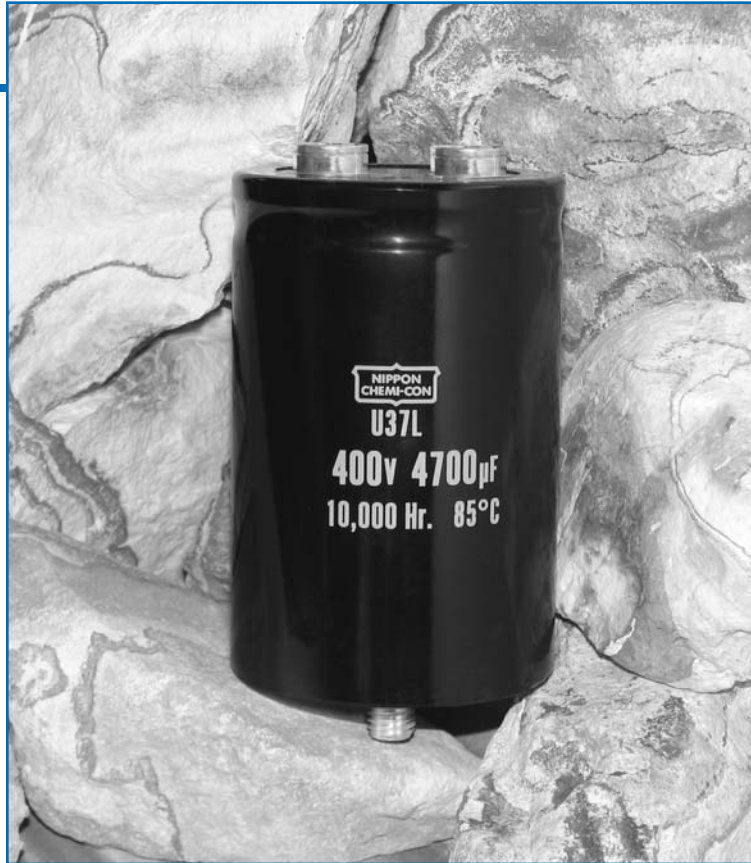


U37L Series



- Large Can
- Screw Terminals
- High Ripple
- 350 to 500VDC Ratings
- RoHS Compliant
- +85°C Maximum Temperature
- 10,000 Hours Lifetime at +85°C
- Up to 175,000 Hours Useful Life



The U37L series is a longer life version of the U37 grade series and is specifically designed to provide the ripple current capability and long life required for high reliability inverter applications. The U37L has an endurance rating of 10,000 hours at +85°C with the rated ripple current applied. The useful life can exceed 175,000 hours at +40°C and 2x the ripple current. These capacitors are available in a variety of high current English or Metric thread terminals. Mounting options include a three-footed clamp or bottom threaded stud. Custom designs are also available.

Summary of Specifications

- Screw terminals: high and low post, English and Metric thread.
- Capacitance range: 1,500 to 18,000µF.
- Voltage range: 350 to 500VDC.
- Category temperature range: -40°C to +85°C.
- Leakage current: 0.02CV(µA) or 5mA, whichever is smaller, after 5 minutes at +25°C.
- Standard capacitance tolerance: ±20%
- Nominal case size (D × L): D = 50.8mm (2.000") to 89mm (3.500"); L = 92mm (3.625") to 219mm (8.625").
- Rated lifetime: 10,000 hours at +85°C with rated ripple current applied.

