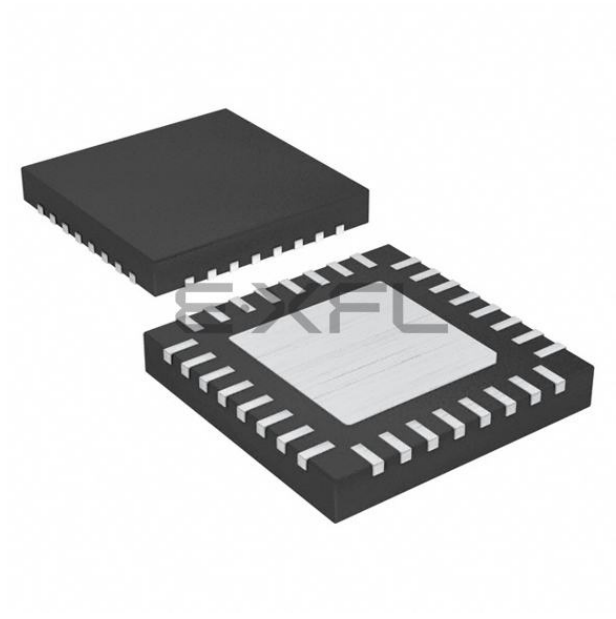


**Welcome to E-XFL.COM**

## 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 | AVR |
| Core Size | 8-Bit |
| Speed | 20MHz |
| Connectivity | I²C, SPI, UART/USART |
| Peripherals | Brown-out Detect/Reset, POR, WDT |
| Number of I/O | 27 |
| Program Memory Size | 32KB (16K x 16) |
| Program Memory Type | FLASH |
| EEPROM Size | 256 x 8 |
| RAM Size | 4K x 8 |
| Voltage - Supply (Vcc/Vdd) | 1.8V ~ 5.5V |
| Data Converters | A/D 12x10b |
| Oscillator Type | Internal |
| Operating Temperature | -40°C ~ 125°C (TA) |
| Mounting Type | Surface Mount |
| Package / Case | 32-VFQFN Exposed Pad |
| Supplier Device Package | 32-VFQFN (5x5) |
| Purchase URL | https://www.e-xfl.com/product-detail/microchip-technology/atmega3208-mfr |

# 4. I/O Multiplexing and Considerations

## 4.1 Multiplexed Signals

| QFN32/ TQFP32 | Pin name (1,2) | Special | ADC0 | AC0 | USARTn | SPI0 | TWI0 | TCA0 | TCBn | Other | CCL-LUTn |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 30 | PA0 | EXTCLK | | | 0,TxD | | | 0-WO0 | | | 0-IN0 |
| 31 | PA1 | | | | 0,RxD | | | 0-WO1 | | | 0-IN1 |
| 32 | PA2 | TWI | | | 0,XCK | | SDA(MS) | 0-WO2 | 0-WO | EVOUTA | 0-IN2 |
| 1 | PA3 | TWI | | | 0,XDIR | | SCL(MS) | 0-WO3 | 1-WO | | 0-OUT |
| 2 | PA4 | | | | 0,TxD(3) | MOSI | | 0-WO4 | | | |
| 3 | PA5 | | | | 0,RxD(3) | MISO | | 0-WO5 | | | |
| 4 | PA6 | | | | 0,XCK(3) | SCK | | | | | 0-OUT(3) |
| 5 | PA7 | CLKOUT | | OUT | 0,XDIR(3) | SS | | | | EVOUTA(3) | |
| 6 | PC0 | | | | 1,TxD | MOSI(3) | | 0-WO0(3) | 2-WO | | 1-IN0 |
| 7 | PC1 | | | | 1,RxD | MISO(3) | | 0-WO1(3) | 3-WO(3) | | 1-IN1 |
| 8 | PC2 | TWI | | | 1,XCK | SCK(3) | SDA(MS)(3) | 0-WO2(3) | | EVOUTC | 1-IN2 |
| 9 | PC3 | TWI | | | 1,XDIR | SS(3) | SCL(MS)(3) | 0-WO3(3) | | | 1-OUT |
| 10 | PD0 | | AIN0 | | | | | 0-WO0(3) | | | 2-IN0 |
| 11 | PD1 | | AIN1 | P3 | | | | 0-WO1(3) | | | 2-IN1 |
| 12 | PD2 | | AIN2 | P0 | | | | 0-WO2(3) | | EVOUTD | 2-IN2 |
| 13 | PD3 | | AIN3 | N0 | | | | 0-WO3(3) | | | 2-OUT |
| 14 | PD4 | | AIN4 | P1 | | | | 0-WO4(3) | | | |
| 15 | PD5 | | AIN5 | N1 | | | | 0-WO5(3) | | | |
| 16 | PD6 | | AIN6 | P2 | | | | | | | 2-OUT(3) |
| 17 | PD7 | VREFA | AIN7 | N2 | | | | | | EVOUTD(3) | |
| 18 | AVDD | | | | | | | | | | |
| 19 | GND | | | | | | | | | | |
| 20 | PF0 | TOSC1 | | | 2,TxD | | | 0-WO0(3) | | | 3-IN0 |
| 21 | PF1 | TOSC2 | | | 2,RxD | | | 0-WO1(3) | | | 3-IN1 |
| 22 | PF2 | TWI | AIN12 | | 2,XCK | | SDA(S)(3) | 0-WO2(3) | | EVOUTF | 3-IN2 |
| 23 | PF3 | TWI | AIN13 | | 2,XDIR | | SCL(S)(3) | 0-WO3(3) | | | 3-OUT |
| 24 | PF4 | | AIN14 | | 2,TxD(3) | | | 0-WO4(3) | 0-WO(3) | | |
| 25 | PF5 | | AIN15 | | 2,RxD(3) | | | 0-WO5(3) | 1-WO(3) | | |
| 26 | PF6 | RESET | | | 2,XCK(3) | | | | | | 3-OUT(3) |
| 27 | UPDI | | | | | | | | | | |
| 28 | VDD | | | | | | | | | | |
| 29 | GND | | | | | | | | | | |

**Note:**

1. Pin names are of type P*xn*, with *x* being the PORT instance (A,B,C, ...) and *n* the pin number. Notation for signals is PORT*x*_PIN*n*. All pins can be used as event input.
2. All pins can be used for external interrupt, where pins P*x*2 and P*x*6 of each port have full asynchronous detection.
3. Alternate pin positions. For selecting the alternate positions, refer to the PORTMUX documentation.

# 5. Electrical Characteristics

## 5.1 Absolute Maximum Ratings

Stresses beyond those listed in this section may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

**Table 5-1. Absolute Maximum Ratings**

| Symbol | Description | Conditions | Min. | Max. | Unit |
|---|---|---|---|---|---|
| $V_{DD}$ | Power Supply Voltage | | -0.5 | 6 | V |
| $I_{VDD}$ | Current into a $V_{DD}$ pin | $T_A$=[-40, 85]°C | - | 200 | mA |
| | | $T_A$=[85, 125]°C | - | 100 | mA |
| $I_{GND}$ | Current out of a GND pin | $T_A$=[-40, 85]°C | - | 200 | mA |
| | | $T_A$=[85, 125]°C | - | 100 | mA |
| $V_{PIN}$ | Pin voltage with respect to GND | | -0.5 | $V_{DD}$+0.5 | V |
| $I_{PIN}$ | I/O pin sink/source current | | -40 | 40 | mA |
| $I_{c1}$(1) | I/O pin injection current except for the RESET pin | $V_{pin}$<GND-0.6V or 5.5V<$V_{pin}$≤6.1V 4.9V<$V_{DD}$≤5.5V | -1 | 1 | mA |
| $I_{c2}$(1) | I/O pin injection current except for the RESET pin | $V_{pin}$<GND-0.6V or $V_{pin}$≤5.5V $V_{DD}$≤4.9V | -15 | 15 | mA |
| $T_{storage}$ | Storage temperature | | -65 | 150 | °C |

**Note:**

1. – If $V_{PIN}$ is lower than GND-0.6V, then a current limiting resistor is required. The negative DC injection current limiting resistor is calculated as R = (GND-0.6V – $V_{pin}$)/$I_{Cn}$.
   – If $V_{PIN}$ is greater than $V_{DD}$+0.6V, then a current limiting resistor is required. The positive DC injection current limiting resistor is calculated as R = ($V_{pin}$-($V_{DD}$+0.6))/$I_{Cn}$.

