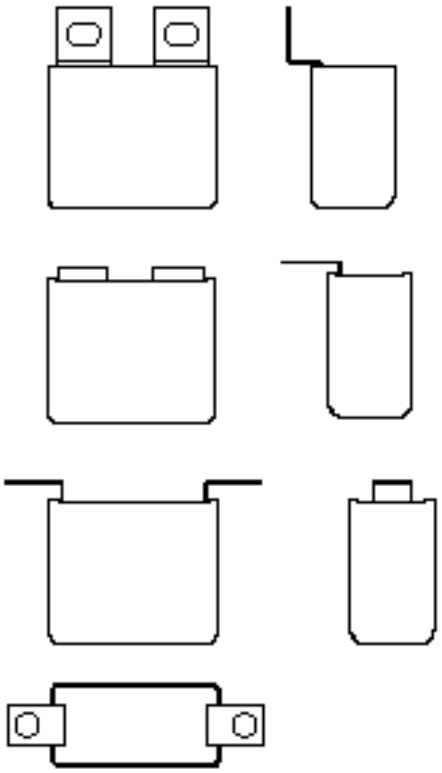
Metallized Polypropylene Film Capacitor AC and Pulse Capacitor MKP Snubber Type



FEATURES
- Low inductance construction
- Low loss dielectric
- Compliant to RoHS Directive 2002/95/EC

APPLICATIONS
Industrial motor control circuits, mounted directly on the IGBT

REFERENCE STANDARDS
IEC 60384-17

PERFORMANCE GRADE
Grade 1 (long life)

STABILITY GRADE
Grade 2

MARKING
C-value, tolerance code, rated voltage, manufacturer's emblem, code for dielectric material, manufacturer's type designation, year and week, manufacturer's location

ENCAPSULATION
Flame retardant plastic case, and epoxy resin sealed

CLIMATIC TESTING CLASS ACC. TO IEC 60068-1
55/085/56

DIELECTRIC
Polypropylene film

ELECTRODES
Metallized film

CONSTRUCTION
Series construction

RATED (DC) VOLTAGE
700 V, 850 V, 1000 V, 1250 V, 1600 V, 2000 V, 2500 V

RATED (AC) VOLTAGE
420 V, 450 V, 500 V, 550 V, 600 V, 700 V, 800 V

INSULATION RESISTANCE
RC between leads, at 500 V after 1 min:
> 100 GΩ for C ≤ 0.33 µF
> 30 000 s for C > 0.33 µF

TEST VOLTAGE BETWEEN TERMINALS
1.6 U_{RDC} for 60 s
(maximum rise time 1000 V/s, cut off current 10 mA)

TEST VOLTAGE BETWEEN TERMINALS AND CASE
1.4 U_{RAC} + 2000 V_{DC} for 60 s

CAPACITANCE RANGE (E12 SERIES)
0.047 µF to 5 µF

CAPACITANCE TOLERANCE
± 5 %

TABS
Tabs tinned coated copper

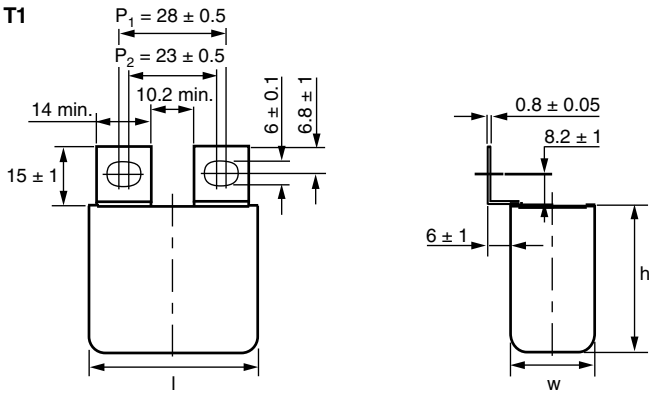
RATED (DC) TEMPERATURE
85 °C

MAXIMUM APPLICATION TEMPERATURE
85 °C

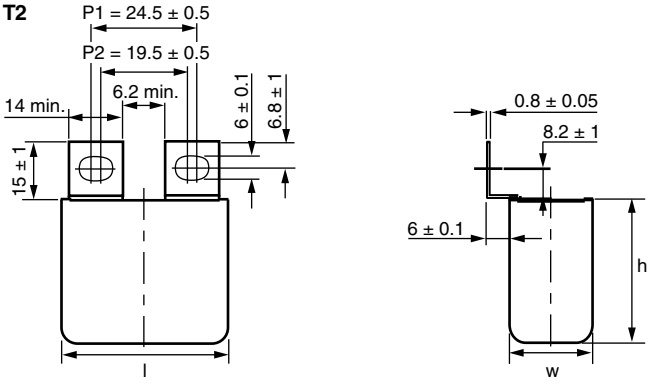
RELIABILITY
Operation life > 300 000 h
Failure rate < 5 FIT (40 °C and 0.5 x U_R)

DETAIL SPECIFICATION
For more detailed data and test requirements contact: dc-film@vishay.com

