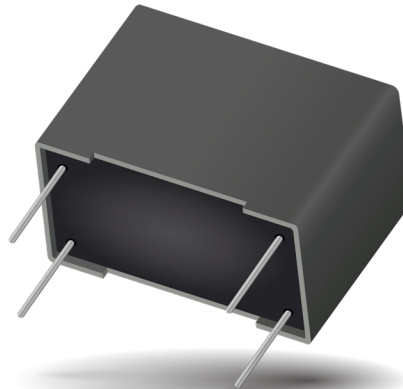
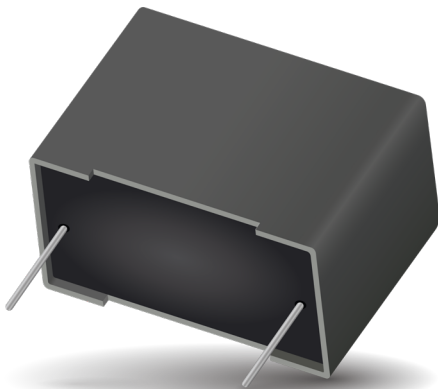




Automotive Medium Power Film Capacitors



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AUTOMOTIVE POWER FILM CAPACITORS



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INTRODUCTION

General Description

DC FILTERING

AVX Power Film series use a wound metallized polypropylene or polyester dielectric. The series are able to operate at a very high dielectric strength up to 105°C hot spot temperature (see specific description). For more information about the self healing process and its features and advantages, please see each individual series or contact AVX directly.

AN ALTERNATIVE TO ELECTROLYTICS

FF series capacitors are an ideal alternative to electrolytic capacitors, because they can withstand much higher levels of surge voltage, very high rms currents and offer longer lifetimes (see section on lifetime as well as determination tables and application notes).

APPLICATIONS

The FF series capacitors are specifically designed for DC filtering and low reactive power. Main applications are: power supplies, motors, drives, electric utilities, induction heating, people movers, tramways, metro systems, unit supported power supplies, etc.

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 of about 2%, with no catastrophic failure mode. The capacitor gradually loses capacitance over its lifetime (like a battery), and eventually becomes an open circuit.

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

- Decrease in capacitance limit (-2% in the example above)
- 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 preestablished limit for capacitance decrease. See lifetime expectancy tables in the individual series data sheets to help in this determination.

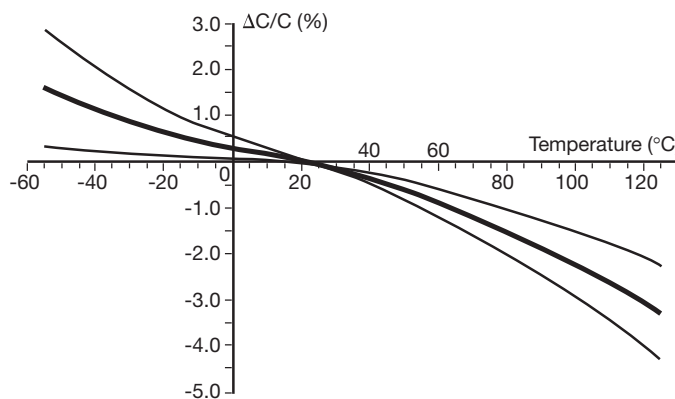
STANDARDS

- IEC 61071-1, IEC 61071-2: Power electronic capacitors
- IEC 60068-1: Environmental testing
- UL 94: Fire requirements
- IEC 60384-2: Fixed metallized polyester capacitors equipment, capacitors for power electronics

ELECTRICAL CHARACTERISTICS FOR POLYPROPYLENE AND POLYESTER DIELECTRIC CAPACITANCE FOR POLYPROPYLENE DIELECTRIC

Polypropylene has a constant dielectric constant, irrespective of frequency up to 1 MHz: $\epsilon_r = 2.2$

POLYPROPYLENE DIELECTRIC CAPACITANCE vs TEMPERATURE



GRAPH 1

TANGENT OF LOSS ANGLE ($\tan \delta_0$) FOR POLYPROPYLENE DIELECTRIC

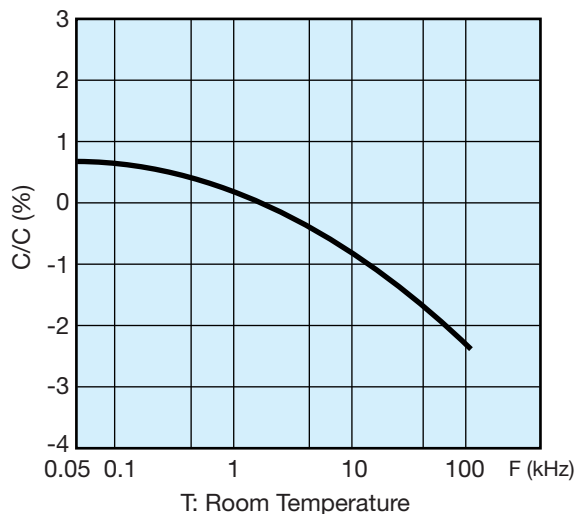
Polypropylene has a constant dielectric loss factor of 2×10^{-4} irrespective of temperature and frequency (up to 1 MHz).

INTRODUCTION

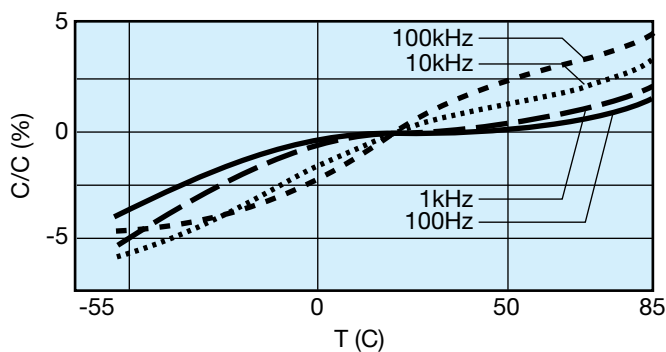
General Description

CAPACITANCE FOR POLYESTER DIELECTRIC

Capacitance of polyester capacitors is a function of temperature and frequency (see the curves).



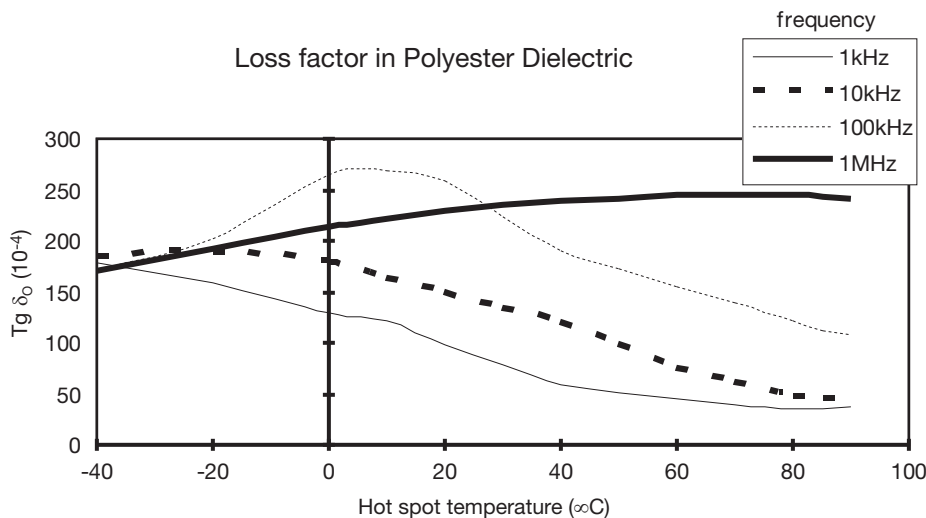
GRAPH 2



GRAPH 3

TANGENT OF LOSS ANGLE (TAN δ_0) FOR POLYESTER DIELECTRIC

Dielectric loss factor of polyester is a function of temperature and frequency (see the curves).



GRAPH 4

HOT SPOT TEMPERATURE

The maximum operating (hot spot) temperature of film capacitors can be calculated in the following manner:

The loss factor of the capacitor is made up of the sum of two components. The first represents electrical losses in the dielectric and the second component represents the Joule heating effect in the external connection and foils ($R_s \cdot C \cdot 2 \pi f$).

For all applications, the temperature in the hot spot must be lower than the maximum operating temperature for the particular capacitor series.

$$\theta_{\text{hot spot}} = \theta_{\text{ambient}} + [\text{tg } \delta_0 \cdot Q + R_s \cdot (I_{\text{rms}})^2] \cdot R_{\text{th}}$$

With:

Q : Reactive power in Var

R_s in Ohm

I_{rms} in Ampere

R_{th} : R_{th} ambient / hot spot in °C/W

$\text{tg } \delta_0 (10^{-4})$ is the tangent of loss angle [see $\text{tan } \delta_0$ page 2 (polypropylene) and graph 4 above (polyester)]

DC FILTERING

FA/FQ *RoHS Compliant



PACKAGING MATERIAL

Self-extinguishing plastic case (V0=in accordance with UL 94) filled thermosetting resin.

Self-extinguishing thermosetting resin(V0=in accordance with UL 94)

STANDARDS

- IEC 61071-1: Power electronic capacitors
- IEC 61071-2: Power electronic capacitors
- IEC 60384-16: Fixed metallized polypropylene film dielectric DC capacitors
- IEC 60384-16-1: Fixed metallized polypropylene film dielectric DC capacitors
Assessment level E
- IEC 60384-17: Fixed metallized polypropylene film dielectric AC and pulse capacitors
- IEC 60384-17-1: Fixed metallized polypropylene film dielectric AC and pulse capacitors
Assessment level E. AEC-Q200

HOW TO ORDER

FQ	27	G*	6	K	0685	K	A
Series	Pitch	Case Size	Type	Voltage	Cap µF Code	Tolerance	Pitch P2
FA (2 pin) FQ (4 pin)	27 = 27.5mm 37 = 37.5mm 52 = 52.5mm	E* for P=27.5mm F* for P=37.5mm G* for P=52.5mm	6 = Polypropylene	I = 450V A = 700V B = 800V C = 900V L = 1100V P = 1200V		J = ± 5% K = ±10% M = ±20%	A = 10.2 B = 20.3 C = 2 pins

(1) FA for 2 pins & FQ for 4 pins

(2) For Pitch P2, add D&E for 6 pins & 12pins products, and the P2 for 6 pins and 12pins is 20.3mm

GENERAL DESCRIPTION

The FA/FQ series uses a non-impregnated metallized polypropylene dielectric specially treated to have a very high dielectric strength in operation condition up to 105°C.

FA/FQ series meets Automotive Electronics Council's AEC-Q200 qualification requirements.

GENERAL CHARACTERISTICS

- Automotive Grade (AEC-Q200)
- Able to Withstand Harsh Environment Conditions
- Low Profile Available

FEATURES & BENEFITS

- High Performance DC Filter
- Low ESR, High Peak & RMS Current
- AEC-Q200 Qualified

APPLICATIONS

- For medium power DC applications
- Renewable Energy Inverter
- OBC & Automotive Applications
- Motor Drives
- Industrial Power Supply

OPERATING TEMPERATURE RANGE

- Operating temperature range: -40°C to +105°C

LIFETIME EXPECTANCY

One unique feature of this technology (versus aluminum electrolytics) is how the capacitor reacts at the end of its lifetime.

Unlike aluminum electrolytic, film capacitors do not have a catastrophic failure mode. Film capacitors simply experience a parametric loss of capacitance of about 3% of initial value, with no risk of a short circuit.

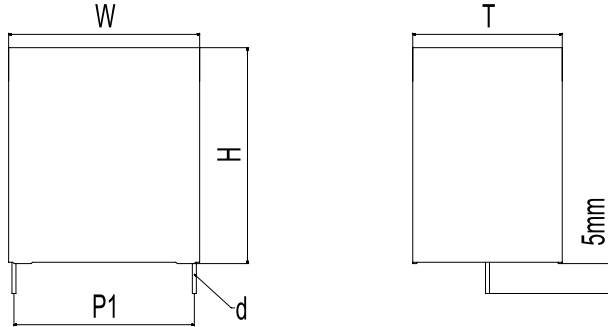
The capacitor continues to be functional even after this 3% decrease.

DC FILTERING

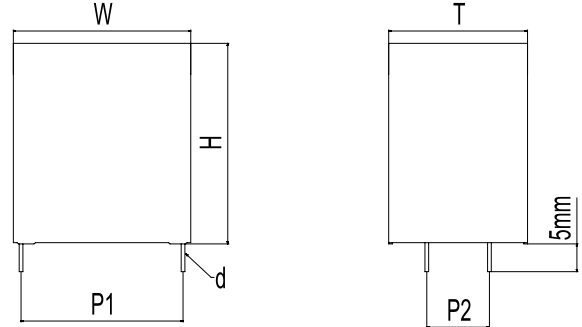
FA/FQ *RoHS Compliant

DIMENSIONS

2 PIN



4 PIN



HOT SPOT CALCULATION

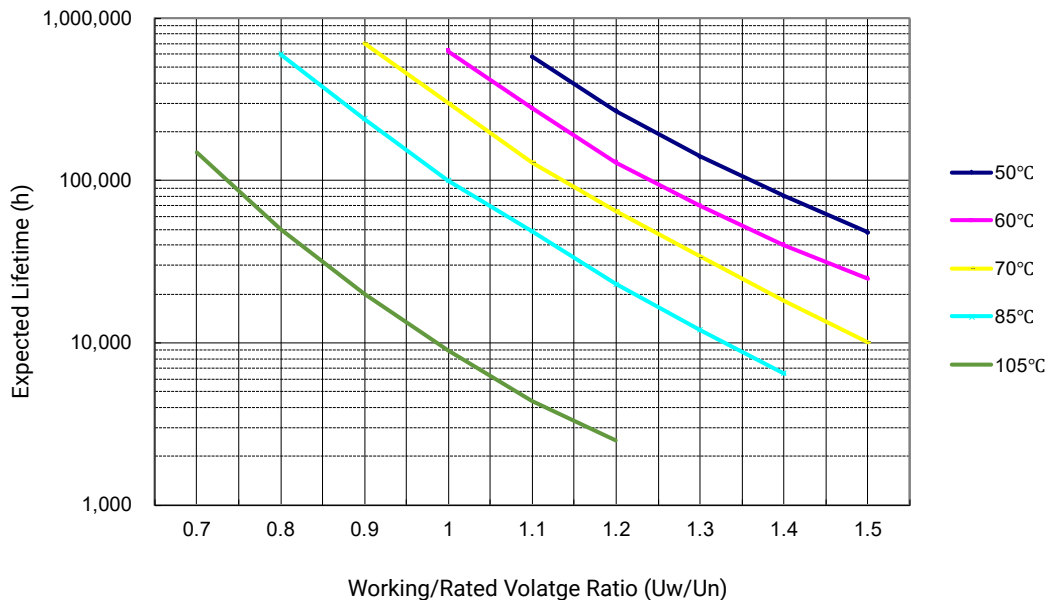
See Hot Spot Temperature, page 2.

$\theta_{\text{hot spot}} = \theta_{\text{ambient}} + (P_d + P_t) \times R_{th}$
 with P_d (Dielectric losses) = $Q \times \text{tg}\delta_0$
 $Q \times \text{tg}\delta_0 \Rightarrow \left[\frac{1}{2} \times C_n \times (V_{\text{peak to peak}})^2 \times f \right] \times \text{tg}\delta_0$
 $\text{tg}\delta_0$ (tan delta)
 For polypropylene, $\text{tg}\delta_0 = 2 \times 10^{-4}$ for frequencies up to 1MHz and is independent of temperatures.

$$P_t \text{ (Thermal losses)} = R_s \times (I_{\text{rms}})^2$$

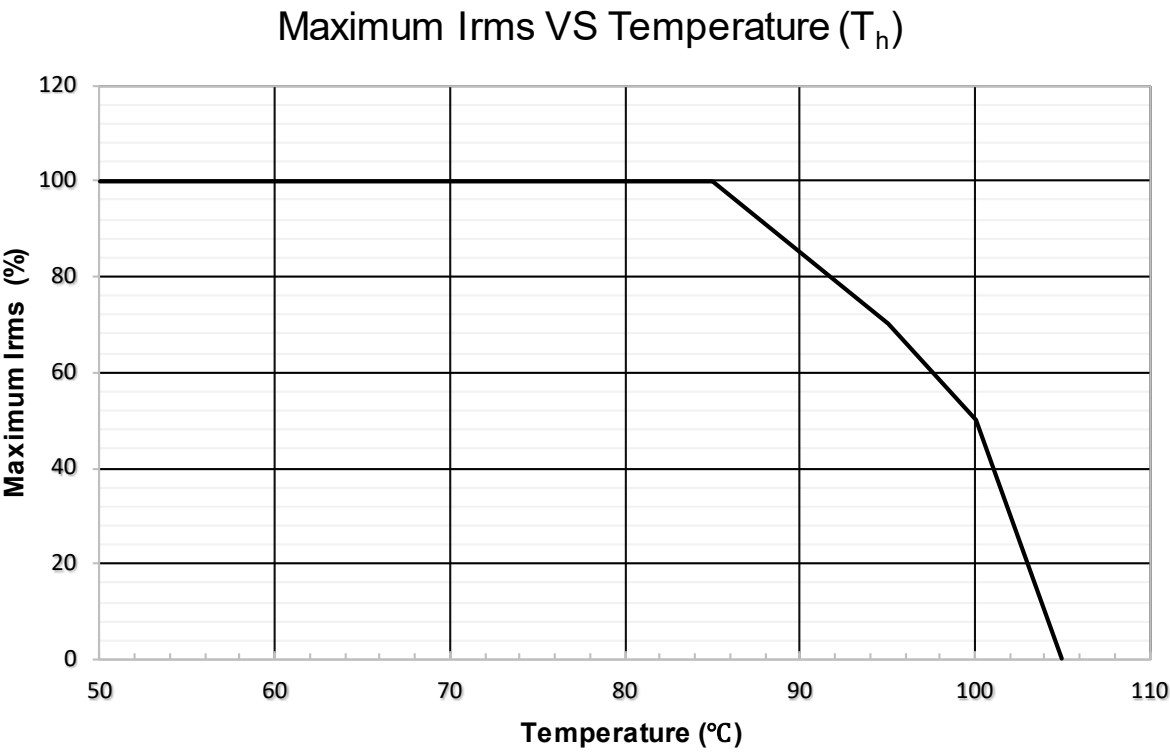
where C_n in Farad I_{rms} in Ampere f in Hertz
 V in Volt R_s in Ohm θ in °C
 R_{th} in °C/W

