Polypropylene Film Foil Capacitors
KP Axial Epoxy Lacquered Type

APPLICATIONS

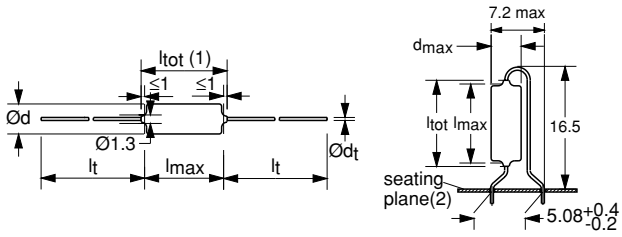
In circuits where close tolerance, reliability and low losses are of prime importance, for example: tuned circuits, filter and timing networks

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



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 ∅1.0.

DIELECTRIC

Polypropylene film

ELECTRODES

Metal foils

COATING

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

CONSTRUCTION

Film/foil mono construction

LEADS

Tinned wire

CAPACITIANCE RANGE (E12 SERIES)

47 to 62000 pF

CAPACITANCE TOLERANCE

±5%; ±2%; ±1%

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 see *"Type detail specification HQN-384-13/101"*

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				
	Loose in box	lead length 30.0 or 28.0 mm	±1%	4				
			±2%	3				
			±5%	2				
	Unidirectional		±1%	1				
			±2%	0				
461	Taped on reel	tape distance 63.5 mm	±5%		6			
	Loose in box	lead length 30.0 or 28.0 mm	±1%		4			
			±2%		3			
			±5%		2			
	Unidirectional		±1%		1			
			±2%		0			
462	Taped on reel	tape distance 63.5 mm	±5%			6		
	Loose in box	lead length 30.0 or 28.0 mm	±1%			4		
			±2%			3		
			±5%			2		
	Unidirectional		±1%			1		
			±2%			0		
463	Taped on reel	tape distance 63.5 mm	±5%				6	
	Loose in box	lead length 30.0 or 28.0 mm	±1%				4	
			±2%				3	
			±5%				2	
	Unidirectional		±1%				1	
			±2%				0	
464	Taped on reel	tape distance 63.5 mm	±5%					6
	Loose in box	lead length 30.0 or 28.0 mm	±1%					4
			±2%					3
			±5%					2
	Unidirectional		±1%					1
			±2%					0

SPECIFIC REFERENCE DATA

DESCRIPTION	VALUE				
Tangent of loss angle:	at 10 kHz		at 100 kHz		at 1MHz[1]
$C \leq 1000$ pF	$\leq 5 \times 10^{-4}$		–		$\leq 10 \times 10^{-4}$
1000 pF < C ≤ 5000 pF	$\leq 5 \times 10^{-4}$		$\leq 10 \times 10^{-4}$		–
5000 pF < C ≤ 20000 pF	$\leq 5 \times 10^{-4}$		$\leq 15 \times 10^{-4}$		–
20000 pF < C ≤ 47000 pF	$\leq 5 \times 10^{-4}$		$\leq 25 \times 10^{-4}$		–
C > 47000 pF	$\leq 5 \times 10^{-4}$		$\leq 40 \times 10^{-4}$		–
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 $\leq 13 \times 10^{-4}$.

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						
			C-tol = ±2%	C-tol = ±1%	SPQ	SPQ	C-tol = ±2%	C-tol = ±1%	SPQ
			last 5 digits of catalog number				last 5 digits of catalog number		
l_t = 30.0 mm; d_t = 0.60 ±0.06 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 mm; d_t = 0.60 ±0.06 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					

Available on request

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

U_{Rdc} = 160 V; U_{Rac} = 63 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						
			C-tol = ±2%	C-tol = ±1%	SPQ	SPQ	C-tol = ±2%	C-tol = ±1%	SPQ
			last 5 digits of catalog number				last 5 digits of catalog number		
l_t = 30.0 mm; d_t = 0.60 ±0.06 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 mm; d_t = 0.60 ±0.06 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 ammopack	52.5
	63.5
Taped on reel	52.5

U_{Rdc} = 250 V; U_{Rac} = 125 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	C-tol = ±2%	C-tol = ±1%	SPQ
			last 5 digits of catalog number				last 5 digits of catalog number		
l_t = 30.0 mm; d_t = 0.60 ±0.06 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 mm; d_t = 0.60 ±0.06 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

U_{Rdc} = 400 V; U_{Rac} = 160 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 = ±2%	C-tol = ±1%			C-tol = ±2%	C-tol = ±1%	
			last 5 digits of catalog number		SPQ	SPQ	last 5 digits of catalog number		SPQ
l_t = 30.0 mm; d_t = 0.60 ±0.06 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 mm; d_t = 0.60 ±0.06 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 ammopack	52.5
	63.5
Taped on reel	52.5

