

Screw Type Series Data

VF · VFL · FX2 · FX3 · HCGW · HCGW2 · HCGW3 · HCGF5 · HCGF6
VFR · VFLR · FXR · VG · VGL · HCGH · VGR · VGLR



AIC*tech*

VF · Screw-Terminal · 6000 h/85 °C

Standard Performances · Bottom cooling design · Smaller Size

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

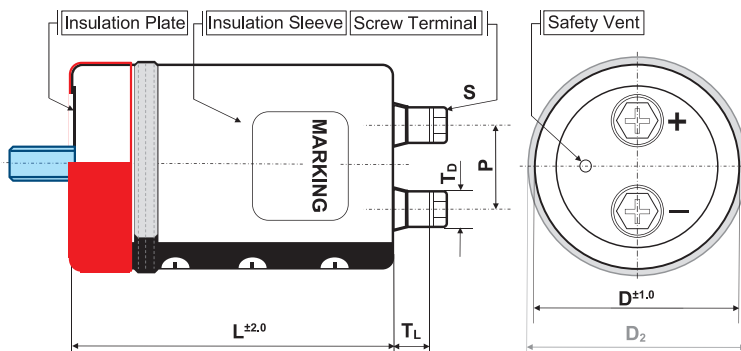
Items	Characteristics
Temperature range	-40°C ~ + 85°C
Capacitance tolerance (at 20°C)	Standard +/- 20%, -10/+30% on request
Surge voltage / Ripple voltage	Repetitive max. 30 sec per 6 Minutes / ≤ 50V
Leakage current max. I _l (20°C, 5 min)	0.01 • C • V _r [μA] or 5 mA, which is smaller.
Useful life	6 000 hours at 85°C
Field failure rate	0.5 FIT = 0.5 • 10 ⁻⁹ Failures/hour
RoHS conform	Directive 2011/65/EU & (EU)2015/863
Specification / Vibration	JIS C 5101-4/0.75mm, 10...55Hz, 10g, 3x2h
Outer materials	UL94-V0/UL224-VW1 certified (cap/sleeve)
Sleeve withstanding voltage	4000 Vac/ 1min between terminals bundled and plate*

* Typical value



> Shape designation · Formbezeichnung

- for details refer to p. 8–9 · technische Details siehe S. 8–9
- for mounting options refer to p. 149 ff · Montageoptionen siehe S. 149 ff



	B	I/Y	N	N+WC
outer sleeve	•	•	•	•
insulation plate	•	•	•	
stud bolt	•			
bottom double sleeve		•		
integrated seating ring				•

ØD	available shape	P	S	T _L	T _D	Cap material
64	B, N, I, Y	28.6	M5x10	8.0	11	PH
77	B, N, I, Y, WC	31.5	M5x10	8.0	11	PH
			M6x12	9.0	12	PH
90	B, N, I, Y, WC	31.5	M5x10	7.0	11	PH
			M6x12	8.0	12	PH

Size in mm. First listed terminal is standard.

> Product Code · Bestellbezeichnung

Example: Series VF · 12000 μF +/- 20 % · 400 V · D=90 mm · L=126 mm with Y-Bracket

VF	2G	123	Y	F	126								
Type of series	Capacitance code		Fixing symbol code	Case code diameter	Specific features (e.g. M6 ...)								
	The first two digits are significant. The last digit indicates the number of following zeros in µF.		B : Bolt N : single outer sleeve I : 2 Stoppers Bracket Y : 3 Stoppers Bracket N + suffix WC: blank bottom + seating ring	<table><tr><th>ØD</th><th>Code</th></tr><tr><td>64</td><td>D</td></tr><tr><td>77</td><td>E</td></tr><tr><td>90</td><td>F</td></tr></table>	ØD	Code	64	D	77	E	90	F	
ØD	Code												
64	D												
77	E												
90	F												
Rated voltage code													
Code	Voltage	Code	Voltage	Code	Voltage								
0J	6.3	1J	63	2V	350								
1A	10	1K	80	2G	400								
1C	16	2A	100	2W	450								
1E	25	2C	160	2H	500								
1V	35	2D	200	2L	550								
1H	50	2E	250	600V	600								
Capacitance tolerance													
Ø : ± 20 % Q : -10 % ~ + 30 %													
Case Code length													
Length in mm (3 digits)													

Rated Voltage Code (Surge Voltage) V_r [V DC]	Capacitance C_r [μF]	Ripple Current at 85°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
6.3 VDC Code: 0J Surge Voltage 10 VDC	330 000	16.1	43.5	8	9	18	1.50	64x94	VF0J334#D094
	470 000	18.6	50.2	7	8	18	1.80	64x107	VF0J474#D107
	560 000	19.7	53.2	6	7	18	2.40	64x123	VF0J564#D123
		18.3	49.4	6	7	20	2.40	77x95	VF0J664#E095
	680 000	20.1	54.3	5	7	20	2.90	77x108	VF0J684#E108
10 VDC Code: 1A Surge Voltage 16 VDC	330 000	17.2	46.4	5	6	18	1.80	64x94	VF1A334#D094
	390 000	18.7	50.5	4	6	18	2.00	64x107	VF1A394#D107
	470 000	21.1	57.0	4	6	18	2.30	64x123	VF1A474#D123
		19.4	52.4	4	6	20	2.30	77x95	VF1A474#E095
	560 000	21.0	56.7	3	5	20	3.00	77x108	VF1A564#E108
	680 000	23.8	64.3	3	5	20	3.70	77x124	VF1A684#E124
		22.9	61.8	3	5	20	3.70	90x97	VF1A684#F097
16 VDC Code: 1C Surge Voltage 25 VDC	270 000	16.2	43.7	4	6	18	1.60	64x94	VF1C274#D094
	330 000	18.3	49.4	4	6	18	1.80	64x123	VF1C334#D123
		18.0	48.6	4	6	20	1.80	77x95	VF1C334#E095
	390 000	19.5	52.7	4	5	20	2.40	77x108	VF1C394#E108
	470 000	22.0	59.4	3	5	20	2.90	77x124	VF1C474#E124
		21.9	59.1	3	5	20	2.90	90x97	VF1C474#F097
	560 000	23.7	64.0	3	5	20	3.20	90x110	VF1C564#F110
25 VDC Code: 1E Surge Voltage 32 VDC	180 000	13.7	37.0	5	6	18	1.20	64x94	VF1E184#D094
	220 000	15.1	40.8	4	5	18	1.20	64x107	VF1E224#D107
	270 000	17.2	46.4	4	5	18	1.40	64x123	VF1E274#D123
	330 000	19.2	51.8	4	5	20	1.40	77x95	VF1E334#E095
	390 000	20.8	56.2	4	5	20	2.10	77x108	VF1E394#E108
	470 000	23.4	63.2	3	5	20	2.30	77x124	VF1E474#E124
		22.9	61.8	3	5	20	2.30	90x97	VF1E474#F097
	560 000	24.8	67.0	3	4	20	2.30	90x110	VF1E564#F110
35 VDC Code: 1V Surge Voltage 44 VDC	120 000	12.9	34.8	5	7	18	1.00	64x94	VF1V124#D094
	150 000	14.4	38.9	5	7	18	1.00	64x107	VF1V154#D107
	180 000	16.3	44.0	5	7	18	1.00	64x123	VF1V184#D123
		15.2	41.0	5	7	20	1.00	77x95	VF1V184#E095
	220 000	16.8	45.4	5	7	20	1.20	77x108	VF1V224#E108
	270 000	19.0	51.3	4	6	20	1.20	77x124	VF1V274#E124
		18.8	50.8	4	6	20	1.20	90x97	VF1V274#F097
	330 000	20.7	55.9	4	6	20	1.80	90x110	VF1V334#F110
50 VDC Code: 1H Surge Voltage 63 VDC	82 000	12.1	32.7	7	8	18	0.70	64x94	VF1H823#D094
	100 000	13.4	36.2	6	7	18	0.70	64x107	VF1H104#D107
	150 000	16.8	45.4	5	7	18	0.90	64x123	VF1H154#D123
		13.9	37.5	5	7	20	0.90	77x95	VF1H154#E095
	180 000	15.2	41.0	5	6	20	1.40	77x108	VF1H184#E108
	220 000	17.2	46.4	4	6	20	1.50	77x124	VF1H224#E124
		16.5	44.6	4	6	20	1.50	90x97	VF1H224#F097
	270 000	18.2	49.1	3	5	20	1.50	90x110	VF1H274#F110

Additional designs on request · Weitere Designs auf Anfrage

Rated VoltageCode (Surge Voltage) V_r [V DC]	Capacitance C_r [μF]	Ripple Current at 85°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
63 VDC Code: 1J Surge Voltage 80 VDC	56 000	13.3	35.9	8	9	18	0.50	64x94	VF1J563#D094
	68 000	14.6	39.4	7	8	18	0.50	64x107	VF1J683#D107
	82 000	16.5	44.6	7	8	18	0.70	64x123	VF1J823#D123
	100 000	15.5	41.9	7	8	20	0.70	77x95	VF1J104#E095
	120 000	16.9	45.6	6	7	20	1.10	77x108	VF1J124#E108
	150 000	19.3	52.1	6	7	20	1.20	77x124	VF1J154#E124
		18.3	49.4	6	7	20	1.20	90x97	VF1J154#F097
	180 000	19.9	53.7	5	6	20	1.20	90x110	VF1J184#F110
80 VDC Code: 1K Surge Voltage 100 VDC	39 000	12.8	34.6	6	7	18	0.35	64x94	VF1K393#D094
	47 000	14.0	37.8	6	7	18	0.35	64x107	VF1K473#D107
	56 000	15.7	42.4	5	7	18	0.40	64x123	VF1K563#D123
		15.3	41.3	5	7	20	0.40	77x95	VF1K563#E095
	68 000	16.8	45.4	4	7	20	0.40	77x108	VF1K683#E108
	82 000	18.9	51.0	3	6	20	0.60	77x124	VF1K823#E124
		18.1	48.9	3	6	20	0.60	90x97	VF1K823#F097
	100 000	19.8	53.5	3	6	20	0.70	90x110	VF1K104#F110
100 VDC Code: 2A Surge Voltage 125 VDC	22 000	9.6	25.9	6	9	18	0.20	64x94	VF2A223#D094
	33 000	11.7	31.6	6	7	18	0.25	64x107	VF2A333#D107
	39 000	13.1	35.4	5	7	18	0.30	64x123	VF2A393#D123
		12.8	34.6	5	7	20	0.30	77x95	VF2A393#E095
	47 000	14.0	37.8	5	7	20	0.30	77x108	VF2A473#E108
		15.6	42.1	4	6	20	0.45	77x124	VF2A563#E124
	56 000	15.8	42.7	4	6	20	0.45	90x97	VF2A563#F097
		17.3	46.7	4	6	20	0.50	90x110	VF2A683#F110
	100 000	20.9	56.4	3	5	20	0.45	77x165	VF2A104#E165
		22.9	61.8	3	5	20	0.45	90x190	VF2A104#F190
160 VDC Code: 2C Surge Voltage 200 VDC	12 000	12.3	33.2	12	15	18	0.25	64x94	VF2C123#D094
	15 000	13.7	37.0	11	12	18	0.25	64x107	VF2C153#D107
	18 000	15.4	41.6	9	11	18	0.25	64x123	VF2C183#D123
		17.4	47.0	9	11	20	0.25	77x95	VF2C183#E095
	22 000	16.8	45.4	8	8	18	0.25	64x147	VF2C223#D147
		19.1	51.6	8	8	20	0.25	77x108	VF2C223#E108
	27 000	21.7	58.6	7	8	20	0.25	77x124	VF2C273#E124
		24.6	66.4	7	8	20	0.25	90x97	VF2C273#F097
	33 000	23.5	63.5	6	7	20	0.25	77x148	VF2C333#E148
		27.0	72.9	6	7	20	0.25	90x110	VF2C333#F110
	39 000	29.1	78.6	5	7	20	0.25	90x126	VF2C393#F126
200 VDC Code: 2D Surge Voltage 250 VDC	12 000	12.3	33.2	12	14	18	0.25	64x94	VF2D123#D094
	15 000	14.1	38.1	10	13	18	0.25	64x123	VF2D153#D123
		15.8	42.7	10	13	20	0.25	77x95	VF2D153#E095
	18 000	15.2	41.0	8	12	18	0.25	64x147	VF2D183#D147
		17.3	46.7	8	12	20	0.25	77x108	VF2D183#E108
	22 000	19.6	52.9	7	7	20	0.25	77x124	VF2D223#E124
		22.2	59.9	7	7	20	0.25	90x97	VF2D223#F097

Additional designs on request · Weitere Designs auf Anfrage

Rated Voltage Code (Surge Voltage) V_r [V DC]	Capacitance C_r [µF]	Ripple Current at 85°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
200 VDC Code: 2D Surge Voltage 250 VDC	27 000	21.3	57.5	6	7	20	0.25	77x148	VF2D273#E148
		24.4	65.9	6	7	20	0.25	90x110	VF2D273#F110
	33 000	26.7	72.1	5	7	20	0.25	90x126	VF2D333#F126
	35 000	24.7	66.7	5	7	20	0.25	77x165	VF2D353#E165
	43 000	30.4	82.1	4	6	20	0.25	90x150	VF2D433#F150
250 VDC Code: 2E Surge Voltage 300 VDC	8 200	10.2	27.5	15	16	18	0.25	64x94	VF2E822#D94
	10 000	11.5	31.1	12	14	18	0.25	64x123	VF2E103#D123
	12 000	12.4	33.5	10	11	18	0.25	64x147	VF2E123#D147
		14.2	38.3	10	11	20	0.25	77x95	VF2E123#E095
	15 000	16.2	43.7	8	11	20	0.25	77x124	VF2E153#E124
		18.3	49.4	8	11	20	0.25	90x97	VF2E153#F097
	18 000	17.4	47.0	7	10	20	0.25	77x148	VF2E183#E148
		19.9	53.7	7	10	20	0.25	90x110	VF2E183#F110
	22 000	21.8	58.9	6	8	20	0.25	90x126	VF2E223#F126
350 VDC Code: 2V Surge Voltage 400 VDC	4 700	15.1	31.7	21	22	18	0.20	64x94	VF2V472#D094
	5 600	16.4	34.4	18	19	18	0.20	64x107	VF2V562#D107
	6 800	18.6	39.1	15	15	18	0.20	64x123	VF2V682#D123
		20.9	43.9	15	15	20	0.20	77x95	VF2V682#E095
	8 200	20.1	42.2	12	15	18	0.20	64x147	VF2V822#D147
		22.9	48.1	12	15	20	0.20	77x108	VF2V822#E108
	10 000	22.9	48.1	10	15	18	0.20	64x187	VF2V103#D187
		25.9	54.4	10	15	20	0.20	77x124	VF2V103#E124
		29.3	61.5	10	15	20	0.20	90x97	VF2V103#F097
	12 000	27.8	58.4	8	13	20	0.20	77x148	VF2V123#E148
		31.7	66.6	8	13	20	0.20	90x126	VF2V123#F126
		31.9	67.0	7	10	20	0.20	77x188	VF2V153#E188
	15 000	35.2	73.9	7	10	20	0.20	90x150	VF2V153#F150
		36.0	75.6	6	9	20	0.20	77x228	VF2V183#E228
		37.9	79.6	6	9	20	0.20	90x167	VF2V183#F167
	22 000	41.1	86.3	5	7	20	0.20	90x230	VF2V223#F230
	26 000	47.1	98.9	5	6	20	0.20	90x230	VF2V293#F230
400 VDC Code: 2G Surge Voltage 450 VDC	3 900	13.7	28.8	26	28	18	0.20	64x94	VF2G392#D094
	4 700	15.0	31.5	21	22	18	0.20	64x107	VF2G472#D107
	5 600	16.9	35.5	18	19	18	0.20	64x123	VF2G562#D123
		19.0	39.9	18	19	20	0.20	77x95	VF2G562#E095
	6 800	18.3	38.4	15	15	18	0.20	64x147	VF2G682#D147
		20.8	43.7	15	15	20	0.20	77x108	VF2G682#E108
	8 200	20.8	43.7	12	15	18	0.20	64x187	VF2G822#D187
		23.5	49.4	12	15	20	0.20	77x124	VF2G822#E124
		26.6	55.9	12	15	20	0.20	90x97	VF2G822#F097
	10 000	25.4	53.3	10	15	20	0.20	77x148	VF2G103#E148
		29.1	61.1	10	15	20	0.20	90x110	VF2G103#F110
		28.5	59.9	8	13	20	0.20	77x188	VF2G123#E188
	12 000	31.7	66.6	8	13	20	0.20	90x126	VF2G123#F126
		32.9	69.1	7	10	20	0.20	77x228	VF2G153#E228
	15 000	34.6	72.7	7	10	20	0.20	90x167	VF2G153#F167
		38.2	80.2	6	9	20	0.20	90x190	VF2G183#F190
	22 000	41.1	86.3	5	7	20	0.20	90x230	VF2G223#F230
	25 000	43.8	92.0	5	7	20	0.20	90x230	VF2G253#F230
	29 000	47.1	98.9	4	6	20	0.20	90x230	VF2G293#F230

Additional designs on request · Weitere Designs auf Anfrage

Rated VoltageCode (Surge Voltage) V_r [V DC]	Capacitance C_r [μF]	Ripple Current at 85°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
450 VDC Code: 2W Surge Voltage 500 VDC	2 700	11.7	24.6	38	40	18	0.20	64x94	VF2W272#D094
	3 300	12.9	27.1	30	35	18	0.20	64x107	VF2W332#D107
	3 900	14.5	30.5	27	32	18	0.20	64x123	VF2W392#D123
		16.2	34.0	27	32	20	0.20	77x95	VF2W392#E095
	4 700	17.8	37.4	21	21	20	0.20	77x108	VF2W472#E108
		17.0	35.7	20	20	18	0.20	64x147	VF2W562#D147
	5 600	19.9	41.8	20	20	20	0.20	77x124	VF2W562#E124
		22.5	47.3	20	20	20	0.20	90x97	VF2W562#F097
		20.4	42.8	17	19	20	0.20	77x108	VF2W622#E108
	6 800	19.4	40.7	15	18	18	0.20	64x187	VF2W682#D187
		21.4	44.9	15	18	20	0.20	77x148	VF2W682#E148
		24.6	51.7	15	18	20	0.20	90x110	VF2W682#F110
	8 200	24.0	50.4	14	16	20	0.20	77x165	VF2W822#E165
		26.8	56.3	14	16	20	0.20	90x126	VF2W822#F126
	10 000	26.7	56.1	10	15	20	0.20	77x188	VF2W103#E188
		29.4	61.7	10	15	20	0.20	90x150	VF2W103#F150
	12 000	29.2	61.3	9	12	20	0.15	77x188	VF2W123#E188
		30.2	63.4	9	12	20	0.20	77x228	VF2W123#E228
		31.7	66.6	9	12	20	0.20	90x167	VF2W123#F167
	15 000	35.7	75.0	7	10	20	0.20	90x190	VF2W153#F190
	18 000	38.1	80.0	6	9	20	0.20	90x230	VF2W183#F230
	20 000	40.1	84.2	6	8	20	0.20	90x230	VF2W203#F230
500 VDC Code: 2H Surge Voltage 550 VDC	1 800	9.1	19.1	53	50	18	0.20	64x94	VF2H182#D094
	2 200	10.0	21.0	40	35	18	0.20	64x107	VF2H222#D107
	2 700	11.4	23.9	37	33	18	0.20	64x123	VF2H272#D123
		12.9	27.1	37	33	20	0.20	77x95	VF2H272#E095
	3 300	12.4	26.0	36	32	18	0.20	64x147	VF2H332#D147
		14.2	29.8	36	32	20	0.20	77x108	VF2H332#E108
		13.9	29.2	27	29	18	0.20	64x164	VF2H392#D164
	3 900	15.8	33.2	27	29	20	0.20	77x124	VF2H392#E124
		17.9	37.6	27	29	20	0.20	90x97	VF2H392#F097
		15.4	32.3	25	25	18	0.20	64x187	VF2H472#D187
	4 700	17.0	35.7	25	25	20	0.20	77x148	VF2H472#E148
		19.5	41.0	25	25	20	0.20	90x110	VF2H472#F110
	5 600	18.9	39.7	23	21	20	0.20	77x165	VF2H562#E165
		21.1	44.3	23	21	20	0.20	90x126	VF2H562#F126
	6 800	20.9	43.9	20	18	20	0.20	77x188	VF2H682#E188
		23.1	48.5	20	18	20	0.20	90x150	VF2H682#F150
	8 200	23.8	50.0	17	16	20	0.20	77x228	VF2H822#E228
		25.0	52.5	17	16	20	0.20	90x167	VF2H822#F167
	10 000	27.8	58.4	14	16	20	0.20	90x190	VF2H103#F190
	12 000	29.6	62.2	12	14	20	0.20	90x230	VF2H123#F230
	14 000	31.9	67.0	11	12	20	0.20	90x230	VF2H143#F230
550 VDC Code: 2L Surge Voltage 600 VDC	1 200	7.2	15.1	93	100	18	0.20	64x94	VF2L122#D094
	1 500	8.1	17.0	74	80	18	0.20	64x107	VF2L152#D107
	1 800	9.1	19.1	61	50	18	0.20	64x123	VF2L182#D123
		10.3	21.6	61	50	20	0.20	77x95	VF2L182#E095

Additional designs on request · Weitere Designs auf Anfrage

Rated VoltageCode (Surge Voltage) V_r [V DC]	Capacitance C_r [μF]	Ripple Current at 85°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
550 VDC Code: 2L Surge Voltage 600 VDC	2 200	9.9	20.8	53	50	18	0.20	64x147	VF2L222#D147
		11.3	23.7	53	50	20	0.20	77x108	VF2L222#E108
	2 700	11.3	23.7	40	35	18	0.20	64x164	VF2L272#D164
		14.5	30.5	40	35	20	0.20	90x97	VF2L272#E097
	3 300	12.6	26.5	38	32	18	0.20	64x187	VF2L332#D187
		14.2	29.8	38	32	20	0.20	77x124	VF2L332#E124
		16.0	33.6	38	32	20	0.20	90x110	VF2L332#F110
	3 900	15.4	32.3	30	27	20	0.20	77x165	VF2L392#E165
		17.2	36.1	30	27	20	0.20	90x126	VF2L392#F126
	4 700	17.0	35.7	25	20	20	0.20	77x188	VF2L472#E188
		18.8	39.5	25	20	20	0.20	90x150	VF2L472#F150
	5 600	19.2	40.3	20	17	20	0.20	77x228	VF2L562#E228
		20.2	42.4	20	17	20	0.20	90x167	VF2L562#F167
	6 800	22.4	47.0	17	17	20	0.20	90x190	VF2L682#F190
	8 200	23.9	50.2	14	14	20	0.20	90x230	VF2L822#F230
600 VDC Code: 600V Surge Voltage 650 VDC	1 500	8.7	18.3	84	63	18	0.20	64x107	VF600V152#D107
	1 800	9.8	20.6	70	53	18	0.20	64x123	VF600V182#D123
		11.0	23.1	70	53	20	0.20	77x95	VF600V182#E095
	2 200	10.6	22.3	58	44	18	0.20	64x147	VF600V222#D147
		12.1	25.4	58	44	20	0.20	77x108	VF600V222#E108
	2 700	12.1	25.4	47	35	18	0.20	64x164	VF600V272#D164
		13.8	29.0	47	35	20	0.20	77x124	VF600V272#E124
		15.6	32.8	47	35	20	0.20	90x97	VF600V272#F097
	3 300	13.5	28.4	39	29	18	0.20	64x187	VF600V332#D187
		14.9	31.3	39	29	20	0.20	77x148	VF600V332#E148
		17.1	35.9	39	29	20	0.20	90x110	VF600V332#F110
	3 900	16.5	34.7	33	25	20	0.20	77x165	VF600V392#E165
		18.5	38.9	33	25	20	0.20	90x126	VF600V392#F126
	4 700	18.3	38.4	27	20	20	0.20	77x188	VF600V472#E188
		20.2	42.4	27	20	20	0.20	90x150	VF600V472#F150
	5 600	20.6	43.3	23	17	20	0.20	77x228	VF600V562#E228
		21.6	45.4	23	17	20	0.20	90x167	VF600V562#F167
	6 800	23.4	49.1	19	14	20	0.20	90x230	VF600V682#F230

Additional designs on request · Weitere Designs auf Anfrage

> Ripple Current Multiplier · Wechselstrommultiplikator

Frequency [Hz]	50/60	120	300	1k	≥ 10k	Forced cooling [m/sec]	v < 0.5	v ≥ 0.5	v ≥ 2.0	v ≥ 3.0
Multiplier	0.80	1.00	1.18	1.34	1.45	Multiplier	1.00	1.10	1.20	1.25

Ta (°C)	40	45	50	55	60	65	70	75	80	85
Multiplier 6.3-100VDC	2.7	2.6	2.4	2.3	2.2	2.0	1.7	1.4	1.2	1.0
Multiplier 160-250VDC	2.7	2.5	2.3	2.2	2.1	1.9	1.6	1.3	1.1	1.0
Multiplier 350-600VDC	2.1	2.0	1.9	1.8	1.7	1.5	1.3	1.2	1.1	1.0

> Life Time Table · Brauchbarkeitsdauer – Tabelle

VF 6.3-100VDC	Useful life as function of ambient temperature and ripple current											
I_r at 85°C	x 1.0	x 1.1	x 1.2	x 1.3	x 1.4	x 1.5	x 1.7	x 2.0	x 2.2	x 2.4	x 2.6	x 2.7
$T_a = 40^\circ\text{C}$	250	250	250	250	250	250	241	178	141	109	83	72
$T_a = 45^\circ\text{C}$	250	242	227	212	197	182	152	112	89	69	52	
$T_a = 50^\circ\text{C}$	162	153	143	134	124	115	96	71	56	43		
$T_a = 55^\circ\text{C}$	102	96	91	84	78	72	61	45	35			
$T_a = 60^\circ\text{C}$	64	61	57	53	49	46	38	28	22			
$T_a = 65^\circ\text{C}$	41	38	36	33	31	29	24	18				
$T_a = 70^\circ\text{C}$	25	24	23	21	19	18	15					
$T_a = 75^\circ\text{C}$	16	15	14	13	12							
$T_a = 80^\circ\text{C}$	10	9	9									
$T_a = 85^\circ\text{C}$	6											

khrs Max. value limited to 250 000 hours.

VF 160-250VDC	Useful life as function of ambient temperature and ripple current											
I_r at 85°C	x 1.0	x 1.1	x 1.2	x 1.3	x 1.4	x 1.5	x 1.7	x 1.9	x 2.1	x 2.3	x 2.5	x 2.7
$T_a = 40^\circ\text{C}$	250	250	250	250	250	250	203	156	116	84	59	40
$T_a = 45^\circ\text{C}$	250	237	218	199	180	162	128	98	73	53	37	
$T_a = 50^\circ\text{C}$	162	150	138	126	114	102	81	62	46	33		
$T_a = 55^\circ\text{C}$	102	95	87	79	72	64	51	39	29			
$T_a = 60^\circ\text{C}$	64	60	55	50	45	41	32	24	18			
$T_a = 65^\circ\text{C}$	41	38	34	31	28	25	20	15				
$T_a = 70^\circ\text{C}$	25	24	22	20	18	16						
$T_a = 75^\circ\text{C}$	16	15	13	12								
$T_a = 80^\circ\text{C}$	10	9										
$T_a = 85^\circ\text{C}$	6											

khrs Max. value limited to 250 000 hours.

VF 350-600VDC	Useful life as function of ambient temperature and ripple current											
I_r at 85°C	x 1.0	x 1.1	x 1.2	x 1.3	x 1.4	x 1.5	x 1.6	x 1.7	x 1.8	x 1.9	x 2.0	x 2.1
$T_a = 40^\circ\text{C}$	250	250	250	246	204	166	134	106	83	64	48	36
$T_a = 45^\circ\text{C}$	250	218	186	156	129	105	84	67	52	40	30	
$T_a = 50^\circ\text{C}$	160	138	117	98	81	66	53	42	33	25		
$T_a = 55^\circ\text{C}$	101	87	74	62	51	42	33	26	21			
$T_a = 60^\circ\text{C}$	64	55	47	39	32	26	21	17				
$T_a = 65^\circ\text{C}$	40	34	29	24	20	16						
$T_a = 70^\circ\text{C}$	25	22	18	15								
$T_a = 75^\circ\text{C}$	16	13	11									
$T_a = 80^\circ\text{C}$	10	8										
$T_a = 85^\circ\text{C}$	6											

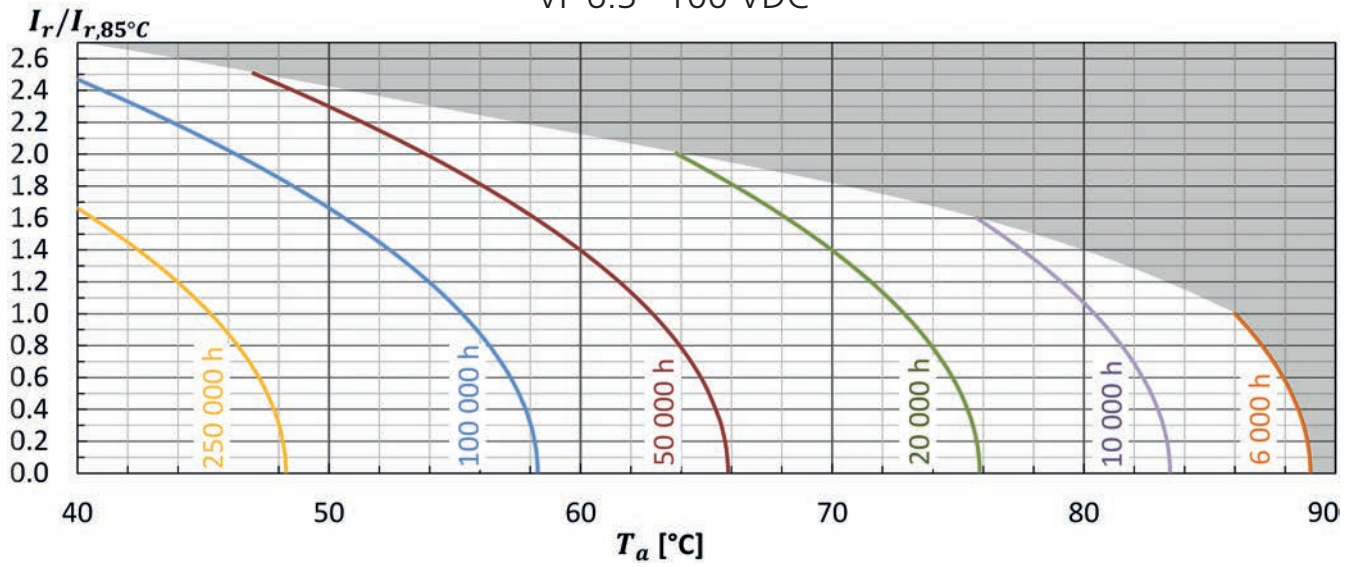
khrs Max. value limited to 250 000 hours.

