N32L40xx8/xB Product Brief

N32L40x series uses 32-bit ARM Cortex-M4F core, maximum working frequency 64MHz, support floating point operation and DSP instructions, integrated up to 128KB embedded encryption Flash, 24KB SRAM, integrated with rich high-performance analog interface, Built-in one 12bit 4.5Msps ADC, two independent rail-to-rail operational amplifiers, two high-speed comparators, one 1Msps 12bit DAC, Integrated multi-channel U(S)ART, I2C, SPI, USB, CAN and other digital communication interfaces, Segment LCD Driver Interface ,built-in password 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 2KB instruction Cache, support Flash acceleration unit execution program 0 wait
  - The highest frequency is 64MHz, 80DMIPS
- **Cryptographic memory**
  - Up to 128KByte in-chip Flash, support encrypted storage, partition management and data protection, support hardware ECC verification, 100,000 erasing times, 10 years of data retention
  - 256KByte Data Flash (some parts support)
  - Up to 24KByte in-chip SRAM, including 16Kbyte SRAM1(Stop2 mode can be configured as retention) and 8 Kbyte SRAM2(both Standby and Stop2 modes can be configured as retention), supporting hardware parity check
- **Low power management**
  - Support Run, Sleep, LP Run, LP Sleep, Stop2, Standby mode
- **High-performance analog interface**
  - One 12bit 4.5Msps ADC with a variety of precision configurable, sampling rate up to 8Msps in 6bit mode, up to 16 external single-ended input channels, supporting differential mode
  - Two rail-to-rail operational amplifiers with built-in programmable gain amplifier up to 32 times
  - Two high-speed analog comparators with built-in 64-level adjustable comparison reference, COMP1 support working in STOP2 mode
  - One 12bit DAC, sampling rate 1Msps
  - Internal 2.048V independent reference voltage reference source
  - All analog interfaces support full voltage from 1.8 to 3.6V
- **Clock**
  - 4MHz~32MHz external high-speed crystal
  - 32.768KHz External low-speed crystal
  - Internal high-speed RC(HSI) 16MHz
  - Internal multi-speed RC(MSI) 100K~4MHz
  - Internal low-speed RC(LSI) 40KHz
  - Built-in high-speed PLL
  - Supports one clock output, which can be configured as low-speed or high-speed clock output

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- **Reset**
  - Support power-on, brown-out, and external pin reset
  - Support watchdog reset, software reset
- **Support up to 64 GPIOs.**
- **Communication interface**
  - Five U(S)ART interfaces, including three USART interfaces (support 1xISO7816, 1xIrDA, LIN) and two UART interfaces
  - One LPUART, support STOP2 to wake up MCU in low power consumption state
  - Two SPI interfaces, the rate is up to 16 Mbps, support I2S communication
  - Two I2C interfaces, the rate is up to 1 MHz, which can be configured in master/slave mode and support dual address response in slave mode
  - One USB2.0 FS Device interface
  - One CAN 2.0A/B bus interface
- **Segment LCD driver interface**
  - Supports up to 320 segments (8x40) or 176 segments (4x44) monochrome passive LCD display
  - Flexible LCD refresh rate support (30~102Hz)
  - Support static, 1/2, 1/3, 1/4, 1/8 duty cycle
  - Support static, 1/2, 1/3, 1/4 bias
  - Support normal display in Stop2 mode
- **One high-speed DMA controller, each controller supports 8 channels, channel source address and destination address can be configured arbitrarily**
- **RTC real-time clock, support leap year perpetual calendar, alarm event, periodic wake up, support internal and external clock calibration**
- **Timer counter**
  - Two 16bit advanced timer counters, support input capture, complementary output, quadrature encoding input, the highest control accuracy is 9.25ns,each timer has four independent channels, three of which support six-channel complementary PWM output
  - Five 16bit general purpose timer counters, each timer has 4 independent channels, support input capture/output comparison /PWM output
  - Two 16bit basic timer counters
  - One 16bit low power timer counter, support quadrature encoding and double pulse counting function, can work in STOP2 mode
  - 1x 24bit SysTick
  - 1x 7bit window Watchdog (WWDG)
  - 1x 12bit independent Watchdog (IWDG)
- **Programming method**
  - Support SWD/JTAG online debugging interface
  - Support UART and USB Bootloader
- **Security features**
  - Built-in cryptographic algorithm hardware acceleration engine
  - Support AES, DES, TDES, SHA1/224/256, SM1, SM3, SM4, and SM7 algorithms

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- Flash storage encryption, multi-user partition management (MMU)
- TRNG true random number generator
- CRC16/32 calculation
- Support write protection (WRP), multiple read protection (RDP) levels (L0/L1/L2)
- Support security start, program encryption download, security update
- Support external clock failure detection, tamper 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**
  - QFN32(4mm x 4mm)
  - QFN32(5mm x 5mm)
  - QFN48 (6mm x 6mm)
  - LQFP48(7mm x 7mm)
  - QFN64 (8mm x 8mm)
  - LQFP64(7mm×7mm)
  - LQFP64(10mm x 10mm)
  - LQFP80(12mm x 12mm)
- **Order model**

Type	Model
N32L402	N32L402C8Q7, N32L402C8L7, N32L402R8L7, N32L402CBQ7, N32L402CBL7, N32L402RBL7, N32L402RDL7
N32L403	N32L403K8Q7, N32L403KBQ7, N32L403KBQ7-1(1)
N32L406	N32L406C8Q7, N32L406R8Q7, N32L406CBQ7, N32L406CBL7, N32L406RBL7，N32L406RBQ7, N32L406MBL7, N32L406RDL7, N32L406CDL7, N32L406RBL7-1(2)

Note:

(1): The package is QFN32(5mm x 5mm)

(1): The package is LQFP64(7mm x 7mm)

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1 Ordering information

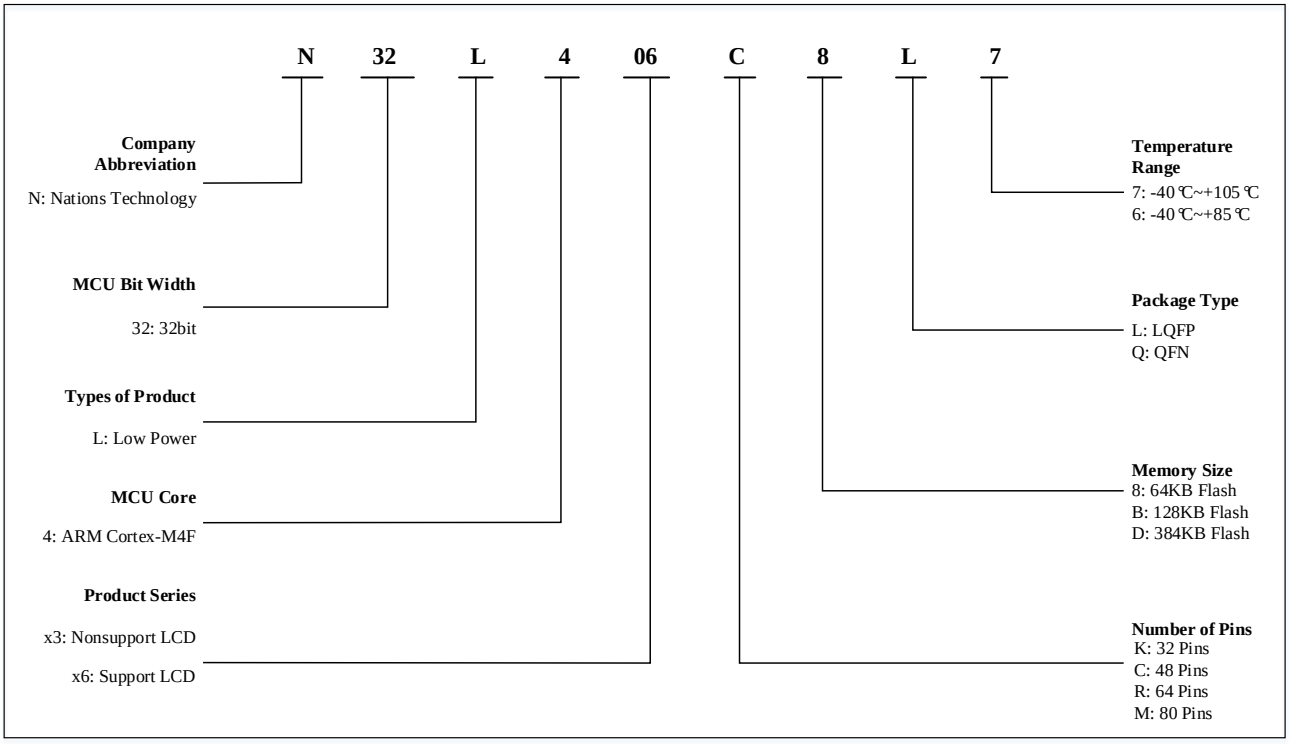

Table 1-1 N32L40x Series Ordering Code

Ordering code(1)	Package	Package size	Packaging(2)	SPQ(3)	Temperature range
N32L406C8Q7	QFN48	6mm * 6mm	Tray	490	-40℃～105℃
N32L406CBQ7	QFN48	6mm * 6mm	Tray	490	-40℃～105℃
N32L406CBL7	LQFP48	7mm * 7mm	Tray	250	-40℃～105℃
N32L406CDL7	LQFP48	7mm * 7mm	Tray	250	-40℃～105℃
N32L406R8Q7	QFN64	8mm * 8mm	Tray	260	-40℃～105℃
N32L406RBL7	LQFP64	10mm * 10mm	Tray	160	-40℃～105℃
N32L406RBL7-1	LQFP64	7mm * 7mm	Tray	250	-40℃～105℃
N32L406RBQ7	QFN64	8mm * 8mm	Tray	260	-40℃～105℃
N32L406RDL7	LQFP64	10mm * 10mm	Tray	160	-40℃～105℃
N32L406MBL7	LQFP80	12mm * 12mm	Tray	119	-40℃～105℃
N32L403K8Q7	QFN32	4mm * 4mm	Tray	490	-40℃～105℃
N32L403KBQ7	QFN32	4mm * 4mm	Tray	490	-40℃～105℃
N32L403KBQ7-1	QFN32	5mm * 5mm	Tray	490	-40℃～105℃
			Reel	3000	

