105-036 to 105-046

Panasonic

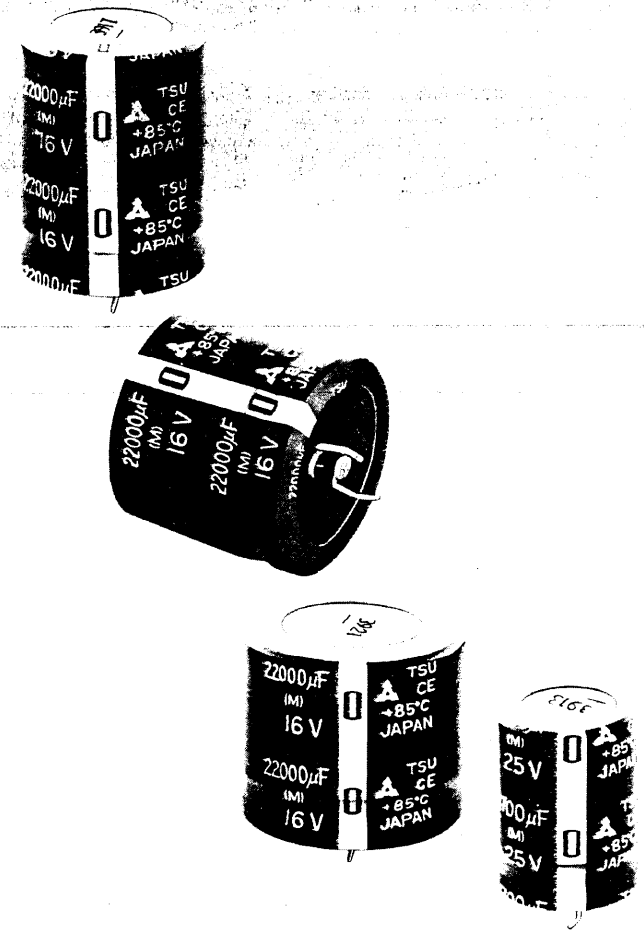
TSU

SERIES

NEW!

LARGE ALUMINUM ELECTROLYTIC CAPACITORS

TSU series (miniaturized version) provides a choice of case sizes to ensure the optimum saving of space in compact power supply design.
Additional features are the PCB snap-in terminals on 10 mm pitch, and a voltage range extending from 16 to 450 V.
This series provides case size options on the most popular capacitance/voltage values and has a guaranteed life of 2,000 hours at 85°C.



FEATURES:

- Very compact size
- A choice of case shape
- Long life (2,000 hours at +85°C)
- Wide C/V availability
  (47 to 33,000μF, 16 to 450V)
- Top vent construction
- Unified pitch (all 10 mm) snap-in terminals
- Anti cleaning solvent
  (16 to 100V)

- **Shelf life test:**
The capacitor shall be held at 85°C for 1,000 hours with no voltage applied. The capacitor shall then be removed from the test chamber and stabilized at room temperature of 15 to 35°C for a minimum 16 hours. The capacitor shall not exceed the specified values listed below.

Capacitance change	Within ±20% of the initial measured value
tan δ	Less than 150% of the initial limits
DC leakage current	Less than the initial limits

- **Cleaning solvents & condition:**
Following solvents are available for 16 to 100 V products at the cheaning condition specified below:

Solvents	Condition
Freon TE Freon TES Freon TP-35	• Vaper, or ultra sonic cleaning • 5 minutes at 40°C • flux density 10% max. in weight.

