

Metal Feature Set Tables



Feature Availability

This table lists the availability of major Metal features.

¹ See [About Argument Buffers](#) for more information about argument buffer tiers, limits, and capabilities.

¹¹ Not all macOS Family TV3 devices support raster order groups. You query `MTLDevice.rasterOrderGroupsSupported` at runtime to check.

Implementation Limits

This table lists the implementation limits in Metal.

OS	iOS 8	iOS 8	iOS 9	iOS 9	iOS 9	iOS 10	iOS 10	iOS 11	iOS 11	iOS 11	iOS 12	iOS 12	iOS 12	iOS 12	tvOS 9	tvOS 10	tvOS 11	tvOS 11	tvOS 12	tvOS 12	macOS 10.11	macOS 10.12	macOS 10.13	macOS 10.14	
GPU Family	1	2	1	2	3	1	2	3	1	2	1	2	3	4	1	1	1	2	1	2	1	1	2	3	
Version	1	1	2	2	1	3	3	2	4	4	3	1	5	5	4	2	1	1	2	3	1	4	2	1	
Feature Set	iOS_GPUFamily1_v1	iOS_GPUFamily2_v1	iOS_GPUFamily1_v2	iOS_GPUFamily2_v2	iOS_GPUFamily1_v3	iOS_GPUFamily2_v1	iOS_GPUFamily3_v3	iOS_GPUFamily1_v4	iOS_GPUFamily2_v2	iOS_GPUFamily3_v4	iOS_GPUFamily1_v5	iOS_GPUFamily2_v3	iOS_GPUFamily4_v1	iOS_GPUFamily5_v5	iOS_GPUFamily1_v2	iOS_GPUFamily2_v1	iOS_GPUFamily1_v3	iOS_GPUFamily2_v2	iOS_GPUFamily1_v4	iOS_GPUFamily2_v1	macOS_GPUFamily1_v1	macOS_GPUFamily1_v2	macOS_GPUFamily1_v3	macOS_GPUFamily1_v4	
Function arguments																									
Maximum number of vertex attributes, per vertex descriptor	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31
Maximum number of entries in the buffer argument table, per graphics or compute function	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31
Maximum number of entries in the texture argument table, per graphics or compute function	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	128	128	128	128
Maximum number of entries in the sampler state argument table, per graphics or compute function ²	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
Maximum number of entries in the threadgroup memory argument table, per compute function	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31
Maximum number of inlined constant data buffers, per graphics or compute function	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	31	14	14	14	14
Maximum length of an inlined constant data buffer, per graphics or compute function	4 KB	4 KB	4 KB	4 KB	4 KB	4 KB	4 KB	4 KB	4 KB	4 KB	4 KB	4 KB	4 KB	4 KB	4 KB										
Maximum threads per threadgroup	512	512	512	512	512	512	512	512	512	512	1024	512	512	512	1024	512	512	512	512	512	512	1024	1024	1024	1024
Maximum total threadgroup memory allocation ³	16352 B	16352 B	16352 B	16352 B	16 KB	16352 B	16 KB	16352 B	16 KB	32 KB	16352 B	16 KB	64 KB	16352 B	16 KB	16352 B	16 KB	32 KB	32 KB	32 KB	32 KB	32 KB	32 KB	32 KB	32 KB
Maximum total tile memory allocation ⁴	Not accessible	32 KB	Not accessible	Not accessible	Not accessible	Not accessible	Not accessible	Not accessible	Not accessible	Not accessible	Not accessible	Not accessible	Not accessible	Not accessible	Not accessible	Not accessible									
