

新品 变更



## 产品规格书

## SPECIFICATION FOR APPROVAL

|                       |                               |
|-----------------------|-------------------------------|
| 产品名称<br>Product Name: | 石英晶体谐振器<br>Quart crystal unit |
| 产品型号<br>Product Type: | SMD2016                       |
| 标称频率<br>Nominal Freq: | 48.000000 MHz                 |
| 明德亨料号<br>MDH P/N:     | 2.D.1.48000B114               |
| 客户料号<br>Customer P/N: |                               |

客户承认  
Approved By Customer签章  
Signature:日期  
Date:

Date: 2024年10月26日

|          |         |        |
|----------|---------|--------|
| 批准       | 审核      | 拟制     |
| Accepted | Checked | Issued |
| 张圣亮      | 乔润国     | 岳坤     |

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RoHS Compliant

## Revision Record

[illegible]

|                            |                                                       |         |                 |      |      |
|----------------------------|-------------------------------------------------------|---------|-----------------|------|------|
| SMD2016QUARTZ CRYSTAL UNIT |                                                       | MDH P/N | 2.D.1.48000B114 |      |      |
|                            |                                                       | REV.    | 01              | PAGE | 3/10 |
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## 1 石英晶体产品规格及特性 / Product specification and features

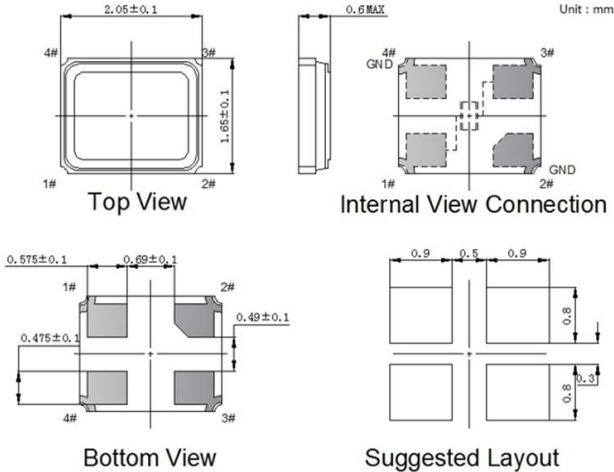
## 1.1 一般特性 / General characteristics

| Items                         | Electrical spec. |      |       | Unit     | Notes                |
|-------------------------------|------------------|------|-------|----------|----------------------|
|                               | Min.             | Typ. | Max.  |          |                      |
| 1.Frequency(FL)               | 48.000000        |      |       | MHz      | -                    |
| 2.Mode of oscillation         | Fundamental      |      |       | -        | -                    |
| 3.Crystal Cutting Type        | AT-CUT           |      |       | -        | Thickness shear mode |
| 4.Frequency tolerance         | -8               | ~    | 8     | ppm      | At 25℃±3℃            |
| 5.Loading capacitance(CL)     | 11.1             |      |       | pF       | -                    |
| 6.Equivalent resistance(RR)   | -                | -    | 22    | Ω        | Series(ESR)          |
| 7.Drive Level (DL)            | 0.01             | 100  | 150   | uW       | -                    |
| 8.Temperature stability       | -18              | ~    | 18    | ppm      | Ref. to 25℃          |
| 9.Operating temperature range | -40              | ~    | 105   | ℃        | -                    |
| 10.Storage temperature range  | -55              | ~    | 125   | ℃        | -                    |
| 11.Shut Capacitance(C0)       | 0.7              | 0.9  | 1.1   | pF       | -                    |
| 12.Motional Capacitance (C1)  | 2.2              | 3.2  | 4.2   | fF       | -                    |
| 13.TS                         | 9.5              | 11   | 13.5  | ppm/pF   | -                    |
| 14.L1                         | 1                | 3.5  | 4     | mH       | -                    |
| 15.Q                          | 40               | -    | -     | k        | -                    |
| 16.DLD2                       | -                | -    | 5     | Ω        | -                    |
| 17.FDLD                       | -                | -    | 8     | ppm      | -                    |
| 18.RLD2                       | -                | -    | 25    | Ω        | -                    |
| 19.SPFR                       | -                | -    | -1000 | ppm      | -                    |
| 20.SPUR                       | 1100             | -    | -     | Ω        | -                    |
| 21.SPDB                       | -                | -    | -3    | dB       | -                    |
| 22.Aging                      | -2               | -    | 2     | ppm/Year | -                    |
| 23.Insulation Resistance      | 500              | -    | -     | MΩ       | DC 100±10V           |

