Power RESPONDER™

HIGH ENERGY SUPERCAPACITOR PRODUCT LINE

Product Features:

- Prismatic thin form factor design
- Up to 65C long term operation
- 5-7X higher energy density than traditional supercapacitors
- Fast recharge – 2-3 minutes charge time
- Low self discharge < 3% per month

Applications:

- Backup power in servers, datacenters
- Hand-held or portable medical diagnostic equipment
- Internet of Things with energy harvesting
- Lead acid battery replacement with 3X greater cycle life, 30% greater energy density and 50% greater efficiency in energy storage cycle (95% compared to 60%)

General Product Characteristics:

Rated Voltage maximum	4.0V	(Volts)
Rated Voltage minimum	2.5V	(Volts)
Operating Temperature	0°C to 65°C	(degrees centigrade)
Surge Absolute Max Voltage	4.2V	(volts) Not to exceed 1 second pulse.
Capacity Range*	160 F – 13,500 F	(Farads)
Max Leakage Current*	0.03 mA - 0.1 mA	(mAmps) After 72 hours at rated voltage and 25°C.
Temperature Characteristics		
Storage Temperature	-25°C to 65°C	Up to 5 years at room temperature; test and recharge annually; less than 18 months at 65°C
Temperature Characteristics	0°C to 65°C	Cap change: less than 50% of the initial ESR change: less than 200% of the initial
Reliability		
Cycle Life	25,000 cycles	Less than 20% decrease in capacitance and < 150% rise in ESR See **Note 1**
High Temperature Load Life	1,000 hours at 65°C	Less than 15% decrease in capacitance and <150% rise in ESR
Shelf Life	5 year	At 25°C and 3.8V (recharge annually)
Vibration Tolerance		As per IEC 60068.2.6
Shock Tolerance		As per IEC 60068.2.27

***** Varies with product size

Note 1: *Cycle using nominal current at 25°C for a given part per following cycle:*

- *Constant Current Charge with Nominal Current to 4V.*
- *Constant Voltage at 4V for 5 min.*
- *Constant Current Discharge with Nominal Current to 2.5V; Repeat.*

Product Part Numbers And Characteristics:

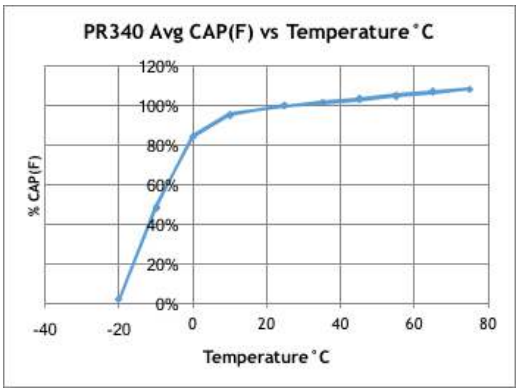
Specification	Units	PR0160F04R3 24.5W044L-S^^	PR0200F02R1-045W050L-S	PR0340F03R0-045W050L-S	PR0500F08R5-025W064L-S^^	PR0800F05R7 045W050L-S	PR1100F08R0 045W050L-S	PR3000F02R3-111W245L-T	PR9000F05R3-111W245L-T	PR13500F08R0-109W245L-T
Rated Capacitance 0%,+30%	Farads	160	200	340	500	800	1100	3000	9000	13500
Max DC ESR (Equivalent Series Resistance)	mOhms	150	140	85	50	45	25	12	6	6
Max AC ESR (@ 1 kHz)	mOhms	65	50	40	25	20	11	6	3	3
Nominal Charge Discharge Current	Amperes	1	2	3	5	5	10	15	30	35
Max Pulse Current (<1 sec pulse)	Amperes	4	5	10	10	15	20	30	90	100
Energy	Whr	0.18	0.25	0.39	0.68	0.9	1.25	3.2	11.0	16.5
Dimensions	mm	24.5X44X4.3	50X45X2.1	50X45X3	25x64x8.5	50X45X5.7	50X45X8	111X245X2.3	111X245X5.3	109X245X8
Mass nominal	Grams	6	8	11	15	21	28.5	100	225	325
Specific Energy	Whr/Kg	30	31.2	35.4	45.3	42.8	43.8	32	48.8	50.7
Energy density	Whr/L	38.3	52.9	57.7	52.8	70.0	69.4	54.4	77.7	77.2
Connector Tabs**	S	S	S	S	S	S	S	T	T	T
										

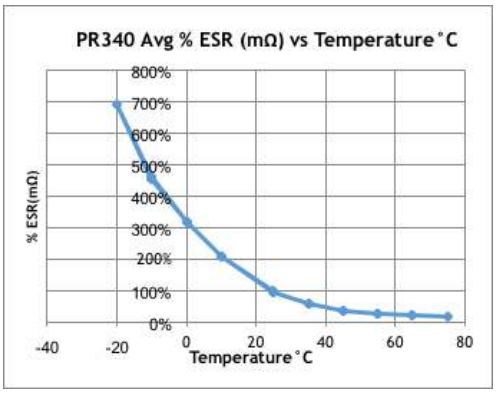
** Tab Configuration: T – standard, S –solderable, W – wire and C - connector

