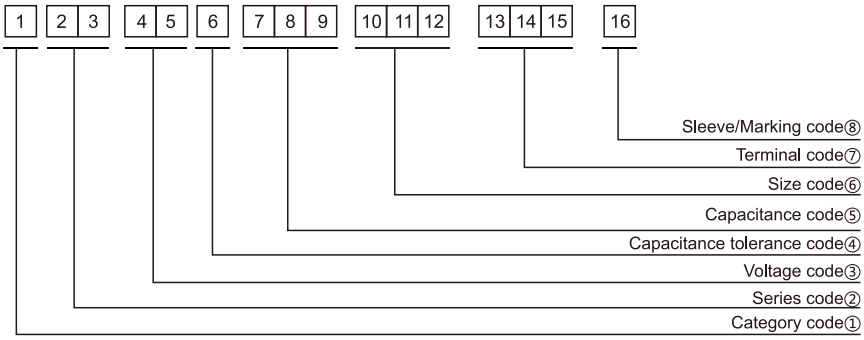
Part Numbering System



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_{dc})	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	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

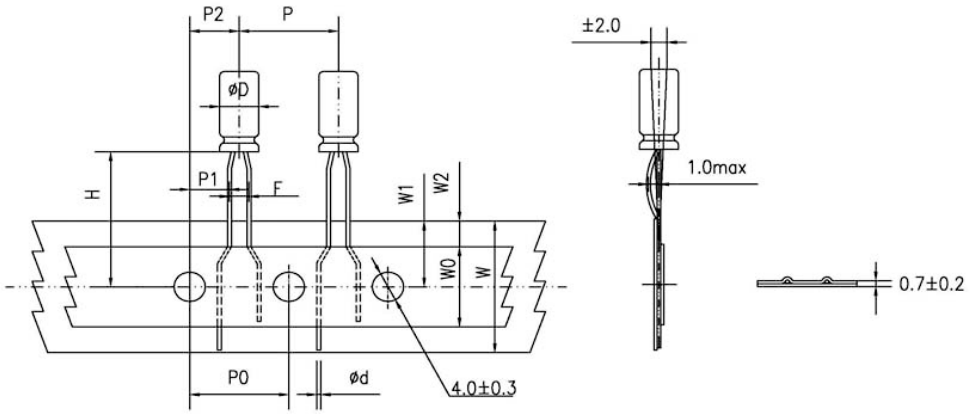


Fig.2 code: B

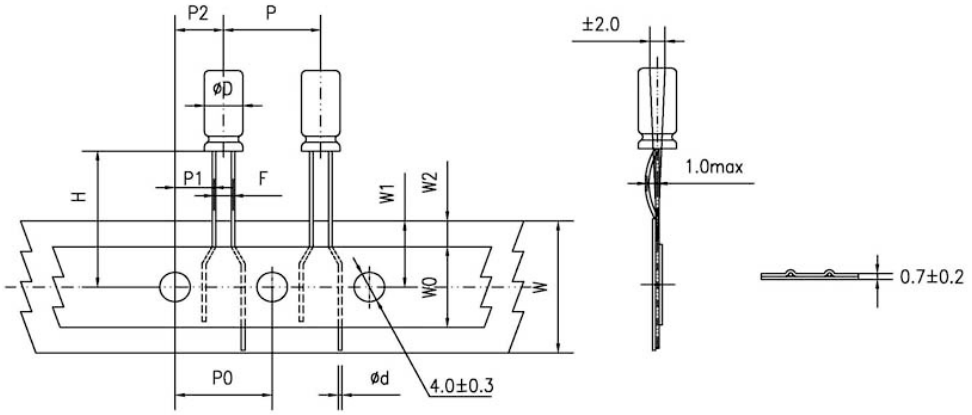


Fig.3 code: B

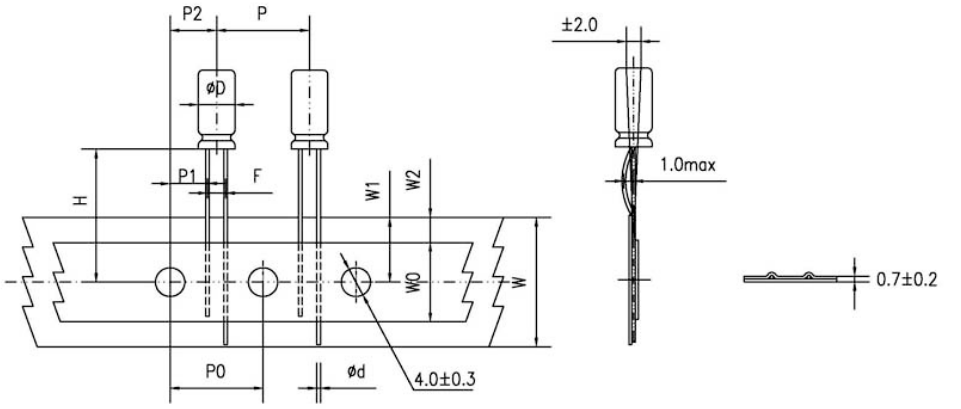
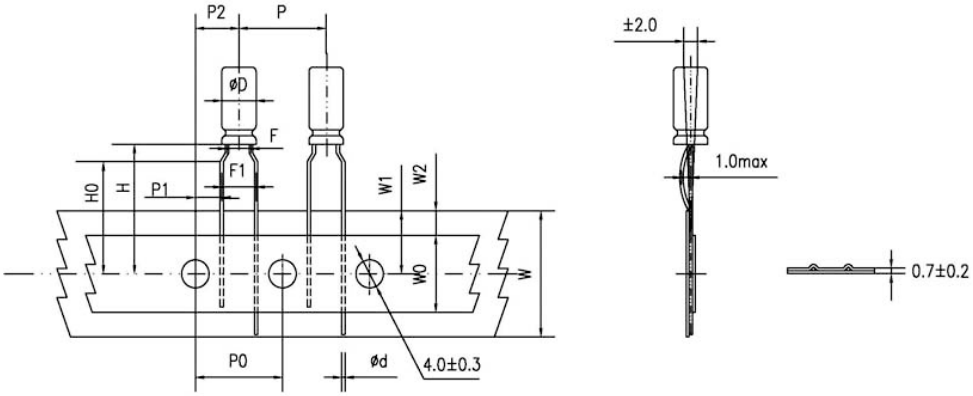


