Type 267 NSeries (AEC-Q200 compliant)

Type 267 NSeries is specially designed to SMD, based on our technology of chip tantalum capacitors acquired over many years. Fully-molded construction provides excellent mechanical protection, superior moisture resistance and high soldering heat resistance.
This series is high-reliability capacitors developed for devices, such as automotive electric components, to be used under severe environmental conditions.

FEATURES

1. Suitable for automotive electronics, such as Engine Control Units, ABS, Air Bags, and etc.
2. AEC-Q200 compliant
3. Lead-free and RoHS compliant

RATING

Item	Rating	Remarks
Category Temperature Range (Operating Temperature Range)	−55 ～ +125℃	To be used at derated voltage when temperature exceeds 85℃ (At 125℃, 2/3 ×rated voltage)
Rated Temperature (Max. Operating Temp, at Rated Voltage)	+85℃	
Rated Voltage	4 ～ 35VDC	See CATALOG NUMBERS AND RATING OF STANDARD PRODUCTS
Nominal Capacitance	0.1 ～ 220 µF	
Nominal Capacitance Tolerance	±20%, ±10%	

ORDERING INFORMATION

267	N	1002	226	M	R	C
TYPE	SERIES	RATED VOLTAGE	Nominal CAPACITANCE	CAPACITANCE TOLERANCE	STYLE OF REELED PACKAGE	CASE CODE

Marking	Rated voltage
4001	4DVC
6301	6.3DVC
1002	10VDC
1602	16VDC
2002	20VDC
2502	25VDC
3502	35VDC

Marking	Rated voltage	Marking	Rated voltage
104	0.1 µF	685	6.8 µF
154	0.15 µF	106	10 µF
224	0.22 µF	156	15 µF
334	0.33 µF	226	22 µF
474	0.47 µF	336	33 µF
684	0.68 µF	476	47 µF
105	1.0 µF	686	68 µF
155	1.5 µF	107	100 µF
225	2.2 µF	157	150 µF
335	3.3 µF	227	220 µF
475	4.7 µF		

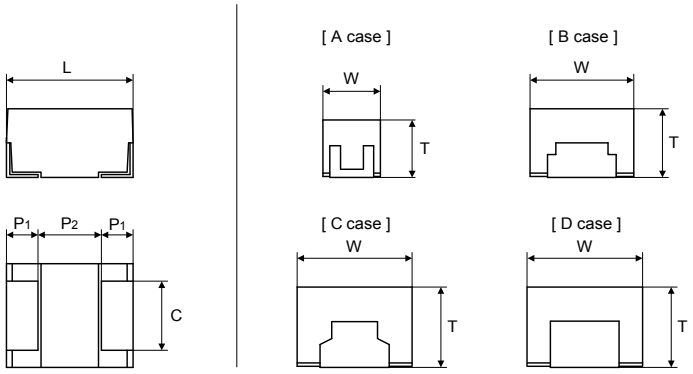
Capacitance Tolerance	Marking
±10%	K
±20%	M

(Taping specification)

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

Case Code	EIA Code
A	3216
B	3528
C	6032
D	7343

DIMENSIONS

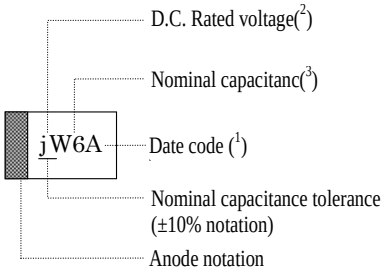


(mm)

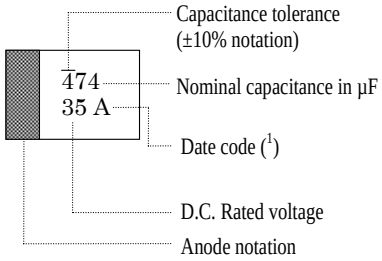
Case Code	EIA Code	L±0.2	W±0.2	T±0.2	P_1±0.2	P_2min.	C±0.1
A	3216	3.2	1.6	1.6	0.75	1.4	1.2
B	3528	3.5	2.8	1.9	0.8	1.5	2.2
C	6032	6.0	3.2	2.5	1.3	3.0	2.2
D	7343	7.3	4.4	2.8	1.3	4.0	2.4

MARKING

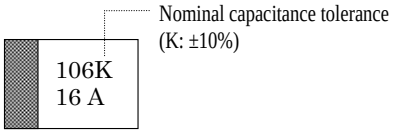
[A case]



[B case]



[C,D case]



Note(1) Product date sign is shown in accordance with appendix 1 table 13 of JIS C 5101-1

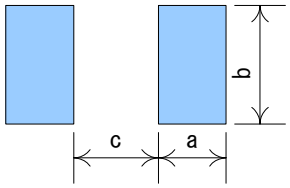
(2) Rated voltage of A case size is shown bellow in accordance with appendix 1 table 9 of JIS C 5101-1

Rated voltage	4	6.3	10	16	20	25	35
code	g	j	A	C	D	E	V

(3) Nominal capacitance of A case size is shown bellow, with 1 Alphabet character and 1 number, in accordance with appendix 1 table 10 and appendix 1 table 11 of JIS C 5101-1

Capacitance (µF)	0.1	0.15	0.22	0.33	0.47	0.68
code	A5	E5	J5	N5	S5	W5
Capacitance (µF)	1.0	1.5	2.2	3.3	4.7	6.8
code	A6	E6	J6	N6	S6	W6
Capacitance (µF)	10	15	22	33	47	68
code	A7	E7	J7	N7	S7	W7

RECOMMENDED SOLDER PAD LAYOUT



(mm)

Case Size	EIA Code	a		b	c
		Flow	Reflow		
A	3216	3.0	2.0	1.5	1.5
B	3528	3.2	2.0	2.4	1.8
C	6032	4.2	2.4	2.5	3.3
D	7343	5.2	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.

