# Intrinsic Functions (DirectX HLSL)

The following table lists the intrinsic functions available in HLSL. Each function has a brief description, and a link to a reference page that has more detail about the input argument and return type.

|  |  |  |
| --- | --- | --- |
| **Name** | **Syntax** | **Description** |
| [abs](http://msdn.microsoft.com/en-us/library/bb509562(VS.85).aspx) | abs(x) | Absolute value (per component). |
| [acos](http://msdn.microsoft.com/en-us/library/bb509563(VS.85).aspx) | acos(x) | Returns the arccosine of each component of x. |
| [all](http://msdn.microsoft.com/en-us/library/bb509564(VS.85).aspx) | all(x) | Test if all components of x are nonzero. |
| [any](http://msdn.microsoft.com/en-us/library/bb509565(VS.85).aspx) | any(x) | Test if any component of x is nonzero. |
| [asfloat](http://msdn.microsoft.com/en-us/library/bb509570(VS.85).aspx) | asfloat(x) | Convert the input type to a float. |
| [asin](http://msdn.microsoft.com/en-us/library/bb509571(VS.85).aspx) | asin(x) | Returns the arcsine of each component of x. |
| [asint](http://msdn.microsoft.com/en-us/library/bb509572(VS.85).aspx) | asint(x) | Convert the input type to an integer. |
| [asuint](http://msdn.microsoft.com/en-us/library/bb509573(VS.85).aspx) | asuint(x) | Convert the input type to an unsigned integer. |
| [atan](http://msdn.microsoft.com/en-us/library/bb509574(VS.85).aspx) | atan(x) | Returns the arctangent of x. |
| [atan2](http://msdn.microsoft.com/en-us/library/bb509575(VS.85).aspx) | atan2(y, x) | Returns the arctangent of of two values (x,y). |
| [ceil](http://msdn.microsoft.com/en-us/library/bb509577(VS.85).aspx) | ceil(x) | Returns the smallest integer which is greater than or equal to x. |
| [clamp](http://msdn.microsoft.com/en-us/library/bb509578(VS.85).aspx) | clamp(x, min, max) | Clamps x to the range [min, max]. |
| [clip](http://msdn.microsoft.com/en-us/library/bb509579(VS.85).aspx) | clip(x) | Discards the current pixel, if any component of x is less than zero. |
| [cos](http://msdn.microsoft.com/en-us/library/bb509583(VS.85).aspx) | cos(x) | Returns the cosine of x. |
| [cosh](http://msdn.microsoft.com/en-us/library/bb509584(VS.85).aspx) | cosh(x) | Returns the hyperbolic cosine of x. |
| [cross](http://msdn.microsoft.com/en-us/library/bb509585(VS.85).aspx) | cross(x, y) | Returns the cross product of two 3D vectors. |
| [D3DCOLORtoUBYTE4](http://msdn.microsoft.com/en-us/library/bb509586(VS.85).aspx) | D3DCOLORtoUBYTE4(x) | Swizzles and scales components of the 4D vector x to compensate for the lack of UBYTE4 support in some hardware. |
| [ddx](http://msdn.microsoft.com/en-us/library/bb509588(VS.85).aspx) | ddx(x) | Returns the partial derivative of x with respect to the screen-space x-coordinate. |
| [ddy](http://msdn.microsoft.com/en-us/library/bb509589(VS.85).aspx) | ddy(x) | Returns the partial derivative of x with respect to the screen-space y-coordinate. |
| [degrees](http://msdn.microsoft.com/en-us/library/bb509590(VS.85).aspx) | degrees(x) | Converts x from radians to degrees. |
| [determinant](http://msdn.microsoft.com/en-us/library/bb509591(VS.85).aspx) | determinant(m) | Returns the determinant of the square matrix m. |
| [distance](http://msdn.microsoft.com/en-us/library/bb509592(VS.85).aspx) | distance(x, y) | Returns the distance between two points. |
| [dot](http://msdn.microsoft.com/en-us/library/bb509594(VS.85).aspx) | dot(x, y) | Returns the dot product of two vectors. |
| [exp](http://msdn.microsoft.com/en-us/library/bb509595(VS.85).aspx) | exp(x) | Returns the base-e exponent. |
| [exp2](http://msdn.microsoft.com/en-us/library/bb509596(VS.85).aspx) | exp2(x) | Base 2 exponent (per component). |
| [faceforward](http://msdn.microsoft.com/en-us/library/bb509598(VS.85).aspx) | faceforward(n, i, ng) | Returns -n \* sign(•(i, ng)). |
