



GDDR4: Today's Ultimate Gaming Memory

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GDDR4 - The Development

- Goals
 - Speed
 - Gamers need the speed
 - Low power
 - Every watt saved in the memory can be spent on the GPU
- ATI lead the development within JEDEC
 - Joe Macri – Chair of the JEDEC GDDR4 Task Group and JC42.3 Dram Committee
 - ATI provided the critical IP that enabled the standard
 - Samsung and Hynix were the key Dram partners during development
- Evolutionary from GDDR3
 - Ease backwards compatibility
 - Speeds development



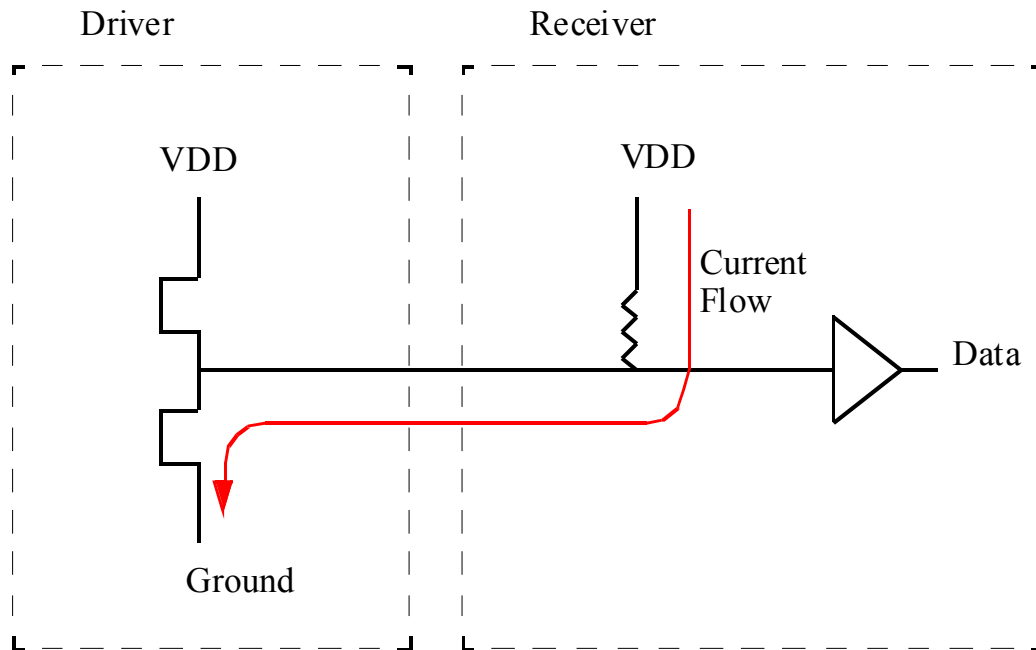
Dram Core– Low Power by Design

- Density 512Mbit – 32Mbit X 32
- Lower VDD than GDDR3
 - Nominal voltage is 1.5v
 - 1.9v used for hi speed gaming and over clocking
 - ~30% power savings
- Fixed Data Burst Length of 8
 - Lowers core frequency by 2x VS GDDR3
 - Significantly reduces power
 - Allows higher clock frequency



DBI – Data Bus Inversion

- Lowers power consumption
- Increases speed by reducing VDD noise
- How does this work?
 - Only Logic 0's use power so eliminate them!





DBI – Data Bus Inversion

- Eliminating Logic 0's

- If number of 0's is >4 then Invert Data and set DBI = 1
- Receiver of data will flip it back via DBI Flag

- Example 1

Original Data = 00000000 → Since # 0's >4 Invert
Data on Bus = 11111111, DBI = 1
When DBI = 1 → Received data = 00000000

- Example 2

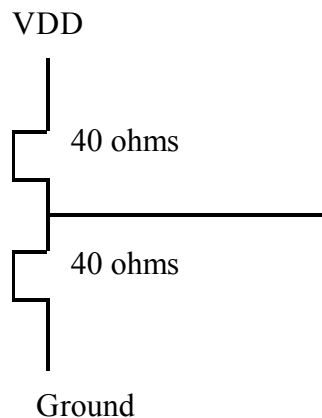
Original Data = 11111000 → Since # 0's <4 Do not Invert
Data on Bus = 11111000, DBI = 0
When DBI = 0 → Received data = 11111000



