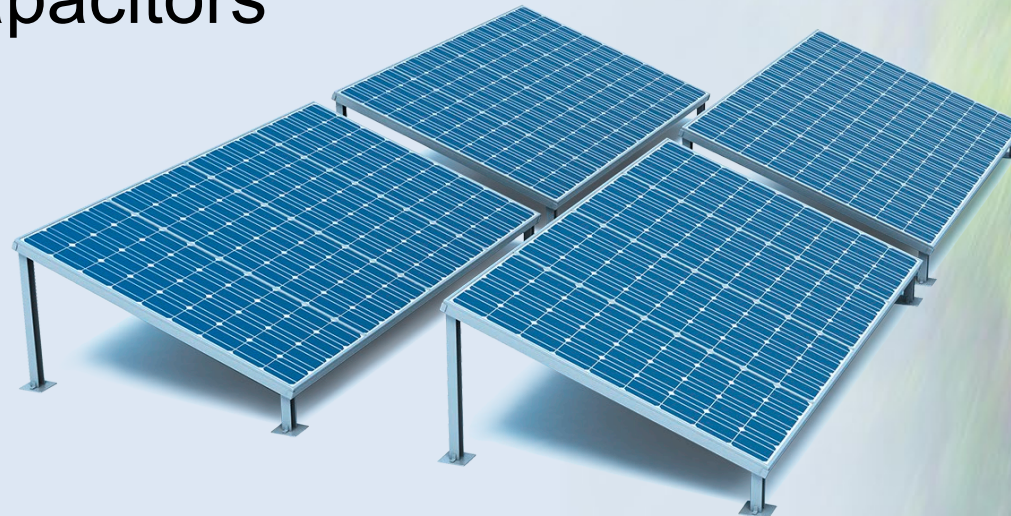


Attracting Tomorrow



PEC LP MKP Capacitors

Aluminum & Film Capacitors
Business Group



TDK Electronics AG
Munich, Germany
July 2022



Aluminum & Film Capacitors Business Group at a glance

Key data

Headquarters	Munich, Germany
Number of plants	8
Employees total	6300
Management	Karl Stoll CEO Bernhard Koch Deputy General Manager Auxi Fernandez CFO

Portfolio

Aluminum electrolytic capacitors

- Screw terminals
- Snap-in / Solder pins / Large size
- Axial-lead / Soldering star
- Single-ended
- Hybrid polymer aluminum electrolytic capacitors
 - SMD
 - Axial-lead / Soldering star

