N32H787 Product Brief

The N32H787 series adopts a high-performance dual-core architecture. The ARM Cortex-M7 core is the main core, running at frequencies up to 600MHz, supporting double-precision floating-point operations and DSP instructions. The Cortex-M4 core is the auxiliary core, running at frequencies up to 300MHz. It has (2/4MB) of on-chip FLASH, integrates up to 1504KB of SRAM (including 1024KB TCM SRAM and 480KB SRAM) + 4KB Backup SRAM, integrates 3 12-bit 5Msps ADCs, 4 high-speed comparators, 6 12-bit DACs, and features multiple high-speed communication interfaces including U(S)ART, I2C, xSPI, SPI, USBFS Dual Role, USBHS Dual Role, CAN-FD, SDRAM, FEMC, SDMMC, and 10/100/1000M Ethernet. It supports digital camera interface (DVP), MIPI, TFT-LCD graphic interface, JPEG hardware encoder/decoder and GPU. The chip has a built-in high-performance encryption algorithm hardware acceleration engine supporting AES/TDES and SHA algorithms, supports TRNG true random number generator, and supports CRC8/16/32. It supports up to 166 GPIOs and is available in UFBGA169, LQFP176, LQFP208, and TFBGA240+25 packages.

Key Features

- **Dual-Core Architecture CPU (Cortex-M7 and Cortex-M4F)**
  - **ARM Cortex-M7**
    - 32-bit ARM Cortex-M7 core, double-precision floating-point unit, supports DSP instructions and MPU
    - Built-in 32KB instruction cache and 32KB data cache with ECC
    - Maximum frequency 600MHz, 1284 DMIPS
- **ARM Cortex-M4F**
  - 32-bit ARM Cortex-M4F core + FPU, single-cycle hardware multiply-divide instructions, supports DSP instructions and MPU
  - Built-in 16KB instruction cache and 16KB data cache with parity checking, supports Flash acceleration unit with 0 wait state program execution
  - Maximum frequency 300MHz, 375 DMIPS
- **Encrypted Memory**
  - 2M/4M Byte on-chip Flash, supports encrypted storage with automatic program decryption during execution
  - 1504KB built-in SRAM with ECC support
    - 1024KB TCM SRAM, configurable as D-TCM, I-TCM or SRAM
    - 480KB on-chip SRAM
- **Operating Modes**
  - Run mode
  - SLEEP mode: AXI enabled, AHB enabled
  - Stop0 mode: SRAM, TCM, RTC, LSE, IWDG enabled

NSING Technologies Pte. Ltd.
Address: 20 Science Park, #03-15/16
Teleteck Park, East Wing, Singapore 117674
Email: sales@nsing.com.sg

- Stop2 mode: Flash in standby mode, SRAM, TCM, RTC, LSE, IWDG, Backup SRAM, backup registers enabled, I/O state maintained
- Standby mode: Backup SRAM, RTC, IWDG, LSE, backup registers enabled, SRAM and TCM disabled
- VBAT mode: Backup SRAM, RTC, LSE, backup registers enabled

- **Clock**
  - 4MHz~48MHz external high-speed crystal
  - 4MHz~50MHz external clock input
  - 32.768KHz external low-speed crystal
  - Three built-in high-speed PLLs
  - Built-in MSI clock supporting 31.25K/62.5K/125K/250K/500K/1M/2M/4M/8M/16MHz configurations
  - Internal high-speed RC 64MHz
  - Internal low-speed RC 32KHz
- **Reset**
  - Supports power-on/power-down/external pin reset
  - Supports watchdog reset and software system reset
  - Supports programmable voltage detection
- **High-Speed Communication Interfaces**
  - 8 USART interfaces/7 UART interfaces, supporting ISO7816, IrDA, LIN
  - 2 LPUART interfaces
  - 7 SPI interfaces, supporting master/slave modes, up to 50 MHz
  - 10 I2C interfaces, up to 3.4 MHz, configurable master/slave modes, supports dual address response in slave mode
  - 1 USBHS Dual Role interface with built-in high-speed PHY
  - 1 USBFS Dual Role interface
  - 8 CAN-FD bus interfaces
  - 2 Ethernet MAC interfaces: ETH1 supports 10M/100M/1000M rates, ETH2 supports 10M/100M rates, both support IEEE 1588 time synchronization protocol
- **High-Performance Analog Interfaces**
  - 3 12-bit 5Msps ADCs, supporting 12-bit/10-bit resolution with hardware oversampling up to 16-bit, up to 55 external single-ended input channels, 5 internal single-ended input channels, supporting single-ended and differential modes
  - 4 high-speed analog comparators
  - 6 12-bit DACs: 2 1Msps DACs supporting buffered/unbuffered external output (internal output only supports unbuffered mode; simultaneous internal/external output requires buffer enabled), 4 DACs supporting only internal chip output with 15Msps sampling rate and unbuffered output
  - 2 MCO outputs, configurable to output SYSCLK, HSE, MSI, LSE, LSI, HSI64 or PLL clock division
  - 1 reference voltage VREFBUF (configurable: 1.5V/1.8V/2.048V/2.5V)

NSING Technologies Pte. Ltd.
Address: 20 Science Park, #03-15/16
Teleteck Park, East Wing, Singapore 117674
Email: sales@nsing.com.sg

- 1 temperature sensor

- **Audio Interfaces**
  - 4 I2S interfaces, supporting half/full duplex modes, audio sampling rates from 8KHz to 192KHz
  - 8 PDM digital microphone interfaces built into DSMU
- **Memory Expansion Interfaces**
  - 1 FEMC (Flexible External Memory Controller) interface, 100 MHz bus rate, SRAM/PSRAM/Nor Flash supporting 16/32-bit data width, NAND Flash supporting 8/16-bit data width
  - 1 xSPI interface, supporting 1/2/4/8-bit data width, master/slave configurable, up to 133 MHz, usable for expanding SRAM, PSRAM and Flash, supports XIP
  - 1 SDRAM interface, up to 133 MHz
  - 2 SDMMC interfaces, supporting SD/SDIO 3.0, eMMC 4.51 format, up to 104MHz
- **Image Processing Interfaces**
  - 2 digital camera interfaces (DVP), supporting 8/10/12/16bit, up to 110MHz
  - 1 MIPI display controller (DSI) with built-in D-PHY
  - 1 TFT-LCD display interface, supporting up to 24-bit parallel digital RGB LCD with all signal interfaces for direct connection to various LCD and TFT panels, resolution up to 1920x1080
  - Built-in 2.5D graphics processor supporting image scaling, rotation, mixing, anti-aliasing, texture mapping, etc.
  - Hardware JPEG encoder/decoder
- **Maximum support for 166 GPIOs, low-speed GPIOs support 5V tolerance (under VDD=3.3V±10% condition)**
- **Motor control Cordic accelerator, supporting trigonometric and hyperbolic functions, supports floating-point input and output**
- **Delta Sigma Module Unit (DSMU)**
- **Built-in filter algorithm accelerator FMAC, supporting FIR and IIR filtering**
- **3 high-speed DMA controllers, each supporting 8 channels, 1 MDMA supporting 16 channels, fully configurable channel source and destination addresses**
- **RTC real-time clock, supporting perpetual calendar with leap year, alarm events, periodic wake-up, internal/external clock calibration**
- **Timers**
  - 2 16-bit ultra-high precision timers (SHRTIM1/SHRTIM2), highest control precision 100ps, each with 1 master timer and 6 16-bit slave timer units. Each timer unit has 2 independent channels, supporting 12 independent PWM outputs or 6 pairs of complementary PWM outputs
  - 4 16-bit advanced timers, supporting input capture, complementary output, quadrature encoder input, etc., highest control precision 3.3ns; each timer has 6 independent channels, 4 of which support 4 pairs of complementary PWM outputs
  - 10 16-bit general-purpose timers (GTIMA13), each with 4 independent channels, supporting input capture, output compare, PWM generation
  - 4 32-bit basic timers (BTIM1~4)

