

# **Product Documentation**

## **CM9V-T1A 0.3**

### **Quartz Crystal Unit 32.768 kHz**

## 2. Product Description

The CM9V-T1A 0.3 is an ultra low profile, low frequency SMD Quartz Crystal Unit that incorporates a tuning fork Quartz Crystal Resonator. The Quartz Crystal Resonator operates under vacuum condition in a hermetically sealed ceramic package with metal lid.

Suitable oscillator-circuitries can operate the CM9V-T1A 0.3 Quartz Crystal Units in fundamental mode consuming very low power. For technical assistance for optimizing oscillator-circuitries please contact Micro Crystal under [sales@microcrystal.com](mailto:sales@microcrystal.com)

### 2.1. Application Examples

IoT  
Industrial  
Health Care  
Smart Cards  
Ultra Thin Devices  
Wearables, Portables

### 2.2. Ordering Information

Example: CM9V-T1A 0.3 32.768 kHz CL: 12.5 pF -20/+20ppm TA QC

Code	Operating temperature range
TA (Standard)	-40 to +85°C
TB	-40 to +125°C
TC	-55 to +125°C

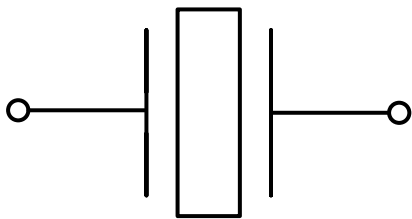
Code	Qualification
QC (Standard)	Commercial Grade

### 3. Electrical Characteristics

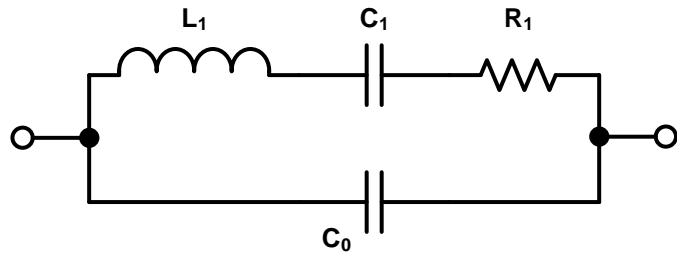
#### 3.1. Equivalent Electrical Model

The Quartz Crystal Unit is a passive component with no polarity. The equivalent circuit of the quartz crystal at its fundamental resonance frequency is represented by the Equivalent Electrical Model:

**Electrical Symbol:**

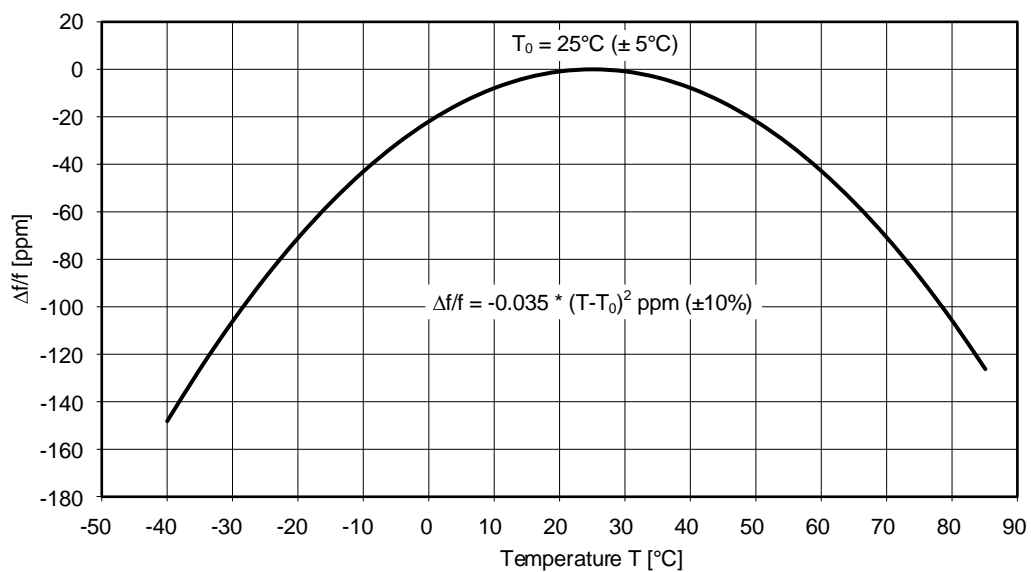


**Equivalent Electrical Model:**



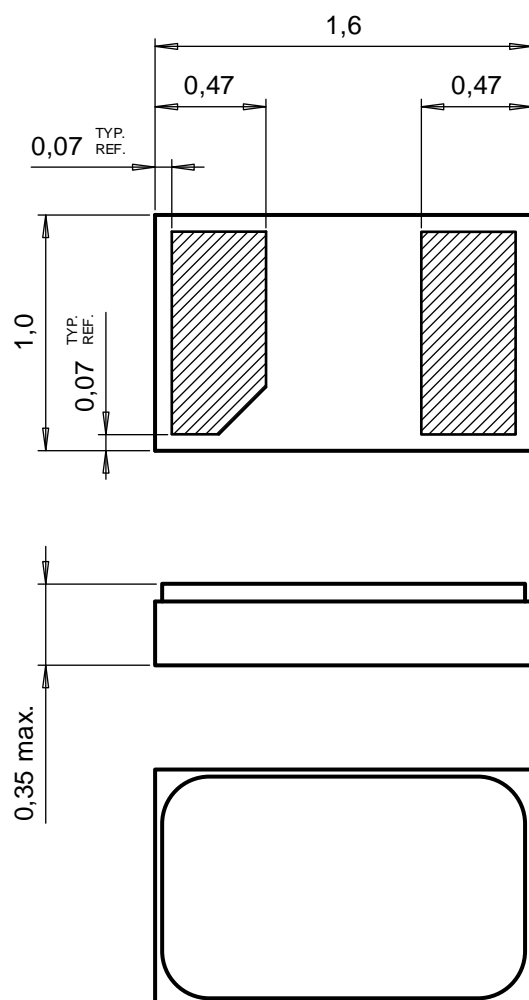
- L<sub>1</sub>** Motional Inductance
- C<sub>1</sub>** Motional Capacitance
- R<sub>1</sub>** Motional Resistance (ESR)
  
- C<sub>0</sub>** Static Capacitance (Shunt capacitance)

