TYPE EDL Electric Double Layer Capacitors

Ultra High Capacitance, Small Case Size Options — RoHS Compliant

Type EDL electric double layer capacitors offer extremely high capacitance values (farads) in a variety of packaging options that will satisfy, low profile, surface mount, through hole and high density assembly requirements. The EDL is a cut above the standard electrolytic capacitor in that it can act as a battery without having to deal with the environmental or hazardous material issues that batteries entail.

Highlights

- Unlimited charging and discharging capability
- Recycling is not necessary
- Long Life - 15 years
- Low ESR
- Will extend battery life up to 1.6 times longer
- First class performance with economy pricing

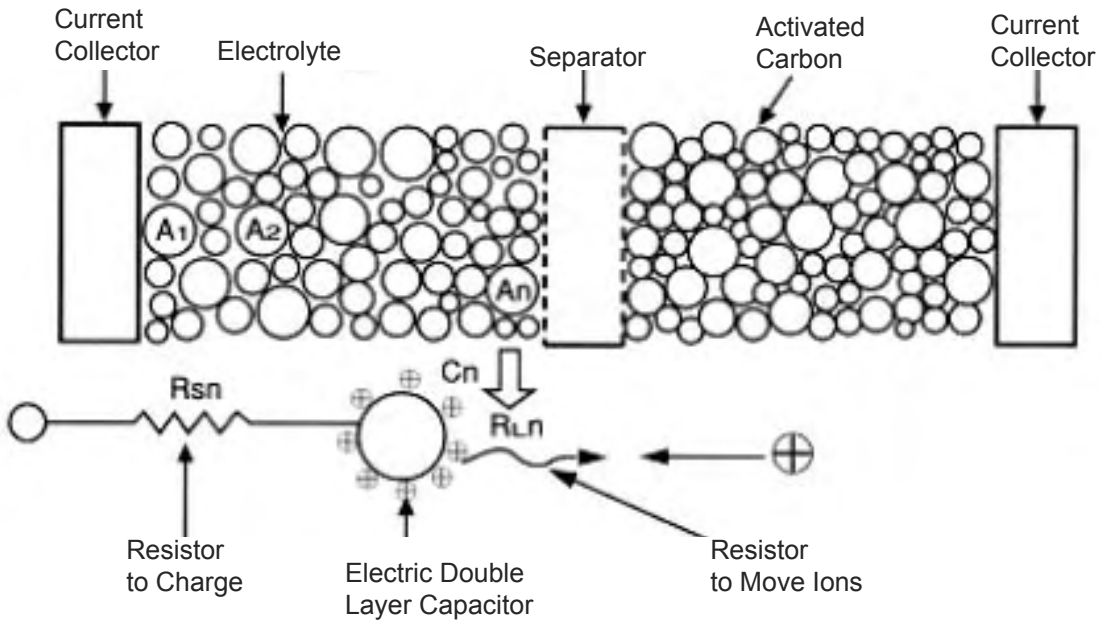
Specifications

Capacitance Range: 0.22 F to 70 F
Voltage Range: 2.1 Vdc to 5.5 Vdc
Temperature Range: –25 ºC to +85 ºC
Case Types: Radial Leaded, Stacked Coin, SMT

Applications

- Telecom - cellular handsets
- Solar battery back-up
- Small motor starter
- Gaming machines
- Real time clock - battery
- Remote reading utility meters

