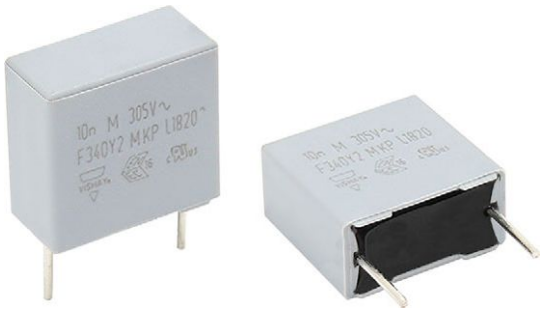
THB Grade IIIB Class Y2 Interference Suppression Film Capacitor Radial MKP 305 V_{AC} - Line Bypass



FEATURES

- IEC 60384-14: 2013 / AMD1: 2016 grade IIIB: 85 °C, 85 % RH, 1000 h at U_{RAC}
- AEC-Q200 qualified
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

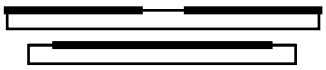
AUTOMOTIVE GRADE

Pb-free

RoHS COMPLIANT

APPLICATIONS

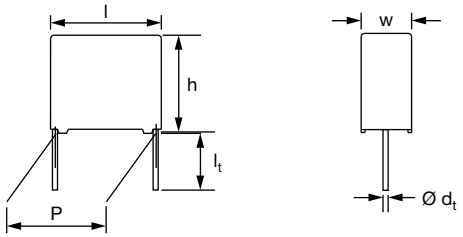
For standard line bypass (between line and ground) Y2 applications.
See also application note: www.vishay.com/doc?28153

QUICK REFERENCE DATA	
Rated capacitance range	0.01 µF to 1 µF (preferred values according to E6)
Capacitance tolerance	± 20 %; ± 10 %; ± 5 % (37.5 mm ± 5 % pitch values on request)
Climatic testing class according to IEC 60068-1	55 / 105 / 56B
Rated DC voltage	1000 V_{DC}
Permissible AC voltage	305 V_{AC}; 50 Hz to 60 Hz
Maximum application temperature	105 °C
Reference standards	IEC 60384-14:2013 IEC 60384-14:2013 / AMD1:2016 EN 60384-14 IEC 60065 requires pass. flamm. class B for volume ≥ 1750 mm^3 Class C for volume < 1750 mm^3 UL 60384-14 (2nd edition) CSA-E60384-1:14 (3rd edition) CQC
Dielectric	Polypropylene film
Electrodes	Metallized
Construction	Series construction 
Encapsulation	Plastic case, epoxy resin sealed, flame retardant UL-class 94 V-0
Leads	Tinned wire
Marking	C-value; tolerance; rated voltage; sub-class; manufacturer's type; code for dielectric material; manufacturer location, manufacturer's logo, year and week; safety approvals

Note

- For more detailed data and test requirements, contact rfi@vishay.com

DIMENSIONS in millimeters



Notes

- Standard dimension
- Ø d_t ± 10 % of standard diameter specified

COMPOSITION OF CATALOG NUMBER

MULTIPLIER (nF)	
0.1	2
1	3
10	4
100	5

CODE	Example:		
310	10 nF	0.01 µF
410	100 nF	0.1 µF
510	1000 nF	1.0 µF

P_1 (mm)	PITCH CODE
15	F
22.5	I
27.5	K
37.5	P

SPECIAL CODE FOR TERMINAL	
2	2 pins
(#)	Customized

VOLTAGE
30 = 305 V_{AC}

1 2 3 4	5 6	7	8 9	10 11	12	13	14	15	16	17
F 3 4 0	Y 2	4	1 0	3 0	M	F	M	2	B	0

TYPE

CLASS

TOLERANCE	
M	± 20 %
K	± 10 %
J	± 5 %
A	Special tolerance

SPECIAL
0 = Standard
Other = Special

l_t (mm)	LEAD LENGTH CODE	PITCH (mm)
3.5 ± 0.3	P	≥ 15
5 ± 1	M	All
25 ± 2	I	All
0: Space holder		

PACKING CODE	PACKING STYLE	REMARK
B / T	Bulk / loose (1)	Not for bent back
R	Tape and reel (H: 16.0 mm; 500 mm)	For bent back only
H	Ammo (H: 16.0 mm)	For bent back only
W	Tape and reel (H: 18.5 mm; 500 mm)	Pitch ≤ 22.5 mm
G	Ammo (H: 18.5 mm)	Pitch ≤ 10 mm

Notes

- For detailed tape specifications refer to packaging information www.vishay.com/doc?28139

(1) Packaging will be bulk for all capacitors with pitch ≤ 15 mm and such with long leads (> 5 mm).
Capacitors with short leads up to 5 mm and pitch > 15 mm will be in tray and asking code will be “T”

SPECIFIC REFERENCE DATA

DESCRIPTION	VALUE	
Rated AC voltage (U_{RAC})	305 V	
Permissible DC voltage (U_{RDC})	1000 V	
Tangent of loss angle	At 1 kHz	At 10 kHz
	≤ 10 x 10^{-4}	≤ 20 x 10^{-4}
Rated voltage pulse slope $(du/dt)_R$ at 420 V_{DC}	100 V/µs	
R between leads, for C ≤ 0.33 µF at 100 V; 1 min	> 15 000 MΩ	
RC between leads, for C > 0.33 µF at 100 V; 1 min	> 5000 s	
R between leads and case; 100 V; 1 min	> 30 000 MΩ	
Withstanding (DC) voltage (cut off current 10 mA) (1); rise time ≤ 1000 V/s	3400 V; 1 min	
Withstanding (AC) voltage between leads and case	2100 V; 1 min	

Note
(1) See “Voltage Proof Test for Metalized Film Capacitors”: www.vishay.com/doc?28169