#### 3.2. Frequency vs Temperature Characteristics



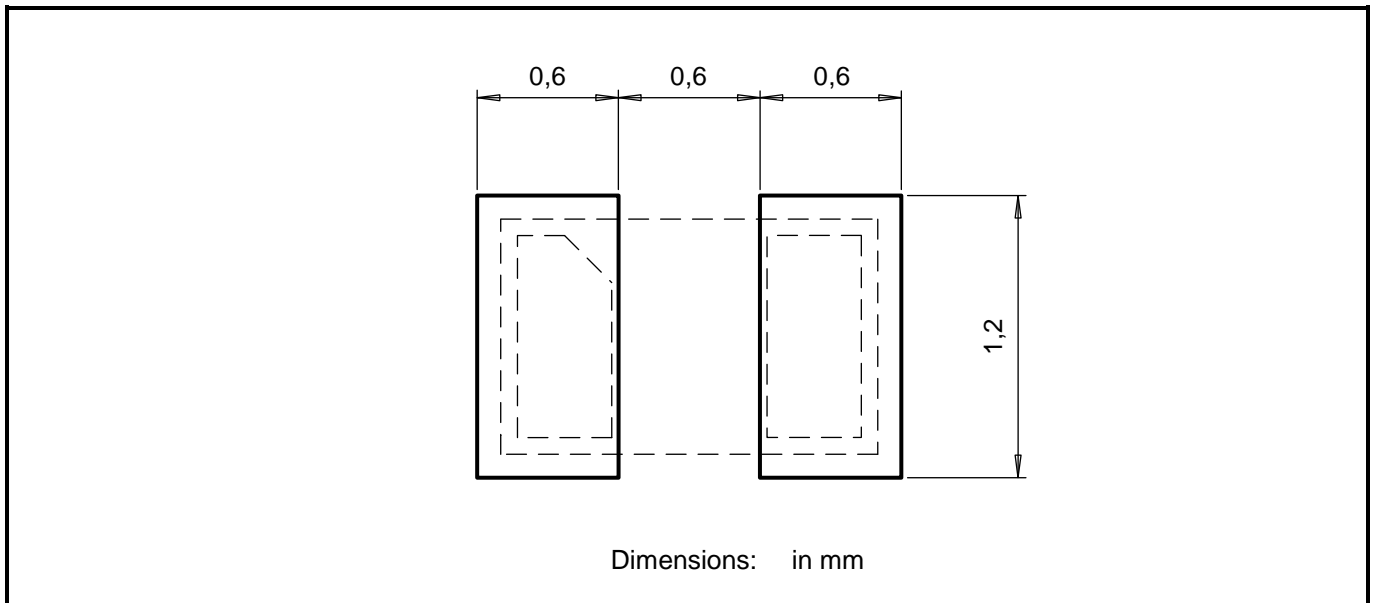
## 4. Mechanical Properties

### 4.1. Package Dimension

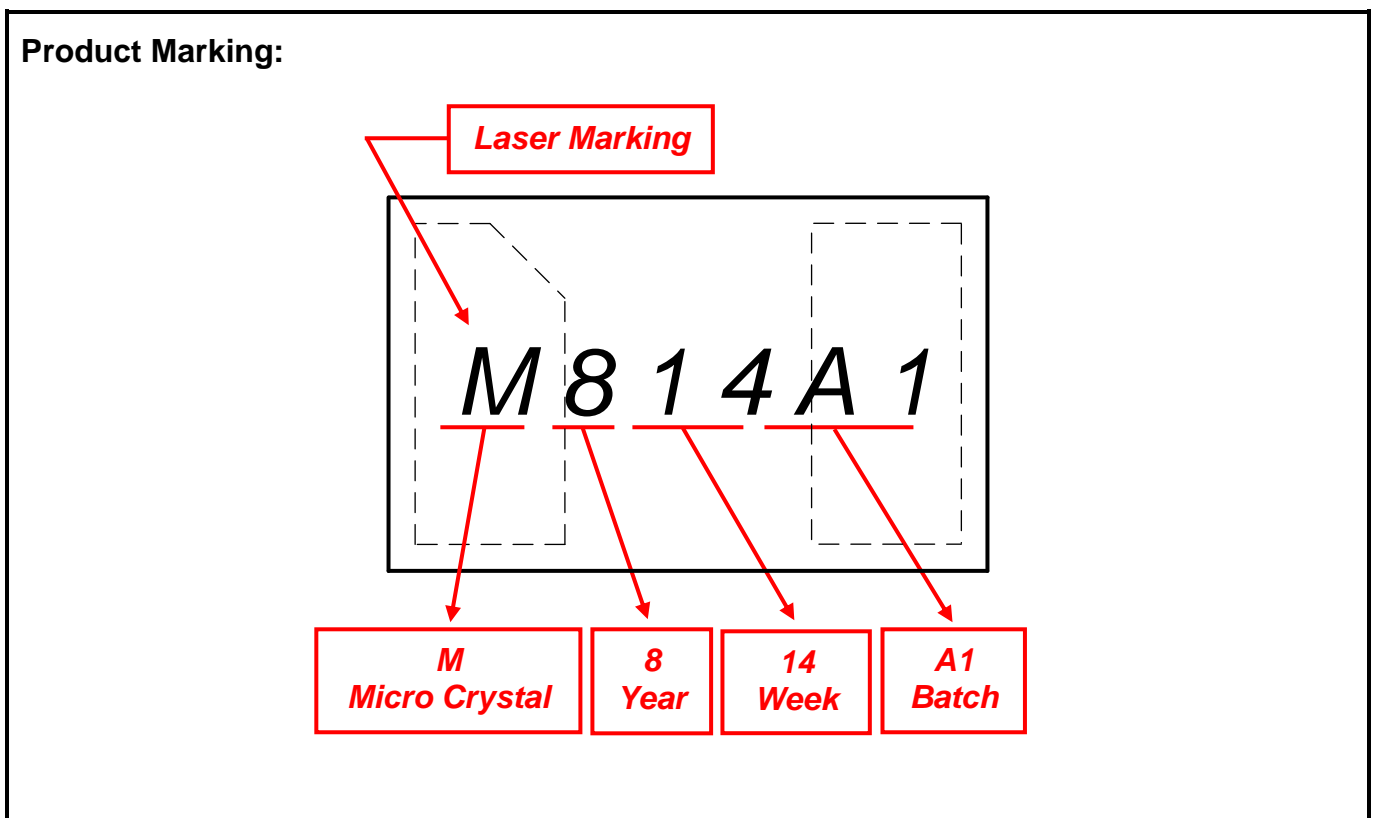


Dimensions: in mm  
Tolerances: unless otherwise specified  $\pm 0.1$ mm  
Drawing: CM9V-T1A\_03\_Pack-drw\_20180321

