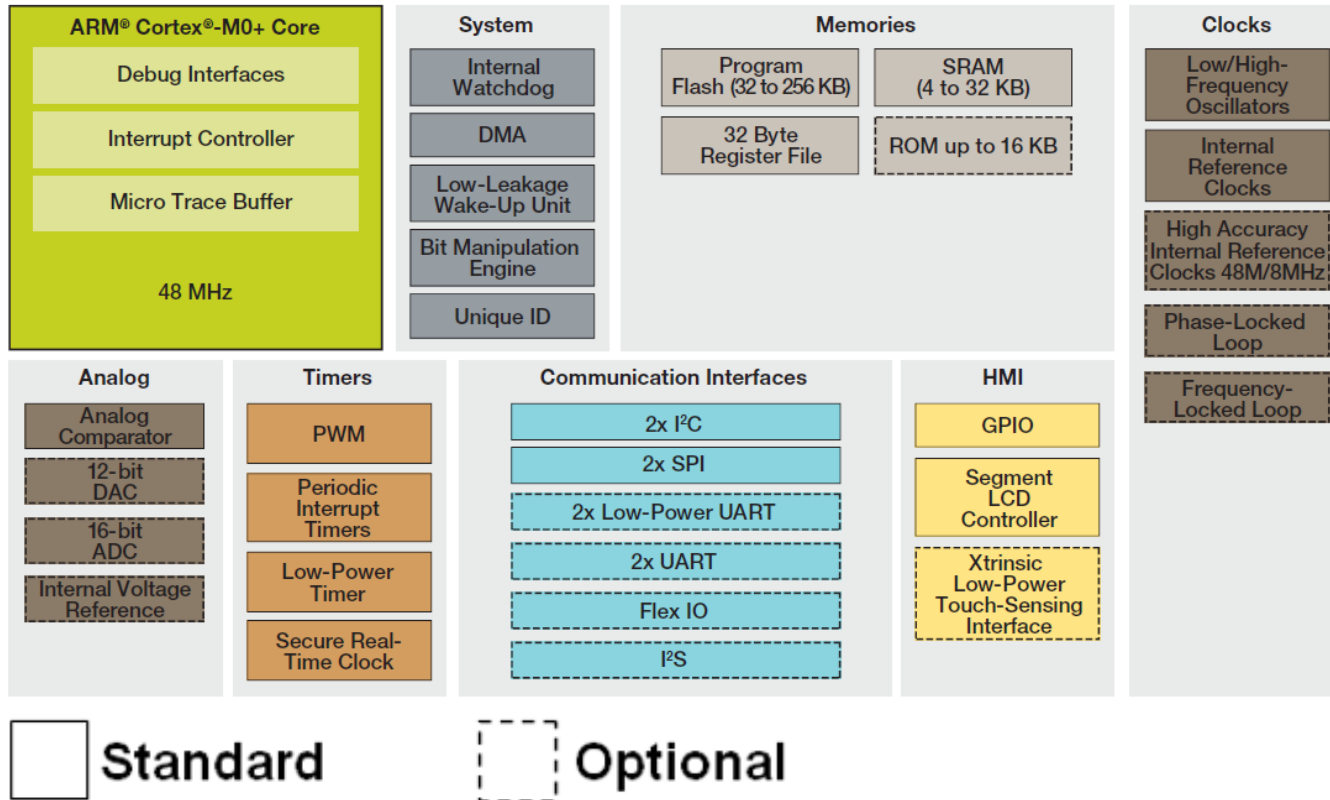| Sub-Family	KL33	KL34	KL36
CPU Frequency	48MHz	48MHz	48MHz
Flash Memory	32-256KB	64KB	32-256KB
SRAM	4-32KB	8KB	4-32KB
ROM Bootloader	Yes	-	-
Segment LCD	40x8/42x6/44x4 - 20x8/22x6/24x4	51x8/55x4 - 28x8/32x4	51x8/55x4 - 28x8/32x4
Analog	16bit ADC, 12bitDAC, CMP, VREF	12bit ADC, CMP	16bit ADC, 12bit DAC, CMP
Connectivity	UART w/ ISO7816, LPUART,SPI, I2C, I2S, FlexIO	UART,LPUART, SPI, I2C	UART,LPUART, SPI, I2C I2S
Package Options	48QFN, 64LQFP, 64MAPBGA, 80LQFP	64LQFP, 100LQFP	64LQFP, 64MAPBGA, 100LQFP, 121MAPBGA

5. Kinetis KL3x family block diagram

Figure 1. Kinetis KL3x family block diagram

6. KL3x family common features

The following features are present on all KL3x MCUs:

- 48 MHz Cortex-CM0+
- 2-pin serial wire debug (SWD), micro trace buffer (MTB)
- 4-channel DMA controller
- Integrated bit manipulation engine (BME)
- 64-Byte cache and 32-Byte register file
- 1 ×6-channel and 2 ×2-channel LPTPM
- Low- and high-frequency OSC
- RTC (32 KHz OSC)
- 1 ×low-power timer, 1 ×2-channel PIT
- High-speed analog comparator containing a 6-bit DAC for programmable reference input

- Power management controller (PMC) with nine power modes

- Non-maskable interrupt (NMI)

- Software and COP watchdog

- 80-bit unique identification number per chip

- Voltage range 1.71 V – 3.6 V

- Temperature range (T_A) -40ºC – 105ºC

7. Kinetis KL3x family differences

Table 2. Family differences

Subfamily		KL33	KL34	KL36
CPU frequency		48MHz	48MHz	48MHz
Memory	Flash / SRAM Size	32KB/4KB - 256KB/32KB	32KB/4KB - 64KB/8KB	32KB/4KB - 256KB/32KB
	Boot ROM	Yes	-	-
Communication Interface	LPUART	2	1	1
	UART	-	2	2
	UART w/ ISO7816	1	-	-
	SPI	2	2	2
	I2C	2[1]	2	2
	I2S	Optional[2]	-	1
	FlexIO	Yes	-	-
Analog Modules	ADC	16-bit	12-bit	16-bit
	ADC channels (SE / DE)	17/3 - 20/4	20/0	20/4
	DAC	12-bit	-	12-bit
	VREF	Yes	-	-
Other Modules	CRC	Optional[3]	-	-
	Segment LCD	40x8/42x6/44x4 - 20x8/22x6/24x4	51x8/55x4 - 28x8/32x4	51x8/55x4 - 28x8/32x4
	TSI	-	-	16ch
	Total GPIOs	40-70	54-84	54-84

	MCG	High Accuracy 48M IRC, 8M/2M IRC	4M/32KHz IRC PLL/FLL	4M/32KHz IRC PLL/FLL
Package Options		48QFN, 64LQFP, 64MAPBGA, 80LQFP	64LQFP, 100LQFP	64LQFP, 64MAPBGA, 100LQFP, 121MAPBGA

[1]Support 1M bps
[2]I2S is only available in 128KB and 256KB flash KL33
[3]CRC is only available in 32KB and 64KB flash KL33

8. Comprehensive enablement solutions

8.1. Kinetis Software Development Kit (SDK)

- Extensive suite of robust peripheral drivers, stacks, and middleware.

- Includes software examples demonstrating the usage of HAL, peripheral drivers, middleware, and RTOSes.

- Operating system abstraction (OSA) for Freescale MQX™ Lite RTOS, FreeRTOS, and Micrium uC / OS kernels and bare-metal (no RTOS) applications.

8.2. Processor Expert

- Free software generation tool for device drivers / start-up code

- Seven steps from project creation to debug – dramatically reduces development time

- Available within Kinetis Design Studio or as a standalone plug-in for IAR/Keil/GNU IDEs

8.3. Integrated development environments (IDE)

- Freescale Kinetis Design Studio IDE
    - No-cost integrated development environment (IDE) for Kinetis MCUs
    - Eclipse and GCC-based IDE for C / C++ editing, compiling, and debugging
- IAR Embedded Workbench®   iar.com/kinetis
- ARM Keil® Microcontroller Development Kit   keil.com/freescale
- Atollic® TrueSTUDIO®   atollic.com/index.php/partnerfreescale
- Green Hills Software MULTI   ghs.com/products/kinetis.html
- Broad ARM ecosystem support through Freescale Connect partners

Kinetis KL3x – General-Purpose Ultra-Low-Power MCUs Product Brief Rev. 0 04/2015

8.4. Online enablement with ARM mbed™ development platform

- Rapid and easy Kinetis MCU prototyping and development
- Online mbed SDK, developer community
- Free software libraries

8.5. Freescale MQX™ Lite RTOS

- Free, light-weight MQX kernel customised for small resource MCUs
- Packaged as a Processor Expert component
- Upwards compatible with MQX RTOS

8.6. Boot-loader

- Common boot-loader for all Kinetis MCUs
- In-system Flash programming over a serial connection: erase, program, verify
- ROM- or Flash-based boot-loader with open-source software and host-side programming utilities

8.7. Development hardware

- Tower System modular development platform
  - Modular and Expandable
  - Rapid prototyping and evaluation
  - Cost Effective
- Freescale Freedom development platforms
  - Low cost (< $ 15 USD)
  - Designed in an industry-standard compact form factor
  - Integrated open-standard serial and debug interface (OpenSDA)
  - Compatible with a rich-set of third-party expansion boards

9. Part identification

9.1. Description

The chip part numbers have fields that identify the specific part. You can use the values of these fields to determine the specific part you have received.

9.2. Format

The device part numbers have the following format: Q KL## A FFF T PP CC (N)

9.3. Fields

The following table lists the possible values for each field in the part number (not all combinations are valid).

