C4AF, Radial, 2 or 4 Leads, 250 – 600 VAC, for Harsh Environment AC Filtering (Automotive Grade)

Overview

The C4AF capacitor is a polypropylene metallized film capacitor with a rectangular, plastic box-type design filled with resin, and uses 2 or 4 tinned wires. These capacitors are intended to withstand harsh environmental conditions.

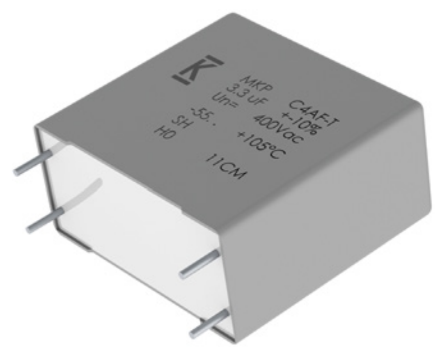
Automotive grade devices meet the demanding Automotive Electronics Council's AEC–Q200 qualification requirements.

Applications

Typical applications include AC and harmonic filtering in UPS systems, motor drives, renewable energy, and automotive systems.

Benefits

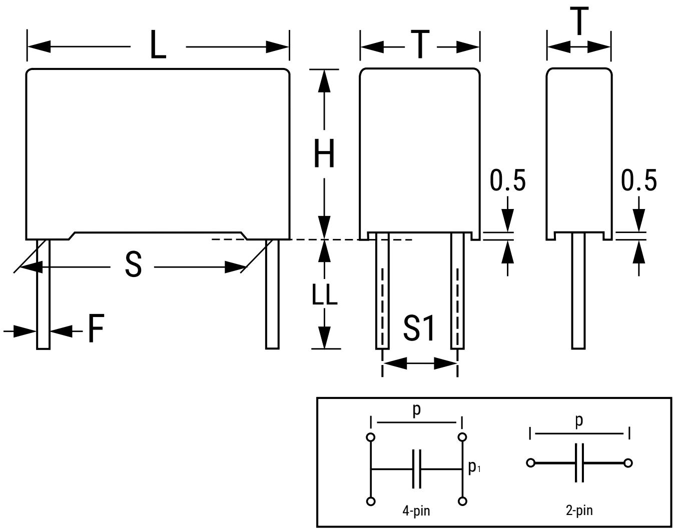
- Self-healing
- Low loss
- High ripple current
- High contact reliability
- Optimized AC voltage performance
- Suitable for high frequency applications
- Able to withstand harsh environmental conditions
- Automotive grades (AEC–Q200)



Part Number System

C4	A	F	1	B	W	5330	T	3	N	J
Series	Type	Application	Rated Voltage (VAC)	Case	Terminals Code	Capacitance Code (pF)	Release	Lead Diameter (mm)	Size Code: B x H x L (mm)	Tolerance
C4 = MKP Power Capacitors	A = Box, wire terminals	F = AC filtering	1 = 250 9 = 310 7 = 350 3 = 400 A = 500 B = 600	B, E = Box plastic case	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 = THB 500 hours 85°C/85% R.H. (Not for new design) T = THB 1,000 hours 85°C/85% R.H.	1 = 0.8 3 = 1.2	Digit 6 = B W = 11 x 20 x 31.5 X = 13 x 25 x 31.5 Y = 14 x 28 x 31.5 1 = 19 x 29 x 31.5 2 = 22 x 37 x 31.5 F = 20 x 40 x 42 J = 28 x 37 x 42 L = 30 x 45 x 42 M = 3 0 x 45 x 57.5 N = 35 x 50 x 57.5 Digit 6 = E A = 45 x 56 x 57.5 B = 45 x 65 x 57.5	J = 5% K = 10%

Dimensions – Millimeters



Size Code		S		S1		T		H		L		LL		F	
Digit 6	Digit 14	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance	Nominal	Tolerance
B	W	27.5	±0.4	-	-	11.0	+0.3/−0.7	20.0	+0.2/−0.7	31.5	+0.5/−0.7	6	+0/−2	0.8	±0.05
B	X	27.5	±0.4	-	-	13.0	+0.3/−0.7	25.0	+0.2/−0.7	31.5	+0.5/−0.7	6	+0/−2	0.8	±0.05
B	Y	27.5	±0.4	-	-	14.0	+0.3/−0.7	28.0	+0.2/−0.7	31.5	+0.5/−0.7	6	+0/−2	0.8	±0.05
B	1	27.5	±0.4	-	-	19.0	+0.3/−0.7	29.0	+0.2/−0.7	31.5	+0.5/−0.7	6	+0/−2	0.8	±0.05
B	2	27.5	±0.4	-	-	22.0	+0.3/−0.7	37.0	+0.2/−0.7	31.5	+0.5/−0.7	6	+0/−2	0.8	±0.05
B	F	37.5	±0.4	5.1/10.2	±0.4	20.0	+0.4/−0.7	40.0	+0.2/−0.7	42.0	+0.6/−0.7	6	+0/−2	1.2	±0.05
B	J	37.5	±0.4	10.2	±0.4	28.0	+0.4/−0.7	37.0	+0.2/−0.7	42.0	+0.6/−0.7	6	+0/−2	1.2	±0.05
B	L	37.5	±0.4	20.3	±0.4	30.0	+0.4/−0.7	45.0	+0.2/−0.7	42.0	+0.6/−0.7	6	+0/−2	1.2	±0.05
B	O	37.5	±0.4	20.3	±0.4	35.0	+0.4/−0.7	50.0	+0.2/−0.7	42.0	+0.6/−0.7	6	+0/−2	1.2	±0.05
B	M	52.5	±0.4	20.3	±0.4	30.0	+0.5/−0.7	45.0	+0.3/−0.7	57.5	+0.6/−0.7	6	+0/−2	1.2	±0.05
B	N	52.5	±0.4	20.3	±0.4	35.0	+0.5/−0.7	50.0	+0.3/−0.7	57.5	+0.8/−0.7	6	+0/−2	1.2	±0.05
E	A	52.5	±0.4	20.3	±0.4	45.0	+0.5/−0.7	56.0	+0.3/−0.7	57.5	+0.8/−0.7	6	+0/−2	1.2	±0.05
E	B	52.5	±0.4	20.3	±0.4	45.0	+0.5/−0.7	65.0	+0.3/−0.7	57.5	+0.8/−0.7	6	+0/−2	1.2	±0.05

Qualification

Reference Standards	IEC 61071, EN 61071, VDE0560
Climatic Category	55/105/56 according to IEC 60068–1

Automotive grade products meet or exceed the requirements outlined by the Automotive Electronics Council. Details regarding test methods and conditions are referenced in document AEC–Q200, Stress Test Qualification for Passive Components. For additional information regarding the Automotive Electronics Council and AEC–Q200, please visit their website at www.aecouncil.com.

