

Graphics Engine Command Reference Manual

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Command List

CMD_NOP

No Operation

CMD_NOP(00h)	LABEL
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

Field Name	Description
LABEL	This command does nothing. User-specific data can be placed in LABEL.

CMD_VADR

Set Vertex Data

CMD_VADR(01h)	VADR
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

Field Name	Description
VADR	Starting address of the vertex data.

CMD_IADR

Set Index Data

CMD_IADR(02h)	IADR
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

Field Name	Description
IADR	Starting address of the index data.

CMD_PRIM

Draw Primitive

CMD_PRIM(04h)	0 0 0 0 0	PRIM	COUNT
31 30 29 28 27 26 25 24	23 22 21 20 19	18 17 16	15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

Field Name	Description
COUNT	Number of vertices to be drawn.
PRIM	000: POINTS 001: LINES 010: LINE_STRIP 011: TRIANGLES 100: TRIANGLE_STRIP 101: TRIANGLE_FAN 110: RECTANGLES 111: Reserved

CMD_BEZIER

Draw Bezier Surface

CMD_BEZIER(05h)	0 0 0 0 0 0 0 0	VCOUNT	UCOUNT
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16	15 14 13 12 11 10 9 8	7 6 5 4 3 2 1 0

Field Name	Description
UCOUNT	Number of control point vertices in the U direction for a patch. The value must have the form $3 \times N + 1$ ($N=1, 2, 3, \dots$).
VCOUNT	Number of control point vertices in the V direction for a patch. The value must have the form $3 \times N + 1$ ($N=1, 2, 3, \dots$).

CMD_SPLINE

Draw Spline Surface

CMD_SPLINE(06h)								0 0 0 0				VF		UF		VCOUNT								UCOUNT							
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Field Name	Description
UCOUNT	Number of control point vertices in the U direction for a spline surface. The value must be 4 or more.
VCOUNT	Number of control point vertices in the V direction for a spline surface. The value must be 4 or more.
UF	Knot types for the starting/ending points in the U direction. 00: Close/Close 01: Open/Close 10: Close/Open 11: Open/Open
VF	Knot types for the starting/ending points in the V direction. 00: Close/Close 01: Open/Close 10: Close/Open 11: Open/Open

CMD_BBOX

Set Bounding Box

CMD_BBOX(07h)								0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0																COUNT							
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Field Name	Description
COUNT	Number of vertices for the bounding box. Must be a multiple of 8.

CMD_JUMP

Jump

CMD_JUMP(08h)	ADDR
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

Field Name	Description
ADDR	Memory address of the jump destination. The low-order 2 bits are ignored.

CMD_BJUMP

Conditional Jump

CMD_BJUMP(09h)	ADDR
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

Field Name	Description
ADDR	When BBOX is inside the drawing region, no jump occurs and the next command is executed. The low-order 2 bits are ignored.

CMD_CALL

List Call

CMD_CALL(0Ah)	ADDR
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

Field Name	Description
ADDR	Memory address of the call destination. The low-order 2 bits are ignored.

CMD_RET

List Return

CMD_RET(0Bh)								0 0																															
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0								

Field Name	Description
All fields	When this command is read, the program returns from the called list back to the original list.

CMD_END

End Reading

CMD_END(0Ch)								LABEL																							
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Field Name	Description
LABEL	When this command is read, reading of the display list is ended, and a read finished interrupt is generated. A value is placed in LABEL so that geman can perform function expansion.

CMD_SIGNAL

Signal Interrupt

CMD_SIGNAL(0Eh)	LABEL																														
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Field Name	Description
LABEL	When this command is read, a signal interrupt is generated. A value is placed in LABEL so that geman can perform function expansion.

CMD_FINISH

Finish Drawing

CMD_FINISH(0Fh)								LABEL																							
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Field Name	Description
All fields	Generates a drawing finished interrupt request. When this command is read, an interrupt is generated when all image processing prior to this command has been completed. As a result, when the interrupt is received, it is guaranteed that all image processing prior to this command has been completed. A value is placed in LABEL so that geman can perform function expansion.

CMD_BASE

Set Address Base

CMD_BASE(10h)								BASE								0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0																			
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0				

Field Name	Description
BASE	Base address used with the JUMP, BJUMP, CALL, VADR, and IADR commands. The base address is used as the high-order 8 bits (bits 31~24) of the address with these commands.

CMD_VTYPE

Set Vertex Type

CMD_VTYPE(12h)																TRU	0 0		MC			0	WC			0	IT		WT		VT		NT		CT			TT	
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0								

Field Name	Description
TT	Texture coordinate type. 00: None 01: 8-bit unsigned fixed-point number 10: 16-bit unsigned fixed-point number/16-bit unsigned integer 11: 32-bit floating-point number
CT	Color type. 000: None 001: Reserved 010: Reserved 011: Reserved 100: 16-bit 5:6:5:0 color format 101: 16-bit 5:5:5:1 color format 110: 16-bit 4:4:4:4 color format 111: 32-bit 8:8:8:8 color format
NT	Normal vector type. 00: None 01: 8-bit signed fixed-point number 10: 16-bit signed fixed-point number 11: 32-bit floating-point number
VT	Model coordinate type. 00: Reserved 01: 8-bit signed fixed-point number 10: 16-bit signed fixed-point number/16-bit signed integer 11: 32-bit floating-point number
WT	Weight type. 00: None 01: 8-bit unsigned fixed-point number 10: 16-bit unsigned fixed-point number 11: 32-bit floating-point number
IT	Index type. 00: None (index transfer is not performed.) 01: 8-bit integer 10: 16-bit integer 11: Reserved

Field Name	Description
WC	Number of weights. 000: 1 001: 2 010: 3 011: 4 100: 5 101: 6 110: 7 111: 8
MC	Number of vertices to blend. 000: No vertex blending 001: 2 vertices 010: 3 vertices 011: 4 vertices 100: 5 vertices 101: 6 vertices 110: 7 vertices 111: 8 vertices
TRU	Through mode. 0: Normal mode 1: Through mode

CMD_OFFSET

Set Offset Address

CMD_OFFSET(13h)	ADDR
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	

Field Name	Description
ADDR	High-order 24 bits of the offset address that is stored in the Offset Address register. Zeroes are stored in the remaining 8 bits.

