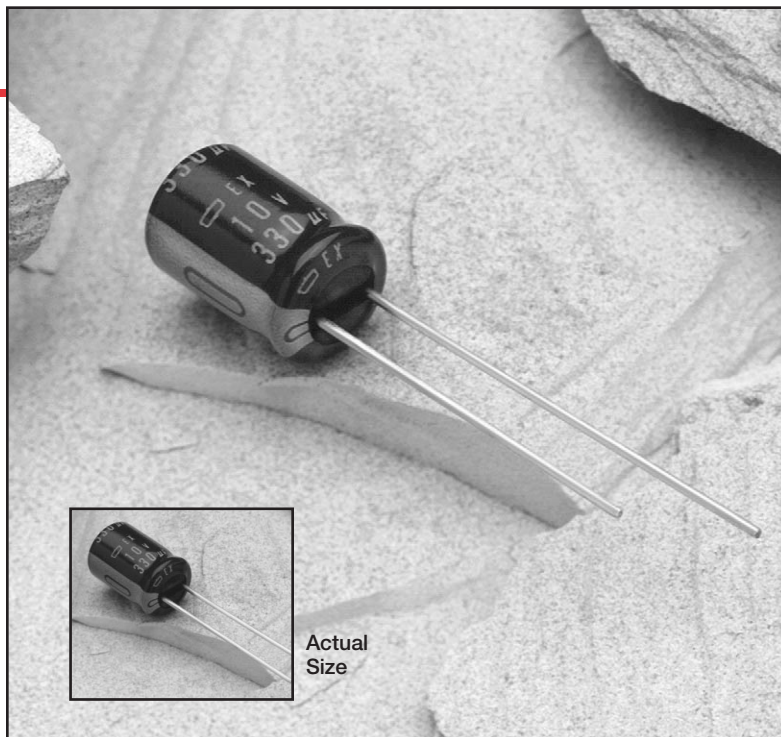


- **Miniature**
- **Long Life**
- **Low Impedance**
- **Solvent Proof**
- **+105°C or +125°C
Maximum
Temperature**



The EX series capacitors have a low impedance and are designed for use over two temperature ranges, -55°C to $+105^{\circ}\text{C}$ and -55°C to $+125^{\circ}\text{C}$. This series is available with two types of sleeving, PVC for use up to $+105^{\circ}\text{C}$ and PET (polyester) for use up to $+125^{\circ}\text{C}$. Please note that the life of the capacitor will be reduced if used at the higher temperature of $+125^{\circ}\text{C}$.

The EX series capacitors were developed to withstand HCFC cleaning agents for five minutes by ultrasonic, vapor or immersion. This solvent proof design allows all circuit board components to be cleaned together, at the same time, without resorting to more expensive epoxy end-sealed capacitors. Refer to the Mini-Glossary for recommended cleaning conditions.

Summary of Specifications

- **Radial lead terminals.**
- **Capacitance range: 0.1 to 10,000 μF .**
- **Voltage range: 10 to 63VDC.**
- **Operating temperature range: -55°C to $+105^{\circ}\text{C}$ for PVC sleeve; -55°C to $+125^{\circ}\text{C}$ for PET sleeve.**
- **Leakage current: 0.01CV or 3 μA , whichever is greater, after 2 minutes at $+20^{\circ}\text{C}$.**
- **Standard capacitance tolerance: $\pm 20\%$**
- **Nominal case size (D $\times$ L): 5 $\times$ 11mm to 18 $\times$ 40mm.**
- **Rated lifetime: 2,000 to 5,000 hours at $+105^{\circ}\text{C}$ or 500 to 1,250 hours at $+125^{\circ}\text{C}$ with the rated ripple current applied, depending on case size.**

