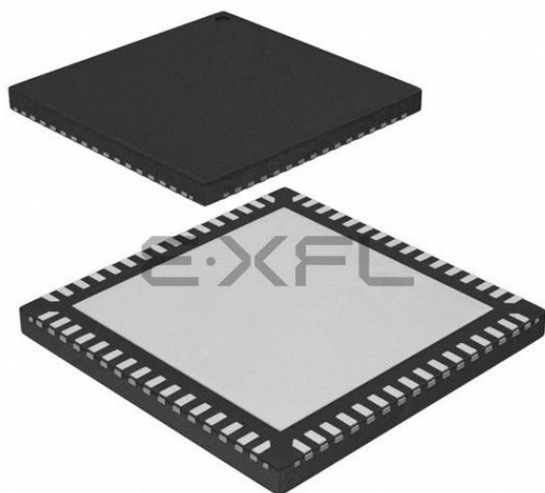




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Details

Product Status	Active
Core Processor	AVR
Core Size	8/16-Bit
Speed	32MHz
Connectivity	I ² C, IrDA, SPI, UART/USART
Peripherals	Brown-out Detect/Reset, POR, PWM, WDT
Number of I/O	50
Program Memory Size	64KB (32K x 16)
Program Memory Type	FLASH
EEPROM Size	2K x 8
RAM Size	4K x 8
Voltage - Supply (Vcc/Vdd)	1.6V ~ 3.6V
Data Converters	A/D 16x12b
Oscillator Type	Internal
Operating Temperature	-40°C ~ 105°C (TA)
Mounting Type	Surface Mount
Package / Case	64-VFQFN Exposed Pad
Supplier Device Package	64-QFN (9x9)
Purchase URL	https://www.e-xfl.com/product-detail/microchip-technology/atxmega64d3-mnr

32.3 Atmel ATxmega128D3

32.3.1 Absolute Maximum Ratings

Stresses beyond those listed in [Table 32-59](#) 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 32-59. Absolute Maximum Ratings

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
V_{CC}	Power supply voltage		-0.3		4	V
I_{VCC}	Current into a V_{CC} pin				200	mA
I_{GND}	Current out of a Gnd pin				200	
V_{PIN}	Pin voltage with respect to Gnd and V_{CC}		-0.5		$V_{CC} + 0.5$	V
I_{PIN}	I/O pin sink/source current		-25		25	mA
T_A	Storage temperature		-65		150	°C
T_J	Junction temperature				150	

32.3.2 General Operating Ratings

The device must operate within the ratings listed in [Table 32-60](#) in order for all other electrical characteristics and typical characteristics of the device to be valid.

Table 32-60. General Operating Conditions

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
V_{CC}	Power supply voltage		1.60		3.6	V
AV_{CC}	Analog supply voltage		1.60		3.6	
T_A	Temperature range		-40		85	°C
T_J	Junction temperature		-40		105	

Table 32-61. Operating Voltage and Frequency

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
Clk_{CPU}	CPU clock frequency	$V_{CC} = 1.6V$	0		12	MHz
		$V_{CC} = 1.8V$	0		12	
		$V_{CC} = 2.7V$	0		32	
		$V_{CC} = 3.6V$	0		32	

The maximum CPU clock frequency depends on V_{CC} . As shown in [Figure 32-15 on page 102](#) the frequency vs. V_{CC} curve is linear between $1.8V < V_{CC} < 2.7V$.

Table 32-63. Current Consumption for Modules and Peripherals

Symbol	Parameter	Condition ⁽¹⁾	Min.	Typ.	Max.	Units
I _{CC}	ULP oscillator			0.9		μA
	32.768kHz int. oscillator			26		
	2MHz int. oscillator			79		
		DFLL enabled with 32.768kHz int. osc. as reference		110		
	32MHz int. oscillator			245		
		DFLL enabled with 32.768kHz int. osc. as reference		415		
	PLL	20× multiplication factor, 32MHz int. osc. DIV4 as reference		305		
	Watchdog timer			1.0		
	BOD	Continuous mode		138		
		Sampled mode, includes ULP oscillator		1.4		
	Internal 1.0V reference			185		mA
	Temperature sensor			173		
	ADC	16ksps V _{REF} = Ext. ref.		1.3		
			CURRLIMIT = LOW	1.15		
			CURRLIMIT = MEDIUM	1.0		
			CURRLIMIT = HIGH	0.9		
		75ksps V _{REF} = Ext. ref.	CURRLIMIT = LOW	1.7		
		300ksps V _{REF} = Ext. ref.		3.1		
	USART	Rx and Tx enabled, 9600 BAUD		7.5		μA
	Flash memory and EEPROM programming			4		mA

Note: 1. All parameters measured as the difference in current consumption between module enabled and disabled. All data at V_{CC} = 3.0V, Clk_{SYS} = 1MHz external clock without prescaling, T = 25°C unless other conditions are given.

32.3.13 Clock and Oscillator Characteristics

32.3.13.1 Calibrated 32.768kHz Internal Oscillator Characteristics

Table 32-77. 32.768kHz Internal Oscillator Characteristics

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
	Frequency			32.768		kHz
	Factory calibration accuracy	T = 85°C, V _{CC} = 3.0V	-0.5		0.5	%
	User calibration accuracy		-0.5		0.5	

32.3.13.2 Calibrated 2MHz RC Internal Oscillator Characteristics

Table 32-78. 2MHz Internal Oscillator Characteristics

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
	Frequency range	DFLL can tune to this frequency over voltage and temperature	1.8	2.0	2.2	MHz
	Factory calibrated frequency			2.0		
	Factory calibration accuracy	T = 85°C, V _{CC} = 3.0V	-1.5		1.5	%
	User calibration accuracy		-0.2		0.2	
	DFLL calibration stepsize			0.18		

32.3.13.3 Calibrated 32MHz Internal Oscillator Characteristics

Table 32-79. 32MHz Internal Oscillator Characteristics

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
	Frequency range	DFLL can tune to this frequency over voltage and temperature	30	32	55	MHz
	Factory calibrated frequency			32		
	Factory calibration accuracy	T = 85°C, V _{CC} = 3.0V	-1.5		1.5	%
	User calibration accuracy		-0.2		0.2	
	DFLL calibration step size			0.2		

32.3.13.4 32kHz Internal ULP Oscillator Characteristics

Table 32-80. 32kHz Internal ULP Oscillator Characteristics

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
	Factory calibrated frequency			32		kHz
	Factory calibration accuracy	T = 85°C, V _{CC} = 3.0V	-12		12	%
	Accuracy		-30		30	

32.4.8 Bandgap and Internal 1.0V Reference Characteristics

Table 32-100. Bandgap and Internal 1.0V Reference Characteristics

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
	Startup time	As reference for ADC	1 Clk _{PER} + 2.5μs			μs
		As input voltage to ADC and AC		1.5		
	Bandgap voltage			1.1		V
INT1V	Internal 1.00V reference	T = 85°C, after calibration	0.99	1.0	1.01	
	Variation over voltage and temperature	Calibrated at T = 85°C		1		

32.4.9 Brownout Detection Characteristics

Table 32-101. Brownout Detection Characteristics ⁽¹⁾

Symbol	Parameter (BOD level 0 at 85°C)	Condition	Min.	Typ.	Max.	Units
V _{BOT}	BOD level 0 falling V _{CC}		1.40	1.60	1.70	V
	BOD level 1 falling V _{CC}			1.8		
	BOD level 2 falling V _{CC}			2.0		
	BOD level 3 falling V _{CC}			2.2		
	BOD level 4 falling V _{CC}			2.4		
	BOD level 5 falling V _{CC}			2.6		
	BOD level 6 falling V _{CC}			2.8		
	BOD level 7 falling V _{CC}			3.0		
t _{BOD}	Detection time	Continuous mode		0.4		μs
		Sampled mode		1000		
V _{HYST}	Hysteresis			1.0		%

Note: 1. BOD is calibrated at 85°C within BOD level 0 values, and BOD level 0 is the default level.

