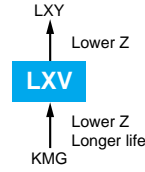


LXV Series

- Low impedance
- Endurance with ripple current : 2,000 to 5,000 hours at 105°C
- Solvent resistant type (see PRECAUTIONS AND GUIDELINES)
- RoHS Compliant

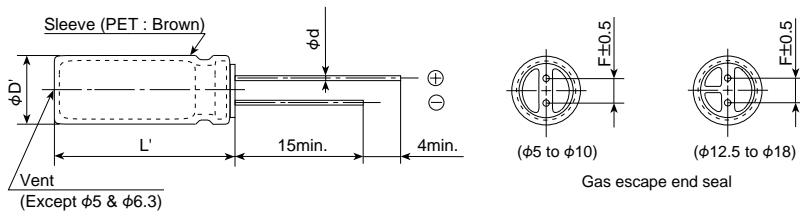


◆ SPECIFICATIONS

Items	Characteristics	
Category	-55 to +105°C	
Temperature Range		
Rated Voltage Range	6.3 to 100V _{dc}	
Capacitance Tolerance	±20% (M) (at 20°C, 120Hz)	
Leakage Current	I=0.01CV or 3µA, whichever is greater. Where, I : Max. leakage current (µA), C : Nominal capacitance (µF), V : Rated voltage (V) (at 20°C after 2 minutes)	
Dissipation Factor (tanδ)	Rated voltage (V _{dc})	6.3V 10V 16V 25V 35V 50V 63V 80V 100V
	tanδ (Max.)	0.22 0.19 0.16 0.14 0.12 0.10 0.10 0.09 0.08
	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	Capacitance change ΔC (-55°C/+20°C)	0.7min.
	Max. impedance ratio (-55°C/+20°C)	3max.(6.3V _{dc} : 4max.) (at 120Hz)
Endurance	The following specifications shall be satisfied when the capacitors are restored to 20°C after subjected to DC voltage with the rated ripple current is applied for the specified period of time at 105°C.	
	Time	φ5 to 6.3 : 2,000hours φ8 & 10 : 3,000hours φ12.5 to φ18 : 5,000hours
	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. Before the measurement, the capacitor shall be preconditioned by applying voltage according to Item 4.1 of JIS C 5101-4.	
	Capacitance change	≤±20% of the initial value
	D.F. (tanδ)	≤200% of the initial specified value
	Leakage current	≤The initial specified value

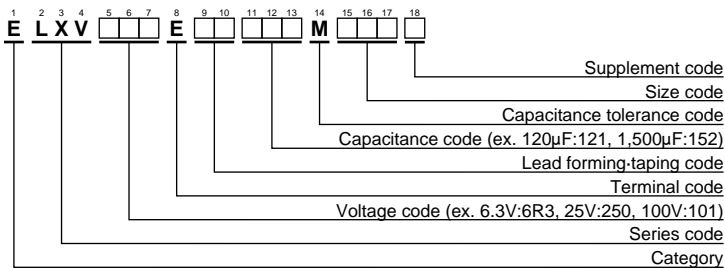
◆ DIMENSIONS [mm]

- Terminal Code : E



φD	5	6.3	8	10	12.5	16	18
φd	0.5	0.5	0.6	0.6	0.6	0.8	0.8
F	2.0	2.5	3.5	5.0	5.0	7.5	7.5
φD'	φD+0.5max.						
L'	L+1.5max.						

◆ PART NUMBERING SYSTEM



Please refer to "Product code guide (radial lead type)"

