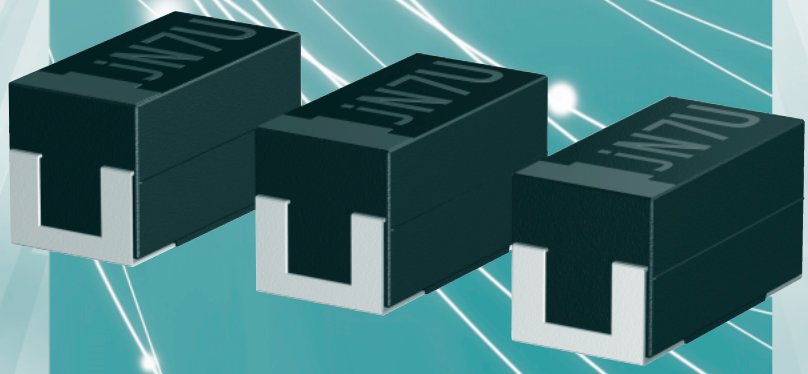
No. P-TCA-003
DATE 2008-10

PRODUCTS DATA SHEET

Tantalum Solid Electrolytic Capacitors with Conductive Polymer

RoHS COMPLIANT
LEAD FREE

Type TCA



MATSUO ELECTRIC CO., LTD.

OUTLINE

Type TCA is a tantalum solid electrolytic capacitor which uses conductive polymer as cathode layer.
Their equivalent series resistance (ESR) is extremely lowered with the characteristics of the polymer having high electric conductivity.
This ensures higher permissible ripple current and excellent noise absorption performance on high-frequency circuits.

APPLICATION

Mobile phones, digital cameras, high-performance portable equipments, personal computers, digital TV sets, DC/DC converters, regulators and peripherals

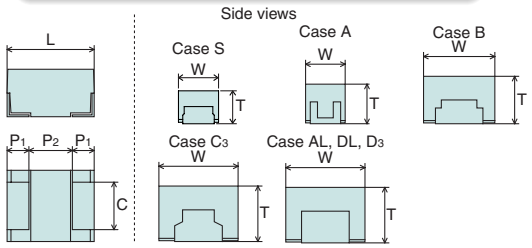
FEATURES

1. Low ESR and Low impedance
   Using a conductive polymer as cathode layer makes possible of low ESR and impedance.
   Type TCA makes high permissible ripple current and is suitable for noise bypass application.
2. Stable ESR over temperature
   ESR is extremely stable from low temperature through high temperature.
3. Compact and Large capacitance
   The capacitor is smaller and has larger capacitance than ceramic capacitor and aluminum electrolytic capacitor.
4. Benign Failure Mode
   Type TCA offers very safe characteristics which makes ignition and smoking harder by taking advantages of characteristics of conductive polymer if the capacitor be short-circuited.
5. Lead Free and RoHS Compliant.

RATINGS

Item	Ratings
Failure Rate Level	1% / 1000 h
Category Temperature Range	−55 to +105°C (to be used at derated voltage when temperature exceeds 85°C)
Rated Voltage	2.5−4−6.3−10 VDC
Derated Voltage	2.0−3.2−5.0−8.0 VDC (105°C)
Capacitance	10~470 µF
Capacitance Tolerances	± 20% (M)

DIMENSIONS

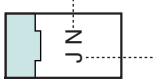


(mm)

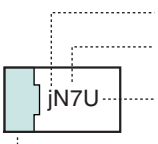
Case Size	EIA Code	L ± 0.2	W ± 0.2	T ± 0.2	P1 ± 0.2	P2 min.	C ± 0.1
S	2012	2.0	1.25	1.2max.	0.5	0.8	0.9
AL	3216L	3.2	1.6	1.2max.	0.8	1.4	1.2
A	3216	3.2	1.6	1.6	0.75	1.4	1.2
B	3528	3.5	2.8	1.9	0.8	1.5	2.2
C3	6032	6.0	3.2	2.5	1.3	3.0	2.2
DL	7343L	7.3	4.4	2.0max.	1.3	4.0	2.4
D3	7343	7.3	4.4	2.8	1.3	4.0	2.4

MARKING

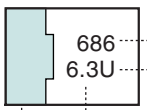
Case S



Case AL, A



Cases B, C3, DL and D3



Note (1) The rated voltage is indicated with one alphabetic letter as shown on the following Table.

Code	e	G	J	A
Voltage (V)	2.5	4	6.3	10

(2) The capacitance is indicated with one alphabetic letter or with a line above the letter or below the letter as shown on the following Table.

Code	A	E	J	N	S	W
Capacitance (µF)	0.1	0.15	0.22	0.33	0.47	0.68
Code	A	E	J	N	S	W
Capacitance (µF)	1	1.5	2.2	3.3	4.7	6.8
Code	A	E	J			
Capacitance (µF)	10	15	22			

(3) The manufacturing date code is determined according to Table 12 of JIS C 5101. (The codes are used cyclically for four years.)
However, small letter of h is indicated h and k is indicated h respectively.

Year	Month	Code	Year	Month	Code	Year	Month	Code	Year	Month	Code
	1	A		1	N		1	a		1	n
	2	B		2	P		2	b		2	p
2005	3	C	2006	3	Q	2007	3	c	2008	3	q
2009	4	D	2010	4	R	2011	4	d	2012	4	r
	5	E		5	S		5	e		5	s
	6	F		6	T		6	f		6	t

Year	Month	Code	Year	Month	Code	Year	Month	Code	Year	Month	Code
	7	G		7	U		7	g		7	u
	8	H		8	V		8	h		8	v
2005	9	J	2006	9	W	2007	9	j	2008	9	w
2009	10	K	2010	10	X	2011	10	k	2012	10	x
	11	L		11	Y		11	l		11	y
	12	M		12	Z		12	m		12	z

(4) The rated voltage is indicated with one alphabetic letter based on Table 9 of Annex 1 to JIS C 5101-1.

