

Polypropylene Film Foil Capacitors KP Axial Epoxy Lacquered Type

APPLICATIONS

In circuits where close tolerance, reliability and low losses are of prime importance, for example: tuned circuits, filter and timing networks

MARKING

C-value; tolerance; rated voltage; code for dielectric material; production date code in accordance with "IEC 60062; clause 5"; manufacturer

Letter codes for year and numbers for month of production

YEAR	LETTER CODE	MONTH	CODE
2003	R	June	6
2004	S	July	7
2005	T	August	8
2006	U	September	9
2007	V	October	O
2008	W	November	N
2009	X	December	D

DIELECTRIC

Polypropylene film

ELECTRODES

Metal foils

COATING

Flame retardant epoxy material (UL-class 94 V-0)

CONSTRUCTION

Film/foil mono construction

LEADS

Tinned wire

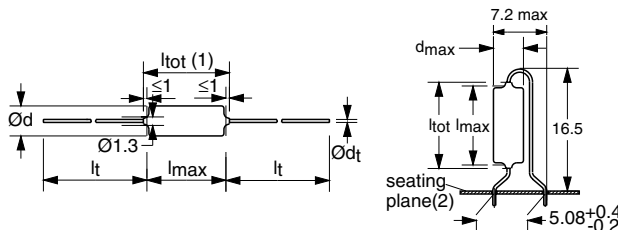


CAPACITANCE RANGE (E12 SERIES)

47 to 62000 pF

CAPACITANCE TOLERANCE

±5%; ±2%; ±1%



Dimensions in mm.

- (1) $l_{tot} \leq 13$ mm for $l_{max} = 11$ mm
 $l_{tot} \leq 16$ mm for $l_{max} = 15$ mm.
- (2) Hole $\varnothing 1.0$.

RATED (DC) VOLTAGE

63 V; 160 V; 250 V; 400 V; 630 V

RATED (AC) VOLTAGE

40 V; 63 V; 125 V; 160 V; 200 V

CLIMATIC CATEGORY

40/100/56

RATED TEMPERATURE

85 °C

MAXIMUM APPLICATION TEMPERATURE

100 °C

REFERENCE SPECIFICATIONS

IEC 60384-13

FEATURES

Supplied loose in box, taped on reel or unidirectional

STABILITY CLASS

63; 160; 250 V versions: class 1;
 400; 630 V versions: class 2

DETAIL SPECIFICATION

For more detailed data and test requirements contact:
filmcaps.roeselare@vishay.com



COMPOSITION OF CATALOG NUMBER

TYPE AND VOLTAGES	
460	63 V
461	160 V
462	250 V
463	400 V
464	630 V

CAPACITANCE
(numerically)

MULTIPLIER (nF)	
0.0001	9
0.001	1
0.01	2
0.1	3

Example:
1003 = 100 x 0.1 = 10 nF

2222 46. X XXX X

TYPE	PACKAGING	LEAD CONFIGURATION AND TAPE DISTANCE	PREFERRED TYPES					
			C-TOL	63 V	160 V	250 V	400 V	630 V
460	Taped on reel	tape distance 63.5 mm	±1%	8				
			±2%	7				
461	Taped on reel	tape distance 63.5 mm	±1%		8			
			±2%		7			
462	Taped on reel	tape distance 63.5 mm	±1%			8		
			±2%			7		
463	Taped on reel	tape distance 63.5 mm	±1%				8	
			±2%				7	
464	Taped on reel	tape distance 63.5 mm	±1%					8
			±2%					7
			ON REQUEST					
460	Taped on reel	tape distance 63.5 mm	±5%	6				
			±1%	4				
	Loose in box	lead length 30.0 or 28.0 mm	±2%	3				
			±5%	2				
			±1%	1				
Unidirectional		±2%	0					
461	Taped on reel	tape distance 63.5 mm	±5%		6			
			±1%		4			
	Loose in box	lead length 30.0 or 28.0 mm	±2%		3			
			±5%		2			
			±1%		1			
Unidirectional		±2%		0				
462	Taped on reel	tape distance 63.5 mm	±5%			6		
			±1%			4		
	Loose in box	lead length 30.0 or 28.0 mm	±2%			3		
			±5%			2		
			±1%			1		
Unidirectional		±2%			0			
463	Taped on reel	tape distance 63.5 mm	±5%				6	
			±1%				4	
	Loose in box	lead length 30.0 or 28.0 mm	±2%				3	
			±5%				2	
			±1%				1	
Unidirectional		±2%				0		
464	Taped on reel	tape distance 63.5 mm	±5%					6
			±1%					4
	Loose in box	lead length 30.0 or 28.0 mm	±2%					3
			±5%					2
			±1%					1
Unidirectional		±2%					0	

