



## Tantalum Chip Capacitors

SpeedPower II, Low ESR

**Ordering code:** B45006B476\*+257

**Date:** July 2006



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## Preliminary Data



## Features

- Wide variety of low ESR values
- High ripple current capability
- 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 (recommended operating conditions see [www.epcos.com/tantalum\\_gti](http://www.epcos.com/tantalum_gti), section 4.4)
- Lead-free and material content compatible with RoHS



## Technical data and ordering code

|   |  |                |   |               |
|---|--|----------------|---|---------------|
| Ordering code   | (tinned terminals)                               |                | B45006B476*+257   |               |
| Rated capacitance   | (20 °C, 120 Hz)                                  | $C_R$          | 47  | $\mu\text{F}$ |
| Rated voltage   | (up to 85 °C)<br>(up to 125 °C)                  | $V_R$          | 6.3<br>4  | VDC           |
| Operating temperature range                               |  | $T_{op}$       | -55 ... +125  | °C            |
| Maximum leakage current                                   | (20 °C, $V_R$ , 5 min)                           | $I_{leak,max}$ | 3.0   | $\mu\text{A}$ |
| Maximum dissipation factor                                | (20 °C, 120 Hz)                                  | $DF_{max}$     | 6   | %             |
| Maximum equivalent series resistance                      | (20 °C, 100 kHz)                                 | $ESR_{max}$    | 250   | m $\Omega$    |
| Maximum ripple current                                    | (20 °C, 100 kHz)                                 | $I_{AC,max}$   | 0.58  | A             |
| Case size   |  |                | B   |               |
| EIA code  |  |                | 3528-21   |               |
| Dimensions  | (L x W x H)                                      |                | 3.5 ±0.2 x 2.8 ±0.2 x 1.9 ±0.2<br>(0.138 ±0.008 x 0.110 ±0.008<br>x 0.075 ±0.008) | mm<br>(inch)  |
| Failure rate<br>(1 fit = 1 · 10 <sup>-9</sup> failures/h) | (at 40 °C; ≤ $V_R$ ,<br>$R_S$ ≤ 0.1 $\Omega/V$ ) |                | ≤40   | fit           |

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

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

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### Ordering code structure

|  |          |           |          |            |          |          |            |
|--|----------|-----------|----------|------------|----------|----------|------------|
| <b>B45</b>   | <b>0</b> | <b>02</b> | <b>D</b> | <b>337</b> | <b>*</b> | <b>+</b> | <b>106</b> |
| <b>Tantalum capacitor</b>  |          |           |          |            |          |          |            |
| <b>Series</b><br>0 = SpeedPower, Low ESR; Low Profile, Low ESR; tinned terminals<br>1 = SpeedPower, Low ESR; gold-plated terminals   |          |           |          |            |          |          |            |
| <b>Rated voltage</b><br>02 = 2.5 V, 04 = 4 V, 06 = 6.3 V, 10 = 10 V, 16 = 16 V, 20 = 20 V, 25 = 25 V, 35 = 35 V, 50 = 50 V   |          |           |          |            |          |          |            |
| <b>Case size</b><br>A, B, C, D, E  |          |           |          |            |          |          |            |
| <b>Rated capacitance + exponent</b><br>C [pF] · 10 <sup>x</sup><br>686 = 68 pF · 10 <sup>6</sup> = 68 µF, 157 = 15 pF · 10 <sup>7</sup> = 150 µF, 108 = 10 pF · 10 <sup>8</sup> = 1000 µF  |          |           |          |            |          |          |            |
| <b>Reel diameter</b><br>9 = 180 mm, 6 = 330 mm   |          |           |          |            |          |          |            |
| <b>Capacitance tolerance</b><br>M = ±20%, K = ±10%   |          |           |          |            |          |          |            |
| <b>ESR value + exponent</b><br>R [nΩ] · 10 <sup>x</sup><br>E.g.: 106 = 10 nΩ · 10 <sup>6</sup> = 10 mΩ, 107 = 10 nΩ · 10 <sup>7</sup> = 100 mΩ, 108 = 10 nΩ · 10 <sup>8</sup> = 1000 mΩ, 109 = 10 nΩ · 10 <sup>9</sup> = 10000 mΩ, |          |           |          |            |          |          |            |

## Preliminary Data

**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* (see "General technical information", section 4.6 and section 4.8 under [www.epcos.com/tantalum\\_capacitors](http://www.epcos.com/tantalum_capacitors)). 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 (see "Quality and environment", section 1.11 under [www.epcos.com/tantalum\\_capacitors](http://www.epcos.com/tantalum_capacitors)).

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 (see "General technical information", section 5 under [www.epcos.com/tantalum\\_capacitors](http://www.epcos.com/tantalum_capacitors)).

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**Low-resistance applications and voltage networks**

For *low-resistance applications*, EPCOS 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 (see "Quality and environment", section 1.11 under [www.epcos.com/tantalum\\_capacitors](http://www.epcos.com/tantalum_capacitors)).

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 (see "Quality and environment", section 1.11 and "General technical information", section 4.11 under [www.epcos.com/tantalum\\_capacitors](http://www.epcos.com/tantalum_capacitors)).

**Storage conditions**

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

**Note**

For more detailed information about cautions and warnings for tantalum electrolytic capacitors (e.g. other electrical values beside those listed above), see "General technical information" and "Quality and environment" under [www.epcos.com/tantalum\\_capacitors](http://www.epcos.com/tantalum_capacitors).

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