Film capacitors – High power capacitors

ModCap – Plastic case modular series

Series/Type:	**B25645**
Ordering code:	**B25645A****K003**
Date:	September 2020
Version:	1.0

Construction ModCap™

- Dielectric: Polypropylene film
- Non PCB, PU Resin (UL 94 V-0 ,
  Fire & Smoke EN 45545-2 HL2 R22-HL3R23)
- Plastic case and cover (UL 94 V-0,
  Fire & Smoke EN 45545-2 HL2 R22-HL3R23)

Design A and B

Features

- Modular design
- Self-healing technology
- Over-voltage capability

Typical applications

- DC link for renewable energy converters (solar, wind).
- DC link for traction applications (locomotive, tramway, metro, light train inverters)
- DC link for industrial motor drive

Terminals

- Optimized low inductance flat female terminals M6

Technical data and specifications

Characteristics	
Rated capacitance C_R	up to 2525 µF (see table)
Tolerance	K (±10%), other tolerances available upon request
Nominal voltage V_N	1100 … 2300 V (see table)
Operation bandwidth (*)	up to 50 kHz
Rated current I_R (1 kHz)	(see table)
Inductance Le	ca. 14 nH
R_{th} (**)	Construction A: 1.4 K/W Construction B: 2 K/W

(*) RMS current value that corresponds to components above 50 kHz limited to 10% of total RMS. Maximum continuous losses defined for rated current at 1 kHz should not be exceed. ESR vs frequency graphs available in page 5 for losses calculation according to a specific current spectrum. For more accurate thermal calculation, please ask for FEA simulation according to your specific operation conditions.

(**) Calculated from T_{amb} to Hotspot considering natural convection and no transfer of heat through the terminals. For more accurate thermal calculation, please ask for FEA simulation according to your specific operation conditions.

Maximum ratings	
Maximum permissible voltage (V_{max})	V_R +10% (30% of on-load daily duration) V_R +15% (up to 30 min daily) V_R +20% (up to 5 min daily) V_R +30% (up to 1 min daily)
Maximum permissible peak voltage	V_R +50% for 30 ms is permitted 1000 times during the lifetime of the capacitor
V_{TC} (isolation) V_{TC} (extinction)	5 kV 3 kV (<10 pC)

The average applied voltage shall not be higher than the specified voltage.
It should be recognised that any significant period of operation at voltages above the rated one would reduce overall lifetime.

Test data	
Voltage test between terminals (V_{TT})	1.5 • V_R, DC, 10 s (room temperature)

Design data	
Weight approx.	3.7 kg (construction A), 6.1 kg (construction B)
Filling	Non PCB, PU resin
Fixing	4 x Ø 6.5 mm

Climatic category 40/75/56	
Θ min	–40 ºC
Θ max	+75 ºC
Storage temperature	–40 …+85 ºC
Θ $_{hotspot}$ max.	+90 ºC
Humidity	av. rel. <93%, 25 g/m^3 max.
Time test	56 days
Maximum altitude	2000 m, higher altitude upon request

Life expectancy	
Lifetime *)	up to 200 000
End of life criteria	C-loss: 3%

*) V_R, I_R and 70 ºC T_{amb} (80 ºC mean dielectric temperature)