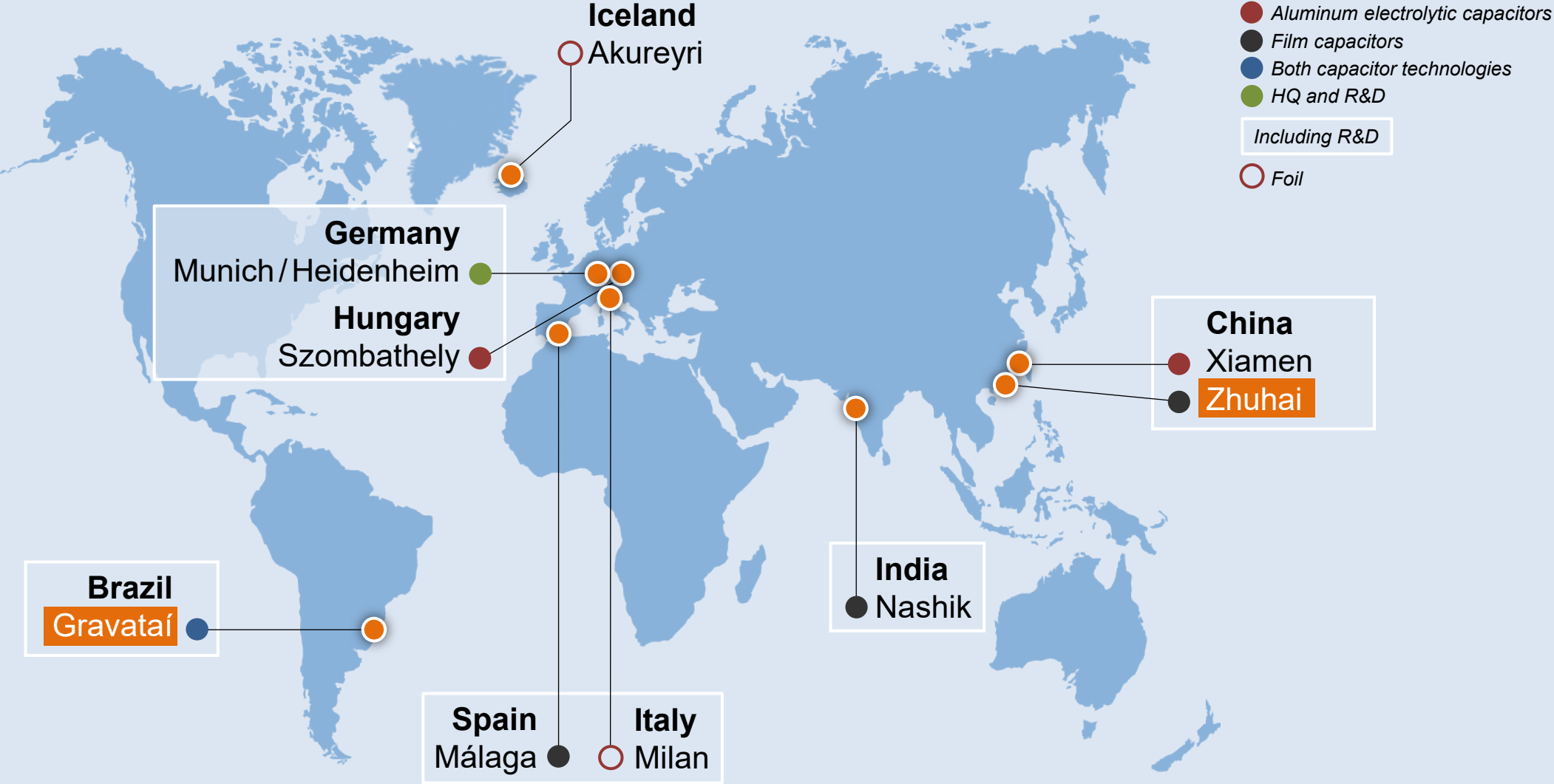
Film capacitors for Industrial and for Automotive

- DC capacitors
- AC capacitors
- Power capacitor chips for low power (PCC LP)
- Power electronic capacitors (MKP)

Film capacitors for Energy Solutions

- Power electronic capacitors for high power (PEC HP)
- Power electronic capacitors for low power (PEC LP MKP)
- Power factor correction (PFC) capacitors and key components for low and medium voltage (LV, MV)
- Power quality solutions (PQS)

Our Aluminum & Film Capacitors Business Group has a global manufacturing presence



Plant in Zhuhai, China

Product range

Aluminum & Film Capacitors BG

Film capacitors

- DC capacitors
- Power capacitor chips for low power (PCC LP)
- Power electronic capacitors for high power (PEC HP MKP)
- Power electronic capacitors for low power (PEC LP MKP)
- Power factor correction (PFC) capacitors and key components for low voltage (LV)
- Power quality solutions (PQS)

Piezo & Protection Devices BG

- Disk, Energy, Strap and Block varistors
- SMD disc varistors (CU)
- Inrush current limiters (ICLs)
- PTC thermistors



70,100 m²

Founded in 1998

Certification

- ISO 3834
- ISO 9001
- ISO 14001
- IRIS (ISO/TS 22163)
- IATF 16949

Plant in Gravataí, Brazil

Product range

Aluminum & Film Capacitors BG

- Aluminum electrolytic capacitors
 - Axial-lead/Soldering star
 - Single-ended
 - Screw terminals
 - Snap-in/Solder pins
- Hybrid polymer aluminum electrolytic capacitors
 - SMD