TYPICAL LIFETIME* CHARACTERISTICS

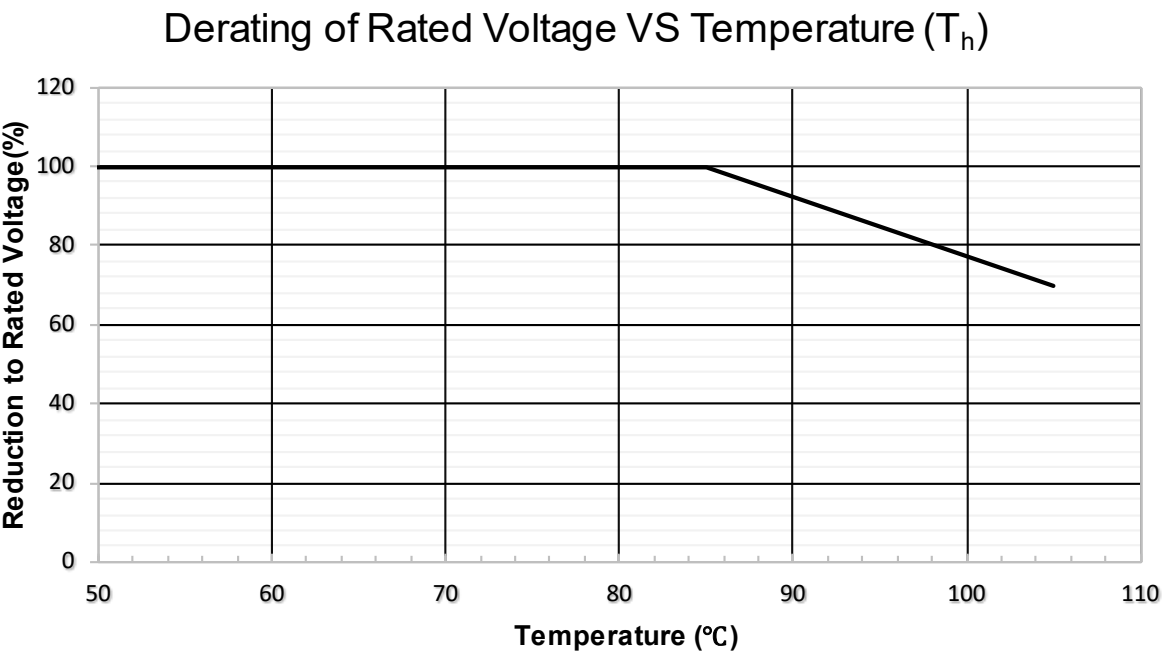


*Lifetime is the number of operating hours required for the capacitor to lose 3% of its initial value.

MAXIMUM IRMS VS TEMPERATURE



VOLTAGE VS TEMPERATURE



DC FILTERING

FA *RoHS Compliant

POLYPROPYLENE DIELECTRIC FOR INDUSTRIAL DC FILTERING

These capacitors have been designed primarily for medium power automotive DC filtering applications.

ELECTRICAL CHARACTERISTICS – POLYPROPYLENE DIELECTRIC

Items	Characteristics
Application	DC Filtering / DC Link
Reference Standard	IEC 61071, IEC 60384-16, AEC-Q200D
Climatic Category	40/105/56 IEC 60068-1
Operating Temperature Range	-40~ +105°C (+85°C observing voltage must be de-rating at 1.35% per °C)
Upper Temperature Tmax	+85°C IEC 61071, Endurance Test Temperature
Lower Temperature Tmin	-40°C
Rated Voltage	450Vdc ~ 1200Vdc
Capacitance Range	1.0μF ~ 80μF
Capacitance Tolerance	±5% or ±10% at +25°C
Dissipation Factor (DF)	≤ 0.002 (0.20%) at 1 KHz. C≤20μF at +25°C ≤ 0.003 (0.30%) at 1 KHz. C>20μF at +25°C
Test Voltage Between Terminals	1.5 x rated voltage for 10s (terminal to terminal)
Test Voltage Terminal to Case	3.0kVrms 50 Hz for 10 sec at +25°C
Insulation Resistance	IR x C ≥ 30,000 Seconds at 100VDC 1 minute at +25°C
Life Expectancy	100,000 hours at Un @ Hot-Spot temperature T=+70°C
Protection	Solvent resistant plastic case UL94 V-0 Thermosetting resin sealing UL 94 V-0 compliant
Installation	Any position
Leads	Tinned copper wires, standard lead wire length 5 ±1mm
Packaging	Packed in cardboard boxes with protection for the terminals
RoHS Compliant	Compliant with the restricted substance requirements of Directive 2002/95/EC
Storage Conditions	Storage time: ≤ 24 months from the date marked on the label package Temperature and relative humidity should be -10°C ~ +40°C and not more than 75%RH. RH ≤ 85% for 30 days randomly distributed throughout the year
Humidity Test	Test conditions & performance: Temperature: +40°C±2°C Relative humidity (RH) :93% ±2% Test duration: 56 days Capacitance change: ≤5% DF change (Δtgδ): ≤50 X 10 ⁻⁴ at 1KHz Insulation resistance: ≥50% of initial limit
Endurance Test	Test conditions & performance: Temperature: +85°C±2°C Voltage applied:1.3 X V _R (d.c.) Test duration: 1000 hours Capacitance change: ≤5% DF change (Δ tgδ): ≤50 X 10 ⁻⁴ at 1KHz Insulation resistance: ≥50% of initial limit
THB Test (Damp heat test with loading)	Test conditions & performance: Temperature: +85°C±2°C Relative humidity (RH) :85% ±2% Loading Voltage: Rated Voltage (DC) Test duration: 1000 hours Capacitance change: ≤5%

DC FILTERING

FA *RoHS Compliant



CASE CODE

mm

Case Code	Dimensions				
	W ± 0.5	H ± 0.5	T ± 0.5	P1 ± 1.0	d ± 0.05
	mm	mm	mm	mm	mm
E1	32.0	20.0	11.0	27.5	0.8
E2	32.0	22.0	13.0	27.5	0.8
E4	32.0	28.0	18.0	27.5	0.8
EC	32.0	18.0	9.0	27.5	0.8
EE	32.0	24.5	15.0	27.5	0.8
EG	32.0	31.0	21.0	27.5	0.8
EI	32.0	35.0	20.0	27.5	0.8
F4	42.5	36.0	19.0	37.5	1.0
F5	42.5	38.0	20.0	37.5	1.0
F8	42.5	44.0	24.0	37.5	1.0
F9	42.5	45.0	30.0	37.5	1.0
G9	57.5	45.0	25.0	52.5	1.2
GA	57.5	45.0	30.0	52.5	1.2
GC	57.5	50.0	35.0	52.5	1.2

RATING & PART NUMBER REFERENCE

Cap	Rated Voltage	AVX PN	Voltage Code	Case Code	Dimensions					dv/dt	Peak Current	I _{rms}	ESR 10KHz	R _{th}	ESL	SPQ
					W ± 0.5	H ± 0.5	T ± 0.5	P1 ± 1.0	d ± 0.05							
					mm	mm	mm	mm	mm							
uF	V									V/us	A	A	mΩ	°C/W	nH	pcs
Voltage V _{ndc} 450V																
1.0	450	FA27EC6I0105*C	I	EC	32.0	18.0	9.0	27.5	0.8	75	75	2.5	54.0	44.4	25	180
2.0	450	FA27EC6I0205*C	I	EC	32.0	18.0	9.0	27.5	0.8	75	150	3.0	34.5	48.3	25	180
3.0	450	FA27E16I0305*C	I	E1	32.0	20.0	11.0	27.5	0.8	75	225	4.0	23.0	40.8	25	150
4.0	450	FA27E16I0405*C	I	E1	32.0	20.0	11.0	27.5	0.8	75	300	4.0	20.5	45.7	25	150
5.0	450	FA27E26I0505*C	I	E2	32.0	22.0	13.0	27.5	0.8	75	375	5.0	16.5	36.4	25	120
6.0	450	FA27EE6I0605*C	I	EE	32.0	24.5	15.0	27.5	0.8	75	450	6.0	13.5	30.9	25	110
7.0	450	FA27EE6I0705*C	I	EE	32.0	24.5	15.0	27.5	0.8	75	525	6.5	11.5	30.9	25	110
8.0	450	FA27E46I0805*C	I	E4	32.0	28.0	18.0	27.5	0.8	75	600	8.5	8.5	24.4	25	90
9.0	450	FA27E46I0905*C	I	E4	32.0	28.0	18.0	27.5	0.8	75	675	8.5	9.0	23.1	25	90
10.0	450	FA27E46I0106*C	I	E4	32.0	28.0	18.0	27.5	0.8	75	750	9.0	8.0	23.1	25	90
12.0	450	FA27EG6I0126*C	I	EG	32.0	31.0	21.0	27.5	0.8	75	900	10.0	7.0	21.4	25	80
15.0	450	FA27EI6I0156*C	I	EI	32.0	35.0	20.0	27.5	0.8	75	1125	11.5	6.0	18.9	25	80
10.0	450	FA37F46I0106*C	I	F4	42.5	36.0	19.0	37.5	1.0	40	400	7.5	13.5	19.8	30	56
12.0	450	FA37F46I0126*C	I	F4	42.5	36.0	19.0	37.5	1.0	40	480	8.0	11.5	20.4	30	56
15.0	450	FA37F46I0156*C	I	F4	42.5	36.0	19.0	37.5	1.0	40	600	9.0	9.0	20.6	30	56
20.0	450	FA37F56I0206*C	I	F5	42.5	38.0	20.0	37.5	1.0	40	800	11.0	7.0	17.7	30	56
22.0	450	FA37F56I0226*C	I	F5	42.5	38.0	20.0	37.5	1.0	40	880	11.0	7.5	16.5	30	56
25.0	450	FA37F56I0256*C	I	F5	42.5	38.0	20.0	37.5	1.0	40	1000	11.5	6.5	17.4	30	56
30.0	450	FA37F86I0306*C	I	F8	42.5	44.0	24.0	37.5	1.0	40	1200	13.5	5.5	15.0	30	49
35.0	450	FA37F96I0356*C	I	F9	42.5	45.0	30.0	37.5	1.0	40	1400	17.0	4.0	13.0	30	35
40.0	450	FA37F96I0406*C	I	F9	42.5	45.0	30.0	37.5	1.0	40	1600	17.0	4.0	13.0	30	35
40.0	450	FA52G96I0406*C	I	G9	57.5	45.0	25.0	52.5	1.2	20	800	13.0	6.5	13.7	35	30
45.0	450	FA52G96I0456*C	I	G9	57.5	45.0	25.0	52.5	1.2	20	900	12.5	7.0	13.7	35	30
50.0	450	FA52GA6I0506*C	I	GA	57.5	45.0	30.0	52.5	1.2	20	1000	15.0	5.5	12.1	35	25
55.0	450	FA52GA6I0556*C	I	GA	57.5	45.0	30.0	52.5	1.2	20	1100	15.0	5.5	12.1	35	25
60.0	450	FA52GA6I0606*C	I	GA	57.5	45.0	30.0	52.5	1.2	20	1200	15.5	5.0	12.5	35	25
65.0	450	FA52GC6I0656*C	I	GC	57.5	50.0	35.0	52.5	1.2	20	1300	19.0	4.0	10.4	35	20
70.0	450	FA52GC6I0706*C	I	GC	57.5	50.0	35.0	52.5	1.2	20	1400	18.0	4.5	10.3	35	20
75.0	450	FA52GC6I0756*C	I	GC	57.5	50.0	35.0	52.5	1.2	20	1500	19.0	4.0	10.4	35	20
80.0	450	FA52GC6I0806*C	I	GC	57.5	50.0	35.0	52.5	1.2	20	1600	19.0	4.0	10.4	35	20
Voltage V _{ndc} 700V																
1.0	700	FA27EC6A0105*C	A	EC	32.0	18.0	9.0	27.5	0.8	75	75	2.5	54.0	44.4	25	180
2.0	700	FA27EC6A0205*C	A	EC	32.0	18.0	9.0	27.5	0.8	75	150	3.0	34.5	48.3	25	180
3.0	700	FA27E16A0305*C	A	E1	32.0	20.0	11.0	27.5	0.8	75	225	4.0	23.0	40.8	25	150



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DC FILTERING

FA *RoHS Compliant



RATING & PART NUMBER REFERENCE

Cap	Rated Voltage	AVX PN	Voltage Code	Case Code	Dimensions					dv/dt	Peak Current	I _{rms}	ESR 10KHz	R _{th}	ESL	SPQ
					W ± 0.5 mm	H ± 0.5 mm	T ± 0.5 mm	P1 ± 1.0 mm	d ± 0.05 mm							
uF	V									V/us	A	A	mΩ	°C/W	nH	pcs
4.0	700	FA27E26A0405*C	A	E2	32.0	22.0	13.0	27.5	0.8	75	300	5.0	17.0	35.3	25	120
5.0	700	FA27EE6A0505*C	A	EE	32.0	24.5	15.0	27.5	0.8	75	375	6.0	14.0	29.8	25	110
6.0	700	FA27E46A0605*C	A	E4	32.0	28.0	18.0	27.5	0.8	75	450	7.5	11.5	23.2	25	90
7.0	700	FA27E46A0705*C	A	E4	32.0	28.0	18.0	27.5	0.8	75	525	8.0	10.0	23.4	25	90
8.0	700	FA27E46A0805*C	A	E4	32.0	28.0	18.0	27.5	0.8	75	600	8.5	8.5	24.4	25	90
9.0	700	FA27EG6A0905*C	A	EG	32.0	31.0	21.0	27.5	0.8	75	675	10.0	7.5	20.0	25	80
10.0	700	FA27EG6A0106*C	A	EG	32.0	31.0	21.0	27.5	0.8	75	750	10.0	7.0	21.4	25	80
12.0	700	FA27EI6A0126*C	A	EI	32.0	35.0	20.0	27.5	0.8	75	900	11.5	6.0	18.9	25	80
10.0	700	FA37F46A0106*C	A	F4	42.5	36.0	19.0	37.5	1.0	40	400	7.5	13.5	19.8	30	56
12.0	700	FA37F46A0126*C	A	F4	42.5	36.0	19.0	37.5	1.0	40	480	8.0	11.5	20.4	30	56
15.0	700	FA37F46A0156*C	A	F4	42.5	36.0	19.0	37.5	1.0	40	600	9.0	9.0	20.6	30	56
20.0	700	FA37F56A0206*C	A	F5	42.5	38.0	20.0	37.5	1.0	40	800	11.0	7.0	17.7	30	56
22.0	700	FA37F86A0226*C	A	F8	42.5	44.0	24.0	37.5	1.0	40	880	13.0	6.0	14.8	30	49
25.0	700	FA37F86A0256*C	A	F8	42.5	44.0	24.0	37.5	1.0	40	1000	13.5	5.5	15.0	30	49
30.0	700	FA37F96A0306*C	A	F9	42.5	45.0	30.0	37.5	1.0	40	1200	16.0	4.5	13.0	30	35
35.0	700	FA37F96A0356*C	A	F9	42.5	45.0	30.0	37.5	1.0	40	1400	17.0	4.0	13.0	30	35
30.0	700	FA52G96A0306*C	A	G9	57.5	45.0	25.0	52.5	1.2	20	600	11.0	9.0	13.8	35	30
35.0	700	FA52G96A0356*C	A	G9	57.5	45.0	25.0	52.5	1.2	20	700	12.0	7.5	13.9	35	30
40.0	700	FA52G96A0406*C	A	G9	57.5	45.0	25.0	52.5	1.2	20	800	13.0	6.5	13.7	35	30
45.0	700	FA52GA6A0456*C	A	GA	57.5	45.0	30.0	52.5	1.2	20	900	14.5	6.0	11.9	35	25
50.0	700	FA52GA6A0506*C	A	GA	57.5	45.0	30.0	52.5	1.2	20	1000	15.0	5.5	12.1	35	25
55.0	700	FA52GC6A0556*C	A	GC	57.5	50.0	35.0	52.5	1.2	20	1100	17.0	5.0	10.4	35	20
60.0	700	FA52GC6A0606*C	A	GC	57.5	50.0	35.0	52.5	1.2	20	1200	18.0	4.5	10.3	35	20
65.0	700	FA52GC6A0656*C	A	GC	57.5	50.0	35.0	52.5	1.2	20	1300	19.0	4.0	10.4	35	20
Voltage Vndc 800V					Voltage Code B											
1.0	800	FA27EC6B0105*C	B	EC	32.0	18.0	9.0	27.5	0.8	75	75	2.0	62.5	60.0	25	180
2.0	800	FA27E16B0205*C	B	E1	32.0	20.0	11.0	27.5	0.8	75	150	3.5	31.0	39.5	25	150
3.0	800	FA27E26B0305*C	B	E2	32.0	22.0	13.0	27.5	0.8	75	225	4.5	21.0	35.3	25	120
4.0	800	FA27EE6B0405*C	B	EE	32.0	24.5	15.0	27.5	0.8	75	300	5.5	15.5	32.0	25	110
5.0	800	FA27E46B0505*C	B	E4	32.0	28.0	18.0	27.5	0.8	75	375	7.0	12.5	24.5	25	90
6.0	800	FA27E46B0605*C	B	E4	32.0	28.0	18.0	27.5	0.8	75	450	7.5	10.5	25.4	25	90
7.0	800	FA27EG6B0705*C	B	EG	32.0	31.0	21.0	27.5	0.8	75	525	9.0	9.0	20.6	25	80
8.0	800	FA27EG6B0805*C	B	EG	32.0	31.0	21.0	27.5	0.8	75	600	9.5	8.0	20.8	25	80
9.0	800	FA27EI6B0905*C	B	EI	32.0	35.0	20.0	27.5	0.8	75	675	10.0	8.0	18.8	25	80
10.0	800	FA37F46B0106*C	B	F4	42.5	36.0	19.0	37.5	1.0	40	400	8.0	12.5	18.8	30	56
12.0	800	FA37F46B0126*C	B	F4	42.5	36.0	19.0	37.5	1.0	40	480	8.5	10.5	19.8	30	56
15.0	800	FA37F56B0156*C	B	F5	42.5	38.0	20.0	37.5	1.0	40	600	10.0	8.5	17.6	30	56
20.0	800	FA37F86B0206*C	B	F8	42.5	44.0	24.0	37.5	1.0	40	800	13.0	6.0	14.8	30	49
22.0	800	FA37F96B0226*C	B	F9	42.5	45.0	30.0	37.5	1.0	40	880	14.5	5.5	13.0	30	35
25.0	800	FA37F96B0256*C	B	F9	42.5	45.0	30.0	37.5	1.0	40	1000	15.5	5.0	12.5	30	35
30.0	800	FA52G96B0306*C	B	G9	57.5	45.0	25.0	52.5	1.2	10	300	12.0	8.0	13.0	35	30
35.0	800	FA52GA6B0356*C	B	GA	57.5	45.0	30.0	52.5	1.2	10	350	13.0	7.0	12.7	35	25
40.0	800	FA52GA6B0406*C	B	GA	57.5	45.0	30.0	52.5	1.2	10	400	14.5	6.0	11.9	35	25
45.0	800	FA52GC6B0456*C	B	GC	57.5	50.0	35.0	52.5	1.2	10	450	16.0	5.5	10.7	35	20
50.0	800	FA52GC6B0506*C	B	GC	57.5	50.0	35.0	52.5	1.2	10	500	17.0	5.0	10.4	35	20
Voltage Vndc 900V					Voltage Code C											
1.0	900	FA27EC6C0105*C	C	EC	32.0	18.0	9.0	27.5	0.8	40	40	2.0	63.0	59.5	25	180
2.0	900	FA27E26C0205*C	C	E2	32.0	22.0	13.0	27.5	0.8	80	160	3.5	32.0	38.3	25	120
3.0	900	FA27EE6C0305*C	C	EE	32.0	24.5	15.0	27.5	0.8	80	240	5.0	21.0	28.6	25	110
4.0	900	FA27E46C0405*C	C	E4	32.0	28.0	18.0	27.5	0.8	80	320	6.0	16.0	26.0	25	90
5.0	900	FA27EG6C0505*C	C	EG	32.0	31.0	21.0	27.5	0.8	80	400	7.5	13.0	20.5	25	80
6.0	900	FA27EG6C0605*C	C	EG	32.0	31.0	21.0	27.5	0.8	80	480	8.5	10.0	20.8	25	80
7.0	900	FA27EI6C0705*C	C	EI	32.0	35.0	20.0	27.5	0.8	80	560	9.0	9.0	20.6	25	80
5.0	900	FA37F46C0505*C	C	F4	42.5	36.0	19.0	37.5	1.0	20	100	6.0	21.0	19.8	30	56
6.0	900	FA37F46C0605*C	C	F4	42.5	36.0	19.0	37.5	1.0	40	240	6.5	18.0	19.7	30	56
7.0	900	FA37F46C0705*C	C	F4	42.5	36.0	19.0	37.5	1.0	40	280	6.5	18.0	19.7	30	56
8.0	900	FA37F46C0805*C	C	F4	42.5	36.0	19.0	37.5	1.0	40	320	7.0	16.0	19.1	30	56
9.0	900	FA37F46C0905*C	C	F4	42.5	36.0	19.0	37.5	1.0	40	360	7.5	14.0	19.0	30	56
10.0	900	FA37F56C0106*C	C	F5	42.5	38.0	20.0	37.5	1.0	40	400	8.5	12.0	17.3	30	56

