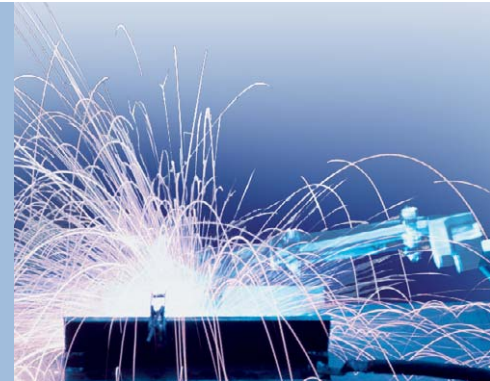
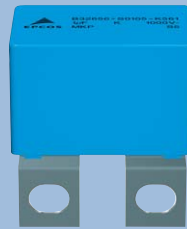
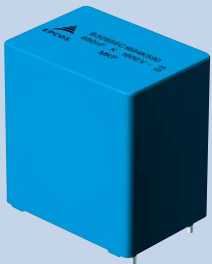




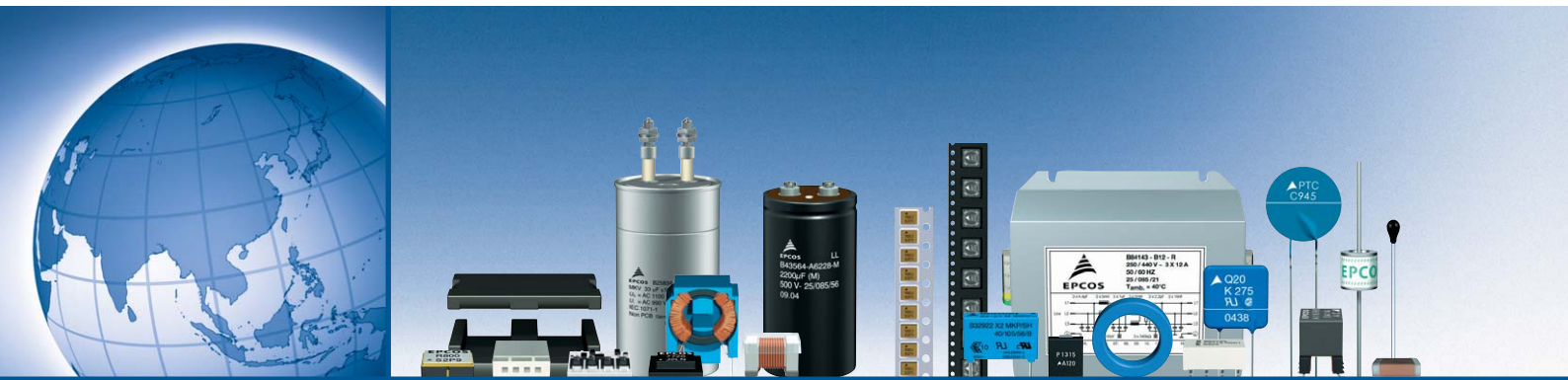
Product Profile 2007



Film Capacitors

for Industrial Applications

Welcome to the World of Electronic Components



With its broad portfolio in electronic components EPCOS provides one-stop shopping for a comprehensive range of products and is market leader in Europe and number two worldwide. We offer manufacturers in the automotive electronics, industrial electronics, IT and telecommunications, and the consumer electronics industries both standard components as well as application-specific solutions. Our products include capacitors and inductors, ceramic components, modules, and surface acoustic wave components.

EPCOS is an innovative and technology-driven company with a global presence able to provide local development support in the early phases of new projects. We have design, manufacturing and marketing facilities in Europe, Asia and the Americas. Increasingly, we are expanding our global network of research and development by locating R&D activities at our new production locations, primarily in Eastern Europe and Asia with a special focus in China.

We are continually improving our processes and our mastery of them – and thus the quality of our products and services. The Group has been ISO TS 16949-accredited since the beginning of 2004. EPCOS remains committed to constantly reviewing and systematically improving its quality management system.

Film Capacitors for Industrial Applications



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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). 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.

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Preview



Today, higher performance is expected of all the components used in new power electronics for industrial applications, from semiconductors to passive components, in terms of both electrical and climatic operating conditions. Capacitors are no exception and challenging standards are being set, in which the reliability of the product is becoming increasingly critical.

In this context, experience has shown that film capacitors offer many advantages over other capacitor technologies. High current capa-

bility, low inductance, flexible design, various mounting options, thermal and electrical stability, reliability and a long service life make them a suitable solution for these applications.

In addition, wherever much higher currents are required, 4-pin configurations are available, that further improve the current handling capability of the standard 2-pin capacitors.

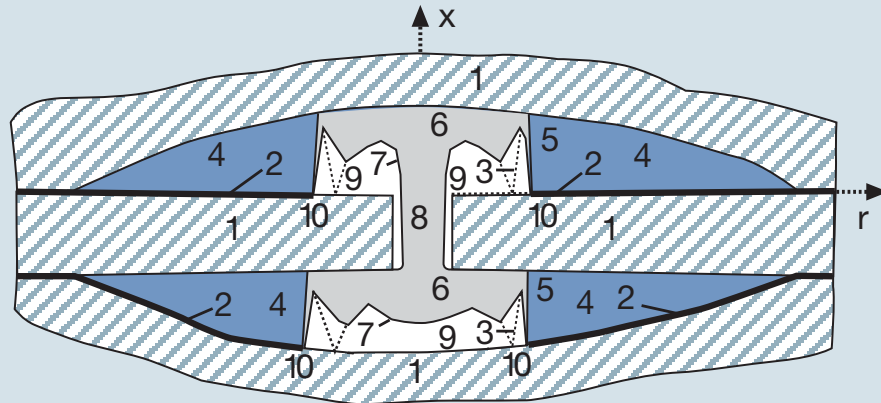
In these highly demanding applications, new design concepts and advanced control systems for semiconductors with high switching

frequencies allow designers to take advantage of the excellent performance of film capacitors in applications where other technologies were traditionally considered to be the preferred solution.

EPCOS has responded to this new trend and offers various series of film capacitors in a range of operating voltages designed to satisfy the technical requirements of every part of a circuit, mainly in medium size equipments from the point of view of the power range of the converter.

Self-healing Capability of Film Capacitors

Self-healing



- | | | |
|----------------------------------|--|---|
| 1 Dielectric | 5,6 Plasma zone | 9 Gas phase dielectric |
| 2 Metallized electrodes | 7 Boundary layer between gas phase dielectric and plasma | 10 Zone of displaced metallization and dielectric (insulating region) |
| 3 Material displacing shock wave | 8 Breakdown channel | |
| 4 Air gap with metal vapor | | |

The self-healing capability of film capacitors may be defined as their ability to remedy defects (such as pores or impurities in the film) under the influence of a voltage.

The metal coatings, vacuum-deposited directly onto the plastic film, are only 20 ... 50 nm thick. If the dielectric breakdown field strength is

exceeded locally at a weak point, a dielectric breakdown occurs. The high temperatures reached in the breakdown channel (up to 6000 K) transform the dielectric into a highly compressed plasma that forces its way out. The thin metal coating in the vicinity of the channel is totally evaporated by interaction with the plasma

so that it escapes from the breakdown channel. The rapid expansion of the plasma causes it to cool after a few microseconds, thus quenching the discharge before a greater voltage drop takes place. The insulated region resulting around the former faulty area will cause the capacitor to regain its full operation ability.



1 Plant Malaga (Spain), 2 Plant Gravatai (Brazil), 3 Plant Zhuhai (China), 4 Plant Nashik (India)

Film capacitors as a reliable solution

The self-healing capability of film capacitors is one of their most important features. It protects them against catastrophic failures and makes them highly reliable compared with other technologies.

They also offer an excellent thermal stability. In addition, their key electrical parameters remain constant when the voltage is changed thanks to the high electrical stability of this technology.

Low ESR values and high I_{rms} handling capability are other important characteristics of film capacitors. They are needed in applications operating with high-frequency ripple currents (up to 100 kHz).

Applicable standards

In terms of its mechanical and electrical performance, IEC 60384-2, IEC 60384-16 and IEC 60384-14 are the sector standards for MKT, MKP and EMI suppression capacitors.

Capacitors designed to be used specifically in power electronic equipment must also comply with the international standard IEC 1071. The objective of this standard is to describe the basic performance, testing, rating and safety rules of all the capacitors used in semiconductor switching, protections applications, filtering and energy-storage applications.

RoHS compatibility

The components described as "RoHS-compatible" are in compliance with the requirements of the regulations listed below ("Regulations") and with the requirements of the provisions which will result from transformation of the Regulations into national law to the extent such provisions reflect the Regulations.

- Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment ("Directive 2002/95/EC");
- Commission Decision of 18 August 2005 amending Directive 2002/95/EC (2005/618/EC);
- Commission Decision of 13 October 2005 and of 21 October 2005 amending the Annex to Directive 2002/95/EC (2005/717/EC; 2005/747/EC).

Application: Drives

General

The function of an adjustable electrical drive is to control the speed, torque, acceleration, deceleration and direction of rotation of the motor driving a machine. Drives may be of direct current or adjustable frequency type (DC and AC drives, respectively).

Because of their simplicity, ease of use, reliability and favorable cost, DC drives have been the preferred solution for industrial applications for many years.

On the other hand, adjustable frequency AC motor drive controllers, frequently known as inverters, are typically more complex than DC controllers since they must perform two power-section functions: conversion from AC to DC and finally again from DC to AC.

A number of different types of AC motor controllers are currently in widespread use as general purpose drives,

i.e. pulse width modulated (PWM), current source input (CSI), and, the load commutated inverter (LCI) types. Each type offers specific benefits and characteristics, and the selection criterion is based on the final application requirements in terms of voltage and power.



EMC filters

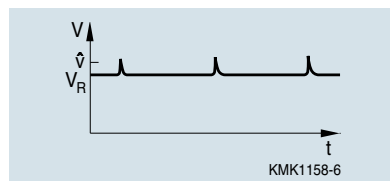
As a rule, across-the-line and line-to-ground capacitors are used in this filtering stage. In most of the cases they must be X2 and Y2 approved capacitors, in accordance to international regulations.

EPCOS has now launched the new Y2 capacitor series **B32021 ... B32026** with capacitance values up to 1 μF in lead spacing 37.5 mm. The **B32921 ... B32926** series of compact high-performance capacitors are available for X2 capacitor needs.

The corresponding international approvals to the EMI suppression capacitor standards (IEC 60384-14, EN 132400, UL 1414, UL 1283, CSA 22.2 No.1 and CSA 22.2 No.8) have been granted to both series by the leading International Certification Institutes (VDE, UL, CSA).

DC link

Capacitors in the DC link module have to support the DC voltage after the AC/DC converter by supplying high peaks of current when it is required.



EPCOS offers a wide range of MKP capacitors in various operating voltages, with its brand new series **B32674 ... B32678**.

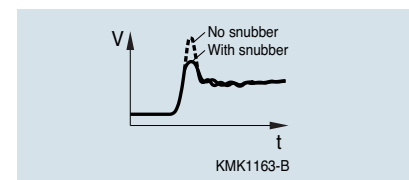
These series cover a spectrum of capacitance values up to 60 μF (lead spacing 27.5 ... 52.5 mm). They also feature very low ESR, high RMS current capability and continuous operating voltages from 450 V DC to 1050 V DC. These capacitors can function at a maximum operating temperature of up to 100 °C.

Snubber capacitors

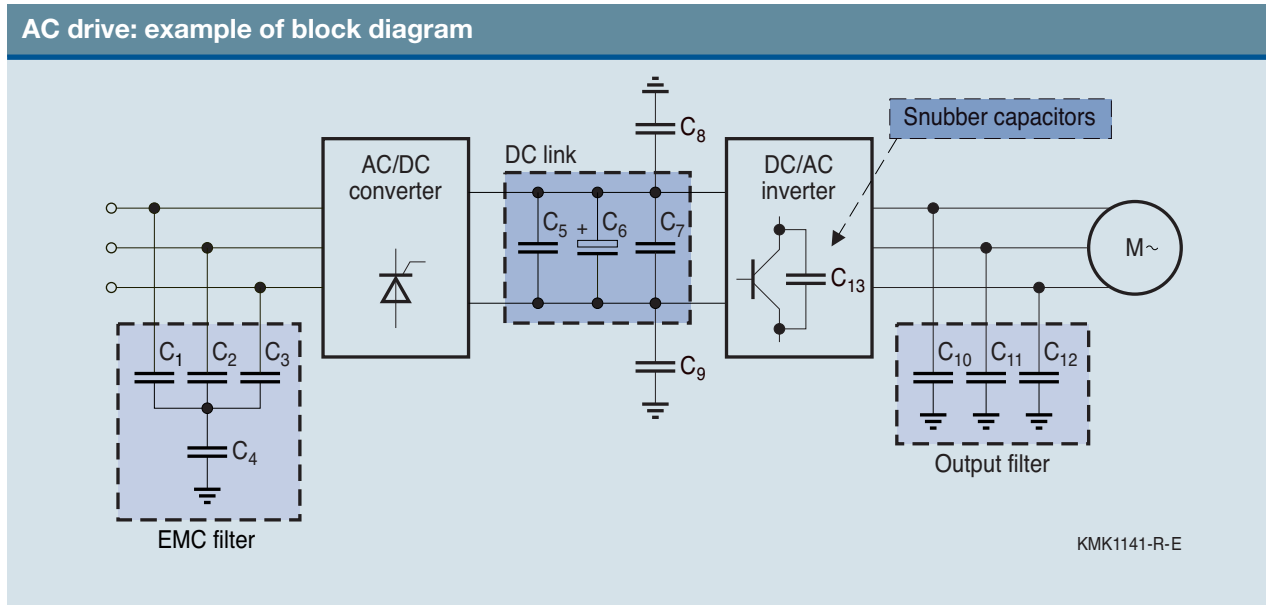
Snubber capacitors are connected in parallel with semiconductor components in order to damp high peaks of voltages that are produced by their switching operation.








In this field, EPCOS offers many different solutions that meet the wide variety of requirements for this application.

The **B32686A, B32686C, B32632 ... B32634, B32656C and B32652 ... B32656** series represent an extensive range of capacitors for very demanding applications, high dv/dt values and I_{rms} at high frequencies.