Code	e	g	j	A
Voltage (V)	2.5	4	6.3	10

(5) The capacitance is indicated with one alphabetic letter and one numeral based on Tables 9 and 10 of Annex 1 to JIS C 5101-1.

Code	A6	E6	J6	N6	S6	W6
Capacitance (µF)	1	1.5	2.2	3.3	4.7	6.8
Code	A7	E7	J7	N7	S7	W7
Capacitance (µF)	10	15	22	33	47	68
Code	A8	E8	J8	N8	S8	W8
Capacitance (µF)	100	150	220	330	470	680

(6) The capacitance of cases B, C3, DL and D3 are indicated as picofarad codes (in pF, the first two numerals are significant digits, and the last numeral indicates the number of zeros following the digits).

ORDERING INFORMATION

TCA	6301	336	M	R	A	0180
TYPE	RATED VOLTAGE	CAPACITANCE	CAPACITANCE TOLERANCE	STYLE OF REELED PACKAGE	CASE CODE	ESR(mΩ)

Rated voltage	Marking
2.5 V	2501
4 V	4001
6.3 V	6301
10 V	1002

Capacitance	Marking	Capacitance	Marking	Capacitance	Marking
10 µF	106	47 µF	476	220 µF	227
15 µF	156	68 µF	686	330 µF	337
22 µF	226	100 µF	107	470 µF	477
33 µF	336	150 µF	157		

Capacitance Tolerance	Marking
± 20%	M

Code	Reel Size	Anode Notation
R	ϕ180 Reel	Feed hole: -
N	ϕ330 Reel	Feed hole: -

EIA Code	Case Code
2012	S
3216L	AL
3216	A
3528	B
6032	C3
7343L	DL
7343	D3

Note : For a capacitor with special requirements from customers, a 2-digit specific numbers will be added between the case code and the ESR for our product management.

