E404X Migration Guide

Preliminary pre-release version 2022-01-25

This guide assists in the transition from the E Series E402/E404 to the E404X.

Software Differences

USER FIRMWARE BINARY SIZE

One major advantage of the E404X is that user firmware binaries can be up to 256 Kbytes, instead of 128 Kbytes on Gen 2 devices including the E Series.

FLASH FILE SYSTEM

On the E404X and Gen 3 devices, there is a flash file system (2 MB) for storing user data. This is not available on Gen 2 devices.

COMBINED AND RESUMABLE OTA

On the E404X and Gen 3 devices, over-the-air (OTA) updates have two features that can improve the speed and reliability of OTA updates:

- Combined OTA can combine Device OS and user firmware updates into a single binary that requires only one download and one reboot to install.
- Resumable OTA allows an update to resume from the point it stopped, instead of starting over from the beginning if interrupted.

SLEEP MODES

- In general, the E404X will use less power in all modes.
- In `HIBERNATE` mode, the RTC (real time clock) does not run on the E404X, so you cannot wake by time from `HIBERNATE` mode (formerly known as `SLEEP_MODE_DEEP`).
- However, you can wake by time from `ULTRA_LOW_POWER` mode, and it uses less power than the E Series`HIBERNATE` mode.
- On Gen 2 devices, you can only wake from `HIBERNATE` with a rising signal on `WKP` (A7). The E404X can wake from `HIBERNATE` on any pin, rising or falling.
- On Gen 2 (STM32F205) devices, if you try to go into `HIBERNATE` mode with WKP already high, the device will go into sleep and will not wake up by time or pin change, essentially rendering it unable to wake until reset manually. This problem does not occur on the E404X and Gen 3 devices.

RTC (REAL-TIME CLOCK)

- The E Series module has the ability to use an external lithium coin cell or supercap to power the RTC when the MCU is unpowered. This feature does not exist on the E404X.
- The RTC on the E404X s is not really a real-time clock. It's basically just a counter, and some advanced wakeup features are not possible on the E404X and Gen 3 devices. These features were not enabled by Device OS on Gen 2 devices, either, so this is generally not an issue.
- On the E404X and Gen 3 devices, in `HIBERNATE` sleep mode the RTC does not run, so it is not possible to wake by time, and the system clock will not be set until you connect to the cloud again. `ULTRA_LOW_POWER` is recommended instead.

Hardware differences

MCU

The microcontroller is different in E Series and E404X:

Measure	E Series	E404X
MCU	STM32F205	nRF52840
Manufacturer	ST Microelectronics	Nordic Semiconductor
Processor	ARM Cortex M3	ARM Cortex M4F
Speed	120 MHz	64 MHz
RAM	128 KB	256 KB
Flash (MCU)	1 MB	1 MB
Flash (external)		4 MB[1]
Hardware floating point		✓

- [1]Most of this space is reserved by the system and only a portion if it is available to user applications as a flash file system.
- Not all RAM is available to user applications. The Device OS firmware uses a portion of it.

BLE (BLUETOOTH LE)

- Bluetooth LE (BLE 5.0) is supported on the E404X but not E Series (Gen 2).

NO 5V TOLERANCE!

On Gen 2 devices (STM32F205), most pins are 5V tolerant. This is not the case for the E404X and Gen 3 (nRF52840). You must not exceed 3.3V on any GPIO pin, including ports such as serial, I2C, and SPI.

PINS NO LONGER AVAILABLE FOR GPIO

Pin	Pin Name	Reason
28	B5	NC on E404X
29	B4	NC on E404X
35	D7	SWD debugging SWDIO
36	D6	SWD debugging SWDCLK
38	D4	SWD debugging SWO
39	D3	NC on E404X

You will need to use different pins if you are currently using these pins.

SPI

- On the E404X, there are only two SPI ports SPI (A pins) and SPI1 (C pins)
- E Series SPI1 on the D pins does not exist on the E404X.
- E Series SPI2 on the C pins is SPI1 on the E404X

The following are all SPI-related pins on the E Series and E404X:

Pin	E Series Pin Name	E Series SPI	E404X Pin Name	E404X SPI
21	A5	SPI (MOSI)	A5	SPI (MOSI)
22	A4	SPI (MISO)	A4	SPI (MISO)
23	A3	SPI (SCK)	A3	SPI (SCK)
24	A2	SPI (SS)	A2	SPI (SS)
37	D5	SPI1 (SS)	D5	SPI1 (SS)
38	D4	SPI1 (SCK)	SWO	
39	D3	SPI1 (MISO)	NC	
40	D2	SPI1 (MOSI)	D2	
46	C3	SPI2 (SCK)	C3	SPI1 (SCK)
47	C2	SPI2 (MISO)	C2	SPI1 (MISO)
48	C1	SPI2 (MOSI)	C1	SPI1 (MOSI)

The following SPI data rates are available:

	E Series SPI	E Series SPI1	E404X SPI & SPI1
Maximum rate	30 MHz	15 MHz	32 MHz
Default rate	15 MHz	15 MHz	16 MHz
Clock	60 MHz	30 MHz	64 MHz

- Available clock divisors: 2, 4 (default), 8, 16, 32, 64, 128, 256
- On the E404X, `SPI_MODE_SLAVE` is only supported on `SPI1` and is limited to 8 MHz

I2C

- On the E Series, only one of `Wire` and `Wire1` can be used at the same time. Both I2C ports be used at the same time on the E404X.

