

Aluminum electrolytic capacitors

Capacitors with screw terminals

Series/Type: B41554
Date: November 2012

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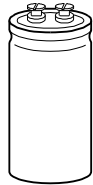
Long-life grade capacitors

Applications

- Highly professional power supplies

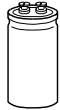
Features

- Outstanding reliability
- Wide temperature range
- Good thermal characteristics and high ripple current capability
- Long useful life
- Shelf life up to 10 years
- All-welded construction ensures reliable electrical contact
- RoHS-compatible



Construction

- Charge-discharge proof, polar
- Aluminum case with insulating sleeve
- Poles with screw terminal connections
- Mounting with ring clips or clamps



Specifications and characteristics in brief

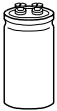
Rated voltage V_R	16 ... 100 V DC			
Surge voltage V_S	$1.15 \cdot V_R$			
Rated capacitance C_R	1500 ... 220000 μ F			
Capacitance tolerance	-10/+30% \triangle Q			
Leakage current I_{leak} (5 min, 20 °C)	$I_{leak} \leq 0.018 \mu\text{A} \cdot \left(\frac{C_R}{\mu\text{F}} \cdot \frac{V_R}{V} \right)^{0.85} + 4 \mu\text{A}$			
Self-inductance ESL	d = 35.7 mm: approx. 10 nH d = 51.6 mm: approx. 15 nH d \geq 64.3 mm: approx. 20 nH			
Useful life ¹⁾	d \leq 51.6 mm	d \geq 64.3 mm	Requirements:	
	125 °C; V_R ; $I_{AC,R}$	> 2500 h	> 5000 h	$\Delta C/C \leq \pm 45\%$ of initial value
	85 °C; V_R ; $I_{AC,max}$	> 15000 h	> 25000 h	ESR \leq 3 times initial specified limit
	40 °C; V_R ; $3.4 \cdot I_{AC,R}$	> 200000 h	–	$I_{leak} \leq$ initial specified limit
	40 °C; V_R ; $3.8 \cdot I_{AC,R}$	–	> 200000 h	
Voltage endurance test 125 °C; V_R ; $I_{AC,R}$	2000 h		Post test requirements:	
			$\Delta C/C \leq \pm 15\%$ of initial value ESR \leq 1.3 times initial specified limit $I_{leak} \leq$ initial specified limit	
Vibration resistance test	To IEC 60068-2-6, test Fc: Frequency range 10 ... 55 Hz, displacement amplitude 0.75 mm, acceleration max. 10 g, duration 3 \times 2 h. Capacitor mounted by its body which is rigidly clamped to the work surface.			
IEC climatic category	To IEC 60068-1: 55/125/56 (–55 °C/+125 °C/56 days damp heat test)			
Detail specification	Similar to CECC 30301-804			
Sectional specification	IEC 60384-4			

Ripple current capability

Due to the ripple current capability of the contact elements, the following current upper limits must not be exceeded:

Capacitor diameter	\leq 51.6 mm	> 51.6 mm
$I_{AC,max}$	30 A	40 A

1) Refer to chapter "General technical information, 5 Useful life" on how to interpret useful life.

