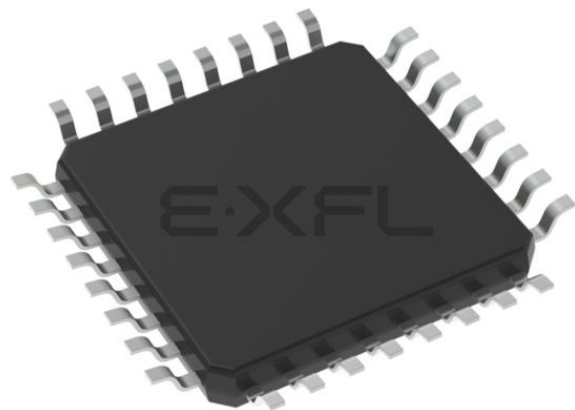




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### What is "[Embedded - Microcontrollers](#)"?

"[Embedded - Microcontrollers](#)" refer to small, integrated circuits designed to perform specific tasks within larger systems. These microcontrollers are essentially compact computers on a single chip, containing a processor core, memory, and programmable input/output peripherals. They are called "embedded" because they are embedded within electronic devices to control various functions, rather than serving as standalone computers. Microcontrollers are crucial in modern electronics, providing the intelligence and control needed for a wide range of applications.

### Applications of "[Embedded - Microcontrollers](#)"

#### Details

|                            |                                                                                                                                                                     |
|----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product Status             | Active                                                                                                                                                              |
| Core Processor             | ARM® Cortex®-M0+                                                                                                                                                    |
| Core Size                  | 32-Bit Single-Core                                                                                                                                                  |
| Speed                      | 48MHz                                                                                                                                                               |
| Connectivity               | I <sup>2</sup> C, SPI, UART/USART                                                                                                                                   |
| Peripherals                | Brown-out Detect/Reset, POR, WDT                                                                                                                                    |
| Number of I/O              | 26                                                                                                                                                                  |
| Program Memory Size        | 32KB (32K x 8)                                                                                                                                                      |
| Program Memory Type        | FLASH                                                                                                                                                               |
| EEPROM Size                | -                                                                                                                                                                   |
| RAM Size                   | 4K x 8                                                                                                                                                              |
| Voltage - Supply (Vcc/Vdd) | 1.62V ~ 3.6V                                                                                                                                                        |
| Data Converters            | A/D 10x12b; D/A 1x10b                                                                                                                                               |
| Oscillator Type            | Internal                                                                                                                                                            |
| Operating Temperature      | -40°C ~ 105°C (TA)                                                                                                                                                  |
| Mounting Type              | Surface Mount                                                                                                                                                       |
| Package / Case             | 32-TQFP                                                                                                                                                             |
| Supplier Device Package    | 32-TQFP (7x7)                                                                                                                                                       |
| Purchase URL               | <a href="https://www.e-xfl.com/product-detail/microchip-technology/atsamd20e15a-ant">https://www.e-xfl.com/product-detail/microchip-technology/atsamd20e15a-ant</a> |

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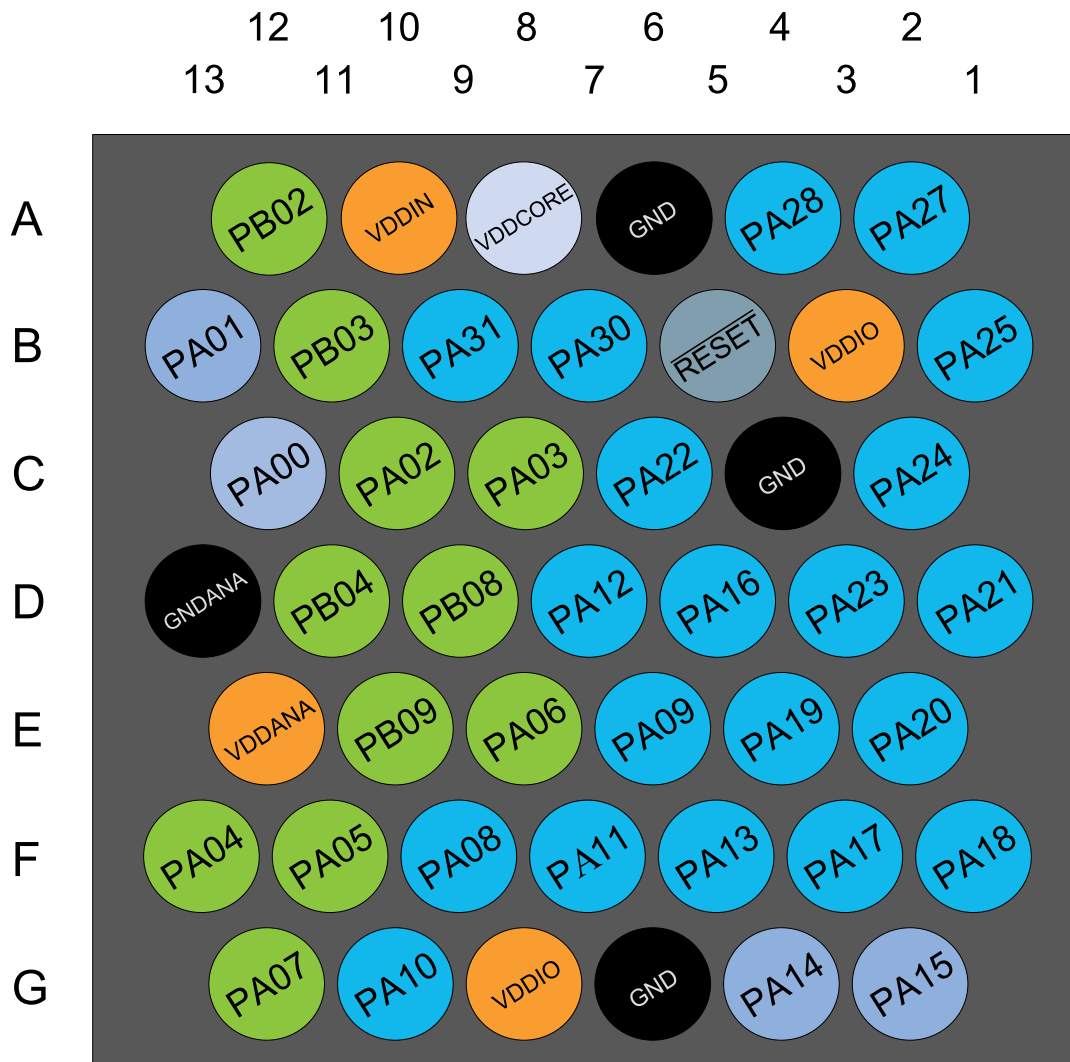
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## 2. Configuration Summary