32.4.10 External Reset Characteristics

Table 32-102. External Reset Characteristics

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
t _{EXT}	Minimum reset pulse width		1000	90		ns
V _{RST}	Reset threshold voltage	V _{CC} = 2.7 - 3.6V		0.45 * V _{CC}		V
		V _{CC} = 1.6 - 2.7V		0.45 * V _{CC}		
R _{RST}	Reset pin pull-up resistor			25		kΩ

32.4.14 SPI Characteristics

Figure 32-26. SPI Timing Requirements in Master Mode

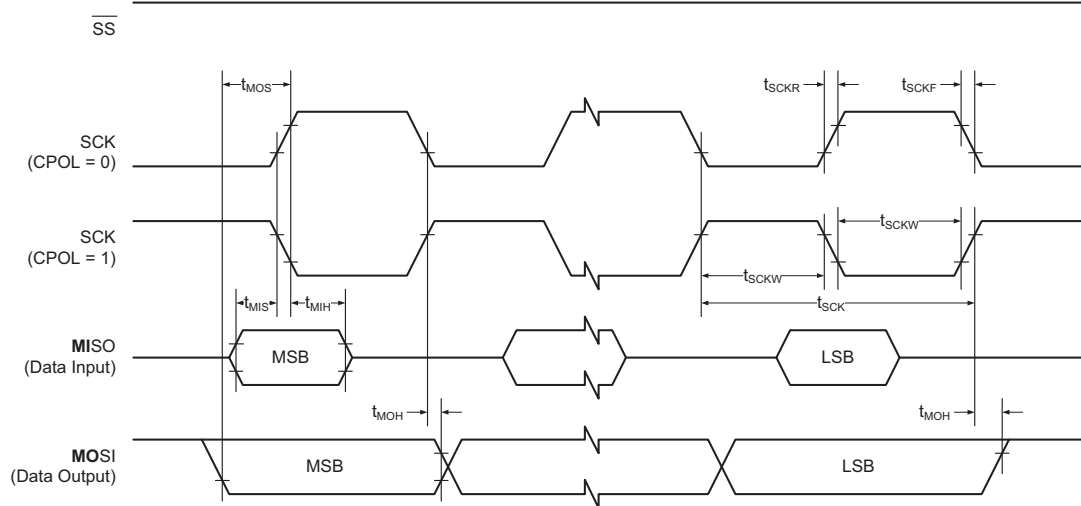
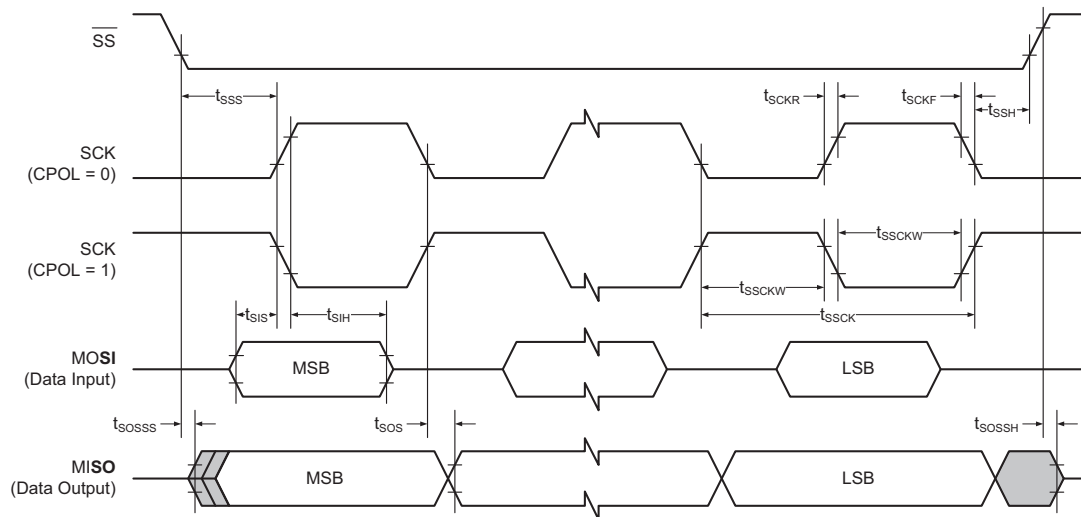


Figure 32-27. SPI Timing Requirements in Slave Mode



32.5 Atmel ATxmega256D3

32.5.1 Absolute Maximum Ratings

Stresses beyond those listed in [Table 32-117](#) 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 32-117. Absolute Maximum Ratings

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
V_{CC}	Power supply voltage		-0.3		4	V
I_{VCC}	Current into a V_{CC} pin				200	mA
I_{GND}	Current out of a Gnd pin				200	
V_{PIN}	Pin voltage with respect to Gnd and V_{CC}		-0.5		$V_{CC} + 0.5$	V
I_{PIN}	I/O pin sink/source current		-25		25	mA
T_A	Storage temperature		-65		150	°C
T_J	Junction temperature				150	

32.5.2 General Operating Ratings

The device must operate within the ratings listed in [Table 32-118](#) in order for all other electrical characteristics and typical characteristics of the device to be valid.

Table 32-118. General Operating Conditions

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
V_{CC}	Power supply voltage		1.60		3.6	V
AV_{CC}	Analog supply voltage		1.60		3.6	
T_A	Temperature range		-40		85	°C
T_J	Junction temperature		-40		105	

Table 32-119. Operating Voltage and Frequency

Symbol	Parameter	Condition	Min.	Typ.	Max.	Units
Clk_{CPU}	CPU clock frequency	$V_{CC} = 1.6V$	0		12	MHz
		$V_{CC} = 1.8V$	0		12	
		$V_{CC} = 2.7V$	0		32	
		$V_{CC} = 3.6V$	0		32	

The maximum CPU clock frequency depends on V_{CC} . As shown in [Figure 32-29 on page 140](#) the frequency vs. V_{CC} curve is linear between $1.8V < V_{CC} < 2.7V$.