SPECIFIC REFERENCE DATA

DESCRIPTION	VALUE				
	at 10 kHz	at 100 kHz	at 1MHz ⁽¹⁾		
Tangent of loss angle:					
C ≤ 1000 pF	≤5 × 10 ⁻⁴	–	≤10 × 10 ⁻⁴		
1000 pF < C ≤ 5000 pF	≤5 × 10 ⁻⁴	≤10 × 10 ⁻⁴	–		
5000 pF < C ≤ 20000 pF	≤5 × 10 ⁻⁴	≤15 × 10 ⁻⁴	–		
20000 pF < C ≤ 47000 pF	≤5 × 10 ⁻⁴	≤25 × 10 ⁻⁴	–		
C > 47000 pF	≤5 × 10 ⁻⁴	≤40 × 10 ⁻⁴	–		
Rated voltage pulse slope (dU/dt) _R	at 63 V (DC)	at 160 V (DC)	at 250 V (DC)	at 400 V (DC)	at 630 V (DC)
	10000 V/μs	10000 V/μs	10000 V/μs	10000 V/μs	10000 V/μs
R between leads:					
at 10 V; 1 minute	>100000 MΩ				
at 100 V; 1 minute		>100000 MΩ	>100000 MΩ	>100000 MΩ	>100000 MΩ
R between interconnecting leads and case;					
at 10 V; 1 minute	>100000 MΩ				
at 100 V; 1 minute		>100000 MΩ	>100000 MΩ	>100000 MΩ	
at 100 V; 1 minute					>100000 MΩ
Withstanding (DC) voltage (cut off current 10 mA); rise time 100 V/s	126 V; 1 minute	320 V; 1 minute	500 V; 1 minute	800 V; 1 minute	1260 V; 1 minute
Withstanding (DC) voltage between leads and case	400 V; 1 minute	400 V; 1 minute	500 V; 1 minute	800 V; 1 minute	1260 V; 1 minute

Note

1. For unidirectional capacitors ≤13 × 10⁻⁴.



$U_{Rdc} = 63 V$; $U_{Rac} = 40 V$

C (E 24) (pF)	DIMENSIONS $d_{max} \times l_{max}$ (mm)	MASS (g)	CATALOG NUMBER 2222 460 AND PACKAGING							
			TAPED ON REEL			LOOSE IN BOX	UNIDIRECTIONAL			
			TAPE DISTANCE 63.5 mm				SPQ	SPQ	C-tol = $\pm 2\%$	C-tol = $\pm 1\%$
			last 5 digits of catalog number		SPQ	last 5 digits of catalog number			SPQ	
$l_t = 30.0 \text{ mm}$; $d_t = 0.60 \pm 0.06 \text{ mm}$										
6800	5.0 × 11.0	0.5	76802	86802	2500	250	06802	16802	1000	
7500		0.5	77502	87502			07502	17502		
8200		0.6	78202	88202			08202	18202		
9100		0.6	79102	89102			09102	19102		
$l_t = 28.0 \text{ mm}$; $d_t = 0.60 \pm 0.06 \text{ mm}$										
10000	6.0 × 15.0	0.6	71003	81003	1500	250				
11000		0.6	71103	81103						
12000		0.7	71203	81203						
13000		0.8	71303	81303						
15000		0.7	71503	81503						
16000		0.7	71603	81603						
18000		0.8	71803	81803						
20000		0.8	72003	82003						
22000		0.9	72203	82203						
24000	6.5 × 15.0	0.9	72403	82403	1500	250				
27000		1.0	72703	82703						
30000	7.0 × 15.0	1.1	73003	83003	1000	200				
33000		1.2	73303	83303						
36000		1.2	73603	83603						
39000	7.5 × 15.0	1.3	73903	83903	1000	150				
43000		1.4	74303	84303						
47000	8.0 × 15.0	1.5	74703	84703	1000	150				
51000		1.6	75103	85103						
56000	8.5 × 15.0	1.7	75603	85603	1000	125				
62000		1.8	76203	86203						