> Life Time Graph · Brauchbarkeitsdauer – Diagramm

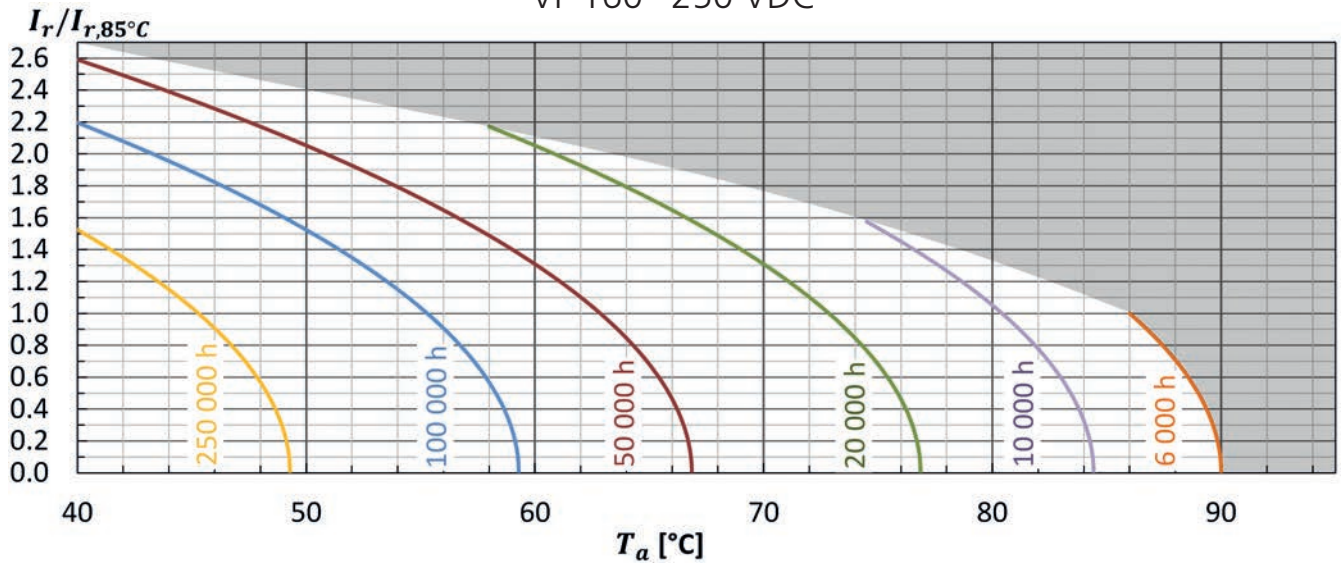
Useful life depending on ambient temperature T_a and ripple current operating conditions I_r versus rated ripple current at the upper category temperature $I_{r, 85^\circ\text{C}, 120\text{Hz}}$

Brauchbarkeitsdauer in Abhängigkeit von Umgebungstemperatur T_a und Wechselstrombelastung I_r im Verhältnis zur max. Wechselstrombelastung bei oberer Kategorie-temperatur $I_{r, 85^\circ\text{C}, 120\text{Hz}}$

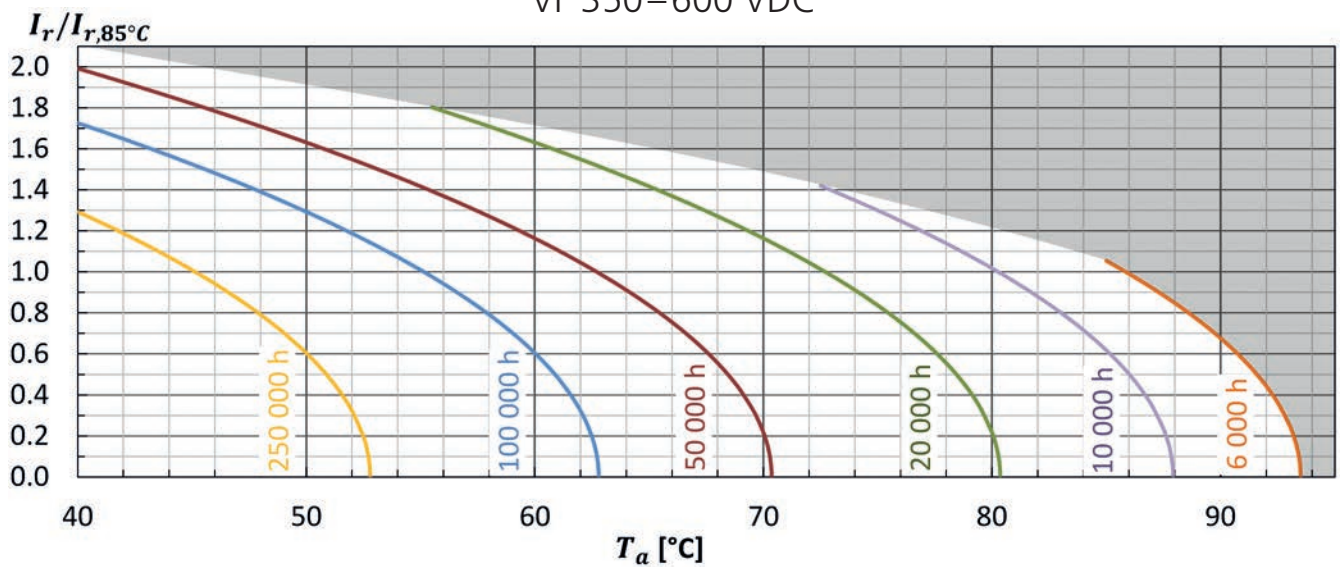
VF 6.3–100 VDC



VF 160–250 VDC



VF 350–600 VDC



> Life Time Tests and Requirements · Anforderungen Brauchbarkeitsdauer

Life time test	Test procedure	Life time criteria
Endurance test	$T_a = 85^{\circ}\text{C}$; V_r , I_r applied 4000 hours	$\Delta C/C \leq 10\%$ (of initial value) $\tan\delta \leq 175\%$ (of specified value) $I_L \leq$ specified value
Useful life	$T_a = 85^{\circ}\text{C}$; V_r , I_r applied 6000 hours	$\Delta C/C \leq 15\%$ (of initial value) $\tan\delta < 200\%$ (of specified value) $I_L \leq$ specified value

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

VFL · Screw-Terminal · 12000 h/85 °C

Long Life · Bottom cooling design · Smaller Size

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

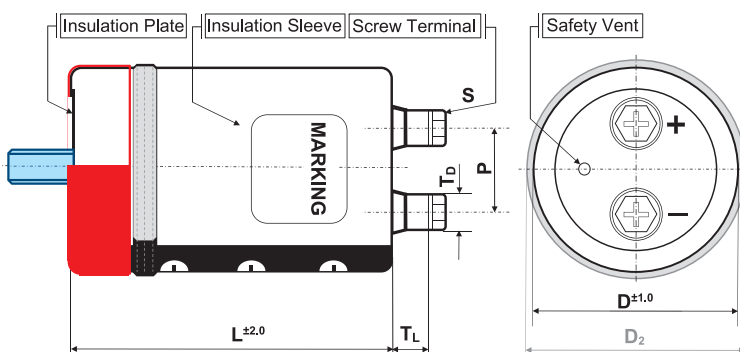
Items	Characteristics
Temperature range	-40°C ~ + 85°C
Capacitance tolerance (at 20°C)	Standard +/- 20%, -10/+30% on request
Surge voltage / Ripple voltage	Repetitive max. 30 sec per 6 Minutes / ≤ 50V
Leakage current max. I_L (20°C, 5 min)	0.01 • C • V_r [μA] or 5 mA, which is smaller.
Useful life	12 000 hours at 85°C
Field failure rate	0.5 FIT = 0.5 • 10 ⁻⁹ Failures/hour
RoHS conform	Directive 2011/65/EU & (EU)2015/863
Specification / Vibration	JIS C 5101-4/0.75mm, 10...55Hz, 10g, 3x2h
Outer materials	UL94-V0/UL224-VW1 certified (cap/sleeve)
Sleeve withstanding voltage	4000 Vac / 1min between terminals bundled and plate*

* Typical value



> Shape designation · Formbezeichnung

- for details refer to p. 8–9 · technische Details siehe S. 8–9
- for mounting options refer to p. 149 ff · Montagemöglichkeiten siehe S. 149 ff



	B	I/Y	N	N+WC
outer sleeve	•	•	•	•
insulation plate	•	•	•	
stud bolt	•			
bottom double sleeve		•		
integrated seating ring				•

ØD	available shape	P	S	T _L	T _D	Cap material
64	B, N, I, Y	28.6	M5x10	8.0	11	PH
77	B, N, I, Y, WC	31.5	M5x10	8.0	11	PH
			M6x12	9.0	12	PH
90	B, N, I, Y, WC	31.5	M5x10	7.0	11	PH
			M6x12	8.0	12	PH

Size in mm. First listed terminal is standard.

> Product Code · Bestellbezeichnung

Example: Series VFL · 12000 μF +/- 20 % · 400 V · D=90 mm · L= 150 mm with Y-Bracket

VFL	2G	123	Y	F	150								
Type of series	Capacitance code		Fixing symbol code	Case code diameter	Specific features (e.g. M6 ...)								
	The first two digits are significant. The last digit indicates the number of following zeros in μF.		B : Bolt N : single outer sleeve I : 2 Stoppers Bracket Y : 3 Stoppers Bracket N + suffix WC: blank bottom + seating ring	<table><tr><th>ØD</th><th>Code</th></tr><tr><td>64</td><td>D</td></tr><tr><td>77</td><td>E</td></tr><tr><td>90</td><td>F</td></tr></table>	ØD	Code	64	D	77	E	90	F	
ØD	Code												
64	D												
77	E												
90	F												
Rated voltage code				Capacitance tolerance	Case Code length								
Code	Voltage	Code	Voltage	Ø : ± 20 % Q : -10 % ~ + 30 %	Length in mm (3 digits)								
2V	350	2H	500										
2G	400	2L	550										
2W	450	600V	600										

Rated VoltageCode (Surge Voltage) V_r [V DC]	Capacitance C_r [μF]	Ripple Current at 85°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
350 VDC Code: 2V Surge Voltage 400 VDC	4 700	15.1	31.7	21	22	18	0.20	64x94	VFL2V472#D094
	5 600	16.9	35.5	18	19	18	0.20	64x107	VFL2V562#D107
	6 800	18.7	39.3	15	15	18	0.20	64x123	VFL2V682#D123
		20.9	43.9	15	15	20	0.20	77x95	VFL2V682#E095
	8 200	20.2	42.4	12	15	18	0.20	64x147	VFL2V822#D147
		22.9	48.1	12	15	20	0.20	77x108	VFL2V822#E108
	10 000	22.9	48.1	10	15	18	0.20	64x187	VFL2V103#D187
		25.9	54.4	10	15	20	0.20	77x124	VFL2V103#E124
		29.3	61.5	10	15	20	0.20	90x97	VFL2V103#F097
	12 000	27.8	58.4	8	13	20	0.20	77x148	VFL2V123#E148
		31.7	66.6	8	13	20	0.20	90x126	VFL2V123#F126
	15 000	31.9	67.0	7	10	20	0.20	77x188	VFL2V153#E188
		35.2	73.9	7	10	20	0.20	90x150	VFL2V153#F150
	18 000	36.0	75.6	7	10	20	0.20	77x228	VFL2V183#E228
		37.9	79.6	7	10	20	0.20	90x167	VFL2V183#F167
	22 000	41.1	86.3	6	9	20	0.20	90x230	VFL2V223#F230
400 VDC Code: 2G Surge Voltage 450 VDC	3 300	12.7	26.7	30	31	18	0.20	64x94	VFL2G332#D094
	3 900	13.8	29.0	26	28	18	0.20	64x94	VFL2G392#D094
	4 700	15.5	32.6	21	22	18	0.20	64x107	VFL2G472#D107
	5 600	16.9	35.5	18	19	18	0.20	64x123	VFL2G562#D123
		19.0	39.9	18	19	20	0.20	77x95	VFL2G562#E095
	6 800	18.4	38.6	15	15	18	0.20	64x147	VFL2G682#D147
		20.8	43.7	15	15	20	0.20	77x108	VFL2G682#E108
	8 200	20.8	43.7	12	15	18	0.20	64x187	VFL2G822#D187
		23.5	49.4	12	15	20	0.20	77x124	VFL2G822#E124
		26.6	55.9	12	15	20	0.20	90x97	VFL2G822#F097
	10 000	25.4	53.3	10	15	20	0.20	77x148	VFL2G103#E148
		28.9	60.7	10	15	20	0.20	90x126	VFL2G103#F126
	12 000	28.5	59.9	8	13	20	0.20	77x188	VFL2G123#E188
		31.3	65.7	8	13	20	0.20	90x143	VFL2G123#F143
		31.5	66.2	8	13	20	0.20	90x150	VFL2G123#F150
	15 000	32.9	69.1	8	10	20	0.20	77x228	VFL2G153#E228
		34.6	72.7	8	10	20	0.20	90x167	VFL2G153#F167
	18 000	37.2	78.1	6	9	20	0.20	90x230	VFL2G183#F230
450 VDC Code: 2W Surge Voltage 500 VDC	2 700	11.7	24.6	38	40	18	0.20	64x94	VFL2W272#D094
	3 300	13.3	27.9	30	35	18	0.20	64x107	VFL2W332#D107
		14.9	31.3	30	33	18	0.20	77x95	VFL2W332#E095
	3 900	14.5	30.5	27	32	18	0.20	64x123	VFL2W392#D123
		16.2	34.0	27	32	20	0.20	77x95	VFL2W392#E095
	4 700	15.6	32.8	21	21	18	0.20	64x147	VFL2W472#D147
		17.8	37.4	21	21	20	0.20	77x108	VFL2W472#E108

Additional designs on request · Weitere Designs auf Anfrage

Rated VoltageCode (Surge Voltage) V_r [V DC]	Capacitance C_r [μF]	Ripple Current at 85°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
450 VDC Code: 2W Surge Voltage 500 VDC	5 600	17.5	36.8	20	20	18	0.20	64x164	VFL2W562#D164
		19.9	41.8	20	20	20	0.20	77x124	VFL2W562#E124
		22.5	47.3	20	20	20	0.20	90x97	VFL2W562#F097
	6 300	21.2	44.3	18	19	20	0.20	77x139	VFL2W632#E139
		19.4	40.7	15	18	18	0.20	64x187	VFL2W682#D187
		21.4	44.9	15	18	20	0.20	77x148	VFL2W682#E148
	6 800	24.6	51.7	15	18	20	0.20	90x110	VFL2W682#F110
		24.0	50.4	14	16	20	0.20	77x165	VFL2W822#E165
		26.8	56.3	14	16	20	0.20	90x126	VFL2W822#F126
	8 200	26.7	56.1	10	15	20	0.20	77x188	VFL2W103#E188
		29.4	61.7	10	15	20	0.20	90x150	VFL2W103#F150
	10 000	30.2	63.4	9	12	20	0.20	77x228	VFL2W123#E228
		31.7	67.0	9	12	20	0.20	90x167	VFL2W123#F167
	12 000	34.8	73.1	7	10	20	0.20	90x230	VFL2W153#F230
		37.0	77.7	6	8	20	0.20	90x230	VFL2W173#F230
500 VDC Code: 2H Surge Voltage 550 VDC	1 800	9.1	19.1	53	50	18	0.20	64x94	VFL2H182#D094
	2 200	10.3	21.6	40	35	18	0.20	64x107	VFL2H222#D107
	2 700	11.5	24.2	37	33	18	0.20	64x123	VFL2H272#D123
		12.9	27.1	37	33	20	0.20	77x95	VFL2H272#E095
	3 300	12.5	26.3	36	32	18	0.20	64x147	VFL2H332#D147
		14.2	29.8	36	32	20	0.20	77x108	VFL2H332#E108
	3 900	13.9	29.2	27	29	18	0.20	64x164	VFL2H392#D164
		15.8	33.2	27	29	20	0.20	77x124	VFL2H392#E124
		17.9	37.6	27	29	20	0.20	90x97	VFL2H392#F097
	4 700	15.4	32.3	25	25	20	0.20	64x187	VFL2H472#D187
		17.0	35.7	25	25	20	0.20	77x148	VFL2H472#E148
		19.5	41.0	25	25	20	0.20	90x110	VFL2H472#F110
	5 600	18.9	39.7	23	21	20	0.20	77x165	VFL2H562#E165
		21.1	44.3	23	21	20	0.20	90x126	VFL2H562#F126
	6 800	20.9	43.9	20	18	20	0.20	77x188	VFL2H682#E188
		23.1	48.5	20	18	20	0.20	90x150	VFL2H682#F150
	8 200	25.0	52.5	17	16	20	0.20	90x167	VFL2H822#F167
	10 000	27.8	58.4	14	12	20	0.20	90x190	VFL2H103#F190
	12 000	29.6	62.2	12	10	20	0.20	90x230	VFL2H123#F230
550 VDC Code: 2L Surge Voltage 600 VDC	1 200	7.3	15.3	93	100	18	0.20	64x94	VFL2L122#D094
	1 500	8.3	17.4	74	80	18	0.20	64x107	VFL2L152#D107
	1 800	9.1	19.1	61	60	18	0.20	64x123	VFL2L182#D123
		10.3	21.6	61	60	20	0.20	77x95	VFL2L182#E095
	2 200	10.0	21.0	53	50	18	0.20	64x147	VFL2L222#D147
		11.3	23.7	53	50	20	0.20	77x108	VFL2L222#E108
	2 700	11.3	23.7	40	35	18	0.20	64x164	VFL2L272#D164
		12.8	26.9	40	35	20	0.20	77x124	VFL2L272#E124
		14.5	30.5	40	35	20	0.20	90x97	VFL2L272#F097

Additional designs on request · Weitere Designs auf Anfrage

Rated VoltageCode (Surge Voltage) V_r [V DC]	Capacitance C_r [μF]	Ripple Current at 85°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
550 VDC Code: 2L Surge Voltage 600 VDC	3 300	12.6	26.5	38	32	20	0.20	64x187	VFL2L332#D187
		13.9	29.2	38	32	20	0.20	77x148	VFL2L332#E148
		16.0	33.6	38	32	20	0.20	90x110	VFL2L332#F110
	3 900	15.4	32.3	30	27	20	0.20	77x165	VFL2L392#E165
		17.2	36.1	30	27	20	0.20	90x126	VFL2L392#F126
		17.0	35.7	25	20	20	0.20	77x188	VFL2L472#E188
	4 700	18.8	39.5	25	20	20	0.20	90x150	VFL2L472#F150
		21.4	44.9	20	17	20	0.20	90x150	VFL2L562#F150
	5 600	20.2	42.4	20	17	20	0.20	90x167	VFL2L562#F167
		22.4	47.0	17	17	20	0.20	90x190	VFL2L682#F190
	6 800	23.9	50.2	14	15	20	0.20	90x230	VFL2L822#F230
600 VDC Code: 600V Surge Voltage 650 VDC	1 200	7.0	14.7	122	125	18	0.20	64x94	VFL600V122#D094
	1 500	8.0	16.8	111	114	18	0.20	64x123	VFL600V152#D123
		9.0	18.9	111	114	20	0.20	77x95	VFL600V152#E095
	1 800	8.6	18.1	99	102	18	0.20	64x147	VFL600V182#D147
		9.8	20.6	99	102	20	0.20	77x108	VFL600V182#E108
	2 200	9.8	20.6	85	87	18	0.20	64x164	VFL600V222#D164
		11.1	23.3	85	87	20	0.20	77x124	VFL600V222#E124
		12.6	26.5	85	87	20	0.20	90x97	VFL600V222#F097
	2 700	10.9	22.9	66	68	18	0.20	64x187	VFL600V272#D187
		13.8	29.0	66	68	20	0.20	90x110	VFL600V272#F110
		13.3	27.9	44	45	20	0.20	77x148	VFL600V332#E148
	3 300	15.2	31.9	44	45	20	0.20	90x126	VFL600V332#F126
		14.9	31.3	33	25	20	0.20	77x188	VFL600V392#E188
	3 900	16.4	34.4	33	25	20	0.20	90x150	VFL600V392#F150
		16.9	35.5	27	20	20	0.20	77x228	VFL600V472#E228
	4 700	17.7	37.2	27	20	20	0.20	90x167	VFL600V472#F167
		19.5	41.0	23	17	20	0.20	90x190	VFL600V562#F190
	5 600	20.9	43.9	19	14	20	0.20	90x230	VFL600V682#F230

Additional designs on request · Weitere Designs auf Anfrage

> Ripple Current Multiplier · Wechselstrommultiplikator

Frequency [Hz]	50/60	120	300	1k	≥ 10k	Forced cooling [m/sec]	v < 0.5	v ≥ 0.5	v ≥ 2.0	v ≥ 3.0
Multiplier	0.80	1.00	1.18	1.34	1.45	Multiplier	1.00	1.10	1.20	1.25

Ta (°C)	40	45	50	55	60	65	70	75	80	85
Multiplier	2.1	2.0	1.9	1.8	1.7	1.5	1.3	1.2	1.1	1.0

> Life Time Table · Brauchbarkeitsdauer – Tabelle

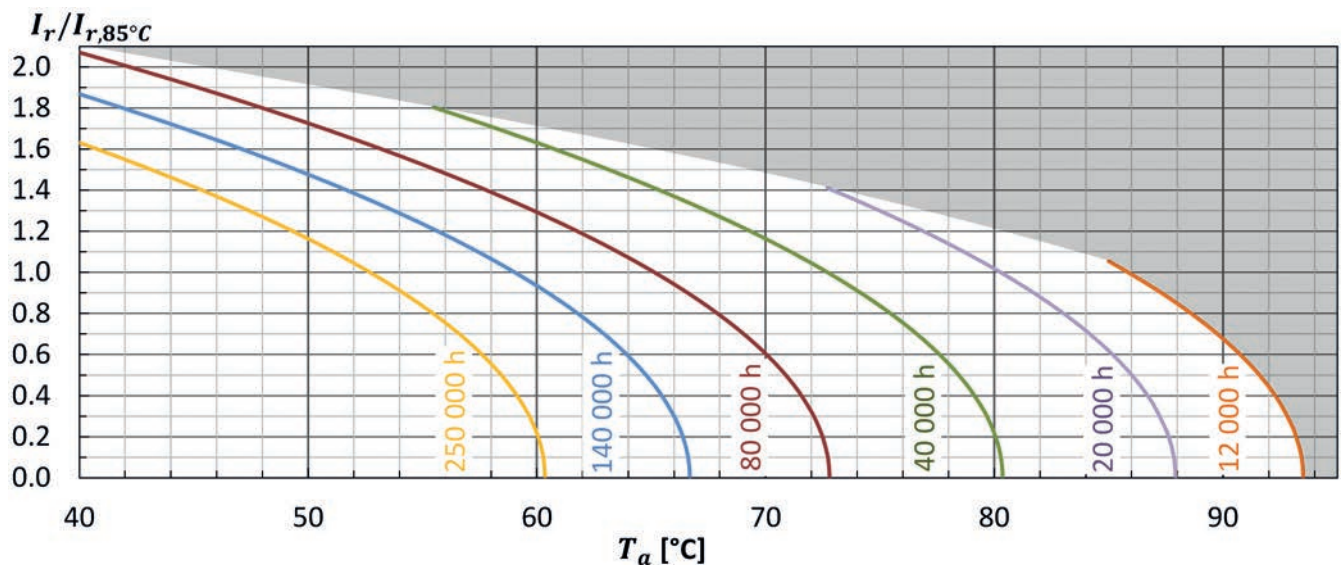
VFL	Useful life as function of ambient temperature and ripple current											
I_r at 85°C	x 1.0	x 1.1	x 1.2	x 1.3	x 1.4	x 1.5	x 1.6	x 1.7	x 1.8	x 1.9	x 2.0	x 2.1
$T_a = 40^\circ\text{C}$	250	250	250	250	250	250	250	212	166	128	97	73
$T_a = 45^\circ\text{C}$	250	250	250	250	250	210	169	134	105	81	61	
$T_a = 50^\circ\text{C}$	250	250	235	197	163	133	107	85	66	51		
$T_a = 55^\circ\text{C}$	202	174	148	124	103	84	67	53	42			
$T_a = 60^\circ\text{C}$	128	110	94	79	65	53	42	34				
$T_a = 65^\circ\text{C}$	81	69	59	49	41	33						
$T_a = 70^\circ\text{C}$	51	44	37	31								
$T_a = 75^\circ\text{C}$	32	27	23									
$T_a = 80^\circ\text{C}$	20	17										
$T_a = 85^\circ\text{C}$	12											

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 $I_{r, 85^\circ\text{C}, 120\text{Hz}}$

Brauchbarkeitsdauer in Abhängigkeit von Umgebungstemperatur T_a und Wechselstrombelastung I_r im Verhältnis zur max. Wechselstrombelastung bei oberer Kategorie-temperatur $I_{r, 85^\circ\text{C}, 120\text{Hz}}$



> Life Time Tests and Requirements · Anforderungen Brauchbarkeitsdauer

Life time test	Test procedure	Life time criteria
Endurance test	$T_a = 85^\circ\text{C}$; V_r , I_r applied 8000 hours	$\Delta C/C \leq 10\%$ (of initial value) $\tan\delta \leq 175\%$ (of specified value) $I_L \leq$ specified value
Useful life	$T_a = 85^\circ\text{C}$; V_r , I_r applied 12000 hours	$\Delta C/C \leq 15\%$ (of initial value) $\tan\delta < 200\%$ (of specified value) $I_L \leq$ specified value

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

FX2 · Screw-Terminal · 12000 h/85 °C

Long Life

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

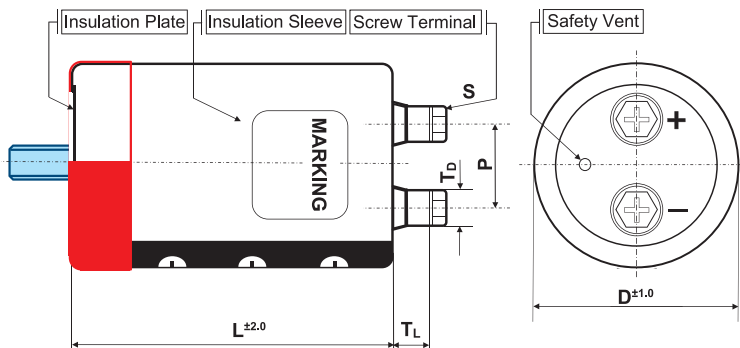
Items	Characteristics
Temperature range	-40°C ~ + 85°C
Capacitance tolerance (at 20°C)	Standard +/- 20%, -10/+30% on request
Surge voltage	Repetitive max. 30 sec per 6 Minutes
Leakage current max. I_L (20°C, 5 min)	$0.01 \cdot C \cdot V_r$ [μA] or 3 mA, which is smaller.
Useful life	12 000 hours at 85°C
Field failure rate	0.5 FIT = $0.5 \cdot 10^{-9}$ Failures/hour
RoHS conform	Directive 2011/65/EU & (EU)2015/863
Specification / Vibration	JIS C 5101-4/0.75mm, 10...55Hz, 10g, 3x2h
Outer materials	UL94-V0/UL224-VW1 certified (cap/sleeve)
Sleeve withstanding voltage	4000 Vac/ 1min between terminals bundled and plate*

* Typical value



> Shape designation · Formbezeichnung

- for details refer to p. 8–9 · technische Details siehe S. 8–9
- for mounting options refer to p. 149 ff · Montageoptionen siehe S. 149 ff



	B	I/Y	N
outer sleeve	•	•	•
insulation plate	•	•	•
stud bolt	•		
bottom double sleeve		•	

ØD	available shape	P	S	T _L	T _D	Cap material
51	B, N, I, Y	22.0	M5x10	5.5	10	PH
64	B, N, I, Y	28.6	M5x10	5.5	10	PH
77	B, N, I, Y	31.5	M5x10	5.0	10	PH
			M6x12	4.5	17.2	PH
90	B, N, I, Y	31.5	M5x10	5.0	10	PH
			M6x12	5.0	17.2	PH
101	B, N, Y	31.5	M8x16	11.0	14	PH
			M6x12	3.0	14	PH

Size in mm. First listed terminal is standard.

> Product Code · Bestellbezeichnung

Example: Series FX2 · 10.000 μF +/- 20 % · 400 V · D=77 mm · L= 195 mm with stud bolt & M6

FX2	2G	103	B	E	195	PHM6											
Type of series	Capacitance code		Fixing symbol code	Case code diameter		Specific features (e.g. M6 ...)											
	The first two digits are significant. The last digit indicates the number of following zeros in μF.		B : Bolt N : single outer sleeve I : 2 Stoppers Bracket Y : 3 Stoppers Bracket	<table><tr><th>ØD</th><th>Code</th></tr><tr><td>51</td><td>C</td></tr><tr><td>64</td><td>D</td></tr><tr><td>77</td><td>E</td></tr><tr><td>90</td><td>F</td></tr><tr><td>101</td><td>G</td></tr></table>			ØD	Code	51	C	64	D	77	E	90	F	101
ØD	Code																
51	C																
64	D																
77	E																
90	F																
101	G																
Rated voltage code				Case Code length													
Code	Voltage	Code	Voltage	Length in mm (3 digits)													
2V	350	2H	500														
2G	400	2L	550														
2W	450	600V	600														

Rated VoltageCode (Surge Voltage) V_r [V DC]	Capacitance C_r [μF]	Ripple Current at 85°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
350 VDC Code: 2V Surge Voltage 400 VDC	2 700	11.2	23.5	25	25	17	0.15	51x115	FX22V272#C115
	3 300	13.0	27.3	22	22	17	0.15	51x130	FX22V332#C130
	3 900	13.8	29.0	19	21	18	0.15	64x96	FX22V392#D096
	4 700	16.1	33.8	16	20	18	0.15	64x115	FX22V472#D115
	5 600	18.5	38.8	14	18	18	0.15	64x130	FX22V562#D130
	6 800	20.6	43.3	12	15	20	0.15	77x115	FX22V682#E115
	8 200	23.7	49.8	12	15	20	0.15	77x130	FX22V822#E130
		25.4	53.3	12	15	20	0.15	77x145	FX22V822#SE145
	10 000	27.0	56.7	11	15	20	0.15	77x143	FX22V103#E143
		28.1	59.0	11	15	20	0.15	77x155	FX22V103#E155
	12 000	32.1	67.4	8	13	20	0.15	77x171	FX22V123#E171
		30.7	64.5	8	13	20	0.15	90x131	FX22V123#F131
	15 000	37.7	79.2	6	10	20	0.15	77x195	FX22V153#E195
		39.6	83.2	6	10	20	0.15	77x220	FX22V153#E220
		36.7	77.1	6	10	20	0.15	90x157	FX22V153#F157
	18 000	43.8	92.0	5	9	20	0.15	90x196	FX22V183#F196
	22 000	52.3	109.8**	5	8	20	0.15	90x236	FX22V223#F236
	27 000	59.8	125.6**	5	8	29	0.15	101x237*	FX22V273#G237
400 VDC Code: 2G Surge Voltage 450 VDC	1 100	6.0	12.6	60	64	17	0.15	51x75	FX22G112#C075
	1 800	7.7	16.2	51	54	17	0.15	51x96	FX22G182#C096
		8.6	18.1	51	54	17	0.15	51x100	FX22G182#C100
	2 200	9.7	20.4	46	48	17	0.15	51x105	FX22G222#C105
		10.1	21.2	46	48	17	0.15	51x115	FX22G222#C115
	2 400	10.5	22.1	43	44	17	0.15	51x115	FX22G242#C115
	2 700	11.5	24.2	38	40	17	0.15	51x115	FX22G272#SC115
	3 300	12.6	26.5	30	32	18	0.15	64x96	FX22G332#D096
	3 900	13.1	27.5	30	32	18	0.15	64x104	FX22G392#D104
		14.7	30.9	26	28	18	0.15	64x115	FX22G392#D115
	4 400	15.2	31.9	23	25	18	0.15	64x106	FX22G442#D106
		17.0	35.7	21	22	18	0.15	64x130	FX22G472#D130
	4 700	16.0	33.6	21	22	20	0.15	77x96	FX22G472#E096
		18.6	39.1	18	19	20	0.15	77x115	FX22G562#E115
	6 800	21.5	45.2	15	15	20	0.15	77x130	FX22G682#E130
	8 200	24.6	51.7	12	15	20	0.15	77x145	FX22G822#E145
		25.3	53.1	12	15	20	0.15	77x155	FX22G822#E155
	10 000	29.1	61.1	10	15	20	0.15	77x171	FX22G103#E171
		30.7	64.5	10	15	20	0.15	77x195	FX22G103#E195
		27.8	58.4	10	15	20	0.15	90x131	FX22G103#F131
	12 000	35.3	74.1	8	13	20	0.15	77x220	FX22G123#E220
		32.8	68.9	8	13	20	0.15	90x157	FX22G123#F157
	15 000	40.0	84.0	7	10	20	0.15	90x196	FX22G153#F196
	18 000	46.1	96.8	6	9	20	0.15	90x221	FX22G183#F221
		47.4	99.5	6	9	20	0.15	90x236	FX22G183#F236
	19 000	48.6	102.2**	6	9	20	0.15	90x236	FX22G193#F236
	22 000	54.0	113.4	5	8	29	0.15	101x237*	FX22G223#G237
	25 000	58.9	123.6**	5	8	29	0.15	101x250*	FX22G253#G250
	27 000	64.4	135.2**	5	7	29	0.15	101x283*	FX22G273#G283
450 VDC Code: 2W Surge Voltage 500 VDC	1 100	5.8	12.2	80	70	17	0.15	51x75	FX22W112#C075
	1 500	7.7	16.2	67	70	17	0.15	51x105	FX22W152#C105
		7.9	16.6	67	60	17	0.15	51x96	FX22W152QC096
	1 800	8.7	18.3	56	56	17	0.15	51x115	FX22W182#C115
	2 000	10.6	22.2	50	52	17	0.15	51x115	FX22W202#C115
	2 200	10.1	21.2	46	45	17	0.15	51x130	FX22W222#C130

Additional designs on request · Weitere Designs auf Anfrage

Rated VoltageCode (Surge Voltage) V_r [V DC]	Capacitance C_r [μF]	Ripple Current at 85°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
450 VDC Code: 2W Surge Voltage 500 VDC	2 700	10.9	22.9	38	40	18	0.15	64x96	FX22W272#D096
		12.0	25.1	38	40	18	0.15	64x106	FX22W272#D106
	3 300	12.9	27.1	30	35	18	0.15	64x115	FX22W332#D115
		12.1	25.4	30	35	20	0.15	77x96	FX22W332#E096
	3 900	14.7	30.9	27	32	18	0.15	64x130	FX22W392#D130
	4 700	17.4	36.5	21	23	18	0.15	64x155	FX22W472#D155
		16.2	34.0	21	23	20	0.15	77x115	FX22W472#E115
	5 600	18.6	39.1	20	22	20	0.15	77x130	FX22W562#E130
	6 600	22.1	46.4	18	19	20	0.15	77x143	FX22W662#E143
	6 800	22.0	46.2	15	18	20	0.15	77x155	FX22W682#E155
	8 200	26.4	55.4	16	16	20	0.15	77x195	FX22W822#E195
		27.8	58.4	16	16	20	0.15	77x220	FX22W822#E220
		24.2	50.8	16	16	20	0.15	90x131	FX22W822#F131
	8 800	26.0	54.6	12	16	20	0.15	77x171	FX22W882#E171
		30.9	64.9	10	15	20	0.15	77x222	FX22W103#E222
	10 000	29.6	62.2	10	15	20	0.15	90x171	FX22W103#F171
		34.2	71.8	9	12	20	0.15	90x196	FX22W123#F196
	12 000	33.7	70.8	9	12	29	0.15	101x175*	FX22W123#G175
		38.2	80.2	7	12	20	0.15	90x196	FX22W153#F196
	15 000	41.3	86.7	7	10	20	0.15	90x236	FX22W153#F236
		45.3	95.2	6	10	20	0.15	90x236	FX22W183#F236
	20 000	53.0	111.3**	5	8	29	0.15	101x237*	FX22W203#G237
	23 000	53.8	113.0**	5	9	29	0.15	101x250*	FX22W233#G250
500 VDC Code: 2H Surge Voltage 550 VDC	820	4.9	10.3	140	151	17	0.20	51x75	FX22H821#C075
	1 000	6.3	13.2	112	120	17	0.20	51x105	FX22H102#C105
	1 200	7.1	14.9	93	100	17	0.20	51x115	FX22H122#C115
		7.2	15.1	93	100	18	0.20	64x96	FX22H122#D096
	1 500	7.9	16.6	74	80	17	0.20	51x115	FX22H152#C115
		8.2	17.2	74	80	18	0.20	64x96	FX22H152#D096
	1 800	9.5	20.0	53	53	18	0.20	64x115	FX22H182#D115
		9.4	19.8	53	53	20	0.20	77x96	FX22H182#E096
	2 200	10.9	22.9	40	40	18	0.20	51x155	FX22H222#C155
		11.0	23.1	40	40	18	0.20	64x130	FX22H222#D130
		10.4	21.7	40	40	20	0.20	77x96	FX22H222#E096
	2 500	12.3	25.8	38	40	18	0.20	64x144	FX22H252#D144
		11.0	23.1	38	40	20	0.20	77x96	FX22H252#E096
	2 700	12.3	25.8	37	37	20	0.20	77x115	FX22H272#E115
	3 300	14.3	30.0	36	36	20	0.20	77x130	FX22H332#E130
	3 900	16.1	33.8	27	29	20	0.20	77x145	FX22H392#E145
		16.6	34.9	27	29	20	0.20	77x155	FX22H392#E155
	4 700	18.2	38.2	25	25	20	0.20	77x155	FX22H472#E155
		19.0	39.9	25	25	20	0.20	77x171	FX22H472#E171
		18.2	38.2	25	25	20	0.20	90x131	FX22H472#F131
	5 600	21.8	45.8	23	21	20	0.20	77x195	FX22H562#E195
		21.4	44.9	23	21	20	0.20	90x157	FX22H562#F157
	6 800	24.4	51.2	20	20	20	0.20	90x171	FX22H682#F171
	8 200	28.2	59.2	17	16	20	0.20	90x196	FX22H822#F196
		27.8	58.4	17	16	29	0.20	101x175*	FX22H822#G175
	9 400	30.1	63.2	15	15	20	0.20	90x196	FX22H942#F196

