

650W Li-Ion Sapphire™ Series Battery Charger Data Sheet

Green Watt Power's 650W Sapphire™ Series universal Li-ion battery on-board and off-board chargers are designed with ultra-high efficiency in a waterproof metal case enclosure. The extraordinary performance of low power dissipation directly results in higher reliability and longer lifetime of the charger. This series of chargers offers solid and safe power conversions with constant current and constant voltage output for use in E-vehicles, E-motorcycles, E-boats, E-machines, I-robots, and similar applications.



Features:

- Universal AC Input: 90 – 264V.
- Output power: 650W @ 220V, 450W @ 120V
- Ultra-wide DC output range: 27 – 84.3V
- Fast charging feature.
- High efficiency: Up to 92%.
- CAN/485 communication.
- LED Charge Status indicator.
- IP67 waterproof rating.
- All-Around Protections: Lightning, UVP, OVP, OCP/SCP, RPP, OTP.
- Ambient temperature to 50°C, fan cooled.
- Compact mechanical design with handle for Fixed On-Board or portable Off-Board mounting.



Model Selection Table

AC Input Voltage	Output		Efficiency (typ.)	Model Number (factory number)	Dimensions L x W x H
	Power	Voltage			
90 – 264V	650W @ 220V 450W @ 120V	27 – 54.6VDC	2.6 – 12.4A	92.5% @ 220V	160 x 125 x 80mm 7.09 x 4.92 x 3.15"
		40-67.2VDC	3-10A	93.0% @ 220V	
		55-84.3VDC	3-8A	93.5% @ 220V	
				EVC-54-650 (PLD650-EVBX01-04812SAW)	
				EVC-67-650 Coming soon	
				EVC-84-650 (PLD680-EVBX01-07208SAW)	



General Condition: 25°C ambient, input 220VAC @ full load unless noted.

Input Specification		
Input Voltage Range	90 – 264VAC	
Input Frequency	47 – 63Hz	
Input Current Max.	4.5A @120VAC	3.5A @ 220VAC
Power Factor (min./typical)	0.98/0.99 @120VAC	0.96 / 0.97 @ 220VAC
Efficiency at full load (min./typical)	89%/90% @120VAC	91% / 92% @ 220VAC
Output Specification		
48V Battery		
Output Voltage: Pre/Fast Charge/Max	27.0 – 39.0V (±1V) / 39.0 – 53.0V (±1V) / 54.2 – 54.6V	
Voltage Accuracy	±0.2V	
Output Current Pre/Fast Charge	2.6 – 3.4A / 11.6 – 12.4A	
Output Power	650W @ 160-264Vin / 450W @ 90-160Vin	
Current Ripple & Noise	25°C, measured in constant current mode with a bandwidth of 20MHz, not exceeding ± 10% of the maximum output current.	
Communication	CAN/485 (270 Ohm termination)	
Turn On Delay	5.0s max. @ Full Load (incl. 3A pre-charge)	
Protection	OVP, OCP, SCP, OTP	
Input Under Voltage Protection (UVP)	TBC	
Output Over Voltage Protection (OVP)	Software OVP triggers and latches when Vout is >58V (±3V) for >3s. Hardware OVP triggers and latches when Vout is >68V (±5V). Return to normal operation after fault condition is removed by recycling AC input.	
Output Under Voltage Protection	UVP triggers and latches when Vout is <27V (±1V) for >3s. Return to normal operation after fault condition is removed by recycling AC input.	
Short Current Protection (SCP)	With the output in short-circuit mode, the power supply will Self-protect. Return to normal operation after fault condition is removed by recycling AC input.	
Output Overcurrent Protection	Overcurrent protection triggers when Iout is >13A (±1A) for >2s. Return to normal operation after fault condition is removed by recycling AC input.	
Reverse Polarity Protection	Self-protection triggers with the charger connected in reverse polarity. Return to normal operation after fault condition is removed by recycling AC input.	
Timing protection	Self-protection triggers with Battery 27 – 39V (±1V) for >1h (±0.5h). Self-protection triggers with Battery >27V (±1V) for >12h (±1h).	
Delay Shut-Off Protection	Shut-off-protection triggers with 39 – 54.6Vout for >180min. Return to normal operation after fault condition is removed by recycling AC input.	
Charger no-load protection	When the output current is less than 400±200mA, the power supply enters the overcharge protection mode and shuts down	
Over Temperature Protection	OTP triggers at Tcase >65°C (±5°C), auto-recovery at <65°C (±5°C) Tcase. Derating from 12A to 9A (±0.4A) at Tcase >60°C (±5°C), recovery at <55°C (±5°C)	
Operating Temperature Range	-20°C to +50°C (see derating for >40°C), RH 10% to 96%	
Storage Temperature Range	-40°C to +85°C with RH 10% to 96%	
Surge Protection	Line to Line 1kV, Line to Earth 2kV	
Isolation Test Voltage	Prim. to Sec.: 3000VAC / Prim. to Earth: 1250Vac / Sec. to Earth: 1750VAC Condition: Leakage current 10mA max. duration 60s max. (3s for production).	
Insulation Resistance	>100MQ primary to secondary with 500VDC test voltage	
Intrusion & Moisture Protection	IP67	

