

This help only covers the parts of GLSL ES that are relevant for Shadertoy. For the complete specification please have a look at [GLSL ES specification](#)

Language:

- **Version:** WebGL 2.0
- **Arithmetic:** () + - ! * / %
- **Logical/Relational:** ~ < > <= >= == != && ||
- **Bit Operators:** & ^ | << >>
- **Comments:** // /* */
- **Types:** void bool int uint float vec2 vec3 vec4 bvec2 bvec3 bvec4 ivec2 ivec3 ivec4 uvec2 uvec3 uvec4 mat2 mat3 mat4 mat?x? sampler2D, sampler3D, samplerCube
- **Format:** float a = 1.0; int b = 1; uint i = 1U; int i = 0x1;
- **Function Parameter Qualifiers:** [none], in, out, inout
- **Global Variable Qualifiers:** const
- **Vector Components:** .xyzw .rgba .stpq
- **Flow Control:** if else for return break continue switch/case
- **Output:** vec4 fragColor
- **Input:** vec2 fragCoord
- **Preprocessor:** # #define #undef #if #ifdef #ifndef #else #elif #endif #error #pragma #line

Built-in Functions:

- | | |
|-------------------------------|------------------------------------------------------------------------------------|
| • type radians (type degrees) | • vec4 texture(sampler? , vec? coord [, float bias]) |
| • type degrees (type radians) | • vec4 textureLod(sampler, vec? coord, float lod) |
| • type sin (type angle) | • vec4 textureLodOffset(sampler? sampler, vec? coord, float lod, ivec? offset) |
| • type cos (type angle) | • vec4 textureGrad(sampler? , vec? coord, vec2 dPdx, vec2 dPdy) |
| • type tan (type angle) | • vec4 textureGradOffset sampler? , vec? coord, vec? dPdx, vec? dPdy, vec? offset) |
| • type asin (type x) | • vec4 textureProj(sampler? , vec? coord [, float bias]) |
| • type acos (type x) | • vec4 textureProjLod(sampler? , vec? coord, float lod) |
| • type atan (type y, type x) | • vec4 textureProjLodOffset(sampler? , vec? coord, float lod, vec? offset) |
| • type atan (type y_over_x) | • vec4 textureProjGrad(sampler? , vec? coord, vec2 dPdx, vec2 dPdy) |

- type sinh (type x)
 - type cosh (type x)
 - type tanh (type x)
 - type asinh (type x)
 - type acosh (type x)
 - type atanh (type x)
-
- type pow (type x, type y)
 - type exp (type x)
 - type log (type x)
 - type exp2 (type x)
 - type log2 (type x)
 - type sqrt (type x)
 - type inversesqrt (type x)
-
- type abs (type x)
 - type sign (type x)
 - type floor (type x)
 - type ceil (type x)
 - type trunc (type x)
 - type fract (type x)
 - type mod (type x, float y)
 - type modf (type x, out type i)
 - type min (type x, type y)
 - type max (type x, type y)
 - type clamp (type x, type minV, type maxV)
 - type mix (type x, type y, type a)
 - type step (type edge, type x)
 - type smoothstep (type a, type b, type x)
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- float length (type x)
 - float distance (type p0, type p1)
 - float dot (type x, type y)
 - vec3 cross (vec3 x, vec3 y)
 - type normalize (type x)
 - type faceforward (type N, type I, type Nref)
 - type reflect (type I, type N)
 - type refract (type I, type N, float eta)
-
- vec4 texelFetch(sampler? , ivec? coord, int lod)
 - vec4 texelFetchOffset(sampler?, ivec? coord, int lod, ivec? offset)
 - vec? textureSize(sampler? , int lod)
-
- type dFdx (type x)
 - type dFdy (type x)
 - type fwidth (type p)
-
- type isnan (type x)
 - type isinf (type x)
 - float intBitsToFloat (int v)
 - uint uintBitsToFloat (uint v)
 - int floatBitsToInt (float v)
 - uint floatBitsToUint (float v)
 - uint packSnorm2x16 (vec2 v)
 - uint packUnorm2x16 (vec2 v)
 - vec2 unpackSnorm2x16 (uint p)
 - vec2 unpackUnorm2x16 (uint p)
-
- bvec lessThan (type x, type y)
 - bvec lessThanEqual (type x, type y)
 - bvec greaterThan (type x, type y)
 - bvec greaterThanEqual (type x, type y)
 - bvec equal (type x, type y)
 - bvec notEqual (type x, type y)
 - bool any (bvec x)
 - bool all (bvec x)
 - bvec not (bvec x)

- float determinant(mat? m)
- mat?x? outerProduct(vec? c, vec? r)
- type matrixCompMult (type x, type y)
- type inverse (type inverse)
- type transpose (type inverse)

How-to

- **Use structs:** struct myDataType { float occlusion; vec3 color; }; myDataType myData = myDataType(0.7, vec3(1.0, 2.0, 3.0));
- **Initialize arrays:** float[] x = float[] (0.0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6);
- **Do conversions:** int a = 3; float b = float(a);
- **Do component swizzling:** vec4 a = vec4(1.0,2.0,3.0,4.0); vec4 b = a.zyyw;
- **Access matrix components:** mat4 m; m[1] = vec4(2.0); m[0][0] = 1.0; m[2][3] = 2.0;

Be careful!

- **the *f* suffix for floating point numbers:** 1.0f is illegal in GLSL. You must use 1.0
- **saturate():** saturate(x) doesn't exist in GLSL. Use clamp(x,0.0,1.0) instead
- **pow/sqrt:** please don't feed sqrt() and pow() with negative numbers. Add an abs() or max(0.0,) to the argument
- **mod:** please don't do mod(x,0.0). This is undefined in some platforms
- **variables:** initialize your variables! Don't assume they'll be set to zero by default
- **functions:** don't call your functions the same as some of your variables

Shadertoy Inputs

vec3	iResolution	image/buffer	The viewport resolution (z is pixel aspect ratio, usually 1.0)
float	iTime	image/sound/buffer	Current time in seconds
float	iTimeDelta	image/buffer	Time it takes to render a frame, in seconds
int	iFrame	image/buffer	Current frame
float	iFrameRate	image/buffer	Number of frames rendered per second
float	iChannelTime[4]	image/buffer	Time for channel (if video or sound), in seconds
vec3	iChannelResolution[4]	image/buffer/sound	Input texture resolution for each channel
vec4	iMouse	image/buffer	xy = current pixel coords (if LMB is down). zw = click pixel
sampler2D	iChannel{i}	image/buffer/sound	Sampler for input textures i
vec4	iDate	image/buffer/sound	Year, month, day, time in seconds in .xyzw
float	iSampleRate	image/buffer/sound	The sound sample rate (typically 44100)

Shadertoy Outputs

Image shaders: fragColor is used as output channel. It is not, for now, mandatory but recommended to leave the alpha channel to 1.0.

Sound shaders: the mainSound() function returns a vec2 containing the left and right (stereo) sound channel wave data.