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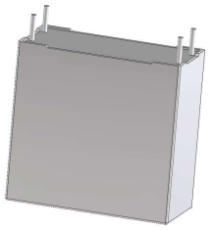
C4AF



BOX CAPACITORS
HARSH ENVIRONMENT
AC FILTERING

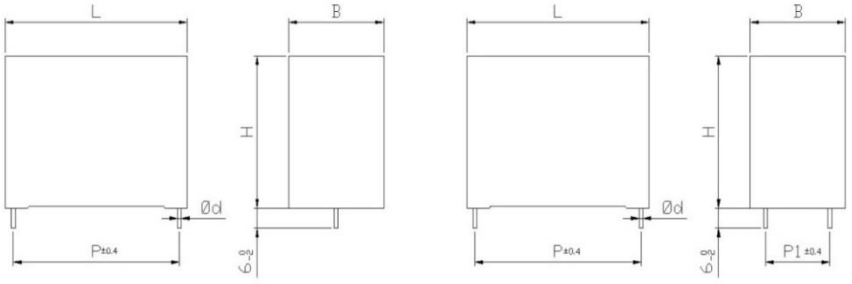
C4AF SERIES
RoHS COMPLIANT

CAPACITORS
FOR PCB APPLICATIONS

OVERVIEW: C4AF capacitors are polypropylene metallized film, rectangular plastic box type filled with resin (white colour), 2 or 4 tinned copper wires and designed to withstand harsh environment condition of work.
Automotive grade devices meet the demanding Automotive Electronics Council's AEC–Q200 qualification requirements.

BENEFIT:

- Self-healing
- Low losses
- High ripple current
- High contact reliability
- Optimized AC Voltage performance
- Suitable for high frequency applications
- Harsh Environment withstanding
- Automotive (AEC–Q200) grades



BOX Style: 2 Wires All dimensions are in mm BOX Style: 4 Wires

P [mm]	nr pins	Ød [mm]
27.5	2	0.8
37.5	4	1.2
52.5	4	1.2

TYPICAL APPLICATION: Clamping, AC filtering, UPS System, Renewable energy - grid interface, Harmonic Filter, Welding equipment, Motor Drives, Automotive

GENERAL TECHNICAL DATA

Dielectric	Polypropylene metallized film, non-inductive, self-healing
Application	AC Filtering (310 Vac ; 400 Vac) AC Output Filtering (250 Vac)
Special Features	AEC-Q200 qualified
Climatic Category	55/105/56 IEC 60068-1
Maximum Operating Temperature	105 °C
Lower Operating Temperature	- 55°C
Standard	IEC 61071, EN61071, VDE0560, AEC-Q200
Protection	Solvent resistant plastic case UL94 V-0 compliant Thermosetting resin sealing UL94 V-0 compliant
Installation	Any position
Leads	Tinned copper wires - standard lead wire length 6 (+0/-2) mm
Packaging	Packed in cardboard trays with protection for the terminals
RoHS Compliance	Compliant with the restricted substance requirements of Directive 2011/65/EU

ELECTRICAL CHARACTERISTICS

Rated Capacitance Range	1 to 62 µF
Rated Voltage (V_{NDC}) Range	250 – 310 - 400 VAC
Capacitance Tolerance	±5% (J) or ±10% (K) measured at T = +25°C
Dissipation Factor PP Typical ($tg\delta_0$)	≤ 0.0002 at 10 kHz with T = 25°C (±5°C)
Surge Voltage	1.5 * V_{NDC} for max. 10 times in lifetime at 25°C
Overvoltage (IEC 61071)	1.15 * V_{NDC} for max. 30 minutes, once per day
	1.3 * V_{NDC} for max. 1 minute, once per day
Peak Non-Repetitive Current	1.5 * I_{PKR}, for max. 1,000 times in lifetime
Insulation Resistance	IR x C ≥ 30.000 seconds at 100 VDC 1 minute (+25°C)
Capacitance Deviation in the operating temperature range -55 to 105°C	±2.5% max. on capacitance value measured at T = +25°C

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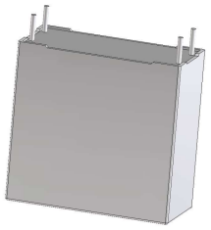

LIFE EXPECTANCY

Life Expectancy	≥ 60.000 hours at U_{NAC} and THS=+85°C
Capacitance Drop at End of Life	-5% (typical)
Failure Rate IEC 61709	10 FIT (≤10 x 10^{-9}/h) at 0.5 X U_{NAC} , 40 °C

TEST METHOD

Peak Non-Repetitive Maximum Current	I_{PKR} x 1.5
Test Voltage Terminal to Terminal V_{TT}	2 V_n for 10 seconds
Test Voltage Terminal to Case V_{TC}	3k V – 50 Hz for 60 seconds
Endurance Test	500h + 500h @ 1.3 x Rated Voltage @ 85°C
	500h + 500h @ 1.3 x Operative Voltage @ 105°C
Damp Heat	IEC 60068-2-78
THB Test 85/85 with Voltage	250 and 310 Vac version 240 Vac 85°C/85% r.h. 500 h: ΔC/C<10% & ΔTg < 3*10-3 at 1 kHz 400 Vac version 335 Vac 85°C/85% r.h. 500 h: ΔC/C<10% & ΔTg < 3*10^{-3} at 1 kHz
Change of Temperature	IEC 60068-2-14