NSING Technologies Pte. Ltd.
Address: 20 Science Park, #03-15/16
Teleteck Park, East Wing, Singapore 117674
Email: sales@nsing.com.sg

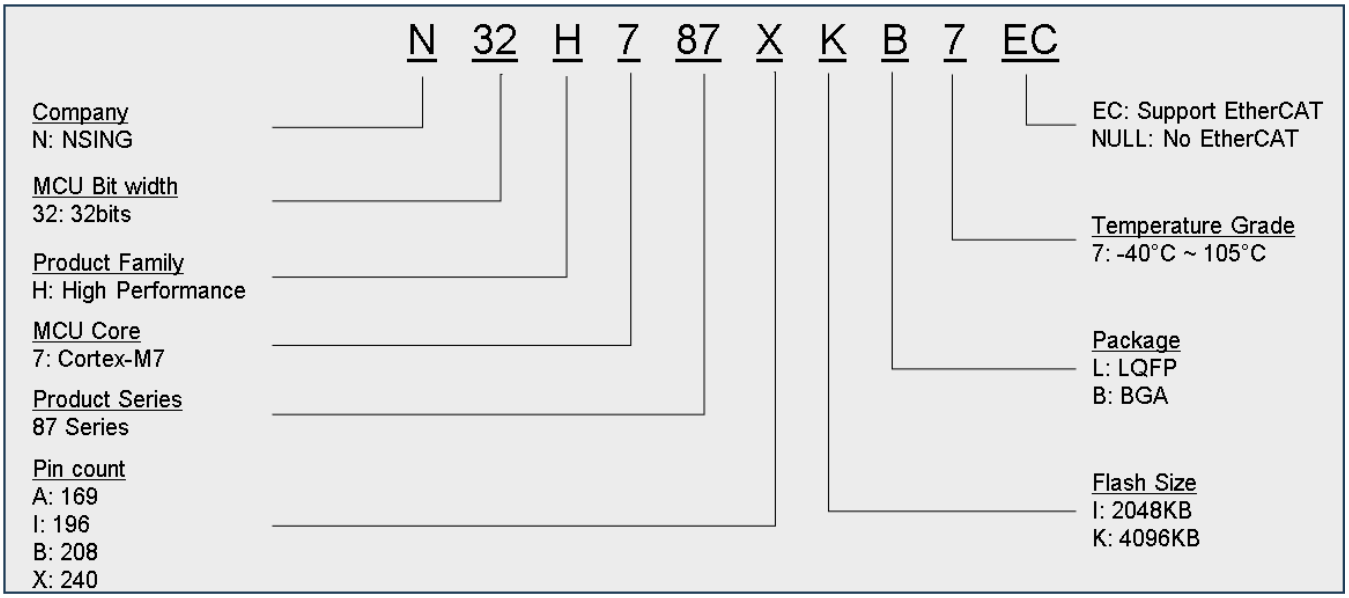
- 5 16-bit low-power timers (LPTIM1~5), operational in Stop2 mode
- 2x 24-bit SysTick, 2x 14-bit window watchdogs (WWDG), 2x 12-bit independent watchdogs (IWDG)

- **Programming**
  - Supports SWD/JTAG online debugging interfaces
  - Supports USB, UART Bootloader
- **Security Features**
  - FLASH has up to 4 encryption partitions, supporting storage encryption
  - Supports write protection (WRP), multiple read protection (RDP) levels (L0/L1/L2)
  - Built-in cryptographic hardware acceleration engine, supporting AES/TDES, SHA, SM4 algorithms
  - TRNG true random number generator, CRC8/16/32 computation
  - Supports secure boot, encrypted program download, secure update, external high and low-speed clock failure detection
  - Supports tamper detection
- **Supports 128-bit UCID in OTP**
- **Operating Conditions**
  - Operating voltage range: 2.3V~3.6V
  - Chip junction temperature range: -40°C~125°C
- **Certification**
  - USB IF
  - IEC61508 SIL2
- **Package**
  - UFBGA169(7mmx7mm)
  - LQFP176(24mm x 24mm)
  - LQFP208(28mmx28mm)
  - TFBGA240+25(14mmx14mm)
- **Ordering Model**

Series	Model
N32H787xxx7	N32H787AKB7, N32H787AIB7, N32H787IKL7, N32H787IIL7, N32H787BKL7, N32H787BIL7, N32H787XKB7, N32H787XIB7

NSING Technologies Pte. Ltd.
Address: 20 Science Park, #03-15/16
Teleteck Park, East Wing, Singapore 117674
Email: sales@nsing.com.sg

1 Naming Convention



NSING Technologies Pte. Ltd.
Address: 20 Science Park, #03-15/16
Teleteck Park, East Wing, Singapore 117674
Email: sales@nsing.com.sg

2 Product Model and Resource Configuration

Table 2-1 N32H787 Series Resource Configuration

Device Model		N32H787A KB7	N32H787A IB7	N32H787I KL7	N32H787I IL7	N32H787B KL7	N32H787B IL7	N32H787XK B7	N32H787X IB7
Flash（KB）		4096	2048	4096	2048	4096	2048	4096	2048
SRAM（KB）	TCM	1024							
	System RAM	480							
	Backup RAM	4							
Core	M7	600MHz							
	M4	300MHz							
Operating Voltage		2.3V~3.6V							
DCDC（step-down）		Yes							
Coprocessor	Cordic	Yes							
	DSMU	Yes							
	FMAC	Yes							
Timers	SHRTIM	2							
	ADTIM	4							
	GPTIM	10							
	BSTIM	4							
	LPTIM	5							
	SysTick timer	2							
	WWDG	2*14bit							
	IWDG	2*12bit							
	RTC	Yes							
Communication Interfaces	SPI/I2S	6/4				7/4			
	I2C	8				10			
	USART	6				7		8	
	UART	5				7			
	LPUART	2							
	USBHS Dual Role	1							
	USBFS Dual Role	1							
	CAN FD	8							
	10/100M ETH	1							
	10/100/1000M ETH	1							
Expanded Storage	SDRAM	Yes							
	xSPI	1							
	FEMC	Yes							
	SDMMC	2							
Analog	12bit ADC	3							
	12bit DAC Number of channels	2+4(1) 2 External channels							

