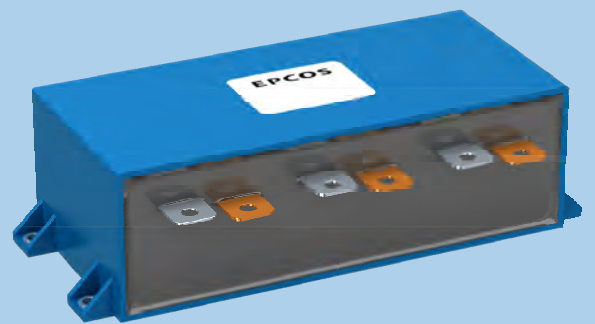
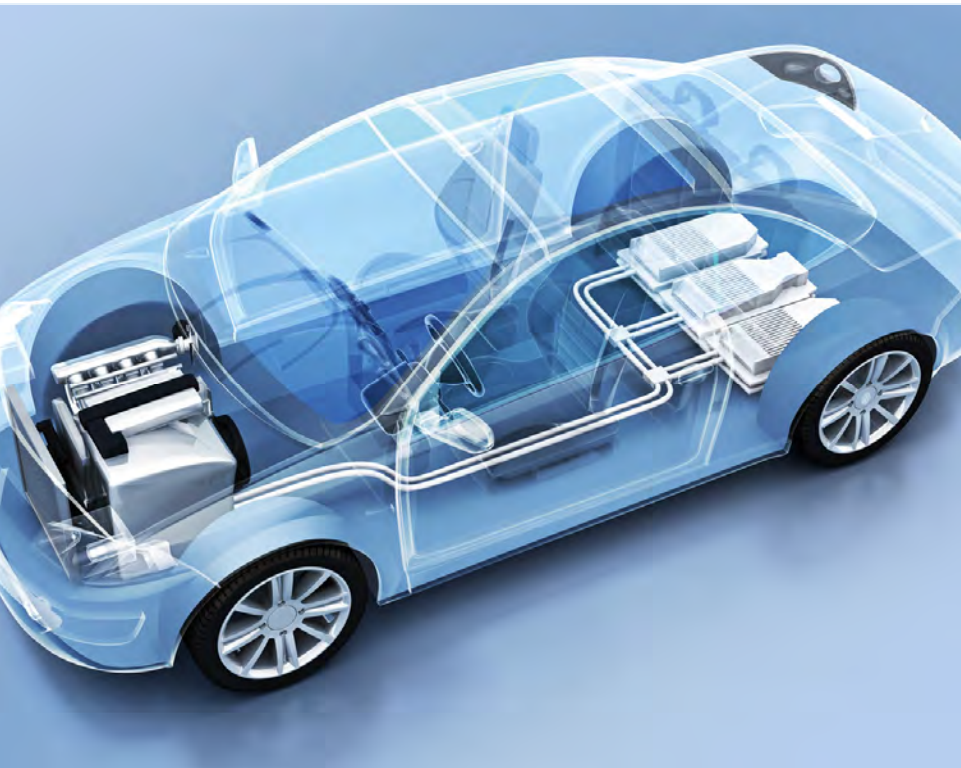


