AN14866

Migrating a Motor Control Application from TMS32F280013x to MCX A34x

Rev. 1.0 — 13 January 2026 Application note

Document information

Information	Content
Keywords	AN14866, MCX A, MCX A34x, hardware migration, motor control
Abstract	This document intends to help you migrate a hardware platform from a TI TMS320F280013x MCU to an NXP MCX A34x MCU.

1 Introduction

This document intends to help you migrate a hardware platform from a TI TMS320F280013x microcontroller (MCU) to an NXP MCX A34x MCU. It introduces the MCX A34x development and tool ecosystem, core architecture, peripheral considerations, and Software Development Kit (SDK).

The document highlights the key features of the NXP MCX A34x MCUs and compares them with the features of the TI TMS320F280013x MCUs. The document mentions the MCX A344 and MCX A346 MCUs as example MCX A34x MCUs.

2 MCX A34x MCU overview

An MCX A34x mixed-signal MCU is based on an Arm Cortex-M33 core running at speeds of up to 180 MHz. The MCX A344 MCU offers 256 KB of flash memory and 64 KB of RAM. The MCX A346 MCU offers 1024 KB of flash memory and 256 KB of RAM.

An MCX A34x MCU provides a rich set of serial peripherals and is optimized for high performance. It supports motor-control applications by providing features, such as eFlexPWM, eQDC, AOI, ADC, MAU, and SmartDMA. To help optimize and accelerate embedded system development, the MCX A34x devices are supported by MCUXpresso Developer Experience.

3 Comparison between TMS320F280013x and MCX A34x MCUs

Table 1 compares the features of the TMS320F280013x and MCX A34x MCUs.

Table 1. Comparison between TMS320F280013x and MCX A34x MCUs

Feature	TMS320F2800137	MCX A343/344	MCX A345/346
Core	• Digital Signal Processor (DSP) core with Floating Point Unit (FPU) and Trigonometric Math Unit (TMU) • Core frequency: 120 MHz	• Arm Cortex-M33 core with DSP and FPU • Core frequency: 180 MHz	• Arm Cortex-M33 core with DSP and FPU • Core frequency: 180 MHz
Math accelerator	TMU	Math Acceleration Unit (MAU)	MAU
Supply voltage	1.9 V to 3.6 V	1.71 V to 3.6 V	1.71 V to 3.6 V
Temperature	-40 °C to +125 °C	-40 °C to +125 °C	-40 °C to +125 °C
Flash memory	64/128/256 KB	128/256 KB	512/1024 KB
Data flash support	No	No	No
I-bus cache	4 KB	8 KB	8 KB
RAM	36 KB	32/64 KB	128/256 KB
SRAMX	Not supported	8 KB	8 KB
Maximum GPIOs	38	55 (LQFP64) / 86 (LQFP100)	114
Analog	• Two 12-bit ADCs (each with one sample-and-hold circuit), supporting a 4 MS/s conversion rate	• Two 16-bit SAR-ADCs, supporting a 3.2 MS/s conversion rate in 16-bit mode and a 4 MS/s conversion rate in 12-bit mode	• Four 16-bit SAR-ADCs, supporting a 3.2 MS/s conversion rate in 16-bit mode and a 4 MS/s conversion rate in 12-bit mode

Table 1. Comparison between TMS320F280013x and MCX A34x MCUs*...continued*

Feature	TMS320F2800137	MCX A343/344	MCX A345/346
	• One windowed comparator (CMPSS) with internal 12-bit DAC • Three windowed comparators (CMPSS_LITE) with internal 9.5-bit DAC	• Three comparators with 8-bit internal Digital-to-Analog Converter (DAC) • Three OPAMPs	• Three comparators with 8-bit internal DAC • One 12-bit DAC • Four OPAMPs
PWM	14-channel PWM output: Seven ePWMs	24-channel PWM output: Two eFlexPWMs, each having four submodules	24-channel PWM output: Two eFlexPWMs, each having four submodules
Other timers	• Three 32-bit CPU timers • Two 16-bit Enhanced Capture (eCAP) modules • One Enhanced Quadrature Encoder Pulse (eQEP) module • One 8-bit windowed watchdog timer	• Three 32-bit CTimers • One 32-bit wake timer • One 24-bit Windowed Watchdog Timer (WWDT) • One 32-bit Low-Power Timer (LPTMR) • One 31-bit Micro-Tick (UTICK) timer • One 42-bit OS event timer • One Real-Time Clock (RTC) timer • One Frequency Measurement (FREQME) timer	• Five 32-bit CTimers • One 32-bit wake timer • One 24-bit WWDT • One 32-bit LPTMR • One 31-bit UTICK • One 42-bit OS event timer • One RTC timer • One FREQME timer
Communication	• One Controller Area Network (CAN) port • Two Inter-Integrated Circuit (I^2C) interfaces • One Serial Peripheral Interface (SPI) • Three Serial Communication Interfaces (SCIs)	• One Flexible Data Rate CAN (FlexCAN) interface with Flexible Data Rate (FD) • Four Low-Power Universal Asynchronous Receiver/ Transmitter (LPUART) interfaces • Two Low-Power Inter-integrated Circuit (LPI2C) interfaces • Two Low-Power Serial Peripheral Interfaces (LPSPIs)	• One FlexCAN interface with FD • Six LPUART interfaces • Four LPI2C interfaces • Two LPSPI interfaces

4 Hardware and software ecosystem comparison

To help you quickly begin with your hardware designs, MCX A34x MCUs are supported by an extensive hardware and software ecosystem, which includes reference designs and code examples.

4.1 Hardware ecosystem

You can evaluate MCX A34x motor control functionality using NXP developed Freedom hardware platforms, such as FRDM-MCXA346 or FRDM-MCXA344. Figure 1 shows an example motor control demo block diagram involving the following hardware components:

- One NXP FRDM-MCXA346 board
- One dual-motor adapter board
- Two NXP FRDM-MC-LVPMSM boards
- Two 3-phase PMSM motors

Note: *For more details on this motor control demo, refer to https://www.nxp.com/doc/AN14717.*