NSING Technologies Pte. Ltd.
Address: 20 Science Park, #03-15/16
Teleteck Park, East Wing, Singapore 117674
Email: sales@nsing.com.sg

	Comparator	4			
	VREFBUF	Yes			
Imaging	LCDC	Yes			
	MIPI	Yes			
	GPU	Yes			
	JPEG	Yes			
	DVP	2			
GPIO		112		139	166
DMA Number of channels		3 24Channel			
MDMA Number of channels		1 16Channel			
Algorithm Support		DES/3DES, AES, SHA1/SHA224/SHA256, CRC8/16/CRC32			
Security Protection		Read/write protection (RDP/WRP), storage encryption, secure boot			
Package		UFBGA169	LQFP176	LQFP208	TFBGA240+25

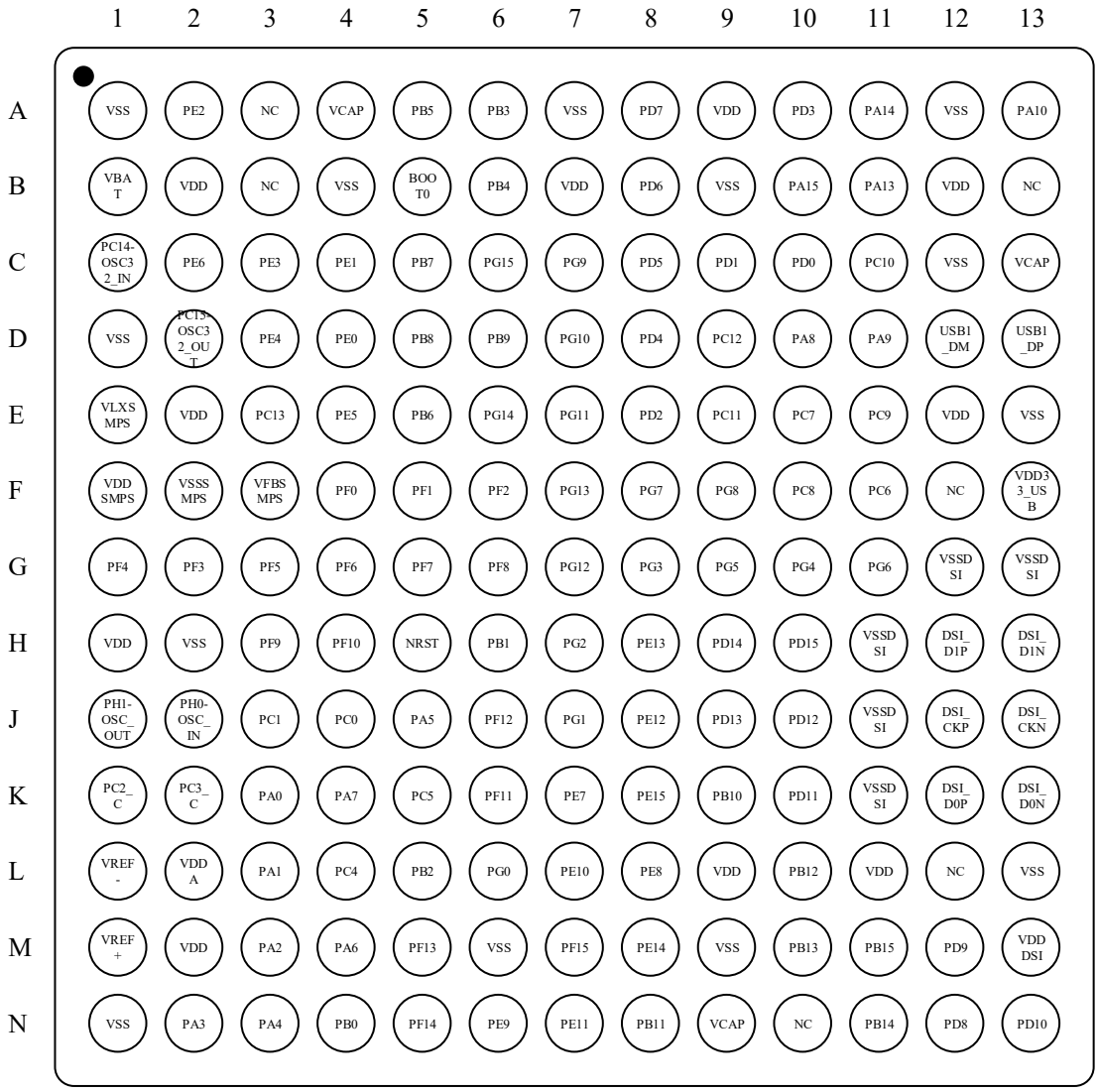
Note：4 DACs only support internal connection and cannot output to GPIO

NSING Technologies Pte. Ltd.
Address: 20 Science Park, #03-15/16
Teleteck Park, East Wing, Singapore 117674
Email: sales@nsing.com.sg