| [floor](http://msdn.microsoft.com/en-us/library/bb509599(VS.85).aspx) | floor(x) | Returns the greatest integer which is less than or equal to x. |
| [fmod](http://msdn.microsoft.com/en-us/library/bb509601(VS.85).aspx) | fmod(x, y) | Returns the floating point remainder of x/y. |
| [frac](http://msdn.microsoft.com/en-us/library/bb509603(VS.85).aspx) | frac(x) | Returns the fractional part of x. |
| [frexp](http://msdn.microsoft.com/en-us/library/bb509604(VS.85).aspx) | frexp(x, exp) | Returns the mantissa and exponent of x. |
| [fwidth](http://msdn.microsoft.com/en-us/library/bb509608(VS.85).aspx) | fwidth(x) | Returns abs(ddx(x)) + abs(ddy(x)) |
| [GetRenderTargetSampleCount](http://msdn.microsoft.com/en-us/library/bb943996(VS.85).aspx) | GetRenderTargetSampleCount() | Returns the number of render-target samples. |
| [GetRenderTargetSamplePosition](http://msdn.microsoft.com/en-us/library/bb943997(VS.85).aspx) | GetRenderTargetSamplePosition(x) | Returns a sample position (x,y) for a given sample index. |
| [isfinite](http://msdn.microsoft.com/en-us/library/bb509612(VS.85).aspx) | isfinite(x) | Returns true if x is finite, false otherwise. |
| [isinf](http://msdn.microsoft.com/en-us/library/bb509613(VS.85).aspx) | isinf(x) | Returns true if x is +INF or -INF, false otherwise. |
| [isnan](http://msdn.microsoft.com/en-us/library/bb509614(VS.85).aspx) | isnan(x) | Returns true if x is NAN or QNAN, false otherwise. |
| [ldexp](http://msdn.microsoft.com/en-us/library/bb509616(VS.85).aspx) | ldexp(x, exp) | Returns x \* 2exp |
| [length](http://msdn.microsoft.com/en-us/library/bb509617(VS.85).aspx) | length(v) | Returns the length of the vector v. |
| [lerp](http://msdn.microsoft.com/en-us/library/bb509618(VS.85).aspx) | lerp(x, y, s) | Returns x + s(y - x). |
| [lit](http://msdn.microsoft.com/en-us/library/bb509619(VS.85).aspx) | lit(n • l, n • h, m) | Returns a lighting vector (ambient, diffuse, specular, 1) |
| [log](http://msdn.microsoft.com/en-us/library/bb509620(VS.85).aspx) | log(x) | Returns the base-e logarithm of x. |
| [log10](http://msdn.microsoft.com/en-us/library/bb509621(VS.85).aspx) | log10(x) | Returns the base-10 logarithm of x. |
| [log2](http://msdn.microsoft.com/en-us/library/bb509622(VS.85).aspx) | log2(x) | Returns the base-2 logarithm of x. |
| [max](http://msdn.microsoft.com/en-us/library/bb509624(VS.85).aspx) | max(x, y) | Selects the greater of x and y. |
| [min](http://msdn.microsoft.com/en-us/library/bb509625(VS.85).aspx) | min(x, y) | Selects the lesser of x and y. |
| [modf](http://msdn.microsoft.com/en-us/library/bb509627(VS.85).aspx) | modf(x, out ip) | Splits the value x into fractional and integer parts. |
| [mul](http://msdn.microsoft.com/en-us/library/bb509628(VS.85).aspx) | mul(x, y) | Performs matrix multiplication using x and y. |
| [noise](http://msdn.microsoft.com/en-us/library/bb509629(VS.85).aspx) | noise(x) | Generates a random value using the Perlin-noise algorithm. |
| [normalize](http://msdn.microsoft.com/en-us/library/bb509630(VS.85).aspx) | normalize(x) | Returns a normalized vector. |
| [pow](http://msdn.microsoft.com/en-us/library/bb509636(VS.85).aspx) | pow(x, y) | Returns xy. |
| [radians](http://msdn.microsoft.com/en-us/library/bb509637(VS.85).aspx) | radians(x) | Converts x from degrees to radians. |
| [reflect](http://msdn.microsoft.com/en-us/library/bb509639(VS.85).aspx) | reflect(i, n) | Returns a reflection vector. |
| [refract](http://msdn.microsoft.com/en-us/library/bb509640(VS.85).aspx) | refract(i, n, R) | Returns the refraction vector. |
| [round](http://msdn.microsoft.com/en-us/library/bb509642(VS.85).aspx) | round(x) | Rounds x to the nearest integer |
| [rsqrt](http://msdn.microsoft.com/en-us/library/bb509643(VS.85).aspx) | rsqrt(x) | Returns 1 / sqrt(x) |
| [saturate](http://msdn.microsoft.com/en-us/library/bb509645(VS.85).aspx) | saturate(x) | Clamps x to the range [0, 1] |
| [sign](http://msdn.microsoft.com/en-us/library/bb509649(VS.85).aspx) | sign(x) | Computes the sign of x. |
