IMUL reg,mem,imm	IMUL CX,DATAY,99	8086	—
		8088	—
		80286	24
		80386	38
		80486	42
		Pentium	10
00001111 10101111 oorrmmm disp			
Format	Examples	Microprocessor	Clocks
IMUL reg,reg	IMUL CX,DX IMUL DI,BX IMUL EDX,EBX	8086	—
		8088	—
		80286	—
		80386	38
		80486	42
		Pentium	10
IMUL reg,mem	IMUL DX,DATAY IMUL CX,LIST IMUL ECX,DATA6[DI]	8086	—
		8088	—
		80286	—
		80386	41
		80486	42
		Pentium	10
1110010w port#			
Format	Examples	Microprocessor	Clocks
IN acc,pt	**IN AL,12H** **IN AX,12H** **IN AL,0FFH** IN AX,0A0H IN EAX,10H		
		80286	5
		80386	12
		80486	14
		Pentium	7

1110110w Format	Examples	Microprocessor	Clocks
IN acc,DX	**IN AL,DX** IN AX,DX IN EAX,DX	[illegible]	[illegible]
		[illegible]	[illegible]
		80286	5
		80386	13
		80486	14
		Pentium	7
[illegible]	[illegible]	[illegible]	[illegible]

1111111w oo000mmm disp Format	Examples	O D I T S Z A P C * * * * * * * * * Microprocessor	Clocks
INC reg8	**INC BL** **INC BH** **INC AL** **INC AH** **INC DH**	[illegible]	[illegible]
		[illegible]	[illegible]
		80286	2
		80386	2
		80486	1
		Pentium	1 or 3
INC mem	**INC DATA3** **INC LIST** **INC COUNT** **INC BYTE PTR [DI]** INC WORD PTR [ECX]	[illegible]	[illegible]
		[illegible]	[illegible]
		80286	7
		80386	6
		80486	3
		Pentium	1 or 3
INC reg16 **INC reg32**	**INC CX** **INC DX** **INC BP** INC ECX INC ESP	[illegible]	[illegible]
		[illegible]	[illegible]
		80286	2
		80386	2
		80486	1
		Pentium	1

INS	Input string from port		
0110110w Format	Examples	Microprocessor	Clocks
INSB INSW INSD	INSB INSW INSD INS DATA2 REP INSB	8086	—
		8088	—
		80286	5
		80386	15
		80486	17
		Pentium	9
11001101 type Format	Examples	Microprocessor	Clocks
INT type	**INT12H** **INT15H** **INT 21H** **INT 2FH** **INT 10H**	80286	23
		80386	37
		80486	30
		Pentium	16–82
11001100 Example		Microprocessor	Clocks
INT 3		80286	23
		80386	33
		80486	26
		Pentium	13–56

11001110
Example

INTO

Microprocessor	Clocks
80286	24
80386	35
80486	28
Pentium	13–56

INVD Invalidate data cache

00001111 00001000
Example

INTVD

Microprocessor	Clocks
8086	—
8088	—
80286	—
80386	—
80486	4
Pentium	15

11001101 data

O	D	I	T	S	Z	A	P	C
*	*	*	*	*	*	*	*	*

Format

IRET
IRETD

Examples

IRET
IRETD
IRET 100

Microprocessor	Clocks
80286	17
80386	22
80486	15
Pentium	8–27

0111cccc disp Format	Examples	Microprocessor	Clocks
Jcnd label (8-bit disp)	**JA ABOVE JB BELOW JG GREATER JE EQUAL JZ ZERO**		
		80286	7/3
		80386	7/3
		80486	3/1
		Pentium	1

00001111 1000cccc disp Format	Examples	Microprocessor	Clocks
Jcnd label (16-bit disp)	**JNE NOT_MORE JLE LESS_OR_SO**		
		80286	—
		80386	7/3
		80486	3/1
		Pentium	1

Condition Codes	Mnemonic	Flag	Description
0000	**JO**	**O = 1**	**Jump if overflow**
0001	**JNO**	**O = 0**	**Jump if no overflow**
0010	**JB/NAE**	**C = 1**	**Jump if below**
0011	**JAE/JNB**	**C = 0**	**Jump if above or equal**
0100	**JE/JZ**	**Z = 1**	**Jump if equal/zero**
0101	**JNE/JNZ**	**Z = 0**	**Jump if not equal/zero**
0110	**JBE/JNA**	**C = 1 + Z = 1**	**Jump if below or equal**
0111	**JA/JNBE**	**C = 0 • Z = 0**	**Jump if above**
1000	**JS**	**S = 1**	**Jump if sign**
1001	**JNS**	**S = 0**	**Jump if no sign**
1010	**JP/JPE**	**P = 1**	**Jump if parity**
1011	**JNP/JPO**	**P = 0**	**Jump if no parity**
1100	**JL/JNGE**	**S • O**	**Jump if less than**
1101	**JGE/JNL**	**S = 0**	**Jump if greater than or equal**
1110	**JLE/JNG**	**Z = 1 + S • O**	**Jump if less than or equal**
1111	**JG/JNLE**	**Z = 0 + S = O**	**Jump if greater than**

