N32H488xE Product Brief

N32H488 series adopts a 32-bit ARM Cortex-M4F core, with a maximum operating frequency of 240MHz, supporting floating-point unit and DSP instructions. It integrates up to 512-KB embedded flash, 192-KB SRAM (including 32-KB CCM SRAM), and 4-KB Backup SRAM. It also integrates 4x 12bit 4.7Msps ADCs, 8x 12bit DAC, 4x PGA, 7x COMP, USB FS Device, USB HS DualRole, U(S)ART, I2C, SPI, CAN-FD, Ethernet, and other communication interfaces. It supports DVP interface, SDIO, FEMC, xSPI high-speed storage interfaces, I2S audio interface, super high-resolution timer, multiple advanced control timers, general timers, basic timers, low-power timers. It also features a built-in hardware acceleration engine for cryptographic algorithms, supporting AES/TDES, SHA, SM3, SM4, MD5 algorithms, TRNG true random number generator, and CRC16/32.

Key Feature

- **CPU Core**
  - 32-bit ARM Cortex-M4F + FPU, single-cycle hardware multiplication and division instruction, support DSP instruction and MPU
  - Built-in 8-KB instruction Cache supporting Flash acceleration unit for zero-wait program execution
  - Frequency up to 240 MHz, 300 DMIPS
- **Memories**
  - 512-KByte of embedded Flash memory with ECC
    - Supports encryption, multi-user partition and data protection
    - 10,000 erase/write cycles and 10-years data retention
  - 160-KByte of general SRAM with hardware parity checking
  - 32-KByte of CCM SRAM with ECC, defaults to general SRAM after power-up, configurable as CCM SRAM
  - 4-KByte of Backup SRAM with ECC available in Standby mode
- **Power Modes**
  - Run mode: 45 mA/MHz@240 MHz (peripherals off, 3.3 V@25°C)
  - Stop0 mode: SRAM and all registers can be configured to retention, RTC run
  - Standby mode: 6uA, all backup registers and Backup SRAM retained, all IOs retained, optional RTC run
  - VBAT mode: 4uA, all backup registers and Backup SRAM retained, optional RTC run
- **Clock**
  - HSE: 4MHz~32MHz high-speed external crystal oscillator
  - LSE: 32.768KHz low-speed external crystal oscillator
  - Built-in multiple high speed PLLs

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- MCO: Supports 2-channel clock outputs, which can be configured independently as clock output
- HSI: High-speed internal RC 8MHz, -1.5% to +2% accuracy (full temperature range)
- LSI: Low-speed internal RC 32KHz, +/-10% accuracy (full temperature range)

- **Reset**
  - Supports power-on/brown-out/external pin reset
  - Supports watchdog reset
  - Supports programmable voltage detection
- **GPIOs**
  - Up to 118 GPIOs
- **Communication Interfaces**
  - 1x USB2.0 FS Device interface, built-in PHY, supports crystal-less mode
  - 6x SPI interfaces, 2x I2S interfaces, support half/full duplex mode, multiplexed with SPI interfaces
  - U(S)ART interfaces
    - 4x USART interfaces (support ISO7816, IrDA, LIN)
    - 4x UART interfaces
    - TX/RX of USART3/UART5/UART8 can be mapped to all pins
  - 4x I2C interfaces(Master/Slave) with speed up to 1 MHz where slave mode support dual address response
  - 3x CAN-FD bus interface, TX/RX can be mapped to all pins
  - 1x IEEE-802.3-2002 compatible Ethernet MAC interface, supports 10M/100M Ethernet, IEEE1588 synchronized Ethernet protocol
  - 1x DVP (Digital Video Port) supporting 8/10/12/16 bit data
- **High Performance Analog Interfaces**
  - 4x 12bit ADCs with 4.7Msps
    - Multiple precision configuration, support 12-bit, 10-bit, 8-bit, 6-bit sampling precision, resolution up to 16-bit with hardware oversample
    - Up to 16 external single-ended input channels, 3 internal single-ended input channels, support differential mode and single-ended mode
  - 8x 12bit DAC
    - DAC1~4: Support 1 internal output channel and 1 external output channel, with a sampling rate of 1Msps. Support output channel buffered/unbuffered modes.
    - DAC5~8: Support 1 internal output channel and 1 external output channel, with a sampling rate of 15Msps. Only support output channel buffered/unbuffered modes.
  - 4x rail-to-rail PGAs, support differential mode and single-ended mode

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- 7x high-speed comparators (COMP)
- Supports 1 reference voltage VREFBUF (2.048V/2.5V/2.9V configurable)
- 1x temperature sensor

