

# 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

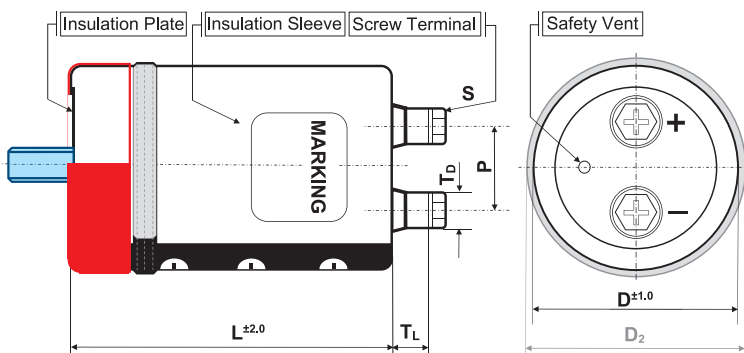
Items	Characteristics
Temperature range	-40°C ~ + 105°C
Capacitance tolerance (at 20°C)	Standard +/- 20%, -10/+30% on request
Surge voltage / Ripple voltage	Repetitive max. 30 sec per 6 Minutes / ≤ 50V
Leakage current max. I <sub>L</sub> (20°C, 5 min)	0.01 • C • V <sub>r</sub> [μA] or 5 mA, which is smaller.
Useful life	6 000 hours at 105°C
Field failure rate	0.5 FIT = 0.5 • 10 <sup>-9</sup> 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 <sub>L</sub>	T <sub>D</sub>	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																																			
<b>Type of series</b>		<b>Capacitance code</b>		<b>Rated voltage code</b>		<b>Fixing symbol code</b>		<b>Case code diameter</b>		<b>Specific features (e.g. M6 ...)</b>																																			
		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 border="1"> <thead> <tr> <th>ØD</th> <th>Code</th> </tr> </thead> <tbody> <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> </tbody> </table>		ØD	Code	51	C	64	D	77	E	90	F	<table border="1"> <thead> <tr> <th colspan="2">Case Code length</th> </tr> </thead> <tbody> <tr> <td colspan="2">Length in mm (3 digits)</td> </tr> </tbody> </table>		Case Code length		Length in mm (3 digits)																					
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Code	Voltage	Code	Voltage	Code	Voltage																																								
1E	25	2A	100	2G	400																																								
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1K	80	2V	350																																										
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								Q : -10 % ~ + 30 %																																					

# VG · Screw-Terminal · 6000 h/105 °C

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	
<b>25 VDC</b> 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	
330 000	20.2	99.0	4	5	20	1.00	90x110	VG1E334#F110		
	<b>35 VDC</b> Code: 1V  Surge Voltage 44 VDC	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		
<b>50 VDC</b> 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		
180 000	20.9	102.4*	4	6	20	0.50	90x110	VG1H184#F110		
	<b>63 VDC</b> Code: 1J  Surge Voltage 80 VDC	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		
<b>80 VDC</b> 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	
		11.7	57.3	6	7	18	0.30	64x123	VG1K473#D123	
	47 000	12.2	59.8	6	7	20	0.30	77x95	VG1K473#E095	
		13.2	64.7	5	7	20	0.30	77x108	VG1K563#E108	
	56 000	15.3	75.0	5	7	20	0.30	90x97	VG1K563#F097	
		14.9	73.0	4	7	20	0.30	77x124	VG1K683#E124	
68 000	16.8	82.3	4	7	20	0.30	90x110	VG1K683#F110		
<b>100 VDC</b> 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		
<b>160 VDC</b> 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	