Application: Drives



| EPCOS solution | | | | | | | |
|---|---|---|---|---|--|---|---|
| EMC and output filters | | | DC link | Snubbing | | | |
| Capacitor number | | | | | | | |
| C1, C2, C3 | C4, C8, C9 | C8, C9, C10, C11, C12 | C5, C7 | C13 | | | |
| | | | | | | | |
|  |  |  |  |  | |  |  |
| X2 | Y2 | MKP 2/4 pins | MKP DC link | MKP strap terminals | MFP strap terminals | MKP 2/4 pins | MFP 2/4 pins |
| B32921 ... B32926 | B32021 ... B32026 | B32651 ... B32656, | B32674 ... B32678 | B32656S | B32686S | B32652 ... B32656, B32656C | B32632 ... B32634, B32686A, B32686C |
| Voltage range | | | | | | | |
| 305 V AC | 300 V AC | 160 V AC ... 1000 V AC | 450 V DC ... 1050 V DC | 850 V DC ... 2000 V DC | 1000 V DC ... 2000 V DC | 250 V DC ... 2000 V DC | 630 V DC ... 2000 V DC |
| Capacitance range | | | | | | | |
| 10 nF ... 10 µF | 1 nF ... 1 µF | 1 nF ... 60 µF | 0.47 ... 60 µF | 0.047 ... 2.2 µF | 0.022 ... 0.68 µF | 1 nF ... 4.7 µF | 0.47 nF ... 0.68 µF |
| Detailed data sheet | | | | | | | |
| Page 16 | Page 18 | Data book 2005 "Film Capacitors" | Page 20 | Page 26 | Data book 2005 "Film Capacitors" | Data book 2005 "Film Capacitors" | Data book 2005 "Film Capacitors" |

C6: aluminum electrolytic capacitor

Application: UPS

General

Uninterruptible power supplies (UPS) are designed to protect the load from any interruptions in the line, including spikes, over- and under-voltages and black-outs, by supplying the needed voltage to the output.

In case of a blackout, the battery will feed the output from a few minutes to several hours depending on its size.

A UPS can also be understood as a system designed to protect the load against instabilities in the power line, which is the best way of ensuring the reliability of the load over its operating life.

Depending on their configuration, three major UPS topologies may be identified: *off-line*, *line interactive* and *on-line*.



EMC filters

The EMC filter is usually composed of approved X2 and Y2 capacitors suitable for use in across-the-line and line-to-ground positions, respectively. These approvals must be granted in accordance with the corresponding international standards (IEC, UL, CSA) that describe the requirements of these safety components.

The EPCOS series **B32921 ... B32926** offer reduced size X2 capacitors, with a wide spectrum of capacitance values up to 10 μF (lead spacing 10 ... 37.5 mm). They feature 310 V AC (50 or 60 Hz) as a maximum operating voltage and a maximum operating temperature of 125 °C. In addition, with the new series **B32021 ... B32026** EPCOS covers the demand for Y2 capacitors. They offer a maximum capacitance value of 1.0 μF and 300 V AC as rated voltage. The robust construction of this series ensures a reliable electrical and mechanical performance.

Output filters

The basic purpose of the output filter is to protect the load connected to the output of the UPS by filtering the RF components coming from the inverter and to withstand the current peaks caused by pulses of rapidly changing voltages.

High pulse handling capability with dv/dt values up to 8,000 V/ μs and very low self-heating characteristics make the EPCOS series **B32652 ... B32656** suitable solutions for this filter. The range of capacitance values covered by this series extends to 4.7 μF , with rated voltages up to 1000 V DC. An alternative to these series are the **B32921 ... B32926** series. They are suited for designs with softer electrical requirements

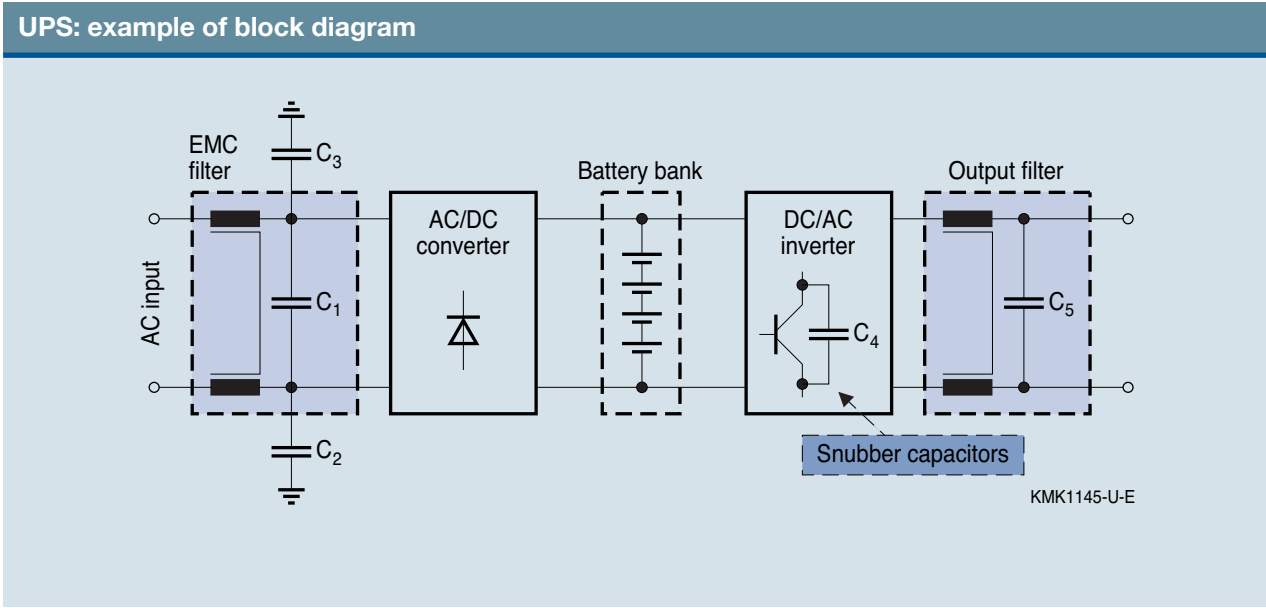
Snubber capacitors








The switching operations of semiconductor components produce high voltage peaks. Snubber capacitors are typically connected in parallel with semiconductors in order to block these peaks.

Specifically designed for snubber applications, the **B32686S**, **B32686C** and **B32632 ... B32634** series are able to withstand dv/dt values up to 18,000 V/ μs and high I_{rms} currents with frequencies higher than 100 kHz.

Capacitors from the series **B32656S**, **B32656C** and **B32652 ... B32656** feature a very good self-heating characteristic. They could be also an excellent alternative product to be used in this position of the circuit.

Application: UPS



| EPCOS solution | | | | | | |
|---|---|---|---|---|---|---|
| EMC and output filters | | | Snubbing | | | |
| Capacitor number | | | | | | |
| C1, C5 | C2, C3 | C5 | C4 | | | |
|  |  |  |  |  |  |  |
| X2 | Y2 | MKP 2/4 pins | MKP strap terminals | MFP strap terminals | MKP 2/4 pins | MFP 2/4 pins |
| B32921 ... B32926 | B32021 ... B32026 | B32651 ... B32656, | B32656S | B32686S | B32652 ... B32656, B32656C | B32632 ... B32634, B32686A, B32686C |
| Voltage range | | | | | | |
| 305 V AC | 300 V AC | 160 V AC ... 1000 V AC | 850 V DC ... 2000 V DC | 1000 V DC ... 2000 V DC | 250 V DC ... 2000 V DC | 630 V DC ... 2000 V DC |
| Capacitance range | | | | | | |
| 10 nF ... 10 µF | 1 nF ... 1 µF | 1 nF ... 60 µF | 0.047... 2.2 µF | 0.022 ... 0.68 µF | 1 nF ... 4.7 µF | 0.47 nF... 0.68 µF |
| Detailed data sheet | | | | | | |
| Page 16 | Page 18 | Data book 2005 "Film Capacitors" | Page 26 | Data book 2005 "Film Capacitors" | Data book 2005 "Film Capacitors" | Data book 2005 "Film Capacitors" |

Application: Switch-Mode Power Supplies (SMPS)

General

A switch-mode power supply is a power electronic DC/DC converter that basically converts the input DC voltage into an output DC voltage, with a different voltage level.

In general, most SMPS are connected to the power line. So the AC voltage coming from the line must be converted into the DC voltage needed at the input of the real DC/DC converter. That is the reason why a rectifier is usually present at the entrance of any SMPS.

SMPS offer higher efficiencies with more compact mechanical dimensions than other DC/DC converters, which is an advantage for portable devices. However, they are more complex and may generate more electro-magnetic noise – due to the switching operation of the semiconductors – which must be efficiently suppressed.

Various topologies with different features (buck, boost, flyback, half-bridge, full-bridge, ...) are available depending on the required output power.



EMC filters

X2 and Y2 capacitors are used for the EMC filter at the SMPS input: they satisfy the relevant international standards (IEC60384-14, EN 132400, UL1414, UL1283, CSA22.2-N1 and CSA22.2-N8). These safety components are connected in across-the-line and line-bypass modes in order to minimize the effects of electromagnetic interference.

The **B32921 ... B32926** series of EPCOS provides our customers with a highly reliable range of X2 capacitors of very compact dimensions. They can withstand a continuous operating voltage of 310 V AC at 50/60 Hz and a maximum operating temperature of 125 °C. EPCOS also offers the new **B32021 ... B32026** series of Y2 capacitors that is ideal for customers needing a solution based on film capacitors.

DC link and PFC

DC-link and PFC modules support the DC voltage after the rectifier and compensate the lagging reactive power generated in the SMPS.

Capacitors used in this part of the circuit must withstand a continuous DC voltage with a superimposed high-frequency ripple voltage. This must also be considered when designing the capacitor in order to avoid its overload during the operation.

The **B32672Z ... B32673Z** series is designed specifically to meet the requirements of this application.

These boxed capacitors use polypropylene as the dielectric material. They ensure excellent performance while handling signals with high-frequency components.

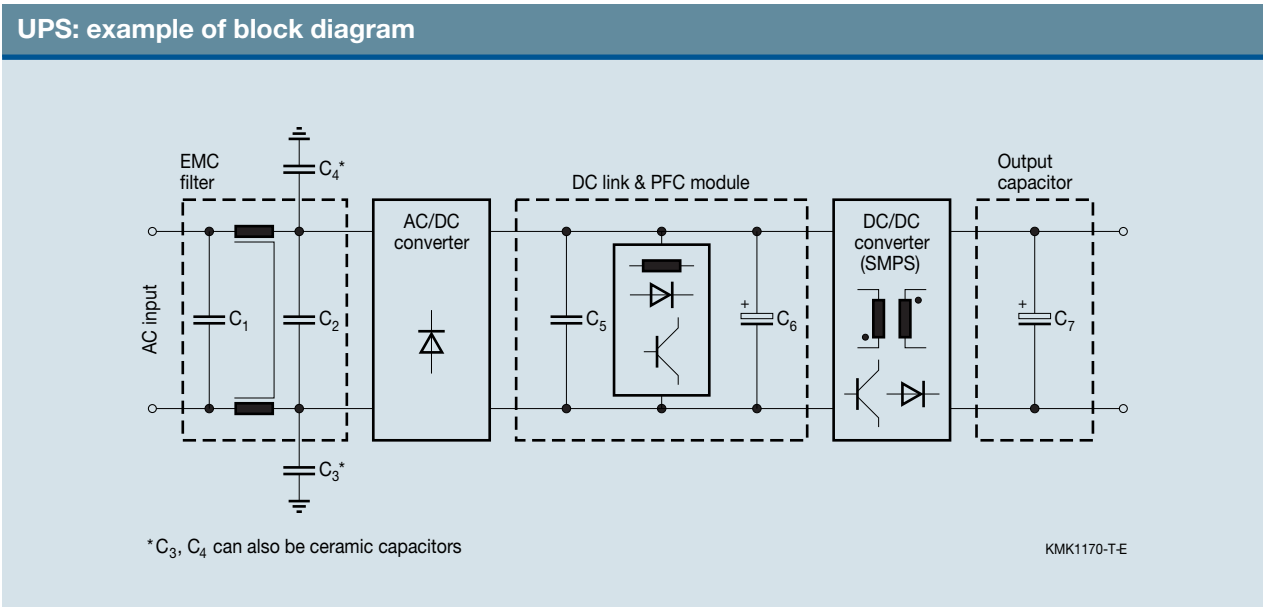
Thanks to a maximum operating temperature of 110 °C, this series can withstand the toughest operating conditions of any SMPS.

Output capacitor




The basic function of the output capacitor is to filter the high-frequency components that may be superimposed onto the output DC voltage. These components are caused by the switching operation of the semiconductors in the SMPS and could affect the performance of the load.

Electrolytic capacitors are usually used in this position because of their higher volumetric efficiency. However, if a designer prefers to use a film capacitor (superior operating life, ripple current capability, lower capacitance values etc.), EPCOS can offer a suitable solution from the various series listed in its catalog.

Application: Switch-Mode Power Supplies (SMPS)



SMPS

| EPCOS solution | | |
|---|---|---|
| EMC | | PFC Capacitor |
| Capacitor number | | |
| C1, C2 | C3*, C4* | C5 |
|  |  |  |
| X2 | Y2 | MKP PFC |
| B32921 ... B32926 | B32021 ... B32026 | B32672Z, B32673Z |
| Voltage range | | |
| 305 V AC | 300 V AC | 450 V DC ... 630 V DC |
| Capacitance range | | |
| 10 nF ... 10 µF | 1 nF ... 1.0 µF | 0.047µF... 2.2 µF |
| Detailed data sheet | | |
| Page 16 | Page 18 | Page 24 |

*C3, *C4: can be also ceramic capacitors
C6, C7: aluminum electrolytic capacitors

Application: Electrical Welding Equipments

General

Electrical welding equipment uses electricity in order to generate the heat needed for joining metal parts.

In the past, welding power supplies were based on large and heavy metal transformers that operated at 50 or 60 Hz and were relatively inefficient.

Advanced power supplies based on inverter technology have become increasingly popular and have changed the design and capability of modern welding equipment.

This new equipment, operating with signals at 20 kHz, is much more efficient and can be even more compact and lightweight thanks to design optimization.



EMC filter

In accordance with international regulations, X2 and Y2 capacitors are used in EMC filters designed to suppress the RF interference that perturbs smooth operation.

X2 capacitor applications are covered by the EPCOS series **B32921 ... B32926** of compact capacitors. In the case of 50/60 Hz applications, 310 V AC is the maximum permissible operating voltage at operating temperatures of up to 125 °C. The new **B32021 ... B32026** series of Y2 capacitors from EPCOS offer a wide range of capacitance values for these applications (from 1 nF to 1 µF in lead spacings from 10 mm to 37.5 mm) with a rated voltage of 300 V AC.

The capacitors of these series bear stamps declaring that they have been approved to the EMI suppression capacitor standards (IEC 60384-14, EN 132400, UL 1414, UL 1283, CSA 22.2 No.1 and CSA 22.2 No.8).

DC link, switching and smoothing

DC link capacitors are used to smooth the DC voltage after the rectifier. In this application, they have to handle large RMS currents at high frequencies.

Peak voltages are also induced during operation by semiconductor switching and system disturbances. According to IEC 1071, these peaks could reach values 50% higher than the rated voltage of the capacitor.

