



管理号: Z12-G08

STANDARD SPECIFICATION

产品规格书

客户 Customer: _____

客户料号 Customer P/N NO.: _____

产品描述 Product Description: SXT-2520 19.200MHZ 7PF ±10PPM

TKD 料号 TKD P/N. NO.: SXT25Y019200B71T

客户批准 Customer Approval :

(请批准后回签一份 PLEASE RETURN A COPY WITH APPROVAL)

湖北泰晶电子科技股份有限公司

HUBEI TKD ELECTRONICS TECHNOLOGY CO., LTD.

随州泰华电子科技有限公司

SUIZHOU TAIWARD ELECTRONIC TECHNOLOGY CO., LTD

批准 APPROVED	审核 CHECK	制作 DESIGNER
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SALES TEL: 0722-7509016, FAX: 0722-7509036 URL: www.sztkd.com

FMT: TH-QW-RD2-23 Ver: C0



REVISION RECORD

Rev	Date	NO.	Description of Revision History
00	2017-10-24		New Publication
01	2018-7-17		Change format version : C
02	2018-10-25	1-5	ESR SPEC :原规格 80Ω Max.

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1. 石英晶体参数规格 QUARTZ CRYSTAL UNIT SPECIFICATION

※描述 Description	: Quartz Crystal
※产品型别 Product Type	: SXT-2520
※水晶切割模式 Crystal cutting type	: AT-CUT
※测量设备 Measure equipment	: S&A 250B
※电气特性 Electrical Characteristics	

项目 Item	代码 Symbol	电气特性规格 Electrical Specification				单位 Units	备注 Notes
		下限 Min.	中心 Typ.	上限 Max.			
1 一般频率 Nominal Frequency	F0	19.200000			MHz		
2 振荡模式 Oscillation Mode	-	Fundamental			-		
3 负载电容 Load Capacitance	CL	7.0			pF		
4 频率公差 Frequency Tolerance	-	-10	-	10	ppm	At 25°C ±3°C	
5 等效串联电阻 Equivalent Series Resistance	ESR	-	-	70	Ω		
6 驱动功率 Drive Level	DL	-	-	100	μW		
7 频率稳定度 Frequency Stability	TC	-12	-	12	ppm	Over Operating Temp. Range (Ref. to 25°C)	
8 动作温度 Operating Temperature	-	-30	-	85	°C		
9 储存温度 Storage Temperature	-	-40	-	85	°C		
10 老化率 Aging	-	-0.7	-	0.7	ppm	Per Year	
11 回流焊后频率稳定度 Frequency drift after reflow	-	-2.0	-	2.0	ppm	After two reflows	
12 绝缘阻抗 Insulation Resistance	-	500	-	-	MΩ	At DC 100V	
13 并联电容 Shunt Capacitance	C0	0.3	-	1.3	pF		
14 动态电容 Motional Capacitance	C1	1.8	-	3.1	fF		

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15	品质因素 Quality Factor	Q	75	-	-	K	
16	副波阻抗 Spurious mode series resistance	SPUR	1100	-	-	Ω	F0: $\pm 1\text{MHz}$
17	拐点温度 Inflection point	-	27.5	29.0	30.5	$^{\circ}\text{C}$	$T=T_0-A_2/(3*A_3)$
18	A1, 一阶曲线拟合系数 First-order curve fitting parameter	A1	-0.4	-	-0.1	ppm/ $^{\circ}\text{C}$	
19	A2, 二阶曲线拟合系数 Second-order curve fitting parameter	A2	-4.5	-	4.5	10^{-4} ppm/ $^{\circ}\text{C}^2$	
20	A3, 三阶曲线拟合系数 Third-order curve fitting parameter	A3	8.5		11.5	10^{-5} ppm/ $^{\circ}\text{C}^3$	

备注 Notes:

1. 超声波清洗 Ultrasonic cleaning

一般的清洁液或超声波清洗方法可以用来清洗我们的产品。但是，在某些情况下，超声波清洗机在我们产品的振荡频率上会产生共振，从而使器件的电气特性恶化，甚至损坏器件的整体结构。因此，建议超声波清洗前进行验证测试。General cleaning solutions or ultrasonic cleaning method may be used to clean our products. However, under certain circumstances, ultrasonic cleaning machine could generate resonance at the oscillation frequency of our products and thus deteriorate the electrical characteristics in devices, and even damage the overall structure of devices. Therefore, verification test is recommended before cleaning.

2. 超声波焊接 Ultrasonic welding

避免使用超声波焊接进行安装和加工，这种方法有可能使晶体产品内部产生过大的振动扩散，成为特性退化而不振动的的原因。Avoid mounting and processing by Ultrasonic welding this method has a possibility of an excessive vibration spreading inside the crystal products and becoming the cause of characteristic deterioration and not oscillating.

3. 储存温度说明 Storage temperature description

储存温度仅适用于产品，而包装材料储存温度 $5^{\circ}\text{C}\sim 40^{\circ}\text{C}$ 。Storage Temperature is only for the product itself, the temperature for the packing material is $5^{\circ}\text{C}\sim 40^{\circ}\text{C}$.

