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Cette fiche technique est  
présentée par le fabricant

105-036 to 105-046

Panasonic

TSU  
SERIES

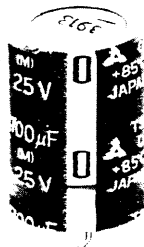
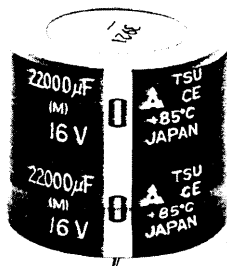
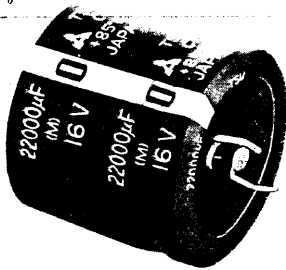
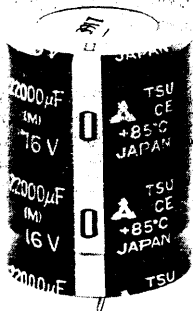
NEW

# 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)

# LARGE ALUMINUM ELECTROLYTIC CAPACITORS

• **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 $\pm 20\%$ of the initial measured value
$\tan \delta$	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 cleaning condition specified below:

Solvents	Condition
Freon TE Freon TES Freon TP-35	<ul style="list-style-type: none"> <li>• Vapor, or ultra sonic cleaning</li> <li>• 5 minutes at 40°C</li> <li>• flux density 10% max. in weight.</li> </ul>

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.

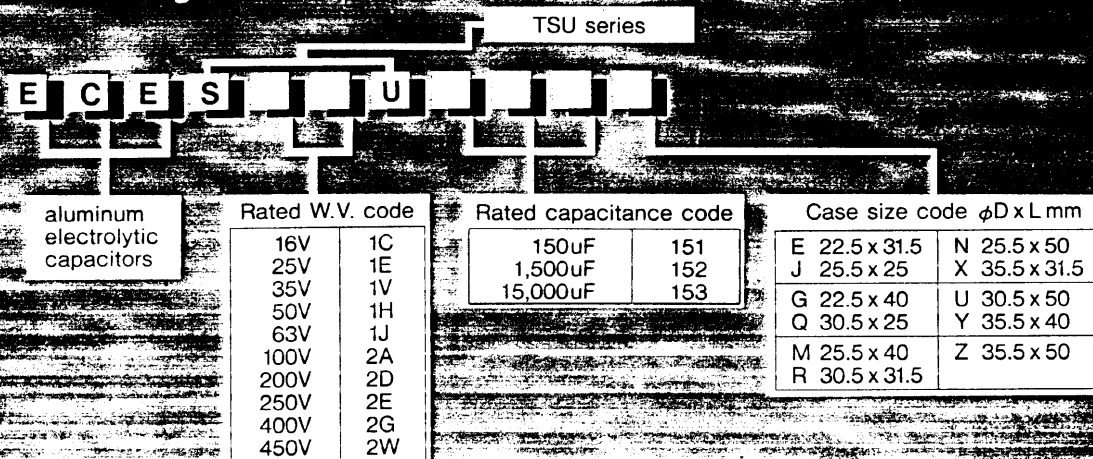
Range of vibration frequency is 10 to 55 Hz. Total amplitude 1.5 mm. Rate of frequency traverse from 10 to 55 Hz and return to 10 Hz is 1 minute. Continuously repeated. The capacitor shall withstand 6 hours of vibration in a vertical plane and two hours each in any of two horizontal planes. There shall be no evidence of intermittent connections or mechanical damage. Total amplitude shall be 0.75 mm for  $\phi 35.5 \times 50$  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,  $\pm 20\%$ )
- DC rated working voltage
- Negative polarity bar
- $\Delta$  (Matsushita trademark)
- CE (Electrolytic capacitor)
- Manufactured Lot number
- 85°C (max. operating temp.)
- JAPAN (country of origin)
- TSU (series name)

## Part number system



## 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  $\mu\text{F}$
- **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 $\pm 20\%$ of initial measured value
$\tan \delta$	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.

$$16 \text{ to } 100 \text{ V: in case of } C \times V \leq 100,000 \mu\text{FV} \\ I = 0.01 CV \mu\text{A max.}$$

$$\text{in case of } C \times V > 100,000 \mu\text{FV} \\ I = 3\sqrt{C \times V} \mu\text{A max.}$$