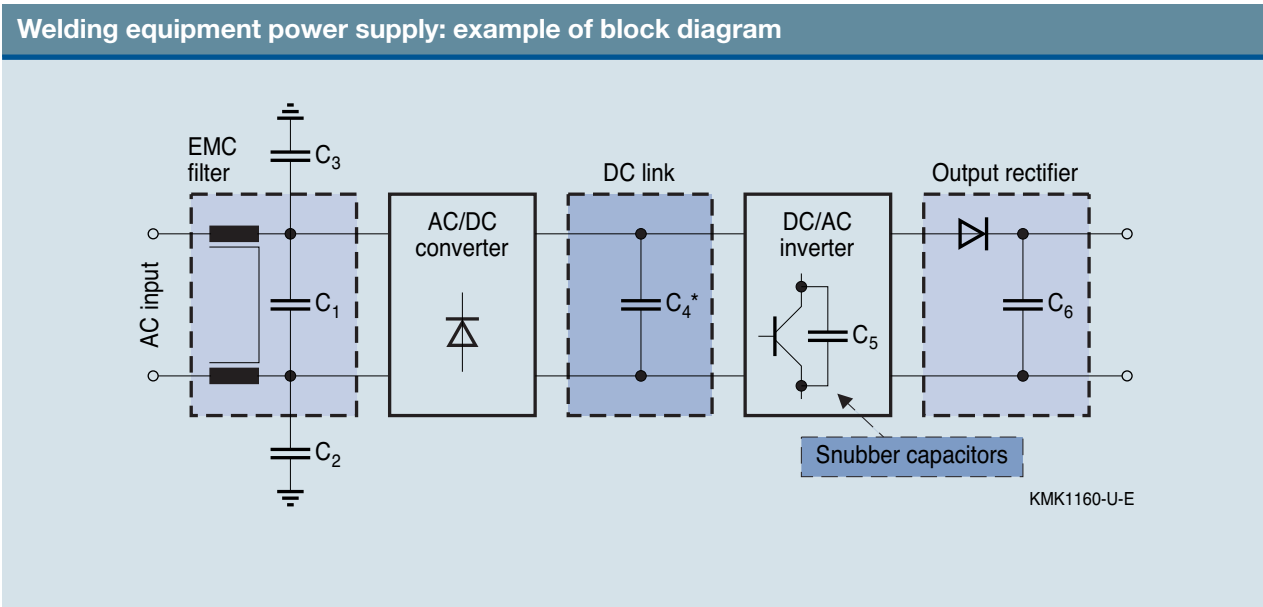
B32674 ... B32678 are series of MKP capacitors developed by EPCOS specifically for this application. Their very low ESR values are a particular highlight and allow the product to operate with RMS currents of up to 25 A at 100 kHz.

Output rectifier








An output rectifier is basically a half-wave rectifier. It converts the AC voltage (with the new frequency after the inverter) into a DC voltage. The positive semi-cycle is then used to carry out the welding process. The RF components are suppressed by the capacitor included in the output rectifier.

For this application, EPCOS offers the **B32652 ... B32656** series with capacitance values of up to 4.7 µF in lead spacing 37.5 mm and rated voltages of up to 1000 V DC. It has excellent characteristics for the requirements of this application: very high dv/dt values (up to 8000 V/µs) and good thermal behavior (very low self-heating when high-frequency AC voltages are applied).

Application: Electrical Welding Equipments



Welding

| EPCOS solution | | | | | | | |
|---|---|---|---|---|--|---|---|
| EMC and output rectifier | | | DC link | Snubbing | | | |
| Capacitor number | | | | | | | |
| C1, C6 | C2, C3 | C6 | C4* | C5 | | | |
|  |  |  |  |  | |  |  |
| X2 | Y2 | MKP 2/4 pins | MKP DC link | MKP strap terminals | MFP strap terminals | MKP 2/4 pins | MFP 2/4 pins |
| B32921 ... B32926 | B32021 ... B32026 | B32651 ... B32656, B32674 ... B32678 | B32674 ... B32678 | B32656S | B32686S | B32652 ... B32656, B32656C | B32632 ... B32634, B32686A, B32686C |
| Voltage range | | | | | | | |
| 305 V AC | 300 V AC | 160 V AC ... 1000 V AC | 450 V DC ... 1050 V DC | 850 V DC ... 2000 V DC | 1000 V DC ... 2000 V DC | 250 V DC ... 2000 V DC | 630 V DC ... 2000 V DC |
| Capacitance range | | | | | | | |
| 10 nF ... 10 µF | 1 nF ... 1 µF | 1 nF ... 60 µF | 0.47 ... 60 µF | 0.047 ... 2.2 µF | 0.022 ... 0.68 µF | 1 nF ... 4.7 µF | 0.47nF ... 0.68 µF |
| Detailed data sheet | | | | | | | |
| Page 16 | Page 18 | Data book 2005 "Film Capacitors" and page 20 | Page 20 | Page 26 | Data book 2005 "Film Capacitors" | Data book 2005 "Film Capacitors" | Data book 2005 "Film Capacitors" |

* Can be also an aluminum electrolytic capacitor.

33292*

X2/305 V AC capacitors for EMC filter

Climatic





- Maximum operating temperature
125 °C
- Climatic category (IEC 60068-1):
40/105/56

- Dielectric: Polypropylene (MKP) film
- Plastic case (UL 94 V-0)
- Epoxy resin sealing, flame-retardant

Terminals

- Parallel wire leads, lead-free tinned

Approvals

| Marks of conformity | Standards | Certificate |
|---|-------------------------|--------------------|
|  | EN 132400, IEC 60384-14 | 40005536, 40010694 |
|  | UL 1414, UL1283 | E97863, E157153 |
|  | CSA C22.2 No.1/No.8 | E97863, E157153 |
|  | CQC (GB/T 14472-1998) | CQC001007-14859 |

For latest approval updates, please refer to www.epcos.com/film_capacitors

Technical data

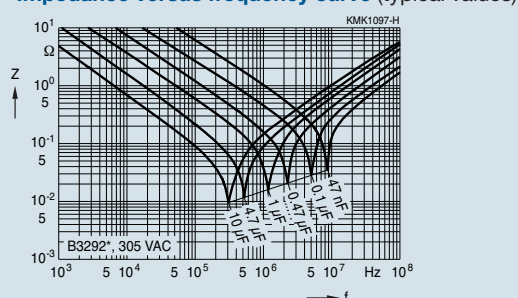
| | | | |
|---|--|---|--------------------------------------|
| Maximum operating temperature $T_{op,max}$ | 125 °C (for C ≤1 μF), B3292*A/B 110 °C (for C >1), B3292*C/D (miniaturized) | | |
| Dissipation factor $\tan \delta$ (in 10⁻³) at 20 °C (upper limit values) | at | 0.1 < C _R ≤ 2.2 | C _R > 2.2 |
| | 1 kHz | 1.0 | 2.0 |
| Time constant $\tau = C_R \cdot R_{ins}$ at 20 °C, rel. humidity ≤ 65% | C _R > 0.33 | 30 000 s (minimum as-delivered values) | |
| DC test voltage | 2121 V, 2 s | | |
| Passive flammability category to IEC 40 (CO) 752 | B | | |
| Maximum continuous AC voltage (V_{AC}) | 310 V (50/60 Hz) | | |
| Rated AC voltage (IEC 60384-14) | 305 V (50/60 Hz) | | |
| Maximum continuous DC voltage (V_{DC}) | 760 V (630 V for C/D version) | | |
| Operating AC voltage V_{op} at high temperature | T _A ≤ 110 °C | V _{op} = V _{AC} (continuously) | |
| | T _A ≤ 110 °C | V _{op} = 1.25 · V _{AC} (1000 h) | |
| | 110 °C < T _A ≤ 125 °C | V _{op} = V _{AC} (1000 h) (only for A/B version) | |
| Damp heat test | 56 days / 40 °C / 93% relative humidity | | |
| Limit values after damp heat test | Capacitance change ($\Delta C/C$) | | ≤ 5% |
| | Dissipation factor change ($\Delta \tan \delta$) | | ≤ 0.5 · 10 ⁻³ (at 1 kHz) |
| | | | ≤ 1.0 · 10 ⁻³ (at 10 kHz) |
| | Insulation resistance R _{ins} or time constant $\tau = C_R \cdot R_{ins}$ | | ≥ 50% of minimum as-delivered values |

Pulse handling capability

“dv/dt” values represent the maximum permissible voltage change per unit of time for non-sinusoidal voltages, expressed in V/us.

" k_0 " represents the maximum permissible pulse characteristic of the waveform applied to the capacitor, expressed in $V^2/\mu s$.

Note: The maximum values of dv/dt and k_0 must not be exceeded in order to avoid damaging the capacitor.



Data Sheet: X2

B3292*

| Characteristics and ordering codes | | | | | | | | | |
|------------------------------------|----------------------|------------------------------------|-----------------|-----------------------|---------------|--------------------------------------|---------------------------|-------------------|----------------------|
| Lead spacing [e] ±0.4 mm | C _R μF | Max. dimensions w x h x l mm | Ordering code | Ød ₁ mm | dv/dt V/μs | k ₀ V ² /μs | Ammo pack pcs./unit | Reel pcs./unit | Untaped pcs./unit |
| 22.5 | 1.0 | 11.0 x 20.5 x 26.5 | B32923C3105+*** | 0.8 | 170 | 146200 | 370 | 350 | 510 |
| | 1.0 | 12.0 x 22.0 x 26.5 | B32923A2105M*** | 0.8 | 200 | 172000 | – | – | 450 |
| | 1.5 | 12.0 x 22.0 x 26.5 | B32923C3155M*** | 0.8 | 170 | 146200 | – | – | 450 |
| | 1.5 | 14.5 x 29.5 x 26.5 | B32923D3155+*** | 0.8 | 170 | 146200 | – | – | 260 |
| | 2.2 | 14.5 x 29.5 x 26.5 | B32923C3225+*** | 0.8 | 170 | 146200 | – | – | 260 |
| 27.5 | 1.0 | 11.0 x 19.0 x 31.5 | B32924C3105+*** | 0.8 | 120 | 103200 | – | 350 | 320 |
| | 1.0 | 11.0 x 21.0 x 31.5 | B32924A2105+*** | 0.8 | 150 | 129000 | – | 350 | 320 |
| | 1.5 | 12.5 x 21.5 x 31.5 | B32924C3155+*** | 0.8 | 120 | 103200 | – | 300 | 280 |
| | 1.5 | 13.5 x 23.0 x 31.5 | B32924A2155M*** | 0.8 | 150 | 129000 | – | 250 | 260 |
| | 1.5 | 14.0 x 24.5 x 31.5 | B32924B2155+*** | 0.8 | 150 | 129000 | – | – | 260 |
| | 2.2 | 14.0 x 24.5 x 31.5 | B32924C3225+*** | 0.8 | 120 | 103200 | – | – | 260 |
| | 2.2 | 18.0 x 27.5 x 31.5 | B32924A2225+*** | 0.8 | 150 | 129000 | – | – | 200 |
| | 3.3 | 18.0 x 27.5 x 31.5 | B32924C3335M*** | 0.8 | 120 | 103200 | – | – | 200 |
| | 3.3 | 16.0 x 32.0 x 31.5 | B32924D3335+*** | 0.8 | 120 | 103200 | – | – | 220 |
| | 3.3 | 21.0 x 31.0 x 31.5 | B32924A2335M*** | 0.8 | 150 | 129000 | – | – | 180 |
| | 4.7 | 18.0 x 33.0 x 31.5 | B32924C3475M*** | 0.8 | 120 | 103200 | – | – | 200 |
| | 4.7 | 21.0 x 31.0 x 31.5 | B32924D3475+*** | 0.8 | 120 | 103200 | – | – | 180 |
| | 4.7 | 22.0 x 36.5 x 31.5 | B32924A2475M*** | 0.8 | 150 | 129000 | – | – | 160 |
| | 5.6 | 22.0 x 36.5 x 31.5 | B32924C3565+*** | 0.8 | 120 | 103200 | – | – | 160 |
| 37.5 | 2.2 | 14.0 x 25.0 x 41.5 | B32926C3225+*** | 1.0 | 80 | 68800 | – | – | 115 |
| | 3.3 | 16.0 x 28.5 x 41.5 | B32926C3335+*** | 1.0 | 80 | 68800 | – | – | 100 |
| | 3.3 | 18.0 x 32.5 x 41.5 | B32926A2335+*** | 1.0 | 100 | 86000 | – | – | 90 |
| | 4.7 | 18.0 x 32.5 x 41.5 | B32926C3475+*** | 1.0 | 80 | 68800 | – | – | 90 |
| | 4.7 | 20.0 x 39.5 x 41.5 | B32926A2475M*** | 1.0 | 100 | 86000 | – | – | 75 |
| | 5.6 | 18.0 x 32.5 x 41.5 | B32926C3565+*** | 1.0 | 80 | 68800 | – | – | 90 |
| | 5.6 | 20.0 x 39.5 x 41.5 | B32926A2565M*** | 1.0 | 100 | 86000 | – | – | 75 |
| | 6.8 | 20.0 x 39.5 x 41.5 | B32926C3685+*** | 1.0 | 80 | 68800 | – | – | 75 |
| | 6.8 | 28.0 x 42.5 x 41.5 | B32926A2685M*** | 1.0 | 100 | 86000 | – | – | 55 |
| | 8.2 | 20.0 x 39.5 x 41.5 | B32926C3825M*** | 1.0 | 80 | 68800 | – | – | 75 |
| | 8.2 | 28.0 x 42.5 x 41.5 | B32926A2825M*** | 1.0 | 100 | 86000 | – | – | 55 |
| | 10 | 28.0 x 42.5 x 41.5 | B32926C3106+*** | 1.0 | 80 | 68800 | – | – | 55 |

For capacitance values between 10 nF and 1.0 μF, please refer to data book 2005 "Film Capacitors".
Further E series and intermediate capacitance values are available on request.

For the complete product range of X2 capacitors, please refer to the data sheets on the Internet at www.epcos.com/emi_capacitors.

■ NEW: Preferred type.