|                                                   | SAM D20J                                                                                                                                                                                                                                                                            | SAM D20G                              | SAM D20E                              |
|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---------------------------------------|
| Pins                                              | 64                                                                                                                                                                                                                                                                                  | 48                                    | 32                                    |
| General Purpose I/O-pins (GPIOs)                  | 52                                                                                                                                                                                                                                                                                  | 38                                    | 26                                    |
| Flash                                             | 256/128/64/32KB                                                                                                                                                                                                                                                                     | 256/128/64/32KB                       | 256/128/64/32KB                       |
| SRAM                                              | 32/16/8/4/2KB                                                                                                                                                                                                                                                                       | 32/16/8/4/2KB                         | 32/16/8/4/2KB                         |
| Timer Counter (TC) instances                      | 8                                                                                                                                                                                                                                                                                   | 6                                     | 6                                     |
| Waveform output channels per TC instance          | 2                                                                                                                                                                                                                                                                                   | 2                                     | 2                                     |
| Serial Communication Interface (SERCOM) instances | 6                                                                                                                                                                                                                                                                                   | 6                                     | 4                                     |
| Analog-to-Digital Converter (ADC) channels        | 20                                                                                                                                                                                                                                                                                  | 14                                    | 10                                    |
| Analog Comparators (AC)                           | 2                                                                                                                                                                                                                                                                                   | 2                                     | 2                                     |
| Digital-to-Analog Converter (DAC) channels        | 1                                                                                                                                                                                                                                                                                   | 1                                     | 1                                     |
| Real-Time Counter (RTC)                           | Yes                                                                                                                                                                                                                                                                                 | Yes                                   | Yes                                   |
| RTC alarms                                        | 1                                                                                                                                                                                                                                                                                   | 1                                     | 1                                     |
| RTC compare values                                | One 32-bit value or two 16-bit values                                                                                                                                                                                                                                               | One 32-bit value or two 16-bit values | One 32-bit value or two 16-bit values |
| External Interrupt lines                          | 16                                                                                                                                                                                                                                                                                  | 16                                    | 16                                    |
| Peripheral Touch Controller (PTC) X and Y lines   | 16x16                                                                                                                                                                                                                                                                               | 12x10                                 | 10x6                                  |
| Maximum CPU frequency                             | 48MHz                                                                                                                                                                                                                                                                               |                                       |                                       |
| Packages                                          | QFN<br>TQFP<br>UFBGA                                                                                                                                                                                                                                                                | QFN<br>TQFP<br>WLCSP                  | QFN<br>TQFP                           |
| Oscillators                                       | 32.768kHz crystal oscillator (XOSC32K)<br>0.4-32MHz crystal oscillator (XOSC)<br>32.768kHz internal oscillator (OSC32K)<br>32KHz ultra-low-power internal oscillator (OSCULP32K)<br>8MHz high-accuracy internal oscillator (OSC8M)<br>48MHz Digital Frequency Locked Loop (DFLL48M) |                                       |                                       |
| Event System channels                             | 8                                                                                                                                                                                                                                                                                   | 8                                     | 8                                     |
| SW Debug Interface                                | Yes                                                                                                                                                                                                                                                                                 | Yes                                   | Yes                                   |
| Watchdog Timer (WDT)                              | Yes                                                                                                                                                                                                                                                                                 | Yes                                   | Yes                                   |

| Ordering Code    | FLASH (bytes) | SRAM (bytes) | Package | Carrier Type |
|------------------|---------------|--------------|---------|--------------|
| ATSAMD20J15A-AU  | 32K           | 4K           | TQFP64  | Tray         |
| ATSAMD20J15A-AUT |               |              |         | Tape & Reel  |
| ATSAMD20J15A-AN  |               |              |         | Tray         |
| ATSAMD20J15A-ANT |               |              |         | Tape & Reel  |
| ATSAMD20J15A-MU  |               |              | QFN64   | Tray         |
| ATSAMD20J15A-MUT |               |              |         | Tape & Reel  |
| ATSAMD20J15A-MN  |               |              |         | Tray         |
| ATSAMD20J15A-MNT |               |              |         | Tape & Reel  |
| ATSAMD20J16A-AU  | 64K           | 8K           | TQFP64  | Tray         |
| ATSAMD20J16A-AUT |               |              |         | Tape & Reel  |
| ATSAMD20J16A-AN  |               |              |         | Tray         |
| ATSAMD20J16A-ANT |               |              |         | Tape & Reel  |
| ATSAMD20J16A-MU  |               |              | QFN64   | Tray         |
| ATSAMD20J16A-MUT |               |              |         | Tape & Reel  |
| ATSAMD20J16A-MN  |               |              |         | Tray         |
| ATSAMD20J16A-MNT |               |              |         | Tape & Reel  |
| ATSAMD20J16A-CU  |               |              | UFBGA64 | Tray         |
| ATSAMD20J16A-CUT |               |              |         | Tape & Reel  |
| ATSAMD20J17A-AU  | 128K          | 16K          | TQFP64  | Tray         |
| ATSAMD20J17A-AUT |               |              |         | Tape & Reel  |
| ATSAMD20J17A-AN  |               |              |         | Tray         |
| ATSAMD20J17A-ANT |               |              |         | Tape & Reel  |
| ATSAMD20J17A-MU  |               |              | QFN64   | Tray         |
| ATSAMD20J17A-MUT |               |              |         | Tape & Reel  |
| ATSAMD20J17A-MN  |               |              |         | Tray         |
| ATSAMD20J17A-MNT |               |              |         | Tape & Reel  |
| ATSAMD20J17A-CU  |               |              | UFBGA64 | Tray         |
| ATSAMD20J17A-CUT |               |              |         | Tape & Reel  |

