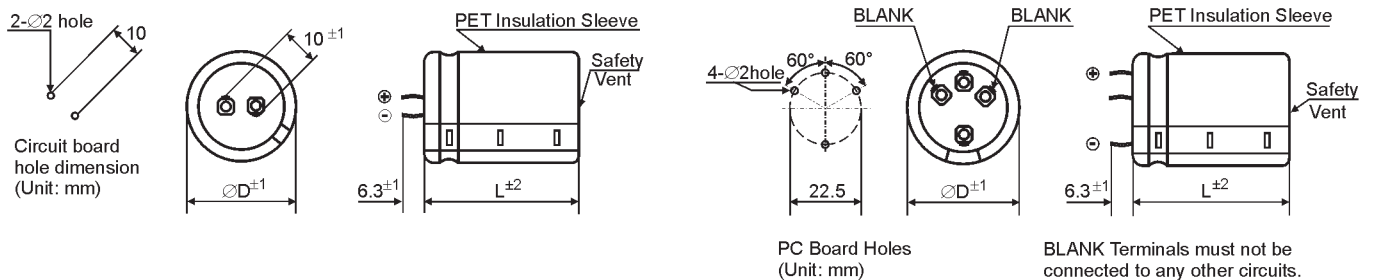


**► Specifications / Spezifikationen**

Items	Characteristics
Temperature range	-40°C ~ + 105°C
Rated voltage	200VDC - 500VDC
Surge voltage	Repetitive max. 30 sec per 6 Minutes
Leakage current at 20°C	0.02 • C • V <sub>r</sub> [μA] or 3 mA, which is smaller.
Capacitance tolerance	+/- 20%
Useful life	12000h at 105°C
Field failure rate	0.5 FIT = 0.5 • 10 <sup>-9</sup> Failures/hour
Failure rate	Less than 0.1% within the useful life



**► Outline Drawing / Bauformen**



Shape / Form: R (Standard, D ≤ 35mm)  
C (with short pin 4 ± 1mm)

Shape / Form: S (D ≥ 35mm)  
X (with short pin 4 ± 1mm)

**► Ripple Current Multiplier / Wechselstrommultiplikator**

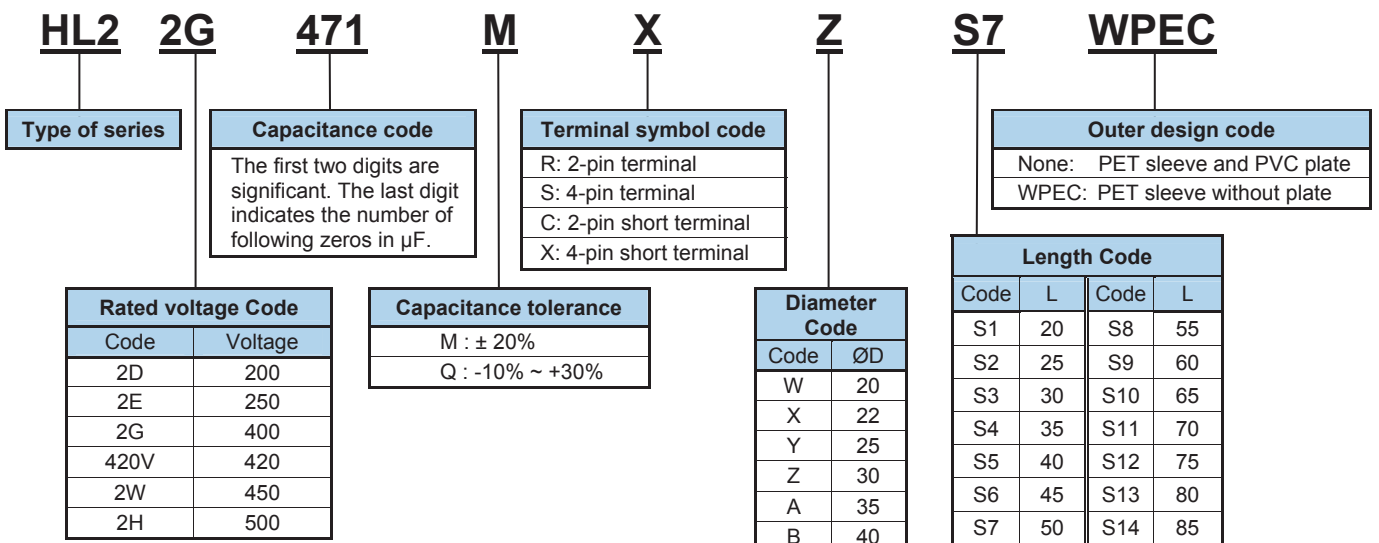
Frequency [Hz]	50/60	120	300	1k	≥ 10k
multiplier	0.7	1.0	1.1	1.3	1.4

