No.P-TCB-E019/1
DATE 2025-02

PRODUCTS DATA SHEET

Face-down terminal structure

Tantalum Solid Electrolytic Capacitors with Conductive Polymer

Type TCB

RoHS COMPLIANT
LEAD FREE

MATSUO ELECTRIC CO., LTD.

OUTLINE(Type TCB)

Type TCB is a tantalum solid electrolytic capacitor with face-down terminal which uses conductive polymer as cathode layer.
Their equivalent series resistance (ESR) is extremely lowered with 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, smart 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 low ESR and impedance possible.
   Type TCB 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. Ultra Compact and Large capacitance
   The face-down terminal structure makes it possible to design land almost in same size as terminals. As result,
   components can be downsized, and mounting area can be reduced to 1/2 to 1/3 compared to the conventional structures.
4. Flame Retardancy
   Type TCB 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. Perfect Lead Free and RoHS Compliant.

APPLICATION CLASSIFICATION BY USE

The application classification by use which divided the market and use into four is set up supposing our products being used for a broad use.
Please confirm the application classification by use of each product that you intend to use.
Moreover, please be sure to inform to our Sales Department in advance in examination of the use of those other than the indicated use.

RATING

Item	Rating
Failure Rate Level	1% / 1000 h
Category Temperature Range	-55 to +105°C (to be used at derated voltage when temperature exceeds Rated Temperature)
Rated Temperature	+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	4.7～220 μF
Capacitance Tolerances	±20% (M)

* Rated temperature and the Derated voltage include a different thing by a specification number.
Please refer to application notes in the use.

ORDERING INFORMATION

TCB	1002	226	M	R	10A	50	0150
TYPE	RATED VOLTAGE	CAPACITANCE	CAPACITANCE TOLERANCE	STYLE OF REELED PACKAGE	CASE CODE	SPECIFICATION NUMBER	ESR（mΩ）

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

Capacitance	Marking
4.7 μF	475
6.8 μF	685
10μF	106
15μF	156
22μF	226
33μF	336
47μF	476
68μF	686
100μF	107
220μF	227

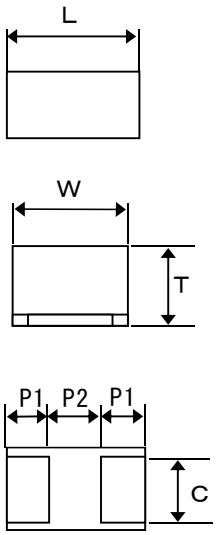
Capacitance Tolerance	Marking
±20%	M

Anode Notation	Reel Size	Code
Feed hole: -	ϕ 180 Reel	R

Case Code	Height of component max. (mm)	Case Size
09M	0.9	1608
10M	1.0	1608
10S	1.0	2012
12S	1.2	2012
13S	1.3	2012
10A	1.0	3216
12A	1.2	3216
13A	1.3	3216

Specification Number	Specification Contents
Blanks	Rated Temperature +85℃
08	Rated Temperature +65℃
50	Rated Temperature +85℃

DIMENSIONS



[Standard Rating] (mm)

Case Code	Case Size	Max.height	L	W	T	P_1 ±0.1	P_2 ±0.1	C
09M	1608	0.9	1.6 +0.2/-0	0.85 +0.2/-0	0.8 ±0.1	0.5	0.75	0.65 ±0.07
12S	2012	1.2	2.0 ±0.1	1.25 ±0.1	1.1 ±0.1	0.5	1.05	0.9±0.1
12A	3216	1.2	3.2 ±0.1	1.6 ±0.1	1.1 ±0.1	0.8	1.65	1.2±0.1

[Low Profile Rating] (mm)

Case Code	Case Size	Max.height	L ±0.1	W ±0.1	T ±0.1	P_1 ±0.1	P_2 ±0.1	C ±0.1
10S	2012	1.0	2	1.25	0.9	0.5	1.05	0.9
10A	3216	1.0	3.2	1.6	0.9	0.8	1.65	1.2

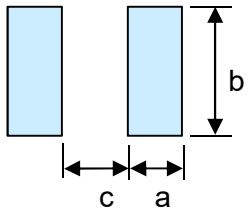
[Custom Profile Rating][Specification Number 08 Profile Rating] (mm)

Case Code	Case Size	Max.height	L ±0.1	W ±0.1	T ±0.1	P_1 ±0.1	P_2 ±0.1	C ±0.1
13S	2012	1.3	2	1.25	1.2	0.5	1.05	0.9
13A	3216	1.3	3.2	1.6	1.2	0.8	1.65	1.2

[Specification Number 50 Profile Rating] ※Dimensional Tolerance of Specification Number 50 is as below. (mm)

Case Code	Case Size	Max.height	L -0.2/-0	W -0.2/-0	T ±0.1	P_1 ±0.1	P_2 ±0.1	C
10M	1608	1.0	1.6	0.85	0.9	0.5	0.75	0.65 ±0.07
12S	2012	1.2	2	1.25	1.1	0.5	1.15	0.9 ±0.1

RECOMMENDED SOLDER PAD LAYOUT



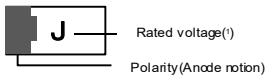
(mm)

Case Code	a	b	c
09M	0.60 or more	0.65	0.65
10M（Spec. Number 50）	0.60 or more	0.65	0.65
10S,12S,13S	0.50 or more	0.8	1.05
12S（Spec. Number 50）	0.50 or more	0.8	1.15
10A,12A,13A	0.80 or more	1.1	1.65

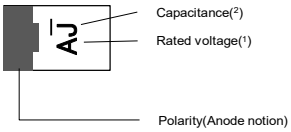
In order to expect the self alignment effect, it is recommended that the land width is almost the same size as terminal of capacitor, and space between lands(c) nearly equal to the space between terminals for appropriate soldering.
Adjust the mask opening so that the mask thickness is equivalent to 100μm.

MARKING

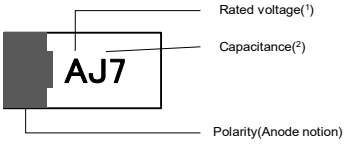
[M case]



[S case]



[A case]



(1) Rated voltage is indicated with one alphabetic letter.

Rated voltage (VDC)	Mcase ,Scase	Acase
2.5	e	
4	G	
6.3	J	j
10	A	A

(2)Capacitance is shown by the code below.

