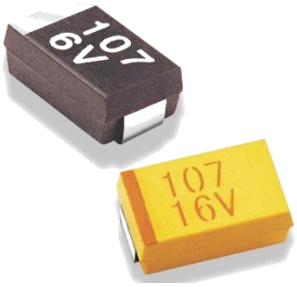


CA45 SERIES

CHIP TANTALUM CAPACITOR

CHIP TANTALUM CAPACITOR ▲ SMD type
Standard industrial grade MnO_2
Meets or exceeds EIA Standard 535BAAC
Laser marked epoxy case
Moisture Sensitivity Level ▲ MSL 3
Extended capacitance range

SPECIFICATION

Item		Characteristics [Note 1]								
Related Documents		EIA 535BAAC ▲ QC300801 ▲ Q/YHC 45-01								
Rated Temperature Range [Note 2]		-55°C to +125°C								
Capacitance Range	C_R	0.1µF to 1000µF								
Capacitance Tolerance	ΔC	±10% ▲ ±20%								
Rated Voltage Range	V_R	$2.5V_{DC}$ to $50V_{DC}$								
Dissipation Factor	tan δ	-55°C	< 1.5 x (+25°C value)							
		+25°C	6% to 30% (Refer to individual items)							
		+85°C	< 1.5 x (+25°C value)							
		+125°C	< 1.5 x (+25°C value)							
Leakage Current [Note 3]	I_{LEAK}	Less than 0.01 x C_R x V_R or 0.5µA (whichever is greater)								
Rated Voltage ≤ 85°C	V_R	2.5V	4V	6.3V	10V	16V	20V	25V	35V	50V
Derated Voltage > 85°C to ≤ 125°C	V_C	1.7V	2.5V	4V	6.3V	10V	13V	16V	23V	33V
Surge Voltage ≤ 85°C	V_{S_85}	3.2V	5V	8V	13V	20V	26V	32V	46V	60V
Derated Surge Voltage > 85°C to ≤ 125°C	V_{S_125}	2.2V	3.4V	5V	8V	12V	16V	20V	26V	38V

Case Sizes	Size	Code	Length	Width	Height
	2012	P	2.0mm	1.2mm	1.2mm
	3216	A	3.2mm	1.6mm	1.6mm
	3528	B	3.5mm	2.8mm	1.9mm
	6032	C	6.0mm	3.2mm	2.5mm
	7343	D	7.3mm	4.3mm	2.8mm
	7343	E	7.3mm	4.3mm	4.0mm

Notes:

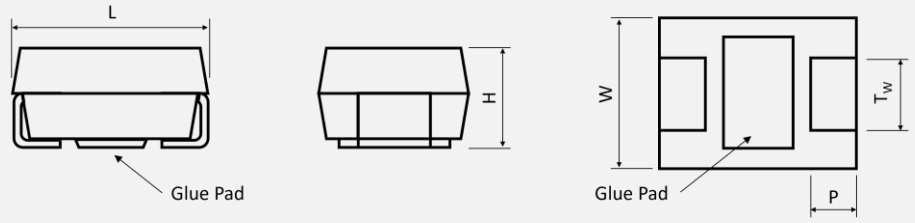
1: **All technical data measured at 25°C**
2: **Above 85°C voltage derating is required**
3: **The leakage current should be measured after 5 minutes application of rated voltage at 85°C. 125°C with voltage derating.**

APPLICATIONS

Consumer Electronics	DC/DC Converter	Filter Circuits	Telecom Infrastucture
			

PACKAGE OUTLINE AND CASE DIMENSIONS

Case Code	EIA/IECQ Size	L (mm)	W (mm)	H (mm)	P (mm)	T_W (mm)
P	2012	2.0 ± 0.2	1.2 ± 0.2	1.2 ± 0.2	0.5 ± 0.3	1.2 ± 0.1
A	3216	3.2 ± 0.2	1.6 ± 0.2	1.6 ± 0.2	0.8 ± 0.3	1.2 ± 0.1
B	3528	3.5 ± 0.2	2.8 ± 0.2	1.9 ± 0.2	0.8 ± 0.3	2.2 ± 0.1
C	6032	6.0 ± 0.3	3.2 ± 0.3	2.5 ± 0.3	1.3 ± 0.3	2.2 ± 0.1
D	7343	7.3 ± 0.3	4.3 ± 0.3	2.8 ± 0.3	1.3 ± 0.3	2.4 ± 0.1
E	7343	7.3 ± 0.3	4.3 ± 0.3	4.0 ± 0.3	1.3 ± 0.3	2.4 ± 0.1



CAPACITOR RATINGS AND CASE CODES

C_R (µF)	Capacitance Code	Rated Voltage V_R at 85°C (V)								
		2.5	4	6.3	10	16	20	25	35	50
0.10	104						P		A	A
0.15	154						P		A	A/B
0.22	224						P		A	A/B
0.33	334						P	A	A	A/B
0.47	474					P	P	A	A/B	A/B/C
0.68	684				P	P	P/A	A	A/B	A/B/C
1.0	105			P	P	P/A	A	A/B	A/B	B/C
1.5	155		P	P	P/A	P/A	B	A/B	A/B/C	C/D
2.2	225		P	P/A	P/A/B	A/B	A/B	A/B/C	B/C	C/D
3.3	335		P/A	P/A	P/A/B	A/B	A/B/C	A/B/C	B/C	C/D
4.7	475		P/A	P/A	P/A/B	A/B	A/B/C	A/B/C	C/D	C/D
6.8	685		P/A	P/A/B	P/A/B	A/B/C	A/B/C	B/C/D	C/D	D
10	106		A/B	P/A/B	P/B/C	A/B/C	B/C/D	B/C/D	C/D	D
15	156		A/B	P/A/B/C	A/B/C	A/B/C	B/C/D	C/D	D	
22	226		A/B/C	P/A/B/C	A/B/C	B/C/D	B/C/D	C/D	D	
33	336	A	A/B/C	A/B/C	A/B/C/D	B/C/D	C/D	D		
47	476	A	A/B/C	A/B/C/D	A/B/C/D	C/D	D	D		
68	686	A	A/B/C/D	A/B/C/D	B/C/D	C/D	D			
100	107	B	A/B/C/D	A/B/C/D	B/C/D	D	D			
150	157	B	B/C/D	B/C/D	C/D	D				
220	227	B/C	B/C/D	C/D	D					
330	337	B/C/D	C/D	B/C/D	D					
470	477	C/D	C/D	D						
680	687	D	D	D						
1000	108	D								