CMD_ORIGIN

Set Origin Address

CMD_ORIGIN(14h)	0 0																															
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	

Field name	Description
All fields	When this command is read, the address of the position of this command is stored in the offset register.

CMD_REGION1 / CMD_REGION2

Set Drawing Region

CMD_REGION1(15h) CMD_REGION2(16h)	0 0 0 0				SY1 SY2										SX1 SX2																
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Field Name	Description
SX1	X-coordinate of upper-left end point of drawing region. 10-bit unsigned integer. Must be in the range 0 to 1023.
SY1	Y-coordinate of upper-left end point of drawing region. 10-bit unsigned integer. Must be in the range 0 to 1023.
SX2	X-coordinate of lower-right end point of drawing region. 10-bit unsigned integer. Must be in the range 0 to 1023. Operation is not guaranteed for values outside this range.
SY2	Y-coordinate of lower-right end point of drawing region. 10-bit unsigned integer. Must be in the range 0 to 1023. Operation is not guaranteed for values outside this range.

CMD_BCE

Culling Enable

CMD_BCE(1Dh)								0 0																								BCE
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	

Field Name	Description
BCE	Back face culling enable 0: Disable back face culling 1: Enable back face culling

CMD_TME

Texture Enable

CMD_TME(1Eh)								0 0																								TME
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	

Field Name	Description
TME	Texture mapping enable. 0: Disable texture mapping 1: Enable texture mapping

CMD_FGE

Fog Enable

CMD_FGE(1Fh)								0 0																								FGE
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	

Field Name	Description
FGE	Fogging enable 0: Disable fogging 1: Enable fogging

CMD_DTE

Dither Enable

CMD_DTE(20h)								0 0																								DTE
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	

Field Name	Description
DTE	Dithering enable 0: Disable dithering 1: Enable dithering

CMD_ABE

Alpha Blending Enable

CMD_ABE(21h)								0 0																								ABE
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	

Field Name	Description
ABE	Alpha blending enable 0: Do not perform alpha blending 1: Perform alpha blending

CMD_ATE

Alpha Test Enable

CMD_ATE(22h)								0 0																								ATE
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	

Field Name	Description
ATE	Alpha test enable 0: Do not perform the alpha test 1: Perform the alpha test

CMD_ZTE

Depth Test Enable

CMD_ZTE(23h)								0 0																							ZTE
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Field Name	Description
ZTE	Depth test enable 0: Do not perform the depth test 1: Perform the depth test

CMD_STE

Stencil Test Enable

CMD_STE(24h)								0 0																								STE
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	

Field Name	Description
STE	Stencil test enable 0: Do not perform the stencil test 1: Perform the stencil test

CMD_AAE

Antialiasing Enable

CMD_AAE(25h)								0 0																							
--------------	--	--	--	--	--	--	--	---	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Field Name	Description
AAE	Antialiasing enable 0: Disable antialiasing 1: Enable antialiasing

Patch Culling Enable

CMD_PCE(26h)								0 0																								PCE
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	

Field Name	Description
PCE	Patch culling enable. 0: Disable patch culling 1: Enable patch culling

CMD_CTE

Color Test Enable

CMD_CTE(27h)								0 0																								CTE
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	

Field Name	Description
CTE	Color test enable 0: Do not perform the color test 1: Perform the color test

CMD_LOE

Logical Operation Enable

CMD_LOE(28h)								0 0																								LOE
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	

Field Name	Description
LOE	Logical operation enable 0: Do not perform logical operations 1: Perform logical operations

CMD_BONEN

Set Bone Matrix Number

CMD_BONEN(2Ah)	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	NUM
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7	6 5 4 3 2 1 0

Field Name	Description
NUM	Matrix number of the bone matrix (BONEA00-11 ~ BONEH00-11). 0-11 : BONEA00-11 12-23: BONEB00-11 24-35: BONEC00-11 36-47: BONED00-11 48-59: BONEE00-11 60-71: BONEF00-11 72-83: BONEG00-11 84-95: BONEH00-11 96-127: Reserved

CMD_BONED

Set Bone Matrix Data

CMD_BONED(2Bh)	BONE
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

Field Name	Description
BONE	Bone matrix data to be set at the position indicated by the bone matrix number. The value represents the high-order 24-bits of a 32-bit single-precision floating-point number. After the bone matrix data is set, the bone matrix number is incremented by 1.

CMD_WEIGHT0-7

Set Vertex Weight

CMD_WEIGHT0-7 (2Ch-2Fh , 30-33h)								WEIGHT0-7																							
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Field Name	Description
WEIGHT0-7	Weights used in morphing. The values represent the high-order 24 bits of 32-bit single-precision floating-point numbers.

CMD_DIVIDE

Set Patch Division Count

CMD_DIVIDE(36h)								0 0 0 0 0 0 0 0 0								VDIV								0	UDIV							
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	

Field Name	Description
UDIV	Patch divisions in the U direction. Value can range from 1 to 64.
VDIV	Patch divisions in the V direction. Value can range from 1 to 64.

CMD_WORLDD

Set World Matrix Data

CMD_WORLDD(3Bh)	WORLD
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

Field Name	Description
WORLD	World matrix data to be set at the position indicated by the world matrix number. The value represents the high-order 24-bits of a 32-bit single-precision floating-point number. After the world matrix data is set, the world matrix number is incremented by 1.