### 4.2. Recommended Solderpad Layout



### 4.3. Product Marking

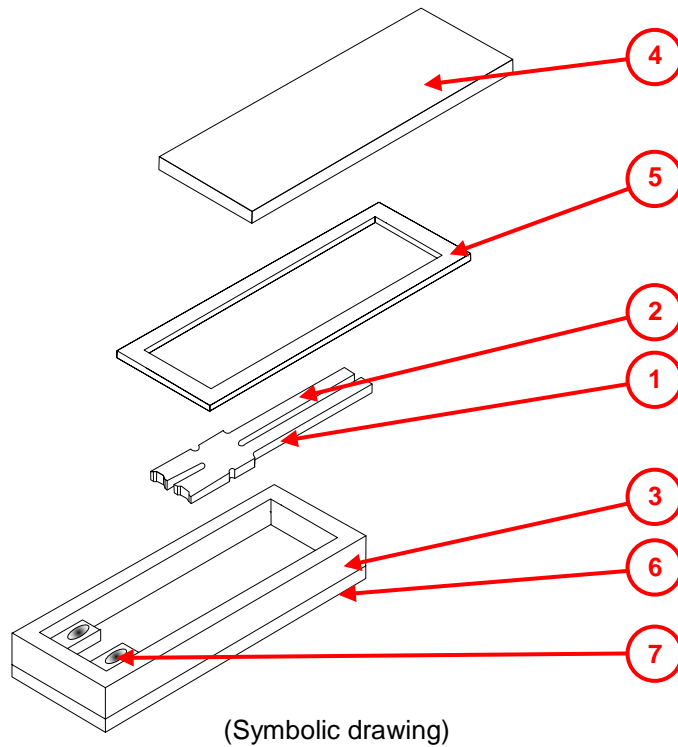


## 5. Material Composition Declaration & Environmental Information

### 5.1. Homogenous Material Composition Declaration

Homogenous material information according to IPC-1752 standard

**Material Composition CM9V-T1A 0.3:**



No.	Item Component Name	Sub Item Material Name	Material Weight		Substance Element	CAS Number	Comment
			(mg)	(%)			
1	Resonator	Quartz Crystal	0.12	100%	SiO <sub>2</sub>	14808-60-7	
2	Electrodes	Cr+Au	0.005	3%	Cr	7440-47-3	
				97%	Au	7440-57-5	
3	Housing	Ceramic	0.99	100%	Al <sub>2</sub> O <sub>3</sub>	1344-28-1	
4	Metal Lid	Kovar Lid	0.74	90%	Fe53Ni29Co18	Fe: 7439-89-6 Ni: 7440-02-0 Co: 7440-48-4	Metal Lid (Kovar)
				9%	Ni	Ni: 7440-02-0	Nickel plating
				1%	Au	Au: 7440-57-5	Gold plating
5	Seal	Solder Preform	0.15	80%	Au80 / Sn20	Au: 7440-57-5	Premelted on Metal Lid
				20%		Sn: 7440-31-5	
6	Terminations	Internal and external terminals	0.20	80%	Mo	Mo: 7439-98-7	Molybdenum
				15%	Ni	Ni: 7440-02-0	Nickel plating
				5%	Au, 0.5 micron	Au: 7440-57-5	Gold plating
7	Resonator attach	Gold bumps	0.009	100%	Au	7440-57-5	
		Unit weight					2.21

## 5.2. Material Analysis & Test Results

Homogenous material information according to IPC-1752 standard

No.	Item Component Name	Sub Item Material Name	RoHS						Halogens				Phthalates			
			Pb	Cd	Hg	Cr(VI)	PBB	PBDE	F	Cl	Br	I	BBP	DBP	DEHP	DIBP
1	Resonator	Quartz Crystal	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
2	Electrodes	Cr+Au	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
3	Housing	Ceramic	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
4	Metal Lid	Kovar Lid & Plating	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
5	Seal	Solder Preform	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
6	Terminations	Int. & ext. terminals	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
7	Resonator attach	Gold bumps	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	MDL [ppm]	Method Detection Limit	2			8	5	50				50				

nd (not detected) = below "Method Detection Limit" (MDL)

