



ThinLine™ Cells and Packs

Planar Sealed Lead Cells and Battery Packs

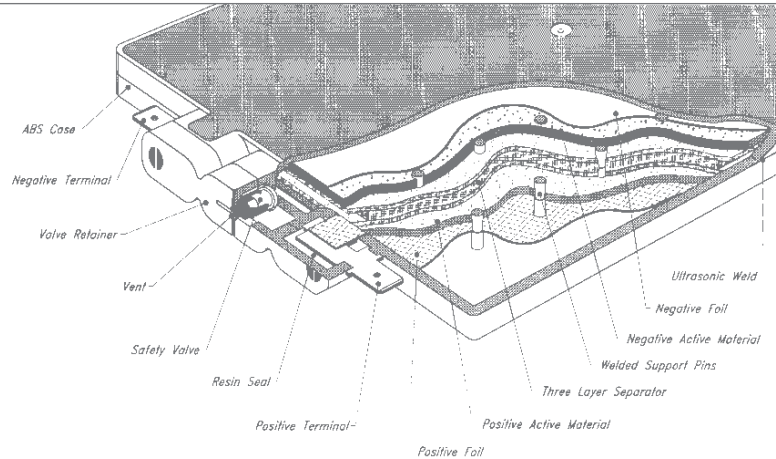
Product Information

TLC02V20-2V, 2.0Ah
TLC02V40-2V, 4.0Ah

TLC02V25-2V, 2.5Ah
TLC02V50-2V, 5.0Ah

TLC02V3-2V, 3.2Ah

ThinLine Patented Technology



Product Description

Innergy Power ThinLine sealed lead cells and batteries represent a unique approach in battery design, one that reduces the weight and volume of the passive cell components, resulting in improved specific energy (by weight) and energy density (by volume). In addition, the planar ThinLine design overcomes the geometric incongruity of packaging round cells into rectangular cases resulting in a 10-25% increase in volumetric efficiency.

Patented Technology

The thin planar design is accomplished through two patented components of the technology.

First, a patented pin and socket case design provides internal reinforcement which is welded through the plates and allows the use of lightweight, thin-wall ABS plastic containers.

Second, the use of lightweight, thin foil current collectors, which are embossed to increase surface contact area, further reduces the weight and volume of the cell. Because the lead used in the current collector is consolidated in a thin foil and is work-hardened to refine its grain structure, its rate of anodic corrosion (oxidation) is reduced over conventional grid-plate designs. This reduces the mass of lead required in the current collector to achieve desired service life.

Features and Benefits

An ever-increasing number of OEMs have incorporated an Innergy ThinLine power solution into their application due to a strong set of desired features and benefits.

Thin Planar Form Factor provides unprecedented flexibility in battery pack configuration and optimizes space utilization.

High Value (performance vs. price) provides the best combination of battery characteristics at low cost.

High Energy Density reduces the weight and volume required for a given energy equivalent.

Simple Charging Requirement minimizes the complexity and cost of designing charge control circuitry using modern microchip technology.

Proven Safety Record of the mature sealed lead electrochemistry provides high reliability without complex protection measures.

Sloping Discharge Profile makes fuel gauging as simple as measuring cell voltage either on open circuit or under load in the application.

Existing Recycling Infrastructure for conventional lead batteries enjoys the highest recycling rate of any commercial product (98+%).

Long Cycle Life depends on depth of discharge and parameters of recharge.

The Chemistry allows for frequent opportunity charging without developing memory effects.

Long Float Life of sealed lead electrochemistry resists the effects of overcharging in continuous float charge, standby applications.

Overdischarge Recovery provides high charge acceptance and complete capacity recovery after inadvertent total discharge.

Low Self-Discharge Rate provides long shelf life during storage (up to a year at room temperature).

Zero Memory Effect eliminates concerns over managing state of charge.