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Ordering code[1]	Package	Package size	Packaging[2]	SPQ[3]	Temperature range
N32L402C8Q7	QFN48	6mm * 6mm	Tray	490	-40℃～105℃
N32L402C8L7	LQFP48	7mm * 7mm	Tray	250	-40℃～105℃
N32L402CBQ7	QFN48	6mm * 6mm	Tray	490	-40℃～105℃
N32L402CBL7	LQFP48	7mm * 7mm	Tray	250	-40℃～105℃
N32L402R8L7	LQFP64	10mm * 10mm	Tray	160	-40℃～105℃
N32L402RBL7	LQFP64	10mm * 10mm	Tray	160	-40℃～105℃
N32L402RDL7	LQFP64	10mm * 10mm	Tray	160	-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 model resource configuration

Table 2-1 N32L40x series resource configuration

Part Number		N32L402C8/B		N32L402R8/B/D			N32L403K8/BQ7		N32L403KBQ7-1[5]	N32L406C8/B/D			N32L406R8/B/D			N32L406MB
Flash (KB)		64	128	64	128	128	64	128	128	64	128	128	64	128	128	128
Data Flash (KB)		No	No	No	No	256	No	No	No	No	No	256	No	No	256	No
SRAM (KB)		16	16	16	16	16	16	24	24	16	24	24	16	24	24	24
CPU frequency		ARM Cortex-M4 @ 64MHz, 80DMIPS														
Working environment		1.8~3.6V/-40~105℃														
Timer	General	5														
	Advanced	2														
	Basic	2														
	LPTIM	1														
Communication interface	SPI[1]	2		2			2		1	2						
	I2S[1]	2		2			2		1	2						
	I2C	2														
	UART	2														
	USART	3		3			2		2	3						
	LPUART	1														
	USB	1							No	1						
	CAN	No		No			1									
GPIO		38		52			26		29	38			52			64
DMA Number of Channels		1x 8 Channel														
12bit ADC Number of Channels		1x 10Channel		1x 16Channel			1x 10Channel		1x 10Channel	1x 10Channel			1x 16Channel			1x 16Channel
12bit DAC Number of Channels		1x 1 Channel														

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Part Number	N32L402C8/B	N32L402R8/B/D	N32L403K8/BQ7	N32L403KBQ7-1[5]	N32L406C8/B/D	N32L406R8/B/D	N32L406MB
OPAMP/COMP	2/2	2/2	2/2	2/2	2/2	2/2	2/2
Segment LCD	4x20	4x34/8x30[2] [3]	No		4x20	4x34/8x30[2] [3]	4x44/8x40[3]
Algorithm support	DES/TDES, AES, SHA1/SHA224/SHA256, SM1, SM3, SM4, SM7, CRC16/CRC32, TRNG						
Security protection	Read-write protection (RDP/WRP), storage encryption, partition protection, secure boot						
Package	LQFP48/QFN48	LQFP64	QFN32[4]	QFN32[5]	LQFP48/QFN48	LQFP64[6]/QFN64	LQFP80

1. SPI1 and SPI2 interfaces have the flexibility to switch between SPI mode and I2S audio mode.
2. LQFP64/QFN64 package version B chips do not support LCD 1/8 duty cycle mode (8x30).
3. In 1/8 duty cycle mode, version B and version C chip LCDs do not support 1/4 bias.
4. The package size is QFN32(4mm x 4mm).
5. The package size is QFN32(5mm x 5mm).
6. LQFP64 packages are available in two sizes (7mm x 7mm) and (10mm x 10mm), with the N32L406RBL7-1 package size being (7mm x 7mm) and the other model packages being (10mm x 10mm).

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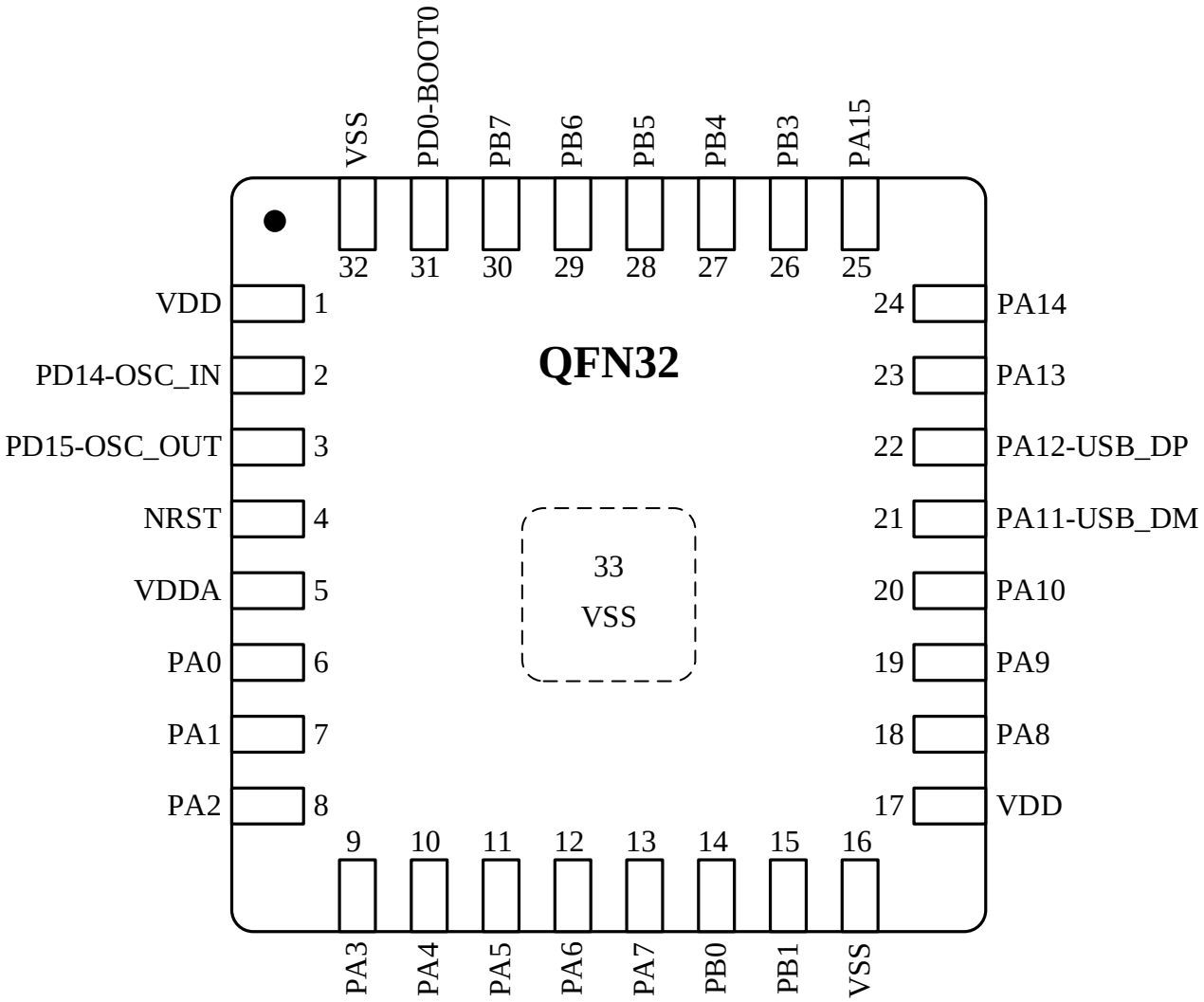
3 Package