General Technical Data

Dielectric	Polypropylene metallized film, non-inductive type, self-healing property
Application	AC Filtering (250 VAC, 310 VAC, 350 VAC, 400 VAC, 500 VAC, 600 VAC) 250 VAC rating recommended ONLY for controlled output filtering
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, EN 61071, VDE0560, AEC-Q200
Protection	Solvent resistant plastic case UL 94 V-0 compliant Thermosetting resin sealing UL 94 V-0 compliant
Installation	Any position
Leads	Tinned wires - standard lead wire length 6 (+0/−2) mm
Packaging	Packed in cardboard trays with protection for the terminals
RoHS Compliance	Compliant with Directive 2002/95/EC and Directive 2011/65/EU of the European Parliament and of the Council on 8 June 2011, including Commission Delegated Directive (EU) 2015/863 amending Annex II to Directive 2011/65/EU.

Electrical Characteristics

Rated Capacitance Range	1 to 62 µF
Rated Voltage (VNAC) Range	250 to 600 VAC (50/60 Hz)
Capacitance Tolerance	±5% (J) or ±10% (K) measured at T = +25°C ±5°C
Dissipation Factor PP Maximum (tgδ0)	≤ 0.0007 with T = 25°C ±5°C
Surge Voltage	1.5 * V_{NDC} for maximum 10 times in lifetime at T = 25°C ±5°C
Overvoltage (IEC 61071)	1.15 * V_{NDC} for maximum 30 minutes, once per day
	1.3 * V_{NDC} for maximum 1 minute, once per day
Peak Non-Repetitive Current	1.5 * I_{PKR}, for maximum 1,000 times in lifetime
Insulation Resistance	IR x C ≥ 30,000 seconds at 100 VDC 1 minute at T = +25°C, ±5°C
Capacitance Deviation in the operating temperature range −55 to 105°C	±2.5% maximum on capacitance value measured at T = +25°C, ±5°C
Temperature Storage	−40 to +80°C
Storage time	≤ 36 months from the date marked on the label glued to the package
Permissible Relative Humidity - Storage	Annual average ≤ 70%, 85% on 30 days/year randomly distributed throughout year. Dewing not admissible.

Life Expectancy

Life Expectancy	≥ 60,000 hours at V_{NAC} and T_{HS} = +85°C
Capacitance Drop at End of Life	−5% (typical)
Failure Rate	See Life Expectancy/Failure Quota Graphs

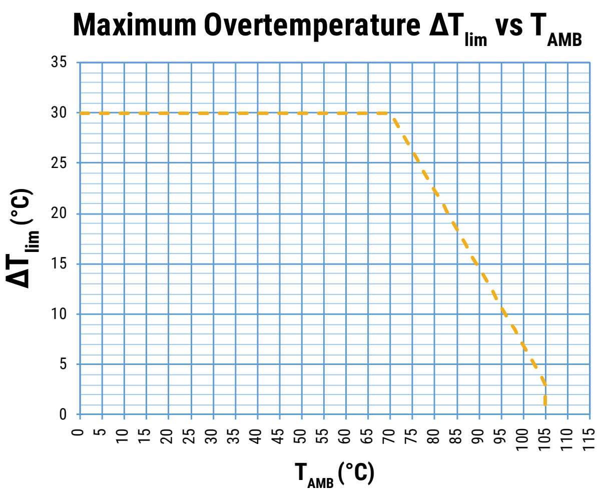
Test Method

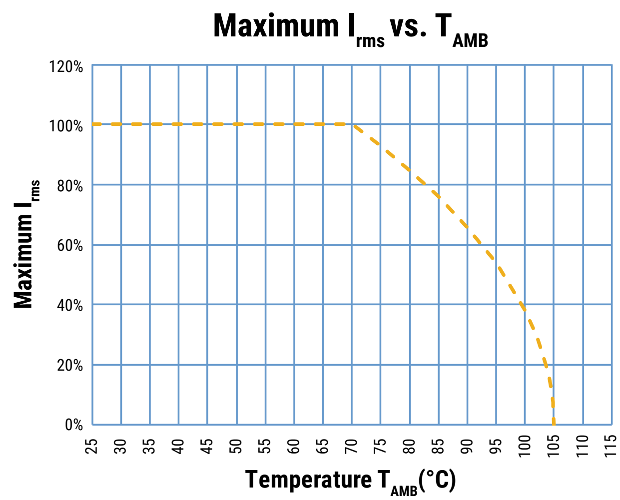
Peak Non-Repetitive Maximum Current	I_{PKR} x 1.5
Test Voltage Terminal to Terminal V_{TT}	1.5 * V_{NDC} for 10 seconds
Test Voltage Terminal to Case V_{TC}	2 k VAC – 50/60 Hz for 60 seconds
Endurance Test	500 hours + 500 hours at 1.25 x rated voltage at 85°C
	500 hours + 500 hours at 1.25 x operative voltage at 105°C
Damp Heat	IEC 60068-2-78
THB Test 85/85 with Voltage Release "A": 500 hours Release "T": 1,000 hours	Test Voltages:
	250 and 310 V_{NAC} version: 240 VAC 350 and 400 V_{NAC} version: 310 VAC 500 V_{NAC} version: 410 VAC 600 V_{NAC} version: 500 VAC
	Performance:
	|ΔC/C| <10% |ΔTg| < 3*10-3 at 1 kHz Release "A" |ΔTg| < 5*10-3 at 1 kHz Release "T" IR ≥ 50% initial limit
Change of Temperature	IEC 60068–2–14

Operative Voltage Derating

	Voltage (VAC)					
Operating Voltage	250	310	350	400	500	600
Rated Voltage at 85°C (T_{HS})	250	310	350	400	500	600
Operating Voltage at 105°C (T_{HS})	175	217	245	280	350	420

