Microsoft® DirectX™ 3
ƒƒƒƒƒƒŠ"ƒƒƒ

—Œ‰□

,,ffffff,‹ ,,,,, •, — ,,,• ,,,,,,,, ,, •',‰Ž– –
 ,,,f f,",‹ ,,,,,,,Œ,‰‹,,,,,, ,,ffffff,'•,,,ˆ•, Microsoft Corporation, –,,,‹‰
,,,, "‹" ‹Š",,,,,•Ž •–,,,•   "',,,,,,,,,
Microsoft , ,,ffffff,‹ ,,,,, ffff fff,"‹,,,   ',"‹   • ' Œ ,,','' —
Œ,•Ž,,,,   ,,ffffff, Microsoft , –,,,‹‰,,,, "‹   • ' Œ ,,','" —Œ,‹‰,—
,,,,,,,,

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Microsoft ActiveMovie Direct3D DirectDraw DirectInput DirectPlay DirectS
ound DirectX MS-DOS Win32 Windows ,,,Windows NT, • Microsoft
Corporation,• ,,,,,', ,,,, •,,,

,,', •–,‰Ž–,ŠŽ, •,,,

9

—Œ‰□

‰□Ž

HAL
ƒ ƒƒƒƒ ƒƒƒƒƒƒƒƒ¥ƒƒƒ ƒƒƒƒŒ—
,Ž',,ƒƒƒƒ ƒƒƒ,•Œ,, ƒ ƒƒƒƒ,ƒƒƒƒ ƒƒƒƒ,ƒƒƒƒƒ,,,   ,,, ƒƒƒƒ ƒƒƒ,,—‹,
,,‹",Œ ,ƒ ƒƒƒƒ,Ž',,,,,   ,,‹",ƒƒƒƒƒƒ,ƒƒƒƒ ƒ,,

HEL
ƒ ƒƒƒƒ ƒƒƒƒ ƒƒƒ ƒƒƒ ƒ ƒƒƒƒ,ƒƒ ƒ,,,‹",ƒƒƒƒƒƒ ƒ ƒ,,,ƒƒƒƒ ƒƒƒ,'‹
,,

Z   z-buffer
ƒ ƒ ,Šƒƒƒƒ, ",Š",,ƒƒƒƒ Z', ,,ƒƒƒƒ,Z',',,ƒƒƒƒ,   ,,,

,

      attach
• ,DirectDrawSurfaceƒƒƒƒƒƒ, Zƒƒƒƒ,,,3Dƒ ƒ ƒƒƒƒƒƒ,•—
,,,,,,,• ", ',,,, ƒƒƒƒ,'•Œ",,,, ,,ƒ ƒƒƒ,,,Ž ,ƒƒƒƒ,,,,,,,,, ƒƒƒƒ ƒƒ
ƒ, ƒƒƒƒ ƒ,,,ƒ ƒƒƒ, ƒƒƒƒ ƒƒƒ,,,ƒ ƒƒƒ,,,ƒƒƒƒ,,,, ••,ƒ ƒƒƒ,ƒƒƒƒƒ ƒƒ
ƒ,,,Œ, ,,,,ƒ ƒƒƒ,",ƒƒƒ,,,,,,,,,

      alpha edge blend
ƒƒƒƒ ƒƒƒƒƒƒƒ ,,,ƒƒƒƒ ƒƒƒƒ • ,——
,,,, ƒƒƒƒ,"—"ˆ,Š,,,ƒƒƒ,   ,,,,,,, ƒƒƒƒƒƒƒ,Œ ,,,•–,,,

      alpha color component
•"–",Ž,',Š,32ƒƒƒ,   —' ,,   ƒƒƒƒ,,,
—' ,,,,ARGB ,,,,,,ƒƒƒƒ •"–" ',•‰,,,,, ˆ"",,,,, ",•—
ˆ,,,ƒƒƒƒ ƒ ƒƒƒ,ƒƒƒƒ,,,ƒƒƒƒ',,,,,•Ž,,,, ,,,

      alpha channel
ƒƒƒƒ,,, —' ,,,,ARGB ,',,,,—ˆ,,,

ƒƒ ƒ,•"–",'‹,,' ,,,"—
,,ƒƒƒƒ ƒ ƒƒƒ,Š",,, ƒƒƒƒ",,,•"–"' ,,, ƒ ƒƒƒ",•"–"'