Threadgroup memory length alignment	16 B	16 B	16 B	16 B	16 B	16 B	16 B	16 B	16 B	16 B	16 B	16 B	16 B	16 B	16 B										
Maximum function memory allocation for a buffer in the constant address space	No limit	No limit	No limit	No limit	No limit	No limit	No limit	No limit	No limit	No limit	No limit	64 KB	64 KB	64 KB	64 KB										
Maximum number of inputs (scalars or vectors) to a fragment function, declared with the <code>stage_in</code> qualifier ⁵	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	32	32	32	32	32
Maximum number of input components to a fragment function, declared with the <code>stage_in</code> qualifier ⁵	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	128	128	128	128	128
Maximum number of function constants	Not available	65536	65536	65536	65536	65536	65536	65536	65536	65536	65536	65536	65536	65536	65536	65536	Not available	65536	65536	65536	65536				
Maximum tessellation factor	Not available	16	Not available	Not available	16	16	Not available	Not available	16	16	64	Not available	Not available	Not available	16	Not available	64	64	64						
Maximum number of viewports and scissor rectangles, per vertex function	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	16	1	1	1	1	1	1	16	16
Maximum number of raster order groups, per fragment function	Not available	8	Not available	Not available	Not available	8	8	Not available	Not available	Not available	Not available	Not available	Not available	Not available	8	8									
Resources																									
Maximum buffer length	256 MB	≥ 256 MB ¹⁰	256 MB	256 MB	256 MB	256 MB	≥ 256 MB ¹⁰	256 MB	1 GB	1 GB	≥ 1 GB ¹⁰	≥ 1 GB ¹⁰													
Minimum buffer offset alignment	4 B	4 B	4 B	4 B	4 B	4 B	4 B	4 B	4 B	4 B	4 B	4 B	4 B	4 B	4 B	4 B	4 B	4 B	4 B	4 B	4 B	256 B	256 B	256 B	256 B
Maximum 1D texture width	4096 px	4096 px	8192 px	8192 px	16384 px	8192 px	16384 px	8192 px	16384 px	8192 px	16384 px	8192 px	16384 px	8192 px	16384 px	8192 px	16384 px	8192 px	16384 px	8192 px	16384 px	16384 px	16384 px	16384 px	16384 px
Maximum 2D texture width and height	4096 px	4096 px	8192 px	8192 px	16384 px	8192 px	16384 px	8192 px	16384 px	8192 px	16384 px	8192 px	16384 px	8192 px	16384 px	8192 px	16384 px	8192 px	16384 px	8192 px	16384 px	16384 px	16384 px	16384 px	16384 px
Maximum cube map texture width and height	4096 px	4096 px	8192 px	8192 px	16384 px	8192 px	16384 px	8192 px	16384 px	8192 px	16384 px	8192 px	16384 px	8192 px	16384 px	8192 px	16384 px	8192 px	16384 px	8192 px	16384 px	16384 px	16384 px	16384 px	16384 px
Maximum 3D texture width, height, and depth	2048 px	2048 px	2048 px	2048 px	2048 px	2048 px	2048 px	2048 px	2048 px	2048 px	2048 px	2048 px	2048 px	2048 px											
Maximum number of layers per 1D texture array, 2D texture array, or 3D texture	2048	2048	2048	2048	2048	2048	2048	2048	2048	2048	2048	2048	2048	2048	2048	2048	2048	2048	2048	2048	2048	2048	2048	2048	2048
Buffer alignment for copying an existing texture to a buffer	64 B	64 B	64 B	64 B	16 B	64 B	64 B	16 B	64 B	64 B	16 B	64 B</td													