11100011 Format	Examples	Microprocessor	Clocks
JCXZ label **JECXZ label**	**JCXZ ABOVE** **JCXZ BELOW** JECXZ GREATER JECXZ EQUAL **JCXZ NEXT**		
		80286	8/4
		80386	9/5
		80486	8/5
		Pentium	6/5

11101011 disp Format	Examples	Microprocessor	Clocks
JMP label **(short)**	**JMP SHORT UP** **JMP SHORT DOWN** **JMP SHORT OVER** **JMP SHORT CIRCUIT** **JMP SHORT JOKE**		
		80286	7
		80386	7
		80486	3
		Pentium	1

11101001 disp Format	Examples	Microprocessor	Clocks
JMP label **(near)**	**JMP VERS** **JMP FROG** **JMP UNDER** **JMP NEAR PTR OVER**		
		80286	7
		80386	7
		80486	3
		Pentium	1

11101010 disp Format	Examples	Microprocessor	Clocks
JMP label (far)	**JMP NOT_MORE JMP UNDER JMP AGAIN JMP FAR PTR THERE**	[illegible]	[illegible]
		80286	11
		80386	12
		80486	17
		Pentium	3
11111111 oo100mmm Format	Examples	Microprocessor	Clocks
JMP reg (near)	**JMP AX **JMP EAX **JMP CX JMP DX**	[illegible]	[illegible]
		80286	7
		80386	7
		80486	3
		Pentium	2
JMP mem (near)	**JMP VERS JMP FROG JMP CS:UNDER **JMP DATA1[DI+2]	[illegible]	[illegible]
		80286	11
		80386	10
		80486	5
		Pentium	4
11111111 oo101mmm Format	Examples	Microprocessor	Clocks
JMP mem (far)	**JMP WAY_OFF JMP TABLE JMP UP JMP OUT_OF_HERE**	[illegible]	[illegible]
		80286	15
		80386	12
		80486	13
		Pentium	4

10011111 Example		Microprocessor	Clocks
LAHF			
		80286	2
		80386	2
		80486	3
		Pentium	2
LAR	Load access rights byte		
00001111 00000010 oorrrmmm disp		O D I T S Z A P C *	
Format	Examples	Microprocessor	Clocks
LAR reg,reg	LAR AX,BX LAR CX,DX LAR ECX,EDX	8086	—
		8088	—
		80286	14
		80386	15
		80486	11
		Pentium	8
LAR reg,mem	LAR CX,DATA1 LAR AX,LIST3 LAR ECX,TOAD	8086	—
		8088	—
		80286	16
		80386	16
		80486	11
		Pentium	8

11000101 oorrrmmm

Format	Examples	Microprocessor	Clocks
LDS reg,mem	**LDS DI,DATA3** **LDS SI,LIST2** **LDS BX,ARRAY_PTR** **LDS CX,PNTR**	80286	7
		80386	7
		80486	6
		Pentium	4

10001101 oorrrmmm disp

Format	Examples	Microprocessor	Clocks
LEA reg,mem	**LEA DI,DATA3** **LEA SI,LIST2** **LEA BX,ARRAY_PTR** **LEA CX,PNTR**	80286	3
		80386	2
		80486	2
		Pentium	1

LEAVE Leave high-level procedure

11001001

Example	Microprocessor	Clocks
LEAVE	8086	—
	8088	—
	80286	5
	80386	4
	80486	5
	Pentium	3

11000100 oorrrmmm Format	Examples	Microprocessor	Clocks
LES reg,mem	**LES DI,DATA3** **LES SI,LIST2** **LES BX,ARRAY_PTR** **LES CX,PNTR**	80286	7
		80386	7
		80486	6
		Pentium	4
LFS	Load far pointer to FS and register		
00001111 10110100 oorrrmmm disp Format	Examples	Microprocessor	Clocks
LFS reg,mem	LFS DI,DATA3 LFS SI,LIST2 LFS BX,ARRAY_PTR LFS CX,PNTR	8086	—
		8088	—
		80286	—
		80386	7
		80486	6
		Pentium	4
LGDT	Load global descriptor table		
00001111 00000001 oo010mmm disp Format	Examples	Microprocessor	Clocks
LGDT mem64	LGDT DESCRIP LGDT TABLED	8086	—
		8088	—
		80286	11
		80386	11
		80486	11
		Pentium	6