    alpha constant
ƒ ƒƒƒ",","—,,,•"–" ƒƒƒƒ'

   penumbra
ƒƒƒƒƒƒƒƒŒ‰ Žˆ,"ˆ,•• —•,Ž,ˆ, Ž•,ˆ,‰,ƒ ƒ,,

Ž ₋• *ffffff*

ambient

*f f ,ffffff,*Œ, ˆ' *f fff,*" ,Š,,, *f f*'', ,,ŒŒ *f f,,,,, ,*",Œ",
 ,,,, *ffff,,,ff f,*ˆ',Œ,, — ,,, ,,,,f *f f,, •* ,*ffffff*ŒŒ,Œ ,,,,,

color space

 ,*fff f,,,•*Ž,,,,, ,,,,,ˆ,,*ffff,,,,,,*Ž, ,ˆ'"",*ff* ¥*ff f,fff,* RGB,YUV
,,,,,,,

color-space conversion

,,,,*ff ff f,,*',*ff ff f,* ,•Š,,‹ *fff f f,*YUV*ff* ,,*ffffff*,RG
B*ff* ,,•Š,"Œ",,,

¥ **audio stream**

 fffff,,, ,,,fffff,,,‰" ,,, *ffff f f* DirectSound, ',Š*fffff
ffff ffff,,f fff fff f,fffff,* Œ‰o,*fffff ffff ffff,* —
,, *fffff ffff ffff, ffff f ffff,f fff f f,*‹‹,,

overdraw

fff f ffff,•‰o,,,•‹‰o

overlay surface

fff ,Š'"‹Œ—
ˆ Š",,,,,*ff f •,* "' *fffff f fff,ff f •,ff ,, f f ff,* ',,,,,*fff
 f*—',*fff,,,,*'',,,,,

Z **overlay z-order**

f f ff,ffffff,,, ",Œ',, ,,,,,, *f ffff fffff ffff,*DirectDraw,,,,Ž'
,,,

¥ **off-screen surface**

fff ,Š'"‹Œ—ˆ ˆ'"", •Ž',*ffffff,ffff*"',,,*ffffff,*Š",,,,,—
,,,, ' *fffff,*Š",,,,——,,,

opcode

Ž *ffff,*'",‰o •−,*ffff* ',• •−,'‹,,——*f f*

'

camera

•Žˆ',•Œ,'‹,,,, *ff f f,*—
,,Direct3DRMFrame*ffffff ff f f, fff ff f,* ,zŽ ,,,‰oŽ*ffffff,*,,
 yŽ , •Œ,*ffffff,,*

¥ **color key**

"–Œ‰o,'"–Œ‰o,,,,—,,,, ,Ž,,' ,,,,*f ffff,ffff*‹",Ž—
,, *ff f ,,,* ',,, , ,‹Œ—
ˆ*ffff,,,,ffff*"',,, ,,,,,, ‹Œ,,,*fffff,f fff ,* ,,,

color table

n ,ff ',"— ' ,RGBŽŒ

current play position

DirectSound*ffff*", *ffff,* ,,,ˆ'

current write position

DirectSound*ffff,*', ˆ',*f f,•* ,,,,,,,,,ˆ'

quaternion

$ffff,$'‹,, $[x, y, z]$',4"–,—' ff $ffff$, 3D‰",ˆ"",——,,,,, —
$ffff$,Ž,,',,,,,,,

clipper

DirectDrawClipper$ffffff$

clip list

f fff,‰Ž—
ˆ,Ž,‹Œ,fff ,,,$fffff$ $ffff$,DirectDrawClipper$ffffff$,Œ,,,,,,,,,, $ffff$
fff, ',,,,,,,,,

group

DirectPlay$fffff$,,,, ,,,,fff,,,,,,,,,ff f,

back clipping plane

Ž ',‰ ,,ŒŠ ,, ,,,$ffffff$,$ffffff$,,,,
Ž   '•$ffff$–

,

service provider

DirectPlay,——
,, $ffff$ f' , ,$ffffff$ fff $fffff$ f ff $fffff$, fff f,'Ž ,•—
,$ffff$ fŒ—,f f,",,,, $fffff$ f ff,Š,,,,,,' , "‰
,,,f $ffff$,' "',,,,f ff $fffff$,‹‹,,,,,,,,

