Product Data Sheet for Approval

Preliminary

Date of Issue: Sep.28th.2023
Edition: 05

To: **SANDEN**

Product Description: **Metallized Polypropylene Film MKP DC Link Capacitors**

Customer Part Number:

Product Part Number: C320B112306J0840

Applications: DC Link applications /Bypass/Decoupling/Smoothing, etc.

Approval Date:

Approved by:

(Signature)

Title:

Department:

We kindly ask for returning this cover sheet with your confirmation and approval of this specification

NINGBO BICAI INDUSTRY CO.LTD.
Jia Village, Yunlong Town, Yinzhou District, Ningbo City, China – P.C. – 315135
Ph.: +86 574 28836048 -
FAX: +86 574 88345777
E-mail: bicai@bicai.com.cn
www.bicai.com.cn

Issued by: Bicai FC BU R&D
DC Division

Developed by (Signature):
Name (Print): Xie Zu
Title: Product Development Eng.

Checked by (Signature):
Name (Print): Sunny Chen
Title: R&D Manager

Approved by (Signature):
Name (Print): Lazaro Rodrigues
Title: CTO

Metallized Polypropylene Film
MKP DC Link Capacitors
Part Number: C320B112306J0840

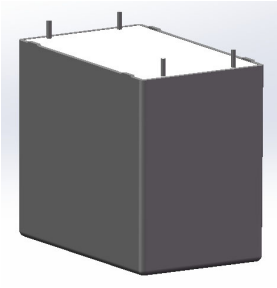
AUTOMOTIVE Series

DATA SHEET

Series C320B

Applications: DC Link applications / Bypass / Decoupling / Smoothing.

Reference Standards: IEC /EN 61071 (2007), IEC 60384-16, IEC 60068-2, UL 94 and AEC-Q200D (Automotive types)



Picture only for reference

Construction

- Dielectric: Polypropylene (High Temperature)
- Electrode: Metallized film (self-healing properties)
- Winding: Wound technology (Non-inductive type)
- Case: Plastic, UL 94 V0 compliant
- Filling Material: Epoxy resin, UL94 V0 compliant
- Terminals: Tinned copper lead wires (lead-free)
- Packaging: EPE with protection for the terminals
- RoHS: Compatible with directive 2011/65/EU and (EU)2015/863

Technical specification		
• Capacitance	C_R	30 µF
• Tolerance	*%*	J =±5%
• Rated Voltage	V_R *(Vdc)*	1100Vdc @85℃
• Continuous operating voltage	*Vop*	850Vdc @110℃
• Insulation Resistance R_{ins} at 500V and RH ≤ 65%.	$R_{ins.}$	≥333 MΩ
• Max. ripple current	*Irms*	23 A @ 70 °C at 10kHz
• Max. peak current	*Ip*	1200A
• Dissipation Factor	*Tanδ*	1.8 x 10^{-3} at 1kHz
• ESR	*mΩ*	< 5.2
• ESL	*nH*	< 16
• Reliability:		
- Failure rate (FIT)(1)	*λ*	10 FIT at 0.5.V_R @ 40 ° C
- Service life	t_{sl}	100.000h at V_R @ 70 °C
- Failure criteria		Short circuit or open circuit or electrode (metallized film) wear out for loss of capacitance > 10%.

