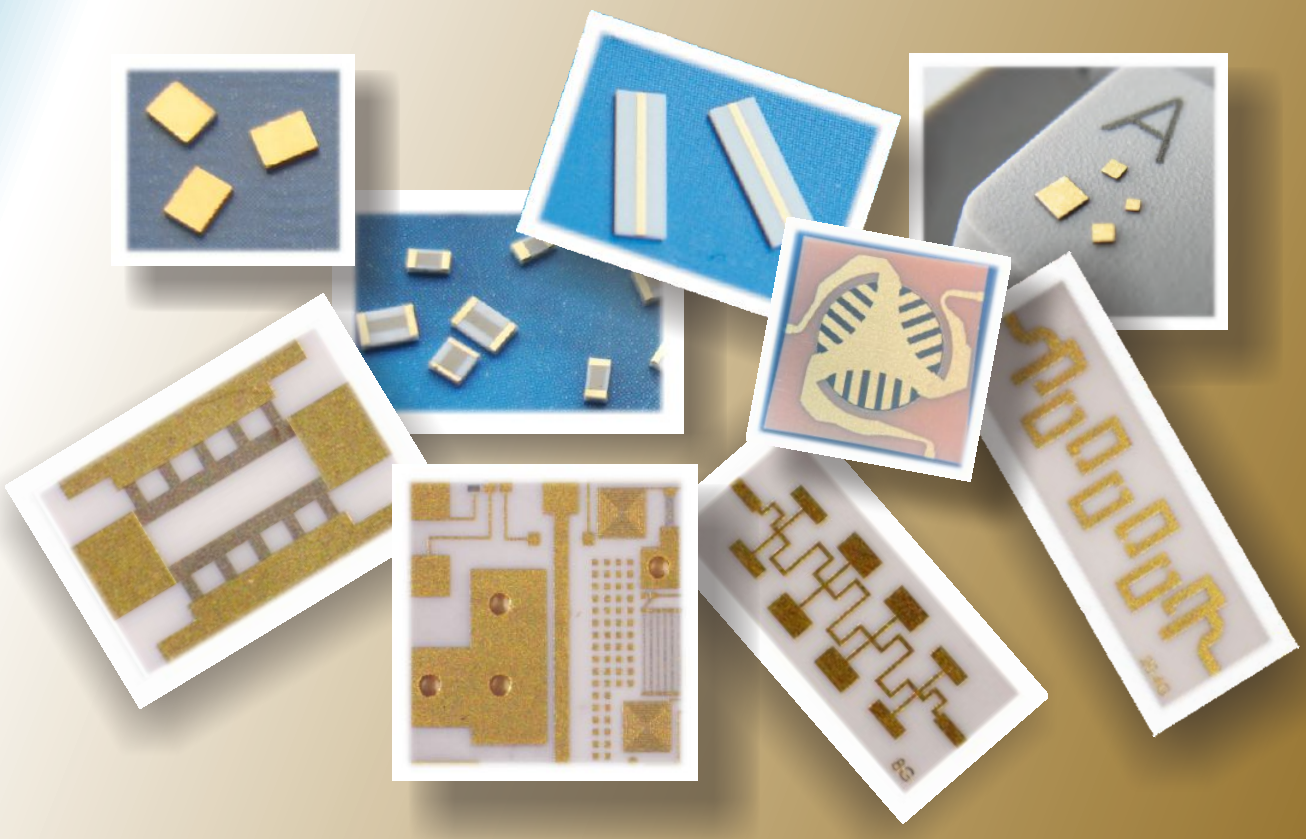


*Microwave Dielectric Ceramic*
*Microwave Ferrite*
*Hi -K Dielectric Ceramic*
*Micro-assembly Part*
*Thin Film*

High Frequency Ceramic Materials and Components

# PRODUCT SELECTOR GUIDE



CanaryTec Co., Ltd
广州可纳瑞电子科技有限公司

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## 公司简介
## Company Profile

广州可纳瑞电子科技有限公司是一家集产品研发、生产、销售、技术服务为一体的高新技术企业，位于广州天河科技园；公司始终专注于电子陶瓷材料、陶瓷薄膜金属化技术及其相关产品的研发和市场化推广工作，　拥有行业内一流的专业技术团队，　积累了多年的陶瓷材料及薄膜产品开发、生产及质量控制经验，相关产品已被广泛应用于微波通讯、光纤通讯、LED照明等超高频化、小型化、高散热要求的行业。公司目前主要客户集中在航天、军工、科研院所、民营高新企业。公司的主要产品为：高Q值陶瓷材料、介质谐振器、微波陶瓷基板、高K值陶瓷基片、微波铁氧体基板、单层电容基板、薄膜电阻、芯片电容、衰减器、陶瓷垫块、金属热沉、陶瓷短路片、薄膜电路、环形器、隔离器等多种系列产品。

公司拥有ISO9001:2000质量管理体系，不仅可以提供高品质的标准产品，同时，还可接受客户的产品定制。

我们坚信：优质的产品是您第一选择；　给我们一个机会，给您自己多一个选项。

*CANARYTEC CO., LTD is your global supplier offering microwave and millimeter-wave components and parts development, manufacture, sales, and services located in Guangzhou, China. With more than 10 years experience, you can turn to us with confidence for your Hi-K and Hi Q dielectric ceramic material and substrate , single layer capacitor, chip resistor, heat sink , thin film attenuator products and so on. These products have been widely applicated in microwave and fiber communications, and area need super high frequency, miniaturization and high heat dissipation. Our customers are mainly concentrated in the military, aerospace, scientific research institute and the like. We will not only supply the highest quality product for you with ISO 9001:2000 at a reasonable price, but also all products can be customized to meet your specific design target.*



# 微波介质陶瓷材料
# *Microwave Dielectric Ceramic*



## 1、特点 *Feature*

⊙ 高Q值，主要被用于微波、毫米波频段的产品
*Hi-Q, applied for microwave and millimeter -wave frequencies.*

⊙ 相对高的介电常数，有效降低电路的几何尺寸
*Higher K value, effectively reduce the geometry size of the circuit.*

⊙ 具有非常好的温度系数，可以使电路稳定工作
*Good temperature coefficient, can make the circuit stably work.*

## 2、材料参数表 *Performance Table*

| 材料编码 *Material Code* | 介电常数 *Dielectric Constant* $\varepsilon_r$ | 品质因数 *Quality Factor* f*Q (GHz) | 频率温度系数 *Temperature Frequency Coefficient* $\tau_f$(ppm/℃) | 比重 *Gravity* (g/cm³) |
|---|---|---|---|---|
| CBS-4 | 3.8 ± 0.2 | ≥20, 000 | - | 2. 2 |
| ZST-7 | 6.8 ± 0.2 | ≥70, 000 | -40 ± 5 | 4. 1 |
| ZST-10 | 10.0 ± 0.2 | ≥65, 000 | 0 ± 5 | 4. 2 |
| MST-12 | 12.0 ± 0.3 | ≥150, 000 | -50 ± 5 | 3. 6 |
| MTC-13 | 12.8 ± 0.2 | ≥60, 000 | 0 ± 5 | - |
| MST-16 | 16.0 ± 0.3 | ≥60, 000 | 0 ± 4 | 3. 9 |
| BCT-21 | 21.0 ± 0.3 | ≥60, 000 | 0 ± 3 | 3. 8 |
| BMT-24 | 24.0 ± 0.3 | ≥200, 000 | 0 ± 2 | 7. 5 |
| MLT-26 | 26.0 ±0.3 | ≥60, 000 | 0 ± 3 | 4. 0 |
| BZN-32 | 32.0 ± 0.3 | ≥70, 000 | 2 ± 3 | 5. 8 |
| BZT-35 | 35.0 ± 0.5 | ≥50, 000 | 1 ± 3 | 4. 6 |
| BZT-36 | 36.0 ± 0.5 | ≥50, 000 | 2 ± 3 | 4. 6 |
| ZST-38 | 39.0 ± 0.5 | ≥55, 000 | 0 ± 2 | 5. 0 |
| ZNT-45 | 45.0 ± 0.5 | ≥40, 000 | 0 ± 2 | 4. 8 |
| ZNT-50 | 50.0 ± 0.7 | ≥30, 000 | 20 ± 5 | 4. 9 |
| BST-78 | 78.0 ± 1.0 | ≥10, 000 | -5 ± 5 | 5. 6 |
| BSNT-85 | 85.0 ± 1.0 | ≥8, 000 | 0 ± 10 | 5. 6 |

# 介质谐振器
# *Dielectric Ceramic Resonator*



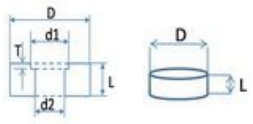
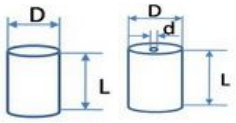
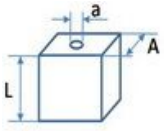
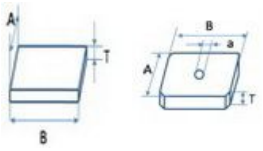
## 1、特点 *Feature*

⊙ 非常好的微波特性，高Q值，有助于减小电路体积
*Good microwave properties. It can provide higher dielectric constant in Hi-Q, the size of the circuit can be narrowed.*

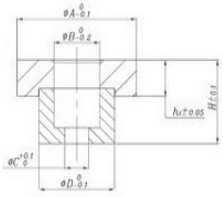
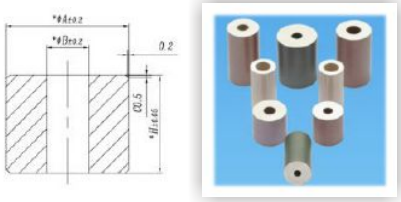
⊙ 优异的频率温度系数，利于设计稳定的电路
*Good frequency-temperature coefficient. Conducive to design the stability circuit.*

⊙ 稳定的介电常数
*Very steady K, provide the better stability state. Flexible form can be expediently made various shapes.*

## 2、技术参数一览表 *Performance Table*

| 项目 *Item* | 圆盘形 *Disc* | 圆柱形 *Cylinder* | 正方体 *Cube* | 片形 *Plate* |
|---|---|---|---|---|
| 示意图 *Diagram* |  |  |  |  |
| 尺寸范围 *Size Range* | *D:Max 63mm*<br>*L:Max 30mm*<br>*d1≥d2:Max 30mm*<br>*T:Max 1.5mm* | *D:Max 30mm*<br>*L:Max 35mm*<br>*d:Min 2.0mm* | *A:Max 40mm*<br>*a:Min 0.5mm*<br>*L:Max 30mm* | *Up: A\B Max 60mm*<br>*T: 0.1~8.0mm*<br>*Down: A\B Max 25mm*<br>*a:Min 0.6mm*<br>*T:Max 6.0mm* |
| K值范围 *K Range* | *20~45* | *20~80* | *20~80* | *6.8~80* |