CATALOG NUMBERS AND RATING

October, 2008

Catalog number (1)	Rated Voltage (VDC)	Capacitance (µF)	Tolerances (±%)	Case Code	Lct. (µA)			Max. Dissipation Factor			ESR (mΩ) 100 kHz	Max. Permissible Ripple Current (2) (mArms) 100 kHz
					20°C	85°C	105°C	-55°C	20°C	105°C		
TCA 2501 226 M_1 S 0500	2.5	22	20	S	5.50	55.0	55.0	0.06	0.06	0.09	500	293
TCA 2501 226 M_1 S 0200	↓	22	↓	S	5.50	55.0	55.0	0.06	0.06	0.09	200	463
TCA 2501 226 M_1 A 0200	↓	22	↓	A	5.50	55.0	55.0	0.06	0.06	0.09	200	474
TCA 2501 226 M_1 A 0180	↓	22	↓	A	5.50	55.0	55.0	0.06	0.06	0.09	180	500
TCA 2501 336 M_1 A 0200	↓	33	↓	A	8.25	82.5	82.5	0.06	0.06	0.09	200	474
TCA 2501 336 M_1 A 0180	↓	33	↓	A	8.25	82.5	82.5	0.06	0.06	0.09	180	500
TCA 2501 476 M_1 A 0200	↓	47	↓	A	11.7	117	117	0.06	0.06	0.09	200	474
TCA 2501 476 M_1 A 0180	↓	47	↓	A	11.7	117	117	0.06	0.06	0.09	180	500
TCA 2501 686 M_1 A 0200	↓	68	↓	A	17.0	170	170	0.06	0.06	0.09	200	474
TCA 2501 686 M_1 B 0070	↓	68	↓	B	17.0	170	170	0.08	0.08	0.12	70	845
TCA 2501 107 M_1 B 0070	↓	100	↓	B	25.0	250	250	0.08	0.08	0.12	70	845
TCA 2501 157 M_1 B 0070	↓	150	↓	B	37.5	375	375	0.08	0.08	0.12	70	845
TCA 4001 156 M_1 S 0500	4	15	20	S	4.00	40.0	40.0	0.06	0.06	0.09	500	293
TCA 4001 156 M_1 S 0200	↓	15	↓	S	4.00	40.0	40.0	0.06	0.06	0.09	200	474
TCA 4001 226 M_1 A 0200	↓	22	↓	A	8.80	88.0	88.0	0.06	0.06	0.09	200	474
TCA 4001 226 M_1 A 0180	↓	22	↓	A	8.80	88.0	88.0	0.06	0.06	0.09	180	500
TCA 4001 336 M_1 A 0200	↓	33	↓	A	13.2	132	132	0.06	0.06	0.09	200	474
TCA 4001 336 M_1 A 0180	↓	33	↓	A	13.2	132	132	0.06	0.06	0.09	180	500
TCA 4001 476 M_1 A 0200	↓	47	↓	A	18.8	188	188	0.06	0.06	0.09	200	474
TCA 4001 476 M_1 A 0180	↓	47	↓	A	18.8	188	188	0.06	0.06	0.09	180	500
TCA 4001 686 M_1 B 0070	↓	68	↓	B	27.2	272	272	0.08	0.08	0.12	70	845
TCA 4001 107 M_1 B 0070	↓	100	↓	B	40.0	400	400	0.08	0.08	0.12	70	845
TCA 4001 157 M_1 B 0070	↓	150	↓	B	60.0	600	600	0.08	0.08	0.12	70	845
TCA 4001 227 M_1 C3 0060	↓	220	↓	C3	88.0	880	880	0.08	0.08	0.12	60	1040
TCA 4001 227 M_1 C3 0040	↓	220	↓	C3	88.0	880	880	0.08	0.08	0.12	40	1275
TCA 4001 227 MR DL 0055	↓	220	↓	DL	88.0	880	880	0.10	0.10	0.15	55	1168
TCA 4001 227 MR DL 0035	↓	220	↓	DL	88.0	880	880	0.10	0.10	0.15	35	1464
TCA 4001 477 M_1 D3 0055	↓	470	↓	D3	188	1880	1880	0.10	0.10	0.15	55	1243
TCA 4001 477 M_1 D3 0040	↓	470	↓	D3	188	1880	1880	0.10	0.10	0.15	40	1458
TCA 6301 106 M_1 S 0500	6.3	10	20	S	6.30	63.0	63.0	0.06	0.06	0.09	500	293
TCA 6301 106 M_1 S 0200	↓	10	↓	S	6.30	63.0	63.0	0.06	0.06	0.09	200	474
TCA 6301 156 M_1 AL 0200	↓	15	↓	AL	9.45	94.5	94.5	0.06	0.06	0.09	200	469
TCA 6301 226 M_1 A 0200	↓	22	↓	A	13.8	138	138	0.06	0.06	0.09	200	474
TCA 6301 226 M_1 A 0180	↓	22	↓	A	13.8	138	138	0.06	0.06	0.09	180	500
TCA 6301 336 M_1 A 0200	↓	33	↓	A	20.8	208	208	0.06	0.06	0.09	200	474
TCA 6301 336 M_1 A 0180	↓	33	↓	A	20.8	208	208	0.06	0.06	0.09	180	500
TCA 6301 336 M_1 B 0080	↓	33	↓	B	20.8	208	208	0.08	0.08	0.12	80	791
TCA 6301 476 M_1 B 0070	↓	47	↓	B	29.6	296	296	0.08	0.08	0.12	70	845
TCA 6301 686 M_1 B 0070	↓	68	↓	B	42.8	428	428	0.08	0.08	0.12	70	845
TCA 6301 157 M_1 C3 0060	↓	150	↓	C3	94.5	945	945	0.08	0.08	0.12	60	1040
TCA 6301 157 M_1 C3 0040	↓	150	↓	C3	94.5	945	945	0.08	0.08	0.12	40	1275
TCA 6301 157 MR DL 0055	↓	150	↓	DL	94.5	945	945	0.10	0.10	0.15	55	1168
TCA 6301 157 MR DL 0035	↓	150	↓	DL	94.5	945	945	0.10	0.10	0.15	35	1464
TCA 6301 227 M_1 D3 0040	↓	220	↓	D3	138	1380	1380	0.10	0.10	0.15	40	1458
TCA 6301 337 M_1 D3 0055	↓	330	↓	D3	208	2080	2080	0.10	0.10	0.15	55	1243
TCA 6301 337 M_1 D3 0040	↓	330	↓	D3	208	2080	2080	0.10	0.10	0.15	40	1458
TCA 1002 106 M_1 AL 0200	10	10	20	AL	10.0	100	100	0.06	0.06	0.09	200	469
TCA 1002 226 M_1 A 0200	↓	22	↓	A	22.0	220	220	0.06	0.06	0.09	200	474
TCA 1002 226 M_1 A 0180	↓	22	↓	A	22.0	220	220	0.06	0.06	0.09	180	500
TCA 1002 336 M_1 B 0080	↓	33	↓	B	33.0	330	330	0.08	0.08	0.12	80	791
TCA 1002 476 M_1 B 0070	↓	47	↓	B	47.0	470	470	0.08	0.08	0.12	70	845
TCA 1002 686 M_1 C3 0060	↓	68	↓	C3	68.0	680	680	0.08	0.08	0.12	60	1040
TCA 1002 686 M_1 C3 0045	↓	68	↓	C3	68.0	680	680	0.08	0.08	0.12	45	1202
TCA 1002 107 MR DL 0055	↓	100	↓	DL	100	1000	1000	0.10	0.10	0.15	55	1168
TCA 1002 107 MR DL 0045	↓	100	↓	DL	100	1000	1000	0.10	0.10	0.15	45	1291
TCA 1002 157 M_1 D3 0055	↓	150	↓	D3	150	1500	1500	0.10	0.10	0.15	55	1243
TCA 1002 157 M_1 D3 0040	↓	150	↓	D3	150	1500	1500	0.10	0.10	0.15	40	1458

Notes : (1) _1 : No code for single item. "R" and "N" for taping specification.
(2) Reference value.

STANDARD RATING

October, 2008

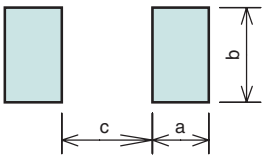
R.V. (VDC) / Cap. (µF)	2.5	4	6.3	10
3.3				
4.7				
6.8				
10			S (200, 500)	AL (200)
15		S (200, 500)	AL (200)	
22	S (200, 500) A (180, 200)	A (180, 200)	A (180, 200)	A (180, 200)

R.V. (VDC) / Cap. (µF)	2.5	4	6.3	10
33	A (180,200)	A (180,200)	A (180,200) B (80)	B (80)
47	A (180,200)	A (180,200)	B (70)	B (70)
68	A (200), B (70)	B (70)	B (70)	C3 (45,60)
100	B (70)	B (70)		DL (45,55)
150	B (70)	B (70)	C3 (40,60) DL (35,55)	D3 (40,55)

R.V. (VDC) / Cap. (µF)	2.5	4	6.3	10
220		C3 (40,60) DL (35,55)	D3 (40)	
330			D3 (40,55)	
470		D3 (40,55)		
680				
1000				

The parenthesized values show ESR.
(maximum values in mΩ at 100 kHz)

RECOMMENDED PAD DIMENSIONS



(mm)