LGS	Load far pointer to GS and register		
00001111 10110101 oorrrmmm disp Format	Examples	Microprocessor	Clocks
LGS reg,mem	LGS DI,DATA3 LGS SI,LIST2 LGS BX,ARRAY_PTR LGS CX,PNTR	8086	—
		8088	—
		80286	—
		80386	7
		80486	6
		Pentium	4
LIDT	Load interrupt descriptor table		
00001111 00000001 oo011mmm disp Format	Examples	Microprocessor	Clocks
LIDT mem64	LIDT DATA3 LIDT LIST2	8086	—
		8088	—
		80286	12
		80386	11
		80486	11
		Pentium	6
LLDT	Load local descriptor table		
00001111 00000000 oo010mmm disp Format	Examples	Microprocessor	Clocks
LLDT reg	LLDT BX LLDT DX LLDT CX	8086	—
		8088	—
		80286	17
		80386	20
		80486	11
		Pentium	9

LLDT mem	LLDT DATA1 LLDT LIST3 LLDT TOAD	8086	—
		8088	—
		80286	19
		80386	24
		80486	11
		Pentium	9
LMSW	Load machine status word (80286 only)		
00001111 00000001 oo110mmm disp			
Format	Examples	Microprocessor	Clocks
LMSW reg	LMSW BX LMSW DX LMSW CX	8086	—
		8088	—
		80286	3
		80386	10
		80486	2
		Pentium	8
LMSW mem	LMSW DATA1 LMSW LIST3 LMSW TOAD	8086	—
		8088	—
		80286	6
		80386	13
		80486	3
		Pentium	8

11110000

Format	Examples	Microprocessor	Clocks
LOCK:inst	LOCK:XCHG AX,BX LOCK:ADD AL,3	80286	0
		80386	0
		80486	1
		Pentium	1

1010110w

Format	Examples	Microprocessor	Clocks
LODSB **LODSW** LODSD	**LODSB** **LODSW** LODSD LODS DATA3	80286	5
		80386	5
		80486	5
		Pentium	2

11100010 disp

Format	Examples	Microprocessor	Clocks
LOOP label **LOOPD label**	**LOOP NEXT** **LOOP BACK** LOOPD LOOPS	80286	8/4
		80386	11
		80486	7/6
		Pentium	5/6

11100001 disp

Format	Examples	Microprocessor	Clocks
LOOPE label LOOPED label **LOOPZ label** LOOPZD label	**LOOPE AGAIN** LOOPED UNTIL **LOOPZ ZORRO** LOOPZD WOW	80286	8/4
		80386	11
		80486	9/6
		Pentium	7/8

11100000 disp

Format	Examples	Microprocessor	Clocks
LOOPNE label LOOPNED label **LOOPNZ label** LOOPNZD label	**LOOPNE FORWARD** LOOPNED UPS **LOOPNZ TRY_AGAIN** LOOPNZD WOO	80286	8/4
		80386	11
		80486	9/6
		Pentium	7/8

LSL Load segment limit

00001111 00000011 oorrrmmm disp

O D I T S Z A P C
*

Format	Examples	Microprocessor	Clocks
LSL reg,reg	LSL AX,BX LSL CX,BX LSL EDX,EAX	8086	—
		8088	—
		80286	14
		80386	25
		80486	10
		Pentium	8

LSL reg,mem	LSL AX,LIMIT LSL EAX,NUM	8086	—
		8088	—
		80286	16
		80386	26
		80486	10
		Pentium	8
LSS	Load far pointer to SS and register		
00001111 10110010 oorrrmmm disp Format	Examples	Microprocessor	Clocks
LSS reg,mem	LSS DI,DATA1 LSS SP,STACK_TOP LSS CX,ARRAY	8086	—
		8088	—
		80286	—
		80386	7
		80486	6
		Pentium	4
LTR	Load task register		
00001111 00000000 oo001mmm disp Format	Examples	Microprocessor	Clocks
LTR reg	LTR AX LTR CX LTR DX	8086	—
		8088	—
		80286	17
		80386	23
		80486	20
		Pentium	10

LTR mem16	LTR TASK LTR NUM	8086	—
		8088	—
		80286	19
		80386	27
		80486	20
		Pentium	10
[illegible]	[illegible]	[illegible]	[illegible]

100010dw oorrrmmm disp

Format	Examples	Microprocessor	Clocks

MOV reg,reg	**MOV CL,CH**
	MOV BH,CL
	MOV CX,DX
	MOV EAX,EBP
	MOV ESP,ESI
		[illegible]	[illegible]

		[illegible]	[illegible]
		80286	2
		80386	2
		80486	1
		Pentium	1

MOV mem,reg	**MOV DATA7,DL**
	MOV NUMB,CX
	MOV TEMP,EBX
	MOV [ECX],BL
	MOV [DI],DH
		[illegible]	[illegible]

		[illegible]	[illegible]
		80286	3
		80386	2
		80486	1
		Pentium	1

MOV reg,mem	**MOV DL,DATA8**
	MOV DX,NUMB
	MOV EBX,TEMP+3
	MOV CH,TEMP[EDI]
	MOV CL,DATA2
		[illegible]	[illegible]

