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What is "Embedded - Microcontrollers"?

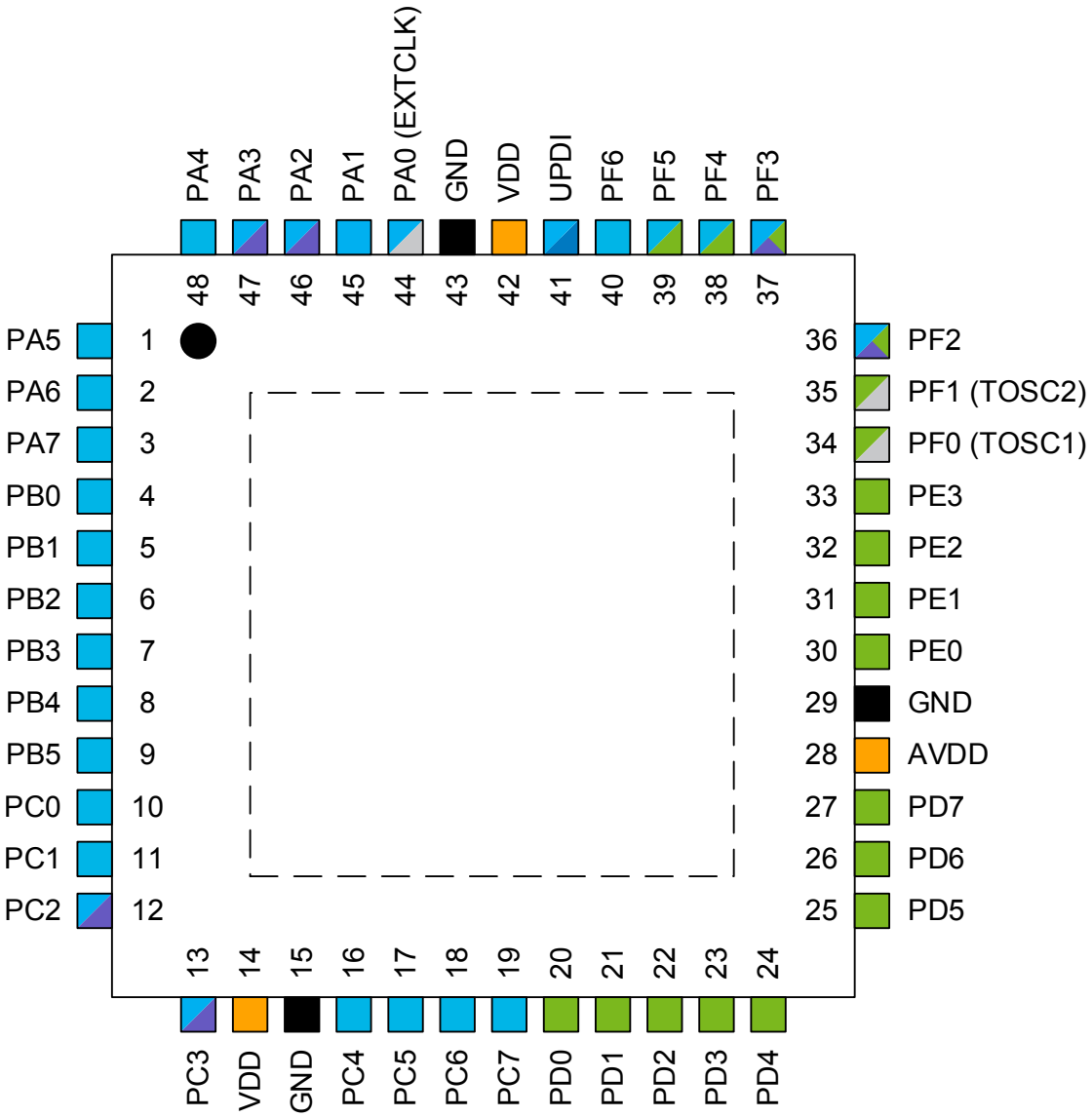
"Embedded - Microcontrollers" refer to small, integrated circuits designed to perform specific tasks within larger systems. These microcontrollers are essentially compact computers on a single chip, containing a processor core, memory, and programmable input/output peripherals. They are called "embedded" 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	AVR
Core Size	8-Bit
Speed	20MHz
Connectivity	I²C, SPI, UART/USART
Peripherals	Brown-out Detect/Reset, POR, PWM, WDT
Number of I/O	41
Program Memory Size	48KB (48K x 8)
Program Memory Type	FLASH
EEPROM Size	256 x 8
RAM Size	6K x 8
Voltage - Supply (Vcc/Vdd)	1.8V ~ 5.5V
Data Converters	A/D 16x10b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 125°C (TA)
Mounting Type	Surface Mount
Package / Case	48-TQFP
Supplier Device Package	48-TQFP (7x7)
Purchase URL	https://www.e-xfl.com/product-detail/microchip-technology/atmega4809-afr

3. Pinout

3.1 48-pin QFN/TQFP



Power

- Input supply
- Ground
- GPIO on VDD power domain
- GPIO on AVDD power domain

Functionality

- Programming, debug
- Clock, crystal
- TWI
- Digital functions only
- Analog functions

4. I/O Multiplexing and Considerations

4.1 Multiplexed Signals

QFN48/ TQFP48	Pin name (1,2)	Special	ADC0	AC0	USARTn	SPI0	TWI0	TCA0	TCBn	Other	CCL-LUTn
44	PA0	EXTCLK			0,TxD			0-WO0			0-IN0
45	PA1				0,RxD			0-WO1			0-IN1
46	PA2	TWI			0,XCK		SDA(MS)	0-WO2	0-WO	EVOUTA	0-IN2
47	PA3	TWI			0,XDIR		SCL(MS)	0-WO3	1-WO		0-OUT
48	PA4				0,TxD(3)	MOSI		0-WO4			
1	PA5				0,RxD(3)	MISO		0-WO5			
2	PA6				0,XCK(3)	SCK					0-OUT(3)
3	PA7	CLKOUT		OUT	0,XDIR(3)	SS				EVOUTA(3)	
4	PB0				3,TxD			0-WO0(3)			
5	PB1				3,RxD			0-WO1(3)			
6	PB2				3,XCK			0-WO2(3)		EVOUTB	
7	PB3				3,XDIR			0-WO3(3)			
8	PB4				3,TxD(3)			0-WO4(3)	2-WO(3)		
9	PB5				3,RxD(3)			0-WO5(3)	3-WO		
10	PC0				1,TxD	MOSI(3)		0-WO0(3)	2-WO		1-IN0
11	PC1				1,RxD	MISO(3)		0-WO1(3)	3-WO(3)		1-IN1
12	PC2	TWI			1,XCK	SCK(3)	SDA(MS)(3)	0-WO2(3)		EVOUTC	1-IN2
13	PC3	TWI			1,XDIR	SS(3)	SCL(MS)(3)	0-WO3(3)			1-OUT
14	VDD										
15	GND										
16	PC4				1,TxD(3)			0-WO4(3)			
17	PC5				1,RxD(3)			0-WO5(3)			
18	PC6				1,XCK(3)						1-OUT(3)
19	PC7				1,XDIR(3)					EVOUTC(3)	
20	PD0		AIN0					0-WO0(3)			2-IN0
21	PD1		AIN1	P3				0-WO1(3)			2-IN1
22	PD2		AIN2	P0				0-WO2(3)		EVOUTD	2-IN2
23	PD3		AIN3	N0				0-WO3(3)			2-OUT
24	PD4		AIN4	P1				0-WO4(3)			
25	PD5		AIN5	N1				0-WO5(3)			
26	PD6		AIN6	P2							2-OUT(3)
27	PD7	VREFA	AIN7	N2						EVOUTD(3)	
28	AVDD										
29	GND										
30	PE0		AIN8			MOSI(3)		0-WO0(3)			
31	PE1		AIN9			MISO(3)		0-WO1(3)			
32	PE2		AIN10			SCK(3)		0-WO2(3)		EVOUTE	
33	PE3		AIN11			SS(3)		0-WO3(3)			
34	PF0	TOSC1			2,TxD			0-WO0(3)			3-IN0
35	PF1	TOSC2			2,RxD			0-WO1(3)			3-IN1
36	PF2	TWI	AIN12		2,XCK		SDA(S)(3)	0-WO2(3)		EVOUTF	3-IN2
37	PF3	TWI	AIN13		2,XDIR		SCL(S)(3)	0-WO3(3)			3-OUT

QFN48/ TQFP48	Pin name [1,2]	Special	ADC0	AC0	USARTn	SPI0	TWI0	TCA0	TCBn	Other	CCL-LUTn
38	PF4		AIN14		2,TxD[3]			0-WO4[3]	0-WO[3]		
39	PF5		AIN15		2,RxD[3]			0-WO5[3]	1-WO[3]		
40	PF6	RESET			2,XCK[3]						3-OUT[3]
41	UPDI										
42	VDD										
43	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.