4. 三次曲线拟合计算式:

$$f(t)=A_3(T-T_0)^3+A_2(T-T_0)^2+A_1(T-T_0)+A_0$$

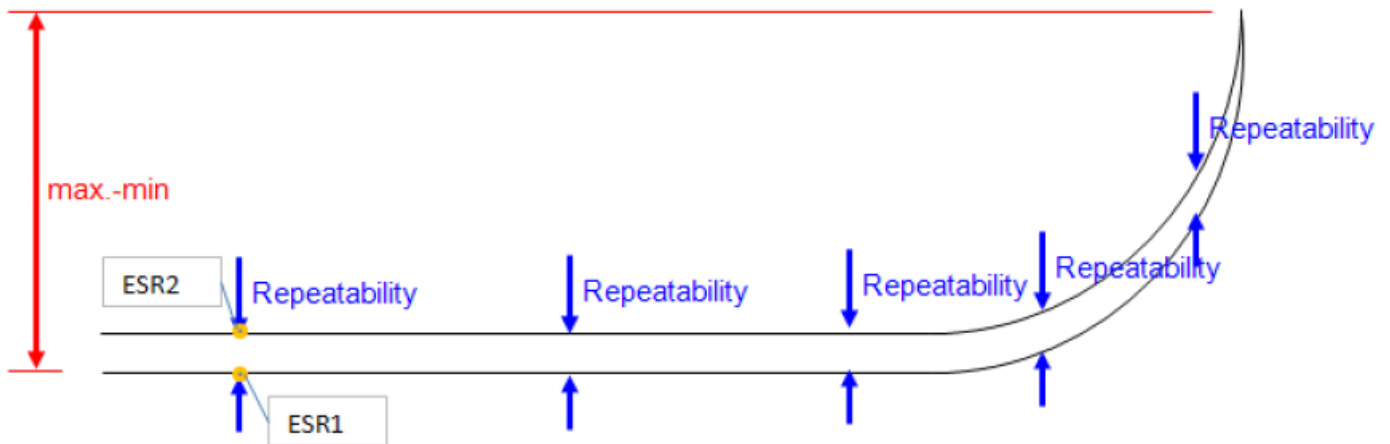
*部分客户会用 C1、C2、C3 表示三次曲线系数。Some customers will use C1, C2 and C3 to represent the tertiary curve coefficient

2. DLD 规范 SPECIFICATION FOR DLD MEASUREMENT OF THE CRYSTAL

	项目 Item	最大-最小 Max. -Min.		可重复性 Repeatability		条件 Condition
		FDL	<3.0ppm	FDLDH	<0.7ppm	
Drive level dependency	Freq	FDL	<3.0ppm	FDLDH	<0.7ppm	0.01 μW to 100 μW to 0.01 μW
	ESR	DLD10	<20%	DLDH3	<10%	

Notes:

1. 测试点数: DLD 功率从低到高 15 个点, DLD 功率从高到低 15 个点。Number of points: 15 points up and 15 points down = 29 total data points.
2. 最大-最小: 在双向测量中最大值和最小值的差值。对于ESR, 变化率为(最大 - 最小)/最小 < 20%。
Max - min: Difference between the maximum and minimum in a two-way measurement. For ESR, the change rate is (max - min)/min < 20%.
3. 可重复性: 上述情况下双向测量的重复性。对于ESR, 变化率是 (ESR2 - ESR1)/ESR1 < 10%。
Repeatability: Repeatability of two-way measurement in the above condition. For ESR, the change rate is (ESR2 - ESR1)/ESR1 < 10%.
4. ESR1: 在每个驱动点的功率上的第一次测量的阻抗。First measurement on each drive level.
5. ESR2: 在每个驱动点的功率上的第二次测量的阻抗;例如, 如何指定每个参数。Second measurement on each drive level; for example, how to specify each parameter.



6. DLD 晶体测量说明 Test instructions for DLD measurement of the crystal
DLD 测试应该在每个设备上进行, 以检测制造问题, 如污染、尘埃颗粒等, 并验证晶体功能的性能。DLD testing should be done on every device to detect fabrication issues such as contamination, particles of dust, and so on, and to verify proper crystal functionality.



3. GPS 规范 GPS QUALITY SPECIFICATIONS

Crystal perturbation specification 1 (residual frequency stability slope)

项目 Item	条件 Condition	规格 Specification	单位 Unit
Residual frequency stability slope (residual = difference from fifth-order curve fit)*	Ta = -30°C to +85°C	±50 (Max.)	ppb/°C
5 °C small orbit hysteresis 1*	Ta = -30°C to +85°C	±50 (Max.)	ppb/°C

* Must meet the 1A and 1B conditions:

■ Condition 1A -Test condition (continuous temperature rate change of ~1.0 °C/min):

Measure FT points every 1°C, heating up from -30 °C to +85 °C, subtract a fifth-order polynomial best fit and then calculate the slope of the residual.

The residual slope should be within ±50 ppb/°C.

■ Condition 1B-Hysteresis 1 test condition (continuous temperature rate change of ~1.0 °C/min):

Measure FT points every 0.5 °C while cycling temperature over a 5°C small temperature orbit; an example 5 °C small orbit temperature cycle is +30°C to +35°C to +30°C.

