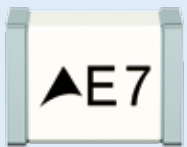


爱普科斯(EPCOS)产品简介2017

Surge Arresters and Switching Spark Gaps

气体放电管和开关放电器



Surge Arresters and Switching Spark Gaps

气体放电管和开关放电器



Contents	目录	页码
Important notes	重要事项	4
Cautions and warnings	敬告和警告	5
Surge arresters general information	浪涌保护器通用信息	
■ Introduction	■ 介绍	6
■ Construction	■ 结构	8
■ Function, PSpice Model	■ 功能、PSpice仿真模型	10
Surge protection for telecom applications	电信应用浪涌保护	
■ General information, definitions, measuring conditions	■ 通用信息、定义、测试条件	18
■ Overview of types	■ 型号概览	28
■ Designation system	■ 放电管标志说明	31
■ 2-electrode arresters	■ 二极放电管	32
■ 3-electrode arresters	■ 三极放电管	50
Surge protection of power lines	电源线的浪涌保护	
■ Overvoltage protection of AC power lines	■ 交流电源线的过压保护	62
■ Overvoltage protection of DC power lines	■ 直流电源线的过压保护	69
Switching spark gaps solutions	开关放电器解决方案	71
■ Commodity series	■ 商用系列	75
■ High-performance series	■ 高性能系列	76
■ Triggered switching spark gaps	■ 触发式开关放电管	79
General	总则	
■ Quality	■ 质量	80
■ Taping and packing	■ 卷带包装	83
■ Mounting instructions	■ 安装说明	84
■ Environmental protection	■ 环境保护	86
■ Addresses	■ 联系信息	87

Important Notes

重要事项

The following applies to all products named in this publication:

1. Some parts of this publication contain **statements about the suitability of our products for certain areas of application**. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. We nevertheless expressly point out **that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application**. As a rule, EPCOS is either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether an EPCOS product with the properties described in the product specification is suitable for use in a particular customer application.
2. We also point out that **in individual cases, a malfunction of electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified**. In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health (e.g. in accident prevention or lifesaving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of an electronic component.
3. **The warnings, cautions and product-specific notes must be observed.**
4. In order to satisfy certain technical requirements, **some of the products described in this publication may contain substances subject to restrictions in certain jurisdictions (e.g. because they are classed as hazardous)**. Useful information on this will be found in our Material Data Sheets on the Internet (www.epcos.com/material). Should you have any more detailed questions, please contact our sales offices.
5. We constantly strive to improve our products. Consequently, **the products described in this publication may change from time to time**. The same is true of the corresponding product specifications. Please check therefore to what extent product descriptions and specifications contained in this publication are still applicable before or when you place an order. We also **reserve the right to discontinue production and delivery of products**. Consequently, we cannot guarantee that all products named in this publication will always be available. The aforementioned does not apply in the case of individual agreements deviating from the foregoing for customer-specific products.
6. Unless otherwise agreed in individual contracts, **all orders are subject to the current version of the "General Terms of Delivery for Products and Services in the Electrical Industry" published by the German Electrical and Electronics Industry Association (ZVEI)**.
7. The trade names EPCOS, CeraDiode, CeraLink, CeraPad, CeraPlas, CSMP, CSSP, CTVS, DeltaCap, DigiSiMic, DSSP, ExoCore, FilterCap, FormFit, LeaXield, MiniBlue, MiniCell, MKD, MKK, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, PQSine, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, SIP5D, SIP5K, TFAP, ThermoFuse, WindCap are **trademarks registered or pending** in Europe and in other countries. Further information will be found on the Internet at www.epcos.com/trademarks.

以下内容适用于所有陈述产品

1. 本出版物的某些部分包括本公司产品在特定领域的适用性声明。这些声明基于我们对所涉及领域对产品的通用要求的了解。尽管如此，仍需明确指出的是，此类声明并不能作为本公司产品在特定终端应用中适用性的约束性声明。通常，爱普科斯(EPCOS)要么不熟悉特定客户的应用，要么比客户自己了解的要少。因此，客户有责任检查和确定爱普科斯(EPCOS)产品是否具有适用于特定应用的特性。
- 2 还需指出的是，个别情况下，即便按照规定的方法操作，现有的技术仍不能完全排除无源电子元件在正常使用寿命前发生故障或失效。具有很高安全要求的应用，特别是电子元件故障或失效可能导致生命安全或健康问题的应用(如事故预防或救生系统)中，必须采用合适的终端应用设计或必要的措施(如安装保护电路或冗余电路)，确保发生电子元件故障或失效时不会对他人产生伤害。
3. 必须严格遵守所有警告、注意和产品提示。
4. 为满足特定技术要求，本出版物所述的有些产品可能包含特定区域内限制的物质(如：被认为有害的物质)。相关信息，可查看我们网站(www.epcos.com/material)上的“物料清单(Material Data Sheets)”。如果有更详细的问题，请联系我们的销售部门。
5. 我们始终坚持产品的持续改进。因此，本出版物所述的产品会不断更新。同时，相关规格也会随之改变。所以，订购时，请查看所述产品的说明和规格是否依然适用。同时，我们有权停止生产和销售这些产品。因此，我们无法保证此处所述所有产品都一直有货。上述声明不适用于就客户指定产品签署的偏离上述声明的个别协议的情形。
6. 除非合同另有规定，所有订货都应符合德国电子电气工业协会(ZVEI)发布的最新“电气行业产品销售和服务通用条款”的规定。
7. 商标EPCOS, CeraDiode, CeraLink, CeraPad, CeraPlas, CSMP, CSSP, CTVS, DeltaCap, DigiSiMic, DSSP, ExoCore, FilterCap, FormFit, LeaXield, MiniBlue, MiniCell, MKD, MKK, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, PQSine, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, SIP5D, SIP5K, TFAP, ThermoFuse, WindCap 是公司在欧洲或其他国家的注册商标或正在审查的商标。详细信息，请访问www.epcos.com/trademarks

Cautions and Warnings

敬告和警告

Correct application and strict adherence to the important information listed below will ensure optimum performance for the components specified in this brochure.

Please consult your local EPCOS sales organization if one or more limits cannot be adhered to.

- Do not continue to use damaged surge arresters.
- Surge arresters must be handled with care and must not be dropped.
- Do not operate surge arresters in power supply networks, whose maximum operating voltage exceeds the minimum sparkover voltage of the surge arresters.
- If the surge arresters are not properly contacted, current load can cause sparks and loud noises.
- Store surge arresters in original packaging only. Do not open the package prior to storage.
- Electromagnetic fields and ionizing radiation may affect the electrical characteristics of the arrester. The impact of such effects (inductive and capacitive field distortion from adjacent components) must be avoided by appropriate circuit design measures.
- Surge arresters may become hot in the event of longer periods of current stress (burn risk). In the event of overload the connectors may fail or the component may be destroyed.
- Leaded and SMD surge arresters should be soldered within 24 months after shipment.
- Operators who suffer from excessive sensitivity to metals should wear light gloves (e.g. cotton gloves) when performing manual assembly operations involving surge arresters.
- Do not continue to use surge arresters whose short-circuit mechanism has been activated.
- Depending on the sensor material the short-circuit spring does not trigger until 140, 200, 260 or 300 °C is reached. Thermal radiation to adjacent components must be taken into consideration in the circuit design. Depending on the mounting position, the surge arrester may have to be secured by additional mechanical means.
- The follow current must be limited (see data sheet) so that the arrester can be properly extinguished when the surge has decayed. The arrester might otherwise heat up and ignite adjacent components.
- Surge arresters should be disposed of in the same way as household-type industrial waste. In individual cases, any specific local legal regulations departing from this rule must be observed.

正确应用和严格遵守下列重要信息，将确保本手册所指定的元件具有最佳的性能表现。

如果无法遵守一条或多条限制性规定，请咨询您当地的爱普科斯 (EPCOS) 销售机构。

- 禁止继续使用已经损坏的气体放电管。
- 气体放电管必须小心存放，以免跌落。
- 禁止操作在电源网络中运行的气体放电管，否则放电管的最大操作电压有可能超过气体放电管的最小放电电压。
- 如果气体放电管接触不良，电流负荷将会导致火花和巨大的噪声。
- 存储前气体放电管应包装完好。禁止在存储前打开原始包装。
- 电磁场和电离辐射都可能会影响气体放电管的电气特性。必须采取适当的电路改进措施以避免此种影响（相邻元件的电感和电容场失真）。
- 电流冲击（燃烧危险）作用下可能会发烫。当回路过载时，连接器排可能会出现故障或者元件也有可能遭受损坏。
- 引线式和SMD（表面安装型）气体放电管应在交货后的24个月内进行焊接。
- 对金属过敏的操作人员在进行包括气体放电管在内的手动装配操作时，应戴轻质手套（如棉手套）。
- 禁止继续使用已启用短路保护机制的气体放电管。
- 根据传感器的材料性质，当温度未达到140、200、260或300 °C之前，短路簧片不会触发。电路设计必须考虑相邻元件的热辐射。根据安装位置的不同，气体放电管必须通过机械装置予以固定。
- 必须对续流进行限制（见数据表），这样当浪涌衰减至某一数值时，气体放电管可以正常熄灭。否则气体放电管可能会发热并引燃相邻元件。
- 气体放电管应当采用与家用型工业废物相同的处理方式。在特殊情况下，还必须遵守任何不符合本规则的本地特殊法律规定。

Surge Arresters

气体放电管



Tried and tested billions of times over

Our customers include many international manufacturers and suppliers of telecommunication systems and manufacturers of surge voltage protection devices and installations. They appreciate our extensive range of types, which enables high flexibility in matching to the most diverse circumstances. They rely on the excellent quality with which we manufacture our arresters in large numbers, more than 300 million items annually.

The development of our surge arresters is based on international standards such as ITU-T, K.12, IEC 61643-311 (EN 61643-311), IEC 61643-11 (EN 61643-11), RUS PE-80/IEEE 465.1 and IEC 61643-21 (EN 61643-21). They are also used to enable modules/equipment to meet various regulatory requirements including ITU K20/K21, IEC 61000-4-5, Telcordia GR974/GR1089.

UL certification

Surge arresters from EPCOS are recognized to UL 497B under UL file E163070, UL 497 under file E214013 and UL 1449 under file E319264.

经历数十亿次试验和测试

我们的客户包括许多跨国运营的电信系统制造商和供应商，以及浪涌电压保护设备和装置制造商。他们赞赏我们的产品类型多样，可以灵活适应多种环境。这些客户信赖我们的质量标准。根据这些标准我们对放电管进行大批量生产，年产量超过3个亿。

我们的气体放电管研制基于以下国际标准：ITU-T、K.12、IEC 61643-311(EN 61643-311)、IEC 61643-11(EN 61643-11)、RUS PE-80/IEEE 465.1以及IEC 61643-21 (EN 61643-21)。气体放电管还应用于模块和设备上，使这些设备满足各种法规要求，包括ITU K20/K21、IEC 61000-4-5、Telcordia GR974/GR1089等。

UL认证

爱普科斯 (EPCOS) 的气体放电管已经经过认证，符合UL 497B (文件号E163070)、UL 497 (文件号E214013)，以及UL 1449 (文件号E319264) 的要求。

Surge Arresters

气体放电管



Surge arresters in brief

Gas-filled surge arresters operate on the gas-physical principle of the highly effective arc discharge. Electrically, surge arresters act as voltage-dependent switches. As soon as the voltage applied to the arrester exceeds the spark-over voltage, an arc is formed in the hermetically sealed discharge region within nanoseconds. The high surge current handling capability and the arc voltage, which is almost independent of the current, short-circuit the overvoltage. When the discharge has died down, the arrester extinguishes and the internal resistance immediately returns to values of several 100 MΩ.

The surge arrester thus meets almost perfectly all requirements made on a protective element. It reliably limits the overvoltage to permissible values, and – under normal operating conditions – the high insulation resistance and the low capacitance contribute to the fact that an arrester has virtually no impact on the system to be protected.

Key characteristics

● DC spark-over voltage	70 ... 7500 V
● Impulse discharge current (8/20 μs)	max. 100 kA
● Impulse discharge current (10/350 μs)	max. 100 kA
● Alternating discharge current (1 s)	max. 20 A
● Alternating discharge current (0.2 s)	max. 300 A
● Arc voltage	10 ... 35 V
● Insulation resistance	min. 1 GΩ
● Capacitance	min. 0.2 pF

气体放电管简介

气体放电管按照高效率弧光放电的气体物理原理工作。从电气角度看，气体放电管等效于压敏开关。一旦施加到放电管上的电压超过击穿电压，电弧将在毫秒时间内、在密封放电区域形成。高浪涌电流处理能力和几乎独立于电流的电弧电压会将过压短路。当放电结束，放电管熄灭时，内阻立即恢复为数100 MΩ。

因此气体放电管几乎满足了被保护元件的所有要求。它能够将过压可靠地限制在允许数值范围内，并且在正常工作条件下，由于其高绝缘阻抗和低电容特性，实质上放电管对受保护系统不会产生任何影响。

主要特性

● 直流击穿电压	70 ... 7500 V
● 冲击放电电流(8/20 μs)	最大值100 kA
● 冲击放电电流(10/350 μs)	最大值100 kA
● 工频放电电流(1 s)	最大值20 A
● 工频放电电流(0.2 s)	最大值300 A
● 弧光电压	10 ... 35 V
● 绝缘电阻	最小值1 GΩ
● 电容	最小值0.2 pF

Construction 结构

Basic construction of 2- and 3-electrode arresters

二极和三极放电管的基本结构

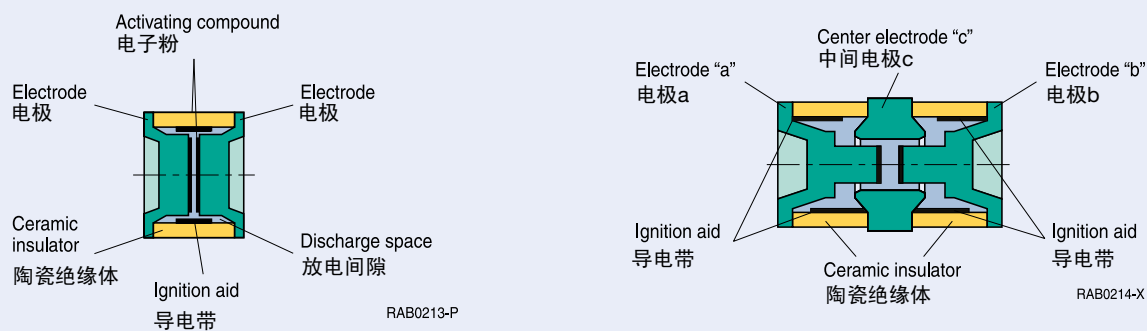


Figure / 图1

The electrical properties of an open gas-discharge path depend greatly on environmental parameters such as gas type, gas pressure, humidity and pollution. Stable conditions can only be ensured if the discharge path is shielded against these environmental influences. The design principle of surge arresters is based on this requirement.

Our proven technique of connecting insulator and electrode ensures a hermetically sealed discharge space. The type and pressure of the gas in the discharge space can thus be selected on the basis of optimum criteria. The noble gases argon and neon are predominantly used in gas-filled arresters since they ensure optimum electrical characteristics throughout the useful life of the component. An activating compound is applied to the effective electron emission surfaces of the electrodes, they themselves separated typically by less than 1 mm, to reduce the work function of the electrons and to guarantee the stability of the ignition voltage even after repeated current loads.

Gas-filled surge arresters feature an optimum balance of size, impulse discharge capability and longer than average service life.

开放型气体放电通路的电气性能主要取决于环境参数，如气体的种类、压力以及湿度和污染程度。只有在其放电路外加保护层才能抵抗外在环境的影响，以确保稳定的工作条件。气体放电管的设计原理即基于此要求。

采用我们久经验证的绝缘体与电极封接技术，可确保放电间隙的气密性。由此，可对放电管中气体的种类和压力进行选择优化。在使用过程中，氩氖两种惰性气体保证了放电管具有最佳的电气性能，因而成为首选气体。在电极的有效电子发射表面涂有电子粉，电极间距一般小于1 mm，以提高电子发射能力。因此，即使在重复加载电流后也能保证击穿电压的稳定性。

爱普科斯气体放电管与管型和耐冲击电流能力精确匹配，使用寿命高于放电管的平均值。

Construction 结构

Basic construction of 3-electrode arresters with failsafe function 带失效保护卡的三极放电管的基本结构

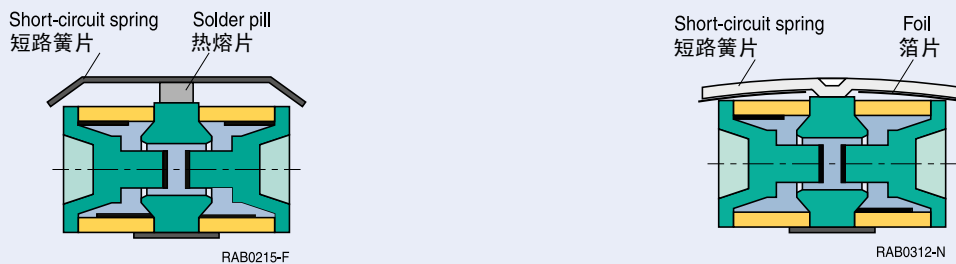


Figure / 图2

To achieve an excellent response characteristic for fast rise time, an ignition aid is attached to the cylindrical inner surface of the insulator. This speeds up gas discharge by distorting the electric field. EPCOS gas-filled arresters thus feature a fast response characteristic with high reproducibility. The electrical characteristics of the arrester such as DC spark-over voltage, pulsed and AC discharge current handling capability as well as service life can be optimized to the specific requirements of various systems. This is achieved by varying the gas type and pressure as well as the spacing of the electrodes and the emission-promoting coating of the electrodes.

Variants such as the 3-electrode arrester with an external short-circuit spring offer an application-specific solution in the event of contact between telecommunications and power lines. (For further information see page 14.)

为在快速上升时获得最佳响应特性，在放电管的绝缘体内表面附加导电带，通过其作用以改变电场分布，加速气体放电过程。因此爱普科斯气体放电管具有快速响应特性及高可重复性。气体放电管的电气特性，如直流击穿电压、冲击电流、工频放电电流处理能力和使用寿命等能按各种通讯系统要求进行调整优化。这种调整是通过改变气体的种类和压力、电极间距及涂敷材料来实现的。

其他形式如外部带有短路簧片装置的三极管，主要是在通讯设备和电力线搭接时提供特殊应用。（详见14页）

Function 功能

Limitation of a sinusoidal overvoltage by a surge arrester 气体放电管对过压正弦波的限制

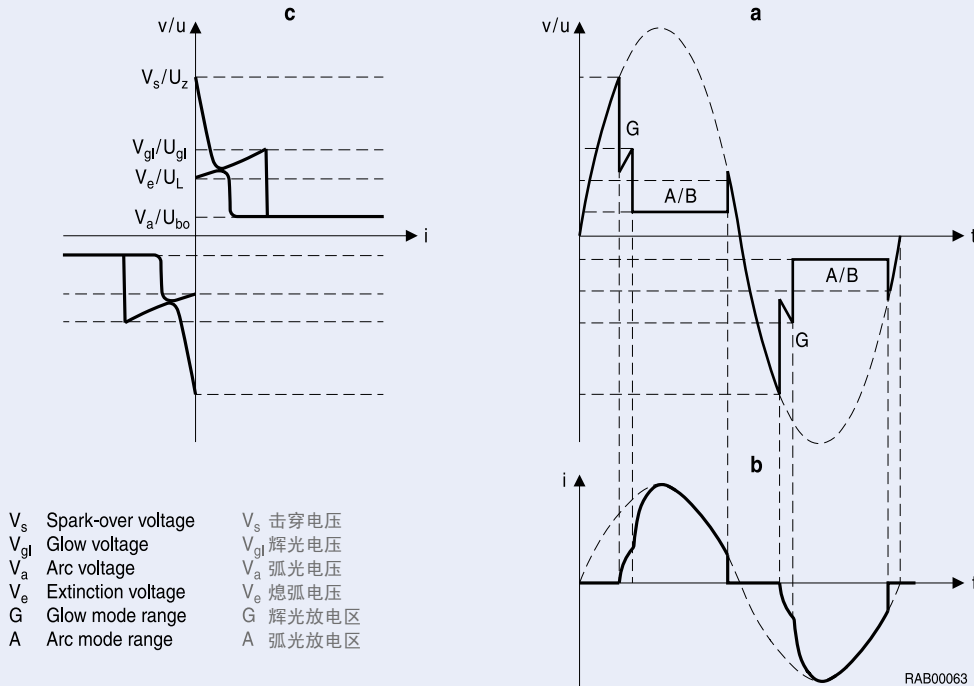


Figure / 图3

Figure 3a shows the voltage curve at the arrester and Figure 3b the current as a function of time when limiting a sinusoidal voltage surge.

图3a显示了放电管的电压曲线，图3b描述了限制正弦波电压时的电流-时间函数。

Figure 3c The V/I characteristic of the surge arrester was obtained by combining the graphs of voltage and current as a function of time.

图3c为结合电压/电流-时间函数获取的气体放电管电气特性。

Protection principle

Generally, a spark-over occurs whenever surge voltages exceed the electric strength of a system's insulation. This discharge limits the surge voltage and reduces the interference energy within a short period of time. As the arc with its high current handling capability is ignited, it prevents a further rise in surge voltage due to its low arc voltage of some 10 V. Gas-filled arresters utilize this natural principle of limiting surge voltages.

保护原理

一般来说，当击穿电压超过系统绝缘的耐电强度时，放电管被击穿放电，从而在短时间内限制浪涌电压及减少干扰能量。当具有大电流处理能力的弧光放电时，由于弧光电压低至几十伏，可以防止浪涌电压进一步上升。气体放电管即利用这一自然原理实现了对浪涌电压的限制。

Function

功能

Operating mode

A simplified surge arrester can be compared with a symmetrical low-capacitance switch whose resistance may jump from several $G\Omega$ during normal operation to values $< 1 \Omega$ after ignition caused by a surge voltage. The arrester automatically returns to its original high-impedance state after the surge has subsided.

Figure 3a shows the voltage curve at the arrester and **Figure 3b** the current as a function of time when limiting a sinusoidal voltage surge.

Virtually no current flows while the voltage rises to the spark-over voltage V_s of the arrester. After ignition the voltage drops to the glow voltage level V_{gl} (70 to 200 V depending on the type, with a current of several 10 mA up to about 1.5 A) in the glow-mode range G. As the current increases further, transition to arc mode A occurs. The extremely low arc voltage V_a of 10 to 35 V typical for this mode is virtually independent of the current over a wide range. With decreasing overvoltage (i.e. in the second half of the wave), the current through the arrester decreases accordingly until it drops below the minimum value necessary to maintain the arc mode. Consequently, the arc discharge stops suddenly and, after passing through the glow mode, the arrester extinguishes at a voltage V_e .

The V/I characteristic of the surge arrester shown in **Figure 3c** was obtained by combining the graphs of voltage and current as a function of time.

Response behavior

Static response behavior

If a voltage with a low rate of rise (typical 100 V/s) is applied to the arrester, the spark-over voltage V_s will be determined mainly by the electrode spacing, the gas type and pressure, and by the degree of pre-ionization of the enclosed noble gas. This ignition value is defined as the DC spark-over voltage V_{sdc} .

工作方式

简易气体放电管可看作是一个低电容的对称开关，在正常工作时，电阻为 $G\Omega$ 级，着火后跌至 1Ω 以下。浪涌消失后放电管恢复到高阻抗状态。

图3a显示了放电管的电压曲线，**图3b**描述了限制正弦波电压时的电流-时间函数。

电压上升到击穿电压 V_s 期间，基本上没有电流通过。点火后，电压降至辉光状态区G内，辉光电压水平 V_{gl} (70-200 V, 电流从10毫安至1.5安培，视管型而定)。随着电流进一步增加，跃变到弧光状态A。在这种状态下，弧光电压极低，一般为10-35 V, 在很宽范围内基本与电流无关。随着过电压进一步降低（例如波形第二半周），流过放电管的电流也相应降到维持弧光状态所需的最小值以下。此时弧光放电骤然停止，经过辉光状态后，放电管在电压 V_e 处熄灭。

图3c为结合电压/电流-时间函数获取的气体放电管的电气特性。

响应特性

静态响应特性

在低上升速率电压（大约100 V/s）下，击穿电压 V_s 主要取决于两电极间的距离、气体种类和压力，以及填充的惰性气体的预电离度。此点火电压值即直流击穿电压 V_{sdc} 。

Function 功能

Typical response behavior of a 230-V arrester
230-V放电管的典型响应模式

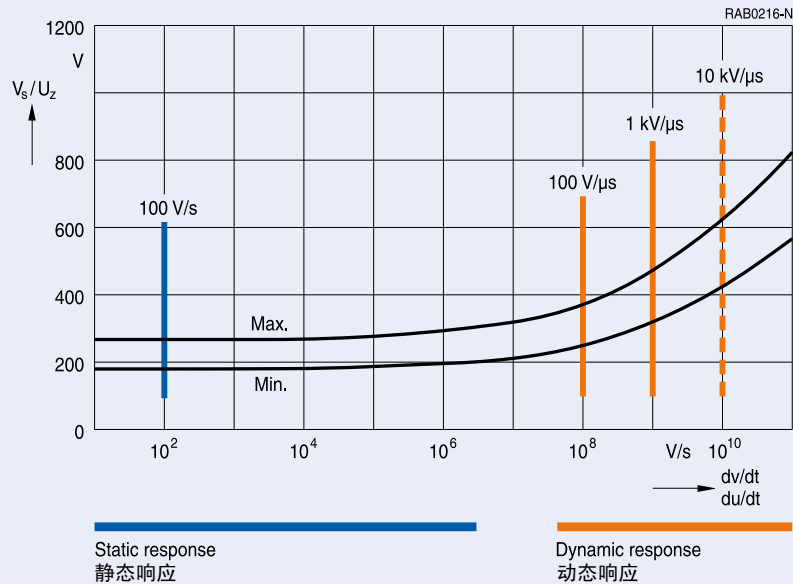


Figure / 图4

Dynamic response behavior

At a fast rate of rise the spark-over voltage V_s of the arrester exceeds V_{sdc} . This effect is caused by the finite time necessary for the gas to ionize. All these dynamic spark-over voltages are subject to considerable statistical variation. However, the average value of the spark-over voltage distribution can be significantly reduced by attaching the ignition aid to the inner surface of the arrester. This reduces the upper limit of the tolerance field considerably and also limits the spread of the spark-over voltage. The ignition voltage in this dynamic range is defined as the impulse spark-over voltage V_{si} . EPCOS gas-filled surge arresters are thus independent of permanent pre-ionization in order to reach this characteristic value (V_{si}), which is crucial for evaluating their protection quality in practical applications.

As a result of the harmonization of national and international specifications, the two voltage rates of rise of $100 \text{ V}/\mu\text{s}$ and $1 \text{ kV}/\mu\text{s}$ (ITU-T, K.12 and IEC 61643-311) are used to evaluate the dynamic characteristic of surge arresters. An example for other rates of rise is shown in **Figure 4**.

动态响应特性

在较快上升速率电压下，放电管的直流击穿电压 V_s 大于 V_{sdc} 。这种效应的产生是因为气体电离需要一定的时间。这些动态击穿电压都有相当大的离散性。但是通过放电管内壁涂敷的导电带可显著降低其击穿电压的容差上限，并显著降低击穿电压的分布数值，此范围内的点火电压即冲击击穿电压 V_{si} 。冲击击穿电压在实际应用中是评估放电管保护水平的关键因素。

由于国内规格与国际规格的统一， $100 \text{ V}/\mu\text{s}$ 和 $1 \text{ kV}/\mu\text{s}$ 电压上升速率（ITU-T、K.12和IEC 61643-11）均用于评估气体放电管的动态特性。其他电压上升速率（如 $10 \text{ kV}/\mu\text{s}$ ）示例见图4。

Function

功能

Extinguishing characteristics

AC operation:

After the surge has subsided, the arrester normally extinguishes since its arc voltage drops below the minimum value in the subsequent zero crossing of the AC voltage.

However, this behavior does not apply to operation with a low-resistance power supply. In this case it is essential to consider the very low internal resistance of the line and of the ignited surge arrester. The maximum permissible follow current of the arrester may be exceeded between the decay of the surge and the subsequent zero crossing. This follow current can reach values up to several 1000 A (refer to page 16).

Note: The follow current must be limited so that the arrester can properly extinguish when the surge has decayed. The arrester might otherwise heat up and ignite adjacent components.

DC operation:

This condition can be found in the protection of telecommunication systems. When continuously operated with DC voltage, the surge arrester must be able to extinguish after the surge has subsided. Surge arresters easily satisfy this requirement when used in communication circuits as these are usually highly resistive throughout. In the case of systems with higher DC voltages or low resistance the arrester's extinguishing characteristics must be examined in each individual case.

The following condition(s) must be achieved in order for the surge arrester to extinguish properly:

- The DC operating voltage is lower than the minimum arc voltage (10 to 35 V depending on the type), or
- the DC operating voltage is lower than the glow voltage (60 to 200 V depending on the type).