Capacitance (μF)	Mcase	Scase	Acase
4.7	no-print		
6.8	no-print		
10	no-print		
15	no-print		
22	no-print	J	J7
47	no-print	S	S7
68			W7
100		A	A8
220			J8

RATING

June , 2024

[STANDARE RATING]

R.V.(VDC) / Cap.(μF)	2.5	4	6.3	10
4.7	09M(200,500)	09M(200,500)	09M(200,500)	09M(200,500)
6.8	09M(200,500)	09M(200,500)	09M(200,500)	09M(200,500)
10	09M(200,500)	09M(200,500)	09M(200,500)	09M(200)
15	09M(200,500)	09M(200,500)		
22			09M(200)	12S(150)
47			12S(150,200)	12A(150,250)
68			12A(150)	
100			12A(70,150)	

[LOW PROFILE RATING]

R.V.(VDC) / Cap.(μF)	2.5	4	6.3	10
22			10S(150)	10A(60,150)
47			10S(200)	
100			10A(90,200)	

[CUSTOM PROFILE RATING]

R.V.(VDC) / Cap.(μF)	2.5	4	6.3	10
100			13S(200)	

[SPECIFICATION NUMBER 08 PROFILE RATING]

R.V.(VDC) / Cap.(μF)	2.5	4	6.3	10
220			13A(150)	

[SPECIFICATION NUMBER 50 PROFILE RATING]

R.V.(VDC) / Cap.(μF)	2.5	4	6.3	10
47			10M(200)	
100			12S(200)	

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

CATALOG NUMBERS AND RATING

June , 2024

Catalog number [1]	Rated voltage	Capacitance	Tolerance	Case code	Lct. (μA)			Max. Dissipation factor			ESR mΩ	Max.permissible Ripple Current [2]	Surge			Resistance to soldering heat			Rapid change of temp.			Damp heat			Endurance Ⅰ			Endurance Ⅱ		
	VDC	μF	±%		20℃	85℃	105℃	-55℃	20℃	105℃	100kHz	mArms 100kHz	Lct.[3]	ΔC/C%	DF[4]	Lct.[3]	ΔC/C%	DF[4]	Lct.[3]	ΔC/C%	DF[4]	Lct.[3]	ΔC/C%	DF[4]	Lct.[3]	ΔC/C%	DF[4]	Lct.[3]	ΔC/C%	DF[4]
TCB 2501 475 M _[1] 09M 0500	2.5	4.7	20	09M	1.18	11.8	11.8	0.10	0.10	0.15	500	337	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 2501 475 M _[1] 09M 0200	↓	4.7	↓	09M	1.18	11.8	11.8	0.10	0.10	0.15	200	533	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 2501 685 M _[1] 09M 0500	↓	6.8	↓	09M	1.70	17.0	17.0	0.10	0.10	0.15	500	337	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 2501 685 M _[1] 09M 0200	↓	6.8	↓	09M	1.70	17.0	17.0	0.10	0.10	0.15	200	533	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 2501 106 M _[1] 09M 0500	↓	10	↓	09M	2.50	25.0	25.0	0.10	0.10	0.15	500	337	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 2501 106 M _[1] 09M 0200	↓	10	↓	09M	2.50	25.0	25.0	0.10	0.10	0.15	200	533	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 2501 156 M _[1] 09M 0500	↓	15	↓	09M	3.75	37.5	37.5	0.10	0.10	0.15	500	337	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 2501 156 M _[1] 09M 0200	↓	15	↓	09M	3.75	37.5	37.5	0.10	0.10	0.15	200	533	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 4001 475 M _[1] 09M 0500	4	4.7	20	09M	1.88	18.8	18.8	0.10	0.10	0.15	500	337	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 4001 475 M _[1] 09M 0200	↓	4.7	↓	09M	1.88	18.8	18.8	0.10	0.10	0.15	200	533	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 4001 685 M _[1] 09M 0500	↓	6.8	↓	09M	2.72	27.2	27.2	0.10	0.10	0.15	500	337	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 4001 685 M _[1] 09M 0200	↓	6.8	↓	09M	2.72	27.2	27.2	0.10	0.10	0.15	200	533	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 4001 106 M _[1] 09M 0500	↓	10	↓	09M	4.00	40.0	40.0	0.10	0.10	0.15	500	337	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 4001 106 M _[1] 09M 0200	↓	10	↓	09M	4.00	40.0	40.0	0.10	0.10	0.15	200	533	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 4001 156 M _[1] 09M 0500	↓	15	↓	09M	6.00	60.0	60.0	0.10	0.10	0.15	500	337	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 4001 156 M _[1] 09M 0200	↓	15	↓	09M	6.00	60.0	60.0	0.10	0.10	0.15	200	533	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 6301 475 M _[1] 09M 0500	6.3	4.7	20	09M	2.96	29.6	29.6	0.10	0.10	0.15	500	337	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 6301 475 M _[1] 09M 0200	↓	4.7	↓	09M	2.96	29.6	29.6	0.10	0.10	0.15	200	533	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 6301 685 M _[1] 09M 0500	↓	6.8	↓	09M	4.28	42.8	42.8	0.10	0.10	0.15	500	337	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 6301 685 M _[1] 09M 0200	↓	6.8	↓	09M	4.28	42.8	42.8	0.10	0.10	0.15	200	533	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 6301 106 M _[1] 09M 0500	↓	10	↓	09M	6.30	63.0	63.0	0.10	0.10	0.15	500	337	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 6301 106 M _[1] 09M 0200	↓	10	↓	09M	6.30	63.0	63.0	0.10	0.10	0.15	200	533	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 6301 226 M _[1] 09M 0200	↓	22	↓	09M	13.8	138	138	0.10	0.10	0.15	200	533	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	D	±20	C	D	±20	D
TCB 6301 226 M _[1] 10S 0150	↓	22	↓	10S	13.8	138	138	0.06	0.06	0.09	150	658	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 6301 476 M _[1] 10S 0200	↓	47	↓	10S	29.6	296	296	0.08	0.08	0.12	200	570	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 6301 476 M _[1] 12S 0200	↓	47	↓	12S	29.6	296	296	0.08	0.08	0.12	200	570	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 6301 476 M _[1] 12S 0150	↓	47	↓	12S	29.6	296	296	0.08	0.08	0.12	150	658	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 6301 476 M _[1] 10M 50 0200	↓	47	↓	10M	59.2	592	592	0.10	0.10	0.15	200	533	C	±20	A	C	±20	B	C	±20	C	C	+40/-20	C	C	±20	C	C	±20	D
TCB 6301 686 M _[1] 12A 0150	↓	68	↓	12A	42.8	428	428	0.08	0.08	0.12	150	721	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 6301 107 M _[1] 10A 0200	↓	100	↓	10A	63.0	630	630	0.10	0.10	0.15	200	624	C	±20	A	C	±20	B	C	±20	C	C	+40/-20	C	D	±20	C	D	±20	D
TCB 6301 107 M _[1] 10A 0090	↓	100	↓	10A	63.0	630	630	0.10	0.10	0.15	90	930	C	±20	A	C	±20	B	C	±20	C	C	+40/-20	C	D	±20	C	D	±20	D
TCB 6301 107 M _[1] 12A 0150	↓	100	↓	12A	63.0	630	630	0.08	0.08	0.12	150	721	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 6301 107 M _[1] 12A 0070	↓	100	↓	12A	63.0	630	630	0.08	0.08	0.12	70	1055	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 6301 107 M _[1] 12S 50 0200	↓	100	↓	12S	126.0	1260	1260	0.10	0.10	0.15	200	574	C	±20	A	C	±20	B	C	±20	C	C	+40/-20	C	C	±20	C	C	±20	D
TCB 6301 107 M _[1] 13S 0200	↓	100	↓	13S	126.0	1260	1260	0.10	0.10	0.15	200	570	C	±20	A	C	±20	B	C	±20	C	C	+40/-20	C	C	±20	C	C	±20	D
TCB 6301 227 M _[1] 13A 08 0150	↓	220	↓	13A	277.0	2770	2770	0.20	0.20	0.30	150	721	C	±20	A	C	±20	B	C	±20	C	C	+40/-20	C	C	±20	C	-	-	-
TCB 1002 475 M _[1] 09M 0500	10	4.7	20	09M	4.70	47.0	47.0	0.10	0.10	0.15	500	337	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 1002 475 M _[1] 09M 0200	↓	4.7	↓	09M	4.70	47.0	47.0	0.10	0.10	0.15	200	533	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 1002 685 M _[1] 09M 0500	↓	6.8	↓	09M	6.80	68.0	68.0	0.10	0.10	0.15	500	337	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 1002 685 M _[1] 09M 0200	↓	6.8	↓	09M	6.80	68.0	68.0	0.10	0.10	0.15	200	533	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 1002 106 M _[1] 09M 0200	↓	10	↓	09M	10.0	100	100	0.10	0.10	0.15	200	533	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 1002 226 M _[1] 10A 0150	↓	22	↓	10A	22.0	220	220	0.06	0.06	0.09	150	721	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 1002 226 M _[1] 10A 0060	↓	22	↓	10A	22.0	220	220	0.06	0.06	0.09	60	1140	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 1002 226 M _[1] 12S 0150	↓	22	↓	12S	22.0	220	220	0.06	0.06	0.09	150	658	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 1002 476 M _[1] 12A 0150	↓	47	↓	12A	47.0	470	470	0.08	0.08	0.12	150	721	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D
TCB 1002 476 M _[1] 12A 0250	↓	47	↓	12A	47.0	470	470	0.08	0.08	0.12	250	558	C	±20	A	B	±20	B	B	±20	C	B	+40/-20	C	B	±20	C	B	±20	D

