Table 2. Pin Configuration

SMD Pin	SOT23-5 Pin	Symbol	I/O	Functionality
1	2, 3	NC/GND	No Connect	Connect to GND or leave floating.
2	1	GND	Power Supply Ground	Connect to ground. All GND pins must be connected to power supply ground.
3	5	CLK Out	OUT	Oscillator clock output. When interfacing to an MCU's XTAL input, the CLK Out is typically connected to the receiving IC's X IN pin.
4	4	Vdd	Power Supply	Connect to power supply 1.5V ≤ Vdd ≤ 3.63V. Under normal operating conditions, Vdd does not require external bypass/decoupling capacitor(s). Internal power supply filtering will reject more than ±150 mVpp with frequency components through 10 MHz.

SOT23-5 (Top View)

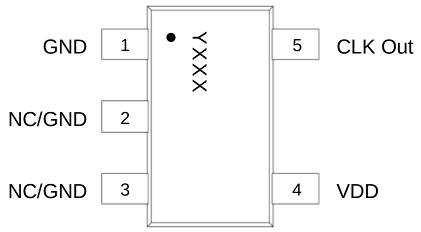


Figure 1. Pin Assignments

SMD Package (Top View)

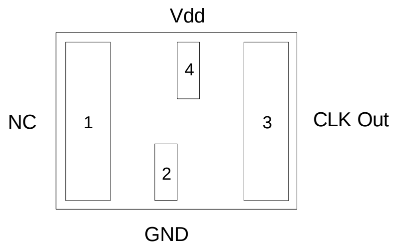


Figure 2. Pin Assignments

System Block Diagram

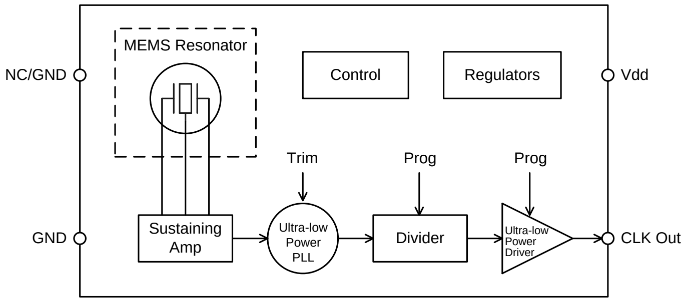


Figure 3. SIT1630 Block Diagram

Table 3. Absolute Maximum

Attempted operation outside the absolute maximum ratings cause permanent damage to the part. Actual performance of the IC is only guaranteed within the operational specifications, not at absolute maximum ratings.

Parameter	Test Condition	Value	Unit
Continuous Power Supply Voltage Range (Vdd)		-0.5 to 3.63	V
Short Duration Maximum Power Supply Voltage (Vdd)	≤30 minutes, over -40°C to +85°C	4.0	V
Short Duration Maximum Operating Temperature Range	Vdd = 1.5V - 3.63V, ≤30 mins	125	°C
Maximum Continuous Operating Life at Temperature Extreme (meeting datasheet limits)	T_A = -55°C, Continuous Vdd = 1.8V – 3.3V ±10%	8	Hours
Human Body Model ESD Protection	JESD22-A114	3000	V
Charge-Device Model (CDM) ESD Protection	JESD22-C101	750	V
Machine Model (MM) ESD Protection	JESD22-A115	300	V
Latch-up Tolerance	JESD78 Compliant		
Mechanical Shock Resistance	Mil 883, Method 2002	10,000	g
Mechanical Vibration Resistance	Mil 883, Method 2007	70	g
2012 SMD Junction Temperature		150	°C
SOT23-5 Junction Temperature		150	°C
Storage Temperature		-65°C to 150°C	

Description

The SiT1630 is an ultra-small and ultra-low power 32.768 kHz oscillator optimized for battery-powered applications.