Note:

1. Pin group A (PA[7:0]), PF[6:2]), pin group B (PB[7:0], PC[7:0]), pin group C (PD:7:0, PE[3:0], PF[1:0]). For 28-pin and 32-pin devices pin group A and B should be seen as a single group. The combined continuous sink/source current for each individual group should not exceed the limits.

5.10 VREF

Table 5-17. Internal Voltage Reference Characteristics

Symbol	Description	Min.	Typ.	Max.	Unit
t_{start}	Start-up time	-	25	-	µs
$V_{DDINT055V}$	Power supply voltage range for INT055V	1.8	-	5.5	V
$V_{DDINT11V}$	Power supply voltage range for INT11V	1.8	-	5.5	
$V_{DDINT15V}$	Power supply voltage range for INT15V	1.8	-	5.5	
$V_{DDINT25V}$	Power supply voltage range for INT25V	3.0	-	5.5	
$V_{DDINT43V}$	Power supply voltage range for INT43V	4.8	-	5.5	

Table 5-18. ADC Internal Voltage Reference Characteristics(1)

Symbol(2)	Description	Condition	Min.	Typ.	Max.	Unit
INT11V	Internal reference voltage	V_{DD}=[1.8V, 3.6V] T=[0 - 105]°C	-2.0		2.0	%
INT055V INT15V INT25V	Internal reference voltage	V_{DD}=[1.8V, 3.6V] T=[0 - 105]°C	-3.0		3.0	
INT055V INT11V INT15V INT25V INT43V	Internal reference voltage	V_{DD}=[1.8V, 5.5V] 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 ADC0REFSEL bit field in the VREF.CTRLA register.

Table 5-19. AC Internal Voltage Reference Characteristics(1)

Symbol(2)	Description	Condition	Min.	Typ.	Max.	Unit
INT055V INT11V	Internal reference voltage	V_{DD}=[1.8V, 3.6V] T=[0 - 105]°C	-3.0		3.0	%

Figure 6-11. Power-Down Mode Supply Current vs. V_{DD} (all functions disabled)

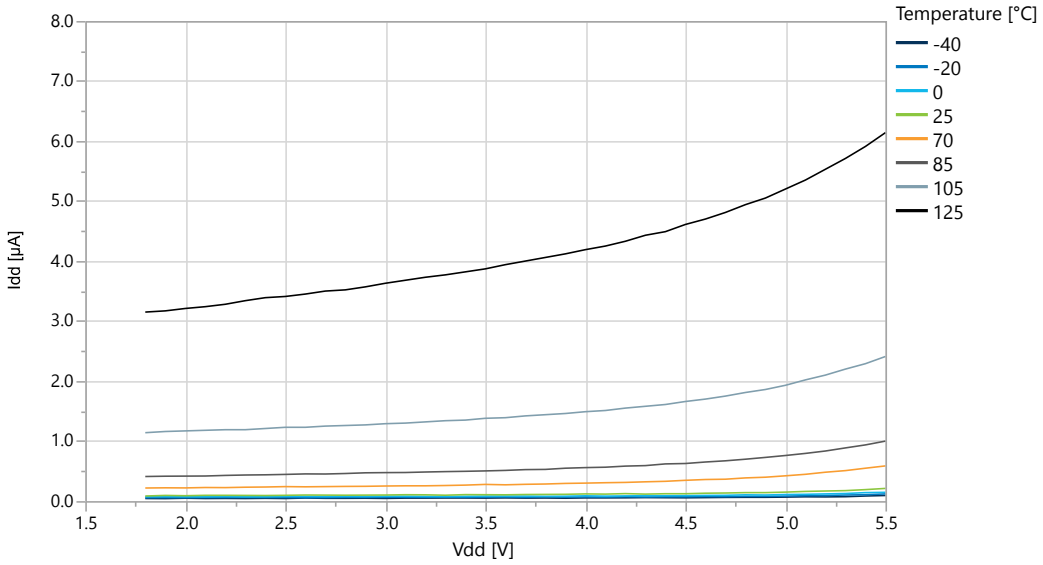
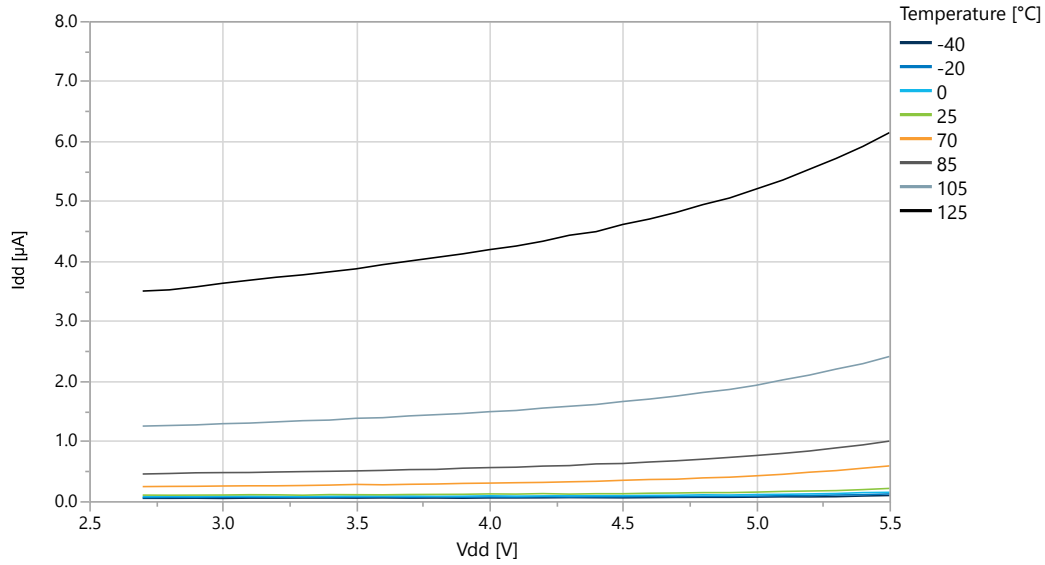


Figure 6-12. Power-Down Mode Supply Current vs. V_{DD} (all functions disabled)