OPERATIVE VOLTAGE DERATING

	Voltage (VAC)		
Operating Voltage	250	310	400
Rated Voltage @ 85°C (T_{HS})	250	310	400
Operating Voltage @ 105°C (T_{HS})	175	217	280

PART NUMBER CODING

C4	A	F	1	B	W	5330	A	3	N	J
Series	Type	Application	Rated Voltage (VAC)	Case	Terminals Code	Capacitance Code (pF)	C-spec	Lead Diameter (mm)	Size Code: BxHxL (mm)	Tolerance
C4 = MKP Power Capacitors	A = Box, wire terminals	F= AC Filtering	1 = 250 9 = 310 3 = 400	B = Box plastic case E = Box plastic case Extended (>35x50x57,5)	U = 2 pins W = 4 pins	Digits 2 – 4 indicate the first three digits of the capacitance value. First digit indicates the number of zeros to be added.	A = Standard Grade	1 = 0.8 3 = 1.2	W = 11x20x31.5 X = 13x25x31.5 Y = 14x28x31.5 1 = 19x29x31.5 2 = 22x37x31.5 F = 20x40x42 J = 28x37x42 L = 30x45x42 M = 30x45x57.5 N = 35x50x57.5 Digit 6=E A = 45x56x57.5 B = 45x65x57.5	J = 5% K = 10%

Reminder

It is not possible to manufacture every part number which could be created from the coding description.
Please refer to the table of standard part numbers below and ask KEMET for other possibilities.

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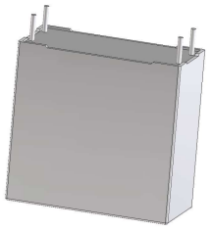

ORDERING CODE

Part number	C (µF)	U_{RAC} (Vac)	dV/dt (V/µs)	Ipkr (Apk)	Max ESL (nH)	Typ. ESR 70°C@10kHz (mΩ)	Irms 70°C@10kHz (Arms)	Rth (°C/W)	Dimensions (mm)				
									B	H	L	P	P1
U_{RAC} @ 85°C = 250 Vac; U_{OPAC} @ 105°C = 175 Vac;													
C4AF1BU4100A1WK	1	250	38	38	24	14.1	4.0	44	11	20	31.5	27.5	\
C4AF1BU4150A1WK	1.5	250	38	56	24	9.7	4.8	44	11	20	31.5	27.5	\
C4AF1BU4220A1XK	2.2	250	38	83	25	7.2	6.2	36	13	25	31.5	27.5	\
C4AF1BU4330A11K	3.3	250	38	125	26	5.3	8.0	29	19	29	31.5	27.5	\
C4AF1BU4470A11K	4.7	250	38	179	26	4.2	9.1	29	19	29	31.5	27.5	\
C4AF1BU4680A12K	6.8	250	38	259	28	3.6	11.0	23	22	37	31.5	27.5	\
C4AF1BU4750A12K	7.5	250	38	285	28	3.4	11.3	23	22	37	31.5	27.5	\
C4AF1BW5100A3FK	10	250	27	272	30	2.7	13.7	20	20	40	42	37.5	10.2
C4AF1BW5150A3LK	15	250	27	400	33	1.9	18.9	15	30	45	42	37.5	20.3
C4AF1BW5220A3OK	22	250	27	587	35	1.4	23.8	13	35	50	42	37.5	20.3
C4AF1BW5245A3OK	24.5	250	27	654	35	1.2	24.8	13	35	50	42	37.5	20.3
C4AF1BW5330A3NK	33	250	18	587	38	1.7	24	10	35	50	57.5	52.5	20.3
C4AF1EW5470A3AK	**47**	250	**18**	**837**	**41**	**1.3**	**30.9**	**8**	**45**	**56**	**57.5**	**52.5**	**20.3**
C4AF1EW5550A3AK	**55**	250	**18**	**960**	**41**	**1.2**	**32.8**	**8**	**45**	**56**	**57.5**	**52.5**	**20.3**
C4AF1EW6220A3BK	**62**	250	**18**	**1116**	**45**	**1.1**	**36.2**	**7**	**45**	**65**	**57.5**	**52.5**	**20.3**
U_{RAC} @ 85°C = 310 Vac; U_{OPAC} @ 105°C = 215 Vac;													
C4AF9BU4100A1WK	1	310	45	45	24	13.4	4.1	44	11	20	31.5	27.5	\
C4AF9BU4150A1XK	1.5	310	45	68	25	9.5	5.4	36	13	25	31.5	27.5	\
C4AF9BU4220A1YK	2.2	310	45	99	26	7.0	6.6	33	14	28	31.5	27.5	\
C4AF9BU4330A11K	3.3	310	45	149	26	5.1	8.2	29	19	29	31.5	27.5	\
C4AF9BU4470A12K	4.7	310	45	212	28	4.3	10.1	23	22	37	31.5	27.5	\
C4AF9BW4680A3FK	6.8	310	32	218	30	3.3	12.3	20	20	40	42	37.5	10.2
C4AF9BW5100A3JK	10	310	32	320	29	2.3	15.5	18	28	37	42	37.5	10.2
C4AF9BW5150A3OK	15	310	32	480	35	1.6	21.6	13	35	50	42	37.5	20.3
C4AF9BW5170A3OK	17	310	32	560	35	1.5	22.8	13	35	50	42	37.5	20.3
C4AF9BW5220A3NK	22	310	21	462	38	2.1	21.6	10	35	50	57.5	52.5	20.3
C4AF9EW5330A3AK	**33**	**310**	**21**	**693**	**41**	**1.5**	**28.6**	**8**	**45**	**56**	**57.5**	**52.5**	**20.3**
C4AF9EW5375A3AK	**37.5**	**310**	**21**	**788**	**41**	**1.4**	**30.2**	**8**	**45**	**56**	**57.5**	**52.5**	**20.3**
C4AF9EW5420A3BK	**42**	**310**	**21**	**882**	**45**	**1.3**	**33.3**	**7**	**45**	**65**	**57.5**	**52.5**	**20.3**
U_{RAC} @ 85°C = 400 Vac; U_{OPAC} @ 105°C = 280 Vac;													
C4AF3BU4100A1YK	1	400	141	141	26	7.9	6.2	33	14	28	31.5	27.5	\
C4AF3BU4150A11K	1.5	400	141	212	26	5.8	7.7	29	19	29	31.5	27.5	\
C4AF3BU4220A12K	2.2	400	141	310	28	4.7	9.7	23	22	37	31.5	27.5	\
C4AF3BU4250A12K	2.5	400	141	353	28	4.3	10.1	23	22	37	31.5	27.5	\
C4AF3BW4330A3FK	3.3	400	90	297	30	3.2	12.4	20	20	40	42	37.5	10.2
C4AF3BW4470A3JK	4.7	400	90	423	29	2.3	15.4	18	28	37	42	37.5	10.2
C4AF3BW4680A3LK	6.8	400	90	612	33	1.7	19.8	15	30	45	42	37.5	20.3
C4AF3BW4900A3OK	9.0	400	90	810	35	1.4	23.8	13	35	50	42	37.5	20.3
C4AF3BW5100A3MK	10	400	61	610	35	1.9	20.8	12	30	45	57.5	52.5	20.3
C4AF3EW5150A3AK	15	**400**	**61**	**915**	**41**	**1.4**	**29.8**	**8**	**45**	**56**	**57.5**	**52.5**	**20.3**
C4AF3EW5200A3AK	20	**400**	**61**	**1220**	**41**	**1.1**	**33.4**	**8**	**45**	**56**	**57.5**	**52.5**	**20.3**
C4AF3EW5225A3BK	22.5	**400**	**61**	**1342**	**45**	**1.1**	**36.8**	**7**	**45**	**65**	**57.5**	**52.5**	**20.3**