CMD_VIEWN

Set View Matrix Number

CMD_VIEWN(3Ch)	0 0	NUM
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	

Field Name	Description
NUM	Matrix number of the view matrix (VIEW00-11) 0-11: VIEW00-11 12-15: Reserved

CMD_VIEWD

Set View Matrix Data

CMD_VIEWD(3Dh)	VIEW
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

Field Name	Description
VIEW	View matrix data to be set at the position indicated by the view matrix number. The value represents the high-order 24-bits of a 32-bit single-precision floating-point number. After the view matrix data is set, the view matrix number is incremented by 1.

CMD_PROJN

Set Perspective Matrix Number

CMD_PROJN(3Eh)	0 0	NUM
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	

Field Name	Description
NUM	Matrix number of the perspective matrix (PROJ00-15). 0-15: PROJ00-15

CMD_PROJD

Set Perspective Matrix Data

CMD_PROJD(3Fh)	PROJ
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

Field Name	Description
PROJ	Perspective matrix data to be set at the position indicated by the perspective matrix number. The value represents the high-order 24-bits of a 32-bit single-precision floating-point number. After the perspective matrix data is set, the perspective matrix number is incremented by 1.

CMD_TGENN

Set Texture Generation Matrix Number

CMD_TGENN(40h)	0 0	NUM
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4	3 2 1 0

Field Name	Description
NUM	Matrix number of the texture generation matrix (TEXGENN00-11). 0-11 : TEXGENN00-11 12-15: Reserved

CMD_TGEND

Texture Generation Matrix Data

CMD_TGEND(41h)	TEXGEN
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

Field Name	Description
TEXGEN	Texture generation matrix data to be set at the position indicated by the texture generation matrix number. The value represents the high-order 24-bits of a 32-bit single-precision floating-point number. After the texture generation matrix data is set, the texture generation matrix number is incremented by 1.

CMD_SX / CMD_SY / CMD_SZ / CMD_TX / CMD_TY / CMD_TZ

Set Viewport

CMD_SX(42h)	SX
CMD_SY(43h)	SY
CMD_SZ(44h)	SZ
CMD_TX(45h)	TX
CMD_TY(46h)	TY
CMD_TZ(47h)	TZ
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	

Field Name	Description
SX, SY, SZ, TX, TY, TZ	Viewport transformation parameters. The values represent the high-order 24-bits of 32-bit single-precision floating-point numbers.

CMD_SU / CMD_SV

Set Texture Scale

CMD_SU(48h)	SU
CMD_SV(49h)	SV
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	

Field Name	Description
SU, SV	Texture scale. The values represent the high-order 24-bits of 32-bit single-precision floating-point numbers.

CMD_TU / CMD_TV

Set Texture Offset

CMD_TU (4Ah)	TU
CMD_TV (4Bh)	TV
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	

Field Name	Description
TU, TV	Texture offset. The values represent the high-order 24-bits of 32-bit single-precision floating-point numbers.

CMD_OFFSETX / CMD_OFFSETY

Set Screen Offset

CMD_OFFSETX(4Ch) CMD_OFFSETY(4Dh)	0 0 0 0 0 0 0 0	OFFX OFFY
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16	15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

Field Name	Description
OFFX	X-coordinate of offset. The value represents a 16-bit unsigned fixed-point number with a 4-bit fraction. Values must be in the range 0.0 to 4095.9375
OFFY	Y-coordinate of offset. The value represents a 16-bit unsigned fixed-point number with a 4-bit fraction. Values must be in the range 0.0 to 4095.9375

CMD_SHADE

Set Shading Mode

CMD_SHADE(50h)	0 0	IIP
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	

Field Name	Description
IIP	Shading mode. 0: Flat shading 1: Gouraud shading

CMD_NREV

Normal Reverse

CMD_NREV(51h)	0 0	NREV
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	

Field Name	Description
NREV	Indicates whether the normal should be reversed during lighting. 0: Do not reverse normal 1: Reverse normal

CMD_MATERIAL

Material

CMD_MATERIAL (53h)	0 0																						SC	DC	AC
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3	2	1	0																					

Field Name	Description
AC	Update the ambient light color.
DC	Update the diffuse light color.
SC	Update the specular light color.

CMD_MEC / CMD_MAC / CMD_MDC / CMD_MSC

Set Model Color

CMD_MEC(54h) CMD_MAC(55h) CMD_MDC(56h) CMD_MSC(57h)	B	G	R
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0		

Field Name	Description
R, G, B	Color values of the model. Each value represents an unsigned 8-bit number.

CMD_MAA

Set Model Color (Alpha)

CMD_MAA(58h)	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	A
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	

Field Name	Description
A	Alpha value of the model. The value represents an unsigned 8-bit number.

CMD_MK

Set Model Specular

CMD_MK(5Bh)	K
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	

Field Name	Description
K	Specular coefficient of the model. The value represents a single-precision floating-point number, with the low-order 8 bits unused.

CMD_AC

Set Ambient Light Color

CMD_AC(5Ch)	B	G	R
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0			

Field Name	Description
R, G, B	Color values of the ambient light to be used for lighting. Each value represents an unsigned 8-bit number.

CMD_AA

Set Ambient Light Color (Alpha)

CMD_AA(5Dh)	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	A
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0		

Field Name	Description
A	Alpha value of the ambient light to be used for lighting. The value represents an unsigned 8-bit number.