### Test methods:

#### RoHS

Test method with reference to:

- Pb, Cd IEC 62321-5:2013 MDL: 2 ppm
- Hg IEC 62321-4:2013 + AMD1:2017 MDL: 2 ppm
- Cr(VI) IEC 62321-7-2:2017 MDL: 8 ppm
- PBB / PBDE IEC 62321-6:2015 MDL: 5 ppm

#### Halogens

Test method with reference to BS EN 14582:2016 MDL: 50 ppm

#### Phthalates

Test method with reference to IEC 62321-8:2017 MDL: 50 ppm

## 5.3. Recycling Material Information

Recycling material information according to IPC-1752 standard.

Element weight is accumulated and referenced to the unit weight of 2.21 mg.

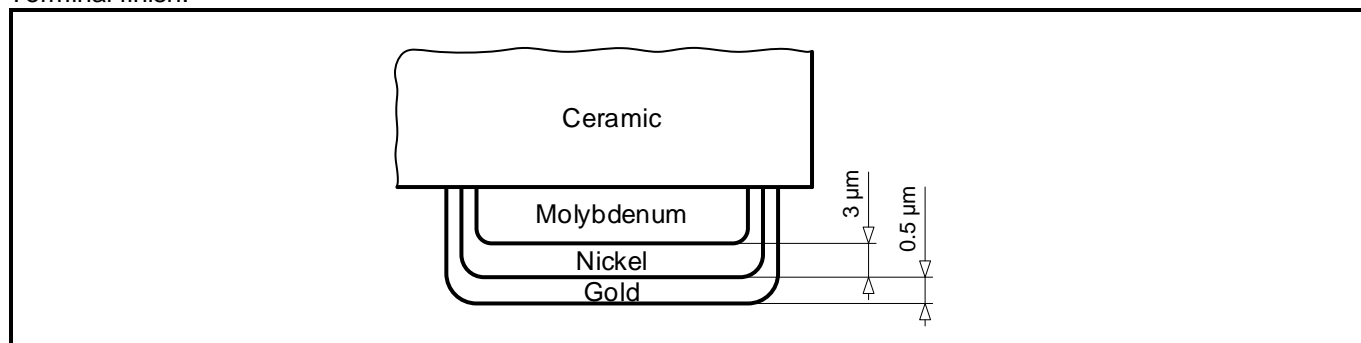
Item Material Name	No.	Item Component Name	Material Weight		Substance Element	CAS Number	Comment
			(mg)	(%)			
Quartz Crystal	1	Resonator	0.12	5.42	SiO <sub>2</sub>	14808-60-7	
Chromium	2	Electrodes	0.00015	0.007	Cr	7440-47-3	
Ceramic	3	Housing	0.99	44.72	Al <sub>2</sub> O <sub>3</sub>	1344-28-1	
Gold	2 4 5 6 7	Electrodes Metal Lid Seal Terminations Resonator attach	0.15	6.83	Au	7440-57-5	
Tin	5	Seal	0.03	1.36	Sn	Sn: 7440-31-5	
Nickel	4 6	Metal Lid (Plating) Terminations	0.097	4.36	Ni	Ni: 7440-02-0	
Molybdenum	6	Terminations	0.16	7.23	Mo	Mo: 7439-98-7	
Kovar	4	Metal Lid	0.67	30.08	Fe53Ni29Co18	Fe: 7439-89-6 Ni: 7440-02-0 Co: 7440-48-4	
Unit weight (total)			2.21	100			

#### 5.4. Environmental Properties & Absolute Maximum Ratings

Package	Description
Ceramic Package	Hermetically sealed ceramic package with metal lid, no-leads

Parameter	Directive	Conditions	Value
Product weight (total)			2.21 mg
Storage temperature		Store as bare product	-55 to +125°C
Moisture sensitivity level (MSL)	IPC/JEDEC J-STD-020D		MSL 1
FIT / MTBF			available on request