ThinLine Cell and ThinLine Pack Specifications

	Flatpack Batteries				Dimensions			Volume		Weight		Energy Density		Specific Energy	
	Product Number	Normal Voltage	Cap. C/20Ah	Energy Watt-Hr.	Length in.	Width in.	Thickness in.	in. ³	cm ³	oz.	g.	Wh/in. ³	Wh/l	Wh/oz.	Wh/kg.
Cells	TLC02V50	2	5.0	10.0	5.48	3.18	0.332	5.78	94.80	8.04	228	1.73	106	1.24	43.9
	TLC02V40	2	4.0	8.0	5.24	2.68	0.332	4.66	76.40	6.46	183	1.72	105	1.24	43.7
	TLC02V32	2	3.2	6.4	4.68	2.48	0.332	3.85	63.10	5.36	152	1.66	101	1.19	42.1
	TLC02V25	2	2.5	5.0	4.05	2.30	0.332	3.09	50.70	4.34	123	1.62	99	1.15	40.7
ThinLine Pack Batteries	TLC02V20	2	2.0	4.0	3.50	2.20	0.332	2.55	41.90	3.36	103	1.57	96	1.10	38.8
	TLP04V50	4	5.0	20.0	5.48	6.36	0.332	11.60	190.00	16.1	456	1.73	106	1.24	43.9
	TLP04V40	4	4.0	16.0	5.24	5.36	0.332	9.32	153.00	12.9	366	1.72	105	1.24	43.7
	TLP04V32	4	3.2	12.8	4.68	4.96	0.332	7.70	126.00	10.7	304	1.66	101	1.19	42.1
	TLP04V25	4	2.5	10.0	4.05	4.60	0.332	6.18	101.00	8.7	246	1.62	99	1.15	40.7
	TLP04V20	4	2.0	8.0	3.50	4.40	0.332	5.11	84.00	7.3	206	1.57	96	1.10	38.8
	TLP06V50	6	5.0	30.0	5.48	9.54	0.332	17.40	284.00	24.1	684	1.73	106	1.24	43.9
	TLP06V40	6	4.0	24.0	5.24	8.04	0.332	14.00	229.00	19.4	549	1.72	105	1.24	43.7
	TLP06V32	6	3.2	19.2	4.68	7.44	0.332	11.60	189.00	16.1	456	1.66	101	1.19	42.1
	TLP06V25	6	2.5	15.0	4.05	6.90	0.332	9.27	152.00	13.0	369	1.62	99	1.15	40.7
	TLP06V20	6	2.0	12.0	3.50	6.60	0.332	7.66	126.00	10.9	309	1.57	96	1.10	38.8
	TLP08V50	8	5.0	40.0	5.48	12.72	0.332	23.10	379.00	32.2	912	1.73	106	1.24	43.9
	TLP08V40	8	4.0	32.0	5.24	10.72	0.332	18.60	305.00	25.8	732	1.72	105	1.24	43.7
	TLP08V32	8	3.2	25.6	4.68	9.92	0.332	15.40	252.00	21.4	608	1.66	101	1.19	42.1
	TLP08V25	8	2.5	20.0	4.05	9.20	0.332	12.40	203.00	17.4	492	1.62	99	1.15	40.7
	TLP08V20	8	2.0	16.0	3.50	8.80	0.332	10.20	167.00	14.5	412	1.57	96	1.10	38.8
	TLP10V50	10	5.0	50.0	5.48	15.90	0.332	28.90	474.00	40.2	1140	1.73	106	1.24	43.9
	TLP10V40	10	4.0	40.0	5.24	13.40	0.332	23.30	382.00	32.3	915	1.72	105	1.24	43.7
	TLP10V32	10	3.2	32.0	4.68	12.40	0.332	19.30	316.00	26.8	760	1.66	101	1.19	42.1
	TLP10V25	10	2.5	25.0	4.05	11.50	0.332	15.50	253.00	21.7	615	1.62	99	1.15	40.7
	TLP10V20	10	2.0	20.0	3.50	11.00	0.332	12.80	209.00	18.2	515	1.57	96	1.10	38.8
	TLP12V50	12	5.0	60.0	5.48	19.08	0.332	34.70	569.00	48.3	1368	1.73	106	1.24	43.9
	TLP12V40	12	4.0	48.0	5.24	16.08	0.332	28.00	458.00	38.7	1098	1.72	105	1.24	43.7
	TLP12V32	12	3.2	38.4	4.68	14.88	0.332	23.10	379.00	32.2	912	1.66	101	1.19	42.1
	TLP12V25	12	2.5	30.0	4.05	13.80	0.332	18.50	304.00	26.0	738	1.62	99	1.15	40.7
	TLP12V20	12	2.0	24.0	3.50	13.20	0.332	15.30	251.00	21.8	618	1.57	96	1.10	38.8

