OP-CODE TABLE

DEC	HEX	CODE	BYTES	CYCLES
ØØØ	ØØ	BRK	1	7
ØØ1	Ø1	ORA - (Indirect,X)	2	6
ØØ2	Ø2	---		
ØØ3	Ø3	---		
ØØ4	Ø4	---		
ØØ5	Ø5	ORA - Zero Page	2	3
ØØ6	Ø6	ASL - Zero Page	2	5
ØØ7	Ø7	---		
ØØ8	Ø8	PHP	1	3
ØØ9	Ø9	ORA - Immediate	2	2
Ø1Ø	ØA	ASL - Accumulator	1	2
Ø11	ØB	---		
Ø12	ØC	---		
Ø13	ØD	ORA - Absolute	3	4
Ø14	ØE	ASL - Absolute	3	6
Ø15	ØF	---		
Ø16	1Ø	BPL	2	2-4
Ø17	11	ORA - (Indirect),Y	2	5-6
Ø18	12	---		
Ø19	13	---		
Ø2Ø	14	---		
Ø21	15	ORA - Zero Page,X	2	4
Ø22	16	ASL - Zero Page,X	2	6
Ø23	17	---		
Ø24	18	CLC	1	2
Ø25	19	ORA - Absolute,Y	3	4-5
Ø26	1A	---		
Ø27	1B	---		
Ø28	1C	---		
Ø29	1D	ORA - Absolute,X	3	4-5
Ø3Ø	1E	ASL - Absolute,X	3	7
Ø31	1F	---		
Ø32	2Ø	JSR	3	6
Ø33	21	AND - (Indirect,X)	2	6
Ø34	22	---		
Ø35	23	---		
Ø36	24	BIT - Zero Page	2	3
Ø37	25	AND - Zero Page	2	3
Ø38	26	ROL - Zero Page	2	5
Ø39	27	---		
Ø4Ø	28	PLP	1	4
Ø41	29	AND - Immediate	2	2
Ø42	2A	ROL - Accumulator	1	2
Ø43	2B	---		
Ø44	2C	BIT - Absolute	3	4
Ø45	2D	AND - Absolute	3	4
Ø46	2E	ROL - Absolute	3	6
Ø47	2F	---		
Ø48	3Ø	BMI	2	2-4
Ø49	31	AND - (Indirect),Y	2	5-6
Ø5Ø	32	---		
Ø51	33	---		
Ø52	34	---		
Ø53	35	AND - Zero Page,X	2	4
Ø54	36	ROL - Zero Page,X	2	6
Ø55	37	---		
Ø56	38	SEC	1	2
Ø57	39	AND - Absolute,Y	3	4-5
Ø58	3A	---		
Ø59	3B	---		
Ø6Ø	3C	---		
Ø61	3D	AND - Absolute,X	3	4-5
Ø62	3E	ROL - Absolute,X	3	7
Ø63	3F	---		
Ø64	4Ø	RTI	1	6
Ø65	41	EOR - (Indirect,X)	2	6
Ø66	42	---		
Ø67	43	---		
Ø68	44	---		
Ø69	45	EOR - Zero Page	2	3
Ø7Ø	46	LSR - Zero Page	2	5
Ø71	47	---		
Ø72	48	PHA	1	3
Ø73	49	EOR - Immediate	2	2
Ø74	4A	LSR - Accumulator	1	2
Ø75	4B	---		
Ø76	4C	JMP - Absolute	3	3
Ø77	4D	EOR - Absolute	3	4
Ø78	4E	LSR - Absolute	3	6
Ø79	4F	---		
Ø8Ø	5Ø	BVC	2	2-4
Ø81	51	EOR - (Indirect),Y	2	5-6
Ø82	52	---		
Ø83	53	---		
Ø84	54	---		