3 Package

3.1 UFBGA169 Package

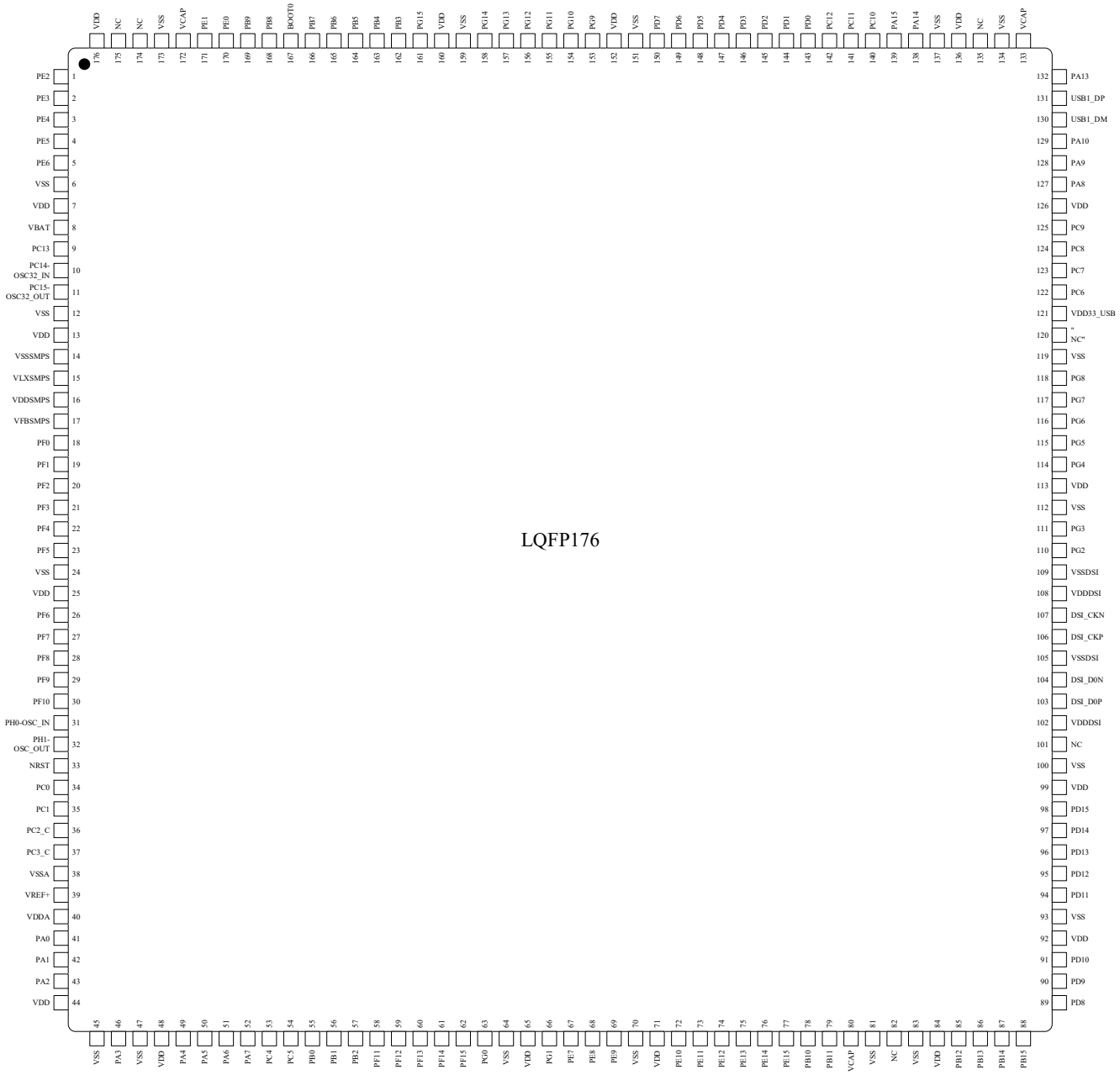
3.1.1 UFBGA169 Pin Distribution



NSING Technologies Pte. Ltd.
Address: 20 Science Park, #03-15/16
Teleteck Park, East Wing, Singapore 117674
Email: sales@nsing.com.sg

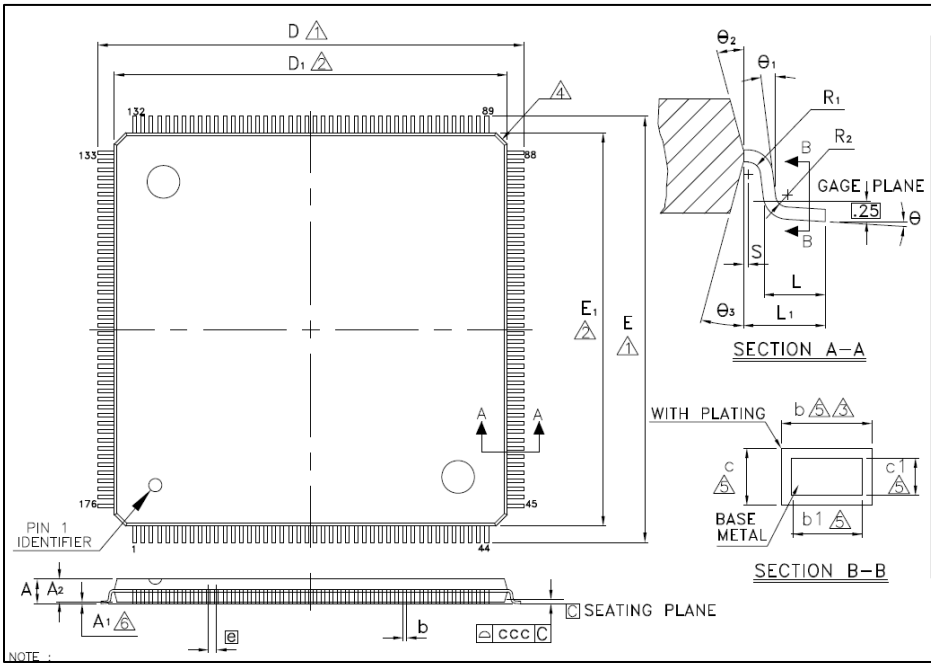
3.2 LQFP176 Package

3.2.1 LQFP176 Pin Distribution



NSING Technologies Pte. Ltd.
Address: 20 Science Park, #03-15/16
Teleteck Park, East Wing, Singapore 117674
Email: sales@nsing.com.sg

