

Arm[®] Cortex[®]-M4F
32-bit Microcontroller

NuMicro[®] Family
M48XXE8AE
(128 KB Flash)
Product Brief

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1 GENERAL DESCRIPTION

The NuMicro® M480 series microcontroller is powered by Arm® Cortex®-M4 with DSP and FPU and runs up to 192 MHz. The dynamic power consumption is around 130 µA/MHz and the standby current can be down to 500 nA. This M480 series consists of three sub-series according to the characteristics and applications and provides 128 KB embedded Flash and 64 KB embedded SRAM. The 128 KB embedded Flash supports eXecute-Only-Memory feature for firmware protection and the 64 KB SRAM supports 32 KB or 64 KB RAM retention in sleep mode.

This M480 series supports Secure Boot functionality to protect firmware integrity and authenticity as well as the AES and TRNG for data security. In addition, this M480 series supports camera interface for image capture, 2 sets of Bosch CAN bus 2.0B for data transmission in industrial control and dual Quad-SPI for signal generation.

The NuMicro® M480 series comprises three sub-series:

- NuMicro® M481 Base series: high performance, low power consumption and versatile high speed UART/SPI/I2C/PWM peripherals, eligible for motor control and data collector.
- NuMicro® M482 USB FS OTG series: Integrated USB 2.0 full speed interface with on-chip OTG PHY, crystal-less USB in device mode, eligible for gaming or PC accessories.
- NuMicro® M483 CAN series: Integrated 2 sets of CAN 2.0B interfaces and 8 sets of UART interfaces, eligible for IoV and industrial control

Series	USB Full Speed	USB High Speed	CAN 2.0B	Cryptography	Ethernet
M481					
M482	√				
M483	√		√		

2 FEATURES

* Core

- Up to 192 MHz ARM® Cortex®-M4F delivering 1.25 DMIPS per MHz
- DSP instruction set
- Memory Protection Unit (MPU)

* Memories

- 128 KB zero-wait state flash memory support 4 eExecute-Only-Memory (XOM) regions
- 64 KB SRAM
- 2 KB One-Time-Programmable ROM

* Cyclic Redundancy Calculation Unit

* 16-channel Peripheral DMA Controller

* External Bus Interface

- LCD parallel interface, i80 mode

* Clock

- 4 to 24 MHz crystal oscillator
- 32 kHz crystal oscillator for RTC
- Internal 48 MHz RC oscillator (X-less USB)
- Internal 12 MHz RC oscillator
- Internal 10 kHz RC oscillator
- Internal PLL up to 480 MHz

* RTC

- Independent V_{BAT} power pin
- 20 bytes of battery-powered backup registers
- Up to six temper detection pins

* Power Management

- Active: 130 µA/MHz at 25°C/3.3V (peripheral off)
- Deep power-down: <1 µA
- V_{BAT} for RTC: < 500 nA

* Timer & PWM

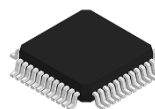
- Four 32-bit timers, each supports up to 2 PWM (Total 8 PWM)
- Twelve Enhanced PWM with twelve 16-bit timers
- Twelve Basic PWM with two 16-bit timers
- One 24-bit count-down SysTick timer
- One watchdog timer
- One window watchdog timer

* Analog Peripheral

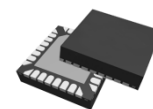
- One 12-bit, up to 24-ch 5MSPS SAR ADC
- One 12-bit, 1MSPS DAC
- Two rail-to-rail comparators
- Built-in internal reference voltage

* Cryptography Accelerator

- ECC-256
- AES-256
- SHA-256 / HMAC
- True Random number generator



LQFP48 (7x7 mm)
LQFP64 (7x7 mm)



QFN33 (5x5 mm)

* Communication Interface

- Up to 8 UART interfaces, including LIN and IrDA interfaces
- One ISO-816-3 interface, which supports full duplex UART mode
- Three I²C interfaces with SMBus/PMBus (Up to 3.4 Mbps)
- Two Quad-SPI interface (Up to 48 MB/s)
- Up to 3 SPI/I²S interfaces (SPI up to 96 Mbps, I²S up to 6 Mbps)
- One I²S interface (Up to 12 Mbps)
- Up to two CAN 2.0B interfaces (Up to 1 Mbps)
- One Secure Digital Host Controllers (Up to 48 Mbps)

* Control Interface

- Up to two quadrature encoder interfaces
- Two 24-bit, 3-ch input capture timer/counter units

* Digital Camera Interface

- CCIR601/CCIR656 camera interface

* Advanced Connectivity

- USB 2.0 full speed device/host/OTG controller with on-chip PHY, which supports crystal-less in device mode