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PACKAGING	TAPE DISTANCE (mm)
Taped in ammpack	52.5
	63.5
Taped on reel	52.5

KP 460 to 464



Vishay BCcomponents Polypropylene Film Foil Capacitors
KP Axial Epoxy Lacquered Type

$U_{Rdc} = 160 \text{ V}$; $U_{Rac} = 63 \text{ V}$

C (E 24) (pF)	DIMENSIONS $d_{max} \times l_{max}$ (mm)	MASS (g)	CATALOG NUMBER 2222 461 AND PACKAGING							
			TAPED ON REEL			LOOSE IN BOX	UNIDIRECTIONAL			
			TAPE DISTANCE 63.5 mm				SPQ	SPQ	C-tol = $\pm 2\%$	C-tol = $\pm 1\%$
			last 5 digits of catalog number		SPQ	last 5 digits of catalog number			SPQ	
$l_t = 30.0 \text{ mm}$; $d_t = 0.60 \pm 0.06 \text{ mm}$										
3600	5.0 × 11.0	0.5	73602	83602	2500	250	03602	13602	1000	
3900		0.5	73902	83902			03902	13902		
4300		0.5	74302	84302			04302	14302		
4700		0.5	74702	84702			04702	14702		
5100		0.5	75102	85102			05102	15102		
5600		0.5	75602	85602			05602	15602		
6200		0.6	76202	86202			06202	16202		
$l_t = 28.0 \text{ mm}$; $d_t = 0.60 \pm 0.06 \text{ mm}$										
6800	6.0 × 15.0	0.4	76802	86802	1500	250				
7500		0.7	77502	87502						
8200		0.6	78202	88202						
9100		0.6	79102	89102						
10000		0.7	71003	81003						
11000		0.7	71103	81103						
12000		0.7	71203	81203						
13000	0.8	71303	81303							
15000	0.8	71503	81503							
16000	6.5 × 15.0	0.9	71603	81603	1500	250				
18000		0.9	71803	81803						
20000		1.0	72003	82003						
22000	7.0 × 15.0	1.1	72203	82203	1000	200				
24000		1.1	72403	82403						
27000	7.5 × 15.0	1.2	72703	82703	1000	150				
30000	8.0 × 15.0	1.3	73003	83003	1000	150				
33000		1.4	73303	83303						
36000	8.5 × 15.0	1.5	73603	83603	1000	125				
39000		1.6	73903	83903						

