N32G451xB/xC/xE Product Brief

N32G451 series uses a 32-bit ARM Cortex-M4 core with a maximum operating frequency of 144MHz, supporting floating point unit and DSP instructions, integrating up to 512KB Flash,96KB SRAM, multi-channel U(S)ART, I2C, SPI, USB, CAN communication interface, integrated 12bit ADC, DAC and other analog interfaces, Built-in cryptographic algorithm hardware acceleration engine

Main features

- **CPU core**
  - 32-bit ARM Cortex-M4 core + FPU, single-cycle hardware multiply and divide instructions, support DSP instructions and MPU
  - Built-in 8KB instruction Cache, support Flash acceleration unit execution program 0 wait
  - Run up to 144MHz, 180DMIPS
- **Encrypted memory**
  - Up to 512KByte embedded Flash memory, support encrypted storage, partition management and data protection, support hardware ECC verification, 100,000 erasing times, 10 years data retention
  - 144KByte embedded SRAM (including 16KByte Retention RAM), supporting hardware parity check
- **Low power management**
  - Stop0 mode: 150uA, RTC Run, all SRAM retained, all IO retained, 20us fast wake-up
  - Stop2 mode: 10uA, RTC Run, 16KByte Retention SRAM retention, CPU register retention, all IO retention, 40us fast wake-up
  - Standby mode: 3uA, 84 backup registers are retained, all IOs are retained, optional RTC Run, 16KByte Retention SRAM retention, support VBAT pin independent power supply, 100us fast wake-up
- **Clock**
  - 4MHz~32MHz external high-speed crystal
  - 32.768KHz external low-speed crystal
  - Internal high-speed RC 8MHz
  - Internal low-speed RC 40KHz
  - Built-in high-speed PLL
  - Supports one-way clock output, which can be configured with system clock, HSE, HSI, or PLL frequency division output
- **Reset**
  - Supports power on, power down, brown-out, and external pin reset
  - Support watchdog reset
- **Up to 80 GPIOs with multiplexing function. The maximum flip speed is 50MHz. Most GPIO supports 5V voltage resistance.**
- **Communication interface**

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- 7x U(S)ART interfaces with speeds up to 4.5Mbps, including 3x USART interfaces (supporting ISO7816, IrDA, LIN) and 4x UART interfaces
- 3x SPI interfaces with speeds up to 36MHz, two of which support I2S
- 4x I2C interfaces with speeds up to 1MHz, which can be configured in master/slave mode and support dual address response in slave mode
- 1x USB2.0 Full Speed Device port
- 1x CAN 2.0B bus interfaces
- 1x SDIO interface, supporting SD/MMC format

- **Analog interface**
  - 3x 12bit 5Msps high-speed ADCs, available in 12/10/8/6 bit mode, sampling rate up to 9Msps in 6bit mode and up to 31 external single-ended input channels, supporting differential mode
  - 2x 12bit DAC, sampling rate 1Msps
  - Support external input independent reference voltage source
  - All analog interfaces support full voltage from 1.8 to 3.6V
- **2x high-speed DMA controllers, each controller supports 8 channels, channel source address and destination address can be arbitrarily configurable**
- **RTC real-time clock, support leap year perpetual calendar, alarm clock event, periodic wake up, support internal and external clock calibration**
- **Timing counter**
  - 2x 16bit advanced timer counters, support input capture, complementary output, orthogonal coding input and other functions, the highest control accuracy of 6.9ns;Each timer has four independent channels, three of which support 6 complementary PWM output
  - 4x 16bit general timer counters, each timer has four independent channels, support input capture/output comparison /PWM output
  - 2x 16bit basic timer counters
  - 1x 24bit SysTick
  - 1x 7bit Window Watchdog (WWDG)
  - 1x 12bit Independent Watchdog (IWDG)
- **Programming mode**
  - Support SWD/JTAG online debugging interface
  - Support UART and USB Bootloader
- **Security features**
  - Built-in cryptographic algorithm hardware acceleration engine
  - Supports AES, DES, SHA, SM1, SM3, SM4, SM7, and MD5 algorithms
  - Flash Storage encryption, Multi-user Partition Management (MMU)
  - TRNG true random number generator
  - CRC16/32 operation

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- Support write protection (WRP), multiple read protection (RDP) levels (L0/L1/L2)
- Support security startup, program encryption download, security updates
- Support clock failure detection, anti-disassembly detection