(1) *– F.I.T – Failures in Time per billion component hours (1 . 10^{-9}/h).*

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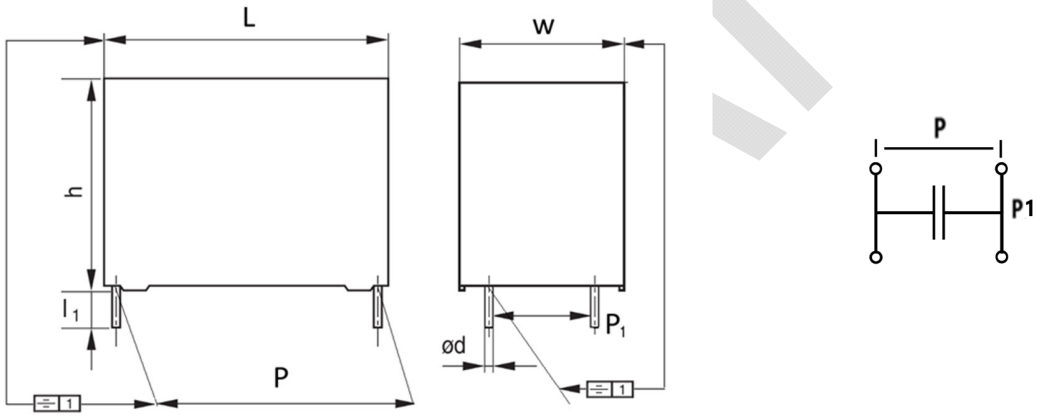
Thermal characteristics		
• Climatic category as per IEC 60068-1		40/110/56
• Operating temperature range		
- Max. operating temperature	$T_{op(max)}$	+110 °C
- Upper category temperature	$T_{max.}$	+110 °C
- Lower category temperature	$T_{min.}$	- 40 °C
• Storage conditions		
- Temperature	**T (°C)**	-40 to +80 °C
- Maximum relative humidity	**RH (%)**	Avr. ≤70% (≤85% for max. 30 days during the Year). Without dew.
- Storage time		Max. 36 months from the date market on package label.
Pulse handling capability		
• Pulse handling capability	***dV/dt***	40V/μs

Capacitor Drawing and Dimensions



Lead Spacing (P)	52.5±0.4 mm
Lead Spacing (P1)	20.3±0.4 mm
Width (W)	35±1 mm
Height (H)	50+1 mm
Length (L)	57.5±1 mm
Lead wire diameter (ϕd)	1.2±0.05 mm
Lead wire length (L_1)	3.75-4.25 mm

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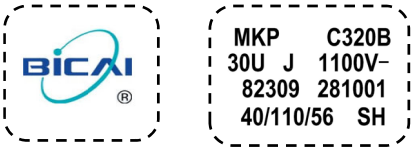
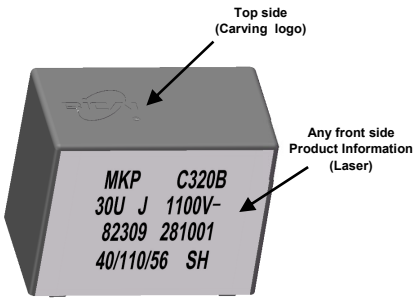
Capacitor Marking





BICAI	Manufacture's logo	1100V -	Rated Voltage V_R (Vdc)
MKP	Dielectric (Polypropylene)	8 23 09	Production Line Year of manufacture Month of manufacture
C320B	Capacitor Series	28 1 001	Production date Production shiftWork Batch number
30U	Capacitance =30µF	40/110/56	Climatic category as per (IEC 60068-1)
J	Capacitance tolerance = ±5%	SH	Self-healing

Explanation of Part Numbers – C320BXXXYYYJYPNN

C320 – Capacitor Series – MKP DC Link Capacitors (4 Pin)

B - Edition

XXX = 112 = Rated Voltage = 1100 Vdc

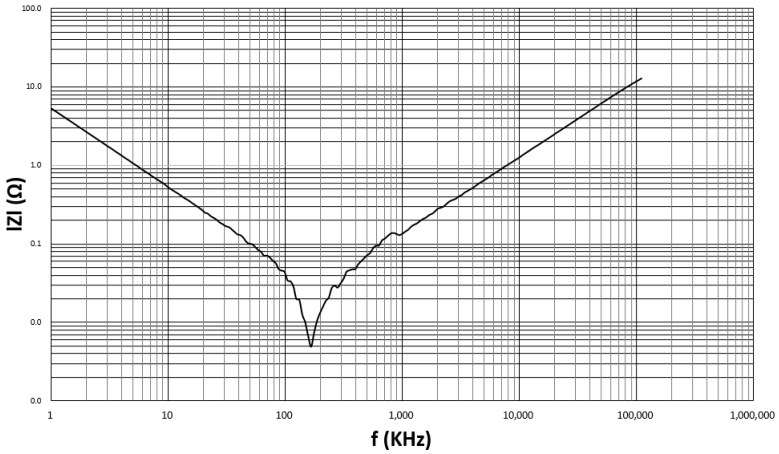
YYYKY =306J0 = Capacitance =30uF

J = Capacitance tolerance = ±5%

P = Lead Space (P) = 8 = 52.5 mm, P1=20.3mm

NN = Packaging code and lead wire length = 4 = Lead wire 4.0 mm, 0 = bulk packing (lead wire diameter 1.2mm)