ELECTRICAL DATA AND ORDERING INFORMATION

U_{RAC} (V)	CAP. (µF)	DIMENSIONS (4) w x h x l (mm)	MASS (g) (3)	CATALOG NUMBER F340Y2... AND PACKAGING						
				LOOSE IN BOX					TAPED REEL (500 mm) (1)(2)	
				SHORT LEADS			LONG LEADS			
				l_t = 3.5 mm ± 0.3 mm	l_t = 5.0 mm ± 1.0 mm	SPQ	l_t = 25.0 mm ± 2.0 mm	SPQ	H = 18.5 mm; P_0 = 12.7 mm	SPQ
305	PITCH = 15.0 mm ± 0.4 mm; d_t = 0.60 mm ± 0.06 mm; C-TOL. = ± 20 %									
	0.01	5.0 x 11.0 x 17.5	1.0	31030MFP2B0	31030MFM2B0	1250	31030MFI2B0	1000	31030MF02W0	1100
	0.012			31230MFP2B0	31230MFM2B0		31230MFI2B0		31230MF02W0	
	0.015			31530MFP2B0	31530MFM2B0		31530MFI2B0		31530MF02W0	
	0.018			31830MFP2B0	31830MFM2B0		31830MFI2B0		31830MF02W0	
	0.022	6.0 x 11.0 x 17.5	1.4	32230MFP2B0	32230MFM2B0	1000	32230MFI2B0	1000	32230MF02W0	900
	PITCH = 15.0 mm ± 0.4 mm; d_t = 0.80 mm ± 0.08 mm; C-TOL. = ± 20 %									
	0.027	7.0 x 13.5 x 17.5	1.8	32730MFP2B0	32730MFM2B0	750	32730MFI2B0	500	32730MF02W0	800
	0.033			33330MFP2B0	33330MFM2B0		33330MFI2B0		33330MF02W0	
	0.039			33930MFP2B0	33930MFM2B0		33930MFI2B0		33930MF02W0	
	0.047	8.5 x 15.0 x 17.5	2.4	34730MFP2B0	34730MFM2B0	750	34730MFI2B0	500	34730MF02W0	650
	0.056			35630MFP2B0	35630MFM2B0		35630MFI2B0		35630MF02W0	
	0.068	10.0 x 16.5 x 17.5	3.0	36830MFP2B0	36830MFM2B0	500	36830MFI2B0	450	36830MF02W0	600
	0.082	10.5 x 17.5 x 18.0	4.5	38230MFP2B0	38230MFM2B0	250	38230MFI2B0	400	-	
	PITCH = 22.5 mm ± 0.4 mm; d_t = 0.80 mm ± 0.08 mm; C-TOL. = ± 20 %									
	0.033	6.0 x 15.5 x 26.0	2.4	33330MIP2T0	33330MIM2T0	300	33330MII2B0	250	-	
	0.039			33930MIP2T0	33930MIM2T0		33930MII2B0			
	0.047			34730MIP2T0	34730MIM2T0		34730MII2B0			
	0.056	7.0 x 16.5 x 26.0	2.9	35630MIP2T0	35630MIM2T0	200	35630MII2B0	250		
	0.068			36830MIP2T0	36830MIM2T0		36830MII2B0			
	0.082	8.5 x 18.0 x 26.0	3.8	38230MIP2T0	38230MIM2T0	200	38230MII2B0	250		
	0.10			41030MIP2T0	41030MIM2T0		41030MII2B0			
	0.12	10.0 x 19.5 x 26.0	6.8	41230MIP2T0	41230MIM2T0	200	41230MII2B0	200		
	0.15			41530MIP2T0	41530MIM2T0		41530MII2B0			
	0.18	12.0 x 22.0 x 26.0	7.8	41830MIP2T0	41830MIM2T0	150	41830MII2B0	200		
	0.22			42230MIP2T0	42230MIM2T0		42230MII2B0			
	0.27	15.5 x 26.5 x 26.5	14	42730MIP2T0	42730MIM2T0	110	42730MII2B0	275		
	0.33			43330MIP2T0	43330MIM2T0		43330MII2B0			
	0.39			43930MIP2T0	43930MIM2T0		43930MII2B0			

Notes
- SPQ = Standard Packing Quantity

(1) Reel diameter = 356 mm is available on request
(2) H = in-tape height; P_0 = sprocket hole distance; for detailed specifications refer to “Packaging Information”
(3) Weight for short lead product only
(4) For tolerances see chapter “Space Requirements for Printed-Circuit Board Applications and Dimension Tolerances”

