Kinetis KE1xZ256 Highly Robust General-Purpose MCUs

256 KB internal flash, 32 KB SRAM, Serial Communication Ports, robust Touch Sense Input

1. Introduction

The Kinetis E family provides a highly scalable portfolio of robust 5-V MCUs, with cores ranging from 20-MHz ARM® Cortex®-M0+ to 160-MHz ARM Cortex-M4. With a power supply of 2.7~5.5 V and the focus on exceptional EMC/ESD robustness, the Kinetis E family is well-suited for a wide range of applications in harsh electrical environments, and is optimized for cost-sensitive applications. The Kinetis E family of MCUs offers a broad range of memory, peripheral, and package options.

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2. Kinetis KE1xZ256 Family Overview

The Kinetis KE1xZ256 MCUs are the most powerful MCUs from the KE1xZ family, based on the ARM Cortex-M0+ core. With up to 256 KB flash, 32 KB RAM, and a complete set of analog/digital features, the KE1xZ256 MCUs extend the Kinetis E family to a higher performance and a broader scalability. The robust TSI provides a high level of stability and accuracy to your HMI system. The 1-Msps ADC and FlexTimer modules provide a perfect solution for BLDC motor-control systems.

- KE14Z—a broad offering with mixed-signal integration, ADCs, DAC, ACMPs, and FlexTimers
- KE15Z—an expansion from the KE14Z family with an additional TSI module

3. Kinetis KE1xZ256 Family Key Features

- 72-MHz ARM Cortex-M0+ core for a broad range of processing bandwidth requirements, while maintaining excellent cost-effectiveness, easy-to-use packages, and a wide range of memory densities.
- Enhanced and robust I/Os for high performance, even in noisy environments.
- Robust TSI supports both the mutual-cap mode and the self-cap mode, providing flexibility for up to 36 touch keys.
- FlexTimer-featured 8-channel PWM for 3-phase motor control with dead-time insertion and fault detection.
- 1-Msps 12-bit ADC with up to a 16-channel input per module with a fast sampling rate for prompt data conversion and storage.
- Analog comparator for a fast response to external analog changes.
- Programmable delay block with a flexible trigger system providing various interconnections for on-chip modules (ADC, DAC, Flextimers, ACMP, and so on).
- FlexIO for a flexible serial communication interface implementation.
- Boot ROM for on-chip boot code and serial port drivers which saves flash space and provides flexible boot options and in-system programming support.
- Faster time to market with comprehensive enablement solutions, including SDK (drivers, libraries, stacks), IDE, bootloader, RTOS, online community, and more.

4. Kinetis KE1xZ256 Family Feature Summary

Table 1. Kinetis KE1xZ256 family feature summary

Kinetis KE1xZ256 sub-family	KE14Z	KE15Z
CPU performance	72 MHz	72 MHz
Flash	128–256 KB	128–256 KB
SRAM	16–32 KB	16–32 KB
Analog	2× 12-bit ADC 2× ACMP	2× 12-bit ADC 2× ACMP 36-channel TSI
Other Features	FlexTimers FlexIO	FlexTimers FlexIO
Package options	100LQFP (14 × 14), 64LQFP (10 × 10)	100LQFP (14 × 14), 64LQFP (10 × 10)

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5. Kinetis KE1xZ256 Family Block Diagram

Core

ARM® Cortex® -M0+ 72MHz

Debug Interfaces

Interrupt Controller

System

8ch eDMA

TRGMUX

MMDVSQ

BME

2.7~5.5V PMC

Memories

256KB Flash

2KB EEPROM

32KB SRAM

Boot ROM

Clocks

3-40M/32K OSC

IRC 48MHz(1%)

IRC 8MHz(3%)