During every individual heating/cooling cycle there should be 11 points; discard the first point of each heating and cooling cycle; this leaves 10 points for each heating and cooling cycle. Subtract the fifth-order polynomial best fit from 1 A for each of the 10 points, and then calculate the slope of the residual for each of these heating and cooling 10 point curves.

The residual slope should be within ±50 ppb/°C.

Crystal perturbation specification 2 (small orbit hysteresis 2)

Item	Condition	Specification	Unit
5 °C small orbit hysteresis 2*	Ta = -30°C to +85°C	100 (magnitude)	magnitude

* Must meet condition 2:

■ Condition 2 - Hysteresis 2 test condition (continuous temperature rate change of ~1.0 °C/min):

Measure FT points every 0.5 °C while cycling temperature over a 5 °C small temperature orbit; an example 5 °C small orbit temperature cycle is +30 °C to +35 °C to +30 °C.

During every individual heating/cooling cycle there should be 11 points; discard the first and last point of each heating and cooling cycle, which results in nine temperature points. Calculate the average measured peak-to-peak frequency difference for these nine temperature points.

The average difference is the magnitude of the small orbit hysteresis 2.

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GPS Test instructions and purpose of these tests/specifications

1. Testing:

- DLD testing should be done on every device to detect fabrication issues such as contamination, particles of dust, etc., and to verify proper crystal functionality.
- Specifications 1A, 1B, and 2 process control confirmation testing is recommended to be done at a minimum on a sampling basis for every lot.

2. The purpose of the specifications:

■ Specification 1A:

- Verify that the FT curve can fit with a fifth-order polynomial.
- Verify that there are no package resonances and no micro-jumps that exceed the residual frequency stability slope specification.
- See Figure 2.

■ Specification 1B:

- Verify that the small orbit hysteresis 1 is controlled to less than 50 ppb/°C residual slope in the crystal (departure from FT curve over small orbits).

- See Figure 3.

■ Specification 2:

- Verify that hysteresis 2 (the gap between the cooling and heating FT curves) over small orbits is of a reasonable value.
- These are the rapid shifts that occur when changing from cooling-to-heating or heating-to-cooling.
- See Figure 4.

3. Measurement technique for specifications 1 and 2:

- Standard thermocouple should not be used since it has a 0.1 °C temperature resolution and therefore can fail a 50 ppb/°C test due to measurement quantization (i.e., which is not part of the real crystal FT performance curve).
- A preferable technique to measure temperature is to use the internal thermistor (or an external thermistor located near crystal on the PCB board). As an example, voltage measurement is a feature of the 34970A Data Acquisition Unit from Agilent. Frequency can be measured via the 53131A_132A 225 MHz Agilent frequency counter.
- A continuous temperature rate change of ~1.0 °C/min is recommended for all tests.