Electric Double Layer Capacitor Construction



Type EDL Electric Double Layer Capacitors

Ratings

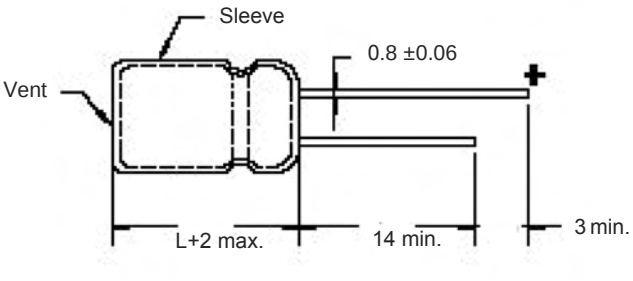
RoHS Compliant

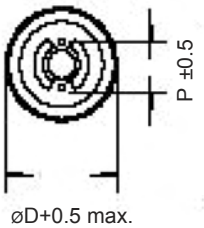
Catalog Part Number	Capacitance	Voltage (Vdc)	Max. Resistance @ 1 kHz (Ω)	Case Type	Case Dia. (mm)	Case Length (mm)	Style
EDLHW335D2R3R	3.3 F	2.3	0.3	Radial Lead	12.5	23	HW 
EDLHW475D2R3R	4.7 F		0.3		12.5	23	
EDLHW106D2R3R	10 F		0.2		12.5	35	
EDLHW226D2R3R	22 F		0.1		18	35	
EDLHW306D2R3R	30 F		0.1		18	35	
EDLHW506D2R3R	50 F		0.1		18	40	
EDLHW706D2R1R	70 F	2.1	0.1		18	50	
EDLF473A5R5C	0.047 F	5.5	120	Stacked Coin	13.5	9.5	F  85 ºC
EDLF104A5R5C	0.10 F		100		13.5	9.5	
EDLF474B5R5C	0.47 F		75		21.5	9.5	
EDLF684B5R5C	0.68 F		50		21.5	9.5	
EDLF105B5R5C	1.00 F		50		21.5	9.5	
EDLNF104A5R5C	.10 F	5.5	75	Stacked Coin	13.5	7.5	NF  70 ºC
EDLNF224A5R5C	.22 F		75		13.5	7.5	
EDLNF474B5R5C	.47 F		30		21.5	8.0	
EDLNF105B5R5C	1.0 F		30		21.5	8.0	
EDLNF155B5R5C	1.5 F		30		21.5	8.0	
EDLSG474V5R5C	.47 F	5.5	30	Stacked Coin	19	5.0	SG  70 ºC
EDLSG105V5R5C	1.0 F		30		19	5.0	
EDLSG155V5R5C	1.5 F		30		19	5.0	
EDLSG474H5R5C	.47 F	5.5	30	Stacked Coin	20	6.0	
EDLSG105H5R5C	1.0 F		30		20	6.0	
EDLSG155H5R5C	1.5 F		30		20	6.0	
EDLSD223V5R5C	.022 F	5.5	150	Stacked Coin	10.5	5.0	SD 
EDLSD473V5R5C	.047 F		120		10.5	5.0	
EDLSD104V5R5C	.10 F		75		10.5	5.0	
EDLSD224V5R5C	.22 F		75		10.5	5.0	
EDLSD334V5R5C	.33 F		75		10.5	5.0	
EDLSD223H5R5C	.022 F	5.5	150	Stacked Coin	11.5	5.5	 70 ºC
EDLSD473H5R5C	.047 F		120		11.5	5.5	
EDLSD104H5R5C	.10 F		75		11.5	5.5	
EDLSD224H5R5C	.22 F		75		11.5	5.5	
EDLSD334H5R5C	.33 F		75		11.5	5.5	
EDLEN204A3R3S	.20 F	3.3	200	SMT Wide Lead	6.8	1.8	EN 
EDLEN204B3R3S	.20 F	3.3	200	SMT Narrow Lead	6.8	1.8	
EDLEN204RL3R3S	.20 F	3.3	200	SMT Radial Lead	6.8	1.8	

Outline Drawings

Dimensions in mm (not to scale)

