Supplemental Explanation

Supplemental explanation 1 80 PLUS

80 PLUS is a guideline promoted by 80 PLUS Program for reduced electricity consumption on electrical appliances. It indicates that the efficiency of conversion from alternating current to direct current is 80% or higher. Using the 80 Plus certified power supply is a requirement for information equipment (workstations and personal computers) to adapt ENERGY STAR*.

The guidelines of 80 PLUS contain input voltages of 115 V AC and 230 V AC. Products are given the certification when they satisfy the condition of an 80% or greater conversion efficiency for each of the load factors 20%, 50% and 100%. The six ranks of Standard, Bronze, Silver, Gold, Platinum and Titanium are defined for the specification, in ascending order of efficiency. However, the top rank of Titanium is only defined for 230 V AC, so this rank is not found on power supply units for general personal computers. Power supply units with improved power conversion efficiency by complying with this 80 PLUS can reduce heat generation, and thereby decreasing the rotation speed of a cooling fan to suppress its noise as well as reducing the thermal degradation of electronic components. This results in noise reduction, and a reduction of the thermal degradation of electronic components is also possible. This has an effect on the comfortableness of the machine and its energy saving, and also has a good effect on the lifespan of the product.

*: International ENERGY STAR Program (ENERGY STAR): An international environmental labeling system for energy saving of electrical equipment. It is operated with the mutual recognition of the Ministry of Economy, Trade and Industry and the United States Environmental Protection Agency. A wide range of products are subject to the labeling, ranging from household electrical products to industrial machinery and computers.

Reference

80PLUS Program, http://www.80plus.org. (accessed 2012-04-10).

Supplemental explanation 2 Battery capacity, discharge rate and charge rate

The battery capacity means the amount of electricity which is taken out a battery from starting discharge to a discharge final voltage. The units used are Ah (ampere hours). For example, a battery with a battery capacity of 10 Ah has enough electricity for a 10 A current to flow for 1 hour. It is also possible to have a 2 A current flowing for 5 hours.

Battery capacity is defined by JIS. The rated capacity is defined as the capacity with a current at which discharging will be completed in 5 hours at 20 °C. This is called 5 hour rate capacity.

The discharge rate is the relative ratio of the current at which a battery is discharged against its capacity. This is a method of description to equalize the characteristics conditions for different batteries. The units used are C.

A discharge rate of 1 C means the current value for discharging to be completed in exactly one hour when a cell with the nominal capacity value is discharged at a constant current. For example, on a battery with a rated capacity of 10 Ah, it will be 10 A for 1 C. If it is discharged with a current of 20 A, it is said that it was discharged at 2 C, and at 2 A it is said that it was discharged at 0.2 C.

The charge rate is defined in the same way.

Supplemental explanation 3 PUE

Power usage effectiveness (PUE) is an index expressing the energy efficiency of data center equipment. It is the value resulting when the electricity consumed by an entire data center is divided by the electricity consumed by IT equipment such as servers. The electricity consumed by an entire data center includes the electricity consumed by the IT equipment such as servers, storages, routers and control terminals, and also the electricity consumed by other equipment such as air conditioning equipment, power equipment, lighting and monitoring equipment.

$$\text{PUE} = \frac{\text{Electricity consumption of entire data center}}{\text{Electricity consumption of IT equipment}}$$

Supplemental explanation 4 MPPT

Solar cells have I-V characteristics like those shown on the figure. The current flowing when in a short circuit state is called I_s. The voltage when in an open state is called V_{oc}. In between these short circuit and open states, there is a maximum power point where a solar cell generates maximum power. This maximum power point changes according to the change in the amount of sunlight, so a power conditioner (PCS) is controlled to search for this operating state during operation. This is called maximum power point tracking (MPPT) control.

When operations start, the PCS gradually lowers its operating voltage in order to find the maximum power point from the V_{oc} state. At this time, the PCS measures the generated output of the solar cell and decrease the solar cell operating voltage whilst the generated power is increasing. When the generated output falls, the PCS increases the operating voltage. In this way, the PCS can maximize the power generated by solar cells through this MPPT control changing the operating voltage of solar cells.

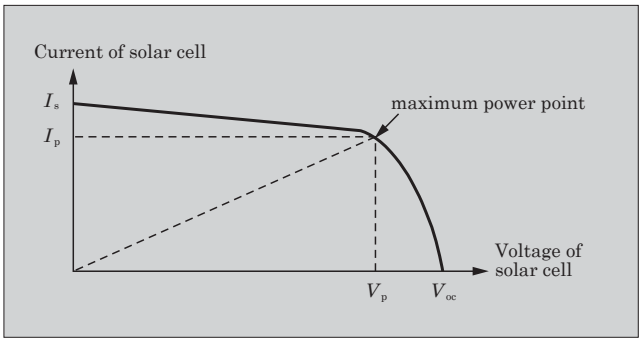

Figure I-V characteristics of solar cell