

VGR · Screw-Terminal · 6000 h/105 °C

High Ripple Current · Bottom cooling design · Low ESR

> Specifications · Spezifikationen

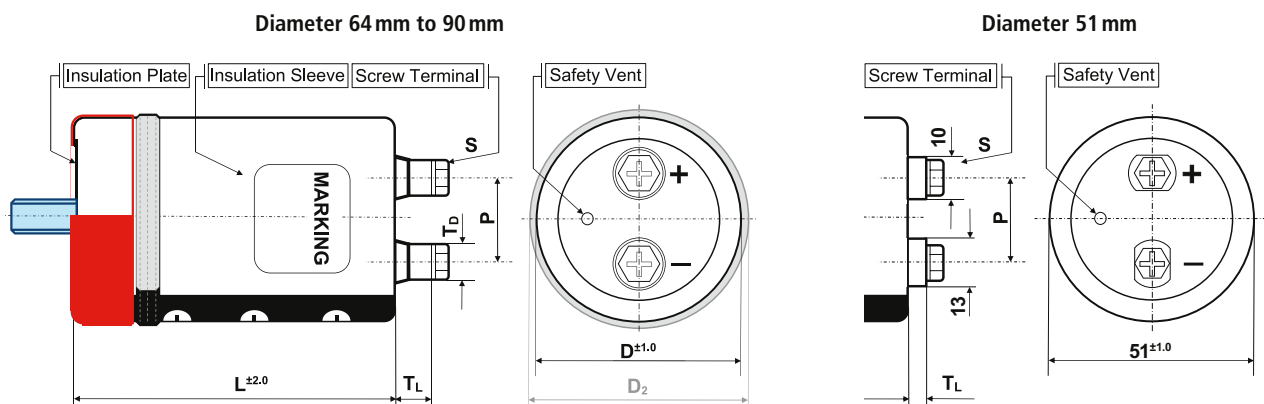
Items	Characteristics
Temperature range	-40°C ~ + 105°C
Capacitance tolerance (at 20°C)	Standard +/- 20%, -10/+30% on request
Surge voltage / Ripple voltage	Repetitive max. 30 sec per 6 Minutes / ≤ 70V
Leakage current max. I_L (20°C, 5 min)	0.01 • C • V_r [μA] or 5 mA, which is smaller.
Useful life	6000 hours at 105°C
Field failure rate	0.5 FIT = 0.5 • 10 ⁻⁹ Failures/hour
Reference standards	IEC 60384-4, JIS C 5101-4
Vibration	0.75mm, 10...55Hz, 10g, 3x2h
Outer materials	UL94-V0/UL224-VW1 certified (cap/sleeve)
Sleeve withstanding voltage	4000 Vac/ 1min between terminals bundled and plate*
Product Compliance	RoHS, REACH, Conflict Minerals a.o. – refer to p. 12–13

* Typical value



> Shape designation · Formbezeichnung

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



Shape code Features	B Bolt	I/Y double sleeve for 2/3 points metal Bracket	N + suffix WC blank bottom + seating ring	N standard
outer insulation sleeve	•	•	•	•
insulation plate	•	•		•
stud bolt	•			
bottom double sleeve		•		
integrated seating ring			•	

diameter code	ØD	available shape	P	S	T _L	T _D	Cap material
C	51	B, N, I, Y	22.0	M5x10	4.5	13/10	PH
D	64	B, N, I, Y	28.6	M5x10	8.0	11	PH
E	77	B, N, I, Y, WC	31.5	M6x12	9.0	12	PH
F	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	2G	123	Y	F	190
Series name	Capacitance code		Shape code	Diameter code	Specific features
Rated voltage code					
Code	Voltage	Code	Voltage	Capacitance tolerance	
2V	350	2W	450	Ø : ± 20 %	
2G	400	2H	500	Q : -10 % ~ +30 %	
Case length code – length in mm (3 digits)					

