# Type EDL , Electric Double Layer Supercapacitors

## Ultra High Capacitance, Small Case Size Options



Type EDL electric double layer supercapacitors 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
- First class performance with economy pricing

## Specifications

| | |
|---|---|
| **Operating Temperature Range** | –25 ºC to +85 ºC |
| **Rated Voltage Range** | 2.1 Vdc to 5.5 Vdc |
| **Capacitance Range** | 0.022 F to 70 F |

## How To Select an Electric Double Layer Capacitor

**Estimated Initial Backup Time**

Back-up time for Type EDL Electric Double Layer Supercapacitors decreases with use and over time especially when the current is large or operating at high temperature. Be sure to specify extra back-up time initially to allow for product changes.

**Select the optimum supercapacitor according to applied current**

The internal resistance of the supercapacitor prevents drawing high discharge currents. Select the supercapacitor capable of delivering the peak current at switchover to back-up mode using the following table.

| 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 | – | – | – | 300 mA | 1 A |

**Back Up Time Example**

Back-up time is the time it takes for the applied voltage to decay to the cut-off voltage set by the user after applying the application's maximum voltage at application maximum temperature.

Example: An F Type EDL, P/N EDLF105B5R5C (Rated at 5.5 V, 1.0 F) is charged to 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.
Using minimum capacitance, calculate the back-up time as follows:

$t = C\Delta V / I = C[V0-(i \cdot R)-V1]/(i+iL)$

$C = 1.0\ F - 20\% = 0.8\ F$, $R = 50\ \Omega$, $V0 = 5\ V$, $V1 = 2\ V$, $i = 10\ \mu A$

Therefore,

$t = 0.8\ (5-0.0005-2)/((10+2)\ x10\text{^}-6) = 55$ hours

And thus the initial back-up time is 55 hours. After 1000 hours, calculate the back-up time will drop to about 38 hours.

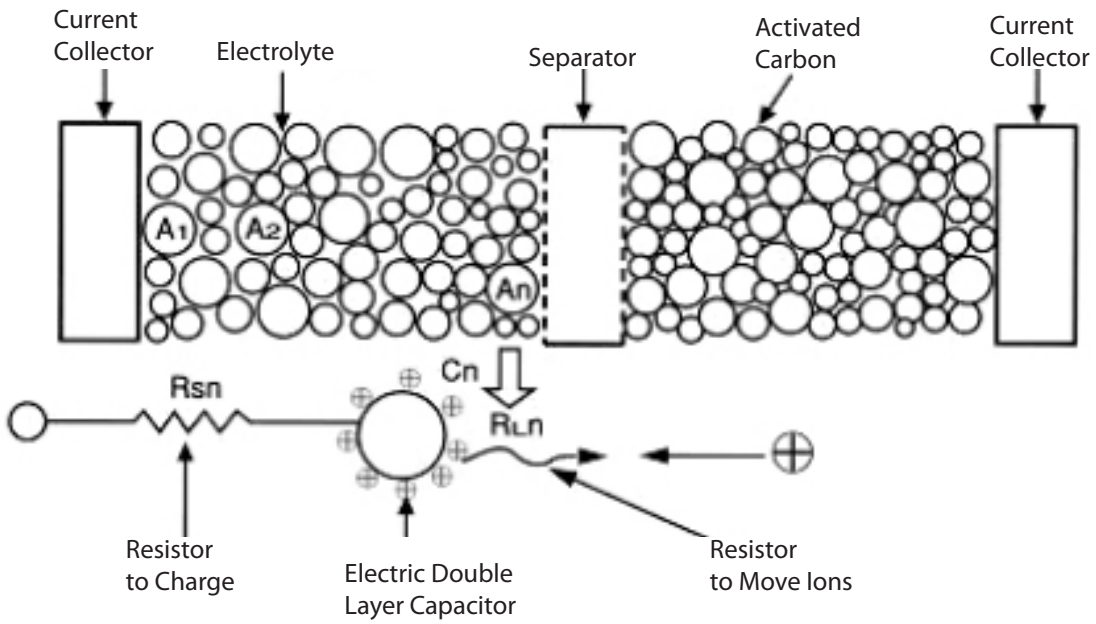
t: Back-up time (s)
C: Capacitance of Type EDL (F)
$V_0$: Applied voltage (V)
$V_1$: Cut-off voltage (V)
i: Current during back-up (A)
$i_L$: Leakage current (A)
R: Internal resistance (Ω) at 1 kHz

