

## Part Numbering System



① Category code

Type	Code	
	2	3
Electrolytic Capacitor	E	
Conductive Polymer	S	

② Series code

Series name	Code	
	2	3
WH	W	H
CD11GE	G	E
CD11GES	G	X
CD11GAS	G	W
CD11GHS	G	S
NR	N	R
PZ	P	Z

③ Voltage code

WV (V <sub>dc</sub> )	Code	
	4	5
2.5	0	E
3	0	D
4	0	G
6.3	0	J
6.8	0	C
7	0	Q
7.5	0	A
10	1	A
12	1	T
16	1	C
25	1	E
35	1	V
40	1	G
50	1	H
63	1	J
80	1	B
100	1	K
120	2	B
160	2	C
180	2	L
200	2	D
220	2	N
250	2	E
315	2	F
350	2	V
380	2	P
400	2	G
420	2	T
450	2	W
500	2	H
550	2	J
600	2	K

④ Capacitance tolerance code

Tol. (%)	Code	
	6	
-10~+10	K	
-20~+20	M	
-10~+30	Q	
-10~+20	V	
0~+20	A	
-5~+20	C	
-10~-20	B	
-5~+5	D	
0~+10	E	
-5~-20	F	
-15~+5	N	

⑤ Capacitance code

Cap (μF)	Code		
	7	8	9
0.10	R	1	0
0.22	R	2	2
0.33	R	3	3
0.47	R	4	7
0.68	R	6	8
1	0	1	0
2.2	2	R	2
3.3	3	R	3
4.7	4	R	7
6.8	6	R	8
10	1	0	0
22	2	2	0
33	3	3	0
47	4	7	0
68	6	8	0
100	1	0	1
220	2	2	1
330	3	3	1
470	4	7	1
680	6	8	1
1000	1	0	2
2200	2	2	2
3300	3	3	2
4700	4	7	2
6800	6	8	2
10000	1	0	3
22000	2	2	3
33000	3	3	3
68000	6	8	3

⑥ Size code

ΦD (mm)	Code	
	10	
4	C	
5	D	
6.3	E	
8	F	
10	G	
11	H	
12	J	
12.5	W	
13	K	
14	X	
16	L	
18	M	
19	Z	
20	N	
22	O	
25	P	
30	Q	
35	R	
40	Y	
51.6	S	
64.3	T	
76.9	U	
91	V	
100	A	

L (mm)	Code	
	11	12
5	0	5
7	0	7
11	1	1
12	1	2
16	1	6
20	2	0
25	2	5
30	3	0
35	3	5
40	4	0
46	4	6
50	5	0
60	6	0
80	8	0
100	A	0
115	B	5
120	C	0
130	D	0
140	E	0
160	G	0
200	K	0
220	M	0
236	N	6
250	P	0

⑦ Terminal code

Specification	Code		
	13	14	15
Bulk packing	O	-	-
Taping (SMD Type)	D	0	0
Φ4~8 Taping F=5.0mm	P	5	0
Φ10~12.5 Taping F=5.0mm	B	5	0
Lead Cut L=3.5mm	C	3	5
Lead Cut L=11.0mm	C	B	0
Lead Forming & Cut L=4.5mm	F	-	-
Kink & Cut L=4.5mm	J	-	-
Snap-in type Terminal 4.0mm in length	K	-	-
Three Terminals	T	-	-
Ring clip mounting standard design	A	0	0
Ring clip mounting special design	S	-	-

⑧ Sleeve/Marking code

Sleeve/Marking	Code	
	16	
PVC	C	
PET	T	
Dark blue	B	
Bright red	R	
Sky-blue	S	
Light blue	T	
Pink	Z	
Black	H	
Purple-blue	V	
Red	O	