STSNDARD RATING

July, 2018

R.V.(VDC) / Cap.(mF)	4	6.3	10	16	20	25	35
0.1							A
0.15							A
0.22							A
0.33							A
0.47						A	A,B
0.68					A	A	A,B
1				A	A	A	A,B
1.5				A	A	A,B	A,B
2.2				A	A,B	A,B	B,C
3.3			A	A,B	A,B	B	B,C
4.7		A	A	A,B	A,B	B,C	C
6.8	A	A	A,B	A,B	B,C	C	C,D
10	A	A,B	A,B	A,B	B,C	C,D	
15	A	A,B	A,B	A,B,C	C	C	
22	B	A,B	A,B,C	B	C,D	D	
33	B	A,B	B	B,C,D	D		
47			B,D	C,D			
68			D	C			
100		B	C	D			
150		C	D				
220			D				

CATALOG NUMBERS AND RATING OF STANDARD PRODUCTS

July, 2018

Catalog number(1)(2)	Rated Voltage (VDC)	Capacitance (μF)	Case Code	Lct. (μA)			Max. Dissipation Factor				ESR Ω 100 kHz
				-55℃ 20℃	85℃	125℃	-55℃	20℃	85℃	125℃	
267N 4001 685 _ [1] _ [2] A	4	6.8	A	0.5	5	6.3	0.08	0.06	0.06	0.08	7.2
267N 4001 106 _ [1] _ [2] A	↓	10	A	0.5	5	6.3	0.08	0.06	0.06	0.08	7.2
267N 4001 156 _ [1] _ [2] A	↓	15	A	0.6	6	7.5	0.20	0.12	0.12	0.14	7.1
267N 4001 226 _ [1] _ [2] B	↓	22	B	0.9	9	11	0.08	0.06	0.06	0.08	2.8
267N 4001 336 _ [1] _ [2] B	↓	33	B	1.3	13	17	0.08	0.06	0.06	0.08	2.8
267N 6301 475 _ [1] _ [2] A	6.3	4.7	A	0.5	5	6.3	0.08	0.06	0.06	0.08	7.2
267N 6301 685 _ [1] _ [2] A	↓	6.8	A	0.5	5	6.3	0.08	0.06	0.06	0.08	7.2
267N 6301 106 _ [1] _ [2] A	↓	10	A	0.6	6	7.9	0.14	0.10	0.10	0.12	7.1
267N 6301 106 _ [1] _ [2] B	↓	10	B	0.6	6	7.9	0.08	0.06	0.06	0.06	2.9
267N 6301 156 _ [1] _ [2] A	↓	15	A	0.9	9	12	0.20	0.12	0.12	0.14	7.1
267N 6301 156 _ [1] _ [2] B	↓	15	B	0.9	9	12	0.08	0.06	0.06	0.08	2.8
267N 6301 226 _ [1] _ [2] A	↓	22	A	1.4	14	17	0.20	0.12	0.12	0.14	7.1
267N 6301 226 _ [1] _ [2] B	↓	22	B	1.4	14	17	0.08	0.06	0.06	0.08	2.8
267N 6301 336 _ [1] _ [2] A	↓	33	A	2.1	21	26	0.20	0.12	0.12	0.14	7.1
267N 6301 336 _ [1] _ [2] B	↓	33	B	2.1	21	26	0.14	0.10	0.10	0.12	2.7
267N 6301 107 _ [1] _ [2] B	↓	100	B	6.3	63	79	0.22	0.12	0.12	0.14	2.7
267N 6301 157 _ [1] _ [2] C	↓	150	C	9.5	95	118	0.18	0.10	0.10	0.12	0.95
267N 1002 335 _ [1] _ [2] A	10	3.3	A	0.5	5	6.3	0.08	0.06	0.06	0.08	7.2
267N 1002 475 _ [1] _ [2] A	↓	4.7	A	0.5	5	6.3	0.10	0.06	0.08	0.10	7.2
267N 1002 685 _ [1] _ [2] A	↓	6.8	A	0.7	7	8.5	0.12	0.10	0.10	0.12	7.1
267N 1002 685 _ [1] _ [2] B	↓	6.8	B	0.7	7	8.5	0.08	0.06	0.06	0.06	2.9
267N 1002 106 _ [1] _ [2] A	↓	10	A	1.0	10	13	0.14	0.10	0.10	0.12	7.1
267N 1002 106 _ [1] _ [2] B	↓	10	B	1.0	10	13	0.08	0.06	0.06	0.08	2.9
267N 1002 156 _ [1] _ [2] A	↓	15	A	1.5	15	19	0.20	0.12	0.12	0.14	7.1
267N 1002 156 _ [1] _ [2] B	↓	15	B	1.5	15	19	0.08	0.06	0.06	0.08	2.8
267N 1002 226 _ [1] _ [2] A	↓	22	A	2.2	22	28	0.20	0.12	0.12	0.14	7.1
267N 1002 226 _ [1] _ [2] B	↓	22	B	2.2	22	28	0.14	0.10	0.10	0.12	2.8
267N 1002 226 _ [1] _ [2] C	↓	22	C	2.2	22	28	0.08	0.06	0.06	0.06	0.55
267N 1002 336 _ [1] _ [2] B	↓	33	B	3.3	33	41	0.14	0.10	0.10	0.12	2.7
267N 1002 476 _ [1] _ [2] B	↓	47	B	4.7	47	59	0.16	0.12	0.12	0.14	2.7
267N 1002 476 _ [1] _ [2] D	↓	47	D	4.7	47	59	0.08	0.06	0.06	0.06	0.95
267N 1002 686 _ [1] _ [2] D	↓	68	D	6.8	68	85	0.08	0.06	0.06	0.08	0.45
267N 1002 107 _ [1] _ [2] C	↓	100	C	10	100	125	0.12	0.10	0.10	0.12	0.95
267N 1002 157 _ [1] _ [2] D	↓	150	D	15	150	188	0.15	0.10	0.10	0.12	0.45
267N 1002 227 _ [1] _ [2] D	↓	220	D	22	220	275	0.15	0.10	0.10	0.12	0.45
267N 1602 105 _ [1] _ [2] A	16	1	A	0.5	5	6.3	0.05	0.04	0.04	0.05	7.4
267N 1602 155 _ [1] _ [2] A	↓	1.5	A	0.5	5	6.3	0.08	0.06	0.06	0.06	7.4
267N 1602 225 _ [1] _ [2] A	↓	2.2	A	0.5	5	6.3	0.08	0.06	0.06	0.08	7.2
267N 1602 335 _ [1] _ [2] A	↓	3.3	A	0.5	5	6.3	0.12	0.08	0.08	0.10	7.4
267N 1602 335 _ [1] _ [2] B	↓	3.3	B	0.5	5	6.3	0.06	0.04	0.04	0.06	2.9
267N 1602 475 _ [1] _ [2] A	↓	4.7	A	0.8	8	9.4	0.12	0.08	0.08	0.10	7.1
267N 1602 475 _ [1] _ [2] B	↓	4.7	B	0.8	8	9.4	0.06	0.04	0.04	0.06	2.9
267N 1602 685 _ [1] _ [2] A	↓	6.8	A	1.1	11	14	0.12	0.10	0.10	0.12	7.1
267N 1602 685 _ [1] _ [2] B	↓	6.8	B	1.1	11	14	0.08	0.06	0.06	0.08	2.9
267N 1602 106 _ [1] _ [2] A	↓	10	A	1.6	16	20	0.14	0.10	0.10	0.12	7.1
267N 1602 106 _ [1] _ [2] B	↓	10	B	1.6	16	20	0.08	0.06	0.06	0.08	2.9
267N 1602 156 _ [1] _ [2] A	↓	15	A	2.4	24	30	0.18	0.12	0.12	0.14	3.6
267N 1602 156 _ [1] _ [2] B	↓	15	B	2.4	24	30	0.14	0.10	0.10	0.12	2.7
267N 1602 156 _ [1] _ [2] C	↓	15	C	2.4	24	30	0.08	0.06	0.06	0.08	1.17
267N 1602 226 _ [1] _ [2] B	↓	22	B	3.5	35	44	0.14	0.10	0.10	0.12	2.7
267N 1602 336 _ [1] _ [2] B	↓	33	B	5.3	53	66	0.14	0.10	0.10	0.12	2.7
267N 1602 336 _ [1] _ [2] C	↓	33	C	5.3	53	66	0.30	0.18	0.18	0.20	0.95
267N 1602 336 _ [1] _ [2] D	↓	33	D	5.3	53	66	0.08	0.06	0.06	0.06	0.97
267N 1602 476 _ [1] _ [2] C	↓	47	C	7.5	75	94	0.30	0.18	0.18	0.20	0.95
267N 1602 476 _ [1] _ [2] D	↓	47	D	7.5	75	94	0.08	0.06	0.06	0.08	0.45
267N 1602 686 _ [1] _ [2] C	↓	68	C	11	109	136	0.12	0.10	0.10	0.12	0.95
267N 1602 107 _ [1] _ [2] D	↓	100	D	16	160	200	0.12	0.10	0.10	0.12	0.45