Ø85	55	EOR - Zero Page,X	2	4
Ø86	56	LSR - Zero Page,X	2	6
Ø87	57	---		
Ø88	58	CLI	1	2
Ø89	59	EOR - Absolute,Y	3	4-5
Ø9Ø	5A	---		
Ø91	5B	---		
Ø92	5C	---		
Ø93	5D	EOR - Absolute,X	3	4-5
Ø94	5E	LSR - Absolute,X	3	7
Ø95	5F	---		
Ø96	6Ø	RTS	1	6
Ø97	61	ADC - (Indirect,X)	2	6
Ø98	62	---		
Ø99	63	---		
1ØØ	64	---		
1Ø1	65	ADC - Zero Page	2	3
1Ø2	66	ROR - Zero Page	2	5
1Ø3	67	---		
1Ø4	68	PLA	1	4
1Ø5	69	ADC - Immediate	2	2
1Ø6	6A	ROR - Accumulator	1	2
1Ø7	6B	---		
1Ø8	6C	JMP - Indirect	3	5
1Ø9	6D	ADC - Absolute	3	4
11Ø	6E	ROR - Absolute	3	6
111	6F	---		
112	7Ø	BVS	2	2-4
113	71	ADC - (Indirect),Y	2	5-6
114	72	---		
115	73	---		
116	74	---		
117	75	ADC - Zero Page,X	2	4
118	76	ROR - Zero Page,X	2	6
119	77	---		
12Ø	78	SEI	1	2
121	79	ADC - Absolute,Y	3	4-5
122	7A	---		
123	7B	---		
124	7C	---		
125	7D	ADC - Absolute,X	3	4-5
126	7E	ROR - Absolute,X	3	7
127	7F	---		
128	8Ø	---		
129	81	STA - (Indirect,X)	2	6
13Ø	82	---		
131	83	---		
132	84	STY - Zero Page	2	3
133	85	STA - Zero Page	2	3
134	86	STX - Zero Page	2	3
135	87	---		
136	88	DEY	1	2
137	89	---		
138	8A	TXA	1	2
139	8B	---		
14Ø	8C	STY - Absolute	3	4
141	8D	STA - Absolute	3	4
142	8E	STX - Absolute	3	4
143	8F	---		
144	9Ø	BCC	2	2-4
145	91	STA - (Indirect),Y	2	6
146	92	---		
147	93	---		
148	94	STY - Zero Page,X	2	4
149	95	STA - Zero Page,X	2	4
15Ø	96	STX - Zero Page,Y	2	4
151	97	---		
152	98	TYA	1	2
153	99	STA - Absolute,Y	3	5
154	9A	TXS	1	2
155	9B	---		
156	9C	---		
157	9D	STA - Absolute,X	3	5
158	9E	---		
159	9F	---		
16Ø	AØ	LDY - Immediate	2	2
161	A1	LDA - (Indirect,X)	2	6
162	A2	LDX - Immediate	2	2
163	A3	---		
164	A4	LDY - Zero Page	2	3
165	A5	LDA - Zero Page	2	3
166	A6	LDX - Zero Page	2	3
167	A7	---		
168	A8	TAY	1	2
169	A9	LDA - Immediate	2	2
17Ø	AA	TAX	1	2
171	AB	---		