Available on request

PACKAGING	TAPE DISTANCE (mm)
Taped in ammpack	52.5
	63.5
Taped on reel	52.5



$U_{Rdc} = 250\text{ V}$; $U_{Rac} = 125\text{ V}$

C (E 24) (pF)	DIMENSIONS $d_{max} \times l_{max}$ (mm)	MASS (g)	CATALOG NUMBER 2222 462 AND PACKAGING									
			TAPED ON REEL			LOOSE IN BOX	UNIDIRECTIONAL					
			TAPE DISTANCE 63.5 mm				C-tol = ±2%	C-tol = ±1%	SPQ	SPQ		
			last 5 digits of catalog number		SPQ	last 5 digits of catalog number					SPQ	
$l_t = 30.0\text{ mm}$; $d_t = 0.60 \pm 0.06\text{ mm}$												
1200	5.0 × 11.0	0.5	71202	81202	2500	250	01202	11202	1000			
1300		0.5	71302	81302			01302	11302				
1500		0.4	71502	81502			01502	11502				
1600		0.5	71602	81602			01602	11602				
1800		0.6	71802	81802			01802	11802				
2000		0.6	72002	82002			02002	12002				
2200		0.5	72202	82202			02202	12202				
2400		0.5	72402	82402			02402	12402				
2700		0.5	72702	82702			02702	12702				
3000		0.5	73002	83002			03002	13002				
3300		0.5	73302	83302			03302	13302				
$l_t = 28.0\text{ mm}$; $d_t = 0.60 \pm 0.06\text{ mm}$												
3600		6.0 × 15.0	0.5	73602			83602	1500		250		
3900	0.5		73902	83902								
4300	0.6		74302	84302								
4700	0.6		74702	84702								
5100	0.6		75102	85102								
5600	0.6		75602	85602								
6200	0.7		76202	86202								
6800	0.7		76802	86802								
7500	0.7		77502	87502								
8200	6.5 × 15.0		0.8	78202	88202	1500	250					
9100		0.8	79102	89102								
10000		0.9	71003	81003								
11000	7.0 × 15.0	0.9	71103	81103	1000	200						
12000		1.0	71203	81203								
13000		1.0	71303	81303								
15000	7.5 × 15.0	1.1	71503	81503	1000	150						
16000		1.2	71603	81603								
18000	8.0 × 15.0	1.3	71803	81803	1000	150						
20000	8.5 × 15.0	1.4	72003	82003	1000	125						
22000		1.5	72203	82203								

Available on request

PACKAGING	TAPE DISTANCE (mm)
Taped in ammopack	52.5
	63.5
Taped on reel	52.5

KP 460 to 464



Vishay BCcomponents Polypropylene Film Foil Capacitors
KP Axial Epoxy Lacquered Type

$U_{Rdc} = 400\text{ V}$; $U_{Rac} = 160\text{ V}$

C (E 24) (pF)	DIMENSIONS $d_{max} \times l_{max}$ (mm)	MASS (g)	CATALOG NUMBER 2222 463 AND PACKAGING						
			TAPED ON REEL			LOOSE IN BOX	UNIDIRECTIONAL		
			TAPE DISTANCE 63.5 mm				C-tol = $\pm 2\%$	C-tol = $\pm 1\%$	SPQ
			C-tol = $\pm 2\%$	C-tol = $\pm 1\%$	last 5 digits of catalog number	SPQ			
$l_t = 30.0\text{ mm}$; $d_t = 0.60 \pm 0.06\text{ mm}$									
620	5.0 × 11.0	0.5	76201	86201	2500	250	06201	16201	1000
680		0.5	76801	86801			06801	16801	
750		0.5	77501	87501			07501	17501	
820		0.5	78201	88201			08201	18201	
910		0.5	79101	89101			09101	19101	
1000		0.5	71002	81002			01002	11002	
1100		0.5	71102	81102			01102	11102	
$l_t = 28.0\text{ mm}$; $d_t = 0.60 \pm 0.06\text{ mm}$									
1200	6.0 × 15.0	0.5	71202	81202	1500	250			
1300		0.5	71302	81302					
1500		0.5	71502	81502					
1600		0.5	71602	81602					
1800		0.5	71802	81802					
2000		0.5	72002	82002					
2200	6.5 × 15.0	0.5	72202	82202	1500	250			
2400		0.5	72402	82402					
2700		0.6	72702	82702					
3000		0.7	73002	83002					
3300	7.0 × 15.0	0.7	73302	83302	1000	200			
3600		0.7	73602	83602					
3900		0.8	73902	83902					
4300	7.5 × 15.0	0.8	74302	84302	1000	150			
4700		0.9	74702	84702					
5100		0.9	75102	85102					
5600	8.0 × 15.0	1.0	75602	85602	1000	150			
6200		1.0	76202	86202					
6800	8.5 × 15.0	1.1	76802	86802	1000	125			
7500		1.2	77502	87502					
8200		1.3	78202	88202					