# Type EDL , Electric Double Layer Supercapacitors

## Ultra High Capacitance, Small Case Size Options

| | |
|---|---|
| **Life Design** | Type EDL supercapacitors have a useful lifetime that decreases with increasing operating temperature, humidity, applied-voltage, current and backup-time requirements.<br><br>Expected lifetime is the product of four factors:<br><br>Expected Life = (Lifetime)•(Temperature Factor)•(Voltage Factor)•(Moisture Factor) |
| **Lifetime** | The minimum rated life at 85 ºC with 5.5 Vdc applied is 1000 hours with maximum permitted end-of-life capacitance change of –30% and a 4 times increase in internal resistance. |
| **Temperature Factor** | To determine the effect of temperature on expected life of a supercapacitor, use the fact that expected lifetime doubles for each 10 ºC that the operating temperature is reduced. As an illustration, at 85 ºC and full voltage the rated lifetime is 1000 hours. So, at 40 ºC the expected lifetime would be multiplied by 2(85-40)/10 = 2^4.5 = 22.6 times. The Temperature Factor is 22.6, and for 1000-h, 85 °C rated life, the expected 40 °C life would be 22600 hours. |
| **Voltage Factor** | The rate of change of capacitance decreases with decreasing applied voltage. The effect on life extension is roughly proportional to the voltage derating, e.g., 5 V applied to 5.5 V rated supercapacitors extends the life 1.1 times. |
| **Moisture Factor** | Expected life of these supercapacitors is considerably shortened by operation in high humidity. The applications discussed here assume that the relative humidity is no more than 50%. |
| **Expected Life Example** | So, for a 5.5 V supercapacitor at 40 °C charged to 5.V in less than 50% RH the expected life is:<br>Expected Life = (Lifetime) (Temperature Factor) (Voltage Factor) (Moisture Factor)<br>= (1000 h) (22.6) (1.1) (1)<br>= 24800 hours<br>= 2.8 years |
| **RoHS Compliant** | |

## Electric Double Layer Supercapacitor Construction



# Type EDL , Electric Double Layer Supercapacitors

## Ratings

| 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 °C |
| 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 °C |
| 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 °C |
| 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 |  |
| 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 | +70 °C |
| | | | | | | | |
| EDLEN204A3R3S** | .20 F | 3.3 | 200 | SMT Wide Lead | 6.8 | 1.8 |  |
| EDLEN204RL3R3S** | .20 F | 3.3 | 200 | SMT Radial Lead | 6.8 | 1.8 | |

** Product is obsolete and no longer available.

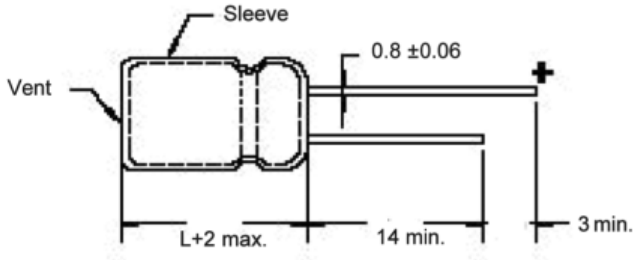
# Type EDL , Electric Double Layer Supercapacitors

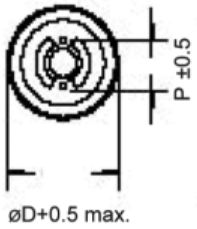
## Outline Drawing and Dimensions

Dimensions in mm (not to scale)