## 3、典型应用 *Typical Application*

| 项目 *Item* | *TE*模介质振荡器 *TE Series Dielectric Resonator* | | | | *TM*模介质振荡器 *TM Series Dielectric Resonator* |
|---|---|---|---|---|---|
| 示意图 *Diagram* |  | |  | |  |
| 产品代码 *P. Code* | *TE-0.85* | *TE-1.90* | *TE-2.60* | *TE-3.60* | *TM-0.90* |
| 工作频率 *Frequency* | *0.80~0.95GHz* | *1.80~2.30GHz* | *2.50~2.80GHz* | *3.40~4.20GHz* | *0.90~0.95GHz* |
| 品质因数 *Q* | *15,000~30,000* | *≥12,000* | *≥10,000* | *≥11,000* | *≥3,800* |
| *T.Drift -40℃~RT* | *±50KHz* | *±150KHz* | *±200KHz* | *±300KHz* | *±200KHz* |
| *T.Drift RT~80℃* | *±50KHz* | *±150KHz* | *±200KHz* | *±300KHz* | *±200KHz* |

# 单层电容用陶瓷基片
# *Ceramic Substrate for SLC*



## 1、特点 *Feature*

⊙ 介电常数覆盖面广，适应不同尺寸和容量的需求
*K Value coverage is wade, adapt to the needs of different size and capacity.*

⊙ 具有较好的频率特性及温度系数，满足SLC的要求
*Has good frequency characteristic and the temper-ature coefficient, can meet the performance requirements of single layer capacitance.*

⊙ 具有较高的绝缘性能，稳定可靠且寿命长
*Has high insulation performance, stable and reliable and long life.*

## 2、材料参数表 *Performance Table*

| 材料编码 *Material Code* | | 介电常数 *Dielectric Constant* $\varepsilon_r$ | 介质损耗 *Dissipation Factor* | 温度系数 *Temperature Coefficient* | 工作电压 *Working Voltage* | 绝缘电阻 *Insulation Resistance* |
|---|---|---|---|---|---|---|
| *Class I* | *200* | *20±2* | *<0.002%* | *0±5PPM@-55~+125℃* | *100V* | *>1,000GΩ* |
| | *340* | *34±2* | *<0.003%* | *5±5PPM@-55~+125℃* | *100V* | *>1,000GΩ* |
| | *450* | *45±3* | *<0.005%* | *5±5PPM@-55~+125℃* | *100V* | *>1,000GΩ* |
| | *900* | *90±5* | *<0.015%* | *5±5PPM@-55~+125℃* | *100V* | *>1,000GΩ* |
| | *141* | *140±10* | *<0.050%* | *30±10PPM@-55~+125℃* | *100V* | *>1,000GΩ* |
| | *221* | *220±15* | *<0.30%* | *-2,200±500PPM@-55~+125℃* | *100V* | *>100GΩ* |
| | *301* | *300±20* | *<0.30%* | *-1,200±120PPM@-55~+125℃* | *100V* | *>100GΩ* |
| | *351* | *350±20* | *<0.30%* | *-1,200±1200PPM @ -55~+125℃* | *100V* | *>100GΩ* |
| | *601* | *600±30* | *<0.50%* | *-2,200±500PPM@-55~+125℃* | *100V* | *>100GΩ* |
| | *901* | *900±40* | *<0.50%* | *-33,000±500PPM@-55~+125℃* | *100V* | *>100GΩ* |
| *Class II* | *202* | *2,000±5%* | *<2.5%* | *±15%@-55~+125℃* | *100V* | *>100GΩ* |
| | *302* | *3,000±8%* | *<2.5%* | *±15%@-55~+125℃* | *100V* | *>100GΩ* |
| | *422* | *4,200±10%* | *<2.5%* | *±15%@-55~+125℃* | *100V* | *>100GΩ* |
| | *852* | *8,500±15%* | *<4.0%* | *+22%~-56%@-30~+85℃* | *100V* | *>100GΩ* |
| | *123* | *12,000±20%* | *<4.0%* | *+22%~-56%@-30~+85℃* | *100V* | *>100GΩ* |
| *Class III* | *253* | *25,000±20%* | *<2.0%* | *±15%@-55~+125℃* | *25~50V* | *>10GΩ* |
| | *333* | *32,500±20%* | *<2.5%* | *±15%@-55~+125℃* | *25~50V* | *>1GΩ* |
| | *403* | *40,000±20%* | *<2.5%* | *±15%@-55~+125℃* | *16~25V* | *>1GΩ* |

1) 测试条件 *Test Condition: 1MHz, 1.0V, Ag Electrode.*
2) 外形尺寸 *L&W Size : 1.5"×1.5" (38.1×38.1mm).*
3) 厚度尺寸 *T Size : 0.006" (0.152mm), 0.007" (0.178mm), 0.008" (0.204mm), 0.010" (0.254mm).*
4) 厚度公差 *T Tolerance: ±0.001" (0.025mm).*

# 薄膜电路用陶瓷基片
# *Ceramic Substrate for Thin Film*

## 1、技术参数一览表 *Performance Table*

| 指标 *Item* | | 单位 *Units* | 实验方法 *Test Methods* | *ADS-995* | *ADS-996* | *Superstrate® 996* | *Superstrate® TPS* |
|---|---|---|---|---|---|---|---|
| 纯度 *Purity* | | 重量 % | *ASTM-D2442* | *99.5* | *99.6* | *99.6* | *99.6* |
| 颜色 *Color* | | —— | —— | 白色 *White* | 白色 *White* | 白色 *White* | 白色 *White* |
| 密度 *Density* | | $g/cm^3$ | *ASTM-C373* | *3.88* | *3.88* | *3.88* | *3.95* |
| 硬度 *Hardness* | | —— | *ASTM-E18,R45N* | *87* | *87* | *87* | *87* |
| 粗糙度 *SR* | 即烧 *As-Fired* | 微英寸(纳米) *Microinches* （*Nanometers*） | *Profilometer 0.004″ Radius Stylus 0.30″ Cutoff ANSI/ASME B46.1* | *5(127)* | *3(77)* | *2(51)* | —— |
| | 研磨 *Lapped* | | | *< 30(762)* | *< 12(305)* | *< 10(254)* | *< 10(254)* |
| | 抛光 *Polished* | | | *< 2(51)* | *< 1(26)* | *< 1(26)* | *< 1(26)* |
| 粒度 *Grain Size* | | *Microns* | —— | *< 2.2* | *< 1.2* | *< 1.0* | *< 1.0* |
| 挠曲强度 *F. S.* | | *Kpsi(MPa)* | *ASTM-F394* | *83(572)* | *86(592)* | *90(620)* | *99(682)* |
| 弹性系数 *E. C.* | | $10^6$ *psi(GPa)* | *ASTM-C848* | *54(372)* | *54(372)* | *54(372)* | *54(372)* |
| 泊松比 *P. R.* | | —— | *ASTM-C848* | *0.2* | *0.2* | *0.2* | *0.2* |
| 热膨胀系数 *COTE* | 25℃-300℃ | $1\times10^{-6}$/℃ | *ASTM-C372* | *7.0* | *7.0* | *7.0* | *6.3* |
| | 25℃-600℃ | | | *7.5* | *7.5* | *7.2* | *7.2* |
| | 25℃-800℃ | | | *8.0* | *8.0* | *7.9* | *7.9* |
| | 25℃-1000℃ | | | *8.3* | *8.3* | *8.2* | *8.2* |
| 热导率 *TC* @100℃ | | *W/m°K* | *ASTM-C408* | *25.5* | *26.6* | *26.9* | *27.0* |
| 介质强度 *D. S.* | 0.025″ | *AC Volts/mil* | *ASTM-D116* | *575* | *575* | *600* | *640* |
| | 0.040″ | | | *450* | *450* | *450* | *500* |
| 介电常数 *D. C.* | @1MHz | —— | *ASTM-D150* | *9.8* | *9.9* | *9.9* | *9.9* |
| | @10GHz | —— | *ASTM-D2520* | *9.6* | *9.7* | *9.8* | *9.9* |
| 损耗因数 *D. L.* | @1MHz | —— | —— | *0.0001* | *0.0001* | *0.0001* | *0.0001* |
| | @10GHz | —— | —— | *0.0002* | *0.0002* | *0.0002* | *0.0001* |
| 体积电阻率 *Volume Resistivity* | 25℃ | *Ohm-cm* | *ASTM-D257* | $>10^{14}$ | $>10^{14}$ | $>10^{14}$ | $>10^{15}$ |
| | 100℃ | | | $>10^{14}$ | $>10^{14}$ | $>10^{14}$ | $>10^{15}$ |
| | 300℃ | | | $>10^{12}$ | $>10^{12}$ | $>10^{13}$ | $>10^{14}$ |
| | 500℃ | | | $>10^{9}$ | $>10^{9}$ | $>10^{10}$ | $>10^{12}$ |
| | 700℃ | | | $>10^{8}$ | $>10^{8}$ | $>10^{9}$ | $>10^{10}$ |

## 2、外形尺寸一览表 *Size Table*

| 标准厚度值 *Standard Thickness* | 厚度公差 *Thickness Tolerance* | | |
|---|---|---|---|
| | 标准即烧型 *Standard As-Fired* | 高级即烧型 *Premium As-Fired* | 抛光型 *Polished* |
| *0.005″ (0.127mm)* | *±0.0005″ (±0.0127mm)* | *±0.0005″ (±0.0127mm)* | *±0.0005″ (±0.0127mm)* |
| *0.010″ (0.254mm)* | *±0.001″ (±0.0254mm)* | *±0.0005″ (±0.0127mm)* | *±0.0005″ (±0.0127mm)* |
| *0.015″ (0.381mm)* | *±0.0015″ (±0.0381mm)* | *±0.00075″ (±0.01905mm)* | *±0.0005″ (±0.0127mm)* |
| *0.020″ (0.508mm)* | *±0.002″ (±0.0508mm)* | *±0.001″ (±0.0254mm)* | *±0.0005″ (±0.0127mm)* |
| *0.025″ (0.635mm)* | *±0.0025″ (±0.0635mm)* | *±0.000125″ (±0.03175mm)* | *±0.0005″ (±0.0127mm)* |
| *0.030″ (0.762mm)* | *±0.003″ (±0.0762mm)* | *±0.0015″ (±0.0381mm)* | *±0.0005″ (±0.0127mm)* |

