TAI-SAW TECHNOLOGY CO., LTD.

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Product Specifications Approval Sheet

Product Description: SMD TSX 2.0x1.6 38.4MHz

(Temperature Sensing Crystal)

TST Part No.: TM0014A

Customer Part No.:_____

Customer signature required

Company:_____

Division:_____

Approved by :_____

Date:_____

Checked by:_____Glen Peng_____ *Glen*

Approved by:_____Kelly Huang_____ *Kelly Huang*

Date:_____06/29/2023_____

1. Customer signed back is required before TST can proceed with sample build and receive orders.

2. Orders received without customer signed back will be regarded as agreement on the specifications.

3. Any specifications changes must be approved upon by both parties and a new revision of specifications shall be released to reflect the changes.

TAI-SAW TECHNOLOGY CO., LTD.
SMD TSX 2.0x1.6 38.4MHz

MODEL NO.: TM0014A　　　　　　　　　　　　　　　　　　　　　　　REV. NO.: 1

Revise:

Rev.	Rev. Page	Rev. Account	Date	Ref. No.	Revised by
1	N/A	Initial release	06/29/23'	N/A	Glen Peng

TAI-SAW TECHNOLOGY CO., LTD.
SMD TSX 2.0x1.6 38.4MHz

MODEL NO.: TM0014A   REV. NO.: 1

Features:

- Surface Mount Hermetic Package
- Excellent Reliability Performance
- Good Frequency Perturbation and Stability over temperature
- Ultra Miniature Package
- Moisture Sensitivity Level (MSL) : Level-1

RoHS Compliant

Lead-free soldering

Description and Applications:

Surface mount 2.0mmx1.6mm crystal unit for use in wireless communications devices, especially for a need of ultra miniature package for mobility.

Electrical Specifications:

TM0014A	Specification(Crystal)
Nominal Frequency	38.4 MHz
Mode of Oscillation	AT-cut Fundamental
Storage Temperature Range	-40°C to +105°C
Operating Temperature Range	-30°C to +85°C
[1]Frequency Stability over Operating Temperature Range	+/-12 ppm (referred to the value at 25°C)
Frequency Make Tolerance (FL)	+/-10 ppm @ 25°C +/- 3°C
Frequency drift after reflow	+/- 2 ppm
Equivalent Series Resistance (ESR)	80 Ω max
Nominal Drive Level	10uW typ and100uW max
Load Capacitance (CL)	8 pF
Spurious modes resistance within +/- 1MHz	1100 Ohm min
Tuning sensitivity (TS)	7~16 ppm/pF
Insulation Resistance at DC 100V	500 MΩ min
Aging	+/- 1.0 ppm max/ First year
DLD spec[1]: Frequency (MAX.–MIN.) Frequency (Repeatability) ESR (MAX.–MIN.) ESR(Repeatability)	3.0 ppm MAX. 0.7 ppm MAX. 20% MAX. 10% MAX.

Marking	Laser Marking

TM0014A	Specification(Crystal curve fitting)
Inflection Point	29°C +/- 1.5°C ($T=T_0-C_2/3C_3$)
[1]Frequency stability slope 1	+/- 0.05 ppm/°C (From -30°C to 85°C)
[2]Frequency stability slope 2	+/- 0.10 ppm/°C (5°C small cycle)
First-order Curve Fitting Parameter (C_1) [2]	-0.4 to -0.1 ppm/°C
Second-order Curve Fitting Parameter (C_2) [2]	- 4.5 to 4.5 x10^{-4} ppm/°C^2
Third-order Curve Fitting Parameter (C_3) [2]	8.5 to 11.5 x10^{-5} ppm/°C^3
Residual Frequency Stability Slope [3,4]	+/- 50 ppb/°C
5°C Small Orbit Hysteresis 1 [3,4,5]	+/- 50 ppb/°C
5°C Small Orbit Hysteresis 2 [4,6]	100 ppb pk-pk

Note1. 0.01uW to 100uW to 0.01uW (measurement 30 points)

Note2. The curve of an AT-cut crystal can be modeled as a third-order polynomial, that be defined by Qualcomm's 80-V9690-23 Rev B.

$$f(T) = C_3(T-T_0)^3 + C_2(T-T_0)^2 + C_1(T-T_0)^1 + C_0 \text{ ,} T_0=29°C$$

Note3. Measure FT point every 1°C, heating up from -30 to 85°C, subtract off a 5th order polynomial best and calculate the slope of the residual.

Note4. Continuous temperature rate change of ~1.0°C/min.

Note5. Measure FT points every 0.5°C while cycling temperature over a 5°C small temperature orbit. Subtract the 5th order polynomial best fit form note2 (discard the first point of each heating and cooling cycle) and calculate the slope of the residual for each of these heating and cooling 10 point curves.