◆STANDARD RATINGS

WV (Vdc)	Cap (μF)	Case size φD×L(mm)	Impedance (Ωmax/100kHz)		Rated ripple current (mA _{rms} / 105°C, 100kHz)	Part No.	WV (Vdc)	Cap (μF)	Case size φD×L(mm)	Impedance (Ωmax/100kHz)		Rated ripple current (mA _{rms} / 105°C, 100kHz)	Part No.	
			20°C	-10°C						20°C	-10°C			
6.3	120	5 × 11.5	0.72	1.8	165	ELXV6R3E□□121MEB5D	16	2,700	12.5 × 35	0.027	0.068	2,230	ELXV160E□□272MK35S	
	220	6.3 × 11.5	0.38	0.95	255	ELXV6R3E□□221MFB5D		2,700	16 × 25	0.028	0.070	2,190	ELXV160E□□272ML25S	
	330	6.3 × 15	0.27	0.68	330	ELXV6R3E□□331MF15D		3,300	12.5 × 40	0.024	0.060	2,460	ELXV160E□□332MK40S	
	390	8 × 12	0.20	0.50	415	ELXV6R3E□□391MH12D		3,300	18 × 20	0.036	0.090	1,940	ELXV160E□□332MM20S	
	470	10 × 12.5	0.12	0.30	635	ELXV6R3E□□471MJC5S		3,900	16 × 30	0.025	0.063	2,510	ELXV160E□□392ML30S	
	560	8 × 15	0.16	0.40	495	ELXV6R3E□□561MH15D		3,900	18 × 25	0.027	0.068	2,350	ELXV160E□□392MM25S	
	680	10 × 16	0.084	0.21	825	ELXV6R3E□□681MJ16S		4,700	16 × 35	0.022	0.055	2,770	ELXV160E□□472ML35S	
	820	8 × 20	0.11	0.28	640	ELXV6R3E□□821MH20D		4,700	18 × 30	0.024	0.060	2,720	ELXV160E□□472MM30S	
	1,200	10 × 20	0.062	0.16	1,060	ELXV6R3E□□122MJ20S		5,600	16 × 40	0.018	0.045	3,110	ELXV160E□□562ML40S	
	1,500	10 × 25	0.052	0.13	1,260	ELXV6R3E□□152MJ25S		6,800	18 × 35	0.021	0.053	3,050	ELXV160E□□682MM35S	
	2,200	10 × 30	0.044	0.11	1,450	ELXV6R3E□□222MJ30S		8,200	18 × 40	0.017	0.043	3,300	ELXV160E□□822MM40S	
	2,200	12.5 × 20	0.046	0.12	1,360	ELXV6R3E□□222MK20S		25	39	5 × 11.5	0.72	1.8	165	ELXV250E□□390MEB5D
	2,700	12.5 × 25	0.034	0.085	1,700	ELXV6R3E□□272MK25S			82	6.3 × 11.5	0.38	0.95	255	ELXV250E□□820MFB5D
	3,900	12.5 × 30	0.030	0.075	1,980	ELXV6R3E□□392MK30S			120	6.3 × 15	0.27	0.68	330	ELXV250E□□121MF15D
	3,900	16 × 20	0.038	0.095	1,770	ELXV6R3E□□392ML20S			150	8 × 12	0.20	0.50	415	ELXV250E□□151MH12D
	4,700	12.5 × 35	0.027	0.068	2,230	ELXV6R3E□□472MK35S			180	10 × 12.5	0.12	0.30	635	ELXV250E□□181MJC5S
	5,600	12.5 × 40	0.024	0.060	2,460	ELXV6R3E□□562MK40S			220	8 × 15	0.16	0.40	495	ELXV250E□□221MH15D
	5,600	16 × 25	0.028	0.070	2,190	ELXV6R3E□□562ML25S			330	8 × 20	0.11	0.28	640	ELXV250E□□331MH20D
5,600	18 × 20	0.036	0.090	1,940	ELXV6R3E□□562MM20S	330	10 × 16		0.084	0.21	825	ELXV250E□□331MJ16S		
6,800	16 × 30	0.025	0.063	2,510	ELXV6R3E□□682ML30S	470	10 × 20		0.062	0.16	1,060	ELXV250E□□471MJ20S		