6.1.4 Supply Currents in Standby Mode

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

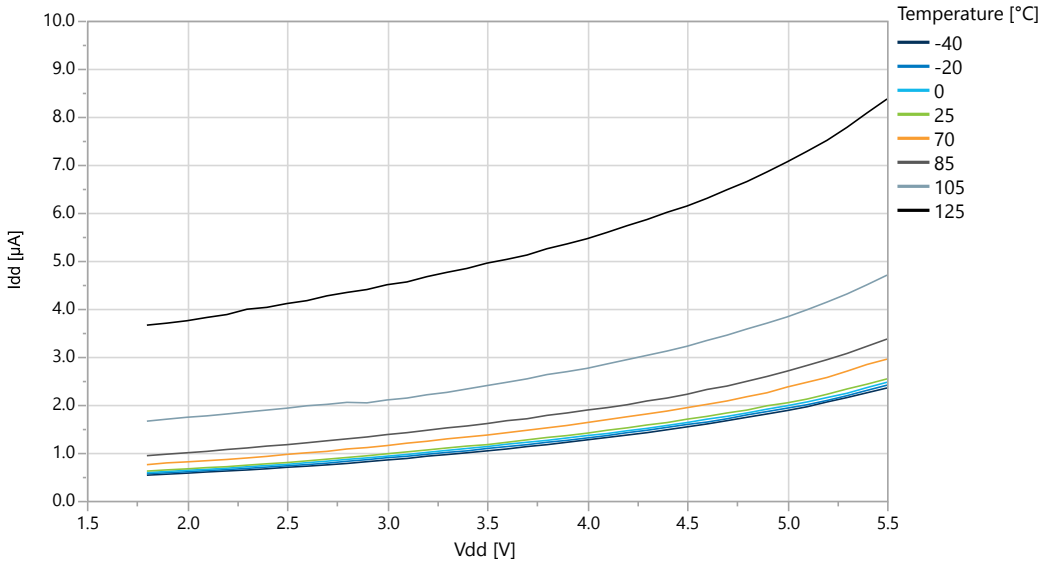
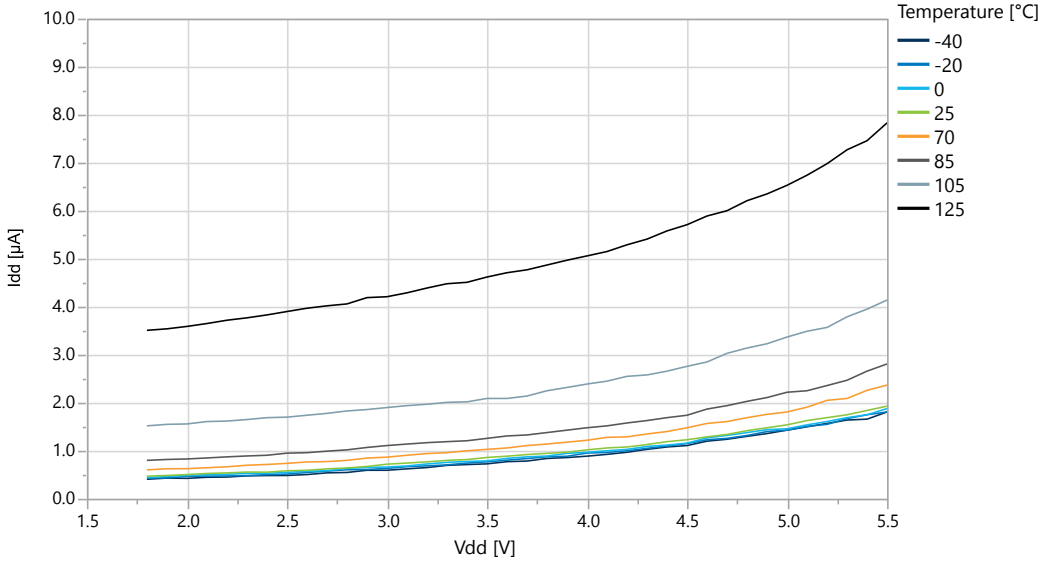


Figure 6-14. Standby Mode Supply Current vs. V_{DD} (Sampled BOD running at 125 Hz)



GPIO Output Characteristics

Figure 6-21. I/O Pin Output Voltage vs. Sink Current (V_{DD}=1.8V)

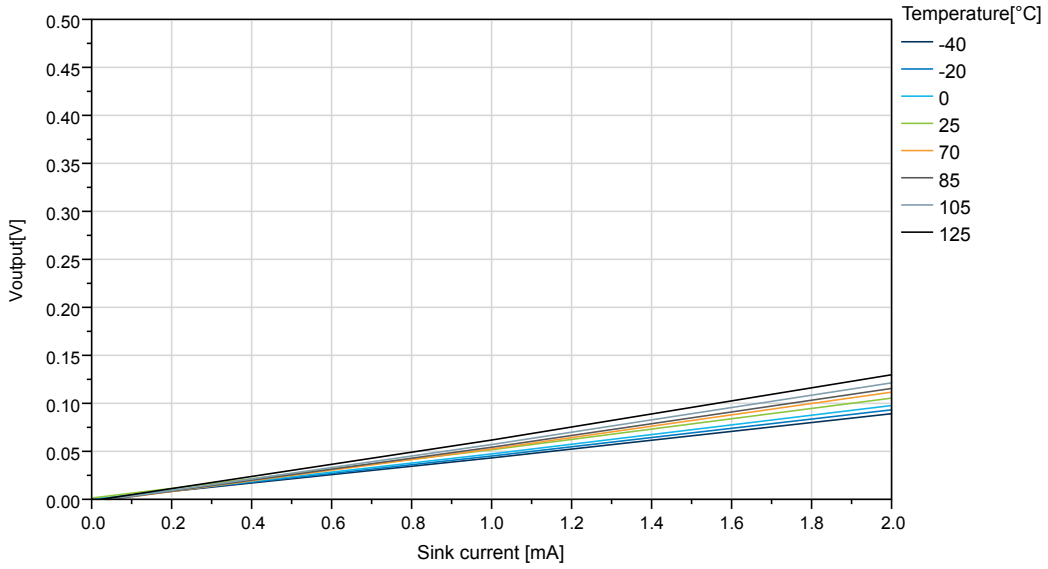


Figure 6-22. I/O Pin Output Voltage vs. Sink Current (V_{DD}=3.0V)

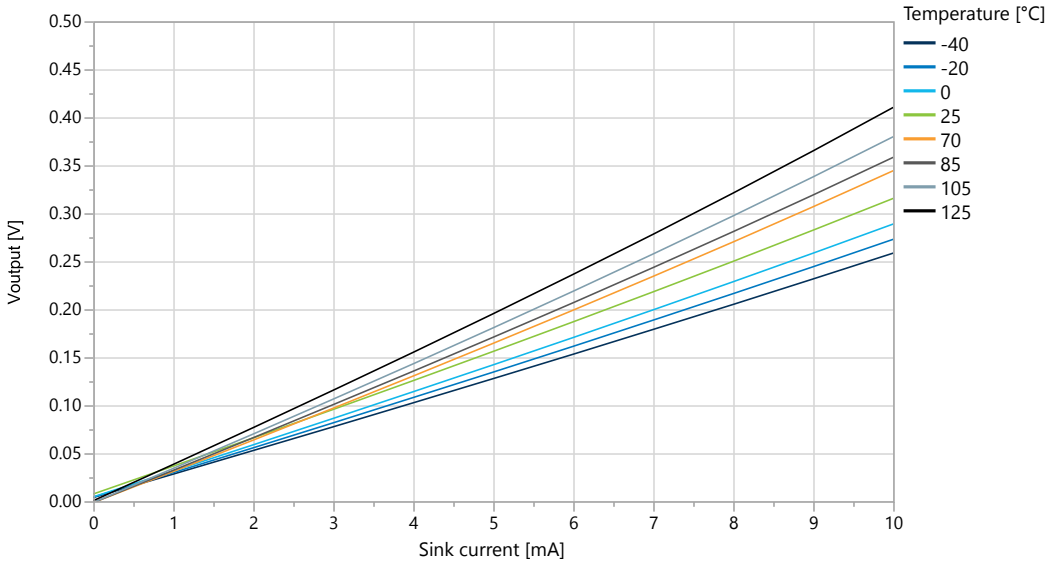
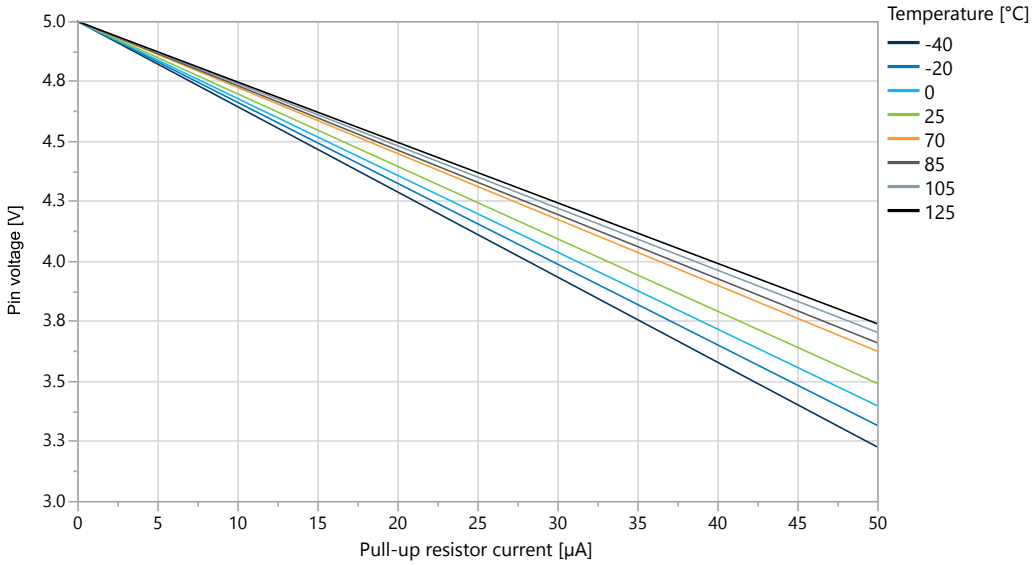