	Brickpack Batteries				Dimensions			Volume		Weight		Energy Density		Specific Energy	
	Product Number	Normal Voltage	Cap. C/20Ah	Energy Watt-Hr.	Length in.	Width in.	Thickness in.	in. ³	cm ³	oz.	g.	Wh/in. ³	Wh/l	Wh/oz.	Wh/kg.
Cells	TLC02V50	2	5.0	10.0	5.48	3.18	0.332	5.78	94.80	8.04	228	1.73	106	1.24	43.9
	TLC02V40	2	4.0	8.0	5.24	2.68	0.332	4.66	76.40	6.46	183	1.72	105	1.24	43.7
	TLC02V32	2	3.2	6.4	4.68	2.48	0.332	3.85	63.10	5.36	152	1.66	101	1.19	42.1
	TLC02V25	2	2.5	5.0	4.05	2.30	0.332	3.09	50.70	4.34	123	1.62	99	1.15	40.7
ThinLine Pack Batteries	TLC02V20	2	2.0	4.0	3.50	2.20	0.332	2.55	41.90	3.36	103	1.57	96	1.10	38.8
	TLP04V50	4	5.0	20.0	5.48	3.18	0.664	11.60	190.00	16.1	456	1.73	106	1.24	43.9
	TLP04V40	4	4.0	16.0	5.24	2.68	0.664	9.32	153.00	12.9	366	1.72	105	1.24	43.7
	TLP04V32	4	3.2	12.8	4.68	2.48	0.664	7.70	126.00	10.7	304	1.66	101	1.19	42.1
	TLP04V25	4	2.5	10.0	4.05	2.30	0.664	6.18	101.00	8.7	246	1.62	99	1.15	40.7
	TLP04V20	4	2.0	8.0	3.50	2.20	0.664	5.11	84.00	7.3	206	1.57	96	1.10	38.8
	TLP06V50	6	5.0	30.0	5.48	3.18	0.996	17.40	284.00	24.1	684	1.73	106	1.24	43.9
	TLP06V40	6	4.0	24.0	5.24	2.68	0.996	14.00	229.00	19.4	549	1.72	105	1.24	43.7
	TLP06V32	6	3.2	19.2	4.68	2.48	0.996	11.60	189.00	16.1	456	1.66	101	1.19	42.1
	TLP06V25	6	2.5	15.0	4.05	2.30	0.996	9.27	152.00	13.0	369	1.62	99	1.15	40.7
	TLP06V20	6	2.0	12.0	3.50	2.20	0.996	7.66	126.00	10.9	309	1.57	96	1.10	38.8
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	TLP08V25	8	2.5	20.0	4.05	2.30	1.328	12.40	203.00	17.4	492	1.62	99	1.15	40.7
	TLP08V20	8	2.0	16.0	3.50	2.20	1.328	10.20	167.00	14.5	412	1.57	96	1.10	38.8
	TLP10V50	10	5.0	50.0	5.48	3.18	1.660	28.90	474.00	40.2	1140	1.73	106	1.24	43.9
	TLP10V40	10	4.0	40.0	5.24	2.68	1.660	23.30	382.00	32.3	915	1.72	105	1.24	43.7
	TLP10V32	10	3.2	32.0	4.68	2.48	1.660	19.30	316.00	26.8	760	1.66	101	1.19	42.1
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	TLP12V20	12	2.0	24.0	3.50	2.20	1.992	15.30	251.00	21.8	618	1.57	96	1.10	38.8

ThinLine Cells can be assembled into a variety of ThinLine Pack batteries with various form factors ranging from one-cell thick Flatpack batteries to one-cell wide Brickpack batteries.