EPCOS Product Brief 2016

# Film Capacitors

PCC Power Capacitors for HybridPACK™ IGBT Modules



# Technology

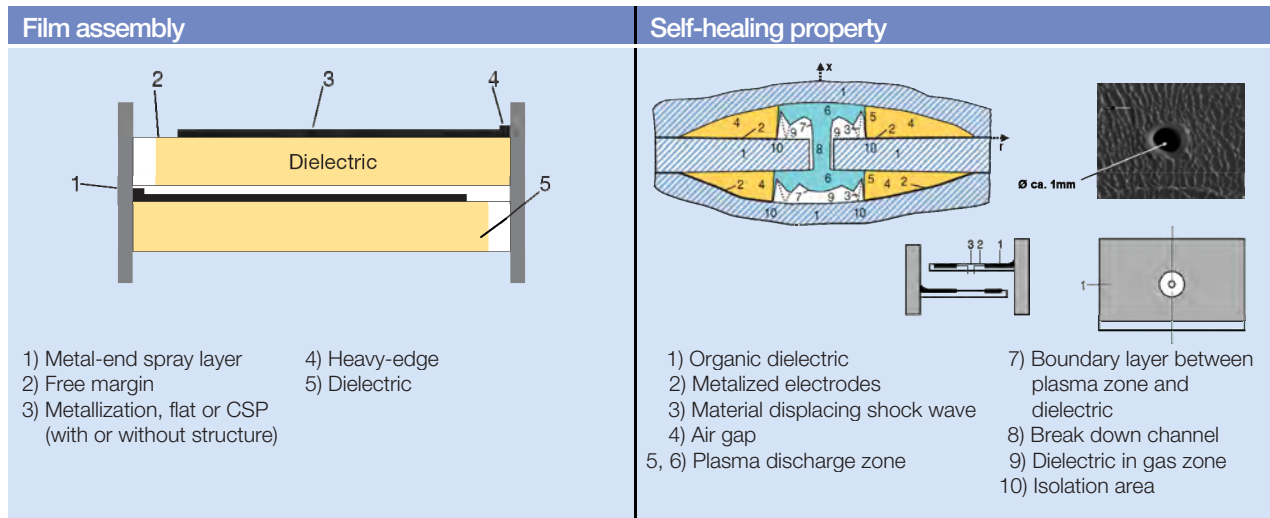


Fig. 1: Cross section of a metalized film capacitor

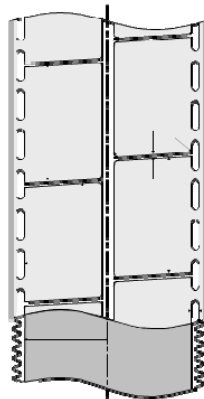
Fig. 2: Self-healing property of a metalized film capacitor

Metallized film capacitors (fig.1) have the advantage that for certain failures in the dielectric the capacitor will not go into short thanks to the ultrathin metallized electrode (thickness typical 10 to 100 nm) and the use of aluminium as material for the electrodes. If a breakdown occurs, the aluminium will evaporate around the breakdown spot and immediately oxidize to  $Al_2O_3$ , which is an excellent insulator. So the breakdown spot becomes high-impedance and is insulated from the rest of the capacitor. The insulated area is formed in a few microseconds and ensures the full functionality of the capacitor after breakdown.

This behaviour is called “clearing” or “self-healing” (fig. 2). In principle there should not be any further clearing during the service life, since all capacitors are typically “cleared” with a voltage of 1.5 times the rated voltage during the production process.

Additionally, to limit the energy dissipation during a clearing event, for some designs at least one electrode is divided into segments, connected by small links or fuses. The capacitors are typically

named “segmented” or “structured” metalized film capacitors. See fig. 3 example of a “T-segmentation”:



EPCOS possesses different winding technologies:

- The stacked technology, typically used for PCC film capacitors, for which the film is already wound flat on the winding machine. This technology offers the highest fill factor and the lowest ESR.
- The flat pressed winding technology which is most commonly used on the market for this type of application today. This technology offers the lowest costs at a good performance.

Typical rated voltages (V):

IGBT rated voltage	PCC capacitor	
	Rated voltage	Maximum voltage <sup>1)</sup>
650 - 705	450	500
750	500	550
1200	900	950