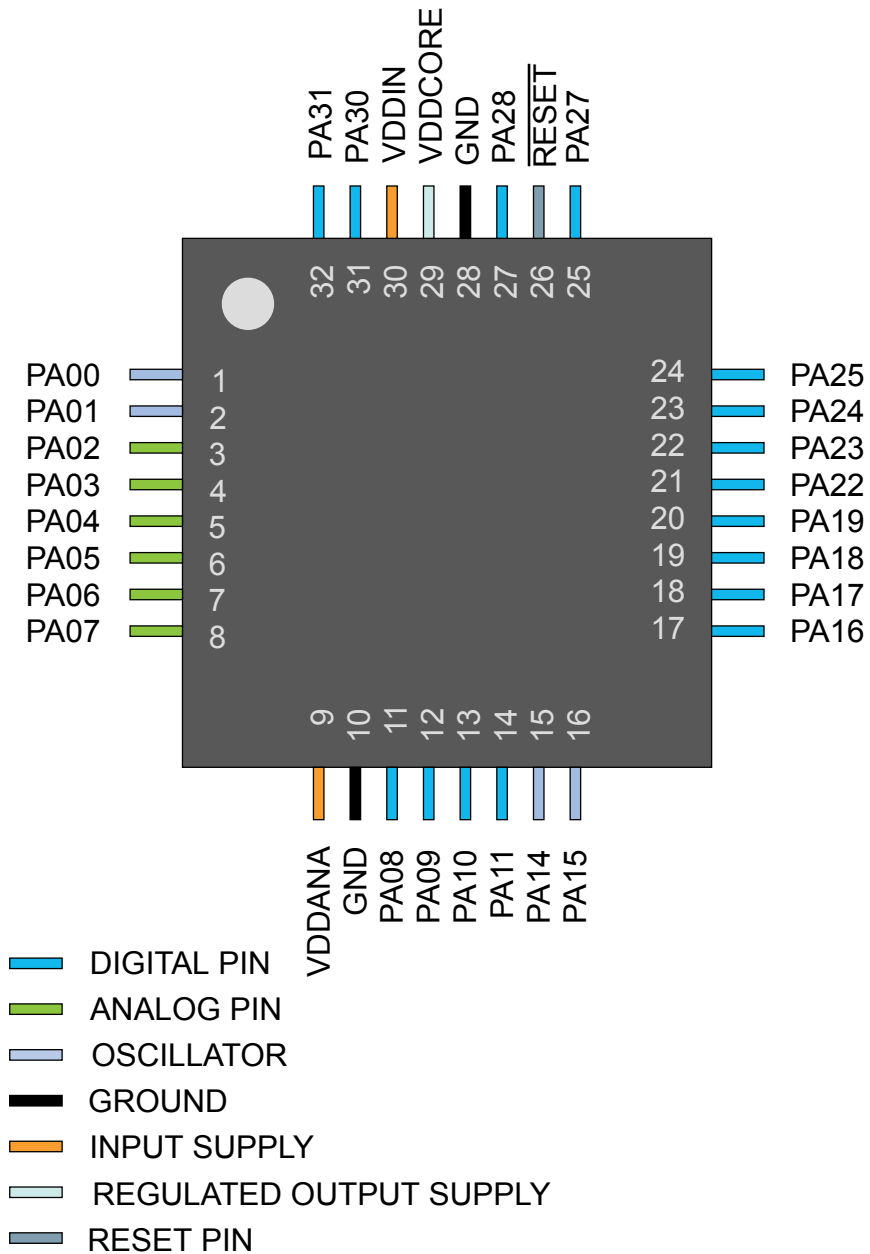
### 5.2.2. WLCSP45



- DIGITAL PIN
- ANALOG PIN
- OSCILLATOR
- GROUND
- INPUT SUPPLY
- REGULATED OUTPUT SUPPLY
- RESET PIN

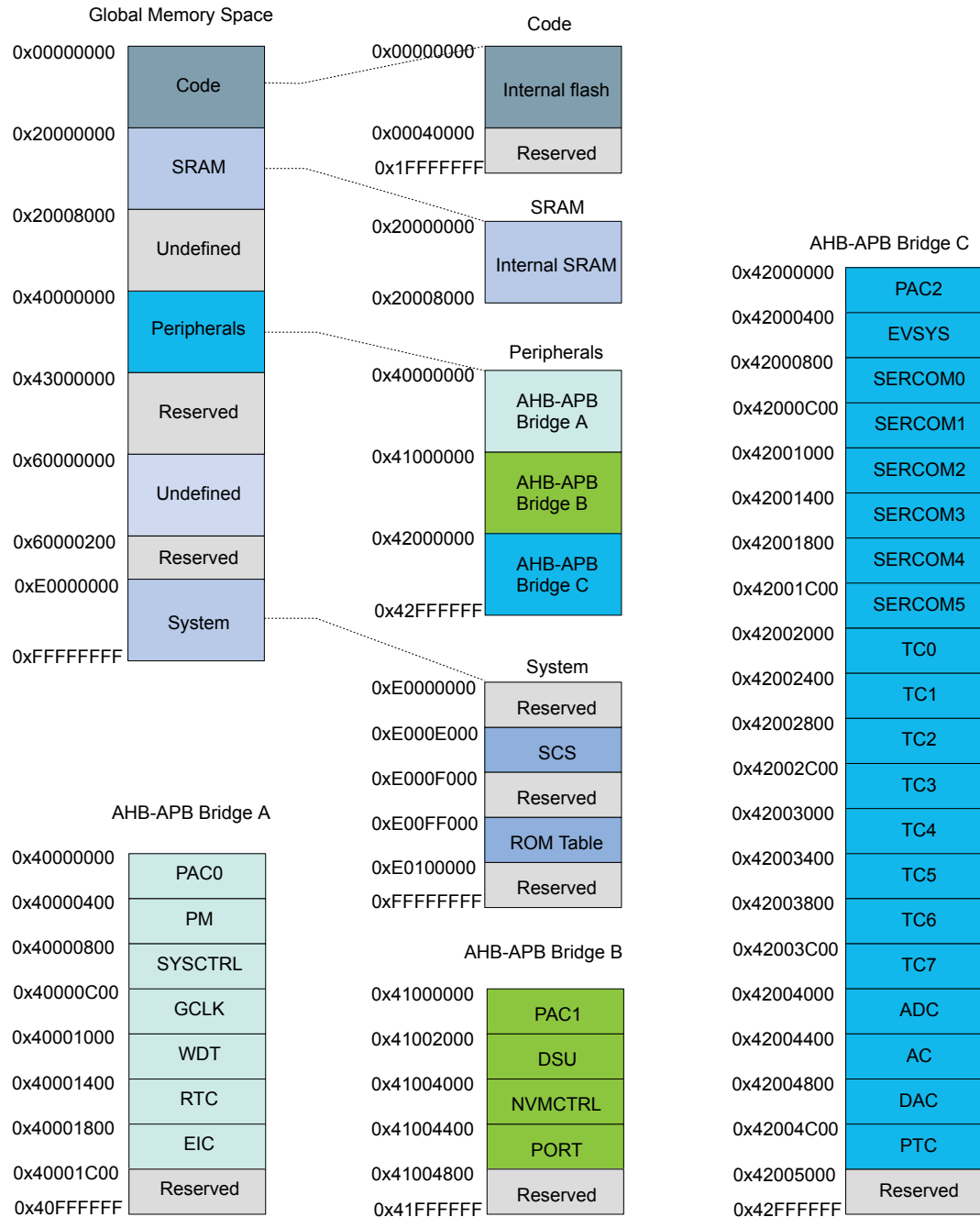
### 5.3. SAM D20E

#### 5.3.1. QFN32 / TQFP32



## 6. Product Mapping

Figure 6-1. Product Mapping



This figure represents the full configuration of the SAM D20 device with maximum flash and SRAM capabilities and a full set of peripherals. Refer to the [Configuration Summary](#) for details.

| Peripheral Source                 | NVIC Line |
|-----------------------------------|-----------|
| DAC – Digital-to-Analog Converter | 23        |
| PTC – Peripheral Touch Controller | 24        |

## 7.3. Micro Trace Buffer

### 7.3.1. Features

- Program flow tracing for the Cortex-M0+ processor
- MTB SRAM can be used for both trace and general purpose storage by the processor
- The position and size of the trace buffer in SRAM is configurable by software
- CoreSight compliant

### 7.3.2. Overview

When enabled, the MTB records changes in program flow, reported by the Cortex-M0+ processor over the execution trace interface shared between the Cortex-M0+ processor and the CoreSight MTB-M0+. This information is stored as trace packets in the SRAM by the MTB. An off-chip debugger can extract the trace information using the Debug Access Port to read the trace information from the SRAM. The debugger can then reconstruct the program flow from this information.

The MTB simultaneously stores trace information into the SRAM, and gives the processor access to the SRAM. The MTB ensures that trace write accesses have priority over processor accesses.