## 5.2 General Operating Ratings

The device must operate within the ratings listed in this section in order for all other electrical characteristics and typical characteristics of the device to be valid.

**Table 5-2. General Operating Conditions**

| Symbol | Description | Condition | Min. | Max. | Unit |
|---|---|---|---|---|---|
| $V_{DD}$ | Operating Supply Voltage | | 1.8(1) | 5.5 | V |
| $T_A$ | Operating temperature range | Standard temperature range | -40 | 125 | °C |

**Note:**

1. Operation is guaranteed down to 1.8V or VBOD with BODLEVEL=1.8V, whichever is lower.

| Mode | Description | Condition | | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| | | | $V_{DD}$=3V | 0.8 | - | mA |
| | | $f_{CLK\_CPU}$=5 MHz (OSC20M div4) | $V_{DD}$=5V | 0.7 | - | mA |
| | | | $V_{DD}$=3V | 0.4 | - | mA |
| | | | $V_{DD}$=2V | 0.25 | - | mA |
| | | $f_{CLK\_CPU}$=32 KHz (OSCULP32K) | $V_{DD}$=5V | 5.6 | - | µA |
| | | | $V_{DD}$=3V | 2.8 | - | µA |
| | | | $V_{DD}$=2V | 1.8 | - | µA |

**Table 5-6. Power Consumption in Power-Down, Standby and Reset Mode**

| Mode | Description | Condition | | Typ. 25°C | Max. 85°C | Max. 125°C | Unit |
|---|---|---|---|---|---|---|---|
| Standby | Standby power consumption | RTC running at 1.024 kHz from external XOSC32K (CL=7.5pF) | $V_{DD}$=3V | 0.69 | - | - | µA |
| | | RTC running at 1.024 kHz from internal OSCULP32K | $V_{DD}$=3V | 0.65 | TBD | TBD | µA |
| Power Down/ Standby | Power down/Standby power consumption are the same when all peripherals are stopped | All peripherals stopped | $V_{DD}$=3V | 0.10 | TBD | TBD | µA |
| Reset | Reset power consumption | RESET line pulled low | $V_{DD}$=3V | 100 | - | - | µA |

## 5.5 Peripherals Power Consumption

The table below can be used to calculate the additional current consumption for the different I/O peripherals in the various operating modes.

Operating conditions:

- $V_{DD}$=3V
- T=25°C
- OSC20M at 1 MHz used as system clock source, except where otherwise specified.

**Table 5-7. Peripherals Power Consumption**

| Peripheral | Conditions | Typ.(1) | Unit |
|---|---|---|---|
| BOD | Continuous | 19 | µA |
| | Sampling @ 1 kHz | 1.2 | |
| TCA | 16-bit count @ 1 MHz | 12.6 | µA |

| Symbol | Description | Condition | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| | Factory calibration accuracy | | $T_A$=25°C, 3.0V | TBD | ±0.75 | TBD | % |
| $E_{TOTAL}$ | Total error with 16 MHz frequency selection | From target frequency | $T_A$=[0, 70]°C, $V_{DD}$=[1.8, 3.6]V | TBD | ±2 | TBD | % |
| | | | Full operation range | TBD | ±3 | TBD | |
| | Total error with 20 MHz frequency selection | From target frequency | $T_A$=[0, 70]°C, $V_{DD}$=[1.8, 3.6]V | TBD | ±2 | TBD | |
| | | | Full operation range | TBD | ±3 | TBD | |
| $E_{DRIFT}$ | Accuracy with 16 MHz Frequency Selection relative to the factory-stored frequency value | Factory calibrated $V_{DD}$=3V(1) | $T_A$=[0, 70]°C, $V_{DD}$=[1.8, 5.5]V | TBD | ±1.5 | TBD | % |
| | Accuracy with 20 MHz Frequency Selection relative to the factory-stored frequency value | Factory calibrated $V_{DD}$=3V(1) | $T_A$=[0, 70]°C, $V_{DD}$=[1.8, 5.5]V | TBD | ±1.5 | TBD | |
| $\Delta f_{OSC20M}$ | Calibration step size | | | - | 0.75 | - | % |
| $D_{OSC20M}$ | Duty cycle | | | - | 50 | - | % |
| $t_{startup}$ | Start-up time | Within 2% accuracy | | - | 12 | - | µs |

**Note:**

1. See also the description of OSC20M on calibration.
2. Oscillator Frequencies above speed specification must be divided so that CPU clock always is within specification.

**Table 5-13. 32.768 kHz Internal Oscillator (OSCULP32K) Characteristics**

| Symbol | Description | Condition | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| $f_{OSCULP32K}$ | Factory calibration frequency | | | | 32.768 | | kHz |
| | Factory calibration accuracy | | $T_A$=25°C, 3.0V | -3 | ±2 | 3 | % |
| $E_{TOTAL}$ | Total error from target frequency | Factory calibrated | $T_A$=[0, 70]°C, $V_{DD}$=[1.8, 3.6]V | -10 | ±5 | +10 | % |
| | | | Full operation range | -30 | ±10 | +30 | |
| $D_{OSCULP32K}$ | Duty cycle | | | | 50 | | % |
| $t_{startup}$ | Start-up time | | | - | 250 | - | µs |

| Symbol(2) | Description | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| INT15V<br>INT25V | | | | | | |
| INT055V<br>INT11V<br>INT15V<br>INT25V<br>INT43V | Internal reference voltage | $V_{DD}$=[1.8V, 5.5V]<br>T=[-40 - 125]°C | -5.0 | | 5.0 | |

**Note:**

1. These values are based on characterization and not covered by production test limits.
2. The symbols INTxxV refer to the respective values of the AC0REFSEL bit field in the VREF.CTRLA register.

## 5.11 ADC

### 5.11.1 Internal Reference Characteristics

Operating conditions:

- $V_{DD}$ = 1.8 to 5.5V
- Temperature = -40°C to 125°C
- DUTYCYC = 25%
- $CLK_{ADC}$ = 13 * $f_{ADC}$
- SAMPCAP is 10 pF for 0.55V reference, while it is set to 5 pF for $V_{REF}$≥1.1V
- Applies for all allowed combinations of $V_{REF}$ selections and Sample Rates unless otherwise noted

**Table 5-20. Power Supply, Reference, and Input Range**

| Symbol | Description | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{DD}$ | Supply voltage | $CLK_{ADC}$ ≤ 1.5 MHz | 1.8 | - | 5.5 | V |
| | | $CLK_{ADC}$ > 1.5 MHz | 2.7 | - | 5.5 | |
| $V_{REF}$ | Reference voltage | REFSEL = Internal reference | 0.55 | - | $V_{DD}$-0.5 | V |
| | | REFSEL = External reference | 1.1 | | $V_{DD}$ | |
| | | REFSEL = $V_{DD}$ | 1.8 | - | 5.5 | |
| $C_{IN}$ | Input capacitance | SAMPCAP=5 pF | - | 5 | - | pF |
| | | SAMPCAP=10 pF | - | 10 | - | |
| $V_{IN}$ | Input voltage range | | 0 | - | $V_{REF}$ | V |
| $I_{BAND}$ | Input bandwidth | 1.1V≤$V_{REF}$ | - | - | 57.5 | kHz |