Pixel Format Capabilities
 This table lists the capabilities of all Metal pixel formats. These capabilities are the operations that can be performed on a texture that uses a given pixel format. All graphics and compute functions can read or sample from any texture, regardless of its pixel format. Additional capabilities are defined as follows:
 • Filter—the texture can be filtered during sampling.
 • Write—the texture can be written by a function.
 • Color—the texture can be used as a color render target.
 • Blend—the texture can be blended.
 • MSAA—the texture can be used as the destination for multisample antialiasing (MSAA) data.
 • Resolve—the texture can be used as the destination for resolved MSAA data.
 • All—the texture has all the previously-listed capabilities.

	ios 8	ios 8	ios 9	ios 9	ios 9	ios 10	ios 10	ios 10	ios 11	ios 11	ios 11	ios 12	ios 12	ios 12	tvOS 9	tvOS 10	tvOS 11	tvOS 11	tvOS 12	tvOS 12	macOS 10.11	macOS 10.12	macOS 10.13	macOS 10.14	macOS 10.14			
GPU Family	1	2	1	2	3	1	2	3	1	2	3	1	2	3	1	1	1	2	1	1	1	1	1	1	2			
Version	1	1	2	2	1	3	3	2	4	4	3	1	5	5	4	2	1	1	2	1	1	2	3	4	1			
Feature Set	IOS_GPUFamily1_v1	IOS_GPUFamily2_v1	IOS_GPUFamily1_v2	IOS_GPUFamily2_v2	IOS_GPUFamily1_v1	IOS_GPUFamily2_v1	IOS_GPUFamily3_v3	IOS_GPUFamily1_v1	IOS_GPUFamily2_v4	IOS_GPUFamily3_v4	IOS_GPUFamily1_v3	IOS_GPUFamily2_v3	IOS_GPUFamily4_v5	IOS_GPUFamily5_v5	tvOS_GPUFamily1_v1	tvOS_GPUFamily2_v2	tvOS_GPUFamily3_v3	tvOS_GPUFamily4_v1	tvOS_GPUFamily5_v2	tvOS_GPUFamily6_v1	macOS_GPUFamily1_v1	macOS_GPUFamily2_v2	macOS_GPUFamily1_v2	macOS_GPUFamily2_v3	macOS_GPUFamily1_v4			
Ordinary 8-bit pixel formats																												
A8Unorm	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter	Filter																
R8Unorm	All	All	All	All	All	All	All	All	All	All	All	All																
RB8norm_sRGB	Filter	Color	MSAA	MSAA	Resolve	Blend	Filter	Color	MSAA	MSAA	Resolve	Blend	Filter	Color	MSAA	MSAA	Resolve	Blend	Filter	Color	MSAA	MSAA	Resolve	Blend	Not available	Not available	Not available	Not available
R8Snorm	Filter	Write	Color	MSAA	MSAA	Resolve	Blend	All	All	All	All	All	Filter	Write	Color	MSAA	MSAA	Resolve	Blend	All	All	All	All	All	All	All	All	All
RB8uint	Write	Color	MSAA	MSAA	MSAA	MSAA	MSAA	Write	Color	MSAA	MSAA	MSAA	Write	Color	MSAA	MSAA	MSAA	MSAA	Write	Color	MSAA	MSAA	MSAA	MSAA	Write	Color	MSAA	MSAA
RG8Sint	Write	Color	MSAA	MSAA	MSAA	MSAA	MSAA	Write	Color	MSAA	MSAA	MSAA	Write	Color	MSAA	MSAA	MSAA	MSAA	Write	Color	MSAA	MSAA	MSAA	MSAA	Write	Color	MSAA	MSAA
Ordinary 16-bit pixel formats																												
R16Unorm	Filter	Write	Color	MSAA	MSAA	Resolve	Blend	Filter	Write	Color	MSAA	MSAA	Resolve	Blend	Filter	Write	Color	MSAA	MSAA	Resolve	Blend	Filter	Write	Color	MSAA	MSAA	Resolve	Blend
R16Snorm	All	All	All	All	All	All	All	All	All	All	All	All																
R16uint	Write	Color	MSAA	MSAA	MSAA	MSAA	MSAA	Write	Color	MSAA	MSAA	MSAA	Write	Color	MSAA	MSAA	MSAA	MSAA	Write	Color	MSAA	MSAA	MSAA	MSAA	Write	Color	MSAA	MSAA