Battery performance and safety is strongly affected by charging parameters. Maximum battery life can be obtained using the lowest charge voltage and the longest recharge time that achieves full charge between discharges. Charge times can be shortened with a penalty in battery life. Please consult with Innergy Power Corporation, Marketing Applications Department toll free at **888 737-7697**, for specifics.

Float applications are those that continually trickle charge the battery and infrequently go into discharge mode. The two methods of charging Innergy batteries in float applications are as follows:

Single Stage Charger

Charge with constant current, constant voltage (CC/CV), with voltage limited to 2.2 – 2.32 volts per cell at 25°C. Temperature compensation must be incorporated according to the Innergy "Charging Temperature Voltage Compensation" graph. Current must be limited to 1C (C = Rated Capacity) or less. Recharge time to full charge is 40 – 70 hours depending on state of charge, current limit and temperature. This charge method has no maximum charge time limit.

Multi-Stage Charger

Charge with constant current, constant voltage (CC/CV), with voltage limited to 2.45 – 2.50 volts per cell at 25°C. Temperature compensation must be incorporated according to the Innergy "Charging Temperature Voltage Compensation" graph. During this charging stage, current must be limited to 0.3C (C = Rated Capacity) or less. Limit charge time in this stage according to the Innergy "Charge Time vs. Charge Voltage" graph. On termination from this stage, switch to single stage float charge

mode or optional pulse charge mode. **Pulse charge** mode is employed to obtain maximum battery life and is defined as follows: CC/CV, with current between C/10 and C/20. Charge until reaching 2.47 volts per cell, turn charge current off until reaching 2.27 volts per cell. Repeat continuously.

Cyclic applications are those that repeatedly discharge and charge the battery on a continuous basis where the battery is not left in charge mode for extended periods of time. Following is the Innergy charging method for cyclic applications:

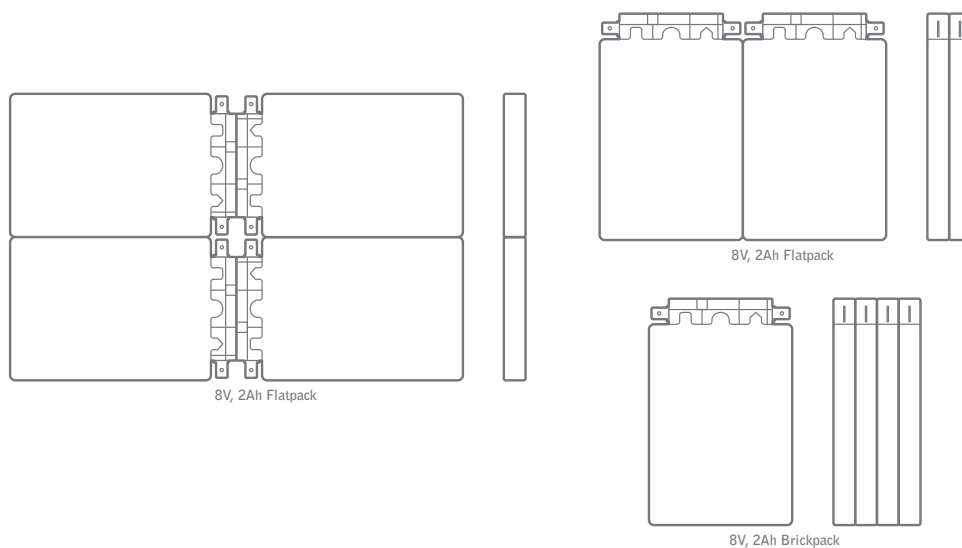
One charge/discharge cycle per day

Charge with constant current, constant voltage (CC/CV), with voltage limited to 2.45 – 2.50 volts per cell at 25°C. Temperature compensation must be incorporated according to the Innergy "Charging Temperature Voltage Compensation" graph. During this charger stage, current must be limited to 0.3C (C = Rated Capacity) or less. Limit charge time in this stage according to the Innergy "Charge Time vs. Charge Voltage" graph. On termination from this stage, switch to single stage float charge mode, the optional pulse charge mode (as described in the Multi-Stage Charger section above) or terminate charge.