| [sin](http://msdn.microsoft.com/en-us/library/bb509651(VS.85).aspx) | sin(x) | Returns the sine of x |
| [sincos](http://msdn.microsoft.com/en-us/library/bb509652(VS.85).aspx) | sincos(x, out s, out c) | Returns the sine and cosine of x. |
| [sinh](http://msdn.microsoft.com/en-us/library/bb509653(VS.85).aspx) | sinh(x) | Returns the hyperbolic sine of x |
| [smoothstep](http://msdn.microsoft.com/en-us/library/bb509658(VS.85).aspx) | smoothstep(min, max, x) | Returns a smooth Hermite interpolation between 0 and 1. |
| [sqrt](http://msdn.microsoft.com/en-us/library/bb509662(VS.85).aspx) | sqrt(x) | Square root (per component) |
| [step](http://msdn.microsoft.com/en-us/library/bb509665(VS.85).aspx) | step(a, x) | Returns (x >= a) ? 1 : 0 |
| [tan](http://msdn.microsoft.com/en-us/library/bb509670(VS.85).aspx) | tan(x) | Returns the tangent of x |
| [tanh](http://msdn.microsoft.com/en-us/library/bb509671(VS.85).aspx) | tanh(x) | Returns the hyperbolic tangent of x |
| [tex1D](http://msdn.microsoft.com/en-us/library/bb509672(VS.85).aspx) | tex1D(s, t) | 1D texture lookup. |
| [tex1Dbias](http://msdn.microsoft.com/en-us/library/bb509673(VS.85).aspx) | tex1Dbias(s, t) | 1D texture lookup with bias. |
| [tex1Dgrad](http://msdn.microsoft.com/en-us/library/bb509674(VS.85).aspx) | tex1Dgrad(s, t, ddx, ddy) | 1D texture lookup with a gradient. |
| [tex1Dlod](http://msdn.microsoft.com/en-us/library/bb509675(VS.85).aspx) | tex1Dlod(s, t) | 1D texture lookup with LOD. |
| [tex1Dproj](http://msdn.microsoft.com/en-us/library/bb509676(VS.85).aspx) | tex1Dproj(s, t) | 1D texture lookup with projective divide. |
| [tex2D](http://msdn.microsoft.com/en-us/library/bb509677(VS.85).aspx) | tex2D(s, t) | 2D texture lookup. |
| [tex2Dbias](http://msdn.microsoft.com/en-us/library/bb509678(VS.85).aspx) | tex2Dbias(s, t) | 2D texture lookup with bias. |
| [tex2Dgrad](http://msdn.microsoft.com/en-us/library/bb509679(VS.85).aspx) | tex2Dgrad(s, t, ddx, ddy) | 2D texture lookup with a gradient. |
| [tex2Dlod](http://msdn.microsoft.com/en-us/library/bb509680(VS.85).aspx) | tex2Dlod(s, t) | 2D texture lookup with LOD. |
| [tex2Dproj](http://msdn.microsoft.com/en-us/library/bb509681(VS.85).aspx) | tex2Dproj(s, t) | 2D texture lookup with projective divide. |
| [tex3D](http://msdn.microsoft.com/en-us/library/bb509682(VS.85).aspx) | tex3D(s, t) | 3D texture lookup. |
| [tex3Dbias](http://msdn.microsoft.com/en-us/library/bb509683(VS.85).aspx) | tex3Dbias(s, t) | 3D texture lookup with bias. |
| [tex3Dgrad](http://msdn.microsoft.com/en-us/library/bb509684(VS.85).aspx) | tex3Dgrad(s, t, ddx, ddy) | 3D texture lookup with a gradient. |
| [tex3Dlod](http://msdn.microsoft.com/en-us/library/bb509685(VS.85).aspx) | tex3Dlod(s, t) | 3D texture lookup with LOD. |
| [tex3Dproj](http://msdn.microsoft.com/en-us/library/bb509686(VS.85).aspx) | tex3Dproj(s, t) | 3D texture lookup with projective divide. |
| [texCUBE](http://msdn.microsoft.com/en-us/library/bb509687(VS.85).aspx) | texCUBE(s, t) | Cube texture lookup. |
| [texCUBEbias](http://msdn.microsoft.com/en-us/library/bb509688(VS.85).aspx) | texCUBEbias(s, t) | Cube texture lookup with bias. |
| [texCUBEgrad](http://msdn.microsoft.com/en-us/library/bb509689(VS.85).aspx) | texCUBEgrad(s, t, ddx, ddy) | Cube texture lookup with a gradient. |
| [texCUBElod](http://msdn.microsoft.com/en-us/library/bb509690(VS.85).aspx) | tex3Dlod(s, t) | Cube texture lookup with LOD. |
| [texCUBEproj](http://msdn.microsoft.com/en-us/library/bb509691(VS.85).aspx) | texCUBEproj(s, t) | Cube texture lookup with projective divide. |
| [transpose](http://msdn.microsoft.com/en-us/library/bb509701(VS.85).aspx) | transpose(m) | Returns the transpose of the matrix m. |
| [trunc](http://msdn.microsoft.com/en-us/library/cc308065(VS.85).aspx) | trunc(x) | Truncates floating-point value(s) to integer value(s) |