## 3、技术等级一览表 *Camber Grade Table*

| 起翘度等级 *Camber Grade* | 起翘度 *Camber* | |
|---|---|---|
| | 电阻 *Resistor* | 电极 *Conductor* |
| 标准即烧型 *Standard As-Fired* | *0.002″* （*0. 0508mm*） | *0.003″* （*0. 0762mm*） |
| 高级即烧型 *Premium As-Fired* | *0.002″* （*0. 0508mm*） | *0.002″* （*0. 0508mm*） |
| 抛光-标准型* *Polished-Standard* | *0.001″ (0.0254mm)* | 0.001″ (0.0254mm) |
| 抛光-高级型* *Polished-Premium* | *0.0005″ (0.0127mm)* | *0.0005″ (0.0127mm)* |

* 抛光基片起翘度的测试结果，基于受控状态下平面度测试数据。

* *Polished material measured for flatness in restrained state.*

# 薄膜电路用陶瓷基片
# *Ceramic Substrate for Thin Film*



## 4、常用材料参数一览表
## *Conventional Materials Performance Table*

| 指标 *Item* | 单位 *Units* | 氮化铝 *ALN* | 氧化铍 *BeO* | 石英玻璃 $SiO_2$ | 微晶玻璃 $SiO_2$ | 钛酸盐 *Titanates* |
|---|---|---|---|---|---|---|
| 纯度 *Purity* | 重量% | 99.0 | 99.5 | 100 | 80.0 | —— |
| 颜色 *Color* | —— | 黄褐色 *Tan* | 白色 *White* | 无色 *Colorless* | 白色 *White* | 灰色 *Gray* |
| 密度 *Density* | $g/cm^3$ | 3.28 | 2.85 | 2.20 | 2.39 | —— |
| 表面粗糙度 *S. R.* | μ-inches(nm) | < 2.0(50) | 2.0~4.0(50~100) | < 2.0(50) | < 2.0(50) | < 3.0(76) |
| 起翘度 *Camber* | inch/inch | 0.0003~0.0005 | 0.0003~0.0005 | 0.0003~0.0005 | 0.0003~0.0005 | 0.0003~0.0005 |
| | nm/mm | 76~152 | 76~152 | 76~152 | 76~152 | 76~152 |
| 厚度 *Thickness* | Inches (mm) | 0.005~0.040 (0.127~1.012) | 0.005~0.040 (0.127~1.012) | 0.010~0.040 (0.254~1.012) | 0.006~0.040 (0.152~1.012) | 0.005~0.020 (0.127~0.508) |
| 厚度公差 T. T. | Inches(mm) | 0.0005(0.0127) | 0.0005(0.0127) | 0.0005(0.0127) | 0.0005(0.0127) | 0.0005(0.0127) |
| 热膨胀系数 *CoTE* | $1\times10^{-6}$/℃ | 4.6(25~300℃) | 9.0(25~1000℃) | 0.55(20~320℃) | 0.97(20~320℃) | —— |
| 热导率 *T. C.* | $W/m^{\circ}K$ | 170~200 | 270 | —— | —— | —— |
| 介电常数 *D. C.* | @1MHz | 8.6 | 6.5 | 3.826 | 5.76 | 4.3~250 |
| 损耗因数 *D. L.* | @1MHz | 0.0004 | 0.0004 | 0.000015 | 0.000038 | 0.0002~0.005 |
| 硬度 *Hardness* | Rockwell | —— | 45.0 | 7.0 Mohs | 7.0 Mohs | —— |
| 挠曲强度 *F. S.* | $K(10^{-3})$ lbs/in$^2$ | 59 ( 4pt.Bend) | 35 ( 3pt.Bend) | 25.0 | 22.0 | —— |
| 抗压强度 *C. S.* | $M(10^{-3})$ lbs/in$^2$ | —— | —— | 161 | 161 | —— |
| 粒度 *Grain Size* | μm(microns) | 5~7 | 9~16 | 非晶态 | 非晶态 | —— |

## 5、材料代码及尺寸一览表 *Material Code & Size Table*

| 代码 *Code* | 材料名称 *Material Description* | 长宽尺寸 *Length & Width Size* | 厚度尺寸 *Thcikness Size* |
|---|---|---|---|
| **A** | 96%三氧化二铝(即烧型)<br>96% *Alumina (As-Fired )* | 2.0"×2.0" (50.8×50.8mm)<br>3.0"×3.0" (76.2×76.2mm) | 0.010" (0.254mm), 0.015" (0.381mm)<br>0.020" (0.508mm), 0.025" (0.635mm) |
| **B** | 99.6%三氧化二铝(即烧型)<br>99.6% *Alumina (As-Fired)* | 2.0"×2.0" (50.8×50.8mm)<br>3.0"×3.0" (76.2×76.2mm) | 0.010" (0.254mm), 0.015" (0.381mm)<br>0.020" (0.508mm), 0.025" (0.635mm) |
| **C** | 99.6%三氧化二铝(抛光型)<br>99.6% *Alumina (Polished)* | 2.0"×2.0" (50.8×50.8mm)<br>3.0"×3.0" (76.2×76.2mm) | 0.010" (0.254mm), 0.015" (0.381mm)<br>0.020" (0.508mm), 0.025" (0.635mm) |
| **D** | 氮化铝 (即烧型)<br>*Aluminum Nitrid (As-Fired)* | 2.0"×2.0" (50.8×50.8mm)<br>3.0"×3.0" (76.2×76.2mm) | 0.010" (0.254mm), 0.015" (0.381mm)<br>0.020" (0.508mm), 0.025" (0.635mm) |
| **E** | 氮化铝 (抛光型)<br>*Aluminum Nitrid(Polished)* | 2.0"×2.0" (50.8×50.8mm)<br>3.0"×3.0" (76.2×76.2mm) | 0.010" (0.254mm), 0.015" (0.381mm)<br>0.020" (0.508mm), 0.025" (0.635mm) |
| **F** | 氧化铍 (即烧型)<br>*Beryllium-Oxide (As-Fired)* | 2.0"×2.0" (50.8×50.8mm) | 0.010" (0.254mm), 0.015" (0.381mm)<br>0.020" (0.508mm), 0.025" (0.635mm) |
| **G** | 氧化铍 (抛光型)<br>*Beryllium-Oxide(Polished)* | 2.0"×2.0" (50.8×50.8mm) | 0.010" (0.254mm), 0.015" (0.381mm)<br>0.020" (0.508mm), 0.025" (0.635mm) |
| **H** | 微晶玻璃<br>*Glass Ceramics* | 1.5"×1.5" (38.1×38.1mm)<br>2.0"×2.0" (50.8×50.8mm) | 0.005" (0.127mm), 0.010" (0.254mm)<br>0.015" (0.381mm), 0.020" (0.508mm) |
| **I** | 石英玻璃<br>*Fused Silicon Quartz* | 1.5"×1.5" (38.1×38.1mm)<br>2.0"×2.0" (50.8×50.8mm) | 0.005" (0.127mm), 0.010" (0.254mm)<br>0.015" (0.381mm), 0.020" (0.508mm) |
| **J** | 蓝宝石 *Sapphire* | 1.5"×1.5" (38.1×38.1mm)<br>2.0"×2.0" (50.8×50.8mm) | 0.010" (0.254mm)-0.040" (1.016mm) |
| **K** | 钛酸盐 *Titanates* | 1.5"×1.5" (38.1×38.1mm) | 0.006" (0.152mm), 0.007" (0.178mm)<br>0.008" (0.203mm), 0.010" (0.254mm) |
| **L** | 硅 *Silicon* | 2.0"×2.0" (50.8×50.8mm)<br>3.0"×3.0" (76.2×76.2mm) | 0.010" (0.254mm)-0.040" (1.016mm) |
| **M** | 铁氧体 *Ferrite* | 2.0"×2.0" (50.8×50.8mm) | 0.010" (0.254mm)-0.040" (1.016mm) |

# 微波铁氧体基片
# *Microwave Ferrite Substrate*

TCI Ceramics, Inc.
Subsidiary of National Magnetics Group, Inc.

## 1、技术参数一览表 *Performance Table*

| 材料体系 *Material System* | 材料编码 *Material Code* | 饱和磁强 *4πMs(±5%) Gauss* | 最大线宽 *@9.4GHz △H@-3dB Oersted* | 介电常数 *Dielectric Constant* $\varepsilon_r$ | 介质损耗 *（@9.4GHz）* $10^{-4}$ | 居里温度 *Curie T.℃* |
|---|---|---|---|---|---|---|
| 镍系 *Nickel System* | NF-2500 | 2,500 | 500 | 13.0 | < 15.0 | 530 |
| | NF-2900 | 2,900 | 130 | 13.0 | < 15.0 | 510 |
| | NF-4000 | 4,000 | 350 | 13.0 | < 15.0 | 480 |
| | NF-5000 | 5,000 | 165 | 13.0 | < 15.0 | 350 |
| 镁系 Magnesium | MF-1500 | 1,500 | 180 | 12.0 | < 2.5 | 180 |
| | MF-3000 | 3,000 | 190 | 12.9 | < 5.0 | 240 |
| 锂系 *Lithium System* | LF-0900 | 900 | 100 | 18.0 | < 10.0 | 150 |
| | LF-1200 | 1,200 | 350 | 16.5 | < 10.0 | 390 |
| | LF-2200 | 2,200 | 450 | 16.5 | < 10.0 | 520 |
| | LF-3000 | 3,000 | 450 | 16.4 | < 10.0 | 390 |
| | LF-3700 | 3,700 | 400 | 16.0 | < 10.0 | 560 |
| 钇系 *Yttrium System* | YG-1780 | 1,780 | 30 | 15.0 | < 2.0 | 280 |
| | YG-1800-SNL | 1,800 | 15 | 15.4 | < 1.5 | 280 |
| | YGZ-1780 | 1,780 | 20 | 15.1 | < 2.0 | 225 |
| 钇钴系 *Yt & Co* | YGC-1780 | 1,780 | 30 | 15.0 | < 1.0 | 280 |
| 钙钒系 *Calcium Vanadium System* | NG-1000 | 1,000 | 10 | 14.0 | < 2.0 | 199 |
| | NG-1000-SNL | 1,000 | 6 | 15.0 | < 1.5 | 215 |
| | NG-1200 | 1,200 | 10 | 14.4 | < 2.0 | 208 |
| | NG-1200-SNL | 1,200 | 6 | 15.0 | < 1.5 | 215 |
| | NG-1400 | 1,400 | 10 | 14.5 | < 2.0 | 215 |
| | NG-1560-SNL | 1,560 | 6 | 15.0 | < 1.5 | 215 |
| | NG-1600 | 1,600 | 10 | 14.6 | < 2.0 | 220 |
| | NGZ-1600 | 1,600 | 10 | 14.6 | < 2.0 | 220 |
| | NG-1850 | 1,850 | 12 | 14.8 | < 2.0 | 214 |
| | NG-1950 | 1,950 | 12 | 15.2 | < 2.0 | 205 |
| 铝系 *Aluminum System* | AL-0400 | 400 | 45 | 14.1 | < 2.0 | 135 |
| | AL-0800 | 800 | 30 | 14.6 | < 2.0 | 210 |
| | AL-1000 | 1,000 | 30 | 14.7 | < 2.0 | 210 |
| | AL-1200 | 1,200 | 30 | 14.8 | < 2.0 | 210 |
| 钆系 *Gadolinium System* | GD-800 | 800 | 75 | 15.3 | < 2.0 | 280 |
| | GD-1000 | 1,000 | 55 | 15.3 | < 2.0 | 280 |
| | GD-1200 | 1,200 | 75 | 15.2 | < 2.0 | 280 |
| | GD-1600 | 1,600 | 50 | 15.1 | < 2.0 | 280 |
| 钆铝系 *Gadolinium Aluminum System* | GA-400 | 400 | 78 | 14.2 | < 2.0 | 150 |
| | GA-650 | 650 | 72 | 14.6 | < 2.0 | 200 |
| | GA-800 | 800 | 70 | 14.7 | < 2.0 | 240 |
| | GA-1000 | 1,000 | 55 | 14.7 | < 2.0 | 250 |
| | GA-1200 | 1,200 | 55 | 15.1 | < 2.0 | 260 |
| | GA-1400 | 1,400 | 55 | 15.1 | < 2.0 | 265 |
| 钬系 *Holmium System* | HG-0475 | 475 | 130 | 14.5 | < 2.0 | 225 |
| | HG-1200 | 1,200 | 120 | 15.2 | < 2.0 | 280 |
| | HG-1600 | 1,600 | 84 | 15.1 | < 2.0 | 280 |

