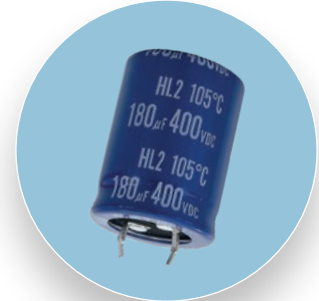


# HL2 · Snap-In · 12000 h/105 °C

## Long Life

### > Specifications · Spezifikationen

Items	Characteristics
Temperature range	-40°C ~ + 105°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)	$0.02 \cdot C \cdot V_r$ [ $\mu$ A] or 3 mA, which is smaller.
Useful life	12 000 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
Sleeve withstanding voltage	3000 Vac/1 min between terminals bundled and plate*



\* Typical value using sleeve which is free from any scratches and damages

### > Outline Drawings · Bauformen

Refer to page 5 for available terminal shapes and dimensions. · Auf Seite 5 finden Sie die verfügbaren Bauformen und Maße.

### > Product Code · Bestellbezeichnung

**Example:** Series HL2 · 400 V · 470  $\mu$ F  $\pm$  20 % · 30x50 mm · 4-pin short · without plate

**HL2**

Type of series

**2G**

Capacitance code

The first two digits are significant.  
The last digit indicates the number of following zeros in  $\mu$ F.

**471**

**M**

Terminal symbol code

- R: 2-pin terminal
- S: 4-pin terminal
- C: 2-pin short terminal
- X: 4-pin short terminal
- E: 3-pin short terminal

**Z**

**S7**

**WPEC**

Outer design code

- None:  
PET sleeve and PVC plate
- WPEC:  
PET sleeve without plate
- Others on request

Rated voltage Code

Code	Voltage
2D	200
2E	250
2G	400
420V	420
2W	450
2H	500

Capacitance tolerance

- M :  $\pm$  20%
- Q : -10% ~ +30%

Diameter Code

Code	$\varnothing$ D
W	20
X	22
Y	25
Z	30
A	35
B	40

Length Code

Code	L	Code	L
S1	20	S8	55
S2	25	S9	60
S3	30	S10	65
S4	35	S11	70
S5	40	S12	75
S6	45	S13	80
S7	50		

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 $\Omega$ ]	Dissipation Factor at 20°C/100Hz Tan $\delta$	DxL [mm]	Product Code  # = variable value, see fixing code in the product code
<b>200 VDC</b> Code: 2D  Surge Voltage 250 VDC	220	0.97	2.72	456	0.15	20x25	HL22D221M#WS2
	270	1.16	3.25	372	0.15	20x30	HL22D271M#WS3
	330	1.35	3.78	304	0.15	20x35	HL22D331M#WS4
		1.31	3.67	304	0.15	22x30	HL22D331M#XS3
	390	1.25	3.50	304	0.15	25x25	HL22D331M#YS2
		1.45	4.06	257	0.15	25x30	HL22D391M#YS3
	470	1.74	4.87	214	0.15	22x40	HL22D471M#XS5
		1.60	4.48	214	0.15	25x30	HL22D471M#YS3
		1.56	4.37	214	0.15	30x25	HL22D471M#ZS2
	560	1.99	5.57	179	0.15	22x45	HL22D561M#XS6
		1.84	5.15	179	0.15	25x35	HL22D561M#YS4
	680	2.12	5.94	148	0.15	25x40	HL22D681M#YS5
		1.99	5.57	148	0.15	30x30	HL22D681M#ZS3
	820	2.44	6.83	122	0.15	25x45	HL22D821M#YS6
		2.31	6.47	122	0.15	30x35	HL22D821M#ZS4
	1 000	2.67	7.48	100	0.15	30x40	HL22D102M#ZS5
		2.26	6.33	100	0.15	35x30	HL22D102M#AS3
	1 200	3.06	8.57	84	0.15	30x45	HL22D122M#ZS6
		2.60	7.28	84	0.15	35x35	HL22D122M#AS4
	1 500	3.04	8.51	67	0.15	35x40	HL22D152M#AS5
<b>250 VDC</b> Code: 2E  Surge Voltage 300 VDC	150	0.8	2.24	496	0.15	20x25	HL22E151M#WS2
	180	0.94	2.63	413	0.15	20x30	HL22E181M#WS3
		0.9	2.52	413	0.15	22x25	HL22E181M#XS2
	220	1.03	2.88	338	0.15	20x30	HL22E221M#WS3
	270	1.22	3.42	275	0.15	20x35	HL22E271M#WS4
		1.13	3.16	275	0.15	25x25	HL22E271M#YS2
	330	1.39	3.89	225	0.15	22x35	HL22E331M#XS4
		1.33	3.72	225	0.15	25x30	HL22E331M#YS3
	390	1.58	4.42	191	0.15	22x40	HL22E391M#XS5
		1.53	4.28	191	0.15	25x35	HL22E391M#YS4
		1.43	4.00	191	0.15	30x25	HL22E391M#ZS2
	470	1.90	5.32	162	0.15	22x50	HL22E471M#XS7
		1.77	4.96	162	0.15	25x40	HL22E471M#YS5
		1.66	4.65	162	0.15	30x30	HL22E471M#ZS3
	560	2.02	5.66	136	0.15	25x45	HL22E561M#YS6
	680	2.32	6.50	112	0.15	25x50	HL22E681M#YS7
		2.10	5.88	112	0.15	30x35	HL22E681M#ZS4
	820	2.42	6.78	93	0.15	30x40	HL22E821M#ZS5
	1 000	2.90	8.12	76	0.15	30x50	HL22E102M#ZS7
	1 200	2.83	7.92	64	0.15	35x45	HL22E122M#AS6
1 500	3.29	9.21	61	0.15	35x50	HL22E152M#AS7	