Fig.4 code: P



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

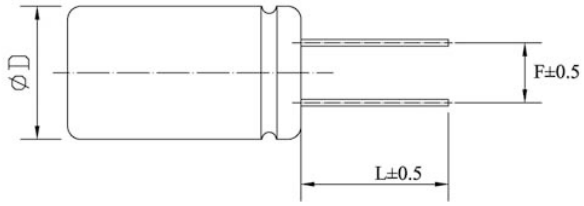
Specification Fig.4

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

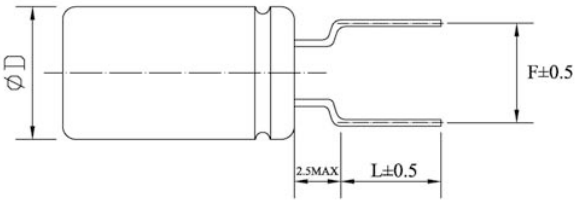
Lead Forming

Lead Forming & Cut

Code:C
RANGE: Φ4~Φ18

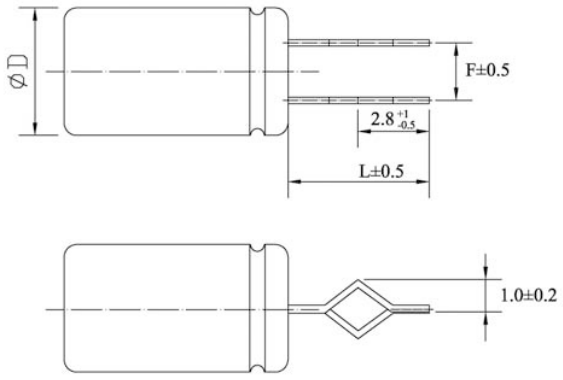


Code:F
RANGE: Φ4~Φ8



ΦD	F	L	ΦD	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	-	-	-

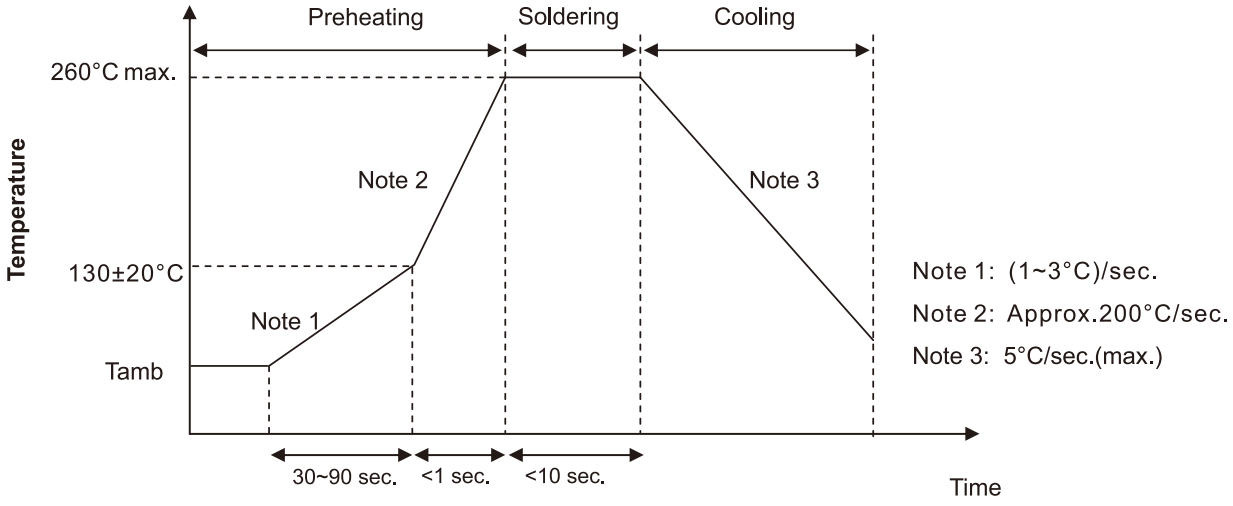
Code:J
RANGE: Φ10~Φ18



ΦD	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

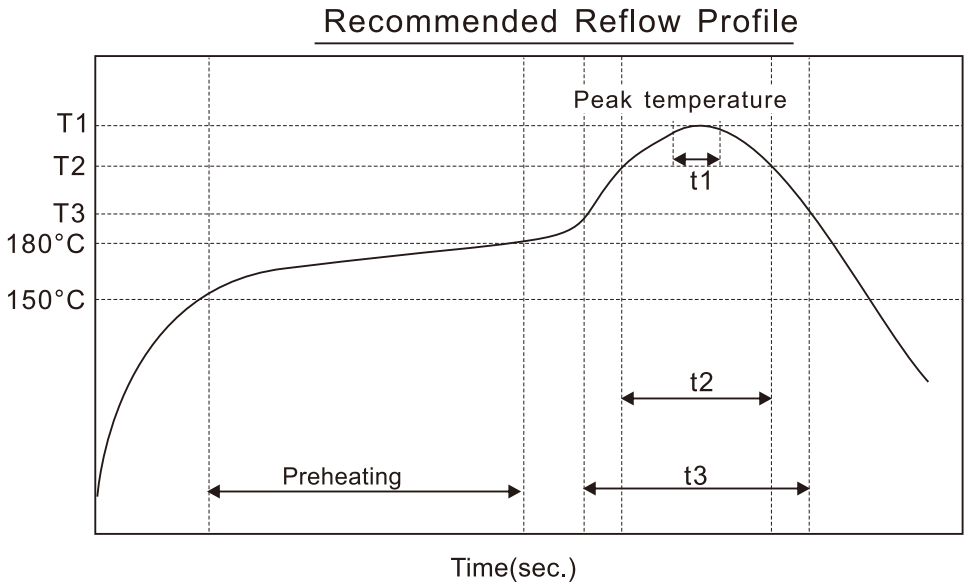
Solering Recommendation

■ Flow Soldering(Radial Lead Type)



■ Reflow Soldering

• (For Polymer SMD Type)