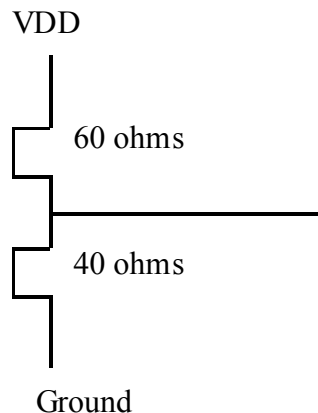
Smaller Transmitter

- GDDR4 has a lower input Capacitance than GDDR3
 - Lower Power
 - More Speed

GDDR3 Driver



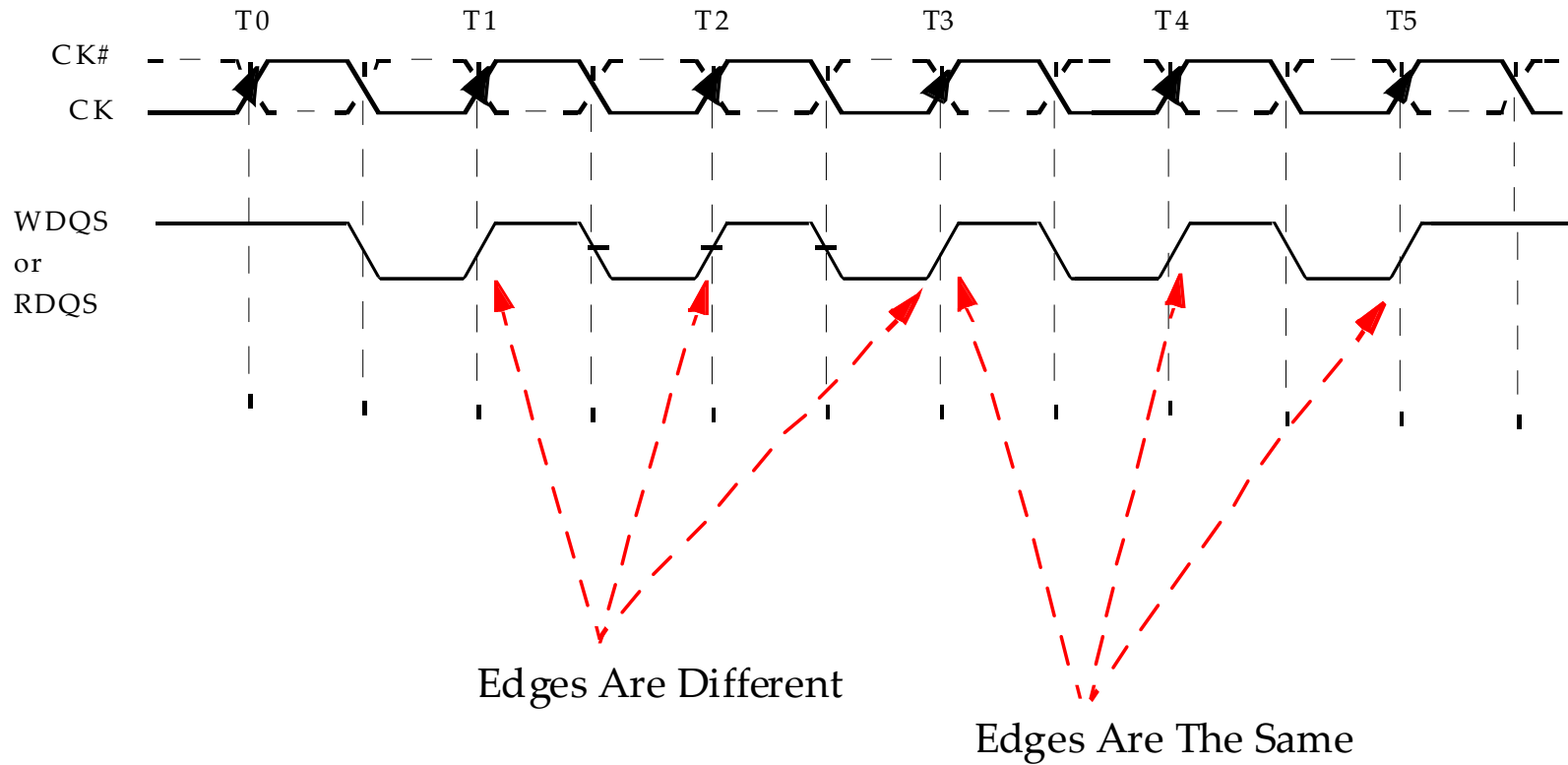
GDDR4 Driver





Multi-Cycle Preamble

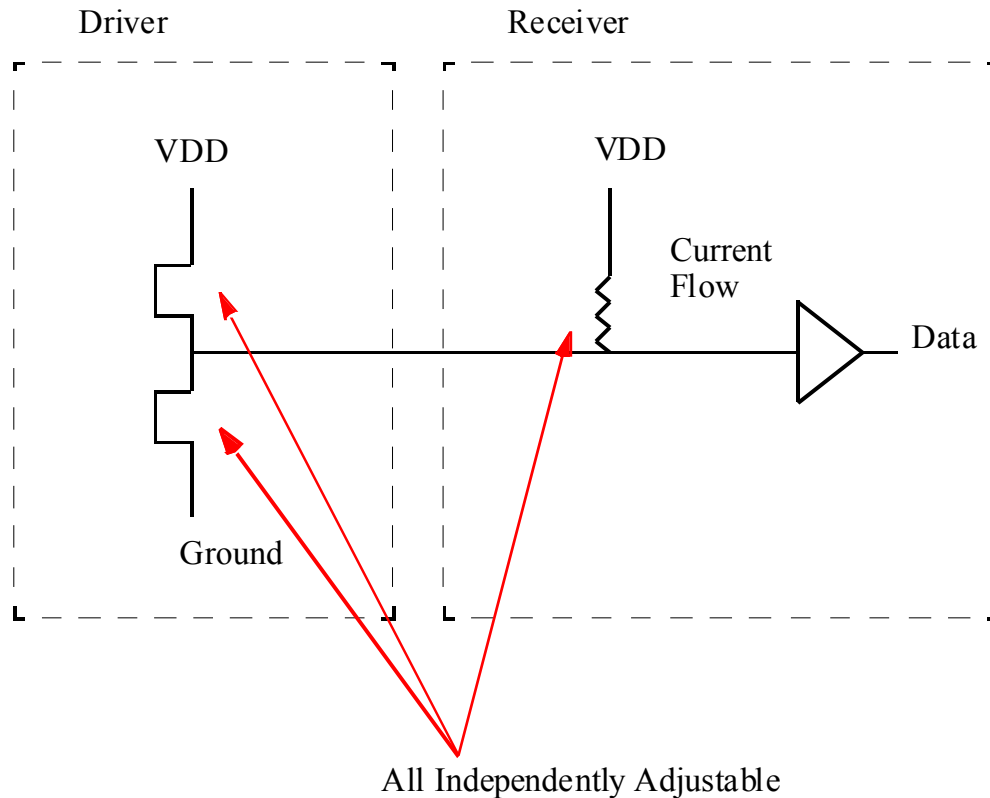
- Reduce Jitter on Data Strobes
 - More Speed