ELECTRICAL CHARACTERISTICS

V_R	C_R (µF)	Case Code	Max. I_{LEAK} (µA) Note 1	Max. tan δ (%) Note 1	Max. ESR at 100kHz (Ω) Note 1	Part Number Note 2
2.5V_{DC} (at 85°C) ▲ 1.7V_{DC} (at 125°C)	33	A	0.8	6	3	CA45–336□002AT
	47	A	1.2	6	3	CA45–476□002AT
	68	A	1.7	6	1.5	CA45–686□002AT
	100	B	2.5	8	0.4	CA45–107□002BT
	150	B	3.8	8	1.6	CA45–157□002BT
	220	B	5.5	8	1.6	CA45–227□002BT
	220	C	5.5	12	0.9	CA45–227□002CT
	330	B	8.3	12	1.6	CA45–337□002BT
	330	C	8.3	12	0.9	CA45–337□002CT
	330	D	8.3	12	0.9	CA45–337□002DT
	470	C	11.8	12	0.9	CA45–477□002CT
	470	D	11.8	12	0.9	CA45–477□002DT
	680	D	17	14	0.9	CA45–687□002DT
	1000	D	25	14	0.5	CA45–108□002DT
4V_{DC} (at 85°C) ▲ 2.5V_{DC} (at 125°C)	1.5	P	0.5	6	20	CA45–155□004PT
	2.2	P	0.5	6	18	CA45–225□004PT
	3.3	P	0.5	6	15	CA45–335□004PT
	3.3	A	0.5	6	8	CA45–335□004AT
	4.7	P	0.5	6	12	CA45–475□004PT
	4.7	A	0.5	6	8	CA45–475□004AT
	6.8	P	0.5	6	10	CA45–685□004PT
	6.8	A	0.5	6	6	CA45–685□004AT
	10	A	0.5	6	6	CA45–106□004AT
	10	B	0.5	6	3.5	CA45–106□004BT
	15	A	0.6	6	4	CA45–156□004AT
	15	B	0.6	6	3.5	CA45–156□004BT
	22	A	0.9	6	4	CA45–226□004AT
	22	B	0.9	6	3.5	CA45–226□004BT
	22	C	0.9	6	1.8	CA45–226□004CT
	33	A	1.3	6	4	CA45–336□004AT
	33	B	1.3	6	3.5	CA45–336□004BT
	33	C	1.3	6	1.8	CA45–336□004CT
	47	A	1.9	6	3	CA45–476□004AT
	47	B	1.9	6	2.5	CA45–476□004BT
	47	C	1.9	6	1.8	CA45–476□004CT
	68	A	2.7	18	2.5	CA45–686□004AT
	68	B	2.7	6	1.8	CA45–686□004BT
	68	C	2.7	6	1.6	CA45–686□004CT
	68	D	2.7	6	0.8	CA45–686□004DT
	100	A# Note 3	4	20	2	CA45–107□004AT
	100	B* Note 3	4	8	1.8	CA45–107□004BT
	100	C	4	8	1.2	CA45–107□004CT
	100	D	4	8	0.8	CA45–107□004DT
	150	B*	6	15	2	CA45–157□004BT
	150	C	6	8	1.2	CA45–157□004CT
	150	D	6	8	1.2	CA45–157□004DT
	220	B# Note 3	8.8	18	2	CA45–227□004BT

Note:
1. **All technical data measured at 25°C. Capacitance and loss test conditions: V = 1.7 to 2.2V, $V_{partial}$ = 0 to 1V (RMS), Measurement frequency: 100 (120)Hz. The leakage current should be measured after 5 minutes application of rated voltage at 85°C. 125°C with voltage derating.**
2. **□ : Enter the appropriate capacitance tolerance code. K for ±10 or M for ±20%.**
3. **"*" indicates at 125°C capacitance change of ± 15%. "#" Indicates at 125°C capacitance change of ± 20%**

ELECTRICAL CHARACTERISTICS

V_R	C_R (µF)	Case Code	Max. I_{LEAK} (µA) Note 1	Max. tan δ (%) Note 1	Max. ESR at 100kHz (Ω) Note 1	Part Number Note 2
4V_{DC} (at 85°C) ▲ 2.5V_{DC} (at 125°C)	220	C	8.8	8	1.2	CA45–227□004CT
	220	D	8.8	8	0.9	CA45–227□004DT
	330	C	13.2	12	0.9	CA45–337□004CT
	330	D	13.2	12	0.9	CA45–337□004DT
	470	C	18.8	12	0.9	CA45–477□004CT
	470	D	18.8	12	0.9	CA45–477□004DT
	680	D# Note 3	27.2	14	0.5	CA45–687□004DT
6.3V_{DC} (at 85°C) ▲ 4V_{DC} (at 125°C)	10	P	0.6	6	8	CA45–106□006PT
	10	B	0.6	6	3.5	CA45–106□006BT
	15	P	0.9	12	5	CA45–156□006PT
	15	A	0.9	6	3.5	CA45–156□006AT
	15	B	0.9	6	3.5	CA45–156□006BT
	15	C	0.9	6	1.8	CA45–156□006CT
	22	P	1.4	18	10	CA45–226□006PT
	22	A	1.4	6	4	CA45–226□006AT
	22	B	1.4	6	3.5	CA45–226□006BT
	22	C	1.4	6	1.8	CA45–226□006CT
	33	A	2.1	8	2.5	CA45–336□006AT
	33	B	2.1	6	2.5	CA45–336□006BT
	33	C	2.1	6	1.8	CA45–336□006CT
	47	A	4	10	3.5	CA45–476□006AT
	47	B	4	6	2	CA45–476□006BT
	47	C	4	6	1.6	CA45–476□006CT
	47	D	4	6	0.8	CA45–686□006DT
	68	A# Note 3	4.3	16	2	CA45–686□006AT
	68	B	4.3	6	0.9	CA45–686□006BT
	68	C	4.3	6	1.2	CA45–686□006CT
	68	D	4.3	6	0.8	CA45–686□006DT
	100	A# Note 3	6.3	30	4	CA45–107□006AT
	100	B* Note 3	6.3	10	3	CA45–107□006BT
	100	C	6.3	8	0.9	CA45–107□006CT
	100	D	6.3	8	0.8	CA45–107□006DT
	150	B# Note 3	9.5	15	1.5	CA45–157□006BT
	150	C	9.5	8	1.2	CA45–157□006CT
	150	D	9.5	8	0.9	CA45–157□006DT
	220	B	13.9	18	1	CA45–227□006BT
	220	C	13.9	8	1.2	CA45–227□006CT
	220	D	13.9	8	0.9	CA45–227□006DT
	330	D	20.8	12	0.9	CA45–337□006DT
	470	D* Note 3	29.6	12	0.4	CA45–477□006DT
	680	D# Note 3	42.8	14	0.5	CA45–687□006DT