^^ PR0160 and PR0500 are in development, with engineering samples for evaluation available now

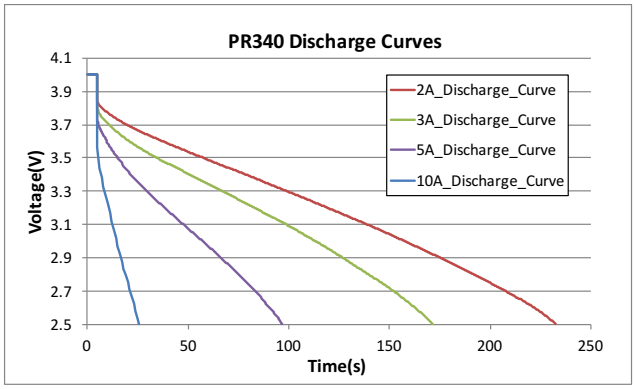
NOTE: 12V, 24V and 48V modules are available on custom basis- Contact sales@powerresponder.co for details.

Product Performance :

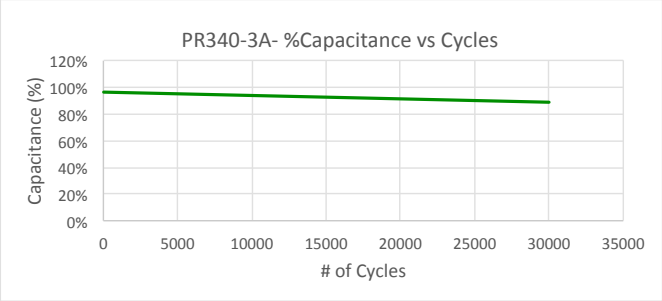


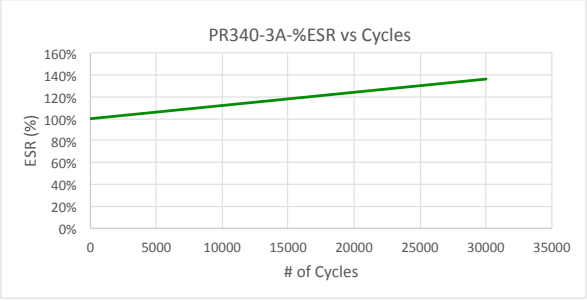


ESR and Capacitance over temperature range at nominal current discharge



Discharge curves at 2A, 3A, 5A, and 10A discharge currents PR0340F





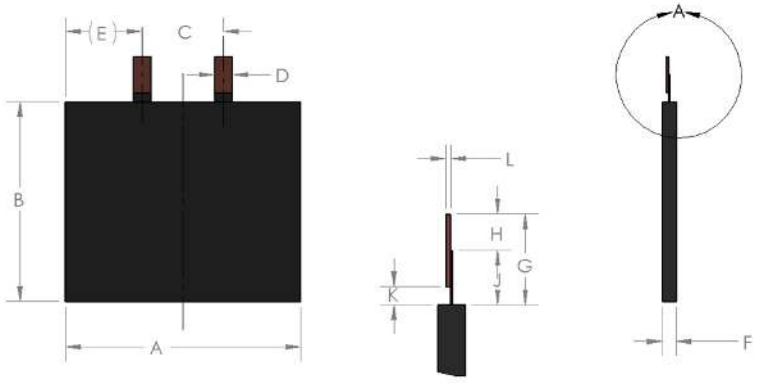
Cycle Life data: charge discharge at 3Amp current over 25,000 cycles

Part Numbering Key:

P/N: **PR** (1) **0340F** (2) **03R0** (3) **-045W** (4) **-050L** (5) **-S** (6)

1	**PR**	PowerRESPONDER product line
2	**0340F**	Capacitance (Farads)
3	**03R0**	Thickness (mm)
4	**045W**	Width (mm)
5	**050L**	Length (mm)
6	**S**	Tab Configuration; **T**-standard, **S** –solderable, both tabs on one side; **O** – solderable, tabs on opposite sides

Product Dimensional Drawing and Tolerances (sample PR0340F03R0-045W050L-S)



Dimension [mm]	A	B	C	D	E	F	G	H	J	K	L
	50	45	18	4	17	3	10	4	6	2	0.1
Tolerance [mm]	±1	±1	±0.2	±0.1	±1	+0.1; -0.2	±0.5	±0.5	n/a	n/a	+0.02; -0.00

Product Handling Notes:

The hybrid supercapacitor product line, PowerRESPONDER®, is a family of high energy, high power storage devices that - if used properly - will provide data sheet performance and reliable service for the life of the product. These devices are UL™ certified (UL BBBG2.MH61110) and are generally robust regarding handling and application.

