

## Window Characteristics<sup>a</sup>

Window (length N)	Main Lobe Width	Side-lobe Level (dB)	Transition Bandwidth	Passband Ripple (dB)	Stopband Attenuation (dB)
rectangular	$4\pi/N$	-13.5	$1.8\pi/N$	0.75	21
von Sump	$6\pi/N$	-22	$4.0\pi/N$	0.66	23
Bartlett	$8\pi/N$	-27	$6.1\pi/N$	0.45	25
von Hann	$8\pi/N$	-32	$6.2\pi/N$	0.055	44
Hamming	$8\pi/N$	-43	$6.6\pi/N$	0.019	53
Blackman	$12\pi/N$	-57	$11\pi/N$	0.0017	74

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<sup>a</sup>Other window names: rectangular=boxcar, Bartlett=triangular, von Hann=Hann=Hanning. NA: the von Sump window is a figment of my imagination and yet to be invented.

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## Common $z$ -Transforms

$x[n]$	$X^z(z)$	ROC
$\delta[n]$	1	All $z$
$u[n]$	$\frac{1}{1 - z^{-1}}$	$ z  > 1$
$a^n u[n]$	$\frac{1}{1 - az^{-1}}$	$ z  >  a $
$na^n u[n]$	$\frac{az^{-1}}{(1 - az^{-1})^2}$	$ z  >  a $
$-a^n u[-n - 1]$	$\frac{1}{1 - az^{-1}}$	$ z  <  a $
$-na^n u[-n - 1]$	$\frac{az^{-1}}{(1 - az^{-1})^2}$	$ z  <  a $
$\cos(\theta_0 n) u[n]$	$\frac{1 - z^{-1} \cos(\theta_0)}{1 - 2z^{-1} \cos(\theta_0) + z^{-2}}$	$ z  > 1$
$\sin(\theta_0 n) u[n]$	$\frac{z^{-1} \sin(\theta_0)}{1 - 2z^{-1} \cos(\theta_0) + z^{-2}}$	$ z  > 1$
$a^n \cos(\theta_0 n) u[n]$	$\frac{1 - az^{-1} \cos(\theta_0)}{1 - 2az^{-1} \cos(\theta_0) + a^2 z^{-2}}$	$ z  >  a $
$a^n \sin(\theta_0 n) u[n]$	$\frac{az^{-1} \sin(\theta_0)}{1 - 2az^{-1} \cos(\theta_0) + a^2 z^{-2}}$	$ z  >  a $