Following solvents are not available.
Arklone E
Freon TMC
Trichloroethylene = Trichlene
1.1.1 trichloroethane = Chlorothan
Per chloroethylene = Tetra chloroethylene

- **Vibration test**
1) Preparation
After mounting the capacitor on PCB, the terminals shall be soldered. The PCB then shall be firmly mounted directly to the vibration table.
2) Test
The capacitor under test, mounted in compliance with 'Preparation' shall be subjected to the following vibration test.
Range of vibration frequency is 10 to 55 Hz. Total amplitude 1.5 mm. Rate of frequency traverse from 10 to 55 Hz and return to 10 Hz is 1 minute. Continuously repeated. The capacitor shall withstand 6 hours of vibration in a vertical plane and two hours each in any of two horizontal planes. There shall be no evidence of intermittent connections or mechanical damage. Total amplitude shall be 0.75 mm for ø35.5×50 size products.
This vibration test meets and exceeds MIL-STD-202E method 201A, EIARS186C, and IEC 68-2 type 2.

- **Marking**
  - Rated capacitance
  - M (cap. tolerance code, ±20%)
  - DC rated working voltage
  - Negative polarity bar
  - ▲ (Matsushita trademark)
  - CE (Electrolytic capacitor)
  - Manufactured Lot number
  - 85°C (max. operating temp.)
  - JAPAN (country of origin)
  - TSU (series name)

Part number system

TSU series

E C E S _ _ U _ _ _ _ _

E C E S: aluminum electrolytic capacitors

Rated W.V. code	
16V	1C
25V	1E
35V	1V
50V	1H
63V	1J
100V	2A
200V	2D
250V	2E
400V	2G
450V	2W

Rated capacitance code	
150uF	151
1,500uF	152
15,000uF	153

Case size code	ϕD x L mm		
E	22.5 x 31.5	N	25.5 x 50
J	25.5 x 25	X	35.5 x 31.5
G	22.5 x 40	U	30.5 x 50
Q	30.5 x 25	Y	35.5 x 40
M	25.5 x 40	Z	35.5 x 50
R	30.5 x 31.5		

Specifications

- **Operating temperature range:**
  16 to 100 V: −40 to +85°C
  200 to 450 V: −25°C to +85°C
- **DC rated working voltage:** 16 to 450 V
- **Rated capacitance range:** 47 to 33,000 µF
- **Capacitance tolerance:** −20 to +20%
- **Surge voltage & surge voltage test:**
  The DC surge voltage is the maximum voltage to which the capacitor should be subjected. The surge voltage listed below is applied in series with a 1,000 ohms resistor at cycle of 0.5 minutes 'ON' and 4.5 minutes 'OFF', repeated 1,000 times at 25°C.

DC rated voltage	16	25	35	50	63	100	200	250	400	450
Surge voltage	20	32	44	63	79	125	250	300	450	500

After test, the capacitor shall meet the following limits.

Capacitance change	Within ±20% of initial measured value
tan δ	Less than 150% of the initial limits
DC leakage current	Less than the initial limits

- **DC leakage current**
  Measurements shall be made at rated working voltage at 20°C. The voltage shall be applied the capacitors for a minimum 5 minutes before reading the leakage current.
  Maximum leakage current shall not exceed the value given by the following formula.

  16 to 100 V: in case of $C \times V \leq 100{,}000$ µFV
  $I = 0.01\ CV$ µA max.

  in case of $C \times V > 100{,}000$ µFV
  $I = 3\sqrt{C \times V}$ µA max.

  200 to 450 V: $I = 3\sqrt{C \times V}$ µA max.

  where I = leakage current in µA
  C = rated capacitance in µF
  V = DC rated w.v. in volts

- **E.S.R. & tan δ :** See products table

- **Ripple voltage:**
  The sum of the DC voltage plus the AC voltage peak ripple voltage shall not exceed the rated DC voltage and there shall be no application of reverse voltage.
- **Permissible ripple current:**
  The capacitor shall withstand the application of the rms ripple current listed in the standard products table at 120 Hz and for 2,000 hours at 85°C, or 1,000 hours at 85°C.