# 微波铁氧体基片
# *Microwave Ferrite Substrate*

Trans-Tech™
Ceramics and Advanced Materials

## 2、微波陶瓷材料一览表 *Microwave Material Performance Table*

| 材料编码 *Material Code* | 介电常数 *Dielectric Constant*（@9.4GHz） | 介电损耗 *Dissipation Factor* $10^{-4}$ | 介电常数温度系数 *D. C. Temperature Coefficient* $℃^{-1}\times10^{-6}$ | 膨胀系数 *Expansion Coefficient* $℃^{-1}\times10^{-6}$ | 导热系数 *Thermal Conductivity* $cal/cm^2/cm/sec/℃\times10^{-3}$ |
|---|---|---|---|---|---|
| K-4 | 4.3 | < 2.0 | +55 | 2.4 | 7 |
| K-6 | 6.3 | < 2.0 | +107 | 10.0 | 9 |
| K-9 | 9.0 | < 2.0 | +115 | 6.0 | 45 |
| K-9.5 | 9.5 | < 1.5 | +100 | 7.5 | 25 |
| K-12 | 12.0 | < 2.0 | +100 | 7.5 | 25 |
| K-15 | 15.0 | < 2.0 | +100 | 7.5 | 25 |
| K-16 | 16.0 | < 2.0 | +120 | 7.5 | 10 |
| K-18 | 18.0 | < 10.0 | +80 | 8.0 | 10 |
| K-20 | 20.0 | < 10.0 | +10 | 8.5 | 10 |
| K-25 | 25.0 | < 10.0 | -125 | 9.0 | 10 |
| K-30 | 30.0 | < 10.0 | -370 | 9.2 | 10 |
| K-50 | 50.0 | < 10.0 | -700 | 9.7 | 10 |
| K-80 | 80.0 | < 10.0 | -980 | 10.0 | 10 |
| K-100 | 100.0 | < 10.0 | -1,100 | 10.3 | 10 |
| K-140 | 140.0 | < 15.0 | -1,200 | 10.7 | 10 |
| K-160 | 160.0 | < 15.0 | -1,250 | 10.8 | 10 |
| K-250 | 250.0 | < 50.0 | -2,600 | 10.0 | 10 |

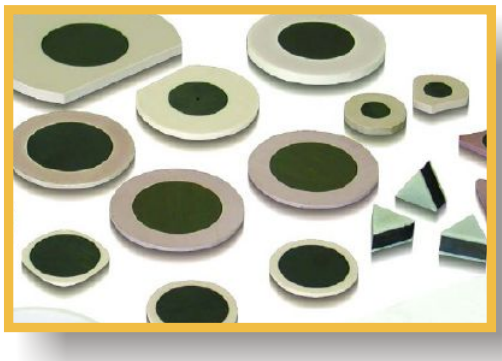
## 3、材料形状 *Material Shape*

- 片*Substrates*：
  圆片*Discs*、方片*Square Plates*、三角形片*Triangles*.
- 环*Rings*：
  内铁氧体/外微波介质 *Ferrite / Dielectric*.
- 块*Blocks*：
  棒条状*Roads* 、圆柱状*Cylinders*、长方体*Cuboids*.



## 4、常用介质环产品一览表 *Common Dielectric Ring Table*

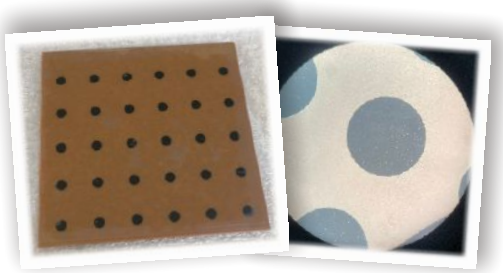
| 产品编码 *Product Code* | 厚度 *mm Thickness* | 内环 *Inner Ring* | | | 外环 *Outer Ring* | | |
|---|---|---|---|---|---|---|---|
| | | *Material Code* | *4πMs* | *Φ mm* | *Material Code* | *K* | *Φ mm* |
| R7.3/10.2/0.65-A | 0.65 | NG-1600 | 1600 | 7.3 | K-20 | 20.0 | 10.2 |
| R15.4/19.5/0.90-A | 0.90 | YG-1780 | 1780 | 15.4 | K-30 | 30.0 | 19.5 |
| R17.0/22.0/1.00-A | 1.00 | YG-1780 | 1780 | 17.0 | K-30 | 30.0 | 22.0 |
| R18.0/23.4/1.00-A | 1.00 | YG-1780 | 1780 | 18.0 | K-30 | 30.0 | 23.4 |

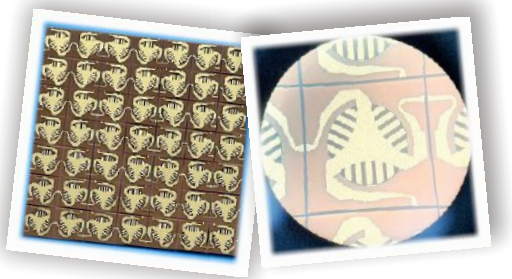


# 复合介质基片
# Composite Dielectric Substrate

## 1、微波陶瓷材料一览表 Microwave Material Performance Table

| 材料编码 Material Code | 介电常数 Dielectric Constant $\varepsilon_r$ | 品质因数 Quality Factor f*Q (GHz) | 频率温度系数 Temperature Frequency Coefficient $\tau_f$(ppm/℃) | 比重 Gravity (g/cm$^3$) |
|---|---|---|---|---|
| MST-12 | 12.0 ± 0.3 | ≥150, 000 | -50 ± 5 | 3. 6 |
| MTC-13 | 12.8 ± 0.2 | ≥60, 000 | 0 ± 5 | - |
| MST-16 | 16.0 ± 0.3 | ≥60, 000 | 0 ± 4 | 3. 9 |
| BCT-21 | 21.0 ± 0.3 | ≥60, 000 | 0 ± 3 | 3. 8 |
| BMT-24 | 24.0 ± 0.3 | ≥200, 000 | 0 ± 2 | 7. 5 |
| MLT-26 | 26.0 ±0.3 | ≥60, 000 | 0 ± 3 | 4. 0 |
| BZN-32 | 32.0 ± 0.3 | ≥70, 000 | 2 ± 3 | 5. 8 |
| BZT-35 | 35.0 ± 0.5 | ≥50, 000 | 1 ± 3 | 4. 6 |
| ZST-38 | 39.0 ± 0.5 | ≥55, 000 | 0 ± 2 | 5. 0 |
| ZNT-45 | 45.0 ± 0.5 | ≥40, 000 | 0 ± 2 | 4. 8 |