In the latter case it must be ensured that the maximum current drawn from the operating voltage source can no longer maintain the arc discharge mode (several 100 mA depending on the type) after the surge has subsided.

熄弧特性

交流工作状态下:

浪涌过后，一般放电管会熄弧，因为交流电压过零时其值会降至放电管的弧光电压以下，但是在低阻抗的电流供给情况下，此熄弧特性无法完全实现。这种情况的出现基本上是电路低内阻和着火后放电管的低电阻特性所造成的。放电管实际通过的电流可能超过允许最大续流量，高达几千安培（见16页）。

备注：浪涌过后，放电管的续流应该受到限制，否则放电管可能启动周边元件。

直流电工作状态下:

在通讯系统防护上一般使用直流电源。在持续的直流电压下，浪涌过后放电管应该能够熄弧。因为通讯线路一般具有高阻抗性，故用于其中的放电管能轻易满足此要求。当系统中存在高直流电压或低阻抗时，必须根据个别情况对放电管的熄弧性能进行确认。

下列情况会造成特殊的熄弧状况:

- 当直流电压低于最低弧光电压时 (10-35 V, 依型号而定)
- 或低于辉光电压 (60-200 V, 依型号而定)。

在后一种情况下，浪涌过后，应确保通过的最大电流不能维持弧光放电（几百毫安，依类型而定）

Function 功能

Failsafe characteristic

失效保护卡特性



Figure / 图5

Failsafe function

In case of direct contact between power and telecommunication lines, current will flow through the ignited arrester for a long period of time. The arrester then heats up. When this happens, the hardware must be protected from thermal overload. The heating is detected by a failsafe mechanism. The spacer (solder pellet or plastic foil) that initially keeps the short-circuit spring at a distance from the electrodes melts at a temperature determined by the choice of material used. The short-circuit spring, to which a bias tension is applied, then drops onto the arrester body and short-circuits the electrodes.

Figure 5 shows a typical short-circuit characteristic as a function of the current flowing through the arrester. This characteristic can be affected by the thermal conductivity of the holder. The coordination between component and package must therefore be subsequently verified by a type test.

Note: The materials used in the sensor to monitor arrester temperature are triggered at temperatures above 200 °C (solder) or 140 °C/260 °C (plastic foil) depending on their composition. The melting temperatures of the solder or plastic foil are up to 300 °C. These temperatures exceed the melting point of standard commercial soft solders used in further processing. This discrepancy must be considered when deciding on the location of the arrester, which may have to be additionally secured by mechanical means. Thermal radiation to adjacent components is another factor of importance.

失效保护卡功能

在电源线和通讯线路搭接时，通常电流会长时间持续通过击穿后的放电管，从而使放电管升温。这种情况下，为了避免周边硬件过热，可通过保护卡装置来监测其受热情况。配置在短路簧片上的分离器（锡焊料或塑料），开始时使短路簧片与电极保持一定的距离，当温度超过使用材料的熔点时锡焊料熔化，簧片偏压使簧片下降并接触放电管电极，使放电管短路。

图5显示以通过放电管电流为函数的短路特性。此特性受制于簧片的热传导性。因此必须通过型式试验来验证部件配套的协调性。

备注：在保护卡上作为传感器以监控放电管温度的材料一般大约在200 °C（锡焊料）或140 °C /260 °C（塑料膜）时被熔化。锡焊料和塑料膜的熔化温度高达300 °C。此温度一般超过在进一步加工中所使用的标准商业软锡焊料的熔点。决定放电管的安装位置时，必须考虑到这种差异。此情况可通过另外的机械加固方式来解决。同时，放电管对周边元件的热辐射也不容忽视。

PSpice Model

PSpice仿真模型

PSpice model for surge arresters 气体放电管的PSpice仿真模型

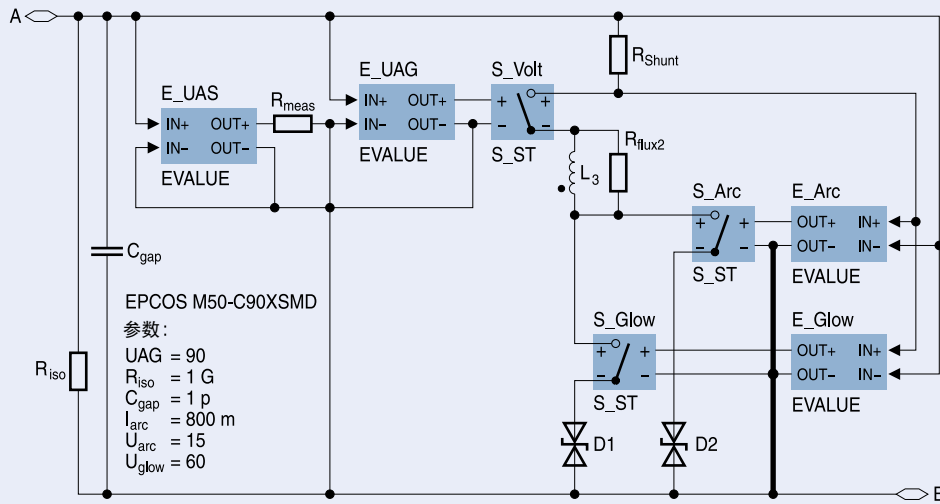


Figure / 图6

Simulation of surge arrester

PSpice model for surge arresters – analog behavioral model for circuit simulation

The EPCOS PSpice model for surge arresters allows users to fit surge arresters into their designs at an early stage of development. Before the first prototype is built the model allows designers to simulate any effects which may occur during normal operation as well as the behavior of the entire circuit under surge. This offers significant advantages such as cost savings and shorter development times for new designs.

A PSpice model is available upon request for every arrester from the EPCOS product range.

Applications

- Analog circuit simulation
- System design and verification
- Functional verification
- Surge simulation

气体放电管仿真

气体放电管的PSpice仿真模型-电路模拟行为仿真模型

爱普科斯气体放电管的PSpice仿真模型允许用户在研发初期将气体放电管添加到他们的设计之中。在搭建原型之前，这种模型允许设计人员对正常工作期间可能产生的任何效应以及浪涌期间整个电路的特性进行模拟。相对于重新设计，这种方式效果非常显著，比如节约成本和缩短开发时间。

对于爱普科斯产品系列的每个气体放电管，我们都提供了相应的PSpice模型。

应用

- 模拟电路仿真
- 系统设计与验证
- 功能验证
- 浪涌模拟

Notes for Applications with Follow Current

持续电流应用说明

Follow current effect

持续电流效应

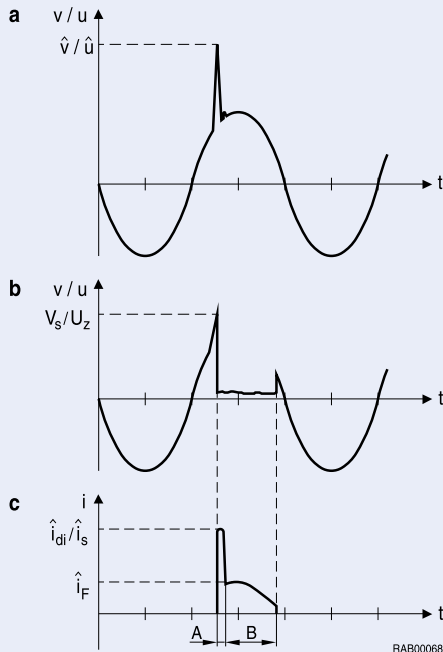


Figure / 图7a
AC operating voltage and superimposed impulse voltage \hat{v}

交流工作电压和叠加脉冲电压 \hat{v}

Figure / 图7b
Impulse voltage limited by a surge arrester
 V_s Spark-over voltage of surge arrester

气体放电管限制的脉冲电压
 V_s 放电管的击穿电压

Figure / 图7c
Impulse discharge current and follow current through the surge arrester
 \hat{i}_{di} Maximum impulse discharge current
 \hat{i}_F Maximum follow current
A Impulse discharge current range
B Follow current range

经过气体放电管的冲击放电电流和持续电流
 \hat{i}_{di} 最大冲击放电电流
 \hat{i}_F 最大持续电流
A 冲击放电电流范围
B 持续电流范围

Figure / 图7

Surge arresters must not be operated directly in power supply networks. (Exception: surge arrester with sufficient follow current capability, see page 62). Because of the extremely low internal resistance of these networks, an excessive current which as a rule exceeds the permissible follow current would flow through the ignited arrester. The arrester no longer extinguishes and can reach very high temperatures.

Varistors connected in series with the arrester are well suited for limiting the follow current. EPCOS metal oxide varistors offer high reliability for this application. The table below shows a selection of these components. To stop the arrester from responding during normal operation, a permissible tolerance of the line voltage of +10% and a possible derating of the arrester of -20% were taken into account.

气体放电管不得直接在电源网络中工作（除非气体放电管具有足够的持续通流能力，见图62）。由于这些网络的内部电阻极低，可能会产生超过持续电流允许范围的电流，并通过放电管。这样放电管就不会熄灭，并产生高温。

放电管和压敏电阻串联，可以有效地限制持续电流。爱普科斯金属氧化物压敏电阻为该应用提供了高可靠性。下表列出了这些元件的型号选择。要防止正常操作时的放电管相应，线路电压可有+10%的容差，放电管可有-20%的容差。

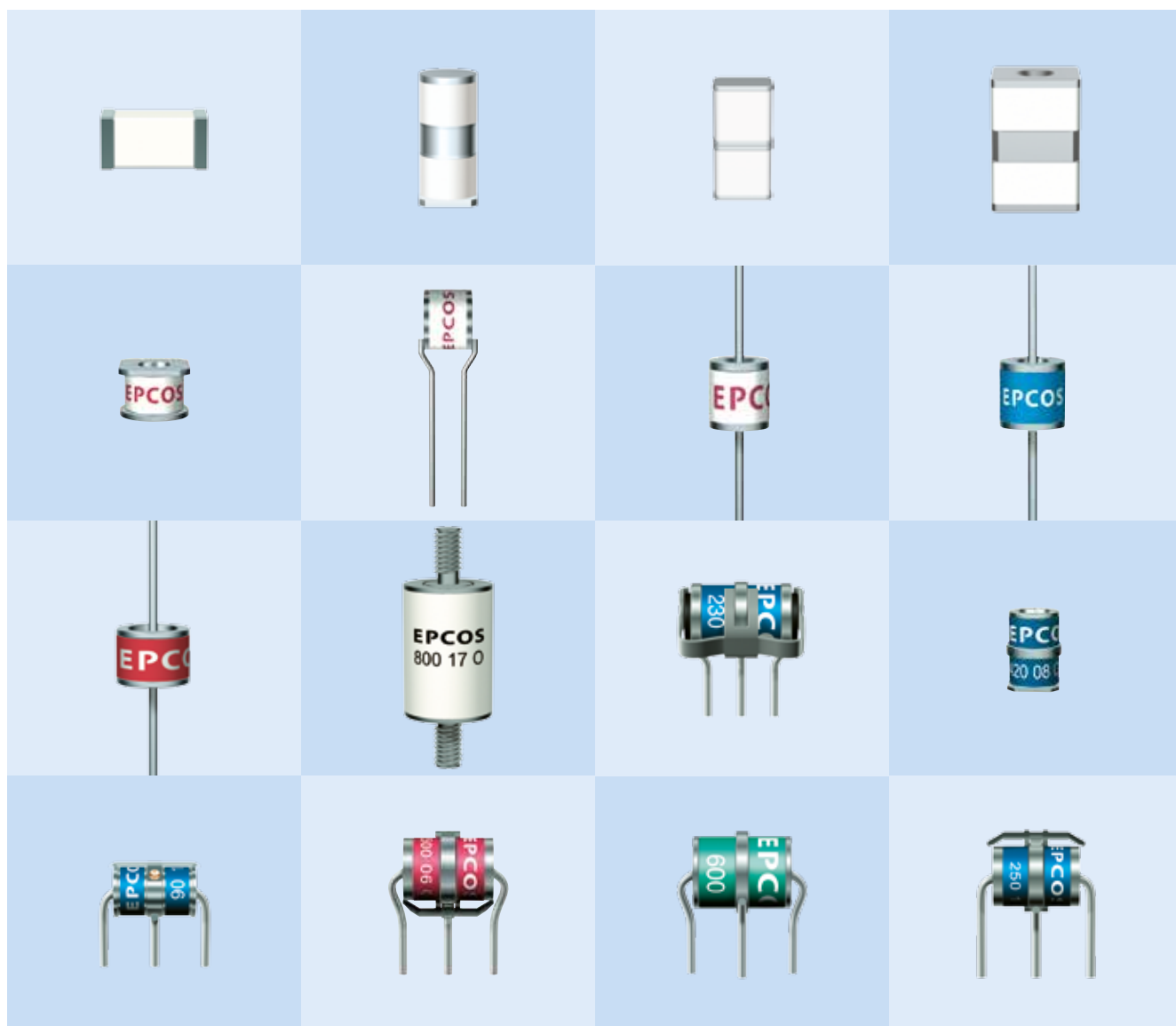
Line voltage V_{rms} 线路电压 V_{rms} (V)	Follow current arrester 持续电流放电管		Varistor 压敏电阻	
	Type/型号	Ordering code / 订货号	Type/型号	Ordering code / 订货号
110	EF270X	B88069X4131S102	S20K150	B72220S0151K101
230	EF470X	B88069X5080S102	S20K250	B72220S0251K101
400	EF800X	B88069X2641S102	S20K460	B72220S0461K101

Note: In the event of particularly frequent and severe surges as well as large fluctuations in line voltage, the dimensioning for each individual combination must be checked.

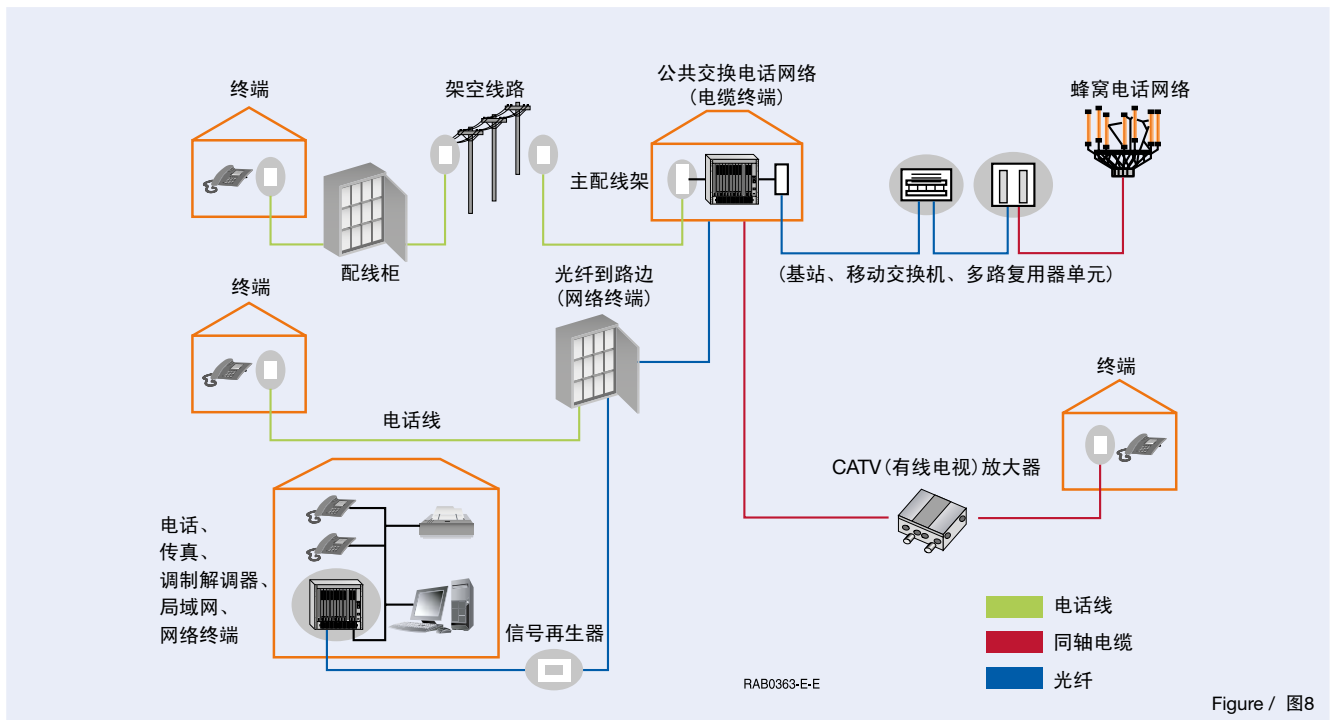
备注: 如果出现经常性、强烈的浪涌以及大的线路电压波动，必须检查每个组合。

Surge Protection for Telecom Applications

电信应用浪涌保护



Telecom Applications 电信应用



Gas-filled surge arresters are classic components for protection of telecommunication installations. It is essential that IT and telecommunication systems – with their high-grade but sensitive electronic circuits – be protected by arresters. They are thus fitted at the input of the power supply system together with varistors and at the connection points to telecommunication lines. They have become equally indispensable for protecting base stations in mobile telephone systems as well as extensive cable television (CATV) networks with their repeaters and distribution systems.

These protective components are also indispensable in other sectors:

- In AC power transmission systems, where they are often used with current-limiting varistors
- In customer premises equipment such as DSL modems, WLAN routers, TV sets and cable modems
- In air-conditioning equipment

The integral black-box concept offers graduated protection by combining arresters with varistors, PTC thermistors, diodes and inductors to create an ideal solution for many applications.

气体放电管是保护电信设备的传统电子元件。它们是IT和电信系统（具有敏感性的高级电子电路）所必需的保护设备。因此气体放电管和压敏电阻一起安装在电源系统的输入端以及连接电信线缆的连接点处。在保护移动通讯系统的基站以及带中继设备和布线系统的有线电视网络 (CATV) 中，气体放电管同样也是不可或缺的。

这些保护性的电子元件在其他领域也是同样重要的:

- 在交流电传输系统中，它们通常和限流压敏电阻一起使用
- 用户终端设备，比如DSL调制解调器、WLAN路由器、电视机和电缆调制解调器
- 空调设备

运用黑匣子理念，将放电管和压敏电阻、PTC热敏电阻、二极管以及电感器结合在一起，提供分级保护，从而为许多应用场合创设理想的保护应用解决方案。

Telecom Applications 电信应用

Basic circuit configurations 基本电路图

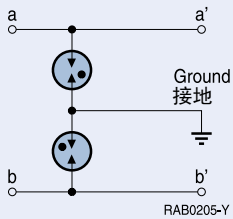


Figure / 图9

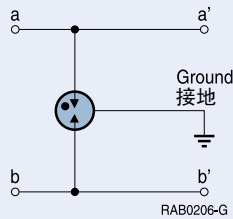


Figure / 图10

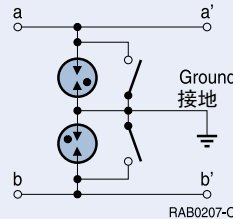


Figure / 图11

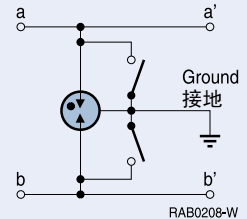


Figure / 图12

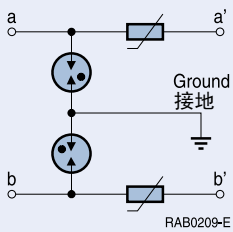


Figure / 图13

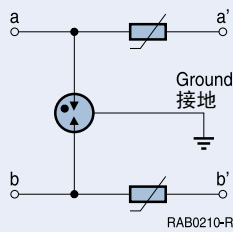


Figure / 图14

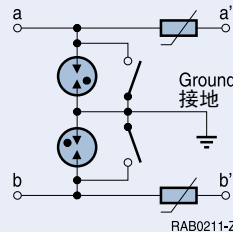


Figure / 图15

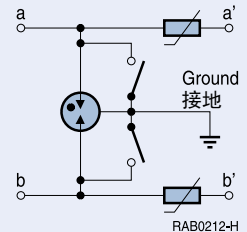


Figure / 图16

Protective circuits

The following basic circuits illustrate standard configurations for surge arresters used in protection circuits for the telecommunications sector. 3-point protection solutions contain only an arrester whereas 5-point protection solutions make additional use of current-limiting components such as PTC thermistors.

3-point protection

3-point protection circuits are connected between the a/b wires and ground and operate by conducting the voltage surge to ground. Both 2-electrode (**Figure 9**) and 3-electrode arresters (**Figure 10**) are used. Arresters with a failsafe mechanism (**Figures 11** and **12**) represent another alternative. For further information about this variant see page 14.

5-point protection

A 5-point protection circuit contains a current-limiting component, usually a PTC thermistor, in addition to the arrester. The thermistor blocks further current flow through it by assuming a very high resistance in the event of an overcurrent.

Figures 13 and **14** show circuits with 2-electrode and 3-electrode arresters, while **Figures 15** and **16** show variants with a failsafe mechanism (for details refer to page 14). However, it may not always be possible to reset an activated thermistor in systems with constant current feed.

保护电路

下面的基本电路描绘了气体放电管应用于通信领域线路保护的标准结构。三端保护解决方案仅包含气体放电管，而五端保护则需另加限流元件，如PTC（正温度系数）热敏电阻。

三端保护

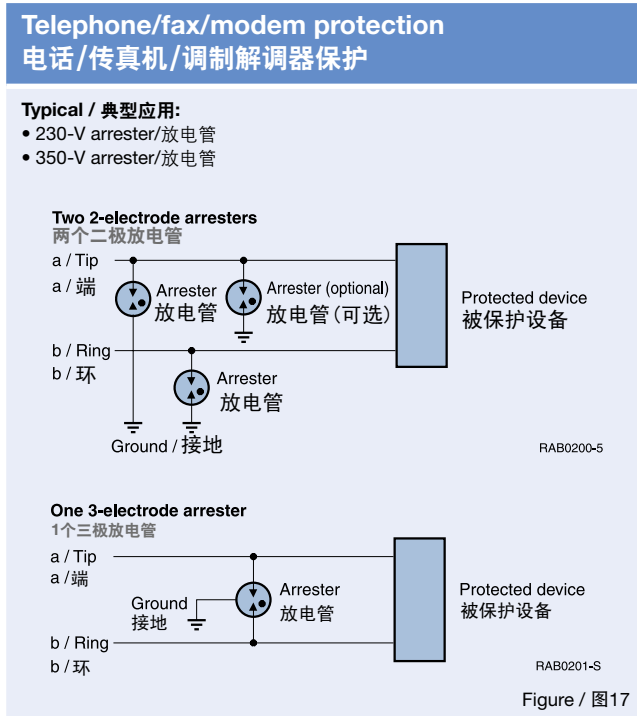
三端保护线路连a/b线和地线，通过将浪涌电压导入地下而起到保护作用。二极管（图9）和三极管（图10）都应用于其中。带有失效保护卡（图11和12）的放电管则代表另一种形式。详细信息，请参见14页。

五端保护

除了气体放电管以外，五端保护线路中还包含有限流元件，通常为PTC热敏电阻。热敏电阻在浪涌电流产生时呈高阻抗状态，以阻止更大电流通过。

图13和14为装设二极管和三极管的线路，图15和16为装设失效保护卡的其它放电管形式（详见14页）。但是，在有恒电流供应的情况下，已被激活的热敏电阻可能不会恢复到低阻抗状态。

Telecom Applications 电信应用

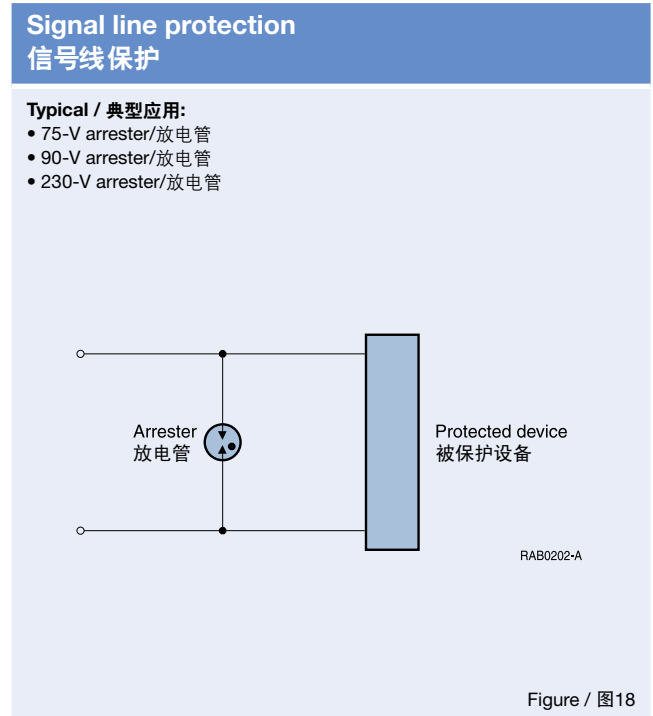


Telephone/fax/modem protection

Telephones, faxes and modems are equipped with sophisticated but sensitive electronics. Typical protection circuits with surge arresters are shown in **Figure 17**. These arresters protect against common-mode interference voltages, i.e. surge voltages that appear in both lines to ground. In the event of an overvoltage, the arrester protects both exchange lines by conducting the surge current away to ground.

Signal line protection

Signal circuits are often run with no ground conductor. A 2-electrode arrester circuit located between the two signal lines prevents the formation of large potential differences at the input of the equipment to be protected before they can cause any damage (**Figure 18**). This circuit offers differential-mode protection.



电话/传真/调制解调器保护

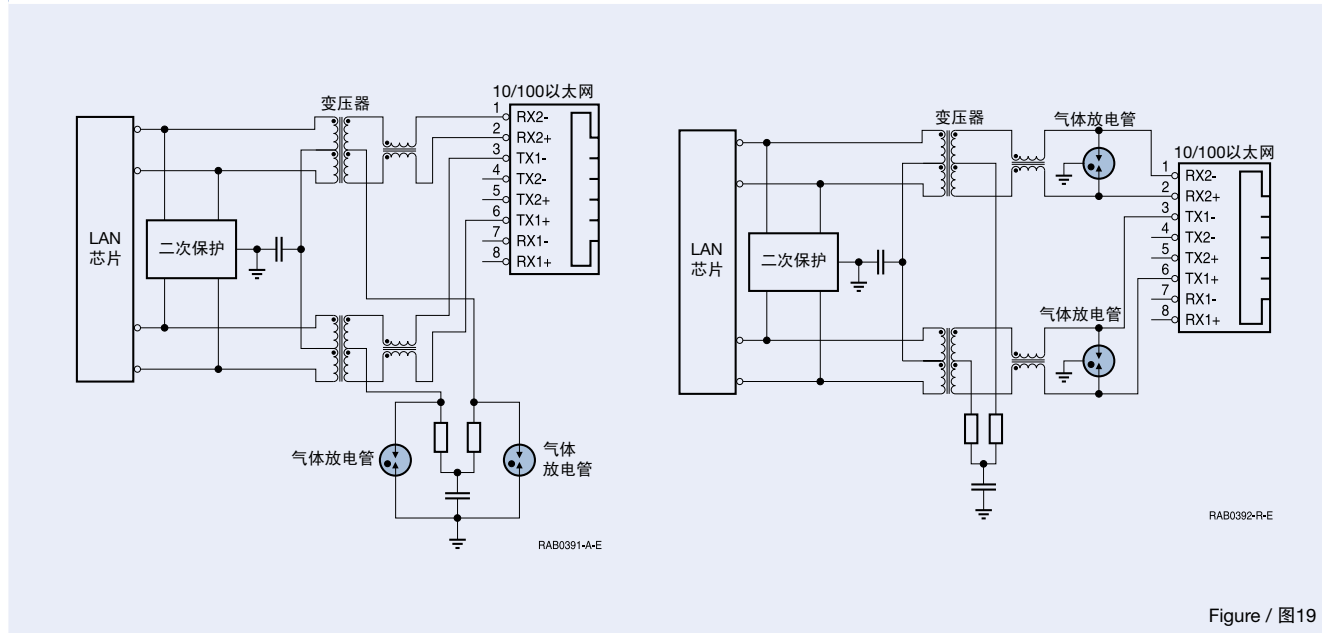
电话、传真机和调制解调器配备精密但是敏感的电子装置。典型的气体放电管保护电路图如图17所示。这些放电管可防止共模干扰电压，即同时出现在两条接地线上的浪涌电压。如果出现过压情况，放电管将浪涌电流向地导通从而保护两条交换机线路。

信号线保护

路通常没有接地导体。位于两条信号线之间的一个二极放电管电路可以在受保护设备输入端在破坏发生之前阻止大电位差的形成（见图18）。该电路提供差模保护。

Telecom Applications 电信应用

Overvoltage protection of Ethernet interfaces 以太网接口过压保护



Protection of Ethernet interfaces

Voltage surges in telecommunication systems caused by lightning or line power faults can damage sensitive electronic circuitry.

Protection components are used inside the device interfaces to avoid such damage. EPCOS offers surge arresters with 2- and 3-electrodes especially designed to protect data interfaces.

The design activities focused on achieving small SMD housing, high current capability, high insulation resistance and low capacity.

Typical applications are Ethernet interfaces in routers and switches, patch panels, modems, PCs and laptops, set-top boxes, IP-TV, CCTV, WLAN-AP.