1) For limited time, please refer to data sheet

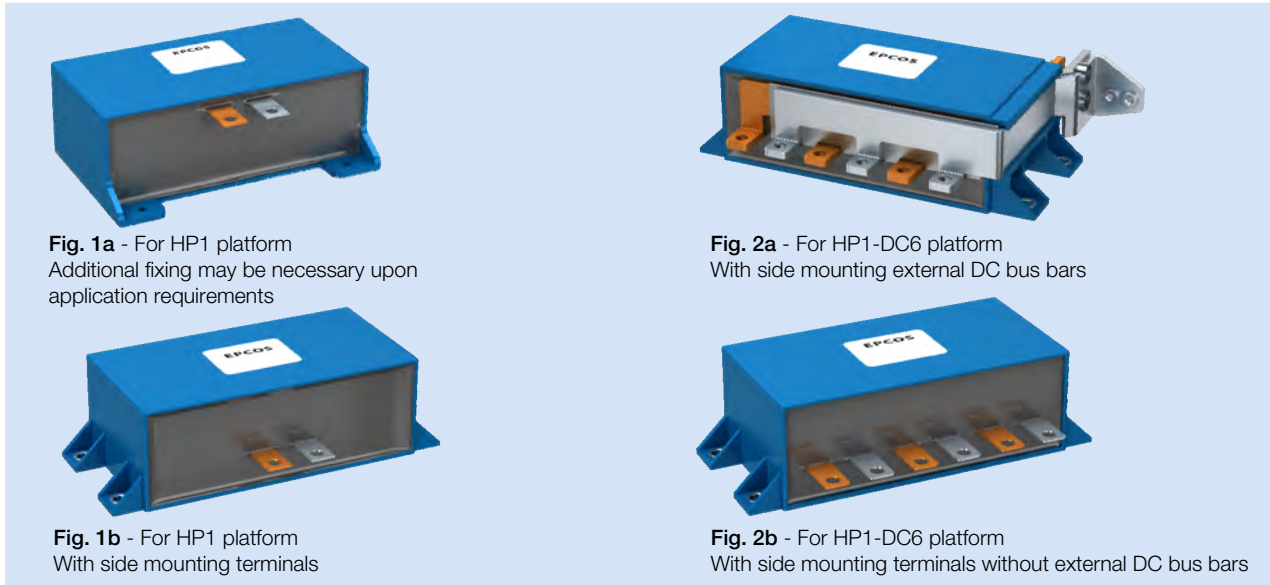
The rated voltage is defined as the continuous operating voltage taking into account for the calculation of the expected lifetime.

The maximum voltage is the maximum operating voltage to be applied on the capacitor for short operations (e.g. up to 10% of the expected calculated lifetime).

A detailed lifetime calculation based on a mission profile (voltage, temperature) can be submitted upon request.

# PCC for Infineon HybridPack™ 1 (HP1)

PRELIMINARY



**Fig. 1a** - For HP1 platform  
Additional fixing may be necessary upon application requirements

**Fig. 2a** - For HP1-DC6 platform  
With side mounting external DC bus bars

**Fig. 1b** - For HP1 platform  
With side mounting terminals

**Fig. 2b** - For HP1-DC6 platform  
With side mounting terminals without external DC bus bars

## HP1 platform 650 V – FS\*\*\*xR07A1\*\*



Ordering code	C <sub>R</sub> μF	V <sub>RDC</sub> V	I <sub>max</sub> <sup>1)</sup> A	L <sub>self</sub> nH	R <sub>S</sub> mΩ	$\hat{I}$ kA	I <sub>S</sub> kA	tanδ 120 Hz	Dimensions L x W x H mm	Weight kg	Fig.
B25655J4307K001	300	450	120	30	0.8	0.9	2.7	8 · 10 <sup>-4</sup>	140 x 72 x 50	0.8	1a
B25655P4467K000	460	450	150	25	0.6	1.5	5.0	5 · 10 <sup>-4</sup>	140 x 72 x 50	0.8	1a
B25655P4567K000	560	450	150	25	0.6	1.8	5.6	5 · 10 <sup>-4</sup>	140 x 72 x 50	0.8	1a
B25655P4407K100 <sup>2)</sup>	400	450	120	25	0.8	1.4	4.4	5 · 10 <sup>-4</sup>	140 x 72 x 50	0.8	1a
B25655P4507K100 <sup>2)</sup>	500	450	120	25	0.8	1.6	5.0	5 · 10 <sup>-4</sup>	140 x 72 x 50	0.8	1a
B25655P4607K100 <sup>3)</sup>	600	450	120	25	0.8	2.0	6.0	5 · 10 <sup>-4</sup>	140 x 72 x 50	0.8	1a
B25655P4467K001	460	450	150	25	0.6	1.5	5.0	5 · 10 <sup>-4</sup>	140 x 72 x 50	0.8	1b
B25655P4567K001	560	450	150	25	0.6	1.8	5.6	5 · 10 <sup>-4</sup>	140 x 72 x 50	0.8	1b
B25655P4407K101 <sup>2)</sup>	400	450	120	25	0.8	1.4	4.4	5 · 10 <sup>-4</sup>	140 x 72 x 50	0.8	1b
B25655P4507K101 <sup>2)</sup>	500	450	120	25	0.8	1.6	5.0	5 · 10 <sup>-4</sup>	140 x 72 x 50	0.8	1b
B25655P4607K101 <sup>3)</sup>	600	450	120	25	0.8	2.0	6.0	5 · 10 <sup>-4</sup>	140 x 72 x 50	0.8	1b