- **96-bit UID and 128-bit UCID**
- **Working conditions**
  - Operating voltage range: 1.8V~3.6V
  - Operating temperature range: -40℃ ~ 105℃
  - ESD: ±4KV (HBM model), ±1KV (CDM model)
- **Package**
  - LQFP48(7mm x 7mm)
  - LQFP64(10mm x 10mm)
  - LQFP100(14mm x 14mm)

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1 Ordering information

Figure 1-1 N32G451 Series Part Number Information

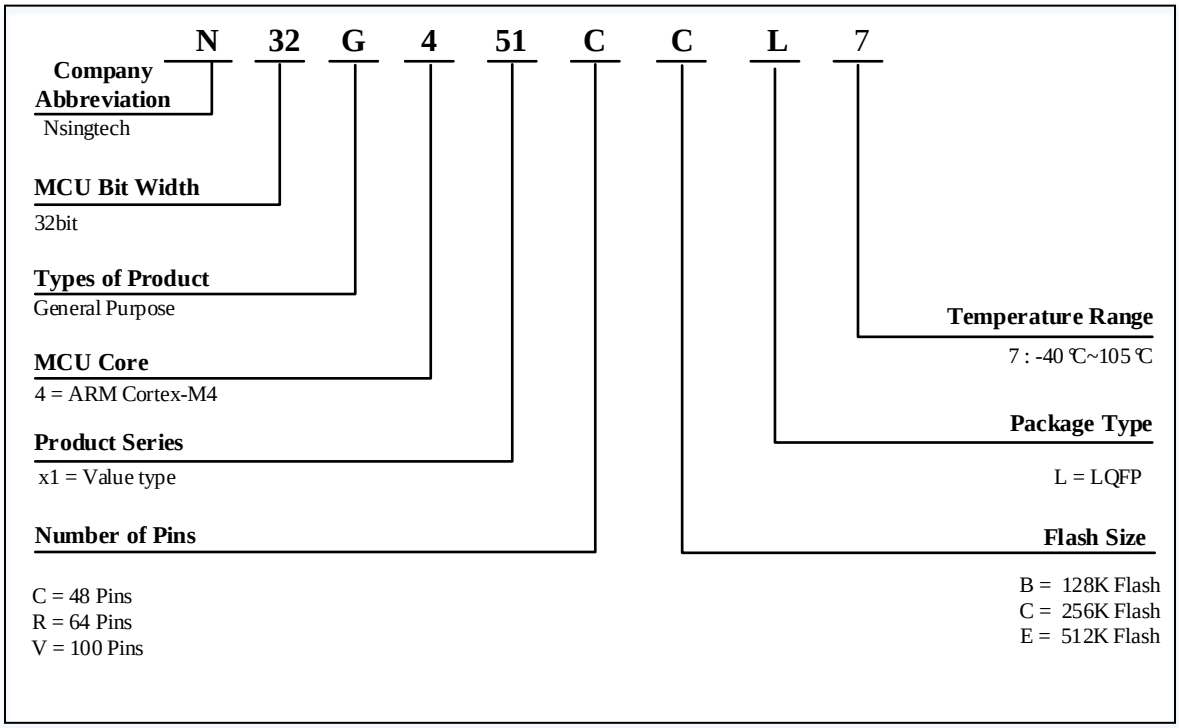

Table 1-1 N32G451 Series Ordering Code

Ordering code (1)	Package	Package size	Packaging (2)	SPQ(3)	Temperature range
N32G451CBL7	LQFP48	7mm*7mm	Tray	250	-40°C ~ 105°C
N32G451CCL7	LQFP48	7mm*7mm	Tray	250	-40°C ~ 105°C
N32G451CEL7	LQFP48	7mm*7mm	Tray	250	-40°C ~ 105°C
N32G451RBL7	LQFP64	10mm*10mm	Tray	160	-40°C ~ 105°C
N32G451RCL7	LQFP64	10mm*10mm	Tray	160	-40°C ~ 105°C
N32G451REL7	LQFP64	10mm*10mm	Tray	160	-40°C ~ 105°C
N32G451VCL7	LQFP100	14mm*14mm	Tray	90	-40°C ~ 105°C
N32G451VEL7	LQFP100	14mm*14mm	Tray	90	-40°C ~ 105°C

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 Nsing.
3. Minimum packaging quantity.