表 3-1 HLSL内置函数

|  |
| --- |
| 函数名            用法 |

abs                         计算输入值的绝对值。

acos                        返回输入值反余弦值。

all                           测试非0值。

any                         测试输入值中的任何非零值。

asin                         返回输入值的反正弦值。

atan                        返回输入值的反正切值。

atan2                       返回y/x的反正切值。

ceil                         返回大于或等于输入值的最小整数。

clamp                      把输入值限制在[min, max]范围内。

clip                         如果输入向量中的任何元素小于0，则丢弃当前像素。

cos                         返回输入值的余弦。

cosh                       返回输入值的双曲余弦。

cross                      返回两个3D向量的叉积。

ddx                         返回关于屏幕坐标x轴的偏导数。

ddy                         返回关于屏幕坐标y轴的偏导数。

degrees                   弧度到角度的转换

determinant              返回输入矩阵的值。

distance                   返回两个输入点间的距离。

dot                          返回两个向量的点积。

exp                         返回以e为底数，输入值为指数的指数函数值。

exp2                       返回以2为底数，输入值为指数的指数函数值。

faceforward             检测多边形是否位于正面。

floor                       返回小于等于x的最大整数。

fmod                       返回a / b的浮点余数。

frac                        返回输入值的小数部分。

frexp                       返回输入值的尾数和指数

fwidth                     返回 abs ( ddx (x) + abs ( ddy(x))。

isfinite                     如果输入值为有限值则返回true，否则返回false。

isinf                        如何输入值为无限的则返回true。

isnan                       如果输入值为NAN或QNAN则返回true。

ldexp                       frexp的逆运算，返回 x \* 2 ^ exp。

len / lenth                返回输入向量的长度。

lerp                         对输入值进行插值计算。

lit                            返回光照向量（环境光，漫反射光，镜面高光，1）。

log                          返回以e为底的对数。

log10                      返回以10为底的对数。

log2                        返回以2为底的对数。

max                        返回两个输入值中较大的一个。

min                         返回两个输入值中较小的一个。

modf                       把输入值分解为整数和小数部分。

mul                         返回输入矩阵相乘的积。

normalize                 返回规范化的向量，定义为 x / length(x)。

pow                        返回输入值的指定次幂。

radians                    角度到弧度的转换。

reflect                     返回入射光线i对表面法线n的反射光线。

refract                     返回在入射光线i，表面法线n，折射率为eta下的折射光线v。

round                      返回最接近于输入值的整数。

rsqrt                       返回输入值平方根的倒数。

saturate                   把输入值限制到[0, 1]之间。

sign                        计算输入值的符号。

sin                          计算输入值的正弦值。

sincos                     返回输入值的正弦和余弦值。

sinh                        返回x的双曲正弦。

smoothstep              返回一个在输入值之间平稳变化的插值。

sqrt                         返回输入值的平方根。

step                        返回（x >= a）? 1 : 0。

tan                          返回输入值的正切值。

fanh                        返回输入值的双曲线切线。

transpose                 返回输入矩阵的转置。

tex1D\*                    1D纹理查询。

tex2D\*                    2D纹理查询。

tex3D\*                    3D纹理查询。

texCUBE\*                立方纹理查询。

# Intrinsic Functions (DirectX HLSL)

The following table lists the intrinsic functions available in HLSL. Each function has a brief description, and a link to a reference page that has more detail about the input argument and return type.