CMD_LMODE

Set Light Mode

CMD_LMODE(5Eh)	0 0																												255		
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Field Name	Description
SSC	Model color calculation method. 0: SINGLE_COLOR 1: SEPARATE SPECULAR COLOR

CMD_LTYPE0-3

Set Light Type

CMD_LTYPE0-3 (5Fh, 60-62h)								0 0 0 0 0 0 0 0 0 0 0 0 0 0 0												TYPE		0 0 0 0 0 0						COMP			
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Field Name	Description
COMP	Indicates whether or not diffuse light and/or specular light should be included in lighting calculations. 00: Include diffuse light, do not include specular light 01: Include both diffuse light and specular light 10: Include powered diffuse light and specular light 11: Reserved
TYPE	Light source type 00: Directional light source 01: Point light source 10: Spotlight 11: Reserved

CMD_LX# / CMD_LY# / CMD_LZ#

Set Light Vector

CMD_LX0(63h)	LX0
CMD_LY0(64h)	LY0
CMD_LZ0(65h)	LZ0
CMD_LX1(66h)	LX1
CMD_LY1(67h)	LY1
CMD_LZ1(68h)	LZ1
CMD_LX2(69h)	LX2
CMD_LY2(6Ah)	LY2
CMD_LZ2(6Bh)	LZ2
CMD_LX3(6Ch)	LX3
CMD_LY3(6Dh)	LY3
CMD_LZ3(6Eh)	LZ3
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	

Field Name	Description
LX0-3, LY0-3, LZ0-3	Positions of the four light sources in the World Coordinate system. Note that when the light type is directional light source, these values are considered to be vectors to the light sources. The values represent the high-order 24 bits of 32-bit single precision floating-point numbers.

CMD_LDX# / CMD_LDY# / CMD_LDZ#

Set Light Direction

CMD_LDX0(6Fh)	LDX0
CMD_LDY0(70h)	LDY0
CMD_LDZ0(71h)	LDZ0
CMD_LDX1(72h)	LDX1
CMD_LDY1(73h)	LDY1
CMD_LDZ1(74h)	LDZ1
CMD_LDX2(75h)	LDX2
CMD_LDY2(76h)	LDY2
CMD_LDZ2(77h)	LDZ2
CMD_LDX3(78h)	LDX3
CMD_LDY3(79h)	LDY3
CMD_LDZ3(7Ah)	LDZ3
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	

Field Name	Description
LDX0-3, LDY0-3, LDZ0-3	Directions of the four light sources. The values represent the high-order 24 bits of 32-bit single-precision floating-point numbers.

CMD_LKA# / CMD_LKB# / CMD_LKC#

Set Light Distance Attenuation Factor

CMD_LKA0(7Bh)	LKA0
CMD_LKB0(7Ch)	LKB0
CMD_LKC0(7Dh)	LKC0
CMD_LKA1(7Eh)	LKA1
CMD_LKB1(7Fh)	LKB1
CMD_LKC1(80h)	LKC1
CMD_LKA2(81h)	LKA2
CMD_LKB2(82h)	LKB2
CMD_LKC2(83h)	LKC2
CMD_LKA3(84h)	LKA3
CMD_LKB3(85h)	LKB3
CMD_LKC3(86h)	LKC3
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	

Field Name	Description
LKA0-3, LKB-3, LKC-3	Distance attenuation factors for the four light sources. The values represent the high-order 24 bits of 32-bit single-precision floating-point numbers.

CMD_LKS0 / CMD_LKS1 / CMD_LKS2 / CMD_LKS3

Set Light Convergence Factor

CMD_LKS0(87h)	LKS0
CMD_LKS1(88h)	LKS1
CMD_LKS2(89h)	LKS2
CMD_LKS3(8Ah)	LKS3
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	

Field Name	Description
LKS0-3	Convergence factors for the four light sources. The values represent the high-order 24 bits of 32-bit single-precision floating-point numbers.

CMD_LKO0 / CMD_LKO1 / CMD_LKO2 / CMD_LKO3

Set Light Cut-Off Dot Product Coefficient

CMD_LKO0(8Bh)	LKO0
CMD_LKO1(8Ch)	LKO1
CMD_LKO2(8Dh)	LKO2
CMD_LKO3(8Eh)	LKO3
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	

Field Name	Description
LKO0-3	Light cut-off dot product coefficients for the four light sources. The values represent the high-order 24 bits of 32-bit single-precision floating-point numbers.

CMD_LAC# / CMD_LDC# / CMD_LSC#

Set Light Color

CMD_LAC0(8Fh)			
CMD_LDC0(90h)			
CMD_LSC0(91h)			
CMD_LAC1(92h)			
CMD_LDC1(93h)			
CMD_LSC1(94h)			
CMD_LAC2(95h)	B	G	R
CMD_LDC2(96h)			
CMD_LSC2(97h)			
CMD_LAC3(98h)			
CMD_LDC3(99h)			
CMD_LSC3(9Ah)			
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0			

Field Name	Description
R, G, B	Vertex color values. The values represent 8-bit unsigned integers.

CMD_CULL

Culling Surface

CMD_CULL(9Bh)								0 0																								CIS
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	

Field Name	Description
CIS	Indicates the 1, 2, 3 order of the first 3 vertices of a TRIANGLE STRIP for a surface when performing back face culling. 0: Counterclockwise order 1: Clockwise order

CMD_FBP

Set Frame Buffer Base Point

CMD_FBP(9Ch)								FBP																							
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Field Name	Description
FBP	Address of frame buffer base point in 8 KB units. The low-order 13 bits must be 0.

CMD_FBW

Set Frame Buffer Width / Base

CMD_FBW(9Dh)								BASE								0 0 0 0 0					FBW											
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	

Field Name	Description
FBW	Frame buffer width. Must be a multiple of 64. Values can range from 64 to 1024. The low-order 6 bits are ignored.
BASE	High-order 8 bits of the frame buffer base address.

CMD_ZBP

Set Depth Buffer Base Point

CMD_ZBP(9Eh)	ZBP
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	

Field Name	Description
ZBP	Address of depth buffer base point in 8 KB units. The low-order 13 bits must be 0.