128K LPO

LPFLL

Safety and Security

CRC

UID

FAC

WDOG/EWM

LVD/POR

Analog

2 x12b ADC

2 x ACMP

1 x 8b DAC

Timers

3 x FlexTimer

1 x PDB

LPIT

LPTMR

PWT

RTC

Communication Interfaces

2x LPI2C

3x LPUART

FlexIO
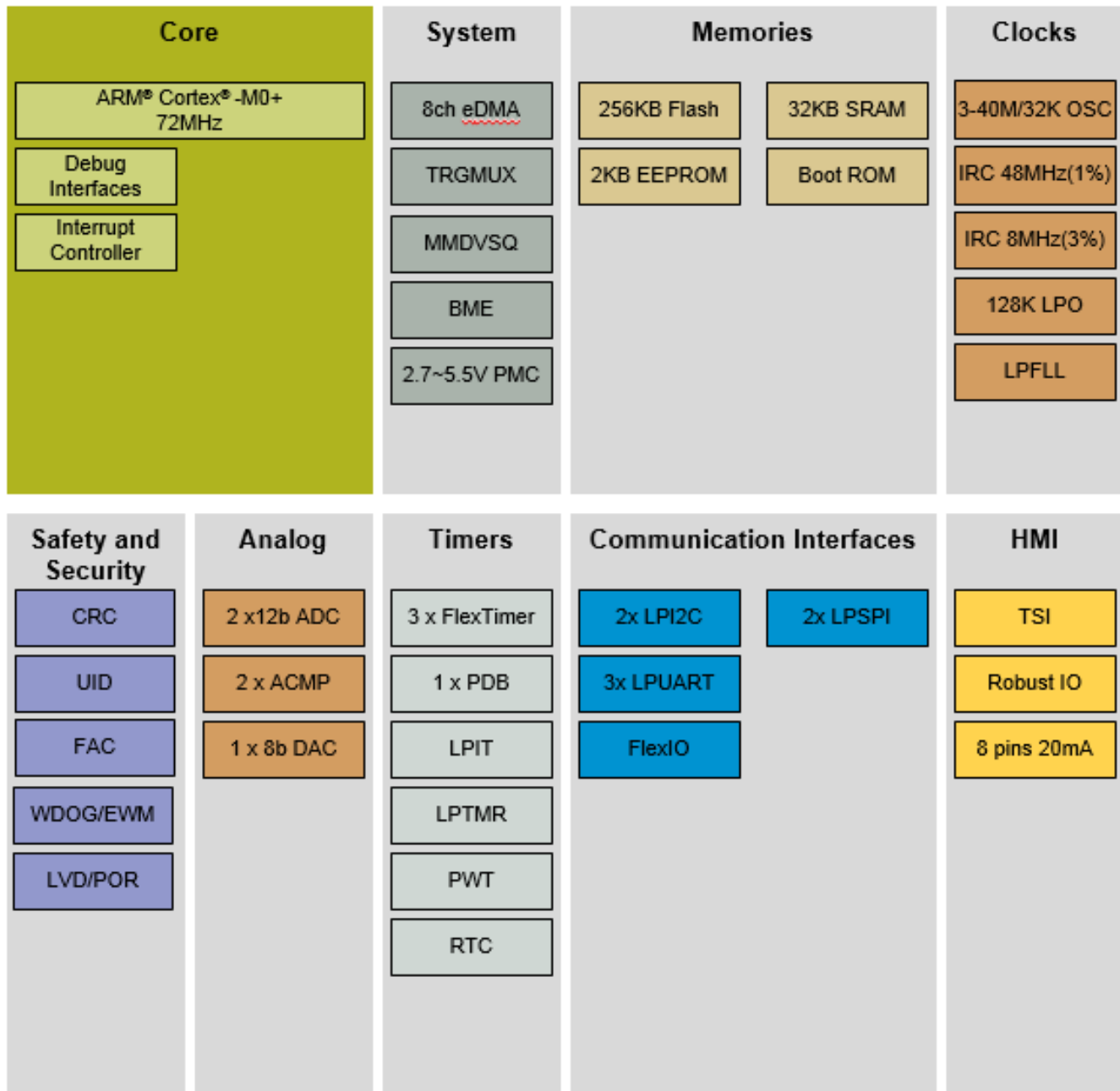
2x LPSPI

HMI

TSI

Robust IO

8 pins 20mA

Figure 1. Kinetis KE1xZ256 family block diagram

6. Kinetis KE1xZ256 Family Features

Table 2.   Kinetis KE1xZ256 family features

Sub-family	KE14Z	KE15Z
Core	ARM Cortex-M0+	ARM Cortex-M0+
Frequency	72 MHz	72 MHz
Flash	256–512 KB	256–512 KB
SRAM	16–32 KB	16–32 KB
EEPROM/data flash	2 KB	2 KB
Clock	48 MHz FIRC (1 %), 8 MHz SIRC (3 %), XOSC (3–40 MHz, 30–40 KHz), 128 KHz LPO, LPFLL	48 MHz FIRC (1 %), 8 MHz SIRC (3 %), XOSC (3–40 MHz, 30–40 KHz), 128 KHz LPO, LPFLL
BootROM (UART, SPI, I^{2}C)	Yes	Yes
DMA	8 channels	8 channels
WDT/POR/LVD	Yes	Yes
ADC	2$\times$ 12-bit, 1 μs	2$\times$ 12 bit, 1 μs
ACMP	2	2
DAC	8-bit (in ACMP)	8-bit (in ACMP)
Timer	3$\times$ FlexTimer, 1$\times$ LPTMR	3$\times$ FlexTimer, 1$\times$ LPTMR
PDB	1	1
PIT	1	1
RTC	1	1
CAN	—	—
UART	3	3
SPI	2	2
I^{2}C	2	2
FlexIO	4 timers, 4 shifters, 8 pins	4 timers, 4 shifters, 8 pins
TSI	—	36-channel TSI
VDD	2.7~5.5 V	2.7~5.5 V
Temperature (Ta)	-40~105 °C	-40~105 °C
Package (GPIOs)	100LQFP (14 $\times$ 14), 64LQFP (10 $\times$ 10)	100LQFP (14 $\times$ 14), 64LQFP (10 $\times$ 10)

7. Comprehensive Enablement Solutions

7.1. Kinetis Software Development Kit (KSDK)

- 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 OS, Micrium µC/OS® kernels, and bare-metal (no RTOS) applications

7.2. Processor Expert

- Free software-generation tool for device drivers/start-up code
- Seven steps from project creation to debug—dramatically reducing the development time
- Available within Kinetis Design Studio (KDS) or as a standalone plug-in for IAR/Keil/GNU IDEs

7.3. Integrated development environments (IDEs)

- IAR Embedded Workbench® IDE   www.iar.com
- ARM Keil® Microcontroller Development Kit IDE www2.keil.com/nxp
- Kinetis Design Studio IDE
    - No-cost (IDE) for Kinetis MCUs