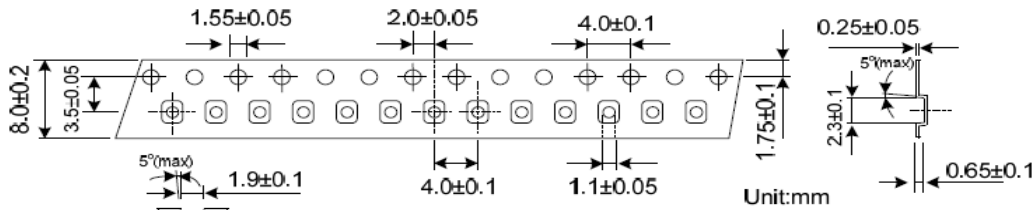
2.0 外形尺寸、外观 / Outline dimensions、Appearances

2.1 产品外形尺寸(mm)/ Product outline dimension(mm)

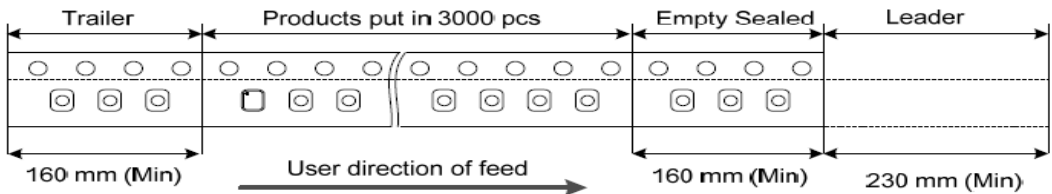
Unit:mm



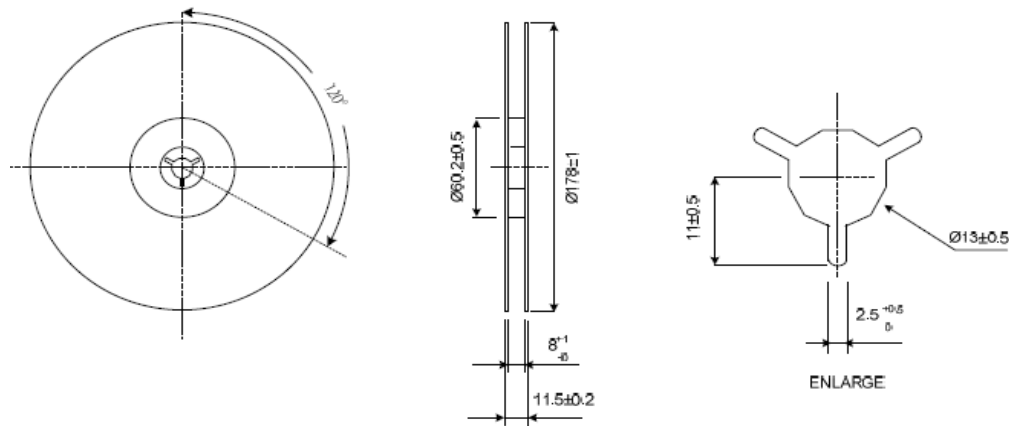
2.2 载带外形尺寸图(mm)/Carrier Dimensional Drawing (mm)



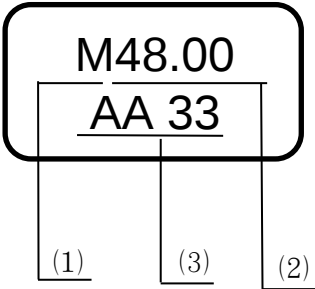
REMARK :



2.3 编带盘外形尺寸图(mm) /Reel Dimensional Drawing (mm)