CMD_ZBW

Set Depth Buffer Width / Base

CMD_ZBW(9Fh)	BASE	0 0 0 0 0	ZBW
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0			

Field Name	Description
ZBW	Depth buffer width. Must be a multiple of 64. Values can range from 64 to 1024. The low-order 6 bits are ignored.
BASE	High-order 8 bits of the depth buffer base address.

CMD_TBP#

Set Texture Buffer Base Point

CMD_TBP0(A0h) CMD_TBP1(A1h) CMD_TBP2(A2h) CMD_TBP3(A3h) CMD_TBP4(A4h) CMD_TBP5(A5h) CMD_TBP6(A6h) CMD_TBP7(A7h)	TBP0-7
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	

Field Name	Description
TBP0-7	Addresses of texture buffer base points in 16-byte units. The low-order 4 bits are ignored.

CMD_TBW#

Set Texture Buffer Width / Base

CMD_TBW0(A8h)	BASE0-7	0 0 0 0 0	TBW0-7
CMD_TBW1(A9h)			
CMD_TBW2(AAh)			
CMD_TBW3(ABh)			
CMD_TBW4(ACH)			
CMD_TBW5(ADh)			
CMD_TBW6(AEh)			
CMD_TBW7(AFh)			
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0			

Field Name	Description
TBW0-7	Texture buffer 0-7 widths. Maximum value of 1024. The following restrictions also apply depending on the pixel format. 32-bit color format : Multiple of 4 32-bit index color format : Multiple of 4 16-bit color format : Multiple of 8 16-bit index color format : Multiple of 8 8-bit index color format : Multiple of 16 4-bit index color format : Multiple of 32 DXT1 : Multiple of 8 DXT3 : Multiple of 4 DXT5 : Multiple of 4
BASE0-7	High-order 8 bits of the base addresses for texture buffer 0-7.

CMD_CBP

Set CLUT Buffer Base Point

CMD_CBP(B0h)	CBP
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	

Field Name	Description
CBP	Address of CLUT buffer base point in 16-byte units. The low-order 4 bits are ignored.

CMD_CBW

Set CLUT Buffer Base Address

CMD_CBW(B1h)	BASE	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16	15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

Field Name	Description
BASE	High-order 8 bits of the CLUT buffer base address.

CMD_XBP1

Set Transfer Buffer Base Point (Source)

CMD_XBP1(B2h)	XBP1
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

Field Name	Description
XBP1	Source transfer buffer base point in 16-byte units. The low-order 4 bits are ignored.

CMD_XBW1

Set Transfer Buffer Width / Base (Source)

CMD_XBW1(B3h)	BASE1	0 0 0 0 0	XBW1
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16	15 14 13 12 11	10 9 8 7 6 5 4 3 2 1 0

Field Name	Description
XBW1	Source transfer buffer width. Must be a multiple of 8. Values can range from 8 to 1024. The low-order 3 bits are ignored.
BASE1	High-order 8 bits of the source transfer buffer base address.

CMD_XBP2

Set Transfer Buffer Base Point (Destination)

CMD_XBP2 (B4h)	XBP2
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

Field Name	Description
XBP2	Destination transfer buffer base point in 16-byte units. The low-order 4 bits are ignored.

CMD_XBW2

Set Transfer Buffer Width (Destination)

CMD_XBW2(B5h)	BASE2	0 0 0 0 0	XBW2
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16	15 14 13 12 11	10 9 8 7 6 5 4 3 2 1 0

Field Name	Description
XBW2	Destination transfer buffer width. Must be a multiple of 8. Values can range from 8 to 1024. The low-order 3 bits are ignored.
BASE2	High-order 8 bits of the destination transfer buffer base address.

CMD_TSIZE0-7

Set Texture Size

CMD_TSIZE0-7 (B8h-B9h, BAh-BFh)	0 0 0 0 0 0 0 0 0 0 0 0 0	TH0-7	0 0 0 0	TW0-7
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12	11 10 9 8	7 6 5 4	3 2 1 0

Field Name	Description
TW0-7	Texture width for each level. The width is expressed as 2^n , where n is entered in the field and must be in the range 0 to 9.
TH0-7	Texture height for each level. The width is expressed as 2^n , where n is entered in the field and must be in the range 0 to 9.

CMD_TMAP

Set Texture Map Mode

CMD_TMAP(C0h)	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	TMI	0 0 0 0 0 0	TMN
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10	9 8	7 6 5 4 3 2	1 0

Field Name	Description
TMN	Texture mapping mode. 00: UV mapping 01: Projection mapping 10: Shade mapping 11: Reserved
TMI	Parameter used for projection mapping. 00: XYZ coordinates (X, Y, Z) 01: Texture coordinates (U, V, 0) 10: Normalized normal coordinates (Nx/ N , Ny/ N , Nz/ N) 11: Non-normalized normal coordinates (Nx, Ny, Nz)

CMD_TSHADE

Set Shade Mapping

CMD_TSHADE(C1h)	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	V	0 0 0 0 0 0	U
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10	9 8	7 6 5 4 3 2	1 0

Field Name	Description
U, V	Number of light sources to be used for shade mapping, in the U and V directions.

CMD_TMODE

Set Texture Mode

CMD_TMODE(C2h)								0 0 0 0 0					MXL			0 0 0 0 0 0 0								MC	0 0 0 0 0 0 0								HSM
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0		

Field Name	Description
HSM	Storage mode for texture data. 0: Normal mode 1: Fast mode
MC	Multiple CLUT enable. 0: Do not use multiple CLUTs. 1: Use multiple CLUTs.
MXL	Maximum texture level (0-7).