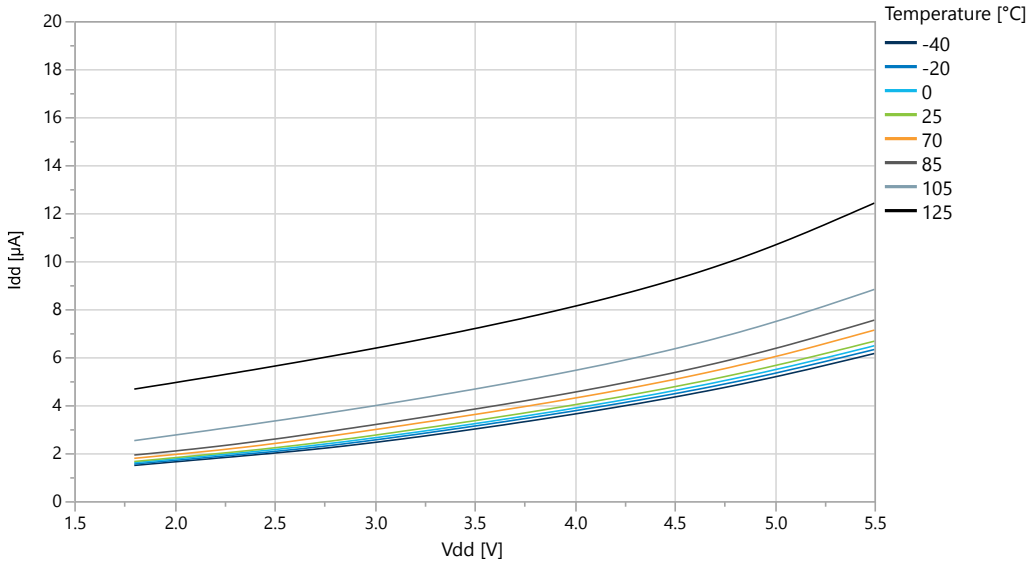
**Table 5-21. Clock and Timing Characteristics**

| Symbol | Description | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $f_{ADC}$ | Sample rate | 1.1V≤$V_{REF}$ | 15 | - | 115 | ksps |
| | | 1.1V≤$V_{REF}$ (8-bit resolution) | 15 | - | 150 | |
| | | $V_{REF}$=0.55V (10 bits) | 7.5 | - | 20 | |
| $CLK_{ADC}$ | Clock frequency | $V_{REF}$=0.55V (10 bits) | 100 | - | 260 | kHz |
| | | 1.1V≤$V_{REF}$ (10 bits) | 200 | - | 1500 | |
| | | 1.1V≤$V_{REF}$ (8-bit resolution) | 200 | - | 2000 | |
| Ts | Sampling time | | 2 | 2 | 33 | $CLK_{ADC}$ cycles |
| $T_{CONV}$ | Conversion time (latency) | Sampling time = 2 $CLK_{ADC}$ | 8.7 | - | 50 | µs |
| $T_{START}$ | Start-up time | Internal $V_{REF}$ | - | 22 | - | µs |

**Table 5-22. Accuracy Characteristics Internal Reference(2)**

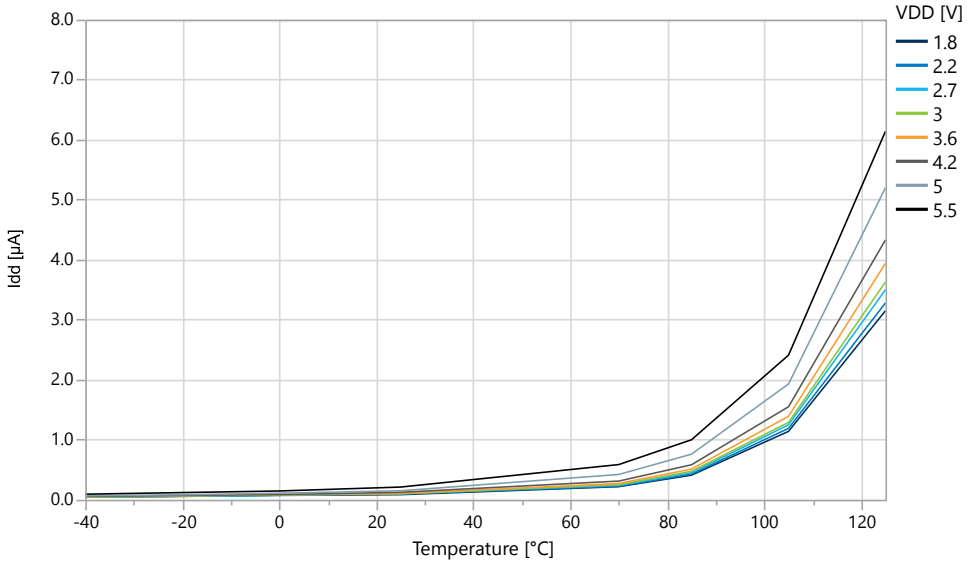
| Symbol | Description | Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| Res | Resolution | | | - | 10 | - | bit |
| INL | Integral Non-linearity | REFSEL = INTERNAL<br>$V_{REF}$=0.55V | $f_{ADC}$=7.7 ksps | - | 1.0 | - | LSB |
| | | REFSEL = INTERNAL or VDD | $f_{ADC}$=15 ksps | - | 1.0 | - | |
| | | REFSEL = INTERNAL or VDD<br>1.1V≤$V_{REF}$ | $f_{ADC}$=77 ksps | - | 1.0 | - | |
| | | | $f_{ADC}$=115 ksps | - | 1.2 | - | |
| DNL(1) | Differential Non-linearity | REFSEL = INTERNAL<br>$V_{REF}$ = 0.55V | $f_{ADC}$=7.7 ksps | - | 0.6 | - | LSB |
| | | REFSEL = INTERNAL<br>$V_{REF}$ = 1.1V | $f_{ADC}$=15 ksps | - | 0.4 | - | |
| | | REFSEL = INTERNAL or VDD<br>1.5V≤$V_{REF}$ | $f_{ADC}$=15 ksps | - | 0.4 | - | |
| | | REFSEL = INTERNAL or VDD<br>1.1V≤$V_{REF}$ | $f_{ADC}$=77 ksps | - | 0.4 | - | |

**Figure 6-9. Idle Supply Current vs. $V_{DD}$ (f=32 KHz OSCULP32K)**




### 6.1.3 Supply Currents in Power-Down Mode

**Figure 6-10. Power-Down Mode Supply Current vs. Temperature (all functions disabled)**



### 6.1.4 Supply Currents in Standby Mode

**Figure 6-13. Standby Mode Supply Current vs. $V_{DD}$ (RTC running with internal OSCULP32K)**

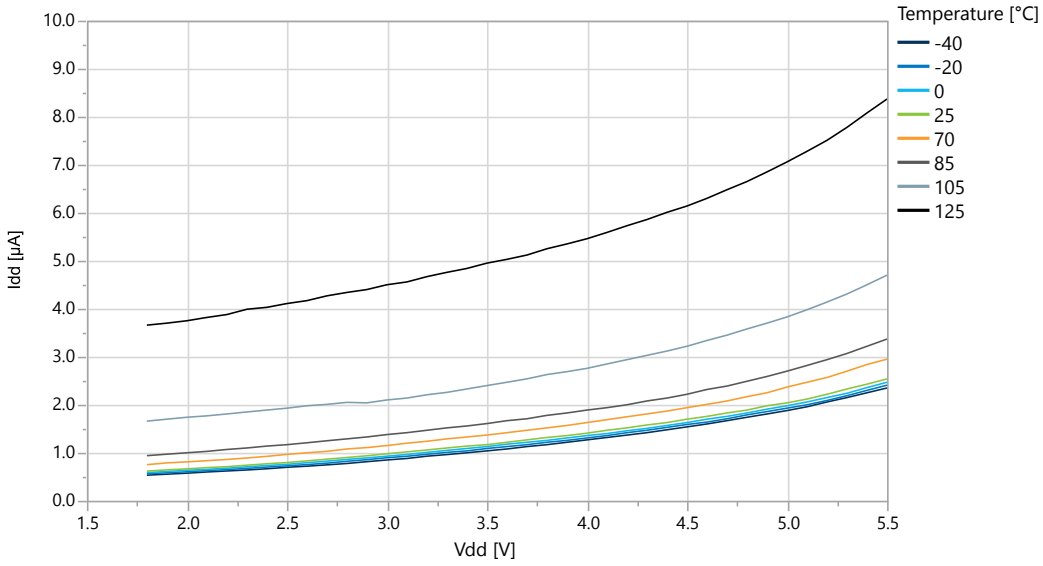
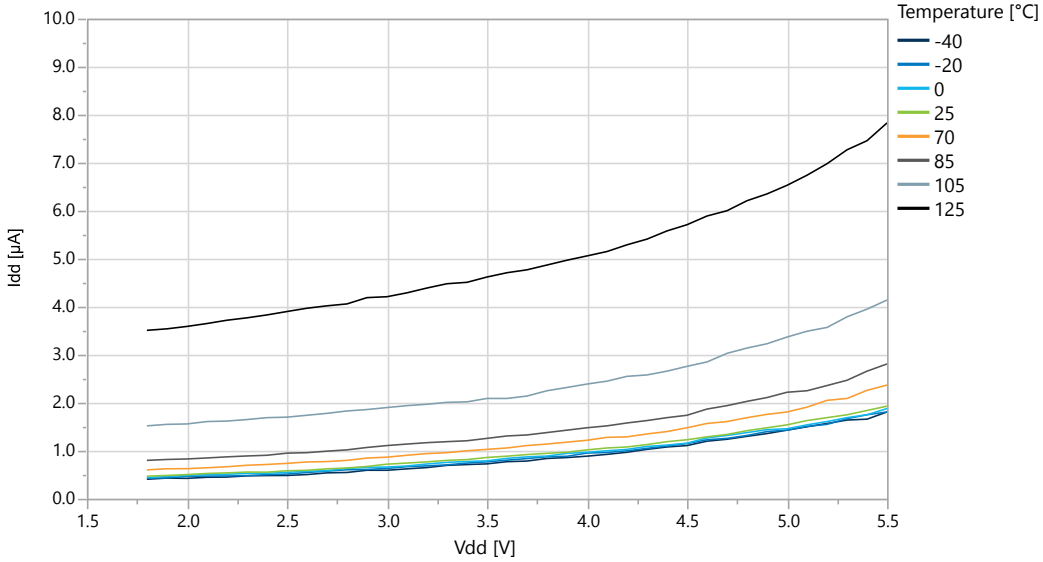