Lead Forming  
Taping Specifications

Fig.1 code: X



Fig.2 code: B



Fig.3 code: B



Fig.4 code: P



## Lead Forming

Specification Fig.1 & Fig.2 & Fig.3

Items	Symbol	Case size										Tolerance		
		4*5 4*7		5*5 5*7		5*11		6.3*5	6.3*7 6.3*9	6.3*11 6.3*12	8*5/7 8*9/11 8*11.5 8*12		8*16 8*20	10*9/12 10*12.5 10*13/16 10*20/25
Pin Code		X	B	X	B	X	B	B	B	B	B	B	B	
Lead wire diameter	Φd	0.45		0.45		0.5		0.45	0.5	0.5	0.45/0.5	0.6	0.6	±0.05
Pitch of body	P	12.7		12.7		12.7		12.7	12.7	12.7	12.7	12.7	12.7	±1.0
Feed hole pitch	P0	12.7		12.7		12.7		12.7	12.7	12.7	12.7	12.7	12.7	±0.2
Distance from hole center to lead	P1	5.1	5.6	5.1	5.35	5.1	5.35	5.1	5.1	5.1	4.6	4.6	3.85	±0.7
Distance from feed hole center to body center	P2	6.35		6.35		6.35		6.35	6.35	6.35	6.35	6.35	6.35	±1.0
Lead-to-lead distance	F	2.5	1.5	2.5	2.0	2.5	2.0	2.5	2.5	2.5	3.5	3.5	5.0	±0.5
Height of body from tape center	H	18.5		18.5		18.5		18.5	18.5	18.5	18.5	18.5	18.5	±0.75
Base tape width	W	18.0		18.0		18.0		18.0	18.0	18.0	18.0	18.0	18.0	±0.5
Adhesive tape width	W0	6.0		6.0		6.0		6.0	6.0	8.0	8.0	8.0	11.0	min
Hole position	W1	9.0		9.0		9.0		9.0	9.0	9.0	9.0	9.0	9.0	+0.75 -0.5
Hole down tape position	W2	3.0		3.0		3.0		3.0	3.0	3.0	3.0	3.0	3.0	max

Specification Fig.4

Items	Symbol	Case size									Tolerance
		4*5 4*7	5*5	5*7	5*11	6.3*5	6.3*7 6.3*9	6.3*11 6.3*12	8*5/7 8*9/11 8*11.5/12	8*16 8*20	
Pin Code		P	P	P	P	P	P	P	P	P	
Lead wire diameter	Φd	0.45	0.45	0.45	0.5	0.45	0.5	0.5	0.45/0.5	0.6	±0.05
Pitch of body	P	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	±1.0
Feed hole pitch	P0	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	±0.2
Distance from hole center to lead	P1	3.85	3.85	3.85	3.85	3.85	3.85	3.85	3.85	3.85	±0.7
Distance from feed hole center to body center	P2	6.35	6.35	6.35	6.35	6.35	6.35	6.35	6.35	6.35	±1.0
Lead-to-lead distance	F	1.5	2.0	2.0	2.0	2.5	2.5	2.5	3.5	3.5	±0.5
Lead to lead distance	F1	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	+0.8 -0.2
Height of body from tape center	H	18.5	18.5	18.5	18.5	18.5	18.5	18.5	18.5	18.5	±0.75
Lead wire clinch height	H0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	±0.5
Base tape width	W	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	±0.5
Adhesive tape width	W0	6.0	6.0	6.0	6.0	6.0	6.0	8.0	8.0	8.0	min
Hole position	W1	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	+0.75 -0.5
Hole down tape position	W2	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	max

**Lead Forming**

Lead Forming & Cut

Code:C  
RANGE:  $\Phi 4\sim\Phi 18$



Code:F  
RANGE:  $\Phi 4\sim\Phi 8$



$\Phi D$	F	L	$\Phi D$	F	L
4	1.5	3.0~12.0	4	5.0	3.5, 4.5, 5.0, 7.0
5	2.0	3.0~12.0	5	5.0	3.5, 4.5, 5.0, 7.0
6.3	2.5	3.0~12.0	6.3	5.0	3.5, 4.5, 5.0, 7.0
8	3.5	3.0~12.0	8	5.0	3.5, 4.5, 5.0, 7.0
10	5.0	3.0~12.0	-	-	-
12.5	5.0	3.0~12.0	-	-	-
16	7.5	3.0~12.0	-	-	-
18	7.5	3.0~12.0	-	-	-

Code:J  
RANGE:  $\Phi 10\sim\Phi 18$



$\Phi D$	F	L
10	5.0	4.0, 4.5, 5.0
12.5	5.0	4.0, 4.5, 5.0
16	7.5	4.0, 4.5, 5.0
18	7.5	4.0, 4.5, 5.0

### Solering Recommendation

■ Flow Soldering(Radial Lead Type)



■ Reflow Soldering

- (For Polymer SMD Type)

#### Recommended Reflow Profile



Item	Preheating	T1(°C)	T2(°C)	T3(°C)	t1(sec.)	t2(sec.)	t3(sec.)	Reflow cycle
Condition 1	150°C to 180°C Within 90sec.	≤260	230	200	≤10	≤40	≤60	1
Condition 2		≤250	230	200	≤10	≤40	≤60	2

● (For Liquid SMD Type)

Case size:  $\Phi 6.3$ – $\Phi 10$ mm:

- Temperature at surface of capacitor shall not exceed  $T^{\circ}\text{C}$ .
- The duration for over  $200^{\circ}\text{C}$  temperature and  $T_1^{\circ}\text{C}$  at surface of capacitor shall not exceed  $t$  and  $t_1$  seconds, respectively.
- Preheat shall be done at  $100^{\circ}\text{C}$  to  $200^{\circ}\text{C}$  and for Maximum 180 seconds.