Available on request

PACKAGING	TAPE DISTANCE (mm)
Taped in ammpack	52.5
	63.5
Taped on reel	52.5



$U_{Rdc} = 630\text{ V}$; $U_{Rac} = 200\text{ V}$

C (E 24) (pF)	DIMENSIONS $d_{max} \times l_{max}$ (mm)	MASS (g)	CATALOG NUMBER 2222 464 AND PACKAGING										
			TAPED ON REEL			LOOSE IN BOX	UNIDIRECTIONAL						
			TAPE DISTANCE 63.5 mm				C-tol = ±2%	C-tol = ±1%	SPQ				
			C-tol = ±2%	C-tol = ±1%	SPQ	SPQ				C-tol = ±2%	C-tol = ±1%	SPQ	
last 5 digits of catalog number			SPQ	SPQ	last 5 digits of catalog number		SPQ						
$l_t = 30.0\text{ mm}$; $d_t = 0.60 \pm 0.06\text{ mm}$													
47	5.0 × 11.0	0.4	74709	84709	2500	250	04709	14709	1000				
51		0.4	75109	85109			05109	15109					
56		0.4	75609	85609			05609	15609					
62		0.4	76209	86209			06209	16209					
68		0.4	76809	86809			06809	16809					
75		0.4	77509	87509			07509	17509					
82		0.4	78209	88209			08209	18209					
91		0.4	79109	89109			09109	19109					
100		0.4	71001	81001			01001	11001					
110		0.4	71101	81101			01101	11101					
120		0.4	71201	81201			01201	11201					
130		0.5	71301	81301			01301	11301					
150		0.4	71501	81501			01501	11501					
160		0.4	71601	81601			01601	11601					
180		0.5	71801	81801			01801	11801					
200		0.5	72001	82001			02001	12001					
220		0.6	72201	82201			02201	12201					
240		0.6	72401	82401			02401	12401					
270		0.6	72701	82701			02701	12701					
300		0.7	73001	83001			03001	13001					
330		0.4	73301	83301			03301	13301					
360		0.4	73601	83601			03601	13601					
390		0.5	73901	83901			03901	13901					
430		0.5	74301	84301			04301	14301					
470		0.5	74701	84701			04701	14701					
510		0.5	75101	85101			05101	15101					
560		0.5	75601	85601			05601	15601					
$l_t = 28.0\text{ mm}$; $d_t = 0.60 \pm 0.06\text{ mm}$													
620		6.0 × 15.0	0.5	76201			86201	1500		250			
680			0.5	76801			86801						
750			0.5	77501			87501						
820			0.5	78201			88201						
910	0.5		79101	89101									
1000	0.5		71002	81002									
1100	0.5		71102	81102									
1200	0.5		71202	81202									
1300	6.5 × 15.0	0.6	71302	81302	1500	250							
1500		0.6	71502	81502									
1600		0.7	71602	81602									
1800		0.7	71802	81802									

C (E 24) (pF)	DIMENSIONS $d_{max} \times l_{max}$ (mm)	MASS (g)	CATALOG NUMBER 2222 464 AND PACKAGING					
			TAPED ON REEL			LOOSE IN BOX	UNIDIRECTIONAL	
			TAPE DISTANCE 63.5 mm				SPQ	SPQ
			C-tol = ±2%	C-tol = ±1%	last 5 digits of catalog number	C-tol = ±2%		
2000	7.0 × 15.0	0.8	72002	82002	1000	200		
2200		0.9	72202	82202				
2400		0.9	72402	82402				
2700	7.5 × 15.0	0.9	72702	82702	1000	150		
3000		1.0	73002	83002				
3300		1.1	73302	83302				
3600	8.0 × 15.0	1.2	73602	83602	1000	150		
3900		1.3	73902	83902				
4300		1.4	74302	84302				
4700	8.5 × 15.0	1.5	74702	84702	1000	125		

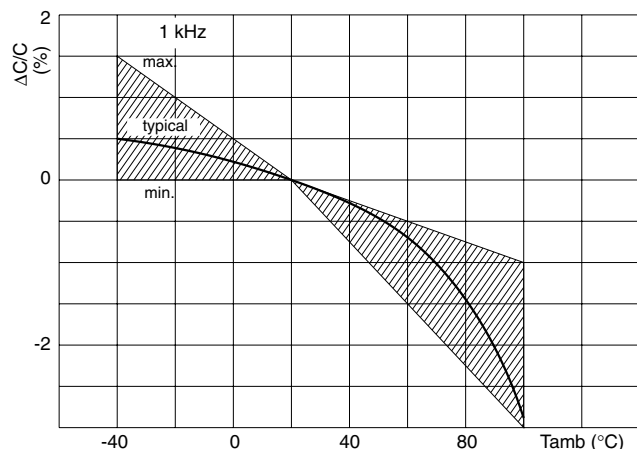
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PACKAGING	TAPE DISTANCE (mm)
Taped in ammopack	52.5
	63.5
Taped on reel	52.5