**Figure 6-14. Standby Mode Supply Current vs. $V_{DD}$ (Sampled BOD running at 125 Hz)**



### GPIO Pull-Up Characteristics

**Figure 6-29. I/O Pin Pull-Up Resistor Current vs. Input Voltage ($V_{DD}$=1.8V)**

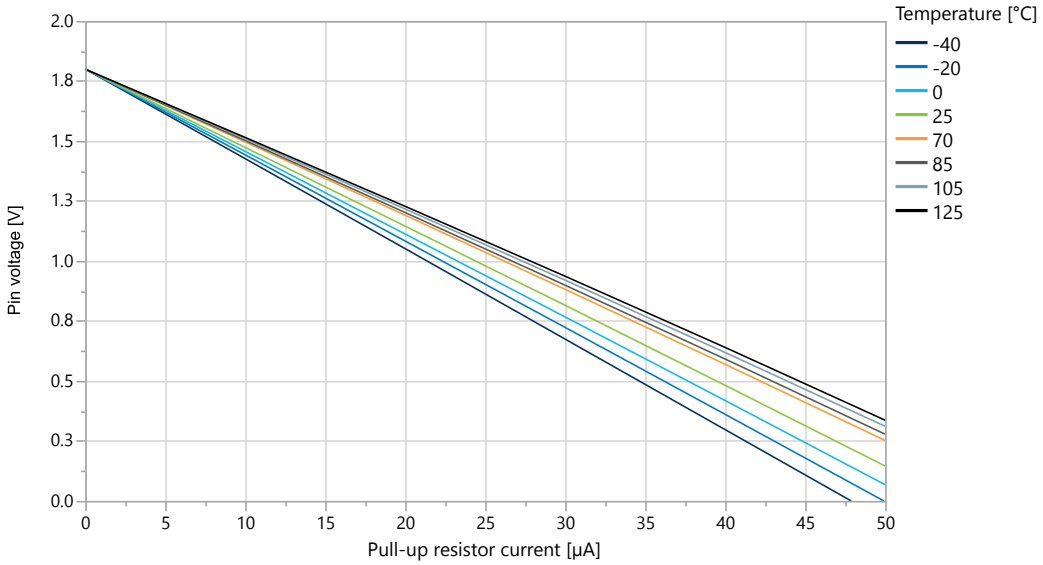



**Figure 6-30. I/O Pin Pull-Up Resistor Current vs. Input Voltage ($V_{DD}$=3.0V)**

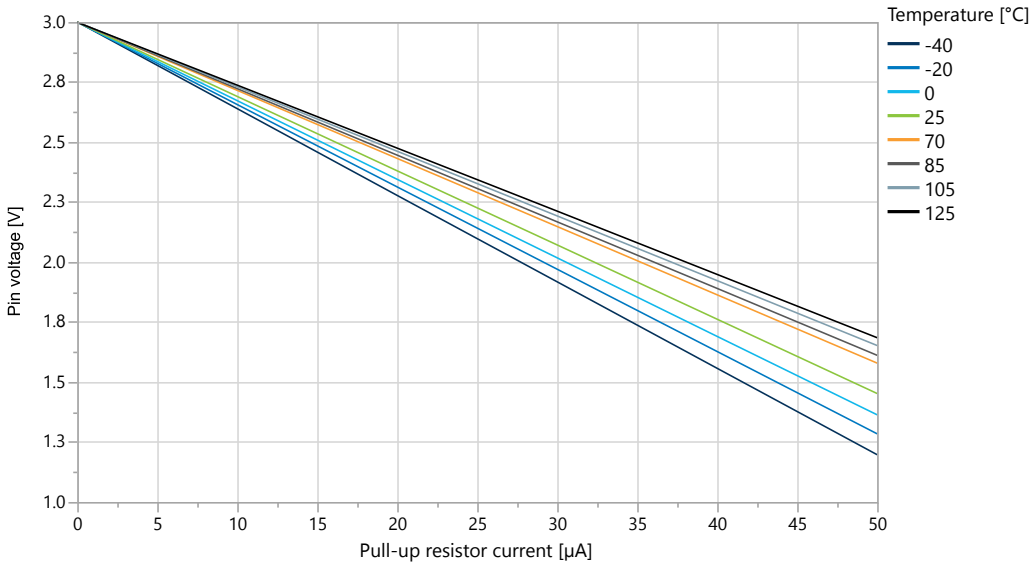
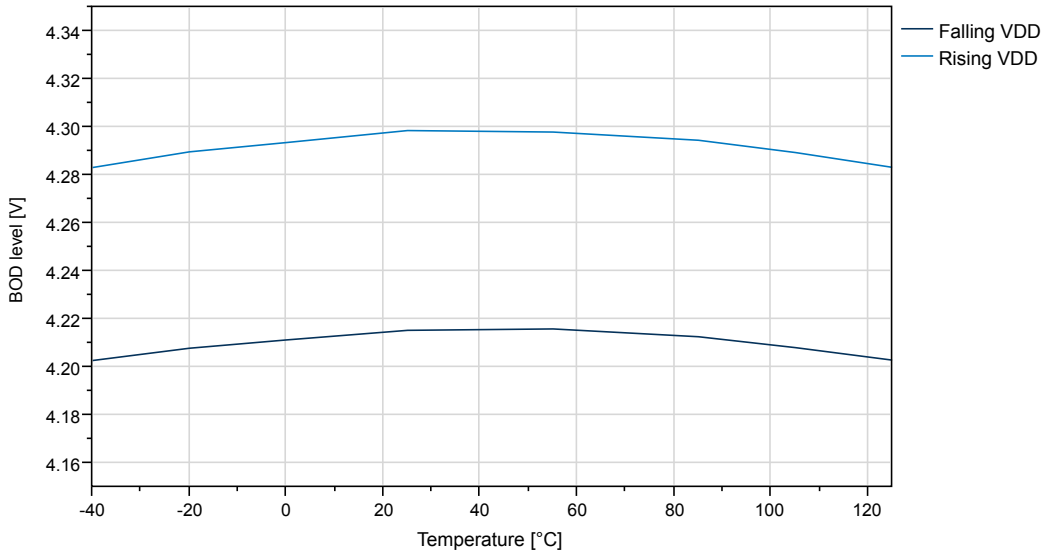