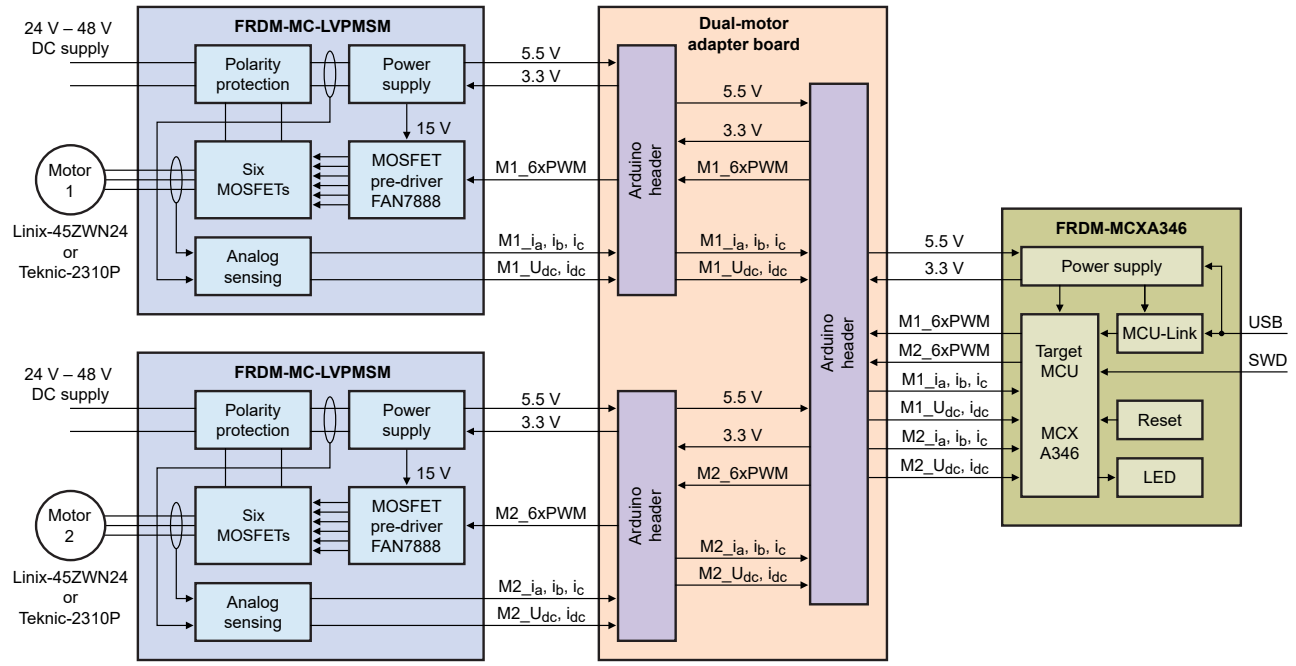

Figure 1. Example motor control demo block diagram

Figure 2 shows the FRDM-MCXA346 board.

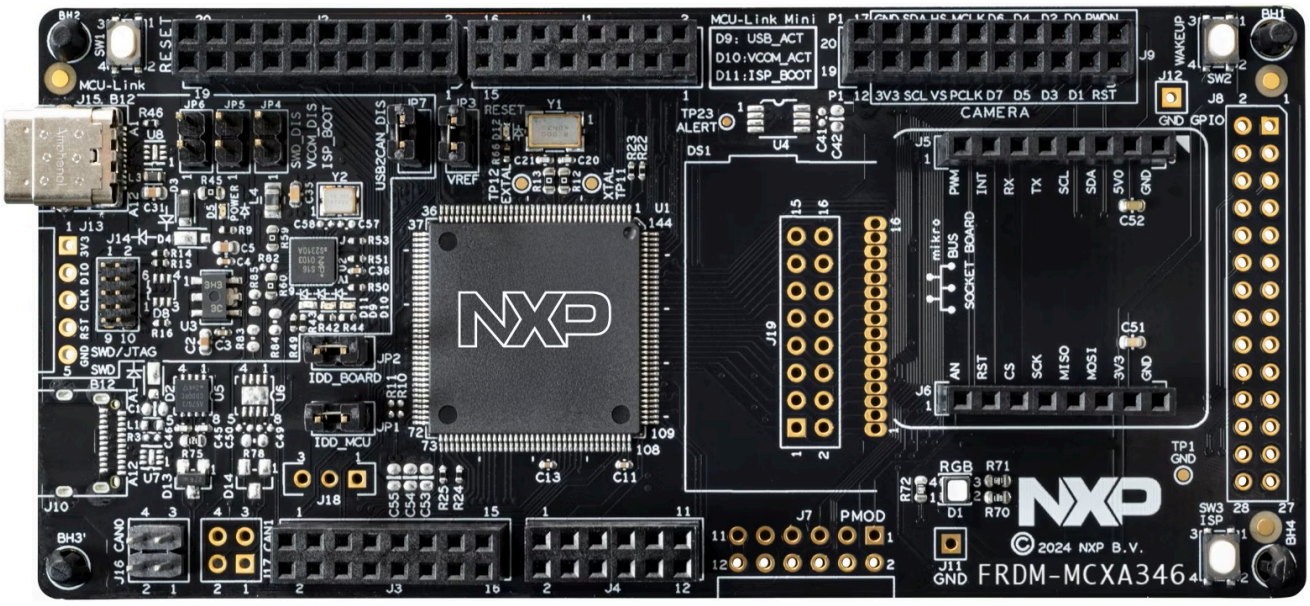

Figure 2. FRDM-MCXA346 board

4.2 Software ecosystem

Table 2 compares the software ecosystem of the TMS320F280013x and MCX A34x MCUs.

Table 2. Software ecosystem comparison between TMS320F280013x and MCX A34x MCUs

Feature	TMS320F280013x	MCX A34x
IDE (first-party)	CCS (available as a free download)	MCUXpresso IDE (available as a free download)
IDE (third-party)	Not applicable	• IAR • Keil • Arm GCC
Software configuration	SysConfig tool	MCUXpresso Config Tools
Display / demo GUI editor	Not applicable	FreeMASTER

4.2.1 MCUXpresso SDK

The MCUXpresso Software Development Kit (SDK) is a comprehensive software enablement package for Arm Cortex-M–based NXP devices, including general-purpose, crossover, and wireless-enabled MCUs. It is designed to simplify and accelerate application development on these devices. The MCUXpresso SDK includes production-grade software, optional integrated RTOS, integrated enabling technologies (stacks and middleware), and reference software. Partner middleware and software can be integrated with the MCUXpresso SDK via custom west manifests or Open-CMSIS-Packs.

To ensure high quality, the MCUXpresso SDK is analyzed with Coverity® static analysis tool from Synopsys. Custom SDK packages are available as custom archives or west manifests, based on your selection of MCU, evaluation board, and optional software components.

To accelerate software development, the MCUXpresso SDK provides many examples and middleware. Figure 3 shows the MCUXpresso SDK Builder page.