+ = Capacitance tolerance code
M = ±20%
K = ±10%
(Closer tolerances on request)

*** = Packing code
289 = Ammo pack
189 = Reel pack
000 = Untaped (lead length 6–1 mm)

Data Sheet: Y2

Y2/300 V AC capacitors

RoHS
compatible

Climatic

- Maximum operating temperature 110 °C
- Climatic category (IEC 60068-1): 40/110/56

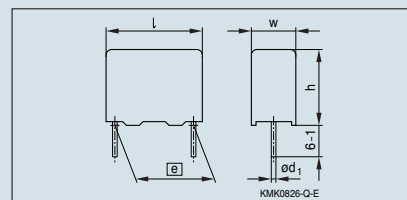
Construction

- Dielectric: Polypropylene (MKP) film
- Internal series connection
- Plastic case (UL 94 V-0)
- Epoxy resin sealing, flame-retardant

Terminals

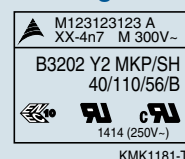
- Parallel wire leads, lead-free tinned

Dimensional drawing



Dimensions in mm

Marking example



Approvals

| Marks of conformity | Standards | Certificate |
|---------------------|-------------------------|-----------------|
| | EN 132400, IEC 60384-14 | 138603 |
| | UL 1414, UL 1283 | E97863, E301966 |
| | CSA C22.2 No.1/No.8 | E97863, E301966 |

For latest approval updates, please refer to www.epcos.com/film_capacitors

Technical data

| | | | |
|---|---|---|---|
| Maximum operating temperature T _{op,max} | 110 °C | | |
| Dissipation factor tan δ (in 10 ⁻³) at 20 °C (upper limit values) | at | C _R ≤ 0.1 μF | C _R > 0.1 μF |
| | 1 kHz | 1.0 | 1.0 |
| Insulation resistance R _{ins} or time constant τ = C _R · R _{ins} at 20 °C, rel. humidity ≤ 65% (minimum as-delivered values) | | C _R ≤ 0.33 μF | C _R > 0.33 μF |
| | | 100 000 MΩ | 30 000 s |
| DC test voltage | | 4000 V, 2 s | 3700 V, 2 s |
| Passive flammability category to IEC 40 (CO) 752 | B | | |
| Maximum continuous AC voltage (V _{AC}) | 480 V (50/60 Hz) | | |
| Rated AC voltage (IEC 60384-14) | 300 V (50/60 Hz) | | |
| Maximum continuous DC voltage (V _{DC}) | 1500 V | | |
| Operating AC voltage V _{op} at high temperature | T _A ≤ 110 °C | V _{op} = V _{AC} (continuously) | |
| | T _A ≤ 110 °C | V _{op} = 1.25 · V _{AC} (1000 h) | |
| Damp heat test | 56 days / 40 °C / 93% relative humidity | | |
| Limit values after damp heat test | Capacitance change (ΔC/C) | | ≤ 5% |
| | Dissipation factor change (Δtan δ) | | ≤ 0.5 · 10 ⁻³ (at 1 kHz) ≤ 1.0 · 10 ⁻³ (at 10 kHz) |
| | Insulation resistance R _{ins} or time constant τ = C _R · R _{ins} | | ≥ 50% of minimum as-delivered values |
| | | | |

Pulse handling capability

"dv/dt" values represent the maximum permissible voltage change per unit of time for non-sinusoidal voltages, expressed in V/ μ s.

" k_0 " represents the maximum permissible pulse characteristic of the waveform applied to the capacitor, expressed in V^2/μ s.
Note: The maximum values of dv/dt and k_0 must not be exceeded in order to avoid damaging the capacitor.

Data Sheet: Y2

| Characteristics and ordering codes | | | | | | | | | |
|------------------------------------|----------------------|------------------------------------|-----------------|-----------------------|---------------|--------------------------------------|-----------------------|------------------|---------------------|
| Lead spacing [e] ±0.4 mm | C _R µF | Max. dimensions w x h x l mm | Ordering code | Ød ₁ mm | dv/dt V/µs | k ₀ V ² /µs | Ammo pack pcs/unit | Reel pcs/unit | Untaped pcs/unit |
| 15 | 10 nF | 5.0 x 10.5 x 18.0 | B32022A3103+*** | 0.8 | 600 | 508000 | 1170 | 1300 | 1000 |
| | 15 nF | 6.0 x 11.0 x 18.0 | B32022A3153+*** | 0.8 | 600 | 508000 | 960 | 1100 | 1000 |
| | 22 nF | 6.0 x 12.0 x 18.0 | B32022A3223M*** | 0.8 | 600 | 508000 | 960 | 1100 | 1000 |
| | 22 nF | 7.0 x 12.5 x 18.0 | B32022B3223+*** | 0.8 | 600 | 508000 | 830 | 900 | 1000 |
| | 33 nF | 8.0 x 14.0 x 18.0 | B32022A3333+*** | 0.8 | 600 | 508000 | 730 | 750 | 500 |
| | 47 nF | 8.5 x 14.5 x 18.0 | B32022A3473M*** | 0.8 | 600 | 508000 | 680 | 700 | 500 |
| | 47 nF | 9.0 x 17.5 x 18.0 | B32022B3473+*** | 0.8 | 600 | 508000 | 640 | 700 | 500 |
| | 68 nF | 9.0 x 17.5 x 18.0 | B32022A3683M*** | 0.8 | 600 | 508000 | 640 | 700 | 500 |
| | 82 nF | 11.0 x 18.5 x 18.0 | B32022A3823M*** | 0.8 | 600 | 508000 | – | 550 | 300 |
| 22.5 | 0.047 µF | 6.0 x 15.0 x 26.5 | B32023A3473+*** | 0.8 | 500 | 423000 | 680 | 700 | 720 |
| | 0.068 µF | 7.0 x 16.0 x 26.5 | B32023A3683+*** | 0.8 | 500 | 423000 | 580 | 600 | 630 |
| | 0.068 µF | 7.5 x 14.5 x 26.5 | B32023B3683M*** | 0.8 | 500 | 423000 | 550 | 500 | 570 |
| | 0.1 µF | 8.5 x 16.5 x 26.5 | B32023A3104M*** | 0.8 | 500 | 423000 | 480 | 500 | 510 |
| | 0.1 µF | 10.5 x 16.5 x 26.5 | B32023B3104+*** | 0.8 | 500 | 423000 | 390 | 400 | 540 |
| | 0.15 µF | 10.5 x 18.5 x 26.5 | B32023A3154M*** | 0.8 | 500 | 423000 | 390 | 400 | 540 |
| | 0.15 µF | 10.5 x 20.5 x 26.5 | B32023B3154+*** | 0.8 | 500 | 423000 | – | – | 540 |
| | 0.22 µF | 12.0 x 22.0 x 26.5 | B32023A3224M*** | 0.8 | 500 | 423000 | – | – | 450 |
| | 0.22 µF | 14.5 x 29.5 x 26.5 | B32023B3224+*** | 0.8 | 500 | 423000 | – | – | 540 |
| | 0.33 µF | 14.5 x 29.5 x 26.5 | B32023A3334+*** | 0.8 | 500 | 423000 | – | – | 540 |
| 27.5 | 0.39 µF | 14.5 x 29.5 x 26.5 | B32023A3394M*** | 0.8 | 500 | 423000 | – | – | 540 |
| | 0.15 µF | 11.0 x 19.0 x 31.5 | B32024A3154+*** | 0.8 | 400 | 338000 | – | 350 | 320 |
| | 0.22 µF | 11.0 x 19.0 x 31.5 | B32024A3224M*** | 0.8 | 400 | 338000 | – | 350 | 320 |
| | 0.22 µF | 11.0 x 21.0 x 31.5 | B32024B3224+*** | 0.8 | 400 | 338000 | – | 350 | 320 |
| | 0.33 µF | 13.5 x 23.0 x 31.5 | B32024A3334M*** | 0.8 | 400 | 338000 | – | 250 | 260 |
| | 0.33 µF | 14.0 x 24.5 x 31.5 | B32024B3334+*** | 0.8 | 400 | 338000 | – | – | 260 |
| | 0.47 µF | 15.0 x 24.5 x 31.5 | B32024A3474M*** | 0.8 | 400 | 338000 | – | – | 240 |
| | 0.47 µF | 18.0 x 27.5 x 31.5 | B32024B3474+*** | 0.8 | 400 | 338000 | – | – | 200 |
| | 0.47 µF | 16.0 x 32.0 x 31.5 | B32024C3474+*** | 0.8 | 400 | 338000 | – | – | 220 |
| | 0.56 µF | 16.0 x 32.0 x 31.5 | B32024A3564+*** | 0.8 | 400 | 338000 | – | – | 220 |
| | 0.68 µF | 19.0 x 30.0 x 31.5 | B32024A3684M*** | 0.8 | 400 | 338000 | – | – | 180 |
| | 0.68 µF | 18.0 x 33.0 x 31.5 | B32024B3684+*** | 0.8 | 400 | 338000 | – | – | 200 |
| | 0.68 µF | 21.0 x 31.0 x 31.5 | B32024C3684+*** | 0.8 | 400 | 338000 | – | – | 180 |
| | 0.82 µF | 22.0 x 36.5 x 31.5 | B32024A3824+*** | 0.8 | 400 | 338000 | – | – | 160 |
| 37.5 | 1.0 µF | 22.0 x 36.5 x 31.5 | B32024A3105M*** | 0.8 | 400 | 338000 | – | – | 160 |
| | 0.33 µF | 12.0 x 22.0 x 41.5 | B32026A3334+*** | 1.0 | 300 | 254000 | – | – | 135 |
| | 0.47 µF | 14.0 x 25.0 x 41.5 | B32026A3474+*** | 1.0 | 300 | 254000 | – | – | 115 |
| | 0.56 µF | 14.0 x 25.0 x 41.5 | B32026A3564M*** | 1.0 | 300 | 254000 | – | – | 115 |
| | 0.56 µF | 16.0 x 28.5 x 41.5 | B32026B3564+*** | 1.0 | 300 | 254000 | – | – | 100 |
| | 0.68 µF | 16.0 x 28.5 x 41.5 | B32026A3684+*** | 1.0 | 300 | 254000 | – | – | 100 |
| | 0.82 µF | 16.0 x 28.5 x 41.5 | B32026A3824M*** | 1.0 | 300 | 254000 | – | – | 100 |
| | 0.82 µF | 18.0 x 32.5 x 41.5 | B32026B3824+*** | 1.0 | 300 | 254000 | – | – | 90 |
| | 1.0 µF | 18.0 x 32.5 x 41.5 | B32026A3105M*** | 1.0 | 300 | 254000 | – | – | 90 |
| | 1.0 µF | 20.0 x 39.5 x 41.5 | B32026B3105+*** | 1.0 | 300 | 254000 | – | – | 75 |

Further E series and intermediate capacitance values are available on request.

For the complete product range of Y2 capacitors (incl. lead spacing 10 mm), please refer to the data sheets on the Internet at www.epcos.com/emi_capacitors.

+ = Capacitance tolerance code

*** = Packing code

M = ±20%, (Closer tolerances on request)

289 = Ammo pack, 189 = Reel pack, 000 = Untaped (lead length 6–1 mm)

B3202*

Data Sheet: MKP DC Link

MKP DC link

RoHS
compatible

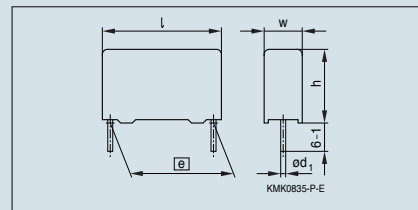
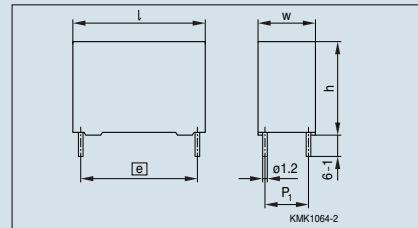
Construction

- Dielectric: Polypropylene (MKP) film
- Plastic case (UL 94 V-0)
- Epoxy resin sealing
- Wound technology

Marking

Manufacturer's logo,
rated capacitance, tolerance,
rated DC voltage,
type number

Dimensional drawing



Dimensions in mm

Terminals

- Parallel wire leads, lead-free tinned
- Lead executions

| Number of Wires | Lead | e ±0.4 (mm) | | |
|-----------------|----------------------|-------------|------|------|
| | Ød ₁ (mm) | 27.5 | 37.5 | 52.5 |
| 2-pin | 0.8 | D | - | - |
| | 1.0 | E | E | - |
| | 1.2 | F | F | - |
| 4-pin | 1.2 | - | G | G |

Preferred lead execution.

Characteristics and ordering codes

| C _R µF | Lead spacing e ±0.4 mm | P ₁ 4-pin mm | Max. dimensions w x h x l mm | Ordering code | dv/dt V/µs | ESR (mΩ), 100 kHz 2-pin | | | 4-pin Ø1.2 | I _{rms} (A), 100 kHz, 70 °C 2-pin | | | | PU (pcs.) |
|----------------------|------------------------------|-------------------------------|------------------------------------|---------------|---------------|----------------------------|------|------|---------------|---|------|------|------|--------------|
| | | | | | | Ø0.8 | Ø1.0 | Ø1.2 | | Ø0.8 | Ø1.0 | Ø1.2 | Ø1.2 | |

V_R = 300 V DC / V_{op} = 450 V DC / V_p = 450 V DC / V_{rms} = 160 V AC

| | | | | | | | | | | | | | | |
|-----|------|------|--------------------|--------------|----|------|------|------|-----|---|----|----|----|-----|
| 2.2 | 27.5 | - | 11.0 x 19.0 x 31.5 | B32674*3225+ | 40 | 12.0 | 11.5 | 11.0 | - | 7 | 7 | 8 | - | 320 |
| 3.3 | 27.5 | - | 12.5 x 21.5 x 31.5 | B32674*3335+ | 40 | 9.0 | 8.4 | 7.8 | - | 7 | 8 | 10 | - | 280 |
| 3.3 | 37.5 | - | 12.0 x 22.0 x 42.0 | B32676*3335+ | 22 | - | 13.1 | 12.2 | - | - | 7 | 9 | - | 135 |
| 4.7 | 27.5 | - | 14.0 x 24.5 x 31.5 | B32674*3475+ | 40 | 7.0 | 6.5 | 6.0 | - | 7 | 10 | 12 | - | 260 |
| 4.7 | 37.5 | - | 12.0 x 22.0 x 42.0 | B32676*3475+ | 22 | - | 12.2 | 11.5 | - | - | 8 | 10 | - | 135 |
| 5.0 | 27.5 | - | 15.0 x 24.5 x 31.5 | B32674*3505+ | 40 | 6.8 | 6.4 | 5.9 | - | 7 | 9 | 12 | - | 240 |
| 5.6 | 27.5 | - | 15.0 x 24.5 x 31.5 | B32674*3565+ | 40 | 6.6 | 6.2 | 5.8 | - | 7 | 8 | 12 | - | 240 |
| 5.6 | 37.5 | - | 14.0 x 25.0 x 42.0 | B32676*3565+ | 22 | - | 11.6 | 10.8 | - | - | 9 | 10 | - | 115 |
| 6.5 | 37.5 | - | 14.0 x 25.0 x 42.0 | B32676*3655+ | 22 | - | 10.8 | 10 | - | - | 9 | 10 | - | 115 |
| 6.8 | 27.5 | - | 18.0 x 27.5 x 31.5 | B32674*3685+ | 40 | 6.4 | 5.9 | 5.5 | - | 7 | 9 | 12 | - | 200 |
| 6.8 | 37.5 | - | 16.0 x 28.5 x 42.0 | B32676*3685+ | 22 | - | 10.4 | 9.4 | - | - | 9 | 11 | - | 100 |
| 8.0 | 27.5 | - | 16.0 x 32.0 x 31.5 | B32674*3805+ | 40 | 6.0 | 5.5 | 5.0 | - | 7 | 9 | 12 | - | 220 |
| 8.0 | 37.5 | - | 16.0 x 28.5 x 42.0 | B32676*3805+ | 22 | - | 8.5 | 8.0 | - | - | 9 | 11 | - | 100 |
| 8.2 | 27.5 | - | 18.0 x 33.0 x 31.5 | B32674*3825+ | 40 | 6.0 | 5.2 | 4.8 | - | 7 | 9 | 12 | - | 200 |
| 10 | 27.5 | - | 21.0 x 31.0 x 31.5 | B32674*3106+ | 40 | 5.3 | 4.6 | 4.2 | - | 7 | 10 | 12 | - | 180 |
| 10 | 37.5 | - | 18.0 x 32.5 x 42.0 | B32676*3106+ | 22 | - | 7.7 | 6.9 | - | - | 10 | 12 | - | 90 |
| 12 | 27.5 | - | 22.0 x 36.5 x 31.5 | B32674*3126+ | 40 | 5.2 | 4.5 | 4.0 | - | 7 | 10 | 12 | - | 160 |
| 12 | 37.5 | - | 18.0 x 32.5 x 42.0 | B32676*3126+ | 22 | - | 6.8 | 6.1 | - | - | 10 | 12 | - | 90 |
| 15 | 37.5 | 10.2 | 20.0 x 39.5 x 42.0 | B32676*3156+ | 22 | - | 5.8 | 5.2 | 4.0 | - | 10 | 12 | 20 | 75 |
| 20 | 37.5 | 10.2 | 28.0 x 37.0 x 42.0 | B32676*3206+ | 22 | - | 5 | 4.3 | 3.1 | - | 10 | 12 | 22 | 55 |
| 22 | 37.5 | 20.3 | 28.0 x 42.5 x 42.0 | B32676*3226+ | 22 | - | 4.8 | 4.1 | 3.0 | - | 10 | 12 | 22 | 55 |
| 25 | 37.5 | 20.3 | 28.0 x 42.5 x 42.0 | B32676*3256+ | 22 | - | 4.6 | 3.8 | 2.8 | - | 10 | 12 | 22 | 55 |
| 30 | 37.5 | 20.3 | 30.0 x 45.0 x 42.0 | B32676*3306+ | 22 | - | 4.4 | 3.7 | 2.6 | - | 10 | 12 | 22 | 54 |
| 30 | 52.5 | 20.3 | 30.0 x 45.0 x 57.5 | B32678*3306+ | 15 | - | - | - | 4 | - | - | - | 22 | 36 |
| 35 | 37.5 | 20.3 | 33.0 x 48.0 x 42.0 | B32676*3356+ | 22 | - | - | - | 2.4 | - | - | - | 22 | 48 |