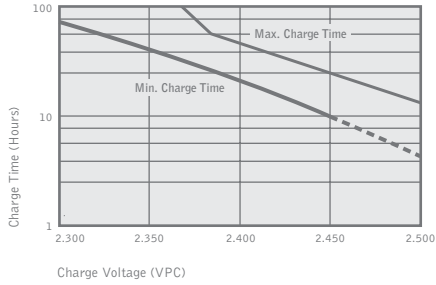
Packaging Versatility

ThinLine technology utilizes space far more efficiently than cylindrical cells. It also provides a much greater degree of freedom in choosing the form factor of the overall battery pack and in matching power requirements of the application to an optimum configuration. ThinLine cells can be assembled into Flatpack configurations. Examples of some four cell configurations are shown in the diagram below.

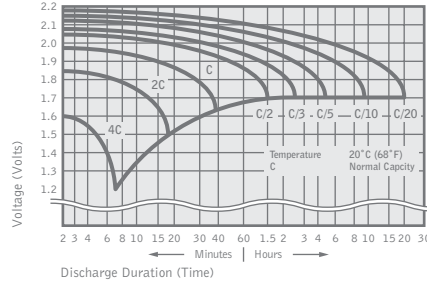
8V, 2Ah Cell Configurations



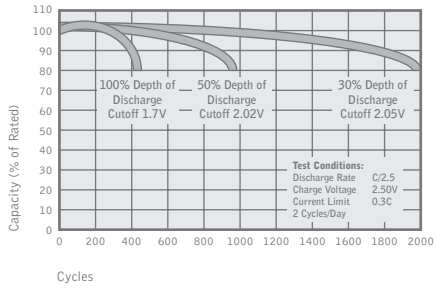
Charge Time Versus Charge Voltage



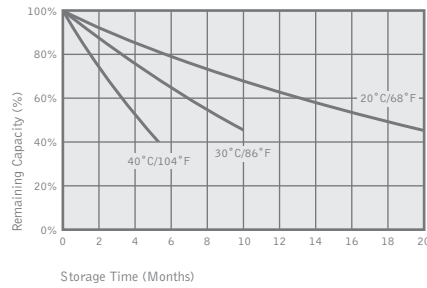
Characteristic Discharge Curves



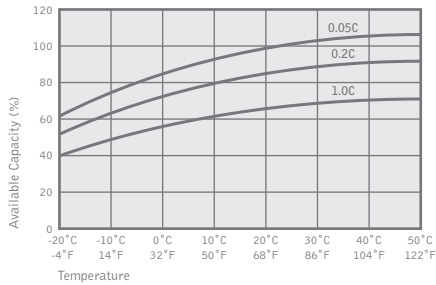
Cycle Life Versus Depth of Discharge



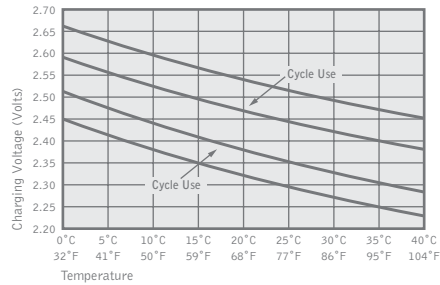
Shelf Life Versus Storage Temperature



Effect of Temperature on Capacity



Changing Temperature Voltage Compensation



Temperature Range Summary

	°C	°F
Discharge	-20° to 50°	-4° to 122°
Charge	0° to 40°	32° to 104°
Storage	-20° to 40°	-4° to 104°

UL Component Recognition

UL Component Recognition approval under UL 924, Section 38, for Emergency Lights and Power Batteries.

For further information please contact Innergy Power toll free at **888 737-7697** or visit our web site, www.innergypower.com