3.1 QFN32package

3.1.1 QFN32 (4mm x 4mm)pinout



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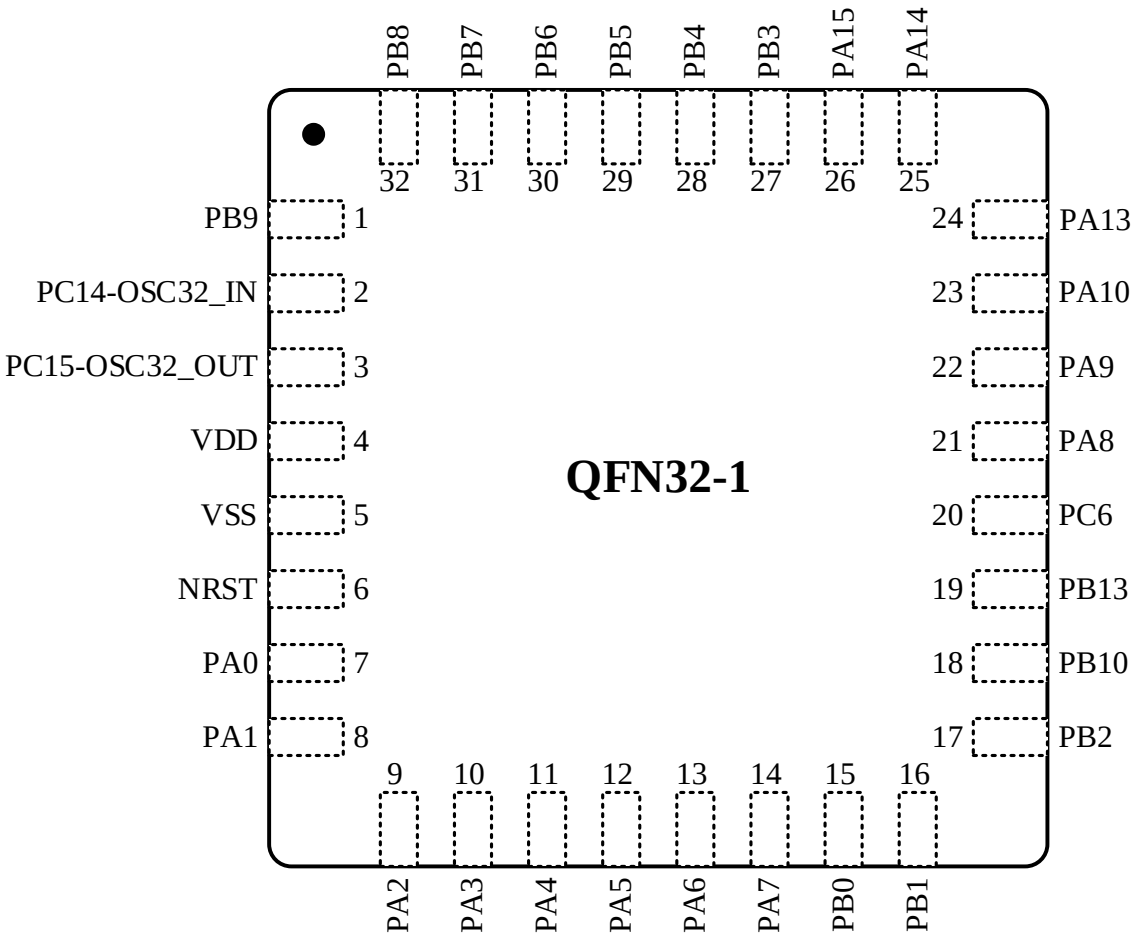
3.1.2 QFN32 (5mm x 5mm)pinout



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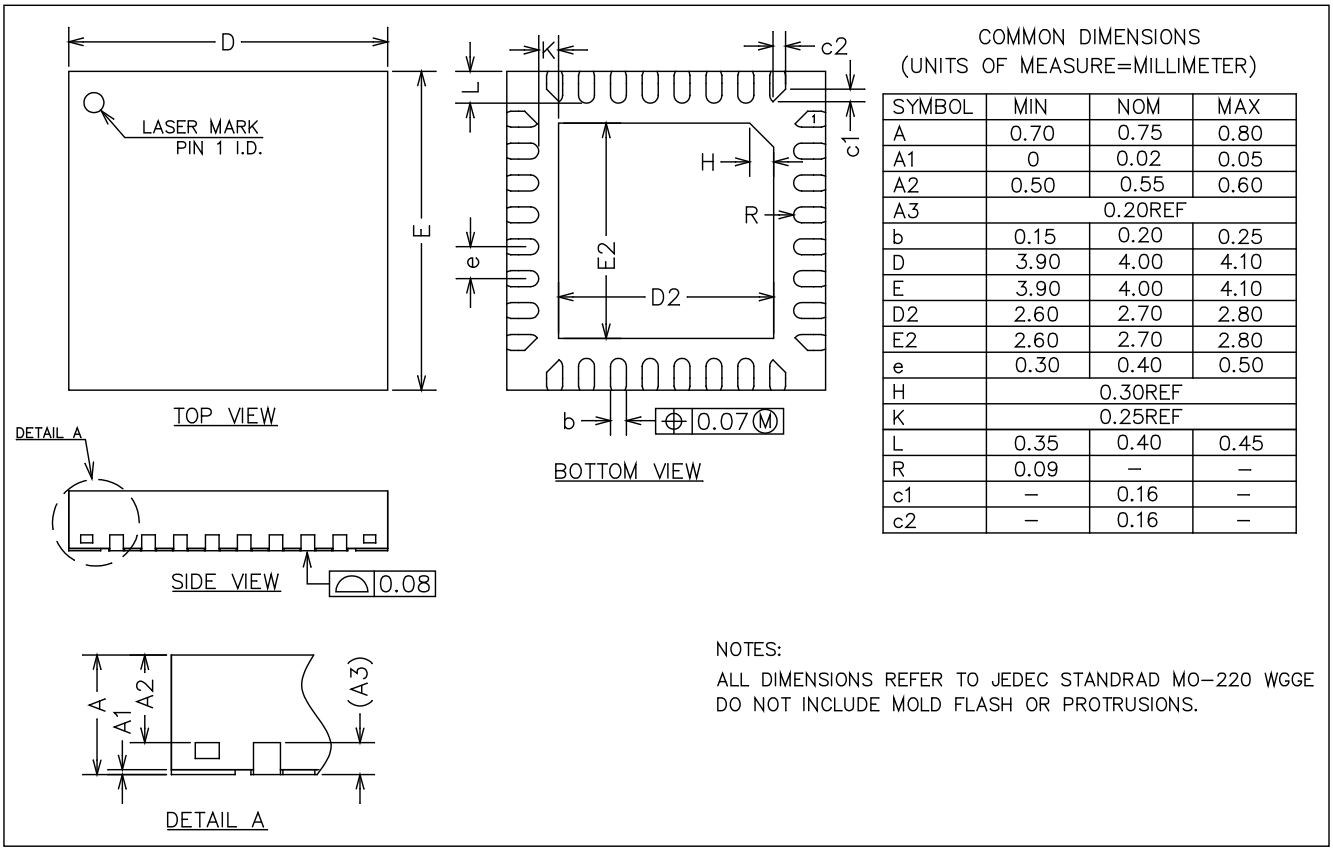
3.1.3 QFN32 (4mm x 4mm) package



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0	0.02	0.05
A2	0.50	0.55	0.60
A3		0.20REF	
b	0.15	0.20	0.25
D	3.90	4.00	4.10
E	3.90	4.00	4.10
D2	2.60	2.70	2.80
E2	2.60	2.70	2.80
e	0.30	0.40	0.50
H		0.30REF	
K		0.25REF	
L	0.35	0.40	0.45
R	0.09	–	–
c1	–	0.16	–
c2	–	0.16	–

NOTES:
ALL DIMENSIONS REFER TO JEDEC STANDRAD MO-220 WGGE
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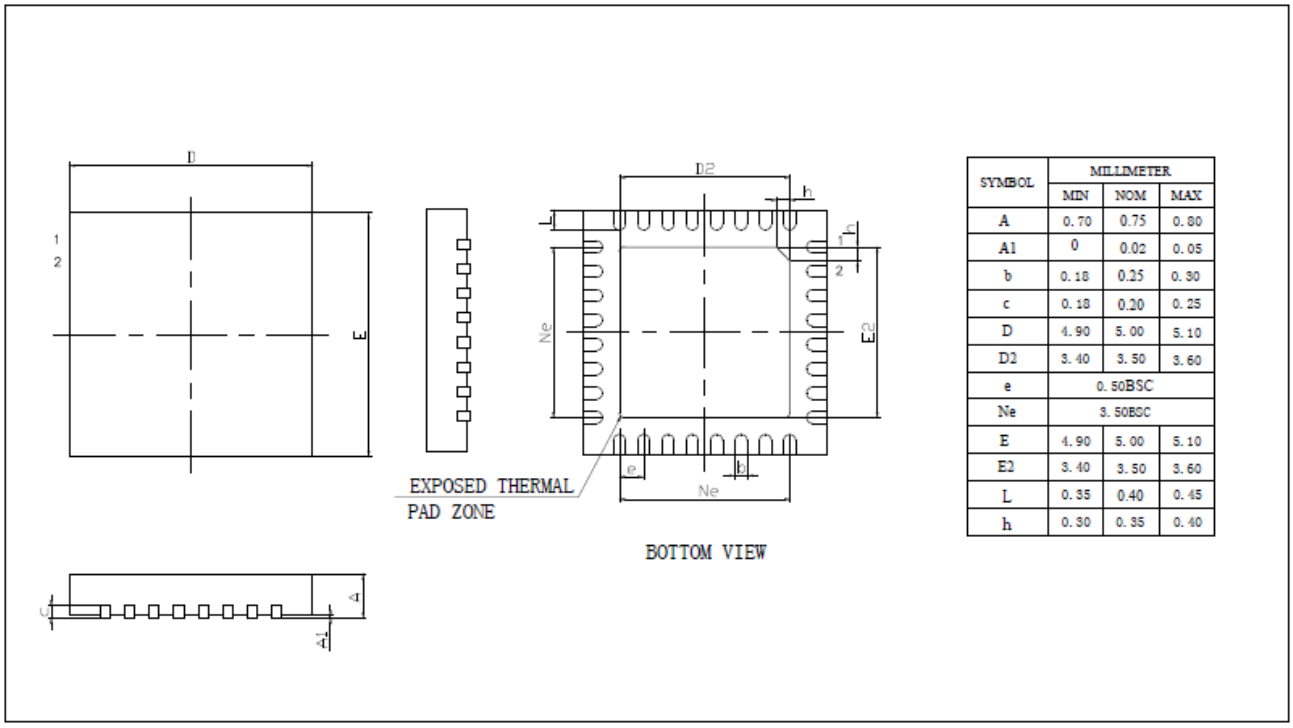
3.1.4 QFN32 (5mm x 5mm) package