  Please apply following factors for different frequencies.

f in Hz	50	60	120	500	1K	10–50K
16 to 100V	0.93	0.95	1.0	1.05	1.08	1.15
200 to 450V	0.75	0.80	1.0	1.20	1.25	1.40

- **Expected life time at different ambient temperature with different ripple current.**

16 to 450V UNIT : hours

ambient temp.	coefficient : ripple current (table in 85℃, 2000h)					
	100%	120%	140%	160%	180%	200%
85℃	2000	—	—	—	—	—
70℃	5600	4800	4000	3300	2600	2000
55℃	16000	13000	11000	9300	7300	5600
40℃	45000	38000	32000	26000	20000	16000

- **Expected failure rate level**
  $< 0.5 \times 10^{-7}$/h
  - Catastrophic failure mode
  - At rated working voltage
  - Ambient temperature is 40°C
  - Confidence level is 60%
- **Load life test:**
  The capacitor shall be subjected to application of the DC rated voltage with full rated ripple current in an ambient temperature of 85°C for a period of 2,000 hours, or 1,000 hours. The capacitor shall then be removed from the test chamber and stabilized at room temperature. After reaching temperature stability, the capacitor shall not exceed the specified values listed below.

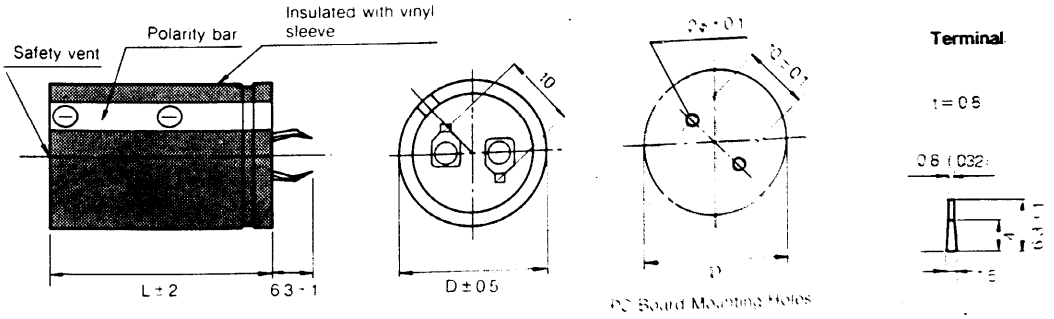
Capacitance change	Within ±20% of the initial measured value
tan δ	Less than 150% of the initial limits
DC leakage current	Less than the initial limits

LARGE ALUMINUM ELECTROLYTIC CAPACITORS

Cap. (μF) \ W.V. (DCV)	200 (2D)	250 (2E)	400 (2G)	450 (2W)
47 (470)				E 22.5 x 31.5 J 25.5 x 25
68 (680)			E 22.5 x 31.5 J 25.5 x 25	G 22.5 x 40 Q 30.5 x 25
100 (101)			G 22.5 x 40 Q 30.5 x 25	M 25.5 x 40 R 30.5 x 31.5
150 (151)		E 22.5 x 31.5 J 25.5 x 25	M 25.5 x 40 R 30.5 x 31.5	N 25.5 x 50 X 35.5 x 31.5
220 (221)	E 22.5 x 31.5 J 25.5 x 25	G 22.5 x 40 Q 30.5 x 25	N 25.5 x 50 X 35.5 x 31.5	U 30.5 x 50 Y 35.5 x 40
270 (271)			U 30.5 x 50 Y 35.5 x 40	
330 (331)	G 22.5 x 40 Q 30.5 x 25	M 25.5 x 40 R 30.5 x 31.5		Z 35.5 x 50
390 (391)			Z 35.5 x 50	
470 (471)	M 25.5 x 40 R 30.5 x 31.5	N 25.5 x 50 X 35.5 x 31.5		
680 (681)	N 25.5 x 50 X 35.5 x 31.5	U 30.5 x 50 Y 35.5 x 40		
1000 (102)	U 30.5 x 50 Y 35.5 x 40	Z 35.5 x 50		
1200 (122)	Z 35.5 x 50			