Note1 : Catalog number[2]: For Reeled Package, insert "R" into _[1].

Note2 : Max.permissible Ripple Current [2]: Reference value.

Note3 : Lct.[3] : A=Shall not exceed the value of initial specification., B=Shall not exceed 2 times the value of initial specification. , C=Shall not exceed 3 times the value of initial specification. , D=Shall not exceed 4 times the value of initial specification. ,

Note4 : DF[4] : A=Shall not exceed the value of initial specification., B=Shall not exceed 1.3 times the value of initial specification.,C=Shall not exceed 1.5 times the value of initial specification.,D=Shall not exceed 3 times the value of initial specification.

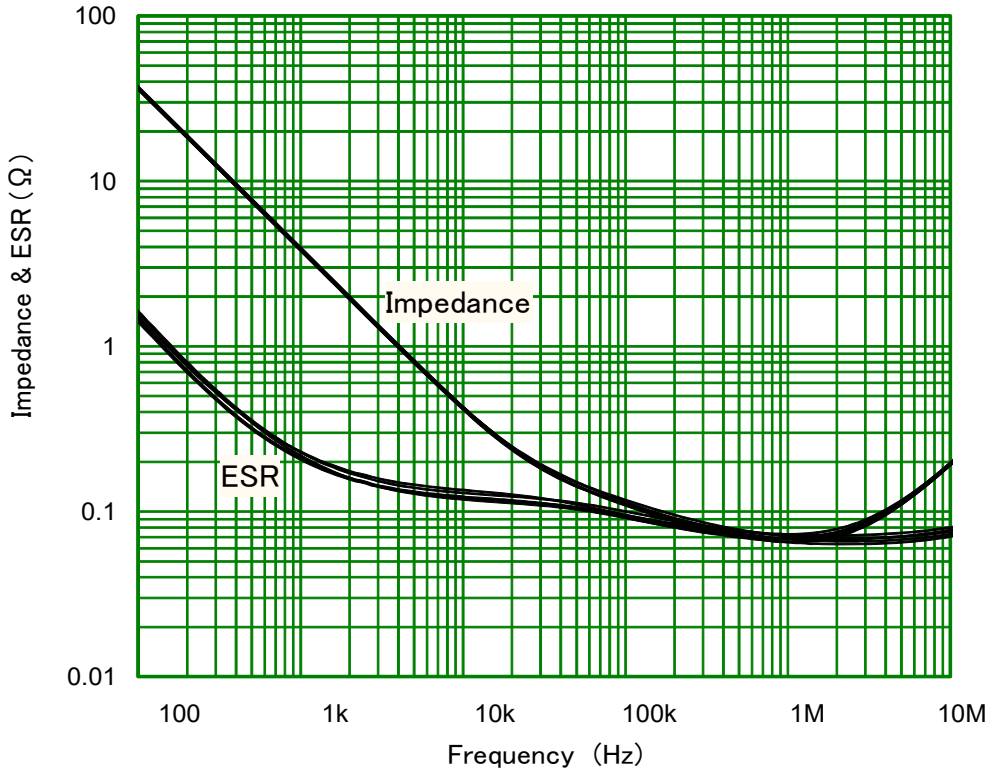
PERFORMANCE

<table>
<tr><th>No</th><th colspan="3">Item</th><th>Performance</th><th>Test Method</th></tr>
<tr><td>1</td><td colspan="3">Leakage Current (μA)</td><td>Shall not exceed the values shown in CATALOG NUMBERS AND RATING.</td><td>JIS C 5101-1, 4.9
Applied voltage : Rated voltage
Duration : 5 min
Measuring temperature : 20 ±2℃</td></tr>
<tr><td>2</td><td colspan="3">Capacitance (μF)</td><td>Shall be within specified tolerances.</td><td>JIS C 5101-1, 4.7
Measuring frequency : 120Hz ±20%
Measuring temperature : 20 ±2℃</td></tr>
<tr><td>3</td><td colspan="3">Dissipation Factor</td><td>Shall not exceed the values shown in CATALOG NUMBERS AND RATING.</td><td>JIS C 5101-1, 4.8
Test conditions shown in No.2</td></tr>
<tr><td>4</td><td colspan="3">Equivalent Series Resistance</td><td>Shall not exceed the values shown in CATALOG NUMBERS AND RATING.</td><td>JIS C 5101-1, 4.8
Measuring frequency : 100 kHz ±10%
Measuring temperature : 20 ±2℃</td></tr>
<tr><td rowspan="7">5</td><td colspan="3">Characteristics at High and Low Temperature</td><td></td><td>JIS C 5101-1, 4.29</td></tr>
<tr><td>Step 1</td><td>Leakage Current
Capacitance
Dissipation Factor</td><td>Shall not exceed the value in CATALOG NUMBERS AND RATING.
Within specified tolerances
Shall not exceed the value in CATALOG NUMBERS AND RATING.</td><td>20 ±2℃</td></tr>
<tr><td>Step 2</td><td>Capacitance
Dissipation Factor</td><td>Within 0/-20% of value at Step 1
Shall not exceed the value in CATALOG NUMBERS AND RATING.</td><td>-55 ±3℃</td></tr>
<tr><td>Step 3</td><td>Leakage Current
Capacitance
Dissipation Factor</td><td>Shall not exceed the value in CATALOG NUMBERS AND RATING.
Within ± 5% of value at Step 1
Shall not exceed the value in CATALOG NUMBERS AND RATING.</td><td>20 ±2℃</td></tr>
<tr><td>Step 4</td><td>Leakage Current</td><td>Shall not exceed the values shown in CATALOG NUMBERS AND RATING.</td><td>85 ±2℃
*Specification Number 08 : 65 ±2℃</td></tr>
<tr><td>Step 5</td><td>Leakage Current
Capacitance
Dissipation Factor</td><td>Shall not exceed the values shown in CATALOG NUMBERS AND RATING.
Within +50/0% of value at Step 1
Shall not exceed the values shown in CATALOG NUMBERS AND RATING.</td><td>105 ±2℃
Derated voltage at 105℃</td></tr>
<tr><td>Step 6</td><td>Leakage Current
Capacitance
Dissipation Factor</td><td>Shall not exceed the values shown in CATALOG NUMBERS AND RATING.
Within ± 5% of value at Step 1
Shall not exceed the values shown in CATALOG NUMBERS AND RATING.</td><td>20 ±2℃</td></tr>
<tr><td>6</td><td colspan="2">Surge</td><td>Leakage current
Capacitance change
Dissipation Factor
Visual Examination</td><td>Shall not exceed the values shown in CATALOG NUMBERS AND RATING.
Shown in CATALOG NUMBERS AND RATING.
Shall not exceed the values shown in CATALOG NUMBERS AND RATING.
There shall be no evidence of mechanical damage.</td><td>JIS C 5101-1, 4.26
Test temperature : 85℃ and 105℃
Applied voltage : According to the following table
<table>
<tr><td colspan="2">Rated voltage (VDC)</td><td>2.5</td><td>4</td><td>6.3</td><td>10</td></tr>
<tr><td rowspan="2">Surge voltage (VDC)</td><td>85℃</td><td>3.3</td><td>5.2</td><td>8.2</td><td>13</td></tr>
<tr><td>105℃</td><td>2.6</td><td>4.2</td><td>6.5</td><td>10.4</td></tr>
</table>
*Specification Number 08
<table>
<tr><td colspan="2">Rated voltage (VDC)</td><td>6.3</td></tr>
<tr><td>Surge voltage (VDC)</td><td>65℃</td><td>8.2</td></tr>
</table>
Series protective resistance : 1000Ω
Discharge resistance : 1000Ω</td></tr>
<tr><td>7</td><td colspan="2">Shear Test</td><td></td><td>There shall be no evidence of mechanical damage.</td><td>JIS C 5101-1, 4.34
Force : M/S/A case: 5N
Holding time : 10±1 sec</td></tr>
<tr><td>8</td><td>Substrate