* Operating Characteristic

- Voltage range: 1.8V to 3.6V
- Temperature range: -40°C to +105°C
- ESD HBM 4KV

* Voltage Adjustable Interface

- Up to six I/O ports support VAI with supply V_{DDIO} from 1.8V to 3.6V

* Up to 52 I/O pins with interrupt capability

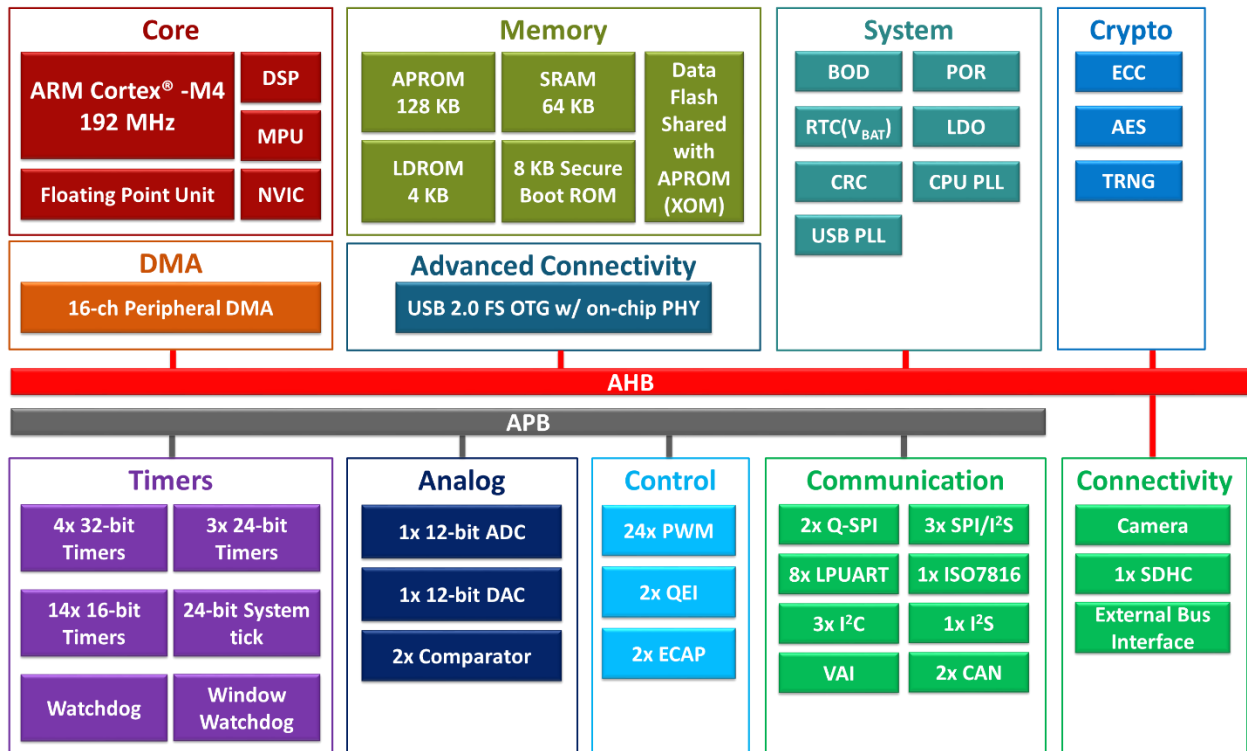
- Up to 28 5V-tolerant I/O pins

* 96-bit Unique ID (UID)

* 128-bit Unique Customer ID (UCID)

* IEC-60730 Class B Compliance

3 BLOCK DIAGRAM



4 PARTS INFORMATION

4.1 Package Type

Part No.	QFN33	LQFP48	LQFP64	LQFP128	LQFP144
M481	M481ZE8AE	M481LE8AE	M481SE8AE		
M482	M482ZE8AE	M482LE8AE	M482SE8AE		
M483			M483SE8AE		

4.2 M481 Base Series

PART NUMBER	M481			
	ZE8AE	LE8AE	SE8AE	
Flash (KB)	128			
SRAM (KB)	64			
ISP Loader ROM (KB)	4			
I/O	26	41	52	
32-bit Timer	4			
Peripheral DMA	16			
Tamper	-	-	1	
Connectivity	LPUART	8		
	ISO-7816	1		
	SPI Master	-		
	Quad SPI	2		
	SPI/I ² S	2	3	3
	I ² S	1		
	I ² C	3		
	USCI	-		
	CAN	-		
	LIN	2		
	SDHC	1		
16-bit PWM	24			
QEI	1	2	2	
ECAP	-	1	1	
USB 2.0 FS OTG	-			
USB 2.0 HS OTG	-			
12-bit ADC	10	12	16	
12-bit DAC	1			
Analog Comparator	2			
Operational Amplifier	-			
Ethernet	-			
Cryptography	AES-256			
TRNG	√			
External Bus Interface	-	√	√	
Camera Interface	-	-	√	
Package	QFN33	LQFP 48	LQFP 64	