Pin	E Series Pin Name	E Series I2C	E404X Pin Name	E404X I2C
41	D1	Wire (SCL)	D1	Wire (SCL)
42	D0	Wire (SDA)	D0	Wire (SDA)
44	C5	Wire1 (SCL)	C5	Wire1 (SCL)
45	C4	Wire1 (SDA)	C4	Wire1 (SDA)

SERIAL (UART)

The primary UART serial (`Serial1`) is on the TX and RX pins on both the E Series and E404X. There is no hardware flow control on this port on E Series, but it can be enabled on the E404X on pins D0 (CTS) and D1 (RTS).

The E Series has additional serial ports `Serial2`, `Serial4`, and `Serial5`. These are not available on the E404X.

	E Series	E404X
Buffer size	64 bytes	configurable[1]
7-bit mode	✓	
8-bit mode	✓	✓
9-bit mode	✓	
Half duplex	✓	
LIN bus	✓	

CTS/RTS flow control	✓[2]	

[1]Default buffer size is 64 bytes but you can configure a larger buffer if desired, limited by available RAM.

[2]CTS/RTS flow control optional on `Serial1`.

Pin	E Series Pin Name	E Series Serial	E404X Pin Name	E404X Serial
16	TX	Serial1 (TX)	TX	Serial1 (TX)
17	RX	Serial1 (RX)	RX	Serial1 (RX)
41	D1		D1	Serial1 (CTS)
42	D0		D0	Serial1 (RTS)
46	C3	USART4_TX	C3	
47	C2	USART4_RX	C2	
48	C1	USART5_TX	C1	
49	C0	USART5_RX	C0	
52	RGBB	Serial2 (RX)	RGBB	
53	RGBG	Serial2 (TX)	RGBG	

Baud rate support

Baud Rate	E Series	E404X
1200	✓	✓
2400	✓	✓
4800	✓	✓
9600	✓	✓
19200	✓	✓
28800		✓
38400	✓	✓
57600	✓	✓
76800		✓
115200	✓	✓
230400	✓	✓
250000		✓
460800		✓
921600		✓
1000000		✓

Serial configurations

Constant	Description	E Series	E404X
SERIAL_8N1	8 data bits, no parity, 1 stop bit (default)	✓	✓
SERIAL_8N2	8 data bits, no parity, 2 stop bits	✓	
SERIAL_8E1	8 data bits, even parity, 1 stop bit	✓	✓
SERIAL_8E2	8 data bits, even parity, 2 stop bits	✓	
SERIAL_8O1	8 data bits, odd parity, 1 stop bit	✓	
SERIAL_8O2	8 data bits, odd parity, 2 stop bits	✓	
SERIAL_9N1	9 data bits, no parity, 1 stop bit	✓	

SERIAL_9N2	9 data bits, no parity, 2 stop bits	✓
SERIAL_7O1	7 data bits, odd parity, 1 stop bit	✓
SERIAL_7O2	7 data bits, odd parity, 1 stop bit	✓
SERIAL_7E1	7 data bits, even parity, 1 stop bit	✓
SERIAL_7E2	7 data bits, even parity, 1 stop bit	✓
LIN_MASTER_13B	8 data bits, no parity, 1 stop bit, LIN Master mode with 13-bit break generation	✓
LIN_SLAVE_10B	8 data bits, no parity, 1 stop bit, LIN Slave mode with 10-bit break detection	✓
LIN_SLAVE_11B	8 data bits, no parity, 1 stop bit, LIN Slave mode with 11-bit break detection	✓

- Using an I2C or SPI UART like the SC16IS750 is also a good way to add support for other bit length, parity, and stop bit options on Gen 3 devices.

ANALOG INPUT (ADC)

For analog to digital conversion (ADC) using `analogRead()`, there are fewer ADC inputs on the E404X:

Pin	E Series Pin Name	E Series ADC	E404X Pin Name	E404X ADC
19	WKP / A7	✓	A7 / WKP	✓
20	DAC / A6	✓	A6	✓
21	A5	✓	A5	✓
22	A4	✓	A4	✓
23	A3	✓	A3	✓
24	A2	✓	A2	✓
25	A1	✓	A1	✓
26	A0	✓	A0	✓
28	B5	✓	NC	
29	B4	✓	NC	
30	B3	✓	B3	
31	B2	✓	B2	

If additional ADC ports are needed, an external I2C and SPI ADC can be added to your base board.

PWM (PULSE-WIDTH MODULATION)

The pins that support PWM are different on the E Series and E404X.

