Tantalum Chip Capacitors

Performance, High Temperature 175 °C

Series/Type: **B45196T, B45198T**
Date: July 2006

RoHS compatible

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Construction



- Polar tantalum capacitors with solid electrolyte
- Conventional, optimized $TaMnO_2$ technology
- Flame-retardant plastic case (UL 94 V-0)
- Optionally tinned or gold-plated terminals

Features

- Operating temperature up to 175 °C
- Outstanding reliability
- Very low failure rate
- High volumetric efficiency
- Excellent solderability
- Stable temperature and frequency characteristics
- Low leakage current, low dissipation factor
- Low self-inductance
- High resistance to shock and vibration
- Suitable for use without series resistor (special operating conditions recommended)
- Lead-free and material content compatible with RoHS

Applications

- Automotive electronics (safety applications e.g. airbag, ABS, motor management, electronic control unit)
- Measuring and control engineering (e.g. voltage regulators)
- Medical engineering
- DC/DC converters
- Telecommunications (e.g. mobile phones, infrastructure)
- Data processing (e.g. laptops, mainframes)

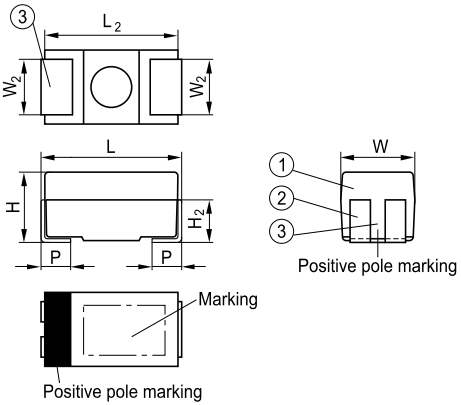
Soldering

Suitable for reflow soldering (IR and vapor phase, in compliance with JEDEC J-STD-020 C) and wave soldering

Delivery mode

Taped and reeled in accordance with IEC 60286-3

Dimensional drawing



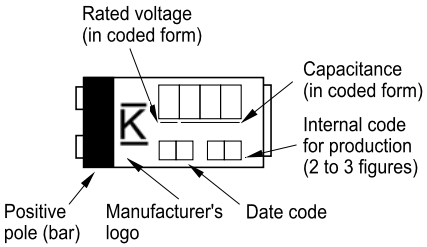
① Encapsulation: molded epoxy resin
② NiFe; tinned surface Sn100 or gold-plated
③ Reduced slot length for case size A

Dimensions

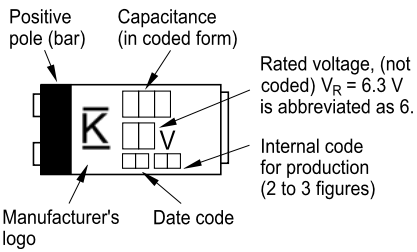
Case size		Dimensions in mm (inches)						
	EIA/IECQ	L	W	H	L_2 typ.	W_2 ±0.1 ±(.004)	H_2 typ.	P ±0.3 ±(.012)
A	3216-18	3.2 ±0.2 (.126 ±0.008)	1.6 ±0.2 (.063 ±0.008)	1.6 ±0.2 (.063 ±0.008)	3.2 (.126)	1.2 (.047)	1.3 (.051)	0.8 (.031)
B	3528-21	3.5 ±0.2 (.138 ±0.008)	2.8 ±0.2 (.110 ±0.008)	1.9 ±0.2 (.075 ±0.008)	3.5 (.138)	2.2 (.087)	1.4 (.055)	0.7 (.027)
C	6032-28	6.0 ±0.3 (.236 ±0.012)	3.2 ±0.3 (.126 ±0.012)	2.5 ±0.3 (.098 ±0.012)	6.1 (.240)	2.2 (.087)	1.8 (.071)	1.3 (.051)
D	7343-31	7.3 ±0.3 (.287 ±0.012)	4.3 ±0.3 (.169 ±0.012)	2.8 ±0.3 (.110 ±0.012)	7.3 (.287)	2.4 (.094)	1.8 (.071)	1.3 (.051)

Marking

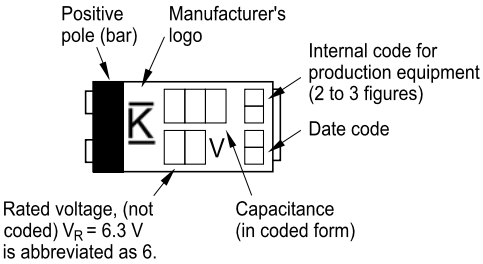
Case size A



Case size B



Case size C, D



Voltage coding for case size A

Rated voltage	4	6.3	10	16	20	25	35	50
Code letter	G	J	A	C	D	E	V	T

Capacitance coding

1st and 2nd digit	Capacitance in pF	
3rd digit	Multiplier:	6 = 10^6 pF 7 = 10^7 pF 8 = 10^8 pF

