HCGH · Screw-Terminal · 6000 h/105 °C

Standard Performances · Small Diameters

Optional design for permanent and deep charge-discharge application with high voltage hub and pulsed operation mode upon request.

Spezielles Design für häufige und tiefe Lade-, Entladeanwendungen mit hohem Spannungshub und Impulsbetrieb auf Anfrage erhältlich.

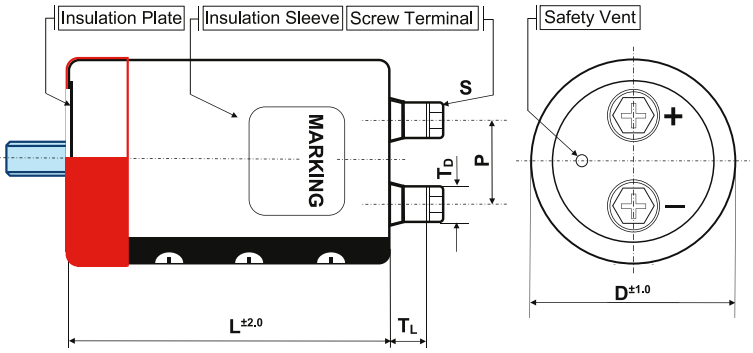
› Specifications · Spezifikationen

Items	Characteristics
Temperature range	-40°C ~ + 105°C
Capacitance tolerance	Standard +/- 20%, -10/+30% on request
Surge voltage	Repetitive max. 30 sec per 6 Minutes / ≤ 50V
Leakage current max. I_L (20°C, 5 min)	0.01 • C • V_r [µA] or 3 mA, which is smaller.
Useful life	6000 hours at 105°C
Field failure rate	0.5 FIT = 0.5 • 10^{-9} Failures/hour
Reference standards	IEC 60384-4, JIS C 5101-4
Vibration	0.75mm, 10…55Hz, 10g, 3x2h
Outer materials	UL94-V0 / UL224-VW1 certified (cap / sleeve)
Sleeve withstanding voltage	4000 Vac / 1min between terminals bundled and plate*
Product Compliance	RoHS, REACH, Conflict Minerals a.o. – refer to p. 12–13

* Typical value

› Shape designation · Formbezeichnung

- additional information on p. 10–11 · Zusatzinformationen auf S. 10–11
- mounting accessories from p. 189 · Montagezubehör ab S. 189



Shape code Features	B Bolt	I / Y double sleeve for 2/3 points metal Bracket	N standard
outer insulation sleeve	•	•	•
insulation plate	•	•	•
stud bolt	•		
bottom double sleeve		•	

diameter code	ØD	available shape	P	S	T_L	T_D	Cap material
A	36	N, I	12.7	M5x10	6.5	8	PH
C	51	B, N, I, Y	22.0	M5x10	5.5	10	PH
D	64	B, N, I, Y	28.6	M5x10	5.5	10	PH
E	77	B, N, I, Y	31.5	M5x10	5.0	10	PH
				M6x12	4.5	17.2	PH
F	90	B, N, I, Y	31.5	M5x10	5.0	10	PH
				M6x12	5.0	17.2	PH

Size in mm. First listed terminal is standard.

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› Product Code · Bestellbezeichnung

Example: Series HCGH · 4700 µF · 250 V · D = 64 mm · L = 115 mm with Y-Bracket

HCGH **2E** **472** **Y** **D** **115** **(PH)**

- **HCGH** – Series name
- **2E** – Rated voltage code
- **472** – Capacitance code
- **Y** – Shape code
- **D** – Diameter code
- **115** – Case length code – length in mm (3 digits)
- **(PH)** – Specific features (e.g. M6 …)
- Capacitance tolerance: Ø : ± 20 % / Q : -10 % ~ + 30 %

Rated voltage code					
Code	Voltage	Code	Voltage	Code	Voltage
1E	25	1K	80	2E	250
1V	35	2A	100	2G	400
1H	50	2C	160	2W	450
1J	63	2D	200		