## HP1-DC6 platform 705 V – FS\*\*\*R07A3\*\*

Ordering code	C <sub>R</sub> μF	V <sub>RDC</sub> V	I <sub>max</sub> <sup>1)</sup> A	L <sub>self</sub> nH	R <sub>S</sub> mΩ	$\hat{I}$ kA	I <sub>S</sub> kA	tanδ 120 Hz	Dimensions L x W x H mm	Weight kg	Fig.
B25655P4607J011	600	450	150	25	0.6	1.5	4.5	10 · 10 <sup>-4</sup>	140 x 72 x 50	0.9	2a
B25655P4607J021 <sup>2)</sup>	600	450	150	25	0.6	1.5	4.5	10 · 10 <sup>-4</sup>	140 x 72 x 50	0.75	2b
B25655P4477J111	470	450	120	25	0.8	1.1	3.0	10 · 10 <sup>-4</sup>	140 x 72 x 50	0.9	2a
B25655P4477J121 <sup>2)</sup>	470	450	120	25	0.8	1.1	3.0	10 · 10 <sup>-4</sup>	140 x 72 x 50	0.75	2b

1) Considering maximum hot spot temperature at +105 °C and cooling efficiency to be validated.

2) Preferred types.

3) Reduced life time, please refer to data sheet.

Green marked lines: New types ...K/J1xx available during 2016.

Red marked line: Not recommended for new designs.

Further mechanical configurations and capacitor values upon request.

2-line EMC filter for HP1-DC6 platform available under preliminary order code P100316-P001.

More information for Infineon HP1-DC6 module, refer to: <http://www.infineon.com/>

# PCC for Infineon HybridPack™ 2 (HP2)

PRELIMINARY

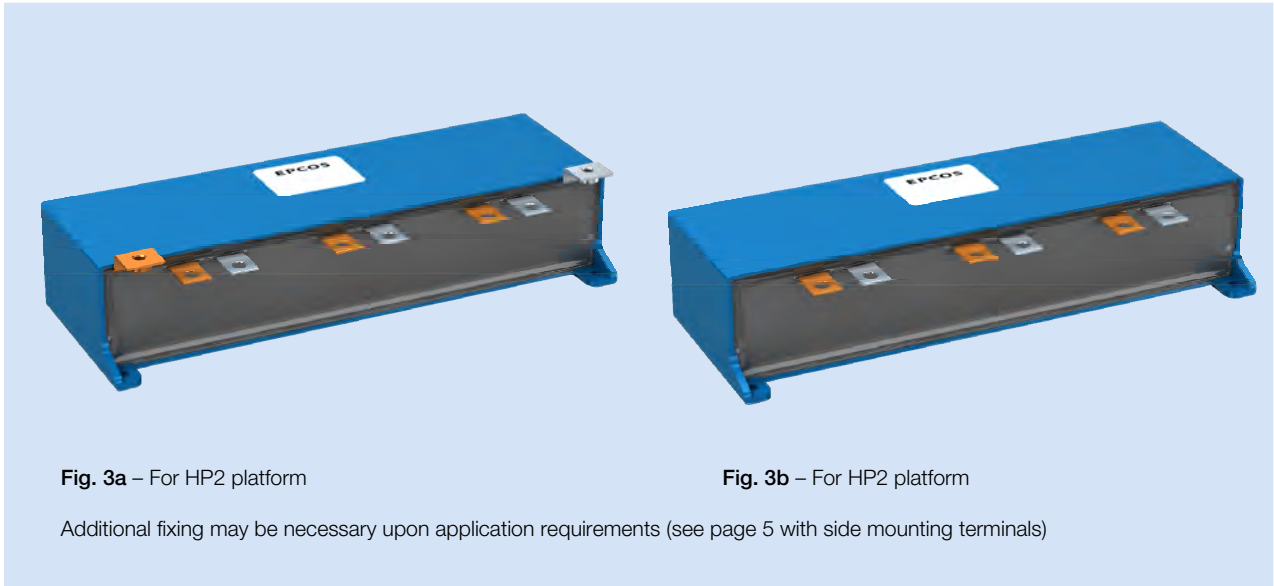


Fig. 3a – For HP2 platform

Fig. 3b – For HP2 platform

Additional fixing may be necessary upon application requirements (see page 5 with side mounting terminals)

