

BRK (00)	Cycles: 7	Size: 2*
Implied		
Cycle	R/W	Desc
-X.2	Read PC	** Store as OpCode. Inc. <b>PC</b> unless <b>PC</b> writes are disabled.
1.1		To be discarded.
1.2	Read PC	Inc. <b>PC</b> unless <b>PC</b> writes are disabled.
2.1		Push <b>PC.H</b> onto stack.
2.2	*** Write <b>S</b>   \$0100	
3.1		Push <b>PC.L</b> onto stack.
3.2	*** Write ( <b>S</b> -1)   \$0100	Use Interrupt flags to decide which vector to use. RESET=\$FFFC NMI=\$FFFA IRQ/BRK=\$FFFF
4.1		Push <b>P</b> onto stack, with <b>B</b> flag if software BRK.
4.2	*** Write ( <b>S</b> -2)   \$0100	Decrease <b>S</b> by 3.
5.1		Store to Address.L.
5.2	Read Vector Low	Set <b>I</b> , unset <b>B</b> (required by Tom Harte tests).
6.1		Store to Address.H.
6.2	Read Vector High	Enable writes to <b>PC</b> (disabled by NMI/IRQ). Copy Address to <b>PC</b> .
7.1		
7.2	Read PC	Store as OpCode.
+X.1		

\* Concerning the BRK instruction, you should also note that although its second byte is basically a “don’t care” byte – that is, it can have any value - the BRK (and COP instruction as well) is a two-byte instruction, the second byte sometimes is used as a signature byte to determine the nature of the BRK being executed. When an RTI instruction is executed, control always returns to the second byte past the BRK opcode. — assembly-programming-manual-for-w65c816.pdf

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0001	00	1	BRK	0001	aa	00	00	fd	nv-BdiZc	CLI	T1
2	0001	00	1	BRK	0001	aa	00	00	fd	nv-BdiZc	CLI	T1
3	0002	20	1		0002	aa	00	00	fd	nv-BdiZc	BRK	T2
3	0002	20	1		0002	aa	00	00	fd	nv-BdiZc	BRK	T2
4	01fd	20	0		0003	aa	00	00	fd	nv-BdiZc	BRK	T3
4	01fd	00	0		0003	aa	00	00	fd	nv-BdiZc	BRK	T3
5	01fc	20	0		0003	aa	00	00	fd	nv-BdiZc	BRK	T4
5	01fc	03	0		0003	aa	00	00	fd	nv-BdiZc	BRK	T4
6	01fb	20	0		0003	aa	00	00	fd	nv-BdiZc	BRK	T5
6	01fb	32	0		0003	aa	00	00	fd	nv-BdiZc	BRK	T5
7	ffffe	00	1		0003	aa	00	00	fa	nv-BdiZc	BRK	
7	ffffe	00	1		0003	aa	00	00	fa	nv-BdiZc	BRK	
8	fffff	00	1		0003	aa	00	00	fa	nv-BdIZc	BRK	T0
8	fffff	00	1		0003	aa	00	00	fa	nv-BdIZc	BRK	T0
9	0000	58	1	CLI	0000	aa	00	00	fa	nv-BdIZc	BRK	T1
9	0000	58	1	CLI	0000	aa	00	00	fa	nv-BdIZc	BRK	T1

\*\* If NMI, IRQ, or RESET, OpCode is forced to 0 and writes to PC are disabled.

\*\*\* If handling a RESET, the writes turn into reads. The databus is populated but ignored.

ORA (01)	Cycles: 6	Size: 2
Indirect, X (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Operand.
2.1		Inc. <b>PC</b> .
2.2	Read Operand	
3.1		Set Pointer to (Operand+X) & \$FF.
3.2	Read Pointer	Store to Address.L.
4.1		
4.2	Read (Pointer+1) & \$FF	Store to Address.H.
5.1		
5.2	Read Address	Store as Operand. * Perform <b>A=A</b>   Operand, set <b>N</b> and <b>Z</b> accordingly.
6.1		
6.2	Read PC	Store as OpCode.
+X.1		<b>A</b> and <b>N</b> , <b>Z</b> applied.

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0001	01	1	ORA (zp,X)	0001	aa	00	00	fd	nv-BdiZc	CLI	T1
2	0001	01	1	ORA (zp,X)	0001	aa	00	00	fd	nv-BdiZc	CLI	T1
3	0002	20	1		0002	aa	00	00	fd	nv-BdiZc	ORA (zp,X)	T2
3	0002	20	1		0002	aa	00	00	fd	nv-BdiZc	ORA (zp,X)	T2
4	0020	22	1		0003	aa	00	00	fd	nv-BdiZc	ORA (zp,X)	T3
4	0020	22	1		0003	aa	00	00	fd	nv-BdiZc	ORA (zp,X)	T3
5	0020	22	1		0003	aa	00	00	fd	nv-BdiZc	ORA (zp,X)	T4
5	0020	22	1		0003	aa	00	00	fd	nv-BdiZc	ORA (zp,X)	T4
6	0021	00	1		0003	aa	00	00	fd	nv-BdiZc	ORA (zp,X)	T5
6	0021	00	1		0003	aa	00	00	fd	nv-BdiZc	ORA (zp,X)	T5
7	0022	ff	1		0003	aa	00	00	fd	nv-BdiZc	ORA (zp,X)	T0
7	0022	ff	1		0003	aa	00	00	fd	nv-BdiZc	ORA (zp,X)	T0
8	0003	10	1	BPL	0003	aa	00	00	fd	nv-BdiZc	ORA (zp,X)	T1
8	0003	10	1	BPL	0003	aa	00	00	fd	nv-BdiZc	ORA (zp,X)	T1
9	0004	00	1		0004	ff	00	00	fd	Nv-Bdizc	BPL	T2
9	0004	00	1		0004	ff	00	00	fd	Nv-Bdizc	BPL	T2

JAM (02)	Cycles: $\infty$	Size: 1
Implied		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		
1.2	Read PC	
2.1		
2.2	Read \$FFFF	
3.1		
3.2	Read \$FFFE	
4.1		
4.2	Read \$FFFE	
5.1		Repeat 5.1 and 5.2 forever.
5.2	Read \$FFFF	

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	02	1	unknown	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
2	0002	02	1	unknown	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
3	0003	10	1		0003	00	00	00	fd	nv-BdIZc	unknown	T2
3	0003	10	1		0003	00	00	00	fd	nv-BdIZc	unknown	T2
4	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T3
4	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T3
5	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T4
5	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T4
6	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T5
6	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T5
7	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
7	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
8	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
8	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
9	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
9	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
10	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
10	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
11	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
11	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	

SLO (03) Cycles: 8		Size: 2
Indirect, X (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		
1.2	Read PC	Store as Operand. Inc. <b>PC</b> .
2.1		
2.2	Read Operand	
3.1		Set Pointer to (Operand+X) & \$FF.
3.2	Read Pointer	Store to Address.L.
4.1		
4.2	Read (Pointer+1) & \$FF	Store to Address.H.
5.1		
5.1	Read Address	Store as Operand.
6.1		
6.2	Write Address	Write unmodified Operand. * Set <b>C</b> if high bit of Operand is set. Perform Operand=Operand << 1, <b>A=A</b>   Operand, set <b>N</b> and <b>Z</b> based off <b>A</b> .
7.1		
7.2	Write Address	Write modified Operand.
8.1		
8.2	Read PC	Store as OpCode. <b>A</b> applied.
+X.1		

\* Setting of A is delayed by 2 cycles until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0001	03	1	unknown	0001	aa	00	00	fd	nv-Bdizc	CLI	T1
2	0001	03	1	unknown	0001	aa	00	00	fd	nv-Bdizc	CLI	T1
3	0002	20	1		0002	aa	00	00	fd	nv-Bdizc	unknown	T2
3	0002	20	1		0002	aa	00	00	fd	nv-Bdizc	unknown	T2
4	0020	22	1		0003	aa	00	00	fd	nv-Bdizc	unknown	T3
4	0020	22	1		0003	aa	00	00	fd	nv-Bdizc	unknown	T3
5	0020	22	1		0003	aa	00	00	fd	nv-Bdizc	unknown	T4
5	0020	22	1		0003	aa	00	00	fd	nv-Bdizc	unknown	T4
6	0021	00	1		0003	aa	00	00	fd	nv-Bdizc	unknown	T5
6	0021	00	1		0003	aa	00	00	fd	nv-Bdizc	unknown	T5
7	0022	ff	1		0003	aa	00	00	fd	nv-Bdizc	unknown	
7	0022	ff	1		0003	aa	00	00	fd	nv-Bdizc	unknown	
8	0022	ff	0		0003	aa	00	00	fd	nv-Bdizc	unknown	
8	0022	ff	0		0003	aa	00	00	fd	nv-Bdizc	unknown	
9	0022	ff	0		0003	aa	00	00	fd	Nv-BdizC	unknown	T0
9	0022	fe	0		0003	aa	00	00	fd	Nv-BdizC	unknown	T0
10	0003	10	1	BPL	0003	aa	00	00	fd	Nv-BdizC	unknown	T1
10	0003	10	1	BPL	0003	aa	00	00	fd	Nv-BdizC	unknown	T1
11	0004	00	1		0004	fe	00	00	fd	Nv-BdizC	BPL	T2
11	0004	00	1		0004	fe	00	00	fd	Nv-BdizC	BPL	T2

NOP (04) Cycles: 3		Size: 2
Zero Page (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Address.
2.1		Inc. <b>PC</b> .
2.2	Read Address	Store as Operand.
3.1		
3.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0001	04	1	unknown	0001	aa	00	00	fd	nv-BdiZc	CLI	T1
2	0001	04	1	unknown	0001	aa	00	00	fd	nv-BdiZc	CLI	T1
3	0002	20	1		0002	aa	00	00	fd	nv-BdiZc	unknown	T2
3	0002	20	1		0002	aa	00	00	fd	nv-BdiZc	unknown	T2
4	0020	22	1		0003	aa	00	00	fd	nv-BdiZc	unknown	T0
4	0020	22	1		0003	aa	00	00	fd	nv-BdiZc	unknown	T0
5	0003	10	1	BPL	0003	aa	00	00	fd	nv-BdiZc	unknown	T1
5	0003	10	1	BPL	0003	aa	00	00	fd	nv-BdiZc	unknown	T1
6	0004	00	1		0004	aa	00	00	fd	nv-BdiZc	BPL	T2
6	0004	00	1		0004	aa	00	00	fd	nv-BdiZc	BPL	T2

ORA (05)	Cycles: 3	Size: 2
Zero Page (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		
1.2	Read PC	Store as Address. Inc. <b>PC</b> .
2.1		
2.2	Read Address	Store as Operand.
3.1		* Perform <b>A=A</b>   Operand, set <b>N</b> and <b>Z</b> accordingly.
3.2	Read PC	Store as OpCode. <b>A</b> and <b>N</b> , <b>Z</b> applied.
+X.1		

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0001	05	1	ORA zp	0001 aa 00 00 fd nv-BdiZc	CLI	T1					
2	0001	05	1	ORA zp	0001 aa 00 00 fd nv-BdiZc	CLI	T1					
3	0002	20	1		0002 aa 00 00 fd nv-BdiZc	ORA zp	T2					
3	0002	20	1		0002 aa 00 00 fd nv-BdiZc	ORA zp	T2					
4	0020	44	1		0003 aa 00 00 fd nv-BdiZc	ORA zp	T0					
4	0020	44	1		0003 aa 00 00 fd nv-BdiZc	ORA zp	T0					
5	0003	10	1	BPL	0003 aa 00 00 fd nv-BdiZc	ORA zp	T1					
5	0003	10	1	BPL	0003 aa 00 00 fd nv-BdiZc	ORA zp	T1					
6	0004	00	1		0004 ee 00 00 fd Nv-Bdizc	BPL	T2					
6	0004	00	1		0004 ee 00 00 fd Nv-Bdizc	BPL	T2					

ASL (06)	Cycles: 5	Size: 2
Zero Page (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Address.
2.1		Inc. <b>PC</b> .
2.2	Read Address	Store as Operand.
3.1		
3.2	Write Address	Write unmodified Operand.
4.1		Set <b>C</b> if high bit of Operand is set. Perform Operand=Operand << 1, set <b>N</b> and <b>Z</b> accordingly.
4.2	Write Address	Write modified Operand.
5.1		
5.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0001	06	1	ASL zp	0001	aa	00	00	fd	nv-BdiZc	CLI	T1
2	0001	06	1	ASL zp	0001	aa	00	00	fd	nv-BdiZc	CLI	T1
3	0002	20	1		0002	aa	00	00	fd	nv-BdiZc	ASL zp	T2
3	0002	20	1		0002	aa	00	00	fd	nv-BdiZc	ASL zp	T2
4	0020	44	1		0003	aa	00	00	fd	nv-BdiZc	ASL zp	T3
4	0020	44	1		0003	aa	00	00	fd	nv-BdiZc	ASL zp	T3
5	0020	44	0		0003	aa	00	00	fd	nv-BdiZc	ASL zp	T4
5	0020	44	0		0003	aa	00	00	fd	nv-BdiZc	ASL zp	T4
6	0020	44	0		0003	aa	00	00	fd	Nv-BdiZc	ASL zp	T0
6	0020	88	0		0003	aa	00	00	fd	Nv-BdiZc	ASL zp	T0
7	0003	10	1	BPL	0003	aa	00	00	fd	Nv-BdiZc	ASL zp	T1
7	0003	10	1	BPL	0003	aa	00	00	fd	Nv-BdiZc	ASL zp	T1
8	0004	00	1		0004	aa	00	00	fd	Nv-BdiZc	BPL	T2
8	0004	00	1		0004	aa	00	00	fd	Nv-BdiZc	BPL	T2

SLO (07)	Cycles: 5	Size: 2
Zero Page (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		
1.2	Read PC	Store as Address. Inc. <b>PC</b> .
2.1		
2.2	Read Address	Store as Operand.
3.1		
3.2	Write Address	Write unmodified Operand.
4.1		Set <b>C</b> if high bit of Operand is set. * Perform Operand=Operand $\ll 1$ , <b>A=A</b>   Operand, set <b>N</b> and <b>Z</b> based off <b>A</b> .
4.2	Write Address	Write modified Operand.
5.1		
5.2	Read PC	Store as OpCode. <b>A</b> and <b>N</b> , <b>Z</b> applied.
+X.1		

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0001	07	1	unknown	0001	aa	00	00	fd	nv-Bdizc	CLI	T1
2	0001	07	1	unknown	0001	aa	00	00	fd	nv-Bdizc	CLI	T1
3	0002	20	1		0002	aa	00	00	fd	nv-Bdizc	unknown	T2
3	0002	20	1		0002	aa	00	00	fd	nv-Bdizc	unknown	T2
4	0020	88	1		0003	aa	00	00	fd	nv-Bdizc	unknown	T3
4	0020	88	1		0003	aa	00	00	fd	nv-Bdizc	unknown	T3
5	0020	88	0		0003	aa	00	00	fd	nv-Bdizc	unknown	T4
5	0020	88	0		0003	aa	00	00	fd	nv-Bdizc	unknown	T4
6	0020	88	0		0003	aa	00	00	fd	nv-BdizC	unknown	T0
6	0020	10	0		0003	aa	00	00	fd	nv-BdizC	unknown	T0
7	0003	10	1	BPL	0003	aa	00	00	fd	nv-BdizC	unknown	T1
7	0003	10	1	BPL	0003	aa	00	00	fd	nv-BdizC	unknown	T1
8	0004	00	1		0004	ba	00	00	fd	Nv-BdizC	BPL	T2
8	0004	00	1		0004	ba	00	00	fd	Nv-BdizC	BPL	T2

PHP (08) Cycles: 3		Size: 1
Implied		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	To be discarded.
2.1		
2.2	Write <b>S</b>   \$0100	Push the status register with <b>B</b> and <b>M</b> set.
3.1		Dec. <b>S</b> .
3.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0001	08	1	PHP	0001	aa	00	00	fd	nv-BdiZc	CLI	T1
2	0001	08	1	PHP	0001	aa	00	00	fd	nv-BdiZc	CLI	T1
3	0002	20	1		0002	aa	00	00	fd	nv-BdiZc	PHP	T2
3	0002	20	1		0002	aa	00	00	fd	nv-BdiZc	PHP	T2
4	01fd	20	0		0002	aa	00	00	fd	nv-BdiZc	PHP	T0
4	01fd	32	0		0002	aa	00	00	fd	nv-BdiZc	PHP	T0
5	0002	20	1	JSR Abs	0002	aa	00	00	fc	nv-BdiZc	PHP	T1
5	0002	20	1	JSR Abs	0002	aa	00	00	fc	nv-BdiZc	PHP	T1
6	0003	10	1		0003	aa	00	00	fc	nv-BdiZc	JSR Abs	T2
6	0003	10	1		0003	aa	00	00	fc	nv-BdiZc	JSR Abs	T2

ORA (09)	Cycles: 2	Size: 2
Immediate (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Operand.
2.1		Inc. <b>PC</b> . * Perform <b>A=A</b>   Operand, set <b>N</b> and <b>Z</b> accordingly.
2.2	Read PC	Store as OpCode.
+X.1		<b>A</b> and <b>N</b> , <b>Z</b> applied.

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0001	09	1	ORA #	0001	aa	00	00	fd	nv-BdiZc	CLI	T1
2	0001	09	1	ORA #	0001	aa	00	00	fd	nv-BdiZc	CLI	T1
3	0002	ff	1		0002	aa	00	00	fd	nv-BdiZc	ORA #	T0+T2
3	0002	ff	1		0002	aa	00	00	fd	nv-BdiZc	ORA #	T0+T2
4	0003	10	1	BPL	0003	aa	00	00	fd	nv-BdiZc	ORA #	T1
4	0003	10	1	BPL	0003	aa	00	00	fd	nv-BdiZc	ORA #	T1
5	0004	00	1		0004	ff	00	00	fd	Nv-Bdizc	BPL	T2
5	0004	00	1		0004	ff	00	00	fd	Nv-Bdizc	BPL	T2

ASL (0A)	Cycles: 2	Size: 1
Implied		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	To be discarded.
2.1		Set <b>C</b> if high bit of Operand is set. Perform <b>A=A &lt;&lt; 1</b> , set <b>N</b> and <b>Z</b> accordingly.
2.2	Read PC	Store as OpCode.
+X.1		<b>A</b> and <b>C, N, Z</b> applied.

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0001	0a	1	ASL	0001	aa	00	00	fd	nv-BdizC	CLI	T1
2	0001	0a	1	ASL	0001	aa	00	00	fd	nv-BdizC	CLI	T1
3	0002	98	1		0002	aa	00	00	fd	nv-BdizC	ASL	T0+T2
3	0002	98	1		0002	aa	00	00	fd	nv-BdizC	ASL	T0+T2
4	0002	98	1	TYA	0002	aa	00	00	fd	nv-BdizC	ASL	T1
4	0002	98	1	TYA	0002	aa	00	00	fd	nv-BdizC	ASL	T1
5	0003	10	1		0003	54	00	00	fd	nv-BdizC	TYA	T0+T2
5	0003	10	1		0003	54	00	00	fd	nv-BdizC	TYA	T0+T2

ANC (0B)	Cycles: 2	Size: 2
Immediate (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Operand.
2.1		Inc. <b>PC</b> . * Perform <b>A=A</b> & Operand, set <b>C, N, and Z</b> accordingly ( <b>C</b> is set using logic for <b>N</b> ).
2.2	Read PC	Store as OpCode.
+X.1		** <b>A</b> and <b>C, N, Z</b> applied.

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

\*\* Visual6502 incorrectly omits the update of A; flags are updated based off the incorrect A value.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0001	0b	1	unknown	0001	aa	00	00	fd	nv-BdiZc	CLI	T1
2	0001	0b	1	unknown	0001	aa	00	00	fd	nv-BdiZc	CLI	T1
3	0002	0f	1		0002	aa	00	00	fd	nv-BdiZc	unknown	T0+T2
3	0002	0f	1		0002	aa	00	00	fd	nv-BdiZc	unknown	T0+T2
4	0003	10	1	BPL	0003	aa	00	00	fd	nv-BdiZc	unknown	T1
4	0003	10	1	BPL	0003	aa	00	00	fd	nv-BdiZc	unknown	T1
5	0004	00	1		0004	aa	00	00	fd	Nv-BdizC	BPL	T2
5	0004	00	1		0004	aa	00	00	fd	Nv-BdizC	BPL	T2

## ANC (ANC2, ANA, ANB)

Type: Combination of an immediate and an implied command (Sub-instructions: AND, ASL/ROL)

Opc.	Mnemonic	Function	Size	Cycles	N	V	-	B	D	I	Z	C
\$0B	ANC #imm	$A = A \& \#imm$	2	2	o						o	o
\$2B	ANC #imm	$A = A \& \#imm$	2	2	o						o	o

**Operation:** ANDs the contents of the A register with an immediate value and then moves bit 7 of A into the Carry flag.

- This opcode works basically identically to AND #imm. except that the Carry flag is set to the same state that the Negative flag is set to. (bit 7 is put into the carry, as if the ASL/ROL would have been executed)

— NoMoreSecrets-NMOS6510UnintendedOpcodes-20232412.pdf

NOP (0C) Cycles: 4		Size: 3
Absolute (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Address.L.
2.1		Inc. <b>PC</b> .
2.2	Read PC	Store as Address.H.
3.1		Inc. <b>PC</b> .
3.2	Read Address	Store as Operand.
4.1		
4.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0001	0c	1	unknown	0001	aa	00	00	fd	nv-BdiZc	CLI	T1
2	0001	0c	1	unknown	0001	aa	00	00	fd	nv-BdiZc	CLI	T1
3	0002	0f	1		0002	aa	00	00	fd	nv-BdiZc	unknown	T2
3	0002	0f	1		0002	aa	00	00	fd	nv-BdiZc	unknown	T2
4	0003	10	1		0003	aa	00	00	fd	nv-BdiZc	unknown	T3
4	0003	10	1		0003	aa	00	00	fd	nv-BdiZc	unknown	T3
5	100f	00	1		0004	aa	00	00	fd	nv-BdiZc	unknown	T0
5	100f	00	1		0004	aa	00	00	fd	nv-BdiZc	unknown	T0
6	0004	00	1	BRK	0004	aa	00	00	fd	nv-BdiZc	unknown	T1
6	0004	00	1	BRK	0004	aa	00	00	fd	nv-BdiZc	unknown	T1
7	0005	4c	1		0005	aa	00	00	fd	nv-BdiZc	BRK	T2
7	0005	4c	1		0005	aa	00	00	fd	nv-BdiZc	BRK	T2

ORA (0D)	Cycles: 4	Size: 3
Absolute (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		Store as Address.L.
1.2	Read PC	Inc. <b>PC</b> .
2.1		Store as Address.H.
2.2	Read PC	Inc. <b>PC</b> .
3.1		Store as Operand.
3.2	Read Address	* Perform <b>A=A   Operand</b> , set <b>N</b> and <b>Z</b> accordingly.
4.1		Store as OpCode.
4.2	Read PC	<b>A</b> and <b>N, Z</b> applied.
+X.1		

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0001	0d	1	ORA Abs	0001 aa 00 00 fd	nv-BdiZc	CLI			T1		
2	0001	0d	1	ORA Abs	0001 aa 00 00 fd	nv-BdiZc	CLI			T1		
3	0002	1f	1		0002 aa 00 00 fd	nv-BdiZc	ORA Abs			T2		
3	0002	1f	1		0002 aa 00 00 fd	nv-BdiZc	ORA Abs			T2		
4	0003	01	1		0003 aa 00 00 fd	nv-BdiZc	ORA Abs			T3		
4	0003	01	1		0003 aa 00 00 fd	nv-BdiZc	ORA Abs			T3		
5	011f	0f	1		0004 aa 00 00 fd	nv-BdiZc	ORA Abs			T0		
5	011f	0f	1		0004 aa 00 00 fd	nv-BdiZc	ORA Abs			T0		
6	0004	a9	1	LDA #	0004 aa 00 00 fd	nv-BdiZc	ORA Abs			T1		
6	0004	a9	1	LDA #	0004 aa 00 00 fd	nv-BdiZc	ORA Abs			T1		
7	0005	4c	1		0005 af 00 00 fd	Nv-Bdizc	LDA #			T0+T2		
7	0005	4c	1		0005 af 00 00 fd	Nv-Bdizc	LDA #			T0+T2		

ASL (0E)	Cycles: 6	Size: 3
Absolute (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		Store as Address.L.
1.2	Read PC	Inc. <b>PC</b> .
2.1		Store as Address.H.
2.2	Read PC	Inc. <b>PC</b> .
3.1		Store as Operand.
3.2	Read Address	Write unmodified Operand.
4.1		Set <b>C</b> if high bit of Operand is set. Perform Operand=Operand << 1, set <b>N</b> and <b>Z</b> accordingly.
4.2	Write Address	Write modified Operand.
5.1		
5.2	Write Address	
6.1		
6.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0001	0e	1	ASL Abs	0001	aa	00	00	fd	nv-BdiZc	CLI	T1
2	0001	0e	1	ASL Abs	0001	aa	00	00	fd	nv-BdiZc	CLI	T1
3	0002	1f	1		0002	aa	00	00	fd	nv-BdiZc	ASL Abs	T2
3	0002	1f	1		0002	aa	00	00	fd	nv-BdiZc	ASL Abs	T2
4	0003	01	1		0003	aa	00	00	fd	nv-BdiZc	ASL Abs	T3
4	0003	01	1		0003	aa	00	00	fd	nv-BdiZc	ASL Abs	T3
5	011f	0f	1		0004	aa	00	00	fd	nv-BdiZc	ASL Abs	T4
5	011f	0f	1		0004	aa	00	00	fd	nv-BdiZc	ASL Abs	T4
6	011f	0f	0		0004	aa	00	00	fd	nv-BdiZc	ASL Abs	T5
6	011f	0f	0		0004	aa	00	00	fd	nv-BdiZc	ASL Abs	T5
7	011f	0f	0		0004	aa	00	00	fd	nv-Bdizc	ASL Abs	T0
7	011f	1e	0		0004	aa	00	00	fd	nv-Bdizc	ASL Abs	T0
8	0004	a9	1	LDA #	0004	aa	00	00	fd	nv-Bdizc	ASL Abs	T1
8	0004	a9	1	LDA #	0004	aa	00	00	fd	nv-Bdizc	ASL Abs	T1
9	0005	4c	1		0005	aa	00	00	fd	nv-Bdizc	LDA #	T0+T2
9	0005	4c	1		0005	aa	00	00	fd	nv-Bdizc	LDA #	T0+T2

SLO (0F)	Cycles: 6	Size: 3
Absolute (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Address.L.
2.1		Inc. <b>PC</b> .
2.2	Read PC	Store as Address.H.
3.1		Inc. <b>PC</b> .
3.2	Read Address	Store as Operand.
4.1		
4.2	Write Address	Write unmodified Operand.
5.1		Set <b>C</b> if high bit of Operand is set. * Perform Operand=Operand << 1, <b>A=A</b>   Operand, set <b>N</b> and <b>Z</b> based off <b>A</b> .
5.2	Write Address	Write modified Operand.
6.1		
6.2	Read PC	Store as OpCode.
+X.1		<b>A</b> and <b>N</b> , <b>Z</b> applied.

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0001	0f	1	unknown	0001	aa	00	00	fd	nv-BdiZc	CLI	T1
2	0001	0f	1	unknown	0001	aa	00	00	fd	nv-BdiZc	CLI	T1
3	0002	1f	1		0002	aa	00	00	fd	nv-BdiZc	unknown	T2
3	0002	1f	1		0002	aa	00	00	fd	nv-BdiZc	unknown	T2
4	0003	01	1		0003	aa	00	00	fd	nv-BdiZc	unknown	T3
4	0003	01	1		0003	aa	00	00	fd	nv-BdiZc	unknown	T3
5	011f	1e	1		0004	aa	00	00	fd	nv-BdiZc	unknown	T4
5	011f	1e	1		0004	aa	00	00	fd	nv-BdiZc	unknown	T4
6	011f	1e	0		0004	aa	00	00	fd	nv-BdiZc	unknown	T5
6	011f	1e	0		0004	aa	00	00	fd	nv-BdiZc	unknown	T5
7	011f	1e	0		0004	aa	00	00	fd	nv-Bdizc	unknown	T0
7	011f	3c	0		0004	aa	00	00	fd	nv-Bdizc	unknown	T0
8	0004	a9	1	LDA #	0004	aa	00	00	fd	nv-Bdizc	unknown	T1
8	0004	a9	1	LDA #	0004	aa	00	00	fd	nv-Bdizc	unknown	T1
9	0005	4c	1		0005	be	00	00	fd	Nv-Bdizc	LDA #	T0+T2
9	0005	4c	1		0005	be	00	00	fd	Nv-Bdizc	LDA #	T0+T2

BPL (10)	Cycles: 2-4	Size: 2
Branch Relative		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> . Check condition ( <b>N == 0</b> ).
1.2	Read PC	Store as Operand. Treat as signed 16-bit (Op16=i16(i8(Operand))).
2.1		Inc. <b>PC</b> . If not jumping, end (next half-cycle is 4.2)
2.2	Read PC	
3.1		If ( <b>PC+Op16</b> ).H != <b>PC.H</b> , end after <b>PC.L</b> fix (next half-cycle is 4.2). <b>PC.L=PC.L+Operand</b> .
3.2	Read PC	
4.1		<b>PC.H=previous “(PC+Op16).H” value.</b>
4.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	10	1	BPL	0002	80	00	00	fd	Nv-BdIZc	LDA #	T1
2	0002	10	1	BPL	0002	80	00	00	fd	Nv-BdIZc	LDA #	T1
3	0003	fc	1		0003	80	00	00	fd	Nv-BdIZc	BPL	T2
3	0003	fc	1		0003	80	00	00	fd	Nv-BdIZc	BPL	T2
4	0004	00	1	BRK	0004	80	00	00	fd	Nv-BdIZc	BPL	
4	0004	00	1	BRK	0004	80	00	00	fd	Nv-BdIZc	BPL	
5	0005	4c	1		0005	80	00	00	fd	Nv-BdIZc	BRK	T2
5	0005	4c	1		0005	80	00	00	fd	Nv-BdIZc	BRK	T2

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	10	1	BPL	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
2	0002	10	1	BPL	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
3	0003	fc	1		0003	00	00	00	fd	nv-BdIZc	BPL	T2
3	0003	fc	1		0003	00	00	00	fd	nv-BdIZc	BPL	T2
4	0004	00	1		0004	00	00	00	fd	nv-BdIZc	BPL	T3
4	0004	00	1		0004	00	00	00	fd	nv-BdIZc	BPL	T3
5	0000	a9	1	LDA #	0000	00	00	00	fd	nv-BdIZc	BPL	
5	0000	a9	1	LDA #	0000	00	00	00	fd	nv-BdIZc	BPL	
6	0001	00	1		0001	00	00	00	fd	nv-BdIZc	LDA #	T0+T2
6	0001	00	1		0001	00	00	00	fd	nv-BdIZc	LDA #	T0+T2

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
5	00fc	10	1	BPL	00fc	00	00	00	fd	nv-BdIZc	JMP Abs	T1
5	00fc	10	1	BPL	00fc	00	00	00	fd	nv-BdIZc	JMP Abs	T1
6	00fd	1c	1		00fd	00	00	00	fd	nv-BdIZc	BPL	T2
6	00fd	1c	1		00fd	00	00	00	fd	nv-BdIZc	BPL	T2
7	00fe	22	1		00fe	00	00	00	fd	nv-BdIZc	BPL	T3
7	00fe	22	1		00fe	00	00	00	fd	nv-BdIZc	BPL	T3
8	001a	00	1		001a	00	00	00	fd	nv-BdIZc	BPL	T0
8	001a	00	1		001a	00	00	00	fd	nv-BdIZc	BPL	T0
9	011a	00	1	BRK	011a	00	00	00	fd	nv-BdIZc	BPL	T1
9	011a	00	1	BRK	011a	00	00	00	fd	nv-BdIZc	BPL	T1
10	011b	00	1		011b	00	00	00	fd	nv-BdIZc	BRK	T2
10	011b	00	1		011b	00	00	00	fd	nv-BdIZc	BRK	T2

ORA (11) Cycles: 5-6		Size: 2
Indirect, Y (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Pointer.
2.1		Inc. <b>PC</b> .
2.2	Read Pointer	Store to Address.L.
3.1		
3.2	Read (Pointer+1) & \$FF	Store to Address.H.
4.1		Final=Address+Y. Address.L = Final.L.
4.2	Read Address	Store as Operand. If Address.H == Final.H, skip the next cycle (next half-cycle is 6.1).
5.1		Address.H = Final.H (fixes high byte of address).
5.2	Read Address	Store as Operand.
6.1		* Perform <b>A=A</b>   Operand, set <b>N</b> and <b>Z</b> accordingly.
6.2	Read PC	Store as OpCode.
+X.1		<b>A</b> and <b>N, Z</b> applied.