Catalog number(1)(2)	Rated Voltage (VDC)	Capacitance (μF)	Case Code	Lct. (μA)			Max. Dissipation Factor				ESR Ω 100 kHz
				-55℃ 20℃	85℃	125℃	-55℃	20℃	85℃	125℃	
267N 2002 684 _1 _2 A	20	0.68	A	0.5	5	6.3	0.05	0.04	0.04	0.05	7.4
267N 2002 105 _1 _2 A	↓	1	A	0.5	5	6.3	0.05	0.04	0.04	0.05	7.4
267N 2002 155 _1 _2 A	↓	1.5	A	0.5	5	6.3	0.08	0.06	0.06	0.08	7.2
267N 2002 225 _1 _2 A	↓	2.2	A	0.5	5	6.3	0.08	0.06	0.06	0.08	7.4
267N 2002 225 _1 _2 B	↓	2.2	B	0.5	5	6.3	0.06	0.04	0.04	0.06	2.9
267N 2002 335 _1 _2 A	↓	3.3	A	0.7	7	8.3	0.12	0.08	0.08	0.10	7.1
267N 2002 335 _1 _2 B	↓	3.3	B	0.7	7	8.3	0.08	0.06	0.06	0.06	2.9
267N 2002 475 _1 _2 A	↓	4.7	A	0.9	9	12	0.10	0.06	0.08	0.10	7.1
267N 2002 475 _1 _2 B	↓	4.7	B	0.9	9	12	0.08	0.06	0.06	0.08	2.9
267N 2002 685 _1 _2 B	↓	6.8	B	1.4	14	17	0.08	0.06	0.06	0.08	2.9
267N 2002 685 _1 _2 C	↓	6.8	C	1.4	14	17	0.08	0.06	0.06	0.08	1.17
267N 2002 106 _1 _2 B	↓	10	B	2.0	20	25	0.12	0.08	0.08	0.10	2.8
267N 2002 106 _1 _2 C	↓	10	C	2.0	20	25	0.08	0.06	0.06	0.08	1.17
267N 2002 156 _1 _2 C	↓	15	C	3.0	30	38	0.08	0.06	0.06	0.08	1.15
267N 2002 226 _1 _2 C	↓	22	C	4.4	44	55	0.08	0.06	0.06	0.08	0.95
267N 2002 226 _1 _2 D	↓	22	D	4.4	44	55	0.08	0.06	0.06	0.06	0.97
267N 2002 336 _1 _2 D	↓	33	D	6.6	66	83	0.08	0.06	0.06	0.06	0.97
267N 2502 474 _1 _2 A	25	0.47	A	0.5	5	6.3	0.05	0.04	0.04	0.05	7.4
267N 2502 684 _1 _2 A	↓	0.68	A	0.5	5	6.3	0.05	0.04	0.04	0.05	7.4
267N 2502 105 _1 _2 A	↓	1	A	0.5	5	6.3	0.06	0.04	0.04	0.06	7.4
267N 2502 155 _1 _2 A	↓	1.5	A	0.5	5	6.3	0.08	0.06	0.06	0.08	7.4
267N 2502 155 _1 _2 B	↓	1.5	B	0.5	5	6.3	0.06	0.04	0.04	0.06	2.9
267N 2502 225 _1 _2 A	↓	2.2	A	0.6	6	6.9	0.12	0.08	0.08	0.10	7.4
267N 2502 225 _1 _2 B	↓	2.2	B	0.6	6	6.9	0.08	0.06	0.06	0.06	2.9
267N 2502 335 _1 _2 B	↓	3.3	B	0.8	8	10	0.08	0.06	0.06	0.08	2.9
267N 2502 475 _1 _2 B	↓	4.7	B	1.2	12	15	0.08	0.06	0.06	0.08	2.9
267N 2502 475 _1 _2 C	↓	4.7	C	1.2	12	15	0.08	0.06	0.06	0.08	1.18
267N 2502 685 _1 _2 C	↓	6.8	C	1.7	17	21	0.08	0.06	0.06	0.06	1.17
267N 2502 106 _1 _2 C	↓	10	C	2.5	25	31	0.08	0.06	0.06	0.08	1.17
267N 2502 106 _1 _2 D	↓	10	D	2.5	25	31	0.08	0.06	0.06	0.08	0.98
267N 2502 156 _1 _2 C	↓	15	C	3.7	38	46	0.10	0.08	0.08	0.10	1.3
267N 2502 226 _1 _2 D	↓	22	D	5.5	55	69	0.08	0.06	0.06	0.08	0.98
267N 3502 104 _1 _2 A	35	0.1	A	0.5	5	6.3	0.05	0.04	0.04	0.05	9.7
267N 3502 154 _1 _2 A	↓	0.15	A	0.5	5	6.3	0.05	0.04	0.04	0.05	9.7
267N 3502 224 _1 _2 A	↓	0.22	A	0.5	5	6.3	0.05	0.04	0.04	0.05	7.4
267N 3502 334 _1 _2 A	↓	0.33	A	0.5	5	6.3	0.05	0.04	0.04	0.05	7.4
267N 3502 474 _1 _2 A	↓	0.47	A	0.5	5	6.3	0.05	0.04	0.04	0.05	7.4
267N 3502 474 _1 _2 B	↓	0.47	B	0.5	5	6.3	0.05	0.04	0.04	0.05	2.9
267N 3502 684 _1 _2 A	↓	0.68	A	0.5	5	6.3	0.06	0.04	0.04	0.06	7.4
267N 3502 684 _1 _2 B	↓	0.68	B	0.5	5	6.3	0.05	0.04	0.04	0.05	2.9
267N 3502 105 _1 _2 A	↓	1	A	0.5	5	6.3	0.06	0.04	0.04	0.06	7.4
267N 3502 105 _1 _2 B	↓	1	B	0.5	5	6.3	0.05	0.04	0.04	0.05	2.9
267N 3502 155 _1 _2 A	↓	1.5	A	0.5	5	6.6	0.12	0.08	0.08	0.10	7.1
267N 3502 155 _1 _2 B	↓	1.5	B	0.5	5	6.6	0.08	0.06	0.06	0.06	2.9
267N 3502 225 _1 _2 B	↓	2.2	B	0.8	8	9.6	0.08	0.06	0.06	0.08	2.9
267N 3502 225 _1 _2 C	↓	2.2	C	0.8	8	9.6	0.08	0.06	0.06	0.08	1.18
267N 3502 335 _1 _2 B	↓	3.3	B	1.2	12	14	0.08	0.06	0.06	0.08	2.9
267N 3502 335 _1 _2 C	↓	3.3	C	1.2	12	14	0.08	0.06	0.06	0.08	1.18
267N 3502 475 _1 _2 C	↓	4.7	C	1.6	16	21	0.08	0.06	0.06	0.06	1.17
267N 3502 685 _1 _2 C	↓	6.8	C	1.6	16	21	0.08	0.06	0.06	0.08	1.17
267N 3502 685 _1 _2 D	↓	6.8	D	2.4	24	30	0.08	0.06	0.06	0.08	0.98

