

Selected Electrical Specifications

$V_{DD} = +1.71 \text{ V to } +3.63 \text{ V}$, $T_A = -40 \text{ to } 85 \text{ }^{\circ}\text{C}$ unless stated otherwise.

Parameter	Symbol	Test Condition/Comment	Min	Typ	Max	Unit
Frequency Range	F_{CLK}	Programmable family range	0.032	—	100	MHz
Supply Voltage	V_{DD}	Supports continuous V_{DD} from Min to Max	1.71	—	3.63	V
Supply Current	I_{DD1}	3.3 V_{DD} , $F_{CLK} = 1 \text{ MHz}$, 4 pF, Low Power mode	—	1.7	2.5	mA
Static Supply Current ¹	I_{DD2}	3.3 V_{DD} , $F_{CLK} = 1 \text{ MHz}$, 4 pF, Low Jitter mode	—	3.9	4.9	mA
		Stop mode, $F_{CLK} = 1 \text{ MHz}$, Low Power mode	—	1.7	2.5	mA
		Stop mode, $F_{CLK} = 1 \text{ MHz}$, Low Jitter mode	—	3.9	4.9	mA
		Doze mode	—	670	890	μA
		Sleep mode	—	0.3	1	μA
Frequency Stability ²	F_{STAB}	$T_A = -20 \text{ }^{\circ}\text{C to } +70 \text{ }^{\circ}\text{C}$, $-40 \text{ }^{\circ}\text{C to } +85 \text{ }^{\circ}\text{C}$	-20	—	+20	ppm
			-30	—	+30	ppm
			-50	—	+50	ppm
CMOS Rise/Fall Time ³	T_R/T_F	1 st option code = A ⁴ or H ⁴	0.4	0.7	1.2	ns
		1 st option code = B, C, D, J, K, L	1	1.3	1.6	ns
		1 st option code = E, M	2	3	4	ns
		1 st option code = F, N	4	5	7	ns
		1 st option code = G, P	7	8	11	ns
Cycle-to-Cycle Jitter	J_{CCPP}	$F_{CLK} = 100 \text{ MHz}$, Low Jitter mode 1 st option code = H	—	14	25	ps pk-pk
Period Jitter Pk-Pk	J_{PPKPK}	$F_{CLK} = 100 \text{ MHz}$, Low Jitter mode 1 st option code = H	—	9	13	ps pk-pk
Period Jitter	J_{PRMS}	$F_{CLK} = 100 \text{ MHz}$, Low Jitter mode 1 st option code = H	—	1	1.6	ps rms
Phase Jitter ⁵	ϕ	$F_{CLK} = 75 \text{ MHz}$, $F_{OFFSET} = 900 \text{ kHz} - 7.5 \text{ MHz}$ Low Jitter mode, 1 st option code = H	—	1	1.3	ps rms
Duty Cycle	DC	Drive strength selected such that T_R/T_F (20% to 80%) < 10 % of period	45	50	55	%
Input High Voltage	V_{IH}		$0.7 \times V_{DD}$	—	—	V
Input Low Voltage	V_{IL}		—	—	$0.3 \times V_{DD}$	V
Output High Voltage	V_{OH}		$0.9 \times V_{DD}$	—	—	V
Output Low Voltage	V_{OL}		—	—	$0.1 \times V_{DD}$	V

- Si501 supports OE/mode functionality. Si502 supports OE/mode and FS functionality. Si503 supports only FS functionality. See data sheet functional description section for more information.
- Frequency stability includes initial tolerance, solder shift, operating temp range, rated power supply voltage change, load change, 10-year aging, shock, and vibration.
- $C_L = 15 \text{ pF}$, T_R/T_F (20% to 80%), 3.3 V unless otherwise stated. See datasheet for additional T_R/T_F options.
- Recommended series termination resistor (R_S) = $24.9 \text{ } \Omega$ for $Z_0 = 50 \text{ } \Omega$.
- Integrated phase jitter exceeds some high-performance data communications system requirements. See AN783 for more information.