2 Product Model Resource configuration

Device type	N32G451CB/CC/CE			N32G451RB/RC/RE			N32G451VC/VE	
Flash size（KB）	128	256	512	128	256	512	256	512

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SRAM size（KB）		48	96	96	48	96	96	96	96
CPU frequency		ARM Cortex-M4 @144MHz,180DMIPS							
Work environment		1.8~3.6V/-40~105℃							
Timer	General	4							
	Advanced	2							
	Basic	2							
Communication Interface	SPI	3							
	I2S	2							
	I2C	3			4				
	USART	3							
	UART	3			4				
	USB	1							
	CAN	1							
	SDIO	No			1				
GPIO		37			51			80	
DMA Number of Channels		2 16Channel							
12bit ADC Number of channels		3 13Channel			3 19Channel			3 31Channel	
12bit DAC Number of channels		2 2Channel							
Algorithm support		DES/3DES、AES、 SHA1/SHA224/SHA256、SM1、SM3、SM4、SM7、MD5、CRC16/CRC32、TRNG							
Security protection		Read/write protection（RDP/WRP）, storage encryption, partition protection, secure startup							
Package		LQFP48			LQFP64			LQFP100	

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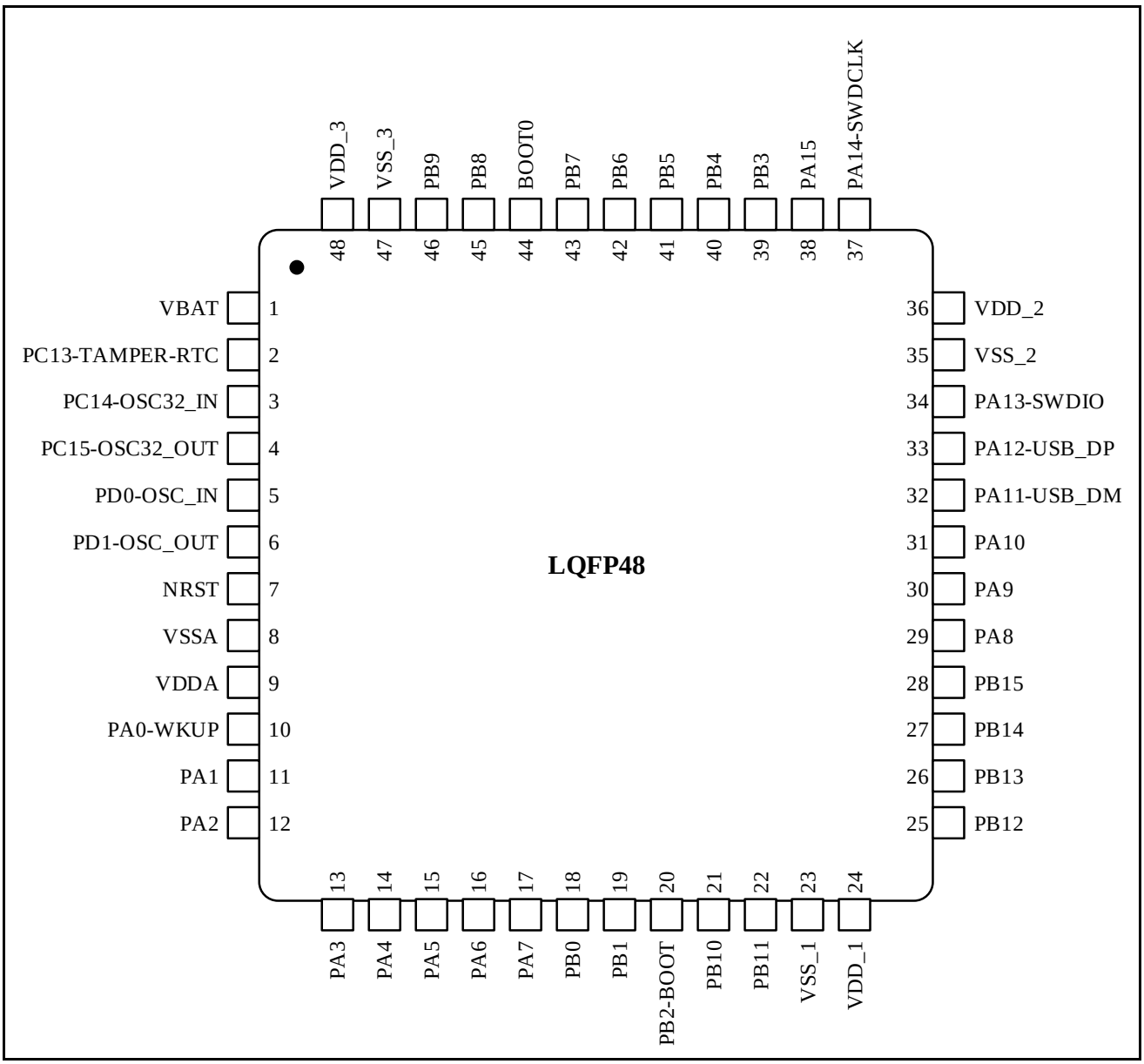
3 Package