EX Series

EX Specifications

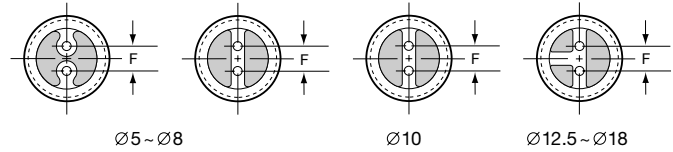
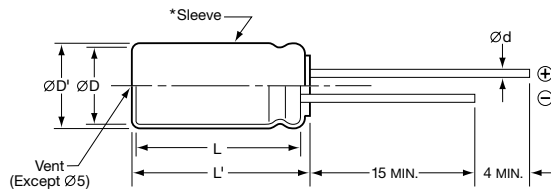
Item	Characteristics						
Operating Temperature Range	− 55 to +105°C for PVC sleeve; − 55 to +125°C for PET sleeve						
Rated Voltage Range	10 to 63VDC						
Capacitance Range	0.1 to 10,000μF						
Capacitance Tolerance	± 20% (M) at +20°C, 120Hz						
Leakage Current	I = 0.01CV or 3μA, whichever is greater, after 2 minutes at +20°C. Where I = Leakage current (μA), C = Nominal capacitance (μF) and V = Rated voltage (V)						
Dissipation Factor (Tan δ)	At +20°C, 120Hz						
	Rated Voltage (V)	10	16	25	35	50	63
	Tan δ (DF)	0.38	0.32	0.28	0.24	0.20	0.16
When nominal capacitance exceeds 1,000μF, add 0.02 to the values above for each 1,000μF increase.							
Equivalent Series Resistance (ESR)	At 100kHz, − 40°C, +20°C, refer to the Ratings Tables.						
Low Temperature Characteristics	At 120Hz, capacitance ratio between the − 40°C value and +20°C value shall not be less than 70% of the specified value at +20°C.						
Ripple Current Multipliers <i>Refer to Section 4 of the Mini-Glossary for explanation of Ripple Current Multipliers.</i>	Frequency (Hz)						
	Rated Voltage (V)	Case Diameter (Capacitance Range)		120Hz	1kHz	10kHz	100kHz
	10V	ø5, ø6.3, ø8		0.70	0.86	0.96	1.00
		ø10, ø12.5, ø16, ø18		0.85	0.95	0.98	1.00
	16-35V	ø5, ø6.3, ø8		0.50	0.80	0.94	1.00
		ø10, ø12.5, ø16, ø18		0.70	0.88	0.97	1.00
	50V, 63V	ø5 (≤1.0μF)		0.20	0.66	0.90	1.00
		ø5 (2.2μF), ø6.3, ø8		0.40	0.76	0.93	1.00
ø10, ø12.5, ø16, ø18		0.60	0.84	0.96	1.00		
Load Life	The following specifications shall be satisfied when the capacitors are restored to +20°C after subjecting them to the DC rated voltage for the specified test time at +105°C or +125°C with the rated ripple current applied. The sum of DC voltage and peak AC voltage must not exceed the full rated voltage of the capacitors.						
	Case Diameter	Test Time at +105°C		Test Time at +125°C			
	ø5 & ø6.3mm	2,000 hours		500 hours			
	ø8 & ø10mm	3,000 hours		750 hours			
	ø12.5mm & above	5,000 hours		1,250 hours			
	Capacitance change: ≤ ± 20% of initial measured value						
	Tan δ (DF) : ≤ 200% of initial specified value						
	Leakage current : ≤ initial specified value						
	ESR : Refer to Ratings Tables. ESR test results apply to case diameters ≥12.5.						
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. The rated voltage shall be applied to the capacitors for a minimum of 30 minutes, at least 24 hours and not more than 48 hours before the measurements.						
	Capacitance change: ≤ ± 20% of initial measured value						
	Tan δ (DF) : ≤ 200% of initial specified value						
	Leakage current : ≤ initial specified value						
	ESR : Refer to Ratings Tables. ESR test results apply to case diameters ≥12.5.						
Others	Satisfies characteristic W of JIS C5141						

EX Series

Diagram of Dimensions

VB/Radial Lead

Unit: mm



*PET sleeve for 125°C applications.

Gas escape end seal for all case diameters.

For optional lead configurations and tape and ammo packaging, refer to the beginning of the Miniature section.

ØD	ØD' max.	L' max.	Ød	F ± 0.5
5	ØD + 0.5	L + 2.0	0.5	2.0
6.3	ØD + 0.5	L + 2.0	0.5	2.5
8	ØD + 0.5	L + 2.0	0.6	3.5
10, 12.5	ØD + 0.5	L + 2.0	0.6	5.0
16, 18	ØD + 0.5	L + 2.0	0.8	7.5

Part Numbering System for EX Series

When ordering, always specify complete catalog number for EX Series.

EX 10 VB 331 M 8X11 LL P

Optional Sleeve Type: P = PET Sleeve. Specify if required.

Lead Length: LL is Standard.

Case Code: See Case Sizes in Tables.