Pin	E Series Pin Name	E Series PWM	E404X Pin Name	E404X PWM
16	TX	TIM1_CH2	TX	PWM2
17	RX	TIM1_CH3	RX	PWM2
19	WKP / A7	TIM5_CH1	A7 / WKP	
21	A5	TIM3_CH2	A5	PWM3
22	A4	TIM3_CH1	A4	PWM3
23	A3		A3	PMW2
24	A2		A2	PMW2
30	B3	TIM3_CH4	B3	PWM1
31	B2	TIM3_CH3	B2	PWM0

32	B1	TIM8_CH1	B1	
33	B0	TIM8_CH3	B0	
39	D3	TIM3_CH1	NC	
40	D2	TIM3_CH2	D2	PWM1
41	D1	TIM4_CH1	D1	PWM3
42	D0	TIM4_CH2	D0	PWM3
44	C5	TIM4_CH3	C5	
45	C4	TIM4_CH4	C4	
49	C0		C0	PWM1

- PWM on the same timer (such as TIM3 or PMM3) must share the same frequency, but can have different duty cycles.
- E404X pin B2 uses PWM0 which is used by the RGB LED. You can have a different duty cycle but should not change the frequency if you are using the RGB LED.

DIGITAL TO ANALOG CONVERTER (DAC)

The E Series supports DAC one A3 and A6 (DAC). There is no DAC on the E404X or Gen 3 devices.

If you need a DAC, it's easy to add one via I2C or SPI on your base board.

Pin	E Series Pin Name	E Series DAC	E404X Pin Name	E404X DAC
20	DAC / A6	✓	A6	
23	A3	✓	A3	

WKP (A7)

	E Series	E404X
Module Pin	30	30
Pin Name	WKP	WKP
	A7	A7
Analog Input	✓	✓
PWM	✓	

On Gen 2 devices (STM32), only the WKP pin rising can wake from HIBERNATE sleep mode.

This restriction does not exist on the E404X and Gen 3 devices; any pin can be used to wake from all sleep modes, rising or falling.

CAN (CONTROLLER AREA NETWORK)

The E series supported CAN on pins D1/D2 or C4/C5. There is no CAN on the E404X or Gen 3 devices (except the Tracker).

- The Tracker SoM includes CAN via a MCP25625 CAN interface with integrated transceiver.
- Both the MCP2515 and MCP25625 work with the library used on the Tracker and can be used to add CAN to the E404X.

Pin	E Series Pin Name	E Series CAN	E404X Pin Name	E404X CAN
40	D2	CAN2_RX	D2	
41	D1	CAN2_TX	D1	

| 44 | C5 | CAN1_RX | C5 |
| 45 | C4 | CAN1_TX | C4 |

I2S (SOUND)

- The E Series theoretically had I2S sound available on pins D1 and D2, however there has never been support for it in Device OS.
- I2S is available on Gen 3 devices including the P404X on any GPIO pins using a 3rd-party library.

INTERRUPTS

There are many limitations for interrupts on the E Series (STM32F205). All pins can be used for interrupts on the E404X Gen 3 devices, however you can only attach interrupts to 8 pins at a time.

SWD

Unlike the E Series module, the E404X SWD pins are dedicated and cannot be used for GPIO.

Pin	E Series Pin Name	E Series SWD	E404X Pin Name	E404X SWD
35	D7	SWDIO	SWDIO	SWDIO
36	D6	SWCLK	SWDCLK	SWCLK
38	D4		SWO	SWO

JTAG

The E404X does not support full JTAG. Some pins are shared with SWD; the E404X SWD pins are dedicated and cannot be used for GPIO.

Pin D5 (module pin 37), however, is available for GPIO as it is not NC and not used by SWD.

Pin	E Series Pin Name	E Series JTAG	E404X Pin Name	E404X JTAG
35	D7	JTAG TMS	SWDIO	
36	D6	JTAG TCK	SWDCLK	
37	D5	JTAG TDI	D5	
38	D4	JTAG TDO	SWO	
39	D3	JTAG RST	NC	

USB

The following USB feature differences exist:

USB Feature		E Series	E404X
Secondary USB serial emulation `USBSerial1`		✓	
USB keyboard emulation		✓	
USB mouse emulation		✓	

PIN FUNCTIONS REMOVED

The following pins were used on the E Series but are not available on the E404X. You should not connect anything to these pins.

Pin	Pin Name	Description
10	VDDA	Power input for ADC. Normally connected to 3V3. Must always be within 300 mV of 3V3.
11	VBAT	Battery for internal real-time clock, backup registers, and SRAM. Supply 1.65VDC to 3.6 VDC at 19 µA..
28	B5	B5 Analog in, GPIO
29	B4	B4 Analog in, GPIO
39	D3	D3 GPIO, SPI1

PIN FUNCTIONS ADDED

No pin functions have been added to previously unused (NC) pins.

FULL MODULE PIN COMPARISON

Module Pin 1 (VIN)

Unchanged between E Series and E404X	
Pin Name	VIN
Description	Power in 3.9V to 12 VDC.

Module Pin 2 (GND)

Unchanged between E Series and E404X	
Pin Name	GND
Description	Ground. Be sure to connect all GND pins.