		[illegible]	[illegible]
		80286	5
		80386	4
		80486	1
		Pentium	1

1100011w oo000mmm disp data Format	Examples	Microprocessor	Clocks
MOV mem,imm	**MOV DATAF,23H** **MOV LIST,12H** **MOV BYTE PTR [DI],2** **MOV NUMB,234H** MOV DWORD PTR[ECX],1		
		80286	3
		80386	2
		80486	1
		Pentium	1
1011wrrr data Format	Examples	Microprocessor	Clocks
MOV reg,imm	**MOV BX,22H** **MOV CX,12H** **MOV CL,2** MOV ECX,123456H **MOV DI,100**		
		80286	3
		80386	2
		80486	1
		Pentium	1
101000dw disp Format	Examples	Microprocessor	Clocks
MOV mem,acc	**MOV DATAF,AL** **MOV LIST,AX** MOV NUMB,EAX		
		80286	3
		80386	2
		80486	1
		Pentium	1
MOV acc,mem	**MOV AL,DATAE** **MOV AX,LIST** MOV EAX,LUTE		
		80286	5
		80386	4
		80486	1
		Pentium	1

100011d0 oosssmmm disp Format	Examples	Microprocessor	Clocks

MOV seg,reg	**MOV SS,AX**
	MOV DS,DX
	MOV ES,CX
	MOV FS,BX
	MOV GS,AX
		8086	2

		80286	2
		80386	2
		80486	1
		Pentium	1
MOV seg,mem	**MOV SS,STACK_TOP** **MOV DS,DATAS** **MOV ES,TEMP1**	8086	12 + ea
		80286	2
		80386	2
		80486	1
		Pentium	2 or 3
MOV reg,seg	**MOV BX,DS** MOV CX,FS **MOV CX,ES**	8086	2
		80286	2
		80386	2
		80486	1
		Pentium	1
MOV mem,seg	**MOV DATA2,CS** **MOV TEMP,DS** **MOV NUMB1,SS** MOV TEMP2,GS	8086	9 + ea
		80286	3
		80386	2
		80486	1
		Pentium	1

00001111 001000d0 11rrrmmm Format	Examples	Microprocessor	Clocks

MOV reg,cr	MOV EBX,CR0
	MOV ECX,CR2
	MOV EBX,CR3
		8086	—

		8088	—
		80286	—
		80386	6
		80486	4
		Pentium	4

MOV cr,reg	MOV CR0,EAX
	MOV CR1,EBX
	MOV CR3,EDX
		8086	—

		8088	—
		80286	—
		80386	10
		80486	4
		Pentium	12–46
00001111 001000d1 11rrrmmm Format	Examples	Microprocessor	Clocks

MOV reg,dr	MOV EBX,DR6
	MOV ECX,DR7
	MOV EBX,DR1
		8086	—

		8088	—
		80286	—
		80386	22
		80486	10
		Pentium	11

MOV dr,reg	MOV DR0,EAX
	MOV DR1,EBX
	MOV DR3,EDX
		8086	—

		8088	—
		80286	—
		80386	22
		80486	11
		Pentium	11

00001111 001001d0 11rrrmmm Format	Examples	Microprocessor	Clocks
MOV reg,tr	MOV EBX,TR6 MOV ECX,TR7	8086	—
		8088	—
		80286	—
		80386	12
		80486	4
		Pentium	11
MOV tr,reg	MOV TR6,EAX MOV TR7,EBX	8086	—
		8088	—
		80286	—
		80386	12
		80486	6
		Pentium	11

1010010w Format	Examples	Microprocessor	Clocks
MOVSB **MOVSW** MOVSD	**MOVSB** **MOVSW** MOVSD MOVS DATA1,DATA2	80286	5
		80386	7
		80486	7
		Pentium	4

MOVSX	Move with sign extend		
00001111 1011111w oorrrmmm disp Format	Examples	Microprocessor	Clocks
MOVSX reg,reg	MOVSX BX,AL MOVSX EAX,DX	8086	—
		8088	—
		80286	—
		80386	3
		80486	3
		Pentium	3
MOVSX reg,mem	MOVSX AX,DATA34 MOVSX EAX,NUMB	8086	—
		8088	—
		80286	—
		80386	6
		80486	3
		Pentium	3
MOVZX	Move with zero extend		
00001111 1011011w oorrrmmm disp Format	Examples	Microprocessor	Clocks
MOVZX reg,reg	MOVZX BX,AL MOVZX EAX,DX	8086	—
		8088	—
		80286	—
		80386	3
		80486	3
		Pentium	3
MOVZX reg,mem	MOVZX AX,DATA34 MOVZX EAX,NUMB	8086	—
		8088	—
		80286	—
		80386	6
		80486	3
		Pentium	3