The execution trace packet consists of a pair of 32-bit words that the MTB generates when it detects the processor PC value changes non-sequentially. A non-sequential PC change can occur during branch instructions or during exception entry. See the CoreSight MTB-M0+ Technical Reference Manual for more details on the MTB execution trace packet format.

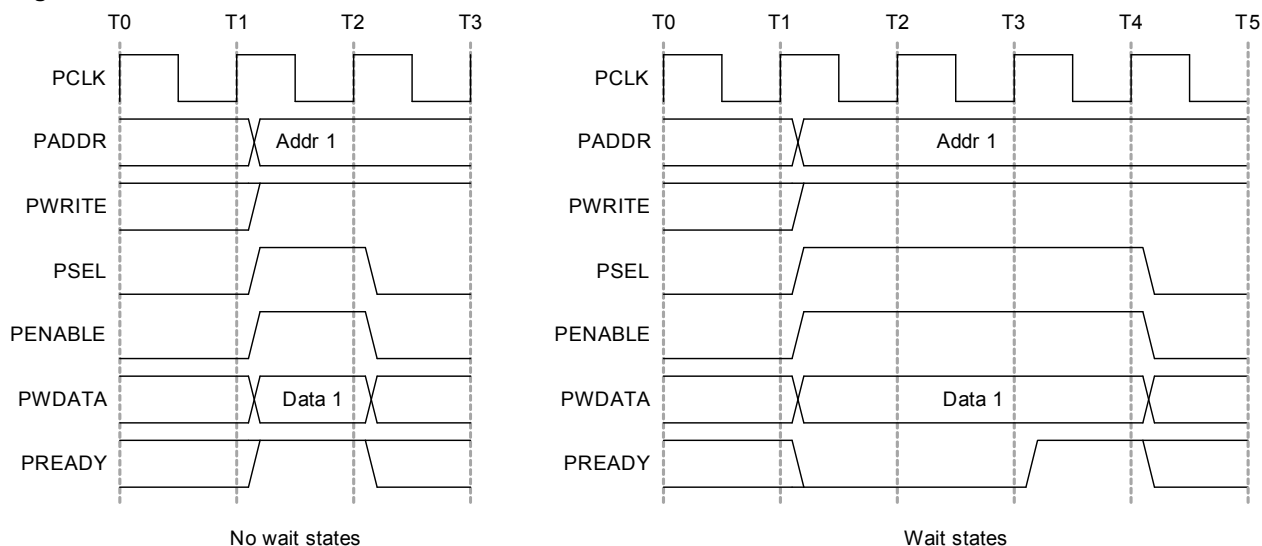
Tracing is enabled when the MASTER.EN bit in the Master Trace Control Register is 1. There are various ways to set the bit to 1 to start tracing, or to 0 to stop tracing. See the CoreSight Cortex-M0+ Technical Reference Manual for more details on the Trace start and stop and for a detailed description of the MTB's MASTER register. The MTB can be programmed to stop tracing automatically when the memory fills to a specified watermark level or to start or stop tracing by writing directly to the MASTER.EN bit. If the watermark mechanism is not being used and the trace buffer overflows, then the buffer wraps around overwriting previous trace packets.

The base address of the MTB registers is 0x41006000; this address is also written in the CoreSight ROM Table. The offset of each register from the base address is fixed and as defined by the CoreSight MTB-M0+ Technical Reference Manual. The MTB has 4 programmable registers to control the behavior of the trace features:

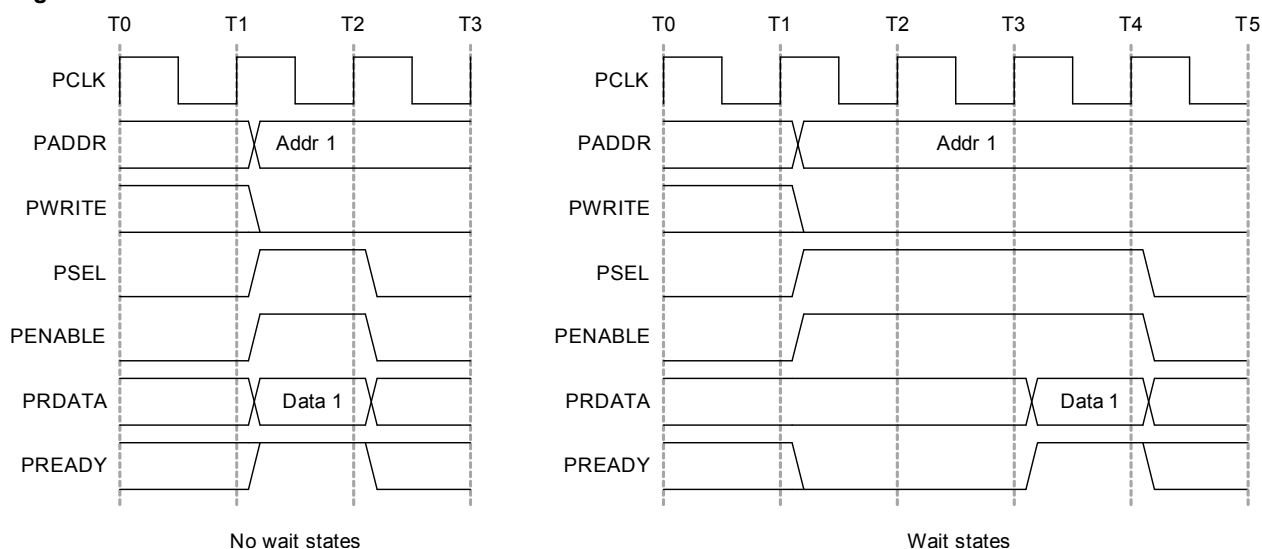
- POSITION: Contains the trace write pointer and the wrap bit,
- MASTER: Contains the main trace enable bit and other trace control fields,
- FLOW: Contains the WATERMARK address and the AUTOSTOP and AUTOHALT control bits,
- BASE: Indicates where the SRAM is located in the processor memory map. This register is provided to enable auto discovery of the MTB SRAM location, by a debug agent.

See the CoreSight MTB-M0+ Technical Reference Manual for a detailed description of these registers.

**Figure 7-1. APB Write Access.**



**Figure 7-2. APB Read Access.**



## Related Links

[Product Mapping](#) on page 19

## 7.6. PAC - Peripheral Access Controller

### 7.6.1. Overview

There is one PAC associated with each AHB-APB bridge. The PAC can provide write protection for registers of each peripheral connected on the same bridge.

The PAC peripheral bus clock (CLK\_PACx\_APB) can be enabled and disabled in the Power Manager. CLK\_PAC0\_APB and CLK\_PAC1\_APB are enabled at reset. CLK\_PAC2\_APB is disabled at reset. Refer to *PM – Power Manager* for details. The PAC will continue to operate in any sleep mode where the selected clock source is running. Write-protection does not apply for debugger access. When the debugger makes an access to a peripheral, write-protection is ignored so that the debugger can update the register.