Examples for the application of surge arresters can be found in **Figure 19**.

以太网接口保护

由雷电或线路电源故障导致的电信系统冲击电压，可能会损坏敏感的电子电路。

应用于设备接口内部的保护元件可以避免这种损坏。爱普科斯提供了专为数据保护接口而设计的二极和三极气体放电管。

这种放电管的突出特点是微型SMD（表面贴装型）外壳、高通流能力、高绝缘电阻以及较低的电容量。

典型应用是路由器和交换机、接线板、调制解调器、PC和笔记本电脑、机顶盒、IP电视、CCTV（闭路电视监控系统），WLAN-AP的以太网接口。

气体放电管的应用实例，请参见图19。

Telecom Applications

电信应用

Data line protection (RS485) 数据线保护(RS485)

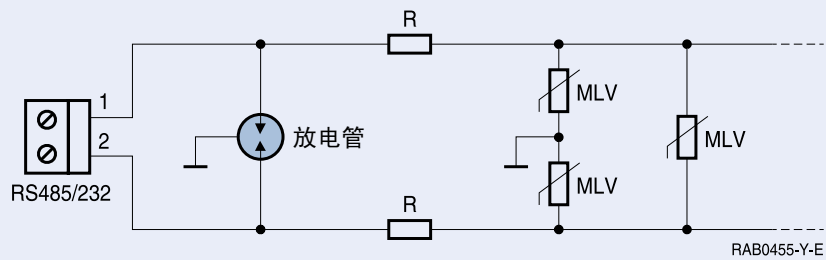


Figure / 图20

Data line protection (RS485)

RS485 interfaces are used for serial data transmissions in a wide range of computer, telecommunications and automation systems. At the receiver, the data signal is determined from the difference between the two signal levels, making data transmission less susceptible to common-mode interference.

A typical circuit for protection against voltage surges consists of a primary side with surge arresters and a secondary side with multilayer varistors (MLV) (see **Figure 20**).

数据线保护 (RS485)

RS485接口广泛应用于计算机、电信和自动化系统中的串行数据传输。在接收机处，数据信号通过两个信号电平之间的差值来确定，从而减少共模干扰对数据传输的影响。

典型的冲击电压保护电路，包括带气体放电管的一次侧和带多层压敏电阻(MLV)的二次侧（见图20）。

Telecom Applications 电信应用

CATV/Coax line protection 有线电视/同轴线路保护

Typical / 典型应用:

- 145-V arrester/放电管
- 150-V arrester/放电管
- 230-V arrester/放电管

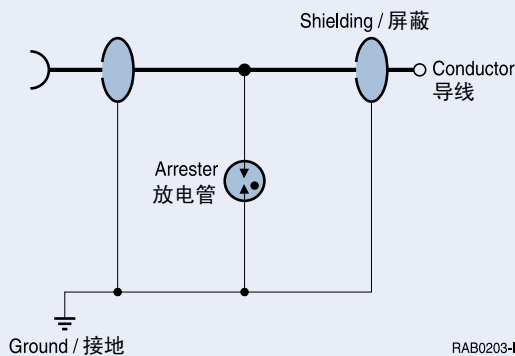


Figure / 图21

AC line protection 交流电线保护

Typical / 典型应用:

- 适合110 VAC应用的270-V放电管
- 适合230 VAC应用的470-V放电管
- 适合230 VAC应用的600-V放电管
- 适合400 VAC应用的800-V放电管

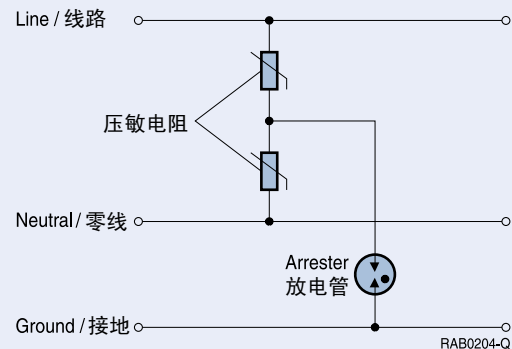


Figure / 图22

Cable TV/coaxial cable protection

Arresters are particularly well suited for protecting the coaxial cables frequently laid in CATV networks, as they do not disturb the system even at high frequencies thanks to their low self-capacitance of typ. 0.5 to 1 pF. The arrester is contained in the coaxial protection module where it is connected between the central conductor and the shielding. It is recommended to ground either the shielding or the housing of the protection module, depending on the application (Figure 21).

AC line protection

Telecommunication installations as well as CATV amplifiers, CB transmitters, home entertainment systems, computers and similar equipment can be exposed to voltage surges via the power network. The combination of a surge arrester and a varistor offers proven protection in these cases. The phase and neutral conductors are connected to ground potential of both protection elements (Figure 22).

EPCOS arresters can be used in SPDs (surge protective devices), to fulfill IEC 61643-11 class I, II or III requirements.

电缆TV/同轴电缆保护

气体放电管特别适用于有线电视网络中的同轴电缆保护。由于放电管具有很低的寄生电容（一般为0.5至1 pF），即使在高频状态都不会对系统造成干扰。放电管置于保护模块中并与导体和外包线连接。根据实际应用，外包线或者保护模块的外盒必须接地（图21）。

交流线路保护

通信装置及有线电视放大器、CB传送器、家用娱乐系统、电脑以及类似设备都有可能接触到电网所感应的浪涌电压。结合使用气体放电管和压敏电阻可对上述情况实施有效保护。通过带有这两种保护元件的串联线路使相线和零线接地（图22）。

爱普科斯放电管可用于符合EN/IEC 61643-11 I、II和III级要求的浪涌保护装置 (SPD)。

Definitions, Measuring Conditions

定义和测试条件

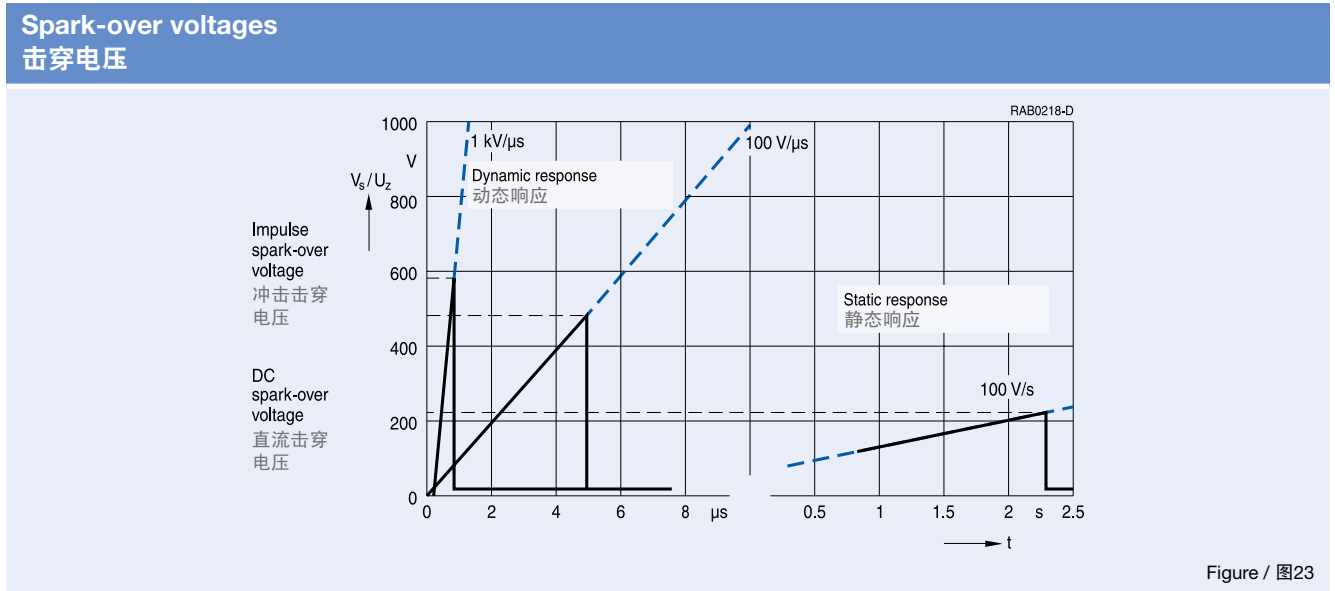


Figure / 图23

DC spark-over voltage V_{sdc}

This voltage is determined by applying a voltage with a low rate of rise $dv/dt = 100 \text{ V/s}$ (Figure 23).

Due to the physical phenomenon of a gas discharge the values are subject to statistical variation.

Tolerance of V_{sdcN}

The tolerance in % is generally specified as a percentage of V_{sdcN} . Tolerance specifications take into account individual and batch variations in arrester production.

Impulse spark-over voltage

The impulse spark-over voltage characterizes the dynamic behavior of a surge arrester (Figure 23). The values specified in the product part refer to a voltage rise rate of $dv/dt = 100 \text{ V}/\mu\text{s}$ and $1 \text{ kV}/\mu\text{s}$. Complete breakdown distribution versus rise time is available upon request.

直流击穿电压 V_{sdc}

此值由施加一低上升速率 $dv/dt = 100 \text{ V/s}$ 的电压(图23)所确定。

由于受到气体放电所产生的物理现象的影响，这些值会呈现统计规律变化。

标称直流击穿电压 V_{sdcN} 容差

此容差一般用 V_{sdcN} 的百分数来表示。容差定义考虑了单个和批量放电管生产中的因素变化。

冲击击穿电压

冲击击穿电压表示气体放电管的动态特性(图23)。本目录产品部分所列数据参照的电压上升速率为 $dv/dt = 100 \text{ V}/\mu\text{s}$ 和 $1 \text{ kV}/\mu\text{s}$ 。完整的冲击击穿电压分布与上升时间数据可根据要求提供。

Definitions, Measuring Conditions

定义和测试条件

Standard impulse discharge current 8/20 μ s 标准冲击放电电流8/20 μ s

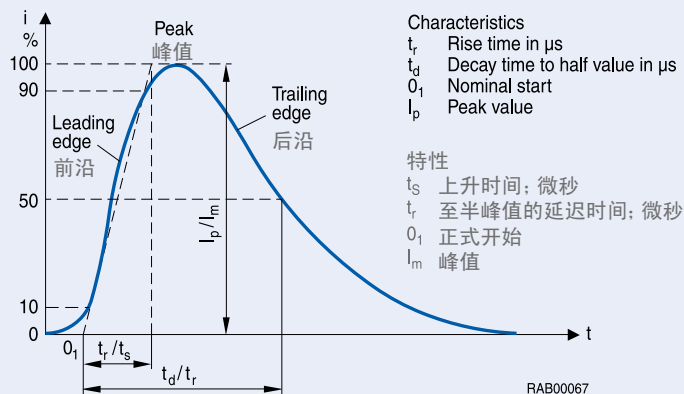


Figure / 图24

Service life

Alternating discharge current

This is the RMS value of an AC current with a frequency of 15 Hz to 62 Hz, which the gas discharge tube is designed to carry for a defined time.

e.g.

ITU-T K12: 10 operations at 50 Hz, 1 s

RUS PE 80: 11 cycles at 60 Hz (9 cycles at 50 Hz)

Impulse discharge current

This is the peak value of the impulse current, with a wave form defined with reference to the time, for which the gas discharge tube is rated.

Wave form is defined in IEC 62475 as rise time/ decay time to half value (see **Figure 24**), e.g. wave form 8/20 μ s surge current with rise time of 8 μ s and decay time to half value of 20 μ s.

e.g.

ITU-T K12:

- 10 operations with rated discharge current 8/20 μ s
- 1 operation with rated discharge current 10/350 μ s
- 300 operations with rated discharge current 10/1000 μ s

使用寿命

工频放电

这是频率为15 Hz至62 Hz时的工频电流有效值，气体放电管专为规定时间而设计。

示例:

ITU-T K12要求: 10次放电(50 Hz/1s)

RUS PE 80要求: 11周期/60 Hz (9周期/50 Hz)

冲击放电电流

这是冲击电流的峰值，其波形定义相对气体放电管的额定时间而言。

IEC 62475定义的波形上升时间/衰减时间为半峰值时间(见图24)，示例: 8/20 μ s冲击电流波形，其上升时间为8 μ s，衰减时间为20 μ s的一半。

示例:

ITU-T K12:

- 10次8/20 μ s额定放电电流放电
- 1次10/350 μ s额定放电电流放电
- 300次10/1000 μ s额定放电电流放电

Definitions, Measuring Conditions

定义和测试条件

Maximum follow current

For the type series EF (data sheet see page 48) we specify this performance feature as the maximum permissible peak current which may flow from the supply current source through the arrester in the interval between the decay of the surge and the following zero crossing of the AC voltage. This discharge may be repeated ten times with an interval of 30 s.

For notes about power line applications refer to page 16.

Insulation resistance R_{ins}

Ohmic resistance of the non-ignited arrester:

- Requirement of ITU-T K12 $> 10^9 \Omega$
- EPCOS surge arresters ¹⁾ $> 10^{10} \Omega$

As a rule the arrester is tested with a voltage of 100 V DC. This value is reduced to 50 V DC for types with 90 and 150 V DC.

Capacitance C

Self-capacitance of the arrester without holder:

- Requirement of ITU-T K12 $< 20 \text{ pF}$
- EPCOS surge arresters $0.2 \dots 3 \text{ pF}$
(depending on type)

Test configuration for 3-electrode arresters

The specified parameters as spark-over voltage, insulation resistance and capacitance refer to the respective measurements between one of the two wire electrodes (a/b) and the center electrode (c).

Unless otherwise specified, the impulse or AC current is applied simultaneously from the two line electrodes to the center electrode with the defined value as the total current through the center electrode (c).

¹⁾ Unless otherwise specified

最大续电流

对于EF系列（参见48页数据表），我们将其最大续电流定义为当冲击电流衰减至下一交流电压过零点时，从电流源流至放电管的最大允许峰值电流。在30秒时限内，这种放电可以重复10次。

电源线应用请参见16页。

绝缘电阻 R_{ins}

未点火放电管的绝缘电阻:

- ITU-T K12要求 $> 10^9 \Omega$
- 爱普科斯气体放电管 ¹⁾ $> 10^{10} \Omega$

一般情况下，气体放电管的测试电压为100 V DC。90和150 V DC型号放电管的测试电压为50 V DC。

电容C

放电管自身电容（不加卡簧）:

- ITU-T K12要求 $< 20 \text{ pF}$
- 爱普科斯气体放电管 $0.2 \dots 3 \text{ pF}$
(视型号而定)

三极管测试形式

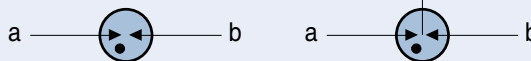
参照相关测试方法，在任意一端电极(a/b)与中间电极(c)之间对特定的参数进行测量，比如击穿电压、绝缘电阻及电容。

除非另有说明，本目录上所注明的冲击或工频电流是指从两端电极同时加载到中间电极(c)上的总电流。

¹⁾ 除非另有说明

Circuit symbol for 2-electrode and 3-electrode arrester:

a, b Line (tip/ring) electrode
c Center electrode

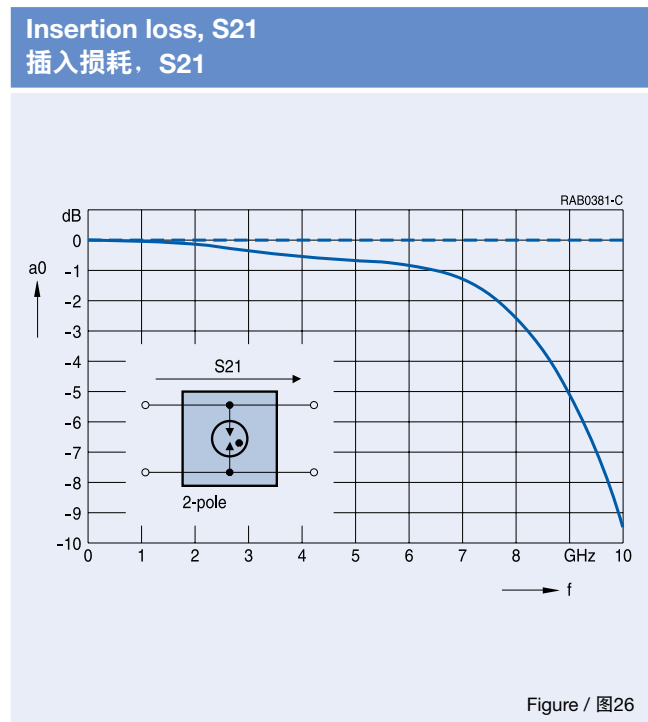
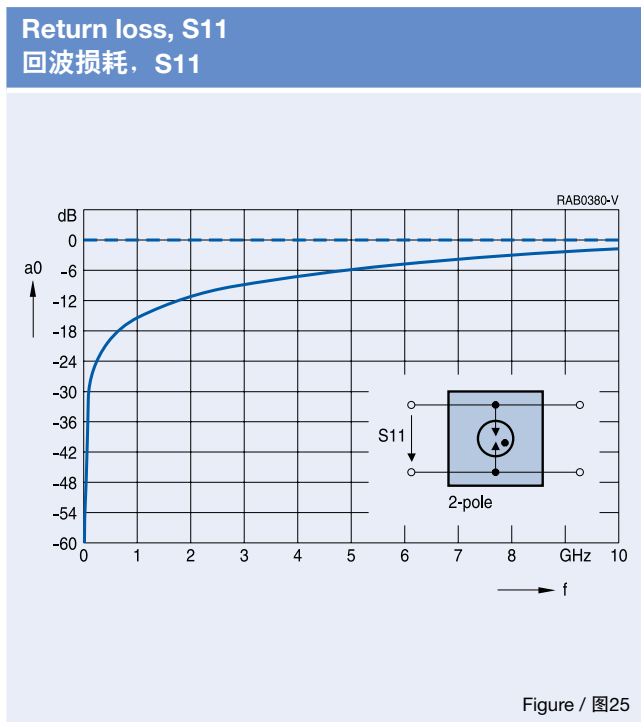


二极和三极放电管的电路符号:

a, b 线(端/环)电极
c 中间电极

Definitions, Measuring Conditions

定义和测试条件



S-parameters

Surge arresters are preferred in high-frequency applications due to their low capacitance and high insulation resistance. To determine the impact of surge arresters on the performance of electrical networks, S-parameters

are essential tools for design definitions. A typical application is shown in **Figure 21**. The most important parameters of such a two-port network are S11 (input return loss) and S21 (insertion loss). For EPCOS surge arresters applicable in RF telecommunication systems those

parameters can be provided. Typical behavior of S11 and S21 versus frequency are shown in **Figure 25** and **Figure 26**.

S参数

气体放电管具有低电容和高绝缘电阻，是高频应用场合的理想选择。为了确定气体放电管对供电网络性能的影响，一般采用S参数作为设计定义的重要工具。典型应用如图21所示。在这种双端口网络中，最重要的参数是S11（输入回波损耗）和S21（插入损耗）。在射频电信系统中，我们给出了爱普科斯气体放电管的这些参数。图25和图26中给出了S11和S21与频率之间的典型关系。

Overview of Types

型号概览



2-electrode arresters 二极放电管		Latest data sheets are available at www.epcos.com/arresters 如需下载最新数据表，敬请访问 www.epcos-china.com/arresters							
系列号	S25 / S20	G3 / G41	S30	ES	EM	EHV6	S50	M5	EC
放电等级 ¹⁾ kA / A	轻载型								
	0.5 / -	1 / -	2 / 2	2.5 / 2.5	2.5 / 2.5	3 / -	5 / 5	5 / 5	5 / 5
直径尺寸 mm (Ø x l)	3.2 x 1.6 x 1.6/ 3.2 x 2.5 x 2.5	2.8 x 3.5/ 4 x 5.1	4.5 x 3.2 x 2.7	4.7 x 4.0	5.5 x 6.0	6 x 7	5.7 x 5 x 5	5 x 5	8 x 6
页码	32	33/34	35	36	37	38	39	40	41
$V_{sdicN}^{2)}$ V									
75									
90									
140									
150									
200									
230									
250									
260									
300									
350									
400									
420									
470									
500									
600									
900									
1000									
2000									
2500									
3000									
3600									
4000									
4500									
Typical applications 典型应用	Customer premises equipment such as DSL modems, WLAN routers, TV sets and cable modems. 用户终端设备，比如DSL调制解调器、WLAN路由器、电视机和电缆调制解调器。								
<p>气体放电管通常根据其放电能力进行分类。 上述内容将产品的型号系列和放电等级联系起来，并列出了可用的额定电压值。 根据耐流级别，单个的产品型号系列可以指派到典型应用上。</p>									

¹⁾ 浪涌电流: 10 x 8/20 μs总电流波; 工频电流: 10 x 1 s / 50 Hz总电流

²⁾ 标称直流击穿电压








Overview of Types

型号概览



2-electrode arresters 两极放电管

Latest data sheets are available at www.epcos.com/arresters
如需下载最新数据表，请访问www.epcos-china.com/arresters

							
系列号	N8	A7 / A9	S80	A8	A83	EF	V1
放电等级 ¹⁾ kA / A	中载型		重载型				
直径尺寸 mm (Ø x l)	8 × 6	8 × 8 / 9 × 9	6 × 8.3 × 8.3	8 × 6	8 × 20	8 × 6	11.8 × 17.4
页码	42	46/47	43	44	45	48	49
V _{sdclN} ²⁾ (V)							
75							
90							
150							
170							
230							
250							
270							
350							
470							
500							
600							
800							
1000							
1200							
1400							
1500							
1600							
2200							
2500							
3000							
3500							
4500							
5500							
6200							
7500							
Typical applications	Crossover junctions for overhead cables, underground cables, subscriber protection		Overhead lines and installations particularly susceptible to lightning threats, subscriber protection in exposed locations				
典型应用	架空电缆、地下线缆转接接头，以及终端保护		高架线和容易遭受雷击的装置，以及露天终端保护。				

气体放电管通常根据其放电能力进行分类。
上述内容将产品的型号系列和放电等级联系起来，并列出了可用的额定电压值。
根据耐流级别，单个的产品型号系列可以指派到典型应用上。

¹⁾ 浪涌电流: 10 x 8/20 μs总电流波; 工频电流: 10 x 1 s / 50 Hz总电流

²⁾ 标称直流击穿电压

Overview of Types

型号概览



3-electrode arresters 三极放电管			Latest data sheets are available at www.epcos.com/arresters 如需下载最新数据表，敬请访问 www.epcos-china.com/arresters							
系列号	TG3	TQ30F	T4N	TQ9	T9	T3	T8	T2	T6	T2 美国规格
放电等级 ¹⁾ kA / A	轻载型		中载型					重载型		
	2 / 2	2 / 2	10 / 10	10 / 10	10 / 10	10 / 10	10 / 10	20 / 10	20 / 20	20 / 10
直径尺寸 mm (Ø x l)	6.8 × 3.5	2 × 6.2	14.3 × 8.3	7.6 × 5 × 5	7.6 × 5	8 × 6	10 × 8	10 × 8	11.5 × 9.5	8 × 10
页码	51	51	50	51	52	53	54/55/56	57/58	59	60
V _{sdcrN} ²⁾ (V)										
75										
90										
150										
230										
250										
260										
300										
350										
400										
420										
470										
500										
600										
650										
Typical applications 典型应用	Protection of data lines 数据线保护		Main distributor and subscriber protection in regions with high frequency of lightning strikes 在经常遭受雷电袭击的地区使用的主配线架和终端保护		Crossover junctions for overhead cables, underground cables, subscriber protection 架空电缆、地下线缆转接接头，以及终端保护			Overhead lines and installations particularly susceptible to lightning threats, subscriber protection in exposed locations 高架线和容易遭受雷击的装置，以及露天终端保护。		

Surge arresters are usually classified by their discharge capability.
The overview above relates type series to discharge classes and shows the available voltage ratings.
According to their discharge class the individual type series can be assigned to typical applications.
气体放电管通常根据其通流能力进行分类。
上述内容将产品的型号系列和放电等级联系起来，并列出了可用的额定电压值。
根据耐流级别，单个的产品型号系列可以指派到典型应用上。

¹⁾ Surge current: 10 x 8/20 µs wave in total;
AC current: 10 x 1 s / 50 Hz in total

¹⁾ 浪涌电流: 10 x 8/20 µs 总电流波;
工频电流: 10 x 1 s / 50 Hz 总电流

²⁾ Nominal DC spark-over voltage

²⁾ 标称直流击穿电压

Designation System

放电管标志说明

2-electrode arresters / 二极放电管

Example / 示例: M51-A350XG

Type / 型号	Dimensions / 尺寸	Discharge class / 耐流等级	Page / 页码	
G30/ G31	∅ 2.8 × 3.5 mm	1 kA / -	33	M5
S20	3.2 × 1.6 × 1.6 mm	0.5 kA / -	32	
S30	4.5 × 3.2 × 2.7 mm	2 kA / 2A	35	
EHV6	∅ 6 × 7 mm	3 kA / -	38	
M5	∅ 5 × 5 mm	5 kA / 5 A	40	
S50	5.7 × 5 × 5 mm	5 kA / 5 A	39	
S80	6 × 8.4 × 8.4 mm	20 kA / 20 A	43	
N8	∅ 8 × 6 mm	10 kA / 10 A	42	
A8/ A83	∅ 8 × 6 mm, 8 × 20 mm	20 kA / 20 A	44, 45	
A7/ A9	∅ 8 × 8 mm, 9 × 9 mm	10 kA / 10 A	46, 47	
V1	∅ 11.8 × 17.4 mm	20 kA / 20 A	49	
Lead styles / 引线类型		without leads / 无引线	0	1
		straight leads / 直引线	1	
Internal identification (e.g. -A, -C, -H) / 内部编码 (如-A, -C, -H) V _{sdcN} following A or C is specified in V, following H in 100 × V / 编码为A或C的型号, V _{sdcN} 单位为V; 编码为H的型号, V _{sdcN} 单位为100 × V				-A
Nominal DC spark-over voltage (e.g. 90 V, 230 V, 350 V, 600 V) / 标称直流击穿电压 (如90 V、230 V、350 V、600 V)				350
Internal coding / 内部编码			X	X
Taped on reel / 卷带			G	G

Example / 示例: EM350XG

Type / 型号	Dimensions / 尺寸	Discharge class / 耐流等级	Page / 页码	
ES	∅ 4.7 × 4 mm	2.5 kA / 2.5A	36	EM
EM	∅ 5.5 × 6 mm	2.5 kA / 2.5 A · 2 kA / 2 A; 1.5 A	37	
EC, EF	∅ 8 × 6 mm	5 kA / 5 A	41, 48	
Nominal DC spark-over voltage (e.g. 90 V, 230 V, 350 V, 400 V, 600 V) / 标称直流击穿电压 (如90 V、230 V、350 V、400V和600 V)				350
Internal coding / 内部编码			X	X
Taped on reel / 卷带			G	G

3-electrode arresters / 三极放电管

Example / 示例: T80-A230XF

Type / 型号	Dimensions / 尺寸	Discharge class / 耐流等级	Page / 页码	
TG3	∅ 3.5 × 6.8 mm	2 kA / 2 A	51	T8
TQ90	7.6 × 5 × 5 mm	10 kA / 10 A	51	
T9	∅ 5 × 7.6 mm	10 kA / 10 A	52	
T3	∅ 6 × 8 mm	10 kA / 10 A	53	
T8	∅ 8 × 10 mm	10 kA / 10 A	54, 55, 56	
T2	∅ 8 × 10 mm	20 kA / 10 A	57, 58	
T6	∅ 9.5 × 11.5 mm	20 kA / 20 A	59	
T2 (美国规格)	∅ 8 × 10 mm	20 kA / 10 A / -	60	
Lead styles / 引线式		without leads / 不带引线	0	0
		straight leads / 直引线	1	
		standard / 标准引线	3	
		short leads / 短引线	5	
Internal identification (e.g. -A, -C) / 内部识别号 (如-A和-C)				-A
Nominal DC spark-over voltage (e.g. 90 V, 230 V, 350 V, 600 V) / 标称直流击穿电压 (如90 V、230 V、350 V和600 V)				230
Internal coding / 内部编码			X	X
Position short-circuit spring / 短路簧片位置		undefined / 待定	F	F
		on top / 顶部	F1	
		below / 下部	F4	

If the meaning of the other code letters and numbers is unclear to you, inquire at EPCOS.
如果不清楚其他编码的意义, 请咨询爱普科斯 (EPCOS)。

2-Electrode Arresters 二极放电管



轻载型 1 kA • 3.2 × 2.5 × 2.5 mm		轻载型 0.5 kA • 3.2 × 1.6 × 1.6 mm					
S25-... / EIA外壳尺寸 1210 / 公制 3225		S20-... / EIA 外壳尺寸 1206 / 公制 3216					
SMD		SMD					
型号 订货号	S25-A90X B88069X 2253T203	S20-A140X B88069X 3013T303	S20-A200X B88069X 9731T303	S20-C350X B88069X 3033T303	S20-A470X B88069X 1193T303	S20-A500X B88069X 1513T303	
标称直流击穿电压 V_{sdCN}	90	140	200	350	470	500	V
V_{sdCN} 容差	±20	±30	±30	-25/+40	±30	±20	%
冲击击穿电压							
测量值 @ 100 V/ μ s 99%	< 500	< 800	< 700	< 900	< 1050	< 1050	V
典型值@ 100 V/ μ s	< 400	< 700	< 500	< 800	< 950	< 950	V
测量值 @ 1 kV/ μ s 99%	< 700	< 900	< 1100	< 1150	< 1200	< 1200	V
典型值@ 1 kV/ μ s	< 600	< 800	< 800	< 1000	< 1050	< 1050	V
使用寿命							
标称耐冲击电流10次, 8/20 μ s	1	0.5	0.5	0.5	0.5	0.5	kA
标称耐冲击电流10次, 5/320 μ s ¹⁾	-	150	150	150	150	150	A
绝缘电阻	> 1	> 1	> 1	> 1	> 1	> 1	G Ω
电容@ 1 MHz	< 0.5	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3	pF

¹⁾ 测试信号发生器6 kV, 40 Ω

尺寸单位为mm

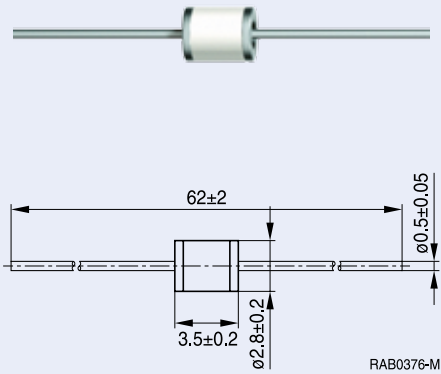
封装信息请参见第83页。

2-Electrode Arresters 二极放电管



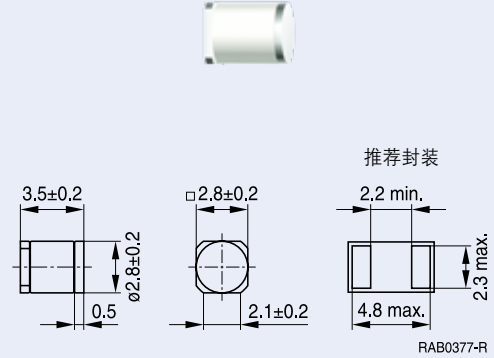
轻载型
1 kA • ϕ 2.8 × 3.5 mm

G31-...