|  |  |  |
| --- | --- | --- |
| **Name** | **Description** | **Minimum shader model** |
| [abs](http://preview.library.microsoft.com/en-us/library/bb509562(v=vs.85).aspx) | Absolute value (per component). | 11 |
| [acos](http://preview.library.microsoft.com/en-us/library/bb509563(v=vs.85).aspx) | Returns the arccosine of each component of x. | 11 |
| [all](http://preview.library.microsoft.com/en-us/library/bb509564(v=vs.85).aspx) | Test if all components of x are nonzero. | 11 |
| [AllMemoryBarrier](http://preview.library.microsoft.com/en-us/library/ff471350(v=vs.85).aspx) | Blocks execution of all threads in a group until all memory accesses have been completed. | 5 |
| [AllMemoryBarrierWithGroupSync](http://preview.library.microsoft.com/en-us/library/ff471351(v=vs.85).aspx) | Blocks execution of all threads in a group until all memory accesses have been completed and all threads in the group have reached this call. | 5 |
| [any](http://preview.library.microsoft.com/en-us/library/bb509565(v=vs.85).aspx) | Test if any component of x is nonzero. | 11 |
| [asdouble](http://preview.library.microsoft.com/en-us/library/dd607357(v=vs.85).aspx) | Reinterprets a cast value into a double. | 5 |
| [asfloat](http://preview.library.microsoft.com/en-us/library/bb509570(v=vs.85).aspx) | Convert the input type to a float. | 4 |
| [asin](http://preview.library.microsoft.com/en-us/library/bb509571(v=vs.85).aspx) | Returns the arcsine of each component of x. | 11 |
| [asint](http://preview.library.microsoft.com/en-us/library/bb509572(v=vs.85).aspx) | Convert the input type to an integer. | 4 |
| [asuint](http://preview.library.microsoft.com/en-us/library/ff471354(v=vs.85).aspx) | Reinterprets the bit pattern of a 64-bit type to a uint. | 5 |
| [asuint](http://preview.library.microsoft.com/en-us/library/bb509573(v=vs.85).aspx) | Convert the input type to an unsigned integer. | 4 |
| [atan](http://preview.library.microsoft.com/en-us/library/bb509574(v=vs.85).aspx) | Returns the arctangent of x. | 11 |
| [atan2](http://preview.library.microsoft.com/en-us/library/bb509575(v=vs.85).aspx) | Returns the arctangent of of two values (x,y). | 11 |
| [ceil](http://preview.library.microsoft.com/en-us/library/bb509577(v=vs.85).aspx) | Returns the smallest integer which is greater than or equal to x. | 11 |
| [clamp](http://preview.library.microsoft.com/en-us/library/bb204824(v=vs.85).aspx) | Clamps x to the range [min, max]. | 11 |
| [clip](http://preview.library.microsoft.com/en-us/library/bb204826(v=vs.85).aspx) | Discards the current pixel, if any component of x is less than zero. | 11 |
| [cos](http://preview.library.microsoft.com/en-us/library/bb509583(v=vs.85).aspx) | Returns the cosine of x. | 11 |
| [cosh](http://preview.library.microsoft.com/en-us/library/bb509584(v=vs.85).aspx) | Returns the hyperbolic cosine of x. | 11 |
| [countbits](http://preview.library.microsoft.com/en-us/library/ff471355(v=vs.85).aspx) | Counts the number of bits (per component) in the input integer. | 5 |
| [cross](http://preview.library.microsoft.com/en-us/library/bb509585(v=vs.85).aspx) | Returns the cross product of two 3D vectors. | 11 |
| [D3DCOLORtoUBYTE4](http://preview.library.microsoft.com/en-us/library/bb509586(v=vs.85).aspx) | Swizzles and scales components of the 4D vector xto compensate for the lack of UBYTE4 support in some hardware. | 11 |
| [ddx](http://preview.library.microsoft.com/en-us/library/bb509588(v=vs.85).aspx) | Returns the partial derivative of x with respect to the screen-space x-coordinate. | 21 |
| [ddx\_coarse](http://preview.library.microsoft.com/en-us/library/ff471361(v=vs.85).aspx) | Computes a low precision partial derivative with respect to the screen-space x-coordinate. | 5 |
| [ddx\_fine](http://preview.library.microsoft.com/en-us/library/ff471362(v=vs.85).aspx) | Computes a high precision partial derivative with respect to the screen-space x-coordinate. | 5 |
| [ddy](http://preview.library.microsoft.com/en-us/library/bb509589(v=vs.85).aspx) | Returns the partial derivative of x with respect to the screen-space y-coordinate. | 21 |
| [ddy\_coarse](http://preview.library.microsoft.com/en-us/library/ff471364(v=vs.85).aspx) | Computes a low precision partial derivative with respect to the screen-space y-coordinate. | 5 |
| [ddy\_fine](http://preview.library.microsoft.com/en-us/library/ff471365(v=vs.85).aspx) | Computes a high precision partial derivative with respect to the screen-space y-coordinate. | 5 |
| [degrees](http://preview.library.microsoft.com/en-us/library/bb509590(v=vs.85).aspx) | Converts x from radians to degrees. | 11 |
| [determinant](http://preview.library.microsoft.com/en-us/library/bb509591(v=vs.85).aspx) | Returns the determinant of the square matrix m. | 11 |
| [DeviceMemoryBarrier](http://preview.library.microsoft.com/en-us/library/ff471366(v=vs.85).aspx) | Blocks execution of all threads in a group until all device memory accesses have been completed. | 5 |
