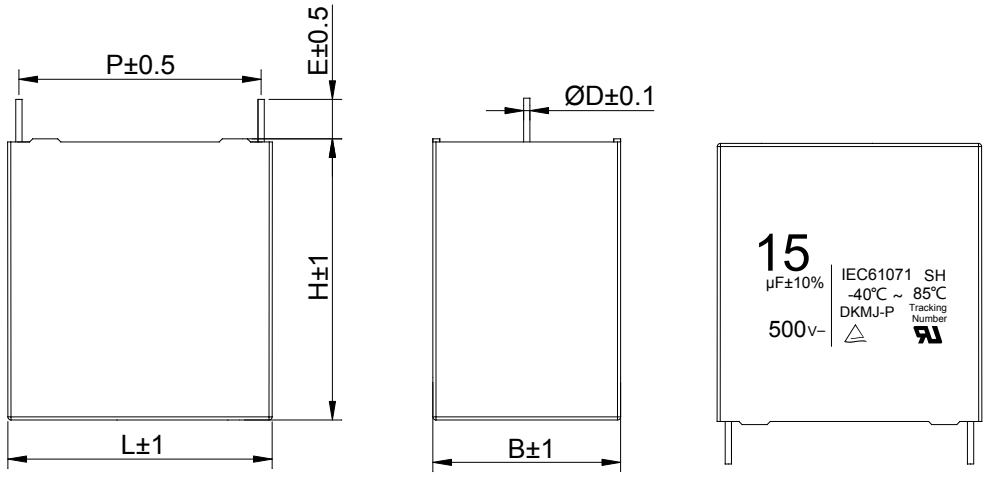
# SPECIFICATION FOR APPROVAL

## Film Capacitor for DC-Link application

**Product Type:** DKMJ-P 15µF ±10% 500VDC

**Ordering Code:** B12G156K500DEN-001

## ■ OUTLINE DRAWING (mm)




| $C_n$ (μF) | $U_n$ (VDC) | L | B | H | P | ΦD | E |
|---|---|---|---|---|---|---|---|
| 15 | 500 | 32 | 22 | 38 | 27.5 | 1.0 | 4.1 |

## ■ REFERENCE STANDARD

GB/T17702, IEC61071

## ■APPLICATIONS

Widely used in power electronics as DC link- and DC filtering- capacitors

## ■FEATURES

- Metallized film, non-inductive structure
- Self-healing property
- High ripple current handling capabilities
- Low ESR, Low ESL
- Long lifetime

## ■SAFETY APPROVALS

| | | |
|---|---|---|
| | TUV | EN61071: 2007, 0.68 μF to 200 μF, 400 VDC to 1400 VDC<br>-40/85 °C or -40/70 °C, Certificate No.: R 50321877 |
| | UL | UL810, Voltage Limits: Max. 1400VDC, 85 °C<br>Certificate No.: E215893 |