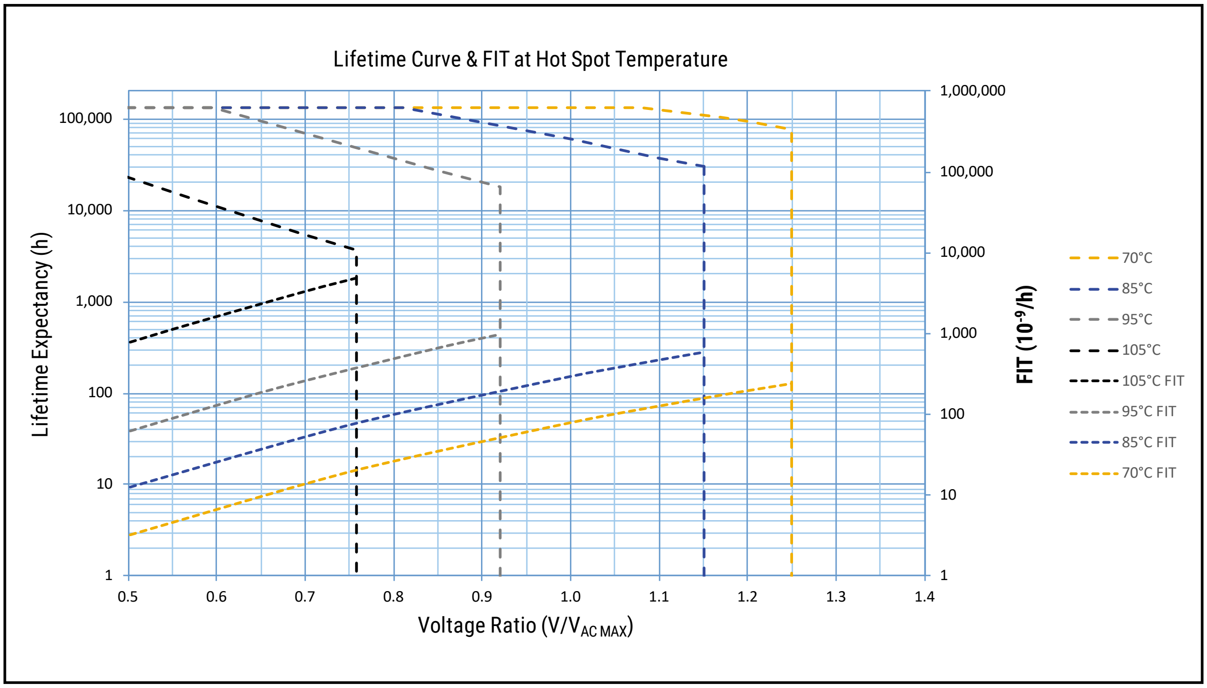
KEMET defines maximum ripple current, based on hot spot/ambient self-heating temperature. For C4AF, maximum allowed self-heating is 30°C, with ambient temperature up to 70°C. DT is reduced linearly with increasing ambient temperature, down to 3°C (caused by the fundamental frequency current, no ripple current) at 105°C:





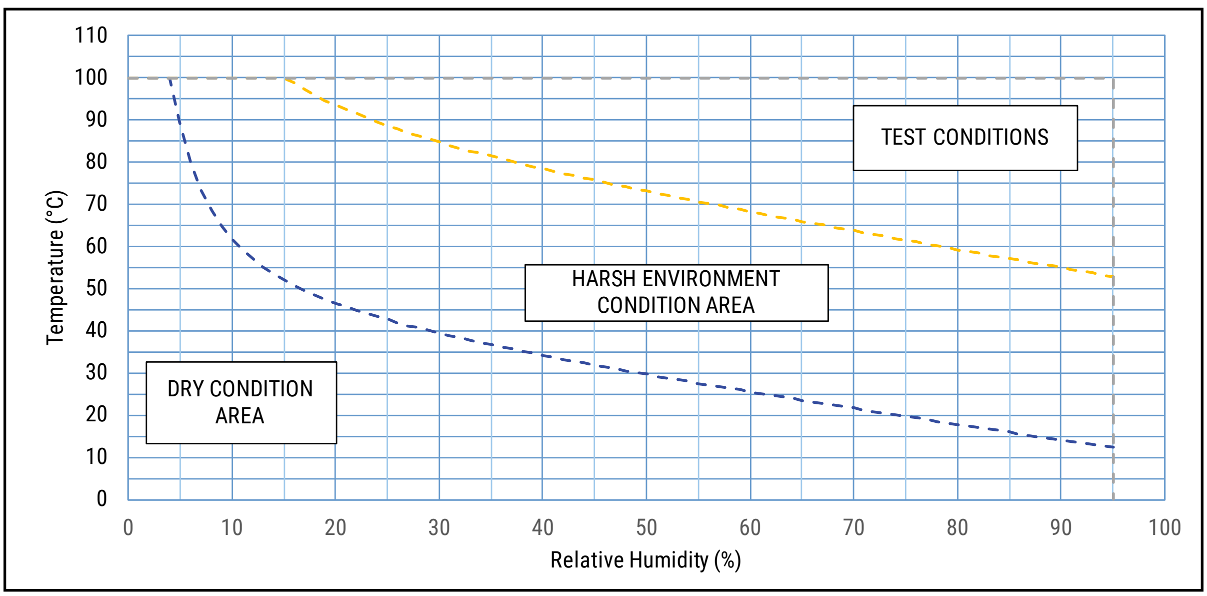
T_{AMB} is the maximum ambient temperature surrounding the capacitor or hottest contact point (e.g. tracks), whichever is higher, in the worst operation conditions in °C.

Life Expectancy/Failure Quota* Graphs



** Evaluated considering an environmental conditions as dry condition.*

Environmental Condition Reference



The dry condition area is defined as the range of temperature and relative humidity to validate the life time and V_{rms}/I_{rms} graphs.
The separation line between harsh environment conditions and test conditions area is calculated for a life time of one year at operating voltage.

