Metallized Polypropylene DC-Link Film Capacitor for High Power Automotive Application

FEATURES

- Very low losses
- Very low inductance
- High robustness under humidity robustness
- ZVEI - Specification for automotive DC-link capacitors
- Customization on customer request possible
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS COMPLIANT

HALOGEN FREE

APPLICATIONS

- High performance DC filtering applications
- Capacitor banks in power inverter /converter application for automotive
- HEV / EV traction inverter

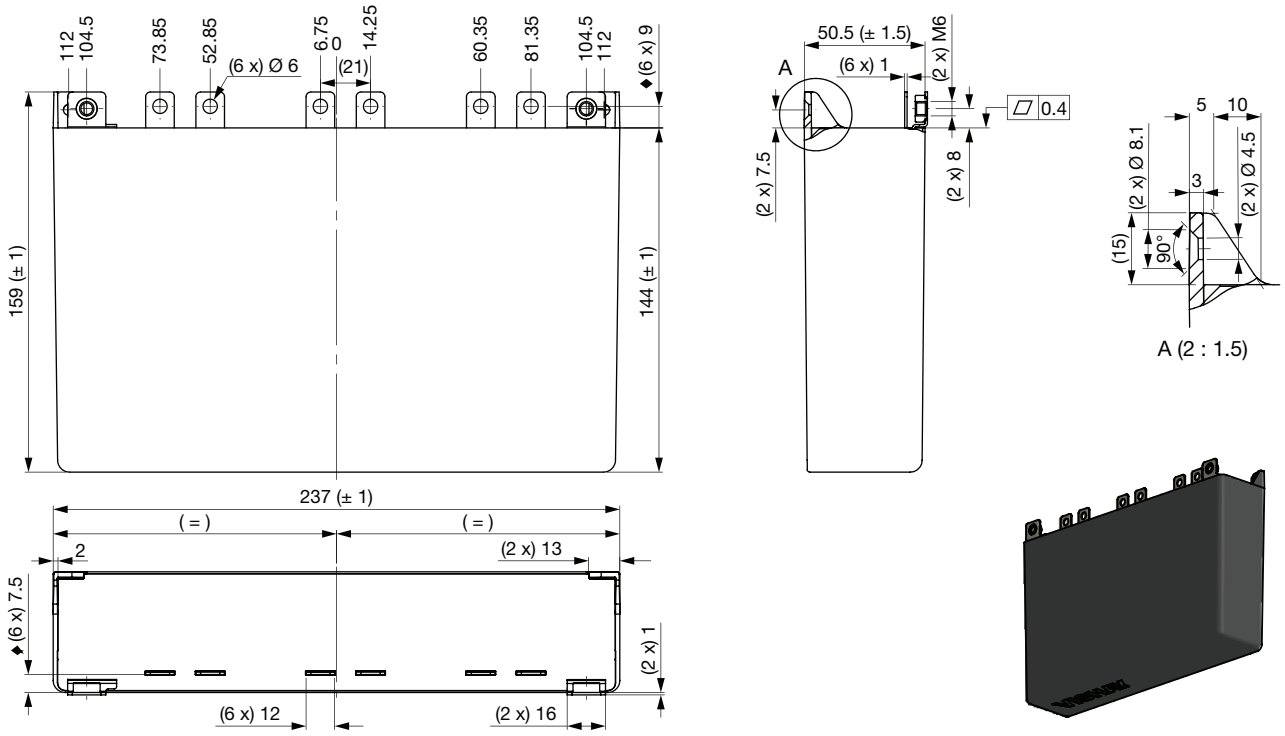
QUICK REFERENCE DATA	
Rated capacitance range	500 µF (other values available on request)
Capacitance tolerance	± 5 %
Climatic testing class	40 / 105 / 56
Rated temperature	105 °C
Maximum operating hotspot temperature	105 °C
Reference standards	ZVEI - Qualification of DC-link capacitors for automotive use ZVEI - Qualification of intermediate circuit capacitors for use in motor vehicle components
Dielectric	Polypropylene film
Electrodes	Metallized dielectric capacitor
Construction	Mono construction
Encapsulation	Plastic case, sealed with resin; flame retardant UL 94 V-0
Terminals	Busbar
DC voltage rating	U_R = 500 V_{DC} at 105 °C U_R = 900 V_{DC} at 105 °C
Insulation resistance	RC between leads, after 1 min > 10 000 s, measuring voltage: 500 V
Life time expectancy	See Fig. 9
Marking	Manufacturer's name; C-value; tolerance; rated voltage; manufacturer's type designation; code for dielectric material manufacturer location, year and week