Additional designs on request · Weitere Designs auf Anfrage

Rated VoltageCode (Surge Voltage) $V_r$ [V DC]	Capacitance $C_r$ [ $\mu$ F]	Ripple Current at 105°C/120Hz $I_r$ [A RMS]	Ripple Current at 40°C/120Hz [A RMS]	ESR (typ) at 20°C/100Hz [m $\Omega$ ]	Zmax at 20°C/10kHz [m $\Omega$ ]	ESL (typ) [nH]	Dissipation Factor at 20°C/120Hz Tan $\delta$	DxL [mm]	Product Code  # = variable value, see fixing code in the product code
<b>160 VDC</b> 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
33 000	14.0	68.6	8	8	20	0.25	90x110	VG2C273#F110	
<b>200 VDC</b> Code: 2D  Surge Voltage 250 VDC	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
		7.2	35.3	12	12	18	0.25	64x123	VG2D123#D123
	15 000	8.1	39.7	12	12	20	0.25	77x95	VG2D123#E095
		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
<b>250 VDC</b> 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
<b>350 VDC</b> 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	
	31.5	85.1	5	7	20	0.20	90x230	VG2V223#F230	
<b>400 VDC</b> 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

# VG · Screw-Terminal · 6000 h/105 °C

Rated VoltageCode (Surge Voltage) $V_r$ [V DC]	Capacitance $C_r$ [ $\mu$ F]	Ripple Current at 105°C/120Hz $I_r$ [A RMS]	Ripple Current at 40°C/120Hz [A RMS]	ESR (typ) at 20°C/100Hz [m $\Omega$ ]	Zmax at 20°C/10kHz [m $\Omega$ ]	ESL (typ) [nH]	Dissipation Factor at 20°C/120Hz Tan $\delta$	DxL [mm]	Product Code  # = variable value, see fixing code in the product code	
<b>400 VDC</b> 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	
	8 200	18.4	49.7	18	18	20	0.20	90x110	VG2G682#F110	
		18.0	48.6	15	17	20	0.20	77x165	VG2G822#E165	
	10 000	20.0	54.0	15	17	20	0.20	90x126	VG2G822#F126	
		19.9	53.7	12	15	20	0.20	77x188	VG2G103#E188	
	12 000	22.0	59.4	12	15	20	0.20	90x150	VG2G103#F150	
		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	
		28.5	77.0	7	9	20	0.20	90x230	VG2G183#F230	
	<b>450 VDC</b> Code: 2W  Surge Voltage 500 VDC	2 700	9.0	24.3	42	42	18	0.20	64x94	VG2W272#D094
			10.2	27.5	35	40	18	0.20	64x107	VG2W332#D107
		3 300	11.4	30.8	35	40	20	0.20	77x95	VG2W332#E095
			10.9	29.4	27	32	18	0.20	64x147	VG2W392#D147
3 900		12.4	33.5	27	32	20	0.20	77x108	VG2W392#E108	
		12.2	32.9	24	27	18	0.20	64x164	VG2W472#D164	
4 700		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	
12 000		22.2	59.9	15	15	20	0.20	90x167	VG2W103#F167	
		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		
	26.6	71.8	10	10	20	0.20	90x230	VG2W153#F230		
<b>500 VDC</b> Code: 2H  Surge Voltage 550 VDC	1 500	6.5	17.6	74	80	18	0.20	64x107	VG2H152#D107	
		7.2	19.4	62	50	18	0.20	64x123	VG2H182#D123	
	1 800	8.0	21.6	62	50	20	0.20	77x95	VG2H182#E095	
		7.8	21.1	53	50	18	0.20	64x147	VG2H222#D147	
	2 200	8.9	24.0	53	50	20	0.20	77x108	VG2H222#E108	
		8.8	23.8	40	35	18	0.20	64x164	VG2H272#D164	
	2 700	11.4	30.8	40	35	20	0.20	90x97	VG2H272#F097	
		9.8	26.5	38	32	18	0.20	64x187	VG2H332#D187	
	3 300	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	
		18.8	50.8	14	14	20	0.20	90x230	VG2H822#F230	