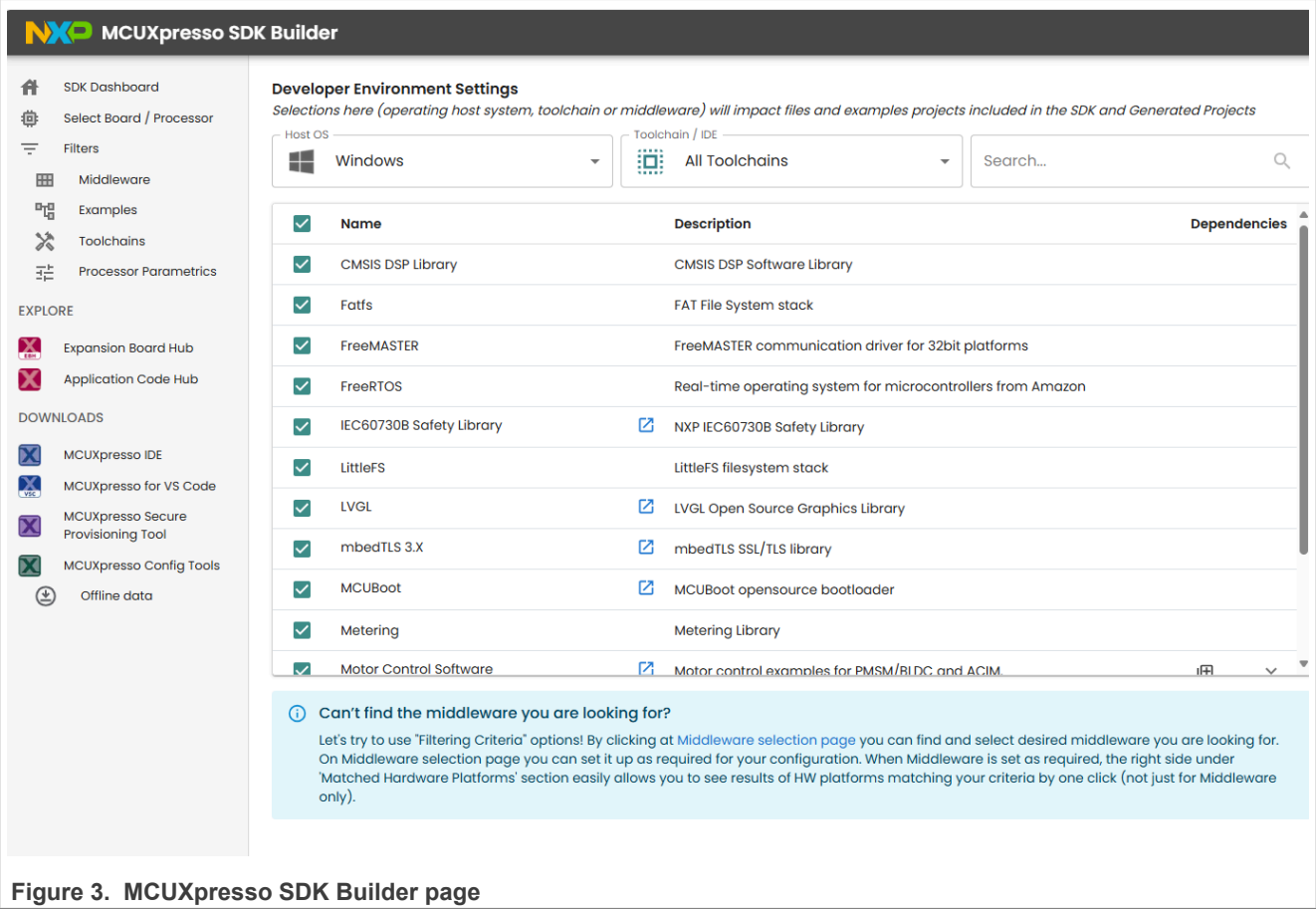

Figure 3. MCUXpresso SDK Builder page

4.2.2 CCS IDE versus MCUXpresso IDE

Similar to the Code Composer Studio (CCS) IDE from TI, NXP provides an easy-to-use integrated development environment for its Arm Cortex-M core based MCUs: MCUXpresso IDE. This Eclipse-based IDE supports C/C++ development and provides advanced editing, compilation, and debugging features, including:

- MCU-specific debug views
- Code trace and profiling
- Multicore debugging
- Integrated configuration tools

The MCUXpresso IDE supports debug connections for NXP general-purpose, crossover, and wireless-enabled MCUs on EVKs and custom boards. The debug connections are supported with optimized open source and commercial probes from NXP, PEmicro, and SEGGER.

4.2.3 SysConfig tool versus MCUXpresso Config Tools

The MCUXpresso Config Tools software is an integrated suite for system configuration that guides developers from evaluation to production software development. It is similar to the SysConfig tool from TI. The tools in MCUXpresso Config Tools are optimized for NXP Arm Cortex-M MCUs, including general-purpose, crossover, and wireless-enabled devices. They help build custom SDKs and generate initialization C code or register values for pins, clocks, and peripherals.

For the best experience, the MCUXpresso Config Tools software is integrated with the MCUXpresso IDE and the MCUXpresso SDK Builder. Runtime software and tools are complimentary, and the source code (assembly

and C) is provided under permissive open source licenses. Support is available through the MCUXpresso Config Tools Community Forum.

Figure 4 shows an example of using MCUXpresso Config Tools configuration tools from MCUXpresso IDE.

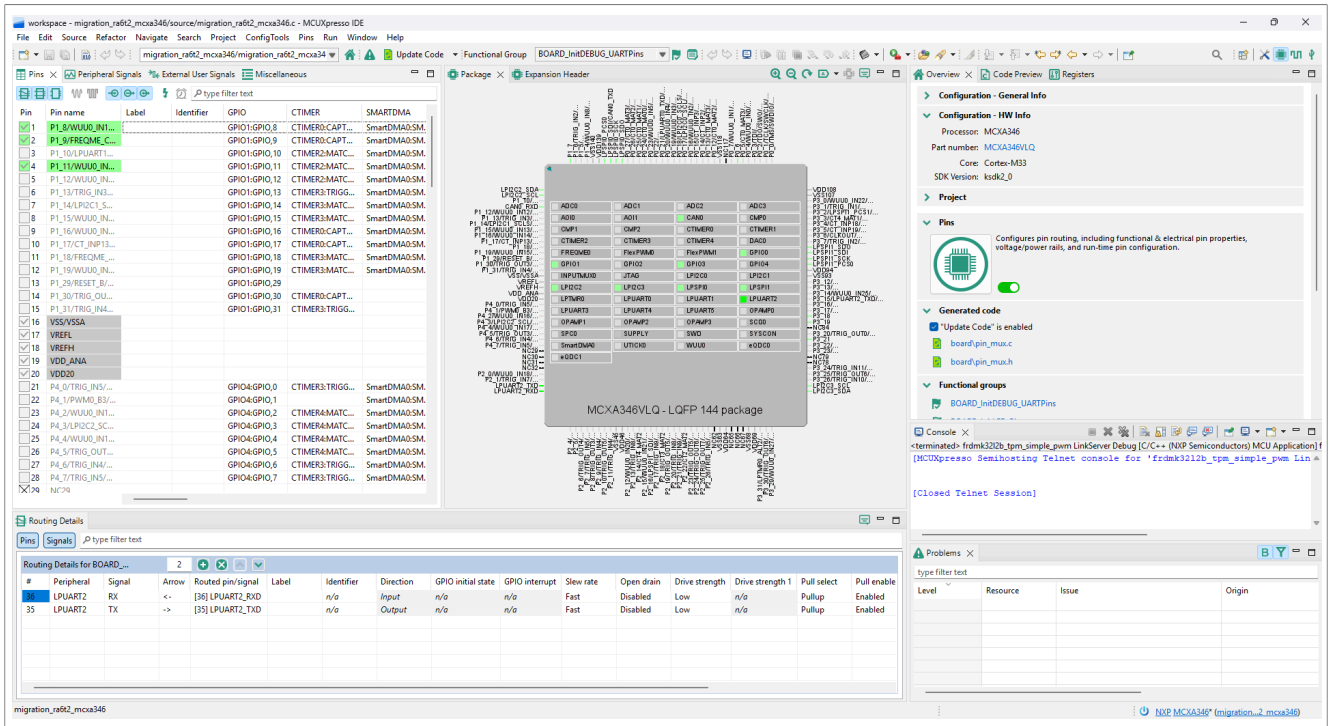

Figure 4. Using configuration tools from MCUXpresso IDE

The other approach is to use a standalone Config Tools project (.mex file). This project file is also present in projects generated by the MCUXpresso SDK in the MCUXpresso IDE. It provides the same functionality as the integrated tools and generates source files in the board folder under the project path.