### Style HW 70º C* Radial Lead





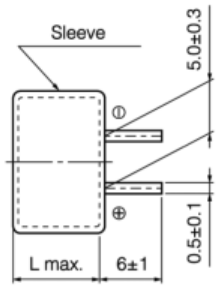



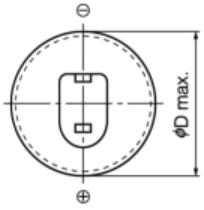

| D | P |
|---|---|
| 12.5 | 5 |
| 18 | 7.5 |

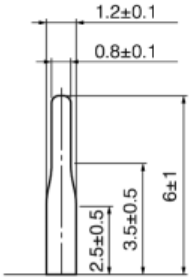
* 30, 50, 70 F : +60 ºC

### Style F 85º C Stacked Coin





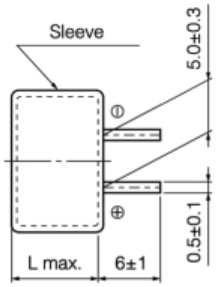



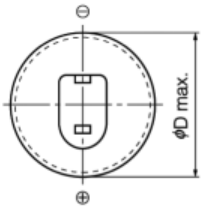



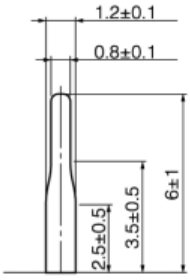

| Case code | Size | |
|---|---|---|
| | D | L |
| A | 13.5 | 9.5 |
| B | 21.5 | 9.5 |

### Style NF 70º C Stacked Coin





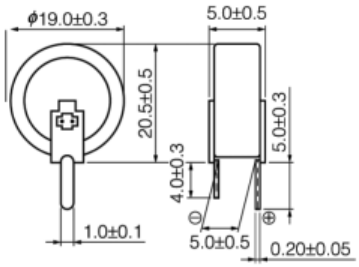

| Case code | Size | |
|---|---|---|
| | D | L |
| A | 13.5 | 7.5 |
| B | 21.5 | 8.0 |

### Style SG 70º C Stacked Coin

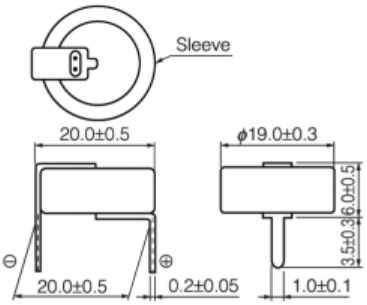




Terminal V




Terminal H



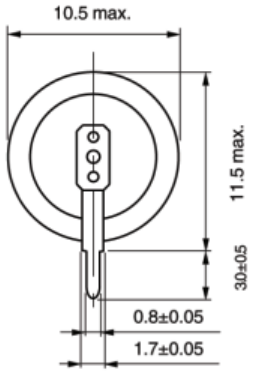
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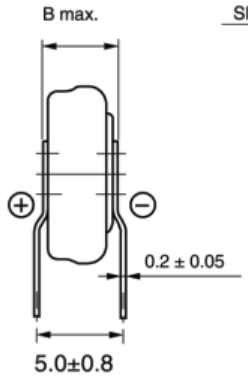
## Outline Drawing and Dimensions