\* 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 < 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 <sub>r</sub> 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 <sub>a</sub> = 40°C	250	250	250	250	250	250	250	250	250	250	207	127
T <sub>a</sub> = 45°C	250	250	250	250	250	250	250	250	250	183	130	
T <sub>a</sub> = 50°C	250	250	250	250	250	250	250	211	158	115		
T <sub>a</sub> = 55°C	250	250	250	250	250	250	189	133	100			
T <sub>a</sub> = 60°C	250	250	250	250	212	162	119	84				
T <sub>a</sub> = 65°C	247	218	185	159	134	102	75					
T <sub>a</sub> = 70°C	156	138	117	101	85	65						
T <sub>a</sub> = 75°C	99	87	74	63	53							
T <sub>a</sub> = 80°C	62	55	46	40								
T <sub>a</sub> = 85°C	39	35	29									
T <sub>a</sub> = 90°C	25	22										
T <sub>a</sub> = 95°C	15	14										
T <sub>a</sub> = 100°C	10											
T <sub>a</sub> = 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 <sub>r</sub> 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 <sub>a</sub> = 40°C	250	250	250	250	250	250	250	250	250	250	225	181
T <sub>a</sub> = 45°C	250	250	250	250	250	250	250	250	215	176	142	
T <sub>a</sub> = 50°C	250	250	250	250	250	237	199	165	136	111		
T <sub>a</sub> = 55°C	250	250	250	250	178	150	125	104	86			
T <sub>a</sub> = 60°C	250	250	250	177	112	95	79	66				
T <sub>a</sub> = 65°C	245	204	165	112	71	60	50					
T <sub>a</sub> = 70°C	155	129	104	71	45	38	31					
T <sub>a</sub> = 75°C	98	81	66	45	28	24						
T <sub>a</sub> = 80°C	62	51	41	28	18							
T <sub>a</sub> = 85°C	39	32	26	18	11							
T <sub>a</sub> = 90°C	24	20	16	11								
T <sub>a</sub> = 95°C	15	13	10									
T <sub>a</sub> = 100°C	9	8										
T <sub>a</sub> = 105°C	6											