Figure 5 shows an example standalone Config Tools project.

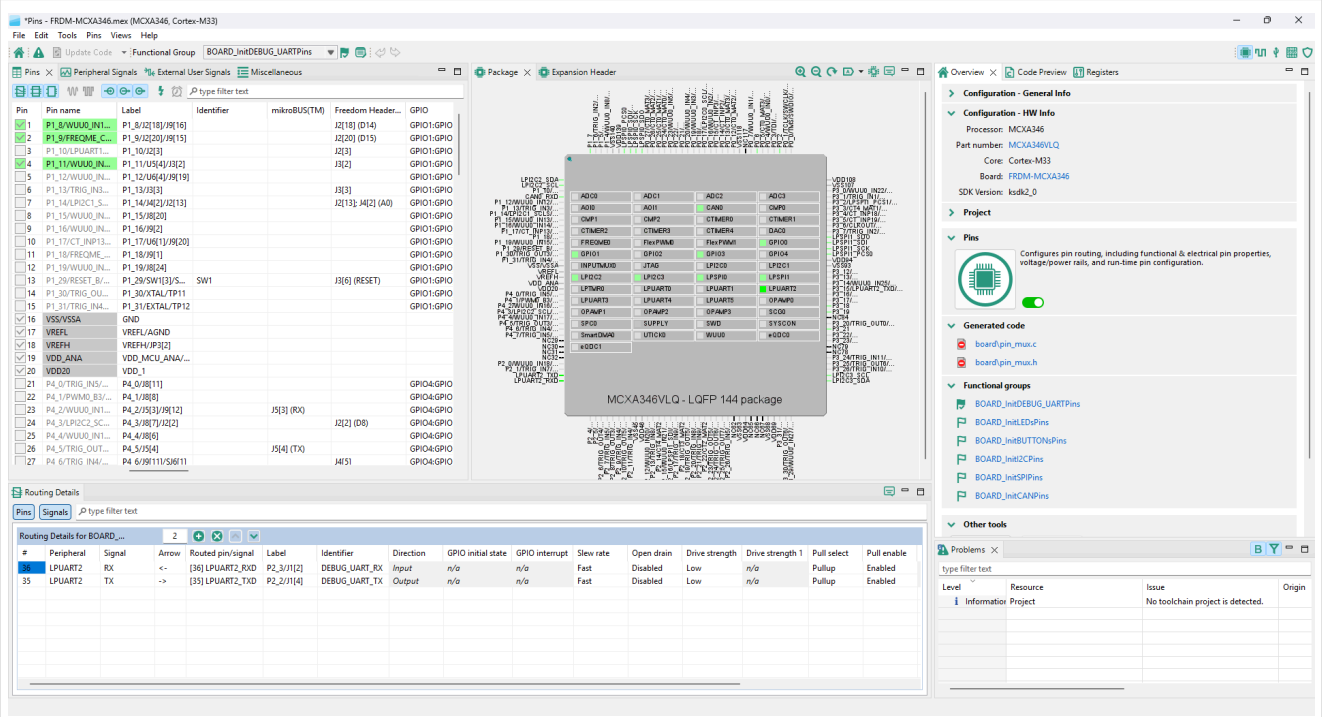

Figure 5. Example standalone Config Tools project

4.3 Debug tools

MCU-Link is a debug probe architecture jointly developed by NXP and Embedded Artists. It can be configured to support different debug feature options.

The MCU-Link architecture is used in:

- Standalone debug probes, such as MCU-Link Pro
- Onboard debug probes implemented on NXP evaluation boards, such as FRDM-MCXA346. The onboard implementation of MCU-Link is referred to as MCU-Link OB.

In the FRDM-MCXA346 board, the MCU-Link architecture is based on the NXP LPC55S16 MCU, which is based on an Arm Cortex-M33 core. The board implements a subset of the MCU-Link architecture features. For more details on the MCU-Link architecture, visit the MCU-Link Debug Probe Architecture page.

The MCU-Link OB on the FRDM-MCXA346 board is factory-programmed with the firmware based on the NXP CMSIS-DAP protocol. The firmware also supports all other features supported in the hardware. A custom version of the J-Link firmware is also available to make the MCU-Link OB compatible with J-Link LITE. However, this firmware version only supports limited features, including debug/SWO and VCOM.

5 Migrating to MCX A34x

Migrating an application to the MCX A34x MCU involves the following major steps:

1. First, select a suitable MCX A34x MCU, for example, MCX A346.
2. Next, create a project using an SDK example in MCUXpresso Config Tools or MCUXpresso IDE. MCUXpresso Config Tools can be used to configure inputs/outputs, clocks, and peripherals.
3. Then, port the application software to this project.
4. Finally, debug the project using an MCU-Link probe or a J-Link probe.

Figure 6 shows a flowchart explaining the MCX A34x migration process.

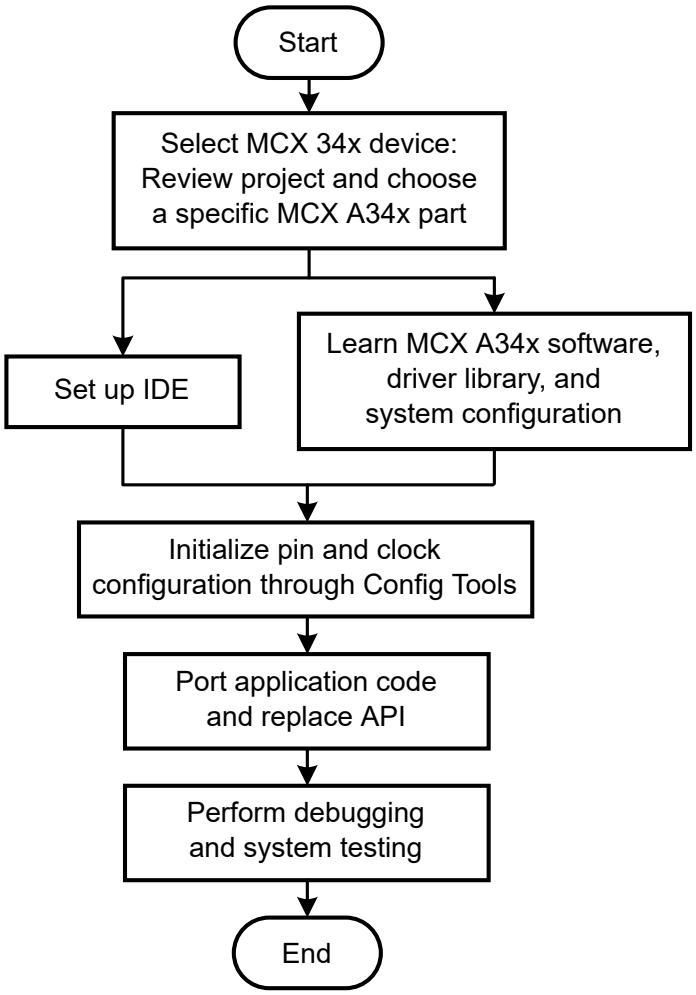

Figure 6. MCX A34x migration process

Figure 7 shows an example of debugging an MCX A34x MCU in the MCUXpresso IDE.