U37L Series

U37L Specifications - Screw Terminals

Item	Characteristics																																																					
Category Temperature Range	− 40 to +85°C																																																					
Rated Voltage Range	350 to 500VDC																																																					
Capacitance Range	1,500 to 18,000µF at +25°C, 120Hz																																																					
Capacitance Tolerance	± 20% (M) at +25°C, 120Hz																																																					
Leakage Current	I = 0.02CV (µA) or 5mA, whichever is smaller, after 5 minutes at +25°C. Where I = Max. leakage current (µA), C = Nominal capacitance (µF) and V = Rated voltage (V)																																																					
Rated Ripple Current Multipliers	Ambient Temperature (°C)																																																					
	+45°C		+65°C		+85°C																																																	
	2.82		1.73		1.00																																																	
	Frequency (Hz)																																																					
	DC Rated Voltage	50Hz	120Hz	300Hz	1kHz	3kHz	10kHz																																															
	350-500V	0.80	1.00	1.20	1.30	1.40	1.41																																															
	To determine maximum ripple current at a specified temperature and frequency, use the appropriate multiplier shown.																																																					
Endurance (Load Life)	The following specifications shall be satisfied when the capacitors are restored to +25°C after subjecting them to DC voltage for 10,000 hours at +85°C with the rated ripple current applied. The sum of the DC voltage and peak AC voltage must not exceed the full rated voltage of the capacitors. Capacitance change: ≤ 20% from initial measurement ESR change : ≤ 200% of initial specified limit Leakage current : ≤ initial specified limit																																																					
Useful Life	With specified standard voltage and ripple current applied, typical life as function of ambient temperature is listed below. <table><tr><td>+85°C</td><td>13,000 hours max.</td></tr><tr><td>+65°C</td><td>47,700 hours max.</td></tr><tr><td>+45°C</td><td>175,000 hours max.</td></tr></table> Capacitance change: ≤ 30% from initial measurement ESR change : ≤ 300% of initial specified limit Leakage current : ≤ initial specified limit							+85°C	13,000 hours max.	+65°C	47,700 hours max.	+45°C	175,000 hours max.																																									
+85°C	13,000 hours max.																																																					
+65°C	47,700 hours max.																																																					
+45°C	175,000 hours max.																																																					
Shelf Life	The following specifications shall be satisfied when the capacitors are restored to +25°C after exposing them for 500 hours at +85°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% from initial measurement ESR change : ≤ 200% of initial specified limit Leakage current : ≤ initial specified limit																																																					
Vibration Rating	10-55Hz, 10g sinusoidal in three axes, 2 hours per axis.																																																					
Maximum Tightening Torque	<table><tr><td>Terminal Code</td><td>HP</td><td>HL</td><td>CD</td><td>CP</td><td>CH</td><td>CA</td><td>CS</td></tr><tr><td>Thread Size</td><td>10-32 NF-2B</td><td>M5x0.8-6H</td><td></td><td>1/4-28 NF-2B</td><td></td><td>M6x1-6H</td><td></td></tr><tr><td>3 Threads Engaged</td><td colspan="3">2.0 N·m (18.0 in·lb)</td><td colspan="4">4.0 N·m (35.0 in·lb)</td></tr><tr><td>6 Threads Engaged</td><td colspan="3">2.8 N·m (25.0 in·lb)</td><td colspan="4">6.2 N·m (55.0 in·lb)</td></tr></table>							Terminal Code	HP	HL	CD	CP	CH	CA	CS	Thread Size	10-32 NF-2B	M5x0.8-6H		1/4-28 NF-2B		M6x1-6H		3 Threads Engaged	2.0 N·m (18.0 in·lb)			4.0 N·m (35.0 in·lb)				6 Threads Engaged	2.8 N·m (25.0 in·lb)			6.2 N·m (55.0 in·lb)																		
Terminal Code	HP	HL	CD	CP	CH	CA	CS																																															
Thread Size	10-32 NF-2B	M5x0.8-6H		1/4-28 NF-2B		M6x1-6H																																																
3 Threads Engaged	2.0 N·m (18.0 in·lb)			4.0 N·m (35.0 in·lb)																																																		
6 Threads Engaged	2.8 N·m (25.0 in·lb)			6.2 N·m (55.0 in·lb)																																																		
Typical Inductance (nH) at 1MHz	<table><tr><td rowspan="2">Case Diameter (mm)</td><td colspan="7">Terminal Code</td></tr><tr><td>HP</td><td>HL</td><td>CD</td><td>CP</td><td>CH</td><td>CA</td><td>CS</td></tr><tr><td>ø50.8</td><td>—</td><td>—</td><td>NA</td><td>NA</td><td>NA</td><td>NA</td><td>NA</td></tr><tr><td>ø63.5</td><td>—</td><td>—</td><td>—</td><td>—</td><td>—</td><td>—</td><td>—</td></tr><tr><td>ø76.2</td><td>30</td><td>30</td><td>25</td><td>20</td><td>25</td><td>20</td><td>25</td></tr><tr><td>ø89.0</td><td>30</td><td>30</td><td>25</td><td>20</td><td>25</td><td>20</td><td>25</td></tr></table>							Case Diameter (mm)	Terminal Code							HP	HL	CD	CP	CH	CA	CS	ø50.8	—	—	NA	NA	NA	NA	NA	ø63.5	—	—	—	—	—	—	—	ø76.2	30	30	25	20	25	20	25	ø89.0	30	30	25	20	25	20	25
Case Diameter (mm)	Terminal Code																																																					
	HP	HL	CD	CP	CH	CA	CS																																															
ø50.8	—	—	NA	NA	NA	NA	NA																																															
ø63.5	—	—	—	—	—	—	—																																															
ø76.2	30	30	25	20	25	20	25																																															
ø89.0	30	30	25	20	25	20	25																																															
Custom Designs	Custom CV values per case size and termination type may be available upon request. Contact appropriate representative with specific requirements.																																																					

U37L Series

U37L Useful Life

Useful Life: 13,000 Hours at +85°C

The life expectancy of a capacitor is shown as a function of ambient temperature and ripple current load.