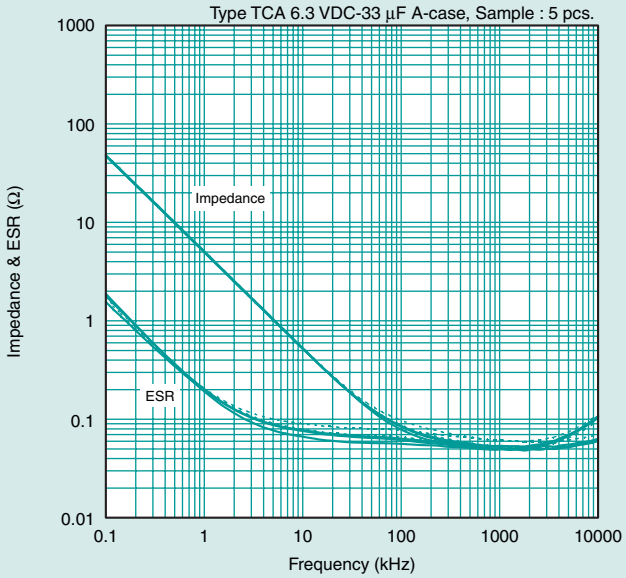
Case Size	a	b	c
S	1.4	1.2	0.9
AL, A	2.0	1.5	1.5
B	2.0	2.4	1.8
C3	2.4	2.5	3.3
DL, D3	2.4	2.7	4.6

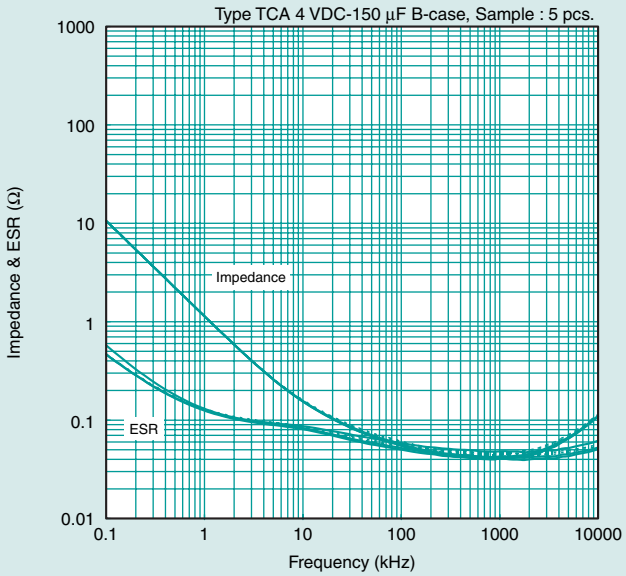
In order to expect the self alignment effect, it is recommended that the land width is almost the same size as terminal of capacitor, and space between lands(c) nearly equal to the space between terminals for appropriate soldering.

