CTVS - Ceramic transient voltage suppressors

SMD multilayer varistor, ESD/EMI filter series

Series/Type:	**CA04F2FT5AUD010G**
Ordering code:	**B72862F1050S160**
Date:	2017-10-11
Version:	5

EPCOS AG is a TDK Group Company.

ESD/EMI 0405 audio filter

Description

Today's electronic devices are more and more sensitive to electrostatic discharges (ESD) and electromagnetic interference (EMI). Therefore reliable protection components become absolutely necessary in order to meet enhanced EMC standards.

The ESD/EMI 0405 Audio Filter has the benefit to offer two different functions in one component. It efficiently attenuates noise between 800 – 3000 MHz from the signal lines generated by electromagnetic interference of the frequency carrier bands of a mobile phone. Additionally it protects the circuit from the impact of ESD. The functionality of up to 10 discrete components was integrated in one component in a small size 0405. The novel feed trough design with common ground electrodes benefits in an easy PCB layout.

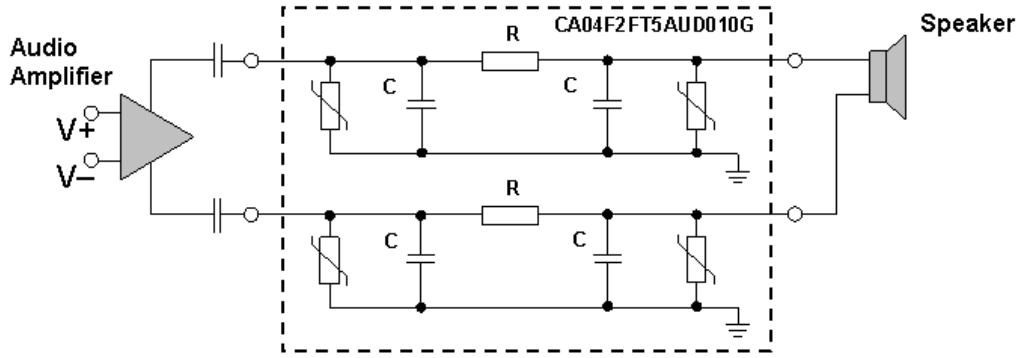
Features

- High attenuation in a wide frequency range covering GSM, UMTS, GPRS, WLAN and Bluetooth and GPS
- ESD robustness according to IEC 61000-4-2 level 4 on input and output ports
- Up to 20 components integrated in one package
- Low DC leakage currents
- Bi-directional protection
- Low inductance due to common ground contacts
- High frequency stability versus temperature
- RoHS-compatible

Applications

Reliable ESD/EMI filtering of audio lines (2-fold array), LCD module interface and camera sensor lines (4-fold array) in mobile phones, PDA's, notebooks.

Example: ESD/EMI filtering of audio speaker lines in mobile phones



Pin configuration

Pin	Description
P1	I/O Line 1
P2	I/O Line 2
P3	I/O Line 1
P4	I/O Line 2
P5	GND
P6	GND

Due to the symmetrical configuration no marking information is needed. P1 and P3, P2 and P4 can be interchanged.

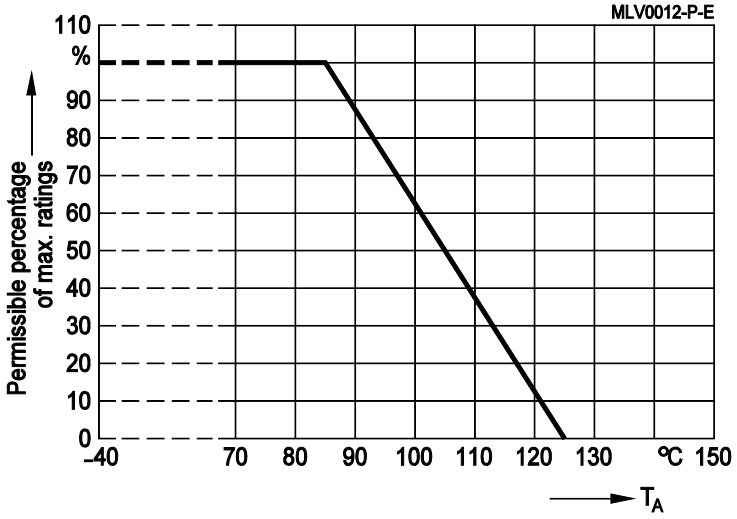
Maximum ratings (T_A = +85 °C)