Module Pin 3 (VBUS)

Unchanged between E Series and E404X	
Pin Name	VBUS
Description	Connect to VBUS power pin on the USB port

Module Pin 4 (GND)

Unchanged between E Series and E404X	
Pin Name	GND
Description	Ground. Be sure to connect all GND pins.

Module Pin 5 (LIPO)

Unchanged between E Series and E404X	
Pin Name	LIPO
Description	Connect to + pin on the LiPo battery, 3.6V maximum

Module Pin 6 (NC)

Unchanged between E Series and E404X	
Pin Name	NC
Description	Do not connect to anything

Module Pin 7 (GND)

Unchanged between E Series and E404X	
Pin Name	GND
Description	Ground. Be sure to connect all GND pins.

Module Pin 8 (PMID)

	E Series	E404X
Pin Name	PMID	PMID
Description	Connected to the PMID pin of the PMIC	Connected to the PMID pin of the PMIC (may change)

Module Pin 9 (3V3)

Unchanged between E Series and E404X	
Pin Name	3V3
Description	Regulated 3.3V DC output, maximum load 800 mA. Cannot be used as a power input.

Module Pin 10

	E Series	E404X
Pin Name	VDDA	NC
Description	Power input for ADC. Normally connected to 3V3. Must always be within 300 mV of 3V3.	Do not connect to anything

Module Pin 11

	E Series	E404X
Pin Name	VBAT	NC
Description	Battery for internal real-time clock, backup registers, and SRAM. Supply 1.65VDC to 3.6 VDC at 19 μA..	Do not connect to anything

Module Pin 12 (GND)

Unchanged between E Series and E404X	
Pin Name	GND
Description	Ground. Be sure to connect all GND pins.

Module Pin 13 (USBDATA+)

	E Series	E404X
Pin Name	USBDATA+	USBDATA+
Description	USB Data+	USB Data+. Cannot be used as GPIO.
Input is 5V Tolerant	Yes	Yes

Module Pin 14 (USBDATA-)

	E Series	E404X
Pin Name	USBDATA-	USBDATA-
Description	USB Data-	USB Data-. Cannot be used as GPIO.
Input is 5V Tolerant	Yes	Yes

Module Pin 15 (GND)

Unchanged between E Series and E404X	
Pin Name	GND

Description	Ground. Be sure to connect all GND pins.	

Module Pin 16 (TX)

	E Series	E404X
Pin Name	TX	TX
Description	Serial1 TX (transmitted data), GPIO, PWM.	Serial1 TX (transmitted data), GPIO, PWM.
Supports digitalRead	Yes	Yes
Supports digitalWrite	Yes	Yes
Supports analogWrite (PWM)	Yes	Yes
Supports tone	Yes	Yes
UART serial	TX. Use Serial1 object.	TX. Use Serial1 object.
Supports attachInterrupt	Yes. C3 and TX share the same interrupt handler.	Yes. You can only have 8 active interrupt pins.
Input is 5V Tolerant	Yes	No

Module Pin 17 (RX)

	E Series	E404X
Pin Name	RX	RX
Description	Serial1 RX (received data), GPIO, PWM.	Serial1 RX (received data), GPIO, PWM.
Supports digitalRead	Yes	Yes
Supports digitalWrite	Yes	Yes
Supports analogWrite (PWM)	Yes	Yes
Supports tone	Yes	Yes
UART serial	RX. Use Serial1 object.	RX. Use Serial1 object.
Supports attachInterrupt	Yes. C4 and RX share the same interrupt handler.	Yes. You can only have 8 active interrupt pins.
Input is 5V Tolerant	Yes	Yes

Module Pin 18 (GND)

	Unchanged between E Series and E404X
Pin Name	GND
Description	Ground. Be sure to connect all GND pins.

Module Pin 19

	E Series	E404X
Pin Name	WKP	A7
Pin Alternate Name	A7	WKP
Description	WKP/A7 Wakeup (active high), analog in, GPIO.	A7 analog in, WKP (wakeup), GPIO.
Supports digitalRead	Yes	Yes
Supports digitalWrite	Yes	Yes
Supports analogRead	Yes	Yes
Supports analogWrite (PWM)	Yes	No
Supports tone	Yes	No

	E Series	E404X
Supports attachInterrupt	Yes. A7 (WKP), B2, and B4 share the same interrupt handler.	Yes. You can only have 8 active interrupt pins.
Input is 5V Tolerant	Yes	No

Module Pin 20

	E Series	E404X
Pin Name	DAC	A6
Pin Alternate Name	A6	n/a
Description	DAC/A6 True analog out, analog in, GPIO.	A6 analog in, GPIO.
Supports digitalRead	Yes	Yes
Supports digitalWrite	Yes	Yes
Supports analogRead	Yes	Yes
Supports analogWrite (DAC)	Yes	No
Supports attachInterrupt	Yes. D3 and DAC/A6 share the same interrupt handler.	Yes. You can only have 8 active interrupt pins.