PERFORMANCE

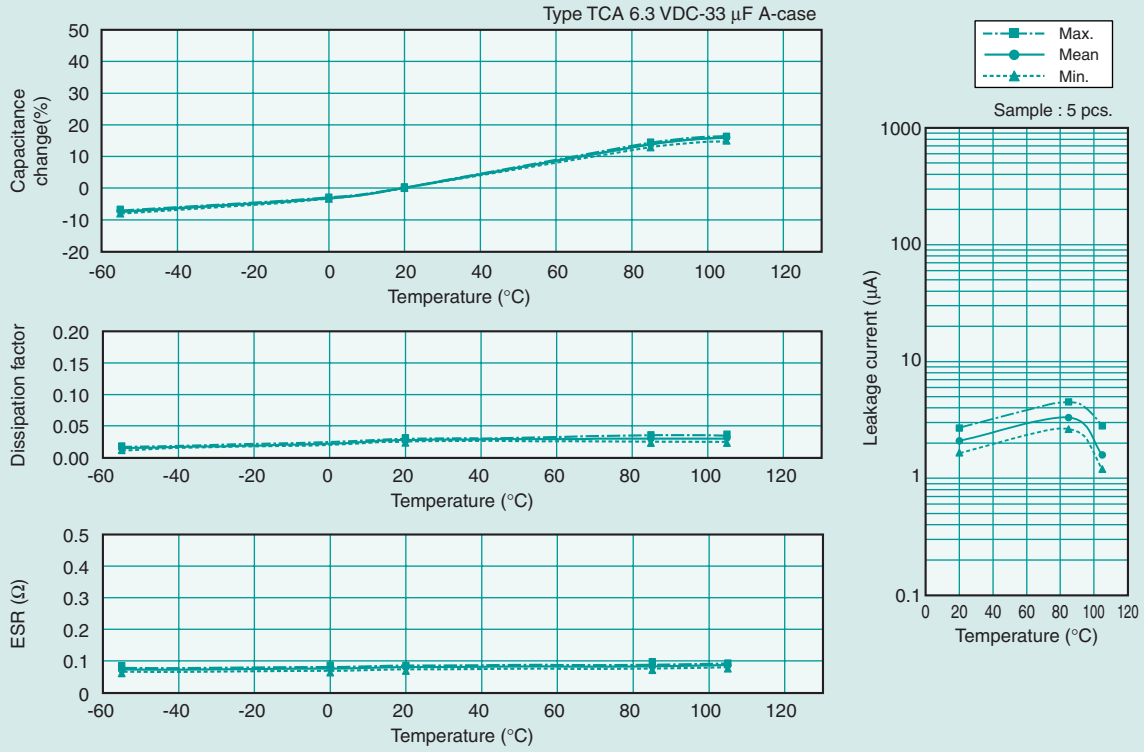
No	Item	Performance			Test Method
1	Leakage Current (μA)	Shall not exceed 0.1 CV Max. or the values shown in CATALOG NUMBERS AND RATING.			JIS C 5101-1, 4.9 Applied voltage : Rated voltage Duration : 5 min Measuring temperature : 20 ± 2°C
2	Capacitance (μF)	Shall be within specified tolerances.			JIS C 5101-1, 4.7 Measuring frequency : 120 Hz ± 20% Measuring temperature : 20 ± 2°C
3	Dissipation Factor	Shall not exceed the values shown in CATALOG NUMBERS AND RATING.			JIS C 5101-1, 4.8 Test conditions shown in No.2
4	Equivalent Series Resistance	Shall not exceed the values shown in CATALOG NUMBERS AND RATING.			EIAJ RC-2378, 4.5.4 Measuring frequency : 100 kHz ± 10% Measuring temperature : 20 ± 2°C
5	Characteristics at High and Low Temperature	Leakage Current	Capacitance	Dissipation Factor	JIS C 5101-1, 4.29
	Step 1	Shall not exceed the value in No.1.	Within specified tolerances	Shall not exceed the value in No.3.	20 ± 2°C
	Step 2	–	Within $^{0}_{-20}$% of value at Step 1	Shall not exceed the value in No.3.	-55 ± 3°C
	Step 3	Shall not exceed the value in No.1.	Within ± 5% of value at Step 1	Shall not exceed the value in No.3.	20 ± 2°C
	Step 4	Shall not exceed 10-times of the value in No.1.	–	–	85 ± 2°C
	Step 5	Shall not exceed 10-times of the value in No.1.	Within $^{+50}_{0}$% of value at Step 1	Shall not exceed 1.5-times of the value in No.3.	105 ± 2°C Derated voltage at 105°C
	Step 6	Shall not exceed the value in No.1.	Within ± 5% of value at Step 1	Shall not exceed the value in No.3.	20 ± 2°C
6	Surge	Leakage current : Shall not exceed 3-times of the value in No.1. Capacitance change : Within ± 20% of the value before test Dissipation Factor : Shall not exceed the value in No.3. Visual Examination : There shall be no evidence of mechanical damage.			JIS C 5101-1, 4.26 Test temperature : 85°C and 105°C Applied voltage : According to the following table Rated voltage (VDC) 2.5 4 6.3 10 Surge voltage (VDC) 85°C 3.3 5.2 8.2 13 105°C 2.6 4.2 6.5 10.4 Series protective resistance : 1000 Ω Discharge resistance : 1000 Ω Number of cycles : 1000 cycles
7	Shear Test	No separation of terminal from solder.			JIS C 5101-1, 4.34 Force : 5 N Holding time : 5 ± 1 sec
8	Substrate Bending Test	Capacitance : Initial value to remain steady during measurement. Visual Examination : There shall be no evidence of mechanical damage.			JIS C 5101-1, 4.35 Bending : 3 mm
9	Vibration	Capacitance : Initial value to remain steady during measurement. Visual Examination : There shall be no evidence of mechanical damage.			JIS C 5101-1 4.17 Frequency range : 10-55 Hz Swing width : 1.5 mm Vibration direction : 3 directions with mutually right-angled Duration : 2 hours in each of these mutually perpendicular directions (total 6 hours) Mounting : Solder terminal to the printed board
10	Shock	There shall be no intermittent contact of 0.5 ms or greater, short, or open. Nor shall there be any spark discharge, insulation breakdown, or evidence of mechanical damage.			JIS C 5101-1 4.19 Peak acceleration : 490 m/s^2 Duration : 11 ms Wave form : Half-sine
11	Solderability	Shall be covered to over 3/4 of terminal surface by new soldering.			JIS C 5101-1 4.15 Solder temperature : 230 ± 5°C Dipping time : 3 to 5 seconds Dipping depth : Terminal shall be dipped into melted solder
12	Resistance to Soldering Heat	Leakage Current : Shall not exceed 2-times of the value in No.1. Capacitance change : Within ± 20% of the value before test. Dissipation Factor : Shall not exceed 1.3-times of the value in No.3. Visual Examination : There shall be no evidence of mechanical damage.			EIAJ RC-2378, 4.6 IR reflow Preheating : 140 to 160°C, 110 to 130 sec Reflow : 200°C, 25 to 30 sec Peak : 240°C max. Number of cycles : 2
13	Rapid Change of Temperature	Leakage Current : Shall not exceed 2-times of the value in No.1. Capacitance change : Within ± 20% of the value before test. Dissipation Factor : Shall not exceed 1.5-times of the value in No.3. Visual Examination : There shall be no evidence of mechanical damage.			JIS C 5101-1, 4.16 Step 1 : -55 ± 3°C, 30 ± 3 min Step 2 : 25 $^{+10}_{-5}$°C, 3 min or less Step 3 : 105 ± 2°C, 30 ± 3 min Step 4 : 25 $^{+10}_{-5}$°C, 3 min or less Number of cycles : 5
14	Damp Heat, Steady State	Leakage Current : Shall not exceed 2-times of the value in No.1. Capacitance change : Within -20% to +40% of the value before test. Dissipation Factor : Shall not exceed 1.5-times of the value in No.3. Visual Examination : There shall be no evidence of mechanical damage.			JIS C 5101-1, 4.21 Temperature : 40 ± 2°C Moisture : 90 to 95% RH Duration : 500 $^{+24}_{0}$ hrs
15	Endurance Ⅰ	Leakage Current : Shall not exceed 2-times of the value in No.1. Capacitance change : Within ± 20% of the value before test. Dissipation Factor : Shall not exceed 1.5-times of the value in No.3. Visual Examination : There shall be no evidence of mechanical damage.			JIS C 5101-1, 4.23 Test temperature : 85 ± 2°C Applied voltage : Rated voltage Duration : 1000 $^{+48}_{0}$ hrs
16	Endurance Ⅱ	Leakage Current : Shall not exceed 2-times of the value in No.1. Capacitance change : Within ± 20% of the value before test. Dissipation Factor : Shall not exceed 3-times of the value in No.3. Visual Examination : There shall be no evidence of mechanical damage.			JIS C 5101-1, 4.23 Test temperature : 105 ± 2°C Applied voltage : Derated voltage Duration : 1000 $^{+48}_{0}$ hrs