Forced cooling [m/sec]	v < 1.0	v ≥ 1.0
multiplier	1.0	1.1

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

**► Product Code / Bestellbezeichnung**

Example: HL2 400V 470μF ±20% 30x50mm Shape „X“



Rated Voltage Code (Surge Voltage) $V_r$ [V DC]	Capacitance $C_r$ [ $\mu$ F]	Dissipation factor $\tan \delta$	Ripple Current at 40°C/120Hz [A RMS]	Ripple Current at 105°C/120Hz $I_r$ [A RMS]	ESR (typ) at 20°C/100Hz [m $\Omega$ ]	DxL [mm]	Product Code
200 2D (250)	220	0.15	2.72	0.97	456	20x25	HL22D221M□WS2
	270	0.15	3.25	1.16	372	20x30	HL22D271M□WS3
	330	0.15	3.50	1.25	304	25x25	HL22D331M□YS3
		0.15	3.67	1.31	304	22x30	HL22D331M□XS3
		0.15	3.78	1.35	304	20x35	HL22D331M□WS5
	390	0.15	4.06	1.45	257	25x30	HL22D391M□YS3
	470	0.15	4.37	1.56	214	30x25	HL22D471M□ZS2
		0.15	4.48	1.60	214	25x30	HL22D471M□YS3
		0.15	4.87	1.74	214	22x40	HL22D471M□XS5
	560	0.15	5.15	1.84	179	25x35	HL22D561M□YS4
		0.15	5.57	1.99	179	22x45	HL22D561M□XS6
	680	0.15	5.57	1.99	148	30x30	HL22D681M□ZS3
		0.15	5.94	2.12	148	25x40	HL22D681M□YS5
	820	0.15	6.47	2.31	122	30x35	HL22D821M□ZS4
		0.15	6.83	2.44	122	25x45	HL22D821M□YS6
	1 000	0.15	6.33	2.26	100	35x30	HL22D102M□AS3
		0.15	7.48	2.67	100	30x40	HL22D102M□ZS5
	1 200	0.15	7.28	2.60	84	35x35	HL22D122M□AS4
0.15		8.57	3.06	84	30x45	HL22D122M□ZS6	
1 500	0.15	8.51	3.04	67	35x40	HL22D152M□AS5	
250 2E (300)	150	0.15	2.24	0.80	496	20x25	HL22E151M□WS2
	180	0.15	2.52	0.90	413	22x25	HL22E181M□XS2
		0.15	2.63	0.94	413	20x30	HL22E181M□WS3
	220	0.15	2.88	1.03	338	20x30	HL22E221M□WS3
	270	0.15	3.16	1.13	275	25x25	HL22E271M□YS2
		0.15	3.42	1.22	275	20x35	HL22E271M□WS4