U_{Rdc} = 630 V; U_{Rac} = 200 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	SPQ	C-tol = ±2%	C-tol = ±1%	SPQ
			last 5 digits of catalog number				last 5 digits of catalog number		
l_t = 30.0 mm; d_t = 0.60 ±0.06 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 mm; d_t = 0.60 ±0.06 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						
			C-tol = ±2%	C-tol = ±1%	SPQ	SPQ	C-tol = ±2%	C-tol = ±1%	SPQ
			last 5 digits of catalog number				last 5 digits of catalog number		
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	8.0 × 15.0	1.1	73302	83302	1000	150			
3600		1.2	73602	83602					
3900		1.3	73902	83902					
4300	8.5 × 15.0	1.4	74302	84302	1000	125			
4700		1.5	74702	84702					

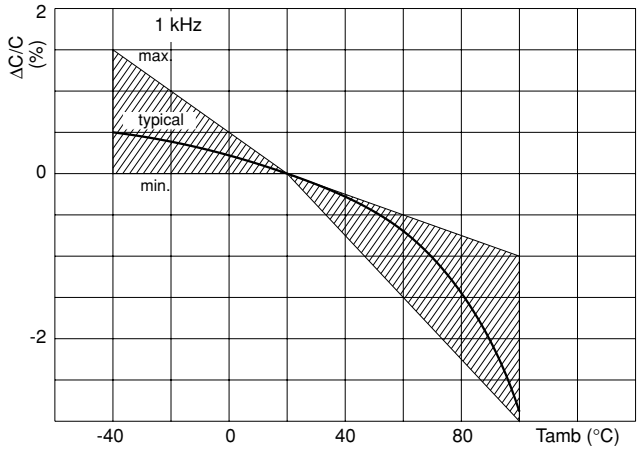
Available on request

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

CAPACITANCE

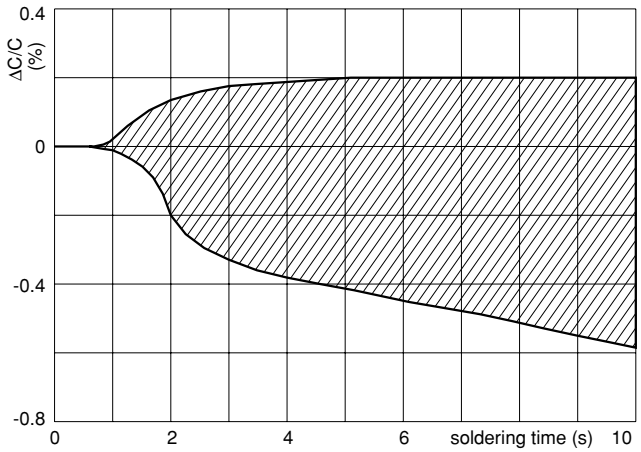
Temperature coefficient:

- between –40 and +20 °C for C ≤ 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.