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0	0.02	0.05
b	0.18	0.25	0.30
c	0.18	0.20	0.25
D	4.90	5.00	5.10
D2	3.40	3.50	3.60
e	0.50BSC		
Ne	3.50BSC		
E	4.90	5.00	5.10
E2	3.40	3.50	3.60
L	0.35	0.40	0.45
h	0.30	0.35	0.40

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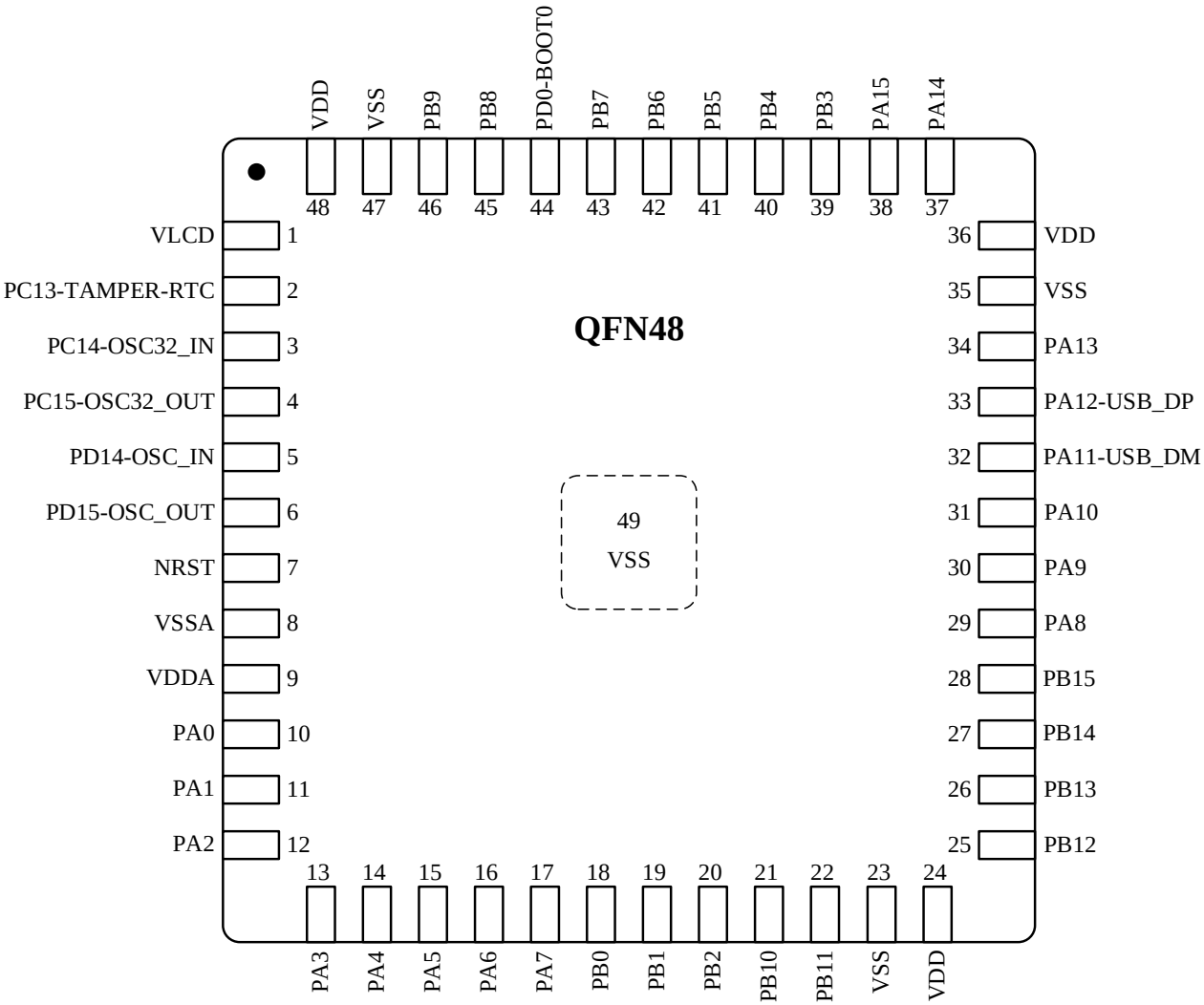
3.2 QFN48 package

3.2.1 QFN48(with LCD) pinout



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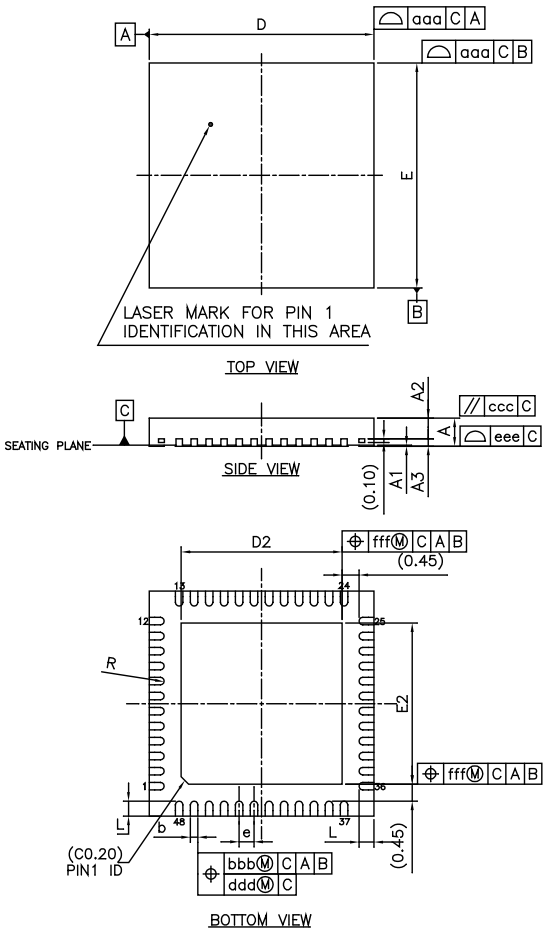
3.2.2 QFN48 (6mm x 6mm)package



Item		Symbol	MIN.	NOM.	MAX.
total height		A	0.70	0.75	0.80
stand off		A1	0.00	0.02	0.05
mold thickness		A2	0.50	0.55	0.60
leadframe thickness		A3		0.20 REF.	
lead width		b	0.15	0.20	0.25
package size	X	D	5.90	6.00	6.10
	Y	E	5.90	6.00	6.10
E-PAD size	X	D2	4.20	4.30	4.40
	Y	E2	4.20	4.30	4.40
lead length		L	0.30	0.40	0.50
lead pitch		e		0.40 bsc	
lead arc		R	0.075	---	---
Package profile of a surface		aaa		0.10	
Lead position		bbb		0.07	
Paralleliam		ccc		0.10	
Lead position		ddd		0.05	
Lead profile of a surface		eee		0.08	
Epad position		fff		0.10	