Film capacitors

- DC capacitors
- AC capacitors
- Power factor correction (PFC) capacitors and key components for low voltage (LV)
- Power electronic capacitors for defibrillators (MKP)



43,000 m²
Founded in 1954

Certification

- ISO 9001
- ISO 14001
- IATF 16949

PEC MKP capacitors portfolio

MKP AC



Input / Output filter

MKP DC



DC link

Defibrillator



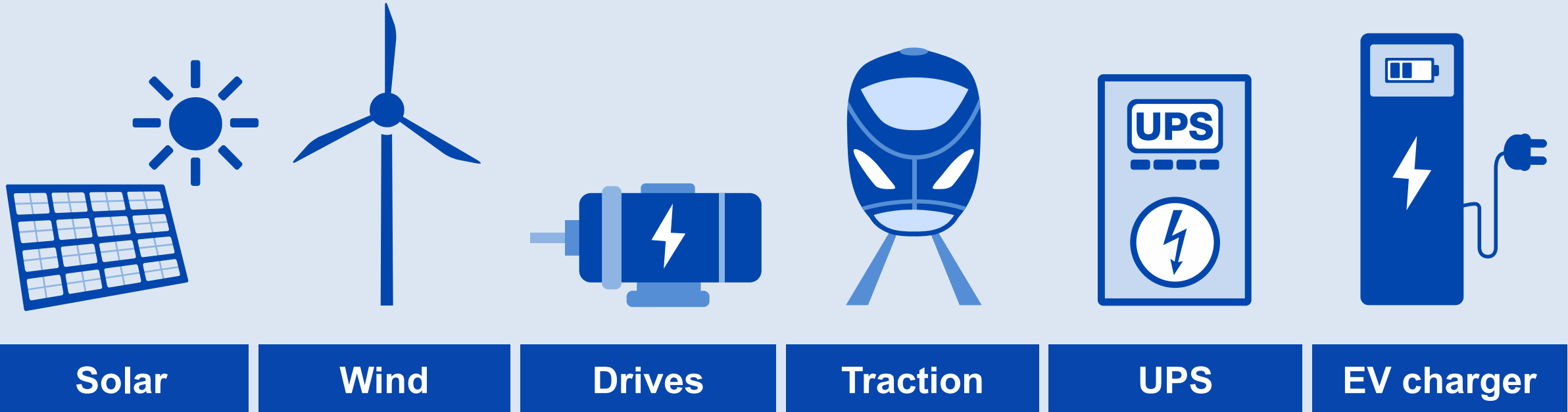
Defibrillator

HVDC-C



Power transmission

Power capacitors for wide area of applications



AC filter capacitors for industrial applications



Series
B32361*
B32362*

Features

- Capacitance range 20 μF to 600 μF , 250 V_{RMS} to 480 V_{RMS}
- IEC 61071, GB/T17702 and UL 810 compliant
- Temperature up to 85 °C hotspot
- Single-phase (1 Ph) capacitors

Applications

- Capacitor for AC input/output filtering for industrial applications, converters, UPS, drives and wind/solar inverters

Benefits

- Self-healing properties
- Safety mechanism, tear-off fuse overpressure disconnecter

Defibrillator capacitor for medical application



Series
B32365*

Features

- Capacitance range 30 μ F to 200 μ F, Voltage up to 5 kV
- Cylindrical and oval design (Plastic or metal case)
- Terminals cable design upon request (Straight/Flag fast-on & Stripped)
- Temperature up to 60 °C hotspot

Applications

- AED (Automated External Defibrillator) and manual defibrillator

Benefits

- Self-healing properties
- Low leakage current. High charge and discharge pulse capability
- Life expectancy up to 10,000 cycles