Dimensions

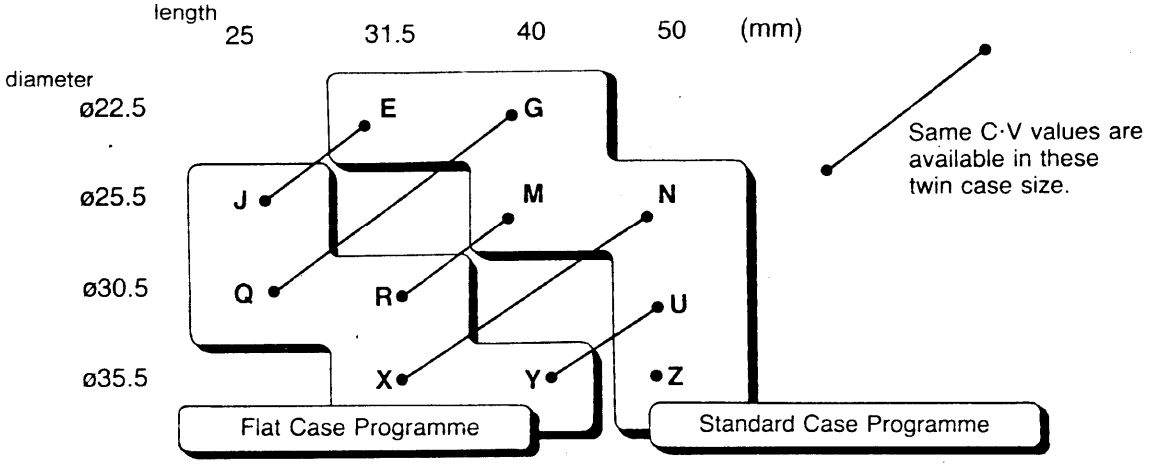
Unit: mm



Case size table

Cap. (μF) \ W.V. (DCV)	16 (1C)	25 (1E)	35 (1V)	50 (1H)	63 (1J)	100 (2A)
680 (681)						E 22.5 x 31.5 J 25.5 x 25
1000 (102)						G 22.5 x 40 Q 30.5 x 25
1500 (152)					E 22.5 x 31.5 J 25.5 x 25	M 25.5 x 40 R 30.5 x 31.5
2200 (222)				J 25.5 x 25	G 22.5 x 40 Q 30.5 x 25	N 25.5 x 50 X 35.5 x 31.5
3300 (332)			J 25.5 x 25	G 22.5 x 40 Q 30.5 x 25	M 25.5 x 40 R 30.5 x 31.5	U 30.5 x 50 Y 35.5 x 40
4700 (472)		J 25.5 x 25	G 22.5 x 40 Q 30.5 x2 5	M 25.5 x 40 R 30.5 x 31.5	N 25.5 x 50 X 35.5 x 31.5	
6800 (682)	J 25.5 x 25	G 22.5 x 40 Q 30.5 x 25	M 25.5 x 40 R 30.5 x 31.5	N 25.5 x 50 X 35.5 x 31.5	U 30.5 x 50 Y 35.5 x 40	
10000 (103)	G 22.5 x 40 Q 30.5 x 25	M 25.5 x 40 R 30.5 x 31.5	N 25.5 x 50 X 35.5 x 31.5	U 30.5 x 50 Y 35.5 x 40		
15000 (153)	M 25.5 x 40 R 30.5 x 31.5	N 25.5 x 50 X 35.5 x 31.5	U 30.5 x 50 Y 35.5 x 40			
22000 (223)	N 25.5 x 50 X 35.5 x 31.5	U 30.5 x 50 Y 35.5 x 40				
33000 (333)	U 30.5 x 50 Y 35.5 x 40					

