

AMBA - AXI - Quick reference card by Matt Hutson

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xRESP[1:0]	Response Encoding
0b00	OKAY
0b01	EXOKAY
0b10	SLVERR
0b11	DECERR

Transaction ID	AXI3	AXI4
Write streams	AWID,WID,BID	AWID,BID
Read streams	ARID,RID	ARID,RID

AxPROT[2:0] Protection access type encoding		
Bit#	0	1
[0]	Unprivileged	Privileged
[1]	Secure	Non-secure
[2]	Data	Instruction

AxLOCK	AXI3 [1:0]	AXI4
Normal	0b00	0b0
Exclusive	0b01	0b1
Locked	0b10	0b0 (AXI3 mapping to AXI4)
Reserved	0b11	-

Access type encoding

AXI4 extras	AxREGION,AxQOS,AxUSER
	WUSER not supported by NoC

AxBURST[1:0]	Burst type encoding
0b00	FIXED
0b01	INCR
0b10	WRAP
0b11	Reserved

AxSIZE[2:0]	Bytes in beat
0b000	1
0b001	2
0b010	4
0b011	8
0b100	16
0b101	32
0b110	64
0b111	128

Burst size encoding (2ⁿvalue) – Bytes in each beat of transfer

AxLEN	AXI3	AXI4
Burst_Length	AxLEN[3:0] + 1	AxLEN[7:0] + 1
Wrapping bursts, the burst length must be 2, 4, 8, or 16		
A burst must not cross a 4KB address boundary		
AXI4 INCR burst is extended only, all others 1 to 16.		

ARCACHE[3:0]	AWCACHE[3:0]	Memory type
0000	0000	Device Non-bufferable
0001	0001	Device Bufferable
0010	0010	Normal Non-cacheable Non-bufferable
0011	0011	Normal Non-cacheable Bufferable
1010	0110	Write-through No-allocate
1110 (0110)	0110	Write-through Read-allocate
1010	1110 (1010)	Write-through Write-allocate
1110	1110	Write-through Read and Write-allocate
1011	0111	Write-back No-allocate
1111 (0111)	0111	Write-back Read-allocate
1011	1111 (1011)	Write-back Write-allocate
1111	1111	Write-back Read and Write-allocate

Memory type encoding - AXI3 legal in ()

AxCACHE - Transaction attribute (0=Non No)		
Bit#	AXI3	AXI4
[0]	Bufferable	Bufferable
[1]	Cacheable	Modifiable
[2]	Read-allocate	W=Other Allocate R=Allocate
[3]	Write-allocate	W=Allocate R=Other Allocate

Modifiable parameters:

[AxADDR,AxREGION,AxSize,AxLEN,AxBURST,AxLOCK,AxPROT]

AxCACHE Ordering requirements			
Memory type	Same ID	Overlapping address	Ordering required
	Yes	X	Yes
		Yes	Yes
Device	No	No	No
		Yes	Yes
Normal	X	No	No

AMBA - AHB APB - Quick reference card by Matt Hutson

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Dec (d)	Hex (x)	Bin (b)	Dec (d)	Hex (x)	Bin (b)
0	0	0000	8	8	1000
1	1	0001	9	9	1001
2	2	0010	10	A	1010
3	3	0011	11	B	1011
4	4	0100	12	C	1100
5	5	0101	13	D	1101
6	6	0110	14	E	1110
7	7	0111	15	F	1111

Value	Log2	Hex mask	Value	Log2	Hex mask
2	1	0001	128K	17	0001_FFFF
4	2	0003	256K	18	0003_FFFF
8	3	0007	512K	19	0007_FFFF
16	4	000F	1M	20	000F_FFFF
32	5	001F	2M	21	001F_FFFF
64	6	003F	4M	22	003F_FFFF
128	7	007F	8M	23	007F_FFFF
256	8	00FF	16M	24	00FF_FFFF
512	9	01FF	32M	25	01FF_FFFF
1K	10	03FF	64M	26	03FF_FFFF
2K	11	07FF	128M	27	07FF_FFFF
4K	12	0FFF	256M	28	0FFF_FFFF
8K	13	1FFF	512M	29	1FFF_FFFF
16K	14	3FFF	1G	30	3FFF_FFFF
32K	15	7FFF	2G	31	7FFF_FFFF
64K	16	FFFF	4G	32	FFFF_FFFF

AXI4 lite

Unsupported signals		
AxLEN	0	
AxSIZE		access data width 32 or 64bit
AxBURST		no meaning as LEN is 0.
AxLOCK	0	Normal.
AxCACHE	0b0000	Non-modifiable/bufferable.
xLAST	1	LEN is 0.
xxID		Optional support only
xRESP	value	EXOKAY unsupported only

APB

Transfer control	
PSEL & PENABLE (& APB3 PREADY)	
APB3 Extras	
PREADY	A ready signal to indicate completion of an APB transfer.
PSLVERR	An error signal to indicate the failure of a transfer.
APB4 Extras	
PPROT[3:0]	Protection encoding
Bit#	0 1
[0]	Normal Privileged
[1]	Secure Non-secure
[2]	Data Instruction
PSTRB[n:0]	Write strobe. Indicates which data byte is active.

AHB

HTRANS[1:0]	transfer type encoding	
0b00	IDLE	
0b01	BUSY	
0b10	NONSEQ	
0b11	SEQ	
HBURST[2:0]	Burst encoding	
0b000	SINGLE	Single transfer
0b001	INCR	Incrementing burst of unspecified length
0b010	WRAP4	4-beat Wrapping
0b011	INCR4	4-beat Incrementing
0b100	WRAP8	8-beat Wrapping
0b101	INCR8	8-beat Incrementing
0b110	WRAP16	16-beat Wrapping
0b111	INCR16	16-beat Incrementing
HSIZE[2:0]	bits	Bytes Name
0b000	8	1 Byte
0b001	16	2 Halfword
0b010	32	4 Word
0b011	64	8-
0b100	128	164-word line
0b101	256	328-word line
0b110	512	64-
0b111	1024	128-
Transfer Size encoding		
HPROT[3:0]		
Bit#	0	1
[0]	Opcode fetch	Data
[1]	User access	Privileged
[2]	Not bufferable	Bufferable
[3]	Not cacheable	Cacheable
Protection encoding		
HRESP[1:0]	Response Encoding	
0b00	OKAY	
0b01	ERROR	
0b10	RETRY	
0b11	SPLIT	