Hybrid Vehicles and Electric Vehicles Capacitors

General Description

The FHC1 & FHC2 range capacitor have been specially design to be use in conjunction with Hybrid & Electric vehicles IGBT modules.

DC FILTERING

The series uses a dry-wound (non-oil-filled) segmented metallized polypropylene, which features the controlled self-healing process, specially treated to have a very high dielectric strength in operating conditions up to 115°C.

For more information on how segmented metallized films and controlled self-healing works see a complete presentation.

APPLICATIONS IN ELECTRIC VEHICLES

The FHC series capacitors are specifically designed to prevent ripple currents from reaching back to the power source, and to smooth out DC bus voltage variations. Capacitors are also used to protect semiconductors - originally thyristors, but now IGBTs.

STANDARDS

IEC 61071-1, IEC 61071-2: Power electronic capacitors

AECQ 200: with specific deviation for power capacitors

LIFETIME EXPECTANCY

One unique feature of the segmented metallized technology is how the capacitor acts at the end of its lifetime. Unlike electrolytic capacitors, which are a short circuit failure mode, film capacitors only experience a parametric loss of capacitance with no catastrophic failure mode. The capacitor gradually loses capacitance over its lifetime and eventually becomes an open circuit.

Lifetime, therefore, as it is defined here, is a function of several elements:

- Decrease in capacitance limit 2-5% or to meet customer needs
- Average applied voltage (expressed as a ratio vs nominal rated voltage)
- Average hot spot temperature

By changing any of these parameters we can change the defined “lifetime” of the capacitor. The capacitor will continue to function even beyond the pre-established limit for capacitance decrease.

CONSTRUCTION

The internal construction of the FHC Series is based on several elementary wound bobbins soldered by reinforced solder point on specific bus bar offering, the benefits of which include: flexibility in internal design, current capability and repartition, reduction of thermal expansion constraints, high winding productivity, modularity in three dimensions.

PACKAGING

FHC Series capacitors are enclosed in an unpainted, rectangular, resin filled plastic case. Aluminium cases are available upon request.

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FHC1 & FHC2

HOW TO ORDER

FHC	1	6	I	2637	--
Series FHC: HEV/EV DC-Link	**Case Size** 1 = 170mmx50mm single terminal 2= 237mm x 72mm three terminal	**Dielectric** 6 = PP (polypropylene)	**Voltage** I = 410/450 Vdc J = 700 Vdc C = 900 Vdc	**Capacitance** EIA Code	-- = front facing mounting brackets JH = side facing mounting brackets

CHARACTERISTICS

- Voltage: 410VDC to 900Vdc (standard)
  300VDC to 1400Vdc (custom)
- Capacitance Value: 300µF - 900µF (standard)
  100µF - 1.5mF (custom)
- Working Temperature: -40°C to 105°C hot spot temperature; up to 115°C hot spot for low duration

ELECTRICAL CHARACTERISTICS

Capacitance tolerance	10%
Tan δ_0	2 x 10^{-4}
Test voltage between terminals (10s)	1.5 x Un @ 25ºC
Test voltage between terminals and case (60s 50Hz)	3 kVrms @ 25ºC
Hot spot max ***	105°C / 115ºC low duration
Temp Min	-40°C
Temp Max	+105°C
Storage	+105°C / -40°C
Lifetime: DC/C = -5%	Up to 15 000h ***
Thermal calculation**** (Q in VAR, Rs in Ohms, Rth in °C/W,T° ambiant without cooling plate)	T° Hot-spot = T°ambiant + (2*10^{-4} . Q + Rs . I^2rms) . Rth
Case	PA66 fiber reinforced 30%
Resin	Epoxy resin
Terminals	Flat copper tinned
RoHS compliance	Yes
FIT	< 100FIT @ 40°C

(***) Max hot spot 105°C according to cooling efficiency
(****) Other conditions on request

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FHC1 & FHC2

xx = “- -”

xx = “JH”

