

ARM[®] Cortex[®]-M0
32-bit Microcontroller

NuMicro[®] Family
NUC029 Series
Product Brief

The information described in this document is the exclusive intellectual property of Nuvoton Technology Corporation and shall not be reproduced without permission from Nuvoton.

Nuvoton is providing this document only for reference purposes of NuMicro microcontroller based system design. Nuvoton assumes no responsibility for errors or omissions.

All data and specifications are subject to change without notice.

For additional information or questions, please contact: Nuvoton Technology Corporation.

www.nuvoton.com

Table of Contents

LIST OF FIGURES 3

LIST OF TABLES 4

1 GENERAL DESCRIPTION 5

2 FEATURES 6

3 PARTS INFORMATION LIST AND PIN CONFIGURATION 10

 3.1 NuMicro® NUC029 Series Selection Guide 10

 3.2 Pin Configuration 12

 3.2.1 NuMicro® NUC029 Pin Diagram 12

4 PACKAGE DIMENSIONS 16

 4.1 48-pin LQFP (7x7x1.4 mm) 16

 4.2 48-pin QFN (7x7x0.8 mm) 17

 4.3 33-pin QFN (5x5x0.75 mm) 18

 4.4 33-pin QFN (4x4x0.75 mm) 19

 4.5 20-pin TSSOP (6.5x4.4x1.2 mm) 20

5 REVISION HISTORY 21

LIST OF FIGURES

Figure 3-1 NuMicro® NUC029 Series Selection Code 11

Figure 3-2 NuMicro® NUC029LAN LQFP 48-pin Diagram..... 12

Figure 3-3 NuMicro® NUC029NAN QFN 48-pin Diagram..... 13

Figure 3-4 NuMicro® NUC029TAN QFN 33-pin Diagram 14

Figure 3-5 NuMicro® NUC029FAE TSSOP 20-pin Diagram..... 15

LIST OF TABLES

Table 1-1 NuMicro® NUC029 Series Difference List..... 5
Table 3-1 NuMicro® NUC029 Series Selection Guide 10

1 GENERAL DESCRIPTION

The NuMicro® NUC029 series 32-bit microcontroller is embedded with ARM® Cortex®-M0 core for industrial control and applications which need rich communication interfaces or require high performance, high integration, and low cost. The Cortex®-M0 is the newest ARM® embedded processor with 32-bit performance at a cost equivalent to the traditional 8-bit microcontroller. The NuMicro® NUC029 series includes four part numbers: NUC029LAN, NUC029NAN, NUC029ZAN, NUC029TAN and NUC029FAE.

The NUC029LAN/ NUC029NAN/NUC029ZAN/NUC029TAN can run up to 50 MHz and operate at 2.5V ~ 5.5V, -40°C ~ 85°C, and the NUC029FAE can run up to 24 MHz and operate at 2.5V ~ 5.5V, -40°C ~ 105°C. Therefore, the NUC029 series can afford to support a variety of industrial control and applications which need high CPU performance.

The NUC029LAN/NUC029NAN/NUC029ZAN/NUC029TAN offers 64K/64K/32K bytes flash, 4 Kbytes Data Flash, 4 Kbytes flash for the ISP, and 4 Kbytes SRAM. The NUC029FAE offers 16 Kbytes flash, size configurable Data Flash (shared with program flash), 2 Kbytes flash for the ISP, and 2K-bytes SRAM.

Many system level peripheral functions, such as I/O Port, EBI (External Bus Interface), Timer, UART, SPI, I²C, PWM, ADC, WDT (Watchdog Timer), WWDT (Window Watchdog Timer), Analog Comparator and Brown-out Detector, have been incorporated into the NUC029 series in order to reduce component count, board space and system cost. These useful functions make the NUC029 series powerful for a wide range of applications.

Additionally, the NuMicro® NUC029 series is equipped with ISP (In-System Programming) and ICP (In-Circuit Programming) functions, and IAP (In-Application Programming), which allow the user to update the program memory without removing the chip from the actual end product.

Item	NUC029LAN/ NUC029NAN/ NUC029ZAN/NUC029TAN	NUC029FAE
Core	Up to 50 MHz	Up to 24 MHz
Operating Temp.	-40°C ~ +85°C	-40°C ~ +105°C
Hardware Divider	√	-
Clock Control	Supports PLL as clock source	-
	-	Supports external 32.768 kHz crystal oscillator as clock source
Window WDT	√	-
PWM	PWM Generator and Capture Timer	Enhanced PWM Generator
ADC	12-bit SAR ADC with 760 kSPS (Supports Single, Burst, Single-Cycle, and Continuous Scan mode)	10-bit SAR ADC with 300 kSPS (Only supports Single mode)
EBI	√	-
Built-in Temp.Sensor	√	-

Table 1-1 NuMicro® NUC029 Series Difference List

2 FEATURES

- ARM[®] Cortex[®]-M0 core
 - Runs up to 50 MHz
 - One 24-bit system timer
 - Supports Low Power Sleep mode
 - A single-cycle 32-bit hardware multiplier
 - NVIC for the 32 interrupt inputs, each with 4-levels of priority
 - Supports Serial Wire Debug (SWD) interface and two watchpoints/four breakpoints
 - Provides hardware divider and supports signed 32-bit dividend, 16-bit divisor operation(NUC029xAN only)
- Operating voltage ranges from 2.5 V to 5.5 V
- Memory
 - 16/32/64 KB Flash for program memory (APROM)
 - Up to 4 KB Flash for loader (LDROM)
 - Up to 4 KB SRAM for internal scratch-pad RAM (SRAM)
 - 4 KB Flash for data memory (Data Flash) (NUC029xAN only)
 - Configurable Data Flash (NUC029FAE only)
- Clock Control
 - Programmable system clock source
 - 22.1184 MHz internal oscillator
 - ◆ Dynamically calibrating the HIRC OSC to 22.1184 MHz $\pm 3\%$ from -40°C to 105°C by external 32.768 kHz crystal oscillator (LXT) (NUC029FAE only)
 - 4~24 MHz external crystal input
 - 10 kHz low-power oscillator for Watchdog Timer and wake-up in Sleep mode
 - PLL allows CPU operation up to the maximum 50 MHz (NUC029xAN only)
 - 32.768 kHz external crystal input (LXT) for Power-down wake-up and system operation clock (NUC029FAE only)
- GPIO
 - Up to 40 general-purpose I/O (GPIO) pins for LQFP/QFN 48-pin package
 - Four I/O modes:
 - ◆ Quasi-bidirectional
 - ◆ Push-pull output
 - ◆ Open-drain output
 - ◆ Input only with high impedance
 - TTL/Schmitt trigger input selectable
 - I/O pin can be configured as interrupt source with edge/level setting
 - Supports high driver and high sink I/O mode
 - Configurable I/O mode after POR
- Timer
 - Up to four sets of 32-bit timers with 24-bit up counter and one 8-bit prescale counter
 - Independent clock source for each timer
 - Provides up to four timer counting modes: one-shot, periodic, toggle and continuous counting
 - 24-bit up counter value is readable through TDR (Timer Data Register)
 - Supports event counting function to count the input event from external counter pin
 - 24-bit capture value is readable through TCAP (Timer Capture Data Register)
 - Supports external capture pin for interval measurement
 - ◆ Supports external capture pin to reset 24-bit up counter
 - ◆ Supports chip wake-up from Idle/Power-down mode if a timer interrupt signal is generated
 - Supports internal capture triggered while internal ACMP output signal transition