Impedance vs frequency (typical value)



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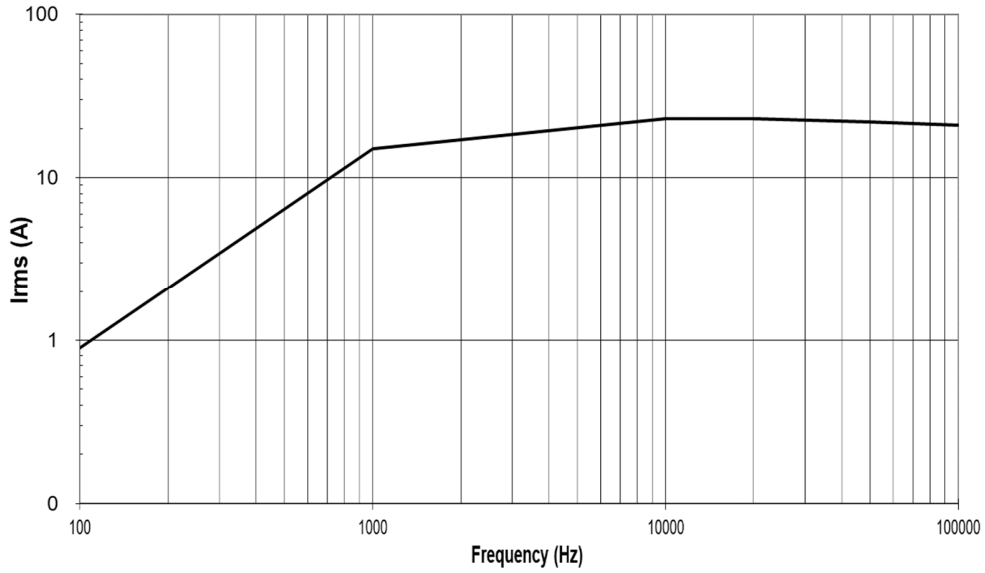
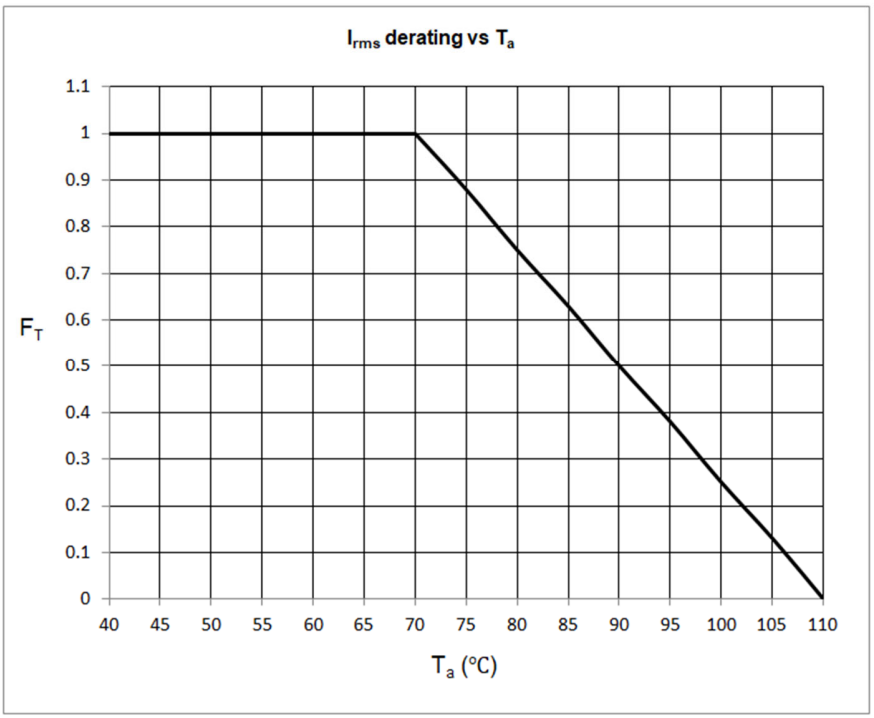
Permissible maximum current (IRMS) versus frequency