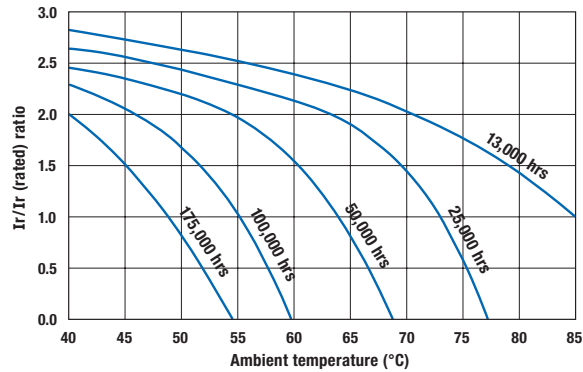
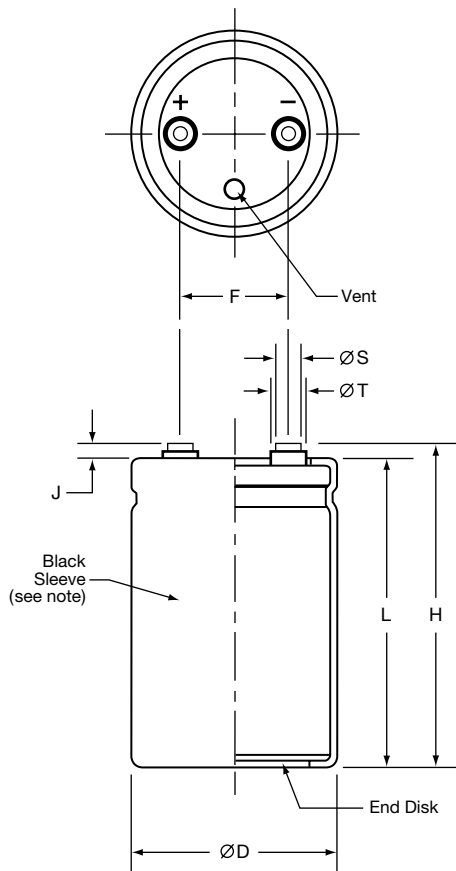


Diagram of Dimensions - Screw Terminals

Large Can/Screw Terminals

Unit: mm (inches)



Case Dimensions and Standard Box Quantities

Case Size Code	ØD +2.0 (0.080)	L ±1.0 (0.040)	F ±0.25 (0.010)	Standard Box Quantity
CB7 CD0	50.8 (2.000)	117 (4.625) 130 (5.125)	22.2 (0.875)	49
D92 DA5 DB7 DD0 DE3	63.5 (2.500)	92 (3.625) 105 (4.125) 117 (4.625) 130 (5.125) 143 (5.625)	28.6 (1.125)	20
E92 EA5 EB7 EE3 EJ1 EM9	76.2 (3.000)	92 (3.625) 105 (4.125) 117 (4.625) 143 (5.625) 181 (7.125) 219 (8.625)	31.8 (1.250)	16 9
F92 FA5 FB7 FE3 FF5 FK0 FM9	89.0 (3.500)	92 (3.625) 105 (4.125) 117 (4.625) 143 (5.625) 155 (6.125) 190 (7.500) 219 (8.625)	31.8 (1.250)	5

Note:

In some cases, the color of the sleeve may change slightly due to the operating conditions, however, the discoloration will not impair capacitor function.