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4.3 M482 USB FS OTG Series

PART NUMBER	M482			
	ZE8AE	LE8AE	SE8AE	
Flash (KB)	128			
SRAM (KB)	64			
ISP Loader ROM (KB)	4			
I/O	26	41	52	
32-bit Timer	4			
Peripheral DMA	16			
Tamper	-	-	1	
Connectivity	LPUART	8		
	ISO-7816	1		
	SPI Master	-		
	Quad SPI	2		
	SPI/I ² S	2	3	3
	I ² S	1		
	I ² C	3		
	USCI	-		
	CAN	-		
	LIN	2		
	SDHC	1		
16-bit PWM	24			
QEI	1	2	2	
ECAP	-	1	1	
USB 2.0 FS OTG	√ (Crystal-less)			
USB 2.0 HS OTG	-			
12-bit ADC	10	12	16	
12-bit DAC	1			
Analog Comparator	2			
Operational Amplifier	-			
Ethernet	-			
Cryptography	AES-256			
TRNG	√			
External Bus Interface	-	√	√	
Camera Interface	-	-	√	
Package	QFN33	LQFP 48	LQFP 64	

4.4 M483 CAN Series

PART NUMBER		M483
		SE8AE
Flash (KB)		128 (Support XOM)
SRAM (KB)		64
ISP Loader ROM (KB)		4
I/O		52
32-bit Timer		4
Peripheral DMA		16
Tamper		1
Connectivity	LPUART	8
	ISO-7816	1
	SPI Master	-
	Quad SPI	2
	SPI/I ² S	3
	I ² S	1
	I ² C	3
	USCI	-
	CAN	2
	LIN	2
	SDHC	1
	16-bit PWM	24
QEI		2
ECAP		1
USB 2.0 FS OTG		√ (Crystal-less)
USB 2.0 HS OTG		-
12-bit ADC		16
12-bit DAC		1
Analog Comparator		2
Operational Amplifier		-
Ethernet		-
Cryptography		AES-256
TRNG		√
External Bus Interface		√
Camera Interface		√
Package		LQFP 64

