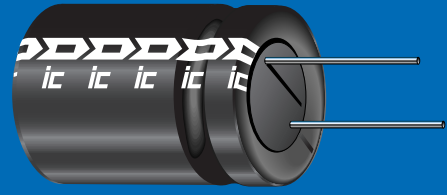


# DLR

## Supercapacitor



*For Battery Backup or Alternative Power*

### APPLICATIONS

- Battery Pack Alternative
- UPS Systems
- Electric/Hybrid Vehicles
- Solenoid/Value Actuation
- Holdup Power
- DC/DC Converters
- Car Stereo Systems
- Solar Systems
- Memory Backup
- Windmill Systems

### FEATURES

- High Capacitance
- Compact Size
- High Power
- Low ESR
- Long Life
- High Energy
- RoHS Compliant
- Environmentally Friendly

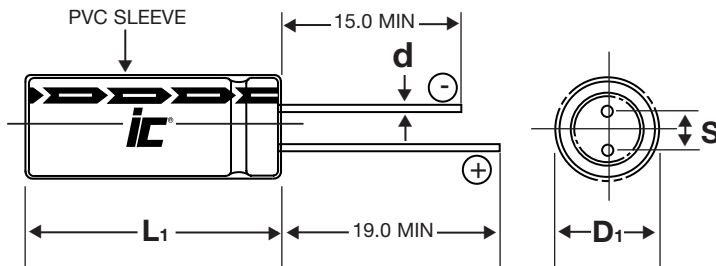
### SPECIFICATIONS

Capacitance Tolerance		$\pm 10\%$ at 20°C					
Operating Temperature Range		-25°C to + 60°C (2.3V) -25°C to + 70°C (2.5V)					
Working Voltage/ Surge Voltage	WVDC	2.3	2.5				
	SVDC	2.5	2.7				
Operating Current	WVDC	2.3				2.5	
	Charging/ Discharging	100mA/Farad				10mA/Farad	
Life cycles	WVDC	Cycles		Capacitance Change			
	2.3	100,000		< 30% of initial value			
	2.5	500,000		< 30% of initial value			
Load Life	<b>1000 hours at +70°C with rated WVDC</b>						
	Capacitance change		≤ 30% of initially measured value				
	ESR		≤ 300% of maximum specified value				
Shelf Life	<b>1000 hours at +70°C and -25°C</b>						
	Capacitance change		≤ 30% of initially measured value				
	ESR		≤ 300% of maximum specified value				

## STANDARD PART LISTING

Capacitance (F)	WVDC	IC <sup>®</sup> PART NUMBER	Maximum ESR mΩ 120 Hz, 20°C	Maximum ESR mΩ DC, 20°C	Galvanometric Energy Density (wh/kg)	Volumetric Energy Density (wh/L)	Weight (grams)	Volume (ml)	DxL (mm)
4	2.5	405DLR2R5K	70	100	1.39	2.21	2.5	1.57	10x20
7	2.5	705DLR2R5K	50	70	2.43	3.1	2.5	1.96	10x25
9	2.5	905DLR2R5K	40	70	1.95	3.32	4	2.36	10x30
10	2.3	106DLR2R3K	100	150	2.94	4.68	2.5	1.57	10x20
12	2.5	126DLR2R5K	40	60	2.6	3.69	4	2.83	12.5x25
15	2.3	156DLR2R3K	80	120	3.44	5.62	3.2	1.96	10x25
20	2.3	206DLR2R3K	60	100	3.67	6.24	4	2.36	10x30
22	2.5	226DLR2R5K	25	40	2.45	3.8	7.8	5.02	16x25
25	2.3	256DLR2R3K	60	100	4.41	7.8	5	2.83	12.5x25
50	2.3	506DLR2R3K	40	70	4.59	7.31	8	5.02	16x25
55	2.5	556DLR2R5K	15	25	3.41	4.69	14	10.17	18x40
90	2.5	906DLR2R5K	5	7	3.47	4.57	22.5	17.1	22x45
120	2.3	127DLR2R3K	20	30	5.19	8.67	17	10.17	18x40
220	2.3	227DLR2R3K	10	20	7.05	10.31	25	17.1	22x45

