32-bit MCUs

Kinetis K20 Family
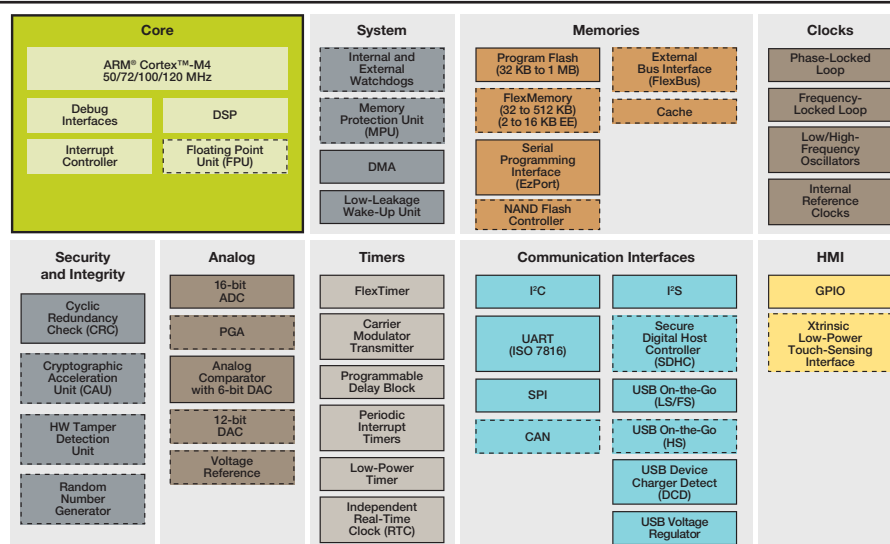
Low-power MCUs with USB On-The-Go

Target Applications

- Barcode scanners
- Portable media players
- Printers
- Programmable logic controllers

Overview

The Kinetis MCU portfolio consists of multiple pin-, peripheral- and software-compatible MCU families based on the ARM® Cortex™-M4 core. Families are built from innovative 90 nm thin-film storage (TFS) flash technology with unique FlexMemory (EEPROM) capability, and offer industry-leading low-power and mixed-signal analog integration.

The K20 MCU family is pin, peripheral and software compatible the K10 MCU family and adds Full- and High-Speed USB 2.0 On-The-Go with device charger detect capability. Devices start from 32 KB of flash in 5 x 5 mm 32 QFN packages extending up to 1 MB in a 144 MAPBGA package with a rich suite of analog, communication, timing and control peripherals. High memory density K20 family devices include a single precision floating point unit and NAND flash controller.

Kinetis K20 Family

Core	System	Memories	Clocks
ARM® Cortex™-M4 50/72/100/120 MHz	Internal and External Watchdogs	Program Flash (32 KB to 1 MB) / External Bus Interface (FlexBus)	Phase-Locked Loop
Debug Interfaces / DSP	Memory Protection Unit (MPU)	FlexMemory (32 to 512 KB) (2 to 16 KB EE) / Cache	Frequency-Locked Loop
Interrupt Controller / Floating Point Unit (FPU)	DMA	Serial Programming Interface (EzPort)	Low/High-Frequency Oscillators
	Low-Leakage Wake-Up Unit	NAND Flash Controller	Internal Reference Clocks

Security and Integrity	Analog	Timers	Communication Interfaces	HMI
Cyclic Redundancy Check (CRC)	16-bit ADC	FlexTimer	I²C / I²S	GPIO
Cryptographic Acceleration Unit (CAU)	PGA	Carrier Modulator Transmitter	UART (ISO 7816) / Secure Digital Host Controller (SDHC)	Xtrinsic Low-Power Touch-Sensing Interface
HW Tamper Detection Unit	Analog Comparator with 6-bit DAC	Programmable Delay Block	SPI / USB On-the-Go (LS/FS)	
Random Number Generator	12-bit DAC	Periodic Interrupt Timers	CAN / USB On-the-Go (HS)	
	Voltage Reference	Low-Power Timer	USB Device Charger Detect (DCD)	
		Independent Real-Time Clock (RTC)	USB Voltage Regulator	

☐ Standard Feature   ⬚ Optional Feature

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One-Stop Enablement Offering—MCU + IDE + RTOS

Freescale Tower System hardware development environment:

- Integrated development environments
  - Eclipse-based CodeWarrior V10.x IDE and Processor Expert
  - IAR Embedded Workbench
  - Keil MDK
  - CodeSourcery Sourcery G++ (GNU)
- Runtime software and RTOS
  - Math, DSP and encryption libraries
  - Motor control libraries
  - Complimentary bootloaders (USB, Ethernet, RF, serial)
  - Complimentary Freescale embedded GUI
  - Complimentary Freescale MQX™
  - Cost-effective Nano™ SSL/Nano™ SSH for Freescale MQX RTOS
  - Micrium uC/OS-III
  - Express Logic ThreadX
  - SEGGER embOS
  - freeRTOS
  - Mocana (security)
- Full ARM ecosystem

Features and Benefits

Features	Benefits
• ARM® Cortex™-M4 core with DSP instruction support and optional single precision floating point unit • Up to 32-channel DMA. Up to 16 KB of cache. Cross bar switch	• Up to 120 MHz core supporting a broad range of processing bandwidth needs • Peripheral and memory servicing with reduced CPU loading. Optimized bus bandwidth and flash execution performance. Concurrent multi-master bus accesses for increased bus bandwidth
• USB On-The-Go (Full- and High-Speed) with device charger detect	• Optimized charging current/time for portable USB devices, enabling longer battery life. USB low-voltage regulator supplies up to 120 mA off chip at 3.3 V to power external components from 5 V input
• Memory protection unit • Hardware cyclic redundancy check engine • Independent-clocked COP. External watchdog monitor • Cryptographic acceleration unit (CAU)* • Hardware tamper detection unit* • Random number generator*	• Provides memory protection for all cross bar switch masters, increasing software reliability • Validates memory contents and communication data, increasing system reliability • Prevents code runaway in fail-safe applications. Drives output pin to safe state external components if watchdog event occurs • Secure data transfer and storage. Faster than software implementations and with minimal CPU loading. Supports a wide variety of algorithms: DES, 3DES, AES, MDS, SHA-1, SHA-256 • Secure key storage with internal/external tamper detect for unsecured flash, temperature/clock/supply voltage variations and physical attack
• Up to four FlexTimers with up to 20 channels • Carrier modulator transmitter • 4-channel, 32-bit periodic interrupt	• General-purpose timers with hardware dead-time insertion and quadrature decoding for motor control • Infrared waveform generation for remote control applications • Time base generation for RTOS task scheduler or trigger source for ADC conversion and programmable delay block
• FlexBus external bus interface • Secure digital host controller • NAND flash controller	• Enables the connection of external memories and peripherals (e.g., graphics displays) • Connection to SD, SDIO, MMC or CE-ATA cards for in-application software upgrades, file systems or adding Wi-Fi® or Bluetooth® support • Supports up to 32-bit ECC current and future NAND types with minimal software overhead
• 32 KB–1 MB flash. Up to 128 KB of SRAM • 32–512 KB FlexMemory	• High reliability, fast access program memory with 4-level security protection. Independent flash banks allow concurrent code execution and firmware updating • FlexMemory provides 32 byte–16 KB of user-segmentable byte write/erase EEPROM. 32–512 KB FlexNVM for extra program code, data or EEPROM backup
• Wafer level chip scale package (WLCSP)	• Maximize board space • 32-bit M4 performance in small package • Miniaturization of existing applications

*Optional

Freescale Development Tool Part Numbers

Tower Module Part Number	Kinetis Family Support	RSL Price	Extended H/W Support Options
FRDM-K20D50M	50 MHz MK10 and MK20	$18	802.11.x, Serial Connectivity, Analog, Sensors, Graphics LCD, Audio, Tower Dock (iPad®, iPhone®, iPod®), General I/O, 2.4GHz and Sub 1 GHz RF, Modules, Motor Control, Memory Modules etc.
TWR-K20D50M	50 MHz MK10 and MK20	$99	
TWR-K21D50M	50 MHz MK11, MK12, MK21 and MK22	$99	
TWR-K20D72M	72 MHz MK10 and MK20	$119	
TWR-K21F120M	120 MHz MK21 and MK22	$99	

Bundled kits with peripheral boards are available. For more information, visit **freescale.com/Tower**