NOTES:
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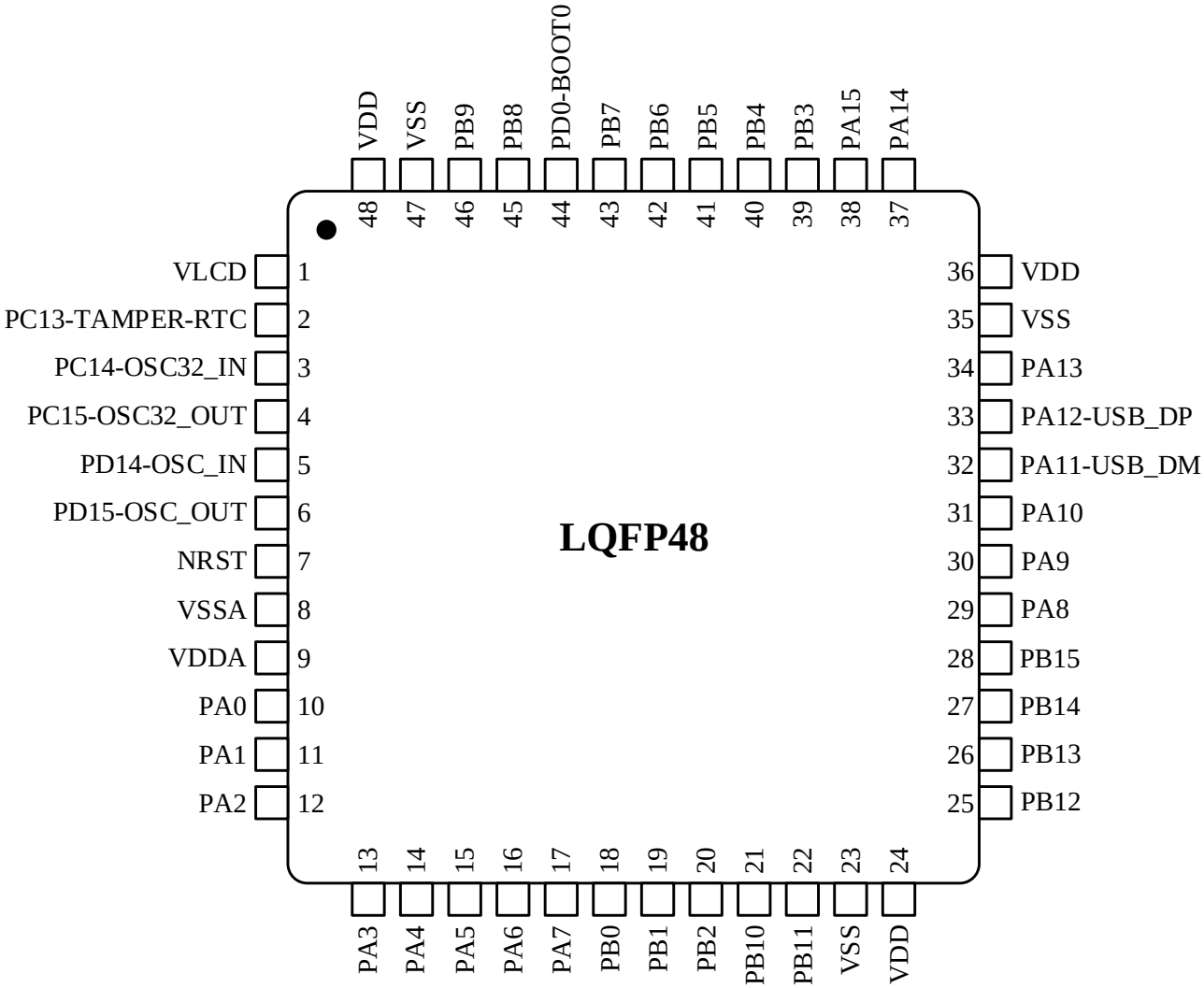
3.3 LQFP48 package

3.3.1 LQFP48(with LCD) pinout



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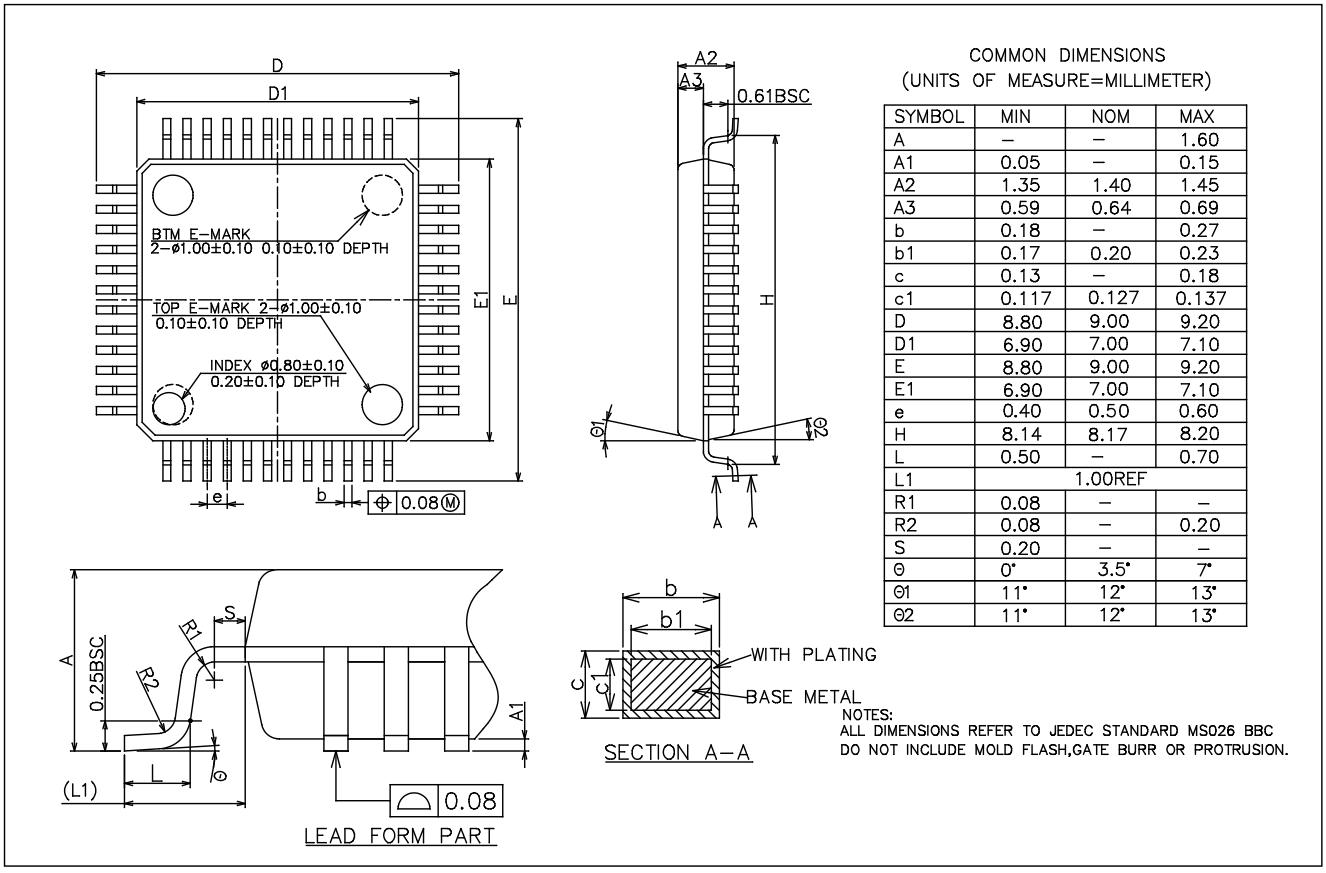
3.3.2 LQFP48 (7mm x 7mm)package



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	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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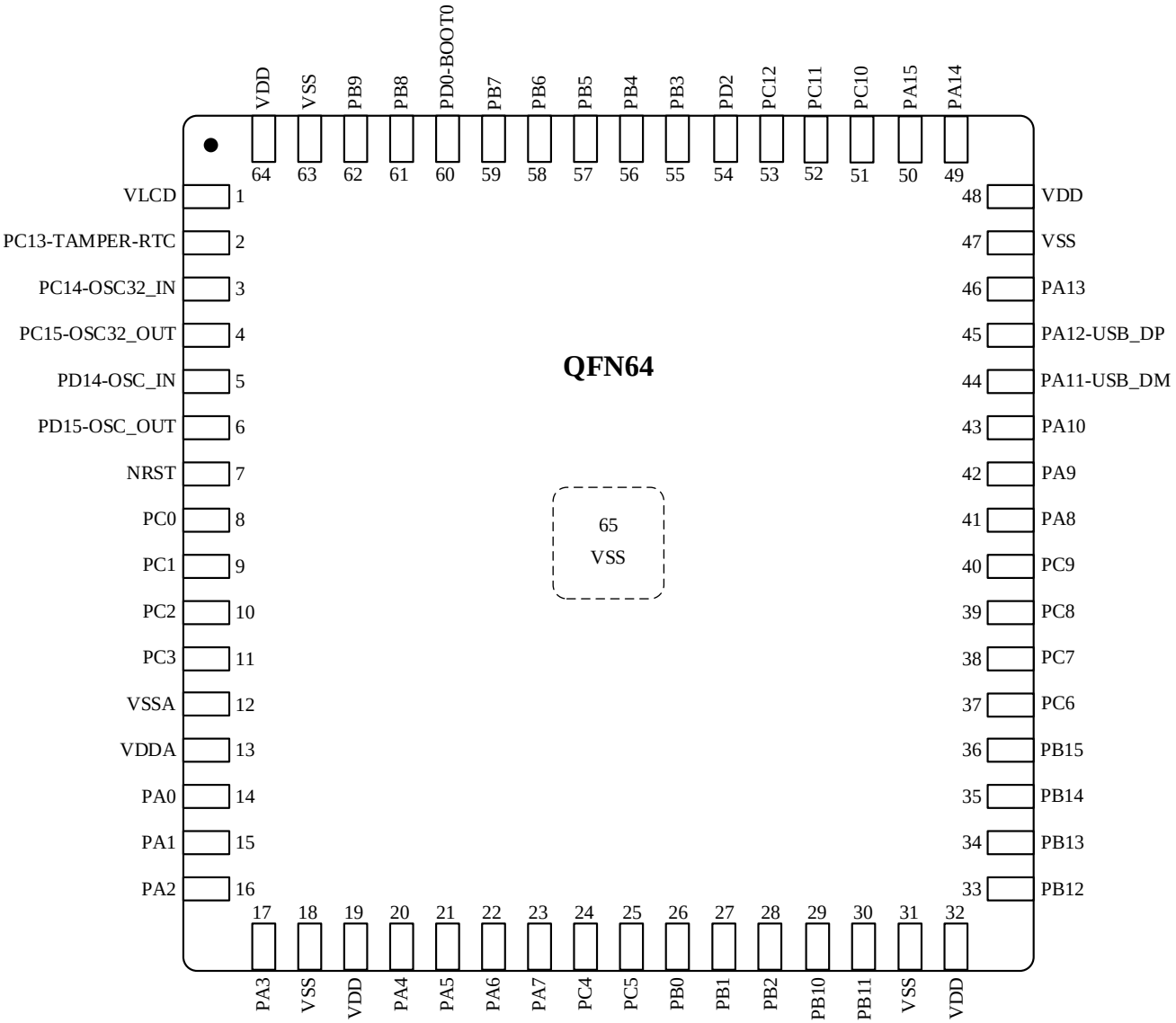
3.4 QFN64 package