- (NUC029xAN only)
 - Supports Inter-Timer trigger mode (NUC029xAN only)
 - Supports internal signal (CPO0, CPO1) for interval measurement (NUC029FAE only)
- WDT (Watchdog Timer)
 - Multiple clock sources
 - Supports wake-up from Power-down or Sleep mode
 - Interrupt or reset selectable on watchdog time-out
 - Time-out reset delay period can be selected to 3/18/130/1026 * WDT_CLK (NUC029xAN only)
- WWDT (Window Watchdog Timer) (NUC029xAN only)
 - 6-bit down counter with 11-bit pre-scale for wide range window selected
- PWM Generator and Capture Timer (NUC029xAN only)
 - Up to four built-in 16-bit PWM generators, providing eight PWM outputs or four complementary paired PWM outputs
 - Individual clock source, clock divider, 8-bit pre-scalar and dead-zone generator for each PWM generator
 - PWM interrupt synchronized to PWM period
 - 16-bit digital Capture timers with rising/falling capture inputs
 - Supports capture interrupt
 - Internal 10 kHz to PWM clock source
 - Polar inverse function
 - Center-aligned type function
 - Timer duty interrupt enable function
 - Two kinds of PWM interrupt period type selection
 - Two kinds of PWM interrupt duty type selection
 - Period/duty trigger ADC function
 - PWM Timer synchronous start function
- Enhanced PWM Generator (NUC029FAE only)
 - Independent 16-bit PWM duty control units with maximum three outputs
 - Supports group/synchronous/independent/ complementary modes
 - Supports One-shot or Auto-reload mode
 - Supports Edge-aligned and Center-aligned type
 - Programmable dead-zone insertion between complementary channels
 - Each output has independent polarity setting control
 - Hardware fault brake protections
 - Supports duty, period, and fault break interrupts
 - Supports duty/period trigger ADC conversion
 - Timer comparing matching event trigger PWM to do phase change
 - Supports comparator event trigger PWM to force PWM output low for current period
 - Provides interrupt accumulation function
- UART
 - Up to two sets of UART devices
 - Programmable baud-rate generator
 - Buffered receiver and transmitter, each with 16 bytes FIFO
 - Optional flow control function (CTS and RTS)
 - Supports IrDA(SIR) function
 - Supports RS-485 function
 - Supports LIN function (NUC029xAN only)
- SPI
 - Up to two sets of SPI devices
 - Supports Master/Slave mode

- Full-duplex synchronous serial data transfer
- Provides 3 wire function
- Variable length of transfer data from 8 to 32 bits
- MSB or LSB first data transfer
- Rx latching data can be either at rising edge or at falling edge of serial clock
- Tx sending data can be either at rising edge or at falling edge of serial clock
- Supports Byte Suspend mode in 32-bit transmission
- 4-level depth FIFO buffer
- PLL clock source (NUC029xAN only)
- I²C
 - Up to two sets of I²C modules
 - Supports Master/Slave mode
 - Bi-directional data transfer between masters and slaves
 - Multi-master bus (no central master)
 - Arbitration between simultaneously transmitting masters without corruption of serial data on the bus
 - Serial clock synchronization allows devices with different bit rates to communicate via one serial bus
 - Serial clock synchronization can be used as a handshake mechanism to suspend and resume serial transfer
 - Programmable clocks allow versatile rate control
 - Supports 7-bit addressing mode
 - Supports multiple address recognition (four slave addresses with mask option)
 - Supports Power-down wake-up function
 - Supports FIFO function (NUC029FAE only)
- ADC
 - 12-bit SAR ADC with 760 kSPS for NUC029xAN, and 10-bit SAR ADC with 300 kSPS for NUC029FAE
 - Up to eight single-end analog input channels
 - ◆ Or four differential analog input channels (NUC029xAN only)
 - Four operation modes (NUC029FAE only support Single mode)
 - ◆ Single mode: A/D conversion is performed one time on a specified channel
 - ◆ Burst mode: A/D converter samples and converts the specified single channel and sequentially stores the result in FIFO
 - ◆ Single-cycle Scan mode: A/D conversion is performed only one cycle on all specified channels with the sequence from the smallest numbered channel to the largest numbered channel
 - ◆ Continuous Scan mode: A/D converter continuously performs Single-cycle Scan mode until software stops A/D conversion
 - An A/D conversion can be started by:
 - ◆ Software Write 1 to ADST bit
 - ◆ External pin (STADC)
 - ◆ PWM trigger with optional start delay period
 - Each conversion result is held in data register with valid and overrun indicators
 - Each channel has individual data register (NUC029xAN only)
 - Conversion result can be compared with specified value and user can select whether to generate an interrupt when conversion result matches the compare register setting
 - Internal temperature sensor output (NUC029xAN only)
- Analog Comparator
 - Up to four sets of Comparator analog modules
 - External input or internal band-gap voltage selectable at negative node
 - Interrupt when compared results change
 - Power-down wake-up

- EBI (External Bus Interface) for external memory-mapped device access (NUC029LAN/NUC029NAN only)
 - Accessible space: 64 KB in 8-bit mode or 128 KB in 16-bit mode
 - Supports 8-bit or 16-bit data width
 - Supports byte-write in 16-bit data width
- ISP (In-System Programming) and ICP (In-Circuit Programming)
- IAP (In-Application Programming)
- One built-in temperature sensor with 1°C resolution (NUC029xAN only)
- BOD (Brown-out Detector)
 - With 4 levels: 4.4V/3.7V/2.7V/2.2V
 - Supports Brown-out interrupt and reset option
- 96-bit unique ID (UID)
- LVR (Low Voltage Reset)
 - Threshold voltage level: 2.0V
- Operating Temperature:
 - NUC029LAN/NUC029NAN/NUC029ZAN/NUC029TAN: -40°C~85°C
 - NUC029FAE:-40°C~105°C
- Reliability: EFT > ± 4 KV, ESD HBM pass 4 KV
- Packages:
 - All Green package (RoHS)
 - 48-pin LQFP, 48-pin QFN, 33-pin QFN, 20-pin TSSOP