3.1 LQFP48 package

3.1.1 LQFP48 pin distribution



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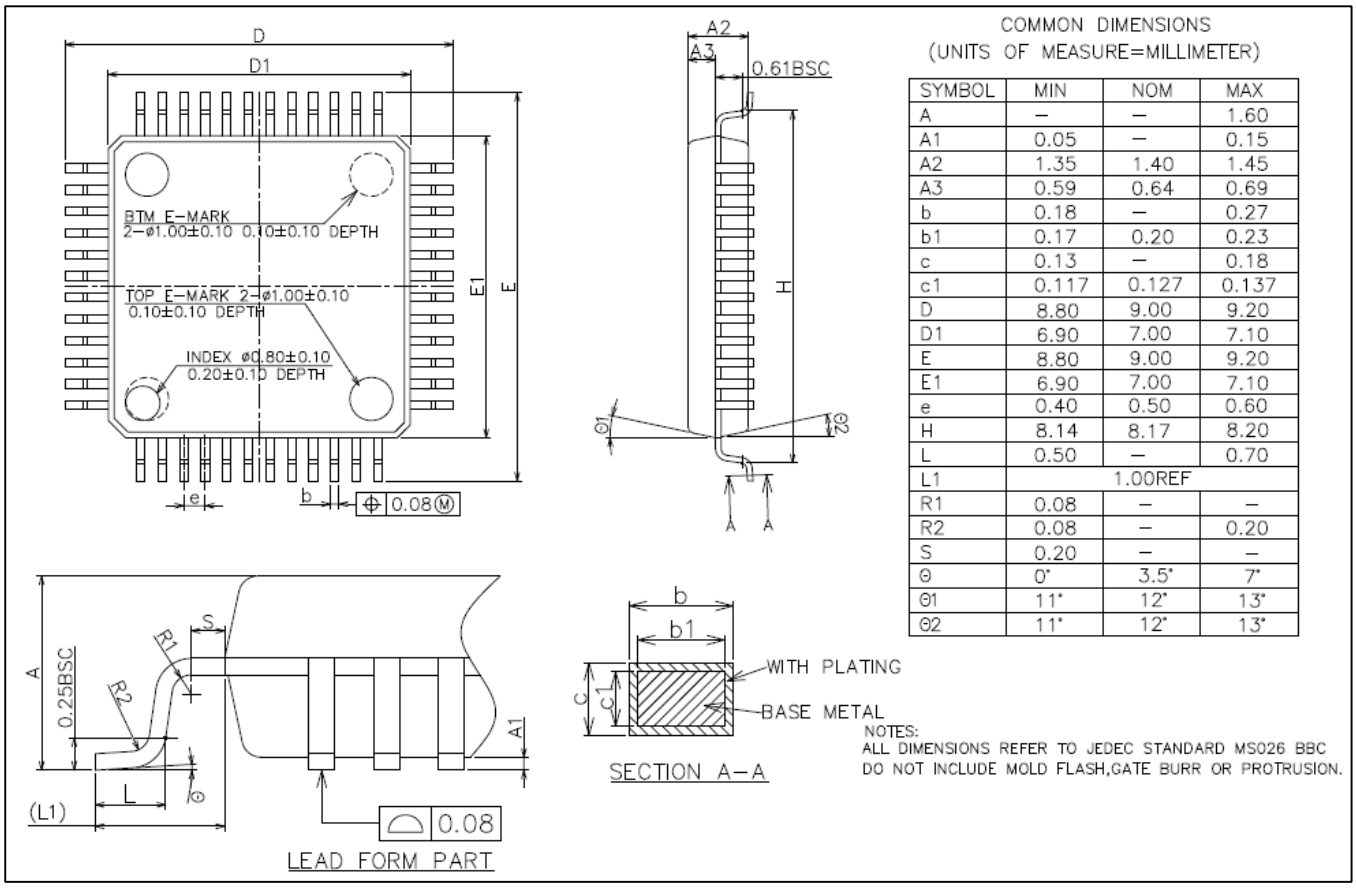
3.1.2 LQFP48 package size