G30-...

SMD



型号 订货号	G31-A75X B88069X 8091B502	G30-A90XSMD B88069X 4103T203 G31-A90X B88069X 9361B502	G31-A200X B88069X 8801B502 B88069X 8801T103	G31-A300X B88069X 2203B502 B88069X 2203T103	G31-A400X B88069X 9321B502	G30-A500XSMD B88069X 2243T203 G31-A500X B88069X 2233B502
-----------	---------------------------------	---	---	---	----------------------------------	---

标称直流击穿电压 V_{sdCN}	75	90	200	300	400	500	V
V_{sdCN} 容差	±20	±20	±20	±20	±20	±30	%

冲击击穿电压

测量值 @ 100 V/ μ s 99%	< 350	< 400	< 500	< 900	< 900	< 1200	V
典型值@ 100 V/ μ s	< 300	< 300	< 450	< 600	< 600	< 1000	V
测量值 @ 1 kV/ μ s 99%	< 650	< 650	< 700	< 1200	< 1200	< 1400	V
典型值@ 1 kV/ μ s	< 600	< 600	< 650	< 800	< 850	< 1200	V

使用寿命

标称耐冲击电流10次, 8/20 μ s	1	1	1	1	1	1	kA
单次耐冲击电流1次, 8/20 μ s	2	2	2	2	2	2	kA
使用寿命300次, 8/20 μ s	100	100	100	100	100	100	A
脉冲放电200次, 1.5 nF; 10 kV; 0 Ω	$1.5 \cdot 10^{-5}$	$1.5 \cdot 10^{-5}$	$1.5 \cdot 10^{-5}$	$1.5 \cdot 10^{-5}$	$1.5 \cdot 10^{-5}$	$1.5 \cdot 10^{-5}$	As
绝缘电阻	> 1	> 1	> 1	> 1	> 1	> 1	G Ω
电容@ 1 MHz	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	pF

尺寸单位为mm

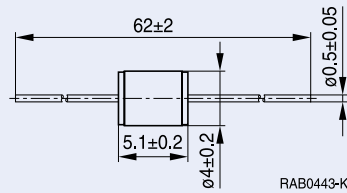
封装信息请参见第83页。

2-Electrode Arresters 二极放电管

轻载型

1 kA • \varnothing 4.0 × 5.1 mm

G41-...



型号	G41-H30	G41-H36	
订货号	B88069X4273T103	B88069X4203T103	
标称直流击穿电压 V_{sdcN}	3000	3600	V
V_{sdcN} 容差	±20	±20	%
冲击击穿电压			
测量值 @ 100 V/ μ s 99%	< 3800	< 4600	V
典型值@ 100 V/ μ s	< 3600	< 4400	V
测量值 @ 1 kV/ μ s 99%	< 4000	< 4800	V
典型值@ 1 kV/ μ s	< 3800	< 4600	V
使用寿命			
标称耐冲击电流10次, 8/20 μ s	1	1	kA
单次耐冲击电流3次, 8/20 μ s	2	2	kA
使用寿命300次, 8/20 μ s	100	100	A
绝缘电阻	> 1	> 1	G Ω
电容@ 1 MHz	< 0.5	< 0.5	pF

尺寸单位为mm

封装信息请参见第83页。

2-Electrode Arresters 二极放电管

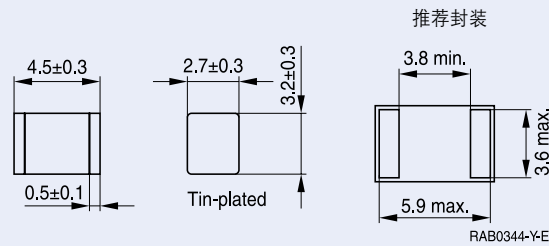


轻载型

2 kA / 2 A • 4.5 × 3.2 × 2.7 mm

S30-... / EIA外壳尺寸1812 / 公制4532

SMD



型号 订货号	S30-A75X B88069X 1023T203	S30-A90X B88069X 9231T203	S30-A150X B88069X 6071T203	S30-A230XS B88069X 9801T203	S30-A300XS B88069X 6891T203	S30-A350X B88069X 8361T203	S30-A420XS B88069X 6311T203	S30-A500XS B88069X 1873T203	
标称直流击穿电压 V_{sdCN}	75	90	150	230	300	350	420	500	V
V_{sdCN} 容差	±30	±30	±30	±30	±30	±25	±25	±20	%
冲击击穿电压									
测量值 @ 100 V/ μ s 99%	< 400	< 500	< 500	< 500	< 580	< 750	< 650	< 950	V
典型值@ 100 V/ μ s	< 350	< 400	< 400	< 400	< 500	< 700	< 550	< 800	V
测量值 @ 1 kV/ μ s 99%	< 700	< 600	< 600	< 600	< 650	< 900	< 750	< 1050	V
典型值@ 1 kV/ μ s	< 650	< 500	< 500	< 500	< 550	< 850	< 600	< 900	V
使用寿命									
标称耐冲击电流10次, 8/20 μ s	2	2	2	1	1	2	1	1	kA
单次耐冲击电流100次, 8/20 μ s	100	100	100	100	100	100	100	100	A
脉冲放电电流10次, 5/320 μ s ¹⁾	150	150	150	150	150	150	150	150	A
脉冲放电电流100次, 10/1000 μ s	10	10	10	10	10	10	10	10	A
绝缘电阻	> 1	> 1	> 1	> 1	> 1	> 1	> 1	> 1	G Ω
电容@ 1 MHz	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	pF

¹⁾ 测试信号发生器6 kV, 40 Ω

尺寸单位为mm

封装信息请参见第83页。

2-Electrode Arresters 二极放电管



轻载型 2.5 kA / 2.5 A • ϕ 4.7 × 4.7 mm								
ES...N	ES...SMD				ES...P			
型号 订货号	ES75XSMD B88069X 7841T902	ES90XSMD B88069X 6241T902 ES90XN B88069X 4421T103 ES90XP B88069X 5151B502	ES150XSMD B88069X 6381T902	ES260XP B88069X 5920B502	ES300XN B88069X 4190T103 ES300XSMD B88069X 4211T902 ES300XP B88069X 4180B502	ES350XN B88069X 4951T103 ES350XSMD B88069X 4911T902	ES400XSMD B88069X 5591T902	
标称直流击穿电压 V_{sdCN}	75	90	150	260	300	350	400	V
V_{sdCN} 容差	±25	±20	±20	-15 / +20	±15	±15	±15	%
冲击击穿电压								
测量值 @ 100 V/ μ s 99%	< 500	< 450	< 500	< 500	< 500	< 530	< 800	V
典型值@ 100 V/ μ s	< 450	< 300	< 450	< 450	< 450	< 450	< 750	V
测量值 @ 1 kV/ μ s 99%	< 700	< 600	< 600	< 600	< 600	< 600	< 1000	V
典型值@ 1 kV/ μ s	< 600	< 550	< 550	< 550	< 550	< 530	< 850	V
使用寿命								
标称耐冲击电流10次, 8/20 μ s	2.5	2.5	2.5	2.5	2.5	2.5	2.5	kA
单次耐冲击电流1次, 8/20 μ s	4	5	5	5	5	5	5	kA
绝缘电阻	> 1	> 1	> 1	> 1	> 1	> 1	> 1	G Ω
电容@ 1 MHz	< 1	< 1	< 1	< 1	< 1	< 1	< 1	pF

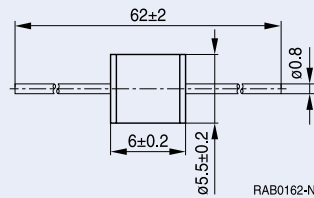
尺寸单位为mm

封装信息请参见第83页。

2-Electrode Arresters 二极放电管



轻载型 2.5 kA / 2.5 A • ϕ 5.5 x 6 mm	轻载/高压型 2 kA / 2 A • ϕ 5.5 x 6 mm
EM...	EM1000X / EM2000X



型号 订货号	EM90X B88069X 0190S102	EM230X B88069X 0900S102	EM300X B88069X 0800S102	EM350X B88069X 0590S102	EM400X B88069X 0200S102	EM1000X B88069X 4651S102	EM2000X B88069X 5600S102	
标称直流击穿电压 V_{sdclN}	90	230	300	350	400	1000	2000	V
V_{sdclN} 容差	±20	±20%	-10/+15	±20	±20	±20	±20	%
冲击击穿电压								
测量值 @ 100 V/ μ s 99%	< 400	< 600	< 700	< 800	< 800	< 1700	< 3400	V
典型值@ 100 V/ μ s	< 330	< 550	< 600	< 700	< 750	< 1600	< 3200	V
测量值 @ 1 kV/ μ s 99%	< 600	< 700	< 800	< 900	< 900	< 1900	< 4100	V
典型值@ 1 kV/ μ s	< 530	< 650	< 700	< 800	< 850	< 1800	< 3800	V
使用寿命								
标称耐冲击电流10次, 8/20 μ s	2.5	2.5	2.5	2.5	2.5	2	1.5	A
标称耐冲击电流3次, 8/20 μ s	-	-	-	-	-	2	2	kA
单次耐冲击电流10次, 8/20 μ s	2.5	2.5	2.5	2.5	2.5	-	-	kA
脉冲放电电流1次, 10/350 μ s	0.5	0.5	0.5	0.5	0.5	-	-	kA
脉冲放电电流300次, 10/1000 μ s	100	100	100	100	100	100	-	A
绝缘电阻	> 1	> 1	> 1	> 1	> 1	> 1	> 1	G Ω
电容@ 1 MHz	< 1	< 1	< 1	< 1	< 1	< 1	< 1	pF

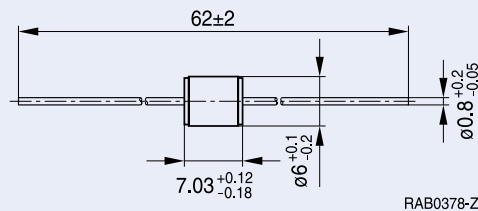
尺寸单位为mm

封装信息请参见第83页。

2-Electrode Arresters 二极放电管

轻载/高压型
3 kA / - • $\phi 6 \times 7$ mm

EHV6*-...



型号 订货号	EHV62-H25 B88069X1893S102	EHV62-H30 B88069X4193S102	EHV62-H36 B88069X1683S102	EHV62-H40 B88069X2103S102	EHV62-H45 B88069X1793S102	
标称直流击穿电压 V_{sdCN}	2500	3000	3600	4000	4500	V
V_{sdCN} 容差	±20	±20	±20	±20	±20	%
冲击击穿电压						
测量值 @ 100 V/ μ s 99%	< 3300	< 3800	< 4350	< 5000	< 5200	V
典型值@ 100 V/ μ s	< 3000	< 3400	< 4150	< 4600	< 4800	V
测量值 @ 1 kV/ μ s 99%	< 3400	< 4000	< 4500	< 5400	< 5500	V
典型值@ 1 kV/ μ s	< 3100	< 3500	< 4300	< 4800	< 5000	V
使用寿命						
标称耐冲击电流 1次, 8/20 μ s	5	5	5	5	5	kA
单次耐冲击电流3 次, 8/20 μ s	3	3	3	3	3	kA
使用寿命300次, 8/20 μ s	100	100	100	100	100	A
绝缘电阻	> 1	> 1	> 1	> 1	> 1	G Ω
电容@ 1 MHz	< 1	< 1	< 1	< 1	< 1	pF

尺寸单位为mm

封装信息请参见第83页。

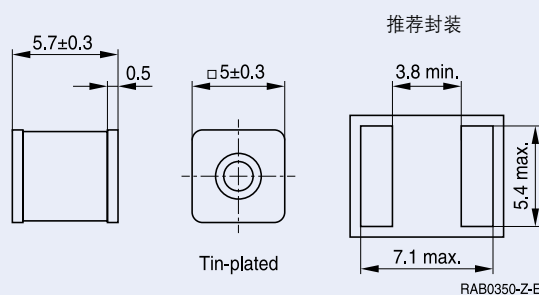
2-Electrode Arresters 二极放电管

轻载型

5 kA / 5 A • 5.7 × 5 × 5 mm

S50-... / EIA外壳尺寸2220 / 公制5750

SMD




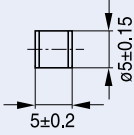

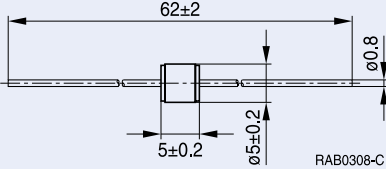
型号 订货号	S50-A90X B88069X1913T902	S50-A230X B88069X1923T902	
标称直流击穿电压 V_{sdcN}	90	230	V
V_{sdcN} 容差	±20	±20	%
冲击击穿电压			
测量值 @ 100 V/μs 99%	< 550	< 550	V
典型值@ 100 V/μs	< 500	< 500	V
测量值 @ 1 kV/μs 99%	< 600	< 650	V
典型值@ 1 kV/μs	< 550	< 600	V
使用寿命			
标称耐工频电流10次@50 Hz, 1 s	5	5	A
耐工频电流1次@50 Hz, 9周期	10	10	A
标称耐冲击电流10次, 8/20 μs	5	5	kA
单次耐冲击电流1次, 8/20 μs ¹⁾	10	10	kA
脉冲放电电流1次, 10/350 μs	0.5	0.5	kA
脉冲放电电流300次, 10/1000 μs	100	100	A
绝缘电阻	> 1	> 1	GΩ
电容@ 1 MHz	< 1	< 1	pF

¹⁾ 加载后直流击穿电压可能会超过初始值，但设备仍然是安全的。

尺寸单位为mm

封装信息请参见第83页。

2-Electrode Arresters 二极放电管

轻载型 5 kA / 5 A • $\phi 5 \times 5$ mm						
M50-...		M51-...				
  RAB0174-C		  RAB0308-C				
型号 订货号	M51-A75X B88069X6131C102	M50-C90X B88069X1590C253 M51-C90X B88069X5010C102	M50-A230X B88069X4600C253 M51-A230X B88069X2930C102	M50-A350X B88069X4630C253 M51-A350X B88069X4640C102	M51-A600X B88069X4590C102	
标称直流击穿电压 V_{sdcN}	75	90	230	350	600	V
V_{sdcN} 容差	±20	±20	±20	±20	-5/+30	%
冲击击穿电压						
测量值 @ 100 V/ μ s 99%	< 350	< 550	< 550	< 800	< 1350	V
典型值@ 100 V/ μ s	< 300	< 500	< 500	< 750	< 1200	V
测量值 @ 1 kV/ μ s 99%	< 650	< 600	< 650	< 900	< 1500	V
典型值@ 1 kV/ μ s	< 550	< 550	< 600	< 800	< 1350	V
使用寿命						
标称耐工频电流10次@50 Hz, 1 s	5	5	5	5	5	A
耐工频电流1次@50 Hz, 9周期	10	10	10	10	10	A
标称耐冲击电流10次, 8/20 μ s	5	5	5	5	5	kA
单次耐冲击电流1次, 8/20 μ s ¹⁾	10	10	10	10	10	kA
脉冲放电电流1次, 10/350 μ s	0.5	0.5	0.5	0.5	0.5	kA
脉冲放电电流300次, 10/1000 μ s	100	100	100	100	-	A
绝缘电阻	> 1	> 1	> 1	> 1	> 1	G Ω
电容@ 1 MHz	< 1	< 1	< 1	< 1	< 1	pF

¹⁾ 加载后直流击穿电压可能会超过初始值，但设备仍然是安全的。

尺寸单位为mm

封装信息请参见第83页。

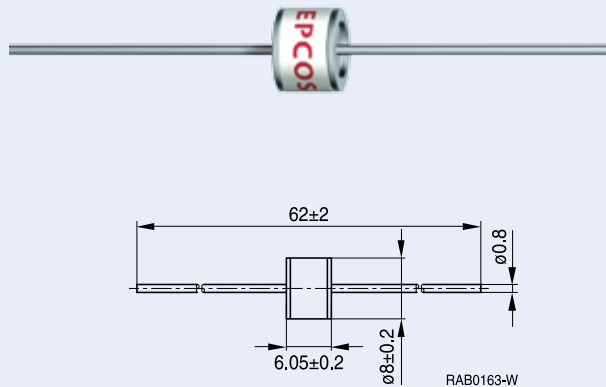
2-Electrode Arresters 二极放电管



轻载型

5 kA / 5 A • $\varnothing 8 \times 6$ mm

EC...



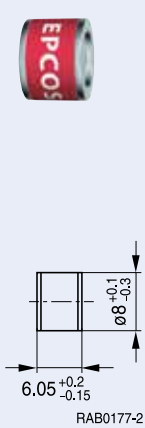
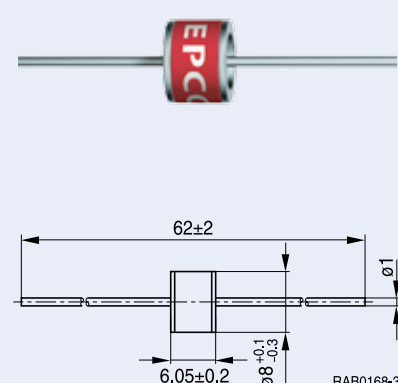
型号 订货号	EC75X B88069X 0180S102	EC90X B88069X 0720S102	EC150X B88069X 0880S102	EC230X B88069X 0660S102	EC350X B88069X 0810S102	EC600X B88069X 0780S102	
标称直流击穿电压 V_{sdCN}	75	90	150	230	350	600	V
V_{sdCN} 容差	±20	±20	±20	±15	±15	-10/+20	%
冲击击穿电压							
测量值 @ 100 V/ μ s 99%	< 500	< 500	< 500	< 550	< 800	< 1200	V
典型值@ 100 V/ μ s	< 400	< 450	< 450	< 500	< 700	< 1000	V
测量值 @ 1 kV/ μ s 99%	< 700	< 600	< 650	< 700	< 900	< 1300	V
典型值@ 1 kV/ μ s	< 600	< 550	< 550	< 600	< 800	< 1100	V
使用寿命							
标称耐工频电流10次@50 Hz, 1 s	5	5	5	5	5	10	A
耐工频电流1次@50 Hz, 9周期	20	20	20	20	20	65	A
标称耐冲击电流10次, 8/20 μ s	5	5	5	5	5	5	kA
单次耐冲击电流1次, 8/20 μ s	10	10	10	10	10	10	kA
脉冲放电电流1次, 10/350 μ s	1	1	1	1	1	1	kA
脉冲放电电流300次, 10/1000 μ s	100	100	100	100	100	-	A
绝缘电阻	> 10	> 10	> 10	> 10	> 10	> 10	G Ω
电容@ 1 MHz	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	pF

尺寸单位为mm

封装信息请参见第83页。

2-Electrode Arresters 二极放电管

中载型
10 kA / 10 A • $\varnothing 8 \times 6$ mm

N80-...		N81-...				
 <p>RAB0177-2</p>		 <p>RAB0168-3</p>				
型号 订货号	N80-C90X B88069X 4890C103 N81-A90X B88069X 4880S102	N80-A230X B88069X 4900C103 N81-A230X B88069X 4930S102	N80-A350X B88069X 4910C103 N81-A350X B88069X 4920S102	N81-A500XG B88069X 4860T502	N80-A600X B88069X 4990C103 N81-A600X B88069X 2830S102	
标称直流击穿电压 V_{sdCN}	90	230	350	500	600	V
V_{sdCN} 容差	± 20	± 20	± 20	± 20	± 20	%
冲击击穿电压						
测量值 @ 100 V/ μ s 99%	< 500	< 500	< 700	< 900	< 1100	V
典型值@ 100 V/ μ s	< 450	< 450	< 650	< 750	< 950	V
测量值 @ 1 kV/ μ s 99%	< 600	< 700	< 900	< 1100	< 1400	V
典型值@ 1 kV/ μ s	< 550	< 600	< 800	< 900	< 1100	V
使用寿命						
标称耐工频电流10次@50 Hz, 1 s	10	10	10	10	10	A
耐工频电流1次@50 Hz, 9周期	65	65	65	65	65	A
标称耐冲击电流10次, 8/20 μ s	10	10	10	10	10	kA
单次耐冲击电流1次, 8/20 μ s	12	12	12	12	12	kA
脉冲放电电流1次, 10/350 μ s	1	1	1	1	1	kA
脉冲放电电流300次, 10/1000 μ s	100	100	100	-	-	A
绝缘电阻	> 10	> 10	> 10	> 10	> 10	G Ω
电容@ 1 MHz	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	pF

尺寸单位为mm

封装信息请参见第83页。

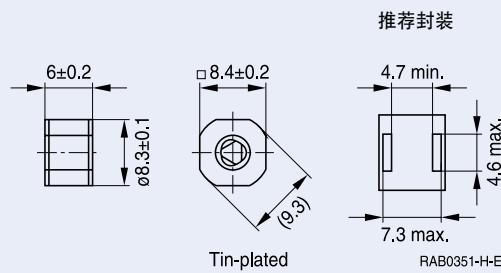
2-Electrode Arresters 二极放电管



重载型
20 kA / 20 A • 6 × 8.4 × 8.4 mm

S80-...

SMD



型号 订货号	S80-A75X B88069X1933T602	S80-A90X B88069X1673T602	S80-A230X B88069X1943T602	
标称直流击穿电压 V_{sdCN}	75	90	230	V
V_{sdCN} 容差	±20	±20	±20	%
冲击击穿电压				
测量值 @ 100 V/μs 99%	< 350	< 500	< 500	V
典型值@ 100 V/μs	< 300	< 450	< 450	V
测量值 @ 1 kV/μs 99%	< 650	< 600	< 650	V
典型值@ 1 kV/μs	< 600	< 550	< 550	V
使用寿命				
标称耐工频电流10次@50 Hz, 1 s	20	20	20	A
耐工频电流1次@50 Hz, 9周期	100	100	100	A
标称耐冲击电流10次, 8/20 μs	20	20	20	kA
单次耐冲击电流1次, 8/20 μs	25	25	25	kA
脉冲放电电流1次, 10/350 μs	2.5	2.5	2.5	kA
脉冲放电电流300次, 10/1000 μs	200	200	200	A
绝缘电阻	> 10	> 10	> 10	GΩ
电容@ 1 MHz	< 1.5	< 1.5	< 1.5	pF


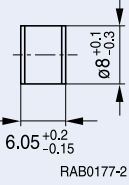

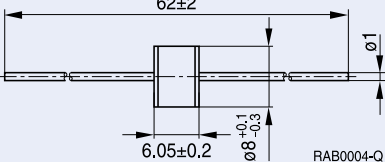
尺寸单位为mm

封装信息请参见第83页。

2-Electrode Arresters 二极放电管

重载型

20 kA / 20 A • $\varnothing 8 \times 6$ mm

A80-...		A81-...					
  RAB0177-2		  RAB0004-Q					
型号 订货号	A81-A75X B88069X 3881S102 B88069X 3881T502	A80-C90X B88069X 1410C103 A81-C90X B88069X 1380S102	A80-A230X B88069X 2240C103 A81-A230X B88069X 2250S102	A80-A250X B88069X 2920C103 A81-A250X B88069X 1500S102	A80-A350X B88069X 2230C103 A81-A350X B88069X 2380S102	A80-A600X B88069X 2900C103 A81-A600X B88069X 2880S102	
标称直流击穿电压 V_{sdCN}	75	90	230	250	350	600	V
V_{sdCN} 容差	±20	±20	±20	±20	±20	±20	%
冲击击穿电压							
测量值 @ 100 V/ μ s 99%	< 350	< 500	< 500	< 550	< 700	< 1100	V
典型值@ 100 V/ μ s	< 300	< 450	< 450	< 500	< 650	< 950	V
测量值 @ 1 kV/ μ s 99%	< 650	< 600	< 650	< 700	< 900	< 1400	V
典型值@ 1 kV/ μ s	< 600	< 550	< 550	< 650	< 800	< 1100	V
使用寿命							
标称耐工频电流10次@50 Hz, 1 s	20	20	20	20	20	20	A
耐工频电流1次@50 Hz, 9周期	100	100	100	100	100	100	A
标称耐冲击电流10次, 8/20 μ s	20	20	20	20	20	20	kA
单次耐冲击电流1次, 8/20 μ s	25	25	25	25	25	25	kA
脉冲放电电流1次, 10/350 μ s	2.5	2.5	2.5	2.5	2.5	2.5	kA
脉冲放电电流300次, 10/1000 μ s	200	200	200	200	200	-	A
绝缘电阻	> 10	> 10	> 10	> 10	> 10	> 10	G Ω
电容@ 1 MHz	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	pF

尺寸单位为mm

封装信息请参见第83页。

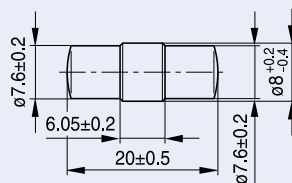
2-Electrode Arresters 二极放电管



重载型

20 kA / 20 A • $\phi 8 \times 20$ mm

A83-...



RAB0178-A

型号 订货号	A83-C90X B88069X 1450C102	A83-A150X B88069X 4350C102	A83-A170X B88069X 4360C102	A83-A230X B88069X 1420C102	A83-A350X B88069X 2860C102	A83-A600X B88069X 2890C102	
标称直流击穿电压 V_{sdCN}	90	150	170	230	350	600	V
V_{sdCN} 容差	±20	±20	±20	±20	±20	±20	%
冲击击穿电压							
测量值 @ 100 V/ μ s 99%	< 500	< 600	< 650	< 550	< 700	< 1100	V
典型值@ 100 V/ μ s	< 450	< 450	< 500	< 450	< 650	< 950	V
测量值 @ 1 kV/ μ s 99%	< 600	< 800	< 800	< 700	< 800	< 1400	V
典型值@ 1 kV/ μ s	< 550	< 600	< 600	< 550	< 700	< 1100	V
使用寿命							
标称耐工频电流10次@50 Hz, 1 s	20	20	20	20	20	20	A
耐工频电流1次@50 Hz, 9周期	100	100	100	100	100	100	A
标称耐冲击电流10次, 8/20 μ s	20	20	20	20	20	20	kA
单次耐冲击电流1次, 8/20 μ s	25	25	25	25	25	25	kA
脉冲放电电流1次, 10/350 μ s	2.5	2.5	2.5	2.5	2.5	2.5	kA
绝缘电阻	> 10	> 10	> 10	> 10	> 10	> 10	G Ω
电容@ 1 MHz	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	pF

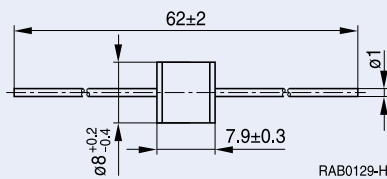
尺寸单位为mm

封装信息请参见第83页。

2-Electrode Arresters 二极放电管

中载/高压型
10 kA / 10 A • $\phi 8 \times 8$ mm

A71-...