Rated VoltageCode (Surge Voltage) V_r [V DC]	Capacitance C_r [µF]	Ripple Current at 105°C/120Hz I_r [A RMS]	Ripple Current at 40°C/120Hz [A RMS]	ESR (typ) at 20°C/100Hz [mΩ]	Zmax at 20°C/10kHz [mΩ]	ESL (typ) [nH]	Dissipation Factor at 20°C/120Hz Tan δ	DxL [mm]	Product Code # = variable value, see fixing code in the product code
25 VDC Code: 1E Surge Voltage 32 VDC	**10 000**	3.3	15.8	32	30	15	0.35	36x53	HCGH1E103#A053PH
	15 000	4.8	23.0	27	27	15	0.35	36x83	HCGH1E153#A083PH
	22 000	5.9	28.3	22	23	15	0.35	36x83	HCGH1E223#A083PH
	33 000	7.2	34.6	15	16	15	0.40	36x100	HCGH1E333#A100PH
	47 000	9.2	44.2	10	11	17	0.40	51x75	HCGH1E473#C075PH
	68 000	11.5	55.2	7	8	17	0.50	51x115	HCGH1E683#C115PH
	100 000	13.0	62.4	6	7	18	0.60	64x96	HCGH1E104#D096PH
	150 000	14.8	71.0	6	7	18	0.80	64x115	HCGH1E154#D115PH
	220 000	17.0	81.6	4	5	20	1.00	77x115	HCGH1E224#E115PH
	330 000	22.9	109.9*	4	5	20	1.00	90x131	HCGH1E334#F131PH
35 VDC Code: 1V Surge Voltage 44 VDC	**6 800**	3.0	14.4	42	37	15	0.30	36x53	HCGH1V682#A053PH
	10 000	4.3	20.6	29	31	15	0.30	36x83	HCGH1V103#A083PH
	15 000	5.2	25.0	19	20	15	0.30	36x83	HCGH1V153#A083PH
	22 000	6.3	30.2	14	15	15	0.35	36x100	HCGH1V223#A100PH
	33 000	7.7	37.0	12	13	17	0.40	51x75	HCGH1V333#C075PH
	47 000	9.3	44.6	8	9	17	0.45	51x96	HCGH1V473#C096PH
	68 000	11.5	55.2	7	8	17	0.50	51x115	HCGH1V683#C115PH
	100 000	13.9	66.7	6	7	18	0.60	64x115	HCGH1V104#D115PH
	150 000	15.9	76.3	5	7	20	0.70	77x115	HCGH1V154#E115PH
	220 000	20.2	97.0	5	7	20	0.70	90x131	HCGH1V224#F131PH
50 VDC Code: 1H Surge Voltage 63 VDC	**3 300**	2.5	12.0	90	80	15	0.20	36x53	HCGH1H332#A053PH
	4 700	3.8	18.2	64	58	15	0.25	36x53	HCGH1H472#A053PH
	6 800	3.9	18.7	44	39	15	0.25	36x83	HCGH1H682#A083PH
	10 000	4.7	22.6	30	28	15	0.25	36x83	HCGH1H103#A083PH
	15 000	5.6	26.9	20	20	15	0.30	36x83	HCGH1H153#A083PH
		5.6	26.9	20	20	15	0.30	36x100	HCGH1H153#A100PH
	22 000	6.9	33.1	14	15	15	0.35	36x100	HCGH1H223#A100PH
		6.8	32.6	14	15	17	0.35	51x75	HCGH1H223#C075PH
	33 000	9.0	43.2	13	14	17	0.40	51x115	HCGH1H333#C115PH