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
5	00fc	11	1	ORA (zp),Y	00fc	aa	00	4c	fd	nv-BdIzc	JMP Abs	T1
5	00fc	11	1	ORA (zp),Y	00fc	aa	00	4c	fd	nv-BdIzc	JMP Abs	T1
6	00fd	ee	1		00fd	aa	00	4c	fd	nv-BdIzc	ORA (zp),Y	T2
6	00fd	ee	1		00fd	aa	00	4c	fd	nv-BdIzc	ORA (zp),Y	T2
7	00ee	22	1		00fe	aa	00	4c	fd	nv-BdIzc	ORA (zp),Y	T3
7	00ee	22	1		00fe	aa	00	4c	fd	nv-BdIzc	ORA (zp),Y	T3
8	00ef	01	1		00fe	aa	00	4c	fd	nv-BdIzc	ORA (zp),Y	T4
8	00ef	01	1		00fe	aa	00	4c	fd	nv-BdIzc	ORA (zp),Y	T4
9	016e	ff	1		00fe	aa	00	4c	fd	nv-BdIzc	ORA (zp),Y	T0
9	016e	ff	1		00fe	aa	00	4c	fd	nv-BdIzc	ORA (zp),Y	T0
10	00fe	4a	1	LSR	00fe	aa	00	4c	fd	nv-BdIzc	ORA (zp),Y	T1
10	00fe	4a	1	LSR	00fe	aa	00	4c	fd	nv-BdIzc	ORA (zp),Y	T1
11	00ff	01	1		00ff	ff	00	4c	fd	Nv-BdIzc	LSR	T0+T2
11	00ff	01	1		00ff	ff	00	4c	fd	Nv-BdIzc	LSR	T0+T2

JAM (12)	Cycles: $\infty$	Size: 1
Implied		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		
1.2	Read PC	
2.1		
2.2	Read \$FFFF	
3.1		
3.2	Read \$FFFE	
4.1		
4.2	Read \$FFFE	
5.1		Repeat 5.1 and 5.2 forever.
5.2	Read \$FFFF	

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	02	1	unknown	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
2	0002	02	1	unknown	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
3	0003	10	1		0003	00	00	00	fd	nv-BdIZc	unknown	T2
3	0003	10	1		0003	00	00	00	fd	nv-BdIZc	unknown	T2
4	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T3
4	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T3
5	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T4
5	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T4
6	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T5
6	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T5
7	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
7	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
8	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
8	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
9	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
9	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
10	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
10	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
11	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
11	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	

SLO (13) Cycles: 8		Size: 2
Indirect, Y (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Pointer.
2.1		Inc. <b>PC</b> .
2.2	Read Pointer	Store to Address.L.
3.1		
3.2	Read (Pointer+1) & \$FF	Store to Address.H.
4.1		Final=Address+ <b>Y</b> . Address.L = Final.L.
4.2	Read Address	Store as Operand.
5.1		Address.H = Final.H (fixes high byte of address).
5.2	Read Address	Store as Operand.
6.1		
6.2	Write Address	Write unmodified Operand.
7.1		* Set <b>C</b> if high bit of Operand is set. Perform Operand=Operand << 1, <b>A=A</b>   Operand, set <b>N</b> and <b>Z</b> based off <b>A</b> .
7.2	Write Address	Write modified Operand.
8.1		
8.2	Read PC	Store as OpCode.
+X.1		<b>A</b> applied.

\* Setting of A is delayed by 2 cycles until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
5	00fc	13	1	unknown	00fc	aa	00	4c	fd	nv-BdIzc	JMP Abs	T1
5	00fc	13	1	unknown	00fc	aa	00	4c	fd	nv-BdIzc	JMP Abs	T1
6	00fd	ee	1		00fd	aa	00	4c	fd	nv-BdIzc	unknown	T2
6	00fd	ee	1		00fd	aa	00	4c	fd	nv-BdIzc	unknown	T2
7	00ee	22	1		00fe	aa	00	4c	fd	nv-BdIzc	unknown	T3
7	00ee	22	1		00fe	aa	00	4c	fd	nv-BdIzc	unknown	T3
8	00ef	01	1		00fe	aa	00	4c	fd	nv-BdIzc	unknown	T4
8	00ef	01	1		00fe	aa	00	4c	fd	nv-BdIzc	unknown	T4
9	016e	ff	1		00fe	aa	00	4c	fd	nv-BdIzc	unknown	T5
9	016e	ff	1		00fe	aa	00	4c	fd	nv-BdIzc	unknown	T5
10	016e	ff	1		00fe	aa	00	4c	fd	nv-BdIzc	unknown	
10	016e	ff	1		00fe	aa	00	4c	fd	nv-BdIzc	unknown	
11	016e	ff	0		00fe	aa	00	4c	fd	nv-BdIzc	unknown	
11	016e	ff	0		00fe	aa	00	4c	fd	nv-BdIzc	unknown	
12	016e	ff	0		00fe	aa	00	4c	fd	Nv-BdIzC	unknown	T0
12	016e	fe	0		00fe	aa	00	4c	fd	Nv-BdIzC	unknown	T0
13	00fe	4a	1	LSR	00fe	aa	00	4c	fd	Nv-BdIzC	unknown	T1
13	00fe	4a	1	LSR	00fe	aa	00	4c	fd	Nv-BdIzC	unknown	T1
14	00ff	01	1		00ff	fe	00	4c	fd	Nv-BdIzC	LSR	T0+T2
14	00ff	01	1		00ff	fe	00	4c	fd	Nv-BdIzC	LSR	T0+T2

NOP (14) Cycles: 4		Size: 2
Zero Page, X (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		Store as Pointer.
1.2	Read PC	Inc. <b>PC</b> .
2.1		Store as Operand.
2.2	Read Pointer	Set Address to (Pointer+X) & \$FF.
3.1		Store as Operand.
3.2	Read Address	Store as Operand.
4.1		
4.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
3	0002	14	1	unknown	0002	aa	00	00	fd	NV-BdIzc	BIT zp	T1
3	0002	14	1	unknown	0002	aa	00	00	fd	NV-BdIzc	BIT zp	T1
4	0003	fb	1		0003	aa	00	00	fd	NV-BdIzc	unknown	T2
4	0003	fb	1		0003	aa	00	00	fd	NV-BdIzc	unknown	T2
5	00fb	80	1		0004	aa	00	00	fd	NV-BdIzc	unknown	T3
5	00fb	80	1		0004	aa	00	00	fd	NV-BdIzc	unknown	T3
6	00fb	80	1		0004	aa	00	00	fd	NV-BdIzc	unknown	T0
6	00fb	80	1		0004	aa	00	00	fd	NV-BdIzc	unknown	T0
7	0004	01	1	ORA (zp,X)	0004	aa	00	00	fd	NV-BdIzc	unknown	T1
7	0004	01	1	ORA (zp,X)	0004	aa	00	00	fd	NV-BdIzc	unknown	T1
8	0005	50	1		0005	aa	00	00	fd	NV-BdIzc	ORA (zp,X)	T2
8	0005	50	1		0005	aa	00	00	fd	NV-BdIzc	ORA (zp,X)	T2

ORA (15)	Cycles: 4	Size: 2
Zero Page, X (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		Store as Pointer.
1.2	Read PC	Inc. <b>PC</b> .
2.1		Store as Operand.
2.2	Read Pointer	Set Address to (Pointer+X) & \$FF.
3.1		Store as Operand.
3.2	Read Address	* Perform <b>A=A</b>   Operand, set <b>N</b> and <b>Z</b> accordingly.
4.1		Store as Operand.
4.2	Read PC	Store as OpCode.
+X.1		<b>A</b> and <b>N</b> , <b>Z</b> applied.

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
5	00fc	15	1	ORA zp,X	00fc	aa	00	01	fd	nv-BdIzc	JMP Abs	T1
5	00fc	15	1	ORA zp,X	00fc	aa	00	01	fd	nv-BdIzc	JMP Abs	T1
6	00fd	ee	1		00fd	aa	00	01	fd	nv-BdIzc	ORA zp,X	T2
6	00fd	ee	1		00fd	aa	00	01	fd	nv-BdIzc	ORA zp,X	T2
7	00ee	2f	1		00fe	aa	00	01	fd	nv-BdIzc	ORA zp,X	T3
7	00ee	2f	1		00fe	aa	00	01	fd	nv-BdIzc	ORA zp,X	T3
8	00ee	2f	1		00fe	aa	00	01	fd	nv-BdIzc	ORA zp,X	T0
8	00ee	2f	1		00fe	aa	00	01	fd	nv-BdIzc	ORA zp,X	T0
9	00fe	4a	1	LSR	00fe	aa	00	01	fd	nv-BdIzc	ORA zp,X	T1
9	00fe	4a	1	LSR	00fe	aa	00	01	fd	nv-BdIzc	ORA zp,X	T1
10	00ff	01	1		00ff	af	00	01	fd	Nv-BdIzc	LSR	T0+T2
10	00ff	01	1		00ff	af	00	01	fd	Nv-BdIzc	LSR	T0+T2

ASL (16)		Cycles: 6	Size: 2	
Zero Page, X (Read/Modify/Write)				
Cycle	R/W	Desc		
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .		
1.1		Store as Pointer.		
1.2	Read PC	Inc. <b>PC</b> .		
2.1		Store as Operand.		
2.2	Read Pointer	Set Address to (Pointer+ <b>X</b> ) & \$FF.		
3.1		Store as Operand.		
3.2	Read Address	Set Address to (Pointer+ <b>X</b> ) & \$FF.		
4.1		Store as Operand.		
4.2	Write Address	Write unmodified Operand.		
5.1		Set <b>C</b> if high bit of Operand is set. Perform Operand=Operand << 1, set <b>N</b> and <b>Z</b> accordingly.		
5.2	Write Address	Write modified Operand.		
6.1				
6.2	Read PC	Store as OpCode.		
+X.1				

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
5	00fc	16	1	ASL zp,X	00fc	aa	00	01	fd	nv-BdIzc	JMP Abs	T1
5	00fc	16	1	ASL zp,X	00fc	aa	00	01	fd	nv-BdIzc	JMP Abs	T1
6	00fd	ee	1		00fd	aa	00	01	fd	nv-BdIzc	ASL zp,X	T2
6	00fd	ee	1		00fd	aa	00	01	fd	nv-BdIzc	ASL zp,X	T2
7	00ee	2f	1		00fe	aa	00	01	fd	nv-BdIzc	ASL zp,X	T3
7	00ee	2f	1		00fe	aa	00	01	fd	nv-BdIzc	ASL zp,X	T3
8	00ee	2f	1		00fe	aa	00	01	fd	nv-BdIzc	ASL zp,X	T4
8	00ee	2f	1		00fe	aa	00	01	fd	nv-BdIzc	ASL zp,X	T4
9	00ee	2f	0		00fe	aa	00	01	fd	nv-BdIzc	ASL zp,X	T5
9	00ee	2f	0		00fe	aa	00	01	fd	nv-BdIzc	ASL zp,X	T5
10	00ee	2f	0		00fe	aa	00	01	fd	nv-BdIzc	ASL zp,X	T0
10	00ee	5e	0		00fe	aa	00	01	fd	nv-BdIzc	ASL zp,X	T0
11	00fe	4a	1	LSR	00fe	aa	00	01	fd	nv-BdIzc	ASL zp,X	T1
11	00fe	4a	1	LSR	00fe	aa	00	01	fd	nv-BdIzc	ASL zp,X	T1
12	00ff	01	1		00ff	aa	00	01	fd	nv-BdIzc	LSR	T0+T2
12	00ff	01	1		00ff	aa	00	01	fd	nv-BdIzc	LSR	T0+T2

SLO (17) Cycles: 6		Size: 2
Zero Page, X (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Pointer.
2.1		Inc. <b>PC</b> .
2.2	Read Pointer	Store as Operand.
3.1		Set Address to (Pointer+ <b>X</b> ) & \$FF.
3.2	Read Address	Store as Operand.
4.1		
4.2	Write Address	Write unmodified Operand.
5.1		* Set <b>C</b> if high bit of Operand is set. Perform Operand=Operand << 1, <b>A=A</b>   Operand, set <b>N</b> and <b>Z</b> based off <b>A</b> .
5.2	Write Address	Write modified Operand.
6.1		
6.2	Read PC	Store as OpCode.
+X.1		<b>A</b> applied.

\* Setting of A is delayed by 2 cycles until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
5	00fc	17	1	unknown	00fc	aa	00	01	fd	nv-BdIzc	JMP Abs	T1
5	00fc	17	1	unknown	00fc	aa	00	01	fd	nv-BdIzc	JMP Abs	T1
6	00fd	ee	1		00fd	aa	00	01	fd	nv-BdIzc	unknown	T2
6	00fd	ee	1		00fd	aa	00	01	fd	nv-BdIzc	unknown	T2
7	00ee	5e	1		00fe	aa	00	01	fd	nv-BdIzc	unknown	T3
7	00ee	5e	1		00fe	aa	00	01	fd	nv-BdIzc	unknown	T3
8	00ee	5e	1		00fe	aa	00	01	fd	nv-BdIzc	unknown	T4
8	00ee	5e	1		00fe	aa	00	01	fd	nv-BdIzc	unknown	T4
9	00ee	5e	0		00fe	aa	00	01	fd	nv-BdIzc	unknown	T5
9	00ee	5e	0		00fe	aa	00	01	fd	nv-BdIzc	unknown	T5
10	00ee	5e	0		00fe	aa	00	01	fd	Nv-BdIzc	unknown	T0
10	00ee	bc	0		00fe	aa	00	01	fd	Nv-BdIzc	unknown	T0
11	00fe	4a	1	LSR	00fe	aa	00	01	fd	Nv-BdIzc	unknown	T1
11	00fe	4a	1	LSR	00fe	aa	00	01	fd	Nv-BdIzc	unknown	T1
12	00ff	01	1		00ff	be	00	01	fd	Nv-BdIzc	LSR	T0+T2
12	00ff	01	1		00ff	be	00	01	fd	Nv-BdIzc	LSR	T0+T2

CLC (18) Cycles: 2		Size: 1
Implied		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	To be discarded.
2.1		Clear the <b>C</b> status bit.
2.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
7	00fc	18	1	CLC	00fc	aa	00	00	fd	nv-BdIZC	JMP Abs	T1
7	00fc	18	1	CLC	00fc	aa	00	00	fd	nv-BdIZC	JMP Abs	T1
8	00fd	ee	1		00fd	aa	00	00	fd	nv-BdIZC	CLC	T0+T2
8	00fd	ee	1		00fd	aa	00	00	fd	nv-BdIZC	CLC	T0+T2
9	00fd	ee	1	INC Abs	00fd	aa	00	00	fd	nv-BdIZc	CLC	T1
9	00fd	ee	1	INC Abs	00fd	aa	00	00	fd	nv-BdIZc	CLC	T1
10	00fe	4a	1		00fe	aa	00	00	fd	nv-BdIZc	INC Abs	T2
10	00fe	4a	1		00fe	aa	00	00	fd	nv-BdIZc	INC Abs	T2

ORA (19) Cycles: 4-5		Size: 3
Absolute, Y (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Address.L.
2.1		Inc. <b>PC</b> .
2.2	Read PC	Store as Address.H.
3.1		Inc. <b>PC</b> . Final=Address+Y. Address.L = Final.L.
3.2	Read Address	Store as Operand. If Address.H == Final.H, skip the next cycle (next half-cycle is 5.1).
4.1		Address.H = Final.H (fixes high byte of address).
4.2	Read Address	Store as Operand.
5.1		* Perform <b>A=A</b>   Operand, set <b>N</b> and <b>Z</b> accordingly.
5.2	Read PC	Store as OpCode.
+X.1		<b>A</b> and <b>N</b> , <b>Z</b> applied.

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
5	00fc	19	1	ORA Abs,Y	00fc	aa	00	38	fd	nv-BdIzc	JMP Abs	T1
5	00fc	19	1	ORA Abs,Y	00fc	aa	00	38	fd	nv-BdIzc	JMP Abs	T1
6	00fd	ff	1		00fd	aa	00	38	fd	nv-BdIzc	ORA Abs,Y	T2
6	00fd	ff	1		00fd	aa	00	38	fd	nv-BdIzc	ORA Abs,Y	T2
7	00fe	00	1		00fe	aa	00	38	fd	nv-BdIzc	ORA Abs,Y	T3
7	00fe	00	1		00fe	aa	00	38	fd	nv-BdIzc	ORA Abs,Y	T3
8	0037	00	1		00ff	aa	00	38	fd	nv-BdIzc	ORA Abs,Y	T4
8	0037	00	1		00ff	aa	00	38	fd	nv-BdIzc	ORA Abs,Y	T4
9	0137	0f	1		00ff	aa	00	38	fd	nv-BdIzc	ORA Abs,Y	T0
9	0137	0f	1		00ff	aa	00	38	fd	nv-BdIzc	ORA Abs,Y	T0
10	00ff	18	1	CLC	00ff	aa	00	38	fd	nv-BdIzc	ORA Abs,Y	T1
10	00ff	18	1	CLC	00ff	aa	00	38	fd	nv-BdIzc	ORA Abs,Y	T1
11	0100	00	1		0100	af	00	38	fd	Nv-BdIzc	CLC	T0+T2
11	0100	00	1		0100	af	00	38	fd	Nv-BdIzc	CLC	T0+T2

NOP (1A)	Cycles: 2	Size: 1
Implied		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		
1.2	Read PC	To be discarded.
2.1		
2.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
5	00fc	1a	1	unknown	00fc	aa	00	38	fd	nv-BdIzc	JMP Abs	T1
5	00fc	1a	1	unknown	00fc	aa	00	38	fd	nv-BdIzc	JMP Abs	T1
6	00fd	18	1		00fd	aa	00	38	fd	nv-BdIzc	unknown	T0+T2
6	00fd	18	1		00fd	aa	00	38	fd	nv-BdIzc	unknown	T0+T2
7	00fd	18	1	CLC	00fd	aa	00	38	fd	nv-BdIzc	unknown	T1
7	00fd	18	1	CLC	00fd	aa	00	38	fd	nv-BdIzc	unknown	T1
8	00fe	00	1		00fe	aa	00	38	fd	nv-BdIzc	CLC	T0+T2
8	00fe	00	1		00fe	aa	00	38	fd	nv-BdIzc	CLC	T0+T2

SLO (1B)		Cycles: 7	Size: 3
Absolute, Y (Read/Modify/Write)			
Cycle	R/W	Desc	
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .	
1.1		Store as Address.L.	
1.2	Read PC	Inc. <b>PC</b> .	
2.1		Store as Address.H.	
2.2	Read PC	Inc. <b>PC</b> . Final=Address+Y. Address.L = Final.L.	
3.1		Store as Operand.	
3.2	Read Address	Address.H = Final.H (fixes high byte of address).	
4.1		Store as Operand.	
4.2	Read Address	Set <b>C</b> if high bit of Operand is set. * Perform Operand=Operand << 1, <b>A=A</b>   Operand, set <b>N</b> and <b>Z</b> based off <b>A</b> .	
5.1		Store as Operand.	
5.2	Write Address	Write unmodified Operand.	
6.1		Set <b>C</b> if high bit of Operand is set. * Perform Operand=Operand << 1, <b>A=A</b>   Operand, set <b>N</b> and <b>Z</b> based off <b>A</b> .	
6.2	Write Address	Write modified Operand.	
7.1		Store as OpCode.	
7.2	Read PC	<b>A</b> and <b>N, Z</b> applied.	
+X.1			

\* Setting of A flags is delayed by 2 cycles until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
5	00fc	1b	1	unknown	00fc	aa	00	38	fd	nv-BdIzc	JMP Abs	T1
5	00fc	1b	1	unknown	00fc	aa	00	38	fd	nv-BdIzc	JMP Abs	T1
6	00fd	18	1		00fd	aa	00	38	fd	nv-BdIzc	unknown	T2
6	00fd	18	1		00fd	aa	00	38	fd	nv-BdIzc	unknown	T2
7	00fe	00	1		00fe	aa	00	38	fd	nv-BdIzc	unknown	T3
7	00fe	00	1		00fe	aa	00	38	fd	nv-BdIzc	unknown	T3
8	0050	0f	1		00ff	aa	00	38	fd	nv-BdIzc	unknown	T4
8	0050	0f	1		00ff	aa	00	38	fd	nv-BdIzc	unknown	T4
9	0050	0f	1		00ff	aa	00	38	fd	nv-BdIzc	unknown	T5
9	0050	0f	1		00ff	aa	00	38	fd	nv-BdIzc	unknown	T5
10	0050	0f	0		00ff	aa	00	38	fd	nv-BdIzc	unknown	
10	0050	0f	0		00ff	aa	00	38	fd	nv-BdIzc	unknown	
11	0050	0f	0		00ff	aa	00	38	fd	nv-BdIzc	unknown	T0
11	0050	1e	0		00ff	aa	00	38	fd	nv-BdIzc	unknown	T0
12	00ff	18	1	CLC	00ff	aa	00	38	fd	nv-BdIzc	unknown	T1
12	00ff	18	1	CLC	00ff	aa	00	38	fd	nv-BdIzc	unknown	T1
13	0100	00	1		0100	be	00	38	fd	Nv-BdIzc	CLC	T0+T2
13	0100	00	1		0100	be	00	38	fd	Nv-BdIzc	CLC	T0+T2

NOP (1C) Cycles: 4-5		Size: 3
Absolute, X (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Address.L.
2.1		Inc. <b>PC</b> .
2.2	Read PC	Store as Address.H.
3.1		Inc. <b>PC</b> . Final=Address+X. Address.L = Final.L.
3.2	Read Address	Store as Operand. If Address.H == Final.H, skip the next cycle (next half-cycle is 5.1).
4.1		Address.H = Final.H (fixes high byte of address).
4.2	Read Address	Store as Operand.
5.1		
5.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
5	00fc	1c	1	unknown	00fc	aa	00	38	fd	nv-BdIzc	JMP Abs	T1
5	00fc	1c	1	unknown	00fc	aa	00	38	fd	nv-BdIzc	JMP Abs	T1
6	00fd	18	1		00fd	aa	00	38	fd	nv-BdIzc	unknown	T2
6	00fd	18	1		00fd	aa	00	38	fd	nv-BdIzc	unknown	T2
7	00fe	00	1		00fe	aa	00	38	fd	nv-BdIzc	unknown	T3
7	00fe	00	1		00fe	aa	00	38	fd	nv-BdIzc	unknown	T3
8	0018	00	1		00ff	aa	00	38	fd	nv-BdIzc	unknown	T0
8	0018	00	1		00ff	aa	00	38	fd	nv-BdIzc	unknown	T0
9	00ff	18	1	CLC	00ff	aa	00	38	fd	nv-BdIzc	unknown	T1
9	00ff	18	1	CLC	00ff	aa	00	38	fd	nv-BdIzc	unknown	T1
10	0100	00	1		0100	aa	00	38	fd	nv-BdIzc	CLC	T0+T2
10	0100	00	1		0100	aa	00	38	fd	nv-BdIzc	CLC	T0+T2

ORA (1D) Cycles: 4-5		Size: 3
Absolute, X (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Address.L.
2.1		Inc. <b>PC</b> .
2.2	Read PC	Store as Address.H.
3.1		Inc. <b>PC</b> . Final=Address+X. Address.L = Final.L.
3.2	Read Address	Store as Operand. If Address.H == Final.H, skip the next cycle (next half-cycle is 5.1).
4.1		Address.H = Final.H (fixes high byte of address).
4.2	Read Address	Store as Operand.
5.1		* Perform <b>A=A</b>   Operand, set <b>N</b> and <b>Z</b> accordingly.
5.2	Read PC	Store as OpCode.
+X.1		<b>A</b> and <b>N</b> , <b>Z</b> applied.

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
5	00fc	1d	1	ORA Abs,X	00fc	aa	1f	00	fd	nv-BdIzc	JMP Abs	T1
5	00fc	1d	1	ORA Abs,X	00fc	aa	1f	00	fd	nv-BdIzc	JMP Abs	T1
6	00fd	ff	1		00fd	aa	1f	00	fd	nv-BdIzc	ORA Abs,X	T2
6	00fd	ff	1		00fd	aa	1f	00	fd	nv-BdIzc	ORA Abs,X	T2
7	00fe	00	1		00fe	aa	1f	00	fd	nv-BdIzc	ORA Abs,X	T3
7	00fe	00	1		00fe	aa	1f	00	fd	nv-BdIzc	ORA Abs,X	T3
8	001e	00	1		00ff	aa	1f	00	fd	nv-BdIzc	ORA Abs,X	T4
8	001e	00	1		00ff	aa	1f	00	fd	nv-BdIzc	ORA Abs,X	T4
9	011e	00	1		00ff	aa	1f	00	fd	nv-BdIzc	ORA Abs,X	T0
9	011e	00	1		00ff	aa	1f	00	fd	nv-BdIzc	ORA Abs,X	T0
10	00ff	18	1	CLC	00ff	aa	1f	00	fd	nv-BdIzc	ORA Abs,X	T1
10	00ff	18	1	CLC	00ff	aa	1f	00	fd	nv-BdIzc	ORA Abs,X	T1
11	0100	00	1		0100	aa	1f	00	fd	Nv-BdIzc	CLC	T0+T2
11	0100	00	1		0100	aa	1f	00	fd	Nv-BdIzc	CLC	T0+T2

ASL (1E)	Cycles: 7	Size: 3
Absolute, X (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		Store as Address.L.
1.2	Read PC	Inc. <b>PC</b> .
2.1		Store as Address.H.
2.2	Read PC	Inc. <b>PC</b> . Final=Address+X. Address.L = Final.L.
3.1		Store as Operand.
3.2	Read Address	Address.H = Final.H (fixes high byte of address).
4.1		Store as Operand.
4.2	Read Address	Write unmodified Operand.
5.1		Set <b>C</b> if high bit of Operand is set. Perform Operand=Operand << 1, set <b>N</b> and <b>Z</b> accordingly.
5.2	Write Address	Write modified Operand.
6.1		+X.1
6.2	Write Address	Store as OpCode.
7.1		
7.2	Read PC	

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
5	00fc	1e	1	ASL Abs,X	00fc aa 1f 00 fd nv-BdIzc					JMP Abs	T1	
5	00fc	1e	1	ASL Abs,X	00fc aa 1f 00 fd nv-BdIzc					JMP Abs	T1	
6	00fd	ff	1		00fd aa 1f 00 fd nv-BdIzc					ASL Abs,X	T2	
6	00fd	ff	1		00fd aa 1f 00 fd nv-BdIzc					ASL Abs,X	T2	
7	00fe	00	1		00fe aa 1f 00 fd nv-BdIzc					ASL Abs,X	T3	
7	00fe	00	1		00fe aa 1f 00 fd nv-BdIzc					ASL Abs,X	T3	
8	001e	00	1		00ff aa 1f 00 fd nv-BdIzc					ASL Abs,X	T4	
8	001e	00	1		00ff aa 1f 00 fd nv-BdIzc					ASL Abs,X	T4	
9	011e	7f	1		00ff aa 1f 00 fd nv-BdIzc					ASL Abs,X	T5	
9	011e	7f	1		00ff aa 1f 00 fd nv-BdIzc					ASL Abs,X	T5	
10	011e	7f	0		00ff aa 1f 00 fd nv-BdIzc					ASL Abs,X		
10	011e	7f	0		00ff aa 1f 00 fd nv-BdIzc					ASL Abs,X		
11	011e	7f	0		00ff aa 1f 00 fd Nv-BdIzc					ASL Abs,X	T0	
11	011e	fe	0		00ff aa 1f 00 fd Nv-BdIzc					ASL Abs,X	T0	
12	00ff	18	1	CLC	00ff aa 1f 00 fd Nv-BdIzc					ASL Abs,X	T1	
12	00ff	18	1	CLC	00ff aa 1f 00 fd Nv-BdIzc					ASL Abs,X	T1	
13	0100	00	1		0100 aa 1f 00 fd Nv-BdIzc				CLC		T0+T2	
13	0100	00	1		0100 aa 1f 00 fd Nv-BdIzc				CLC		T0+T2	

SLO (1F)	Cycles: 7	Size: 3
Absolute, X (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Address.L.
2.1		Inc. <b>PC</b> .
2.2	Read PC	Store as Address.H.
3.1		Inc. <b>PC</b> . Final=Address+X. Address.L = Final.L.
3.2	Read Address	Store as Operand.
4.1		Address.H = Final.H (fixes high byte of address).
4.2	Read Address	Store as Operand.
5.1		
5.2	Write Address	Write unmodified Operand. * Set <b>C</b> if high bit of Operand is set. Perform Operand=Operand << 1, <b>A=A</b>   Operand, set <b>N</b> and <b>Z</b> based off <b>A</b> .
6.1		
6.2	Write Address	Write modified Operand.
7.1		
7.2	Read PC	Store as OpCode.
+X.1		<b>A</b> applied.

\* Setting of A is delayed by 2 cycles until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
7	00fc	1f	1	unknown	00fc	00	1f	00	fd	nv-BdIZc	LDA #	T1
7	00fc	1f	1	unknown	00fc	00	1f	00	fd	nv-BdIZc	LDA #	T1
8	00fd	ff	1		00fd	00	1f	00	fd	nv-BdIZc	unknown	T2
8	00fd	ff	1		00fd	00	1f	00	fd	nv-BdIZc	unknown	T2
9	00fe	00	1		00fe	00	1f	00	fd	nv-BdIZc	unknown	T3
9	00fe	00	1		00fe	00	1f	00	fd	nv-BdIZc	unknown	T3
10	001e	00	1		00ff	00	1f	00	fd	nv-BdIZc	unknown	T4
10	001e	00	1		00ff	00	1f	00	fd	nv-BdIZc	unknown	T4
11	011e	fe	1		00ff	00	1f	00	fd	nv-BdIZc	unknown	T5
11	011e	fe	1		00ff	00	1f	00	fd	nv-BdIZc	unknown	T5
12	011e	fe	0		00ff	00	1f	00	fd	nv-BdIZc	unknown	
12	011e	fe	0		00ff	00	1f	00	fd	nv-BdIZc	unknown	
13	011e	fe	0		00ff	00	1f	00	fd	Nv-BdIzC	unknown	T0
13	011e	fc	0		00ff	00	1f	00	fd	Nv-BdIzC	unknown	T0
14	00ff	18	1	CLC	00ff	00	1f	00	fd	Nv-BdIzC	unknown	T1
14	00ff	18	1	CLC	00ff	00	1f	00	fd	Nv-BdIzC	unknown	T1
15	0100	00	1		0100	fc	1f	00	fd	Nv-BdIzC	CLC	T0+T2
15	0100	00	1		0100	fc	1f	00	fd	Nv-BdIzC	CLC	T0+T2

JSR (20)	Cycles: 6	Size: 3
Absolute		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Address.L.
2.1		Inc. <b>PC</b> .
2.2	Read <b>S</b>   \$0100	
3.1		
3.2	Write <b>S</b>   \$0100	Push <b>PC.H</b> onto stack.
4.1		
4.2	Write ( <b>S-1</b> )   \$0100	Push <b>PC.L</b> onto stack.
5.1		
5.2	Read PC	Store as Address.H. <b>PC</b> =Address. Decrease <b>S</b> by 2.
6.1		
6.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	20	1	JSR Abs	0002 aa 1f 00 fd nv-BdIzc					LDX #	T1	
2	0002	20	1	JSR Abs	0002 aa 1f 00 fd nv-BdIzc					LDX #	T1	
3	0003	fa	1		0003 aa 1f 00 fd nv-BdIzc					JSR Abs	T2	
3	0003	fa	1		0003 aa 1f 00 fd nv-BdIzc					JSR Abs	T2	
4	01fd	00	1		0004 aa 1f 00 fa nv-BdIzc					JSR Abs	T3	
4	01fd	00	1		0004 aa 1f 00 fa nv-BdIzc					JSR Abs	T3	
5	01fd	00	0		0004 aa 1f 00 fa nv-BdIzc					JSR Abs	T4	
5	01fd	00	0		0004 aa 1f 00 fa nv-BdIzc					JSR Abs	T4	
6	01fc	00	0		0004 aa 1f 00 fa nv-BdIzc					JSR Abs	T5	
6	01fc	04	0		0004 aa 1f 00 fa nv-BdIzc					JSR Abs	T5	
7	0004	00	1		0004 aa 1f 00 fa nv-BdIzc					JSR Abs	T0	
7	0004	00	1		0004 aa 1f 00 fa nv-BdIzc					JSR Abs	T0	
8	00fa	a9	1	LDA #	00fa aa 1f 00 fb nv-BdIzc					JSR Abs	T1	
8	00fa	a9	1	LDA #	00fa aa 1f 00 fb nv-BdIzc					JSR Abs	T1	
9	00fb	00	1		00fb aa 1f 00 fb nv-BdIzc					LDA #	T0+T2	
9	00fb	00	1		00fb aa 1f 00 fb nv-BdIzc					LDA #	T0+T2	

AND (21) Cycles: 6		Size: 2
Indirect, X (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Operand.
2.1		Inc. <b>PC</b> .
2.2	Read Operand	
3.1		Set Pointer to (Operand+X) & \$FF.
3.2	Read Pointer	Store to Address.L.
4.1		
4.2	Read (Pointer+1) & \$FF	Store to Address.H.
5.1		
5.2	Read Address	Store as Operand. * Perform <b>A=A</b> & Operand, set <b>N</b> and <b>Z</b> accordingly.
6.1		
6.2	Read PC	Store as OpCode.
+X.1		<b>A</b> and <b>N</b> , <b>Z</b> applied.