RATINGS AND PART NUMBER

Part Number	Capacitance (µF)	Un (Vdc)	Imax (A) (*)	L parasitic inductance nH (**)	Rs (mΩ)	Rth hot spot/bottom (°C/W)	Tanδ 100Hz	Dimension LxWxH (mm)	Lifetime Expectancy Curve
FHC16I0307Kxx	300	450	120	18	0.69	4.4	5×10^{-4}	140 x 72 x 50	A
FHC16I0517Kxx	510	410	150	18	0.51	3.7	5×10^{-4}	140 x 72 x 50	B
FHC16J0267Kxx	260	700	80	18	1.57	4	5×10^{-4}	140 x 72 x 50	C
FHC16C0147Kxx	140	900	70	18	2.09	4	5×10^{-4}	140 x 72 x 50	D

xx = “- -”

xx = “JH”

RATINGS AND PART NUMBER

Part Number	Capacitance (µF)	Un (Vdc)	Imax (A) (*)	L parasitic inductance nH (**)	Rs (mΩ)	Rth hot spot/bottom (°C/W)	Tanδ 100Hz	Dimension LxWxH (mm)	Lifetime Expectancy Curve
FHC26I0507Kxx	500	450	170	15	0.45	2.6	5 x 10-4	237 x 72 x 50	A
FHC26I0707Kxx	700	450	190	15	0.38	2.4	5 x 10-4	237 x 72 x 50	A
FHC26I0907Kxx	900	410	190	15	0.33	2.1	5 x 10-4	237 x 72 x 50	B
FHC26J0507Kxx	500	700	160	15	0.87	2.1	5 x 10-4	237 x 72 x 50	C
FHC26C0267Kxx	260	900	140	18	1.17	2.1	5 x 10-4	237 x 72 x 50	D

(*) Imax Max hot spot 105°C
(**) Measurement at 1MHz
Nb: Upon request FHC are available equiped with thermocouple for thermal measurement
Other value or bus bar design please contact your local AVX rep