Date coding

Year	Month	
S = 2004	1 = January	7 = July
T = 2005	2 = February	8 = August
U = 2006	3 = March	9 = September
V = 2007	4 = April	O = October
W = 2008	5 = May	N = November
X = 2009	6 = June	D = December

Specifications and characteristics in brief

Series			Performance, High Temperature 175 °C		
Ordering code			B45196T	B45198T	
Technology			$Ta\text{-}MnO_2$	$Ta\text{-}MnO_2$	
Terminals			Tinned	Gold-plated	
Rated voltage	(up to 85 °C) (up to 125 °C) (up to 150 °C) (up to 175 °C)	V_R	6.3 ... 35 4.0 ... 23 3.2 ... 17.5 2.1 ... 11.7		VDC
Rated capacitance	(20 °C, 120 Hz)	C_R	0.15 ... 150		µF
Capacitance tolerance			±20%, ±10%		
Maximum impedance	(20 °C, 100 kHz)	Z_{max}	0.5 ... 23		Ω
Operating temperature range		T_{op}	−55 ... +175		°C
Failure rate (1 fit = $1 \cdot 10^{-9}$ failures/h) $C_R \cdot V_R \leq 330\ \mu F \cdot V$ $C_R \cdot V_R > 330\ \mu F \cdot V$	(at 40 °C; ≤ V_R, $R_S \geq 3\ \Omega/V$)		 ≤0.8 ≤2.5		fit
Service life			>500000		h
Leakage current	(V_R, 5 min, 20 °C)	I_{leak}	10		nA/µC
Detail specification			CECC 30801-801/-802		
Climatic category (to IEC 60068-1)	(−55 °C/+125 °C/56 days damp heat test)		55/125/56		

Maximum working voltage at 175 °C: 0.33 V_R (Maximum 500 h).
Details for this operating condition must be agreed upon between supplier and customer.

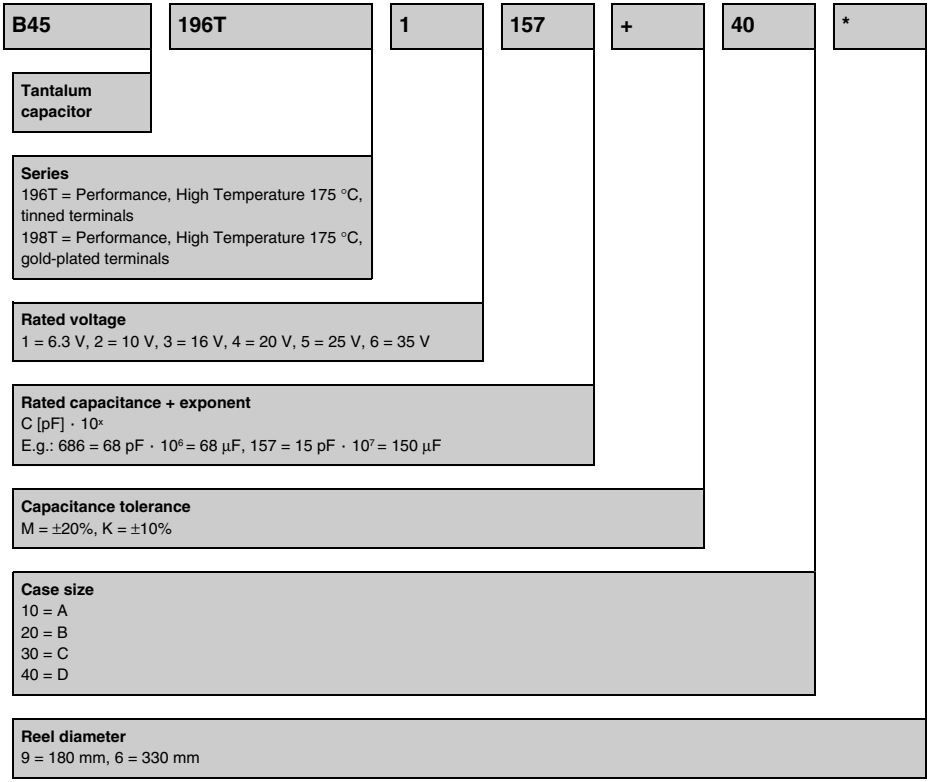
For high temperature types, individual tests are carried out under more extreme conditions, supplementary to the tests specified by CECC.

