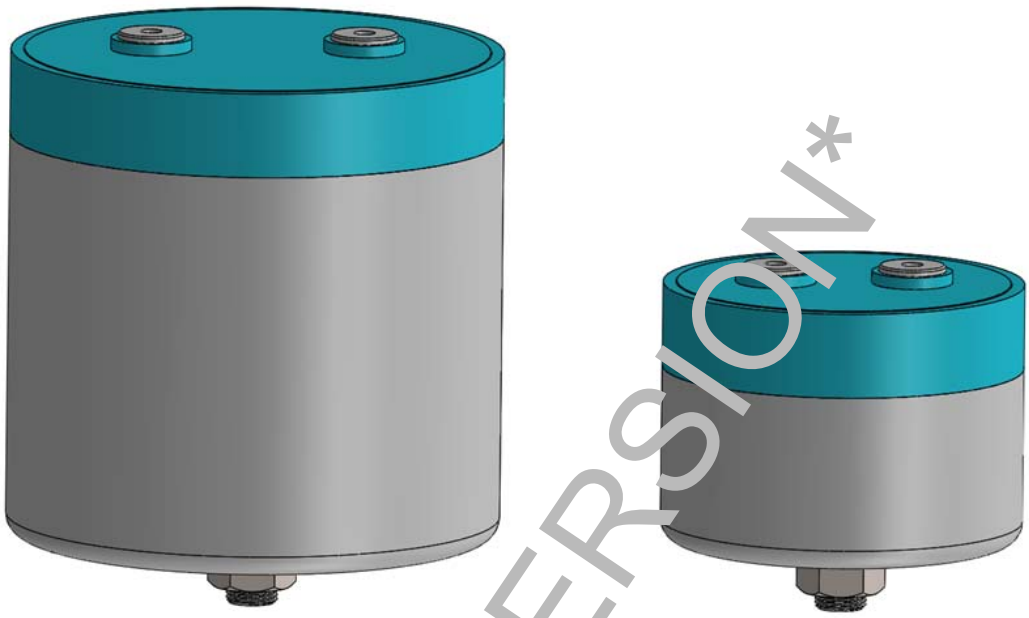
ISO 9001:2015
TÜV SÜD

MKPP-I36

DC link capacitors for power electronics devices



General characteristics

MKPP-I36 capacitors are power electronics capacitors designed for use in DC and AC circuits with values in accordance with technical data. Particularly dedicated for filtering the DC bus of power electronics converters as DC Link capacitors. They meet the requirements of the EN 61071 standard for capacitors for power electronics devices.

The design of the capacitors minimizes the parasitic inductance, and the self-healing metallized film improves the safety and lifetime of the capacitors.

The low inductance and series resistance of the capacitors allows their use in applications in which high current pulses will flow through the capacitors. Capacitors are made in an aluminum casing with a plastic cover, capacitor winding element is hermetically sealed with an insulating resin.

ATTENTION:
The capacitors are not equipped with a discharging device, voltage and energy level stored in capacitors is dangerous for human health and life. Be especially careful during assembly, service and maintenance of devices containing these capacitors.

*) - the dimensions and parameters of the capacitors may change

MIFLEX S.A.
ZAKŁADY PODZESPOŁÓW RADIOWYCH
99-300 KUTNO, ul.GRUNWALDZKA 3
Telephone: +48 24 355 11 00
Fax: +48 24 355 11 88
e-mail: miflexsa@miflex.com.pl

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Basic technical data

Capacitance tolerance	K: ±10%, (J: ±5% to be agreed individually)
Dielectric dissipation factor ($tg\delta_0$)	0,0002
Dielectric dissipation factor ($tg\delta_0$) @ 100Hz	0,0012 for C_R<450uF 0,0015 for 450uF ≤ C_R ≤ 800uF 0,0020 for C_R >800uF
Expected lifetime	100 000h @ θ_{hs} +75°C to U_{NDC}
Minimum operating temperature θ_{min}	-40°C
Maximum operating temperature θ_{max}	+85°C for diameter 85mm +75°C for diameter 116mm
Hottest ambient point θ_{hs}	+85°C for diameter 85mm +75°C for diameter 116mm
IEC climatic category	40/85/56 for diameter 85mm 40/75/56 for diameter 116mm
Humidity class	maximum relative humidity: 75% on average per year, 95% 30 days a year, condensation is not allowed
Maximum operating altitude	2000m above sea level
Freequency range	100 Hz ÷ 10kHz
Pulsation voltage U_r	0,25U_{NDC}