Absolute Maximum Ratings¹

Parameter	Symbol	Condition	Rating	Unit
Storage Temperature	T_S		-55 to 125	$^{\circ}\text{C}$
Supply Voltage	V_{DD}		-0.5 to 3.8	$^{\circ}\text{C}$
Input Voltage	V_{IN}		$0.5 \text{ to } V_{DD} + 0.3$	V
ESD HBM (JESD22-A114)	HBM		2000	V
ESD CDM	CDM		500	V
Solder Temp ²	T_{PEAK}		260	$^{\circ}\text{C}$
Solder Time at T_{PEAK} ²	T_P		20-40	s
Max Junction Temp	T_J		125	$^{\circ}\text{C}$

- Stresses beyond those listed in this table may cause permanent damage to the device. Functional operation specification compliance is not implied at these conditions. Exposure to maximum rating conditions for extended periods may affect device reliability.
- The device is compliant with JEDEC J-STD-020.

Environmental Compliance and Package Information

Parameter	Test Condition
Mechanical Shock	MIL-STD-883, M2002 Cond B. (1,500g)
Mechanical Shock High g	MIL-STD-883, M2002, Cond. E (10,000g)
Mechanical Vibration	MIL-STD-883, Method 2007
Solderability	MIL-STD-883, Method 2003
Temperature Cycle	JESD22, Method A104
Resistance to Solder Heat	MIL-STD-883, Method 2036
Contact Pads	Gold over Nickel/Palladium

Thermal Conditions

Parameter	Symbol	Test Condition	Value	Unit
Thermal Impedance	Θ_{JA}	3.2 x 5 mm, still air	187	°C/W
		2.5 x 3.2 mm, still air	239	
		2 x 2.5 mm, still air	241	

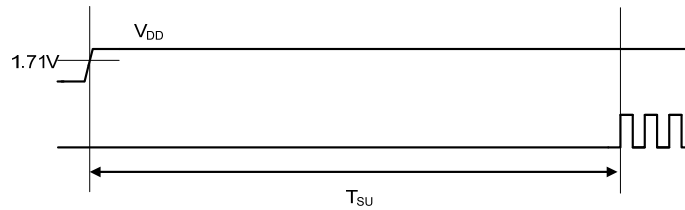
Clock Timing Characteristics

$V_{DD} = +1.71 \text{ V to } +3.63 \text{ V}$, $T_A = -40 \text{ to } 85 \text{ °C}$ unless stated otherwise.

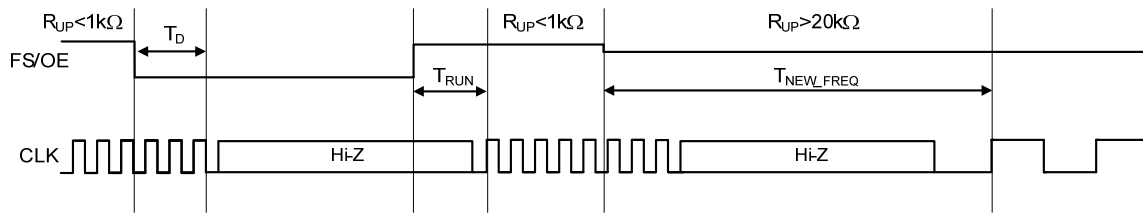
Parameter	Symbol	Test Condition/Comment	Min	Typ	Max	Unit
Startup Time ¹	T_{SU}	From V_{DD} crossing 1.71 to first clock	—	2.5	4	ms
Resume Time ^{2,3}	T_{RUN}	From Stop mode	—	—	$1.5 \times T_{CLK} + 35$	ns
		From Sleep mode	—	2.5	5	ms
		From Doze mode	—	—	2.55	
Output Disable Time ^{2,3}	T_D	To Stop	—	—	$1.5 \times T_{CLK} + 35$	ns
		To Sleep/Doze	—	—	225	μs
Frequency Update Time ²	T_{NEW_FREQ}	To New Frequency	—	—	5	ms

1. Hold FS/OE high (strong or weak) during powerup for fastest time to clock.
2. Si501 and Si502 only. Si503 has frequency select (FS) only and does not support Stop, Doze or Sleep.
3. $T_{CLK} = \text{clock period} = 1 / F_{CLK}$.