FREQUENCY CHARACTERISTICS

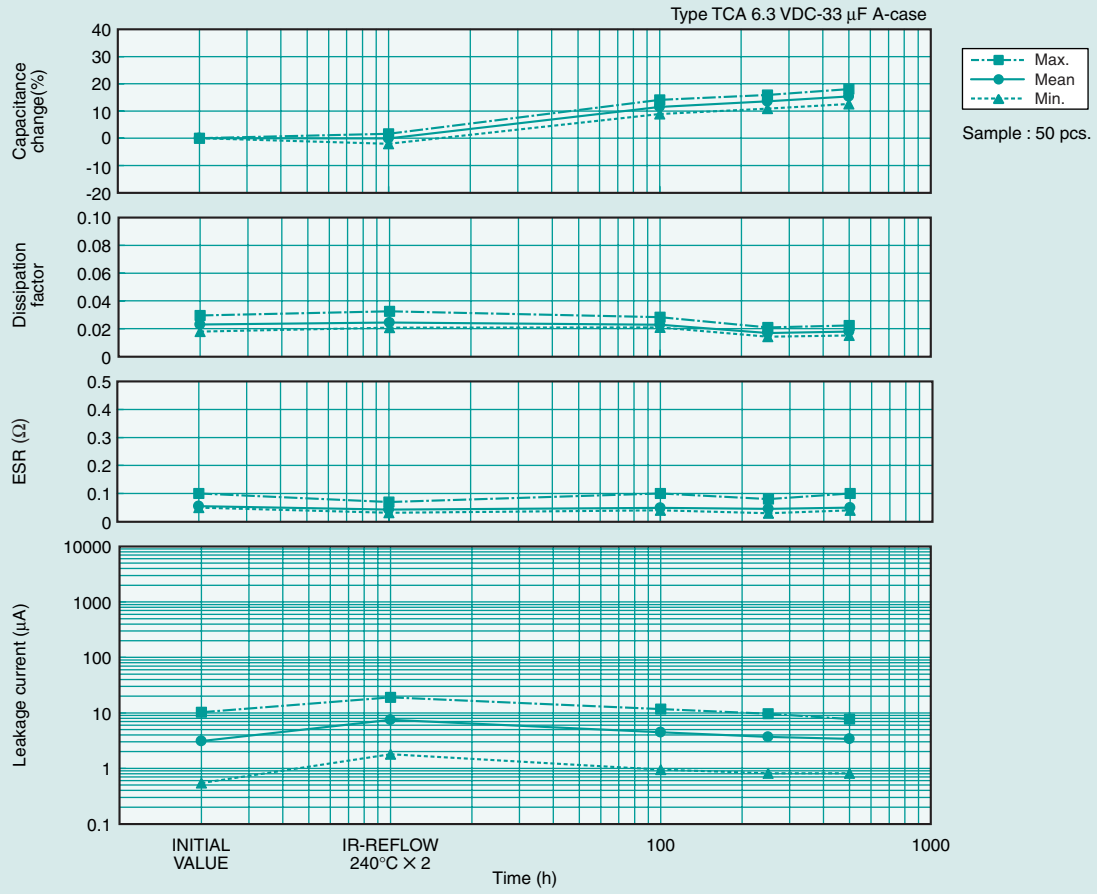




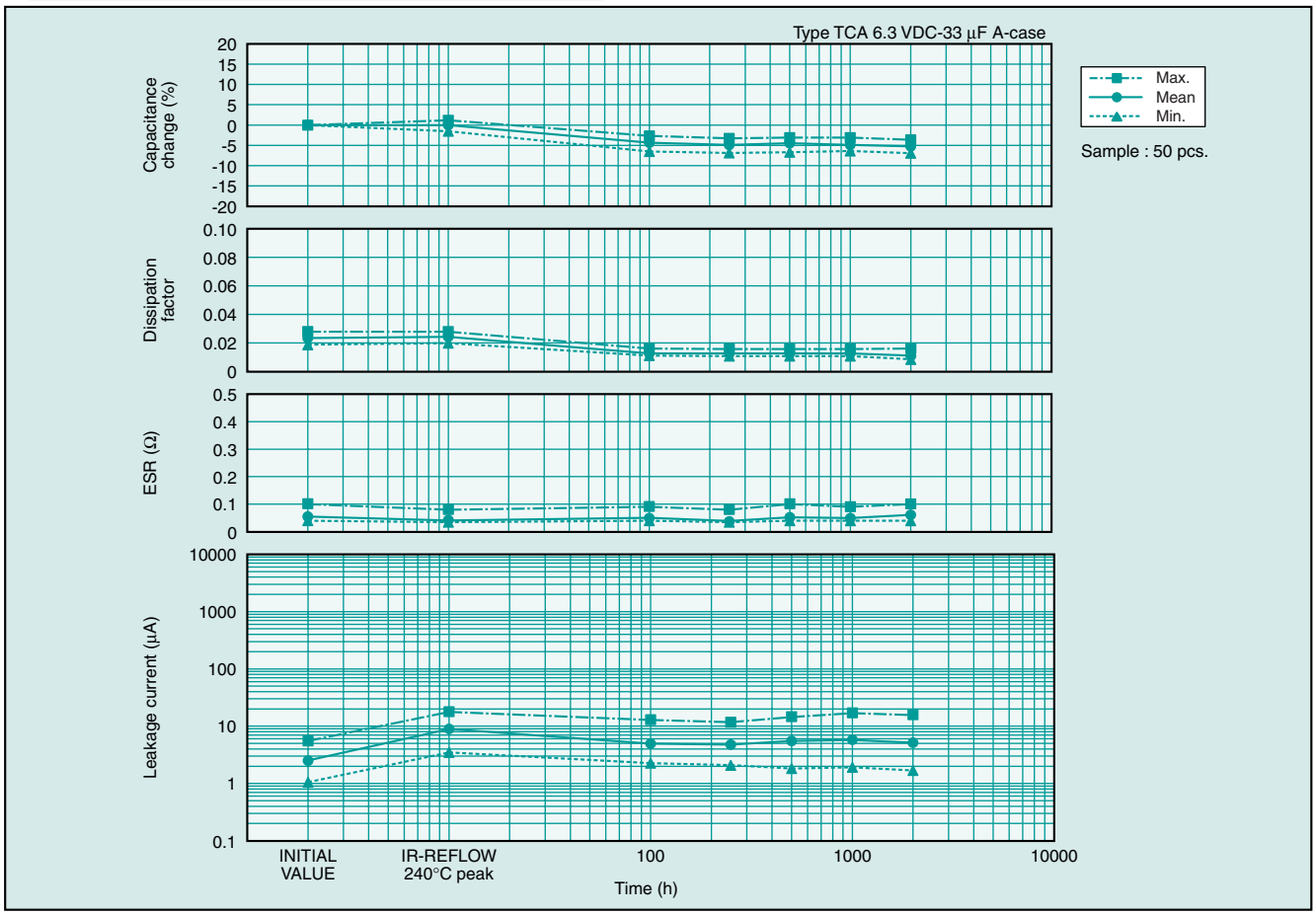
CHARACTERISTICS AT HIGH AND LOW TEMPERATURE



