

ISSUE 1; March 2016

Description

- Smallest footprint chip scale package (CSP), ultra low power MEMS Temperature Compensated Oscillator at 32.768kHz with CMOS output in a plastic package featuring a programmable drive strength feature to optimise specific clock applications. Factory programmable for a short lead time. Uses SiTime's MEMS First™ technology.
- APPLICATIONS:
 - Smart Meters (Automatic Meter Reading)
 - Health and Wellness Monitors
 - Pulse-per-Second (pps) Timekeeping
 - RTC Reference Clock

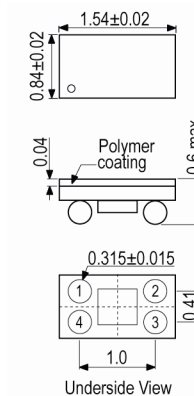
Frequency Parameters

- Frequency: 32.768kHz
- Frequency Stability: $\pm 5.00\text{ppm}$ to $\pm 20.00\text{ppm}$
- Ageing: $\pm 1\text{ppm}$ max in 1st year @ 25°C & $V_s=3.3\text{V}$
- Frequency Stability and Tolerance Combined (Over Temperature):
 - When stability= $\pm 5\text{ppm}$, stability and tolerance combined= $\pm 10\text{ppm}$
 - When stability= $\pm 10\text{ppm}$, stability and tolerance combined= $\pm 13\text{ppm}$
 - When stability= $\pm 20\text{ppm}$, stability and tolerance combined= $\pm 22\text{ppm}$
- Note: Frequency Stability is measured as peak-to-peak/2. Inclusive of three reflow processes and $\pm 20\%$ load variation, no board level underfill. Tested with an Agilent 53132A frequency counter. Due to the low operating frequency the gate time must be $\geq 100\text{ms}$ to ensure an accurate frequency measurement.
- Supply Voltage Variation:
 - @ $V_s=1.8\text{V} \pm 10\%$: $\pm 0.75\text{ppm}$ max
 - @ $V_s=1.5\text{V}$ to 3.63V : $\pm 1.5\text{ppm}$ max

Electrical Parameters

- Supply Voltage: 1.5V to 3.63V @ -40°C to 85°C
- Absolute Maximum Supply Voltage Rating: -0.5 to 3.63V
- Absolute Short Duration Supply Voltage (30mins max): 4.0V max
- Note: Operating beyond these limits may result in change or permanent damage to the oscillator.
- Core Operating Current:
 - Measured with -
 - $T_A=25^\circ\text{C}$, $V_s=1.8\text{V}$ and no load: $0.99\mu\text{A}$ typ
 - $T_A=-40^\circ\text{C}$ to 85°C , $V_s=1.5\text{V}$ to 3.63V and no load: $1.52\mu\text{A}$ max
- Note: Core Operating Current does not include Output Driver Operating Current or load current. To derive Total Operating Current (no load) add Core Operating Current + Output Driver Operating Current (a function of Output Voltage Swing).
- Power Supply Ramp (V_s ramp-up from 0 to 90%, $T_A=-40^\circ\text{C}$ to 85°C): 100ms max
- Start Up Time @ Power Up:
 - Measured with -
 - $T_A=-40^\circ\text{C}$ to 60°C , valid output: 180ms typ, 300ms max
 - $T_A=60^\circ\text{C}$ to 70°C , valid output: 350ms max
 - $T_A=70^\circ\text{C}$ to 85°C , valid output: 380ms max

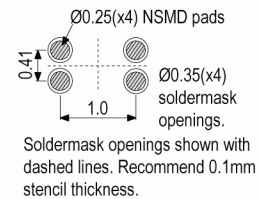
Outline (mm)



Pad Connections

- GND
- GND
- Output
- +Vs

Solder Pad Layout



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Operating Temperature Ranges

- 0 to 70°C
- -40 to 85°C

Output Details

- Output Compatibility CMOS
- Drive Capability 15pF
- Output Voltage Levels ($V_s=1.5V$ to $3.63V$, $I_{oh}/I_{ol}=\pm 1\mu A$ & $load=15pF$):
Output Low (VoL): 10% V_s max
Output High (VoH): 90% V_s min
- Rise & Fall Time (10% to 90% V_s):
Load=15pF: 200ns max
Load=5pF load & $V_s=1.62V$ max): 50ns max
- Programmable Drive Strength: The IQMS-143 includes a programmable drive strength feature to provide a flexible tool to optimise the clock rise/fall time for specific applications.
- Programmable Output Voltage Swing Tolerance ($TA=-40^\circ C$ to $85^\circ C$ & $V_s=1.5V$ to $3.63V$): $\pm 0.055V$ max
- Reduced Swing Output Details:
Rise & Fall Time (30% to 70% V_s & $load=10pF$): 200ns max
Duty Cycle: 48/52% max
- AC-Coupled Programmable Output Swing ($V_s=1.5V$ to $3.63V$, $load=10pF$ & $I_{oh}/I_{ol}=\pm 0.2\mu A$): Typically 0.2V to 0.8V
(Note: IQMS-143 does not internally AC-couple. This output description is intended for a receiver that is AC-coupled.)
- DC-Biased Programmable Output Voltage High Range ($V_s=1.5V$ to $3.63V$, $load=10pF$ & $I_{oh}=-0.2\mu A$): Typically 0.6V to 1.225V
- DC-Biased Programmable Output Voltage Low Range ($V_s=1.5V$ to $3.63V$, $load=10pF$ & $I_{ol}=0.2\mu A$): 0.35V to 0.8V

Noise Parameters

- Period Jitter (10000 cycles):
Measured with $TA=25^\circ C$, $V_s=1.5V$ to $3.63V$: 35ns RMS typ
- Long Term Jitter (81920 cycles [2.5 sec], 100 samples):
Measured over operating temperature range: 2.5 μs pk-pk max

Environmental Parameters

- Storage Temperature Range: -65 to $150^\circ C$
- Absolute Operating Temperature ($V_s=1.5V$ to $3.63V$): $105^\circ C$ max
- Absolute Short Duration Operating Temperature (30mins max, $V_s=1.5V$ to $3.63V$): $125^\circ C$ max
- Junction Temperature: $150^\circ C$ max
- ESD Levels:
Human Body Model (JESD22-A114): 3000V max
Charge Device Model (JESD22-A115): 750V max
Machine Model (JESD22-C101): 300V max
- Mechanical Shock: MIL-STD-883, Method 2002: 10000G max
- Vibration: MIL-STD-883, Method 2007: 70G max
- Latch Up Tolerance (JESD78): Compliant
- Note: Operating beyond these limits may result in change or permanent damage to the oscillator.

Manufacturing Details

- Maximum Process Temperature: Reflow profile as per JESD22-A113D.
- Cleaning: Do not ultrasonic clean, this may cause permanent damage or long-term reliability issues to the oscillator.
- Note: Do not apply underfill to the oscillator, the device will not meet the frequency stability specification if underfill is applied.

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Compliance

- RoHS Status (2011/65/EU) Compliant
- REACH Status Compliant
- MSL Rating (JDEC-STD-033): 1

Packaging Details

- Pack Style: Reel Tape & reel in accordance with EIA-481-D
Pack Size: 1,000

Electrical Specification - maximum limiting values

Frequency	Temperature Range	Stability (Min)	Current (NoLoad)	Rise and Fall Time	Duty Cycle
	°C	ppm	mA	ns	%
32.768000kHz	-40 to 85	±5.00	-	200	48/52%
	0 to 70	±5.00	-	200	48/52%

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