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 $\Omega$ ]	Dissipation Factor at 20°C/100Hz 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	47	0.46	1.29	1625	0.15	20x25	HL22G470M#WS2
	68	0.56	1.57	1121	0.15	20x25	HL22G680M#WS2
	82	0.64	1.79	1126	0.15	20x25	HL22G820M#WS2
	100	0.77	2.16	781	0.15	20x35	HL22G101M#WS4
		0.75	2.10	781	0.15	22x30	HL22G101M#XS3
		0.72	2.02	781	0.15	25x25	HL22G101M#YS2
	120	0.85	2.38	651	0.15	20x35	HL22G121M#WS4
		0.87	2.44	651	0.15	22x35	HL22G121M#XS4
		0.84	2.35	651	0.15	25x30	HL22G121M#YS3
	150	1.02	2.86	521	0.15	22x40	HL22G151M#XS5
		0.94	2.63	521	0.15	25x30	HL22G151M#YS3
		0.88	2.46	521	0.15	30x25	HL22G151M#ZS2
		1.18	3.30	475	0.15	22x45	HL22G181M#XS6
	180	1.09	3.05	475	0.15	25x35	HL22G181M#YS4
		1.02	2.86	475	0.15	30x30	HL22G181M#ZS3
		1.35	3.78	389	0.15	22x50	HL22G221M#XS7
	220	1.26	3.53	389	0.15	25x40	HL22G221M#YS5
		1.13	3.16	389	0.15	30x30	HL22G221M#ZS3
		1.46	4.09	317	0.15	25x45	HL22G271M#YS6
	270	1.33	3.72	317	0.15	30x35	HL22G271M#ZS4
		1.33	3.72	317	0.15	35x30	HL22G271M#AS3
		1.67	4.68	259	0.15	25x50	HL22G331M#YS7
	330	1.54	4.31	259	0.15	30x40	HL22G331M#ZS5
		1.54	4.31	259	0.15	35x35	HL22G331M#AS4
		1.75	4.90	219	0.15	30x45	HL22G391M#ZS6
	390	1.67	4.68	219	0.15	35x35	HL22G391M#AS4
		2.16	6.04	219	0.15	40x31	HL22G391M#BS3
		2.00	5.61	182	0.15	30x50	HL22G471M#ZS7
	470	1.92	5.38	182	0.15	35x40	HL22G471M#AS5
		2.19	6.13	156	0.15	35x45	HL22G561M#AS6
560	2.51	7.02	126	0.15	35x50	HL22G681M#AS7	
	2.75	7.70	124	0.15	35x50	HL22G681M#AS72P	
	2.44	6.84	130	0.15	40x40	HL22G681M#BS5	
820	2.98	8.35	105	0.15	35x70	HL22G821M#AS11	
1 000	3.48	9.73	86	0.15	35x80	HL22G102M#AS13	
<b>420 VDC</b> Code: 420V  Surge Voltage 470 VDC	150	0.94	2.63	570	0.15	30x30	HL2420V151M#ZS3
	180	1.08	3.02	475	0.15	30x35	HL2420V181M#ZS4
		1.08	3.02	475	0.15	35x30	HL2420V181M#AS3
	220	1.36	3.82	389	0.15	25x50	HL2420V221M#YS7
		1.20	3.36	389	0.15	30x35	HL2420V221M#ZS4
		1.20	3.36	389	0.15	35x30	HL2420V221M#AS3
	330	1.54	4.31	259	0.15	30x40	HL2420V331M#ZS5