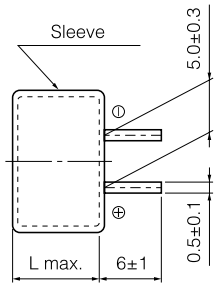
Style HW 70º C Radial Lead

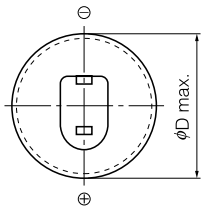


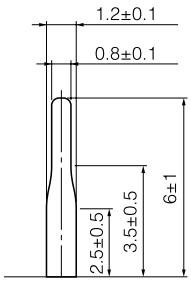


D	P
12.5	5
18	7.5

Style F 85º C Stacked Coin

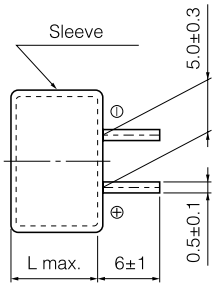


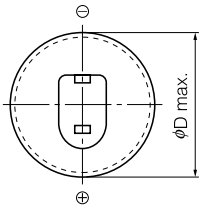


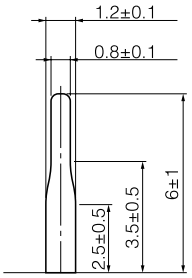


Case code	Size	
	D	L
A	13.5	9.5
B	21.5	9.5

Style NF 70º C Stacked Coin



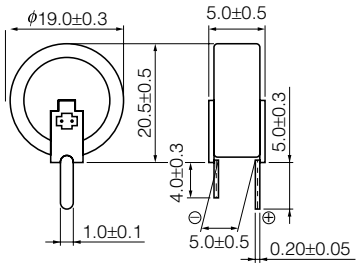




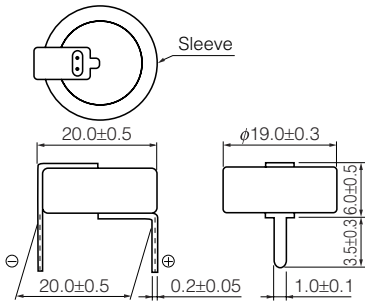
Case code	Size	
	D	L
A	13.5	7.5
B	21.5	8.0

Style SG 70º C Stacked Coin

Terminal V



Terminal H



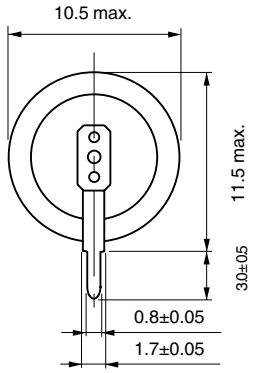
Type EDL Electric Double Layer Capacitors

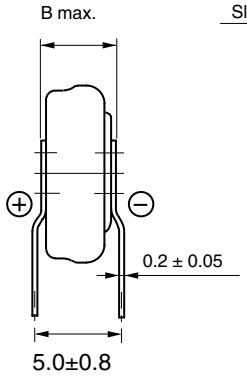
Outline Drawings

Dimensions in mm (not to scale)

