

VFL · Screw-Terminal · 12000 h/85 °C

Long Life · Bottom cooling design
Suited for optional permanent Charge-Discharge Design

> 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



> Outline Drawings · Bauformen

Shape: B (ØD = 51-101)
(for Bolt – Mounting, M12x16,
stud bolt is not isolated)

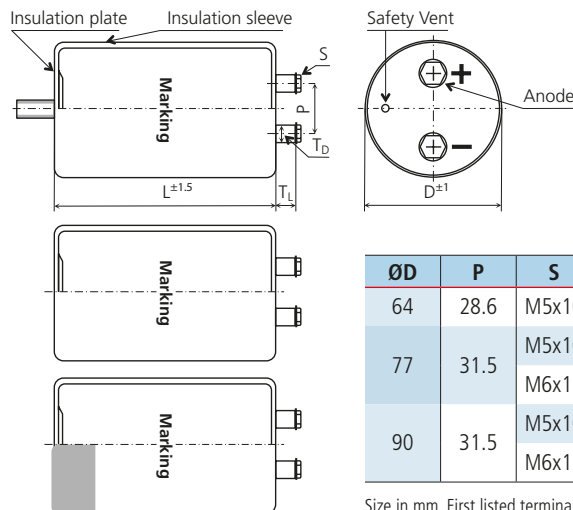
Form: B (ØD = 51-101)
(für Bolzenbefestigung, M12x16,
Bolzen nicht isoliert)

Shape: N (for PBT-Holder ØD = 77-101 and
Press Ring ØD = 64-90)

Form: N (für PBT-Halter ØD = 77-101 und
Einpressring ØD = 64-90)

Shape: Y (ØD = 51-101)
(double sleeve, Y-bracket free of charge)

Form: Y (ØD = 51-101)
(mit doppelter Isolierung, Y-Schelle wird
kostenlos mitgeliefert)



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		Customers' Specification (e.g. M6 ...)																									
The first two digits are significant. The last digit indicates the number of following zeros in μF.						B : Bolt ØD = 51 - 101		<table border="1"> <thead> <tr> <th>ØD</th> <th>Code</th> </tr> </thead> <tbody> <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	64	D	77	E	90	F																		
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				Y : 3 Stoppers Bracket ØD = 64 – 90		For bolt: Case length + 1mm																													