Power Losses & Hot Spot Temperature Calculation

At each frequency, the power lossess are the sum of:

1. Dielectric power losses

$$P_D(f_i) = 2 * \pi * f_i * C * V(f_i)^2 * tg\delta_0$$

which can be alternatively calculated as

$$P_D(f_i) = \frac{I(f_i)^2}{2 * \pi * f_i * C} * tg\delta_0$$

where:

$$tgd_0 = 7 * 10^{-4} \text{ (maximum value)}$$

2. Joule power losses

$$P_J(f_i) = Rs * I(f_i)^2$$

The total power losses are the sum of the components at each frequency:

$$P_T = \Sigma_i [P_D(f_i) + P_J(f_i)]$$

The thermal jump in the hot spot is:

$$\Delta T_{HS} = P_T * R_{th}$$

The hot spot temperature is:

$$T_{HS} = T_a + \Delta T_{HS}$$

Power Losses & Hot Spot Temperature Calculation cont.

Limits for the formulas

The limits listed below should not be exceeded:

$$1.\quad \sqrt{\sum_i V(f_i)^2} \le VAC_{MAX}$$

$$2.\quad \sqrt{\sum_i I(f_i)^2} \le I_{RMS_{MAX}}$$

$$T_{HS} = T_a + \Delta T_{HS} \le (T_{HS})_{MAX}$$

where Ta is the ambient temperature (steady state temperature of the cooling air flowing around the capacitor, measured at 100 mm of distance from the capacitor and at a height of 2/3 height of the capacitor).

Example of calculation

P/N: C4AF9BW5100T3JK	$P_D(50) = 2 * \pi * 50 * 10 * 10^{-6} * 310^2 * 7 * 10^{-4} = 0.211$ [W]
Rated $V_{RMS} = 310$ [V_{RMS}]	$P_D(15{,}000) = [7.9^2/(2 * \pi * 15{,}000 * 10 * 10^{-6})] * 7 * 10^{-4} = 0.0463$ [W]
Rated $I_{RMS\,MAX} = 16.6$ [A]	$P_J(50) = 4.2 * 10^{-3} * [(2 * \pi * 50 * 10 * 10^{-6} * 310)^2] = 0.00398$ [W]
$R_s = 4.2$[mΩ]	$P_J(15000) = 4.2 * 10^{-3} * 7.9^2 = 0.262$ [W]
$R_{th} = 18$ [°C/W]	$P_T = 0.211+0.0463+0.00398+0.262 = 0.523$ [W]
Fundamental Frequency $F_1 = 50$ [Hz]	$\Delta T_{HS} = 18 * 0.523 = 9.4$ [°C]
Ripple Frequency $F_2 = 15{,}000$ [Hz]	$T_{HS} = Ta + \Delta T_{HS}$
Fundamental Voltage $V_1 = 310$ [V~]	$T_{HS} = 75 + 9.4 = 84.4$ [°C] » OK since hot spot temperature is less than maximum admitted
Ripple Current $I_2 = 7.9$ [A]	Expected Life at $T_{HS} = 85$°C » 60,000 hours (see lifetime curve)
$T_a = 75$°C	
$I_1 = I(50) = 2 * \pi * 50 * 10 * 10^{-6} * 310 = 0.973$ [A]	
$V_2 = V(15{,}000) = [7.9/(2 * \pi * 15{,}000 * 10 * 10^{-6})] = 8.4$ [V]	

Environmental Compliance

As a leading global supplier of electronic components and an environmentally conscious company, KEMET continually aspires to improve the environmental effects of our manufacturing processes and our finished electronic components.

In Europe (RoHS Directive) and in some other geographical areas such as China (China RoHS), legislation has been enacted to prevent or otherwise limit the use of certain hazardous materials, including lead (Pb), in electronic equipment. KEMET monitors legislation globally to ensure compliance and endeavors to adjust our manufacturing processes and/or electronic components as may be required by applicable law.

For military, medical, automotive, and some commercial applications, the use of lead (Pb) in the termination is necessary and/or required by design. KEMET is committed to communicating RoHS compliance to our customers. Information related to RoHS compliance will be provided in data sheets and using specific identifiers on the packaging labels.

All KEMET power film capacitors are RoHS compliant.

Materials & Environment

The selection of raw materials that KEMET uses for the production of its electronic components is the result of extensive experience. KEMET directs specific attention toward environmental protection. KEMET selects its suppliers according to ISO 9001 standards and performs statistical analyses on raw materials before acceptance for use in manufacturing our electronic components. All materials are, to the best of KEMET’s knowledge, non-toxic and free from cadmium; mercury; chrome and compounds; polychlorine triphenyl (PCB); bromide and chlorinedioxins bromurate clorurate; CFC and HCFC; and asbestos.

Dissipation Factor

Dissipation factor is a complex function involved with capacitor inefficiency. The tgδ may vary up and down with increased temperature. For more information, refer to Performance Characteristics.

Sealing

Hermetically Sealed Capacitors
As the temperature increases, the pressure inside the capacitor increases. If the internal pressure is high enough, it can cause a breach in the capacitor. Such a breach can result in leakage, impregnation, filling fluid, or moisture susceptibility.

Barometric Pressure
The altitude at which hermetically sealed capacitors are operated controls the capacitor's voltage rating. As the barometric pressure decreases, the susceptibility to terminal arc-over increases. Non-hermetic capacitors can be affected by internal stresses due to pressure changes. These effects can be in the form of capacitance changes, dielectric arc-over, and/or low insulation resistance. Altitude can also affect heat transfer. Heat that is generated in an operation cannot be dissipated properly, and high RI^2 losses and eventual failure can result.