**Figure 6-41. BOD Threshold vs. Temperature (Level 4.3V)**




## 6.5 ADC Characteristics

**Figure 6-42. Absolute Accuracy vs. $V_{DD}$ ($f_{ADC}$=115 ksps) at T=25°C, REFSEL = Internal Reference**

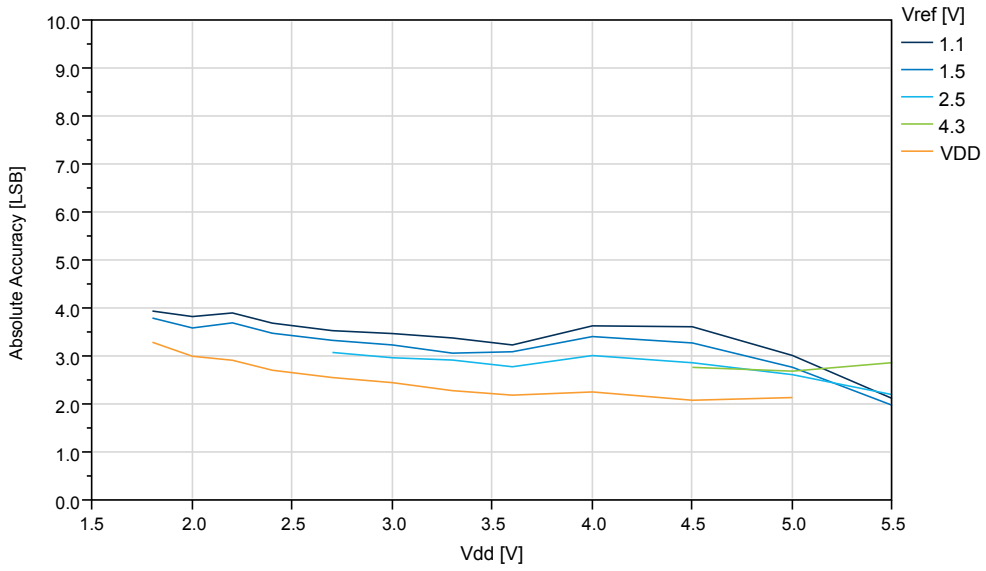


**Figure 6-47. Gain Error vs. $V_{ref}$ ($V_{DD}$=5.0V, $f_{ADC}$=115 ksps), REFSEL = Internal Reference**

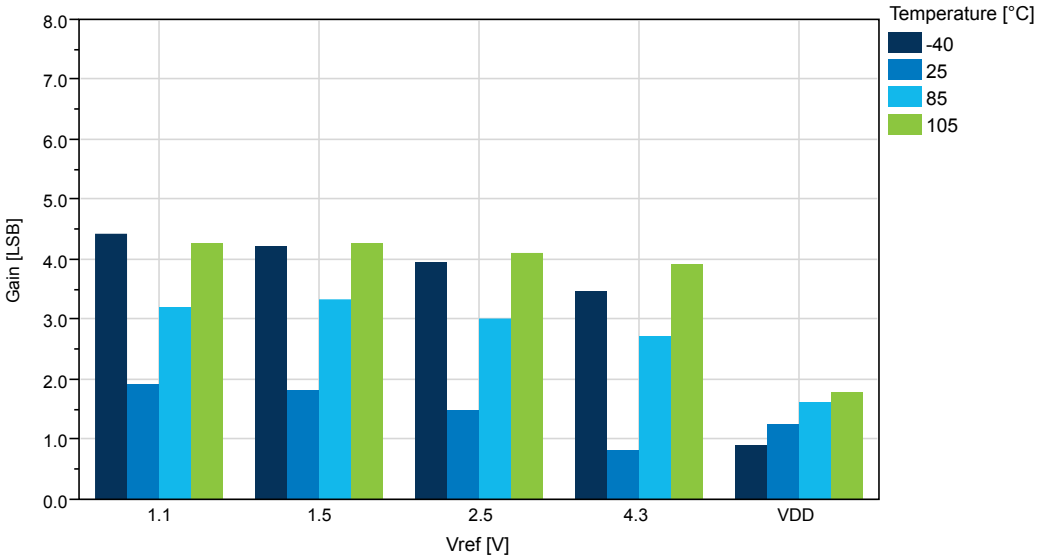



**Figure 6-48. INL vs. $V_{DD}$ ($f_{ADC}$=115 ksps) at T=25°C, REFSEL = Internal Reference**

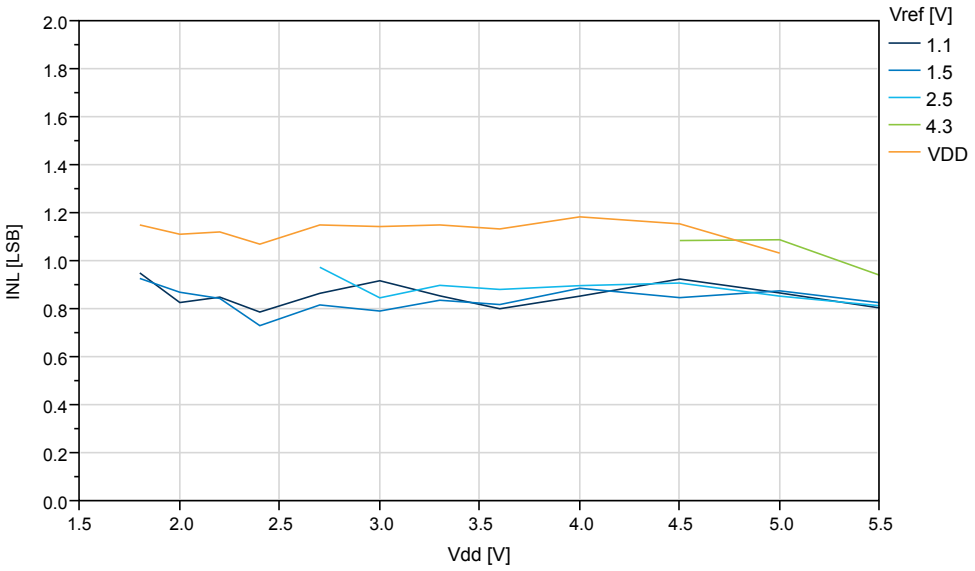


**Figure 6-49. INL vs. $V_{ref}$ ($V_{DD}$=5.0V, $f_{ADC}$=115 ksps), REFSEL = Internal Reference**

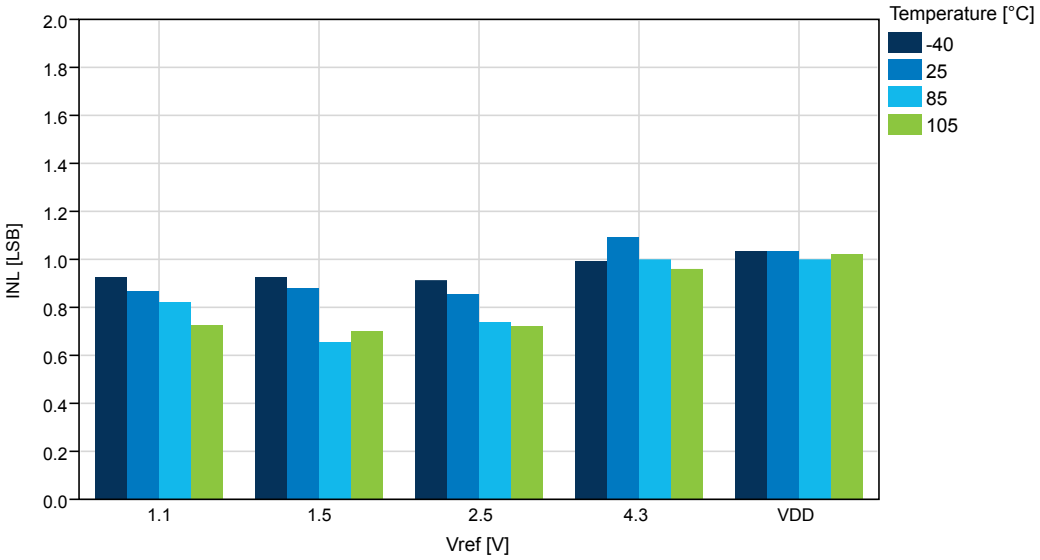