Bending Test</td><td>Capacitance
Visual Examination</td><td>Initial value to remain steady during measurement.
There shall be no evidence of mechanical damage.</td><td>JIS C 5101-1, 4.35
Bending : 1 mm</td></tr>
<tr><td>9</td><td>Vibration</td><td>Capacitance
Visual Examination</td><td>Initial value to remain steady during measurement.
There shall be no evidence of mechanical damage.</td><td>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 erpendicular directions (total 6 hours)
Mounting : Solder terminal to the printed board</td></tr>
<tr><td>10</td><td colspan="2">Shock</td><td>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.</td><td>JIS C 5101-1 4.19
Peak acceleration : 490 m/s^2
Duration : 11 ms
Wave form : Half-sine</td></tr>
<tr><td>11</td><td colspan="2">Solderability</td><td>Solder shall be in close contact with terminal (pinholes, non-solderability and solder repelling are not allowed). (1)
Note (1) : If any question arises relating to the judgment, make sure that the part dipped in solder, more than 3/4 of the terminal surface, is covered with new solder.</td><td>JIS C 5101-1 4.15
Solder temperature : 235 ±5℃
Dipping time : 2 ±0.5 sec
Dipping depth : Terminal shall be dipped into melted solder</td></tr>
<tr><td>12</td><td>Resistance to Soldering Heat</td><td>Leakage Current
Capacitance change
Dissipation Factor
Visual Examination</td><td>Shall not exceed the values shown in CATALOG NUMBERS AND RATING.
Shown in CATALOG NUMBERS AND RATING.
Shall not exceed the values shown in CATALOG NUMBERS AND RATING.
There shall be no evidence of mechanical damage.</td><td>JIS C 5101-1, 4.14
IR reflow Preheating : 150 to 200℃, 180 sec.(max.)
Reflow : 217℃,90 sec.(max.)
Peak : 260°C 5sec.(max.)
Number of cycles : 2</td></tr>
<tr><td>13</td><td>Component solvent resistance</td><td>Leakage Current
Capacitance change
Dissipation Factor</td><td>Shall not exceed the values shown in CATALOG NUMBERS AND RATING.
Shown in CATALOG NUMBERS AND RATING.
Shall not exceed the values shown in CATALOG NUMBERS AND RATING.</td><td>JIS C 5101-1 4.31
Temperature : 23 ±5℃
Dipping time : 5 ±0.5 min.
Conditioning : JIS C 0052 method 2
Solvent : 2-proparol (Isopropyl alcohol)</td></tr>
</table>

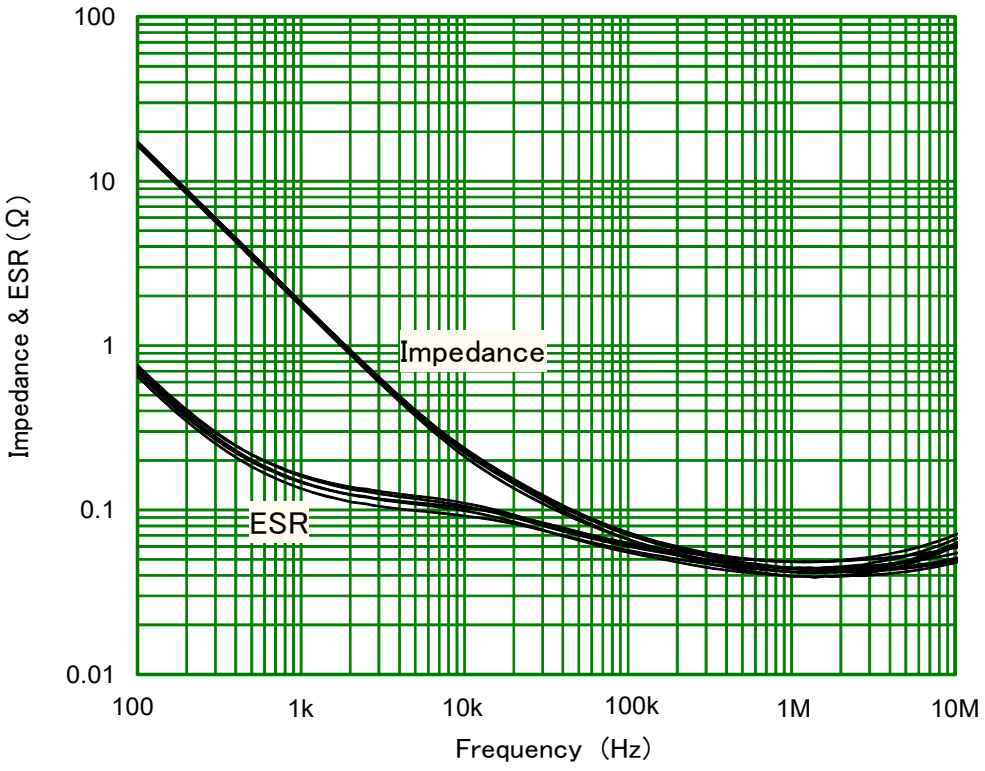
No	Item		Performance	Test Method
14	Solvent resistance of marking	Visual examination	After the test the marking shall be legible.	JIS C 5101-1 4.32 Temperature : 23 ±5℃ Dipping time : 5 ±0.5 min. Conditioning : JIS C 0052 method 2 Solvent : 2-proparol (Isopropyl alcohol)
15	Rapid Change of Temperature	Leakage Current Capacitance change Dissipation Factor Visual Examination	Shall not exceed the values shown in CATALOG NUMBERS AND RATING. Shown in CATALOG NUMBERS AND RATING. Shall not exceed the values shown in CATALOG NUMBERS AND RATING. There shall be no evidence of mechanical damage.	JIS C 5101-1, 4.16 Step 1 : -55 ±3℃ , 30 ±3 min Step 2 : 25 +10/-5℃, 3 min or less Step 3 : 105 ±2℃, 30 ±3 min Step 4 : 25 +10/-5℃, 3 min or less Number of cycles : 5
16	Damp Heat, Steady State	Leakage Current Capacitance change Dissipation Factor Visual Examination	Shall not exceed the values shown in CATALOG NUMBERS AND RATING. Shown in CATALOG NUMBERS AND RATING. Shall not exceed the values shown in CATALOG NUMBERS AND RATING. There shall be no evidence of mechanical damage.	JIS C 5101-1, 4.22 Temperature : 40 ±2℃ Moisture : 90 to 95% RH Duration : 500 +24/0hrs
17	Endurance I	Leakage Current Capacitance change Dissipation Factor Visual Examination	Shall not exceed the values shown in CATALOG NUMBERS AND RATING. Shown in CATALOG NUMBERS AND RATING. Shall not exceed the values shown in CATALOG NUMBERS AND RATING. There shall be no evidence of mechanical damage.	JIS C 5101-1, 4.23 Test temperature : Rated temperature Applied voltage : Rated voltage Duration : 1000 -48/0hrs Power supply impedance : 3Ω or less
18	Endurance II * specification number 08 articles do not apply it.	Leakage Current Capacitance change Dissipation Factor Visual Examination	Shall not exceed the values shown in CATALOG NUMBERS AND RATING. Shown in CATALOG NUMBERS AND RATING. Shall not exceed the values shown in CATALOG NUMBERS AND RATING. There shall be no evidence of mechanical damage.	JIS C 5101-1, 4.23 Test temperature : 105 ±2℃ Applied voltage : Derated voltage Duration : 1000 +48/0hrs For 6.3V-100μF 13S : 240 ±8 hrs Power supply impedance : 3Ω or less