ELECTRICAL DATA AND ORDERING INFORMATION

U_{RAC} (V)	CAP. (µF)	DIMENSIONS [4] w x h x l (mm)	MASS (g) [3]	CATALOG NUMBER F340Y2... AND PACKAGING						
				LOOSE IN BOX					TAPED REEL (500 mm) [1][2]	
				SHORT LEADS			LONG LEADS			
				l_t = 3.5 mm ± 0.3 mm	l_t = 5.0 mm ± 1.0 mm	SPQ	l_t = 25.0 mm ± 2.0 mm	SPQ	H = 18.5 mm; P_0 = 12.7 mm	SPQ
305	PITCH = 27.5 mm ± 0.4 mm; d_t = 0.80 mm ± 0.08 mm; C-TOL. = ± 20 %									
	0.10	9.0 x 19.0 x 31.0	5.5	41030MKP2T0	41030MKM2T0	100	41030MKI2B0	150	-	
	0.12			41230MKP2T0	41230MKM2T0		41230MKI2B0			
	0.15	11.0 x 21.0 x 31.0	7.4	41530MKP2T0	41530MKM2T0	100	41530MKI2B0	125		
	0.18			41830MKP2T0	41830MKM2T0		41830MKI2B0			
	0.22	13.0 x 23.0 x 31.0	9.2	42230MKP2T0	42230MKM2T0	100	42230MKI2B0	125		
	0.27			42730MKP2T0	42730MKM2T0		42730MKI2B0			
	0.33	15.0 x 25.0 x 31.0	12.3	43330MKP2T0	43330MKM2T0	100	43330MKI2B0	125		
	0.39	18.0 x 28.0 x 31.0	16.1	43930MKP2T0	43930MKM2T0	100	43930MKI2B0	100		
	0.47			44730MKP2T0	44730MKM2T0		44730MKI2B0			
	0.56	21.0 x 31.0 x 31.0	20.3	45630MKP2T0	45630MKM2T0	50	45630MKI2B0	75		
	0.68			46830MKP2T0	46830MKM2T0		46830MKI2B0			
	0.82	20.0 x 35.0 x 31.0	17.5	48230MKP2T0	48230MKM2T0	50	48230MKI2B0	75		
	PITCH = 37.5 mm ± 0.5 mm; d_t = 1.0 mm ± 0.1 mm; C-TOL. = ± 20 %									
	0.47	14.5 x 24.5 x 41.5	15.5	44730MPP2T0	44730MPM2T0	80	44730MPI2T0	80	-	
	0.68	16.0 x 28.5 x 41.5	19.5	46830MPP2T0	46830MPM2T0	70	46830MPI2T0	70		
	1.0	18.0 x 32.5 x 41.5	25	51030MPP2T0	51030MPM2T0	60	51030MPI2T0	60		
	PITCH = 15.0 mm ± 0.4 mm; d_t = 0.60 mm ± 0.06 mm; C-TOL. = ± 10 %									
	0.010	5.0 x 11.0 x 17.5	1.0	31030KFP2B0	31030KFM2B0	1250	31030KFI2B0	1000	31030KF02W0	1100
	0.012			31230KFP2B0	31230KFM2B0		31230KFI2B0		31230KF02W0	
	0.015			31530KFP2B0	31530KFM2B0		31530KFI2B0		31530KF02W0	
	0.018			31830KFP2B0	31830KFM2B0		31830KFI2B0		31830KF02W0	
	0.022	6.0 x 12.0 x 17.5	1.4	32230KFP2B0	32230KFM2B0	1000	32230KFI2B0	1000	32230KF02W0	900
	PITCH = 15.0 mm ± 0.4 mm; d_t = 0.80 mm ± 0.08 mm; C-TOL. = ± 10 %									
	0.027	7.0 x 13.5 x 17.5	1.8	32730KFP2B0	32730KFM2B0	750	32730KFI2B0	500	32730KF02W0	800
	0.033			33330KFP2B0	33330KFM2B0		33330KFI2B0		33330KF02W0	
	0.039	8.5 x 15.0 x 17.5	2.4	33930KFP2B0	33930KFM2B0	750	33930KFI2B0	500	33930KF02W0	650
	0.047			34730KFP2B0	34730KFM2B0		34730KFI2B0		34730KF02W0	
	0.056	10.0 x 16.5 x 17.5	3.0	35630KFP2B0	35630KFM2B0	500	35630KFI2B0	450	35630KF02W0	600
	0.068			36830KFP2B0	36830KFM2B0		36830KFI2B0		36830KF02W0	
	0.082	10.5 x 17.5 x 18.0	4.5	38230KFP2B0	38230KFM2B0	250	38230KFI2B0	400	-	-
	PITCH = 22.5 mm ± 0.4 mm; d_t = 0.80 mm ± 0.08 mm; C-TOL. = ± 10 %									
	0.033	6.0 x 15.5 x 26.0	2.4	33330KIP2T0	33330KIM2T0	300	33330KFI2B0	250	-	-
	0.039			33930KIP2T0	33930KIM2T0		33930KFI2B0			
	0.047			34730KIP2T0	34730KIM2T0		34730KFI2B0			
	0.056	7.0 x 16.5 x 26.0	2.9	35630KIP2T0	35630KIM2T0	200	35630KFI2B0	250		
	0.068	8.5 x 18.0 x 26.0	3.8	36830KIP2T0	36830KIM2T0	200	36830KFI2B0	250		
	0.082			38230KIP2T0	38230KIM2T0		38230KFI2B0			
	0.10			41030KIP2T0	41030KIM2T0		41030KFI2B0			
	0.12	10.0 x 19.5 x 26.0	6.8	41230KIP2T0	41230KIM2T0	200	41230KFI2B0	200		
	0.15	12.0 x 22.0 x 26.0	7.8	41530KIP2T0	41530KIM2T0	150	41530KFI2B0	200		
	0.18			41830KIP2T0	41830KIM2T0		41830KFI2B0			
	0.22	12.5 x 22.5 x 26.5	11.0	42230KIP2T0	42230KIM2T0	140	42230KFI2B0	200		
	0.27	15.5 x 26.5 x 26.5	14.0	42730KIP2T0	42730KIM2T0	110	42730KFI2B0	275		
	0.33			43330KIP2T0	43330KIM2T0		43330KFI2B0			
	0.39	18.0 x 29.5 x 26.5	20.5	43930KIP2T0	43930KIM2T0	90	43930KFI2B0	250		

Notes

- SPQ = Standard Packing Quantity

(1) Reel diameter = 356 mm is available on request

(2) H = in-tape height; P_0 = sprocket hole distance; for detailed specifications refer to “Packaging Information”

(3) Weight for short lead product only

(4) For tolerances see chapter “Space Requirements for Printed-Circuit Board Applications and Dimension Tolerances”