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

where  $I$  = leakage current in  $\mu\text{A}$   
 $C$  = rated capacitance in  $\mu\text{F}$   
 $V$  = DC rated w.v. in volts

- **E.S.R. &  $\tan \delta$ :** 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.**

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

- **Expected failure rate level**  
 $< 0.5 \times 10^{-7}/\text{h}$ 
  - Catastrophic failure mode
  - At rated working voltage
  - Ambient temperature is 40°C
  - Confidence level is 60%

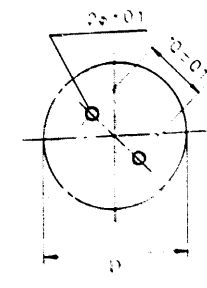
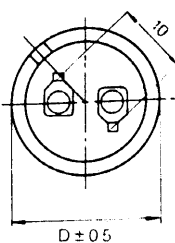
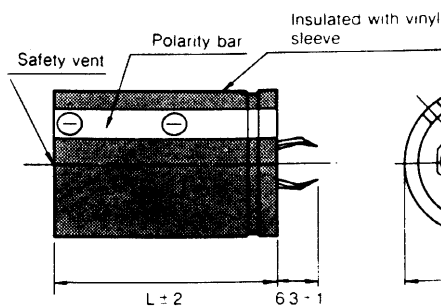
- **Load life test:**  
The capacitor shall be subjected to application of the DC rated voltage with full rated ripple current in an ambient temperature of 85°C for a period of 2,000 hours, or 1,000 hours. The capacitor shall then be removed from the test chamber and stabilized at room temperature. After reaching temperature stability, the capacitor shall not exceed the specified values listed below.

Capacitance change	Within $\pm 20\%$ of the initial measured value
$\tan \delta$	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



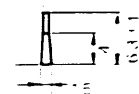
Ø2 Board Mounting Holes

Unit: mm

### Terminal

$t = 0.5$

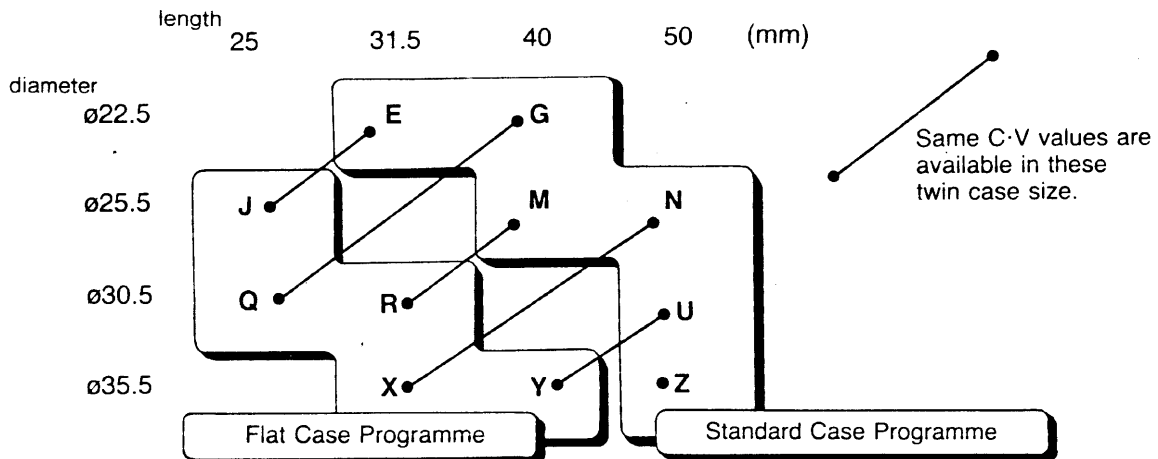
Ø6 (Ø32)



## 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 x 25	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. Cap. (Surge V)	Part No. code	Case size ( $\phi D \times L$ mm)		Leakage current max. mA after 5 min.	E. S. R. max. m ohm at 20°C 120Hz	tan $\delta$ Typical at 20°C 120Hz	Ripple current A r.m.s. 120Hz	
		Standard case code	Flat case code				85°C 2000h	85°C 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