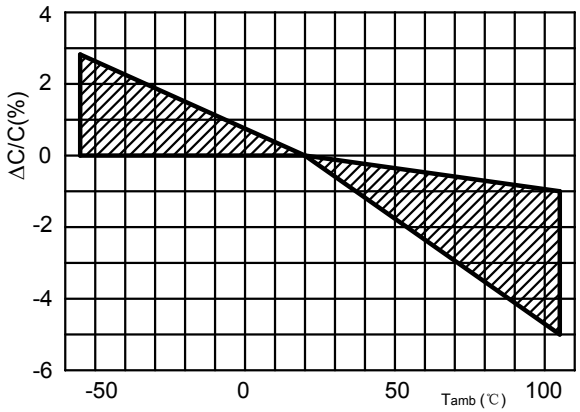
## ■TEST CONDITIONS

Environment Temperature: T = +20 °C ± 10 °C
Environment Humidity: RH ≤ 65%

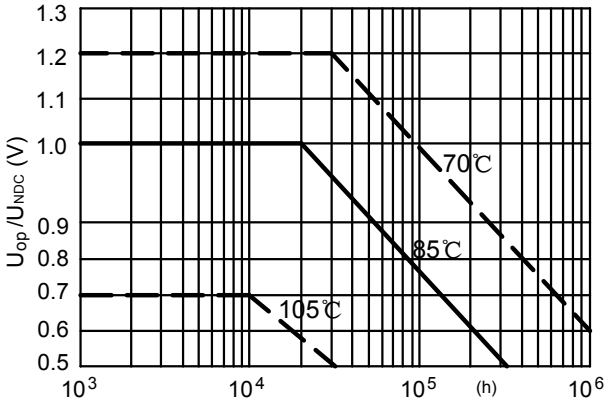
## ■ QUICK REFERENCE DATA

| | | |
|---|---|---|
| Rated capacitance | Cn | 15μF |
| Rated voltage | Un | 500VDC |
| Maximum permissible peak to peak ripple voltage | Urptp | 0.2x $U_{NDC}$ |
| lowest operating temperature | | -40 °C |
| Rated temperature | | +85 °C |
| Storage temperature range | | -40 °C to + 85 °C |
| Maximum permissible case temperature | | +105 °C, respecting voltage derating |
| Capacitance tolerance | | ±10% |
| Tangent of loss angle | tgδ | ≤ 0.0010 ( 1kHz) |
| Test voltage between terminals | Ut-t | 1.5 x Un for 10s |
| Maximum ripple current | Irms | 10A (at 70℃ 10 kHz) |
| Maximum peak current | Ipeak | 450 A |
| Voltage rise time | dv/dt | 30V/μs |
| Equivalent series resistance | ESR | ≤4mΩ (at 10kHz) |
| Equivalent series inductance | Ls | ≤27.5nH |
| Insulation resistance | IR | Given as time constant t (Cn x IR) at rel. humidity ≤ 65%.<br>After 1 min.: t >10000s<br>(measuring voltage 100VDC for 60s) |
| Temporarily Overvoltage (per day) | 1.1 x Un, 30% on load duration. | |
| | 1.15 x Un for 30min | |
| | 1.2 x Un for 5min | |
| | 1.3 x Un for 1min | |
| | 1.5 x Un for 100ms each time, 1,000 times during the life of the capacitor. | |

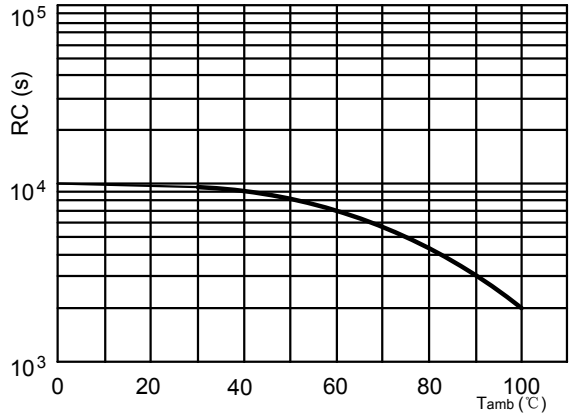
## ■CHARACTERISTICS



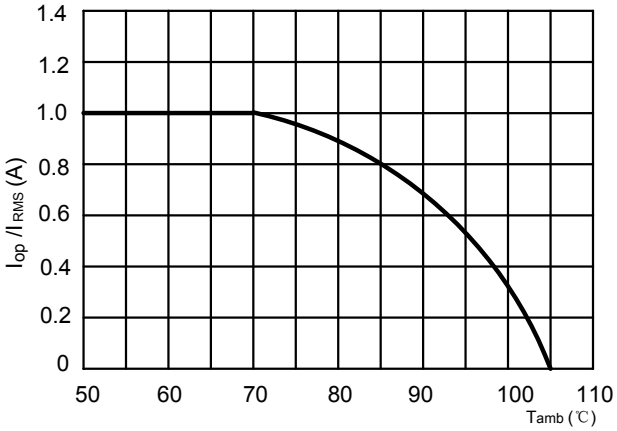

Capacitance vs. temperature (typical)




Expected lifetime (typical)




Insulation resistance vs. temperature (typical)




Irms vs. temperature (typical)

## ■TECHNICAL SPECIFICATION

| SUB-CLAUSE NUMBER AND TEST | | CONDITIONS | PERFORMANCE REQUIREMENTS |
|---|---|---|---|
| **ROUTINE TEST-FINAL INSPECTION** | | | |
| 1 | External inspection, visual examination | | Legible marking as specified |
| 2 | Dimensions | | See specification drawing |
| 3 | Capacitance | 1 kHz at room temperature | See specific reference data |
| 4 | tan δ | 1 kHz at room temperature | See specific reference data |
| 5 | Voltage test between terminal | 1.5 x $U_{NDC}$ at $T_{amb}$<br>Duration 10 s | No visible damage or puncture<br>No flashover |
| 6 | Insulation resistance | $U_{NDC}$ > 100 V measuring voltage 100V at room temperature<br>Duration 1 min | See specific reference data |
| **TYPE TESTS** | | | |
| 1 | External inspection | Check for finish, marking and overall dimensions | Legible marking and finish as specified<br>Dimensions: see specific drawing |
| 2 | Mechanical tests | | |
| 2.1 | Robustness of terminations | | |
| 2.1.1 | Initial measurements | Capacitance at 1kHz<br>Tan δ at 1kHz | |
| 2.1.2 | Robustness of terminations<br>IEC 60068-2-21 | Tensile Ua1<br>Wire diameter section load<br>≤ 0.8 mm ≤ 0.5 $mm^2$ 10 N<br>≤1.25 mm ≤ 1.2 $mm^2$ 20 N<br>Duration 10 s ± 1s<br>Bending Ub method 1<br>Wire diameter section load<br>≤ 0.8 mm ≤ 0.05 $mm^3$ 10 N<br>≤1.25 mm ≤ 0.019 $mm^3$ 20 N<br>4 x 90 °,<br>Duration 2 s to 3 s/bend | |
| 2.1.3 | Resistance to soldering heat<br>IEC 60068-2-20 | No predrying, Method 1A<br>Solder bath: 260 °C<br>Duration 10 s ± 1 s | |
| 2.1.4 | Final measurements | Capacitance at 1kHz<br>Tan δ at 1kHz | \|ΔC/C\| ≤ 0.5%<br>Increase of tan δ ≤ 0.0050<br>Compared to values measured in 2.1.1 |
| 3 | Voltage test between terminals | | |
| 3.1 | Initial measurements | Capacitance at 1kHz<br>Tan δ at 1kHz<br>R insulation | |
| 3.2 | Voltage test between terminal | 1.5 x $U_{NDC}$ at $T_{amb}$<br>Duration 60 s | |
| 3.3 | Final measurements | Capacitance at 1kHz<br>Tan δ at 1kHz<br>R insulation | \|ΔC/C\|≤0.5 %<br>Increase of tan δ ≤ 1.2 initial tan δ + 0.0001<br>R insulation ≥ 50 % of specified values |