Rating	Symbol	Value	Unit
Maximum DC operating voltage	$V_{DC,max}$	5	V
Air discharge ESD capability (to IEC 61000-4-2 method)	$V_{ESD,air}$	15	kV
Contact discharge ESD capability (to IEC 61000-4-2 method)	$V_{ESD,contact}$	8	kV
Operating temperature (without derating)	T_{op}	–40 … +85	°C
Storage temperature	T_{stg}	–40 … +125	°C

Characteristics (TA = +25 °C)

Parameter	Symbol	Conditions	Minimum	Typical	Maximum	Unit
Varistor voltage	V_V	I_V = 1 mA	8	10	-	V
DC leakage current	I_{leak}	V_{leak} = 3 V	-	0.05	1	µA
Capacitance	$C_{line}=C_1+C_2$	V = 0.5 V, f = 1 MHz	189	270	351	V
DC resistance	R_s		-	0.2	-	Ω
Response time			-	-	0.5	ns

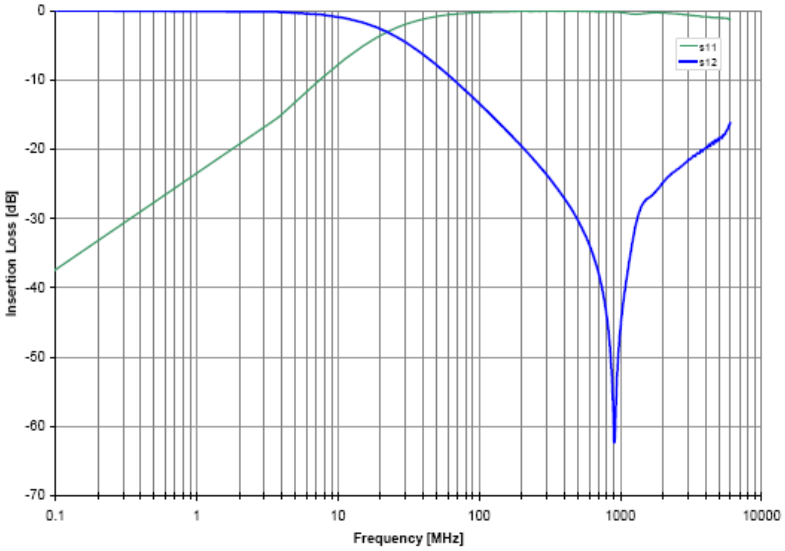
Temperature derating



Filtering characteristics

Ordering code	Capacitance	DC resistance	Cut-off frequency		Resonance frequency	−20 dB attenuation band
	1 MHz, 0.5 V DC		−3 dB		typical	typical
	±30%	Typ.	50 Ω, Bias = 0 V		50 Ω, Bias = 0 V	50 Ω, Bias = 0 V
	pF	Ohm	MHz		MHz	MHz
			Min.	Typ.		
B72862F1050S160	270	0.2	10	25	900	200 … 4000

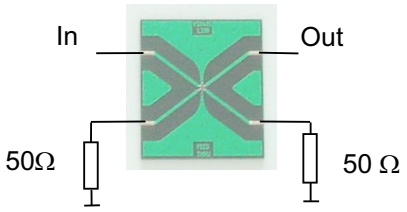
Typical s-parameters



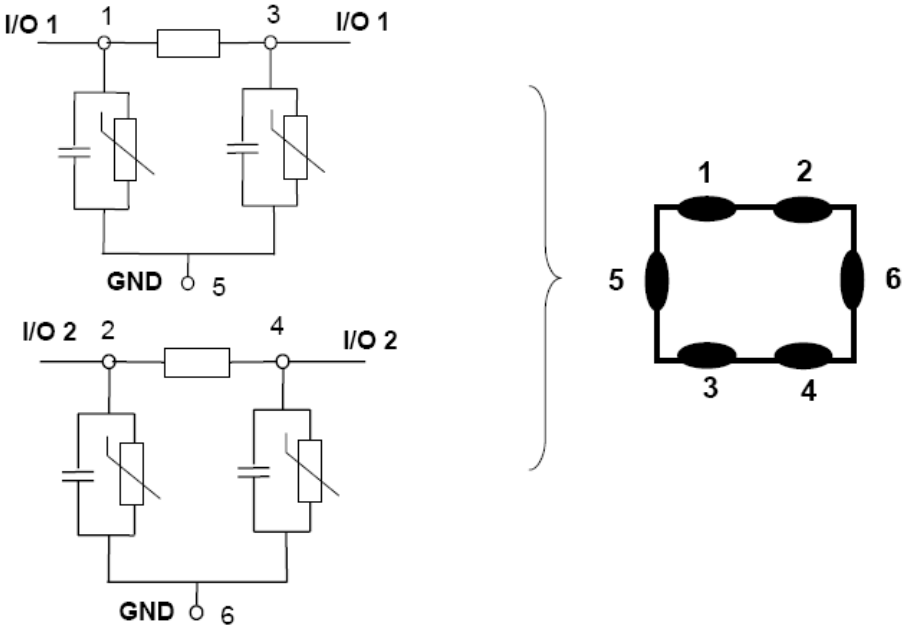
Measurement setup:

Network analyzer HP8573D with 50 Ω impedance reference.

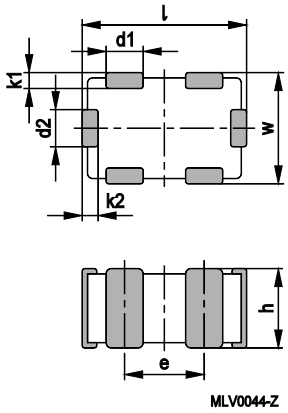
Calibration procedure with full 4 port S-O-L-T in fixture cal kit. Measurement test boards are available upon request.



Equivalent circuit

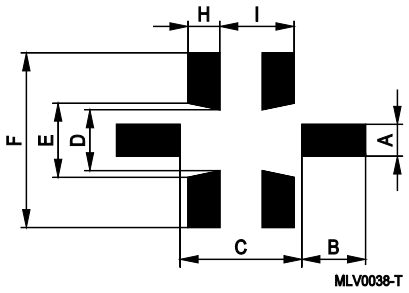


Dimensional drawing in mm



	Case size 0405	
Symbol	**Dimensions mm**	**Tolerance**
l	1.37	±0.15
w	1.00	+0/−0.15
h	0.65	Max.
e	0.64	Ref.
d1	0.36	±0.1
k1	0.20	±0.1
d2	0.36	±0.15
k2	0.20	±0.15

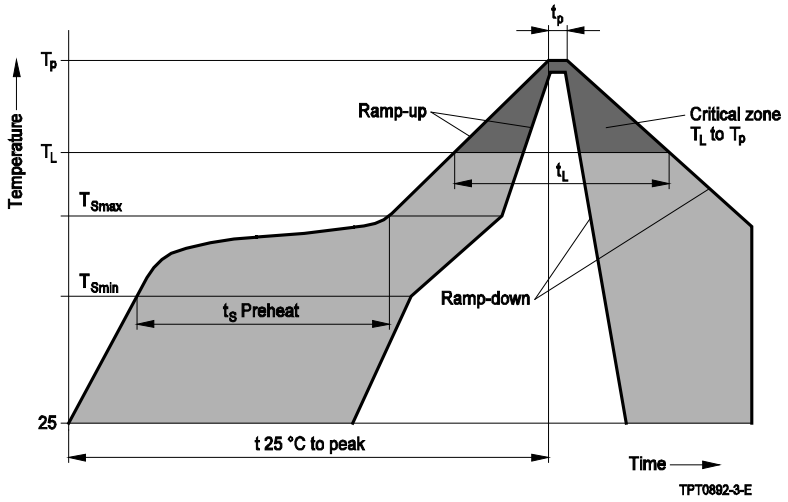
Recommended solder pad layout



A = 0.4 mm
B = 0.55 mm
C = 1.04 mm
D = 0.6 mm
E = 0.7 mm
F = 1.7 mm
G = -
H = 0.4 mm
I = 0.64 mm

Recommended soldering temperature profiles

Reflow soldering temperature profile



Profile feature	Sn-Pb eutectic assembly	Pb-free assembly
Average ramp-up rate (T_{Smax} to T_p)	+3 °C/ second max.	+3 °C/ second max.
Preheat		
- Temperature min (T_{Smin})	+100 °C	+150 °C
- Temperature max (T_{Smax})	+150 °C	+200 °C
- Time (t_{Smin} to t_{Smax})	60 … 120 seconds	60 … 180 seconds
Time maintained above		
- Temperature min (T_L)	+183 °C	+217 °C
- Time (t_L)	60 … 150 seconds	60 … 150 seconds
Peak classification temperature (T_p)	+220 °C … +240 °C	+240 °C … +260 °C
Time within 5 °C of actual peak temperature (t_p)	10 … 30 seconds	20 … 40 seconds
Ramp-down rate	−6 °C/ second max.	−6 °C/ second max.
Time +25 °C to peak temperature	6 minutes max.	8 minutes max.