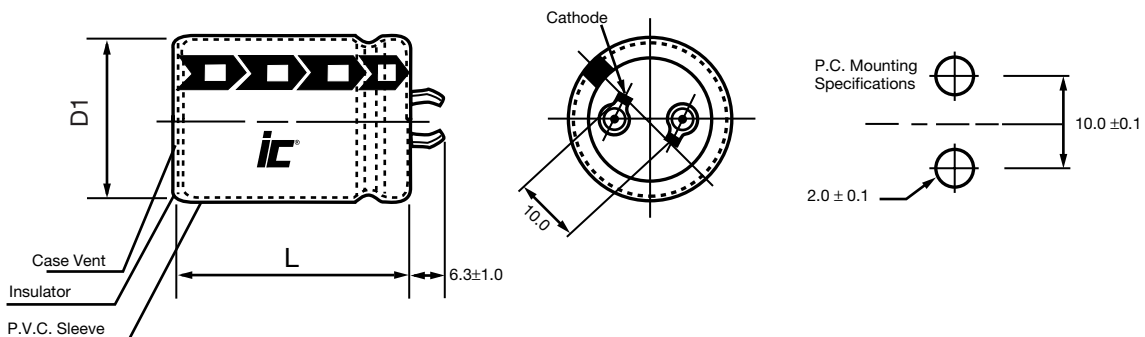
### Case diameters 10, 12.5, 16, 18



D	10.0	12.5	16.0	18.0	Tolerance
d	0.6	0.6	0.8	0.8	+/- 0.05
S	5.0	5.0	7.5	7.5	+/- 0.5

D<sub>1</sub>=D + 0.5 mm Max.  
L<sub>1</sub>=L ± 2.0 mm Max.

### Case size 22x45



D<sub>1</sub>=D + 1.0 mm Max.  
L<sub>1</sub>=L ± 2.0 mm Max.

## Application Guidelines

### 1. Do not apply a reversed voltage.

Reverse polarity is not recommended. If a reversed voltage is applied for a long time, the leakage current will increase abruptly, which may cause a decrease in the capacity, an increase in the internal resistance, and cause electrolyte leakage or damage to the capacitor in some cases.

### 2. Do not apply any voltage higher than the operating maximum voltage.

Supercapacitors are rated with a nominal recommended working or applied voltage. If an over voltage is applied to the capacitor, the leakage current will increase abruptly and the capacitor will become overheated, which may cause a decrease in the capacity, an increase in the internal resistance, and cause leakage or damage to the capacitor in some cases. But, surge voltage can usually be tolerated by the super capacitor.

### 3. Ripple Current

Supercapacitors have a higher internal resistance than aluminum electrolytic capacitors and are more susceptible to internal heat generation when exposed to ripple current, this may cause a decrease in the capacity, an increase in the internal resistance, and cause electrolyte leakage or damage to the capacitor in some cases.

### 4. Charging and Discharging.

Supercapacitors can be charged using various methods, including constant current, constant power, constant voltage or by paralleling to an energy source, i.e. battery, fuel cell, DC converter, etc. In general, characteristics of constant current and constant resistance discharging are respectively represented by the equation (1) and (2) below:

Discharging time (t) of constant current discharge

$$t = C \times (V_0 - V_1) / I \dots (1)$$

Discharging time (t) of constant resistance discharge

$$t = -CR \ln(V_1/V_0) \dots (2)$$

t = discharging time(s)

v<sub>0</sub> = initial voltage (v)

v<sub>1</sub> = terminal voltage (v)

I = current during back-up (A)