Notes

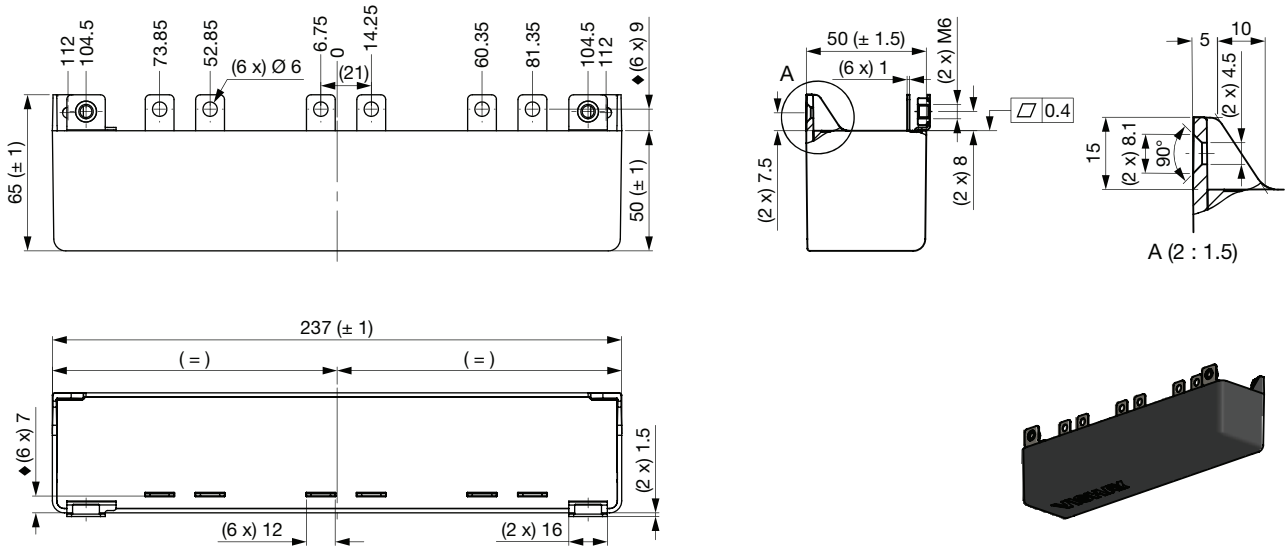
- For more detailed data and test requirements, contact dc-film@vishay.com
- For general information like characteristics and definitions used for film capacitors follow the link: www.vishay.com/doc?28147

DIMENSIONS in millimeters

MKP 1849 750 090K



MKP1849 750 050K



ELECTRICAL DATA AND ORDERING CODE

U_{RDC} (V)	CAP. (µF)	CASE DIMENSIONS (mm)			MASS (kg)	ORDERING CODE	SPQ (1)
		w	h	l			
500	500	237	50	50	1.3	MKP1849750050K	2
900	500	237	50	144	3.4	MKP1849750090K	1