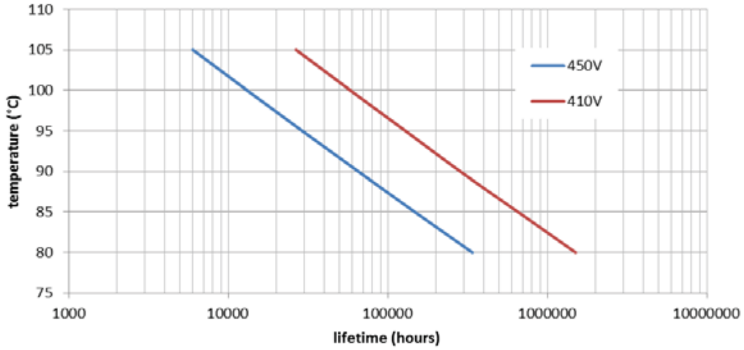
HEV/EV Caps

Hybrid Vehicles and Electric Vehicles Capacitors

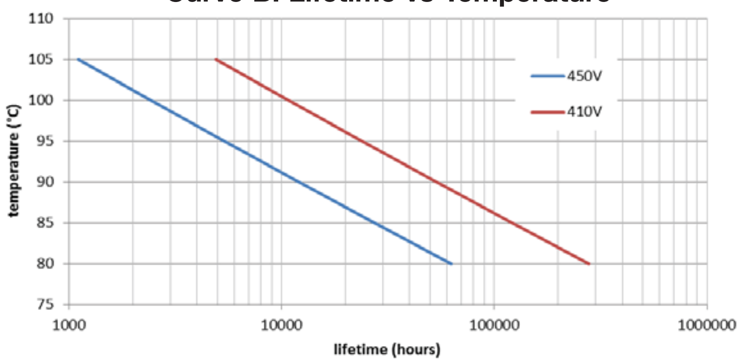
FHC1 & FHC2

LIFETIME EXPECTANCY CURVES

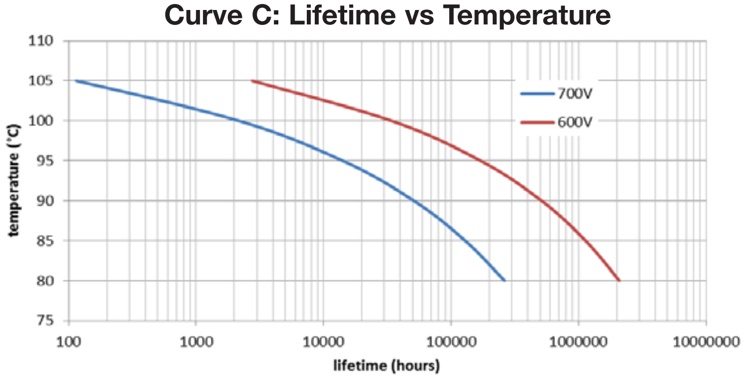
Curve A: Lifetime vs Temperature