32.5.14 SPI Characteristics

Figure 32-33. SPI Timing Requirements in Master Mode

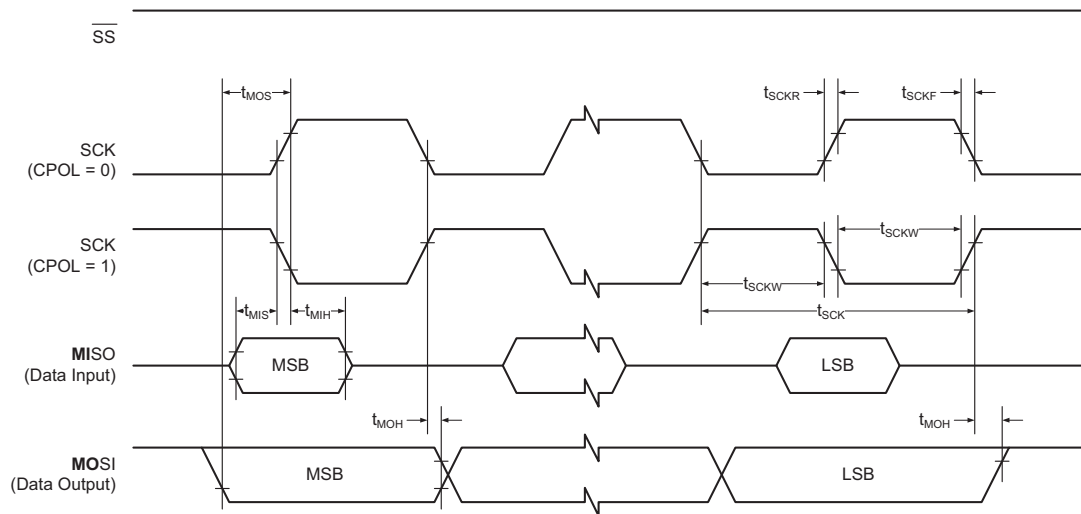
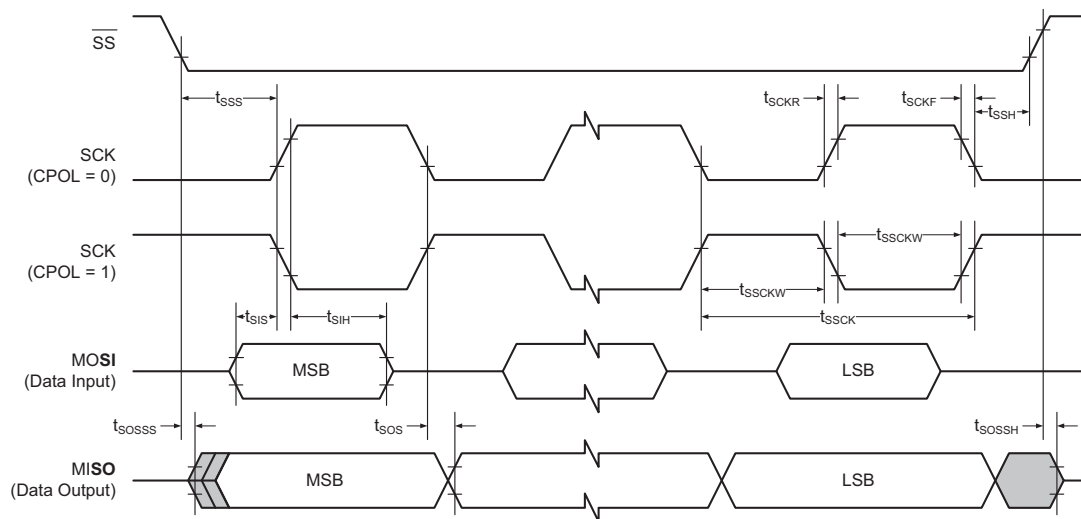