172	AC	LDY - Absolute	3	4
173	AD	LDA - Absolute	3	4
174	AE	LDX - Absolute	3	4
175	AF	---		
176	BØ	BCS	2	2-4
177	B1	LDA - (Indirect),Y	2	5-6
178	B2	---		
179	B3	---		
18Ø	B4	LDY - Zero Page,X	2	4
181	B5	LDA - Zero Page,X	2	4
182	B6	LDX - Zero Page,Y	2	4
183	B7	---		
184	B8	CLV	1	2
185	B9	LDA - Absolute,Y	3	4-5
186	BA	TSX	1	2
187	BB	---		
188	BC	LDY - Absolute,X	3	4-5
189	BD	LDA - Absolute,X	3	4-5
19Ø	BE	LDX - Absolute,Y	3	4-5
191	BF	---		
192	CØ	CPY - Immediate	2	2
193	C1	CMP - (Indirect,X)	2	6
194	C2	---		
195	C3	---		
196	C4	CPY - Zero Page	2	3
197	C5	CMP - Zero Page	2	3
198	C6	DEC - Zero Page	2	5
199	C7	---		
2ØØ	C8	INY	1	2
2Ø1	C9	CMP - Immediate	2	2
2Ø2	CA	DEX	1	2
2Ø3	CB	---		
2Ø4	CC	CPY - Absolute	3	4
2Ø5	CD	CMP - Absolute	3	4
2Ø6	CE	DEC - Absolute	3	6
2Ø7	CF	---		
2Ø8	DØ	BNE	2	2-4
2Ø9	D1	CMP - (Indirect),Y	2	5-6
21Ø	D2	---		
211	D3	---		
212	D4	---		
213	D5	CMP - Zero Page,X	2	4
214	D6	DEC - Zero Page,X	2	6
215	D7	---		
216	D8	CLD	1	2
217	D9	CMP - Absolute,Y	3	4-5
218	DA	---		
219	DB	---		
22Ø	DC	---		
221	DD	CMP - Absolute,X	3	4-5
222	DE	DEC - Absolute,X	3	7
223	DF	---		
224	EØ	CPX - Immediate	2	2
225	E1	SBC - (Indirect,X)	2	6
226	E2	---		
227	E3	---		
228	E4	CPX - Zero Page	2	3
229	E5	SBC - Zero Page	2	3
23Ø	E6	INC - Zero Page	2	5
231	E7	---		
232	E8	INX	1	2
233	E9	SBC - Immediate	2	2
234	EA	NOP	1	2
235	EB	---		
236	EC	CPX - Absolute	3	4
237	ED	SBC - Absolute	3	4
238	EE	INC - Absolute	3	6
239	EF	---		
24Ø	FØ	BEQ	2	2-4
241	F1	SBC - (Indirect),Y	2	5-6
242	F2	---		
243	F3	---		
244	F4	---		
245	F5	SBC - Zero Page,X	2	4
246	F6	INC - Zero Page,X	2	6
247	F7	---		
248	F8	SED	1	2
249	F9	SBC - Absolute,Y	3	4-5
25Ø	FA	---		
251	FB	---		
252	FC	---		
253	FD	SBC - Absolute,X	3	4-5
254	FE	INC - Absolute,X	3	7
255	FF	---		