## HP2 platform 680 V – FS\*\*\*R07A2\*\*



Ordering code	C <sub>R</sub> μF	V <sub>RDC</sub> V	I <sub>max</sub> <sup>1)</sup> A	L <sub>self</sub> nH	R <sub>S</sub> mΩ	$\hat{I}$ kA	I <sub>S</sub> kA	tanδ 120 Hz	Dimensions L x W x H mm	Weight kg	Fig.
B25655J4507K005	500	450	120	15	1.0	1.5	4.5	5 · 10 <sup>-4</sup>	237 x 72 x 50	1.2	3a
B25655P4707K030	700	450	190	15	0.5	2.5	7.5	5 · 10 <sup>-4</sup>	237 x 72 x 50	1.2	3a
B25655P4907K030	900	450	190	15	0.5	3.0	9.0	5 · 10 <sup>-4</sup>	237 x 72 x 50	1.2	3a
B25655P4108K030	1000	450	190	15	0.5	3.2	10.0	5 · 10 <sup>-4</sup>	237 x 72 x 50	1.2	3a
B25655P4507K130 <sup>2)</sup>	500	450	170	15	0.7	1.8	5.5	5 · 10 <sup>-4</sup>	237 x 72 x 50	1.2	3a
B25655P4507K140 <sup>2)</sup>	500	450	170	15	0.7	1.8	5.5	5 · 10 <sup>-4</sup>	237 x 72 x 50	1.2	3b
B25655P4707K130 <sup>2)</sup>	700	450	170	15	0.7	2.8	8.4	5 · 10 <sup>-4</sup>	237 x 72 x 50	1.2	3a
B25655P4707K140 <sup>2)</sup>	700	450	170	15	0.7	2.8	8.4	5 · 10 <sup>-4</sup>	237 x 72 x 50	1.2	3b
B25655P4857K130	850	450	170	15	0.7	3.1	9.3	5 · 10 <sup>-4</sup>	237 x 72 x 50	1.2	3a
B25655P4857K140	850	450	170	15	0.7	3.1	9.3	5 · 10 <sup>-4</sup>	237 x 72 x 50	1.2	3b
B25655P4907K130 <sup>2)</sup>	900	450	170	15	0.7	3.3	9.9	5 · 10 <sup>-4</sup>	237 x 72 x 50	1.2	3a
B25655P4907K140 <sup>2)</sup>	900	450	170	15	0.7	3.3	9.9	5 · 10 <sup>-4</sup>	237 x 72 x 50	1.2	3b
B25655P4108K130 <sup>3)</sup>	1000	450	170	15	0.7	3.3	10.0	5 · 10 <sup>-4</sup>	237 x 72 x 50	1.2	3a
B25655P4108K140 <sup>3)</sup>	1000	450	170	15	0.7	3.3	10.0	5 · 10 <sup>-4</sup>	237 x 72 x 50	1.2	3b