3.2.2 LQFP176 Package Size

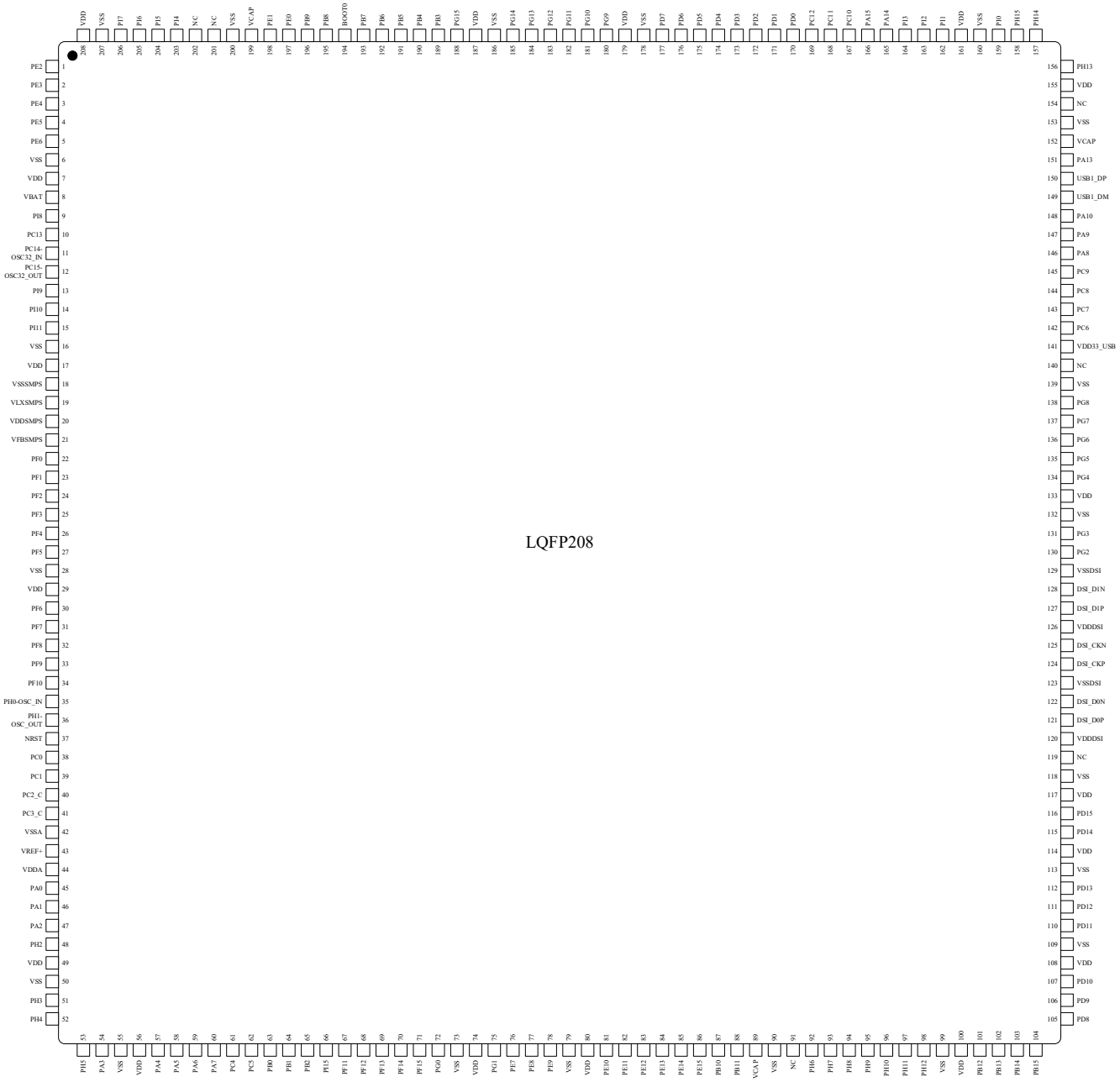


Symbol	Dimension in mm			Dimension in inch		
	Min	Nom	Max	Min	Nom	Max
A	—	—	1.60	—	—	0.063
A1	0.025	—	0.127	0.001	—	0.005
A2	1.35	1.40	1.45	0.053	0.055	0.057
b	0.17	0.22	0.27	0.007	0.009	0.011
b1	0.17	0.20	0.23	0.007	0.008	0.009
c	0.09	0.14	0.20	0.004	0.006	0.008
c1	0.09	0.12	0.16	0.004	0.005	0.006
D	25.85	26.00	26.15	1.018	1.024	1.030
D1	23.90	24.00	24.10	0.941	0.945	0.949
E	25.85	26.00	26.15	1.018	1.024	1.030
E1	23.90	24.00	24.10	0.941	0.945	0.949
e	0.50 BSC			0.020 BSC		
L	0.45	0.60	0.75	0.018	0.024	0.030
L1	1.00 REF			0.039 REF		
R1	0.08	—	—	0.003	—	—
R2	0.08	—	0.20	0.003	—	0.008
S	0.20	—	—	0.008	—	—
θ	0°	3.5°	7°	0°	3.5°	7°
θ1	0°	—	—	0°	—	—
θ2	11°	12°	13°	11°	12°	13°
θ3	11°	12°	13°	11°	12°	13°
ccc	0.08			0.003		

NSING Technologies Pte. Ltd.
Address: 20 Science Park, #03-15/16
Teleteck Park, East Wing, Singapore 117674
Email: sales@nsing.com.sg

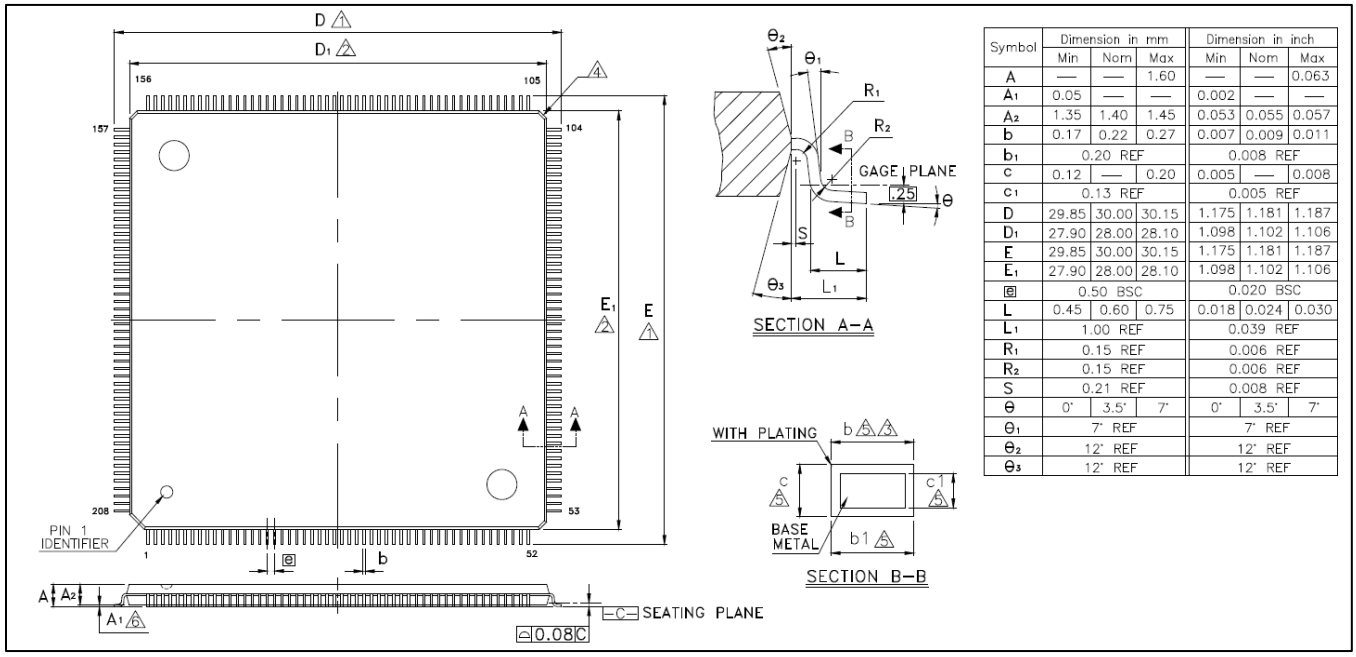
3.3 LQFP208 Package

3.3.1 LQFP208 Pin Distribution



NSING Technologies Pte. Ltd.
Address: 20 Science Park, #03-15/16
Teleteck Park, East Wing, Singapore 117674
Email: sales@nsing.com.sg