Preferred lead execution. Other executions, intermediate capacitance values are available upon request.

+ = Tolerance: J = ±5%, K = ±10% * = Diameter: D = Ø0.8 mm, E = Ø1.0 mm, F = Ø1.2 mm, G = Ø1.2 mm, 4-pin

PU = Packing unit

Please refer to typical waveforms on page 23. **Note:** Not for across the line applications! Only unidirectional AC voltage!

Data Sheet: MKP DC Link

B3267*

| Characteristics and ordering codes | | | | | | | | | | | | | | |
|--|--------------------------------|-------------------------------|------------------------------------|---------------|-------|-------------------|------|------|------|--------------------------------------|------|------|------|--------------|
| C _R | Lead spacing [E] ±0.4 mm | P ₁ 4-pin mm | Max. dimensions w x h x l mm | Ordering code | dv/dt | ESR (mΩ), 100 kHz | | | | I _{rms} (A), 100 kHz, 70 °C | | | | PU (pcs.) |
| μF | | | | | V/μs | Ø0.8 | Ø1.0 | Ø1.2 | Ø1.2 | Ø0.8 | Ø1.0 | Ø1.2 | Ø1.2 | |
| V _R = 300 V DC / V _{op} = 450 V DC / V _p = 450 V DC / V _{rms} = 160 V AC | | | | | | | | | | | | | | |
| 35 | 52.5 | 20.3 | 30.0 x 45.0 x 57.5 | B32678*3356+ | 15 | – | – | – | 3.4 | – | – | – | 22 | 36 |
| 40 | 52.5 | 20.3 | 30.0 x 45.0 x 57.5 | B32678*3406+ | 15 | – | – | – | 3 | – | – | – | 22 | 36 |
| 47 | 52.5 | 20.3 | 35.0 x 50.0 x 57.5 | B32678*3476+ | 15 | – | – | – | 2.7 | – | – | – | 22 | 28 |
| 60 | 52.5 | 20.3 | 35.0 x 50.0 x 57.5 | B32678*3606K | 15 | – | – | – | 2.6 | – | – | – | 22 | 28 |
| V _R = 450 V DC / V _{op} = 630 V DC / V _p = 675 V DC / V _{rms} = 275 V AC | | | | | | | | | | | | | | |
| 1.5 | 27.5 | – | 11.0 x 19.0 x 31.5 | B32674*4155+ | 75 | 7.9 | 7.5 | 7.1 | – | 8 | 9 | 10 | – | 320 |
| 2.2 | 27.5 | – | 12.5 x 21.5 x 31.5 | B32674*4225+ | 75 | 6.3 | 6.0 | 5.7 | – | 9 | 10 | 11 | – | 280 |
| 2.2 | 37.5 | – | 12.0 x 22.0 x 42.0 | B32676*4225+ | 54 | – | 14.0 | 13.1 | – | – | 9 | 10 | – | 135 |
| 3 | 37.5 | – | 12.0 x 22.0 x 42.0 | B32676*4305+ | 54 | – | 13.7 | 12.7 | – | – | 10 | 11 | – | 135 |
| 3.3 | 27.5 | – | 15.0 x 24.5 x 31.5 | B32674*4335+ | 75 | 4.7 | 4.3 | 4.0 | – | 9 | 10 | 12 | – | 240 |
| 3.3 | 37.5 | – | 14.0 x 25.0 x 42.0 | B32676*4335+ | 54 | – | 13.2 | 12.2 | – | – | 10 | 11 | – | 115 |
| 4 | 37.5 | – | 14.0 x 25.0 x 42.0 | B32676*4405+ | 54 | – | 12.2 | 11.1 | – | – | 11 | 12 | – | 115 |
| 4.7 | 27.5 | – | 18.0 x 27.5 x 31.5 | B32674*4475+ | 75 | 4.8 | 4.1 | 3.5 | – | 9 | 11 | 14 | – | 200 |
| 4.7 | 37.5 | – | 16.0 x 28.5 x 42.0 | B32676*4475+ | 54 | – | 11.5 | 10.3 | – | – | 12 | 13 | – | 100 |
| 5.0 | 27.5 | – | 16.0 x 32.0 x 31.5 | B32674*4505+ | 75 | 4.8 | 4.1 | 3.5 | – | 9 | 11 | 14 | – | 220 |
| 5.0 | 37.5 | – | 16.0 x 28.5 x 42.0 | B32676*4505+ | 54 | – | 10.8 | 9.9 | – | – | 12 | 14 | – | 100 |
| 5.6 | 27.5 | – | 18.0 x 33.0 x 31.5 | B32674*4565+ | 75 | 4.2 | 3.6 | 3.1 | – | 9 | 12 | 14 | – | 200 |
| 5.6 | 37.5 | – | 16.0 x 28.5 x 42.0 | B32676*4565+ | 54 | – | 10.2 | 9.5 | – | – | 12 | 14 | – | 100 |
| 6 | 27.5 | – | 21.0 x 31.0 x 31.5 | B32674*4605+ | 75 | 4.1 | 3.5 | 3.0 | – | 9 | 12 | 14 | – | 180 |
| 6.8 | 27.5 | – | 22.0 x 36.5 x 31.5 | B32674*4685+ | 75 | 3.8 | 3.3 | 2.8 | – | 9 | 12 | 14 | – | 160 |
| 6.8 | 37.5 | – | 18.0 x 32.5 x 42.0 | B32676*4685+ | 54 | – | 8.6 | 7.7 | – | – | 12 | 14 | – | 90 |
| 7.5 | 27.5 | – | 22.0 x 36.5 x 31.5 | B32674*4755+ | 75 | 3.7 | 3.2 | 2.8 | – | 9 | 12 | 14 | – | 160 |
| 8.2 | 37.5 | 10.2 | 20.0 x 39.5 x 42.0 | B32676*4825+ | 54 | – | 7.2 | 6.4 | 3.3 | – | 12 | 14 | 24 | 75 |
| 10 | 37.5 | 10.2 | 20.0 x 39.5 x 42.0 | B32676*4106+ | 54 | – | 6.0 | 5.3 | 2.2 | – | 12 | 14 | 27 | 75 |
| 15 | 37.5 | 10.2 | 28.0 x 42.5 x 42.0 | B32676*4156+ | 54 | – | 4.1 | 3.3 | 1.8 | – | 12 | 14 | 29 | 55 |
| 20 | 37.5 | 20.3 | 30.0 x 45.0 x 42.0 | B32676*4206K | 54 | – | 3.3 | 2.6 | 1.4 | – | 12 | 14 | 29 | 54 |
| 20 | 52.5 | 20.3 | 30.0 x 45.0 x 57.5 | B32678*4206+ | 35 | – | – | – | 2.2 | – | – | – | 29 | 36 |
| 25 | 37.5 | 20.3 | 33.0 x 48.0 x 42.0 | B32676*4256K | 54 | – | – | – | 1.2 | – | – | – | 29 | 48 |
| 25 | 52.5 | 20.3 | 30.0 x 45.0 x 57.5 | B32678*4256+ | 35 | – | – | – | 2 | – | – | – | 29 | 36 |
| 30 | 52.5 | 20.3 | 35.0 x 50.0 x 57.5 | B32678*4306+ | 35 | – | – | – | 1.7 | – | – | – | 29 | 28 |
| 35 | 52.5 | 20.3 | 35.0 x 50.0 x 57.5 | B32678*4356+ | 35 | – | – | – | 1.4 | – | – | – | 29 | 28 |
| 40 | 52.5 | 20.3 | 35.0 x 50.0 x 57.5 | B32678*4406K | 35 | – | – | – | 1.2 | – | – | – | 29 | 28 |
| V _R = 630 V DC / V _{op} = 800 V DC / V _p = 950 V DC / V _{rms} = 350 V AC | | | | | | | | | | | | | | |
| 1 | 27.5 | – | 11.0 x 19.0 x 31.5 | B32674*6105+ | 100 | 10.5 | 9.9 | 9.4 | – | 7 | 8 | 9 | – | 320 |
| 1.5 | 27.5 | – | 12.5 x 21.5 x 31.5 | B32674*6155+ | 100 | 7.7 | 7.4 | 7.1 | – | 9 | 12 | 12 | – | 280 |
| 2 | 37.5 | – | 12.0 x 22.0 x 42.0 | B32676*6205+ | 73 | – | 12.2 | 11.5 | – | – | 10 | 11 | – | 135 |
| 2.2 | 27.5 | – | 15.0 x 24.5 x 31.5 | B32674*6225+ | 100 | 6.0 | 5.5 | 5.0 | – | 9 | 12 | 13 | – | 240 |
| 2.7 | 37.5 | – | 14.0 x 25.0 x 42.0 | B32676*6275+ | 73 | – | 10.5 | 9.8 | – | – | 10 | 12 | – | 115 |
| 3.3 | 27.5 | – | 16.0 x 32.0 x 31.5 | B32674*6335+ | 100 | 5.0 | 4.5 | 4.0 | – | 9 | 12 | 14 | – | 220 |
| 3.3 | 37.5 | – | 16.0 x 28.5 x 42.0 | B32676*6335+ | 73 | – | 9.3 | 8.5 | – | – | 10 | 13 | – | 100 |
| 4 | 37.5 | – | 16.0 x 28.5 x 42.0 | B32676*6405+ | 73 | – | 7.2 | 6.4 | – | – | 11 | 13 | – | 100 |
| 4.7 | 27.5 | – | 22.0 x 36.5 x 31.5 | B32674*6475+ | 100 | 4.7 | 4.0 | 3.4 | – | 9 | 12 | 14 | – | 160 |
| 4.7 | 37.5 | – | 18.0 x 32.5 x 42.0 | B32676*6475+ | 73 | – | 5.8 | 5.1 | – | – | 12 | 14 | – | 90 |
| 5 | 27.5 | – | 22.0 x 36.5 x 31.5 | B32674*6505+ | 100 | 4.7 | 4.0 | 3.4 | – | 9 | 12 | 14 | – | 160 |
| 6.8 | 37.5 | 10.2 | 20.0 x 39.5 x 42.0 | B32676*6685+ | 73 | – | 4.9 | 4.2 | 2.5 | – | 12 | 14 | 22 | 75 |

Preferred lead execution. Other executions, intermediate capacitance values are available upon request.

+ = Tolerance: J = ±5%, K = ±10% * = Diameter: D = Ø0.8 mm, E = Ø1.0 mm, F = Ø1.2 mm, G = Ø1.2 mm, 4-pin

PU = Packing unit

Please refer to typical waveforms on page 23. **Note:** Not for across the line applications! Only unidirectional AC voltage!