FREQUENCY CHARACTERISTICS

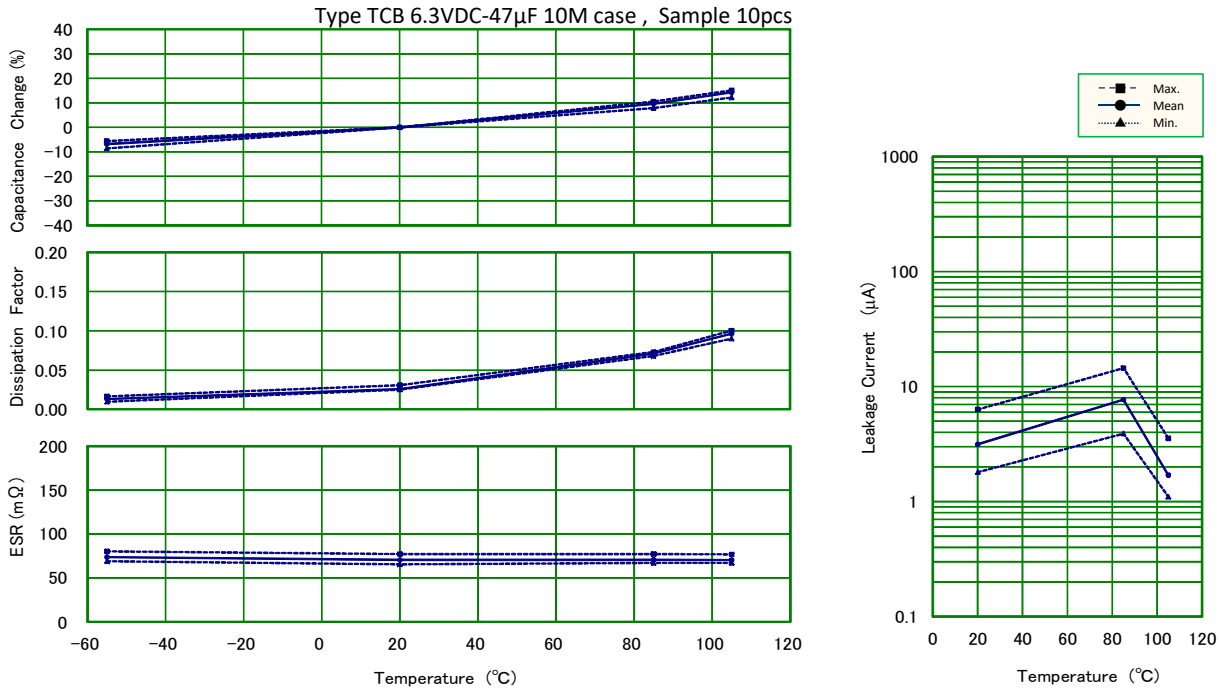
Type TCB 6.3VDC-47μF 10M case , Sample 5pcs



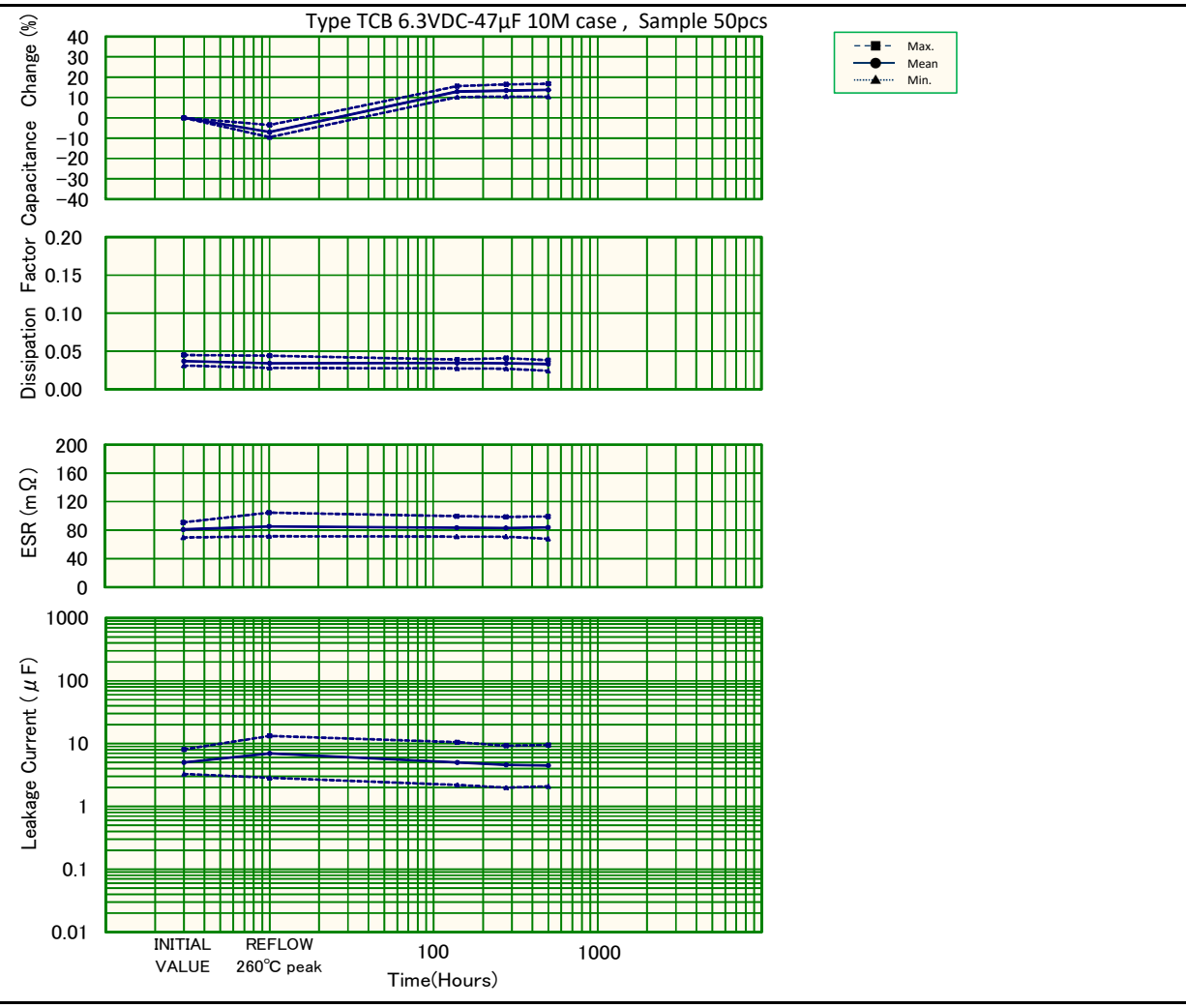
Type TCB 6.3VDC-100μF 12S case , Sample 5pcs