Note6. Measure FT points every 0.5°C while cycling temperature over a 5°C small temperature orbit. Calculate the average difference between each pair of 9 same temperature cooling-heating frequency measurement(discard the first and last point of each heating and cooling cycle).
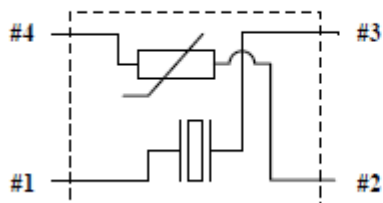
Thermistor Electrical Specification

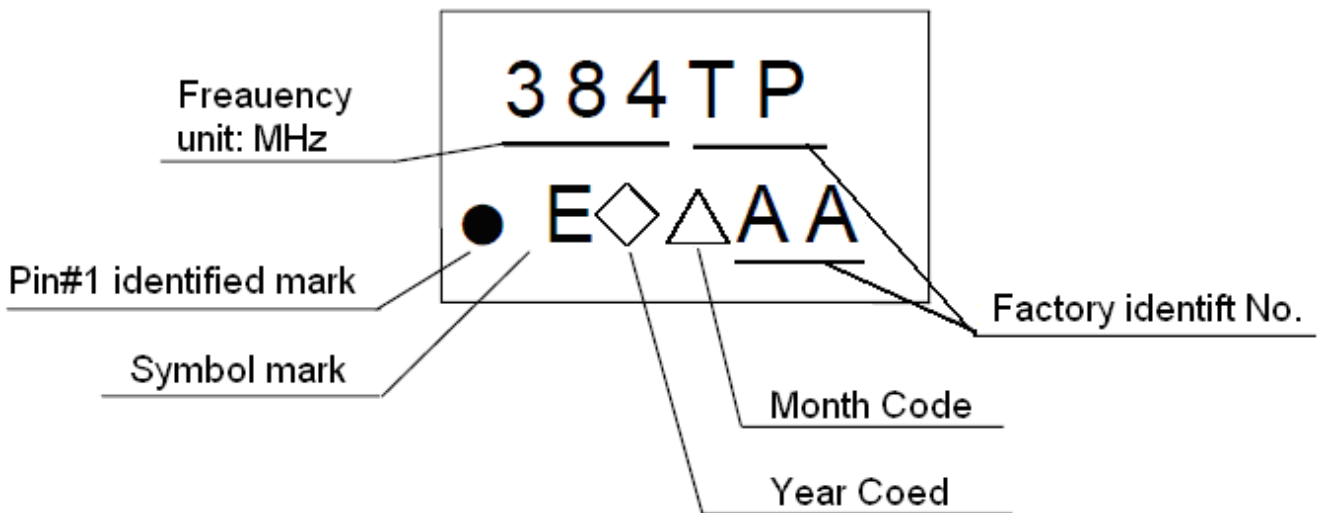| Parameters	Specification
Thermistor type	NTC($R/R0 = \exp(B*(1/T - 1/T0))$, T is in Kelvin.)
Resistance (25°C)	100K +/- 1% Ω
B-constant	4250 +/- 1% k (Evaluated from 25°C to 50°C, 1% tolerance)

Mechanical Dimensions (unit: mm):
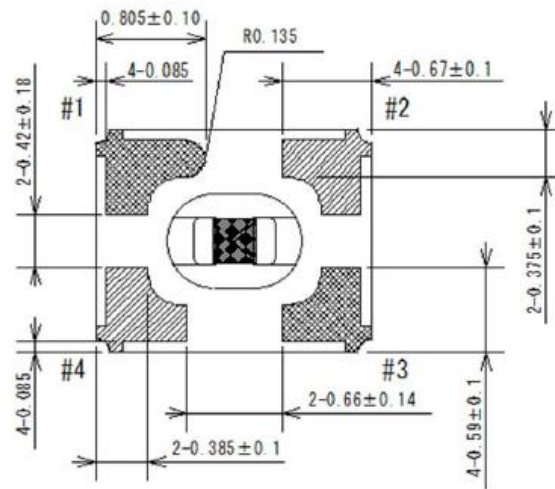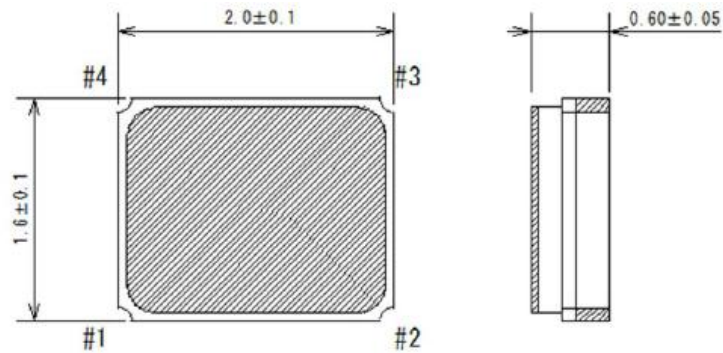
TOP VIEW