surface

ŽŠff f,•Ž,,fff ,,,$ffffff$ fff,Ž,, $ffff$ fff,,,,,,,
Ž • f fff $fffff$ f f fff f f ff f fff $fffff$ f fff

sound buffer

DirectSound$f$ fff f f,Š",,fff $ffff$ $ffff$,$fffff$,,$fffff$,,,, ,, $fffff$
f,,fff f,,,,

reference count

fff fff $ffffff$ fff COM $ffffff$,$ffff$ f,,,,,$ffff$ $ffffff$, ,,,,
  Ž $ffff$,1, ',,, fff $ffff$,$ffffff$,Œ,,,,,,,,,Ž $ffff$,$fffffff$,, ,, ',
  ',,,, Ž $ffff$,$ffffff$,,, Ž $ffff$,0,,,,,, $ffffff$,"Š,, ,,$ffffff$,,,,,,ff
f $ffff$,–Œ,,,

scene

‰'Š‹, ,,$ffffff$'',fff ‰Ž$ffffff$ $ffff$ Œ ff f,Š, Direct3D,, f
  f ff f,Š,,,$ffffff$,fff,Ž,
Ž f f ff f

viewing frustrum

ff f f,fff,',,'"",",",,,f f,—' Ž ',',,,$ffffff$,‰Ž ',,, "Ž"‰
,, '•$ffff$–,Œ•$ffff$–,Š,‰'",$fffff$Œ,Ž, • "‰,,,,,—•',,,

execute buffer

3Df f,‹ ,, Š',ŽŒ"•Œ, "—,, •$ffff$ Ž $ffff$,, Œ,——
fff f,',"',fff,Š,,,,, ——
fff f, fff $ffff$ f fff f , ,,fff f,' ,,f f,,   ,,,,,

stretching

ˆ,,fff,"' ,ff f,$ffff$,,,, ,,' ,' ff f,,f $ffff$,,,

static sound buffer

Š',ƒƒƒƒ,Š",,,,ƒƒƒ ƒƒƒƒ''‚ˆ",ƒƒƒƒ, ,,,,,, •—,,,

sticky focus

DirectSound,,,, ƒ ƒ   ƒƒƒƒ ƒƒƒ,"—ƒƒ ƒƒ,Ž,,,,,,,,,ƒƒƒƒ,   ,,,"—
 ,,,, DirectSoundƒƒƒƒ ƒƒƒ, ƒ ƒ ,',ƒƒƒƒ ƒƒƒ,",,,,,,,,, ƒƒƒƒ ƒƒƒƒ,
  ,',,,,,,,,

stride alignment

DirectX,, ƒƒƒƒƒ,, ,,ƒƒƒ ƒƒƒ,Ž,ƒƒƒ ƒƒƒ,,Š,ƒƒƒƒƒ,Ž, ƒƒƒƒƒ ƒƒƒƒƒƒƒ,
  ƒƒƒƒƒƒ ƒƒƒ ƒ ƒƒƒ,ƒƒƒƒƒƒ,, , —, Œ—',,,   ,,,

streaming sound buffer

',ƒƒƒƒ,   ,,,,,,,,   ,,ƒƒƒƒ ƒƒƒƒ ƒƒƒƒ ƒƒƒ, ƒ ƒƒƒ ƒ ƒ,   ,,,,"",ƒƒ
ƒƒ,ƒ ƒ,, ,,,,ƒƒƒƒ ƒƒƒ, 3•,ƒ ƒƒƒ ƒ ƒ,•Ž,,,ƒƒƒƒ,2•,ƒƒƒƒ,   ,,,,,Ž—
,,,,,,,, ƒƒƒ ƒ ƒƒƒƒ, ƒƒƒƒƒƒ ƒƒƒƒ,,,,,,, ,,ƒƒƒ,,•—,,,,

