Product Documentation

MS3V-T1R

Quartz Crystal Unit
32.768 kHz

2. Product Description

The MS3V-T1R is a low frequency surface mount technology Quartz Crystal Unit that incorporates a tuning fork Quartz Crystal Resonator. The Quartz Crystal Resonator operates under vacuum condition in a hermetically sealed square-bodied metal can package.

Suitable oscillator-circuitries can operate the MS3V-T1R 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

MS3V-T1R is compatible with other suppliers' same footprint crystals.

2.1. Application Examples

IoT
Metering
Wearables
Health Care
Mobile Phones
Consumer Electronics

2.2. Ordering Information

Example: MS3V-T1R 32.768 kHz CL: 12.5 pF -20/+20ppm TA QC

Code	Operating temperature range
TA	-40 to +85°C

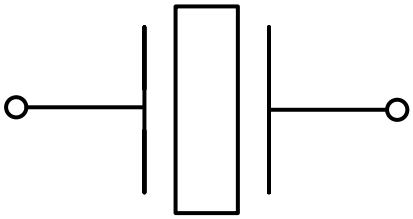
Code	Qualification
QC	Commercial Grade

3. Electrical Characteristics

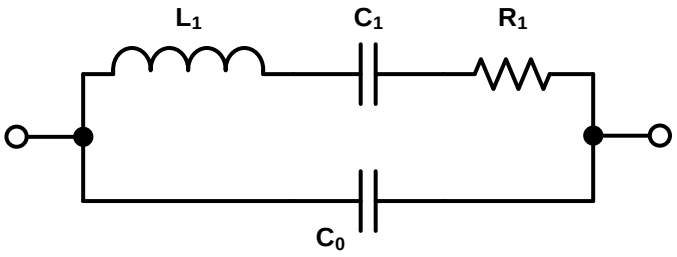
3.1. Equivalent Electrical Model

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:

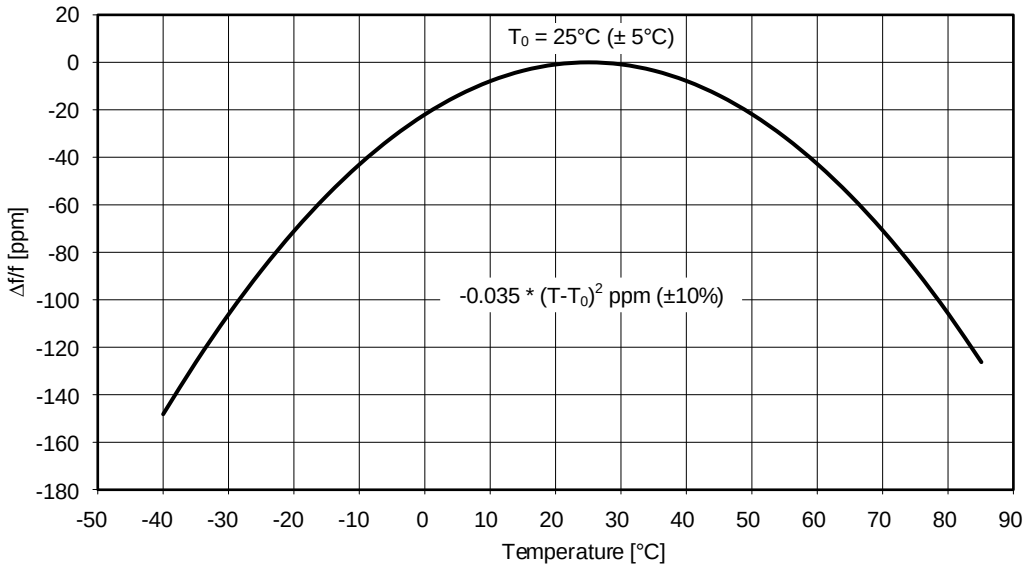


Equivalent Electrical Model:



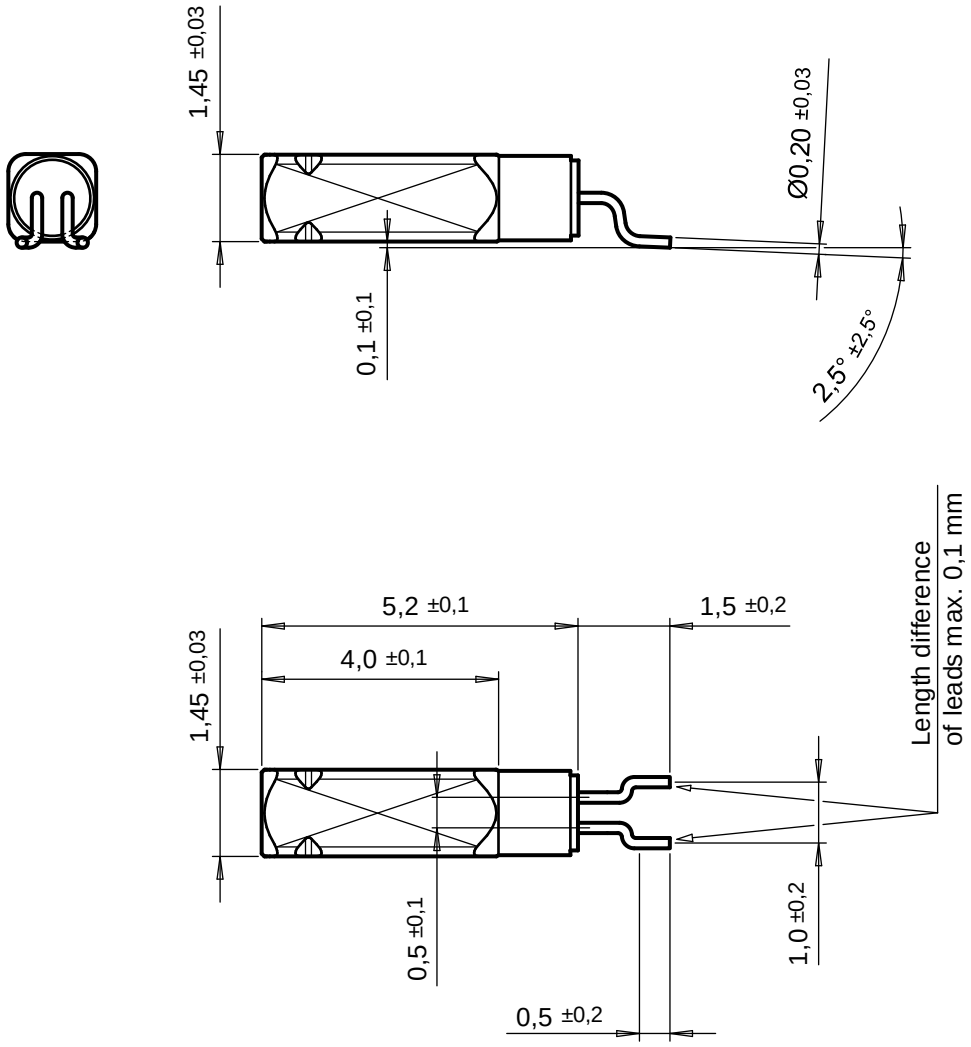
L_1	Motional Inductance
C_1	Motional Capacitance
R_1	Motional Resistance (ESR)
C_0	Static Capacitance (Shunt capacitance)

3.2. Frequency vs Temperature Characteristics



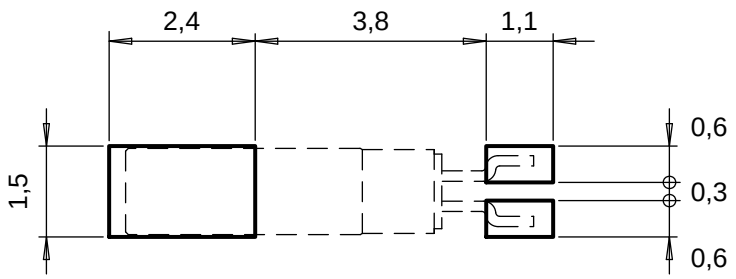
4. Mechanical Properties

4.1. Package Dimension



Dimensions: in mm
Tolerances: unless otherwise specified ± 0.1mm
Drawing: MS3V-T1R_Pack-drw_20170127