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	0.2	64x94	VFL2V472#D094
	5 600	16.9	35.5	18	19	18	0.2	64x107	VFL2V562#D107
	6 800	18.7	39.3	15	15	18	0.2	64x123	VFL2V682#D123
		20.9	43.9	15	15	20	0.2	77x95	VFL2V682#E095
	8 200	20.2	42.4	12	15	18	0.2	64x147	VFL2V822#D147
		22.9	48.1	12	15	20	0.2	77x108	VFL2V822#E108
	10 000	22.9	48.1	10	15	18	0.2	64x187	VFL2V103#D187
		25.9	54.4	10	15	20	0.2	77x124	VFL2V103#E124
	12 000	29.3	61.5	10	15	20	0.2	90x97	VFL2V103#F097
		27.8	58.4	8	13	20	0.2	77x148	VFL2V123#E148
	15 000	31.7	66.6	8	13	20	0.2	90x126	VFL2V123#F126
		31.9	67.0	7	10	20	0.2	77x188	VFL2V153#E188
18 000	35.2	73.9	7	10	20	0.2	90x150	VFL2V153#F150	
	36.0	75.6	7	10	20	0.2	77x228	VFL2V183#E228	
22 000	37.9	79.6	7	10	20	0.2	90x167	VFL2V183#F167	
	41.1	86.3	6	9	20	0.2	90x230	VFL2V223#F230	
400 VDC Code: 2G Surge Voltage 450 VDC	3 900	13.8	29.0	26	28	18	0.2	64x94	VFL2G392#D094
	4 700	15.5	32.6	21	22	18	0.2	64x107	VFL2G472#D107
	5 600	16.9	35.5	18	19	18	0.2	64x123	VFL2G562#D123
		19.0	39.9	18	19	20	0.2	77x95	VFL2G562#E095
	6 800	18.4	38.6	15	15	18	0.2	64x147	VFL2G682#D147
		20.8	43.7	15	15	20	0.2	77x108	VFL2G682#E108
	8 200	20.8	43.7	12	15	18	0.2	64x187	VFL2G822#D187
		23.5	49.4	12	15	20	0.2	77x124	VFL2G822#E124
	10 000	26.6	55.9	12	15	20	0.2	90x97	VFL2G822#F097
		25.4	53.3	10	15	20	0.2	77x148	VFL2G103#E148
	12 000	28.9	60.7	10	15	20	0.2	90x126	VFL2G103#F126
		28.5	59.9	8	13	20	0.2	77x188	VFL2G123#E188
15 000	31.3	65.7	8	13	20	0.2	90x143	VFL2G123#F143	
	31.5	66.2	8	13	20	0.2	90x150	VFL2G123#F150	
18 000	32.9	69.1	8	10	20	0.2	77x228	VFL2G153#E228	
	34.6	72.7	8	10	20	0.2	90x167	VFL2G153#F167	
22 000	37.2	78.1	6	9	20	0.2	90x230	VFL2G183#F230	
	37.2	78.1	6	9	20	0.2	90x230	VFL2G183#F230	
450 VDC Code: 2W Surge Voltage 500 VDC	2 700	11.7	24.6	38	40	18	0.2	64x94	VFL2W272#D094
	3 300	13.3	27.9	30	35	18	0.2	64x107	VFL2W332#D107
	3 900	14.5	30.5	27	32	18	0.2	64x123	VFL2W392#D123
		16.2	34.0	27	32	20	0.2	77x95	VFL2W392#E095
	4 700	15.6	32.8	21	21	18	0.2	64x147	VFL2W472#D147
		17.8	37.4	21	21	20	0.2	77x108	VFL2W472#E108
	5 600	17.5	36.8	20	20	18	0.2	64x164	VFL2W562#D164
		19.9	41.8	20	20	20	0.2	77x124	VFL2W562#E124
	6 300	22.5	47.3	20	20	20	0.2	90x97	VFL2W562#F097
		21.2	44.3	18	19	20	0.2	77x139	VFL2W632#E139