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	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
e	0.40	0.50	0.60
H	8.14	8.17	8.20
L	0.50	–	0.70
L1		1.00REF	
R1	0.08	–	–
R2	0.08	–	0.20
S	0.20	–	–
θ	0°	3.5°	7°
θ1	11°	12°	13°
θ2	11°	12°	13°

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

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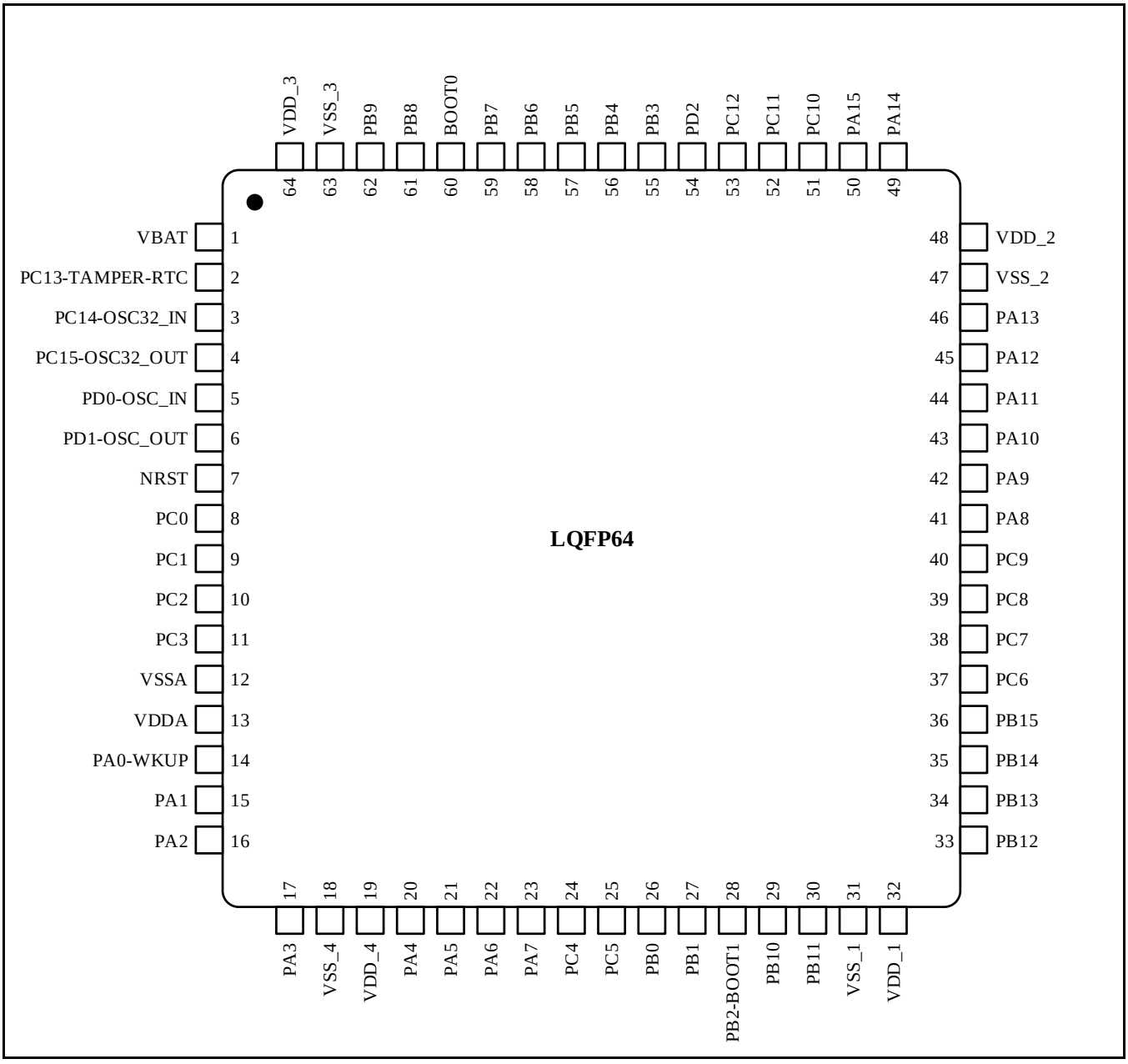
3.2 LQFP64 package