Capacitance Tolerance: M = ± 20%

Capacitance Value: Expressed in Microfarads. The first two digits are significant figures, and the third digit indicates the number of zeros for capacitance of 100µF or more. R indicates the decimal point for capacitance less than 100µF (e.g. R33 = .33µF; 3R3 = 3.3µF; 33R = 33µF; 331 = 330µF; 332 = 3,300µF; 333 = 33,000µF).

Lead Configuration: VB = Radial Lead Terminals.

DC Rated Voltage: Expressed in Volts (e.g. 10 = 10WVDC).

Series Name: Indicates Basic Capacitor Design.

Standard Voltage Ratings - VB/Radial Lead

Rated Voltage (WVDC)	Capacitance (µF)	Catalog Part Number	Nominal Case Size* D × L (mm)	Maximum ESR (Ω) at 100kHz				Maximum Ripple Current (mA rms) at +105°C	
				Initial Value	End of Life	+20°C	-40°C	120Hz	100kHz
10 Volts 13 Volts Surge	100	EX10VB101M5X11LL	5 × 11	2.7	41	-	-	60	86
	220	EX10VB221M6X11LL	6.3 × 11	1.2	18	-	-	102	147
	330	EX10VB331M8X11LL	8 × 11.5	0.58	8.7	-	-	169	242
	470	EX10VB471M8X11LL	8 × 11.5	0.58	8.7	-	-	169	242
	1,000	EX10VB102M10X16LL	10 × 16	0.28	4.2	-	-	385	453
	2,200	EX10VB222M12X20LL	12.5 × 20	0.12	1.8	0.24	3.6	706	832
	3,300	EX10VB332M12X25LL	12.5 × 25	0.089	1.4	0.18	2.8	892	1,050
	4,700	EX10VB472M16X25LL	16 × 25	0.065	0.98	0.13	2.0	1,160	1,360
	6,800	EX10VB682M16X31LL	16 × 31.5	0.05	0.75	0.10	1.5	1,420	1,670
16 Volts 20 Volts Surge	10,000	EX10VB103M18X35LL	18 × 35.5	0.04	0.6	0.08	1.2	1,690	1,990
	47	EX16VB47RM5X11LL	5 × 11	2.7	41	-	-	43	86
	100	EX16VB101M6X11LL	6.3 × 11	1.2	18	-	-	74	147
	220	EX16VB221M8X11LL	8 × 11.5	0.58	8.7	-	-	121	242
	330	EX16VB331M8X11LL	8 × 11.5	0.58	8.7	-	-	121	242

*The case sizes in table are with no sleeve, refer to diagram for case sizes with sleeve.