Pin	Connection
1	XTAL
2	GND, thermistor
3	XTAL
4	Thermistor

Marking:

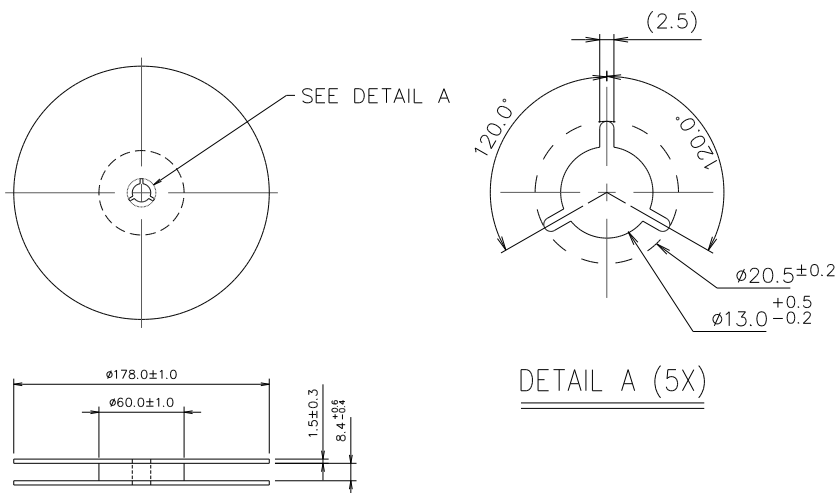Nominal frequency omits the figure below the first place of decimals.

Ex) 38.4 MHz...... [384]

△Month Code Table:

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Month Code	1	2	3	4	5	6	7	8	9	X	Y	Z

◇Year Code Table:

Year	2017	2018	2019	2020	2021
Code	7	8	9	0	1
Year	2022	2023	2024	2025	2026
Code	2	3	4	5	6

Reel Dimensions (mm):

DETAIL A (5X)

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Tape Dimensions (mm):