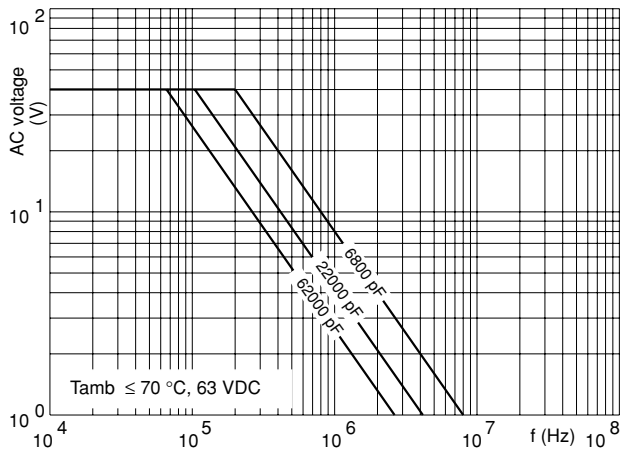


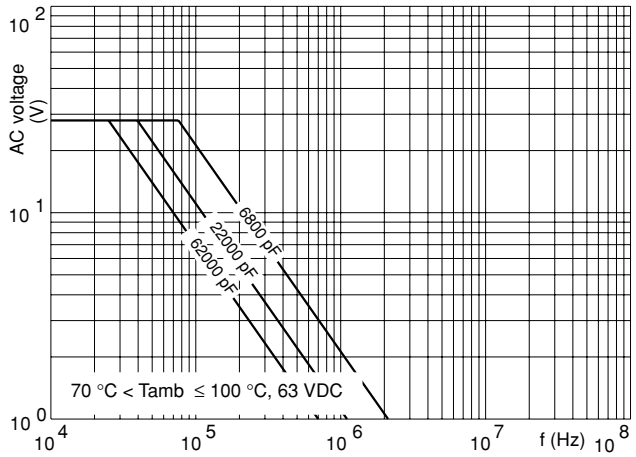
SOLDERING CONDITIONS

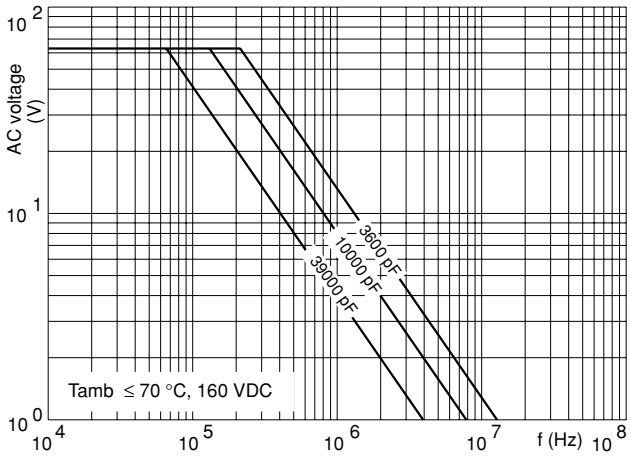
The capacitance stability is dependent on the maximum temperature the capacitor reaches during soldering.
The figure below shows the typical ΔC/C as a function of soldering time under the worst possible mounting conditions (horizontal on the PCB, minimum possible pitch) and with 80 °C preheating.

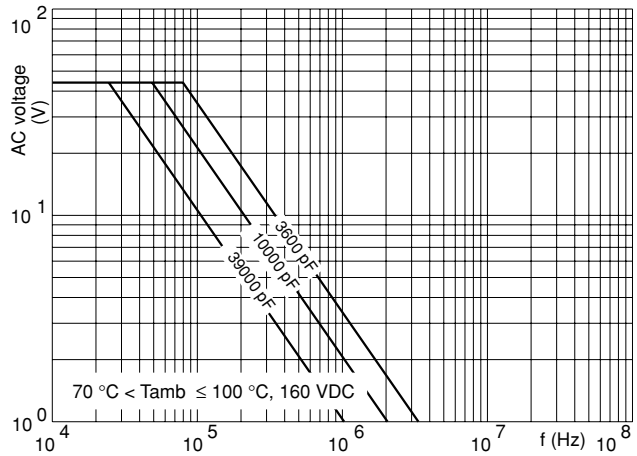


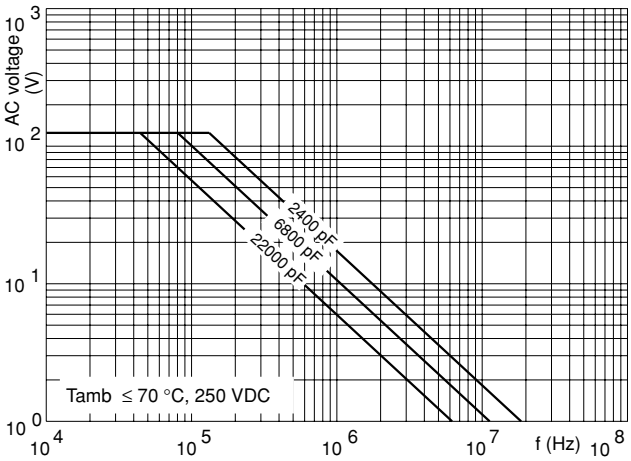
MAXIMUM RMS VOLTAGE (SINEWAVE) AS A FUNCTION OF FREQUENCY