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 $\Omega$ ]	Dissipation Factor at 20°C/100Hz Tan $\delta$	DxL [mm]	Product Code  # = variable value, see fixing code in the product code
<b>450 VDC</b> Code: 2W  Surge Voltage 500 VDC	47	0.46	1.29	1820	0.15	20x25	HL22W470M#WS2
	56	0.55	1.54	1527	0.15	20x30	HL22W560M#WS3
		0.53	1.48	1527	0.15	22x25	HL22W560M#XS2
	68	0.60	1.68	1258	0.15	20x30	HL22W680M#WS3
		0.62	1.74	1258	0.15	22x30	HL22W680M#XS3
	82	0.59	1.65	1258	0.15	25x25	HL22W680M#YS2
		0.70	1.96	1043	0.15	20x35	HL22W820M#WS4
	100	0.79	2.21	855	0.15	22x35	HL22W101M#XS4
		0.72	2.00	855	0.15	25x25	HL22W101M#YS2
	120	0.91	2.55	713	0.15	22x40	HL22W121M#XS5
		0.88	2.46	713	0.15	25x35	HL22W121M#YS4
		0.79	2.21	713	0.15	30x25	HL22W121M#ZS2
	150	1.12	3.14	570	0.15	22x50	HL22W151M#XS7
		1.04	2.91	570	0.15	25x40	HL22W151M#YS5
		0.94	2.63	570	0.15	30x30	HL22W151M#ZS3
	180	1.19	3.33	475	0.15	25x45	HL22W181M#YS6
		1.08	3.02	475	0.15	30x35	HL22W181M#ZS4
	220	1.40	3.92	389	0.15	25x40	HL22W221M#YS5
		1.20	3.36	389	0.15	35x30	HL22W221M#AS3
	270	1.45	4.06	317	0.15	30x45	HL22W271M#ZS6
1.40		3.92	317	0.15	35x35	HL22W271M#AS4	
330	1.67	4.68	259	0.15	30x50	HL22W331M#ZS7	
	1.62	4.54	259	0.15	35x40	HL22W331M#AS5	
390	1.83	5.12	224	0.15	35x45	HL22W391M#AS6	
470	2.08	5.82	190	0.15	35x50	HL22W471M#AS7	
<b>500 VDC</b> Code: 2H  Surge Voltage 550 VDC	100	0.74	2.06	960	0.20	25x45	HL22H101M#YS6
	120	0.85	2.37	800	0.20	25x50	HL22H121M#YS7
		0.79	2.22	800	0.20	30x35	HL22H121M#ZS4
	150	0.79	2.22	800	0.20	35x30	HL22H121M#AS3
		0.94	2.62	640	0.20	30x40	HL22H151M#ZS5
	180	0.94	2.62	640	0.20	35x35	HL22H151M#AS4
		1.11	3.11	540	0.20	30x50	HL22H181M#ZS7
	220	1.07	2.99	540	0.20	35x40	HL22H181M#AS5
		1.23	3.45	440	0.20	35x45	HL22H221M#AS6
	270	1.42	3.97	360	0.20	35x50	HL22H271M#AS7
	330	1.56	4.37	340	0.20	35x60	HL22H331M#AS9
390	1.94	5.43	250	0.20	40x61	HL22H391M#BS9	