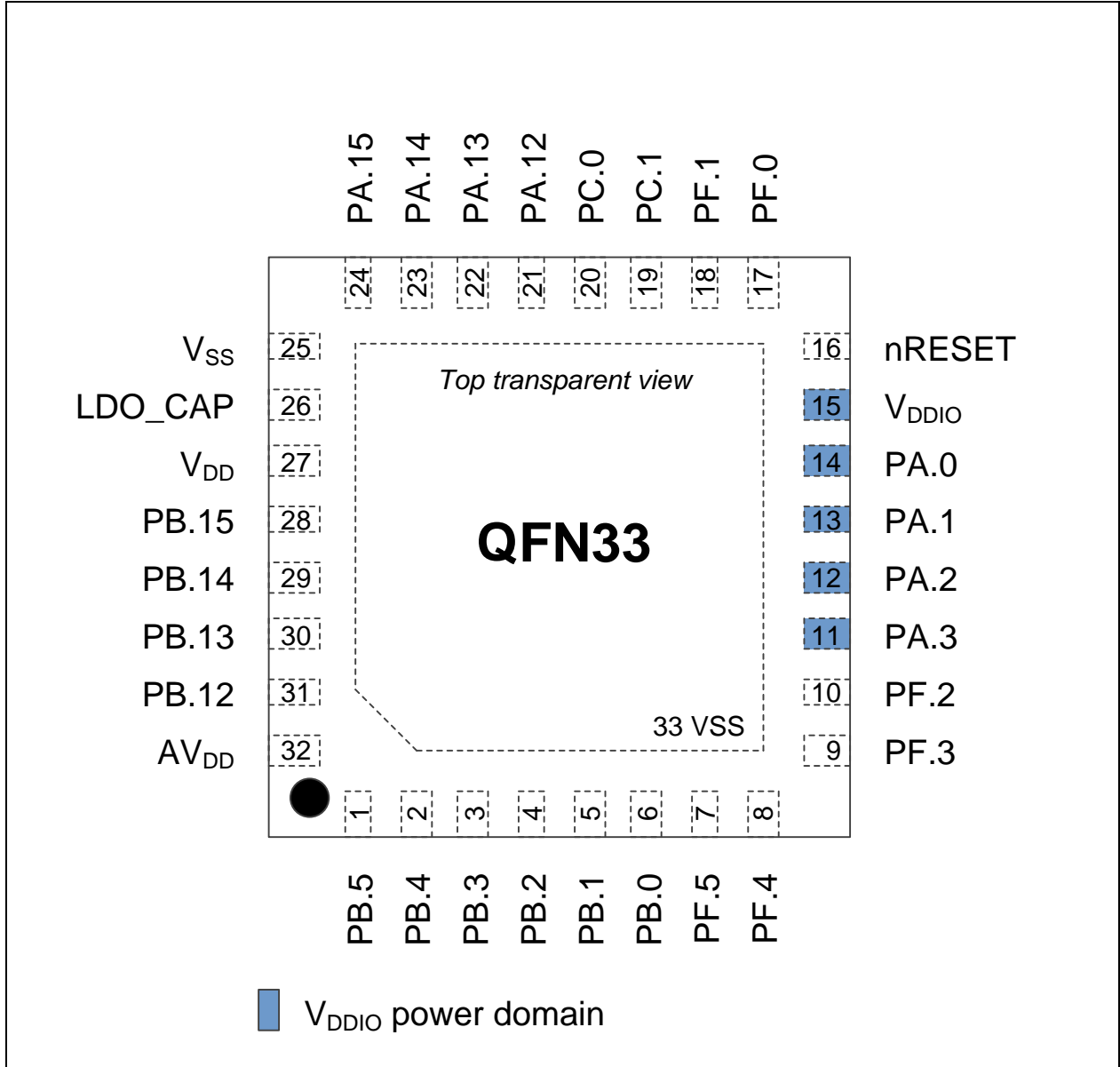
4.5 Naming Rule

M4	81	Z	G	D	A	E	
Core	Series	Package	Flash Size	SRAM Size	Revision	Temperature	
Cortex®-M4F	81: Base	Z: QFN33	A: 8 KB	1: 4 KB		E:-40°C ~ 105°C	
	82: USB FS	(5x5 mm)	B: 16 KB	2: 8 KB			
	83: CAN	L: LQFP48	C: 32 KB	3: 16 KB			
	84: USB HS	(7x7 mm)	D: 64 KB	4: 20 KB			
	85: Crypto	C: WLCSP	E: 128 KB	5: 24 KB			
	87: Ethernet	S: LQFP64	(7x7 mm)	F: 192 KB	6: 32 KB		
			O: QFN88	G: 256 KB	7: 48 KB		
			(10x10 mm)	H: 384 KB	8: 64 KB		
			V: LQFP100	I: 512 KB	9: 80 KB		
			(14x14 mm)	A: 96 KB	B: 112 KB		
	K: LQFP128	(14x14 mm)	C: 128 KB				
	J: LQFP144	(20x20 mm)	D: 160 KB				