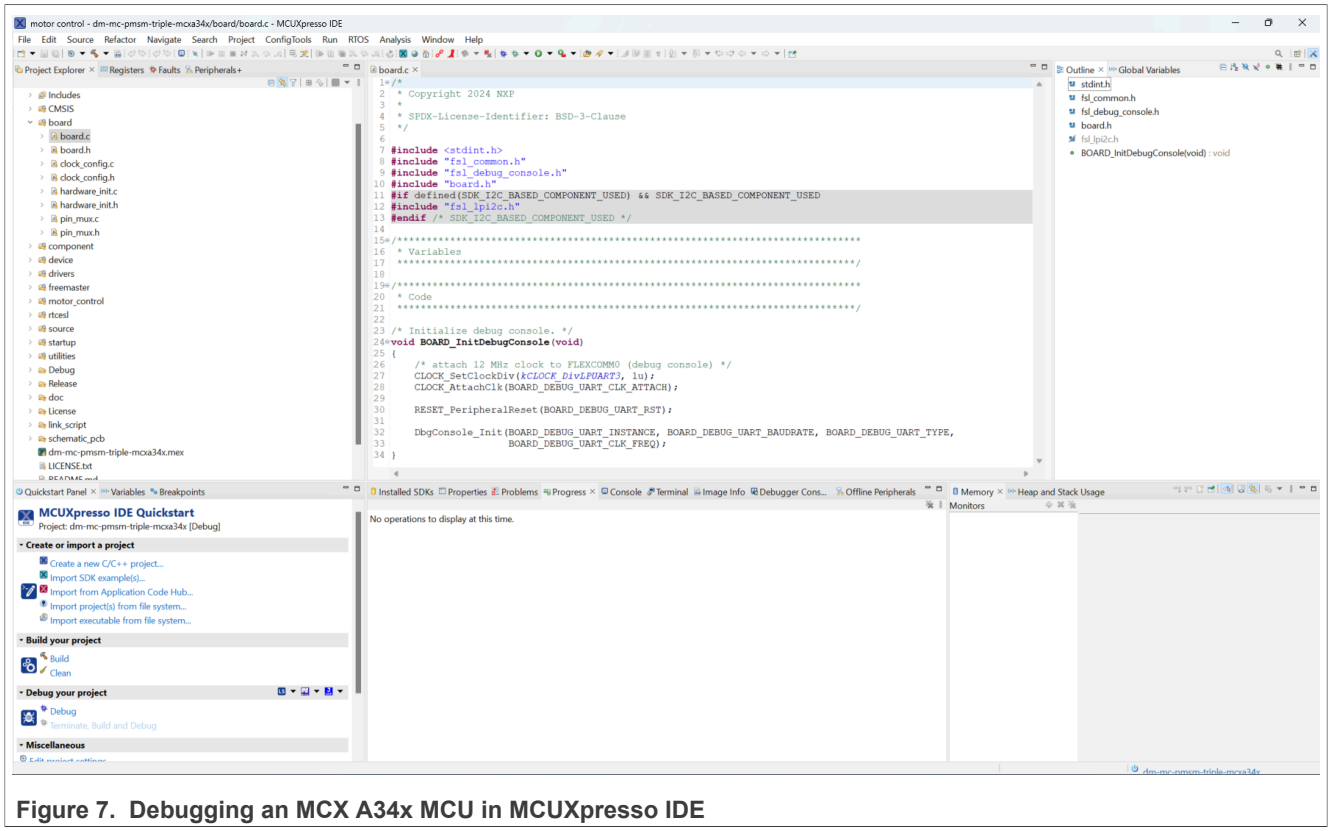

Figure 7. Debugging an MCX A34x MCU in MCUXpresso IDE

6 Core architecture comparison

This section contains the following subsections:

- Section 6.1 "Flash memory"
- Section 6.2 "Embedded SRAM"
- Section 6.3 "Clocks"

6.1 Flash memory

The MCX A344 MCU provides 256 KB flash memory, which is divided into 32 sectors of 8 KB each. The MCX A346 MCU provides 1024 KB flash memory, which is divided into 128 sectors of 8 KB each. Each MCU supports an Error-Correcting Code (ECC) on every 128 bits of the flash memory. Each MCU has a Flash Memory Controller (FMC), which implements a 128-bit entry buffer and a 128-bit prefetch buffer for faster flash access.

The TMS320F280013x MCU provides 256 KB flash memory with ECC support. The flash memory is divided into 128 sectors of 2 KB each.

6.2 Embedded SRAM

The MCX A344 MCU includes 64 KB SRAM and supports running critical code from RAM. The MCX A346 MCU provides 256 KB SRAM, enabling better performance for applications, such as motor control.

Table 3 compares the SRAM features of the TMS320F280013x and MCX A34x MCUs.

Table 3. SRAM comparison between TMS320F280013x and MCX A34x MCUs

Feature	TMS320F2800137	MCX A344	MCX A346
SRAM memory	• M0 RAM: 1 KW x 16 • M1 RAM: 1 KW x 16 • PieVectTable: 256 W x 16 • LS0 RAM: 8 KW x 16 • LS1 RAM: 8 KW x 16	• SRAM X0: 8 KB 32-bit RAM • SRAM X1: 8 KB 32-bit RAM • SRAM A0: 8 KB 32+7-bit ECC RAM • SRAM A1: 8 KB 32-bit RAM • SRAM B0: 16 KB 32-bit RAM • SRAM C0: 16 KB 32-bit RAM	• SRAM X0: 8 KB 32-bit RAM • SRAM X1: 8 KB 32-bit RAM • SRAM A0: 8 KB 32+7-bit ECC RAM • SRAM A1: 4 KB 32-bit RAM • SRAM A2: 4 KB 32-bit RAM • SRAM A3: 16 KB 32-bit RAM • SRAM A4: 32 KB 32-bit RAM • SRAM B0: 32 KB 32-bit RAM • SRAM B1: 32 KB 32-bit RAM • SRAM C0: 32 KB 32-bit RAM • SRAM C1: 32 KB 32-bit RAM • SRAM C2: 32 KB 32-bit RAM • SRAM C3: 16 KB 32-bit RAM
Zero wait states at maximum CPU	Yes	Yes (SRAM X)	Yes (SRAM X)

6.3 Clocks

For the MCX A34x devices, the System Clock Generator (SCG) module is the core of the clock architecture. The SCG module manages multiple clock sources distributed to the CPU platform, memory modules, and peripheral modules. A peripheral module uses an interface clock for CPU/DMA access to its registers. Sometimes, a peripheral module also has a functional clock for its primary timing function. For example, a functional clock can source the baud rate of a serial peripheral or drive the counter of a timer peripheral.

The SCG module controls the on-chip clock sources, including the 8–50 MHz System Oscillator (SOSC), FRO180M, and FRO12M. It also generates functional clock sources for peripherals. A clock multiplexer is implemented in SCG-Lite to select the source for main_clk from the following:

- Up to 50 MHz SOSC
- FRO180M
- FRO12M
- FRO16k
- SCG SPLL as one source

A clock monitor is implemented for SOSC. When enabled, FRO12M monitors the SOSC clock. FRO12M derives a 1 MHz clock, which is always ON in Active and Sleep modes.

Figure 8 shows the clock configuration for an MCX A34x MCU.