ELECTRICAL DATA AND ORDERING INFORMATION

U_{RAC} (V)	CAP. (µF)	DIMENSIONS [4] w x h x l (mm)	MASS (g) [3]	CATALOG NUMBER F340Y2... AND PACKAGING						
				LOOSE IN BOX					TAPED REEL (500 mm) [1][2]	
				SHORT LEADS			LONG LEADS			
				l_t = 3.5 mm ± 0.3 mm	l_t = 5.0 mm ± 1.0 mm	SPQ	l_t = 25.0 mm ± 2.0 mm	SPQ	H = 18.5 mm; P_0 = 12.7 mm	SPQ
305	PITCH = 27.5 mm ± 0.4 mm; d_t = 0.80 mm ± 0.08 mm; C-TOL. = ± 10 %									
	0.10	9.0 x 19.0 x 31.0	5.5	41030KKP2T0	41030KKM2T0	100	41030KKI2B0	150	-	-
	0.12			41230KKP2T0	41230KKM2T0		41230KKI2B0			
	0.15	11.0 x 21.0 x 31.0	7.4	41530KKP2T0	41530KKM2T0	100	41530KKI2B0	125		
	0.18			41830KKP2T0	41830KKM2T0		41830KKI2B0			
	0.22	13.0 x 23.0 x 31.0	9.2	42230KKP2T0	42230KKM2T0	100	42230KKI2B0	125		
	0.27	15.0 x 25.0 x 31.0	12.3	42730KKP2T0	42730KKM2T0	100	42730KKI2B0	125		
	0.33	18.0 x 28.0 x 31.0	16.1	43330KKP2T0	43330KKM2T0	100	43330KKI2B0	100		
	0.39			43930KKP2T0	43930KKM2T0		43930KKI2B0			
	0.47	21.0 x 31.0 x 31.0	20.3	44730KKP2T0	44730KKM2T0	50	44730KKI2B0	75		
	0.56			45630KKP2T0	45630KKM2T0		45630KKI2B0			
	0.68	20.0 x 35.0 x 31.0	17.5	46830KKP2T0	46830KKM2T0	50	46830KKI2B0	75		
	PITCH = 37.5 mm ± 0.5 mm; d_t = 1.0 mm ± 0.1 mm; C-TOL. = ± 10 %									
	0.47	14.5 x 24.5 x 41.5	14.8	44730KPP2T0	44730KPM2T0	80	44730KPI2T0	80	-	-
	0.56	16.0 x 28.5 x 41.5	19.5	45630KPP2T0	45630KPM2T0	70	45630KPI2T0	70		
	0.68		18.5	46830KPP2T0	46830KPM2T0	70	46830KPI2T0	70		
	0.82	18.0 x 32.5 x 41.5	26	48230KPP2T0	48230KPM2T0	60	48230KPI2T0	60		
	1.0	18.5 x 35.5 x 43.0	30	51030KPP2T0	51030KPM2T0	105	51030KPI2T0	105		
	PITCH = 15.0 mm ± 0.4 mm; d_t = 0.60 mm ± 0.06 mm; C-TOL. = ± 5 %									
	0.010	5.0 x 11.0 x 17.5	1.0	31030JFP2B0	31030JFM2B0	1250	31030JFI2B0	1000	31030JF02W0	1100
	0.012			31230JFP2B0	31230JFM2B0		31230JFI2B0		31230JF02W0	
	0.015			31530JFP2B0	31530JFM2B0		31530JFI2B0		31530JF02W0	
	0.018	6.0 x 12.0 x 17.5	1.4	31830JFP2B0	31830JFM2B0	1000	31830JFI2B0		31830JF02W0	900
	0.022			32230JFP2B0	32230JFM2B0		32230JFI2B0		32230JF02W0	
	PITCH = 15.0 mm ± 0.4 mm; d_t = 0.80 mm ± 0.08 mm; C-TOL. = ± 5 %									
	0.027	7.0 x 13.5 x 17.5	1.8	32730JFP2B0	32730JFM2B0	750	32730JFI2B0	500	32730JF02W0	800
	0.033			33330JFP2B0	33330JFM2B0		33330JFI2B0		33330JF02W0	
	0.039	8.5 x 15.0 x 17.5	2.4	33930JFP2B0	33930JFM2B0	750	33930JFI2B0		33930JF02W0	650
	0.047			34730JFP2B0	34730JFM2B0		34730JFI2B0		34730JF02W0	
	0.056	10.0 x 16.5 x 17.5	3.0	35630JFP2B0	35630JFM2B0	500	35630JFI2B0	450	35630JF02W0	600
	0.068			36830JFP2B0	36830JFM2B0		36830JFI2B0		36830JF02W0	
	0.082	11.0 x 18.5 x 18.0	5.5	38230JFP2B0	38230JFM2B0	225	38230JFI2B0	350	-	-
	PITCH = 22.5 mm ± 0.4 mm; d_t = 0.80 mm ± 0.08 mm; C-TOL. = ± 5 %									
	0.033	6.0 x 15.5 x 26.0	2.4	33330JIP2T0	33330JIM2T0	300	33330JII2B0	250	-	-
	0.039			33930JIP2T0	33930JIM2T0		33930JII2B0			
	0.047	7.0 x 16.5 x 26.0	2.9	34730JIP2T0	34730JIM2T0	200	34730JII2B0	250		
	0.056			35630JIP2T0	35630JIM2T0		35630JII2B0			
	0.068	8.5 x 18.0 x 26.0	3.8	36830JIP2T0	36830JIM2T0	200	36830JII2B0	250		
	0.082			38230JIP2T0	38230JIM2T0		38230JII2B0			
	0.10	10.0 x 19.5 x 26.0	6.8	41030JIP2T0	41030JIM2T0	200	41030JII2B0	200		
	0.12			41230JIP2T0	41230JIM2T0		41230JII2B0			
	0.15	12.0 x 22.0 x 26.0	7.8	41530JIP2T0	41530JIM2T0	150	41530JII2B0	200		
	0.18			41830JIP2T0	41830JIM2T0		41830JII2B0			
	0.22	12.5 x 22.5 x 26.5	8.4	42230JIP2T0	42230JIM2T0	140	42230JII2B0	200		
	0.27	15.5 x 26.5 x 26.5	14	42730JIP2T0	42730JIM2T0	110	42730JII2B0	275		
	0.33			43330JIP2T0	43330JIM2T0		43330JII2B0			
	0.39	18.0 x 29.5 x 26.5	20.5	43930JIP2T0	43930JIM2T0	90	43930JII2B0	250		

Notes

- SPQ = Standard Packing Quantity

(1) Reel diameter = 356 mm is available on request

(2) H = in-tape height; P_0 = sprocket hole distance; for detailed specifications refer to “Packaging Information”

(3) Weight for short lead product only

(4) For tolerances see chapter “Space Requirements for Printed-Circuit Board Applications and Dimension Tolerances”

ELECTRICAL DATA AND ORDERING INFORMATION

U_{RAC} (V)	CAP. (µF)	DIMENSIONS [4] w x h x l (mm)	MASS (g) [3]	CATALOG NUMBER F340Y2... AND PACKAGING						
				LOOSE IN BOX					TAPED REEL (500 mm) [1][2]	
				SHORT LEADS			LONG LEADS			
				l_t = 3.5 mm ± 0.3 mm	l_t = 5.0 mm ± 1.0 mm	SPQ	l_t = 25.0 mm ± 2.0 mm	SPQ	H = 18.5 mm; P_0 = 12.7 mm	SPQ
305	PITCH = 27.5 mm ± 0.4 mm; d_t = 0.80 mm ± 0.08 mm; C-TOL. = ± 5 %									
	0.10	9.0 x 19.0 x 31.0	5.5	41030JKP2T0	41030JKM2T0	100	41030JKI2B0	150	-	-
	0.12			41230JKP2T0	41230JKM2T0		41230JKI2B0			
	0.15	11.0 x 21.0 x 31.0	7.4	41530JKP2T0	41530JKM2T0	100	41530JKI2B0	125		
	0.18			41830JKP2T0	41830JKM2T0		41830JKI2B0			
	0.22	13.0 x 23.0 x 31.0	9.2	42230JKP2T0	42230JKM2T0	100	42230JKI2B0	125		
	0.27	15.0 x 25.0 x 31.0	12.3	42730JKP2T0	42730JKM2T0	100	42730JKI2B0	125		
	0.33	18.0 x 28.0 x 31.0	16.1	43330JKP2T0	43330JKM2T0	100	43330JKI2B0	100		
	0.39			43930JKP2T0	43930JKM2T0		43930JKI2B0			
	0.47	21.0 x 31.0 x 31.0	20.3	44730JKP2T0	44730JKM2T0	50	44730JKI2B0	75		
	0.56			45630JKP2T0	45630JKM2T0		45630JKI2B0			
	0.68	20.0 x 35.0 x 31.0	17.5	46830JKP2T0	46830JKM2T0	50	46830JKI2B0	75		