MUL	Multiply	(unsigned integer)	
1111011w oo100mmm disp		O D I T S Z A P C * ? ? ? ? *	
Format	Examples	Microprocessor	Clocks
MUL reg	**MUL BL** **MUL CX** MUL EDX	8086/8	118
		8088	143
		80286	21
		80386	38
		80486	42
		Pentium	10 or 11
MUL mem	**MUL DATA9** MUL WORD PTR [ESI]	8086/8	139
		8088	143
		80286	24
		80386	41
		80486	42
		Pentium	11
NEG	Negate	(two's complement)	
1111011w oo011mmm disp		O D I T S Z A P C * * * * * *	
Format	Examples	Microprocessor	Clocks
NEG reg	**NEG BL** **NEG CX** NEG EDI	8086	3
		8088	3
		80286	2
		80386	2
		80486	1
		Pentium	1 or 3

NEG mem	**NEG DATA9** NEG WORD PTR [ESI]	8086	24 + ea
		80286	7
		80386	6
		80486	3
		Pentium	1 or 3

NOP No operation

10010000

Example	Microprocessor	Clocks
NOP	8086	3
	8088	3
	80286	3
	80386	3
	80486	3
	Pentium	1

NOT One's complement

1111011w oo010mmm disp

Format	Examples	Microprocessor	Clocks
NOT reg	**NOT BL** **NOT CX** NOT EDI	8086	3
		8088	3
		80286	2
		80386	2
		80486	1
		Pentium	1 or 3
NOT mem	**NOT DATA9** NOT WORD PTR [ESI]	8086	16 + ea
		8088	24 + ea
		80286	7
		80386	6
		80486	3
		Pentium	1 or 3

000010dw oorrrmmm disp		O D I T S Z A P C 0 * * ? * 0	
Format	Examples	Microprocessor	Clocks
OR reg,reg	OR AX,BX OR AL,BL OR EAX,EBX OR CX,SI OR ESI,EDI	[illegible]	[illegible]
		[illegible]	[illegible]
		80286	2
		80386	2
		80486	1
		Pentium	1 or 2
OR mem,reg	**OR DATAY,AL** **OR LIST,SI** **OR DATA2[DI],CL** OR [EAX],BL OR [EBX+2*ECX],EDX	[illegible]	[illegible]
		[illegible]	[illegible]
		80286	7
		80386	7
		80486	3
		Pentium	1 or 3
OR reg,mem	**OR BL,DATA1** **OR SI,LIST1** **OR CL,DATA2[SI]** OR CX,[ESI] OR ESI,[2*ECX]	[illegible]	[illegible]
		80286	7
		80386	6
		80486	2
		Pentium	1 or 3
100000sw oo001mmm disp data			
Format	Examples	Microprocessor	Clocks
OR reg,imm	**OR CX,3** **OR DI,1AH** **OR DL,34H** OR EDX,1345H OR CX,1834H	[illegible]	[illegible]
		[illegible]	[illegible]
		80286	3
		80386	2
		80486	1
		Pentium	1 or 3

OR mem,imm	**OR DATAS,3** OR BYTE PTR[EDI],1AH **OR DADDY,34H** **OR LIST,'A'** **OR TOAD,1834H**	[illegible]	[illegible]
		80286	7
		80386	7
		80486	3
		Pentium	1 or 3
0000110w data Format	Examples	Microprocessor	Clocks
OR acc,imm	**OR AX,3** **OR AL,1AH** **OR AH,34H** OR EAX,1345H **OR AL,'Y'**	[illegible]	[illegible]
		80286	3
		80386	2
		80486	1
		Pentium	1
[illegible]			
1110011w port# Format	Examples	Microprocessor	Clocks
OUT pt,acc	**OUT 12H,AL** **OUT 12H,AX** **OUT 0FFH,AL** **OUT 0A0H,AX** OUT 10H,EAX	[illegible]	[illegible]
		80286	3
		80386	10
		80486	10
		Pentium	12–26
1110111w Format	Examples	Microprocessor	Clocks
OUT DX,acc	**OUT DX,AL** **OUT DX,AX** OUT DX,EAX	[illegible]	[illegible]
		80286	3
		80386	11
		80486	10
		Pentium	12–26

OUTS	Output string to port		
0110111w Format	Examples	Microprocessor	Clocks
OUTSB OUTSW OUTSD	OUTSB OUTSW OUTSD OUTS DATA2 REP OUTSB	8086	—
		8088	—
		80286	5
		80386	14
		80486	10
		Pentium	13–27
POP	Pop data from stack		
01011rrr Format	Examples	Microprocessor	Clocks
POP reg	**POP CX** **POP AX** POP EDI	8086	8
		8088	12
		80286	5
		80386	4
		80486	1
		Pentium	1
10001111 oo000mmm disp Format	Examples	Microprocessor	Clocks
POP mem	**POP DATA1** **POP LISTS** **POP NUMBS**	8086	17 + ea
		8088	25 + ea
		80286	5
		80386	5
		80486	4
		Pentium	3