	330	0.15	3.72	1.33	225	25x30	HL22E331M□YS3
		0.15	3.89	1.39	225	22x35	HL22E331M□XS4
	390	0.15	4.00	1.43	191	30x25	HL22E391M□ZS2
		0.15	4.28	1.53	191	25x35	HL22E391M□YS4
		0.15	4.42	1.58	191	22x40	HL22E391M□XS5
	470	0.15	4.65	1.66	162	30x30	HL22E471M□ZS3
		0.15	4.96	1.77	162	25x40	HL22E471M□YS5
		0.15	5.32	1.90	162	22x50	HL22E471M□XS7
	560	0.15	5.66	2.02	136	25x45	HL22E561M□YS6
	680	0.15	5.88	2.10	112	30x35	HL22E681M□ZS4
		0.15	6.50	2.32	112	25x50	HL22E681M□YS7
	820	0.15	6.78	2.42	93	30x40	HL22E821M□ZS5
1 000	0.15	8.12	2.90	76	30x50	HL22E102M□ZS7	
1 200	0.15	7.92	2.83	64	35x45	HL22E122M□AS6	
1 500	0.15	9.21	3.29	61	35x50	HL22E152M□AS7	
400 2G (450)	47	0.15	1.29	0.46	1625	20x25	HL22G470M□WS2
	68	0.15	1.57	0.56	1121	20x25	HL22G680M□WS2
	82	0.15	1.79	0.64	952	22x25	HL22G820M□XS2
		0.15	1.85	0.66	952	20x30	HL22G820M□WS3
	100	0.15	2.02	0.72	781	25x25	HL22G101M□YS2
		0.15	2.10	0.75	781	22x30	HL22G101M□XS3
		0.15	2.16	0.77	781	20x35	HL22G101M□WS4
	120	0.15	2.35	0.84	651	25x30	HL22G121M□YS3
		0.15	2.38	0.85	651	20x35	HL22G121M□WS4
		0.15	2.44	0.87	651	22x35	HL22G121M□XS4
	150	0.15	2.46	0.88	521	30x25	HL22G151M□ZS2
		0.15	2.63	0.94	521	25x30	HL22G151M□YS3
		0.15	2.86	1.02	521	22x40	HL22G151M□XS5
	180	0.15	2.86	1.02	475	30x30	HL22G181M□ZS3
		0.15	3.05	1.09	475	25x35	HL22G181M□YS4
		0.15	3.30	1.18	475	22x45	HL22G181M□XS6
	220	0.15	3.16	1.13	389	30x30	HL22G221M□ZS3
		0.15	3.53	1.26	389	25x40	HL22G221M□YS5
0.15		3.78	1.35	389	22x50	HL22G221M□XS7	
270	0.15	3.72	1.33	317	30x35	HL22G271M□ZS4	
	0.15	3.72	1.33	317	35x30	HL22G271M□AS3	
0.15	4.09	1.46	317	25x45	HL22G271M□YS6		

