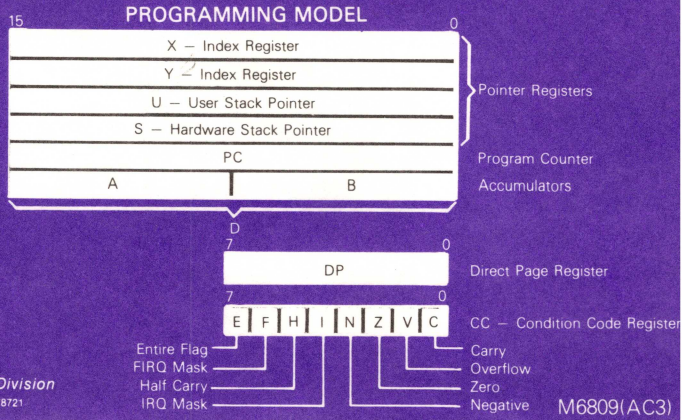


MC6809 — MC6809E

8-bit microprocessor Reference Card



MOTOROLA INC.
MOS Integrated Circuits Division
3501 ED BLUESTEIN BLVD. AUSTIN, TEXAS 78721

OP	MNEM	MODE	~	#	OP	MNEM	MODE	~	#	OP	MNEM	MODE	~	#
00	NEG	DIRECT	6	2	1C	ANDCC	IMMED	3	2	2E	BGT	RELATIVE	3	2
03	COM	↑	6	2	1D	SEX	INHERENT	2	1	2F	BLE	RELATIVE	3	2
04	LSR	↑	6	2	1E	EXG	IMMED	8	2	30	LEAX	INDEXED	4	2
06	ROR	↑	6	2	1F	TFR	IMMED	6	2	31	LEAY	↑	4	2
07	ASR	↑	6	2	20	BRA	RELATIVE	3	2	32	LEAS	↑	4	2
08	ASL/LSL	↑	6	2	21	BRN	↑	3	2	33	LEAU	INDEXED	4	2
09	ROL	↑	6	2	22	BHI	↑	3	2	34	PSHS	IMMED	5	2
0A	DEC	↑	6	2	23	BLS	↑	3	2	35	PULS	↑	5	2
0C	INC	↑	6	2	24	BHS/BCC	↑	3	2	36	PSHU	↑	5	2
0D	TST	↑	6	2	25	BLO/BCS	↑	3	2	37	PULU	IMMED	5	2
0E	JMP	↓	3	2	26	BNE	↑	3	2	39	RTS	INHERENT	5	1
0F	CLR	DIRECT	6	2	27	BEQ	↑	3	2	3A	ABX	↑	3	1
12	NOP	INHERENT	2	1	28	BVC	↑	3	2	3B	RTI	INHERENT	6/15	1
13	SYNC	INHERENT	4	1	29	BVS	↑	3	2	3C	CWAI	IMMED	20	2
16	LBRA	RELATIVE	5	3	2A	BPL	↑	3	2	3D	MUL	INHERENT	11	1
17	LBSR	RELATIVE	9	3	2B	BMI	↑	3	2	3F	SWI	↑	19	1
19	DAA	INHERENT	2	1	2C	BGE	↑	3	2	40	NEGA	↑	2	1
1A	ORCC	IMMED	3	2	2D	BLT	RELATIVE	3	2	43	COMA	INHERENT	2	1