Figure 32-34. SPI Timing Requirements in Slave Mode



32.6.14 SPI Characteristics

Figure 32-40. SPI Timing Requirements in Master Mode

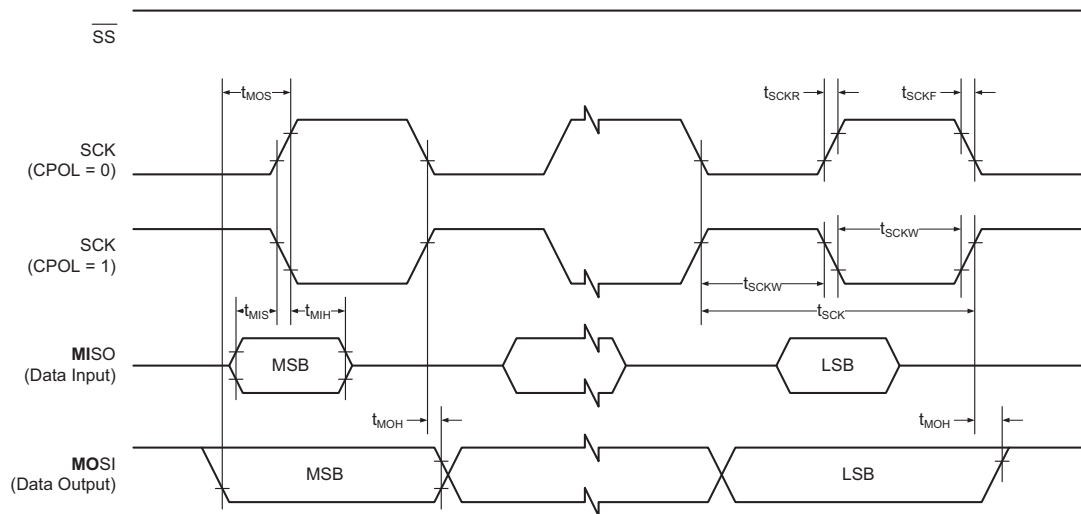


Figure 32-41. SPI Timing Requirements in Slave Mode

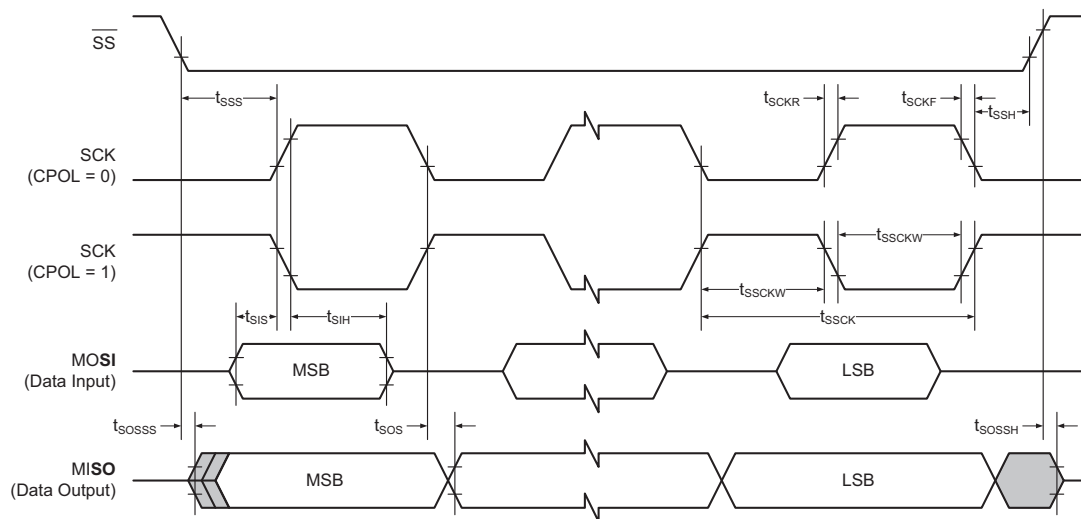


Figure 33-43. Analog Comparator Hysteresis vs. V_{CC}
Large hysteresis

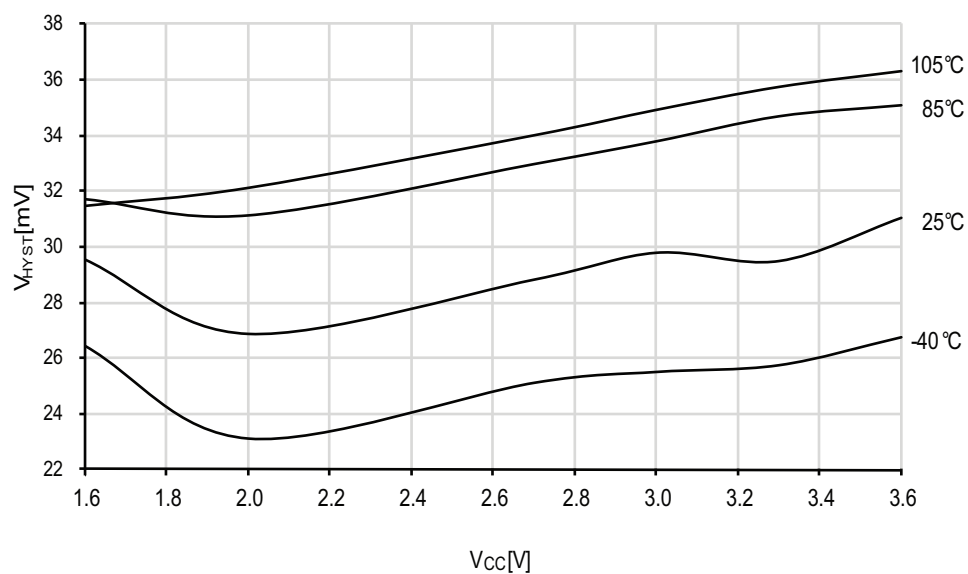
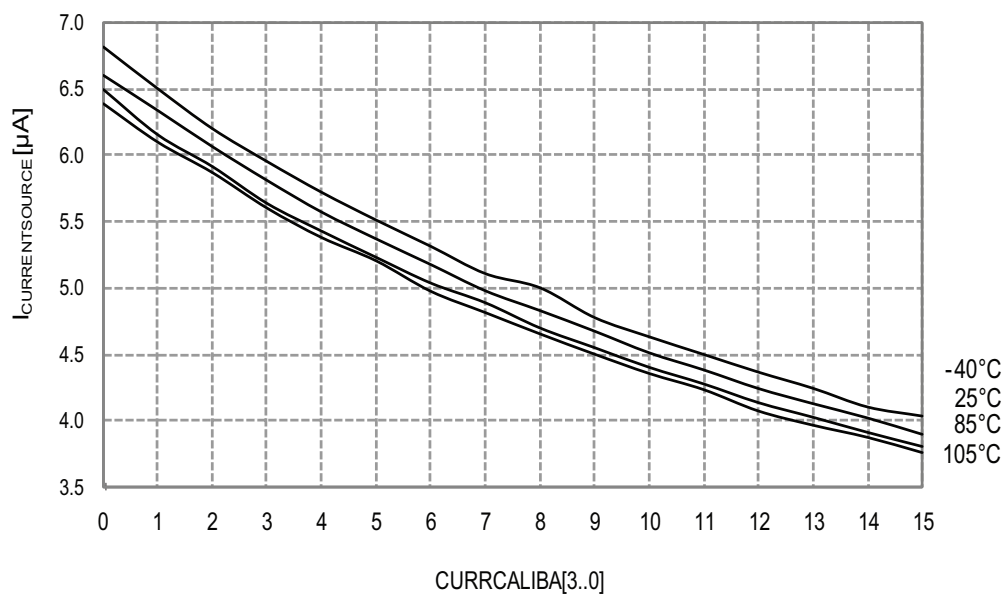


Figure 33-44. Analog Comparator Current Source vs. Calibration Value
 $V_{CC} = 3.0V$



33.1.10 PDI Characteristics

Figure 33-71. Maximum PDI Frequency vs. V_{CC}

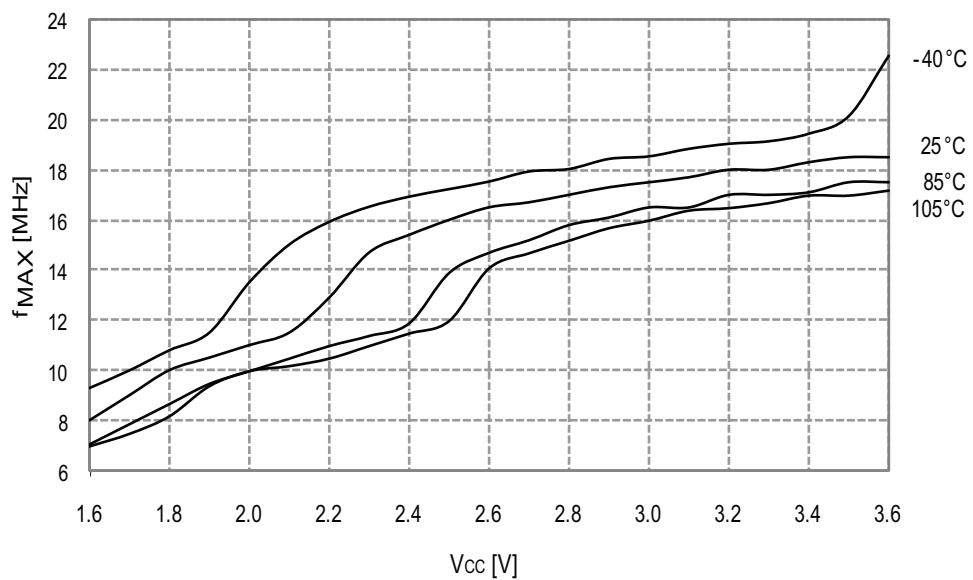
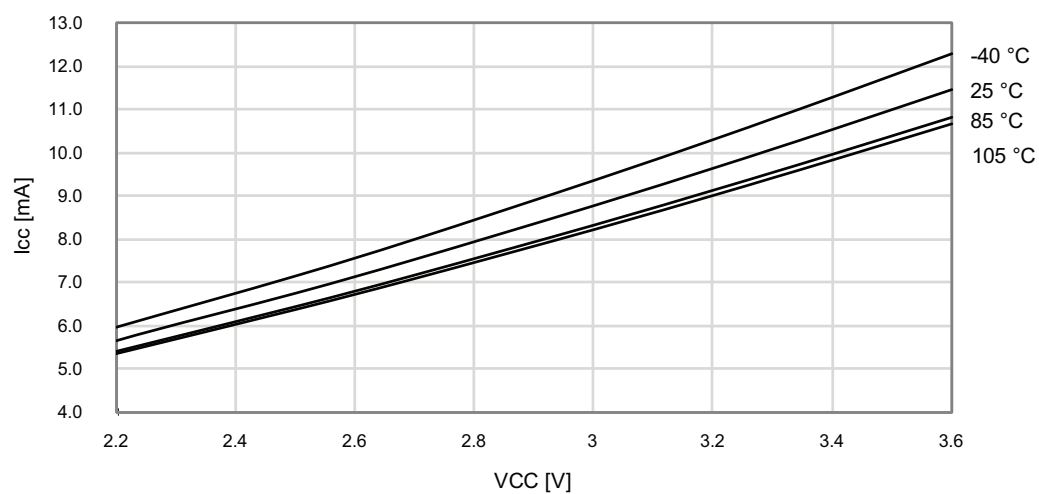


Figure 33-149. Active Mode Supply Current vs. V_{CC}

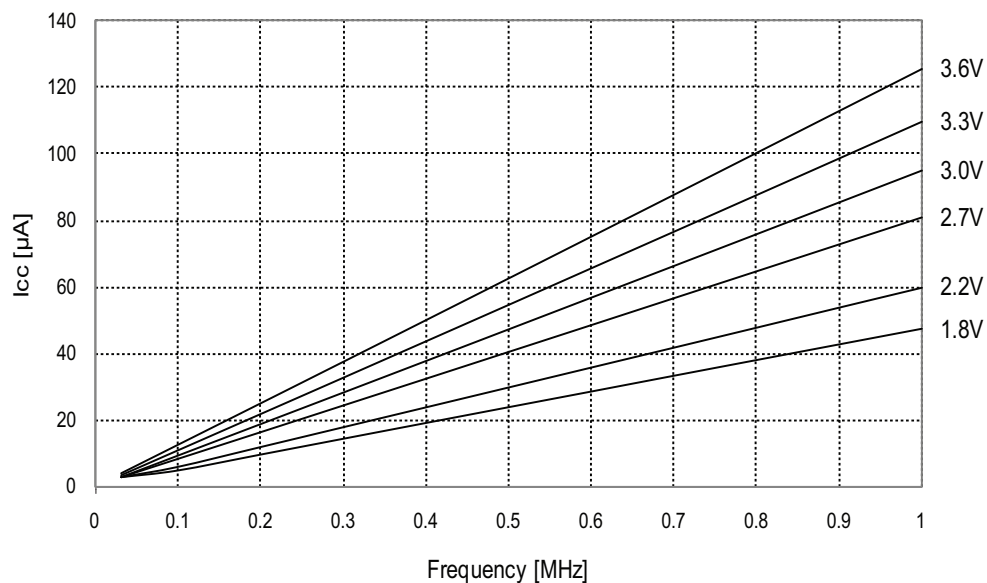
$f_{SYS} = 32\text{MHz}$ internal oscillator