- **High Speed External Memory Interfaces**
  - 1x xSPI interface, supporting external SRAM, PSRAM and Flash, supporting XIP
  - 1x FEMC (Flexible External Memory Controller) interface, supporting external SRAM, PSRAM, NOR Flash and NAND Flash, 8/16-bit data bus width configurable
  - 1x SDIO interface, support SD/SDIO/MMC format
- **Mathematical hardware accelerator CORDIC for motor control functions**
- **Built-in filter mathematical accelerator FMAC, supporting FIR, IIR filtering**
- **DMA Controllers**
  - 2x DMA controller
  - Each controller supports 8 channels
  - Channel source address and destination address can be configured arbitrarily
- **RTC real-time clock**
  - Supports leap-year calendar, alarm event, periodic wake up
  - Supports internal and external clock calibration
- **Timers**
  - 1x 16bit super high-resolution timer (SHRTIM1)
    - Supports 6x 16-bit timer units, each timer unit has 2 independent channels, with a maximum control precision of 125ps.
    - Supports 12 independent PWM outputs or 6 pairs of complementary PWM outputs.
  - 3x 16-bit advanced control timers with maximum control precision of 4.16 ns
    - Support input capture, complementary output, quadrature encoder input etc.
    - Each timer has 6 independent channels, 4 of which support 4 pairs of complementary PWM output.
  - 10x 16-bit general purpose timers (GTIM1~10)
    - GTIM1~7, with a maximum control precision of 5.56ns, each timer has up to 4 independent channels, each channel supports input capture, output comparison, PWM generation, and single-pulse mode output.
    - GTIM8~10, with a maximum control precision of 4.16ns, each timer has up to 4 independent channels, each channel supports input capture, output comparison, PWM generation, and single-pulse mode output, only channel 1 supports complementary output with dead time, supports break input.
  - 2x 32-bit basic timers
  - 2x 16-bit low-power timer, can operate in Stop0 and Standby mode.

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- 1x 24-bit SysTick timer.
- 1x 14-bit Window Watchdog (WWDG)
- 1x 12-bit Independent Watchdog (IWDG)

- **Programming Methods**
  - Support SWD/JTAG debugging interface.
  - Support UART and USB Bootloader
- **Security Features**
  - Flash encryption, multi-user partition management unit (SMPU)
  - Supports write protection (WRP), multiple read protection (RDP) levels (L0/L1/L2)
  - Built-in hardware acceleration engine for cryptographic algorithm
  - Supports AES/TDES, SHA, SM3, SM4, and MD5 algorithms
  - True random number generator(TRNG)
  - CRC16/32 operation
  - Supports secure boot, program encryption download, secure firmware update
  - Supports external clock failure detection, anti-tamper detection.
- **96-bit UID and 128-bit UCID**
- **Operating Conditions**
  - Operating voltage range: 1.8V~3.6V
  - Operating temperature range: -40℃ ~ 105℃
  - ESD: ±4KV (HBM model), ±1KV (CDM model)
  - EFT: VDD (+/-4KV，level A)，I/O (+/-2KV，level A)
- **Packages**
  - LQFP64-1(7mm ×7mm)
  - LQFP64(10mm ×10mm)
  - LQFP100(14mm ×14mm)
  - LQFP144(20mm ×20mm)
- **Ordering Information**

Reference	Part Number
N32H488xE	N32H488REL7K, N32H488REL7, N32H488VEL7, N32H488ZEL7

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1 Ordering Information

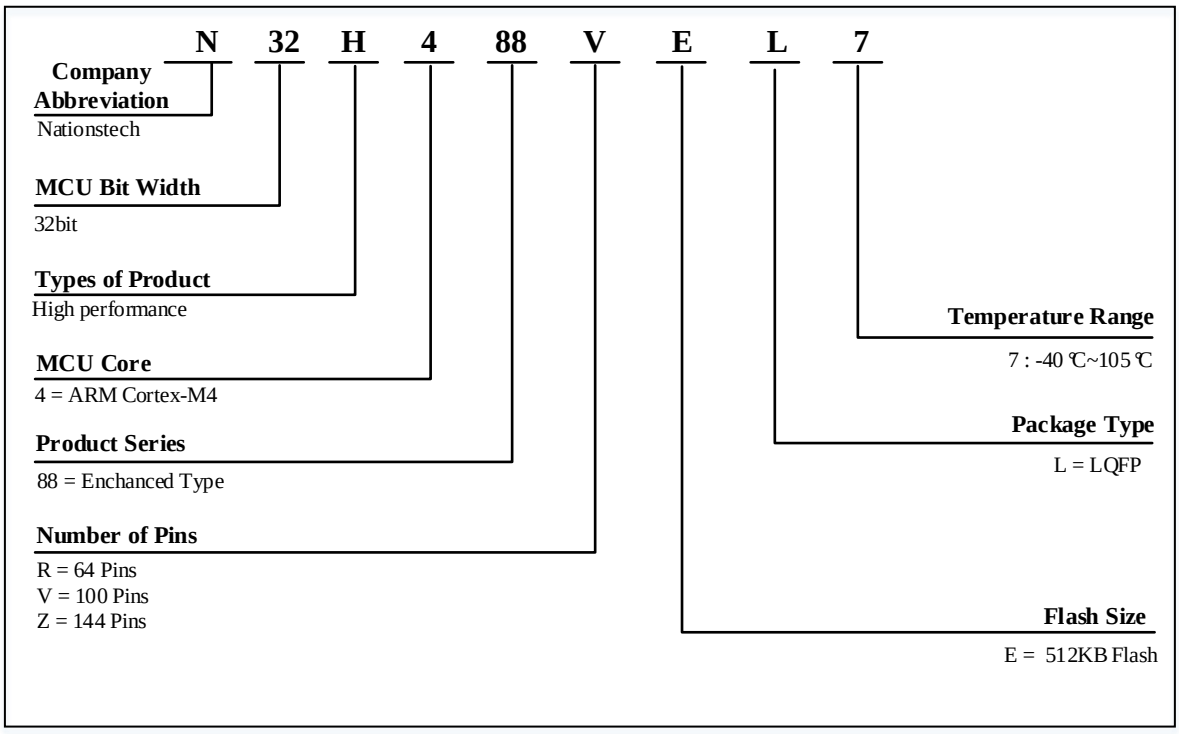

Table 1-1 N32H488 Series Ordering Code

Ordering Code(1)	Package	Size	Packaging(2)	SPQ(3)	Temperature range
N32H481REL7K	LQFP64-1	7mm x 7mm	Tray	250	-40℃～105℃
N32H488REL7	LQFP64	10mm x 10mm	Tray	160	-40℃～105℃
N32H488VEL7	LQFP100	14mm x 14mm	Tray	90	-40℃～105℃
N32H488ZEL7	LQFP144	20mm x 20mm	Tray	60	-40℃～105℃

1. For the latest detailed-ordering information, please refer to the Selection Guide.
2. The packaging provided is the basic packaging. If user has any other requirements, please contact Naitons.
3. Minimum packaging quantity.