Module Pin 21 (A5)

	E Series	E404X
Pin Name	A5	A5
Description	A5 Analog in, GPIO, SPI.	A5 Analog in, GPIO, SPI MOSI, PWM.
Supports digitalRead	Yes	Yes
Supports digitalWrite	Yes	Yes
Supports analogRead	Yes	Yes
Supports analogWrite (PWM)	Yes. D2 and A5 share the same PWM channel and the PWM duty cycle is set for both.	Yes
Supports tone	Yes. D2 and A5 share the same PWM channel and only one frequency can be set for both.	Yes
SPI interface	MOSI. Use SPI object.	MOSI. Use SPI object.
Supports attachInterrupt	No	Yes. You can only have 8 active interrupt pins.
Input is 5V Tolerant	Yes	No

Module Pin 22 (A4)

	E Series	E404X
Pin Name	A4	A4
Description	A4 Analog in, GPIO, SPI.	A4 Analog in, GPIO, SPI MISO, PWM.
Supports digitalRead	Yes	Yes
Supports digitalWrite	Yes	Yes
Supports analogRead	Yes	Yes

	E Series	E404X
Supports analogWrite (PWM)	Yes. D3 and A4 share the same PWM channel and the PWM duty cycle is set for both.	Yes
Supports tone	Yes. D3 and A4 share the same PWM channel and only one frequency can be set for both.	Yes
SPI interface	MISO. Use SPI object.	MISO. Use SPI object.
Supports attachInterrupt	Yes. D1 and A4 share the same interrupt handler.	Yes. You can only have 8 active interrupt pins.
Input is 5V Tolerant	Yes	No

Module Pin 23 (A3)

	E Series	E404X
Pin Name	A3	A3
Description	A3 True analog out, analog in, GPIO.	A3 analog in, GPIO, SPI SCK, PWM
Supports digitalRead	Yes	Yes
Supports digitalWrite	Yes	Yes
Supports analogRead	Yes	Yes
Supports analogWrite (DAC)	Yes	No
Supports analogWrite (PWM)	No	Yes
Supports tone	No	Yes
SPI interface	SCK. Use SPI object.	SCK. Use SPI object.
Supports attachInterrupt	Yes. D2, A0, and A3 share the same interrupt handler.	Yes. You can only have 8 active interrupt pins.

Module Pin 24 (A2)

	E Series	E404X
Pin Name	A2	A2
Description	A2 Analog in, GPIO, SPI SS	A2 Analog in, GPIO, SPI SS, PWM
Supports digitalRead	Yes	Yes
Supports digitalWrite	Yes	Yes
Supports analogRead	Yes	Yes
Supports analogWrite (PWM)	No	Yes
Supports tone	No	Yes
SPI interface	SS. Use SPI object. This is only the default SS/CS pin, you can use any GPIO instead.	SS. Use SPI object. This is only the default SS/CS pin, you can use any GPIO instead.
Supports attachInterrupt	Yes. A2 and C0 share the same interrupt handler.	Yes. You can only have 8 active interrupt pins.
Input is 5V Tolerant	Yes	No

Module Pin 25 (A1)

	E Series	E404X
Pin Name	A1	A1

Description	A1 Analog in, GPIO	A1 Analog in, GPIO
Supports digitalRead	Yes	Yes
Supports digitalWrite	Yes	Yes
Supports analogRead	Yes	Yes
Supports attachInterrupt	Yes. D4 and A1 share the same interrupt handler.	Yes. You can only have 8 active interrupt pins.
Input is 5V Tolerant	Yes	No

Module Pin 26 (A0)

	E Series	E404X
Pin Name	A0	A0
Description	A0 Analog in, GPIO	A0 Analog in, GPIO
Supports digitalRead	Yes	Yes
Supports digitalWrite	Yes	Yes
Supports analogRead	Yes	Yes
Supports attachInterrupt	Yes. D2, A0, and A3 share the same interrupt handler.	Yes. You can only have 8 active interrupt pins.
Input is 5V Tolerant	Yes	No

Module Pin 27 (GND)

	Unchanged between E Series and E404X
Pin Name	GND
Description	Ground. Be sure to connect all GND pins.

Module Pin 28

	E Series	E404X
Pin Name	B5	NC
Description	B5 Analog in, GPIO	Do not connect to anything
Supports digitalRead	Yes	n/a
Supports digitalWrite	Yes	n/a
Supports analogRead	Yes	n/a
Supports attachInterrupt	Yes. B3 and B5 share the same interrupt handler.	n/a
Input is 5V Tolerant	Yes	n/a

Module Pin 29

	E Series	E404X
Pin Name	B4	NC
Description	B4 Analog in, GPIO	Do not connect to anything
Supports digitalRead	Yes	n/a
Supports digitalWrite	Yes	n/a
Supports analogRead	Yes	n/a
Supports attachInterrupt	Yes. A7 (WKP), B2, and B4 share the same interrupt handler.	n/a
Input is 5V Tolerant	Yes	n/a

Module Pin 30 (B3)