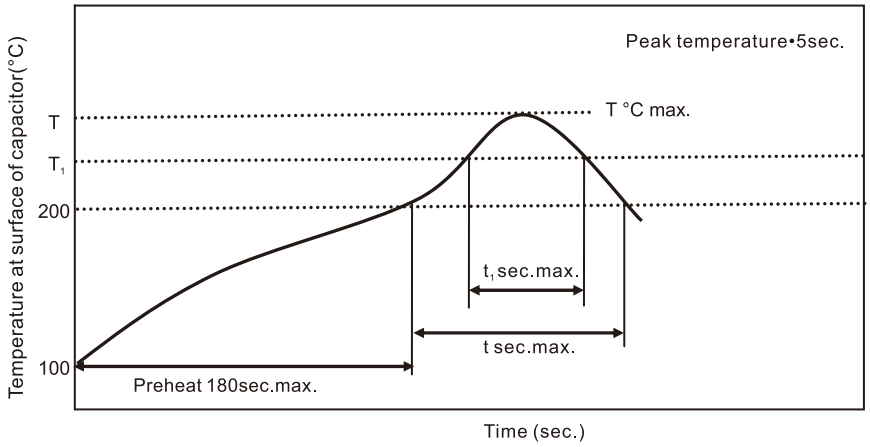


Item	Preheating	T1(°C)	T2(°C)	T3(°C)	t1(sec.)	t2(sec.)	t3(sec.)	Reflow cycle
Condition 1	150°C to 180°C Within 90sec.	≤260	230	200	≤10	≤40	≤60	1
Condition 2		≤250	230	200	≤10	≤40	≤60	2

• (For Liquid SMD Type)

Case size:Φ6.3~Φ10mm:

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

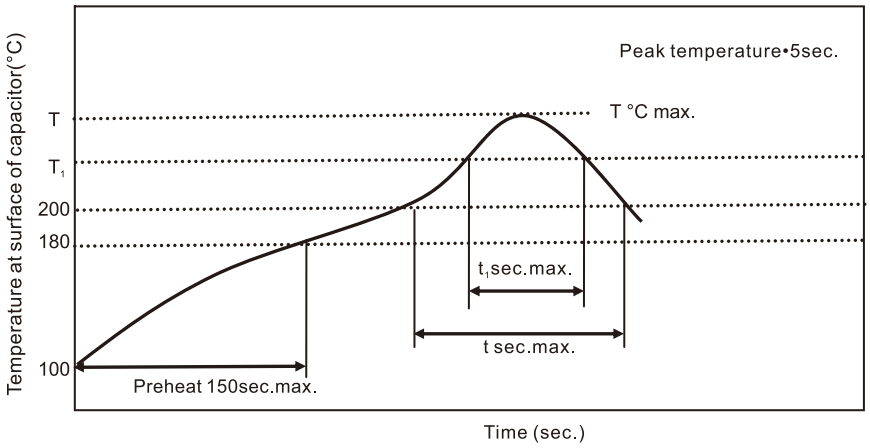


Case size (mm)	T(°C) ①	T_1(°C)	t(sec.) ②	t_1(sec.) ③	Reflow cycle
Φ6.3	250	230	90	40	1
Φ8	240	230	90	30	1
Φ10	235	230	60	30	1

① Peak temperature
② The duration over 200°C (max.)
③ The duration over T_1°C
■ Please contact us if capacitors are subject to the conditions other than the allowable range of reflow.

Case size:Φ12.5~Φ18mm:

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



Case size (mm)	T(°C) ①	T_1(°C)	t(sec.) ②	t_1(sec.) ③	Reflow cycle
Φ12.5~Φ18	240	230	60	30	1

① Peak temperature
② The duration over 200°C (max.)
③ The duration over T_1°C
■ Please contact us if capacitors are subject to the conditions other than the allowable range of reflow.