R16Sint	All	All	All	All	All	All	All	All	All	All	All	All																
R16float	All	All	All	All	All	All	All	All	All	All	All	All																
RG8Unorm_sRGB	Filter	Color	MSAA	MSAA	Resolve	Blend	All	All	All	All	All	All	Filter	Color	MSAA	MSAA	Resolve	Blend	All	All	All	All	All	Not available	Not available	Not available	Not available	
RG8Snorm	Filter	Color	MSAA	MSAA	Resolve	Blend	All	All	All	All	All	All	Filter	Color	MSAA	MSAA	Resolve	Blend	All	All	All	All	All	All	All	All	All	
RG8uint	Write	Color	MSAA	MSAA	MSAA	MSAA	MSAA	Write	Color	MSAA	MSAA	MSAA	Write	Color	MSAA	MSAA	MSAA	MSAA	Write	Color	MSAA	MSAA	MSAA	MSAA	Write	Color	MSAA	MSAA
RG8Sint	Write	Color	MSAA	MSAA	MSAA	MSAA	MSAA	Write	Color	MSAA	MSAA	MSAA	Write	Color	MSAA	MSAA	MSAA	MSAA	Write	Color	MSAA	MSAA	MSAA	MSAA	Write	Color	MSAA	MSAA
Packed 16-bit pixel formats																												
BGCR8Unorm	Filter	Color	MSAA	MSAA	Resolve	Blend	Filter	Color	MSAA	MSAA	Resolve	Blend	Filter	Color	MSAA	MSAA	Resolve	Blend	Filter	Color	MSAA	MSAA	Resolve	Blend	Not available	Not available	Not available	Not available
ABGR5Unorm	All	All	All	All	All	All	All	All	All	All	All	All																
ABGR4Unorm	All	All	All	All	All	All	All	All	All	All	All	All																
BGR5A1Unorm	All	All	All	All	All	All	All	All	All	All	All	All																
Ordinary 32-bit pixel formats																												
R32Uint	Color	Color	Write	Color	Color	Color	Write	Color	Color	Color	Color	Write	Color	Color	Color	Color	Color	Color	Color	Color	Color	Color	Color	Color	Color	Color	Color	Color
R32Sint	All	All	All	All	All	All	All	All	All	All	All	All																
R32Float	Color	MSAA	MSAA	MSAA	MSAA	MSAA	MSAA	MSAA	MSAA	MSAA	MSAA	MSAA	MSAA	MSAA														
RG16Unorm	Filter	Write	Color	MSAA	MSAA	Resolve	Blend	Filter	Write	Color	MSAA	MSAA	Resolve	Blend	Filter	Write	Color	MSAA	MSAA	Resolve	Blend	Filter	Write	Color	MSAA	MSAA	Resolve	Blend
RG16Snorm	All	All	All	All	All	All	All	All	All	All	All	All																
RG16uint	Write	Color	MSAA	MSAA	MSAA	MSAA	MSAA	Write	Color	MSAA	MSAA	MSAA	Write	Color	MSAA	MSAA	MSAA	MSAA	Write	Color	MSAA	MSAA	MSAA	MSAA	Write	Color	MSAA	MSAA
RG16Sint	All	All	All	All	All	All	All	All	All	All	All	All																
RG16float	All	All	All	All	All	All	All	All	All	All	All	All																
RGBAB8Unorm_sRGB	Filter	Color	MSAA	MSAA	Resolve	Blend	All	All	All	All	All	All	Filter	Color	MSAA	MSAA	Resolve	Blend	All	All	All	All	All	All	All	All	All	
RGBAB8Unorm	Filter	Color	MSAA	MSAA	Resolve	Blend	All	All	All	All	All	All	Filter	Color	MSAA	MSAA	Resolve	Blend	All	All	All	All	All	All	All	All	All	
RGB8Unorm	Filter	Color	MSAA	MSAA	Resolve	Blend	All	All	All	All	All	All	Filter	Color	MSAA	MSAA	Resolve	Blend	All	All	All	All	All	All	All	All	All	
RGB8Sint	Write	Color	MSAA	MSAA	MSAA	MSAA	MSAA	Write	Color	MSAA	MSAA	MSAA	Write	Color	MSAA	MSAA	MSAA	MSAA	Write</									



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1 Infinite Loop
Cupertino, CA 95014
408-996-1010

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