Note: 1 **All technical data measured at 25°C. Capacitance and loss test conditions: V = 1.7 to 2.2V, $V_{partial}$ = 0 to 1V (RMS), Measurement frequency: 100 (120)Hz. The leakage current should be measured after 5 minutes application of rated voltage at 85°C. 125°C with voltage derating.**

2 **□: Enter the appropriate capacitance tolerance code. K for ±10 or M for ±20%.**

3 **"*" indicates at 125°C capacitance change of ± 15%. "#" Indicates at 125°C capacitance change of ± 20**

ELECTRICAL CHARACTERISTICS

V_R	C_R (µF)	Case Code	Max. I_{LEAK} (µA) Note 1	Max. tan δ (%) Note 1	Max. ESR at 100kHz (Ω) Note 1	Part Number Note 2
10V_{DC} (at 85°C) ▲ 6.3V_{DC} (at 125°C)	0.68	P	0.5	4	28	CA45–684□010PT
	1	P	0.5	4	25	CA45–105□010PT
	1.5	P	0.5	6	15	CA45–155□010PT
	1.5	A	0.5	6	8	CA45–155□010AT
	2.2	P	0.5	6	10	CA45–225□010PT
	2.2	A	0.5	6	8	CA45–225□010AT
	2.2	B	0.5	6	3.5	CA45–225□010BT
	3.3	P	0.5	8	10	CA45–335□010PT
	3.3	A	0.5	6	6	CA45–335□010AT
	3.3	B	0.5	6	5	CA45–335□010BT
	4.7	P	0.5	8	6	CA45–475□010PT
	4.7	A	0.5	6	5	CA45–475□010AT
	4.7	B	0.5	6	3.5	CA45–475□010BT
	6.8	A	0.7	6	4	CA45–685□010AT
	6.8	P	0.7	8	6	CA45–685□010PT
	6.8	B	0.7	6	3.5	CA45–685□010BT
	10	P	1	14	6	CA45–106□010PT
	10	A	1	6	4	CA45–106□010AT
	10	B	1	6	3.5	CA45–106□010BT
	10	C	1	6	1.8	CA45–106□010CT
	15	A	1.5	6	6	CA45–156□010AT
	15	B	1.5	6	2.8	CA45–156□010BT
	15	C	1.5	6	1.8	CA45–156□010CT
	22	A	2.2	8	6	CA45–226□010AT
	22	B	2.2	6	2.4	CA45–226□010BT
	22	C	2.2	6	1.8	CA45–226□010CT
	33	A# Note 3	3.3	15	3	CA45–336□010AT
	33	B	3.3	6	1.8	CA45–336□010BT
	33	C	3.3	6	1.6	CA45–336□010CT
	33	D	3.3	6	0.8	CA45–336□010DT
	47	A	4.7	15	2.5	CA45–476□010AT
	47	B	4.7	8	1	CA45–476□010BT
	47	C	4.7	6	1.2	CA45–476□010CT
	47	D	4.7	6	0.8	CA45–476□010DT
	68	B# Note 3	6.8	10	3	CA45–686□010BT
	68	C	6.8	6	1.2	CA45–686□010CT
	68	D	6.8	6	0.8	CA45–686□010DT
	100	C	10	8	1.2	CA45–107□010CT
	100	B# Note 3	10	15	1.2	CA45–107□010BT
	100	D# Note 3	10	8	0.9	CA45–107□010DT
	150	C# Note 3	15	10	1.5	CA45–157□010CT
	150	D	15	8	0.9	CA45–157□010DT
	220	D	22	8	0.5	CA45–227□010DT
	330	D* Note 3	33	12	0.5	CA45–337□010DT

Note: 1 **All technical data measured at 25°C. Capacitance and loss test conditions: V = 1.7 to 2.2V, $V_{partial}$ = 0 to 1V (RMS), Measurement frequency: 100 (120)Hz. The leakage current should be measured after 5 minutes application of rated voltage at 85°C. 125°C with voltage derating.**

2 **□: Enter the appropriate capacitance tolerance code. K for ±10 or M for ±20%.**

3 **"*" indicates at 125°C capacitance change of ± 15%. "#" Indicates at 125°C capacitance change of ± 20%**