DC FILTERING

FA *RoHS Compliant



RATING & PART NUMBER REFERENCE

Cap	Rated Voltage	AVX PN	Voltage Code	Case Code	Dimensions					dv/dt	Peak Current	Irms	ESR 10KHz	Rth	ESL	SPQ
					W ± 0.5	H ± 0.5	T ± 0.5	P1 ± 1.0	d ± 0.05							
uF	V				mm	mm	mm	mm	mm	V/us	A	A	mΩ	°C/W	nH	pcs
12.0	900	FA37F56C0126*C	C	F5	42.5	38.0	20.0	37.5	1.0	40	480	9.5	10.0	16.6	30	56
15.0	900	FA37F86C0156*C	C	F8	42.5	44.0	24.0	37.5	1.0	40	600	11.0	8.0	15.5	30	49
16.0	900	FA37F86C0166*C	C	F8	42.5	44.0	24.0	37.5	1.0	40	640	11.0	8.0	15.5	30	49
20.0	900	FA37F96C0206*C	C	F9	42.5	45.0	30.0	37.5	1.0	40	800	14.0	6.0	12.8	30	35
15.0	900	FA52G96C0156*C	C	G9	57.5	45.0	25.0	52.5	1.2	20	300	9.0	14.0	13.2	35	30
20.0	900	FA52G96C0206*C	C	G9	57.5	45.0	25.0	52.5	1.2	20	400	9.5	12.0	13.9	35	30
22.0	900	FA52G96C0226*C	C	G9	57.5	45.0	25.0	52.5	1.2	20	440	10.0	11.0	13.6	35	30
25.0	900	FA52GA6C0256*C	C	GA	57.5	45.0	30.0	52.5	1.2	20	500	11.0	10.0	12.4	35	25
30.0	900	FA52GA6C0306*C	C	GA	57.5	45.0	30.0	52.5	1.2	20	600	12.5	8.0	12.0	35	25
35.0	900	FA52GC6C0356*C	C	GC	57.5	50.0	35.0	52.5	1.2	20	700	14.5	7.0	10.2	35	20
40.0	900	FA52GC6C0406*C	C	GC	57.5	50.0	35.0	52.5	1.2	20	800	15.5	6.0	10.4	35	20
Voltage Vndc 1100V					Voltage Code L											
1.0	1100	FA27E16L0105*C	L	E1	32.0	20.0	11.0	27.5	0.8	95	95	3.0	45.5	36.6	25	150
2.0	1100	FA27EE6L0205*C	L	EE	32.0	24.5	15.0	27.5	0.8	95	190	4.5	23.0	32.2	25	110
3.0	1100	FA27E46L0305*C	L	E4	32.0	28.0	18.0	27.5	0.8	95	285	6.0	15.5	26.9	25	90
4.0	1100	FA27EG6L0405*C	L	EG	32.0	31.0	21.0	27.5	0.8	95	380	8.0	11.5	20.4	25	80
5.0	1100	FA27EI6L0505*C	L	EI	32.0	35.0	20.0	27.5	0.8	95	475	9.0	9.5	19.5	25	80
5.0	1100	FA37F46L0505*C	L	F4	42.5	36.0	19.0	37.5	1.0	45	225	6.5	18.0	19.7	30	56
6.0	1100	FA37F46L0605*C	L	F4	42.5	36.0	19.0	37.5	1.0	45	270	7.0	15.0	20.4	30	56
7.0	1100	FA37F56L0705*C	L	F5	42.5	38.0	20.0	37.5	1.0	45	315	8.0	13.0	18.0	30	56
8.0	1100	FA37F56L0805*C	L	F5	42.5	38.0	20.0	37.5	1.0	45	360	9.0	11.0	16.8	30	56
9.0	1100	FA37F86L0905*C	L	F8	42.5	44.0	24.0	37.5	1.0	45	405	10.0	10.0	15.0	30	49
10.0	1100	FA37F86L0106*C	L	F8	42.5	44.0	24.0	37.5	1.0	45	450	10.5	9.0	15.1	30	49
12.0	1100	FA37F96L0126*C	L	F9	42.5	45.0	30.0	37.5	1.0	45	540	12.5	7.5	12.8	30	35
10.0	1100	FA52G96L0106*C	L	G9	57.5	45.0	25.0	52.5	1.2	23	230	8.0	18.0	13.0	35	30
12.0	1100	FA52G96L0126*C	L	G9	57.5	45.0	25.0	52.5	1.2	23	276	8.5	15.0	13.8	35	30
15.0	1100	FA52G96L0156*C	L	G9	57.5	45.0	25.0	52.5	1.2	23	345	9.5	12.0	13.9	35	30
20.0	1100	FA52GA6L0206*C	L	GA	57.5	45.0	30.0	52.5	1.2	23	460	11.5	9.0	12.6	35	25
22.0	1100	FA52GC6L0226*C	L	GC	57.5	50.0	35.0	52.5	1.2	23	506	13.5	8.0	10.3	35	20
25.0	1100	FA52GC6L0256*C	L	GC	57.5	50.0	35.0	52.5	1.2	23	575	14.5	7.0	10.2	35	20
Voltage Vndc 1200V					Voltage Code P											
1.0	1200	FA27E16P0105*C	P	E1	32.0	20.0	11.0	27.5	0.8	100	100	3.0	43.0	38.8	25	150
2.0	1200	FA27EE6P0205*C	P	EE	32.0	24.5	15.0	27.5	0.8	100	200	5.0	21.5	27.9	25	110
3.0	1200	FA27E46P0305*C	P	E4	32.0	28.0	18.0	27.5	0.8	100	300	6.5	14.5	24.5	25	90
4.0	1200	FA27EG6P0405*C	P	EG	32.0	31.0	21.0	27.5	0.8	100	400	8.0	11.0	21.3	25	80
5.0	1200	FA37F46P0505*C	P	F4	42.5	36.0	19.0	37.5	1.0	48	240	6.5	17.0	20.9	30	56
6.0	1200	FA37F46P0605*C	P	F4	42.5	36.0	19.0	37.5	1.0	48	288	7.5	14.0	19.0	30	56
7.0	1200	FA37F56P0705*C	P	F5	42.5	38.0	20.0	37.5	1.0	48	336	8.5	12.0	17.3	30	56
8.0	1200	FA37F56P0805*C	P	F5	42.5	38.0	20.0	37.5	1.0	48	384	9.0	10.5	17.6	30	56
9.0	1200	FA37F86P0905*C	P	F8	42.5	44.0	24.0	37.5	1.0	48	432	10.5	9.5	14.3	30	49
10.0	1200	FA37F86P0106*C	P	F8	42.5	44.0	24.0	37.5	1.0	48	480	11.0	8.5	14.6	30	49
12.0	1200	FA37F96P0126*C	P	F9	42.5	45.0	30.0	37.5	1.0	48	576	13.0	7.0	12.7	30	35
10.0	1200	FA52G96P0106*C	P	G9	57.5	45.0	25.0	52.5	1.2	24	240	8.0	17.0	13.8	35	30
12.0	1200	FA52G96P0126*C	P	G9	57.5	45.0	25.0	52.5	1.2	24	288	9.0	14.0	13.2	35	30
15.0	1200	FA52G96P0156*C	P	G9	57.5	45.0	25.0	52.5	1.2	24	360	10.0	11.0	13.6	35	30
20.0	1200	FA52GC6P0206*C	P	GC	57.5	50.0	35.0	52.5	1.2	24	480	13.0	8.5	10.4	35	20
22.0	1200	FA52GC6P0226*C	P	GC	57.5	50.0	35.0	52.5	1.2	24	528	14.0	7.5	10.2	35	20
25.0	1200	FA52GC6P0256*C	P	GC	57.5	50.0	35.0	52.5	1.2	24	600	15.0	6.5	10.3	35	20

DC FILTERING

FQ *RoHS Compliant

POLYPROPYLENE DIELECTRIC FOR INDUSTRIAL DC FILTERING

These capacitors have been designed primarily for medium power automotive DC filtering applications.

ELECTRICAL CHARACTERISTICS – POLYPROPYLENE DIELECTRIC

Items	Characteristics
Application	DC Filtering / DC Link
Reference Standard	IEC 61071, IEC 60384-16, AEC-Q200D
Climatic Category	40/105/56 IEC 60068-1
Operating Temperature Range	-40~ +105°C (+85°C observing voltage must be de-rating at 1.35% per °C)
Upper Temperature Tmax	+85°C IEC 61071, Endurance Test Temperature
Lower Temperature Tmin	-40°C
Rated Voltage	450Vdc ~ 1200Vdc
Capacitance Range	5μF ~ 400μF
Capacitance Tolerance	±5% or ±10% at +25°C
Dissipation Factor (DF)	≤ 0.002 (0.20%) at 1 KHz. C≤20μF at +25°C ≤ 0.003 (0.30%) at 1 KHz. C>20μF at +25°C
Test Voltage Between Terminals	1.5 x rated voltage for 10s (terminal to terminal)
Test Voltage Terminal to Case	3.0kVrms 50 Hz for 10 sec at +25°C
Insulation Resistance	IR x C ≥ 30,000 Seconds at 100VDC 1 minute at +25°C
Life Expectancy	100,000 hours at Un @ Hot-Spot temperature T=+70°C
Protection	Solvent resistant plastic case UL94 V-0 Thermosetting resin sealing UL 94 V-0 compliant
Installation	Any position
Leads	Tinned copper wires, standard lead wire length 5 ±1mm
Packaging	Packed in cardboard boxes with protection for the terminals
RoHS Compliant	Compliant with the restricted substance requirements of Directive 2002/95/EC
Storage Conditions	Storage time: ≤ 24 months from the date marked on the label package Temperature and relative humidity should be -10°C ~ +40°C and not more than 75%RH. RH ≤ 85% for 30 days randomly distributed throughout the year
Humidity Test	Test conditions & performance: Temperature: +40°C±2°C Relative humidity (RH): 93% ±2% Test duration: 56 days Capacitance change: ≤5% DF change (Δtgδ): ≤50 X 10 ⁻⁴ at 1KHz Insulation resistance: ≥50% of initial limit
Endurance Test	Test conditions & performance: Temperature: +85°C±2°C Voltage applied: 1.3 X V _R (d.c.) Test duration: 1000 hours Capacitance change: ≤5% DF change (Δ tgδ): ≤50 X 10 ⁻⁴ at 1KHz Insulation resistance: ≥50% of initial limit
THB Test (Damp heat test with loading)	Test conditions & performance: Temperature: +85°C±2°C Relative humidity (RH): 85% ±2% Loading Voltage: Rated Voltage (DC) Test duration: 1000 hours Capacitance change: ≤5%

DC FILTERING

FQ *RoHS Compliant



CASE CODE

mm

Case Code	Dimensions					
	W ± 0.5	H ± 0.5	T ± 0.5	P1 ± 1.0	P2 ± 0.05	d ± 0.05
	mm	mm	mm	mm	mm	mm
F4	42.5	36.0	19.0	37.5	10.2	1.2
F5	42.5	38.0	20.0	37.5	10.2	1.2
F8	42.5	44.0	24.0	37.5	10.2	1.2
F9	42.5	45.0	30.0	37.5	20.3	1.2
G9	57.5	45.0	25.0	52.5	10.2	1.2
GA	57.5	45.0	30.0	52.5	20.3	1.2
GB	57.5	45.0	45.0	52.5	20.3	1.2
GC	57.5	50.0	35.0	52.5	20.3	1.2
GG	57.5	65.0	130.0	52.5	20.3	1.2
GJ	57.5	65.0	70.0	52.5	20.3	1.2