Additional designs on request · Weitere Designs auf Anfrage

Rated VoltageCode (Surge Voltage) V_r [V DC]	Capacitance C_r [μF]	Ripple Current at 85°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
500 VDC Code: 2H Surge Voltage 550 VDC	10 000	33.7	70.8	14	14	20	0.20	90x236	FX22H103#F236
		32.1	67.4	14	14	29	0.20	101x195*	FX22H103#G195
	12 000	36.8	77.3	12	12	20	0.20	90x236	FX22H123#F236
		38.1	80.0	11	11	29	0.20	101x237*	FX22H123#G237
550 VDC Code: 2L Surge Voltage 600 VDC	680	5.1	10.7	165	177	17	0.20	51x105	FX22L681#C105
	1 000	6.8	14.3	112	120	17	0.20	51x130	FX22L102#C130
	1 200	7.8	16.4	93	100	18	0.20	64x115	FX22L122#D115
	1 500	9.2	19.3	74	80	18	0.20	64x130	FX22L152#D130
	1 800	10.0	21.0	61	50	20	0.20	77x115	FX22L182#E115
	2 200	11.6	24.4	53	40	20	0.20	77x130	FX22L222#E130
	2 700	12.9	27.0	40	35	20	0.20	77x130	FX22L272#E130
	3 300	15.3	32.1	38	32	20	0.20	77x155	FX22L332#E155
	3 900	17.8	37.4	30	27	20	0.20	90x157	FX22L392#F157
	4 200	17.9	37.6	28	27	20	0.20	77x171	FX22L422#E171
	4 700	20.4	42.8	25	20	20	0.20	77x203	FX22L472#E203
		20.2	42.4	25	20	20	0.20	90x171	FX22L472#F171
	5 000	22.4	47.0	24	20	20	0.20	77x235	FX22L502#E235
	5 600	22.1	46.4	20	17	20	0.20	90x171	FX22L562#F171
		23.3	48.9	20	17	20	0.20	90x196	FX22L562#F196
	6 000	24.5	51.4	19	17	20	0.20	77x235	FX22L602#E235
		25.6	53.8	17	17	20	0.20	90x196	FX22L682#F196
	6 800	27.7	58.2	17	17	20	0.20	90x236	FX22L682#F236
		30.4	63.8	15	15	20	0.20	90x236	FX22L822#F236
	9 200	32.2	67.6	13	13	20	0.20	90x236	FX22L922#F236
600 VDC Code: 600V Surge Voltage 650 VDC	1 000	4.8	10.1	129	133	22	0.20	64x96	FX2600V102#D096
	1 200	5.6	11.8	122	125	22	0.20	64x115	FX2600V122#D115
	1 500	6.3	13.2	111	114	24	0.20	77x96	FX2600V152#E096
	1 800	7.3	15.5	99	102	24	0.20	77x115	FX2600V182#E115
	2 200	8.5	17.9	85	87	24	0.20	77x130	FX2600V222#E130
	2 700	10.1	21.2	66	68	24	0.20	77x155	FX2600V272#E155
	3 300	11.3	23.7	44	45	24	0.20	90x131	FX2600V332#F131
	3 900	13.1	27.5	22	22	24	0.20	90x157	FX2600V392#F157

* For Bolt mounting, length dimensions increase by +3 mm for M6 items and by +2 mm for M8 items

** Please contact us if load condition exceeds terminals related $I_{r max}$ referred on page 9

Additional designs on request · Weitere Designs auf Anfrage

> Ripple Current Multiplier · Wechselstrommultiplikator

Frequency [Hz]	50/60	120	300	1k	≥ 10k	Forced cooling [m/sec]	v < 1.0	v ≥ 1.0
Multiplier	0.80	1.00	1.18	1.34	1.45	Multiplier	1.0	1.1

Temperature (°C)	40	45	50	55	60	65	70	75	80	85
Multiplier	2.1	2.0	1.9	1.8	1.7	1.5	1.4	1.3	1.1	1.0

> Life Time Table · Brauchbarkeitsdauer – Tabelle

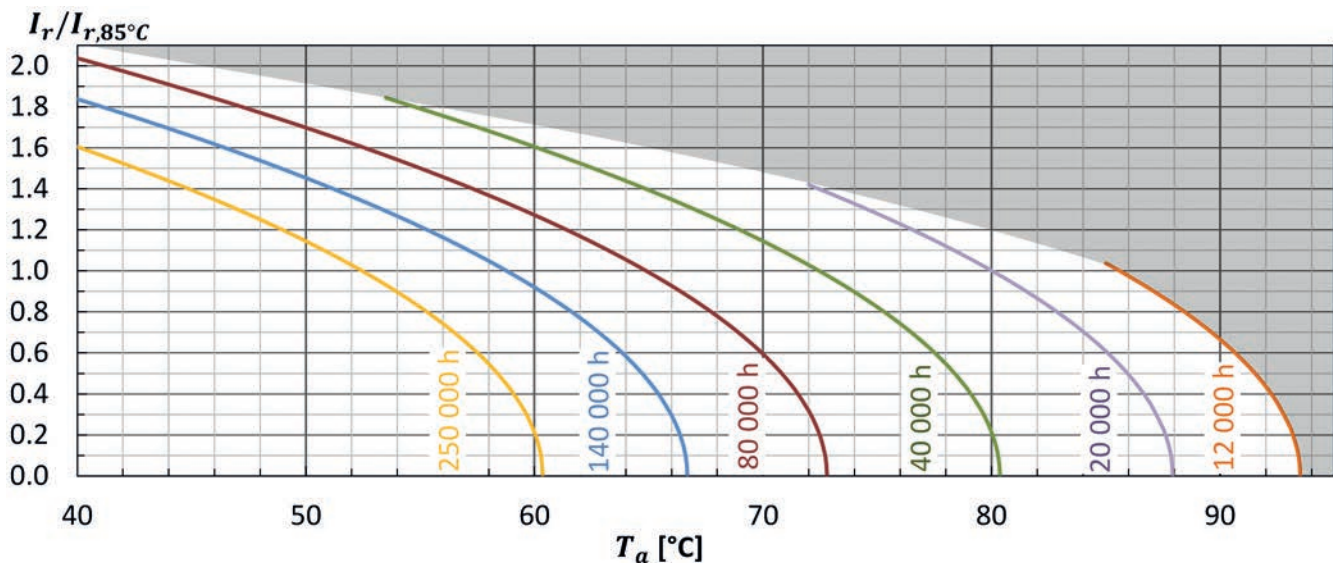
FX2	Useful life as function of ambient temperature and ripple current											
I_r at 85°C	x 1.0	x 1.1	x 1.2	x 1.3	x 1.4	x 1.5	x 1.6	x 1.7	x 1.8	x 1.9	x 2.0	x 2.1
$T_a = 40^\circ\text{C}$	250	250	250	250	250	250	250	199	154	118	89	66
$T_a = 45^\circ\text{C}$	250	250	250	250	247	200	160	126	97	74	56	
$T_a = 50^\circ\text{C}$	250	250	227	190	156	126	101	79	61	47		
$T_a = 55^\circ\text{C}$	198	170	144	120	98	80	64	50	39			
$T_a = 60^\circ\text{C}$	125	107	91	76	62	50	40	31				
$T_a = 65^\circ\text{C}$	79	68	57	48	39	32						
$T_a = 70^\circ\text{C}$	50	43	36	30	25							
$T_a = 75^\circ\text{C}$	31	27	23	19								
$T_a = 80^\circ\text{C}$	20	17										
$T_a = 85^\circ\text{C}$	12											

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 $I_{r, 85^\circ\text{C}, 120\text{Hz}}$

Brauchbarkeitsdauer in Abhängigkeit von Umgebungstemperatur T_a und Wechselstrombelastung I_r im Verhältnis zur max. Wechselstrombelastung bei oberer Kategorie-temperatur $I_{r, 85^\circ\text{C}, 120\text{Hz}}$



> Life Time Tests and Requirements · Anforderungen Brauchbarkeitsdauer

Life time test	Test procedure	Life time criteria
Endurance test	$T_a = 85^\circ\text{C}$; V_r , I_r applied 8000 hours	$\Delta C/C \leq 10\%$ (of initial value) $\tan\delta \leq 175\%$ (of specified value) $I_L \leq \text{specified value}$
Useful life	$T_a = 85^\circ\text{C}$; V_r , I_r applied 12000 hours	$\Delta C/C \leq 15\%$ (of initial value) $\tan\delta < 200\%$ (of specified value) $I_L \leq \text{specified value}$

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

FX3 · Screw-Terminal · 10 000 h/85 °C

Compact Design · Long Life

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

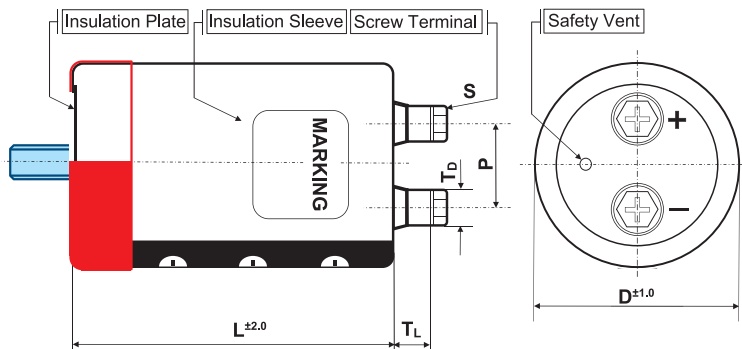
Items	Characteristics
Temperature range	-40°C ~ +85°C
Capacitance tolerance (at 20°C)	Standard +/- 20%, -10/+30% on request
Surge voltage	Repetitive max. 30 sec per 6 Minutes
Leakage current max. I_L (20°C, 5 min)	0.01 • C • V, [μA] or 3 mA, which is smaller.
Useful life	10 000 hours at 85°C
Field failure rate	0.5 FIT = 0.5 • 10 ⁻⁹ Failures/hour
RoHS conform	Directive 2011/65/EU & (EU)2015/863
Specification / Vibration	JIS C 5101-4/0.75mm, 10...55Hz, 10g, 3x2h
Outer materials	UL94-V0/UL224-VW1 certified (cap/sleeve)
Sleeve withstanding voltage	4000 Vac/1min between terminals bundled and plate*

* Typical value



> Shape designation · Formbezeichnung

- for details refer to p. 8–9 · technische Details siehe S. 8–9
- for mounting options refer to p. 149 ff · Montageoptionen siehe S. 149 ff



	B	I/Y	N
outer sleeve	•	•	•
insulation plate	•	•	•
stud bolt	•		
bottom double sleeve		•	

ØD	available shape	P	S	T _L	T _D	Cap material
51	B, N, I, Y	22.0	M5x10	5.5	10	PH
64	B, N, I, Y	28.6	M5x10	5.5	10	PH
77	B, N, I, Y	31.5	M5x10	5.0	10	PH
			M6x12	4.5	17.2	PH
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

> Product Code · Bestellbezeichnung

Example: Series FX3 · 8200 μF +/- 20 % · 400 V · D=77 mm · L=130 mm with Y-Bracket

FX3

Type of series

2G

Rated voltage code

Code	Voltage
2G	400
2W	450
2H	500

822

Capacitance code

The first two digits are significant.
The last digit indicates the number of following zeros in μF.

Y

Fixing symbol code

B : Bolt
N : single outer sleeve
I : 2 Stoppers Bracket
Y : 3 Stoppers Bracket

Capacitance tolerance

Ø : ± 20 %
Q : -10 % ~ +30 %

E

Case code diameter

ØD	Code
51	C
64	D
77	E
90	F

130

Specific features (e.g. M6 ...)

Case Code length

Length in mm (3 digits)

Rated VoltageCode (Surge Voltage) V_r [V DC]	Capacitance C_r [μF]	Ripple Current at 85°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	2 200	9.7	20.3	46	48	17	0.20	51x96	FX32G222#C096
	2 700	11.5	24.2	38	40	17	0.20	51x115	FX32G272#C115
	3 000	12.1	25.4	34	36	17	0.20	51x115	FX32G302#C115
	3 300	13.3	28.0	30	32	17	0.20	51x130	FX32G332#C130
	3 900	14.1	29.7	26	28	18	0.20	64x96	FX32G392#D096
	4 700	16.7	35.0	21	22	18	0.20	64x115	FX32G472#D115
	5 600	19.1	40.1	18	19	18	0.20	64x130	FX32G562#D130
	6 800	22.7	47.6	15	15	18	0.20	64x155	FX32G682#D155
		21.3	44.7	15	15	20	0.20	77x115	FX32G682#E115
	8 200	24.4	51.2	12	15	20	0.20	77x130	FX32G822#E130
	8 400	25.6	53.9	12	14	20	0.20	77x143	FX32G842#E143
	10 000	28.9	60.6	10	15	20	0.20	77x155	FX32G103#E155
	12 000	34.8	73.2	8	13	20	0.20	77x195	FX32G123#E195
	15 000	39.1	82.1	8	10	20	0.20	90x171	FX32G153#F171
	18 000	45.3	95.2	6	9	20	0.20	90x196	FX32G183#F196
	22 000	54.1	113.5*	6	8	20	0.20	90x236	FX32G223#F236
450 VDC Code: 2W Surge Voltage 500 VDC	1 800	8.3	17.4	71	73	17	0.20	51x96	FX32W182#C096
	2 200	9.9	20.8	58	60	17	0.20	51x115	FX32W222#C115
	2 700	11.6	24.4	47	49	17	0.20	51x130	FX32W272#C130
	3 300	12.4	26.1	39	41	18	0.20	64x96	FX32W332#D096
	3 900	14.5	30.4	33	35	18	0.20	64x115	FX32W392#D115
	4 700	16.8	35.3	27	29	18	0.20	64x130	FX32W472#D130
	5 600	19.7	41.3	23	25	18	0.20	64x155	FX32W562#D155
		18.4	38.6	23	25	20	0.20	77x115	FX32W562#E115
	6 800	21.3	44.7	19	21	20	0.20	77x130	FX32W682#E130
	8 200	25.1	52.6	16	18	20	0.20	77x155	FX32W822#E155
		26.1	54.8	16	18	20	0.20	77x170	FX32W822#E170
	10 000	29.6	62.1	13	15	20	0.20	90x157	FX32W103#F157
	12 000	33.5	70.3	11	13	20	0.20	90x171	FX32W123#F171
	15 000	39.6	83.1	9	11	20	0.20	90x196	FX32W153#F196
	18 000	46.8	98.3	8	10	20	0.20	90x236	FX32W183#F236
500 VDC Code: 2H Surge Voltage 550 VDC	1 200	7.2	15.2	92	100	17	0.20	51x96	FX32H122#C096
	1 500	8.7	18.4	74	80	17	0.20	51x115	FX32H152#C115
	1 800	10.0	21.0	53	50	17	0.20	51x130	FX32H182#C130
	2 200	10.8	22.7	40	35	18	0.20	64x96	FX32H222#D096
	2 700	13.5	28.3	37	33	18	0.20	64x130	FX32H272#D130
	3 300	16.0	33.6	36	32	18	0.20	64x155	FX32H332#D155
		15.1	31.6	36	32	20	0.20	77x115	FX32H332#E115
	3 900	17.1	36.0	27	29	20	0.20	77x130	FX32H392#E130
	4 700	19.6	41.2	25	27	20	0.20	77x144	FX32H472#E144
	5 600	22.9	48.1	23	21	20	0.20	77x171	FX32H562#E171
		22.0	46.1	23	21	20	0.20	90x131	FX32H562#F131
	6 800	26.7	56.0	20	18	20	0.20	77x195	FX32H682#E195
		25.9	54.3	20	18	20	0.20	90x157	FX32H682#F157
	8 200	29.4	61.8	17	16	20	0.20	90x171	FX32H822#F171
	10 000	34.4	72.2	15	14	20	0.20	90x196	FX32H103#F196
	12 000	40.6	85.2	13	12	20	0.20	90x236	FX32H123#F236

*Please contact us if load condition exceeds terminals related $I_{r\max}$ referred on page 9

Additional designs on request · Weitere Designs auf Anfrage

> Ripple Current Multiplier · Wechselstrommultiplikator

Frequency [Hz]	50/60	120	300	1k	≥ 10k	Forced cooling [m/sec]	v < 1.0	v ≥ 1.0
Multiplier	0.80	1.00	1.18	1.34	1.45	Multiplier	1.0	1.1

Temperature (°C)	40	45	50	55	60	65	70	75	80	85
Multiplier	2.1	2.0	1.9	1.8	1.7	1.5	1.4	1.3	1.1	1.0

> Life Time Table · Brauchbarkeitsdauer – Tabelle

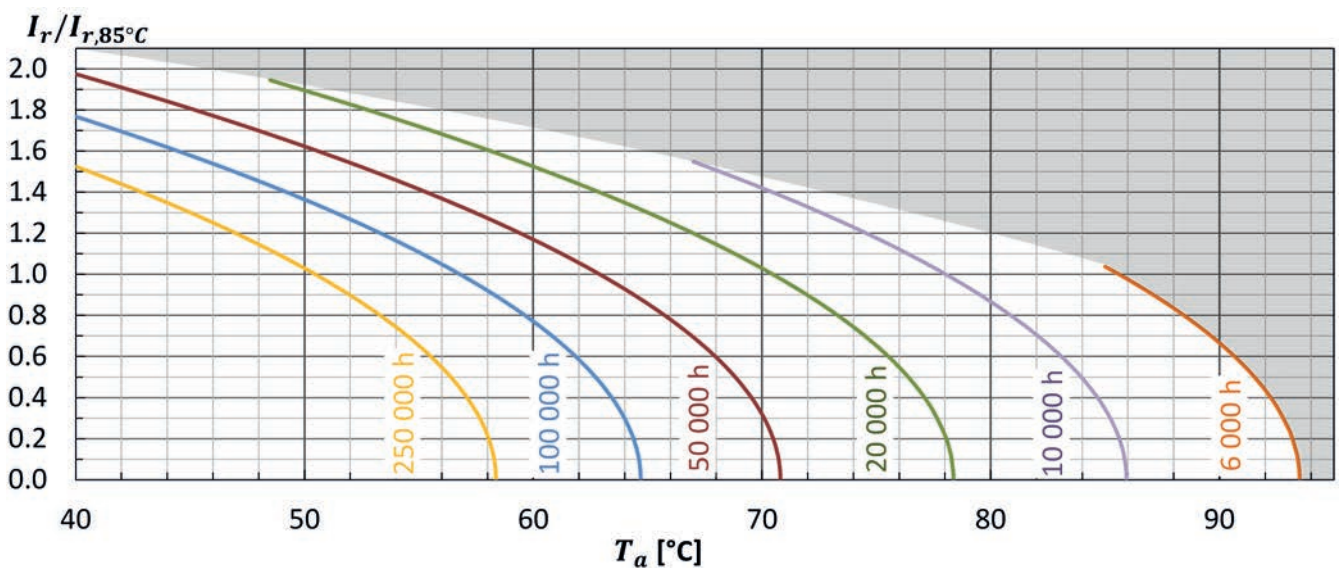
FX3	Useful life as function of ambient temperature and ripple current											
I_r at 85°C	x 1.0	x 1.1	x 1.2	x 1.3	x 1.4	x 1.5	x 1.6	x 1.7	x 1.8	x 1.9	x 2.0	x 2.1
$T_a = 40°C$	250	250	250	250	250	250	210	166	128	98	74	55
$T_a = 45°C$	250	250	250	250	205	166	133	105	81	62	47	
$T_a = 50°C$	250	224	189	158	130	105	84	66	51	39		
$T_a = 55°C$	165	141	120	100	82	66	53	42	32			
$T_a = 60°C$	104	89	75	63	52	42	33	26				
$T_a = 65°C$	66	56	48	40	32	26						
$T_a = 70°C$	41	35	30	25	20							
$T_a = 75°C$	26	22	19	16								
$T_a = 80°C$	16	14										
$T_a = 85°C$	10											

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 $I_{r, 85°C, 120Hz}$

Brauchbarkeitsdauer in Abhängigkeit von Umgebungstemperatur T_a und Wechselstrombelastung I_r im Verhältnis zur max. Wechselstrombelastung bei oberer Kategorie-temperatur $I_{r, 85°C, 120Hz}$



> Life Time Tests and Requirements · Anforderungen Brauchbarkeitsdauer

Life time test	Test procedure	Life time criteria
Endurance test	$T_a = 85^{\circ}\text{C}$; V_r , I_r applied 8000 hours	$\Delta C/C \leq 10\%$ (of initial value) $\tan\delta \leq 175\%$ (of specified value) $I_L \leq$ specified value
Useful life	$T_a = 85^{\circ}\text{C}$; V_r , I_r applied 10000 hours	$\Delta C/C \leq 15\%$ (of initial value) $\tan\delta < 200\%$ (of specified value) $I_L \leq$ specified value

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

HCGW · Screw-Terminal · 6000 h/85 °C

High capacitance · Ultra compact

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

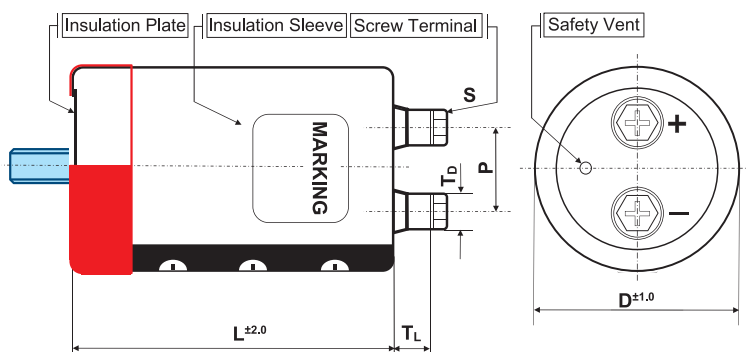
Items	Characteristics
Temperature range	-10°C ~ +85°C
Capacitance tolerance (at 20°C)	Standard +/- 20%, -10/+30% on request
Surge voltage	Repetitive max. 30 sec per 6 Minutes
Leakage current max. I_L (20°C, 5 min)	$0.01 \cdot C \cdot V_r$ [μA] or 7 mA, which is smaller.
Useful life	6 000 hours at 85°C
Field failure rate	0.5 FIT = $0.5 \cdot 10^{-9}$ Failures/hour
RoHS conform	Directive 2011/65/EU & (EU)2015/863
Specification / Vibration	JIS C 5101-4/0.75mm, 10...55Hz, 10g, 3x2h
Outer materials	UL94-V0/UL224-VW1 certified (cap/sleeve)
Sleeve withstanding voltage	4000 Vac / 1min between terminals bundled and plate*

* Typical value



> Shape designation · Formbezeichnung

- for details refer to p. 8–9 · technische Details siehe S. 8–9
- for mounting options refer to p. 149 ff · Montageoptionen siehe S. 149 ff



	B	I/Y/X	N
outer sleeve	•	•	•
insulation plate	•	•	•
stud bolt	•		
bottom double sleeve		•	

ØD	available shape	P	S	T _L	T _D	Cap material
51	B, N, I, Y	22.0	M5x10	5.5	10	PH
64	B, N, I, Y	28.6	M5x10	5.5	10	PH
77	B, N, I, Y	31.5	M5x10	5.0	10	PH
			M6x12	4.5	17.2	PH
90	B, N, I, Y	31.5	M5x10	5.0	10	PH
			M6x12	5.0	17.2	PH
101	B, N, Y	31.5	M6x12	3.0	14	PH
121	N, X	41.5	M6x12	3.0	14	PPS

Size in mm. First listed terminal is standard.

> Product Code · Bestellbezeichnung

Example: Series HCGW · 32000 μF +/- 20 % · 400 V · D=101 mm · L=237 mm with Y-Bracket

HCGW	2G	323	Y	G	237	PH
Type of series	Capacitance code The first two digits are significant. The last digit indicates the number of following zeros in μF.		Fixing symbol code B : Bolt N : single outer sleeve I : 2 Stoppers Bracket Y : 3 Stoppers Bracket X : 4 Stoppers Bracket	Case code diameter	Specific features (e.g. M6 ...)	
Rated voltage code		Capacitance tolerance Ø : ± 20 % Q : -10 % ~ + 30 %		Case Code length Length in mm (3 digits)		
Code	Voltage	Code	Voltage	ØD	Code	
2V	350	2W	450	51	C	
2G	400	2H	500	64	D	
				77	E	
				90	F	
				101	G	
				121	K	

Rated VoltageCode (Surge Voltage) V_r [V DC]	Capacitance C_r [μF]	Ripple Current at 85°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
350 VDC Code: 2V Surge Voltage 400 VDC	13 000	12.8	32.0	25	26	22	0.70	77x155	HCGW2V133#E155
	17 000	15.6	39.0	19	20	22	0.70	90x157	HCGW2V173#F157
	18 000	16.6	41.5	18	20	22	0.70	77x195	HCGW2V183#E195
	22 000	19.8	49.5	17	18	22	0.70	77x235	HCGW2V223#E235
	24 000	19.9	49.8	16	18	32	0.70	101x175*	HCGW2V243#G175PH
	25 000	20.7	51.8	15	16	22	0.70	90x196	HCGW2V253#F196
	31 000	24.9	62.3	12	13	22	0.70	90x236	HCGW2V313#F236
		23.9	59.8	12	13	32	0.70	101x195*	HCGW2V313#G195PH
	34 000	26.0	65.0	12	13	22	0.70	90x236	HCGW2V343#F236W2
	36 000	26.8	67.0	11	12	22	0.70	90x236	HCGW2V363#F236W2
		29.0	72.5	11	13	22	0.70	90x283	HCGW2V363#F283
	38 000	29.7	74.3	11	12	22	0.70	90x283	HCGW2V383#F283W2
	39 000	29.0	72.5	10	12	32	0.70	101x237*	HCGW2V393#G237PH
	44 000	33.2	83.0	10	12	32	0.70	101x283*	HCGW2V443#G283PH
	57 000	40.7	101.8**	7	8	3	0.70	121x283	HCGW2V573XK283
400 VDC Code: 2G Surge Voltage 450 VDC	11 000	11.8	29.5	31	32	22	0.70	77x155	HCGW2G113#E155
	14 000	14.6	36.5	24	25	22	0.70	77x195	HCGW2G143#E195
	15 000	15.8	39.5	23	24	22	0.70	77x220	HCGW2G153#E220
	16 000	16.9	42.3	21	22	22	0.70	77x235	HCGW2G163#E235
		15.2	38.0	21	22	22	0.70	90x157	HCGW2G163#F157
	20 000	18.5	46.3	20	21	22	0.70	90x196	HCGW2G203#F196
	22 000	19.3	48.3	18	19	32	0.70	101x175*	HCGW2G223#G175PH
	25 000	21.4	53.5	16	18	32	0.70	101x195*	HCGW2G253#G195PH
	27 000	23.8	59.5	15	17	22	0.70	90x221	HCGW2G273#F221
	28 000	23.7	59.3	15	15	22	0.70	90x236	HCGW2G283#F236W2
	29 000	25.3	63.3	14	16	22	0.70	90x236	HCGW2G293#F236
	30 000	24.9	62.3	14	16	32	0.70	101x222*	HCGW2G303#G222PH
		27.3	68.3	12	13	22	0.70	90x283	HCGW2G323#F283
	32 000	26.3	65.8	12	13	32	0.70	101x237*	HCGW2G323#G237PH
		27.8	69.5	11	13	32	0.70	101x250*	HCGW2G343#G250PH
	34 000	27.8	69.5	11	13	32	0.70	101x250*	HCGW2G343#G250PH
	38 000	30.8	77.0	10	11	32	0.70	101x283*	HCGW2G383#G283PH
	50 000	38.1	95.3	9	11	32	0.70	121x283	HCGW2G503XK283
450 VDC Code: 2W Surge Voltage 500 VDC	3 300	5.2	13.0	114	118	19	0.70	51x130	HCGW2W332#C130
	5 600	7.5	18.8	67	70	20	0.70	64x130	HCGW2W562#D130
	9 500	10.9	27.3	36	37	22	0.70	77x155	HCGW2W952#E155
	10 000	11.8	27.5	34	35	22	0.70	90x145	HCGW2W103#F145
	12 000	13.5	33.8	28	29	22	0.70	77x195	HCGW2W123#E195
	13 000	13.7	34.3	26	27	22	0.70	90x157	HCGW2W133#F157
	15 000	16.4	41.0	24	27	22	0.70	77x235	HCGW2W153#E235
	17 000	17.1	42.8	21	22	22	0.70	90x196	HCGW2W173#F196
	18 000	17.0	42.5	20	21	32	0.70	101x175*	HCGW2W183#G175PH
		17.9	44.8	20	21	22	0.70	90x196	HCGW2W183#F196
	22 000	20.1	50.3	18	19	32	0.70	101x195*	HCGW2W223#G195PH
		21.0	52.5	18	19	22	0.70	90x236	HCGW2W223#F236
	24 000	22.6	56.5	17	18	22	0.70	90x236	HCGW2W243#F236
	25 000	22.3	55.8	16	17	22	0.70	90x236	HCGW2W253#F236W2

Additional designs on request · Weitere Designs auf Anfrage

Rated VoltageCode (Surge Voltage) V_r [V DC]	Capacitance C_r [μF]	Ripple Current at 85°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
450 VDC Code: 2W Surge Voltage 500 VDC	27 000	25.1	62.8	15	17	22	0.70	90x283	HCGW2W273#F283
		24.1	60.3	15	17	32	0.70	101x237*	HCGW2W273#G237PH
	29 000	25.6	64.0	14	16	32	0.70	101x237*	HCGW2W293#G237PH
	33 000	28.7	71.8	13	15	32	0.70	101x283*	HCGW2W333#G283PH
	42 000	34.9	87.3	10	12	32	0.70	121x283	HCGW2W423XK283
500 VDC Code: 2H Surge Voltage 550 VDC	5 600	8.4	21.0	60	62	22	0.70	77x155	HCGW2H562#E155
		11.2	28.0	41	43	22	0.70	77x195	HCGW2H822#E195
	8 200	10.8	27.0	41	43	22	0.70	90x157	HCGW2H822#F157
		13.0	32.5	36	37	22	0.70	77x235	HCGW2H952#E235
	11 000	13.7	34.3	32	33	22	0.70	90x196	HCGW2H113#F196
	12 000	13.5	33.8	30	33	32	0.70	101x175*	HCGW2H123#G175PH
	14 000	16.7	41.8	29	30	22	0.70	90x236	HCGW2H143#F236
		16.0	40.0	29	30	32	0.70	101x195*	HCGW2H143#G195PH
	16 000	19.3	48.3	25	27	22	0.70	90x283	HCGW2H163#F283
		18.6	46.5	25	26	32	0.70	101x237*	HCGW2H163#G237PH
	18 000	18.9	47.3	23	23	22	0.70	90x236	HCGW2H183#F236W2
	20 000	21.5	53.8	20	20	22	0.70	90x283	HCGW2H203#F283W2

* For Bolt mounting, lenght dimensions increase by +3 mm

** Please contact us if load condition exceeds terminals related I_{rmax} referred on page 9

Additional designs on request · Weitere Designs auf Anfrage

> Ripple Current Multiplier · Wechselstrommultiplikator

Frequency [Hz]	50/60	120	300	1k	≥ 10k	Forced cooling [m/sec]	v < 1.0	v ≥ 1.0
Multiplier	0.70	1.00	1.18	1.34	1.45	Multiplier	1.0	1.1

Temperature (°C)	40	45	50	55	60	65	70	75	80	85
Multiplier	2.5	2.4	2.3	2.2	2.0	1.8	1.6	1.4	1.2	1.0

> Life Time Table · Brauchbarkeitsdauer – Tabelle

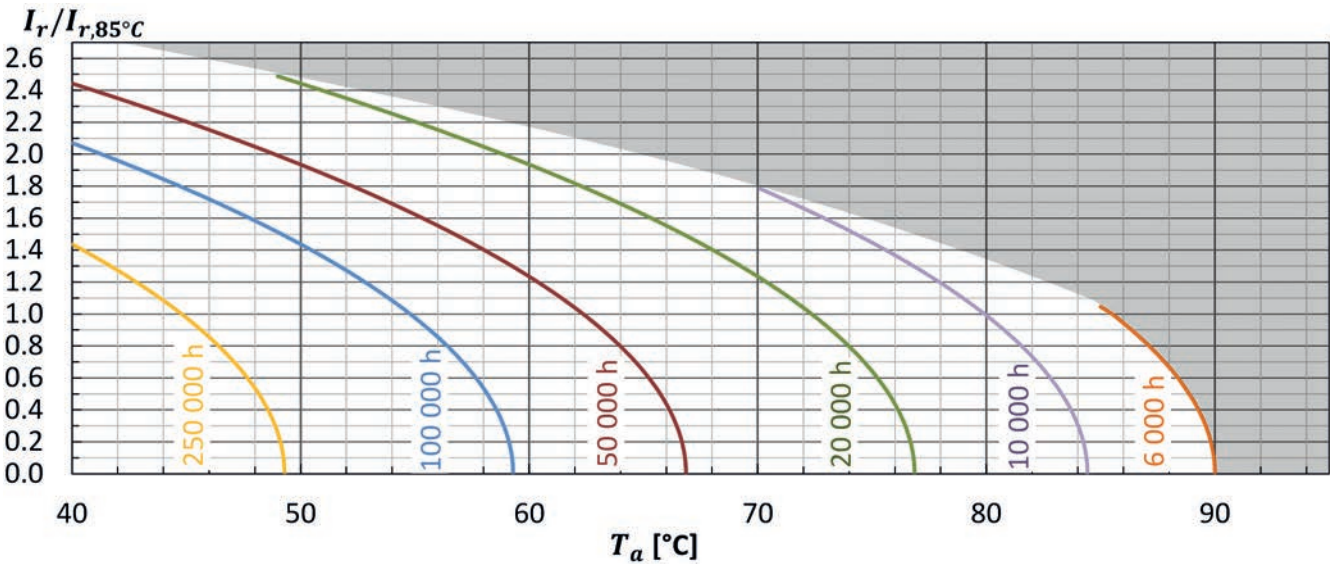
HCGW	Useful life as function of ambient temperature and ripple current											
I_r at 85°C	x 1.0	x 1.2	x 1.4	x 1.6	x 1.8	x 1.9	x 2.0	x 2.1	x 2.2	x 2.3	x 2.4	x 2.5
$T_a = 40°C$	250	250	250	203	154	132	112	95	79	66	54	44
$T_a = 45°C$	245	204	165	128	97	83	71	60	50	41	34	
$T_a = 50°C$	155	129	104	81	61	52	45	38	31	26		
$T_a = 55°C$	98	81	66	51	38	33	28	24	20			
$T_a = 60°C$	62	51	41	32	24	21	18					
$T_a = 65°C$	39	32	26	20	15							
$T_a = 70°C$	24	20	16	13								
$T_a = 75°C$	15	13	10									
$T_a = 80°C$	9	8										
$T_a = 85°C$	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 $I_{r, 85^\circ\text{C}, 120\text{Hz}}$

Brauchbarkeitsdauer in Abhängigkeit von Umgebungstemperatur T_a und Wechselstrombelastung I_r im Verhältnis zur max. Wechselstrombelastung bei oberer Kategorietemperatur $I_{r, 85^\circ\text{C}, 120\text{Hz}}$



> Life Time Tests and Requirements · Anforderungen Brauchbarkeitsdauer

Life time test	Test procedure	Life time criteria
Endurance test	$T_a = 85^\circ\text{C}$; V_r , I_r applied 4000 hours	$\Delta C/C \leq 10\%$ (of initial value) $\tan\delta \leq 175\%$ (of specified value) $I_L \leq$ specified value
Useful life	$T_a = 85^\circ\text{C}$; V_r , I_r applied 6000 hours	$\Delta C/C \leq 15\%$ (of initial value) $\tan\delta < 200\%$ (of specified value) $I_L \leq$ specified value

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

HCGW2 · Screw-Terminal · 6000 h/85 °C

Higher capacitance · Ultra compact

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

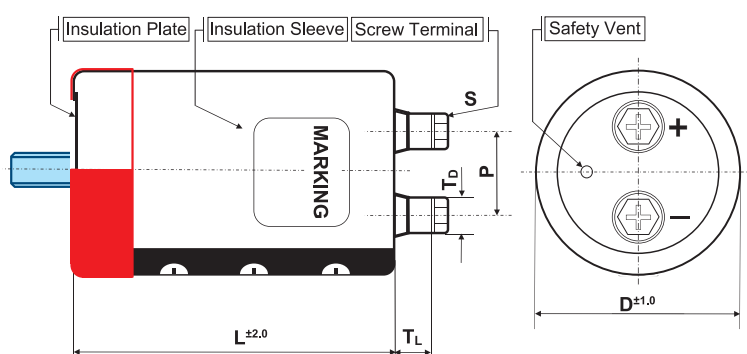
Items	Characteristics
Temperature range	-10°C ~ +85°C
Capacitance tolerance (at 20°C)	Standard +/- 20%, -10/+30% on request
Surge voltage	Repetitive max. 30 sec per 6 Minutes
Leakage current max. I_L (20°C, 5 min)	$0.01 \cdot C \cdot V_r$ [μA] or 7 mA, which is smaller.
Useful life	6 000 hours at 85°C
Field failure rate	0.5 FIT = $0.5 \cdot 10^{-9}$ Failures/hour
RoHS conform	Directive 2011/65/EU & (EU)2015/863
Specification / Vibration	JIS C 5101-4/0.75mm, 10...55Hz, 10g, 3x2h
Outer materials	UL94-V0/UL224-VW1 certified (cap/sleeve)
Sleeve withstanding voltage	4000 Vac / 1min between terminals bundled and plate*

* Typical value



> Shape designation · Formbezeichnung

- for details refer to p. 8–9 · technische Details siehe S. 8–9
- for mounting options refer to p. 149 ff · Montageoptionen siehe S. 149 ff



	B	I/Y	N
outer sleeve	•	•	•
insulation plate	•	•	•
stud bolt	•		
bottom double sleeve		•	

ØD	available shape	P	S	T _L	T _D	Cap material
77	B, N, I, Y	31.5	M6x12	9.0	12	PH
			M5x10	8.0	11	PH
90	B, N, I, Y	31.5	M6x12	8.0	12	PH

Size in mm. First listed terminal is standard.