Additional designs on request · Weitere Designs auf Anfrage

Rated VoltageCode (Surge Voltage) V_r [V DC]	Capacitance C_r [µF]	Ripple Current at 105°C/120Hz I_r [A RMS]	Ripple Current at 40°C/120Hz [A RMS]	ESR (typ) at 20°C/100Hz [mΩ]	Zmax at 20°C/10kHz [mΩ]	ESL (typ) [nH]	Dissipation Factor at 20°C/120Hz Tan δ	DxL [mm]	Product Code # = variable value, see fixing code in the product code
50 VDC Code: 1H Surge Voltage 63 VDC	**47 000**	10.9	52.3	11	12	18	0.40	64x96	HCGH1H473#D096PH
	68 000	13.3	63.8	8	9	18	0.45	64x115	HCGH1H683#D115PH
	100 000	16.2	77.8	6	7	20	0.50	77x115	HCGH1H104#E115PH
	140 000	22.4	107.5*	5	8	20	0.50	77x137	HCGH1H144#E137PH
	150 000	21.7	104.2*	5	7	20	0.50	90x131	HCGH1H154#F131PH
63 VDC Code: 1J Surge Voltage 79 VDC	**2 200**	2.4	11.5	95	87	15	0.15	36x53	HCGH1J222#A053PH
	3 300	2.5	12.0	63	58	15	0.20	36x53	HCGH1J332#A053PH
	4 700	3.6	17.3	54	50	15	0.20	36x83	HCGH1J472#A083PH
	6 800	4.3	20.6	38	35	15	0.20	36x83	HCGH1J682#A083PH
	10 000	5.1	24.5	28	28	15	0.25	36x100	HCGH1J103#A100PH
		5.3	25.4	28	28	17	0.25	51x75	HCGH1J103#C075PH
	15 000	6.6	31.7	21	22	17	0.25	51x75	HCGH1J153#C075PH
	22 000	7.8	37.4	13	14	17	0.30	51x96	HCGH1J223#C096PH
	33 000	10.6	50.9	10	11	18	0.30	64x96	HCGH1J333#D096PH
	47 000	11.3	54.1	8	9	20	0.35	90x77	HCGH1J473#F077PH
		12.5	60.0	8	9	18	0.35	64x115	HCGH1J473#D115PH
	68 000	15.0	72.0	7	8	20	0.40	77x115	HCGH1J683#E115PH
	100 000	19.8	95.0	7	8	20	0.40	90x131	HCGH1J104#F131PH
80 VDC Code: 1K Surge Voltage 100 VDC	**2 200**	2.4	11.5	68	63	15	0.15	36x53	HCGH1K222#A053PH
	3 300	3.5	16.8	45	42	15	0.15	36x83	HCGH1K332#A083PH
	4 700	4.1	19.7	32	30	15	0.15	36x83	HCGH1K472#A083PH
	6 800	4.6	22.1	22	23	15	0.20	36x100	HCGH1K682#A100PH
	10 000	6.0	28.8	15	16	17	0.20	51x75	HCGH1K103#C075PH
	15 000	7.1	34.1	10	11	17	0.25	51x96	HCGH1K153#C096PH
	22 000	9.4	45.1	9	10	18	0.25	64x96	HCGH1K223#D096PH
	33 000	11.2	53.8	7	7	20	0.30	77x96	HCGH1K333#E096PH
	47 000	14.4	69.1	6	7	20	0.30	77x115	HCGH1K473#E115PH
	68 000	18.9	90.7	4	7	20	0.30	90x131	HCGH1K683#F131PH
100 VDC Code: 2A Surge Voltage 125 VDC	**1 000**	1.6	7.7	112	100	15	0.15	36x53	HCGH2A102#A053PH
	1 500	2.0	9.6	75	87	15	0.15	36x53	HCGH2A152#A053PH
	2 200	2.9	13.9	51	47	15	0.15	36x83	HCGH2A222#A083PH
	3 300	3.5	16.8	34	32	15	0.15	36x83	HCGH2A332#A083PH
	4 700	4.5	21.6	24	24	15	0.15	36x100	HCGH2A472#A100PH
	6 800	5.8	27.8	19	20	17	0.15	51x75	HCGH2A682#C075PH
	10 000	7.5	36.0	13	14	17	0.15	51x96	HCGH2A103#C096PH
	15 000	8.7	41.8	11	12	18	0.20	64x96	HCGH2A153#D096PH
	22 000	11.2	53.8	8	9	20	0.20	77x96	HCGH2A223#E096PH
	33 000	13.6	65.3	6	7	20	0.25	77x130	HCGH2A333#E130PH
	47 000	17.3	83.0	5	7	20	0.25	90x131	HCGH2A473#F131PH
160 VDC Code: 2C Surge Voltage 200 VDC	**470**	1.2	5.8	277	261	15	0.15	36x53	HCGH2C471#A053PH
	680	1.3	6.2	191	180	15	0.15	36x53	HCGH2C681#A053PH
	1 000	2.0	9.6	130	120	15	0.15	36x83	HCGH2C102#A083PH
	1 500	2.3	11.0	87	80	15	0.15	36x83	HCGH2C152#A083PH
	2 200	3.1	14.9	59	53	15	0.15	36x100	HCGH2C222#A100PH
	3 300	4.0	19.2	40	35	17	0.15	51x75	HCGH2C332#C075PH