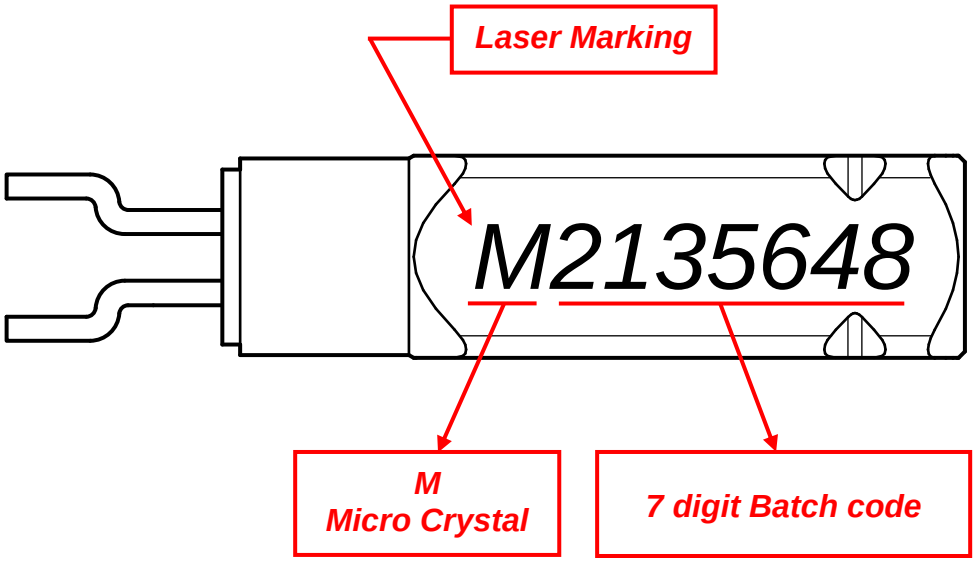
4.2. Recommended Solderpad Layout



Dimensions: in mm

4.3. Product Marking

Product Marking: “Batch code”

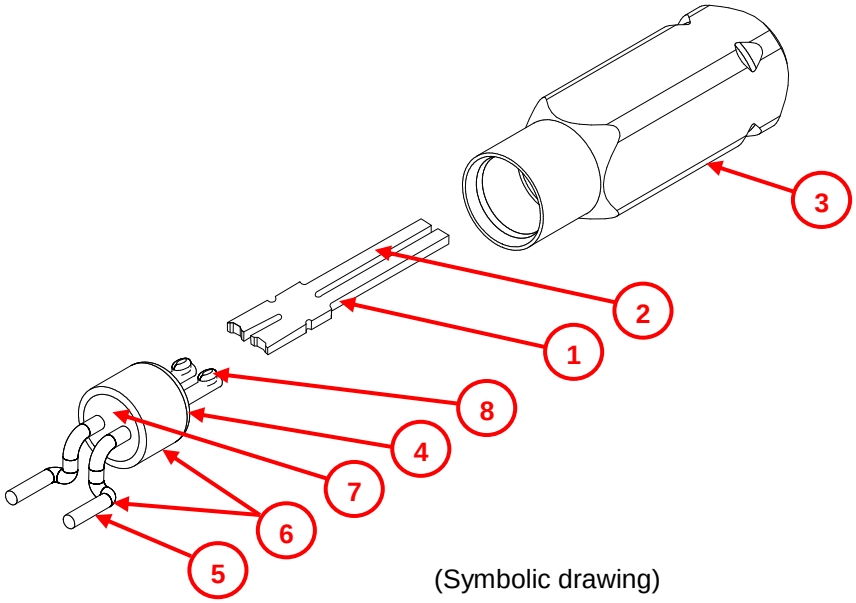


5. Material Composition Declaration & Environmental Information

5.1. Homogenous Material Composition Declaration

Homogenous material information according to IPC-1752 standard

Material Composition MS3V-T1R:



(Symbolic drawing)

No.	Item Component Name	Sub Item Material Name	Material Weight (mg)	Material Weight (%)	Substance Element	CAS Number	Comment
1	Resonator	Quartz Crystal	0.65	100%	SiO_2	14808-60-7	
2	Electrodes	Cr+Au	0.01	6%	Cr	7440-47-3	
				94%	Au	7440-57-5	
3	Cap	Brass	40.5	98.9%	Cu58Zn39Pb3	12597-71-6	Pb RoHS exempt in copper alloys up to 4% (exemption (6(c))
		Ni-plating		1%	Ni, 1 micron	Ni: 7440-02-0	
		Au-plating		0.1%	Au, 0.05 micron	Au: 7440-57-5	
4	Holder ring	Alloy 42	1.8	100%	Fe57Ni42Mn1	Fe: 7439-89-6 Ni: 7440-02-0 Mn: 7439-96-5	
5	Leads	Kovar	1.0	100%	Fe53Ni29Co18	Fe: 7439-89-6 Ni: 7440-02-0 Co: 7440-48-4	
6	Lead plating	Cu-plating	1.1	17%	Cu, 3 micron	7440-50-8	
		SnPb-plating		75%	Pb93Sn7, 11 micron	Pb: 7439-92-1 Sn: 7440-31-5	Pb RoHS exempt in high temperature solder with more than 85% lead (exemption 7(a))
		Ag-plating		7%	Ag, 1 micron	Ag: 7440-22-4	
		Au-flashed		1%	Au, 0.1 micron	Au: 7440-57-5	
7	Seal	Glass	2.70	100%		65997-17-3	
8	Resonator attach	Silver filled Epoxy	0.075	30%	Epoxy resin	129915-35-1	
				70%	Ag	7440-22-4	
		Unit weight	47.8				

