

## Part Numbering System



① Category code

Type	Code
	1
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
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	Size	
	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



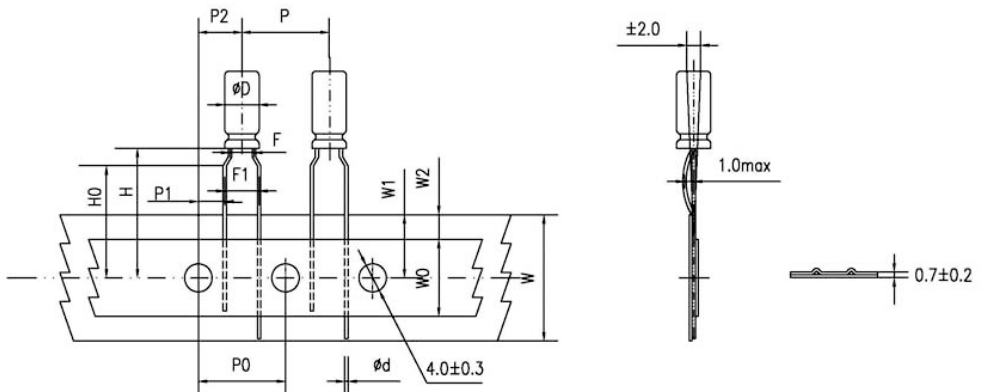
Fig.2 code: B



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

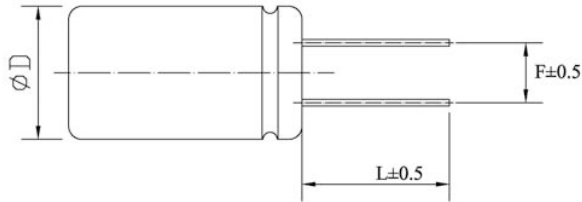
Specification Fig.4

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

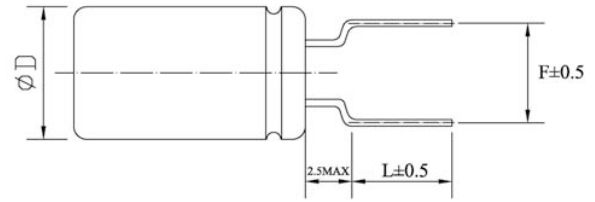
### Lead Forming

#### 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.

# HS series

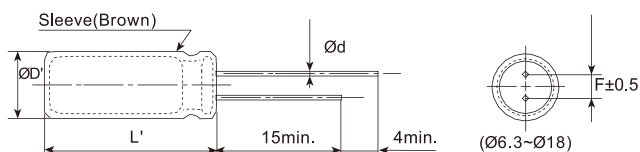
- High ripple current; For power supply applications
- Endurance: +105°C 3,000~5,000 hours
- RoHS Compliant



## SPECIFICATIONS

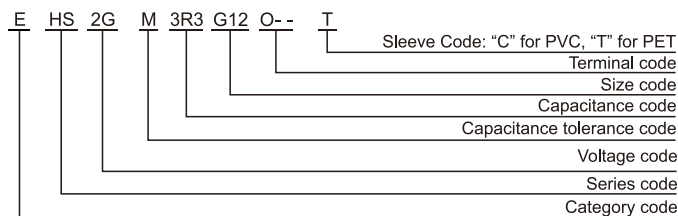
Items	Characteristics							
Category Temperature Range	-25~+105°C							
Rated Voltage Range	160~450 V <sub>dc</sub>							
Capacitance Tolerance	±20%(M) (at 20°C, 120Hz)							
Leakage Current		After 1 minute		After 5 minutes			Where, I: Max. leakage current (µA), C: Nominal capacitance (µF), V: Rated 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	
	tanδ (max.)	0.15	0.15	0.15	0.20	0.20	0.20	
Low Temperature Characteristics (Max. Impedance Ratio)	Rated Voltage(V <sub>dc</sub> )	160	200	250	350	400	450	
	Z(-25°C)/Z(+20°C)	3	3	3	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					Case Dia.	Load life (hours)
	D.F. (tanδ)	≤ 200% of the initial specified value					ØD ≤ 8	3,000
	Leakage Current	≤ The initial specified value					ØD ≥ 10	5,000
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	6.3	8	10	12.5	16	18
Ød	0.5	0.5	0.6	0.6	0.8	0.8
F	2.5	3.5	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.