33.3.1.2 Idle Mode Supply Current

Figure 33-150. Idle Mode Supply Current vs. Frequency

$f_{SYS} = 0 - 1\text{MHz}$ external clock, $T = 25^\circ\text{C}$



33.3.2.2 Output Voltage vs. Sink/Source Current

Figure 33-163. I/O Pin Output Voltage vs. Source Current

$V_{CC} = 1.8V$

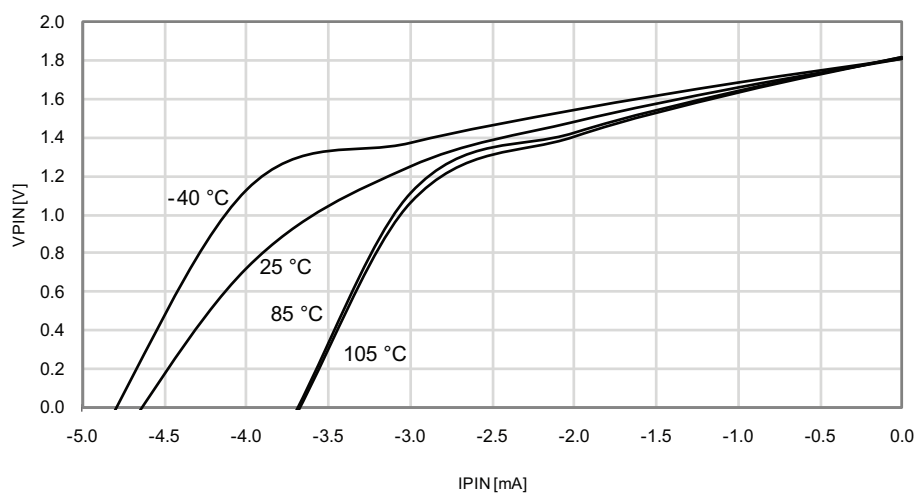
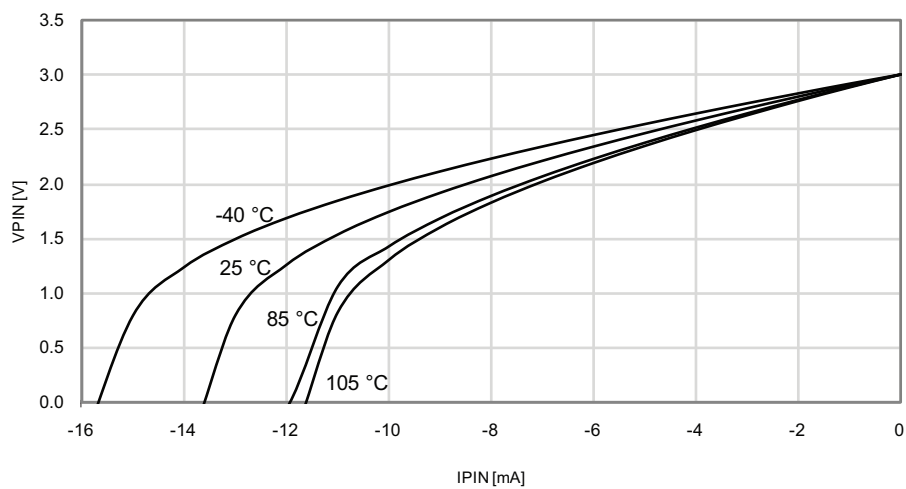


Figure 33-164. I/O Pin Output Voltage vs. Source Current

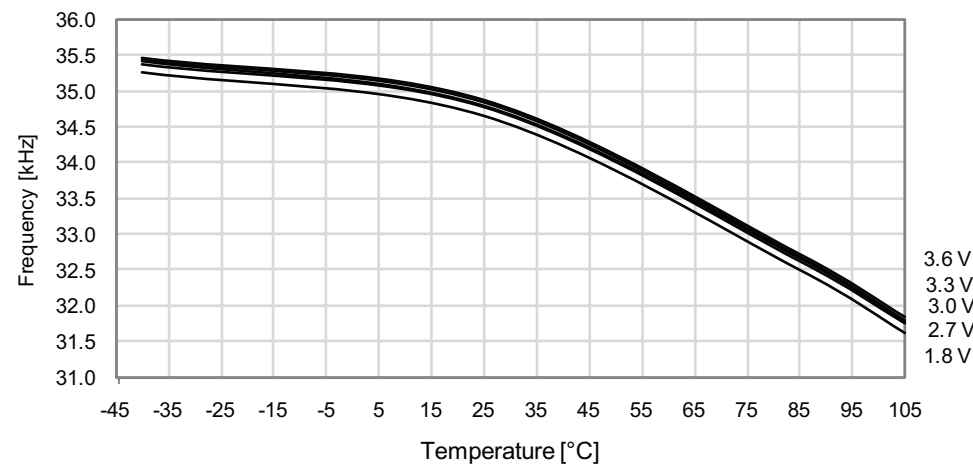
$V_{CC} = 3.0V$



33.3.8 Oscillator Characteristics

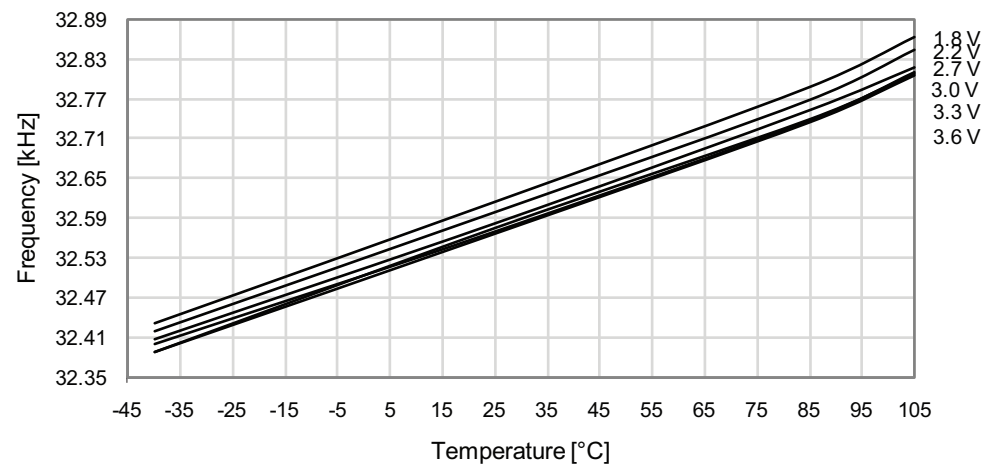
33.3.8.1 Ultra Low-Power Internal Oscillator

Figure 33-195. Ultra Low-Power Internal Oscillator Frequency vs. Temperature



33.3.8.2 32.768kHz Internal Oscillator

Figure 33-196. 32.768kHz Internal Oscillator Frequency vs. Temperature



33.4.2.3 Thresholds and Hysteresis

Figure 33-239. I/O Pin Input Threshold Voltage vs. V_{CC}
 V_{IH} I/O pin read as “1”