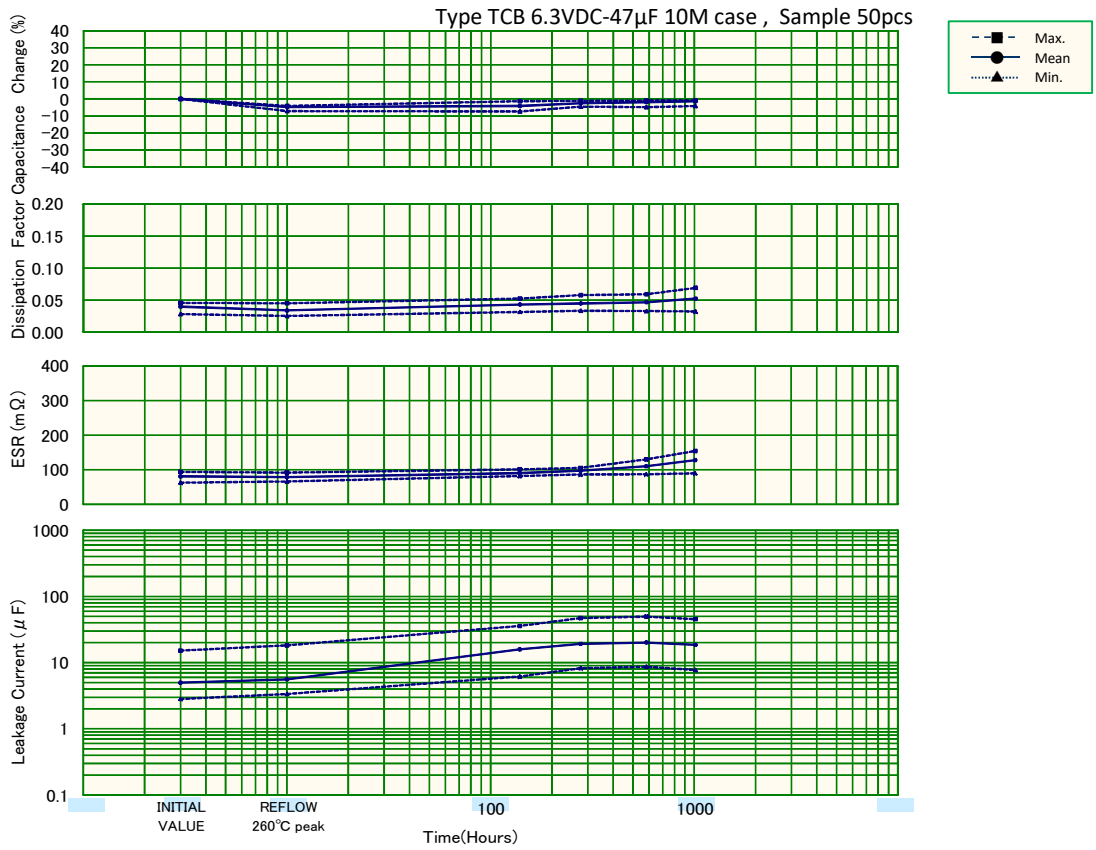
CHARACTERISTICS AT HIGH AND LOW TEMPERATURE



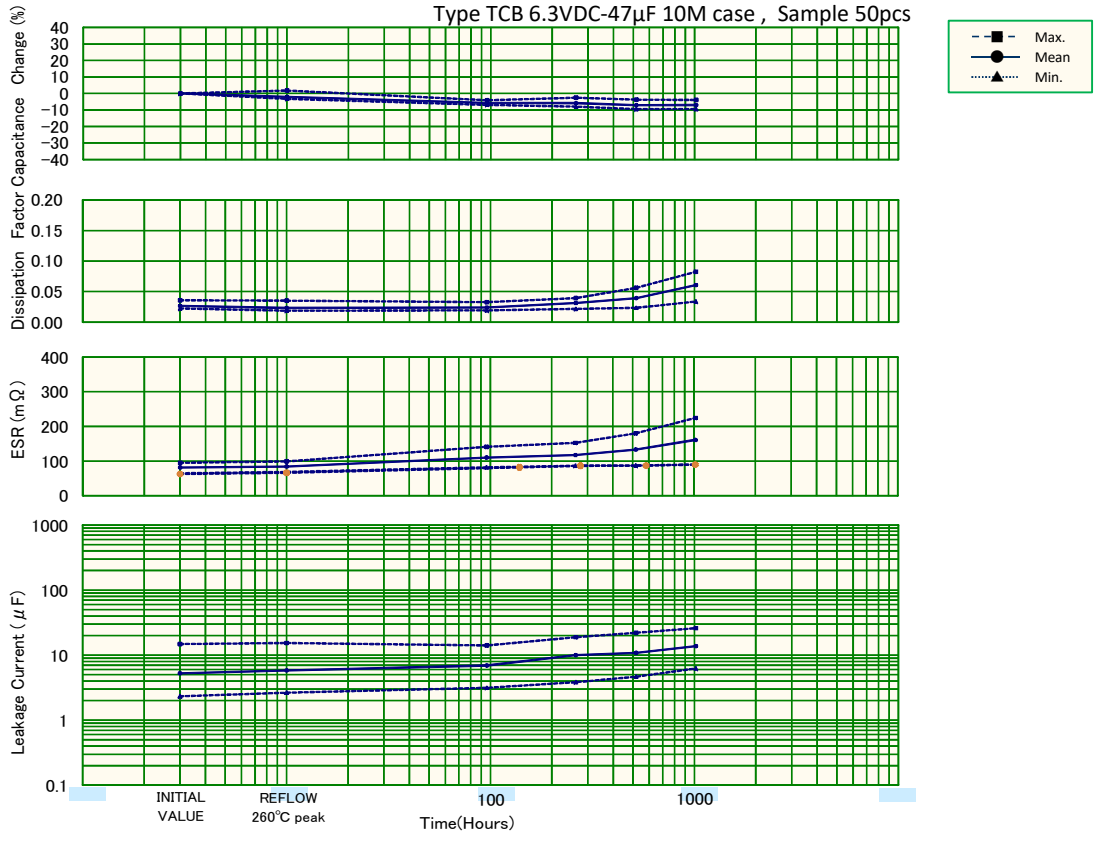
DAMP HEAT STEADY STATE 40℃ , 95%RH



ENDURANCE Ⅰ 85℃ RATED VOLTAGE



ENDURANCE Ⅱ 105℃ DERATED VOLTAGE

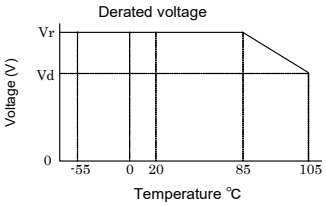


Application Notes for Tantalum Solid Electrolytic Capacitor with Conductive Polymer Type TCB

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 rated temperature, derate the applied voltage. The voltage derating formula of rated temperature 85℃ is shown below.