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
4	0004	21	1	AND (zp,X)	0004	7f 0f 00	fd	nv-BdIzc		LDX #	T1	
4	0004	21	1	AND (zp,X)	0004	7f 0f 00	fd	nv-BdIzc		LDX #	T1	
5	0005	0e	1		0005	7f 0f 00	fd	nv-BdIzc	AND (zp,X)		T2	
5	0005	0e	1		0005	7f 0f 00	fd	nv-BdIzc	AND (zp,X)		T2	
6	000e	00	1		0006	7f 0f 00	fd	nv-BdIzc	AND (zp,X)		T3	
6	000e	00	1		0006	7f 0f 00	fd	nv-BdIzc	AND (zp,X)		T3	
7	001d	80	1		0006	7f 0f 00	fd	nv-BdIzc	AND (zp,X)		T4	
7	001d	80	1		0006	7f 0f 00	fd	nv-BdIzc	AND (zp,X)		T4	
8	001e	00	1		0006	7f 0f 00	fd	nv-BdIzc	AND (zp,X)		T5	
8	001e	00	1		0006	7f 0f 00	fd	nv-BdIzc	AND (zp,X)		T5	
9	0080	88	1		0006	7f 0f 00	fd	nv-BdIzc	AND (zp,X)		T0	
9	0080	88	1		0006	7f 0f 00	fd	nv-BdIzc	AND (zp,X)		T0	
10	0006	4c	1	JMP Abs	0006	7f 0f 00	fd	Nv-BdIzc	AND (zp,X)	JMP Abs	T1	
10	0006	4c	1	JMP Abs	0006	7f 0f 00	fd	Nv-BdIzc	AND (zp,X)	JMP Abs	T1	
11	0007	00	1		0007	08 0f 00	fd	nv-BdIzc	JMP Abs	JMP Abs	T2	
11	0007	00	1		0007	08 0f 00	fd	nv-BdIzc	JMP Abs	JMP Abs	T2	

JAM (22)	Cycles: $\infty$	Size: 1
Implied		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		
1.2	Read PC	
2.1		
2.2	Read \$FFFF	
3.1		
3.2	Read \$FFFE	
4.1		
4.2	Read \$FFFE	
5.1		Repeat 5.1 and 5.2 forever.
5.2	Read \$FFFF	

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	02	1	unknown	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
2	0002	02	1	unknown	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
3	0003	10	1		0003	00	00	00	fd	nv-BdIZc	unknown	T2
3	0003	10	1		0003	00	00	00	fd	nv-BdIZc	unknown	T2
4	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T3
4	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T3
5	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T4
5	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T4
6	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T5
6	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T5
7	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
7	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
8	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
8	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
9	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
9	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
10	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
10	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
11	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
11	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	

RLA (23)	Cycles: 8	Size: 2
Indirect, X (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		Store as Operand.
1.2	Read PC	Inc. <b>PC</b> .
2.1		
2.2	Read Operand	
3.1		Set Pointer to (Operand+X) & \$FF.
3.2	Read Pointer	Store to Address.L.
4.1		
4.2	Read (Pointer+1) & \$FF	Store to Address.H.
5.1		
5.2	Read Address	Store as Operand.
6.1		
6.2	Write Address	Write unmodified Operand.
7.1		* Perform Operand=(Operand << 1)   <b>C</b> , <b>A=A</b> & Operand, set <b>N</b> and <b>Z</b> based off <b>A</b> . Set <b>C</b> if high bit of Operand was set before the shift operation.
7.2	Write Address	Write modified Operand.
8.1		
8.2	Read PC	Store as OpCode.
+X.1		<b>A</b> applied.

\* Setting of A is delayed by 2 cycles until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
4	0004	23	1	unknown	0004	7f 0f 00	fd	nv-BdIzc		LDX #	T1	
4	0004	23	1	unknown	0004	7f 0f 00	fd	nv-BdIzc		LDX #	T1	
5	0005	0e	1		0005	7f 0f 00	fd	nv-BdIzc	unknown		T2	
5	0005	0e	1		0005	7f 0f 00	fd	nv-BdIzc	unknown		T2	
6	000e	00	1		0006	7f 0f 00	fd	nv-BdIzc	unknown		T3	
6	000e	00	1		0006	7f 0f 00	fd	nv-BdIzc	unknown		T3	
7	001d	80	1		0006	7f 0f 00	fd	nv-BdIzc	unknown		T4	
7	001d	80	1		0006	7f 0f 00	fd	nv-BdIzc	unknown		T4	
8	001e	00	1		0006	7f 0f 00	fd	nv-BdIzc	unknown		T5	
8	001e	00	1		0006	7f 0f 00	fd	nv-BdIzc	unknown		T5	
9	0080	88	1		0006	7f 0f 00	fd	nv-BdIzc	unknown			
9	0080	88	1		0006	7f 0f 00	fd	nv-BdIzc	unknown			
10	0080	88	0		0006	7f 0f 00	fd	nv-BdIzc	unknown			
10	0080	88	0		0006	7f 0f 00	fd	nv-BdIzc	unknown			
11	0080	88	0		0006	7f 0f 00	fd	nv-BdIzc	unknown		T0	
11	0080	10	0		0006	7f 0f 00	fd	nv-BdIzc	unknown		T0	
12	0006	4c	1	JMP Abs	0006	7f 0f 00	fd	nv-BdIzc	unknown		T1	
12	0006	4c	1	JMP Abs	0006	7f 0f 00	fd	nv-BdIzc	unknown		T1	
13	0007	00	1		0007	10 0f 00	fd	nv-BdIzc	JMP Abs		T2	
13	0007	00	1		0007	10 0f 00	fd	nv-BdIzc	JMP Abs		T2	

BIT (24)	Cycles: 3	Size: 2
Zero Page (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		
1.2	Read PC	Store as Address. Inc. <b>PC</b> .
2.1		
2.2	Read Address	Store as Operand. <b>V</b> =(Operand & (1 << 6)) != 0. <b>N</b> =(Operand & (1 << 7)) != 0. <b>Z</b> =(Operand & <b>A</b> ) == 0.
3.1		
3.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	24	1	BIT zp	0002 00 00 00 fd	nv-BdIZc	LDA #			T1		
2	0002	24	1	BIT zp	0002 00 00 00 fd	nv-BdIZc	LDA #			T1		
3	0003	10	1		0003 00 00 00 fd	nv-BdIZc	BIT zp			T2		
3	0003	10	1		0003 00 00 00 fd	nv-BdIZc	BIT zp			T2		
4	0010	e8	1		0004 00 00 00 fd	nv-BdIZc	BIT zp			T0		
4	0010	e8	1		0004 00 00 00 fd	nv-BdIZc	BIT zp			T0		
5	0004	a9	1	LDA #	0004 00 00 00 fd	NV-BdIZc	BIT zp			T1		
5	0004	a9	1	LDA #	0004 00 00 00 fd	NV-BdIZc	BIT zp			T1		
6	0005	4c	1		0005 00 00 00 fd	NV-BdIZc	LDA #	T0+T2				
6	0005	4c	1		0005 00 00 00 fd	NV-BdIZc	LDA #	T0+T2				

AND (25) Cycles: 3		Size: 2
Zero Page (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		
1.2	Read PC	Store as Address. Inc. <b>PC</b> .
2.1		
2.2	Read Address	Store as Operand.
3.1		* Perform <b>A=A &amp; Operand</b> , set <b>N</b> and <b>Z</b> accordingly.
3.2	Read PC	Store as OpCode. <b>A</b> and <b>N, Z</b> applied.
+X.1		

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	25	1	AND zp	0002 01	00 00	fd	nv-BdIzc		LDA #	T1	
2	0002	25	1	AND zp	0002 01	00 00	fd	nv-BdIzc		LDA #	T1	
3	0003	10	1		0003 01	00 00	fd	nv-BdIzc	AND zp		T2	
3	0003	10	1		0003 01	00 00	fd	nv-BdIzc	AND zp		T2	
4	0010	e8	1		0004 01	00 00	fd	nv-BdIzc	AND zp		T0	
4	0010	e8	1		0004 01	00 00	fd	nv-BdIzc	AND zp		T0	
5	0004	a9	1	LDA #	0004 01	00 00	fd	Nv-BdIzc	AND zp		T1	
5	0004	a9	1	LDA #	0004 01	00 00	fd	Nv-BdIzc	AND zp		T1	
6	0005	4c	1		0005 00	00 00	fd	nv-BdIZc	LDA #		T0+T2	
6	0005	4c	1		0005 00	00 00	fd	nv-BdIZc	LDA #		T0+T2	

ROL (26) Cycles: 5		Size: 2
Zero Page (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		Store as Address. Inc. <b>PC</b> .
1.2	Read PC	
2.1		Store as Operand.
2.2	Read Address	
3.1		
3.2	Write Address	Write unmodified Operand.
4.1		Perform Operand=(Operand << 1)   <b>C</b> , set <b>N</b> and <b>Z</b> accordingly. Set <b>C</b> if high bit of Operand was set before the shift operation.
4.2	Write Address	Write modified Operand.
5.1		
5.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
6	0004	26	1	ROL zp	0004	aa	01	00	fd	Nv-BdIzc	AND zp	T1
6	0004	26	1	ROL zp	0004	aa	01	00	fd	Nv-BdIzc	AND zp	T1
7	0005	4c	1		0005	a8	01	00	fd	Nv-BdIzc	ROL zp	T2
7	0005	4c	1		0005	a8	01	00	fd	Nv-BdIzc	ROL zp	T2
8	004c	00	1		0006	a8	01	00	fd	Nv-BdIzc	ROL zp	T3
8	004c	00	1		0006	a8	01	00	fd	Nv-BdIzc	ROL zp	T3
9	004c	00	0		0006	a8	01	00	fd	Nv-BdIzc	ROL zp	T4
9	004c	00	0		0006	a8	01	00	fd	Nv-BdIzc	ROL zp	T4
10	004c	00	0		0006	a8	01	00	fd	nv-BdIZc	ROL zp	T0
10	004c	00	0		0006	a8	01	00	fd	nv-BdIZc	ROL zp	T0
11	0006	45	1	EOR zp	0006	a8	01	00	fd	nv-BdIZc	ROL zp	T1
11	0006	45	1	EOR zp	0006	a8	01	00	fd	nv-BdIZc	ROL zp	T1
12	0007	00	1		0007	a8	01	00	fd	nv-BdIZc	EOR zp	T2
12	0007	00	1		0007	a8	01	00	fd	nv-BdIZc	EOR zp	T2

RLA (27)	Cycles: 5	Size: 2
Zero Page (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Address.
2.1		Inc. <b>PC</b> .
2.2	Read Address	Store as Operand.
3.1		
3.2	Write Address	Write unmodified Operand.
4.1		* Perform Operand=(Operand << 1)   <b>C</b> , <b>A=A</b> & Operand, set <b>N</b> and <b>Z</b> based off <b>A</b> . Set <b>C</b> if high bit of Operand was set before the shift operation.
4.2	Write Address	Write modified Operand.
5.1		
5.2	Read PC	Store as OpCode.
+X.1		<b>A</b> applied.

\* Setting of A is delayed by 2 cycles until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
6	0004	27	1	unknown	0004	aa	01	00	fd	Nv-BdIzc	AND zp	T1
6	0004	27	1	unknown	0004	aa	01	00	fd	Nv-BdIzc	AND zp	T1
7	0005	4c	1		0005	a8	01	00	fd	Nv-BdIzc	unknown	T2
7	0005	4c	1		0005	a8	01	00	fd	Nv-BdIzc	unknown	T2
8	004c	00	1		0006	a8	01	00	fd	Nv-BdIzc	unknown	T3
8	004c	00	1		0006	a8	01	00	fd	Nv-BdIzc	unknown	T3
9	004c	00	0		0006	a8	01	00	fd	Nv-BdIzc	unknown	T4
9	004c	00	0		0006	a8	01	00	fd	Nv-BdIzc	unknown	T4
10	004c	00	0		0006	a8	01	00	fd	nv-BdIzc	unknown	T0
10	004c	00	0		0006	a8	01	00	fd	nv-BdIzc	unknown	T0
11	0006	45	1	EOR zp	0006	a8	01	00	fd	nv-BdIzc	unknown	T1
11	0006	45	1	EOR zp	0006	a8	01	00	fd	nv-BdIzc	unknown	T1
12	0007	00	1		0007	00	01	00	fd	nv-BdIzc	EOR zp	T2
12	0007	00	1		0007	00	01	00	fd	nv-BdIzc	EOR zp	T2

PLP (28)		Cycles: 4	Size: 1
Implied			
Cycle	R/W	Desc	
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .	
1.1			
1.2	Read PC	To be discarded.	
2.1			
2.2	Read <b>S</b>   \$0100		
3.1		Inc. <b>S</b> .	
3.2	Read <b>S</b>   \$0100	Store as Operand. <b>P</b> =(Operand & $\sim$ <b>B</b> )   <b>M</b> (the reserved bit).	
4.1			
4.2	Read PC	Store as OpCode.	
+X.1			

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
3	0002	28	1	PLP	0002	aa	a6	00	fd	Nv-BdIzc	LDX zp	T1
3	0002	28	1	PLP	0002	aa	a6	00	fd	Nv-BdIzc	LDX zp	T1
4	0003	10	1		0003	aa	a6	00	fd	Nv-BdIzc	PLP	T2
4	0003	10	1		0003	aa	a6	00	fd	Nv-BdIzc	PLP	T2
5	01fd	00	1		0003	aa	a6	00	fd	Nv-BdIzc	PLP	T3
5	01fd	00	1		0003	aa	a6	00	fd	Nv-BdIzc	PLP	T3
6	01fe	01	1		0003	aa	a6	00	fe	Nv-BdIzc	PLP	T0
6	01fe	01	1		0003	aa	a6	00	fe	Nv-BdIzc	PLP	T0
7	0003	10	1	BPL	0003	aa	a6	00	fe	nv-BdizC	PLP	T1
7	0003	10	1	BPL	0003	aa	a6	00	fe	nv-BdizC	PLP	T1
8	0004	27	1		0004	aa	a6	00	fe	nv-BdizC	BPL	T2
8	0004	27	1		0004	aa	a6	00	fe	nv-BdizC	BPL	T2

AND (29) Cycles: 2		Size: 2
Immediate (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Operand.
2.1		Inc. <b>PC</b> . * Perform <b>A=A</b> & Operand, set <b>N</b> and <b>Z</b> accordingly.
2.2	Read PC	Store as OpCode.
+X.1		<b>A</b> and <b>N, Z</b> applied.

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	29	1	AND #	0002 ff 00 00 fd	Nv-BdIzc	LDA #		T1			
2	0002	29	1	AND #	0002 ff 00 00 fd	Nv-BdIzc	LDA #		T1			
3	0003	33	1		0003 ff 00 00 fd	Nv-BdIzc	AND #		T0+T2			
3	0003	33	1		0003 ff 00 00 fd	Nv-BdIzc	AND #		T0+T2			
4	0004	a6	1	LDX zp	0004 ff 00 00 fd	nv-BdIzc	AND #		T1			
4	0004	a6	1	LDX zp	0004 ff 00 00 fd	nv-BdIzc	AND #		T1			
5	0005	4c	1		0005 33 00 00 fd	nv-BdIzc	LDX zp		T2			
5	0005	4c	1		0005 33 00 00 fd	nv-BdIzc	LDX zp		T2			

ROL (2A)	Cycles: 2	Size: 1
Implied (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		
1.2	Read PC	
2.1		Perform Operand=(Operand << 1)   <b>C</b> , set <b>N</b> and <b>Z</b> accordingly. Set <b>C</b> if high bit of Operand was set before the shift operation.
2.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
3	0002	2a	1	ROL	0002	aa	00	00	fd	NV-BdIzc	BIT zp	T1
3	0002	2a	1	ROL	0002	aa	00	00	fd	NV-BdIzc	BIT zp	T1
4	0003	56	1		0003	aa	00	00	fd	NV-BdIzc	ROL	T0+T2
4	0003	56	1		0003	aa	00	00	fd	NV-BdIzc	ROL	T0+T2
5	0003	56	1	LSR zp,X	0003	aa	00	00	fd	NV-BdIzc	ROL	T1
5	0003	56	1	LSR zp,X	0003	aa	00	00	fd	NV-BdIzc	ROL	T1
6	0004	01	1		0004	54	00	00	fd	nV-BdIzC	LSR zp,X	T2
6	0004	01	1		0004	54	00	00	fd	nV-BdIzC	LSR zp,X	T2

ANC (2B)		Cycles: 2	Size: 2
Immediate (Read)			
Cycle	R/W	Desc	
-X.2	Read PC	Store as OpCode.	
1.1		Inc. <b>PC</b> .	
1.2	Read PC	Store as Operand.	
2.1		Inc. <b>PC</b> . * Perform <b>A=A</b> & Operand, set <b>C, N, and Z</b> accordingly ( <b>C</b> is set using logic for <b>N</b> ).	
2.2	Read PC	Store as OpCode.	
+X.1		** <b>A</b> and <b>C, N, Z</b> applied.	

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

\*\* Visual6502 incorrectly omits the update of A; flags are updated based on the incorrect A value.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	2b	1	unknown	0002	0f	00	00	fd	nv-BdIzc	LDA #	T1
2	0002	2b	1	unknown	0002	0f	00	00	fd	nv-BdIzc	LDA #	T1
3	0003	33	1		0003	0f	00	00	fd	nv-BdIzc	unknown	T0+T2
3	0003	33	1		0003	0f	00	00	fd	nv-BdIzc	unknown	T0+T2
4	0004	a6	1	LDX zp	0004	0f	00	00	fd	nv-BdIzc	unknown	T1
4	0004	a6	1	LDX zp	0004	0f	00	00	fd	nv-BdIzc	unknown	T1
5	0005	4c	1		0005	0f	00	00	fd	nv-BdIzc	LDX zp	T2
5	0005	4c	1		0005	0f	00	00	fd	nv-BdIzc	LDX zp	T2

## ANC (ANC2, ANA, ANB)

Type: Combination of an immediate and an implied command (Sub-instructions: AND, ASL/ROL)

Opc.	Mnemonic	Function	Size	Cycles	N	V	-	B	D	I	Z	C
\$0B	ANC #imm	$A = A \& \#imm$	2	2	o						o	o
\$2B	ANC #imm	$A = A \& \#imm$	2	2	o						o	o

**Operation:** ANDs the contents of the A register with an immediate value and then moves bit 7 of A into the Carry flag.

- This opcode works basically identically to AND #imm, except that the Carry flag is set to the same state that the Negative flag is set to. (bit 7 is put into the carry, as if the ASL/ROL would have been executed)

— NoMoreSecrets-NMOS6510UnintendedOpcodes-20232412.pdf

BIT (2C)	Cycles: 4	Size: 3
Absolute (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		Store as Address.L.
1.2	Read PC	Inc. <b>PC</b> .
2.1		Store as Address.H.
2.2	Read PC	Inc. <b>PC</b> .
3.1		Store as Operand.
3.2	Read Address	<b>V</b> =(Operand & (1 << 6)) != 0. <b>N</b> =(Operand & (1 << 7)) != 0. <b>Z</b> =(Operand & A) == 0.
4.1		Store as OpCode.
4.2	Read PC	
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	2c	1	BIT Abs	0002	0f 00 00	fd	nv-BdIzc		LDA #	T1	
2	0002	2c	1	BIT Abs	0002	0f 00 00	fd	nv-BdIzc		LDA #	T1	
3	0003	10	1		0003	0f 00 00	fd	nv-BdIzc	BIT Abs	BIT Abs	T2	
3	0003	10	1		0003	0f 00 00	fd	nv-BdIzc	BIT Abs	BIT Abs	T2	
4	0004	00	1		0004	0f 00 00	fd	nv-BdIzc	BIT Abs	BIT Abs	T3	
4	0004	00	1		0004	0f 00 00	fd	nv-BdIzc	BIT Abs	BIT Abs	T3	
5	0010	e8	1		0005	0f 00 00	fd	nv-BdIzc	BIT Abs	BIT Abs	T0	
5	0010	e8	1		0005	0f 00 00	fd	nv-BdIzc	BIT Abs	BIT Abs	T0	
6	0005	4c	1	JMP Abs	0005	0f 00 00	fd	NV-BdIzc	BIT Abs	BIT Abs	T1	
6	0005	4c	1	JMP Abs	0005	0f 00 00	fd	NV-BdIzc	BIT Abs	BIT Abs	T1	
7	0006	45	1		0006	0f 00 00	fd	NV-BdIzc	JMP Abs	JMP Abs	T2	
7	0006	45	1		0006	0f 00 00	fd	NV-BdIzc	JMP Abs	JMP Abs	T2	

AND (2D) Cycles: 4		Size: 3
Absolute (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		
1.2	Read PC	Store as Address.L. Inc. <b>PC</b> .
2.1		
2.2	Read PC	Store as Address.H. Inc. <b>PC</b> .
3.1		
3.2	Read Address	Store as Operand. * Perform <b>A=A &amp; Operand</b> , set <b>N</b> and <b>Z</b> accordingly.
4.1		
4.2	Read PC	Store as OpCode. <b>A</b> and <b>N, Z</b> applied.
+X.1		

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	2d	1	AND Abs	0002	0f	00	00	fd	nv-BdIzc	LDA #	T1
2	0002	2d	1	AND Abs	0002	0f	00	00	fd	nv-BdIzc	LDA #	T1
3	0003	10	1		0003	0f	00	00	fd	nv-BdIzc	AND Abs	T2
3	0003	10	1		0003	0f	00	00	fd	nv-BdIzc	AND Abs	T2
4	0004	00	1		0004	0f	00	00	fd	nv-BdIzc	AND Abs	T3
4	0004	00	1		0004	0f	00	00	fd	nv-BdIzc	AND Abs	T3
5	0010	88	1		0005	0f	00	00	fd	nv-BdIzc	AND Abs	T0
5	0010	88	1		0005	0f	00	00	fd	nv-BdIzc	AND Abs	T0
6	0005	4c	1	JMP Abs	0005	0f	00	00	fd	Nv-BdIzc	AND Abs	T1
6	0005	4c	1	JMP Abs	0005	0f	00	00	fd	Nv-BdIzc	AND Abs	T1
7	0006	45	1		0006	08	00	00	fd	nv-BdIzc	JMP Abs	T2
7	0006	45	1		0006	08	00	00	fd	nv-BdIzc	JMP Abs	T2

ROL (2E) Cycles: 6		Size: 3
Absolute (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		Store as Address.L.
1.2	Read PC	Inc. <b>PC</b> .
2.1		Store as Address.H.
2.2	Read PC	Inc. <b>PC</b> .
3.1		Store as Operand.
3.2	Read Address	Write unmodified Operand.
4.1		Perform Operand=(Operand << 1)   <b>C</b> , set <b>N</b> and <b>Z</b> accordingly.
4.2	Write Address	Set <b>C</b> if high bit of Operand was set before the shift operation.
5.1		Write modified Operand.
5.2	Write Address	
6.1		
6.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
3	0002	2e	1	ROL Abs	0002	aa	00	00	fd	NV-BdIzc	BIT zp	T1
3	0002	2e	1	ROL Abs	0002	aa	00	00	fd	NV-BdIzc	BIT zp	T1
4	0003	fb	1		0003	aa	00	00	fd	NV-BdIzc	ROL Abs	T2
4	0003	fb	1		0003	aa	00	00	fd	NV-BdIzc	ROL Abs	T2
5	0004	01	1		0004	aa	00	00	fd	NV-BdIzc	ROL Abs	T3
5	0004	01	1		0004	aa	00	00	fd	NV-BdIzc	ROL Abs	T3
6	01fb	8f	1		0005	aa	00	00	fd	NV-BdIzc	ROL Abs	T4
6	01fb	8f	1		0005	aa	00	00	fd	NV-BdIzc	ROL Abs	T4
7	01fb	8f	0		0005	aa	00	00	fd	NV-BdIzc	ROL Abs	T5
7	01fb	8f	0		0005	aa	00	00	fd	NV-BdIzc	ROL Abs	T5
8	01fb	8f	0		0005	aa	00	00	fd	nV-BdIzC	ROL Abs	T0
8	01fb	1e	0		0005	aa	00	00	fd	nV-BdIzC	ROL Abs	T0
9	0005	50	1	BVC	0005	aa	00	00	fd	nV-BdIzC	ROL Abs	T1
9	0005	50	1	BVC	0005	aa	00	00	fd	nV-BdIzC	ROL Abs	T1
10	0006	2e	1		0006	aa	00	00	fd	nV-BdIzC	BVC	T2
10	0006	2e	1		0006	aa	00	00	fd	nV-BdIzC	BVC	T2

RLA (2F)	Cycles: 6	Size: 3
Absolute (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Address.L.
2.1		Inc. <b>PC</b> .
2.2	Read PC	Store as Address.H.
3.1		Inc. <b>PC</b> .
3.2	Read Address	Store as Operand.
4.1		
4.2	Write Address	Write unmodified Operand.
5.1		* Perform Operand=(Operand << 1)   <b>C</b> , <b>A=A</b> & Operand, set <b>N</b> and <b>Z</b> based off <b>A</b> . Set <b>C</b> if high bit of Operand was set before the shift operation.
5.2	Write Address	Write modified Operand.
6.1		
6.2	Read PC	Store as OpCode.
+X.1		<b>A</b> applied.

\* Setting of A is delayed by 2 cycles until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
4	0003	2f	1	unknown	0003	0f	00	00	fd	nv-BdIzC	SEC	T1
4	0003	2f	1	unknown	0003	0f	00	00	fd	nv-BdIzC	SEC	T1
5	0004	2e	1		0004	0f	00	00	fd	nv-BdIzC	unknown	T2
5	0004	2e	1		0004	0f	00	00	fd	nv-BdIzC	unknown	T2
6	0005	00	1		0005	0f	00	00	fd	nv-BdIzC	unknown	T3
6	0005	00	1		0005	0f	00	00	fd	nv-BdIzC	unknown	T3
7	002e	7f	1		0006	0f	00	00	fd	nv-BdIzC	unknown	T4
7	002e	7f	1		0006	0f	00	00	fd	nv-BdIzC	unknown	T4
8	002e	7f	0		0006	0f	00	00	fd	nv-BdIzC	unknown	T5
8	002e	7f	0		0006	0f	00	00	fd	nv-BdIzC	unknown	T5
9	002e	7f	0		0006	0f	00	00	fd	Nv-BdIzc	unknown	T0
9	002e	ff	0		0006	0f	00	00	fd	Nv-BdIzc	unknown	T0
10	0006	00	1	BRK	0006	0f	00	00	fd	Nv-BdIzc	unknown	T1
10	0006	00	1	BRK	0006	0f	00	00	fd	Nv-BdIzc	unknown	T1
11	0007	00	1		0007	0f	00	00	fd	nv-BdIzc	BRK	T2
11	0007	00	1		0007	0f	00	00	fd	nv-BdIzc	BRK	T2

BMI (30)	Cycles: 2-4	Size: 2
Branch Relative		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> . Check condition ( <b>N == 1</b> ).
1.2	Read PC	Store as Operand. Treat as signed 16-bit (Op16=i16(i8(Operand))).
2.1		Inc. <b>PC</b> . If not jumping, end (next half-cycle is 4.2)
2.2	Read PC	
3.1		If ( <b>PC+Op16</b> ).H != <b>PC.H</b> , end after <b>PC.L</b> fix (next half-cycle is 4.2). <b>PC.L=PC.L+Operand</b> .
3.2	Read PC	
4.1		<b>PC.H=previous “(PC+Op16).H” value.</b>
4.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
4	0003	30	1	BMI	0003	0f	00	00	fd	nv-BdIzC	SEC	T1
4	0003	30	1	BMI	0003	0f	00	00	fd	nv-BdIzC	SEC	T1
5	0004	2e	1		0004	0f	00	00	fd	nv-BdIzC	BMI	T2
5	0004	2e	1		0004	0f	00	00	fd	nv-BdIzC	BMI	T2
6	0005	00	1	BRK	0005	0f	00	00	fd	nv-BdIzC	BMI	
6	0005	00	1	BRK	0005	0f	00	00	fd	nv-BdIzC	BMI	
7	0006	00	1		0006	0f	00	00	fd	nv-BdIzC	BRK	T2
7	0006	00	1		0006	0f	00	00	fd	nv-BdIzC	BRK	T2

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
4	0003	30	1	BMI	0003	ff	00	00	fd	Nv-BdIzC	SEC	T1
4	0003	30	1	BMI	0003	ff	00	00	fd	Nv-BdIzC	SEC	T1
5	0004	2e	1		0004	ff	00	00	fd	Nv-BdIzC	BMI	T2
5	0004	2e	1		0004	ff	00	00	fd	Nv-BdIzC	BMI	T2
6	0005	00	1		0005	ff	00	00	fd	Nv-BdIzC	BMI	T3
6	0005	00	1		0005	ff	00	00	fd	Nv-BdIzC	BMI	T3
7	0033	00	1	BRK	0033	ff	00	00	fd	Nv-BdIzC	BMI	
7	0033	00	1	BRK	0033	ff	00	00	fd	Nv-BdIzC	BMI	
8	0034	00	1		0034	ff	00	00	fd	Nv-BdIzC	BRK	T2
8	0034	00	1		0034	ff	00	00	fd	Nv-BdIzC	BRK	T2

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
7	00fc	30	1	BMI	00fc	ff	00	00	fd	Nv-BdIzC	JMP Abs	T1
7	00fc	30	1	BMI	00fc	ff	00	00	fd	Nv-BdIzC	JMP Abs	T1
8	00fd	2e	1		00fd	ff	00	00	fd	Nv-BdIzC	BMI	T2
8	00fd	2e	1		00fd	ff	00	00	fd	Nv-BdIzC	BMI	T2
9	00fe	00	1		00fe	ff	00	00	fd	Nv-BdIzC	BMI	T3
9	00fe	00	1		00fe	ff	00	00	fd	Nv-BdIzC	BMI	T3
10	002c	00	1		002c	ff	00	00	fd	Nv-BdIzC	BMI	T0
10	002c	00	1		002c	ff	00	00	fd	Nv-BdIzC	BMI	T0
11	012c	00	1	BRK	012c	ff	00	00	fd	Nv-BdIzC	BMI	T1
11	012c	00	1	BRK	012c	ff	00	00	fd	Nv-BdIzC	BMI	T1
12	012d	00	1		012d	ff	00	00	fd	Nv-BdIzC	BRK	T2
12	012d	00	1		012d	ff	00	00	fd	Nv-BdIzC	BRK	T2

AND (31) Cycles: 5-6		Size: 2
Indirect, Y (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Pointer.
2.1		Inc. <b>PC</b> .
2.2	Read Pointer	Store to Address.L.
3.1		
3.2	Read (Pointer+1) & \$FF	Store to Address.H.
4.1		Final=Address+Y. Address.L = Final.L.
4.2	Read Address	Store as Operand. If Address.H == Final.H, skip the next cycle (next half-cycle is 6.1).
5.1		Address.H = Final.H (fixes high byte of address).
5.2	Read Address	Store as Operand.
6.1		* Perform <b>A=A</b> & Operand, set <b>N</b> and <b>Z</b> accordingly.
6.2	Read PC	Store as OpCode.
+X.1		<b>A</b> and <b>N, Z</b> applied.

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
4	0003	31	1	AND (zp),Y	0003	aa	00	ff	fd	Nv-BdIzC	SEC	T1
4	0003	31	1	AND (zp),Y	0003	aa	00	ff	fd	Nv-BdIzC	SEC	T1
5	0004	fc	1		0004	aa	00	ff	fd	Nv-BdIzC	AND (zp),Y	T2
5	0004	fc	1		0004	aa	00	ff	fd	Nv-BdIzC	AND (zp),Y	T2
6	00fc	30	1		0005	aa	00	ff	fd	Nv-BdIzC	AND (zp),Y	T3
6	00fc	30	1		0005	aa	00	ff	fd	Nv-BdIzC	AND (zp),Y	T3
7	00fd	2e	1		0005	aa	00	ff	fd	Nv-BdIzC	AND (zp),Y	T4
7	00fd	2e	1		0005	aa	00	ff	fd	Nv-BdIzC	AND (zp),Y	T4
8	2e2f	00	1		0005	aa	00	ff	fd	Nv-BdIzC	AND (zp),Y	T5
8	2e2f	00	1		0005	aa	00	ff	fd	Nv-BdIzC	AND (zp),Y	T5
9	2f2f	00	1		0005	aa	00	ff	fd	Nv-BdIzC	AND (zp),Y	T0
9	2f2f	00	1		0005	aa	00	ff	fd	Nv-BdIzC	AND (zp),Y	T0
10	0005	00	1	BRK	0005	aa	00	ff	fd	nv-BdIZC	AND (zp),Y	T1
10	0005	00	1	BRK	0005	aa	00	ff	fd	nv-BdIZC	AND (zp),Y	T1
11	0006	00	1		0006	00	00	ff	fd	nv-BdIZC	BRK	T2
11	0006	00	1		0006	00	00	ff	fd	nv-BdIZC	BRK	T2

JAM (32)	Cycles: $\infty$	Size: 1
Implied		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		
1.2	Read PC	
2.1		
2.2	Read \$FFFF	
3.1		
3.2	Read \$FFFE	
4.1		
4.2	Read \$FFFE	
5.1		Repeat 5.1 and 5.2 forever.
5.2	Read \$FFFF	

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	02	1	unknown	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
2	0002	02	1	unknown	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
3	0003	10	1		0003	00	00	00	fd	nv-BdIZc	unknown	T2
3	0003	10	1		0003	00	00	00	fd	nv-BdIZc	unknown	T2
4	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T3
4	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T3
5	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T4
5	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T4
6	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T5
6	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T5
7	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
7	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
8	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
8	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
9	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
9	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
10	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
10	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
11	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
11	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	

RLA (33)	Cycles: 8	Size: 2
Indirect, Y (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Pointer.
2.1		Inc. <b>PC</b> .
2.2	Read Pointer	Store to Address.L.
3.1		
3.2	Read (Pointer+1) & \$FF	Store to Address.H.
4.1		Final=Address+ <b>Y</b> . Address.L = Final.L.
4.2	Read Address	Store as Operand.
5.1		Address.H = Final.H (fixes high byte of address).
5.2	Read Address	Store as Operand.
6.1		
6.2	Write Address	Write unmodified Operand.
7.1		* Perform Operand=(Operand << 1)   <b>C</b> , <b>A=A</b> & Operand, set <b>N</b> and <b>Z</b> based off <b>A</b> . Set <b>C</b> if high bit of Operand was set before the shift operation.
7.2	Write Address	Write modified Operand.
8.1		
8.2	Read PC	Store as OpCode.
+X.1		<b>A</b> applied.