3 PARTS INFORMATION LIST AND PIN CONFIGURATION

3.1 NuMicro® NUC029 Series Selection Guide

Part Number	APROM (KB)	RAM (KB)	Data Flash (KB)	ISP ROM (KB)	I/O	Timer (32-Bit)	Connectivity			PWM (16-bit)	ADC (12-bit)	ADC (10-bit)	Comparator	WDT	WWDT	EBI	PLL	32.768 kHz Crystal Oscillator	ISP/ICP/IAP	Package	Operating Temperature Range(°C)
							UART	SPI	I ² C												
NUC029LAN	64	4	4	4	40	4	2	2	2	8	8	-	4	√	√	√	√	-	√	LQFP48	-40 to +85
NUC029NAN	64	4	4	4	40	4	2	2	2	8	8	-	4	√	√	√	√	-	√	QFN48	-40 to +85
NUC029ZAN	64	4	4	4	24	4	2	1	2	5	5	-	3*	√	√	-	√	-	√	QFN33 (5x5)	-40 to +85
NUC029TAN	32	4	4	4	24	4	2	1	2	5	5	-	3*	√	√	-	√	-	√	QFN33 (4x4)	-40 to +85
NUC029FAE	16	2	Config.	2	17	2	1	1	1	3	-	4	2**	√	-	-	-	√	√	TSSOP20	-40 to +105

Table 3-1 NuMicro® NUC029 Series Selection Guide

Note:

*: ACMP3 only has positive and negative input.