3.3.2 LQFP208 Package Size

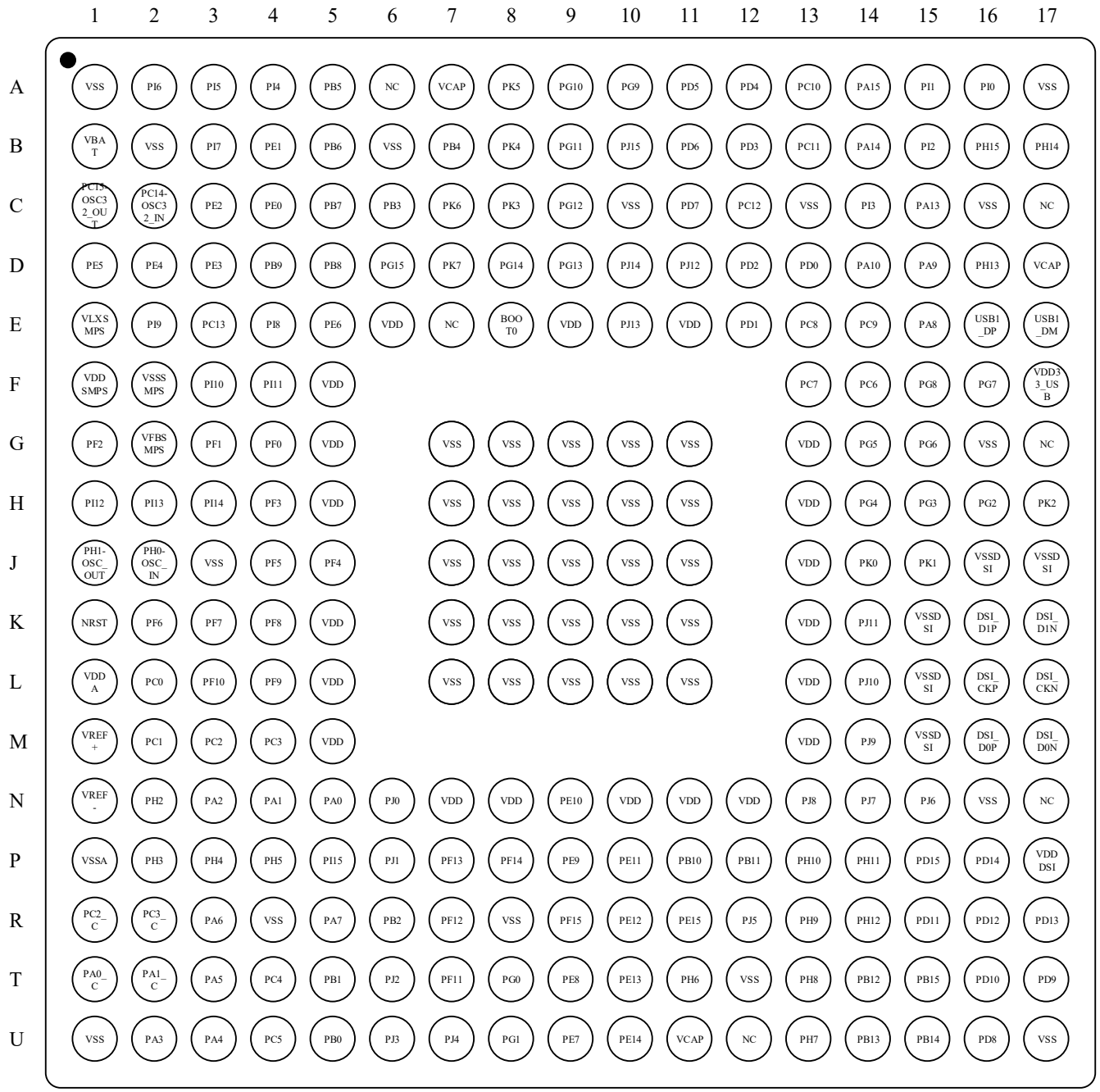


Symbol	Dimension in mm			Dimension in inch		
	Min	Nom	Max	Min	Nom	Max
A	—	—	1.60	—	—	0.063
A_1	0.05	—	—	0.002	—	—
A_2	1.35	1.40	1.45	0.053	0.055	0.057
b	0.17	0.22	0.27	0.007	0.009	0.011
b_1	0.20 REF			0.008 REF		
c	0.12	—	0.20	0.005	—	0.008
c_1	0.13 REF			0.005 REF		
D	29.85	30.00	30.15	1.175	1.181	1.187
D_1	27.90	28.00	28.10	1.098	1.102	1.106
E	29.85	30.00	30.15	1.175	1.181	1.187
E_1	27.90	28.00	28.10	1.098	1.102	1.106
e	0.50 BSC			0.020 BSC		
L	0.45	0.60	0.75	0.018	0.024	0.030
L_1	1.00 REF			0.039 REF		
R_1	0.15 REF			0.006 REF		
R_2	0.15 REF			0.006 REF		
S	0.21 REF			0.008 REF		
θ	0°	3.5°	7°	0°	3.5°	7°
$θ_1$	7° REF			7° REF		
$θ_2$	12° REF			12° REF		
$θ_3$	12° REF			12° REF		

NSING Technologies Pte. Ltd.
Address: 20 Science Park, #03-15/16
Teleteck Park, East Wing, Singapore 117674
Email: sales@nsing.com.sg