Notes (1) _1 : Permissible tolerance K (±10%) or M (±20%)

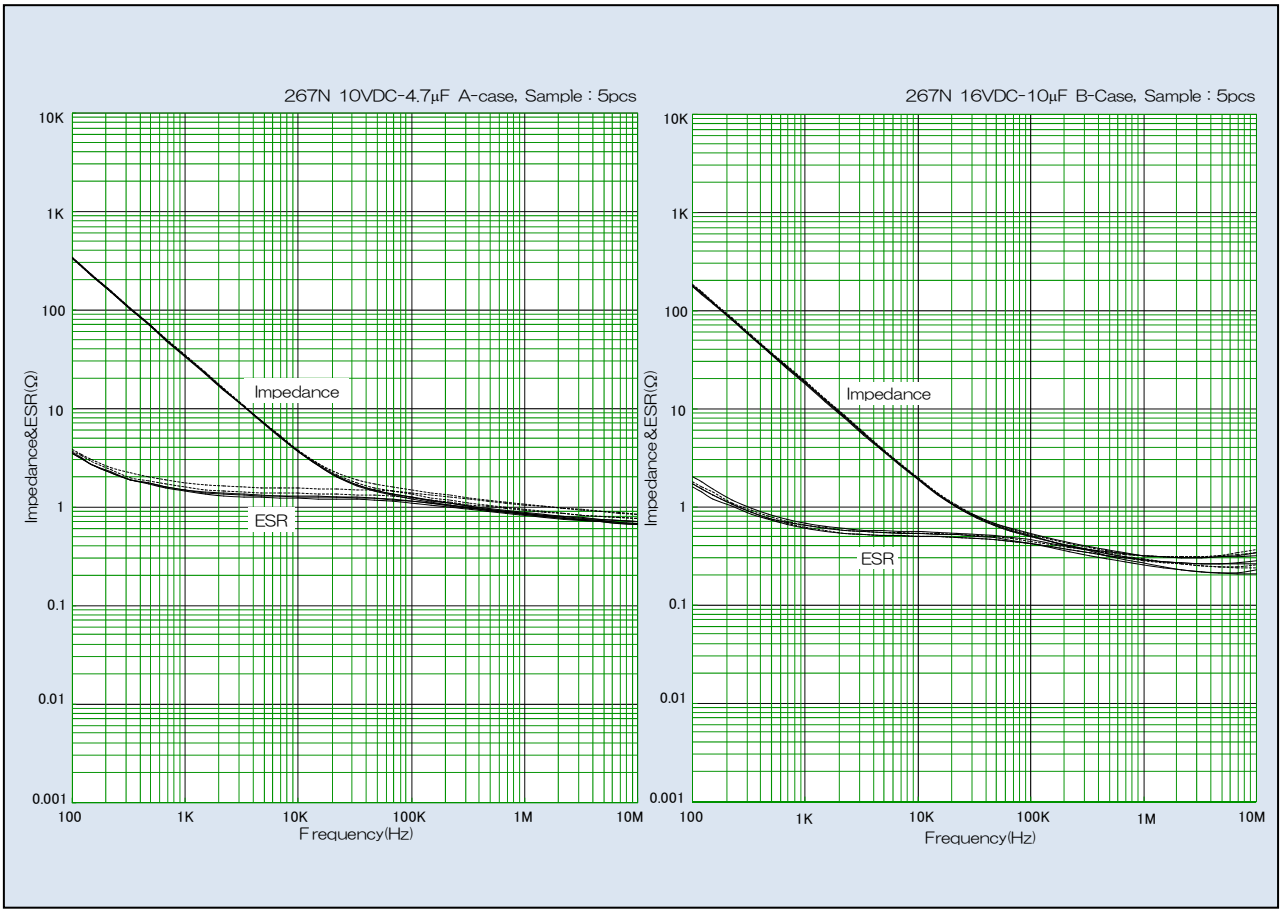
(2) _2 :No code for single item. 'R'('N') or 'L'('P') for taping specification