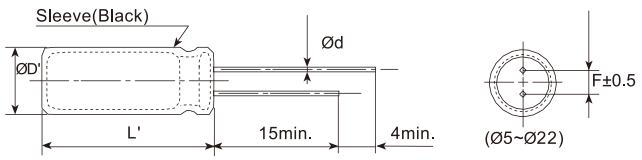
WH series

- Standard series for general purpose
- Wide temperature range from -40 °C to +105 °C
- Endurance: +105 °C 2,000 hours
- **RoHS Compliant**

SPECIFICATIONS

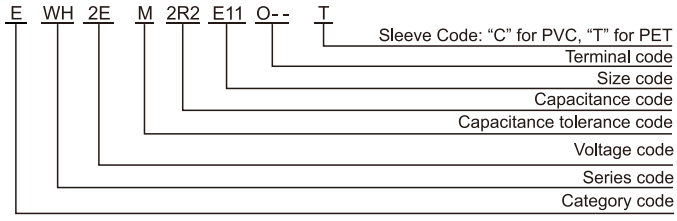
Items	Characteristics												
Category Temperature Range	-40~+105 °C (6.3~100 Vdc) -25~+105°C(160~500 Vdc)												
Rated Voltage Range	6.3~500 Vdc												
Capacitance Tolerance	±20%(M) (at 20°C,120Hz)												
Leakage Current	6.3~100 Vdc: I≤0.03CV or 4μA (at 1 minute); I≤0.01CV or 3μA (at 2 minutes); Whichever is greater. 160~500 Vdc: CV≤1,000 I≤0.1CV+40μA (After 1 minute) I≤0.03CV+15μA (After 5 minutes); CV>1,000 I≤0.04CV+100μA (After 1 minute) I≤0.02CV+25μA (After 5 minutes). Where, I:Max. leakage current (μA), C:Nominal capacitance (μF), V: Rated voltage (V) (at 20°C)												
Dissipation Factor (tanδ)	Rated Voltage(Vdc)	6.3	10	16	25	35	50	63	100	160~250	350~400	450	500
	tanδ (max.)	0.26	0.19	0.16	0.14	0.12	0.10	0.09	0.08	0.20	0.24	0.24	0.24
	When nominal capacitance exceeds 1,000μF, add 0.02 to the value above for each 1,000μF increase. (at 20°C,120Hz)												
Low Temperature Characteristics (Max. Impedance Ratio)	Rated Voltage(Vdc)	6.3	10	16	25	35	50	63	100	160~250	350~400	450	500
	Z(-25°C)/Z(+20°C)	5	4	3	2					3	6	6	8
	Z(-40°C)/Z(+20°C)	12	10	8	5	4	3			-	-	-	- (at 120Hz)
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 2,000 hours at 105°C.												
	Capacitance Change	≤±20% of the initial value											
	D.F. (tanδ)	≤200% of the initial specified value											
	Leakage Current	≤The initial specified value											
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	5	6.3	8		10	12.5	16	18	22
Ød	0.5	0.5	0.5	0.6	0.6	0.6	0.8	0.8	0.8
F	2.0	2.5	3.5		5.0	5.0	7.5	7.5	10.0
ØD'	ØD+0.5max.								
L'	L+2max.								

PART NUMBERING SYSTEM



RATED RIPPLE CURRENT MULTIPLIERS

Frequency correction factor for ripple current

Freq.(Hz) / Cap.(μF)	50	120	300	1k	10k	100k
Cap.<10	0.65	1.00	1.35	1.75	2.30	2.50
10≤Cap.<100	0.75	1.00	1.25	1.50	1.75	1.80
100≤Cap.≤1000	0.80	1.00	1.15	1.30	1.40	1.50
Cap.>1000	0.85	1.00	1.03	1.05	1.08	1.08

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.