Table 1 – Ratings & Part Number Reference

Cap Value (µF)	V_{NAC}	V_{NDC}	Dimensions (mm)					dV/dt	Ipkr	ESL	R_S	I_{rms} maximum (*)	Rth (HS/Amb)	Packaging Quantity	PART NUMBER
			T	H	L	S	S1	V/µs	Apk	nH	mΩ	A_{rms}	(°C/W)		
V_{NAC} at 85°C = 250 VAC; V_{OPAC} at 105°C = 175 VAC															
1	250	500	11	20	31.5	27.5	\	38	38	17	22	4.5	44	256	C4AF1BU4100T1WK
1.5	250	500	11	20	31.5	27.5	\	38	56	17	15.6	5.4	44	256	C4AF1BU4150T1WK
2.2	250	500	13	25	31.5	27.5	\	38	83	22	11.8	6.9	36	234	C4AF1BU4220T1XK
3.3	250	500	19	29	31.5	27.5	\	38	125	25	9	8.9	29	72	C4AF1BU4330T11K
4.7	250	500	19	29	31.5	27.5	\	38	179	25	7.4	10	29	72	C4AF1BU4470T11K
6.8	250	500	22	37	31.5	27.5	\	38	259	28	6.6	12.1	23	64	C4AF1BU4680T12K
7.5	250	500	22	37	31.5	27.5	\	38	285	28	6.4	12.3	23	64	C4AF1BU4750T12K
10	250	500	20	40	42	37.5	10.2	27	272	12	4.8	15.2	20	58	C4AF1BW5100T3FK
15	250	500	30	45	42	37.5	20.3	27	400	13	3.4	20.8	15	36	C4AF1BW5150T3LK
22	250	500	35	50	42	37.5	20.3	27	587	14	2.6	25.4	13	30	C4AF1BW5220T3OK
24.5	250	500	35	50	42	37.5	20.3	27	654	14	2.4	26.3	13	30	C4AF1BW5245T3OK
33	250	500	35	50	57.5	52.5	20.3	18	587	15	3.4	26.1	10	23	C4AF1BW5330T3NK
47	250	500	45	56	57.5	52.5	20.3	18	837	17	2.8	32	8	18	C4AF1EW5470T3AK
55	250	500	45	56	57.5	52.5	20.3	18	960	17	2.4	33.9	8	18	C4AF1EW5550T3AK
62	250	500	45	65	57.5	52.5	20.3	18	1116	19	2.4	36.5	7	18	C4AF1EW5620T3BK
V_{NAC} at 85°C = 310 VAC; V_{OPAC} at 105°C = 215 VAC															
1	310	630	11	20	31.5	27.5	\	45	45	17	20.8	4.5	44	256	C4AF9BU4100T1WK
1.5	310	630	13	25	31.5	27.5	\	45	68	22	15	6	36	234	C4AF9BU4150T1XK
2.2	310	630	14	28	31.5	27.5	\	45	99	24	11.4	7.2	33	96	C4AF9BU4220T1YK
3.3	310	630	19	29	31.5	27.5	\	45	149	25	8.6	9	29	72	C4AF9BU4330T11K
4.7	310	630	22	37	31.5	27.5	\	45	212	28	7.6	11	23	64	C4AF9BU4470T12K
6.8	310	630	20	40	42	37.5	10.2	32	218	12	5.8	13.5	20	58	C4AF9BW4680T3FK
10	310	630	28	37	42	37.5	10.2	32	320	10	4.2	16.6	18	36	C4AF9BW5100T3JK
15	310	630	35	50	42	37.5	20.3	32	480	14	3	23.1	13	30	C4AF9BW5150T3OK
17	310	630	35	50	42	37.5	20.3	32	560	14	2.8	23.8	13	30	C4AF9BW5170T3OK
22	310	630	35	50	57.5	52.5	20.3	21	462	15	4.2	23.2	10	23	C4AF9BW5220T3NK
33	310	630	45	56	57.5	52.5	20.3	21	693	17	3	30.3	8	18	C4AF9EW5330T3AK
37.5	310	630	45	56	57.5	52.5	20.3	21	788	17	2.8	30.9	8	18	C4AF9EW5375T3AK
42	310	630	45	65	57.5	52.5	20.3	21	882	19	2.6	34.5	7	18	C4AF9EW5420T3BK
Cap Value (µF)	V_{NAC}	V_{NDC}	T	H	L	S	S1	V/µs	Apk	nH	mΩ	A_{rms}	(°C/W)	Packaging Quantity	PART NUMBER
			Dimensions (mm)					dV/dt	Ipkr	ESL	R_S	I_{rms} maximum (*)	Rth (HS/Amb)		

For Packaging quantites not listed, please contact KEMET.
(*) Current corresponding to 30°C of self-heating in dry conditions and composed by nominal 50 Hz current at rated VAC plus 10 kHz overlapped harmonics. For Expected Life and FIT performances, please refer always to the Curves reported inside the datasheet based on working voltage and hot spot temperatures.

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Table 1 – Ratings & Part Number Reference cont.

Cap Value (µF)	V_{NAC}	V_{NDC}	Dimensions (mm)					dV/dt	Ipkr	ESL	R_S	I_{rms} maximum (*)	Rth (HS/Amb)	Packaging Quantity	PART NUMBER
			T	H	L	S	S1	V/µs	Apk	nH	mΩ	A_{rms}	(°C/W)		
V_{NAC} at 85°C = 350 VAC; V_{OPAC} at 105°C = 245 VAC															
1	350	700	13	25	31.5	27.5	\	115	115	22	10.6	6.1	36	234	C4AF7BU4100T1XK
1.5	350	700	14	28	31.5	27.5	\	115	173	24	8.2	7.5	33	96	C4AF7BU4150T1YK
2.2	350	700	19	29	31.5	27.5	\	115	253	25	6.6	9.1	29	72	C4AF7BU4220T11K
3.3	350	700	22	37	31.5	27.5	\	115	380	28	6	11.4	23	64	C4AF7BU4330T12K
3.7	350	700	22	37	31.5	27.5	\	115	426	28	5.8	11.7	23	64	C4AF7BU4370T12K
4.7	350	700	20	40	42	37.5	10.2	75	353	12	4	14.7	20	58	C4AF7BW4470T3FK
6.8	350	700	28	37	42	37.5	10.2	75	510	10	2.8	18.3	18	36	C4AF7BW4680T3JK
10	350	700	35	50	42	37.5	20.3	75	750	14	2.2	24.8	13	30	C4AF7BW5100T3OK
12.5	350	700	35	50	42	37.5	20.3	75	938	14	2	26.1	13	30	C4AF7BW5125T3OK
15	350	700	35	50	57.5	52.5	20.3	50	750	15	2.8	27.1	10	23	C4AF7BW5150T3NK
22	350	700	45	56	57.5	52.5	20.3	50	1100	17	2.2	34.2	8	18	C4AF7EW5220T3AK
27	350	700	45	56	57.5	52.5	20.3	50	1350	17	2.0	35.4	8	18	C4AF7EW5270T3AK
32	350	700	45	65	57.5	52.5	20.3	50	1600	19	1.8	39.9	7	18	C4AF7EW5320T3BK
V_{NAC} at 85°C = 400 VAC; V_{OPAC} at 105°C = 280 VAC															
1	400	800	14	28	31.5	27.5	\	141	141	24	9.8	6.5	33	96	C4AF3BU4100T1YK
1.5	400	800	19	29	31.5	27.5	\	141	212	25	7.6	8.1	29	72	C4AF3BU4150T11K
2.2	400	800	22	37	31.5	27.5	\	141	310	28	6.8	10.2	23	64	C4AF3BU4220T12K
2.5	400	800	22	37	31.5	27.5	\	141	353	28	6.4	10.6	23	64	C4AF3BU4250T12K
3.3	400	800	20	40	42	37.5	10.2	90	297	12	4.8	13	20	58	C4AF3BW4330T3FK
4.7	400	800	28	37	42	37.5	10.2	90	423	10	3.4	16.1	18	36	C4AF3BW4470T3JK
6.8	400	800	30	45	42	37.5	20.3	90	612	13	2.6	20.4	15	36	C4AF3BW4680T3LK
9	400	800	35	50	42	37.5	20.3	90	810	14	2.2	24.1	13	30	C4AF3BW4900T3OK
10	400	800	30	45	57.5	52.5	20.3	61	610	13	3.4	21.8	12	27	C4AF3BW5100T3MK
15	400	800	45	56	57.5	52.5	20.3	61	915	17	2.6	31.1	8	18	C4AF3EW5150T3AK
20	400	800	45	56	57.5	52.5	20.3	61	1220	17	2.2	33.3	8	18	C4AF3EW5200T3AK
22.5	400	800	45	65	57.5	52.5	20.3	61	1373	19	2	37.4	7	18	C4AF3EW5225T3BK
Cap Value (µF)	V_{NAC}	V_{NDC}	T	H	L	S	S1	V/µs	Apk	nH	mΩ	A_{rms}	(°C/W)	Packaging Quantity	PART NUMBER
			Dimensions (mm)					dV/dt	Ipkr	ESL	R_S	I_{rms} maximum (*)	Rth (HS/Amb)		