spotlight

‰o   ,Œ,•,ŒŒ ‰o ,',,,ƒƒƒƒƒƒ,,, ,,,, ‰o ,,,,,‹",   ,, '‰o,–,,• –
• ,ƒƒƒƒŒŒ,",",,, Žˆ,"ˆ,•• ˆ‰o• , Ž•,ˆ,‰o,ƒ ƒ,,,

secondary sound buffer

ƒ ƒƒƒ ƒƒƒ,,,, ƒƒƒƒ ƒƒƒ,',,   ,,,Œ ,ƒƒƒƒ,Š",,•• ƒƒƒƒ, 1‰o
,ƒƒƒƒ,,,   ,,,,, ƒ ƒ ƒƒƒƒ,,,Œ,•,   ,,,,,,,,, ,, ƒƒƒƒƒ ƒƒƒƒ, —
Œ,ƒƒƒƒ ƒƒƒƒ ƒƒƒ,,',ƒƒƒƒ,   ,,,,,‰o",,, ,,ƒƒƒƒ,   ,,,,,,,,,ƒƒƒƒ,ˆ••,Š",
,ƒƒ ,,,,–Š,Ž,,,,

session

DirectPlay, Œ,,' ,,,,ƒƒ ƒ ƒƒƒ ,ƒƒƒƒ ƒƒƒ,ƒƒƒƒƒƒ

front clipping plane

Ž ‚,'–,ŒŠ '•ƒƒƒƒ–,,,ƒƒƒ,‹,ˆ',,,ƒƒƒƒƒƒ,ƒƒƒƒƒƒ,,,, '•ƒƒƒƒ–
, ,, ƒƒ ,ƒƒ ƒƒ,'‹,,

Ž   Œ•ƒƒƒƒ–

'

vertex

3D‹Š,"

tearing

ƒƒƒ ƒ,ƒƒƒƒƒƒ ƒ ƒ,ƒƒƒƒ ƒƒƒ,ƒƒ ƒ¥ƒ ƒ,"Š,,,,,,,,‹,, •Ž,,,,,,,Œ,,Œ
,,,,ƒƒ ƒ, •,•,ƒƒ ƒ,‰o•,"Ž,•Ž,, ,,,,ƒƒ ƒ,Š,—,–, ,,

texture

Direct3D,,,, ƒƒƒƒƒ ƒƒƒƒƒƒ,"—,,, ƒƒƒƒ,‹Œ,•,,"—

texture coordinates

Šƒƒƒƒƒ,ƒƒƒƒ, ƒƒƒƒƒƒ ,Š'",,,Š˜,,,,,,Œ',, •

texture blending

ƒƒƒƒƒ, ,ƒƒƒ ,ƒ ƒƒƒ, ,', ,,,‹

texture mapping

ƒƒƒƒƒ,ƒƒƒƒƒƒ,",,,,,, ƒƒƒƒƒ,•–
ƒƒ ƒ,,ƒƒƒƒƒƒ,,,,,,   ,',,, ƒƒƒƒƒ •,ƒƒƒƒƒ ƒƒƒ,—
,,ƒƒƒƒƒ,ƒƒƒƒƒƒ,ƒ ƒƒƒ,ƒƒƒ,,,,,,,,,,

Ž   ƒƒƒƒƒ • ƒƒƒ

texel

ƒƒƒƒƒ,'ˆ,—' ƒƒƒƒƒ,ƒƒƒƒƒƒ,"—,,,,, ƒƒƒƒ,ƒƒƒ ƒ,ƒƒƒƒ,'‰ ,,,,,,,,,,, ƒƒƒƒ ƒƒƒ, ƒƒƒƒ,,,ƒƒƒƒŠ,•Š,,, Œ,,,,, ƒƒƒƒƒ ƒƒƒƒƒƒƒ,Ž— ,,,,,,,,

decal

ƒƒƒƒƒ ƒƒƒƒƒƒ,,,' ƒƒƒƒƒƒ,,,ƒƒƒƒƒ ƒƒ ƒ ƒ,ˆ',,‹Œ,ƒƒƒƒƒƒ,,,

source color key

ƒƒƒƒ"',,,,ƒƒ ,,,, ,,, ƒ ƒ ƒƒ,,,, — ,•Ž,,,,

destination color key

ƒƒƒƒ"',,,,, ',Š,,,, ƒ ƒ ƒƒ,,,,, "' ,ƒ ƒƒƒ ,•,‰,,,

'