Data Sheet: MKP DC Link

Characteristics and ordering codes

| C _R | Lead spacing [e] ±0.4 | P ₁ 4-pin | Max. dimensions w x h x l | Ordering code | dv/dt | ESR (mΩ), 100 kHz 2-pin | | | | 4-pin | I _{rms} (A), 100 kHz, 70 °C 2-pin | | | | 4-pin | PU (pcs.) |
|--|--------------------------|-------------------------|------------------------------|---------------|-------|----------------------------|------|------|------|-------|---|------|------|-----|-------|--------------|
| μF | mm | mm | mm | | V/μs | Ø0.8 | Ø1.0 | Ø1.2 | Ø1.2 | Ø0.8 | Ø1.0 | Ø1.2 | Ø1.2 | | | |
| V _R = 630 V DC / V _{op} = 800 V DC / V _p = 950 V DC / V _{rms} = 350 V AC | | | | | | | | | | | | | | | | |
| 7.5 | 37.5 | 10.2 | 20.0 x 39.5 x 42.0 | B32676*6755+ | 73 | – | 4.6 | 3.9 | 2.3 | – | 12 | 14 | 27 | 75 | | |
| 8.2 | 37.5 | 10.2 | 28.0 x 37.0 x 42.0 | B32676*6825+ | 73 | – | 4.3 | 3.6 | 2.1 | – | 12 | 14 | 29 | 55 | | |
| 10 | 37.5 | 20.3 | 28.0 x 42.5 x 42.0 | B32676*6106+ | 73 | – | 3.9 | 3.1 | 1.9 | – | 12 | 14 | 29 | 55 | | |
| 12 | 37.5 | 20.3 | 28.0 x 42.5 x 42.0 | B32676*6126+ | 73 | – | 3.8 | 3 | 1.8 | – | 12 | 14 | 29 | 55 | | |
| 14 | 37.5 | 20.3 | 30.0 x 45.0 x 42.0 | B32676*6146+ | 73 | – | 3.7 | 2.9 | 1.7 | – | 12 | 14 | 29 | 54 | | |
| 15 | 37.5 | 20.3 | 33.0 x 48.0 x 42.0 | B32676*6156+ | 73 | – | – | – | 1.6 | – | – | – | 29 | 48 | | |
| 15 | 52.5 | 20.3 | 30.0 x 45.0 x 57.5 | B32678*6156+ | 50 | – | – | – | 2.7 | – | – | – | 29 | 36 | | |
| 20 | 52.5 | 20.3 | 35.0 x 50.0 x 57.5 | B32678*6206+ | 50 | – | – | – | 2 | – | – | – | 29 | 28 | | |
| 25 | 52.5 | 20.3 | 35.0 x 50.0 x 57.5 | B32678*6256+ | 50 | – | – | – | 1.8 | – | – | – | 29 | 28 | | |
| V _R = 750 V DC / V _{op} = 900 V DC / V _p = 1125 V DC / V _{rms} = 375 V AC | | | | | | | | | | | | | | | | |
| 0.68 | 27.5 | – | 11.0 x 19.0 x 31.5 | B32674*1684+ | 125 | 12.0 | 11.4 | 10.8 | – | 7 | 8 | 8 | – | 320 | | |
| 1 | 27.5 | – | 12.5 x 21.5 x 31.5 | B32674*1105+ | 125 | 9.0 | 8.4 | 7.8 | – | 9 | 9 | 10 | – | 280 | | |
| 1.5 | 27.5 | – | 14.0 x 24.5 x 31.5 | B32674*1155+ | 125 | 6.9 | 6.3 | 5.8 | – | 9 | 12 | 13 | – | 260 | | |
| 1.5 | 37.5 | – | 12.0 x 22.0 x 42.0 | B32676*1155+ | 85 | – | 15.2 | 12.2 | – | – | 9 | 11 | – | 135 | | |
| 2 | 37.5 | – | 14.0 x 25.0 x 42.0 | B32676*1205+ | 85 | – | 12.2 | 10.9 | – | – | 10 | 12 | – | 115 | | |
| 2.2 | 27.5 | – | 18.0 x 27.5 x 31.5 | B32674*1225+ | 125 | 5.3 | 4.8 | 4.4 | – | 9 | 12 | 14 | – | 200 | | |
| 3.3 | 27.5 | – | 21.0 x 31.0 x 31.5 | B32674*1335+ | 125 | 5.0 | 4.4 | 3.9 | – | 9 | 12 | 14 | – | 180 | | |
| 3.3 | 37.5 | – | 18.0 x 32.5 x 42.0 | B32676*1335+ | 85 | – | 9.6 | 8.4 | – | – | 11 | 14 | – | 90 | | |
| 4.0 | 27.5 | – | 22.0 x 36.5 x 31.5 | B32674*1405+ | 125 | 4.9 | 4.1 | 3.5 | – | 9 | 12 | 14 | – | 160 | | |
| 4.7 | 37.5 | 10.2 | 20.0 x 39.5 x 42.0 | B32676*1475+ | 85 | – | 5.7 | 4.7 | 3.8 | – | 12 | 14 | 22 | 75 | | |
| 5.6 | 37.5 | 10.2 | 20.0 x 39.5 x 42.0 | B32676*1565+ | 85 | – | 5.2 | 4.2 | 3.6 | – | 12 | 14 | 24 | 75 | | |
| 6.8 | 37.5 | 20.3 | 28.0 x 37.0 x 42.0 | B32676*1685+ | 85 | – | 4.9 | 4 | 3.2 | – | 12 | 14 | 28 | 55 | | |
| 9 | 37.5 | 20.3 | 28.0 x 42.5 x 42.0 | B32676*1905+ | 85 | – | 4.4 | 3.3 | 2.5 | – | 12 | 14 | 29 | 55 | | |
| 10 | 37.5 | 20.3 | 30.0 x 45.0 x 42.0 | B32676*1106+ | 85 | – | 4.2 | 3 | 2.3 | – | 12 | 14 | 29 | 54 | | |
| 12 | 37.5 | 20.3 | 33.0 x 48.0 x 42.0 | B32676*1126+ | 85 | – | – | – | 2.0 | – | – | – | 29 | 48 | | |
| 15 | 52.5 | 20.3 | 30.0 x 45.0 x 57.5 | B32678*1156K | 60 | – | – | – | 2.7 | – | – | – | 29 | 36 | | |
| 20 | 52.5 | 20.3 | 35.0 x 50.0 x 57.5 | B32678*1206K | 60 | – | – | – | 1.9 | – | – | – | 29 | 28 | | |
| V _R = 875 V DC / V _{op} = 1050 V DC / V _p = 1300 V DC / V _{rms} = 400 V AC | | | | | | | | | | | | | | | | |
| 0.47 | 27.5 | – | 11.0 x 19.0 x 31.5 | B32674*8474+ | 150 | 14.0 | 13.5 | 13.0 | – | 7 | 7 | 7 | – | 320 | | |
| 0.68 | 27.5 | – | 11.0 x 21.0 x 31.5 | B32674*8684+ | 150 | 11.5 | 11.0 | 10.5 | – | 8 | 8 | 8 | – | 320 | | |
| 1 | 27.5 | – | 13.5 x 23.0 x 31.5 | B32674*8105+ | 150 | 8.4 | 8.0 | 7.6 | – | 9 | 9 | 10 | – | 260 | | |
| 1 | 37.5 | – | 12.0 x 22.0 x 42.0 | B32676*8105+ | 100 | – | 14.1 | 13.3 | – | – | 10 | 11 | – | 135 | | |
| 1.5 | 27.5 | – | 18.0 x 27.5 x 31.5 | B32674*8155+ | 150 | 5.5 | 5.0 | 4.6 | – | 9 | 12 | 14 | – | 200 | | |
| 1.5 | 37.5 | – | 14.0 x 25.0 x 42.0 | B32676*8155+ | 100 | – | 12.2 | 11.1 | – | – | 10 | 11 | – | 115 | | |
| 2.2 | 27.5 | – | 18.0 x 33.0 x 31.5 | B32674*8225+ | 150 | 5.3 | 4.8 | 4.4 | – | 9 | 12 | 14 | – | 200 | | |
| 2.2 | 37.5 | – | 16.0 x 28.5 x 42.0 | B32676*8225+ | 100 | – | 10.5 | 9.5 | – | – | 11 | 12 | – | 100 | | |
| 3 | 27.5 | – | 22.0 x 36.5 x 31.5 | B32674*8305+ | 150 | 4.5 | 4.0 | 3.6 | – | 9 | 12 | 14 | – | 160 | | |
| 3.3 | 37.5 | 10.2 | 20.0 x 39.5 x 42.0 | B32676*8335+ | 100 | – | 6.5 | 5.5 | 4.8 | – | 12 | 14 | 25 | 75 | | |
| 4 | 37.5 | 10.2 | 20.0 x 39.5 x 42.0 | B32676*8405+ | 100 | – | 5.8 | 4.7 | 4 | – | 12 | 14 | 26 | 75 | | |
| 4.7 | 37.5 | 20.3 | 28.0 x 37.0 x 42.0 | B32676*8475+ | 100 | – | 5.1 | 4.1 | 3.3 | – | 12 | 14 | 27 | 55 | | |
| 6.8 | 37.5 | 20.3 | 28.0 x 42.5 x 42.0 | B32676*8685+ | 100 | – | 4.9 | 3.7 | 3.1 | – | 12 | 14 | 28 | 55 | | |
| 7.5 | 37.5 | 20.3 | 30.0 x 45.0 x 42.0 | B32676*8755+ | 100 | – | 4.7 | 3.5 | 2.9 | – | 12 | 14 | 29 | 54 | | |
| 10 | 37.5 | 20.3 | 33.0 x 48.0 x 42.0 | B32676*8106K | 100 | – | – | – | 2.2 | – | – | – | 29 | 48 | | |
| 10 | 52.5 | 20.3 | 30.0 x 45.0 x 57.5 | B32678*8106+ | 70 | – | – | – | 2.5 | – | – | – | 29 | 36 | | |
| 15 | 52.5 | 20.3 | 35.0 x 50.0 x 57.5 | B32678*8156K | 70 | – | – | – | 2 | – | – | – | 29 | 28 | | |

Preferred lead execution. Other executions, intermediate capacitance values are available upon request.

+ = Tolerance: J = ±5%, K = ±10% * = Diameter: D = Ø0.8 mm, E = Ø1.0 mm, F = Ø1.2 mm, G = Ø1.2 mm, 4-pin

PU = Packing unit

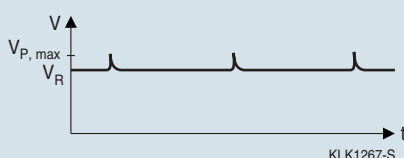
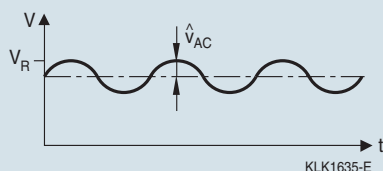
Please refer to typical waveforms on page 23. **Note:** Not for across the line applications! Only unidirectional AC voltage!

Data Sheet: MKP DC Link

B3267*

| Technical data | | | | | | |
|---|---|-----|--|-----|---|------|
| Reference standards IEC 61071 / IEC 60068 / IEC 60384-16 | | | | | | |
| Maximum operating temperature T _{op,max} | 100 °C | | | | | |
| Climatic category | 40/100/56 | | | | | |
| Dissipation factor tan δ (in 10 ⁻³) at 1 kHz and 20 °C (upper limit values) | ≤ 1 | | | | | |
| Insulation resistance R _{ins} or time constant τ = C _R · R _{ins} at 20 °C, rel. humidity ≤ 65% (minimum as-delivered values) | 30 000 s | | | | | |
| DC test voltage between terminations (to IEC 61017) | 1.5 · V _R , 10 s / 1.65 · V _R , 2 s | | | | | |
| Continuous operation voltage (V _{op}) | 70 °C | 450 | 630 | 800 | 900 | 1050 |
| Nominal operation voltage (V _R) | 85 °C | 300 | 450 | 630 | 750 | 875 |
| Maximum peak voltage (V _{P,max}) | | 450 | 675 | 950 | 1125 | 1300 |
| Category voltage V _C (continuous operation with V _{DC} or V _{AC} at f ≤ 1 kHz) | T _A (°C) | | DC voltage derating | | AC voltage derating | |
| | T _A ≤ 85 85 < T _A ≤ 100 | | V _C = V _R V _C = V _R · (165–T _A) / 80 | | V _{C,rms} = V _{R,rms} V _{C,rms} = V _{R,rms} · (165–T _A) / 80 | |
| Operating voltage V _{op} for short operating periods (V _{DC} or V _{AC} at f ≤ 1kHz) | T _A (°C) | | DC voltage (max. hours) | | AC voltage (max. hours) | |
| | T _A ≤ 85 85 < T _A ≤ 100 | | V _{op} = 1.25 · V _C (2000 h) V _{op} = 1.25 · V _C (1000 h) | | V _{op} = 1.0 · V _{C,rms} (2000 h) V _{op} = 1.0 · V _{C,rms} (1000 h) | |
| Pulse rise time (dv/dt) | Refer to table | | | | | |
| Maximum peak current (I _{P,max}) | C (μF) · dv/dt (V/μs) | | | | | |
| Peak non-repetitive current | 1.5 · I _P | | | | | |
| Damp heat test | 56 days / 40 °C / 93% relative humidity | | | | | |
| Limit values after damp heat test | Capacitance change (ΔC/C) | | | | ≤ 5% | |
| | Dissipation factor change (Δtan δ) | | | | ≤ 0.5 · 10 ⁻³ (at 1 kHz) ≤ 1.0 · 10 ⁻³ (at 10 kHz) | |
| | Insulation resistance R _{ins} or time constant τ = C _R · R _{ins} | | | | ≥ 50% of minimum as-delivered values | |
| Reliability: | | | | | | |
| Failure rate λ | 1 fit (≤ 1 · 10 ⁻⁹ /h) at 0.5 · V _R , 40 °C | | | | | |
| Service life t _{SL} | 200 000 h at 1.0 · V _R , 40 °C | | | | | |
| | For conversion to other operating conditions and temperatures refer to chapter “Quality assurance”, data book 2005 “Film Capacitors”, page 390. | | | | | |
| Failure criteria: | | | | | | |
| Total failure | Short circuit or open circuit | | | | | |
| Failure due to variation of parameters | Capacitance change (ΔC/C) | | | | > 10% | |
| | Dissipation factor tan δ | | | | > 4 times upper limit value | |
| | Insulation resistance R _{ins} or time constant τ = C _R · R _{ins} | | | | < 500 s | |
| Delivery mode | Bulk | | | | | |

Typical waveforms:



V_R = maximum operating peak of voltage of either polarity but of a non-reversing waveform, for which the capacitor has been designed, for continuous operation.

$\hat{V}_{AC} = 0.1 \cdot V_R$ (DC)

$V_{P,max}$ = this is the maximum permissible recurrent voltage that may appear for max. 1% of the period.