Case size code



LARGE ALUMINUM ELECTROLYTIC CAPACITORS

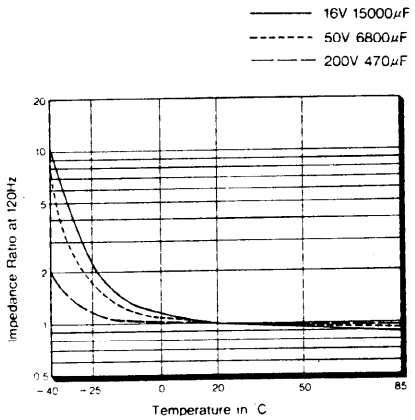
W.V. (Surge V)	Cap.	Part No. code	Case size (φD x L mm) Standard case code	Case size (φD x L mm) Flat case code	Leakage current max. mA after 5 min.	E. S. R. max. m ohm at 20℃ 120Hz	tan δ Typical at 20℃ 120Hz	Ripple current A r.m.s. 120Hz 85℃ 2000h	Ripple current A r.m.s. 120Hz 85℃ 1000h
200 (250)	220	ECES2DU221 □	E 22.5 x 31.5	J 25.5 x 25	0.62	1130	0.06	0.87	1.2
	330	ECES2DU331 □	G 22.5 x 40	Q 30.5 x 25	0.77	754	0.06	1.10	1.5
	470	ECES2DU471 □	M 25.5 x 40	R 30.5 x 31.5	0.91	529	0.06	1.30	1.8
	680	ECES2DU681 □	N 25.5 x 50	X 35.5 x 31.5	1.10	366	0.06	1.50	2.2
	1,000	ECES2DU102 □	U 30.5 x 50	Y 35.5 x 40	1.34	249	0.06	1.80	2.8
	1,200	ECES2DU122Z	Z 35.5 x 50	—	1.46	207	0.06	2.00	3.2
250 (300)	150	ECES2EU151 □	E 22.5 x 31.5	J 25.5 x 25	0.58	1660	0.07	0.65	1.0
	220	ECES2EU221 □	G 22.5 x 40	Q 30.5 x 25	0.70	1130	0.07	0.87	1.2
	330	ECES2EU331 □	M 25.5 x 40	R 30.5 x 31.5	0.86	754	0.07	1.10	1.5
	470	ECES2EU471 □	N 25.5 x 50	X 35.5 x 31.5	1.02	529	0.07	1.30	1.8
	680	ECES2EU681 □	U 30.5 x 50	Y 35.5 x 40	1.23	366	0.07	1.50	2.2
	1,000	ECES2EU102Z	Z 35.5 x 50	—	1.50	249	0.07	1.80	2.8
400 (450)	68	ECES2GU680 □	E 22.5 x 31.5	J 25.5 x 25	0.49	4879	0.08	0.35	0.44
	100	ECES2GU101 □	G 22.5 x 40	Q 30.5 x 25	0.60	3317	0.08	0.47	0.59
	150	ECES2GU151 □	M 25.5 x 40	R 30.5 x 31.5	0.73	2212	0.08	0.60	0.76
	220	ECES2GU221 □	N 25.5 x 50	X 35.5 x 31.5	0.88	1508	0.08	0.75	0.95
	270	ECES2GU271 □	U 30.5 x 50	Y 35.5 x 40	0.98	1229	0.08	0.90	1.1
	390	ECES2GU391Z	Z 35.5 x 50	—	1.18	850	0.08	1.10	1.3
450 (500)	47	ECES2WU470 □	E 22.5 x 31.5	J 25.5 x 25	0.43	7058	0.08	0.29	0.37
	68	ECES2WU680 □	G 22.5 x 40	Q 30.5 x 25	0.52	4879	0.08	0.38	0.48
	100	ECES2WU101 □	M 25.5 x 40	R 30.5 x 31.5	0.63	3317	0.08	0.52	0.66
	150	ECES2WU151 □	N 25.5 x 50	X 35.5 x 31.5	0.77	2212	0.08	0.70	0.89
	220	ECES2WU221 □	U 30.5 x 50	Y 35.5 x 40	0.94	1508	0.08	0.92	1.2
	330	ECES2WU331Z	Z 35.5 x 50	—	1.15	1005	0.08	1.10	1.4