3.4.1 QFN64 pinout



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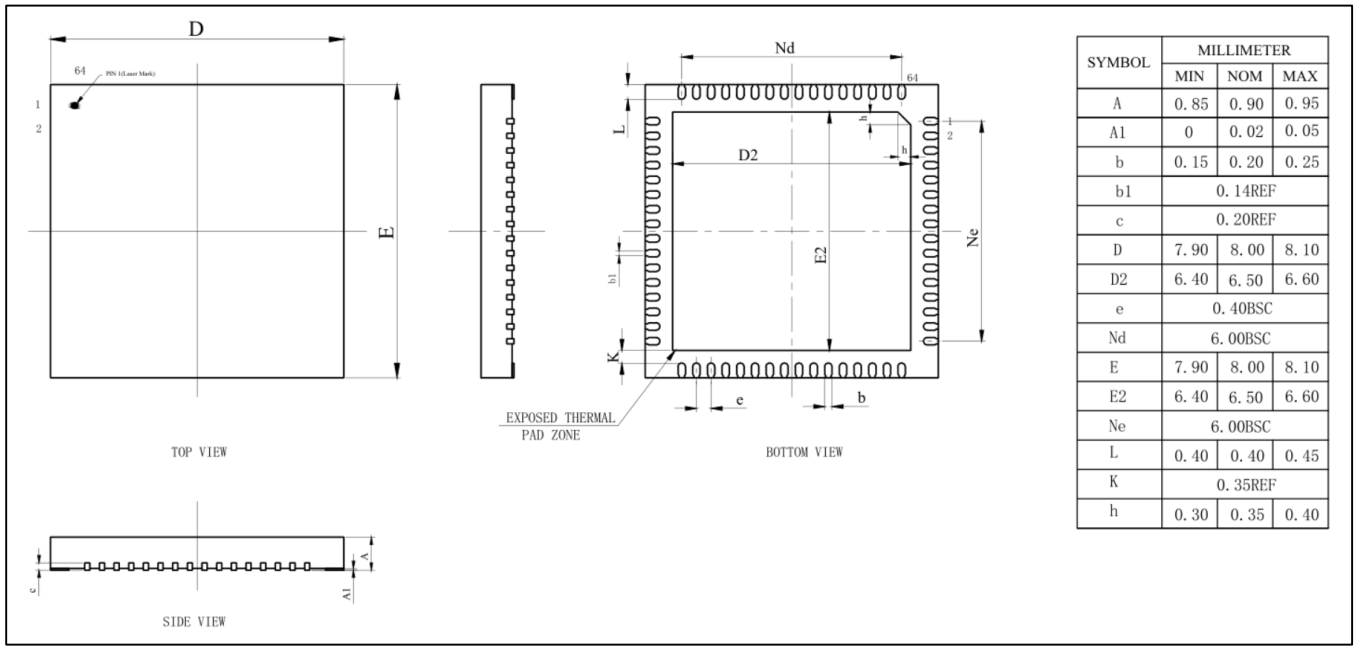
3.4.2 QFN64 (8mm x 8mm)package



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.85	0.90	0.95
A1	0	0.02	0.05
b	0.15	0.20	0.25
b1		0.14REF	
c		0.20REF	
D	7.90	8.00	8.10
D2	6.40	6.50	6.60
e		0.40BSC	
Nd		6.00BSC	
E	7.90	8.00	8.10
E2	6.40	6.50	6.60
Ne		6.00BSC	
L	0.40	0.40	0.45
K		0.35REF	
h	0.30	0.35	0.40

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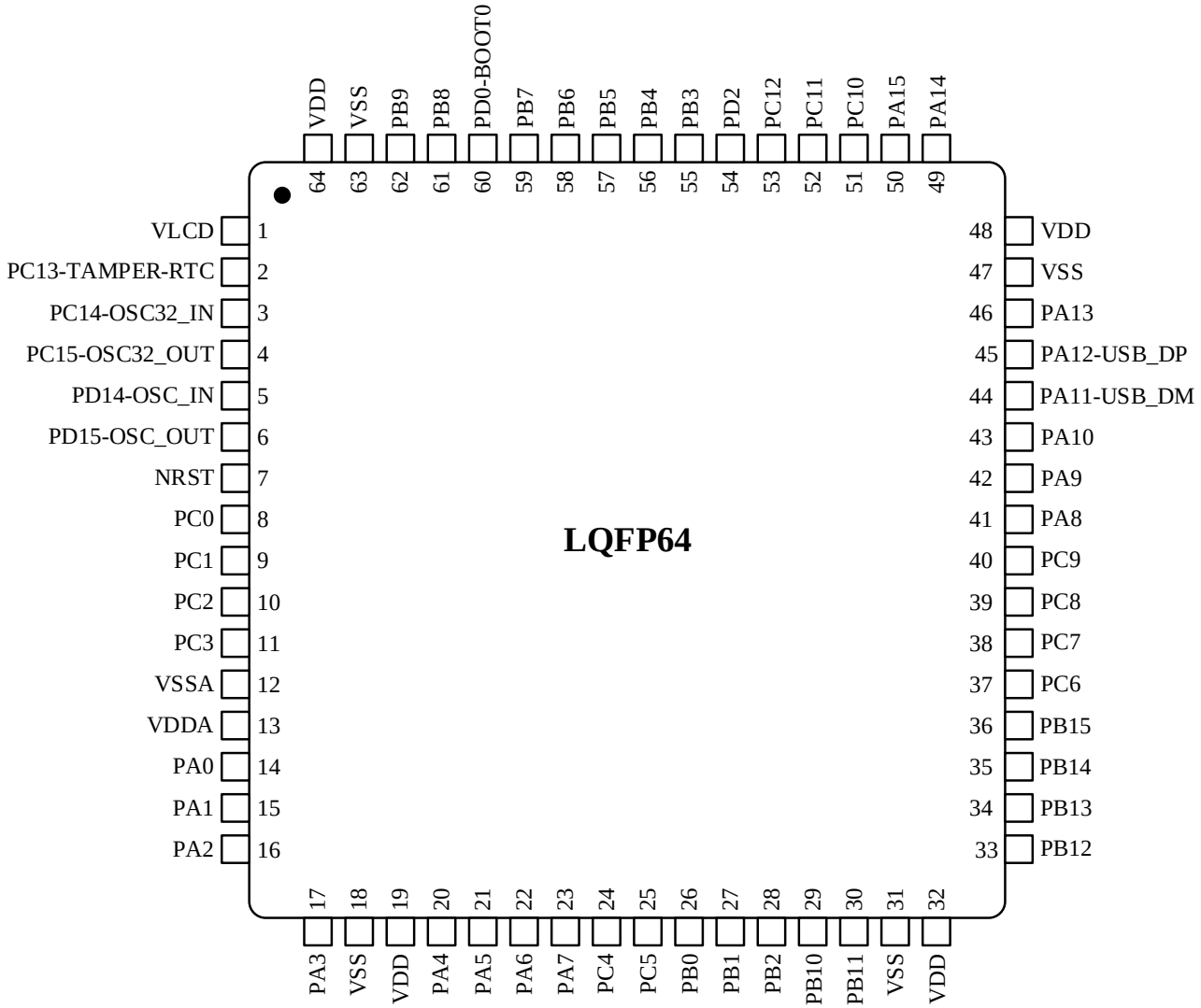
3.5 LQFP64 package

