



## Surge arrester

2-electrode arrester

**Series/Type:** S20-A470X  
**Ordering code:** B88069X1193T303  
Version/Date: Issue 04 / 2013-09-17

## Description

The S20-series has been especially designed to meet data transmission protection requirements. The optimized design features a high level of protection against fast rising transients usually caused by lightning disturbances. For use in high frequency data lines, the series offers ultra low capacitances and shows only marginally signal losses up to high frequencies. The devices are extremely reliable and are able to withstand high surge currents without destruction.

## Features

- Very small size (EIA 1206)
- Short response time
- High current handling capability
- Stable performance over service life
- Ultra low capacitance and insertion loss
- High insulation resistance
- Excellent SMD handling
- RoHS-compatible

## Applications

### Telecommunication:

- Ethernet, PoE, xDSL
- Cable modem, splitters, line cards
- Wireless antenna protection

### Others:

- CCTV
- Switching power supply

## Product characteristics

Physical dimensions (width x depth x height)	0.126 x 0.063 x 0.063	in
	3.2 x 1.6 x 1.6	mm
	EIA 1206 / 3216 metric	
Weight	~ 0.05	g
Operating temperature	-40 ... +90	°C
Recommended storage <sup>1)</sup>		
- temperature	+5 ... +35	°C
- humidity	45 ... 80	%
- period	≤ 2	years
Climatic category (IEC 60068-1)	40/ 90/ 21	
Moisture sensitivity level <sup>2)</sup>	1	
Marking	without	
Certifications	UL 497B (E163070)	

### Notes:

<sup>1)</sup> Specified in terms of corrosion against Sn-plating

<sup>2)</sup> Tests according to JEDEC J-STD-020

**Electrical specifications and stress test methods**

Nominal DC spark-over voltage <sup>3) 4)</sup>	470	V
Tolerance	±30	%
Min.	329	V
Max.	611	V
Impulse spark-over voltage		
at 100 V/μs	- for 99% of measured values - typical values of distribution	< 1050 V < 950 V
at 1 kV/μs	- for 99% of measured values - typical values of distribution	< 1200 V < 1050 V
at 10/700 μs, 6 kV	- for 99% of measured values - typical values of distribution	< 1200 V < 1000 V
Service life <sup>5) 6)</sup>		
10 operations [5x (+) & 5x (-)] 8/20 μs	0.5	kA
10 operations [5x (+) & 5x (-)] 5/320 μs <sup>7)</sup>	150	A
Insulation resistance at 100 V <sub>DC</sub>	> 1	GΩ
Capacitance at 1 MHz	< 0.3	pF
Arc voltage at 1 A	~ 10	V
Glow to arc transition current	~ 1.0	A
Glow voltage	~ 60	V

<sup>3)</sup> At delivery AQL 0.65 level II, DIN ISO 2859

<sup>4)</sup> In ionized mode

<sup>5)</sup> Tests according to ITU-T Rec. K. 12 and UL 497B

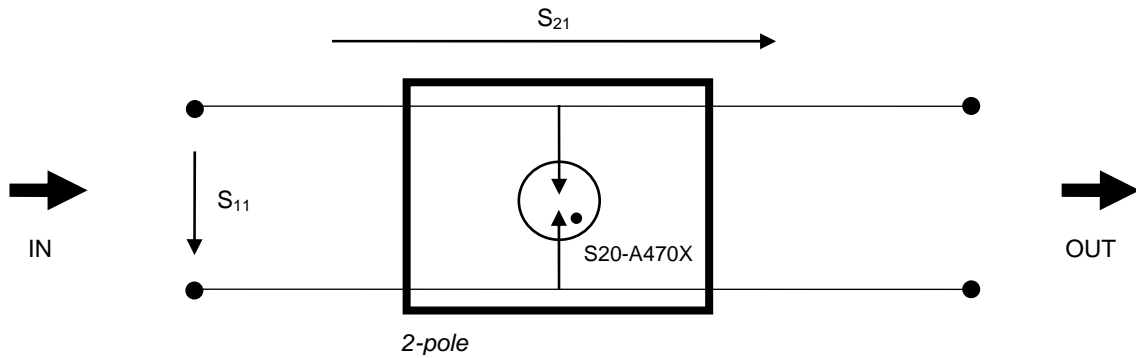
<sup>6)</sup> After service life: DC spark-over voltage 470 V ±40%

<sup>7)</sup> Test generator 6 kV, 10/700 μs, 40 Ω

Terms and current waveforms in accordance with ITU-T Rec. K. 12; IEC 61643-21; IEC 61643-311 and IEC 61663-2.