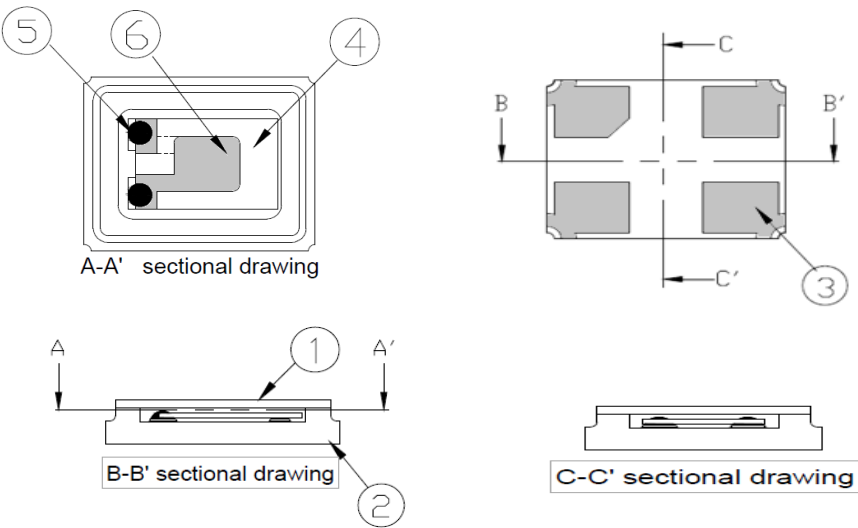


2.4 印字 Marking



- (1) 代表公司Logo
- (2) 代表标称频率
- (3) 代表批次号

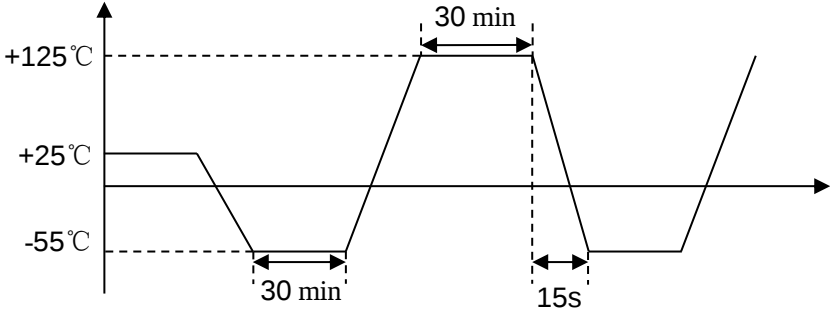
3.0 内部构造图 / Product internal structure



| 质量（参考值）：0.005±0.002 g/pcs |                     |                                                                     |                                           |
|---------------------------|---------------------|---------------------------------------------------------------------|-------------------------------------------|
| NO.                       | COMPONENETS         | MATERIALS                                                           | SPECIFICATIONS                            |
| 1                         | LID                 | Kovar (Fe/Co/Ni)                                                    | -                                         |
| 2                         | Package             | Ceramic (Al <sub>2</sub> O <sub>3</sub> ) + Kovar (Fe/Co/Ni)+ Au/Ni | Color Blank                               |
| 3                         | Pad                 | Au                                                                  | Tungsten metalize+ Ni plating+ Au plating |
| 4                         | Crystal blank       | SiO <sub>2</sub>                                                    | -                                         |
| 5                         | Conductive adhesive | Resin+Ag                                                            | Silicon resin                             |
| 6                         | Electrode           | Noble Metal                                                         | -                                         |

|         |                     |         |                 |      |      |
|---------|---------------------|---------|-----------------|------|------|
| SMD2016 | QUARTZ CRYSTAL UNIT | MDH P/N | 2.D.1.48000B114 |      |      |
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4.0 石英晶体之可靠性 / Product reliability

| 项 目<br>(Item) | 条 件 (Condition)                                                                                                                                                                                                | 结 果<br>(Result) |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| A.1           | 耐低温性（耐寒性）测试（Cold resistance）                                                                                                                                                                                   | ( I )           |
|               | Stored at $-40\pm 2^{\circ}\text{C}$ for $500\pm 2$ hrs then $25\pm 2^{\circ}\text{C}$ 2 hrs before testing                                                                                                    |                 |
| A.2           | 耐高温性（耐热性）测试（Heat resistance）                                                                                                                                                                                   | ( I )           |
|               | Stored at $125\pm 2^{\circ}\text{C}$ for $500\pm 2$ hrs then $25\pm 2^{\circ}\text{C}$ 2 hrs before testing                                                                                                    |                 |
| A.3           | 耐湿热性 (Humidity Resistance Result)                                                                                                                                                                              | ( I )           |
|               | 稳态温度: $85\pm 2^{\circ}\text{C}$ ; 湿度: $85\pm 3\%\text{RH}$ ; 时间: $500\pm 2$ hrs<br>Steady temperature: $85\pm 2^{\circ}\text{C}$ ; humidity: $85\pm 3\%\text{RH}$ ; time: $500\pm 2$ hrs                       |                 |
| A.4           | 老化测试（Aging）                                                                                                                                                                                                    | ( I )           |
|               | Stored at $85\pm 2^{\circ}\text{C}$ for $720\pm 2$ Hrs then $25\pm 2^{\circ}\text{C}$ 2 Hrs before testing                                                                                                     |                 |
| A.5           | 气密性 (Leakage)                                                                                                                                                                                                  | ( IV )          |
|               | 细漏 Fine leak: Put the product in the Helium pressure tank, $4 \sim 5\text{kgf/cm}^2$ , 0.5hrs.                                                                                                                 |                 |
| A.6           | 冷热冲击实验 温度循环（Temperature Cycle）                                                                                                                                                                                 | ( I )           |
|               | <p><math>-55^{\circ}\text{C} \sim 125^{\circ}\text{C}</math>, Retain 30Min, 100 cycles</p>  <p>温度循环（Temperature Cycle）</p> |                 |