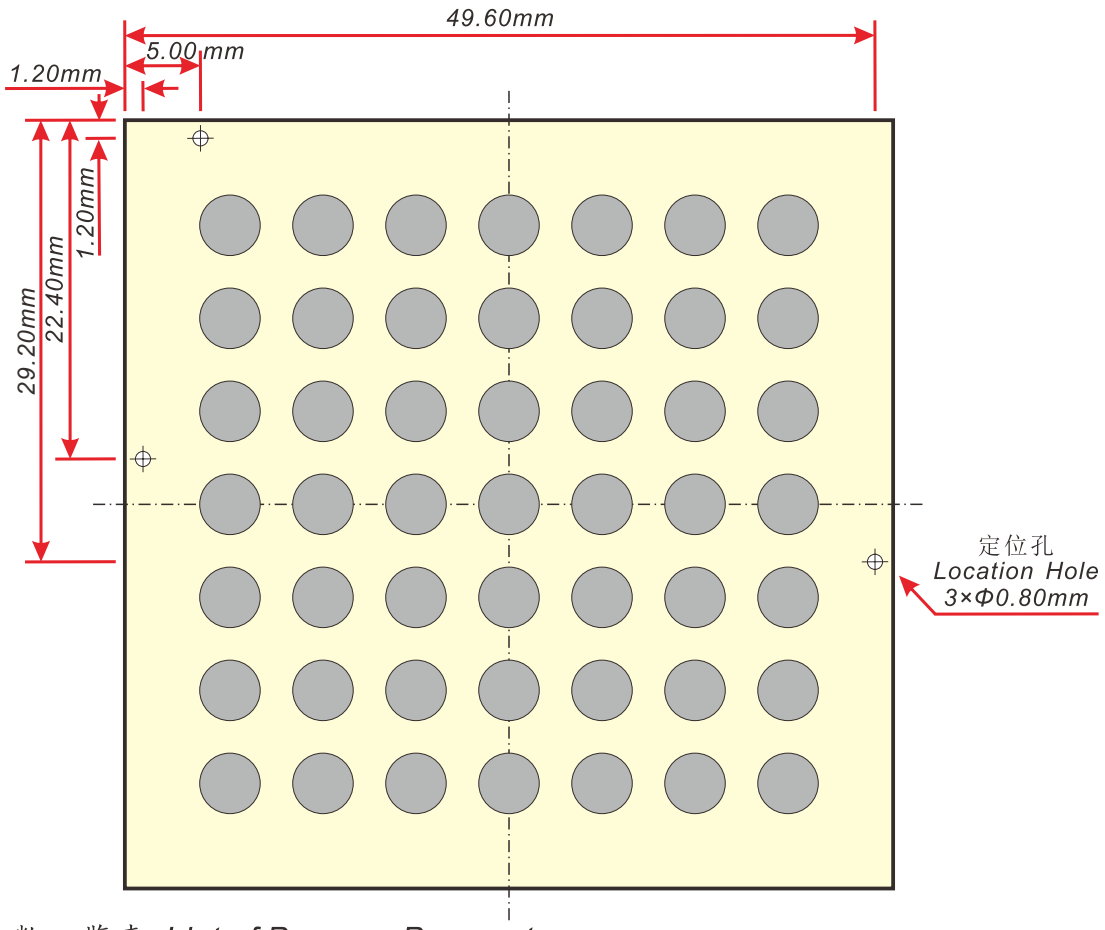


## 2、常用微波铁氧体材料一览表 Common Microwave Ferrite Table

| 材料编码 Material Code | 饱和磁强 $4\pi$ Ms (±5%) Gauss | 最大线宽 @9.4GHz △H@-3dB Oersted | 介电常数 Dielectric Constant $\varepsilon_r$ | 介质损耗 (@9.4GHz) $10^{-4}$ | 居里温度 Curie T.℃ |
|---|---|---|---|---|---|
| YG-1780 | 1,780 | 30 | 15.0 | < 2.0 | 280 |
| YG-1800 | 1,800 | 15 | 15.4 | < 1.5 | 280 |
| NG-1850 | 1,850 | 12 | 14.8 | < 2.0 | 214 |
| NG-1950 | 1,950 | 12 | 15.2 | < 2.0 | 250 |
| NF-2100 | 2,100 | 220 | 12.0 | < 15.0 | 530 |
| NF-2300 | 2,300 | 220 | 12.5 | < 15.0 | 530 |
| NF-2500 | 2,500 | 220 | 13.0 | < 15.0 | 530 |
| NF-3000 | 3,000 | 130 | 13.0 | < 15.0 | 510 |

# 复合介质基片设计规范
# Composite Dielectric Substrate Design Rules

## 3、定位孔设计规范 Design Specification for Positioning Holes




## 4、工艺参数一览表 List of Process Parameters

| 分类 Classification | 项目 Item | 参数 Feature |
|---|---|---|
| 陶瓷基板 Ceramic Substrate | 长&宽及公差 Length & Width, Tolerance | 50.8×50.8mm, ±0.05mm |
| | 厚度及公差 Thickness, Tolerance | 0.20~2.00mm, ±0.02mm |
| | 孔径及公差 Apertures, Tolerance | 1.00~10.0mm, (+0.01,0)mm |
| | 表面光洁度-A面 Surface Finishment-A Side | 抛光 Polished, Ra≤0.02um |
| | 表面光洁度-B面 Surface Finishment-B Side | 精磨 lapped , Ra≤0.30um |
| 铁氧体瓷粒 Ferrite Cylinder | 直径及公差 Diameter, Tolerance | 1.00~10.0mm, (0,-0.01)mm |
| | 高度 Height | T + 0.50mm |
| 金属化工艺 Metallization | 拼板有效面积 Effective Area | 47.0×47.0mm |
| | 划切刀宽 Cutting width | 0.15mm |
| | 镍铬层厚度 Ni-Cr Layer Thickness | 0.08~0.12um |
| | 铜层厚度 Cu Layer Thickness | 2.00~3.00um |
| | 金层厚度 Au Layer Thickness | 3.00~5.00um |

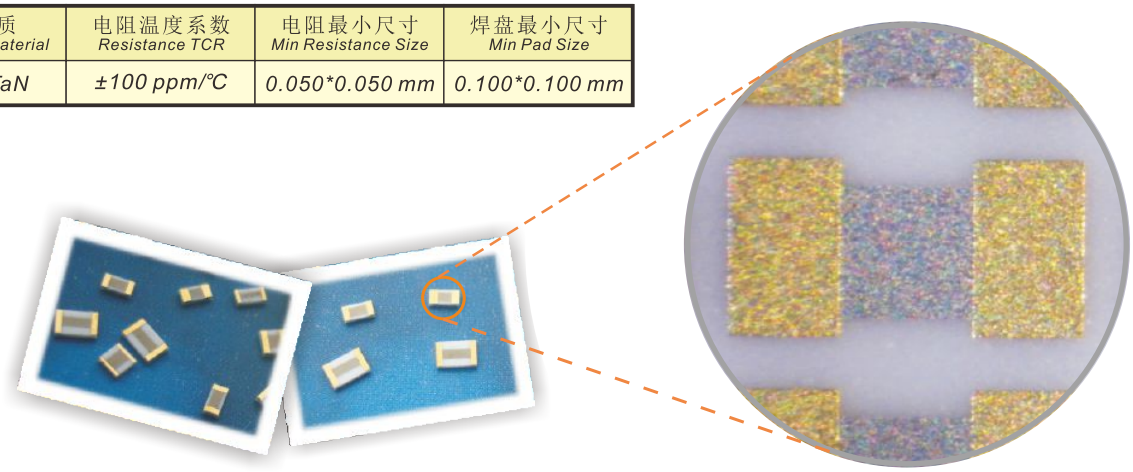
# 芯片电阻（微波薄膜电阻）
# *Chip Resistor（Microwave Thin Film Resistor）*

## 1、技术参数一览表 *Performance Table*

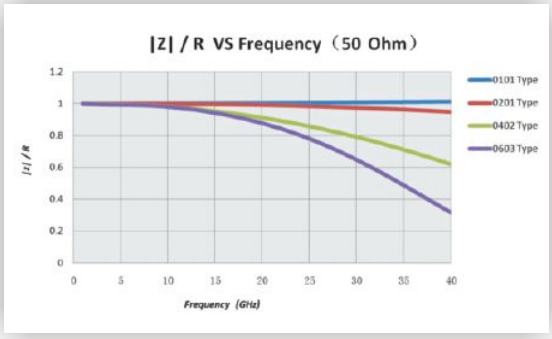
| 尺寸 Size / 精度 Tolerance / 阻值 Resistance | 0201(0.51*0.25mm) | | 0402(1.02*0.51mm) | | 0603(1.52*0.76mm) | |
|---|---|---|---|---|---|---|
| | J (±5%) | K (±10%) | J (±5%) | K (±10%) | J (±5%) | K (±10%) |
| 50Ω | R0201B500J | R0201B500K | R0402B500J | R0402B500K | R0603B500J | R0603B500K |
| 100Ω | R0201B101J | R0201B101K | R0402B101J | R0402B101K | R0603B101J | R0603B101K |
| 200Ω | R0201B201J | R0201B201K | R0402B201J | R0402B201K | R0603B201J | R0603B201K |

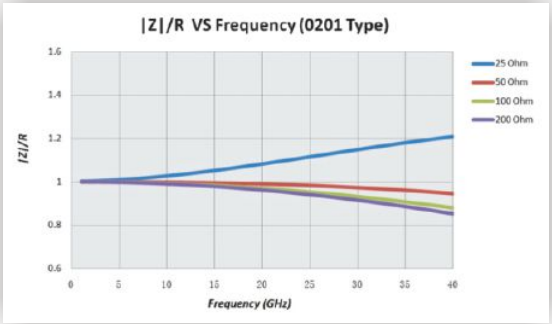
1、以上产品型号均对基片材质 99.6% $AL_2O_3$而言。*The above products code no. refers to the material of 99.6% $AL_2O_3$.*
2、基片标准厚度 *0.010 inches（0.254mm）。Standard Thickness 0.010 inches(0.254mm).*

| 电阻材质 Resistance Material | 电阻温度系数 Resistance TCR | 电阻最小尺寸 Min Resistance Size | 焊盘最小尺寸 Min Pad Size |
|---|---|---|---|
| 氮化钽 TaN | ±100 ppm/℃ | 0.050*0.050 mm | 0.100*0.100 mm |

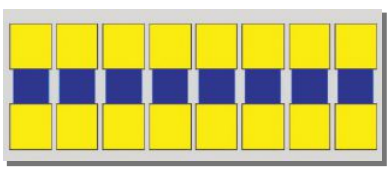


## 2、性能曲线图 *Performance Graph*

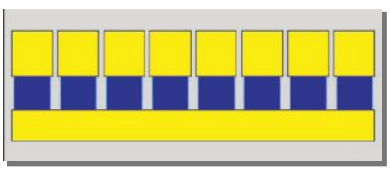


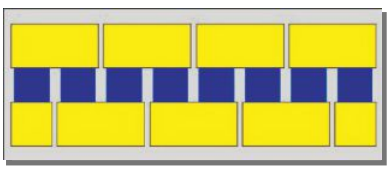

## 3、电阻网络 *Resistor Network*



隔离型电阻网络
*Isolated Connection Resistor Array*



共电极型电阻网络
*Common Connection Resistor Array*



串联型电阻网络
*Series Connection Resistor Array*

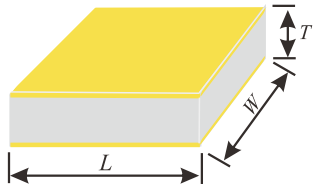
# 芯片电容（单层电容）
# *Chip Capacitor（Single Layer Capacitor）*

## 1、技术参数一览表 *Performance Table*

| 尺寸 Size / 容值 Capacitance | 15*15mil (0.38*0.38mm) | 20*20mil (0.51*0.51mm) | 25*25mil (0.64*0.64mm) | 30*30mil (0.76*0.76mm) | 35*35mil (0.89*0.89mm) | 90*90mil (2.29*2.29mm) |
|---|---|---|---|---|---|---|
| 3.0 pF | C1515K3R0M | | | | | |
| 3.6 pF | C1515K3R6M | | | | | |
| 14.0 pF | | C2020K140M | | | | |
| 20.0 pF | | | C2525K200M | | | |
| 22.0 pF | C1515K220M | | | C3030K220M | | |
| 30.0 pF | | | | C3030K300M | | |
| 33.0 pF | C1515K330M | | | | | |
| 39.0 pF | C1515K390M | | | | | |
| 75.0 pF | | C2020K750M | | | | |
| 100 pF | C1515K101M | | C2525K101M | C3030K101M | | |
| 220 pF | | C2020K221M | | | | |
| 330 pF | | C2020K331M | | | | |
| 470 pF | | | C2525K471M | | | |
| 1, 000 pF | | | | | C3535K102M | |
| 10, 000 pF | | | | | | C9090K103M |

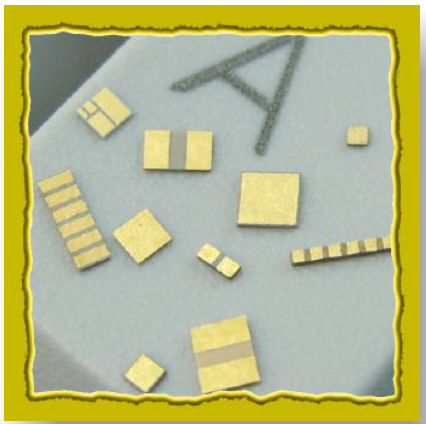
1、以上产品容值公差等级均为M级（±20%）。*The above SLC capacitance tolerance is M Level（±20%）.*
2、产品厚度为*0. 152mm, 0. 178mm, 0. 254mm。The thickness size is 0. 006″, 0. 007″, 0. 010″.*