**S-parameters**

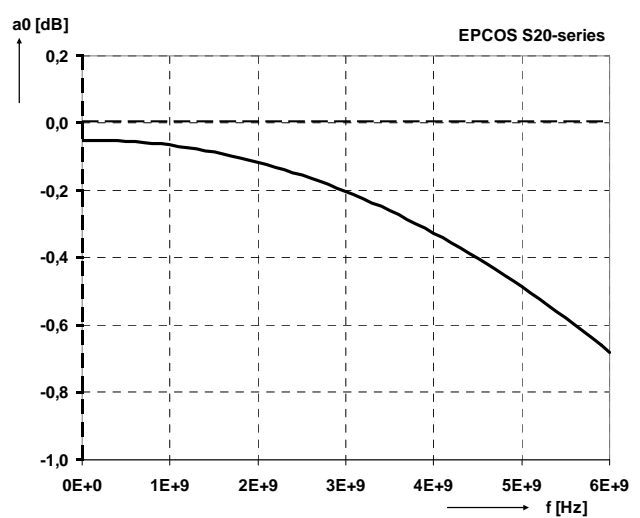
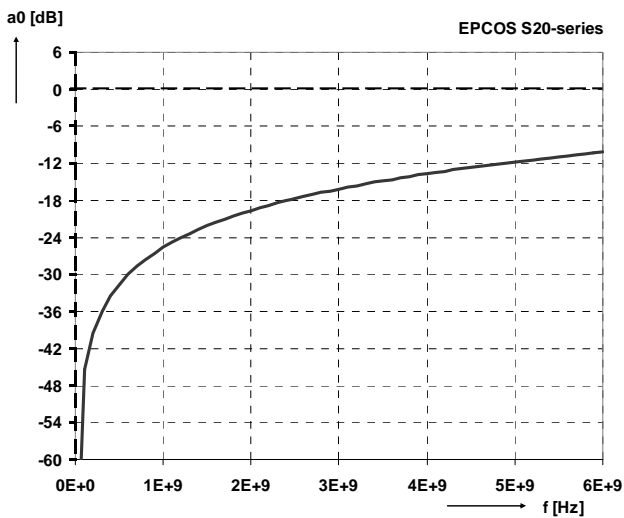
Circuit diagram:



Electrical specifications according circuit diagram:

**Input port voltage reflection coefficient  $S_{11}$**   
(typical values of distribution)

**Forward voltage gain  $S_{21}$**   
(typical values of distribution)

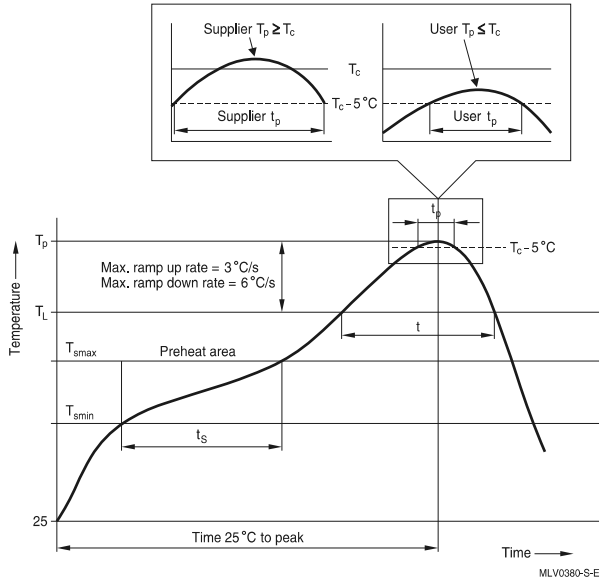


Frequency	$S_{11}$
1.00 GHz	-25 dB
1.40 GHz	-22 dB
1.80 GHz	-20 dB
2.10 GHz	-19 dB
2.45 GHz	-17 dB
2.80 GHz	-16 dB
3.10 GHz	-15 dB
3.50 GHz	-14 dB
4.00 GHz	-13 dB
5.00 GHz	-11 dB
6.00 GHz	-10 dB