CAPACITANCE

Temperature coefficient:

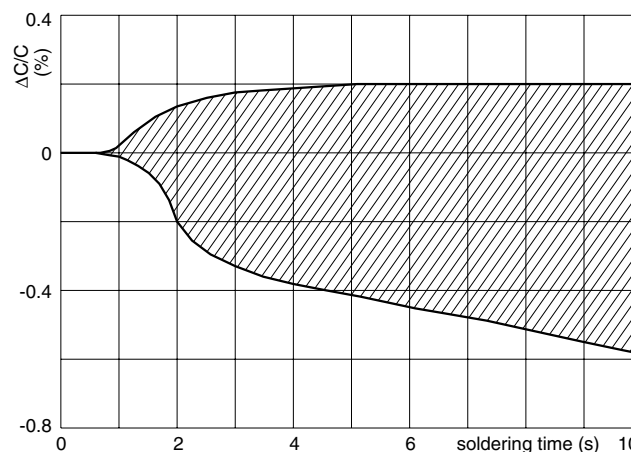
- between -40 and +20 °C for $C \leq 1000$ pF: $-(125 \pm 125) \times 10^{-6}/K$
- between -40 and +20 °C for $C > 1000$ pF:
 $-(125 \pm 60) \times 10^{-6}/K$
- between +20 and +100 °C: $-(250 \pm 120) \times 10^{-6}/K$.