5 PIN CONFIGURATION

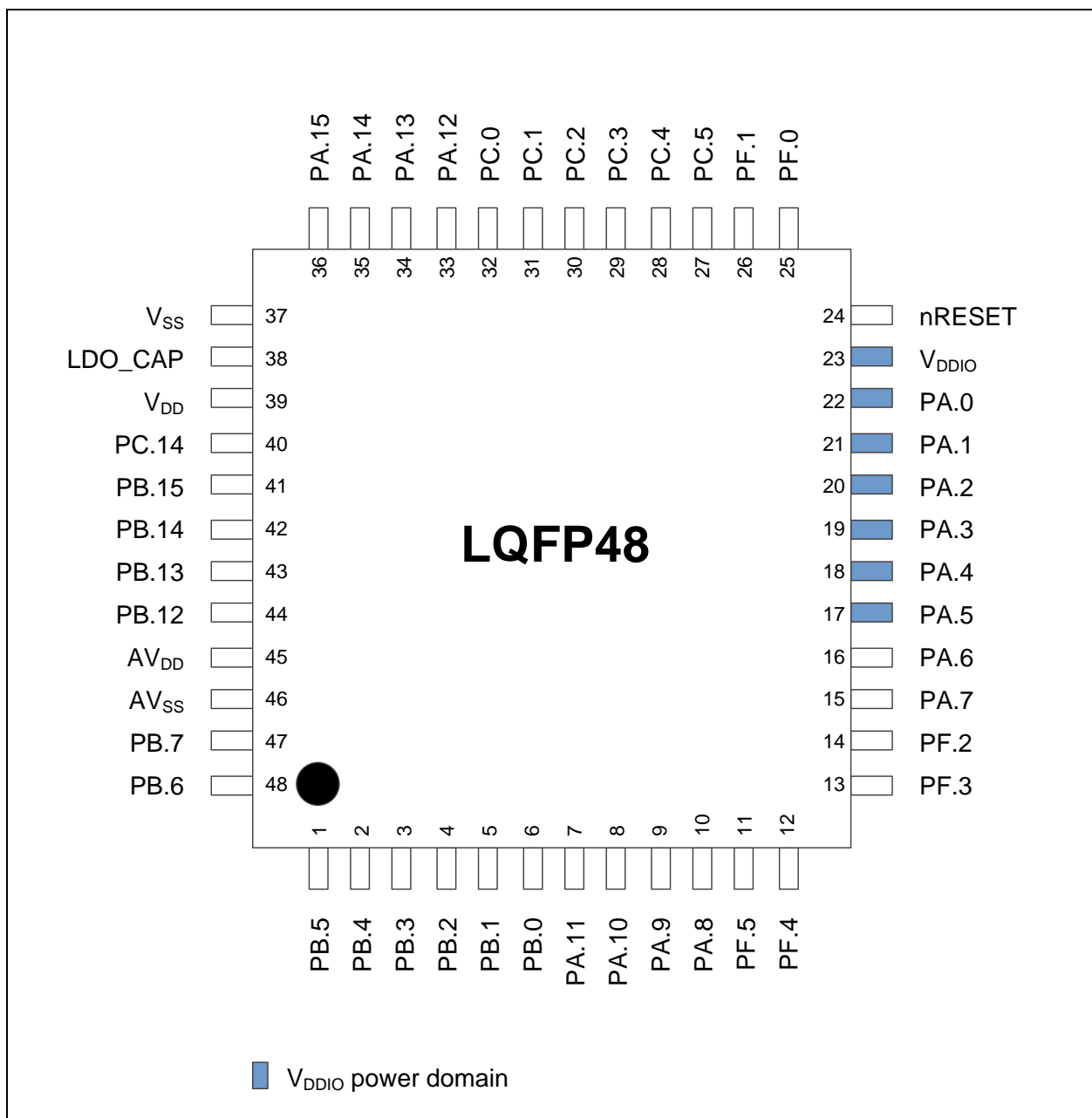
5.1 QFN-33 Pin Diagram

Corresponding Part Number: M481ZE8AE, M482ZE8AE



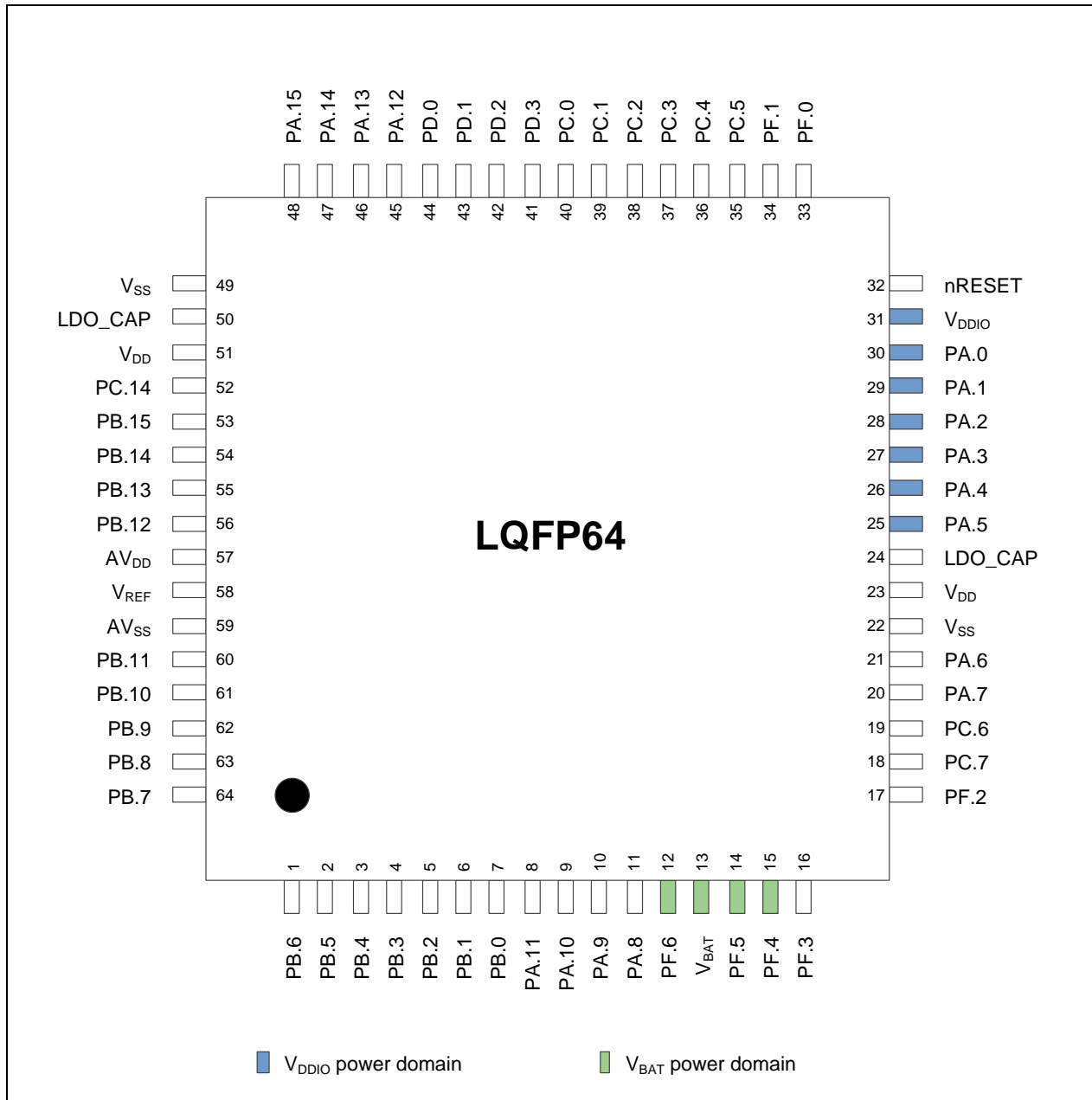
5.2 LQFP-48 Pin Diagram (0/1 USB FS)