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]	Z _{max} 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	1 800	9.1	21.0	30	31	17	0.20	51x96	VGR2V182#C096
	2 200	10.2	23.5	25	26	17	0.20	51x109	VGR2V222#C109
	2 700	11.4	26.3	20	21	17	0.20	51x125	VGR2V272#C125
	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
		18.2	41.9	11	13	18	0.20	64x147	VGR2V472#D147
	4 700	20.6	47.4	11	13	20	0.20	77x108	VGR2V472#E108
		20.3	46.7	10	11	18	0.20	64x164	VGR2V562#D164
	5 600	23.1	53.1	10	11	20	0.20	77x124	VGR2V562#E124
		22.6	52.0	8	10	18	0.20	64x187	VGR2V682#D187
	6 800	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	
22 000	48.3	111.1*	3	3	20	0.20	90x268	VGR2V223#F268	
400 VDC Code: 2G Surge Voltage 450 VDC	1 500	8.4	19.4	35	38	17	0.20	51x96	VGR2G152#C096
	1 800	9.4	21.7	30	32	17	0.20	51x109	VGR2G182#C109
	2 200	10.6	24.4	24	26	17	0.20	51x125	VGR2G222#C125
	2 700	13.6	31.3	20	22	18	0.20	64x107	VGR2G272#D107
	3 300	15.5	35.7	16	18	18	0.20	64x123	VGR2G332#D123
		16.5	38.0	14	16	18	0.20	64x147	VGR2G392#D147
	3 900	18.8	43.2	14	16	20	0.20	77x108	VGR2G392#E108
		18.6	42.8	11	13	18	0.20	64x164	VGR2G472#D164
	4 700	21.2	48.8	11	13	20	0.20	77x124	VGR2G472#E124
		20.5	47.2	10	11	18	0.20	64x187	VGR2G562#D187
	5 600	23.1	53.1	10	11	20	0.20	77x124	VGR2G562#E124
		22.6	52.0	10	11	20	0.20	77x148	VGR2G562#E148
26.0	59.8	10	11	20	0.20	90x110	VGR2G562#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	
400 VDC Code: 2G Surge Voltage 450 VDC	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	
		32.0	73.6	5	7	20	0.20	77x228	VGR2G103#E228	
	10 000	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	41.4	95.2	4	5	20	0.20	90x190	VGR2G153#F190	
		40.4	92.9	4	5	20	0.20	90x230	VGR2G153#F230	
	18 000	43.7	100.5*	3	4	20	0.20	90x268	VGR2G183#F268	
	450 VDC Code: 2W Surge Voltage 500 VDC	1 200	7.9	18.2	44	47	17	0.20	51x96	VGR2W122#C096
		1 500	9.0	20.7	36	39	17	0.20	51x109	VGR2W152#C109
		1 800	10.1	23.3	30	33	17	0.20	51x125	VGR2W182#C125
2 200		12.6	29.0	24	27	18	0.20	64x107	VGR2W222#D107	
		14.4	33.1	20	22	18	0.20	64x123	VGR2W272#D123	
2 700		16.1	37.0	20	22	20	0.20	77x108	VGR2W272#E108	
		15.6	35.9	16	18	18	0.20	64x147	VGR2W332#D147	
3 300		17.8	41.0	16	18	20	0.20	77x108	VGR2W332#E108	
		18.2	41.9	16	18	20	0.20	77x124	VGR2W332#E124	
		18.1	41.6	16	18	20	0.20	77x139	VGR2W332#E139	
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	
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		23.2	53.4	10	11	20	0.20	77x148	VGR2W562#E148	
		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		28.9	66.5	8	10	20	0.20	90x150	VGR2W682#F150	
		29.8	68.5	7	8	20	0.20	77x228	VGR2W822#E228	
8 200		31.8	73.1	7	8	20	0.20	90x150	VGR2W822#F150	
		31.6	72.7	6	7	20	0.20	90x150	VGR2W103#F150	
10 000		33.9	78.0	5	6	20	0.20	90x230	VGR2W103#F230	
		12 000	38.1	87.6	5	7	20	0.20	90x190	VGR2W123#F190
		15 000	41.0	94.3	4	5	20	0.20	90x268	VGR2W153#F268
500 VDC Code: 2H Surge Voltage 550 VDC		680	4.6	10.6	85	90	17	0.20	51x96	VGR2H681#C096
	820	5.2	12.0	70	74	17	0.20	51x109	VGR2H821#C109	
	1 000	5.9	13.6	58	62	17	0.20	51x125	VGR2H102#C125	
	1 500	8.4	19.3	38	41	18	0.20	64x107	VGR2H152#D107	
	1 800	9.5	21.9	32	36	18	0.20	64x123	VGR2H182#D123	