Terminal Specifications

Terminal Code	Available Case Diameter		Thread Size	Minimum Thread Depth	J ±0.5 (0.020)	H ±2.0 (0.080)	ØS ±0.25 (0.010)	ØT ±0.25 (0.010)
	ØD Code	ØD mm (inches)						
HP	C	50.8 (2.000)	10-32 NF-2B	9.5 (0.375)	6.4 (0.250)	L+J	8.0 (0.313)	11.1 (0.438)
HL	C	50.8 (2.000)	M5x0.8-6H	9.5 (0.375)	6.4 (0.250)	L+J	8.0 (0.313)	11.1 (0.438)
CD	D-E	63.5 – 76.2 (2.500 – 3.000)	M5x0.8-6H	8.5 (0.335)	5.0 (0.200)	L+J	13.0 (0.512)	18.8 (0.740)
CP	D-F	63.5 – 89.0 (2.500 – 3.500)	1/4-28 NF-2B	8.7 (0.344)	2.4 (0.093)	L+J	17.5 (0.689)	—
CH	D-F	63.5 – 89.0 (2.500 – 3.500)	1/4-28 NF-2B	11.9 (0.468)	6.4 (0.250)	L+J	17.5 (0.689)	—
CA	D-F	63.5 – 89.0 (2.500 – 3.500)	M6x1-6H	8.7 (0.344)	2.4 (0.093)	L+J	17.5 (0.689)	—
CS	D-F	63.5 – 89.0 (2.500 – 3.500)	M6x1-6H	11.9 (0.468)	6.4 (0.250)	L+J	17.5 (0.689)	—

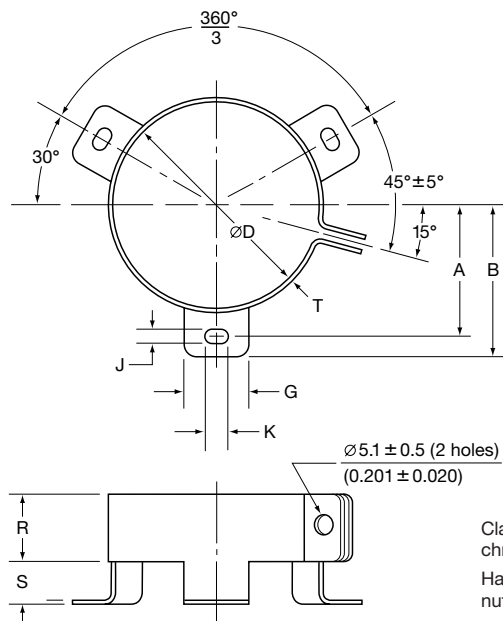
Mounting Hardware is optional. Refer to hardware specifications on the following page.

U37L Series

Mounting Hardware - Screw Terminals

Type C: Three-Footed Clamp

Unit: mm (inches)



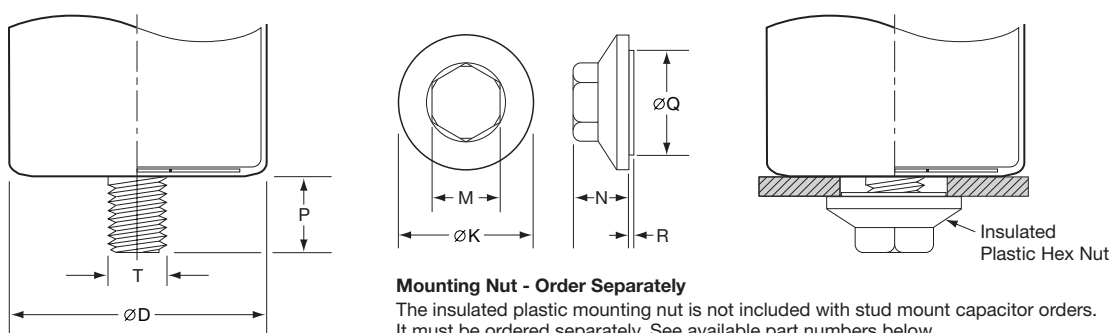
Clamp: Zinc with silver trivalent chromate post treatment.

Hardware: Screw, washer and hexagon nut included with each clamp.

Type C: Clamp Dimensions

Mounting Code	Case ØD	A ±1.0 (0.040)	B ±1.0 (0.040)	G ±1.0 (0.040)	J ±0.5 (0.020)	K ±0.5 (0.020)	R ±1.0 (0.040)	S ±1.0 (0.040)	T ±0.5 (0.020)
C	50.8 (2.000)	31.8 (1.250)	36.5 (1.437)	13.3 (0.524)	4.5 (0.177)	7.1 (0.280)	19.1 (0.751)	9.5 (0.374)	0.8 (0.032)
C	63.5 (2.500)	38.1 (1.500)	42.9 (1.689)	13.3 (0.524)	4.5 (0.177)	7.1 (0.280)	19.1 (0.751)	9.5 (0.374)	0.8 (0.032)
C	76.2 (3.000)	44.5 (1.750)	49.2 (1.937)	13.3 (0.524)	4.5 (0.177)	7.1 (0.280)	19.1 (0.751)	9.5 (0.374)	1.0 (0.040)
C	89.0 (3.500)	50.8 (2.000)	56.5 (2.224)	16.0 (0.630)	4.5 (0.177)	8.0 (0.313)	21.0 (0.827)	9.0 (0.354)	1.0 (0.040)