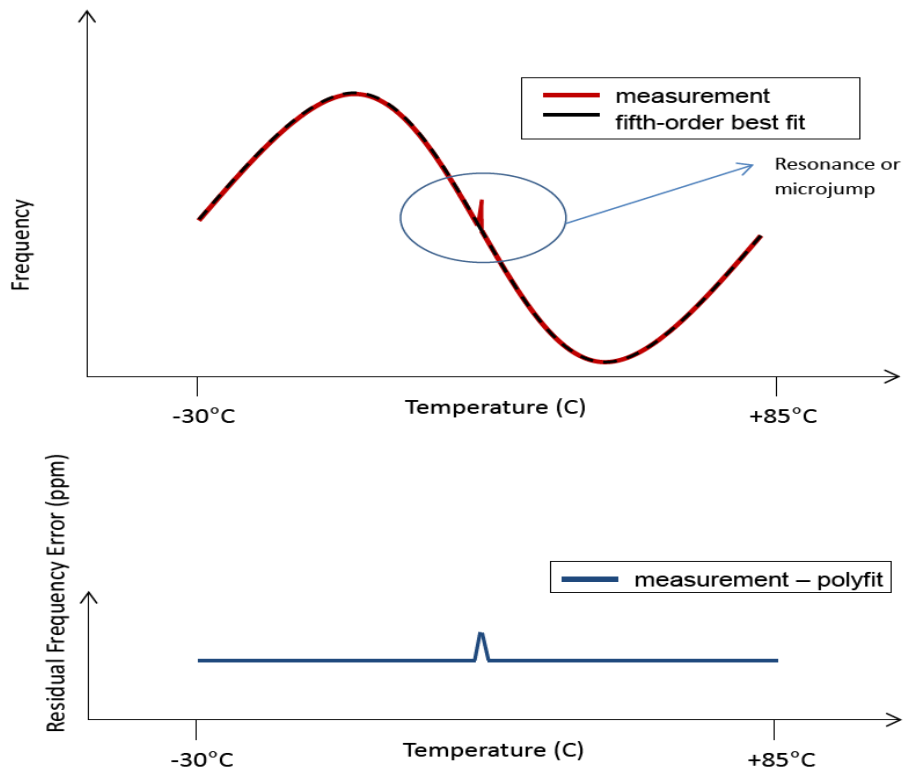


Figure 2 Measurement to locate resonances or micro-jumps

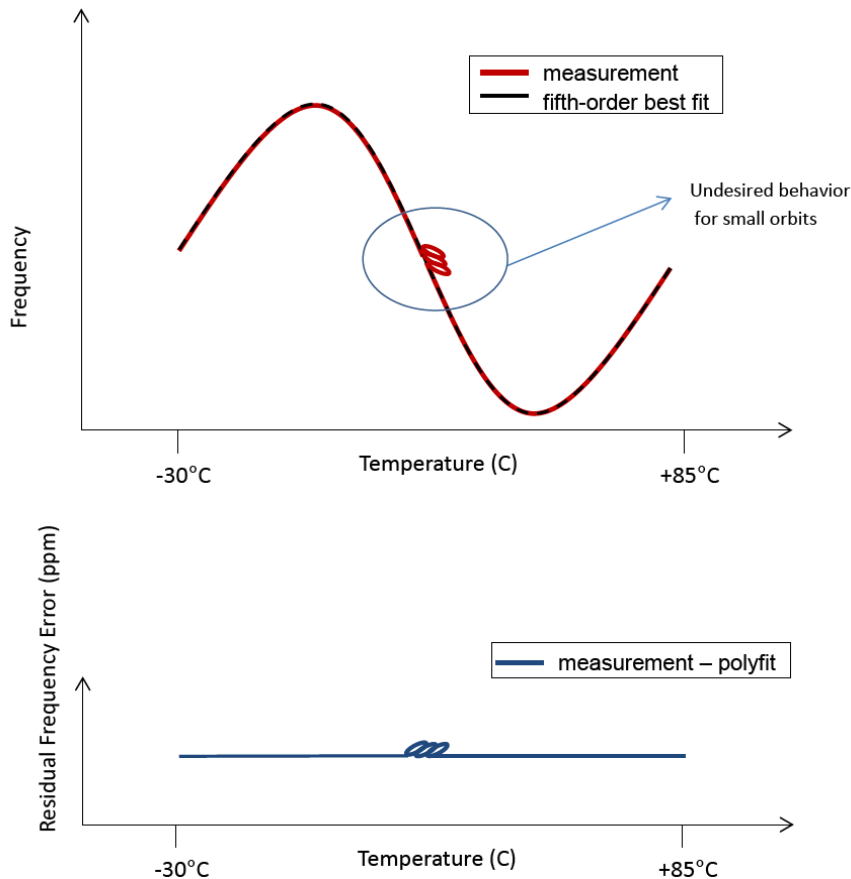


Figure 3 Measurement to locate small orbit hysteresis 1

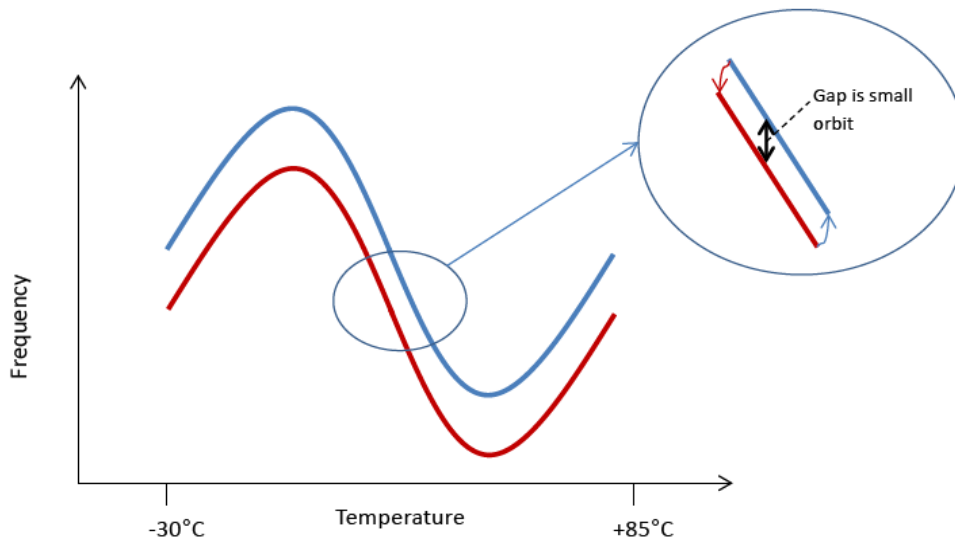
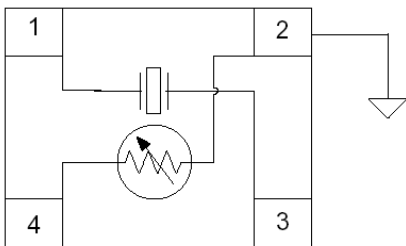


Figure 4 Measurement to locate hysteresis 2

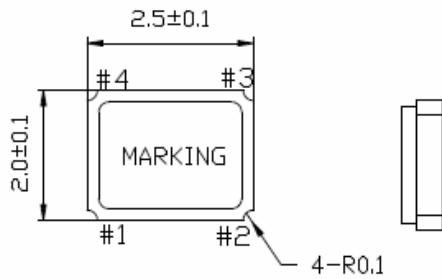
4. 热敏电阻规格 THERMISTOR SPECIFICATIONS



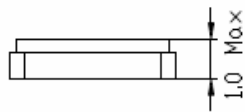
尺寸Size : 0.6mmx0.3mm

参数 Parameter	下限 Min	中心 TYP.	上限 Max	单位 Unit	条件 Condition
动作温度 Operating temperature	-30		105	°C	
储存温度 Storage temperature	-40		105	°C	
电阻 Resistance		100		KΩ	25°C
常数 B-constant		4250		K	25-50°C
公差 Tolerance	-1.0		+1.0	%	