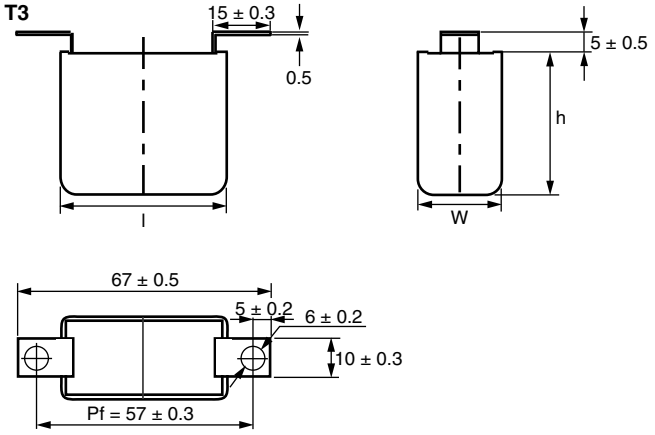
T1



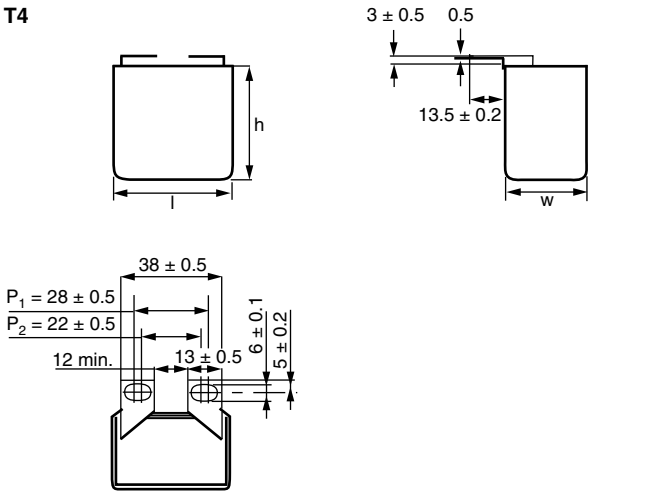
T2



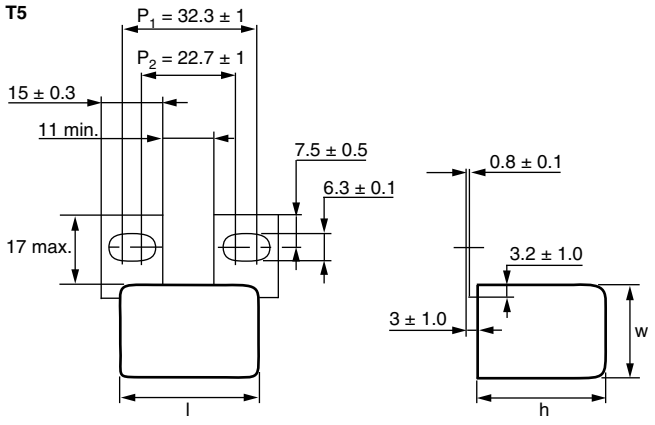
T3



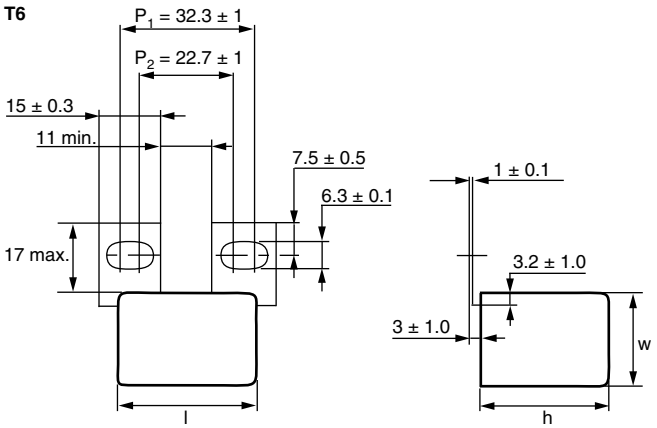
T4

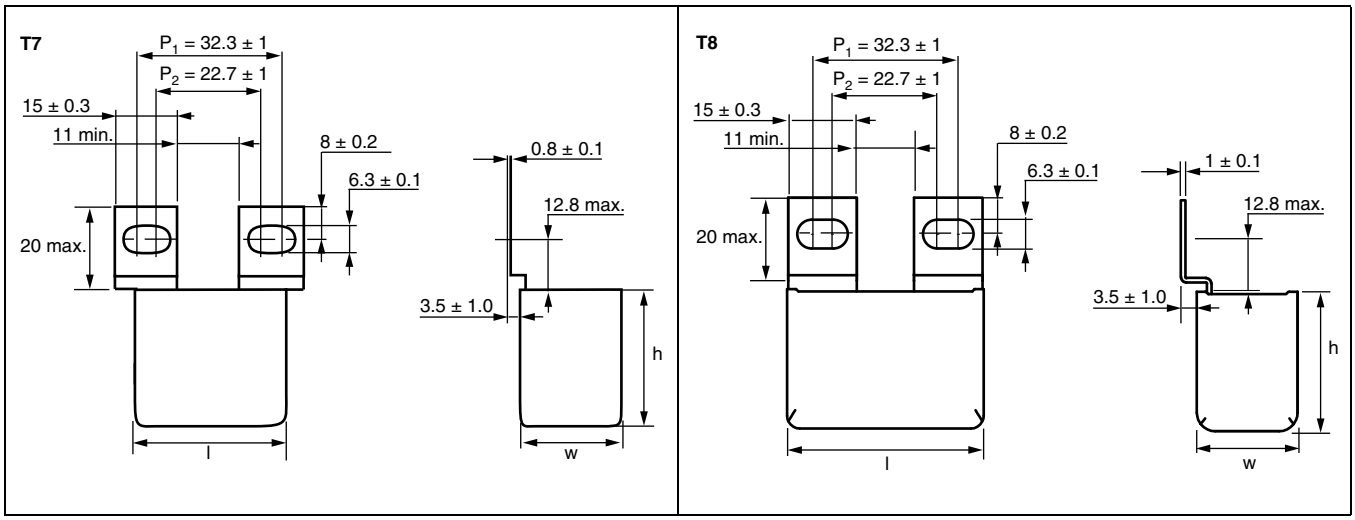


T5



T6





COMPOSITION OF CATALOG NUMBER

MKP	386	M	X	XX	XXX	X	XX

TYPE

MULTIPLIER (nF)

0.1	2
1	3
10	4
100	5

EXAMPLE

468	680 nF

CAPACITANCE (numerically)

TOLERANCE

J	± 5 %

METALLIZED POLYPROPYLENE

MINI VERSION SINGLE METALLIZED

VOLTAGE

070	700 V_{DC}	420 V_{AC}
085	850 V_{DC}	450 V_{AC}
100	1000 V_{DC}	500 V_{AC}
125	1250 V_{DC}	550 V_{AC}
160	1600 V_{DC}	600 V_{AC}
200	2000 V_{DC}	700 V_{AC}
250	2500 V_{DC}	800 V_{AC}

SPECIAL CODE FOR TERMINAL

DRAWING	L (mm)	P_1 (mm)	P_2 (mm)	DRAWING
T1	44	28 ± 0.5	23 ± 0.5	
T2	44	24.5 ± 0.5	19.5 ± 0.5	
T3	44	-	57 ± 0.5	
T4	44	28 ± 0.5	22 ± 0.5	
T5	33.5	32.3 ± 1	22.7 ± 1	
T6	44	32.3 ± 1	22.7 ± 1	
T7	33.5	32.3 ± 1	22.7 ± 1	
T8	44	32.3 ± 1	22.7 ± 1	

SPECIFIC REFERENCE DATA (700 V_{DC})