CMD_TPF

Set Texture Pixel Format

CMD_TPF(C3h)								0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0																EXT	0 0 0 0					TPF			
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0		

Field Name	Description
TPF	Pixel format of the texture buffer.
0000:	16-bit 5:6:5:0 color format
0001:	16-bit 5:5:5:1 color format
0010:	16-bit 4:4:4:4 color format
0011:	32-bit 8:8:8:8 color format
0100:	4-bit index color format
0101:	8-bit index color format
0110:	16-bit index color format
0111:	32-bit index color format
1000:	DXT1
1001:	DXT3
1010:	DXT5
1011:	Reserved
1100:	Reserved
1101:	Reserved
1110:	Reserved
1111:	Reserved

Field Name	Description
EXT	Specifies the method of expanding the format from 5:6:5:0 to 8:8:8:8 during the decoding of DXT1, DXT3 and DXT5. 0: 0 Expansion 1: Use the high-order bit

CMD_CLOAD

CLUT Load

CMD_CLOAD(C4h)	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	NP
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6	5 4 3 2 1 0

Field Name	Description
NP	<p>Number of palettes to be loaded into the CLUT from the CLUT buffer.</p> <p>For 16-bit color format, the value is in 16-palette units. For 32-bit color format, the value is in 8-palette units.</p> <p>16-bit color Number of palettes to be loaded = $16 \times NP$ ($1 \leq NP \leq 32$)</p> <p>32-bit color Number of palettes to be loaded = $8 \times NP$ ($1 \leq NP \leq 32$)</p>

CMD_CLUT

Set CLUT

CMD_CLUT (C5h)	0 0 0	CSA	MSK	0	SFT	CPF
31 30 29 28 27 26 25 24	23 22 21	20 19 18 17 16	15 14 13 12 11 10 9 8	7	6 5 4 3 2	1 0

Field Name	Description
CPF	<p>Pixel format of the CLUT buffer.</p> <p>00: 16-bit 5:6:5:0 color format 01: 16-bit 5:5:5:1 color format 10: 16-bit 4:4:4:4 color format 11: 32-bit 8:8:8:8 color format</p>
SFT	Shift amount used for generating the index in index color mode.
MSK	Mask used for generating the index in index color mode.
CSA	<p>CLUT read starting position.</p> <p>Starting palette number = $CSA \times 16$</p>

CMD_TFILTER

Set Texture Filter

CMD_TFILTER (C6h)								0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0																MAG	0 0 0 0 0					MIN		
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	

Field Name	Description
MIN	Minimizing filter mode used during texture mapping. 000: NEAREST 001: LINEAR 100: NEAREST_MIPMAP_NEAREST 101: LINEAR_MIPMAP_NEAREST 110: NEAREST_MIPMAP_LINEAR 111: LINEAR_MIPMAP_LINEAR
MAG	Magnifying filter mode used during texture mapping. 0: NEAREST 1: LINEAR

CMD_TWRAP

Set Texture Wrap Mode

CMD_TWRAP(C7h)								0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0																WMT	0 0 0 0 0 0 0 0								WMS
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0		

Field Name	Description
WMS	Wrap mode of texture coordinate S. 0: REPEAT 1: CLAMP
WMT	Wrap mode of texture coordinate T. 0: REPEAT 1: CLAMP

CMD_TLEVEL

Set Texture Level Mode

CMD_TLEVEL(C8h)	OFFL	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	LCM
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0			

Field Name	Description
LCM	Texture level calculation mode. 0: Variable mode 1 1: Fixed mode 2: Variable mode 2 3: Reserved
OFFL	Offset for the level. Signed fixed-point number. The low-order 4 bits represent the fractional part.

CMD_TFUNC

Set Texture Function

CMD_TFUNC(C9h)	0 0 0 0 0 0 0 0	CD	0 0 0 0 0 0 0 0	TCC	0 0 0 0 0 0	TXF
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0						

Field Name	Description
TXF	Texture function. 000: MODULATE 001: DECAL 010: BLEND 011: REPLACE 100: ADD 101: Reserved 110: Reserved 111: Reserved
TCC	Color components of the texture. 0: RGB 1: RGBA
CD	Color doubling enable. 0: Disable color doubling 1: Enable color doubling

CMD_TEC

Set Texture Environment Color

CMD_TEC(CAh)	B	G	R
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16	15 14 13 12 11 10 9 8	7 6 5 4 3 2 1 0

Field Name	Description
R, G, B	Texture environment color values. 8-bit unsigned integers.

CMD_TFLUSH

Texture Flush

CMD_TFLUSH(CBh)	0 0
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

Field Name	Description
All fields	Flushes the texture cache.

CMD_TSYNC

Texture Synchronization

CMD_TSYNC(CCh)	0 0
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

Field Name	Description
All fields	Blocks texture accesses to the local memory buffer until drawing is completed.

CMD_FOG1 / CMD_FOG2

Set Fog Parameter

CMD_FOG1(CDh) CMD_FOG2(CEh)	FOG1 FOG2
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

Field Name	Description
FOG1, FOG2	Fog parameters. Values represent the high-order 24 bits of 32-bit single-precision floating-point numbers.

CMD_FC

Set Fog Color

CMD_FC(CFh)	B	G	R
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16	15 14 13 12 11 10 9 8	7 6 5 4 3 2 1 0

Field Name	Description
R, G, B	Fog color values. 8-bit unsigned integers.

CMD_TSLOPE

Set Texture Slope

CMD_TSLOPE(CDh)	TSLOPE
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

Field Name	Description
TSLOPE	Slope of the texel coordinates used for calculating LOD. Value represents the high-order 24 bits of a 32-bit single-precision floating-point number.