00sss111 Format	Examples	Microprocessor	Clocks
POP seg	**POP DS** **POP ES** **POP SS**	8086	8
		8088	10
		80286	5
		80386	7
		80486	3
		Pentium	3
00001111 10sss001 Format	Examples	Microprocessor	Clocks
POP seg	POP FS POP GS	8086	—
		8088	—
		80286	—
		80386	7
		80486	3
		Pentium	3
POPA/POPAD	Pop all registers from stack		
01100001 Example		Microprocessor	Clocks
POPA POPAD		8086	—
		8088	—
		80286	19
		80386	24
		80486	9
		Pentium	5

10010000	O D I T S Z A P C * * * * * * * * * *
Example	Microprocessor / Clocks
POPF POPFD	8086 / 8088 / 80286 / 80386 / 80486 / Pentium 8086 / 8088 / 80286 / 80386 / 80486 / Pentium 8086 / 8088 / 80286 / 80386 / 80486 / Pentium 8086 / 8088 / 80286 / 80386 / 80486 / Pentium 8086 / 8088 / 80286 / 80386 / 80486 / Pentium 8086 / 8088 / 80286 / 80386 / 80486 / Pentium 8086 / 8088 / 80286 / 80386 / 80486 / Pentium 8086 / 8088 / 80286 / 80386 / 80486 / Pentium 8086 / 8088 / 80286 / 80386 / 80486 / Pentium 8086 / 8088 / 80286 / 80386 / 80486 / Pentium

01010rrr		
Format	Examples	Microprocessor / Clocks
PUSH reg	**PUSH CX** **PUSH AX** PUSH EDI	8086 / 8088 / 80286 / 80386 / 80486 / Pentium 8086 / 8088 / 80286 / 80386 / 80486 / Pentium 8086 / 8088 / 80286 / 80386 / 80486 / Pentium 8086 / 8088 / 80286 / 80386 / 80486 / Pentium 8086 / 8088 / 80286 / 80386 / 80486 / Pentium 8086 / 8088 / 80286 / 80386 / 80486 / Pentium 8086 / 8088 / 80286 / 80386 / 80486 / Pentium 8086 / 8088 / 80286 / 80386 / 80486 / Pentium 8086 / 8088 / 80286 / 80386 / 80486 / Pentium 8086 / 8088 / 80286 / 80386 / 80486 / Pentium

11111111 oo110mmm disp		
Format	Examples	Microprocessor / Clocks
PUSH mem	**PUSH DATA1** **PUSH LISTS** **PUSH NUMBS**	8086 / 8088 / 80286 / 80386 / 80486 / Pentium 8086 / 8088 / 80286 / 80386 / 80486 / Pentium 8086 / 8088 / 80286 / 80386 / 80486 / Pentium 8086 / 8088 / 80286 / 80386 / 80486 / Pentium 8086 / 8088 / 80286 / 80386 / 80486 / Pentium 8086 / 8088 / 80286 / 80386 / 80486 / Pentium 8086 / 8088 / 80286 / 80386 / 80486 / Pentium 8086 / 8088 / 80286 / 80386 / 80486 / Pentium 8086 / 8088 / 80286 / 80386 / 80486 / Pentium 8086 / 8088 / 80286 / 80386 / 80486 / Pentium

00ss110 Format	Examples	Microprocessor	Clocks
PUSH seg	**PUSH ES** **PUSH CS** **PUSH DS**	[illegible]	[illegible]
		80286	3
		80386	2
		80486	3
		Pentium	1
00001111 10sss000 Format	Examples	Microprocessor	Clocks
PUSH seg	PUSH FS PUSH GS	8086	—
		8088	—
		80286	—
		80386	2
		80486	3
		Pentium	1
011010s0 data Format	Examples	Microprocessor	Clocks
PUSH imm	PUSH 2000H PUSH 53220 PUSHW 10H PUSH ',' PUSHD 100000H	8086	—
		8088	—
		80286	3
		80386	2
		80486	1
		Pentium	1

PUSHA/PUSHAD Push all registers onto stack

01100000
Example

Microprocessor	Clocks
8086	—
8088	—
80286	17
80386	18
80486	11
Pentium	5

PUSHA
PUSHAD

PUSHF/PUSHFD Push flags onto stack

10011100
Example

Microprocessor	Clocks
8086	10
8088	14
80286	3
80386	4
80486	3
Pentium	3 or 4

PUSHF
PUSHFD

ROL/ROR/RCL/RCR Rotate

1101000w ooTTTmmm disp

O	D	I	T	S	Z	A	P	C
*								*

TTT = 000 = ROL, TTT = 001 = ROR, TTT = 010 = RCL, and TTT = 011 = RCR

Format	Examples	Microprocessor	Clocks
ROL reg,1 **ROR reg,1**	**ROL CL,1** **ROL DX,1** **ROR CH,1** **ROR SI,1**	8086	2
		8088	2
		80286	2
		80386	3
		80486	3
		Pentium	1 or 3