OP	MNEM	MODE	~	#	OP	MNEM	MODE	~	#	OP	MNEM	MODE	~	#
44	LSRA	INHERENT	2	1	5D	TSTB	INHERENT	2	1	77	ASR	EXTENDED	7	3
46	RORA	↑	2	1	5F	CLRB	INHERENT	2	1	78	ASL/LSL	↑	7	3
47	ASRA	↑	2	1	60	NEG	INDEXED	6	2	79	ROL	↑	7	3
48	ASLA/LSLA	↑	2	1	63	COM	↑	6	2	7A	DEC	↑	7	3
49	ROLA	↑	2	1	64	LSR	↑	6	2	7C	INC	↑	7	3
4A	DECA	↑	2	1	66	ROR	↑	6	2	7D	TST	↑	7	3
4C	INCA	↑	2	1	67	ASR	↑	6	2	7E	JMP	↑	4	3
4D	TSTA	↑	2	1	68	ASL/LSL	↑	6	2	7F	CLR	EXTENDED	7	3
4F	CLRA	↑	2	1	69	ROL	↑	6	2	80	SUBA	IMMED	2	2
50	NEGB	↑	2	1	6A	DEC	↑	6	2	81	CMPA	↑	2	2
53	COMB	↑	2	1	6C	INC	↑	6	2	82	SBCA	↑	2	2
54	LSRB	↑	2	1	6D	TST	↑	6	2	83	SUBD	↑	4	3
56	RORB	↑	2	1	6E	JMP	↑	3	2	84	ANDA	↑	2	2
57	ASRB	↑	2	1	6F	CLR	INDEXED	6	2	85	BITA	↑	2	2
58	ASLB/LSLB	↑	2	1	70	NEG	EXTENDED	7	3	86	LDA	↑	2	2
59	ROLB	↑	2	1	73	COM	↑	7	3	88	EORA	↑	2	2
5A	DECB	↑	2	1	74	LSR	↑	7	3	89	ADCA	↑	2	2
5C	INCB	INHERENT	2	1	76	ROR	EXTENDED	7	3	8A	ORA	↑	2	2

OP	MNEM	MODE	~	#	OP	MNEM	MODE	~	#	OP	MNEM	MODE	~	#
8B	ADDA	IMMED	2	2	9E	LDX	DIRECT	5	2	B0	SUBA	EXTENDED	5	3
8C	CMPX	IMMED	4	3	9F	STX	DIRECT	5	2	B1	CMPA	↑	5	3
8D	BSR	RELATIVE	7	2	A0	SUBA	INDEXED	4	2	B2	SBCA	↑	5	3
8E	LDX	IMMED	3	3	A1	CMPA	↑	4	2	B3	SUBD	↑	7	3
90	SUBA	DIRECT	4	2	A2	SBCA	↑	4	2	B4	ANDA	↑	5	3
91	CMPA	↑	4	2	A3	SUBD	↑	6	2	B5	BITA	↑	5	3
92	SBCA	↑	4	2	A4	ANDA	↑	4	2	B6	LDA	↑	5	3
93	SUBD	↑	6	2	A5	BITA	↑	4	2	B7	STA	↑	5	3
94	ANDA	↑	4	2	A6	LDA	↑	4	2	B8	EORA	↑	5	3
95	BITA	↑	4	2	A7	STA	↑	4	2	B9	ADCA	↑	5	3
96	LDA	↑	4	2	A8	EORA	↑	4	2	BA	ORA	↑	5	3
97	STA	↑	4	2	A9	ADCA	↑	4	2	BB	ADDA	↑	5	3
98	EORA	↑	4	2	AA	ORA	↑	4	2	BC	CMPX	↑	7	3
99	ADCA	↑	4	2	AB	ADDA	↑	4	2	BD	JSR	↑	8	3
9A	ORA	↑	4	2	AC	CMPX	↑	6	2	BE	LDX	↓	6	3
9B	ADDA	↑	4	2	AD	JSR	↑	7	2	BF	STX	EXTENDED	6	3
9C	CMPX	↓	6	2	AE	LDX	↑	5	2	C0	SUBB	IMMED	2	2
9D	JSR	DIRECT	7	2	AF	STX	INDEXED	5	2	C1	CMPB	IMMED	2	2