    - Eclipse and GCC-based IDE for C/C++ editing, compiling, and debugging
- Broad ARM ecosystem support through NXP Partner Program

7.4. Online enablement with ARM mbed™ development platform

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

7.5. Bootloader

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

7.6. Development hardware

- NXP Freedom development platform
  - Low cost (< $20)
  - 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

8. Part Identification

8.1. Description

The chip part numbers contain fields that identify the specific part. Use the values of these fields to determine the specific part you've got.

8.2. Format

The part numbers for these MCUs have this format: Q KE## A FFF T PP CC (N)

8.3. Fields

This 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
KE##	Kinetis family	KE14Z KE15Z
A	Key attribute	Z = ARM Cortex-M0+
FFF	Program flash memory size	256 = 256 KB 128 = 128 KB
R	Silicon revision	(Blank) = main A = revision after main
T	Temperature range	V = -40–105 °C
PP	Package identifier	LL = 100LQFP (14 mm × 14 mm) LH = 64LQFP (10 mm × 10 mm)
CC	Maximum CPU frequency (MHz)	7 = 72 MHz
N	Packaging type	R = tape and reel (Blank) = trays

9. Orderable Part Numbers

Table 4.   Ordering information

Product	Memory		Package		IO and ADC channels		
MC part number	Flash	SRAM	Pin count	Package	GPIOs	GPIOs (INT/HD)[1]	ADC[2] channels (SE/DP)
MKE15Z256VLL7	256 KB	32 KB	100	LQFP	89	89/8	28/0
MKE15Z256VLH7	256 KB	32 KB	64	LQFP	58	58/8	27/0
MKE15Z128VLL7	128 KB	16 KB	100	LQFP	89	89/8	28/0
MKE15Z128VLH7	128 KB	16 KB	64	LQFP	58	58/8	27/0
MKE14Z256VLL7	256 KB	32 KB	100	LQFP	89	89/8	28/0
MKE14Z256VLH7	256 KB	32 KB	64	LQFP	58	58/8	27/0
MKE14Z128VLL7	128 KB	16 KB	100	LQFP	89	89/8	28/0
MKE14Z128VLH7	128 KB	16 KB	64	LQFP	58	58/8	27/0

1. INT: interrupt pin numbers; HD: high drive pin numbers
2. ADC0 + ADC1

10.   Revision History

Table 5.   Revision history

Revision number	Date	Substantive changes
0	05/2016	Initial release.

Document Number: KE1XZ256PB
Rev. 0
05/2016