DC-link filter capacitors for industrial applications



Features

- Capacitance range 40 μF to 4000 μF , 500 V DC to 3000 V DC
- Low ESR $<1 \text{ m}\Omega$ & low ESL $<12 \text{ nH}$ (B2563*E series, ultra low ESL design)
- Temperature up to 85 °C hotspot
- IEC 61071, RoHS compliant and UL 810 compliant

Applications

- DC link for renewable energy inverters, industrial drives, e-mobility, medical and traction

Benefits

- Hermetically sealed (B2568* series)
- Self-healing properties
- 85 °C/85% RH V_N 1000 h (B2568*/B2569* series)
- Life expectancy up to 100,000 hours at hot spot temperature +75 °C

Series
 B2568* **New**
 B2569* **New**
 B2562*
 B2563xB*
 B2563xE* **New**

MKP DC filter capacitors product range

	Rated DC V _R DC [V]	C _R [μF] tol. +/- 10%	Diameter [mm]	Height H _c [mm]	Features
Standard	700	40	85	70	B2562* series • DC link for renewable energies, industrial drives and traction
	
	3000	4000	116	345	
Low LSI ULSI HF	500	50	85	50	B2563* series • L _s <13 nH • DC link for e-mobility
	
	2000	400	85	65	
Heavy duty	900	60	85	99	B2568* series • Metal top, hermetically sealed • LS<14nH with 4T
	
	3000	4000	136	368	
High PD	700	45	75	95	B2569* series • Resin top, high humidity resistance and partial discharge
	
	3000	5500	136	370	

B2562* series



B2563* series



New



New

B2568* series



- Hermetically closed for operations in harsh environment
- Fire and smoke classification according to EN 45545
- Ultra low ESL (4 terminals upon request)
- Customized designs (high frequency and segmented film) upon request

B2569* series



- Resin top with improved partial discharge capabilities
- High humidity resistance 1.3 V_N, 85 °C/85%/500 hours
- Improved high Partial Discharge (PD) extinction voltage >1.6 kV AC (10 pC)

Power capacitors in round can for DC applications

MKP DC
standard

MKP DC
HF

MKP DC
Resin top

MKP DC
Metal top

MKP DC
4T

MKP
DC LSI

MKP DC
ULSI

B2562

B2569

B2568

B25689

B2563*B

B2563*E



40 μ F
4000 μ F

Customized

40 μ F
5500 μ F

40 μ F
4000 μ F

80 μ F
3000 μ F

20 μ F
270 μ F

20 μ F
270 μ F

700 V DC
3 kV DC

700 V DC
3 kV DC

700 V
3 kV

900 V DC
3 kV DC

900 V DC
3 kV DC

700 V DC
2000 V DC

700 V DC
2000 V DC

HF version
available

High frequency
till 100 kHz

High humidity
HF version
available

Hermetically
sealed

Special types
Very low ESL < 10 nH
Hermetically sealed

Very low ESL
High frequency design

Recommendations for EV charging

High power density

- Trend to develop high-power density converters using SiC semiconductors
- Capacitors with high current capability, ultra low ESL and lower ESR at high frequencies are requested.