Additional designs on request · Weitere Designs auf Anfrage

VFL · 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	
450 VDC Code: 2W Surge Voltage 500 VDC	6 800	19.4	40.7	15	18	18	0.2	64x187	VFL2W682#D187	
		21.4	44.9	15	18	20	0.2	77x148	VFL2W682#E148	
		24.6	51.7	15	18	20	0.2	90x110	VFL2W682#F110	
	8 200	24.0	50.4	14	16	20	0.2	77x165	VFL2W822#E165	
		26.8	56.3	14	16	20	0.2	90x126	VFL2W822#F126	
		26.7	56.1	10	15	20	0.2	77x188	VFL2W103#E188	
	10 000	29.4	61.7	10	15	20	0.2	90x150	VFL2W103#F150	
		30.2	63.4	9	12	20	0.2	77x228	VFL2W123#E228	
		31.7	67.0	9	12	20	0.2	90x167	VFL2W123#F167	
	15 000	34.8	73.1	7	10	20	0.2	90x230	VFL2W153#F230	
	500 VDC Code: 2H Surge Voltage 550 VDC	1 800	9.1	19.1	53	50	18	0.2	64x94	VFL2H182#D094
		2 200	10.3	21.6	40	35	18	0.2	64x107	VFL2H222#D107
2 700		11.5	24.2	37	33	18	0.2	64x123	VFL2H272#D123	
		12.9	27.1	37	33	20	0.2	77x95	VFL2H272#E095	
3 300		12.5	26.3	36	32	18	0.2	64x147	VFL2H332#D147	
		14.2	29.8	36	32	20	0.2	77x108	VFL2H332#E108	
3 900		13.9	29.2	27	29	18	0.2	64x164	VFL2H392#D164	
		15.8	33.2	27	29	20	0.2	77x124	VFL2H392#E124	
		17.9	37.6	27	29	20	0.2	90x97	VFL2H392#F097	
4 700		15.4	32.3	25	25	20	0.2	64x187	VFL2H472#D187	
		17.0	35.7	25	25	20	0.2	77x148	VFL2H472#E148	
4 700		19.5	41.0	25	25	20	0.2	90x110	VFL2H472#F110	
		18.9	39.7	23	21	20	0.2	77x165	VFL2H562#E165	
		21.1	44.3	23	21	20	0.2	90x126	VFL2H562#F126	
6 800		20.9	43.9	20	18	20	0.2	77x188	VFL2H682#E188	
		23.1	48.5	20	18	20	0.2	90x150	VFL2H682#F150	
8 200		25.0	52.5	17	16	20	0.2	90x167	VFL2H822#F167	
10 000		27.8	58.4	14	12	20	0.2	90x190	VFL2H103#F190	
12 000	29.6	62.2	12	10	20	0.2	90x230	VFL2H123#F230		
550 VDC Code: 2L Surge Voltage 600 VDC	1 200	7.3	15.3	93	100	18	0.2	64x94	VFL2L122#D094	
	1 500	8.3	17.4	74	80	18	0.2	64x107	VFL2L152#D107	
	1 800	9.1	19.1	61	60	18	0.2	64x123	VFL2L182#D123	
		10.3	21.6	61	60	20	0.2	77x95	VFL2L182#E095	
	2 200	10.0	21.0	53	50	18	0.2	64x147	VFL2L222#D147	
		11.3	23.7	53	50	20	0.2	77x108	VFL2L222#E108	
		11.3	23.7	40	35	18	0.2	64x164	VFL2L272#D164	
	2 700	12.8	26.9	40	35	20	0.2	77x124	VFL2L272#E124	
		14.5	30.5	40	35	20	0.2	90x97	VFL2L272#F097	
		12.6	26.5	38	32	20	0.2	64x187	VFL2L332#D187	
	3 300	13.9	29.2	38	32	20	0.2	77x148	VFL2L332#E148	
		16.0	33.6	38	32	20	0.2	90x110	VFL2L332#F110	
15.4		32.3	30	27	20	0.2	77x165	VFL2L392#E165		
3 900	17.2	36.1	30	27	20	0.2	90x126	VFL2L392#F126		

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
550 VDC Code: 2L Surge Voltage 600 VDC	4 700	17.0	35.7	25	20	20	0.2	77x188	VFL2L472#E188
		18.8	39.5	25	20	20	0.2	90x150	VFL2L472#F150
	5 600	21.4	44.9	20	17	20	0.2	90x150	VFL2L562#F150
		20.2	42.4	20	17	20	0.2	90x167	VFL2L562#F167
	6 800	22.4	47.0	17	17	20	0.2	90x190	VFL2L682#F190
8 200	23.9	50.2	14	15	20	0.2	90x230	VFL2L822#F230	
600 VDC Code: 600V Surge Voltage 650 VDC	1 200	7.0	14.7	122	125	18	0.2	64x94	VFL600V122#D094
		8.0	16.8	111	114	18	0.2	64x123	VFL600V152#D123
	1 500	9.0	18.9	111	114	20	0.2	77x95	VFL600V152#E095
		8.6	18.1	99	102	18	0.2	64x147	VFL600V182#D147
	1 800	9.8	20.6	99	102	20	0.2	77x108	VFL600V182#E108
		9.8	20.6	85	87	18	0.2	64x164	VFL600V222#D164
	2 200	11.1	23.3	85	87	20	0.2	77x124	VFL600V222#E124
		12.6	26.5	85	87	20	0.2	90x97	VFL600V222#F097
	2 700	10.9	22.9	66	68	18	0.2	64x187	VFL600V272#D187
		13.8	29.0	66	68	20	0.2	90x110	VFL600V272#F110
	3 300	13.3	27.9	44	45	20	0.2	77x148	VFL600V332#E148
		15.2	31.9	44	45	20	0.2	90x126	VFL600V332#F126
	3 900	14.9	31.3	33	25	20	0.2	77x188	VFL600V392#E188
		16.4	34.4	33	25	20	0.2	90x150	VFL600V392#F150
	4 700	16.9	35.5	27	20	20	0.2	77x228	VFL600V472#E228
		17.7	37.2	27	20	20	0.2	90x167	VFL600V472#F167
	5 600	19.5	41.0	23	17	20	0.2	90x190	VFL600V562#F190
	6 800	20.9	43.9	19	14	20	0.2	90x230	VFL600V682#F230