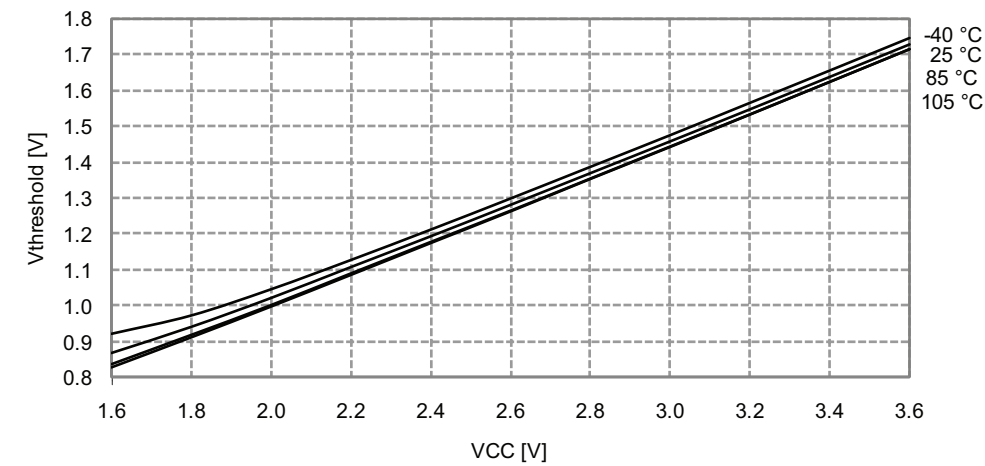


Figure 33-240. I/O Pin Input Threshold Voltage vs. V_{CC}
 V_{IL} I/O pin read as “0”

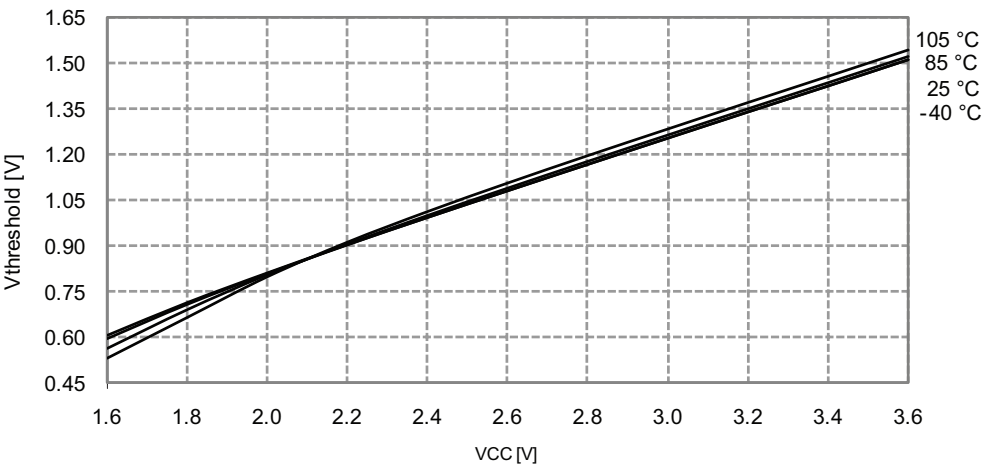
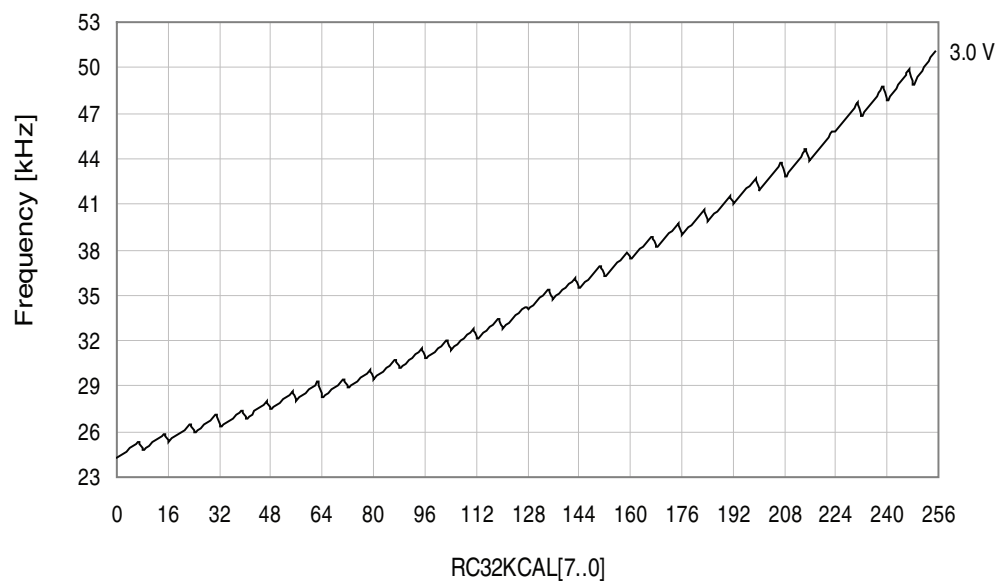


Figure 33-267. 32.768kHz Internal Oscillator Frequency vs. Calibration Value

$V_{CC} = 3.0V$, $T = 25^{\circ}C$



33.4.8.3 2MHz Internal Oscillator

Figure 33-268. 2MHz Internal Oscillator Frequency vs. Temperature

DPLL disabled

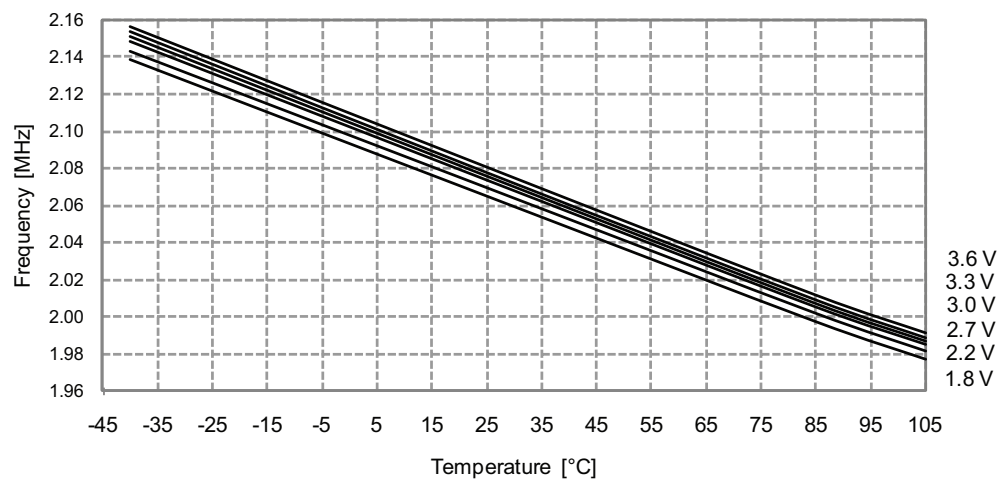
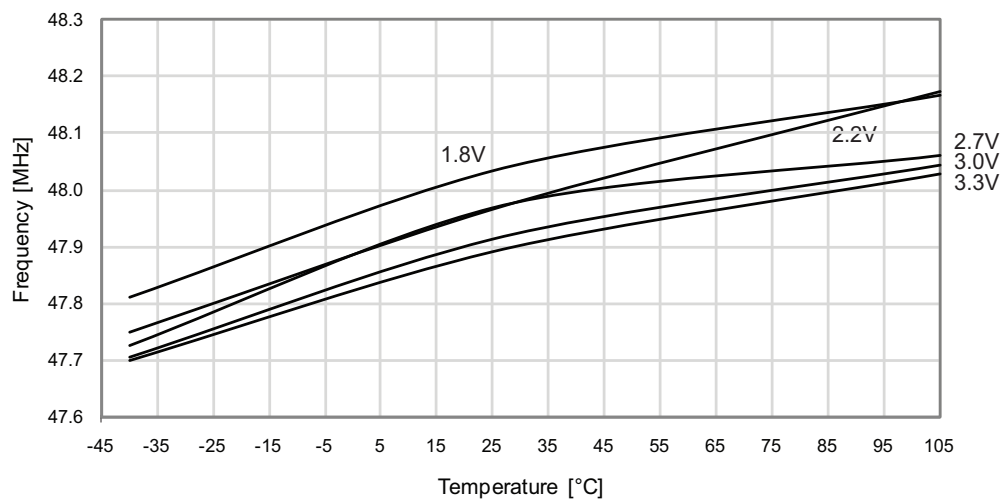