MKP DC ultra low inductance series B2563*E

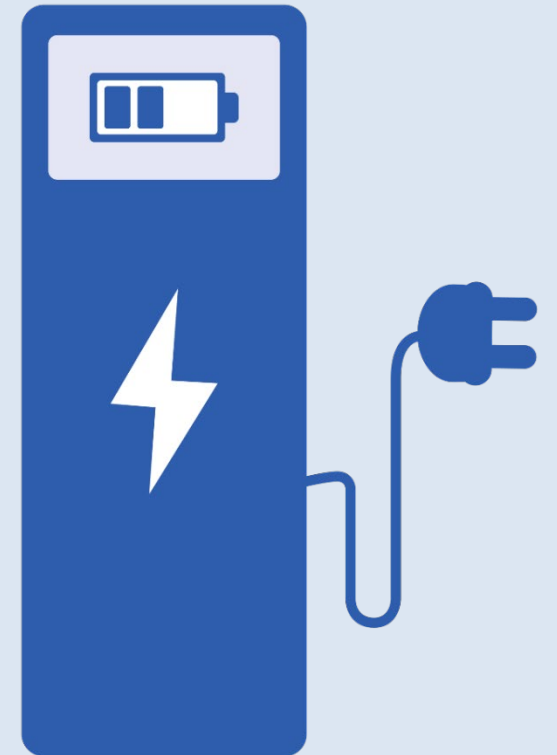
Ultra low ESL < 13 nH

Main applications

- DC fast charging
- Solar string inverters
- Induction heating
- Traction
- High speed switching applications

Product description

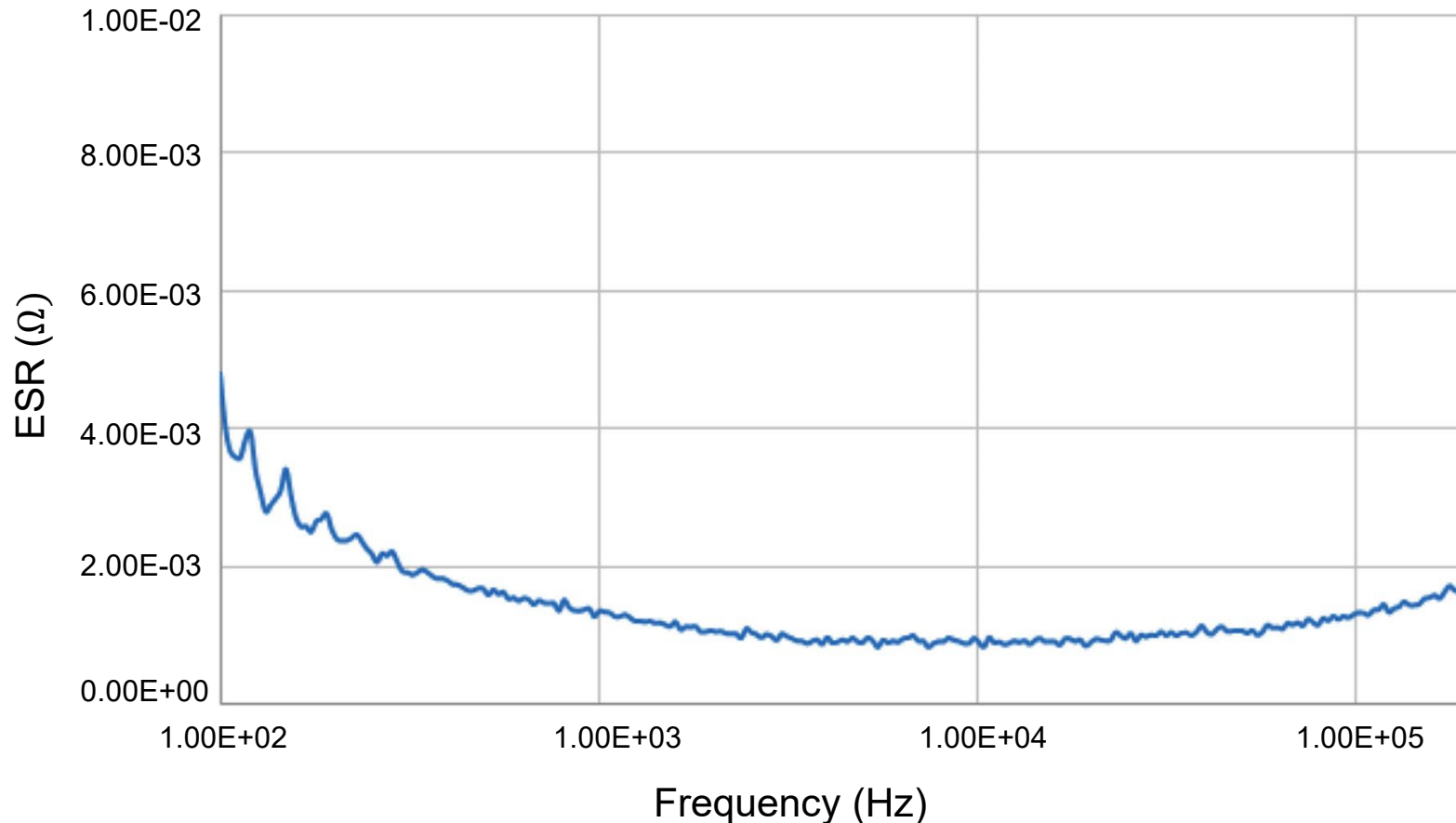
- Capacitance range 20 μ F to 270 μ F; V DC: 700 V to 2 KV
- **ESL < 13 nH**
- **Low ESR** over frequency
- Diameter: 85 mm
- Height: 50 mm and 65 mm
- Male (M8) or female (M5) terminals
- High current capability
- DC link for SiC power modules and Si modules with high speed switching
- For 85 °C HS, (samples available at higher temperatures)