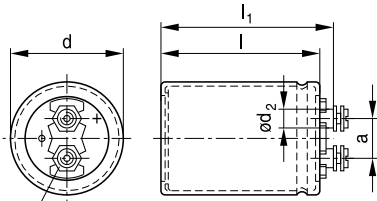


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Dimensional drawings

$d = 35.7 \text{ mm}$

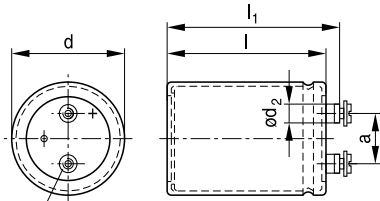


Min. reach of screw = 9.5 mm

Positive pole marking: +

KAL1319-J-E

$d \geq 51.6 \text{ mm}$



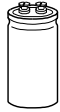
Min. reach of screw = 9.5 mm

Positive pole marking: +

KAL1320-M-E

Dimensions and weights

Ter- minal	Dimensions (mm) with insulating sleeve					Approx. weight (g)
	d	$l \pm 1$	$l_1 \pm 1$	$d_2 \text{ max.}$	$a +0.2/-0.4$	
M5	$35.7 +0/-0.8$	55.7	62.0	8.2	12.7	65
M5	$35.7 +0/-0.8$	80.7	87.0	8.2	12.7	105
M5	$35.7 +0/-0.8$	105.7	112.0	8.2	12.7	135
M5	$51.6 +0/-0.8$	80.7	87.0	8.2	22.2	220
M5	$64.3 +0/-0.8$	80.7	87.0	8.2	28.5	370
M5	$64.3 +0/-0.8$	105.7	112.0	8.2	28.5	440
M5	$76.9 +0/-0.7$	105.7	112.0	8.2	31.7	620
M5	$76.9 +0/-0.7$	143.2	149.5	8.2	31.7	840


Packing

Capacitor diameter d (mm)	length l (mm)	Packing units (pcs.)
35.7	all	36
51.6	all	36

Capacitor diameter d (mm)	length l (mm)	Packing units (pcs.)
64.3	all	25
76.9	all	16



For ecological reasons the packing is pure cardboard.

Accessories

The following items are included in the delivery package, but are not fastened to the capacitors:

	Thread	Toothed washers	Screws/nuts	Maximum torque
For terminals	M5	A 5.1 DIN 6797	DIN 7985 / ISO 7045-M5 × 10-5.6-Z	2 Nm

The following items must be ordered separately. For details, refer to chapter "Capacitors with screw terminals – Accessories".

Item	Type
Ring clips	B44030
Clamps for capacitors with $d \geq 64.3$ mm	B44030



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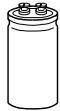
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Overview of available types

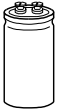
V_R (V DC)	16	25	40	63	100
	Case dimensions $d \times l$ (mm)				
C_R (μ F)					
1500					35.7 × 55.7
2200				35.7 × 55.7	35.7 × 80.7
3300				35.7 × 80.7	35.7 × 105.7
4700			35.7 × 55.7	35.7 × 80.7	51.6 × 80.7
6800		35.7 × 55.7	35.7 × 80.7	35.7 × 105.7	64.3 × 80.7
10000	35.7 × 55.7	35.7 × 80.7	35.7 × 80.7	51.6 × 80.7	64.3 × 80.7
15000	35.7 × 80.7	35.7 × 80.7	35.7 × 105.7	64.3 × 80.7	64.3 × 105.7
22000	35.7 × 80.7	35.7 × 105.7	51.6 × 80.7	64.3 × 105.7	76.9 × 105.7
33000	35.7 × 105.7	51.6 × 80.7	64.3 × 80.7	76.9 × 105.7	76.9 × 143.2
47000	51.6 × 80.7	64.3 × 80.7	64.3 × 105.7	76.9 × 143.2	
68000	64.3 × 80.7	64.3 × 105.7	76.9 × 105.7		
100000	64.3 × 105.7	76.9 × 105.7	76.9 × 143.2		
150000	76.9 × 105.7	76.9 × 143.2			
220000	76.9 × 143.2				

The capacitance and voltage ratings listed above are available in different cases upon request.

Other voltage and capacitance ratings are also available upon request.


