# ARM-based Flash MCU

## SAM4N Series

## SUMMARY DATASHEET

## SAM4N8/16 Description

The Atmel SAM4N series is a member of a family of Flash microcontrollers based on the high performance 32-bit ARM® Cortex®-M4 RISC processor. It operates at a maximum speed of 100 MHz and features up to 1024 Kbytes of Flash and up to 80 Kbytes of SRAM. The peripheral set includes 3x USARTs, 4x UARTs, 3x TWIs, 1x SPI, as well as 1 PWM timer, 2x three-channel general-purpose 16-bit timers (with stepper motor and quadrature decoder logic support), an RTC, a 10-bit ADC (up to 12-bit with digital averaging) and a 10-bit DAC with an internal voltage reference.

The SAM4N device is a medium range general purpose microcontroller with the best ratio in terms of reduced power consumption, processing power and peripheral set. This enables the SAM4N to sustain a wide range of applications including industrial automation and M2M (machine-to-machine), energy metering, consumer and appliance, building and home control.

It operates from 1.62V to 3.6V and is available in 48-, 64- and 100-pin QFP, 48-, 64-pin QFN, and 100-ball BGA packages.

The SAM4N series offers pin-to-pin compatibility with Atmel SAM4S, SAM3S, SAM3N and SAM7S devices, facilitating easy migration within the portfolio.

The SAM4N series is the ideal migration path from the SAM4S for applications that require a reduced BOM cost.

# 1. Features

- Core
  - ARM® Cortex®-M4 running at up to 100 MHz
  - Memory Protection Unit (MPU)
  - Thumb®-2 instruction Set
- Pin-to-pin compatible with SAM3N, SAM3S products (48-, 64- and 100-pin versions), SAM4S (64- and 100-pin versions) and SAM7S legacy products (64-pin version)
- Memories
  - Up to 1024 Kbytes embedded Flash
  - Up to 80 Kbytes embedded SRAM
  - 8 Kbytes ROM with embedded boot loader routines (UART) and IAP routines, single-cycle access at maximum speed
- System
  - Embedded voltage regulator for single supply operation
  - Power-on-Reset (POR), Brown-out Detector (BOD) and Watchdog for safe operation

- Quartz or ceramic resonator oscillators: 3 to 20 MHz main power with Failure Detection and optional low power 32.768 kHz for RTC or device clock
- High precision 8/12 MHz factory trimmed internal RC oscillator with 4 MHz default frequency for device start-up. In-application trimming access for frequency adjustment
- Slow Clock Internal RC oscillator as permanent low-power mode device clock
- PLL up to 240 MHz for device clock
- Temperature Sensor
- Up to 23 peripheral DMA (PDC) channels

- Low Power Modes
  - Sleep and Backup modes, down to 0.7 µA in Backup mode
  - Low-power RTC
- Peripherals
  - Up to 3 USARTs with ISO7816 , IrDA®(only USART0), RS-485, and SPI Mode
  - Up to 4 2-wire UARTs
  - Up to 3 Two Wire Interfaces (TWI)
  - 1 SPI
  - 2 Three-channel 16-bit Timer/Counter with capture, waveform, compare and PWM mode. Quadrature Decoder Logic and 2-bit Gray Up/Down for Stepper Motor
  - 1 Four-channel 16-bit PWM
  - 32-bit Real-time Timer and RTC with calendar and alarm features
- I/Os
  - Up to 79 I/O lines with external interrupt capability (edge or level sensitivity), debouncing, glitch filtering and on-die Series Resistor Termination. Individually Programmable Open-drain, Pull-up and Pull-down resistor and Synchronous Output
  - Three 32-bit Parallel Input/Output Controllers
- Analog
  - One 10-bit ADC up to 510 ksamples/sec, with Digital Averaging Function providing Enhanced Resolution Mode up to 12-bit, Up to 16-channels
  - One 10-bit DAC up to 1 MSamples/sec
  - Internal voltage reference, 3V typ
- Packages
  - 100-lead LQFP, 14 x 14 mm, pitch 0.5 mm/100-ball TFBGA, 9 x 9 mm, pitch 0.8 mm/100-ball VFBGA 7 x 7 mm, pitch 0.65 mm
  - 64-lead LQFP, 10 x 10 mm, pitch 0.5 mm/64-pad QFN 9 x 9 mm, pitch 0.5 mm
  - 48-lead LQFP, 7 x7 mm, pitch 0.5 mm/48-pad QFN 7 x 7 mm, pitch 0.5 mm

## 1.1 Configuration Summary

The SAM4N series devices differ in memory size, package and features. Table 1-1 summarizes the configurations of the device family.

**Table 1-1. Configuration Summary**

| Feature | SAM4N16C | SAM4N16B | SAM4N8C | SAM4N8B | SAM4N8A |
|---|---|---|---|---|---|
| Flash | 1024 Kbytes | 1024 Kbytes | 512 Kbytes | 512 Kbytes | 512 Kbytes |
| SRAM | 80 Kbytes | 80 Kbytes | 64 Kbytes | 64 Kbytes | 64 Kbytes |
| Package | LQFP100<br>TFBGA100<br>VFBGA100 | LQFP64<br>QFN64 | LQFP100<br>TFBGA100<br>VFBGA100 | LQFP64<br>QFN64 | LQFP48<br>QFN48 |
| Number of PIOs | 79 | 47 | 79 | 47 | 34 |
| 10-bit ADC | 17 ch (1) | 11 ch (1) | 17 ch (1) | 11 ch (1) | 9 ch (1) |
| 10-bit DAC | 1 ch | 1 ch | 1 ch | 1 ch | - |
| 16-bit Timer | 6 | 6(2) | 6 | 6(2) | 6(2) |
| PDC Channels | 23 | 23 | 23 | 23 | 23 |
| USART/ UART | 3/4 | 2/4 | 3/4 | 2/4 | 1/4 |
| SPI | 4(3) | 3(3) | 4(3) | 3(3) | 2(3) |
| TWI | 3 | 3 | 3 | 3 | 3 |
| PWM | 7(4) | 4(4) | 7(4) | 4(4) | 4(4) |

Notes:
1. Included Temperature Sensor.
2. Only 3 channels output.
3. USARTs with SPI mode are taken into account.
4. Timer Counter in PWM mode is taken into account.