| [DeviceMemoryBarrierWithGroupSync](http://preview.library.microsoft.com/en-us/library/ff471367(v=vs.85).aspx) | Blocks execution of all threads in a group until all device memory accesses have been completed and all threads in the group have reached this call. | 5 |
| [distance](http://preview.library.microsoft.com/en-us/library/bb509592(v=vs.85).aspx) | Returns the distance between two points. | 11 |
| [dot](http://preview.library.microsoft.com/en-us/library/bb509594(v=vs.85).aspx) | Returns the dot product of two vectors. | 1 |
| [dst](http://preview.library.microsoft.com/en-us/library/ff471368(v=vs.85).aspx) | Calculates a distance vector. | 5 |
| [EvaluateAttributeAtCentroid](http://preview.library.microsoft.com/en-us/library/ff471394(v=vs.85).aspx) | Evaluates at the pixel centroid. | 5 |
| [EvaluateAttributeAtSample](http://preview.library.microsoft.com/en-us/library/ff471395(v=vs.85).aspx) | Evaluates at the indexed sample location. | 5 |
| [EvaluateAttributeSnapped](http://preview.library.microsoft.com/en-us/library/ff471396(v=vs.85).aspx) | Evaluates at the pixel centroid with an offset. | 5 |
| [exp](http://preview.library.microsoft.com/en-us/library/bb509595(v=vs.85).aspx) | Returns the base-e exponent. | 11 |
| [exp2](http://preview.library.microsoft.com/en-us/library/bb509596(v=vs.85).aspx) | Base 2 exponent (per component). | 11 |
| [f16tof32](http://preview.library.microsoft.com/en-us/library/ff471397(v=vs.85).aspx) | Converts the float16 stored in the low-half of the uint to a float. | 5 |
| [f32tof16](http://preview.library.microsoft.com/en-us/library/ff471399(v=vs.85).aspx) | Converts an input into a float16 type. | 5 |
| [faceforward](http://preview.library.microsoft.com/en-us/library/bb509598(v=vs.85).aspx) | Returns -n \* sign(dot(i, ng)). | 11 |
| [firstbithigh](http://preview.library.microsoft.com/en-us/library/ff471400(v=vs.85).aspx) | Gets the location of the first set bit starting from the highest order bit and working downward, per component. | 5 |
| [firstbitlow](http://preview.library.microsoft.com/en-us/library/ff471401(v=vs.85).aspx) | Returns the location of the first set bit starting from the lowest order bit and working upward, per component. | 5 |
| [floor](http://preview.library.microsoft.com/en-us/library/bb509599(v=vs.85).aspx) | Returns the greatest integer which is less than or equal to x. | 11 |
| [fmod](http://preview.library.microsoft.com/en-us/library/bb509601(v=vs.85).aspx) | Returns the floating point remainder of x/y. | 11 |
| [frac](http://preview.library.microsoft.com/en-us/library/bb509603(v=vs.85).aspx) | Returns the fractional part of x. | 11 |
| [frexp](http://preview.library.microsoft.com/en-us/library/bb509604(v=vs.85).aspx) | Returns the mantissa and exponent of x. | 21 |
| [fwidth](http://preview.library.microsoft.com/en-us/library/bb509608(v=vs.85).aspx) | Returns abs(ddx(x)) + abs(ddy(x)) | 21 |
| [GetRenderTargetSampleCount](http://preview.library.microsoft.com/en-us/library/bb943996(v=vs.85).aspx) | Returns the number of render-target samples. | 4 |
| [GetRenderTargetSamplePosition](http://preview.library.microsoft.com/en-us/library/bb943997(v=vs.85).aspx) | Returns a sample position (x,y) for a given sample index. | 4 |
| [GroupMemoryBarrier](http://preview.library.microsoft.com/en-us/library/ff471403(v=vs.85).aspx) | Blocks execution of all threads in a group until all group shared accesses have been completed. | 5 |
| [GroupMemoryBarrierWithGroupSync](http://preview.library.microsoft.com/en-us/library/ff471404(v=vs.85).aspx) | Blocks execution of all threads in a group until all group shared accesses have been completed and all threads in the group have reached this call. | 5 |
| [InterlockedAdd](http://preview.library.microsoft.com/en-us/library/ff471406(v=vs.85).aspx) | Performs a guaranteed atomic add of value to the dest resource variable. | 5 |
| [InterlockedAnd](http://preview.library.microsoft.com/en-us/library/ff471407(v=vs.85).aspx) | Performs a guaranteed atomic and. | 5 |
| [InterlockedCompareExchange](http://preview.library.microsoft.com/en-us/library/ff471409(v=vs.85).aspx) | Atomically compares the input to the comparison value and exchanges the result. | 5 |
| [InterlockedCompareStore](http://preview.library.microsoft.com/en-us/library/ff471410(v=vs.85).aspx) | Atomically compares the input to the comparison value. | 5 |
| [InterlockedExchange](http://preview.library.microsoft.com/en-us/library/ff471411(v=vs.85).aspx) | Assigns value to dest and returns the original value. | 5 |
| [InterlockedMax](http://preview.library.microsoft.com/en-us/library/ff471412(v=vs.85).aspx) | Performs a guaranteed atomic max. | 5 |
| [InterlockedMin](http://preview.library.microsoft.com/en-us/library/ff471413(v=vs.85).aspx) | Performs a guaranteed atomic min. | 5 |
| [InterlockedOr](http://preview.library.microsoft.com/en-us/library/ff471414(v=vs.85).aspx) | Performs a guaranteed atomic or. | 5 |