Terminals	
Terminations	4x M6, 25 x 30 mm, contact area 60 mm^2
Max. torque	6 Nm

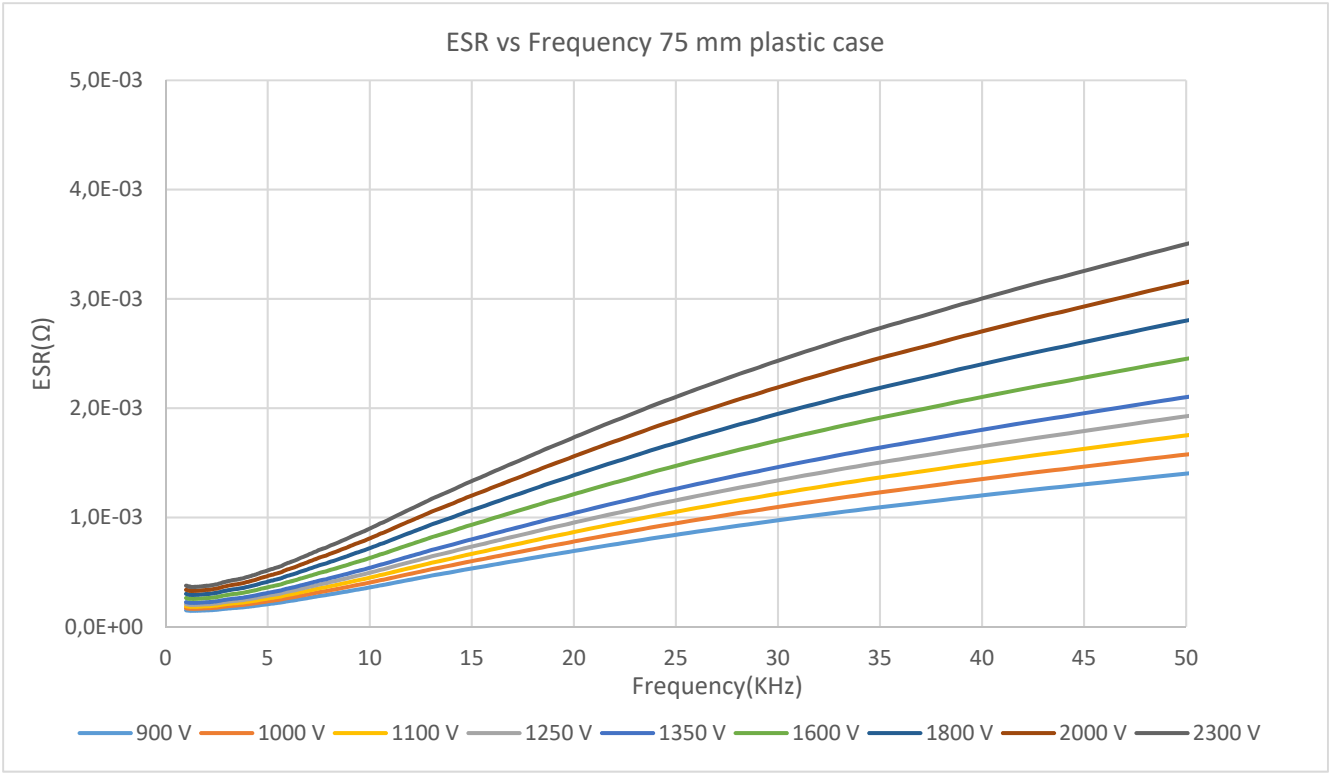
Reference standards	
IEC 61071	(International Standard Capacitors for power electronics)
IEC 61881-1	(International Standard Railway applications - Rolling stock equipment - Capacitors for power electronics)
EN 45545-2	(Railway applications-Fire protection on railway vehicles)