Data Sheet: MKP PFC

MKP PFC

RoHS
compatible

Climatic

- Maximum operating temperature 110 °C
- Climatic category (IEC 60068-1): 55/110/56

Construction

- Dielectric: Polypropylene (MKP) film
- Plastic case (UL 94 V-0)
- Epoxy resin sealing, flame-retardant

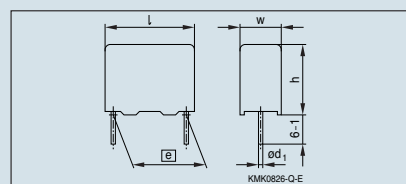
Terminals

- Parallel wire leads, lead-free tinned

Marking

- Manufacturer's logo, lot number, series number
Rated capacitance, tolerance,
Rated DC voltage, date of manufacture (coded)

Dimensional drawing



Dimensions in mm

Characteristics and ordering codes

| Lead spacing [E] ±0.4 mm | C _R μF | Max. dimensions w x h x l mm | Ordering code | Ød ₁ mm | dv/dt V/μs | k ₀ V ² /μs | Ammo pack pcs/unit | Reel pcs/unit | Untaped pcs/unit |
|---------------------------------|----------------------|------------------------------------|-----------------|-----------------------|---------------|--------------------------------------|--------------------------|------------------|---------------------|
| V_R = 450 V DC | | | | | | | | | |
| 15 | 0.10 | 5.0 x 10.5 x 18.0 | B32672Z4104+*** | 0.8 | 160 | 128000 | 1000 | 1700 | 1000 |
| | 0.15 | 5.0 x 10.5 x 18.0 | B32672Z4154+*** | 0.8 | 160 | 128000 | 1000 | 1700 | 1000 |
| | 0.22 | 6.0 x 11.0 x 18.0 | B32672Z4224+*** | 0.8 | 160 | 128000 | 830 | 1300 | 1000 |
| | 0.33 | 7.0 x 12.5 x 18.0 | B32672Z4334+*** | 0.8 | 160 | 128000 | 830 | 1300 | 1000 |
| | 0.47 | 8.0 x 14.0 x 18.0 | B32672Z4474+*** | 0.8 | 160 | 128000 | 680 | 1100 | 1000 |
| | 0.47 | 13.0 x 14.0 x 18.0 | B32672T4474+*** | 0.8 | 160 | 128000 | 680 | 1100 | 1000 |
| | 0.68 | 9.0 x 17.5 x 18.0 | B32672Z4684+*** | 0.8 | 160 | 128000 | 680 | 1100 | 1000 |
| | 0.68 | 13.0 x 14.0 x 18.0 | B32672T4684+*** | 0.8 | 160 | 128000 | – | 500 | 300 |
| | 1.00 | 11.0 x 18.5 x 18.0 | B32672Z4105+*** | 0.8 | 160 | 128000 | – | 550 | 250 |
| V_R = 520 V DC | | | | | | | | | |
| 15 | 0.047 | 5.0 x 10.5 x 18.0 | B32672Z5473+*** | 0.8 | 200 | 208000 | 960 | 1100 | 1000 |
| | 0.10 | 6.0 x 11.0 x 18.0 | B32672Z5104+*** | 0.8 | 200 | 208000 | 830 | 900 | 1000 |
| | 0.15 | 6.0 x 11.0 x 18.0 | B32672Z5154+*** | 0.8 | 200 | 208000 | 680 | 700 | 500 |
| | 0.22 | 7.0 x 12.5 x 18.0 | B32672Z5224+*** | 0.8 | 200 | 208000 | 680 | 700 | 500 |
| | 0.33 | 8.5 x 14.5 x 18.0 | B32672Z5334+*** | 0.8 | 200 | 208000 | 640 | 700 | 500 |
| | 0.33 | 13.0 x 14.0 x 18.0 | B32672T5334+*** | 0.8 | 200 | 208000 | – | 500 | 300 |
| | 0.47 | 9.0 x 17.5 x 18.0 | B32672Z5474+*** | 0.8 | 200 | 208000 | 640 | 700 | 500 |
| | 0.47 | 13.0 x 14.0 x 18.0 | B32672T5474+*** | 0.8 | 200 | 208000 | – | 500 | 300 |
| | 0.68 | 11.0 x 18.5 x 18.0 | B32672Z5684+*** | 0.8 | 200 | 208000 | – | 550 | 250 |
| V_R = 630 V DC | | | | | | | | | |
| 15 | 0.068 | 6.0 x 11.0 x 18.0 | B32672Z6683+*** | 0.8 | 250 | 315000 | 680 | 700 | 500 |
| | 0.10 | 7.0 x 12.5 x 18.0 | B32672Z6104+*** | 0.8 | 250 | 315000 | 680 | 700 | 500 |
| | 0.22 | 8.5 x 14.5 x 18.0 | B32672Z6224+*** | 0.8 | 250 | 315000 | 640 | 700 | 500 |

Further E series and intermediate capacitance values are available on request.

+ = Capacitance tolerance code: J = ±5%, K = ±10%

*** = Packing code: 289 = Ammo pack, 189 = Reel, 000 = Untaped (lead length 6-1 mm)

Data Sheet: MKP PFC

B3267*

| Characteristics and ordering codes | | | | | | | | | |
|------------------------------------|----------------------|------------------------------------|-----------------|-----------------------|---------------|--------------------------------------|-----------------------|------------------|---------------------|
| Lead spacing [E] ±0.4 mm | C _R μF | Max. dimensions w x h x l mm | Ordering code | Ød ₁ mm | dv/dt V/μs | k ₀ V ² /μs | Ammo pack pcs/unit | Reel pcs/unit | Untaped pcs/unit |
| V_R = 450 V DC | | | | | | | | | |
| 22.5 | 0.22 | 6.0 x 15.0 x 26,5 | B32673Z4224+*** | 0.8 | 100 | 80000 | 680 | 700 | 720 |
| | 0.22 | 7.5 x 14.0 x 26,5 | B32673T4224+*** | 0.8 | 100 | 80000 | 550 | 500 | 570 |
| | 0.33 | 6.0 x 15.0 x 26,5 | B32673Z4334+*** | 0.8 | 100 | 80000 | 680 | 700 | 720 |
| | 0.33 | 7.5 x 14.0 x 26,5 | B32673T4334+*** | 0.8 | 100 | 80000 | 550 | 500 | 570 |
| | 0.47 | 6.0 x 15.0 x 26,5 | B32673Z4474+*** | 0.8 | 100 | 80000 | 680 | 700 | 720 |
| | 0.47 | 7.5 x 14.0 x 26,5 | B32673T4474+*** | 0.8 | 100 | 80000 | 550 | 500 | 570 |
| | 0.68 | 7.0 x 16.0 x 26,5 | B32673Z4684+*** | 0.8 | 100 | 80000 | 580 | 600 | 630 |
| | 0.68 | 7.5 x 14.0 x 26,5 | B32673T4684+*** | 0.8 | 100 | 80000 | 550 | 500 | 570 |
| | 1.00 | 10.5 x 16.5 x 26,5 | B32673Z4105+*** | 0.8 | 100 | 80000 | 390 | 400 | 540 |
| | 1.50 | 11.0 x 20.5 x 26,5 | B32673Z4155+*** | 0.8 | 100 | 80000 | 370 | 350 | 510 |
| | 2.20 | 12.0 x 22.0 x 26,5 | B32673Z4225+*** | 0.8 | 100 | 80000 | – | – | 450 |
| V_R = 520 V DC | | | | | | | | | |
| 22.5 | 0.22 | 6.0 x 15.0 x 26,5 | B32673Z5224+*** | 0.8 | 120 | 125000 | 680 | 700 | 720 |
| | 0.22 | 7.5 x 14.0 x 26,5 | B32673T5224+*** | 0.8 | 120 | 125000 | 550 | 500 | 570 |
| | 0.33 | 6.0 x 15.0 x 26,5 | B32673Z5334+*** | 0.8 | 120 | 125000 | 680 | 700 | 720 |
| | 0.33 | 7.5 x 14.0 x 26,5 | B32673T5334+*** | 0.8 | 120 | 125000 | 550 | 500 | 570 |
| | 0.47 | 7.0 x 16.0 x 26,5 | B32673Z5474+*** | 0.8 | 120 | 125000 | 580 | 600 | 630 |
| | 0.47 | 7.5 x 14.0 x 26,5 | B32673T5474+*** | 0.8 | 120 | 125000 | 550 | 500 | 570 |
| | 0.68 | 10.5 x 16.5 x 26,5 | B32673Z5684+*** | 0.8 | 120 | 125000 | 390 | 400 | 540 |
| | 1.00 | 10.5 x 20.5 x 26,5 | B32673Z5105+*** | 0.8 | 120 | 125000 | 390 | 400 | 540 |
| | 1.50 | 12.0 x 22.0 x 18.0 | B32673Z5155+*** | 0.8 | 120 | 125000 | – | – | 450 |

Further E series and intermediate capacitance values are available on request.

+ = Capacitance tolerance code: J = ±5%, K = ±10%

*** = Packing code: 289 = Ammo pack, 189 = Reel, 000 = Untaped (lead length 6-1 mm)

| Technical data | | | |
|---|---|--|---|
| | | | |
| Maximum operating temperature T _{op,max} | 110 °C | | |
| Dissipation factor tan δ (in 10 ⁻³) at 20 °C (upper limit values) | at | C _R ≤ 0.1 μF | C _R > 0.1 μF |
| | 1 kHz | 1.0 | 1.0 |
| | 100 kHz | 5.0 | – |
| Insulation resistance R _{ins} or time constant τ = C _R · R _{ins} at 20 °C, rel. humidity ≤ 65% (minimum as-delivered values) | 30 000 MΩ | | |
| DC test voltage | 1.6 · V _R , 2 s | | |
| Passive flammability category to IEC 40 (CO) 752 | C | | |
| Maximum continuous AC voltage (V _{AC}) | 220 V / 277 V / 310 V (50/60 Hz) | | |
| Surge pulse test to IEC 1000-4-5 | 1.2 μs / 50 μs / 1200 V 8.0 μs / 20 μs / 1200 V | | |
| Damp heat test | 56 days / 40 °C / 93% relative humidity | | |
| Limit values after damp heat test | Capacitance change (ΔC/C) | | ≤ 5% |
| | Dissipation factor change (Δtan δ) | | ≤ 0.5 · 10 ⁻³ (at 1 kHz) ≤ 1.0 · 10 ⁻³ (at 10 kHz) |
| | Insulation resistance R _{ins} or time constant τ = C _R · R _{ins} | | ≥ 50% of minimum as-delivered values |
| Pulse handling capability | | | |
| “dv/dt” values represent the maximum permissible voltage change per unit of time for non-sinusoidal voltages, expressed in V/μs. | | “k ₀ ” represents the maximum permissible pulse characteristic of the waveform applied to the capacitor, expressed in V ² /μs. | |
| | | Note: The maximum values of dv/dt and k ₀ must not be exceeded in order to avoid damaging the capacitor. | |

Data Sheet: MKP Snubbers

MKP capacitors for snubbing

RoHS
compatible

Climatic

- Maximum operating temperature 100 °C
- Climatic category (IEC 60068-1): 55/100/56

Construction

- Dielectric: Polypropylene (MKP) film
- Wound technology with internal series connection
- Plastic case (UL 94 V-0)
- Epoxy resin sealing (UL 94 V-0)

Terminals

- Strap terminals, tinned copper (maximum torque 10 Nm)

Marking

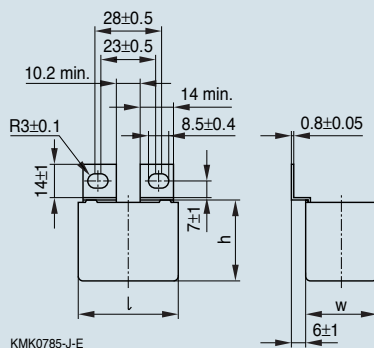
Manufacturer's logo, ordering code, style (MKP), rated capacitance (coded), cap. tolerance (code letter), rated DC voltage, date of manufacture (coded)

Delivery mode

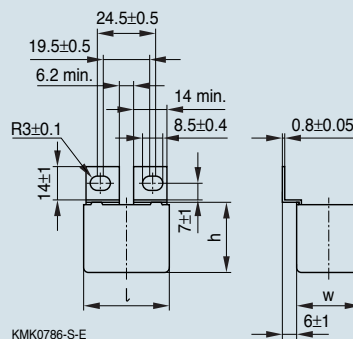
Bulk

Dimensional drawing

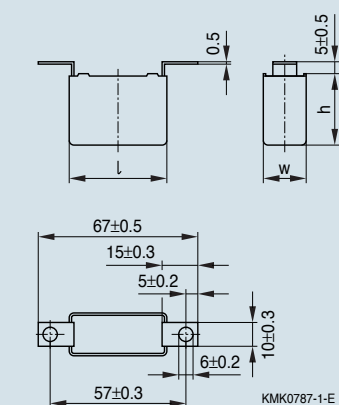
T1 (code no. 561)



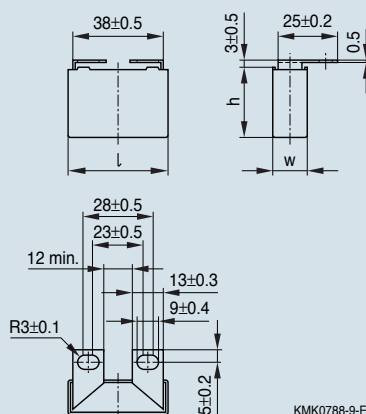
T2 (code no. 562)



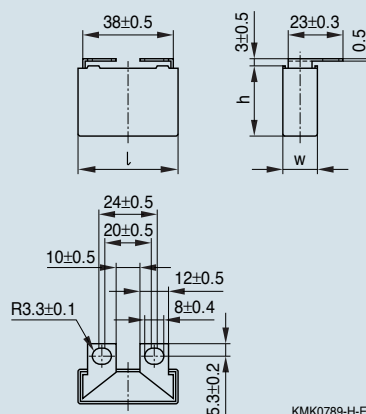
T3 (code no. 563)



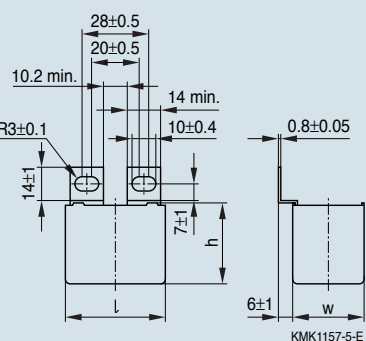
T4 (code no. 564)



T5 (code no. 565)



T6 (code no. 566)