[1] ***Bold only for samples***

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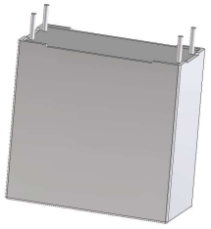
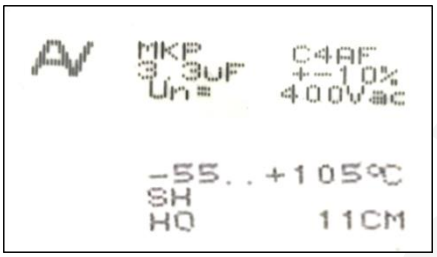


DIMENSIONS TABLE (mm)

Size Code		P		P1		B		H		L		L wires	
Dgt 6	Dgt 14	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
B	W	27.5	±0.4	-	-	11.0	+0.3	20.0	+0.2	31.5	+0.5	6.0	0.0/-2.0
B	X	27.5	±0.4	-	-	13.0	+0.3	25.0	+0.2	31.5	+0.5	6.0	0.0/-2.0
B	Y	27.5	±0.4	-	-	14.0	+0.3	28.0	+0.2	31.5	+0.5	6.0	0.0/-2.0
B	1	27.5	±0.4	-	-	19.0	+0.3	29.0	+0.2	31.5	+0.5	6.0	0.0/-2.0
B	2	27.5	±0.4	-	-	22.0	+0.3	37.0	+0.2	31.5	+0.5	6.0	0.0/-2.0
B	F	37.5	±0.4	10.2	±0.4	20.0	+0.4	40.0	+0.2	42.0	+0.6	6.0	0.0/-2.0
B	J	37.5	±0.4	10.2	±0.4	28.0	+0.4	37.0	+0.2	42.0	+0.6	6.0	0.0/-2.0
B	L	37.5	±0.4	20.3	±0.4	30.0	+0.4	45.0	+0.2	42.0	+0.6	6.0	0.0/-2.0
B	O	37.5	±0.4	20.3	±0.4	35.0	+0.4	50.0	+0.2	42.0	+0.6	6.0	0.0/-2.0
B	M	52.5	±0.4	20.3	±0.4	30.0	+0.5	45.0	+0.3	57.5	+0.8	6.0	0.0/-2.0
B	N	52.5	±0.4	20.3	±0.4	35.0	+0.5	50.0	+0.3	57.5	+0.8	6.0	0.0/-2.0
E	A	52.5	±0.4	20.3	±0.4	45.0	+0.5	56.0	+0.3	57.5	+0.8	6.0	0.0/-2.0
E	B	52.5	±0.4	20.3	±0.4	45.0	+0.5	65.0	+0.3	57.5	+0.8	6.0	0.0/-2.0