Corresponding Part Number: M481LE8AE, M482LE8AE



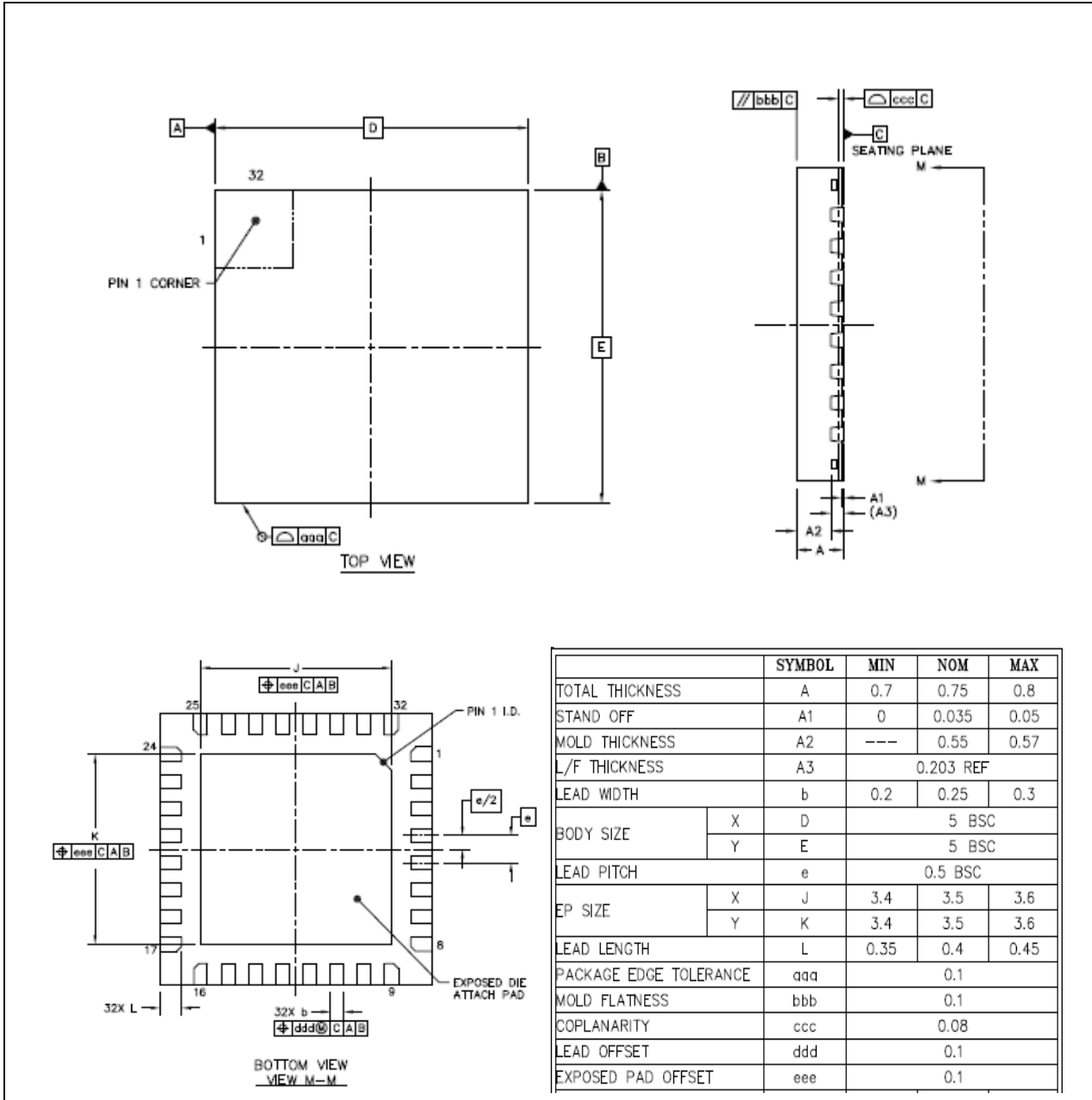
5.3 LQFP-64 Pin Diagram (0/1 USB FS)