6502 INSTRUCTION SUMMARY

	Accumulator	Immediate	Zero Page	Zero Page, X	Zero Page, Y	Absolute	Absolute, X	Absolute, Y	Implied	Relative	(Indirect, X)	(Indirect), Y	Absolute Indirect
ADC	-	1Ø5 69	1Ø1 65	117 75	-	1Ø9 6D	125 7D	121 79	-	-	Ø97 61	113 71	-
AND	-	Ø41 29	Ø37 25	Ø53 35	-	Ø45 2D	Ø61 3D	Ø57 39	-	-	Ø33 21	Ø49 31	-
ASL	Ø1Ø ØA	-	ØØ6 Ø6	Ø22 16	-	Ø14 ØE	Ø3Ø 1E	-	-	-	-	-	-
BCC	-	-	-	-	-	-	-	-	-	144 9Ø	-	-	-
BCS	-	-	-	-	-	-	-	-	-	176 BØ	-	-	-
BEQ	-	-	-	-	-	-	-	-	-	24Ø FØ	-	-	-
BIT	-	-	Ø36 24	-	-	Ø44 2C	-	-	-	-	-	-	-
BMI	-	-	-	-	-	-	-	-	-	Ø48 3Ø	-	-	-
BNE	-	-	-	-	-	-	-	-	-	2Ø8 DØ	-	-	-
BPL	-	-	-	-	-	-	-	-	-	Ø16 1Ø	-	-	-
BRK	-	-	-	-	-	-	-	-	ØØØ ØØ	-	-	-	-
BVC	-	-	-	-	-	-	-	-	-	Ø8Ø 5Ø	-	-	-
BVS	-	-	-	-	-	-	-	-	-	112 7Ø	-	-	-
CLC	-	-	-	-	-	-	-	-	Ø24 18	-	-	-	-
CLD	-	-	-	-	-	-	-	-	216 D8	-	-	-	-
CLI	-	-	-	-	-	-	-	-	Ø88 58	-	-	-	-
CLV	-	-	-	-	-	-	-	-	184 B8	-	-	-	-
CMP	-	2Ø1 C9	197 C5	213 D5	-	2Ø5 CD	221 DD	217 D9	-	-	193 C1	2Ø9 D1	-
CPX	-	224 EØ	228 E4	-	-	236 EC	-	-	-	-	-	-	-
CPY	-	192 CØ	196 C4	-	-	2Ø4 CC	-	-	-	-	-	-	-
DEC	-	-	198 C6	214 D6	-	2Ø6 CE	222 DE	-	-	-	-	-	-
DEX	-	-	-	-	-	-	-	-	2Ø2 CA	-	-	-	-
DEY	-	-	-	-	-	-	-	-	136 88	-	-	-	-
EOR	-	Ø73 49	Ø69 45	Ø85 55	-	Ø77 4D	Ø93 5D	Ø89 59	-	-	Ø65 41	Ø81 51	-
INC	-	-	23Ø E6	246 F6	-	238 EE	254 FE	-	-	-	-	-	-
INX	-	-	-	-	-	-	-	-	232 E8	-	-	-	-
INY	-	-	-	-	-	-	-	-	2ØØ C8	-	-	-	-
JMP	-	-	-	-	-	Ø76 4C	-	-	-	-	-	-	1Ø8 6C
JSR	-	-	-	-	-	Ø32 2Ø	-	-	-	-	-	-	-
LDA	-	169 A9	165 A5	181 B5	-	173 AD	189 BD	185 B9	-	-	161 A1	177 B1	-
LDX	-	162 A2	166 A6	-	182 B6	174 AE	-	19Ø BE	-	-	-	-	-
LDY	-	16Ø AØ	164 A4	18Ø B4	-	172 AC	188 BC	-	-	-	-	-	-
LSR	Ø74 4A	-	Ø7Ø 46	Ø86 56	-	Ø78 4E	Ø94 5E	-	-	-	-	-	-
NOP	-	-	-	-	-	-	-	-	234 EA	-	-	-	-
ORA	-	ØØ9 Ø9	ØØ5 Ø5	Ø21 15	-	Ø13 ØD	Ø29 1D	Ø25 19	-	-	ØØ1 Ø1	Ø17 11	-
PHA	-	-	-	-	-	-	-	-	Ø72 48	-	-	-	-
PHP	-	-	-	-	-	-	-	-	ØØ8 Ø8	-	-	-	-
PLA	-	-	-	-	-	-	-	-	1Ø4 68	-	-	-	-
PLP	-	-	-	-	-	-	-	-	Ø4Ø 28	-	-	-	-
ROL	Ø42 2A	-	Ø38 26	Ø54 36	-	Ø46 2E	Ø62 3E	-	-	-	-	-	-
ROR	1Ø6 6A	-	1Ø2 66	118 76	-	11Ø 6E	126 7E	-	-	-	-	-	-
RTI	-	-	-	-	-	-	-	-	Ø64 4Ø	-	-	-	-
RTS	-	-	-	-	-	-	-	-	Ø96 6Ø	-	-	-	-
SBC	-	233 E9	229 E5	245 F5	-	237 ED	253 FD	249 F9	-	-	225 E1	241 F1	-
SEC	-	-	-	-	-	-	-	-	Ø56 38	-	-	-	-
SED	-	-	-	-	-	-	-	-	248 F8	-	-	-	-
SEI	-	-	-	-	-	-	-	-	12Ø 78	-	-	-	-
STA	-	-	133 85	149 95	-	141 8D	157 9D	153 99	-	-	129 81	145 91	-
STX	-	-	134 86	-	15Ø 96	142 8E	-	-	-	-	-	-	-
STY	-	-	132 84	148 94	-	14Ø 8C	-	-	-	-	-	-	-
TAX	-	-	-	-	-	-	-	-	17Ø AA	-	-	-	-
TAY	-	-	-	-	-	-	-	-	168 A8	-	-	-	-
TSX	-	-	-	-	-	-	-	-	186 BA	-	-	-	-
TXA	-	-	-	-	-	-	-	-	138 8A	-	-	-	-
TXS	-	-	-	-	-	-	-	-	154 9A	-	-	-	-
TYA	-	-	-	-	-	-	-	-	152 98	-	-	-	-