U_{RDC} = 700 V; U_{RAC} = 420 V; U_{PP} = 1130 V

CAP. (µF)	DIM. (mm) (4)			dU/dt (V/µs)	I_{peak} (A)	I_{RMS} (2) (A)	ESR (3) (mΩ)	tan δ 1 kHz < (10^{-4})	tan δ 10 kHz < (10^{-4})	tan δ 100 kHz < (10^{-4})	PART NUMBER (1)	TERMINAL AVAILABLE							
	B	H	L									T1	T2	T3	T4	T5	T6	T7	T8
0.47	22.0	30.5	33.5	800	376	7.0	16.0	4.0	8.0	50	MKP386M447070J**					T5		T7	
0.68	22.0	30.5	33.5	800	544	8.0	11.0	4.0	8.0	50	MKP386M468070J**					T5		T7	
1.0	22.0	30.5	33.5	800	800	9.0	7.5	4.0	8.0	50	MKP386M510070J**					T5		T7	
1.5	22.0	30.5	33.5	800	1200	10.0	5.0	4.0	8.0	-	MKP386M515070J**					T5		T7	
2.0	22.0	38.0	44.0	370	740	10.0	7.5	5.0	15	-	MKP386M520070J**	T1	T2	T3	T4		T6		T8
2.2	22.0	38.0	44.0	370	814	10.0	6.5	5.0	15	-	MKP386M522070J**	T1	T2	T3	T4		T6		T8
3.0	30.0	46.0	44.0	370	1110	14.0	5.5	5.0	15	-	MKP386M530070J**	T1	T2	T3	T4		T6		T8
3.3	30.0	46.0	44.0	370	1221	14.0	5.0	5.0	15	-	MKP386M533070J**	T1	T2	T3	T4		T6		T8
4.0	30.0	46.0	44.0	370	1480	15.0	4.5	5.0	15	-	MKP386M540070J**	T1	T2	T3	T4		T6		T8
4.7	30.0	46.0	44.0	370	1739	15.0	6.0	5.0	15	-	MKP386M547070J**	T1	T2	T3	T4		T6		T8
5.0	30.0	46.0	44.0	370	1850	15.0	6.0	5.0	15	-	MKP386M550070J**	T1	T2	T3	T4		T6		T8

SPECIFIC REFERENCE DATA (850 V_{DC})

U_{RDC} = 850 V; U_{RAC} = 450 V; U_{PP} = 1300 V

CAP. (µF)	DIM. (mm) (4)			dU/dt (V/µs)	I_{peak} (A)	I_{RMS} (2) (A)	ESR (3) (mΩ)	tan δ 1 kHz < (10^{-4})	tan δ 10 kHz < (10^{-4})	tan δ 100 kHz < (10^{-4})	PART NUMBER (1)	TERMINAL AVAILABLE							
	B	H	L									T1	T2	T3	T4	T5	T6	T7	T8
0.47	22.0	30.5	33.5	800	376	7.5	13.0	4.0	8.0	50	MKP386M447085J**					T5		T7	
0.68	22.0	30.5	33.5	800	544	8.5	10.0	4.0	8.0	50	MKP386M468085J**					T5		T7	
0.82	22.0	30.5	33.5	800	656	9.0	8.5	4.0	8.0	50	MKP386M482085J**					T5		T7	
1.0	22.0	30.5	33.5	800	800	10.0	7.0	4.0	8.0	50	MKP386M510085J**					T5		T7	
1.5	22.0	38.0	44.0	370	555	10.0	9.0	5.0	15	-	MKP386M515085J**	T1	T2	T3	T4		T6		T8
2.0	22.0	38.0	44.0	370	740	12.0	7.0	5.0	15	-	MKP386M520085J**	T1	T2	T3	T4		T6		T8
2.2	22.0	38.0	44.0	370	814	13.0	6.0	5.0	15	-	MKP386M522085J**	T1	T2	T3	T4		T6		T8
3.0	30.0	46.0	44.0	370	1110	16.0	4.5	5.0	15	-	MKP386M530085J**	T1	T2	T3	T4		T6		T8
3.3	30.0	46.0	44.0	370	1221	16.0	4.0	5.0	15	-	MKP386M533085J**	T1	T2	T3	T4		T6		T8
4.0	30.0	46.0	44.0	370	1480	18.0	3.5	5.0	15	-	MKP386M540085J**	T1	T2	T3	T4		T6		T8

SPECIFIC REFERENCE DATA (1000 V_{DC})

U_{RDC} = 1000 V; U_{RAC} = 500 V; U_{PP} = 1400 V

CAP. (µF)	DIM. (mm) (4)			dU/dt (V/µs)	I_{peak} (A)	I_{RMS} (2) (A)	ESR (3) (mΩ)	tan δ 1 kHz < (10^{-4})	tan δ 10 kHz < (10^{-4})	tan δ 100 kHz < (10^{-4})	PART NUMBER (1)	TERMINAL AVAILABLE							
	B	H	L									T1	T2	T3	T4	T5	T6	T7	T8
0.47	22.0	30.5	33.5	725	341	7.5	13.0	4.0	8.0	50	MKP386M447100J**					T5		T7	
0.56	22.0	30.5	33.5	725	406	8.0	11.0	4.0	8.0	50	MKP386M456100J**					T5		T7	
0.68	22.0	30.5	33.5	725	493	9.0	9.0	4.0	8.0	50	MKP386M468100J**					T5		T7	
0.82	22.0	30.5	33.5	725	595	9.0	7.5	4.0	8.0	50	MKP386M482100J**					T5		T7	
1.0	22.0	30.5	33.5	725	725	10.0	6.0	4.0	8.0	50	MKP386M510100J**					T5		T7	
1.2	22.0	38.0	44.0	340	408	10.0	10.0	5.0	15	-	MKP386M512100J**	T1	T2	T3	T4		T6		T8
1.5	22.0	38.0	44.0	340	510	11.0	8.0	5.0	15	-	MKP386M515100J**	T1	T2	T3	T4		T6		T8
1.8	22.0	38.0	44.0	340	612	12.0	6.5	5.0	15	-	MKP386M518100J**	T1	T2	T3	T4		T6		T8
2.0	30.0	46.0	44.0	340	680	14.0	6.0	5.0	15	-	MKP386M520100J**	T1	T2	T3	T4		T6		T8
2.2	30.0	46.0	44.0	340	748	15.0	5.5	5.0	15	-	MKP386M522100J**	T1	T2	T3	T4		T6		T8
2.5	30.0	46.0	44.0	340	850	15.0	5.0	5.0	15	-	MKP386M525100J**	T1	T2	T3	T4		T6		T8
2.7	30.0	46.0	44.0	340	918	16.0	4.5	5.0	15	-	MKP386M527100J**	T1	T2	T3	T4		T6		T8
3.3	30.0	46.0	44.0	340	1122	18.0	3.5	5.0	15	-	MKP386M533100J**	T1	T2	T3	T4		T6		T8

Notes

(1) Change the symbol ** according special code for the terminals

(2) Maximum RMS current at 100 kHz, + 85 °C

(3) The ESR (Equivalent Series Resistance) typical values at 100 kHz

(4) Standard dimension

SPECIFIC REFERENCE DATA (1250 V_{DC})