Style SD 70º C Stacked Coin

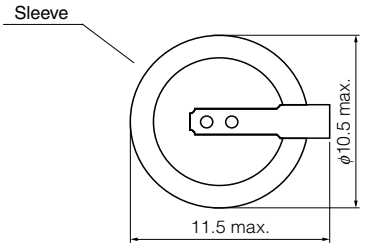
Terminal V

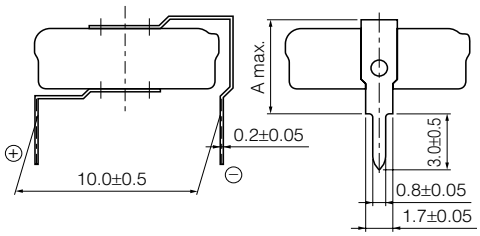




Cap. (F)	B
0.022 to 0.22	5.0
0.33	5.5

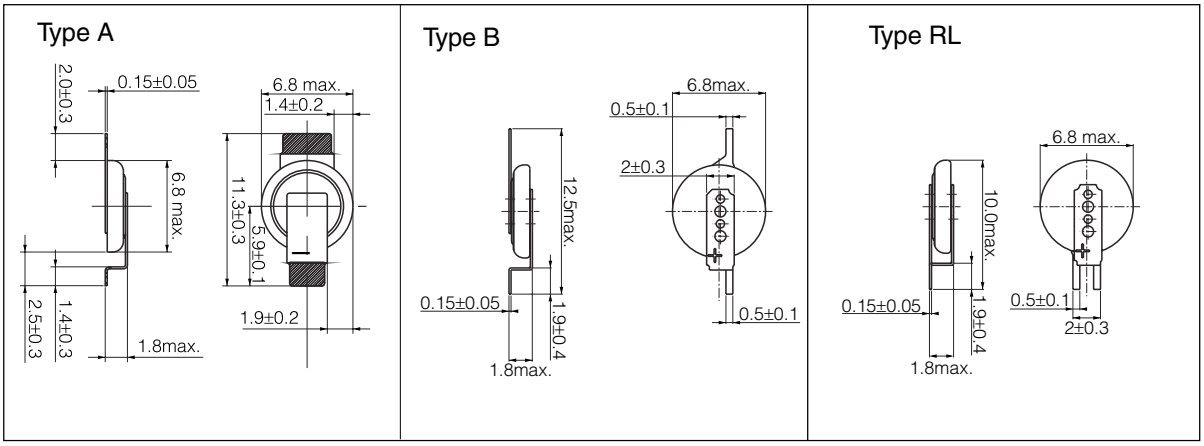
Terminal H





Cap.(F)	A
0.022 to 0.1	5.5
0.22	6.0
0.33	6.5

Style EN 60 °C Surface Mount



Applications and Recommended Series

Application	Function	Recommended Series	Component
Mobile Phones	Real-Time Clock Back-Up	EN	
PDA	Real-Time Clock Back-Up		
DSC	Real-Time Clock Back-Up	EN, SD	
DVD Recorder	Real-Time Clock and Channel Back-Up	SD, SG	
Digitial TV	Real-Time Clock and Channel Back-Up	SD, SG NF	
PC, Server	Real-Time Clock and Channel Back-Up	F	
Mobile Phone Base Station	Real-Time Clock and Channel Back-Up		
Inkjet Printer	Time and Impact Back-Up	SD, SG, NF	
Electric Power Gas and Water Meters	Real-Time Clock and Data Back-Up	F	
LED Light with Solar Battery	LED Lighting at Night	HW	
Toys	Motor Drives		
Toy Games	Real-Time Clock Back-Up	EN	
Robot	Real-Time Clock and Data Back-Up	F	
Car Audio Memory	Real-Time Clock Back-Up		

Life Design for Electric Double Layer Capacitors

Type EDL capacitors have a useful life-time similar to that of aluminum electrolytic capacitors. The life of a EDL is largely dependent on the operating temperature, humidity, applied voltage, current and backup time requirements. Therefore, the life of a EDL is determined based on the back-up time set by the customer.

Example of expected life:
An example of an expected lifetime of the Type EDL capacitor is shown as follows:

Expected Life = Lifetime x Temperature Factor x Voltage Factor x Moisture Factor

Life-time is defined as the time it takes to reach back-up time set by the customer after applying the rated maximum temperature and rated voltage to the capacitor.

Example: An F Type EDL, P/N EDLF105B5R5C (Rated at 5.5 V, 1.0 F), is fully charged at 5.0 Vdc. The circuit requirement is such that it must maintain a memory circuit with a current drain of 10 µA in an ambient temperature of +40 ºC. The memory RTC cut-off voltage is 2.0 Vdc.

The back-up time can be calculated from the following equation.

$t=CV/i = C \times (V_0 - i \times R - V_1)/(I+i_L)$

C=0.8F(1.0 F–20%), R=50 Ω, V_0=5 V, V_1=2 V, i=10 µA

Therefore,

$t=0.8 \times (5-0.0005-2)/(10+2 \times 10^{-6}) = 55$ hours

t: Back-up time (s)
C: Capacitance of Type EDL (F)
V_0: Applied voltage (V)
V_1: Cut-off voltage (V)
i: Current during back-up (A)
i_L: Leakage current (A)
R: Internal resistance (Ω) at 1 kHz

This calculation shows the initial back-up time to be 55 hours.

Product Life

The guaranteed life is 1000 hours for –30% capacitance change, 4 times the internal resistance change at 85 ºC with 5.5 Vdc applied. After 1000 hours, the back-up time will be changed to approximately 38 hours.

Temperature Factor

To determine the serviceable life of a Type EDL capacitor, one can use the *Arrenhenius Equation,* which states that the life will double for every 10 ºC reduction in ambient temperature.

$2^{(85-40)/10} = 2^{4.5} = 22.6$

Voltage Factor

The capacitance rate of change for each applied voltage becomes smaller when the applied voltage becomes lower. The time to reach the same change rate at 5 V will be 1.1 times longer than 5.5 V.

Expected Life

Expected Life = Guaranteed life x temperature factor x voltage factor

= 1000 (h) x 22.6 x 1.1 = 24800 = 2.8 years

Humidity Factor

The life time of the Type EDL is largely dependent on humidity. If the capacitor is to be used in high humidity conditions, the factory should be contacted for assistance.

These calculations are for reference only. They are not guaranteed values.
Your design parameters should be carefully reviewed prior to implementation.