array object

,,,,"—,,,,,,,ƒƒƒƒƒ,ƒƒ ƒ "—ƒƒƒƒƒ,,,ƒƒ ƒ'',,,Š',' ,,, "—
ƒƒƒƒƒƒ,——,,,COM,ƒƒƒ ƒƒƒƒ,, **GetElement**ƒƒƒƒ,**GetSize**ƒƒƒƒ,—
ˆ,,,,, ,,,,ƒƒƒƒ,,,,, "——',,ƒƒƒƒ "—,ƒƒƒ,Ž",,

back buffer

ƒƒƒƒƒ ƒ ƒƒƒ,Œ ,‰Žƒƒ ƒ,•Ž,,,,Š, ƒƒƒƒƒƒ,,',ƒƒ ƒ,•,,,,,,, •‰Žƒ ƒƒ ƒ

width

ƒƒƒ,Š",,,ƒƒƒƒƒƒ", ,,ƒƒƒ,Ž",,,ƒƒƒ, ",,Ž,,,,,‹— ,,‹—
,ƒƒƒ ,ƒƒƒƒƒƒ,•,,•,, ‹Œƒƒƒ,,ˆ,,ƒƒƒƒƒƒ,Ž, ,Ž",,',,,,,•—,,•'ƒƒƒ,Š,,,

parallel point

ƒƒƒƒ ƒƒƒ,ƒƒƒƒƒƒ, ,,ŒŒ,, Œ,Œ,,ƒƒƒƒ ƒƒƒƒŒŒ,ˆ',,Œ',,, ,,,, ƒƒƒƒ
ƒƒƒƒŒŒ,—',ƒƒƒƒ,,, ŒŒ,–,,,,,,,,ƒƒƒƒ,–,,,,

palette

ƒƒƒƒƒƒ,ƒƒƒƒ ƒƒƒ,Ž—,, ,ƒƒƒ DirectX,, DirectDrawPaletteƒƒƒƒƒƒ,Ž,

palette index

,'',,,,,—,,,, ƒƒƒƒ ƒ ƒƒ"—,, ƒƒƒƒƒƒ

power

' ,"Ž" , ƒƒƒƒƒ ƒƒƒƒƒ,'–",Œ',,' ,,',5,,,,‹"',ŠŠ,,, ,,ˆ ,,,,,,, ,,,,,ŠŠ ,,,

specular property

ŒŒ,"Ž,'‰
,,Œ,ƒƒƒƒƒƒ ,Œ",,,,,,•Ž,,,,,Œ',, ' ," "Ž" , ' ,,,Œ,"Ž,,,Œ',,,,,," ,,,,,,,,,,
Ž •Ž"

pan value

‰,ƒ ƒƒƒ ƒƒƒƒ,''‰— 100•,1ƒƒƒƒ'ˆ,•,,,

viewport

3Dƒ ƒ,,,,,,2Dƒƒƒƒƒ,ƒƒƒƒƒƒ,,,,,'‹,,‹Œ ,,ƒƒƒƒƒƒ,ƒƒƒƒƒƒ,,, ƒƒƒƒ ,—
ˆ,'‹,,

pick

ƒƒ ƒ ƒ,,2D •,ƒ ƒ,ƒƒƒƒƒ ƒƒƒƒƒƒ,' ,,,,

pitch

ƒƒƒ,Š",,,ƒƒƒƒƒƒ", ,, ,Ž"‚Ž, ,Ž"‚Ž,,,,,‹—
  DirectDraw,, ,,,,ƒƒƒƒƒƒ ƒƒƒ,,,,, Œƒƒƒƒ,,,"',,,,,Œ,,,,, ƒƒƒ ƒƒƒ,ƒƒƒ
•,ˆ,, —,,, ,,,,‹Œ,ƒƒƒ,, ƒƒƒƒƒƒ ƒƒƒ,ƒƒƒ,, ƒƒƒƒƒƒ•,‰
,ƒƒƒƒƒ,ˆ•,Š,,,   ,,,