SOLDERING CONDITIONS

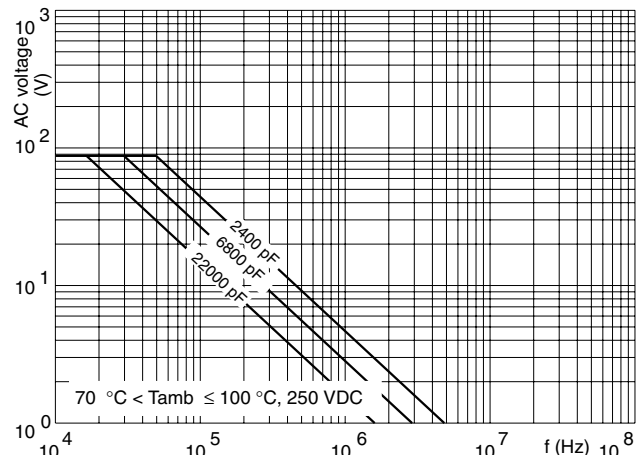
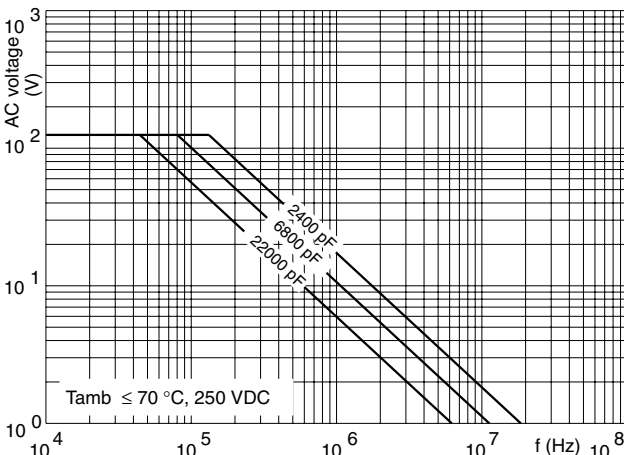
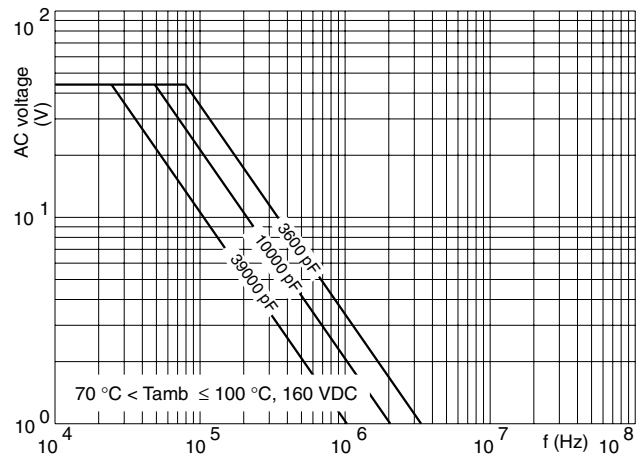
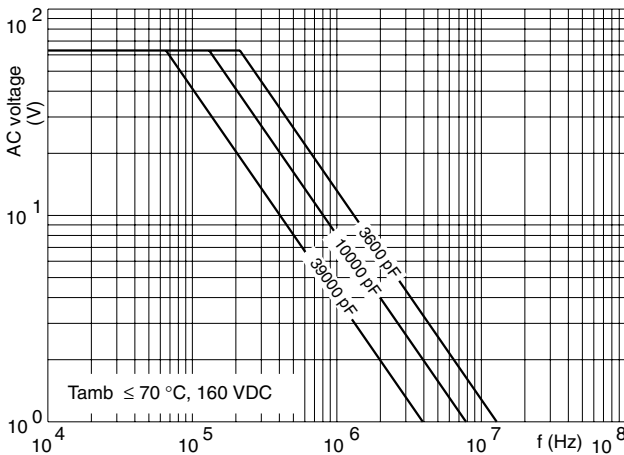
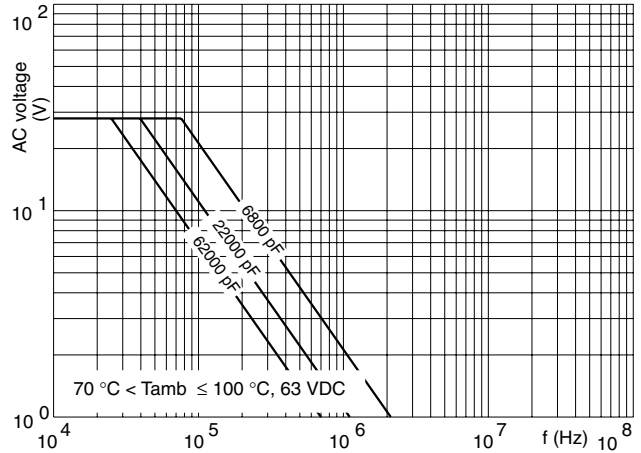
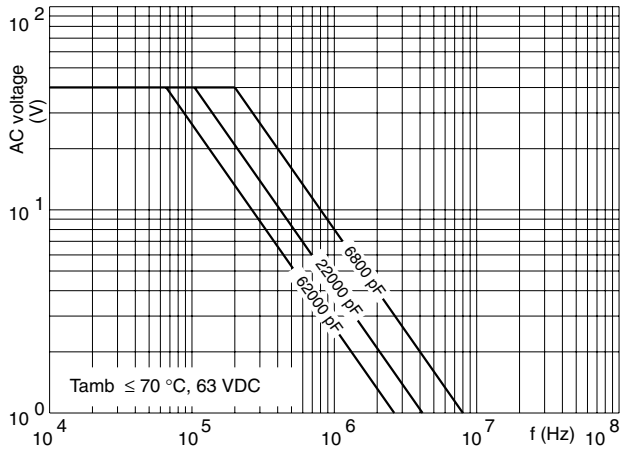
The capacitance stability is dependent on the maximum temperature the capacitor reaches during soldering.

The figure below shows the typical $\Delta C/C$ as a function of soldering time under the worst possible mounting conditions (horizontal on the PCB, minimum possible pitch) and with 80 °C preheating.





MAXIMUM RMS VOLTAGE (SINEWAVE) AS A FUNCTION OF FREQUENCY



KP 460 to 464

Vishay BCcomponents

Polypropylene Film Foil Capacitors
KP Axial Epoxy Lacquered Type