Case size (mm)	$T(^{\circ}\text{C})$ ①	$T_1(^{\circ}\text{C})$	$t(\text{sec.})$ ②	$t_1(\text{sec.})$ ③	Reflow cycle
$\Phi 6.3$	250	230	90	40	1
$\Phi 8$	240	230	90	30	1
$\Phi 10$	235	230	60	30	1

- ① Peak temperature
- ② The duration over  $200^{\circ}\text{C}$  (max.)
- ③ The duration over  $T_1^{\circ}\text{C}$
- Please contact us if capacitors are subject to the conditions other than the allowable range of reflow.

Case size:  $\Phi 12.5$ – $\Phi 18$ mm:

- Temperature at surface of capacitor shall not exceed  $T^{\circ}\text{C}$ .
- The duration for over  $200^{\circ}\text{C}$  temperature and  $T_1^{\circ}\text{C}$  at surface of capacitor shall not exceed  $t$  and  $t_1$  seconds, respectively.
- Preheat shall be done at  $100^{\circ}\text{C}$  to  $180^{\circ}\text{C}$  and for Maximum 150 seconds.



Case size (mm)	$T(^{\circ}\text{C})$ ①	$T_1(^{\circ}\text{C})$	$t(\text{sec.})$ ②	$t_1(\text{sec.})$ ③	Reflow cycle
$\Phi 12.5$ – $\Phi 18$	240	230	60	30	1

- ① Peak temperature
- ② The duration over  $200^{\circ}\text{C}$  (max.)
- ③ The duration over  $T_1^{\circ}\text{C}$
- Please contact us if capacitors are subject to the conditions other than the allowable range of reflow.

## HL series

- Long life, downsized, high ripple current; For power supply applications
- Endurance: +105°C 8,000~12,000 hours
- RoHS Compliant

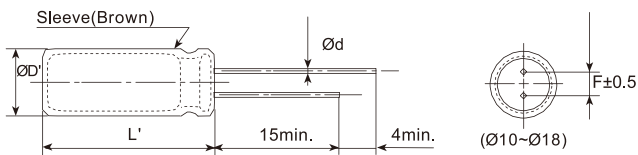
Upgrade



### SPECIFICATIONS

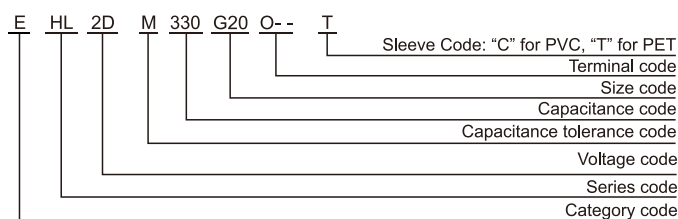
Items	Characteristics								
Category Temperature Range	-25~+105°C								
Rated Voltage Range	160~500 V <sub>dc</sub>								
Capacitance Tolerance	±20%(M) (at 20°C, 120Hz)								
Leakage Current		After 1 minute		After 5 minutes				Where, I: Max. leakage current (μA), C: Nominal capacitance (μF), V: Rated voltage (V) (at 20°C)	
	CV ≤ 1000	I ≤ 0.1CV + 40μA		I ≤ 0.03CV + 15μA					
	CV > 1000	I ≤ 0.04CV + 100μA		I ≤ 0.02CV + 25μA					
Dissipation Factor (tanδ)	Rated Voltage (V <sub>dc</sub> )	160	200	250	350	400	450	500	(at 20°C, 120Hz)
	tanδ (max.)	0.18	0.18	0.18	0.24	0.24	0.24	0.24	
Low Temperature Characteristics (Max. Impedance Ratio)	Rated Voltage (V <sub>dc</sub> )	160	200	250	350	400	450	500	(at 120Hz)
	Z(-25°C)/Z(+20°C)	3	3	3	6	6	6	6	
Endurance	The following specifications shall be satisfied when the capacitors are restored to 20°C after DC voltage plus the rated ripple current is applied for a specified period of time at 105°C.								
	Capacitance Change	≤ ±20% of the initial value					Rated Voltage	160 to 400V <sub>dc</sub>	500V <sub>dc</sub>
	D.F. (tanδ)	≤ 200% of the initial specified value						Life time	L ≤ 20: 10,000 hours
	Leakage Current	≤ The initial specified value					L > 20: 12,000 hours		Φ ≥ 12.5: 10,000 hours
Shelf Life	The following specifications shall be satisfied when the capacitors are restored to 20°C after exposing them for 1,000 hours at 105°C without voltage applied.								
	Capacitance Change	≤ ±20% of the initial value							
	D.F. (tanδ)	≤ 200% of the initial specified value							
	Leakage Current	≤ 200% of the initial specified value							