U_{RDC} = 1250 V; U_{RAC} = 550 V; U_{PP} = 1550 V

CAP. (µF)	DIM. (mm) (4)			dU/dt (V/µs)	I_{peak} (A)	I_{RMS} (2) (A)	ESR (3) (mΩ)	tan δ 1 kHz < (10^{-4})	tan δ 10 kHz < (10^{-4})	tan δ 100 kHz < (10^{-4})	PART NUMBER (1)	TERMINAL AVAILABLE							
	B	H	L									T1	T2	T3	T4	T5	T6	T7	T8
0.33	22.0	30.5	33.5	800	264	7.0	16.0	4.0	8.0	40	MKP386M433125J**					T5		T7	
0.39	22.0	30.5	33.5	800	312	7.0	14.0	4.0	8.0	40	MKP386M439125J**					T5		T7	
0.47	22.0	30.5	33.5	800	376	8.0	11.0	4.0	8.0	40	MKP386M447125J**					T5		T7	
0.56	22.0	30.5	33.5	800	448	8.5	10.0	4.0	8.0	40	MKP386M456125J**					T5		T7	
0.68	22.0	30.5	33.5	800	544	9.5	8.0	4.0	8.0	40	MKP386M468125J**					T5		T7	
0.82	22.0	38.0	44.0	375	308	9.0	13.0	5.0	15.0	60	MKP386M482125J**	T1	T2	T3	T4		T6		T8
1.0	22.0	38.0	44.0	375	375	10.0	10.0	5.0	15.0	60	MKP386M510125J**	T1	T2	T3	T4		T6		T8
1.2	22.0	38.0	44.0	375	450	11.0	9.0	5.0	15.0	-	MKP386M512125J**	T1	T2	T3	T4		T6		T8
1.5	30.0	46.0	44.0	375	563	14.0	7.0	5.0	15.0	-	MKP386M515125J**	T1	T2	T3	T4		T6		T8
1.8	30.0	46.0	44.0	375	675	15.0	6.0	5.0	15.0	-	MKP386M518125J**	T1	T2	T3	T4		T6		T8
2.0	30.0	46.0	44.0	375	750	16.0	5.5	5.0	15.0	-	MKP386M520125J**	T1	T2	T3	T4		T6		T8
2.2	30.0	46.0	44.0	375	825	18.0	4.5	5.0	15.0	-	MKP386M522125J**	T1	T2	T3	T4		T6		T8

SPECIFIC REFERENCE DATA (1600 V_{DC})

U_{RDC} = 1600 V; U_{RAC} = 600 V; U_{PP} = 1690 V

CAP. (µF)	DIM. (mm) (4)			dU/dt (V/µs)	I_{peak} (A)	I_{RMS} (2) (A)	ESR (3) (mΩ)	tan δ 1 kHz < (10^{-4})	tan δ 10 kHz < (10^{-4})	tan δ 100 kHz < (10^{-4})	PART NUMBER (1)	TERMINAL AVAILABLE							
	B	H	L									T1	T2	T3	T4	T5	T6	T7	T8
0.22	22.0	30.5	33.5	800	176	7.0	16.0	3.0	5.0	40	MKP386M422160J**					T5		T7	
0.27	22.0	30.5	33.5	800	216	7.0	15.0	3.0	5.0	40	MKP386M427160J**					T5		T7	
0.33	22.0	30.5	33.5	800	264	8.0	12.0	3.0	5.0	40	MKP386M433160J**					T5		T7	
0.39	22.0	30.5	33.5	800	312	8.5	10.0	3.0	5.0	40	MKP386M439160J**					T5		T7	
0.47	22.0	30.5	33.5	800	376	9.0	8.5	3.0	5.0	40	MKP386M447160J**					T5		T7	
0.56	22.0	38.0	44.0	375	210	9.0	14.0	4.0	10.0	60	MKP386M456160J**	T1	T2	T3	T4		T6		T8
0.68	22.0	38.0	44.0	375	255	9.0	12.0	4.0	10.0	60	MKP386M468160J**	T1	T2	T3	T4		T6		T8
0.82	22.0	38.0	44.0	375	308	10.0	10.0	4.0	10.0	60	MKP386M482160J**	T1	T2	T3	T4		T6		T8
1.0	22.0	38.0	44.0	375	375	12.0	8.0	4.0	10.0	60	MKP386M510160J**	T1	T2	T3	T4		T6		T8
1.3	30.0	46.0	44.0	375	488	16.0	6.0	4.0	10.0	-	MKP386M5130160J**	T1	T2	T3	T4		T6		T8
1.5	30.0	46.0	44.0	375	563	16.0	5.5	4.0	10.0	-	MKP386M515160J**	T1	T2	T3	T4		T6		T8
1.8	30.0	46.0	44.0	375	675	18.0	4.5	4.0	10.0	-	MKP386M518160J**	T1	T2	T3	T4		T6		T8
2.0	30.0	46.0	44.0	375	750	19.0	4	4.0	10.0	-	MKP386M520160K **	T1	T2	T3	T4		T6		T8

Notes

(1) Change the symbol ** according special code for the terminals

(2) Maximum RMS current at 100 kHz, + 85 °C

(3) The ESR (Equivalent Series Resistance) typical values at 100 kHz

(4) Standard dimension

SPECIFIC REFERENCE DATA (2000 V_{DC})

U_{RDC} = 2000 V; U_{RAC} = 700 V; U_{PP} = 1980 V

CAP. (µF)	DIM. (mm) (4)			dU/dt (V/µs)	I_{peak} (A)	I_{RMS} (2) (A)	ESR (3) (mΩ)	tan δ 1 kHz < (10^{-4})	tan δ 10 kHz < (10^{-4})	tan δ 100 kHz < (10^{-4})	PART NUMBER (1)	TERMINAL AVAILABLE							
	B	H	L									T1	T2	T3	T4	T5	T6	T7	T8
0.047	22.0	30.5	33.5	2000	94	6.0	20.0	3.0	5.0	30	MKP386M347200J**					T5		T7	
0.068	22.0	30.5	33.5	2000	136	6.5	17.0	3.0	5.0	30	MKP386M368200J**					T5		T7	
0.10	22.0	30.5	33.5	2000	200	8.0	11.0	3.0	5.0	30	MKP386M410200J**					T5		T7	
0.12	22.0	30.5	33.5	2000	240	9.0	9.0	3.0	5.0	30	MKP386M412200J**					T5		T7	
0.15	22.0	30.5	33.5	2000	300	9.5	8.0	3.0	5.0	30	MKP386M415200J**					T5		T7	
0.22	22.0	38.0	44.0	850	187	10.0	10.0	4.0	10.0	50	MKP386M422200J**	T1	T2	T3	T4		T6		T8
0.27	22.0	38.0	44.0	850	230	11.0	8.5	4.0	10.0	50	MKP386M427200J**	T1	T2	T3	T4		T6		T8
0.33	22.0	38.0	44.0	850	281	12.0	7.0	4.0	10.0	50	MKP386M433200J**	T1	T2	T3	T4		T6		T8
0.39	22.0	38.0	44.0	850	332	12.0	6.0	4.0	10.0	50	MKP386M439200J**	T1	T2	T3	T4		T6		T8
0.47	30.0	46.0	44.0	850	400	16.0	5.0	4.0	10.0	50	MKP386M447200J**	T1	T2	T3	T4		T6		T8
0.56	30.0	46.0	44.0	850	476	18.0	4.0	4.0	10.0	50	MKP386M456200J**	T1	T2	T3	T4		T6		T8
0.68	30.0	46.0	44.0	850	578	20.0	3.5	4.0	10.0	50	MKP386M468200J**	T1	T2	T3	T4		T6		T8