6,800	18 × 25	0.027	0.068	2,350	ELXV6R3E□□682MM25S	560	10 × 25		0.052	0.13	1,260	ELXV250E□□561MJ25S		
8,200	16 × 35	0.022	0.055	2,770	ELXV6R3E□□822ML35S	820	10 × 30		0.044	0.11	1,450	ELXV250E□□821MJ30S		
10,000	16 × 40	0.018	0.045	3,110	ELXV6R3E□□103ML40S	820	12.5 × 20		0.046	0.12	1,360	ELXV250E□□821MK20S		
10,000	18 × 30	0.024	0.060	2,720	ELXV6R3E□□103MM30S	1,000	12.5 × 25		0.034	0.085	1,700	ELXV250E□□102MK25S		
12,000	18 × 35	0.021	0.053	3,050	ELXV6R3E□□123MM35S	1,500	12.5 × 30		0.030	0.075	1,980	ELXV250E□□152MK30S		
15,000	18 × 40	0.017	0.043	3,300	ELXV6R3E□□153MM40S	1,500	16 × 20		0.038	0.095	1,770	ELXV250E□□152ML20S		
10	82	5 × 11.5	0.72	1.8	165	ELXV100E□□820MEB5D	1,800		12.5 × 35	0.027	0.068	2,230	ELXV250E□□182MK35S	
	180	6.3 × 11.5	0.38	0.95	255	ELXV100E□□181MFB5D	1,800		16 × 25	0.028	0.070	2,190	ELXV250E□□182ML25S	
	270	6.3 × 15	0.27	0.68	330	ELXV100E□□271MF15D	2,200		12.5 × 40	0.024	0.060	2,460	ELXV250E□□222MK40S	
	330	8 × 12	0.20	0.50	415	ELXV100E□□331MH12D	2,200	18 × 20	0.036	0.090	1,940	ELXV250E□□222MM20S		
	390	10 × 12.5	0.12	0.30	635	ELXV100E□□391MJC5S	2,700	16 × 30	0.025	0.063	2,510	ELXV250E□□272ML30S		
	470	8 × 15	0.16	0.40	495	ELXV100E□□471MH15D	2,700	18 × 25	0.027	0.068	2,350	ELXV250E□□272MM25S		
	680	8 × 20	0.11	0.28	640	ELXV100E□□681MH20D	3,300	16 × 35	0.022	0.055	2,770	ELXV250E□□332ML35S		
	680	10 × 16	0.084	0.21	825	ELXV100E□□681MJ16S	3,300	18 × 30	0.024	0.060	2,720	ELXV250E□□332MM30S		
	1,000	10 × 20	0.062	0.16	1,060	ELXV100E□□102MJ20S	3,900	16 × 40	0.018	0.045	3,110	ELXV250E□□392ML40S		
	1,200	10 × 25	0.052	0.13	1,260	ELXV100E□□122MJ25S	3,900	18 × 35	0.021	0.053	3,050	ELXV250E□□392MM35S		
	1,500	10 × 30	0.044	0.11	1,450	ELXV100E□□152MJ30S	4,700	18 × 40	0.017	0.043	3,300	ELXV250E□□472MM40S		
	1,800	12.5 × 20	0.046	0.12	1,360	ELXV100E□□182MK20S	35	27	5 × 11.5	0.72	1.8	165	ELXV350E□□270MEB5D	
	2,200	12.5 × 25	0.034	0.085	1,700	ELXV100E□□222MK25S		56	6.3 × 11.5	0.38	0.95	255	ELXV350E□□560MFB5D	
	2,700	12.5 × 30	0.030	0.075	1,980	ELXV100E□□272MK30S		82	6.3 × 15	0.27	0.68	330	ELXV350E□□820MF15D	
	3,300	12.5 × 35	0.027	0.068	2,230	ELXV100E□□332MK35S		120	8 × 12	0.20	0.50	415	ELXV350E□□121MH12D	
	3,300	16 × 20	0.038	0.095	1,770	ELXV100E□□332ML20S		120	10 × 12.5	0.12	0.30	635	ELXV350E□□121MJC5S	
	3,900	12.5 × 40	0.024	0.060	2,460	ELXV100E□□392MK40S		180	8 × 15	0.16	0.40	495	ELXV350E□□181MH15D	
	3,900	16 × 25	0.028	0.070	2,190	ELXV100E□□392ML25S		220	8 × 20	0.11	0.28	640	ELXV350E□□221MH20D	