RATING & PART NUMBER REFERENCE

Cap	Rated Voltage	AVX PN	Voltage Code	Case Code	Dimensions						dv/dt	Peak Current	Irms	ESR 10KHz	Rth	ESL	SPQ
					W ± 0.5	H ± 0.5	T ± 0.5	P1 ± 1.0	P2 ± 1.0	d ± 0.05							
					mm	mm	mm	mm	mm	mm							
uF	V										V/us	A	A	mΩ	°C/W	nH	pcs
Voltage Vndc 450V																	
Voltage Code I																	
10.0	450	FQ37F46I0106*A	I	F4	42.5	36.0	19.0	37.5	10.2	1.2	40	400	8.0	12.0	19.5	30	56
12.0	450	FQ37F46I0126*A	I	F4	42.5	36.0	19.0	37.5	10.2	1.2	40	480	8.5	10.0	20.8	30	56
15.0	450	FQ37F46I0156*A	I	F4	42.5	36.0	19.0	37.5	10.2	1.2	40	600	10.0	8.0	18.8	30	56
20.0	450	FQ37F56I0206*A	I	F5	42.5	38.0	20.0	37.5	10.2	1.2	40	800	12.0	6.0	17.4	30	56
22.0	450	FQ37F56I0226*A	I	F5	42.5	38.0	20.0	37.5	10.2	1.2	40	880	11.5	6.5	17.4	30	56
25.0	450	FQ37F56I0256*A	I	F5	42.5	38.0	20.0	37.5	10.2	1.2	40	1000	12.5	5.5	17.5	30	56
30.0	450	FQ37F86I0306*A	I	F8	42.5	44.0	24.0	37.5	10.2	1.2	40	1200	15.0	4.5	14.8	30	49
35.0	450	FQ37F96I0356*B	I	F9	42.5	45.0	30.0	37.5	20.3	1.2	40	1400	18.5	3.5	12.5	30	35
40.0	450	FQ37F96I0406*B	I	F9	42.5	45.0	30.0	37.5	20.3	1.2	40	1600	18.5	3.5	12.5	30	35
40.0	450	FQ52G96I0406*A	I	G9	57.5	45.0	25.0	52.5	10.2	1.2	20	800	13.5	6.0	13.7	35	30
45.0	450	FQ52G96I0456*A	I	G9	57.5	45.0	25.0	52.5	10.2	1.2	20	900	13.5	6.0	13.7	35	30
50.0	450	FQ52GA6I0506*B	I	GA	57.5	45.0	30.0	52.5	20.3	1.2	20	1000	15.5	5.0	12.5	35	25
55.0	450	FQ52GA6I0556*B	I	GA	57.5	45.0	30.0	52.5	20.3	1.2	20	1100	15.5	5.0	12.5	35	25
60.0	450	FQ52GA6I0606*B	I	GA	57.5	45.0	30.0	52.5	20.3	1.2	20	1200	16.5	4.5	12.2	35	25
65.0	450	FQ52GC6I0656*B	I	GC	57.5	50.0	35.0	52.5	20.3	1.2	20	1300	20.5	3.5	10.2	35	20
70.0	450	FQ52GC6I0706*B	I	GC	57.5	50.0	35.0	52.5	20.3	1.2	20	1400	19.0	4.0	10.4	35	20
75.0	450	FQ52GC6I0756*B	I	GC	57.5	50.0	35.0	52.5	20.3	1.2	20	1500	20.5	3.5	10.2	35	20
80.0	450	FQ52GC6I0806*B	I	GC	57.5	50.0	35.0	52.5	20.3	1.2	20	1600	20.5	3.5	10.2	35	20
90.0	450	FQ52GB6I0906*B	I	GB	57.5	45.0	45.0	52.5	20.3	1.2	20	1800	21.5	3.0	10.8	35	15
95.0	450	FQ52GB6I0956*B	I	GB	57.5	45.0	45.0	52.5	20.3	1.2	20	1900	21.5	3.0	10.8	35	15
100.0	450	FQ52GB6I0107*B	I	GB	57.5	45.0	45.0	52.5	20.3	1.2	20	2000	23.5	2.5	10.9	35	15
200.0	450	FQ52GJ6I0207*D	I	GJ	57.5	65.0	70.0	52.5	20.3	1.2	20	2000	30.5	2.0	8.1	35	10
400.0	450	FQ52GG6I0407*E	I	GG	57.5	65.0	130.0	52.5	20.3	1.2	10	4000	50.5	1.5	3.9	35	5
Voltage Vndc 700V																	
Voltage Code A																	
10.0	700	FQ37F46A0106*A	A	F4	42.5	36.0	19.0	37.5	10.2	1.2	40	400	8.0	12.0	19.5	30	56
12.0	700	FQ37F46A0126*A	A	F4	42.5	36.0	19.0	37.5	10.2	1.2	40	480	8.5	10.0	20.8	30	56
15.0	700	FQ37F46A0156*A	A	F4	42.5	36.0	19.0	37.5	10.2	1.2	40	600	10.0	8.0	18.8	30	56
20.0	700	FQ37F56A0206*A	A	F5	42.5	38.0	20.0	37.5	10.2	1.2	40	800	12.0	6.0	17.4	30	56
22.0	700	FQ37F86A0226*A	A	F8	42.5	44.0	24.0	37.5	10.2	1.2	40	880	13.5	5.5	15.0	30	49
25.0	700	FQ37F86A0256*A	A	F8	42.5	44.0	24.0	37.5	10.2	1.2	40	1000	14.5	5.0	14.3	30	49
30.0	700	FQ37F96A0306*B	A	F9	42.5	45.0	30.0	37.5	20.3	1.2	40	1200	17.0	4.0	13.0	30	35
35.0	700	FQ37F96A0356*B	A	F9	42.5	45.0	30.0	37.5	20.3	1.2	40	1400	18.5	3.5	12.5	30	35
30.0	700	FQ52G96A0306*A	A	G9	57.5	45.0	25.0	52.5	10.2	1.2	20	600	12.0	8.0	13.0	35	30
35.0	700	FQ52G96A0356*A	A	G9	57.5	45.0	25.0	52.5	10.2	1.2	20	700	12.5	7.0	13.7	35	30
40.0	700	FQ52G96A0406*A	A	G9	57.5	45.0	25.0	52.5	10.2	1.2	20	800	13.5	6.0	13.7	35	30
45.0	700	FQ52GA6A0456*B	A	GA	57.5	45.0	30.0	52.5	20.3	1.2	20	900	15.0	5.5	12.1	35	25
50.0	700	FQ52GA6A0506*B	A	GA	57.5	45.0	30.0	52.5	20.3	1.2	20	1000	15.5	5.0	12.5	35	25
55.0	700	FQ52GC6A0556*B	A	GC	57.5	50.0	35.0	52.5	20.3	1.2	20	1100	18.0	4.5	10.3	35	20
60.0	700	FQ52GC6A0606*B	A	GC	57.5	50.0	35.0	52.5	20.3	1.2	20	1200	19.0	4.0	10.4	35	20



The Important Information/Disclaimer is incorporated in the catalog where these specifications came from or available online at www.avx.com/disclaimer/ by reference and should be reviewed in full before placing any order.

DC FILTERING

FQ *RoHS Compliant

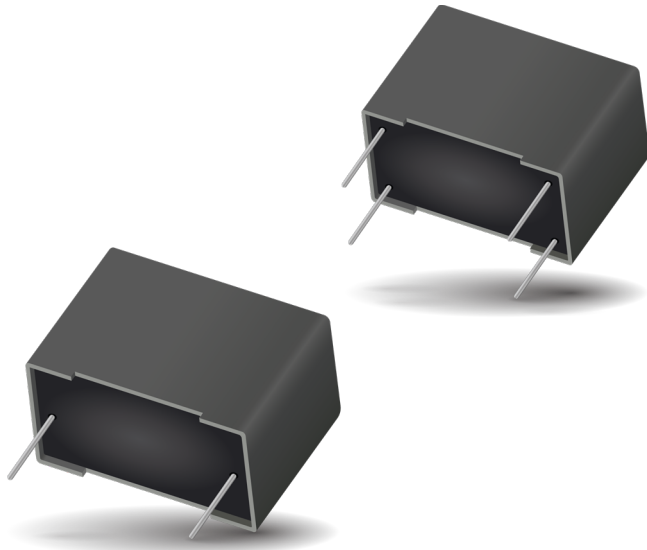


RATING & PART NUMBER REFERENCE

Cap	Rated Voltage	AVX PN	Voltage Code	Case Code	Dimensions						dv/dt	Peak Current	Irms	ESR 10KHz	Rth	ESL	SPQ
					W	H	T	P1	P2	d							
					± 0.5	± 0.5	± 0.5	± 1.0	± 1.0	± 0.05							
uF	V				mm	mm	mm	mm	mm	mm	V/us	A	A	mΩ	°C/W	nH	pcs
65.0	700	FQ52GC6A0656*B	A	GC	57.5	50.0	35.0	52.5	20.3	1.2	20	1300	20.5	3.5	10.2	35	20
70.0	700	FQ52GB6A0706*B	A	GB	57.5	45.0	45.0	52.5	20.3	1.2	20	1400	20.0	3.5	10.7	35	15
75.0	700	FQ52GB6A0756*B	A	GB	57.5	45.0	45.0	52.5	20.3	1.2	20	1500	21.5	3.0	10.8	35	15
80.0	700	FQ52GB6A0806*B	A	GB	57.5	45.0	45.0	52.5	20.3	1.2	20	1600	21.5	3.0	10.8	35	15
160.0	700	FQ52GJ6A0167*D	A	GJ	57.5	65.0	70.0	52.5	20.3	1.2	20	3200	30.5	2.5	6.4	35	10
320.0	700	FQ52GG6A0327*E	A	GG	57.5	65.0	130.0	52.5	20.3	1.2	20	6400	54.0	1.3	4.0	35	5
Voltage Vndc 800V																	
10.0	800	FQ37F46B0106*A	B	F4	42.5	36.0	19.0	37.5	10.2	1.2	40	400	8.5	11.0	18.9	30	56
12.0	800	FQ37F46B0126*A	B	F4	42.5	36.0	19.0	37.5	10.2	1.2	40	480	9.0	9.0	20.6	30	56
15.0	800	FQ37F56B0156*A	B	F5	42.5	38.0	20.0	37.5	10.2	1.2	40	600	11.0	7.5	16.5	30	56
20.0	800	FQ37F86B0206*A	B	F8	42.5	44.0	24.0	37.5	10.2	1.2	40	800	13.5	5.5	15.0	30	49
22.0	800	FQ37F96B0226*B	B	F9	42.5	45.0	30.0	37.5	20.3	1.2	40	880	15.5	5.0	12.5	30	35
25.0	800	FQ37F96B0256*B	B	F9	42.5	45.0	30.0	37.5	20.3	1.2	40	1000	16.0	4.5	13.0	30	35
30.0	800	FQ52G96B0306*A	B	G9	57.5	45.0	25.0	52.5	10.2	1.2	10	300	12.0	7.5	13.9	35	30
35.0	800	FQ52GA6B0356*B	B	GA	57.5	45.0	30.0	52.5	20.3	1.2	10	350	14.5	6.0	11.9	35	25
40.0	800	FQ52GA6B0406*B	B	GA	57.5	45.0	30.0	52.5	20.3	1.2	10	400	15.0	5.5	12.1	35	25
45.0	800	FQ52GC6B0456*B	B	GC	57.5	50.0	35.0	52.5	20.3	1.2	10	450	17.0	5.0	10.4	35	20
50.0	800	FQ52GC6B0506*B	B	GC	57.5	50.0	35.0	52.5	20.3	1.2	10	500	18.0	4.5	10.3	35	20
55.0	800	FQ52GB6B0556*B	B	GB	57.5	45.0	45.0	52.5	20.3	1.2	10	550	18.5	4.0	11.0	35	15
60.0	800	FQ52GB6B0606*B	B	GB	57.5	45.0	45.0	52.5	20.3	1.2	10	600	20.0	3.5	10.7	35	15
120.0	800	FQ52GJ6B0127*D	B	GJ	57.5	65.0	70.0	52.5	20.3	1.2	10	1200	27.0	3.2	6.4	35	10
240.0	800	FQ52GG6B0247*E	B	GG	57.5	65.0	130.0	52.5	20.3	1.2	10	2400	48.5	1.6	4.0	35	5
Voltage Vndc 1100V																	
5.0	1100	FQ37F46L0505*A	L	F4	42.5	36.0	19.0	37.5	10.2	1.2	45	225	7.0	16.0	19.1	30	56
6.0	1100	FQ37F46L0605*A	L	F4	42.5	36.0	19.0	37.5	10.2	1.2	45	270	7.5	13.5	19.8	30	56
7.0	1100	FQ37F56L0705*A	L	F5	42.5	38.0	20.0	37.5	10.2	1.2	45	315	8.5	11.5	18.1	30	56
8.0	1100	FQ37F56L0805*A	L	F5	42.5	38.0	20.0	37.5	10.2	1.2	45	360	9.5	10.0	16.6	30	56
9.0	1100	FQ37F86L0905*A	L	F8	42.5	44.0	24.0	37.5	10.2	1.2	45	405	10.5	9.0	15.1	30	49
10.0	1100	FQ37F86L0106*A	L	F8	42.5	44.0	24.0	37.5	10.2	1.2	45	450	11.0	8.0	15.5	30	49
12.0	1100	FQ37F96L0126*B	L	F9	42.5	45.0	30.0	37.5	20.3	1.2	45	540	13.5	6.5	12.7	30	35
10.0	1100	FQ52G96L0106*A	L	G9	57.5	45.0	25.0	52.5	10.2	1.2	23	230	8.5	16.0	13.0	35	30
12.0	1100	FQ52G96L0126*A	L	G9	57.5	45.0	25.0	52.5	10.2	1.2	23	276	9.0	13.0	14.2	35	30
15.0	1100	FQ52G96L0156*A	L	G9	57.5	45.0	25.0	52.5	10.2	1.2	23	345	10.5	10.5	13.0	35	30
20.0	1100	FQ52GA6L0206*B	L	GA	57.5	45.0	30.0	52.5	20.3	1.2	23	460	12.5	8.0	12.0	35	25
22.0	1100	FQ52GC6L0226*B	L	GC	57.5	50.0	35.0	52.5	20.3	1.2	23	506	14.5	7.0	10.2	35	20
25.0	1100	FQ52GC6L0256*B	L	GC	57.5	50.0	35.0	52.5	20.3	1.2	23	575	15.0	6.5	10.3	35	20
30.0	1100	FQ52GB6L0306*B	L	GB	57.5	45.0	45.0	52.5	20.3	1.2	23	690	16.5	5.0	11.0	35	15
60.0	1100	FQ52GJ6L0606*D	L	GJ	57.5	65.0	70.0	52.5	20.3	1.2	23	1380	40.0	2.5	3.8	35	10
70.0	1100	FQ52GJ6L0706*D	L	GJ	57.5	65.0	70.0	52.5	20.3	1.2	23	1610	34.5	2.0	6.3	35	10
120.0	1100	FQ52GG6L0127*E	L	GG	57.5	65.0	130.0	52.5	20.3	1.2	23	2760	39.5	2.4	4.0	35	5
140.0	1100	FQ52GG6L0147*E	L	GG	57.5	65.0	130.0	52.5	20.3	1.2	23	3220	43.5	2.0	4.0	35	5
Voltage Vndc 1200V																	
5.0	1200	FQ37F46P0505*A	P	F4	42.5	36.0	19.0	37.5	10.2	1.2	48	240	7.0	15.0	20.4	30	56
6.0	1200	FQ37F46P0605*A	P	F4	42.5	36.0	19.0	37.5	10.2	1.2	48	288	8.0	12.5	18.8	30	56
7.0	1200	FQ37F56P0705*A	P	F5	42.5	38.0	20.0	37.5	10.2	1.2	48	336	9.0	11.0	16.8	30	56
8.0	1200	FQ37F56P0805*A	P	F5	42.5	38.0	20.0	37.5	10.2	1.2	48	384	9.5	9.5	17.5	30	56
9.0	1200	FQ37F86P0905*A	P	F8	42.5	44.0	24.0	37.5	10.2	1.2	48	432	11.0	8.5	14.6	30	49
10.0	1200	FQ37F86P0106*A	P	F8	42.5	44.0	24.0	37.5	10.2	1.2	48	480	11.5	7.5	15.1	30	49
12.0	1200	FQ37F96P0126*B	P	F9	42.5	45.0	30.0	37.5	20.3	1.2	48	576	13.5	6.5	12.7	30	35
10.0	1200	FQ52G96P0106*A	P	G9	57.5	45.0	25.0	52.5	10.2	1.2	24	240	8.5	15.0	13.8	35	30
12.0	1200	FQ52G96P0126*A	P	G9	57.5	45.0	25.0	52.5	10.2	1.2	24	288	9.5	12.5	13.3	35	30
15.0	1200	FQ52G96P0156*A	P	G9	57.5	45.0	25.0	52.5	10.2	1.2	24	360	10.5	10.0	13.6	35	30
20.0	1200	FQ52GC6P0206*B	P	GC	57.5	50.0	35.0	52.5	20.3	1.2	24	480	14.0	7.5	10.2	35	20
22.0	1200	FQ52GC6P0226*B	P	GC	57.5	50.0	35.0	52.5	20.3	1.2	24	528	14.5	7.0	10.2	35	20
25.0	1200	FQ52GC6P0256*B	P	GC	57.5	50.0	35.0	52.5	20.3	1.2	24	600	15.5	6.0	10.4	35	20
30.0	1200	FQ52GB6P0306*B	P	GB	57.5	45.0	45.0	52.5	20.3	1.2	24	720	16.5	5.0	11.0	35	15
60.0	1200	FQ52GJ6P0606*D	P	GJ	57.5	65.0	70.0	52.5	20.3	1.2	24	1440	23.0	4.5	6.3	35	10
120.0	1200	FQ52GG6P0127*E	P	GG	57.5	65.0	130.0	52.5	20.3	1.2	24	2880	40.5	2.3	4.0	35	5

DC FILTERING

FT - 1820 *RoHS Compliant



OPERATING TEMPERATURE RANGE

- Operating temperature range: -40°C to +105°C

STANDARDS

- IEC 61071: Power Electronic Capacitors IEC 60384-2: Fixed Capacitors for Use in Electronic Equipment - Fixed Metallized Polyester Film Dielectric DC Capacitors
- IEC 60384-2: Fixed Capacitors for Use in Electronic Equipment - Fixed Metallized Polyester Film Dielectric DC Capacitors
- IEC 60068-1: Environmental testing - Part 1: General and guidance
- AEC-Q200D: Automotive Electronics Council

HOW TO ORDER

FT Series FT	D* Case A* for P=10mm C* for P=15mm D* for P=22.5mm E* for P=27.5mm F* for P=37.5mm G* for P=52.5mm	4 Type 4 = Polyester	K Voltage S = 63V T = 100V F = 160V D = 250V I = 400V E = 630V K = 1000V	0104 Cap µF Code	K Tolerance J = ± 5% K = ±10% M = ±20%	02 Lead Type 02 = 2 Leads 04 = 4 Leads	C Lead Type C = 2pins Short Lead L = 2pins Long Lead A = 4 pins P2 = 10.2mm B = 4 pins P2 = 20.3mm
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*Lead length for 2pins short lead & 4pins is 5mm, 20mm min for long lead

GENERAL DESCRIPTION

The FT series uses a non-impregnated metallized polyester dielectric specially treated to have a very high dielectric strength in operation condition up to 125 °C. (Operating temperature for 105°C to 125°C should be derated at 1.25%/°C) Please see derating graphs for more information.

FT series meets Automotive Electronics Council's AEC- Q200 qualification requirements for pitch ≤ 27.5mm.

APPLICATIONS

- High Performance & High Reliability DC Link Circuits
- Automotive Applications

PACKAGING MATERIAL

Self-extinguishing plastic case (V0 = in accordance with UL 94) filled thermosetting resin.

Self-extinguishing thermosetting resin (V0 = in accordance with UL 94; I3F2 = in accordance with NF F 16-101).

LIFETIME EXPECTANCY

One unique feature of this technology (versus aluminum electrolytics) is how the capacitor reacts at the end of its lifetime.

Unlike aluminum electrolytic, film capacitors do not have a catastrophic failure mode. Film capacitors simply experience a parametric loss of capacitance of about 3% of initial value, with no risk of a short circuit.

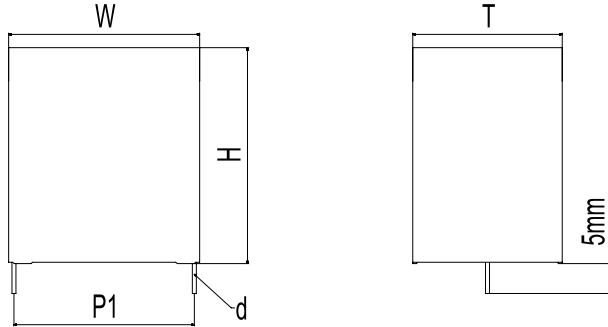
The capacitor continues to be functional even after this 3% decrease.