RCL reg,1 **RCR reg,1**	**RCL CL,1** **RCL SI,1** **RCR AH,1** RCR EBX,1	[illegible]	[illegible]
		80286	2
		80386	9
		80486	3
		Pentium	1 or 3
ROL mem,1 **ROR mem,1**	**ROL DATAY,1** **ROL LIST,1** **ROR DATA2[DI],1** ROR BYTE PTR [EAX],1	[illegible]	[illegible]
		80286	7
		80386	7
		80486	4
		Pentium	1 or 3
RCL mem,1 **RCR mem,1**	**RCL DATA1,1** **RCL LIST,1** **RCR DATA2[SI],1** RCR WORD PTR [ESI],1	[illegible]	[illegible]
		80286	7
		80386	10
		80486	4
		Pentium	1 or 3
1101001w ooTTTmmm disp Format	Examples	Microprocessor	Clocks
ROL reg,CL **ROR reg,CL**	**ROL CH,CL** **ROL DX,CL** **ROR AL,CL** ROR ESI,CL	[illegible]	[illegible]
		80286	5 + n
		80386	3
		80486	3
		Pentium	4

RCL reg,CL **RCR reg,CL**	**RCL CH,CL** **RCL SI,CL** **RCR AH,CL** RCR EBX,CL		
		80286	5 + n
		80386	9
		80486	3
		Pentium	7–27
ROL mem,CL **ROR mem,CL**	**ROL DATAY,CL** **ROL LIST,CL** **ROR DATA2[DI],CL** ROR BYTE PTR [EAX],CL		
		80286	8 + n
		80386	7
		80486	4
		Pentium	4
RCL mem,CL **RCR mem,CL**	**RCL DATA1,CL** **RCL LIST,CL** **RCR DATA2[SI],CL** RCR WORD PTR [ESI],CL		
		80286	8 + n
		80386	10
		80486	9
		Pentium	9–26
1100000w ooTTTmmm disp data Format	Examples	Microprocessor	Clocks
ROL reg,imm ROR reg,imm	ROL CH,4 ROL DX,5 ROR AL,2 ROR ESI,14	8086	—
		8088	—
		80286	5 + n
		80386	3
		80486	2
		Pentium	1 or 3

RCL reg,imm RCR reg,imm	RCL CL,2 RCL SI,12 RCR AH,5 RCR EBX,18	8086	—
		8088	—
		80286	5 + n
		80386	9
		80486	8
		Pentium	8–27
ROL mem,imm ROR mem,imm	ROL DATAY,4 ROL LIST,3 ROR DATA2[DI],7 ROR BYTE PTR [EAX],11	8086	—
		8088	—
		80286	8 + n
		80386	7
		80486	4
		Pentium	1 or 3
RCL mem,imm RCR mem,imm	RCL DATA1,5 RCL LIST,3 RCR DATA2[SI],9 RCR WORD PTR [ESI],8	8086	—
		8088	—
		80286	8 + n
		80386	10
		80486	9
		Pentium	8–27

RDMSR	Read model specific register	
00001111 00110010 Example	Microprocessor	Clocks
RDMSR	8086	—
	8088	—
	80286	—
	80386	—
	80486	—
	Pentium	20–24

REP	Repeat prefix		
11110011 1010010w			
Format	Examples	Microprocessor	Clocks
REP MOVS	**REP MOVSB** **REP MOVSW** REP MOVSD REP MOVS DATA1,DATA2	8086	9 + 17n
		8088	9 + 25n
		80286	5 + 4n
		80386	8 + 4n
		80486	12 + 3n
		Pentium	13 + n
11110011 1010101w			
Format	Examples	Microprocessor	Clocks
REP STOS	**REP STOSB** **REP STOSW** REP STOSD REP STOS ARRAY	8086	9 + 10n
		8088	9 + 14n
		80286	4 + 3n
		80386	5 + 5n
		80486	7 + 4n
		Pentium	9 + n
11110011 0110110w			
Format	Examples	Microprocessor	Clocks
REP INS	REP INSB REP INSW REP INSD REP INS ARRAY	8086	—
		8088	—
		80286	5 + 4n
		80386	12 + 5n
		80486	17 + 5n
		Pentium	25 + 3n

11110011 0110111w Format	Examples	Microprocessor	Clocks
REP OUTS	REP OUTSB REP OUTSW REP OUTSD REP OUTS ARRAY	8086	—
		8088	—
		80286	5 + 4n
		80386	12 + 5n
		80486	17 + 5n
		Pentium	25 + 4n

REPE/REPNE Repeat conditional

11110011 1010011w Format	Examples	Microprocessor	Clocks
REPE CMPS	**REPE CMPSB** **REPE CMPSW** REPE CMPSD REPE CMPS DATA1,DATA2	8086	9 + 22n
		8088	9 + 30n
		80286	5 + 9n
		80386	5 + 9n
		80486	7 + 7n
		Pentium	9 + 4n

11110011 1010111w Format	Examples	Microprocessor	Clocks
REPE SCAS	**REPE SCASB** **REPE SCASW** REPE SCASD REPE SCAS ARRAY	8086	9 + 15n
		8088	9 + 19n
		80286	5 + 8n
		80386	5 + 8n
		80486	7 + 5n
		Pentium	9 + 4n