### 7.7.1.1. Write Protect Clear

**Name:** WPCLR  
**Offset:** 0x00  
**Reset:** 0x000000  
**Property:** –

|        |    |     |     |     |      |         |     |    |
|--------|----|-----|-----|-----|------|---------|-----|----|
| Bit    | 31 | 30  | 29  | 28  | 27   | 26      | 25  | 24 |
|        |    |     |     |     |      |         |     |    |
| Access |    |     |     |     |      |         |     |    |
| Reset  |    |     |     |     |      |         |     |    |
| Bit    | 23 | 22  | 21  | 20  | 19   | 18      | 17  | 16 |
|        |    |     |     |     |      |         |     |    |
| Access |    |     |     |     |      |         |     |    |
| Reset  |    |     |     |     |      |         |     |    |
| Bit    | 15 | 14  | 13  | 12  | 11   | 10      | 9   | 8  |
|        |    |     |     |     |      |         |     |    |
| Access |    |     |     |     |      |         |     |    |
| Reset  |    |     |     |     |      |         |     |    |
| Bit    | 7  | 6   | 5   | 4   | 3    | 2       | 1   | 0  |
|        |    | EIC | RTC | WDT | GCLK | SYSCTRL | PM  |    |
| Access |    | R/W | R/W | R/W | R/W  | R/W     | R/W |    |
| Reset  |    | 0   | 0   | 0   | 0    | 0       | 0   |    |

#### Bit 6 – EIC

Writing a zero to these bits has no effect.

Writing a one to these bits will clear the Write Protect bit for the corresponding peripherals.

| Value | Description                   |
|-------|-------------------------------|
| 0     | Write-protection is disabled. |
| 1     | Write-protection is enabled.  |

#### Bit 5 – RTC

Writing a zero to these bits has no effect.

Writing a one to these bits will clear the Write Protect bit for the corresponding peripherals.

| Value | Description                   |
|-------|-------------------------------|
| 0     | Write-protection is disabled. |
| 1     | Write-protection is enabled.  |

#### Bit 4 – WDT

Writing a zero to these bits has no effect.

Writing a one to these bits will clear the Write Protect bit for the corresponding peripherals.

| Value | Description                   |
|-------|-------------------------------|
| 0     | Write-protection is disabled. |
| 1     | Write-protection is enabled.  |

#### Bit 1 – DSU

Writing a zero to these bits has no effect.

Writing a one to these bits will clear the Write Protect bit for the corresponding peripherals.

| Value | Description                   |
|-------|-------------------------------|
| 0     | Write-protection is disabled. |
| 1     | Write-protection is enabled.  |

### 7.7.2.2. Write Protect Set

**Name:** WPSET  
**Offset:** 0x04  
**Reset:** 0x000002  
**Property:** –

|        |    |     |    |    |      |         |     |    |
|--------|----|-----|----|----|------|---------|-----|----|
| Bit    | 31 | 30  | 29 | 28 | 27   | 26      | 25  | 24 |
|        |    |     |    |    |      |         |     |    |
| Access |    |     |    |    |      |         |     |    |
| Reset  |    |     |    |    |      |         |     |    |
| Bit    | 23 | 22  | 21 | 20 | 19   | 18      | 17  | 16 |
|        |    |     |    |    |      |         |     |    |
| Access |    |     |    |    |      |         |     |    |
| Reset  |    |     |    |    |      |         |     |    |
| Bit    | 15 | 14  | 13 | 12 | 11   | 10      | 9   | 8  |
|        |    |     |    |    |      |         |     |    |
| Access |    |     |    |    |      |         |     |    |
| Reset  |    |     |    |    |      |         |     |    |
| Bit    | 7  | 6   | 5  | 4  | 3    | 2       | 1   | 0  |
|        |    | MTB |    |    | PORT | NVMCTRL | DSU |    |
| Access |    | R/W |    |    | R/W  | R/W     | R/W |    |
| Reset  |    | 0   |    |    | 0    | 0       | 1   |    |

#### Bit 6 – MTB

Writing a zero to these bits has no effect.

Writing a one to these bits will clear the Write Protect bit for the corresponding peripherals.

| Value | Description                   |
|-------|-------------------------------|
| 0     | Write-protection is disabled. |
| 1     | Write-protection is enabled.  |

#### Bit 3 – PORT

Writing a zero to these bits has no effect.

Writing a one to these bits will clear the Write Protect bit for the corresponding peripherals.

| Value | Description                   |
|-------|-------------------------------|
| 0     | Write-protection is disabled. |
| 1     | Write-protection is enabled.  |

#### Bit 2 – NVMCTRL

Writing a zero to these bits has no effect.

Writing a one to these bits will clear the Write Protect bit for the corresponding peripherals.

| Value | Description                   |
|-------|-------------------------------|
| 0     | Write-protection is disabled. |
| 1     | Write-protection is enabled.  |

#### Bit 1 – DSU

Writing a zero to these bits has no effect.

Writing a one to these bits will clear the Write Protect bit for the corresponding peripherals.

| Value | Description                   |
|-------|-------------------------------|
| 0     | Write-protection is disabled. |
| 1     | Write-protection is enabled.  |

### 7.7.3. PAC2 Register Description

### 7.7.3.1. Write Protect Clear

**Name:** WPCLR  
**Offset:** 0x00  
**Reset:** 0x00800000  
**Property:** –

|        |         |         |         |         |         |         |       |     |
|--------|---------|---------|---------|---------|---------|---------|-------|-----|
| Bit    | 31      | 30      | 29      | 28      | 27      | 26      | 25    | 24  |
|        |         |         |         |         |         |         |       |     |
| Access |         |         |         |         |         |         |       |     |
| Reset  |         |         |         |         |         |         |       |     |
| Bit    | 23      | 22      | 21      | 20      | 19      | 18      | 17    | 16  |
|        |         |         |         |         | PTC     | DAC     | AC    | ADC |
| Access |         |         |         |         | R/W     | R/W     | R/W   | R/W |
| Reset  |         |         |         |         | 0       | 0       | 0     | 0   |
| Bit    | 15      | 14      | 13      | 12      | 11      | 10      | 9     | 8   |
|        | TC7     | TC6     | TC5     | TC4     | TC3     | TC2     | TC1   | TC0 |
| Access | R/W     | R/W     | R/W     | R/W     | R/W     | R/W     | R/W   | R/W |
| Reset  | 0       | 0       | 0       | 0       | 0       | 0       | 0     | 0   |
| Bit    | 7       | 6       | 5       | 4       | 3       | 2       | 1     | 0   |
|        | SERCOM5 | SERCOM4 | SERCOM3 | SERCOM2 | SERCOM1 | SERCOM0 | EVSYS |     |
| Access | R/W     | R/W     | R/W     | R/W     | R/W     | R/W     | R/W   |     |
| Reset  | 0       | 0       | 0       | 0       | 0       | 0       | 0     |     |

#### Bit 19 – PTC

Writing a zero to these bits has no effect.

Writing a one to these bits will clear the Write Protect bit for the corresponding peripherals.

| Value | Description                   |
|-------|-------------------------------|
| 0     | Write-protection is disabled. |
| 1     | Write-protection is enabled.  |

#### Bit 18 – DAC

Writing a zero to these bits has no effect.