# 2. SAM4N8/16 Block Diagram

**Figure 2-1. SAM4N8/16 100-pin Version Block Diagram**

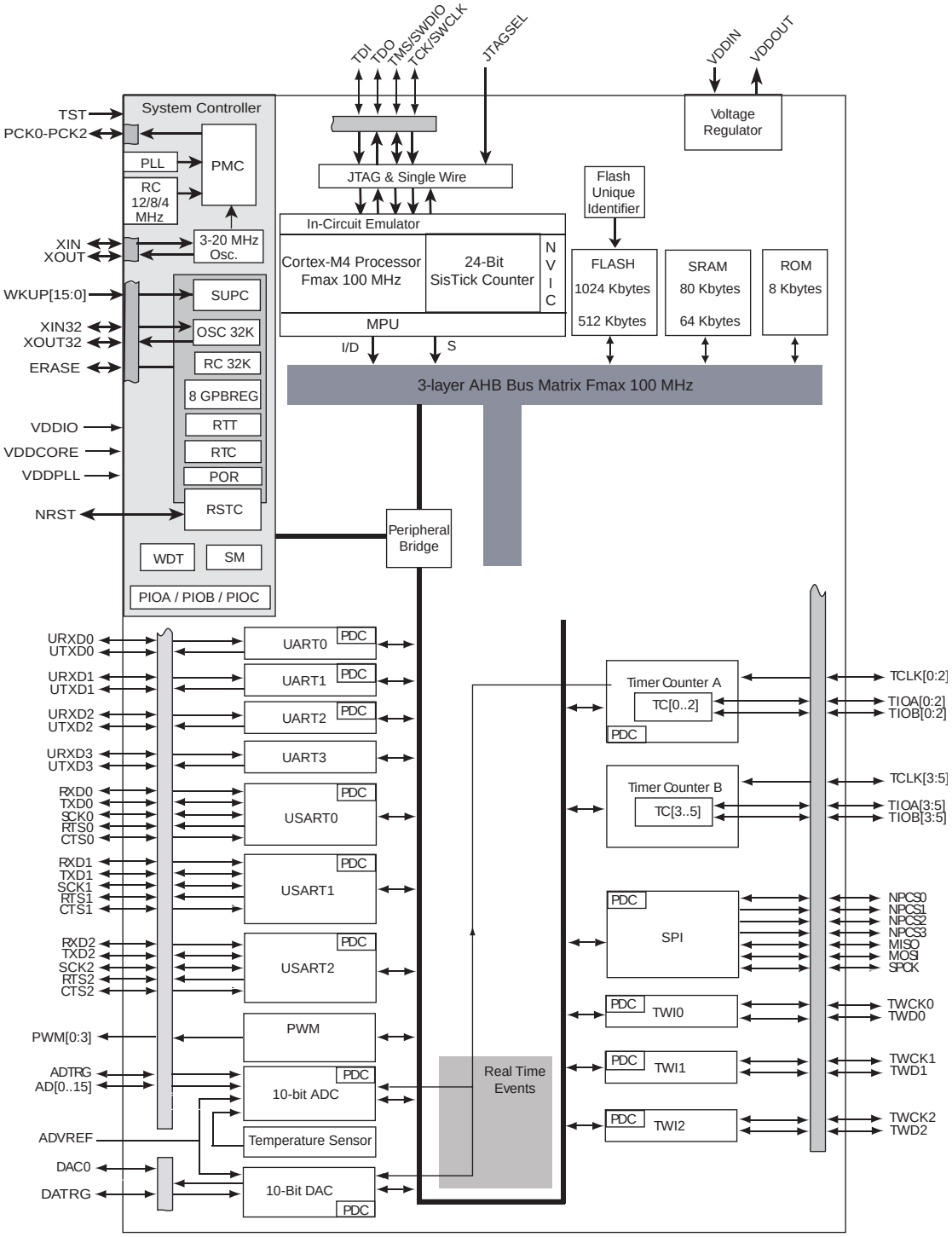


**Figure 2-2. SAM4N8/16 64-pin Version Block Diagram**

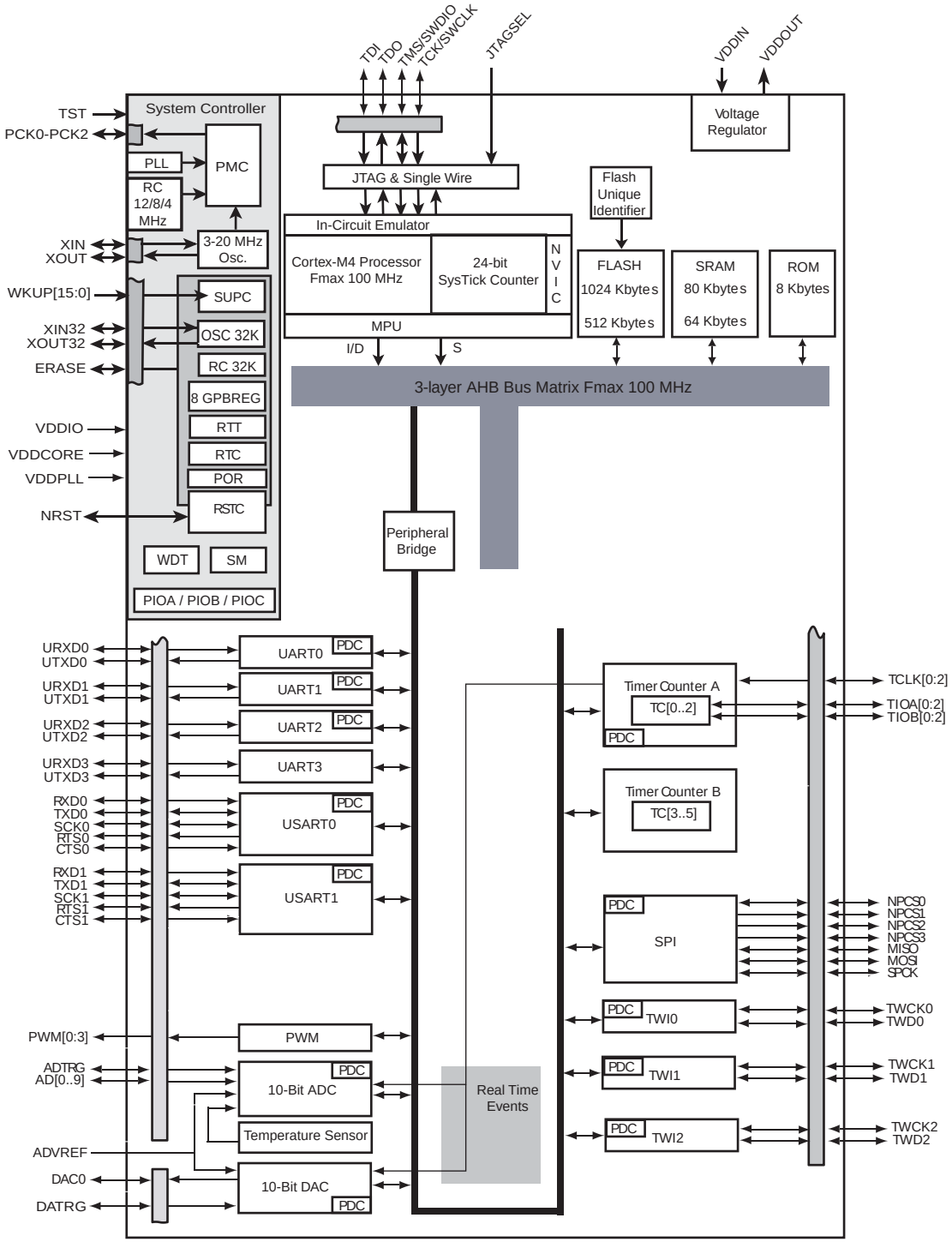
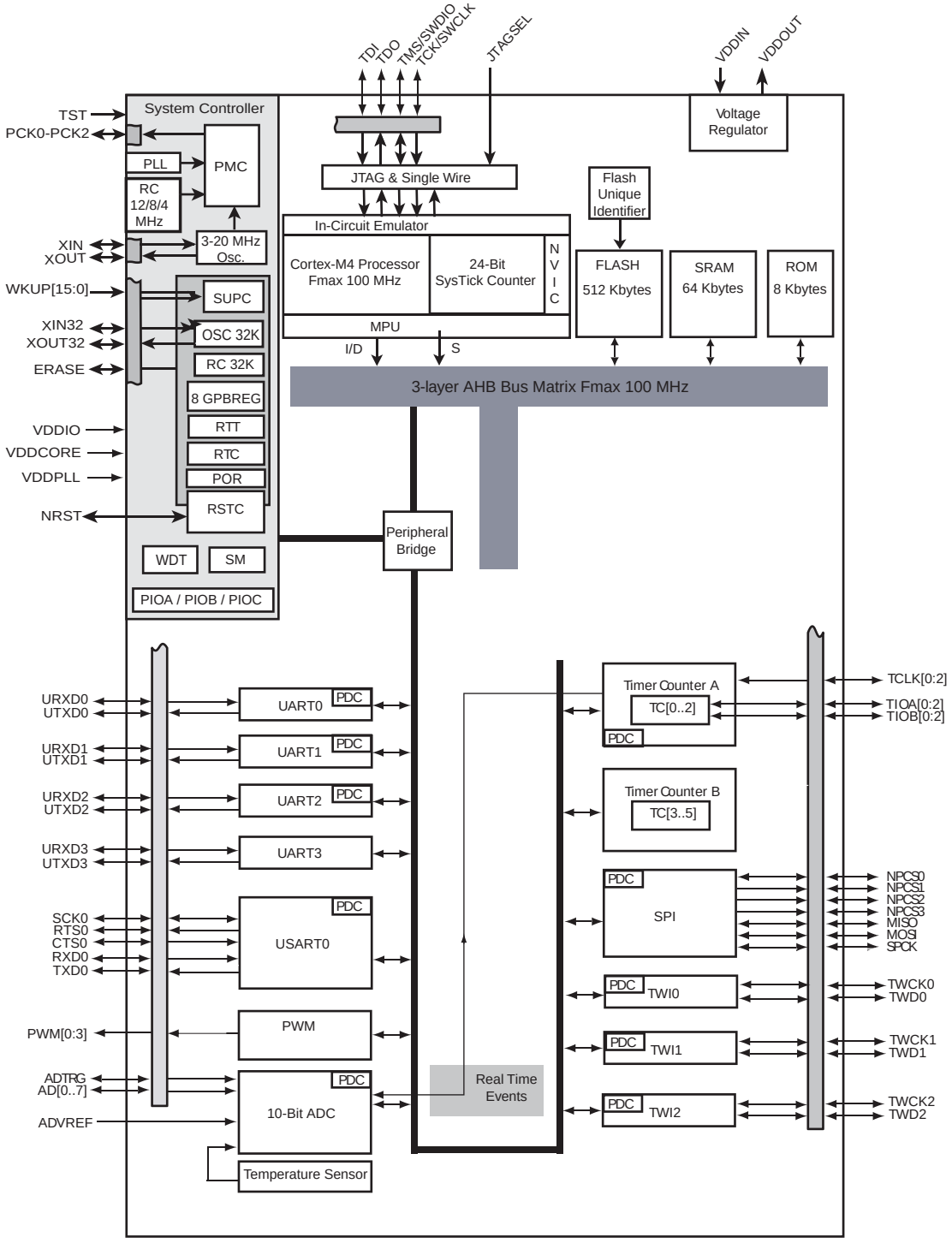


**Figure 2-3. SAM4N8 48-pin Version Block Diagram**



# 3. Signals Description

Table 3-1 gives details on the signal name classified by peripheral.

**Table 3-1. Signal Description List**

| Signal Name | Function | Type | Active Level | Voltage Reference | Comments |
|---|---|---|---|---|---|
| **Power Supplies** | | | | | |
| VDDIO | Peripherals I/O Lines Power Supply | Power | | | 1.62V to 3.6V |
| VDDIN | Voltage Regulator, ADC and DAC Power Supply | Power | | | 1.6V to 3.6V |
| VDDOUT | Voltage Regulator Output | Power | | | 1.2V Output |
| VDDPLL | Oscillator Power Supply | Power | | | 1.08V to 1.32V |
| VDDCORE | Core Chip Power Supply | Power | | | 1.08V to 1.32V<br>Connected externally to VDDOUT |
| GND | Ground | Ground | | | |
| **Clocks, Oscillators and PLLs** | | | | | |
| XIN | Main Oscillator Input | Input | | VDDIO | |
| XOUT | Main Oscillator Output | Output | | | |
| XIN32 | Slow Clock Oscillator Input | Input | | VDDIO | |
| XOUT32 | Slow Clock Oscillator Output | Output | | | |
| PCK0 - PCK2 | Programmable Clock Output | Output | | | |
| **ICE and JTAG** | | | | | |
| TCK | Test Clock | Input | | VDDIO | No pull-up resistor |
| TDI | Test Data In | Input | | VDDIO | No pull-up resistor |
| TDO | Test Data Out | Output | | VDDIO | |
| TRACESWO | Trace Asynchronous Data Out | Output | | VDDIO | |
| SWDIO | Serial Wire Input/Output | I/O | | VDDIO | |
| SWCLK | Serial Wire Clock | Input | | VDDIO | |
| TMS | Test Mode Select | Input | | VDDIO | No pull-up resistor |
| JTAGSEL | JTAG Selection | Input | High | VDDIO | Pull-down resistor |
| **Flash Memory** | | | | | |
| ERASE | Flash and NVM Configuration Bits Erase Command | Input | High | VDDIO | Pull-down (15 kΩ) resistor |
| **Reset/Test** | | | | | |
| NRST | Microcontroller Reset | I/O | Low | VDDIO | Pull-Up resistor |
| TST | Test Mode Select | Input | | VDDIO | Pull-down resistor |
| **Universal Asynchronous Receiver Transmitter - UARTx** | | | | | |
| URXDx | UART Receive Data | Input | | | |
| UTXDx | UART Transmit Data | Output | | | |

**Table 3-1. Signal Description List**

| Signal Name | Function | Type | Active Level | Voltage Reference | Comments |
|---|---|---|---|---|---|
| **PIO Controller - PIOA - PIOB - PIOC** | | | | | |
| PA0 - PA31 | Parallel IO Controller A | I/O | | VDDIO | Pulled-up input at reset |
| PB0 - PB14 | Parallel IO Controller B | I/O | | VDDIO | Pulled-up input at reset |
| PC0 - PC31 | Parallel IO Controller C | I/O | | VDDIO | Pulled-up input at reset |
| **Universal Synchronous Asynchronous Receiver Transmitter USARTx** | | | | | |
| SCKx | USARTx Serial Clock | I/O | | | |
| TXDx | USARTx Transmit Data | I/O | | | |
| RXDx | USARTx Receive Data | Input | | | |
| RTSx | USARTx Request To Send | Output | | | |
| CTSx | USARTx Clear To Send | Input | | | |
| **Timer/Counter - TCx** | | | | | |
| TCLKx | TC Channel x External Clock Input | Input | | | |
| TIOAx | TC Channel x I/O Line A | I/O | | | |
| TIOBx | TC Channel x I/O Line B | I/O | | | |
| **Pulse Width Modulation Controller- PWMC** | | | | | |
| PWM | PWM Waveform Output for channel | Output | | | |
| **Serial Peripheral Interface - SPI** | | | | | |
| MISO | Master In Slave Out | I/O | | | |
| MOSI | Master Out Slave In | I/O | | | |
| SPCK | SPI Serial Clock | I/O | | | |
| NPCS0 | SPI Peripheral Chip Select 0 | I/O | Low | | |
| NPCS1 - NPCS3 | SPI Peripheral Chip Select | Output | Low | | |
| **Two-Wire Interface- TWIx** | | | | | |
| TWDx | TWIx Two-wire Serial Data | I/O | | | |
| TWCKx | TWIx Two-wire Serial Clock | I/O | | | |
| **Analog** | | | | | |
| ADVREF | ADC and DAC Reference | Analog | | | |
| **10-bit Analog-to-Digital Converter - ADCC** | | | | | |
| AD0 - AD15 | Analog Inputs | Analog | | | |
| ADTRG | ADC Trigger | Input | | | |
| **Digital-to-Analog Converter - DAC** | | | | | |
| DAC0 | DAC Channel Analog Output | Analog | | | |
| DACTRG | DAC Trigger | Input | | | |