ELECTRICAL CHARACTERISTICS

V_R	C_R (µF)	Case Code	Max. I_{LEAK} (µA) Note 1	Max. tan δ (%) Note 1	Max. ESR at 100kHz (Ω) Note 1	Part Number Note 2
16V_{DC} (at 85°C) ▲ 10V_{DC} (at 125°C)	0.47	P	0.5	4	25	CA45–474□016PT
	0.68	P	0.5	4	25	CA45–684□016PT
	1	P	0.5	4	20	CA45–105□016PT
	1	A	0.5	4	11	CA45–105□016AT
	1.5	P	0.5	6	20	CA45–155□016PT
	1.5	A	0.5	6	8	CA45–155□016AT
	2.2	A	0.5	6	6	CA45–225□016AT
	2.2	B	0.5	6	4.6	CA45–225□016BT
	3.3	A	0.5	6	5	CA45–335□016AT
	3.3	B	0.5	6	3.5	CA45–335□016BT
	4.7	A	0.8	6	4	CA45–475□016AT
	4.7	B	0.8	6	3.5	CA45–475□016BT
	6.8	B	1.1	6	2.5	CA45–685□016BT
	6.8	A	1.1	6	3.5	CA45–685□016AT
	6.8	C	1.1	6	1.9	CA45–685□016CT
	10	A* Note 3	1.6	8	7	CA45–106□016AT
	10	B	1.6	6	2.8	CA45–106□016BT
	10	C	1.6	6	2	CA45–106□016CT
	15	A# Note 3	2.4	10	3.5	CA45–156□016AT
	15	B	2.4	6	2.5	CA45–156□016BT
	15	C	2.4	6	1.8	CA45–156□016CT
	22	B	3.5	8	2.2	CA45–226□016BT
	22	C	3.5	6	1.6	CA45–226□016CT
	22	D	3.5	6	1.1	CA45–226□016DT
	33	B* Note 3	5.3	8	2.1	CA45–336□016BT
	33	C	5.3	6	1.5	CA45–336□016CT
	33	D	5.3	6	0.9	CA45–336□016DT
	47	C	7.5	6	1.4	CA45–476□016CT
	47	D	7.5	6	0.9	CA45–476□016DT
	68	C	10.9	6	1.3	CA45–686□016CT
	68	D	10.9	6	0.9	CA45–686□016DT
	100	C	16	8	1.2	CA45–107□016CT
	100	D	16	8	0.9	CA45–107□016DT
	150	D* Note 3	24	12	0.9	CA45–157□016DT
20V_{DC} (at 85°C) ▲ 13V_{DC} (at 125°C)	0.10	P	0.5	4	25	CA45–104□020PT
	0.15	P	0.5	4	25	CA45–154□020PT
	0.22	P	0.5	4	25	CA45–224□020PT
	0.33	P	0.5	4	25	CA45–334□020PT
	0.47	P	0.5	4	25	CA45–474□020PT
	0.68	P	0.5	4	25	CA45–684□020PT
	0.68	A	0.5	4	12	CA45–684□020AT
	1	A	0.5	4	9	CA45–105□020AT
	1.5	B	0.5	6	5	CA45–155□020BT
	2.2	A	0.5	6	7	CA45–225□020AT
	2.2	B	0.5	6	3.5	CA45–225□020BT
	3.3	A	0.7	6	4.5	CA45–335□020AT

Note:
1. **All technical data measured at 25°C. Capacitance and loss test conditions: V = 1.7 to 2.2V, $V_{partial}$ = 0 to 1V (RMS), Measurement frequency: 100 (120)Hz. The leakage current should be measured after 5 minutes application of rated voltage at 85°C. 125°C with voltage derating.**
2. **□ : Enter the appropriate capacitance tolerance code. K for ±10 or M for ±20%.**
3. **"*" indicates at 125°C capacitance change of ± 15%. "#" Indicates at 125°C capacitance change of ± 20%**

ELECTRICAL CHARACTERISTICS

V_R	C_R (µF)	Case Code	Max. I_{LEAK} (µA) Note 1	Max. tan δ (%) Note 1	Max. ESR at 100kHz (Ω) Note 1	Part Number Note 2
20V_{DC} (at 85°C) ▲ 13V_{DC} (at 125°C)	3.3	B	0.7	6	3	CA45–335□020BT
	3.3	C	0.7	6	2.5	CA45–335□020BT
	4.7	A	0.9	6	4	CA45–475□020AT
	4.7	C	0.9	6	2.4	CA45–475□020CT
	4.7	B	0.9	6	3	CA45–475□020BT
	6.8	A	1.4	6	6	CA45–685□020AT
	6.8	B	1.4	6	2.5	CA45–685□020BT
	6.8	C	1.4	6	2	CA45–685□020CT
	10	C	2	6	1.8	CA45–106□020CT
	10	D	2	6	1.3	CA45–106□020DT
	15	B	3	6	2	CA45–156□020BT
	15	C	3	6	1.7	CA45–156□020CT
	15	D	3	6	1	CA45–156□020DT
	22	B# Note 3	4.4	6	2.5	CA45–226□020BT
	22	C	4.4	6	1.6	CA45–226□020CT
	22	D	4.4	6	0.9	CA45–226□020DT
	33	C	6.6	6	1.5	CA45–336□020CT
	33	D	6.6	6	0.9	CA45–336□020DT
	47	D	9.4	6	0.9	CA45–476□020DT
	68	D* Note 3	13.6	6	0.9	CA45–686□020DT
	100	D* Note 3	20	8	0.9	CA45–107□020DT
25V_{DC} (at 85°C) ▲ 16V_{DC} (at 125°C)	0.33	A	0.5	4	15	CA45–334□025AT
	0.47	A	0.5	4	14	CA45–474□025AT
	0.68	A	0.5	4	10	CA45–684□025AT
	1	A	0.5	4	8	CA45–105□025AT
	1	B	0.5	4	5	CA45–105□025BT
	1.5	A	0.5	6	7.5	CA45–155□025AT
	1.5	B	0.5	6	5	CA45–155□025BT
	2.2	A	0.6	6	7	CA45–225□025AT
	2.2	B	0.6	6	4.5	CA45–225□025BT
	2.2	C	0.6	6	3.5	CA45–225□025CT
	3.3	A	0.8	6	4.5	CA45–335□025AT
	3.3	B	0.8	6	3.5	CA45–335□025BT
	4.7	A# Note 3	1.2	8	2.5	CA45–475□025AT
	4.7	B	1.2	6	2.8	CA45–475□025BT
	4.7	C	1.2	6	2.4	CA45–475□025CT
	6.8	B	1.7	6	2.8	CA45–685□025BT
	6.8	C	1.7	6	2	CA45–685□025CT
	10	B# Note 3	2.5	8	3	CA45–106□025BT
	10	C	2.5	6	1.8	CA45–106□025CT
	10	D	2.5	6	1.2	CA45–106□025DT
	15	C	3.8	6	1.6	CA45–156□025CT
	15	D	3.8	6	1	CA45–156□025DT
	22	C	5.5	6	1.4	CA45–226□025CT
	22	D	5.5	6	0.9	CA45–226□025DT
	47	D* Note 3	11.8	6	0.9	CA45–476□025DT
	68	D* Note 3	17	6	0.9	CA45–686□025DT