Ž   •

complex surface

DirectDrawSurfaceƒƒƒƒƒƒ, ƒ ƒ ƒ ƒƒƒ,ƒƒƒƒ,,,,,,,,,,,Ž,Œ • ƒ ƒƒƒ '',
  ƒ ƒ,"Š,,,,,,,,"Š,,,,,,,,

flipping surface

ƒƒƒƒƒƒ‰",ƒƒƒ

Ž   ƒƒƒƒ

flip

ƒƒƒ ƒƒƒƒ,ƒƒƒƒ ƒƒƒƒ,ƒƒƒƒ,ŒŠ,,ƒƒƒƒ Ž ,,ƒƒƒ ƒƒƒƒ,ƒƒ ƒ,ƒƒƒƒ ƒƒƒƒ,
ŒŠ,, ,,,,,,ƒƒ ƒ,•Ž,,,

frame

ƒ ƒ ,,ƒƒƒƒƒƒ,"',Œ,,, "•Ž,˜ ƒƒƒƒƒƒ, Š˜,,Ž ƒƒ ƒ,‘,,‹Š"ŠŒ,Ž',,,,,,,,
ƒ ƒ ,"',,, ƒƒƒƒƒ ƒƒƒƒƒƒ, ,,ˆ,Œ,,ƒƒ ƒ,,Ž",, ,, "‰
,ƒƒƒ ƒƒƒ',,,,,ƒƒ ƒ,ƒƒ ƒ,,Ž",,,

front buffer

ƒƒƒƒƒƒ ƒƒ ƒ,   ,ƒƒƒƒ ',,   ‰Ž ',ƒƒƒƒƒ ƒ ƒƒƒ,Ž, ,,,,,,,, ƒƒƒƒƒ
,ƒƒƒƒƒƒ ƒƒ ƒ,,,, 3Dƒƒƒƒ,ƒƒƒƒƒ,Ž",,ƒ ƒƒƒ,,,,,, ,,   ,ƒƒƒƒƒ ƒ ƒƒƒ,,
,, •Ž,,,,, ƒƒƒƒƒƒ ƒ ƒ ƒƒ ƒ ƒƒƒ,,ƒƒƒƒ ƒƒƒƒ,•Ž,,,, ,,,',ƒƒƒƒƒ ƒ ƒ
ƒƒ,ƒ ƒ ƒƒ,,,ƒ ƒƒƒ,,,,,

Ž   ƒƒƒƒƒ ƒ ƒƒƒ

blit

ƒƒƒƒƒƒƒ"'

blend factor

ƒƒƒƒƒ ƒƒƒƒƒƒƒ,,,, Š —',,,,,,   ,,,,,Ž,Œ

blend mode

ƒƒƒƒƒ,,,,,,ƒƒƒ ,ƒ ƒƒƒ, ,   ,,,,,Œ',,ƒƒƒƒƒƒ

primary surface

ƒƒƒ   ,•Ž,,,ƒƒ ƒ,Š,,ƒƒƒ—
ˆ DirectX,, ƒƒƒƒƒ ƒ ƒƒƒ,ƒƒƒƒƒDirectDrawSurfaceƒƒƒƒƒƒ,,,,•,,,

primary sound buffer

ƒ ƒ',ƒ ƒ ,Ž,•,,,,‰,Ž,ƒƒƒƒ ˆ",,ƒƒƒƒ¥ƒƒƒƒ,,,ƒƒƒƒ,ƒƒƒƒƒ,,,,—
,,, ƒƒƒƒ ƒƒƒƒƒ,,,','"•," , ,,, ƒƒƒƒƒ,ƒƒƒƒ,,,,,,,,,

player

DirectPlayƒƒƒƒƒ,Ž‰Ž Šƒƒƒƒ, ƒƒƒƒŠ,ƒƒƒ ƒŒŠ,‰",,,ƒƒƒƒID,Š˜,,,,,

ID   player ID

DirectPlayƒƒƒƒƒ,ŠŽ‰Ž,Š˜,,,,,ƒƒ ƒ,Ž•Ž ƒƒƒƒ,   Ž,Š,",,,, ƒƒƒƒ ƒƒƒ,ƒ
ƒƒƒID,Ž—
,, ƒƒƒƒŠ,ƒƒƒ ƒ,ŒŠ,,,,,,,,, ƒƒƒ,,,,,,DPID_SYSMSGƒƒƒƒID,Š,",,,,