Figure 33-279. 48MHz Internal Oscillator Frequency vs. Temperature
DPLL enabled, from the 32.768kHz internal oscillator



33.4.9 Two-Wire Interface Characteristics

Figure 33-280. SDA Hold Time vs. Temperature

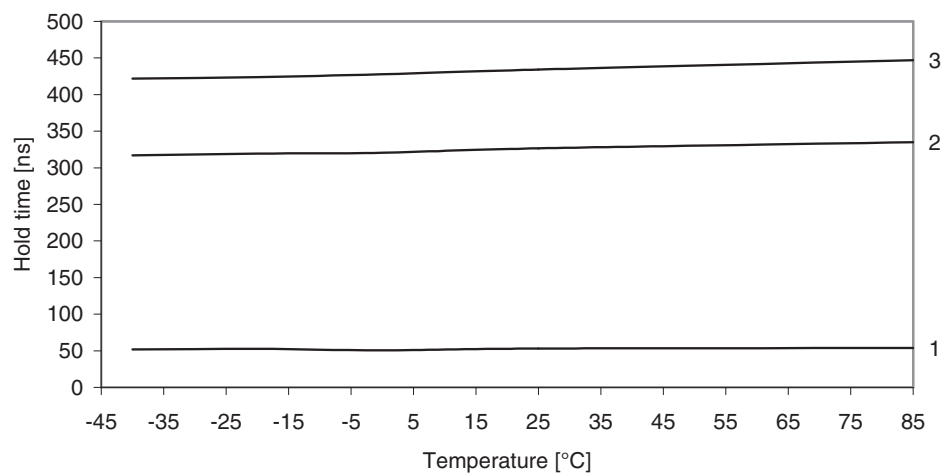


Figure 33-339. 2MHz Internal Oscillator Frequency vs. Temperature
DPLL enabled, from the 32.768kHz internal oscillator

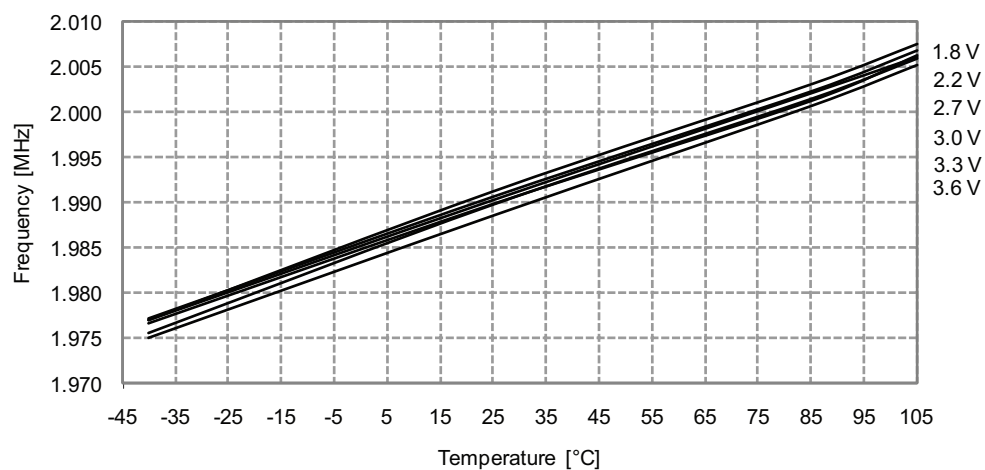
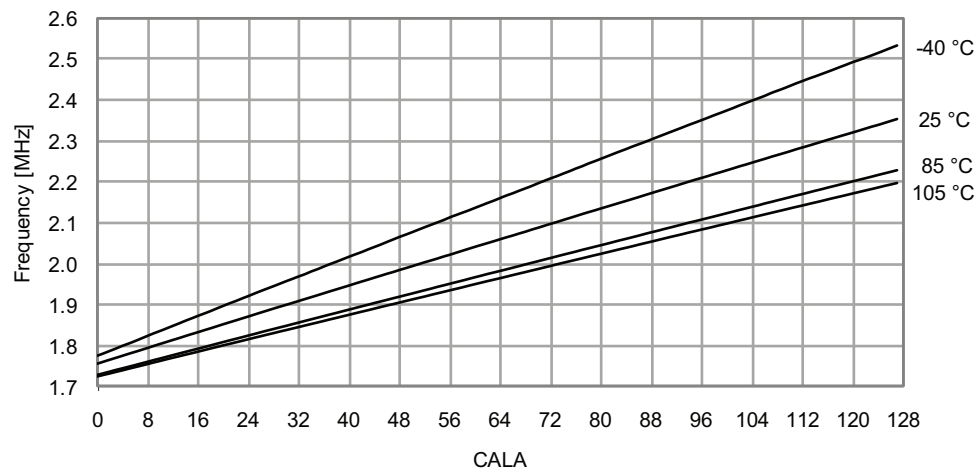


Figure 33-340. 2MHz Internal Oscillator Frequency vs. CALA Calibration Value
 $V_{CC} = 3V$



