MT0 Hardware Integration guide

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Introduction

The Cisco Meraki MT0 is a Bluetooth module that uses the Nordic nRF52840 Bluetooth chipset and is design to integrate into Cisco Meraki MT IoT sensors. This module is made to be integrated exclusively with products made by Cisco Systems, Inc. will not be integrated in any product not made by Cisco Systems, Inc..

Features

- *Bluetooth*® 5, IEEE 802.15.4-2006, 2.4 GHz transceiver
  - -95 dBm sensitivity in 1 Mbps *Bluetooth*® low energy mode
  - -103 dBm sensitivity in 125 kbps *Bluetooth*® low energy mode (long range)
  - -20 to +8 dBm TX power, configurable in 4 dB steps
  - On-air compatible with nRF52, nRF51, nRF24L, and nRF24AP Series
  - Supported data rates:
    - *Bluetooth*® 5 – 2 Mbps, 1 Mbps, 500 kbps, and 125 kbps
    - IEEE 802.15.4-2006 – 250 kbps
    - Proprietary 2.4 GHz – 2 Mbps, 1 Mbps
  - Single-ended antenna output (on-chip balun)
  - 128-bit AES/ECB/CCM/AAR co-processor (on-the-fly packet encryption)
  - 4.8 mA peak current in TX (0 dBm)
  - 4.6 mA peak current in RX
  - RSSI (1 dB resolution)
- ARM® Cortex®-M4 32-bit processor with FPU, 64 MHz
  - 212 EEMBC CoreMark® score running from flash memory
  - 52 µA/MHz running CoreMark from flash memory
  - Watchpoint and trace debug modules (DWT, ETM, and ITM)
  - Serial wire debug (SWD)
- Rich set of security features
  - ARM® TrustZone® Cryptocell 310 security subsystem
    - NIST SP800-90A and SP800-90B compliant random number generator
    - AES-128 – ECB, CBC, CMAC/CBC-MAC, CTR, CCM/CCM*
    - Chacha20/Poly1305 AEAD supporting 128- and 256-bit key size
    - SHA-1, SHA-2 up to 256 bits
    - Keyed-hash message authentication code (HMAC)
    - RSA up to 2048-bit key size
    - SRP up to 3072-bit key size
    - ECC support for most used curves, including P-256 (secp256r1) and Ed25519/Curve25519
    - Application key management using derived key model
  - Secure boot ready
    - Flash access control list (ACL)
    - Root-of-trust (RoT)
    - Debug control and configuration
    - Access port protection (CTRL-AP)
  - Secure erase
- Flexible power management
  - 1.7 V to 5.5 V supply voltage range
  - On-chip DC/DC and LDO regulators with automated low current modes
  - 1.8 V to 3.3 V regulated supply for external components
  - Automated peripheral power management
  - Fast wake-up using 64 MHz internal oscillator
  - 0.4 µA at 3 V in System OFF mode, no RAM retention
  - 1.5 µA at 3 V in System ON mode, no RAM retention, wake on RTC
- 1 MB flash and 256 kB RAM
- Advanced on-chip interfaces
  - USB 2.0 full speed (12 Mbps) controller
  - QSPI 32 MHz interface
  - High-speed 32 MHz SPI
  - Type 2 near field communication (NFC-A) tag with wake-on field
    - Touch-to-pair support
  - Programmable peripheral interconnect (PPI)
  - 48 general purpose I/O pins
  - EasyDMA automated data transfer between memory and peripherals
- Nordic SoftDevice ready with support for concurrent multiprotocol
- 12-bit, 200 ksps ADC – 8 configurable channels with programmable gain
- 64 level comparator
- 15 level low-power comparator with wake-up from System OFF mode
- Temperature sensor
- 4x four channel pulse width modulator (PWM) unit with EasyDMA
- Audio peripherals – I^2S, digital microphone interface (PDM)
- 5x 32-bit timer with counter mode
- Up to 4x SPI master/3x SPI slave with EasyDMA
- Up to 2x I^2C compatible two-wire master/slave
- 2x UART (CTS/RTS) with EasyDMA
- Quadrature decoder (QDEC)
- 3x real-time counter (RTC)
- Single crystal operation
- Package variants
  - aQFN™ 73 package, 7 x 7 mm
  - QFN48 package, 6 x 6 mm
  - WLCSP package, 3.544 x 3.607 mm