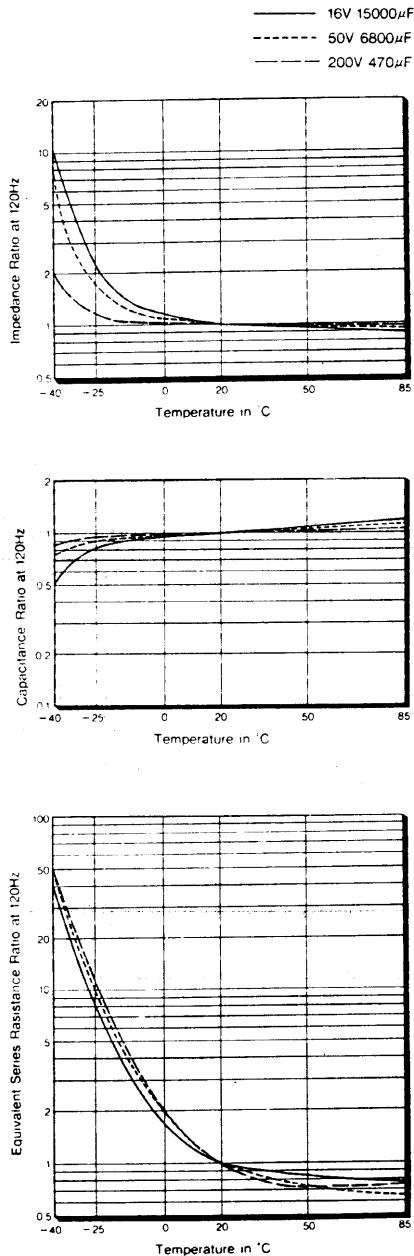
## Standard products table

W.V. Cap. (Surge V)	Part No.  code	Case size ( $\phi D \times L$ mm)		Leakage current max. mA after 5 min.	E. S. R. max. m ohm at 20°C 120Hz	tan $\delta$ Typical at 20°C 120Hz	Ripple current A r.m.s. 120Hz	
		Standard case	Flat case				85°C 2000h	85°C 1000h
		code	code					
16 (20)	6,800 ECES1CU682J	—	J 25.5 x 25	0.98	86	0.20	1.80	2.3
	10,000 ECES1CU103 <input type="checkbox"/>	G 22.5 x 40	Q 30.5 x 25	1.20	58	0.20	2.40	3.0
	15,000 ECES1CU153 <input type="checkbox"/>	M 25.5 x 40	R 30.5 x 31.5	1.46	39	0.25	3.20	4.0
	22,000 ECES1CU223 <input type="checkbox"/>	N 25.5 x 50	X 35.5 x 31.5	1.77	27	0.25	3.60	4.6
	33,000 ECES1CU333 <input type="checkbox"/>	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 <input type="checkbox"/>	G 22.5 x 40	Q 30.5 x 25	1.23	61	0.15	2.30	2.9
	10,000 ECES1EU103 <input type="checkbox"/>	M 25.5 x 40	R 30.5 x 31.5	1.50	58	0.20	2.70	3.4
	15,000 ECES1EU153 <input type="checkbox"/>	N 25.5 x 50	X 35.5 x 31.5	1.83	39	0.20	3.40	4.3
	22,000 ECES1EU223 <input type="checkbox"/>	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 <input type="checkbox"/>	G 22.5 x 40	Q 30.5 x 25	1.21	88	0.13	2.00	2.5
	6,800 ECES1VU682 <input type="checkbox"/>	M 25.5 x 40	R 30.5 x 31.5	1.46	61	0.15	2.40	3.0
	10,000 ECES1VU103 <input type="checkbox"/>	N 25.5 x 50	X 35.5 x 31.5	1.77	50	0.15	3.00	3.8
	15,000 ECES1VU153 <input type="checkbox"/>	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 <input type="checkbox"/>	G 22.5 x 40	Q 30.5 x 25	1.21	101	0.13	1.70	2.2
	4,700 ECES1HU472 <input type="checkbox"/>	M 25.5 x 40	R 30.5 x 31.5	1.45	88	0.15	2.10	2.7
	6,800 ECES1HU682 <input type="checkbox"/>	N 25.5 x 50	X 35.5 x 31.5	1.74	61	0.15	2.60	3.3
	10,000 ECES1HU103 <input type="checkbox"/>	U 30.5 x 50	Y 35.5 x 40	2.12	50	0.20	3.40	4.3
63 (79)	1,500 ECES1JU152 <input type="checkbox"/>	E 22.5 x 31.5	J 25.5 x 25	0.94	166	0.10	1.20	1.5
	2,200 ECES1JU222 <input type="checkbox"/>	G 22.5 x 40	Q 30.5 x 25	1.11	113	0.10	1.50	1.9
	3,300 ECES1JU332 <input type="checkbox"/>	M 25.5 x 40	R 30.5 x 31.5	1.36	101	0.13	1.90	2.4
	4,700 ECES1JU472 <input type="checkbox"/>	N 25.5 x 50	X 35.5 x 31.5	1.63	71	0.13	2.30	2.9
	6,800 ECES1JU682 <input type="checkbox"/>	U 30.5 x 50	Y 35.5 x 40	1.96	49	0.13	3.00	3.8
100 (125)	680 ECES2AU681 <input type="checkbox"/>	E 22.5 x 31.5	J 25.5 x 25	0.68	366	0.08	1.00	1.2
	1,000 ECES2AU102 <input type="checkbox"/>	G 22.5 x 40	Q 30.5 x 25	1.00	249	0.08	1.20	1.5
	1,500 ECES2AU152 <input type="checkbox"/>	M 25.5 x 40	R 30.5 x 31.5	1.16	166	0.10	1.40	1.8
	2,200 ECES2AU222 <input type="checkbox"/>	N 25.5 x 50	X 35.5 x 31.5	1.40	113	0.10	1.80	2.3
	3,300 ECES2AU332 <input type="checkbox"/>	U 30.5 x 50	Y 35.5 x 40	1.72	75	0.13	2.40	3.0

