

VFLR · Screw-Terminal · 12000 h/85 °C

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

> Specifications · Spezifikationen

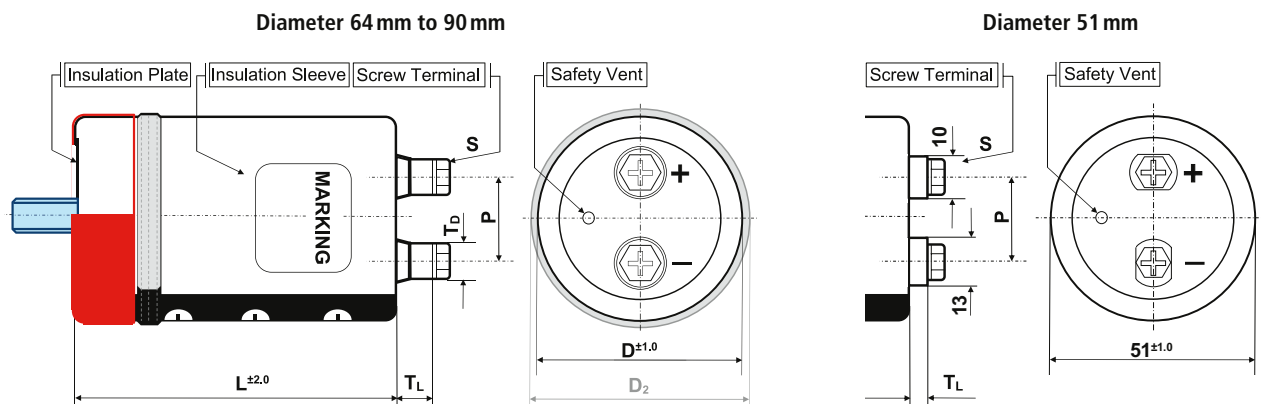
Items	Characteristics
Temperature range	-40°C ~ + 85°C
Capacitance tolerance (at 20°C)	Standard +/- 20%, -10/+30% on request
Surge voltage / Ripple voltage	Repetitive max. 30 sec per 6 Minutes / ≤ 70V
Leakage current max. I _L (20°C, 5 min)	0.01 • C • V _r [μA] or 5 mA, which is smaller.
Useful life	12 000 hours at 85°C
Field failure rate	0.5 FIT = 0.5 • 10 ⁻⁹ Failures/hour
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 VFLR · 12000 µF +/- 20 % · 400 V · D=90 mm · L=167 mm with Y-Bracket

VFLR	2G	123	Y	F	167
Series name	Capacitance code	Shape code	Diameter code	Capacitance tolerance	Specific features
Rated voltage code					
Code	Voltage	Code	Voltage	Case length code – length in mm (3 digits)	
2V	350	2W	450	Ø : ± 20 % Q : -10 % ~ +30 %	
2G	400	2H	500		

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]	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	2 200	10.2	21.5	24	26	17	0.20	51x96	VFLR2V222#C096
	2 700	11.4	24.0	20	21	17	0.20	51x109	VFLR2V272#C109
	3 300	12.7	26.7	16	17	17	0.20	51x125	VFLR2V332#C125
	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
		20.6	43.3	10	11	18	0.20	64x147	VFLR2V562#D147
	5 600	23.5	49.4	10	11	20	0.20	77x108	VFLR2V562#E108
		23.3	48.9	8	10	18	0.20	64x164	VFLR2V682#D164
	6 800	26.5	55.7	8	10	20	0.20	77x124	VFLR2V682#E124
		25.8	54.2	7	8	18	0.20	64x187	VFLR2V822#D187
	8 200	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	
27 000	56.0	117.6*	2	3	20	0.20	90x268	VFLR2V273#F268	
400 VDC Code: 2G Surge Voltage 450 VDC	1 800	9.5	20.0	30	31	17	0.20	51x96	VFLR2G182#C096
	2 200	10.6	22.3	25	26	17	0.20	51x109	VFLR2G222#C109
	2 700	11.9	25.0	20	21	17	0.20	51x125	VFLR2G272#C125
	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
	21.1	44.3	10	11	20	0.20	77x95	VFLR2G562#E095	