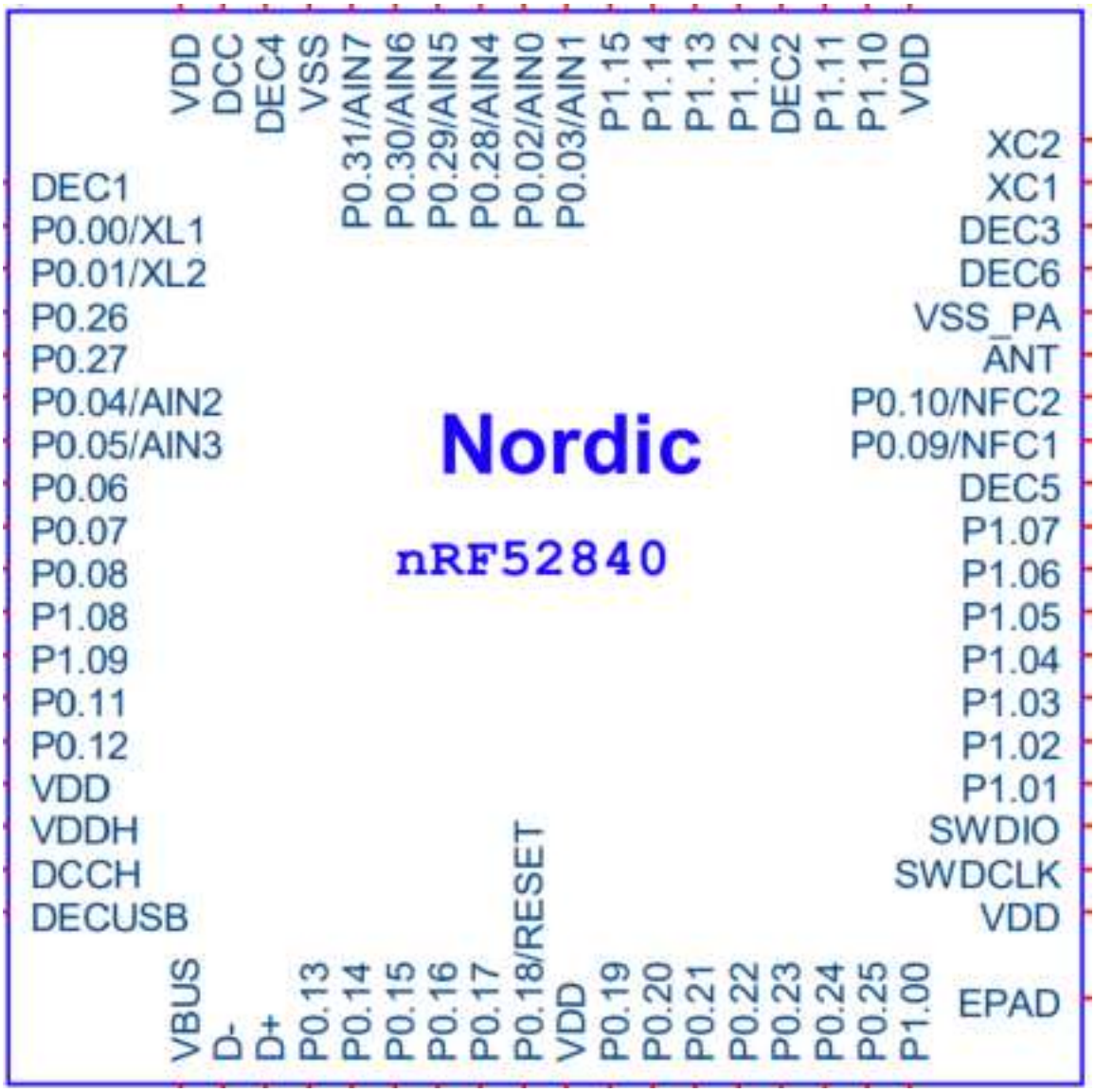
Hardware Integration

The MT0, Nordic based chipset, shall be integrated into the host board according to the following specifications in this guide: https://infocenter.nordicsemi.com/pdf/nRF52840_PS_v1.7.pdf

*please visit nordicsemi.com for the most current specifications and integration instructions.