型号 订货号	A71-H08X B88069X2140S102	A71-H10X B88069X3820S102	A71-H12X B88069X2090S102	A71-H14X B88069X2180S102	A71-H16X B88069X2610S102	
标称直流击穿电压 V_{sdCN}	800	1000	1200	1400	1600	V
V_{sdCN} 容差	±15	±15	±20	±20	±20	%
冲击击穿电压						
测量值 @ 100 V/ μ s 99%	< 1100	< 1300	< 1900	< 2100	< 2300	V
典型值@ 100 V/ μ s	< 1000	< 1200	< 1800	< 2000	< 2200	V
测量值 @ 1 kV/ μ s 99%	< 1200	< 1400	< 2000	< 2200	< 2400	V
典型值@ 1 kV/ μ s	< 1100	< 1300	< 1900	< 2100	< 2300	V
使用寿命						
标称耐工频电流10次@50 Hz, 1 s	10	10	10	10	10	A
耐工频电流1次@50 Hz, 9周期	65	65	65	65	65	A
标称耐冲击电流10次, 8/20 μ s	10	10	10	10	10	kA
单次耐冲击电流1次, 8/20 μ s	15	15	15	15	15	kA
绝缘电阻	> 10	> 10	> 10	> 10	> 10	G Ω
电容@ 1 MHz	< 1	< 1	< 1	< 1	< 1	pF

尺寸单位为mm

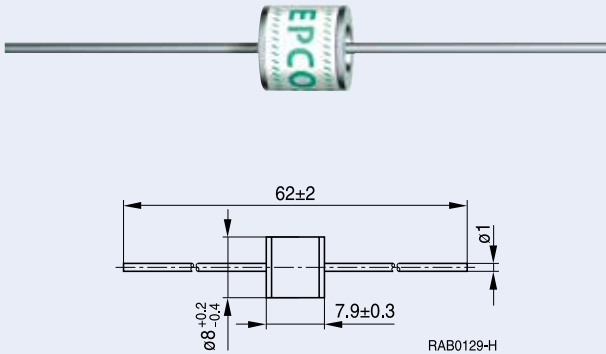
封装信息请参见第83页。

2-Electrode Arresters 二极放电管

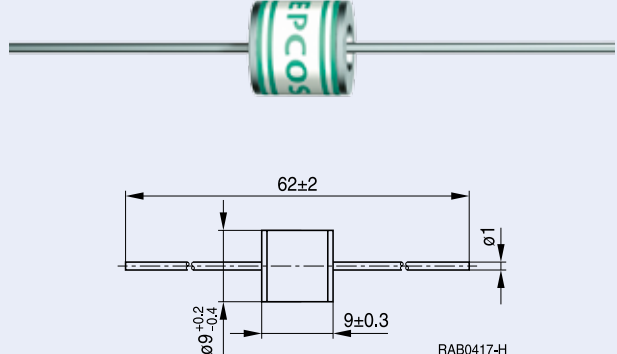


中载/高压型
10 kA / 10 A • $\varnothing 8 \times 8$ mm

A71-...



A91-...



Electrode spacing > 3 mm, acc. to IEC 60950-1
电极间距 > 3 mm, 符合 IEC 60950-1 标准

型号 订货号	A71-H25X B88069X 2190S102	A71-H35X B88069X 2200S102	A71-H45X B88069X 2590S102	A71-H55X B88069X 2620S102	A91-H62SE B88069X 3103S102	A91-H75SE B88069X 3443S102	
标称直流击穿电压 V_{sdC-N}	2500	3500	4500	5500	6200	7500	V
V_{sdC-N} 容差	±20	±20	±20	±15	-15/+20	±20	%
冲击击穿电压							
测量值 @ 100 V/μs 99%	< 3900	< 4900	< 5800	< 6500	-	-	V
典型值 @ 100 V/μs	< 3800	< 4800	< 5700	< 6000	-	-	V
测量值 @ 1 kV/μs 99%	< 4000	< 5000	< 6000	< 7000	< 9000	< 10 500	V
典型值 @ 1 kV/μs	< 3900	< 4900	< 5800	< 6500	< 8000	< 9500	V
使用寿命							
标称耐工频电流 10次 @ 50 Hz, 1 s	10	10	10	5	-	-	A
耐工频电流 1次 @ 50 Hz, 9周期	20	20	20	10	-	-	A
标称耐冲击电流 10次, 8/20 μs	10	10	10	10	5	5	kA
单次耐冲击电流 1次, 8/20 μs	15	15	15	15	10	10	kA
绝缘电阻	> 10	> 10	> 10	> 10	> 1	> 1	GΩ
电容 @ 1 MHz	< 1	< 1	< 1	< 1	< 1.5	< 1.5	pF

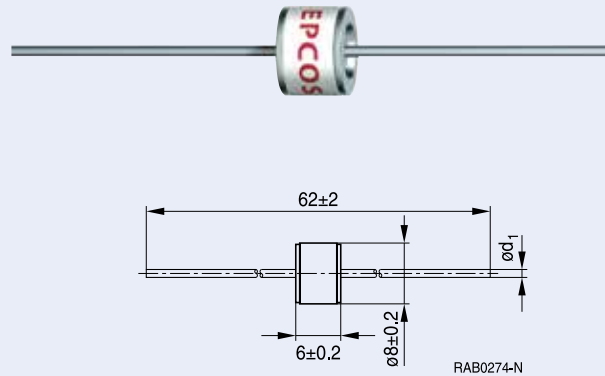
尺寸单位为mm

封装信息请参见第83页。

2-Electrode Arresters 二极放电管

带续电流限制功能的型号
5 kA / 5 A • $\varnothing 8 \times 6$ mm

EF...



型号 订货号	EF270X B88069X4131S102	EF470X B88069X5080S102	EF800X B88069X2641S102	EF1500X B88069X4301S102	EF2500XS B88069X1583S102	
标称直流击穿电压 V_{sdCN}	270	470	800	1500	2500	V
V_{sdCN} 容差	-15/+25	-15/+25	-15/+25	±20	±20	%
冲击击穿电压						
测量值 @ 100 V/ μ s 99%	< 500	< 700	< 1200	< 1800	< 3200	V
典型值@ 100 V/ μ s	< 450	< 600	< 1000	< 1700	< 3000	V
测量值 @ 1 kV/ μ s 99%	< 550	< 800	< 1300	< 2000	< 3500	V
典型值@ 1 kV/ μ s	< 500	< 700	< 1100	< 1800	< 3300	V
使用寿命						
标称耐工频电流10次@50 Hz, 1 s	5	5	5	5	5	A
耐工频电流1次@50 Hz, 9周期	65	65	65	35	35	A
标称耐冲击电流10次, 8/20 μ s	5	5	5	5	5	kA
单次耐冲击电流1次, 8/20 μ s	10	10	10	10	10	kA
单次电压冲击半周期内的最大续电流@ 50 Hz	200	200	200	200	200	A
绝缘电阻	> 10	> 10	> 10	> 10	> 10	G Ω
电容@ 1 MHz	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	pF

尺寸单位为mm

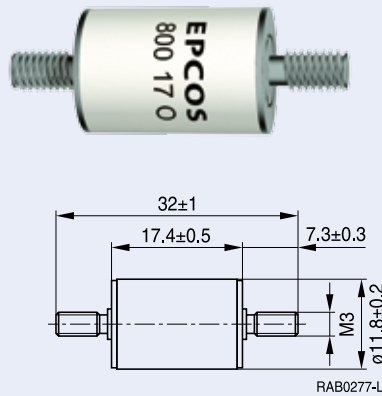
封装信息请参见第83页。

2-Electrode Arresters 二极放电管

重载型

20 kA / 20 A • ϕ 11.8 × 17.4 mm

V10-...



型号 订货号	V10-H08X B88069X9170C251	V10-H14X B88069X4300C251	V10-H22X B88069X4420CB251	V10-H30X B88069X4330C251	
标称直流击穿电压 V_{sdCN}	800	1400	2200	3000	V
直流击穿电压	±20	±20	±20	±25	%
冲击击穿电压					
测量值 @ 100 V/ μ s 99%	< 1000	< 1900	< 2700	< 4500	V
典型值@ 100 V/ μ s	< 900	< 1800	< 2400	< 4300	V
测量值 @ 1 kV/ μ s 99%	< 1200	< 2200	< 2800	< 5000	V
典型值@ 1 kV/ μ s	< 1100	< 2000	< 2500	< 4500	V
使用寿命					
标称耐工频电流10次@50 Hz, 1 s	20	20	20	20	A
耐工频电流1次@50 Hz, 9周期	120	120	120	120	A
标称耐冲击电流10次, 8/20 μ s	20	20	20	20	kA
单次耐冲击电流1次, 8/20 μ s	30	30	25	30	kA
脉冲放电电流1次, 10/350 μ s	5	-	-	-	kA
绝缘电阻	> 10	> 10	> 10	> 10	G Ω
电容@ 1 MHz	< 1.5	< 1.5	< 1.5	< 1.5	pF

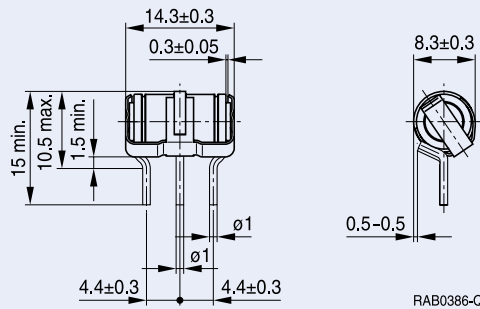
尺寸单位为mm

封装信息请参见第83页。

3-Electrode Arresters 三极放电管

放电管/压敏电阻组合
10 kA / 10 A • $\varnothing 8 \times 10$ mm

T4N-...FV



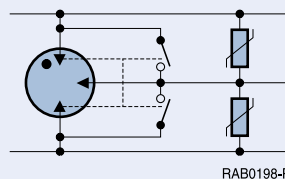
型号 订货号	T4N-A90XFV B88069X1953B202	T4N-A230XFV B88069X7480B202	
标称直流击穿电压 V_{sdCN}	90	230	V
V_{sdCN} 容差	±20	±20	%
冲击击穿电压			
测量值 @ 100 V/ μ s 99%	< 200	< 350	V
典型值@ 100 V/ μ s	< 170	< 320	V
使用寿命			
标称耐工频电流10次@50 Hz 1 s	10	10	A
标称耐冲击电流10次, 8/20 μ s	10	10	kA
单次耐冲击电流1次, 8/20 μ s	20	20	kA
绝缘电阻	> 0.1	> 0.1	G Ω
电容@ 1 MHz	< 240	< 85	pF

电流通过中心电极，每个线电极各占一半。

尺寸单位为mm


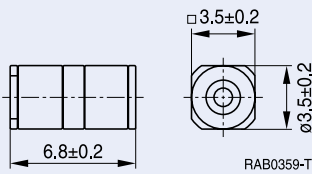

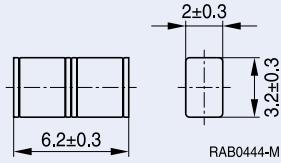

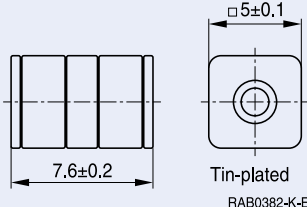
封装信息请参见第83页。

电路:



3-Electrode Arresters 三极放电管



轻载型 2 kA / 2 A • \varnothing 3.5 × 6.8 mm	轻载型 2 kA / 2 A • 2 × 3.2 × 6.2 mm	中载型 10 kA / 10 A • 7.6 × 5 × 5 mm
TG30-...	TQ30F-...	TQ90-...
SMD  	SMD  	SMD  

型号 订货号	TG30-A90XSMD B88069X9991T203	TG30-A420XSMD B88069X1833T203	TQ30F-C420 B88069X2713T203	TQ90-A90 B88069X1963T902	
标称直流击穿电压 V_{sdcN}	90	420	420	90	V
V_{sdcN} 容差	±30	±30	-17/+30	±20	%
冲击击穿电压					
测量值 @ 100 V/ μ s 99%	< 450	< 700	< 750	< 450	V
典型值@ 100 V/ μ s	< 350	< 600	< 700	< 350	V
测量值 @ 1 kV/ μ s 99%	< 650	< 800	< 870	< 650	V
典型值@ 1 kV/ μ s	< 550	< 700	< 800	< 550	V
使用寿命					
标称耐工频电流10次@50 Hz 1 s	2	-	2	10	A
耐工频电流1次@50 Hz, 0.18 s	-	-	-	-	A
标称耐冲击电流10次, 8/20 μ s	2	2	-	10	kA
单次耐冲击电流1次, 8/20 μ s	-	-	-	-	kA
使用寿命300次, 8/20 μ s	100	100	-	200	A
脉冲放电电流10次, 5/320 μ s ¹⁾	150	150	200	150	A
脉冲放电电流1次, 10/350 μ s	-	-	-	-	kA
脉冲放电电流300次, 10/1000 μ s	20	-	-	200	A
绝缘电阻	> 1	> 1	> 1	> 1	G Ω
电容@ 1 MHz	< 1.2	< 1.2	< 1.2	< 1.2	pF

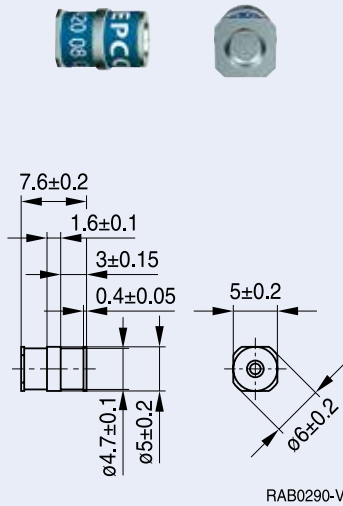
¹⁾ 测试信号发生器6 kV、10/700 μ s、40 Ω
 电流通过中心电极，每个线电极各占一半。
 尺寸单位为mm
 封装信息请参见第83页。

3-Electrode Arresters 三极放电管

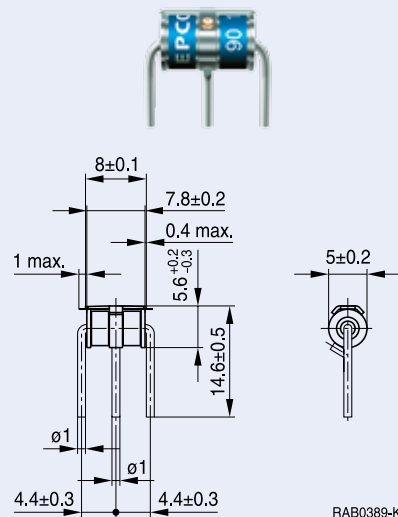
中载型
10 kA / 10 A • $\phi 5 \times 7.6$ mm

T90-...SMD

SMD



T97A-...X1F1



型号 订货号	T90-A90XSMD B88069X2331T902 T97A-A90X1F1 B88069X1713B502	T90-A230XSMD B88069X6680T902 T97A-A230X1F1 B88069X1743B502	T90-A350XSMD B88069X4030T902	T90-A420XSMD B88069X7041T902 T97A-A420X1F1 B88069X1763B502	
标称直流击穿电压 V_{sdCN}	90	230	350	420	V
V_{sdCN} 容差	±20	±20	±20	±20	%
冲击击穿电压					
测量值 @ 100 V/ μ s 99%	< 450	< 600	< 850	< 850	V
典型值@ 100 V/ μ s	< 350	< 550	< 750	< 750	V
测量值 @ 1 kV/ μ s 99%	< 600	< 700	< 1000	< 1000	V
典型值@ 1 kV/ μ s	< 500	< 650	< 850	< 900	V
使用寿命					
标称耐工频电流10次@50 Hz 1 s	10	10	10	10	A
耐工频电流1次@50 Hz, 0.18 s	10	10	10	10	A
标称耐冲击电流10次, 8/20 μ s	10	10	10	10	kA
单次耐冲击电流1次, 8/20 μ s	10	10	10	10	kA
脉冲放电电流1次, 10/350 μ s	1	1	1	1	kA
脉冲放电电流300次, 10/1000 μ s	200	200	200	200	A
绝缘电阻	> 1	> 1	> 1	> 1	G Ω
电容@ 1 MHz	< 1.5	< 1.5	< 1.5	< 1.5	pF

电流通过中心电极，每个线电极各占一半。

尺寸单位为mm

封装信息请参见第83页。

3-Electrode Arresters 三极放电管



中载型
10 kA / 10 A • $\phi 6 \times 8$ mm

T30-...SMD	T30-...	T31-...	T33-...	T33-...F

型号 订货号	T30-A90X B88069X 3030C253 T31-A90X B88069X 2261B252 T33-A90X B88069X 2271B502	T30-A230X B88069X 3060C253 T30-A230XSMD B88069X 6731T702 T31-A230X B88069X 3130B252 T33-A230X B88069X 9800B502 T33-A230XF1 B88069X 9550B502	T30-A250X B88069X 3951C253	T30-A350X B88069X 3180C253 T31-A350X B88069X 3090B252 T33-A350X B88069X 1470B502 T33-A350X8F1 B88069X 9921B502	T30-A420X B88069X 3040C253 T30-A420XSMD B88069X 4961T702	T30-A500X B88069X 3070C253	
标称直流击穿电压 V_{sdCN}	90	230	250	350	420	500	V
V_{sdCN} 容差	± 20	± 20	± 20	± 20	-15/+25	± 20	%

冲击击穿电压							
测量值 @ 100 V/ μ s 99%	< 450	< 400	< 500	< 800	< 850	< 1100	V
典型值@ 100 V/ μ s	< 350	< 350	< 400	< 650	< 700	< 900	V
测量值 @ 1 kV/ μ s 99%	< 500	< 450	< 550	< 900	< 950	< 1400	V
典型值@ 1 kV/ μ s	< 400	< 420	< 450	< 700	< 850	< 1000	V

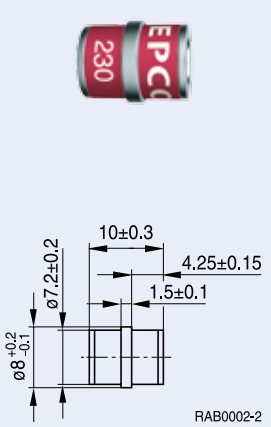
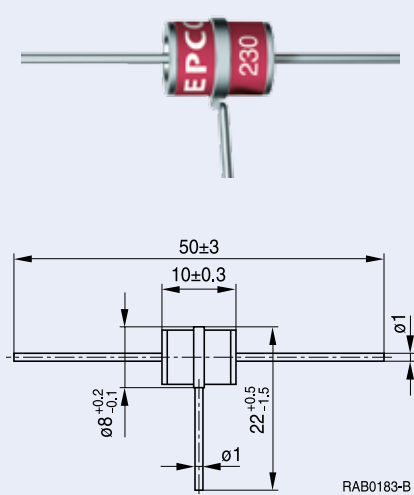
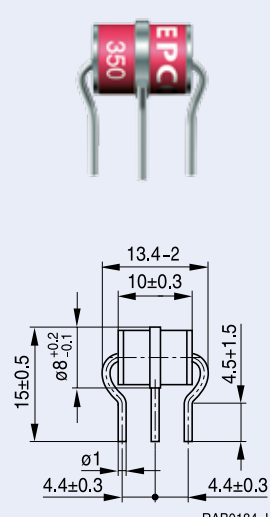
使用寿命							
标称耐工频电流10次@50 Hz, 1 s	10	10	10	10	10	10	A
耐工频电流1次@50 Hz, 9周期	30	30	30	30	30	30	A
标称耐冲击电流10次, 8/20 μ s	10	10	10	10	10	10	kA
单次耐冲击电流1次, 8/20 μ s	10	10	10	10	10	10	kA
脉冲放电电流1次, 10/350 μ s	2	2	2	2	2	2	kA
绝缘电阻	> 10	> 10	> 10	> 10	> 10	> 10	G Ω
电容@ 1 MHz	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	pF

电流通过中心电极，每个线电极各占一半。
尺寸单位为mm
封装信息请参见第83页。

3-Electrode Arresters 三极放电管



中载型
10 kA / 10 A • $\phi 8 \times 10$ mm

T80-...	T81-...	T83-...
 <p>RAB0002-2</p>	 <p>RAB0183-B</p>	 <p>RAB0184-J</p>

型号 订货号	T80-A90X B88069X8360C203 T81-A90X B88069X8440B252 T83-A90X B88069X8300B502	T81-A150X B88069X9580B252 T83-A150X B88069X9590B502	T80-A230X B88069X9380C203 T81-A230X B88069X8470B252 T83-A230X B88069X8910B502	T80-A250X B88069X8170C203 T83-A250X B88069X8340B502	
标称直流击穿电压 V_{sdCN}	90	150	230	250	V
V_{sdCN} 容差	±20	±20	±20	±20	%
冲击击穿电压					
测量值 @ 100 V/ μ s 99%	< 400	< 450	< 450	< 500	V
典型值@ 100 V/ μ s	< 300	< 400	< 400	< 450	V
测量值 @ 1 kV/ μ s 99%	< 550	< 550	< 650	< 650	V
典型值@ 1 kV/ μ s	< 500	< 500	< 600	< 600	V
使用寿命					
标称耐工频电流10次@50 Hz, 1 s	10	10	10	10	A
耐工频电流1次@50 Hz, 9周期	40	40	40	40	A
标称耐冲击电流10次, 8/20 μ s	10	10	10	10	kA
单次耐冲击电流1次, 8/20 μ s	15	15	15	15	kA
脉冲放电电流1次, 10/350 μ s	2	2	5	2	kA
脉冲放电电流300次, 10/1000 μ s	200	200	200	200	A
绝缘电阻	> 10	> 10	> 10	> 10	G Ω
电容@ 1 MHz	< 1.5	< 1.5	< 1.5	< 1.5	pF

电流通过中心电极，每个线电极各占一半。


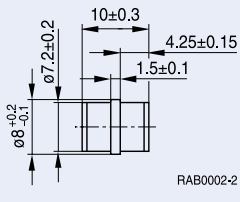

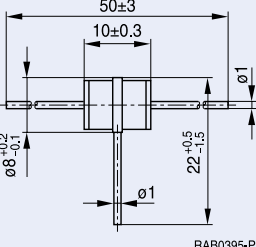

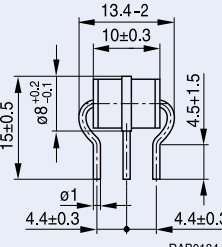

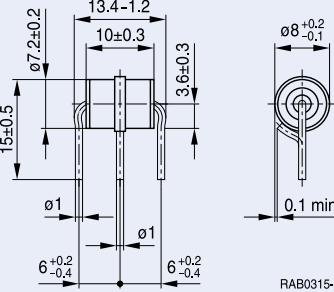
尺寸单位为mm

封装信息请参见第83页。

3-Electrode Arresters 三极放电管



中载型
10 kA / 10 A • $\phi 8 \times 10$ mm

T80-...	T81-...	T83-...	T87-...
  RAB0002-2	  RAB0395-P	  RAB0184-J	  RAB0315-L

型号 订货号	T81-A300X B88069X9000B252 T83-A300X B88069X7990B502	T80-A350X B88069X8500C203 T81-A350X B88069X9190B252 T83-A350X B88069X8690B502	T80-A420X B88069X7910C203 T83-A420X B88069X7960B502	T83-C600X B88069X8530B502 T87-C600X B88069X8550B502	
标称直流击穿电压 V_{sdcN}	300	350	420	600	V
V_{sdcN} 容差	± 20	± 20	± 20	$-30/+17$	%

冲击击穿电压					
测量值 @ 100 V/ μ s 99%	< 700	< 700	< 850	< 900	V
典型值@ 100 V/ μ s	< 600	< 600	< 700	< 800	V
测量值 @ 1 kV/ μ s 99%	< 800	< 900	< 950	< 1100	V
典型值@ 1 kV/ μ s	< 700	< 800	< 850	< 1000	V

使用寿命					
标称耐工频电流10次@50 Hz, 1 s	10	10	10	10	A
耐工频电流1次@50 Hz, 9周期	40	40	40	40	A
标称耐冲击电流10次, 8/20 μ s	10	10	10	10	kA
单次耐冲击电流1次, 8/20 μ s	15	15	15	15	kA
脉冲放电电流1次, 10/350 μ s	2	2	2	2	kA
脉冲放电电流300次, 10/350 μ s	200	200	200	on request	A
绝缘电阻	> 10	> 10	> 10	> 10	G Ω
电容@ 1 MHz	< 1.5	< 1.5	< 1.5	< 1.5	pF

电流通过中心电极，每个线电极各占一半。
尺寸单位为mm
封装信息请参见第83页。

3-Electrode Arresters 三极放电管



中载型 / 带短路簧片
10 kA / 10 A • $\phi 8 \times 10$ mm

T80-...F	T8*-...F1		T8*-...F4			
型号 订货号	T80-A90XF B88069X2391B502 T83-A90XF1 B88069X8430B502 T83-A90XF4 B88069X8350B502 T83-A150XF1 B88069X9930B502	T80-A230XF B88069X8380B502 T83-A230XF1 B88069X9420B502 T83-A230XF4 B88069X8870B502 T85-A230XF4¹⁾ B88069X9260B502	T80-A250XF B88069X8230B502 T83-A250XF4 B88069X8990B502 T83-A260XF4 B88069X8250B502	T80-A350XF B88069X8390B502 T83-A350XF1 B88069X9410B502 T83-A350XF4 B88069X9120B502 T85-A350XF4¹⁾ B88069X9230B502	T83-A500XF4 B88069X3771B502	
标称直流击穿电压 V_{sdclN}	90/150	230	250/260	350	500	V

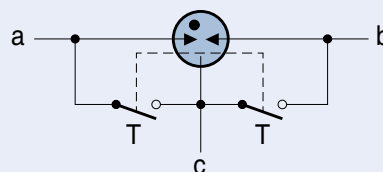
¹⁾ 引线长度更短的类型
尺寸单位为mm
封装信息请参见第83页。

Variants ...F1 and ...F4 show the most common positions for the short-circuit spring. The electrical characteristics are the same as those given for the corresponding types without a short-circuit spring on pages 52 and 53. Alternative voltages, lead configurations and spring positions on request.

压敏电阻...F1和...F4显示了最常见的短路簧片位置。其电气特性与52页和53页无短路簧片的相应型号的电气特性相同。电压、引线配置及簧片位置可以根据要求自行选择。

Circuit:

- a, b Line (tip/ring) electrode
- c Center electrode
- T Temperature-controlled short-circuit mechanism



电路:

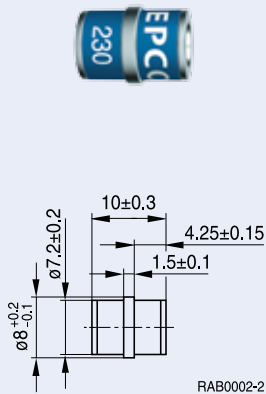
- a, b 线(端/环)电极
- c 中间电极
- T 温控短路机构

3-Electrode Arresters 三极放电管

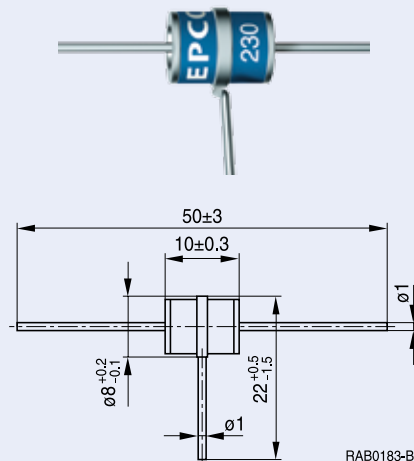


重载型
20 kA / 10 A • $\phi 8 \times 10$ mm

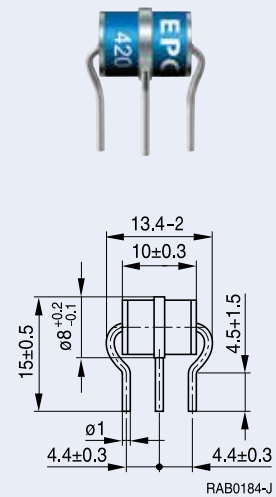
T20-...



T21-...



T23-...