Additional designs on request · Weitere Designs auf Anfrage

VFLR · Screw-Terminal · 12000 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	6 800	23.5	49.4	8	10	18	0.20	64x187	VFLR2G682#D187
		26.4	55.4	8	10	20	0.20	77x124	VFLR2G682#E124
		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
	22 000	50.5	106.1*	3	3	20	0.20	90x268	VFLR2G223#F268
450 VDC Code: 2W Surge Voltage 500 VDC	1 500	9.0	18.9	35	37	17	0.20	51x96	VFLR2W152#C096
	1 800	10.1	21.3	30	32	17	0.20	51x109	VFLR2W182#C109
	2 200	11.3	23.8	24	26	17	0.20	51x125	VFLR2W222#C125
	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
		17.6	37.0	14	16	18	0.20	64x147	VFLR2W392#D147
	3 900	20.1	42.2	14	16	20	0.20	77x108	VFLR2W392#E108
		19.9	41.8	11	13	18	0.20	64x164	VFLR2W472#D164
	4 700	22.6	47.5	11	13	20	0.20	77x124	VFLR2W472#E124
		21.9	46.0	10	11	18	0.20	64x187	VFLR2W562#D187
	5 600	24.1	50.6	10	11	20	0.20	77x148	VFLR2W562#E148
		27.6	58.0	10	11	20	0.20	90x110	VFLR2W562#F110
	6 800	22.9	48.1	8	10	20	0.20	64x187	VFLR2W682#D187
		26.5	55.7	8	10	20	0.20	77x148	VFLR2W682#E148
		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
	10 000	34.1	71.6	5	7	20	0.20	77x228	VFLR2W103#E228
		36.5	76.7	5	7	20	0.20	90x150	VFLR2W103#F150
12 000	39.4	82.7	5	5	20	0.20	90x190	VFLR2W123#F190	
13 000	41.0	86.1	5	5	20	0.20	90x190	VFLR2W133#F190	
15 000	43.3	90.9	4	5	20	0.20	90x230	VFLR2W153#F230	
18 000	46.9	98.5	3	4	20	0.20	90x268	VFLR2W183#F268	
500 VDC Code: 2H Surge Voltage 550 VDC	820	6.1	12.9	71	74	17	0.20	51x96	VFLR2H821#C096
	1 000	7.0	14.7	58	61	17	0.20	51x109	VFLR2H102#C109
	1 200	7.9	16.6	48	51	17	0.20	51x125	VFLR2H122#C125
	1 800	11.3	23.7	32	35	18	0.20	64x107	VFLR2H182#D107
	2 200	12.8	26.9	26	28	18	0.20	64x123	VFLR2H222#D123
	2 700	13.9	29.2	22	24	18	0.20	64x147	VFLR2H272#D147
15.9		33.4	22	24	20	0.20	77x108	VFLR2H272#E108	

Additional designs on request · Weitere Designs auf Anfrage

Rated VoltageCode (Surge Voltage) V_r [V DC]	Capacitance C_r [μ F]	Ripple Current at 85°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	3 000	14.6	30.7	20	22	20	0.20	64x147	VFLR2H272#D147
		15.8	33.2	18	20	18	0.20	64x164	VFLR2H332#D164
	3 300	18.0	37.8	18	20	20	0.20	77x124	VFLR2H332#E124
		17.3	36.3	15	17	18	0.20	64x187	VFLR2H392#D187
	3 900	19.1	40.1	15	17	20	0.20	77x148	VFLR2H392#E148
		21.9	46.0	15	17	20	0.20	90x110	VFLR2H392#F110
	4 700	20.9	43.9	13	15	20	0.20	77x148	VFLR2H472#E148
		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	22.8	47.9	11	13	20	0.20	77x148	VFLR2H562#E148
		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
		28.6	60.1	9	10	20	0.20	90x150	VFLR2H682#F150
		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
			33.6	70.6	6	7	20	0.20	90x230
	12 000	36.3	76.2	5	6	20	0.20	90x268	VFLR2H123#F268
		14 000	38.3	80.4	4	5	20	0.20	90x268