3,900	18 × 20	0.036	0.090	1,940	ELXV100E□□392MM20S	220		10 × 16	0.084	0.21	825	ELXV350E□□221MJ16S		
4,700	18 × 25	0.027	0.068	2,350	ELXV100E□□472MM25S	330		10 × 20	0.062	0.16	1,060	ELXV350E□□331MJ20S		
5,600	16 × 30	0.025	0.063	2,510	ELXV100E□□562ML30S	390		10 × 25	0.052	0.13	1,260	ELXV350E□□391MJ25S		
6,800	16 × 35	0.022	0.055	2,770	ELXV100E□□682ML35S	560		10 × 30	0.044	0.11	1,450	ELXV350E□□561MJ30S		
6,800	18 × 30	0.024	0.060	2,720	ELXV100E□□682MM30S	560		12.5 × 20	0.046	0.12	1,360	ELXV350E□□561MK20S		
8,200	16 × 40	0.018	0.045	3,110	ELXV100E□□822ML40S	680		12.5 × 25	0.034	0.085	1,700	ELXV350E□□681MK25S		
8,200	18 × 35	0.021	0.053	3,050	ELXV100E□□822MM35S	1,000		12.5 × 30	0.030	0.075	1,980	ELXV350E□□102MK30S		
10,000	18 × 40	0.017	0.043	3,300	ELXV100E□□103MM40S	1,000		16 × 20	0.038	0.095	1,770	ELXV350E□□102ML20S		
16	56	5 × 11.5	0.72	1.8	165	ELXV160E□□560MEB5D		1,200	12.5 × 35	0.027	0.068	2,230	ELXV350E□□122MK35S	
	120	6.3 × 11.5	0.38	0.95	255	ELXV160E□□121MFB5D		1,200	16 × 25	0.028	0.070	2,190	ELXV350E□□122ML25S	
	180	6.3 × 15	0.27	0.68	330	ELXV160E□□181MF15D		1,500	12.5 × 40	0.024	0.060	2,460	ELXV350E□□152MK40S	
	270	8 × 12	0.20	0.50	415	ELXV160E□□271MH12D	1,500	18 × 20	0.036	0.090	1,940	ELXV350E□□820MM20S		
	270	10 × 12.5	0.12	0.30	635	ELXV160E□□271MJC5S	1,800	16 × 30	0.025	0.063	2,510	ELXV350E□□182ML30S		
	330	8 × 15	0.16	0.40	495	ELXV160E□□331MH15D	1,800	18 × 25	0.027	0.068	2,350	ELXV350E□□182MM25S		
	470	8 × 20	0.11	0.28	640	ELXV160E□□471MH20D	2,200	16 × 35	0.022	0.055	2,770	ELXV350E□□222ML35S		
	470	10 × 16	0.084	0.21	825	ELXV160E□□471MJ16S	2,200	18 × 30	0.024	0.060	2,720	ELXV350E□□222MM30S		
	680	10 × 20	0.062	0.16	1,060	ELXV160E□□681MJ20S	2,700	16 × 40	0.018	0.045	3,110	ELXV350E□□272ML40S		
	820	10 × 25	0.052	0.13	1,260	ELXV160E□□821MJ25S	2,700	18 × 35	0.021	0.053	3,050	ELXV350E□□272MM35S		
	1,200	10 × 30	0.044	0.11	1,450	ELXV160E□□122MJ30S	3,300	18 × 40	0.017	0.043	3,300	ELXV350E□□332MM40S		
	1,200	12.5 × 20	0.046	0.12	1,360	ELXV160E□□122MK20S	50	18	5 × 11.5	1.1	3.3	165	ELXV500E□□180MEB5D	
	1,500	12.5 × 25	0.034	0.085	1,700	ELXV160E□□152MK25S		39	6.3 × 11.5	0.56	1.6	255	ELXV500E□□390MFB5D	
	2,200	12.5 × 30	0.030	0.075	1,980	ELXV160E□□222MK30S		56	6.3 × 15	0.41	1.2	310	ELXV500E□□560MF15D	
	2,200	16 × 20	0.038	0.095	1,770	ELXV160E□□222ML20S		68	8 × 12	0.29	0.84	415	ELXV500E□□680MH12D	