PERFORMANCE

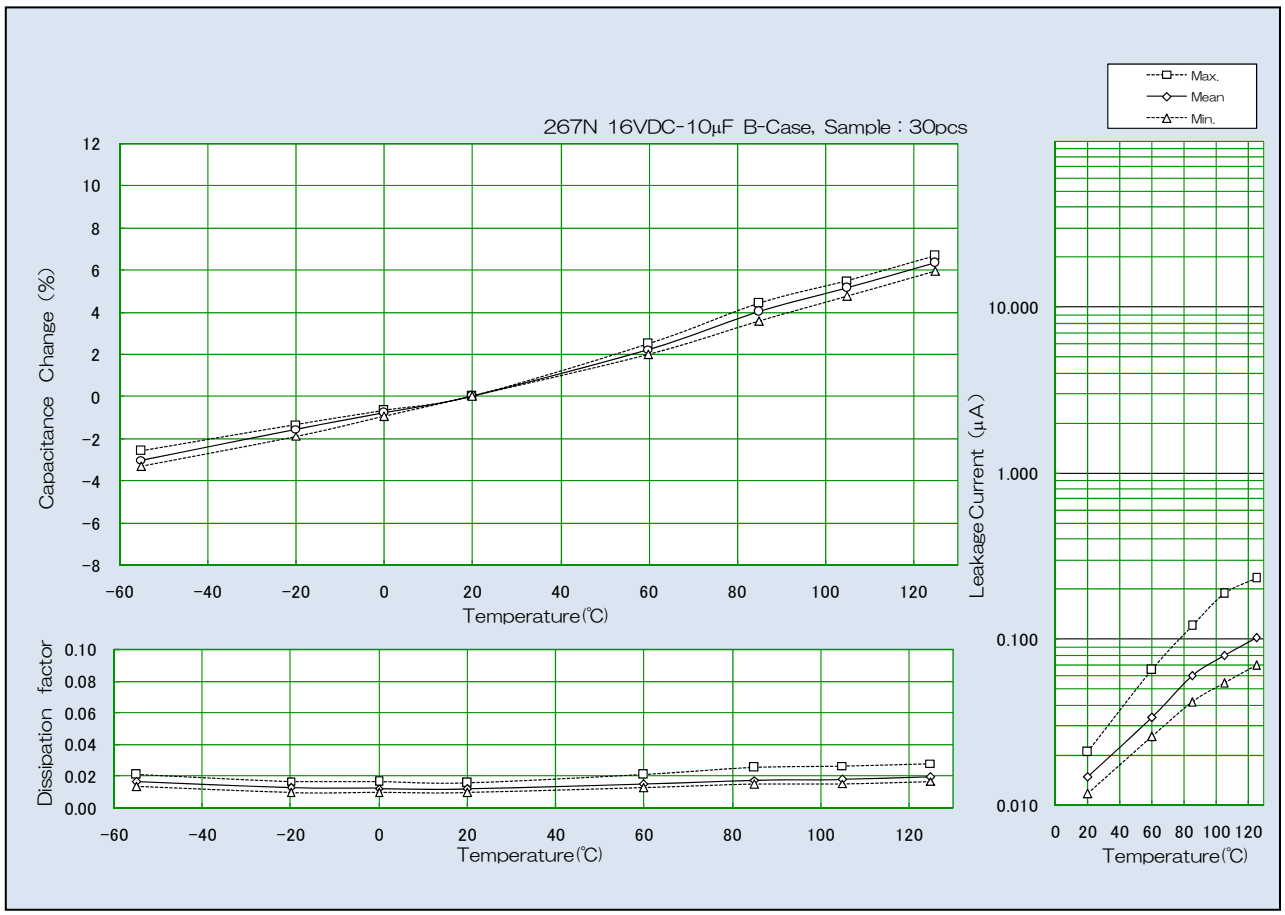
No.	Item		Performance	Test method
1	Leakage Current (μA)		Shall not exceed 0.01 CV or 0.5 μA whichever is greater.	IEC 60384-1, 4.9 Applied voltage : Rated voltage Duration : 5 min Measuring temperature : Room temperature
2	Capacitance (μF)		Shall be within tolerance of the nominal value specified.	IEC 60384-1, 4.7 Measuring frequency : 120 Hz ± 20% Measuring voltage : 0.5 Vrms +1.5 ~ 2 VDC Measuring temperature : Room temperature
3	Dissipation Factor		Shall not exceed the values shown in CATALOG NUMBERS AND RATING OF STANDARD PRODUCTS .	IEC 60384-1, 4.8 Measuring frequency : 120 Hz ± 20% Measuring voltage : 0.5 Vrms +1.5 ~ 2 VDC Measuring temperature : Room temperature
4	Equivalent Series Resistance		Shall not exceed the values shown in CATALOG NUMBERS AND RATING OF STANDARD PRODUCTS .	Measuring frequency : 100 kHz Measuring temperature : Room temperature
5	Characteristics at High and LowTemperature			IEC 60384-1, 4.29
	Step 1	Leakage Current Capacitance Dissipation Factor	Shall not exceed the value in No.1. Shall be within tolerance of the nominal value specified. Shall not exceed the values shown in CATALOG NUMBERS AND RATING OF STANDARD PRODUCTS .	Measuring temperature : 20 ± 2°C
	Step 2	Leakage Current Capacitance Change Dissipation Factor	Shall not exceed the values shown in CATALOG NUMBERS AND RATING OF STANDARD PRODUCTS . Shall be within $^{0}_{-12}$ % of the value at Step 1 Shall not exceed the values shown in CATALOG NUMBERS AND RATING OF STANDARD PRODUCTS .	Measuring temperature : -55 ± 3°C
	Step 3	Leakage Current Capacitance Change Dissipation Factor	Shall not exceed the value in No.1. Shall be within ± 2% of the value at Step 1. Shall not exceed the values shown in CATALOG NUMBERS AND RATING OF STANDARD PRODUCTS.	Measuring temperature : 20 ± 2°C
	Step 4	Leakage Current Capacitance Change Dissipation Factor	Shall not exceed 0.1 CV or 5 μA whichever is greater. Shall be within $^{+10}_{0}$ % of the value at Step 1 Shall not exceed the values shown in CATALOG NUMBERS AND RATING OF STANDARD PRODUCTS .	Measuring temperature : 85 ± 2°C
	Step 5	Leakage Current Capacitance Change Dissipation Factor	Shall not exceed 0.125CV or 6.3 μA whichever is greater. Shall be within $^{+15}_{0}$ % of the value at Step 1 Shall not exceed the values shown in CATALOG NUMBERS AND RATING OF STANDARD PRODUCTS.	Measuring temperature : 125 ± 2°C Measuring voltage : Derated voltage at 125°C
	Step 6	Leakage Current Capacitance Change Dissipation Factor	Shall not exceed the value in No.1. Shall be within ± 2% of the value at Step 1. Shall not exceed the values shown in CATALOG NUMBERS AND RATING OF STANDARD PRODUCTS.	Measuring temperature : 20 ± 2°C
6	HighTemperature Exposure	Leakage Current Capacitance Change Dissipation Factor Appearance	Shall not exceed 10 times value in No.1 Within ± 15%of initial value. Shall not exceed the values shown in CATALOG NUMBERS AND RATING OF STANDARD PRODUCTS. There shall be no evidence of mechanical damage.	MIL-STD-202 Method 108 Temperature : 125 ± 2°C Duration : 1000$^{+48}_{0}$ hrs Measurement at 24±4hours after test Conclusion.
7	Temperature Cycle	Leakage Current Capacitance Change Dissipation Factor Appearance	Shall not exceed 5 times value in No.1 Within ± 15%of initial value. Shall not exceed the values shown in CATALOG NUMBERS AND RATING OF STANDARD PRODUCTS. There shall be no evidence of mechanical damage.	JESD22 Method JA-104 Step 1 : -55 ± 3°C, 30 ± 3 min. Step 2 : 25$^{+10}_{-5}$ °C, 3 min.max. Step 3 : 125 ± 2°C, 30 ± 3 min. Step 4 : 25$^{+10}_{-5}$ °C, 3 min.max. Number of cycles : 1000 Measurement at 24±4hours after test Conclusion.
8	Biased Humidity	Leakage Current Capacitance Change Dissipation Factor Appearance	Shall not exceed 10 times value in No.1 Within ± 10%of initial value. Shall not exceed the values shown in CATALOG NUMBERS AND RATING OF STANDARD PRODUCTS. There shall be no evidence of mechanical damage.	MIL-STD-202 Method 103 Temperature : 85 ± 2°C Moisture : 85± 5%RH Applied voltage : DC rated voltage Duration : 1000$^{+48}_{0}$ hrs Measurement at 24±4hours after test Conclusion.
9	Operational Life	Leakage Current Capacitance Change Dissipation Factor Appearance	Shall not exceed 1.25 times value in No.1 Within ± 15%of initial value. Shall not exceed the values shown in CATALOG NUMBERS AND RATING OF STANDARD PRODUCTS. There shall be no evidence of mechanical damage.	MIL-STD-202 Method 108 Test temperature : 125 ± 3°C Applied voltage :DC rated voltage × 2/3 Duration : 2000$^{72}_{0}$ hrs Series resistance: do not exceed 3 Ω Measurement at 24±4hours after test Conclusion.
10	Resistance to Solvents	Leakage Current Capacitance Change Dissipation Factor	Shall not exceed the value in No.1. Shall n Within ± 10%of initial value. Shall not exceed the values shown in CATALOG NUMBERS AND RATING OF STANDARD PRODUCTS.	MIL-STD-202 Method 215
11	Mechanical Shock (specified pulse)		There shall be no intermittent contact of 0.5 ms or greater duration or arcing or other indication of breakdown, nor shall there be any open or short-circuiting or evidence of mechanical damage.	MIL-STD-202 Method 213 Test condition : F Peak value: 1500G Duration : 0.5ms Wave form : Half-sine