General Condition: 25°C ambient, input 220VAC @ full load unless noted.

Input Specification		
Input Voltage Range	90 – 264VAC	
Input Frequency	47 – 63Hz	
Input Current Max.	4.5A @120VAC	3.5A @ 220VAC
Power Factor (min./typical)	0.98/0.99 @120VAC	0.96 / 0.97 @ 220VAC
Efficiency at full load (min./typical)	90%/91% @120VAC	92% / 93.5% @ 220VAC
Output Specification		
72V Battery		
Output Voltage: Pre/Fast Charge/Max	40– 55V (±1V) / 55-82V (±1V) / 83.8 – 84.2V	
Voltage Accuracy	±0.2V	
Output Current Pre/Fast Charge	2.4– 3.6A / 7.6 –8.4A	
Output Power	680W @ 160-264Vin / 450W @ 90-160Vin	
Current Ripple & Noise (20MHz BW)	TBD	
Communication	CAN/485 (270 Ohm termination)	
Turn On Delay	5.0s max. @ Full Load (incl. 3A pre-charge)	
Protection		
OVP, OCP, SCP, OTP		
Input Under Voltage Protection (UVP)	TBC	
Output Over Voltage Protection (OVP)	Software OVP triggers and latches when Vout is >89V (±3V) for >3s. Hardware OVP triggers and latches when Vout is >87V (±5V). Return to normal operation after fault condition is removed by recycling AC input.	
Output Under Voltage Protection	UVP triggers and latches when Vout is <38V (±2V) for >3s. Return to normal operation after fault condition is removed by recycling AC input.	
Short Current Protection (SCP)	With the output in short-circuit mode, the power supply will Self-protect. Return to normal operation after fault condition is removed by recycling AC input.	
Output Overcurrent Protection	Overcurrent protection triggers when Iout is >10A (±1A) for >2s. Return to normal operation after fault condition is removed by recycling AC input.	
Reverse Polarity Protection	Self-protection triggers with the charger connected in reverse polarity. Return to normal operation after fault condition is removed by recycling AC input.	
Timing protection	Self-protection triggers with Battery 40 – 55V (±1V) for >1h (±0.5h). Self-protection triggers with Battery >27V (±1V) for >12h (±1h).	
Delay Shut-Off Protection	Shut-off-protection triggers with 55 – 82Vout for >180min. Return to normal operation after fault condition is removed by recycling AC input.	
Charger no-load protection	When the output current is less than 400±200mA, the power supply enters the overcharge protection mode and shuts down	
Over Temperature Protection	OTP triggers at Tcase >65°C (±5°C), auto-recovery at <65°C (±5°C) Tcase. Derating from 12A to 9A (±0.4A) at Tcase >60°C (±5°C), recovery at <55°C (±5°C)	
Operating Temperature Range	-20°C to +50°C (see derating for >40°C), RH 10% to 96%	
Storage Temperature Range	-40°C to +85°C with RH 10% to 96%	
Surge Protection	Line to Line 1kV, Line to Earth 2kV	
Isolation Test Voltage	Prim. to Sec.: 3000VAC / Prim. to Earth: 1250Vac / Sec. to Earth: 1750VAC Condition: Leakage current 10mA max. duration 60s max. (3s for production).	
Insulation Resistance	>100MΩ primary to secondary with 500VDC test voltage	
Intrusion & Moisture Protection	IP67	

Electromagnetic Compatibility

Emission:

EN 55014-1/EN 55014-2/FCC PART 15, CLASS B (System Level Test).

