

Performance Parameters of DC-DC Converters

1. Efficiency (Efficiency)

- Ratio of output power to input power.
- Higher efficiency reduces heat dissipation and power loss.
- Typically ranges from 80% to 98%.

2. Voltage Regulation

- Measures the stability of output voltage despite input or load changes.
- Formula: $\text{Voltage Regulation} = [(V_{\text{no_load}} - V_{\text{full_load}}) / V_{\text{full_load}}] \times 100\%$
- Lower values indicate better performance.

3. Load Regulation

- Measures variation in output voltage with changing load current.
- Important for applications with varying loads.

4. Line Regulation

- Measures how well the output voltage remains constant despite input variations.
- Formula: $\text{Line Regulation} = (\Delta V_{\text{out}} / \Delta V_{\text{in}}) \times 100\%$

5. Ripple and Noise

- Small AC voltage fluctuations in the DC output.
- Measured in mV peak-to-peak (mVpp).
- Lower ripple is preferred in sensitive applications.

6. Switching Frequency

- The frequency at which the converter switches power devices.
- Common values: 100 kHz to several MHz.
- Higher frequencies allow smaller components but increase switching losses.

7. Transient Response

- Converter's ability to respond to sudden load or input changes.
- Measured in microseconds (microseconds).
- Fast response prevents voltage dips and overshoots.

8. Power Density

- Power delivered per unit volume.
- Higher power density allows compact designs for portable applications.

9. Thermal Performance

- Determines heat dissipation and cooling requirements.
- Efficient converters produce less heat, improving reliability.

10. Isolation (for Isolated Converters)

- Electrical separation between input and output.
- Isolation voltage typically ranges from 1 kV to 5 kV.
- Essential for safety-critical applications.