MARKING

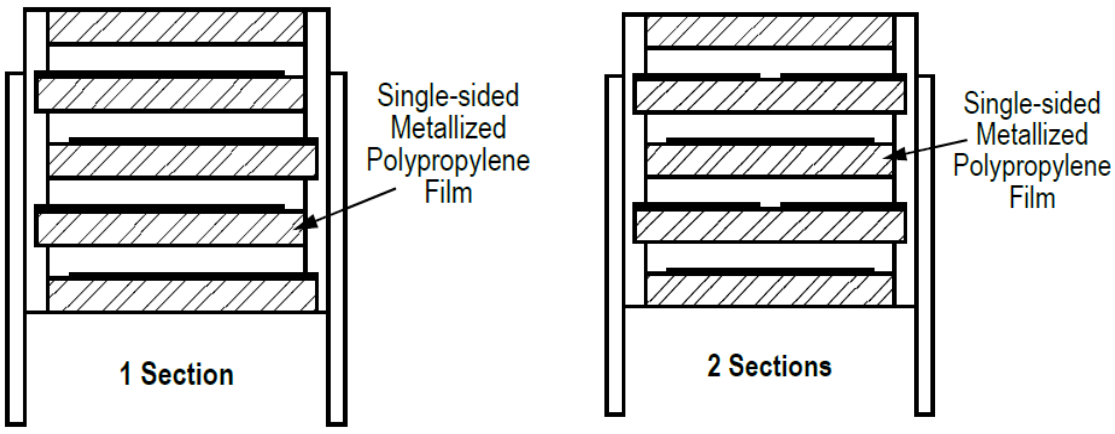
Typical data on marking:



MKP	C4AF	→ *Dielectric type* *Series*
3.3 uF	+-10%	→ *Capacitance* *Tolerance*
Un = 400Vac		→ *Rated Voltage*
-55	+105°C	→ *Climatic Category Temperatures - Min / Max*
SH		→ *Self-Healing dielectric*
HO	11CM	→ *Production date**: Year/Month - Day - Prod Line (Internal Code)*

*** Year/Month correspondence table available on General Catalogue - in the example H=2016 / O=October / 11=11th / CM=internal*

CONSTRUCTION



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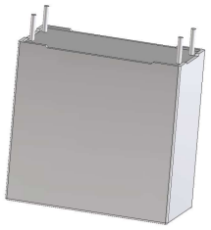
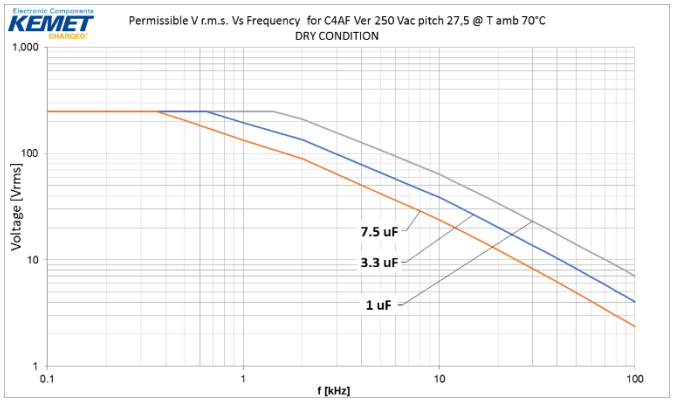
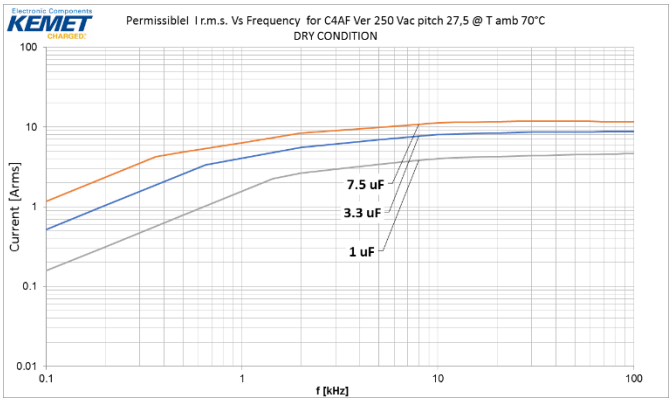
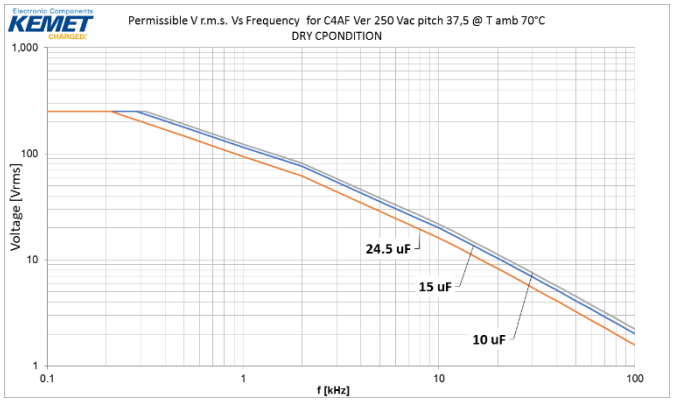