**Table 3-1. Signal Description List**

| Signal Name | Function | Type | Active Level | Voltage Reference | Comments |
|---|---|---|---|---|---|
| **Fast Flash Programming Interface** | | | | | |
| PGMEN0-PGMEN2 | Programming Enabling | Input | | VDDIO | |
| PGMM0-PGMM3 | Programming Mode | Input | | VDDIO | |
| PGMD0-PGMD15 | Programming Data | I/O | | VDDIO | |
| PGMRDY | Programming Ready | Output | High | VDDIO | |
| PGMNVALID | Data Direction | Output | Low | VDDIO | |
| PGMNOE | Programming Read | Input | Low | VDDIO | |
| PGMCK | Programming Clock | Input | | VDDIO | |
| PGMNCMD | Programming Command | Input | Low | VDDIO | |

# 4. Package and Pinout

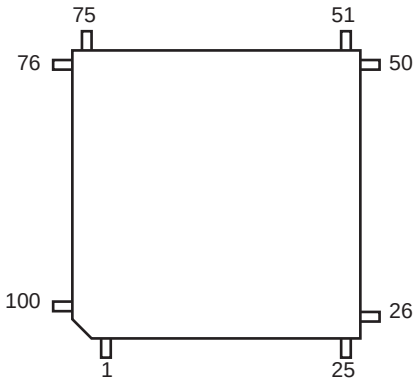
SAM4N devices are pin-to-pin compatible with SAM3N4.

**Table 4-1. SAM4N Packages**

| | 100 Pins/ Balls | 64 Pins/ Balls | 48 Pins/balls |
|---|---|---|---|
| SAM4N16 | LQFP,TFBGA and VFBGA | LQFP and QFN | - |
| SAM4N8 | LQFP,TFBGA and VFBGA | LQFP and QFN | LQFP and QFN |

## 4.1 Overview of the 100-lead LQFP Package

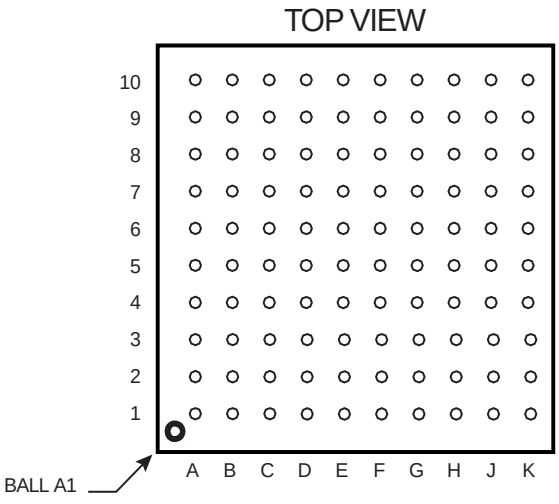
**Figure 4-1. Orientation of the 100-lead LQFP Package**




## 4.2 Overview of the 100-ball TFBGA Package

The 100-ball TFBGA package has a 0.8 mm ball pitch and respects the Green Standards. Its dimensions are 9 x 9 x 1.1 mm.

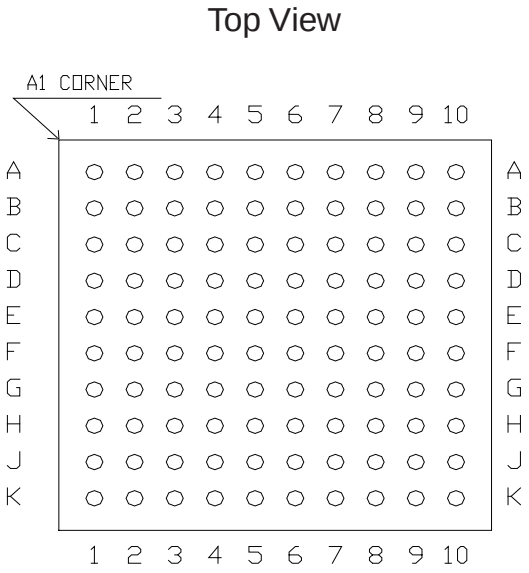
**Figure 4-2. Orientation of the 100-ball TFBGA Package**



## 4.3 Overview of the 100-ball VFBGA Package

The 100-ball VFBGA package has a 0.65 mm ball pitch and respects the Green Standards. Its dimensions are 7x 7x 1 mm.

**Figure 4-3. Orientation of the 100-ball VFBGA Package**



## 4.4 100-lead LQFP, TFBGA and VFBGA Pinout

**Table 4-2. SAM4N8/16 100-lead LQFP Pinout**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | ADVREF | 26 | GND | 51 | TDI/PB4 | 76 | TDO/TRACESWO/ PB5 |
| 2 | GND | 27 | VDDIO | 52 | PA6/PGMNOE | 77 | JTAGSEL |
| 3 | PB0/AD4 | 28 | PA16/PGMD4 | 53 | PA5/PGMRDY | 78 | PC18 |
| 4 | PC29/AD13 | 29 | PC7 | 54 | PC28 | 79 | TMS/SWDIO/PB6 |
| 5 | PB1/AD5 | 30 | PA15/PGMD3 | 55 | PA4/PGMNCMD | 80 | PC19 |
| 6 | PC30/AD14 | 31 | PA14/PGMD2 | 56 | VDDCORE | 81 | PA31 |
| 7 | PB2/AD6 | 32 | PC6 | 57 | PA27 | 82 | PC20 |
| 8 | PC31/AD15 | 33 | PA13/PGMD1 | 58 | PC8 | 83 | TCK/SWCLK/PB7 |
| 9 | PB3/AD7 | 34 | PA24 | 59 | PA28 | 84 | PC21 |
| 10 | VDDIN | 35 | PC5 | 60 | NRST | 85 | VDDCORE |
| 11 | VDDOUT | 36 | VDDCORE | 61 | TST | 86 | PC22 |
| 12 | PA17/PGMD5/ AD0 | 37 | PC4 | 62 | PC9 | 87 | ERASE/PB12 |
| 13 | PC26 | 38 | PA25 | 63 | PA29 | 88 | PB10 |
| 14 | PA18/PGMD6/ AD1 | 39 | PA26 | 64 | PA30 | 89 | PB11 |
| 15 | PA21/AD8 | 40 | PC3 | 65 | PC10 | 90 | PC23 |
| 16 | VDDCORE | 41 | PA12/PGMD0 | 66 | PA3 | 91 | VDDIO |
| 17 | PC27 | 42 | PA11/PGMM3 | 67 | PA2/PGMEN2 | 92 | PC24 |
| 18 | PA19/PGMD7/ AD2 | 43 | PC2 | 68 | PC11 | 93 | PB13/DAC0 |
| 19 | PC15/AD11 | 44 | PA10/PGMM2 | 69 | VDDIO | 94 | PC25 |
| 20 | PA22/AD9 | 45 | GND | 70 | GND | 95 | GND |
| 21 | PC13/AD10 | 46 | PA9/PGMM1 | 71 | PC14 | 96 | PB8/XOUT |
| 22 | PA23 | 47 | PC1 | 72 | PA1/PGMEN1 | 97 | PB9/PGMCK/XIN |
| 23 | PC12/AD12 | 48 | PA8/XOUT32/ PGMM0 | 73 | PC16 | 98 | VDDIO |
| 24 | PA20/AD3 | 49 | PA7/XIN32/ PGMNVALID | 74 | PA0/PGMEN0 | 99 | PB14 |
| 25 | PC0 | 50 | VDDIO | 75 | PC17 | 100 | VDDPLL |

**Table 4-3. SAM4N8/16 100-ball TFBGA Pinout**

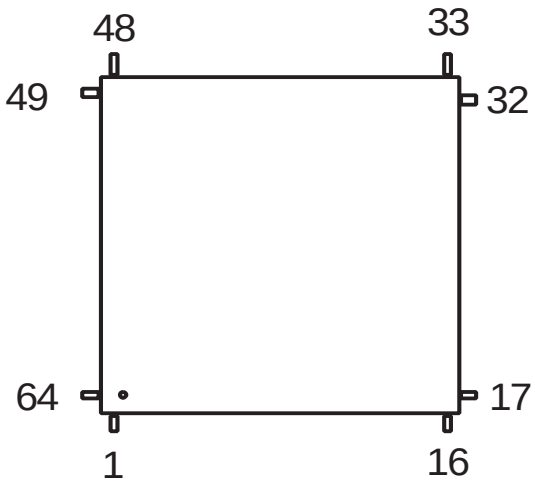
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A1 | PB1/AD5 | C6 | TCK/SWCLK/PB7 | F1 | PA18/PGMD6/ AD1 | H6 | PC4 |
| A2 | PC29 | C7 | PC16 | F2 | PC26 | H7 | PA11/PGMM3 |
| A3 | VDDIO | C8 | PA1/PGMEN1 | F3 | VDDOUT | H8 | PC1 |
| A4 | PB9/PGMCK/XIN | C9 | PC17 | F4 | GND | H9 | PA6/PGMNOE |
| A5 | PB8/XOUT | C10 | PA0/PGMEN0 | F5 | VDDIO | H10 | TDI/PB4 |
| A6 | PB13/DAC0 | D1 | PB3/AD7 | F6 | PA27 | J1 | PC15/AD11 |
| A7 | PB11 | D2 | PB0/AD4 | F7 | PC8 | J2 | PC0 |
| A8 | PB10 | D3 | PC24 | F8 | PA28 | J3 | PA16/PGMD4 |
| A9 | TMS/SWDIO/PB6 | D4 | PC22 | F9 | TST | J4 | PC6 |
| A10 | JTAGSEL | D5 | GND | F10 | PC9 | J5 | PA24 |
| B1 | PC30 | D6 | GND | G1 | PA21/AD8 | J6 | PA25 |
| B2 | ADVREF | D7 | VDDCORE | G2 | PC27 | J7 | PA10/PGMM2 |
| B3 | GND | D8 | PA2/PGMEN2 | G3 | PA15/PGMD3 | J8 | GND |
| B4 | PB14 | D9 | PC11 | G4 | VDDCORE | J9 | VDDCORE |
| B5 | PC21 | D10 | PC14 | G5 | VDDCORE | J10 | VDDIO |
| B6 | PC20 | E1 | PA17/PGMD5/ AD0 | G6 | PA26 | K1 | PA22/AD9 |
| B7 | PA31 | E2 | PC31 | G7 | PA12/PGMD0 | K2 | PC13/AD10 |
| B8 | PC19 | E3 | VDDIN | G8 | PC28 | K3 | PC12/AD12 |
| B9 | PC18 | E4 | GND | G9 | PA4/PGMNCMD | K4 | PA20/AD3 |
| B10 | TDO/TRACESWO/ PB5 | E5 | GND | G10 | PA5/PGMRDY | K5 | PC5 |
| C1 | PB2/AD6 | E6 | NRST | H1 | PA19/PGMD7/ AD2 | K6 | PC3 |
| C2 | VDDPLL | E7 | PA29/AD13 | H2 | PA23 | K7 | PC2 |
| C3 | PC25 | E8 | PA30/AD14 | H3 | PC7 | K8 | PA9/PGMM1 |
| C4 | PC23 | E9 | PC10 | H4 | PA14/PGMD2 | K9 | PA8/XOUT32/ PGMM0 |
| C5 | ERASE/PB12 | E10 | PA3 | H5 | PA13/PGMD1 | K10 | PA7/XIN32/ PGMNVALID |