Frequency	$S_{21}$
1.00 GHz	-0.07 dB
1.40 GHz	-0.08 dB
1.80 GHz	-0.10 dB
2.10 GHz	-0.12 dB
2.45 GHz	-0.15 dB
2.80 GHz	-0.18 dB
3.10 GHz	-0.21 dB
3.50 GHz	-0.26 dB
4.00 GHz	-0.35 dB
5.00 GHz	-0.50 dB
6.00 GHz	-0.70 dB

Soldering parameters

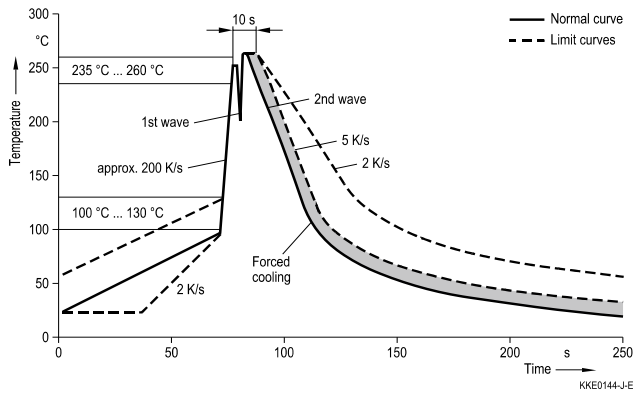
Reflow soldering



Reflow profile feature		Sn- Pb eutectic assembly	Pb-free assembly
Preheat and soak - Temperature min - Temperature max - Time	$T_{smin}$ $T_{smax}$ $t_{smin}$ to $t_{smax}$	100 °C 150 °C 60 ... 120 s	150 °C 200 °C 60 ... 180 s
Average ramp-up rate	$T_{smax}$ to $T_p$	max. 3 °C/ s	max. 3 °C/ s
Liquidous temperature Time at liquidous	$T_L$ $t_L$	183 °C 60 ... 150 s	217 °C 60 ... 150 s
Peak package body temperature *	$T_p$	220 ... 235 °C **	245 ... 260 °C **
Time ( $t_p$ ) ** within 5 °C of the specified classification temperature ( $T_c$ )		20 s ***	30 s ***
Average ramp-down rate	$T_p$ to $T_{smax}$	max. 6 °C/ s	max. 6 °C/ s
Time 25 °C to peak temperature		max. 6 min	max. 8 min

\* = Tolerance for peak profile temperature ( $T_p$ ) is defined as a supplier minimum and a user maximum.  
 \*\* = For details please refer to JEDEC J-STD-020D.  
 \*\*\* = Tolerance for time at peak profile temperature ( $t_p$ ) is defined as a supplier minimum and a user maximum.

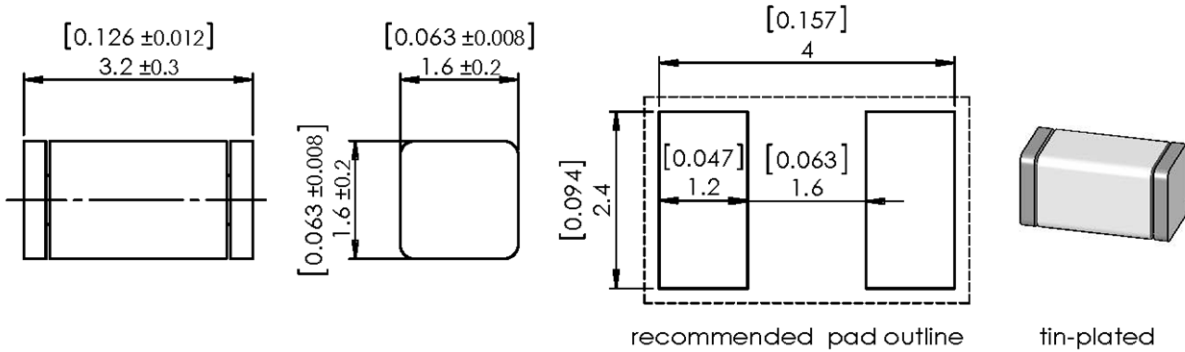
Wave soldering



Wave profile feature	Pb-free assembly
Solder	Sn 95.5 / Ag 3.8 / Cu 0.7
Solder bath temperature	263 (±3) °C
Dwell time	< 3 s