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2 Product Configurations

Table 2-1 N32H488 Series Product Configuration

Device		N32H488REL7K	N32H488REL7	N32H488VEL7	N32H488ZEL7
Operating Condition		1.8~3.6V/-40~105℃			
CPU Frequency		ARM Cortex-M4F @240MHz, 300DMIPS			
Flash Capacity (KB)		512	512	512	512
Total SRAM (KB)	General SRAM	160	160	160	160
	CCM SRAM(1)	32			
	Backup SRAM	4			
Times	SHRTIM	1*16bit			
	ATIM	3*16bit			
	GTIM	7*16bit 3*16bit(2)			
	BTIM	2*32bit			
	LPTIM	2*16bit			
	SysTick timer	1			
	WWDG	1*14bit			
	IWDG	1*12bit			
	RTC	Yes			
Communication Interfaces	SPI/I2S	6/2	5/2	6/2	
	I^2C	4			
	USART	4			
	UART	4			
	USB FS Device	No	Yes		
	USB HS DualRole	Yes			
	FDCAN	3			
	Ethernet	Yes			
Memory Expansion	XSPI	Yes			
	FEMC	No	No	Yes(3)	Yes
	SDIO	Yes			
Human-computer interaction	DVP	Yes			
GPIO WKUP Pins		56 4	54 4	85 5	118 5
DMA Number of channels		2 16Channel			

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12bit ADC Number of channels	4 47Channel(4)	4 26Channel	4 42Channel	4 51Channel
12bit DAC Number of channels	8 8 (4 External/Internal + 4 Internal)			
PGA	4			
COMP	7			
VREFBUF	Yes			
Algorithm Support	DES/3DES、AES、SHA1/SHA224/SHA256、SM3、SM4、MD5、CRC16/CRC32			
TRNG	Yes			
Cordic	Yes			
FMAC	Yes			
Security Protection	Read-write protection (RDP/WRP), storage encryption, partition protection, secure boot			
Package	LQFP64-1	LQFP64	LQFP100	LQFP144

Notes:

(1) CCM SRAM is powered up as general SRAM by default, and users can configure it as CCM SRAM.

(2) Supports break input, Channel 1 supports complementary channel output.

(3) Only supports address bus and data bus multiplexing.

(4) 2 ADCs are multiplexed with OSC_IN and OSC_OUT, 2 ADCs are multiplexed with USB_HS_DP and USB_HS_DM, ADC1 has 14 channels, ADC2 has 16 channels, ADC3 has 19 channels, ADC4 has 18 channels

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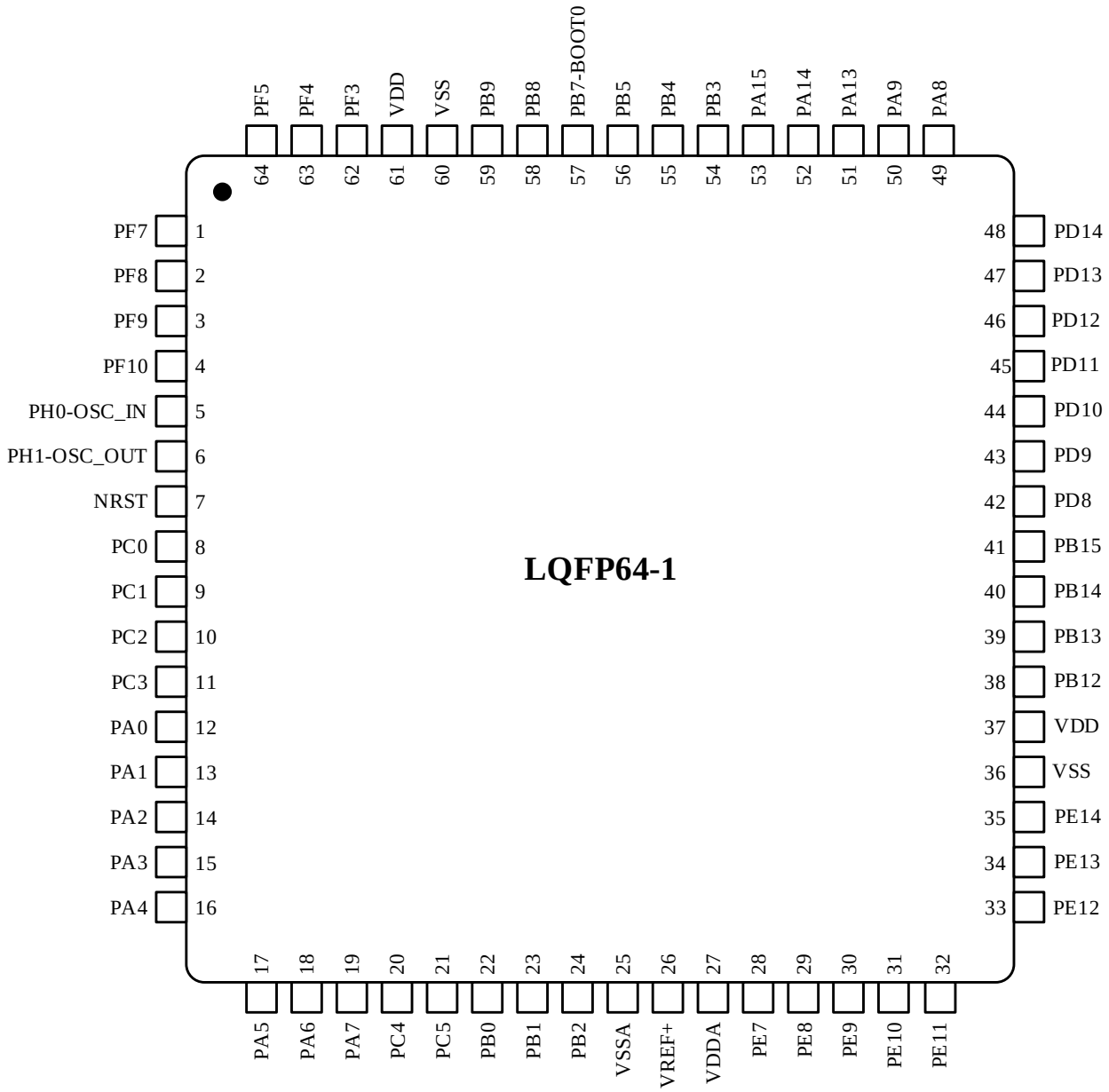
3 Package