## 2、容量的换算 *Capacitance Conversion*




$$C=\frac{K\times L\times W}{f\times T}$$

*C*:容量 *Capacitance*
*K*:介电常数 *Dielectric Constant*
*L*：长度 *Length*
*W*：宽度 *Width*
*T*：厚度 *Thickness*
*f*：换算因子*Conversion Factor*
*mm, f=113. 1; inch, f=4. 452*



## 3、导体层的选择 *Metal Electrode Choice*

| 金属结构 *Metal Construction* | 金属层厚度 *Layer Thickness* | 适用焊接工艺 *Applicable Scope* |
|---|---|---|
| 钛钨-镍-金 *TiW-Ni-Au* | *TiW：0.8 um*<br>*Ni：1~2 um*<br>*Au：＞2.54 um* | *SMT/手工焊*<br>*SMT / Hand Welding* |
| 钛钨-金 *TiW-Au* | *TiW：0.8 um*<br>*Au：＞2.54 um* | 微组装（金丝绑定）<br>*Wire Bonding* |

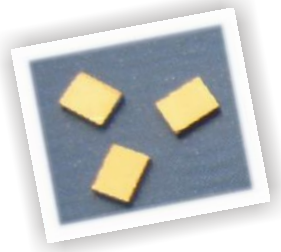
# 金属热沉/衬底/载体 金锡合金焊片

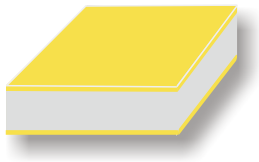
# *Metal Heat Sink / Chip Carrier And Gold-Tin Alloys Solder Foil*

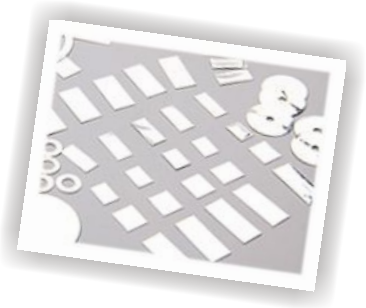
## 1、技术参数一览表 *Performance Table*

| 代码 Code / 材料 Material / 项目 Item | 密度-g/cm³ Density | 膨胀系数-PPM/℃ Coefficient of expansion | 导热系数-W/mK Thermal conductivity | 硬度-HB Hardness |
|---|---|---|---|---|
| **P** 钨铜合金 W80%:Cu20% | 15.15 | 8.3 | 200 | 220 |
| **Q** 钨铜合金 W85%:Cu15% | 15.90 | 7.3 | 190 | 240 |
| **R** 钼铜合金 Mo80%：Cu20% | 9.96 | 7.6 | 204 | 172 |
| **S** 钼铜合金 Mo85%：Cu15% | 10.01 | 7.0 | 195 | 156 |
| **T** 铜钼铜(CMC) 13:74:13 | 9.88 | 5.6 | 200 | — |
| **U** 无氧铜 OFC TU1/TU2 | 8.90 | 16.7 | 397 | 102 |
| **V** 可伐合金 Kovar 4J29 | 8.30 | 5.3 | 17 | 155 |
| **W** 金锡合金 Au80%：Sn20% | 14.5 | 16.0 | 57.0 | 276 |

1、金锡合金焊片是一种预成型焊接材料；*Gold-Tin Alloys Soler Fiol is preformed welding material*；
2、金锡合金焊片熔点是 280℃；*Melting Point of Gold-Tin Alloys Soler Fiol is 280℃*；
3、金锡合金焊接温度是 320~330℃. *Welding Temperature of Gold-Tin Alloys Soler Fiol is 320~330℃.*







## 2、选择尺寸 *Size Choice*

| 项目 Item | 选项 Option |
|---|---|
| 长/宽度 Length/Width (mm) | 0.20 ~ 20.0 |
| 金属热沉厚度 MHT Thickness(mm) | 0.15, 0.20, 0.25, 0.30, 0.40, 0.50, 0.80, 1.00, 1.20 ±0.05 |
| 金锡合金厚度 AuSn Thickness(um) | 17, 34, 40 |

## 3、典型产品及编码 *Typiacl Product Code*

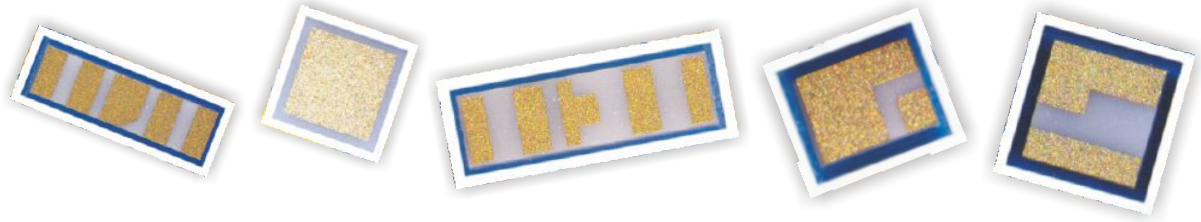
| 产品代码 Product Code | 技术参数 Specification | 产品代码 Product Code | 技术参数 Specification |
|---|---|---|---|
| M320160P06C | W80%:Cu20%, 3.2×1.6×0.15mm | M320300T20C | CMC, 3.2×3.0×0.5mm |
| M150120R10C | Mo80%:Cu20%, 1.5×1.2×0.25mm | M110040W17 | Au80%:Sn20%, 1.1×0.4×0.017mm |

# 陶瓷垫片（短路片/支撑片）
# Submount（Shorter/Standoff）

## 1、技术参数一览表 Performance Table

| 代码 Code / 材料 Material / 项目 Item | | 密度-g/cm³ Density | 膨胀系数-PPM/℃ Coefficient of expansion | 导热系数-W/mK Thermal conductivity | 硬度-GPa Hardness |
|---|---|---|---|---|---|
| A | 96.0% 三氧化二铝 $AL_2O_3$ | 3.78 | 7.3 | 24.7 | 78 |
| B | 99.6% 三氧化二铝 $AL_2O_3$ | 3.90 | 7.5 | 29.3 | 83 |
| D | 99.0% 氮化铝 AlN | 3.33 | 4.6 | 170 | 73 |
| F | 99.5% 氧化铍 BeO | 3.03 | 6.8 | 270 | 82 |

硬度值是采用ROCKWELL 45N 方法测试 The hardness value is tested by ROCKWELL 45N method.



## 2、典型产品一览表 Typiacl Product Table

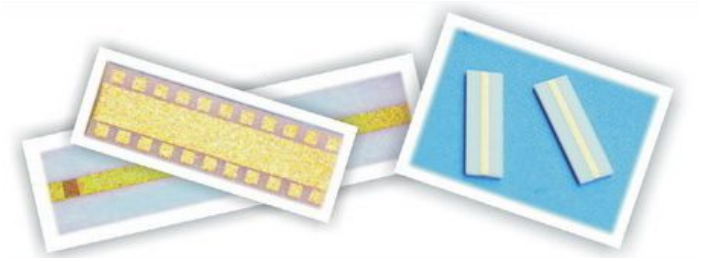
| 示意图 Diagram / 代码 Code / 长宽尺寸 L & W Size |  A |  B |  C |  D |
|---|---|---|---|---|
| 0.010*0.010 Inch (0.254*0.254 mm) | M1010A010A | M1010A010B | M1010A010C | M1010A010D |
| 0.015*0.015 Inch (0.381*0.381 mm) | M1515A010A | M1515A010B | M1515A010C | M1515A010D |
| 0.020*0.020 Inch (0.508*0.508mm) | M2020A010A | M2020A010B | M2020A010C | M2020A010D |
| 0.025*0.025 Inch (0.635*0.635 mm) | M2525A010A | M2525A010B | M2525A010C | M2525A010D |
| 0.030*0.030 Inch (0.762*0.762mm) | M3030A010A | M3030A010B | M3030A010C | M3030A010D |
| 0.035*0.035 Inch (0.889*0.889 mm) | M3535A010A | M3535A010B | M3535A010C | M3535A010D |
| 0.040*0.040 Inch (1.016*1.016mm) | M4040A010A | M4040A010B | M4040A010C | M4040A010D |
| 0.050*0.050 Inch (1.270*1.270mm) | M5050A010A | M5050A010B | M5050A010C | M5050A010D |

1、以上产品型号均对基片材质 96.0% $AL_2O_3$而言。The above products code no. refers to the material of 96.0% $AL_2O_3$.
2、基片标准厚度 0.010 inches（0.254mm）。Standard Thickness 0.010 inches(0.254mm).
3、A型产品留边量为 0.002inches（0.051mm）。 The border width of A type is 0.002inches (0.051mm).

# 50欧姆微带传输线
# *50 Ohm Microstrip Transmission Line*

## 1、技术参数一览表 *Performance Table*

| 代码 Code / 材料 Material / 项目 Item | 介电常数 *Dielectric Constant* | 介质损耗 *Loss Tangent* | 工作频率 *Operating Frequency* |
|---|---|---|---|
| **B** 99.6%三氧化二铝 $AL_2O_3$ | *9.9@1MHz* | *0.0001@1MHz* | *DC~30GHz* |
| **I** 石英玻璃 Fused Silicon Quartz | *3.826@1MHz* | *0.000015@1MHz* | *DC~60GHz* |