Pin Assignments

The nRF52840 device provides flexibility regarding GPIO pin routing and configuration. However, some pins have limitations or recommendations for pin configurations and uses.



Pin	Name	IO	Signal Name
D2	P0.00/ XL1	I	XL1
F2	P0.01/ XL2	I	XL2
A12	P0.02/ AIN0	I/O	GPIO2
B13	P0.03/ AIN1	I/O	GPIO1
J1	P0.04/ AIN2		N/C
K2	P0.05/ AIN3		N/C
L1	P0.06		N/C
M2	P0.07	O	R_LED
N1	P0.08	O	UART0_TXD
L24	P0.09/ NFC1	I/O	GPIO3
J24	P0.10/ NFC2	I/O	GPIO4
T2	P0.11	O	B_LED
U1	P0.12		N/C
AD8	P0.13		N/C
AC9	P0.14		N/C
AD10	P0.15		N/C
AC11	P0.16		N/C
AD12	P0.17	I	SYSTEM_RESET
AC13	P0.18/ nRESET	I	SYSTEM_RESET
AC15	P0.19	I/O	GPIO5
AD16	P0.20	I/O	GPIO6
AC17	P0.21	I/O	GPIO7
AD18	P0.22	I/O	GPIO8
AC19	P0.23	I/O	GPIO9
AD20	P0.24	I/O	GPIO10
AC21	P0.25		N/C
G1	P0.26	I	General_PB
H2	P0.27	O	
B11	P0.28/ AIN4	I/O	GPIO11
A10	P0.29/ AIN5		
B9	P0.30/ AIN6	I	DET_BAT/USB
A8	P0.31/AIN7	I	DET_BAT
AD22	P1.00	I/O	SWO
Y23	P1.01		N/C
W24	P1.02	O	SCL
V23	P1.03		N/C
U24	P1.04	I/O	SDA
T23	P1.05	O	RST_SC
R24	P1.06		VC2
P23	P1.07		VC1
P2	P1.08	O	G_LED
R1	P1.09	I	UART0_RXD
A20	P1.10	O	EN_BST5V0
B19	P1.11	O	EN_BST3V3
B17	P1.12	O	EN_ACT2
A16	P1.13		N/C
B15	P1.14		N/C
A14	P1.15		N/C

B3	DCC		Passive components
B5	DEC4		Passive components
C1	DEC1		100nF to GND
D23	DEC3		100nF to GND
E24	DEC6		Passive components
N24	DECS		820pF to GND
F23	VSS_PA		Connect to GND
H23	ANT		Antenna Path
AA24	SWDCLK	I/O	SWDCLK
AC24	SWDIO	I/O	SWDIO
AD4	D-	I/O	D-
AD6	D+	I/O	D+
AB2	DCCH		N/C
A22	VDD	I	VDD_1V9
B1	VDD	I	VDD_1V9
W1	VDD	I	VDD_1V9
Y2	VDDH	I	VDD_1V9
AD14	VDD	I	VDD_1V9
AD23	VDD	I	VDD_1V9
B7	VSS	I	GND
Die pad	VSS	I	GND
AD2	VBUS	I	Passive components
A18	DEC2		N/C 100nF to GND
AC5	DECUSB		N/C 47uF to GND
B24	XC1		XC1
A23	XC2		XC2

Regulatory Information

FCC Compliance Statement

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This de-vice may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

FCC Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from which the receiver is connected.

- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution

Any changes or modifications not expressly approved by Meraki could void the user's authority to operate this equipment. This Transmitter must not be co-located or operation in conjunction with any other antenna or transmitter.

FCC Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Industry Canada Statement

This device complies with RSS -247 of the Industry Canada Rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Ce dispositif est conforme à la norme CNR-247 d'Industrie Canada applicable aux appareils radio exempts de licence.
Son fonctionnement est sujet aux deux conditions suivantes: (1) le dispositif ne doit pas produire de brouillage préjudiciable, et (2) ce dispositif doit accepter tout brouillage reçu, y compris un brouillage susceptible de provoquer un fonctionnement indésirable.

Industry Canada Radiation Exposure Statement

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator & your body.

Déclaration d'exposition aux radiations
Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non con trôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 cm de distance entre la source de rayonnement et votre corps.

For additional information on the certification status for the product, please visit Meraki.com/compliance.

For additional information on Meraki hardware and for other installation guides, please refer to documentation.meraki.com.