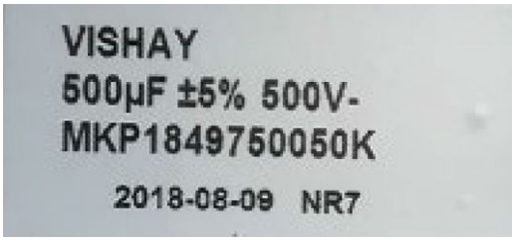
Note

(1) Carton box dimension (mm) 285 x 315 x 90. Product fixed with foam cavities

SPECIFIC REFERENCE DATA

DESCRIPTION	MKP1849750050K	MKP1849750090K
U_R Maximum operating peak voltage of either polarity voltage of a non reversing waveform for which the capacitor have been designed	500 V_{DC}	900 V_{DC}
U_S Non recurrent surge voltage or peak operating DC voltage (test duration 10 s)	750 V_{DC}	1350 V_{DC}
U_{ripple} Ripple voltage or peak to peak alternating component of the unidirectional voltage	50 V_{pp}	90 V_{pp}
tan δ Typical tangent of loss angle at 23 °C, 1 V tan δ = *R*esr ω C	0.0020 at 1 kHz	0.0015 at 1 kHz
R_{esr} Typical equivalent series resistance of a capacitor measured 23 °C, 1 V	0.5 mΩ at 10 kHz	0.4 mΩ at 10 kHz
$I_{max.}$ Maximum r.m.s. current for continuous operation at T_{amb} = 85 °C	110 A at 10 kHz	160 A at 10 kHz
$P_{max.}$ Maximum ohmic power dissipation in function of r.m.s. current	See Fig. 3	See Fig. 6
ΔT_{case} Temperature difference between the case and ambient free air in function of the power dissipation	See Fig. 7	See Fig. 8
$T_{min.}$ Lowest operating temperature or lowest temperature of the dielectric at which the capacitor may be energized	-40 °C	
$\hat{I}$ Maximum repetitive peak current that can occur during continuous operation	2.5 kA	3.5 kA
dU/dt Rated voltage pulse slope $(dU/dt)_R$	5 V/µs	7 V/µs
L_S Self inductance value by short circuit of connections with the same polarity	< 10 nH	
Ri Insulation resistance between leads, at 500 V, 1 minute after full charge	> 0.1 GΩ	
Ui DC Insulation voltage between terminals and case	3.5 kV	

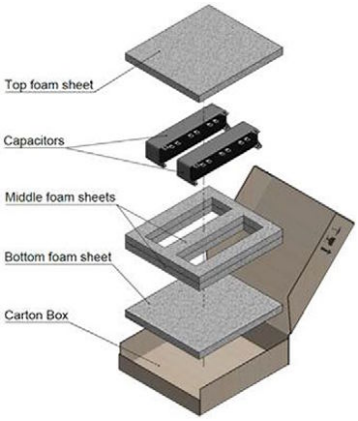
PRODUCT MARKING



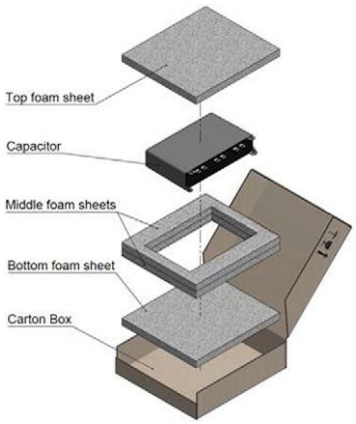
PACKING LABEL

1. Manufacturer's logo
2. Country of origin
3. Sub family
4. Type description
5. Capacitance value, tolerance, voltage, and climatic category according to IEC 60068-1
6. Production center
7. Preference origin code: A - country of origin in code
8. Product type description
9. Batch number
10. Quantity and production date, year week code
11. Product code

PACKAGING INFORMATION



HP2 500 V



HP2 900 V

CONSTRUCTION

Low inductive wound cell elements of metallized polypropylene film, potted with resin in a flame retardant case.

MOUNTING

The capacitor unit is designed for mounting directly on ECU, IGBT module, or bus bar.

In order to withstand vibration and shock tests, it must be insured that the bus bar is in good contact with the IGBT module.

The capacitors shall be mechanically fixed and the body clamped.

STORAGE TEMPERATURE

T_{stg} = -25 °C to +35 °C

RH maximum = 75 % without condensation for a maximum period of 2 years.

RATINGS AND CHARACTERISTICS REFERENCE CONDITIONS

Unless otherwise specified, all electrical values apply to an ambient temperature of 23 °C ± 1 °C, an atmospheric pressure of 86 kPa to 106 kPa and a relative humidity of 50 % ± 2 %.

For reference testing, a conditioning period shall be applied over 96 hours ± 4 hours by heating the products in a circulating air oven at the rated temperature and a relative humidity not exceeding 20 %.