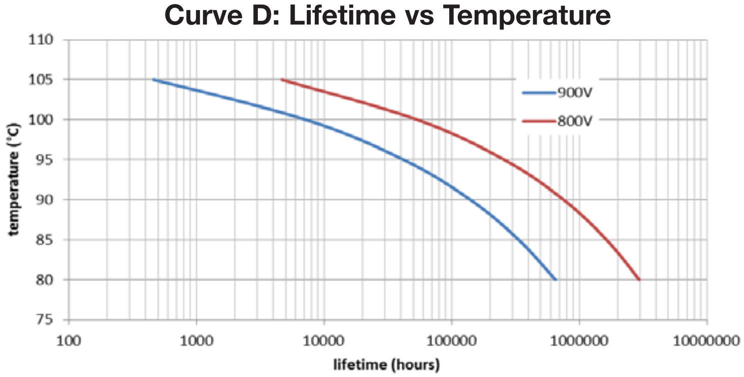
Curve B: Lifetime vs Temperature



Curve C: Lifetime vs Temperature



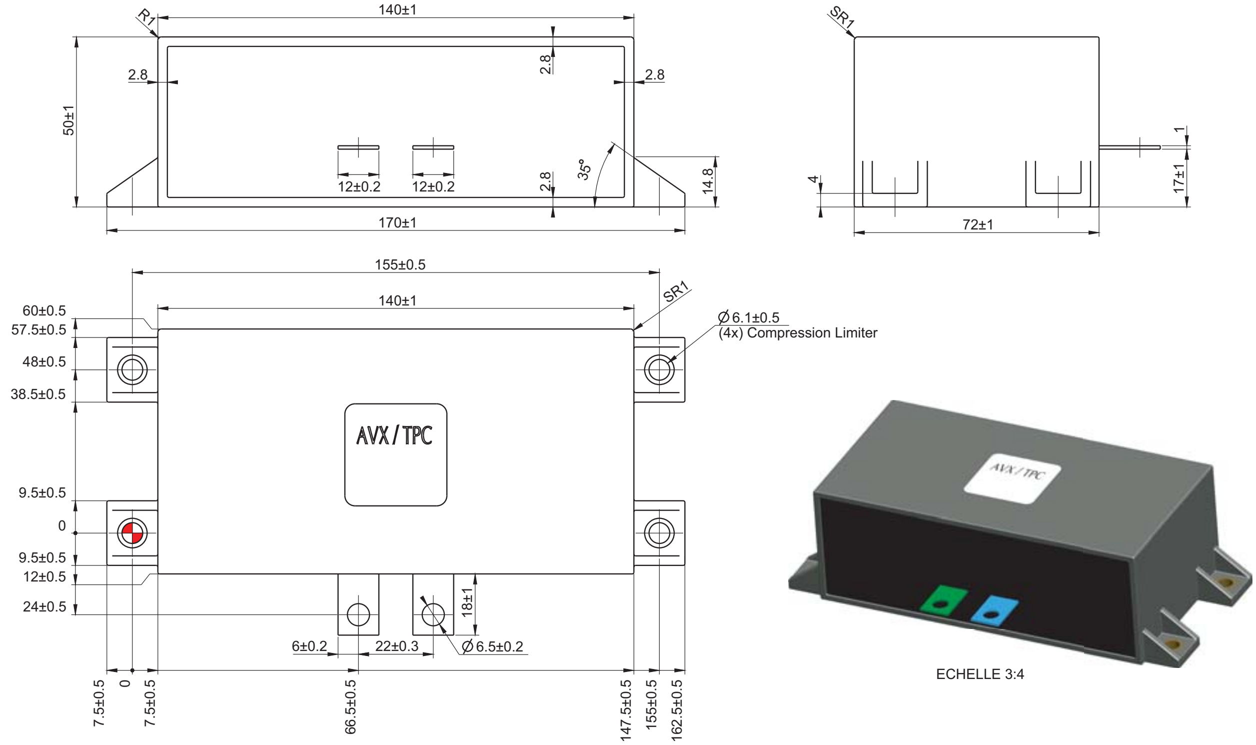
Curve D: Lifetime vs Temperature



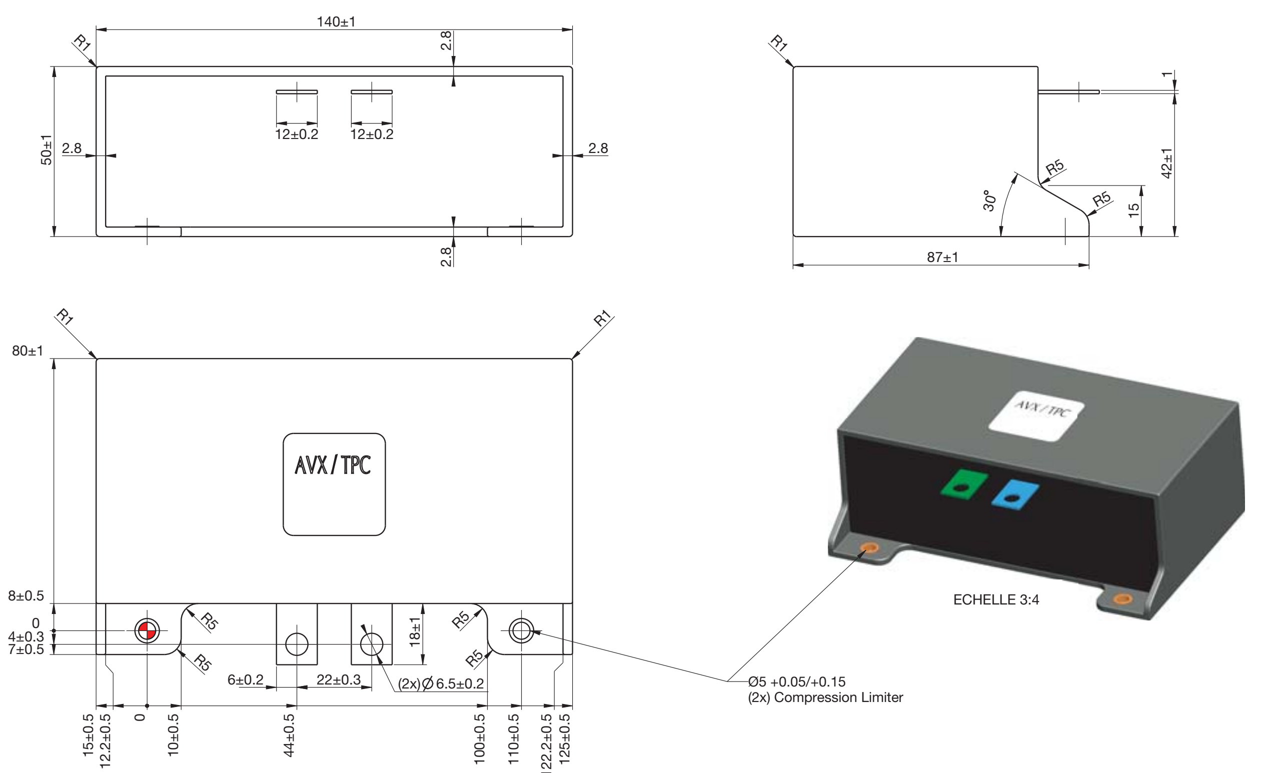
Hybrid Vehicles and Electric Vehicles Capacitors