Note:

1. **All technical data measured at 25°C. Capacitance and loss test conditions: V = 1.7 to 2.2V, $V_{partial}$ = 0 to 1V (RMS), Measurement frequency: 100 (120)Hz. The leakage current should be measured after 5 minutes application of rated voltage at 85°C. 125°C with voltage derating.**
2. **□ : Enter the appropriate capacitance tolerance code. K for ±10 or M for ±20%.**
3. **"*" indicates at 125°C capacitance change of ± 15%. "#" Indicates at 125°C capacitance change of ± 20%**

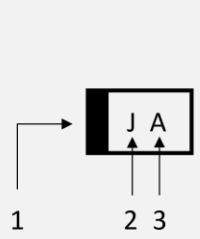
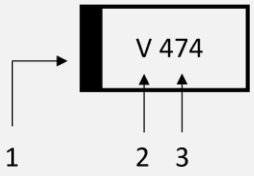
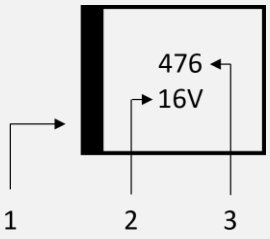
ELECTRICAL CHARACTERISTICS

V_R	C_R (µF)	Case Code	Max. I_{LEAK} (µA) Note 1	Max. tan δ (%) Note 1	Max. ESR at 100kHz (Ω) Note 1	Part Number Note 2
35V_{DC} (at 85°C) ▲ 23V_{DC} (at 125°C)	0.10	A	0.5	4	24	CA45–104□035AT
	0.15	A	0.5	4	21	CA45–154□035AT
	0.22	A	0.5	4	18	CA45–224□035AT
	0.33	A	0.5	4	15	CA45–334□035AT
	0.47	A	0.5	4	12	CA45–474□035AT
	0.47	B	0.5	4	10	CA45–474□035BT
	0.68	A	0.5	4	8	CA45–684□035AT
	0.68	B	0.5	4	8	CA45–684□035BT
	1	A	0.5	6	7.5	CA45–105□035AT
	1	B	0.5	6	6.5	CA45–105□035BT
	1.5	A	0.5	6	7.5	CA45–155□035AT
	1.5	B	0.5	6	5.2	CA45–155□035BT
	1.5	C	0.5	6	4.5	CA45–155□035CT
	2.2	B	0.8	6	4.2	CA45–225□035BT
	2.2	C	0.8	6	3.5	CA45–225□035CT
	3.3	B	1.2	6	3.5	CA45–335□035BT
	3.3	C	1.2	6	2.5	CA45–335□035CT
	4.7	D	1.6	6	1.5	CA45–475□035DT
	6.8	C	2.4	6	1.8	CA45–685□035CT
	6.8	D	2.4	6	1.3	CA45–685□035DT
	10	C	3.5	6	1.6	CA45–106□035CT
	10	D	3.5	6	1	CA45–106□035DT
	15	D	5.3	6	0.9	CA45–156□035DT
	22	D	7.7	6	0.9	CA45–226□035DT
50V_{DC} (at 85°C) ▲ 35V_{DC} (at 125°C)	0.10	A	0.5	4	22	CA45–104□050AT
	0.15	A	0.5	4	15	CA45–154□050AT
	0.15	B	0.5	4	16	CA45–154□050BT
	0.22	A	0.5	4	18	CA45–224□050AT
	0.22	B	0.5	4	14	CA45–224□050BT
	0.33	A	0.5	4	12	CA45–334□050AT
	0.33	B	0.5	4	12	CA45–334□050BT
	0.47	A	0.5	4	9.5	CA45–474□050AT
	0.47	B	0.5	4	9.5	CA45–474□050BT
	0.47	C	0.5	4	8	CA45–474□050CT
	0.68	A	0.5	4	8	CA45–684□050AT
	0.68	B	0.5	4	8	CA45–684□050BT
	0.68	C	0.5	4	7	CA45–684□050CT
	1	B	0.5	4	7	CA45–105□050BT
	1	C	0.5	4	5.5	CA45–105□050CT
	1.5	C	0.8	6	4.5	CA45–155□050CT
	1.5	D	0.8	6	4	CA45–155□050DT
	2.2	C	1.1	6	3	CA45–225□050CT
	2.2	D	1.1	6	2.5	CA45–225□050DT
	3.3	C	1.7	6	2.5	CA45–335□050CT
	3.3	D	1.7	6	2	CA45–335□050DT
	4.7	C	2.4	6	1.4	CA45–475□050CT
	4.7	D	2.4	6	1.4	CA45–475□050DT
	10	D	5	6	0.8	CA45–106□050DT

Note: 1 **All technical data measured at 25°C. Capacitance and loss test conditions: V = 1.7 to 2.2V, $V_{partial}$ = 0 to 1V (RMS), Measurement frequency: 100 (120)Hz. The leakage current should be measured after 5 minutes application of rated voltage at 85°C. 125°C with voltage derating.**

2 **□ : Enter the appropriate capacitance tolerance code. K for ±10 or M for ±20%.**

PRODUCT MARKING

Marking			Details	
P-CASE	A-CASE	B / C / D / E-CASE	No.	Description
			1	Polarity (+) Anode side
			2	Rated voltage (Code or voltage value)
			3	Capacitance (Code)
6.3V ▲ 1µF	35V ▲ 0.47µF	16V ▲ 47µF	Example	

RATED VOLTAGE CODE MARKING ▲ P-CASE AND A-CASE

Code	E	G	J	A	C	D	E	V	T
Rated Voltage V_R at 85°C	2.5V	4V	6.3V	10V	16V	20V	25V	35V	50V