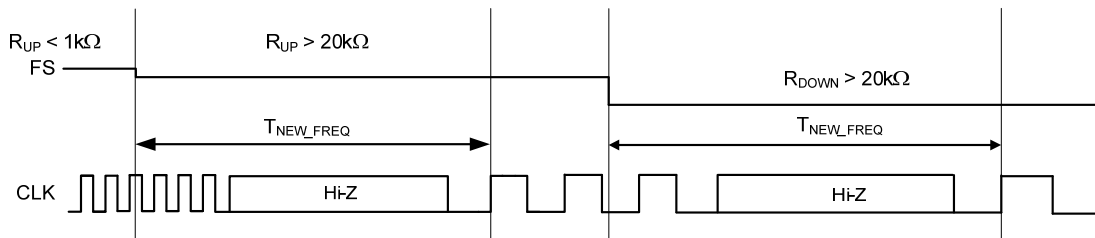
AC Waveforms



Si501/2/3 Power On Time

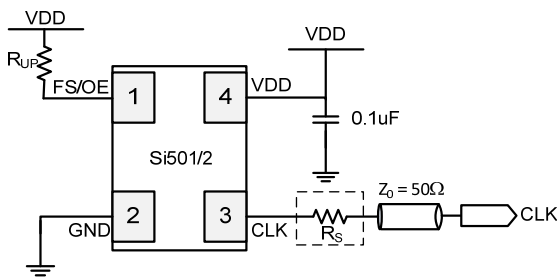


Si501/2 AC Waveform

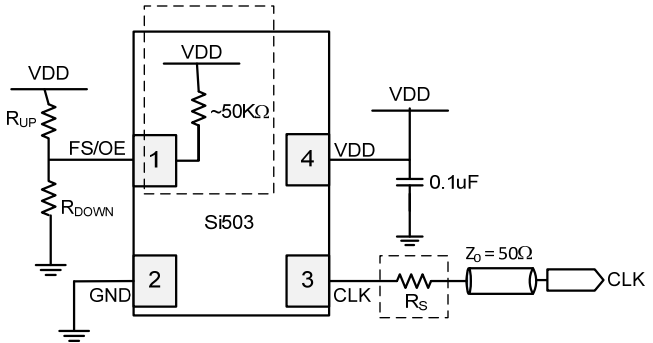


Si503 AC Waveform

Applications Circuits



Si501/2 Apps Circuit w/ Optional Series Resistor



Si503 Apps Circuit w/ Configurable Options

Notes:

- Dotted line boxes show optional components depending on configuration options. See data sheet for additional information and for applications using a microcontroller. Data sheet is available at www.silabs.com/cmems.
- Recommended series termination resistor (R_S) = 24.9 Ω for $Z_0 = 50 \Omega$.

Si502 FS/OE States and Resistor Values

FS/OE State	R_{UP}	Clock Output
Strong High	$0 \Omega \leq R_{UP} \leq 1 \text{ k}\Omega$	Frequency 1
Weak High	$20 \text{ k}\Omega \leq R_{UP} \leq 200 \text{ k}\Omega$	Frequency 2
Low	—	Hi-Z