Derating voltage Vt at any temperature T between 85℃ and 105℃ shall be calculated by the follwing formula.

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

Vr : Rated voltage
Vd : Derating voltage at 105℃

Property value of the specification number

Specification Number	Rated Temperature			Rated voltage (VDC)			
			Temperature	2.5	4.0	6.3	10.0
Blanks,50	+85℃	Derated voltage Vd(VDC)	+105℃	2.0	3.2	5.0	8.0
08	+65℃		+85℃	-	-	4.5	-
			+105℃	-	-	3.3	-

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 code (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.

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

$$\text{Permissible ripple current } Imax = \sqrt{\frac{P\ max}{ESR}} \quad (Arms)$$

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

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 code

Case Code	Pmax（W）
09M	0.057
10M（Specification Number 50）	0.057
10S,12S,13S	0.063
12S（Specification Number 50）	0.066
10A,12A,13A	0.077

Table 2 Pmax multiplier at each operating temperature

Operating temperature（℃）	Multiplier
20	1.0
55	0.9
65	0.86
85	0.8
105	0.4

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.

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 150～200℃ for approximately 60～180 seconds.

6.2 Soldering

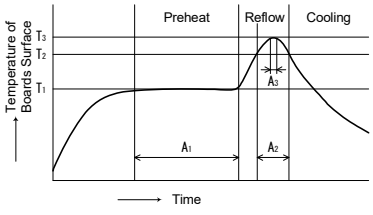
The body of the capacitor should not exceed 260℃ during soldering. Leakage current can be increased slightly due to the soldering heat. In this case, leakage current will be decreased gradually when leaving capacitors in the normal temperature and humidity adequately.

(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.
Recommended condition by IR Re-flow procedure is shown in picture-1.



Temperature	Time
T1= 150℃～200℃	A1=180sec.(max.)
T2= 217℃	A2=90sec.(max.)
T3= 260℃	A3=5sec.(max.)

- Number of cycles : 2

(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

The plastic reel (made of PS) used for packaging the product is intended for use in ambient temperatures (5-35℃). To prevent issues during automated insertion due to reel deformation or other factors, please keep the reel away from direct sunlight and heat sources, and ensure it does not reach high temperatures (above 60℃), including during transportation. Capacitors should be tightly sealed in moisture prevention bag and stored with supplied reel. After unpacking, capacitors should be used within the floor life listed in Table 3.

Moisture Sensitivity Level ：Table 3 shows the moisture sensitivity level and the floor life of the dampproof wrapping products.

Table 3 MSL&Floor Life

JEDEC MSL	Floor Life
3	168hrs.(7days)
	Less than 30℃/60%RH

（Reference IPC/JEDEC J-STD-020C July 2004）

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.

11. Additional Notes

Wear-out failure（Lifetime）

When the operating time exceeded the specified guarantee time of Endurance and Damp heat, the electric characteristics changes significantly and the open circuit might by the degradation of electrolyte.

Please note that the electric characteristics of capacitance and ESR might change within the specified range in specifications when it used under the condition of electric and mechanical performance.

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 Tantalum Solid Electrolytic Capacitor with Conductive Polymer.

Overseas Sales	5-3,3-Chome,Sennari-cho,Toyonaka-shi,Osaka 561-8558,Japan	Tel:06-6332-0883	Fax:06-6332-0920
Head office	5-3,3-Chome,Sennari-cho,Toyonaka-shi,Osaka 561-8558,Japan	Tel:06-6332-0871	Fax:06-6331-1386
URL	https://www.ncc-matsuo.co.jp/		

Specifications on this catalog are subject to change without prior notice. Please inquire of our Sales Department to confirm specifications prior to use.

適用用途分類 / APPLICATION CLASSIFICATION BY USE

Rev.6 (2023.03.01)

市場	適用用途分類	用途		推奨品種	推奨品種	推奨品種	推奨品種
		概要	代表的なアプリケーション例	チップタンタルコンデンサ	リード付タンタルコンデンサ	回路保護素子	フィルムコンデンサ
高信頼度機器	1	・高度な安全性や信頼性が要求される機器 ・製品の保守交換が不可能な機器、製品の故障が人命に直接かかわる、または、致命的なシステムダウンを引き起こす可能性がある機器	・宇宙開発機器関連(衛星、ロケット、人工衛星) ・航空・防衛システム ・原子力・火力・水力発電システム	267型Pシリーズ	111型Pシリーズ	該当なし	該当なし
車載・産業機器	2	・信頼性が重視される機器 ・製品の保守交換が極めて困難な機器や、製品の故障が人命に影響する、あるいは故障の範囲が広範囲である機器	・自動車および鉄道・船舶等の輸送機器の車両制御(エンジン制御,駆動制御,ブレーキ制御) ・新幹線・主要幹線の運行制御システム	267型Nシリーズ 271型Nシリーズ 279型Mシリーズ	111型Nシリーズ 111型Mシリーズ 112型Mシリーズ 204型Nシリーズ 247型	JAG型Nシリーズ JAJ型Nシリーズ JAK型Nシリーズ JHC型Nシリーズ KAB型Nシリーズ KVA型Nシリーズ	431型 431型Aシリーズ 503型 553型 801型 802型
	3	・製品の保守交換が可能な機器や、製品の故障が人命に影響しないが故障によるシステムダウンの損失が大きく保全管理が要求される機器	・エアコン,カーナビ等の車室内搭載部品、車載用通信機器 ・家庭用/ビル用等のセキュリティ管理システム ・工業用ロボットや工作機械等の制御機器	267型Mシリーズ 267型Eシリーズ 281型Mシリーズ TCA型	204型Mシリーズ	KAB型Mシリーズ	
汎用機器	4	・最先端技術を積極的に適用する小型・薄型品 ・製品の保守交換が可能な機器や、製品の故障によるシステムダウンが部分的な機器向けの市場で広く使用されることを想定した製品	・スマートフォン、携帯電話、モバイルPC(タブレット)、電子辞書 ・デスクトップPC、ノートPC、ホームネットワーク ・アミューズメント機器(パチンコ、ゲーム機)	251型Mシリーズ 281型Eシリーズ TCB型		JAE型、JAG型 JAJ型、JAK型 JHC型 KAB型 KAB型Tシリーズ KVA型	503型Aシリーズ