	E Series	E404X
Pin Name	B3	B3
Description	B3, analog in, GPIO, PWM	B3, GPIO, PWM
Supports digitalRead	Yes	Yes
Supports digitalWrite	Yes	Yes
Supports analogRead	Yes	No
Supports analogWrite (PWM)	Yes	Yes
Supports tone	Yes	Yes
Supports attachInterrupt	Yes. B3 and B5 share the same interrupt handler.	Yes. You can only have 8 active interrupt pins.
Input is 5V Tolerant	Yes	No

Module Pin 31 (B2)

	E Series	E404X
Pin Name	B2	B2
Description	B2, analog in, GPIO, PWM	B2, GPIO, PWM
Supports digitalRead	Yes	Yes
Supports digitalWrite	Yes	Yes
Supports analogRead	Yes	No
Supports analogWrite (PWM)	Yes	Timer is shared with RGB LED; duty cycle can be set but not frequency.
Supports tone	Yes	No
Supports attachInterrupt	Yes. A7 (WKP), B2, and B4 share the same interrupt handler.	Yes. You can only have 8 active interrupt pins.
Input is 5V Tolerant	Yes	No

Module Pin 32 (B1)

	E Series	E404X
Pin Name	B1	B1
Description	B1, GPIO, PWM	B1, GPIO
Supports digitalRead	Yes	Yes
Supports digitalWrite	Yes	Yes
Supports analogWrite (PWM)	Yes	No
Supports tone	Yes	No
Supports attachInterrupt	Yes. D1, A4, and B1 share the same interrupt handler.	Yes. You can only have 8 active interrupt pins.
Input is 5V Tolerant	Yes	No

Module Pin 33 (B0)

	E Series	E404X
Pin Name	B0	B0
Description	B0, GPIO, PWM	B0, GPIO
Supports digitalRead	Yes	Yes

Supports digitalWrite	Yes	Yes
Supports analogWrite (PWM)	Yes	No
Supports tone	Yes	No
Supports attachInterrupt	Yes. B0 and C5 share the same interrupt handler.	Yes. You can only have 8 active interrupt pins.
Input is 5V Tolerant	Yes	No

Module Pin 34 (GND)

	Unchanged between E Series and E404X
Pin Name	GND
Description	Ground. Be sure to connect all GND pins.

Module Pin 35

	E Series	E404X
Pin Name	D7	SWDIO
Description	D7 GPIO	SWDIO for JTAG/SWD debugger. Internal pull-up. Not GPIO.
Supports digitalRead	Yes	No
Supports digitalWrite	Yes	No
Supports attachInterrupt	No. Shared with BAT_INT_PC13	No
Input is 5V Tolerant	Yes	No
JTAG interface	JTAG TMS. 40K pull-up at boot.	n/a
SWD interface	SWDIO. 40K pull-up at boot.	SWDIO

Module Pin 36

	E Series	E404X
Pin Name	D6	SWDCLK
Description	D6 GPIO	SWCLK for JTAG/SWD debugger. Internal pull-down. Not GPIO.
Supports digitalRead	Yes	No
Supports digitalWrite	Yes	No
Supports attachInterrupt	Yes	No
Input is 5V Tolerant	Yes	No
JTAG interface	JTAG TCK. 40K pull-down at boot.	n/a
SWD interface	SWCLK. 40K pull-down at boot.	SWCLK

Module Pin 37 (D5)

	E Series	E404X
Pin Name	D5	D5
Description	D5 GPIO, SPI1	D5 GPIO, SPI1 SS
Supports digitalRead	Yes	Yes

Supports digitalWrite	Yes	Yes
SPI interface	SS. Use SPI1 object. Can use any pin for SPI1 SS/CS however.	SS. Use SPI1 object. Can use any pin for SPI1 SS/CS however.
Supports attachInterrupt	Yes	Yes. You can only have 8 active interrupt pins.
I2S interface	I2S3_WS	n/a
Input is 5V Tolerant	Yes	No
JTAG interface	JTAG TDI. 40K pull-up at boot.	n/a

Module Pin 38

	E Series	E404X
Pin Name	D4	SWO
Description	D4 GPIO, SPI1	SWO for JTAG/SWD debugger. Not GPIO.
Supports digitalRead	Yes	No
Supports digitalWrite	Yes	No
SPI interface	SCK. Use SPI1 object.	n/a
Supports attachInterrupt	Yes. D4 and A1 share the same interrupt handler.	No
I2S interface	I2S3_SD	n/a
Input is 5V Tolerant	Yes	No
JTAG interface	JTAG TDO. Floating at boot.	n/a
SWD interface	n/a	SWO

Module Pin 39

	E Series	E404X
Pin Name	D3	NC
Description	D3 GPIO, SPI1	Do not connect to anything
Supports digitalRead	Yes	n/a
Supports digitalWrite	Yes	n/a
Supports analogWrite (PWM)	Yes. D3 and A4 share the same PWM channel and the PWM duty cycle is set for both.	n/a
Supports tone	Yes. D3 and A4 share the same PWM channel and only one frequency can be set for both.	n/a
SPI interface	MISO. Use SPI1 object.	n/a
Supports attachInterrupt	Yes. D3 and DAC/A6 share the same interrupt handler.	n/a
Input is 5V Tolerant	Yes	n/a
JTAG interface	JTAG RST. 40K pull-up at boot.	n/a