SiTime's MEMS oscillators consist of MEMS resonators and a programmable analog circuit. Our MEMS resonators are built with SiTime's unique MEMS First™ process. A key manufacturing step is EpiSeal™ during which the MEMS resonator is annealed with temperatures over 1000°C. EpiSeal creates an extremely strong, clean, vacuum chamber that encapsulates the MEMS resonator and ensures the best performance and reliability. During EpiSeal, a poly silicon cap is grown on top of the resonator cavity, which eliminates the need for additional cap wafers or other exotic packaging. As a result, SiTime's MEMS resonator die can be used like any other semiconductor die. One unique result of SiTime's MEMS First and EpiSeal manufacturing processes is the capability to integrate SiTime's MEMS die with a SOC, ASIC, microprocessor or analog die within a package to eliminate external timing components and provide a highly integrated, smaller, cheaper solution to the customer.

Frequency Stability

The SiT1630 is factory calibrated (trimmed) to guarantee frequency stability to be less than 20 ppm at room temperature and very tight stability over temperature. Unlike quartz crystals that have a classic tuning fork parabola temperature curve with a 25°C turnover point, the SiT1630 temperature coefficient is extremely flat across temperature.

When measuring the SiT1630 output frequency with a frequency counter, it is important to make sure the counter's gate time is >100 ms. The slow frequency of a 32 kHz clock will give false readings with faster gate times.

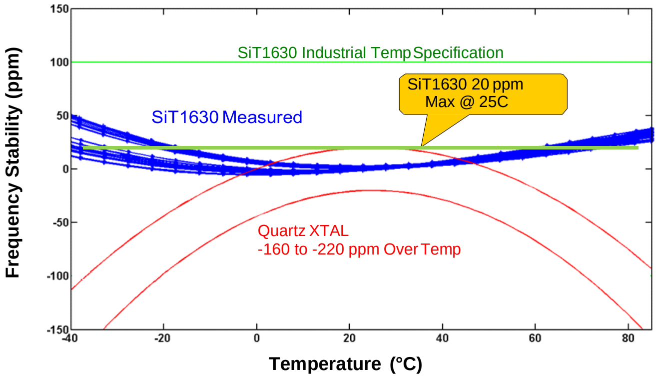


Figure 4. SiTime vs. Quartz

Power Supply Noise Immunity

The SiT1630 is an ultra-small 32 kHz oscillator. In addition to eliminating external output load capacitors common with standard XTALs, this device includes special power supply filtering and thus, eliminates the need for an external Vdd bypass-decoupling capacitor. This feature further simplifies the design and keeps the footprint as small as possible. Internal power supply filtering is designed to reject AC-noise greater than ±150 mVpp magnitude and beyond 10 MHz frequency component.

Power-up

The SiT1630 starts-up to a valid output frequency within 300 ms (180 ms typ). To ensure the device starts-up within the specified limit, make sure the power-supply ramps-up in approximately 10 – 20 ms (to within 90% of Vdd).

Typical Operating Curves

(T_A = 25°C, Vdd = 1.8V, unless otherwise stated)