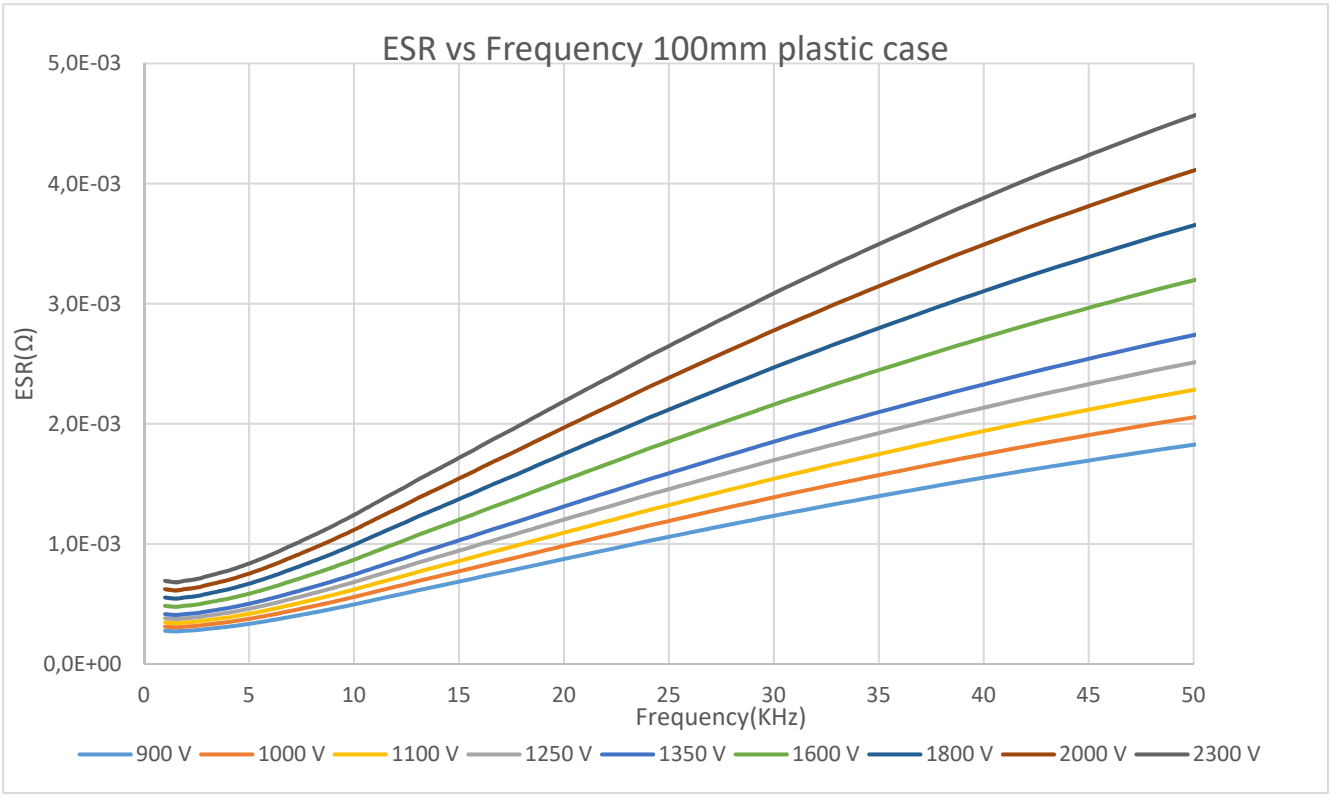
Ordering codes

V_N V	C_R µF	I_N A	I_S kA	Î kA	Dimensions LxWxH mm	Design	Packing unit pcs/box	Ordering code
1100	1395	180	215	5	243x169.5x90	A	4	B25645A1138K003
	2525	140	240	5	258x215x115	B	3	B25645A1258K003
1250	1100	170	210	5	243x169.5x90	A	4	B25645A1118K003
	1985	135	235	5	258x215x115	B	3	B25645A1198K003
1350	1025	160	205	5	243x169.5x90	A	4	B25645A1108K013
	1865	130	230	5	258x215x115	B	3	B25645A1188K003
1600	755	150	200	5	243x169.5x90	A	4	B25645A1757K003
	1375	120	225	5	258x215x115	B	3	B25645A1138K013
1800	560	140	195	5	243x169.5x90	A	4	B25645A1567K003
	1025	115	220	5	258x215x115	B	3	B25645A1108K003
2000	445	130	185	5	243x169.5x90	A	4	B25645A2447K003
	820	110	210	5	258x215x115	B	3	B25645A2827K003
2300	365	120	175	5	243x169.5x90	A	4	B25645A2367K003
	670	105	200	5	258x215x115	B	3	B25645A2677K003

V_N Nominal voltage
C_R Rated capacitance, tolerance ±10%
I_N Nominal current
I_S Surge current
Î Repetitive peak current