Type and parameters of tests

Electrical strength between terminals U_{TT}	1,5U_{NDC}, 10s
Electrical strength between terminals and casing U_{TC}	4000V_{AC}, 10s
Endurance testing	according to EN 61071

Construction data

Dielectric type	metallized polypropylene with self-healing properties
Filling	without PCB, PUR solid, self-extinguishing resin according to UL 94 V0
Working position	any
Type of work	continuous
Cooling	natural or forced
Protection	no internal protection
Discharging device	none
Terminals type	radial with internal thread M6 or M8 (see table 1)
Tightening torque – terminals (M6)	5 Nm
Tightening torque – fixing the housing (M12)	10 Nm
Overload, maximum allowable voltage	1,10U_{NDC} 30% of working time in one day 1,15U_{NDC} 30 min /d 1,20U_{NDC} 5 min /d 1,30U_{NDC} 1 min /d 1,50U_{NDC} 30ms not more than 1000 times during the life time

Standards, directives, certificates

EN 61071 - Capacitors for power electronics
RoHS
REACH
UL 94

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Storage and use

It is suggested not to store capacitors for more than 5 years. After 1 year of storage, it is recommended to perform initial measurement of capacitance and tgδ factor before switching on the power supply. The polypropylene film capacitors do not require electrical formatting before use (as in the case of electrolytic capacitors).

Storage conditions to be met:
- relative humidity: 75% on average per year
- maximum relative humidity: 95%, 30 days a year
- condensation: not allowed
- minimum storage temperature: -40 °C
- maximum storage temperature: + 85 °C

Capacitors should be stored in closed rooms with no corrosive atmosphere (for example the presence of chlorides and gaseous sulphides, acids, alkaline substances, salts or equivalents are not permittedsubstances). Packed capacitors should be transported carefully, especially while using a forklift.

Maintenance and other operational activities

Prior to each service, maintenance or other operation on the circuit containing DC Link capacitors, turn the device off, wait for a minimum 5 minutes, discharge capacitors or DC Link batteries using the impedance to ensure that the maximum peak current is not exceeded. Then short the terminals of the capacitors or battery DC Link and ground them. Never touch any capacitor terminals, if it has not been discharged previously and is not grounded, never touch both capacitor terminals or DC Link batteries at the same time. For DC Link capacitors, you need periodic inspections. Failure to do so may result in serious adverse effects such as cracking of capacitors and, in extreme cases, their ignition.

Two weeks after the installation the following should be done:
- Measurement of current in capacitors and its comparison with the nominal value. In the case of a difference greater than the specified tolerance, check the capacitors and the application in which they are installed.
- Check the correctness of capacitor connections with the system.

Periodically (at least once a year) the following should be done:
- Visual inspection to check for possible mechanical deformation.
- Cleaning capacitor terminals and terminal strip to avoid short circuit due to dust and other contaminants.
- Check the temperature in the housing in which the capacitors are installed and the efficiency of the cooling systems (if installed), clean the cooling system from dust and other contaminants.
- Measurement of current in capacitors and compare with the nominal value, in the case of a difference greater than that resulting from the tolerance, check the capacitors and the application in which they are installed. In the event of excessive temperature of a given capacitor, it is recommended to replace it. This may be due to the increase in dielectric dissipation factor tgδ, which is an indicator of the end of the capacitor's lifetime.
- Checking the quality of connection of terminals.
- C and tgδ measurement. If the capacity is reduced by more than 3% in relation to the initial value or if tgδ increases more than 3 times in relation to the initial value, the capacitor should be replaced with a new one.

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Terms and definitions

U_{NDC} - Rated DC voltage for which the capacitor has been designed for continuous operation.

U_r - Pulsation voltage, peak-to-peak voltage of the voltage component of the unidirectional voltage.

U_{TT} - Electrical strength between terminals.

U_{TC} - Electrical strength between terminals and casing.

C_N - Rated capacity measured at 20°C ± 5°C at 1kHz frequency and 1V voltage.