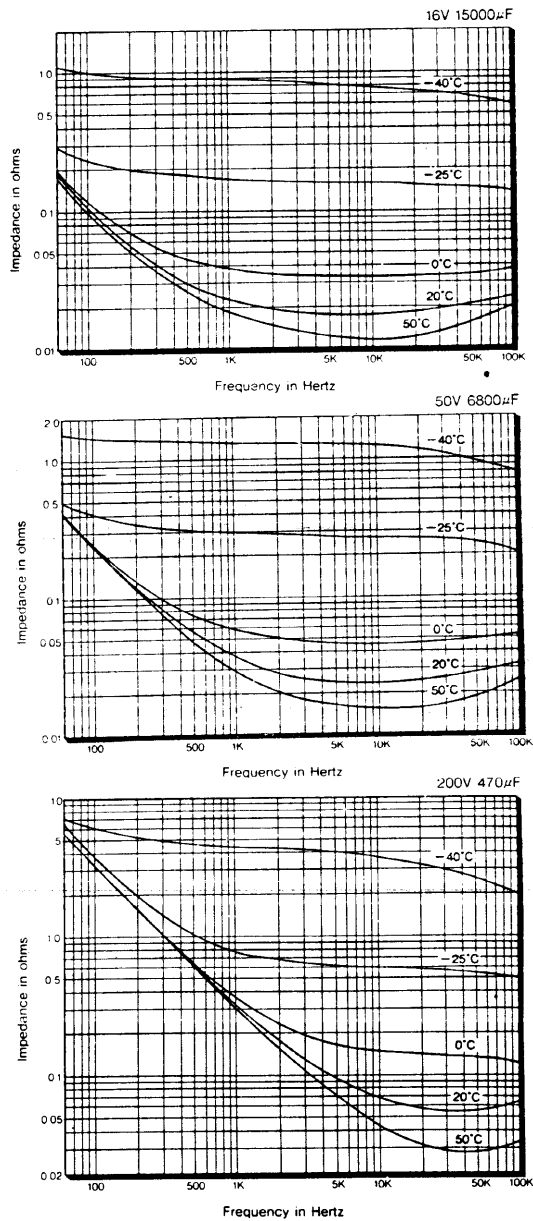


# Panasonic®

## Typical temperature characteristics



## Typical curves of Impedance VS. Frequency



Panasonic Deutschland GmbH  
 Winsbergring 15 2000 Hamburg 54 FR Germany  
 Tel (040)85490 Tlx 02-162454 PDGH D

Panasonic Industrial (UK) Ltd  
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[ECES1VU103N](#)

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Cette fiche technique est  
présentée par le fabricant