OP	MNEM	MODE	~	#	OP	MNEM	MODE	~	#	OP	MNEM	MODE	~	#
C2	SBCB	IMMED	2	2	D7	STB	DIRECT	4	2	E9	ADCB	INDEXED	4	2
C3	ADDD		4	3	D8	EORB		4	2	EA	ORB		4	2
C4	ANDB		2	2	D9	ADCB		4	2	EB	ADDB		4	2
C5	BITB		2	2	DA	ORB		4	2	EC	LDD		5	2
C6	LDB		2	2	DB	ADDB		4	2	ED	STD		5	2
C8	EORB		2	2	DC	LDD		5	2	EE	LDU		5	2
C9	ADCB		2	2	DD	STD		5	2	EF	STU	INDEXED	5	2
CA	ORB		2	2	DE	LDU		5	2	F0	SUBB	EXTENDED	5	3
CB	ADDB		2	2	DF	STU	DIRECT	5	2	F1	CMPB		5	3
CC	LDD		3	3	E0	SUBB	INDEXED	4	2	F2	SBCB		5	3
CE	LDU	IMMED	3	3	E1	CMPB		4	2	F3	ADDD		7	3
D0	SUBB	DIRECT	4	2	E2	SBCB		4	2	F4	ANDB		5	3
D1	CMPB		4	2	E3	ADDD		6	2	F5	BITB		5	3
D2	SBCB		4	2	E4	ANDB		4	2	F6	LDB		5	3
D3	ADDD		6	2	E5	BITB		4	2	F7	STB		5	3
D4	ANDB		4	2	E6	LDB		4	2	F8	EORB		5	3
D5	BITB		4	2	E7	STB		4	2	F9	ADCB		5	3
D6	LDB	DIRECT	4	2	E8	EORB	INDEXED	4	2	FA	ORB	EXTENDED	5	3

OP	MNEM	MODE	~	#	OP	MNEM	MODE	~	#	OP	MNEM	MODE	~	#
FB	ADDB	EXTENDED	5	3	102E	LBGT	RELATIVE	5(6)	4	10CE	LDS	IMMED	4	4
FC	LDD		6	3	102F	LBLE	RELATIVE	5(6)	4	10DE	LDS	DIRECT	6	3
FD	STD		6	3	103F	SWI2	INHERENT	20	2	10DF	STS	DIRECT	6	3
FE	LDU		6	3	1083	CMPP	IMMED	5	4	10EE	LDS	INDEXED	6	3
FF	STU	EXTENDED	6	3	108C	CMPP		5	4	10EF	STS	INDEXED	6	3
1021	LBRN	RELATIVE	5	4	108E	LDY	IMMED	4	4	10FE	LDS	EXTENDED	7	4
1022	LBHI		5(6)	4	1093	CMPP	DIRECT	7	3	10FF	STS	EXTENDED	7	4
1023	LBLS		5(6)	4	109C	CMPP		7	3	113F	SWI3	INHERENT	20	2
1024	LBHS/LBCC		5(6)	4	109E	LDY		6	3	1183	CMPU	IMMED	5	4
1025	LBGS/LBLO		5(6)	4	109F	STY	DIRECT	6	3	118C	CMPS	IMMED	5	4
1026	LBNE		5(6)	4	10A3	CMPP	INDEXED	7	3	1193	CMPU	DIRECT	7	3
1027	LBEQ		5(6)	4	10AC	CMPP		7	3	119C	CMPS	DIRECT	7	3
1028	LBVC		5(6)	4	10AE	LDY		6	3	11A3	CMPU	INDEXED	7	3
1029	LBVS		5(6)	4	10AF	STY	INDEXED	6	3	11AC	CMPS	INDEXED	7	3
102A	LBPL		5(6)	4	10B3	CMPP	EXTENDED	8	4	11B3	CMPU	EXTENDED	8	4
102B	LBMI		5(6)	4	10BC	CMPP		8	4	11BC	CMPS	EXTENDED	8	4
102C	LBGE		5(6)	4	10BE	LDY		7	4					
102D	LBLT	RELATIVE	5(6)	4	10BF	STY	EXTENDED	7	4					

STACKING ORDER

Pull Order

- ↓
- CC
- A
- B
- DP
- X Hi
- X Lo
- Y Hi
- Y Lo
- U/S Hi
- U/S Lo
- PC Hi
- PC Lo

↑

Increasing Memory

INTERRUPT VECTORS

- FFFF Restart
- FFFC NMI
- FFFA SWI
- FFF8 IRQ
- FFF6 FIRQ
- FFF4 SWI2
- FFF2 SWI3
- FFF0 Reserved