CHARACTERISTICS

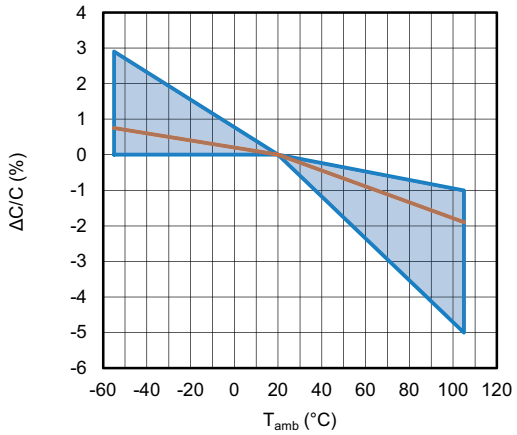


Fig. 1 - Capacitance in function of ambient temperature (typical curve 1 kHz)

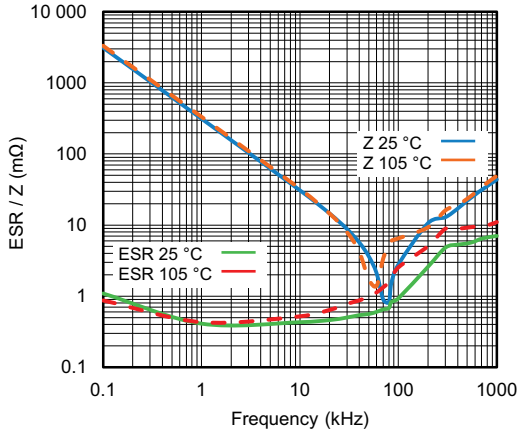


Fig. 2 - ESR and Impedance in function of frequency at different temperatures (MKP1849750090K)

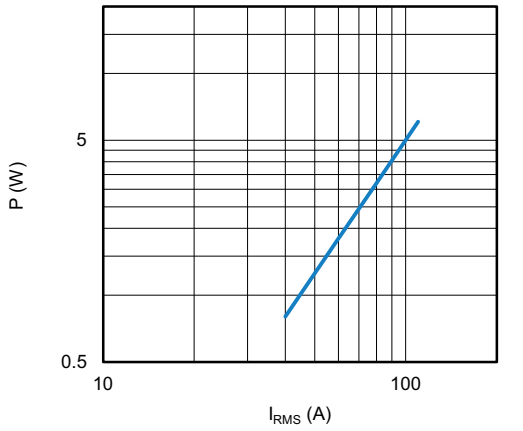


Fig. 3 - Ohmic power dissipation in function of r.m.s. current. Based on typical ESR = 0.5 mΩ and capacitance = 500 µF (MKP1849750050K)

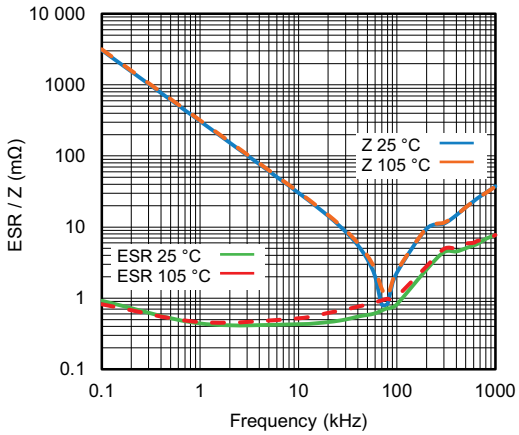


Fig. 4 - ESR and Impedance in function of frequency at different temperatures (MKP1849750050K)

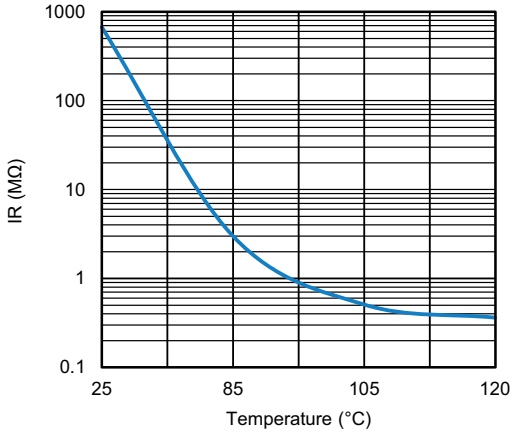


Fig. 5 - IR in function of temperature

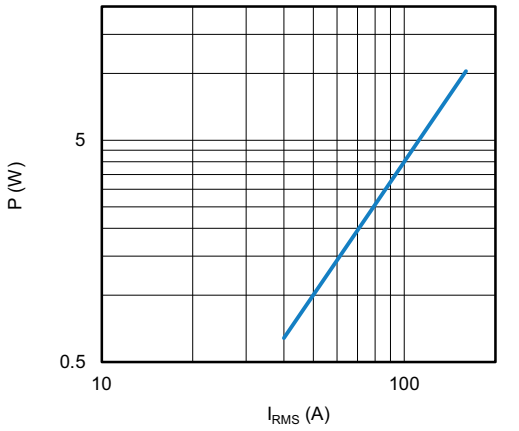


Fig. 6 - Ohmic power dissipation in function of r.m.s. current. Based on typical ESR = 0.4 mΩ and capacitance = 500 µF (MKP1849750090K)