ESR vs frequency

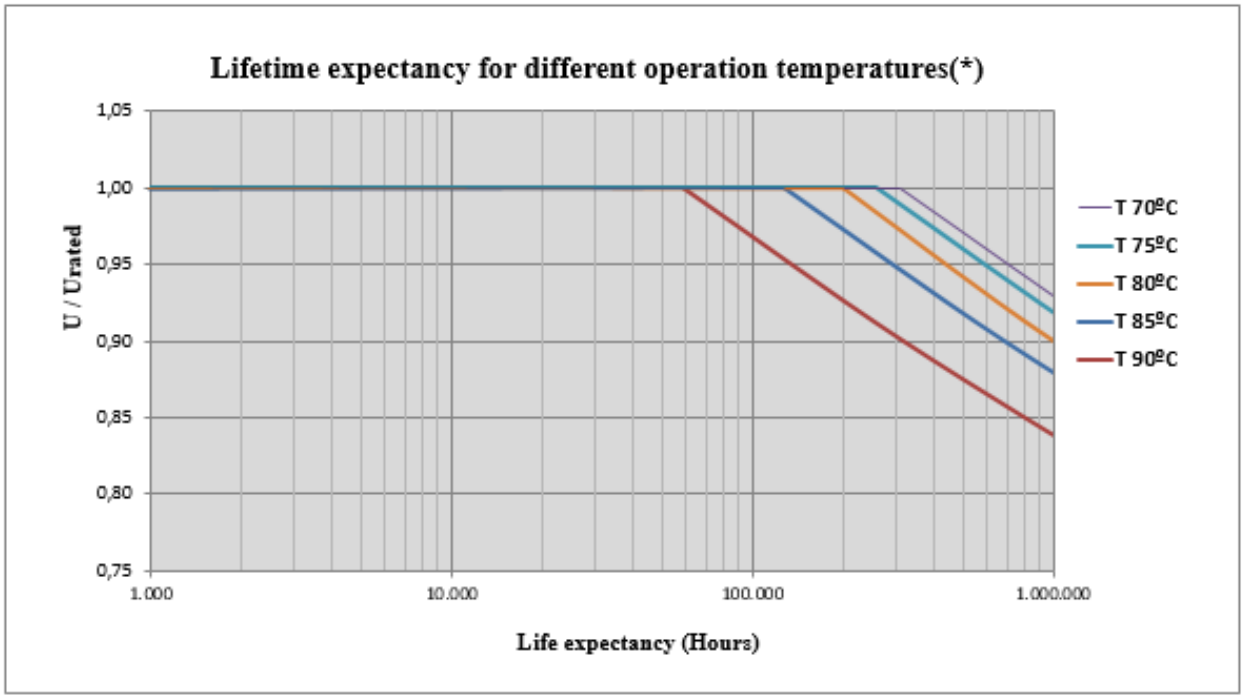




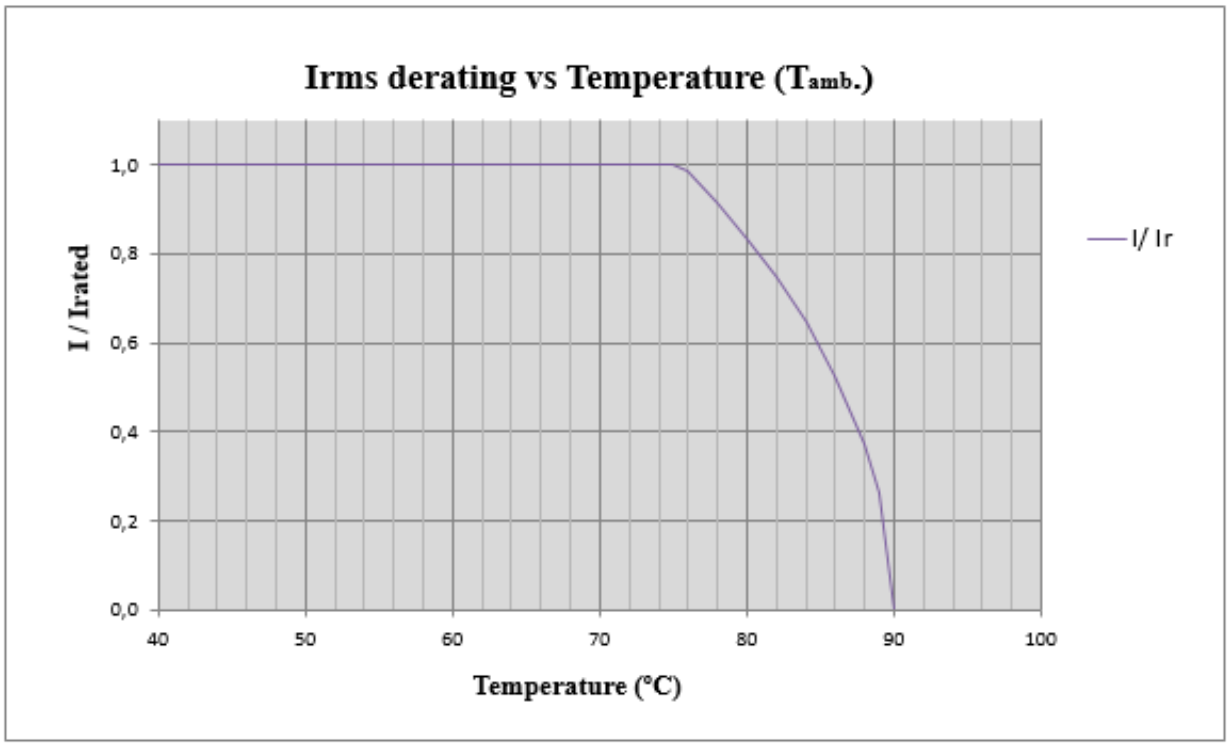
No internal resonances

September 2020

Lifetime expectancy

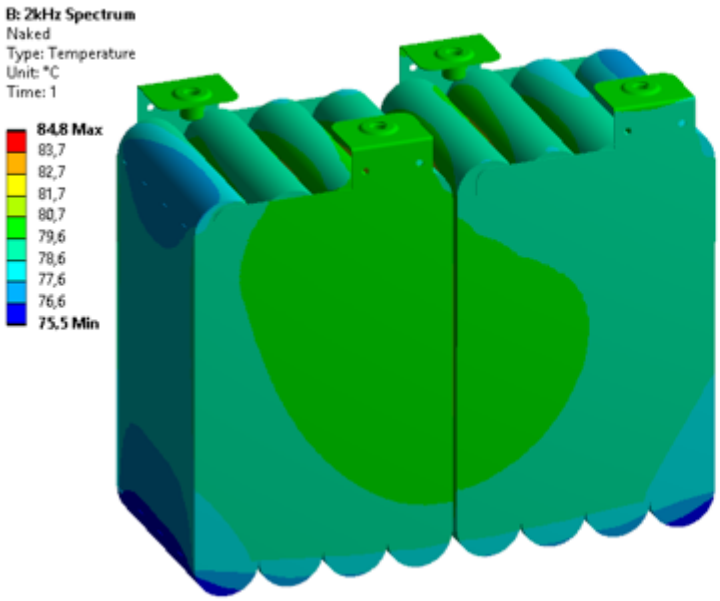