Additional designs on request · Weitere Designs auf Anfrage

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Rated VoltageCode (Surge Voltage) V_r [V DC]	Capacitance C_r [µF]	Ripple Current at 105°C/120Hz I_r [A RMS]	Ripple Current at 40°C/120Hz [A RMS]	ESR (typ) at 20°C/100Hz [mΩ]	Zmax at 20°C/10kHz [mΩ]	ESL (typ) [nH]	Dissipation Factor at 20°C/120Hz Tan δ	DxL [mm]	Product Code # = variable value, see fixing code in the product code
160 VDC Code: 2C Surge Voltage 200 VDC	**4 700**	4.7	22.6	30	30	17	0.15	51x75	HCGH2C472#C075PH
		5.1	24.5	30	25	17	0.15	51x96	HCGH2C472#C096PH
	6 800	6.8	32.6	22	23	18	0.15	64x96	HCGH2C682#D096PH
	10 000	8.7	41.8	15	16	20	0.15	77x96	HCGH2C103#E096PH
	15 000	11.8	56.6	13	13	20	0.15	77x130	HCGH2C153#E130PH
	22 000	15.2	73.0	10	10	20	0.15	90x131	HCGH2C223#F131PH
200 VDC Code: 2D Surge Voltage 250 VDC	**330**	0.9	4.3	395	372	15	0.15	36x53	HCGH2D331#A053PH
	470	1.2	5.8	277	261	15	0.15	36x53	HCGH2D471#A053PH
	680	1.3	6.2	191	180	15	0.15	36x53	HCGH2D681#A053PH
	1 000	2.0	9.6	120	100	15	0.15	36x83	HCGH2D102#A083PH
	1 500	2.5	12.0	100	85	15	0.15	36x100	HCGH2D152#A100PH
	2 200	3.2	15.4	68	60	17	0.15	51x75	HCGH2D222#C075PH
	3 300	4.3	20.6	45	35	17	0.15	51x96	HCGH2D332#C096PH
	4 700	5.6	26.9	31	27	18	0.15	64x96	HCGH2D472#D096PH
	6 800	7.2	34.6	21	20	18	0.15	64x115	HCGH2D682#D115PH
		8.4	40.3	21	20	20	0.15	77x145	HCGH2D682#E145PH
	10 000	9.3	44.6	14	14	20	0.15	77x115	HCGH2D103#E115PH
		10.2	49.0	14	14	20	0.15	77x145	HCGH2D103#E145PH
	15 000	12.5	60.0	10	10	20	0.15	90x131	HCGH2D153#F131PH
	22 000	17.7	85.0	7	7	20	0.15	77x215	HCGH2D223#E215PH
250 VDC Code: 2E Surge Voltage 300 VDC	**330**	0.9	4.3	285	268	15	0.15	36x53	HCGH2E331#A053PH
	470	1.2	5.8	200	187	15	0.15	36x53	HCGH2E471#A053PH
	680	1.6	7.7	138	131	15	0.15	36x83	HCGH2E681#A083PH
	1 000	2.2	10.6	84	70	15	0.15	36x100	HCGH2E102#A100PH
	1 500	2.6	12.5	56	50	17	0.15	51x75	HCGH2E152#C075PH
	2 200	3.6	17.3	50	45	17	0.15	51x96	HCGH2E222#C096PH
	3 300	4.8	23.0	36	35	18	0.15	64x96	HCGH2E332#D096PH
	4 700	6.2	29.8	25	23	18	0.15	64x115	HCGH2E472#D115PH
	6 800	7.9	37.9	18	18	20	0.15	77x115	HCGH2E682#E115PH
	10 000	10.7	51.4	13	13	20	0.15	77x155	HCGH2E103#E155PH
	15 000	14.0	67.2	9	9	20	0.15	90x157	HCGH2E153#F157PH
400 VDC Code: 2G Surge Voltage 450 VDC	**1 000**	2.9	11.0	102	105	17	0.15	51x75	HCGH2G102#C075PH
	1 200	3.5	13.3	85	88	17	0.15	51x96	HCGH2G122#C096PH
	1 500	4.1	15.6	68	70	17	0.15	51x115	HCGH2G152#C115PH
	1 800	4.7	17.9	57	58	17	0.15	51x130	HCGH2G182#C130PH
	2 200	4.8	18.2	46	48	17	0.15	51x105	HCGH2G222#C105PH
		5.2	19.8	46	48	18	0.15	64x96	HCGH2G222#D096PH
	2 700	6.1	23.2	38	40	18	0.15	64x115	HCGH2G272#D115PH
	3 300	7.1	27.0	30	32	18	0.15	64x130	HCGH2G332#D130PH
		6.9	26.2	30	32	20	0.15	77x105	HCGH2G332#E105PH
	3 900	8.3	31.5	26	28	18	0.15	64x155	HCGH2G392#D155PH
		7.8	29.6	26	28	20	0.15	77x115	HCGH2G392#E115PH
	4 700	10.0	38.0	21	22	18	0.15	64x195	HCGH2G472#D195PH
		9.0	34.2	21	22	20	0.15	77x130	HCGH2G472#E130PH