CAPACITANCE CODE MARKING ▲ P-CASE

Code	A	E	J	N	s	W	A	E
Capacitance	0.1µF	0.15µF	0.22µF	0.33µF	0.47µF	0.68µF	1µF	1.5µF

Code	J	N	S	W	Ā	Ē	J̄	N̄
Capacitance	2.2µF	3.3µF	4.7µF	6.8µF	10µF	15µF	22µF	33µF

PRODUCT CODE

Example: CA45 series ▲ 10µF ▲ 16V_{DC} ▲ ±10% ▲ Case Code B = 3.5 x 2.8mm ▲ Tape and Reel

CA45-		106		K		016		B		T	
Series		Capacitance Code Note1 (pF)		Capacitance Tolerance (%)		Rated Voltage (V_{DC})		Case Code Note2		Packaging Type	
Code	Series	Code	µF	Code	Tol.	Code	VDC	Code	Size	Code	Type
CA45-	CA45	104	0.1	K	±10	002	2.5	P	2.0 x 1.2	T	Tape & Reel
		564	0.56	M	±20	004	4	A	3.2 x 1.6		
		225	2.2			006	6.3	B	3.5 x 2.8		
		686	68			010	10	C	6.0 x 3.2		
		337	330			016	16	D	7.3 x 4.3		
		108	1000			020	20	E	7.3 x 4.3		
						025	25				
						035	35				
						050	50				

Note: **1** **Capacitance code expressed in pF. The first two digits represent significant figures. The last digit specifies the total number of zeros to be added.**

2 **Size L x W in mm**

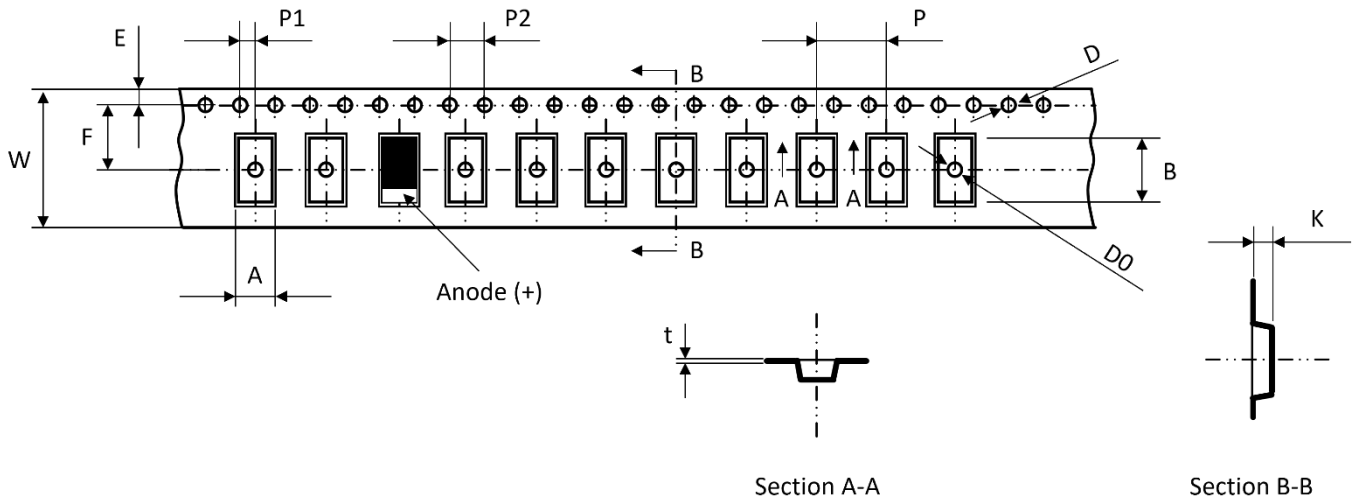
TECHNICAL SPECIFICATION

No.	Category	Specification	
1	Scope	This specification applies to CHIP TANTALUM CAPACITORS for electronics applications. Reference standards: EIA 535BAAC ▲ QC300801 ▲ Q/YHC 45-01	
2	Product Name	Molded chip tantalum capacitors, Type CA45	
3	Testing Conditions	Room temperature	25°C
		Relative humidity	60% to 70%
		Air pressure	800mbar to 1060mbar
4	Handling	It is mandatory to fully discharge capacitor to avoid failure test results. The product is a polarized component. It is prohibited to connect positive poles and negative poles reversely to avoid product performance failure.	

No.	Category	Item	Characteristics	Testing Method
5	Checking List	Drawing and dimension	See package outline and case dimensions	Measured with gauge
		Appearance	Complete marking, clear, centered	Visual
		Leakage current (I_{LEAK})	Less than 0.01·C·V or 0.5μA (whichever I greater)	Pressurize related voltage between two poles (Series connection with 1kΩ current limiting resistor). Read value.
		Capacitance tolerance (ΔC)	± 10% (K); ± 20% (M)	Measurement frequency: 100 (120)Hz Voltage: 0.3 ± 0.02V
		Dissipation factor (tan δ)	See electrical characteristics of the individual item	Measurement frequency: 100 (120)Hz
		ESR	See electrical characteristics of the individual item	Measurement frequency: 100 (120)Hz
		Solderability	Soldering coverage rate ≥ 95%	Dip capacitor into flux for two seconds, then remove excessive amount of lux, dip capacitor into 245±3°C welding slot with 10mm depth for three seconds, withdraw capacitor, clean capacitor with proper amount of solution, use ten times the microscope to observe.