**Figure 6-50. Offset Error vs. $V_{DD}$ ($f_{ADC}$=115 ksps) at T=25°C, REFSEL = Internal Reference**

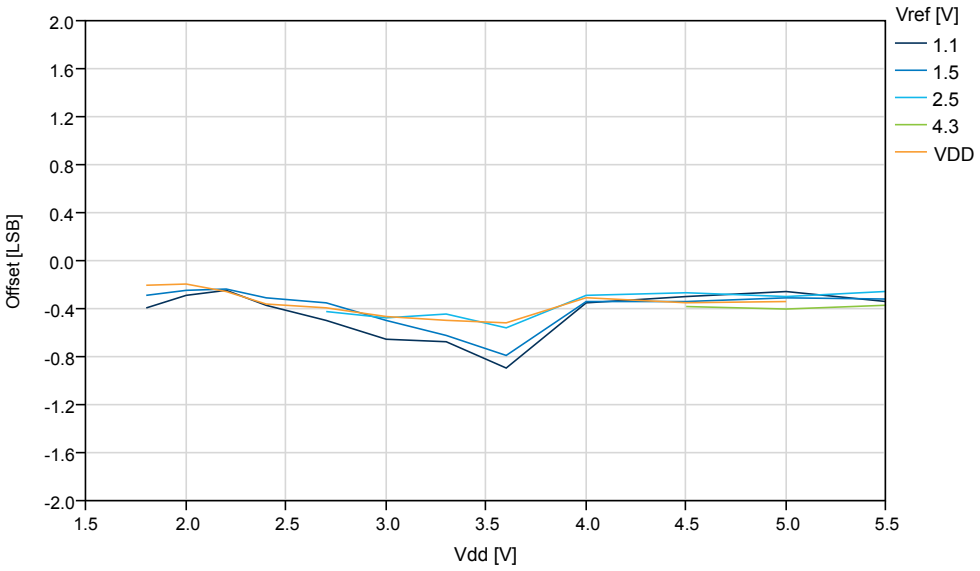


**Figure 6-57. Gain vs. $V_{REF}$ ($V_{DD}$=5.0V, $f_{ADC}$=115 ksps, REFSEL = External Reference)**

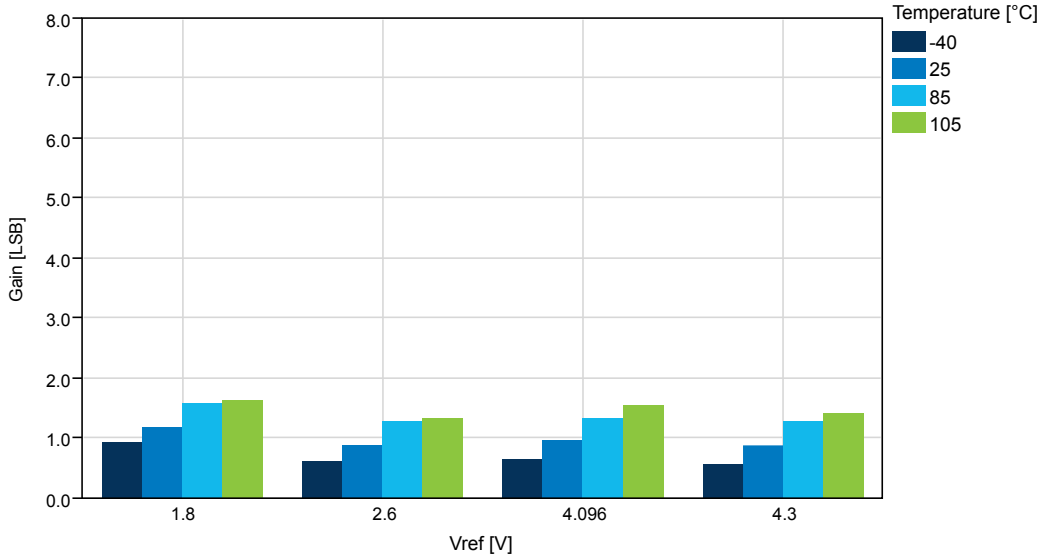



**Figure 6-58. INL vs. $V_{DD}$ ($f_{ADC}$=115 ksps, T=25°C, REFSEL = External Reference)**

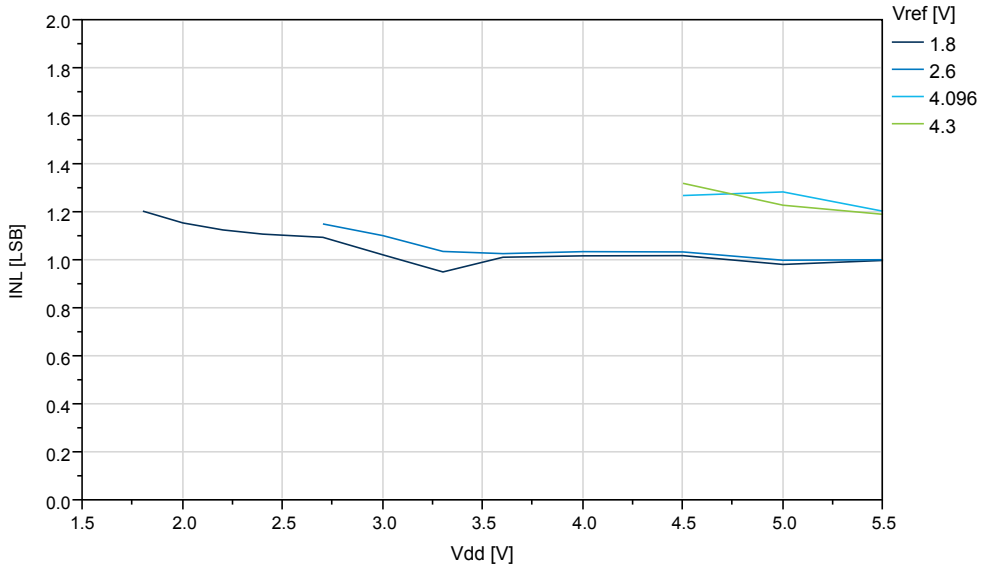


**Figure 6-59. INL vs. $V_{REF}$ ($V_{DD}$=5.0V, $f_{ADC}$=115 ksps, REFSEL = External Reference)**

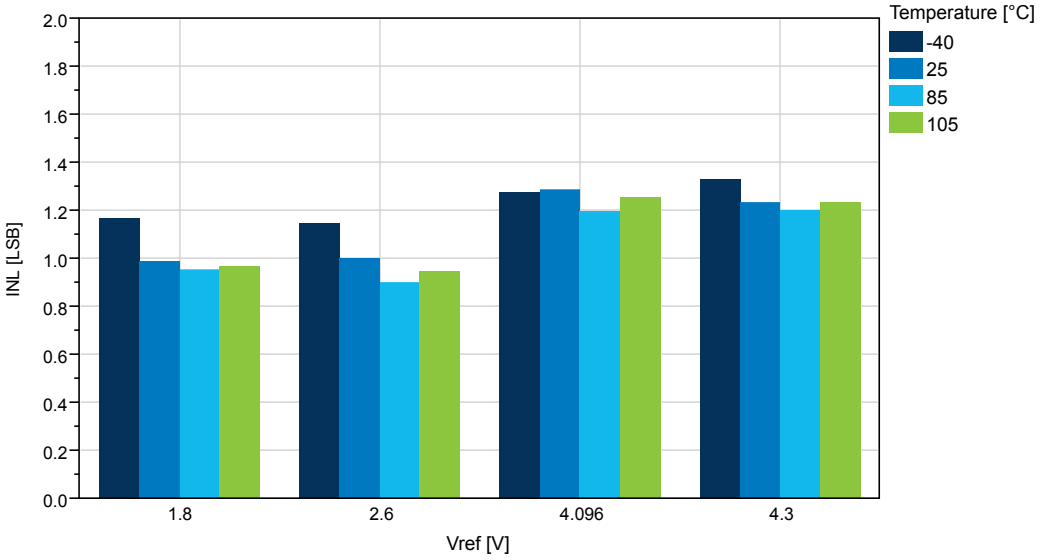



**Figure 6-60. Offset vs. $V_{DD}$ ($f_{ADC}$=115 ksps, T=25°C, REFSEL = External Reference)**

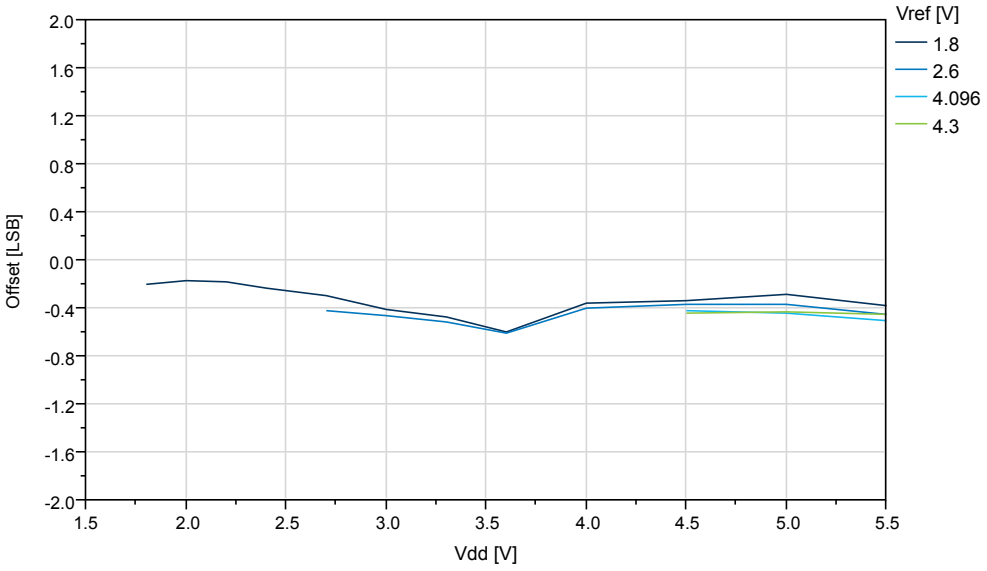
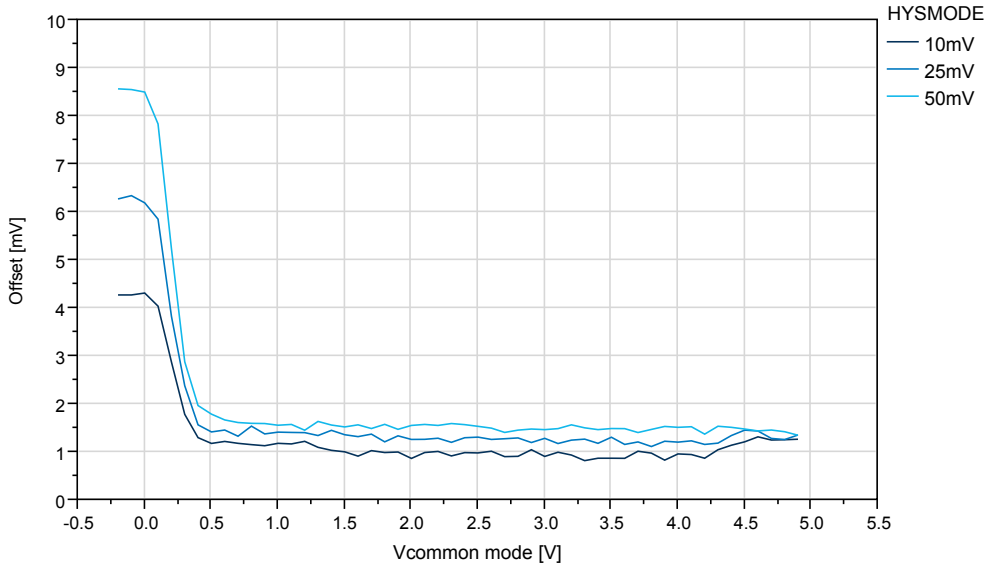