Figure 6-31. I/O Pin Pull-Up Resistor Current vs. Input Voltage (V_{DD}=5.0V)



6.3 VREF Characteristics

Figure 6-32. Internal 0.55V Reference vs. Temperature

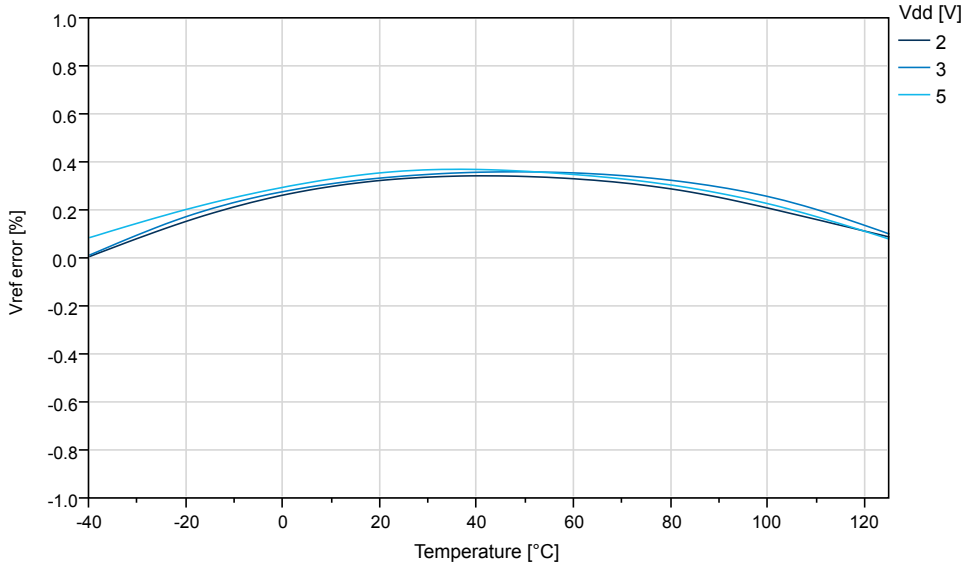


Figure 6-33. Internal 1.1V Reference vs. Temperature

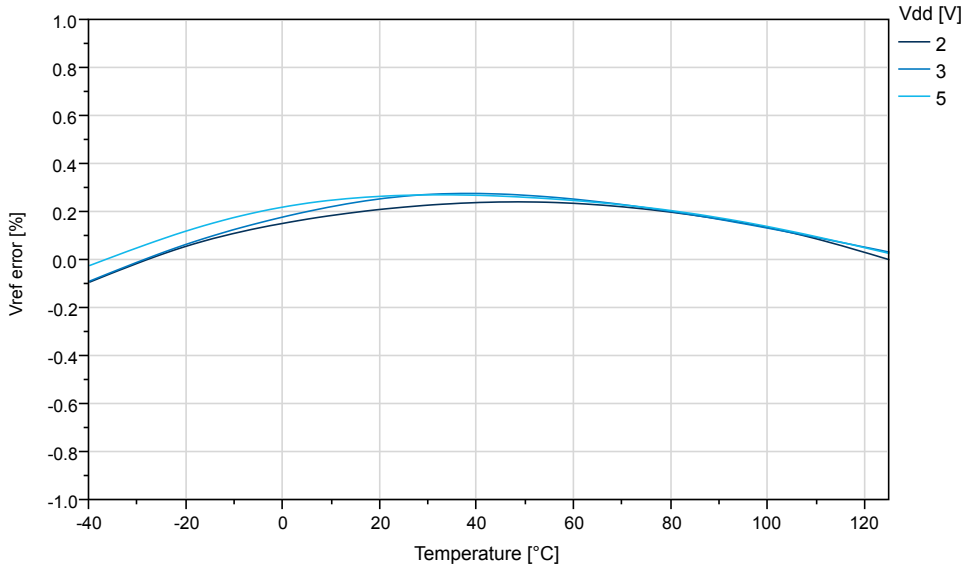


Figure 6-34. Internal 2.5V Reference vs. Temperature

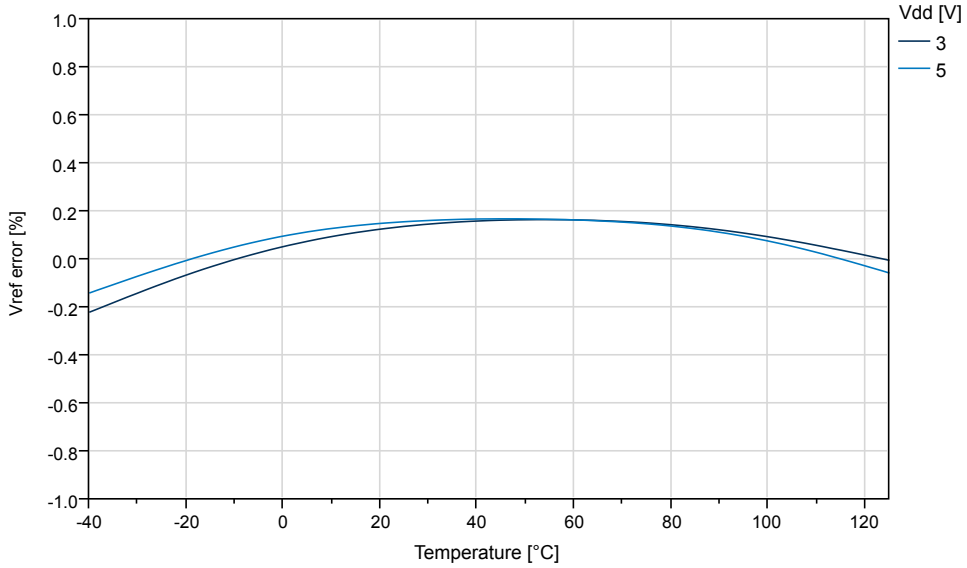
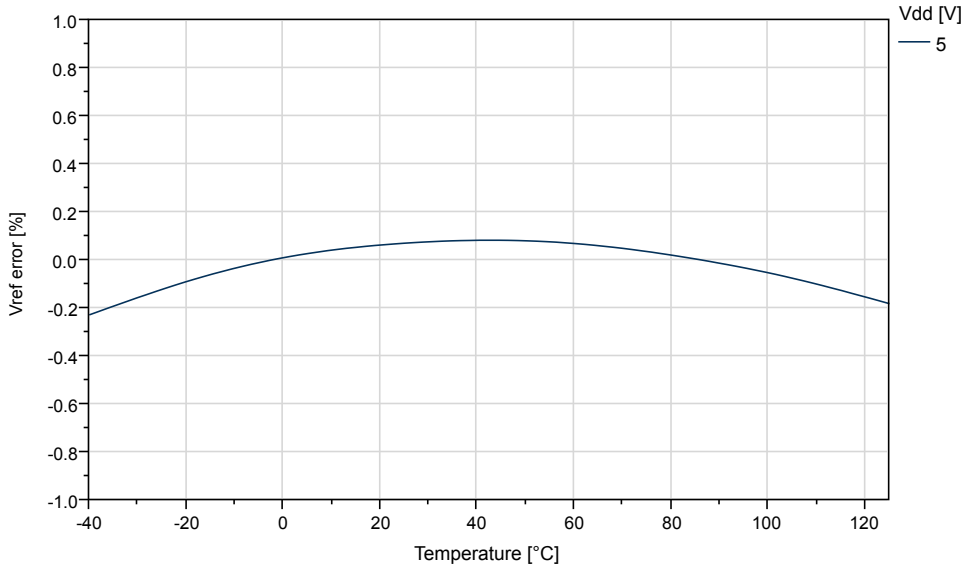


Figure 6-35. Internal 4.3V Reference vs. Temperature



6.4 BOD Characteristics

BOD Current vs. V_{DD}

Figure 6-36. BOD Current vs. V_{DD} (Continuous Mode Enabled)