How to Select an Electric Double Layer Capacitor

Estimated initial back-up time

Back-up time for Type EDL Electric Double Layer Capacitors decrease with use and over time. Especially, when the applied current is large or operating conditions are severe (high temperature).

Initial back-up time should be considered with enough margins.

Avoid setting the minimum back-up time. (Refer the life design for details)

Select the optimum Type EDL capacitor according to applied current.

Where the applied current to a Type EDL capacitor is large, flash voltage drop (IR drop) may occur when changing to back-up mode. Therefore, the product should be selected according to applied operating current. Since the internal resistance varies by product, use the following table to choose the correct operating (discharge) current.

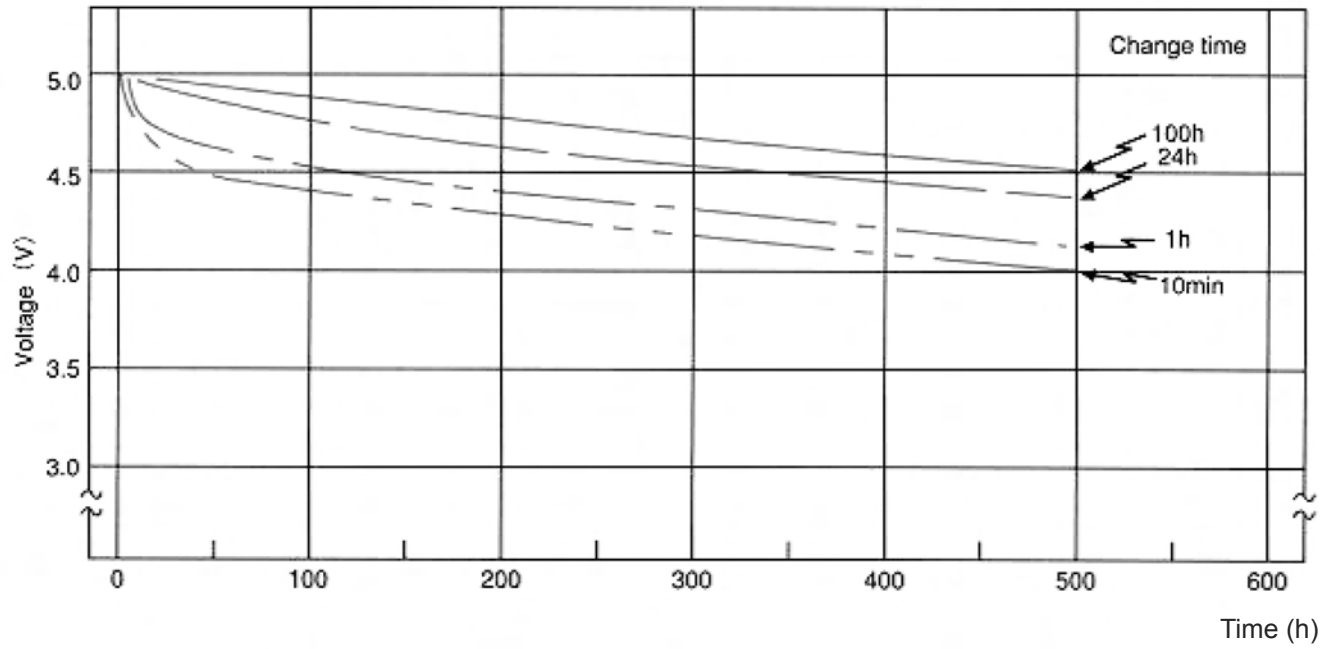
Recommended currents are shown below.

Series	Maximum Operating (Discharge) Current				
	0.047 F	0.1 F to 0.33 F	0.47 F to 1.5 F	3.3 F to 4.7 F	10 F to 50 F
SG, SD, NF	200 µA	300 µA	1 mA	–	–
F	200 µA	300 µA	300 µA	–	–
EN	–	10 µA	–	–	–
HW	–	–	100 mA	300 mA	1 A

Performance Data

Self-Discharging Characteristics Versus Charging Time

Part number EDLF105B5R5C (5.5 V 1.0 F) Charge voltage: 5 V



Charging Characteristics

Part number EDLF105B5R5C (5.5 V 1.0 F) @ +20 ºC