**Figure 6-65. Offset vs. $V_{CM}$ - 10 mV to 50 mV ($V_{DD}$=5V, T=25°C)**




## 6.7 OSC20M Characteristics

**Figure 6-66. OSC20M Internal Oscillator: Calibration Stepsize vs. Calibration Value ($V_{DD}$=3V)**

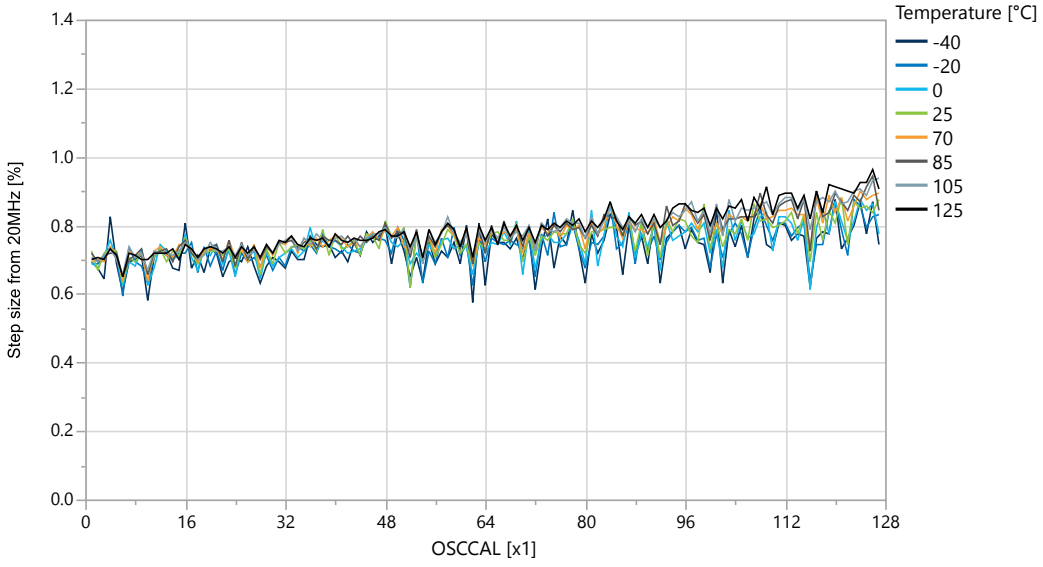


**Figure 6-67. OSC20M Internal Oscillator: Frequency vs. Calibration Value ($V_{DD}$=3V)**

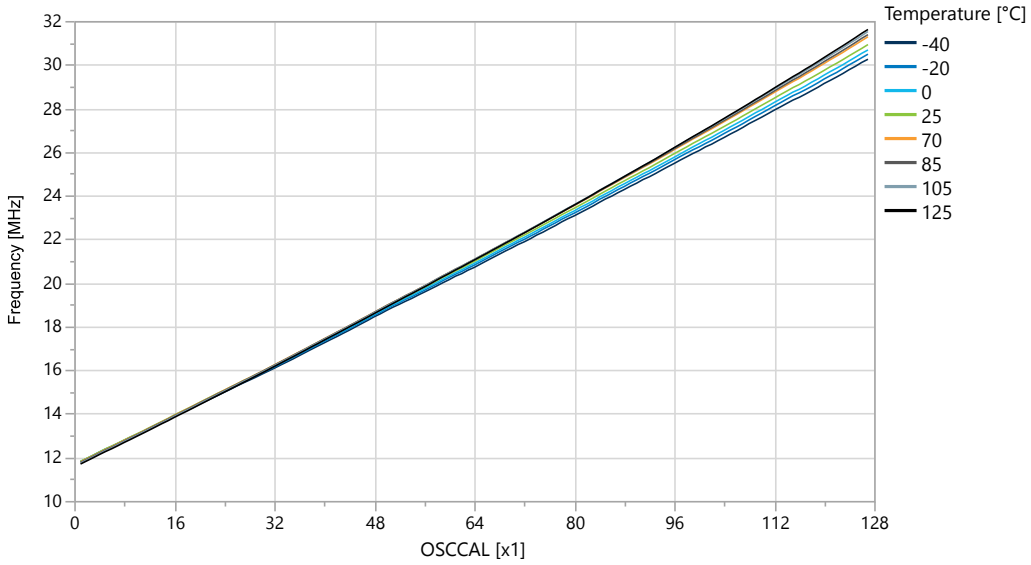



**Figure 6-68. OSC20M Internal Oscillator: Frequency vs. Temperature**

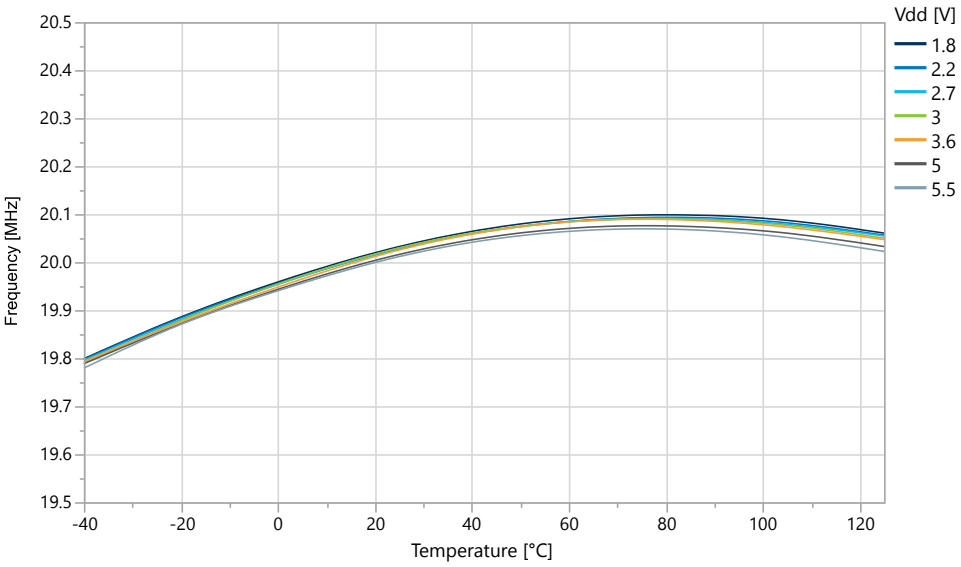
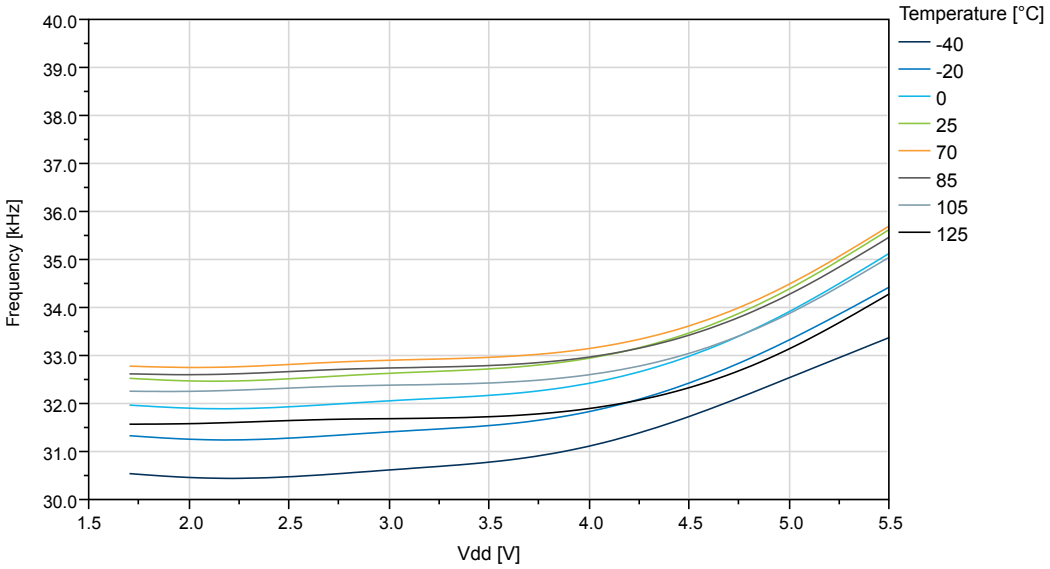
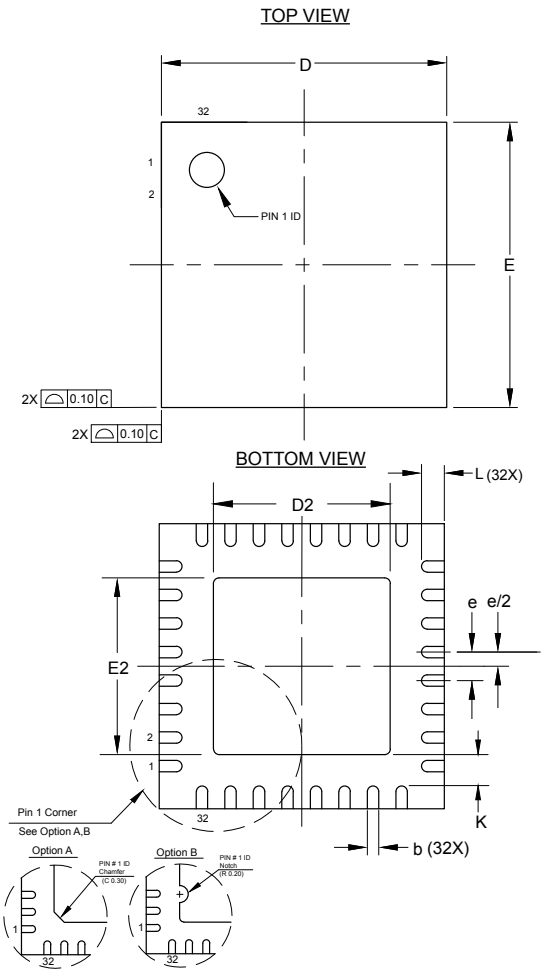


**Figure 6-71. OSCULP32K Internal Oscillator Frequency vs. $V_{DD}$**



## 7.2 32-pin VQFN




NOTE:

1. Refer to JEDEC Drawing MO-220, Variation VHHD-2 (Figure 1/Saw Singulation)
2. Dimension “b” applies to metalized terminal and is measured between 0.15mm and 0.30mm from the terminal tip. If the terminal has the optional radius on the other end of the terminal, the dimensions should not be measured in that radius area.

COMMON DIMENSIONS
(Unit of Measure = mm)

| SYMBOL | MIN | TYP | MAX | NOTE |
|---|---|---|---|---|
| A | 0.80 | - | 0.90 | |
| A1 | 0.00 | - | 0.05 | |
| A3 | | 0.20 REF | | |
| b | 0.18 | 0.25 | 0.30 | 2 |
| D | 4.90 | 5.00 | 5.10 | |
| D2 | 3.00 | 3.10 | 3.20 | |
| E | 4.90 | 5.00 | 5.10 | |
| E2 | 3.00 | 3.10 | 3.20 | |
| e | - | 0.50 | - | |
| L | 0.30 | 0.40 | 0.50 | |
| K | 0.20 | - | - | |

12/4/13

| Atmel<br>Package Drawing Contact:<br>packagedrawings@atmel.com | TITLE<br>32MS1, 32-pad 5.0x5.0x0.9 mm Body, 0.50mm pitch, 3.1x3.1 mm Exposed pad, Saw Singulated Thermally Enhanced Plastic Very-thin Fine pitch, Quad Flat No Lead package (VFQFN) | GPC<br>ZMF | DRAWING NO.<br>32MS1 | REV.<br>A |
|---|---|---|---|---|

# 8. Conventions

## 8.1 Memory Size and Type

**Table 8-1. Memory Size and Bit Rate**

| Symbol | Description |
|---|---|
| KB | kilobyte ($2^{10}$ = 1024) |
| MB | megabyte ($2^{20}$ = 1024*1024) |
| GB | gigabyte ($2^{30}$ = 1024*1024*1024) |
| b | bit (binary '0' or '1') |
| B | byte (8 bits) |