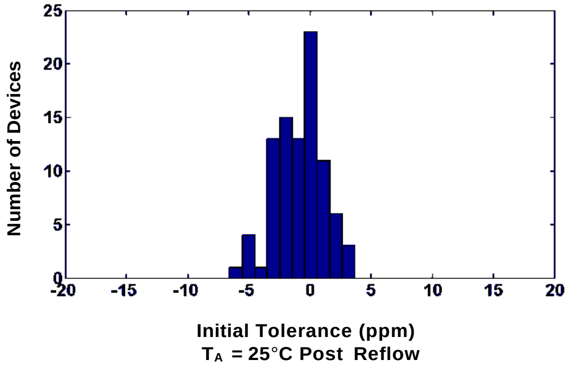


Figure 5. Initial Tolerance Histogram

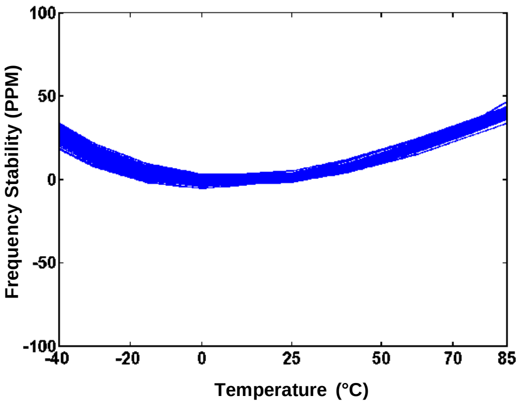


Figure 6. Frequency Stability Over Temperature

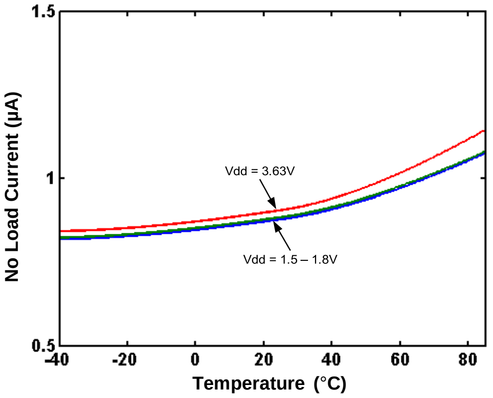


Figure 7. Supply Current Over Temperature (No Load)

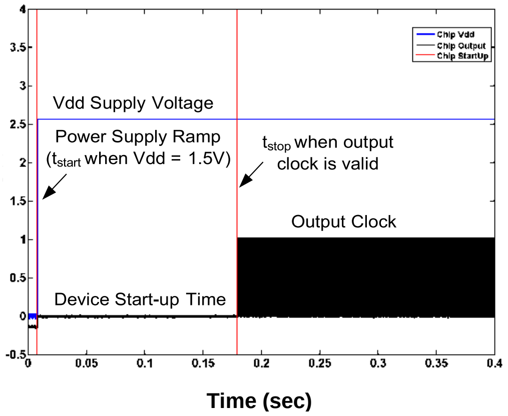


Figure 8. Start-up Time

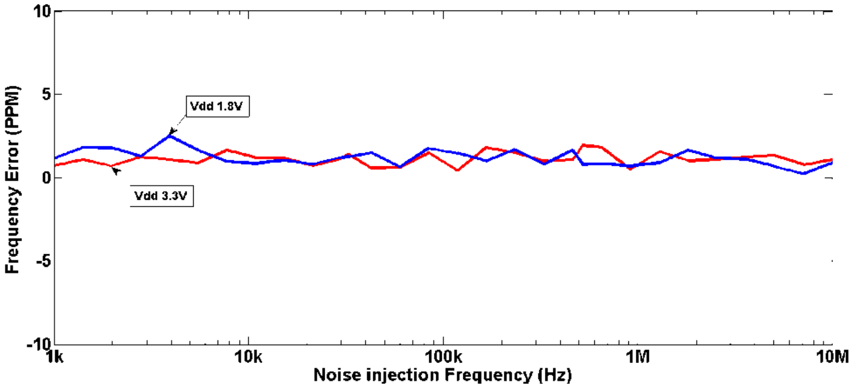


Figure 9. Power Supply Noise Rejection (±150mV Noise)

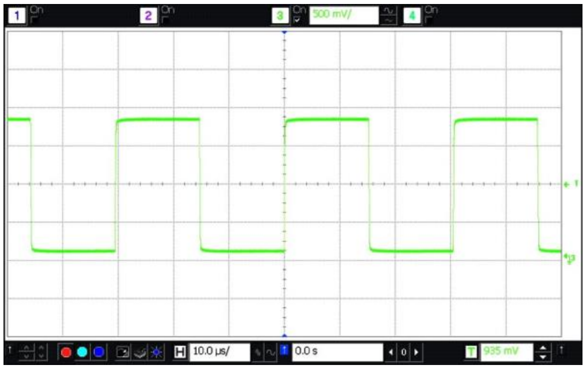


Figure 10. LVCMOS Output Waveform
(Vswing = 1.8V, SiT1630AI-H4-DCC-32.768)