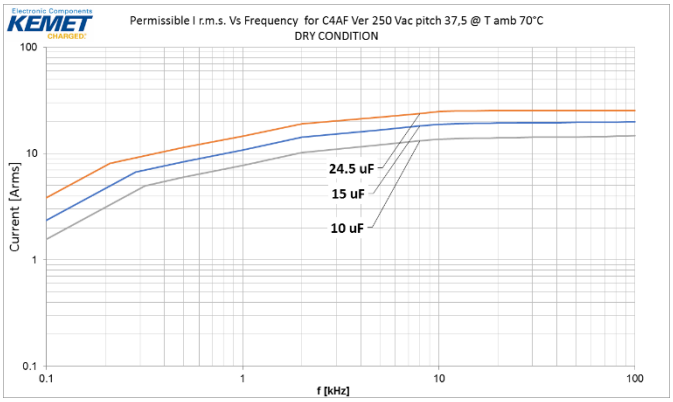
VOLTAGE AND CURRENT GRAPH

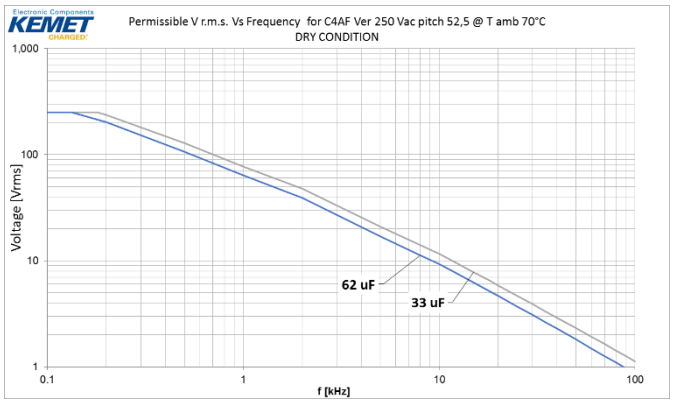
250 VAC

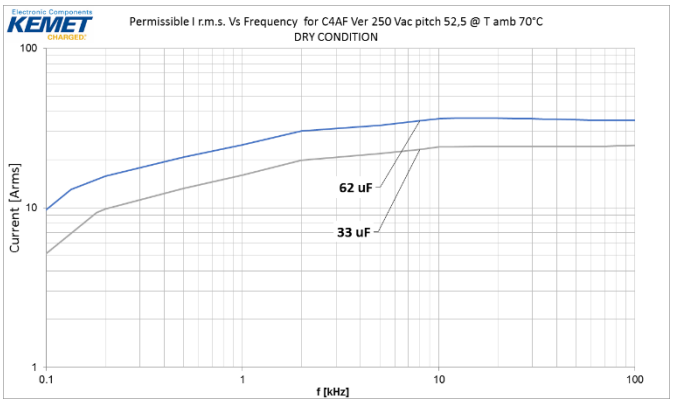












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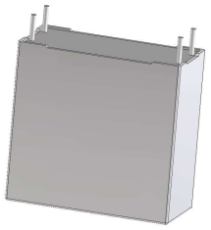
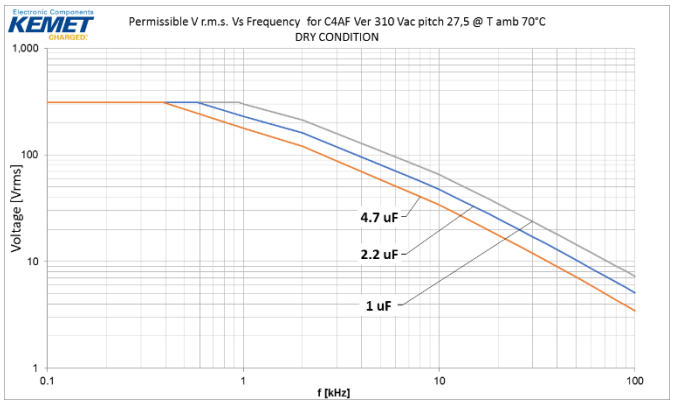
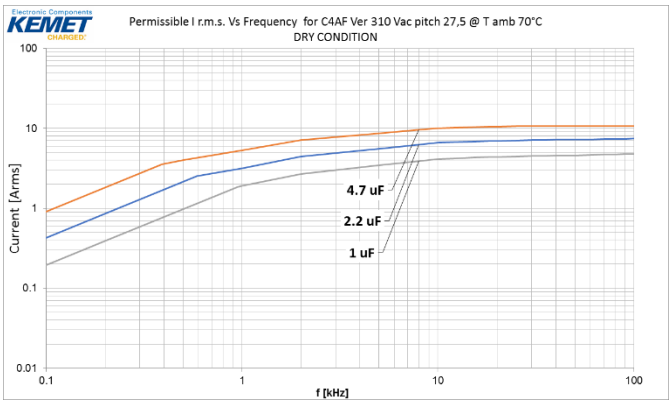
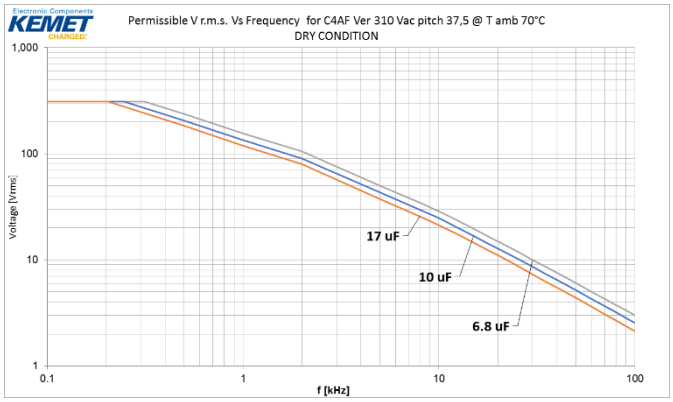
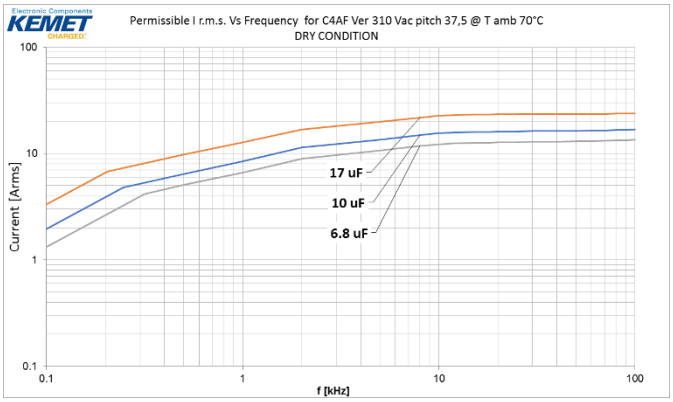