Temperature performance	Capacitance (μF)	Change of Capacitance (ΔC) (%)			Max. tan δ (%)				Max. I_{LEAK} (μA)	
		-55°C	+85°C	+125°C	-55°C	+25°C	+85°C	+125°C	+85°C	+125°C
	≤ 1.0	-10	+10	+12	< 1.5 x (25°C value)	See individual item	< 1.5 x (25°C value)		$10 \cdot I_{LEAK\_25°C}$	$12.5 \cdot I_{LEAK\_25°C}$
	1.5 to 68									
	100 to 220									
	330 to 470									
	> 470									

TAPE DIMENSIONS ▲ All dimensions in mm

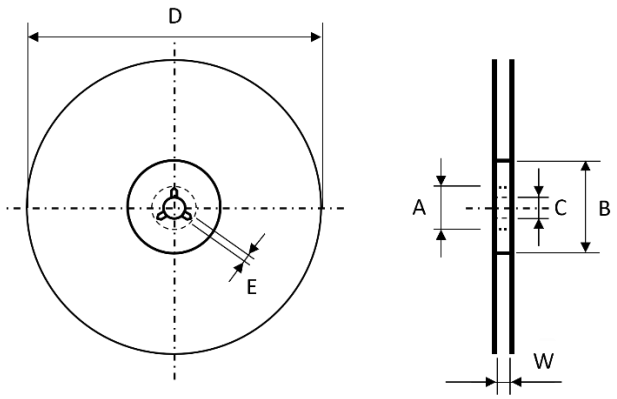


Section A-A

Section B-B

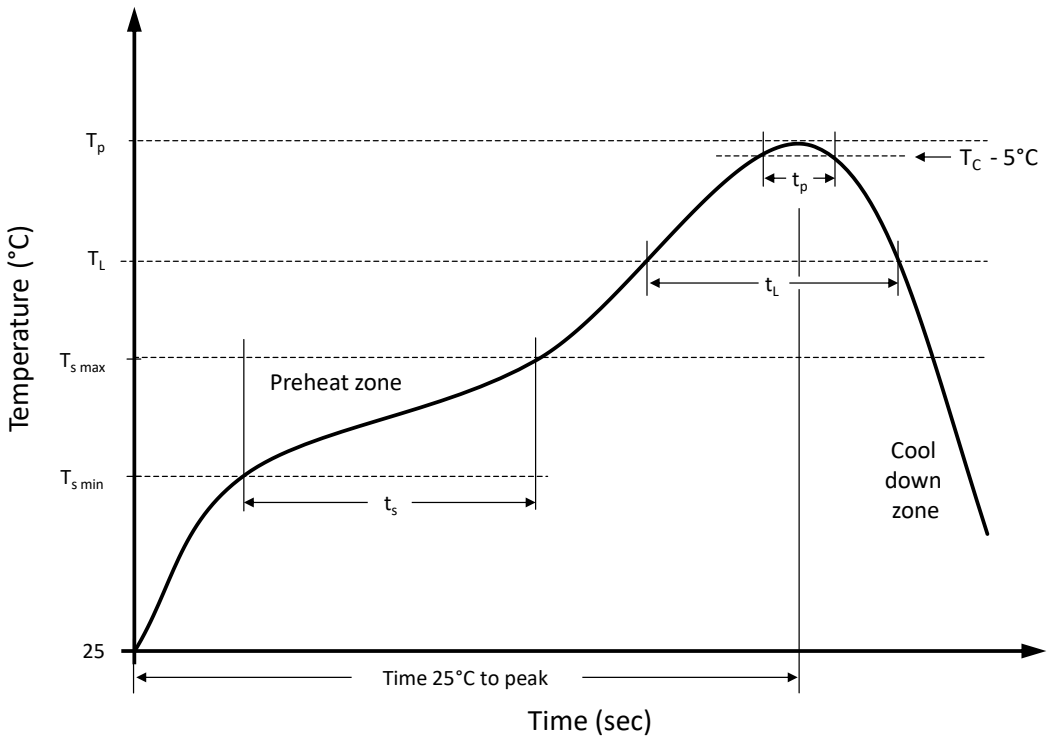
Case Code	W ± 0.3	F ± 0.1	E ± 0.1	P ± 0.1	P1 ± 0.1	P2 ± 0.1	D + 0.1	D_{0MIN}	t ± 0.3	A ± 0.2	B ±0.2	K ± 0.2
P	8	3.5	1.75	4	2	4	Ø1.5	Ø1.0	0.2	1.4	2.2	1.2
A	8	3.5	1.75	4	2	4	Ø1.5	Ø1.0	0.2	1.9	3.5	1.9
B	8	3.5	1.75	4	2	4	Ø1.5	Ø1.0	0.3	3.3	3.8	2.1
C	12	5.5	1.75	8	2	4	Ø1.5	Ø1.5	0.3	3.7	6.4	3.0
D	12	5.5	1.75	8	2	4	Ø1.5	Ø1.5	0.3	4.8	7.7	3.3
E	12	5.5	1.75	8	2	4	Ø1.5	Ø1.5	0.3	4.8	7.7	4.1

REEL DIMENSIONS ▲ All dimensions in mm



Case Code	A	B	C	D	E	W	QTY /Reel
P	21 ± 0.5	50	13	178 ± 2	2	8.4 + 1.5	3000
A	21 ± 0.5	50	13	178 ± 2	2	8.4 + 1.5	2000
B	21 ± 0.5	50	13	178 ± 2	2	8.4 + 1.5	2000
C	21 ± 0.5	50	13	178 ± 2	2	12.4 + 2	500
D	21 ± 0.5	50	13	178 ± 2	2	12.4 + 2	500
E	21 ± 0.5	50	13	178 ± 2	2	12.4 + 2	400

RECOMMENDED REFLOW SOLDERING PROFILE



Recommended reflow soldering conditions ▲ Refer to JEDEC J-STD-020E

Profile Features		Sn-Pb Eutetic Assembly	Pb-Free Assembly
Preheat temperature min.	$T_{s\,min}$	100 °C	150 °C
Preheat temperature max.	$T_{s\,max}$	150 °C	200 °C
Preheat time t_s from $T_{s\,min}$ to $T_{s\,max}$	t_s	120 seconds	120 seconds
Ramp-up rate (T_L to T_p)		max. 3 °C/second	max. 3 °C/second
Liquidous temperature	T_L	183 °C	217 °C
Time t_L maintained above T_L	t_L	150 seconds max.	150 seconds max.
Peak package body temperature	T_p	235°C	260°C
Timeframe of within 5°C below and up to max actual peak body temperature	t_p	20 seconds max.	30 seconds max.
Ramp-down rate (T_L to T_p)		max. 6 °C/second	max. 6 °C/second
Time 25°C to peak temperature		max. 6 minutes	max. 8 minutes