Writing a one to these bits will clear the Write Protect bit for the corresponding peripherals.

| Value | Description                   |
|-------|-------------------------------|
| 0     | Write-protection is disabled. |
| 1     | Write-protection is enabled.  |

#### Bit 17 – AC

Writing a zero to these bits has no effect.

Writing a one to these bits will clear the Write Protect bit for the corresponding peripherals.

| Value | Description                   |
|-------|-------------------------------|
| 0     | Write-protection is disabled. |
| 1     | Write-protection is enabled.  |

#### Bit 16 – ADC

Writing a zero to these bits has no effect.

Writing a one to these bits will clear the Write Protect bit for the corresponding peripherals.

| Value | Description                   |
|-------|-------------------------------|
| 0     | Write-protection is disabled. |
| 1     | Write-protection is enabled.  |

#### Bits 15,14,13,12,11,10,9,8 – TCx

Writing a zero to these bits has no effect.

Writing a one to these bits will clear the Write Protect bit for the corresponding peripherals.

| Value | Description                   |
|-------|-------------------------------|
| 0     | Write-protection is disabled. |
| 1     | Write-protection is enabled.  |

#### Bits 7,6,5,4,3,2 – SERCOMx

Writing a zero to these bits has no effect.

Writing a one to these bits will clear the Write Protect bit for the corresponding peripherals.

| Value | Description                   |
|-------|-------------------------------|
| 0     | Write-protection is disabled. |
| 1     | Write-protection is enabled.  |

#### Bit 1 – EVSYS

Writing a zero to these bits has no effect.

Writing a one to these bits will clear the Write Protect bit for the corresponding peripherals.

| Value | Description                   |
|-------|-------------------------------|
| 0     | Write-protection is disabled. |
| 1     | Write-protection is enabled.  |

## 8. Packaging Information

### 8.1. Thermal Considerations

#### Related Links

[Junction Temperature](#) on page 39

#### 8.1.1. Thermal Resistance Data

The following *table* summarizes the thermal resistance data depending on the package.

**Table 8-1. Thermal Resistance Data**

| Package Type  | $\theta_{JA}$ | $\theta_{JC}$ |
|---------------|---------------|---------------|
| 32-pin TQFP   | 68.0°C/W      | 25.8°C/W      |
| 48-pin TQFP   | 78.8°C/W      | 12.3°C/W      |
| 64-pin TQFP   | 66.7°C/W      | 11.9°C/W      |
| 32-pin QFN    | 37.2°C/W      | 13.1°C/W      |
| 48-pin QFN    | 33.0°C/W      | 11.4°C/W      |
| 64-pin QFN    | 33.5°C/W      | 11.2°C/W      |
| 64-ball UFBGA | 67.4°C/W      | 12.4°C/W      |
| 45-ball WLCSP | 37.0°C/W      | 0.36°C/W      |

#### 8.1.2. Junction Temperature

The average chip-junction temperature,  $T_J$ , in °C can be obtained from the following:

1.  $T_J = T_A + (P_D \times \theta_{JA})$
2.  $T_J = T_A + (P_D \times (\theta_{HEATSINK} + \theta_{JC}))$

where:

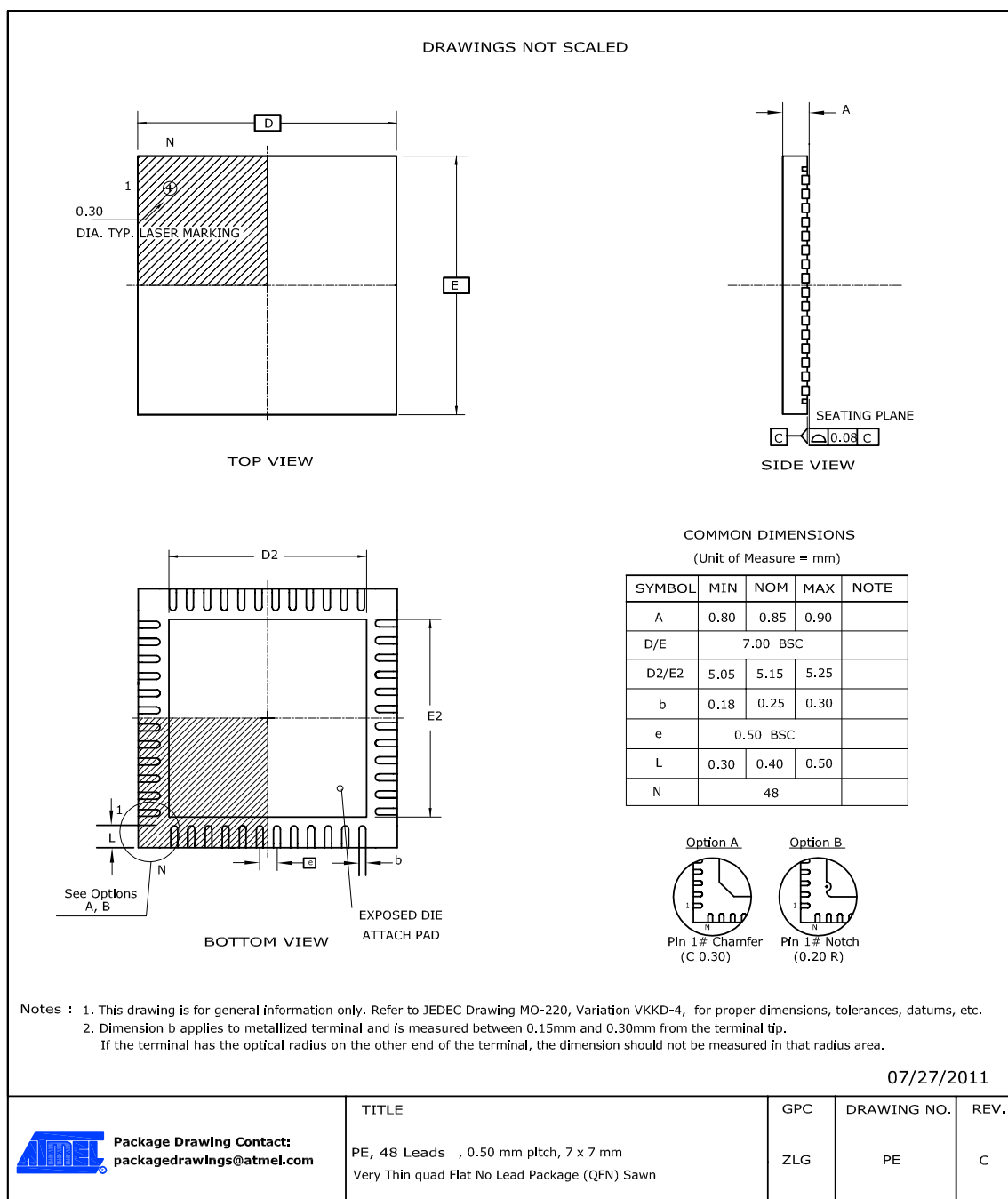
- $\theta_{JA}$  = Package thermal resistance, Junction-to-ambient (°C/W), see Thermal Resistance Data
- $\theta_{JC}$  = Package thermal resistance, Junction-to-case thermal resistance (°C/W), see Thermal Resistance Data
- $\theta_{HEATSINK}$  = Thermal resistance (°C/W) specification of the external cooling device
- $P_D$  = Device power consumption (W)
- $T_A$  = Ambient temperature (°C)

From the first equation, the user can derive the estimated lifetime of the chip and decide if a cooling device is necessary or not. If a cooling device is to be fitted on the chip, the second equation should be used to compute the resulting average chip-junction temperature  $T_J$  in °C.