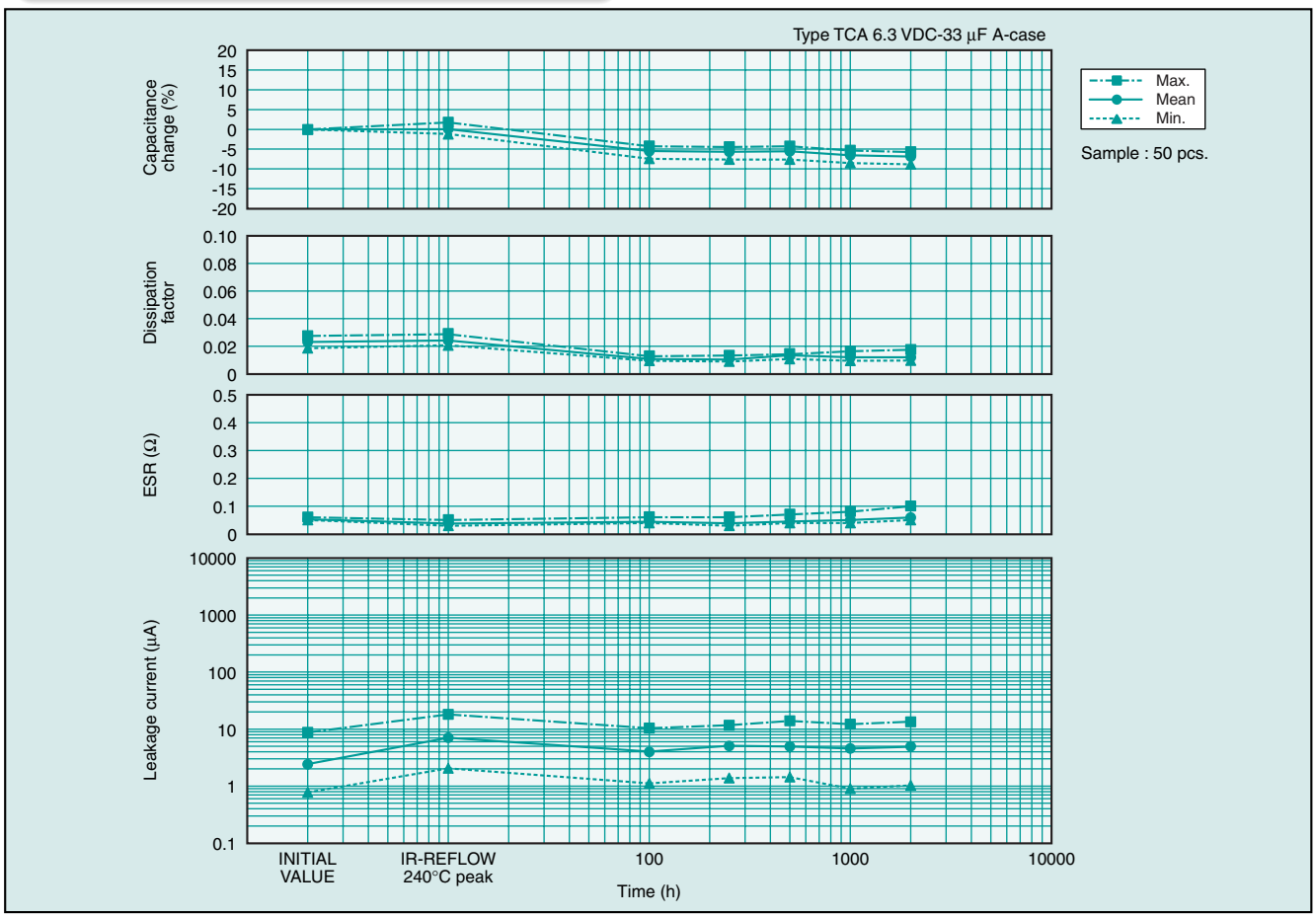
HIGH TEMPERATURE / MOISTURE 40°C, 95%RH



ENDURANCE Ⅰ 85°C RATED VOLTAGE 6.3 V



ENDURANCE Ⅱ 105°C DERATED VOLTAGE 5.0 V

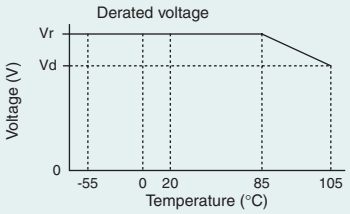


⚠Application Notes for Tantalum Solid Electrolytic Capacitor with Conductive Polymer

1. Operating voltage

The capacitors shall be operated at the rated voltage or lower. Over rated voltage applied even for a short time may cause short failure.
When designing the circuit, the equipment's required reliability must be considered and appropriate voltage derating must be performed.