Notes

- SPQ = Standard Packing Quantity

(1) Reel diameter = 356 mm is available on request
(2) H = in-tape height; P_0 = sprocket hole distance; for detailed specifications refer to “Packaging Information”
(3) Weight for short lead product only
(4) For tolerances see chapter “Space Requirements for Printed-Circuit Board Applications and Dimension Tolerances”

APPROVALS

SAFETY APPROVALS Y2	VOLTAGE	VALUE	FILE NUMBERS	LINK
EN 60384-14 (ENEC) (= IEC 60384-14 ed-4 (2013))	305 V_{AC}	1 nF to 1 µF	ENEC16/FI/19/10007	www.vishay.com/doc?28253
UL 60384-14 (2nd edition)	305 V_{AC}	1 nF to 1 µF	E354331	www.vishay.com/doc?28256
CSA-E60384-1:14 (3rd edition)	305 V_{AC}	1 nF to 1 µF	E354331	www.vishay.com/doc?28256
CQC	305 V_{AC}	1 nF to 1 µF	L-15001128762	www.vishay.com/doc?28251
			F-15001128766	www.vishay.com/doc?28252
CB-test certificate	305 V_{AC}	1 nF to 1 µF	FI-39833	www.vishay.com/doc?28254

The ENEC-approval together with the CB-certificate replace all national marks of the following countries (they have already signed the ENEC-agreement): Austria; Belgium; Czech Republic; Denmark; Finland; France; Germany; Greece; Hungary; Ireland; Italy; Luxembourg; Netherlands; Norway; Portugal; Slovenian; Spain; Sweden, Switzerland, and United Kingdom.

MOUNTING

Normal Use

The capacitors are designed for mounting on printed-circuit boards. The capacitors packed in bandoliers are designed for mounting in printed-circuit boards by means of automatic insertion machines.

For detailed tape specifications refer to packaging information www.vishay.com/docs?28139

Specific Method of Mounting to Withstand Vibration and Shock

In order to withstand vibration and shock tests, it must be ensured that the stand-off pips are in good contact with the printed-circuit board:

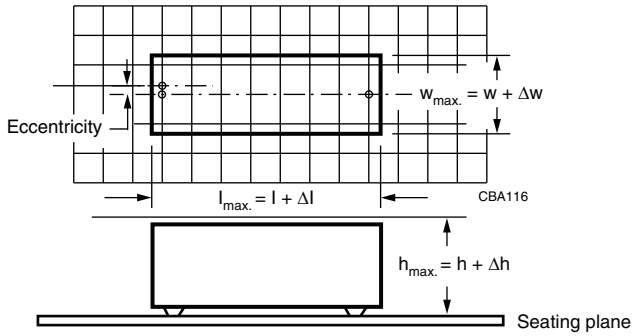
- For original pitch ≤ 15 mm the capacitors shall be mechanically fixed by the leads
- For larger pitches the capacitors shall be mounted in the same way and the body clamped

Space Requirements for Printed-Circuit Board Applications and Dimension Tolerances

For the maximum product dimensions and maximum space requirements for length ($l_{max.}$), width ($w_{max.}$) and height ($h_{max.}$) following tolerances must be taken in account in the envelopment of the components as shown in the drawings below.

- For products with pitch ≤ 15 mm, $\Delta w = \Delta l = 0.3$ mm, and $\Delta h = 0.1$ mm
- For products with 15 mm < pitch ≤ 27.5 mm, $\Delta w = \Delta l = 0.5$ mm, and $\Delta h = 0.1$ mm
- For products with pitch = 37.5 mm, $\Delta w = \Delta l = 0.7$ mm, and $\Delta h = 0.5$ mm

Eccentricity defined as in drawing. The maximum eccentricity is smaller than or equal to the lead diameter of the product concerned.



For the minimum product dimensions for length ($l_{min.}$), width ($w_{min.}$), and height ($h_{min.}$) following tolerances of the components are valid:

$l_{min.} = l - \Delta l$, $w_{min.} = w - \Delta w$, and $h_{min.} = h - \Delta h$ following

- For products with pitch ≤ 10 mm, $\Delta l = 0.3$ mm, and $\Delta w = \Delta h = 0.3$ mm
- For products with pitch = 15 mm, $\Delta l = 0.5$ mm, and $\Delta w = \Delta h = 0.5$ mm
- For products with 15 mm < pitch ≤ 27.5 mm, $\Delta l = 1.0$ mm, and $\Delta w = \Delta h = 0.5$ mm
- For products with pitch = 37.5 mm, $\Delta l = 1.0$ mm, and $\Delta w = \Delta h = 1.0$ mm

SOLDERING CONDITIONS

For general soldering conditions and wave soldering profile we refer to the document “Soldering Guidelines for Film Capacitors”: www.vishay.com/doc?28171

STORAGE TEMPERATURE

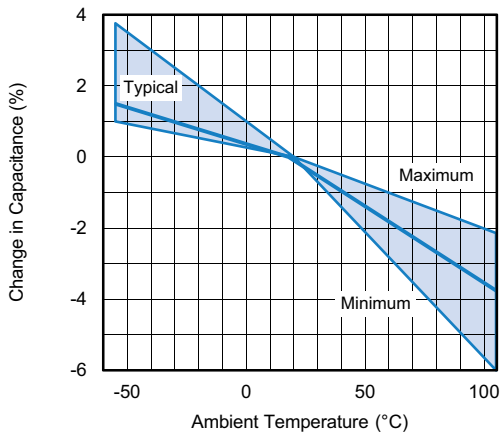
T_{stg} = -25 °C to +35 °C with RH maximum 75 % without condensation