3.1 LQFP64-1

3.1.1 LQFP64-1 Pinout



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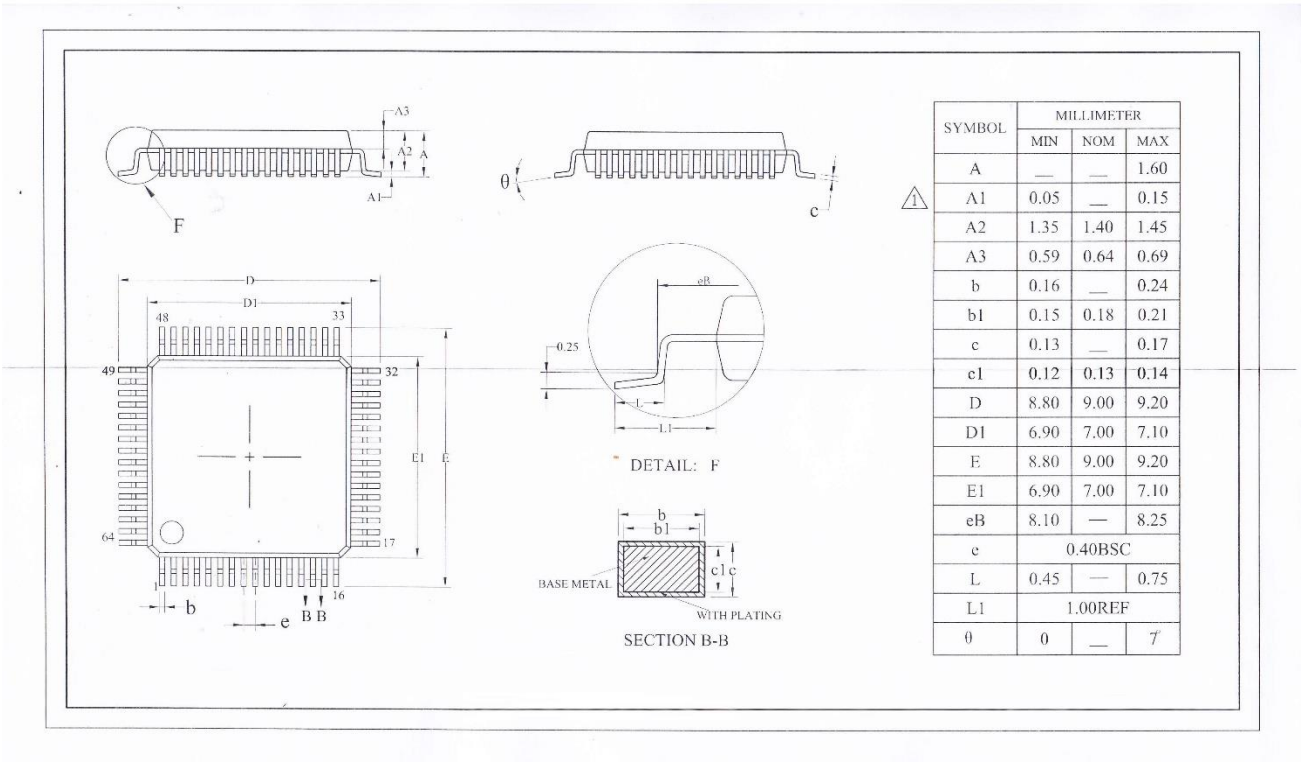
3.1.2 LQFP64-1 Package



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.60
A1	0.05	—	0.15
A2	1.35	1.40	1.45
A3	0.59	0.64	0.69
b	0.16	—	0.24
b1	0.15	0.18	0.21
c	0.13	—	0.17
c1	0.12	0.13	0.14
D	8.80	9.00	9.20
D1	6.90	7.00	7.10
E	8.80	9.00	9.20
E1	6.90	7.00	7.10
eB	8.10	—	8.25
e	0.40BSC		
L	0.45	—	0.75
L1	1.00REF		
θ	0	—	7°