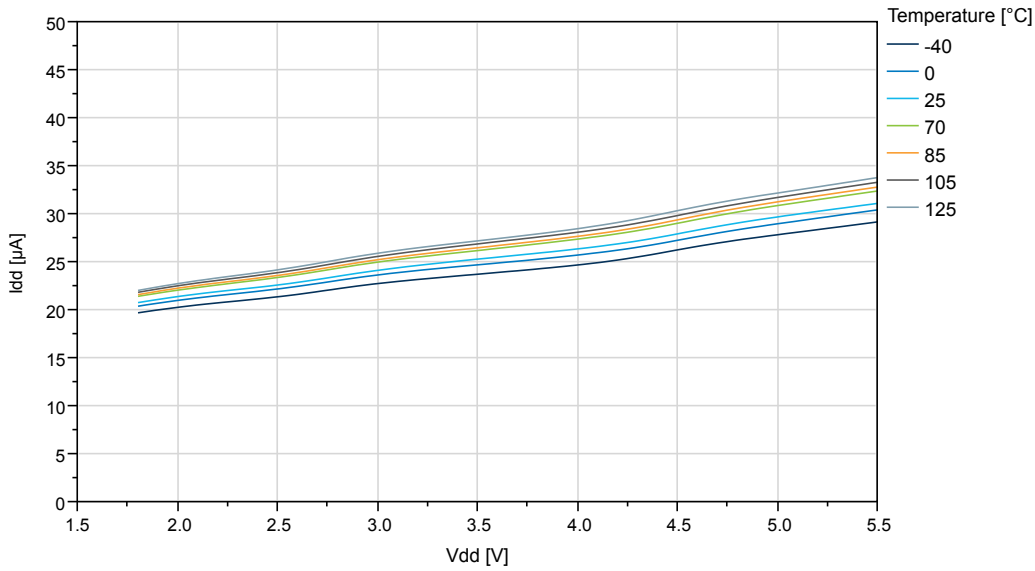


Figure 6-37. BOD Current vs. V_{DD} (Sampled BOD at 125 Hz)

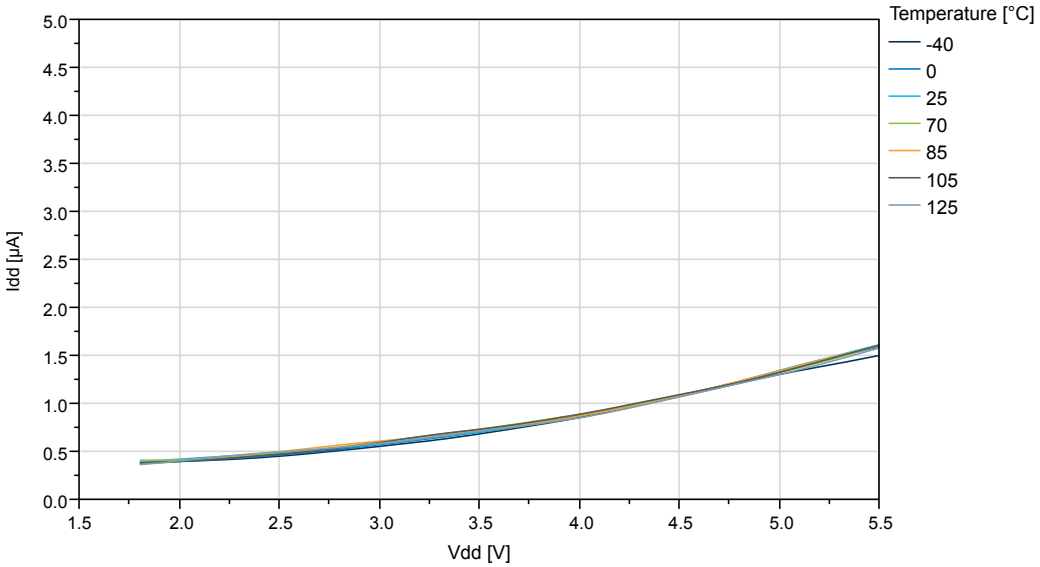


Figure 6-38. BOD Current vs. V_{DD} (Sampled BOD at 1 kHz)

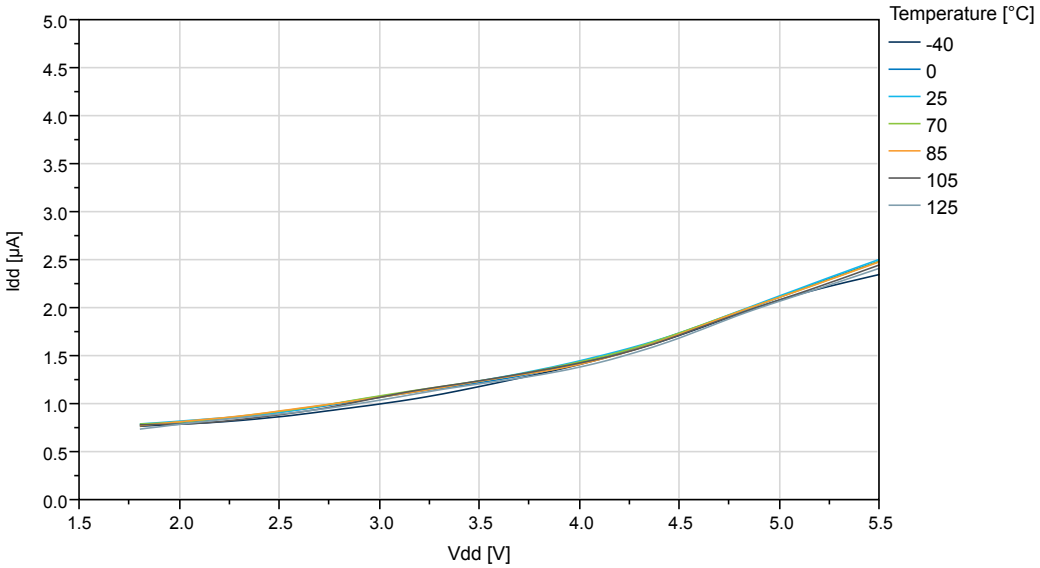


Figure 6-47. Gain Error vs. V_{ref} (V_{DD}=5.0V, f_{ADC}=115 ksps), REFSEL = Internal Reference

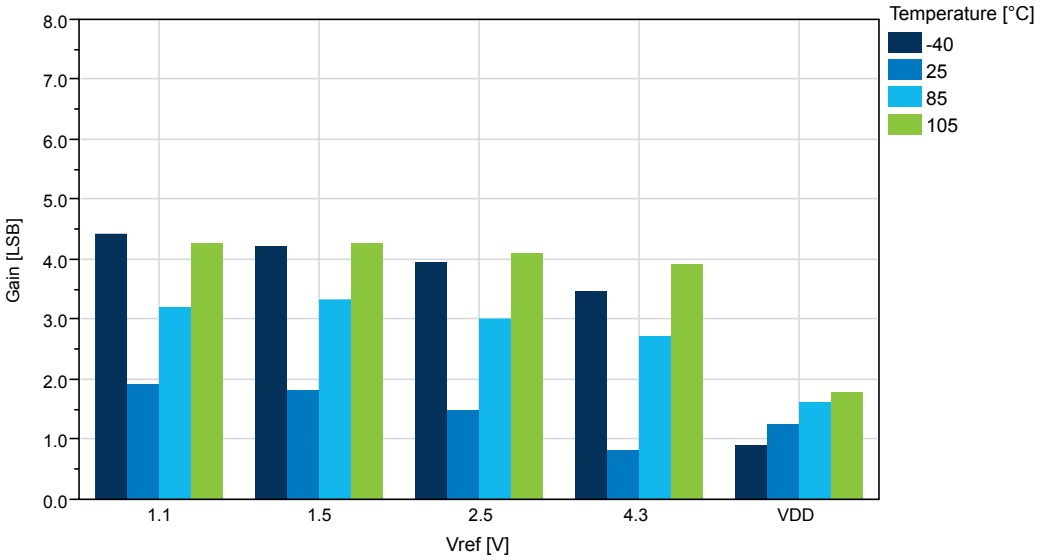


Figure 6-48. INL vs. V_{DD} (f_{ADC}=115 ksps) at T=25°C, REFSEL = Internal Reference