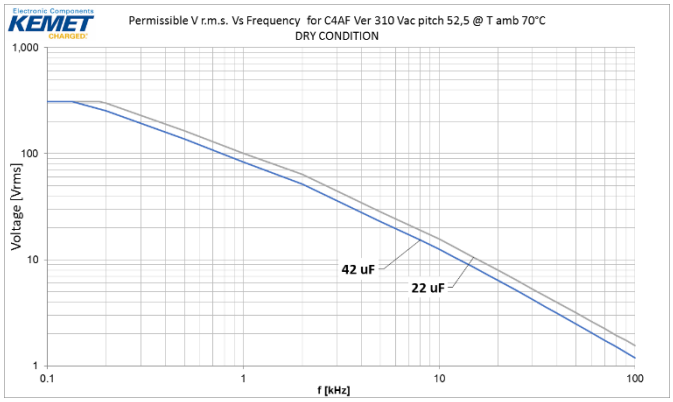
310 VAC

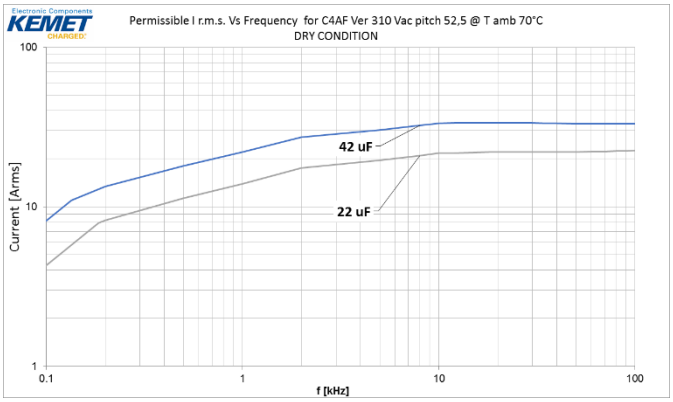






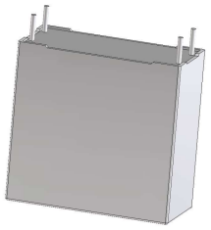




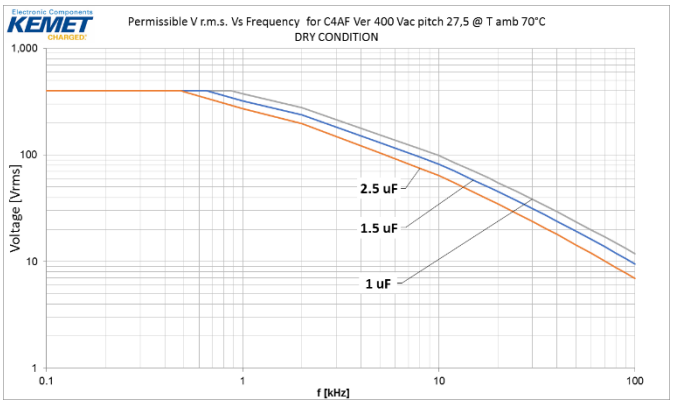


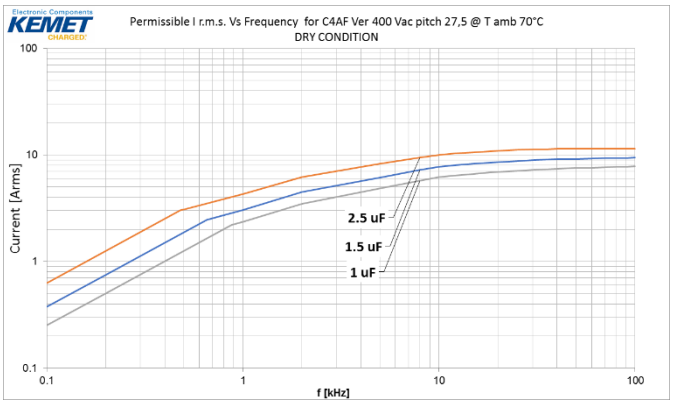
Electronic Components KEMET CHARGED.