\* Setting of A is delayed by 2 cycles until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
4	0003	33	1	unknown	0003	aa	00	ff	fd	Nv-BdIzC	SEC	T1
4	0003	33	1	unknown	0003	aa	00	ff	fd	Nv-BdIzC	SEC	T1
5	0004	fc	1		0004	aa	00	ff	fd	Nv-BdIzC	unknown	T2
5	0004	fc	1		0004	aa	00	ff	fd	Nv-BdIzC	unknown	T2
6	00fc	30	1		0005	aa	00	ff	fd	Nv-BdIzC	unknown	T3
6	00fc	30	1		0005	aa	00	ff	fd	Nv-BdIzC	unknown	T3
7	00fd	2e	1		0005	aa	00	ff	fd	Nv-BdIzC	unknown	T4
7	00fd	2e	1		0005	aa	00	ff	fd	Nv-BdIzC	unknown	T4
8	2e2f	00	1		0005	aa	00	ff	fd	Nv-BdIzC	unknown	T5
8	2e2f	00	1		0005	aa	00	ff	fd	Nv-BdIzC	unknown	T5
9	2f2f	00	1		0005	aa	00	ff	fd	Nv-BdIzC	unknown	
9	2f2f	00	1		0005	aa	00	ff	fd	Nv-BdIzC	unknown	
10	2f2f	00	0		0005	aa	00	ff	fd	Nv-BdIzC	unknown	
10	2f2f	00	0		0005	aa	00	ff	fd	Nv-BdIzC	unknown	
11	2f2f	00	0		0005	aa	00	ff	fd	nv-BdIzc	unknown	T0
11	2f2f	01	0		0005	aa	00	ff	fd	nv-BdIzc	unknown	T0
12	0005	00	1	BRK	0005	aa	00	ff	fd	nv-BdIzc	unknown	T1
12	0005	00	1	BRK	0005	aa	00	ff	fd	nv-BdIzc	unknown	T1
13	0006	00	1		0006	00	00	ff	fd	nv-BdIZc	BRK	T2
13	0006	00	1		0006	00	00	ff	fd	nv-BdIZc	BRK	T2

NOP (34) Cycles: 4		Size: 2
Zero Page, X (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		Store as Pointer.
1.2	Read PC	Inc. <b>PC</b> .
2.1		Store as Operand.
2.2	Read Pointer	Set Address to (Pointer+X) & \$FF.
3.1		Store as Operand.
3.2	Read Address	Store as Operand.
4.1		
4.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
4	0003	34	1	unknown	0003	aa	00	ff	fd	Nv-BdIzC	SEC	T1
4	0003	34	1	unknown	0003	aa	00	ff	fd	Nv-BdIzC	SEC	T1
5	0004	fc	1		0004	aa	00	ff	fd	Nv-BdIzC	unknown	T2
5	0004	fc	1		0004	aa	00	ff	fd	Nv-BdIzC	unknown	T2
6	00fc	30	1		0005	aa	00	ff	fd	Nv-BdIzC	unknown	T3
6	00fc	30	1		0005	aa	00	ff	fd	Nv-BdIzC	unknown	T3
7	00fc	30	1		0005	aa	00	ff	fd	Nv-BdIzC	unknown	T0
7	00fc	30	1		0005	aa	00	ff	fd	Nv-BdIzC	unknown	T0
8	0005	00	1	BRK	0005	aa	00	ff	fd	Nv-BdIzC	unknown	T1
8	0005	00	1	BRK	0005	aa	00	ff	fd	Nv-BdIzC	unknown	T1
9	0006	00	1		0006	aa	00	ff	fd	Nv-BdIzC	BRK	T2
9	0006	00	1		0006	aa	00	ff	fd	Nv-BdIzC	BRK	T2

AND (35) Cycles: 4		Size: 2
Zero Page, X (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		Store as Pointer.
1.2	Read PC	Inc. <b>PC</b> .
2.1		Store as Operand.
2.2	Read Pointer	Set Address to (Pointer+ <b>X</b> ) & \$FF.
3.1		Store as Operand.
3.2	Read Address	* Perform <b>A=A</b> & Operand, set <b>N</b> and <b>Z</b> accordingly.
4.1		Store as Operand.
4.2	Read PC	Store as OpCode.
+X.1		<b>A</b> and <b>N</b> , <b>Z</b> applied.

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
4	0003	35	1	AND zp,X	0003	aa	00	ff	fd	Nv-BdIzC	SEC	T1
4	0003	35	1	AND zp,X	0003	aa	00	ff	fd	Nv-BdIzC	SEC	T1
5	0004	fc	1		0004	aa	00	ff	fd	Nv-BdIzC	AND zp,X	T2
5	0004	fc	1		0004	aa	00	ff	fd	Nv-BdIzC	AND zp,X	T2
6	00fc	30	1		0005	aa	00	ff	fd	Nv-BdIzC	AND zp,X	T3
6	00fc	30	1		0005	aa	00	ff	fd	Nv-BdIzC	AND zp,X	T3
7	00fc	30	1		0005	aa	00	ff	fd	Nv-BdIzC	AND zp,X	T0
7	00fc	30	1		0005	aa	00	ff	fd	Nv-BdIzC	AND zp,X	T0
8	0005	00	1	BRK	0005	aa	00	ff	fd	nv-BdIzC	AND zp,X	T1
8	0005	00	1	BRK	0005	aa	00	ff	fd	nv-BdIzC	AND zp,X	T1
9	0006	00	1		0006	20	00	ff	fd	nv-BdIzC	BRK	T2
9	0006	00	1		0006	20	00	ff	fd	nv-BdIzC	BRK	T2

ROL (36) Cycles: 6		Size: 2
Zero Page, X (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Pointer.
2.1		Inc. <b>PC</b> .
2.2	Read Pointer	Store as Operand.
3.1		Set Address to (Pointer+ <b>X</b> ) & \$FF.
3.2	Read Address	Store as Operand.
4.1		
4.2	Write Address	Write unmodified Operand.
5.1		Perform Operand=(Operand << 1)   <b>C</b> , set <b>N</b> and <b>Z</b> accordingly. Set <b>C</b> if high bit of Operand was set before the shift operation.
5.2	Write Address	Write modified Operand.
6.1		
6.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
4	0003	36	1	ROL zp,X	0003	aa	00	ff	fd	Nv-BdIzC	SEC	T1
4	0003	36	1	ROL zp,X	0003	aa	00	ff	fd	Nv-BdIzC	SEC	T1
5	0004	fc	1		0004	aa	00	ff	fd	Nv-BdIzC	ROL zp,X	T2
5	0004	fc	1		0004	aa	00	ff	fd	Nv-BdIzC	ROL zp,X	T2
6	00fc	30	1		0005	aa	00	ff	fd	Nv-BdIzC	ROL zp,X	T3
6	00fc	30	1		0005	aa	00	ff	fd	Nv-BdIzC	ROL zp,X	T3
7	00fc	30	1		0005	aa	00	ff	fd	Nv-BdIzC	ROL zp,X	T4
7	00fc	30	1		0005	aa	00	ff	fd	Nv-BdIzC	ROL zp,X	T4
8	00fc	30	0		0005	aa	00	ff	fd	Nv-BdIzC	ROL zp,X	T5
8	00fc	30	0		0005	aa	00	ff	fd	Nv-BdIzC	ROL zp,X	T5
9	00fc	30	0		0005	aa	00	ff	fd	nv-BdIzc	ROL zp,X	T0
9	00fc	61	0		0005	aa	00	ff	fd	nv-BdIzc	ROL zp,X	T0
10	0005	00	1	BRK	0005	aa	00	ff	fd	nv-BdIzc	ROL zp,X	T1
10	0005	00	1	BRK	0005	aa	00	ff	fd	nv-BdIzc	ROL zp,X	T1
11	0006	00	1		0006	aa	00	ff	fd	nv-BdIzc	BRK	T2
11	0006	00	1		0006	aa	00	ff	fd	nv-BdIzc	BRK	T2

RLA (37)	Cycles: 6	Size: 2
Zero Page, X (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Pointer.
2.1		Inc. <b>PC</b> .
2.2	Read Pointer	Store as Operand.
3.1		Set Address to (Pointer+ <b>X</b> ) & \$FF.
3.2	Read Address	Store as Operand.
4.1		
4.2	Write Address	Write unmodified Operand.
5.1		* Perform Operand=(Operand << 1)   <b>C</b> , <b>A=A</b> & Operand, set <b>N</b> and <b>Z</b> based off <b>A</b> . Set <b>C</b> if high bit of Operand was set before the shift operation.
5.2	Write Address	Write modified Operand.
6.1		
6.2	Read PC	Store as OpCode.
+X.1		<b>A</b> applied.

\* Setting of A is delayed by 2 cycles until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
4	0003	37	1	unknown	0003	aa	00	ff	fd	Nv-BdIzC	SEC	T1
4	0003	37	1	unknown	0003	aa	00	ff	fd	Nv-BdIzC	SEC	T1
5	0004	fc	1		0004	aa	00	ff	fd	Nv-BdIzC	unknown	T2
5	0004	fc	1		0004	aa	00	ff	fd	Nv-BdIzC	unknown	T2
6	00fc	61	1		0005	aa	00	ff	fd	Nv-BdIzC	unknown	T3
6	00fc	61	1		0005	aa	00	ff	fd	Nv-BdIzC	unknown	T3
7	00fc	61	1		0005	aa	00	ff	fd	Nv-BdIzC	unknown	T4
7	00fc	61	1		0005	aa	00	ff	fd	Nv-BdIzC	unknown	T4
8	00fc	61	0		0005	aa	00	ff	fd	Nv-BdIzC	unknown	T5
8	00fc	61	0		0005	aa	00	ff	fd	Nv-BdIzC	unknown	T5
9	00fc	61	0		0005	aa	00	ff	fd	Nv-BdIzc	unknown	T0
9	00fc	c3	0		0005	aa	00	ff	fd	Nv-BdIzc	unknown	T0
10	0005	00	1	BRK	0005	aa	00	ff	fd	Nv-BdIzc	unknown	T1
10	0005	00	1	BRK	0005	aa	00	ff	fd	Nv-BdIzc	unknown	T1
11	0006	00	1		0006	82	00	ff	fd	Nv-BdIzc	BRK	T2
11	0006	00	1		0006	82	00	ff	fd	Nv-BdIzc	BRK	T2

SEC (38)	Cycles: 2	Size: 1
Implied		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		To be discarded.
1.2	Read PC	Set the <b>C</b> status bit.
2.1		
2.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	38	1	SEC	0002	aa	00	ff	fd	Nv-BdIzc	LDY #	T1
2	0002	38	1	SEC	0002	aa	00	ff	fd	Nv-BdIzc	LDY #	T1
3	0003	39	1		0003	aa	00	ff	fd	Nv-BdIzc	SEC	T0+T2
3	0003	39	1		0003	aa	00	ff	fd	Nv-BdIzc	SEC	T0+T2
4	0003	39	1	AND Abs,Y	0003	aa	00	ff	fd	Nv-BdIzc	SEC	T1
4	0003	39	1	AND Abs,Y	0003	aa	00	ff	fd	Nv-BdIzc	SEC	T1
5	0004	fc	1		0004	aa	00	ff	fd	Nv-BdIzc	AND Abs,Y	T2
5	0004	fc	1		0004	aa	00	ff	fd	Nv-BdIzc	AND Abs,Y	T2

AND (39) Cycles: 4-5		Size: 3
Absolute, Y (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Address.L.
2.1		Inc. <b>PC</b> .
2.2	Read PC	Store as Address.H.
3.1		Inc. <b>PC</b> . Final=Address+Y. Address.L = Final.L.
3.2	Read Address	Store as Operand. If Address.H == Final.H, skip the next cycle (next half-cycle is 5.1).
4.1		Address.H = Final.H (fixes high byte of address).
4.2	Read Address	Store as Operand.
5.1		* Perform <b>A=A</b> & Operand, set <b>N</b> and <b>Z</b> accordingly.
5.2	Read PC	Store as OpCode.
+X.1		<b>A</b> and <b>N</b> , <b>Z</b> applied.

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
4	0003	39	1	AND Abs,Y	0003	aa	00	ff	fd	Nv-BdIzC	SEC	T1
4	0003	39	1	AND Abs,Y	0003	aa	00	ff	fd	Nv-BdIzC	SEC	T1
5	0004	fc	1		0004	aa	00	ff	fd	Nv-BdIzC	AND Abs,Y	T2
5	0004	fc	1		0004	aa	00	ff	fd	Nv-BdIzC	AND Abs,Y	T2
6	0005	00	1		0005	aa	00	ff	fd	Nv-BdIzC	AND Abs,Y	T3
6	0005	00	1		0005	aa	00	ff	fd	Nv-BdIzC	AND Abs,Y	T3
7	00fb	00	1		0006	aa	00	ff	fd	Nv-BdIzC	AND Abs,Y	T4
7	00fb	00	1		0006	aa	00	ff	fd	Nv-BdIzC	AND Abs,Y	T4
8	01fb	00	1		0006	aa	00	ff	fd	Nv-BdIzC	AND Abs,Y	T0
8	01fb	00	1		0006	aa	00	ff	fd	Nv-BdIzC	AND Abs,Y	T0
9	0006	00	1	BRK	0006	aa	00	ff	fd	nv-BdIzC	AND Abs,Y	T1
9	0006	00	1	BRK	0006	aa	00	ff	fd	nv-BdIzC	AND Abs,Y	T1
10	0007	00	1		0007	00	00	ff	fd	nv-BdIzC	BRK	T2
10	0007	00	1		0007	00	00	ff	fd	nv-BdIzC	BRK	T2

NOP (3A) Cycles: 2		Size: 1
Implied		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		
1.2	Read PC	To be discarded.
2.1		
2.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
4	0003	3a	1	unknown	0003	aa	00	ff	fd	Nv-BdIzC	SEC	T1
4	0003	3a	1	unknown	0003	aa	00	ff	fd	Nv-BdIzC	SEC	T1
5	0004	a9	1		0004	aa	00	ff	fd	Nv-BdIzC	unknown	T0+T2
5	0004	a9	1		0004	aa	00	ff	fd	Nv-BdIzC	unknown	T0+T2
6	0004	a9	1	LDA #	0004	aa	00	ff	fd	Nv-BdIzC	unknown	T1
6	0004	a9	1	LDA #	0004	aa	00	ff	fd	Nv-BdIzC	unknown	T1
7	0005	00	1		0005	aa	00	ff	fd	Nv-BdIzC	LDA #	T0+T2
7	0005	00	1		0005	aa	00	ff	fd	Nv-BdIzC	LDA #	T0+T2

RLA (3B)		Cycles: 7	Size: 3
Absolute, Y (Read/Modify/Write)			
Cycle	R/W	Desc	
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .	
1.1		Store as Address.L.	
1.2	Read PC	Inc. <b>PC</b> .	
2.1		Store as Address.H.	
2.2	Read PC	Inc. <b>PC</b> . Final=Address+Y. Address.L = Final.L.	
3.1		Store as Operand.	
3.2	Read Address	Address.H = Final.H (fixes high byte of address).	
4.1		Store as Operand.	
4.2	Read Address	Address.H = Final.H (fixes high byte of address).	
5.1		Store as Operand.	
5.2	Write Address	Write unmodified Operand. * Perform Operand=(Operand << 1)   C, A=A & Operand, set N and Z based off A. Set C if high bit of Operand was set before the shift operation.	
6.1		Write modified Operand.	
6.2	Write Address	Write modified Operand.	
7.1		Store as OpCode.	
7.2	Read PC	<b>A</b> applied.	
+X.1			

\* Setting of A is delayed by 2 cycles until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
4	0003	3b	1	unknown	0003	aa	00	ff	fd	Nv-BdIzC	SEC	T1
4	0003	3b	1	unknown	0003	aa	00	ff	fd	Nv-BdIzC	SEC	T1
5	0004	a9	1		0004	aa	00	ff	fd	Nv-BdIzC	unknown	T2
5	0004	a9	1		0004	aa	00	ff	fd	Nv-BdIzC	unknown	T2
6	0005	00	1		0005	aa	00	ff	fd	Nv-BdIzC	unknown	T3
6	0005	00	1		0005	aa	00	ff	fd	Nv-BdIzC	unknown	T3
7	00a8	00	1		0006	aa	00	ff	fd	Nv-BdIzC	unknown	T4
7	00a8	00	1		0006	aa	00	ff	fd	Nv-BdIzC	unknown	T4
8	01a8	00	1		0006	aa	00	ff	fd	Nv-BdIzC	unknown	T5
8	01a8	00	1		0006	aa	00	ff	fd	Nv-BdIzC	unknown	T5
9	01a8	00	0		0006	aa	00	ff	fd	Nv-BdIzC	unknown	
9	01a8	00	0		0006	aa	00	ff	fd	Nv-BdIzC	unknown	
10	01a8	00	0		0006	aa	00	ff	fd	nv-BdIzc	unknown	T0
10	01a8	01	0		0006	aa	00	ff	fd	nv-BdIzc	unknown	T0
11	0006	00	1	BRK	0006	aa	00	ff	fd	nv-BdIzc	unknown	T1
11	0006	00	1	BRK	0006	aa	00	ff	fd	nv-BdIzc	unknown	T1
12	0007	00	1		0007	00	00	ff	fd	nv-BdIzc	BRK	T2
12	0007	00	1		0007	00	00	ff	fd	nv-BdIzc	BRK	T2

NOP (3C) Cycles: 4-5		Size: 3
Absolute, X (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Address.L.
2.1		Inc. <b>PC</b> .
2.2	Read PC	Store as Address.H.
3.1		Inc. <b>PC</b> . Final=Address+X. Address.L = Final.L.
3.2	Read Address	Store as Operand. If Address.H == Final.H, skip the next cycle (next half-cycle is 5.1).
4.1		Address.H = Final.H (fixes high byte of address).
4.2	Read Address	Store as Operand.
5.1		
5.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
4	0003	3c	1	unknown	0003	aa	00	ff	fd	Nv-BdIzC	SEC	T1
4	0003	3c	1	unknown	0003	aa	00	ff	fd	Nv-BdIzC	SEC	T1
5	0004	a9	1		0004	aa	00	ff	fd	Nv-BdIzC	unknown	T2
5	0004	a9	1		0004	aa	00	ff	fd	Nv-BdIzC	unknown	T2
6	0005	00	1		0005	aa	00	ff	fd	Nv-BdIzC	unknown	T3
6	0005	00	1		0005	aa	00	ff	fd	Nv-BdIzC	unknown	T3
7	00a9	00	1		0006	aa	00	ff	fd	Nv-BdIzC	unknown	T0
7	00a9	00	1		0006	aa	00	ff	fd	Nv-BdIzC	unknown	T0
8	0006	00	1	BRK	0006	aa	00	ff	fd	Nv-BdIzC	unknown	T1
8	0006	00	1	BRK	0006	aa	00	ff	fd	Nv-BdIzC	unknown	T1
9	0007	00	1		0007	aa	00	ff	fd	Nv-BdIzC	BRK	T2
9	0007	00	1		0007	aa	00	ff	fd	Nv-BdIzC	BRK	T2

AND (3D) Cycles: 4-5		
Size: 3		
Absolute, X (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Address.L.
2.1		Inc. <b>PC</b> .
2.2	Read PC	Store as Address.H.
3.1		Inc. <b>PC</b> . Final=Address+X. Address.L = Final.L.
3.2	Read Address	Store as Operand. If Address.H == Final.H, skip the next cycle (next half-cycle is 5.1).
4.1		Address.H = Final.H (fixes high byte of address).
4.2	Read Address	Store as Operand.
5.1		* Perform <b>A=A</b> & Operand, set <b>N</b> and <b>Z</b> accordingly.
5.2	Read PC	Store as OpCode.
+X.1		<b>A</b> and <b>N, Z</b> applied.

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
5	0003	3d	1	AND Abs,X	0003	aa	33	00	fd	nv-BdIzC	SEC	T1
5	0003	3d	1	AND Abs,X	0003	aa	33	00	fd	nv-BdIzC	SEC	T1
6	0004	a9	1		0004	aa	33	00	fd	nv-BdIzC	AND Abs,X	T2
6	0004	a9	1		0004	aa	33	00	fd	nv-BdIzC	AND Abs,X	T2
7	0005	00	1		0005	aa	33	00	fd	nv-BdIzC	AND Abs,X	T3
7	0005	00	1		0005	aa	33	00	fd	nv-BdIzC	AND Abs,X	T3
8	00dc	f0	1		0006	aa	33	00	fd	nv-BdIzC	AND Abs,X	T0
8	00dc	f0	1		0006	aa	33	00	fd	nv-BdIzC	AND Abs,X	T0
9	0006	00	1	BRK	0006	aa	33	00	fd	Nv-BdIzC	AND Abs,X	T1
9	0006	00	1	BRK	0006	aa	33	00	fd	Nv-BdIzC	AND Abs,X	T1
10	0007	00	1		0007	a0	33	00	fd	Nv-BdIzC	BRK	T2
10	0007	00	1		0007	a0	33	00	fd	Nv-BdIzC	BRK	T2

ROL (3E)		Cycles: 7	Size: 3
Absolute, X (Read/Modify/Write)			
Cycle	R/W	Desc	
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .	
1.1		Store as Address.L.	
1.2	Read PC	Inc. <b>PC</b> .	
2.1		Store as Address.H.	
2.2	Read PC	Inc. <b>PC</b> . Final=Address+X. Address.L = Final.L.	
3.1		Store as Operand.	
3.2	Read Address	Address.H = Final.H (fixes high byte of address).	
4.1		Store as Operand.	
4.2	Read Address	Store as Operand.	
5.1		Write unmodified Operand.	
5.2	Write Address	Perform Operand=(Operand << 1)   <b>C</b> , set <b>N</b> and <b>Z</b> accordingly.	
6.1		Set <b>C</b> if high bit of Operand was set before the shift operation.	
6.2	Write Address	Write modified Operand.	
7.1			
7.2	Read PC	Store as OpCode.	
+X.1			

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
5	0003	3e	1	ROL Abs,X	0003 aa 33 00 fd nv-BdIzC					SEC	T1	
5	0003	3e	1	ROL Abs,X	0003 aa 33 00 fd nv-BdIzC					SEC	T1	
6	0004	a9	1		0004 aa 33 00 fd nv-BdIzC	ROL Abs,X				T2		
6	0004	a9	1		0004 aa 33 00 fd nv-BdIzC	ROL Abs,X				T2		
7	0005	00	1		0005 aa 33 00 fd nv-BdIzC	ROL Abs,X				T3		
7	0005	00	1		0005 aa 33 00 fd nv-BdIzC	ROL Abs,X				T3		
8	00dc	f0	1		0006 aa 33 00 fd nv-BdIzC	ROL Abs,X				T4		
8	00dc	f0	1		0006 aa 33 00 fd nv-BdIzC	ROL Abs,X				T4		
9	00dc	f0	1		0006 aa 33 00 fd nv-BdIzC	ROL Abs,X				T5		
9	00dc	f0	1		0006 aa 33 00 fd nv-BdIzC	ROL Abs,X				T5		
10	00dc	f0	0		0006 aa 33 00 fd nv-BdIzC	ROL Abs,X						
10	00dc	f0	0		0006 aa 33 00 fd nv-BdIzC	ROL Abs,X						
11	00dc	f0	0		0006 aa 33 00 fd Nv-BdIzC	ROL Abs,X				T0		
11	00dc	e1	0		0006 aa 33 00 fd Nv-BdIzC	ROL Abs,X				T0		
12	0006	00	1	BRK	0006 aa 33 00 fd Nv-BdIzC	ROL Abs,X				T1		
12	0006	00	1	BRK	0006 aa 33 00 fd Nv-BdIzC	ROL Abs,X				T1		
13	0007	00	1		0007 aa 33 00 fd Nv-BdIzC	BRK				T2		
13	0007	00	1		0007 aa 33 00 fd Nv-BdIzC	BRK				T2		

RLA (3F)		Cycles: 7	Size: 3
Absolute, X (Read/Modify/Write)			
Cycle	R/W	Desc	
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .	
1.1		Store as Address.L.	
1.2	Read PC	Inc. <b>PC</b> .	
2.1		Store as Address.H.	
2.2	Read PC	Inc. <b>PC</b> . Final=Address+X. Address.L = Final.L.	
3.1		Store as Operand.	
3.2	Read Address	Address.H = Final.H (fixes high byte of address).	
4.1		Store as Operand.	
4.2	Read Address	Store as Operand.	
5.1		Write unmodified Operand.	
5.2	Write Address	* Perform Operand=(Operand << 1)   C, A=A & Operand, set N and Z based off A. Set C if high bit of Operand was set before the shift operation.	
6.1		Write modified Operand.	
6.2	Write Address	Write modified Operand.	
7.1		Store as OpCode.	
7.2	Read PC	<b>A</b> applied.	
+X.1			

\* Setting of A is delayed by 2 cycles until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
5	0003	3f	1	unknown	0003	aa	33	00	fd	nv-BdIzC	SEC	T1
5	0003	3f	1	unknown	0003	aa	33	00	fd	nv-BdIzC	SEC	T1
6	0004	a9	1		0004	aa	33	00	fd	nv-BdIzC	unknown	T2
6	0004	a9	1		0004	aa	33	00	fd	nv-BdIzC	unknown	T2
7	0005	00	1		0005	aa	33	00	fd	nv-BdIzC	unknown	T3
7	0005	00	1		0005	aa	33	00	fd	nv-BdIzC	unknown	T3
8	00dc	e1	1		0006	aa	33	00	fd	nv-BdIzC	unknown	T4
8	00dc	e1	1		0006	aa	33	00	fd	nv-BdIzC	unknown	T4
9	00dc	e1	1		0006	aa	33	00	fd	nv-BdIzC	unknown	T5
9	00dc	e1	1		0006	aa	33	00	fd	nv-BdIzC	unknown	T5
10	00dc	e1	0		0006	aa	33	00	fd	nv-BdIzC	unknown	
10	00dc	e1	0		0006	aa	33	00	fd	nv-BdIzC	unknown	
11	00dc	e1	0		0006	aa	33	00	fd	Nv-BdIzC	unknown	T0
11	00dc	c3	0		0006	aa	33	00	fd	Nv-BdIzC	unknown	T0
12	0006	00	1	BRK	0006	aa	33	00	fd	Nv-BdIzC	unknown	T1
12	0006	00	1	BRK	0006	aa	33	00	fd	Nv-BdIzC	unknown	T1
13	0007	00	1		0007	82	33	00	fd	Nv-BdIzC	BRK	T2
13	0007	00	1		0007	82	33	00	fd	Nv-BdIzC	BRK	T2

RTI (40)	Cycles: 6	Size: 1
Implied		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Address.L.
2.1		Inc. <b>PC</b> .
2.2	Read <b>S</b>   \$0100	
3.1		
3.2	Read ( <b>S+1</b> )   \$0100	Store as Tmp.
4.1		Copy all but the <b>M</b> and <b>B</b> flags from Tmp to <b>P</b> ( <b>M</b> and <b>B</b> remain unchanged on <b>P</b> ).
4.2	Read ( <b>S+2</b> )   \$0100	Store as Address.L.
5.1		Increase <b>S</b> by 3.
5.2	Read <b>S</b>   \$0100	Store as Address.H.
6.1		<b>PC</b> =Address.
6.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	40	1	RTI	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
2	0002	40	1	RTI	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
3	0003	10	1		0003	00	00	00	fd	nv-BdIZc	RTI	T2
3	0003	10	1		0003	00	00	00	fd	nv-BdIZc	RTI	T2
4	01fd	ff	1		0004	00	00	00	fd	nv-BdIZc	RTI	T3
4	01fd	ff	1		0004	00	00	00	fd	nv-BdIZc	RTI	T3
5	01fe	88	1		0004	00	00	00	fd	nv-BdIZc	RTI	T4
5	01fe	88	1		0004	00	00	00	fd	nv-BdIZc	RTI	T4
6	01ff	12	1		0004	00	00	00	fd	Nv-BDizc	RTI	T5
6	01ff	12	1		0004	00	00	00	fd	Nv-BDizc	RTI	T5
7	0100	00	1		0004	00	00	00	00	Nv-BDizc	RTI	T0
7	0100	00	1		0004	00	00	00	00	Nv-BDizc	RTI	T0
8	0012	e6	1	INC zp	0012	00	00	00	00	Nv-BDizc	RTI	T1
8	0012	e6	1	INC zp	0012	00	00	00	00	Nv-BDizc	RTI	T1
9	0013	0f	1		0013	00	00	00	00	Nv-BDizc	INC zp	T2
9	0013	0f	1		0013	00	00	00	00	Nv-BDizc	INC zp	T2

EOR (41) Cycles: 6		Size: 2
Indirect, X (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		Store as Operand.
1.2	Read PC	Inc. <b>PC</b> .
2.1		
2.2	Read Operand	
3.1		Set Pointer to (Operand+X) & \$FF.
3.2	Read Pointer	Store to Address.L.
4.1		
4.2	Read (Pointer+1) & \$FF	Store to Address.H.
5.1		
5.2	Read Address	Store as Operand. * Perform <b>A=A ^ Operand</b> , set <b>N</b> and <b>Z</b> accordingly.
6.1		
6.2	Read PC	Store as OpCode.
+X.1		<b>A</b> and <b>N, Z</b> applied.

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
4	0003	41	1	EOR (zp,X)	0003	1f 00 00	fd	nv-BdIzC		SEC	T1	
4	0003	41	1	EOR (zp,X)	0003	1f 00 00	fd	nv-BdIzC		SEC	T1	
5	0004	a9	1		0004	1f 00 00	fd	nv-BdIzC	EOR (zp,X)		T2	
5	0004	a9	1		0004	1f 00 00	fd	nv-BdIzC	EOR (zp,X)		T2	
6	00a9	55	1		0005	1f 00 00	fd	nv-BdIzC	EOR (zp,X)		T3	
6	00a9	55	1		0005	1f 00 00	fd	nv-BdIzC	EOR (zp,X)		T3	
7	00a9	55	1		0005	1f 00 00	fd	nv-BdIzC	EOR (zp,X)		T4	
7	00a9	55	1		0005	1f 00 00	fd	nv-BdIzC	EOR (zp,X)		T4	
8	00aa	00	1		0005	1f 00 00	fd	nv-BdIzC	EOR (zp,X)		T5	
8	00aa	00	1		0005	1f 00 00	fd	nv-BdIzC	EOR (zp,X)		T5	
9	0055	f8	1		0005	1f 00 00	fd	nv-BdIzC	EOR (zp,X)		T0	
9	0055	f8	1		0005	1f 00 00	fd	nv-BdIzC	EOR (zp,X)		T0	
10	0005	00	1	BRK	0005	1f 00 00	fd	nv-BdIzC	EOR (zp,X)		T1	
10	0005	00	1	BRK	0005	1f 00 00	fd	nv-BdIzC	EOR (zp,X)		T1	
11	0006	00	1		0006	e7 00 00	fd	Nv-BdIzC	BRK		T2	
11	0006	00	1		0006	e7 00 00	fd	Nv-BdIzC	BRK		T2	

JAM (42)	Cycles: $\infty$	Size: 1
Implied		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		
1.2	Read PC	
2.1		
2.2	Read \$FFFF	
3.1		
3.2	Read \$FFFE	
4.1		
4.2	Read \$FFFE	
5.1		Repeat 5.1 and 5.2 forever.
5.2	Read \$FFFF	

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	02	1	unknown	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
2	0002	02	1	unknown	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
3	0003	10	1		0003	00	00	00	fd	nv-BdIZc	unknown	T2
3	0003	10	1		0003	00	00	00	fd	nv-BdIZc	unknown	T2
4	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T3
4	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T3
5	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T4
5	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T4
6	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T5
6	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T5
7	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
7	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
8	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
8	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
9	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
9	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
10	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
10	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
11	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
11	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	

SRE (43) Cycles: 8		Size: 2
Indirect, X (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Operand.
2.1		Inc. <b>PC</b> .
2.2	Read Operand	
3.1		Set Pointer to (Operand+X) & \$FF.
3.2	Read Pointer	Store to Address.L.
4.1		
4.2	Read (Pointer+1) & \$FF	Store to Address.H.
5.1		
5.1	Read Address	Store as Operand.
6.1		Set <b>C</b> if lowest bit of Operand is set.
6.2	Write Address	Write unmodified Operand.
7.1		* Perform Operand=Operand >> 1, <b>A=A ^ Operand</b> , set <b>N</b> and <b>Z</b> based off <b>A</b> .
7.2	Write Address	Write modified Operand.
8.1		
8.2	Read PC	Store as OpCode.
+X.1		<b>A</b> applied.