3.2.1 LQFP64 pin distribution



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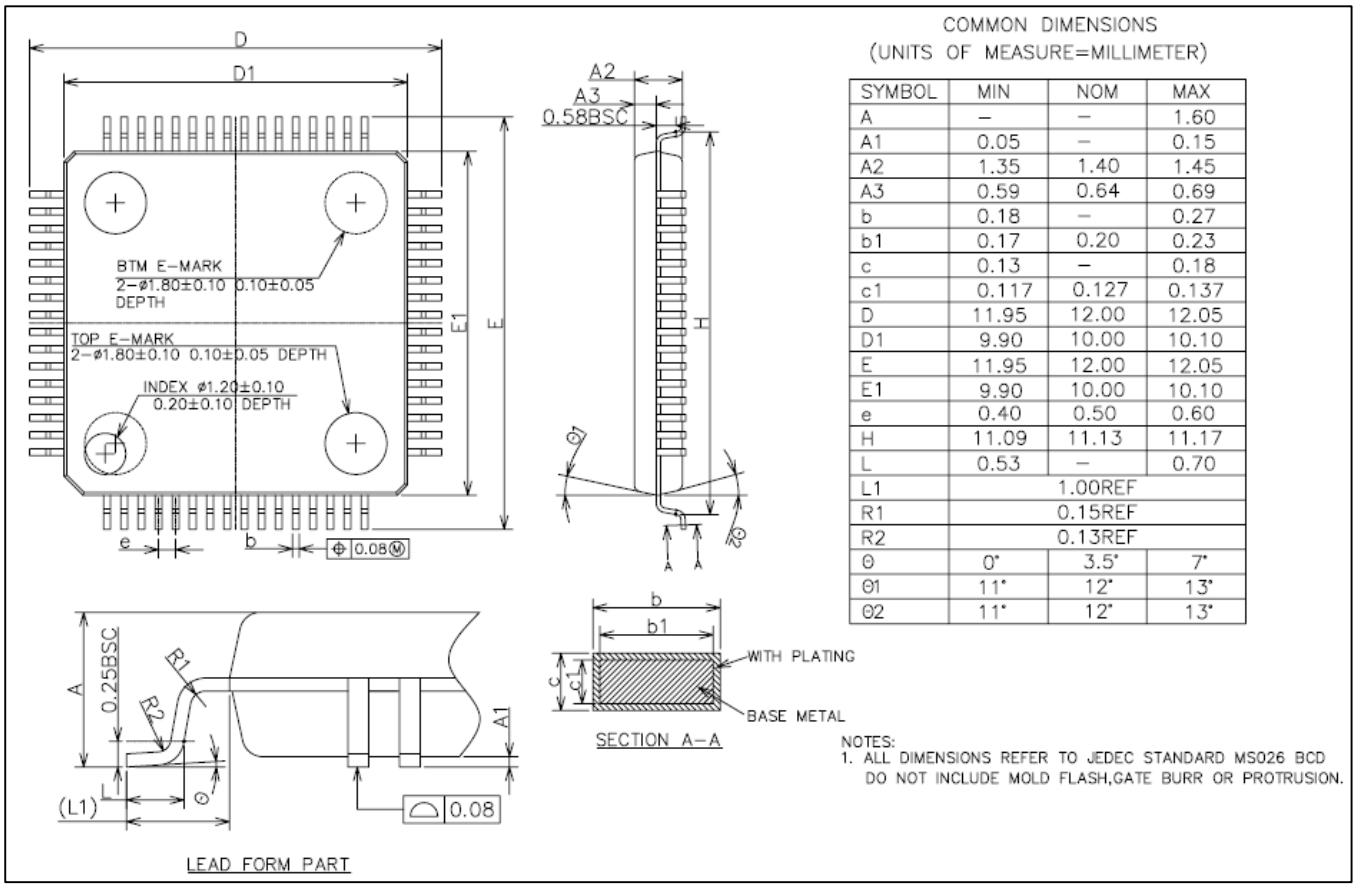
3.2.2 LQFP64 package size