The maximum recommended charge current, I, for a super capacitor is calculated as follows:

$$I = V_w / 5R$$

where V<sub>w</sub> is the charge voltage and R is the super capacitors DC ESR

### 5. Do not use in a circuit where quick charge and discharge are repeated very often.

In a circuit where quick charge and discharge are repeated very often, the capacitor will become overheated, which may cause a decrease in the capacitance, an increase in the internal resistance, and cause electrolyte leakage or damage to the capacitor in some cases. Reduce the charge and discharge currents while selecting a capacitor with low internal resistance, and make sure that the capacitor surface temperature does not rise more than 10°C.

### 6. Super capacitor life depends on the ambient temperature.

The lifetime of super capacitor is seriously affected by change in ambient temperature. If the temperature is lowered by 10°C, the lifetime will be approximately doubled. As a result, it is recommended to use the super capacitor at the lowest temperature possible to decrease internal degradation and ESR increase. If the capacitor is used at a temperature exceeding its maximum guaranteed temperature, not only is its life shortened, but increased vapor pressure of electrolyte or electrochemical reactions may increase the internal pressure, and cause electrolyte leakage or damage to the capacitor in some cases.

### 7. Voltage drop occurs during back-up operation.

In applications where the discharge current is large, or a large current flows instantaneously, super capacitor may not operate at the start of discharge because of the large voltage drop (IR drop) caused by the capacitors internal resistance (ESR). The formula for the voltage drop, V<sub>drop</sub>, during a discharge at I current for t seconds is:

$$V_{drop} = I(R + t/C)$$

### 8. Series Connecting of super capacitor.

A series connection can cause an imbalance in the voltage across a super capacitor causing the capacitors to have an over voltage which can cause electrolyte degradation, excessive gas generation, increased ESR, decrease in capacitance and reduced life. To prevent voltage imbalance, passive or active voltage balancing is recommended. Passive voltage balancing should be performed using divider resistors placed in parallel with the super capacitors. Using resistance values between 100 Ω/F to 470 Ω/F are recommended.

**9. About vibration.**

A terminal blank, a terminal bend, and a crease may occur by adding too much vibration to a capacitor. When there becomes too much vibration, please contact our company.

**10. When used on a double sided printed circuit board, do not design exposed circuit board traces under the super capacitor.**

An electrical short could occur if the super capacitor electrolyte should leak onto the circuit board.

**11. Do not store in high temperature and high humidity conditions.**

Avoid high temperature or high humidity or direct rays when storing capacitors. Avoid direct contact with water, salt water or oil, toxic gases, or dusty environment.

**12. When soldering the super capacitor to the wiring board, do not attach the body of the super capacitor to the circuit boards.**

If the body of the capacitor is attached directly to the circuit board, the flux or solder can blow through the mounting holes in the circuit board, possibly causing internal damage to the super capacitor.

**13. Do not overheat when soldered.**

Excessive heat may cause deterioration of the electrical characteristics of the aerogel super capacitor, electrolyte leakage or an increase in internal pressure.

**14. Circuit board cleaning after soldering.**

Circuit boards can be immersed or ultrasonically cleaned using suitable cleaning solvents for up to 5 minutes and up to 60°C maximum temperatures. The boards should be thoroughly rinsed and dried.

Wave solder Temperature (°C)	Exposure time (seconds)	
	Recommended exposure time	Maximum exposure time
220	7	9
240	7	9
250	5	7
260	3	5

**15. Be careful not to apply an excessive force to the capacitor body, terminals or lead wires.**

If the capacitor body is subjected to stress such as grabbing, falling, bend, pushing or twisting after mounted, its terminals may come off, leading to open, short or liquid leakage.

**16. Emergency procedures.**

If a super capacitor is found to be overheating or starts to smell, immediately switch off the unit's main power or load to stop operation. Do not expose your face and hands if exposed to electrolyte. Wash exposed area thoroughly with soap and water.