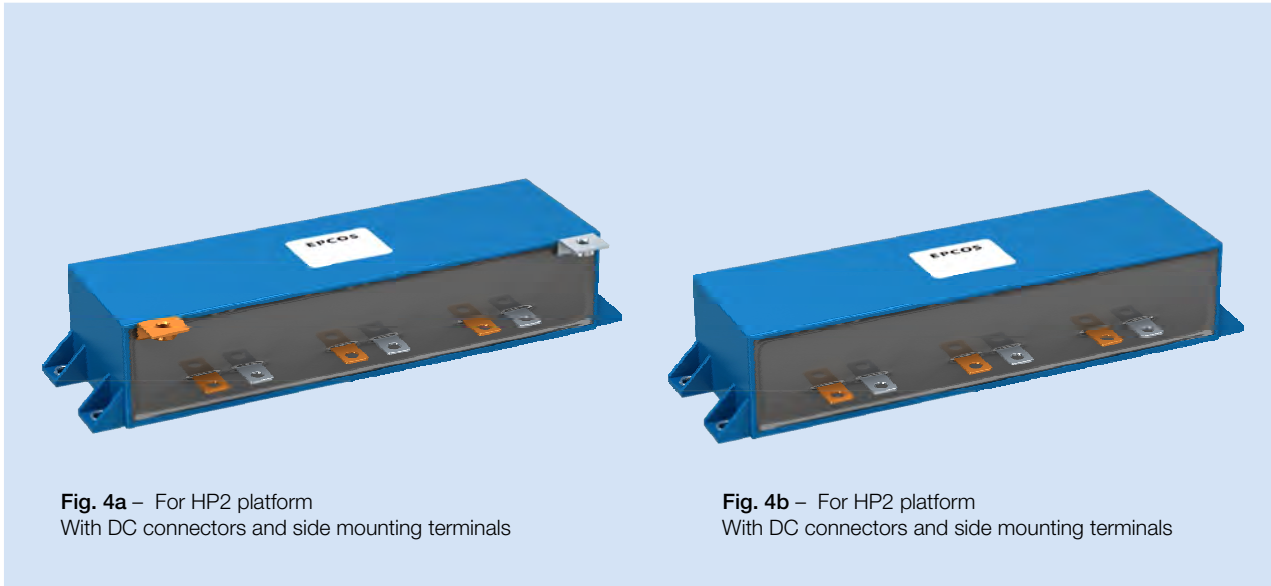
- 1) Considering maximum hot spot temperature at +105 °C and cooling efficiency to be validated.
- 2) Preferred types.
- 3) Reduced life time, please refer to data sheet.

Green marked lines: New types ...K/J1xx available during 2016.

Red marked line: Not recommended for new designs.

# PCC for Infineon HybridPack™ 2 (HP2)

PRELIMINARY



**Fig. 4a** – For HP2 platform  
With DC connectors and side mounting terminals

**Fig. 4b** – For HP2 platform  
With DC connectors and side mounting terminals

## HP2 platform 680 V – FS\*\*\*R07A2\*\*



Ordering code	C <sub>R</sub> μF	V <sub>RDC</sub> V	I <sub>max</sub> <sup>1)</sup> A	L <sub>self</sub> nH	R <sub>S</sub> mΩ	$\hat{I}$ kA	I <sub>S</sub> kA	tanδ 120 Hz	Dimensions L x W x H mm	Weight kg	Fig.
B25655P4707K031	700	450	190	15	0.5	2.5	7.5	5 · 10 <sup>-4</sup>	237 x 72 x 50	1.2	4a
B25655P4907K031	900	450	190	15	0.5	3.0	9.0	5 · 10 <sup>-4</sup>	237 x 72 x 50	1.2	4a
B25655P4108K031	1000	450	190	15	0.5	3.2	10.0	5 · 10 <sup>-4</sup>	237 x 72 x 50	1.2	4a
B25655P4507K131 <sup>2)</sup>	500	450	170	15	0.7	1.8	5.5	5 · 10 <sup>-4</sup>	237 x 72 x 50	1.2	4a
B25655P4507K141 <sup>2)</sup>	500	450	170	15	0.7	1.8	5.5	5 · 10 <sup>-4</sup>	237 x 72 x 50	1.2	4b
B25655P4707K131 <sup>2)</sup>	700	450	170	15	0.7	2.8	8.4	5 · 10 <sup>-4</sup>	237 x 72 x 50	1.2	4a
B25655P4707K141 <sup>2)</sup>	700	450	170	15	0.7	2.8	8.4	5 · 10 <sup>-4</sup>	237 x 72 x 50	1.2	4b
B25655P4857K131	850	450	170	15	0.7	3.1	9.3	5 · 10 <sup>-4</sup>	237 x 72 x 50	1.2	4a
B25655P4857K141	850	450	170	15	0.7	3.1	9.3	5 · 10 <sup>-4</sup>	237 x 72 x 50	1.2	4b
B25655P4907K131 <sup>2)</sup>	900	450	170	15	0.7	3.3	9.9	5 · 10 <sup>-4</sup>	237 x 72 x 50	1.2	4a
B25655P4907K141 <sup>2)</sup>	900	450	170	15	0.7	3.3	9.9	5 · 10 <sup>-4</sup>	237 x 72 x 50	1.2	4b
B25655P4108K131 <sup>3)</sup>	1000	450	170	15	0.7	3.3	10.0	5 · 10 <sup>-4</sup>	237 x 72 x 50	1.2	4a
B25655P4108K141 <sup>3)</sup>	1000	450	170	15	0.7	3.3	10.0	5 · 10 <sup>-4</sup>	237 x 72 x 50	1.2	4b