I_{max} - Maximum effective value of the current during continuous operation.

$\hat{i}_s$ - Maximum impact current. Peak value of current caused by switching operations or other disturbancesin the work of the system, with a duration shorter than the period of the basic course, the occurrence of which isacceptable in a limited number of times.

$\hat{i}$ - Maximum peak current. Maximum, repeatable peak current value that can occur during continuous operation.

R_s - Series resistance. Resistance of capacitor current paths under specific operating conditions.

L_s - Self-inductance. Sum of inductances of all internal capacitor elements.

R_{th} - Thermal resistance. Indicates how many degrees the temperature of the capacitor rises in the hottest point due to power losses.

f_r - Nominal frequency. The highest frequency at which the capacitor impedance reaches the minimum value.

θ_{amb} - The temperature of the cooling air. The temperature of the cooling air measured in the hottest spot of a capacitor bank, in conditions set at half the distance between two capacitors, in the case of a single capacitor, this is the temperature measured at a point about 0.1 m away from the housing in 2/3 of the height of the capacitor, measured from the base.

θ_{min} - The lowest operating temperature. The lowest temperature of the dielectric, at which voltage applied can be connected to the capacitor terminals.

θ_{max} - Maximum working temperature. The highest temperature of housing at which the capacitor can work.

θ_{hs} - The temperature of the hottest point inside the capacitor. The temperature θ_{hs} can be estimated in accordance with the given formula. During operation, the temperature θ_{hs} cannot be exceeded. At rated load and not exceeding this temperature, the expected lifetime will be consistent with the given value with the statistical failure rate of 300FIT.

$$\theta_{hs}=\theta_{amb} + I^2_{max}\cdot R_{esr}\cdot R_{th}$$

R_{esr} - The equivalent series resistance of the capacitor, which in series with the capacitor of the capacity equivalent to capacitance of the considered capacitor, will cause in it a loss of power equal to the active power released in the capacitor under specific operating conditions.

$tg\delta$ - Dielectric dissipation factor. The ratio of the equivalent series resistance and the capacitance reactance of the capacitor at a specific sinusoidal voltage, frequency and temperature.

$$tg\delta = R_{esr}\omega C = tg\delta_0 + R_s\omega C$$

P_{max} - Maximum power loss. Maximum power loss allowed at maximum temperature of the capacitor housing.

$$P_{max}=\frac{\theta_{hs}-\theta_{amb}}{R_{th}}$$

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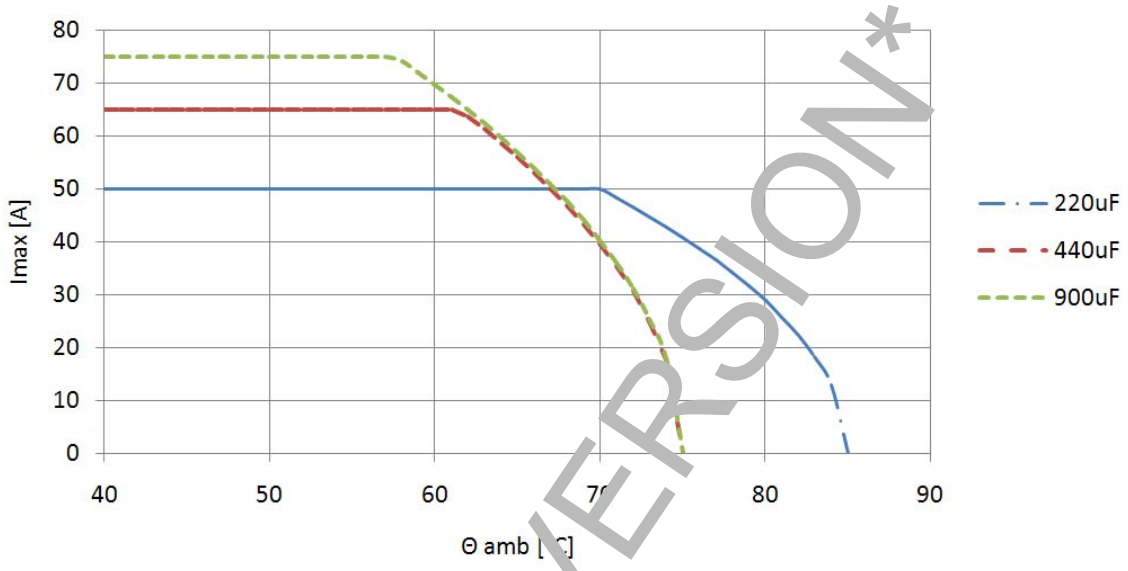
Graphs of dependence of rated current I_{max} from θ_{amb} temperature