(*) Homogeneous dielectric temperatures



Thermal stability under specific operation conditions (example)

Thermal map, naked capacitor



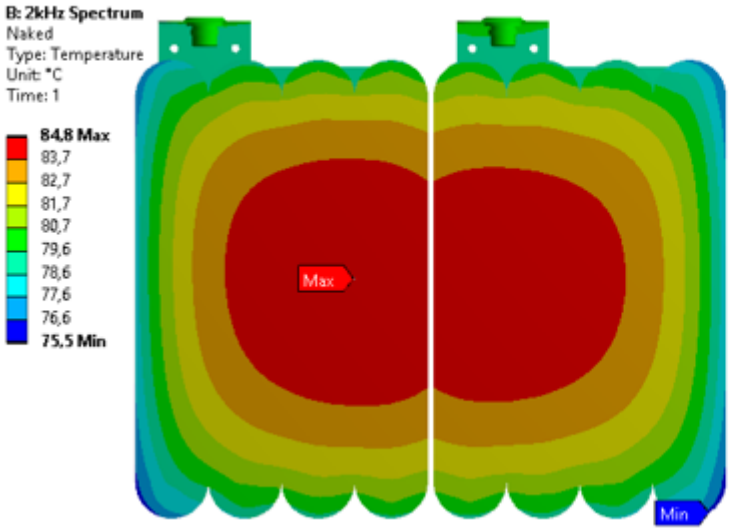
MKK DC-R Modular series:

- Capacitance: 1 mF
- Current: 155 A
- Power losses: **11 W**
- DeltaT = **15 K**

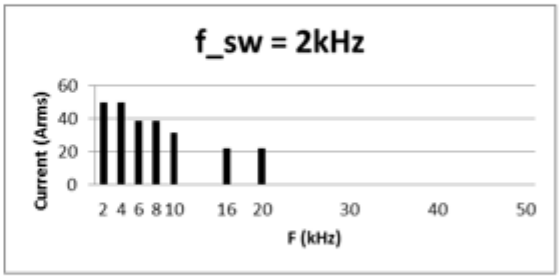
Boundary conditions considered:

- Ambient temp: 70 ºC
- Busbar temp: 80 ºC
- Natural convection

Thermal map, cross section



Current spectrum considered

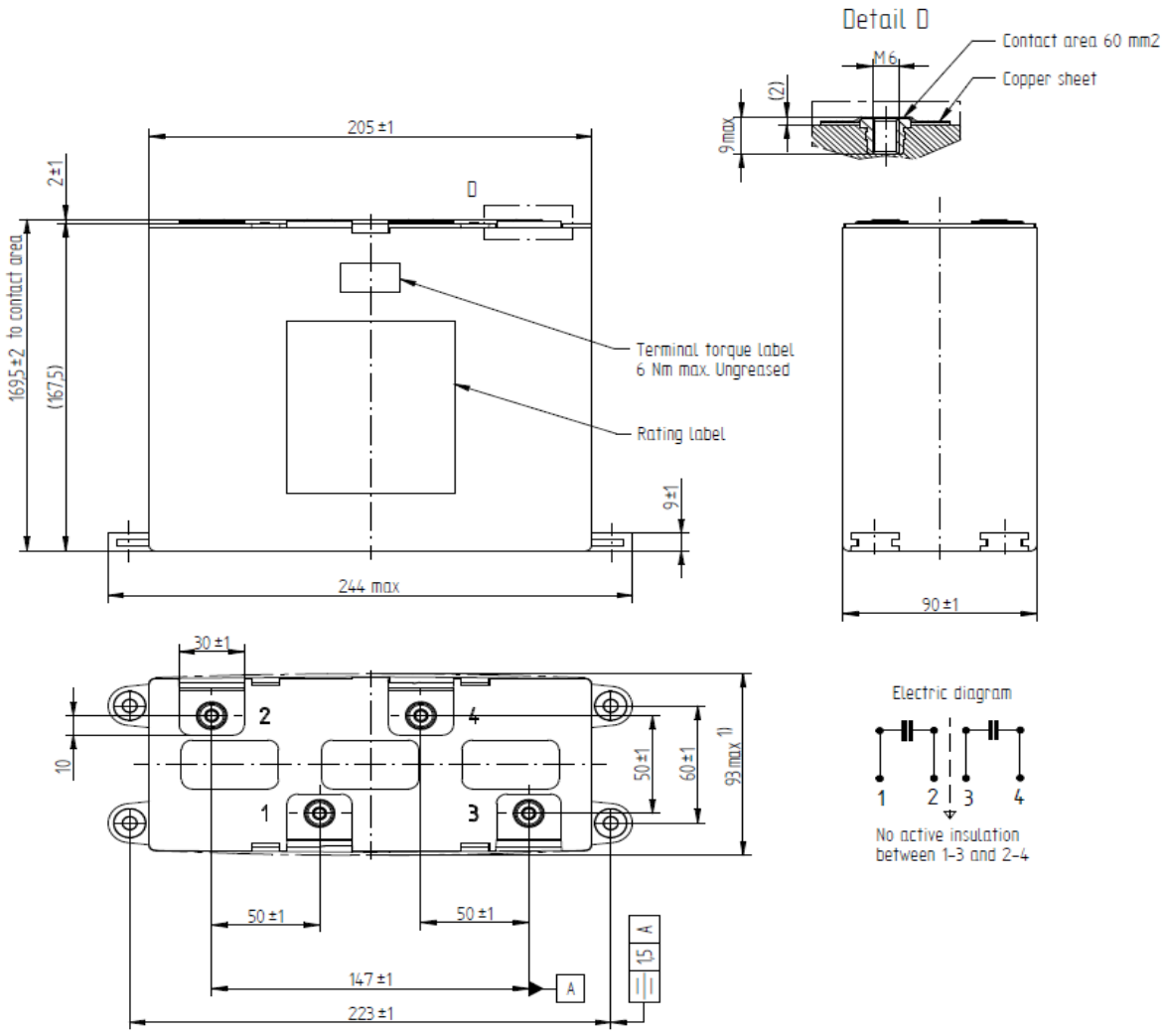


Standard product – Customized solutions

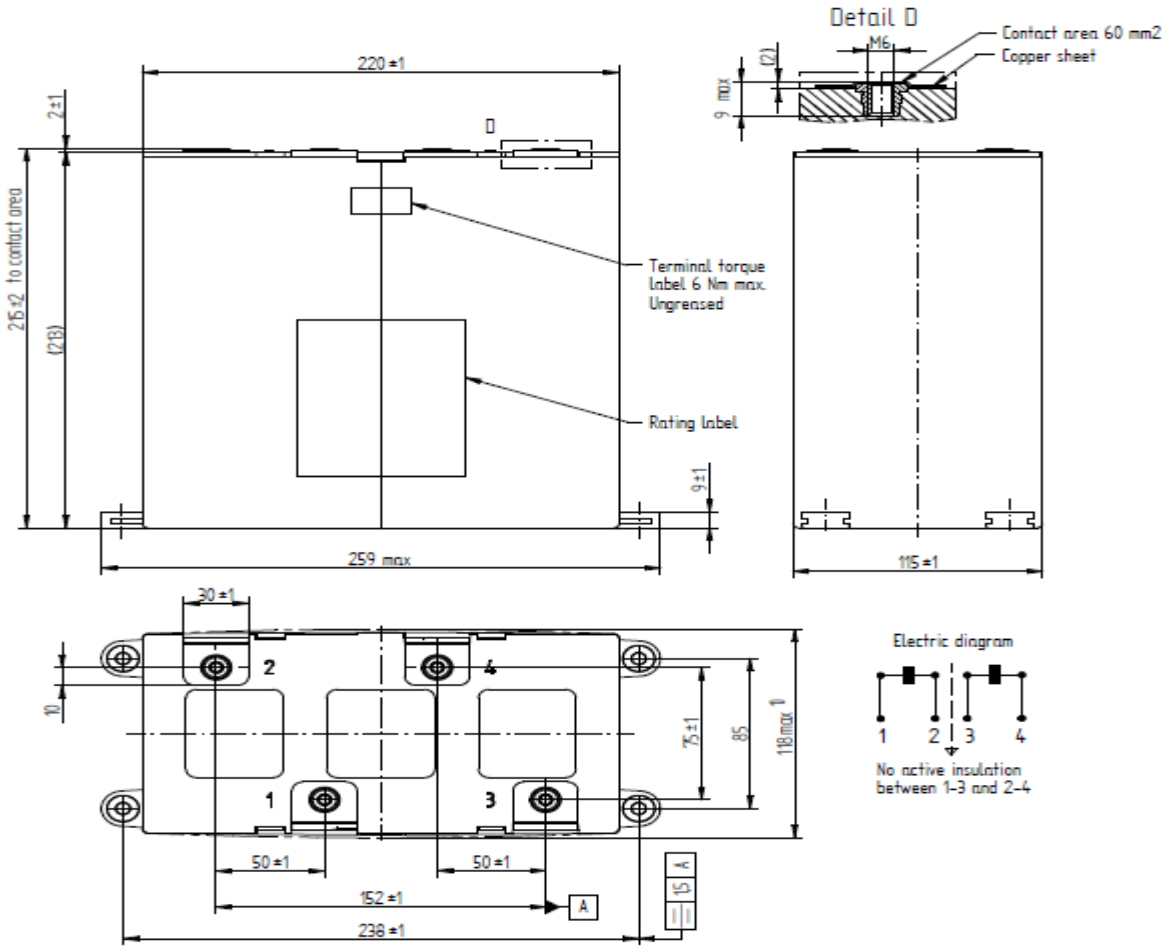
- F.E.A. model available for specific simulation according to spectrum and boundary conditions defined by the customer