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°
θ1	11°	12°	13°
θ2	11°	12°	13°

NOTES:
1. ALL DIMENSIONS REFER TO JEDEC STANDARD MS026 BCD
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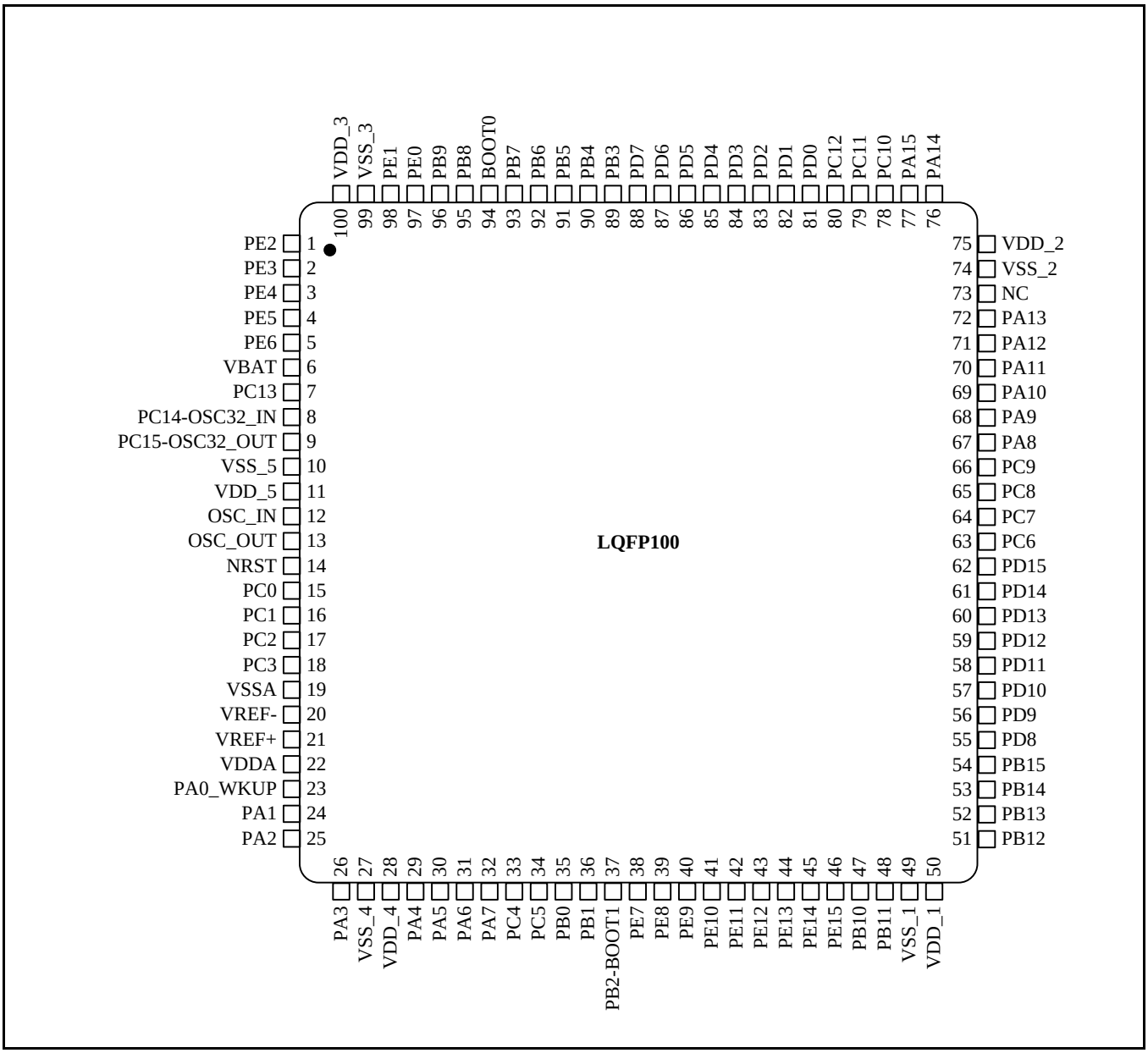
3.3 LQFP100 package