Additional designs on request · Weitere Designs auf Anfrage

Rated VoltageCode (Surge Voltage) V_r [V DC]	Capacitance C_r [µF]	Ripple Current at 105°C/120Hz I_r [A RMS]	Ripple Current at 40°C/120Hz [A RMS]	ESR (typ) at 20°C/100Hz [mΩ]	Zmax at 20°C/10kHz [mΩ]	ESL (typ) [nH]	Dissipation Factor at 20°C/120Hz Tan δ	DxL [mm]	Product Code # = variable value, see fixing code in the product code
400 VDC Code: 2G Surge Voltage 450 VDC	**5 600**	11.0	41.8	18	19	18	0.15	64x195	HCGH2G562#D195PH
		10.6	40.3	18	19	20	0.15	77x155	HCGH2G562#E155PH
	6 800	11.6	44.1	15	15	20	0.15	77x155	HCGH2G682#E155PH
		12.3	46.7	15	15	20	0.15	90x157	HCGH2G682#F157PH
	8 200	13.2	50.2	12	15	20	0.15	77x171	HCGH2G822#E171PH
		13.6	51.7	12	15	20	0.15	90x157	HCGH2G822#F157PH
	10 000	16.2	61.6	10	15	20	0.15	90x196	HCGH2G103#F196PH
	14 000	19.2	73.0	9	8	20	0.15	90x196	HCGH2G143#F196PH
	15 000	19.6	74.5	6	8	20	0.15	90x196	HCGH2G153#F196PH
450 VDC Code: 2W Surge Voltage 500 VDC	**1 500**	3.8	14.4	67	70	17	0.15	51x105	HCGH2W152#C105PH
	2 200	5.5	20.9	46	48	20	0.15	77x103	HCGH2W222#E103PH
	4 700	8.9	33.8	24	26	20	0.15	77x144	HCGH2W472#E144PH
	5 600	9.8	37.2	21	22	20	0.15	77x144	HCGH2W562#E144PH
	6 000	10.4	39.3	19	20	20	0.15	77x155	HCGH2W602#E155PH

* Please contact us if load condition exceeds terminals related $I_{r\,max}$ referred on page 11

Additional designs on request · Weitere Designs auf Anfrage

› Ripple Current Multiplier · Wechselstrommultiplikator

Frequency [Hz]	50/60	120	300	1k	≥ 10k
Multiplier	0.80	1.00	1.18	1.34	1.45

Ta (°C)	40	45	50	55	60	65	70	75	80	85	90	95	100	105
Multiplier 25-250 VDC	4.8	4.5	4.2	3.8	3.5	3.3	3.0	2.5	2.1	1.8	1.5	1.3	1.1	1.0
Multiplier 400-450 VDC	3.8	3.7	3.6	3.4	3.2	2.9	2.6	2.4	2.2	2.0	1.7	1.4	1.2	1.0

Forced cooling – Wind speed [m/sec]	v < 0.25	v ≥ 0.25	v ≥ 0.5	v ≥ 1.0	v ≥ 2.0	v ≥ 3.0
Multiplier	1.00	1.05	1.10	1.15	1.20	1.25