Type S: Stud Mounting



Mounting Nut - Order Separately

The insulated plastic mounting nut is not included with stud mount capacitor orders. It must be ordered separately. See available part numbers below.

Type S: Stud Dimensions

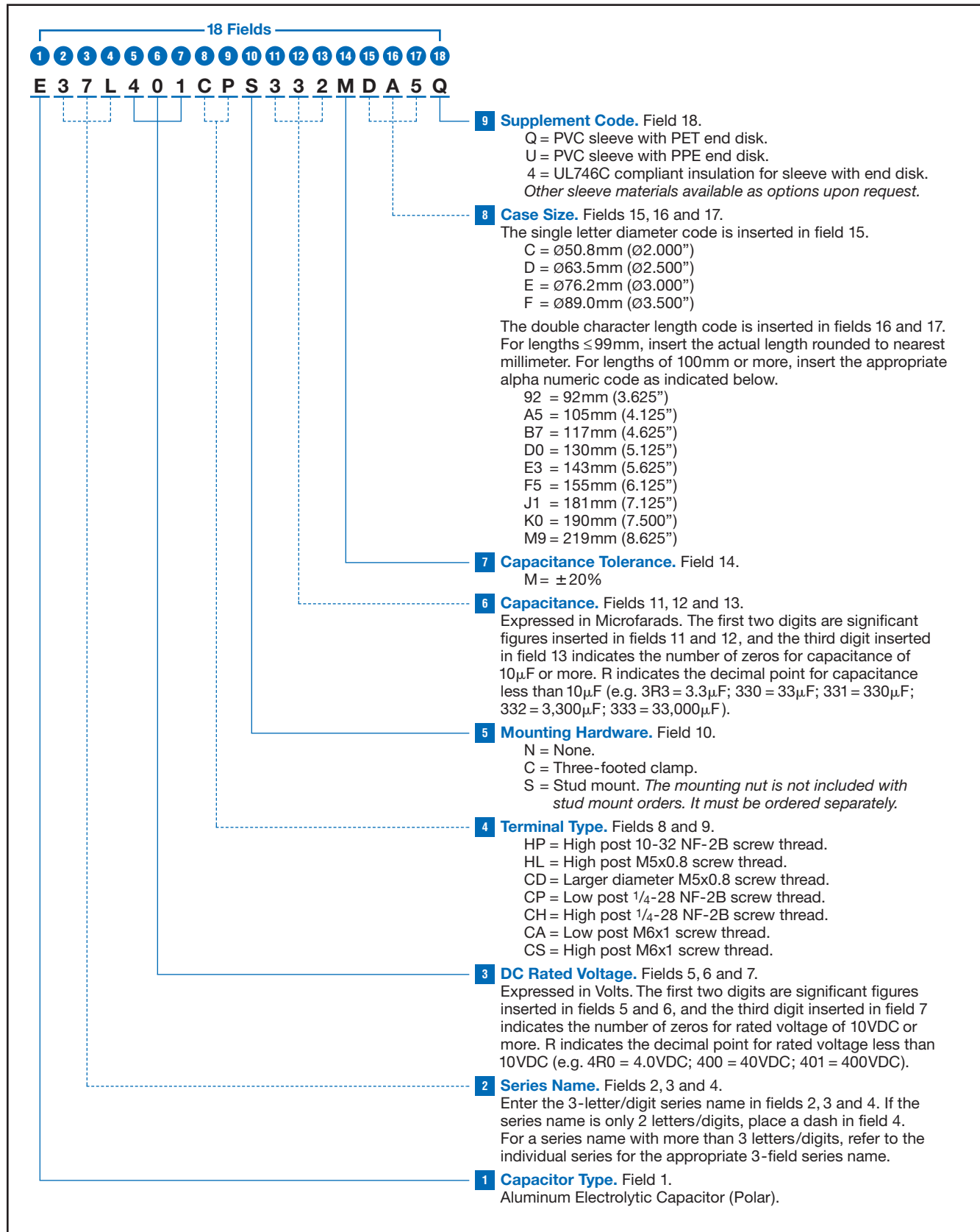
Mounting Code	P ±1.0 (0.040)	T Thread Size
S	16.0 (0.630)	M12