4.0
2.0
$\phi 1.5^{+0.1}_{0.0}$
0.3 ±0.05
1.75
3.5
8.0
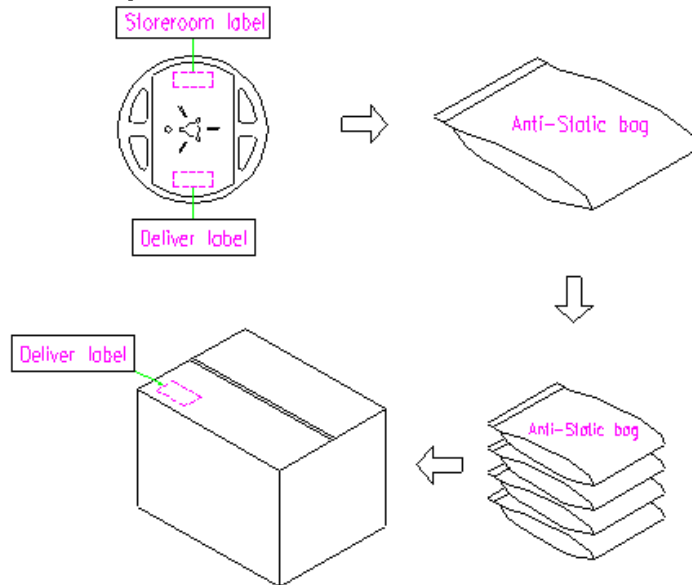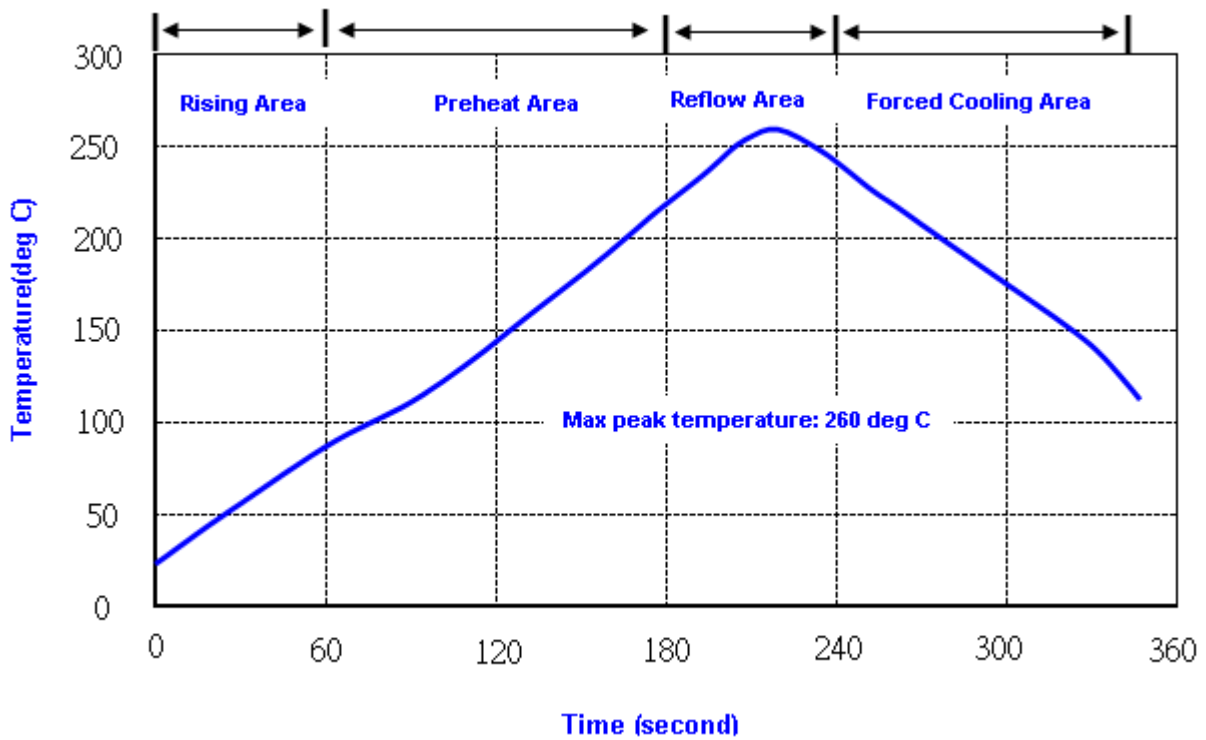2.7
1.2
2.25
$\phi 1.0$ MIN.
4.0
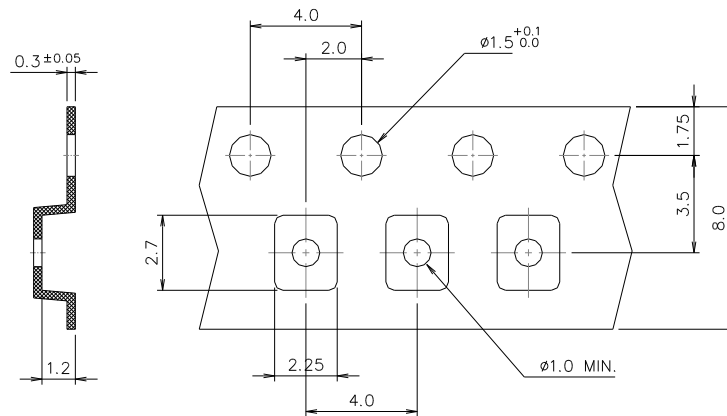
[NOTE]:

    1. Unless otherwise specified tolerance on dimension +/-0.1 mm.

    2. Material: conductive polystyrene with color black

Direction of Feed

    3. 10 pitch cumulative tolerance +/-0.2 mm.

Packing Quantity/Packing:

3K pcs maximum per reel

Storeroom label

Deliver label

Anti-Static bag

Deliver label

Anti-Static bag

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Reflow Profile:

Note: 1.Max peak temperature: 38.40+/-5 deg C; Time: 10+/-2 sec
      2. Temperature: 217+/-5 deg C; Time: 90~100 sec

Reliability Specifications

Test name	Test process / method	Reference standard
Mechanical characteristics		
resistance to Soldering heat (IR reflow)	Temp./ Duration : 265°C /10sec ×2 times Total time : 4min.(IR-reflow)	EIAJED-4701 -300(301)M(II)
Vibration	Total peak amplitude : 1.5mm Vibration frequency : 10 to 2000 Hz Sweep period : 20 minute Vibration directions : 3 mutually perpendicular Duration : 2 hr / direc.	MIL-STD 202G method 204
Mechanical Shock	directions : 3 impacts per axis Acceleration : 3000g's, +20/-0 % Duration : 0.3 ms (total 18 shocks) Waveform : Half-sine	MIL-STD 202G method 213
Solderability	Solder Temperature:265±5°C Duration time: 5±0.5 seconds.	J-STD-002
Environmental characteristics		
Thermal Shock	Heat cycle conditions -40 ℃ (30min) ⟷ 85 ℃ (30min) * cycle time : 10 times	MIL-STD 883G method 1010.8
Humidity test	Temperature : 85 ± 2 °C Relative humidity : 85% Duration : 96 hours	MIL-STD 202G method 103
Dry heat (Aging test)	Temperature : 125 ± 2 °C Duration : 168 hours	MIL-STD 202G method 108A
Cold resistance (Low Temp Storage)	Temperature : -40 ± 2 °C Duration : 96 hours	IEC 60068-2-1