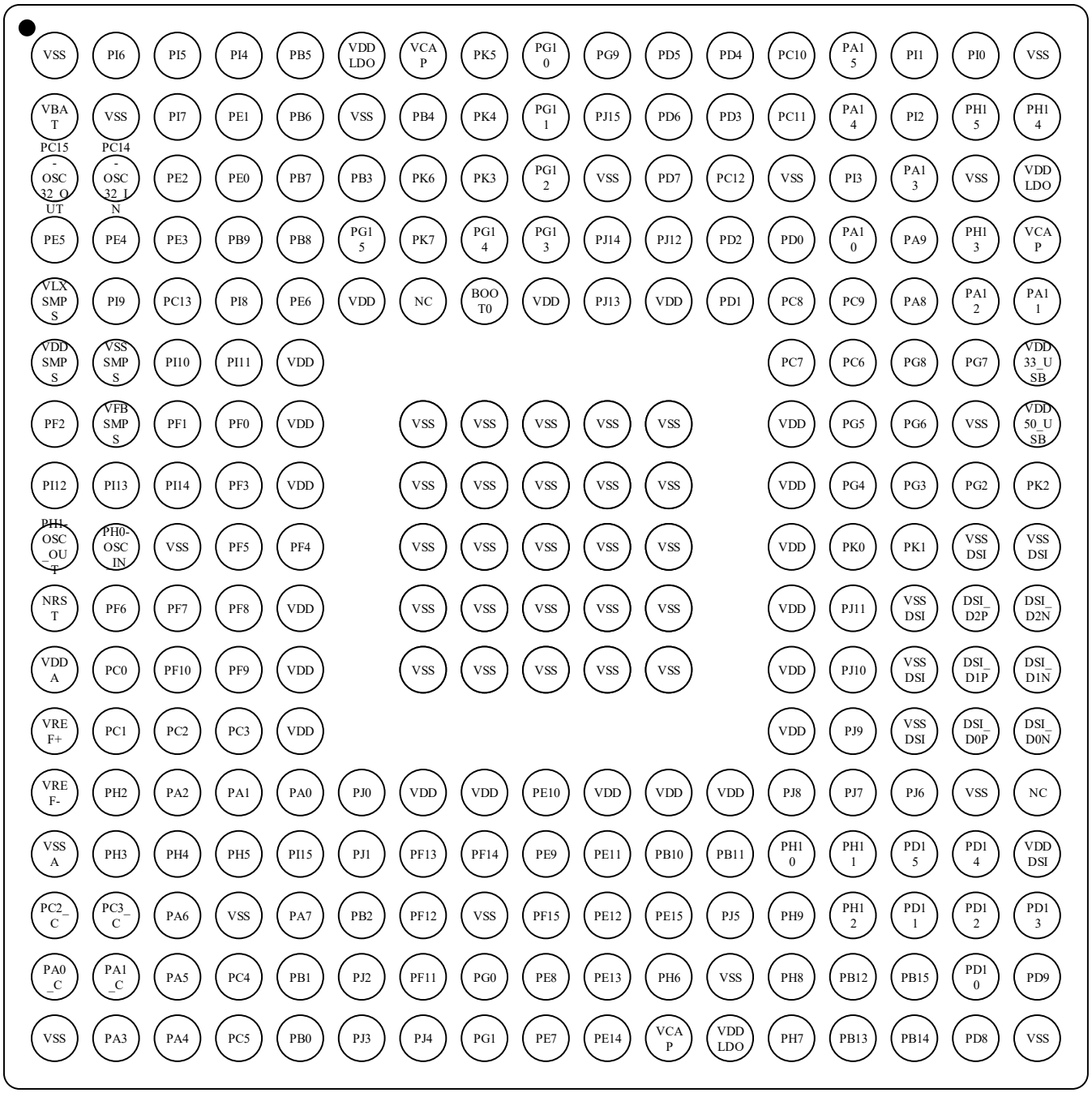
3.4 TFBGA240+25 Package

3.4.1 TFBGA240+25 Pin Distrubition

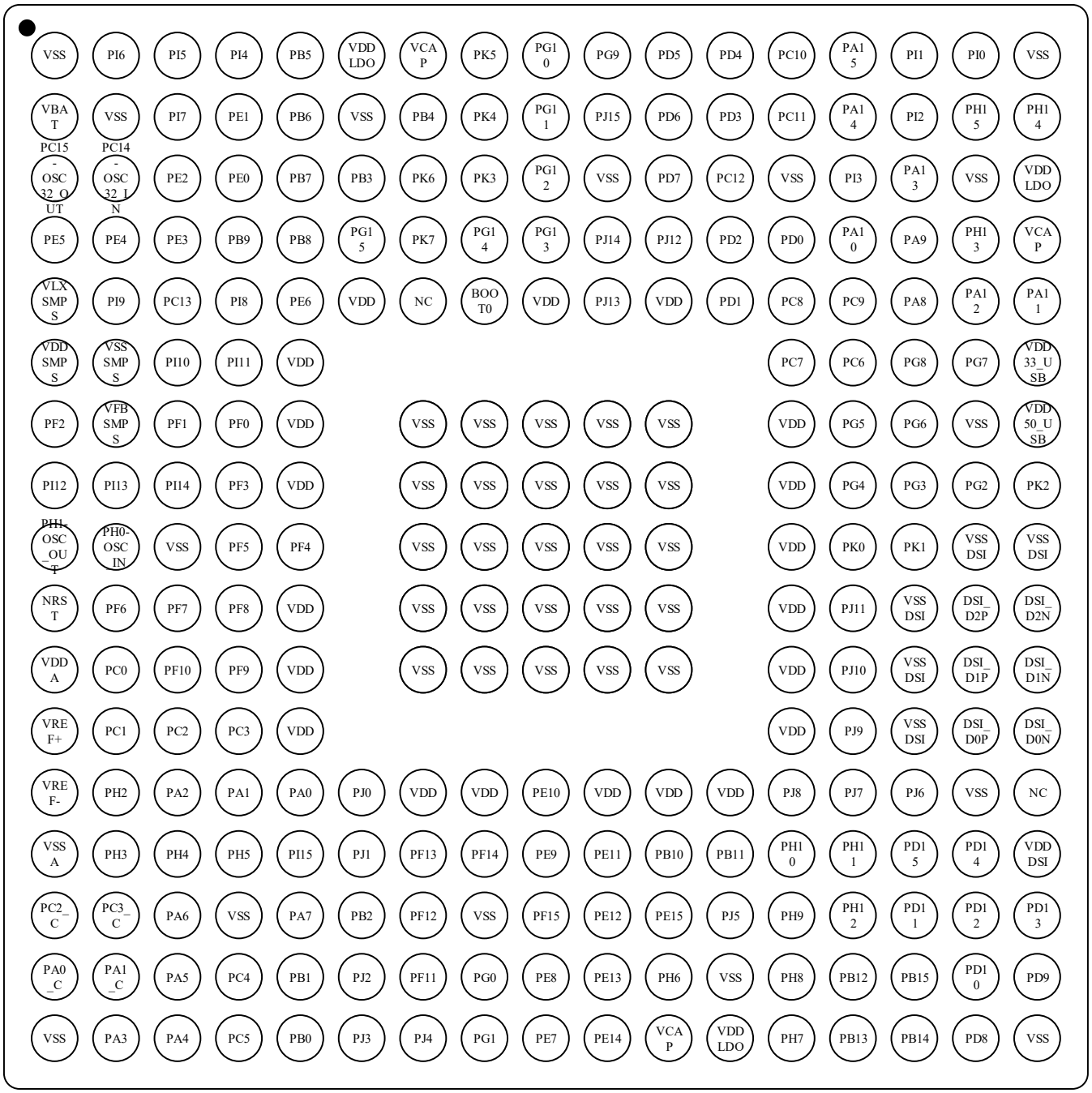


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A	VSS	PI6	PI5	PI4	PB5	NC	VCAP	PK5	PG10	PG9	PD5	PD4	PC10	PA15	PI1	PI0	VSS
B	VBAT	VSS	PI7	PE1	PB6	VSS	PB4	PK4	PG11	PJ15	PD6	PD3	PC11	PA14	PI2	PH15	PH14
C	PC15-OSC32_OUT	PC14-OSC32_IN	PE2	PE0	PB7	PB3	PK6	PK3	PG12	VSS	PD7	PC12	VSS	PI3	PA13	VSS	NC
D	PE5	PE4	PE3	PB9	PB8	PG15	PK7	PG14	PG13	PJ14	PJ12	PD2	PD0	PA10	PA9	PH13	VCAP
E	VLXSMPS	PI9	PC13	PI8	PE6	VDD	NC	BOOT0	VDD	PJ13	VDD	PD1	PC8	PC9	PA8	USB1_DP	USB1_DM
F	VDDSMPS	VSSSMPS	PI10	PI11	VDD								PC7	PC6	PG8	PG7	VDD33_USB
G	PF2	VFBSMPS	PF1	PF0	VDD		VSS	VSS	VSS	VSS	VSS		VDD	PG5	PG6	VSS	NC
H	PI12	PI13	PI14	PF3	VDD		VSS	VSS	VSS	VSS	VSS		VDD	PG4	PG3	PG2	PK2
J	PH1-OSC_OUT	PH0-OSC_IN	VSS	PF5	PF4		VSS	VSS	VSS	VSS	VSS		VDD	PK0	PK1	VSSDSI	VSSDSI
K	NRST	PF6	PF7	PF8	VDD		VSS	VSS	VSS	VSS	VSS		VDD	PJ11	VSSDSI	DSI_D1P	DSI_D1N
L	VDDA	PC0	PF10	PF9	VDD		VSS	VSS	VSS	VSS	VSS		VDD	PJ10	VSSDSI	DSI_CKP	DSI_CKN
M	VREF+	PC1	PC2	PC3	VDD								VDD	PJ9	VSSDSI	DSI_D0P	DSI_D0N
N	VREF-	PH2	PA2	PA1	PA0	PJ0	VDD	VDD	PE10	VDD	VDD	VDD	PJ8	PJ7	PJ6	VSS	NC
P	VSSA	PH3	PH4	PH5	PI15	PJ1	PF13	PF14	PE9	PE11	PB10	PB11	PH10	PH11	PD15	PD14	VDDDSI
R	PC2_C	PC3_C	PA6	VSS	PA7	PB2	PF12	VSS	PF15	PE12	PE15	PJ5	PH9	PH12	PD11	PD12	PD13
T	PA0_C	PA1_C	PA5	PC4	PB1	PJ2	PF11	PG0	PE8	PE13	PH6	VSS	PH8	PB12	PB15	PD10	PD9
U	VSS	PA3	PA4	PC5	PB0	PJ3	PJ4	PG1	PE7	PE14	VCAP	NC	PH7	PB13	PB14	PD8	VSS

NSING Technologies Pte. Ltd.
Address: 20 Science Park, #03-15/16
Teleteck Park, East Wing, Singapore 117674
Email: sales@nsing.com.sg

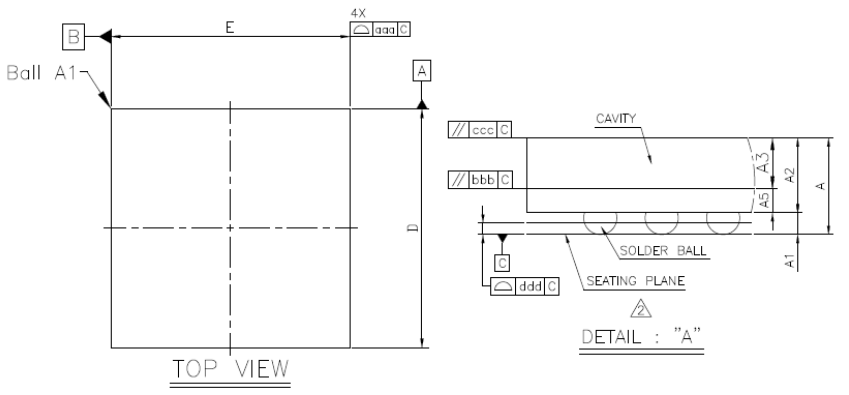


NSING Technologies Pte. Ltd.
Address: 20 Science Park, #03-15/16
Teleteck Park, East Wing, Singapore 117674
Email: sales@nsing.com.sg



NSING Technologies Pte. Ltd.
Address: 20 Science Park, #03-15/16
Teleteck Park, East Wing, Singapore 117674
Email: sales@nsing.com.sg

3.4.2 TFBGA240+25 Package Size



Symbol	Dimension in mm			Dimension in inch		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.009	1.090	1.171	0.040	0.043	0.046
A1	0.250	0.300	0.350	0.010	0.012	0.014
A2	0.726	0.790	0.854	0.029	0.031	0.034
A3	0.480	0.530	0.580	0.019	0.021	0.023
A5	0.220	0.260	0.300	0.009	0.010	0.012
E	13.900	14.000	14.100	0.547	0.551	0.555
D	13.900	14.000	14.100	0.547	0.551	0.555
E1	---	12.800	---	---	0.504	---
D1	---	12.800	---	---	0.504	---
e	---	0.800	---	---	0.031	---
b	0.360	0.410	0.460	0.014	0.016	0.018
aaa		0.150			0.006	
bbb		0.100			0.004	
ccc		0.100			0.004	
ddd		0.130			0.005	
eee		0.150			0.006	
fff		0.080			0.003	
MD/ME		17/17				
SE		0.800			0.031	
SD		0.800			0.031	

NSING Technologies Pte. Ltd.