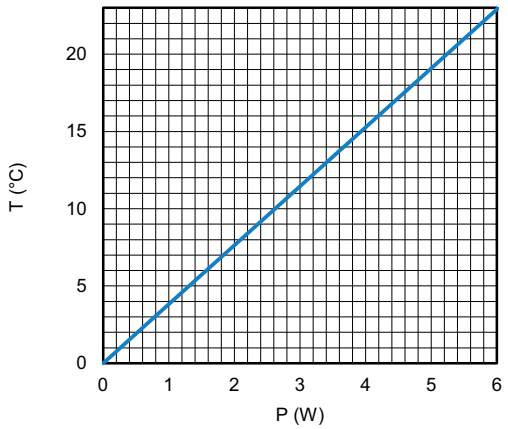


Fig. 7 - Temperature difference between the case and ambient free air in function of the power dissipation. Based on typical ESR = 0.5 mΩ and capacitance = 500 µF (MKP1849750050K)

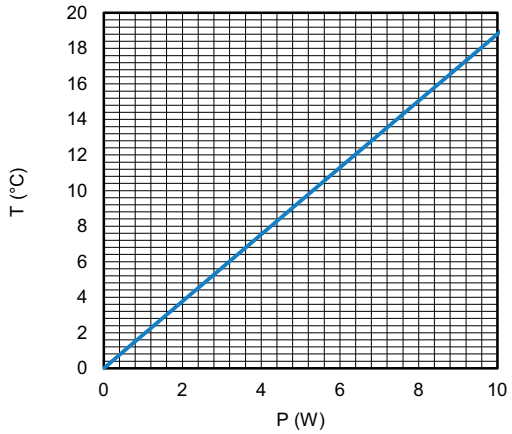


Fig. 8 - Temperature difference between the case and ambient free air in function of the power dissipation. Based on typical ESR = 0.4 mΩ and capacitance = 500 µF (MKP1849750090K)

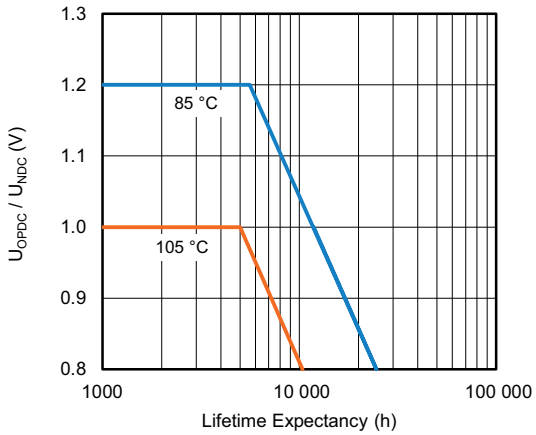


Fig. 9 - Life time expectancy according to IEC 61709 (typical curve) in function of voltage and hot spot temperature [1]

Note

[1] Statements about life time are based on calculations which are based on internal tests. They have to be understood exclusively as estimations. Also due to external factors, the life time in the field application may deviate from the calculated life time

APPLICATION NOTES AND LIMITING CONDITIONS

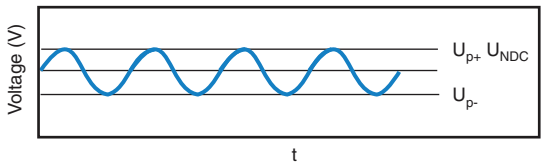
These capacitors are not suitable for mains applications as across-the-line.

These mains applications are strictly regulated in safety standards and therefore electromagnetic interference suppression capacitors conforming the standards must be used.