3.5.1 LQFP64 (7mm x 7mm) pinout



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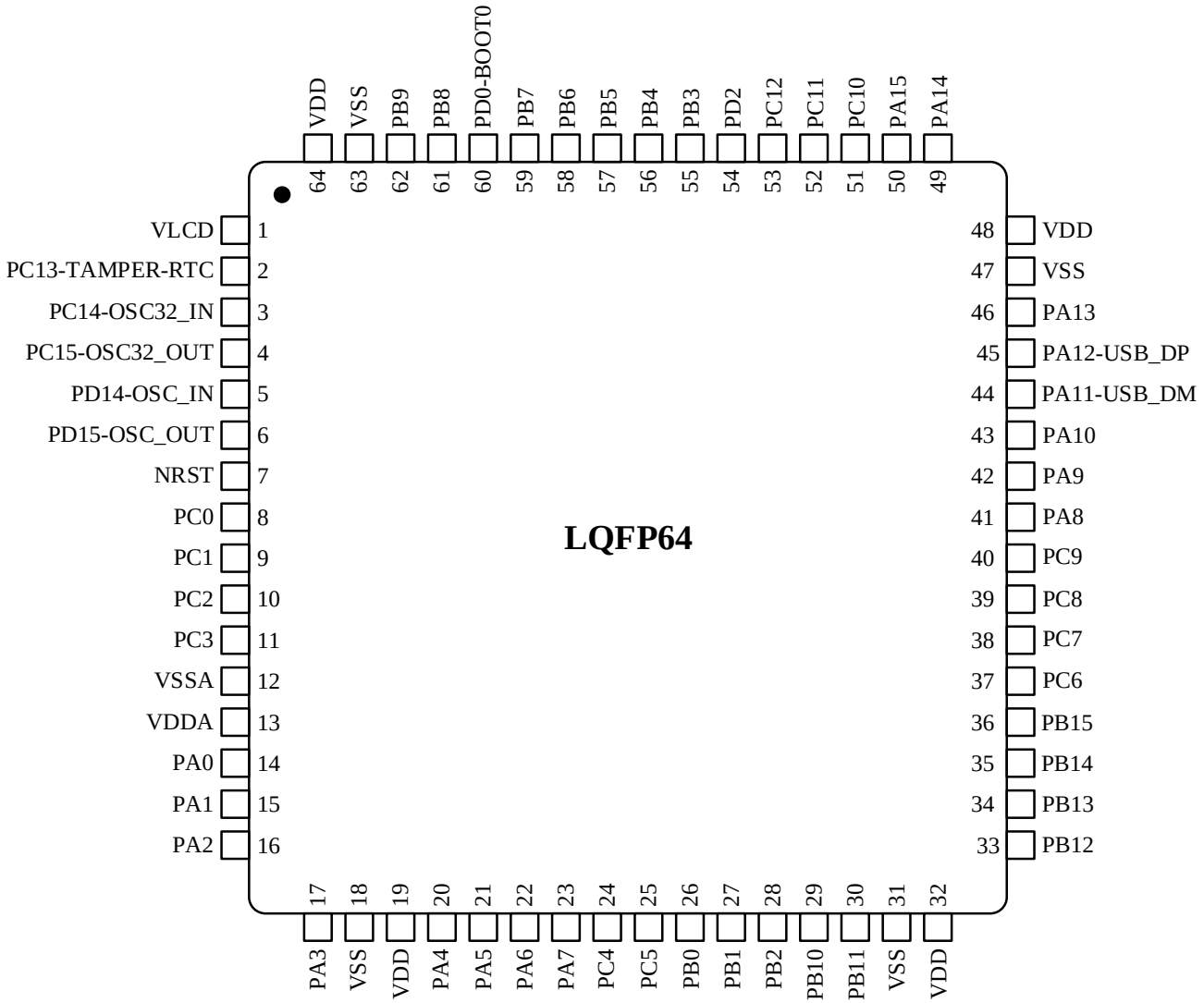
3.5.2 LQFP64 (10mm x 10mm) pinout



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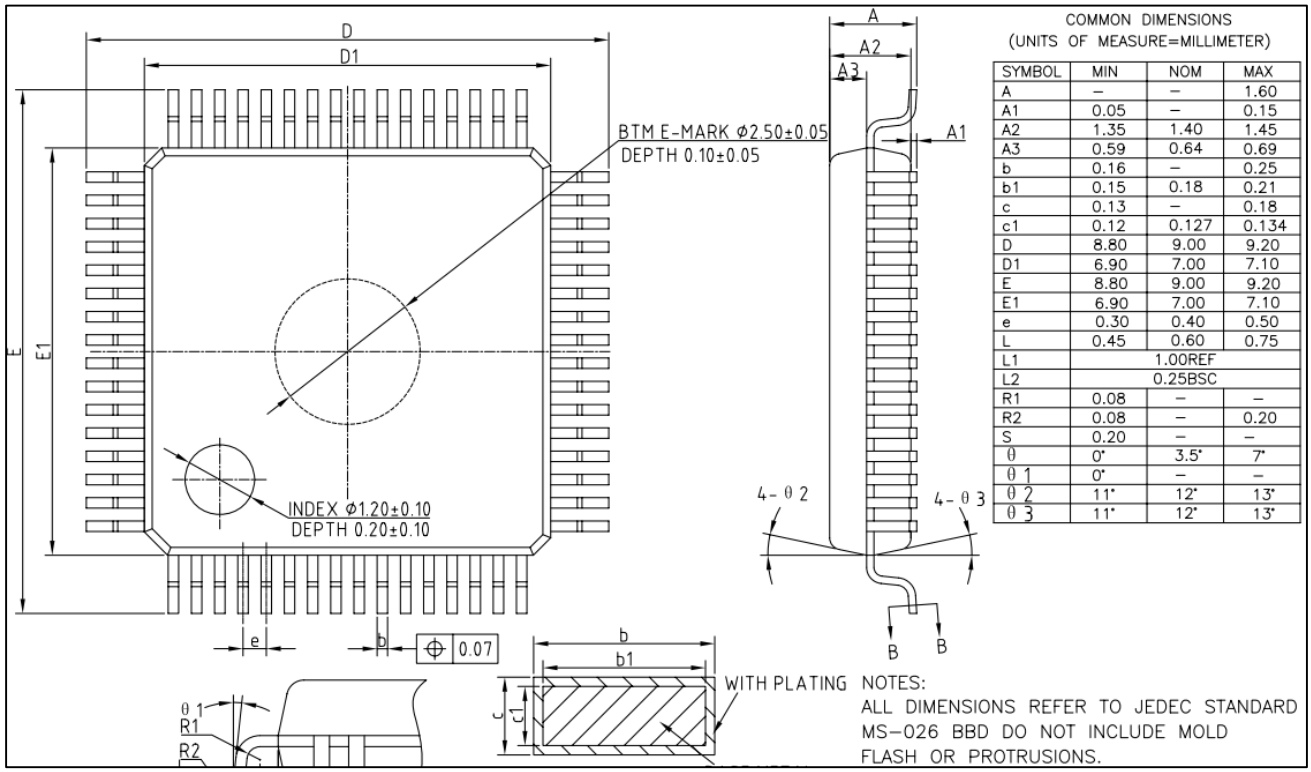
3.5.3 LQFP64 (7mm x 7mm) package



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	0.16	–	0.25
b1	0.15	0.18	0.21
c	0.13	–	0.18
c1	0.12	0.127	0.134
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	0.30	0.40	0.50
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°

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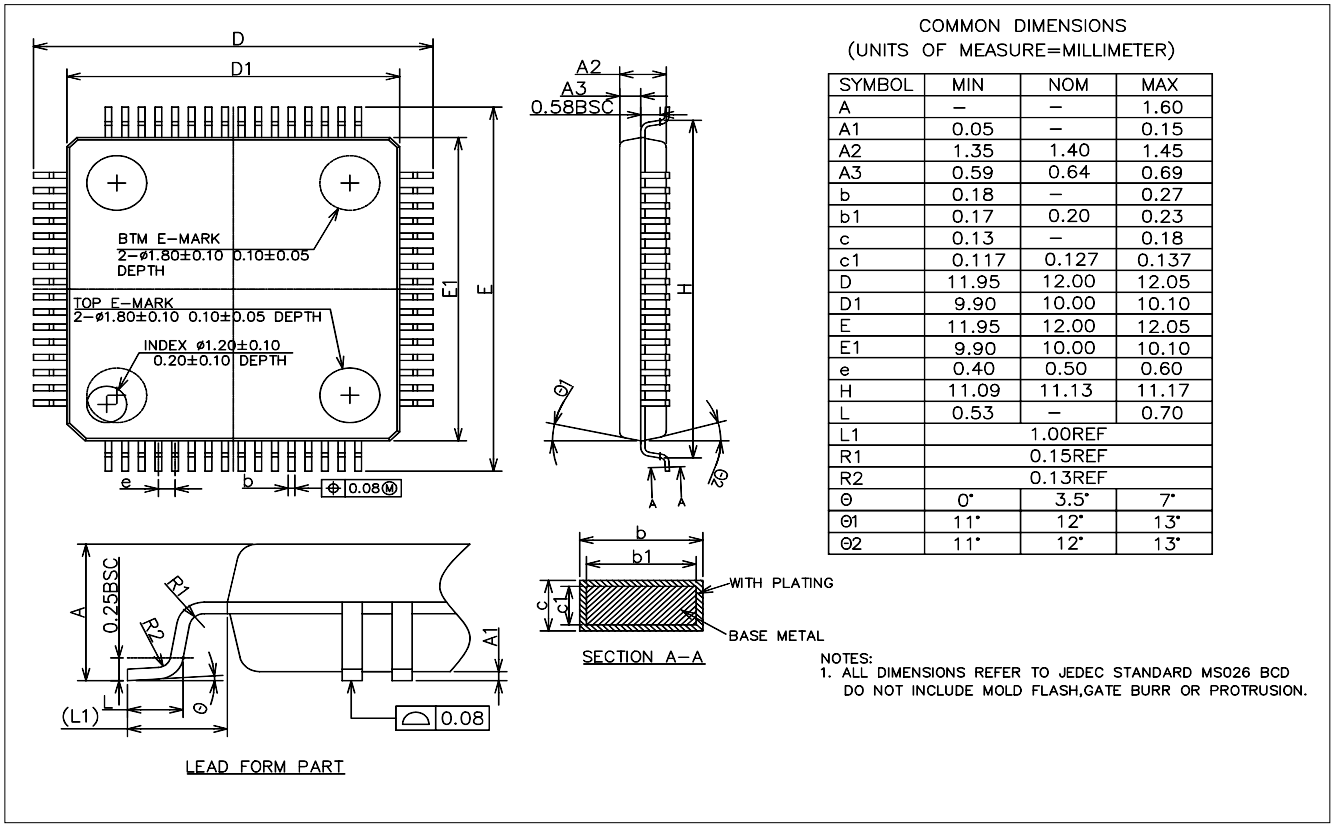
3.5.4 LQFP64 (10mm x 10mm) package