Mounting Nut Dimensions

Part Number	ØK ±2.0 (0.080)	M ±1.0 (0.040)	N ±1.0 (0.040)	ØQ ±1.0 (0.040)	R ±1.0 (0.040)
50-8D	30.0 (1.181)	19.0 (0.748)	18.0 (0.709)	22.0 (0.866)	1.40 (0.055)
50-8E	38.0 (1.496)	19.0 (0.748)	18.0 (0.709)	30.0 (1.181)	1.40 (0.055)

U37L Series

Part Numbering System for U37L Series When ordering, always specify complete 18-field global part number.



U37L Series

Standard Voltage Ratings - Screw Terminals

Rated Voltage (WVDC)	Capacitance (μF)	Global Part Number†	Nominal Case Size* D × L (mm)	Case Size Code	Maximum ESR (mΩ) at +25°C, 120Hz	Rated Ripple Current (A rms) at +85°C		
						120Hz	300Hz	>3kHz
350 Volts 400 Volts Surge	3,300	E37L351HPN332MCB7Q	50.8 × 117	CB7	29	10.6	12.7	14.8
	3,300	E37L351HPN332MCD0Q	50.8 × 130	CD0	29	11.0	13.1	15.3
	3,300	E37L351CPN332MD92Q	63.5 × 92	D92	30	10.7	12.8	15.0
	3,900	E37L351CPN392MDA5Q	63.5 × 105	DA5	26	12.2	14.6	17.0
	3,900	E37L351CPN392MDB7Q	63.5 × 117	DB7	26	12.6	15.2	17.7
	4,700	E37L351CPN472MDD0Q	63.5 × 130	DD0	21	14.4	17.3	20.2
	5,600	E37L351CPN562MDE3Q	63.5 × 143	DE3	18	16.3	19.5	22.8
	4,700	E37L351CPN472ME92Q	76.2 × 92	E92	22	13.9	16.7	19.5
	5,600	E37L351CPN562MEA5Q	76.2 × 105	EA5	18	15.8	19.0	22.1
	6,800	E37L351CPN682MEB7Q	76.2 × 117	EB7	15	18.1	21.7	25.4
	8,200	E37L351CPN822MEE3Q	76.2 × 143	EE3	13	21.3	25.6	29.9
	12,000	E37L351CPN123MEJ1Q	76.2 × 181	EJ1	9	28.2	33.9	39.5
	15,000	E37L351CPN153MEM9Q	76.2 × 219	EM9	7	34.0	40.8	47.6
	6,800	E37L351CPN682MF92Q	89 × 92	F92	15	18.3	22.0	25.6
	8,200	E37L351CPN822MFA5Q	89 × 105	FA5	13	21.0	25.2	29.3
	8,200	E37L351CPN822MFB7Q	89 × 117	FB7	13	21.8	26.1	30.5
	12,000	E37L351CPN123MFE3Q	89 × 143	FE3	9	28.2	33.8	39.5
	12,000	E37L351CPN123MFF5Q	89 × 155	FF5	9	29.0	34.8	40.6
	15,000	E37L351CPN153MFK0Q	89 × 190	FK0	7	35.0	42.0	49.1
	18,000	E37L351CPN183MFM9Q	89 × 219	FM9	6	41.1	49.4	57.6
400 Volts 450 Volts Surge	2,700	E37L401HPN272MCB7Q	50.8 × 117	CB7	35	9.5	11.5	13.4
	3,300	E37L401HPN332MCD0Q	50.8 × 130	CD0	29	11.0	13.1	15.3