## 2、典型产品一览表 *Typiacl Product Table*

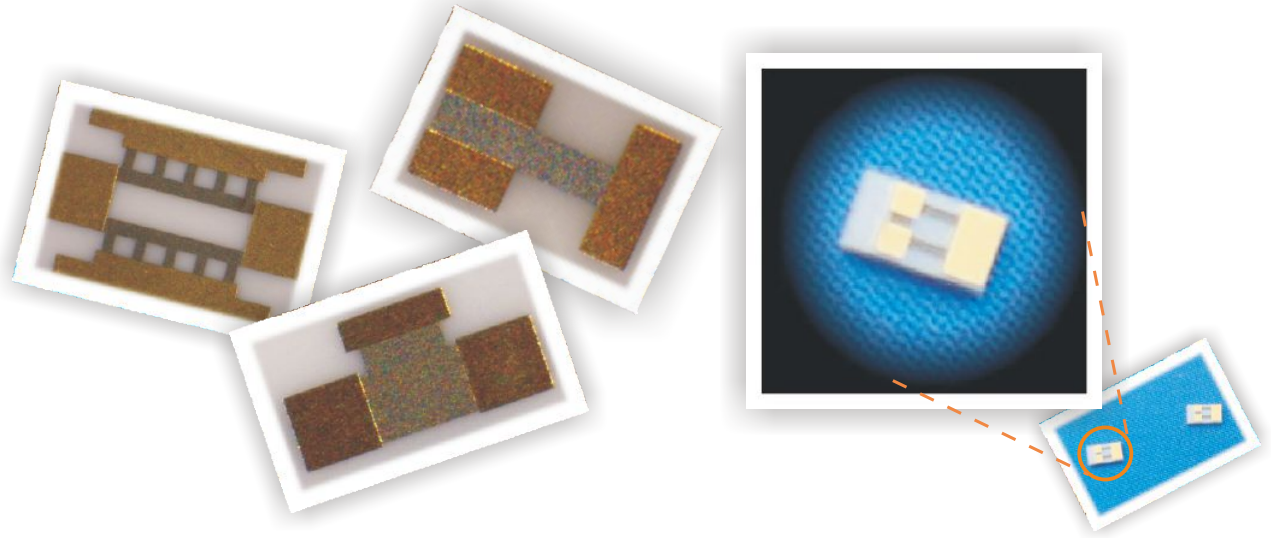
| 产品代码 *Product Code* | 材质 *Material* | 厚度 *Thickness* (mm) | 宽度 *Width* (mm) | 长度 *Length* (mm) |
|---|---|---|---|---|
| *L1050B-XX* | *99.6%$A_2O_3$* | *0.254* | *1.27* | *1.0~50.8* |
| *L10120B-XX* | *99.6%$A_2O_3$* | *0.254* | *3.0* | *1.0~50.8* |
| *L2040B-XX* | *99.6%$A_2O_3$* | *0.508* | *1.0* | *1.0~50.8* |
| *L2050B-XX* | *99.6%$A_2O_3$* | *0.508* | *1.27* | *1.0~50.8* |
| *L2080B-XX* | *99.6%$A_2O_3$* | *0.508* | *2.0* | *1.0~50.8* |
| *L2540B-XX* | *99.6%$A_2O_3$* | *0.635* | *1.0* | *1.0~50.8* |
| *L2580B-XX* | *99.6%$A_2O_3$* | *0.635* | *2.0* | *1.0~50.8* |
| *L25120B-XX* | *99.6%$A_2O_3$* | *0.635* | *3.0* | *1.0~50.8* |
| *L0540I-XX* | 石英玻璃 *Fused Silicon Quartz* | *0.127* | *1.5* | *1.0~38.1* |
| *L0550I-XX* | 石英玻璃 *Fused Silicon Quartz* | *0.127* | *2.0* | *1.0~38.1* |

上表“产品编码”中的XX代表是以微英寸表示的微带传输线长度。
*XX above table representative the length of Microstrip transmission line in microinches.*

# 薄膜衰减器
# *Thin Film Attenuator*

## 1、技术参数一览表 *Performance Table*

| 代码 Code / 材料 Material / 项目 Item | 介电常数 Dielectric Constant | 介质损耗 Loss Tangent | 工作频率 Operating Frequency |
|---|---|---|---|
| **B** 99.6% 三氧化二铝 $AL_2O_3$ | 9.9@1MHz | 0.0001@1MHz | DC~30GHz |



## 2、典型产品一览表 *Typical Product Table*

| 尺寸 Size / 精度 Tolanance / 衰减值 Attenuation | 0402(1.02*0.51mm) | | | 0603(1.52*0.76mm) | | |
|---|---|---|---|---|---|---|
| | D (±0.50dB @DC~18GHz) | E (±0.75dB @DC~18GHz) | G (±1.00dB @DC~18GHz) | D (±0.50dB @DC~18GHz) | E (±0.75dB @DC~18GHz) | G (±1.00dB @DC~18GHz) |
| 1dB | A0402B010D | | | A0603B010D | | |
| 2dB | A0402B020D | | | A0603B020D | | |
| 3dB | A0402B030D | | | A0603B030D | | |
| 4dB | A0402B040D | | | A0603B040D | | |
| 6dB | A0402B060D | | | A0603B060D | | |
| 8dB | A0402B080D | | | A0603B080D | | |
| 10dB | A0402B100D | | | A0603B100D | | |
| 16dB | | A0402B160E | | | A0603B160E | |
| 32dB | | | A0402B320G | | | A0603B320G |

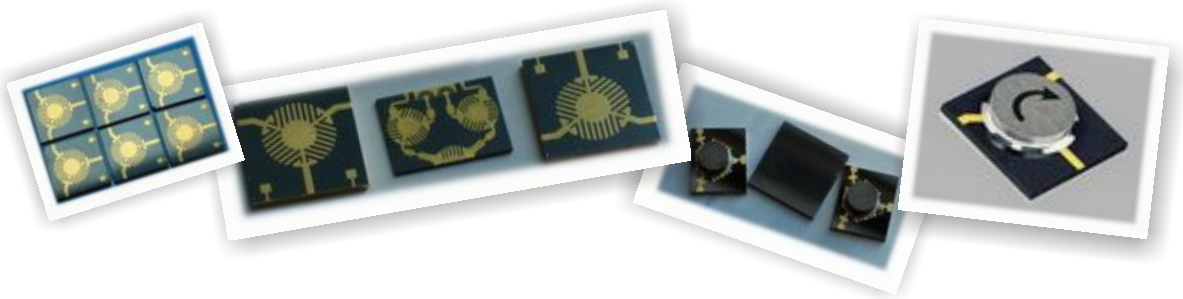
1、以上产品型号均指简单T型、π型衰减器而言。*The above products code no. refers to the simple T & π type attenuators.*
2、以上产品型号均对基片材质 99.6% $AL_2O_3$ 而言。*The above products code no. refers to the material of 99.6% $AL_2O_3$.*
3、基片标准厚度 *0.010 inches（0.254mm）. Standard Thickness 0.010 inches(0.254mm).*
4、回波损耗 *VSWR（Max：1） 1.35 ： 1 @ DC~18GHz.*

我们接受客户各种薄膜衰减器的个性化设计和制作需求。
*We can design and manufacture Thin Film Attenuator to meet your individual requirements.*

# 微带环行器/微带隔离器
# *Microstrip Circulator/ Microstrip Isolator*

## 1、技术参数一览表 *Performance Table*

| 材料 *Material* / 项目 *Item* | 电极材质 *Electrode Material* | 最小线宽 *Minimum Line Width* | 工作频率 *Operating Frequency* |
|---|---|---|---|
| 请参看第6页 Please see page 6 | 铬*Cr* / 铜*Cu* / 金*Au* | *0. 020 mm* | *DC ~30GHz* |



## 2、典型环行器产品一览表 *Typical Microstrip Circulator Table*

| 产品代码 *Product Code* | 频率范围 *Frequency Range - Ghz* | 带宽 *Band Width* | 正向损耗 *Forward Loss - dB* | 反向损耗 *Reverse Loss - dB* | 驻波 *SWR* | 通过功率 *Directional Power - W* | 温度范围 *Temperature Range - ℃* |
|---|---|---|---|---|---|---|---|
| *MC-2629* | *2. 6 ~ 2. 9* | *Full* | *0. 4* | *20* | *1. 20* | *10. 0* | *-20~+60* |
| *MC-2932* | *2. 9 ~ 3. 2* | *Full* | *0. 4* | *20* | *1. 20* | *10. 0* | *-20~+60* |
| *MC-3236* | *3. 2 ~ 3. 6* | *Full* | *0. 4* | *20* | *1. 20* | *10. 0* | *-20~+60* |
| *MC-3740* | *3. 7 ~ 4. 0* | *Full* | *0. 4* | *20* | *1. 20* | *10. 0* | *-20~+60* |
| *MC-4045* | *4. 0 ~ 4. 5* | *Full* | *0. 4* | *20* | *1. 20* | *10. 0* | *-40~+70* |
| *MC-4650* | *4. 6 ~ 5. 0* | *Full* | *0. 4* | *20* | *1. 20* | *10. 0* | *-40~+70* |
| *MC-5056* | *5. 0 ~ 5. 6* | *Full* | *0. 4* | *20* | *1. 25* | *10. 0* | *-40~+70* |
| *MC-5760* | *5. 7 ~ 6. 0* | *Full* | *0. 5* | *20* | *1. 25* | *10. 0* | *-40~+70* |
| *MC-6065* | *6. 0 ~ 6. 5* | *Full* | *0. 5* | *20* | *1. 25* | *10. 0* | *-40~+70* |
| *MC-6470* | *6. 4 ~ 7. 0* | *Full* | *0. 5* | *20* | *1. 25* | *10. 0* | *-40~+70* |
| *MC-7080* | *7. 0 ~ 8. 0* | *Full* | *0. 5* | *20* | *1. 25* | *10. 0* | *-40~+70* |
| *MC-8090* | *8. 0 ~ 9. 0* | *Full* | *0. 5* | *20* | *1. 25* | *5. 0* | *-40~+70* |
| *MC-90100* | *9. 0 ~ 10. 0* | *Full* | *0. 5* | *20* | *1. 25* | *5. 0* | *-40~+70* |
| *MC-105115* | *10. 5 ~ 11. 5* | *Full* | *0. 5* | *20* | *1. 25* | *5. 0* | *-40~+70* |
| *MC-115125* | *11. 5 ~ 12. 5* | *Full* | *0. 5* | *20* | *1. 25* | *5. 0* | *-40~+70* |
| *MC-120130* | *12. 0 ~ 13. 0* | *Full* | *0. 5* | *20* | *1. 25* | *5. 0* | *-40~+70* |
| *MC-130140* | *13. 0 ~ 14. 0* | *Full* | *0. 5* | *20* | *1. 25* | *5. 0* | *-40~+70* |
| *MC-135145* | *13. 5 ~ 14. 5* | *Full* | *0. 5* | *20* | *1. 25* | *5. 0* | *-40~+70* |
| *MC-145155* | *14. 5 ~ 15. 5* | *Full* | *0. 5* | *20* | *1. 25* | *5. 0* | *-40~+70* |
| *MC-155165* | *15. 5 ~ 16. 5* | *Full* | *0. 5* | *20* | *1. 25* | *5. 0* | *-40~+70* |
| *MC-165175* | *16. 5 ~ 17. 5* | *Full* | *0. 5* | *20* | *1. 25* | *5. 0* | *-40~+70* |

# 薄膜电路（陶瓷电路）
# *Thin Film（Ceramic Circuit）*

产品测试及检验标准
*Standard for Testing and Inspecting*
*GJB2442-95, GJB360A-96, GJB548B-2005*
*MIL-STD-202, GB/T 2828. 1-2003.*