RATINGS AND CHARACTERISTICS REFERENCE CONDITIONS

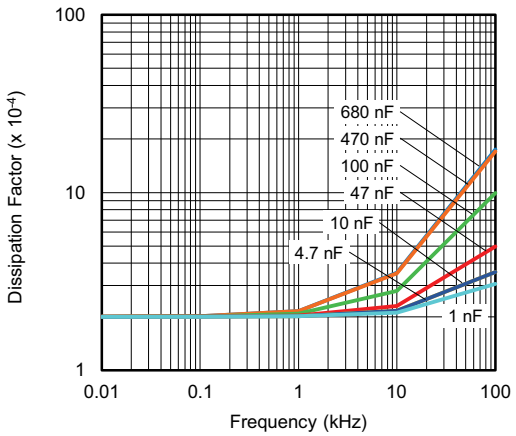
Unless otherwise specified, all electrical values apply to an ambient temperature of 23 °C ± 1 °C, an atmospheric pressure of 86 kPa to 106 kPa and a relative humidity of 50 % ± 2 %.

For reference testing, a conditioning period shall be applied over 96 h ± 4 h by heating the products in a circulating air oven at the rated temperature and a relative humidity not exceeding 20 %.

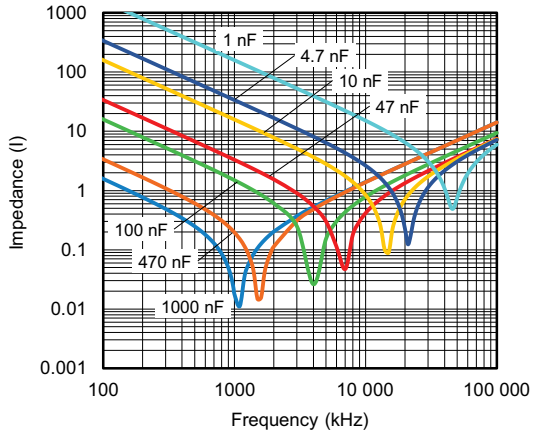
CHARACTERISTICS



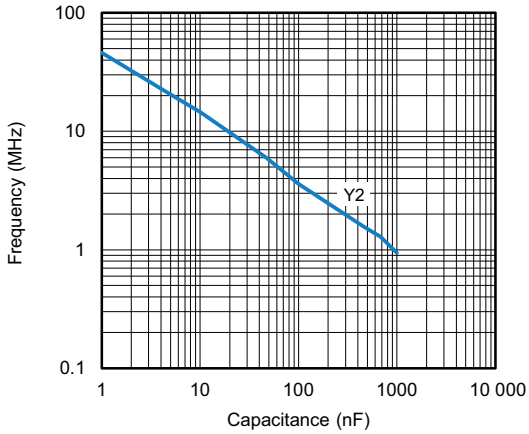
Capacitance as a function of ambient temperature (typical curve)



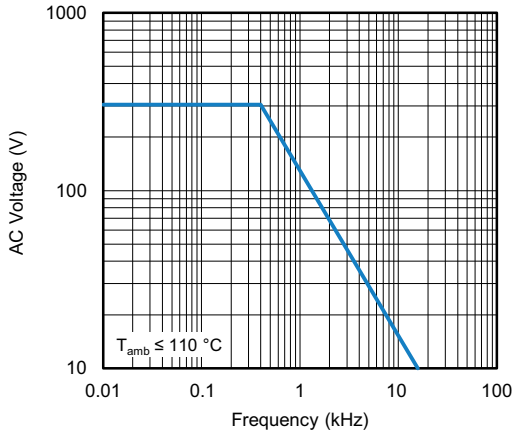
Tangent of loss angle as a function of frequency (typical curve)



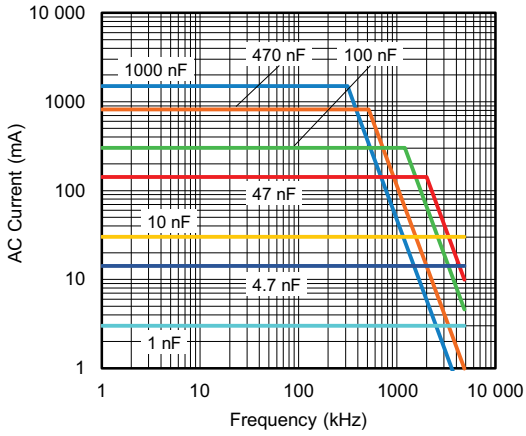
Impedance as a function of frequency (typical curve)



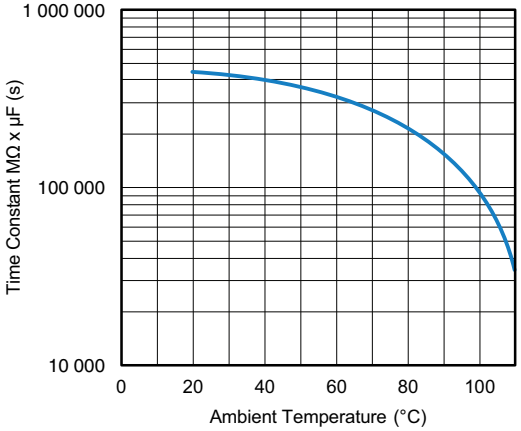
Resonant frequency as a function of capacitance (typical curve)



Max. RMS voltage as a function of frequency



Max. RMS current as a function of frequency



Insulation resistance as a function of ambient temperature
(typical curve)

APPLICATION NOTES

- For Y2 electromagnetic interference suppression in standard line bypass applications (50 Hz / 60 Hz) with a maximum of 305 V_{AC} rated voltage including fluctuation of the mains. It is recommended to use these components in a mains with maximum nominal voltage of 240 V_{AC}. Higher continuous applied voltages will shorten the life time
- For series impedance applications we refer to the application note: www.vishay.com/doc?28153
- To ensure withstanding high humidity requirements in the application it is recommended not to damage the epoxy adhesion at the leads. Therefore the leads may not be damaged or bent before soldering
- For capacitors connected in parallel, normally the proof voltage and possibly the rated voltage must be reduced. For information depending of the capacitance value and the number of parallel connections contact: rfi@vishay.com
- These capacitors are not intended for continuous pulse applications. For these situations, capacitors of the AC and pulse programs must be used
- The maximum ambient temperature must not exceed 105 °C
- Rated voltage pulse slope:
  if the pulse voltage is lower than the rated voltage, the values of the specific reference data can be multiplied by 420 V_{DC} and divided by the applied voltage

INSPECTION REQUIREMENTS

General Notes

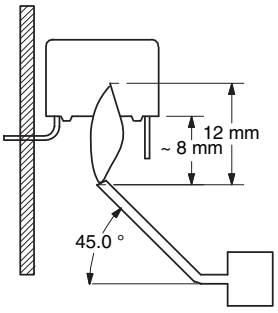
Sub-clause numbers of tests and performance requirements refer to the “Sectional Specification, Publication IEC 60384-14 ed-3 and Specific Reference Data”.