No.	Item (1)		Performance	Test method
12	Vibration	Capacitance Appearance	Initial value to remain steady during measurement. There shall be no evidence of mechanical damage.	MIL-STD-202 Method 204 Vibration Amplitude : 5G (peak) Frequency range : 10 ~ 2000 Hz Duration : 20min in each of three mutually perpendicular directions , 12 cycles.
13	Resistance to Soldering Heat	Leakage Current Capacitance Change Dissipation Factor Appearance	Shall not exceed the value in No.1. Shall n Within ± 10%of initial value. Shall not exceed the values shown in CATALOG NUMBERS AND RATING OF STANDARD PRODUCTS. There shall be no cracks and other damage.	MIL-STD-202 Method 210 Solder temperature : 260 ± 5°C Duration: 10 ± 1 sec Number of heat cycles : 1
14	ESD		There shall be no evidence of mechanical damage.	AEC-Q200-002 Component classification 1B
15	Solderability	Solder Bath/Dip And Look Test	The dipped portion of the lead shall be covered more than 95% with new solder.	J-STD-002 Solder temperature : 235 ± 5°C Dipping time : 5 ± 0.5 sec Capacitor terminal shall be dipped into melted solder.
		Resistance to Dissolution Metallization Test	Leaching/dewetting shall be no more than 5% of the solderable metallization exhibiting exposed underlying.	J-STD-002 Solder temperature : 260 ± 5°C Dipping time : 30± 0.5 sec Capacitor terminal shall be dipped into melted solder.
		Pb-free Solderability Test	Inspect devices at 10x to 20x magnification. The inspected area of each lead must have 95% solder coverage minimum.	JESD22-B102E Steam Precondition :8h± 15min Solder temperature : 245 ± 5°C Dipping time : 5 ± 0.5 sec Capacitor terminal shall be dipped into melted solder.
16	Board Flex (Substrate bending test)	Capacitance Appearance	Capacitance shall be stable during bending position of the substrate. There shall be no evidence of mechanical damage.	AEC-Q200-005 Bend the board : 3 mm Duration : 5s
17	Terminal strength (Shear Test)		No exfoliation between lead terminal and board.	AEC-Q200-006 Applied pressure : 17.7N Duration : 60s
18	Whisker		Shall be satisfied Class2 at JESD201A.	JESD201A