** : ACMP0 only has positive and negative input, and ACMP1 only has positive input.

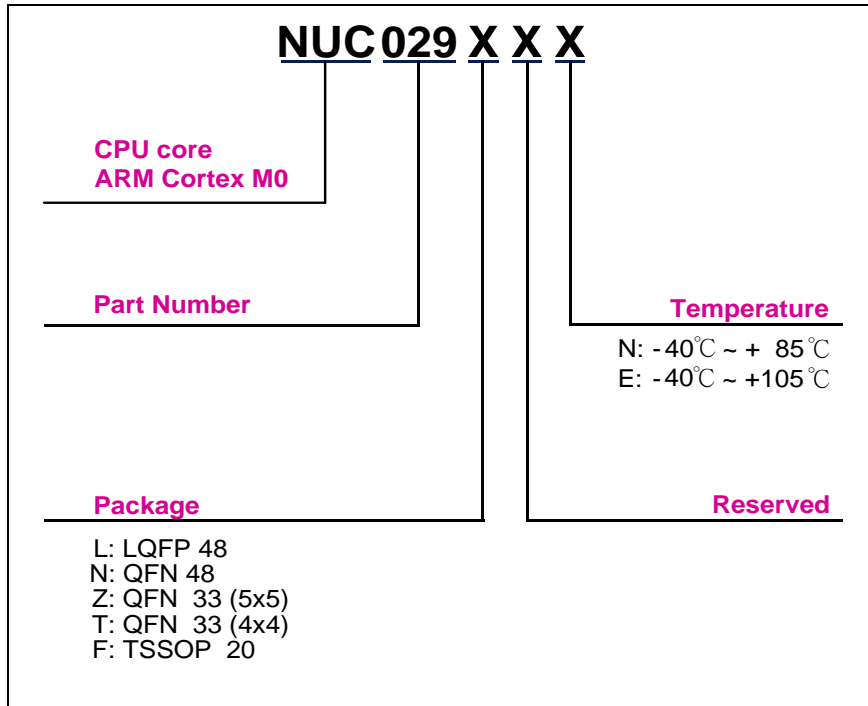


Figure 3-1 NuMicro® NUC029 Series Selection Code

3.2 Pin Configuration

3.2.1 NuMicro® NUC029 Pin Diagram

3.2.1.1 NuMicro® NUC029LAN LQFP 48 pin

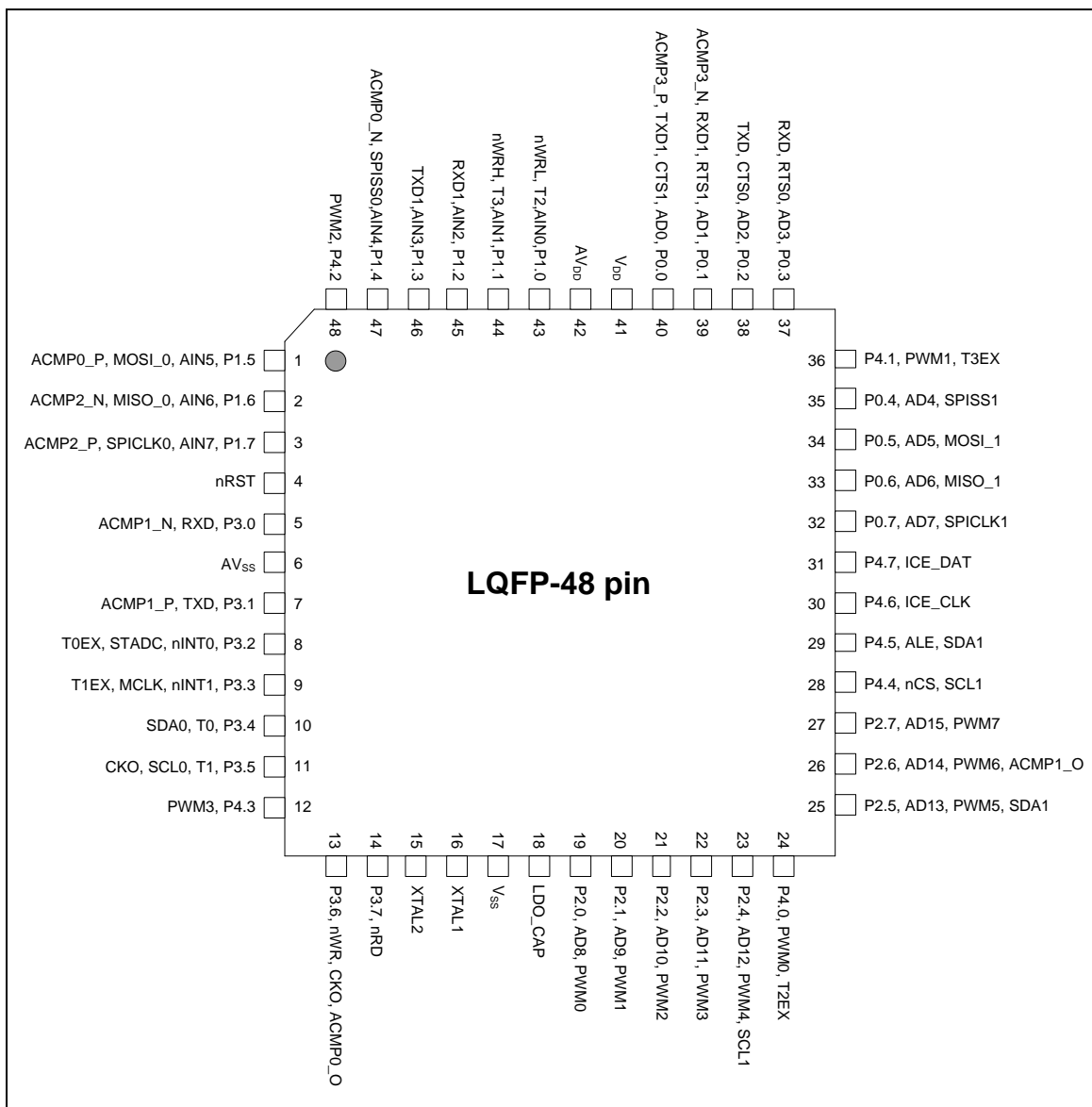