INSPECTION REQUIREMENTS		
SUB-CLAUSE NUMBER AND TEST	**CONDITIONS**	**PERFORMANCE REQUIREMENTS**
SUB-GROUP C1A PART OF SAMPLE OF SUB-GROUP C1		
4.1 Dimensions (detail)		As specified in chapters “General Data” of this specification
Initial measurements	Capacitance Tangent of loss angle: for C ≤ 1 µF at 10 kHz	
4.3 Robustness of terminations	Tensile: load 10 N; 10 s Bending: load 5 N; 4 x 90°	
4.4 Resistance to soldering heat	No pre-drying Method: 1A Solder bath: 280 °C ± 5 °C Duration: 10 s	

INSPECTION REQUIREMENTS		
SUB-CLAUSE NUMBER AND TEST	**CONDITIONS**	**PERFORMANCE REQUIREMENTS**
SUB-GROUP C1A PART OF SAMPLE OF SUB-GROUP C1		
4.19 Component solvent resistance	Isopropylalcohol at room temperature Method: 2 Immersion time: 5 min ± 0.5 min Recovery time: min. 1 h, max. 2 h	
4.4.2 Final measurements	Visual examination	No visible damage Legible marking
	Capacitance	$\|\Delta C/C\| \leq 5$ % of the value measured initially
	Tangent of loss angle	Increase of tan δ: ≤ 0.008 for: C ≤ 1 µF Compared to values measured initially
	Insulation resistance	As specified in section “Insulation Resistance” of this specification
SUB-GROUP C1B OTHER PART OF SAMPLE OF SUB-GROUP C1		
Initial measurements	Capacitance Tangent of loss angle: for C ≤ 1 µF at 10 kHz	
4.20 Solvent resistance of the marking	Isopropyl alcohol at room temperature Method: 1 Rubbing material: cotton wool Immersion time: 5 min ± 0.5 min	No visible damage Legible marking
4.6 Rapid change of temperature	θA = -55 °C θB = +105 °C 5 cycles Duration t = 30 min	
4.6.1 Inspection	Visual examination	No visible damage
4.7 Vibration	Mounting: see section “Mounting” of this specification Procedure B4: frequency range: 10 Hz to 55 Hz Amplitude: 0.75 mm or Acceleration 98 m/s² (whichever is less severe) Total duration 6 h	
4.7.2 Final inspection	Visual examination	No visible damage
4.9 Shock	Mounting: see section “Mounting” for more information Pulse shape: half sine Acceleration: 490 m/s² Duration of pulse: 11 ms	
4.9.2 Final measurements	Visual examination	No visible damage
	Capacitance	$\|\Delta C/C\| \leq 5$ % of the value measured initially
	Tangent of loss angle	Increase of tan δ: ≤ 0.008 for: C ≤ 1 µF Compared to values measured initially
	Insulation resistance	As specified in section “Insulation Resistance” of this specification

INSPECTION REQUIREMENTS		
SUB-CLAUSE NUMBER AND TEST	**CONDITIONS**	**PERFORMANCE REQUIREMENTS**
SUB-GROUP C1 COMBINED SAMPLE OF SPECIMENS OF SUB-GROUPS C1A AND C1B		
4.11 Climatic sequence		
4.11.1 Initial measurements	Capacitance Measured in 4.4.2 and 4.9.2 Tangent of loss angle: measured initially in C1A and C1B	
4.11.2 Dry heat	Temperature: 105 °C	
4.11.3 Damp heat cyclic Test Db First cycle	Duration: 16 h	
4.11.4 Cold	Temperature: -55 °C	
4.11.5 Damp heat cyclic Test Db remaining cycles	Duration: 2 h	
4.11.6 Final measurements	Visual examination	No visible damage Legible marking
	Capacitance	$\lvert\Delta C/C\rvert \leq 5$ % of the value measured in 4.11.1.
	Tangent of loss angle	Increase of tan δ: ≤ 0.008 for $C \leq 1$ µF Compared to values measured in 4.11.1
	Voltage proof 2250 V_{DC}; 1 min between terminations	No permanent breakdown or flash-over
	Insulation resistance	≥ 50 % of values specified in section “Insulation Resistance” of this specification
SUB-GROUP C2		
4.12 Damp heat steady state	56 days, 40 °C, 90 % to 95 % RH, no load	
4.12.1 Initial measurements	Capacitance Tangent of loss angle at 1 kHz	
4.12.3 Final measurements	Visual examination	No visible damage Legible marking
	Capacitance	$\lvert\Delta C/C\rvert \leq 5$ % of the value measured in 4.12.1.
	Tangent of loss angle	Increase of tan δ: ≤ 0.008 for $C \leq 1$ µF Compared to values measured in 4.12.1.
	Voltage proof 2250 V_{DC}; 1 min between terminations	No permanent breakdown or flash-over
	Insulation resistance	≥ 50 % of values specified in section “Insulation Resistance” of this specification