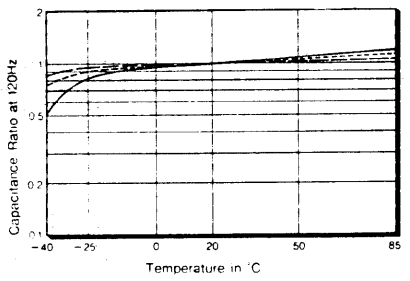
Standard products table

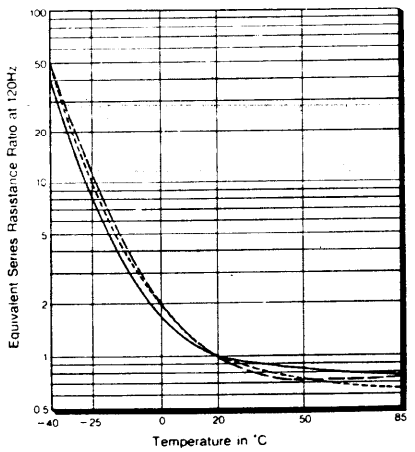
W.V. (Surge V)	Cap.	Part No.	Case size (φD x L mm) Standard case	Case size (φD x L mm) Flat case	Leakage current max. mA after 5 min.	E.S.R. max. m ohm at 20℃ 120Hz	tan δ Typical at 20℃ 120Hz	Ripple current A r.m.s. 120Hz 85℃ 2000h	Ripple current A r.m.s. 120Hz 85℃ 1000h
		code	code	code					
16 (20)	6,800	ECES1CU682J	—	J 25.5 x 25	0.98	86	0.20	1.80	2.3
	10,000	ECES1CU103 □	G 22.5 x 40	Q 30.5 x 25	1.20	58	0.20	2.40	3.0
	15,000	ECES1CU153 □	M 25.5 x 40	R 30.5 x 31.5	1.46	39	0.25	3.20	4.0
	22,000	ECES1CU223 □	N 25.5 x 50	X 35.5 x 31.5	1.77	27	0.25	3.60	4.6
	33,000	ECES1CU333 □	U 30.5 x 50	Y 35.5 x 40	2.17	18	0.30	3.90	5.2
25 (32)	4,700	ECES1EU472J	—	J 25.5 x 25	1.02	89	0.15	1.80	2.3
	6,800	ECES1EU682 □	G 22.5 x 40	Q 30.5 x 25	1.23	61	0.15	2.30	2.9
	10,000	ECES1EU103 □	M 25.5 x 40	R 30.5 x 31.5	1.50	58	0.20	2.70	3.4
	15,000	ECES1EU153 □	N 25.5 x 50	X 35.5 x 31.5	1.83	39	0.20	3.40	4.3
	22,000	ECES1EU223 □	U 30.5 x 50	Y 35.5 x 40	2.22	27	0.25	4.20	5.3
35 (44)	3,300	ECES1VU332J	—	J 25.5 x 25	1.01	126	0.13	1.70	2.2
	4,700	ECES1VU472 □	G 22.5 x 40	Q 30.5 x 25	1.21	88	0.13	2.00	2.5
	6,800	ECES1VU682 □	M 25.5 x 40	R 30.5 x 31.5	1.46	61	0.15	2.40	3.0
	10,000	ECES1VU103 □	N 25.5 x 50	X 35.5 x 31.5	1.77	50	0.15	3.00	3.8
	15,000	ECES1VU153 □	U 30.5 x 50	Y 35.5 x 40	2.17	33	0.20	3.70	4.7
50 (63)	2,200	ECES1HU222J	—	J 25.5 x 25	0.99	152	0.13	1.40	1.8
	3,300	ECES1HU332 □	G 22.5 x 40	Q 30.5 x 25	1.21	101	0.13	1.70	2.2
	4,700	ECES1HU472 □	M 25.5 x 40	R 30.5 x 31.5	1.45	88	0.15	2.10	2.7
	6,800	ECES1HU682 □	N 25.5 x 50	X 35.5 x 31.5	1.74	61	0.15	2.60	3.3
	10,000	ECES1HU103 □	U 30.5 x 50	Y 35.5 x 40	2.12	50	0.20	3.40	4.3
63 (79)	1,500	ECES1JU152 □	E 22.5 x 31.5	J 25.5 x 25	0.94	166	0.10	1.20	1.5
	2,200	ECES1JU222 □	G 22.5 x 40	Q 30.5 x 25	1.11	113	0.10	1.50	1.9
	3,300	ECES1JU332 □	M 25.5 x 40	R 30.5 x 31.5	1.36	101	0.13	1.90	2.4
	4,700	ECES1JU472 □	N 25.5 x 50	X 35.5 x 31.5	1.63	71	0.13	2.30	2.9
	6,800	ECES1JU682 □	U 30.5 x 50	Y 35.5 x 40	1.96	49	0.13	3.00	3.8
100 (125)	680	ECES2AU681 □	E 22.5 x 31.5	J 25.5 x 25	0.68	366	0.08	1.00	1.2
	1,000	ECES2AU102 □	G 22.5 x 40	Q 30.5 x 25	1.00	249	0.08	1.20	1.5
	1,500	ECES2AU152 □	M 25.5 x 40	R 30.5 x 31.5	1.16	166	0.10	1.40	1.8
	2,200	ECES2AU222 □	N 25.5 x 50	X 35.5 x 31.5	1.40	113	0.10	1.80	2.3
	3,300	ECES2AU332 □	U 30.5 x 50	Y 35.5 x 40	1.72	75	0.13	2.40	3.0