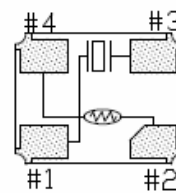
5. 产品图纸 DIMENSIONS (Units:mm)



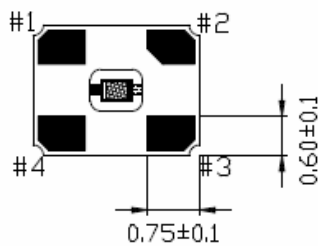
PIN CONNECT	
#1	Crystal
#2	GND
#3	Crystal
#4	Sensor



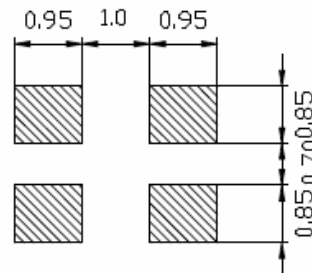
<TOP VIEW>



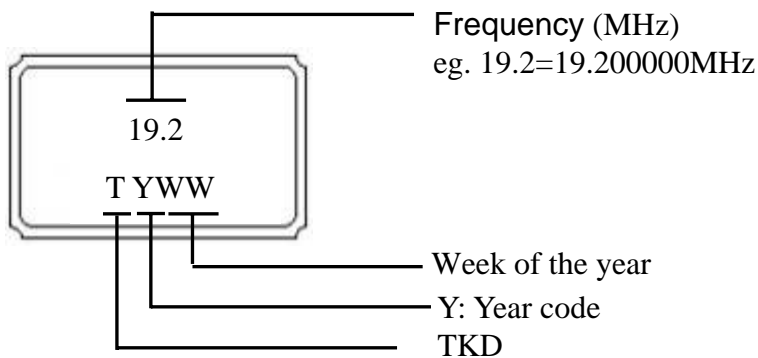
<BOTTOM VIEW>



LAND PATTERN REFERENCE



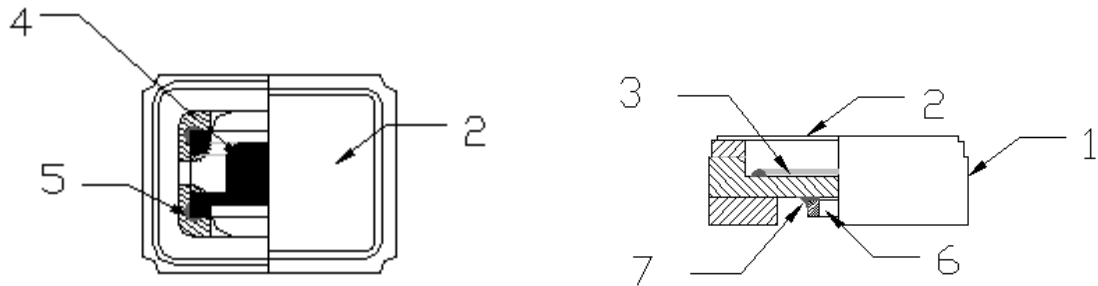
6. 印字 MARKING



Year code: 1 2 3 4 5 6 7 8 9 0 (Last 1 digit of the year)