> Product Code · Bestellbezeichnung

Example: Series HCGW2 · 29000 μF · +/- 20 % · 400 V · D=90 mm · L=230 mm with Y-Bracket

HCGW2

Type of series

2G

Capacitance code

The first two digits are significant.
The last digit indicates the number of following zeros in μF.

293

Rated voltage code

Code	Voltage	Code	Voltage
2V	350	2W	450
2G	400	2H	500

Y

Fixing symbol code

B : Bolt
N : single outer sleeve
I : 2 Stoppers Bracket
Y : 3 Stoppers Bracket

F

Case code diameter

ØD	Code
77	E
90	F

Capacitance tolerance

Ø : ± 20 %
Q : -10 % ~ +30 %

230

Specific features (e.g. M5 ...)

Case Code length

Length in mm (3 digits)

HCGW2 · Screw-Terminal · 6000 h/85 °C

Rated VoltageCode (Surge Voltage) V_r [V DC]	Capacitance C_r [μF]	Ripple Current at 85°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	13 000	13.0	32.5	26	27	20	0.70	77x148	HCGW22G133#E148
	14 000	13.4	33.5	24	25	20	0.70	77x148	HCGW22G143#E148
	16 000	15.5	38.8	21	22	20	0.70	77x188	HCGW22G163#E188
	18 000	16.4	41.0	19	20	20	0.70	90x150	HCGW22G183#F150
	19 000	17.5	43.8	18	20	20	0.70	90x167	HCGW22G193#F167
	20 000	18.8	47.0	17	18	20	0.70	77x228	HCGW22G203#E228
	23 000	19.8	49.5	15	16	20	0.70	90x190	HCGW22G233#F190
	29 000	23.9	59.8	12	13	20	0.70	90x230	HCGW22G293#F230
450 VDC Code: 2W Surge Voltage 500 VDC	7 000	8.4	21.0	56	52	20	0.70	77x108	HCGW22W702#E108
	10 000	10.9	27.3	40	42	20	0.70	77x148	HCGW22W103#E148
	12 000	12.5	31.3	33	35	20	0.70	77x165	HCGW22W123#E165
	14 000	13.8	34.5	29	30	20	0.70	77x188	HCGW22W143#E188
	15 000	14.3	35.8	27	29	20	0.70	90x150	HCGW22W153#F150
	17 000	15.8	39.5	24	26	20	0.70	90x167	HCGW22W173#F167
	18 000	17.0	42.5	22	23	20	0.70	77x228	HCGW22W183#E228
	20 000	17.6	44.0	20	21	20	0.70	90x190	HCGW22W203#F190
	22 000	19.8	49.5	18	19	20	0.70	90x230	HCGW22W223#F230
500 VDC Code: 2H Surge Voltage 550 VDC	7 500	9.5	23.8	47	48	20	0.70	77x148	HCGW22H752#E148
	9 000	10.9	27.3	40	41	20	0.70	77x165	HCGW22H902#E165
	10 000	11.7	29.3	36	38	20	0.70	77x188	HCGW22H103#E188
	11 000	12.2	30.5	33	34	20	0.70	90x150	HCGW22H113#F150
	13 000	14.5	36.3	28	29	20	0.70	77x228	HCGW22H133#E228
		14.0	35.0	28	29	20	0.70	90x167	HCGW22H133#F167
	15 000	15.3	38.3	24	25	20	0.70	90x190	HCGW22H153#F190
	18 000	18.1	45.3	20	21	20	0.70	90x230	HCGW22H183#F230
	19 000	18.5	46.3	19	20	20	0.70	90x230	HCGW22H193#F230

Additional designs on request · Weitere Designs auf Anfrage

> Ripple Current Multiplier · Wechselstrommultiplikator

Frequency [Hz]	50/60	120	300	1k	≥ 10k	Forced cooling [m/sec]	v < 1.0	v ≥ 1.0
Multiplier	0.70	1.00	1.18	1.34	1.45	Multiplier	1.0	1.1

Temperature (°C)	40	45	50	55	60	65	70	75	80	85
Multiplier	2.5	2.4	2.3	2.2	2.0	1.8	1.6	1.4	1.2	1.0

> Life Time Table · Brauchbarkeitsdauer – Tabelle

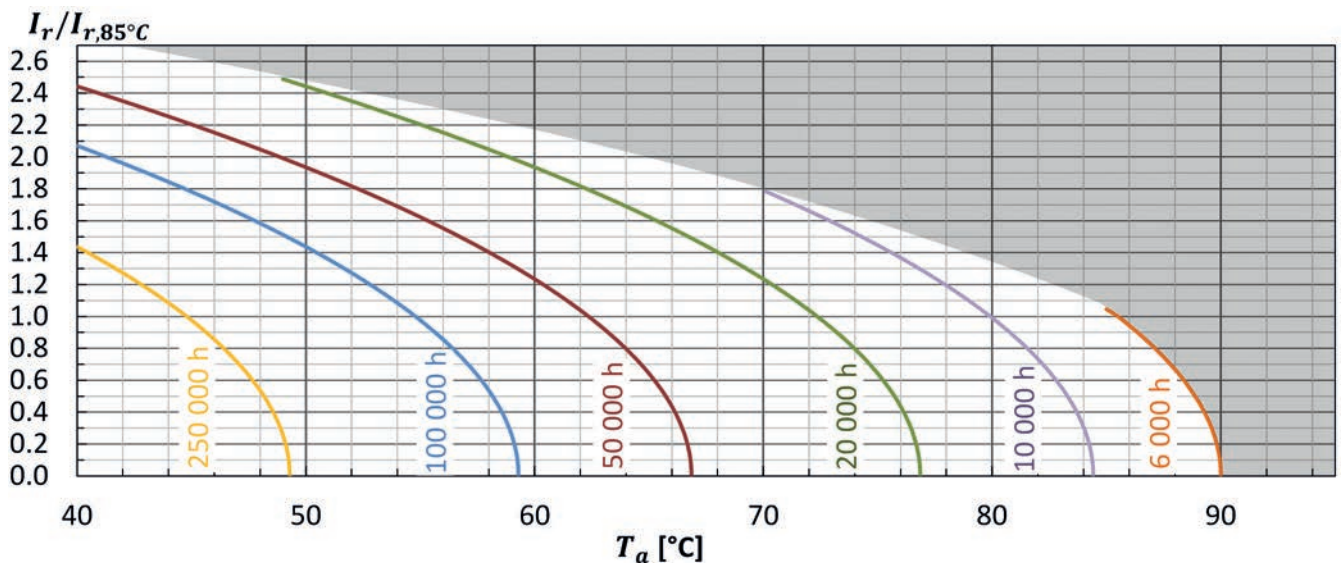
HCGW2	Useful life as function of ambient temperature and ripple current											
I_r at 85°C	x 1.0	x 1.2	x 1.4	x 1.6	x 1.8	x 1.9	x 2.0	x 2.1	x 2.2	x 2.3	x 2.4	x 2.5
$T_a = 40^\circ\text{C}$	250	250	250	203	154	132	112	95	79	66	54	44
$T_a = 45^\circ\text{C}$	245	204	165	128	97	83	71	60	50	41	34	
$T_a = 50^\circ\text{C}$	155	129	104	81	61	52	45	38	31	26		
$T_a = 55^\circ\text{C}$	98	81	66	51	38	33	28	24	20			
$T_a = 60^\circ\text{C}$	62	51	41	32	24	21	18					
$T_a = 65^\circ\text{C}$	39	32	26	20	15							
$T_a = 70^\circ\text{C}$	24	20	16	13								
$T_a = 75^\circ\text{C}$	15	13	10									
$T_a = 80^\circ\text{C}$	9	8										
$T_a = 85^\circ\text{C}$	6											

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 $I_{r, 85^\circ\text{C}, 120\text{Hz}}$

Brauchbarkeitsdauer in Abhängigkeit von Umgebungstemperatur T_a und Wechselstrombelastung I_r im Verhältnis zur max. Wechselstrombelastung bei oberer Kategorie-temperatur $I_{r, 85^\circ\text{C}, 120\text{Hz}}$



> Life Time Tests and Requirements · Anforderungen Brauchbarkeitsdauer

Life time test	Test procedure	Life time criteria
Endurance test	$T_a = 85^\circ\text{C}$; V_r , I_r applied 4000 hours	$\Delta C/C \leq 10\%$ (of initial value) $\tan\delta \leq 175\%$ (of specified value) $I_L \leq$ specified value
Useful life	$T_a = 85^\circ\text{C}$; V_r , I_r applied 6000 hours	$\Delta C/C \leq 15\%$ (of initial value) $\tan\delta < 200\%$ (of specified value) $I_L \leq$ specified value

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

HCGW3 · Screw-Terminal · 5000 h/70 °C

Highest capacitance · Ultra Compact

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

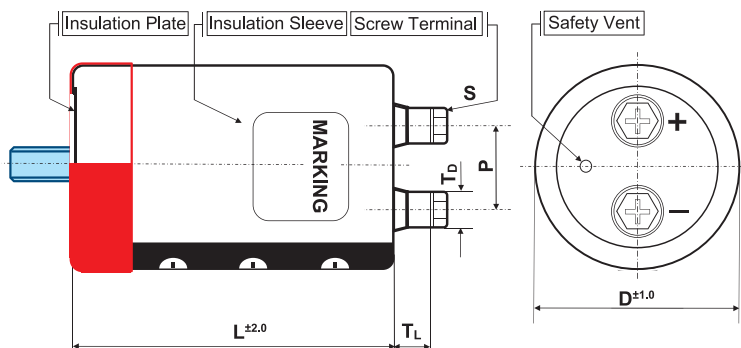
Items	Characteristics
Temperature range	-10°C ~ + 70°C
Capacitance tolerance (at 20°C)	Standard +/- 20%, -10/+30% on request
Surge voltage	Repetitive max. 30 sec per 6 Minutes
Leakage current max. I_L (20°C, 5 min)	$0.01 \cdot C \cdot V_r$ [μA] or 7 mA, which is smaller.
Useful life	5 000 hours at 70°C
Field failure rate	0.5 FIT = $0.5 \cdot 10^{-9}$ Failures/hour
RoHS conform	Directive 2011/65/EU & (EU)2015/863
Specification / Vibration	JIS C 5101-4/0.75mm, 10...55Hz, 10g, 3x2h
Outer materials	UL94-V0/UL224-VW1 certified (cap/sleeve)
Sleeve withstanding voltage	4000 Vac/ 1min between terminals bundled and plate*

* Typical value



> Shape designation · Formbezeichnung

- for details refer to p. 8–9 · technische Details siehe S. 8–9
- for mounting options refer to p. 149 ff · Montageoptionen siehe S. 149 ff



	B	I/Y	N
outer sleeve	•	•	•
insulation plate	•	•	•
stud bolt	•		
bottom double sleeve		•	

ØD	available shape	P	S	T _L	T _D	Cap material
77	B, N, I, Y	31.5	M6x12	9.0	12	PH
90	B, N, I, Y	31.5	M6x12	8.0	12	PH

Size in mm

> Product Code · Bestellbezeichnung

Example: Series HCGW3 · 36000 μF · 400 V · D=90 mm · L=230mm with Y-Bracket

HCGW3

Type of series

2G

Capacitance code

The first two digits are significant.
The last digit indicates the number of following zeros in μF.

363

Y

Fixing symbol code

B : Bolt
N : single outer sleeve
I : 2 Stoppers Bracket
Y : 3 Stoppers Bracket

F

Case code diameter

ØD	Code
77	E
90	F

230

Specific features

Rated voltage code			
Code	Voltage	Code	Voltage
2V	350	2W	450
2G	400	2H	500

Capacitance tolerance

Ø : ± 20 %
Q : -10 % ~ +30 %

Case Code length

Length in mm
(3 digits)

Rated VoltageCode (Surge Voltage) V_r [V DC]	Capacitance C_r [μF]	Ripple Current at 70°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
350 VDC Code: 2V Surge Voltage 400 VDC	19 000	15.8	36.3	18	19	20	0.70	77x148	HCGW32V193#E148
	21 000	17.3	39.8	16	17	20	0.70	77x165	HCGW32V213#E165
	25 000	19.4	44.6	14	15	20	0.70	77x188	HCGW32V253#E188
	28 000	20.4	46.9	12	13	20	0.70	90x150	HCGW32V283#F150
	30 000	22.0	50.6	12	13	20	0.70	90x167	HCGW32V303#F167
	31 000	23.4	53.8	11	12	20	0.70	77x228	HCGW32V313#E228
	35 000	24.3	55.9	10	11	20	0.70	90x190	HCGW32V353#F190
	44 000	29.5	67.9	8	9	20	0.70	90x230	HCGW32V443#F230
400 VDC Code: 2G Surge Voltage 450 VDC	16 000	14.5	33.4	21	22	20	0.70	77x148	HCGW32G163#E148
	17 000	15.6	35.9	20	21	20	0.70	77x165	HCGW32G173#E165
	20 000	17.4	40.0	17	18	20	0.70	77x188	HCGW32G203#E188
	22 000	18.2	41.9	16	17	20	0.70	90x150	HCGW32G223#F150
	24 000	19.7	45.3	14	15	20	0.70	90x167	HCGW32G243#F167
	25 000	21.0	48.3	14	15	20	0.70	77x228	HCGW32G253#E228
	29 000	22.1	50.8	12	13	20	0.70	90x190	HCGW32G293#F190
	36 000	26.8	61.6	10	11	20	0.70	90x230	HCGW32G363#F230
450 VDC Code: 2W Surge Voltage 500 VDC	8 600	9.3	21.4	47	43	20	0.70	77x108	HCGW32W862#E108
	13 000	12.5	28.8	31	32	20	0.70	77x148	HCGW32W133#E148
		13.0	29.9	31	32	20	0.70	90x126	HCGW32W133#F126
	14 000	13.4	30.8	29	29	20	0.70	90x126	HCGW32W143#F126
	15 000	14.0	32.2	27	28	20	0.70	77x165	HCGW32W153#E165
	16 000	14.8	34.0	25	26	20	0.70	90x150	HCGW32W163#F150
	17 000	15.3	35.2	23	25	20	0.70	77x188	HCGW32W173#E188
	18 000	15.7	36.1	22	23	20	0.70	90x150	HCGW32W183#F150
	21 000	17.6	40.5	19	20	20	0.70	90x167	HCGW32W213#F167
	22 000	18.8	43.2	18	19	20	0.70	77x228	HCGW32W223#E228
	25 000	19.6	45.1	16	17	20	0.70	90x190	HCGW32W253#F190
	32 000	24.1	55.4	12	13	20	0.70	90x230	HCGW32W323#F230
500 VDC Code: 2H Surge Voltage 550 VDC	10 000	11.0	25.3	36	37	20	0.70	77x148	HCGW32H103#E148
	12 000	12.5	28.8	30	31	20	0.70	77x165	HCGW32H123#E165
	14 000	13.9	32.0	26	27	20	0.70	77x188	HCGW32H143#E188
	15 000	14.3	32.9	24	25	20	0.70	90x150	HCGW32H153#F150
	17 000	16.5	38.0	21	22	20	0.70	77x228	HCGW32H173#E228
		15.9	36.6	21	22	20	0.70	90x167	HCGW32H173#F167
	20 000	17.6	40.5	18	19	20	0.70	90x190	HCGW32H203#F190
	25 000	21.4	49.2	15	15	20	0.70	90x230	HCGW32H253#F230

Additional designs on request · Weitere Designs auf Anfrage

> Ripple Current Multiplier · Wechselstrommultiplikator

Frequency [Hz]	50/60	120	300	1k	≥ 10k	Forced cooling [m/sec]	v < 1.0	v ≥ 1.0
Multiplier	0.70	1.00	1.05	1.10	1.35	Multiplier	1.0	1.1

Ta (°C)	40	45	50	55	60	65	70
Multiplier	2.3	2.2	2.1	1.9	1.7	1.4	1.0

> Life Time Table · Brauchbarkeitsdauer – Tabelle

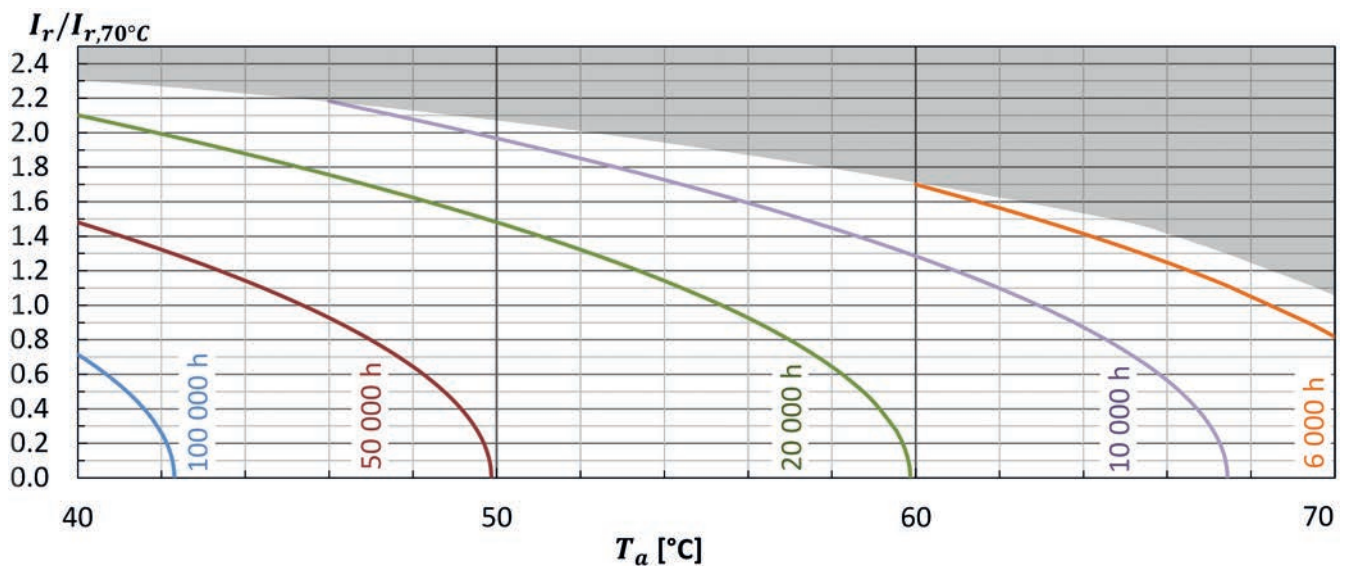
HCGW3	Useful life as function of ambient temperature and ripple current										
I_r at 70°C	0.0	0.5	1.0	1.2	1.4	1.7	1.9	2.0	2.1	2.2	2.3
$T_a = 40^\circ\text{C}$	123	111	81	68	55	37	27	23	20	16	13
$T_a = 45^\circ\text{C}$	78	70	51	43	34	23	17	15	12	10	
$T_a = 50^\circ\text{C}$	49	44	32	27	22	15	11	9	8		
$T_a = 55^\circ\text{C}$	31	28	20	17	13	9	7				
$T_a = 60^\circ\text{C}$	19	17	13	10	8	6					
$T_a = 65^\circ\text{C}$	12	11	8	6	5						
$T_a = 70^\circ\text{C}$	7	7	5								

khrs

> 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 , 70°C, 120Hz

Brauchbarkeitsdauer in Abhängigkeit von Umgebungstemperatur T_a und Wechselstrombelastung I_r im Verhältnis zur max. Wechselstrombelastung bei oberer Kategorietemperatur I_r , 70°C, 120Hz



> Life Time Tests and Requirements · Anforderungen Brauchbarkeitsdauer

Life time test	Reference	Test procedure	Life time criteria
Endurance test	JIS-C-5101-4 JIS-C-5102 IEC 60384-4	$T_a = 70^\circ\text{C}$; V_r , I_r applied 4000 hours	$\Delta C/C \leq 10\%$ (of initial value) $\tan\delta \leq 175\%$ (of specified value) $I_L \leq$ specified value
Useful life	JIS-C-5104-4 IEC 60384-4	$T_a = 70^\circ\text{C}$; V_r , I_r applied 5000 hours	$\Delta C/C \leq 15\%$ (of initial value) $\tan\delta < 200\%$ (of specified value) $I_L \leq$ specified value

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

HCGF5 · Screw-Terminal · 6000 h/85 °C

Rated VoltageCode (Surge Voltage) V_r [V DC]	Capacitance C_r [μF]	Ripple Current at 85°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 VD	3 300	6.0	16.2	40	35	15	0.20	36x121	HCGF52C332#A121PH
	3 900	6.1	16.5	37	28	17	0.20	51x75	HCGF52C392#C075PH
	4 700	6.7	18.1	30	25	17	0.20	51x75	HCGF52C472#C075PH
	5 600	8.0	21.6	26	23	17	0.20	51x96	HCGF52C562#C096PH
	6 800	9.0	24.3	22	22	17	0.20	51x96	HCGF52C682#C096PH
	8 200	10.5	28.4	18	19	17	0.20	51x115	HCGF52C822#C115PH
	10 000	12.2	32.9	15	16	17	0.20	51x130	HCGF52C103#C130PH
		12.0	32.4	14	17	18	0.20	64x96	HCGF52C103#D096PH
	12 000	13.0	35.1	12	15	18	0.20	64x96	HCGF52C123#D096PH
	15 000	16.4	44.3	11	12	18	0.20	64x130	HCGF52C153#D130PH
	18 000	17.9	48.3	9	11	18	0.20	64x130	HCGF52C183#D130PH
	22 000	21.0	56.7	8	8	20	0.20	77x130	HCGF52C223#E130PH
	27 000	23.2	62.6	7	8	20	0.20	77x130	HCGF52C273#E130PH
	33 000	27.4	74.0	6	7	20	0.20	90x131	HCGF52C333#F131PH
	39 000	32.1	86.7	5	7	20	0.20	90x157	HCGF52C393#F157PH
	47 000	37.1	100.2**	5	7	20	0.20	77x195	HCGF52C473#E195PH
	50 000	39.2	105.8**	5	7	20	0.20	77x220	HCGF52C503#E220PH
	52 000	40.0	108.0**	5	6	20	0.20	77x220	HCGF52C523#E220PH
		40.3	108.8**	5	6	20	0.20	90x196	HCGF52C523#F196PH
	68 000	42.6	115.0**	4	6	20	0.20	90x203	HCGF52C683#F203PH
	100 000	55.7	150.4**	4	6	29	0.20	101x250*	HCGF52C104#G250PH
200 VDC Code: 2D Surge Voltage 250 VD	2 200	4.5	12.2	68	60	15	0.20	36x100	HCGF52D222#A100PH
	2 700	5.4	14.6	48	39	15	0.20	36x121	HCGF52D272#A121PH
	3 300	5.6	15.1	43	35	17	0.20	51x75	HCGF52D332#C075PH
	3 900	6.1	16.5	37	30	17	0.20	51x75	HCGF52D392#C075PH
	4 700	7.4	20.0	30	27	17	0.20	51x96	HCGF52D472#C096PH
	5 600	8.6	23.2	26	25	17	0.20	51x115	HCGF52D562#C115PH
	6 800	10.1	27.3	21	20	17	0.20	51x130	HCGF52D682#C130PH
	8 200	10.8	29.2	17	18	18	0.20	64x96	HCGF52D822#D096PH
	10 000	12.0	32.4	14	14	18	0.20	64x96	HCGF52D103#D096PH
	12 000	13.9	37.5	12	14	20	0.20	77x96	HCGF52D123#E096PH
	15 000	16.6	44.8	10	13	20	0.20	77x96	HCGF52D153#E096PH
	18 000	19.0	51.3	8	12	20	0.20	77x130	HCGF52D183#E130PH
	20 000	21.0	56.7	8	8	20	0.20	77x145	HCGF52D203#E145PH
	22 000	22.5	60.8	7	7	20	0.20	77x155	HCGF52D223#E155PH
	27 000	28.9	78.0	6	7	20	0.20	77x220	HCGF52D273#E220PH
		24.8	67.0	6	7	20	0.20	90x131	HCGF52D273#F131PH
	33 000	29.3	79.1	5	7	20	0.20	90x157	HCGF52D333#F157PH
	39 000	34.7	93.7	5	7	20	0.20	77x220	HCGF52D393#E220PH
	40 000	32.3	87.2	5	7	20	0.20	90x157	HCGF52D403#F157PH
	52 000	40.3	108.8**	5	7	20	0.20	90x196	HCGF52D523#F196PH
250 VDC Code: 2E Surge Voltage 300 VD	1 500	3.7	10.0	56	50	15	0.20	36x100	HCGF52E152#A100PH
	1 800	4.0	10.8	52	44	15	0.20	36x100	HCGF52E182#A100PH
	2 200	4.6	12.4	50	40	17	0.20	51x75	HCGF52E222#C075PH
	2 700	5.1	13.8	41	36	17	0.20	51x75	HCGF52E272#C075PH

Additional designs on request · Weitere Designs auf Anfrage

Rated VoltageCode (Surge Voltage) V_r [V DC]	Capacitance C_r [μF]	Ripple Current at 85°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
250 VDC Code: 2E Surge Voltage 300 VD	3 300	6.2	16.7	36	35	17	0.20	51x96	HCGF52E332#C096PH
	3 900	7.2	19.4	31	30	17	0.20	51x115	HCGF52E392#C115PH
	4 700	8.2	22.1	25	23	18	0.20	64x96	HCGF52E472#D096PH
	5 600	9.0	24.3	21	21	18	0.20	64x96	HCGF52E562#D096PH
	6 800	10.5	28.4	18	18	18	0.20	64x115	HCGF52E682#D115PH
	8 200	11.5	31.0	15	16	18	0.20	64x115	HCGF52E822#D115PH
	10 000	13.5	36.4	12	14	18	0.20	64x130	HCGF52E103#D130PH
		14.7	39.7	12	13	20	0.20	77x148	HCGF52E103#E148PH
	12 000	14.8	40.0	10	11	20	0.20	77x115	HCGF52E123#E115PH
	15 000	17.4	47.0	8	11	20	0.20	77x130	HCGF52E153#E130PH
	18 000	20.4	55.1	7	10	20	0.20	77x155	HCGF52E183#E155PH
	22 000	24.0	64.8	6	8	20	0.20	90x157	HCGF52E223#F157PH
	26 000	26.8	72.4	6	7	20	0.20	77x220	HCGF52E263#E220PH

* For Bolt mounting, length dimensions increase by +3 mm

** Please contact us if load condition exceeds terminals related I_{rmax} referred on page 9

Additional designs on request · Weitere Designs auf Anfrage

> Ripple Current Multiplier · Wechselstrommultiplikator

Frequency [Hz]	50/60	120	300	1k	≥ 10k	Forced cooling [m/sec]	v < 1.0	v ≥ 1.0
Multiplier	0.80	1.00	1.18	1.34	1.45	Multiplier	1.0	1.1

Temperature (°C)	40	45	50	55	60	65	70	75	80	85
Multiplier	2.7	2.6	2.4	2.2	2.0	1.8	1.6	1.4	1.2	1.0

> Life Time Table · Brauchbarkeitsdauer – Tabelle

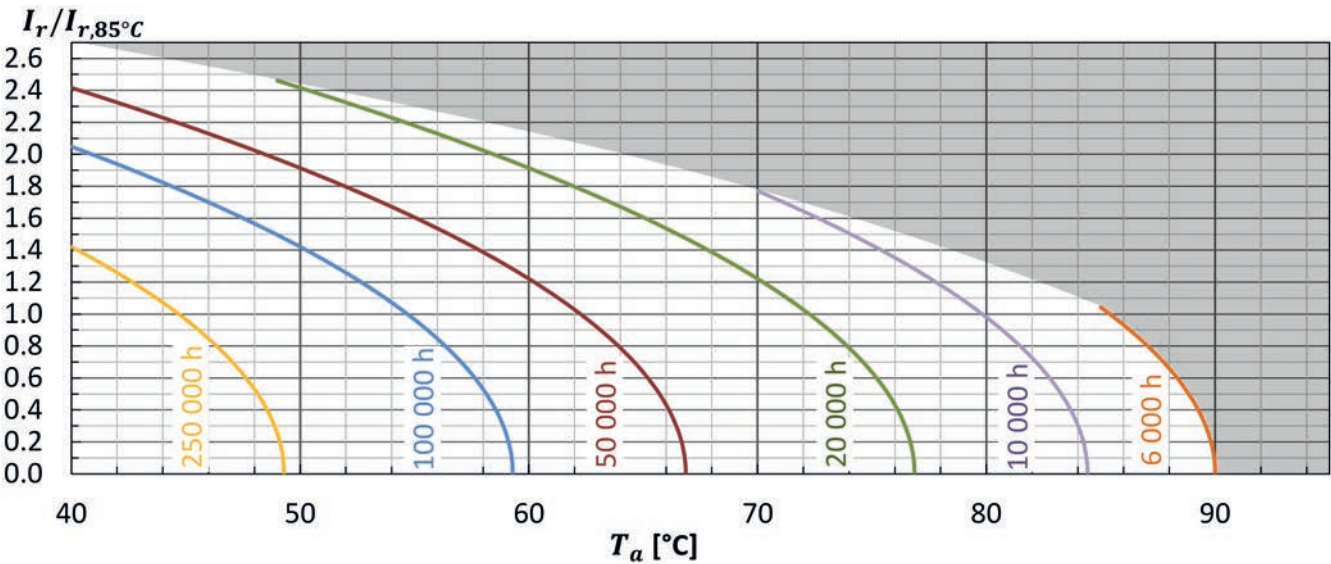
HCGF5	Useful life as function of ambient temperature and ripple current												
I_r at 85°C	x 1.0	x 1.2	x 1.4	x 1.6	x 1.8	x 2.0	x 2.1	x 2.2	x 2.3	x 2.4	x 2.5	x 2.6	x 2.7
$T_a = 40°C$	250	250	250	199	149	108	91	76	63	51	42	33	27
$T_a = 45°C$	243	201	162	125	94	68	57	48	39	32	26	21	
$T_a = 50°C$	153	127	102	79	59	43	36	30	25	20			
$T_a = 55°C$	97	80	64	50	37	27	23	19					
$T_a = 60°C$	61	51	41	31	23	17							
$T_a = 65°C$	38	32	25	20	15								
$T_a = 70°C$	24	20	16	12									
$T_a = 75°C$	15	12	10										
$T_a = 80°C$	9	8											
$T_a = 85°C$	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 $I_{r, 85^\circ\text{C}, 120\text{Hz}}$

Brauchbarkeitsdauer in Abhängigkeit von Umgebungstemperatur T_a und Wechselstrombelastung I_r im Verhältnis zur max. Wechselstrombelastung bei oberer Kategorietemperatur $I_{r, 85^\circ\text{C}, 120\text{Hz}}$



> Life Time Tests and Requirements · Anforderungen Brauchbarkeitsdauer

Life time test	Test procedure	Life time criteria
Endurance test	$T_a = 85^\circ\text{C}$; V_r , I_r applied 4000 hours	$\Delta C/C \leq 10\%$ (of initial value) $\tan\delta \leq 175\%$ (of specified value) $I_L \leq \text{specified value}$
Useful life	$T_a = 85^\circ\text{C}$; V_r , I_r applied 6000 hours	$\Delta C/C \leq 15\%$ (of initial value) $\tan\delta < 200\%$ (of specified value) $I_L \leq \text{specified value}$

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

HCGF6 · Screw-Terminal · 6000 h/85 °C

Standard Performances

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

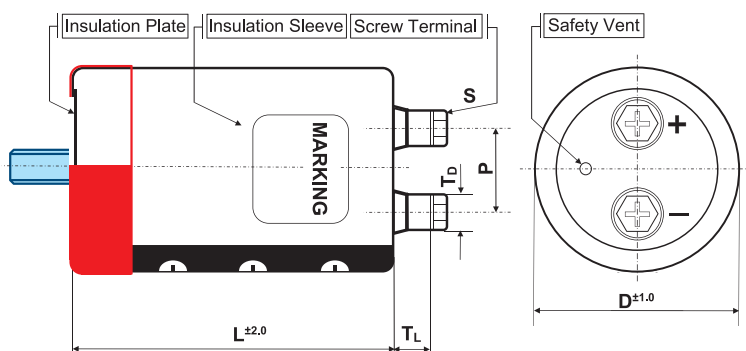
Items	Characteristics
Temperature range	-25°C ~ + 85°C
Capacitance tolerance (at 20°C)	Standard +/- 20%, -10/+30% on request
Surge voltage	Repetitive max. 30 sec per 6 Minutes
Leakage current max. I _L (20°C, 5 min)	0.01 • C • V _r [μA] or 3 mA, which is smaller.
Useful life	6 000 hours at 85°C
Field failure rate	0.5 FIT = 0.5 • 10 ⁻⁹ Failures/hour
RoHS conform	Directive 2011/65/EU & (EU)2015/863
Specification / Vibration	JIS C 5101-4/0.75mm, 10...55Hz, 10g, 3x2h
Outer materials	UL94-V0/UL224-VW1 certified (cap/sleeve)
Sleeve withstanding voltage	4000 Vac / 1min between terminals bundled and plate*

* Typical value



> Shape designation · Formbezeichnung

- for details refer to p. 8–9 · technische Details siehe S. 8–9
- for mounting options refer to p. 149 ff · Montageoptionen siehe S. 149 ff



	B	I/Y	N
outer sleeve	•	•	•
insulation plate	•	•	•
stud bolt	•		
bottom double sleeve		•	

ØD	available shape	P	S	T _L	T _D	Cap material
51	B, N, I, Y	22.0	M5x10	5.5	10	PH
64	B, N, I, Y	28.6	M5x10	5.5	10	PH
77	B, N, I, Y	31.5	M5x10	5.0	10	PH
			M6x12	4.5	17.2	PH
90	B, N, I, Y	31.5	M5x10	5.0	10	PH
			M6x12	5.0	17.2	PH
101	B, N, Y	31.5	M6x12	3.0	14	PH

Size in mm. First listed terminal is standard.