Technical data and ordering codes

C_R 100 Hz 20 °C μF	Case dimensions $d \times l$ mm	ESR_{typ} 100 Hz 20 °C m Ω	ESR_{max} 100 Hz 20 °C m Ω	Z_{max} 20 kHz 20 °C m Ω	$I_{\text{AC,max}}$ 100 Hz 40 °C A	$I_{\text{AC,max}}$ 100 Hz 85 °C A	$I_{\text{AC,R}}$ 100 Hz 125 °C A	Ordering code
$V_R = 16 \text{ V DC}$								
10000	35.7 × 55.7	15	38	26	17	12	4.5	B41554E4109Q000
15000	35.7 × 80.7	12	26	21	23	16	5.8	B41554E4159Q000
22000	35.7 × 80.7	9.0	21	18	29	21	7.5	B41554E4229Q000
33000	35.7 × 105.7	7.0	17	15	30	24	8.7	B41554E4339Q000
47000	51.6 × 80.7	5.0	13	13	30	30	11	B41554E4479Q000
68000	64.3 × 80.7	4.0	13	11	40	38	14	B41554E4689Q000
100000	64.3 × 105.7	4.0	10	9.0	40	39	14	B41554E4100Q000
150000	76.9 × 105.7	4.0	10	8.0	40	40	16	B41554E4150Q000
220000	76.9 × 143.2	3.0	8.0	7.0	40	40	19	B41554B4220Q000
$V_R = 25 \text{ V DC}$								
6800	35.7 × 55.7	16	32	27	18	13	4.7	B41554B5688Q000
10000	35.7 × 80.7	14	28	21	21	15	5.4	B41554E5109Q000
15000	35.7 × 80.7	11	24	17	26	19	6.8	B41554E5159Q000
22000	35.7 × 105.7	8.0	20	15	30	22	8.1	B41554E5229Q000
33000	51.6 × 80.7	6.0	15	12	30	29	10	B41554E5339Q000
47000	64.3 × 80.7	5.0	13	11	40	34	12	B41554E5479Q000
68000	64.3 × 105.7	5.0	11	9.0	40	35	13	B41554E5689Q000
100000	76.9 × 105.7	4.0	9.0	8.0	40	39	15	B41554E5100Q000
150000	76.9 × 143.2	4.0	7.0	6.0	40	40	19	B41554B5150Q000
$V_R = 40 \text{ V DC}$								
4700	35.7 × 55.7	14	33	24	20	14	5.2	B41554E7478Q000
6800	35.7 × 80.7	12	28	17	24	16	6.2	B41554B7688Q000
10000	35.7 × 80.7	11	27	17	26	19	6.7	B41554E7109Q000
15000	35.7 × 105.7	8.0	20	12	30	22	8.0	B41554E7159Q000
22000	51.6 × 80.7	6.0	15	12	30	29	10	B41554E7229Q000
33000	64.3 × 80.7	5.0	11	10	40	34	12	B41554E7339Q000
47000	64.3 × 105.7	5.0	10	9.0	40	35	13	B41554E7479Q000
68000	76.9 × 105.7	4.0	9.0	8.0	40	39	15	B41554E7689Q000
100000	76.9 × 143.2	4.0	7.0	6.0	40	40	19	B41554B7100Q000

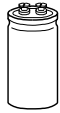


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Technical data and ordering codes

C_R	Case dimensions	ESR _{typ} 100 Hz 20 °C μF	ESR _{max} 100 Hz 20 °C mΩ	Z _{max} 20 kHz 20 °C mΩ	I _{AC,max} 100 Hz 40 °C A	I _{AC,max} 100 Hz 85 °C A	I _{AC,R} 100 Hz 125 °C A	Ordering code
V_R = 63 V DC								
2200	35.7 × 55.7	26	60	30	13	9.4	3.4	B41554E8228Q000
3300	35.7 × 80.7	17	39	24	19	14	4.9	B41554E8338Q000
4700	35.7 × 80.7	13	31	20	24	17	6.2	B41554E8478Q000
6800	35.7 × 105.7	10	23	17	28	20	7.2	B41554E8688Q000
10000	51.6 × 80.7	7.0	18	14	30	27	9.6	B41554E8109Q000
15000	64.3 × 80.7	6.0	15	11	40	31	11	B41554E8159Q000
22000	64.3 × 105.7	5.0	12	9.0	40	35	13	B41554E8229Q000
33000	76.9 × 105.7	4.0	9.0	8.0	40	39	15	B41554E8339Q000
47000	76.9 × 143.2	4.0	7.0	6.0	40	40	19	B41554B8479Q000
V_R = 100 V DC								
1500	35.7 × 55.7	38	83	34	12	8.8	3.1	B41554B9158Q000
2200	35.7 × 80.7	26	57	30	17	12	4.2	B41554E9228Q000
3300	35.7 × 105.7	17	37	24	21	15	5.4	B41554E9338Q000
4700	51.6 × 80.7	13	29	20	29	20	7.2	B41554E9478Q000
6800	64.3 × 80.7	8.0	22	17	36	25	9.1	B41554E9688Q000
10000	64.3 × 80.7	7.0	15	14	40	30	11	B41554E9109Q000
15000	64.3 × 105.7	6.0	13	11	40	36	13	B41554E9159Q000
22000	76.9 × 105.7	5.0	11	9.0	40	39	14	B41554B9229Q000
33000	76.9 × 143.2	4.0	9.0	8.0	40	40	17	B41554B9339Q000