Si503 FS States and Resistor Values

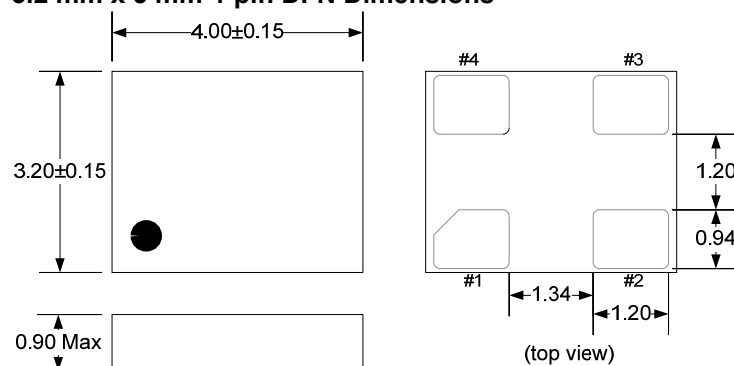
FS/OE State	R_{UP}	R_{DOWN}	Clock Output
Strong High	$0 \Omega \leq R_{UP} \leq 1 \text{ k}\Omega$	No pop	Frequency 1
Weak High	$20 \text{ k}\Omega \leq R_{UP} \leq 200 \text{ k}\Omega$	No pop	Frequency 2
Weak Low	No pop	$20 \text{ k}\Omega \leq R_{DOWN} \leq 200 \text{ k}\Omega$	Frequency 3
Low	No pop	$0 \Omega \leq R_{DOWN} \leq 1 \text{ k}\Omega$	Frequency 4

Notes for both FS/OE tables above:

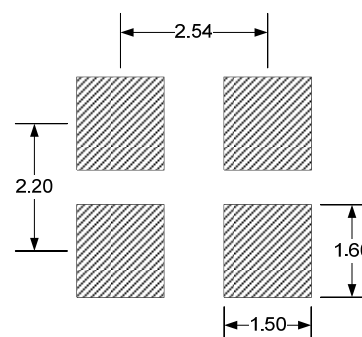
- If the internal pull-up resistor order option is NOT selected, an MCU internal pull-up resistor or an external pull-up resistor should be used. See data sheet for more information.
- The parallel combination of all pull-up resistors on the FS/OE pin including the optional internal pull-up resistor must be $> 20 \text{ k}\Omega$ to select Weak High.
- If the Si50x internal pull-up resistor is enabled with no other external OE connections, the OE state will be detected as "Weak High", selecting Frequency 2 by default.

Package Dimensions and Landing Patterns

3.2 mm x 5 mm 4-pin DFN Dimensions

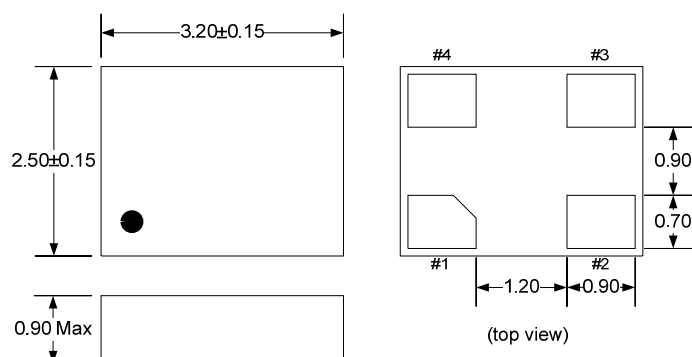


3.2 mm x 5 mm 4-pin DFN Landing Pattern

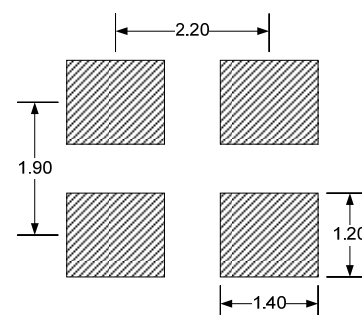


Note: The 3.2 x 5 mm package is delivered as a 3.2 x 4 mm package and is drop-in compatible to industry-standard 3.2 x 5 landing patterns.