CORRECT USE OF CHIP TANTALUM CAPACITORS

<table>
<tr><th>No.</th><th>Category</th><th colspan="7">Specification</th></tr>
<tr><td rowspan="20">1</td><td rowspan="20">Ripple Current and Ripple Voltage</td><td colspan="7">If ripple current is applied, heat is generated within capacitor by Joule's heat (power dissipation) and it may affect to reliability of the capacitor.</td></tr>
<tr><td>Power dissipation</td><td colspan="6">The actual power dissipated in capacitor is calculated using the formula:
$P = I^2 \cdot ESR$
Where:
P: Power dissipation (W)
I: Ripple current (A rms)
ESR: Equivalent Series Resistance</td></tr>
<tr><td></td><td colspan="6">Table 1 ▲ Max. power dissipation</td></tr>
<tr><td></td><td>Case code</td><td colspan="5">Max. power dissipation at 100kHz/25°C (W)</td></tr>
<tr><td></td><td>P</td><td colspan="5">0.025</td></tr>
<tr><td></td><td>A</td><td colspan="5">0.075</td></tr>
<tr><td></td><td>B</td><td colspan="5">0.085</td></tr>
<tr><td></td><td>C</td><td colspan="5">0.110</td></tr>
<tr><td></td><td>D</td><td colspan="5">0.150</td></tr>
<tr><td></td><td>E</td><td colspan="5">0.150</td></tr>
<tr><td>Ripple current</td><td colspan="6">Using P_{MAX} from Table 1, maximum ripple current (A rms) may be determined as follow:
$I = \sqrt{\frac{P}{ESR}} \cdot K \cdot F$
Where:
K: Temperature derating factor (Table 2)
F: Frequency derating factor (Table 3)
ESR: Refer to individual item ratings</td></tr>
<tr><td></td><td colspan="6">Table 2 ▲ Temperature derating factor K</td></tr>
<tr><td></td><td>Temperature</td><td colspan="5">Temperature derating factor K</td></tr>
<tr><td></td><td>25°C</td><td colspan="5">1</td></tr>
<tr><td></td><td>85°C</td><td colspan="5">0.9</td></tr>
<tr><td></td><td>125°C</td><td colspan="5">0.4</td></tr>
<tr><td></td><td colspan="6">Table 3 ▲ Frequency derating factor F</td></tr>
<tr><td></td><td>Type</td><td>10kHz</td><td>100kHz</td><td>500kHz</td><td colspan="2">1MHz</td></tr>
<tr><td></td><td>MnO_2</td><td>0.80</td><td>1.00</td><td>1.15</td><td colspan="2">1.20</td></tr>
<tr><td></td><td>Polymer</td><td>0.75</td><td>1.00</td><td>1.10</td><td colspan="2">1.30</td></tr>
<tr><td>Ripple voltage</td><td colspan="6">Ripple voltage E is calculated using the formula
$E = Z \cdot I$
Where:
E: Ripple voltage
Z: Impedance at specified frequency</td></tr>
<tr><td></td><td colspan="6">The ripple voltage that may be applied is limited by three criteria:</td></tr>
<tr><td></td><td>[a]</td><td colspan="5">The power dissipated in the ESR of the capacitor must not exceed the appropriate value specified in table 1.</td></tr>
<tr><td></td><td>[b]</td><td colspan="5">The sum of DC voltage and peak value of the ripple voltage must not exceed the rated voltage.</td></tr>
<tr><td></td><td>[c]</td><td colspan="5">The negative peak value of the ripple voltage must not exceed the permissible reverse voltage value specified in the following section, Reverse Voltage.</td></tr>
</table>

CORRECT USE OF CHIP TANTALUM CAPACITORS

No.	Category	Specification	
2	Reverse Voltage	Because the solid tantalum capacitor is a polarized type, do not apply a reverse voltage to it. If reverse voltage cannot be avoided, it must be applied for a short time and must not exceed the following values:	
		25°C	10% max. of rated voltage or $1V_{DC}$, whichever is smaller
		85°C	5% max. of rated voltage or $0.5V_{DC}$, whichever is smaller
		125°C	1% max. of rated voltage or $0.1V_{DC}$, whichever is smaller
		The capacitors should not be operated continuously in reverse mode, even within these limits.	
3	Applied Voltage	(1)	For general application, apply 70% or less of the rated voltage to the capacitor.
		(2)	When the capacitor is used in a power line or a low impedance circuit, keep the applied voltage within 30% of the rated voltage to avoid the adverse influence of inrush current.
		(3)	Derated voltage at 85°C or more.
		(4)	When using a Chip type capacitor at a temperature of 85°C or higher, calculate reduced voltage V_T from the following expression. Note, however, that the ambient temperature must not exceed 125°C $V_T = (V_R - V_C) \cdot \frac{(T - 85°C)}{40°C}$ Where: V_R: Rated voltage (V) at ≤ 85°C V_C: Derated voltage at 125°C (V) V_T: Derated voltage between 85°C to 125°C T: Ambient temperature (°C)
4	Current (Series Resistance)	Reliability of tantalum capacitor is increased by inserting a series resistance of at least 3Ω/V into circuits where current flow is momentary (switching circuit, charge/discharge circuits, etc). If the capacitor is in a low impedance circuit, the voltage applied to the capacitor should be less than 1/2 to 1/3 of DC rated voltage.	
5	Risk of Short Circuit	Manganese oxide tantalum capacitor (conventional tantalum capacitor) is heated and may generate fire and be burned depending upon its excess current, time and other factors. **When design the circuit, provide as much margin as possible to maintain capacitor reliability.**	
6	Product Soldering	SMT Tantalum capacitors are suitable for reflow soldering and not suitable for wave flow soldering or hand soldering. See details in our recommended reflow soldering profile.	

REVISION TABLE

Revision	Date	Status	Notes
001	26/06/2022	Initial release	Initial publication

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