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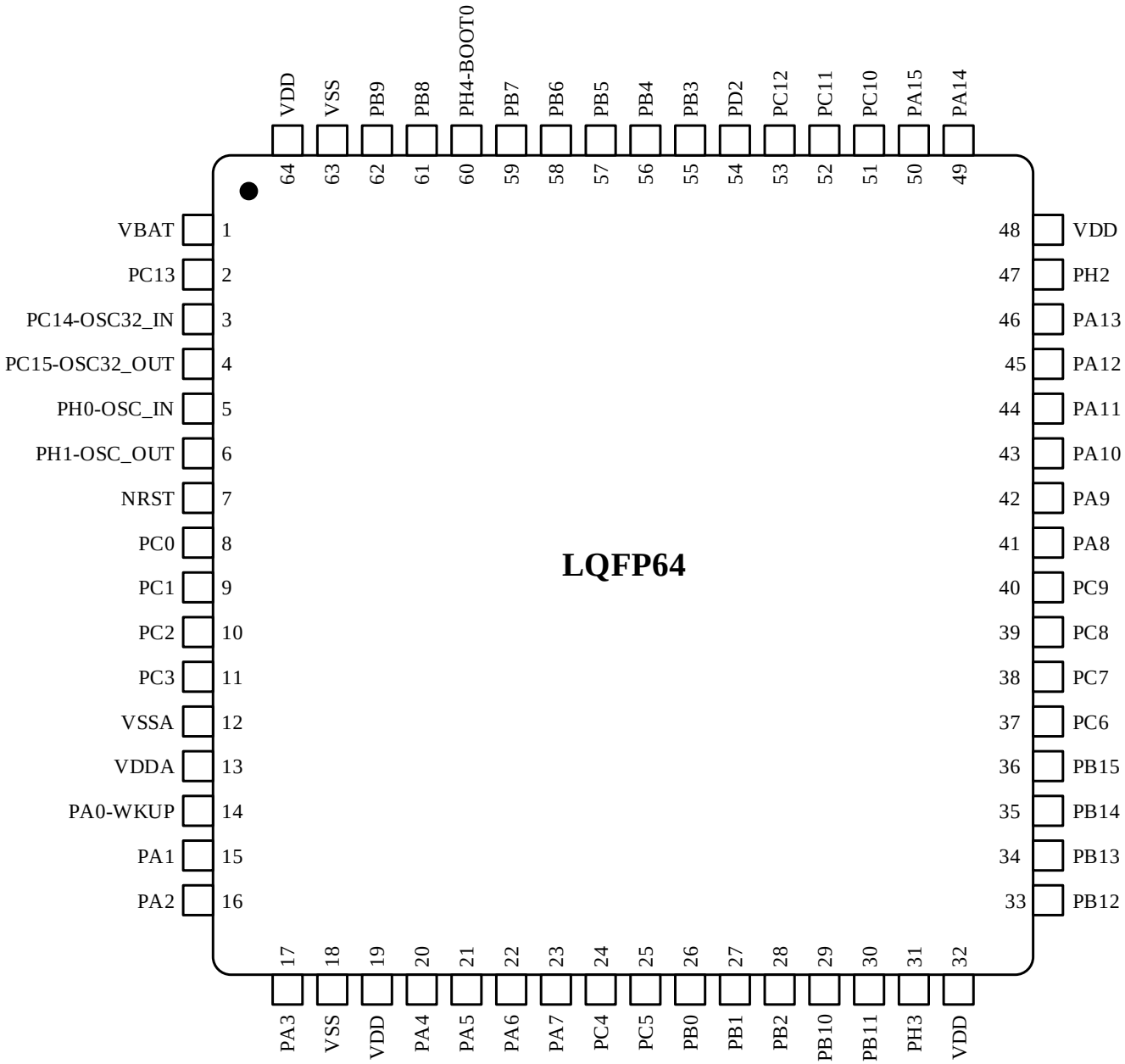
3.2 LQFP64