DC FILTERING

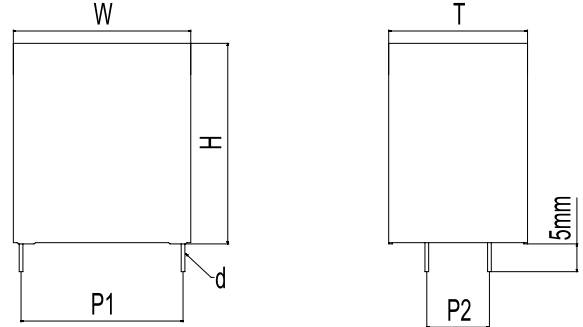
FT - 1820 *RoHS Compliant

DIMENSIONS

2 PIN



4 PIN



CASE CODE

mm

Case Code	Dimensions				
	W ± 0.5	H ± 0.5	T ± 0.5	P1 ± 1.0	d ± 0.05
	mm	mm	mm	mm	mm
A1	13.0	11.0	5.0	10	0.6
A2	13.0	12.0	6.0	10	0.6
A3	13.0	16.0	9.0	10	0.6
C1	18.0	11.0	5.0	15	0.6
C2	18.0	13.0	7.0	15	0.6
C4	18.0	13.5	7.5	15	0.8
C5	18.0	14.5	8.5	15	0.8
C8	18.0	18.0	10.0	15	0.8
C7	18.0	18.0	9.0	15	0.8
D8	26.0	14.0	7.0	22.5	0.8
D1	26.0	17.0	8.5	22.5	0.8
D2	26.0	19.0	10.0	22.5	0.8
D3	26.0	20.0	11.0	22.5	0.8
D7	26.0	20.0	12.5	22.5	0.8
EC	32.0	18.0	9.0	27.5	0.8
E1	32.0	20.0	11.0	27.5	0.8
E2	32.0	22.0	13.0	27.5	0.8
ED	32.0	23.5	13.5	27.5	0.8
EE	32.0	24.5	15.0	27.5	0.8
E4	32.0	28.0	18.0	27.5	0.8
EF	32.0	29.5	16.5	27.5	0.8
EG	32.0	31.0	21.0	27.5	0.8
EH	32.0	31.0	31.0	27.5	0.8
EI	32.0	35.0	20.0	27.5	0.8
FJ	42.5	35.5	18.5	37.5	1.0
FM	42.5	38.5	21.5	37.5	1.0
F8	42.5	44.0	24.0	37.5	1.0
F9	42.5	45.0	30.0	37.5	1.0
G9	57.5	45.0	25.0	52.5	1.2
GA	57.5	45.0	30.0	52.5	1.2
GC	57.5	50.0	35.0	52.5	1.2

DC FILTERING

FT - 1820 *RoHS Compliant

POLYESTER DIELECTRIC FOR INDUSTRIAL DC FILTERING

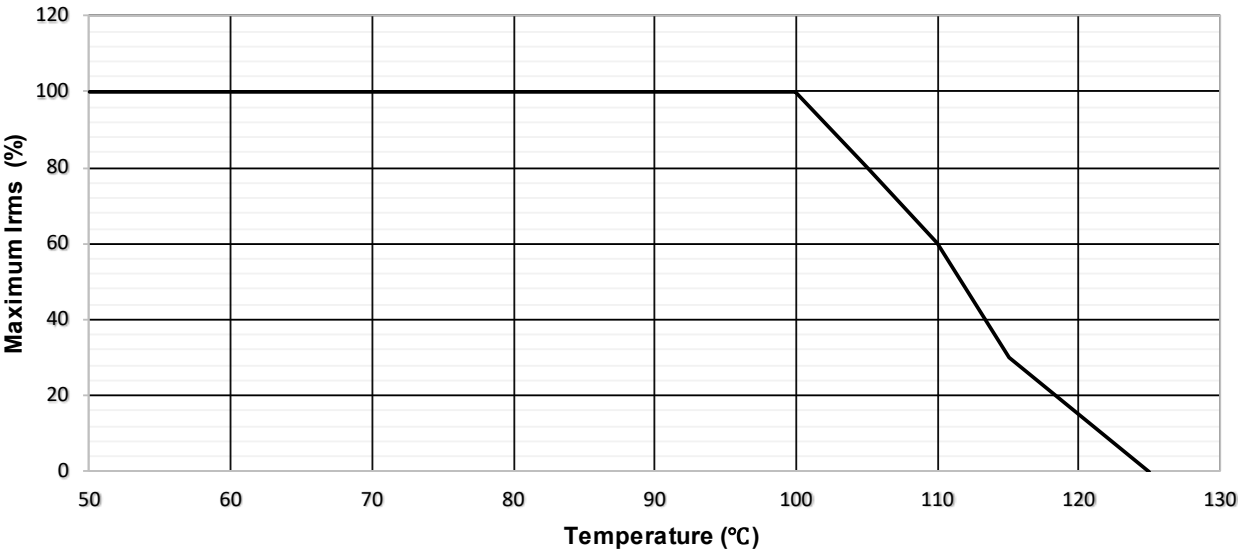
These capacitors have been designed primarily for medium power automotive DC filtering applications.

ELECTRICAL CHARACTERISTICS – POLYESTER DIELECTRIC

Items	Characteristics
Reference Standard	IEC 61071, IEC 60384-2, AEC-Q200D
Climatic Category	40/125/56 IEC60068-1
Operating Temperature Range	-40~ +125°C
Rated Voltage	63Vdc ~ 1000Vdc
Capacitance Range	0.0047μF ~ 470μF
Capacitance Tolerance	±5% or ±10% at +25°C
Dissipation Factor (DF)	≤ 0.01 (1.0%) at 1 KHz. at +25°C
Test Voltage Between Terminals	1.5 x rated voltage for 10s (terminal to terminal)
Test Voltage Terminal to Case	2.0kVrms 50 Hz for 10 sec at +25°C
Insulation Resistance	>30,000 MΩ (C≤0.33μF) at 100VDC 1 minute at +25°C
	>10,000 MΩ (C>0.33μF) at 100VDC 1 minute at +25°C
Life Expectancy	100,000 hours at Un @ Hot-Spot temperature T=+70°C
Protection	Solvent resistant plastic case UL94 V-0
	Thermosetting resin sealing UL 94 V-0 compliant
Installation	Any position
Leads	Tinned copper wires or Copper-clad Steel Wire
Packaging	Packed in cardboard boxes with protection for the terminals
RoHS Compliant	Compliant with the restricted substance requirements of Directive 2002/95/EC
Storage Conditions	Storage time: ≤ 24 months from the date marked on the label package
	Temperature and relative humidity should be -10°C ~ +40°C and not more than 75%RH.
	RH ≤ 85% for 30 days randomly distributed throughout the year
Humidity Test	Test conditions & performance:
	Temperature: +40°C±2°C Relative humidity (RH) :93% ±2%
	Test duration: 56 days
	Capacitance change: ≤5% DF change (Δtgδ): ≤10 X 10 ⁻³ at 1KHz
	Insulation resistance: ≥50% of initial limit
Endurance Test	Test conditions & performance:
	Temperature: +105°C±2°C Voltage applied: 1.25 X V _R (d.c.)
	Test duration: 1000 hours
	Capacitance change: ≤5% DF change (Δ tgδ): ≤10 X 10 ⁻³ at 1KHz
	Insulation resistance: ≥50% of initial limit

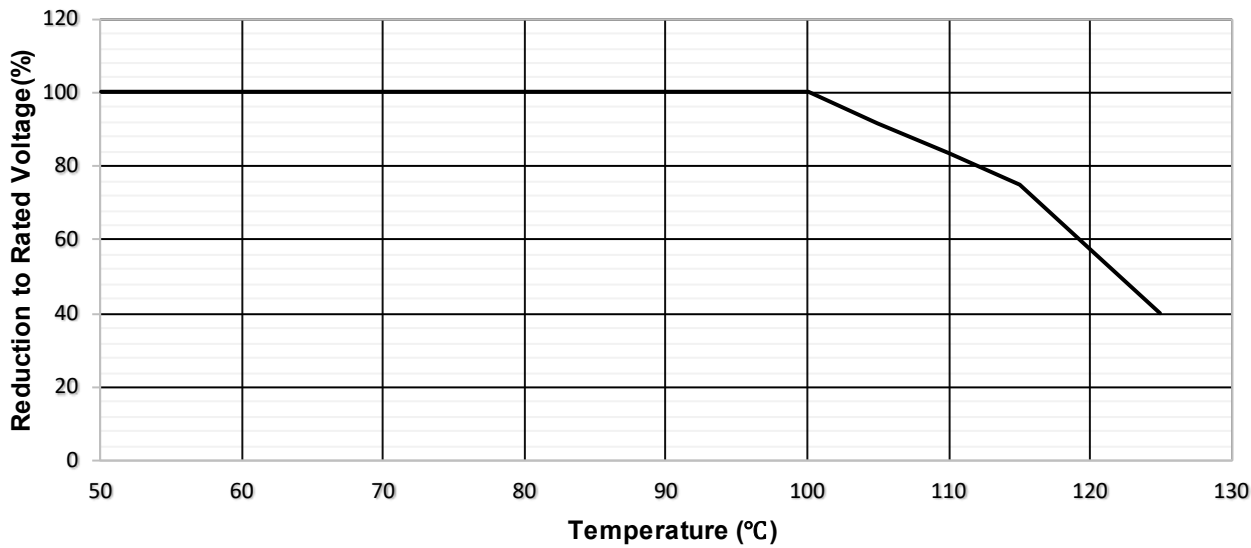
MAXIUM IRMS VS TEMPERATURE

Maximum Irms VS Temperature (T_h)



VOLTAGE VS TEMPERATURE

Derating of Rated Voltage VS Temperature (T_h)



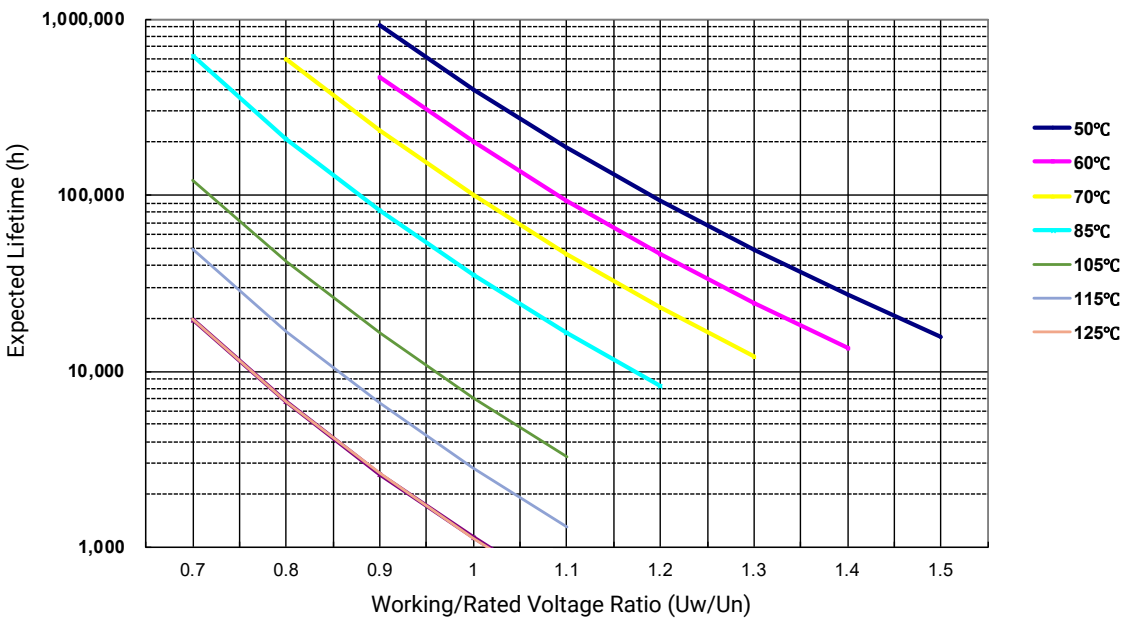
HOT SPOT CALCULATION

See Hot Spot Temperature, page 2.

$\theta_{hot\ spot} = \theta_{ambient} + (P_d + P_t) \times R_{th}$
with P_d (Dielectric losses) = $Q \times tg\delta_0$
 $Q \times tg\delta_0 \Rightarrow [\frac{1}{2} \times C_n \times (V_{peak\ to\ peak})^2 \times f] \times tg\delta_0$
 $tg\delta_0$ (tan delta)
For PET please refer to Polyester graphs.
 P_t (Thermal losses) = $R_s \times (I_{rms})^2$

where C_n in Farad I_{rms} in Ampere f in Hertz
 V in Volt R_s in Ohm θ in °C
 R_{th} in °C/W

TYPICAL LIFETIME* CHARACTERISTICS



*Lifetime is the number of operating hours required for the capacitor to lose 3% of its initial value.

RATING & PART NUMBER REFERENCE

Cap	Rated Voltage	AVX PN	Voltage Code	Case Code	Dimensions					dv/dt	Peak Current	SPQ
					W ± 0.5	H ± 0.5	T ± 0.5	P1 ± 1.0	d ± 0.05			
uF	V				mm	mm	mm	mm	mm	V/us	A	pcs
Voltage Vndc 63V					Voltage Code S							
1.5	63	FTA14S0155*025	S	A1	13.0	11.0	5.0	10	0.6	12	18	825
2.2	63	FTA24S0225*025	S	A2	13.0	12.0	6.0	10	0.6	12	26	675
3.3	63	FTA34S0335*025	S	A3	13.0	16.0	9.0	10	0.6	12	40	450
3.3	63	FTC24S0335*025	S	C2	18.0	13.0	7.0	15	0.8	8	26	414
4.7	63	FTA34S0475*025	S	A3	13.0	16.0	9.0	10	0.6	12	56	450
4.7	63	FTC44S0475*025	S	C4	18.0	13.5	7.5	15	0.8	8	38	396
6.8	63	FTC54S0685*025	S	C5	18.0	14.5	8.5	15	0.8	8	54	342

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RATING & PART NUMBER REFERENCE

Cap	Rated Voltage	AVX PN	Voltage Code	Case Code	Dimensions					dv/dt	Peak Current	SPQ
					W ± 0.5	H ± 0.5	T ± 0.5	P1 ± 1.0	d ± 0.05			
uF	V				mm	mm	mm	mm	mm	V/us	A	pcs
10.0	63	FTC74S0106*025	S	C7	18.0	18.0	9.0	15	0.8	8	80	324
15.0	63	FTD14S0156*025	S	D1	26.0	17.0	8.5	22.5	0.8	5	75	228
22.0	63	FTD24S0226*025	S	D2	26.0	19.0	10.0	22.5	0.8	5	110	192
18.0	63	FTEC4S0186*025	S	EC	32.0	18.0	9.0	27.5	0.8	3	54	180
22.0	63	FTE14S0226*025	S	E1	32.0	20.0	11.0	27.5	0.8	3	66	150
27.0	63	FTE14S0276*025	S	E1	32.0	20.0	11.0	27.5	0.8	3	81	150
33.0	63	FTE24S0336*025	S	E2	32.0	22.0	13.0	27.5	0.8	3	99	120
39.0	63	FTE24S0396*025	S	E2	32.0	22.0	13.0	27.5	0.8	3	117	120
47.0	63	FTEE4S0476*025	S	EE	32.0	24.5	15.0	27.5	0.8	3	141	110
56.0	63	FTE44S0566*025	S	E4	32.0	28.0	18.0	27.5	0.8	3	168	90
68.0	63	FTE44S0686*025	S	E4	32.0	28.0	18.0	27.5	0.8	3	204	90
82.0	63	FTEG4S0826*025	S	EG	32.0	31.0	21.0	27.5	0.8	3	246	80
100.0	63	FTEG4S0107*025	S	EG	32.0	31.0	21.0	27.5	0.8	3	300	80
100.0	63	FTFJ4S0107*025	S	FJ	42.5	35.5	18.5	37.5	1.0	0.8	80	56
120.0	63	FTFJ4S0127*025	S	FJ	42.5	35.5	18.5	37.5	1.0	0.8	96	56
150.0	63	FTFJ4S0157*025	S	FJ	42.5	35.5	18.5	37.5	1.0	0.8	120	56
180.0	63	FTFM4S0187*025	S	FM	42.5	38.5	21.5	37.5	1.0	0.8	144	49
220.0	63	FTF84S0227*025	S	F8	42.5	44.0	24.0	37.5	1.0	0.8	176	49
270.0	63	FTF94S0277*025	S	F9	42.5	45.0	30.0	37.5	1.0	0.8	216	35
330.0	63	FTF94S0337*025	S	F9	42.5	45.0	30.0	37.5	1.0	0.8	264	35
220.0	63	FTG94S0227*025	S	G9	57.5	45.0	25.0	52.5	1.2	0.2	44	30
270.0	63	FTG94S0277*025	S	G9	57.5	45.0	25.0	52.5	1.2	0.2	54	30
330.0	63	FTG94S0337*025	S	G9	57.5	45.0	25.0	52.5	1.2	0.2	66	30
390.0	63	FTGA4S0397*025	S	GA	57.5	45.0	30.0	52.5	1.2	0.2	78	25
470.0	63	FTGC4S0477*025	S	GC	57.5	50.0	35.0	52.5	1.2	0.2	94	20
560.0	63	FTGC4S0567*025	S	GC	57.5	50.0	35.0	52.5	1.2	0.2	112	20
Voltage Vndc 100V					Voltage Code T							
1.0	100	FTC14T0105*025	T	C1	18.0	11.0	5.0	10	0.6	10	10	594
1.5	100	FTC24T0155*025	T	C2	18.0	13.0	7.0	10	0.8	10	15	414
2.2	100	FTC24T0225*025	T	C2	18.0	13.0	7.0	10	0.8	10	22	414
3.3	100	FTC54T0335*025	T	C5	18.0	14.5	8.5	15	0.8	10	33	342
4.7	100	FTC54T0475*025	T	C5	18.0	14.5	8.5	15	0.8	10	47	342
4.7	100	FTD14T0475*025	T	D1	26.0	17.0	8.5	22.5	0.8	6	28	228
6.8	100	FTD14T0685*025	T	D1	26.0	17.0	8.5	22.5	0.8	6	41	228
10.0	100	FTD24T0106*025	T	D2	26.0	19.0	10.0	22.5	0.8	6	60	192
15.0	100	FTD24T0156*025	T	D2	26.0	19.0	10.0	22.5	0.8	6	90	192
15.0	100	FTE14T0156*025	T	E1	32.0	20.0	11.0	27.5	0.8	5	75	150
18.0	100	FTE24T0186*025	T	E2	32.0	22.0	13.0	27.5	0.8	5	90	120
22.0	100	FTE24T0226*025	T	E2	32.0	22.0	13.0	27.5	0.8	5	110	120
27.0	100	FTEE4T0276*025	T	EE	32.0	24.5	15.0	27.5	0.8	5	135	110
33.0	100	FTE44T0336*025	T	E4	32.0	28.0	18.0	27.5	0.8	5	165	90
39.0	100	FTE44T0396*025	T	E4	32.0	28.0	18.0	27.5	0.8	5	195	90
47.0	100	FTEG4T0476*025	T	EG	32.0	31.0	21.0	27.5	0.8	5	235	80
56.0	100	FTEG4T0566*025	T	EG	32.0	31.0	21.0	27.5	0.8	5	280	80
56.0	100	FTFJ4T0566*025	T	FJ	42.5	35.5	18.5	37.5	1.0	1	56	56
68.0	100	FTFJ4T0686*025	T	FJ	42.5	35.5	18.5	37.5	1.0	1	68	56
82.0	100	FTFJ4T0826*025	T	FJ	42.5	35.5	18.5	37.5	1.0	1	82	56
100.0	100	FTFM4T0107*025	T	FM	42.5	38.5	21.5	37.5	1.0	1	100	49
120.0	100	FTF84T0127*025	T	F8	42.5	44.0	24.0	37.5	1.0	1	120	49
150.0	100	FTF94T0157*025	T	F9	42.5	45.0	30.0	37.5	1.0	1	150	35
180.0	100	FTF94T0187*025	T	F9	42.5	45.0	30.0	37.5	1.0	1	180	35
120.0	100	FTG94T0127*025	T	G9	57.5	45.0	25.0	52.5	1.2	0.3	36	30
150.0	100	FTG94T0157*025	T	G9	57.5	45.0	25.0	52.5	1.2	0.3	45	30