4.1机械性能 / Mechanism characteristics

|             |                                                                                                                          |       |
|-------------|--------------------------------------------------------------------------------------------------------------------------|-------|
| B.1         | 跌落测试（Drop Test）                                                                                                          | （I）   |
|             | Device are dropped from a height of 150 cm onto 20mm thickness stainless plate executing 3 times of random drops.        |       |
| B.2         | 耐振性（Resistance of Vibration）                                                                                             | （I）   |
|             | Frequency: 10~55Hz, amplitude(total excursion): 1.5mm±15%,3 direction (X,Y,Z) each 2 hrs then 25±2℃ 2 hrs before testing |       |
| B.3         | 可焊性试验（Solderability）                                                                                                     | （III） |
|             | 245±5℃，5±1s                                                                                                              |       |
| B.4         | 耐焊接热（Reflow）Resistance to soldering heat（Reflow）                                                                         | （I）   |
|             | 参考曲线图（Reference Curve）：                                                                                                  |       |
| <div></div> |                                                                                                                          |       |

| 项目<br>Item | 结果编号Result<br>NO. | 规格要求 Specification Requirements                                                                                                                  |
|------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| 1          | ( I )             | 频率变化<±10ppm；电阻变化<±5Ω或规格电阻的±15%，取大者<br>Frequency variation <±10ppm；<br>Resistance variation < ±5Ω or ±15% of RR spec., select the bigger value.   |
| 2          | ( II )            | 频率变化<±10ppm；电阻变化<±10Ω或规格电阻的±20%，取大者<br>Frequency variation <±10ppm；<br>Resistance variation < ±10Ω or ±20% of RR spec., select the bigger value. |
| 3          | (III)             | 上锡覆盖率高于95%<br>The covering rate of Tin-plating is more than 95%.                                                                                 |
| 4          | (IV)              | <1*10 <sup>-9</sup> Pa.m³/s Max                                                                                                                  |

5.0 生产商及产地说明 / Manufacturer and origin

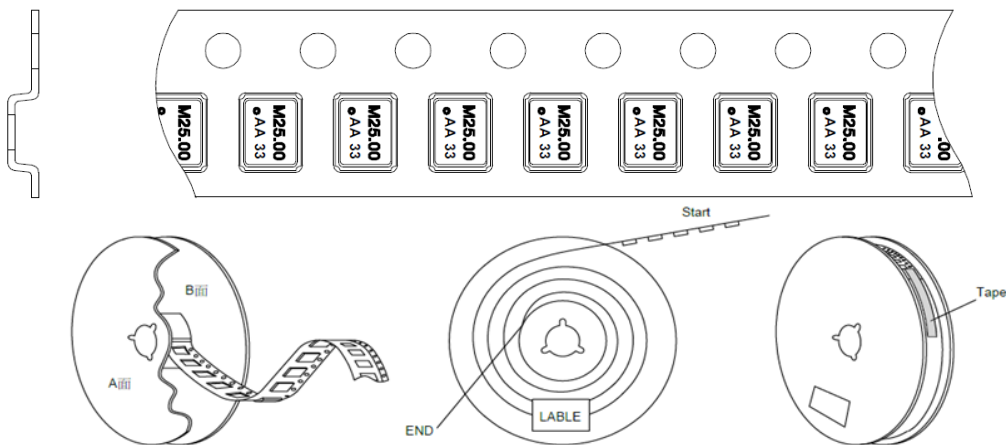
生产商/Manufacturer: 烟台明德亨电子科技有限公司 ☒

YanTai MDH Technology Co.,Ltd

四川明德亨电子科技有限公司

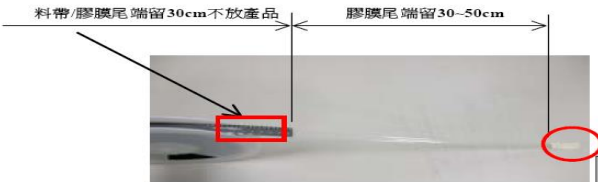
SiChuan MDH Technology Co.,Ltd

5.1 包装规格 Package specification

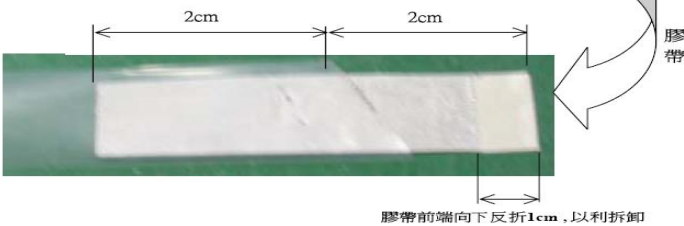


Standard Reel Quantity is 3,000 pcs per reel

(2)



(3)



165°~180°