**Table 4-4. SAM4N8/16 100-ball VFBGA Pinout**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A1 | ADVREF | C6 | PC9 | F1 | VDDOUT | H6 | PA12/PGMD0 |
| A2 | VDDPLL | C7 | TMS/SWDIO/PB6 | F2 | PA18/PGMD6/AD1 | H7 | PA9/PGMM1 |
| A3 | PB9/PGMCK/XIN | C8 | PA1/PGMEN1 | F3 | PA17/PGMD5/AD0 | H8 | VDDCORE |
| A4 | PB8/XOUT | C9 | PA0/PGMEN0 | F4 | GND | H9 | PA6/PGMNOE |
| A5 | JTAGSEL | C10 | PC16 | F5 | GND | H10 | PA5/PGMRDY |
| A6 | PB11 | D1 | PB1/AD5 | F6 | PC26 | J1 | PA20/AD3 |
| A7 | PB10 | D2 | PC30 | F7 | PA4/PGMNCMD | J2 | PC12/AD12 |
| A8 | PC20 | D3 | PC31 | F8 | PA28 | J3 | PA16/PGMD4 |
| A9 | PC19 | D4 | PC22 | F9 | TST | J4 | PC6 |
| A10 | TDO/TRACESWO/ PB5 | D5 | PC5 | F10 | PC8 | J5 | PA24 |
| B1 | GND | D6 | PA29/AD13 | G1 | PC15/AD11 | J6 | PA25 |
| B2 | PC25 | D7 | PA30/AD14 | G2 | PA19/PGMD7/AD2 | J7 | PA11/PGMM3 |
| B3 | PB14 | D8 | GND | G3 | PA21/PGMD9/AD8 | J8 | VDDCORE |
| B4 | PB13/DAC0 | D9 | PC14 | G4 | PA15/PGMD3 | J9 | VDDCORE |
| B5 | PC23 | D10 | PC11 | G5 | PC3 | J10 | TDI/PB4 |
| B6 | PC21 | E1 | VDDIN | G6 | PA10/PGMM2 | K1 | PA23 |
| B7 | TCK/SWCLK/PB7 | E2 | PB3/AD7 | G7 | PC1 | K2 | PC0 |
| B8 | PA31 | E3 | PB2/AD6 | G8 | PC28 | K3 | PC7 |
| B9 | PC18 | E4 | GND | G9 | NRST | K4 | PA13/PGMD1 |
| B10 | PC17 | E5 | GND | G10 | PA27 | K5 | PA26 |
| C1 | PB0/AD4 | E6 | GND | H1 | PC13/AD10 | K6 | PC2 |
| C2 | PC29 | E7 | VDDIO | H2 | PA22/AD9 | K7 | VDDIO |
| C3 | PC24 | E8 | PC10 | H3 | PC27 | K8 | VDDIO |
| C4 | ERASE/PB12 | E9 | PA2/PGMEN2 | H4 | PA14/PGMD2 | K9 | PA8/XOUT32/PGMM0 |
| C5 | VDDCORE | E10 | PA3 | H5 | PC4 | K10 | PA7/XIN32/PGMNVALID |

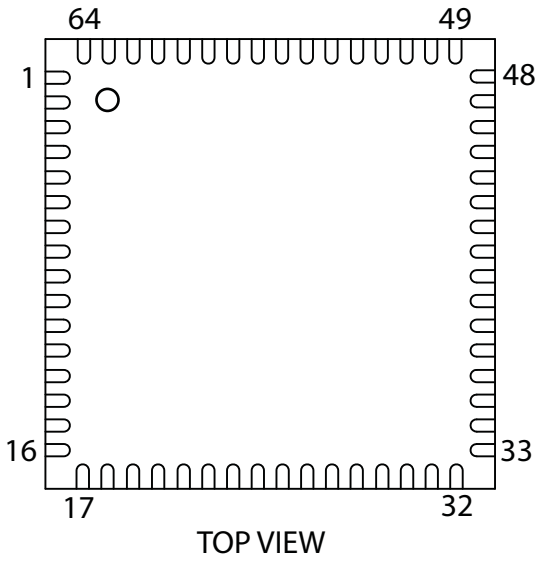
## 4.5 Overview of the 64-lead LQFP Package

**Figure 4-4. Orientation of the 64-lead LQFP Package**




## 4.6 Overview of the 64-lead QFN Package

**Figure 4-5. Orientation of the 64-lead QFN Package**



## 4.7 64-lead LQFP and QFN Pinout

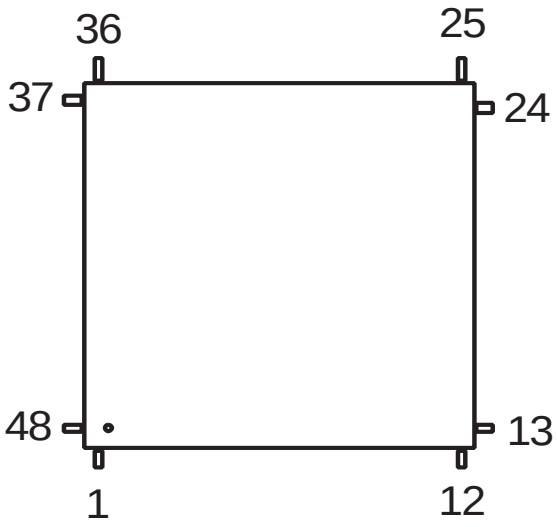
**Table 4-5. 64-pin SAM4N8/16 Pinout**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | ADVREF | 17 | GND | 33 | TDI/PB4 | 49 | TDO/TRACESWO/PB5 |
| 2 | GND | 18 | VDDIO | 34 | PA6/PGMNOE | 50 | JTAGSEL |
| 3 | PB0/AD4 | 19 | PA16/PGMD4 | 35 | PA5/PGMRDY | 51 | TMS/SWDIO/PB6 |
| 4 | PB1/AD5 | 20 | PA15/PGMD3 | 36 | PA4/PGMNCMD | 52 | PA31 |
| 5 | PB2/AD6 | 21 | PA14/PGMD2 | 37 | PA27/PGMD15 | 53 | TCK/SWCLK/PB7 |
| 6 | PB3/AD7 | 22 | PA13/PGMD1 | 38 | PA28 | 54 | VDDCORE |
| 7 | VDDIN | 23 | PA24/PGMD12 | 39 | NRST | 55 | ERASE/PB12 |
| 8 | VDDOUT | 24 | VDDCORE | 40 | TST | 56 | PB10 |
| 9 | PA17/PGMD5/AD0 | 25 | PA25/PGMD13 | 41 | PA29 | 57 | PB11 |
| 10 | PA18/PGMD6/AD1 | 26 | PA26/PGMD14 | 42 | PA30 | 58 | VDDIO |
| 11 | PA21/PGMD9/AD8 | 27 | PA12/PGMD0 | 43 | PA3 | 59 | PB13/DAC0 |
| 12 | VDDCORE | 28 | PA11/PGMM3 | 44 | PA2/PGMEN2 | 60 | GND |
| 13 | PA19/PGMD7/AD2 | 29 | PA10/PGMM2 | 45 | VDDIO | 61 | XOUT/PB8 |
| 14 | PA22/PGMD10/AD9 | 30 | PA9/PGMM1 | 46 | GND | 62 | XIN/PGMCK/PB9 |
| 15 | PA23/PGMD11 | 31 | PA8/XOUT32/PGMM0 | 47 | PA1/PGMEN1 | 63 | PB14 |
| 16 | PA20/PGMD8/AD3 | 32 | PA7/XIN32/XOUT32/PGMNVALID | 48 | PA0/PGMEN0 | 64 | VDDPLL |

Note: The bottom pad of the QFN package must be connected to ground.

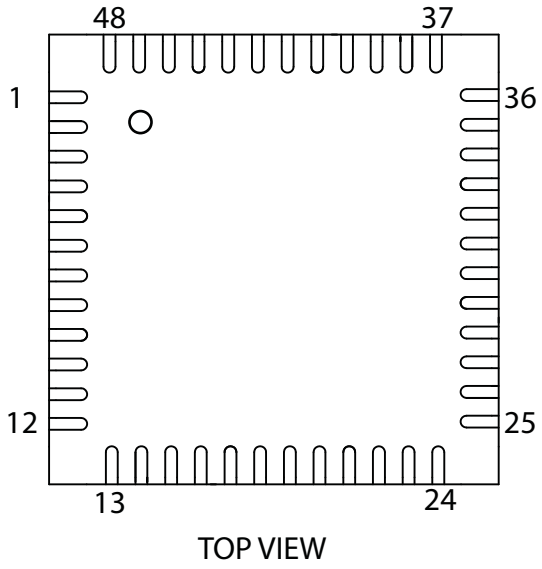
## 4.8 Overview of the 48-lead LQFP Package