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	DINP
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	Cap	Brass	RoHS 2.62%	RoHS 5 ppm	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
4	Holder ring	Alloy 42	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
5	Leads	Kovar	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
6	Lead plating	Cu+SnPb+Ag+Au	RoHS 92.34%	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
7	Seal	Glass	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
8	Resonator attach	Silver filled Epoxy	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	MDL	Method Detection Limit	2 ppm				5 ppm		50 ppm				0.003%			0.01%

nd (not detected) = below “Method Detection Limit” (MDL)
RoHS = RoHS compliant, substances accepted by RoHS Directive

Test methods:

RoHS Test method with reference to:

- Pb, Cd IEC 62321-5:2013 MDL: 2 ppm
- Hg IEC 62321-4:2013 MDL: 2 ppm
- Cr(VI) IEC 62321:2008 MDL: 2 ppm
- PBB / PBDE IEC 62321:2008 MDL: 5 ppm

Halogens Test method with reference to BS EN 14582:2007 MDL: 50 ppm

Phthalates Test method with reference to EN 14372:2004 MDL: 0.003% (DINP 0.01%)

5.3. Recycling Material Information

Recycling material information according to IPC-1752 standard.
Element weight is accumulated and referenced to the unit weight of 47.8 mg.

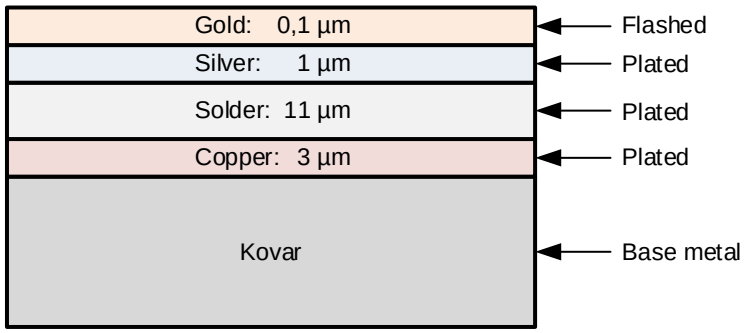
Item Material Name	No.	Item Component Name	Material Weight (mg)	Material Weight (%)	Substance Element	CAS Number	Comment
Quartz Crystal	1	Resonator	0.65	1.36	SiO_2	14808-60-7	
Chromium	2	Electrodes	0.0006	0.001	Cr	7440-47-3	
Brass	3	Cap	40.05	83.73	Cu58Zn39Pb3	12597-71-6	
Gold	2 3 6	Electrodes Cap Lead plating	0.06	0.13	Au	7440-57-5	
Nickel	3	Cap	0.41	0.85	Ni	Ni: 7440-02-0	
Alloy 42	4	Holder ring	1.80	3.76	Fe57Ni42Mn1	Fe: 7439-89-6 Ni: 7440-02-0 Mn: 7439-96-5	
Kovar	5	Leads	1.00	2.09	Fe53Ni29Co18	Fe: 7439-89-6 Ni: 7440-02-0 Co: 7440-48-4	
Copper	6	Lead plating	0.19	0.39	Cu	7440-50-8	
Solder SnPb	6	Lead plating	0.82	1.72	Pb93Sn7	Pb: 7439-92-1 Sn: 7440-31-5	
Silver	6 8	Lead plating Resonator attach	0.13	0.27	Ag	7440-22-4	
Glass	7	Seal	2.70	5.64		65997-17-3	
Epoxy	8	Resonator attach	0.02	0.05	Epoxy resin	129915-35-1	
	Unit weight (total)		47.8	100			

5.4. Environmental Properties & Absolute Maximum Ratings

Package	Description
Metal Package	Hermetic metal-package, with formed leads.