\* Setting of A is delayed by 2 cycles until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
4	0003	43	1	unknown	0003	1f	00	00	fd	nv-BdIzC	SEC	T1
4	0003	43	1	unknown	0003	1f	00	00	fd	nv-BdIzC	SEC	T1
5	0004	a9	1		0004	1f	00	00	fd	nv-BdIzC	unknown	T2
5	0004	a9	1		0004	1f	00	00	fd	nv-BdIzC	unknown	T2
6	00a9	55	1		0005	1f	00	00	fd	nv-BdIzC	unknown	T3
6	00a9	55	1		0005	1f	00	00	fd	nv-BdIzC	unknown	T3
7	00a9	55	1		0005	1f	00	00	fd	nv-BdIzC	unknown	T4
7	00a9	55	1		0005	1f	00	00	fd	nv-BdIzC	unknown	T4
8	00aa	00	1		0005	1f	00	00	fd	nv-BdIzC	unknown	T5
8	00aa	00	1		0005	1f	00	00	fd	nv-BdIzC	unknown	T5
9	0055	f8	1		0005	1f	00	00	fd	nv-BdIzC	unknown	
9	0055	f8	1		0005	1f	00	00	fd	nv-BdIzC	unknown	
10	0055	f8	0		0005	1f	00	00	fd	nv-BdIzc	unknown	
10	0055	f8	0		0005	1f	00	00	fd	nv-BdIzc	unknown	
11	0055	f8	0		0005	1f	00	00	fd	nv-BdIzc	unknown	T0
11	0055	7c	0		0005	1f	00	00	fd	nv-BdIzc	unknown	T0
12	0005	00	1	BRK	0005	1f	00	00	fd	nv-BdIzc	unknown	T1
12	0005	00	1	BRK	0005	1f	00	00	fd	nv-BdIzc	unknown	T1
13	0006	00	1		0006	63	00	00	fd	nv-BdIzc	BRK	T2
13	0006	00	1		0006	63	00	00	fd	nv-BdIzc	BRK	T2

NOP (44)		Cycles: 3	Size: 2
Zero Page (Read)			
Cycle	R/W	Desc	
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .	
1.1		Store as Address. Inc. <b>PC</b> .	
1.2	Read PC		
2.1		Store as Operand. Inc. <b>PC</b> .	
2.2	Read Address		
3.1		Store as Operand.	
3.2	Read PC	Store as OpCode.	
+X.1			

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
4	0003	44	1	unknown	0003	1f	00	00	fd	nv-BdIzC	SEC	T1
4	0003	44	1	unknown	0003	1f	00	00	fd	nv-BdIzC	SEC	T1
5	0004	a9	1		0004	1f	00	00	fd	nv-BdIzC	unknown	T2
5	0004	a9	1		0004	1f	00	00	fd	nv-BdIzC	unknown	T2
6	00a9	55	1		0005	1f	00	00	fd	nv-BdIzC	unknown	T0
6	00a9	55	1		0005	1f	00	00	fd	nv-BdIzC	unknown	T0
7	0005	00	1	BRK	0005	1f	00	00	fd	nv-BdIzC	unknown	T1
7	0005	00	1	BRK	0005	1f	00	00	fd	nv-BdIzC	unknown	T1
8	0006	00	1		0006	1f	00	00	fd	nv-BdIzC	BRK	T2
8	0006	00	1		0006	1f	00	00	fd	nv-BdIzC	BRK	T2

EOR (45) Cycles: 3		Size: 2
Zero Page (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		
1.2	Read PC	Store as Address. Inc. <b>PC</b> .
2.1		
2.2	Read Address	Store as Operand.
3.1		* Perform <b>A=A ^ Operand</b> , set <b>N</b> and <b>Z</b> accordingly.
3.2	Read PC	Store as OpCode. <b>A</b> and <b>N, Z</b> applied.
+X.1		

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
4	0003	45	1	EOR zp	0003	1f	00	00	fd	nv-BdIzC	SEC	T1
4	0003	45	1	EOR zp	0003	1f	00	00	fd	nv-BdIzC	SEC	T1
5	0004	9f	1		0004	1f	00	00	fd	nv-BdIzC	EOR zp	T2
5	0004	9f	1		0004	1f	00	00	fd	nv-BdIzC	EOR zp	T2
6	009f	f8	1		0005	1f	00	00	fd	nv-BdIzC	EOR zp	T0
6	009f	f8	1		0005	1f	00	00	fd	nv-BdIzC	EOR zp	T0
7	0005	f8	1	SED	0005	1f	00	00	fd	nv-BdIzC	EOR zp	T1
7	0005	f8	1	SED	0005	1f	00	00	fd	nv-BdIzC	EOR zp	T1
8	0006	00	1		0006	e7	00	00	fd	Nv-BdIzC	SED	T0+T2
8	0006	00	1		0006	e7	00	00	fd	Nv-BdIzC	SED	T0+T2

LSR (46)	Cycles: 5	Size: 2
Zero Page (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		Store as Address.
1.2	Read PC	Inc. <b>PC</b> .
2.1		Store as Operand.
2.2	Read Address	Set <b>C</b> if lowest bit of Operand is set.
3.1		Write unmodified Operand.
3.2	Write Address	Perform Operand=Operand << 1, set <b>N</b> and <b>Z</b> accordingly.
4.1		
4.2	Write Address	
5.1		
5.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
4	0003	46	1	LSR zp	0003	1f	00	00	fd	nv-BdIzC	SEC	T1
4	0003	46	1	LSR zp	0003	1f	00	00	fd	nv-BdIzC	SEC	T1
5	0004	9f	1		0004	1f	00	00	fd	nv-BdIzC	LSR zp	T2
5	0004	9f	1		0004	1f	00	00	fd	nv-BdIzC	LSR zp	T2
6	009f	f8	1		0005	1f	00	00	fd	nv-BdIzC	LSR zp	T3
6	009f	f8	1		0005	1f	00	00	fd	nv-BdIzC	LSR zp	T3
7	009f	f8	0		0005	1f	00	00	fd	nv-BdIzc	LSR zp	T4
7	009f	f8	0		0005	1f	00	00	fd	nv-BdIzc	LSR zp	T4
8	009f	f8	0		0005	1f	00	00	fd	nv-BdIzc	LSR zp	T0
8	009f	7c	0		0005	1f	00	00	fd	nv-BdIzc	LSR zp	T0
9	0005	a0	1	LDY #	0005	1f	00	00	fd	nv-BdIzc	LSR zp	T1
9	0005	a0	1	LDY #	0005	1f	00	00	fd	nv-BdIzc	LSR zp	T1
10	0006	00	1		0006	1f	00	00	fd	nv-BdIzc	LDY #	T0+T2
10	0006	00	1		0006	1f	00	00	fd	nv-BdIzc	LDY #	T0+T2

SRE (47) Cycles: 5		Size: 2
Zero Page (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		Store as Address.
1.2	Read PC	Inc. <b>PC</b> .
2.1		Store as Operand.
2.2	Read Address	Set <b>C</b> if lowest bit of Operand is set.
3.1		Write unmodified Operand.
3.2	Write Address	* Perform Operand=Operand >> 1, <b>A=A ^ Operand</b> , set <b>N</b> and <b>Z</b> based off <b>A</b> .
4.1		Write modified Operand.
4.2	Write Address	
5.1		Store as OpCode.
5.2	Read PC	<b>A</b> applied.
+X.1		

\* Setting of A is delayed by 2 cycles until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
4	0003	47	1	unknown	0003	1f	00	00	fd	nv-BdIzC	SEC	T1
4	0003	47	1	unknown	0003	1f	00	00	fd	nv-BdIzC	SEC	T1
5	0004	9f	1		0004	1f	00	00	fd	nv-BdIzC	unknown	T2
5	0004	9f	1		0004	1f	00	00	fd	nv-BdIzC	unknown	T2
6	009f	7e	1		0005	1f	00	00	fd	nv-BdIzC	unknown	T3
6	009f	7e	1		0005	1f	00	00	fd	nv-BdIzC	unknown	T3
7	009f	7e	0		0005	1f	00	00	fd	nv-BdIzc	unknown	T4
7	009f	7e	0		0005	1f	00	00	fd	nv-BdIzc	unknown	T4
8	009f	7e	0		0005	1f	00	00	fd	nv-BdIzc	unknown	T0
8	009f	3f	0		0005	1f	00	00	fd	nv-BdIzc	unknown	T0
9	0005	a0	1	LDY #	0005	1f	00	00	fd	nv-BdIzc	unknown	T1
9	0005	a0	1	LDY #	0005	1f	00	00	fd	nv-BdIzc	unknown	T1
10	0006	00	1		0006	20	00	00	fd	nv-BdIzc	LDY #	T0+T2
10	0006	00	1		0006	20	00	00	fd	nv-BdIzc	LDY #	T0+T2

PHA (48) Cycles: 3		Size: 1
Implied		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		To be discarded.
1.2	Read PC	
2.1		
2.2	Write <b>S</b>   \$0100	Write <b>A</b> .
3.1		
3.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	48	1	PHA	0002	fe	00	00	fd	Nv-BdIzc	LDA #	T1
2	0002	48	1	PHA	0002	fe	00	00	fd	Nv-BdIzc	LDA #	T1
3	0003	10	1		0003	fe	00	00	fd	Nv-BdIzc	PHA	T2
3	0003	10	1		0003	fe	00	00	fd	Nv-BdIzc	PHA	T2
4	01fd	10	0		0003	fe	00	00	fd	Nv-BdIzc	PHA	T0
4	01fd	fe	0		0003	fe	00	00	fd	Nv-BdIzc	PHA	T0
5	0003	10	1	BPL	0003	fe	00	00	fc	Nv-BdIzc	PHA	T1
5	0003	10	1	BPL	0003	fe	00	00	fc	Nv-BdIzc	PHA	T1
6	0004	00	1		0004	fe	00	00	fc	Nv-BdIzc	BPL	T2
6	0004	00	1		0004	fe	00	00	fc	Nv-BdIzc	BPL	T2

EOR (49) Cycles: 2		Size: 2
Immediate		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Operand.
2.1		Inc. <b>PC</b> . * Perform <b>A=A ^ Operand</b> , set <b>N</b> and <b>Z</b> accordingly.
2.2	Read PC	Store as OpCode.
+X.1		<b>A</b> and <b>N, Z</b> applied.

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	49	1	EOR #	0002	80 00 00	fd	Nv-BdIzc		LDA #	T1	
2	0002	49	1	EOR #	0002	80 00 00	fd	Nv-BdIzc		LDA #	T1	
3	0003	80	1		0003	80 00 00	fd	Nv-BdIzc		EOR #	T0+T2	
3	0003	80	1		0003	80 00 00	fd	Nv-BdIzc		EOR #	T0+T2	
4	0004	35	1	AND zp,X	0004	80 00 00	fd	Nv-BdIzc		EOR #	T1	
4	0004	35	1	AND zp,X	0004	80 00 00	fd	Nv-BdIzc		EOR #	T1	
5	0005	4c	1		0005	00 00 00	fd	nv-BdIZc	AND zp,X		T2	
5	0005	4c	1		0005	00 00 00	fd	nv-BdIZc	AND zp,X		T2	

LSR (4A)	Cycles: 2	Size: 1
Implied		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	To be discarded.
2.1		Set <b>C</b> if low bit of <b>A</b> is set. Perform <b>A=A &gt;&gt; 1</b> , unset <b>N</b> and set <b>Z</b> accordingly.
2.2	Read PC	Store as OpCode.
+X.1		<b>A</b> and <b>N</b> , <b>Z</b> applied.

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	4a	1	LSR	0002	80	00	00	fd	Nv-BdIzc	LDA #	T1
2	0002	4a	1	LSR	0002	80	00	00	fd	Nv-BdIzc	LDA #	T1
3	0003	35	1		0003	80	00	00	fd	Nv-BdIzc	LSR	T0+T2
3	0003	35	1		0003	80	00	00	fd	Nv-BdIzc	LSR	T0+T2
4	0003	35	1	AND zp,X	0003	80	00	00	fd	Nv-BdIzc	LSR	T1
4	0003	35	1	AND zp,X	0003	80	00	00	fd	Nv-BdIzc	LSR	T1
5	0004	00	1		0004	40	00	00	fd	nv-BdIzc	AND zp,X	T2
5	0004	00	1		0004	40	00	00	fd	nv-BdIzc	AND zp,X	T2

ASR (4B)	Cycles: 2	Size: 2
Immediate		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Operand.
2.1		Inc. <b>PC</b> . * Perform <b>A=A &amp; Operand, A=A &gt;&gt; 1</b> , set <b>C, N</b> and <b>Z</b> accordingly. <b>C</b> is set if ( <b>A &amp; 1</b> ) before the shift.
2.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	4b	1	unknown	0002	ff	00	00	fd	Nv-BdIzc	LDA #	T1
2	0002	4b	1	unknown	0002	ff	00	00	fd	Nv-BdIzc	LDA #	T1
3	0003	0f	1		0003	ff	00	00	fd	Nv-BdIzc	unknown	T0+T2
3	0003	0f	1		0003	ff	00	00	fd	Nv-BdIzc	unknown	T0+T2
4	0004	30	1	BMI	0004	ff	00	00	fd	Nv-BdIzC	unknown	T1
4	0004	30	1	BMI	0004	ff	00	00	fd	Nv-BdIzC	unknown	T1
5	0005	4c	1		0005	7f	00	00	fd	nv-BdIzC	BMI	T2
5	0005	4c	1		0005	7f	00	00	fd	nv-BdIzC	BMI	T2

JMP (4C)	Cycles: 3	Size: 3
Absolute		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		
1.2	Read PC	Store as Address.L. Inc. <b>PC</b> .
2.1		
2.2	Read PC	Store as Address.H. Copy Address to <b>PC</b> .
3.1		
3.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	4c	1	JMP Abs	0002	ff	00	00	fd	Nv-BdIzc	LDA #	T1
2	0002	4c	1	JMP Abs	0002	ff	00	00	fd	Nv-BdIzc	LDA #	T1
3	0003	20	1		0003	ff	00	00	fd	Nv-BdIzc	JMP Abs	T2
3	0003	20	1		0003	ff	00	00	fd	Nv-BdIzc	JMP Abs	T2
4	0004	01	1		0004	ff	00	00	fd	Nv-BdIzc	JMP Abs	T0
4	0004	01	1		0004	ff	00	00	fd	Nv-BdIzc	JMP Abs	T0
5	0120	35	1	AND zp,X	0120	ff	00	00	fd	Nv-BdIzc	JMP Abs	T1
5	0120	35	1	AND zp,X	0120	ff	00	00	fd	Nv-BdIzc	JMP Abs	T1
6	0121	00	1		0121	ff	00	00	fd	Nv-BdIzc	AND zp,X	T2
6	0121	00	1		0121	ff	00	00	fd	Nv-BdIzc	AND zp,X	T2

EOR (4D) Cycles: 4		Size: 3
Absolute (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		Store as Address.L.
1.2	Read PC	Inc. <b>PC</b> .
2.1		Store as Address.H.
2.2	Read PC	Inc. <b>PC</b> .
3.1		Store as Operand.
3.2	Read Address	* Perform <b>A=A ^ Operand</b> , set <b>N</b> and <b>Z</b> accordingly.
4.1		Store as OpCode.
4.2	Read PC	<b>A</b> and <b>N, Z</b> applied.
+X.1		

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	4d	1	EOR Abs	0002	ff 00 00	fd	Nv-BdIzc	LDA #	T1		
2	0002	4d	1	EOR Abs	0002	ff 00 00	fd	Nv-BdIzc	LDA #	T1		
3	0003	20	1		0003	ff 00 00	fd	Nv-BdIzc	EOR Abs	T2		
3	0003	20	1		0003	ff 00 00	fd	Nv-BdIzc	EOR Abs	T2		
4	0004	01	1		0004	ff 00 00	fd	Nv-BdIzc	EOR Abs	T3		
4	0004	01	1		0004	ff 00 00	fd	Nv-BdIzc	EOR Abs	T3		
5	0120	35	1		0005	ff 00 00	fd	Nv-BdIzc	EOR Abs	T0		
5	0120	35	1		0005	ff 00 00	fd	Nv-BdIzc	EOR Abs	T0		
6	0005	20	1	JSR Abs	0005	ff 00 00	fd	Nv-BdIzc	EOR Abs	T1		
6	0005	20	1	JSR Abs	0005	ff 00 00	fd	Nv-BdIzc	EOR Abs	T1		
7	0006	02	1		0006	ca 00 00	fd	Nv-BdIzc	JSR Abs	T2		
7	0006	02	1		0006	ca 00 00	fd	Nv-BdIzc	JSR Abs	T2		

LSR (4E)		Cycles: 6		Size: 3									
Absolute (Read/Modify/Write)													
Cycle	R/W	Desc											
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .											
1.1		Store as Address.L.											
1.2	Read PC	Inc. <b>PC</b> .											
2.1		Store as Address.H.											
2.2	Read PC	Inc. <b>PC</b> .											
3.1		Store as Operand.											
3.2	Read Address	Set <b>C</b> if lowest bit of Operand is set.											
4.1		Write unmodified Operand.											
4.2	Write Address												
5.1		Perform Operand=Operand << 1, set <b>N</b> and <b>Z</b> accordingly.											
5.2	Write Address	Write modified Operand.											
6.1													
6.2	Read PC	Store as OpCode.											
+X.1													

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
3	0002	4e	1	LSR Abs	0002	aa	00	00	fd	NV-BdIzc	BIT zp	T1
3	0002	4e	1	LSR Abs	0002	aa	00	00	fd	NV-BdIzc	BIT zp	T1
4	0003	fb	1		0003	aa	00	00	fd	NV-BdIzc	LSR Abs	T2
4	0003	fb	1		0003	aa	00	00	fd	NV-BdIzc	LSR Abs	T2
5	0004	01	1		0004	aa	00	00	fd	NV-BdIzc	LSR Abs	T3
5	0004	01	1		0004	aa	00	00	fd	NV-BdIzc	LSR Abs	T3
6	01fb	3f	1		0005	aa	00	00	fd	NV-BdIzc	LSR Abs	T4
6	01fb	3f	1		0005	aa	00	00	fd	NV-BdIzc	LSR Abs	T4
7	01fb	3f	0		0005	aa	00	00	fd	NV-BdIzC	LSR Abs	T5
7	01fb	3f	0		0005	aa	00	00	fd	NV-BdIzC	LSR Abs	T5
8	01fb	3f	0		0005	aa	00	00	fd	nV-BdIzC	LSR Abs	T0
8	01fb	1f	0		0005	aa	00	00	fd	nV-BdIzC	LSR Abs	T0
9	0005	50	1	BVC	0005	aa	00	00	fd	nV-BdIzC	LSR Abs	T1
9	0005	50	1	BVC	0005	aa	00	00	fd	nV-BdIzC	LSR Abs	T1
10	0006	2e	1		0006	aa	00	00	fd	nV-BdIzC	BVC	T2
10	0006	2e	1		0006	aa	00	00	fd	nV-BdIzC	BVC	T2

SRE (4F)	Cycles: 6	Size: 3
Absolute (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Address.L.
2.1		Inc. <b>PC</b> .
2.2	Read PC	Store as Address.H.
3.1		Inc. <b>PC</b> .
3.2	Read Address	Store as Operand.
4.1		Set <b>C</b> if lowest bit of Operand is set.
4.2	Write Address	Write unmodified Operand.
5.1		* Perform Operand=Operand >> 1, <b>A=A ^ Operand</b> , set <b>N</b> and <b>Z</b> based off <b>A</b> .
5.2	Write Address	Write modified Operand.
6.1		
6.2	Read PC	Store as OpCode.
+X.1		<b>A</b> applied.

\* Setting of A is delayed by 2 cycles until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	4f	1	unknown	0002	ff	00	00	fd	Nv-BdIzc	LDA #	T1
2	0002	4f	1	unknown	0002	ff	00	00	fd	Nv-BdIzc	LDA #	T1
3	0003	20	1		0003	ff	00	00	fd	Nv-BdIzc	unknown	T2
3	0003	20	1		0003	ff	00	00	fd	Nv-BdIzc	unknown	T2
4	0004	01	1		0004	ff	00	00	fd	Nv-BdIzc	unknown	T3
4	0004	01	1		0004	ff	00	00	fd	Nv-BdIzc	unknown	T3
5	0120	ff	1		0005	ff	00	00	fd	Nv-BdIzc	unknown	T4
5	0120	ff	1		0005	ff	00	00	fd	Nv-BdIzc	unknown	T4
6	0120	ff	0		0005	ff	00	00	fd	Nv-BdIzC	unknown	T5
6	0120	ff	0		0005	ff	00	00	fd	Nv-BdIzC	unknown	T5
7	0120	ff	0		0005	ff	00	00	fd	nv-BdIzC	unknown	T0
7	0120	7f	0		0005	ff	00	00	fd	nv-BdIzC	unknown	T0
8	0005	20	1	JSR Abs	0005	ff	00	00	fd	nv-BdIzC	unknown	T1
8	0005	20	1	JSR Abs	0005	ff	00	00	fd	nv-BdIzC	unknown	T1
9	0006	02	1		0006	80	00	00	fd	Nv-BdIzC	JSR Abs	T2
9	0006	02	1		0006	80	00	00	fd	Nv-BdIzC	JSR Abs	T2

BVC (50) Cycles: 2-4		Size: 2
Branch Relative		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> . Check condition ( <b>V == 0</b> ).
1.2	Read PC	Store as Operand. Treat as signed 16-bit (Op16=i16(i8(Operand))).
2.1		Inc. <b>PC</b> . If not jumping, end (next half-cycle is 4.2)
2.2	Read PC	
3.1		If ( <b>PC+Op16</b> ).H != <b>PC.H</b> , end after <b>PC.L</b> fix (next half-cycle is 4.2). <b>PC.L=PC.L+Operand</b> .
3.2	Read PC	
4.1		<b>PC.H=previous “(PC+Op16).H” value.</b>
4.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
3	0002	50	1	BVC	0002	aa	00	00	fd	nV-BdIzc	BIT zp	T1
3	0002	50	1	BVC	0002	aa	00	00	fd	nV-BdIzc	BIT zp	T1
4	0003	20	1		0003	aa	00	00	fd	nV-BdIzc	BVC	T2
4	0003	20	1		0003	aa	00	00	fd	nV-BdIzc	BVC	T2
5	0004	01	1	ORA (zp,X)	0004	aa	00	00	fd	nV-BdIzc	BVC	
5	0004	01	1	ORA (zp,X)	0004	aa	00	00	fd	nV-BdIzc	BVC	
6	0005	50	1		0005	aa	00	00	fd	nV-BdIzc	ORA (zp,X)	T2
6	0005	50	1		0005	aa	00	00	fd	nV-BdIzc	ORA (zp,X)	T2

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	50	1	BVC	0002	ff	00	00	fd	Nv-BdIzc	LDA #	T1
2	0002	50	1	BVC	0002	ff	00	00	fd	Nv-BdIzc	LDA #	T1
3	0003	20	1		0003	ff	00	00	fd	Nv-BdIzc	BVC	T2
3	0003	20	1		0003	ff	00	00	fd	Nv-BdIzc	BVC	T2
4	0004	01	1		0004	ff	00	00	fd	Nv-BdIzc	BVC	T3
4	0004	01	1		0004	ff	00	00	fd	Nv-BdIzc	BVC	T3
5	0024	16	1	ASL zp,X	0024	ff	00	00	fd	Nv-BdIzc	BVC	
5	0024	16	1	ASL zp,X	0024	ff	00	00	fd	Nv-BdIzc	BVC	
6	0025	32	1		0025	ff	00	00	fd	Nv-BdIzc	ASL zp,X	T2
6	0025	32	1		0025	ff	00	00	fd	Nv-BdIzc	ASL zp,X	T2

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
6	01fb	50	1	BVC	01fb	aa	00	00	fd	nv-BdIzc	JMP Abs	T1
6	01fb	50	1	BVC	01fb	aa	00	00	fd	nv-BdIzc	JMP Abs	T1
7	01fc	7f	1		01fc	aa	00	00	fd	nv-BdIzc	BVC	T2
7	01fc	7f	1		01fc	aa	00	00	fd	nv-BdIzc	BVC	T2
8	01fd	00	1		01fd	aa	00	00	fd	nv-BdIzc	BVC	T3
8	01fd	00	1		01fd	aa	00	00	fd	nv-BdIzc	BVC	T3
9	017c	00	1		017c	aa	00	00	fd	nv-BdIzc	BVC	T0
9	017c	00	1		017c	aa	00	00	fd	nv-BdIzc	BVC	T0
10	027c	00	1	BRK	027c	aa	00	00	fd	nv-BdIzc	BVC	T1
10	027c	00	1	BRK	027c	aa	00	00	fd	nv-BdIzc	BVC	T1
11	027d	00	1		027d	aa	00	00	fd	nv-BdIzc	BRK	T2
11	027d	00	1		027d	aa	00	00	fd	nv-BdIzc	BRK	T2

EOR (51) Cycles: 5-6		Size: 2
Indirect, Y (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Pointer.
2.1		Inc. <b>PC</b> .
2.2	Read Pointer	Store to Address.L.
3.1		
3.2	Read (Pointer+1) & \$FF	Store to Address.H.
4.1		Final=Address+Y. Address.L = Final.L.
4.2	Read Address	Store as Operand. If Address.H == Final.H, skip the next cycle (next half-cycle is 6.1).
5.1		Address.H = Final.H (fixes high byte of address).
5.2	Read Address	Store as Operand.
6.1		* Perform <b>A=A ^ Operand</b> , set <b>N</b> and <b>Z</b> accordingly.
6.2	Read PC	Store as OpCode.
+X.1		<b>A</b> and <b>N, Z</b> applied.

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
3	0002	51	1	EOR (zp),Y	0002	aa	00	00	fd	NV-BdIzc	BIT zp	T1
3	0002	51	1	EOR (zp),Y	0002	aa	00	00	fd	NV-BdIzc	BIT zp	T1
4	0003	fb	1		0003	aa	00	00	fd	NV-BdIzc	EOR (zp),Y	T2
4	0003	fb	1		0003	aa	00	00	fd	NV-BdIzc	EOR (zp),Y	T2
5	00fb	80	1		0004	aa	00	00	fd	NV-BdIzc	EOR (zp),Y	T3
5	00fb	80	1		0004	aa	00	00	fd	NV-BdIzc	EOR (zp),Y	T3
6	00fc	00	1		0004	aa	00	00	fd	NV-BdIzc	EOR (zp),Y	T4
6	00fc	00	1		0004	aa	00	00	fd	NV-BdIzc	EOR (zp),Y	T4
7	0080	7f	1		0004	aa	00	00	fd	NV-BdIzc	EOR (zp),Y	T0
7	0080	7f	1		0004	aa	00	00	fd	NV-BdIzc	EOR (zp),Y	T0
8	0004	01	1	ORA (zp,X)	0004	aa	00	00	fd	NV-BdIzc	EOR (zp),Y	T1
8	0004	01	1	ORA (zp,X)	0004	aa	00	00	fd	NV-BdIzc	EOR (zp),Y	T1
9	0005	50	1		0005	d5	00	00	fd	NV-BdIzc	ORA (zp,X)	T2
9	0005	50	1		0005	d5	00	00	fd	NV-BdIzc	ORA (zp,X)	T2

JAM (52)	Cycles: $\infty$	Size: 1
Implied		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		
1.2	Read PC	
2.1		
2.2	Read \$FFFF	
3.1		
3.2	Read \$FFFE	
4.1		
4.2	Read \$FFFE	
5.1		Repeat 5.1 and 5.2 forever.
5.2	Read \$FFFF	

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	02	1	unknown	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
2	0002	02	1	unknown	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
3	0003	10	1		0003	00	00	00	fd	nv-BdIZc	unknown	T2
3	0003	10	1		0003	00	00	00	fd	nv-BdIZc	unknown	T2
4	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T3
4	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T3
5	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T4
5	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T4
6	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T5
6	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T5
7	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
7	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
8	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
8	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
9	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
9	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
10	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
10	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
11	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
11	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	

SRE (53) Cycles: 8		Size: 2
Indirect, Y (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1	Read PC	Store as Pointer.
2.1	Read Pointer	Inc. <b>PC</b> . Store to Address.L.
3.1	Read (Pointer+1) & \$FF	Store to Address.H.
4.1	Read Address	Final=Address+ <b>Y</b> . Address.L = Final.L. Store as Operand.
5.1	Read Address	Address.H = Final.H (fixes high byte of address). Store as Operand.
5.2	Read Address	Set <b>C</b> if lowest bit of Operand is set.
6.1	Write Address	Write unmodified Operand.
7.1	Write Address	* Perform Operand=Operand >> 1, <b>A=A ^ Operand</b> , set <b>N</b> and <b>Z</b> based off <b>A</b> .
7.2	Write Address	Write modified Operand.
8.1	Read PC	Store as OpCode.
+X.1		<b>A</b> applied.