MC6809

VSS	1	40	HALT
NMI	2	39	XTAL
IRQ	3	38	EXTAL
FIRQ	4	37	RESET
BS	5	36	MRDY
BA	6	35	Q
VCC	7	34	E
A0	8	33	DMA/BREQ
A1	9	32	R/W
A2	10	31	D0
A3	11	30	D1
A4	12	29	D2
A5	13	28	D3
A6	14	27	D4
A7	15	26	D5
A8	16	25	D6
A9	17	24	D7
A10	18	23	A15
A11	19	22	A14
A12	20	21	A13

MC6809E

VSS	1	40	HALT
NMI	2	39	TSC
IRQ	3	38	LIC
FIRQ	4	37	RESET
BS	5	36	AVMA
BA	6	35	Q
VCC	7	34	E
A0	8	33	BUSY
A1	9	32	R/W
A2	10	31	D0
A3	11	30	D1
A4	12	29	D2
A5	13	28	D3
A6	14	27	D4
A7	15	26	D5
A8	16	25	D6
A9	17	24	D7
A10	18	23	A15
A11	19	22	A14
A12	20	21	A13

HEXADEXIMAL AND DECIMAL CONVERSION

HOW TO USE THE TABLES

CONVERSION TO DECIMAL: Find the decimal weights for corresponding hexadecimal characters beginning with the least significant character. The sum of the decimal weight is the decimal value of the hexadecimal number.

CONVERSION TO HEXADEXIMAL: Find the highest decimal value in the table which is lower than or equal to the decimal number to be converted. The corresponding hexadecimal character is the most significant character. Subtract the decimal value found from the decimal number to be converted. With the difference, repeat the process to find subsequent hexadecimal characters.

HEXADEXIMAL AND DECIMAL CONVERSION								
15	BYTE	8	7	BYTE	0			
15	CHAR	12	11	CHAR	8	7	CHAR	0
HEX	DEC	HEX	DEC	HEX	DEC	HEX	DEC	DEC
0	0	0	0	0	0	0	0	0
1	4	096	1	256	1	16	1	1
2	8	192	2	512	2	32	2	2
3	12	288	3	768	3	48	3	3
4	16	384	4	1024	4	64	4	4
5	20	480	5	1280	5	80	5	5
6	24	576	6	1536	6	96	6	6
7	28	672	7	1792	7	112	7	7
8	32	768	8	2048	8	128	8	8
9	36	864	9	2304	9	144	9	9
A	40	960	A	2560	A	160	A	10
B	45	1056	B	2816	B	176	B	11
C	49	1152	C	3072	C	192	C	12
D	53	1248	D	3328	D	208	D	13
E	57	1344	E	3584	E	224	E	14
F	61	1440	F	3840	F	240	F	15

ASCII CHARACTER SET

Most Significant Character								
Hex	0	1	2	3	4	5	6	7
0	NUL	DLE	SP	0	@	P	-	p
1	SOH	DC1	1	1	A	Q	a	q
2	STX	DC2	2	2	B	R	b	r
3	ETX	DC3	3	3	C	S	c	s
4	EOT	DC4	4	4	D	T	d	t
5	ENQ	NAK	5	5	E	U	e	u
6	ACK	SYN	6	6	F	V	f	v
7	BEL	ETB	7	7	G	W	g	w
8	BS	CAN	8	8	H	X	h	x
9	HT	EM	9	9	I	Y	i	y
A	LF	SUB	10	10	J	Z	j	z
B	VT	ESC	11	11	K	[k	[
C	FF	FS	12	12	L	\	l	l
D	CR	GS	13	13	M]	m]
E	SO	RS	14	14	N	^	n	^
F	SI	US	15	15	O	_	o	_
								DEL

POWERS OF TWO			
2 ⁿ	n	2 ⁿ	n
1	0	128	7
2	1	256	8
4	2	512	9
8	3	1,024	10
16	4	2,048	11
32	5	4,096	12
64	6	8,192	13
			14
			15
			16
			17
			18
			19
			20