Rated Voltage Code (Surge Voltage) $V_r$ [V DC]	Capacitance $C_r$ [ $\mu$ F]	Dissipation factor $\tan \delta$	Ripple Current at 40°C/120Hz [A RMS]	Ripple Current at 105°C/120Hz $I_r$ [A RMS]	ESR (typ) at 20°C/100Hz [m $\Omega$ ]	DxL [mm]	Product Code
400 2G (450)	330	0.15	4.31	1.54	259	30x40	HL22G331M□ZS5
		0.15	4.31	1.54	259	35x35	HL22G331M□AS4
		0.15	4.68	1.67	259	25x50	HL22G331M□YS7
	390	0.15	4.68	1.67	219	35x35	HL22G391M□AS4
		0.15	4.90	1.75	219	30x45	HL22G391M□ZS6
		0.15	6.04	2.16	218	40x31	HL22G391M□BS3
	470	0.15	5.38	1.92	182	35x40	HL22G471M□AS5
		0.15	5.61	2.00	182	30x50	HL22G471M□ZS7
	560	0.15	6.13	2.19	156	35x45	HL22G561M□AS6
	680	0.15	6.84	2.44	130	40x40	HL22G681M□BS5
0.15		7.02	2.51	126	35x50	HL22G681M□AS7	
820	0.15	8.35	2.98	105	35x70	HL22G821M□AS11	
1 000	0.15	9.73	3.48	86	35x80	HL22G102M□AS13	
420 420V (470)	150	0.15	2.63	0.94	570	30x30	HL2420V151M□ZS3
	180	0.15	3.02	1.08	475	30x35	HL2420V181M□ZS4
		0.15	3.02	1.08	475	35x30	HL2420V181M□AS3
	220	0.15	3.36	1.20	389	30x35	HL2420V221M□ZS4
		0.15	3.36	1.20	389	35x30	HL2420V221M□AS3
		0.15	3.82	1.36	389	25x50	HL2420V221M□YS7
	330	0.15	4.31	1.54	259	30x40	HL2420V331M□ZS5
450 2W (500)	47	0.15	1.29	0.46	1820	20x25	HL22W470M□WS2
	56	0.15	1.48	0.53	1527	22x25	HL22W560M□XS2
		0.15	1.54	0.55	1527	20x30	HL22W560M□WS3
	68	0.15	1.65	0.59	1258	25x25	HL22W680M□YS2
		0.15	1.68	0.60	1258	20x30	HL22W680M□WS3
		0.15	1.74	0.62	1258	22x30	HL22W680M□XS3
	82	0.15	1.96	0.70	1043	20x35	HL22W820M□WS4
		0.15	2.00	0.72	855	25x25	HL22W101M□YS2
		0.15	2.13	0.76	855	25x30	HL22W101M□YS3
	100	0.15	2.21	0.79	855	22x35	HL22W101M□XS4
		0.15	2.21	0.79	713	30x25	HL22W121M□ZS2
		0.15	2.46	0.88	713	25x35	HL22W121M□YS4
	120	0.15	2.55	0.91	713	22x40	HL22W121M□XS5
		0.15	2.63	0.94	570	30x30	HL22W151M□ZS3
		0.15	2.91	1.04	570	25x40	HL22W151M□YS5
	150	0.15	3.14	1.12	570	22x50	HL22W151M□XS7
		0.15	3.02	1.08	475	30x35	HL22W181M□ZS4
		0.15	3.33	1.19	475	25x45	HL22W181M□YS6
	180	0.15	3.36	1.20	389	35x30	HL22W221M□AS3
		0.15	3.50	1.25	389	30x40	HL22W221M□ZS5
	220	0.15	3.92	1.40	317	35x35	HL22W271M□AS4
		0.15	4.06	1.45	317	30x45	HL22W271M□ZS6
	270	0.15	4.54	1.62	259	35x40	HL22W331M□AS5
		0.15	4.68	1.67	259	30x50	HL22W331M□ZS7
330	0.15	5.12	1.83	224	35x45	HL22W391M□AS6	
	0.15	5.82	2.08	190	35x50	HL22W471M□AS7	
500 2H (550)	100	0.20	2.06	0.74	960	25x45	HL22H101M□YS6
	120	0.20	2.22	0.79	800	30x35	HL22H121M□ZS4
		0.20	2.22	0.79	800	35x30	HL22H121M□AS3
		0.20	2.37	0.85	800	25x50	HL22H121M□YS7
	150	0.20	2.62	0.94	640	30x40	HL22H151M□ZS5
		0.20	2.62	0.94	640	35x35	HL22H151M□AS4
	180	0.20	2.99	1.07	540	35x40	HL22H181M□AS5
		0.20	3.11	1.11	540	30x50	HL22H181M□ZS7
	220	0.20	3.45	1.23	440	35x45	HL22H221M□AS6
	270	0.20	3.97	1.42	360	35x50	HL22H271M□AS7
	330	0.20	4.37	1.56	340	35x60	HL22H331M□AS9
	390	0.20	5.43	1.94	250	40x61	HL22H391M□BS9