Notes: All temperatures refer to topside of the package, measured on the package body surface.
Max. number of reflow cycles: 3

Soldering guidelines

The usage of mild, non-activated fluxes for soldering is recommended, as well as proper cleaning of the PCB.

The components are suitable for reflow soldering to JEDEC J-STD-020D.

Taping and packaging

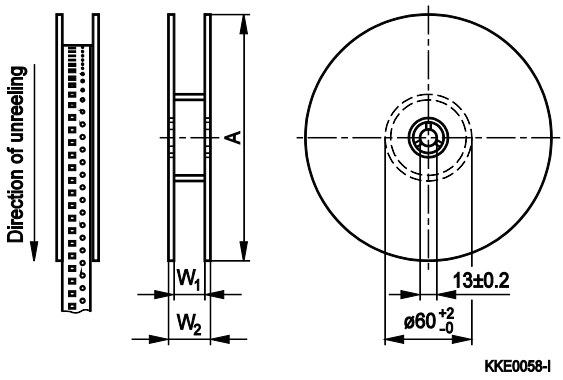
Tape and reel packing according to IEC 60286-3
Tape material: Cardboard

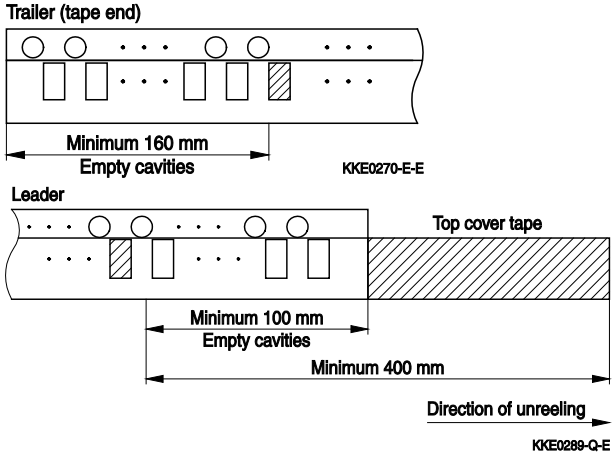
	Case size 0405		
Definition	**Symbol**	**in mm**	**Tolerance**
Tape width	W	8.00	±0.3

Packing

Packing material: Plastic

Reel dimensions





Definition	Symbol	Dimensions mm	Tolerance mm
Reel diameter	A	180	+0/−3
Reel width (inside)	W_1	8.4	+1.5/−0
Reel width (outside)	W_2	14.4	max.

Packing units

Type	Ordering code	Case size	Qty. per reel	Reel size
CA04F2FT5AUD010G	B72862F1050S160	0405	5000	180 mm

Cautions and warnings

General

Some parts of this publication contain statements about the suitability of our ceramic transient voltage suppressor (CTVS) components (multilayer varistors (MLVs)), CeraDiodes, ESD/EMI filters, leaded transient voltage/ RFI suppressors (SHCV types)) for certain areas of application, including recommendations about incorporation/design-in of these products into customer applications. The statements are based on our knowledge of typical requirements often made of our CTVS devices in the particular areas. We nevertheless expressly point out that such statements cannot be regarded as binding statements about the suitability of our CTVS components 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 incumbent on the customer to check and decide whether the CTVS devices with the properties described in the product specification are suitable for use in a particular customer application.

- Do not use EPCOS CTVS components for purposes not identified in our specifications, application notes and data books.
- Ensure the suitability of a CTVS in particular by testing it for reliability during design-in. Always evaluate a CTVS component under worst-case conditions.
- Pay special attention to the reliability of CTVS devices intended for use in safety-critical applications (e.g. medical equipment, automotive, spacecraft, nuclear power plant).