#### Related Links

[Thermal Considerations](#) on page 39

## 8.2.5. 48 pin QFN



**Note:** The exposed die attach pad is not connected electrically inside the device.

**Table 8-14. Device and Package Maximum Weight**

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

**Table 8-15. Package Characteristics**

|                            |      |
|----------------------------|------|
| Moisture Sensitivity Level | MSL3 |
|----------------------------|------|

Table 8-16. Package Reference

|                         |        |
|-------------------------|--------|
| JEDEC Drawing Reference | MO-220 |
| JESD97 Classification   | E3     |

## 8.2.6. 45-ball WLCSP

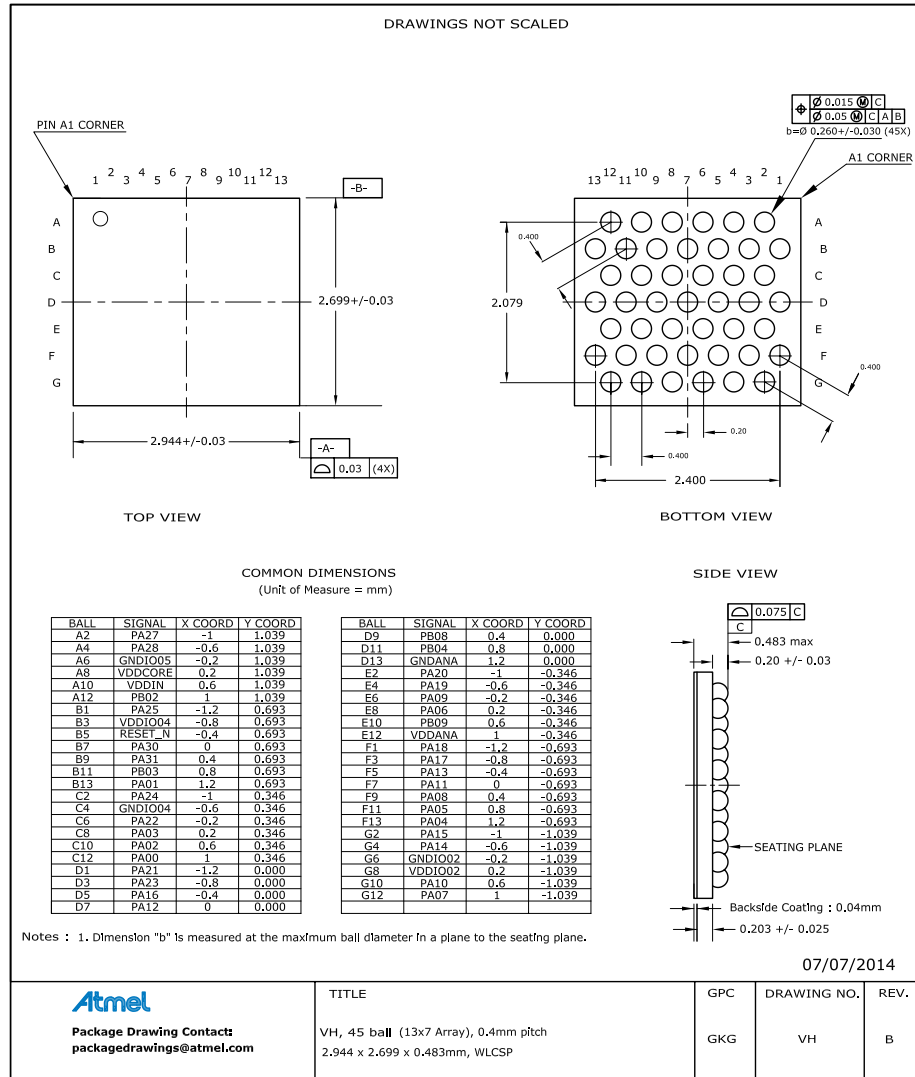


Table 8-17. Device and Package Maximum Weight

|     |    |
|-----|----|
| 7.3 | mg |
|-----|----|

Table 8-18. Package Characteristics

|                            |      |
|----------------------------|------|
| Moisture Sensitivity Level | MSL1 |
|----------------------------|------|

Table 8-19. Package Reference

|                         |        |
|-------------------------|--------|
| JEDEC Drawing Reference | MO-220 |
| JESD97 Classification   | E1     |