**Figure 4-6. Orientation of the 48-lead LQFP Package**




## 4.9 Overview of the 48-lead QFN Package

**Figure 4-7. Orientation of the 48-lead QFN Package**



## 4.10 48-lead LQFP and QFN Pinout

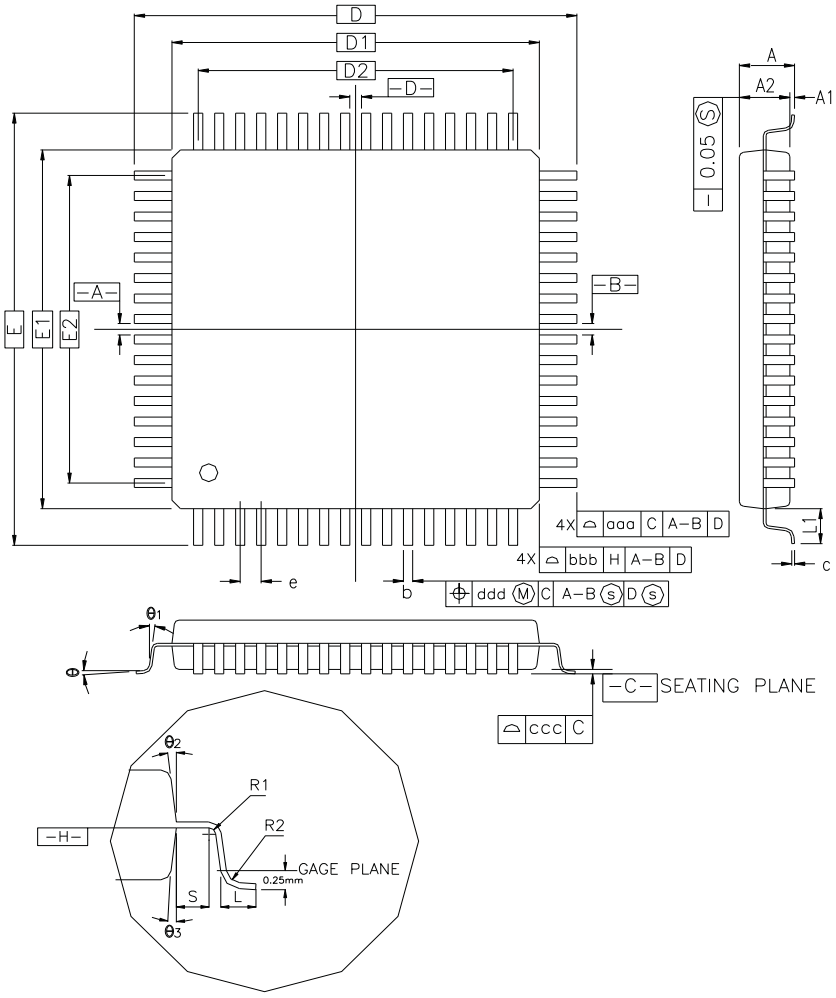
**Table 4-6. 48-pin SAM4N8 Pinout**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | ADVREF | 13 | VDDIO | 25 | TDI/PB4 | 37 | TDO/TRACESWO/ PB5 |
| 2 | GND | 14 | PA16/PGMD4 | 26 | PA6/PGMNOE | 38 | JTAGSEL |
| 3 | PB0/AD4 | 15 | PA15/PGMD3 | 27 | PA5/PGMRDY | 39 | TMS/SWDIO/PB6 |
| 4 | PB1/AD5 | 16 | PA14/PGMD2 | 28 | PA4/PGMNCMD | 40 | TCK/SWCLK/PB7 |
| 5 | PB2/AD6 | 17 | PA13/PGMD1 | 29 | NRST | 41 | VDDCORE |
| 6 | PB3/AD7 | 18 | VDDCORE | 30 | TST | 42 | ERASE/PB12 |
| 7 | VDDIN | 19 | PA12/PGMD0 | 31 | PA3 | 43 | PB10 |
| 8 | VDDOUT | 20 | PA11/PGMM3 | 32 | PA2/PGMEN2 | 44 | PB11 |
| 9 | PA17/PGMD5/AD0 | 21 | PA10/PGMM2 | 33 | VDDIO | 45 | XOUT/PB8 |
| 10 | PA18/PGMD6/AD1 | 22 | PA9/PGMM1 | 34 | GND | 46 | XIN/P/PB9/GMCK |
| 11 | PA19/PGMD7/AD2 | 23 | PA8/XOUT32/PG MM0 | 35 | PA1/PGMEN1 | 47 | VDDIO |
| 12 | PA20/AD3 | 24 | PA7/XIN32/PGMN VALID | 36 | PA0/PGMEN0 | 48 | VDDPLL |

Note: The bottom pad of the QFN package must be connected to ground.

# 5. SAM4N Mechanical Characteristics

**Figure 5-1. 100-lead LQFP Package Mechanical Drawing**




COTROL DIMENSIONS ARE IN MILLIMETERS.

| SYMBOL | MILLIMETER | | | INCH | | |
|---|---|---|---|---|---|---|
| | MIN. | NOM. | MAX. | MIN. | NOM. | MAX. |
| A | — | — | 1.60 | — | — | 0.063 |
| $A_1$ | 0.05 | — | 0.15 | 0.002 | — | 0.006 |
| $A_2$ | 1.35 | 1.40 | 1.45 | 0.053 | 0.055 | 0.057 |
| D | 16.00 BSC. | | | 0.630 BSC. | | |
| $D_1$ | 14.00 BSC. | | | 0.551 BSC. | | |
| E | 16.00 BSC. | | | 0.630 BSC. | | |
| $E_1$ | 14.00 BSC. | | | 0.551 BSC. | | |
| $R_2$ | 0.08 | — | 0.20 | 0.003 | — | 0.008 |
| $R_1$ | 0.08 | — | — | 0.003 | — | — |
| θ | 0° | 3.5° | 7° | 0° | 3.5° | 7° |
| $\theta_1$ | 0° | — | — | 0° | — | — |
| $\theta_2$ | 11° | 12° | 13° | 11° | 12° | 13° |
| $\theta_3$ | 11° | 12° | 13° | 11° | 12° | 13° |
| c | 0.09 | — | 0.20 | 0.004 | — | 0.008 |
| L | 0.45 | 0.60 | 0.75 | 0.018 | 0.024 | 0.030 |
| $L_1$ | 1.00 REF | | | 0.039 REF | | |
| S | 0.20 | — | — | 0.008 | — | — |
| b | 0.17 | 0.20 | 0.27 | 0.007 | 0.008 | 0.011 |
| e | 0.50 BSC. | | | 0.020 BSC. | | |
| D2 | 12.00 | | | 0.472 | | |
| E2 | 12.00 | | | 0.472 | | |
| TOLERANCES OF FORM AND POSITION | | | | | | |
| aaa | 0.20 | | | 0.008 | | |
| bbb | 0.20 | | | 0.008 | | |
| ccc | 0.08 | | | 0.003 | | |
| ddd | 0.08 | | | 0.003 | | |

Note : 1. This drawing is for general information only. Refer to JEDEC Drawing MS-026 for additional information.

**Table 5-1. Device and LQFP Package Maximum Weight**

| | | |
|---|---|---|
| SAM4N | 800 | mg |

**Table 5-2. LQFP Package Reference**

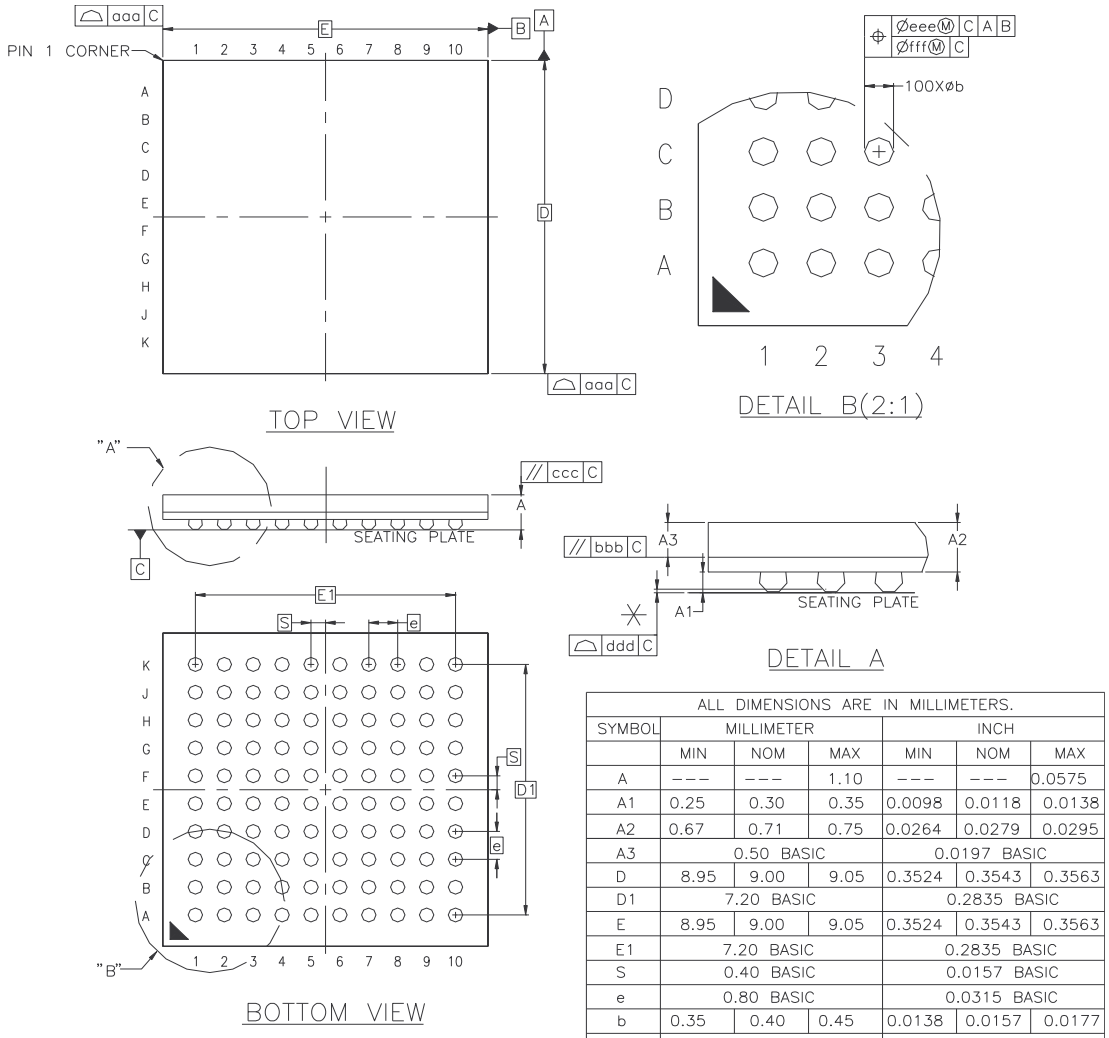
| | |
|---|---|
| JEDEC Drawing Reference | MS-026 |
| JESD97 Classification | e3 |

**Table 5-3. LQFP Package Characteristics**

| | |
|---|---|
| Moisture Sensitivity Level | 3 |

This package respects the recommendations of the NEMI User Group.