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RATING & PART NUMBER REFERENCE

Cap	Rated Voltage	AVX PN	Voltage Code	Case Code	Dimensions					dv/dt	Peak Current	SPQ
					W ± 0.5	H ± 0.5	T ± 0.5	P1 ± 1.0	d ± 0.05			
uF	V				mm	mm	mm	mm	mm	V/us	A	pcs
180.0	100	FTG94T0187*025	T	G9	57.5	45.0	25.0	52.5	1.2	0.3	54	30
220.0	100	FTGA4T0227*025	T	GA	57.5	45.0	30.0	52.5	1.2	0.3	66	25
270.0	100	FTGC4T0277*025	T	GC	57.5	50.0	35.0	52.5	1.2	0.3	81	20
330.0	100	FTGC4T0337*025	T	GC	57.5	50.0	35.0	52.5	1.2	0.3	99	20
Voltage Vndc 160V					Voltage Code F							
4.7	160	FTEC4F0475*025	F	EC	32.0	18.0	9.0	27.5	0.8	6	28	180
6.8	160	FTE14F0685*025	F	E1	32.0	20.0	11.0	27.5	0.8	6	41	150
10.0	160	FTE14F0106*025	F	E1	32.0	20.0	11.0	27.5	0.8	6	60	150
15.0	160	FTE24F0156*025	F	E2	32.0	22.0	13.0	27.5	0.8	6	90	120
18.0	160	FTEE4F0186*025	F	EE	32.0	24.5	15.0	27.5	0.8	6	108	110
22.0	160	FTE44F0226*025	F	E4	32.0	28.0	18.0	27.5	0.8	6	132	90
27.0	160	FTE44F0276*025	F	E4	32.0	28.0	18.0	27.5	0.8	6	162	90
33.0	160	FTEH4F0336*025	F	EH	32.0	31.0	31.0	27.5	0.8	6	198	50
33.0	160	FTFJ4F0336*025	F	FJ	42.5	35.5	18.5	37.5	1.0	2	66	56
39.0	160	FTFJ4F0396*025	F	FJ	42.5	35.5	18.5	37.5	1.0	2	78	56
47.0	160	FTFJ4F0476*025	F	FJ	42.5	35.5	18.5	37.5	1.0	2	94	56
56.0	160	FTFM4F0566*025	F	FM	42.5	38.5	21.5	37.5	1.0	2	112	49
68.0	160	FTFM4F0686*025	F	FM	42.5	38.5	21.5	37.5	1.0	2	136	49
82.0	160	FTF84F0826*025	F	F8	42.5	44.0	24.0	37.5	1.0	2	164	49
100.0	160	FTF94F0107*025	F	F9	42.5	45.0	30.0	37.5	1.0	2	200	35
120.0	160	FTF94F0127*025	F	F9	42.5	45.0	30.0	37.5	1.0	2	240	35
82.0	160	FTG94F0826*025	F	G9	57.5	45.0	25.0	52.5	1.2	0.4	33	30
100.0	160	FTG94F0107*025	F	G9	57.5	45.0	25.0	52.5	1.2	0.4	40	30
120.0	160	FTG94F0127*025	F	G9	57.5	45.0	25.0	52.5	1.2	0.4	48	30
150.0	160	FTGA4F0157*025	F	GA	57.5	45.0	30.0	52.5	1.2	0.4	60	25
180.0	160	FTGC4F0187*025	F	GC	57.5	50.0	35.0	52.5	1.2	0.4	72	20
220.0	160	FTGC4F0227*025	F	GC	57.5	50.0	35.0	52.5	1.2	0.4	88	20
Voltage Vndc 250V					Voltage Code D							
0.15	250	FTA14D0154*025	D	A1	13.0	11.0	5.0	10	0.6	36	5.4	825
0.22	250	FTA24D0224*025	D	A2	13.0	12.0	6.0	10	0.6	36	7.9	675
0.33	250	FTA24D0334*025	D	A2	13.0	12.0	6.0	10	0.6	36	12	675
0.33	250	FTC14D0334*025	D	C1	18.0	11.0	5.0	15	0.6	20	6.6	594
0.47	250	FTA34D0474*025	D	A3	13.0	16.0	9.0	10	0.6	36	17	450
0.47	250	FTC24D0474*025	D	C2	18.0	13.0	7.0	15	0.6	20	9.4	414
0.68	250	FTC44D0684*025	D	C4	18.0	13.5	7.5	15	0.8	20	14	396
1.0	250	FTC54D0105*025	D	C5	18.0	14.5	8.5	15	0.8	20	20	342
1.5	250	FTC84D0155*025	D	C8	18.0	18.0	10.0	15	0.8	20	30	288
1.5	250	FTD14D0155*025	D	D1	26.0	17.0	8.5	22.5	0.8	12	18	228
2.2	250	FTD24D0225*025	D	D2	26.0	19.0	10.0	22.5	0.8	12	26	192
3.3	250	FTD74D0335*025	D	D7	26.0	20.0	12.5	22.5	0.8	12	40	144
4.7	250	FTE14D0475*025	D	E1	32.0	20.0	11.0	27.5	0.8	8	38	150
6.8	250	FTE24D0685*025	D	E2	32.0	22.0	13.0	27.5	0.8	8	54	120
10.0	250	FTEE4D0106*025	D	EE	32.0	24.5	15.0	27.5	0.8	8	80	110
15.0	250	FTE44D0156*025	D	E4	32.0	28.0	18.0	27.5	0.8	8	120	90
18.0	250	FTEG4D0186*025	D	EG	32.0	31.0	21.0	27.5	0.8	8	144	80
18.0	250	FTFJ4D0186*025	D	FJ	42.5	35.5	18.5	37.5	1.0	3	54	56
22.0	250	FTFJ4D0226*025	D	FJ	42.5	35.5	18.5	37.5	1.0	3	66	56
27.0	250	FTFJ4D0276*025	D	FJ	42.5	35.5	18.5	37.5	1.0	3	81	56
33.0	250	FTFM4D0336*025	D	FM	42.5	38.5	21.5	37.5	1.0	3	99	49
39.0	250	FTFM4D0396*025	D	FM	42.5	38.5	21.5	37.5	1.0	3	117	49
47.0	250	FTF84D0476*025	D	F8	42.5	44.0	24.0	37.5	1.0	3	141	49
56.0	250	FTF94D0566*025	D	F9	42.5	45.0	30.0	37.5	1.0	3	168	35
68.0	250	FTF94D0686*025	D	F9	42.5	45.0	30.0	37.5	1.0	3	204	35

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Cap	Rated Voltage	AVX PN	Voltage Code	Case Code	Dimensions					dv/dt	Peak Current	SPQ
					W ± 0.5	H ± 0.5	T ± 0.5	P1 ± 1.0	d ± 0.05			
uF	V				mm	mm	mm	mm	mm	V/us	A	pcs
56.0	250	FTG94D0566*025	D	G9	57.5	45.0	25.0	52.5	1.2	1	56	30
68.0	250	FTG94D0686*025	D	G9	57.5	45.0	25.0	52.5	1.2	1	68	30
82.0	250	FTG94D0826*025	D	G9	57.5	45.0	25.0	52.5	1.2	1	82	30
100.0	250	FTGA4D0107*025	D	GA	57.5	45.0	30.0	52.5	1.2	1	100	25
120.0	250	FTGC4D0127*025	D	GC	57.5	50.0	35.0	52.5	1.2	1	120	20
Voltage Vndc 400V					Voltage Code I							
0.068	400	FTA14I0683*025	I	A1	13.0	11.0	5.0	10	0.6	52	3.5	825
0.10	400	FTA24I0104*025	I	A2	13.0	12.0	6.0	10	0.6	52	5.2	675
0.15	400	FTA34I0154*025	I	A3	13.0	16.0	9.0	10	0.6	52	7.8	450
0.15	400	FTC24I0154*025	I	C2	18.0	13.0	7.0	15	0.6	32	4.8	414
0.22	400	FTA34I0224*025	I	A3	13.0	16.0	9.0	10	0.6	52	11	450
0.22	400	FTC24I0224*025	I	C2	18.0	13.0	7.0	15	0.6	32	7.0	414
0.33	400	FTC44I0334*025	I	C4	18.0	13.5	7.5	15	0.8	32	11	396
0.47	400	FTC74I0474*025	I	C7	18.0	18.0	9.0	15	0.8	32	15	324
0.68	400	FTD14I0684*025	I	D1	26.0	17.0	8.5	22.5	0.8	18	12	228
1.0	400	FTD24I0105*025	I	D2	26.0	19.0	10.0	22.5	0.8	18	18	192
1.5	400	FTD34I0155*025	I	D3	26.0	20.0	11.0	22.5	0.8	18	27	180
1.5	400	FTE14I0155*025	I	E1	32.0	20.0	11.0	27.5	0.8	14	21	150
2.2	400	FTED4I0225*025	I	ED	32.0	23.5	13.5	27.5	0.8	14	31	110
3.3	400	FTEE4I0335*025	I	EE	32.0	24.5	15.0	27.5	0.8	14	46	110
4.7	400	FTE44I0475*025	I	E4	32.0	28.0	18.0	27.5	0.8	14	66	90
Voltage Vndc 630V					Voltage Code E							
0.022	630	FTA14E0223*025	E	A1	13.0	11.0	5.0	10	0.6	70	1.5	825
0.033	630	FTA24E0333*025	E	A2	13.0	12.0	6.0	10	0.6	70	2.3	675
0.033	630	FTC14E0333*025	E	C1	18.0	11.0	5.0	15	0.6	66	2.2	594
0.047	630	FTA24E0473*025	E	A2	13.0	12.0	6.0	10	0.6	70	3.3	675
0.047	630	FTC24E0473*025	E	C2	18.0	13.0	7.0	15	0.6	66	3.1	414
0.068	630	FTC44E0683*025	E	C4	18.0	13.5	7.5	15	0.8	66	4.5	396
0.10	630	FTC44E0104*025	E	C4	18.0	13.5	7.5	15	0.8	66	6.6	396
0.10	630	FTD84E0104*025	E	D8	26.0	14.0	7.0	22.5	0.8	38	3.8	276
0.15	630	FTD14E0154*025	E	D1	26.0	17.0	8.5	22.5	0.8	38	5.7	228
0.22	630	FTD14E0224*025	E	D1	26.0	17.0	8.5	22.5	0.8	38	8.4	228
0.33	630	FTE14E0334*025	E	E1	32.0	20.0	11.0	27.5	0.8	28	9.2	150
0.47	630	FTE14E0474*025	E	E1	32.0	20.0	11.0	27.5	0.8	28	13	150
0.68	630	FTED4E0684*025	E	ED	32.0	23.5	13.5	27.5	0.8	28	19	110
1.0	630	FTEE4E0105*025	E	EE	32.0	24.5	15.0	27.5	0.8	28	28	110
1.5	630	FTE44E0155*025	E	E4	32.0	28.0	18.0	27.5	0.8	28	42	90
Voltage Vndc 1000V					Voltage Code K							
0.0047	1000	FTA14K0472*025	K	A1	13.0	11.0	5.0	10	0.6	260	1.2	825
0.0068	1000	FTA24K0682*025	K	A2	13.0	12.0	6.0	10	0.6	260	1.8	675
0.010	1000	FTC14K0103*025	K	C1	18.0	11.0	5.0	15	0.6	130	1.3	594
0.015	1000	FTC24K0153*025	K	C2	18.0	13.0	7.0	15	0.6	130	2.0	414
0.022	1000	FTC44K0223*025	K	C4	18.0	13.5	7.5	15	0.8	130	2.9	396
0.033	1000	FTC54K0333*025	K	C5	18.0	14.5	8.5	15	0.8	130	4.3	342
0.033	1000	FTD84K0333*025	K	D8	26.0	14.0	7.0	22.5	0.8	68	2.2	276
0.047	1000	FTD14K0473*025	K	D1	26.0	17.0	8.5	22.5	0.8	68	3.2	228
0.068	1000	FTD14K0683*025	K	D1	26.0	17.0	8.5	22.5	0.8	68	4.6	228
0.10	1000	FTD24K0104*025	K	D2	26.0	19.0	10.0	22.5	0.8	68	6.8	192
0.15	1000	FTE14K0154*025	K	E1	32.0	20.0	11.0	27.5	0.8	50	7.5	150
0.22	1000	FTED4K0224*025	K	ED	32.0	23.5	13.5	27.5	0.8	50	11	110
0.33	1000	FTEF4K0334*025	K	EF	32.0	29.5	16.5	27.5	0.8	50	17	100
0.47	1000	FTEI4K0474*025	K	EI	32.0	35.0	20.0	27.5	0.8	50	24	80

DC FILTERING

FW - X2 AEC-Q200 *RoHS Compliant



GENERAL DESCRIPTION

The FW series are non-inductively wound with metallized polypropylene film as dielectric and electrode, encapsulated in solvent resistant and self-extinguishing UL94 V-0 thermoplastic case, with epoxy resin sealed. They provide interference suppression with safety approvals; capacitance value range from 0.01 μ F to 20 μ F.

FW series meets Automotive Electronics Council's AEC- Q200 qualification requirements and passed the THB test at 85°C, 85% relative humidity with a rated voltage applied for 1000 hours.

FEATURES & BENEFITS

- AEC-Q200 Qualified
- High Moisture Resistance
- Over Voltage Stress Withstanding
- Excellent Active and Passive Flame Resistant Abilities
- Automotive Grade (AEC-Q200)

APPLICATIONS

They are suitable for Across-the-line Capacitors, EMI Filters, Spark-Killer, Main-Connected Circuits.