Corresponding Part Number: M481SE8AE, M482SE8AE, M483SE8AE

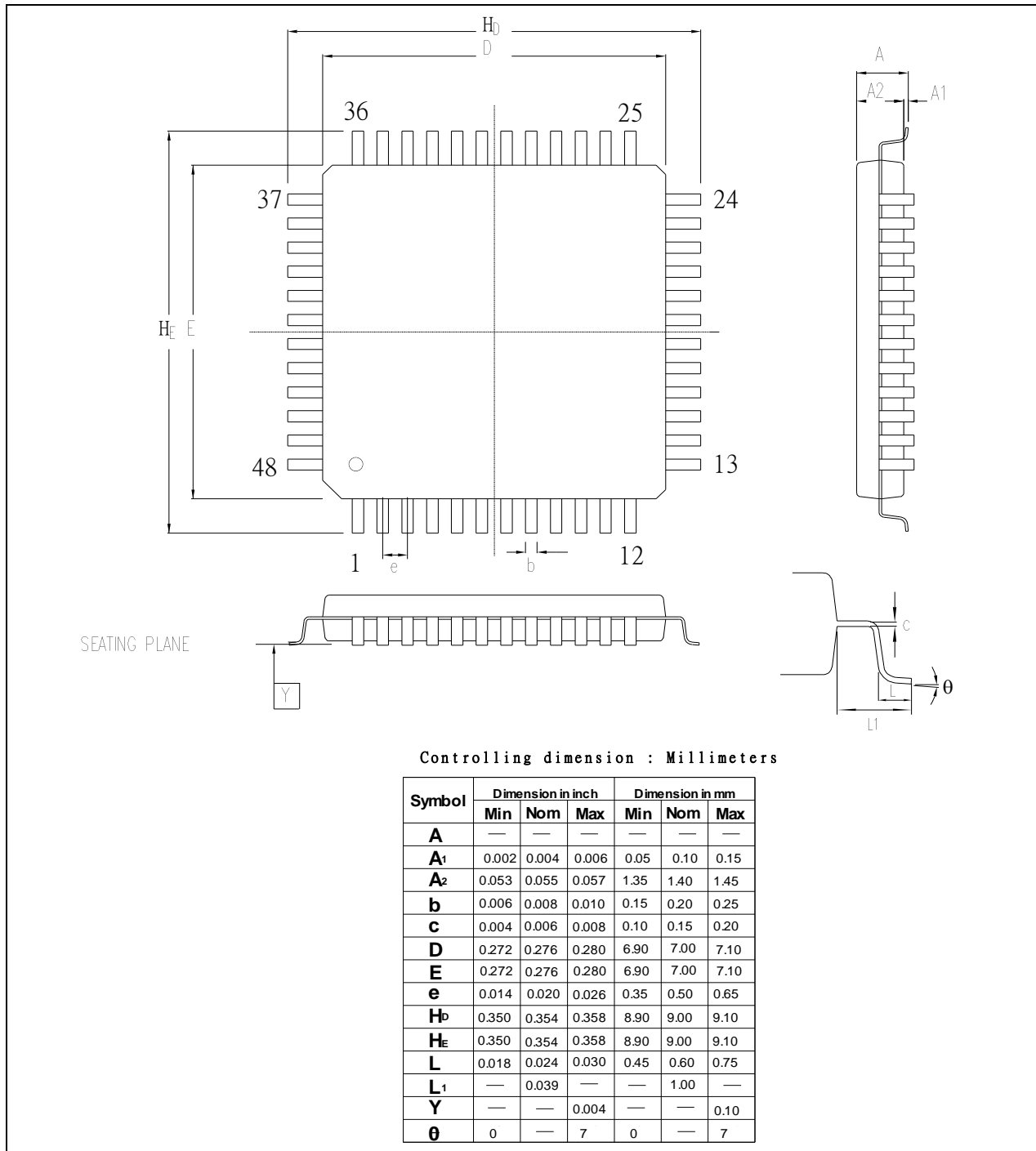


6 PACKAGE DIMENSIONS

6.1 QFN 33L (5x5x0.8 mm³ Pitch 0.5 mm)

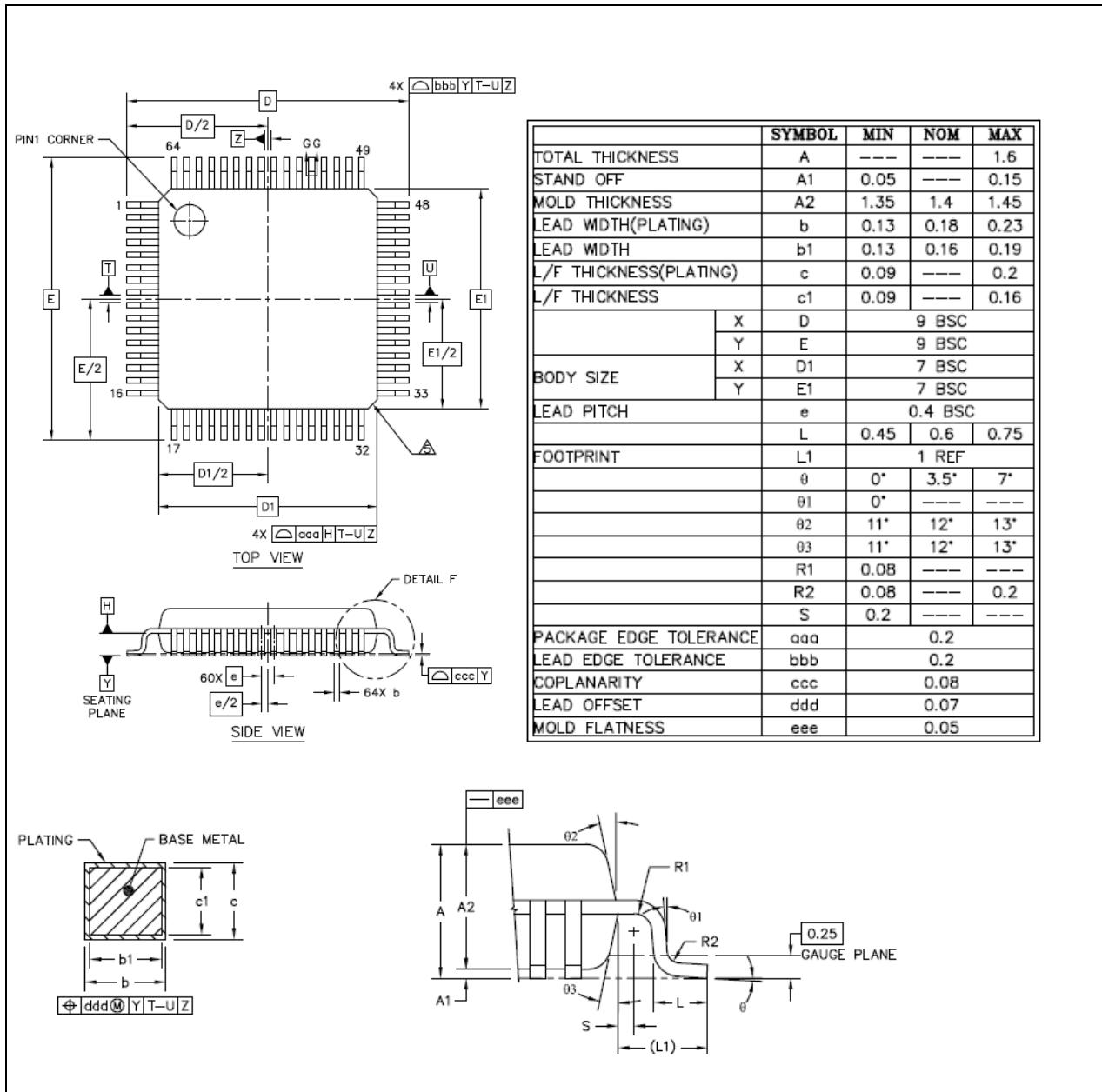


6.2 LQFP 48L (7x7x1.4 mm³ Footprint 2.0mm)



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6.3 LQFP 64L (7x7x1.4 mm³ footprint 2.0 mm)



7 UTILITIES

7.1 Programmer and Debugger

Nu-Link	Basic hardware programmer/debugger
Nu-Link-Pro	Advance hardware programmer/debugger with programming counter
Nu-Link2	Multi-functional hardware programmer/debugger which support high-speed USB 2.0
Nu-Trace	Nu-Trace supports all of Nu-Link2's features plus ETM trace function (4-bit data).
Nu-Link-Gang	Standalone hardware programmer which supports up to four chips programming in mass production.
ISP Tool	Software programming tool for In-System Programming. Supported interface includes UART and USB https://www.nuvoton.com/hq/support/tool-and-software/software/programmer/
ICP Tool	Software programming tool for In-Chip Programming, supported Nu-LinkX hardware programmer. https://www.nuvoton.com/hq/support/tool-and-software/software/programmer/

7.2 Development Environment

<https://www.nuvoton.com/hq/support/tool-and-software/software/development-tool/>

Supported IDE	Keil [®] MDK, IAR Embedded Workbench, NuEclipse (GCC) https://www.nuvoton.com/hq/support/tool-and-software/software/
Software Package	Board Support Package (BSP), Sample Code
Configure Software	NuTool PinConfig, NuTool PinView, NuTool ClockConfig, NuConsole, GUI Builder https://www.nuvoton.com/hq/support/tool-and-software/software/development-tool/
Real Time OS	Arm [®] Mbed [®] OS, FreeRTOS, Amazon FreeRTOS, AliOS Things
Graphic Library	emWin (embedded graphics library)

7.3 Development Board

Part No.	Description
NK-M483KG	Development board of NuMicro [®] M480 series.

8 REVISION HISTORY

Date	Revision	Description
2019.10.08	2.00	Preliminary version.

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