Fully adjustable Driver and Terminator

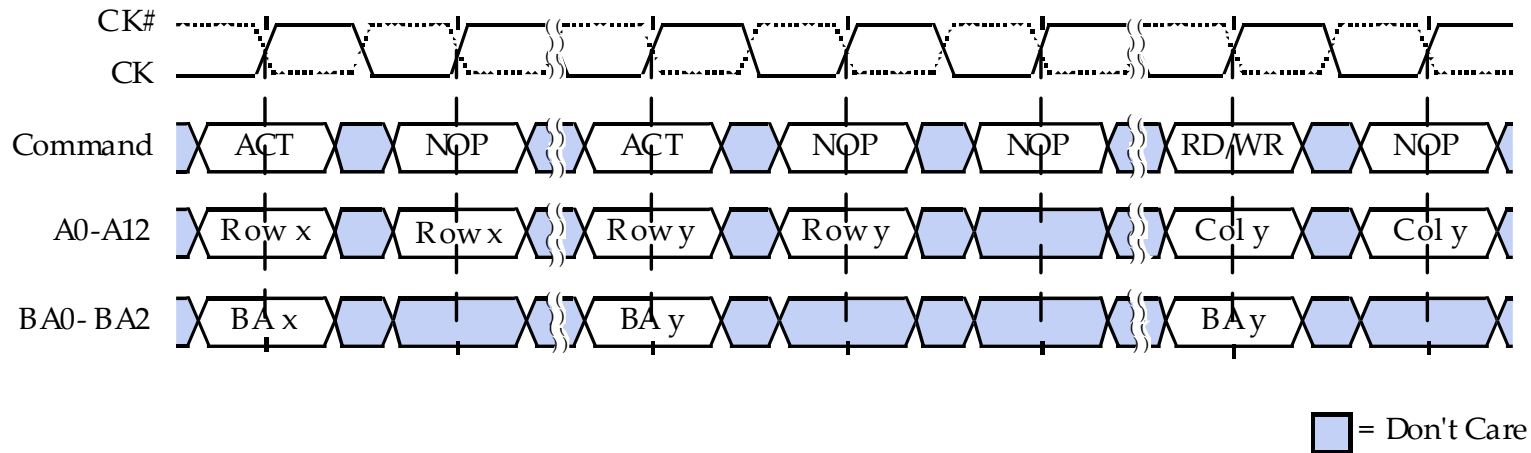
- Every Dram Manufacturer is a bit different
 - Adjustability allows optimizing for speed





Double Pumped Address Bus

- GDDR4 uses 1/2 the pins for address than GDDR3
 - Slight reduction in Power
- Frees pins up to be used for Power and Ground
 - Increases Speed
- Address are sent on two consecutive cycles





GDDR4 - 136ball BGA

GDDR4

	1	2	3	4	5	6	7	8	9	10	11	12
A	VDDQ	VDD	VSS	ZQ					MF	VSS	VDD	VDDQ
B	VSSQ	DQ0	DQ1	VSSQ					VSSQ	DQ9	DQ8	VSSQ
C	VDDQ	DQ2	DQ3	VDDQ					VDDQ	DQ11	DQ10	VDDQ
D	VSSQ	WDQS0	RDQS0	VSSQ					VSSQ	RDQS1	WDQS1	VSSQ
E	VDDQ	DQ4	DM0	VDDQ					VDDQ	DM1	DQ12	VDDQ
F	VDD	DQ6	DQ5	VSSQ					VSSQ	DQ13	DQ14	VDD
G	VSS	VSSQ	DQ7	CAS#					CS#	DQ15	VSSQ	VSS
H	VDDQ	RAS#	CKE#	BA0 A1					BA1 A5	WE#	NC	VDDQ
J	VSSA	RFU	PERR#	VREFC					VREFD	CK#	CK	VSSA
K	VDDA	A10 A0	A2 A2	VSS					VSS	BA2 A6	A8 A4	VDDA
L	VSS	VSSQ	DQ25	A11 A3					A9 A7	DQ17	VSSQ	VSS
M	VDD	DQ24	DQ27	VSSQ					VSSQ	DQ19	DQ16	VDD
N	VDDQ	DQ26	DM3	VDDQ					VDDQ	DM2	DQ18	VDDQ
P	VSSQ	WDQS3	RDQS3	VSSQ					VSSQ	RDQS2	WDQS2	VSSQ
R	VDDQ	DQ28	DQ29	VDDQ					VDDQ	DQ21	DQ20	VDDQ
T	VSSQ	DQ30	DQ31	VSSQ					VSSQ	DQ23	DQ22	VSSQ
V	VDDQ	VDD	VSS	RFU					RES	VSS	VDD	VDDQ



GDDR4 The Ultimate Gamers Memory

- Improved Over Clocking
 - Lower power at all frequency VS GDDR3
 - Improved signaling technology allows higher speeds
- Higher Frequencies enhances gaming experience
 - Smoothes Frame Rates

X1950 combined with GDDR4 is the Gamers Choice bar None!!!