Figure 3-2 NuMicro® NUC029LAN LQFP 48-pin Diagram

3.2.1.2 NuMicro® NUC029NAN QFN 48 pin

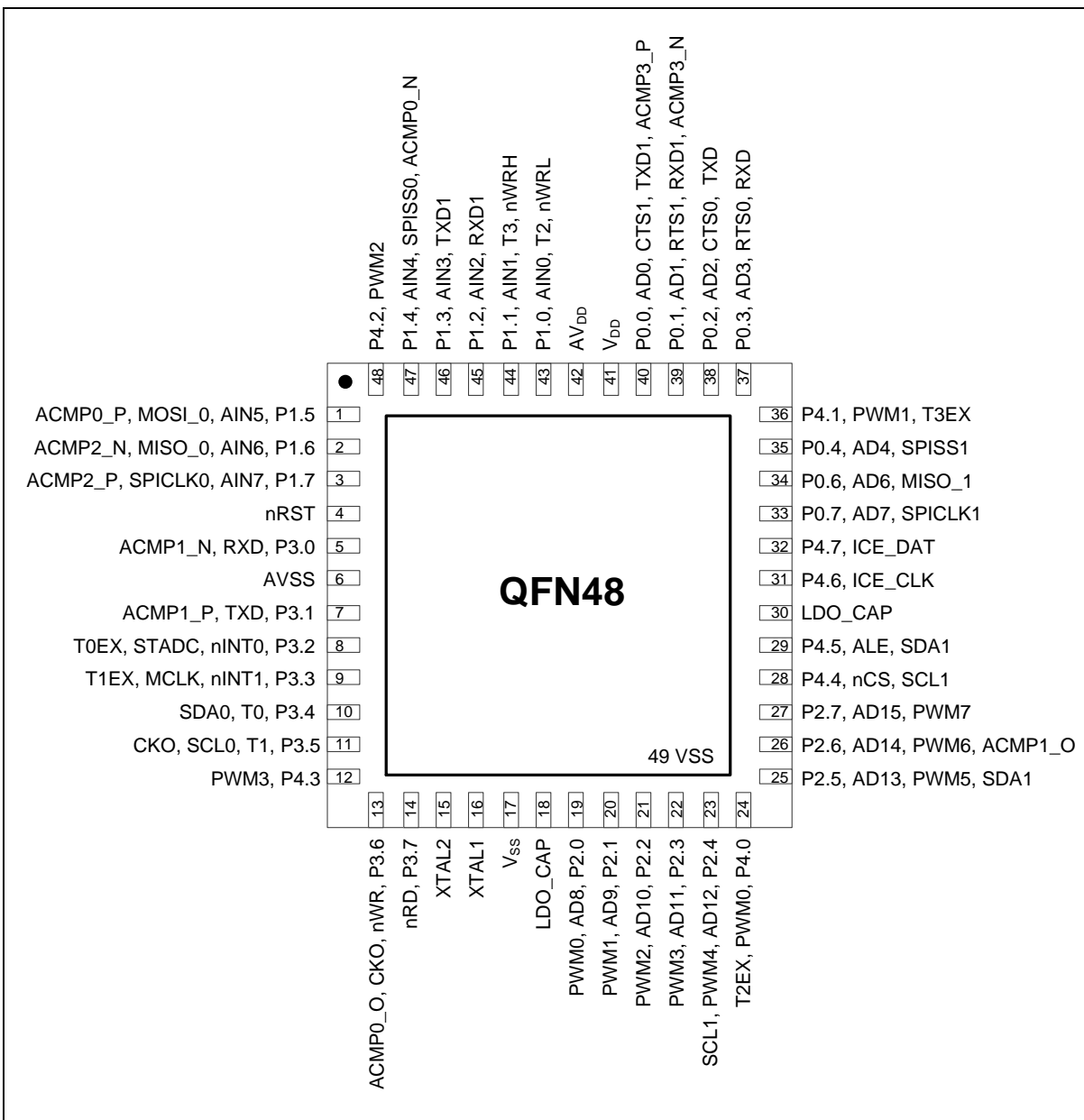


Figure 3-3 NuMicro® NUC029NAN QFN 48-pin Diagram

3.2.1.3 NuMicro® NUC029ZAN/NUC029TAN QFN 33 pin

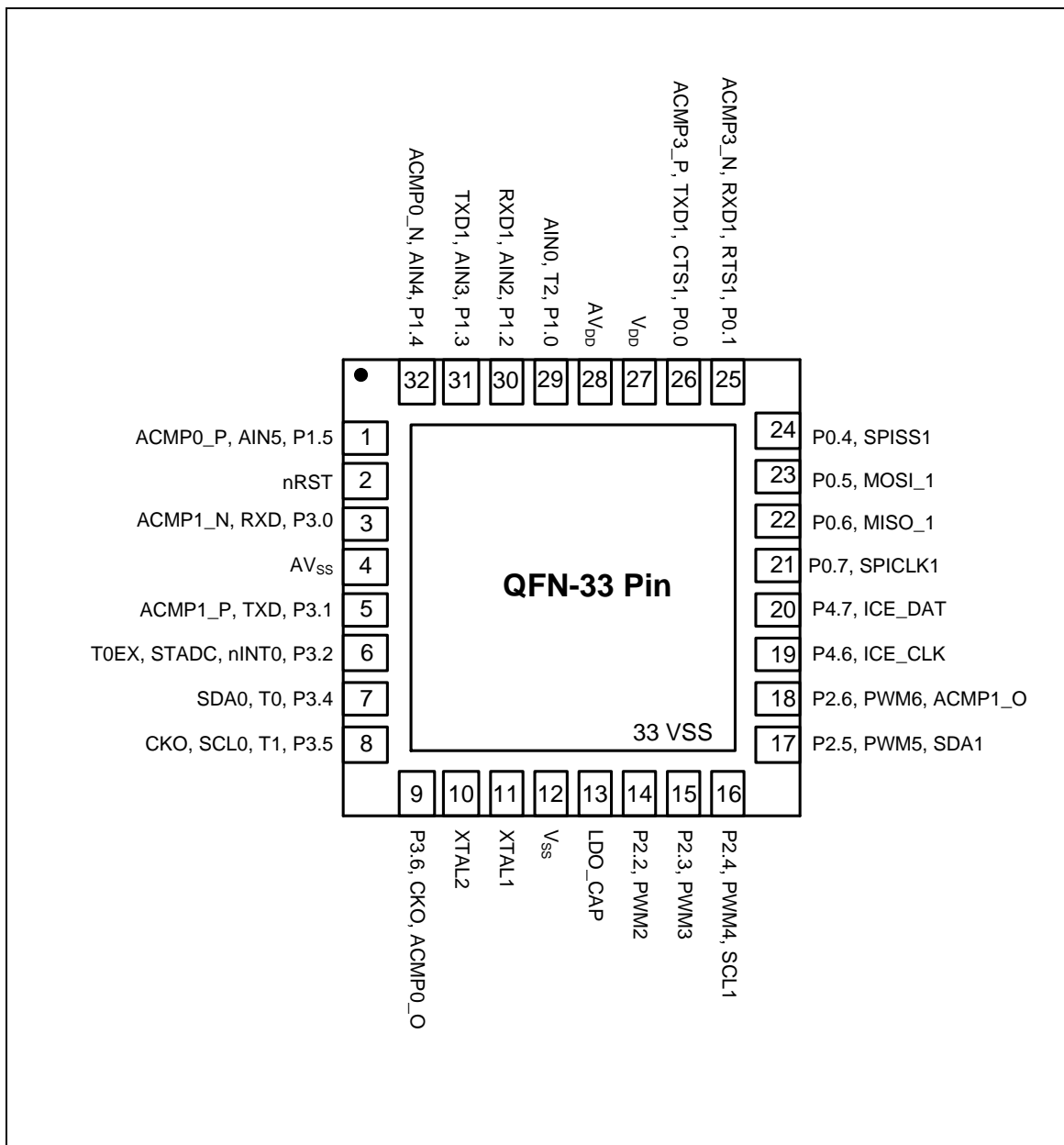


Figure 3-4 NuMicro® NUC029TAN QFN 33-pin Diagram

3.2.1.4 NuMicro® NUC029FAE TSSOP 20 pin