› Life Time Table · Brauchbarkeitsdauer – Tabelle

HCGH $V_r \leq 250V$	Useful life as function of ambient temperature and ripple current													
I_r at 105°C	**x 1.0**	**x 1.1**	**x 1.3**	**x 1.5**	**x 1.8**	**x 2.1**	**x 2.5**	**x 3.0**	**x 3.3**	**x 3.5**	**x 3.8**	**x 4.2**	**x 4.5**	**x 4.8**
T_a = 40°C	250	250	250	250	250	250	250	250	250	250	250	250	198	138
T_a = 45°C	250	250	250	250	250	250	250	250	250	250	250	175	125	
T_a = 50°C	250	250	250	250	250	250	250	250	250	221	166	110		
T_a = 55°C	250	250	250	250	250	250	250	212	166	139	105			
T_a = 60°C	250	250	250	250	250	241	190	134	105	88				
T_a = 65°C	236	230	216	201	177	152	120	84	66					
T_a = 70°C	149	145	137	127	112	96	76	53						
T_a = 75°C	94	92	86	80	71	61	48							
T_a = 80°C	59	58	54	51	44	38								
T_a = 85°C	37	36	34	32	28									
T_a = 90°C	23	23	21	20										
T_a = 95°C	15	14	13											
T_a = 100°C	9	9												
T_a = 105°C	6		khrs	Max. value limited to 250 000 hours.										

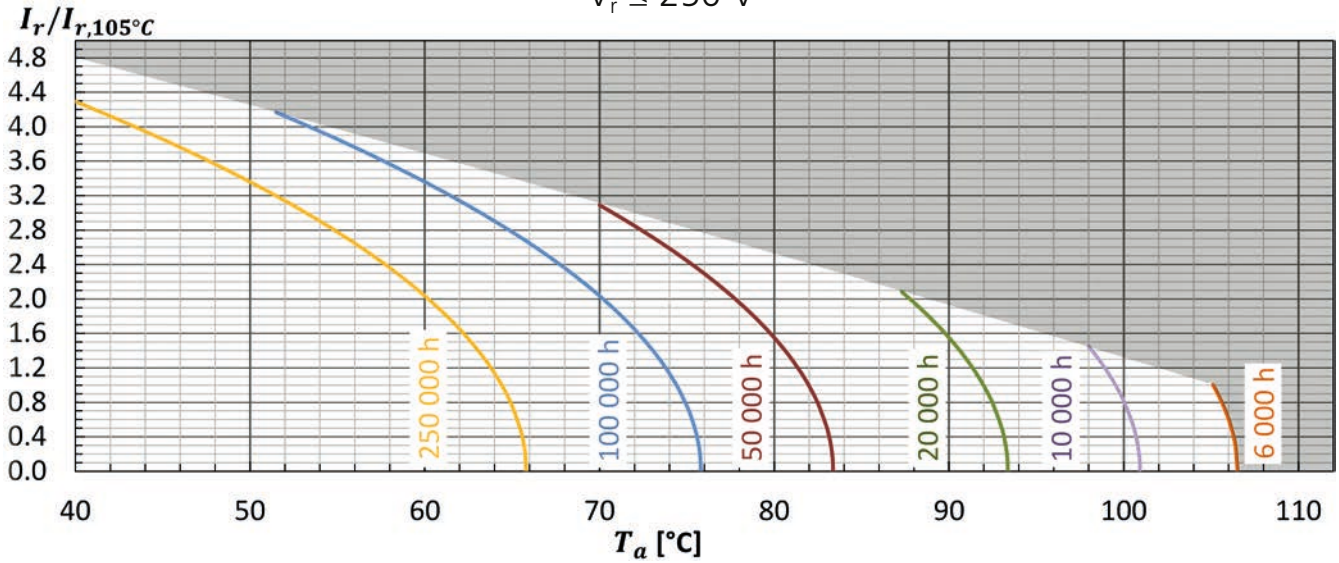
HCGH $V_r \geq 400V$	Useful life as function of ambient temperature and ripple current													
I_r at 105°C	**x 1.0**	**x 1.2**	**x 1.4**	**x 1.7**	**x 2.0**	**x 2.2**	**x 2.4**	**x 2.6**	**x 2.9**	**x 3.2**	**x 3.4**	**x 3.6**	**x 3.7**	**x 3.8**
T_a = 40°C	250	250	250	250	250	250	250	250	250	250	229	168	143	121
T_a = 45°C	250	250	250	250	250	250	250	250	250	194	145	106	90	
T_a = 50°C	250	250	250	250	250	250	250	250	183	122	91	67		
T_a = 55°C	250	250	250	250	250	250	208	167	116	77	58			
T_a = 60°C	250	250	250	248	194	161	132	105	73	49				
T_a = 65°C	238	216	193	157	123	102	83	66	46					
T_a = 70°C	150	136	122	99	77	64	52	42						
T_a = 75°C	95	86	77	62	49	40	33							
T_a = 80°C	60	54	48	39	31	25								
T_a = 85°C	38	34	30	25	19									
T_a = 90°C	24	21	19	15										
T_a = 95°C	15	13	12											
T_a = 100°C	9	8												
T_a = 105°C	6		khrs	Max. value limited to 250 000 hours.										