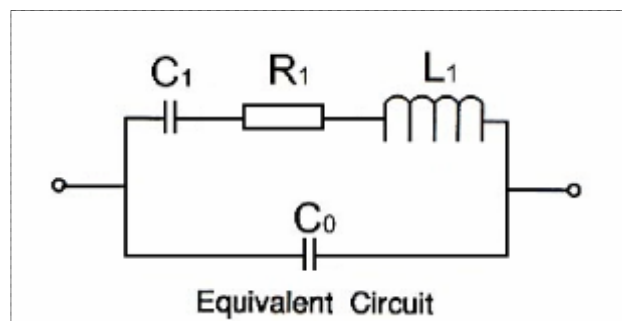
WW : Week of the year

7. 内部结构产品图纸 INSIDE STRUCTURE



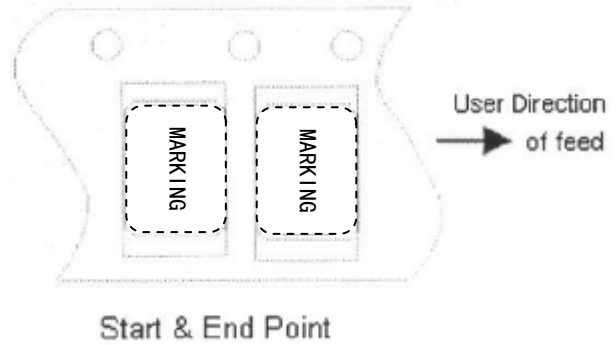
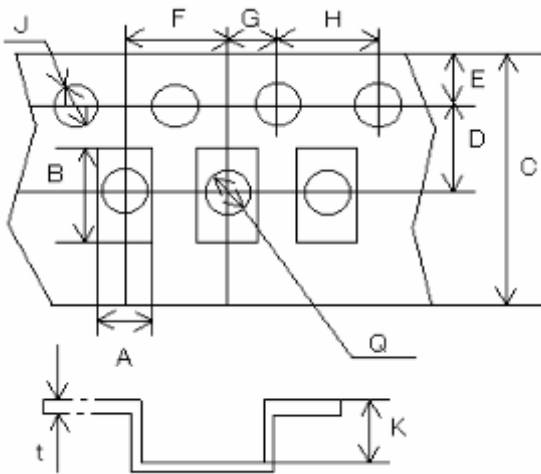
No.	组件 COMPONENTS	材料成份 MATERIALS
1	基座 Package	陶瓷 Ceramic (Al2O3)
2	外壳 LID	KV 合金 KV (Fe/Co/Ni)
3	水晶片 Crystal blank	二氧化硅 SiO ₂
4	电极 Electrode	贵金属 Noble Metal (Au)
5	接着剂 Adhesive	树脂、银粉 Resin、Ag
6	热敏电阻 Thermistor	陶瓷 Ceramic (Al2O3) + Ag+Ni
7	焊料 Solder	金属锡 Sn

8. 等效电路图 EQUIVALENT CIRCUIT



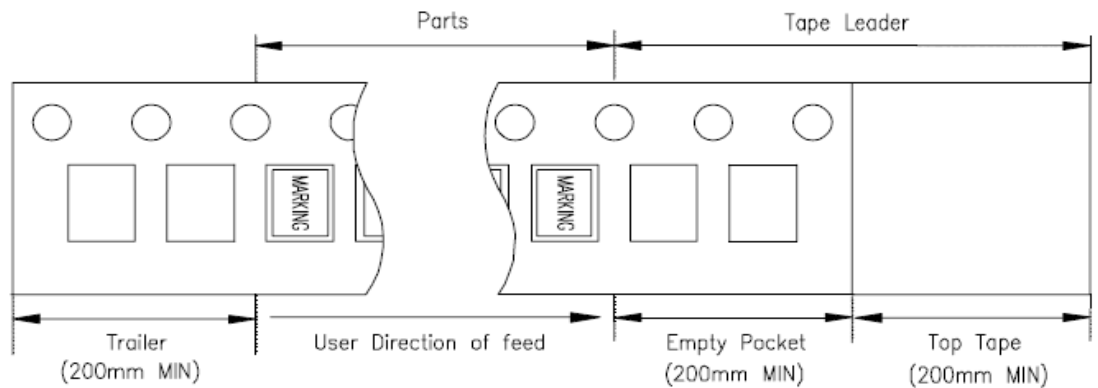
9. 包装 PACKING (Units:mm)

※载带类型 CARRIER TYPE

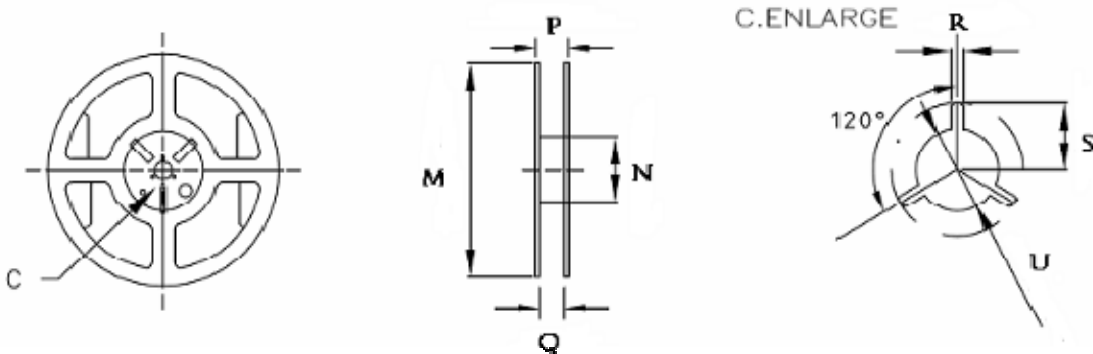


A	B	C	D	E	F	G	H	J	K	t
2.40	2.90	8.0	3.5	1.75	4.0	2.0	4.0	1.55	1.10	0.25

备注 REMARK:



※圆卷 REEL: 3000 PCS/Reel



M	N	P	Q	R	S	U
178.0	60.2	11.5	8.0	2.5	11.0	13.0

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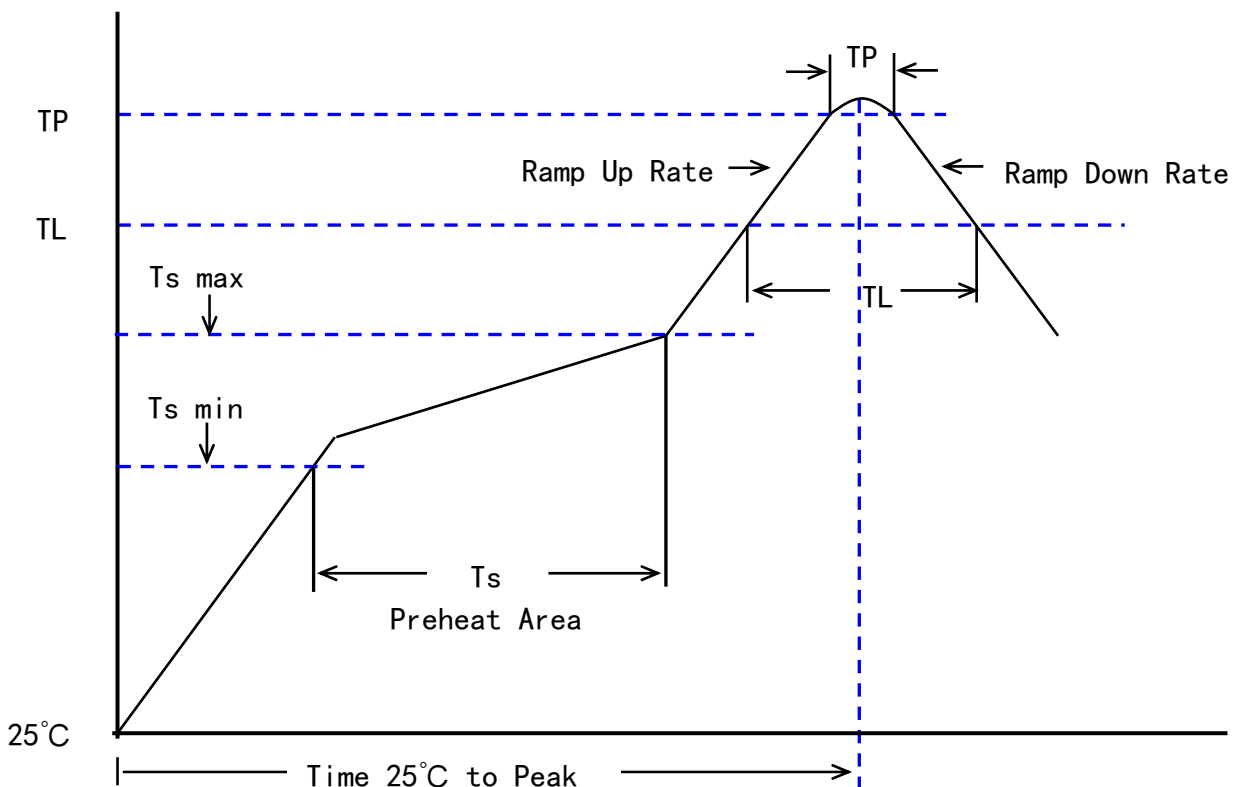
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10. 回流焊温度曲线 REFLOW PROFILES

参考标准 REFER: JEDEC J-STD-020D	
Profiles Feature	Pb-Free Assembly
Preheat/Soak	
Temperature Min (Ts min)	150°C
Temperature Max (Ts max)	200°C
Time (Ts) from (Ts min to Ts max)	60-120 seconds
Ramp-up rate (TL to TP)	3°C/second max.
Liquidous temperature (TL)	217°C
Time (TL) maintained above TL	60-150 seconds
Peak/Classification Temperature (TP)	260±5°C
Time within 5°C of actual Peak Temperature (TP)	20~40 seconds
Ramp-down rate (TP to TL)	6°C/second max.
Time 25 ° C to peak temperature	8 minutes max.
Suggest reflow times	3 Times max



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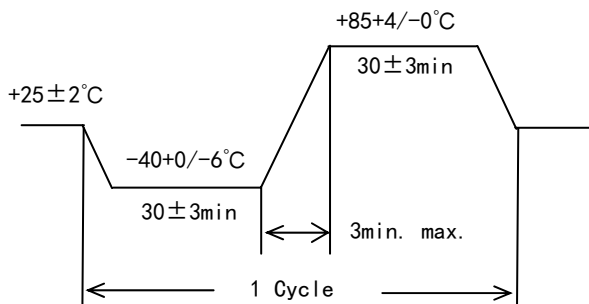
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11. 可靠性试验 RELIABILITY SPECIFICATION