型号
订货号

T20-A230X
B88069X8710C203
T21-A230X
B88069X8920B252
T23-A230X
B88069X8740B502

T20-A250X
B88069X8810C203
T21-A250X
B88069X8800B252
T23-A250X
B88069X8840B502

T20-A350X
B88069X7320C203
T21-A350X
B88069X5120B252
T23-A350X
B88069X7200B502

T20-A420X
B88069X7820C203
T23-A420X
B88069X8070B502

标称直流击穿电压 V_{sdcN}

230

250

350

420

V

V_{sdcN} 容差

±20

±20

±20

-17/+30

%

冲击击穿电压

测量值
@ 100 V/ μ s 99%

< 400

< 500

< 650

< 750

V

典型值@ 100 V/ μ s

< 350

< 400

< 550

< 700

V

测量值
@ 1 kV/ μ s 99%

< 500

< 600

< 700

< 850

V

典型值@ 1 kV/ μ s

< 450

< 550

< 600

< 800

V

使用寿命

标称耐工频电流10次@50 Hz, 1 s

10

10

10

10

A

耐工频电流1次@50 Hz, 9周期

50

50

50

50

A

标称耐冲击电流10次, 8/20 μ s

20

20

20

20

kA

单次耐冲击电流1次, 8/20 μ s

25

25

25

25

kA

脉冲放电电流1次, 10/350 μ s

5

5

5

2

kA

脉冲放电电流300次, 10/1000 μ s

200

200

200

on request

A

绝缘电阻

> 10

> 10

> 10

> 10

G Ω

电容@ 1 MHz

< 1.5

< 1.5

< 1.5

< 1.5

pF


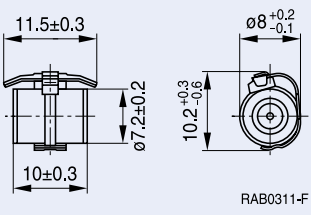

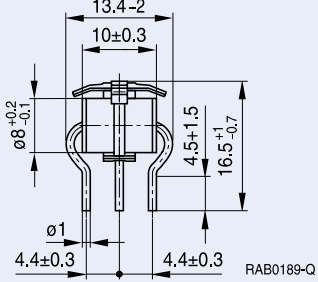

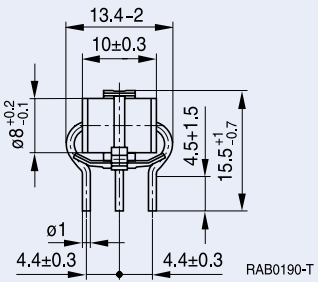
电流通过中心电极, 每个线电极各占一半。

尺寸单位为mm

封装信息请参见第83页。

3-Electrode Arresters 三极放电管

重载型 / 带短路簧片
20 kA / 10 A • $\phi 8 \times 10$ mm

T20-...F	T23-...F1	T23-...F4			
 	 	 			
型号 订货号	T20-A230XF B88069X8720B502 T23-A230XF1 B88069X8680B502 T25-A230XF1 ¹⁾ B88069X8630B502 T23-A230XF4 B88069X8750B502	T23-A250XF1 B88069X9810B502 T23-A250XF4 B88069X8860B502	T23-A350XF1 B88069X7240B502 T23-A350XF4 B88069X7000B502	T20-A420XF B88069X7580B502 T23-A420XF1 B88069X6210B502 T23-A420XF4 B88069X7140B502	
标称直流击穿电压 V_{sdCN}	230	250	350	420	V

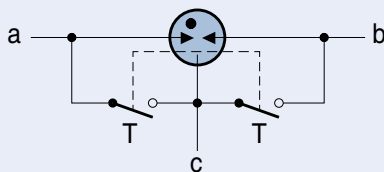
¹⁾ 引线长度更短的类型
尺寸单位为mm
封装信息请参见第83页。

Variants ...F1 and ...F4 show the most common positions for the short-circuit spring. The electrical characteristics are the same as those given for the corresponding types without a short-circuit spring on page 55. Alternative voltages, lead configurations and spring positions on request.

压敏电阻...F1和...F4显示了最常见的短路簧片位置。其电气特性与55页无短路簧片的相应型号的电气特性相同。电压、引线配置及簧片位置可以根据要求自行选择。

Circuit:

- a, b Line (tip/ring) electrode
- c Center electrode
- T Temperature-controlled short-circuit mechanism




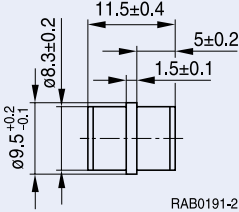

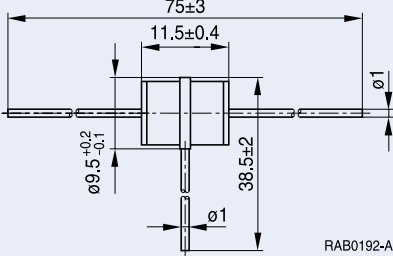
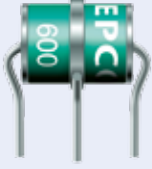
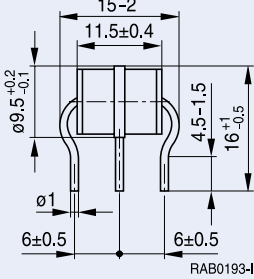
电路:

- a, b 线(端/环)电极
- c 中间电极
- T 温控短路机构

3-Electrode Arresters 三极放电管



重载型
20 kA / 20 A • $\varnothing 9.5 \times 11.5$ mm

T60-...	T61-...			T63-...		
  RAB0191-2	  RAB0192-A			  RAB0193-I		
型号 订货号	T60-A260X B88069X7120C203	T60-C350X B88069X7450C502 T61-C350X B88069X7700B102 T63-C350X B88069X7460B102	T60-A420X B88069X6980C203	T61-C600X B88069X8820B102 T63-C600X B88069X8830B252	T61-C650X B88069X7230B102 T63-C650X B88069X6990B102	
标称直流击穿电压 V_{sd0N}	260	350	420	600	650	V
直流击穿电压	210 ... 310	300 ... 500	330 ... 600	420 ... 700	500 ... 800	%
冲击击穿电压						
测量值 @ 100 V/ μ s 99%	< 600	< 800	< 750	< 900	< 1100	V
典型值 @ 100 V/ μ s	< 550	< 700	< 650	< 800	< 1000	V
测量值 @ 1 kV/ μ s 99%	< 650	< 900	< 850	< 1000	< 1350	V
典型值 @ 1 kV/ μ s	< 600	< 800	< 750	< 900	< 1100	V
使用寿命						
标称耐工频电流10次@50 Hz, 1 s	20	20	20	20	20	A
耐工频电流1次@50 Hz, 9周期	130	130	130	130	130	A
标称耐冲击电流10次, 8/20 μ s	20	20	20	20	20	kA
单次耐冲击电流1次, 8/20 μ s	40	40	40	40	40	kA
脉冲放电电流1次, 10/350 μ s	-	5	-	5	5	kA
绝缘电阻	> 10	> 10	> 10	> 10	> 10	G Ω
电容 @ 1 MHz	< 1.5	< 1.5	< 1.5	< 1.5	< 1.5	pF

电流通过中心电极，每个线电极各占一半。

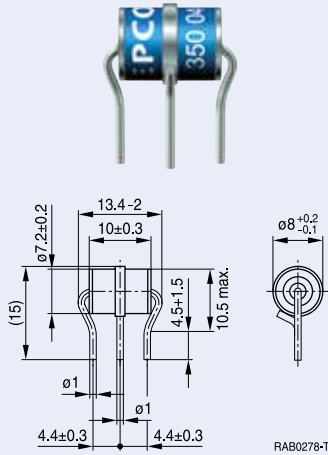
尺寸单位为mm

封装信息请参见第83页。

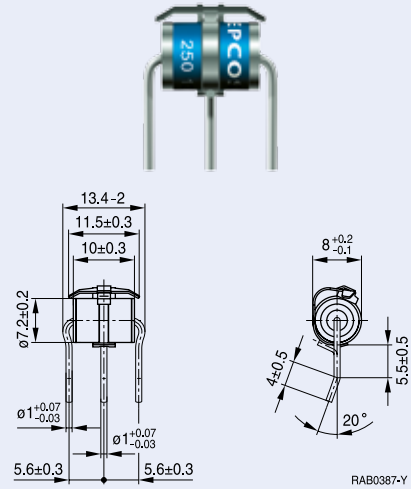
3-Electrode Arresters 三极放电管

符合美国规格要求的型号

T23-C350XS



T2B-A350XF1



型号 订货号	T23-C350XS ¹⁾ B88069X8160B502	T2B-A350XF1 ²⁾ B88069X3741B502	
标称直流击穿电压V _{sdcN}	350	350	V
直流击穿电压	300 ... 500	±20	%
冲击击穿电压			
测量值 @ 100 V/μs 99%	< 650	< 750	V
典型值@ 100 V/μs	< 550	-	V
测量值@ 1 kV/μs 99%	< 800	< 900	V
典型值@ 1 kV/μs	< 750	< 800	V
使用寿命			
标称耐工频电流60次@50 Hz, 1 s	-	2	A
标称耐工频电流10次@50 Hz, 1 s	10	-	A
标称耐工频电流5次@50 Hz, 1 s	-	20	A
耐工频电流1次@50 Hz, 9周期	130	130	A
标称耐冲击电流10次, 8/20 μs	20	20	kA
单次耐冲击电流1次, 8/20 μs	25	-	kA
脉冲放电电流100次, 10/1000 μs	-	200	A
脉冲放电电流400次, 10/1000 μs	1000	1000	A
脉冲放电电流1500次, 10/1000 μs	-	20	A
直流保持电压	< 150 @ 150 V / 200 mA	< 150 @ 135 V / 1300 Ω	ms
绝缘电阻	> 10	> 10	GΩ
电容@ 1 MHz	< 1.5	< 1.5	pF

¹⁾ 用于RUS PE80大功率系列

²⁾ 用于Telcordia GR974-CORE系列

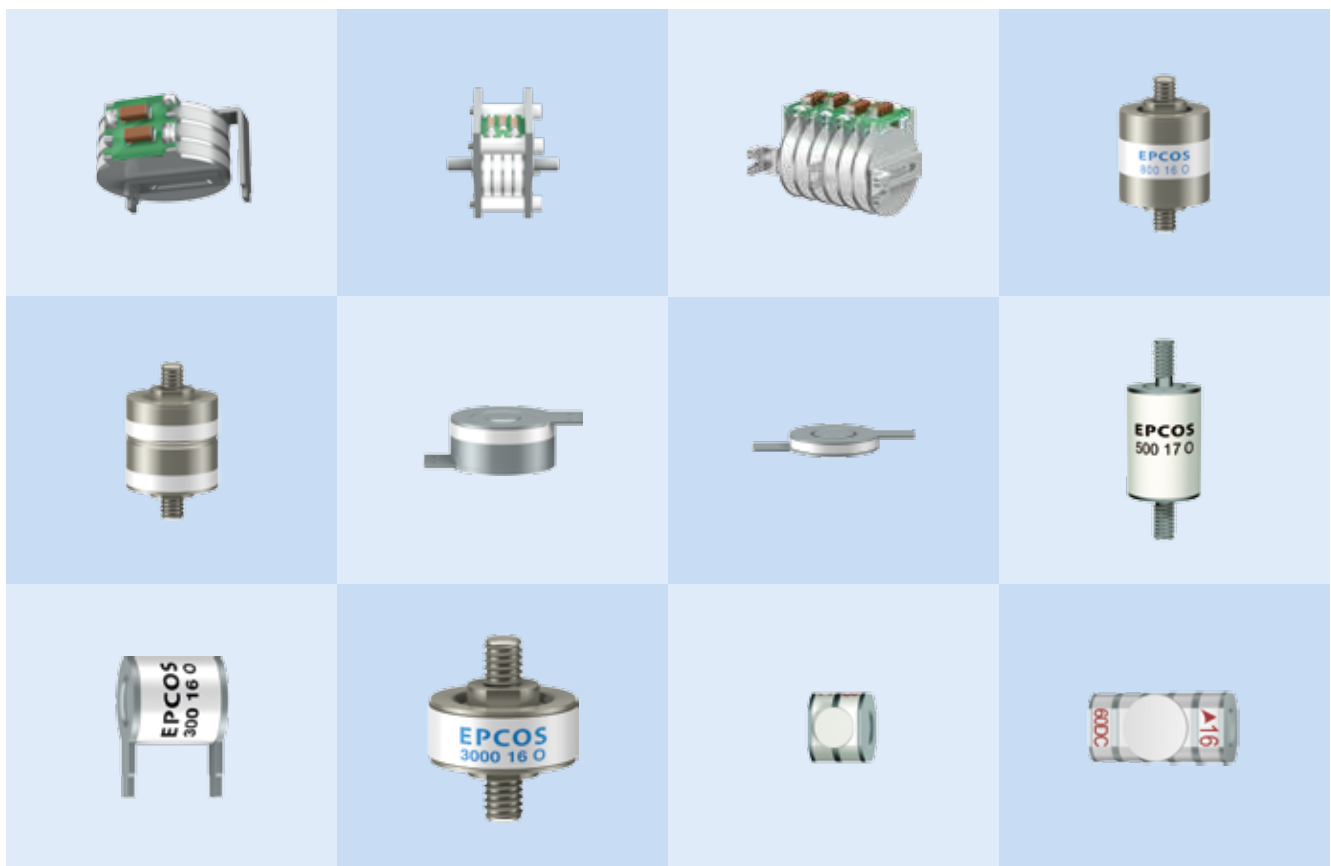
电流通过中心电极，每个线电极各占一半。

尺寸单位为mm

封装信息请参见第83页。

Surge Protection of AC/DC Power Lines

交流/直流电源线的浪涌保护



Overvoltage Protection of AC Power Lines

交流电源线的过压保护

Lightning protection acc. to IEC 61643-11
符合IEC 61643-11标准的防雷保护

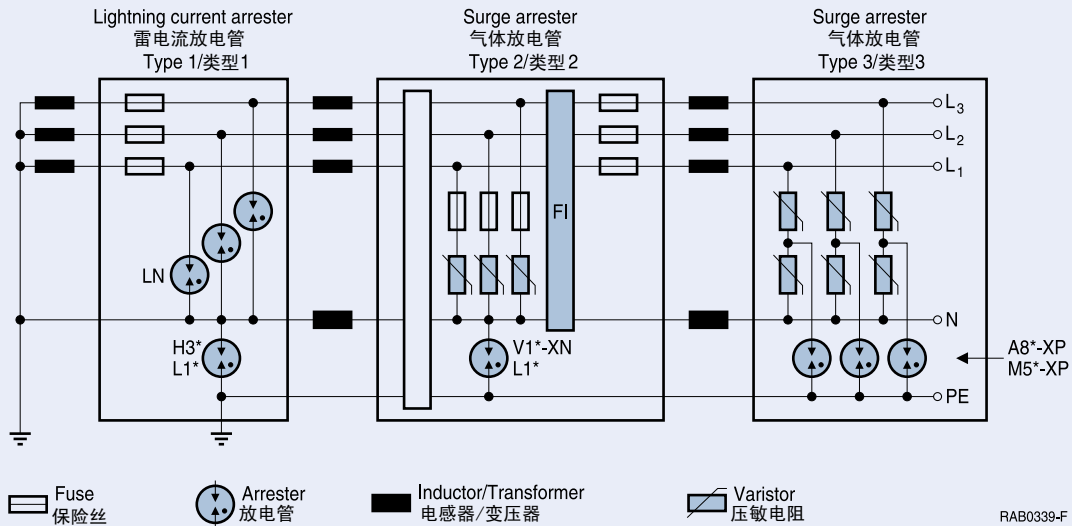


Figure / 图27

Electrical and electronic systems in building installations and also in power supplies for industrial or telecom installations may be exposed to considerable voltage surges due to direct lightning strikes or interference in the immediate vicinity.

EPCOS surge arresters enable protection modules to be constructed with different protection classes for both L-N and N-PE applications.

L-N arresters

For protection of L-N networks it should be noted that extremely high currents can flow through the low-resistance AC networks. To ensure that the arresters will extinguish them safely, EPCOS has designed special stacked arresters for this application.

应用于建筑设施以及工业或电信设施电源的电气电子系统，可能会遭受直接雷击或临近过电压，而承受相当大的浪涌电压的冲击。

爱普科斯气体放电管使保护模块可以在不同的保护等级之间进行自由选择，从而同时应用于L-N（火线-零线）和N-PE（零线-保护接地）场合中。

L-N放电管

在L-N网络保护中，应当注意特别高的电流可以流过具有低电阻特性的交流网络。为了确保气体放电管能够安全熄灭过电流，爱普科斯专门为此设计了特殊的层叠式放电管。

Overvoltage Protection of AC Power Lines

交流电源线的过压保护

Lightning protection acc. to IEC 61643-11 符合IEC 61643-11标准的防雷保护

N-PE arresters

In TT and TN-C-S systems, the so called N-PE arrester is positioned between neutral and protective ground where it is exposed to the sum of the lightning surge currents from all discharge lines. This means that – depending on the classification of the building to the lightning classes defined by DIN VDE 0185-305 – it must carry a direct lightning current of 50, 75 or 100 kA of waveform 10/350 μ s and additionally inductive coupled currents with a waveform of 8/20 μ s and a maximum value of up to 150 kA. The IEC 61643-11 standard specifies a test program which includes both waveforms as well as a sinusoidal follow current of up to 100 A that may occur in the event of operation. The limitation of this follow current to the duration of a halfwave, known as its lightning-current discharge capability, is a key characteristic of the arrester.

N-PE放电管

在TT和TN-C-S系统中，所谓的N-PE放电管位于中性点和保护接地之间，它承受着所有放电线路的雷电冲击电流之和。根据建筑物分类以及DIN VDE 0185-305所定义的雷电类型，这意味着N-PE放电管必须能够承受波形为10/350 μ s、电流峰值为50、75或100 kA的直接雷电电流的冲击，此外还包括波形为8/20 μ s，峰值为150 kA的感性耦合电流。IEC 61643-11标准对测试过程进行了定义，测试电流包括上述两种电流波形，以及操作过程中可能产生的、峰值高达100 A的正弦后续电流。这种后续电流受到半波持续时间的限制，称为雷电流放电能力，是气体放电管的关键特征参数。

The different protection classes are defined as follows:

不同的保护等级定义如下所示：

Class I

Protection against direct lightning strike. This is tested in accordance with IEC 61643-11 by means of the “operation duty test” with I_N of the wave form 8/20 μ s and additionally with the impulse current I_{imp} of the wave form 10/350 μ s (additional duty test).

I类

直接雷击防护。根据IEC 61643-11标准，采用“操作负载测试(operation duty test)”方法进行测试，输入波形为8/20 μ s，并叠加波形为10/350 μ s的操作冲击电流 I_{imp} 。

Class II

Protection against induced/injected surges and interference from distant lightning strikes. The components are tested in accordance with IEC 61643-11 – the so-called “operation duty test” – with I_N of the wave form 8/20 μ s and additionally with I_{max} with the wave form 8/20 μ s.

II类

感应/叠加浪涌和持续雷击干扰防护。根据IEC 61643-11标准，采用所谓的“操作负载测试(operation duty test)”方法对元件进行测试，输入波形为8/20 μ s，并叠加波形为8/20 μ s的操作冲击电流 I_{max} 。

Class III

Class III protection modules are used essentially for protecting terminal equipment. They reduce voltage surges to a level that is harmless to the electrical terminal equipment. These surge arresters are tested with a loading of the wave form 8/20 μ s in accordance with IEC 61643-11.

III类

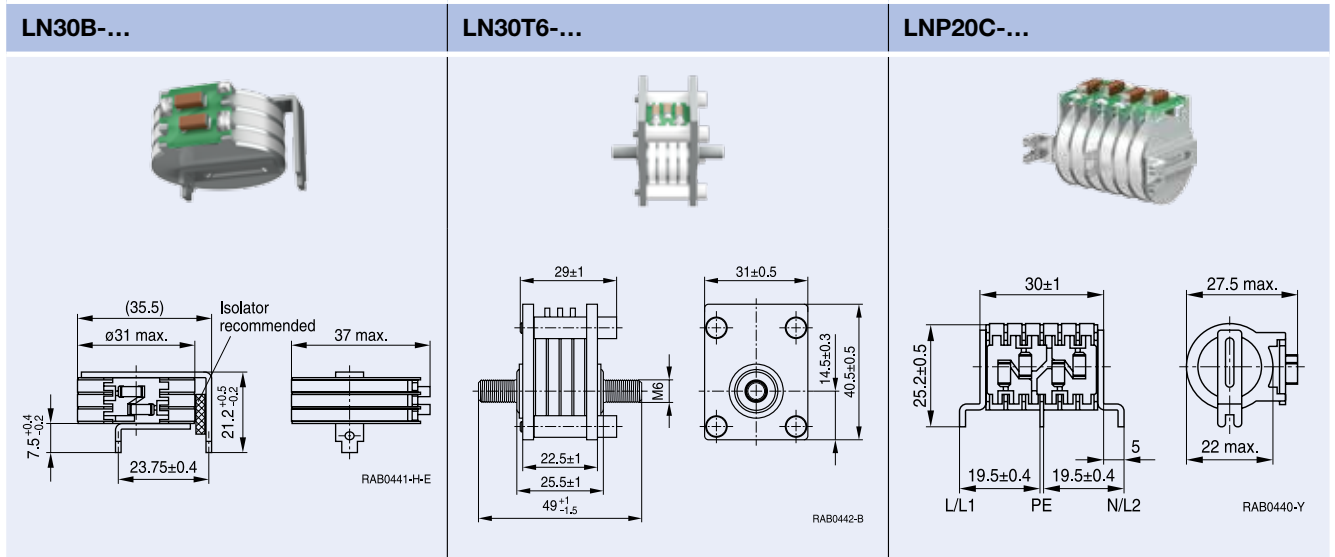
III类保护模块主要用于终端设备的保护。它们将冲击电压降低到电气终端设备的安全绝缘水平。根据IEC 61643-11标准，对这些气体放电管进行8/20 μ s电流波测试。

AC Power Line Protection, L-N

工频电源线保护, L-N



保护等级 I & II



型号 订货号	LN30B-A1800AC-3C B88069X3643B201	LN30T6-A2000AC-4C upon request	LNP20C-A1800AC-6C upon request	
类别	I & II	I	I & II	
应用	L-N	L-N	L-PE / N-PE	
标称直流击穿电压 V_{sdcn}	1800	-	-	V
直流击穿电压	> 600	> 700	> 600	V
波前击穿电压 @ 1.2/50 μ s, 6 kV	U_p < 2500	< 2500	< 2500	V
I类				
最大连续工作电压 @ 50/60 Hz	U_c 275	440	250	V
标称放电电流 8/20 μ s	I_n 25	25	8	kA
脉冲电流, 10/350 μ s	I_{imp} 25	25	8	kA
续电流@ 50/60 Hz	I_f 6000	10000	1000	A
II类				
最大连续工作电压 @ 50/60 Hz	U_c 275	-	250	V
标称放电电流 8/20 μ s	I_n 25	-	8	kA
最大放电电流 8/20 μ s	I_{max} 40	-	16	kA
续电流@ 50/60 Hz	I_f 6000	-	1000	A
工频放电电流 (1200V暂态过电压, N-PE连接) 放电电流1次50 Hz, 0.2 s	-	-	-	A
最大暂态过电压 (最长5 s), L-N连接	440	440	440	V
绝缘电阻	> 10	> 1	> 1	G Ω

放电管设计符合IEC 61643-11标准。

尺寸单位为mm


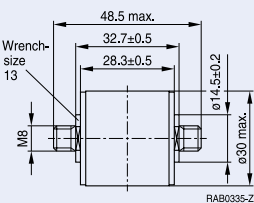

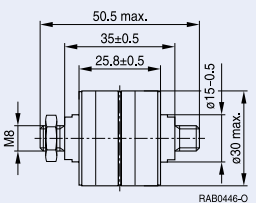
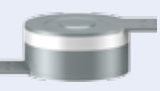
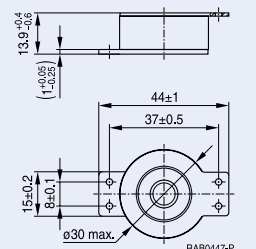

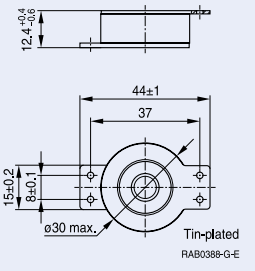
封装信息请参见第83页。

AC Power Line Protection, N-PE

交流电源线保护, N-PE



保护等级 I

H38M-...	D38T28M-...	D3E14M-...	L1B-...		
 	 	 	 		
型号 订货号	H38M-A800XP1 B88069X3993B201	D38T28M-A1000P1-2 upon request	D3E14M-A800XP1 upon request	L1B-A800XP1 B88069X6551B201	
类别	I	I	I	I	
应用	N-PE	N-PE	N-PE	N-PE	
标称直流击穿电压 V_{sdcN}	800	1000	800	800	V
直流击穿电压	> 600	> 800	> 600	> 600	V
波前击穿电压 @ 1.2/50 μ s, 6 kV	U_p < 1500	< 2200	< 1500	< 1500	V
I类					
最大连续工作电压 @ 50/60 Hz	U_c 255	440	264	264	V
标称放电电流 8/20 μ s	I_n 100	100	100	50	kA
脉冲电流, 10/350 μ s	I_{imp} 100	100	100	50	kA
续电流 @ 50/60 Hz	I_f 100	100	100	100	A
II类					
最大连续工作电压 @ 50/60 Hz	U_c -	-	-	-	V
标称放电电流 8/20 μ s	I_n -	-	-	-	kA
最大放电电流 8/20 μ s	I_{max} -	-	-	-	kA
续电流 @ 50/60 Hz	I_f -	-	-	-	A
工频放电电流 (1200V暂态过电压, N-PE连接) 放电电流1次50 Hz, 0.2 s	300	300	300	300	A
绝缘电阻	> 1	> 1	> 1	> 1	G Ω

放电管设计符合IEC 61643-11标准。

尺寸单位为mm

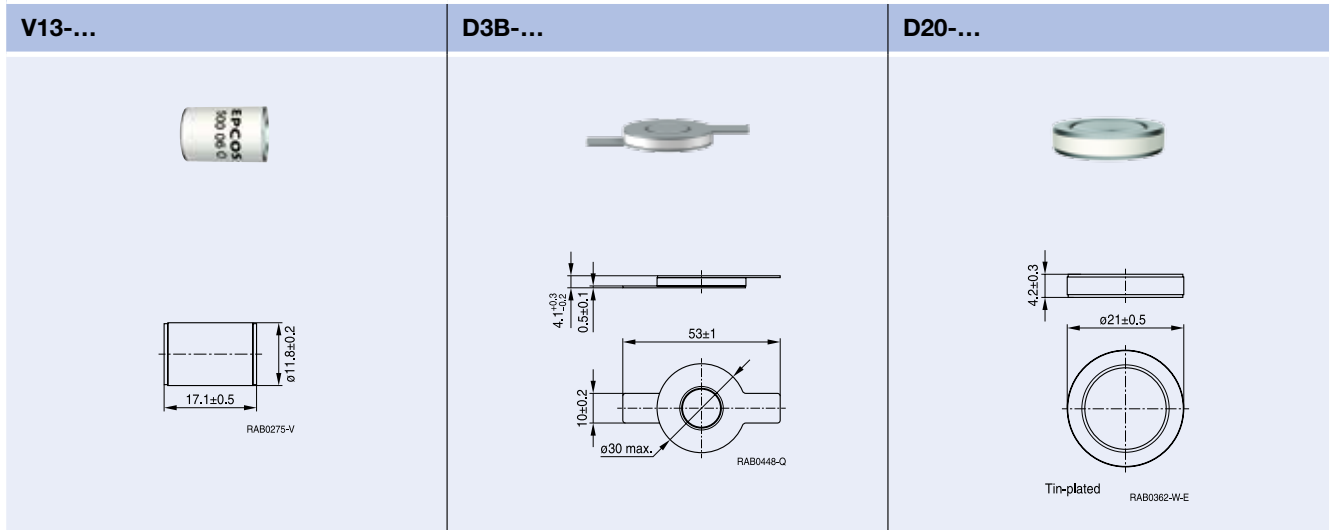
封装信息请参见第83页。

AC Power Line Protection, N-PE

交流电源线保护, N-PE



保护等级 I & II



型号 订货号	V13-A500XN B88069X6940C251	V13-A800XN B88069X4380C251	D3B-A700XP B88069X2513B401	D20-A800XP B88069X7691B301	
类别	I & II	I & II	I & II	I & II	
应用	N-PE	N-PE	N-PE	N-PE	
标称直流击穿电压 V_{sdCN}	500	800	700	800	V
直流击穿电压	500 ... 850	> 600	> 550	> 600	V
波前击穿电压 @ 1.2/50 μ s, 6 kV	U_p < 1300	< 1500	< 1500	< 1500	V
I类					
最大连续工作电压 @ 50/60 Hz	U_c 255	255	264	264	V
标称放电电流 8/20 μ s	I_n 40	40	30	30	kA
脉冲电流, 10/350 μ s	I_{imp} 12	25	25	25	kA
续电流@ 50/60 Hz	I_f 100	100	100	100	A
II类					
最大连续工作电压 @ 50/60 Hz	U_c 255	255	264	264	V
标称放电电流 8/20 μ s	I_n 40	40	30	30	kA
最大放电电流 8/20 μ s	I_{max} 60	60	40	40	kA
续电流@ 50/60 Hz	I_f 100	100	100	100	A
工频放电电流 (1200 V暂态过电压, N-PE连接) 放电电流1次50 Hz, 0.2 s	300	300	300	300	A
绝缘电阻	> 1	> 1	> 1	> 1	G Ω

放电管设计符合IEC 61643-11标准。

尺寸单位为mm


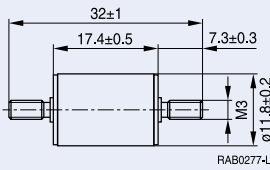

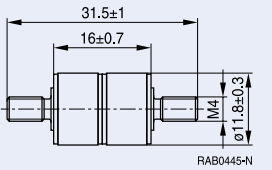

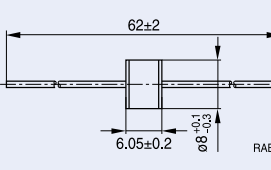

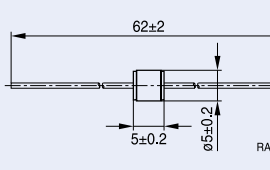
封装信息请参见第83页。

AC Power Line Protection, N-PE

交流电源线保护, N-PE



保护等级 II & III

V1...	V84...	A8...	M51-...		
 	 	 	 		