Dimensional drawings

Design A



Design B


Detail D
Contact area 60 mm2
Copper sheet
M6
220 ±1
2±1
D
25±2 to contact area
(213)
Terminal torque
label 6 Nm max.
Ungreased
Rating label
9±1
259 max
115 ±1
30 ±1
10
2
4
1
3
75±1
85
118max 1
50 ±1
50 ±1
152 ±1
238 ±1
A
15
Electric diagram
1 2 3 4
No active insulation
between 1-3 and 2-4

Cautions & warnings

General safety recommendations

When employed in power electronics applications, the capacitors run with high energy and high currents.

The energy stored in capacitors may be lethal. To prevent any risks of shocks, the capacitor must be discharged with adequate means by qualified people and short-circuited between terminals before handling.

The screws supplied in the terminals of the capacitor are only to ensure the short circuit during transportation and storage, they should not be used for the final connection in the application.

The capacitor can contain dangerous residual charges even after long time without operation. For this reason, the electrical terminals must remain short-circuited until the capacitors are connected in the operating circuit.

TDK cannot predict all possible stresses that a Power Electronic Capacitors can be subjected to. There is a remaining probability of Power Electronic Capacitors showing malfunction due to excess temperature, overvoltage, wrong application, wrong installation, faulty maintenance, mechanical damage, operation at the limits of the specification or other reasons.

Transportation and handling

- The electrical terminals must not be used for grabbing or suspending the capacitor during transportation and handling.
- Do not handle the capacitor before it is discharged.
- Handle capacitors carefully, because they may still be charged even after disconnection due to faulty discharging devices.
- Protect the capacitor properly against over current and short circuit.
- Failure to follow cautions may result, worst case, in premature failures, bursting and fire.

Fixing

- The threaded screw 4x Ø 6.5 mm in the bottom of the capacitor has to be used for fixing.

Storage and operating conditions

Capacitors must never be stored outside the specified temperature and humidity ranges.
Capacitors may not be stored in corrosive atmospheres, particularly not when chlorides, sulfides, acids, alkalis, salts, organic solvents or similar substances are present.

Risk minimization with protective devices for power electronic capacitors

The German Electrical and Electronic Manufacturers' Association - ZVEI - is advising the implementation of protective devices when using power electronic capacitors as a suitable measure to eliminate danger to humans and property to the largest extend.
The utilization of protection devices will significantly reduce the risk of active capacitor failures which could occur due to the high amount of energy stored and the possibility of creating flammable gases [Ref 3].

TDK cannot predict all possible stresses, which a power electronic capacitor can be subjected to. There is a remaining probability of power electronic capacitors showing malfunction due to excess temperature, overvoltage, wrong application, wrong installation, faulty maintenance, mechanical damage, operation at the technical limits of the specification or other reasons.

As a member of ZVEI, TDK is recommending the use of power electronic capacitors equipped with appropriate protective devices, such as over-pressure switches and will be glad to provide concrete technical recommendations regarding Protective Devices during the creation of a power electronic capacitor specification.

TDK has collected profound experience in designing power electronic capacitors compliant with the international standards (see Ref.1 & 2.).

[Ref.1] IEC 61071: Capacitors for power electronics
[Ref.2] IEC 61881-1: Railway applications – Rolling stock equipment – Capacitors for power electronics
[Ref.3] ZVEI Power Capacitors Division - General Safety Data Sheet for Power Capacitors

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Important notes

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