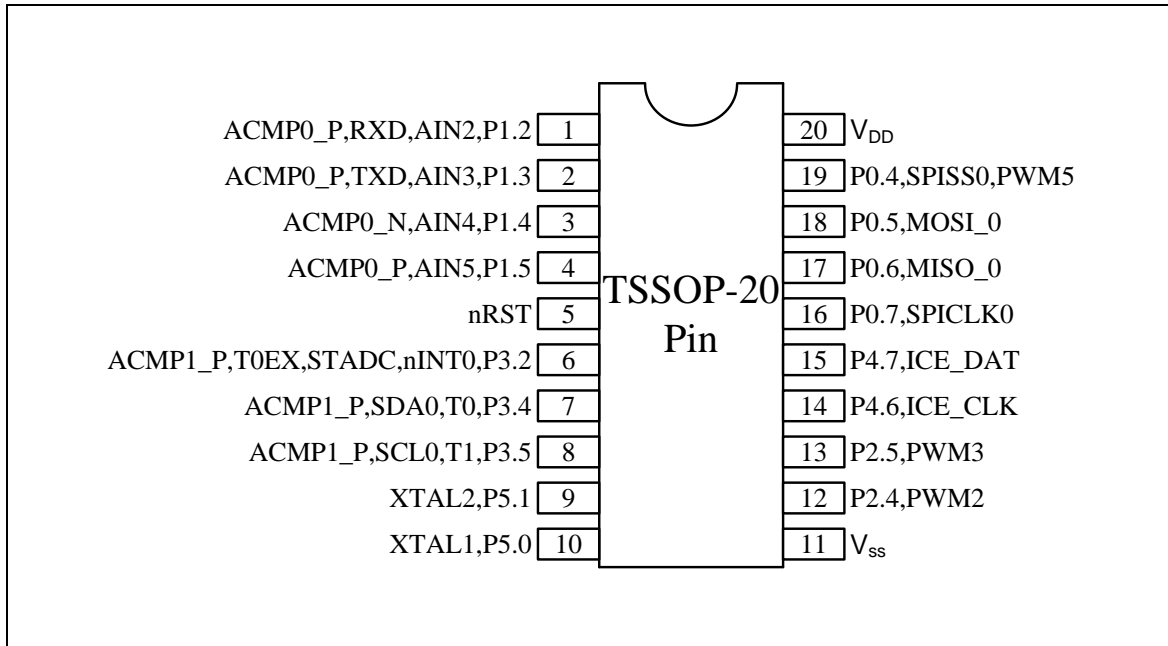
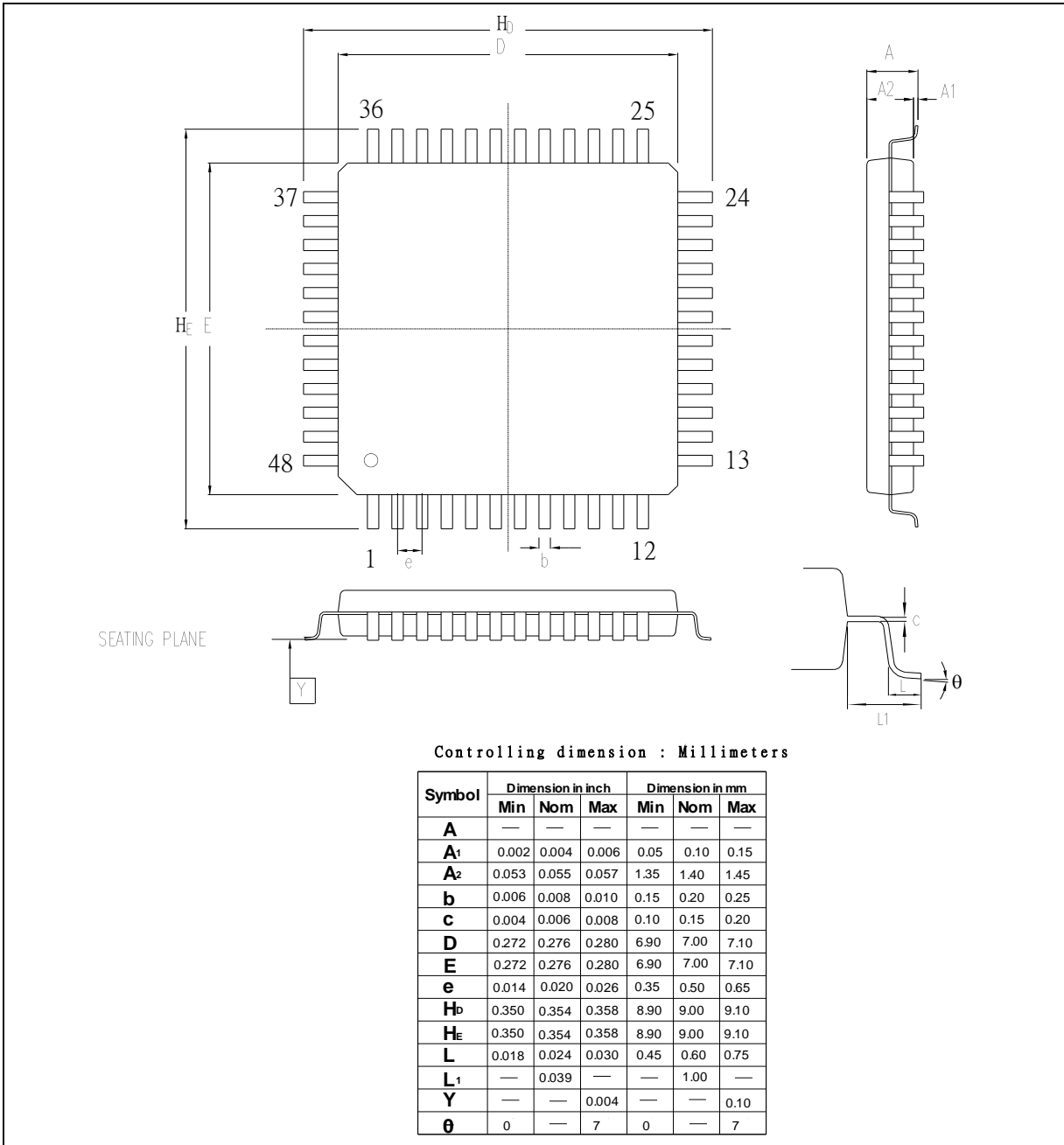


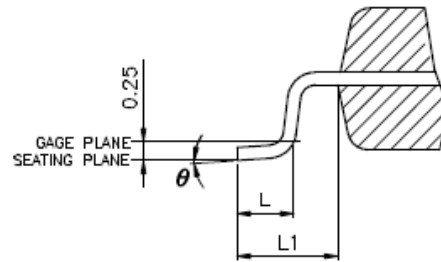
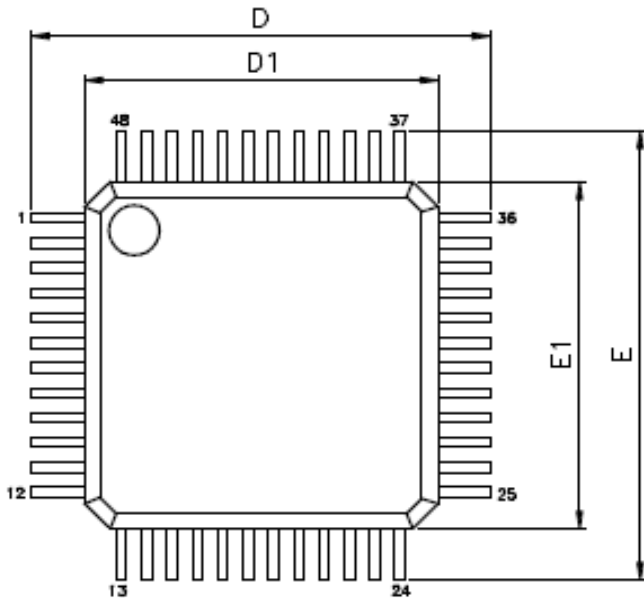
Figure 3-5 NuMicro® NUC029FAE TSSOP 20-pin Diagram

4 PACKAGE DIMENSIONS

4.1 48-pin LQFP (7x7x1.4 mm)

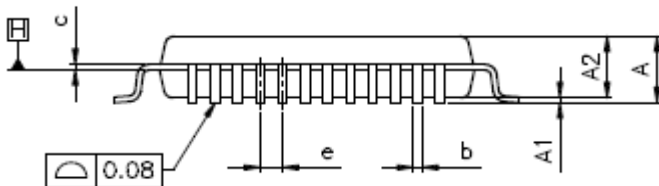


4.2 48-pin QFN (7x7x0.8 mm)