型号 订货号	V10-A500X B88069X4400C251 V13-A500X B88069X4390C251	V84-A1200XP2-2 upon request	A80-A800XP B88069X5691C103 A81-A800XP B88069X5701S102	M51-A800XP B88069X4781S102 B88069X4781T502	
类别	II	II	II & III	II & III	
应用	N-PE	N-PE	N-PE	N-PE	
标称直流击穿电压 V_{sdcN}	500	1200	800	800	V
直流击穿电压	400 ... 600	> 900	> 600	> 600	V
波前击穿电压 @ 1.2/50 μ s, 6 kV	U_p < 1500	< 2500	< 1500	< 1500	V
II类					
最大连续工作电压 @ 50/60 Hz	U_c 255	440	255	255	V
标称放电电流 8/20 μ s	I_n 20	20	10	3	kA
最大放电电流 8/20 μ s	I_{max} 40	40	20	3	kA
续电流 @ 50/60 Hz	I_f 100	100	100	5	A
工频放电电流 (TOV @ 1200 V) 放电电流1次50 Hz, 0.2 s	300	300	-	-	A
绝缘电阻	> 1	> 1	> 1	> 1	G Ω

放电管设计符合IEC 61643-11标准。

尺寸单位为mm

封装信息请参见第83页。


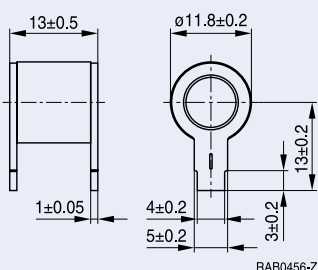

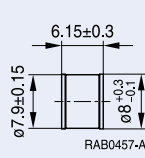

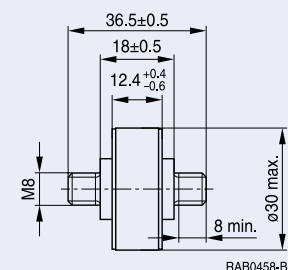

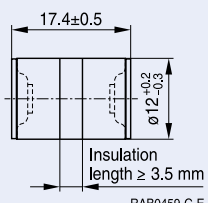
AC Power Line Protection, N-PE

交流电源线保护, N-PE



保护等级 I、II & III

Surge arresters with varistors in series / 与压敏电阻串联的气体放电管

V87A-...	A80-...	L18A-...	V13M-...
  RAB0456-Z	  RAB0457-A	  RAB0458-B	  RAB0459-C-E

型号 订货号	V87A-A300XSPD B88069X2453B251	A80-A900XPDP B88069X2523C103	L18A-A3000XPDP B88069X9471B122	V13M-H40XPDP B88069X3313B251	
类别	I, II & III (串联压敏电阻)	II (串联压敏电阻)	I & II (串联压敏电阻)	II (串联压敏电阻)	
应用	N-PE	N-PE	N-PE	N-PE	
标称直流击穿电压 V_{sdCN}	300	900	3000	4000	V
直流击穿电压	225 ... 375	> 700	2700 ... 3900	> 3200	V
波前击穿电压 @ 1.2/50 μ s, 6 kV	U_p < 900	< 1700	< 4500	< 5500	V
I类					
最大连续工作电压 @ 50/60 Hz	U_c 110	-	1000	-	V
标称放电电流 8/20 μ s	I_n 20	-	50	-	kA
脉冲电流, 10/350 μ s	I_{imp} 12.5	-	35	-	kA
II类					
最大连续工作电压 @ 50/60 Hz	U_c 110	255	1000	440	V
标称放电电流 8/20 μ s	I_n 20	10	50	15	kA
最大放电电流 8/20 μ s	I_{max} 40	20	100	30	kA
绝缘电阻	> 1	> 1	> 1	> 1	G Ω
III类					
最大连续工作电压 @ 50/60 Hz	U_c 110	-	-	-	
组合电流波发生器的 限制电压, 1.2/50 μ s, 6 kV; 8/20 μ s, 3 kA	U_p < 650	-	-	-	

放电管设计符合IEC 61643-11标准。

Please read *Important notes* on page 4 and *Cautions and warnings* on page 5.
请仔细阅读第4页的“重要事项”和第5页的“警告和警告”。

Overvoltage Protection of DC Power Networks

直流电源线的过压保护

Typical protection circuit 典型保护电路

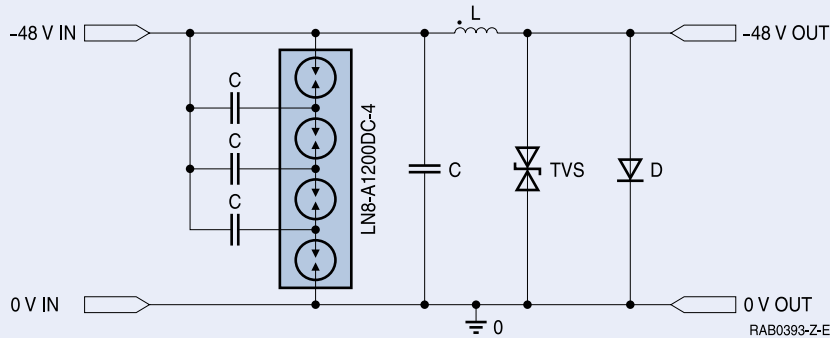


Figure / 图28

The overvoltage protection of DC power networks is a very sophisticated challenge. These networks, which are able to provide short circuit currents of 30 A or more, can be efficiently protected by the gas-filled stacked arresters of the LN8 series.

For this application it is important that, after the external interference surge has subsided, the arc extinguishes safely. This can only be guaranteed if the arc voltage of the arrester is higher than the DC operating voltage. Connecting stacked arresters in series raises the arc voltage to the required value. The number of arc chambers will determine the maximum DC operating voltage. Unfortunately, the series connection also leads to increased impulse breakdown voltages, an effect that can be minimized by parallel connection of capacitors. The remaining residual voltages can then easily be reduced to small harmless values with a secondary protection circuit.

The LN8 series of surge arresters enables DC power networks to be protected up to 72 V. With an extremely low capacitance of less than 1 pF at 1 MHz and a high insulation resistance of more than 10 GΩ at 100 V DC, these RoHS-compatible SMD components have negligible parasitic impact on the network.

直流电网过压防护面临着非常复杂的挑战。这些能够产生30A甚至更大短路电流的电源网络，可经由LN8系列层叠式气体放电管进行有效防护。

在这种应用中，最重要的是，当消除外部浪涌的干扰之后，电弧可以安全地熄灭。通常只有当放电管的弧光电压高于直流工作电压时，才能够保证此种现象的发生。串联的层叠式放电管可以将弧光电压升高到所需的数值。灭弧室的数量将决定直流工作电压的最大值。然而，串联可能会导致冲击击穿电压升高，这种效应可以通过电容器的并联连接来将其降低到最小程度。随后残余电压可以通过二次保护电路，很容易地降低到设备的绝缘安全水平。

LN8系列气体放电管能够有效保护电压高达72 V的直流电网。当频率为1 MHz时，LN8放电管的电容小于1 pF，并且当电压为100 V DC时，其绝缘电阻高达10 GΩ以上，这些兼容RoHS标准的表面贴装型元件对电网造成的寄生效应完全可以忽略不计。

DC Power Line Protection

直流电源线保护

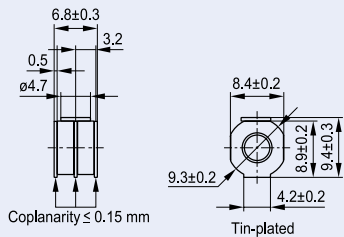
层叠式气体放电管
10 kA • 8.4 × 16.3 mm

LN8-... / LN8A-...

SMD



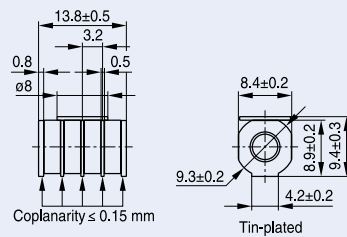
LN8A-...



SMD



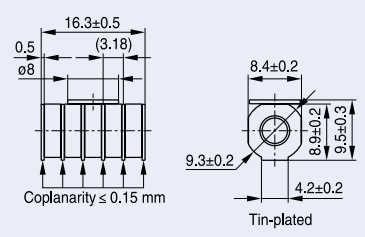
LN8A-...



SMD



LN8A-...



型号 订货号	LN8-A450DC-2 ¹⁾ B88069X1983B102 LN8A-A450DC-2 B88069X1883T152	LN8-A1200DC-4 ¹⁾ B88069X1993B501 LN8A-A1200DC-4 B88069X2003T152	LN8-A1400DC-5 ¹⁾ B88069X1123B501 LN8A-A1400DC-5 B88069X1003T152	
直流击穿电压	450	1200	1400	V
V _{sdic} 容差	±30	±30	±30	%
波前击穿电压 @ 1.2/50 µs, 6 kV	< 1100	< 2000	< 2300	V
波前击穿电压 @ 1.2/50 µs, 6 kV	参见直流电源保护电路 ①	参见直流电源保护电路 ②	参见直流电源保护电路 ③	
初始值 退役后	< 780 < 1200	< 850 < 1600	< 900 < 1500	V V
直流工作电压	24 +25%	48 +20%	60 +20%	V
使用寿命				
标称耐冲击电流10次, 8/20 µs	10	20	20	kA
脉冲放电电流10次, 10/350 µs	-	4	4	kA
脉冲放电电流100次, 10/350 µs	-	500	500	A
脉冲放电电流300次, 10/1000 µs	100	100	100	A
绝缘电阻	> 10	> 10	> 10	GΩ
电容@ 1 MHz	< 1	< 1	< 1	pF

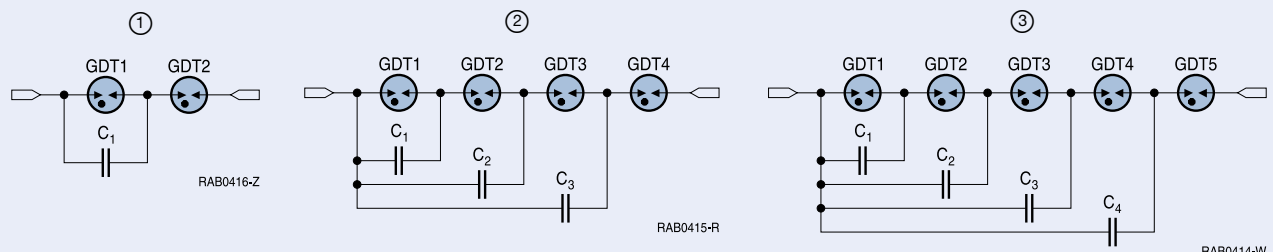
¹⁾ LN8-...型号没有进行统一编码。可根据要求提供尺寸图纸。

放电管设计符合IEC 61643-11标准。

尺寸单位为mm

封装信息请参见第83页。

直流电源保护电路



Switching Spark Gaps 开关放电器



Switching Spark Gaps

开关放电器



The principle of gas discharge is used not only for overvoltage protection but also in switching applications. Unlike surge arresters, switching spark gaps are active components that work reliably even after igniting hundreds of thousands of times. They can be used in all applications where high voltage pulses are generated, for example to ignite modern high-pressure gas discharge lamps such as xenon lamps in automotive headlights.

Ignition performance is determined to a large degree by the properties of the switching component. An extremely fast switch is called for, which operates virtually without loss and with high insulation resistance in the non-conducting state. It should also be as compact as possible, rugged, highly reliable, and capable of operating over a wide temperature range.

Switching spark gaps from EPCOS make use of the advantages of arc discharge: The enormous speed at which the arc is formed (< 50 ns) as well as the high current carrying capability allow the generation of short pulses of some 10 μ s duration with extremely high current or voltage rise times and low power loss. Insulation resistance in a non-conducting state is determined by the extremely low leakage currents and is in the M Ω range.

The construction of our switching spark gaps as well as the high quality of the manufacturing processes (ISO TS 16949) satisfy the strict requirements set by the automobile industry for component reliability. Our switching spark gaps have already proven their worth to ignite xenon headlights for more than 25 years.

气体放电原理不仅可以用于过压保护，还可用于开关领域。与气体放电管不同的是，开关放电器属于有源部件，经过数百万次点火后，仍具有稳定的性能。开关放电器可用于所有需要产生高压冲击的应用场合，例如点燃现代高压气体放电灯（如汽车前灯里面的氙气灯）。

这些点火器的性能主要取决于开关部件的特性。因此需要配置一种极速开关，在非导通状态下，具有高绝缘阻抗，且损失极小。此外它还应尽可能的紧凑、坚固，并且具有较高的可靠性以及温度适应性。

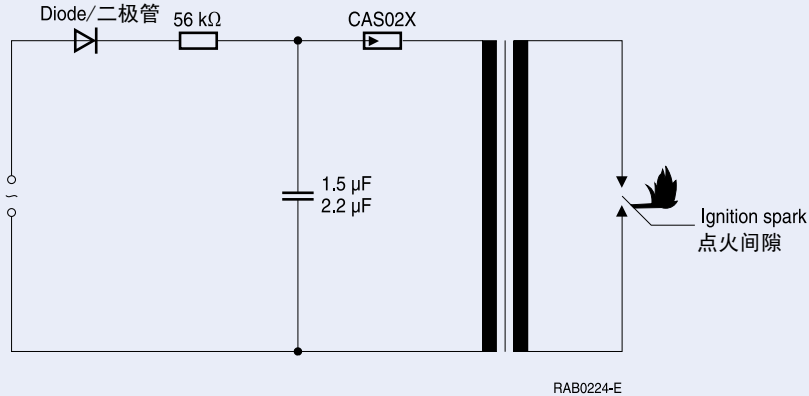
爱普科斯开关放电器充分利用电弧放电的特点：电弧放电形成的高速(<50 ns)及其强大的电流负载能力使其能产生瞬时的脉冲(10 μ s)以及超高的电流、电压上升时间和低功率损耗。非导通状态下，放电器的绝缘电阻由极低的泄电流决定，其数值高达数兆欧姆。

我们开关放电器的结构及其生产过程标准(ISO TS 16949)有效满足了汽车行业对元件可靠性所提出的严格要求。25年多的实践经验证明，我们的开关放电器在氙气前灯应用方面具有极高的功能性及可靠性优势。

Switching Spark Gaps

开关放电器

Circuit example for CAS02X CAS02X电路示例



RAB0224-E

Figure / 图29

General technical information

The basic circuit of a pulse igniter contains a charging resistor, an ignition capacitor, a spark gap and a high-voltage transformer as shown in **Figure 29** and **Figure 30**.

When the ignition voltage of the spark gap is reached, the energy stored in the capacitor is discharged across the primary side of the transformer to generate the required high-voltage pulses on the secondary side. Their amplitude is determined by the ignition voltage of the spark gap, the selected capacitance and by the winding ratio of the transformer. The repetition frequency can be set by selecting a suitable charging resistor.

The construction of gas-filled switching spark gaps is similar to that of a surge arrester with two electrodes (see page 8). The electrical properties required for switching applications and the long switching life are set by matching design features such as the spacing and shape of the electrodes, the electrode activating compound, the type and pressure of the gas filling as well as the number, type and position of the ignition aids. The rugged hard-solder connection between the electrodes and the ceramic insulator ensures the high reliability demanded for a wide temperature range.

Type series CAS02X

Application: igniters for gas cookers and central heating systems.

Principle: The switching spark gap generates the current pulse for the ignition transformer on the primary side. This in turn generates the high voltage required to ignite the gas mixture, typically 12 kV, on the secondary side through its winding ratio.

通用技术信息

脉冲点火器基本电路包括充电电阻器、点火电容器、开关放电器和高压变压器，如图29和30所示。

当达到开关器要求的点火电压，电容器内储存的电能将通过变压器的一次侧释放，同时在二次侧产生所需的高压。其波幅取决于火花隙的点火电压、选定的电容以及变压器的绕组比。通过选择合适的充电电阻器可以对其重复频率进行设置。

开关放电器的结构与二极气体放电管的结构相似（见8页）。通过匹配设计特点，如电极的间隙和形状、电极启动装置、气体的类型和压力以及点火装置的数量、类型和位置，可以设定开关应用以及开关使用寿命需要的电气特性。电极和陶瓷绝缘体之间的坚固硬质焊接连接有效确保了温度适应性及高可靠性。

CAS02X系列

应用：煤气炉和中央供暖系统的点火器。

原理：开关放电器在点火变压器一次侧产生电流脉冲，进而通过其绕组比在二次侧产生点燃混合气体所需的高压，一般为12 kV。

Switching Spark Gaps

开关放电器

Basic circuit of pulse igniter for HID lamps
HID灯脉冲点火器基本电路图

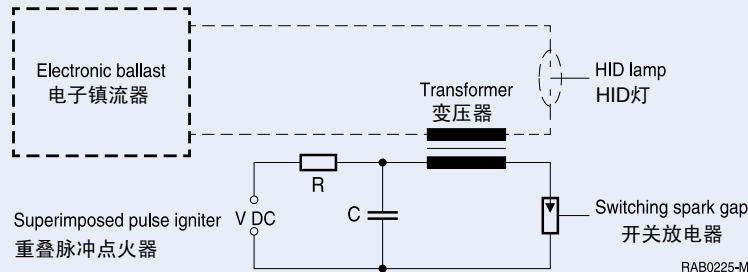


Figure / 图30

Characteristics / 特性

Switching time / 开关时间	< 50 ns
Switching current, peak value (depending on type) / 开关电流、峰值 (取决于型号)	< 1000 A
Energy per discharge (depending on type) / 每次放电能量 (取决于型号)	< 200 mJ
Service life (switch operations) ¹⁾ / 寿命 (开关) ¹⁾	10 ⁵ ... 10 ⁶
Arc voltage / 弧光典雅	10 ... 50 V

Type series SSG

Application: igniters for cold and hot ignition of high-pressure and ultra-high-pressure gas discharge lamps for video and data projectors, general illumination (e.g. stadium and studio lighting, lighting effects for goods in stores), special applications (endoscopy).

Principle: The high-voltage pulses generated in the ignition circuit are superposed onto the lamp operating voltage supplied by the ballast. The low losses of switching with spark gaps mean that ignition circuits can be dimensioned so that only a few pulses – in some cases just one – suffice to ignite a high-pressure gas discharge lamp.

Type series FS

Application: igniters in xenon discharge lamps for automotive headlights as well as in auxiliary lighting used in construction and mining.

Feature: The FS series is designed for use over a wide temperature range of -40 to +170 °C with a relatively tight range of breakdown voltages. Normally one pulse is sufficient to ignite a gas discharge lamp.

Principle: as for the SSG.

SSG系列

应用: 视频和数据投影仪高压/超高压气体放电灯冷/热点火器、普通照明（如体育馆和工作室照明、商店商品照明）、特殊应用（如内窥镜等）。

原理: 点火电路产生的高压脉冲与镇流器产生的工作电压叠加。由于开关放电器的损失很低，所以在某些情况下，点火电路仅需少量脉冲即可点燃高压气体放电灯。

FS系列

应用: 汽车前灯使用的氙气灯以及建筑和采矿行业的辅助照明灯点火器。

特点: FS系列具有宽泛的温度适应性（-40 °C至+170 °C），而击穿电压范围相对较小。通常，一次脉冲即可点燃气体放电灯。

原理: 与SSG系列相同。

¹⁾ The number of switching operations and the breakdown voltage during component service life are largely determined by ignition circuit parameters, i.e. by the capacitance of the ignition capacitor as well as the primary inductance of the high-voltage transformer. Because the layout of the circuits depends on the user, these values have not been included in the table. Data sheets with values for switching operations and breakdown voltages obtained from standardized test circuits are available upon request.

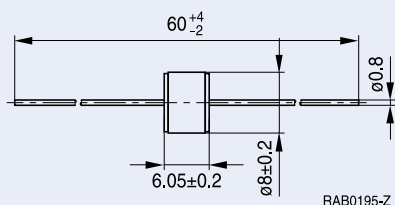
¹⁾ 元件使用期间的开关操作次数和击穿电压主要取决于点火电路的参数，即点火电容器的电容以及高压变压器的一次绕组电感。由于电路的布局由用户决定，因此表格中并未包含这些数据。采用标准化测试电路获得的开关次数和击穿电压数据表可以根据要求提供。

Switching Spark Gaps 开关放电器

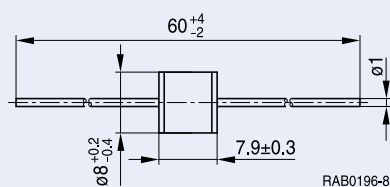


Commodity series 商用系列

CAS...



SSG...



系列号 订货号	CAS02X-68 B88069X0680T502	SSG3X-1 B88069X0260S102	SSG5X-1 B88069X0270S102	
标称击穿电压	230	3000	5000	V
初始静态击穿电压 ¹⁾	200 ... 255	2550 ... 3540	4000 ... 6000	V
使用期间击穿电压 ¹⁾	-	2400 ... 3600	3750 ... 6250	V
击穿时间	-	≤ 50	≤ 50	ns
开关操作@ 25 °C ²⁾	2 000 000	1 000 000	100 000	
放电峰值电流 ²⁾	300	50	30	A
工作温度	-20 ... +125	0 ... +100	0 ... +100	°C
绝缘电阻	> 100	> 100	> 100	MΩ

¹⁾ 已电离。

²⁾ 按要求提供测试电路。

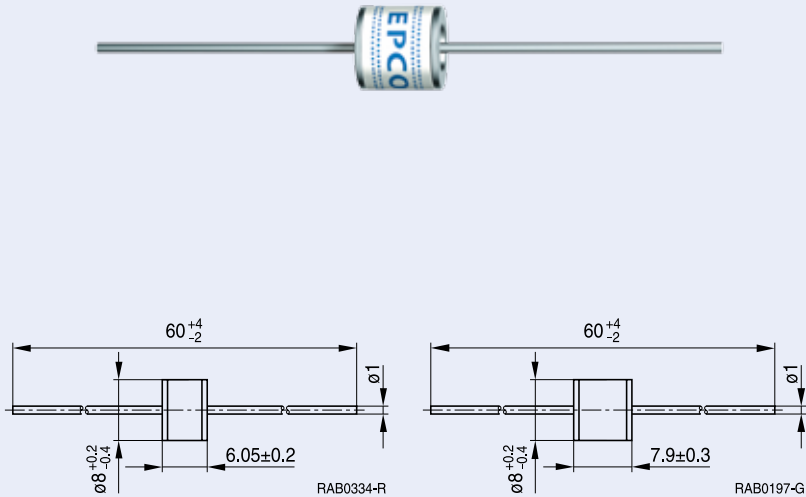
尺寸单位为mm

封装信息请参见第83页。

Switching Spark Gaps 开关放电器

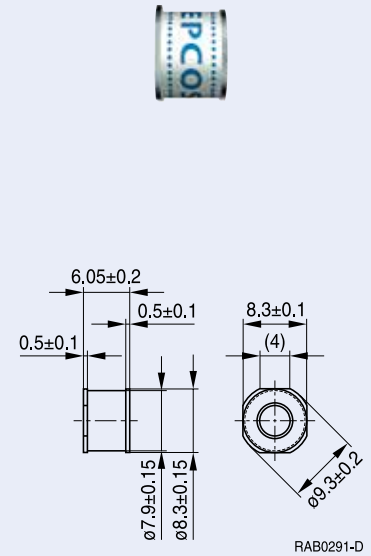
High-performance series 高性能系列

FS...



FS...SMD

SMD



系列号 订货号	FS04X-1JMG B88069X0410T502	FS06X-1NG B88069X3660T502	FS08X-1GH B88069X0340T502	FS08HF1BSMD B88069X8061T602	
标称击穿电压	400	600	800	800	V
初始静态击穿电压 ¹⁾	350 ... 430	560 ... 680	704 ... 896	704 ... 896	V
使用期间击穿电压 ¹⁾	340 ... 460	540 ... 700	680 ... 920	680 ... 920	V
击穿时间	≤ 50	≤ 50	≤ 50	≤ 50	ns
开关操作@ 25 °C ²⁾	200 000	40 000	100 000	340 000	
放电峰值电流 ²⁾	500	1000	650	500	A
工作温度	-40 ... +125	-40 ... +125	-40 ... +150	-40 ... +170	°C
绝缘电阻	> 100	> 100	> 100	> 100	MΩ

¹⁾ 已电离。

²⁾ 按要求提供测试电路。

尺寸单位为mm

封装信息请参见第83页。

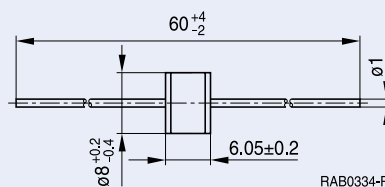
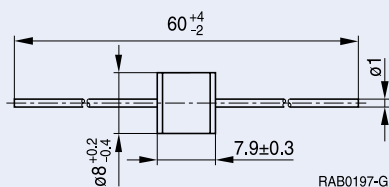
Switching Spark Gaps 开关放电器



High-performance series 高性能系列

FS...

FS...J...



系列号 订货号	FS08X-1JG B88069X3560T502	FS08X-1JGS B88069X5980T502	FS1X-1G B88069X3450T502	FS5,5X-1 B88069X3440S102	
标称击穿电压	800	850	1000	5500	V
初始静态击穿电压 ¹⁾	704 ... 920	748 ... 952	900 ... 1130	4850 ... 6150	V
使用期间击穿电压 ¹⁾	680 ... 920	720 ... 980	850 ... 1150	4000 ... 6600	V
击穿时间	≤ 50	≤ 50	≤ 50	≤ 50	ns
开关操作@ 25 °C ²⁾	200 000	200 000	200 000	500 000	
放电峰值电流 ²⁾	400	650	400	200	A
工作温度	-40 ... +150	-40 ... +150	-40 ... +125	-40 ... +125	°C
绝缘电阻	> 100	> 100	> 100	> 100	MΩ

¹⁾ 已电离。

²⁾ 按要求提供测试电路。

尺寸单位为mm

封装信息请参见第83页。

Triggered Switching Spark Gaps 触发式开关放电器

Typical circuit for shock wave lithotripsy 冲击波碎石的典型电路

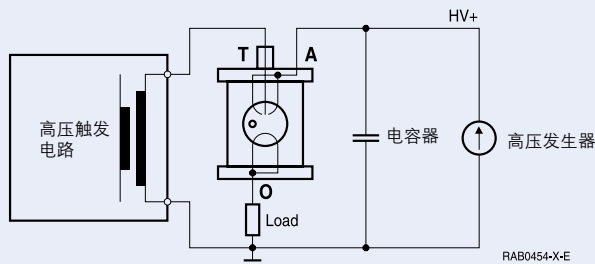
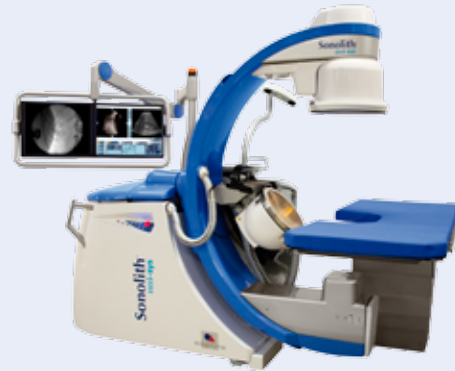


Figure / 图31



©: EDAP TMS, 持续37年的无创治疗领域创新

To generate short high-energy current impulses, EPCOS offers the triggered spark gaps of the TF series. A high voltage capacitance with a typical electrical strength of approximately 22 kV is discharged with currents of up to 10 kA.

A typical application for this kind of high-energy discharge current is the method of extracorporeal shock wave therapy (ESWT) or extracorporeal shock wave lithotripsy (ESWL) for medical purposes. For this application the capacitance, with typical values of between 100 nF and 1.2 μ F, is discharged across an inductance of a coil with a membrane (electro-dynamic principle), or across a spark gap immersed in an electrolyte fluid (spark plug principle). The mechanical impulse wave is focused onto the specified object (e.g. a kidney stone) in order to disintegrate it.

EPCOS offers various types for this purpose with different self-breakdown voltages and trigger designs. A triggered switching spark gap enables the main discharge of the capacitance to be controlled for voltages below the self-breakdown voltage. Typically the trigger voltage is between about 30% and 80% of the self-breakdown voltage. The advantage of triggered operation is that it controls the discharge voltage of the capacitor and, in the case of ESWT, it enables the medical treatment to start with low current impulses which can subsequently be increased.

General technical information

A typical circuit for creating a high energy surge impulse is shown in **Figure 31**. The capacitance C is charged by means of a generator and then at the required frequency the discharge to the switching spark gap is triggered by the trigger circuit. For high capacitances the switching spark gaps are triggered at a rate of 2 Hz. Under the conditions defined in the data sheet, a service life of between two and four million operations can be achieved.