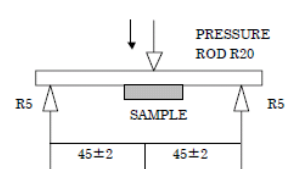
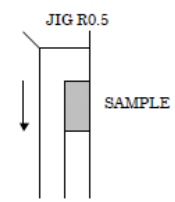
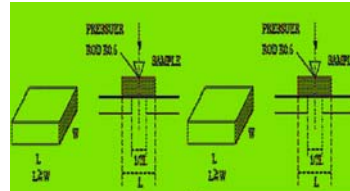
参考标准 REFER		JIS C 6701	
NO.	项目 ITEM	测试条件 CONDITIONS	测试标准 Criteria
1	跌落 FREE FALL	从100cm位置高度, 自由跌落在木板上, 连续3次 FREE DROPPING FROM 100 cm HEIGHT 3 TIMES ON A HARD	A. C
2	振动 VIBRATION	振动频率: 10~55 Hz, 振幅: 1.5mm±15%, 时间: 每个方位三面(X、Y、Z)各振动2小时 FREQUENCY: 10~55Hz AMPLITUDE (TOTAL EXCURSION): 1.5mm±15%, SWEEP TIME: 1MIN, 3 DIRECTION(X, Y, Z) EACH FOR 2 Hrs.	A. C
3	冷热冲击 TEMPERATURE CYCLE	晶体放入试验箱中, 高、低温循环100次 THE CRYSTAL UNIT SHALL BE SUBJECTED TO 100 SUCCESSIVE CHANGE OF TEMPERATURE CYCLES 	A. C. H
4	气密性(大漏) GROSS LEAK	标准件自动压差比对测试 STANDARD SAMPLE FOR AUTOMATIC GROSS LEAK DETECTOR	E
4	气密性(小漏) FINE LEAK	氦气压力标准: 5.0~5.5Kg/cm ² , 加压时间: 2小时 HELIUM BOMBING 5.0~5.5 Kgf / cm ² , FOR 2 HOURS.	F
5	可焊性 SOLDERABILITY	温度: 260±5°C, 浸锡时间: 2±0.6秒 THE LEAD IS IMMERSERD IN A 260±5°C SOLDER BATH WITHIN 2±0.6 SECONDS.	G
6	高温高湿 HIGH TEMP. & HUMIDITY	温度: 60°C ± 2°C, 湿度: 90%~95%, 保持时间: 500个小时 STORED AT 60±2°C AND HUMIDITY 90~95% FOR 500±12 H.	A. C. D. H
7	高温存储 HIGH TEMPERATURE STORAGE	高温温度: 85°C ± 2°C, 时间: 500±12个小时 如果客户的温度要求是高于标准, 则必须根据客户的要求测试 STORED AT 85±2°C FOR 500±12H. If Customer's temperature request is higher than the standard, Temperature test must be done for customer requirements	A. C. H
8	低温存储 LOW TEMPERATURE	低温温度: -40°C ± 2°C, 时间: 500±12个小时 STORED AT -40±2°C FOR 500±12H. 如果客户的温度要求是低于标准, 则必须根据客户的要求测试	A. C. H

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	STORAGE	If Customer's temperature request is lower than the standard, Temperature test must be done for customer requirements	
9	折板弯曲试验 TERMINAL STRENGTH	<p>弯曲度：3mm, 保持时间：5sec, 速度：0.5mm/sec SHALL BE PRESSURIZED AT A SPEED OF APPROX. 0.5mm/sec IN THE DIRECTION INDICATED BY THE ARROW UNTIL THE BENDING WIDTH REACHES 3mm AND HELD FOR 5 SECONDS.</p> 	A. C
10	折板推力试验 STICKING TENDENCY	<p>荷重：10N, 保持时间：10秒, 治具：R0.5 (制品侧边位置) A R0.5 JIG SHALL BE USED TO APPLY A 10N DEAD LOAD IN THE DIRECTION INDICATED BY THE ARROW TO THE ELEMENT AND RETAIN IT FOR 10 SECONDS.</p> 	A. C
11	本体荷重试验 ELEMENT ASSEMBLY STRENGTH	<p>荷重：10N, 保持时间：10秒, 治具：R0.5 (制品中心位置) A R0.5 PRESSURIZED BAR SHALL BE USED TO APPLY A 10N LOAD IN THE CENTER OF ELEMENT AND RETAIN IT FOR 10 SECONDS.</p> 	A. C

SPECIFICATIONS

A	FREQUENCY CHANGE PERMITTED.	$\Delta F \leq 5\text{PPM}$
B	FREQUENCY CHANGE PERMITTED.	$\Delta F \leq 10\text{PPM}$
C	EQUIVALENT SERIES RESISTANCE CHANGE PERMITTED.	$\Delta CI \leq 5\Omega$ or 15%
D	INSULATION RESISTANCE	$> 500\text{M}\Omega$
E	PRESSURE GAP LESS THAN	$< 1 \cdot 10^{-4} \text{ Pa} \cdot \text{m}^3 / \text{sec}$
F	LEAK RATE LESS THAN	$< 1 \cdot 10^{-9} \text{ Pa} \cdot \text{m}^3 / \text{sec}$
G	A NEW UNIFORM COATING OF SOLDER SHALL COVER A MINIMUM 95% OF THE SURFACE	
H	THEN $25 \pm 2^\circ\text{C}$ OVER 2Hr BEFORE TESTING	

Remark:

※ Each test done independently

※ Measurement condition: Electrical characteristics measured by S&A250B or equivalent.

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12. 有害物质含量声明 HARMFUL SUBSTANCE CONTENT STATEMENT

随州泰华电子科技有限公司 SXT-2520 产品

有毒有害物质或元素的名称及含量表

材料名称	有毒有害物质或元素						备注
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr (VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)	
BLANK	ND	ND	ND	ND	ND	ND	
Package	ND	ND	ND	ND	ND	ND	
LID	ND	ND	ND	ND	ND	ND	
Electrode	ND	ND	ND	ND	ND	ND	
Adhesive	ND	ND	ND	ND	ND	ND	
... ..							
... ..							
... ..							
... ..							
... ..							
拆分部件 n							

○：表示该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T11363-2006 规定的限量要求以下

×：表示该有毒有害物质至少在该部件的某一均质材料中的含量超出 SJ/T11363-2006 规定的限量要求。

(供应商应将其原材料按要求进行拆分, 并按照此表格进行详细标注, 对不能满足标准要求的零部件进行具体的原因描述)

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