► Life Time Table / Brauchbarkeitsdauer – Tabelle

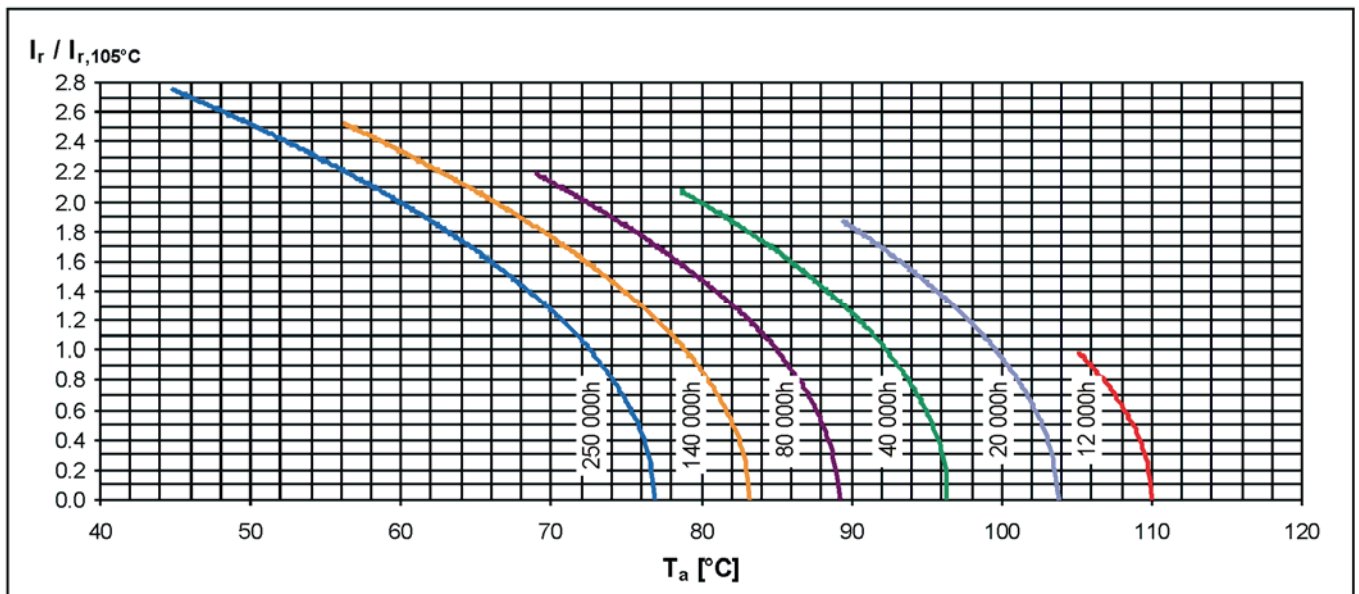
HL2	Useful life as function of ambient temperature and ripple current														
	$I_r$ at 105°C	x 1.0	x 1.2	x 1.4	x 1.6	x 1.8	x 2.0	x 2.1	x 2.2	x 2.3	x 2.4	x 2.5	x 2.6	x 2.7	x 2.8
$T_a = 40^\circ\text{C}$	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
$T_a = 45^\circ\text{C}$	250	250	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	250	213		
$T_a = 55^\circ\text{C}$	250	250	250	250	250	250	250	250	238	198	164				
$T_a = 60^\circ\text{C}$	250	250	250	250	250	248	212	179	150	125					
$T_a = 65^\circ\text{C}$	250	250	250	250	211	157	134	113	95						
$T_a = 70^\circ\text{C}$	250	250	219	174	133	99	85								
$T_a = 75^\circ\text{C}$	201	170	139	110	84	63	54								
$T_a = 80^\circ\text{C}$	127	107	88	69	53	40									
$T_a = 85^\circ\text{C}$	80	68	55	44	34	25									
$T_a = 90^\circ\text{C}$	50	43	35	28	21										
$T_a = 95^\circ\text{C}$	31	27	22	18											
$T_a = 100^\circ\text{C}$	19	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  $T_u$  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	Reference	Test procedure	Life time criteria
Endurance test	JIS-C-5101-4 JIS-C-5102 IEC 60384-4	$T_a = 105^\circ\text{C}$ ; $V_r, I_r$ applied 8000 hours	$\Delta C/C < 15\%$ $\text{Tan}\delta < 175\%$ (of initial value) $I_L = \text{spec. value}$
Useful life	JIS-C-5104-4 IEC 60384-4	$T_a = 105^\circ\text{C}$ ; $V_r, I_r$ applied 12000 hours	$\Delta C/C < 20\%$ $\text{Tan}\delta < 200\%$ (of initial value) $I_L = \text{spec. value}$