Address: 20 Science Park, #03-15/16
Teleteck Park, East Wing, Singapore 117674
Email: sales@nsing.com.sg

4 Version History

Version	Date	Changes
V1.0.0	2025.4.23	First release

NSING Technologies Pte. Ltd.
Address: 20 Science Park, #03-15/16
Teleteck Park, East Wing, Singapore 117674
Email: sales@nsing.com.sg

5 Disclaimer

This document is the exclusive property of NSING TECHNOLOGIES PTE. LTD. (Hereinafter referred to as NSING). This document, and the product of NSING described herein (Hereinafter referred to as the Product) are owned by NSING under the laws and treaties of Republic of Singapore and other applicable jurisdictions worldwide. The intellectual properties of the product belong to Nations Technologies Inc. and Nations Technologies Inc. does not grant any third party any license under its patents, copyrights, trademarks, or other intellectual property rights. Names and brands of third party may be mentioned or referred thereto (if any) for identification purposes only. NSING reserves the right to make changes, corrections. enhancements, modifications, and improvements to this document at any time without notice. Please contact NSING and obtain the latest version of this document before placing orders. Although NATIONS has attempted to provide accurate and reliable information, NATIONS assumes no responsibility for the accuracy and reliability of this document. It is the responsibility of the user of this document to properly design, program, and test the functionality and safety of any application made of this information and any resulting product. In no event shall NATIONS be liable for any direct, indirect, incidental, special, exemplary, or consequential damages arising in any way out of the use of this document or the Product. NATIONS 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, all types of safety devices, and other applications intended to supporter sustain life. All Insecure Usage shall be made at user's risk. User shall indemnify NATIONS and hold NATIONS harmless from and against all claims, costs, damages, and other liabilities, arising from or related to any customer's Insecure Usage Any express or implied warranty with regard to this document or the Product, including, but not limited to. The warranties of merchantability, fitness for a particular purpose and non-infringement are disclaimed to the fullest extent permitted by law. Unless otherwise explicitly permitted by NATIONS, anyone may not use, duplicate, modify, transcribe or otherwise distribute this document for any purposes, in whole or in part.

NSING Technologies Pte. Ltd.
Address: 20 Science Park, #03-15/16
Teleteck Park, East Wing, Singapore 117674
Email: sales@nsing.com.sg