Digital to Analog Converter (8A)

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2/9/14

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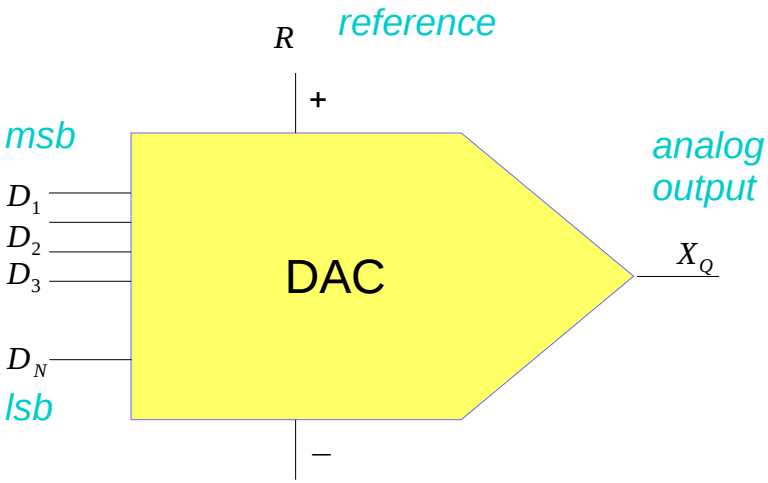
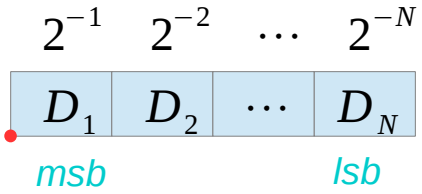
DAC



Unipolar Natural Binary

$$X_Q = R\left(D_1 2^{-1} + D_2 2^{-2} + \cdots + D_N 2^{-N}\right)$$



$\boldsymbol{D} = [0,\ 0,\ \cdots,\ 0]$	minimum level	$X_Q = 0$
$\boldsymbol{D} = [0,\ 0,\ \cdots,\ 1]$	the lsb pattern	$X_Q = R2^{-N} = Q$ the smallest non-zero level
$\boldsymbol{D} = [1,\ 0,\ \cdots,\ 0]$	the msb pattern	$X_Q = R2^{-1}$
$\boldsymbol{D} = [1,\ 1,\ \cdots,\ 1]$	the maximum level	$X_Q = R\left(2^{-1} + 2^{-2} + \cdots + 2^{-N}\right) = R\left(1 - 2^{-N}\right) = R - Q$

DAC – unipolar natural binary

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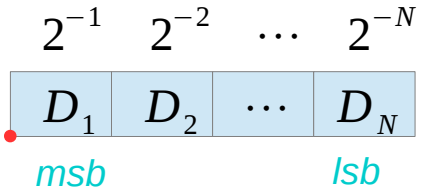

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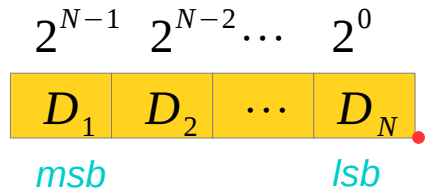
$$Q = R2^{-N}$$ quantization width

$$X_Q = R2^{-N}\left(D_1 2^{N-1} + D_2 2^{N-2} + \cdots + D_N 2^{0}\right)$$

$$X_Q = Qm$$

$$m = \left(D_1 2^{N-1} + D_2 2^{N-2} + \cdots + D_N 2^{0}\right)$$



References

[1] http://en.wikipedia.org/
[2] http://planetmath.org/
[3] M.L. Boas, “Mathematical Methods in the Physical Sciences”