SPECIFIC REFERENCE DATA (2500 V_{DC})

U_{RDC} = 2500 V; U_{RAC} = 800 V; U_{PP} = 2260 V

CAP. (µF)	DIM. (mm) (4)			dU/dt (V/µs)	I_{peak} (A)	I_{RMS} (2) (A)	ESR (3) (mΩ)	tan δ 1 kHz < (10^{-4})	tan δ 10 kHz < (10^{-4})	tan δ 100 kHz < (10^{-4})	PART NUMBER (1)	TERMINAL AVAILABLE							
	B	H	L									T1	T2	T3	T4	T5	T6	T7	T8
0.047	22.0	30.5	33.5	2500	118	6.0	20.0	3.0	5.0	30	MKP386M347250J **					T5		T7	
0.068	22.0	30.5	33.5	2500	170	7.0	14.0	3.0	5.0	30	MKP386M368250J**					T5		T7	
0.10	22.0	30.5	33.5	2500	250	8.5	10.0	3.0	5.0	30	MKP386M410250J**					T5		T7	
0.12	22.0	30.5	33.5	2500	300	9.5	8.0	3.0	5.0	30	MKP386M412250J**					T5		T7	
0.15	22.0	38.0	44.0	1000	150	9.5	12.5	4.0	10.0	50	MKP386M415250J**	T1	T2	T3	T4		T6		T8
0.18	22.0	38.0	44.0	1000	180	10.0	11.0	4.0	10.0	50	MKP386M418250J**	T1	T2	T3	T4		T6		T8
0.22	22.0	38.0	44.0	1000	220	11.0	8.5	4.0	10.0	50	MKP386M422250J**	T1	T2	T3	T4		T6		T8
0.33	30.0	46.0	44.0	1000	330	15.0	6.0	4.0	10.0	50	MKP386M433250J**	T1	T2	T3	T4		T6		T8
0.39	30.0	46.0	44.0	1000	390	16.0	5.0	4.0	10.0	50	MKP386M439250J**	T1	T2	T3	T4		T6		T8
0.47	30.0	46.0	44.0	1000	470	18.0	4.0	4.0	10.0	50	MKP386M447250J**	T1	T2	T3	T4		T6		T8

Notes

(1) Change the symbol ** according special code for the terminals

(2) Maximum RMS current at 100 kHz, + 85 °C

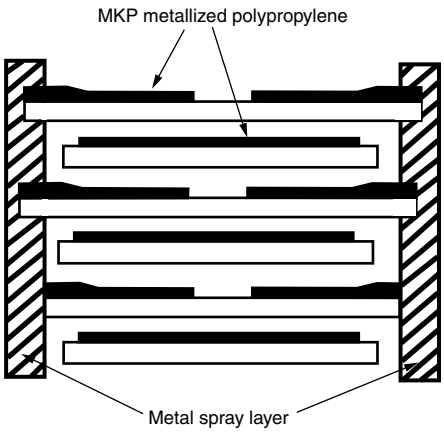
(3) The ESR (Equivalent Series Resistance) typical values at 100 kHz

(4) Standard dimension

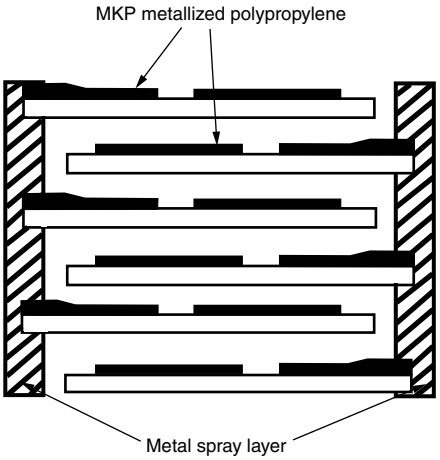
CONSTRUCTION

Low inductive wound cells elements of metallized polypropylene film, potted with resin in flame retardant case.

Series construction 420 V_{AC} to 600 V_{AC} versions



Triple construction for 700 V_{AC} and 800 V_{AC} versions



MOUNTING

NORMAL USE

The capacitors are designed for direct mounting on IGBT.

SPECIFIC METHOD OF MOUNTING TO WITHSTAND VIBRATION AND SHOCK

In order to withstand vibration and shock tests, it must be ensured that the tabs are screwed tightly on the test board.

STORAGE TEMPERATURE

- Storage temperature: T_{stg} = - 25 °C to + 40 °C with RH maximum 80 % without condensation

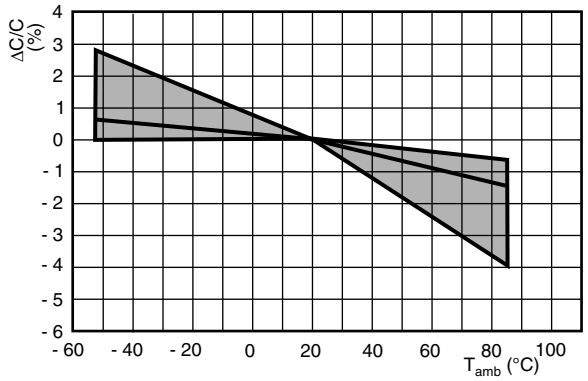
RATINGS AND CHARACTERISTICS REFERENCE CONDITIONS

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 %.

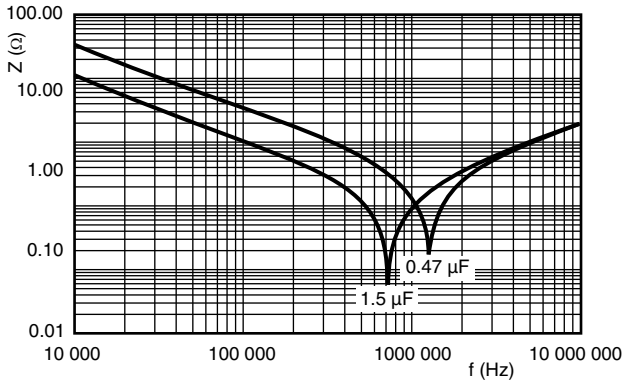
For reference testing, a conditioning period shall be applied over 96 h ± 4 h by heating the products in a circulating air oven at the rated temperature and a relative humidity not exceeding 20 %.