EX Series

Standard Voltage Ratings - VB/Radial Lead

Rated Voltage (WVDC)	Capacitance (μF)	Catalog Part Number	Nominal Case Size* D × L (mm)	Maximum ESR (Ω) at 100kHz				Maximum Ripple Current (mA rms) at +105°C	
				Initial Value		End of Life		120Hz	100kHz
				+20°C	-40°C	+20°C	-40°C		
16 Volts 20 Volts Surge	470	EX16VB471M10X12LL	10 × 12.5	0.40	6.0	–	–	241	344
	1,000	EX16VB102M10X20LL	10 × 20	0.20	3.0	–	–	408	581
	2,200	EX16VB222M12X25LL	12.5 × 25	0.089	1.4	0.18	2.8	734	1,050
	3,300	EX16VB332M16X25LL	16 × 25	0.065	0.98	0.13	2.0	951	1,360
	4,700	EX16VB472M16X31LL	16 × 31.5	0.05	0.75	0.10	1.5	1,170	1,670
	6,800	EX16VB682M18X35LL	18 × 35.5	0.04	0.60	0.08	1.2	1,390	1,990
	10,000	EX16VB103M18X40LL	18 × 40	0.036	0.54	0.072	1.1	1,490	2,130
25 Volts 32 Volts Surge	47	EX25VB47RM5X11LL	5 × 11	2.7	41	–	–	43	86
	100	EX25VB101M6X11LL	6.3 × 11	1.2	18	–	–	74	147
	220	EX25VB221M8X11LL	8 × 11.5	0.58	8.7	–	–	121	242
	330	EX25VB331M10X12LL	10 × 12.5	0.40	6.0	–	–	241	344
	470	EX25VB471M10X16LL	10 × 16	0.28	4.2	–	–	317	453
	1,000	EX25VB102M12X20LL	12.5 × 20	0.12	1.8	0.24	3.6	582	832
	2,200	EX25VB222M16X25LL	16 × 25	0.065	0.98	0.13	2.0	951	1,360
	3,300	EX25VB332M16X31LL	16 × 31.5	0.05	0.75	0.10	1.5	1,170	1,670
	4,700	EX25VB472M18X35LL	18 × 35.5	0.04	0.60	0.08	1.2	1,390	1,990
	6,800	EX25VB682M18X40LL	18 × 40	0.036	0.54	0.072	1.1	1,490	2,130
35 Volts 44 Volts Surge	33	EX35VB33RM5X11LL	5 × 11	2.7	41	–	–	43	86
	47	EX35VB47RM6X11LL	6.3 × 11	1.2	18	–	–	74	147
	100	EX35VB101M8X11LL	8 × 11.5	0.58	8.7	–	–	121	242
	220	EX35VB221M10X12LL	10 × 12.5	0.40	6.0	–	–	241	344
	330	EX35VB331M10X16LL	10 × 16	0.28	4.2	–	–	317	453
	470	EX35VB471M10X20LL	10 × 20	0.20	3.0	–	–	407	581
	1,000	EX35VB102M12X25LL	12.5 × 25	0.089	1.4	0.18	2.8	734	1,050
	2,200	EX35VB222M16X31LL	16 × 31.5	0.05	0.75	0.10	1.5	1,170	1,670
	3,300	EX35VB332M18X35LL	18 × 35.5	0.04	0.60	0.08	1.2	1,390	1,990
	4,700	EX35VB472M18X40LL	18 × 40	0.036	0.54	0.072	1.1	1,490	2,130
50 Volts 63 Volts Surge	22	EX50VB22RM5X11LL	5 × 11	2.7	41	–	–	34	86
	33	EX50VB33RM6X11LL	6.3 × 11	1.2	18	–	–	59	147
	47	EX50VB47RM6X11LL	6.3 × 11	1.2	18	–	–	59	147
	100	EX50VB101M8X11LL	8 × 11.5	0.58	8.7	–	–	97	242
	220	EX50VB221M10X16LL	10 × 16	0.28	4.2	–	–	272	453
	330	EX50VB331M10X20LL	10 × 20	0.20	3.0	–	–	349	581
	470	EX50VB471M12X20LL	12.5 × 20	0.12	1.8	0.24	3.6	499	832
	1,000	EX50VB102M16X25LL	16 × 25	0.065	0.98	0.13	2.0	815	1,360
	2,200	EX50VB222M18X35LL	18 × 35.5	0.04	0.60	0.08	1.2	1,200	1,990
63 Volts 79 Volts Surge	0.1	EX63VBR10M5X11LL	5 × 11	21	315	–	–	6	30
	0.22	EX63VBR22M5X11LL	5 × 11	16	240	–	–	7	35
	0.33	EX63VBR33M5X11LL	5 × 11	12	180	–	–	8	40
	0.47	EX63VBR47M5X11LL	5 × 11	10	150	–	–	9	44
	1.0	EX63VB1R0M5X11LL	5 × 11	7	105	–	–	10	53
	2.2	EX63VB2R2M5X11LL	5 × 11	6	90	–	–	22	57
	3.3	EX63VB3R3M5X11LL	5 × 11	5	75	–	–	25	63
	4.7	EX63VB4R7M5X11LL	5 × 11	4	60	–	–	28	70
	10	EX63VB10RM5X11LL	5 × 11	2.7	41	–	–	34	86
	22	EX63VB22RM6X11LL	6.3 × 11	1.2	18	–	–	58	147
	33	EX63VB33RM6X11LL	6.3 × 11	1.2	18	–	–	58	147
	47	EX63VB47RM8X11LL	8 × 11.5	0.58	8.7	–	–	96	242
	100	EX63VB101M10X12LL	10 × 12.5	0.40	6.0	–	–	206	344
	220	EX63VB221M10X20LL	10 × 20	0.20	3.0	–	–	348	581
	330	EX63VB331M12X20LL	12.5 × 20	0.12	1.8	0.24	3.6	499	832
	470	EX63VB471M16X25LL	16 × 25	0.089	1.4	0.18	2.8	629	1,050
	1,000	EX63VB102M16X31LL	16 × 31.5	0.05	0.75	0.10	1.5	1,000	1,670

* The case sizes in table are with no sleeve, refer to diagram for case sizes with sleeve.

EX
MINIATURE - 105°C