### DIMENSIONS [mm]



ØD	10	12.5	16	18
Ød	0.6	0.6	0.8	0.8
F	5.0	5.0	7.5	7.5
ØD'	ØD + 0.5max.			
L'	L + 2max.			

### PART NUMBERING SYSTEM



### RATED RIPPLE CURRENT MULTIPLIERS

Frequency correction factor for ripple current

Freq.(Hz)	120	1k	10k	100k
Cap.(μF)				
<100	1.0	1.75	2.25	2.50
≥100	1.0	1.67	2.05	2.25

The endurance of capacitors is shortened with internal heating produced by ripple current at the rate of halving the lifetime with every 5°C rise. When long life performance is required in actual use, the rms ripple current has to be reduced.

# HL series

■ STANDARD RATINGS

WV (V <sub>dc</sub> )	Cap (μF)	Size ΦDxL(mm)	tanδ	Rated ripple current (mA <sub>rms</sub> /105°C, 120Hz)
160(2C)	33	10*16	0.18	210
	47	10*20	0.18	300
	56	10*20	0.18	318
	68	10*25	0.18	345
	82	10*25	0.18	416
		10*30	0.18	448
	100	12.5*20	0.18	575
	120	10*35	0.18	572
	150	10*40	0.18	668
		10*45	0.18	696
		12.5*25	0.18	767
	180	10*50	0.18	788
		12.5*30	0.18	885
		16*20	0.18	858
		12.5*35	0.18	1044
	220	16*25	0.18	1022
		18*20	0.18	992
		12.5*40	0.18	1196
	270	12.5*45	0.18	1230
		12.5*50	0.18	1404
	330	16*30	0.18	1355
		18*25	0.18	1292
		16*35	0.18	1505
	390	16*40	0.18	1708
		16*45	0.18	1730
		18*30	0.18	1665
	470	18*35	0.18	1722
		16*50	0.18	1924
18*40		0.18	1910	
680	18*45	0.18	2135	
	18*50	0.18	2148	
	33	10*20	0.18	255
39	10*20	0.18	268	
47	10*20	0.18	302	
56	10*25	0.18	346	
68	10*30	0.18	406	
82	12.5*20	0.18	522	
100	10*35	0.18	520	
	12.5*25	0.18	628	
	10*40	0.18	595	
120	10*45	0.18	624	
	12.5*30	0.18	728	
	16*20	0.18	698	
150	10*50	0.18	720	
	12.5*35	0.18	862	
	16*25	0.18	928	
180	18*20	0.18	895	
	12.5*40	0.18	1078	
	12.5*45	0.18	1116	
220	18*25	0.18	1050	
	12.5*50	0.18	1268	
	16*30	0.18	1225	
270	16*35	0.18	1252	
	16*40	0.18	1428	
	18*30	0.18	1402	
330	16*45	0.18	1575	
	18*35	0.18	1570	
	16*50	0.18	1762	
470	18*40	0.18	1748	
	18*45	0.18	1775	
	18*50	0.18	1952	
560	18*50	0.18	1952	