Additional designs on request · Weitere Designs auf Anfrage

## > Ripple Current Multiplier · Wechselstrommultiplikator

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

Temperature [°C]	40	60	70	85	105
Multiplier	2.8	2.4	2.1	2.0	1.0

> Life Time Table · Brauchbarkeitsdauer – Tabelle

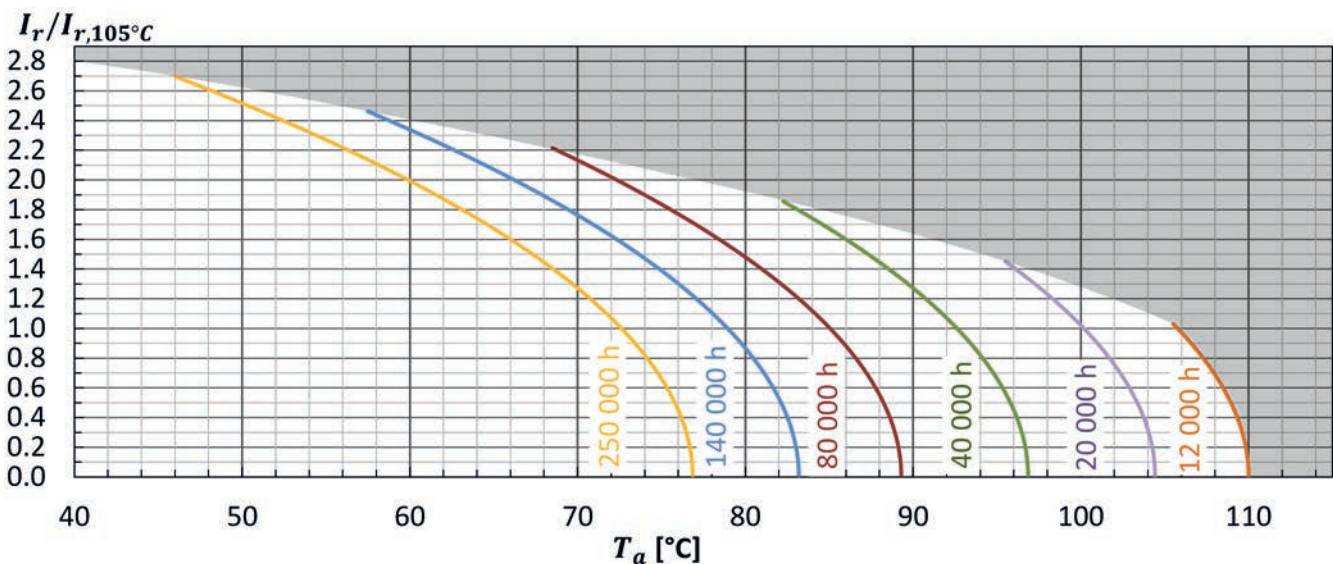
HL2	Useful life as function of ambient temperature and ripple current													
	$x 1.0$	$x 1.2$	$x 1.4$	$x 1.6$	$x 1.8$	$x 2.0$	$x 2.1$	$x 2.2$	$x 2.3$	$x 2.4$	$x 2.5$	$x 2.6$	$x 2.7$	$x 2.8$
$T_a = 40^\circ\text{C}$	250	250	250	250	250	250	250	250	250	250	250	250	250	250
$T_a = 45^\circ\text{C}$	250	250	250	250	250	250	250	250	250	250	250	250	250	250
$T_a = 50^\circ\text{C}$	250	250	250	250	250	250	250	250	250	250	250	211		
$T_a = 55^\circ\text{C}$	250	250	250	250	250	250	250	237	198	163				
$T_a = 60^\circ\text{C}$	250	250	250	250	248	211	179	150	125					
$T_a = 65^\circ\text{C}$	250	250	250	210	156	133	113	94						
$T_a = 70^\circ\text{C}$	250	250	219	173	133	99	84							
$T_a = 75^\circ\text{C}$	201	169	138	109	84	62	53							
$T_a = 80^\circ\text{C}$	127	107	87	69	53	39								
$T_a = 85^\circ\text{C}$	80	67	55	43	33	25								
$T_a = 90^\circ\text{C}$	50	42	35	27	21									
$T_a = 95^\circ\text{C}$	32	27	22	17										
$T_a = 100^\circ\text{C}$	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	$\Delta C/C \leq 15\%$ (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 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