3.2.1 LQFP64 Pinout



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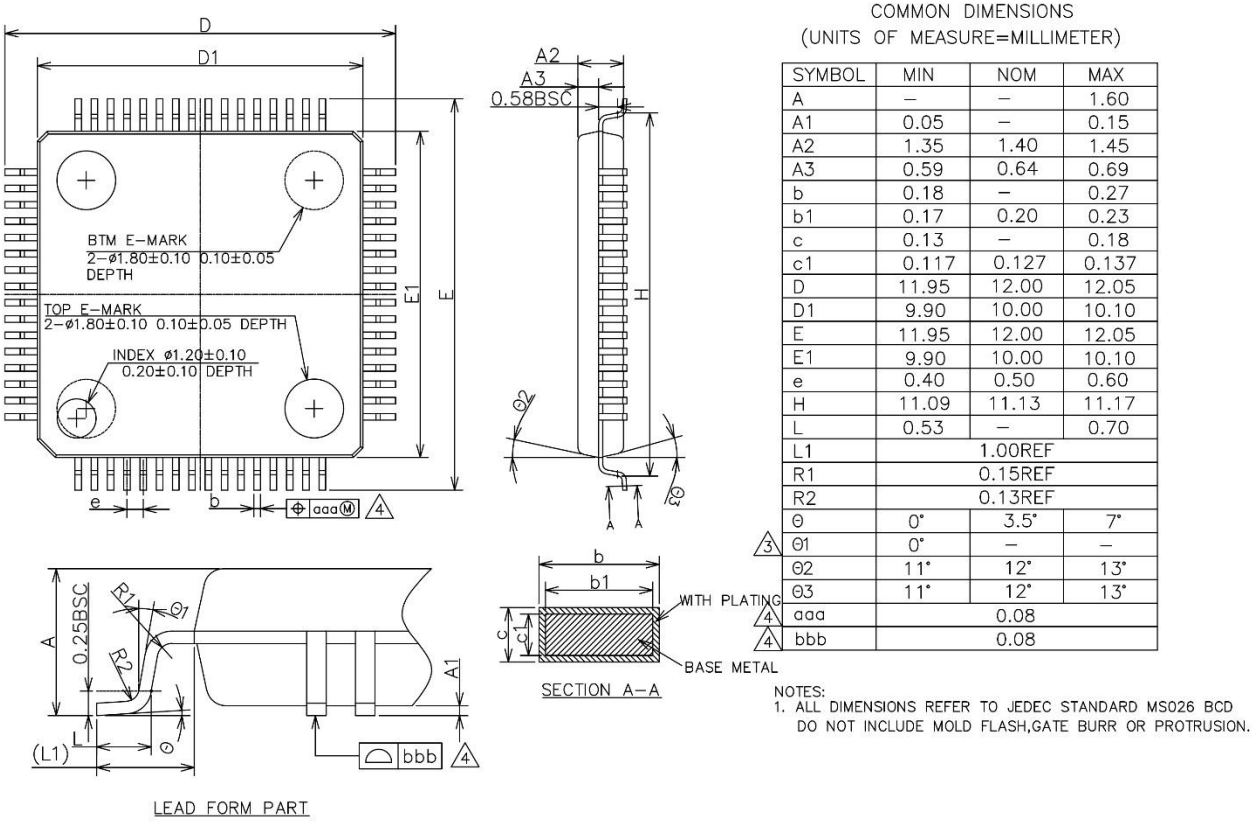
3.2.2 LQFP64 Package



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

	SYMBOL	MIN	NOM	MAX
	A	–	–	1.60
	A1	0.05	–	0.15
	A2	1.35	1.40	1.45
	A3	0.59	0.64	0.69
	b	0.18	–	0.27
	b1	0.17	0.20	0.23
	c	0.13	–	0.18
	c1	0.117	0.127	0.137
	D	11.95	12.00	12.05
	D1	9.90	10.00	10.10
	E	11.95	12.00	12.05
	E1	9.90	10.00	10.10
	e	0.40	0.50	0.60
	H	11.09	11.13	11.17
	L	0.53	–	0.70
	L1	1.00REF		
	R1	0.15REF		
	R2	0.13REF		
	θ	0°	3.5°	7°
3	θ1	0°	–	–
	θ2	11°	12°	13°
	θ3	11°	12°	13°
4	aaa	0.08		
4	bbb	0.08		

NOTES:
1. ALL DIMENSIONS REFER TO JEDEC STANDARD MS026 BCD
DO NOT INCLUDE MOLD FLASH,GATE BURR OR PROTRUSION.

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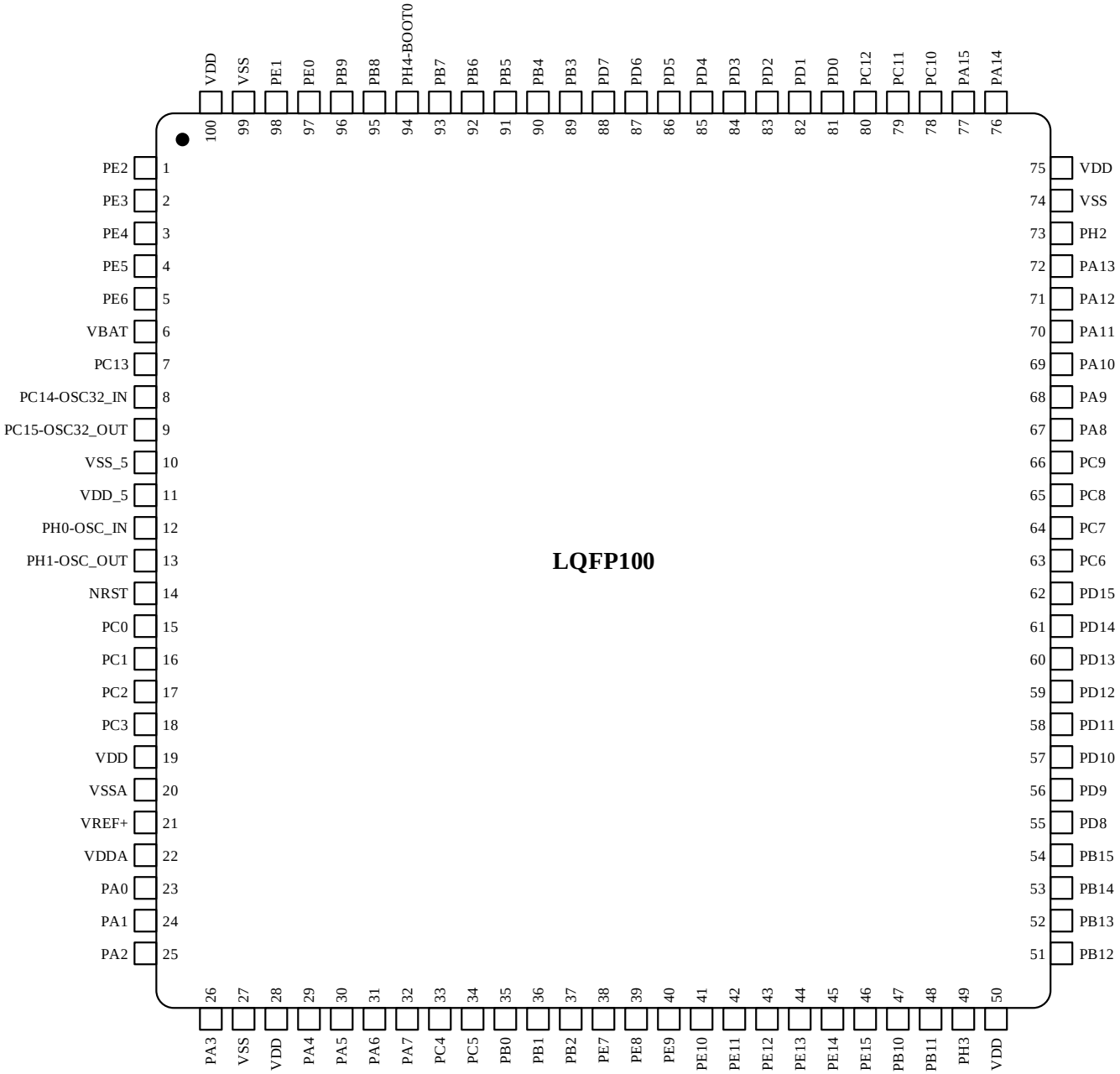
3.3 LQFP100