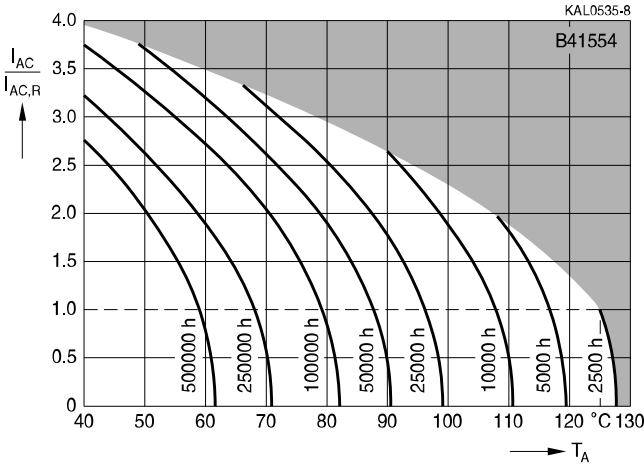
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Useful life¹⁾

depending on ambient temperature T_A under ripple current operating conditions

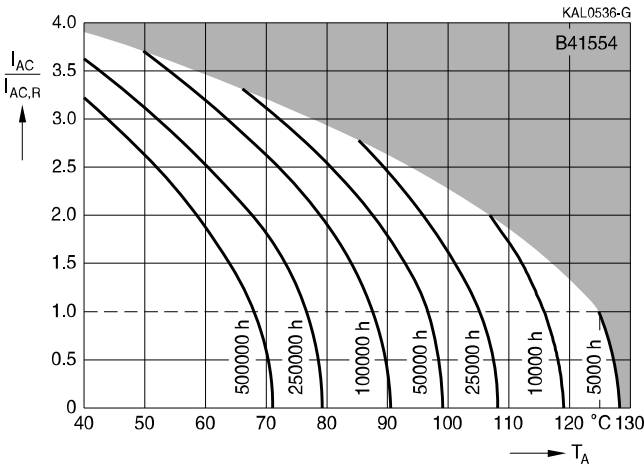
$d \leq 51.6$ mm



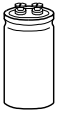
Useful life¹⁾

depending on ambient temperature T_A under ripple current operating conditions

$d \geq 64.3$ mm



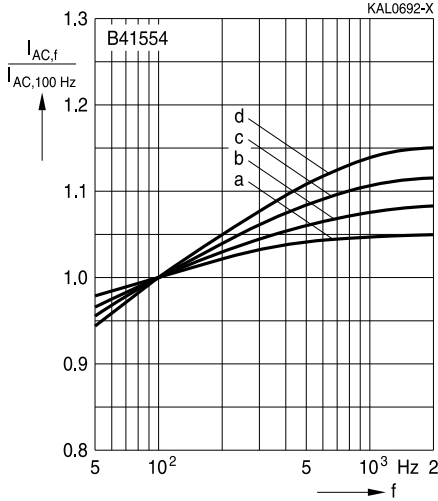
1) Refer to chapter "General technical information, 5 Useful life" on how to interpret useful life.



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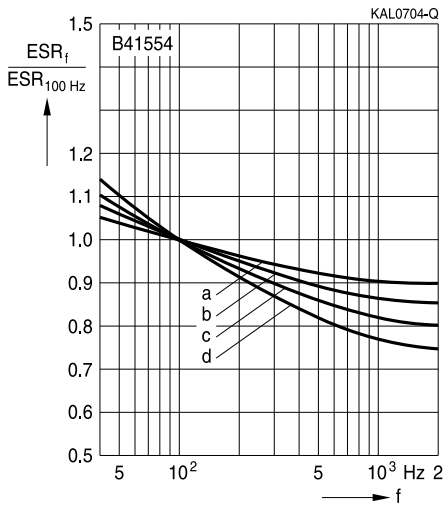
Frequency factor of permissible ripple current I_{AC} versus frequency f



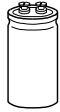
V_R (V DC)	16; 25	40	63	100
$d = 35.7$ mm	b	c	d	d
$d = 51.6$ mm	a	b	c	c
$d = 64.3$ mm	a	a	c	c
$d = 76.9$ mm	a	a	b	c