To select the capacitor for a certain application, the following conditions must be checked:

1. The peak voltage (U_{p+}) shall not be greater than the DC voltage rating (U_{NDC})
2. The peak-to-peak ripple voltage (U_{PP}) shall not be greater than U_{ripple}

Non reversing recurrent waveform



3. The voltage peak slope (dU/dt) shall not exceed the pulse slope at the DC voltage rating.
   If the pulse voltage is lower than the rated DC voltage, the rated voltage pulse slope may be multiplied by U_{NDC} and divided by the applied voltage.
   For all other pulses following equation must be fulfilled:

$$2 \times \int_0^T \left(\frac{dU}{dt}\right)^2 \times dt < U_{NDC} \times \left(\frac{dU}{dt}\right)_{rated}$$

   T is the pulse duration

4. The maximum component surface temperature must be lower than $T_{max.}$ (see graph)

TEST CONDITIONS ACCORDING ZVEI TESTING GUIDELINES				
STRESS	**NO.**	**REFERENCE**	**TEST CONDITIONS**	**PERFORMANCE REQUIREMENTS**
B-01 Temperature cycling (2 chamber device) followed by B-04 Vibration	B01 and B04	IEC 60068-2-14 and IEC 60068-2-6	1000 cycles, -40 °C, $T_{max.}$, product stays > 5 minutes after reaching of the -40 °C and > 5 minutes after reaching of $T_{max.}$ in the center of the capacitor. Followed by vibration test logarithmic sinus sweep 10 Hz to 2000 Hz, 106 vibrations, Δf = 10 Hz, 10 g at f > 58 Hz; 0.75 mm at f < 58 Hz	No visual damage. Mechanical in datasheet requirements. High voltage between terminals and capacitor box: no breakdown Requirements according Vishay datasheet
				MKP1849 750 050K
				$\Delta C/C$< 5 % ESR < 1 mΩ at 10 kHz IR between terminals > 0.05 GΩ
				MKP1849 750 090K
				$\Delta C/C$< 5 % ESR < 0.8 mΩ at 10 kHz IR between terminals > 0.05 GΩ
B-02 High damp heat constant	B02	IEC 60068-2-78	1700 h, 65 °C, 93 % RH without condensation, without voltage Followed by 50 h, 65 °C, 93 % RH without condensation at U_{rated} (500 V / 900 V) Total test time 1750 h	No visual damage. Mechanical in datasheet requirements. High voltage between terminals and capacitor box: no breakdown Requirements according Vishay datasheet
				MKP1849 750 050K
				$\Delta C/C$ < 5 % ESR < 1 mΩ at 10 kHz IR between terminals > 0.05 GΩ
				MKP1849 750 090K
				$\Delta C/C$ < 5 % ESR < 0.8 mΩ at 10 kHz IR between terminals > 0.05 GΩ
B-03 High-temperature	B03	IEC 60068-2-2	At 105 °C with U_{rated} (500 V / 900 V) for 5000 h (class 2)	No visual damage. Mechanical in datasheet requirements. High voltage between terminals and capacitor box: no breakdown Requirements according Vishay datasheet
				MKP1849 750 050K
				$\Delta C/C$ < 5 % ESR < 1 mΩ at 10 kHz IR between terminals > 0.05 GΩ
				MKP1849 750 090K
				$\Delta C/C$ < 5 % ESR < 0.8 mΩ at 10 kHz IR between terminals > 0.05 GΩ
B-05 Charge / discharge followed by B-06 Short circuit test	B05 and B06	IEC 60384-1 and IEC 61071	1000 cycles at 1 x dV/dt (datasheet) at 500 V / 900 V Followed by 5 cycles at dV/dt (short circuit) at free voltage with 2 minutes between each cycle.	No visual damage. Mechanical in datasheet requirements. High voltage between terminals and capacitor box: no breakdown Requirements according Vishay datasheet
				MKP1849 750 050K
				$\Delta C/C$ < 5 % ESR < 1 mΩ at 10 kHz IR between terminals > 0.05 GΩ
				MKP1849 750 090K
				$\Delta C/C$ < 5 % ESR < 0.8 mΩ at 10 kHz IR between terminals > 0.05 GΩ

Note

Measurement conditions at 23 °C:

- Capacitance at 1 kHz
- tan δ at 1 kHz (additional tan δ at 100 Hz and ESR at 10 kHz)
- Insulation resistance 500 V, 1 min after full charge

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