> Product Code · Bestellbezeichnung

Example: Series HCGF6 · 500 V · 12000 μ F +/- 20 % · D=90 mm · L=236 mm with Y-Bracket

The diagram illustrates the structure of a 4-digit capacitor code. It is divided into five main sections, each with a label above it and a description below it. The sections are: HCGF6 (Type of series), 2H (Capacitance code), 123 (Capacitance code), Y (Fixing symbol code), F (Case code diameter), 236 (Case code length), and PH (Specific features). The 123 code is further detailed with a table showing the relationship between the code and the voltage rating. The Y code is detailed with a table showing the relationship between the code and the capacitance tolerance. The F code is detailed with a table showing the relationship between the code and the case code diameter. The PH code is detailed with a table showing the relationship between the code and the specific features.

Code	Voltage	Code	Voltage
2V	350	2W	450
2G	400	2H	500

Code	Capacitance tolerance
Ø	± 20 %
Q	-10 % ~ +30 %

Case code diameter	Code
51	C
64	D
77	E
90	F
101	G

Specific features (e.g. M6 ...)
Length in mm (3 digits)

HCGF6 · Screw-Terminal · 6000 h/85 °C

Rated VoltageCode (Surge Voltage) V_r [V DC]	Capacitance C_r [μF]	Ripple Current at 85°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
350 VDC Code: 2V Surge Voltage 400 VDC	2 700	7.7	20.8	48	50	17	0.20	51x115	HCGF62V272#C115PH
	3 300	9.0	24.3	39	40	17	0.20	51x130	HCGF62V332#C130PH
	3 900	9.5	25.6	33	35	18	0.20	64x96	HCGF62V392#D096PH
	4 700	11.3	30.5	27	30	18	0.20	64x115	HCGF62V472#D115PH
	5 600	12.8	34.6	25	28	18	0.20	64x130	HCGF62V562#D130PH
	6 800	14.3	38.6	21	24	20	0.20	77x115	HCGF62V682#E115PH
	8 200	16.3	44.1	17	21	20	0.20	77x130	HCGF62V822#E130PH
	10 000	19.4	52.4	14	17	20	0.20	77x155	HCGF62V103#E155PH
	12 000	22.1	59.6	12	15	20	0.20	77x171	HCGF62V123#E171PH
		21.3	57.5	12	15	20	0.20	90x131	HCGF62V123#F131PH
	15 000	25.5	68.8	10	13	20	0.20	90x157	HCGF62V153#F157PH
	18 000	30.4	82.0	9	15	20	0.20	90x196	HCGF62V183#F196PH
	20 000	32.0	86.4	8	11	20	0.20	90x196	HCGF62V203#F196PH
	22 000	36.3	98.0	8	10	20	0.20	90x221	HCGF62V223#F221PH
		32.9	88.8	8	11	29	0.20	101x175*	HCGF62V223#G175PH
	27 000	40.9	110.4**	7	8	29	0.20	101x237*	HCGF62V273#G237PH
400 VDC Code: 2G Surge Voltage 450 VDC	2 200	6.6	17.8	58	60	17	0.20	51x100	HCGF62G222#C100PH
	2 700	7.9	21.4	48	50	18	0.20	64x96	HCGF62G272#D096PH
		7.9	24.4	48	50	17	0.20	51x115	HCGF62G272#C115PH
	3 300	8.7	23.6	39	40	18	0.20	64x96	HCGF62G332#D096PH
	3 900	10.2	27.5	33	35	18	0.20	64x115	HCGF62G392#D115PH
	4 700	11.7	31.7	27	30	18	0.20	64x130	HCGF62G472#D130PH
	5 600	13.0	35.1	25	28	20	0.20	77x115	HCGF62G562#E115PH
	6 800	15.0	40.4	21	24	20	0.20	77x130	HCGF62G682#E130PH
	8 200	17.3	16.6	18	20	20	0.20	77x145	HCGF62G822#E145PH
	10 000	20.4	55.1	17	20	20	0.20	77x171	HCGF62G103#E171PH
		19.4	52.5	14	17	20	0.20	90x131	HCGF62G103#F131PH
	12 000	22.9	61.8	12	15	20	0.20	90x157	HCGF62G123#F157PH
	15 000	27.9	75.3	10	13	20	0.20	90x196	HCGF62G153#F196PH
	18 000	32.2	86.9	9	12	20	0.20	90x221	HCGF62G183#F221PH
		29.7	80.1	9	12	29	0.20	101x175*	HCGF62G183#G175PH
	20 000	34.9	94.2	9	12	20	0.20	90x236	HCGF62G203#F236PH
	22 000	36.9	99.6	8	11	29	0.20	101x237*	HCGF62G223#G237PH
	24 000	41.2	111.2**	8	10	20	0.20	90x283	HCGF62G243#F283PH
	25 000	41.3	111.5**	8	10	20	0.20	101x250*	HCGF62G253#G250PH
	27 000	44.1	119.0**	7	10	29	0.20	101x283*	HCGF62G273#G283PH
450 VDC Code: 2W Surge Voltage 500 VDC	1 800	6.3	17.0	77	80	17	0.20	51x115	HCGF62W182#C115PH
	2 200	7.4	19.9	63	65	17	0.20	51x130	HCGF62W222#C130PH
		7.2	19.5	63	65	18	0.20	64x96	HCGF62W222#D096PH
	2 700	7.9	21.3	52	54	18	0.20	64x96	HCGF62W272#D096PH
	3 300	9.4	25.4	42	44	18	0.20	64x115	HCGF62W332#D115PH
		9.3	25.2	42	44	20	0.20	77x96	HCGF62W332#E096PH
	3 900	10.7	28.9	38	40	18	0.20	64x130	HCGF62W392#D130PH
	4 700	11.2	30.2	34	36	20	0.20	77x96	HCGF62W472#E096PH
		11.8	32.0	34	36	20	0.20	77x115	HCGF62W472#E115PH

Additional designs on request · Weitere Designs auf Anfrage

Rated VoltageCode (Surge Voltage) V_r [V DC]	Capacitance C_r [μF]	Ripple Current at 85°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
450 VDC Code: 2W Surge Voltage 500 VDC	5 600	13.1	35.4	32	34	20	0.20	90x96	HCGF62W562#F096PH
		13.6	36.6	31	33	20	0.20	77x130	HCGF62W562#E130PH
	6 800	16.1	43.5	25	27	20	0.20	77x155	HCGF62W682#E155PH
		19.4	52.5	21	23	20	0.20	77x195	HCGF62W822#E195PH
	8 200	17.6	47.5	21	23	20	0.20	90x131	HCGF62W822#F131PH
		23.2	62.6	17	19	20	0.20	77x220	HCGF62W103#E220PH
	10 000	21.5	58.0	17	19	20	0.20	90x171	HCGF62W103#F171PH
		25.0	67.4	16	18	20	0.20	90x196	HCGF62W123#F196PH
	12 000	24.3	65.5	16	18	29	0.20	101x175*	HCGF62W123#G175PH
		27.9	75.3	17	20	20	0.20	90x196	HCGF62W143#F196PH
	14 000	28.5	77.0	15	17	20	0.20	90x196	HCGF62W153#F196PH
		30.1	81.4	15	17	20	0.20	90x236	HCGF62W153#F236PH
	15 000	30.3	81.8	16	18	20	0.20	90x221	HCGF62W163#F221PH
		33.4	90.2	14	16	29	0.20	90x236	HCGF62W183#F236PH
	18 000	34.4	92.9	13	15	29	0.20	101x222*	HCGF62W203#G222PH
		38.8	104.8**	12	14	29	0.20	101x250*	HCGF62W223#G250PH
500 VDC Code: 2H Surge Voltage 550 VDC	1 200	5.2	14.0	112	120	17	0.20	51x115	HCGF62H122#C115PH
		5.3	14.3	112	120	18	0.20	64x96	HCGF62H122#D096PH
	1 500	6.0	16.2	90	96	17	0.20	51x119	HCGF62H152#C119PH
		5.9	15.8	90	96	18	0.20	64x96	HCGF62H152#D096PH
	1 800	6.9	18.6	75	80	18	0.20	64x115	HCGF62H182#D115PH
	2 200	7.1	19.2	61	65	18	0.20	64x96	HCGF62H222#D096PH
	2 700	9.1	24.6	50	53	20	0.20	77x115	HCGF62H272#E115PH
	3 300	10.5	28.4	45	48	20	0.20	77x130	HCGF62H332#E130PH
	3 900	12.2	32.9	38	41	20	0.20	77x155	HCGF62H392#E155PH
	4 700	13.9	37.6	34	37	20	0.20	77x171	HCGF62H472#E171PH
		13.3	36.0	34	37	20	0.20	90x131	HCGF62H472#F131PH
	5 600	16.0	43.1	28	31	20	0.20	77x195	HCGF62H562#E195PH
		15.5	41.9	28	31	20	0.20	90x157	HCGF62H562#F157PH
	6 800	17.7	47.8	23	25	20	0.20	90x171	HCGF62H682#F171PH
		20.6	55.6	21	23	20	0.20	90x196	HCGF62H822#F196PH
	8 200	20.0	54.0	21	23	29	0.20	101x175*	HCGF62H822#G175PH
		24.0	64.8	17	19	20	0.20	90x221	HCGF62H103#F221PH
	10 000	23.0	62.1	17	19	29	0.20	101x195*	HCGF62H103#G195PH
		27.0	72.9	16	18	20	0.20	90x236	HCGF62H123#F236PH
	15 000	30.5	82.4	14	16	29	0.20	101x237*	HCGF62H153#G237PH

* For Bolt mounting, lenght dimensions increase by +3 mm

** Please contact us if load condition exceeds terminals related I_{rmax} referred on page 9

Additional designs on request · Weitere Designs auf Anfrage

> Ripple Current Multiplier · Wechselstrommultiplikator

Frequency [Hz]	50/60	120	300	1k	≥ 10k	Forced cooling [m/sec]	v < 1.0	v ≥ 1.0
Multiplier	0.80	1.00	1.18	1.34	1.45	Multiplier	1.0	1.1

Temperature (°C)	40	45	50	55	60	65	70	75	80	85
Multiplier	2.7	2.6	2.4	2.2	2.0	1.8	1.6	1.4	1.2	1.0

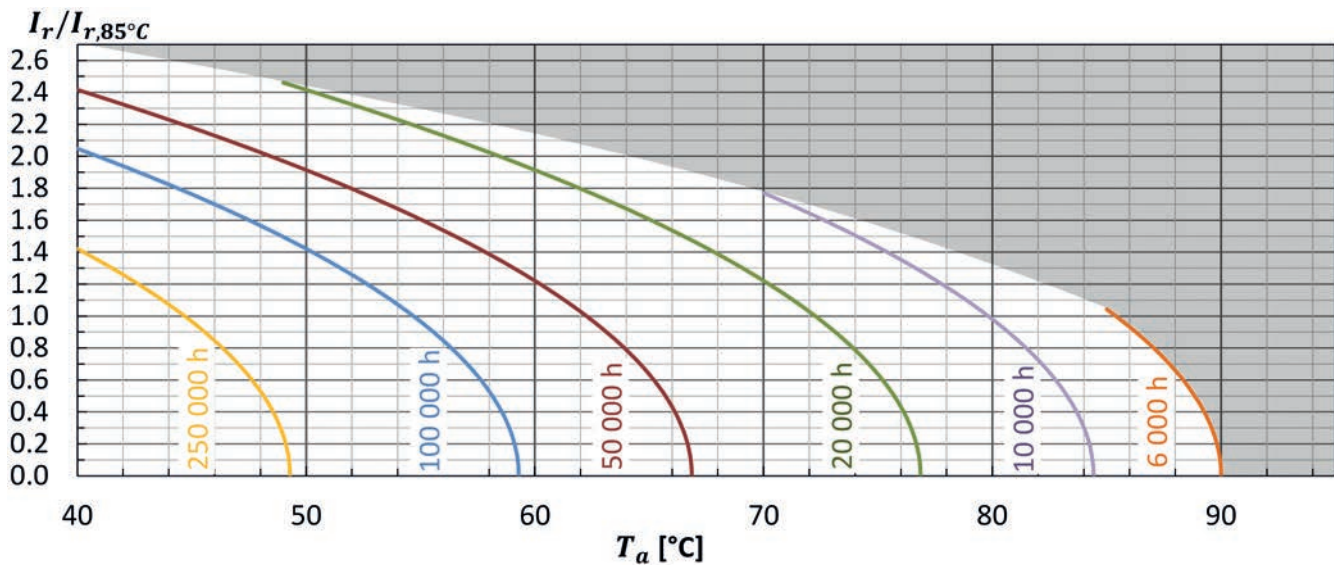
> Life Time Table · Brauchbarkeitsdauer – Tabelle

HCGF6	Useful life as function of ambient temperature and ripple current												
I _r at 85°C	x 1.0	x 1.2	x 1.4	x 1.6	x 1.8	x 2.0	x 2.1	x 2.2	x 2.3	x 2.4	x 2.5	x 2.6	x 2.7
T _a = 40°C	250	250	250	199	149	108	91	76	63	51	42	33	27
T _a = 45°C	243	201	162	125	94	68	57	48	39	32	26	21	
T _a = 50°C	153	127	102	79	59	43	36	30	25	20			
T _a = 55°C	97	80	64	50	37	27	23	19					
T _a = 60°C	61	51	41	31	23	17							
T _a = 65°C	38	32	25	20	15								
T _a = 70°C	24	20	16	12									
T _a = 75°C	15	12	10										
T _a = 80°C	9	8											
T _a = 85°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 $I_{r, 85^\circ\text{C}, 120\text{Hz}}$

Brauchbarkeitsdauer in Abhängigkeit von Umgebungstemperatur T_a und Wechselstrombelastung I_r im Verhältnis zur max. Wechselstrombelastung bei oberer Kategorietemperatur $I_{r, 85^\circ\text{C}, 120\text{Hz}}$



> Life Time Tests and Requirements · Anforderungen Brauchbarkeitsdauer

Life time test	Test procedure	Life time criteria
Endurance test	$T_a = 85^\circ\text{C}$; V_r , I_r applied 4000 hours	$\Delta C/C \leq 10\%$ (of initial value) $\tan\delta \leq 175\%$ (of specified value) $I_L \leq \text{specified value}$
Useful life	$T_a = 85^\circ\text{C}$; V_r , I_r applied 6000 hours	$\Delta C/C \leq 15\%$ (of initial value) $\tan\delta < 200\%$ (of specified value) $I_L \leq \text{specified value}$

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

VFR · Screw-Terminal · 6000 h/85 °C

High Ripple Current · Bottom cooling design · Low ESR

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

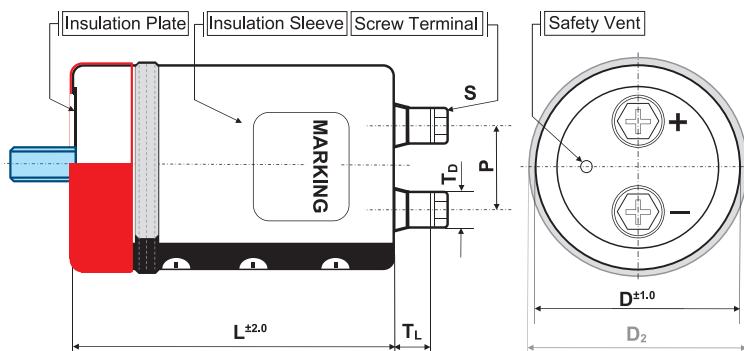
Items	Characteristics
Temperature range	-40°C ~ +85°C
Capacitance tolerance (at 20°C)	Standard +/- 20%, -10/+30% on request
Surge voltage / Ripple voltage	Repetitive max. 30 sec per 6 Minutes / ≤ 70V
Leakage current max. I_L (20°C, 5 min)	$0.01 \cdot C \cdot V_r$ [μA] or 5 mA, which is smaller.
Useful life	6 000 hours at 85°C
Field failure rate	0.5 FIT = $0.5 \cdot 10^{-9}$ Failures/hour
RoHS conform	Directive 2011/65/EU & (EU)2015/863
Specification / Vibration	JIS C 5101-4/0.75mm, 10...55Hz, 10g, 3x2h
Outer materials	UL94-V0/UL224-VW1 certified (cap/sleeve)
Sleeve withstanding voltage	4000 Vac / 1min between terminals bundled and plate*

* Typical value



> Shape designation · Formbezeichnung

- for details refer to p. 8–9 · technische Details siehe S. 8–9
- for mounting options refer to p. 149 ff · Montageoptionen siehe S. 149 ff



	B	I/Y	N	N+WC
outer sleeve	•	•	•	•
insulation plate	•	•	•	
stud bolt	•			
bottom double sleeve		•		
integrated seating ring				•

ØD	available shape	P	S	T _L	T _D	Cap material
64	B, N, I, Y	28.6	M5x10	8.0	11	PH
77	B, N, I, Y, WC	31.5	M6x12	9.0	12	PH
90	B, N, I, Y, WC	31.5	M6x12	8.0	12	PH

Size in mm

> Product Code · Bestellbezeichnung

Example: Series VFR · 12000 μF +/- 20 % · 400 V · D=90 mm · L=167 mm with Y-Bracket

VFR	2G	123	Y	F	167
Type of series	Capacitance code	Fixing symbol code	Case code diameter	Specific features	
	The first two digits are significant. The last digit indicates the number of following zeros in μF.	B : Bolt N : single outer sleeve I : 2 Stoppers Bracket Y : 3 Stoppers Bracket N + suffix WC: blank bottom + seating ring	ØD	Code	Case Code length Length in mm (3 digits)
			64	D	
			77	E	
			90	F	
					Capacitance tolerance
					Ø : ± 20 %
					Q : -10 % ~ +30 %

Rated VoltageCode (Surge Voltage) V_r [V DC]	Capacitance C_r [μF]	Ripple Current at 85°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
350 VDC Code: 2V Surge Voltage 400 VDC	3 900	17.0	35.7	14	16	18	0.20	64x107	VFR2V392#D107
	4 700	19.2	40.3	11	13	18	0.20	64x123	VFR2V472#D123
	5 600	20.6	43.3	10	11	18	0.20	64x147	VFR2V562#D147
		23.5	49.4	10	11	20	0.20	77x108	VFR2V562#E108
	6 800	23.3	48.9	8	10	18	0.20	64x164	VFR2V682#D164
		26.5	55.7	8	10	20	0.20	77x124	VFR2V682#E124
	8 200	25.8	54.2	7	8	18	0.20	64x187	VFR2V822#D187
		28.5	59.9	7	8	20	0.20	77x148	VFR2V822#E148
		32.6	68.5	7	8	20	0.20	90x110	VFR2V822#F110
	10 000	32.1	67.4	5	7	20	0.20	77x165	VFR2V103#E165
		35.9	75.4	5	7	20	0.20	90x126	VFR2V103#F126
	12 000	35.3	74.1	5	5	20	0.20	77x188	VFR2V123#E188
		39.1	82.1	5	5	20	0.20	90x150	VFR2V123#F150
	15 000	40.8	85.7	4	5	20	0.20	77x228	VFR2V153#E228
		43.3	90.9	4	5	20	0.20	90x167	VFR2V153#F167
	18 000	47.1	98.9	3	4	20	0.20	90x190	VFR2V183#F190
	22 000	51.2	107.5*	3	4	20	0.20	90x230	VFR2V223#F230
400 VDC Code: 2G Surge Voltage 450 VDC	3 300	15.7	33.0	16	19	18	0.20	64x107	VFR2G332#D107
	3 900	17.1	35.9	14	16	18	0.20	64x95	VFR2G392#D095
		17.5	36.8	14	16	18	0.20	64x123	VFR2G392#D123
	4 700	18.9	39.7	11	13	18	0.20	64x147	VFR2G472#D147
		21.5	45.2	11	13	20	0.20	77x108	VFR2G472#E108
	5 600	21.2	44.5	10	11	18	0.20	64x164	VFR2G562#D164
		24.0	50.4	10	11	20	0.20	77x124	VFR2G562#E124
	6 800	23.5	49.4	8	10	18	0.20	64x187	VFR2G682#D187
		26.0	54.6	8	10	20	0.20	77x148	VFR2G682#E148
		29.7	62.4	8	10	20	0.20	90x110	VFR2G682#F110
	8 200	28.4	59.6	7	8	20	0.20	77x148	VFR2G822#E148
		29.1	61.1	7	8	20	0.20	77x165	VFR2G822#E165
		32.5	68.3	7	8	20	0.20	90x126	VFR2G822#F126
	10 000	32.2	67.6	5	7	20	0.20	77x188	VFR2G103#E188
		35.7	75.0	5	7	20	0.20	90x150	VFR2G103#F150
	12 000	36.5	76.7	5	5	20	0.20	77x228	VFR2G123#E228
		38.7	81.3	5	5	20	0.20	90x167	VFR2G123#F167
	15 000	43.0	90.3	4	5	20	0.20	90x190	VFR2G153#F190
	18 000	46.3	97.2	3	4	20	0.20	90x230	VFR2G183#F230
450 VDC Code: 2W Surge Voltage 500 VDC	2 700	14.5	30.5	20	23	18	0.20	64x107	VFR2W272#D107
	3 300	16.5	34.7	16	19	18	0.20	64x123	VFR2W332#D123
	3 900	17.6	37.0	14	16	18	0.20	64x147	VFR2W392#D147
		20.1	42.2	14	16	20	0.20	77x108	VFR2W392#E108
	4 700	19.9	41.8	11	13	18	0.20	64x164	VFR2W472#D164
		22.6	47.5	11	13	20	0.20	77x124	VFR2W472#E124
	5 600	21.9	46.0	10	11	18	0.20	64x187	VFR2W562#D187
		24.1	50.6	10	11	20	0.20	77x148	VFR2W562#E148
		27.6	58.0	10	11	20	0.20	90x110	VFR2W562#F110
	6 800	27.1	56.9	8	10	20	0.20	77x165	VFR2W682#E165
		30.3	63.6	8	10	20	0.20	90x126	VFR2W682#F126
	8 200	29.9	62.8	7	8	20	0.20	77x188	VFR2W822#E188
		33.1	69.5	7	8	20	0.20	90x150	VFR2W822#F150

Additional designs on request · Weitere Designs auf Anfrage

Rated Voltage Code: (Surge Voltage) V_r [V DC]	Capacitance C_r [μF]	Ripple Current at 85°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
450 VDC Code: 2W Surge Voltage 500 VDC	10 000	34.1	71.6	5	7	20	0.20	77x228	VFR2W103#E228
		36.2	76.0	5	7	20	0.20	90x167	VFR2W103#F167
	12 000	39.4	82.7	5	5	20	0.20	90x190	VFR2W123#F190
	15 000	43.3	90.9	4	5	20	0.20	90x230	VFR2W153#F230
	17 000	44.5	93.4	4	5	20	0.20	90x230	VFR2W173#F230
500 VDC Code: 2H Surge Voltage 550 VDC	1 800	11.3	23.7	32	38	18	0.20	64x107	VFR2H182#D107
		12.8	26.9	26	31	18	0.20	64x123	VFR2H222#D123
	2 200	13.9	29.2	22	26	18	0.20	64x147	VFR2H272#D147
		15.9	33.4	22	26	20	0.20	77x108	VFR2H272#E108
	3 300	15.8	33.2	18	21	18	0.20	64x164	VFR2H332#D164
		18.0	37.8	18	21	20	0.20	77x124	VFR2H332#E124
	3 900	17.3	36.3	15	18	18	0.20	64x187	VFR2H392#D187
		19.1	40.1	15	18	20	0.20	77x148	VFR2H392#E148
		21.9	46.0	15	18	20	0.20	90x110	VFR2H392#F110
	4 700	21.4	44.9	13	15	20	0.20	77x165	VFR2H472#E165
		24.0	50.4	13	15	20	0.20	90x126	VFR2H472#F126
	5 600	23.5	49.4	11	13	20	0.20	77x188	VFR2H562#E188
		26.0	54.6	11	13	20	0.20	90x150	VFR2H562#F150
	6 800	26.7	56.1	9	10	20	0.20	77x228	VFR2H682#E228
		28.4	59.6	9	10	20	0.20	90x167	VFR2H682#F167
	8 200	31.0	65.1	8	8	20	0.20	90x190	VFR2H822#F190
	10 000	33.6	70.6	6	7	20	0.20	90x230	VFR2H103#F230

* Please contact us if load condition exceeds terminals related $I_{r,max}$ referred on page 9

Additional designs on request · Weitere Designs auf Anfrage

> Ripple Current Multiplier · Wechselstrommultiplikator

Frequency [Hz]	50/60	120	300	1k	≥ 10k	Forced cooling [m/sec]	v < 0.5	v ≥ 0.5	v ≥ 2.0	v ≥ 3.0
Multiplier	0.80	1.00	1.18	1.34	1.45	Multiplier	1.00	1.10	1.20	1.25

Ta (°C)	40	45	50	55	60	65	70	75	80	85
Multiplier	2.1	2.1	2.0	1.9	1.8	1.6	1.5	1.3	1.1	1.0

> Life Time Table · Brauchbarkeitsdauer – Tabelle

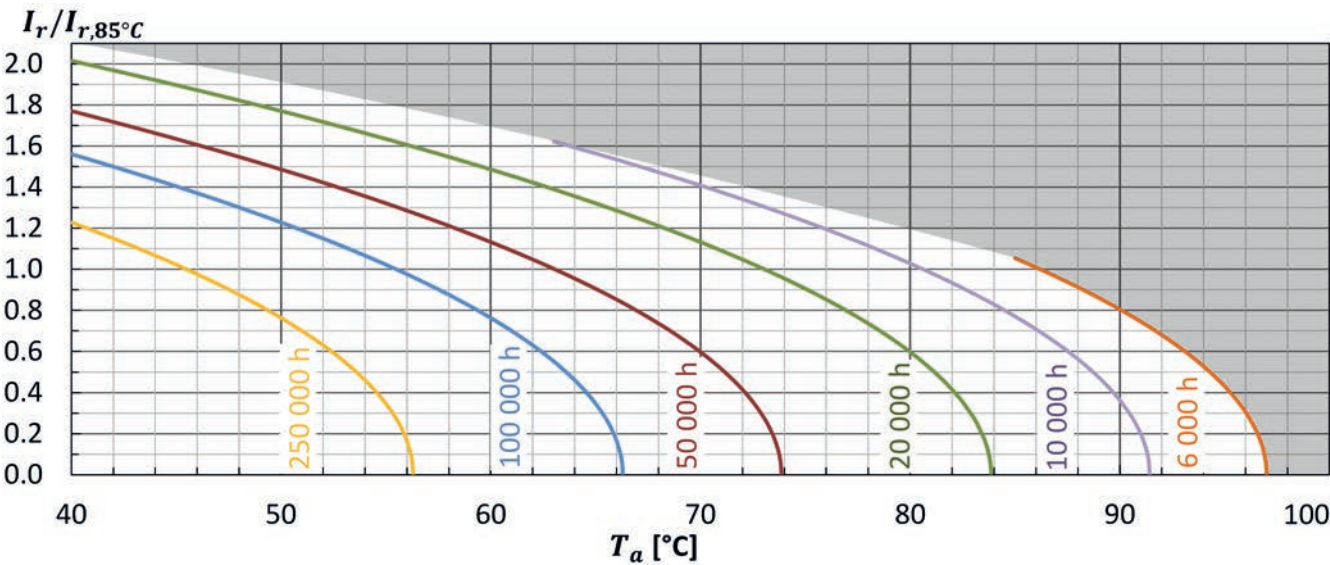
VFR	Useful life as function of ambient temperature and ripple current											
I_r at 85°C	x 1.0	x 1.1	x 1.2	x 1.3	x 1.4	x 1.5	x 1.6	x 1.7	x 1.8	x 1.9	x 2.0	x 2.1
T _a = 40°C	250	250	250	208	159	120	88	63	45	31	21	14
T _a = 45°C	250	212	169	132	101	75	55	40	28	19	13	8
T _a = 50°C	165	134	107	83	63	48	35	25	18	12	8	
T _a = 55°C	104	85	67	52	40	30	22	16	11	7		
T _a = 60°C	66	53	42	33	25	19	14	10	7			
T _a = 65°C	41	34	27	21	16	12	8					
T _a = 70°C	26	21	17	13	10	7						
T _a = 75°C	16	13	10	8								
T _a = 80°C	10	8										
T _a = 85°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 $I_{r, 85^\circ\text{C}, 120\text{Hz}}$

Brauchbarkeitsdauer in Abhängigkeit von Umgebungstemperatur T_a und Wechselstrombelastung I_r im Verhältnis zur max. Wechselstrombelastung bei oberer Kategorietemperatur $I_{r, 85^\circ\text{C}, 120\text{Hz}}$



> Life Time Tests and Requirements · Anforderungen Brauchbarkeitsdauer

Life time test	Test procedure	Life time criteria
Endurance test	$T_a = 85^\circ\text{C}$; V_r , I_r applied 4000 hours	$\Delta C/C \leq 10\%$ (of initial value) $\tan\delta \leq 175\%$ (of specified value) $I_L \leq \text{specified value}$
Useful life	$T_a = 85^\circ\text{C}$; V_r , I_r applied 6000 hours	$\Delta C/C \leq 15\%$ (of initial value) $\tan\delta < 200\%$ (of specified value) $I_L \leq \text{specified value}$

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

VFLR · Screw-Terminal · 12000 h/85 °C

Long Life · High Ripple Current · Bottom cooling design · Low ESR

> Specifications · Spezifikationen

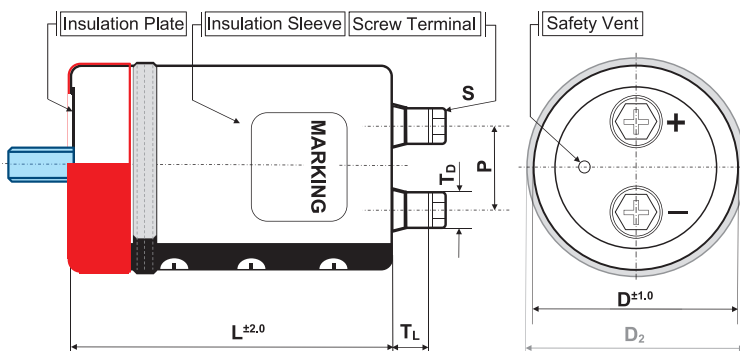
Items	Characteristics
Temperature range	-40°C ~ + 85°C
Capacitance tolerance (at 20°C)	Standard +/- 20%, -10/+30% on request
Surge voltage / Ripple voltage	Repetitive max. 30 sec per 6 Minutes / ≤ 70V
Leakage current max. I _L (20°C, 5 min)	0.01 • C • V _r [μA] or 5 mA, which is smaller.
Useful life	12 000 hours at 85°C
Field failure rate	0.5 FIT = 0.5 • 10 ⁻⁹ Failures/hour
RoHS conform	Directive 2011/65/EU & (EU)2015/863
Specification / Vibration	JIS C 5101-4/0.75mm, 10...55Hz, 10g, 3x2h
Outer materials	UL94-V0/UL224-VW1 certified (cap/sleeve)
Sleeve withstanding voltage	4000 Vac / 1min between terminals bundled and plate*

* Typical value



> Shape designation · Formbezeichnung

- for details refer to p. 8–9 · technische Details siehe S. 8–9
- for mounting options refer to p. 149 ff · Montageoptionen siehe S. 149 ff



	B	I/Y	N	N+WC
outer sleeve	•	•	•	•
insulation plate	•	•	•	
stud bolt	•			
bottom double sleeve		•		
integrated seating ring				•

ØD	available shape	P	S	T _L	T _D	Cap material
64	B, N, I, Y	28.6	M5x10	8.0	11	PH
77	B, N, I, Y, WC	31.5	M6x12	9.0	12	PH
90	B, N, I, Y, WC	31.5	M6x12	8.0	12	PH

Size in mm

> Product Code · Bestellbezeichnung

Example: Series VFLR · 12000 μF +/- 20 % · 400 V · D=90 mm · L=167 mm with Y-Bracket

VFLR	2G	123	Y	F	167
Type of series	Capacitance code The first two digits are significant. The last digit indicates the number of following zeros in μF.		Fixing symbol code B : Bolt N : single outer sleeve I : 2 Stoppers Bracket Y : 3 Stoppers Bracket N + suffix WC: blank bottom + seating ring	Case code diameter ØDCode 64D 77E 90F	Specific features Case Code length Length in mm (3 digits)
Rated voltage code				Capacitance tolerance	
Code	Voltage	Code	Voltage	Ø : ± 20 % Q : -10 % ~ + 30 %	
2V	350	2W	450		
2G	400	2H	500		

Rated VoltageCode (Surge Voltage) V_r [V DC]	Capacitance C_r [μF]	Ripple Current at 85°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
350 VDC Code: 2V Surge Voltage 400 VDC	3 900	17.0	35.7	14	16	18	0.20	64x107	VFLR2V392#D107
	4 700	19.2	40.3	11	13	18	0.20	64x123	VFLR2V472#D123
	5 600	20.6	43.3	10	11	18	0.20	64x147	VFLR2V562#D147
		23.5	49.4	10	11	20	0.20	77x108	VFLR2V562#E108
	6 800	23.3	48.9	8	10	18	0.20	64x164	VFLR2V682#D164
		26.5	55.7	8	10	20	0.20	77x124	VFLR2V682#E124
	8 200	25.8	54.2	7	8	18	0.20	64x187	VFLR2V822#D187
		28.5	59.9	7	8	20	0.20	77x148	VFLR2V822#E148
		32.6	68.5	7	8	20	0.20	90x110	VFLR2V822#F110
	10 000	32.1	67.4	5	7	20	0.20	77x165	VFLR2V103#E165
		35.9	75.4	5	7	20	0.20	90x126	VFLR2V103#F126
	12 000	35.3	74.1	5	5	20	0.20	77x188	VFLR2V123#E188
		39.1	82.1	5	5	20	0.20	90x150	VFLR2V123#F150
	15 000	40.8	85.7	4	5	20	0.20	77x228	VFLR2V153#E228
		43.3	90.9	4	5	20	0.20	90x167	VFLR2V153#F167
	18 000	47.1	98.9	3	4	20	0.20	90x190	VFLR2V183#F190
	22 000	52.0	109.2*	3	4	20	0.20	90x190	VFLR2V223#F190
		51.2	107.5*	3	4	20	0.20	90x230	VFLR2V223#F230
400 VDC Code: 2G Surge Voltage 450 VDC	3 300	15.7	33.0	16	19	18	0.20	64x107	VFLR2G332#D107
	3 900	17.5	36.8	14	16	18	0.20	64x123	VFLR2G392#D123
	4 700	18.9	39.7	11	13	18	0.20	64x147	VFLR2G472#D147
		21.5	45.2	11	13	20	0.20	77x108	VFLR2G472#E108
	5 600	21.2	44.5	10	11	18	0.20	64x164	VFLR2G562#D164
		24.0	50.4	10	11	20	0.20	77x124	VFLR2G562#E124
	6 800	23.5	49.4	8	10	18	0.20	64x187	VFLR2G682#D187
		26.0	54.6	8	10	20	0.20	77x148	VFLR2G682#E148
		29.7	62.4	8	10	20	0.20	90x110	VFLR2G682#F110
	8 200	28.4	59.6	7	8	20	0.20	77x148	VFLR2G822#E148
		29.1	61.1	7	8	20	0.20	77x165	VFLR2G822#E165
		32.5	68.3	7	8	20	0.20	90x126	VFLR2G822#F126
	10 000	32.2	67.6	5	7	20	0.20	77x188	VFLR2G103#E188
		35.7	75.0	5	7	20	0.20	90x150	VFLR2G103#F150
	12 000	36.5	76.7	5	5	20	0.20	77x228	VFLR2G123#E228
		38.7	81.3	5	5	20	0.20	90x167	VFLR2G123#F167
	15 000	43.0	90.3	4	5	20	0.20	90x190	VFLR2G153#F190
	18 000	46.3	97.2	3	4	20	0.20	90x230	VFLR2G183#F230
450 VDC Code: 2W Surge Voltage 500 VDC	2 700	14.5	30.5	20	23	18	0.20	64x107	VFLR2W272#D107
	3 300	16.5	34.7	16	19	18	0.20	64x123	VFLR2W332#D123
	3 900	17.6	37.0	14	16	18	0.20	64x147	VFLR2W392#D147
		20.1	42.2	14	16	20	0.20	77x108	VFLR2W392#E108
	4 700	19.9	41.8	11	13	18	0.20	64x164	VFLR2W472#D164
		22.6	47.5	11	13	20	0.20	77x124	VFLR2W472#E124
	5 600	21.9	46.0	10	11	18	0.20	64x187	VFLR2W562#D187
		24.1	50.6	10	11	20	0.20	77x148	VFLR2W562#E148
		27.6	58.0	10	11	20	0.20	90x110	VFLR2W562#F110