WV (V <sub>dc</sub> )	Cap (μF)	Size ΦDxL(mm)	tanδ	Rated ripple current (mA <sub>rms</sub> /105°C, 120Hz)
250(2E)	27	10*20	0.18	205
	33	10*20	0.18	242
	47	10*25	0.18	316
		10*30	0.18	342
	56	12.5*20	0.18	430
	68	10*35	0.18	432
	82	10*40	0.18	495
		10*45	0.18	518
		12.5*25	0.18	565
		12.5*30	0.18	575
	100	10*50	0.18	586
		12.5*30	0.18	662
		16*20	0.18	638
	120	12.5*35	0.18	770
		16*25	0.18	758
		18*20	0.18	732
	150	12.5*40	0.18	892
		12.5*45	0.18	922
		12.5*50	0.18	1040
	180	16*30	0.18	995
		18*25	0.18	955
		16*35	0.18	1130
	220	18*30	0.18	1138
		16*40	0.18	1290
		16*45	0.18	1315
	270	18*35	0.18	1300
		16*50	0.18	1480
		18*40	0.18	1466
330	18*45	0.18	1488	
	18*50	0.18	1630	
	15	10*16	0.24	150
18	10*20	0.24	165	
22	10*20	0.24	200	
27	10*25	0.24	242	
	10*30	0.24	256	
33	12.5*20	0.24	332	
39	10*35	0.24	326	
47	10*40	0.24	376	
	12.5*25	0.24	425	
	10*45	0.24	426	
56	12.5*30	0.24	498	
	16*20	0.24	476	
	10*50	0.24	486	
68	12.5*35	0.24	583	
	18*20	0.24	550	
	12.5*40	0.24	658	
82	16*25	0.24	628	
	12.5*45	0.24	752	
	12.5*50	0.24	772	
100	16*30	0.24	744	
	18*25	0.24	710	
	16*35	0.24	832	
120	16*40	0.24	964	
	16*45	0.24	978	
	18*30	0.24	944	
150	16*50	0.24	1095	
	18*35	0.24	1065	
	18*40	0.24	1086	
180	18*45	0.24	1215	
	18*50	0.24	1222	
	220	18*50	0.24	1222



# HL series

■ STANDARD RATINGS

WV (V <sub>dc</sub> )	Cap (μF)	Size ΦDxL(mm)	tanδ	Rated ripple current (mA <sub>rms</sub> /105°C,120Hz)
400(2G)	12	10*16	0.24	135
	15	10*20	0.24	155
	18	10*20	0.24	180
	22	10*25	0.24	216
	27	10*30	0.24	256
		12.5*20	0.24	300
	33	10*35	0.24	300
		10*40	0.24	342
	39	10*45	0.24	358
		12.5*25	0.24	390
	47	12.5*30	0.24	456
		16*20	0.24	438
	56	10*50	0.24	440
		12.5*35	0.24	528
		18*20	0.24	502
	68	12.5*40	0.24	600
		16*25	0.24	572
	82	12.5*45	0.24	684
		12.5*50	0.24	700
		16*30	0.24	672
		18*25	0.24	644
	100	16*35	0.24	760
		16*40	0.24	864
	120	16*45	0.24	880
18*30		0.24	842	
18*35		0.24	875	
150	16*50	0.24	1000	
	18*40	0.24	985	
180	18*45	0.24	1098	
	220	18*50	0.24	1225

WV (V <sub>dc</sub> )	Cap (μF)	Size ΦDxL(mm)	tanδ	Rated ripple current (mA <sub>rms</sub> /105°C,120Hz)
450(2W)	10	10*16	0.24	120
	12	10*20	0.24	150
	15	10*25	0.24	186
	18	10*30	0.24	216
		12.5*20	0.24	256
	22	10*35	0.24	252
		10*40	0.24	292
	27	10*45	0.24	306
		12.5*25	0.24	342
	33	12.5*30	0.24	400
		16*20	0.24	386
	39	10*50	0.24	378
		12.5*35	0.24	462
		18*20	0.24	440
	47	12.5*40	0.24	528
		16*25	0.24	500
	56	12.5*45	0.24	592
		16*30	0.24	588
		18*25	0.24	562
		12.5*50	0.24	672
	68	16*35	0.24	664
		16*40	0.24	750
	82	16*45	0.24	762
		18*30	0.24	734
100	16*50	0.24	858	
	18*35	0.24	836	
120	18*40	0.24	935	
	18*45	0.24	948	
150	18*50	0.24	1065	
500(2H)	6.8	10*20	0.24	90
	10	10*30	0.24	130
		12.5*20	0.24	125
	12	12.5*20	0.24	135
		10*35	0.24	170
	15	12.5*25	0.24	170
		16*20	0.24	165
	18	10*45	0.24	190
		12.5*30	0.24	190
	22	10*50	0.24	230
		12.5*35	0.24	225
	33	16*20	0.24	220
18*25		0.24	285	
47	18*30	0.24	400	

Radial Type

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