Data Sheet: MKP Snubbers

| Characteristics and ordering codes | | | | | | | | | | | |
|---|------------------------------|-----------------|-----------|----|----|----|----|----|-------|----------------|-----------------------------|
| C _R | Max. dimensions w x h x l | Ordering code | Terminals | | | | | | dv/dt | ESR 100 kHz | I _{rms} 100 kHz |
| μF | mm | | T1 | T2 | T3 | T4 | T5 | T6 | V/μs | mΩ | A |
| V_R = 850 V DC / V_{rms} = 450 V AC | | | | | | | | | | | |
| 0.22 | 12 x 22.5 x 42 | B32656S8224+*** | | | | | | | 400 | 10 | 5 |
| 0.27 | 12 x 22.5 x 42 | B32656S8274+*** | | | | | | | 400 | 9 | 6 |
| 0.33 | 12 x 22.5 x 42 | B32656S8334+*** | | | | | | | 400 | 9 | 6 |
| 0.39 | 12 x 22.5 x 42 | B32656S8394+*** | | | | | | | 400 | 8 | 7 |
| 0.47 | 12 x 22.5 x 42 | B32656S8474+*** | | | | | | | 400 | 8 | 8 |
| 0.56 | 14 x 25 x 42 | B32656S8564+*** | | | | | | | 400 | 7 | 8 |
| 0.68 | 16 x 28.5 x 42 | B32656S8684+*** | | | | | | | 400 | 6 | 9 |
| 0.82 | 16 x 28.5 x 42 | B32656S8824+*** | | | | | | | 400 | 6 | 10 |
| 1.00 | 18 x 32.5 x 42 | B32656S8105+*** | | | | | | | 400 | 6 | 11 |
| 1.20 | 18 x 32.5 x 42 | B32656S8125+*** | | | | | | | 400 | 5 | 11 |
| 1.50 | 31 x 26.5 x 43.6 | B32656S8155+*** | | | | | | | 400 | 5 | 13 |
| 1.80 | 28 x 37 x 42 | B32656S8185+*** | | | | | | | 400 | 4.5 | 15 |
| 2.20 | 30 x 45 x 42 | B32656S8255+*** | | | | | | | 400 | 3.5 | 17 |
| V_R = 1000 V DC / V_{rms} = 480 V AC | | | | | | | | | | | |
| 0.22 | 12 x 22.5 x 42 | B32656S0224+*** | | | | | | | 450 | 10 | 6 |
| 0.27 | 12 x 22.5 x 42 | B32656S0274+*** | | | | | | | 450 | 9 | 7 |
| 0.33 | 14 x 25 x 42 | B32656S0334+*** | | | | | | | 450 | 9 | 7 |
| 0.39 | 14 x 25 x 42 | B32656S0394+*** | | | | | | | 450 | 8 | 8 |
| 0.47 | 14 x 25 x 42 | B32656S0474+*** | | | | | | | 450 | 8 | 9 |
| 0.56 | 16 x 28.5 x 42 | B32656S0564+*** | | | | | | | 450 | 7 | 9 |
| 0.68 | 16 x 28.5 x 42 | B32656S0684+*** | | | | | | | 450 | 6 | 10 |
| 0.82 | 18 x 32.5 x 42 | B32656S0824+*** | | | | | | | 450 | 6 | 11 |
| 1.00 | 20 x 39.5 x 42 | B32656S0105+*** | | | | | | | 450 | 6 | 12 |
| 1.20 | 20 x 39.5 x 42 | B32656S0125+*** | | | | | | | 450 | 5 | 13 |
| 1.50 | 30 x 45 x 42 | B32656S0155+*** | | | | | | | 450 | 5 | 15 |
| 1.80 | 30 x 45 x 42 | B32656S0185+*** | | | | | | | 450 | 4.5 | 16 |
| V_R = 1250 V DC / V_{rms} = 500 V AC | | | | | | | | | | | |
| 0.12 | 12 x 22.5 x 42 | B32656S7124+*** | | | | | | | 500 | 15 | 5 |
| 0.15 | 12 x 22.5 x 42 | B32656S7154+*** | | | | | | | 500 | 15 | 6 |
| 0.22 | 14 x 25 x 42 | B32656S7224+*** | | | | | | | 500 | 10 | 8 |
| 0.27 | 14 x 25 x 42 | B32656S7274+*** | | | | | | | 500 | 9 | 8 |
| 0.33 | 16 x 28.5 x 42 | B32656S7334+*** | | | | | | | 500 | 9 | 8 |
| 0.39 | 18 x 32.5 x 42 | B32656S7394+*** | | | | | | | 500 | 8 | 9 |
| 0.47 | 18 x 32.5 x 42 | B32656S7474+*** | | | | | | | 500 | 8 | 9 |
| 0.56 | 20 x 39.5 x 42 | B32656S7564+*** | | | | | | | 500 | 7 | 10 |
| 0.68 | 20 x 39.5 x 42 | B32656S7684+*** | | | | | | | 500 | 6 | 10 |
| 0.82 | 28 x 37 x 42 | B32656S7824+*** | | | | | | | 500 | 6 | 11 |
| 1.00 | 28 x 37 x 42 | B32656S7105+*** | | | | | | | 500 | 6 | 13 |
| 1.20 | 30 x 45 x 42 | B32656S7125+*** | | | | | | | 500 | 5 | 14 |

Available terminal types

+ = Capacitance tolerance code

J = ±5%

K = ±10%

*** = Terminal configuration

T1 = 561

T2 = 562

T3 = 563

T4 = 564

T5 = 565

T6 = 566

B32656S

Data Sheet: MKP Snubbers

Characteristics and ordering codes

| C _R | Max. dimensions w x h x l | Ordering code | Terminals | | | | | | dv/dt | ESR 100 kHz | I _{rms} 100 kHz |
|--|------------------------------|-----------------|-----------|----|----|----|----|----|-------|----------------|-----------------------------|
| μF | mm | | T1 | T2 | T3 | T4 | T5 | T6 | V/μs | mΩ | A |
| V _R = 1600 V DC / V _{rms} = 750 V AC | | | | | | | | | | | |
| 0.068 | 12 x 22.5 x 42 | B32656S1683+*** | | | | | | | 600 | 25 | 5 |
| 0.10 | 12 x 22.5 x 42 | B32656S1104+*** | | | | | | | 600 | 20 | 6 |
| 0.12 | 14 x 25 x 42 | B32656S1124+*** | | | | | | | 600 | 15 | 6 |
| 0.15 | 14 x 25 x 42 | B32656S1154+*** | | | | | | | 600 | 15 | 7 |
| 0.22 | 16 x 28.5 x 42 | B32656S1224+*** | | | | | | | 600 | 10 | 9 |
| 0.27 | 18 x 32.5 x 42 | B32656S1274+*** | | | | | | | 600 | 9 | 10 |
| 0.33 | 20 x 39.5 x 42 | B32656S1334+*** | | | | | | | 600 | 9 | 10 |
| 0.39 | 28 x 37 x 42 | B32656S1394+*** | | | | | | | 600 | 8 | 11 |
| 0.47 | 28 x 37 x 42 | B32656S1474+*** | | | | | | | 600 | 8 | 12 |
| 0.56 | 30 x 45 x 42 | B32656S1564+*** | | | | | | | 600 | 7 | 13 |
| 0.68 | 30 x 45 x 42 | B32656S1684+*** | | | | | | | 600 | 6 | 14 |
| V _R = 2000 V DC / V _{rms} = 800 V AC | | | | | | | | | | | |
| 0.047 | 12 x 22.5 x 42 | B32656S2473+*** | | | | | | | 700 | 35 | 5 |
| 0.068 | 14 x 25 x 42 | B32656S2683+*** | | | | | | | 700 | 25 | 6 |
| 0.10 | 14 x 25 x 42 | B32656S2104+*** | | | | | | | 700 | 20 | 7 |
| 0.12 | 16 x 28.5 x 42 | B32656S2124+*** | | | | | | | 700 | 15 | 7 |
| 0.15 | 18 x 32.5 x 42 | B32656S2154+*** | | | | | | | 700 | 15 | 8 |
| 0.22 | 20 x 39.5 x 41.5 | B32656S2224+*** | | | | | | | 700 | 10 | 10 |
| 0.27 | 28 x 37 x 42 | B32656S2274+*** | | | | | | | 700 | 9 | 11 |
| 0.33 | 28 x 37 x 42 | B32656S2334+*** | | | | | | | 700 | 9 | 12 |
| 0.39 | 30 x 45 x 42 | B32656S2394+*** | | | | | | | 700 | 8 | 13 |
| 0.47 | 30 x 45 x 42 | B32656S2474+*** | | | | | | | 700 | 8 | 15 |

Available terminal types
 + = Capacitance tolerance code
 J = ±5%
 K = ±10%

*** = Terminal configuration
 T1 = 561
 T2 = 562
 T3 = 563
 T4 = 564
 T5 = 565
 T6 = 566

B32656S

Data Sheet: MKP Snubbers

B32656S

| Technical data | | | | |
|---|---|--|---|---|
| Operating temperature range | Max. operating temperature T _{op,max} | | +100 °C | |
| | Upper category temperature T _{max} | | +100 °C | |
| | Lower category temperature T _{min} | | −55 °C | |
| | Rated temperature T _R | | +85 °C | |
| Dissipation factor tan δ (in 10 ^{−3}) at 20 kHz and 20 °C (upper limit values) | at | C _R ≤ 0.1 μF | 0.1 μF < C _R ≤ 1 μF | C _R > 1 μF |
| | 1 kHz | – | 0.5 | 0.5 |
| | 10 kHz | – | 0.8 | 1.5 |
| | 100 kHz | 5.0 | – | – |
| Insulation resistance R _{ins} or time constant τ = C _R · R _{ins} at 20 °C, rel. humidity ≤ 65% (minimum as-delivered values) | C _R ≤ 0.33 μF | C _R ≤ 0.33 μF | | |
| | 100 GΩ | 30 000 s | | |
| DC test voltage | 1.6 · V _R , 2 s | | | |
| Category voltage V _C (continuous operation with V _{DC} or V _{AC} at f ≤ 1 kHz) | T _A (°C) | DC voltage derating | | AC voltage derating |
| | T _A ≤ 85 85 < T _A ≤ 100 | V _C = V _R V _C = V _R · (165–T _A) / 80 | | V _{C,rms} = V _{R,rms} V _{C,rms} = V _{R,rms} · (165–T _A) / 80 |
| Operating voltage V _{op} for short operating periods (V _{DC} or V _{AC} at f ≤ 1 kHz) | T _A (°C) | DC voltage (max. hours) | | AC voltage (max. hours) |
| | T _A ≤ 85 85 < T _A ≤ 100 | V _{op} = 1.25 · V _C (2000 h) V _{op} = 1.25 · V _C (1000 h) | | V _{op} = 1.0 · V _{C,rms} (2000 h) V _{op} = 1.0 · V _{C,rms} (1000 h) |
| Damp heat test | 56 days / 40 °C / 93% relative humidity | | | |
| Limit values after damp heat test | Capacitance change (ΔC/C) | | ≤ 3% | |
| | Dissipation factor change (Δtan δ) | | ≤ 0.3 · 10 ^{−3} (at 1 kHz) ≤ 1.0 · 10 ^{−3} (at 10 kHz) | |
| | Insulation resistance R _{ins} or time constant τ = C _R · R _{ins} | | ≥ 50% of minimum as-delivered values | |
| | | | | |
| Reliability: | | | | |
| Failure rate λ | 1 fit (≤ 1 · 10 ^{−9} /h) at 0.5 · V _R , 40 °C | | | |
| Service life t _{SL} | up to 200 000 h at 1.0 · V _R , 40 °C | | | |
| | For conversion to other operating conditions and temperatures refer to chapter “Quality assurance”, data book 2005 “Film Capacitors”, page 390. | | | |
| Failure criteria: | | | | |
| Total failure | Short circuit or open circuit | | | |
| Failure due to variation of parameters | Capacitance change (ΔC/C) | | > 10% | |
| | Dissipation factor tan δ | | > 4 times upper limit value | |
| | Insulation resistance R _{ins} or time constant τ = C _R · R _{ins} | | < 1500 MΩ (C _R ≤ 0.33 μF) < 500 s (C _R ≤ 0.33 μF) | |
| | | | | |

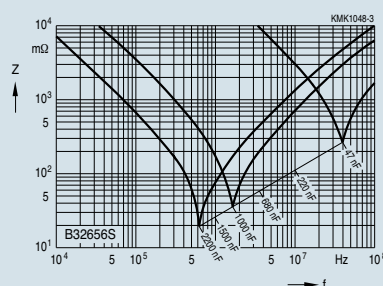
Pulse handling capability

"dv/dt" values represent the maximum permissible voltage change per unit of time for non-sinusoidal voltages, expressed in V/ μ s.

" k_0 " represents the maximum permissible pulse characteristic of the waveform applied to the capacitor, expressed in V²/ μ s.

Note: The maximum values of dv/dt and k_0 must not be exceeded in order to avoid damaging the capacitor.

Impedance versus frequency curve (typical values)



Cautions and Warnings

- Do not exceed the upper category temperature (UCT).
- Do not apply any mechanical stress to the capacitor terminals.
- Avoid any compressive, tensile or flexural stress.
- Do not move the capacitor after it has been soldered to the PC board.
- Do not pick up the PC board by the soldered capacitor.

- Do not place the capacitor on a PC board whose hole space differs from the specified lead space.
- Do not exceed the specified time or temperature limits during soldering.
- Avoid external energy inputs, such as fire or electricity.
- Avoid overload of the capacitors.

Resistance to soldering heat

Resistance to soldering heat is tested to IEC 60068-2-20, test Tb, method 1A. Conditions:

| Series | Solder bath temp. | Soldering time |
|---|-------------------|----------------|
| MKT boxed (except 2.5 x 6.5 x 7.2 mm); coated; MKP/MFP | 260 ±5 °C | 10 ±1 s |
| MKT boxed (case 2.5 x 6.5 x 7.2 mm) | 260 ±5 °C | 5 ±1 s |

General notes on soldering

Permissible heat-exposure loads on film capacitors are primarily characterized by the upper category temperature T_{max} . Long exposure to temperatures above this type-related temperature limit can lead to changes in the plastic dielectric and thus irreversibly change a capacitor's electrical characteristics. For short exposure times (as in practical soldering processes), the heat load (and thus the possible effects on the capacitor) will also depend on other factors such as:

- The pre-heating temperature and time.
- The forced cooling immediately after soldering.
- The terminal characteristics: diameter, length, thermal resistance, special configurations (e.g. crimping).
- The height of the capacitor above the solder bath.
- Shadowing by neighboring components.
- Additional heating due to heat dissipation by neighboring components.
- Use of solder-resistant coatings.

The overheating associated with some of these factors can usually be reduced by suitable countermeasures. For example, if a pre-heating step cannot be avoided, an additional or reinforced cooling process may have to be included.

Cleaning

To determine whether a particular solvent, often used to remove flux residues and other substances, is suitable for the capacitors described, please refer to data book 2005 "Film Capacitors", in which this information is available. Even when suitable solvents are used, a reversible change of the electrical characteristics may occur in uncoated capacitors immediately after they have been washed. Thus it is always recommended to dry the components (e.g. 4 h at 70 °C) before they are subjected to subsequent electrical testing.

Embedding of capacitors in finished assemblies

In many applications, finished circuit assemblies are embedded in plastic resins. In this case, both chemical and thermal influences of the embedding ("potting") and

curing processes must be taken into account. Our experience has shown that the following potting materials can be recommended considering maximum curing temperature 100 °C:

- Non-flexible epoxy resins with acid-anhydride hardeners
- Chemically inert, non-conducting fillers

Caution: Consult us first if you also wish to embed other uncoated component types!

Storage conditions

All capacitors listed in this product profile can be stored for short periods at any temperature within the entire range of category temperatures. For long storage periods, however, the following conditions should be observed:

- Storage temperature -40 to +40 °C
- Maximum relative humidity 80%, no dew allowed on the capacitor
- Maximum duration 24 months (12 months for taped components)

Resistance to vibration

A capacitor's ability to withstand vibration (e.g. such as that occurring in applications involving rotating machinery) is tested to IEC 60068-2-6. The test procedure used here involves continuous sinusoidal vibration along three orthogonal axes, with a continuously varying frequency (10 ... 500 Hz), an acceleration amplitude of 10 g, a displacement amplitude of 0.75 mm and a duration of 360 minutes for each axis. EPCOS offers film capacitors specially designed for operation under more severe vibration regimes such as those found in automotive applications. Consult our catalog "Film Capacitors for Automotive Electronics".

Passive flammability

The passive flammability test is applied to ensure that components bearing the corresponding qualification contribute less energy to the combustion behavior of their immediate vicinity than is required to ignite them. This measure is designed to contain any localized fire that may occur. In the respective tests, the capacitors are subjected to a standardized flame to evaluate their combustion behavior by checking whether the flame persists for longer than a maximum permissible period or not. The severity of the test is determined essentially by the test flame and exposure time in accordance with various international standards (IEC 60040 CO 752 (amendment to IEC 60384-1), IEC 60695-2-2 and UL 1414). Unless the detail specifications stipulate otherwise, EMI suppression capacitors are tested to IEC 60384-14, section 4.17, test severity categories B and C.

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