Table 3.   Part number field descriptions

Field	Description	Values
Q	Qualification status	M = Fully-qualified, general market flow P = Prequalification
KL##	Kinetis family	KL33 KL34 KL36
A	Key attribute	Z = Cortex-M0+
FFF	Program Flash memory size	32 = 32 KB 64 = 64 KB 128 = 128 KB 256 = 256 KB
R	Silicon revision	(Blank) = Main A = Revision after main
T	Temperature range	V = -40ºC – 105ºC
PP	Package identifier	FM = 32QFN (5 mm × 5 mm × 0.65 mm, Pitch 0.5mm) FT = 48QFN (7 mm × 7 mm × 0.65mm, Pitch 0.5mm) LH = 64LQFP (10 mm × 10 mm × 1.4mm, Pitch 0.5mm) MP = 64MAPBGA (5 mm × 5 mm × 1.5mm, Pitch 0.5mm) LK = 80LQFP (12 mm × 12 mm × 1.6mm, Pitch 0.5mm) LL = 100LQFP (14 mm x 14 mm × 1.7mm, Pitch 0.5mm) MC = 121MAPBGA (8 mm x 8 mm × 1.5mm, Pitch 0.65mm)
CC	Maximum CPU frequency (MHz)	4 = 48 MHz
N	Packaging type	R = Tape and reel (Blank) = Trays

10. Orderable part numbers

Table 4.   Ordering information

Product	Memory		Package		HMI and ADC Channel			
MC Part number	Flash (KB)	SRAM (KB)	Pin Count	Package	GPIOs	GPIOs (INT/HD)[1]	LCD Segments	ADC channels (SE/DP)
MKL33Z32VFT4	32	4	48	QFN[2]	40	40/4	20x8/22x6/24x4	17/3

Kinetis KL3x – General-Purpose Ultra-Low-Power MCUs Product Brief Rev. 0 04/2015

Product	Memory		Package		HMI and ADC Channel			
MC Part number	Flash (KB)	SRAM (KB)	Pin Count	Package	GPIOs	GPIOs (INT/HD)[1]	LCD Segments	ADC channels (SE/DP)
MKL33Z32VLH4	32	4	64	LQFP	54	54/4	28x8/30x6/32x4	20/4
MKL33Z32VMP4	32	4	64	MAPBGA[2]	54	54/4	28x8/30x6/32x4	20/4
MKL33Z32VLK4	32	4	80	LQFP	70	70/4	40x8/42x6/44x4	20/4
MKL33Z64VFT4	64	8	48	QFN[2]	40	40/4	20x8/22x6/24x4	17/3
MKL33Z64VLH4	64	8	64	LQFP	54	54/4	28x8/30x6/32x4	20/4
MKL33Z64VMP4	64	8	64	MAPBGA[2]	54	54/4	28x8/30x6/32x4	20/4
MKL33Z64VLK4	64	8	80	LQFP	70	70/4	40x8/42x6/44x4	20/4
MKL33Z128VLH4	128	16	64	LQFP	54	31/6	28x8/32x4	20/4
MKL33Z128VMP4	128	16	64	MAPBGA	54	31/6	28x8/32x4	20/4
MKL33Z256VLH4	256	32	64	LQFP	54	31/6	28x8/32x4	20/4
MKL33Z256VMP4	256	32	64	MAPBGA	54	31/6	28x8/32x4	20/4
MKL34Z64VLH4	64	8	64	LQFP	54	31/4	28x8/32x4	20/0
MKL34Z64VLL4	64	8	100	LQFP	84	46/4	51x8/55x4	20/0
MKL36Z64VLH4	64	8	64	LQFP	54	31/4	28x8/32x4	20/4
MKL36Z64VLL4	64	8	100	LQFP	84	46/4	51x8/55x4	20/4
MKL36Z128VLH4	128	16	64	LQFP	54	31/4	28x8/32x4	20/4
MKL36Z128VLL4	128	16	100	LQFP	84	46/4	51x8/55x4	20/4
MKL36Z128VMC4	128	16	121	MAPBGA	84	46/4	51x8/55x4	20/4
MKL36Z256VLH4	256	32	64	LQFP	54	31/4	28x8/32x4	20/4
MKL36Z256VLL4	256	32	100	LQFP	84	46/4	51x8/55x4	20/4
MKL36Z256VMC4	256	32	121	MAPBGA	84	46/4	51x8/55x4	20/4
MKL36Z256VMP4	256	32	64	MAPBGA	54	31/4	28x8/32x4	20/4

[1] INT: interrupt pin numbers; HD: high drive pin numbers
[2] This package is included in a Package Your Way program for Kinetis MCUs. Please visit Freescale.com/KPYW for more detail.

Table 5. Revision history

Revision	Substantial changes
0	Initial release