| SUB-CLAUSE NUMBER AND TEST | CONDITIONS | PERFORMANCE REQUIREMENTS |
|---|---|---|
| 4 Surge discharge test | | |
| 4.1 Initial measurements | Capacitance at 1kHz<br>Tan δ at 1kHz | |
| 4.2 Surge discharge test | 1.1 x $U_{NDC}$<br>Number of discharges: 5<br>Time lapse: every 2 min (10 min total) | |
| 4.3 Voltage test between terminal | Within 5 min after the surge discharge test<br>Duration 60 s<br>1.5 x $U_{NDC}$ at $T_{amb}$ | |
| 4.4 Final measurements | Capacitance at 1kHz<br>Tan δ at 1kHz | \|ΔC/C\| ≤ 1.0 %<br>tan δ ≤ 1.2 initial tan δ + 0.0001<br>Compared to values measured in 4.1 |
| 5 Self healing test | | |
| 5.1 Initial measurements | Capacitance at 1kHz<br>Tan δ at 1kHz | |
| 5.2 Self healing test | 1.5 x $U_{NDC}$<br>Duration 10 s<br>Number of clearings ≤ 5<br>Clearing = voltage drop of 5 %<br>increase the voltage at 100 V/s till 5 clearings occur<br>with a max. of 2.5 x $U_{NDC}$<br>for a duration of 10 s | |
| 5.3 Final measurements | Capacitance at 1kHz<br>Tan δ at 1kHz | \|ΔC/C\| ≤ 0.5 %<br>tan δ≤ 1.2 × initial tan δ + 0.0001<br>Compared to values measured in 5.1 |
| 6 Environmental testing | | |
| 6.1 Initial measurements | Capacitance at 1kHz<br>Tan δ at 1kHz | |
| 6.2 Change of temperature acc. to IEC 60068-2-14 | Test Nb<br>$T_{max.}$ = 85 °C<br>$T_{min.}$ = -40 °C<br>Transition time: 1 h, equivalent to 1 °C/min | |
| 6.3 Damp heat steady state acc. to IEC 60068-2-78 | Test Ca<br>$T_{max.}$ = 40 °C ± 2 °C<br>RH = 93 % ± 3 %<br>Duration 56 days | |
| 6.4 Final measurements | Capacitance at 1kHz<br>Tan δ at 1kHz | \|ΔC/C\| ≤ 2%<br>Increase of tan δ ≤ 0.0150<br>Compared to values measured in 6.1 |

| SUB-CLAUSE NUMBER AND TEST | | CONDITIONS | PERFORMANCE REQUIREMENTS |
|---|---|---|---|
| 7 | Thermal stability test | | |
| 7.1 | Initial measurements | Capacitance at 1kHz<br>Tan δ at 1kHz | |
| 7.2 | Thermal stability test under overload conditions | Natural cooling $T_{amb}$ ± 5 °C<br>1.21 × $P_{max.}$ = ($U_2$/2) × $W_2$ × C × tan δ = 121 × ($I^2$max./$W_2$ ×C) × tan $\delta_2$ with $W_2$ = 2 × p × $f_2$ for $I_{max.}$<br>(see specific reference data)<br>$f_2$ = 1 kHz | |
| 7.3 | Final measurements | Capacitance at 1kHz<br>Tan δ at 1kHz | \|ΔC/C\| ≤2%<br>Increase of tan δ ≤ 1.2× initial + 0.0150 |
| 8 | Endurance test between terminals | | |
| 8.1 | Initial measurements | Capacitance at 1kHz<br>Tan δ at 1kHz | |
| 8.2 | Endurance test between terminals | Sequence<br>1.3 x $U_{NDC}$ at $T_{max.}$ = 85 °C<br>Duration 500 h<br>1000 ×discharge at 1.4×Ipeak (maximum repetitive peak current in continuous Operation)<br>1.3 x $U_{NDC}$ at $T_{max.}$ = 85 °C<br>Duration 500 h | |
| 8.3 | Final measurements | Capacitance at 1kHz<br>Tan δ at 1kHz | \|ΔC/C\| ≤ 3 %<br>Increase of tan δ ≤ 0.0150<br>Compared to values measured in 9.1 |