Derating factor F_T of I_{rms} current vs Ambient temperature T_a.



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Reliability type tests

Test	Standard	Test Conditions	Performance Requirements
Electrical parameters	Data Sheet	Test voltage between terminals: 1.5 V_R, 10 s.	Within specified limits
High Temperature Exposure (Storage)	MIL-STD 202 Method 108	1000h at 105º C, unpowered	ΔC/C ≤ ±10% ΔTanδ ≤ 0.015 at 1kHz R_{ins} ≥50% of initial limit
Temperature Cycling	JESD22 Method JA-104	1000 cycles -40º C + 105º C, 30 min. maximum dwell time at each temperature extreme, 1 min. maximum transition time.	ΔC/C ≤±10% ΔTanδ ≤ 0.015 at 1kHz R_{ins} ≥50% of initial limit
Moisture Resistance	MIL-STD-202 Method 106	10 cycles /24 h (unpowered)	ΔC/C ≤±5% ΔTanδ ≤ 0.015 at 1 kHz R_{ins} ≥50% of initial limit
Biased Humidity	MIL-STD 202 Method 103	40 ºC; 93% RH, U_{NDC} =1100V, 1000h	ΔC/C ≤±10% ΔTanδ ≤ 0.015 at 1 kHz R_{ins} ≥50% of initial limit
Operation Life	MIL-STD-202 – Method 108	105ºC /1100Vdc/1000h	ΔC/C ≤±10% ΔTanδ ≤ 0.015 at 1kHz R_{ins} ≥50% of initial limit
External Visual	MIL-STD 883 Method 2009	Inspect device construction, marking and workmanship	No visible damage and legible marking
Physical Dimension	JESD22 Method JB100	As per Data Sheet	As per Data Sheet tolerance
Terminal Strength (Lead Wires)	AEC-Q200D (MIL-STD-202 Method 211)	Pull Test: 44.1N (10s) Lead Wire Bend Test: 227g (3x3s)	No visual damage
Resistant to Solvents	MIL-STD 202 Method 215	Also aqueous chemical – OKEN clean or equivalent Do not use banned solvents.	No visual damage
Mechanical Shock	MIL-STD 202 Method 213	100g's for 6 ms Half-sine: 3.75 m/s	No visual damage
Vibration	MIL-STD 202 Method 204	5 g's for 20 minutes, 12 cycles each of 3 orientations. Use 8"X5" PCB, 031" thick. 7 secure points on one 8" side and secure points at corners of opposite sides. Parts mounted within 2" from any secure point. Test from 10-2000Hz.	No visual damage

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Resistance to soldering heat	MIL-STD 202 Method 210	280 ºC for 10s Solder within 1.5mm of device body	ΔC/C ≤±5% ΔTanδ ≤ 0.015 at 1kHz R_{ins} ≥50% of initial limit
Solderability of leads (1)	J-STD-002	Leaded: Method A @ 235 ºC, category 3 (245 ºC/3s)	Visual inspection: Wetting of wire surface by new solder ≥ 95% free-flowing solder
Electrical Characterization	Data Sheet	Parametrically test per lot and sample size requirements, summary to show Min., Max., Mean and Standard deviation at room as well as Min. and Max. operating temperature	As per Data Sheet torelarance
Flammability	UL-94	UL 94 V0 Test	As per UL 94 V0 requirement

(1) Before of solderability test, terminals are subjected to accelerated ageing as per IEC 60068-2-2, test Ba: 4h exposure to dry heat at 155 °C. Since the ageing temperature is higher than the upper category temperature of the capacitors, the terminal wires should be cut off from the capacitor before the ageing procedure to prevent the solderability being impaired by the products of any capacitor decomposition that might occur.