* 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	≥ 10k
Multiplier	0.80	1.00	1.18	1.34	1.45

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

Forced cooling – Wind speed [m/sec]	v < 0.25	v ≥ 0.25	v ≥ 0.5	v ≥ 1.0	v ≥ 2.0	v ≥ 3.0
Multiplier	1.00	1.07	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

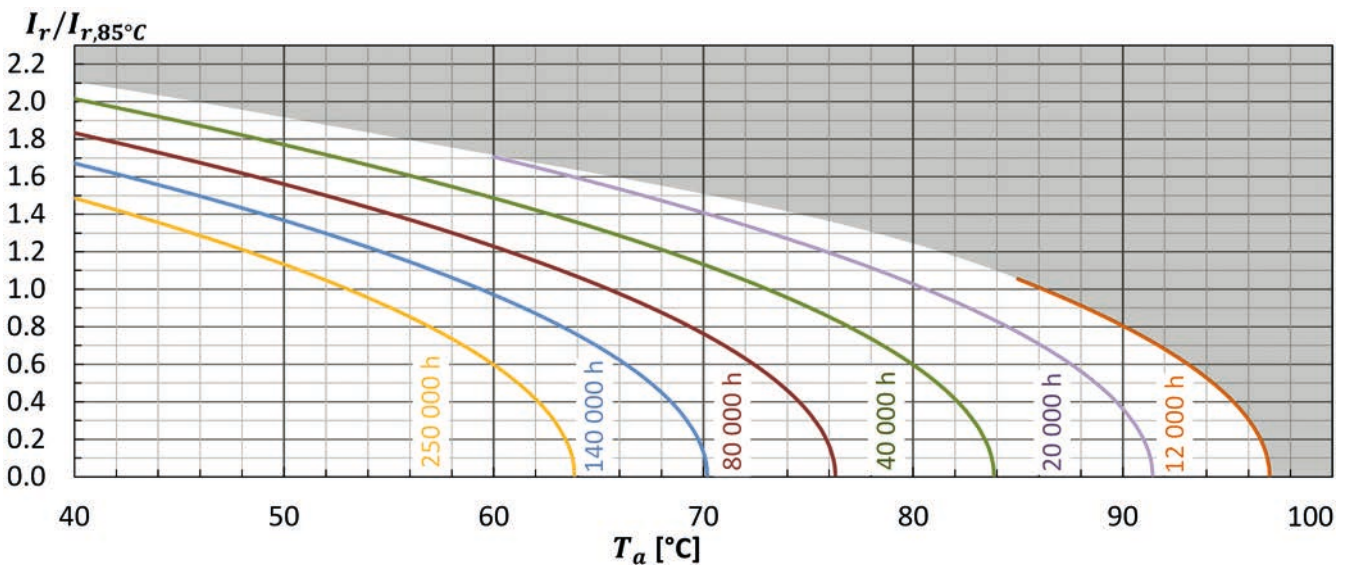
VFLR	Useful life as function of ambient temperature and ripple current											
I_r at 85°C	x 1.0	x 1.1	x 1.2	x 1.3	x 1.4	x 1.5	x 1.6	x 1.7	x 1.8	x 1.9	x 2.0	x 2.1
$T_a = 40^\circ\text{C}$	250	250	250	250	250	240	176	127	90	62	42	28
$T_a = 45^\circ\text{C}$	250	250	250	250	202	151	111	80	57	39	26	17
$T_a = 50^\circ\text{C}$	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											

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



> 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