Overview of types

(VDC) (up to 85 °C)	6.3	10	16	20	25	35
C_R (µF)						
0.15						A
0.22						A
0.33						A
0.47					A	B
0.68				A	A	B
1.0			A	A	A	B
1.5		A	A	A	B	C
2.2	A	A	A	B	B	C
3.3	A	A	A B	B	C	C
4.7	A	A B	A B	B C	C	C D
6.8	A B	A B	A B C	C	C D	D
10	B	B C	B C	C	D	D
15	B C	B C	C	C D	D	
22	B C	C	C D	D	D	
33	B C	C D	D		D	
47	C D	D	D			
68	C D	D				
100	D					
150	D					

Upon request

Ordering code structure



Technical data and ordering codes

C_R (20 °C, 120 Hz) µF	Case size	DF_{max} (20 °C, 120 Hz) %	$I_{leak,max}$ (20 °C, V_R, 5 min) µA	Z_{max} (20 °C, 100 kHz) Ω	Ordering code
$V_{R,85}$ = 6.3 VDC, $V_{R,125}$ = 4.0 VDC, $V_{R,150}$ = 3.2 VDC, $V_{R,175}$ = 2.1 VDC					
2.2	A	4.5	0.5	6.5	B45196T1225+10*
3.3	A	4.5	0.5	4.6	B45196T1335+10*
4.7	A	4.5	0.5	3.6	B45196T1475+10*
6.8	A	4.5	0.5	2.9	B45196T1685+10*
6.8	B	4.5	0.5	2.7	B45196T1685+20*
10	B	4.5	0.6	2.1	B45196T1106+20*
15	B	4.5	0.9	1.8	B45196T1156+20*
15	C	4.5	0.9	1.7	B45196T1156+30*
22	B	4.5	1.4	1.5	B45196T1226+20*
22	C	4.5	1.4	1.3	B45196T1226+30*
33	B	4.5	2.1	1.3	B45196T1336+20*
33	C	4.5	2.1	1.1	B45196T1336+30*
47	C	4.5	3.0	0.8	B45196T1476+30*
47	D	4.5	3.0	0.8	B45196T1476+40*
68	C	6.0	4.3	0.8	B45196T1686+30*
68	D	4.5	4.3	0.6	B45196T1686+40*
100	D	4.5	6.3	0.6	B45196T1107+40*
150	D	4.5	9.5	0.5	B45196T1157+40* ●
$V_{R,85}$ = 10 VDC, $V_{R,125}$ = 6.3 VDC, $V_{R,150}$ = 5.0 VDC, $V_{R,175}$ = 3.3 VDC					
1.5	A	4.5	0.5	6.5	B45196T2155+10*
2.2	A	4.5	0.5	4.6	B45196T2225+10*
3.3	A	4.5	0.5	3.6	B45196T2335+10*
4.7	A	4.5	0.5	2.9	B45196T2475+10*
4.7	B	4.5	0.5	2.7	B45196T2475+20*
6.8	A	4.5	0.7	2.0	B45196T2685+10*
6.8	B	4.5	0.7	2.1	B45196T2685+20*
10	B	4.5	1.0	1.8	B45196T2106+20*
10	C	4.5	1.0	1.7	B45196T2106+30*
15	B	4.5	1.5	1.5	B45196T2156+20*
15	C	4.5	1.5	1.4	B45196T2156+30*
22	C	4.5	2.2	1.1	B45196T2226+30*
33	C	4.5	3.3	0.9	B45196T2336+30*