Dimensions and Patterns

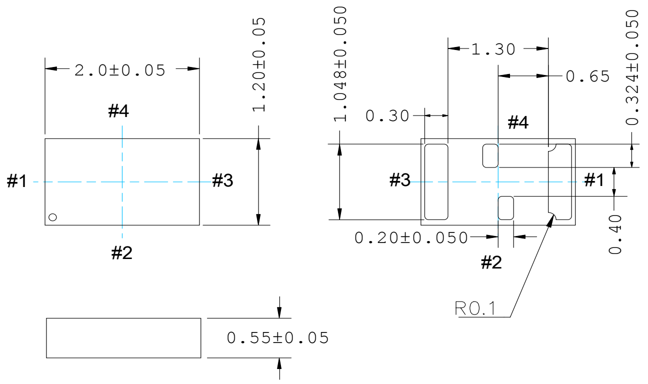
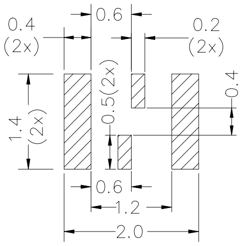
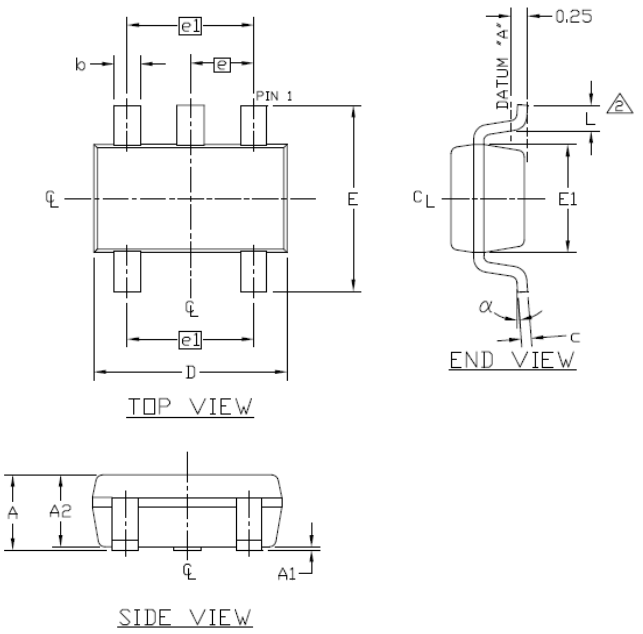
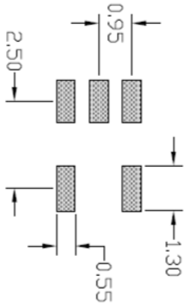
Package Size – Dimensions (Unit: mm)	Recommended Land Pattern (Unit: mm)
2.0 x 1.2 mm SMD  	
2.90 x 2.80 mm SOT23-5  	

Table 4. SOT23-5 Dimension Table

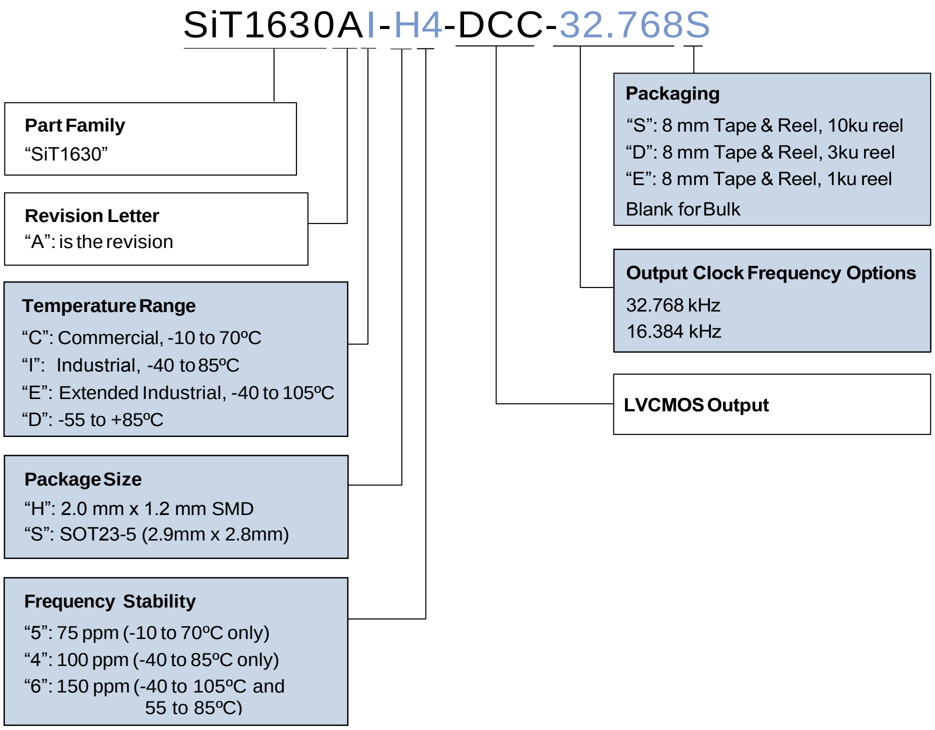
Symbol	Min.	Nom.	Max.
A	0.90	1.27	1.45
A1	0.00	0.07	0.15
A2	0.90	1.20	1.30
b	0.30	0.35	0.50
c	0.14	0.15	0.20
D	2.75	2.90	3.05
E	2.60	2.80	3.00
E1	1.45	1.60	1.75
L	0.30	0.38	0.55
L1	0.25 REF		
e	0.95 BSC.		
e1	1.90 BSC.		
α	0°	–	8°