## 1、技术参数一览表 *Performance Table*

### *A、基片的选择 The Choice of Ceramic Substrate*

| 项目 Item / 工作频率 Frequency | DC~6GHz | DC~18GHz | DC~40GHz | DC~60GHz |
|---|---|---|---|---|
| 基片厚度的选择（99.6% $AL_2O_3$） *The choice of substrate thickness (99.6% Alumina)* | 0.635mm (0.025 inch) | 0.381mm (0.015 inch) | 0.254mm (0.010 inch) | 0.127mm (0.005 inch) |
| 基片表面粗糙度与光刻精度关系 *Substrate surface roughness and lithography accuracy* | 0.020mm @ 即烧型$AL_2O_3$基片 *Asfired Alumina Substrate*<br>0.012mm @ 抛光型$AL_2O_3$基片 *Polished Alumina Substrate* | | | |

### *B、技术参数 Performance*

| 序号 No. | 项目 Item | 参数 Performance |
|---|---|---|
| 1 | 有效面积 *Effective area* | 45*45mm @ 2*2 inches Substrate<br>60*60mm @ 3*3inches Substrate |
| 2 | 最小线宽/缝宽 *Minimum Line Width / Slit Width* | 0.020mm |
| 3 | 最小孔径 *Minimum Hole Diameter* | 0.200mm |
| 4 | 最小径厚比 *Minimum Hole Diameter-Thickness Ratio* | 0.8 |



## 2、产品检验标准 *Inspection Standard*

| No. | 检验项目 *Test Item* | 测试标准和条件 *Standards & Condition* |
|---|---|---|
| 1 | 物理尺寸 *Physical Dimension* | Mil-STD-883G 方法2016。 *Mil-STD-883G, method 2016.* |
| 2 | 外 观 *Visual Inspection* | 100% 外观检验，符合或者超过Mil-STD-883G，方法2032的要求。 *100% Visual inspection to meet or exceed Mil-STD-883G, method 2032 requirements.* |
| 3 | 导体厚度 *Conductor Thickness* | 导体厚度符合或者超过客户要求。 *Conductor thickness to meet or exceed the customer's requirements.* |
| 4 | 膜层粘附性 *Film Adhesion* | 采用ASTM B571-97胶带测试方法(3M #610 胶带)。 *ASTM B571-97(Film Adhesion use 3M #610 tape ).* |
| 5 | 膜层耐高温 *High Temp. Resistance* | 所有薄膜产品必须在400度下维持10分钟不出现问题。 *All general thin film products must be met customer requirements at 400℃ for 10 Minutes.* |
| 6 | 键合强度 *Wire Bond Strength* | Mil-STD-883G，方法2011。 *Mil-STD-883G, method 2011.* |
| 7 | 芯片抗剪强度 *Die Shear Strength* | Mil-STD-883G，方法2019。 *Mil-STD-883G, method 2019.* |
| 8 | 金丝键合剪切强度 *Wire Bond Shear Strength* | *EIA/JESD22-B116.* |
| 9 | 热冲击 *Thermal Shock* | Mil-Std-883G，方法1011，条件C。 *Mil-Std-883G,method 1011 condition c.* |

# 薄膜电路设计规范
# *Thin Film Design Rules*

## 1、设计图纸 *Design Document*

| 序号 No. | 项目 Item | 要求 Requirements |
|---|---|---|
| 1 | 文件格式 File Format | 需要提供CAD文件, 接受以DXF或DWF为后缀的文件.<br>*Must be in AutoCAD . DXF or . DWG files.* |
| 2 | 图形比例 Drawing scale | *1 : 1* |
| 3 | 图形单位 Drawing unit | 毫米 *mm* |
| 4 | 图层及线条颜色标识<br>*Layer&Line colour Identification* | 图层1 *Layer 1* 产品轮廓线 *Product Outline*<br>图层2 *Layer 2* 导体轮廓线 *Conductor Outline*<br>图层3 *Layer 3* 电阻轮廓线 *ResistorsOutline*<br>图层4 *Layer 4* 孔轮廓线 *Holes Outline*<br>图层5 *Layer 5* 外框及标注颜色 *Frame&Mark Line colour*<br>图层6 *Layer 6* 客户自定义 *Customization* |
| 5 | 图形及线条<br>*Drawing & Line* | （1）所有图形必须是封闭的；<br>*Zero width polylines are needed to create closed boundary polygons for all geometries.*<br>（2）避免图形重叠和不必要的线条；<br>*Avoid double entities or extraneous lines.*<br>（3）图形不需要颜色填充。<br>*All geometries only need their frame, not need fill in.*<br><br>正确图形 *Acceptable*　错误图形 *Unacceptable*　错误图形 *Unacceptable* |

## 2、电阻的设计 *Resistors Design*

*TaN* 薄膜电阻通常是按照以下经验公式设计的：
*The design of thin film TaN resistor is governed by the following equation:*

$$R=\rho L/(W t)$$

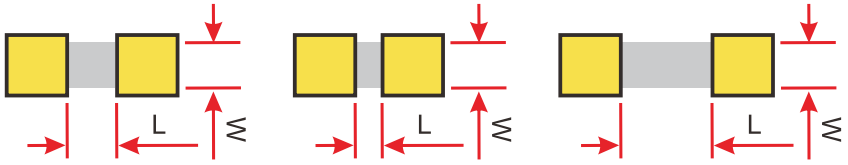
其中 *Where*： *R*=电阻的电阻值 *Total Resistance*(Ω)
ρ=电阻材料的体积电阻率 *Bulk Resistivity of Resistor Material*(Ω-cm)
*L*=电阻薄膜的长度 *Resistor Length(cm)*
*W*=电阻薄膜的宽度 *Resistor Width(cm)*
*t*=电阻薄膜的厚度 *Resistor Thickness (cm)*

为设计方便，假设 *L=W* 时，方块电阻$R_{sheet}$=Rs=ρ/t (Ω/Square)，那么，电阻阻值=方块电阻$R_{sheet}$×(L/W)。

*To ease design , assumes L=W,* $R_{sheet}$=Rs=ρ/t (Ω/Square), *so that R=Rs×(L/W).*

假设：以下TaN薄膜电阻设计时，采用的方阻为50欧姆/方。
*Example: The thin film TaN resistors is 50 Ohm/Square.*

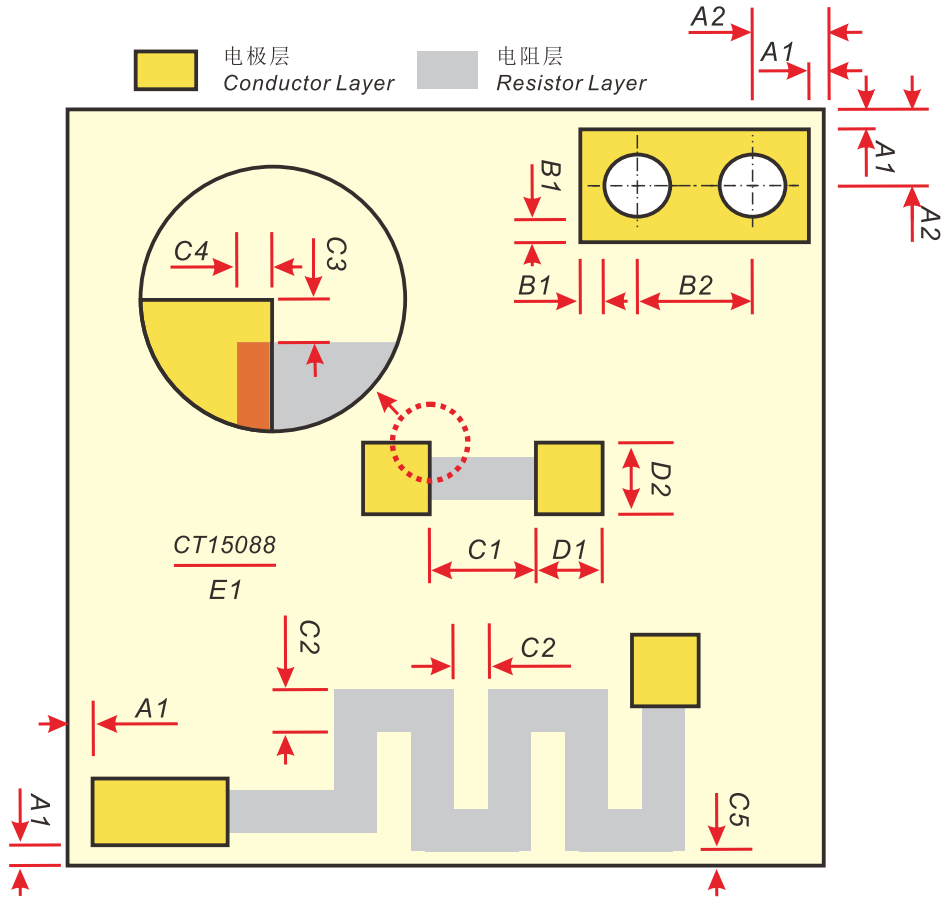
| 项目 Item | 参数 Performance |
|---|---|
| 方块电阻值 Square Resistorance | 50 Ω/Square (20~200Ω) |
| -55~+125℃电阻温度变化系数 TCR (-55~+125℃) | ±100 ppm |
| 1000小时*125℃阻值稳定性 Stability (1000 H*125℃) | 0.02 % |
| 短时间耐高温（5分钟） Short Term Max ET(5minutes) | 450 ℃ |
| 最小电阻偏差 Minimum Resistor Tolerance | ±5.0 % |
| 25℃时膜层最大承受电流（mA/um） Maximum Rated Current(mA/um)@25℃ | 0.12 |




L/W =1.0　L/W =0.5　L/W =2.0
R=1.0×50=50 Ohm　R=0.5×50=25 Ohm　R=2.0×50=100 Ohm

# 薄膜电路设计规范
# *Thin Film Design Rules*

## 3、设计规则 *Design Rules*




| 编号 Code | 参数 Feature | 最小值 Minimum |
|---|---|---|
| A1 | 电极留边量 *Metalization Pullback* | *0.050 mm* |
| A2 | 孔中心到边缘距离 *Hole Center to Border Spacing* | *2R* |
| B1 | 孔边缘到电极的距离 *Via Hole Cover Pad* | *0.050 mm* |
| B2 | 孔距 *Pitch of Holes* | *4R* |
| C1 | 电阻长度 *Resistor Length* | *0.050 mm* |
| C2 | 电阻宽度 / 间距 *Resistor Width/ Gap* | *0.050 mm* |
| C3 | 电阻对电极预留量 *Conductor Margin at Resistor* | *0.025 mm* |
| C4 | 电阻电极重叠量 *Overlap* | *0.050 mm* |
| C5 | 电阻留边量 *Resistor Pullback* | *0.050 mm* |
| D1 | 电极长度 *Conductor Length* | *0.100 mm* |
| D2 | 电极宽度 *Conductor Width* | *0.100 mm* |
| E1 | 标识位置 *Mark Position* | 空白处 *Space* |

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Printed in China