Module Pin 40 (D2)

	E Series	E404X
Pin Name	D2	D2
Description	D2 GPIO, SPI1, CAN	D2 GPIO, PWM
Supports digitalRead	Yes	Yes

	E Series	E404X
Supports digitalWrite	Yes	Yes
Supports analogWrite (PWM)	Yes. D2 and A5 share the same PWM channel and the PWM duty cycle is set for both.	Yes
Supports tone	Yes. D2 and A5 share the same PWM channel and only one frequency can be set for both.	Yes
SPI interface	MOSI. Use SPI1 object.	n/a
Supports attachInterrupt	Yes. D2, A0, and A3 share the same interrupt handler.	Yes. You can only have 8 active interrupt pins.
CAN interface	CAN2_RX	n/a
I2S interface	I2S3_SD	n/a
Input is 5V Tolerant	Yes	No

Module Pin 41 (D1)

	E Series	E404X
Pin Name	D1	D1
Description	D0 GPIO, I2C, CAN	D0 GPIO, I2C Wire SCL, Serial1 RTS, PWM
Supports digitalRead	Yes	Yes
Supports digitalWrite	Yes	Yes
Supports analogWrite (PWM)	Yes	Yes
Supports tone	Yes	Yes
UART serial	n/a	CTS flow control (optional). Use Serial1 object.
I2C interface	SCL. Use Wire object. Use 1.5K to 10K external pull-up resistor. Is 5V tolerant.	SCL. Use Wire object. Use 1.5K to 10K external pull-up resistor.
Supports attachInterrupt	Yes. D1, A4, and B1 share the same interrupt handler.	Yes. You can only have 8 active interrupt pins.
CAN interface	CAN2_TX	n/a
Input is 5V Tolerant	Yes	No

Module Pin 42 (D0)

	E Series	E404X
Pin Name	D0	D0
Description	D0 GPIO, I2C	D0 GPIO, I2C Wire SDA, Serial1 CTS, PWM
Supports digitalRead	Yes	Yes
Supports digitalWrite	Yes	Yes
Supports analogWrite (PWM)	Yes	Yes
Supports tone	Yes	Yes
UART serial	n/a	RTS flow control (optional). Use Serial1 object.
I2C interface	SDA. Use Wire object. Use 1.5K to 10K external pull-up resistor. Is 5V tolerant.	SDA. Use Wire object. Use 1.5K to 10K external pull-up resistor.

Supports attachInterrupt	No	Yes. You can only have 8 active interrupt pins.
Input is 5V Tolerant	Yes	No

Module Pin 43 (GND)

	Unchanged between E Series and E404X
Pin Name	GND
Description	Ground. Be sure to connect all GND pins.

Module Pin 44 (C5)

	E Series	E404X
Pin Name	C5	C5
Description	I2C, CAN, GPIO.	I2C Wire1 SCL, not GPIO
Supports digitalRead	Yes	No
Supports digitalWrite	Yes	No
Supports analogWrite (PWM)	Yes	No
Supports tone	Yes	No
I2C interface	SCL. Use Wire1 object. You can only use Wire or Wire1, not both!	SCL. Use Wire1 object. Shared with PMIC and Fuel Gauge.
Supports attachInterrupt	Yes. B0 and C5 share the same interrupt handler.	n/a
CAN interface	CAN1_RX	n/a
Input is 5V Tolerant	Yes	No

Module Pin 45 (C4)

	E Series	E404X
Pin Name	C4	C4
Description	I2C, CAN, GPIO.	I2C Wire1 SDA, not GPIO
Supports digitalRead	Yes	No
Supports digitalWrite	Yes	No
Supports analogWrite (PWM)	Yes	No
Supports tone	Yes	No
I2C interface	SDA. Use Wire1 object. You can only use Wire or Wire1, not both!	SDA. Use Wire1 object. Shared with PMIC and Fuel Gauge.
Supports attachInterrupt	Yes. C4 and RX share the same interrupt handler.	No
CAN interface	CAN1_TX	n/a
Input is 5V Tolerant	Yes	No

Module Pin 46 (C3)

	E Series	E404X
Pin Name	C3	C3
Description	Serial4 TX (transmitted data), SPI2, GPIO.	SPI1 SCK, GPIO.
Supports digitalRead	Yes	Yes

Supports digitalWrite	Yes	Yes
UART serial	TX. Use Serial4 object.	n/a
SPI interface	SCK. Use SPI2 object.	SCK. Use SPI1 object.
Supports attachInterrupt	Yes. C3 and TX share the same interrupt handler.	Yes. You can only have 8 active interrupt pins.
Input is 5V Tolerant	Yes	No

Module Pin 47 (C2)

	E Series	E404X
Pin Name	C2	C2
Description	Serial4 RX (received data), SPI2, GPIO.	SPI1 MISO, GPIO.
Supports digitalRead	Yes	Yes
Supports digitalWrite	Yes	Yes
UART serial	RX. Use Serial4 object.	n/a
SPI interface	MISO. Use SPI2 object.	MISO. Use SPI1 object.
Supports attachInterrupt	No	Yes. You can only have 8 active interrupt pins.
Input is 5V Tolerant	Yes	No