Parameter	Directive	Conditions	Value
Product weight (total)			47.8 mg
Storage temperature		Store as bare product	-55 to +85°C
Moisture sensitivity level (MSL)	IPC/JEDEC J-STD-020D		MSL 1
FIT / MTBF			available on request

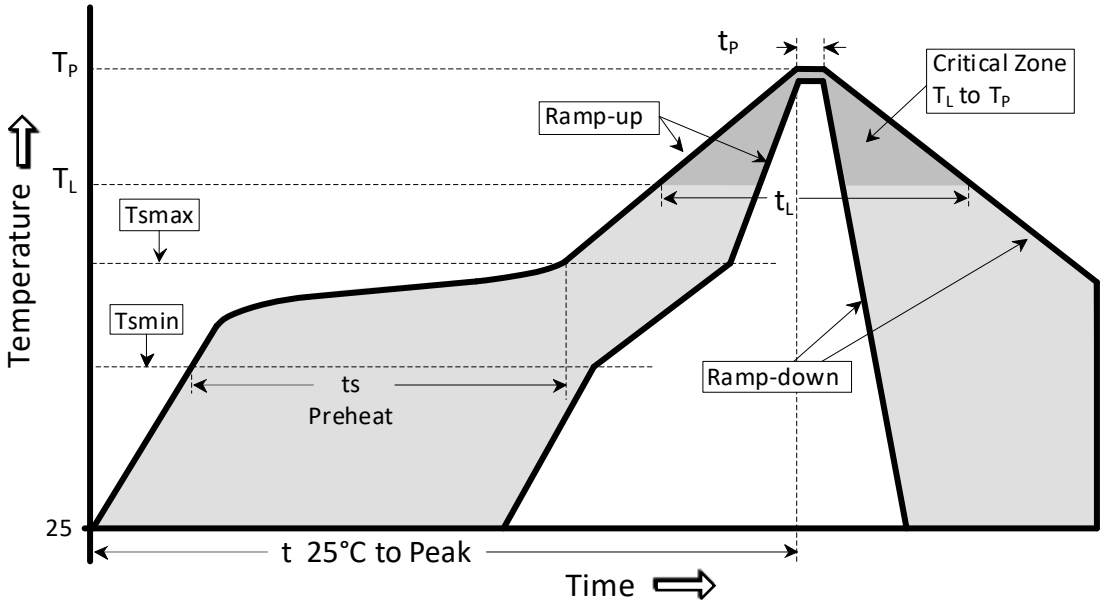
Finish for Holder ring and Leads:



6. Application Information

6.1. Soldering Information

Maximum Reflow Conditions in accordance with IPC/JEDEC J-STD-020C "Pb-free"



Temperature Profile	**Symbol**	**Condition**	**Unit**
Average ramp-up rate	(Ts_{max} 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	$T_{to\text{-}peak}$	8 minutes max	min
Preheat			
Temperature min	Ts_{min}	150	°C
Temperature max	Ts_{max}	200	°C
Time Ts_{min} to Ts_{max}	ts	60 – 180	sec
Soldering above liquidus			
Temperature liquidus	T_L	217	°C
Time above liquidus	t_L	60 – 150	sec
Peak temperature			
Peak Temperature	Tp	260	°C
Time within 5°C of peak temperature	tp	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.