Accumulator | Immediate | Zero Page | Zero Page, X | Zero Page, Y | Absolute | Absolute, X | Absolute, Y | Implied | Relative | (Indirect, X) | (Indirect), Y | Absolute Indirect

INSTRUCTION ADDRESSING MODES AND RELATED EXECUTION TIMES (in clock cycles)

	Accumulator	Immediate	Zero Page	Zero Page, X	Zero Page, Y	Absolute	Absolute, X	Absolute, Y	Implied	Relative	(Indirect, X)	(Indirect), Y	Absolute Indirect
ADC	.	2	3	4	.	4	4*	4*	.	.	6	5*	.
AND	.	2	3	4	.	4	4*	4*	.	.	6	5*	.
ASL	2	.	5	6	.	6	7	.	.	.	.	.	.
BCC	.	.	.	.	.	.	.	.	.	2**	.	.	.
BCS	.	.	.	.	.	.	.	.	.	2**	.	.	.
BEQ	.	.	.	.	.	.	.	.	.	2**	.	.	.
BIT	.	.	3	.	.	4	.	.	.	.	.	.	.
BMI	.	.	.	.	.	.	.	.	.	2**	.	.	.
BNE	.	.	.	.	.	.	.	.	.	2**	.	.	.
BPL	.	.	.	.	.	.	.	.	.	2**	.	.	.
BRK	.	.	.	.	.	.	.	.	7	.	.	.	.
BVC	.	.	.	.	.	.	.	.	.	2**	.	.	.
BVS	.	.	.	.	.	.	.	.	.	2**	.	.	.
CLC	.	.	.	.	.	.	.	.	2	.	.	.	.
CLD	.	.	.	.	.	.	.	.	2	.	.	.	.
CLI	.	.	.	.	.	.	.	.	2	.	.	.	.
CLV	.	.	.	.	.	.	.	.	2	.	.	.	.
CMP	.	2	3	4	.	4	4*	4*	.	.	6	5*	.
CPX	.	2	3	.	.	4	.	.	.	.	.	.	.
CPY	.	2	3	.	.	4	.	.	.	.	.	.	.
DEC	.	.	5	6	.	6	7	.	.	.	.	.	.
DEX	.	.	.	.	.	.	.	.	2	.	.	.	.
DEY	.	.	.	.	.	.	.	.	2	.	.	.	.
EOR	.	2	3	4	.	4	4*	4*	.	.	6	5*	.
INC	.	.	5	6	.	6	7	.	.	.	.	.	.
INX	.	.	.	.	.	.	.	.	2	.	.	.	.
INY	.	.	.	.	.	.	.	.	2	.	.	.	.
JMP	.	.	.	.	.	3	.	.	.	.	.	.	5