3.3.1 LQFP100 pin distribution



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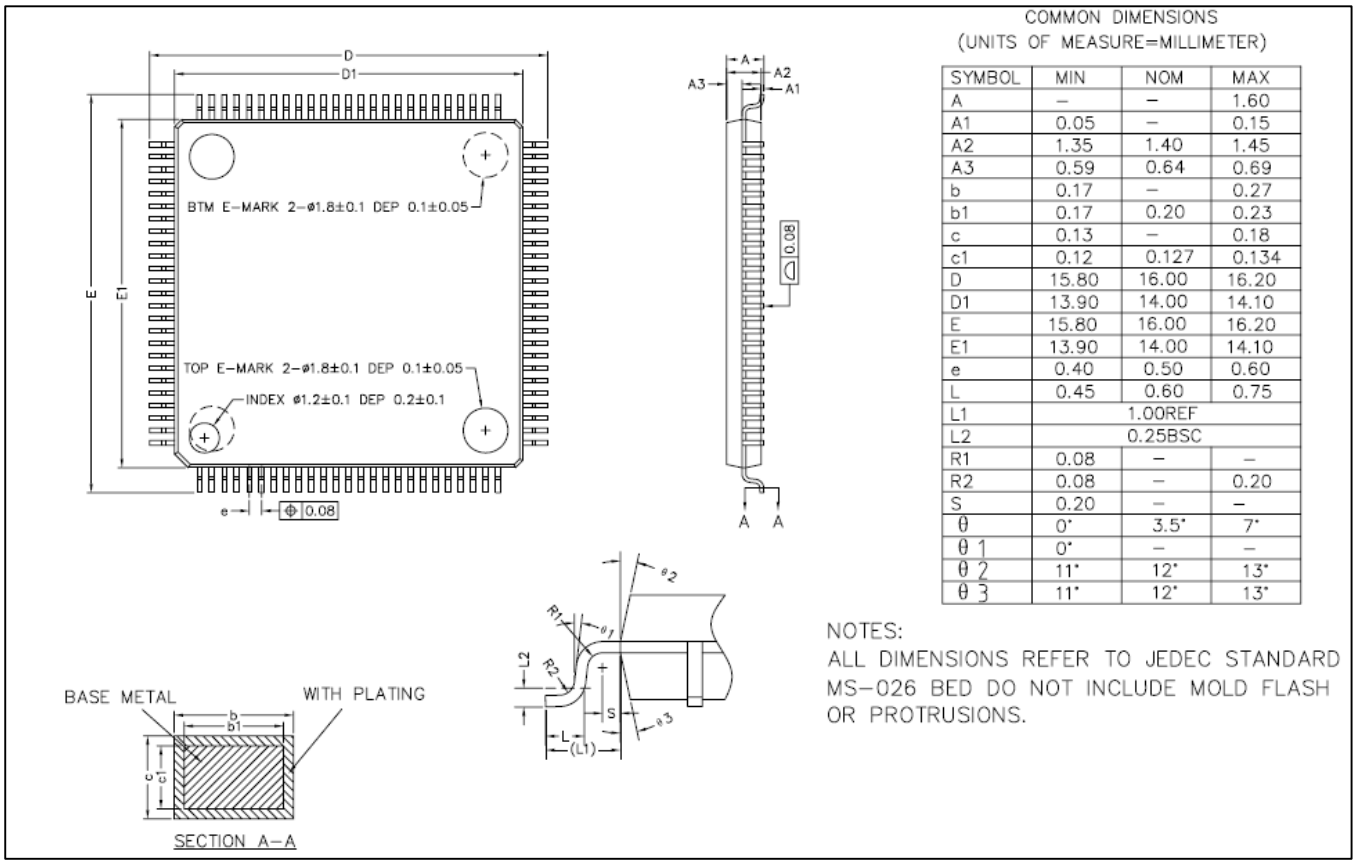
3.3.2 LQFP100 package size



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
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	–	0.20
S	0.20	–	–
θ	0°	3.5°	7°
θ1	0°	–	–
θ2	11°	12°	13°
θ3	11°	12°	13°

NOTES:
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4 Version history

Version	The date	Note
V1.1.0	2024.11.19	New document

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