· Recommended operating voltage : 80% or less of the rated voltage
· When the operating temperature exceeds 85°C, derate the applied voltage.
The voltage derating formula is shown below.



The derated voltage VT, at a temperature T, between 85 to 105°C is obtained by the following formula.

$$VT = Vr - \frac{Vr - Vd}{20}(T-85)$$

Vr : Rated voltage,
Vd : Derated voltage at 105°C.

Vr	Rated voltage (VDC)	2.5	4	6.3	10
Vd	Derated voltage (VDC)	2.0	3.2	5.0	8.0

2. Application that contain AC Voltage

Special attention to the following 3 items.
(1) The sum of the DC bias voltage and the positive peak value of the AC voltage should not exceed the rated voltage.
(2) Reverse voltage should not exceed the allowable values of the negative peak AC voltage.
(3) Ripple voltage should not exceed the allowable values.

3. Reverse voltage

Special attention to the polar character.
Reverse Voltage should not be applied.

4. Permissible ripple current

The permissible ripple current and voltage at about 100 kHz or higher can be determined by the following formula from the permissible power loss for each case size (Pmax value) shown in Table 1 and the specified ESR value. However, when the expected operating temperature is higher than room temperature, determine the permissible values multiplying the Pmax value by the specified multiplier (Table 2).
For the permissible values at different frequencies, consult our Sales Department.

$$P = I^2 \times ESR \text{ or } P = \frac{E^2 \times ESR}{Z^2}$$

Permissible ripple current $Imax = \sqrt{\frac{Pmax}{ESR}}$ (Arms)

Permissible ripple voltage $Emax = \sqrt{\frac{Pmax}{ESR}} \times Z = Imax \times Z$ (Vrms)

Imax : Permissible ripple current at regulated frequency (Arms : RMS value)
Emax : Permissible ripple voltage at regulated frequency (Vrms : RMS value)
Pmax : Permissible power loss (W)
ESR : Specified ESR value at regulated frequency (Ω)
Z : Impedance at regulated frequency (Ω)

Table 1 Permissible power loss for each case size

Case size	Pmax (W)
S	0.043
AL	0.044
A	0.045
B	0.050
C_3	0.065
DL	0.075
D_3	0.085

Note: Above values are measured at 0.8t glass epoxy board mounting in free air and may be changed depending on the kind of board, packing density, and air convection condition. Please consult us if calculated power loss value is different from above list of P max value.

Table 2 Pmax multiplier at each operating temperature

Operating temperature(°C)	Multiplier
20	1.0
55	0.9
85	0.8
105	0.4

5. Non Polar Connection

The capacitor cannot be used as a non-polar unit.

6. Soldering

6.1 Preheating

To obtain optimal reliability, lowering the heat shock during the soldering process is favorable. Capacitors should be pre-heated at 130-160°C for approximately 60 seconds.

6.2 Soldering

The body of the capacitor should not exceed 240°C during soldering.
(1) Reflow Soldering
Reflow soldering is a process in which the capacitors are mounted on a printed circuit board with solder paste. Two methods of Reflow Soldering: Direct and Atmospheric Heat.
· Direct Heat (Hot plate)
· Atmospheric Heat
a) Near and Far IR Ray
b) Convection Oven
Vapor Phase Soldering and Flow Soldering are not recommended.
(2) Soldering Iron
Soldering with a soldering iron cannot be recommended due to the lack of consistency in maintaining temperatures and process times. If this method should be necessary, the iron should never touch the capacitor's terminals, and the temperature of the soldering iron should never exceed 350°C. The application of the iron should not exceed 3 seconds and 30 watt.
(3) Please consult us for other methods.

7. Solvent cleaning

Cleaning by organic solvent may damage capacitor's appearance and performance. However, our capacitors are not effected even when soaked at 20-30°C 2-propanol for 5 minutes. When introducing new cleaning methods or changing the cleaning term, please consult us.

8. Ultrasonic cleaning

Ultrasonic cleaning under severe condition may break terminals. Also, from an electrical characteristics aspect, it is unfavorable. Therefore, please do not use ultrasonic cleaning if possible. If the Ultrasonic cleaning process will be used, please note the following.
(1) The solvent should not be boiled. (Lower the ultrasonic wave output or use solvent with the high boiling point.)
(2) The recommended wattage is less than 0.5 watts per cm^2.
(3) The cleaning time should be kept to a minimum. Also, samples must be swang in the solvent. Please consult us.

9. Storage

Capacitors should be tightly sealed in moisture prevention bag and stored with supplied reel.

10. Inapplicable circuits

The capacitors may cause nonconformity if they are used on the following circuits.
(1) High-impedance voltage holding circuits
(2) Coupling circuits
(3) Time constant circuits
(4) Circuits significantly affected by leakage current

If a short circuit occurs, the capacitors may generate heat or smoke depending on the short-circuit current.
When designing a circuit, take the instructions stated herein into consideration, and take as much redundant measures as possible.

These application notes are prepared based on the technical report RCR-2368B "Guideline of notabilia for fixed tantalum electrolytic capacitors with solid electrolyte for use in electronic equipment" issued by Japan Electronics and Information Technology Industries Association. For the details of the instructions (explanation, reasons and concrete examples), please refer to this guideline, or consult our Sales Department.

MATSUO ELECTRIC CO., LTD.

Please feel free to ask our Sales Department for more information on the Tantalum Solid Electrolytic Capacitor with Conductive Polymer.

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