	Accumulator	Immediate	Zero Page	Zero Page, X	Zero Page, Y	Absolute	Absolute, X	Absolute, Y	Implied	Relative	(Indirect, X)	(Indirect), Y	Absolute Indirect
JSR	.	.	.	.	.	6	.	.	.	.	.	.	.
LDA	.	2	3	4	.	4	4*	4*	.	.	6	5*	.
LDX	.	2	3	.	4	4	.	4*	.	.	.	.	.
LDY	.	2	3	4	.	4	4*	.	.	.	.	.	.
LSR	2	.	5	6	.	6	7	.	.	.	.	.	.
NOP	.	.	.	.	.	.	.	.	2	.	.	.	.
ORA	.	2	3	4	.	4	4*	4*	.	.	6	5*	.
PHA	.	.	.	.	.	.	.	.	3	.	.	.	.
PHP	.	.	.	.	.	.	.	.	3	.	.	.	.
PLA	.	.	.	.	.	.	.	.	4	.	.	.	.
PLP	.	.	.	.	.	.	.	.	4	.	.	.	.
ROL	2	.	5	6	.	6	7	.	.	.	.	.	.
ROR	2	.	5	6	.	6	7	.	.	.	.	.	.
RTI	.	.	.	.	.	.	.	.	6	.	.	.	.
RTS	.	.	.	.	.	.	.	.	6	.	.	.	.
SBC	.	2	3	4	.	4	4*	4*	.	.	6	5*	.
SEC	.	.	.	.	.	.	.	.	2	.	.	.	.
SED	.	.	.	.	.	.	.	.	2	.	.	.	.
SEI	.	.	.	.	.	.	.	.	2	.	.	.	.
STA	.	.	3	4	.	4	5	5	.	.	6	6	.
STX	.	.	3	.	4	4	.	.	.	.	.	.	.
STY	.	.	3	4	.	4	.	.	.	.	.	.	.
TAX	.	.	.	.	.	.	.	.	2	.	.	.	.
TAY	.	.	.	.	.	.	.	.	2	.	.	.	.
TSX	.	.	.	.	.	.	.	.	2	.	.	.	.
TXA	.	.	.	.	.	.	.	.	2	.	.	.	.
TXS	.	.	.	.	.	.	.	.	2	.	.	.	.
TYA	.	.	.	.	.	.	.	.	2	.	.	.	.

* Add one cycle if indexing across page boundary
** Add one cycle if branch is taken, Add one additional if branching operation crosses page boundary

MCS6501-MCS6505 MICROPROCESSOR INSTRUCTION SET – ALPHABETIC SEQUENCE

ADC Add Memory to Accumulator with Carry
AND "AND" Memory with Accumulator
ASL Shift Left One Bit (Memory or Accumulator)

BCC Branch on Carry Clear
BCS Branch on Carry Set
BEQ Branch on Result Zero
BIT Test Bits in Memory with Accumulator
BMI Branch on Result Minus
BNE Branch on Result not Zero
BPL Branch on Result Plus
BRK Force Break
BVC Branch on Overflow Clear
BVS Branch on Overflow Set

CLC Clear Carry Flag
CLD Clear Decimal Mode
CLI Clear Interrupt Disable Bit
CLV Clear Overflow Flag
CMP Compare Memory and Accumulator
CPX Compare Memory and Index X
CPY Compare Memory and Index Y

DEC Decrement Memory by One
DEX Decrement Index X by One
DEY Decrement Index Y by One

EOR "Exclusive Or" Memory with Accumulator

INC Increment Memory by One
INX Increment Index X by One
INY Increment Index Y by One

JMP Jump to New Location
JSR Jump to New Location Saving Return Address

LDA Load Accumulator with Memory
LDX Load Index X with Memory
LDY Load Index Y with Memory
LSR Shift Right One Bit (Memory or Accumulator)

NOP No Operation

ORA "OR" Memory with Accumulator

PHA Push Accumulator on Stack
PHP Push Processor Status on Stack
PLA Pull Accumulator from Stack
PLP Pull Processor Status from Stack

ROL Rotate One Bit Left (Memory or Accumulator)
ROR Rotate One Bit Right (Memory or Accumulator)
RTI Return from Interrupt
RTS Return from Subroutine

SBC Subtract Memory from Accumulator with Borrow
SEC Set Carry Flag
SED Set Decimal Mode
SEI Set Interrupt Disable Status
STA Store Accumulator in Memory
STX Store Index X in Memory
STY Store Index Y in Memory

TAX Transfer Accumulator to Index X
TAY Transfer Accumulator to Index Y
TSX Transfer Stack Pointer to Index X
TXA Transfer Index X to Accumulator
TXS Transfer Index X to Stack Pointer
TYA Transfer Index Y to Accumulator