Immunity:

EN61000-3-2: Harmonic Current Emission, Criteria A

EN61000-3-3: Voltage Fluctuations and Flicker.

EN61000-4-2: ESD 8kV Air Discharge, 4kV Contact Discharge, Criteria B.

EN61000-4-3: Radio-Frequency Electromagnetic Field Susceptibility Test-Rs Level 3, Criteria A.

EN61000-4-4: Electrical Fast Transient/Burst-EFT 1kV, Criteria B.

EN61000-4-5: Surge Immunity Test, AC Power Line: Line to Line 1kV; Line to Earth 2kV Criteria B.

EN61000-4-6: Conducted Radio Frequency Disturbance Test-CS Level 3, Criteria A.

EN61000-4-8: Power Frequency Magnetic Field Test 3A/m, Criteria A.

EN61000-4-11: Voltage Dips, Criteria B.

Safety (Designed to meet):

EN60335 & UL62368 (International Standards needed!)

Fan control:

When the charger is working and the case temperature exceeds $40\pm 5^{\circ}\text{C}$, the fan works. Then when the case temperature is below $35\pm 5^{\circ}\text{C}$ or the charger is turned off, the fan stops working.

Communication Protocol:

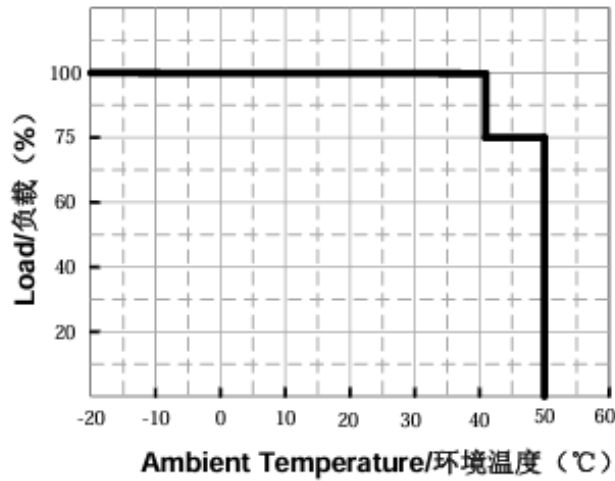
The charger has a CAN/485 communication function. The charger does have a terminal resistor of 270 Ohm by default. Contact factory for specific documents and communication protocols.

LED Status Indicator showing Charge Status:

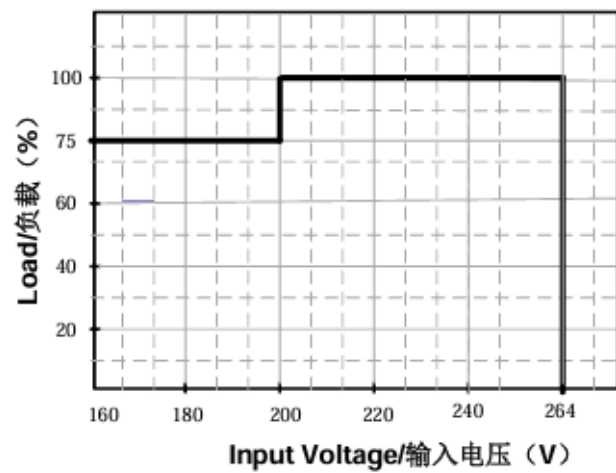
Battery Status	LED Indicators				
	LED 0	LED 1	LED 2	LED 3	LED 4
Charge state 0% – 25%	ON	FLASHING	OFF	OFF	OFF
Charge state 26% – 50%	ON	ON	FLASHING	OFF	OFF
Charge state 51% – 75%	ON	ON	ON	FLASHING	OFF
Charge state 76% – 100%	ON	ON	ON	ON	ON
Charger Fault Detected (OVP, UVP, OCP/SC, OTP, RPP)	FLASHING	OFF	OFF	OFF	OFF
BMS Fault Detected	FLASHING	FLASHING	OFF	OFF	OFF
Self-protection: Pre-charge timing	FLASHING	FLASHING	FLASHING	OFF	OFF
Self-protection: Overcharge	FLASHING	FLASHING	FLASHING	FLASHING	OFF
Self-protection: Delay cut-off	FLASHING	FLASHING	FLASHING	FLASHING	FLASHING
Charge State: Standby/No Load	OFF	FLASHING	FLASHING	FLASHING	FLASHING
Charge State: Full charge timing protection	OFF	ON	ON	ON	ON