| [InterlockedXor](http://preview.library.microsoft.com/en-us/library/ff471415(v=vs.85).aspx) | Performs a guaranteed atomic xor. | 5 |
| [isfinite](http://preview.library.microsoft.com/en-us/library/bb509612(v=vs.85).aspx) | Returns true if x is finite, false otherwise. | 11 |
| [isinf](http://preview.library.microsoft.com/en-us/library/bb509613(v=vs.85).aspx) | Returns true if x is +INF or -INF, false otherwise. | 11 |
| [isnan](http://preview.library.microsoft.com/en-us/library/bb509614(v=vs.85).aspx) | Returns true if x is NAN or QNAN, false otherwise. | 11 |
| [ldexp](http://preview.library.microsoft.com/en-us/library/bb509616(v=vs.85).aspx) | Returns x \* 2exp | 11 |
| [length](http://preview.library.microsoft.com/en-us/library/bb509617(v=vs.85).aspx) | Returns the length of the vector v. | 11 |
| [lerp](http://preview.library.microsoft.com/en-us/library/bb509618(v=vs.85).aspx) | Returns x + s(y - x). | 11 |
| [lit](http://preview.library.microsoft.com/en-us/library/bb509619(v=vs.85).aspx) | Returns a lighting vector (ambient, diffuse, specular, 1) | 11 |
| [log](http://preview.library.microsoft.com/en-us/library/bb509620(v=vs.85).aspx) | Returns the base-e logarithm of x. | 11 |
| [log10](http://preview.library.microsoft.com/en-us/library/bb509621(v=vs.85).aspx) | Returns the base-10 logarithm of x. | 11 |
| [log2](http://preview.library.microsoft.com/en-us/library/bb509622(v=vs.85).aspx) | Returns the base-2 logarithm of x. | 11 |
| [mad](http://preview.library.microsoft.com/en-us/library/ff471418(v=vs.85).aspx) | Performs an arithmetic multiply/add operation on three values. | 5 |
| [max](http://preview.library.microsoft.com/en-us/library/bb509624(v=vs.85).aspx) | Selects the greater of x and y. | 11 |
| [min](http://preview.library.microsoft.com/en-us/library/bb509625(v=vs.85).aspx) | Selects the lesser of x and y. | 11 |
| [modf](http://preview.library.microsoft.com/en-us/library/bb509627(v=vs.85).aspx) | Splits the value x into fractional and integer parts. | 11 |
| [mul](http://preview.library.microsoft.com/en-us/library/bb509628(v=vs.85).aspx) | Performs matrix multiplication using x and y. | 1 |
| [noise](http://preview.library.microsoft.com/en-us/library/bb509629(v=vs.85).aspx) | Generates a random value using the Perlin-noise algorithm. | 11 |
| [normalize](http://preview.library.microsoft.com/en-us/library/bb509630(v=vs.85).aspx) | Returns a normalized vector. | 11 |
| [pow](http://preview.library.microsoft.com/en-us/library/bb509636(v=vs.85).aspx) | Returns xy. | 11 |
| [Process2DQuadTessFactorsAvg](http://preview.library.microsoft.com/en-us/library/ff471426(v=vs.85).aspx) | Generates the corrected tessellation factors for a quad patch. | 5 |
| [Process2DQuadTessFactorsMax](http://preview.library.microsoft.com/en-us/library/ff471427(v=vs.85).aspx) | Generates the corrected tessellation factors for a quad patch. | 5 |
| [Process2DQuadTessFactorsMin](http://preview.library.microsoft.com/en-us/library/ff471428(v=vs.85).aspx) | Generates the corrected tessellation factors for a quad patch. | 5 |
| [ProcessIsolineTessFactors](http://preview.library.microsoft.com/en-us/library/ff471429(v=vs.85).aspx) | Generates the rounded tessellation factors for an isoline. | 5 |
| [ProcessQuadTessFactorsAvg](http://preview.library.microsoft.com/en-us/library/ff471430(v=vs.85).aspx) | Generates the corrected tessellation factors for a quad patch. | 5 |
| [ProcessQuadTessFactorsMax](http://preview.library.microsoft.com/en-us/library/ff471431(v=vs.85).aspx) | Generates the corrected tessellation factors for a quad patch. | 5 |
| [ProcessQuadTessFactorsMin](http://preview.library.microsoft.com/en-us/library/ff471432(v=vs.85).aspx) | Generates the corrected tessellation factors for a quad patch. | 5 |
| [ProcessTriTessFactorsAvg](http://preview.library.microsoft.com/en-us/library/ff471433(v=vs.85).aspx) | Generates the corrected tessellation factors for a tri patch. | 5 |
| [ProcessTriTessFactorsMax](http://preview.library.microsoft.com/en-us/library/ff471434(v=vs.85).aspx) | Generates the corrected tessellation factors for a tri patch. | 5 |
| [ProcessTriTessFactorsMin](http://preview.library.microsoft.com/en-us/library/ff471435(v=vs.85).aspx) | Generates the corrected tessellation factors for a tri patch. | 5 |
| [radians](http://preview.library.microsoft.com/en-us/library/bb509637(v=vs.85).aspx) | Converts x from degrees to radians. | 1 |
| [rcp](http://preview.library.microsoft.com/en-us/library/ff471436(v=vs.85).aspx) | Calculates a fast, approximate, per-component reciprocal. | 5 |
| [reflect](http://preview.library.microsoft.com/en-us/library/bb509639(v=vs.85).aspx) | Returns a reflection vector. | 1 |
| [refract](http://preview.library.microsoft.com/en-us/library/bb509640(v=vs.85).aspx) | Returns the refraction vector. | 11 |
| [reversebits](http://preview.library.microsoft.com/en-us/library/ff471437(v=vs.85).aspx) | Reverses the order of the bits, per component. | 5 |