For Packaging quantites not listed, please contact KEMET.
(*) Current corresponding to 30°C of self-heating in dry conditions and composed by nominal 50 Hz current at rated VAC plus 10 kHz overlapped harmonics. For Expected Life and FIT performances, please refer always to the Curves reported inside the data-sheet based on working voltage and hot spot temperatures

Table 1 – Ratings & Part Number Reference cont.

Cap Value (μF)	V_{NAC}	V_{NDC}	Dimensions (mm)					dV/dt	Ipkr	ESL	R_S	I_{rms} maximum (*)	Rth (HS/Amb)	Packaging Quantity	PART NUMBER
			T	H	L	S	S1	V/μs	Apk	nH	mΩ	A_{rms}	(°C/W)		
V_{NAC} at 85°C = 500 VAC; V_{OPAC} at 105°C = 350 VAC															
1	500	1,000	19	29	31.5	27.5	\	176	176	25	8.3	7.1	29	72	C4AFABU4100T11K
1.5	500	1,000	22	37	31.5	27.5	\	176	264	28	7.2	8.9	23	64	C4AFABU4150T12K
2.2	500	1,000	20	40	42	37.5	10.2	113	249	12	5.7	11.0	20	58	C4AFABW4220T3FK
3	500	1,000	28	37	42	37.5	10.2	113	339	10	4.3	13.3	18	36	C4AFABW4300T3JK
4.4	500	1,000	30	45	42	37.5	20.3	113	498	13	3.2	16.9	15	36	C4AFABW4440T3LK
5.5	500	1,000	35	50	42	37.5	20.3	113	623	14	2.7	20.5	13	30	C4AFABW4550T3OK
6.6	500	1,000	30	45	57.5	52.5	20.3	75	498	13	4.2	18.1	12	27	C4AFABW4660T3MK
8	500	1,000	35	50	57.5	52.5	20.3	76	604	17	3.7	21.3	10	23	C4AFABW4800T3NK
12	500	1,000	45	56	57.5	52.5	20.3	76	907	17	2.7	27.1	8	18	C4AFAEW5120T3AK
15	500	1,000	45	65	57.5	52.5	20.3	76	1133	19	2.4	30.4	7	18	C4AFAEW5150T3BK
V_{NAC} at 85°C = 600 VAC; V_{OPAC} at 105°C = 420 VAC															
1	600	1,200	22	37	31.5	27.5	/	204	204	28	8.0	7.8	23	64	C4AFBBU4100T12K
1.8	600	1,200	20	40	42	37.5	10.2	126	226	12	5.9	10.3	20	58	C4AFBBW4180T3FK
2.2	600	1,200	28	37	42	37.5	10.2	126	277	10	4.9	11.9	18	36	C4AFBBW4220T3JK
3.3	600	1,200	30	45	42	37.5	20.3	126	416	13	3.5	15.3	15	36	C4AFBBW4330T3LK
4.7	600	1,200	35	50	42	37.5	20.3	126	592	14	2.7	19.5	13	30	C4AFBBW4470T3OK
5	600	1,200	30	45	57.5	52.5	20.3	82	409	13	4.8	16.5	12	27	C4AFBBW4500T3MK
7	600	1,200	35	50	57.5	52.5	20.3	82	573	15	3.6	20.4	10	23	C4AFBBW4700T3NK
10	600	1,200	45	56	57.5	52.5	20.3	82	820	17	2.8	25.5	8	18	C4AFBEW5100T3AK
12	600	1,200	45	65	57.5	52.5	20.3	82	984	19	2.6	28.3	7	18	C4AFBEW5120T3BK
Cap Value (μF)	V_{NAC}	V_{NDC}	T	H	L	S	S1	V/μs	Apk	nH	mΩ	A_{rms}	(°C/W)	Packaging Quantity	PART NUMBER
			Dimensions (mm)					dV/dt	Ipkr	ESL	R_S	I_{rms} maximum (*)	Rth (HS/Amb)		

For Packaging quantites not listed, please contact KEMET.
(*) Current corresponding to 30°C of self-heating in dry conditions and composed by nominal 50 Hz current at rated VAC plus 10 kHz overlapped harmonics. For Expected Life and FIT performances, please refer always to the Curves reported inside the data-sheet based on working voltage and hot spot temperatures