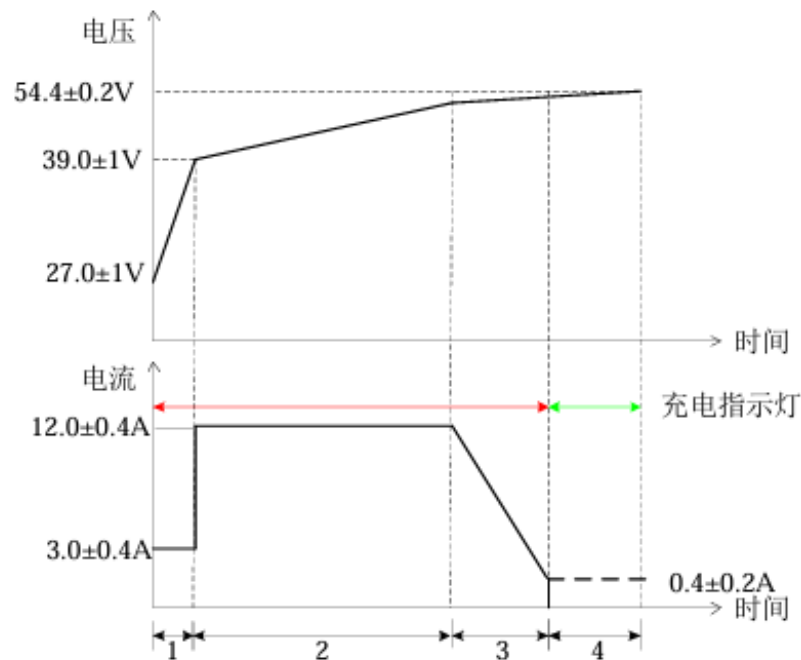
Derating: Input Voltage vs. Load



Temp vs. Load



Typical Charge Curves

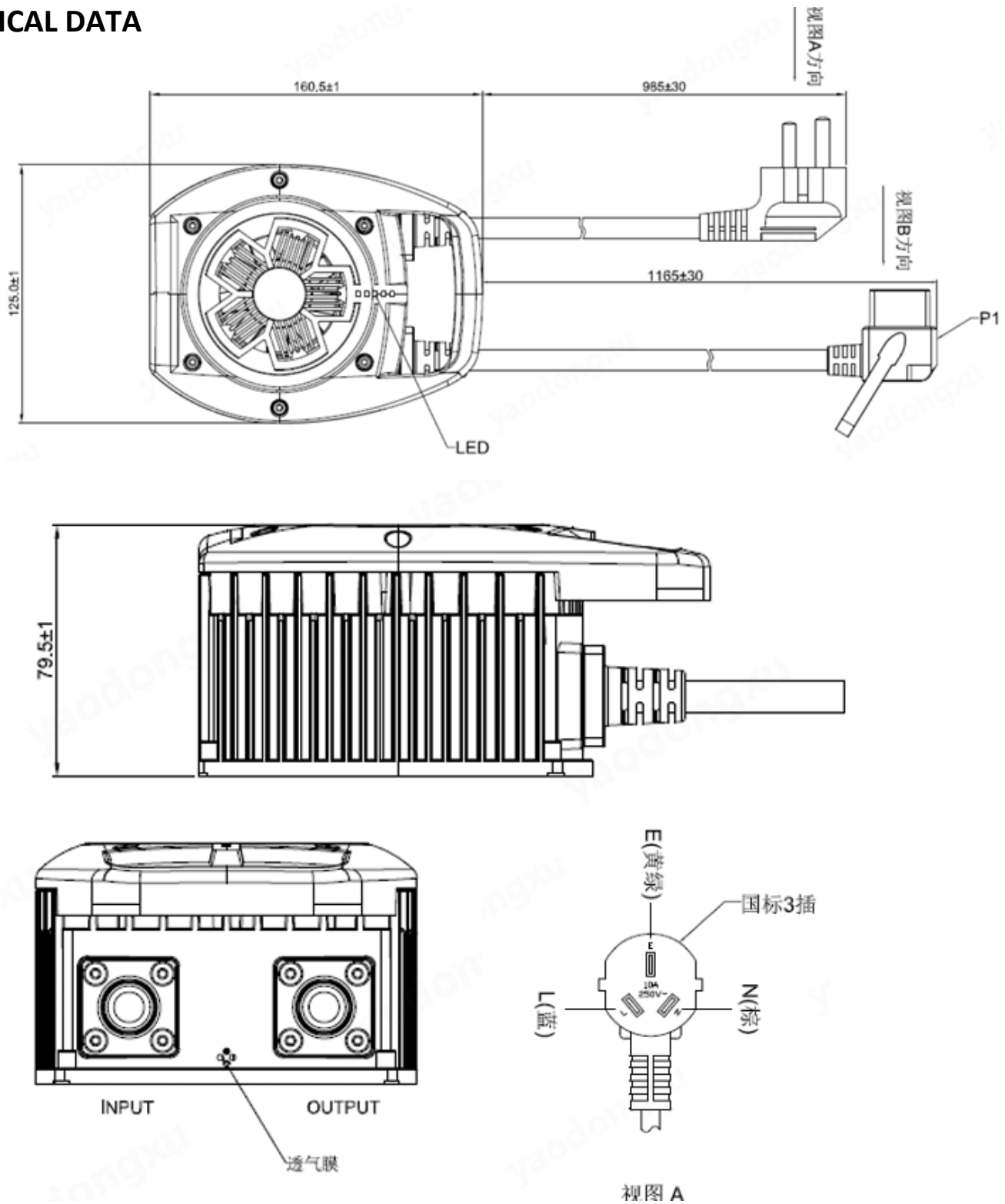


Note:

1. The charging curve is based on the charging request, output current, and voltage, sent by the BMS. When the requested current and voltage received are higher than the maximum output capacity of the charger, the charger outputs the current and voltage based on its own maximum output capacity.
2. When the battery voltage is between 27V and 39V ($\pm 1V$), the charger operates in Pre-charge mode.
When the battery voltage is between 39V and 53V ($\pm 1V$), the charger operates in Fast-charge mode.