Market	Application classification by use	Use		Recommendation Type	Recommendation Type	Recommendation Type	Recommendation Type
		Outline	Typical example of application	Chip Tantalum Capacitors	Leaded Tantalum Capacitors	Circuit Protection Components	Film Capacitors
High reliability apparatus	1	- Apparatus in which advanced safety and reliability are demanded. - Whether failure of the apparatus which cannot maintenance exchange products, and a product is direct for a human life, apparatus which changes or may cause a fatal system failure.	- Space development apparatus relation (Satellite, Rocket, Artificial Satellite) - Aviation and a defensive system - Atomic power, fire power, and a water-power generation system	Type 267 P Sereis	Type 111 P series	With no relevance	With no relevance
In-vehicle – Industrial apparatus	2	- Apparatus in which reliability is important. - The apparatus in which maintenance exchange of a product is very difficult, and failure of a product influence a human life, or the range of failure is wide range.	- Vehicles control of transport machines, such as a car, and a railroad, a vessel (Engine control, drive control, brake control) - The operation control system of the Shinkansen and a main artery	Type 267 N Sereis Type 271 N Sereis Type 279 M Sereis	Type 111 N series Type 111 M series Type 112 M series Type 204 N series Type 247	Type JAG N series Type JAJ N series Type JAK N series Type JHC N series Type KAB N series Type KVA N series	Type 431 Type 431 A series Type 503 Type 553 Type 801 Type 802
	3	-Apparatus which can maintenance exchange products, and apparatus in which the loss of the system failure is large although failure of a product does not influence a human life, and maintenance engineering is demanded	- Vehicle indoor loading parts, such as an air-conditioner and car navigation, and in-vehicle communication facility - Security management system for home/buildings etc. - Control apparatus, such as Industrial use robots and a machine tool etc.	Type 267 M Sereis Type 267 E Sereis Type 281 M Sereis Type TCA	Type 204 M series	Type KAB M series	
Apparatus in general	4	- The small size and the thin article which applies leading-edge technology positively - The product supposing being used widely in the market for the apparatus which can maintenance exchange products, and apparatus with a partial system failure by failure of product.	-Smart phone, Mobile phone, Mobile PC (tablet), Electronic dictionary - Desktop PC, Notebook PC, Home network - Amusement apparatus (Pachinko,Game machine)	Type 251M Series Type 281 E Series Type TCB		Type JAE, Type JAG Type JAJ, Type JAK Type JHC Type KAB Type KAB T series Type KVA	Type 503 A series

テーピング数量・リール寸法
Taping Quantity And Carrier Tape Dimensions

チップタンタルコンデンサ
Chip Tantalum Capacitors

定格：251型Mシリーズ, TCB型
Type：251 M Series, TCB

ケース記号 Case Code	ケースサイズ Case size	W (mm)	F (mm)	E (mm)	P_1 (mm)	P_2 (mm)	P_0 (mm)	ϕD_0 (mm)	包装数/リール(個) Quantity/Reel (pcs)
									ϕ180
U	1.0×0.5	8.0±0.3	3.5±0.05	1.75±0.1	2.0±0.05	2.0±0.05	4.0±0.1	1.55±0.03	10,000
M	1.6×0.8				4.0±0.1			$1.5^{+0.1}_{0}$	3,000
S	2.0×1.25								
A	3.2×1.6								

定格：267型Mシリーズ, 267型Eシリーズ, 267型Pシリーズ, 271Nシリーズ
279型Mシリーズ, 281型Mシリーズ, 281型Eシリーズ
Type：267 M Series, 267 E Series, 267 P Series, 271 N Series
279 M Series, 281 M Series, 281 E Series

ケース記号 Case Code	ケースサイズ Case size	W (mm)	F (mm)	E (mm)	P_1 (mm)	P_2 (mm)	P_0 (mm)	D_0 (mm)	包装数/リール(個) Quantity/Reel (pcs)	
									ϕ180	ϕ330
A	3.2×1.6	8.0±0.3	3.5±0.05	1.75±0.1	4.0±0.1	2.0±0.05	4.0±0.1	$\phi 1.5^{+0.1}_{0}$	2,000	9,000
B	3.5×2.8									8,000
C3	6.0×3.2	12.0±0.3	5.5±0.05		8.0±0.1				500	3,000
D3	7.3×4.4		5.7±0.05	1.5±0.1						2,500
H	7.3×4.4		5.7±0.1							1,500
E	7.3×5.8		5.5±0.05	1.75±0.05						2,000

定格：267型Nシリーズ、TCA型
Type：267 N Series, TCA

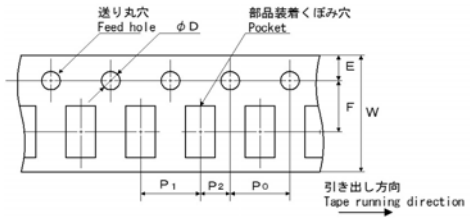
ケース記号 Case Code	ケースサイズ Case size	W (mm)	F (mm)	E (mm)	P_1 (mm)	P_2 (mm)	P_0 (mm)	D_0 (mm)	包装数/リール(個) Quantity/Reel (pcs)	
									ϕ180	ϕ330
A	3.2×1.6	8.0±0.3	3.5±0.05	1.75±0.1	4.0±0.1	2.0±0.05	4.0±0.1	$\phi 1.5^{+0.1}_{0}$	2,000	9,000
B	3.5×2.8									8,000
C	6.0×3.2	12.0±0.3	5.5±0.05		8.0±0.1				500	3,000
D	7.3×4.4		5.7±0.05	1.5±0.1						2,500

回路保護素子
Circuit Protection Components

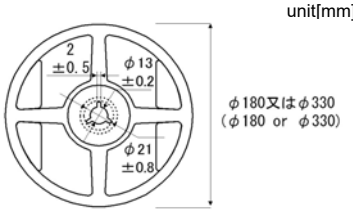
定格：JAE型、JAG型、JAG型Nシリーズ、JAJ型、JAJ型Nシリーズ、JAK型、JAK型Nシリーズ、JHC型、JHC型Nシリーズ
KAB型、KAB型Nシリーズ、KAB型Mシリーズ、KAB型Tシリーズ、KVA型、KVA型Nシリーズ
Type：JAE, JAG, JAG N Series, JAJ, JAJ N Series, JAK, JAK N Series, JHC, JHC N Series
KAB, KAB N Series, KAB M Series, KAB T Series, KVA, KVA N Series

ケース記号 Case Code	ケースサイズ Case size	W (mm)	F (mm)	E (mm)	P_1 (mm)	P_2 (mm)	P_0 (mm)	D_0 (mm)	包装数/リール(個) Quantity/Reel (pcs)	
									ϕ180	ϕ330
29	1.6×0.8	8.0±0.3	3.5±0.05	1.75±0.05	4.0±0.1	2.0±0.05	4.0±0.1	ϕ1.55±0.03	5,000	-
31	2.0×1.25									-
52	3.2×1.6			1.75±0.1				ϕ1.5±0.1	2,000	-
44E	7.3×5.8	12±0.3	5.5±005		8.0±0.1			$\phi 1.5^{+0.1}_{0}$	500	1,500
59F	11.0×7.3	24±0.3	11.5±005		12.0±0.1				-	500

テーピング寸法/Tape dimensions



リール寸法/Reel dimensions　単位[mm]
unit[mm]



チップタンタルコンデンサ テーピング形状記号
Chip Tantalum Capacitors Tape code

φ180リール φ180Reel	φ330リール φ330Reel	極性 Anode notation
L	P	送り穴側 ＋ Feed hole ＋
R	N	送り穴側 － Feed hole －