CMD_FPF

Set Frame Pixel Format

CMD_FPF(D2h)								0 0																FPF							
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Field Name	Description
FPF	Pixel format of the frame buffer. 00: 16-bit 5:6:5:0 color format 01: 16-bit 5:5:5:1 color format 10: 16-bit 4:4:4:4 color format 11: 32-bit 8:8:8:8 color format

CMD_CMODE

Set Clear Mode

CMD_CM0DE (D3h)								0 0 0 0 0 0 0 0 0 0 0 0 0 0												ZEN	AEN	CEN	0 0 0 0 0 0 0								SET
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Field Name	Description
SET	Mode setting 0: Normal mode 1: Clear mode
CEN	Enable color value update when drawing in clear mode. 0: Do not update color values 1: Update color values
AEN	Enable alpha value update when drawing in clear mode. 0: Do not update alpha values 1: Update alpha values
ZEN	Enable depth value update when drawing in clear mode. 0: Do not update depth values 1: Update depth values

CMD_SCISSOR1 / CMD_SCISSOR2

Set Scissoring Area

CMD_SCISSOR1(D4h) CMD_SCISSOR2(D5h)	0 0 0 0	SY1 SY2	SX1 SX2
31 30 29 28 27 26 25 24	23 22 21 20	19 18 17 16 15 14 13 12 11 10	9 8 7 6 5 4 3 2 1 0

Field Name	Description
SX1	X-coordinate of upper-left end point of scissoring area. 10-bit unsigned integer. Valid range is 0 to 1023.
SY1	Y-coordinate of upper-left end point of scissoring area. 10-bit unsigned integer. Valid range is 0 to 1023.
SX2	X-coordinate of lower-right end point of scissoring area. 10-bit unsigned integer. Valid range is 0 to 1023. Proper operation is not guaranteed for a value outside this range.
SY2	Y-coordinate of lower-right end point of scissoring area. 10-bit unsigned integer. Valid range is 0 to 1023. Proper operation is not guaranteed for a value outside this range.

CMD_MINZ / CMD_MAXZ

Set Depth Range

CMD_MINZ(D6h) CMD_MAXZ(D7h)	0 0 0 0 0 0 0 0	MINZ MAXZ
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16	15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

Field Name	Description
MINZ	Minimum Z value. 16-bit unsigned integer.
MAXZ	Maximum Z value. 16-bit unsigned integer.

CMD_CTEST

Set Color Test Parameter

CMD_CTEST(D8h)	0 0	CTF
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0	

Field Name	Description
CTF	Color test function. 00: NEVER 01: ALWAYS 10: EQUAL 11: NOTEQUAL

CMD_CREF

Set Color Test Reference

CMD_CREF(D9h)	B	G	R
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16	15 14 13 12 11 10 9 8	7 6 5 4 3 2 1 0

Field Name	Description
R, G, B	Reference color values.

CMD_CMSK

Set Color Test Mask

CMD_CMSK(DAh)	BMSK	GMSK	RMSK
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16	15 14 13 12 11 10 9 8	7 6 5 4 3 2 1 0

Field Name	Description
RMSK, GMSK, BMSK	Mask used during the color test. Only bits set to 1 are compared with the color test reference.

CMD_ATEST

Set Alpha Test Parameters

CMD_ATEST(DBh)	AMSK	AREF	0 0 0 0 0	ATF
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16	15 14 13 12 11 10 9 8	7 6 5 4 3	2 1 0

Field Name	Description
ATF	Alpha test function. 000: NEVER 001: ALWAYS 010: EQUAL 011: NOTEQUAL 100: LESS 101: LEQUAL 110: GREATER 111: GEQUAL
AREF	Alpha test reference. Value represents an unsigned 8-bit integer.
AMSK	Mask used during the alpha test. Only bits set to 1 are compared with the alpha test reference.

CMD_STEST

Set Stencil Test Parameters

CMD_STEST(DCh)	SMSK	SREF	0 0 0 0 0	STF
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16	15 14 13 12 11 10 9 8	7 6 5 4 3	2 1 0

Field Name	Description
STF	Stencil test function. 000: NEVER 001: ALWAYS 010: EQUAL 011: NOTEQUAL 100: LESS 101: LEQUAL 110: GREATER 111: GEQUAL
SREF	Stencil test reference.
SMSK	Mask used during the stencil test. Only bits set to 1 are compared with the stencil test reference.

CMD_SOP

Set Stencil Operation

CMD_SOP(DDh)	0 0 0 0 0	ZPASS	0 0 0 0 0 0	ZFAIL	0 0 0 0 0 0	SFAIL
31 30 29 28 27 26 25 24	23 22 21 20 19	18 17 16	15 14 13 12 11	10 9 8	7 6 5 4 3	2 1 0

Field Name	Description
SFAIL	Operation performed when the stencil test fails. 000: KEEP 001: ZERO 010: REPLACE 011: INVERT 100: INCR 101: DECR 110: Reserved 111: Reserved
ZFAIL	Operation performed when the stencil test passes and the depth test fails. 000: KEEP 001: ZERO 010: REPLACE 011: INVERT 100: INCR 101: DECR 110: Reserved 111: Reserved
ZPASS	Operation performed when the stencil test passes and the depth test passes. 000: KEEP 001: ZERO 010: REPLACE 011: INVERT 100: INCR 101: DECR 110: Reserved 111: Reserved

CMD_ZTEST

Set Depth Test Parameter

CMD_ZTEST(DEh)	000000000000000000000000	ZTF
3130292827262524	23222120191817161514131211109876543	210

Field Name	Description
ZTF	Depth test function. 000: NEVER 001: ALWAYS 010: EQUAL 011: NOTEQUAL 100: LESS 101: LEQUAL 110: GREATER 111: GEQUAL

CMD_BLEND

Set Alpha Blending Parameters

CMD_BLEND(DfH)								0 0 0 0 0 0 0 0 0 0 0 0 0 0																EQU			B				A			
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0			