Frequency characteristics of ESR

Typical behavior

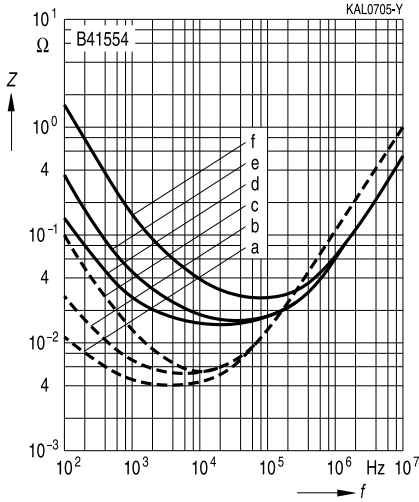


V_R (V DC)	16; 25	40	63	100
$d = 35.7$ mm	b	c	d	d
$d = 51.6$ mm	a	b	c	c
$d = 64.3$ mm	a	a	c	c
$d = 76.9$ mm	a	a	b	c

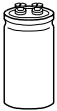


Impedance Z versus frequency f

Typical behavior at 20 °C



C_R μF	V_R V DC	d mm	Curve
150000	16	76.9	a
68000	40	76.9	b
15000	100	64.3	c
10000	16	35.7	d
47000	40	35.7	e
1500	100	35.7	f



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Cautions and warnings

Personal safety

The electrolytes used by EPCOS have been optimized both with a view to the intended application and with regard to health and environmental compatibility. They do not contain any solvents that are detrimental to health, e.g. dimethyl formamide (DMF) or dimethyl acetamide (DMAC).

Furthermore, some of the high-voltage electrolytes used by EPCOS are self-extinguishing.

As far as possible, EPCOS does not use any dangerous chemicals or compounds to produce operating electrolytes. However, in exceptional cases, such materials must be used in order to achieve specific physical and electrical properties because no alternative materials are currently known. However, the amount of dangerous materials used in our products is limited to an absolute minimum.

Materials and chemicals used in EPCOS aluminum electrolytic capacitors are continuously adapted in compliance with the EPCOS Corporate Environmental Policy and the latest EU regulations and guidelines such as RoHS, REACH/SVHC, GADSL, and ELV.

MDS (Material Data Sheets) are available on the EPCOS website for all types listed in the data book. MDS for customer specific capacitors are available upon request.

MSDS (Material Safety Data Sheets) are available for all of our electrolytes upon request.

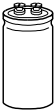
Nevertheless, the following rules should be observed when handling aluminum electrolytic capacitors: No electrolyte should come into contact with eyes or skin. If electrolyte does come into contact with the skin, wash the affected areas immediately with running water. If the eyes are affected, rinse them for 10 minutes with plenty of water. If symptoms persist, seek medical treatment. Avoid inhaling electrolyte vapor or mists. Workplaces and other affected areas should be well ventilated. Clothing that has been contaminated by electrolyte must be changed and rinsed in water.



Product safety

The table below summarizes the safety instructions that must be observed without fail. A detailed description can be found in the relevant sections of chapter "General technical information".

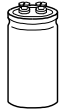
Topic	Safety information	Reference chapter "General technical information"
Polarity	Make sure that polar capacitors are connected with the right polarity.	1 "Basic construction of aluminum electrolytic capacitors"
Reverse voltage	Voltages polarity classes should be prevented by connecting a diode.	3.1.6 "Reverse voltage"
Mounting position of screw-terminal capacitors	Do not mount the capacitor with the terminals (safety vent) upside down.	11.1. "Mounting positions of capacitors with screw terminals"
Robustness of terminals	The following maximum tightening torques must not be exceeded when connecting screw terminals: M5: 2.5 Nm M6: 4.0 Nm	11.3 "Mounting torques"
Mounting of single-ended capacitors	The internal structure of single-ended capacitors might be damaged if excessive force is applied to the lead wires. Avoid any compressive, tensile or flexural stress. Do not move the capacitor after soldering to PC board. Do not pick up the PC board by the soldered capacitor. Do not insert the capacitor on the PC board with a hole space different to the lead space specified.	11.4 "Mounting considerations for single-ended capacitors"
Soldering	Do not exceed the specified time or temperature limits during soldering.	11.5 "Soldering"
Soldering, cleaning agents	Do not allow halogenated hydrocarbons to come into contact with aluminum electrolytic capacitors.	11.6 "Cleaning agents"
Upper category temperature	Do not exceed the upper category temperature.	7.2 "Maximum permissible operating temperature"
Passive flammability	Avoid external energy, such as fire or electricity.	8.1 "Passive flammability"