INSPECTION REQUIREMENTS		
SUB-CLAUSE NUMBER AND TEST	**CONDITIONS**	**PERFORMANCE REQUIREMENTS**
SUB-GROUP C2A		
4.12A Damp heat steady state with load	RH: 85 %, temp.: 85 °C, load: 305 V_{AC} Duration: 1000 h	
4.12.1A Initial measurements	Capacitance Tangent of loss angle: for C ≤ 1 µF at 10 kHz	
4.12.3A Final measurements	Visual examination	No visible damage Legible marking
	Capacitance	$\lvert\Delta C/C\rvert$ ≤ 10 % of the value measured in 4.12.1A.
	Tangent of loss angle	Increase of tan δ: ≤ 0.0240 for C ≤ 1 µF at 10 kHz Compared to values measured in 4.12.1A.
	Insulation resistance	≥ 50 % of values specified in section “Insulation Resistance” of this specification
SUB-GROUP C3		
4.13.1 Initial measurements	Capacitance Tangent of loss angle: for C ≤ 1 µF at 10 kHz	
4.13 Impulse voltage	3 successive impulses, full wave, peak voltage: Y2: 5 kV for C ≤ 1 µF Max. 24 pulses	No self healing breakdowns or flash-over
4.14 Endurance	Duration: 1000 h 1.7 x U_{RAC} at 105 °C Once in every hour the voltage is increased to 1000 V_{RMS} for 0.1 s via resistor of 47 Ω ± 5 %	
4.14.7 Final measurements	Visual examination	No visible damage Legible marking
	Capacitance	$\lvert\Delta C/C\rvert$ ≤ 10 % compared to values measured in 4.13.1.
	Tangent of loss angle	Increase of tan δ: ≤ 0.008 for C ≤ 1 µF Compared to values measured in 4.13.1
	Voltage proof 2250 V_{DC}; 1 min between terminations 2110 V_{AC}; 1 min between terminations and case	No permanent breakdown or flash-over
	Insulation resistance	≥ 50 % of values specified in section “Insulation Resistance” of this specification

INSPECTION REQUIREMENTS		
SUB-CLAUSE NUMBER AND TEST	**CONDITIONS**	**PERFORMANCE REQUIREMENTS**
SUB-GROUP C4		
4.15 Charge and discharge	10 000 cycles Charged to 420 V_{DC} Discharge resistance: $R = \frac{420\ V_{DC}}{1.5 \times C\ (du/dt)}$	
4.15.1 Initial measurements	Capacitance Tangent of loss angle: for C ≤ 1 µF at 10 kHz for C > 1 µF at 1 kHz	
4.15.3 Final measurements	Capacitance	$\lvert\Delta C/C\rvert \leq 10$ % compared to values measured in 4.15.1.
	Tangent of loss angle	Increase of tan δ: ≤ 0.008 for: C ≤ 1 µF Compared to values measured in 4.15.1
	Insulation resistance	≥ 50 % of values specified in section "Insulation Resistance" of this specification
SUB-GROUP C5		
4.16 Radio frequency characteristic	Resonance frequency	≥ 0.9 times the value as specified in section "Resonant Frequency" of this specification
SUB-GROUP C6		
4.17 Passive flammability Class B for volume > 1750 mm^3 Class C for volume ≤ 1750 mm^3	Bore of gas jet: Ø 0.5 mm Fuel: butane Test duration for actual volume V in mm^3: Class B / Class C 250 < V ≤ 500: - / 10 s 500 < V ≤ 1750: - / 20 s V > 1750: 60 s / - One flame application: 	After removing test flame from capacitor, the capacitor must not continue to burn for more than 10 s (class B) and more than 30 s (class C). No burning particle must drop from the sample.
SUB-GROUP C7		
4.18 Active flammability	20 cycles of 5 kV discharges on the test capacitor connected to U_{RAC}	The cheese cloth around the capacitors shall not burn with a flame. No electrical measurements are required.

AUTOMOTIVE AEC-Q200, REVISION D QUALIFICATION				
STRESS	**REVISION**	**CONDITION**	**SAMPLE SIZE**	**PERFORMANCE REQUIREMENTS**
1. High temperature exposure (storage)	D	Temp.: 105 °C; unpowered 250 h / 500 h / 1000 h	77	$\|\Delta C/C\| \leq 5$ % Increase of tan δ: ≤ 0.008 for C ≤ 1 µF at 10 kHz Increase of tan δ: ≤ 0.005 for C > 1 µF at 1 kHz IR > 50 % of initial specified value
2. Temperature cycling	D	Total no. of cycles: 1000 cycles Lower temp.: -40 °C Upper temp: +105 °C 30 min dwell time at each temperature Transition time < 1 min	77	$\|\Delta C/C\| \leq 5$ % Increase of tan δ: ≤ 0.008 for C ≤ 1 µF at 10 kHz IR > 50 % of initial specified value
3. Moisture resistance		No. of cycle: 10 cycles t = 24 h/cycle	77	$\|\Delta C/C\| \leq 5$ % Increase of tan δ: ≤ 0.008 for C ≤ 1 µF at 10 kHz IR > 50% of initial specified value
4. Biased humidity AC	D	Temp.: 40 °C; RH: 93 %; U_{RAC} 250 h / 500 h / 1000 h	77	$\|\Delta C/C\| \leq 10$ % Increase of tan δ: ≤ 0.008 for C ≤ 1 µF at 10 kHz IR > 50 % of initial specified value
5. Operational life AC	D	Temp. = 105 °C; U_{RAC} 1000 h	77	$\|\Delta C/C\| \leq 10$ % Increase of tan δ: ≤ 0.008 for C ≤ 1 µF at 10 kHz IR > 50 % of initial specified value
6. Terminal strength (leaded)	D	Test leaded device lead integrity only. - A (pull-test): 2.27 kg (10 s) - C (wire-lead bend test): 227 g (3 x 3 s)	30	No visual damage
7. Resistance to solvents	D	MIL-STD-202 method 215. - Also aqueous chemical - OKEM clean or equivalent. Do not use banned solvents.	5	No visual damage Legible marking
8. Mechanical shock	D	100 g's ; 6 ms half-sine; 3.75 m/s	30	No visual damage
9. Vibration	D	5 g's for 20 min 12 cycles x 3 directions 10 Hz to 2000 Hz	30	No visual damage
10. Resistance to soldering heat	D	Temp.: 280 °C; time: 10 s solder within 1.5 mm of device body	30	$\|\Delta C/C\| \leq 5$ % Increase of tan δ: ≤ 0.008 for C ≤ 1 µF at 10 kHz IR > 50 % of initial specified value
11. Solderability	D	Leaded: method A at 235 °C, category 3 (245 °C / 3 s)	15	Good tinning as evidence by free flowing of the solder with wetting of terminations > 95 %
12. Electrical characterization		-	30	-
13. Flammability		One flame application Class B	15	V-0 or V-1 are acceptable. Class B or C according IEC is also acceptable

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