Mounting guidelines

Normal Use

The capacitors are designed for mounting on printed-circuit boards (PCB).

Soldering Process

Polypropylene capacitors are sensitive to heat, the wave of soldering process can be destructive, specially for small capacitors and great care has to be taken during soldering.

Reflow soldering is not recommended for PP film capacitors with lead wires.

For short exposures the heat load will also depend on other factors like:

- Pre-heating temperature and time
- Forced cooling immediately after soldering'
- Terminal characteristics: diameter, length, thermal resistance, etc.
- Height of capacitor above solder bath
- Shadowing by neighboring components
- Additional heating due to heat dissipation by neighboring components
- Use of solder-resist coatings

Wave soldering recommendations

As a reference the recommended wave soldering profile for our capacitors is as following:

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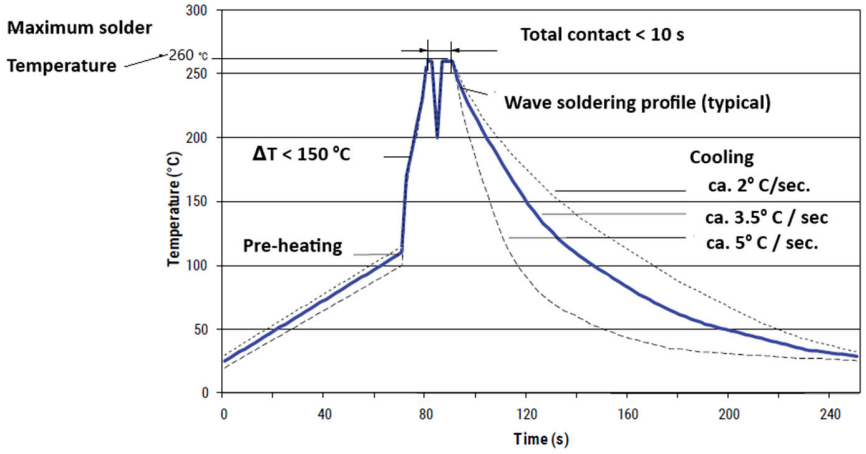

The body temperature of capacitor should follow the specification below:

- During the pre-heating ≤ 110 °C
- During soldering ≤ 120 °C

Manual soldering recommendations

The soldering iron tip temperature should be set at < 360 °C with the soldering duration not to exceed more than 3 seconds.

- Do not move the capacitor immediately after it has been soldered to the PCB
- Do not pick up the PCB by the soldered capacitor
- Do not place the capacitor on a PCB whose PTH hole spacing differs from the specified lead spacing
- Do not exceed the specified time and temperature limits during soldering

Washing the mounted PCB

The MKP DC link capacitors are encapsulated with plastic case and epoxy resin, both materials resistant to cleaning agents and hardily affected by detergents or alcohol derivative washing solvent, but it is recommended to be washed for short duration.

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Dimensions

All dimensions in this Data Sheet are giving in **mm.**

The illustrations are for reference only

Symbols and Terms:

Symbol	English
C_R	Rated capacitance
V_R	Rated Voltage
V_{DC}	DC Voltage
W_R	0,5 **x** C_R **x** V_R^2 Rated stored energy
I_{max}	Maximum capacitor current for continuous operation
I_{DC}	Maximum DC input current for continuous operation
ESL	Equivalent Self-Inductance of Stray inductance, measured using the resonant method1 / $(4*\pi^2 *f_{res}^2 *C_R(120Hz))$
ESR	Equivalent series resistance, measured at 10kHz
tan	Maximum dissipation factor of the capacitor measured at specified frequency
V_{max}	V_R + peak voltage transient = Maximum voltage
V_s	Non recurrent surge voltage
I_P	Max. current transient amplitude during continuous operation
I_s	Admissible peak current transient for a limited number of time (typical value: 1000 times during operation time)
$(dV/dt)_{max}$	I_P / C_R = Rate of voltage rise
$(dV/dt)_s$	I_s / C_R = Rate of voltage rise
V_{TT}	Test voltage for capacitor, applied between terminal and terminal
V_{TC}	Test voltage for capacitor, applied between terminal and case
R_{ins}	Insulation resistance of the capacitor (terminal - terminal), measured at 100V
T_{min}	Lowest permitted ambient working temperature
T_{max}	Highest permitted ambient working temperature
T_a	Ambient temperature where the capacitor is installed
T_{OP}	Operating temperature T_a
T_{HS}	Capacitor hot spot temperature
T_{ST}	Storage Temperature
F_T	Derating factor
t_{LD}	Load duration for mix of inverter and charging operation
λ	Failure rate (FIT)
Z	Impedance
f	Frequency