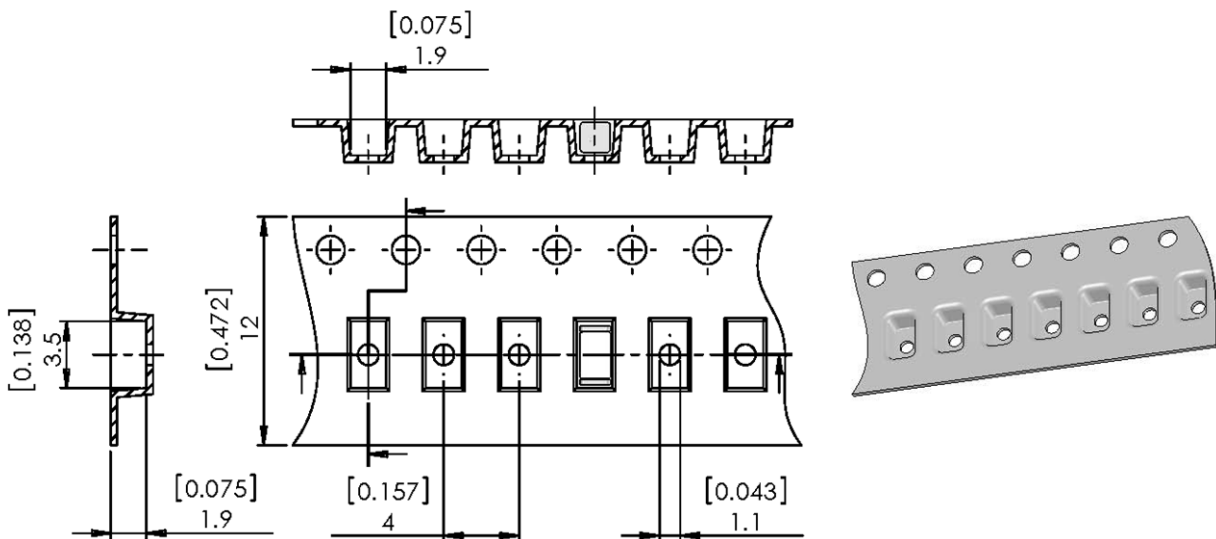
Soldering profile applied to a single soldering process.

Dimensions in mm and inch [...]



Ordering code and packing advice

B88069X1193T303 = 3000 pcs. on SMD-tape



**Reliability inspections**

Test	Parameter
Outer dimensions	Arrester (acc. data sheet)
Environmental testing – test B: dry heat DIN IEC 60068 part 2-2 test Bd	T = max. operating temperature period: 16 h
Environmental testing – test A: cold DIN IEC 60068 part 2-1 test Ab	T = min. operating temperature period = 16 h
Environmental testing – test N: change of temperature DIN IEC 60068 part 2-14 test Na	TA = min. operating temperature; TB = max. operating temperature t1 = each 30 min.; cycles = 5
Environmental testing – test Cab: damp heat, steady state DIN IEC 60068 part 2-78 test Cab	T = 40 °C; relative humidity = 93% test period = 21 days
Environmental testing – test N: bump DIN IEC 60068 part 2-29 test Eb	a = 400 m/s <sup>2</sup> ; shock period = 6 ms; shock number = 4000
Environmental testing – test Fc: vibration DIN IEC 60068 part 2-6 test Fc	f = 10 ... 500 Hz; A = 0.75 mm; a = 100 m/s <sup>2</sup> ; cycles = 10; directions = 2
Environmental testing – test T: soldering DIN IEC 60068 part 2-20 test Ta method 3	Enclosing time in delivery status ≤2 s; after aging ≤4 s regular QCC-control
Environmental testing – test Td: solderability (SMD) DIN IEC 60068 part 2-58 test Td	Solder temperature = 260 °C pre heating = 150 °C / 120 s cooling <50 s; dipping time = 3 x 10 s

**Cautions and warnings**

- Surge arresters must not be operated directly in power supply networks.
- Surge arresters may become hot in the event of longer periods of current stress (danger of burning). In the event of thermal overload. The connectors may fail or the component may be destroyed.
- Surge arresters must be handled with care and must not be dropped.
- Damaged surge arresters must not be re-used.

**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](http://www.epcos.com/orderingcodes).

## Important notes

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 life-saving 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](http://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, BAOKE, Alu-X, CeraDiode, CeraLink, CeraPlas, CSMP, CSSP, CTVS, DeltaCap, DigiSiMic, DSSP, FilterCap, FormFit, MiniBlue, MiniCell, MKD, MKK, MLSC, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, SIP5D, SIP5K, 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](http://www.epcos.com/trademarks).