	2,700	E37L401CPN272MD92Q	63.5 × 92	D92	37	9.7	11.6	13.6
	3,300	E37L401CPN332MDA5Q	63.5 × 105	DA5	30	11.2	13.4	15.7
	3,900	E37L401CPN392MDB7Q	63.5 × 117	DB7	26	12.6	15.2	17.7
	3,900	E37L401CPN392MDD0Q	63.5 × 130	DD0	26	13.1	15.7	18.4
	4,700	E37L401CPN472MDE3Q	63.5 × 143	DE3	21	14.9	17.9	20.9
	3,900	E37L401CPN392ME92Q	76.2 × 92	E92	27	12.7	15.2	17.7
	4,700	E37L401CPN472MEA5Q	76.2 × 105	EA5	22	14.5	17.4	20.3
	5,600	E37L401CPN562MEB7Q	76.2 × 117	EB7	18	16.4	19.7	23.0
	6,800	E37L401CPN682MEE3Q	76.2 × 143	EE3	15	19.4	23.3	27.2
	10,000	E37L401CPN103MEJ1Q	76.2 × 181	EJ1	10	25.8	30.9	36.1
	12,000	E37L401CPN123MEM9Q	76.2 × 219	EM9	9	30.4	36.5	42.6
	5,600	E37L401CPN562MF92Q	89 × 92	F92	18	16.6	20.0	23.3
	6,800	E37L401CPN682MFA5Q	89 × 105	FA5	15	19.1	22.9	26.7
	8,200	E37L401CPN822MFB7Q	89 × 117	FB7	13	21.8	26.1	30.5
	10,000	E37L401CPN103MFE3Q	89 × 143	FE3	10	25.7	30.9	36.0
	12,000	E37L401CPN123MFF5Q	89 × 155	FF5	9	29.0	34.8	40.6
	15,000	E37L401CPN153MFK0Q	89 × 190	FK0	7	35.0	42.0	49.1
	18,000	E37L401CPN183MFM9Q	89 × 219	FM9	6	40.6	48.7	56.8
420 Volts 470 Volts Surge	2,700	E37L421HPN272MCB7Q	50.8 × 117	CB7	35	9.5	11.5	13.4
	2,900	E37L421HPN292MCD0Q	50.8 × 130	CD0	33	10.3	12.3	14.4
	2,200	E37L421CPN222MD92Q	63.5 × 92	D92	45	8.7	10.5	12.2
	2,700	E37L421CPN272MDA5Q	63.5 × 105	DA5	37	10.1	12.1	14.2
	3,300	E37L421CPN332MDB7Q	63.5 × 117	DB7	30	11.6	14.0	16.3
	3,900	E37L421CPN392MDD0Q	63.5 × 130	DD0	26	13.1	15.7	18.4
	4,700	E37L421CPN472MDE3Q	63.5 × 143	DE3	21	14.9	17.9	20.9
	3,900	E37L421CPN392ME92Q	76.2 × 92	E92	27	12.7	15.2	17.7
	4,700	E37L421CPN472MEA5Q	76.2 × 105	EA5	22	14.5	17.4	20.3
	5,600	E37L421CPN562MEB7Q	76.2 × 117	EB7	18	16.4	19.7	23.0
	6,800	E37L421CPN682MEE3Q	76.2 × 143	EE3	15	19.4	23.3	27.2
	8,200	E37L421CPN822MEJ1Q	76.2 × 181	EJ1	13	23.3	28.0	32.7
	12,000	E37L421CPN123MEM9Q	76.2 × 219	EM9	9	30.4	36.5	42.6
	5,600	E37L421CPN562MF92Q	89 × 92	F92	18	16.6	20.0	23.3
	6,800	E37L421CPN682MFA5Q	89 × 105	FA5	15	19.1	22.9	26.7