### Style SD 70 ºC Stacked Coin

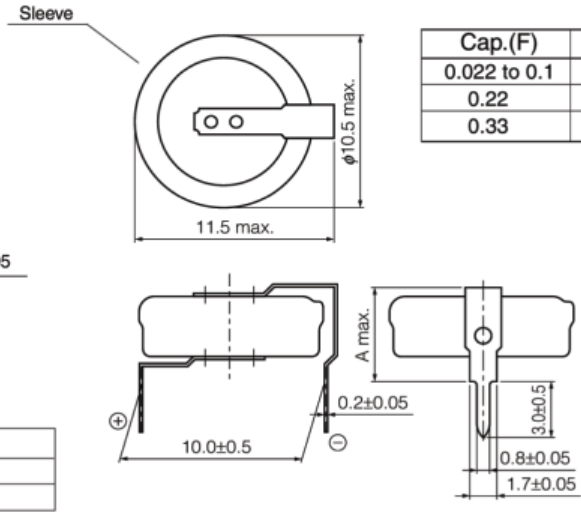







| Cap. (F) | B |
|---|---|
| 0.022 to 0.22 | 5.0 |
| 0.33 | 5.5 |

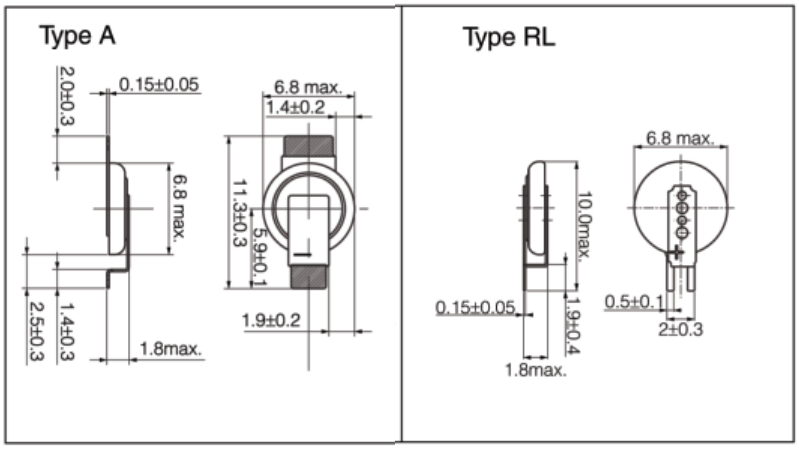



| Cap.(F) | A |
|---|---|
| 0.022 to 0.1 | 5.5 |
| 0.22 | 6.0 |
| 0.33 | 6.5 |

### Style EN -10 to +60 ºC Surface Mount





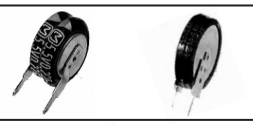



Notes:

1 - Style EN is packaged on 24 mm wide tape and a 330 mm dia. reel, with 2000 pieces per reel.
2 - Only Style EN is capable of reflow soldering. Peak reflow soldering temperature is 250 ºC for a maximum of 5 seconds, with a maximum of 30 seconds at or above 220 ºC.
3 - Do not reflow solder when the cell voltage is above 0.3 V.

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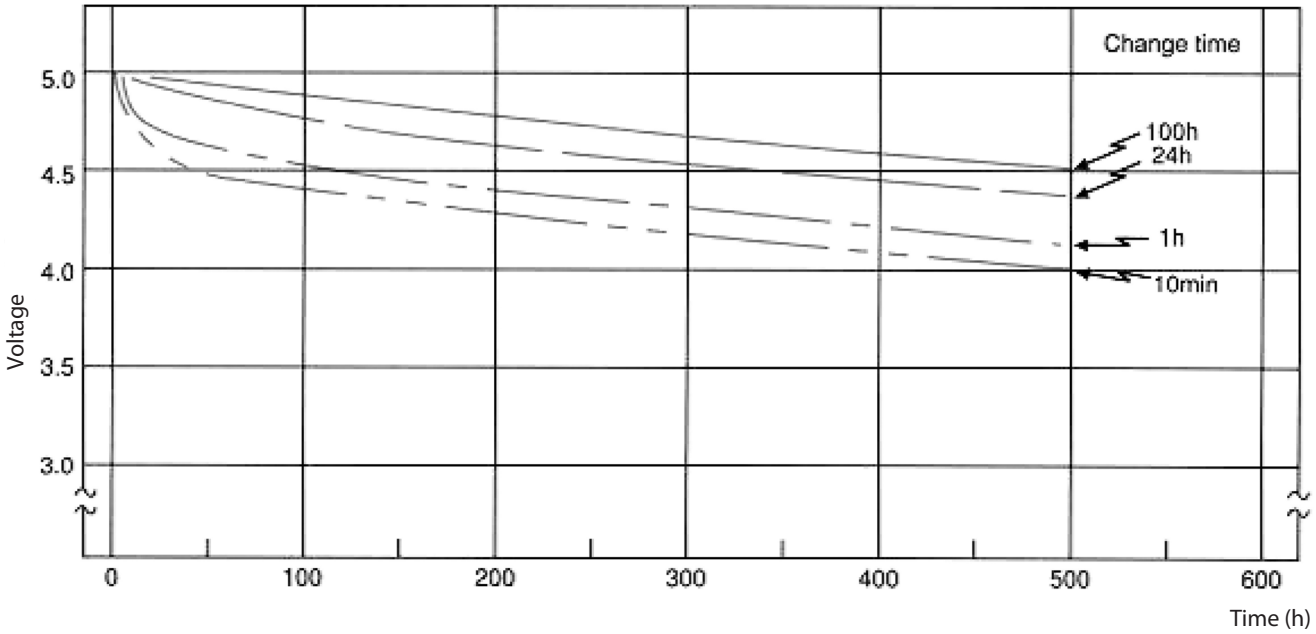
## Applications and Recommended Series