3. When the output current is $< 400mA$ ($\pm 200mA$), the power supply enters the overcharge protection mode and shuts down
4. Derating conditions should be considered for the actual output current.



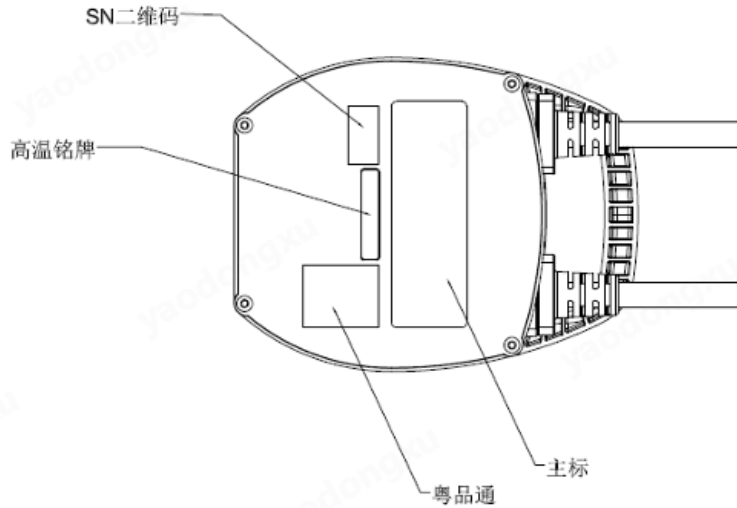
MECHANICAL DATA



Mechanical	Fan-type with Handle
Dimensions (L x W x H)	225/280.5 x 137 x 73 mm 8.86/11.05 x 4.29 x 2.88 inch
Weight	3.0kg / 6.61 lbs.



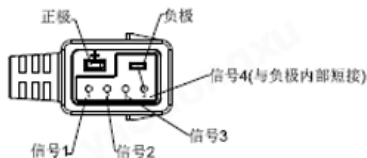
Connectors, LED Indicators and Labels:



P1插头接线方式

插头	线材规格	线材颜色	定义
正极	2.5mm²	红	正极
负极	2.5mm²	黑	负极
信号1			有PIN不焊线
信号2	0.5mm²	灰/白	485B
信号3	0.5mm²	黑	485A
信号4			充电互锁

负极与信号4内部短接



VIEW B

输出插头需符合 GB42296-2022 标准要求

5.2 Label/标签

TBD