- UPS Systems
- AC Drive
- Industrial Power Supply
- Battery Charger
- Home Appliance & Induction Cooking

OPERATING TEMPERATURE RANGE

- Operating temperature range: -40°C to +110°C

STANDARDS

- UL60384-14
- IEC60384-14
- IEC 60068-1
- AEC-Q200D

HOW TO ORDER

FW └─┘ Series FW	C* └─┘ Case A* for P=10mm C* for P=15mm D* for P=22.5mm E* for P=27.5mm F* for P=37.5mm G* for P=52.5mm	6 └─┘ Type 6 = Polypropylene	H └─┘ Voltage H = 305Vac	0224 └─┘ Cap μ F Code	K └─┘ Tolerance J = $\pm$ 5% K = $\pm$ 10% M = $\pm$ 20%	02 └─┘ Lead Type 02 = 2 Leads 04 = 4 Leads	C └─┘ Lead Type C = 2pins Short Lead L = 2pins Long Lead A = 4 pins P2 = 10.2mm B = 4 pins P2 = 20.3mm
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*Lead length for 2pins short lead & 4pins is 5mm, 20mm min for long lead

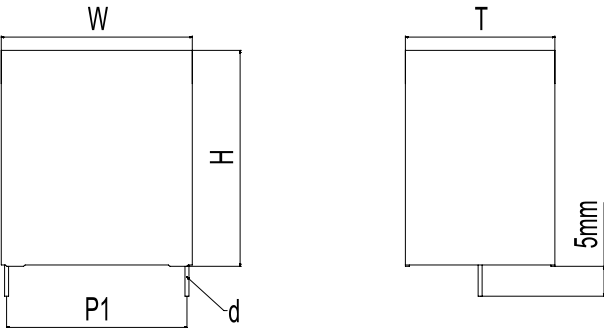
DC FILTERING

FW - X2 AEC-Q200 *RoHS Compliant

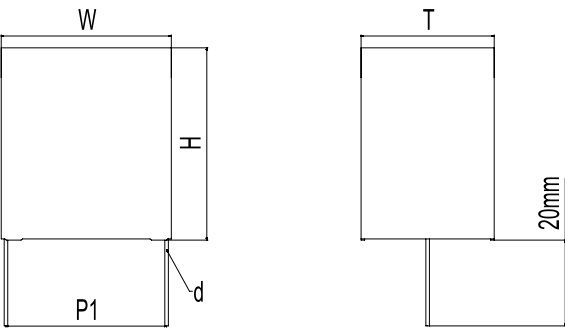


DIMENSIONS

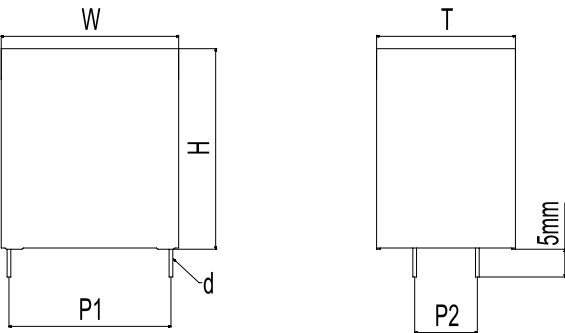
2 PIN



2 PIN - 20mm LEAD LENGTH



4 PIN



CASE CODE

mm

Case Code	Dimensions				
	W ± 0.5	H ± 0.5	T ± 0.5	P1 ± 1.0	d ± 0.05
	mm	mm	mm	mm	mm
A1	13.0	11.0	5.0	10	0.6
A2	13.0	12.0	6.0	10	0.6
A4	13.0	14.0	8.0	10	0.6
C2	18.0	13.0	7.0	15	0.6
C3	18.0	12.0	6.0	15	0.6
C5	18.0	14.5	8.5	15	0.8
C6	18.0	16.0	10.0	15	0.8
C9	18.0	19.0	11.0	15	0.8
CA	18.0	22.0	12.5	15	0.8
D1	26.0	17.0	8.5	22.5	0.8
D2	26.0	19.0	10.0	22.5	0.8
D3	26.0	20.0	11.0	22.5	0.8
D4	26.0	22.0	12.0	22.5	0.8
D5	26.0	23.0	13.0	22.5	0.8
D6	26.0	25.0	15.0	22.5	0.8
D8	26.0	16.5	7.0	22.5	0.8
D9	26.0	24.0	14.0	22.5	0.8
E1	32.0	20.0	11.0	27.5	0.8
E2	32.0	22.0	13.0	27.5	0.8
E3	32.0	28.0	14.0	27.5	0.8
E6	32.0	33.0	18.0	27.5	0.8
E9	32.0	37.0	22.0	27.5	0.8
EJ	32.0	24.5	13.0	27.5	0.8
F3	42.5	32.0	19.0	37.5	1.0
F8	42.5	44.0	24.0	37.5	1.0
F9	42.5	45.0	30.0	37.5	1.0
GA	57.5	45.0	30.0	52.5	1.2
GC	57.5	50.0	35.0	52.5	1.2
GM	57.5	60.0	45.0	52.5	1.2

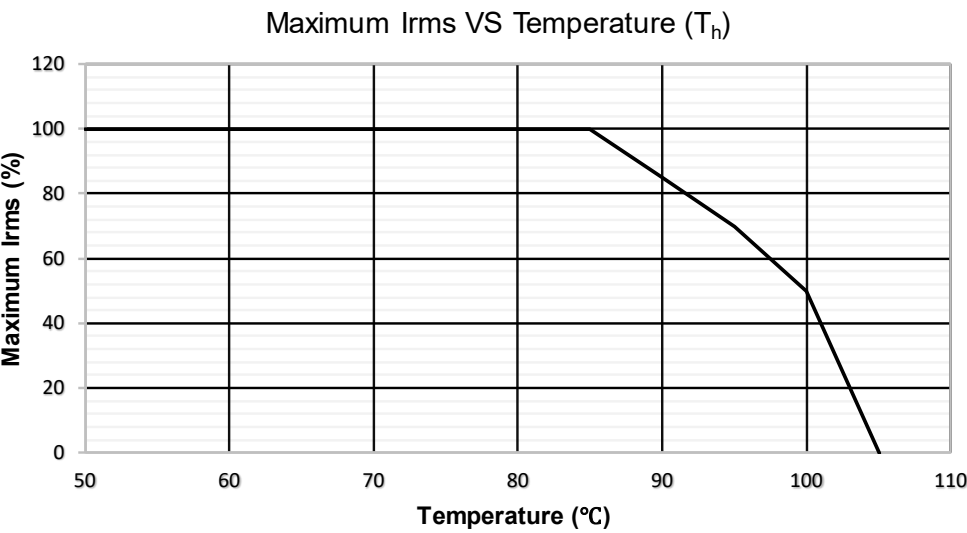
DC FILTERING

FW - X2 AEC-Q200 *RoHS Compliant

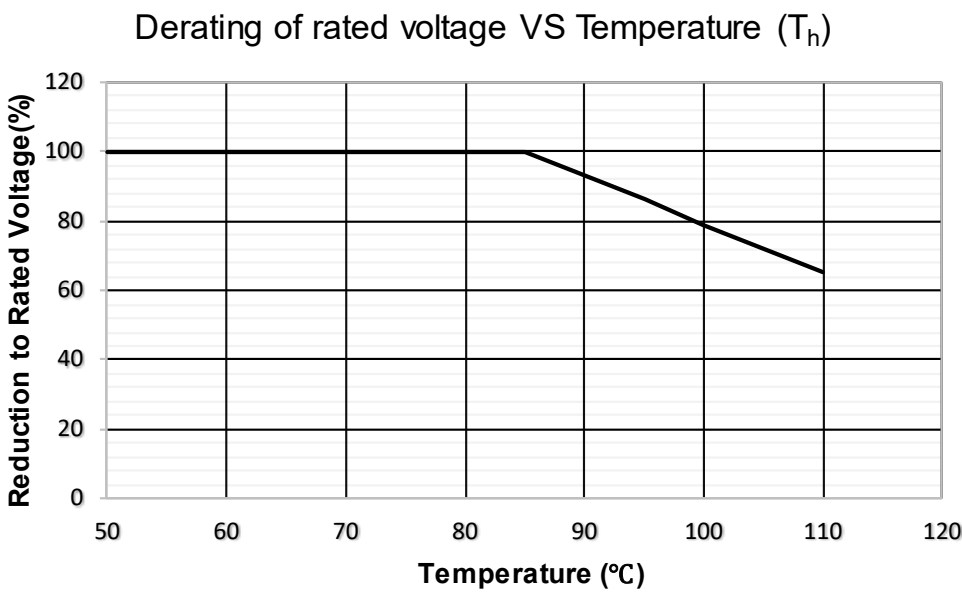
ELECTRICAL CHARACTERISTICS

Items	Characteristics
Reference Standard	IEC 60384-14, UL 60384-14, AEC-Q200D
Climatic Category	40/110/56 IEC60068-1
Passive Flammability Class	B
Operating Temperature Range	-40~ +110°C
Capacitance Range	0.01μF ~ 20μF
Capacitance Tolerance	±10% or ±20% at +25°C
Dissipation Factor (DF)	≤ 0.001 (0.10%) at 1 KHz. at +25°C
Test Voltage Between Terminals	1.5 x rated voltage for 10s (terminal to terminal)
Test Voltage Terminal to Case	2.0kVrms 50 Hz for 10 sec at +25°C
Insulation Resistance	>15,000 MΩ (C≤0.33μF) at 100VDC 1 minute at +25°C
	>5,000 MΩ x uF (C>0.33μF) at 100VDC 1 minute at +25°C
Life Expectancy	100,000 hours at Un @ Hot-Spot temperature T=+70°C
Protection	Solvent resistant plastic case UL94 V-0
	Thermosetting resin sealing UL 94 V-0 compliant
Installation	Any position
Leads	Tinned copper wires or Copper-clad Steel Wire
Packaging	Packed in cardboard boxes with protection for the terminals
RoHS Compliant	Compliant with the restricted substance requirements of Directive 2002/95/EC
Storage Conditions	Storage time: ≤ 24 months from the date marked on the label package
	Temperature and relative humidity should be -10°C ~ +40°C and not more than 75%RH.
	RH ≤ 85% for 30 days randomly distributed throughout the year
Humidity Test	Test conditions & performance:
	Temperature: +40°C±2°C Relative humidity (RH): 93% ±2%
	Test duration: 56 days
	Capacitance change: ≤5% DF change (Δtgδ): ≤50 X 10 ⁻⁴ at 1KHz
	Insulation resistance: ≥50% of initial limit
Endurance Test	Test conditions & performance:
	Temperature: +110°C±2°C Voltage applied: 1.25 X V _R (a.c.)
	Test duration: 1000 hours
	Capacitance change: ≤10% DF change (Δ tgδ): ≤50 X 10 ⁻⁴ at 1KHz
	Insulation resistance: ≥50% of initial limit
THB Test (Damp heat test with loading)	Test conditions & performance:
	Temperature: +85°C±2°C Relative humidity (RH): 85% ±2%
	Loading Voltage: Rated Voltage (DC)
	Test duration: 1000 hours
	Capacitance change: ≤10%

MAXIMUM IRMS VS TEMPERATURE



VOLTAGE OR TEMPERATURE



RATING & PART NUMBER REFERENCE

Cap	Rated Voltage	AVX PN	Voltage Code	Case Code	Dimensions					dv/dt	Peak Current	SPQ
					W ± 0.5	H ± 0.5	T ± 0.5	P1 ± 1.0	d ± 0.05			
uF	V				mm	mm	mm	mm	mm	V/us	A	pcs
Voltage Vndc 305Vac					Voltage Code H							
0.010	305	FWA16H0103*02°	H	A1	13.0	11.0	5.0	10	0.6	500	5	825
0.022	305	FWA16H0223*02°	H	A1	13.0	11.0	5.0	10	0.6	500	11	825
0.033	305	FWA16H0333*02°	H	A1	13.0	11.0	5.0	10	0.6	500	17	825
0.047	305	FWA26H0473*02°	H	A2	13.0	12.0	6.0	10	0.6	500	24	675
0.068	305	FWA26H0683*02°	H	A2	13.0	12.0	6.0	10	0.6	500	34	675

° Please choose lead type from the four options in "How to Order"

DC FILTERING

FW - X2 AEC-Q200 *RoHS Compliant



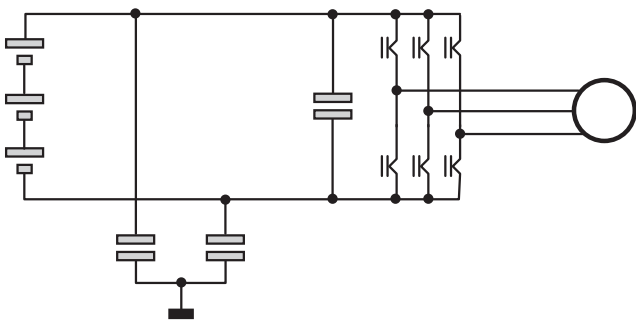
RATING & PART NUMBER REFERENCE

Cap	Rated Voltage	AVX PN	Voltage Code	Case Code	Dimensions					dv/dt	Peak Current	SPQ
					W	H	T	P1	d			
					± 0.5	± 0.5	± 0.5	± 1.0	± 0.05			
uF	V				mm	mm	mm	mm	mm	V/us	A	pcs
0.082	305	FWA26H0823*02°	H	A2	13.0	12.0	6.0	10	0.6	500	41	675
0.10	305	FWA26H0104*02°	H	A2	13.0	12.0	6.0	10	0.6	500	50	675
0.15	305	FWA46H0154*02°	H	A4	13.0	14.0	8.0	10	0.6	500	75	500
0.047	305	FWC36H0473*02°	H	C3	18.0	12.0	6.0	15	0.6	400	19	486
0.068	305	FWC36H0683*02°	H	C3	18.0	12.0	6.0	15	0.6	400	27	486
0.082	305	FWC36H0823*02°	H	C3	18.0	12.0	6.0	15	0.6	400	33	486
0.10	305	FWC36H0104*02°	H	C3	18.0	12.0	6.0	15	0.6	400	40	486
0.15	305	FWC36H0154*02°	H	C3	18.0	12.0	6.0	15	0.6	400	60	486
0.15	305	FWC26H0154*02°	H	C2	18.0	13.0	7.0	15	0.6	400	60	414
0.22	305	FWC56H0224*02°	H	C5	18.0	14.5	8.5	15	0.8	400	88	342
0.27	305	FWC56H0274*02°	H	C5	18.0	14.5	8.5	15	0.8	400	108	342
0.33	305	FWC66H0334*02°	H	C6	18.0	16.0	10.0	15	0.8	400	132	288
0.47	305	FWC96H0474*02°	H	C9	18.0	19.0	11.0	15	0.8	400	188	252
0.56	305	FWC96H0564*02°	H	C9	18.0	19.0	11.0	15	0.8	400	224	252
0.68	305	FWCA6H0684*02°	H	CA	18.0	22.0	12.5	15	0.8	400	272	234
0.82	305	FWCA6H0824*02°	H	CA	18.0	22.0	12.5	15	0.8	400	328	234
0.22	305	FWD86H0224*02°	H	D8	26.0	16.5	7.0	22.5	0.8	200	44	276
0.27	305	FWD86H0274*02°	H	D8	26.0	16.5	7.0	22.5	0.8	200	54	276
0.33	305	FWD16H0334*02°	H	D1	26.0	17.0	8.5	22.5	0.8	200	66	228
0.47	305	FWD26H0474*02°	H	D2	26.0	19.0	10.0	22.5	0.8	200	94	192
0.56	305	FWD26H0564*02°	H	D2	26.0	19.0	10.0	22.5	0.8	200	112	192
0.68	305	FWD36H0684*02°	H	D3	26.0	20.0	11.0	22.5	0.8	200	136	180
0.82	305	FWD36H0824*02°	H	D3	26.0	20.0	11.0	22.5	0.8	200	164	180
1.0	305	FWD46H0105*02°	H	D4	26.0	22.0	12.0	22.5	0.8	200	200	156
1.2	305	FWD56H0125*02°	H	D5	26.0	23.0	13.0	22.5	0.8	200	240	144
1.5	305	FWD96H0155*02°	H	D9	26.0	24.0	14.0	22.5	0.8	200	300	132
1.5	305	FWD66H0155*02°	H	D6	26.0	25.0	15.0	22.5	0.8	200	300	132
1.0	305	FWE16H0105*02°	H	E1	32.0	20.0	11.0	27.5	0.8	150	150	150
1.2	305	FWE26H0125*02°	H	E2	32.0	22.0	13.0	27.5	0.8	150	180	120
1.5	305	FWEJ6H0155*02°	H	EJ	32.0	24.5	13.0	27.5	0.8	150	225	120
2.2	305	FWE36H0225*02°	H	E3	32.0	28.0	14.0	27.5	0.8	150	330	110
3.3	305	FWE66H0335*02°	H	E6	32.0	33.0	18.0	27.5	0.8	150	495	90
4.7	305	FWE96H0475*02°	H	E9	32.0	37.0	22.0	27.5	0.8	150	705	70
4.7	305	FWF36H0475*02°	H	F3	42.5	32.0	19.0	37.5	1.0	100	470	56
6.8	305	FWF86H0685*02°	H	F8	42.5	44.0	24.0	37.5	1.0	100	680	49
10	305	FWF96H0106*02°	H	F9	42.5	45.0	30.0	37.5	1.0	100	1000	35
12	305	FWF96H0126*02°	H	F9	42.5	45.0	30.0	37.5	1.0	100	1200	35
12	305	FWGA6H0126*02°	H	GA	57.5	45.0	30.0	52.5	1.2	100	1200	25
15	305	FWF96H0156*02°	H	F9	42.5	45.0	30.0	37.5	1.0	100	1500	35
15	305	FWGA6H0156*02°	H	GA	57.5	45.0	30.0	52.5	1.2	100	1500	25
18	305	FWGA6H0186*02°	H	GA	57.5	45.0	30.0	52.5	1.2	100	1800	25
20	305	FWGA6H0206*02°	H	GA	57.5	45.0	30.0	52.5	1.2	100	2000	25
22	305	FWGA6H0226*02°	H	GA	57.5	45.0	30.0	52.5	1.2	100	2200	25
25	305	FWGA6H0256*02°	H	GA	57.5	45.0	30.0	52.5	1.2	100	2500	25
30	305	FWGA6H0306*02°	H	GA	57.5	45.0	30.0	52.5	1.2	100	3000	25
33	305	FWGC6H0336*02°	H	GC	57.5	50.0	35.0	52.5	1.2	100	3300	20
39	305	FWGC6H0396*02°	H	GC	57.5	50.0	35.0	52.5	1.2	100	3900	20
40	305	FWGC6H0406*02°	H	GC	57.5	50.0	35.0	52.5	1.2	100	4000	20
45	305	FWGM6H0456*02°	H	GM	57.5	60.0	45.0	52.5	1.2	100	4500	15

* Please choose lead type from the four options in "How to Order"



The Important Information/Disclaimer is incorporated in the catalog where these specifications came from or available online at www.avx.com/disclaimer/ by reference and should be reviewed in full before placing any order.



FUNCTION, PRODUCTS

DC Filtering

Between battery and converter, a capacitor is needed.

Its main purpose is to filter the ripple coming from the converter, to avoid damaging the battery.

Metallized Film Capacitors are able to fulfill this function using 2 or 3 cases (only electrolytic can not).

Products to offer

<i>FHC/FQ/FA</i>	Custom μ F	Custom Vdc
<i>FFVE/FFWE</i>	12 to 400 μ F	300 to 1900Vdc
<i>FFVI/FFWI</i>	47 to 275 μ F	500 to 1100Vdc

According to quantity, a custom design could be developed, achieving the total function with a single case.

FILM TECHNOLOGY TO REPLACE ALUMINUM ELECTROLYTIC TECHNOLOGY

The trend in the industrial and traction market for power conversion is to replace electrolytic capacitors by film technology.

This trend is generated by the many advantages that film technology offers. Among these advantages, we have:

- *High rms. current capabilities up to 1Arms. per μ F
- *Overvoltage withstanding up to 2 times the rated voltage
- *Handle a reversal voltage
- *High peak current capabilities
- *No acid inside
- *Long lifetime
- *No storage problem

However, this replacement is not necessarily capacitance but for capacitance by application/Function.