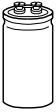
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Topic	Safety information	Reference chapter "General technical information"
Active flammability	Avoid overload of the capacitors.	8.2 "Active flammability"
Maintenance	<p>Make periodic inspections of the capacitors. Before the inspection, make sure that the power supply is turned off and carefully discharge the electricity of the capacitors.</p> <p>Do not apply any mechanical stress to the capacitor terminals.</p>	10 "Maintenance"
Storage	Do not store capacitors at high temperatures or high humidity. Capacitors should be stored at +5 to +35 °C and a relative humidity of $\leq 75\%$.	7.3 Storage conditions
		Reference chapter "Capacitors with screw terminals"
Breakdown strength of insulating sleeves	Do not damage the insulating sleeve, especially when ring clips are used for mounting.	"Screw terminals – accessories"


Symbols and terms

Symbol	English	German
C	Capacitance	Kapazität
C_R	Rated capacitance	Nennkapazität
C_S	Series capacitance	Serienkapazität
$C_{S,T}$	Series capacitance at temperature T	Serienkapazität bei Temperatur T
C_f	Capacitance at frequency f	Kapazität bei Frequenz f
d	Case diameter, nominal dimension	Gehäusedurchmesser, Nennmaß
d_{max}	Maximum case diameter	Maximaler Gehäusedurchmesser
ESL	Self-inductance	Eigeninduktivität
ESR	Equivalent series resistance	Ersatzserienwiderstand
ESR_f	Equivalent series resistance at frequency f	Ersatzserienwiderstand bei Frequenz f
ESR_T	Equivalent series resistance at temperature T	Ersatzserienwiderstand bei Temperatur T
f	Frequency	Frequenz
I	Current	Strom
I_{AC}	Alternating current (ripple current)	Wechselstrom
$I_{AC,rms}$	Root-mean-square value of alternating current	Wechselstrom, Effektivwert
$I_{AC,f}$	Ripple current at frequency f	Wechselstrom bei Frequenz f
$I_{AC,max}$	Maximum permissible ripple current	Maximal zulässiger Wechselstrom
$I_{AC,R}$	Rated ripple current	Nennwechselstrom
$I_{AC,R} (B)$	Rated ripple current for base cooling	Nennwechselstromstrom für Bodenkühlung
I_{leak}	Leakage current	Reststrom
$I_{leak,op}$	Operating leakage current	Betriebsreststrom
l	Case length, nominal dimension	Gehäuselänge, Nennmaß
l_{max}	Maximum case length (without terminals and mounting stud)	Maximale Gehäuselänge (ohne Anschlüsse und Gewindebolzen)
R	Resistance	Widerstand
R_{ins}	Insulation resistance	Isolationswiderstand
R_{symm}	Balancing resistance	Symmetrierwiderstand
T	Temperature	Temperatur
ΔT	Temperature difference	Temperaturdifferenz
T_A	Ambient temperature	Umgebungstemperatur
T_C	Case temperature	Gehäusetemperatur
T_B	Capacitor base temperature	Temperatur des Becherbodens
t	Time	Zeit
Δt	Period	Zeitraum
t_b	Service life (operating hours)	Brauchbarkeitsdauer (Betriebszeit)



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Symbol	English	German
V	Voltage	Spannung
V _F	Forming voltage	Formierspannung
V _{op}	Operating voltage	Betriebsspannung
V _R	Rated voltage, DC voltage	Nennspannung, Gleichspannung
V _S	Surge voltage	Spitzenspannung
X _C	Capacitive reactance	Kapazitiver Blindwiderstand
X _L	Inductive reactance	Induktiver Blindwiderstand
Z	Impedance	Scheinwiderstand
Z _T	Impedance at temperature T	Scheinwiderstand bei Temperatur T
tan δ	Dissipation factor	Verlustfaktor
λ	Failure rate	Ausfallrate
ε ₀	Absolute permittivity	Elektrische Feldkonstante
ε _r	Relative permittivity	Dielektrizitätszahl
ω	Angular velocity; $2 \cdot \pi \cdot f$	Kreisfrequenz; $2 \cdot \pi \cdot f$

Note

All dimensions are given in mm.

Important notes

The following applies to all products named in this publication:

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