- 1) Considering maximum hot spot temperature at +105 °C and cooling efficiency to be validated.
- 2) Preferred types.
- 3) Reduced life time, please refer to data sheet.

Green marked lines: New types .../K/J1xx available during 2016.

# PCC for Infineon HybridPack™ Drive (HP Drive)

PRELIMINARY



Fig. 5 – For HP Drive platform  
With side mounting terminals

## HP Drive platform 750 V – FS\*\*\*R08A6\*\*



Ordering code	C <sub>R</sub> μF	V <sub>RDC</sub> V	I <sub>max</sub> <sup>1)</sup> A	L <sub>self</sub> nH	R <sub>S</sub> mΩ	$\hat{I}$ kA	I <sub>S</sub> kA	tanδ 120 Hz	Dimensions L x W x H mm	Weight kg	Fig.
B25655P5507K051	500	500	160	15	0.5	2.0	6.0	5 · 10 <sup>-4</sup>	154 x 72 x 50	0.8	5
B25655P5407K151 <sup>2)</sup>	400	500	150	15	0.6	2.0	6.0	5 · 10 <sup>-4</sup>	154 x 72 x 50	0.8	5

## HP Drive platform 1200 V – FS\*\*\*R12A6\*\*

Ordering code	C <sub>R</sub> μF	V <sub>RDC</sub> V	I <sub>max</sub> <sup>1)</sup> A	L <sub>self</sub> nH	R <sub>S</sub> mΩ	$\hat{I}$ kA	I <sub>S</sub> kA	tanδ 120 Hz	Dimensions L x W x H mm	Weight kg	Fig.
B25655P9127K151 <sup>2)</sup>	120	900	120	15	0.8	3.5	11.0	5 · 10 <sup>-4</sup>	154 x 72 x 50	0.8	5

1) Considering maximum hot spot temperature at +105 °C and cooling efficiency to be validated.

2) Preferred types.

Green marked lines: New types .../K/J1xx available during 2016.

# Cautions and Warnings

PRELIMINARY



Specifications and characteristics	
Capacitance tolerance	K $\pm$ 10% / J $\pm$ 5%
$\tan \delta_0$	$2 \cdot 10^{-4}$
$V_R$	450 / 500 / 900 V DC
$V_S$	600 / 700 / 1300 V DC

Test data	
Voltage between terminals $V_{TT}$	675 / 750 / 1350 V DC, 10 s
Voltage between terminals and case $V_{TC}$	3000 V DC, 10 s
Rins C	$\geq$ 10000 s
Life expectancy	Up to 15 000 hours @ THS <sup>1)</sup>
$\alpha$ FQ	300 fit
Values after Test Ca, IEC 68-2 (21 days, 40 °C, 93% rel. humidity)	
$ \Delta C/C $	$\leq$ 5%
$\Delta \tan \delta$	$\leq 5 \cdot 10^{-4}$
Rins C	$\leq$ 3000 s
Tested based on AEC Q-200 rev. D	

Climatic category	40/105/21
$T_{stg}$	-45 ... +110 °C
$T_{min}$	-40 °C
$T_{max}$	+105 °C
THS (maximum hot spot temperature)	+105 °C
Max. permissible humidity	95%

Construction and general data	
Resin filling	Polyurethane resin
Case	Plastic (Polycarbonate)
Terminals	Flat copper (tinned)
Creepage and clearance distance	Figure 1: 9 mm Figure 2: 8 mm
Cooling	to be confirmed
Degree of protection	Indoor mounting (IP54)
RoHS compliant	

1) To be confirmed; depending on the application

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