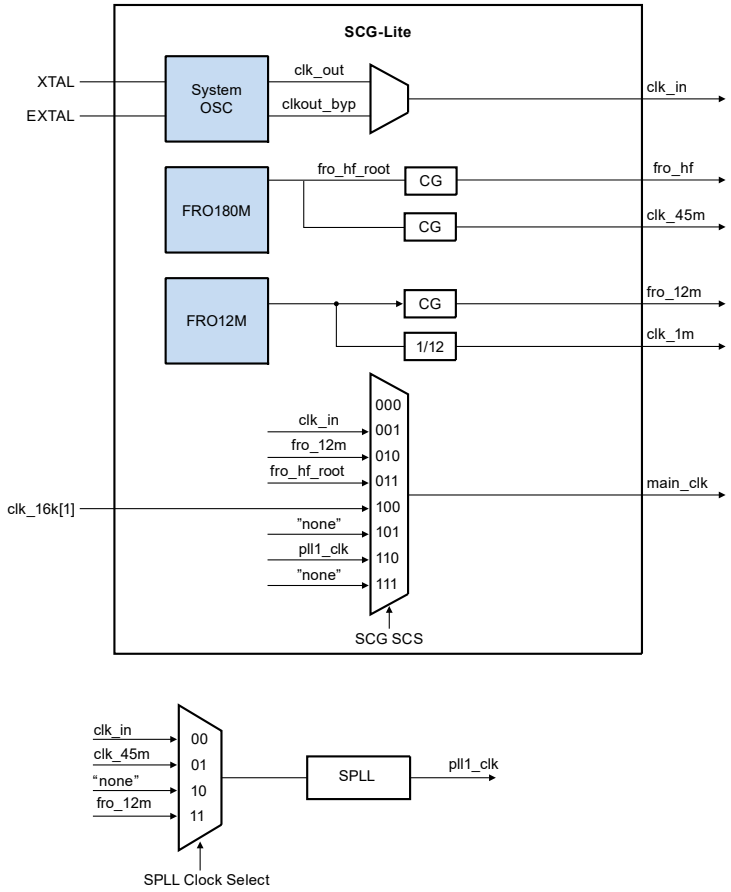

Figure 8. Clock configuration for an MCX A34x MCU

The TMS320F280013x clock architecture differs from the clock architecture of an MCX A34x MCU. In the TMS320F280013x MCU, all the clocks are derived from one of the following clock sources:

- Primary Internal Oscillator (INTOSC2)
- Backup Internal Oscillator (INTOSC1)
- Auxiliary Clock Input (AUXCLKIN)
- External Oscillator (XTAL)

The TMS320F280013x MCU supports a 10–20 MHz input clock crystal, whereas the MCX A34x MCU supports an 8–50 MHz input clock crystal.

For clock configuration of the TMS320F280013x MCU, refer to the TMS320F280013x data sheet available at https://www.ti.com/lit/ds/symlink/tms320f2800137.pdf.

7 Digital peripheral comparison

This section contains the following subsections:

7.1 GPIO

The MCX A344 and MCX A346 MCUs offer up to 86 and 114 General-Purpose Input/Output (GPIO) pins. The GPIO pins support the following modes:

- Push-pull
- Open drain with pull-up/pull-down

The TMS320F280013x MCU offers up to 38 GPIO pins.

Table 4 compares the GPIO features of the TMS320F280013x and MCX A34x MCUs.

Table 4. GPIO feature comparison between TMS320F280013x and MCX A34x MCUs

Feature	TMS320F2800137	MCX A344	MCX A346
Output modes	• Push-pull • Open drain with pull-up	• Push-pull • Open drain with pull-up/ pull-down	• Push-pull • Open drain with pull-up/ pull-down
GPIO speed selection	6 ns rise time and 6 ns fall time for medium I/O pins	• 0.8 ns rise time and 4 ns fall time for medium I/O pins • Fast slew rate	• 0.8 ns rise time and 4 ns fall time for medium I/O pins • Fast slew rate
High-drive GPIO	20 mA	20 mA	20 mA
Input modes	• Floating • Pull-up • Analog	• Floating • Pull-up/pull-down • Analog	• Floating • Pull-up/pull-down • Analog
Atomic bit set and reset support	No	Yes	Yes
Wake-up support	GPIO pin	GPIO pin interrupt	GPIO pin interrupt
Support for GPIOs controlled by DMA	No	Yes	Yes
Support for user-controlled input filtering	Yes	Yes	Yes

7.2 UART

Both MCX A34x and TMS320F280013x provide peripherals for asynchronous communication. MCX A34x supports Universal Asynchronous Receiver/Transmitter (UART) based debugging with the FreeMASTER GUI tool.

Table 5 compares the UART features of the TMS320F280013x and MCX A34x MCUs.

Table 5. UART feature comparison between TMS320F280013x and MCX A34x MCUs

Feature	TMS320F2800137	MCX A344	MCX A346
Support for hardware flow control	No	Yes	Yes
Support for continuous communication using DMA	No	Yes	Yes
Support for single-wire, half-duplex communication	No	Yes	Yes
Data length	1-bit – 8-bit	7/8/9/10-bit	7/8/9/10-bit
Tx/Rx FIFO depth	16-level	256-level	256-level
IrDA support	No	Yes	Yes

Table 5. UART feature comparison between TMS320F280013x and MCX A34x MCUs*...continued*

Feature	TMS320F2800137	MCX A344	MCX A346
Local Interconnect Network (LIN) support	No	Yes	Yes

7.3 CAN/SPI/I^{2}C

MCX A34x provides a Controller Area Network (CAN) interface, which is similar to that of TMS320F280013x. For Serial Peripheral Interface (SPI) and Inter-Integrated Circuit (I^{2}C), MCX A34x offers a more flexible configuration and can support all TMS320F280013x use cases.

7.4 Timers

This section contains the following subsections:

- Section 7.4.1 "CPU timer / CTimer"
- Section 7.4.2 "ePWM/eFlexPWM"
- Section 7.4.3 "eQEP/eQDC"
- Section 7.4.4 "WWDT"

7.4.1 CPU timer / CTimer

The MCX A344 and MCX A346 MCUs provide three and five 32-bit CTimers, respectively. A CTimer acts similar to a CPU timer of the TI TMS320F280013x MCU and has some additional functions, such as Pulse Width Modulation (PWM) and capture. TMS320F280013x provides three CPU timers.

Table 6 compares the CPU timer / CTimer features of the TMS320F280013x and MCX A34x MCUs.

Table 6. CPU timer / CTimer comparison between TMS320F280013x and MCX A34x MCUs

Feature	TMS320F2800137	MCX A344	MCX A346
Resolution	32-bit	32-bit	32-bit
PWM mode	Not supported	Edge Aligned	Edge Aligned
Capture support	No	Yes	Yes
Compare support	No	Yes	Yes
One-shot support	No	Yes	Yes
Operating power modes	Not supported	• Normal mode • Sleep mode • Deep-Sleep mode	• Normal mode • Sleep mode • Deep-Sleep mode
Programmable prescaler	Yes	Yes	Yes
Support for events or interrupts	Yes	Yes	Yes
Support for auto reload functionality	Yes	Yes	Yes
Support for Shadow Register mode	Yes	Yes	Yes

7.4.2 ePWM/eFlexPWM

MCX A34x provides two Enhanced Flex Pulse Width Modulator (eFlexPWM) modules with four submodules each, supporting up to 16 PWM outputs with dead-time insertion. Each submodule can control a single half-bridge power stage with fault channel support. An eFlexPWM module is used for the motor control and power conversion applications.

eFlexPWM acts similar to ePWM of the TI TMS320F280013x MCU. TMS320F280013x provides seven ePWM modules supporting up to 14 PWM outputs.

