

D/A Converters Definition Of Terms

Differential Nonlinearity: Ideally, any two adjacent digital codes correspond to output analog voltages that are exactly one LSB apart. Differential non-linearity is a measure of the worst case deviation from the ideal 1 LSB step. For example, a DAC with a 1.5 LSB output change for a 1 LSB digital code change exhibits $\frac{1}{2}$ LSB differential non-linearity. Differential non-linearity may be expressed in fractional bits or as a percentage of full scale. A differential non-linearity greater than 1 LSB will lead to a non-monotonic transfer function in a DAC.

Gain Error (Full Scale Error): The difference between the output voltage (or current) with full scale input code and the ideal voltage (or current) that should exist with a full scale input code.

Gain Temperature Coefficient (Full Scale Temperature Coefficient): Change in gain error divided by change in temperature. Usually expressed in parts per million per degree Celsius (ppm/°C).

Integral Nonlinearity (Linearity Error): Worst case deviation from the line between the endpoints (zero and full scale). Can be expressed as a percentage of full scale or in fraction of an LSB.

LSB (Least-Significant Bit): In a binary coded system this is the bit that carries the smallest value or weight. Its value is the full scale voltage (or current) divided by 2^n , where n is the resolution of the converter.

Monotonicity: A monotonic function has a slope whose sign does not change. A monotonic DAC has an output that changes in the same direction (or remains constant) for each increase in the input code. the converse is true for decreasing codes.

MSB (Most Significant Bit): In a binary coded system this is the bit that has the largest value or weight. Its value is one half of full scale.

Multiplying DAC: In a sense, every DAC is a multiplying DAC since the output voltage (or current) is equal to the reference voltage times a constant determined by the digital input code divided by 2^n (n is the number of bits of resolution). In a two quadrant multiplying DAC the reference voltage or the digital input code can change the output voltage polarity. If both the reference voltage and the digital code change the output voltage polarity, four quadrant multiplication exists.

Offset Error (Zero Error): The output voltage that exists when the input digital code is set to give an ideal output of zero volts. All the digital codes in the transfer curve are offset by the same value. Offset error is usually expressed in LSBs.

Power supply Rejection (Power Supply Sensitivity): The sensitivity of a converter to changes in the dc power supply voltages.

Resolution: the smallest analog increment corresponding to a 1 LSB converter code change. For converters, resolution is normally expressed in bits, where the number of analog levels is equal to 2^n .

Settling Time: The time from a change in input code until a DAC's output signal remains within $\pm\frac{1}{2}$ LSB (or some other specified tolerance) of the final value.

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