□ : Enter the appropriate lead forming or taping code.



◆STANDARD RATINGS

WV (Vdc)	Cap (μF)	Case size φD×L(mm)	Impedance (Ωmax/100kHz)		Rated ripple current (mA _{rms} /105°C, 100kHz)	Part No.	WV (Vdc)	Cap (μF)	Case size φD×L(mm)	Impedance (Ωmax/100kHz)		Rated ripple current (mA _{rms} /105°C, 100kHz)	Part No.
			20°C	-10°C						20°C	-10°C		
50	82	8×15	0.24	0.72	505	ELXV500E□□820MH15D	80	27	6.3×15	0.62	1.7	220	ELXV800E□□270MF15D
	82	10×12.5	0.16	0.40	530	ELXV500E□□820MJC5S		33	8×12	0.53	1.5	275	ELXV800E□□330MH12D
	120	8×20	0.18	0.52	610	ELXV500E□□121MH20D		39	10×12.5	0.47	1.3	380	ELXV800E□□390MJC5S
	120	10×16	0.12	0.30	755	ELXV500E□□121MJ16S		47	8×15	0.35	0.97	360	ELXV800E□□470MH15D
	180	10×20	0.088	0.22	945	ELXV500E□□181MJ20S		56	8×20	0.27	0.74	490	ELXV800E□□560MH20D
	220	10×25	0.068	0.17	1,150	ELXV500E□□221MJ25S		56	10×16	0.33	0.90	500	ELXV800E□□560MJ16S
	330	10×30	0.059	0.15	1,260	ELXV500E□□331MJ30S		82	10×20	0.26	0.70	620	ELXV800E□□820MJ20S
	330	12.5×20	0.059	0.15	1,190	ELXV500E□□331MK20S		100	10×25	0.19	0.52	795	ELXV800E□□101MJ25S
	470	12.5×25	0.045	0.11	1,500	ELXV500E□□471MK25S		150	10×30	0.15	0.41	955	ELXV800E□□151MJ30S
	560	12.5×30	0.039	0.098	1,720	ELXV500E□□561MK30S		150	12.5×20	0.15	0.41	890	ELXV800E□□151MK20S
	680	12.5×35	0.033	0.083	1,900	ELXV500E□□681MK35S		180	12.5×25	0.11	0.30	1,040	ELXV800E□□181MK25S
	680	16×20	0.043	0.11	1,500	ELXV500E□□681ML20S		270	12.5×30	0.094	0.26	1,270	ELXV800E□□271MK30S
	820	12.5×40	0.029	0.073	2,120	ELXV500E□□821MK40S		270	16×20	0.11	0.30	1,240	ELXV800E□□271ML20S
	820	16×25	0.033	0.083	1,880	ELXV500E□□821ML25S		330	12.5×35	0.087	0.24	1,450	ELXV800E□□331MK35S
	820	18×20	0.039	0.098	1,660	ELXV500E□□821MM20S		330	16×25	0.081	0.22	1,440	ELXV800E□□331ML25S
	1,000	16×30	0.029	0.073	2,150	ELXV500E□□102ML30S		390	12.5×40	0.060	0.17	1,610	ELXV800E□□391MK40S
	1,000	18×25	0.030	0.075	2,020	ELXV500E□□102MM25S		390	18×20	0.085	0.23	1,450	ELXV800E□□391MM20S
	1,200	16×35	0.025	0.063	2,320	ELXV500E□□122ML35S		470	16×30	0.058	0.16	1,790	ELXV800E□□471ML30S
	1,500	16×40	0.021	0.053	2,650	ELXV500E□□152ML40S		470	18×25	0.070	0.19	1,650	ELXV800E□□471MM25S
	1,500	18×30	0.026	0.065	2,340	ELXV500E□□152MM30S		560	16×35	0.052	0.14	2,000	ELXV800E□□561ML35S
1,800	18×35	0.023	0.058	2,620	ELXV500E□□182MM35S	680	16×40	0.041	0.11	2,200	ELXV800E□□681ML40S		
2,200	18×40	0.020	0.050	2,790	ELXV500E□□222MM40S	680	18×30	0.058	0.16	1,850	ELXV800E□□681MM30S		
63	12	5×11.5	1.9	4.8	100	ELXV630E□□120MEB5D	820	18×35	0.052	0.14	1,990	ELXV800E□□821MM35S	
	27	6.3×11.5	1.1	2.8	160	ELXV630E□□270MFB5D	1,000	18×40	0.041	0.11	2,370	ELXV800E□□102MM40S	
	39	6.3×15	0.62	1.6	230	ELXV630E□□390MF15D	100	5.6	5×11.5	1.9	5.1	100	ELXV101E□□5R6MEB5D
	47	8×12	0.49	1.3	275	ELXV630E□□470MH12D		12	6.3×11.5	1.1	3.0	150	ELXV101E□□120MFB5D
	56	10×12.5	0.27	0.68	420	ELXV630E□□560MJC5S		18	6.3×15	0.62	1.7	220	ELXV101E□□180MF15D