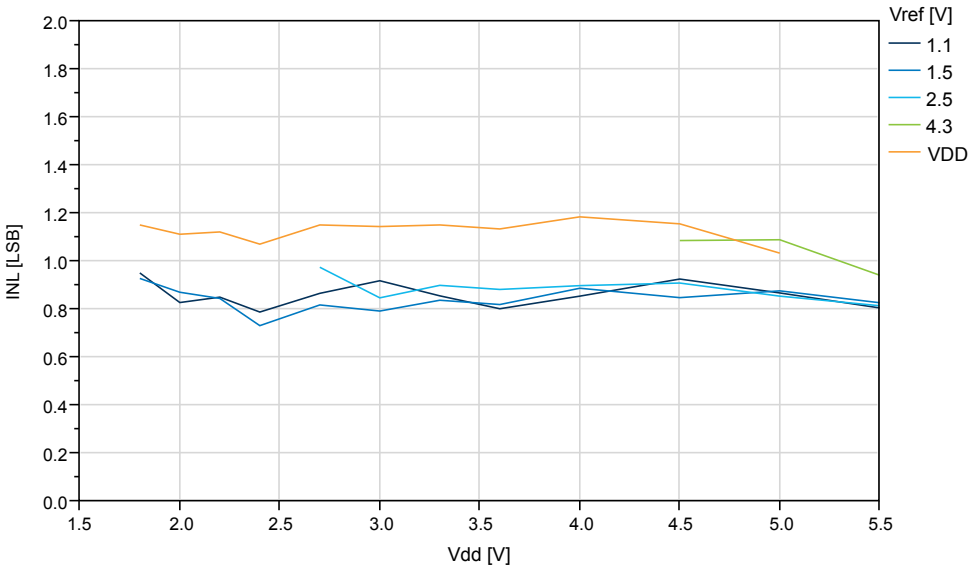


Figure 6-49. INL vs. V_{ref} (V_{DD}=5.0V, f_{ADC}=115 ksps), REFSEL = Internal Reference

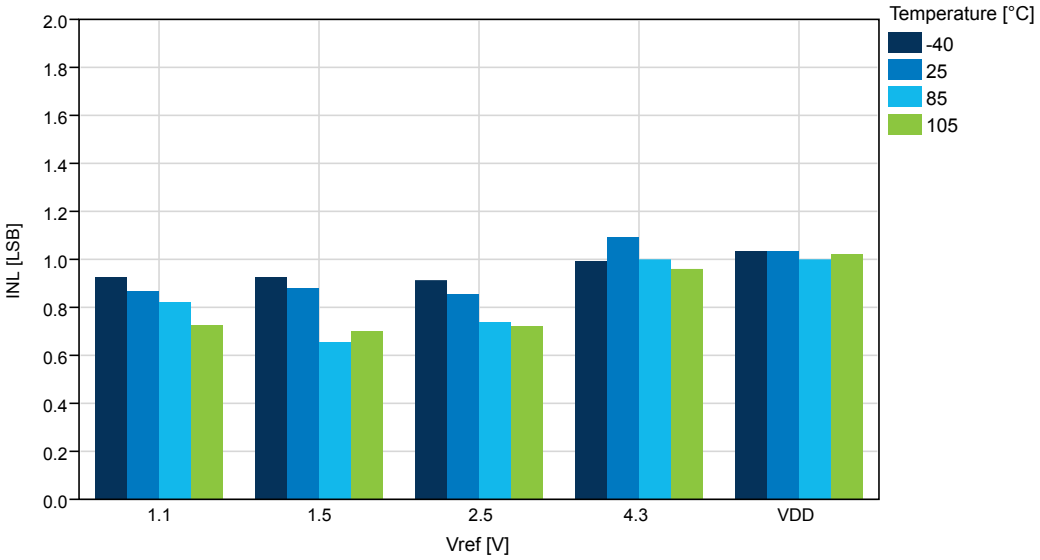


Figure 6-50. Offset Error vs. V_{DD} (f_{ADC}=115 ksps) at T=25°C, REFSEL = Internal Reference

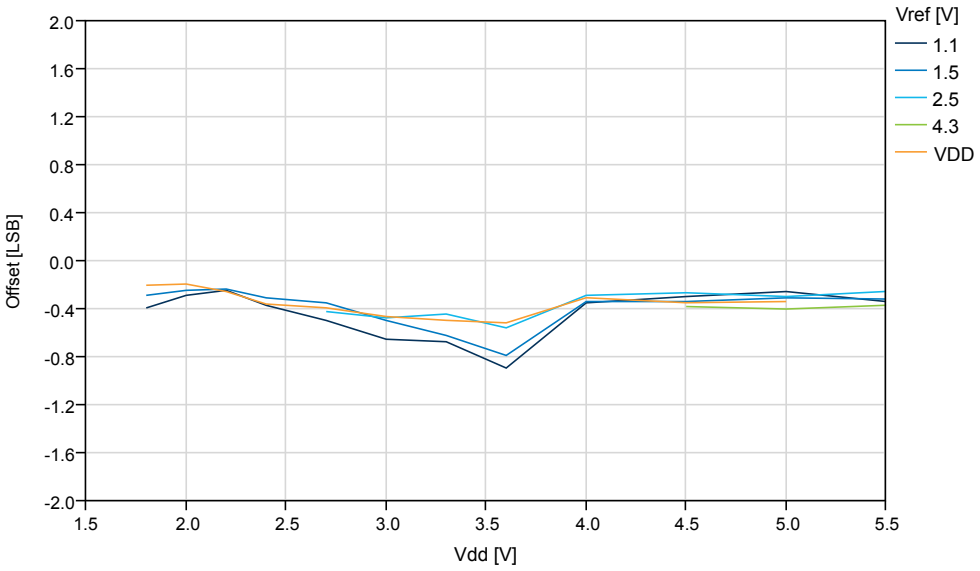


Figure 6-51. Offset Error vs. V_{ref} (V_{DD}=5.0V, f_{ADC}=115 ksps), REFSEL = Internal Reference

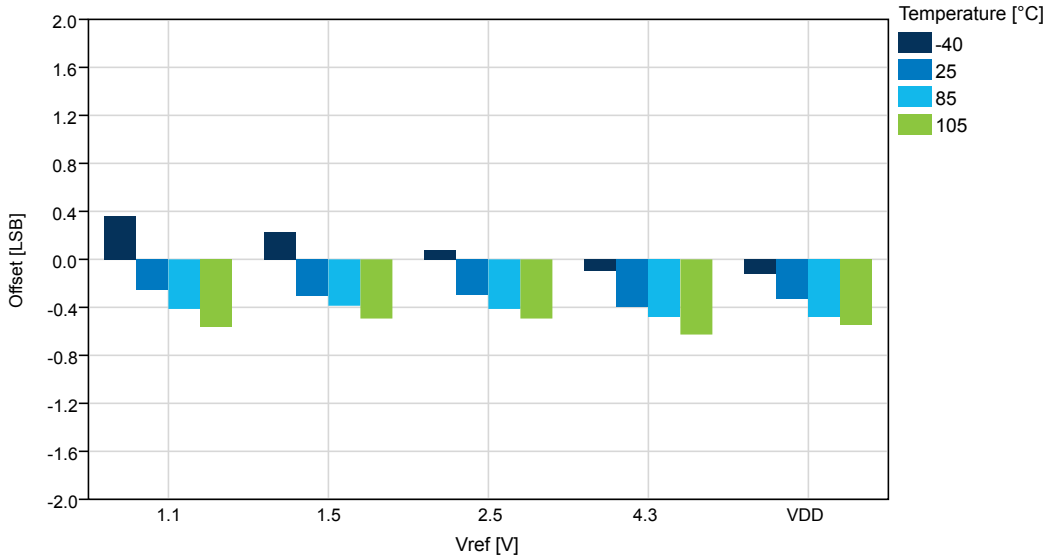


Figure 6-52. Absolute Accuracy vs. V_{DD} (f_{ADC}=115 ksps, T=25°C), REFSEL = External Reference

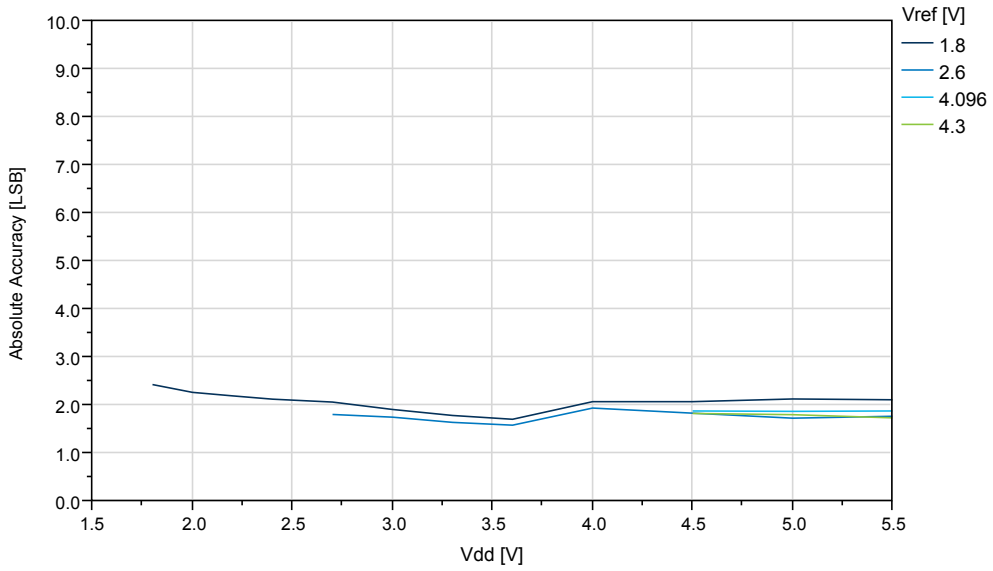


Figure 6-57. Gain vs. V_{REF} (V_{DD}=5.0V, f_{ADC}=115 ksps, REFSEL = External Reference)