\* Setting of A is delayed by 2 cycles until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
3	0002	53	1	unknown	0002	aa	00	00	fd	NV-BdIzc	BIT zp	T1
3	0002	53	1	unknown	0002	aa	00	00	fd	NV-BdIzc	BIT zp	T1
4	0003	fb	1		0003	aa	00	00	fd	NV-BdIzc	unknown	T2
4	0003	fb	1		0003	aa	00	00	fd	NV-BdIzc	unknown	T2
5	00fb	27	1		0004	aa	00	00	fd	NV-BdIzc	unknown	T3
5	00fb	27	1		0004	aa	00	00	fd	NV-BdIzc	unknown	T3
6	00fc	00	1		0004	aa	00	00	fd	NV-BdIzc	unknown	T4
6	00fc	00	1		0004	aa	00	00	fd	NV-BdIzc	unknown	T4
7	0027	00	1		0004	aa	00	00	fd	NV-BdIzc	unknown	T5
7	0027	00	1		0004	aa	00	00	fd	NV-BdIzc	unknown	T5
8	0027	00	1		0004	aa	00	00	fd	NV-BdIzc	unknown	
8	0027	00	1		0004	aa	00	00	fd	NV-BdIzc	unknown	
9	0027	00	0		0004	aa	00	00	fd	NV-BdIzc	unknown	
9	0027	00	0		0004	aa	00	00	fd	NV-BdIzc	unknown	
10	0027	00	0		0004	aa	00	00	fd	nV-BdIZc	unknown	T0
10	0027	00	0		0004	aa	00	00	fd	nV-BdIZc	unknown	T0
11	0004	01	1	ORA (zp,X)	0004	aa	00	00	fd	nV-BdIZc	unknown	T1
11	0004	01	1	ORA (zp,X)	0004	aa	00	00	fd	nV-BdIZc	unknown	T1
12	0005	50	1		0005	aa	00	00	fd	NV-BdIzc	ORA (zp,X)	T2
12	0005	50	1		0005	aa	00	00	fd	NV-BdIzc	ORA (zp,X)	T2

NOP (54) Cycles: 4		Size: 2
Zero Page, X (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		
1.2	Read PC	Store as Pointer. Inc. <b>PC</b> .
2.1		
2.2	Read Pointer	Store as Operand.
3.1		Set Address to (Pointer+X) & \$FF.
3.2	Read Address	Store as Operand.
4.1		
4.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
3	0002	54	1	unknown	0002	aa	00	00	fd	NV-BdIzc	BIT zp	T1
3	0002	54	1	unknown	0002	aa	00	00	fd	NV-BdIzc	BIT zp	T1
4	0003	fb	1		0003	aa	00	00	fd	NV-BdIzc	unknown	T2
4	0003	fb	1		0003	aa	00	00	fd	NV-BdIzc	unknown	T2
5	00fb	80	1		0004	aa	00	00	fd	NV-BdIzc	unknown	T3
5	00fb	80	1		0004	aa	00	00	fd	NV-BdIzc	unknown	T3
6	00fb	80	1		0004	aa	00	00	fd	NV-BdIzc	unknown	T0
6	00fb	80	1		0004	aa	00	00	fd	NV-BdIzc	unknown	T0
7	0004	01	1	ORA (zp,X)	0004	aa	00	00	fd	NV-BdIzc	unknown	T1
7	0004	01	1	ORA (zp,X)	0004	aa	00	00	fd	NV-BdIzc	unknown	T1
8	0005	50	1		0005	aa	00	00	fd	NV-BdIzc	ORA (zp,X)	T2
8	0005	50	1		0005	aa	00	00	fd	NV-BdIzc	ORA (zp,X)	T2

EOR (55) Cycles: 4		Size: 2
Zero Page, X (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		Store as Pointer.
1.2	Read PC	Inc. <b>PC</b> .
2.1		Store as Operand.
2.2	Read Pointer	Set Address to (Pointer+X) & \$FF.
3.1		Store as Operand.
3.2	Read Address	* Perform <b>A=A ^ Operand</b> , set <b>N</b> and <b>Z</b> accordingly.
4.1		Store as OpCode.
4.2	Read PC	<b>A</b> and <b>N, Z</b> applied.
+X.1		

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
3	0002	55	1	EOR zp,X	0002	aa	00	00	fd	NV-BdIzc	BIT zp	T1
3	0002	55	1	EOR zp,X	0002	aa	00	00	fd	NV-BdIzc	BIT zp	T1
4	0003	fb	1		0003	aa	00	00	fd	NV-BdIzc	EOR zp,X	T2
4	0003	fb	1		0003	aa	00	00	fd	NV-BdIzc	EOR zp,X	T2
5	00fb	80	1		0004	aa	00	00	fd	NV-BdIzc	EOR zp,X	T3
5	00fb	80	1		0004	aa	00	00	fd	NV-BdIzc	EOR zp,X	T3
6	00fb	80	1		0004	aa	00	00	fd	NV-BdIzc	EOR zp,X	T0
6	00fb	80	1		0004	aa	00	00	fd	NV-BdIzc	EOR zp,X	T0
7	0004	01	1	ORA (zp,X)	0004	aa	00	00	fd	NV-BdIzc	EOR zp,X	T1
7	0004	01	1	ORA (zp,X)	0004	aa	00	00	fd	NV-BdIzc	EOR zp,X	T1
8	0005	50	1		0005	2a	00	00	fd	nV-BdIzc	ORA (zp,X)	T2
8	0005	50	1		0005	2a	00	00	fd	nV-BdIzc	ORA (zp,X)	T2

LSR (56)	Cycles: 6	Size: 2
Zero Page, X (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		Store as Pointer.
1.2	Read PC	Inc. <b>PC</b> .
2.1		Store as Operand.
2.2	Read Pointer	Set Address to (Pointer+X) & \$FF.
3.1		Store as Operand.
3.2	Read Address	Set <b>C</b> if lowest bit of Operand is set.
4.1		Write unmodified Operand.
4.2	Write Address	Perform Operand=Operand << 1, set <b>N</b> and <b>Z</b> accordingly.
5.1		Write modified Operand.
5.2	Write Address	
6.1		
6.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
3	0002	56	1	LSR zp,X	0002	aa	00	00	fd	NV-BdIzc	BIT zp	T1
3	0002	56	1	LSR zp,X	0002	aa	00	00	fd	NV-BdIzc	BIT zp	T1
4	0003	fb	1		0003	aa	00	00	fd	NV-BdIzc	LSR zp,X	T2
4	0003	fb	1		0003	aa	00	00	fd	NV-BdIzc	LSR zp,X	T2
5	00fb	4f	1		0004	aa	00	00	fd	NV-BdIzc	LSR zp,X	T3
5	00fb	4f	1		0004	aa	00	00	fd	NV-BdIzc	LSR zp,X	T3
6	00fb	4f	1		0004	aa	00	00	fd	NV-BdIzc	LSR zp,X	T4
6	00fb	4f	1		0004	aa	00	00	fd	NV-BdIzc	LSR zp,X	T4
7	00fb	4f	0		0004	aa	00	00	fd	NV-BdIzC	LSR zp,X	T5
7	00fb	4f	0		0004	aa	00	00	fd	NV-BdIzC	LSR zp,X	T5
8	00fb	4f	0		0004	aa	00	00	fd	nV-BdIzC	LSR zp,X	T0
8	00fb	27	0		0004	aa	00	00	fd	nV-BdIzC	LSR zp,X	T0
9	0004	01	1	ORA (zp,X)	0004	aa	00	00	fd	nV-BdIzC	LSR zp,X	T1
9	0004	01	1	ORA (zp,X)	0004	aa	00	00	fd	nV-BdIzC	LSR zp,X	T1
10	0005	50	1		0005	aa	00	00	fd	nV-BdIzC ORA (zp,X)		T2
10	0005	50	1		0005	aa	00	00	fd	nV-BdIzC ORA (zp,X)		T2

SRE (57)	Cycles: 6	Size: 2
Zero Page, X (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Pointer.
2.1		Inc. <b>PC</b> .
2.2	Read Pointer	Store as Operand.
3.1		Set Address to (Pointer+ <b>X</b> ) & \$FF.
3.2	Read Address	Store as Operand.
4.1		Set <b>C</b> if lowest bit of Operand is set.
4.2	Write Address	Write unmodified Operand.
5.1		* Perform Operand=Operand >> 1, <b>A=A ^ Operand</b> , set <b>N</b> and <b>Z</b> based off <b>A</b> .
5.2	Write Address	Write modified Operand.
6.1		
6.2	Read PC	Store as OpCode.
+X.1		<b>A</b> applied.

\* Setting of A is delayed by 2 cycles until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	57	1	unknown	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
2	0002	57	1	unknown	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
3	0003	ff	1		0003	00	00	00	fd	nv-BdIZc	unknown	T2
3	0003	ff	1		0003	00	00	00	fd	nv-BdIZc	unknown	T2
4	00ff	7f	1		0004	00	00	00	fd	nv-BdIZc	unknown	T3
4	00ff	7f	1		0004	00	00	00	fd	nv-BdIZc	unknown	T3
5	00ff	7f	1		0004	00	00	00	fd	nv-BdIZc	unknown	T4
5	00ff	7f	1		0004	00	00	00	fd	nv-BdIZc	unknown	T4
6	00ff	7f	0		0004	00	00	00	fd	nv-BdIZC	unknown	T5
6	00ff	7f	0		0004	00	00	00	fd	nv-BdIZC	unknown	T5
7	00ff	7f	0		0004	00	00	00	fd	nv-BdIzC	unknown	T0
7	00ff	3f	0		0004	00	00	00	fd	nv-BdIzC	unknown	T0
8	0004	20	1	JSR Abs	0004	00	00	00	fd	nv-BdIzC	unknown	T1
8	0004	20	1	JSR Abs	0004	00	00	00	fd	nv-BdIzC	unknown	T1
9	0005	4c	1		0005	3f	00	00	fd	nv-BdIzC	JSR Abs	T2
9	0005	4c	1		0005	3f	00	00	fd	nv-BdIzC	JSR Abs	T2

CLI (58)	Cycles: 2	Size: 1
Implied		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	To be discarded.
2.1		Clear the <b>I</b> status bit.
2.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	58	1	CLI	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
2	0002	58	1	CLI	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
3	0003	21	1		0003	00	00	00	fd	nv-BdIZc	CLI	T0+T2
3	0003	21	1		0003	00	00	00	fd	nv-BdIZc	CLI	T0+T2
4	0003	21	1	AND (zp,X)	0003	00	00	00	fd	nv-BdiZc	CLI	T1
4	0003	21	1	AND (zp,X)	0003	00	00	00	fd	nv-BdiZc	CLI	T1
5	0004	20	1		0004	00	00	00	fd	nv-BdiZc	AND (zp,X)	T2
5	0004	20	1		0004	00	00	00	fd	nv-BdiZc	AND (zp,X)	T2

EOR (59) Cycles: 4-5		Size: 3
Absolute, Y (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Address.L.
2.1		Inc. <b>PC</b> .
2.2	Read PC	Store as Address.H.
3.1		Inc. <b>PC</b> . Final=Address+Y. Address.L = Final.L.
3.2	Read Address	Store as Operand. If Address.H == Final.H, skip the next cycle (next half-cycle is 5.1).
4.1		Address.H = Final.H (fixes high byte of address).
4.2	Read Address	Store as Operand.
5.1		* Perform <b>A=A ^ Operand</b> , set <b>N</b> and <b>Z</b> accordingly.
5.2	Read PC	Store as OpCode.
+X.1		<b>A</b> and <b>N, Z</b> applied.

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	59	1	EOR Abs,Y	0002	ff	00	00	fd	Nv-BdIzc	LDA #	T1
2	0002	59	1	EOR Abs,Y	0002	ff	00	00	fd	Nv-BdIzc	LDA #	T1
3	0003	21	1		0003	ff	00	00	fd	Nv-BdIzc	EOR Abs,Y	T2
3	0003	21	1		0003	ff	00	00	fd	Nv-BdIzc	EOR Abs,Y	T2
4	0004	01	1		0004	ff	00	00	fd	Nv-BdIzc	EOR Abs,Y	T3
4	0004	01	1		0004	ff	00	00	fd	Nv-BdIzc	EOR Abs,Y	T3
5	0121	7f	1		0005	ff	00	00	fd	Nv-BdIzc	EOR Abs,Y	T0
5	0121	7f	1		0005	ff	00	00	fd	Nv-BdIzc	EOR Abs,Y	T0
6	0005	4c	1	JMP Abs	0005	ff	00	00	fd	Nv-BdIzc	EOR Abs,Y	T1
6	0005	4c	1	JMP Abs	0005	ff	00	00	fd	Nv-BdIzc	EOR Abs,Y	T1
7	0006	02	1		0006	80	00	00	fd	Nv-BdIzc	JMP Abs	T2
7	0006	02	1		0006	80	00	00	fd	Nv-BdIzc	JMP Abs	T2

NOP (5A) Cycles: 2		Size: 1
Implied		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		
1.2	Read PC	To be discarded.
2.1		
2.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	5a	1	unknown	0002	ff	00	00	fd	Nv-BdIzc	LDA #	T1
2	0002	5a	1	unknown	0002	ff	00	00	fd	Nv-BdIzc	LDA #	T1
3	0003	21	1		0003	ff	00	00	fd	Nv-BdIzc	unknown	T0+T2
3	0003	21	1		0003	ff	00	00	fd	Nv-BdIzc	unknown	T0+T2
4	0003	21	1	AND (zp,X)	0003	ff	00	00	fd	Nv-BdIzc	unknown	T1
4	0003	21	1	AND (zp,X)	0003	ff	00	00	fd	Nv-BdIzc	unknown	T1
5	0004	01	1		0004	ff	00	00	fd	Nv-BdIzc	AND (zp,X)	T2
5	0004	01	1		0004	ff	00	00	fd	Nv-BdIzc	AND (zp,X)	T2

SRE (5B)	Cycles: 7	Size: 3
Absolute, Y (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Address.L.
2.1		Inc. <b>PC</b> .
2.2	Read PC	Store as Address.H.
3.1		Inc. <b>PC</b> . Final=Address+Y. Address.L = Final.L.
3.2	Read Address	Store as Operand.
4.1		Address.H = Final.H (fixes high byte of address).
4.2	Read Address	Store as Operand.
5.1		Set <b>C</b> if lowest bit of Operand is set.
5.2	Write Address	Write unmodified Operand.
6.1		* Perform Operand=Operand >> 1, <b>A=A ^ Operand</b> , set <b>N</b> and <b>Z</b> based off <b>A</b> .
6.2	Write Address	Write modified Operand.
7.1		
7.2	Read PC	Store as OpCode.
+X.1		<b>A</b> applied.

\* Setting of A is delayed by 2 cycles until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	5b	1	unknown	0002	ff	00	00	fd	Nv-BdIzC	LDA #	T1
2	0002	5b	1	unknown	0002	ff	00	00	fd	Nv-BdIzC	LDA #	T1
3	0003	21	1		0003	ff	00	00	fd	Nv-BdIzC	unknown	T2
3	0003	21	1		0003	ff	00	00	fd	Nv-BdIzC	unknown	T2
4	0004	01	1		0004	ff	00	00	fd	Nv-BdIzC	unknown	T3
4	0004	01	1		0004	ff	00	00	fd	Nv-BdIzC	unknown	T3
5	0121	ff	1		0005	ff	00	00	fd	Nv-BdIzC	unknown	T4
5	0121	ff	1		0005	ff	00	00	fd	Nv-BdIzC	unknown	T4
6	0121	ff	1		0005	ff	00	00	fd	Nv-BdIzC	unknown	T5
6	0121	ff	1		0005	ff	00	00	fd	Nv-BdIzC	unknown	T5
7	0121	ff	0		0005	ff	00	00	fd	Nv-BdIzC	unknown	
7	0121	ff	0		0005	ff	00	00	fd	Nv-BdIzC	unknown	
8	0121	ff	0		0005	ff	00	00	fd	nv-BdIzC	unknown	T0
8	0121	7f	0		0005	ff	00	00	fd	nv-BdIzC	unknown	T0
9	0005	4c	1	JMP Abs	0005	ff	00	00	fd	nv-BdIzC	unknown	T1
9	0005	4c	1	JMP Abs	0005	ff	00	00	fd	nv-BdIzC	unknown	T1
10	0006	02	1		0006	80	00	00	fd	Nv-BdIzC	JMP Abs	T2
10	0006	02	1		0006	80	00	00	fd	Nv-BdIzC	JMP Abs	T2

NOP (5C) Cycles: 4-5		Size: 3
Absolute, X (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		Store as Address.L.
1.2	Read PC	Inc. <b>PC</b> .
2.1		Store as Address.H.
2.2	Read PC	Inc. <b>PC</b> . Final=Address+X. Address.L = Final.L.
3.1		Store as Operand. If Address.H == Final.H, skip the next cycle (next half-cycle is 5.1).
3.2	Read Address	Address.H = Final.H (fixes high byte of address).
4.1		Store as Operand.
4.2	Read Address	
5.1		
5.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	5c	1	unknown	0002	aa	ff	00	fd	Nv-BdIzc	LDX #	T1
2	0002	5c	1	unknown	0002	aa	ff	00	fd	Nv-BdIzc	LDX #	T1
3	0003	21	1		0003	aa	ff	00	fd	Nv-BdIzc	unknown	T2
3	0003	21	1		0003	aa	ff	00	fd	Nv-BdIzc	unknown	T2
4	0004	01	1		0004	aa	ff	00	fd	Nv-BdIzc	unknown	T3
4	0004	01	1		0004	aa	ff	00	fd	Nv-BdIzc	unknown	T3
5	0120	00	1		0005	aa	ff	00	fd	Nv-BdIzc	unknown	T4
5	0120	00	1		0005	aa	ff	00	fd	Nv-BdIzc	unknown	T4
6	0220	00	1		0005	aa	ff	00	fd	Nv-BdIzc	unknown	T0
6	0220	00	1		0005	aa	ff	00	fd	Nv-BdIzc	unknown	T0
7	0005	4c	1	JMP Abs	0005	aa	ff	00	fd	Nv-BdIzc	unknown	T1
7	0005	4c	1	JMP Abs	0005	aa	ff	00	fd	Nv-BdIzc	unknown	T1
8	0006	02	1		0006	aa	ff	00	fd	Nv-BdIzc	JMP Abs	T2
8	0006	02	1		0006	aa	ff	00	fd	Nv-BdIzc	JMP Abs	T2

EOR (5D) Cycles: 4-5		Size: 3
Absolute, X (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		Store as Address.L.
1.2	Read PC	Inc. <b>PC</b> .
2.1		Store as Address.H.
2.2	Read PC	Inc. <b>PC</b> . Final=Address+X. Address.L = Final.L.
3.1		Store as Operand. If Address.H == Final.H, skip the next cycle (next half-cycle is 5.1).
3.2	Read Address	Address.H = Final.H (fixes high byte of address).
4.1		Store as Operand.
4.2	Read Address	* Perform <b>A=A ^ Operand</b> , set <b>N</b> and <b>Z</b> accordingly.
5.1		Store as OpCode.
5.2	Read PC	<b>A</b> and <b>N, Z</b> applied.
+X.1		

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	5d	1	EOR Abs,X	0002	aa ff 00	fd	Nv-BdIzc		LDX #	T1	
2	0002	5d	1	EOR Abs,X	0002	aa ff 00	fd	Nv-BdIzc		LDX #	T1	
3	0003	21	1		0003	aa ff 00	fd	Nv-BdIzc	EOR Abs,X		T2	
3	0003	21	1		0003	aa ff 00	fd	Nv-BdIzc	EOR Abs,X		T2	
4	0004	01	1		0004	aa ff 00	fd	Nv-BdIzc	EOR Abs,X		T3	
4	0004	01	1		0004	aa ff 00	fd	Nv-BdIzc	EOR Abs,X		T3	
5	0120	00	1		0005	aa ff 00	fd	Nv-BdIzc	EOR Abs,X		T4	
5	0120	00	1		0005	aa ff 00	fd	Nv-BdIzc	EOR Abs,X		T4	
6	0220	00	1		0005	aa ff 00	fd	Nv-BdIzc	EOR Abs,X		T0	
6	0220	00	1		0005	aa ff 00	fd	Nv-BdIzc	EOR Abs,X		T0	
7	0005	4c	1	JMP Abs	0005	aa ff 00	fd	Nv-BdIzc	EOR Abs,X		T1	
7	0005	4c	1	JMP Abs	0005	aa ff 00	fd	Nv-BdIzc	EOR Abs,X		T1	
8	0006	02	1		0006	aa ff 00	fd	Nv-BdIzc	JMP Abs		T2	
8	0006	02	1		0006	aa ff 00	fd	Nv-BdIzc	JMP Abs		T2	

LSR (5E)	Cycles: 7	Size: 3
Absolute, X (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Address.L.
2.1		Inc. <b>PC</b> .
2.2	Read PC	Store as Address.H.
3.1		Inc. <b>PC</b> . Final=Address+X. Address.L = Final.L.
3.2	Read Address	Store as Operand.
4.1		Address.H = Final.H (fixes high byte of address).
4.2	Read Address	Store as Operand.
5.1		Set <b>C</b> if lowest bit of Operand is set.
5.2	Write Address	Write unmodified Operand.
6.1		Perform Operand=Operand << 1, set <b>N</b> and <b>Z</b> accordingly.
6.2	Write Address	Write modified Operand.
7.1		
7.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	5e	1	LSR Abs,X	0002	aa	ff	00	fd	Nv-BdIzc	LDX #	T1
2	0002	5e	1	LSR Abs,X	0002	aa	ff	00	fd	Nv-BdIzc	LDX #	T1
3	0003	21	1		0003	aa	ff	00	fd	Nv-BdIzc	LSR Abs,X	T2
3	0003	21	1		0003	aa	ff	00	fd	Nv-BdIzc	LSR Abs,X	T2
4	0004	00	1		0004	aa	ff	00	fd	Nv-BdIzc	LSR Abs,X	T3
4	0004	00	1		0004	aa	ff	00	fd	Nv-BdIzc	LSR Abs,X	T3
5	0020	7f	1		0005	aa	ff	00	fd	Nv-BdIzc	LSR Abs,X	T4
5	0020	7f	1		0005	aa	ff	00	fd	Nv-BdIzc	LSR Abs,X	T4
6	0120	7f	1		0005	aa	ff	00	fd	Nv-BdIzc	LSR Abs,X	T5
6	0120	7f	1		0005	aa	ff	00	fd	Nv-BdIzc	LSR Abs,X	T5
7	0120	7f	0		0005	aa	ff	00	fd	Nv-BdIzC	LSR Abs,X	
7	0120	7f	0		0005	aa	ff	00	fd	Nv-BdIzC	LSR Abs,X	
8	0120	7f	0		0005	aa	ff	00	fd	nv-BdIzC	LSR Abs,X	T0
8	0120	3f	0		0005	aa	ff	00	fd	nv-BdIzC	LSR Abs,X	T0
9	0005	4c	1	JMP Abs	0005	aa	ff	00	fd	nv-BdIzC	LSR Abs,X	T1
9	0005	4c	1	JMP Abs	0005	aa	ff	00	fd	nv-BdIzC	LSR Abs,X	T1
10	0006	02	1		0006	aa	ff	00	fd	nv-BdIzC	JMP Abs	T2
10	0006	02	1		0006	aa	ff	00	fd	nv-BdIzC	JMP Abs	T2

SRE (5F)	Cycles: 7	Size: 3
Absolute, X (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Address.L.
2.1		Inc. <b>PC</b> .
2.2	Read PC	Store as Address.H.
3.1		Inc. <b>PC</b> . Final=Address+X. Address.L = Final.L.
3.2	Read Address	Store as Operand.
4.1		Address.H = Final.H (fixes high byte of address).
4.2	Read Address	Store as Operand.
5.1		Set <b>C</b> if lowest bit of Operand is set.
5.2	Write Address	Write unmodified Operand.
6.1		* Perform Operand=Operand >> 1, <b>A=A ^ Operand</b> , set <b>N</b> and <b>Z</b> based off <b>A</b> .
6.2	Write Address	Write modified Operand.
7.1		
7.2	Read PC	Store as OpCode.
+X.1		<b>A</b> applied.

\* Setting of A is delayed by 2 cycles until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	5f	1	unknown	0002	aa	ff	00	fd	Nv-BdIzC	LDX #	T1
2	0002	5f	1	unknown	0002	aa	ff	00	fd	Nv-BdIzC	LDX #	T1
3	0003	21	1		0003	aa	ff	00	fd	Nv-BdIzC	unknown	T2
3	0003	21	1		0003	aa	ff	00	fd	Nv-BdIzC	unknown	T2
4	0004	00	1		0004	aa	ff	00	fd	Nv-BdIzC	unknown	T3
4	0004	00	1		0004	aa	ff	00	fd	Nv-BdIzC	unknown	T3
5	0020	7f	1		0005	aa	ff	00	fd	Nv-BdIzC	unknown	T4
5	0020	7f	1		0005	aa	ff	00	fd	Nv-BdIzC	unknown	T4
6	0120	3f	1		0005	aa	ff	00	fd	Nv-BdIzC	unknown	T5
6	0120	3f	1		0005	aa	ff	00	fd	Nv-BdIzC	unknown	T5
7	0120	3f	0		0005	aa	ff	00	fd	Nv-BdIzC	unknown	
7	0120	3f	0		0005	aa	ff	00	fd	Nv-BdIzC	unknown	
8	0120	3f	0		0005	aa	ff	00	fd	nv-BdIzC	unknown	T0
8	0120	1f	0		0005	aa	ff	00	fd	nv-BdIzC	unknown	T0
9	0005	4c	1	JMP Abs	0005	aa	ff	00	fd	nv-BdIzC	unknown	T1
9	0005	4c	1	JMP Abs	0005	aa	ff	00	fd	nv-BdIzC	unknown	T1
10	0006	02	1		0006	b5	ff	00	fd	Nv-BdIzC	JMP Abs	T2
10	0006	02	1		0006	b5	ff	00	fd	Nv-BdIzC	JMP Abs	T2

RTS (60)		Cycles: 6	Size: 1	
Implied				
Cycle	R/W	Desc		
-X.2	Read PC	Store as OpCode.		
1.1		Inc. <b>PC</b> .		
1.2	Read PC	Inc. <b>PC</b> .		
2.1		Inc. <b>PC</b> .		
2.2	Read <b>S</b>   \$0100			
3.1				
3.2	Read ( <b>S+1</b> )   \$0100	Store as Address.L.		
4.1		Increase <b>S</b> by 2.		
4.2	Read <b>S</b>   \$0100	Store as Address.H.		
5.1		Copy Address to <b>PC</b> .		
5.2	Read PC			
6.1		Inc. PC.		
6.2	Read PC	Store as OpCode.		
+X.1				

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
8	0021	60	1	RTS	0021	aa	ff	00	fb	Nv-BdIzc	JSR Abs	T1
8	0021	60	1	RTS	0021	aa	ff	00	fb	Nv-BdIzc	JSR Abs	T1
9	0022	00	1		0022	aa	ff	00	fb	Nv-BdIzc	RTS	T2
9	0022	00	1		0022	aa	ff	00	fb	Nv-BdIzc	RTS	T2
10	01fb	60	1		0023	aa	ff	00	fb	Nv-BdIzc	RTS	T3
10	01fb	60	1		0023	aa	ff	00	fb	Nv-BdIzc	RTS	T3
11	01fc	04	1		0023	aa	ff	00	fb	Nv-BdIzc	RTS	T4
11	01fc	04	1		0023	aa	ff	00	fb	Nv-BdIzc	RTS	T4
12	01fd	00	1		0023	aa	ff	00	fd	Nv-BdIzc	RTS	T5
12	01fd	00	1		0023	aa	ff	00	fd	Nv-BdIzc	RTS	T5
13	0004	00	1		0004	aa	ff	00	fd	Nv-BdIzc	RTS	T0
13	0004	00	1		0004	aa	ff	00	fd	Nv-BdIzc	RTS	T0
14	0005	4c	1	JMP Abs	0005	aa	ff	00	fd	Nv-BdIzc	RTS	T1
14	0005	4c	1	JMP Abs	0005	aa	ff	00	fd	Nv-BdIzc	RTS	T1
15	0006	02	1		0006	aa	ff	00	fd	Nv-BdIzc	JMP Abs	T2
15	0006	02	1		0006	aa	ff	00	fd	Nv-BdIzc	JMP Abs	T2

ADC (61) Cycles: 6		Size: 2
Indirect, X (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		Store as Operand.
1.2	Read PC	Inc. <b>PC</b> .
2.1		
2.2	Read Operand	
3.1		Set Pointer to (Operand+X) & \$FF.
3.2	Read Pointer	Store to Address.L.
4.1		
4.2	Read (Pointer+1) & \$FF	Store to Address.H.
5.1		
5.2	Read Address	Store as Operand. * u16 Tmp = A + Operand + ( <b>C</b> flag). <b>V</b> =(~(u16(A) ^ u16(Operand)) & (u16(A) ^ Tmp) & \$0080) != 0. <b>A</b> =u8(Tmp). <b>C</b> =Tmp > \$FF. <b>Z</b> =A == \$00. <b>N</b> =(A & \$80) != 0.
6.1		
6.2	Read PC	Store as OpCode.
+X.1		<b>A</b> and <b>C</b> , <b>N</b> , <b>V</b> , <b>Z</b> applied.

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	61	1	ADC (zp,X)	0002	aa	ff	00	fd	Nv-BdIzc	LDX #	T1
2	0002	61	1	ADC (zp,X)	0002	aa	ff	00	fd	Nv-BdIzc	LDX #	T1
3	0003	21	1		0003	aa	ff	00	fd	Nv-BdIzc	ADC (zp,X)	T2
3	0003	21	1		0003	aa	ff	00	fd	Nv-BdIzc	ADC (zp,X)	T2
4	0021	01	1		0004	aa	ff	00	fd	Nv-BdIzc	ADC (zp,X)	T3
4	0021	01	1		0004	aa	ff	00	fd	Nv-BdIzc	ADC (zp,X)	T3
5	0020	23	1		0004	aa	ff	00	fd	Nv-BdIzc	ADC (zp,X)	T4
5	0020	23	1		0004	aa	ff	00	fd	Nv-BdIzc	ADC (zp,X)	T4
6	0021	01	1		0004	aa	ff	00	fd	Nv-BdIzc	ADC (zp,X)	T5
6	0021	01	1		0004	aa	ff	00	fd	Nv-BdIzc	ADC (zp,X)	T5
7	0123	6c	1		0004	aa	ff	00	fd	Nv-BdIzc	ADC (zp,X)	T0
7	0123	6c	1		0004	aa	ff	00	fd	Nv-BdIzc	ADC (zp,X)	T0
8	0004	20	1	JSR Abs	0004	aa	ff	00	fd	Nv-BdIzc	ADC (zp,X)	T1
8	0004	20	1	JSR Abs	0004	aa	ff	00	fd	Nv-BdIzc	ADC (zp,X)	T1
9	0005	4c	1		0005	16	ff	00	fd	nv-BdIzc	JSR Abs	T2
9	0005	4c	1		0005	16	ff	00	fd	nv-BdIzc	JSR Abs	T2

JAM (62)	Cycles: $\infty$	Size: 1
Implied		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		
1.2	Read PC	
2.1		
2.2	Read \$FFFF	
3.1		
3.2	Read \$FFFE	
4.1		
4.2	Read \$FFFE	
5.1		Repeat 5.1 and 5.2 forever.
5.2	Read \$FFFF	

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	02	1	unknown	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
2	0002	02	1	unknown	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
3	0003	10	1		0003	00	00	00	fd	nv-BdIZc	unknown	T2
3	0003	10	1		0003	00	00	00	fd	nv-BdIZc	unknown	T2
4	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T3
4	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T3
5	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T4
5	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T4
6	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T5
6	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T5
7	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
7	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
8	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
8	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
9	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
9	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
10	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
10	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
11	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
11	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	

RRA (63)		Cycles: 8	Size: 2
Indirect, X (Read/Modify/Write)			
Cycle	R/W	Desc	
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .	
1.1		Store as Operand. Inc. <b>PC</b> .	
1.2	Read PC		
2.1			
2.2	Read Operand		
3.1		Set Pointer to (Operand+X) & \$FF.	
3.2	Read Pointer	Store to Address.L.	
4.1			
4.2	Read (Pointer+1) & \$FF	Store to Address.H.	
5.1			
5.1	Read Address	Store as Operand.	
6.1			
6.2	Write Address	Write unmodified Operand. * Tmp = ( <b>C</b> << 7).	
7.1		Set <b>C</b> if low bit of <b>P</b> is set. Operand=(Operand >> 1)   Tmp.	
7.2	Write Address	<b>A</b> =( <b>A</b> ADC Operand), set <b>C</b> , <b>N</b> , <b>V</b> , and <b>Z</b> based off <b>A</b> . Write modified Operand.	
8.1			
8.2	Read PC	Store as OpCode.	
+X.1		<b>A</b> and <b>C</b> , <b>N</b> , <b>V</b> , <b>Z</b> applied.	

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	63	1	unknown	0002	f0	00	00	fd	Nv-BdIzc	LDA #	T1
2	0002	63	1	unknown	0002	f0	00	00	fd	Nv-BdIzc	LDA #	T1
3	0003	10	1		0003	f0	00	00	fd	Nv-BdIzc	unknown	T2
3	0003	10	1		0003	f0	00	00	fd	Nv-BdIzc	unknown	T2
4	0010	19	1		0004	f0	00	00	fd	Nv-BdIzc	unknown	T3
4	0010	19	1		0004	f0	00	00	fd	Nv-BdIzc	unknown	T3
5	0010	19	1		0004	f0	00	00	fd	Nv-BdIzc	unknown	T4
5	0010	19	1		0004	f0	00	00	fd	Nv-BdIzc	unknown	T4
6	0011	00	1		0004	f0	00	00	fd	Nv-BdIzc	unknown	T5
6	0011	00	1		0004	f0	00	00	fd	Nv-BdIzc	unknown	T5
7	0019	ff	1		0004	f0	00	00	fd	Nv-BdIzc	unknown	
7	0019	ff	1		0004	f0	00	00	fd	Nv-BdIzc	unknown	
8	0019	ff	0		0004	f0	00	00	fd	Nv-BdIzC	unknown	
8	0019	ff	0		0004	f0	00	00	fd	Nv-BdIzC	unknown	
9	0019	ff	0		0004	f0	00	00	fd	nv-BdIzC	unknown	T0
9	0019	7f	0		0004	f0	00	00	fd	nv-BdIzC	unknown	T0
10	0004	00	1	BRK	0004	f0	00	00	fd	nv-BdIzC	unknown	T1
10	0004	00	1	BRK	0004	f0	00	00	fd	nv-BdIzC	unknown	T1
11	0005	4c	1		0005	70	00	00	fd	nv-BdIzC	BRK	T2
11	0005	4c	1		0005	70	00	00	fd	nv-BdIzC	BRK	T2

NOP (64)		Cycles: 3	Size: 2
Zero Page (Read)			
Cycle	R/W	Desc	
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .	
1.1			
1.2	Read PC	Store as Address. Inc. <b>PC</b> .	
2.1			
2.2	Read Address	Store as Operand.	
3.1			
3.2	Read PC	Store as OpCode.	
+X.1			

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	64	1	unknown	0002	f0	00	00	fd	Nv-BdIzc	LDA #	T1
2	0002	64	1	unknown	0002	f0	00	00	fd	Nv-BdIzc	LDA #	T1
3	0003	10	1		0003	f0	00	00	fd	Nv-BdIzc	unknown	T2
3	0003	10	1		0003	f0	00	00	fd	Nv-BdIzc	unknown	T2
4	0010	19	1		0004	f0	00	00	fd	Nv-BdIzc	unknown	T0
4	0010	19	1		0004	f0	00	00	fd	Nv-BdIzc	unknown	T0
5	0004	a4	1	LDY zp	0004	f0	00	00	fd	Nv-BdIzc	unknown	T1
5	0004	a4	1	LDY zp	0004	f0	00	00	fd	Nv-BdIzc	unknown	T1
6	0005	4c	1		0005	f0	00	00	fd	Nv-BdIzc	LDY zp	T2
6	0005	4c	1		0005	f0	00	00	fd	Nv-BdIzc	LDY zp	T2

ADC (65) Cycles: 3		Size: 2
Zero Page (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		
1.2	Read PC	Store as Address.
2.1		Inc. <b>PC</b> .
2.2	Read Address	Store as Operand. * $u16\text{Tmp} = A + \text{Operand} + (\mathbf{C} \text{ flag})$ . $V = (\sim(u16(A) \wedge u16(\text{Operand})) \& (u16(A) \wedge \text{Tmp}) \& \$0080) != 0$ . $A = u8(\text{Tmp})$ . $C = \text{Tmp} > \$FF$ . $Z = A == \$00$ . $N = (A \& \$80) != 0$ .
3.1		Store as OpCode. <b>A</b> and <b>C, N, V, Z</b> applied.
3.2	Read PC	
+X.1		

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	65	1	ADC zp	0002	f0	00	00	fd	Nv-BdIzc	LDA #	T1
2	0002	65	1	ADC zp	0002	f0	00	00	fd	Nv-BdIzc	LDA #	T1
3	0003	10	1		0003	f0	00	00	fd	Nv-BdIzc	ADC zp	T2
3	0003	10	1		0003	f0	00	00	fd	Nv-BdIzc	ADC zp	T2
4	0010	19	1		0004	f0	00	00	fd	Nv-BdIzc	ADC zp	T0
4	0010	19	1		0004	f0	00	00	fd	Nv-BdIzc	ADC zp	T0
5	0004	a4	1	LDY zp	0004	f0	00	00	fd	Nv-BdIzc	ADC zp	T1
5	0004	a4	1	LDY zp	0004	f0	00	00	fd	Nv-BdIzc	ADC zp	T1
6	0005	4c	1		0005	09	00	00	fd	nv-BdIzc	LDY zp	T2
6	0005	4c	1		0005	09	00	00	fd	nv-BdIzc	LDY zp	T2

ROR (66) Cycles: 5		Size: 2
Zero Page (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Address.
2.1		Inc. <b>PC</b> .
2.2	Read Address	Store as Operand.
3.1		
3.2	Write Address	Write unmodified Operand.
4.1		Tmp = ( <b>C</b> << 7). Set <b>C</b> if low bit of Operand is set. Operand=(Operand >> 1)   Tmp. Set <b>N</b> , and <b>Z</b> based off Operand.
4.2	Write Address	Write modified Operand.
5.1		
5.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
4	0002	66	1	ROR zp	0002 aa	00 00	fd	nv-BdIZC	SEC		T1	
4	0002	66	1	ROR zp	0002 aa	00 00	fd	nv-BdIZC	SEC		T1	
5	0003	10	1		0003 aa	00 00	fd	nv-BdIZC	ROR zp		T2	
5	0003	10	1		0003 aa	00 00	fd	nv-BdIZC	ROR zp		T2	
6	0010	7f	1		0004 aa	00 00	fd	nv-BdIZC	ROR zp		T3	
6	0010	7f	1		0004 aa	00 00	fd	nv-BdIZC	ROR zp		T3	
7	0010	7f	0		0004 aa	00 00	fd	nv-BdIZC	ROR zp		T4	
7	0010	7f	0		0004 aa	00 00	fd	nv-BdIZC	ROR zp		T4	
8	0010	7f	0		0004 aa	00 00	fd	Nv-BdIzC	ROR zp		T0	
8	0010	bf	0		0004 aa	00 00	fd	Nv-BdIzC	ROR zp		T0	
9	0004	a4	1	LDY zp	0004 aa	00 00	fd	Nv-BdIzC	ROR zp		T1	
9	0004	a4	1	LDY zp	0004 aa	00 00	fd	Nv-BdIzC	ROR zp		T1	
10	0005	4c	1		0005 aa	00 00	fd	Nv-BdIzC	LDY zp		T2	
10	0005	4c	1		0005 aa	00 00	fd	Nv-BdIzC	LDY zp		T2	

RRA (67) Cycles: 5		Size: 2
Zero Page (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		Store as Address.
1.2	Read PC	Inc. <b>PC</b> .
2.1		Store as Operand.
2.2	Read Address	
3.1		Write unmodified Operand. * Tmp = ( <b>C</b> << 7).
3.2	Write Address	Set <b>C</b> if low bit of <b>P</b> is set. Operand=(Operand >> 1)   Tmp.
4.1		<b>A</b> =( <b>A</b> ADC Operand), set <b>C, N, V</b> , and <b>Z</b> based off <b>A</b> .
4.2	Write Address	Write modified Operand.
5.1		
5.2	Read PC	Store as OpCode.
+X.1		<b>A</b> and <b>C, N, V, Z</b> applied.