| 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 | | |

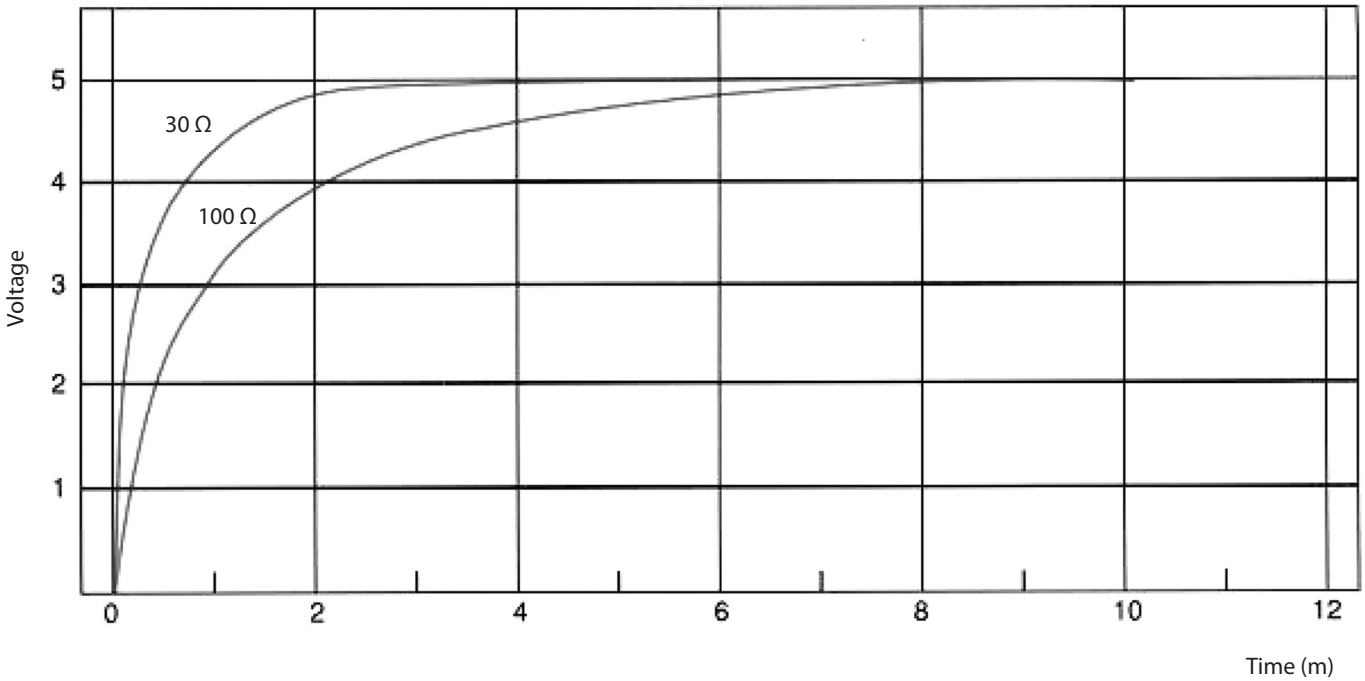
# Type EDL , Electric Double Layer Supercapacitors

## Performance Data

**Self-Discharging Characteristics Versus Charging Time**
**Part number: EDLF105B5R5C (5.5 V 1.0 F) Charge voltage: 5V**




**Charging Characteristics**
**Part number: EDLF105B5R5C (5.5 V 1.0 F) @ +20 ºC**



LifeElectronics
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