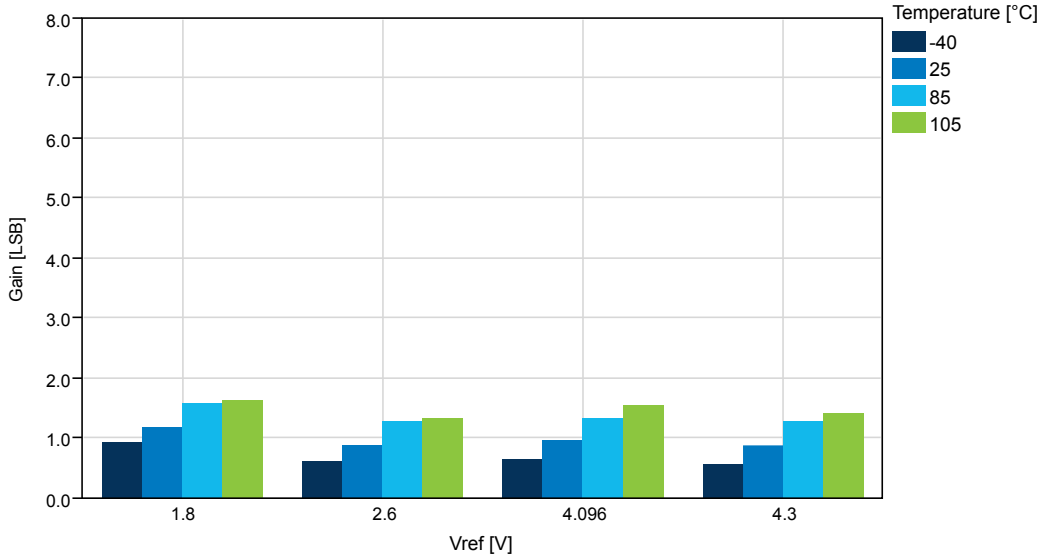


Figure 6-58. INL vs. V_{DD} (f_{ADC}=115 ksps, T=25°C, REFSEL = External Reference)

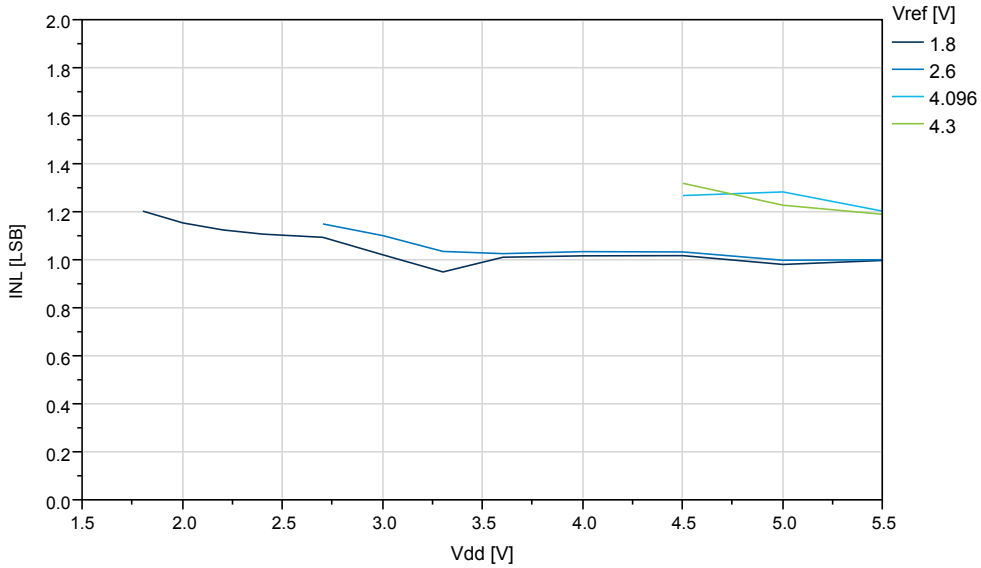


Figure 6-59. INL vs. V_{REF} (V_{DD}=5.0V, f_{ADC}=115 ksps, REFSEL = External Reference)

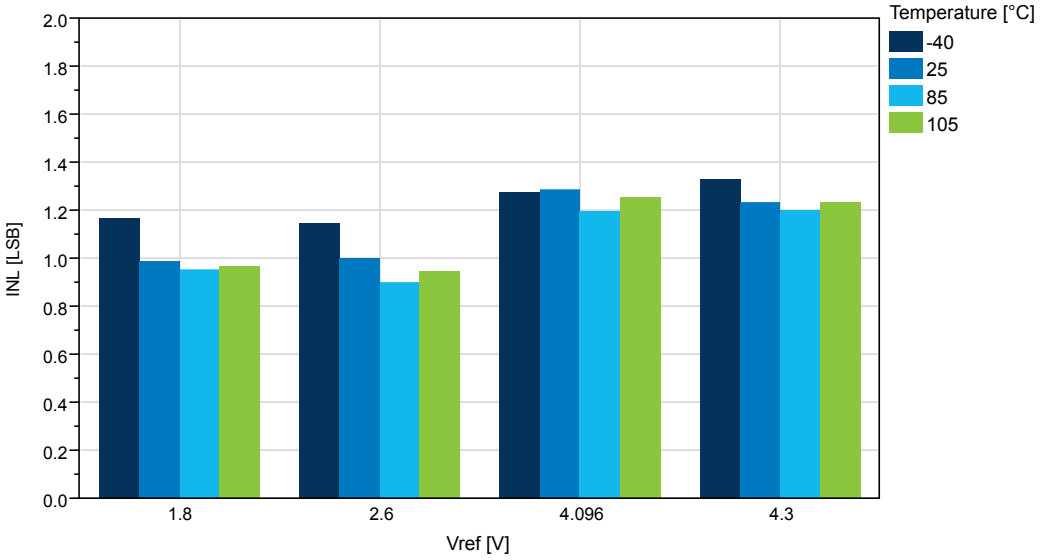


Figure 6-60. Offset vs. V_{DD} (f_{ADC}=115 ksps, T=25°C, REFSEL = External Reference)

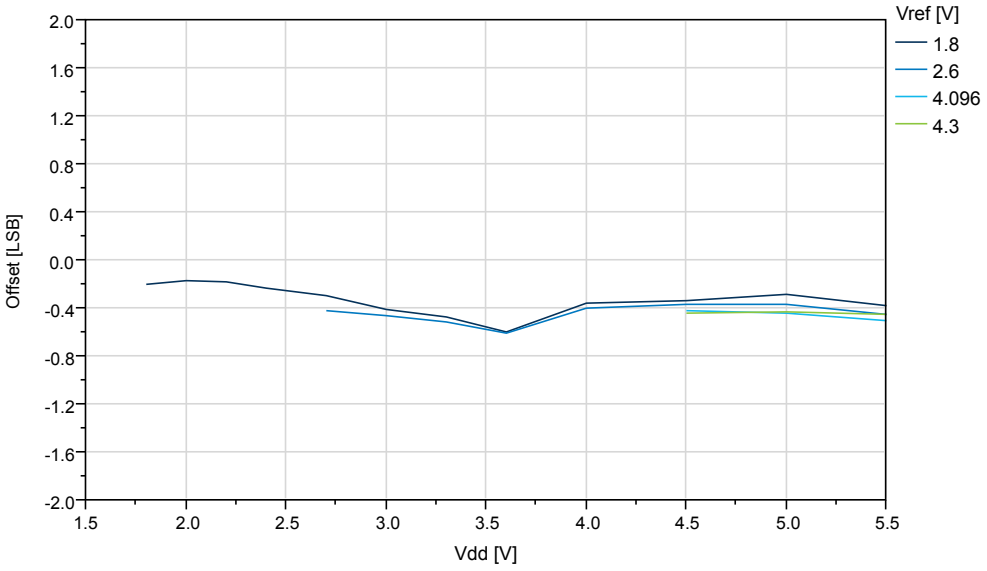


Figure 6-67. OSC20M Internal Oscillator: Frequency vs. Calibration Value (V_{DD}=3V)