3.3.1 LQFP100 Pinout



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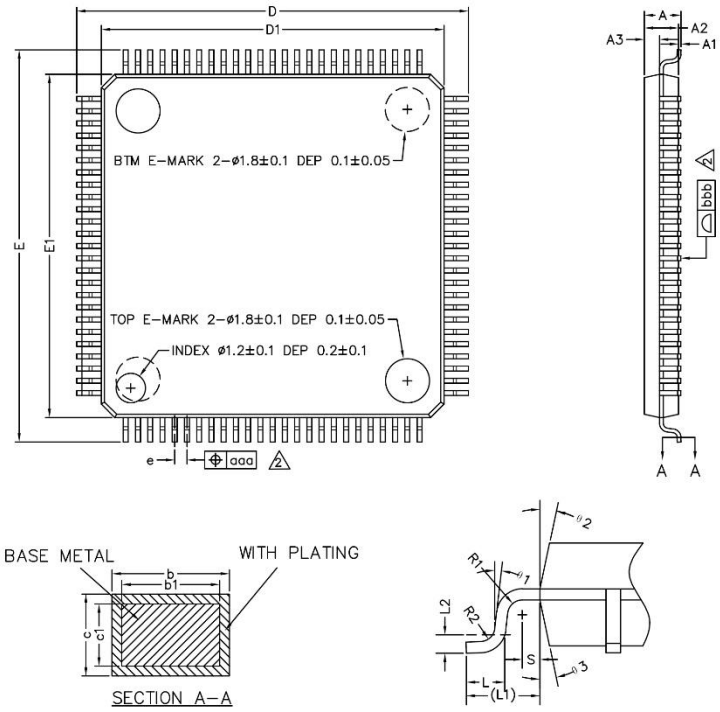
3.3.2 LQFP100 Package



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

	SYMBOL	MIN	NOM	MAX
	A	–	–	1.60
	A1	0.05	–	0.15
	A2	1.35	1.40	1.45
	A3	0.59	0.64	0.69
	b	0.17	–	0.27
	b1	0.17	0.20	0.23
	c	0.13	–	0.18
	c1	0.12	0.127	0.134
	D	15.80	16.00	16.20
	D1	13.90	14.00	14.10
	E	15.80	16.00	16.20
	E1	13.90	14.00	14.10
3	e		0.50BSC	
	L	0.45	0.60	0.75
	L1		1.00REF	
	L2		0.25BSC	
	R1	0.08	–	–
	R2	0.08	–	0.20
	S	0.20	–	–
	θ	0°	3.5°	7°
	θ 1	0°	–	–
	θ 2	11°	12°	13°
	θ 3	11°	12°	13°
2	aaa		0.08	
2	bbb		0.08	