CHARACTERISTICS

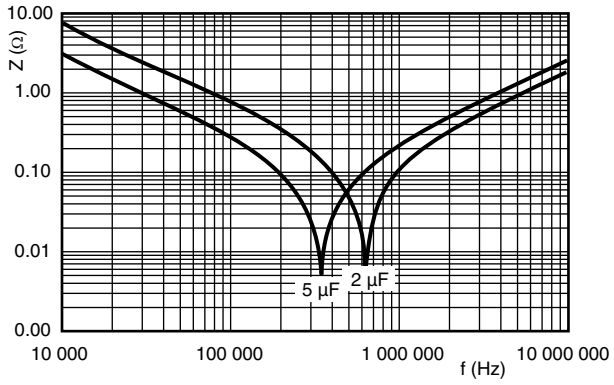
Capacitance as a function of ambient temperature (typical curve)



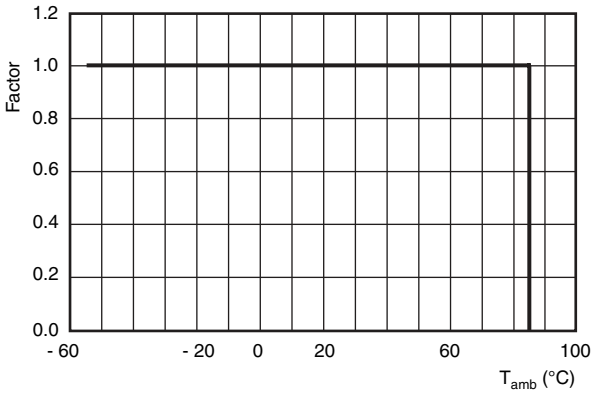
Impedance as a function of frequency for box length 33.5 mm (typical curve)



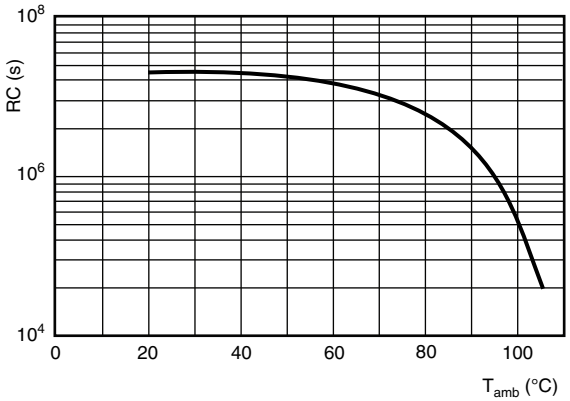
Impedance as function of frequency for box length 44.0 mm (typical curve)



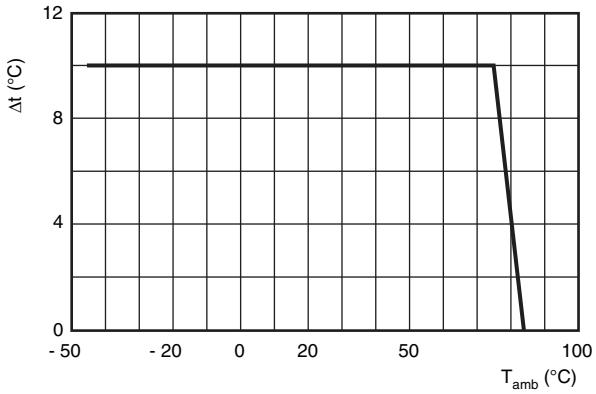
Max. DC and AC voltage as a function of temperature



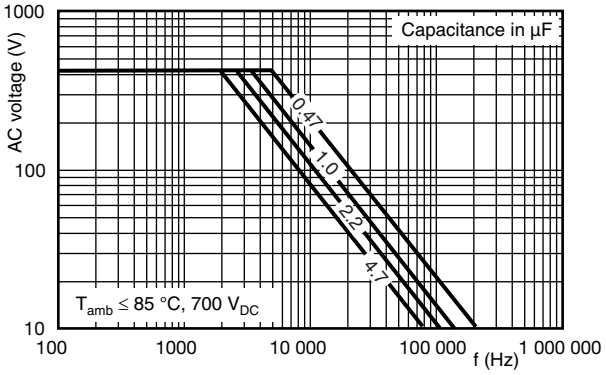
Insulation resistance as a function of ambient temperature (typical curve)

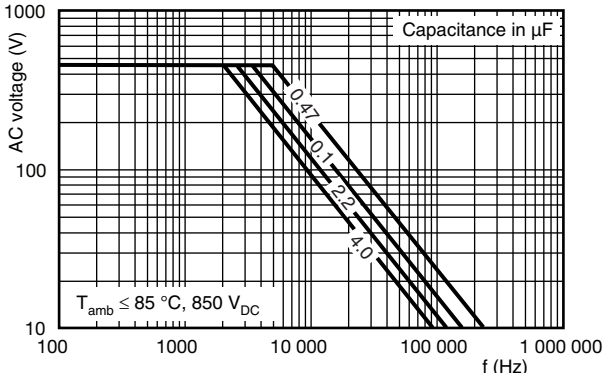


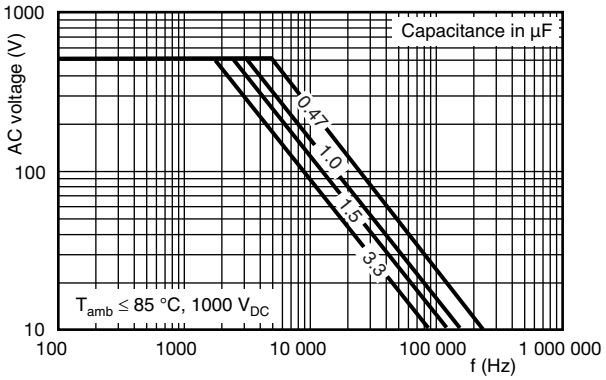
Maximum allowed component temperature rise (Δt) as function of the ambient temperature (T_{amb})