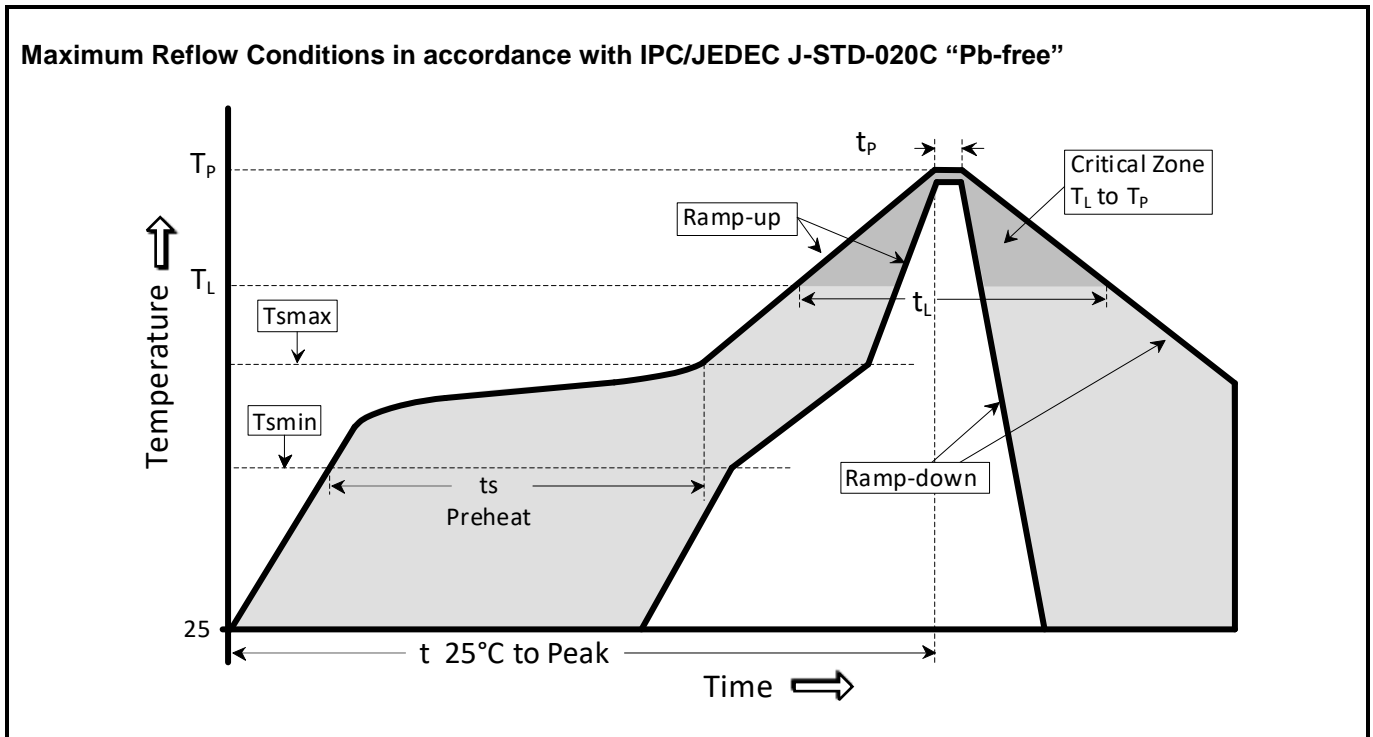
Terminal finish:





## 6. Application Information

### 6.1. Soldering Information



Temperature Profile	Symbol	Condition	Unit
Average ramp-up rate	( $T_{Smax}$ to $T_P$ )	3°C / second max	°C / s
Ramp down Rate	$T_{cool}$	6°C / second max	°C / s
Time 25°C to Peak Temperature	$T_{to-peak}$	8 minutes max	min
<b>Preheat</b>			
Temperature min	$T_{Smin}$	150	°C
Temperature max	$T_{Smax}$	200	°C
Time $T_{Smin}$ to $T_{Smax}$	$t_s$	60 – 180	sec
<b>Soldering above liquidus</b>			
Temperature liquidus	$T_L$	217	°C
Time above liquidus	$t_L$	60 – 150	sec
<b>Peak temperature</b>			
Peak Temperature	$T_p$	260	°C
Time within 5°C of peak temperature	$t_p$	20 – 40	sec

## 6.2. Handling Instructions for Quartz Crystal Units

The built-in tuning-fork crystal consists of pure Silicon Dioxide in crystalline form. The cavity inside the package is evacuated and hermetically sealed in order for the crystal blank to function undisturbed from air molecules, humidity and other influences.