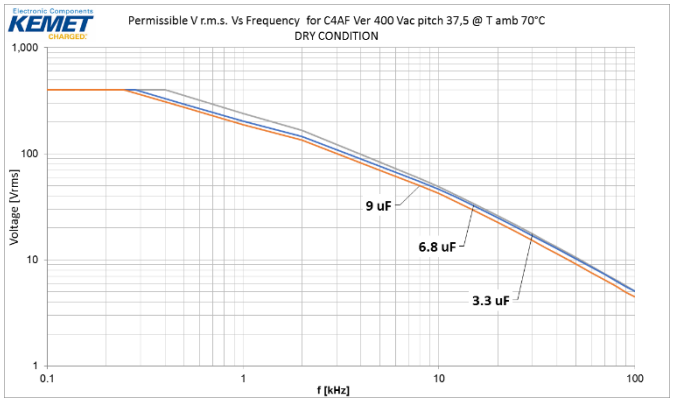
C4AF

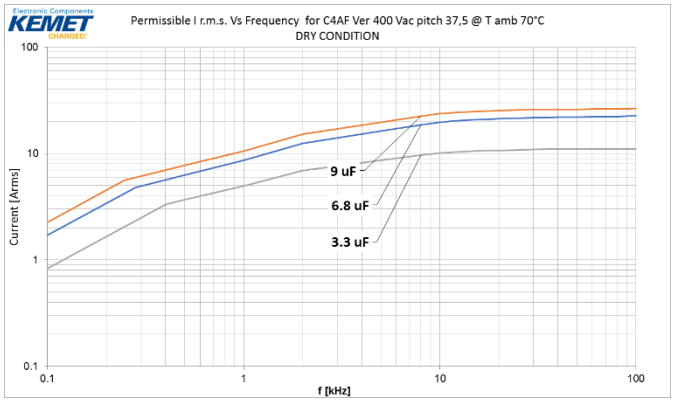


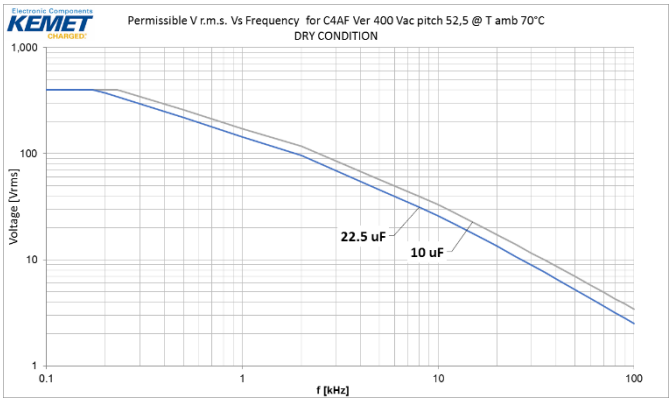
400 VAC

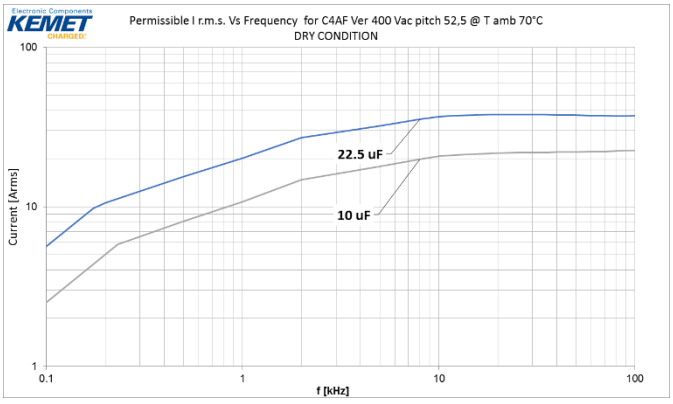


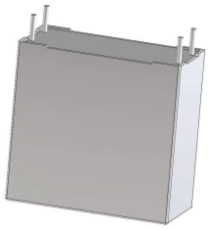




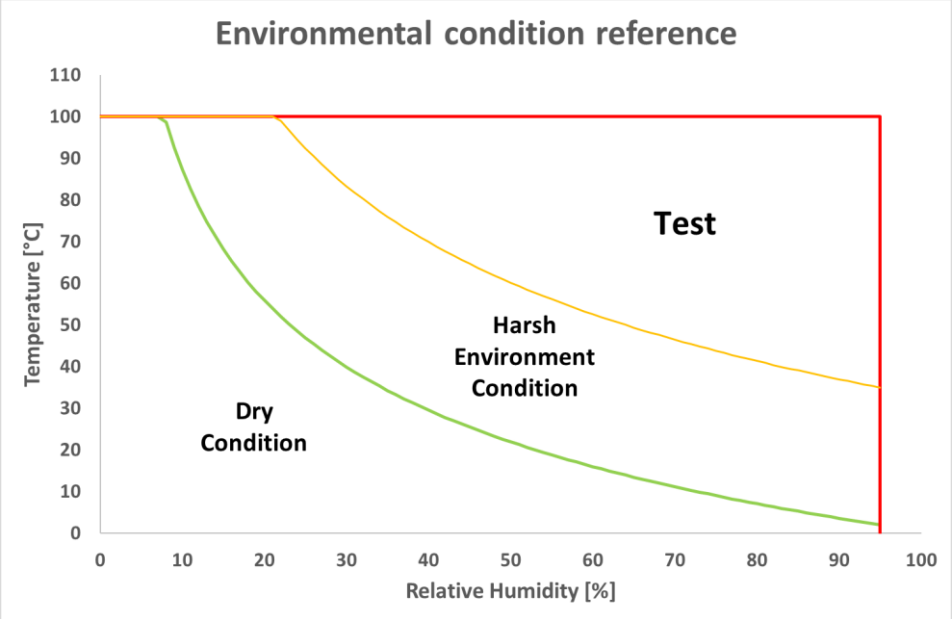








Environmental Condition Reference



The formula used to calculate the max power dissipated by the capacitor is the following:

$$P_{diss} = \sum_{i}^{N} \frac{(I_{rms}^2)_i}{2 * \pi * f_i * C} * tg\delta_{max}(f_i)$$

Where:

- P_{diss} [W]= Dissipated power by Customer application
- $(I_{rms})_i$ $[Arms]$ = r.m.s current of the i[th] harmonic in Ampere from customer application
- f_i $[Hz]$ = Frequency of the i[th] harmonic in Hertz
- $tg\delta_{max}(f)_i$ = Max. dissipation factor corresponding to the frequency of the i[th] harmonic
- N= Number of significant harmonics
- C [F] = Capacity in Farad

$$P_{MAX} = \frac{(I_{rms,PRM})^2}{2 * \pi * f_i * C} * tg\delta_{max}(f)_i$$

$$\frac{P_{diss}}{P_{MAX}} \leq 1$$

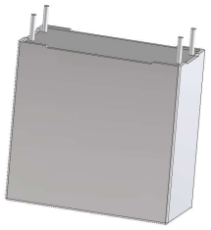