# HS 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)	1	6.3*12	0.15	21
	2.2	6.3*12	0.15	32
	3.3	6.3*12	0.15	40
	4.7	6.3*12	0.15	47
	6.8	8*12	0.15	62
	10	8*12	0.15	75
	15	10*16	0.15	115
	22	10*20	0.15	140
	33	10*20	0.15	175
	47	12.5*20	0.15	240
	68	12.5*25	0.15	370
	100	16*25	0.15	430
	150	16*25	0.15	500
	220	16*30	0.15	815
	270	18*30	0.15	880
330	18*40	0.15	980	
200(2D)	0.47	6.3*12	0.15	13
	1	6.3*12	0.15	19
	2.2	6.3*12	0.15	32
	3.3	6.3*12	0.15	40
	4.7	8*12	0.15	47
	6.8	10*12	0.15	70
	10	10*12	0.15	80
	15	10*16	0.15	118
	22	10*20	0.15	140
	33	10*20	0.15	160
	47	12.5*20	0.15	250
	68	12.5*25	0.15	330
	100	16*25	0.15	440
	150	16*25	0.15	600
	220	18*30	0.15	680
270	18*40	0.15	1040	
250(2E)	0.47	6.3*12	0.15	13
	1	6.3*12	0.15	19
	2.2	6.3*12	0.15	37
	3.3	8*12	0.15	50
	4.7	8*12	0.15	58
	6.8	10*12	0.15	72
	10	10*16	0.15	100
	15	10*16	0.15	120
	22	10*20	0.15	168
	33	12.5*20	0.15	210
	47	12.5*25	0.15	320
	68	16*25	0.15	410
	100	16*30	0.15	530
	150	18*25	0.15	550
	220	18*35	0.15	710

WV (V <sub>dc</sub> )	Cap (μF)	Size ΦDxL(mm)	tanδ	Rated ripple current (mA <sub>rms</sub> /105°C, 120Hz)	
350(2V)	0.47	6.3*12	0.20	20	
	1	6.3*12	0.20	24	
	2.2	8*12	0.20	40	
	3.3	8*12	0.20	52	
	4.7	10*12	0.20	65	
	6.8	10*20	0.20	88	
	10	10*20	0.20	105	
	15	12.5*20	0.20	130	
	22	12.5*20	0.20	182	
	33	12.5*25	0.20	240	
	47	16*25	0.20	305	
	68	16*30	0.20	390	
	100	18*30	0.20	480	
	400(2G)	1	8*12	0.20	25
		2.2	8*12	0.20	40
3.3		10*12	0.20	55	
4.7		10*16	0.20	76	
6.8		10*20	0.20	80	
10		12.5*20	0.20	110	
15		12.5*20	0.20	135	
22		12.5*25	0.20	205	
33		16*20	0.20	255	
47		16*25	0.20	330	
68		16*35	0.20	400	
82		18*30	0.20	420	
100		18*35	0.20	495	
120		18*40	0.20	520	
450(2W)		1	8*12	0.20	35
	2.2	10*12	0.20	40	
	3.3	10*16	0.20	65	
	4.7	10*16	0.20	85	
	6.8	10*20	0.20	90	
	10	12.5*20	0.20	140	
	15	16*20	0.20	160	
	22	16*25	0.20	200	
	33	16*25	0.20	320	
	47	18*25	0.20	350	
	68	18*30	0.20	440	
	82	18*35	0.20	500	
	100	18*40	0.20	560	



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