WH series

■ STANDARD RATINGS

WV (Vdc)	Cap (μF)	Size ΦDxL(mm)	tanδ	Rated ripple current (mArms/105°C,120Hz)
6.3(0J)	33	5*11	0.26	54
	47	5*11	0.26	64
	100	5*11	0.26	94
	220	5*11	0.26	140
	330	6.3*11	0.26	190
	470	6.3*11	0.26	230
	1000	8*12	0.26	380
	2200	10*20	0.28	710
	3300	10*20	0.30	840
	4700	12.5*20	0.32	1090
	6800	12.5*25	0.36	1350
	10000	16*25	0.44	1650
	15000	16*35	0.54	2010
	22000	18*40	0.68	2350
10(1A)	22	5*11	0.19	46
	33	5*11	0.19	57
	47	5*11	0.19	68
	100	5*11	0.19	100
	220	6.3*11	0.19	170
	330	6.3*11	0.19	200
	470	8*11	0.19	250
	1000	10*12.5	0.19	460
	2200	10*20	0.21	760
	3300	12.5*20	0.23	1000
	4700	12.5*25	0.25	1260
	6800	16*25	0.29	1570
	10000	16*35	0.37	1890
	15000	18*35	0.47	2180
16(1C)	10	5*11	0.16	34
	22	5*11	0.16	51
	33	5*11	0.16	63
	47	5*11	0.16	75
	100	5*11	0.16	110
	220	6.3*11	0.16	180
	330	8*11	0.16	260
	470	8*12	0.16	310
	1000	10*16	0.16	560
	2200	12.5*20	0.18	920
	3300	12.5*25	0.20	1170
	4700	16*25	0.22	1480
	6800	16*30	0.26	1780
	10000	18*35	0.34	2060
25(1E)	4.7	5*11	0.14	25
	10	5*11	0.14	36
	22	5*11	0.14	54
	33	5*11	0.14	67
	47	5*11	0.14	80
	100	6.3*11	0.14	130
	220	8*11	0.14	230
	330	8*12	0.14	310
	470	10*12.5	0.14	380
	1000	10*20	0.14	680
	2200	12.5*25	0.16	1090
	3300	16*25	0.18	1400
	4700	16*30	0.20	1710
	6800	18*35	0.24	2040

WV (Vdc)	Cap (μF)	Size ΦDxL(mm)	tanδ	Rated ripple current (mArms/105°C,120Hz)
35(1V)	4.7	5*11	0.12	28
	10	5*11	0.12	41
	22	5*11	0.12	61
	33	5*11	0.12	75
	47	5*11	0.12	90
	100	6.3*11	0.12	150
	220	8*12	0.12	270
	330	10*12.5	0.12	350
	470	10*16	0.12	460
	1000	12.5*20	0.12	810
	2200	16*25	0.14	1260
	3300	16*35	0.16	1610
	4700	18*35	0.18	1910
50(1H)	0.10	5*11	0.10	1.3
	0.22	5*11	0.10	2.9
	0.33	5*11	0.10	4.3
	0.47	5*11	0.10	6.2
	1.0	5*11	0.10	13
	2.2	5*11	0.10	20
	3.3	5*11	0.10	25
	4.7	5*11	0.10	30
	10	5*11	0.10	40
	22	5*11	0.10	65
	33	6.3*11	0.10	90
	47	6.3*11	0.10	110
	100	8*11	0.10	180
	220	10*12.5	0.10	300
	330	10*16	0.10	410
	470	10*20	0.10	530
	1000	12.5*25	0.10	950
	2200	16*35	0.12	1470
	3300	18*35	0.14	1770
63(1J)	10	5*11	0.09	46
	22	5*11	0.09	71
	33	6.3*11	0.09	100
	47	6.3*11	0.09	120
	100	10*12.5	0.09	215
	220	10*16	0.09	335
	330	10*20	0.09	510
	470	12.5*20	0.09	640
	1000	16*25	0.09	930
100(1K)	0.10	5*11	0.08	1.5
	0.22	5*11	0.08	3.4
	0.33	5*11	0.08	5.0
	0.47	5*11	0.08	7.1
	1.0	5*11	0.08	15
	2.2	5*11	0.08	21
	3.3	5*11	0.08	29
	4.7	5*11	0.08	62
	10	6.3*11	0.08	54
	22	8*11	0.08	93
	33	8*12	0.08	130
	47	10*12.5	0.08	165
	100	10*20	0.08	265
	220	12.5*25	0.08	440