| 1 kbit/s | 1,000 bit/s rate (not 1,024 bit/s) |
| 1 Mbit/s | 1,000,000 bit/s rate |
| 1 Gbit/s | 1,000,000,000 bit/s rate |
| word | 16-bit |

## 8.2 Frequency and Time

**Table 8-2. Frequency and Time**

| Symbol | Description |
|---|---|
| kHz | 1 kHz = $10^3$ Hz = 1,000 Hz |
| KHz | 1 KHz = 1,024 Hz, 32 KHz = 32,768 Hz |
| MHz | 1 MHz = $10^6$ Hz = 1,000,000 Hz |
| GHz | 1 GHz = $10^9$ Hz = 1,000,000,000 Hz |
| s | second |
| ms | millisecond |
| µs | microsecond |
| ns | nanosecond |

## The Microchip Web Site

Microchip provides online support via our web site at http://www.microchip.com/. This web site is used as a means to make files and information easily available to customers. Accessible by using your favorite Internet browser, the web site contains the following information:

- **Product Support** – Data sheets and errata, application notes and sample programs, design resources, user's guides and hardware support documents, latest software releases and archived software
- **General Technical Support** – Frequently Asked Questions (FAQ), technical support requests, online discussion groups, Microchip consultant program member listing
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

## Customer Change Notification Service

Microchip's customer notification service helps keep customers current on Microchip products. Subscribers will receive e-mail notification whenever there are changes, updates, revisions or errata related to a specified product family or development tool of interest.

To register, access the Microchip web site at http://www.microchip.com/. Under "Support", click on "Customer Change Notification" and follow the registration instructions.

## Customer Support

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support

Customers should contact their distributor, representative or Field Application Engineer (FAE) for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in the back of this document.

Technical support is available through the web site at: http://www.microchip.com/support