	68	8×15	0.34	0.85	360	ELXV630E□□680MH15D		22	8×12	0.53	1.5	275	ELXV101E□□220MH12D
	68	10×16	0.21	0.53	523	ELXV630E□□680MJ16S		27	10×12.5	0.47	1.3	380	ELXV101E□□270MJC5S
	82	8×20	0.21	0.53	500	ELXV630E□□820MH20D		33	8×15	0.35	0.97	360	ELXV101E□□330MH15D
	120	10×20	0.16	0.40	650	ELXV630E□□121MJ20S		33	10×16	0.33	0.90	500	ELXV101E□□330MJ16S
	150	10×25	0.13	0.33	780	ELXV630E□□151MJ25S		39	8×20	0.27	0.74	490	ELXV101E□□390MH20D
	180	10×30	0.10	0.25	960	ELXV630E□□181MJ30S		56	10×20	0.26	0.70	620	ELXV101E□□560MJ20S
	220	12.5×20	0.11	0.28	870	ELXV630E□□221MK20S		68	10×25	0.19	0.52	795	ELXV101E□□680MJ25S
	270	12.5×25	0.074	0.19	1,150	ELXV630E□□271MK25S		100	10×30	0.15	0.41	955	ELXV101E□□101MJ30S
	390	12.5×30	0.068	0.17	1,280	ELXV630E□□391MK30S		100	12.5×20	0.15	0.41	890	ELXV101E□□101MK20S
	390	16×20	0.085	0.22	1,100	ELXV630E□□391ML20S		120	12.5×25	0.11	0.30	1,040	ELXV101E□□121MK25S
	470	12.5×35	0.063	0.16	1,390	ELXV630E□□471MK35S		180	12.5×30	0.094	0.26	1,270	ELXV101E□□181MK30S
	470	16×25	0.055	0.14	1,480	ELXV630E□□471ML25S		180	16×20	0.11	0.30	1,240	ELXV101E□□181ML20S
	560	12.5×40	0.051	0.13	1,530	ELXV630E□□561MK40S		220	12.5×35	0.087	0.24	1,450	ELXV101E□□221MK35S
	560	18×20	0.085	0.22	1,170	ELXV630E□□561MM20S		220	16×25	0.081	0.22	1,440	ELXV101E□□221ML25S
	680	16×30	0.046	0.12	1,720	ELXV630E□□681ML30S		270	12.5×40	0.060	0.17	1,610	ELXV101E□□271MK40S
680	18×25	0.055	0.14	1,520	ELXV630E□□681MM25S	270		18×20	0.085	0.23	1,450	ELXV101E□□271MM20S	
820	16×35	0.040	0.10	1,910	ELXV630E□□821ML35S	330		16×30	0.058	0.16	1,790	ELXV101E□□331ML30S	
820	18×30	0.046	0.12	1,770	ELXV630E□□821MM30S	330	18×25	0.070	0.19	1,650	ELXV101E□□331MM25S		
1,000	16×40	0.036	0.09	2,070	ELXV630E□□102ML40S	390	16×35	0.052	0.14	2,000	ELXV101E□□391ML35S		
1,000	18×35	0.040	0.10	1,970	ELXV630E□□102MM35S	390	18×30	0.058	0.16	1,850	ELXV101E□□391MM30S		
1,200	18×40	0.036	0.09	2,130	ELXV630E□□122MM40S	470	16×40	0.041	0.11	2,200	ELXV101E□□471ML40S		
80	8.2	5×11.5	1.9	5.1	100	ELXV800E□□8R2MEB5D	560	18×35	0.052	0.14	1,990	ELXV101E□□561MM35S	
	18	6.3×11.5	1.1	3.0	150	ELXV800E□□180MFB5D	680	18×40	0.041	0.11	2,370	ELXV101E□□681MM40S	

□ : Enter the appropriate lead forming or taping code.

◆RATED RIPPLE CURRENT MULTIPLIERS

●Frequency Multipliers

Rated voltage (V _{dc})	Case size φD (mm)	Frequency (Hz)				Rated voltage (V _{dc})	Case size φD (mm)	Frequency (Hz)			
		120	1k	10k	100k			120	1k	10k	100k
6.3 & 10	5 to 8	0.65	0.83	0.95	1.00	35 & 50	5 to 8	0.40	0.66	0.85	1.00
	10 & 12.5	0.70	0.85	0.96	1.00		10 & 12.5	0.50	0.73	0.89	1.00
	16 & 18	0.85	0.92	0.97	1.00		16 & 18	0.60	0.81	0.94	1.00
16 & 25	5 to 8	0.55	0.76	0.91	1.00	63 to 100	5 to 8	0.20	0.55	0.80	1.00
	10 & 12.5	0.65	0.83	0.93	1.00		10 & 12.5	0.35	0.65	0.85	1.00
	16 & 18	0.70	0.87	0.96	1.00		16 & 18	0.50	0.75	0.90	1.00

The endurance of capacitors is reduced 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.