8.2.7. 32 pin TQFP

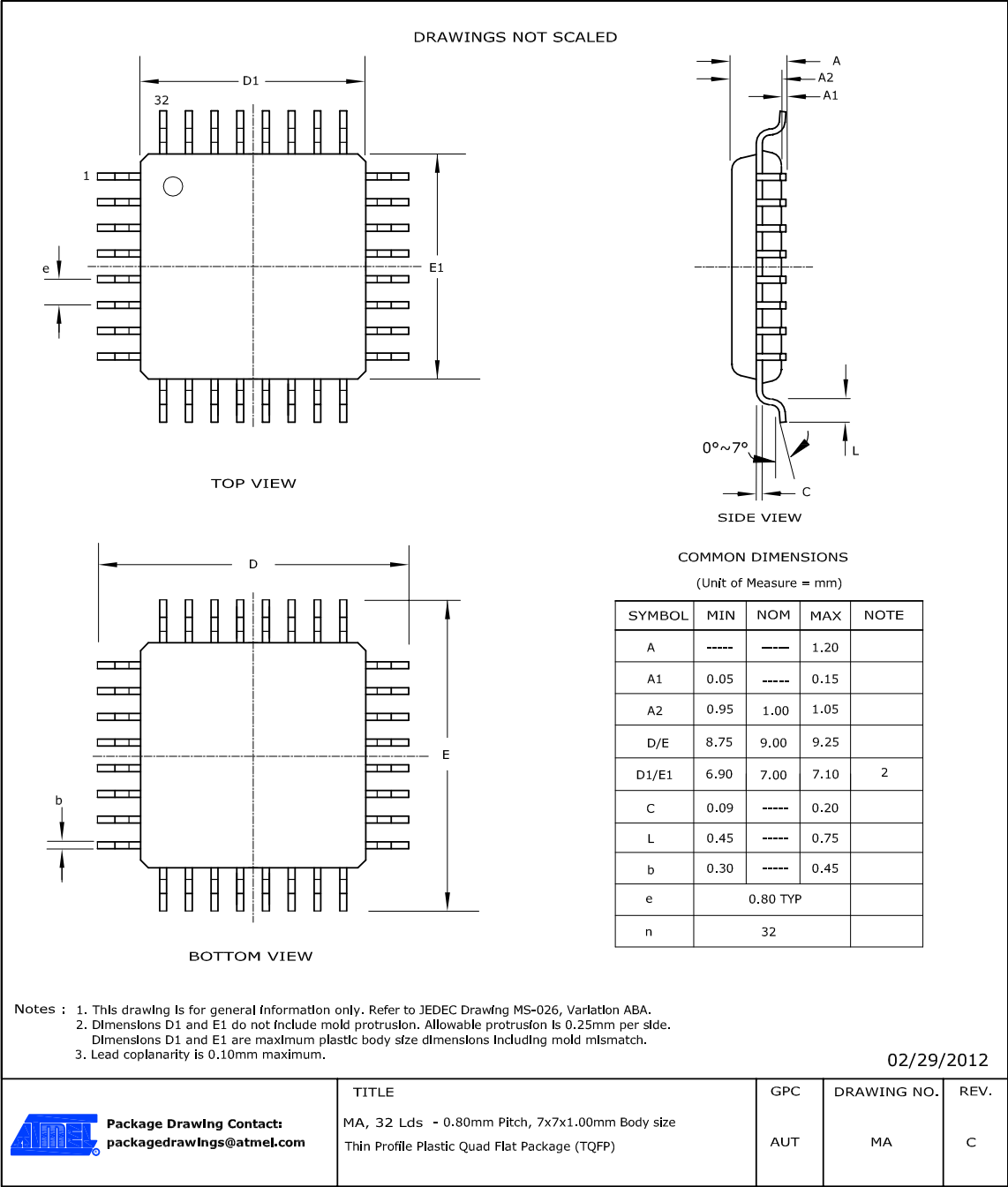


Table 8-20. Device and Package Maximum Weight

|     |    |
|-----|----|
| 100 | mg |
|-----|----|

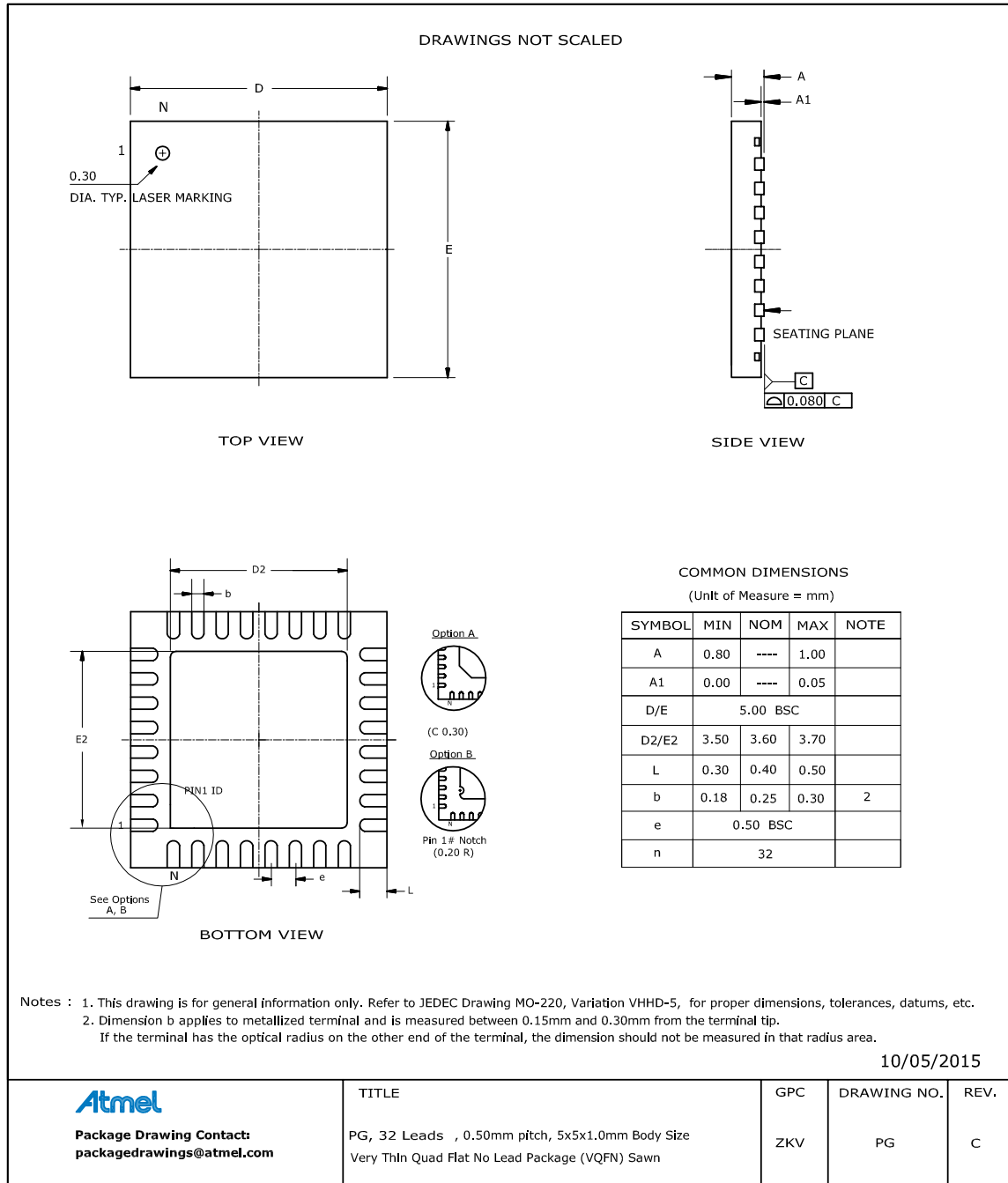
Table 8-21. Package Characteristics

|                            |      |
|----------------------------|------|
| Moisture Sensitivity Level | MSL3 |
|----------------------------|------|

**Table 8-22. Package Reference**

|                         |        |
|-------------------------|--------|
| JEDEC Drawing Reference | MS-026 |
| JESD97 Classification   | E3     |

### 8.2.8. 32 pin QFN



**Note:** The exposed die attach pad is connected inside the device to GND and GNDANA.

**Table 8-23. Device and Package Maximum Weight**

|    |    |
|----|----|
| 90 | mg |
|----|----|

**Table 8-27. Package Characteristics**

|                            |      |
|----------------------------|------|
| Moisture Sensitivity Level | MSL1 |
|----------------------------|------|

**Table 8-28. Package Reference**

|                         |        |
|-------------------------|--------|
| JEDEC Drawing Reference | MO-220 |
| JESD97 Classification   | E1     |

### 8.3. Soldering Profile

The following table gives the recommended soldering profile from J-STD-20.

**Table 8-29.**

| Profile Feature                            | Green Package  |
|--------------------------------------------|----------------|
| Average Ramp-up Rate (217°C to peak)       | 3°C/s max.     |
| Preheat Temperature 175°C ±25°C            | 150-200°C      |
| Time Maintained Above 217°C                | 60-150s        |
| Time within 5°C of Actual Peak Temperature | 30s            |
| Peak Temperature Range                     | 260°C          |
| Ramp-down Rate                             | 6°C/s max.     |
| Time 25°C to Peak Temperature              | 8 minutes max. |

A maximum of three reflow passes is allowed per component.