Soldering Process

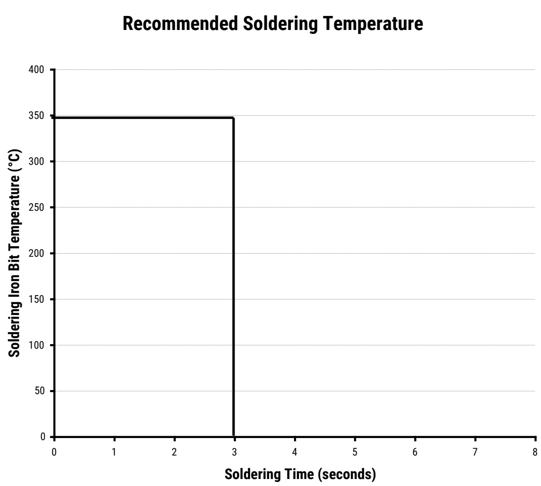
The implementation of the RoHS directive has resulted in the selection of SnAuCu (SAC) alloys, or SnCu alloys, as the primary solder material. This has increased the liquidus temperature from 183°C for a SnPb eutectic alloy to 217 – 221°C for new alloys. As a result, the heat stress to the components, even in wave soldering, has increased considerably due to higher pre-heat and wave temperatures. Polypropylene capacitors are especially sensitive to heat (the melting point of polypropylene is 160 – 170°C). Wave soldering can be destructive, especially for mechanically small polypropylene capacitors (with lead spacing of 5 – 15 mm), and great care must be taken during soldering. The recommended solder profiles from KEMET should be used. Contact KEMET with any questions. In general, the wave soldering curve from IEC Publication 61760–1 Edition 2 serves as a solid guideline for successful soldering. See Figure 1.

Reflow soldering is not recommended for through-hole film capacitors. Exposing capacitors to a soldering profile in excess of the recommended limits may result in degradation or permanent damage to the capacitors.

Do not place the polypropylene capacitor through an adhesive curing oven to cure resin for surface mount components. Insert through-hole parts after curing the surface mount parts. Contact KEMET to discuss the actual temperature profile in the oven, if through-hole components must pass through the adhesive curing process. A maximum two soldering cycles is recommended. Allow time for the capacitor surface temperature to return to normal before the second soldering cycle.

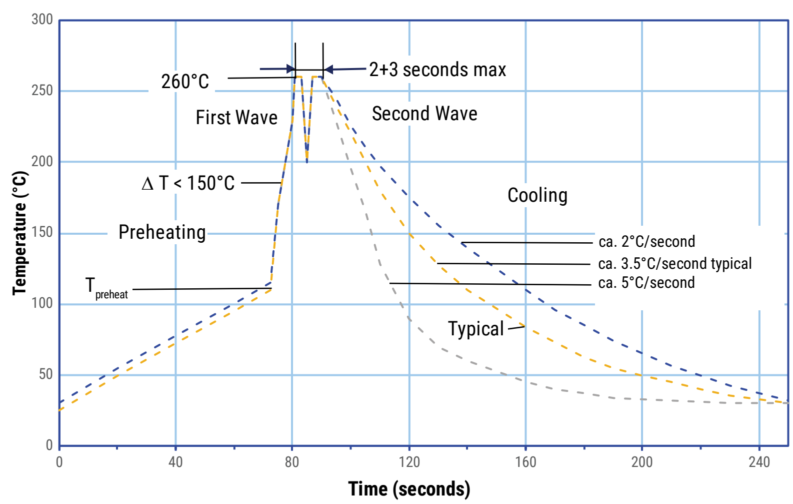
Manual Soldering Recommendations

Following is the recommendation for manual soldering with a soldering iron.



The soldering iron tip temperature should be set at 350°C (+10°C) maximum with the soldering duration not to exceed more than 3 seconds.

Wave Soldering Recommendations



Soldering Process cont.

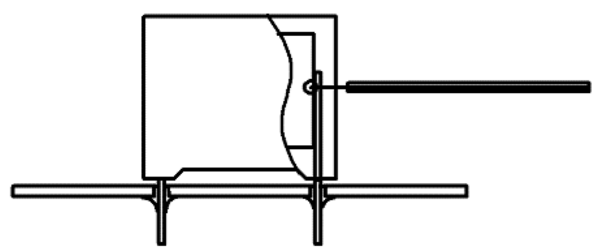
Wave Soldering Recommendations cont.

1. The tables indicates the maximum set-up temperature of the soldering process

Dielectric Film Material	Maximum Preheat Temperature		Maximum Peak Soldering Temperature	
	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm	Capacitor Pitch ≤ 15 mm	Capacitor Pitch > 15 mm
Polyester	130°C	130°C	270°C	270°C
Polypropylene	110°C	130°C	260°C	270°C
Paper	130°C	140°C	270°C	270°C
Polyphenylene Sulphide	150°C	160°C	270°C	270°C

2. The maximum temperature measured inside the capacitor: set the temperature so that inside the element the maximum temperature is below the limit.

Dielectric Film Material	Maximum Temperature Measured Inside the Element
Polyester	160°C
Polypropylene	110°C
Paper	160°C
Polyphenylene Sulphide	160°C



Temperature monitored inside the capacitor.

Selective Soldering Recommendations

Selective dip soldering is a variation of reflow soldering. In this method, the printed circuit board with through-hole components to be soldered is pre-heated and transported over the solder bath, as in normal flow soldering, without touching the solder. When the board is over the bath, it is stopped. Pre-designed solder pots are lifted from the bath with molten solder, only at the places of the selected components, and pressed against the lower surface of the board to solder the components.

The temperature profile for selective soldering is similar to the double wave flow soldering outlined in this document. However, instead of two baths, there is only one with a time from 3 – 10 seconds. In selective soldering, the risk of overheating is greater than in double wave flow soldering, and great care must be taken so that the parts do not overheat.