› Life Time Graph · Brauchbarkeitsdauer – Diagramm

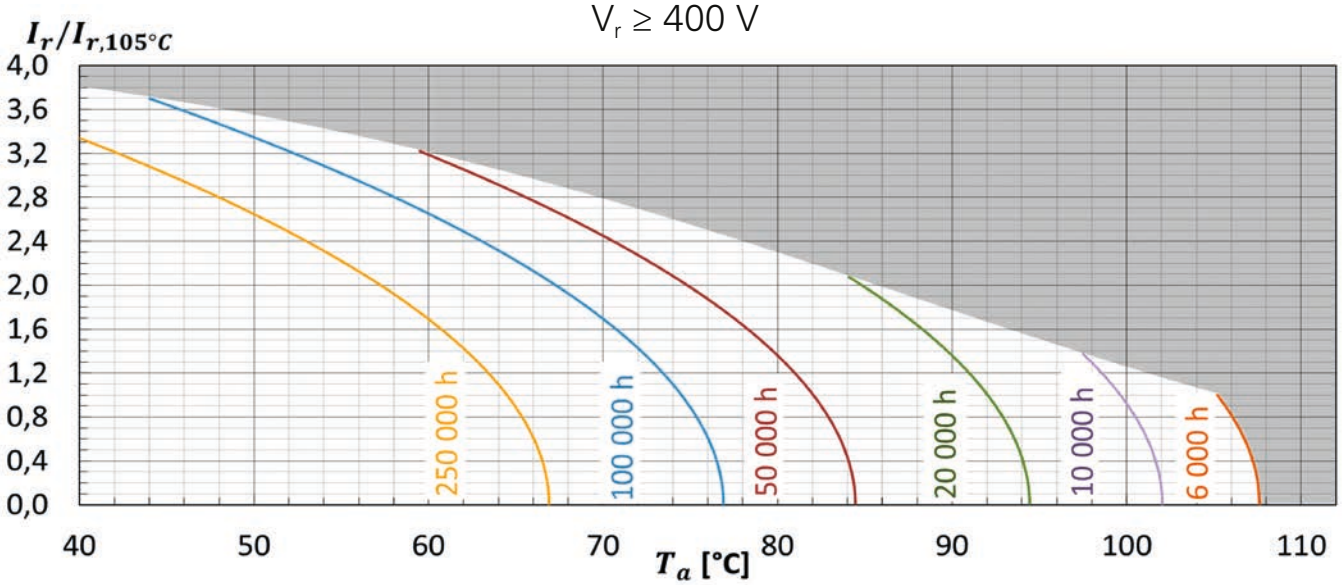
Useful life depending on ambient temperature T_a and ripple current operating conditions I_r versus rated ripple current at the upper category temperature $I_{r,\ 105°C,120Hz}$

Brauchbarkeitsdauer in Abhängigkeit von Umgebungstemperatur T_a und Wechselstrombelastung I_r im Verhältnis zur max. Wechselstrombelastung bei oberer Kategorietemperatur $I_{r,\ 105°C,120Hz}$

$V_r \leq 250$ V



$V_r \geq 400$ V



› Life Time Tests and Requirements · Anforderungen Brauchbarkeitsdauer

Life time test	Test procedure	Life time criteria
Endurance test	T_a = 105°C; V_r, I_r applied 4000 hours	ΔC/C ≤ 10% (of initial value) Tanδ ≤ 175% (of specified value) I_L ≤ specified value
Useful life	T_a = 105°C; V_r, I_r applied 6000 hours	ΔC/C ≤ 15% (of initial value) Tanδ < 200% (of specified value) I_L ≤ specified value

Reference Specification: JIS C 5101-4, JIS C 5102, IEC 60384-4