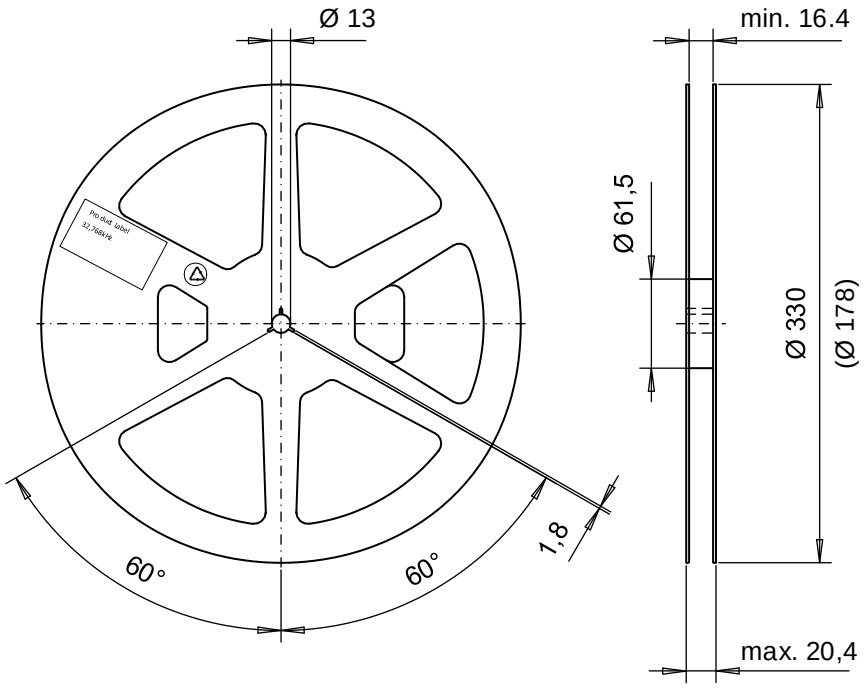
Overheating, rework high temperature exposure:
Avoid overheating the package. The package is sealed with a solder consisting of 93% Lead and 7% Tin. The melting temperature of this alloy is at 280°C. Heating the package up to >280°C will cause melting of the metal seal which then, due to the vacuum, is sucked into the cavity forming an air duct. This happens when using hot-air-gun set at temperatures >280°C.

Use the following method for rework:

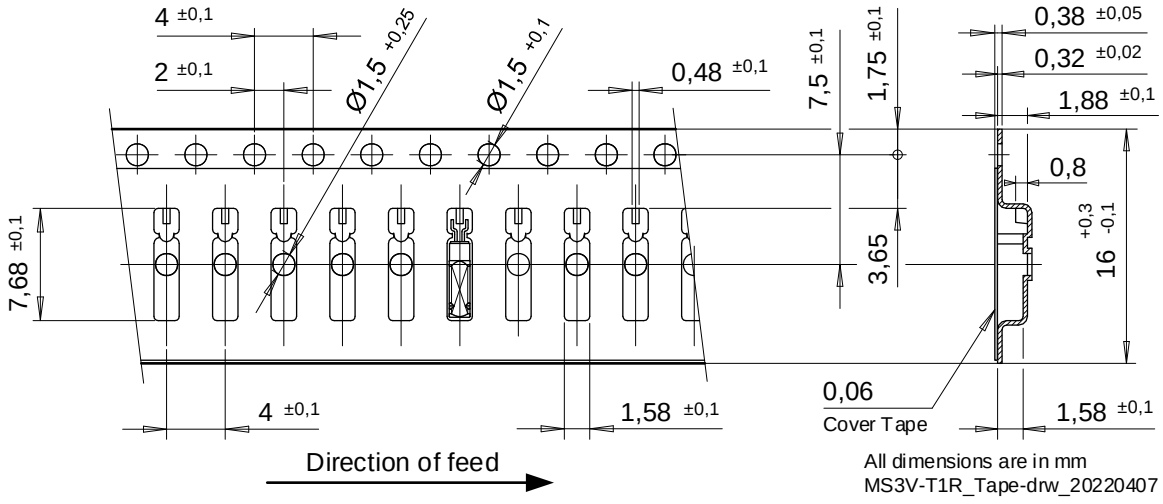
- Use a hot-air-gun set at 270°C.

7. Packing & Shipping Information

Reel: 13” = 330 mm (7” = 178 mm)



Carrier Tape:
Material: Polycarbonate
Width: 16 mm
Tape Leader and Trailer: Minimum length 300 mm



Cover Tape:
Tape: Polypropylene, 3M™ Universal Cover Tape (UCT)
Adhesive Type: Pressure sensitive, Synthetic Polymer
Thickness: 0.06 mm

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

8. Compliance Information

Micro Crystal confirms that the standard product Quartz Crystal Unit MS3V-T1R 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_MS-Series.pdf

9. Document Revision History

Date	Revision #	Revision Details
February 2017	1.0	First release
September 2020	1.1	Added that MS3V-T1R is compatible with other suppliers’ same footprint crystals, 2.
April 2022	1.2	Corrected Ordering Information, 2.2. Added "Dimensions: in mm", 4.1. and 4.2. Removed "SiO_2" in item 8 (Glass), 5.1. and 5.3. Described test methods in more detail, 5.2. Corrected text to "hot-air-gun set at temperatures >280°C.", 6.2. Replaced Tape drawing with new version, 7. Updated CoC Hyperlink, 8. Added new disclaimer

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