FHC1

FHC16xxxxxKJH



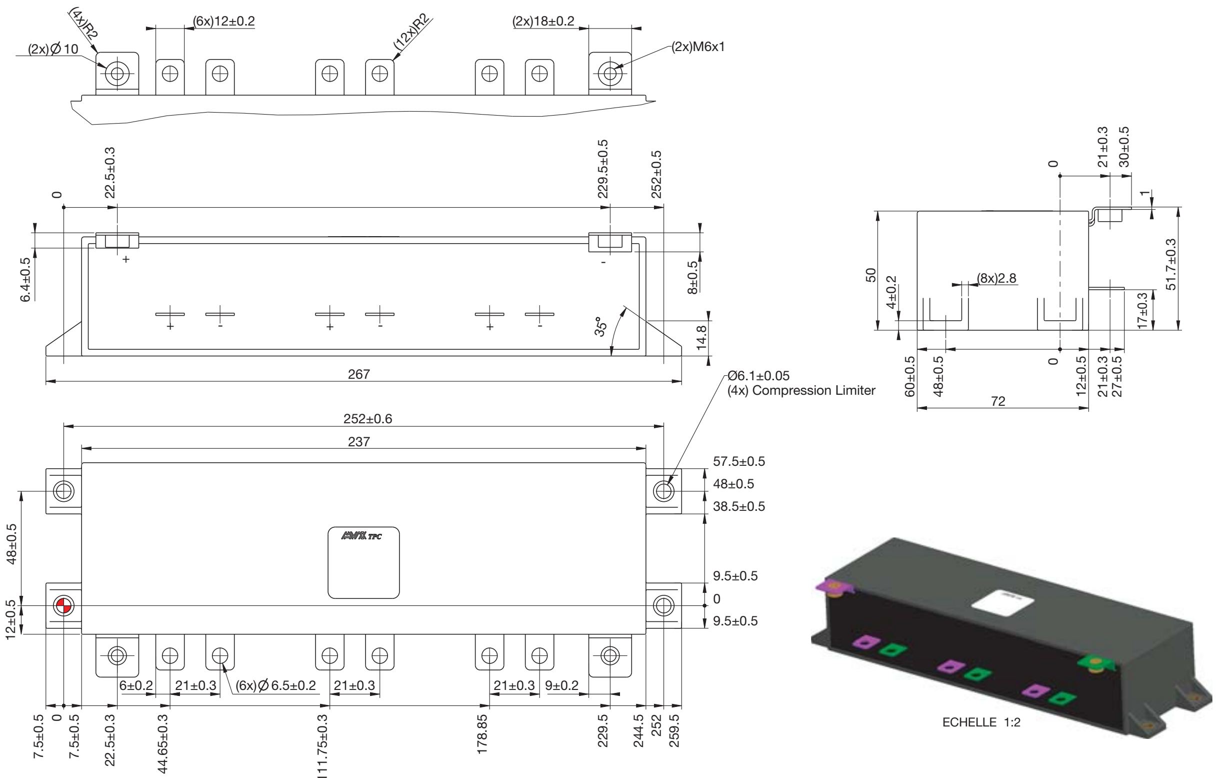
FHC16xxxxxK--



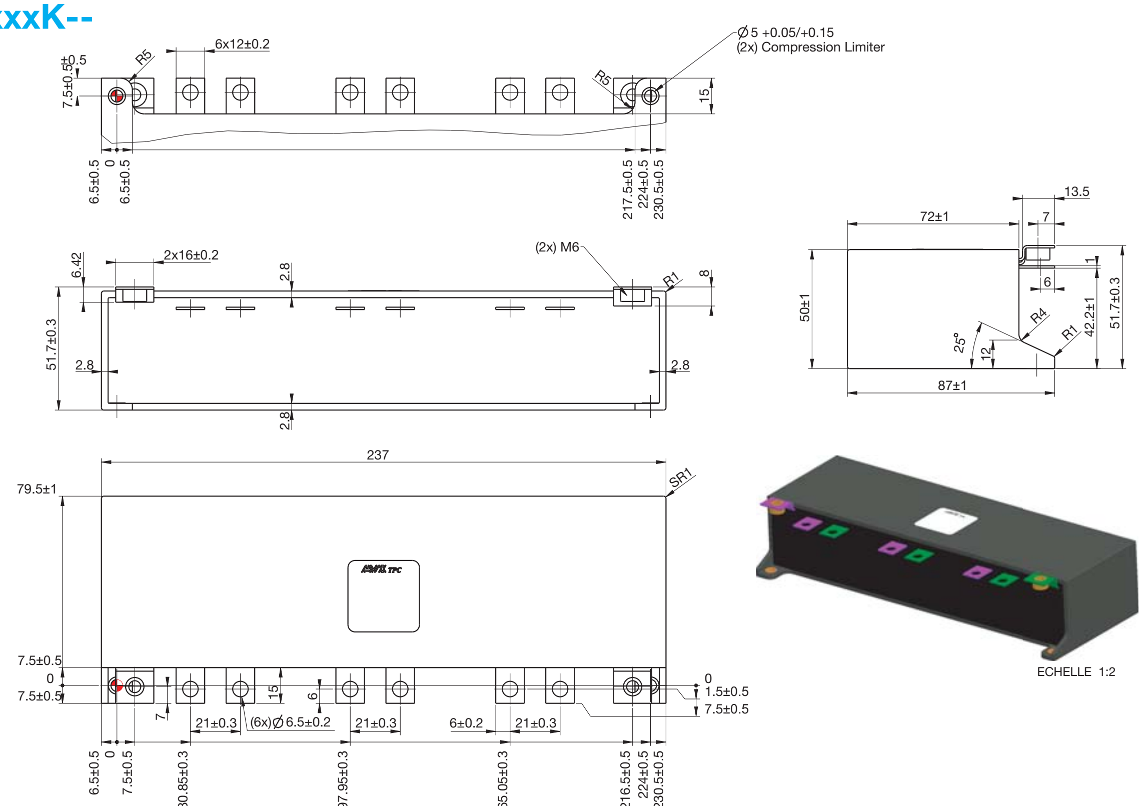
Hybrid Vehicles and Electric Vehicles Capacitors

FHC1 & FHC2

FHC26xxxxxKJH



FHC26xxxK--



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Custom Design Sheet

HEV/EV Caps

Company /Name / Email

Date	
EAU	
Expecte ASP	
Timing for Design	
Customer	
Proposed Catalog PN	

Applications	DC Filtering	
Capacitance (µF)		
Tolerance (%)		
Operating Voltage	Vpeak	
Ripple Voltage (peak to peak)*	V	
Working Frequency (Hz)		
Operating Current*	Arms	
Maximum Current/Duration	Arms Arms	s s
Maximum Inductance (nH)		
Test Voltage between Terminals (V)		
Test Voltage between Shorted Terminals and Case (V)		
Maximum Surge Voltage (MSV)		
MSV Duration / Frequency	s	/year

*Due to the particularities of varying waveforms in such application, more information on the exact nature of waveform is generally required for a full analysis.

Thermal Characteristics						
Storage Temperature (ºC)		Ambient (ºC)	Operating Temperature (ºC)		Cooling Method	
min.			min.		Natural Convection	
average			average		Forced Air (m/s)	
max.			max.		Water cooling plate	

***Providing Mission Profile for U, I and OºC is a must**