

How to use Single CS 32M SGRAM in Dual CS system (like Voodoo3)

How to use 1CS 32M SG in Voodoo3

Frame Buffer Memory Interface in Voodoo3 (Source: Rev 1.5 of Voodoo3 specification)

Pin	8Mbit SGRAM	16Mbit SGRAM	16Mbit SDRAM	32Mbit SGRAM *
MA_A/B[8:0]	A[8:0]	A[8:0]	A[8:0]	A[8:0]
MA_A/B[9]	NC(BA1 on 16Mbit)	BA1	A[9]	A[9]
MCS_0	Bank Select		A10 (MD[127:64])	A10 (MD[127:64])
MCS_1			A10 (MD[63:0])	A10 (MD[63:0])

* : Samsung's Proposal for 32Mb SGRAM with 1 CS

Same method as supporting 16M SD

Memory Address Mapping of Graphics Memory

Pin of Voodoo3	8Mbit SGRAM (256Kx32)	16Mbit SGRAM (512Kx32)	16Mbit SDRAM (1Mx16)	32Mbit SGRAM (1Mx32)
Address Composition	BA & RA[8:0] CA[7:0]	BA & RA[9:0] CA[7:0]	BA & RA[10:0] CA[7:0]	BA & RA[10:0] CA[7:0]
# of Total Addr.	10ea (A9/BA & A[8:0])	11ea (A10/BA & A[9:0])	12ea (A11/BA & A[9:0])	12ea (A11/BA & A[9:0])
Pin Name of AP	A8/AP	A9/AP	A10/AP	A8/AP
MA_A/B[10]	A9(BA)	A10(BA)	A11(BA)	A11(BA)
MA_A/B[9]	NC	A9	A9	A9
MA_A/B[8:0]	A[8:0]	A[8:0]	A[8:0]	A[8:0]
MA_A/B[7:0]	A[7:0]	A[7:0]	A[7:0]	A[7:0]
MCS_0	CS0	CS0	A10 (CS Pull-down)	A10 (CS Pull-down)
MCS_1	CS1 (if support)	CS1 (if support)		

Dual CS vs. Single CS

Dual CS vs. Single CS

Product Type	Single CS & Single Chip	Dual CS & Single Chip	Dual CS & Dual Chip
Company	Samsung, ESMT, UMC, ETRON	ESMT,(ETRON)	ETRON
Package Type	100-QFP	100-QFP	100-QFP
Cost	Best	Normal •Chip Size penalty for separate CS	Worst •2Chip Stacked
Forward Compatibility	8MSG / 16M SG	No Compatibility	
Address Composition	<ul style="list-style-type: none"> •Bank Addr. : BA •Row Addr. : RA0 ~ RA10 •Column Addr. : CA0 ~ CA7 	<ul style="list-style-type: none"> •Bank Addr. : BA •Row Addr. : RA0 ~ RA9 •Column Addr. : CA0 ~ CA7 	
Controller Design Change	Additional Address(A10)	No Change	
Board Design Change	Additional Connecting to A10	Additional Connecting to CS1	
Performance	Good •Upto 200MHz operation	Good •CS interleaving only if Multi-CS available	
Size Expandability	Good •16MB @64bit B/W & 2CS(Cntrl) •32MB @128bit B/W & 2CS(Cntrl)	Bad •8MB @64bit B/W & 2CS(Controller) •16MB @128bit B/W & 2CS(Controller)	
Standardization	JEDEC Standard	Non-JEDEC	