Manufacturing Guidelines

1) No Ultrasonic Cleaning. Do not subject the SiT1630 to an ultrasonic cleaning environment. Permanent damage or long term reliability issues to the MEMS structure may occur.
2) For Noisy, high EM environments, we recommend the following design guidelines:
    - Place oscillator as far away from EM noise sources as possible (e.g., high-voltage switching regulators, motor drive control).
    - Route noisy PCB traces, such as digital data lines or high di/dt power supply lines, away from the SiTime oscillator.
    - Add a low ESR/ESL, 0.1uF to 1.0uF ceramic capacitor (X7R) to help filter high frequency noise on the Vdd power-supply line. Place it as close to the SiTime oscillator Vdd pin as possible.
    - Place a solid GND plane underneath the SiTime oscillator to shield the oscillator from noisy traces on the other board layers.
3) For additional manufacturing guidelines and marking/tape-reel instructions, refer to SiTime Manufacturing Notes.

Ordering Information

Part number characters in blue represent the customer specific options. The other characters in the part number are fixed.



SiT1630AI-H4-DCC-32.768S

Part Family
"SiT1630"

Revision Letter
"A": is the revision

Temperature Range
"C": Commercial, -10 to 70ºC
"I": Industrial, -40 to 85ºC
"E": Extended Industrial, -40 to 105ºC
"D": -55 to +85ºC

Package Size
"H": 2.0 mm x 1.2 mm SMD
"S": SOT23-5 (2.9mm x 2.8mm)

Frequency Stability
"5": 75 ppm (-10 to 70ºC only)
"4": 100 ppm (-40 to 85ºC only)
"6": 150 ppm (-40 to 105ºC and
55 to 85ºC)

Packaging
"S": 8 mm Tape & Reel, 10ku reel
"D": 8 mm Tape & Reel, 3ku reel
"E": 8 mm Tape & Reel, 1ku reel
Blank for Bulk

Output Clock Frequency Options
32.768 kHz
16.384 kHz

LVCMOS Output

Table 5. Revision History

Version	Release Date	Change Summary
1.0	09/03/2014	Rev 0.85 Preliminary to Rev 1.0 Production Release Updated start-up time specification Deleted SOT23 package option Added typical operating plots Added maximum output drive specification Added *Manufacturing Guidelines* section
1.1	09/03/2014	Updated start-up time plot in *Typical Operating Curves* section Updated start-up time specification
1.2	11/10/2014	Added additional design-in/mfg guidelines
1.3	02/09/2018	Added SOT23-5 package option Improved max supply current for commercial and industrial temp ranges Improved max start-up time at 85°C Updated start-up time temperature range conditions Updated *Ordering Information*

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