MKP DC ULSI HF

ESR versus frequency

B25632E1117K000 (110 μ F, 1000 V DC)



Typical switching frequency power module

20 kHz to 40 kHz, so it is important to characterize the capacitor to low/stable ESR values until several hundreds kHz and consider all the harmonics for the thermal considerations

110 μ F, 1000 V DC:

- 10 kHz: 1.18 m Ω
- 100 kHz: 1.38 m Ω
- 160 kHz: 1.5 m Ω

Low ESR in the working frequency range

MKP DC metal top B2568*

Hermetically sealed MKP DC series with metal top disk (B2568*)

- **Range:** 900 V to 3 kV, 50 μ F to 4 mF
- Main DC link voltage for traction: 1 kV for 1.7 kV IGBTs and 2 kV for 3.3 kV IGBTs
- **Target applications:**
 - Traction inverters
 - Commercial agricultural vehicles (CAV)
 - Medium-voltage drives (MVD)
- **Humidity:** 85 °C/85% RH 1000 hours
- **Fire & smoke classification acc. to EN 45545:** R22: HL3 R23,; HL2
- **Dimensions:** \varnothing 85, \varnothing 116 and \varnothing 136 mm; height 74 mm to 368 mm
- **Light weight** (aluminum)
- Good cooling (normally stacked 2 windings)
- Ultra low ESL with 4 terminals design (<14 nH, in some cases <10 nH possible)

Standard datasheet available under:

www.tdk-electronics.tdk.com/en/power_capacitors



MKP DC 4T: The hermetically sealed DC capacitor with ultra low ESL

Hermetically sealed MKP DC series with 4 terminals for ESL <14 nH (B25689* series)

- **Range:** 900 V to 3 kV, 50 μ F to 3 mF
- Main DC link voltage for traction: 1 kV for 1.7 kV IGBTs and 2 kV for 3.3 kV IGBTs
- **Target applications:**
 - Traction inverters
 - All high-speed switching applications
- **Humidity:** 85 °C/85% RH 1000 hours
- **Fire & smoke classification acc. to EN 45545:** R22: HL3 R23: HL2
- **Dimensions:** Ø116; Height: 74 mm to 345 mm
- **Light weight** (aluminum)
- Good cooling (normally stacked 2 windings)
- Approx. **60% less ESL** than standard capacitor with 2T
- Typical ESL 12 to 15 nH (special designs with 10 nH possible)
- Lifetime up to 200,000 hours
- Samples available

Standard datasheet available under: www.tdk-electronics.tdk.com/en/power_capacitors

NEW



**For harsh
operating conditions
especially traction
applications**

MKP DC metal top: Modular approach

Typical values requested – diameter = 116 mm:

Hc (mm)	1000 V DC (1.7 kV power modules)	1800 V DC (3.3 kV power modules)	2000 V DC (3.3 kV power modules)	ESL 2 terminals	ESL 4 terminals
75	360 µF	100 µF	80 µF	32	13
100	550 µF	165 µF	130 µF	25	10
179	1100 µF	330 µF	260 µF	34	14
229	1500 µF	450 µF	360 µF	38	15

Typical values requested – diameter = 85 mm:

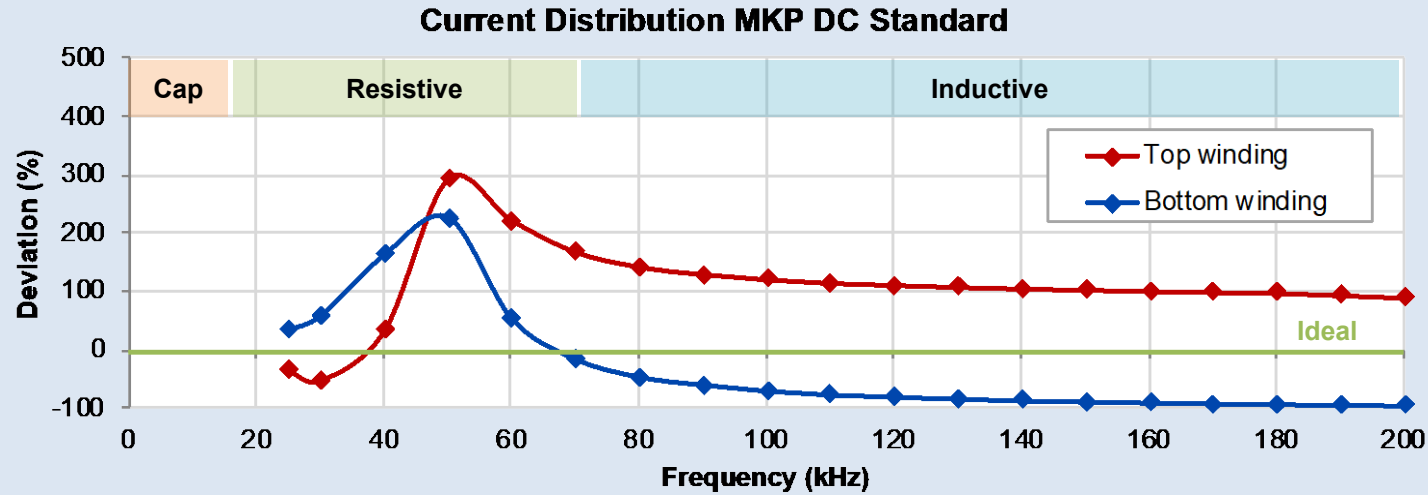
Hc (mm)	1000 V DC (1.7 kV power modules)	1800 V DC (3.3 kV power modules)	2000 V DC (3.3 kV power modules)	ESL (typical nH)
179	550 µF	160 µF	130 µF	22 nH
229	740 µF	220 µF	180 µF	25 nH
252	810 µF	240 µF	195 µF	28 nH