● Preliminary Data

* = Code number for reel diameter
6 = 330-mm reel
9 = 180-mm reel

\+ = Capacitance tolerance
M = ±20%
K = ±10%

C_R (20 °C, 120 Hz) µF	Case size	DF_{max} (20 °C, 120 Hz) %	$I_{leak,max}$ (20 °C, V_R, 5 min) µA	Z_{max} (20 °C, 100 kHz) Ω	Ordering code
33	D	4.5	3.3	0.8	B45196T2336+40*
47	D	4.5	4.7	0.6	B45196T2476+40*
68	D	4.5	6.8	0.6	B45196T2686+40*
$V_{R,85}$ = 16 VDC, $V_{R,125}$ = 10.0 VDC, $V_{R,150}$ = 8.0 VDC, $V_{R,175}$ = 5.3 VDC					
1.0	A	3.0	0.5	6.5	B45196T3105+10*
1.5	A	4.5	0.5	5.2	B45196T3155+10*
2.2	A	4.5	0.5	4.3	B45196T3225+10*
3.3	A	4.5	0.5	3.4	B45196T3335+10*
3.3	B	4.5	0.6	3.0	B45196T3335+20*
4.7	A	4.5	0.8	3.0	B45196T3475+10* ●
4.7	B	4.5	0.8	2.1	B45196T3475+20*
6.8	A	4.5	1.1	2.0	B45196T3685+10* ●
6.8	B	4.5	1.1	1.8	B45196T3685+20*
6.8	C	4.5	1.1	1.7	B45196T3685+30*
10	B	4.5	1.6	3.0	B45196T3106+20*
10	C	4.5	1.6	1.4	B45196T3106+30*
15	C	4.5	2.4	1.1	B45196T3156+30*
22	C	4.5	3.5	1.0	B45196T3226+30*
22	D	4.5	3.5	0.8	B45196T3226+40*
33	D	4.5	5.3	0.7	B45196T3336+40*
47	D	4.5	7.5	0.6	B45196T3476+40*
$V_{R,85}$ = 20 VDC, $V_{R,125}$ = 13.0 VDC, $V_{R,150}$ = 10.0 VDC, $V_{R,175}$ = 6.7 VDC					
0.68	A	3.0	0.5	7.8	B45196T4684+10*
1.0	A	3.0	0.5	5.9	B45196T4105+10*
1.5	A	4.5	0.5	5.2	B45196T4155+10*
2.2	B	4.5	0.5	3.6	B45196T4225+20*
3.3	B	4.5	0.7	2.7	B45196T4335+20*
4.7	B	4.5	0.9	1.9	B45196T4475+20*
4.7	C	4.5	0.9	1.7	B45196T4475+30*
6.8	C	4.5	1.4	1.3	B45196T4685+30*
10	C	4.5	2.0	1.1	B45196T4106+30*
15	C	4.5	3.0	1.0	B45196T4156+30*
15	D	4.5	3.0	0.9	B45196T4156+40*
22	D	4.5	4.4	0.7	B45196T4226+40*

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M = ±20%
K = ±10%

C_R (20 °C, 120 Hz) µF	Case size	DF_{max} (20 °C, 120 Hz) %	$I_{leak,max}$ (20 °C, V_R, 5 min) µA	Z_{max} (20 °C, 100 kHz) Ω	Ordering code
$V_{R,85}$ = 25 VDC, $V_{R,125}$ = 16.0 VDC, $V_{R,150}$ = 12.5 VDC, $V_{R,175}$ = 8.3 VDC					
0.47	A	3.0	0.5	7.8	B45196T5474+10*
0.68	A	3.0	0.5	5.9	B45196T5684+10*
1.0	A	3.0	0.5	5.2	B45196T5105+10*
1.5	B	4.5	0.5	4.2	B45196T5155+20*
2.2	B	4.5	0.6	3.0	B45196T5225+20*
3.3	C	4.5	0.8	2.0	B45196T5335+30*
4.7	C	4.5	1.2	1.6	B45196T5475+30*
6.8	C	4.5	1.7	1.4	B45196T5685+30*
6.8	D	4.5	1.7	1.1	B45196T5685+40*
10	D	4.5	2.5	0.9	B45196T5106+40*
15	D	4.5	3.8	0.7	B45196T5156+40*
22	D	4.5	5.5	0.6	B45196T5226+40*
33	D	4.5	8.3	0.6	B45196T5336+40* ●
$V_{R,85}$ = 35 VDC, $V_{R,125}$ = 23.0 VDC, $V_{R,150}$ = 17.5 VDC, $V_{R,175}$ = 11.7 VDC					
0.15	A	3.0	0.5	23.0	B45196T6154+10*
0.22	A	3.0	0.5	15.0	B45196T6224+10*
0.33	A	3.0	0.5	11.0	B45196T6334+10*
0.47	B	3.0	0.5	8.0	B45196T6474+20*
0.68	B	3.0	0.5	5.5	B45196T6684+20*
1.0	B	3.0	0.5	4.4	B45196T6105+20*
1.5	C	4.5	0.5	3.3	B45196T6155+30*
2.2	C	4.5	0.8	2.2	B45196T6225+30*
3.3	C	4.5	1.2	1.7	B45196T6335+30*
4.7	C	4.5	1.6	1.3	B45196T6475+30*
4.7	D	4.5	1.6	1.0	B45196T6475+40*
6.8	D	4.5	2.4	0.9	B45196T6685+40*
10	D	4.5	3.5	0.7	B45196T6106+40*