Additional designs on request · Weitere Designs auf Anfrage

Rated VoltageCode (Surge Voltage) V_r [V DC]	Capacitance C_r [μF]	Ripple Current at 85°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
450 VDC Code: 2W Surge Voltage 500 VDC	6 800	22.9	48.1	8	10	20	0.20	64x187	VFLR2W682#D187
		27.1	56.9	8	10	20	0.20	77x165	VFLR2W682#E165
		30.3	63.6	8	10	20	0.20	90x126	VFLR2W682#F126
	8 200	29.9	62.8	7	8	20	0.20	77x188	VFLR2W822#E188
		33.1	69.5	7	8	20	0.20	90x150	VFLR2W822#F150
		34.1	71.6	5	7	20	0.20	77x228	VFLR2W103#E228
	10 000	36.5	76.7	5	7	20	0.20	90x150	VFLR2W103#F150
		39.4	82.7	5	5	20	0.20	90x190	VFLR2W123#F190
	15 000	43.3	90.9	4	5	20	0.20	90x230	VFLR2W153#F230
500 VDC Code: 2H Surge Voltage 550 VDC	1 800	11.3	23.7	32	38	18	0.20	64x107	VFLR2H182#D107
	2 200	12.8	26.9	26	31	18	0.20	64x123	VFLR2H222#D123
	2 700	13.9	29.2	22	26	18	0.20	64x147	VFLR2H272#D147
		15.9	33.4	22	26	20	0.20	77x108	VFLR2H272#E108
	3 300	15.8	33.2	18	21	18	0.20	64x164	VFLR2H332#D164
		18.0	37.8	18	21	20	0.20	77x124	VFLR2H332#E124
	3 900	17.3	36.3	15	18	18	0.20	64x187	VFLR2H392#D187
		19.1	40.1	15	18	20	0.20	77x148	VFLR2H392#E148
		21.9	46.0	15	18	20	0.20	90x110	VFLR2H392#F110
	4 700	21.4	44.9	13	15	20	0.20	77x165	VFLR2H472#E165
		24.0	50.4	13	15	20	0.20	90x126	VFLR2H472#F126
	5 600	23.5	49.4	11	13	20	0.20	77x188	VFLR2H562#E188
		26.0	54.6	11	13	20	0.20	90x150	VFLR2H562#F150
	6 800	26.7	56.1	9	10	20	0.20	77x228	VFLR2H682#E228
		28.4	59.6	9	10	20	0.20	90x167	VFLR2H682#F167
	8 200	31.0	65.1	8	8	20	0.20	90x190	VFLR2H822#F190
	10 000	34.2	71.8	6	7	20	0.20	90x190	VFLR2H103#F190
		33.6	70.6	6	7	20	0.20	90x230	VFLR2H103#F230

* Please contact us if load condition exceeds terminals related $I_{r,max}$ referred on page 9

Additional designs on request · Weitere Designs auf Anfrage

> Ripple Current Multiplier · Wechselstrommultiplikator

Frequency [Hz]	50/60	120	300	1k	≥ 10k	Forced cooling [m/sec]	v < 0.5	v ≥ 0.5	v ≥ 2.0	v ≥ 3.0
Multiplier	0.80	1.00	1.18	1.34	1.45	Multiplier	1.00	1.10	1.20	1.25

Ta (°C)	40	45	50	55	60	65	70	75	80	85
Multiplier	2.1	2.1	2.0	1.9	1.8	1.6	1.5	1.3	1.1	1.0

> Life Time Table · Brauchbarkeitsdauer – Tabelle

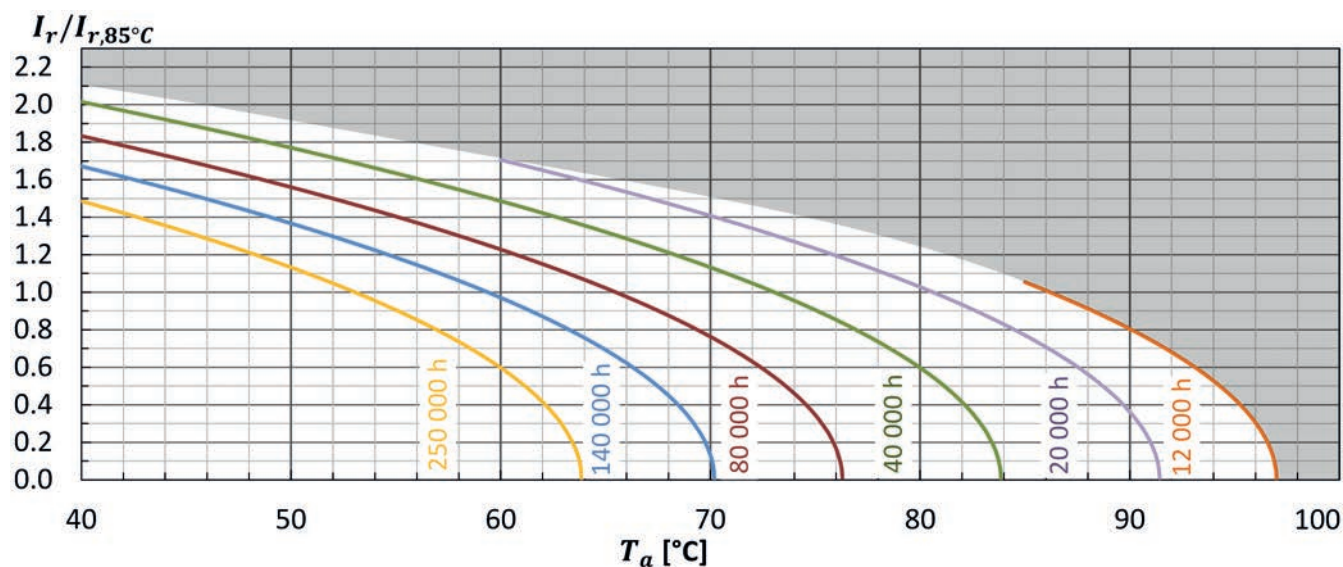
VFLR	Useful life as function of ambient temperature and ripple current											
I_r at 85°C	x 1.0	x 1.1	x 1.2	x 1.3	x 1.4	x 1.5	x 1.6	x 1.7	x 1.8	x 1.9	x 2.0	x 2.1
$T_a = 40^\circ\text{C}$	250	250	250	250	250	240	176	127	90	62	42	28
$T_a = 45^\circ\text{C}$	250	250	250	250	202	151	111	80	57	39	26	17
$T_a = 50^\circ\text{C}$	250	250	214	167	127	96	70	50	36	25	16	
$T_a = 55^\circ\text{C}$	209	170	135	105	80	60	44	32	22	15		
$T_a = 60^\circ\text{C}$	132	107	85	66	51	38	28	20	14			
$T_a = 65^\circ\text{C}$	83	68	54	42	32	24	17					
$T_a = 70^\circ\text{C}$	52	43	34	26	20	15						
$T_a = 75^\circ\text{C}$	33	27	21	16								
$T_a = 80^\circ\text{C}$	21	17										
$T_a = 85^\circ\text{C}$	12											

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 $I_{r, 85^\circ\text{C}, 120\text{Hz}}$

Brauchbarkeitsdauer in Abhängigkeit von Umgebungstemperatur T_a und Wechselstrombelastung I_r im Verhältnis zur max. Wechselstrombelastung bei oberer Kategorie-temperatur $I_{r, 85^\circ\text{C}, 120\text{Hz}}$



> Life Time Tests and Requirements · Anforderungen Brauchbarkeitsdauer

Life time test	Test procedure	Life time criteria
Endurance test	$T_a = 85^\circ\text{C}$; V_r , I_r applied 8000 hours	$\Delta C/C \leq 10\%$ (of initial value) $\tan\delta \leq 175\%$ (of specified value) $I_L \leq$ specified value
Useful life	$T_a = 85^\circ\text{C}$; V_r , I_r applied 12000 hours	$\Delta C/C \leq 15\%$ (of initial value) $\tan\delta < 200\%$ (of specified value) $I_L \leq$ specified value

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

FXR · Screw-Terminal · 12 000 h/85 °C

High Ripple Current · Long Life · Bottom cooling design

> Specifications · Spezifikationen

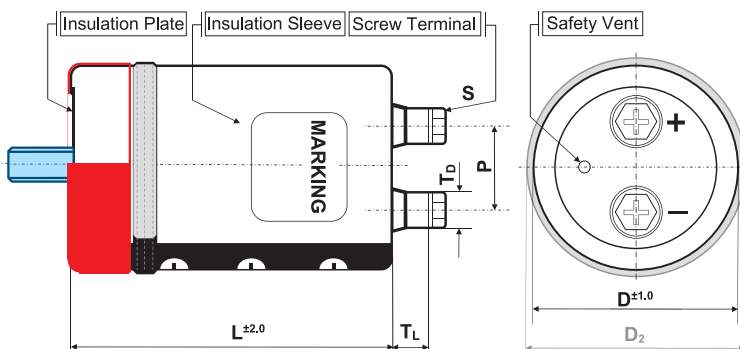
Items	Characteristics
Temperature range	-40°C ~ + 85°C
Capacitance tolerance (at 20°C)	Standard +/- 20%, -10/+30% on request
Surge voltage	Repetitive max. 30 sec per 6 Minutes
Leakage current max. I_L (20°C, 5 min)	$0.01 \cdot C \cdot V_r$ [μ A] or 3 mA, which is smaller.
Useful life	12 000 hours at 85°C
Field failure rate	0.5 FIT = $0.5 \cdot 10^{-9}$ Failures/hour
RoHS conform	Directive 2011/65/EU & (EU)2015/863
Specification / Vibration	JIS C 5101-4/0.75mm, 10...55Hz, 10g, 3x2h
Outer materials	UL94-V0/UL224-VW1 certified (cap/sleeve)
Sleeve withstanding voltage	4000 Vac / 1min between terminals bundled and plate*

* Typical value



> Shape designation · Formbezeichnung

- for details refer to p. 8–9 · technische Details siehe S. 8–9
- for mounting options refer to p. 149 ff · Montageoptionen siehe S. 149 ff



	B	I/Y	N	N+WC
outer sleeve	•	•	•	•
insulation plate	•	•	•	
stud bolt	•			
bottom double sleeve		•		
integrated seating ring				•

ØD	available shape	P	S	T _L	T _D	Cap material
64	B, N, I, Y	28.6	M5x10	4.5	10	PPS
77	B, N, I, Y, WC	31.5	M6x12	3.0	16	PPS
90	B, N, I, Y, WC	31.5	M6x12	3.0	16	PPS

Size in mm

> Product Code · Bestellbezeichnung

Example: Series FXR · 3900 μ F +/- 20 % · 500 V · D=77 mm · L=161 mm with Y-Bracket

FXR	2H	392	Y	E	161								
Type of series	Capacitance code The first two digits are significant. The last digit indicates the number of following zeros in μ F		Fixing symbol code B : Bolt N : single outer sleeve I : 2 Stoppers Bracket Y : 3 Stoppers Bracket N + suffix WC: blank bottom + seating ring	Case code diameter <table><tr><th>ØD</th><th>Code</th></tr><tr><td>64</td><td>D</td></tr><tr><td>77</td><td>E</td></tr><tr><td>90</td><td>F</td></tr></table>	ØD	Code	64	D	77	E	90	F	Specific features Case Code length Length in mm (3 digits)
ØD	Code												
64	D												
77	E												
90	F												
Rated voltage code				Capacitance tolerance									
Code	Voltage	Code	Voltage	Ø : $\pm 20\%$ Q : $-10\% \sim +30\%$									
2V	350	2W	450										
2G	400	2H	500										

Rated VoltageCode (Surge Voltage) V_r [V DC]	Capacitance C_r [μF]	Ripple Current at 85°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
350 VDC Surge Voltage 400 VDC	3 900	16.8	33.6	23	25	18	0.20	64x115	FXR2V392#D115
	4 700	19.4	38.8	18	20	18	0.20	64x131	FXR2V472#D131
	5 600	22.8	45.6	15	16	18	0.20	64x155	FXR2V562#D155
		24.8	49.6	15	16	19	0.20	77x121	FXR2V562#E121
		25.6	51.2	15	16	19	0.20	90x106	FXR2V562#F106
	6 800	28.8	57.6	12	13	19	0.20	77x137	FXR2V682#E137
		30.1	60.2	12	13	19	0.20	90x121	FXR2V682#F121
	8 200	33.7	67.4	10	10	19	0.20	77x161	FXR2V822#E161
		34.6	69.2	10	10	19	0.20	90x137	FXR2V822#F137
	10 000	41.1	82.2	8	9	19	0.20	90x161	FXR2V103#F161
	12 000	45.0	90.0	7	7	19	0.20	90x161	FXR2V123#F161
	14 000	50.5	101.0*	7	7	19	0.20	90x178	FXR2V143#F178
400 VDC Surge Voltage 450 VDC	2 700	13.2	26.4	34	36	18	0.20	64x100	FXR2G272#D100
	3 300	16.3	32.6	27	29	18	0.20	64x131	FXR2G332#D131
	3 900	19.0	38.0	23	25	18	0.20	64x155	FXR2G392#D155
		20.7	41.4	23	25	19	0.20	77x121	FXR2G392#E121
	4 700	20.8	41.6	18	20	18	0.20	64x155	FXR2G472#D155
		23.6	47.2	18	20	19	0.20	90x106	FXR2G472#F106
		23.9	47.8	18	20	19	0.20	77x137	FXR2G472#E137
	5 600	26.1	52.2	16	17	19	0.20	77x137	FXR2G562#E137
		27.4	54.8	16	17	19	0.20	90x121	FXR2G562#F121
	6 800	30.6	61.2	13	14	19	0.20	77x161	FXR2G682#E161
		31.5	63.0	13	14	19	0.20	90x137	FXR2G682#F137
	8 200	37.0	74.0	10	10	19	0.20	90x161	FXR2G822#F161
	10 000	41.1	82.2	9	9	19	0.20	90x161	FXR2G103#F161
450 VDC Surge Voltage 500 VDC	2 200	12.0	24.0	42	45	18	0.20	64x100	FXR2W222#D100
		14.4	28.8	46	48	19	0.20	77x96	FXR2W222#E096
	2 700	14.7	29.4	35	37	18	0.20	64x131	FXR2W272#D131
		17.5	35.0	28	30	18	0.20	64x155	FXR2W332#D155
	3 300	17.7	35.4	28	30	19	0.20	77x121	FXR2W332#E121
		19.0	38.0	25	27	18	0.20	64x155	FXR2W392#D155
		20.7	41.4	25	27	19	0.20	77x121	FXR2W392#E121
	3 900	21.4	42.8	25	27	19	0.20	90x106	FXR2W392#F106
		23.9	47.8	18	20	19	0.20	77x137	FXR2W472#E137
		25.1	50.2	18	20	19	0.20	90x121	FXR2W472#F121
	5 600	27.8	55.6	16	18	19	0.20	77x161	FXR2W562#E161
		28.6	57.2	16	18	19	0.20	90x137	FXR2W562#F137
	6 800	33.8	67.6	13	14	19	0.20	90x161	FXR2W682#F161
	8 200	37.0	74.0	10	10	19	0.20	90x161	FXR2W822#F161
	10 000	42.4	84.8	9	9	19	0.20	90x178	FXR2W103#F178
500 VDC Surge Voltage 550 VDC	1 500	9.9	19.8	74	78	18	0.20	64x115	FXR2H152#D115
	1 800	11.5	23.0	62	65	18	0.20	64x131	FXR2H182#D131
	2 200	13.5	27.0	51	54	18	0.20	64x155	FXR2H222#D155
	2 700	17.2	34.4	39	41	19	0.20	77x121	FXR2H272#E121
	3 000	16.4	32.8	35	37	18	0.20	64x155	FXR2H302#D155R

Additional designs on request · Weitere Designs auf Anfrage

Rated VoltageCode (Surge Voltage) V_r [V DC]	Capacitance C_r [μF]	Ripple Current at 85°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
500 VDC Code: 2H Surge Voltage 550 VDC	3 300	16.9	33.8	32	34	19	0.20	90x106	FXR2H332#F106
		21.3	42.6	32	34	19	0.20	77x161	FXR2H332#E161
	3 900	21.8	43.6	25	28	19	0.20	90x121	FXR2H392#F121
		23.2	46.4	25	28	19	0.20	77x161	FXR2H392#E161
	4 200	23.6	47.2	24	27	19	0.20	77x178	FXR2H422#E178
	4 700	25.1	50.2	22	25	19	0.20	90x137	FXR2H472#F137
	5 600	29.1	58.2	18	20	19	0.20	90x161	FXR2H562#F161
	6 800	33.4	66.8	15	17	19	0.20	90x178	FXR2H682#F178
	7 000	32.5	65.0	15	17	19	0.20	90x161	FXR2H702#F161

* Please contact us if load condition exceeds terminals related $I_{r \max}$ referred on page 9

Additional designs on request · Weitere Designs auf Anfrage

> Ripple Current Multiplier · Wechselstrommultiplikator

Frequency [Hz]	50/60	120	300	1k	≥ 10k	Forced cooling [m/sec]	v < 0.5	v ≥ 0.5	v ≥ 1.0	v ≥ 3.0
Multiplier	0.80	1.00	1.18	1.34	1.45	Multiplier	1.0	1.1	1.2	1.3

Temperature (°C)	40	45	50	55	60	65	70	75	80	85
Multiplier	2.0	2.0	1.9	1.8	1.7	1.6	1.5	1.3	1.2	1.0

> Life Time Table · Brauchbarkeitsdauer – Tabelle

FXR	Useful life as function of ambient temperature and ripple current										
I_r at 85°C	x 1.0	x 1.1	x 1.2	x 1.3	x 1.4	x 1.5	x 1.6	x 1.7	x 1.8	x 1.9	x 2.0
$T_a = 40°C$	250	250	250	250	250	250	211	159	118	86	62
$T_a = 45°C$	250	250	250	250	222	174	133	101	75	54	39
$T_a = 50°C$	250	250	218	176	140	110	84	63	47	34	
$T_a = 55°C$	200	168	138	111	89	69	53	40	30		
$T_a = 60°C$	127	106	87	70	56	44	33	25			
$T_a = 65°C$	80	67	55	44	35	27	21				
$T_a = 70°C$	50	42	34	28	22	17					
$T_a = 75°C$	32	26	22	17							
$T_a = 80°C$	20	17	13								
$T_a = 85°C$	12										

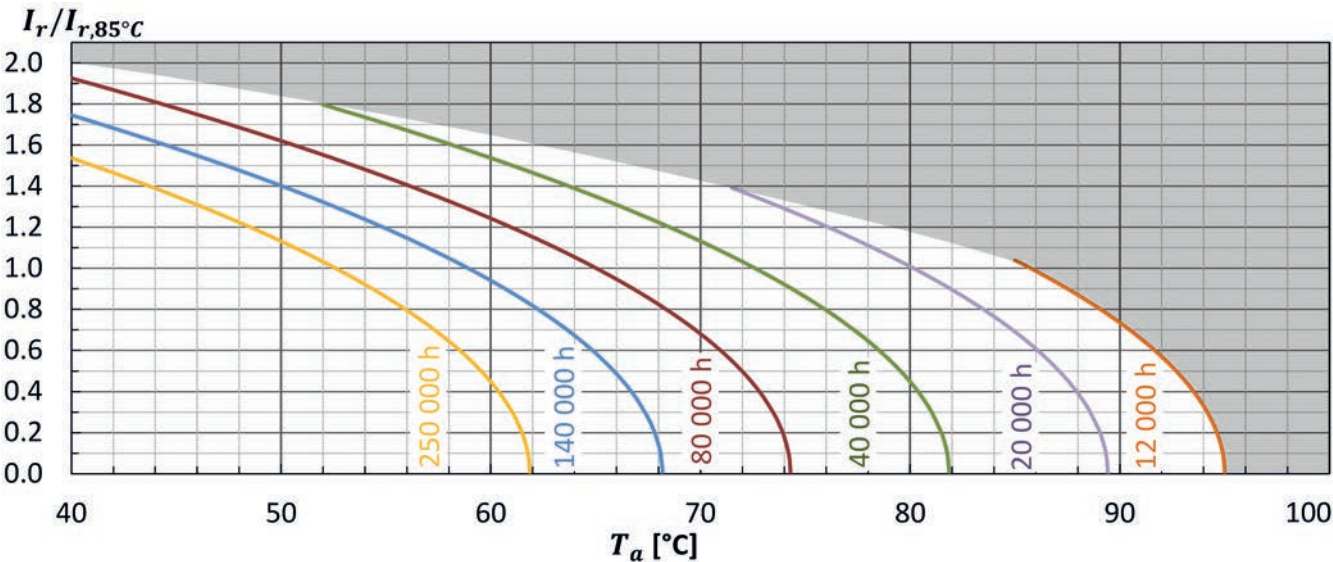
khrs

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 $I_{r, 85^{\circ}\text{C}, 120\text{Hz}}$

Brauchbarkeitsdauer in Abhängigkeit von Umgebungstemperatur T_a und Wechselstrombelastung I_r im Verhältnis zur max. Wechselstrombelastung bei oberer Kategorietemperatur $I_{r, 85^{\circ}\text{C}, 120\text{Hz}}$



> Life Time Tests and Requirements · Anforderungen Brauchbarkeitsdauer

Life time test	Test procedure	Life time criteria
Endurance test	$T_a = 85^{\circ}\text{C}$; V_r , I_r applied 8000 hours	$\Delta C/C \leq 10\%$ (of initial value) $\tan\delta \leq 175\%$ (of specified value) $I_L \leq$ specified value
Useful life	$T_a = 85^{\circ}\text{C}$; V_r , I_r applied 12000 hours	$\Delta C/C \leq 15\%$ (of initial value) $\tan\delta < 200\%$ (of specified value) $I_L \leq$ specified value

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

VG · Screw-Terminal · 6000 h/105 °C

Standard Performances · Bottom cooling design

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

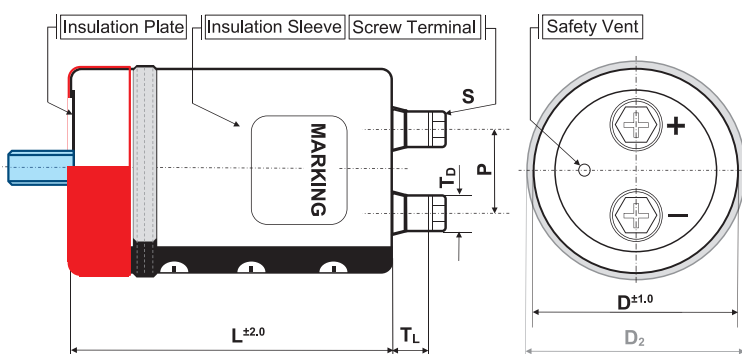
Items	Characteristics
Temperature range	-40°C ~ + 105°C
Capacitance tolerance (at 20°C)	Standard +/- 20%, -10/+30% on request
Surge voltage / Ripple voltage	Repetitive max. 30 sec per 6 Minutes / ≤ 50V
Leakage current max. I_L (20°C, 5 min)	0.01 • C • V_r [μA] or 5 mA, which is smaller.
Useful life	6 000 hours at 105°C
Field failure rate	0.5 FIT = 0.5 • 10 ⁻⁹ Failures/hour
RoHS conform	Directive 2011/65/EU & (EU)2015/863
Specification / Vibration	JIS C 5101-4/0.75mm, 10...55Hz, 10g, 3x2h
Outer materials	UL94-V0/UL224-VW1 certified (cap/sleeve)
Sleeve withstanding voltage	4000 Vac/1min between terminals bundled and plate*

* Typical value



> Shape designation · Formbezeichnung

- for details refer to p. 8–9 · technische Details siehe S. 8–9
- for mounting options refer to p. 149 ff · Montageoptionen siehe S. 149 ff



	B	I/Y	N	N+WC
outer sleeve	•	•	•	•
insulation plate	•	•	•	
stud bolt	•			
bottom double sleeve		•		
integrated seating ring				•

ØD	available shape	P	S	T _L	T _D	Cap material
51	B, N, I, Y	22.0	M5x10	5.5	10	PH
64	B, N, I, Y	28.6	M5x10	8.0	11	PH
77	B, N, I, Y, WC	31.5	M5x10	8.0	11	PH
			M6x12	9.0	12	PH
90	B, N, I, Y, WC	31.5	M5x10	7.0	11	PH
			M6x12	8.0	12	PH

Size in mm. First listed terminal is standard.

> Product Code · Bestellbezeichnung

Example: Series VG · 15000 μF +/- 20 % · 400 V · D=90 mm · L= 190 mm with Y-Bracket

VG		2G		153		Y		F		190													
Type of series		Capacitance code				Fixing symbol code		Case code diameter		Specific features (e.g. M6 ...)													
		The first two digits are significant. The last digit indicates the number of following zeros in µF.				B : Bolt N : single outer sleeve I : 2 Stoppers Bracket Y : 3 Stoppers Bracket N + suffix WC: blank bottom + seating ring		<table><tr><th>ØD</th><th>Code</th></tr><tr><td>51</td><td>C</td></tr><tr><td>64</td><td>D</td></tr><tr><td>77</td><td>E</td></tr><tr><td>90</td><td>F</td></tr></table>		ØD	Code	51	C	64	D	77	E	90	F	<table><tr><th>Case Code length</th></tr><tr><td>Length in mm (3 digits)</td></tr></table>		Case Code length	Length in mm (3 digits)
ØD	Code																						
51	C																						
64	D																						
77	E																						
90	F																						
Case Code length																							
Length in mm (3 digits)																							
Rated voltage code						Capacitance tolerance																	
Code	Voltage	Code	Voltage	Code	Voltage	Ø : ± 20 % Q : -10 % ~ + 30 %																	
1E	25	2A	100	2G	400																		
1V	35	2C	160	2W	450																		
1H	50	2D	200	2H	500																		
1J	63	2E	250																				
1K	80	2V	350																				

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	150 000	12.9	63.2	6	7	18	0.80	64x94	VG1E154#D094
	180 000	14.1	69.1	5	6	18	0.90	64x107	VG1E184#D107
	220 000	16.0	78.4	4	5	20	1.00	64x123	VG1E224#D123
		14.9	73.0	4	5	20	1.00	77x95	VG1E224#E095
	270 000	16.4	80.4	4	5	20	1.00	77x108	VG1E274#E108
		18.2	89.2	4	5	20	1.00	90x97	VG1E274#F097
35 VDC Code: 1V Surge Voltage 44 VDC	330 000	20.2	99.0	4	5	20	1.00	90x110	VG1E334#F110
	100 000	12.3	60.3	6	7	18	0.60	64x94	VG1V104#D094
	120 000	13.4	65.7	6	7	18	0.70	64x107	VG1V124#D107
	150 000	15.4	75.5	5	7	20	0.70	64x123	VG1V154#D123
		14.0	68.6	5	7	20	0.70	77x95	VG1V154#E095
	180 000	15.2	74.5	5	7	20	0.70	77x108	VG1V184#E108
		16.3	79.9	5	7	20	0.70	90x97	VG1V184#F097
	220 000	17.2	84.3	5	7	20	0.70	77x124	VG1V224#E124
		17.9	87.7	5	7	20	0.70	90x110	VG1V224#F110
50 VDC Code: 1H Surge Voltage 63 VDC	68 000	11.2	54.9	8	9	18	0.45	64x94	VG1H683#D094
	82 000	12.3	60.3	8	8	18	0.50	64x107	VG1H823#D107
	100 000	13.9	68.1	6	7	18	0.50	64x123	VG1H104#D123
		14.2	69.6	6	7	20	0.50	77x95	VG1H104#E095
	120 000	15.5	76.0	5	7	20	0.50	77x108	VG1H124#E108
	150 000	17.7	86.7	5	7	20	0.50	77x124	VG1H154#E124
		19.2	94.1	5	7	20	0.50	90x97	VG1H154#F097
63 VDC Code: 1J Surge Voltage 80 VDC	180 000	20.9	102.4*	4	6	20	0.50	90x110	VG1H184#F110
	47 000	10.5	51.5	8	9	18	0.35	64x94	VG1J473#D094
	56 000	11.5	56.4	8	9	18	0.40	64x107	VG1J563#D107
	68 000	13.0	63.7	7	8	18	0.40	64x123	VG1J683#D123
		12.9	63.2	7	8	20	0.40	77x95	VG1J683#E095
	82 000	14.1	69.1	7	8	20	0.40	77x108	VG1J823#E108
		15.5	76.0	7	8	20	0.40	90x97	VG1J823#F097
	100 000	16.0	78.4	7	8	20	0.40	77x124	VG1J104#E124
		17.0	83.3	7	8	20	0.40	90x110	VG1J104#F110
80 VDC Code: 1K Surge Voltage 100 VDC	10 000	5.2	25.5	15	9	17	0.30	51x75	VG1K103#C075
	27 000	8.6	42.1	8	7	18	0.30	64x94	VG1K273#D094
	33 000	9.5	46.6	7	7	18	0.30	64x107	VG1K333#D107
	47 000	11.7	57.3	6	7	18	0.30	64x123	VG1K473#D123
		12.2	59.8	6	7	20	0.30	77x95	VG1K473#E095
	56 000	13.2	64.7	5	7	20	0.30	77x108	VG1K563#E108
		15.3	75.0	5	7	20	0.30	90x97	VG1K563#F097
	68 000	14.9	73.0	4	7	20	0.30	77x124	VG1K683#E124
		16.8	82.3	4	7	20	0.30	90x110	VG1K683#F110
100 VDC Code: 2A Surge Voltage 125 VDC	18 000	8.6	42.1	9	10	18	0.20	64x94	VG2A183#D094
	22 000	9.5	46.6	8	9	18	0.20	64x107	VG2A223#D107
	33 000	12.0	58.8	6	7	18	0.25	64x123	VG2A333#D123
		12.1	59.3	6	7	20	0.25	77x95	VG2A333#E095
	39 000	13.1	64.2	5	7	20	0.25	77x108	VG2A393#E108
		11.3	55.4	5	7	20	0.25	90x68	VG2A393#F068
	47 000	14.7	72.0	5	7	20	0.25	77x124	VG2A473#E124
		15.2	74.5	5	7	20	0.25	90x97	VG2A473#F097
	56 000	16.5	80.9	4	6	20	0.25	90x110	VG2A563#F110
160 VDC Code: 2C Surge Voltage 200 VDC	8 200	5.8	28.4	18	19	18	0.25	64x94	VG2C822#D094
	10 000	6.4	31.4	15	16	18	0.25	64x107	VG2C103#D107
	15 000	8.1	39.7	14	14	18	0.25	64x123	VG2C153#D123
		9.1	44.6	14	14	20	0.25	77x95	VG2C153#E095

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Rated Voltage Code (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	18 000	8.7	42.6	12	12	18	0.25	64x147	VG2C183#D147
		9.9	48.5	12	12	20	0.25	77x108	VG2C183#E108
	22 000	11.2	54.9	10	10	20	0.25	77x124	VG2C223#E124
		12.7	62.2	10	10	20	0.25	90x97	VG2C223#F097
	27 000	12.2	59.8	8	8	20	0.25	77x148	VG2C273#E148
		14.0	68.6	8	8	20	0.25	90x110	VG2C273#F110
200 VDC Code: 2D Surge Voltage 250 VDC	33 000	15.3	75.0	7	7	20	0.25	90x126	VG2C333#F126
	2 200	2.8	13.7	68	60	17	0.25	51x75	VG2D222#C075
	6 800	5.3	26.0	21	20	18	0.25	64x94	VG2D682#D094
	10 000	6.4	31.4	14	14	18	0.25	64x110	VG2D103#D110
	12 000	7.2	35.3	12	12	18	0.25	64x123	VG2D123#D123
		8.1	39.7	12	12	20	0.25	77x95	VG2D123#E095
	15 000	7.9	38.7	10	10	18	0.25	64x147	VG2D153#D147
		9.1	44.6	10	10	20	0.25	77x108	VG2D153#E108
		10.5	51.5	10	10	20	0.25	90x97	VG2D153#F097
	18 000	10.2	50.0	8	8	20	0.25	77x124	VG2D183#E124
		11.4	55.9	8	8	20	0.25	90x110	VG2D183#F110
250 VDC Code: 2E Surge Voltage 300 VDC	4 700	4.4	21.6	25	23	18	0.25	64x94	VG2E472#D094
	5 600	4.8	23.5	21	20	18	0.25	64x107	VG2E562#D107
	8 200	6.0	29.4	15	15	18	0.25	64x123	VG2E822#D123
		6.7	32.8	15	15	20	0.25	77x95	VG2E822#E095
	10 000	6.5	31.9	13	13	18	0.25	64x147	VG2E103#D147
		7.4	36.3	13	13	20	0.25	77x108	VG2E103#E108
	12 000	8.3	40.7	11	11	20	0.25	77x124	VG2E123#E124
		9.4	46.1	11	11	20	0.25	90x97	VG2E123#F097
	15 000	9.1	44.6	9	9	20	0.25	77x148	VG2E153#E148
		10.3	50.5	9	9	20	0.25	90x126	VG2E153#F126
350 VDC Code: 2V Surge Voltage 400 VDC	3 900	10.5	28.4	27	32	18	0.20	64x94	VG2V392#D094
	4 700	11.9	32.1	22	23	18	0.20	64x107	VG2V472#D107
	5 600	13.0	35.1	20	21	18	0.20	64x123	VG2V562#D123
		14.6	39.4	20	21	20	0.20	77x95	VG2V562#E095
	6 800	14.1	38.1	18	18	18	0.20	64x147	VG2V682#D147
		16.0	43.2	18	18	20	0.20	77x108	VG2V682#E108
		18.5	50.0	18	18	20	0.20	90x97	VG2V682#F097
	8 200	15.9	42.9	15	17	18	0.20	64x187	VG2V822#D187
		18.0	48.6	15	17	20	0.20	77x124	VG2V822#E124
		20.2	54.5	15	17	20	0.20	90x110	VG2V822#F110
	10 000	19.5	52.7	12	15	20	0.20	77x148	VG2V103#E148
		22.1	59.7	12	15	20	0.20	90x126	VG2V103#F126
	12 000	21.8	58.9	10	13	20	0.20	77x188	VG2V123#E188
		24.1	65.1	10	13	20	0.20	90x150	VG2V123#F150
	15 000	25.2	68.0	8	11	20	0.20	77x228	VG2V153#E228
		26.5	71.6	8	11	20	0.20	90x167	VG2V153#F167
	18 000	29.3	79.1	6	9	20	0.20	90x190	VG2V183#F190
	22 000	31.5	85.1	5	7	20	0.20	90x230	VG2V223#F230
400 VDC Code: 2G Surge Voltage 450 VDC	2 700	8.8	23.8	38	40	18	0.20	64x94	VG2G272#D094
	3 300	9.7	26.2	30	35	18	0.20	64x94	VG2G332#D094
	3 900	10.8	29.2	27	32	18	0.20	64x107	VG2G392#D107
	4 700	11.9	32.1	22	23	18	0.20	64x123	VG2G472#D123
		13.3	35.9	22	23	20	0.20	77x95	VG2G472#E095