Module Pin 48 (C1)

	E Series	E404X
Pin Name	C1	C1
Description	Serial5 TX (trasmitted data), SPI2, GPIO.	SPI1 MOSI, GPIO.
Supports digitalRead	Yes	Yes
Supports digitalWrite	Yes	Yes
UART serial	TX. Use Serial5 object.	n/a
SPI interface	MOSI. Use SPI2 object.	MOSI. Use SPI1 object.
Supports attachInterrupt	No	Yes. You can only have 8 active interrupt pins.
Input is 5V Tolerant	Yes	No

Module Pin 49 (C0)

	E Series	E404X
Pin Name	C0	C0
Description	Serial5 RX (received data), GPIO.	GPIO, PWM.
Supports digitalRead	Yes	Yes
Supports digitalWrite	Yes	Yes
Supports analogWrite (PWM)	No	Yes
Supports tone	No	Yes
UART serial	RX. Use Serial5 object.	n/a
Supports attachInterrupt	Yes. A2 and C0 share the same interrupt handler.	Yes. You can only have 8 active interrupt pins.
Input is 5V Tolerant	Yes	No

Module Pin 50 (NC)

Unchanged between E Series and E404X	
Pin Name	NC

Description	Do not connect to anything

Module Pin 51 (GND)

	Unchanged between E Series and E404X
Pin Name	GND
Description	Ground. Be sure to connect all GND pins.

Module Pin 52 (RGBB)

	E Series	E404X
Pin Name	RGBB	RGBB
Description	RGB LED Blue	RGB LED Blue
UART serial	RX. Use Serial2 object.	n/a

Module Pin 53 (RGBG)

	E Series	E404X
Pin Name	RGBG	RGBG
Description	RGB LED Green	RGB LED Green
UART serial	TX. Use Serial2 object.	n/a

Module Pin 54 (RGBR)

	Unchanged between E Series and E404X
Pin Name	RGBR
Description	RGB LED Red

Module Pin 55 (MODE)

	E Series	E404X
Pin Name	MODE	MODE
Description	MODE button, has internal pull-up. Pin number constant is BTN.	MODE button, has internal pull-up. Pin number constant is BTN.
I2S interface	I2S3_MCK	n/a

Module Pin 56 (RESET)

	Unchanged between E Series and E404X
Pin Name	RESET
Description	Hardware reset. Pull low to reset; can leave unconnected in normal operation.

Module Pin 57 (STAT)

	Unchanged between E Series and E404X
Pin Name	STAT
Description	Charge status output from the PMIC.

Module Pin 58 (GND)

	Unchanged between E Series and E404X
Pin Name	GND
Description	Ground. Be sure to connect all GND pins.

Module Pin 59 (GND)

Unchanged between E Series and E404X	
Pin Name	GND
Description	Ground. Be sure to connect all GND pins.

Module Pin 60 (GND)

Unchanged between E Series and E404X	
Pin Name	GND
Description	Ground. Be sure to connect all GND pins.

Module Pin 61 (NC)

Unchanged between E Series and E404X	
Pin Name	NC
Description	Leave unconnected

Module Pin 62 (NC)

Unchanged between E Series and E404X	
Pin Name	NC
Description	Leave unconnected

Module Pin 63 (NC)

Unchanged between E Series and E404X	
Pin Name	NC
Description	Leave unconnected

Module Pin 64 (NC)

Unchanged between E Series and E404X	
Pin Name	NC
Description	Leave unconnected

Module Pin 65 (NC)

Unchanged between E Series and E404X	
Pin Name	NC
Description	Leave unconnected

Module Pin 66 (NC)

Unchanged between E Series and E404X	
Pin Name	NC
Description	Leave unconnected

Module Pin 67 (NC)

Unchanged between E Series and E404X	
Pin Name	NC
Description	Leave unconnected

Module Pin 68 (NC)

Unchanged between E Series and E404X	
Pin Name	NC
Description	Leave unconnected

Module Pin 69 (NC)

Unchanged between E Series and E404X	
Pin Name	NC
Description	Leave unconnected

Module Pin 70 (NC)

Unchanged between E Series and E404X	
Pin Name	NC
Description	Leave unconnected

Module Pin 71 (NC)

Unchanged between E Series and E404X	
Pin Name	NC
Description	Leave unconnected

Module Pin 72 (NC)

Unchanged between E Series and E404X	
Pin Name	NC
Description	Leave unconnected

Software

Most third-party libraries are believed to be compatible. The exceptions include:

- Libraries that use peripherals that are not present (such as DAC)
- Libraries for MCU-specific features (such as ADC DMA)
- Libraries that are hardcoded to support only certain platforms by their PLATFORM_ID

Since the E404X uses the same MCU as Gen 3 devices (Boron, B Series SoM, Tracker SoM), most libraries intended for those platforms will work with no changes or minimal changes.