### Shock and vibration:

Keep the crystal / module from being exposed to **excessive mechanical shock and vibration**. Micro Crystal guarantees that the crystal / module will bear a mechanical shock of 5000 g / 0.3 ms.

The following special situations may generate either shock or vibration:

**Multiple PCB panels** - Usually at the end of the pick & place process the single PCBs are cut out with a router. These machines sometimes generate vibrations on the PCB that have a fundamental or harmonic frequency close to 32.768 kHz. This might cause breakage of crystal blanks due to resonance. Router speed should be adjusted to avoid resonant vibration.

**Ultrasonic cleaning** - Avoid cleaning processes using ultrasonic energy. These processes can damage the crystals due to the mechanical resonance frequencies of the crystal blank.

### Overheating, rework high temperature exposure:

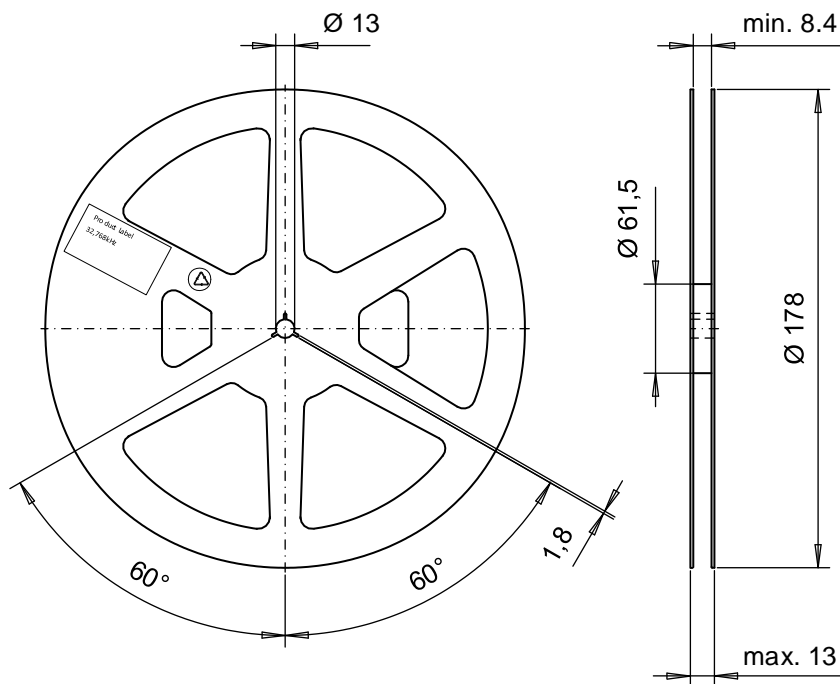
Avoid overheating the package. The package is sealed with a seal ring consisting of 80% Gold and 20% Tin. The eutectic melting temperature of this alloy is at 280°C. Heating the seal ring up to >280°C will cause melting of the metal seal which then, due to the vacuum, is sucked into the cavity forming an air duct. This happens when using hot-air-gun set at temperatures >280°C.

Use the following methods for rework:

- Use a hot-air-gun set at 270°C.
- Use 2 temperature controlled soldering irons, set at 270°C, with special-tips to contact all solder-joints from both sides of the package at the same time, remove part with tweezers when pad solder is liquid.