Additional designs on request · Weitere Designs auf Anfrage

VGR · Screw-Terminal · 6000 h/105 °C

Rated VoltageCode (Surge Voltage) V_r [V DC]	Capacitance C_r [μ 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 Ω]	Zmax at 20°C/10kHz [m Ω]	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	2 200	10.3	23.7	26	30	18	0.20	64x147	VGR2H222#D147
		11.7	26.9	26	30	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
	10 000	27.0	62.1	7	7	20	0.20	90x268	VGR2H103#F268
	14 000	29.6	68.1	5	6	20	0.20	90x268	VGR2H143#F268

* Please contact us if load condition exceeds terminals related I_{rmax} referred on page 11

Additional designs on request · Weitere Designs auf Anfrage

> Ripple Current Multiplier · Wechselstrommultiplikator

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

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

Forced cooling – Wind speed [m/sec]	v < 0.25	v \geq 0.25	v \geq 0.5	v \geq 1.0	v \geq 2.0	v \geq 3.0
Multiplier	1.00	1.07	1.15	1.25	1.30	1.35

Water cooled heatsink – size ratio [L/D]	1.10	1.25	1.40	1.55	1.70	2.00	2.50	3.00
Multiplier	2.0	1.9	1.7	1.6	1.5	1.4	1.2	1.1

> Life Time Table · Brauchbarkeitsdauer – Tabelle

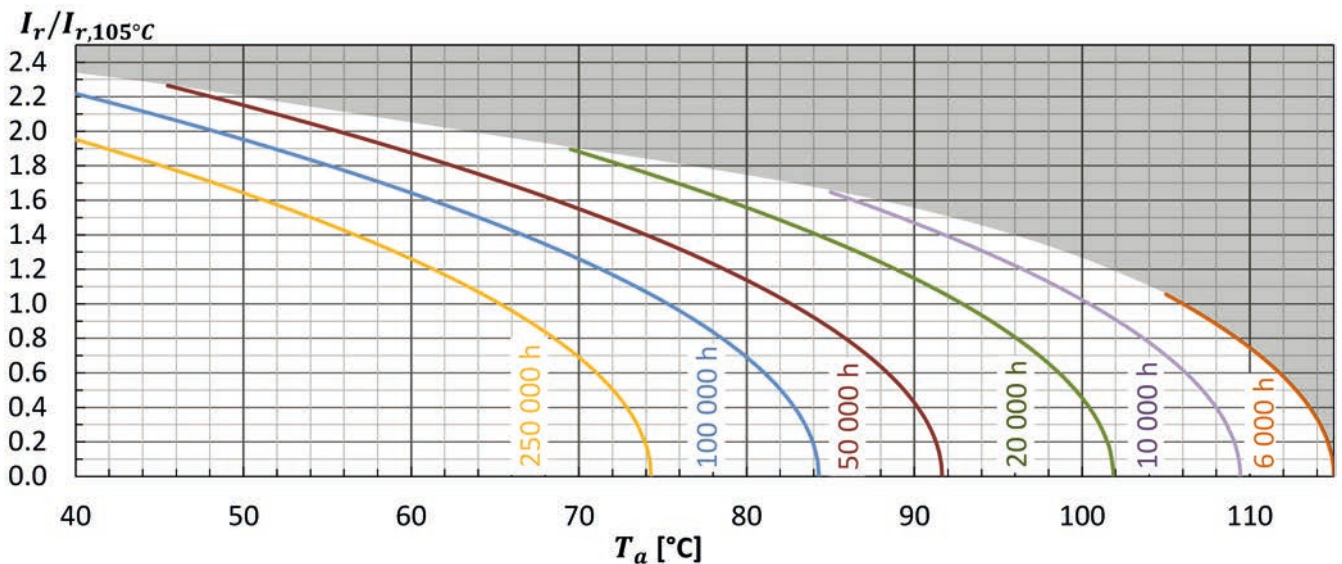
VGR	Useful life as function of ambient temperature and ripple current												
	I_r at 105°C	x 1.0	x 1.1	x 1.2	x 1.4	x 1.6	x 1.7	x 1.8	x 1.9	x 2.0	x 2.1	x 2.2	x 2.3
$T_a = 40^\circ\text{C}$	250	250	250	250	250	250	250	250	250	213	152	106	73
$T_a = 45^\circ\text{C}$	250	250	250	250	250	250	250	250	186	135	96	67	
$T_a = 50^\circ\text{C}$	250	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												

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 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