**Figure 5-2. 100-ball TFBGA Package Drawing**




| ALL DIMENSIONS ARE IN MILLIMETERS. | | | | | | |
|---|---|---|---|---|---|---|
| SYMBOL | MILLIMETER | | | INCH | | |
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | --- | --- | 1.10 | --- | --- | 0.0575 |
| A1 | 0.25 | 0.30 | 0.35 | 0.0098 | 0.0118 | 0.0138 |
| A2 | 0.67 | 0.71 | 0.75 | 0.0264 | 0.0279 | 0.0295 |
| A3 | 0.50 BASIC | | | 0.0197 BASIC | | |
| D | 8.95 | 9.00 | 9.05 | 0.3524 | 0.3543 | 0.3563 |
| D1 | 7.20 BASIC | | | 0.2835 BASIC | | |
| E | 8.95 | 9.00 | 9.05 | 0.3524 | 0.3543 | 0.3563 |
| E1 | 7.20 BASIC | | | 0.2835 BASIC | | |
| S | 0.40 BASIC | | | 0.0157 BASIC | | |
| e | 0.80 BASIC | | | 0.0315 BASIC | | |
| b | 0.35 | 0.40 | 0.45 | 0.0138 | 0.0157 | 0.0177 |
| aaa | 0.15 | | | 0.0059 | | |
| bbb | 0.20 | | | 0.0079 | | |
| ccc | 0.20 | | | 0.0079 | | |
| ddd | 0.12 | | | 0.0047 | | |
| eee | 0.15 | | | 0.0059 | | |
| fff | 0.08 | | | 0.0031 | | |

**Table 5-4. TFBGA Package Reference - Soldering Information (Substrate Level)**

| | |
|---|---|
| Ball Land | Diameter 0.35 mm |
| Soldering Mask Opening | 350 µm |

**Table 5-5. Device and 100-ball TFBGA Package Maximum Weight**

| | | |
|---|---|---|
| SAM4N | 140 | mg |

**Table 5-6. 100-ball TFBGA Package Characteristics**

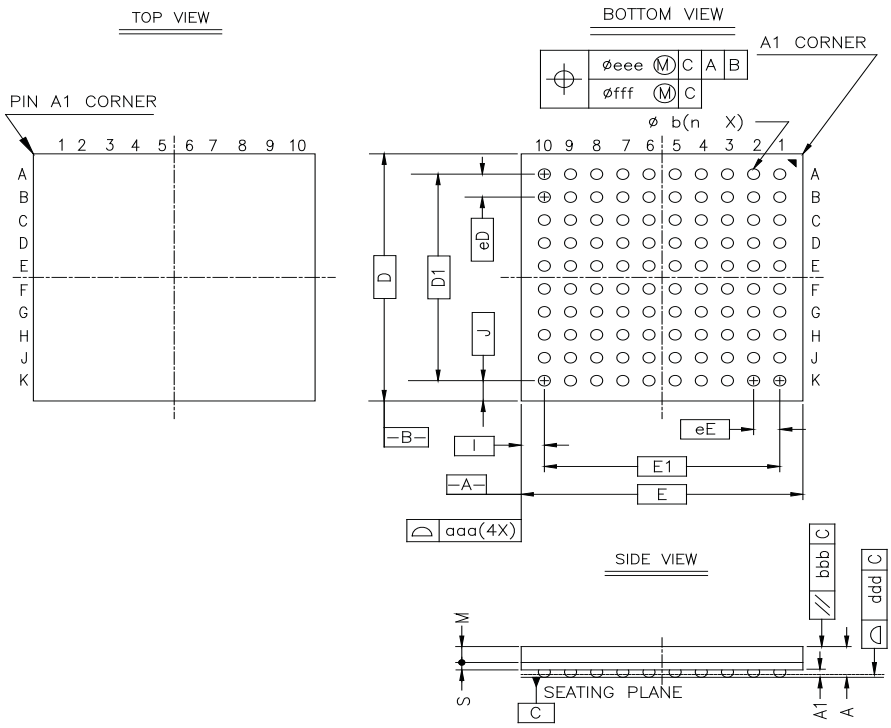
| | |
|---|---|
| Moisture Sensitivity Level | 3 |

**Table 5-7. 100-ball TFBGA Package Reference**

| | |
|---|---|
| JEDEC Drawing Reference | MO-275-DDAC-01 |
| JESD97 Classification | e8 |

This package respects the recommendations of the NEMI User Group.

**Figure 5-3. 100-ball VFBGA Package Drawing**




| | | Symbol | Common Dimensions |
|---|---|---|---|
| Package : | | | VFBGA |
| Body Size: | X | E | 7.000±0.100 |
| | Y | D | 7.000±0.100 |
| Ball Pitch : | X | eE | 0.650 |
| | Y | eD | 0.650 |
| Total Thickness : | | A | 1.000 MAX |
| Mold Thickness : | | M | 0.450 Ref. |
| Substrate Thickness : | | S | 0.210 Ref. |
| Ball Diameter : | | | 0.300 |
| Stand Off : | | A1 | 0.160 ~ 0.260 |
| Ball Width : | | b | 0.270 ~ 0.370 |
| Package Edge Tolerance : | | aaa | 0.100 |
| Mold Flatness : | | bbb | 0.100 |
| Coplanarity: | | ddd | 0.080 |
| Ball Offset (Package) : | | eee | 0.150 |
| Ball Offset (Ball) : | | fff | 0.080 |
| Ball Count : | | n | 100 |
| Edge Ball Center to Center : | X | E1 | 5.850 |
| | Y | D1 | 5.850 |
| Corner Ball Center to Package Edge: | X | I | 0.575 |
| | Y | J | 0.575 |

**Table 5-8. VFBGA Package Reference - Soldering Information (Substrate Level)**

| | |
|---|---|
| Ball Land | Diameter 0.27 mm |
| Soldering Mask Opening | 275 µm |

**Table 5-9. Device and 100-ball VFBGA Package Maximum Weight**

| | | |
|---|---|---|
| SAM4N | 75 | mg |

**Table 5-10. 100-ball VFBGA Package Characteristics**

| | |
|---|---|
| Moisture Sensitivity Level | 3 |

**Table 5-11. 100-ball VFBGA Package Reference**

| | |
|---|---|
| JEDEC Drawing Reference | MO-275-BBE-1 |
| JESD97 Classification | e8 |

This package respects the recommendations of the NEMI User Group.

**Figure 5-4. 64-lead LQFP Package Drawing**

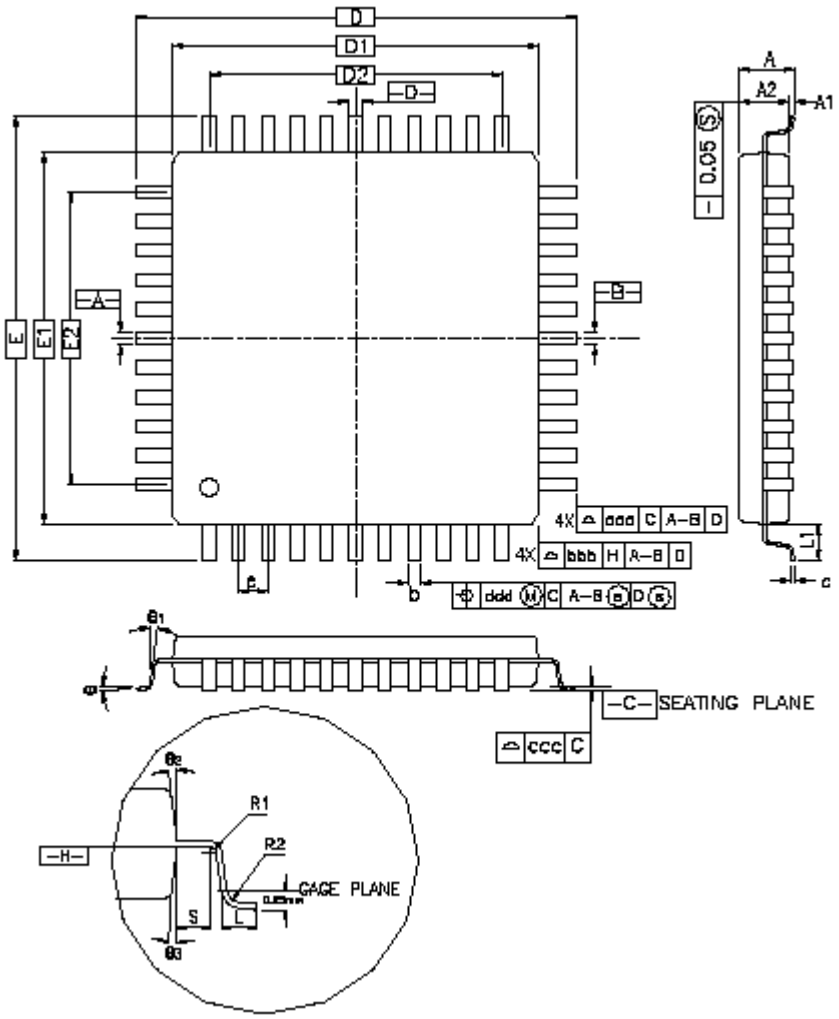


**Table 5-12. 64-lead LQFP Package Dimensions (in mm)**

| Symbol | Millimeter | | | Inch | | |
|---|---|---|---|---|---|---|
| | Min | Nom | Max | Min | Nom | Max |
| A | – | – | 1.60 | – | – | 0.063 |
| A1 | 0.05 | – | 0.15 | 0.002 | – | 0.006 |
| A2 | 1.35 | 1.40 | 1.45 | 0.053 | 0.055 | 0.057 |
| D | 12.00 BSC | | | 0.472 BSC | | |
| D1 | 10.00 BSC | | | 0.383 BSC | | |
| E | 12.00 BSC | | | 0.472 BSC | | |
| E1 | 10.00 BSC | | | 0.383 BSC | | |
| R2 | 0.08 | – | 0.20 | 0.003 | – | 0.008 |
| R1 | 0.08 | – | – | 0.003 | – | – |
| q | 0° | 3.5° | 7° | 0° | 3.5° | 7° |
| $\theta_1$ | 0° | – | – | 0° | – | – |
| $\theta_2$ | 11° | 12° | 13° | 11° | 12° | 13° |
| $\theta_3$ | 11° | 12° | 13° | 11° | 12° | 13° |
| c | 0.09 | – | 0.20 | 0.004 | – | 0.008 |
| L | 0.45 | 0.60 | 0.75 | 0.018 | 0.024 | 0.030 |
| L1 | 1.00 REF | | | 0.039 REF | | |
| S | 0.20 | – | – | 0.008 | – | – |
| b | 0.17 | 0.20 | 0.27 | 0.007 | 0.008 | 0.011 |
| e | 0.50 BSC. | | | 0.020 BSC. | | |
| D2 | 7.50 | | | 0.285 | | |
| E2 | 7.50 | | | 0.285 | | |
| Tolerances of Form and Position | | | | | | |
| aaa | 0.20 | | | 0.008 | | |
| bbb | 0.20 | | | 0.008 | | |
| ccc | 0.08 | | | 0.003 | | |
| ddd | 0.08 | | | 0.003 | | |