● Preliminary Data

* = Code number for reel diameter
6 = 330-mm reel
9 = 180-mm reel

\+ = Capacitance tolerance
M = ±20%
K = ±10%

Cautions and warnings

When using tantalum capacitors with a manganese dioxide coating, the following cautions and warnings should be taken into account:

Polarity

Because tantalum capacitors are *polar capacitors,* it is important to observe their polarity markings (positive pole on the anode, negative pole on the cathode). Any incorrect polarity resulting from the sum of the AC and DC voltage components must be smaller than or equal to the permitted *polarity reversal voltage*. To avoid reducing their reliability, this voltage may only occur for a short time, at most five times for a duration of one minute per hour.

Voltage

The *maximum continuous voltage* depends on the ambient temperature. Within the temperature range of −55 to +85 °C, the rated voltage is equal to the maximum continuous voltage. Between + 85 and + 125 °C the maximum continuous voltage must be reduced linearly from the full rated voltage to 2/3 of it (derating). At 150 °C (only B4519*P series) the voltage must be reduced to 1/2 and at 175 °C (only B4519*T series) to 1/3 of the rated voltage. Operation below the maximum continuous voltage has a positive effect on the capacitor's failure rate. The maximum continuous voltage must not be exceeded.

All unfavourable operating conditions (such as possible line overvoltages, unfavourable tolerances of the transformation ratio of the line transformer in the equipment, repeated overvoltages when the equipment is switched on, high ambient temperatures) must be taken into account when determining the *operating voltage*.

The *surge voltage* is the maximum voltage (peak value) that may be applied to the capacitor for short periods, at most five times for a total duration of up to 1 minute per hour. The surge voltage must not be applied for periodic charging and discharging in the course of normal operation and cannot be part of the operating voltage. The permissible surge voltage for all capacitors in this data book is 1.3 x the rated voltage. The occurrence of voltage impulses (transient voltages) that exceed the surge voltage may lead to irreparable damage.

Capacitance

The actual *capacitance* of a capacitor can deviate from the rated capacitance by as much as the full magnitude of the tolerance at delivery. The capacitance varies with the temperature (at +125 °C +12% up to +20%) and decreases with increasing frequency.

Low-resistance applications and voltage networks

For *low-resistance applications*, KEMET recommends a maximum operating voltage of half the permissible maximum continuous voltage, so that the capacitors have sufficient tolerance to withstand voltage peaks. Depending on the conditions of use, the early failure rate is higher here by a factor of 2 to 20 than in the range with a constant failure rate as specified in the data book.

When operated directly in a *voltage network*, the capacitor should be protected against overvoltage, e.g. by a suppressor diode, and against polarity reversal by a diode. If a capacitor is operated in an unprotected low-impedance circuit and fails because the permissible conditions for the forward DC voltage, reverse DC voltage, surge current, power dissipation or temperature are exceeded, the continued current flow through the overstressed capacitor may produce overheating. The overheated capacitor may damage the surrounding components and the circuit board.

Storage conditions

Capacitors with solid electrolyte may be stored at temperatures down to –80 °C. The upper *storage temperature* must not exceed +85 °C (for blister tape the temperature limit is +40 °C). The storage conditions should not exceed +40 °C and 70% R. H. A drypack is useful to prevent the effects of humidity.

Important notes

The following applies to all products named in this publication:

1. Some parts of this publication contain **statements about the suitability of our products for certain areas of application**. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. We nevertheless expressly point out **that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application**. As a rule, KEMET is either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether a KEMET product with the properties described in the product specification is suitable for use in a particular customer application.
2. We also point out that **in individual cases, a malfunction of passive electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified**. In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of a passive electronic component could endanger human life or health (e.g. in accident prevention or life-saving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g. installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of a passive electronic component.
3. **The warnings, cautions and product-specific notes must be observed**.
4. In order to satisfy certain technical requirements, **some of the products described in this publication may contain substances subject to restrictions in certain jurisdictions (e.g. because they are classed as "hazardous")**. Should you have any more detailed questions, please contact our sales offices.
5. We constantly strive to improve our products. Consequently, **the products described in this publication may change from time to time**. The same is true of the corresponding product specifications. Please check therefore to what extent product descriptions and specifications contained in this publication are still applicable before or when you place an order.

   We also **reserve the right to discontinue production and delivery of products**. Consequently, we cannot guarantee that all products named in this publication will always be available.
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