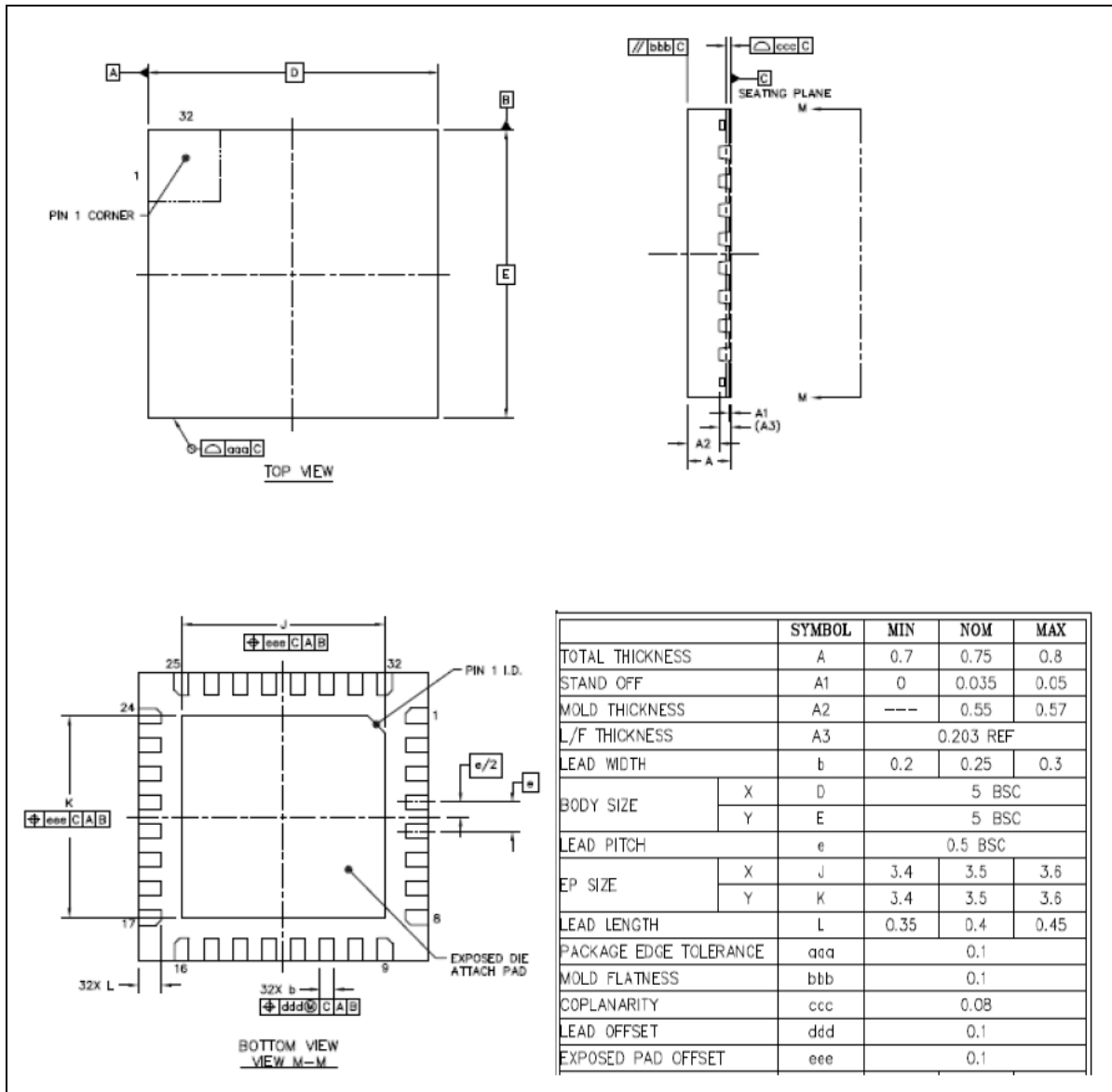


VARIATIONS (ALL DIMENSIONS SHOWN IN MM)

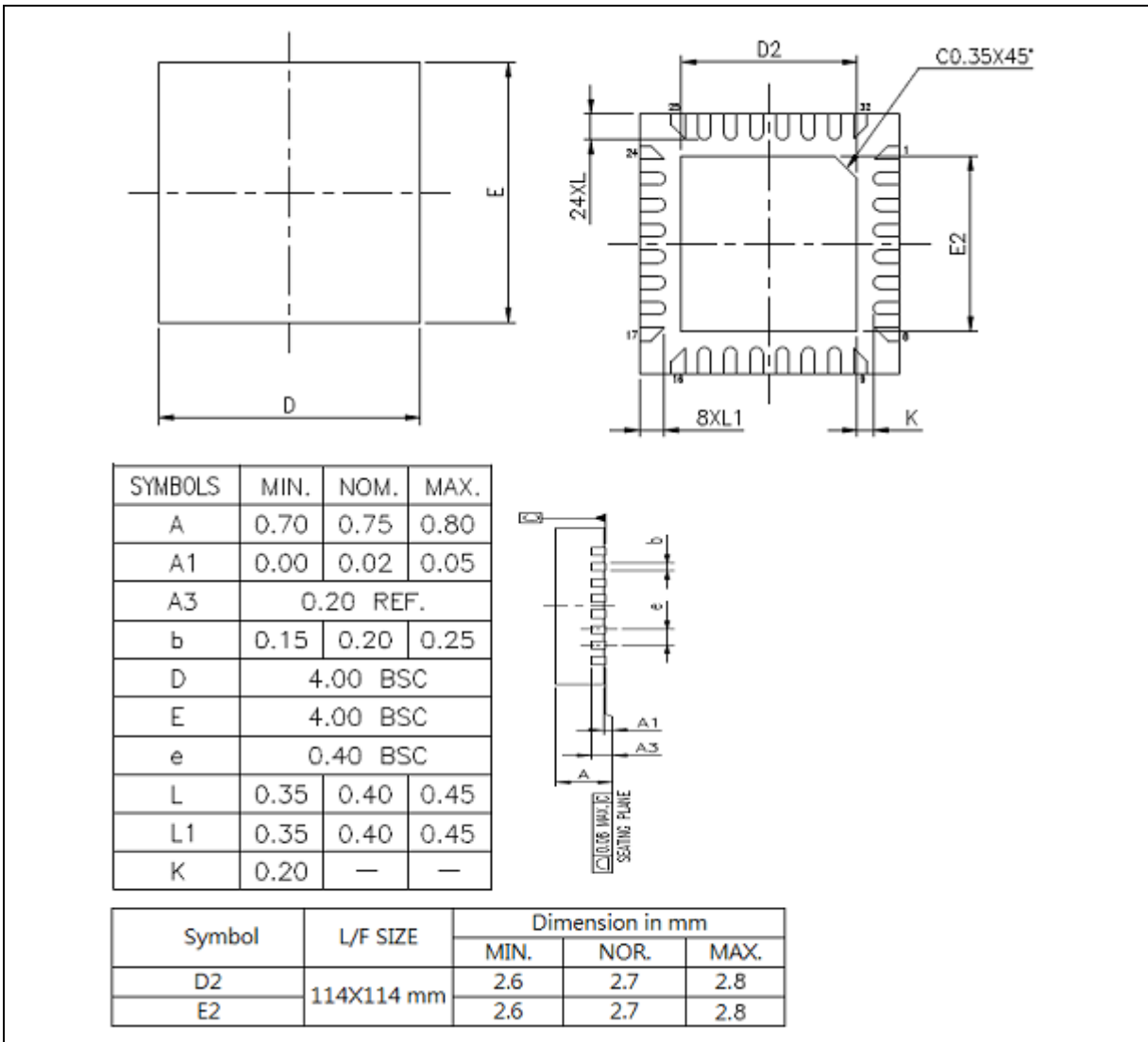
SYMBOLS	MIN.	NOM.	MAX.
A	--	--	1.60
A1	0.05	--	0.15
A2	1.35	1.40	1.45
b	0.17	0.22	0.27
c	0.09	--	0.20
D	9.00 BSC		
D1	7.00 BSC		
E	9.00 BSC		
E1	7.00 BSC		
e	0.50 BSC		
L	0.45	0.60	0.75
L1	1.00 REF		
θ	0°	3.5°	7°