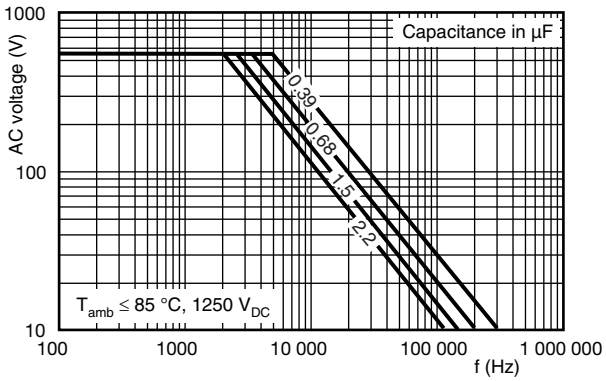


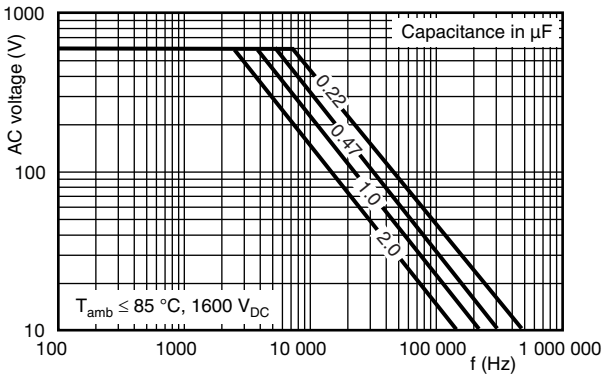
MAXIMUM RMS VOLTAGE (SINEWAVE) AS A FUNCTION OF FREQUENCY

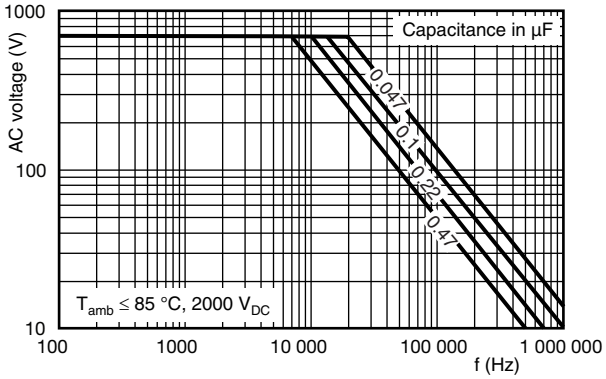


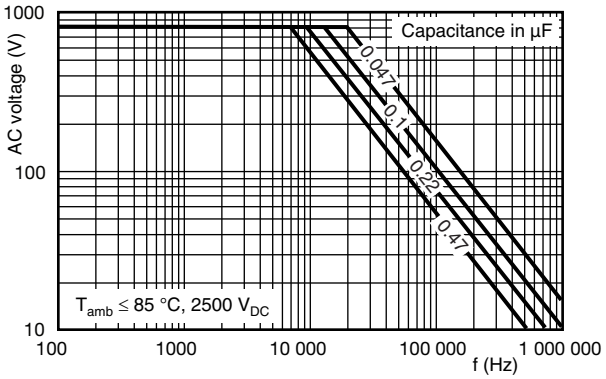












MARKING

PRODUCT MARKING AND IDENTIFICATION

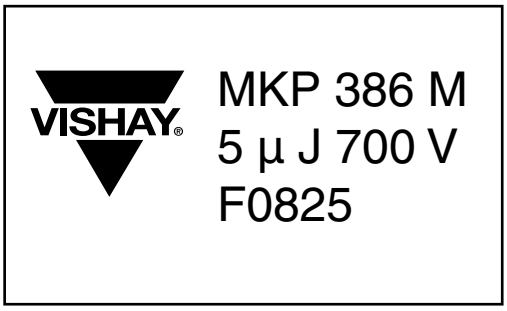
The capacitor is marked by laser print or stamp, with following information:

1. Manufacturer's logo
2. Code for dielectric material (MKP)
3. Manufacturer's type designation (386)
4. Single metallized (M)
5. Rated capacitance value (5 µF)
6. Tolerance on rated capacitance (J = ± 5 %)
7. Rated DC voltage (700 V)
8. Code for factory of origin (F)
9. Year and week of manufacture (e.g. 0825)

PACKING BAR CODE LABEL

1. Manufacturer's logo
2. Country of origin
3. Sub family
4. Type description
5. Capacitance value, tolerance, voltage and climatic category according to IEC 60068-1
6. Production center
7. Preference origin code: A
8. Product type description
9. Batch number
10. Quantity and production date, year week code
11. Product code

PRINTING EXAMPLE:



LABEL EXAMPLE:

HEAT CONDUCTIVITY (G) AS A FUNCTION OF ORIGINAL PITCH AND CAPACITOR BODY THICKNESS IN mW/°C

$W_{max.}$ (mm)	HEAT CONDUCTIVITY (mW/°C)	
	BOX LENGTH 33.5 mm	BOX LENGTH 44.0 mm
22.0	75	100
30.0	-	140

POWER DISSIPATION AND MAXIMUM COMPONENT TEMPERATURE RISE

The power dissipation must be limited in order not to exceed the maximum allowed component temperature rise as a function of the free air ambient temperature.

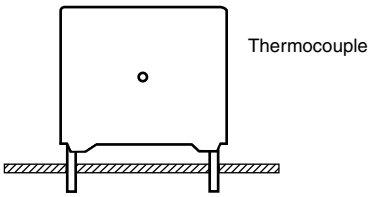
The power dissipation can be calculated according type detail specification "HQN-384-01/101: Technical Information Film Capacitors" with the typical tgd of the curves.

The component temperature rise (ΔT) can be measured (see section "Measuring the Component Temperature" for more details) or calculated by ΔT = P/G:

- ΔT = Component temperature rise (°C) with maximum of 10 °C rise (°C)
- P = Power dissipation of the component (mW)
- G = Heat conductivity of the component (mW/°C)

MEASURING THE COMPONENT TEMPERATURE

A thermocouple must be attached to the capacitor body as in:



The temperature is measured in unloaded (T_{amb}) and maximum loaded condition (T_C).
The temperature rise is given by $\Delta T = T_C - T_{amb}$.
To avoid radiation or convection, the capacitor should be tested in a wind-free box.

APPLICATION NOTE AND LIMITING CONDITIONS

These capacitors are not suitable for mains applications as across-the-line capacitors without additional protection, as described hereunder. These mains applications are strictly regulated in safety standards and therefore electromagnetic interference suppression capacitors conforming the standards must be used.

To select the capacitor for a certain application, the following conditions must be checked:

1. The peak voltage (U_P) shall not be greater than the rated DC voltage (U_{RDC})
2. The peak-to-peak voltage (U_{PP}) shall not be greater than the maximum ($U_{p\text{-}p}$) to avoid the ionization inception level
3. The voltage peak slope (dU/dt) shall not exceed the rated voltage pulse slope in an RC-circuit at rated voltage and without ringing. If the pulse voltage is lower than the rated DC voltage, the rated voltage pulse slope may be multiplied by U_{RDC} and divided by the applied voltage.