Mounting

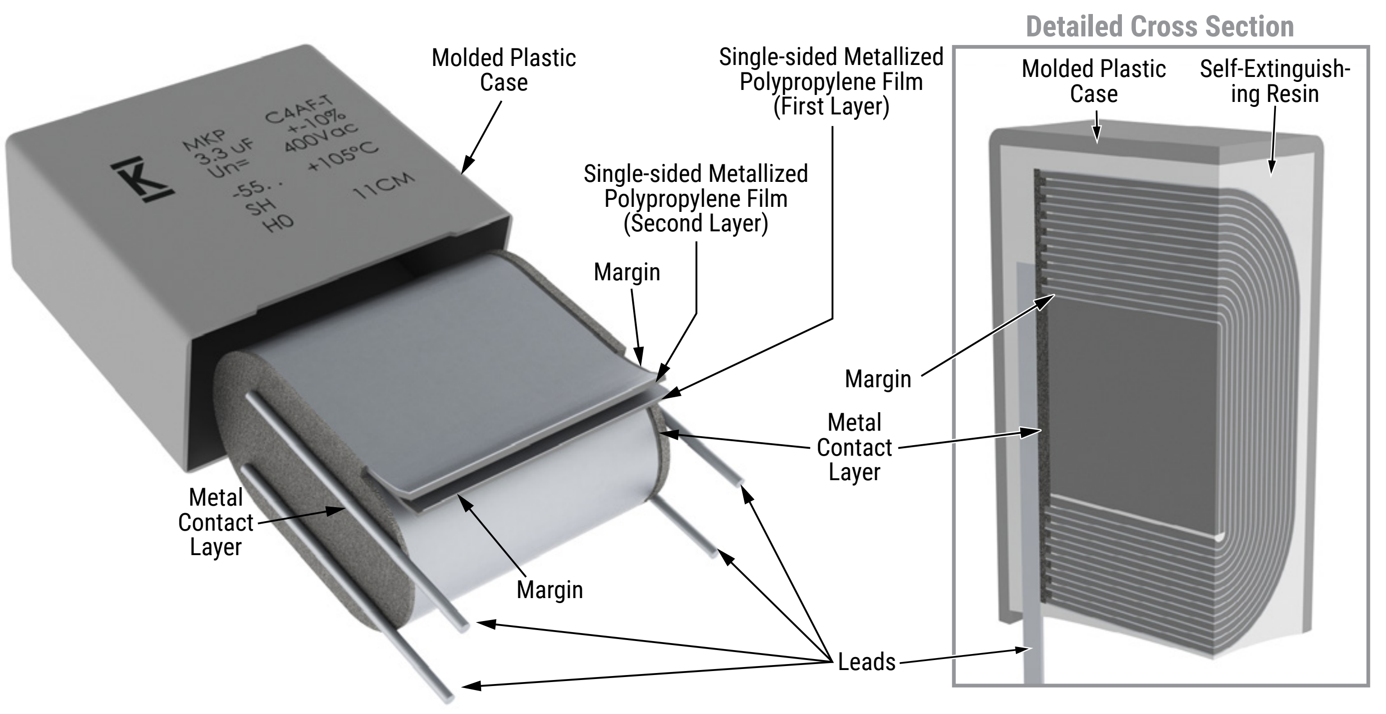
Resistance to Vibration and Mechanical Shock

AEC-Q200 Mechanical Stress Tests:

Mechanical Shock	**MIL-SDT-202 Method 213**	Test condition C Peak value 100 g, duration 6 ms, half-sine-wave (see MIL-HDBK for details)
Vibration	**MIL-SDT-202 Method 204**	5 g for 20 minutes, 12 cycles each of 3 orientations Use 8"X5" PCB, .031" thick. 7 secure points on one 8" side and 2 secure points at corners of opposite sides. Parts mounted within 2" from any secure point. Test from 10 – 2,000 Hz.

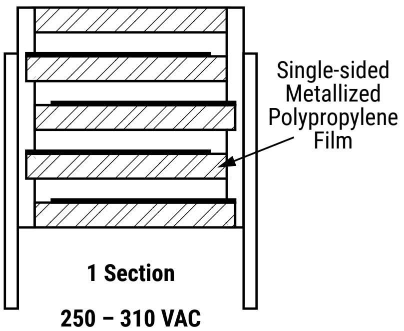
The capacitors are designed for PCB mounting.
The stand-off pipes must be in good contact with the printed circuit board.
The capacitor body has to be properly fixed (e.g. clamped or glued).

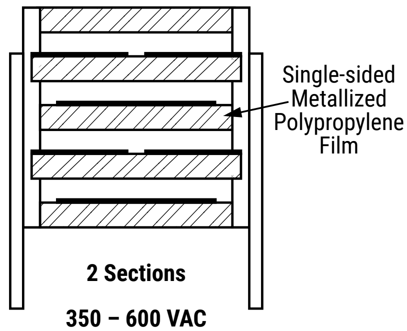
Construction



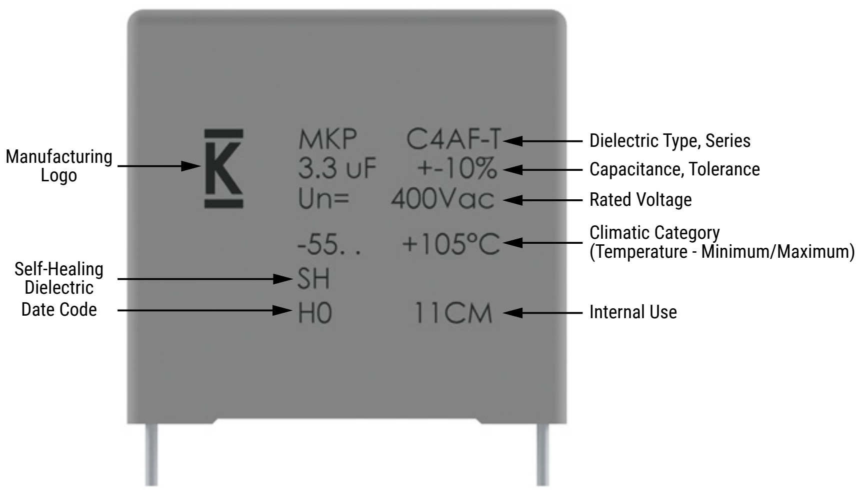
Construction cont.

Winding Scheme





Marking



Manufacturing Date Code (IEC–60062)									
Y = Year, Z = Month									
Year	Code	Year	Code	Year	Code	Month	Code	Month	Code
2010	A	2017	J	2024	S	January	1	July	7
2011	B	2018	K	2025	T	February	2	August	8
2012	C	2019	L	2026	U	March	3	September	9
2013	D	2020	M	2027	V	April	4	October	O
2014	E	2021	N	2028	W	May	5	November	N
2015	F	2022	P	2029	X	June	6	December	D
2016	H	2023	R	2030	A				

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