WH series

■ STANDARD RATINGS

WV (Vdc)	Cap (μF)	Size ΦDxL(mm)	tanδ	Rated ripple current (mArms/105°C,120Hz)
100(1K)	330	16*25	0.08	540
	470	16*30	0.08	715
	1000	18*40	0.08	985
160(2C)	3.3	6.3*11	0.20	32
	4.7	6.3*11	0.20	38
	10	8*12	0.20	65
		10*12	0.20	76
	22	10*12	0.20	98
		10*16	0.20	108
		10*20	0.20	120
	33	10*16	0.20	158
		10*20	0.20	165
	47	10*20	0.20	182
		12.5*20	0.20	205
	68	12.5*20	0.20	265
	100	12.5*25	0.20	318
		16*25	0.20	335
	220	16*30	0.20	568
	330	18*35	0.20	710
	470	18*40	0.20	870
200(2D)	1	6.3*11	0.20	16
	2.2	6.3*11	0.20	22
	3.3	6.3*11	0.20	32
	4.7	8*12	0.20	48
	10	8*12	0.20	78
		10*12	0.20	82
		10*16	0.20	86
	22	10*16	0.20	128
		10*20	0.20	132
	33	10*20	0.20	185
		12.5*20	0.20	194
	47	12.5*20	0.20	225
	68	12.5*25	0.20	308
	82	12.5*25	0.20	318
	100	16*25	0.20	345
	150	16*25	0.20	446
	180	16*30	0.20	560
	220	16*35	0.20	678
		18*30	0.20	695
	330	18*35	0.20	755
	470	18*45	0.20	938
250(2E)	2.2	6.3*11	0.20	22
	3.3	6.3*11	0.20	32
		8*12	0.20	34
	4.7	6.3*11	0.20	38
		8*12	0.20	48
	10	10*12	0.20	75
		10*16	0.20	84
	22	10*20	0.20	128
		12.5*20	0.20	145
	33	10*20	0.20	150
		12.5*20	0.20	185
	47	12.5*20	0.20	232
		12.5*25	0.20	245
	100	16*25	0.20	370
		16*30	0.20	400
	150	16*35	0.20	468
	220	18*35	0.20	660
		18*40	0.20	702
	330	18*40	0.20	730

WV (Vdc)	Cap (μF)	Size ΦDxL(mm)	tanδ	Rated ripple current (mArms/105°C,120Hz)
350(2V)	0.47	6.3*11	0.24	11
	1	6.3*11	0.24	16
	2.2	8*12	0.24	26
	3.3	8*12	0.24	34
		10*12	0.24	38
	4.7	8*12	0.24	48
		10*12	0.24	52
	10	10*12	0.24	68
		10*16	0.24	82
		10*20	0.24	88
	22	12.5*20	0.24	154
	33	12.5*20	0.24	184
		16*20	0.24	198
	47	16*25	0.24	250
	68	16*25	0.24	336
	100	18*30	0.24	398
400(2G)	1	6.3*11	0.24	16
	2.2	6.3*11	0.24	30
		8*12	0.24	34
	3.3	8*12	0.24	35
		10*12	0.24	38
	4.7	8*12	0.24	48
		10*12	0.24	52
	10	10*16	0.24	98
		10*20	0.24	115
	22	12.5*25	0.24	192
	33	16*20	0.24	258
	47	16*25	0.24	305
	68	16*30	0.24	465
		18*25	0.24	445
	82	18*25	0.24	474
	100	16*40	0.24	544
		18*30	0.24	532
	120	18*35	0.24	588
	150	18*40	0.24	668
450(2W)	0.47	8*12	0.24	11
	1	8*12	0.24	18
	2.2	8*12	0.24	25
		10*12	0.24	32
	3.3	10*12	0.24	36
		10*16	0.24	40
	4.7	10*20	0.24	55
	10	10*20	0.24	90
		12.5*20	0.24	100
	22	12.5*25	0.24	168
		16*20	0.24	185
	33	16*25	0.24	215
	47	16*30	0.24	344
	68	18*30	0.24	455
	82	18*30	0.24	472
	100	18*35	0.24	530
	120	18*40	0.24	582
	150	18*50	0.24	700
500(2H)	4.7	10*20	0.24	60
	10	12.5*20	0.24	115
	15	12.5*25	0.24	140
	22	16*25	0.24	185
	33	18*25	0.24	215
	47	18*35	0.24	345
	68	18*40	0.24	455
	82	18*50	0.24	520
	100	22*40	0.24	550
	120	22*46	0.24	580