Despite the advantages of film technology, replacement solutions won't be possible for each application, there will be several approaches to do this.

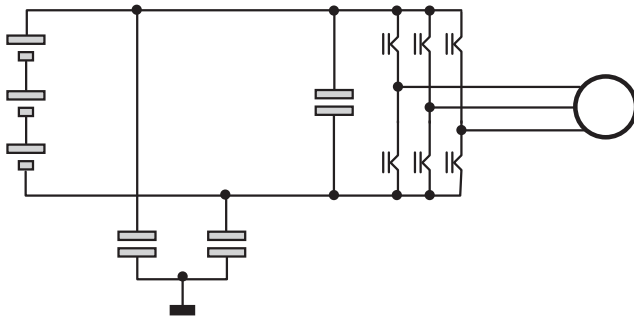
In order to help the use, we will present some examples where film gives a major benefit over electrolytic technology.

1) DC LINK FILTER: HIGH CURRENT DESIGN & CAPACITANCE VALUE DESIGN

1a) Energy supplied with batteries

Applications will be:

electric car
electric fork lift truck



In that case, capacitor will be used as a decoupling capacitor.

Film capacitor is particularly well adapted for this use, because main criteria for DC link capacitor will be rms. current withstanding.

It means that DC link capacitor can be designed on rms. current value.

If we take an electric car in account as example:

Requirement data:

Working voltage:	120Vdc
Ripple voltage allowed:	4Vrms
Rms. current:	80 Arms. @ 20kHz

Minimum capacitance value will be:

$$C = \frac{I_{rms}}{U_{ripple} \times 2 \times \pi \times f} = 159 \mu F$$

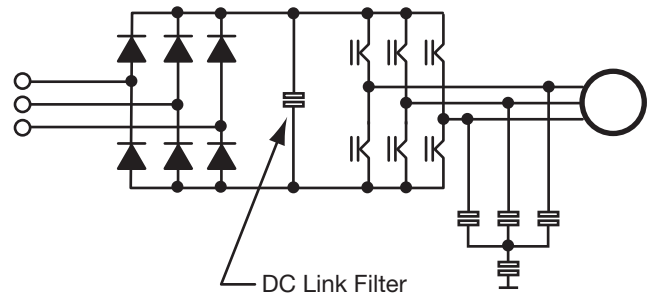
So, it will be easy to find a capacitance value close to these values.

Comparison with electrolytic capacitor.

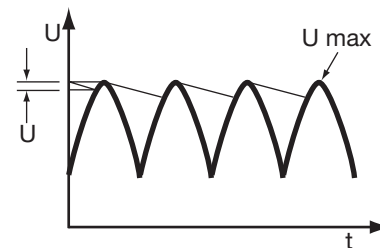
If we take in account 20mA per μF for example, in order to handle 80 Arms, capacitance value minimum would be:

$$C = \frac{80}{0.02} = 4000 \mu F$$

1b) Industrial motor drive, energy supplied from supply network



DC link voltage waveform:



Capacitance value will be defined taken in account that supply frequency is lower than converter frequency.

To determine needed capacitance, we can use the following approached equation:

$$C = \frac{P_{load}}{U_{ripple} \times \left[U_{max} - \frac{U_{ripple}}{2} \right] \times F_{rectifier}}$$

Irms. through capacitor will be (approached expression):

Of course this current doesn't take in account frequency converter current

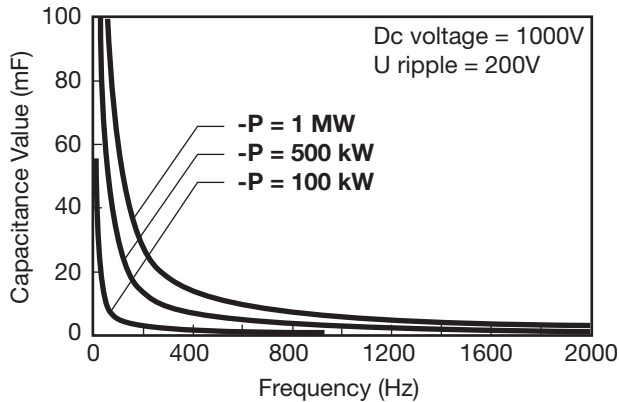
$$I_{rms} = \frac{U_{ripple}}{2 \times \sqrt{2}} \times C \times 2 \times \pi \times F_{rectifier} = \frac{P_{load} \times \pi}{\left[U_{max} - \frac{U_{ripple}}{2} \right] \sqrt{2}}$$

So, with this approximation, Irms. through the capacitor will be depending of the Power of load, Umax and U ripple.

To illustrate, we will take a concrete example:

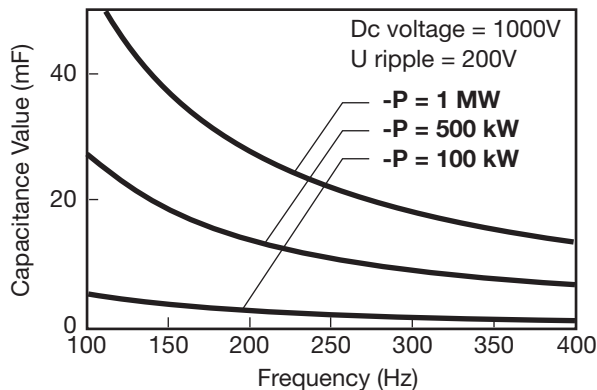
DC voltage 1000 Volts

U ripple 200 volts



P	I _{rms}
1 MW	2468 Arms
500 kW	1234 Arms
100 kW	247 Arms

It becomes necessary to have a zoom on low frequency:



To compare with electrolytic solution, we will take a current capability of 20mA per μF for electrolytic capacitors. First case, power at 1Mwatt:

Rms. current is 2468 Arms, which would impose minimum capacitance value of 123.4mF (taking into account 0.02Arms. per μF).

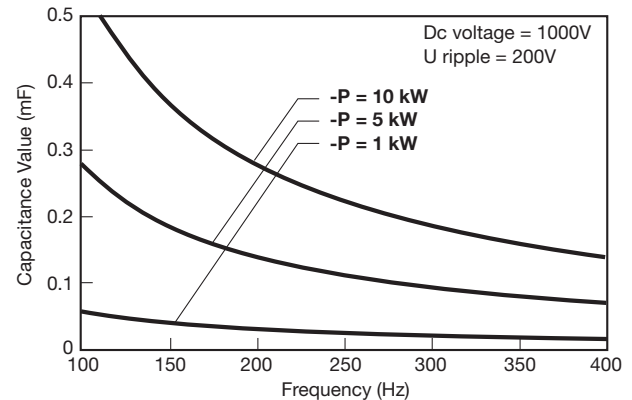
If we look at this value on the curve, we can see that this capacitance value is needed (the given example for film technology) for a rectifier frequency lower than 100Hz.

So, with 3 phases, 6 diodes rectifier, frequency will be 300Hz.

We can see on the 1 megawatt curve that capacitance needed is 18.5mF. Film solution will be almost 4 times smaller than electrolytic solution, with high reliability in addition.

Lower power will give similar results, and for power up to 10 kwatts, capacitance value becomes so small that film technology still constitutes the best solution.

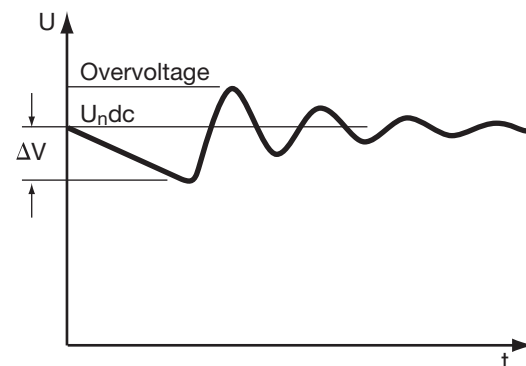
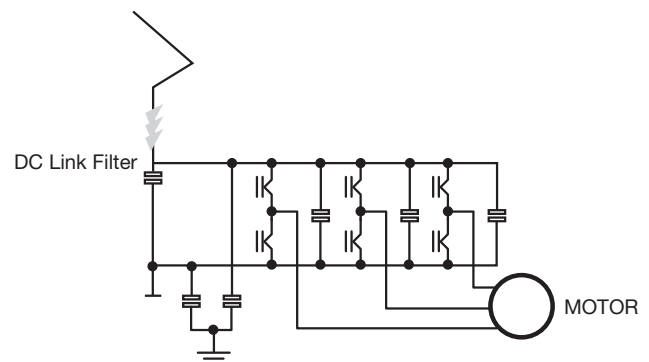
Even at 100Hz rectifier frequency, no more than 555 μF are needed, supply voltage and ripple still the same than previously.



2) OVERVOLTAGE DESIGN

We will consider light traction application, like metro, tramway, electric buses, ...

DC link voltage wave form:



Due to the principle of carrying the power from the catenary to the train, some contact discontinuity appears between pantograph and catenary.

When contact is not done, energy come from DC link filter, with for effect, to decrease the voltage. So, as soon as the contact is re-established, an overvoltage appears.

$$V(t) = U_{ndc} - \Delta V \times e^{-\alpha t} \times (\cos \omega t + \frac{\alpha}{\omega} \sin \omega t)$$

$$\text{with } \omega = \sqrt{\beta_0^2 - \alpha^2}$$

$$\beta_0 = \frac{1}{\sqrt{L \times C}}$$

$$\alpha = \frac{R}{2 \times L}$$

Worse case would be ΔV = catenary voltage, because overvoltage could almost reach 2 times the rated voltage.

So, film capacitor can handle this kind of overvoltage.

Comparison with electrolytic technology:

Electrolytic handle 1.2 DC voltage max:

So minimum voltage that electrolytic should handle would be:

$$\text{DC voltage of electrolytic technology: } \frac{2 \times 1000V}{1.2} = 1670V$$

4 capacitors 450 Volts in series would be needed.

Volume occupied for 10mF with electrolytic would be: 26 l and Irms. max would be 220Arms.

With film, volume occupied would be 25 l, and rms. current capability would be higher than 500Arms.

In other hand, link to these overvoltages, peak current appear through the capacitor:

So, we have to calculate the energy generated by this overvoltage

$$I^2 t = \int i^2(t) dt.$$

$$i(t) = \frac{C \beta_0^2 V_0}{\omega} e^{-\alpha t} \sin \omega t$$

$$i^2(t) = \frac{C^2 \beta_0^4 V_0^2}{\omega^2} e^{-2\alpha t} \sin^2 \omega t$$

$$\int_0^\infty i^2(t) dt = \left[\frac{1}{4} \frac{e^{-2\alpha t} C^2 \beta_0^4 V_0^2 (-\alpha^2 - \omega^2 + \alpha^2 \cos 2\omega t - \alpha \omega \sin 2\omega t)}{\alpha \omega^2 (\alpha^2 + \omega^2)} \right]_0^\infty$$

After few periods, current becomes null, then:

$$\int_0^\infty i^2(t) dt = [0] - \left[-\frac{1}{4} \frac{C^2 \beta_0^4 V_0^2}{\alpha (\alpha^2 + \omega^2)} \right] = \frac{1}{4} \frac{C^2 \beta_0^4 V_0^2}{\alpha (\alpha^2 + \omega^2)}$$

$$\text{with: } \beta_0 = \frac{1}{\sqrt{L \times C}}; \alpha = \frac{R}{2 \times L}; \omega = \sqrt{\beta_0^2 - \alpha^2}$$

This energy calculation will be used for short circuit discharge between terminal as well. Such discharge will generate a very high peak current and some ringing that electrolytic could not handle.

3) VOLTAGE RATING

Function of the voltage rating needed, film solution will become more and more interesting.

If high capacitance value is requested, film solution will be less competitive. Indeed, if there is no overvoltage, low rms. current, large capacitance value, it will be difficult for film technology to be competitive below 900 volts.

LIFETIME CALCULATION

Film technology allows a very long lifetime expectancy, depending on voltage load conditions (working voltage) and hot spot temperature.

For DC filtering, lifetime meets the curves shown in this catalog.

End of life criteria is a decrease of capacitance value of 2%. However, this is a theoretical end of life, because capacitor can be still used after this point. If application can allow 5% capacitance decrease, lifetime will be widely increased.

Hot spot temperature will be determined with the following expression:

$$\theta_{max_{hotspot}} = \theta_{ambient} + P_{rms} \times \left[R_s + \frac{1}{C \times 2 \times \pi} \times tg \delta_0 \right] \times R_{th}$$

with: $\theta_{max_{hotspot}}$: the maximum hot spot temperature

$tg \delta_0$: dielectric losses

R_{th} : Thermal resistance

R_s : Serial resistance

$\theta_{hot spot}$ will be 85°C or 105°C function of the application and the technology.

4) CONCLUSION

This document gives some ways for the engineer designer to do their choice. Of course, for each case a complete calculation will have to be done.

Anyway, if the request is only capacitance value, low voltage, low rms. Current, no overvoltage, no reversal voltage, no peak current, film technology certainly won't be a good solution.

SPECIFIC PRODUCT REQUEST

This questionnaire lists the information we require to prepare an offer according to your exact requirements

Company / Name / Email	Project / Quantity
------------------------	--------------------

Applications	DC Filtering	Discharge*	Protection*	Tuning
Capacitance (µF)				
Tolerance (%)				
Operating Voltage	Vpeak	Vch	Vpeak Vdc	Vrms
Ripple Voltage (peak to peak)	V			
Working Frequency (Hz)				
Operating Current	Arms	Apeak	Arms	Arms
Maximum Current/Duration	Arms s		Apeak	
Discharge		Aperiodic Oscillatory		
Pulse Duration (5% Ipeak)				
Time to Ipeak (µs)				
Ringing Frequency (Hz)				
Reversal Voltage (%)				
Repetition Rate		shots/min/hour/day	Hz	
Hold Time @ Full Voltage (s)				
Fault Peak Current / nb shots	Apeak shots	Apeak shots		
Fault Reversal Voltage (%)				
Lifetime Expectancy	hours	shots	hours	hours
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		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.

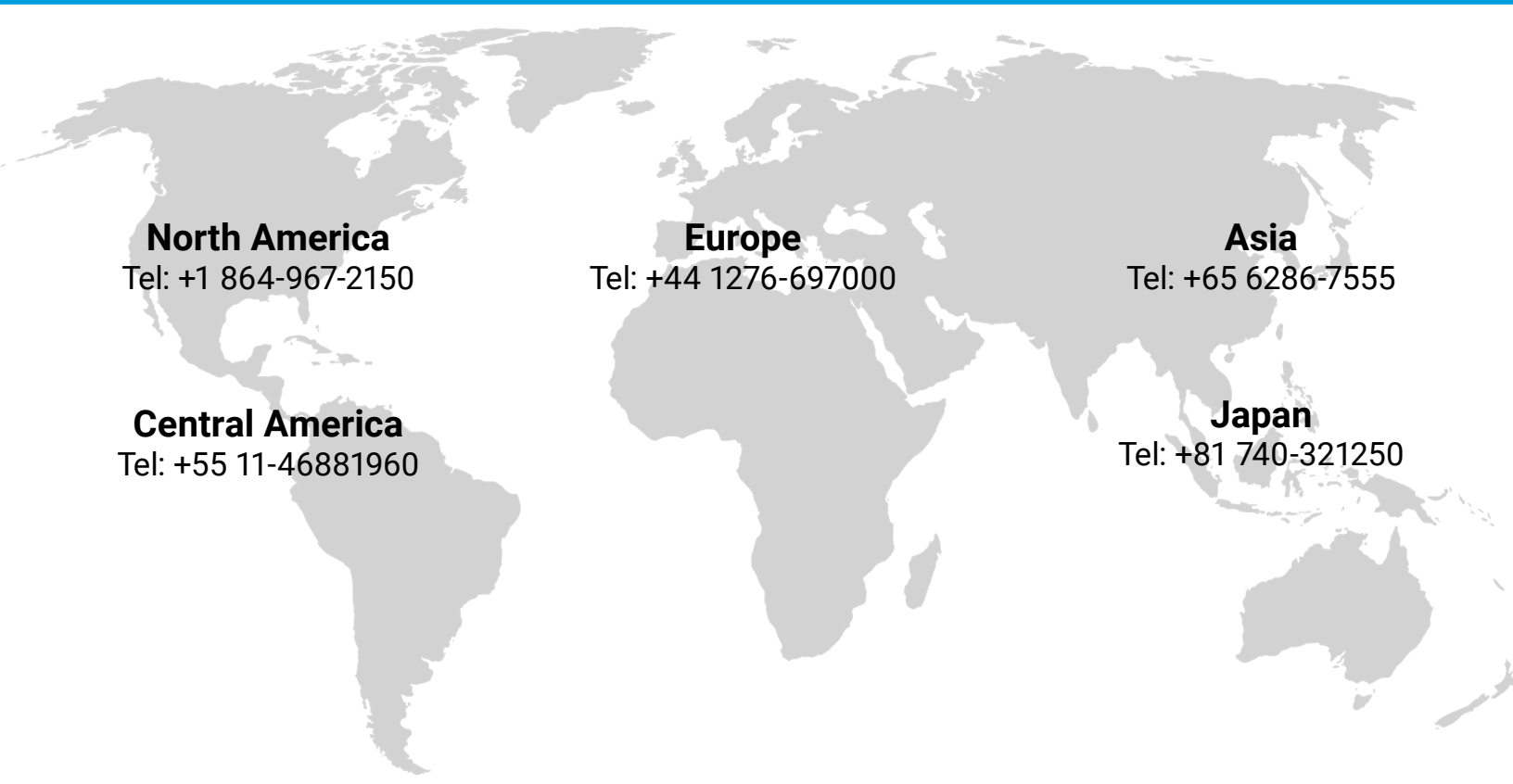
Description			
Dimensions (mm) / Shape		Operating Position	Terminals
Section:	Height:	vertical, horizontal inclined, upside down	type
rectangular, cylindrical			quantity

Thermal Characteristics					
Storage Temperature (°C)		Operating Temperature (°C)		Cooling Method	
min.		min.		Natural Convection	
average		average		Forced Air (m/s)	
max.		max.		Water	

Remarks

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