$$\sum_{i}^{N} \left(\frac{I_{rms,i}}{I_{rmsPRM,i}}\right)^2 \leq 1$$

$$\Delta T = \Delta T_{Lim} * \sum_{i}^{N} \left(\frac{I_{rms,i}}{I_{rmsPRM,i}}\right)^2$$

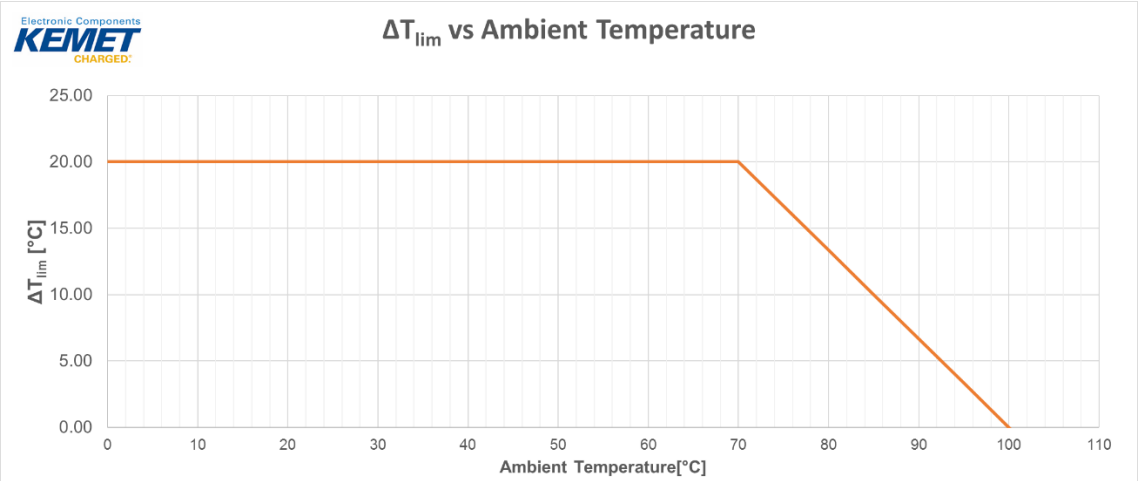
- $(I_{rmsPRM})_i$ $[Arms]$= Permissible r.m.s current of the i[th] harmonic in Ampere linked to the graphic of the working condition
- P_{MAX} $[W]$= Max power dissipated by the capacitor:

$$P_{MAX} = \frac{\Delta T_{Lim}}{R_{th}}$$

- ΔT $[°C]$ = Temperature change from ambient temperature
- ΔT_{Lim} $[°C]$ = Maximum temperature change allowed for the capacitor
- R_{th} $\left[\frac{°C}{W}\right]$ = Thermal resistance linked to the box dimension



KEMET defines maximum ripple current, based on Hot-Spot/Ambient self-heating temperature. For C4AF series, maximum allowed self-heating is 20°C whith ambient temperature up to 70°C. ΔT is reduced linearly with increasing ambient temperature, down to 0°C at 100°C (no self-heating allowed at maximum operating temperature):



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