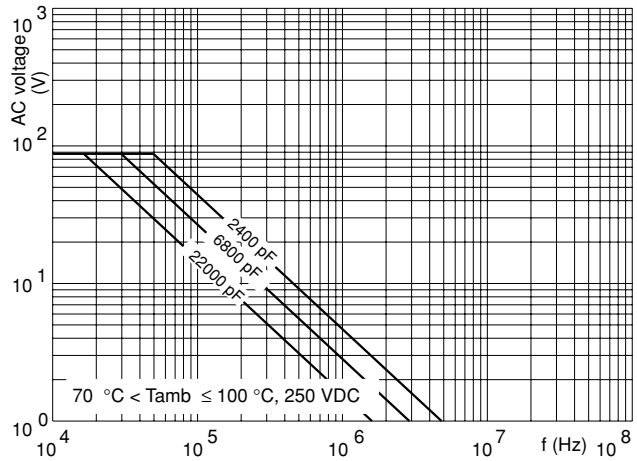


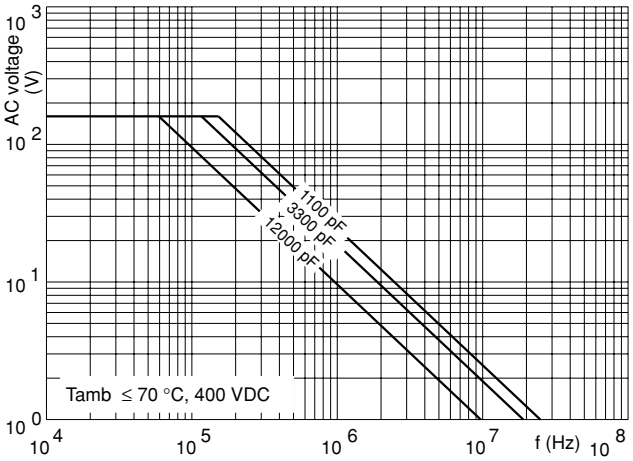


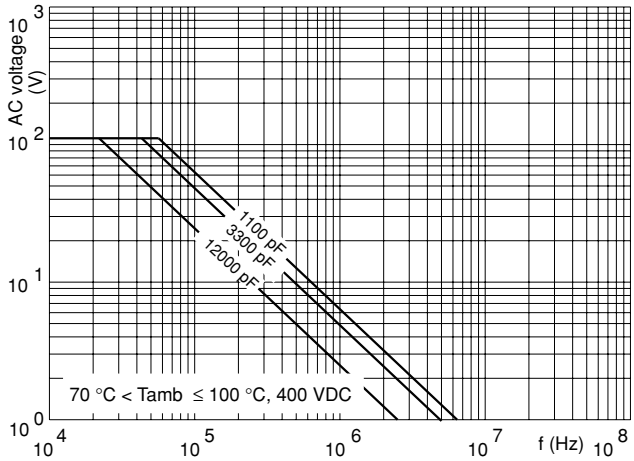


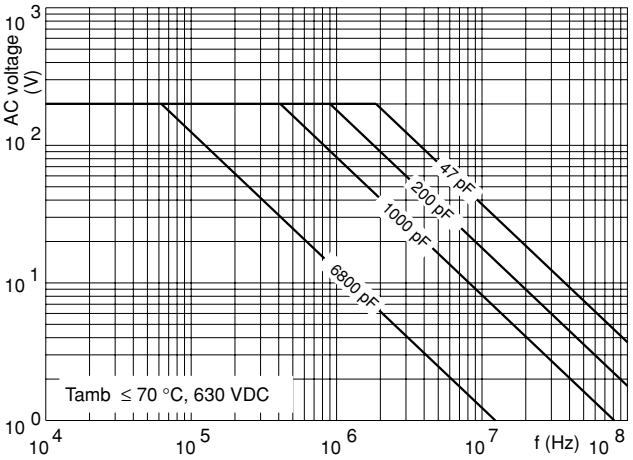


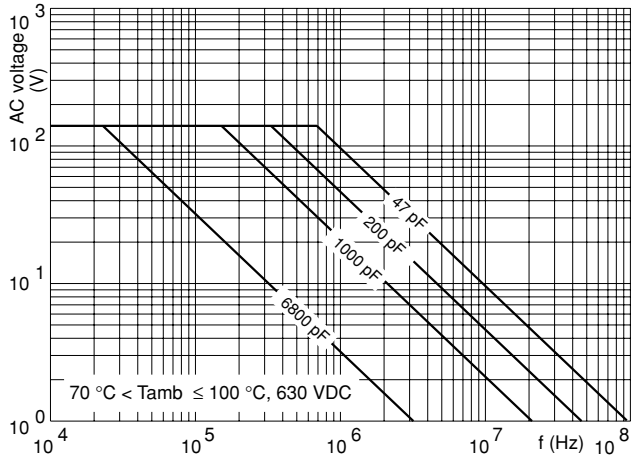





AC voltage (V)
10 3
10 2
10 1
10 0
1100 pF
3300 pF
12000 pF
Tamb ≤ 70 °C, 400 VDC
10 4
10 5
10 6
10 7
f (Hz)
10 8


AC voltage (V)
10 3
10 2
10 1
10 0
1100 pF
3900 pF
12000 pF
70 °C < Tamb ≤ 100 °C, 400 VDC
10 4
10 5
10 6
10 7
f (Hz)
10 8


AC voltage (V)
10 3
10 2
10 1
10 0
47 pF
200 pF
1000 pF
6800 pF
Tamb ≤ 70 °C, 630 VDC
10 4
10 5
10 6
10 7
f (Hz)
10 8


AC voltage (V)
10 3
10 2
10 1
10 0
47 pF
200 pF
1000 pF
6800 pF
70 °C < Tamb ≤ 100 °C, 630 VDC
10 4
10 5
10 6
10 7
f (Hz)
10 8