**Table 5-13. Device and LQFP Package Maximum Weight**

| | | |
|---|---|---|
| SAM4N | 750 | mg |

**Table 5-14. LQFP Package Reference**

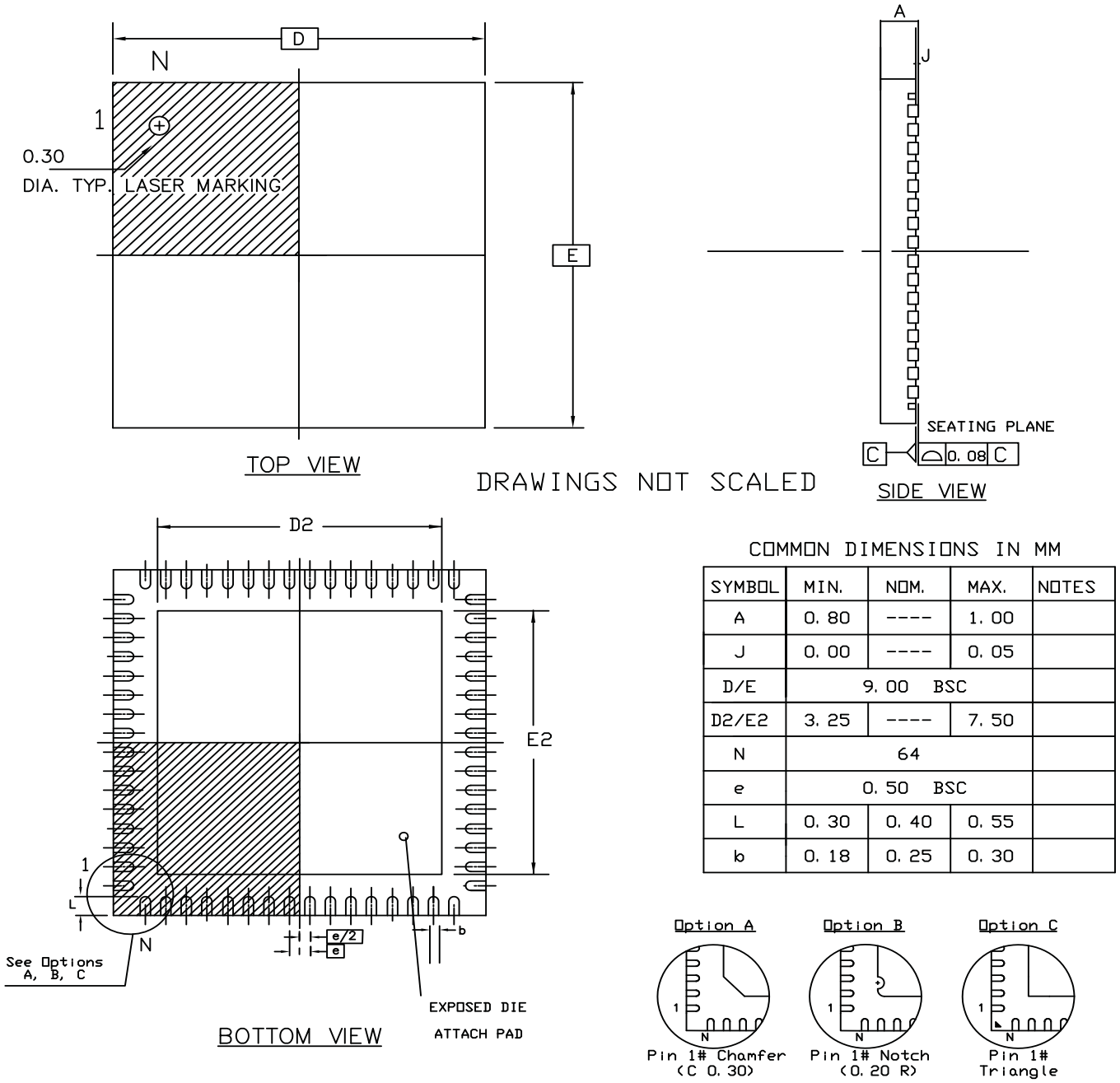
| | |
|---|---|
| JEDEC Drawing Reference | MS-026 |
| JESD97 Classification | e3 |

**Table 5-15. LQFP Package Characteristics**

| | |
|---|---|
| Moisture Sensitivity Level | 3 |

This package respects the recommendations of the NEMI User Group.

**Figure 5-5. 64-pad QFN Package Drawing**




COMMON DIMENSIONS IN MM

| SYMBOL | MIN. | NOM. | MAX. | NOTES |
|---|---|---|---|---|
| A | 0.80 | ---- | 1.00 | |
| J | 0.00 | ---- | 0.05 | |
| D/E | | 9.00 BSC | | |
| D2/E2 | 3.25 | ---- | 7.50 | |
| N | | 64 | | |
| e | | 0.50 BSC | | |
| L | 0.30 | 0.40 | 0.55 | |
| b | 0.18 | 0.25 | 0.30 | |

**Table 5-16. 64-pad QFN Package Dimensions (in mm)**

| Symbol | Millimeter | | | Inch | | |
|---|---|---|---|---|---|---|
| | Min | Nom | Max | Min | Nom | Max |
| A | – | – | 090 | – | – | 0.035 |
| A1 | – | – | 0.05 | – | – | 0.001 |
| A2 | – | 0.65 | 0.70 | – | 0.026 | 0.028 |
| A3 | | 0.20 REF | | | 0.008 REF | |
| b | 0.23 | 0.25 | 0.28 | 0.009 | 0.010 | 0.011 |
| D | | 9.00 BSC | | | 0.354 BSC | |
| D2 | 6.95 | 7.10 | 7.25 | 0.274 | 0.280 | 0.285 |
| E | | 9.00 BSC | | | 0.354 BSC | |
| E2 | 6.95 | 7.10 | 7.25 | 0.274 | 0.280 | 0.285 |
| L | 0.35 | 0.40 | 0.45 | 0.014 | 0.016 | 0.018 |
| e | | 0.50 BSC | | | 0.020 BSC | |
| R | 0.125 | – | – | 0.0005 | – | – |
| Tolerances of Form and Position | | | | | | |
| aaa | | 0.10 | | | 0.004 | |
| bbb | | 0.10 | | | 0.004 | |
| ccc | | 0.05 | | | 0.002 | |

**Table 5-17. Device and QFN Package Maximum Weight (Preliminary)**

| | | |
|---|---|---|
| SAM4N | 280 | mg |

**Table 5-18. QFN Package Reference**

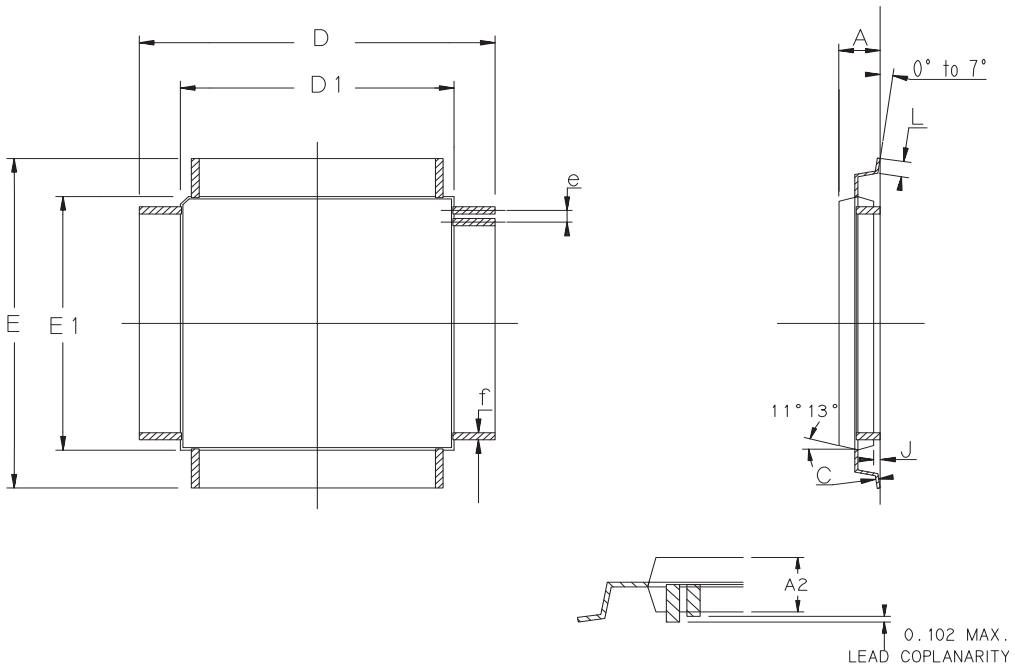
| | |
|---|---|
| JEDEC Drawing Reference | MO-220 |
| JESD97 Classification | e3 |

**Table 5-19. QFN Package Characteristics**

| | |
|---|---|
| Moisture Sensitivity Level | 3 |

This package respects the recommendations of the NEMI User Group.

**Figure 5-6. 48-lead LQFP Package Drawing**




| | MM | | INCH | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | – | 1.60 | – | .063 |
| C | 0.09 | 0.16 | .004 | .006 |
| A2 | 1.35 | 1.45 | .053 | .057 |
| D | 9.00 BSC | | .354 BSC | |
| D1 | 7.00 BSC | | .276 BSC | |
| E | 9.00 BSC | | .354 BSC | |
| E1 | 7.00 BSC | | .276 BSC | |
| J | 0.05 | 0.15 | .002 | .006 |
| L | 0.45 | 0.75 | .018 | .030 |
| e | 0.50 BSC | | .0197 BSC | |
| f | 0.17 | 0.27 | .007 | .011 |

**Table 5-20. 48-lead LQFP Package Dimensions (in mm)**

| Symbol | Millimeter | | | Inch | | |
|---|---|---|---|---|---|---|
| | Min | Nom | Max | Min | Nom | Max |
| A | – | – | 1.60 | – | – | 0.063 |
| A1 | 0.05 | – | 0.15 | 0.002 | – | 0.006 |
| A2 | 1.35 | 1.40 | 1.45 | 0.053 | 0.055 | 0.057 |
| D | 9.00 BSC | | | 0.354SC | | |
| D1 | 7.00 BSC | | | 0.276 BSC | | |
| E | 9.00 BSC | | | 0.354 BSC | | |
| E1 | 7.00 BSC | | | 0.276 BSC | | |
| R2 | 0.08 | – | 0.20 | 0.003 | – | 0.008 |
| R1 | 0.08 | – | – | 0.003 | – | – |
| q | 0° | 3.5° | 7° | 0° | 3.5° | 7° |
| $\theta_1$ | 0° | – | – | 0° | – | – |
| $\theta_2$ | 11° | 12° | 13° | 11° | 12° | 13° |
| $\theta_3$ | 11° | 12° | 13° | 11° | 12° | 13° |
| c | 0.09 | – | 0.20 | 0.004 | – | 0.008 |
| L | 0.45 | 0.60 | 0.75 | 0.018 | 0.024 | 0.030 |
| L1 | 1.00 REF | | | 0.039 REF | | |
| S | 0.20 | – | – | 0.008 | – | – |
| b | 0.17 | 0.20 | 0.27 | 0.007 | 0.008 | 0.011 |
| e | 0.50 BSC. | | | 0.020 BSC. | | |
| D2 | 5.50 | | | 0.217 | | |
| E2 | 5.50 | | | 0.217 | | |
| Tolerances of Form and Position | | | | | | |
| aaa | 0.20 | | | 0.008 | | |
| bbb | 0.20 | | | 0.008 | | |
| ccc | 0.08 | | | 0.003 | | |
| ddd | 0.08 | | | 0.003 | | |