†For terminal, mounting and construction options, refer to the part numbering system for descriptions and codes.

*Refer to diagram of dimensions for detailed case size specifications.

U37L Series

Standard Voltage Ratings - Screw Terminals

Rated Voltage (WVDC)	Capacitance (µF)	Global Part Number†	Nominal Case Size* D × L (mm)	Case Size Code	Maximum ESR (mΩ) at +25°C, 120Hz	Rated Ripple Current (A rms) at +85°C		
						120Hz	300Hz	>3kHz
420 Volts 470 Volts Surge	6,800	E37L421CPN682MFB7Q	89 × 117	FB7	15	19.8	23.8	27.8
	10,000	E37L421CPN103MFE3Q	89 × 143	FE3	10	25.7	30.9	36.0
	10,000	E37L421CPN103MFF5Q	89 × 155	FF5	10	26.5	31.8	37.1
	12,000	E37L421CPN123MFK0Q	89 × 190	FK0	9	31.3	37.6	43.9
	15,000	E37L421CPN153MFM9Q	89 × 219	FM9	7	37.0	44.5	51.9
450 Volts 500 Volts Surge	2,200	E37L451HPN222MCB7Q	50.8 × 117	CB7	43	8.6	10.3	12.1
	2,200	E37L451HPN222MCD0Q	50.8 × 130	CD0	43	8.9	10.7	12.5
	2,200	E37L451CPN222MD92Q	63.5 × 92	D92	45	8.7	10.5	12.2
	2,200	E37L451CPN222MDA5Q	63.5 × 105	DA5	45	9.1	11.0	12.8
	2,700	E37L451CPN272MDB7Q	63.5 × 117	DB7	37	10.5	12.6	14.7
	3,300	E37L451CPN332MDD0Q	63.5 × 130	DD0	30	12.1	14.5	16.9
	3,900	E37L451CPN392MDE3Q	63.5 × 143	DE3	26	13.6	16.3	19.0
	3,300	E37L451CPN332ME92Q	76.2 × 92	E92	31	11.6	14.0	16.3
	3,900	E37L451CPN392MEA5Q	76.2 × 105	EA5	27	13.2	15.8	18.5
	4,700	E37L451CPN472MEB7Q	76.2 × 117	EB7	22	15.1	18.1	21.1
	5,600	E37L451CPN562MEE3Q	76.2 × 143	EE3	18	17.6	21.2	24.7
	6,800	E37L451CPN682MEJ1Q	76.2 × 181	EJ1	15	21.2	25.5	29.7
	10,000	E37L451CPN103MEM9Q	76.2 × 219	EM9	10	27.8	33.3	38.9
	4,700	E37L451CPN472MF92Q	89 × 92	F92	22	15.2	18.3	21.3
	5,600	E37L451CPN562MFA5Q	89 × 105	FA5	18	17.3	20.8	24.2
	5,600	E37L451CPN562MFB7Q	89 × 117	FB7	18	18.0	21.6	25.2
	8,200	E37L451CPN822MFE3Q	89 × 143	FE3	13	23.3	28.0	32.6
	8,200	E37L451CPN822MFF5Q	89 × 155	FF5	13	24.0	28.8	33.6
	12,000	E37L451CPN123MFK0Q	89 × 190	FK0	9	31.3	37.6	43.9
	12,000	E37L451CPN123MFM9Q	89 × 219	FM9	9	33.1	39.8	46.4
500 Volts 550 Volts Surge	1,500	E37L501HPN152MCB7Q	50.8 × 117	CB7	64	7.1	8.5	10.0
	1,500	E37L501HPN152MCD0Q	50.8 × 130	CD0	64	7.4	8.9	10.3
	1,800	E37L501CPN182MD92Q	63.5 × 92	D92	55	7.9	9.5	11.1
	2,200	E37L501CPN222MDA5Q	63.5 × 105	DA5	45	9.1	11.0	12.8
	2,200	E37L501CPN222MDB7Q	63.5 × 117	DB7	45	9.5	11.4	13.3
	2,700	E37L501CPN272MDD0Q	63.5 × 130	DD0	37	10.9	13.1	15.3
	2,700	E37L501CPN272MDE3Q	63.5 × 143	DE3	37	11.3	13.6	15.8
	2,700	E37L501CPN272ME92Q	76.2 × 92	E92	38	10.5	12.6	14.7
	3,300	E37L501CPN332MEA5Q	76.2 × 105	EA5	31	12.1	14.6	17.0
	3,300	E37L501CPN332MEB7Q	76.2 × 117	EB7	31	12.6	15.2	17.7
	4,700	E37L501CPN472MEE3Q	76.2 × 143	EE3	22	16.2	19.4	22.6
	5,600	E37L501CPN562MEJ1Q	76.2 × 181	EJ1	18	19.3	23.1	27.0
	8,200	E37L501CPN822MEM9Q	76.2 × 219	EM9	13	25.2	30.2	35.2
	3,900	E37L501CPN392MF92Q	89 × 92	F92	27	13.9	16.6	19.4
	3,900	E37L501CPN392MFA5Q	89 × 105	FA5	27	14.5	17.3	20.2
	4,700	E37L501CPN472MFB7Q	89 × 117	FB7	22	16.5	19.8	23.1
	6,800	E37L501CPN682MFE3Q	89 × 143	FE3	15	21.2	25.5	29.7
	6,800	E37L501CPN682MFF5Q	89 × 155	FF5	15	21.9	26.2	30.6
	8,200	E37L501CPN822MFK0Q	89 × 190	FK0	12	26.7	32.0	37.4
	10,000	E37L501CPN103MFM9Q	89 × 219	FM9	9	33.1	39.8	46.4

† For terminal, mounting and construction options, refer to the part numbering system for descriptions and codes.

* Refer to diagram of dimensions for detailed case size specifications.