为了产生短时高能电流脉冲，爱普科斯提供了TF系列触发放电器。耐压约为22 kV的高压电容可以产生10 kA以上的放电电流。

这种高能放电电流的典型应用是具有医疗用途的体外冲击波治疗(ESWT)或体外冲击波碎石术(ESWL)。在这些应用中，电容（电容量一般为100 nF至1.2 μ F）通过薄膜线圈电感（电动力学原理），或浸没在电解液中的火花间隙（火花塞原理）进行放电。放电形成的机械脉冲波聚焦到特定物体（例如肾结石）上并将其分解。为此，爱普科斯提供了各种具有不同自击穿电压和触发器设计的放电器型号。已触发的开关放电器使得电容的主放电电压可以低于自击穿电压。触发电压一般介于自击穿电压约30%与80%之间。触发操作的突出特点是其可以对电容器的放电电压进行控制，并且在体外冲击波治疗(ESWT)情况下，触发操作使得医疗过程的起始电流脉冲变得相当之低，然后再使电流缓慢升高。

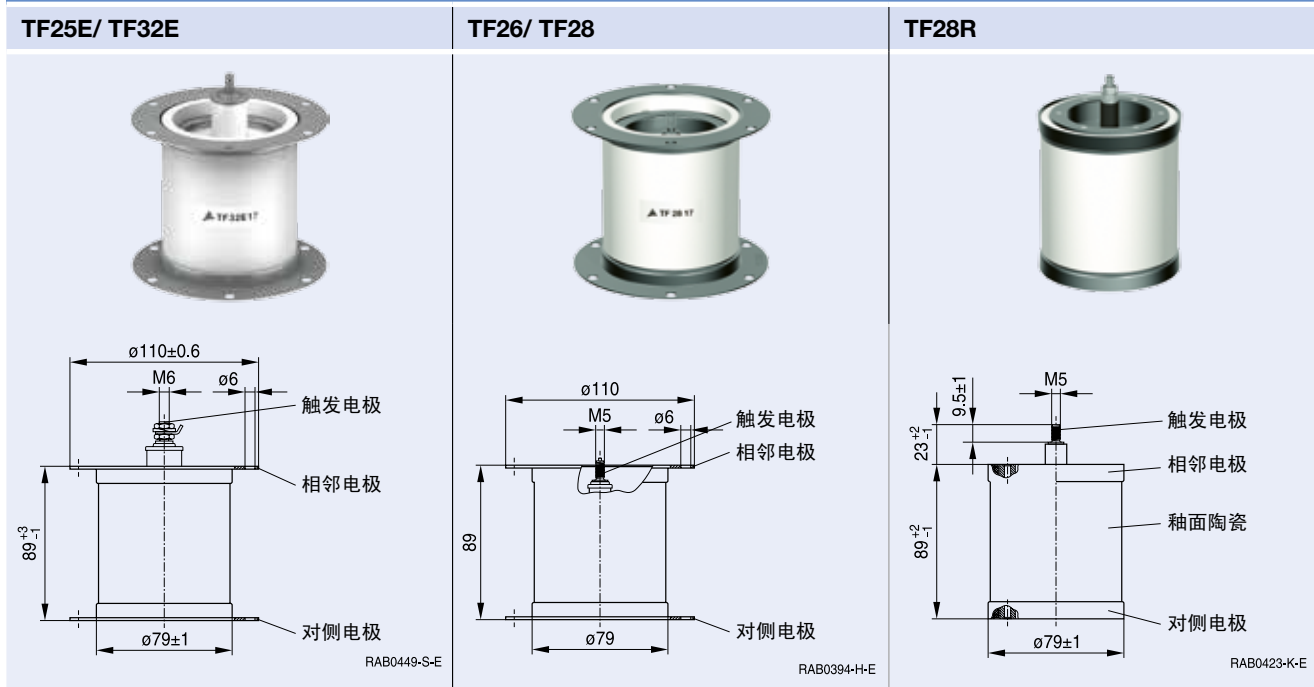
通用技术信息

用于产生高能量冲击脉冲的典型电路如图31所示。电容C通过电压发生器进行充电，然后根据所需频率，经由触发电路触发开关放电器进行放电。当电容较大时，开关放电器以2 Hz的频率进行触发。在数据表规定的条件下，开关放电器的使用寿命可以达到两百万到四百万次操作。

Triggered Switching Spark Gaps 触发式开关放电器



Triggered switching spark gaps 触发式开关放电器



型号 订货号	TF25E B88069X1093B011	TF26 B88069X9601B011	TF28 B88069X9091B011	TF28R B88069X3523B011	TF32E B88069X1443B011	
自击穿电压	25	26	28	28	32	kV
SBV容差	±10	±10	±10	±10	±10	%
初始触发击穿电压	8 ... 19	8.5 ... 21	8.5 ... 22	8.5 ... 22	10 ... 22	kV
使用期间触发击穿电压	8 ... 16	9.5 ... 21	10 ... 22	10 ... 22	10 ... 20	kV
开关操作@ 2 Hz	4 000 000	2 000 000	2 000 000	4 000 000	4 000 000	
放电电容	1.2	1.2	1.2	0.1	1.2	μF
开路峰值触发电压	> 15	> 15	> 15	> 15	> 15	kV
触发峰值电流	5 ... 20	~ 5	~ 5	~ 5	5 ... 20	A
击穿时间	< 50	< 50	< 50	< 50	< 50	ns
I绝缘电阻	> 100	> 100	> 100	> 100	> 100	MΩ

尺寸单位为mm

封装信息请参见第83页。

Display of ordering codes for EPCOS products

The ordering code for one and the same EPCOS product can be represented differently in data sheets, data books, other publications, on the EPCOS website, or in order-related documents such as shipping notes, order confirmations and product labels. **The varying representations of the ordering codes are due to different processes employed and do not affect the specifications of the respective products.**

Detailed information can be found on the Internet under www.epcos.com/orderingcodes.

爱普科斯产品订货号

某两个相同的爱普科斯产品的订货号在数据清单、数据手册、其他出版物、爱普科斯官网，或者与订单相关的文档（比如，发货票据、确认订单和产品标签）上的表述方式可能会有所不同。订货号表述方式的差异性是由不同的工艺流程造成的，并不影响各个产品的规格参数。

如需了解产品详细信息，敬请访问www.epcos.com/orderingcodes。

Quality

质量

No compromises

With our quality management (QM) system, and with a company wide zero-defect campaign based on the “Six Sigma” method, we are consistently improving our process control and, as a result, the quality of our products. Numerous awards illustrate how much customers appreciate this strict approach to quality.

Today, increasingly demanding quality requirements are passed along through the entire production chain. Tougher quality standards are becoming increasingly relevant to the company's key markets, which include the automobile industry, information and communications technology as well as industrial and consumer electronics.



International QM system standards

Manufacturers insist that their suppliers run QM systems that cover every function within the company and are precisely aimed at reliably controlling its processes and improving them continuously. These requirements are laid down in the international QM system standards ISO 9001 and ISO/TS 16949.

Certification to ISO 9001 and ISO/TS 16949

Our quality policy stipulates that our QM system must satisfy the requirements of the most demanding international standards in any particular case. Our factories and their supporting sites are therefore audited regularly by external third parties in order to maintain certification to ISO 9001 and ISO/TS 16949. The QM system is continuously monitored and systematically developed within the company. We do not accept any compromises with regard to quality, which means that we constantly strive for ongoing improvement in a continuous process, whereas process control is the key to business success. It is the only way to ensure products and services of the highest quality and thus customer satisfaction.

卓越品质

通过内部质量管理体系以及公司范围内基于“六西格玛”的零差错运动，爱普科斯不断地改善过程控制，以及提高产品质量。众多的奖项已说明顾客对这一严格的质量控制途径的认可。

目前，社会对整个供应链的质量要求不断提高。更加严格的质量标准与公司主要市场的关系变得越来越密切，其中包括汽车行业、信息和通讯技术以及工业和消费电子行业。

国际质量管理标准

生产商坚持要求供应商采用涵盖公司所有功能部门、严格控制生产过程并不断改进过程的质量管理体系。这些要求在国际质量管理体系标准ISO TS 16949:2002都有着相关规定。

通过ISO 9001和ISO/TS 16949认证

爱普科斯的质量方针规定，在任何特定条件下，质量管理体系都必须满足最严格的国际标准。因此，公司工厂及其服务站点都需经由外部第三方进行定期审核，以符合ISO 9001和ISO/TS 16949的认证标准。爱普科斯质量管理体系始终处于监控之下，并得以不断的系统开发。质量零差错同时还意味着在连续生产过程中不断改进，而过程控制则是企业成功的关键所在。这是确保产品和服务质量、满足顾客需求的唯一途径。

Quality

质量

Quality monitoring

100% test

Arresters and spark gaps are individually tested for correct operation before dispatch.

Sampling inspections

In our quality tests, we apply sampling inspections based on the following internationally recognized standard: ANSI Z 1.4, normal inspection level II.

These quality monitoring processes are applied within the scope of statistical process control (SPC) to the process steps, the type and delivery inspections as well as the reliability inspections. Our delivery inspection (including simulation of the customer's incoming inspection) operates with the test features V_{sdc} and R_{ins} unless otherwise agreed. For our outgoing quality inspection we practice AQL 0.65 or better. The average outgoing quality (AOQ) is measured regularly in ppm and evaluated on the basis of these values.

For switching spark gaps, application oriented lifetime tests are carried out (see individual data sheets).

Reliability inspections

The following tests are carried out on the basis of the international standards IEC or DIN EN 60068:

- Lifetime tests (switching spark gaps)
- Temperature cycling tests:

Arresters	-40 °C ... + 90 °C
Switching spark gaps	-40 °C ... + 125 °C
- Humidity tests (relative humidity = 93%)
- Continuous shock tests ($a = 400 \text{ ms}^{-2}$)
- Vibration tests ($f = 10$ to 500 Hz)
- Tension/bending tests of the lead wires
- Torsional strength tests of the lead wires
- Solderability tests
- Inspection of mechanical dimensions

The frequency and stress parameters used in these tests depend on the component types.

The product and dispatch packaging is monitored to DIN EN 24180 (strain, vibration and impact tests) as well as by means of transport tests performed under practical conditions.

Electrical stress

In the most international specifications, the failure modes for surge arresters are determined. Other failure modes are as follows:

质量监控

100%测试

发货前，放电管和开关放电器已经过单独测试，符合正常工作要求。

抽检

在质量测试中，我们采用了基于以下公认的国际标准进行抽检：ANSI Z 1.4，正常检查水平II。

这些质量监控过程涵盖动态过程控制(SPC)、过程步骤、型式和发货检验以及可靠性检验。除非另有规定，否则我们的发货检验（包括模拟客户进货检验）将采用 V_{sdc} 和 R_{ins} 测试。我们的出货质量检验将达到可接受质量水平（AQL 0.65）。平均出货质量(AOQ)以ppm进行测量，并以这些数值为基础进行评价。

对于开关放电器，我们采用了应用寿命测试（见单独数据表）。

可靠性检验

以下测试，我们采用了国际标准IEC或DIN EN 60068:

- 寿命测试（开关放电器）
- 温度循环测试：

放电管	-40 °C ... + 90 °C
开关放电器	-40 °C ... + 125 °C
- 湿度测试（相对湿度 = 93%）
- 连续冲击测试 ($a = 400 \text{ ms}^{-2}$)
- 振动测试 ($f = 10$ 至 500 Hz)
- 引线拉力/弯曲测试
- 引线扭转强度测试
- 可焊性测试
- 机械尺寸检测

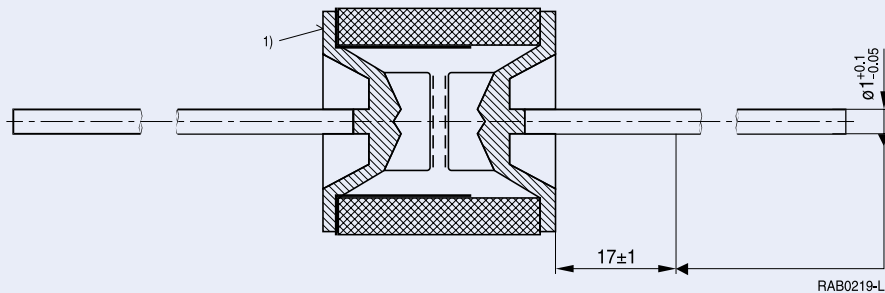
这些测试使用的频率和应力参数取决于元件的型号。

产品和封装符合DIN EN 24180要求（应力、振动和冲击测试），同时通过实际条件下的运输测试进行监控。

电气应力

大多数国际规范都确定了气体放电管的故障模式。其他故障模式如下：

Arresters with tin-plated surface 镀锡放电管



1) Thickness of tin plating measured on one point in the middle of the flange.

1) 法兰中间一点上测得的镀锡厚度

Figure / 图32

- Nominal discharge current and nominal alternating discharge current

Failure criteria:

Total failure

Short circuit

Failures due to variations:

$$V_{sdc} < 0.7 \times V_{sdcN}$$

$$V_{sdc} > 1.3 \times V_{sdcN}$$

Permissible failure rate:

$$< 5\%$$

- Single-discharge current and alternating discharge current

Failure criteria:

Total failure

Short circuit

Failures due to variations:

$$V_{sdc} < 0.5 \times V_{sdcN}$$

$$V_{sdc} > 1.5 \times V_{sdcN}$$

Permissible failure rate:

$$\leq 5\%$$

- 标称放电电流和标称耐工频电流

失效标准:

完全失效

变量失效:

短路

$$V_{sdc} < 0.7 \times V_{sdcN}$$

$$V_{sdc} > 1.3 \times V_{sdcN}$$

允许故障率:

$$< 5\%$$

- 单次放电电流和工频放电电流

失效标准:

完全失效

变量失效:

短路

$$V_{sdc} < 0.5 \times V_{sdcN}$$

$$V_{sdc} > 1.5 \times V_{sdcN}$$

允许故障率:

$$\leq 5\%$$

Layer thickness test of electrolytic surfaces

The electrolytic layers of the surge arresters and switching spark gaps are monitored during the manufacturing process at the measuring point shown in **Figure 32**.

Climatic framework conditions

The diverse requirements profiles for surge arresters and switching spark gaps are used to derive various temperature ranges for operation and storage. Due to their predominant use in telecom applications arresters have to comply with ITU-T, K.12, unless otherwise specified.

For switching spark gaps, the standards of the automotive industry are generally applied.

Temperature values are given in the product part of this brochure or in data sheets which are available at www.epcos.com/arresters.

镀层厚度测试

生产过程中对放电管和开关放电器的电镀层进行监控，测量点如图32所示。

天气条件

气体放电管和开关放电器的众多要求都用于确定工作和储存温度范围。由于这些产品主要用于电信领域，放电管必须符合ITU-T、K.12的要求，除非另有规定。

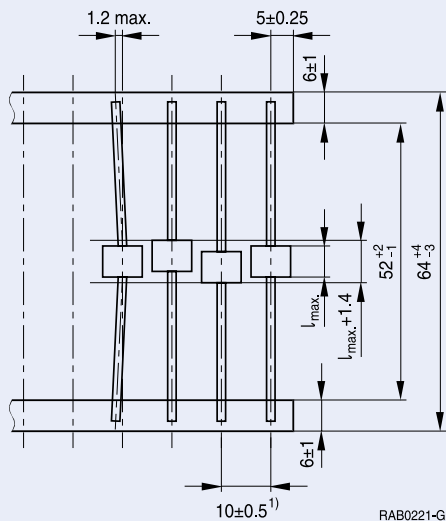
对于开关放电器，汽车行业的标准一般均可适用。

温度数值可参考本手册产品部分或网站www.epcos.com/arresters上的数据表。

Taping and Packing

卷带包装

Tape packing to IEC 60286-1 卷带包装符合IEC 60286-1标准

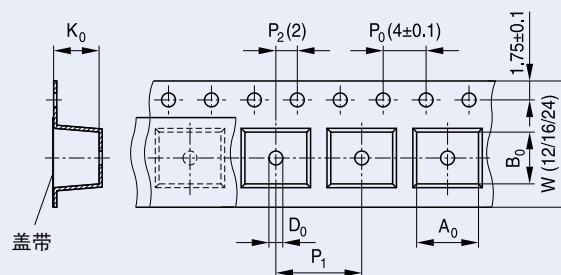


1) Permissible deviation over 10 spacings ± 2

1) 10个间隙间允许的误差为 ± 2

Figure / 图33a

Tape packaging to IEC 60286-3 卷带包装符合IEC 60286-3标准



IEC 60286-3规范和容差

RAB0364-M-E

Figure / 图33b

Packing

Surge arresters and switching spark gaps are supplied in various types of packing and packing units. These are encoded in the last four digits of ordering codes.

Depending on the design, 2-electrode arresters with a terminal wire are preferably supplied taped to IEC 60286-1. The wire length available for processing in taped arresters is correspondingly reduced (see **Figure 33a**).

In general unleaded arresters are delivered in plastic tapes to IEC 60286-3 (see **Figure 33b**).

包装

气体放电管和开关电器具有多种封装类型和封装单位，以定货号的后四位表示。

根据具体设计，带端子线的二极管放电管优先选择符合EN 60286-1要求的卷带封装方式。这相应减少了加工的引线长度（见图33a）。

根据IEC 60286-3标准，无引线的放电管一般采用塑料卷带运输（见图33b）。

Ordering code system / 订货号系统

订货号: B88069X1234 **S 102**

Packing / 包装

A =	AMMO packing on request / AMMO (弹药箱) 包装按要求提供
B =	Blister tray / 吸塑托盘
C =	Bulk packing / 散装
S =	Strip / 散装
T =	Standard tape / 标准卷带

Packing unit / 包装单位

代码	Pieces / 个数	代码	Pieces / 个数
101	10	252	250
102	10 (on 5 strips / 5根条带)	253	2500
103	1000	352	350
202	200	403	4000
203	2000	502	500
251	25	902	900

Mounting Instructions

安装说明

Bending lead wires 弯曲引线

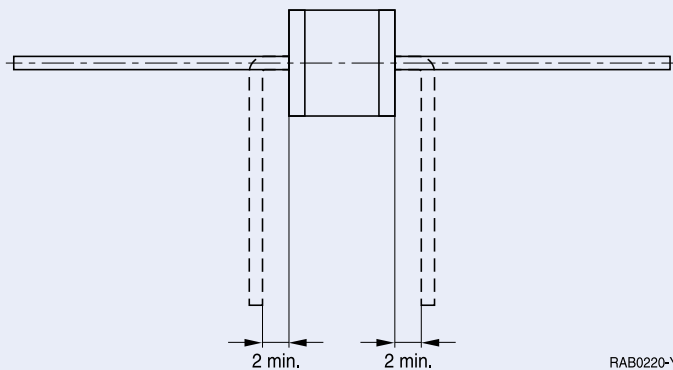


Figure / 图34

Bending and truncating lead wires

The processing of surge arresters may involve the bending or truncating of lead wires. It is then absolutely necessary to ensure that the metal-ceramic compound (electrodes/ceramic insulator) is not subject to mechanical stress and that no sudden stress affects the ceramic.

A minimum spacing of 2 mm must be observed between the body and the bend point (**Figure 34**). This ensures that the strength at the welding point between wire and electrode is not diminished.

The bending pattern of surge arresters from EPCOS may differ from that described above.

弯曲和剪切引线

气体放电管的加工可能涉及到引线的弯曲或剪切。然后必须完全确定金属-陶瓷组合（电极/陶瓷绝缘体）不会承受机械应力，并且陶瓷不会受到突然应力。

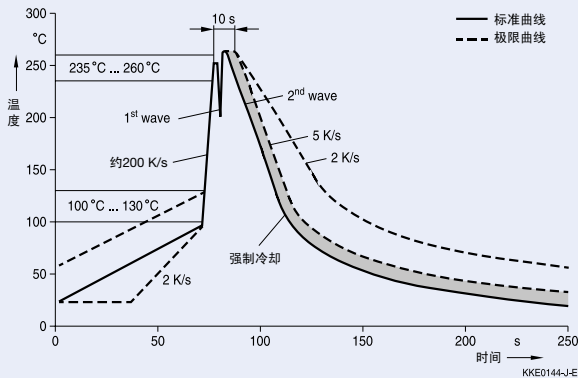
引线本身和弯曲点必须保持2 mm的最小间距（图34），确保引线和电极之间焊接点的强度不会降低。

爱普科斯气体放电管的弯曲形式可能与上述有所不同。

Mounting Instructions 安装说明

Recommended soldering profiles 建议焊接曲线

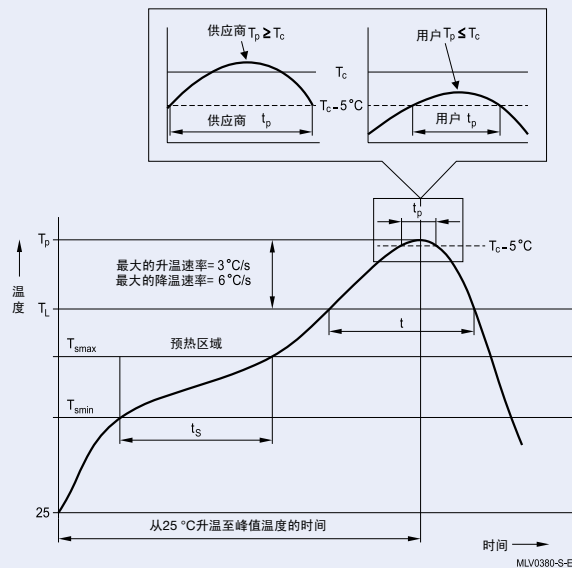
Wave soldering / 波峰焊



Soldering profile applied to a single soldering process.
单次焊接过程的焊接曲线。

Figure / 图35

Reflow soldering / 回流焊



Temperature rise rate: 3 °C/s
温度上升速率: 3 °C/s

Figure / 图36

EPCOS surge arresters are designed for the requirements of lead-free soldering.

Soldering temperature profiles are according to JEDEC J-STD-020D and IEC 60068-2-58 recommendations.

爱普科斯气体放电管专为满足无引线焊接的要求而设计。

焊接温度曲线符合JEDEC J-STD-020D和IEC 60068-2-58标准。

Solder 焊料	Solder bath temperature 焊锡槽温度	Dwell time 停留时间
Sn 95.5/Ag3.8/Cu 0.7	263 (±3) °C	< 3 s

Notes:

Soldering surge arresters with a failsafe mechanism needs to be examined individually.

- Recommended storage temperature +5 ... +35 °C
- Relative humidity 45 ... 80%
- Maximum storage period 2 years

备注:

带失效保护卡装置的气体放电管焊接应进行个体检验。

- 建议储存温度: +5 ... +35 °C
- 相对湿度: 45 ... 80%
- 最大储存期限: 2年

回流曲线特点		锡铅共熔合金	无铅合金	
预热和浸透				
最低温度	T_{smin}	100	150	°C
最高温度	T_{smax}	150	200	°C
时间	t_{smin} to t_{smax}	60 ... 120	60 ... 120	s
平均升温速度	T_L 至 T_p	最大3	最大3	°C/s
液态温度	T_L	183	217	°C
变为液态的时间	t_L	60 ... 150	60 ... 150	s
封装主体的峰值温度 ¹⁾	T_p	对于用户而言, T_p 不得超过分类温度。对于供应商而言, T_p 必须不低于分类温度。		°C
分类温度 ²⁾	T_C	220 ... 235	245 ... 260	°C
在指定分类温度(T_C) 5 °C 内的时间(t_p)	t_p ²⁾	20 ³⁾	30 ³⁾	s
平均降温速度	T_p to T_L	最大6	最大6	°C/s
从25 °C升温至峰值温度的时间		最大6	最大8	min

¹⁾ 采用供应商最小值与用户最大值定义的峰值特征温度 (T_p) 的公差。

²⁾ 取决于封装的厚度。详细信息请参考JEDEC J-STD-020D。

³⁾ 采用供应商最小值与用户最大值定义的峰值特征温度 (T_p) 下的时间公差。

Environmental Protection

环境保护

Global environment management

With our global environmental management in accordance with ISO 14001 we are protecting the environment to the same high standard in all parts of the world.

The same requirements are placed on every site; external institutes ensure, at regular intervals, that they are being observed.

As well as satisfying both statutory requirements and those imposed by the relevant authorities, our environmental management system aims to utilize natural resources efficiently. For that reason, we use our technological expertise to design and manufacture our electronic components in the most environmentally compatible way possible. We are continuously optimizing our products and processes in order to use materials in a way that minimizes the impact on resources, to use substitutes for hazardous materials wherever possible, and to reduce waste to a minimum.



Material data sheets

An obligatory list of materials and substances has its foundations in our quality management system, and this guarantees that a consistent procedure is applied to all our products. We are, moreover, active in a large number of committees, working groups and commissions associated with the electronics industry, with the aim of pushing forward the standardization of material data sheets for electronic components. The materials contained in our products are listed in detail on these material data sheets, so that customers, in turn, can satisfy the environmental requirements imposed upon them.

Material data sheets for EPCOS products can be found under www.epcos.com/material.

Substances in components regulated by law (RoHS)

Although components are not directly covered by Directive 2011/65/EU (RoHS), we observe this directive on the basis of the current state of knowledge. With due consideration to the exemptions defined in the Annex III to 2011/65/EU, all our products are free¹⁾ of:

- Cadmium and cadmium compounds
- Hexavalent chromium
- Mercury and mercury compounds
- PBBs and PBDEs
- Lead and lead compounds.

¹⁾ “free” means that the substances listed in para. 4 of Directive 2011/65/EU may be contained in the homogeneous material less than 0.1%.

全球环境管理

通过实行符合ISO14001的全球环境管理，我们在世界任何地点都能达到相同的环保标准。

所有爱普科斯公司、分公司及外部研究院都采用相同的要求，并定期检查其执行情况。

在满足法律要求以及相关方面规定的同时，我们的环境管理体系的目的还在于有效利用自然资源。鉴于此，我们以最环保的方式利用专业技术设计和生产无源电子元件。我们不断优化产品和过程，以便以最环保的方式利用材料，尽量选择有害材料的替代材料，将浪费降到最低程度。

材料清单

我们的环境管理体系采用强制性的材料和物质清单，确保所有爱普科斯产品都遵从一致的程序。同时，我们积极参加各类与电子行业有关的委员会、工作组和协会，以期推动无源电子元件材料清单的标准化。我们的产品所含的材料都详细地记录在此类清单上，因而客户也可以满足对他们的环保要求。

我们将爱普科斯的材料清单公布在网站www.epcos.com/material上。

法律限制的物质 (RoHS)

尽管指令2002/95/EU (RoHS) 并未包含某些元件，但是我们仍以最新的认识来遵守该指令。充分考虑到2002/95/EU附件III所确定的豁免个例，所有爱普科斯产品均不含有：¹⁾

- 镉和镉化合物
- 六价铬
- 汞和汞化合物
- 多溴联苯 (PBB) 及多溴联苯醚 (PBDE)
- 铅和铅化合物。

¹⁾ “不含”意味着指令2011/65 / EU第4节所列物质在均质材料中的含量小于0.1%。

Get in Contact

联系信息

联系爱普科斯在大中华区销售办事处

■ 爱普科斯（上海）产品服务有限公司·上海办事处

上海市长宁区延安西路2201号国际贸易中心
33楼3305室
邮编: 200336
电话: +86 21 22 19 15 00
传真: +86 21 22 19 15 99

■ 爱普科斯（上海）产品服务有限公司·深圳办事处

中国广东省深圳市福田区益田路5033号
平安金融中心69楼
邮编: 58048
电话: +86 755 82 75 91 00
传真: +86 755 82 75 91 35

■ 爱普科斯（上海）产品服务有限公司·北京办事处

中国北京市朝阳区光华路7号汉威大厦B座5B501室
邮编: 100004
电话: +86 10 85 86 86 73
传真: +86 10 85 86 92 04

■ 爱普科斯（上海）产品服务有限公司·厦门办事处

福建省厦门市集美区同集南路413-419号
邮编: 361021
电话: +86 592 22 02 21 0
传真: +86 592 22 02 25 0

■ 爱普科斯（上海）产品服务有限公司·西安办事处

陕西省西安市高新区科技路48号创业广场B905B室
邮编: 710075
电话: +86 29 88 32 04 60
传真: +86 29 88 32 07 83

■ 爱普科斯股份有限公司·台北办事处

台北市115南港区三重路66号7楼700-702室
电话: +886 2 26 55 76 76
传真: +886 2 27 82 03 89

■ 爱普科斯有限公司·香港办事处

香港新界沙田香港科学园科技大道东六号新科中心1楼
电话: +852 36 69 82 00
传真: +852 36 69 82 56

重要信息: 本出版物的部分内容包含有关我们的产品在某些应用领域使用时的适用描述。这些描述是基于我们对产品在特定应用领域时典型要求的了解。但我们明确指出，这些描述不能被视为是产品在特定的客户应用时的适应性的约束。客户负有最终的责任,根据产品的性能规格决定爱普科斯的产品是否满足应用的要求。本出版物只是简明的产品概述，内容会随着时间的推移而不断更改。如需查询详细产品信息，请查阅我们的产品数据手册。重要说明(www.epcos.com/ImportantNotes)，以及产品特定的警告和敬告需要得到严格遵守。所有相关信息，都可通过我们销售办事处获得。

有关爱普科斯全球分销网络和地区销售网点，详情请登录 www.epcos-china.com/sales

在未获得爱普科斯(EPCOS)预先许可的情况下，禁止复制、发行和传播本出版物及其包含的信息。