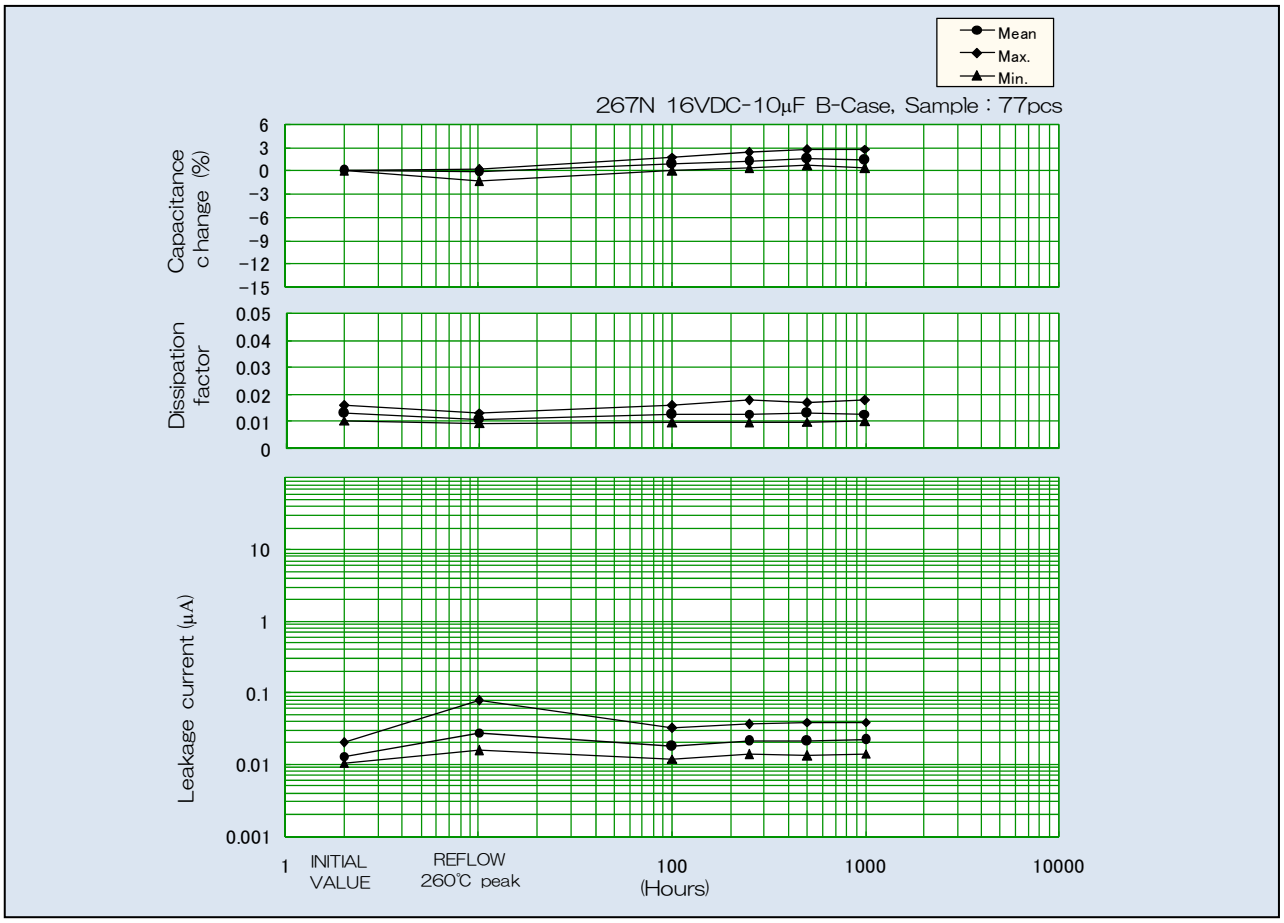
FREQUENCY CHARACTERISTICS



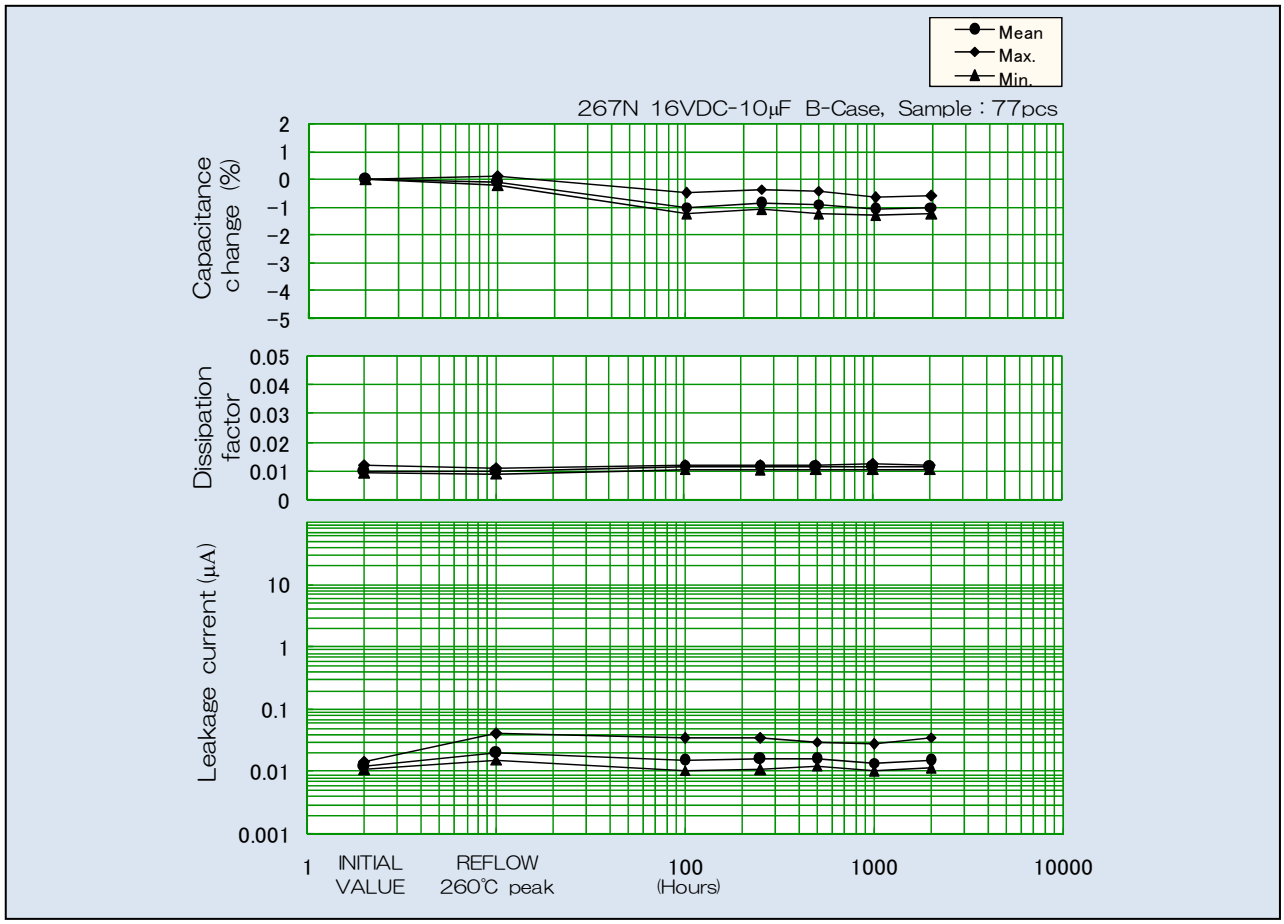
TEMPERATURE CHARACTERISTICS



BIASED HUMIDITY 85℃, 85%RH



OPERATIONAL LIFE 125℃, RATED VOLTAGE×2/3



Application Notes for Tantalum Solid Electrolytic Capacitor

1. Operating Voltage

Tantalum Solid Electrolytic Capacitor shall be operated at the rated voltage or lower.
Rated voltage: The "rated voltage" refers to the maximum DC voltage that is allowed to be continuously applied between the capacitor terminals at the rated temperature.
Surge voltage: The "surge voltage" refers to the voltage that is allowed to be instantaneously applied to the capacitor at the rated temperature or the maximum working temperature. The capacitor shall withstand the voltage when a 30-second cycle of application of the voltage through a 1000 Ω series resistance is repeated 1000 times in 6-minute periods.
When designing the circuit, the equipment's required reliability must be considered and appropriate voltage derating must be performed.

