

What is the difference between efficiency and average efficiency?

Efficiency

Power supply datasheets include product efficiency in a percentage format for each voltage and output power model, as a guidance to how much power is lost in wasted heat when the product is running. As the actual operating efficiency varies with input voltage, output load, ambient temperature and component tolerance, usually there is a test condition noted.

Phrases like “up to 95%” or “typically 93% at 230Vac input, 100% load and 25°C ambient” are widely used.

If the selection of the power supply is being made purely on efficiency, then the manufacturer’s evaluation data has to be studied in order to determine the measured efficiency at the user’s load condition. Figure 1 shows the efficiency vs. output current plot for TDK-Lambda’s 600W rated 24V output GXE600-24 for different input voltages. At 60% load, 230Vac input one could expect the efficiency to be 94%.

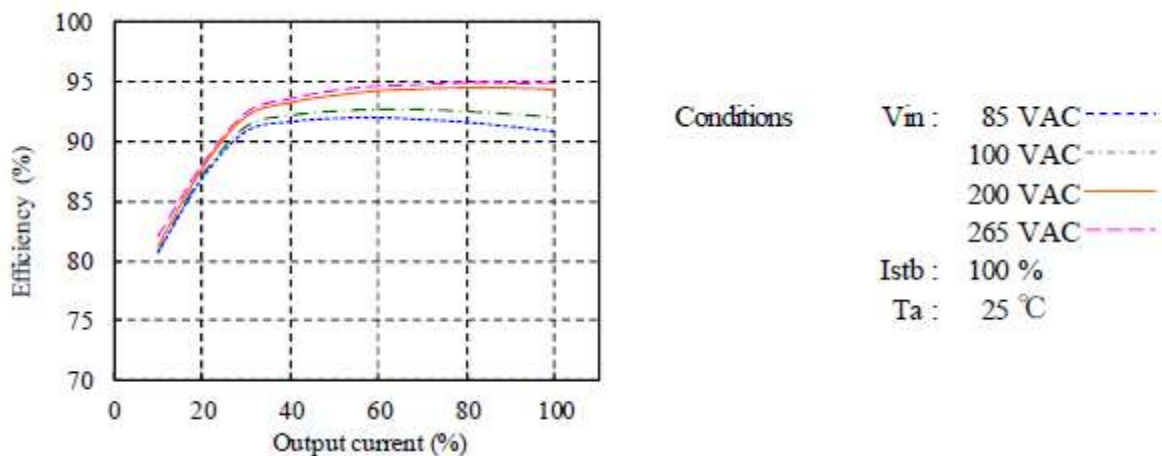


Figure 1: GXE600-24 Efficiency vs Output Current

Average efficiency

External power supplies complying with the DoE (Department of Energy) and EU efficiency regulations will sometimes only state the standard (and its revision) they comply with. TDK-Lambda’s DTM110PW240C8 datasheet for example, states compliance with the latest DoE Level VI & EU Tier 2 Efficiency standards and also includes that the average efficiency is >89%. The average efficiency for an external power supply rated between 49-250W has to be at least 89% to comply with the current and proposed standards.

Is “Average Efficiency” the same as “Efficiency”? No.

Average efficiency is calculated by measuring the efficiency at 25%, 50%, 75% and 100% loads. These four values are added together and the total is divided by four to obtain the average. Measurements are taken at 115Vac and 230Vac inputs.

Using the measurements from Figure 2 for the DTM110PW240C8, the calculated average efficiency at 115Vac is 90% and 90.5% at 230Vac.

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Load (%)	Power (W)	Voltage (Vdc)	Current (A)	Power (W)	Efficiency (%)
Vin: 115V/50Hz					
100	121.53	24.16	4.54	109.69	90.0
75	91.67	24.20	3.43	83.11	91.0
50	61.27	24.26	2.28	55.40	90.0
25	31.73	24.27	1.17	28.35	89.0
10	12.44	24.27	0.46	11.07	89.0
0	0.08	24.25	--	--	--
Vin: 230V/50Hz					
100	119.33	24.16	4.52	109.07	91.0
75	92.19	24.21	3.47	83.87	91.0
50	62.11	24.27	2.30	55.83	90.0
25	30.74	24.34	1.14	27.63	90.0
10	13.26	24.35	0.49	11.82	89.0
0	0.11	24.25	--	--	--

Figure 2: DTM110PW240C8 Efficiency Measurements

Efficiency readings are also taken at 10% to check compliance to the EU Tier 2 Efficiency standard. For a power supply rated at 49-250W it must have a minimum efficiency of 79%. At 10% load the DTM250-D has an efficiency of 89%.

Power Guy