### 7. Packing & Shipping Information

Reel: 7" = 178 mm

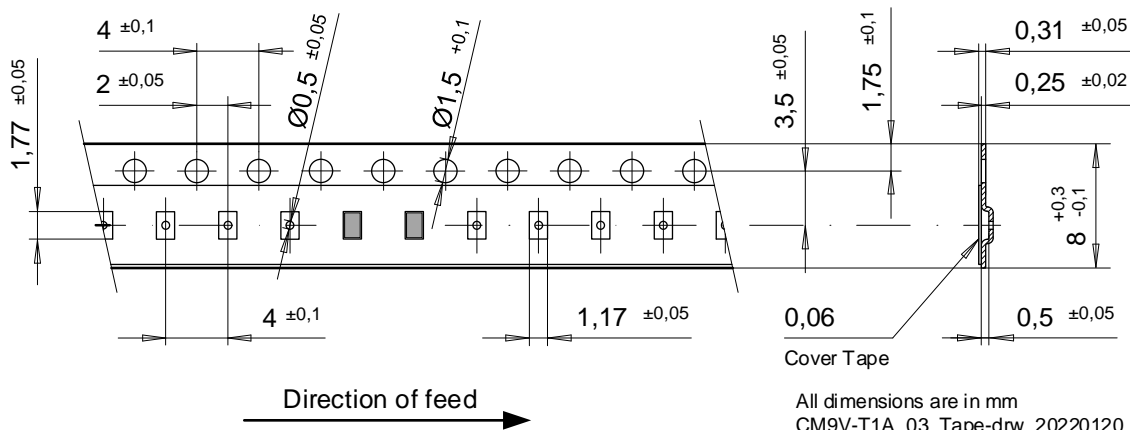


**Carrier Tape:**

Material: Polycarbonate

Width: 8 mm

Tape Leader and Trailer: Minimum length 300 mm



All dimensions are in mm  
CM9V-T1A\_03\_Tape-drw\_20220120

**Pressure Seal Cover Tape:**

Polypropylene (PP)

3M™ Universal Cover Tape (UCT)

Synthetic polymer adhesive, pressure sensitive

Peel Method: Medial section removal,  
both lateral stripes remain on carrier

**Heat Seal Cover Tape:**

Polyethylene Terephthalate (PET)

Synthetic polymer adhesive, heat activated

Peel Method: Removal of the entire cover tape

## 8. Compliance Information

Micro Crystal confirms that the standard product Quartz Crystal Unit CM9V-T1A 0.3 is compliant with "EU RoHS Directive" and "EU REACH Directives".

Please find the actual Certificate of Conformance for Environmental Regulations on our website:

[CoC Environment CC&CM-Series.pdf](#)

## 9. Document Revision History

Date	Revision #	Revision Details
April 2018	1.0	First release
January 2022	1.1	Added "ultra low profile", 2. Changed term "SMT" to "SMD", 2. Added " $\Delta f/f =$ " at formula and "T" at X axis, 3.2. Added "Dimensions: in mm", 4.1. and 4.2. Adapted limit values and methods in accordance with the latest standards, 5.2. Completed to "Hermetically sealed ceramic package with metal lid, no-leads", 5.4. Corrected text to "hot-air-gun set at temperatures $>280^{\circ}\text{C}$ .", 6.2. Adapted Cover/Carrier Tape height (0,06/0,31), 7. Added specification for Heat Seal Cover Tape, 7. Updated CoC Hyperlink, 8. Added new disclaimer

The information contained in this document is believed to be accurate and reliable. However, Micro Crystal assumes no responsibility for any consequences resulting from the use of such information nor for any infringement of patents or other rights of third parties, which may result from its use. In accordance with our policy of continuous development and improvement, Micro Crystal reserves the right to modify specifications mentioned in this publication without prior notice and as deemed necessary.

Any use of Products for the manufacture of arms is prohibited. Customer shall impose that same obligation upon all third-party purchasers.

Without the express written approval of Micro Crystal, Products are not authorized for use as components in safety and life supporting systems as well as in any implantable medical devices. The unauthorized use of Products in such systems / applications / equipment is solely at the risk of the customer and such customer agrees to defend and hold Micro Crystal harmless from and against any and all claims, suits, damages, cost, and expenses resulting from any unauthorized use of Products.

No licenses to patents or other intellectual property rights of Micro Crystal are granted in connection with the sale of Micro Crystal products, neither expressly nor implicitly. In respect of the intended use of Micro Crystal products by customer, customer is solely responsible for observing existing patents and other intellectual property rights of third parties and for obtaining, as the case may be, the necessary licenses.



A COMPANY OF THE  SWATCH GROUP

Micro Crystal AG  
 Muehlestrasse 14  
 CH-2540 Grenchen  
 Switzerland

Phone +41 32 655 82 82  
 sales@microcrystal.com  
 www.microcrystal.com