33.6 Atmel ATxmega384D3

33.6.1 Current Consumption

33.6.1.1 Active Mode Supply Current

Figure 33-353. Active Supply Current vs. Frequency

$f_{SYS} = 0 - 1\text{MHz}$ external clock, $T = 25^\circ\text{C}$

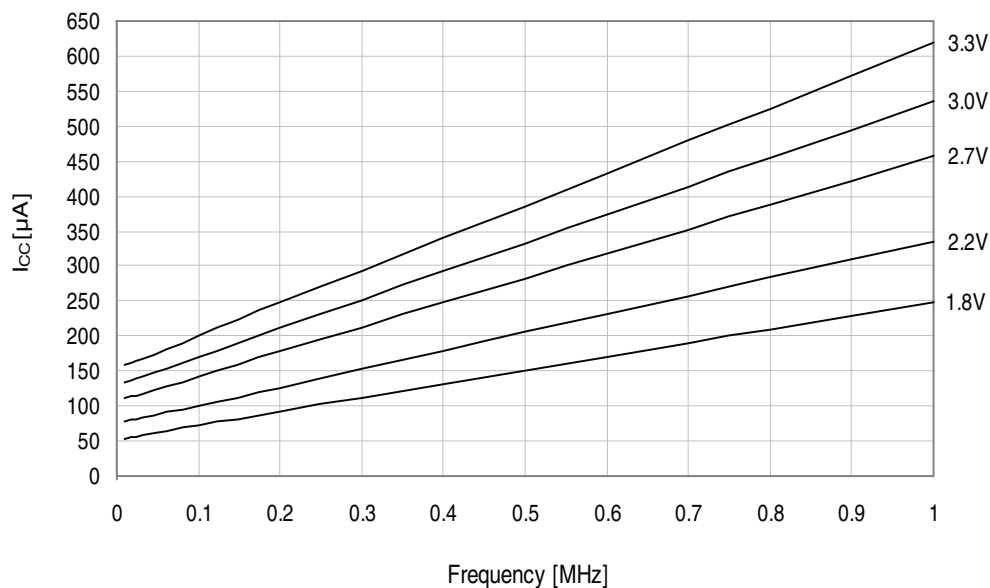


Figure 33-354. Active Supply Current vs. Frequency

$f_{SYS} = 1 - 32\text{MHz}$ external clock, $T = 25^\circ\text{C}$

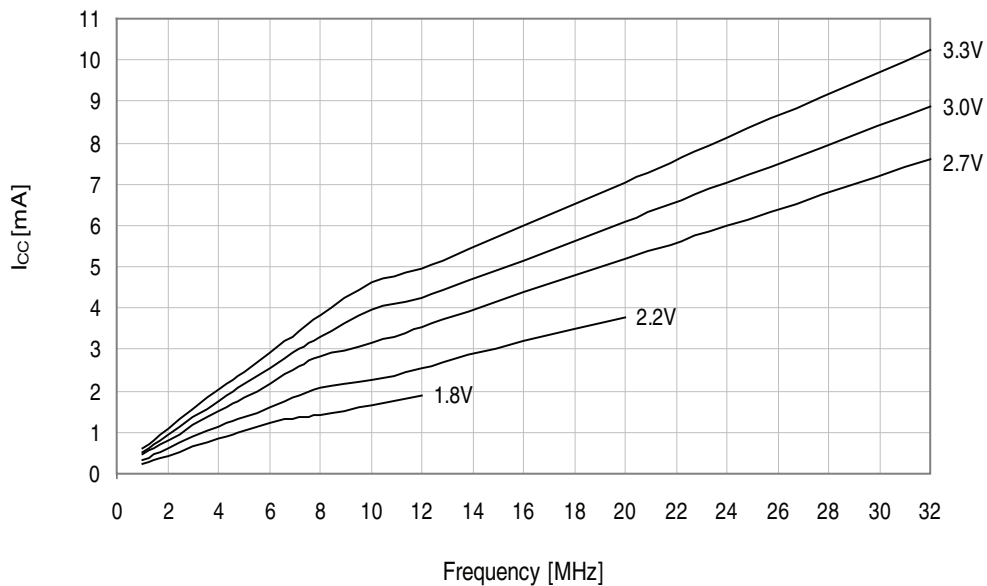
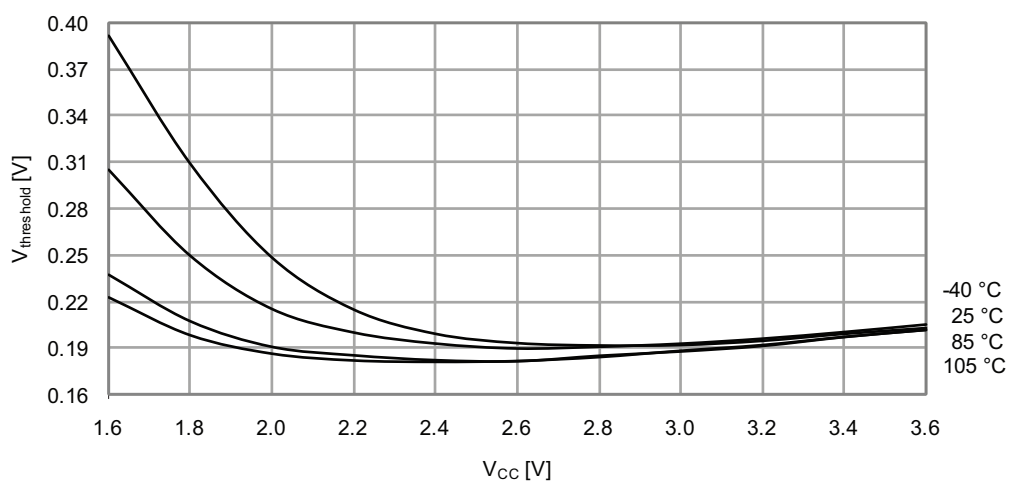


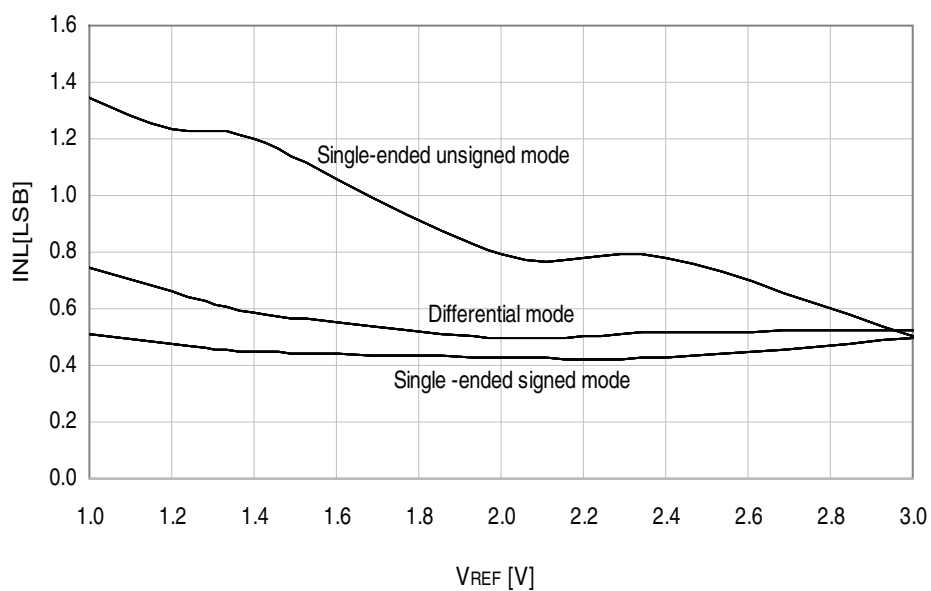
Figure 33-381. I/O Pin Input Hysteresis vs. V_{CC}



33.6.3 ADC Characteristics

Figure 33-382. INL Error vs. External V_{REF}

$T = 25\text{ °C}$, $V_{CC} = 3.6\text{V}$, external reference



33.6.9 Two-Wire Interface Characteristics

Figure 33-417. SDA Hold Time vs. Temperature

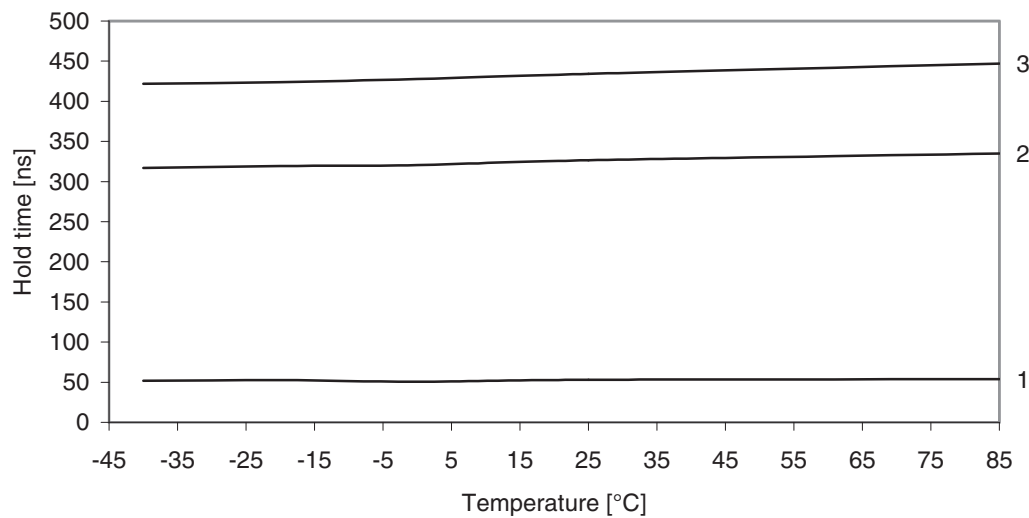


Figure 33-418. SDA Hold Time vs. Supply Voltage