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	12.8	34.6	20	21	18	0.20	64x147	VG2G562#D147
		14.5	39.2	20	21	20	0.20	77x108	VG2G562#E108
		16.8	45.4	20	21	20	0.20	90x97	VG2G562#F097
	6 800	14.5	39.2	18	18	18	0.20	64x187	VG2G682#D187
		16.4	44.3	18	18	20	0.20	77x124	VG2G682#E124
		16.5	44.6	18	18	20	0.20	90x93	VG2G682#F093
		18.4	49.7	18	18	20	0.20	90x110	VG2G682#F110
	8 200	18.0	48.6	15	17	20	0.20	77x165	VG2G822#E165
		20.0	54.0	15	17	20	0.20	90x126	VG2G822#F126
	10 000	19.9	53.7	12	15	20	0.20	77x188	VG2G103#E188
		22.0	59.4	12	15	20	0.20	90x150	VG2G103#F150
	12 000	23.7	64.0	10	13	20	0.20	90x167	VG2G123#F167
	15 000	26.7	72.1	8	11	20	0.20	90x190	VG2G153#F190
	18 000	28.5	77.0	7	9	20	0.20	90x230	VG2G183#F230
450 VDC Code: 2W Surge Voltage 500 VDC	2 700	9.0	24.3	42	42	18	0.20	64x94	VG2W272#D094
	3 300	10.2	27.5	35	40	18	0.20	64x107	VG2W332#D107
		11.4	30.8	35	40	20	0.20	77x95	VG2W332#E095
	3 900	10.9	29.4	27	32	18	0.20	64x147	VG2W392#D147
		12.4	33.5	27	32	20	0.20	77x108	VG2W392#E108
	4 700	12.2	32.9	24	27	18	0.20	64x164	VG2W472#D164
		13.9	37.5	24	27	20	0.20	77x124	VG2W472#E124
		15.8	42.7	24	27	20	0.20	90x97	VG2W472#F097
	5 600	14.9	40.2	24	23	20	0.20	77x148	VG2W562#E148
		17.1	46.2	24	23	20	0.20	90x110	VG2W562#F110
	6 800	16.8	45.4	20	20	20	0.20	77x165	VG2W682#E165
		18.7	50.5	20	20	20	0.20	90x126	VG2W682#F126
	8 200	18.5	50.0	18	18	20	0.20	77x188	VG2W822#E188
		20.4	55.1	18	18	20	0.20	90x150	VG2W822#F150
	10 000	20.3	54.8	15	15	20	0.20	77x188	VG2W103#E188
		22.5	60.8	15	15	20	0.20	90x150	VG2W103#F150
		22.2	59.9	15	15	20	0.20	90x167	VG2W103#F167
	12 000	24.5	66.2	13	12	20	0.20	90x190	VG2W123#F190
	14 000	26.3	71.0	11	11	20	0.20	90x190	VG2W143#F190
	15 000	26.6	71.8	10	10	20	0.20	90x230	VG2W153#F230
500 VDC Code: 2H Surge Voltage 550 VDC	1 500	6.5	17.6	74	80	18	0.20	64x107	VG2H152#D107
	1 800	7.2	19.4	62	50	18	0.20	64x123	VG2H182#D123
		8.0	21.6	62	50	20	0.20	77x95	VG2H182#E095
	2 200	7.8	21.1	53	50	18	0.20	64x147	VG2H222#D147
		8.9	24.0	53	50	20	0.20	77x108	VG2H222#E108
	2 700	8.8	23.8	40	35	18	0.20	64x164	VG2H272#D164
		11.4	30.8	40	35	20	0.20	90x97	VG2H272#F097
	3 300	9.8	26.5	38	32	18	0.20	64x187	VG2H332#D187
		11.1	30.0	38	32	20	0.20	77x124	VG2H332#E124
		12.5	33.8	38	32	20	0.20	90x110	VG2H332#F110
	3 900	11.9	32.1	30	27	20	0.20	77x148	VG2H392#E148
		13.5	36.5	30	27	20	0.20	90x126	VG2H392#F126
	4 700	13.3	35.9	25	20	20	0.20	77x165	VG2H472#E165
		14.7	39.7	25	20	20	0.20	90x150	VG2H472#F150
	5 600	14.6	39.4	20	17	20	0.20	77x188	VG2H562#E188
		15.8	42.7	20	17	20	0.20	90x167	VG2H562#F167
	6 800	17.5	47.3	17	17	20	0.20	90x190	VG2H682#F190
	8 200	18.8	50.8	14	14	20	0.20	90x230	VG2H822#F230

* Please contact us if load condition exceeds terminals related $I_{r\max}$ referred on page 9

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> Ripple Current Multiplier · Wechselstrommultiplikator

Frequency [Hz]	50/60	120	300	1k	≥ 10k	Forced cooling [m/sec]	v < 0.5	v ≥ 0.5	v ≥ 2.0	v ≥ 3.0
Multiplier	0.80	1.00	1.18	1.34	1.45	Multiplier	1.00	1.10	1.20	1.25

Ta (°C)	40	50	60	65	70	75	80	85	90	95	100	105
Multiplier 25-250 VDC	4.9	4.2	3.6	3.2	3.0	2.4	2.1	1.8	1.6	1.4	1.2	1.0
Multiplier 350-500 VDC	2.7	2.6	2.5	2.4	2.3	2.2	2.1	2.0	1.7	1.4	1.2	1.0

> Life Time Table · Brauchbarkeitsdauer – Tabelle

VG 25-250 VDC	Useful life as function of ambient temperature and ripple current											
I _r at 105°C	x 1.0	x 1.4	x 1.8	x 2.1	x 2.4	x 2.8	x 3.2	x 3.6	x 3.9	x 4.2	x 4.5	x 4.9
T _a = 40°C	250	250	250	250	250	250	250	250	250	250	207	127
T _a = 45°C	250	250	250	250	250	250	250	250	250	183	130	
T _a = 50°C	250	250	250	250	250	250	250	211	158	115		
T _a = 55°C	250	250	250	250	250	250	189	133	100			
T _a = 60°C	250	250	250	250	212	162	119	84				
T _a = 65°C	247	218	185	159	134	102	75					
T _a = 70°C	156	138	117	101	85	65						
T _a = 75°C	99	87	74	63	53							
T _a = 80°C	62	55	46	40								
T _a = 85°C	39	35	29									
T _a = 90°C	25	22										
T _a = 95°C	15	14										
T _a = 100°C	10											
T _a = 105°C	6											

Max. value limited to 250 000 hours.

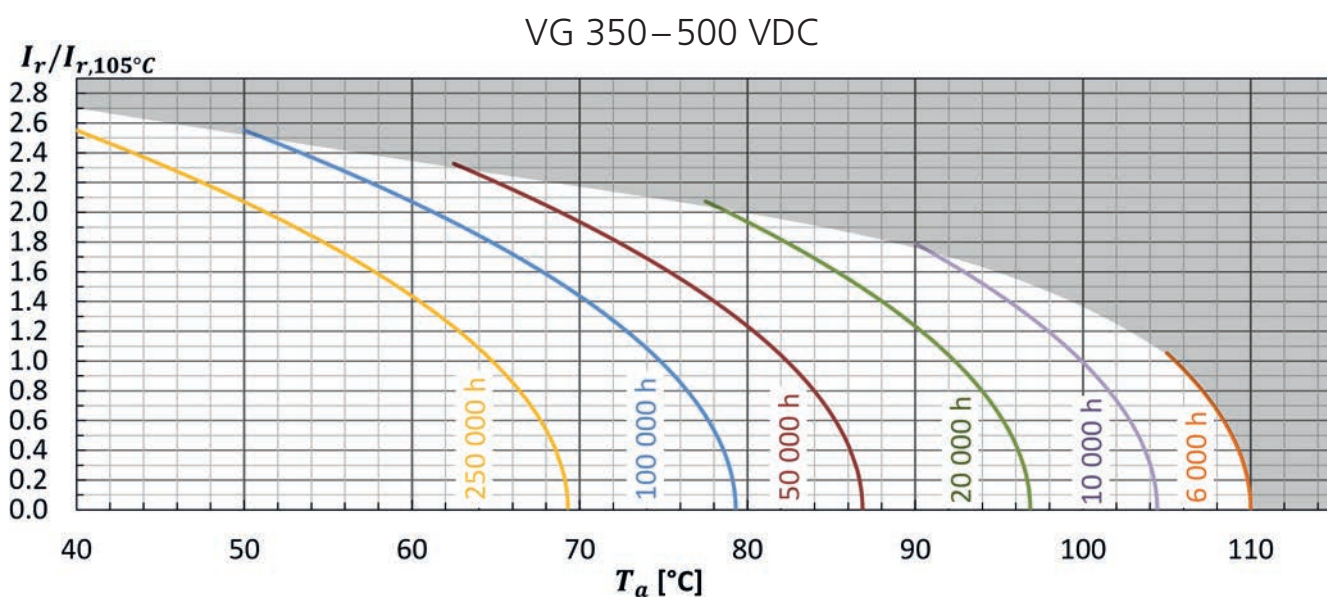
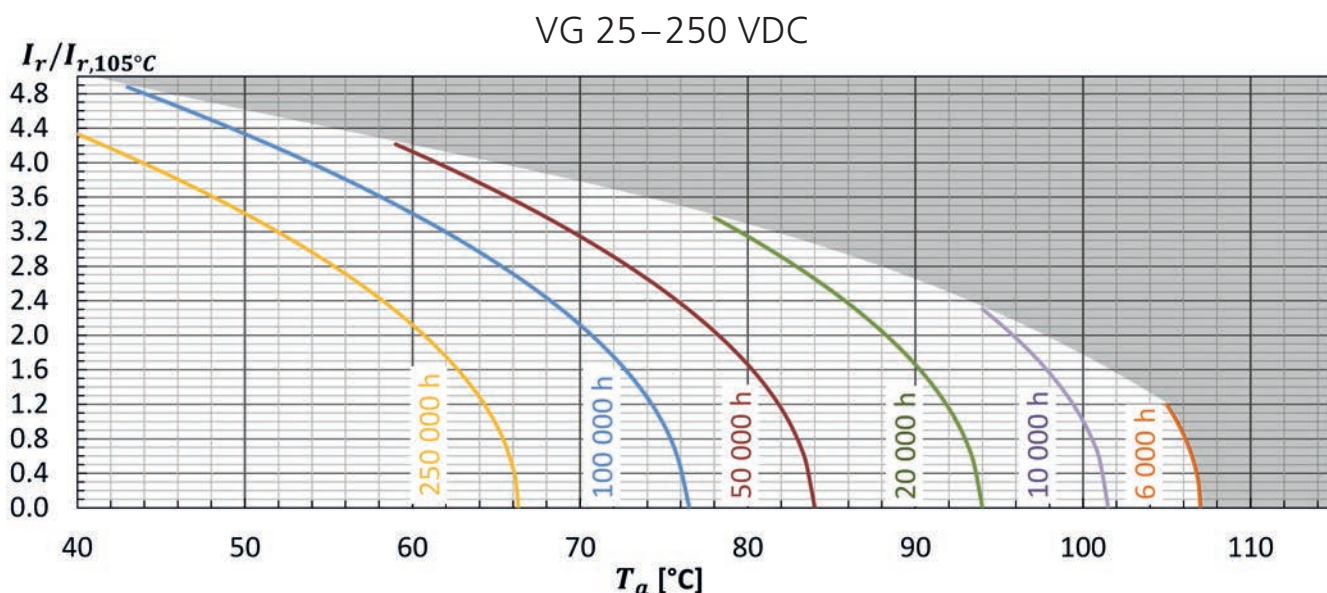
VG 350-500 VDC	Useful life as function of ambient temperature and ripple current											
I _r at 105°C	x 1.0	x 1.2	x 1.4	x 1.7	x 2.0	x 2.1	x 2.2	x 2.3	x 2.4	x 2.5	x 2.6	x 2.7
T _a = 40°C	250	250	250	250	250	250	250	250	250	250	225	181
T _a = 45°C	250	250	250	250	250	250	250	250	215	176	142	
T _a = 50°C	250	250	250	250	250	237	199	165	136	111		
T _a = 55°C	250	250	250	250	178	150	125	104	86			
T _a = 60°C	250	250	250	177	112	95	79	66				
T _a = 65°C	245	204	165	112	71	60	50					
T _a = 70°C	155	129	104	71	45	38	31					
T _a = 75°C	98	81	66	45	28	24						
T _a = 80°C	62	51	41	28	18							
T _a = 85°C	39	32	26	18	11							
T _a = 90°C	24	20	16	11								
T _a = 95°C	15	13	10									
T _a = 100°C	9	8										
T _a = 105°C	6											

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 $I_{r, 105^\circ\text{C}, 120\text{Hz}}$

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



> Life Time Tests and Requirements · Anforderungen Brauchbarkeitsdauer

Life time test	Test procedure	Life time criteria
Endurance test	$T_a = 105^\circ\text{C}$; V_r , I_r applied 4000 hours	$\Delta C/C \leq 10\%$ (of initial value) $\tan\delta \leq 175\%$ (of specified value) $I_L \leq \text{specified value}$
Useful life	$T_a = 105^\circ\text{C}$; V_r , I_r applied 6000 hours	$\Delta C/C \leq 15\%$ (of initial value) $\tan\delta < 200\%$ (of specified value) $I_L \leq \text{specified value}$

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

VGL · Screw-Terminal · 12000 h/105°C

Long Life · Bottom cooling design

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

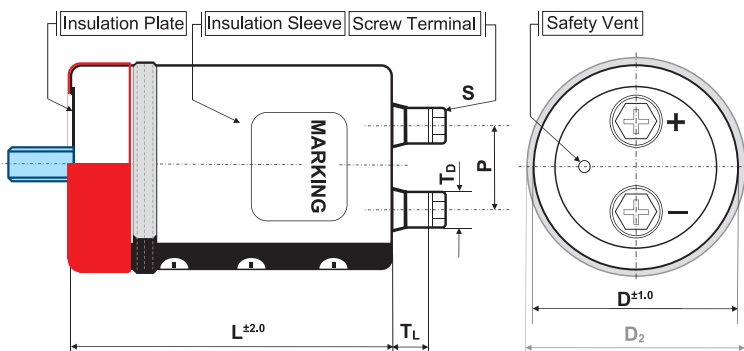
Items	Characteristics
Temperature range	-40°C ~ + 105°C
Capacitance tolerance (at 20°C)	Standard +/- 20%, -10/+30% on request
Surge voltage / Ripple voltage	Repetitive max. 30 sec per 6 Minutes / ≤ 50V
Leakage current max. I_L (20°C, 5 min)	0.01 • C • V_r [μA] or 5 mA, which is smaller.
Useful life	12 000 hours at 105°C
Field failure rate	0.5 FIT = 0.5 • 10 ⁻⁹ Failures/hour
RoHS conform	Directive 2011/65/EU & (EU)2015/863
Specification / Vibration	JIS C 5101-4/0.75mm, 10...55Hz, 10g, 3x2h
Outer materials	UL94-V0/UL224-VW1 certified (cap/sleeve)
Sleeve withstanding voltage	4000 Vac / 1min between terminals bundled and plate*

* Typical value



> Shape designation · Formbezeichnung

- for details refer to p. 8–9 · technische Details siehe S. 8–9
- for mounting options refer to p. 149ff · Montageoptionen siehe S. 149ff



	B	I/Y	N	N+WC
outer sleeve	•	•	•	•
insulation plate	•	•	•	
stud bolt	•			
bottom double sleeve		•		
integrated seating ring				•

ØD	available shape	P	S	T _L	T _D	Cap material
64	B, N, I, Y	28.6	M5x10	8.0	11	PH
77	B, N, I, Y, WC	31.5	M5x10	8.0	11	PH
			M6x12	9.0	12	PH
90	B, N, I, Y, WC	31.5	M5x10	7.0	11	PH
			M6x12	8.0	12	PH

Size in mm. First listed terminal is standard.

> Product Code · Bestellbezeichnung

Example: Series VGL · 15000 μF +/- 20 % · 400 V · D=90 mm · L=190 mm with Y-Bracket

VGL	2G	153	Y	F	190								
Type of series	Capacitance code		Fixing symbol code	Case code diameter	Specific features (e.g. M6 ...)								
	The first two digits are significant. The last digit indicates the number of following zeros in µF.		B : Bolt N : single outer sleeve I : 2 Stoppers Bracket Y : 3 Stoppers Bracket N + suffix WC: blank bottom + seating ring	<table><tr><th>ØD</th><th>Code</th></tr><tr><td>64</td><td>D</td></tr><tr><td>77</td><td>E</td></tr><tr><td>90</td><td>F</td></tr></table>	ØD	Code	64	D	77	E	90	F	
ØD	Code												
64	D												
77	E												
90	F												
Rated voltage code				Capacitance tolerance	Case Code length								
Code	Voltage	Code	Voltage	Ø : ± 20 % Q : -10 % ~ + 30 %	Length in mm (3 digits)								
2V	350	2W	450										
2G	400	2H	500										

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
350 VDC Code: 2V Surge Voltage 400 VDC	3 900	10.5	28.4	27	32	18	0.20	64x94	VGL2V392#D094
	4 700	11.9	32.1	22	23	18	0.20	64x107	VGL2V472#D107
	5 600	13.0	35.1	20	21	18	0.20	64x123	VGL2V562#D123
		14.6	39.4	20	21	20	0.20	77x95	VGL2V562#E095
	6 800	14.1	38.1	18	18	18	0.20	64x147	VGL2V682#D147
		16.0	43.2	18	18	20	0.20	77x108	VGL2V682#E108
		18.5	50.0	18	18	20	0.20	90x97	VGL2V682#F097
	8 200	15.9	42.9	15	17	18	0.20	64x187	VGL2V822#D187
		18.0	48.6	15	17	20	0.20	77x124	VGL2V822#E124
		20.2	54.5	15	17	20	0.20	90x110	VGL2V822#F110
	10 000	19.5	52.7	12	15	20	0.20	77x148	VGL2V103#E148
		22.1	59.7	12	15	20	0.20	90x126	VGL2V103#F126
	12 000	21.8	58.9	10	13	20	0.20	77x188	VGL2V123#E188
		24.1	65.1	10	13	20	0.20	90x150	VGL2V123#F150
	15 000	25.2	68.0	8	11	20	0.20	77x228	VGL2V153#E228
		26.5	71.6	8	11	20	0.20	90x167	VGL2V153#F167
	18 000	29.3	79.1	6	9	20	0.20	90x190	VGL2V183#F190
	22 000	31.5	85.1	5	7	20	0.20	90x230	VGL2V223#F230
400 VDC Code: 2G Surge Voltage 450 VDC	3 300	9.7	26.2	30	35	18	0.20	64x94	VGL2G332#D094
	3 900	10.8	29.2	27	32	18	0.20	64x107	VGL2G392#D107
	4 700	11.9	32.1	22	23	18	0.20	64x123	VGL2G472#D123
		13.3	35.9	22	23	20	0.20	77x95	VGL2G472#E095
	5 600	12.8	34.6	20	21	18	0.20	64x147	VGL2G562#D147
		14.5	39.2	20	21	20	0.20	77x108	VGL2G562#E108
		16.8	45.4	20	21	20	0.20	90x97	VGL2G562#F097
	6 800	14.5	39.2	18	18	18	0.20	64x187	VGL2G682#D187
		16.4	44.3	18	18	20	0.20	77x124	VGL2G682#E124
		18.4	49.7	18	18	20	0.20	90x110	VGL2G682#F110
	8 200	18.0	48.6	15	17	20	0.20	77x165	VGL2G822#E165
		20.0	54.0	15	17	20	0.20	90x126	VGL2G822#F126
	10 000	19.9	53.7	12	15	20	0.20	77x188	VGL2G103#E188
		22.0	59.4	12	15	20	0.20	90x150	VGL2G103#F150
	12 000	23.7	64.0	10	13	20	0.20	90x167	VGL2G123#F167
	15 000	26.7	72.1	8	11	20	0.20	90x190	VGL2G153#F190
	18 000	28.5	77.0	7	9	20	0.20	90x230	VGL2G183#F230
450 VDC Code: 2W Surge Voltage 500 VDC	2 200	8.1	21.9	42	42	18	0.20	64x94	VGL2W222#D094
	2 700	9.2	24.8	42	42	18	0.20	64x107	VGL2W272#D107
	3 300	10.2	27.5	35	40	18	0.20	64x123	VGL2W332#D123
		11.4	30.8	35	40	20	0.20	77x95	VGL2W332#E095
	3 900	10.9	29.4	27	32	18	0.20	64x147	VGL2W392#D147
		12.4	33.5	27	32	20	0.20	77x108	VGL2W392#E108
		12.2	32.9	24	27	18	0.20	64x164	VGL2W472#D164
	4 700	13.9	37.5	24	27	20	0.20	77x124	VGL2W472#E124
		15.8	42.7	24	27	20	0.20	90x97	VGL2W472#F097

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
450 VDC Code: 2W Surge Voltage 500 VDC	5 600	13.5	36.5	24	23	18	0.20	64x187	VGL2W562#D187
		14.9	40.2	22	23	20	0.20	77x148	VGL2W562#E148
		17.1	46.2	22	23	20	0.20	90x110	VGL2W562#F110
	6 800	16.8	45.4	20	20	20	0.20	77x165	VGL2W682#E165
		18.7	50.5	20	20	20	0.20	90x126	VGL2W682#F126
	8 200	18.5	50.0	18	18	20	0.20	77x188	VGL2W822#E188
		20.4	55.1	18	18	20	0.20	90x150	VGL2W822#F150
	10 000	20.4	55.1	15	15	20	0.20	77x188	VGL2W103#E188
		22.2	59.9	15	15	20	0.20	90x167	VGL2W103#F167
	12 000	24.5	66.2	13	12	20	0.20	90x190	VGL2W123#F190
500 VDC Code: 2H Surge Voltage 550 VDC	1 500	6.5	17.6	74	80	18	0.20	64x107	VGL2H152#D107
	1 800	7.2	19.4	62	50	18	0.20	64x123	VGL2H182#D123
		8.0	21.6	62	50	20	0.20	77x95	VGL2H182#E095
	2 200	7.8	21.1	53	50	18	0.20	64x147	VGL2H222#D147
		8.9	24.0	53	50	20	0.20	77x108	VGL2H222#E108
	2 700	8.8	23.8	40	35	18	0.20	64x164	VGL2H272#D164
		11.4	30.8	40	35	20	0.20	90x97	VGL2H272#F097
		9.8	26.5	38	32	18	0.20	64x187	VGL2H332#D187
	3 300	11.1	30.0	38	32	20	0.20	77x124	VGL2H332#E124
		12.5	33.8	38	32	20	0.20	90x110	VGL2H332#F110
		11.9	32.1	30	27	20	0.20	77x148	VGL2H392#E148
	3 900	13.5	36.5	30	27	20	0.20	90x126	VGL2H392#F126
		13.3	35.9	25	20	20	0.20	77x165	VGL2H472#E165
	4 700	14.7	39.7	25	20	20	0.20	90x150	VGL2H472#F150
		14.6	39.4	20	17	20	0.20	77x188	VGL2H562#E188
		15.8	42.7	20	17	20	0.20	90x167	VGL2H562#F167
	6 800	17.5	47.3	17	17	20	0.20	90x190	VGL2H682#F190
	8 200	18.8	50.8	14	14	20	0.20	90x230	VGL2H822#F230

Additional designs on request · Weitere Designs auf Anfrage

> Ripple Current Multiplier · Wechselstrommultiplikator

Frequency [Hz]	50/60	120	300	1k	≥ 10k	Forced cooling [m/sec]	v < 0.5	v ≥ 0.5	v ≥ 2.0	v ≥ 3.0
Multiplier	0.80	1.00	1.18	1.34	1.45	Multiplier	1.00	1.10	1.20	1.25

Ta (°C)	40	50	60	65	70	75	80	85	90	95	100	105
Multiplier	2.7	2.6	2.5	2.4	2.3	2.2	2.1	2.0	1.8	1.4	1.2	1.0

> Life Time Table · Brauchbarkeitsdauer – Tabelle

VGL	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 2.1	x 2.2	x 2.3	x 2.4	x 2.5	x 2.6	x 2.7
$T_a = 40^\circ\text{C}$	250	250	250	250	250	250	250	250	250	250	250	250
$T_a = 45^\circ\text{C}$	250	250	250	250	250	250	250	250	250	250	250	
$T_a = 50^\circ\text{C}$	250	250	250	250	250	250	250	250	250	222		
$T_a = 55^\circ\text{C}$	250	250	250	250	250	250	250	209	172			
$T_a = 60^\circ\text{C}$	250	250	250	250	225	190	159	132				
$T_a = 65^\circ\text{C}$	250	250	250	225	142	120	100					
$T_a = 70^\circ\text{C}$	250	250	208	142	90	76	63					
$T_a = 75^\circ\text{C}$	196	163	132	90	56	48						
$T_a = 80^\circ\text{C}$	124	103	83	56	36							
$T_a = 85^\circ\text{C}$	78	65	52	36	22							
$T_a = 90^\circ\text{C}$	49	41	33	22								
$T_a = 95^\circ\text{C}$	31	26	21									
$T_a = 100^\circ\text{C}$	19	16										
$T_a = 105^\circ\text{C}$	12											

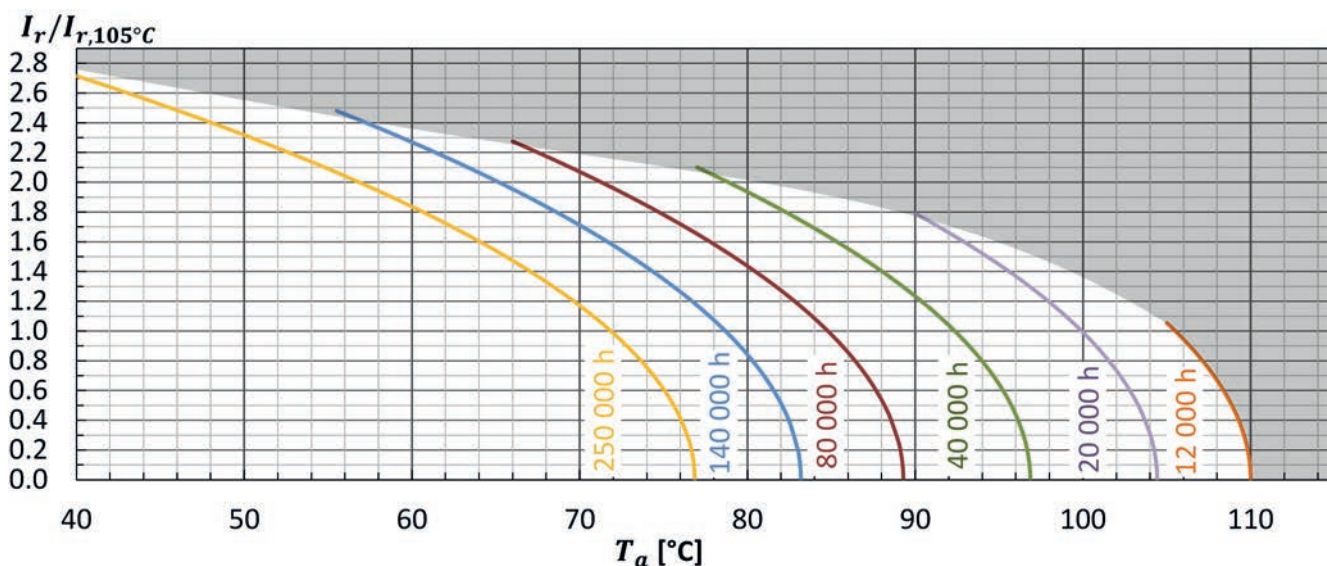
khrs

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



> Life Time Tests and Requirements · Anforderungen Brauchbarkeitsdauer

Life time test	Test procedure	Life time criteria
Endurance test	$T_a = 105^\circ\text{C}$; V_r , I_r applied 8000 hours	$\Delta C/C \leq 10\%$ (of initial value) $\tan\delta \leq 175\%$ (of specified value) $I_L \leq$ specified value
Useful life	$T_a = 105^\circ\text{C}$; V_r , I_r applied 12000 hours	$\Delta C/C \leq 15\%$ (of initial value) $\tan\delta < 200\%$ (of specified value) $I_L \leq$ specified value

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

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

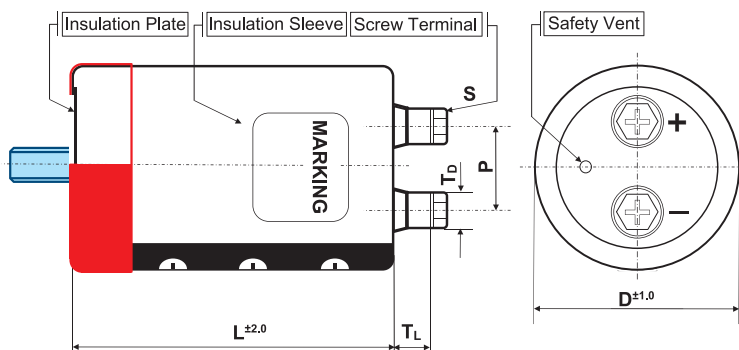
Items	Characteristics
Temperature range	-40°C ~ + 105°C
Capacitance tolerance	Standard +/- 20%, -10/+30% on request
Surge voltage	Repetitive max. 30 sec per 6 Minutes / ≤ 50V
Leakage current max. I_L (20°C, 5 min)	0.01 • C • V_r [μA] or 3 mA, which is smaller.
Useful life	6 000 hours at 105°C
Field failure rate	0.5 FIT = 0.5 • 10 ⁻⁹ Failures/hour
RoHS conform	Directive 2011/65/EU & (EU)2015/863
Specification / Vibration	JIS C 5101-4/0.75mm, 10...55Hz, 10g, 3x2h
Outer materials	UL94-V0/UL224-VW1 certified (cap/sleeve)
Sleeve withstanding voltage	4000 Vac / 1min between terminals bundled and plate*

* Typical value



> Shape designation · Formbezeichnung

- for details refer to p. 8–9 · technische Details siehe S. 8–9
- for mounting options refer to p. 149 ff · Montageoptionen siehe S. 149 ff



	B	I/Y	N
outer sleeve	•	•	•
insulation plate	•	•	•
stud bolt	•		
bottom double sleeve		•	

ØD	available shape	P	S	T _L	T _D	Cap material
36	B, N, I	12.7	M5x10	6.5	8	PH
51	B, N, I, Y	22.0	M5x10	5.5	10	PH
64	B, N, I, Y	28.6	M5x10	5.5	10	PH
77	B, N, I, Y	31.5	M5x10	5.0	10	PH
			M6x12	4.5	17.2	PH
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.

> Product Code · Bestellbezeichnung

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

HCGH

Type of series

2E

Capacitance code

The first two digits are significant. The last digit indicates the number of following zeros in μF.

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		

Y

Fixing symbol code

- B : Bolt
- N : single outer sleeve
- I : 2 Stoppers Bracket
- Y : 3 Stoppers Bracket

Capacitance tolerance

Ø : ± 20 %

Q : -10 % ~ +30 %

D

Case code diameter

ØD	Code
36	A
51	C
64	D
77	E
90	F

115 (PH)

Specific features (e.g. M6 ...)

Case Code length

Length in mm (3 digits)

HCGH · Screw-Terminal · 6000 h/105 °C

Rated Voltage Code (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
	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

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
63 VDC Code: 1J Surge Voltage 79 VDC	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
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
	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	14	14	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

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
200 VDC Code: 2D Surge Voltage 250 VDC	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
		7.1	27.0	30	32	18	0.15	64x130	HCGH2G332#D130PH
	3 300	6.9	26.2	30	32	20	0.15	77x105	HCGH2G332#E105PH
		8.3	31.5	26	28	18	0.15	64x155	HCGH2G392#D155PH
	3 900	7.8	29.6	26	28	20	0.15	77x115	HCGH2G392#E115PH
		10.0	38.0	21	22	18	0.15	64x195	HCGH2G472#D195PH
	4 700	9.0	34.2	21	22	20	0.15	77x130	HCGH2G472#E130PH
		11.0	41.8	18	19	18	0.15	64x195	HCGH2G562#D195PH
	5 600	10.6	40.3	18	19	20	0.15	77x155	HCGH2G562#E155PH
		11.6	44.1	18	18	20	0.15	77x155	HCGH2G682#E155PH
	6 800	12.3	46.7	15	15	20	0.15	90x157	HCGH2G682#F157PH
		13.2	50.2	12	15	20	0.15	77x171	HCGH2G822#E171PH
	8 200	13.6	51.7	12	15	20	0.15	90x157	HCGH2G822#F157PH
		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_{rmax} referred on page 9

Additional designs on request · Weitere Designs auf Anfrage

> Ripple Current Multiplier · Wechselstrommultiplikator

Frequency [Hz]	50/60	120	300	1k	≥ 10k	Forced cooling [m/sec]	v < 1.0	v ≥ 1.0
Multiplier	0.80	1.00	1.18	1.34	1.45	Multiplier	1.0	1.1

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

> Life Time Table · Brauchbarkeitsdauer – Tabelle

HCGH V _r ≤ 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													

Max. value limited to 250 000 hours.