**Table 5-21. Device and LQFP Package Maximum Weight**

| | | |
|---|---|---|
| SAM4N | 190 | mg |

**Table 5-22. LQFP Package Characteristics**

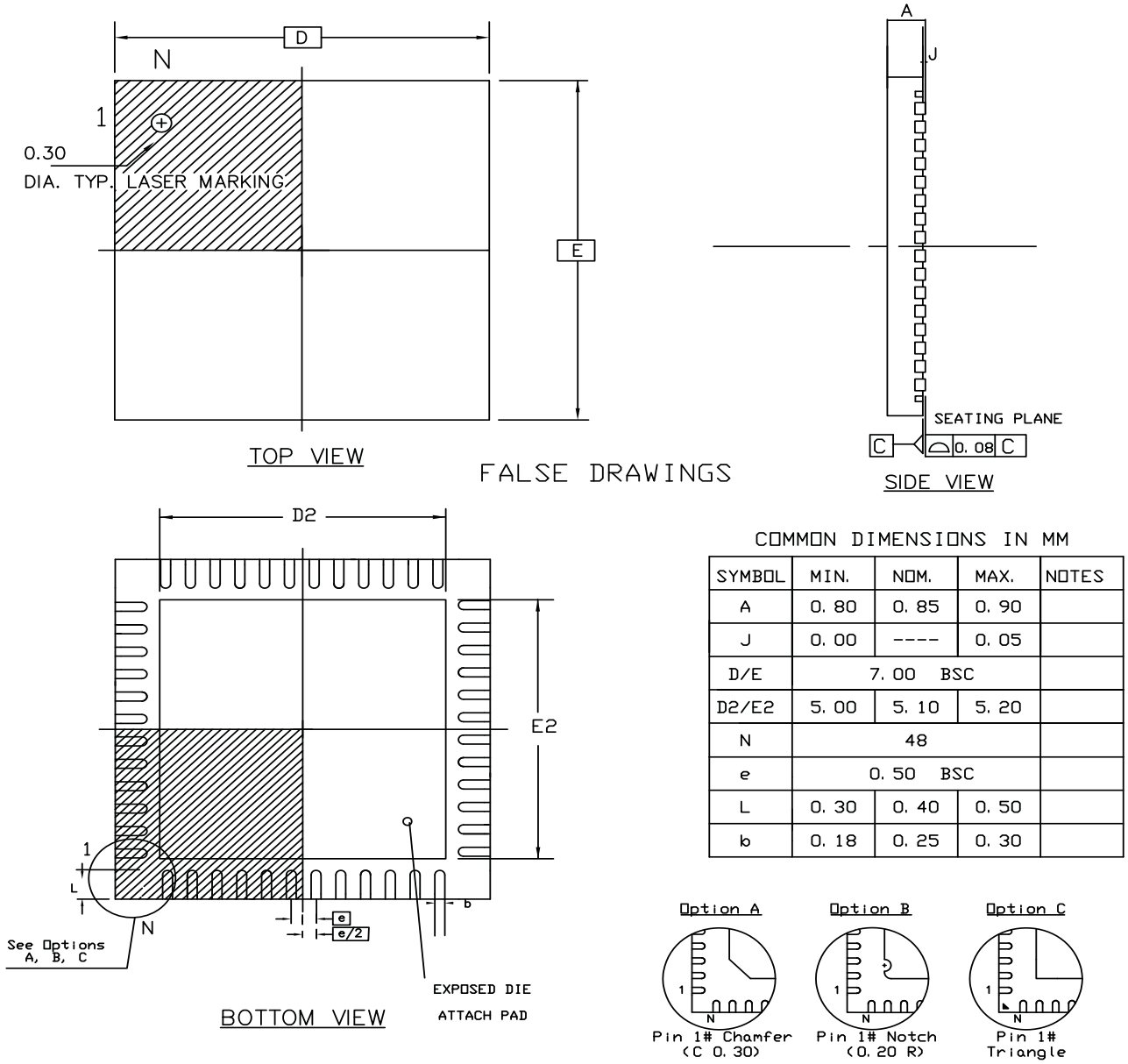
| | |
|---|---|
| Moisture Sensitivity Level | 3 |

**Table 5-23. LQFP Package Reference**

| | |
|---|---|
| JEDEC Drawing Reference | MS-026 |
| JESD97 Classification | e3 |

This package respects the recommendations of the NEMI User Group.

**Figure 5-7. 48-pad QFN Package Drawing**




COMMON DIMENSIONS IN MM

| SYMBOL | MIN. | NOM. | MAX. | NOTES |
|---|---|---|---|---|
| A | 0.80 | 0.85 | 0.90 | |
| J | 0.00 | ---- | 0.05 | |
| D/E | | 7.00 BSC | | |
| D2/E2 | 5.00 | 5.10 | 5.20 | |
| N | | 48 | | |
| e | | 0.50 BSC | | |
| L | 0.30 | 0.40 | 0.50 | |
| b | 0.18 | 0.25 | 0.30 | |

**Table 5-24. 48-pad QFN Package Dimensions (in mm)**

| Symbol | Millimeter | | | Inch | | |
|---|---|---|---|---|---|---|
| | Min | Nom | Max | Min | Nom | Max |
| A | – | – | 090 | – | – | 0.035 |
| A1 | – | – | 0.05 | – | – | 0.002 |
| A2 | – | 0.65 | 0.70 | – | 0.026 | 0.028 |
| A3 | | 0.20 REF | | | 0.008 REF | |
| b | 0.18 | 0.20 | 0.23 | 0.007 | 0.008 | 0.009 |
| D | | 7.00 BSC | | | 0.276 BSC | |
| D2 | 5.45 | 5.60 | 5.75 | 0.215 | 0.220 | 0.226 |
| E | | 7.00 BSC | | | 0.274 BSC | |
| E2 | 5.45 | 5.60 | 5.75 | 0.215 | 0.220 | 0.226 |
| L | 0.35 | 0.40 | 0.45 | 0.014 | 0.016 | 0.018 |
| e | | 0.50 BSC | | | 0.020 BSC | |
| R | 0.09 | – | – | 0.004 | – | – |
| Tolerances of Form and Position | | | | | | |
| aaa | | 0.10 | | | 0.004 | |
| bbb | | 0.10 | | | 0.004 | |
| ccc | | 0.05 | | | 0.002 | |

**Table 5-25. Device and QFN Package Maximum Weight**

| | | |
|---|---|---|
| SAM4N | 142 | mg |

**Table 5-26. QFN Package Characteristics**

| | |
|---|---|
| Moisture Sensitivity Level | 3 |

**Table 5-27. QFN Package Reference**

| | |
|---|---|
| JEDEC Drawing Reference | MO-220 |
| JESD97 Classification | e3 |

This package respects the recommendations of the NEMI User Group.

# 6. Ordering Information

**Table 6-1. Ordering Codes for SAM4N Devices**

| Ordering Code | MRL | Flash (Kbytes) | RAM (Kbytes) | Package | Conditioning | Package Type | Temperature Operating Range |
|---|---|---|---|---|---|---|---|
| ATSAM4N16CA-CFU | A | 1024 | 80 | VFBGA 100 | Tray | Green | Industrial -40°C to 85°C |
| ATSAM4N16CA-CFUR | A | 1024 | 80 | VFBGA 100 | Reel | Green | |
| ATSAM4N16CA-CU | A | 1024 | 80 | TFBGA100 | Tray | Green | Industrial -40°C to 85°C |
| ATSAM4N16CA-CUR | A | 1024 | 80 | TFBGA100 | Reel | Green | |
| ATSAM4N16CA-AU | A | 1024 | 80 | QFP100 | Tray | Green | Industrial -40°C to 85°C |
| ATSAM4N16CA-AUR | A | 1024 | 80 | QFP100 | Reel | Green | |
| ATSAM4N16BA-AU | A | 1024 | 80 | QFP64 | Tray | Green | Industrial -40°C to 85°C |
| ATSAM4N16BA-AUR | A | 1024 | 80 | QFP64 | Reel | Green | |
| ATSAM4N16BA-MU | A | 1024 | 80 | QFN64 | Tray | Green | Industrial -40°C to 85°C |
| ATSAM4N16BA-MUR | A | 1024 | 80 | QFN64 | Reel | Green | |
| ATSAM4N8CA-CFU | A | 512 | 64 | VFBGA 100 | Tray | Green | Industrial -40°C to 85°C |
| ATSAM4N8CA-CFUR | A | 512 | 64 | VFBGA 100 | Reel | Green | |
| ATSAM4N8CA-CU | A | 512 | 64 | TFBGA100 | Tray | Green | Industrial -40°C to 85°C |
| ATSAM4N8CA-CUR | A | 512 | 64 | TFBGA100 | Reel | Green | |
| ATSAM4N8CA-AU | A | 512 | 64 | QFP100 | Tray | Green | Industrial -40°C to 85°C |
| ATSAM4N8CA-AUR | A | 512 | 64 | QFP100 | Reel | Green | |
| ATSAM4N8BA-AU | A | 512 | 64 | QFP64 | Tray | Green | Industrial -40°C to 85°C |
| ATSAM4N8BA-AUR | A | 512 | 64 | QFP64 | Reel | Green | |
| ATSAM4N8BA-MU | A | 512 | 64 | QFN64 | Tray | Green | Industrial -40°C to 85°C |
| ATSAM4N8BA-MUR | A | 512 | 64 | QFN64 | Reel | Green | |
| ATSAM4N8AA-AU | A | 512 | 64 | QFP48 | Tray | Green | Industrial -40°C to 85°C |
| ATSAM4N8AA-AUR | A | 512 | 64 | QFP48 | Reel | Green | |
| ATSAM4N8AA-MU | A | 512 | 64 | QFN48 | Tray | Green | Industrial -40°C to 85°C |
| ATSAM4N8AA-MUR | A | 512 | 64 | QFN48 | Reel | Green | |

## Revision History

| Doc. Rev. 11158AS | Comments | Change Request Ref. |
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