Tab.1. - Basic technical data

U_{NDC}=900V / $U_r \leq$135V / U_{TT}=1350V_{DC}, 10s / U_{TC} = 4000V_{AC}, 10s

C_N [µF]	I_{max} [A]	$\hat{I}_s$ [kA] 1)	$\hat{I}$ [kA]	R_s [mΩ]	L_s [nH]	R_{th} [K/W]	D±2 [mm]	L_C ±2 [mm]	L_T ±2 [mm]	K ±1 [mm]	m [kg]	Fig.	Index
220	50	8,1	2,7	1,5	≤ 40	4,0	85	74	78,5	35	0,6	1	I36HD722K-A1
440	65	16,3	5,4	1,1	≤ 40	2,9	116	74	78,5	50	1,0	1	I36HD744K-A1
900	75	16,3	5,4	1,4	≤ 40	2,2	116	128	132,5	50	1,3	1	I36HD790K-A1

1) - no more than 1000 times during the life time

Other capacitances and voltages are possible - according to individual arrangements

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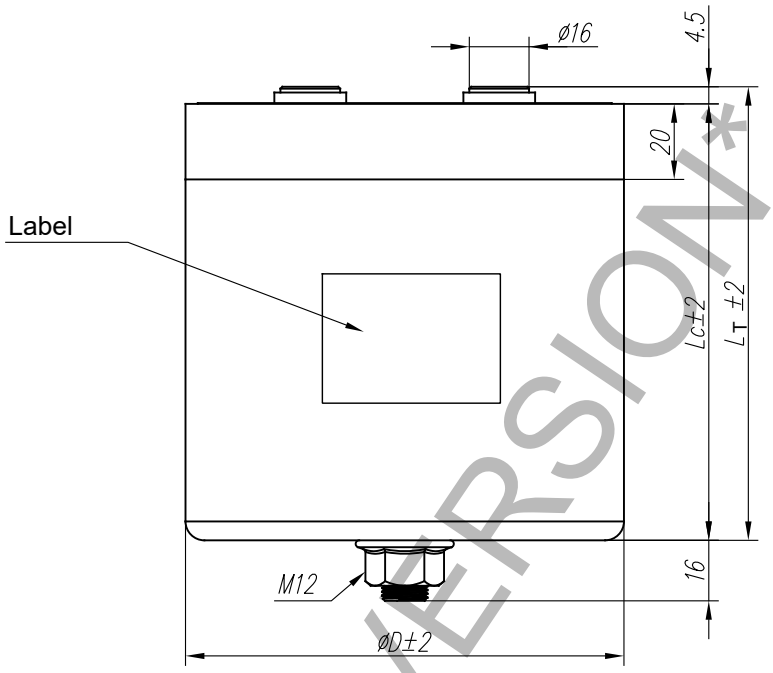
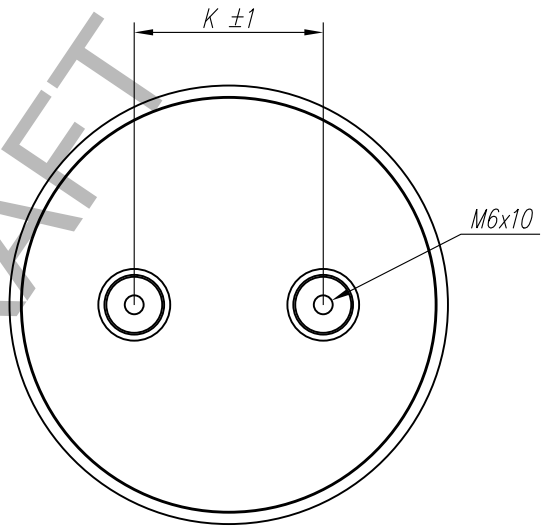
Drawing 1





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Revision date 25.05.2020
Edition 1