   For all other pulses following equation must be fulfilled:

$$2 \times \int_0^T \left(\frac{dU}{dt}\right)^2 \times dt < U_{Rdc} \times \left(\frac{dU}{dt}\right)_{rated}$$

   T is the pulse duration.
4. The maximum component surface temperature rise must be lower than the limits (see figure max. allowed component temperature rise)
5. Since in circuits used at voltages over 280 V peak-to-peak the risk for an intrinsically active flammability after a capacitor breakdown (short circuit) increases, it is recommended that the power to the component is limited to 100 times the values mentioned in the table “Heat conductivity”
6. When using these capacitors as across-the-line capacitor in the input filter for mains applications or as series connected with an impedance to the mains the applicant must guarantee that the following conditions are fulfilled in any case (spikes and surge voltages from the mains included)

VOLTAGE CONDITIONS FOR 6 ABOVE

ALLOWED VOLTAGES	$T_{amb} \leq 85$ °C
Maximum continuous RMS voltage	U_{RAC}
Maximum temporary RMS overvoltage (< 24 h)	1.25 x U_{RAC}
Maximum peak voltage ($V_{o\text{-}p}$) (< 2 s)	1.6 x U_{RAC}

INSPECTION REQUIREMENTS

General Notes:

Sub-clause numbers of tests and performance requirements refer to the “Sectional Specification, Publication IEC 60384-17”

Group C 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
4.3.1 Initial measurements	Capacitance Tangent of loss angle: For C > 1 µF at 1 kHz For C ≤ 1 µF at 10 kHz	
4.3 Robustness of terminations	Tensile: load 30 N; 10 s Bending: load 15 N; 90°	No visible damage
4.4 Resistance to soldering heat	No pre-drying Method: 1A Solder bath: 265 °C Duration: 10 s	
4.4.2 Final measurements	Visual examination	No visible damage Legible marking
	Capacitance	$\lvert\Delta C/C\rvert \leq 2$ % of the value measured initially
	Tangent of loss angle	Increase of tan δ: ≤ 0.002 Compared to values measured initially
	Insulation resistance	≤ 50 % values specified in section “Insulation Resistance” of this specification
4.14 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
SUB-GROUP C1B PART OF SAMPLE OF SUB-GROUP C1		
4.6.1 Initial measurements	Capacitance Tangent of loss angle: For C > 1 µF at 1 kHz For C ≤ 1 µF at 10 kHz	
4.6 Rapid change of temperature	θA = - 55 °C θB = + 85 °C 5 cycles Duration t = 30 min 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	
4.9.3 Final measurements	Visual examination	No visible damage
	Capacitance	$\lvert\Delta C/C\rvert \leq 2$ % of the value measured initially Increase of tan δ ≤ 0.002
	Tangent of loss angle	Compared to values measured initially
	Insulation resistance	≥ 50 % values specified in section “Insulation Resistance” of this specification

SUB-CLAUSE NUMBER AND TEST	CONDITIONS	PERFORMANCE REQUIREMENTS
SUB-GROUP C1 COMBINED SAMPLE OF SPECIMENS OF SUB-GROUPS C1A AND C1B		
4.10 Climatic sequence		
4.10.2 Dry heat	Temperature: 85 °C Duration: 16 h	
4.10.3 Damp heat cyclic Test Db First cycle		
4.10.4 Cold	Temperature: - 55 °C Duration: 2 h	
4.10.6 Damp heat cyclic Test Db remaining cycles		
4.10.6.2 Final measurements	Voltage proof = U_{RDC} for 1 min within 15 min after removal from test chamber	No breakdown or flash-over
	Visual examination	No visible damage Legible marking
	Capacitance	$\|\Delta C/C\| \leq 3$ % of the value measured initially
	Tangent of loss angle	Increase of tan δ: ≤ 0.002 Compared to values measured in 4.3.1 or 4.6.1 as applicable
	Insulation resistance	$\geq$ 50 % of values specified in section "Insulation Resistance" of this specification
SUB-GROUP C2		
4.11 Damp heat steady state		
4.11.1 Initial measurements	Capacitance Tangent of loss angleat 1 kHz	
4.11.3 Final measurements	Visual examination Voltage proof = U_{RDC} for 1 min within 15 min after removal from test chamber	No visible damage Legible marking No breakdown or flash-over
	Capacitance	$\|\Delta C/C\| \leq 3$ % of the value measured in 4.11.1.
	Tangent of loss angle	Increase of tan $\delta \leq 0.002$ Compared to values measured in 4.11.1
	Insulation resistance	$\geq$ 50 % of values specified in Section "Insulation Resistance" of this specification
SUB-GROUP C3 A		
4.12 1 Endurance test at 50 Hz alternative voltage	Duration: 2000 h 1.25 x U_{RAC} at 85 °C	
4.12.1.1 Initial measurements	Capacitance Tangent of loss angle at: For C > 1 µF at 1 kHz For C $\leq$ 1 µF at 10 kHz	
4.12.1.3 Final measurements	Visual examination	No visible damage Legible marking
	Capacitance	$\|\Delta C/C\| \leq 5$ % of the value measured in 4.12.1.1
	Tangent of loss angle	Increase of tan δ : ≤ 0.0015 for C $\leq$ 1 µF ≤ 0.0015 for C > 1 µF Compared to values measured in 4.12.1.1
	Insulation resistance	$\geq$ 50 % of values specified in section "Insulation Resistance" of this specification

SUB-CLAUSE NUMBER AND TEST	CONDITIONS	PERFORMANCE REQUIREMENTS
SUB-GROUP C4		
4.2.6 Temperature characteristics Initial measurements Intermediate measurements	Capacitance Capacitance at - 55 °C Capacitance at 20 °C Capacitance at 85 °C	For - 55 °C to 20 °C 0 % ≤ |ΔC/C| ≤ 2.75 % or For 20 °C to 85 °C - 5.5 % ≤ |ΔC/C| ≤ 0 % As specified in section “Capacitance” of this specification
4.13 Charge and discharge	10 000 cycles (1...50 c/s) 2.5 x $(dU/dt)_R$ charged to U_{RDC} with maximum pulse slope ≤ $0.01(dU/dt)_R$ Discharge resistance: $R = \frac{Un(V_{DC})}{2.5 \times C\ (dU/dt)}$	
4.13.1 Initial measurements	Capacitance Tangent of loss angle: For C > 1 µF at 1 kHz For C ≤ 1 µF at 10 kHz	
4.13.3 Final measurements	Capacitance	|ΔC/C| ≤ 5 % compared to values measured in 4.13.1.
	Tangent of loss angle	Increase of tan δ : ≤ 0.0015 for C ≤ 1 µF ≤ 0.0015 for C > 1 µF Compared to values measured in 4.13.1
	Insulation resistance	≥ 50 % of values specified in section “Insulation Resistance” of this specification

Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, “Vishay”), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay’s knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer’s responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer’s technical experts. Product specifications do not expand or otherwise modify Vishay’s terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.

Material Category Policy

Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.

Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.

Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.