Table 7 compares the ePWM/eFlexPWM features of the TMS320F280013x and MCX A34x MCUs.

Table 7. ePWM/eFlexPWM comparison between TMS320F280013x and MCX A34x MCUs

Feature	TMS320F2800137	MCX A344	MCX A346
Resolution	16-bit	16-bit	16-bit
Operating power modes	• Center mode • Edge Aligned mode • Asymmetrical mode	• Center mode • Edge Aligned mode • Asymmetrical mode	• Center mode • Edge Aligned mode • Asymmetrical mode
Capture support	No, it uses eCAP modules.	Yes	Yes
Compare support	Yes	Yes	Yes
One-shot support	Yes	Yes	Yes
Programmable pre-scalar support	Yes	Yes	Yes
Shadow register mode support	Yes	Yes	Yes
Support for events or interrupts	Yes	Yes	Yes
Fault event mechanism support	Yes	Yes	Yes
Support for auto reload functionality	Yes	Yes	Yes

7.4.3 eQEP/eQDC

MCX A34x provides two Quadrature Decoder (eQDC) modules. An eQDC module interfaces with position and speed sensors used in industrial motor-control applications. It accepts five input signals—PHASEA, PHASEB, INDEX, TRIGGER, and HOME—and decodes shaft position, revolution count, and speed.

eQDC acts similar to the Enhanced Quadrature Encoder Pulse (eQEP) module of a TI TMS320F280013x MCU.

Table 8 compares the eQEP/eQDC features of the TMS320F280013x and MCX A34x MCUs.

Table 8. eQEP/eQDC comparison between TMS320F280013x and MCX A34x MCUs

Feature	TMS320F2800137	MCX A344	MCX A346
Input filters	Yes	Yes	Yes
Position counter resolution	32-bit	32-bit	32-bit
Position difference resolution	32-bit	16-bit	16-bit
Non-rotating detection	Yes	Yes	Yes
Defined position detection	Yes	Yes	Yes
Maximum count frequency	120 MHz	90 MHz	90 MHz

7.4.4 WWDT

A Windowed Watchdog Timer (WWDT) can be programmed to reset or interrupt an MCU if the MCU (or its core) is stuck in an infinite loop or is executing unintended code. If the application fails to service the watchdog within the predefined window, a watchdog reset is generated (if enabled).

MCX A34x provides one 24-bit windowed watchdog timer, whereas TMS320F280013x provides one 8-bit windowed watchdog timer.

Table 9 compares the WWDT features of the TMS320F280013x and MCX A34x MCUs.

Table 9. WWDT comparison between TMS320F280013x and MCX A34x MCUs

Feature	TMS320F2800137	MCX A344	MCX A346
Window mode support	Yes	Yes	Yes
Interval timer mode support	No	Yes	Yes
LFCLK source support	No (INTOSC1)	Yes	Yes
Support for interrupts	Yes	Yes	Yes
Counter resolution	8-bit	24-bit	24-bit
Clock divider support	Yes	Yes	Yes

8 Analog peripheral comparison

This section contains the following subsections:

- Section 8.1 "Comparators"
- Section 8.2 "Analog-to-digital converters"
- Section 8.3 "Operational amplifiers"

8.1 Comparators

Both the NXP MCX A34x and TI TMS320F280013x device families offer integrated comparators as optional peripherals on some devices. A Comparator (CMP) module can provide windowed-comparator functionality on devices with multiple comparators, accept inputs from various internal and external sources, and trigger power-mode changes or truncate/control PWM signals.

Table 10 compares the comparator features of the TMS320F280013x and MCX A34x MCUs.

Table 10. Comparator feature comparison between TMS320F280013x and MCX A34x MCUs

Feature	TMS320F2800137	MCX A344	MCX A346
Number of comparators available	4	3	3
Number of positive and negative inputs	• Number of positive inputs: Up to 5 • Number of negative inputs: Up to 5	• Number of positive inputs: Up to 6 • Number of negative inputs: Up to 6	• Number of positive inputs: Up to 6 • Number of negative inputs: Up to 6
Output routing	• To ePWM XBAR • To output XBAR	• To DMA • To IRQ • To CMPO	• To DMA • To IRQ • To CMPO
Noninverting input sources	Supported	• Multiplexed I/O pins • OPAMPx_OUT	• Multiplexed I/O pins • OPAMPx_OUT

Table 10. Comparator feature comparison between TMS320F280013x and MCX A34x MCUs*...continued*

Feature	TMS320F2800137	MCX A344	MCX A346
		• CMPx DAC	• CMPx DAC
Inverting input sources	Not supported	• Multiplexed I/O pins • OPAMPx_OUT • CMPx DAC	• Multiplexed I/O pins • OPAMPx_OUT • CMPx DAC
Programmable hysteresis	• 0: None • 1: Set to typical hysteresis • 2: Set to 2x of typical hysteresis • 3: Set to 3x of typical hysteresis • 4: Set to 4x of typical hysteresis	• 0 mV • 10 mV • 20 mV • 30 mV	• 0 mV • 10 mV • 20 mV • 30 mV
Window comparator configuration support	Yes	Yes	Yes
Operating power modes	Supported	• Nano-Power mode • Low-Power mode • High-Power mode	• Nano-Power mode • Low-Power mode • High-Power mode
Support for fast PWM shutdowns	Yes	Yes (through internal trigger)	Yes (through internal trigger)
Input filtering support	Yes	Yes	Yes
Output filtering support	Yes	Yes (through low-pass filter)	Yes (through low-pass filter)
Support for output polarity control	Yes	Yes	Yes
Support for interrupts	Yes	Yes	Yes

8.2 Analog-to-digital converters

Both MCX A34x and TMS320F280013x include Analog-to-Digital Converter (ADC) peripherals for converting analog signals to digital values. The MCX A344 and MCX A346 MCUs provide two and four 16-bit ADCs, respectively. TMS320F280013x offers two 12-bit ADCs.

Table 11 compares the ADC features of the TMS320F280013x and MCX A34x MCUs.

Table 11. ADC feature comparison between TMS320F280013x and MCX A34x MCUs

Feature	TMS320F2800137	MCX A344	MCX A346
Resolution	12-bit	16-bit	16-bit
Conversion rate	4 MS/s	• 3.2 MS/s in 16-bit mode • 4 MS/s in 12-bit mode	• 3.2 MS/s in 16-bit mode • 4 MS/s in 12-bit mode
Hardware oversampling support	No	Yes (128 samples)	Yes (128 samples)
FIFO support	No	Yes (8-entry FIFO)	Yes (8-entry FIFO)
ADC reference	VREFH: 0.1 V – VDDA	• VREFH: 0.99 V – VDDA • VREFL: VSSAD	• VREFH: 0.99 V – VDDA • VREFL: VSSAD
Operating power modes	Not supported	Normal / Sleep / Deep-Sleep mode	Normal / Sleep / Deep-Sleep mode

Table 11. ADC feature comparison between TMS320F280013x and MCX A34x MCUs*...continued*

Feature	TMS320F2800137	MCX A344	MCX A346
Number of external input channels	Up to 21	Up to 39	Up to 82
Internal input channels	Yes	• Temperature • PMC • ATX • Bandgap • pmc_1vbuf_ana_1p8v	• Temperature • PMC • ATX • Bandgap • pmc_1vbuf_ana_1p8v
DMA support	No	Yes	Yes
Number of ADCs	2	2	4
Oversampling support	Not supported	1024-bit averaging multiplier	1024-bit averaging multiplier
ADC windowed comparator unit	Digital Compare (DC) submodule	Not supported	Not supported

8.3 Operational amplifiers

The TMS320F280013x device family does not include an integrated Operational Amplifier (OPAMP) peripheral. When migrating to an MCX A34x device, you can use the internal OPAMPs of the MCX A34x device to replace external discrete devices. The MCX A344 and MCX A346 MCUs provide three and four OPAMP modules, respectively.