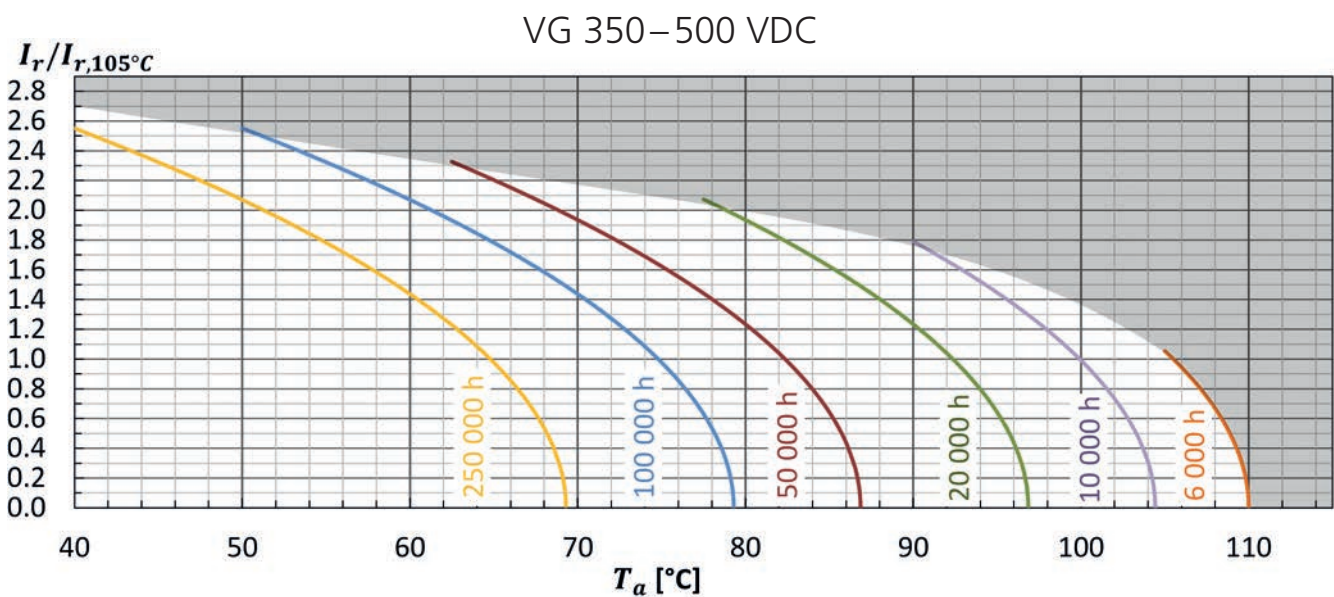
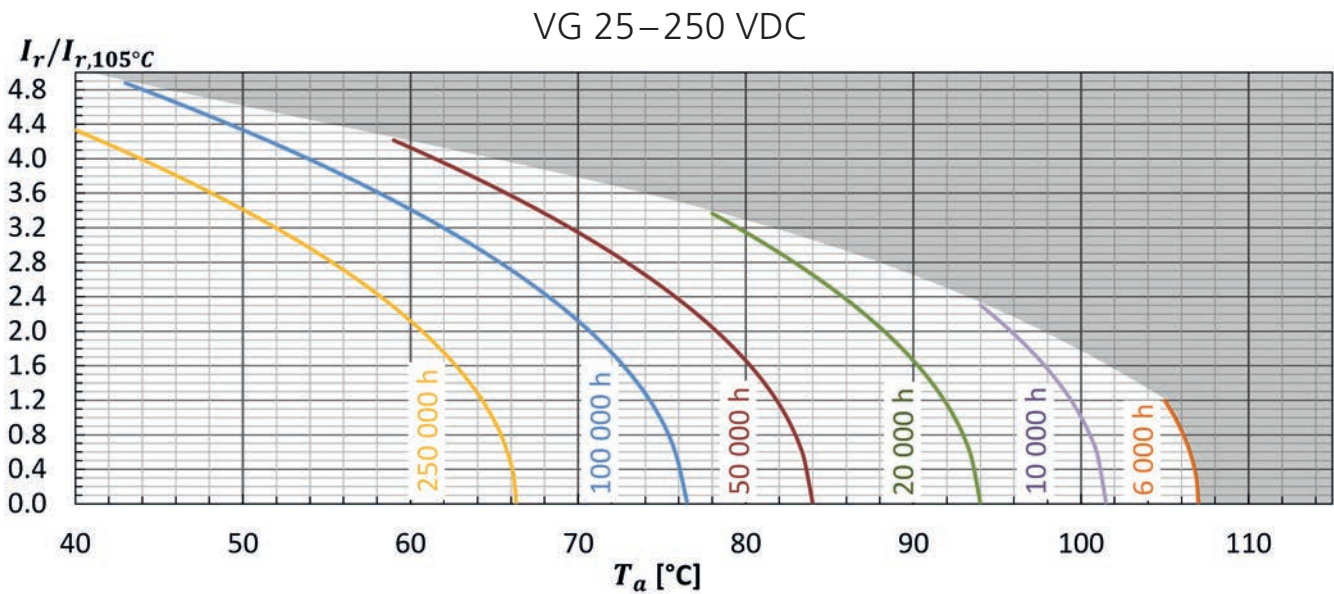
Max. value limited to 250 000 hours.



> 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 Kategorie-temperatur  $I_{r, 105^\circ\text{C}, 120\text{Hz}}$



> 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) $\text{Tan}\delta \leq 175\%$ (of specified value) $I_L \leq$ specified value
Useful life	$T_a = 105^\circ\text{C}$ ; $V_r, I_r$ applied 6000 hours	$\Delta C/C \leq 15\%$ (of initial value) $\text{Tan}\delta < 200\%$ (of specified value) $I_L \leq$ specified value

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