K20 Family Options

Part Number	CPU (MHz)	Flash (KB)	Flex NVM (KB)	SRAM (KB)	I/D Cache (KB)	Single Precision Floating Point Unit	Memory Protection Unit	CAN	Secure Digital Host Controller	NAND Flash Controller	External Bus Interface	12-bit DAC	Prog. Gain Amplifier	5 V Tolerant I/O	Other	AB 120 WLCSP (5×5)	FM 32 QFN (5×5)	FT 48 QFN (7×7)	LF 48 LQFP (7×7)	MP 64 MAPBGA (5×5)	LH 64 LQFP (10×10)	LK 80 LQFP (12×12)	LL 100 LQFP (14×14)	MC 121 BGA (8×8)	LQ 144 LQFP (20×20)	MD 144 BGA (13×13)
MK20DN32Vyy5	50	32		8											USB OTG (FS)		√	√	√	√	√						
MK20DN64Vyy5	50	64		16											USB OTG (FS)		√	√	√	√	√						
MK20DN128Vyy5	50	128		16											USB OTG (FS)		√	√	√	√	√						
MK20DN512Vyy10	100	512		128			√	√	√		√	√	√	√	USB OTG (FS)							√	√	√	√	√
MK20FN1M0Vyy12	120	1 MB		128	8/8	√	√	√	√	√	√	√	√	√	USB OTG (FS/HS)										√	√
MK20DX32Vyy5	50	32	32	8											USB OTG (FS)		√	√	√	√	√						
MK20DX64Vyy5	50	64	32	16											USB OTG (FS)		√	√	√	√	√						
MK20DX128Vyy5	50	128	32	16											USB OTG (FS)		√	√	√	√	√						
MK20DX64Vyy7	72	64	32	16				√			√	√	√	√	USB OTG (FS)						√	√		√		
MK20DX128Vyy7	72	128	32	32				√			√	√	√	√	USB OTG (FS)						√	√	√	√		
MK20DX256Vyy7	72	256	32	64				√			√	√	√	√	USB OTG (FS)						√	√	√	√		
MK20DX128Vyy10	100	128	128	32			√	√	√		√	√	√	√	USB OTG (FS)										√	√
MK20DX256Vyy10	100	256	256	64			√	√	√		√	√	√	√	USB OTG (FS)							√	√	√	√	√
MK20FX512Vyy12	120	512	512	128	8/8	√	√	√	√	√	√	√	√	√	USB OTG (FS/HS)										√	√
MK20DN512Zyy10R	100	512		128			√	√	√		√	√	√	√	USB OTG (FS)	√										
MK20DN512ZCyy10R	100	512		128			√	√	√		√	√	√	√	USB OTG (FS)	√										
MK21DX128Vyy5(R)	50	128	64	32										√	USB OTG (FS), HW Encryption and Tamper Detect									√	√	
MK21DX256Vyy5(R)	50	256	64	32										√	USB OTG (FS), HW Encryption and Tamper Detect									√	√	
MK21DN512VLK5(R)	50	512		64										√	USB OTG (FS), HW Encryption and Tamper Detect									√	√	
MK22DX128Vyy5(R)	50	128	64	32										√	USB OTG (FS)							√		√	√	
MK22DX256Vyy5(R)	50	256	64	32										√	USB OTG (FS)							√		√	√	
MK22DN512VLH5(R)	50	512		64										√	USB OTG (FS)									√	√	
MK21FN1M0Vyy12	120	1MB		128		√	√	√	√		√	√		√	USB OTG (FS), HW Encryption and Tamper Detect								√		√	√
MK21FX512VLQ12	120	512	128	128		√	√	√	√		√	√		√	USB OTG (FS), HW Encryption and Tamper Detect								√		√	√
MK22FN1M0VLH12	120	1MB		128		√	√	√			√	√		√	USB OTG (FS)								√			
MK22FN1M0VLK12	120	1MB		128		√	√	√	√		√	√		√	USB OTG (FS)							√	√	√	√	√
MK22FX512VLH12	120	512	128	128		√	√	√			√	√		√	USB OTG (FS)								√			
MK22FX512VLK12	120	512	128	128		√	√	√	√		√	√		√	USB OTG (FS)							√	√	√	√	√

yy = package designator

For current information about Kinetis products and documentation, please visit freescale.com/Kinetis

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