Voltage and electrical current precautions:

- The maximum voltage value identified in the data sheet (Rated Voltage maximum) is set to derive the specified product performance. Exceeding this value for extended periods of time could result in shorter Cycle Life and ultimately may lead to device failure. Operation below this maximum has been shown to extend product life.
- The minimum voltage value identified in the data sheet (Rated Voltage minimum) is set to derive the specified product performance. Discharging the device below this value for extended periods of time could result in shorter product Life and ultimately may lead to device failure.
- The maximum current value identified in the data sheet (Nominal Charge/Discharge current: Tolerance) is set to derive the specified product performance. Exceeding this value for extended periods of time could result in shorter Cycle Life and ultimately may lead to device failure. Operation below the Nominal Charge/Discharge current has been shown to extend product life.

Temperature precaution:

- General Product Characteristics are representative of the device characteristics at 25°C. Use or storage at temperatures above the Temperature or Storage Characteristics maximum may result in permanent loss of capacity over time. Temperatures from 25°C down to Temperature Characteristics may result in temporarily lower Capacitance and higher Max initial DC/AC ESR values.

Terminal precaution:

- PowerRESPONDER terminals are designated by polarity "+" and "-". "+" is the high-potential input and precautions should be observed to insure that the terminals are not reversed or shorted. The TAB construction is fragile and therefore multiple bends should be avoided.

Physical package precaution:

- PowerRESPONDER sleeve packaging material is not guaranteed to be non-conductive. Use precaution to insure this contact points to the exterior neither deform nor penetrate the device. DO NOT FLEX devices in handling. Creases in edge seal may result in rupture and loss of electrolyte, resulting in premature failure.

Series Parallel Connection precaution:

- PowerRESPONDER devices maybe connected in series and/or parallel in order to achieve the desired operational voltage and storage requirements of the application. Assembly techniques need to insure that the difference in terminal voltage of individual cells intended for parallel combination not exceed a difference of 500mV to avoid excessive current transfer during connection. Devices, or parallel combinations of devices, will require balancing during operation in order to insure maximum performance (see ***Application Note #1805*** for further information).

Assembly precaution:

- The PowerRESPONDER Hybrid-Supercapacitor is shipped in a charged state. DO NOT DISCHARGE BELOW Voltage Range Min TO ASSEMBLE. A commonly available Li-Ion protection device may be employed in the circuit in order to electrically isolate the device from the end product (see ***Application Note #1802*** for further information).

Soldering precaution:

- The PowerRESPONDER solderable tab (S) is NOT suitable for solder bath or solder reflow assembly. Devices are hand soldered to the following specification: The recommended temperature of the soldering rod tip is 275°C. The soldering duration should be shorter than eight (8) seconds. Minimize the time that the soldering iron is in direct contact with the terminals of the device as excessive heating of the leads may lead to seal compromise. Recommended solder composition Sn 42% and Bi 58% (example Fromosol Sn42Bi58 low temperature solder: https://www.fromosol.net/PRODUCT/Sn42Bi58-Solder-Wire/Sn42Bi58-Low-Temperature-Solder-Wire.html). If not

using flux core wire, use a halide free, activated rosin-based flux if required. Maximum contact time with component leads is 10 seconds at 275C.

Tab handling precaution:

- The PowerRESPONDER™ positive terminal is fabricated from aluminum and therefore should be handled with care to avoid detachment. If bending of the terminal is required, it is recommended to use a bend radius of no less than 1mm.

Shipping precaution:

- PowerRESPONDER cells may be shipped as a normal consignment with **no hazardous labeling restrictions.**
- With reference to IATA guidelines, the PowerRESPONDER cells are classified as "UN 3508 Capacitor, asymmetric" and under IATA special provision A196 and 49CFR 173.176 the typical labeling and shipping requirements are waived.

Product disposal precaution:

- Though non-toxic and ROHS compliant you should comply with local regulations when disposing of PowerRESPONDER devices.

General Terms of Use

- PRC Tech LLC shall not be responsible for any defects in products or equipment incorporating such products, which are caused under the conditions other than those specified in this data sheet.
- Please conduct validation and verification of products in actual condition of mounting and operating environment before commercial shipment of the equipment.
- The electronic components described in this data sheet are developed, designed and intended for use in general electronics equipment. Usage in transportation signaling, disaster prevention, medical equipment which may have direct influence to harm or injure a human body are not recommended.
- In addition, even electronic components or functional modules that are used for the general electronic equipment, if the equipment or the electric circuit require high safety or reliability function or performances, a sufficient reliability evaluation check for safety shall be performed before commercial shipment and moreover, due consideration to install a protective circuit is strongly recommended at customer's design stage.
- This data sheet pertains to components purchased from PRC Tech, LLC with no representation regarding the suitability for a particular application.
- PRC Tech shall have no responsibility for any disputes that may occur in connection with a third party's intellectual property rights and other related rights arising from usage of products.
- US Federal Regulation may restrict the export of products containing this product.

For further details of product specifications, contact Mark Burnside at mburnside@powerresponder.co

For sample purchase and custom orders, contact: sales@powerresponder.co