* Special types with even lower ESL upon request

NEW

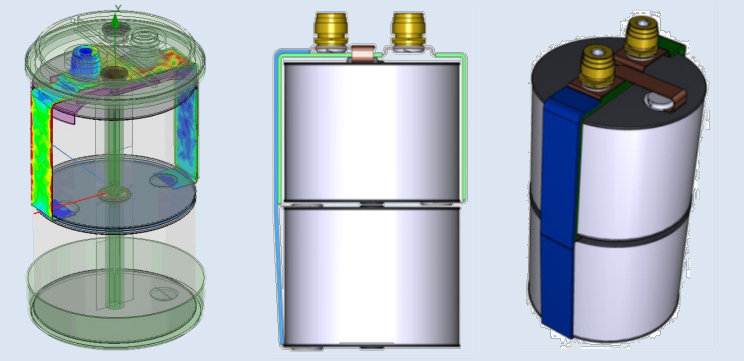
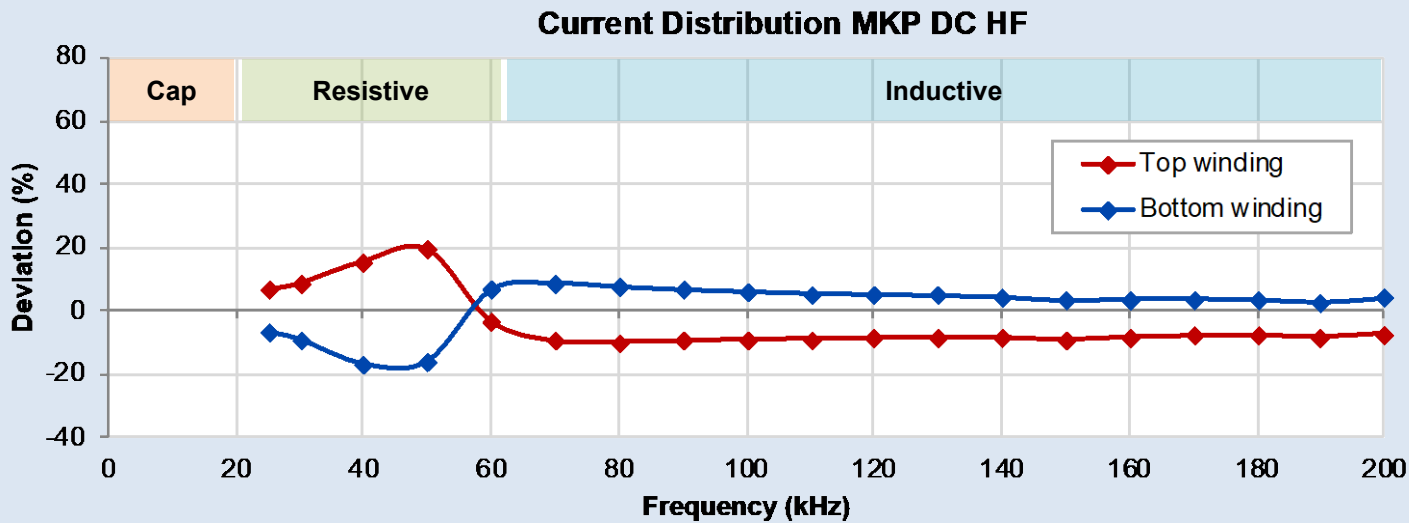
MKP DC high frequency vs MKP DC standard



- Operation above its resonance frequency
- Homogeneous current distribution
- Internal resonance avoidance

Solution: Same impedance vs frequency for all the internal capacitance elements

- Operative capacitor up to 200 kHz
- Reduced inductance



MKP DC high frequency

Recommendations for renewable energies solar & wind

Better efficiency

- **Solar.** Since PV is strongly influenced by cost pressure then new inverters are forced to offer very high efficiency (97% to 98%) with longer maintenance periods.
- Application is demanding cost optimized standard products with higher nominal voltages and reduced ESR/ESL. Capacitors should be optimized to work at higher frequencies.
- **Wind** is as well strongly influenced by cost pressure with a trend to increase the output power specially in off-shore application.
- Both applications are demanding higher current densities.



Semikron Skiiip4 module
with our resin top DC link series



Full SiC String inverter using our
ULSI capacitors family

Recommendations for traction

High power density

- In light train application, the use of light and low volume converters is a must, so standardization of components (modular platforms) together compact designs is highly appreciated.
- Becoming more popular the use of fast switching IGBTs and SiC semiconductors with higher switching frequencies. This requires low ESL capacitors. Two good series are our MKP 4 terminal capacitor with ESL as low as 10 nH.





www.tdk-electronics.tdk.com