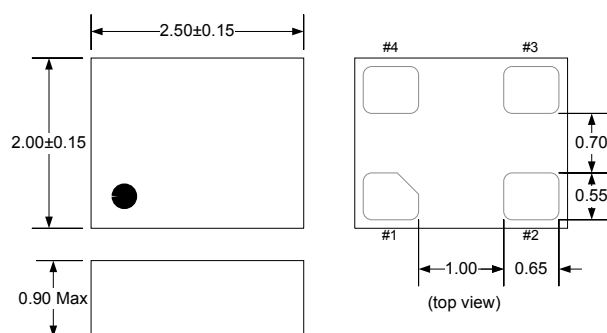
2.5 mm x 3.2 mm 4-pin DFN Dimensions



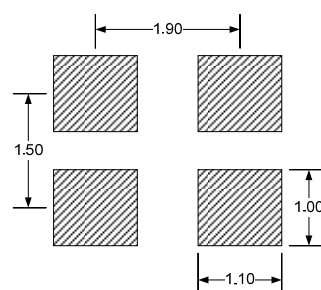
2.5 mm x 3.2 mm 4-pin DFN Landing Pattern



2 mm x 2.5 mm 4-pin DFN Dimensions

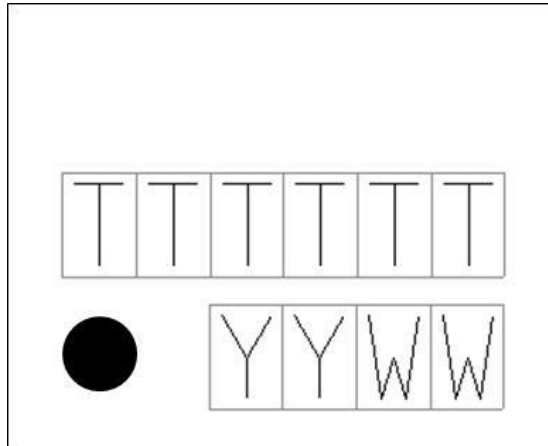


2 mm x 2.5 mm 4-pin DFN Landing Pattern



Package Top Marks and Explanations

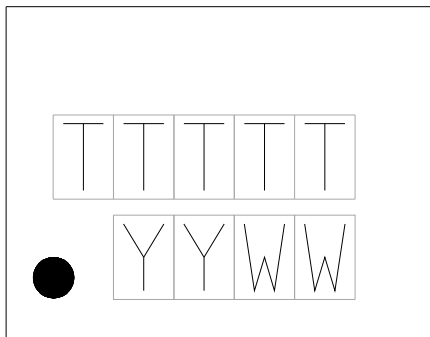
3.2 mm x 5 mm Top Mark



3.2 mm x 5 mm Top Mark Explanation

Mark Method:	Laser	
Font:	0.66 mm Right-Justified	
Line 1 Marking:	TTTTT=Trace Code	Manufacturing Code from the Assembly Purchase Order form.
Line 2 Marking:	Circle=0.5mm diameter Left-Justified	Pin 1 Indicator
	YY = Year WW = Work Week	Assigned by the Assembly House. Corresponds to the year and work week of the build date.

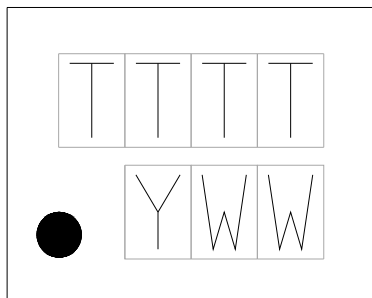
2.5 mm x 3.2 mm Top Mark



2.5 mm x 3.2 mm Top Mark Explanation

Mark Method:	Laser	
Font:	0.50 mm Right-Justified	
Line 1 Marking:	TTTT=Trace Code	Manufacturing Code from the Assembly Purchase Order form.
Line 2 Marking:	Circle=0.3 mm diameter Left-Justified	Pin 1 Indicator
	YY = Year WW = Work Week	Assigned by the Assembly House. Corresponds to the year and work week of the build date.

2 mm x 2.5 mm Top Mark



2 mm x 2.5 mm Top Mark Explanation

Mark Method:	Laser	
Font:	0.50 mm Right-Justified	
Line 1 Marking:	TTTT=Trace Code	Manufacturing Code from the Assembly Purchase Order form.
Line 2 Marking:	Circle=0.3 mm diameter Left-Justified	Pin 1 Indicator
	Y = Year WW = Work Week	Assigned by the Assembly House. Corresponds to the year and work week of the build date.

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