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	67	1	unknown	0002	38	00	00	fd	nv-BdIzc	LDA #	T1
2	0002	67	1	unknown	0002	38	00	00	fd	nv-BdIzc	LDA #	T1
3	0003	10	1		0003	38	00	00	fd	nv-BdIzc	unknown	T2
3	0003	10	1		0003	38	00	00	fd	nv-BdIzc	unknown	T2
4	0010	2f	1		0004	38	00	00	fd	nv-BdIzc	unknown	T3
4	0010	2f	1		0004	38	00	00	fd	nv-BdIzc	unknown	T3
5	0010	2f	0		0004	38	00	00	fd	nv-BdIzC	unknown	T4
5	0010	2f	0		0004	38	00	00	fd	nv-BdIzC	unknown	T4
6	0010	2f	0		0004	38	00	00	fd	nv-BdIzC	unknown	T0
6	0010	17	0		0004	38	00	00	fd	nv-BdIzC	unknown	T0
7	0004	a4	1	LDY zp	0004	38	00	00	fd	nv-BdIzC	unknown	T1
7	0004	a4	1	LDY zp	0004	38	00	00	fd	nv-BdIzC	unknown	T1
8	0005	4c	1		0005	50	00	00	fd	nv-BdIzc	LDY zp	T2
8	0005	4c	1		0005	50	00	00	fd	nv-BdIzc	LDY zp	T2

PLA (68)		Cycles: 4	Size: 1	
Implied				
Cycle	R/W	Desc		
-X.2	Read PC	Store as OpCode.		
1.1		Inc. <b>PC</b> .		
1.2	Read PC	To be discarded.		
2.1				
2.2	Read <b>S</b>   \$0100			
3.1		Inc. <b>S</b> .		
3.2	Read <b>S</b>   \$0100	Store as Operand.		
4.1		<b>A</b> =Operand, set <b>N</b> and <b>Z</b> based off <b>A</b> .		
4.2	Read PC	Store as OpCode.		
+X.1				

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	68	1	PLA	0002	80	00	00	fd	Nv-BdIzc	LDA #	T1
2	0002	68	1	PLA	0002	80	00	00	fd	Nv-BdIzc	LDA #	T1
3	0003	10	1		0003	80	00	00	fd	Nv-BdIzc	PLA	T2
3	0003	10	1		0003	80	00	00	fd	Nv-BdIzc	PLA	T2
4	01fd	00	1		0003	80	00	00	fd	Nv-BdIzc	PLA	T3
4	01fd	00	1		0003	80	00	00	fd	Nv-BdIzc	PLA	T3
5	01fe	00	1		0003	80	00	00	fe	Nv-BdIzc	PLA	T0
5	01fe	00	1		0003	80	00	00	fe	Nv-BdIzc	PLA	T0
6	0003	10	1	BPL	0003	00	00	00	fe	nv-BdIZc	PLA	T1
6	0003	10	1	BPL	0003	00	00	00	fe	nv-BdIZc	PLA	T1
7	0004	00	1		0004	00	00	00	fe	nv-BdIZc	BPL	T2
7	0004	00	1		0004	00	00	00	fe	nv-BdIZc	BPL	T2

ADC (69) Cycles: 2		Size: 2
Immediate (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Operand.
2.1		* u16 Tmp = <b>A</b> + Operand + ( <b>C</b> flag). <b>V</b> =(~(u16(A) ^ u16(Operand)) & (u16(A) ^ Tmp) & \$0080) != 0. <b>A</b> =u8(Tmp). <b>C</b> =Tmp > \$FF. <b>Z</b> = <b>A</b> == \$00. <b>N</b> =( <b>A</b> & \$80) != 0.
2.2	Read PC	Store as OpCode.
+X.1		<b>A</b> and <b>C, N, V, Z</b> applied.

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	69	1	ADC #	0002	f0	00	00	fd	Nv-BdIzc	LDA #	T1
2	0002	69	1	ADC #	0002	f0	00	00	fd	Nv-BdIzc	LDA #	T1
3	0003	10	1		0003	f0	00	00	fd	Nv-BdIzc	ADC #	T0+T2
3	0003	10	1		0003	f0	00	00	fd	Nv-BdIzc	ADC #	T0+T2
4	0004	a4	1	LDY zp	0004	f0	00	00	fd	Nv-BdIzc	ADC #	T1
4	0004	a4	1	LDY zp	0004	f0	00	00	fd	Nv-BdIzc	ADC #	T1
5	0005	4c	1		0005	00	00	00	fd	nv-BdIZC	LDY zp	T2
5	0005	4c	1		0005	00	00	00	fd	nv-BdIZC	LDY zp	T2

ROR (6A)		Cycles: 2	Size: 1
Implied			
Cycle	R/W	Desc	
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .	
1.1		To be discarded.	
1.2	Read PC	* Tmp = ( <b>C</b> << 7). Set <b>C</b> if low bit of <b>A</b> is set. <b>A</b> =( <b>A</b> >> 1)   Tmp.	
2.1		Set <b>N</b> , and <b>Z</b> based off <b>A</b> .	
2.2	Read PC	Store as OpCode. <b>A</b> and <b>C</b> , <b>N</b> , <b>Z</b> applied.	
+X.1			

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
4	0003	6a	1	ROR	0003	08 00 00	fd	nv-BdIzc		SEC	T1	
4	0003	6a	1	ROR	0003	08 00 00	fd	nv-BdIzc		SEC	T1	
5	0004	a4	1		0004	08 00 00	fd	nv-BdIzc	ROR	T0+T2		
5	0004	a4	1		0004	08 00 00	fd	nv-BdIzc	ROR	T0+T2		
6	0004	a4	1	LDY zp	0004	08 00 00	fd	nv-BdIzc	ROR	T1		
6	0004	a4	1	LDY zp	0004	08 00 00	fd	nv-BdIzc	ROR	T1		
7	0005	4c	1		0005	84 00 00	fd	Nv-BdIzc	LDY zp	T2		
7	0005	4c	1		0005	84 00 00	fd	Nv-BdIzc	LDY zp	T2		

ARR (6B) Cycles: 2		Size: 2
Immediate (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		Store as Operand.
1.2	Read PC	Inc. <b>PC</b> . * Perform <b>A=A &amp; Operand</b> . Tmp = ( <b>C</b> << 7). Set <b>C</b> if highest bit of <b>A</b> is set. <b>A</b> = ( <b>A</b> >> 1)   Tmp. Set <b>Z</b> and <b>N</b> based off <b>A</b> . Set <b>V</b> as ( <b>C</b> ^ (( <b>A</b> >> 5) & 1)) != 0.
2.1		
2.2	Read PC	Store as OpCode.
+X.1		<b>A</b> and <b>C, N, V, Z</b> applied.

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
4	0003	6b	1	unknown	0003	02	00	00	fd	nv-BdIzC	SEC	T1
4	0003	6b	1	unknown	0003	02	00	00	fd	nv-BdIzC	SEC	T1
5	0004	01	1		0004	02	00	00	fd	nv-BdIzC	unknown	T0+T2
5	0004	01	1		0004	02	00	00	fd	nv-BdIzC	unknown	T0+T2
6	0005	4c	1	JMP Abs	0005	02	00	00	fd	nv-BdIzc	unknown	T1
6	0005	4c	1	JMP Abs	0005	02	00	00	fd	nv-BdIzc	unknown	T1
7	0006	02	1		0006	81	00	00	fd	Nv-BdIzc	JMP Abs	T2
7	0006	02	1		0006	81	00	00	fd	Nv-BdIzc	JMP Abs	T2

JMP (6C)		Cycles: 5	Size: 3
Indirect			
Cycle	R/W	Desc	
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .	
1.1		Store as Pointer.L.	
1.2	Read PC	Inc. <b>PC</b> .	
2.1		Store as Pointer.H.	
2.2	Read PC	Inc. <b>PC</b> .	
3.1		Store as Address.L.	
3.2	Read Pointer	Inc. <b>PC</b> .	
4.1		Store as Address.H.	
4.2	* Read (Pointer.H<<8) u8(Pointer.L+1)	<b>PC</b> =Address.	
5.1		Store as Address.H.	
5.2	Read PC	Store as OpCode.	
+X.1			

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	6c	1	JMP (Abs)	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
2	0002	6c	1	JMP (Abs)	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
3	0003	10	1		0003	00	00	00	fd	nv-BdIZc	JMP (Abs)	T2
3	0003	10	1		0003	00	00	00	fd	nv-BdIZc	JMP (Abs)	T2
4	0004	00	1		0004	00	00	00	fd	nv-BdIZc	JMP (Abs)	T3
4	0004	00	1		0004	00	00	00	fd	nv-BdIZc	JMP (Abs)	T3
5	0010	e8	1		0005	00	00	00	fd	nv-BdIZc	JMP (Abs)	T4
5	0010	e8	1		0005	00	00	00	fd	nv-BdIZc	JMP (Abs)	T4
6	0011	01	1		0005	00	00	00	fd	nv-BdIZc	JMP (Abs)	T0
6	0011	01	1		0005	00	00	00	fd	nv-BdIZc	JMP (Abs)	T0
7	01e8	79	1	ADC Abs,Y	01e8	00	00	00	fd	nv-BdIZc	JMP (Abs)	T1
7	01e8	79	1	ADC Abs,Y	01e8	00	00	00	fd	nv-BdIZc	JMP (Abs)	T1
8	01e9	00	1		01e9	00	00	00	fd	nv-BdIZc	ADC Abs,Y	T2
8	01e9	00	1		01e9	00	00	00	fd	nv-BdIZc	ADC Abs,Y	T2

\* Read operation does not cross into a new page if (Pointer+1) causes overflow, hence the high byte of Pointer is retained while “+ 1” is applied only to the low byte.

ADC (6D) Cycles: 4		Size: 3
Absolute (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Address.L.
2.1		Inc. <b>PC</b> .
2.2	Read PC	Store as Address.H.
3.1		Inc. <b>PC</b> .
3.2	Read Address	Store as Operand. * $u16 \text{Tmp} = A + \text{Operand} + (\mathbf{C} \text{ flag})$ . $V=(\sim(u16(A) \wedge u16(\text{Operand})) \& (u16(A) \wedge \text{Tmp}) \& \$0080) != 0$ . $A=u8(\text{Tmp})$ . $C=\text{Tmp} > \$FF$ . $Z=A == \$00$ . $N=(A \& \$80) != 0$ .
4.1		Store as OpCode.
4.2	Read PC	<b>A</b> and <b>C, N, V, Z</b> applied.
+X.1		

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	6d	1	ADC Abs	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
2	0002	6d	1	ADC Abs	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
3	0003	10	1		0003	00	00	00	fd	nv-BdIZc	ADC Abs	T2
3	0003	10	1		0003	00	00	00	fd	nv-BdIZc	ADC Abs	T2
4	0004	01	1		0004	00	00	00	fd	nv-BdIZc	ADC Abs	T3
4	0004	01	1		0004	00	00	00	fd	nv-BdIZc	ADC Abs	T3
5	0110	e8	1		0005	00	00	00	fd	nv-BdIZc	ADC Abs	T0
5	0110	e8	1		0005	00	00	00	fd	nv-BdIZc	ADC Abs	T0
6	0005	4c	1	JMP Abs	0005	00	00	00	fd	nv-BdIZc	ADC Abs	T1
6	0005	4c	1	JMP Abs	0005	00	00	00	fd	nv-BdIZc	ADC Abs	T1
7	0006	02	1		0006	e8	00	00	fd	Nv-BdIZc	JMP Abs	T2
7	0006	02	1		0006	e8	00	00	fd	Nv-BdIZc	JMP Abs	T2

ROR (6E) Cycles: 6		Size: 3
Absolute (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		Store as Address.L.
1.2	Read PC	Inc. <b>PC</b> .
2.1		Store as Address.H.
2.2	Read PC	Inc. <b>PC</b> .
3.1		Store as Operand.
3.2	Read Address	Write unmodified Operand.
4.1		Tmp = ( <b>C</b> << 7).
4.2	Write Address	Set <b>C</b> if low bit of Operand is set. Operand=(Operand >> 1)   Tmp.
5.1		Set <b>N</b> , and <b>Z</b> based off Operand.
5.2	Write Address	Write modified Operand.
6.1		
6.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	6e	1	ROR Abs	0002 ff 00 00 fd	Nv-BdIzc	LDA	#	T1			
2	0002	6e	1	ROR Abs	0002 ff 00 00 fd	Nv-BdIzc	LDA	#	T1			
3	0003	10	1		0003 ff 00 00 fd	Nv-BdIzc	ROR Abs		T2			
3	0003	10	1		0003 ff 00 00 fd	Nv-BdIzc	ROR Abs		T2			
4	0004	00	1		0004 ff 00 00 fd	Nv-BdIzc	ROR Abs		T3			
4	0004	00	1		0004 ff 00 00 fd	Nv-BdIzc	ROR Abs		T3			
5	0010	80	1		0005 ff 00 00 fd	Nv-BdIzc	ROR Abs		T4			
5	0010	80	1		0005 ff 00 00 fd	Nv-BdIzc	ROR Abs		T4			
6	0010	80	0		0005 ff 00 00 fd	Nv-BdIzc	ROR Abs		T5			
6	0010	80	0		0005 ff 00 00 fd	Nv-BdIzc	ROR Abs		T5			
7	0010	80	0		0005 ff 00 00 fd	nv-BdIzc	ROR Abs		T0			
7	0010	40	0		0005 ff 00 00 fd	nv-BdIzc	ROR Abs		T0			
8	0005	4c	1	JMP Abs	0005 ff 00 00 fd	nv-BdIzc	ROR Abs		T1			
8	0005	4c	1	JMP Abs	0005 ff 00 00 fd	nv-BdIzc	ROR Abs		T1			
9	0006	02	1		0006 ff 00 00 fd	nv-BdIzc	JMP Abs		T2			
9	0006	02	1		0006 ff 00 00 fd	nv-BdIzc	JMP Abs		T2			

RRA (6F)	Cycles: 6	Size: 3
Absolute (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Address.L.
2.1		Inc. <b>PC</b> .
2.2	Read PC	Store as Address.H.
3.1		Inc. <b>PC</b> .
3.2	Read Address	Store as Operand.
4.1		
4.2	Write Address	Write unmodified Operand. * Tmp = ( <b>C</b> << 7).
5.1		Set <b>C</b> if low bit of <b>P</b> is set. Operand=(Operand >> 1)   Tmp. <b>A</b> =( <b>A</b> ADC Operand), set <b>C</b> , <b>N</b> , <b>V</b> , and <b>Z</b> based off <b>A</b> .
5.2	Write Address	Write modified Operand.
6.1		
6.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	6f	1	unknown	0002 ff 00 00 fd	Nv-BdIzc	LDA	#		T1		
2	0002	6f	1	unknown	0002 ff 00 00 fd	Nv-BdIzc	LDA	#		T1		
3	0003	10	1		0003 ff 00 00 fd	Nv-BdIzc	unknown			T2		
3	0003	10	1		0003 ff 00 00 fd	Nv-BdIzc	unknown			T2		
4	0004	00	1		0004 ff 00 00 fd	Nv-BdIzc	unknown			T3		
4	0004	00	1		0004 ff 00 00 fd	Nv-BdIzc	unknown			T3		
5	0010	40	1		0005 ff 00 00 fd	Nv-BdIzc	unknown			T4		
5	0010	40	1		0005 ff 00 00 fd	Nv-BdIzc	unknown			T4		
6	0010	40	0		0005 ff 00 00 fd	Nv-BdIzc	unknown			T5		
6	0010	40	0		0005 ff 00 00 fd	Nv-BdIzc	unknown			T5		
7	0010	40	0		0005 ff 00 00 fd	nv-BdIzc	unknown			T0		
7	0010	20	0		0005 ff 00 00 fd	nv-BdIzc	unknown			T0		
8	0005	4c	1	JMP Abs	0005 ff 00 00 fd	nv-BdIzc	unknown			T1		
8	0005	4c	1	JMP Abs	0005 ff 00 00 fd	nv-BdIzc	unknown			T1		
9	0006	02	1		0006 1f 00 00 fd	nv-BdIzc	JMP	Abs		T2		
9	0006	02	1		0006 1f 00 00 fd	nv-BdIzc	JMP	Abs		T2		

BVS (70)	Cycles: 2-4	Size: 2
Branch Relative		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> . Check condition ( <b>V == 1</b> ).
1.2	Read PC	Store as Operand. Treat as signed 16-bit (Op16=i16(i8(Operand))).
2.1		Inc. <b>PC</b> . If not jumping, end (next half-cycle is 4.2)
2.2	Read PC	
3.1		If ( <b>PC+Op16</b> ).H != <b>PC.H</b> , end after <b>PC.L</b> fix (next half-cycle is 4.2). <b>PC.L=PC.L+Operand</b> .
3.2	Read PC	
4.1		<b>PC.H=previous “(PC+Op16).H” value.</b>
4.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
6	01fb	70	1	BVS	01fb	aa	00	00	fd	nv-BdIZc	JMP Abs	T1
6	01fb	70	1	BVS	01fb	aa	00	00	fd	nv-BdIZc	JMP Abs	T1
7	01fc	7f	1		01fc	aa	00	00	fd	nv-BdIZc	BVS	T2
7	01fc	7f	1		01fc	aa	00	00	fd	nv-BdIZc	BVS	T2
8	01fd	00	1	BRK	01fd	aa	00	00	fd	nv-BdIZc	BVS	
8	01fd	00	1	BRK	01fd	aa	00	00	fd	nv-BdIZc	BVS	
9	01fe	00	1		01fe	aa	00	00	fd	nv-BdIZc	BRK	T2
9	01fe	00	1		01fe	aa	00	00	fd	nv-BdIZc	BRK	T2

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
6	01fb	70	1	BVS	01fb	aa	00	00	fd	NV-BdIZc	JMP Abs	T1
6	01fb	70	1	BVS	01fb	aa	00	00	fd	NV-BdIZc	JMP Abs	T1
7	01fc	02	1		01fc	aa	00	00	fd	NV-BdIZc	BVS	T2
7	01fc	02	1		01fc	aa	00	00	fd	NV-BdIZc	BVS	T2
8	01fd	00	1		01fd	aa	00	00	fd	NV-BdIZc	BVS	T3
8	01fd	00	1		01fd	aa	00	00	fd	NV-BdIZc	BVS	T3
9	01ff	4a	1	LSR	01ff	aa	00	00	fd	NV-BdIZc	BVS	
9	01ff	4a	1	LSR	01ff	aa	00	00	fd	NV-BdIZc	BVS	
10	0200	00	1		0200	aa	00	00	fd	NV-BdIZc	LSR	T0+T2
10	0200	00	1		0200	aa	00	00	fd	NV-BdIZc	LSR	T0+T2

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
6	01fb	70	1	BVS	01fb	aa	00	00	fd	NV-BdIZc	JMP Abs	T1
6	01fb	70	1	BVS	01fb	aa	00	00	fd	NV-BdIZc	JMP Abs	T1
7	01fc	7f	1		01fc	aa	00	00	fd	NV-BdIZc	BVS	T2
7	01fc	7f	1		01fc	aa	00	00	fd	NV-BdIZc	BVS	T2
8	01fd	00	1		01fd	aa	00	00	fd	NV-BdIZc	BVS	T3
8	01fd	00	1		01fd	aa	00	00	fd	NV-BdIZc	BVS	T3
9	017c	00	1		017c	aa	00	00	fd	NV-BdIZc	BVS	T0
9	017c	00	1		017c	aa	00	00	fd	NV-BdIZc	BVS	T0
10	027c	00	1	BRK	027c	aa	00	00	fd	NV-BdIZc	BVS	T1
10	027c	00	1	BRK	027c	aa	00	00	fd	NV-BdIZc	BVS	T1
11	027d	00	1		027d	aa	00	00	fd	NV-BdIZc	BRK	T2
11	027d	00	1		027d	aa	00	00	fd	NV-BdIZc	BRK	T2

ADC (71) Cycles: 5-6		Size: 2
Indirect, Y (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Pointer.
2.1		Inc. <b>PC</b> .
2.2	Read Pointer	Store to Address.L.
3.1		
3.2	Read (Pointer+1) & \$FF	Store to Address.H.
4.1		Final=Address+Y. Address.L = Final.L.
4.2	Read Address	Store as Operand. If Address.H == Final.H, skip the next cycle (next half-cycle is 6.1).
5.1		Address.H = Final.H (fixes high byte of address).
5.2	Read Address	Store as Operand.
6.1		* u16 Tmp = A + Operand + ( <b>C</b> flag). <b>V</b> = $(\sim(u16(A) \wedge u16(Operand)) \& (u16(A) \wedge Tmp) \& \$0080) \neq 0$ . <b>A</b> = $u8(Tmp)$ . <b>C</b> = $Tmp > \$FF$ . <b>Z</b> = $A == \$00$ . <b>N</b> = $(A \& \$80) \neq 0$ .
6.2	Read PC	Store as OpCode.
+X.1		<b>A</b> and <b>C, N, V, Z</b> applied.

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	71	1	ADC (zp),Y	0002 ff 00 00 fd Nv-BdIzc	LDA #					T1	
2	0002	71	1	ADC (zp),Y	0002 ff 00 00 fd Nv-BdIzc	LDA #					T1	
3	0003	10	1		0003 ff 00 00 fd Nv-BdIzc	ADC (zp),Y					T2	
3	0003	10	1		0003 ff 00 00 fd Nv-BdIzc	ADC (zp),Y					T2	
4	0010	74	1		0004 ff 00 00 fd Nv-BdIzc	ADC (zp),Y					T3	
4	0010	74	1		0004 ff 00 00 fd Nv-BdIzc	ADC (zp),Y					T3	
5	0011	01	1		0004 ff 00 00 fd Nv-BdIzc	ADC (zp),Y					T4	
5	0011	01	1		0004 ff 00 00 fd Nv-BdIzc	ADC (zp),Y					T4	
6	0174	ff	1		0004 ff 00 00 fd Nv-BdIzc	ADC (zp),Y					T0	
6	0174	ff	1		0004 ff 00 00 fd Nv-BdIzc	ADC (zp),Y					T0	
7	0004	00	1	BRK	0004 ff 00 00 fd Nv-BdIzc	ADC (zp),Y					T1	
7	0004	00	1	BRK	0004 ff 00 00 fd Nv-BdIzc	ADC (zp),Y					T1	
8	0005	4c	1		0005 fe 00 00 fd Nv-BdIzc	BRK					T2	
8	0005	4c	1		0005 fe 00 00 fd Nv-BdIzc	BRK					T2	

JAM (72)	Cycles: $\infty$	Size: 1
Implied		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		
1.2	Read PC	
2.1		
2.2	Read \$FFFF	
3.1		
3.2	Read \$FFFE	
4.1		
4.2	Read \$FFFE	
5.1		Repeat 5.1 and 5.2 forever.
5.2	Read \$FFFF	

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	02	1	unknown	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
2	0002	02	1	unknown	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
3	0003	10	1		0003	00	00	00	fd	nv-BdIZc	unknown	T2
3	0003	10	1		0003	00	00	00	fd	nv-BdIZc	unknown	T2
4	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T3
4	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T3
5	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T4
5	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T4
6	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T5
6	fffe	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T5
7	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
7	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
8	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
8	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
9	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
9	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
10	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
10	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
11	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	
11	ffff	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	

RRA (73)	Cycles: 8	Size: 2
Indirect, Y (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Pointer.
2.1		Inc. <b>PC</b> .
2.2	Read Pointer	Store to Address.L.
3.1		
3.2	Read (Pointer+1) & \$FF	Store to Address.H.
4.1		Final=Address+ <b>Y</b> . Address.L = Final.L.
4.2	Read Address	Store as Operand.
5.1		Address.H = Final.H (fixes high byte of address).
5.2	Read Address	Store as Operand.
6.1		Set <b>C</b> if lowest bit of Operand is set.
6.2	Write Address	Write unmodified Operand.
7.1		* Tmp = ( <b>C</b> << 7). Set <b>C</b> if low bit of <b>P</b> is set. Operand=(Operand >> 1)   Tmp.
		<b>A</b> =( <b>A</b> ADC Operand), set <b>C</b> , <b>N</b> , <b>V</b> , and <b>Z</b> based off <b>A</b> .
7.2	Write Address	Write modified Operand.
8.1		
8.2	Read PC	Store as OpCode.
+X.1		<b>A</b> and <b>C</b> , <b>N</b> , <b>V</b> , <b>Z</b> applied.

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	73	1	unknown	0002	ff	00	00	fd	Nv-BdIzc	LDA #	T1
2	0002	73	1	unknown	0002	ff	00	00	fd	Nv-BdIzc	LDA #	T1
3	0003	10	1		0003	ff	00	00	fd	Nv-BdIzc	unknown	T2
3	0003	10	1		0003	ff	00	00	fd	Nv-BdIzc	unknown	T2
4	0010	e8	1		0004	ff	00	00	fd	Nv-BdIzc	unknown	T3
4	0010	e8	1		0004	ff	00	00	fd	Nv-BdIzc	unknown	T3
5	0011	88	1		0004	ff	00	00	fd	Nv-BdIzc	unknown	T4
5	0011	88	1		0004	ff	00	00	fd	Nv-BdIzc	unknown	T4
6	88e8	00	1		0004	ff	00	00	fd	Nv-BdIzc	unknown	T5
6	88e8	00	1		0004	ff	00	00	fd	Nv-BdIzc	unknown	T5
7	88e8	00	1		0004	ff	00	00	fd	Nv-BdIzc	unknown	
7	88e8	00	1		0004	ff	00	00	fd	Nv-BdIzc	unknown	
8	88e8	00	0		0004	ff	00	00	fd	Nv-BdIzc	unknown	
8	88e8	00	0		0004	ff	00	00	fd	Nv-BdIzc	unknown	
9	88e8	00	0		0004	ff	00	00	fd	nv-BdIZc	unknown	T0
9	88e8	00	0		0004	ff	00	00	fd	nv-BdIZc	unknown	T0
10	0004	a4	1	LDY zp	0004	ff	00	00	fd	nv-BdIZc	unknown	T1
10	0004	a4	1	LDY zp	0004	ff	00	00	fd	nv-BdIZc	unknown	T1
11	0005	4c	1		0005	ff	00	00	fd	Nv-BdIzc	LDY zp	T2
11	0005	4c	1		0005	ff	00	00	fd	Nv-BdIzc	LDY zp	T2

NOP (74) Cycles: 4		Size: 2
Zero Page, X (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		Store as Pointer.
1.2	Read PC	Inc. <b>PC</b> .
2.1		Store as Operand.
2.2	Read Pointer	Set Address to (Pointer+X) & \$FF.
3.1		Store as Operand.
3.2	Read Address	Store as Operand.
4.1		
4.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	74	1	unknown	0002 ff 00 00	fd	Nv-BdIzc	LDA #	T1			
2	0002	74	1	unknown	0002 ff 00 00	fd	Nv-BdIzc	LDA #	T1			
3	0003	10	1		0003 ff 00 00	fd	Nv-BdIzc	unknown	T2			
3	0003	10	1		0003 ff 00 00	fd	Nv-BdIzc	unknown	T2			
4	0010	e8	1		0004 ff 00 00	fd	Nv-BdIzc	unknown	T3			
4	0010	e8	1		0004 ff 00 00	fd	Nv-BdIzc	unknown	T3			
5	0010	e8	1		0004 ff 00 00	fd	Nv-BdIzc	unknown	T0			
5	0010	e8	1		0004 ff 00 00	fd	Nv-BdIzc	unknown	T0			
6	0004	a4	1	LDY zp	0004 ff 00 00	fd	Nv-BdIzc	unknown	T1			
6	0004	a4	1	LDY zp	0004 ff 00 00	fd	Nv-BdIzc	unknown	T1			
7	0005	4c	1		0005 ff 00 00	fd	Nv-BdIzc	LDY zp	T2			
7	0005	4c	1		0005 ff 00 00	fd	Nv-BdIzc	LDY zp	T2			

ADC (75) Cycles: 4		Size: 2
Zero Page, X (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		Store as Pointer.
1.2	Read PC	Inc. <b>PC</b> .
2.1		Store as Operand.
2.2	Read Pointer	Set Address to (Pointer+ <b>X</b> ) & \$FF.
3.1		Store as Operand.
3.2	Read Address	* u16 Tmp = <b>A</b> + Operand + ( <b>C</b> flag). <b>V</b> =(~(u16(A) ^ u16(Operand)) & (u16(A) ^ Tmp) & \$0080) != 0. <b>A</b> =u8(Tmp). <b>C</b> =Tmp > \$FF. <b>Z</b> =A == \$00. <b>N</b> =(A & \$80) != 0.
4.1		Store as OpCode.
4.2	Read PC	<b>A</b> and <b>C</b> , <b>N</b> , <b>V</b> , <b>Z</b> applied.
+X.1		

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	75	1	ADC zp,X	0002	7f	00	00	fd	nv-BdIzc	LDA #	T1
2	0002	75	1	ADC zp,X	0002	7f	00	00	fd	nv-BdIzc	LDA #	T1
3	0003	10	1		0003	7f	00	00	fd	nv-BdIzc	ADC zp,X	T2
3	0003	10	1		0003	7f	00	00	fd	nv-BdIzc	ADC zp,X	T2
4	0010	01	1		0004	7f	00	00	fd	nv-BdIzc	ADC zp,X	T3
4	0010	01	1		0004	7f	00	00	fd	nv-BdIzc	ADC zp,X	T3
5	0010	01	1		0004	7f	00	00	fd	nv-BdIzc	ADC zp,X	T0
5	0010	01	1		0004	7f	00	00	fd	nv-BdIzc	ADC zp,X	T0
6	0004	00	1	BRK	0004	7f	00	00	fd	nv-BdIzc	ADC zp,X	T1
6	0004	00	1	BRK	0004	7f	00	00	fd	nv-BdIzc	ADC zp,X	T1
7	0005	4c	1		0005	80	00	00	fd	NV-BdIzc	BRK	T2
7	0005	4c	1		0005	80	00	00	fd	NV-BdIzc	BRK	T2