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⚠ Caution and safety notice

Safety protection

The dielectric film of capacitor is not a flame-retardant material and the metallized film of this series is without internal safety protection. Despite the capacitor element (winding) has self-healing properties and it was assembled inside plastic case and epoxy resin both flame-retardant materials and comply with UL94V-0, we recommend taking protected means by protecting the periphery with cover and flame-retardant materials.
For application that need special protection, please inquire us for capacitor series with internal safety protection (segmented film).

Capacitor hum noise

Hum noise produced by capacitor is results of mechanical vibration of capacitor electrodes (metallized film) by coulomb forces with opposite polarity, making it contract and expand during with electrical cycle and it could be higher under high frequencies. The hum noise does not affect the capacitor electrical performance.

Environments of application:

Ensure that during the application the specification defined in this data sheet will not exceed.

Do not use the product beyond the rated voltage, current and temperature as this may create excessive heat and short the life of capacitor.

Pay attention when mounting the capacitor to avoid assembly it closer with other products that radiate heat.

When other parts in the circuit have failure, ensure that the capacitor was over-loaded with high voltage, current and temperature.

Do not use the capacitor with application with switching operation that exceed the maximum dv/dt specified. The inrush current could damage the capacitor connections and short the capacitor life time. For application that need high inrush current, please inquire us.

Do not use the capacitor with water, salt water and oil spilt direct on or condenses dews on.

When used for a long period in humid environments the moisture could penetrate between lead wires and epoxy resin and reach the capacitor winding. The capacitor winding will absorb the moisture. It will cause oxidation on metallization layer and lead the capacitor to fail.

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Do not use under condition with harmful gas, like: hydrogen sulfide, sulfurous acid, nitrous acid, chlorine, ammonia, etc.

Product should not be applied directly to ozone, ultraviolet rays and radiation more than usually.

Do not exceed the vibration that could damage the capacitor terminals.

Do not apply any mechanical stress to the capacitor terminals, like: compressive, tensile or flexural stress. It may cause cracking or detaching the epoxy resin over the terminals and it will allow the moisture penetration inside the capacitor.

Others cautions

In case of connecting more than one capacitor in series, keep the capacitances under balance to avoid overload the capacitor with voltage higher than the specification.

For several capacitors connected in parallel, the proof voltage and rated voltage may need to be reduced.

Do not reuse the capacitor that have been used in another equipment.
In case needed to embedding the capacitor with other potting material, ensure that both chemical and thermal properties of capacitor will not be affected.

Application for hybrid vehicles in general higher temperature capacitors than full electric vehicles. For DC link capacitors for higher temperature applications contact: bicai@bicai.com.cn.

We recommend that the user contact us in advance if the product will be used on listed below applications or need special requirements that exceed the technical specification defined in this Data Sheet:

1) Aerospace /Aviation equipment
2) Medical equipment
3) Atomic energy-related equipment.
4) Military equipment.
5) Other similar application that are not considered general-purpose applications.

All materials used in this product comply RoHS directive 2011/65/EU and (EU)2015/863. However, in certain jurisdictions may classify some substances as hazardous. Therefore, we recommend to check our Material Data Sheet on the Internet (www.bicai.com.cn)contact our Sales-offices bicai@bicai.com.cn.

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