> Ripple Current Multiplier · Wechselstrommultiplikator

Frequency [Hz]	50/60	120	300	1k	$\geq 10k$	Forced cooling [m/sec]	$v < 0.5$	$v \geq 0.5$	$v \geq 2.0$	$v \geq 3.0$
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

Additional designs on request · Weitere Designs auf Anfrage

> Life Time Table · Brauchbarkeitsdauer – Tabelle

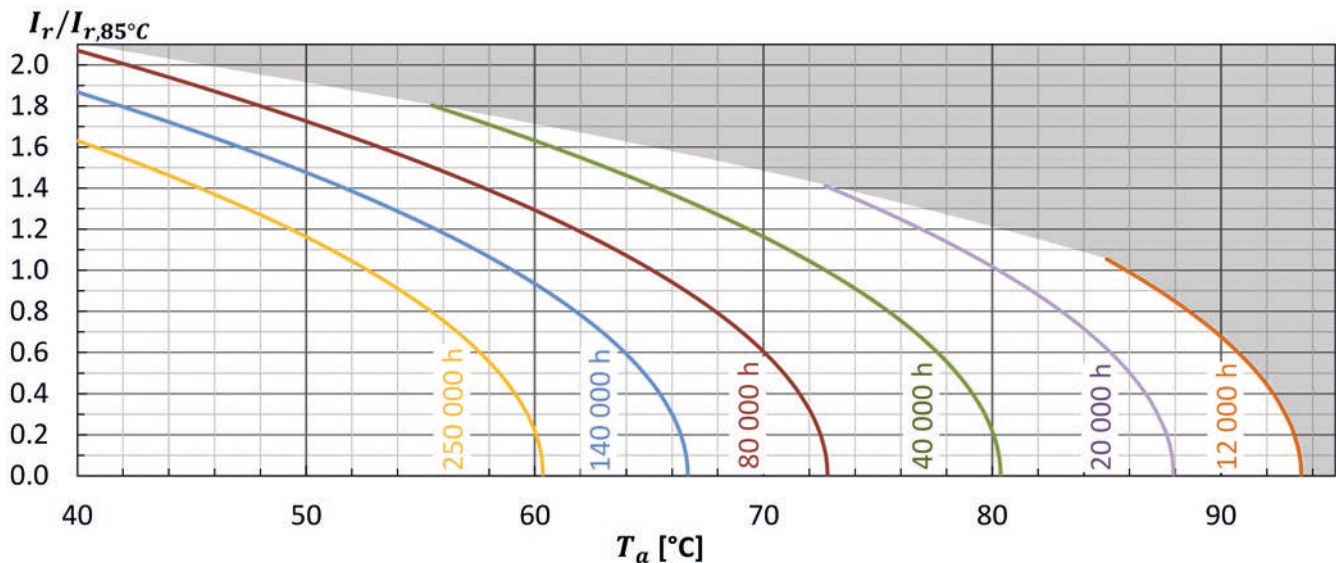
VFL I_r at 85°C	Useful life as function of ambient temperature and ripple current											
	x 1.0	x 1.1	x 1.2	x 1.3	x 1.4	x 1.5	x 1.6	x 1.7	x 1.8	x 1.9	x 2.0	x 2.1
$T_a = 40^\circ\text{C}$	250	250	250	250	250	250	250	212	166	128	97	73
$T_a = 45^\circ\text{C}$	250	250	250	250	250	210	169	134	105	81	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											

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	$\Delta C/C \leq 15\%$ (of initial value) $\text{Tan}\delta \leq 175\%$ (of specified value) $I_L \leq$ specified value
Useful life	$T_a = 85^\circ\text{C}$; V_r, I_r applied 12000 hours	$\Delta C/C \leq 20\%$ (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