

## Application Note 2020

# High Power Capacitors ModCap

Modular standard DCR series in plastic case

The ModCap™ B25645 series is offered as an ultra-compact solution with highest energy density.

### Features

- Capacitance from 365 up to 2525  $\mu\text{F}$
- Voltage from 1100 up to 2300 V
- Low ESL <14 nH
- Temperature up to 90 °C hotspot
- Lifetime up to 200 000 hours
- IEC 61071, IEC 61881-1, EN 45545-2 HL3 R23 (fire and smoke)

- Filled with polyurethane resin (dry technology)
- Plastic case (opened)
- Flat windings
- Modular concept for parallelization

### Main applications

- Compact converters for traction
- Renewable energies
- Industrial applications



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## Modular standard DCR series

TDK has developed an innovative High Power Capacitor series for DC link applications. This new modular standard series enables to have versatile solutions due to their wide spectrum in the voltage and capacity range. Renewable energies, traction and industrial drives are main applications for this capacitors.

ModCap is based on 15 years' experience designing ad-hoc resin filled solutions and use smart metal profile to maximise self-healing capability. Capacitor dimensions have been fixed to be compatible with actual and upcoming IGBT power modules in order to optimise DC link footprint in dimensions and performance.

### Features

ModCap has been designed to minimize the stray inductance; values below 14 nH are achieved for the whole series. Thanks to its reduced parasitic inductance, ModCap is able to supply the power to the switching devices in a fast way, without developing voltage overshoots and, avoiding additional devices such as snubber capacitors. This makes the ModCap to be the best volume, cost saving solution and the most compact DC link solution with highest energy density.

Technical data and specifications	
Rated capacitance $C_R$	up to 2525 $\mu$ F (see table)
Tolerance	K ( $\pm$ 10%), other tolerances up on request
Rated voltage range $V_N$	1100 ... 2300 V (see table)
Operation bandwidth <sup>*)</sup>	up to 50 KHz
Rated current $I_R$ (1 kHz)	(see table)
Inductance $L_e$	< 14 nH
$R_{th}$ <sup>**)</sup>	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.

\*\*\*) Calculated from  $T_{amb}$  to  $T_{hotspot}$  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.

### Design

Construction A



Construction B



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

$V_N$	Nominal voltage
$C_R$	Rated capacitance, tolerance •10%
$I_N$	Nominal current
$I_S$	Surge current
$\hat{I}$	Repetitive peak current

### Benefits of a Modular DC link capacitor

The main advantages of a modular capacitor are reduced volume, low cost, standard design, low stray inductance and high current and energy density. Additionally, the smart mechanical design adapted to the existing SiC/IGBT power modules makes the ModCap the closest experience to the “plug and play” philosophy in the industry.

As a standardized product, the ModCap is compliant with most of the industry standards: EN 45545-2, IEC 61071, IEC61881-1, UL, and so on. Since the moment of purchasing, our customers receive a fully validated product with all the necessary documentation.

Despite of being a standard design, TDK offers a customized solution. Thanks to our wide catalogue

and technical support: SPICE models and electro-magnetic and thermal FEA simulations; we can offer the best standard solution for your particular requirements.

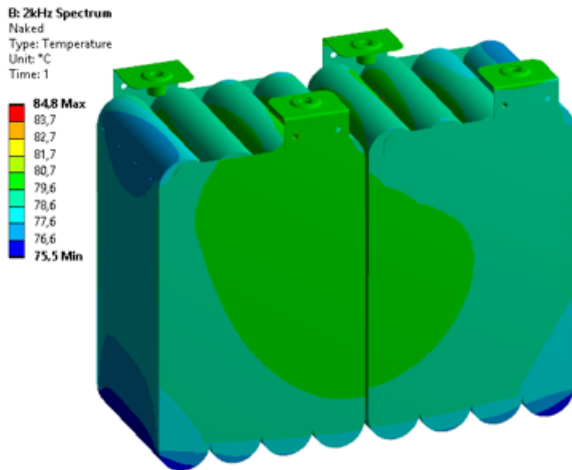
### Thermal stability under specific operation conditions (example)

Additionally, for precise thermal distribution inside the capacitor, TDK offers FEA simulations according to your specific electrical and mechanical conditions. We can simulate the ModCap in your setup, considering not only the electrical conditions, but also the rest of elements that can affect, i.e. external electromagnetic interferences, cooling system, mechanical assembly, etc.

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*Thermal map, naked capacitor*



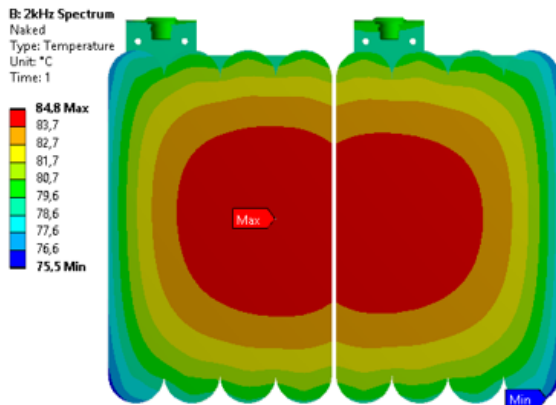
**MKK DC-R Modular series:**

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

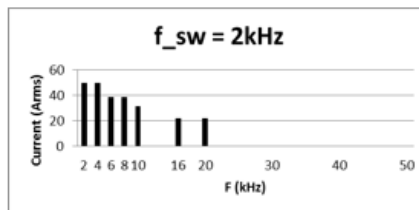
Boundary conditions considered:

- Ambient temp: 70 °C
- Busbar temp: 80 °C
- Natural convection

*Thermal map, cross section*



*Current spectrum considered*



**Advanced material technologies**

The technology applied to the ModCap product is the result of TDK’s long experience in the film capacitor industry. Up to 90 °C of hot-spot temperature can be achieved during operation thanks to the use of high

crystallinity BOPP and our fine-tuned automated process parameters. This makes our product more robust against self-healing events, being able to operate at higher temperatures than the rest of the market, always assuring the specified lifetime.

# High Power Capacitors ModCap

## Modular standard DCR series

Further information on the products can be found under

<https://www.tdk-electronics.tdk.com/en/2863834/products/product-catalog/power-capacitors/modcap>

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