ROR (76) Cycles: 6		Size: 2
Zero Page, X (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Pointer.
2.1		Inc. <b>PC</b> .
2.2	Read Pointer	Store as Operand.
3.1		Set Address to (Pointer+ <b>X</b> ) & \$FF.
3.2	Read Address	Store as Operand.
4.1		
4.2	Write Address	Write unmodified Operand.
5.1		Tmp = ( <b>C</b> << 7). Set <b>C</b> if low bit of Operand is set. Operand=(Operand >> 1)   Tmp.
5.2	Write Address	Set <b>N</b> , and <b>Z</b> based off Operand. Write modified Operand.
6.1		
6.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	76	1	ROR zp,X	0002 09 00 00	fd	nv-BdIzc	LDA #		T1		
2	0002	76	1	ROR zp,X	0002 09 00 00	fd	nv-BdIzc	LDA #		T1		
3	0003	10	1		0003 09 00 00	fd	nv-BdIzc	ROR zp,X		T2		
3	0003	10	1		0003 09 00 00	fd	nv-BdIzc	ROR zp,X		T2		
4	0010	01	1		0004 09 00 00	fd	nv-BdIzc	ROR zp,X		T3		
4	0010	01	1		0004 09 00 00	fd	nv-BdIzc	ROR zp,X		T3		
5	0010	01	1		0004 09 00 00	fd	nv-BdIzc	ROR zp,X		T4		
5	0010	01	1		0004 09 00 00	fd	nv-BdIzc	ROR zp,X		T4		
6	0010	01	0		0004 09 00 00	fd	nv-BdIzc	ROR zp,X		T5		
6	0010	01	0		0004 09 00 00	fd	nv-BdIzc	ROR zp,X		T5		
7	0010	01	0		0004 09 00 00	fd	nv-BdIzc	ROR zp,X		T0		
7	0010	00	0		0004 09 00 00	fd	nv-BdIzc	ROR zp,X		T0		
8	0004	75	1	ADC zp,X	0004 09 00 00	fd	nv-BdIzc	ROR zp,X		T1		
8	0004	75	1	ADC zp,X	0004 09 00 00	fd	nv-BdIzc	ROR zp,X		T1		
9	0005	4c	1		0005 09 00 00	fd	nv-BdIzc	ADC zp,X		T2		
9	0005	4c	1		0005 09 00 00	fd	nv-BdIzc	ADC zp,X		T2		

RRA (77)	Cycles: 6	Size: 2
Zero Page, X (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Pointer.
2.1		Inc. <b>PC</b> .
2.2	Read Pointer	Store as Operand.
3.1		Set Address to (Pointer+ <b>X</b> ) & \$FF.
3.2	Read Address	Store as Operand.
4.1		
4.2	Write Address	Write unmodified Operand.
5.1		Tmp = ( <b>C</b> << 7). Set <b>C</b> if low bit of <b>P</b> is set. Operand=(Operand >> 1)   Tmp.
5.2	Write Address	<b>A</b> =( <b>A</b> ADC Operand), set <b>C</b> , <b>N</b> , <b>V</b> , and <b>Z</b> based off <b>A</b> . Write modified Operand.
6.1		
6.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	77	1	unknown	0002 ff 00 00 fd	Nv-BdIzc	LDA #			T1		
2	0002	77	1	unknown	0002 ff 00 00 fd	Nv-BdIzc	LDA #			T1		
3	0003	10	1		0003 ff 00 00 fd	Nv-BdIzc	unknown			T2		
3	0003	10	1		0003 ff 00 00 fd	Nv-BdIzc	unknown			T2		
4	0010	01	1		0004 ff 00 00 fd	Nv-BdIzc	unknown			T3		
4	0010	01	1		0004 ff 00 00 fd	Nv-BdIzc	unknown			T3		
5	0010	01	1		0004 ff 00 00 fd	Nv-BdIzc	unknown			T4		
5	0010	01	1		0004 ff 00 00 fd	Nv-BdIzc	unknown			T4		
6	0010	01	0		0004 ff 00 00 fd	Nv-BdIzc	unknown			T5		
6	0010	01	0		0004 ff 00 00 fd	Nv-BdIzc	unknown			T5		
7	0010	01	0		0004 ff 00 00 fd	nv-BdIzc	unknown			T0		
7	0010	00	0		0004 ff 00 00 fd	nv-BdIzc	unknown			T0		
8	0004	75	1	ADC zp,X	0004 ff 00 00 fd	nv-BdIzc	unknown			T1		
8	0004	75	1	ADC zp,X	0004 ff 00 00 fd	nv-BdIzc	unknown			T1		
9	0005	4c	1		0005 00 00 00 fd	nv-BdIzc	ADC zp,X			T2		
9	0005	4c	1		0005 00 00 00 fd	nv-BdIzc	ADC zp,X			T2		

SEI (78)	Cycles: 2	Size: 1
Implied		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		To be discarded.
1.2	Read PC	Set the <b>I</b> status bit.
2.1		
2.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0001	78	1	SEI	0001	aa	00	00	fd	nv-BdIZc	CLI	T1
2	0001	78	1	SEI	0001	aa	00	00	fd	nv-BdIZc	CLI	T1
3	0002	a9	1		0002	aa	00	00	fd	nv-BdIZc	SEI	T0+T2
3	0002	a9	1		0002	aa	00	00	fd	nv-BdIZc	SEI	T0+T2
4	0002	a9	1	LDA #	0002	aa	00	00	fd	nv-BdIZc	SEI	T1
4	0002	a9	1	LDA #	0002	aa	00	00	fd	nv-BdIZc	SEI	T1
5	0003	10	1		0003	aa	00	00	fd	nv-BdIZc	LDA #	T0+T2
5	0003	10	1		0003	aa	00	00	fd	nv-BdIZc	LDA #	T0+T2

ADC (79) Cycles: 4-5		Size: 3
Absolute, Y (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Address.L.
2.1		Inc. <b>PC</b> .
2.2	Read PC	Store as Address.H.
3.1		Inc. <b>PC</b> . Final=Address+Y. Address.L = Final.L.
3.2	Read Address	Store as Operand. If Address.H == Final.H, skip the next cycle (next half-cycle is 5.1).
4.1		Address.H = Final.H (fixes high byte of address).
4.2	Read Address	Store as Operand.
5.1		* u16 Tmp = A + Operand + ( <b>C</b> flag). <b>V</b> =(~(u16(A) ^ u16(Operand)) & (u16(A) ^ Tmp) & \$0080) != 0. A=u8(Tmp). <b>C</b> =Tmp > \$FF. <b>Z</b> =A == \$00. <b>N</b> =(A & \$80) != 0.
5.2	Read PC	Store as OpCode.
+X.1		<b>A</b> and <b>C</b> , <b>N</b> , <b>V</b> , <b>Z</b> applied.

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
4	0003	79	1	ADC Abs,Y	0003	ff	00	00	fd	Nv-Bdizc	LDA #	T1
4	0003	79	1	ADC Abs,Y	0003	ff	00	00	fd	Nv-Bdizc	LDA #	T1
5	0004	02	1		0004	ff	00	00	fd	Nv-Bdizc	ADC Abs,Y	T2
5	0004	02	1		0004	ff	00	00	fd	Nv-Bdizc	ADC Abs,Y	T2
6	0005	01	1		0005	ff	00	00	fd	Nv-Bdizc	ADC Abs,Y	T3
6	0005	01	1		0005	ff	00	00	fd	Nv-Bdizc	ADC Abs,Y	T3
7	0102	01	1		0006	ff	00	00	fd	Nv-Bdizc	ADC Abs,Y	T0
7	0102	01	1		0006	ff	00	00	fd	Nv-Bdizc	ADC Abs,Y	T0
8	0006	01	1	ORA (zp,X)	0006	ff	00	00	fd	Nv-Bdizc	ADC Abs,Y	T1
8	0006	01	1	ORA (zp,X)	0006	ff	00	00	fd	Nv-Bdizc	ADC Abs,Y	T1
9	0007	00	1		0007	00	00	00	fd	nv-BdizC	ORA (zp,X)	T2
9	0007	00	1		0007	00	00	00	fd	nv-BdizC	ORA (zp,X)	T2

NOP (7A) Cycles: 2		Size: 1
Implied		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		To be discarded.
1.2	Read PC	
2.1		
2.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
4	0003	7a	1	unknown	0003	ff	00	00	fd	Nv-Bdizc	LDA #	T1
4	0003	7a	1	unknown	0003	ff	00	00	fd	Nv-Bdizc	LDA #	T1
5	0004	01	1		0004	ff	00	00	fd	Nv-Bdizc	unknown	T0+T2
5	0004	01	1		0004	ff	00	00	fd	Nv-Bdizc	unknown	T0+T2
6	0004	01	1	ORA (zp,X)	0004	ff	00	00	fd	Nv-Bdizc	unknown	T1
6	0004	01	1	ORA (zp,X)	0004	ff	00	00	fd	Nv-Bdizc	unknown	T1
7	0005	01	1		0005	ff	00	00	fd	Nv-Bdizc	ORA (zp,X)	T2
7	0005	01	1		0005	ff	00	00	fd	Nv-Bdizc	ORA (zp,X)	T2

RRA (7B)	Cycles: 7	Size: 3
Absolute, Y (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		Store as Address.L.
1.2	Read PC	Inc. <b>PC</b> .
2.1		Store as Address.H.
2.2	Read PC	Inc. <b>PC</b> . Final=Address+Y. Address.L = Final.L.
3.1		Store as Operand.
3.2	Read Address	Address.H = Final.H (fixes high byte of address).
4.1		Store as Operand.
4.2	Read Address	
5.1		
5.2	Write Address	Write unmodified Operand. * Tmp = ( <b>C</b> << 7).
6.1		Set <b>C</b> if low bit of <b>P</b> is set. Operand=(Operand >> 1)   Tmp.
		<b>A</b> =( <b>A</b> ADC Operand), set <b>C</b> , <b>N</b> , <b>V</b> , and <b>Z</b> based off <b>A</b> .
6.2	Write Address	Write modified Operand.
7.1		
7.2	Read PC	Store as OpCode.
+X.1		<b>A</b> and <b>C</b> , <b>N</b> , <b>V</b> , <b>Z</b> applied.

\* Setting of A flags is delayed by 2 cycles until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
4	0003	7b	1	unknown	0003	ff	00	00	fd	Nv-Bdizc	LDA #	T1
4	0003	7b	1	unknown	0003	ff	00	00	fd	Nv-Bdizc	LDA #	T1
5	0004	01	1		0004	ff	00	00	fd	Nv-Bdizc	unknown	T2
5	0004	01	1		0004	ff	00	00	fd	Nv-Bdizc	unknown	T2
6	0005	01	1		0005	ff	00	00	fd	Nv-Bdizc	unknown	T3
6	0005	01	1		0005	ff	00	00	fd	Nv-Bdizc	unknown	T3
7	0101	01	1		0006	ff	00	00	fd	Nv-Bdizc	unknown	T4
7	0101	01	1		0006	ff	00	00	fd	Nv-Bdizc	unknown	T4
8	0101	01	1		0006	ff	00	00	fd	Nv-Bdizc	unknown	T5
8	0101	01	1		0006	ff	00	00	fd	Nv-Bdizc	unknown	T5
9	0101	01	0		0006	ff	00	00	fd	Nv-BdizC	unknown	
9	0101	01	0		0006	ff	00	00	fd	Nv-BdizC	unknown	
10	0101	01	0		0006	ff	00	00	fd	nv-BdizC	unknown	T0
10	0101	00	0		0006	ff	00	00	fd	nv-BdizC	unknown	T0
11	0006	01	1	ORA (zp,X)	0006	ff	00	00	fd	nv-BdizC	unknown	T1
11	0006	01	1	ORA (zp,X)	0006	ff	00	00	fd	nv-BdizC	unknown	T1
12	0007	00	1		0007	00	00	00	fd	nv-BdizC	ORA (zp,X)	T2
12	0007	00	1		0007	00	00	00	fd	nv-BdizC	ORA (zp,X)	T2

NOP (7C) Cycles: 4-5		Size: 3
Absolute, X (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Address.L.
2.1		Inc. <b>PC</b> .
2.2	Read PC	Store as Address.H.
3.1		Inc. <b>PC</b> . Final=Address+X. Address.L = Final.L.
3.2	Read Address	Store as Operand. If Address.H == Final.H, skip the next cycle (next half-cycle is 5.1).
4.1		Address.H = Final.H (fixes high byte of address).
4.2	Read Address	Store as Operand.
5.1		
5.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
4	0003	7c	1	unknown	0003	ff	00	00	fd	Nv-Bdizc	LDA #	T1
4	0003	7c	1	unknown	0003	ff	00	00	fd	Nv-Bdizc	LDA #	T1
5	0004	01	1		0004	ff	00	00	fd	Nv-Bdizc	unknown	T2
5	0004	01	1		0004	ff	00	00	fd	Nv-Bdizc	unknown	T2
6	0005	01	1		0005	ff	00	00	fd	Nv-Bdizc	unknown	T3
6	0005	01	1		0005	ff	00	00	fd	Nv-Bdizc	unknown	T3
7	0101	00	1		0006	ff	00	00	fd	Nv-Bdizc	unknown	T0
7	0101	00	1		0006	ff	00	00	fd	Nv-Bdizc	unknown	T0
8	0006	01	1	ORA (zp,X)	0006	ff	00	00	fd	Nv-Bdizc	unknown	T1
8	0006	01	1	ORA (zp,X)	0006	ff	00	00	fd	Nv-Bdizc	unknown	T1
9	0007	00	1		0007	ff	00	00	fd	Nv-Bdizc	ORA (zp,X)	T2
9	0007	00	1		0007	ff	00	00	fd	Nv-Bdizc	ORA (zp,X)	T2

ADC (7D) Cycles: 4-5		Size: 3
Absolute, X (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Address.L.
2.1		Inc. <b>PC</b> .
2.2	Read PC	Store as Address.H.
3.1		Inc. <b>PC</b> . Final=Address+X. Address.L = Final.L.
3.2	Read Address	Store as Operand. If Address.H == Final.H, skip the next cycle (next half-cycle is 5.1).
4.1		Address.H = Final.H (fixes high byte of address).
4.2	Read Address	Store as Operand.
5.1		* u16 Tmp = A + Operand + ( <b>C</b> flag). <b>V</b> =(~(u16(A) ^ u16(Operand)) & (u16(A) ^ Tmp) & \$0080) != 0. A=u8(Tmp). <b>C</b> =Tmp > \$FF. <b>Z</b> =A == \$00. <b>N</b> =(A & \$80) != 0. Store as OpCode.
5.2	Read PC	A and <b>C</b> , <b>N</b> , <b>V</b> , <b>Z</b> applied.
+X.1		

\* Setting of A flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p
2	0002	7d	1	ADC Abs,X	0002	00 00 00	fd	nv-BdIZc		
2	0002	7d	1	ADC Abs,X	0002	00 00 00	fd	nv-BdIZc		
3	0003	10	1		0003	00 00 00	fd	nv-BdIZc		
3	0003	10	1		0003	00 00 00	fd	nv-BdIZc		
4	0004	00	1		0004	00 00 00	fd	nv-BdIZc		
4	0004	00	1		0004	00 00 00	fd	nv-BdIZc		
5	0010	e8	1		0005	00 00 00	fd	nv-BdIZc		
5	0010	e8	1		0005	00 00 00	fd	nv-BdIZc		
6	0005	4c	1	JMP Abs	0005	00 00 00	fd	nv-BdIZc		
6	0005	4c	1	JMP Abs	0005	00 00 00	fd	nv-BdIZc		
7	0006	02	1		0006	e8 00 00	fd	Nv-BdIZc		
7	0006	02	1		0006	e8 00 00	fd	Nv-BdIZc		

ROR (7E)		Cycles: 7	Size: 3
Absolute, X (Read/Modify/Write)			
Cycle	R/W	Desc	
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .	
1.1		Store as Address.L.	
1.2	Read PC	Inc. <b>PC</b> .	
2.1		Store as Address.H.	
2.2	Read PC	Inc. <b>PC</b> . Final=Address+X. Address.L = Final.L.	
3.1		Store as Operand.	
3.2	Read Address	Address.H = Final.H (fixes high byte of address).	
4.1		Store as Operand.	
4.2	Read Address	Address.H = Final.H (fixes high byte of address).	
5.1		Store as Operand.	
5.2	Write Address	Write unmodified Operand. Tmp = ( <b>C</b> << 7).	
6.1		Set <b>C</b> if low bit of Operand is set. Operand=(Operand >> 1)   Tmp.	
		Set <b>N</b> , and <b>Z</b> based off Operand.	
6.2	Write Address	Set <b>N</b> , and <b>Z</b> based off Operand. Write modified Operand.	
7.1			
7.2	Read PC	Store as OpCode.	
+X.1			

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	7e	1	ROR Abs,X	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
2	0002	7e	1	ROR Abs,X	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
3	0003	10	1		0003	00	00	00	fd	nv-BdIZc	ROR Abs,X	T2
3	0003	10	1		0003	00	00	00	fd	nv-BdIZc	ROR Abs,X	T2
4	0004	00	1		0004	00	00	00	fd	nv-BdIZc	ROR Abs,X	T3
4	0004	00	1		0004	00	00	00	fd	nv-BdIZc	ROR Abs,X	T3
5	0010	01	1		0005	00	00	00	fd	nv-BdIZc	ROR Abs,X	T4
5	0010	01	1		0005	00	00	00	fd	nv-BdIZc	ROR Abs,X	T4
6	0010	01	1		0005	00	00	00	fd	nv-BdIZc	ROR Abs,X	T5
6	0010	01	1		0005	00	00	00	fd	nv-BdIZc	ROR Abs,X	T5
7	0010	01	0		0005	00	00	00	fd	nv-BdIZC	ROR Abs,X	
7	0010	01	0		0005	00	00	00	fd	nv-BdIZC	ROR Abs,X	
8	0010	01	0		0005	00	00	00	fd	nv-BdIZC	ROR Abs,X	T0
8	0010	00	0		0005	00	00	00	fd	nv-BdIZC	ROR Abs,X	T0
9	0005	4c	1	JMP Abs	0005	00	00	00	fd	nv-BdIZC	ROR Abs,X	T1
9	0005	4c	1	JMP Abs	0005	00	00	00	fd	nv-BdIZC	ROR Abs,X	T1
10	0006	02	1		0006	00	00	00	fd	nv-BdIZC	JMP Abs	T2
10	0006	02	1		0006	00	00	00	fd	nv-BdIZC	JMP Abs	T2

RRA (7F)	Cycles: 7	Size: 3
Absolute, X (Read/Modify/Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Address.L.
2.1		Inc. <b>PC</b> .
2.2	Read PC	Store as Address.H.
3.1		Inc. <b>PC</b> . Final=Address+X. Address.L = Final.L.
3.2	Read Address	Store as Operand.
4.1		Address.H = Final.H (fixes high byte of address).
4.2	Read Address	Store as Operand.
5.1		
5.2	Write Address	Write unmodified Operand. * Tmp = ( <b>C</b> << 7).
6.1		Set <b>C</b> if low bit of <b>P</b> is set. Operand=(Operand >> 1)   Tmp. <b>A</b> =( <b>A</b> ADC Operand), set <b>C</b> , <b>N</b> , <b>V</b> , and <b>Z</b> based off <b>A</b> .
6.2	Write Address	Write modified Operand.
7.1		
7.2	Read PC	Store as OpCode.
+X.1		

\* Setting of A flags is delayed by 2 cycles until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
2	0002	7f	1	unknown	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
2	0002	7f	1	unknown	0002	00	00	00	fd	nv-BdIZc	LDA #	T1
3	0003	10	1		0003	00	00	00	fd	nv-BdIZc	unknown	T2
3	0003	10	1		0003	00	00	00	fd	nv-BdIZc	unknown	T2
4	0004	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T3
4	0004	00	1		0004	00	00	00	fd	nv-BdIZc	unknown	T3
5	0010	01	1		0005	00	00	00	fd	nv-BdIZc	unknown	T4
5	0010	01	1		0005	00	00	00	fd	nv-BdIZc	unknown	T4
6	0010	01	1		0005	00	00	00	fd	nv-BdIZc	unknown	T5
6	0010	01	1		0005	00	00	00	fd	nv-BdIZc	unknown	T5
7	0010	01	0		0005	00	00	00	fd	nv-BdIZC	unknown	
7	0010	01	0		0005	00	00	00	fd	nv-BdIZC	unknown	
8	0010	01	0		0005	00	00	00	fd	nv-BdIZC	unknown	T0
8	0010	00	0		0005	00	00	00	fd	nv-BdIZC	unknown	T0
9	0005	4c	1	JMP Abs	0005	00	00	00	fd	nv-BdIZC	unknown	T1
9	0005	4c	1	JMP Abs	0005	00	00	00	fd	nv-BdIZC	unknown	T1
10	0006	02	1		0006	01	00	00	fd	nv-BdIZc	JMP Abs	T2
10	0006	02	1		0006	01	00	00	fd	nv-BdIZc	JMP Abs	T2

NOP (80)	Cycles: 2	Size: 2
Immediate (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		
1.2	Read PC	Store as Operand.
2.1		
2.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State	
8	0010	80	1	unknown	0010	00	00	00	fb	nv-BdIZc	JSR Abs	T1	
8	0010	80	1	unknown	0010	00	00	00	fb	nv-BdIZc	JSR Abs	T1	
9	0011	88	1			0011	00	00	00	fb	nv-BdIZc	unknown	T0+T2
9	0011	88	1			0011	00	00	00	fb	nv-BdIZc	unknown	T0+T2
10	0012	e6	1	INC	zp	0012	00	00	00	fb	nv-BdIZc	unknown	T1
10	0012	e6	1	INC	zp	0012	00	00	00	fb	nv-BdIZc	unknown	T1
11	0013	0f	1			0013	00	00	00	fb	nv-BdIZc	INC	zp T2
11	0013	0f	1			0013	00	00	00	fb	nv-BdIZc	INC	zp T2

STA (81)	Cycles: 6	Size: 2
Indirect, X (Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		
1.2	Read PC	Store as Operand.
2.1		Inc. <b>PC</b> .
2.2	Read Operand	
3.1		Set Pointer to (Operand+X) & \$FF.
3.2	Read Pointer	Store to Address.L.
4.1		
4.2	Read (Pointer+1) & \$FF	Store to Address.H.
5.1		
5.2	Write Address	Write <b>A</b> .
6.1		
6.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
10	0010	81	1	STA (zp,X)	0010	80	40	00	fb	nv-BdIzc	LDX #	T1
10	0010	81	1	STA (zp,X)	0010	80	40	00	fb	nv-BdIzc	LDX #	T1
11	0011	55	1		0011	80	40	00	fb	nv-BdIzc	STA (zp,X)	T2
11	0011	55	1		0011	80	40	00	fb	nv-BdIzc	STA (zp,X)	T2
12	0055	7f	1		0012	80	40	00	fb	nv-BdIzc	STA (zp,X)	T3
12	0055	7f	1		0012	80	40	00	fb	nv-BdIzc	STA (zp,X)	T3
13	0095	90	1		0012	80	40	00	fb	nv-BdIzc	STA (zp,X)	T4
13	0095	90	1		0012	80	40	00	fb	nv-BdIzc	STA (zp,X)	T4
14	0096	00	1		0012	80	40	00	fb	nv-BdIzc	STA (zp,X)	T5
14	0096	00	1		0012	80	40	00	fb	nv-BdIzc	STA (zp,X)	T5
15	0090	00	0		0012	80	40	00	fb	nv-BdIzc	STA (zp,X)	T0
15	0090	80	0		0012	80	40	00	fb	nv-BdIzc	STA (zp,X)	T0
16	0012	e6	1	INC zp	0012	80	40	00	fb	nv-BdIzc	STA (zp,X)	T1
16	0012	e6	1	INC zp	0012	80	40	00	fb	nv-BdIzc	STA (zp,X)	T1
17	0013	0f	1		0013	80	40	00	fb	nv-BdIzc	INC zp	T2
17	0013	0f	1		0013	80	40	00	fb	nv-BdIzc	INC zp	T2

NOP (82)	Cycles: 2	Size: 2
Immediate (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode.
1.1		Inc. <b>PC</b> .
1.2	Read PC	Store as Operand.
2.1		
2.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
10	0010	82	1	unknown	0010	80	40	00	fb	nv-BdIzc	LDX #	T1
10	0010	82	1	unknown	0010	80	40	00	fb	nv-BdIzc	LDX #	T1
11	0011	55	1		0011	80	40	00	fb	nv-BdIzc	unknown	T0+T2
11	0011	55	1		0011	80	40	00	fb	nv-BdIzc	unknown	T0+T2
12	0012	e6	1	INC zp	0012	80	40	00	fb	nv-BdIzc	unknown	T1
12	0012	e6	1	INC zp	0012	80	40	00	fb	nv-BdIzc	unknown	T1
13	0013	0f	1		0013	80	40	00	fb	nv-BdIzc	INC zp	T2
13	0013	0f	1		0013	80	40	00	fb	nv-BdIzc	INC zp	T2

SAX (83)	Cycles: 6	Size: 2
Indirect, X (Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		
1.2	Read PC	Store as Operand. Inc. <b>PC</b> .
2.1		
2.2	Read Operand	
3.1		Set Pointer to (Operand+X) & \$FF.
3.2	Read Pointer	Store to Address.L.
4.1		
4.2	Read (Pointer+1) & \$FF	Store to Address.H.
5.1		
5.2	Write Address	Write <b>A</b> & <b>X</b> .
6.1		
6.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p	Execute	State
10	0010	83	1	unknown	0010	81	7f	00	fb	nv-BdIzc	LDX #	T1
10	0010	83	1	unknown	0010	81	7f	00	fb	nv-BdIzc	LDX #	T1
11	0011	55	1		0011	81	7f	00	fb	nv-BdIzc	unknown	T2
11	0011	55	1		0011	81	7f	00	fb	nv-BdIzc	unknown	T2
12	0055	7f	1		0012	81	7f	00	fb	nv-BdIzc	unknown	T3
12	0055	7f	1		0012	81	7f	00	fb	nv-BdIzc	unknown	T3
13	00d4	90	1		0012	81	7f	00	fb	nv-BdIzc	unknown	T4
13	00d4	90	1		0012	81	7f	00	fb	nv-BdIzc	unknown	T4
14	00d5	00	1		0012	81	7f	00	fb	nv-BdIzc	unknown	T5
14	00d5	00	1		0012	81	7f	00	fb	nv-BdIzc	unknown	T5
15	0090	00	0		0012	81	7f	00	fb	nv-BdIzc	unknown	T0
15	0090	01	0		0012	81	7f	00	fb	nv-BdIzc	unknown	T0
16	0012	e6	1	INC zp	0012	81	7f	00	fb	nv-BdIzc	unknown	T1
16	0012	e6	1	INC zp	0012	81	7f	00	fb	nv-BdIzc	unknown	T1
17	0013	0f	1		0013	81	7f	00	fb	nv-BdIzc	INC zp	T2
17	0013	0f	1		0013	81	7f	00	fb	nv-BdIzc	INC zp	T2

STY (84)	Cycles: 3	Size: 2
Zero Page (Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		
1.2	Read PC	Store as Address. Inc. <b>PC</b> .
2.1		
2.2	Write Address	Write <b>Y</b> .
3.1		
3.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p
2	0002	84	1	STY zp	0002 aa	00 80	fd		Nv-BdIzc	
2	0002	84	1	STY zp	0002 aa	00 80	fd		Nv-BdIzc	
3	0003	ee	1		0003 aa	00 80	fd		Nv-BdIzc	
3	0003	ee	1		0003 aa	00 80	fd		Nv-BdIzc	
4	00ee	ee	0		0004 aa	00 80	fd		Nv-BdIzc	
4	00ee	80	0		0004 aa	00 80	fd		Nv-BdIzc	
5	0004	a9	1	LDA #	0004 aa	00 80	fd		Nv-BdIzc	
5	0004	a9	1	LDA #	0004 aa	00 80	fd		Nv-BdIzc	
6	0005	4c	1		0005 aa	00 80	fd		Nv-BdIzc	
6	0005	4c	1		0005 aa	00 80	fd		Nv-BdIzc	

STA (85)	Cycles: 3	Size: 2
Zero Page (Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		
1.2	Read PC	Store as Address. Inc. <b>PC</b> .
2.1		
2.2	Write Address	Write <b>A</b> .
3.1		
3.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p
2	0002	85	1	STA zp	0002	80	00	00	fd	Nv-BdIzc
2	0002	85	1	STA zp	0002	80	00	00	fd	Nv-BdIzc
3	0003	ee	1		0003	80	00	00	fd	Nv-BdIzc
3	0003	ee	1		0003	80	00	00	fd	Nv-BdIzc
4	00ee	ee	0		0004	80	00	00	fd	Nv-BdIzc
4	00ee	80	0		0004	80	00	00	fd	Nv-BdIzc
5	0004	a0	1	LDY #	0004	80	00	00	fd	Nv-BdIzc
5	0004	a0	1	LDY #	0004	80	00	00	fd	Nv-BdIzc
6	0005	4c	1		0005	80	00	00	fd	Nv-BdIzc
6	0005	4c	1		0005	80	00	00	fd	Nv-BdIzc

STX (86)	Cycles: 3	Size: 2
Zero Page (Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		
1.2	Read PC	Store as Address. Inc. <b>PC</b> .
2.1		
2.2	Write Address	Write <b>X</b> .
3.1		
3.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p
2	0002	86	1	STX zp	0002 aa	80 00	fd		Nv-BdIzc	
2	0002	86	1	STX zp	0002 aa	80 00	fd		Nv-BdIzc	
3	0003	ee	1		0003 aa	80 00	fd		Nv-BdIzc	
3	0003	ee	1		0003 aa	80 00	fd		Nv-BdIzc	
4	00ee	ee	0		0004 aa	80 00	fd		Nv-BdIzc	
4	00ee	80	0		0004 aa	80 00	fd		Nv-BdIzc	
5	0004	a0	1	LDY #	0004 aa	80 00	fd		Nv-BdIzc	
5	0004	a0	1	LDY #	0004 aa	80 00	fd		Nv-BdIzc	
6	0005	4c	1		0005 aa	80 00	fd		Nv-BdIzc	
6	0005	4c	1		0005 aa	80 00	fd		Nv-BdIzc	

SAX(87)	Cycles: 3	Size: 2
Zero Page (Write)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		
1.2	Read PC	Store as Address. Inc. <b>PC</b> .
2.1		
2.2	Write Address	Write <b>A &amp; X</b> .
3.1		
3.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p
2	0002	87	1	unknown	0002 aa	81 00	fd	Nv-BdIzc		
2	0002	87	1	unknown	0002 aa	81 00	fd	Nv-BdIzc		
3	0003	ee	1		0003 aa	81 00	fd	Nv-BdIzc		
3	0003	ee	1		0003 aa	81 00	fd	Nv-BdIzc		
4	00ee	ee	0		0004 aa	81 00	fd	Nv-BdIzc		
4	00ee	80	0		0004 aa	81 00	fd	Nv-BdIzc		
5	0004	a0	1	LDY #	0004 aa	81 00	fd	Nv-BdIzc		
5	0004	a0	1	LDY #	0004 aa	81 00	fd	Nv-BdIzc		
6	0005	4c	1		0005 aa	81 00	fd	Nv-BdIzc		
6	0005	4c	1		0005 aa	81 00	fd	Nv-BdIzc		

DEY (88)	Cycles: 2	Size: 1
Implied		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		To be discarded.
1.2	Read PC	Decrease <b>Y</b> , set <b>N</b> and <b>Z</b> accordingly.
2.1		Store as OpCode.
2.2	Read PC	<b>Y</b> , <b>N</b> , and <b>Z</b> applied.
+X.1		

\* Setting of Y flags is delayed by 1 cycle until the start of the following instruction.

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p
2	0002	88	1	DEY	0002	aa	00	80	fd	Nv-BdIzc
2	0002	88	1	DEY	0002	aa	00	80	fd	Nv-BdIzc
3	0003	ee	1		0003	aa	00	80	fd	Nv-BdIzc
3	0003	ee	1		0003	aa	00	80	fd	Nv-BdIzc
4	0003	ee	1	INC Abs	0003	aa	00	80	fd	Nv-BdIzc
4	0003	ee	1	INC Abs	0003	aa	00	80	fd	Nv-BdIzc
5	0004	a0	1		0004	aa	00	7f	fd	nv-BdIzc
5	0004	a0	1		0004	aa	00	7f	fd	nv-BdIzc

NOP (89)	Cycles: 2	Size: 2
Immediate (Read)		
Cycle	R/W	Desc
-X.2	Read PC	Store as OpCode. Inc. <b>PC</b> .
1.1		
1.2	Read PC	Store as Operand.
2.1		
2.2	Read PC	Store as OpCode.
+X.1		

cycle	ab	db	rw	Fetch	pc	a	x	y	s	p
2	0002	89	1	unknown	0002	aa	00	80	fd	Nv-BdIzc
2	0002	89	1	unknown	0002	aa	00	80	fd	Nv-BdIzc
3	0003	ee	1		0003	aa	00	80	fd	Nv-BdIzc
3	0003	ee	1		0003	aa	00	80	fd	Nv-BdIzc
4	0004	a0	1	LDY #	0004	aa	00	80	fd	Nv-BdIzc
4	0004	a0	1	LDY #	0004	aa	00	80	fd	Nv-BdIzc
5	0005	4c	1		0005	aa	00	80	fd	Nv-BdIzc
5	0005	4c	1		0005	aa	00	80	fd	Nv-BdIzc