Panasonic®

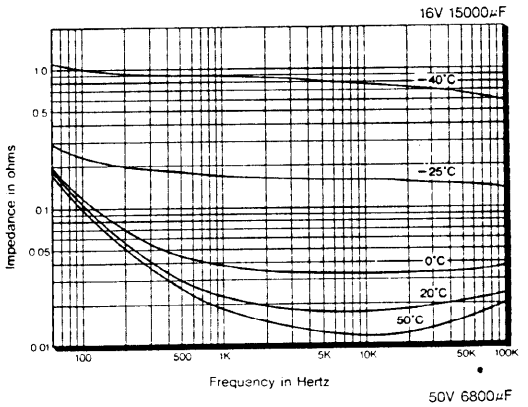
Typical temperature characteristics

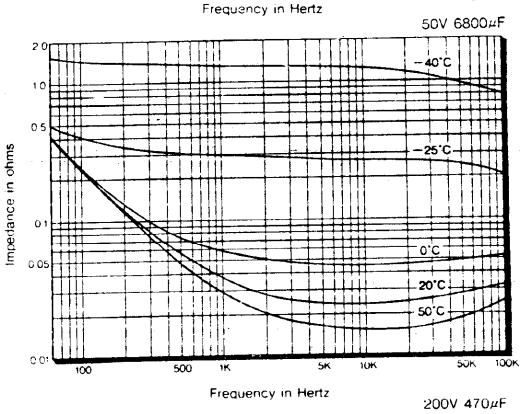


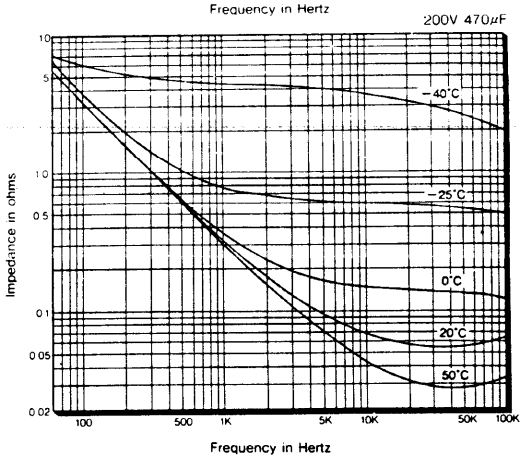




Typical curves of Impedance VS. Frequency







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