Field Name	Description
A	Value of A used by the alpha blending function 0000: Cd 0001: 255-Cd 0010: As 0011: 255-As 0100: Ad 0101: 255-Ad 0110: 2×As 0111: 25-2×As 1000: 2×Ad 1001: 255-2×Ad 1010: FIXA 1011: Reserved 1100: Reserved 1101: Reserved 1111: Reserved
B	Value of B used by the alpha blending function. 0000: Cs 0001: 255-Cs 0010: As 0011: 255-As 0100: Ad 0101: 255-Ad 0110: 2×As 0111: 255-2×As 1000: 2×Ad 1001: 255-2×Ad 1010: FIXB 1011: Reserved 1100: Reserved 1101: Reserved 1111: Reserved
EQU	Alpha blending function to be performed 000: $Cs \odot A + Cd \odot B$ 001: $Cs \odot A - Cd \odot B$ 010: $Cd \odot B - Cs \odot A$ 011: $\min(Cs, Cd)$ 100: $\max(Cs, Cd)$ 101: $\text{abs}(Cs - Cd)$ 110: Reserved

Field Name	Description
	111: Reserved

CMD_FIXA

Set Fixed Color A

CMD_FIXA(E0h)	B	G	R
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0			

Field Name	Description
R, G, B	Fixed color of A value used by the alpha blending function. 8-bit unsigned integer.

CMD_FIXB

Set Fixed Color B

CMD_FIXB(E1h)	B	G	R
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0			

Field Name	Description
R, G, B	Fixed color of B value used by the alpha blending function. 8-bit unsigned integer.

CMD_DITH1

Set Dither Coefficients

CMD_DITH1(E2h)	0 0 0 0 0 0 0 0	DM03	DM02	DM01	DM00
31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0					

Field Name	Description
DM00-DM03	Dither matrix elements 00 ~ 03. Values represent dither coefficients in the range -8 to +7.

CMD_DITH2

Set Dither Coefficients

CMD_DITH2(E3h)	0 0 0 0 0 0 0 0								DM07				DM06				DM05				DM04										
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Field Name	Description
DM04-DM07	Dither matrix elements 04 ~ 07. Values represent dither coefficients in the range -8 to +7.

CMD_DITH3

Set Dither Coefficients

CMD_DITH3(E4h)	0 0 0 0 0 0 0 0								DM11				DM10				DM09				DM08										
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Field Name	Description
DM08-DM11	Dither matrix elements 08 ~ 11. Values represent dither coefficients in the range -8 to +7.

CMD_DITH4

Set Dither Coefficients

CMD_DITH4(E5h)	0 0 0 0 0 0 0 0								DM15				DM14				DM13				DM12										
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Field Name	Description
DM12-DM15	Dither matrix elements 12 ~ 15. Values represent dither coefficients in the range -8 to +7.

CMD_LOP

Set Logical Operation Parameter

CMD_LOP(E6h)	0 0	LOP
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4	3 2 1 0

Field Name	Description
LOP	Logical operation 0000: CLEAR 0 0001: AND $C_s \& C_d$ 0010: AND_REVERSE $C_s \& \sim C_d$ 0011: COPY C_s 0100: AND_INVERTED $\sim C_s \& C_d$ 0101: NOOP C_d 0110: XOR $C_s \wedge C_d$ 0111: OR $C_s C_d$ 1000: NOR $\sim (C_s C_d)$ 1001: EQUIV $\sim (C_s \wedge C_d)$ 1010: INVERT $\sim C_d$ 1011: OR_REVERSE $C_s \sim C_d$ 1100: COPY_INVERTED $\sim C_s$ 1101: OR_INVERTED $\sim C_s C_d$ 1110: NAND $\sim (C_s \& C_d)$ 1111: SET 1

CMD_ZMSK

Depth Mask

CMD_ZMSK(E7h)	0 0	ZMSK
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4	3 2 1 0

Field Name	Description
ZMSK	Z buffer update control. 0: Update the value in the Z buffer. 1: Do not update the Z buffer regardless of the result of the depth test.

CMD_PMSK1

Set Plane Mask

CMD_PMSK1(E8h)	BMSK	GMSK	RMSK
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16	15 14 13 12 11 10 9 8	7 6 5 4 3 2 1 0

Field Name	Description
RMSK, GMSK, BMSK	Color value mask used during drawing. Bits set to 1 will not be changed.

CMD_PMSK2

Set Plane Mask

CMD_PMSK2(E9h)	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	AMSK
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8	7 6 5 4 3 2 1 0

Field Name	Description
AMSK	Alpha value mask used during drawing. Bits set to 1 will not be changed.

CMD_XSTART

Inter-Buffer Transfer Start

CMD_XSTART(EAh)	0 0	XPF
31 30 29 28 27 26 25 24	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8	7 6 5 4 3 2 1 0

Field Name	Description
XPF	Pixel format used for the inter-buffer transfer. The transfer starts after the pixel format is set. 0: 16-bit color format (5:6:5:0, 5:5:5:1, or 4:4:4:4) 1: 32-bit color format (8:8:8:8)

CMD_XPOS1

Set Source Buffer Transfer Position

CMD_XPOS1(EBh)	0 0 0 0	SY1	SX1
31 30 29 28 27 26 25 24	23 22 21 20	19 18 17 16 15 14 13 12 11 10	9 8 7 6 5 4 3 2 1 0

Field Name	Description
SX1, SY1	Upper-left end point of the source buffer transfer area.

CMD_XPOS2

Set Destination Buffer Transfer Position

CMD_XPOS2(ECh)	0 0 0 0	SY2	SX2
31 30 29 28 27 26 25 24	23 22 21 20	19 18 17 16 15 14 13 12 11 10	9 8 7 6 5 4 3 2 1 0

Field Name	Description
SX2, SY2	Upper-left end point of the destination buffer transfer area.

CMD_XSIZE

Set Transfer Size

CMD_XSIZE(EEh)	0 0 0 0	HEIGHT	WIDTH
31 30 29 28 27 26 25 24	23 22 21 20	19 18 17 16 15 14 13 12 11 10	9 8 7 6 5 4 3 2 1 0

Field Name	Description
WIDTH	Width of transfer area - 1
HEIGHT	Height of transfer area - 1