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 current should not exceed the allowable values.

3. Reverse Voltage

Tantalum solid electrolytic capacitor is polarity. Please do not impress reverse voltage. As well, please confirm the potential of the tester beforehand when both ends of the capacitor are checked with the tester etc.

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 (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.

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

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

Permissible ripple voltage $Emax=\sqrt{\dfrac{P\,max}{ESR}} \times Z$

$= Imax \times Z\ (Vrms)$

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

Case size	Pmax（W）
A	0.045
B	0.050
C	0.065
D	0.085

Table 2 Pmax multiplier at each operating temperature

Operating temperature (℃)	Multiplier
25	1.0
55	0.9
85	0.8
125	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.

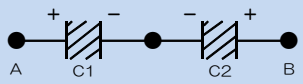
5. Application on low-impedance circuit

The failure rate of low impedance circuit at 0.1Ω/V is about five times greater than that of a 1Ω/V circuit. To curtail this higher failure rate, tantalum capacitors used in low impedance circuits, such as filters for power supplies, particularly switching power supplies, or for noise by-passing, require that operating voltage be derated to less than half of the rated voltage. Actually, less than 1/3 of the rated voltage is recommended.

6. Non Polar Application(BACK TO BACK)

Tantalum capacitors can be used as a non-polar unit if two capacitors are connected "BACK-TO-BACK" when reserve voltage is applied at a more than permissible value, or in a purely AC circuit. The two capacitors should both be of the same rated voltage and capacitance tolerance, and they should both be twice the required capacitance value.

Ripple Voltage: Permissible Ripple Voltage shall not exceed the value allowed for either C1 or C2 (This will be the same, as the capacitors should be identical.)
Capacitance: (C1 × C2) / (C1 + C2)
Leakage Current: If terminal A is (+), the Leakage Current will be equal to C1's Leakage Current.
If terminal B is (+), the Leakage Current will be equal to C2's Leakage Current.



7. Soldering

7.1. Preheating

To obtain optimal reliability and solderability conditions, capacitors should be pre-heated at 130 to 200 °C for approximately 60 to 120 seconds.

7.2. Soldering

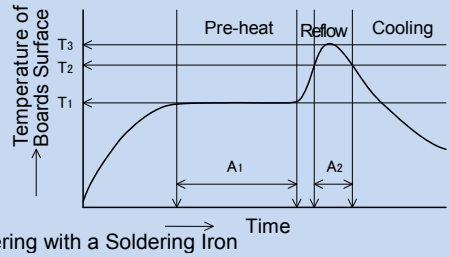
The body of the capacitor shall not exceed 260 °C during soldering.
(1) Reflow Soldering
Reflow soldering is a process in which the capacitors are mounted on a printed board with solder paste. There are two methods of Reflow Soldering: Direct and Atmospheric Heat.
· Direct Heat (Hot plate)
During the Direct Heat method, the capacitor has been positioned on a printed board, which is then placed upon a hot plate. The capacitor maintains a lower temperature than the substrate, which in turn stays at a lower temperature than the hot plate.
· Atmospheric Heat

a) VPS (Vapor Phase Soldering)

During VPS,the substrate is heated by an inert liquid with a high boiling point. The temperature of the capacitor's body and the temperature of the substrate are about the same as the atmosphere. This temperature should be below 240°C.

b) Near and Far IR Ray
Due to the heat absorption of the capacitor's body, the internal temperature of the capacitors may be 20 ~ 30°C higher than the setting temperature and may exceed 260°C.
Temperature control is crucial in maintaining a temperature of 260 °C or lower.

c) Convention Oven
An infrared ray is the main source of heat in this process. The temperature of the substrate and the capacitors can be maintained at a similar level by the circulation of heated air, or an inert gas.



Temperature	Time
T1=130℃～200℃	A1= 60～120sec.
T2=220℃～230℃	A2＜60sec.
T3=～260℃	10 sec. or less than 10

Number of times：2 times max..

(2) Soldering with a 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 5 seconds.

(3) Please consult us for other methods.

8. 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.

9. Protective Resin Coating

After components are assembled to substrate, a protective resin coating is sometimes applied. As this resin coating cures, it gives mechanical and thermal stress to Tantalum capacitors. This stress can cause damage to the capacitors, which affects their reliability.
Before using a resin coating, proper research must be done in regards to the material and process to insure that excessive stress will not be applied to capacitors and other components.

10. Vibration

Approximately 300 G shall be applied to a capacitor, when dropped from 1 meter to a concrete floor.
Although capacitors are made to withstand this drop test, stress from shock due to falling or striking does cause damage to the capacitors and increases failure rates. Do not subject capacitors to this type of mechanical stress.

11. Ultrasonic cleaning

Matsuo does not recommend Ultrasonic cleaning. This may cause damage to the capacitors, and may even cause broken terminals. 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 solvlent. Please consult us.

12. Additional Notes

· When more than one capacitor is connected in series, a resistor that can distribute the voltage equally to the capacitors shall be connected in parallel.
· The capacitor cases shall not be cut even if the mounting space is insufficient.
· During a customers aging process, voltage should remain under the rated voltage at all times.
· Capacitors should never be touched or manipulated while operating.
· Capacitors are not meant to be dismantled.
· When testing capacitors, please examine the power source before conducting test to insure the tester's polarity and applied voltage.
· In the event of a capacitor burning, smoking, or emitting an offensive smell during operation, please turn the circuit "off" and keep hands and face away from the burning capacitor.
· If a capacitor be electrical shorted, it becomes hot, and the capacitor element may ignite. In this case, the printed board may be burnt out.
· Capacitors should be stored at room temperature under low humidity. Capacitors should never be stored under direct sunlight, and should be stored in an environment containing dust.
· If the capacitors will be operated in a humid environment, they should be sealed with a compound under proper conditions.
· Capacitors should not be stored or operated in environments containing acids, alkalis or active gasses.
· When capacitors are disposed of as "scrap" or waste, they should be treated as Industria Waste since they contain various metals and polymers.
· Capacitors submitted as samples should not be used for production purposes.

These application notes are prepared based on "Guideline of notabilia for fixed tantalum electrolytic capacitors with solid electrolyte for use in electronic equipment" (EIAJ RCR-2368) issued by Japan Electronics and Information Technology Industries Association (JEITA). 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 .

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