The features of the MCX A34x OPAMP modules are summarized in Table 12, and examples of common OPAMP configurations are provided in the MCUXpresso SDK code examples.

Table 12. MCX A34x OPAMP module features

Feature	TMS320F2800137	MCX A344	MCX A346
Number of operational amplifiers	0	3	4
Gain bandwidth	Not applicable	• 8 MHz, gain = 2 • 16 MHz, gain = 4 • 32 MHz, gain = 8 • 64 MHz, gain = 16	• 8 MHz, gain = 2 • 16 MHz, gain = 4 • 32 MHz, gain = 8 • 64 MHz, gain = 16
Amplifier configuration	Not applicable	General-purpose mode	General-purpose mode
Input/output routing	Not applicable	• Internal connections to ADC and COMP modules • External pin routing	• Internal connections to ADC and COMP modules • External pin routing
Reference voltage	Not applicable	Not internal	Not internal

9 References

For more details on the MCX A34x MCU, refer to:

- MCX A34 MCU home page
- *MCX A345 and A346 Reference Manual* (MCXAP144M240F60RM)
- *MCXA345/346 Data Sheet* (MCXAP144M240F60)

10 Acronyms

Table 13 lists the acronyms used in this document.

Table 13. Acronyms

Acronym	Description
ADC	Analog-to-Digital Converter
AOI	AND/OR/INVERT
CAN	Controller Area Network
CCS	Code Composer Studio
CMP	Comparator
DAC	Digital-to-Analog Converter
DC	Digital Compare
DMA	Direct Memory Access
DSP	Digital Signal Processor
eCAP	Enhanced Capture
eFlexPWM	Enhanced Flex Pulse Width Modulator
eQDC	Quadrature Decoder
eQEP	Enhanced Quadrature Encoder Pulse
FD	Flexible Data Rate
FlexCAN	Flexible Data Rate CAN
FPU	Floating Point Unit
GPIO	General-Purpose Input/Output
FREQME	Frequency Measurement
I^2C	Inter-Integrated Circuit
IDE	Integrated Development Environment
I/O	Input/output
LIN	Local Interconnect Network
LPI2C	Low-Power Inter-integrated Circuit
LPSPI	Low-Power Serial Peripheral Interface
LPTMR	Low-Power Timer
LPUART	Low-Power Universal Asynchronous Receiver/Transmitter
MAU	Math Acceleration Unit
MCU	Microcontroller Unit
MS/s	Mega samples per second
OB	Onboard
OPAMP	Operational Amplifier
PMSM	Permanent Magnet Synchronous Motor
PWM	Pulse Width Modulation/Modulator

Table 13. Acronyms...*continued*

Acronym	Description
RAM	Random-Access Memory
RTC	Real-Time Clock
SAR	Successive Approximation Register
SCI	Serial Communication Interface
SCG	System Clock Generator
SDK	Software Development Kit
SOSC	System Oscillator
SPI	Serial Peripheral Interface
TMU	Trigonometric Math Unit
UTICK	Micro-Tick
WWDT	Windowed Watchdog Timer

11 Revision history

Table 14 summarizes the revisions to this document.

Table 14. Revision history

Document ID	Release date	Description
AN14866 v.1.0	13 January 2026	Initial public release

Legal information

Definitions

Draft — A draft status on a document indicates that the content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included in a draft version of a document and shall have no liability for the consequences of use of such information.

Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. NXP Semiconductors takes no responsibility for the content in this document if provided by an information source outside of NXP Semiconductors.

In no event shall NXP Semiconductors be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, NXP Semiconductors' aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the Terms and conditions of commercial sale of NXP Semiconductors.

Right to make changes — NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use — NXP Semiconductors products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors and its suppliers accept no liability for inclusion and/or use of NXP Semiconductors products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. NXP Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using NXP Semiconductors products, and NXP Semiconductors accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the NXP Semiconductors product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

NXP Semiconductors does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using NXP Semiconductors products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). NXP does not accept any liability in this respect.

Terms and conditions of commercial sale — NXP Semiconductors products are sold subject to the general terms and conditions of commercial sale, as published at https://www.nxp.com/profile/terms, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. NXP Semiconductors hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of NXP Semiconductors products by customer.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Suitability for use in non-automotive qualified products — Unless this document expressly states that this specific NXP Semiconductors product is automotive qualified, the product is not suitable for automotive use. It is neither qualified nor tested in accordance with automotive testing or application requirements. NXP Semiconductors accepts no liability for inclusion and/or use of non-automotive qualified products in automotive equipment or applications.

In the event that customer uses the product for design-in and use in automotive applications to automotive specifications and standards, customer (a) shall use the product without NXP Semiconductors' warranty of the product for such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond NXP Semiconductors' specifications such use shall be solely at customer's own risk, and (c) customer fully indemnifies NXP Semiconductors for any liability, damages or failed product claims resulting from customer design and use of the product for automotive applications beyond NXP Semiconductors' standard warranty and NXP Semiconductors' product specifications.

HTML publications — An HTML version, if available, of this document is provided as a courtesy. Definitive information is contained in the applicable document in PDF format. If there is a discrepancy between the HTML document and the PDF document, the PDF document has priority.

Translations — A non-English (translated) version of a document, including the legal information in that document, is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

Security — Customer understands that all NXP products may be subject to unidentified vulnerabilities or may support established security standards or specifications with known limitations. Customer is responsible for the design and operation of its applications and products throughout their lifecycles to reduce the effect of these vulnerabilities on customer's applications and products. Customer's responsibility also extends to other open and/or proprietary technologies supported by NXP products for use in customer's applications. NXP accepts no liability for any vulnerability. Customer should regularly check security updates from NXP and follow up appropriately.

Customer shall select products with security features that best meet rules, regulations, and standards of the intended application and make the ultimate design decisions regarding its products and is solely responsible for compliance with all legal, regulatory, and security related requirements concerning its products, regardless of any information or support that may be provided by NXP.

NXP has a Product Security Incident Response Team (PSIRT) (reachable at PSIRT@nxp.com) that manages the investigation, reporting, and solution release to security vulnerabilities of NXP products.

NXP B.V. — NXP B.V. is not an operating company and it does not distribute or sell products.

Trademarks

Notice: All referenced brands, product names, service names, and trademarks are the property of their respective owners.

NXP — wordmark and logo are trademarks of NXP B.V.

Contents