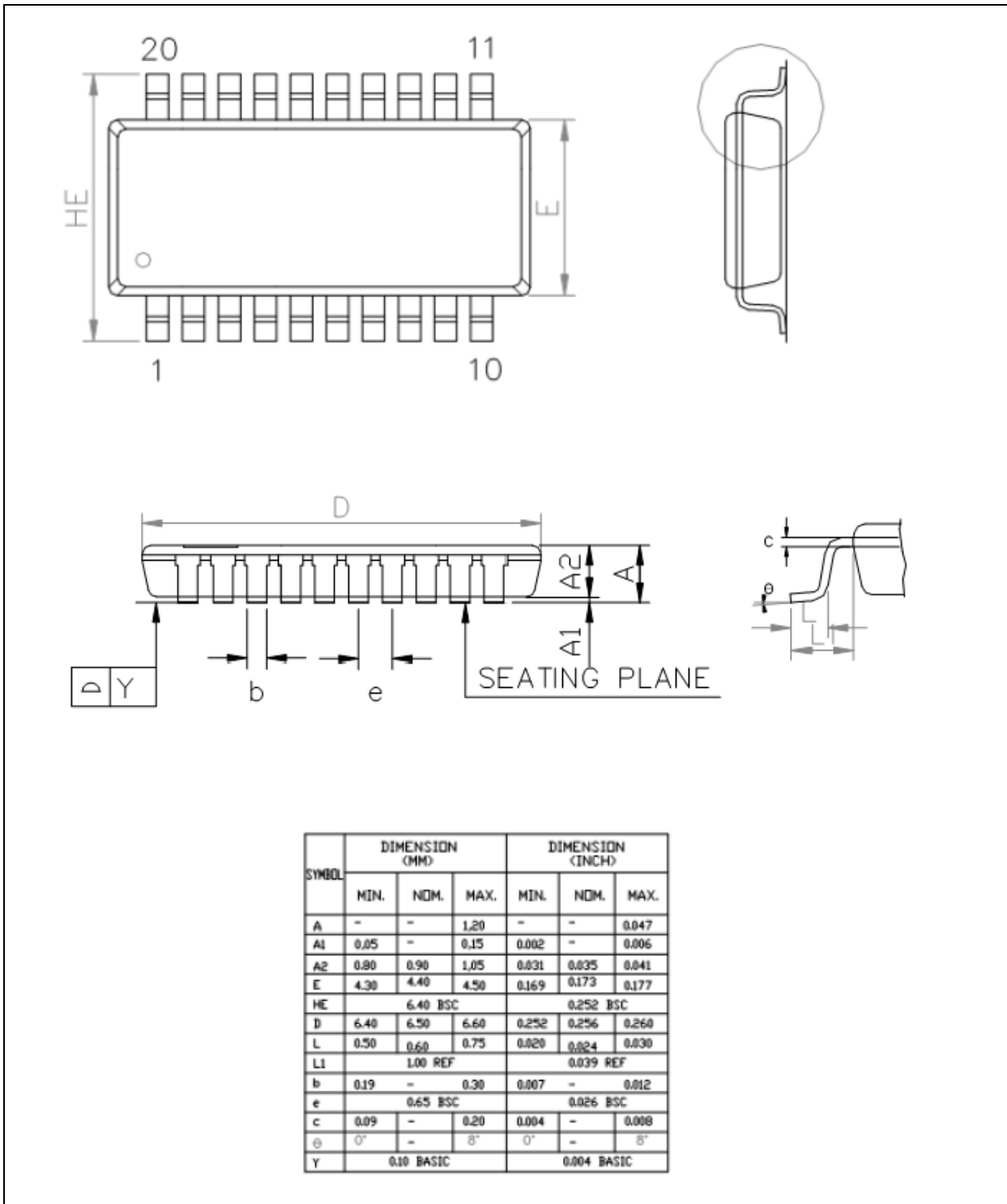
4.3 33-pin QFN (5x5x0.75 mm)



4.4 33-pin QFN (4x4x0.75 mm)



4.5 20-pin TSSOP (6.5x4.4x1.2 mm)



5 REVISION HISTORY

Date	Revision	Description
2014.04.24	1.00	1. Preliminary version.
2014.08.26	1.01	1. Modified Figure 3-1 NuMicro® NUC029 Series Selection Code.
2015.05.18	1.02	<ol style="list-style-type: none"> 1. Fixed typos and obscure descriptions. 2. Removed description about ACMP output inverse function available on NUC029xAN series. 3. Removed Chapter Pin Description. 4. Updated 33-pin QFN (4x4) package dimension in Chapter 4.4.
2017.06.23	1.03	1. Added new part number NUC029ZAN.
2017.12.11	1.04	1. Added new part number NUC029NAN.

Important Notice

Nuvoton Products are neither intended nor warranted for usage in systems or equipment, any malfunction or failure of which may cause loss of human life, bodily injury or severe property damage. Such applications are deemed, “Insecure Usage”.

Insecure usage includes, but is not limited to: equipment for surgical implementation, atomic energy control instruments, airplane or spaceship instruments, the control or operation of dynamic, brake or safety systems designed for vehicular use, traffic signal instruments, all types of safety devices, and other applications intended to support or sustain life.

All Insecure Usage shall be made at customer’s risk, and in the event that third parties lay claims to Nuvoton as a result of customer’s Insecure Usage, customer shall indemnify the damages and liabilities thus incurred by Nuvoton.

*Please note that all data and specifications are subject to change without notice.
All the trademarks of products and companies mentioned in this datasheet belong to their respective owners.*