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°
θ1	11°	12°	13°
θ2	11°	12°	13°

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

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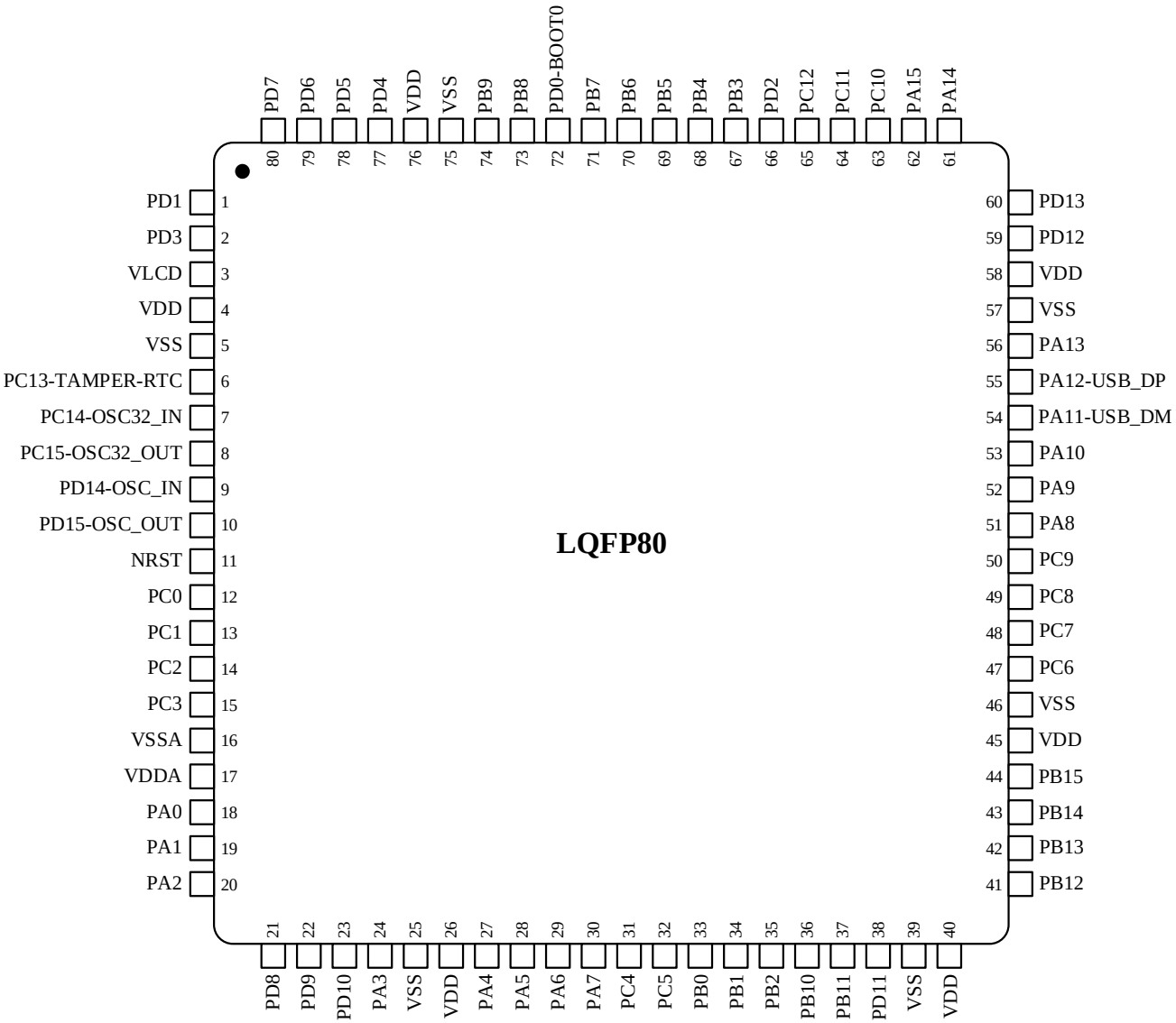
3.6 LQFP80 package

3.6.1 LQFP80 pinout



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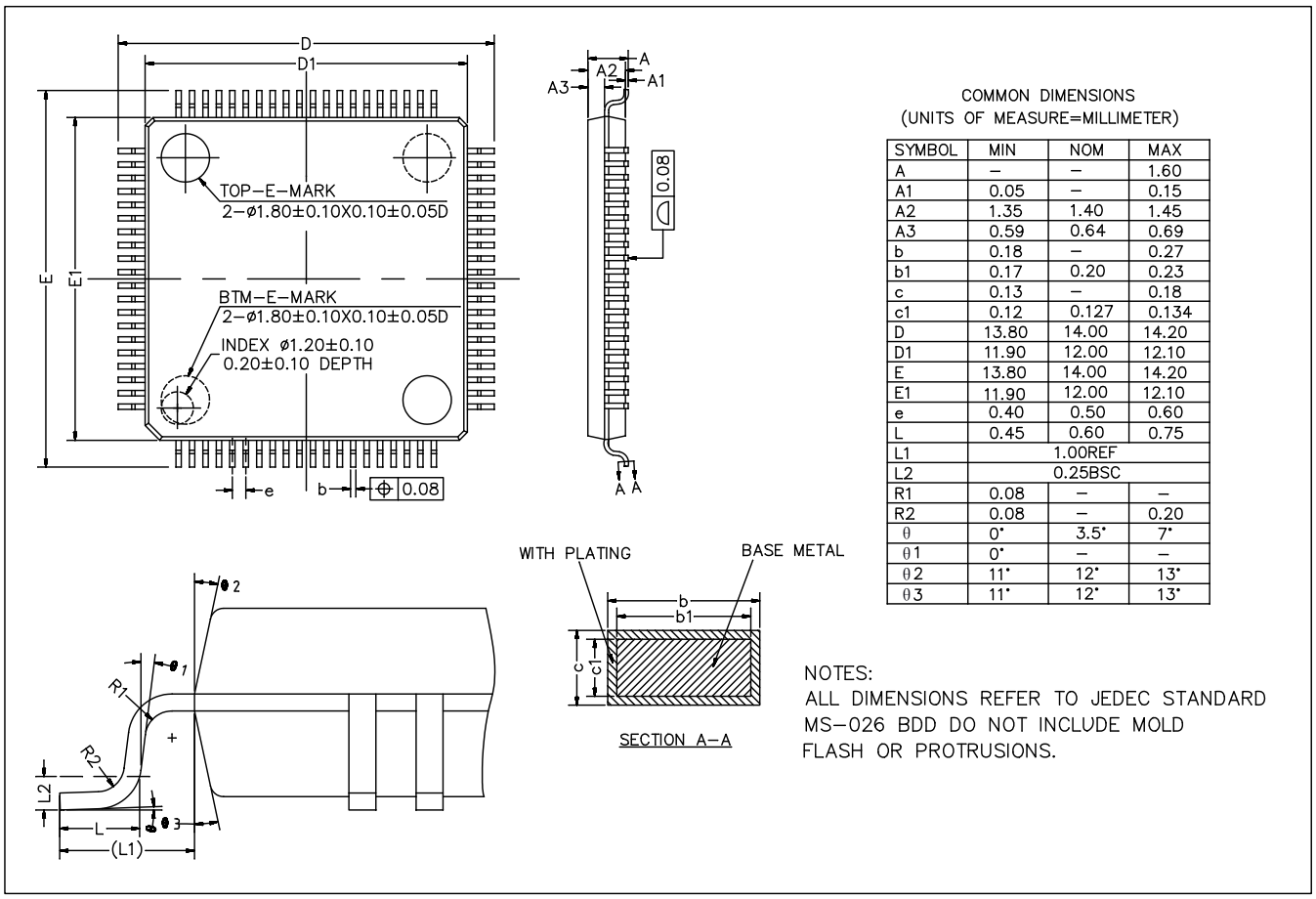
3.6.2 LQFP80 (12mm x 12mm)package



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	0.12	0.127	0.134
D	13.80	14.00	14.20
D1	11.90	12.00	12.10
E	13.80	14.00	14.20
E1	11.90	12.00	12.10
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
θ	0°	3.5°	7°
θ1	0°	–	–
θ2	11°	12°	13°
θ3	11°	12°	13°

NOTES:
ALL DIMENSIONS REFER TO JEDEC STANDARD MS-026 BDD DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS.

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4 Version history

Version	Date	Note
V1.0	2020.7.1	New document
V1.2	2021.4.14	1. Added N32L401x 2. Updated LCD version difference description, add the precautions for LCD 1/8 duty cycle mode
V1.3	2022.7.6	1. Modify the description of low power 2. Delete N32L401x 3. Modify the description of time counter 4. Modify reset description
V1.4	2022.9.5	1. Add the type N32L403KBQ7-1(1) 2. Modify the number of DAC channels in the resource configuration table 2-1 3. Modify the PB8 pin number of QFN64 pinout 4. Add N32L402 series type 5. Modify LQFP packages size description
V2.0.0	2024.7.19	1. Add N32L406RDL7 series type 2. Add N32L406CDL7 series type 3. Add N32L402RDL7 series type 4. Add N32L406RBL7-1 series type 5. Add LQFP64 (7mm x 7mm) pinout 6. Add LQFP64 (7mm x 7mm) package 7. Add Table 1-1 N32L40x Series Ordering Code

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