page flipping

Ž   ƒƒƒƒ

host
DirectPlay,,,, ID,DPID_SYSMSG,,,‰‘*ffff*   *ffff*   *fff*   *f,*   *fffff*’,,,,
,*ffff* ,’’,,,*fff*   *f,*   *fff,,,,*   —,,,

point
Œ“,,‘•Œ‹“,Œ,•,ŒŒ

emissive setting
Ž   •Ž“

emissive property
‘ ,“ ,,,,   ‘ ,Œ,•Ž,,,,,,,Ž, •Ž“ , ‘ ,Œ,”Ž,,,,,Œ’,,,,,,“ ,,,,,,,,,,
Ž   ”Ž“

normal vector
–,Œ,,’‹,, *f* *fff,,* ’,,,,‰‹,Œ

,

material
–,,,,,,Œ,”Ž,,,,Œ’,,“   ‘ ,, •Ž“   Œ,•Ž,,,,,, ,”Ž“ ,,,,,   —‘,,, ”Ž,–
,,, ‹“, ’,,,,Œ’,,,

mixing
DirectSound,,,,   ’,*ffff* *ffff,* , Œ‰
,*fffff* *ffff* *ffff,* ,,,*ffff* *ffff* *f* *ffff,f* *fff* *f* *f,* —,,   —
ŽŠ,Ž—,‘,,,, ,,,,, *fffff,,*“,*ffff,* , Œ,,,

mipmap
˜‘,,*fffff* Š*fffff,* “,*ff* *f,ffff,,,,*   ,’‰‘“,,,,,,,, ‰Ž*ffffff,*Š‘Ž,‹,,,,
,,,, ‰‘“*ff* *f,*—,,, *ffffff,*‰,,, ,,, ,,,, ,,,,,, ,,’‰‘“,*ff* *f,*—,,,,

umbra
fffffff,‰   ,Œ, ’‰,–,,•• *ffff*ŒŒ,“,“ ,,,,,,,,
Ž   ^‰• *fffffff*

mesh
’ ,*ffff,*•Œ,,,–,*fff*

face
ffff’,,,,,*ffff*

X   **Mode X**
ffff *f*VGA*f* *f*13,’‹,,*ffffff,ffffff* *f* *f* ,,*f* *f,,* VGA*ffff,*EGA*fff*
ff *fff* *ff* *f* *ffff,,,,* Mode 13,Ž—
,,,64K,,,,, 256K,,,*ffffff* *fff,*Ž,,,,,,,

model coordinates
Ž*ff* *f,*‘,,“ •
Ž   *f* *ff* •

,

directional
ff *f,ffff,,,*ŒŒ,, ,,,,*ffffff,*“,‹“, ,, ŒŒ,*ffffff,,*–Œ‰,^,,,,,,Œ‰
,—,, —ŒŒŒ,Œ,,Ž,,^’,Ž,, ^”, ‘—,,,,‰,—,,ŒŒ,*ffff* *f,,,,,*—,,,,

enable frame

ŒŒ,"—,,,,,,,,ff f

,

wrap

−,ffff,fffff •,ŒŽ,—
,,fff ff Š−",fffff fff,, ffff ‰' ‹' fff,,,

root frame

Direct3D,,,,   ff f,Ž,,,ff f ff fŠ',fff,,,ff f f f ff f, f f,
  ,,ffffff'',fff,Š,,,,

Ž   f f

latency

ffff ffff,   ,,,,, ff f,Ž ,ffff,−
,,,,,'‰ŽŠ   DirectSound fff,fffff, ˆ",20ff•,,,

lobby client

f f,ffff f,Š˜,,,,,ff Š—
f ff ffff fff,ffff f f   fff ffff,ffff f ff   f f,,' ,Š,

lobby server

ff f f f,Š˜,,,,,ff Š—
f ff ff   f f, "',ffff fff, ',,f f ,Š,,,,,, •,' ,,

,

world coordinates

f f ff f,',," •

Ž   fff •