NOTES:
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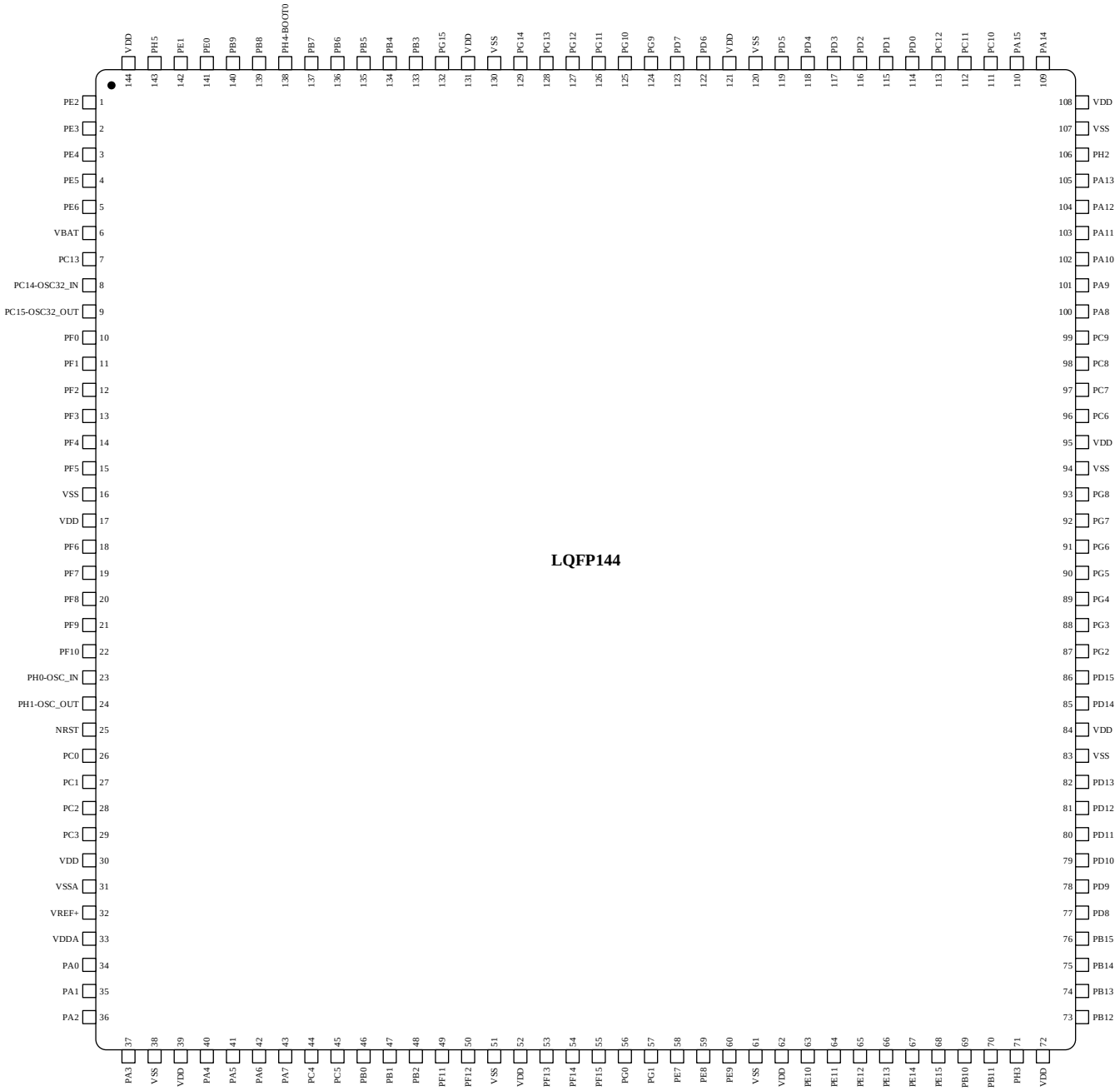
3.4 LQFP144

3.4.1 LQFP144 Pinout



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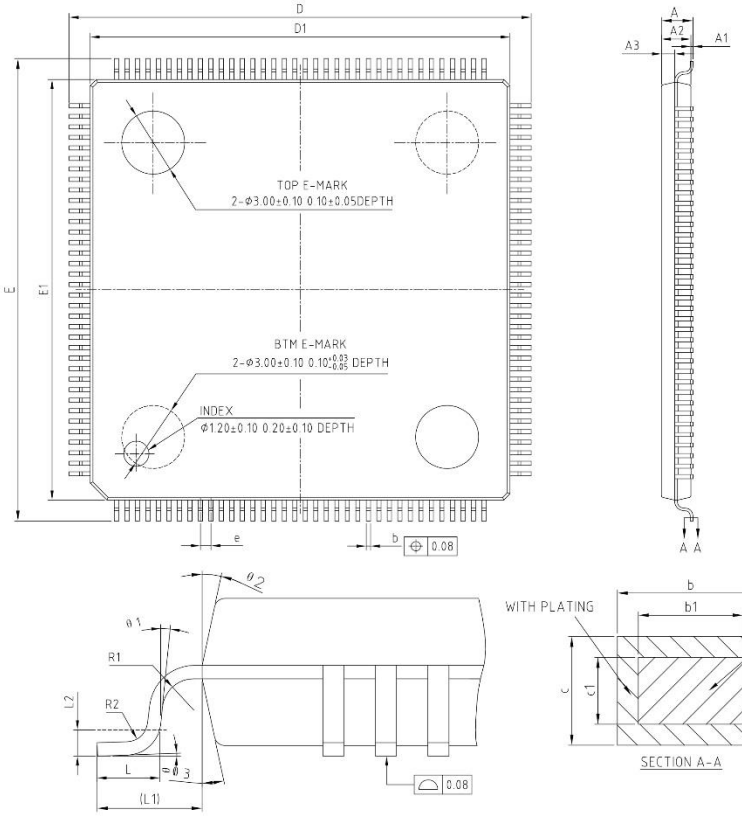
3.4.2 LQFP144 Package



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	–	–	1.60
A1	0.05	–	0.15
A2	1.35	1.40	1.45
A3	0.59	0.64	0.69
b	0.17	–	0.27
b1	0.17	0.20	0.23
c	0.127	–	0.18
c1	0.119	0.127	0.135
D	21.80	22.00	22.20
D1	19.90	20.00	20.10
E	21.80	22.00	22.20
E1	19.90	20.00	20.10
e	0.40	0.50	0.60
L	0.45	0.60	0.75
L1	1.00REF		
L2	0.25BSC		
R1	0.08	–	–
R2	0.08	–	–
θ	0°	–	7°
θ1	0°	–	–
θ2	11°	12°	13°
θ3	11°	12°	13°

NOTES:
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4 Version History

Version	Date	Changes
V1.0.0	2025.5.9	Initial release.

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