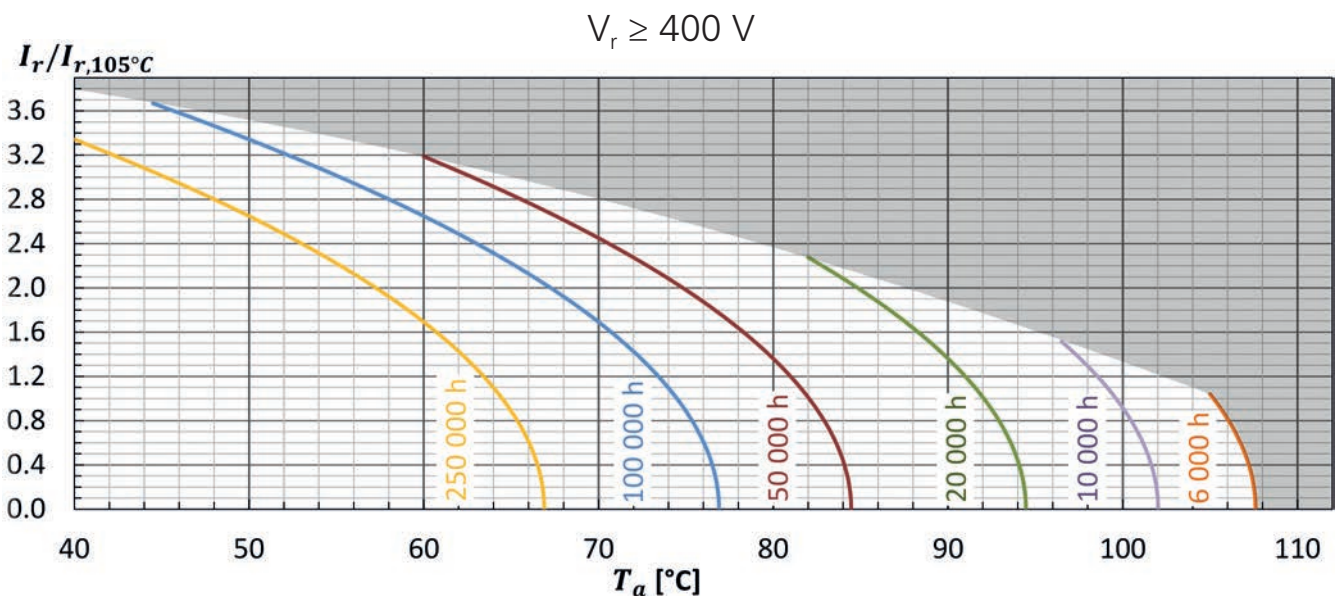
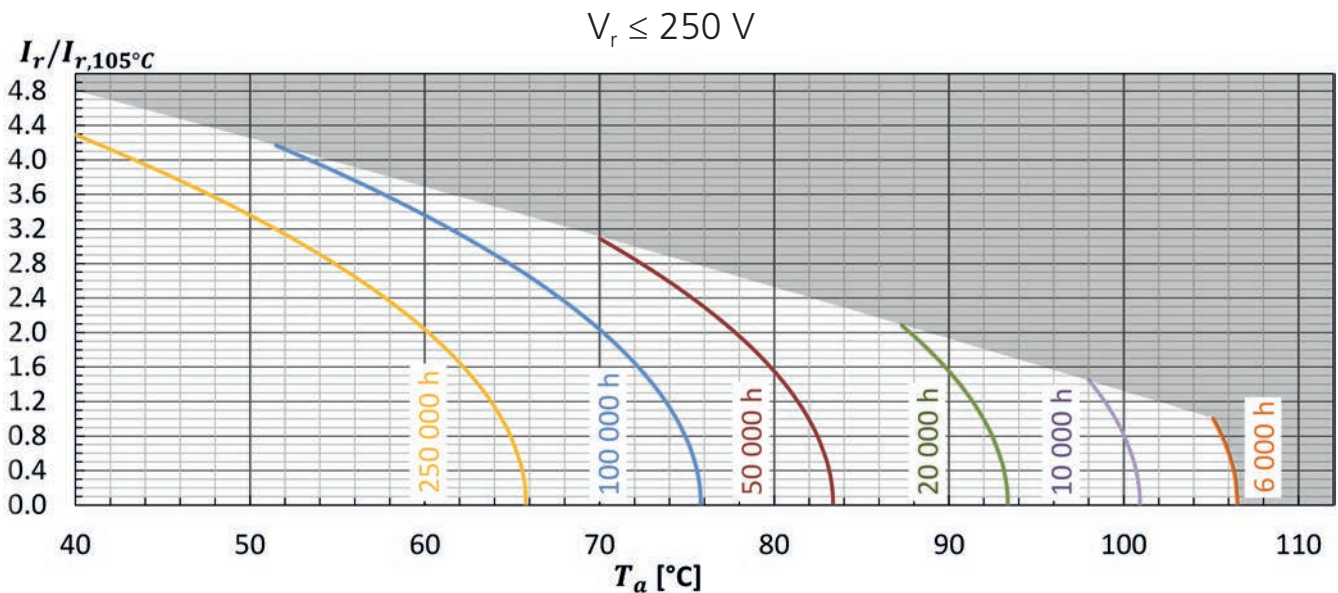
HCGH V _r ≥ 400V	Useful life as function of ambient temperature and ripple current													
I _r at 105°C	x 1.0	x 1.4	x 1.7	x 2.0	x 2.2	x 2.4	x 2.6	x 2.8	x 3.0	x 3.2	x 3.3	x 3.5	x 3.6	x 3.8
T _a = 40°C	250	250	250	250	250	250	250	250	250	250	229	168	143	121
T _a = 45°C	250	250	250	250	250	250	250	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													

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 $I_{r, 105^\circ\text{C}, 120\text{Hz}}$

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



> Life Time Tests and Requirements · Anforderungen Brauchbarkeitsdauer

Life time test	Test procedure	Life time criteria
Endurance test	$T_a = 105^\circ\text{C}$; V_r , I_r applied 4000 hours	$\Delta C/C \leq 10\%$ (of initial value) $\tan\delta \leq 175\%$ (of specified value) $I_L \leq \text{specified value}$
Useful life	$T_a = 105^\circ\text{C}$; V_r , I_r applied 6000 hours	$\Delta C/C \leq 15\%$ (of initial value) $\tan\delta < 200\%$ (of specified value) $I_L \leq \text{specified value}$

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

VGR · Screw-Terminal · 6000 h/105 °C

High Ripple Current · Bottom cooling design · Low ESR

> Specifications · Spezifikationen

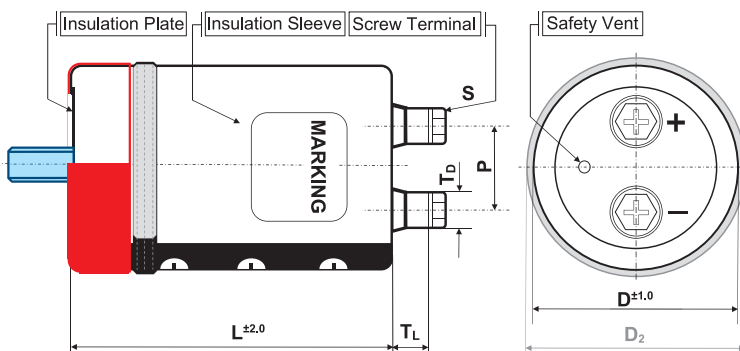
Items	Characteristics
Temperature range	-40°C ~ + 105°C
Capacitance tolerance (at 20°C)	Standard +/- 20%, -10/+30% on request
Surge voltage / Ripple voltage	Repetitive max. 30 sec per 6 Minutes / ≤ 70V
Leakage current max. I_L (20°C, 5 min)	$0.01 \cdot C \cdot V_r$ [μA] or 5 mA, which is smaller.
Useful life	6 000 hours at 105°C
Field failure rate	0.5 FIT = $0.5 \cdot 10^{-9}$ Failures/hour
RoHS conform	Directive 2011/65/EU & (EU)2015/863
Specification / Vibration	JIS C 5101-4/0.75mm, 10...55Hz, 10g, 3x2h
Outer materials	UL94-V0/UL224-VW1 certified (cap/sleeve)
Sleeve withstanding voltage	4000 Vac / 1min between terminals bundled and plate*

* Typical value



> Shape designation · Formbezeichnung

- for details refer to p. 8–9 · technische Details siehe S. 8–9
- for mounting options refer to p. 149 ff · Montageoptionen siehe S. 149 ff



	B	I/Y	N	N+WC
outer sleeve	•	•	•	•
insulation plate	•	•	•	
stud bolt	•			
bottom double sleeve		•		
integrated seating ring				•

ØD	available shape	P	S	T _L	T _D	Cap material
64	B, N, I, Y	28.6	M5x10	8.0	11	PH
77	B, N, I, Y, WC	31.5	M6x12	9.0	12	PH
90	B, N, I, Y, WC	31.5	M6x12	8.0	12	PH

Size in mm

> Product Code · Bestellbezeichnung

Example: Series VGR · 12000 μF +/- 20 % · 400 V · D=90 mm · L=190 mm with Y-Bracket

VGR

Type of series

2G

Capacitance code

The first two digits are significant.
The last digit indicates the number of following zeros in μF.

123

Rated voltage code

Code	Voltage	Code	Voltage
2V	350	2W	450
2G	400	2H	500

Y

Fixing symbol code

B : Bolt
N : single outer sleeve
I : 2 Stoppers Bracket
Y : 3 Stoppers Bracket
N + suffix WC: blank bottom + seating ring

F

Case code diameter

ØD	Code
64	D
77	E
90	F

Capacitance tolerance

Ø : ± 20 %
Q : - 10 % ~ + 30 %

190

Specific features

Case Code length

Length in mm (3 digits)

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
350 VDC Code: 2V Surge Voltage 400 VDC	3 300	15.1	34.7	16	19	18	0.20	64x107	VGR2V332#D107
	3 900	16.8	38.6	14	16	18	0.20	64x123	VGR2V392#D123
	4 700	18.2	41.9	11	13	18	0.20	64x147	VGR2V472#D147
		20.6	47.4	11	13	20	0.20	77x108	VGR2V472#E108
	5 600	20.3	46.7	10	11	18	0.20	64x164	VGR2V562#D164
		23.1	53.1	10	11	20	0.20	77x124	VGR2V562#E124
	6 800	22.6	52.0	8	10	18	0.20	64x187	VGR2V682#D187
		24.9	57.3	8	10	20	0.20	77x148	VGR2V682#E148
		28.6	65.8	8	10	20	0.20	90x110	VGR2V682#F110
	8 200	27.9	64.2	7	8	20	0.20	77x165	VGR2V822#E165
		31.0	71.3	7	8	20	0.20	90x150	VGR2V822#F150
	10 000	31.0	71.3	5	7	20	0.20	77x188	VGR2V103#E188
		34.2	78.7	5	7	20	0.20	90x150	VGR2V103#F150
	12 000	35.1	80.7	5	5	20	0.20	77x228	VGR2V123#E228
		36.8	84.6	5	5	20	0.20	90x167	VGR2V123#F167
	15 000	41.5	95.5	4	5	20	0.20	90x190	VGR2V153#F190
	18 000	44.3	101.9*	3	4	20	0.20	90x230	VGR2V183#F230
400 VDC Code: 2G Surge Voltage 450 VDC	2 700	13.6	31.3	20	23	18	0.20	64x107	VGR2G272#D107
	3 300	15.5	35.7	16	19	18	0.20	64x123	VGR2G332#D123
	3 900	16.5	38.0	14	16	18	0.20	64x147	VGR2G392#D147
		18.8	43.2	14	16	20	0.20	77x108	VGR2G392#E108
	4 700	18.6	42.8	11	13	18	0.20	64x164	VGR2G472#D164
		21.2	48.8	11	13	20	0.20	77x124	VGR2G472#E124
	5 600	20.5	47.2	10	11	18	0.20	64x187	VGR2G562#D187
		22.6	52.0	10	11	20	0.20	77x148	VGR2G562#E148
		26.0	59.8	10	11	20	0.20	90x110	VGR2G562#F110
	6 800	24.9	57.3	8	10	20	0.20	77x148	VGR2G682#E148
		25.4	58.4	8	10	20	0.20	77x165	VGR2G682#E165
		28.6	65.8	8	10	20	0.20	90x93	VGR2G682#F093
		28.2	64.9	8	10	20	0.20	90x150	VGR2G682#F150
	8 200	27.4	63.0	7	8	20	0.20	77x148	VGR2G822#E148
		28.1	64.6	7	8	20	0.20	77x188	VGR2G822#E188
		31.0	71.3	7	8	20	0.20	90x150	VGR2G822#F150
	10 000	32.0	73.6	5	7	20	0.20	77x228	VGR2G103#E228
		33.6	77.3	5	7	20	0.20	90x167	VGR2G103#F167
	12 000	37.1	85.3	5	5	20	0.20	90x190	VGR2G123#F190
	15 000	40.4	92.9	4	5	20	0.20	90x230	VGR2G153#F230
450 VDC Code: 2W Surge Voltage 500 VDC	2 200	12.6	29.0	24	28	18	0.20	64x107	VGR2W222#D107
	2 700	14.4	33.1	20	23	18	0.20	64x123	VGR2W272#D123
		16.1	37.0	20	23	20	0.20	77x108	VGR2W272#E108
	3 300	15.6	35.9	16	19	18	0.20	64x147	VGR2W332#D147
		18.2	41.9	16	19	20	0.20	77x124	VGR2W332#E124
	3 900	17.5	40.3	14	16	18	0.20	64x164	VGR2W392#D164
		19.4	44.6	14	16	20	0.20	77x148	VGR2W392#E148
		22.3	51.3	14	16	20	0.20	90x110	VGR2W392#F110

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
450 VDC Code: 2W Surge Voltage 500 VDC	4 700	19.3	44.4	11	13	18	0.20	64x187	VGR2W472#D187
		21.3	49.0	11	13	20	0.20	77x148	VGR2W472#E148
		24.2	55.7	11	13	20	0.20	90x126	VGR2W472#F126
	5 600	23.7	54.5	10	11	20	0.20	77x165	VGR2W562#E165
		26.3	60.5	10	11	20	0.20	90x150	VGR2W562#F150
		26.3	60.5	8	10	20	0.20	77x188	VGR2W682#E188
	6 800	28.5	65.6	8	10	20	0.20	90x167	VGR2W682#F167
		29.8	68.5	7	8	20	0.20	77x228	VGR2W822#E228
		31.5	72.5	7	8	20	0.20	90x190	VGR2W822#F190
	8 200	31.6	72.7	6	7	20	0.20	90x150	VGR2W103#F150
		33.9	78.0	5	7	20	0.20	90x230	VGR2W103#F230
500 VDC Code: 2H Surge Voltage 550 VDC	1 500	8.4	19.3	38	45	18	0.20	64x107	VGR2H152#D107
	1 800	9.5	21.9	32	38	18	0.20	64x123	VGR2H182#D123
	2 200	10.3	23.7	26	31	18	0.20	64x147	VGR2H222#D147
		11.7	26.9	26	31	20	0.20	77x108	VGR2H222#E108
	2 700	11.8	27.1	22	26	18	0.20	64x187	VGR2H272#D187
		13.3	30.6	22	26	20	0.20	77x124	VGR2H272#E124
	3 300	14.4	33.1	18	21	18	0.20	77x148	VGR2H332#E148
		16.5	38.0	18	21	20	0.20	90x110	VGR2H332#F110
	3 900	15.9	36.6	15	18	20	0.20	77x165	VGR2H392#E165
		17.8	40.9	15	18	20	0.20	90x126	VGR2H392#F126
	4 700	17.6	40.5	13	15	20	0.20	77x188	VGR2H472#E188
		19.4	44.6	13	15	20	0.20	90x150	VGR2H472#F150
	5 600	19.8	45.5	11	13	20	0.20	77x228	VGR2H562#E228
		20.8	47.8	11	13	20	0.20	90x167	VGR2H562#F167
	6 800	23.1	53.1	9	10	20	0.20	90x190	VGR2H682#F190
	8 200	24.7	56.8	8	8	20	0.20	90x230	VGR2H822#F230

* Please contact us if load condition exceeds terminals related $I_{r,max}$ referred on page 9

Additional designs on request · Weitere Designs auf Anfrage

> Ripple Current Multiplier · Wechselstrommultiplikator

Frequency [Hz]	50/60	120	300	1k	≥ 10k	Forced cooling [m/sec]	v < 0.5	v ≥ 0.5	v ≥ 2.0	v ≥ 3.0
Multiplier	0.80	1.00	1.18	1.34	1.45	Multiplier	1.00	1.10	1.20	1.25

Ta (°C)	40	50	60	65	70	75	80	85	90	95	100	105
Multiplier	2.3	2.1	2.0	1.9	1.9	1.8	1.7	1.6	1.4	1.2	1.1	1.0

> Life Time Table · Brauchbarkeitsdauer – Tabelle

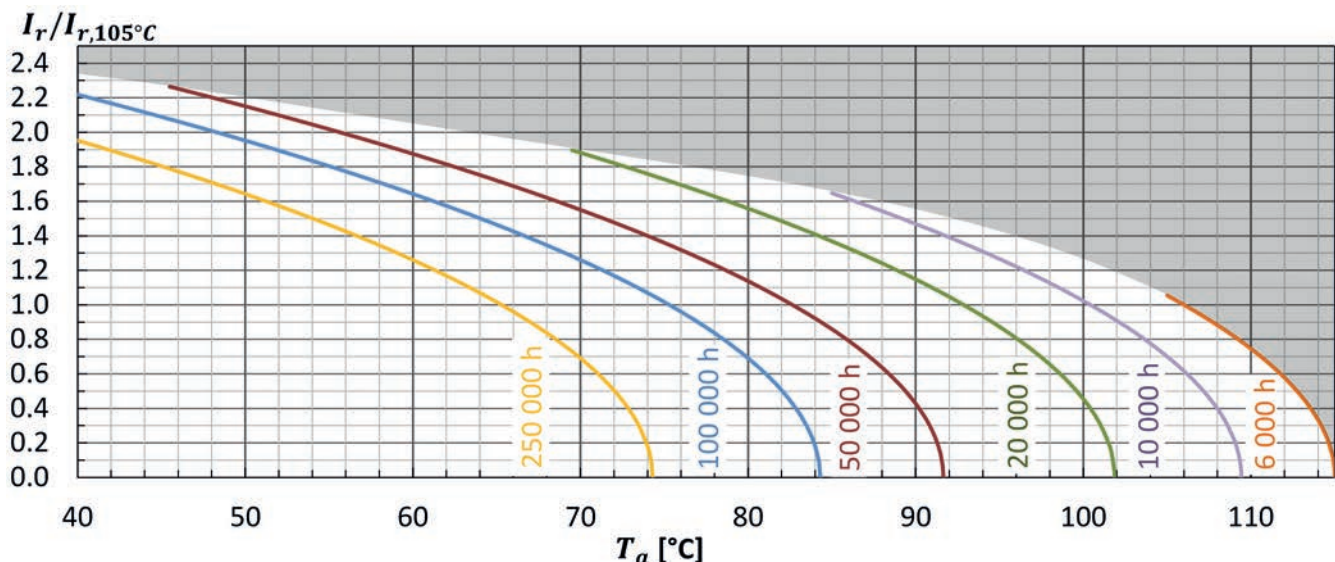
VGR	Useful life as function of ambient temperature and ripple current											
I_r at 105°C	x 1.0	x 1.1	x 1.2	x 1.4	x 1.6	x 1.7	x 1.8	x 1.9	x 2.0	x 2.1	x 2.2	x 2.3
$T_a = 40^\circ\text{C}$	250	250	250	250	250	250	250	250	213	152	106	73
$T_a = 45^\circ\text{C}$	250	250	250	250	250	250	250	186	135	96	67	
$T_a = 50^\circ\text{C}$	250	250	250	250	250	213	160	117	85	61		
$T_a = 55^\circ\text{C}$	250	250	250	250	177	135	101	74	54	38		
$T_a = 60^\circ\text{C}$	250	250	250	184	112	85	64	47	34			
$T_a = 65^\circ\text{C}$	250	216	178	116	70	54	40	29				
$T_a = 70^\circ\text{C}$	162	136	113	73	44	34	25	18				
$T_a = 75^\circ\text{C}$	102	86	71	46	28	21	16					
$T_a = 80^\circ\text{C}$	64	54	45	29	17	13						
$T_a = 85^\circ\text{C}$	41	34	28	18	11							
$T_a = 90^\circ\text{C}$	25	21	18	11								
$T_a = 95^\circ\text{C}$	16	13	11									
$T_a = 100^\circ\text{C}$	10	8										
$T_a = 105^\circ\text{C}$	6											

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 $I_r, 105^\circ\text{C}, 120\text{Hz}$

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



> Life Time Tests and Requirements · Anforderungen Brauchbarkeitsdauer

Life time test	Test procedure	Life time criteria
Endurance test	$T_a = 105^\circ\text{C}$; V_r, I_r applied 4000 hours	$\Delta C/C \leq 10\%$ (of initial value) $\tan\delta \leq 175\%$ (of specified value) $I_L \leq \text{specified value}$
Useful life	$T_a = 105^\circ\text{C}$; V_r, I_r applied 6000 hours	$\Delta C/C \leq 15\%$ (of initial value) $\tan\delta < 200\%$ (of specified value) $I_L \leq \text{specified value}$

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

VGLR · Screw-Terminal · 12000 h/105 °C

Long Life · High Ripple Current · Bottom cooling design · Low ESR

> Specifications · Spezifikationen

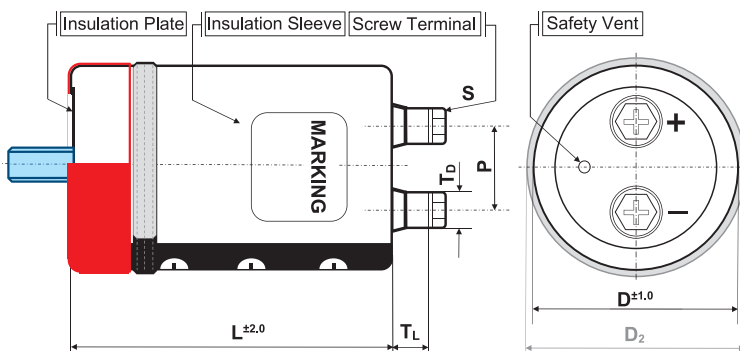
Items	Characteristics
Temperature range	-40°C ~ + 105°C
Capacitance tolerance (at 20°C)	Standard +/- 20%, -10/+30% on request
Surge voltage / Ripple voltage	Repetitive max. 30 sec per 6 Minutes / ≤ 50V
Leakage current max. I _L (20°C, 5 min)	0.01 • C • V _r [μA] or 5 mA, which is smaller.
Useful life	12 000 hours at 105°C
Field failure rate	0.5 FIT = 0.5 • 10 ⁻⁹ Failures/hour
RoHS conform	Directive 2011/65/EU & (EU)2015/863
Specification / Vibration	JIS C 5101-4/0.75mm, 10...55Hz, 10g, 3x2h
Outer materials	UL94-V0/UL224-VW1 certified (cap/sleeve)
Sleeve withstanding voltage	4000 Vac / 1min between terminals bundled and plate*

* Typical value



> Shape designation · Formbezeichnung

- for details refer to p. 8–9 · technische Details siehe S. 8–9
- for mounting options refer to p. 149 ff · Montageoptionen siehe S. 149 ff



	B	I/Y	N	N+WC
outer sleeve	•	•	•	•
insulation plate	•	•	•	
stud bolt	•			
bottom double sleeve		•		
integrated seating ring				•

ØD	available shape	P	S	T _L	T _D	Cap material
64	B, N, I, Y	28.6	M5x10	8.0	11	PH
77	B, N, I, Y, WC	31.5	M6x12	9.0	12	PH
90	B, N, I, Y, WC	31.5	M6x12	8.0	12	PH

Size in mm

> Product Code · Bestellbezeichnung

Example: Series VGLR · 12000 μF +/- 20 % · 400 V · D=90 mm · L=190 mm for bottom cooling

VGLR	2G	123	N	F	190	WC								
Type of series	Capacitance code		Fixing symbol code	Case code diameter	Specific features									
	The first two digits are significant. The last digit indicates the number of following zeros in µF.		B : Bolt N : single outer sleeve I : 2 Stoppers Bracket Y : 3 Stoppers Bracket N + suffix WC: blank bottom + seating ring	<table><tr><th>ØD</th><th>Code</th></tr><tr><td>64</td><td>D</td></tr><tr><td>77</td><td>E</td></tr><tr><td>90</td><td>F</td></tr></table>	ØD	Code	64	D	77	E	90	F		
ØD	Code													
64	D													
77	E													
90	F													
Rated voltage code				Capacitance tolerance	Case Code length									
Code	Voltage	Code	Voltage											
2V	350	2W	450	Ø : ± 20 %	Length in mm									
2G	400	2H	500	Q : -10 % ~ + 30 %	(3 digits)									

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
350 VDC Code: 2V Surge Voltage 400 VDC	3 300	15.1	34.7	16	19	18	0.20	64x107	VGLR2V332#D107
	3 900	16.8	38.6	14	16	18	0.20	64x123	VGLR2V392#D123
	4 700	18.2	41.9	11	13	18	0.20	64x147	VGLR2V472#D147
		20.6	47.4	11	13	20	0.20	77x108	VGLR2V472#E108
	5 600	20.3	46.7	10	11	18	0.20	64x164	VGLR2V562#D164
		23.1	53.1	10	11	20	0.20	77x124	VGLR2V562#E124
	6 800	22.6	52.0	8	10	18	0.20	64x187	VGLR2V682#D187
		24.9	57.3	8	10	20	0.20	77x148	VGLR2V682#E148
		28.6	65.8	8	10	20	0.20	90x110	VGLR2V682#F110
	8 200	27.9	64.2	7	8	20	0.20	77x165	VGLR2V822#E165
		31.0	71.3	7	8	20	0.20	90x150	VGLR2V822#F150
	10 000	31.0	71.3	5	7	20	0.20	77x188	VGLR2V103#E188
		34.2	78.7	5	7	20	0.20	90x150	VGLR2V103#F150
	12 000	35.1	80.7	5	5	20	0.20	77x228	VGLR2V123#E228
		36.8	84.6	5	5	20	0.20	90x167	VGLR2V123#F167
	15 000	41.5	95.5	4	5	20	0.20	90x190	VGLR2V153#F190
	18 000	44.3	101.9*	3	4	20	0.20	90x230	VGLR2V183#F230
400 VDC Code: 2G Surge Voltage 450 VDC	2 700	13.6	31.3	20	23	18	0.20	64x107	VGLR2G272#D107
	3 300	15.5	35.7	16	19	18	0.20	64x123	VGLR2G332#D123
	3 900	16.5	38.0	14	16	18	0.20	64x147	VGLR2G392#D147
		18.8	43.2	14	16	20	0.20	77x108	VGLR2G392#E108
	4 700	18.6	42.8	11	13	18	0.20	64x164	VGLR2G472#D164
		21.2	48.8	11	13	20	0.20	77x124	VGLR2G472#E124
	5 600	20.5	47.2	10	11	18	0.20	64x187	VGLR2G562#D187
		22.6	52.0	10	11	20	0.20	77x148	VGLR2G562#E148
		26.0	59.8	10	11	20	0.20	90x110	VGLR2G562#F110
	6 800	24.9	57.3	8	10	20	0.20	77x148	VGLR2G682#E148
		25.4	58.4	8	10	20	0.20	77x165	VGLR2G682#E165
		28.2	64.9	8	10	20	0.20	90x150	VGLR2G682#F150
	8 200	28.1	64.6	7	8	20	0.20	77x188	VGLR2G822#E188
		31.0	71.3	7	8	20	0.20	90x150	VGLR2G822#F150
	10 000	32.0	73.6	5	7	20	0.20	77x228	VGLR2G103#E228
		33.6	77.3	5	7	20	0.20	90x167	VGLR2G103#F167
	12 000	37.1	85.3	5	5	20	0.20	90x190	VGLR2G123#F190
	15 000	40.4	92.9	4	5	20	0.20	90x230	VGLR2G153#F230
450 VDC Code: 2W Surge Voltage 500 VDC	2 200	12.6	29.0	24	28	18	0.20	64x107	VGLR2W222#D107
		14.9	34.3	24	28	18	0.20	77x77	VGLR2W222#E077
	2 700	14.4	33.1	20	23	18	0.20	64x123	VGLR2W272#D123
		16.1	37.0	20	23	20	0.20	77x108	VGLR2W272#E108
	3 300	15.6	35.9	16	19	18	0.20	64x147	VGLR2W332#D147
		18.5	42.6	16	19	20	0.20	77x108	VGLR2W332#E108
		18.2	41.9	16	19	20	0.20	77x124	VGLR2W332#E124
	3 900	17.5	40.3	14	16	18	0.20	64x164	VGLR2W392#D164
		19.4	44.6	14	16	20	0.20	77x148	VGLR2W392#E148
		22.3	51.3	14	16	20	0.20	90x110	VGLR2W392#F110

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
450 VDC Code: 2W Surge Voltage 500 VDC	4 700	19.3	44.4	11	13	18	0.20	64x187	VGLR2W472#D187
		21.3	49.0	11	13	20	0.20	77x148	VGLR2W472#E148
		24.2	55.7	11	13	20	0.20	90x126	VGLR2W472#F126
	5 600	23.7	54.5	10	11	20	0.20	77x165	VGLR2W562#E165
		26.3	60.5	10	11	20	0.20	90x150	VGLR2W562#F150
		26.3	60.5	8	10	20	0.20	77x188	VGLR2W682#E188
	6 800	28.5	65.6	8	10	20	0.20	90x167	VGLR2W682#F167
		29.8	68.5	7	8	20	0.20	77x228	VGLR2W822#E228
		31.5	72.5	7	8	20	0.20	90x190	VGLR2W822#F190
	10 000	33.9	78.0	5	7	20	0.20	90x230	VGLR2W103#F230
500 VDC Code: 2H Surge Voltage 550 VDC	1 500	8.4	19.3	38	45	18	0.20	64x107	VGLR2H152#D107
	1 800	9.5	21.9	32	38	18	0.20	64x123	VGLR2H182#D123
	2 200	10.3	23.7	26	31	18	0.20	64x147	VGLR2H222#D147
		11.7	26.9	26	31	20	0.20	77x108	VGLR2H222#E108
	2 700	11.8	27.1	22	26	18	0.20	64x187	VGLR2H272#D187
		13.3	30.6	22	26	20	0.20	77x124	VGLR2H272#E124
	3 300	14.4	33.1	18	21	18	0.20	77x148	VGLR2H332#E148
		16.5	38.0	18	21	20	0.20	90x110	VGLR2H332#F110
	3 900	15.9	36.6	15	16	20	0.20	77x165	VGLR2H392#E165
		17.8	40.9	15	16	20	0.20	90x126	VGLR2H392#F126
	4 700	17.6	40.5	13	13	20	0.20	77x188	VGLR2H472#E188
		19.4	44.6	13	13	20	0.20	90x150	VGLR2H472#F150
	5 600	19.8	45.5	11	11	20	0.20	77x228	VGLR2H562#E228
		20.8	47.8	11	11	20	0.20	90x167	VGLR2H562#F167
	6 800	23.1	53.1	9	11	20	0.20	90x190	VGLR2H682#F190
	7 500	24.2	55.7	9	10	20	0.20	90x190	VGLR2H752#F190
	8 200	24.7	56.8	8	9	20	0.20	90x230	VGLR2H822#F230

* Please contact us if load condition exceeds terminals related $I_{r,max}$ referred on page 9

Additional designs on request · Weitere Designs auf Anfrage

> Ripple Current Multiplier · Wechselstrommultiplikator

Frequency [Hz]	50/60	120	300	1k	≥ 10k	Forced cooling [m/sec]	v < 0.5	v ≥ 0.5	v ≥ 2.0	v ≥ 3.0
Multiplier	0.80	1.00	1.18	1.34	1.45	Multiplier	1.00	1.10	1.20	1.25

Ta (°C)	40	50	60	65	70	75	80	85	90	95	100	105
Multiplier	2.3	2.1	2.0	1.9	1.9	1.8	1.7	1.6	1.4	1.2	1.1	1.0

> Life Time Table · Brauchbarkeitsdauer – Tabelle

VGLR	Useful life as function of ambient temperature and ripple current											
I_r at 105°C	x 1.0	x 1.1	x 1.2	x 1.4	x 1.6	x 1.7	x 1.8	x 1.9	x 2.0	x 2.1	x 2.2	x 2.3
$T_a = 40^\circ\text{C}$	250	250	250	250	250	250	250	250	250	250	213	147
$T_a = 45^\circ\text{C}$	250	250	250	250	250	250	250	250	250	192	135	
$T_a = 50^\circ\text{C}$	250	250	250	250	250	250	250	235	171	122		
$T_a = 55^\circ\text{C}$	250	250	250	250	250	250	202	149	108	77		
$T_a = 60^\circ\text{C}$	250	250	250	250	224	170	128	94	68			
$T_a = 65^\circ\text{C}$	250	250	250	232	141	108	81	59				
$T_a = 70^\circ\text{C}$	250	250	226	147	89	68	51	37				
$T_a = 75^\circ\text{C}$	205	172	142	93	56	43	32					
$T_a = 80^\circ\text{C}$	129	109	90	58	35	27						
$T_a = 85^\circ\text{C}$	82	69	57	37	22							
$T_a = 90^\circ\text{C}$	51	43	36	23								
$T_a = 95^\circ\text{C}$	32	27	22									
$T_a = 100^\circ\text{C}$	20	17										
$T_a = 105^\circ\text{C}$	12											

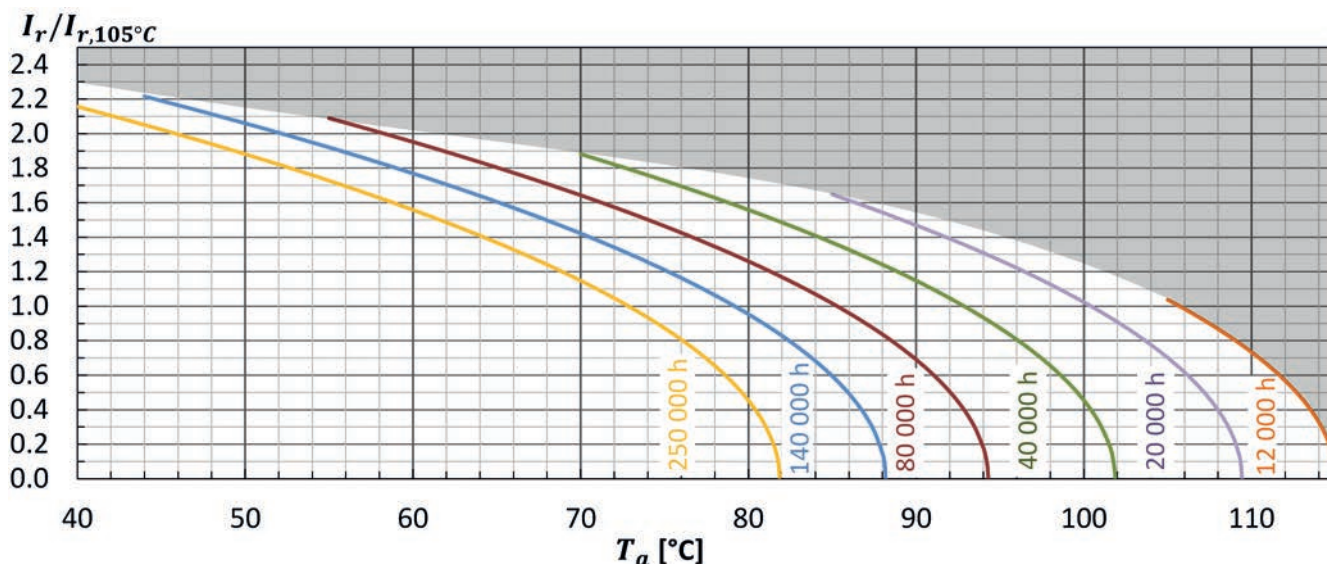
khrs

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 $I_r, 105^\circ\text{C}, 120\text{Hz}$

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



> Life Time Tests and Requirements · Anforderungen Brauchbarkeitsdauer

Life time test	Test procedure	Life time criteria
Endurance test	$T_a = 105^\circ\text{C}$; V_r, I_r applied 8000 hours	$\Delta C/C \leq 10\%$ (of initial value) $\tan\delta \leq 175\%$ (of specified value) $I_L \leq$ specified value
Useful life	$T_a = 105^\circ\text{C}$; V_r, I_r applied 12000 hours	$\Delta C/C \leq 15\%$ (of initial value) $\tan\delta < 200\%$ (of specified value) $I_L \leq$ specified value

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