| [round](http://preview.library.microsoft.com/en-us/library/bb509642(v=vs.85).aspx) | Rounds x to the nearest integer | 11 |
| [rsqrt](http://preview.library.microsoft.com/en-us/library/bb509643(v=vs.85).aspx) | Returns 1 / sqrt(x) | 11 |
| [saturate](http://preview.library.microsoft.com/en-us/library/bb509645(v=vs.85).aspx) | Clamps x to the range [0, 1] | 1 |
| [sign](http://preview.library.microsoft.com/en-us/library/bb509649(v=vs.85).aspx) | Computes the sign of x. | 11 |
| [sin](http://preview.library.microsoft.com/en-us/library/bb509651(v=vs.85).aspx) | Returns the sine of x | 11 |
| [sincos](http://preview.library.microsoft.com/en-us/library/bb509652(v=vs.85).aspx) | Returns the sine and cosine of x. | 11 |
| [sinh](http://preview.library.microsoft.com/en-us/library/bb509653(v=vs.85).aspx) | Returns the hyperbolic sine of x | 11 |
| [smoothstep](http://preview.library.microsoft.com/en-us/library/bb509658(v=vs.85).aspx) | Returns a smooth Hermite interpolation between 0 and 1. | 11 |
| [sqrt](http://preview.library.microsoft.com/en-us/library/bb509662(v=vs.85).aspx) | Square root (per component) | 11 |
| [step](http://preview.library.microsoft.com/en-us/library/bb509665(v=vs.85).aspx) | Returns (x >= a) ? 1 : 0 | 11 |
| [tan](http://preview.library.microsoft.com/en-us/library/bb509670(v=vs.85).aspx) | Returns the tangent of x | 11 |
| [tanh](http://preview.library.microsoft.com/en-us/library/bb509671(v=vs.85).aspx) | Returns the hyperbolic tangent of x | 11 |
| [tex1D(s, t)](http://preview.library.microsoft.com/en-us/library/bb509672(v=vs.85).aspx) | 1D texture lookup. | 1 |
| [tex1D(s, t, ddx, ddy)](http://preview.library.microsoft.com/en-us/library/ff471388(v=vs.85).aspx) | 1D texture lookup. | 21 |
| [tex1Dbias](http://preview.library.microsoft.com/en-us/library/bb509673(v=vs.85).aspx) | 1D texture lookup with bias. | 21 |
| [tex1Dgrad](http://preview.library.microsoft.com/en-us/library/bb509674(v=vs.85).aspx) | 1D texture lookup with a gradient. | 21 |
| [tex1Dlod](http://preview.library.microsoft.com/en-us/library/bb509675(v=vs.85).aspx) | 1D texture lookup with LOD. | 31 |
| [tex1Dproj](http://preview.library.microsoft.com/en-us/library/bb509676(v=vs.85).aspx) | 1D texture lookup with projective divide. | 21 |
| [tex2D(s, t)](http://preview.library.microsoft.com/en-us/library/bb509677(v=vs.85).aspx) | 2D texture lookup. | 11 |
| [tex2D(s, t, ddx, ddy)](http://preview.library.microsoft.com/en-us/library/ff471389(v=vs.85).aspx) | 2D texture lookup. | 21 |
| [tex2Dbias](http://preview.library.microsoft.com/en-us/library/bb509678(v=vs.85).aspx) | 2D texture lookup with bias. | 21 |
| [tex2Dgrad](http://preview.library.microsoft.com/en-us/library/bb509679(v=vs.85).aspx) | 2D texture lookup with a gradient. | 21 |
| [tex2Dlod](http://preview.library.microsoft.com/en-us/library/bb509680(v=vs.85).aspx) | 2D texture lookup with LOD. | 3 |
| [tex2Dproj](http://preview.library.microsoft.com/en-us/library/bb509681(v=vs.85).aspx) | 2D texture lookup with projective divide. | 21 |
| [tex3D(s, t)](http://preview.library.microsoft.com/en-us/library/bb509682(v=vs.85).aspx) | 3D texture lookup. | 11 |
| [tex3D(s, t, ddx, ddy)](http://preview.library.microsoft.com/en-us/library/ff471391(v=vs.85).aspx) | 3D texture lookup. | 21 |
| [tex3Dbias](http://preview.library.microsoft.com/en-us/library/bb509683(v=vs.85).aspx) | 3D texture lookup with bias. | 21 |
| [tex3Dgrad](http://preview.library.microsoft.com/en-us/library/bb509684(v=vs.85).aspx) | 3D texture lookup with a gradient. | 21 |
| [tex3Dlod](http://preview.library.microsoft.com/en-us/library/bb509685(v=vs.85).aspx) | 3D texture lookup with LOD. | 31 |
| [tex3Dproj](http://preview.library.microsoft.com/en-us/library/bb509686(v=vs.85).aspx) | 3D texture lookup with projective divide. | 21 |
| [texCUBE(s, t)](http://preview.library.microsoft.com/en-us/library/bb509687(v=vs.85).aspx) | Cube texture lookup. | 11 |
| [texCUBE(s, t, ddx, ddy)](http://preview.library.microsoft.com/en-us/library/ff471392(v=vs.85).aspx) | Cube texture lookup. | 21 |
| [texCUBEbias](http://preview.library.microsoft.com/en-us/library/bb509688(v=vs.85).aspx) | Cube texture lookup with bias. | 21 |
| [texCUBEgrad](http://preview.library.microsoft.com/en-us/library/bb509689(v=vs.85).aspx) | Cube texture lookup with a gradient. | 21 |
| [texCUBElod](http://preview.library.microsoft.com/en-us/library/bb509690(v=vs.85).aspx) | Cube texture lookup with LOD. | 31 |
| [texCUBEproj](http://preview.library.microsoft.com/en-us/library/bb509691(v=vs.85).aspx) | Cube texture lookup with projective divide. | 21 |
| [transpose](http://preview.library.microsoft.com/en-us/library/bb509701(v=vs.85).aspx) | Returns the transpose of the matrix m. | 1 |
| [trunc](http://preview.library.microsoft.com/en-us/library/cc308065(v=vs.85).aspx) | Truncates floating-point value(s) to integer value(s) | 1 |

1 see reference page for restrictions.