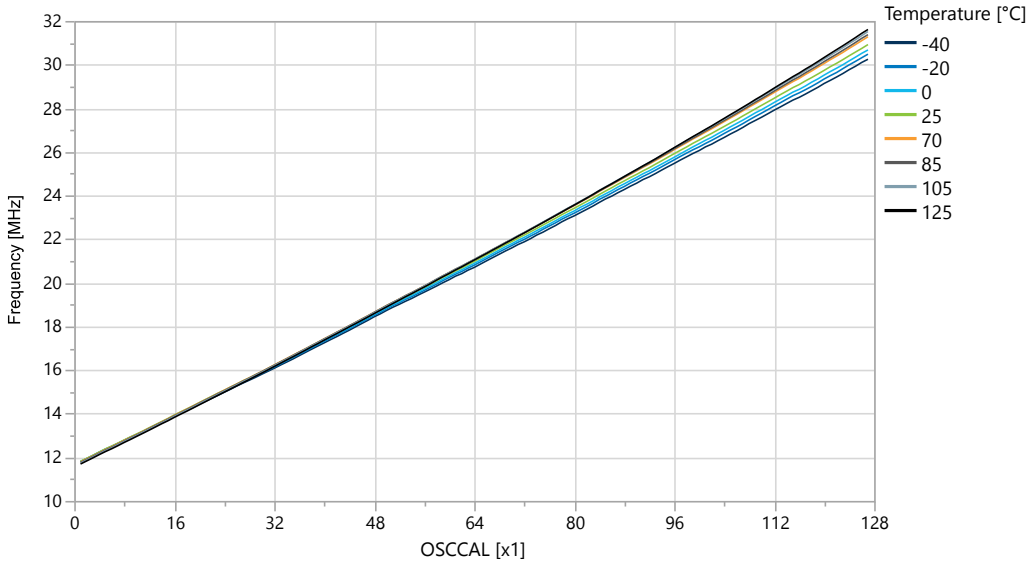
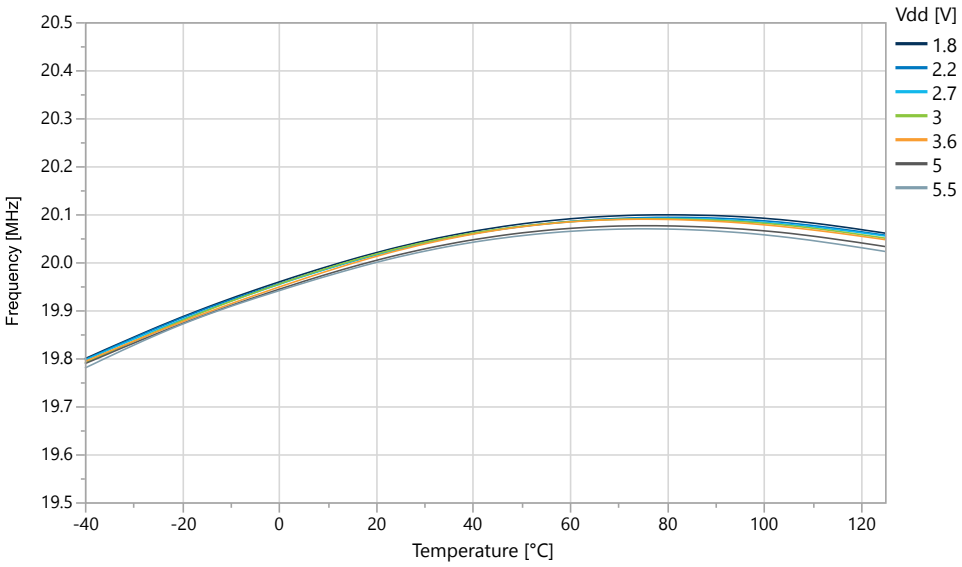


Figure 6-68. OSC20M Internal Oscillator: Frequency vs. Temperature



7. Package Drawings

7.1 48 pin TQFP

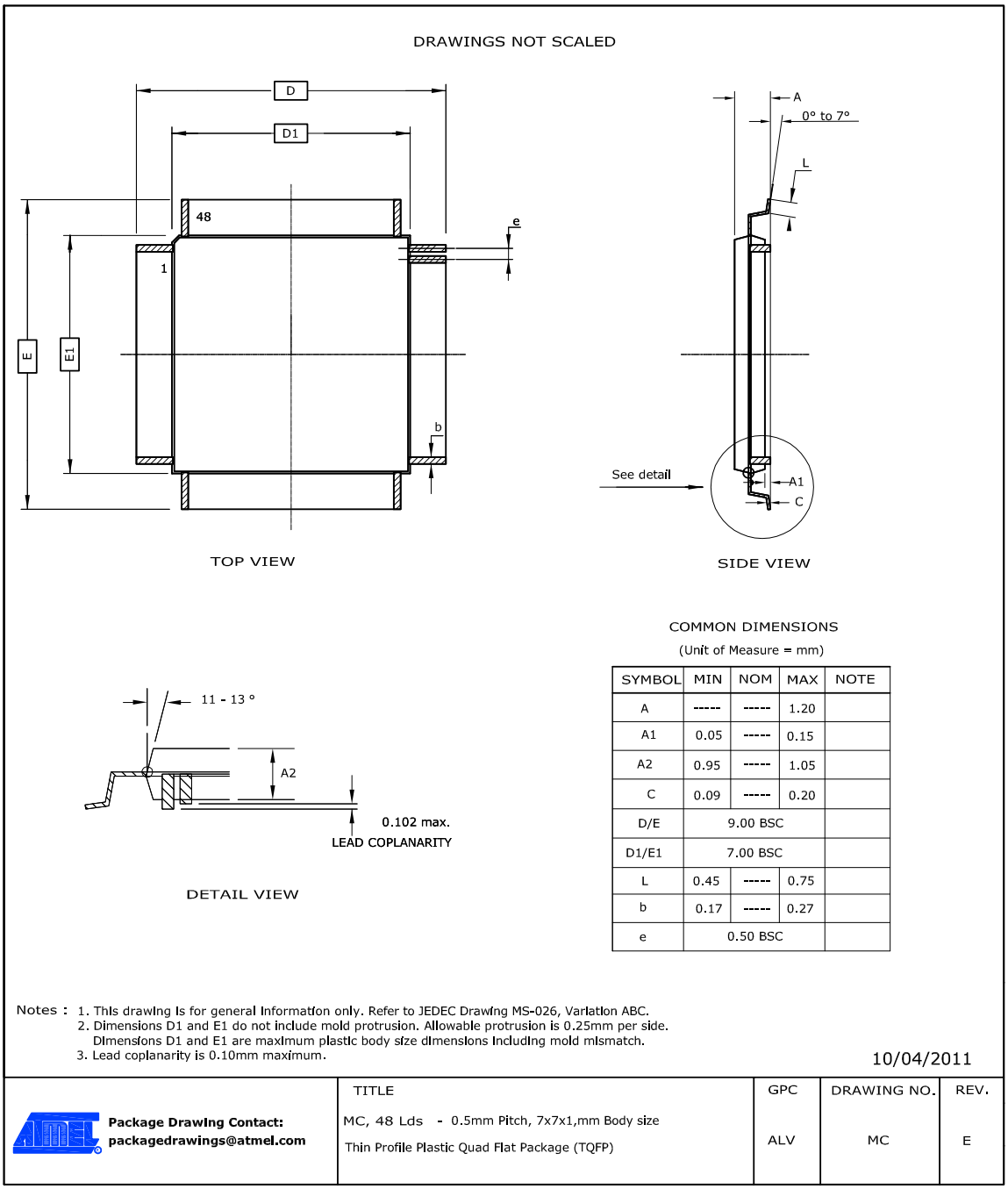


Table 7-1. Device and Package Maximum Weight

140	mg

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ISO/TS 16949

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