Design notes

- Always connect a CTVS in parallel with the electronic circuit to be protected.
- Consider maximum rated power dissipation if a CTVS has insufficient time to cool down between a number of pulses occurring within a specified isolated time period. Ensure that electrical characteristics do not degrade.
- Consider derating at higher operating temperatures. Choose the highest voltage class compatible with derating at higher temperatures.
- Surge currents beyond specified values will puncture a CTVS. In extreme cases a CTVS will burst.
- If steep surge current edges are to be expected, make sure your design is as low-inductance as possible.
- In some cases the malfunctioning of passive electronic components or failure before the end of their service life cannot be completely ruled out in the current state of the art, even if they are operated as specified. In applications requiring a very high level of operational safety and especially when the malfunction or failure of a passive electronic component could endanger human life or health (e.g. in accident prevention, life-saving systems, or automotive battery line applications such as clamp 30), ensure by suitable design of the application or other measures (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of such a malfunction or failure. Only use CTVS components from the automotive series in safety-relevant applications.
- Specified values only apply to CTVS components that have not been subject to prior electrical, mechanical or thermal damage. The use of CTVS devices in line-to-ground applications is therefore not advisable, and it is only allowed together with safety countermeasures like thermal fuses.

Storage

- Only store CTVS in their original packaging. Do not open the package before storage.
- Storage conditions in original packaging: temperature 25 to +45°C, relative humidity d75% annual average, maximum 95%, dew precipitation is inadmissible.
- Do not store CTVS devices where they are exposed to heat or direct sunlight. Otherwise the packaging material may be deformed or CTVS may stick together, causing problems during mounting.
- Avoid contamination of the CTVS surface during storage, handling and processing.
- Avoid storing CTVS devices in harmful environments where they are exposed to corrosive gases for example (SO_x, Cl).
- Use CTVS as soon as possible after opening factory seals such as polyvinyl-sealed packages.
- Solder CTVS components after shipment from EPCOS within the time specified:
  - CTVS with Ni barrier termination, 12 months
  - CTVS with AgPt termination, 6 months
  - SHCV 24 months

Handling

- Do not drop CTVS components and allow them to be chipped.
- Do not touch CTVS with your bare hands - gloves are recommended.
- Avoid contamination of the CTVS surface during handling.
- Washing processes may damage the product due to the possible static or cyclic mechanical loads (e.g. ultrasonic cleaning). They may cause cracks to develop on the product and its parts, which might lead to reduced reliability or lifetime.

Mounting

- When CTVS devices are encapsulated with sealing material or overmolded with plastic material, electrical characteristics might be degraded and the life time reduced.
- Make sure an electrode is not scratched before, during or after the mounting process.
- Make sure contacts and housings used for assembly with CTVS components are clean before mounting.
- The surface temperature of an operating CTVS can be higher. Ensure that adjacent components are placed at a sufficient distance from a CTVS to allow proper cooling.
- Avoid contamination of the CTVS surface during processing.

Soldering

- Complete removal of flux is recommended to avoid surface contamination that can result in an instable and/or high leakage current.
- Use resin-type or non-activated flux.
- Bear in mind that insufficient preheating may cause ceramic cracks.
- Rapid cooling by dipping in solvent is not recommended, otherwise a component may crack.

Operation

- Use CTVS only within the specified operating temperature range.
- Use CTVS only within specified voltage and current ranges.
- Environmental conditions must not harm a CTVS. Only use them in normal atmospheric conditions. Reducing the atmosphere (e.g. hydrogen or nitrogen atmosphere) is prohibited.
- Prevent a CTVS from contacting liquids and solvents. Make sure that no water enters a CTVS (e.g. through plug terminals).
- Avoid dewing and condensation.
- EPCOS CTVS components are mainly designed for encased applications. Under all circumstances avoid exposure to:
    - direct sunlight
    - rain or condensation
    - steam, saline spray
    - corrosive gases
    - atmosphere with reduced oxygen content
- EPCOS CTVS devices are not suitable for switching applications or voltage stabilization where static power dissipation is required.

This listing does not claim to be complete, but merely reflects the experience of EPCOS AG.

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

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 we are 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 a 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.tdk-electronics.tdk.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 our General Terms and Conditions of Supply.**
7. **Our manufacturing sites serving the automotive business apply the IATF 16949 standard.** The IATF certifications confirm our compliance with requirements regarding the quality management system in the automotive industry. Referring to customer requirements and customer specific requirements (“CSR”) TDK always has and will continue to have the policy of respecting individual agreements. Even if IATF 16949 may appear to support the acceptance of unilateral requirements, we hereby like to emphasize that **only requirements mutually agreed upon can and will be implemented in our Quality Management System.** For clarification purposes we like to point out that obligations from IATF 16949 shall only become legally binding if individually agreed upon.
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