11110010 1010011w Format	Examples	Microprocessor	Clocks
REPNE CMPS	**REPNE CMPSB** **REPNE CMPSW** REPNE CMPSD REPNE CMPS ARRAY,LIST	[illegible]	[illegible]
		80286	5 + 9n
		80386	5 + 9n
		80486	7 + 7n
		Pentium	8 + 4n

11110010 101011w Format	Examples	Microprocessor	Clocks
REPNE SCAS	**REPNE SCASB** **REPNE SCASW** REPNE SCASD REPNE SCAS ARRAY	[illegible]	[illegible]
		80286	5 + 8n
		80386	5 + 8n
		80486	7 + 5n
		Pentium	9 + 4n

11000011 Example	Microprocessor	Clocks
RET **(near)**	[illegible]	[illegible]
	80286	11
	80386	10
	80486	5
	Pentium	2

11000010 data Format	Examples	Microprocessor	Clocks
RET imm (near)	**RET 4 RET 100H**	[illegible]	[illegible]
		80286	11
		80386	10
		80486	5
		Pentium	3
11001011 Example		Microprocessor	Clocks
RET (far)		[illegible]	
		80286	15
		80386	18
		80486	13
		Pentium	4–23
11001010 data Format	Examples	Microprocessor	Clocks
RET imm (far)	**RET 4 RET 100H**	[illegible]	[illegible]
		80286	11
		80386	10
		80486	5
		Pentium	4–23

RSM Resume from system management mode

00001111 10101010

O D I T S Z A P C
* * * * * * * * *

Example

Microprocessor	Clocks
8086	—
8088	—
80286	—
80386	—
80486	—
Pentium	83

10011110

O D I T S Z A P C
* * * * * *

Example

Microprocessor	Clocks
SAHF	
80286	2
80386	3
80486	2
Pentium	2

1101000w ooTTTmmm disp

O D I T S Z A P C
* * ? * *

TTT = 100 = SHL/SAL , TTT = 101 = SHR, and TTT = 111 = SAR

Format	Examples	Microprocessor	Clocks
SAL reg,1 **SHL reg,1** **SHR reg,1** **SAR reg,1**	**SAL CL,1** **SHL DX,1** **SAR CH,1** **SHR SI,1**	80286	2
		80386	3
		80486	3
		Pentium	1 or 3

SAL mem,1 **SHL mem,1** **SHR mem,1** **SAR mem,1**	**SAL DATA1,1** **SHL BYTE PTR [DI],1** **SAR NUMB,1** SHR WORD PTR[EDI],1	[illegible]	[illegible]
		80286	7
		80386	7
		80486	4
		Pentium	1 or 3
1101001w ooTTTmmm disp Format	Examples	Microprocessor	Clocks
SAL reg,CL **SHL reg,CL** **SAR reg,CL** **SHR reg,CL**	**SAL CH,CL** **SHL DX,CL** **SAR AL,CL** SHR ESI,CL	[illegible]	[illegible]
		80286	5 + n
		80386	3
		80486	3
		Pentium	4
SAL mem,CL **SHL mem,CL** **SAR mem,CL** **SHR mem,CL**	**SAL DATAU,CL** SHL BYTE PTR [ESI],CL **SAR NUMB,CL** **SHR TEMP,CL**	[illegible]	[illegible]
		80286	8 + n
		80386	7
		80486	4
		Pentium	4
1100000w ooTTTmmm disp data Format	Examples	Microprocessor	Clocks
SAL reg,imm SHL reg,imm SAR reg,imm SHR reg,imm	SAL CH,4 SHL DX,10 SAR AL,2 SHR ESI,23	8086	—
		8088	—
		80286	5 + n
		80386	3
		80486	2
		Pentium	1 or 3

SAL mem,imm SHL mem,imm SAR mem,imm SHR mem,imm	SAL DATAU,3 SHL BYTE PTR [ESI],15 SAR NUMB,3 SHR TEMP,5	8086	—
		8088	—
		80286	8 + n
		80386	7
		80486	4
		Pentium	1 or 3
[illegible]			
000110dw oorrrmmm disp		O D I T S Z A P C * * * * *	
Format	Examples	Microprocessor	Clocks
SBB reg,reg	**SBB CL,DL** **SBB AX,DX** **SBB CH,CL** SBB EAX,EBX SBB ESI,EDI	[illegible]	
		80286	2
		80386	2
		80486	1
		Pentium	1 or 2
SBB mem,reg	**SBB DATAJ,CL** **SBB BYTES,CX** SBB NUMBS,ECX SBB [EAX],CX	[illegible]	
		80286	7
		80386	6
		80486	3
		Pentium	1 or 3
SBB reg,mem	**SBB CL,DATAL** **SBB CX,BYTES** SBB ECX,NUMBS SBB DX,[EBX+EDI]	[illegible]	
		80286	7
		80386	7
		80486	2
		Pentium	1 or 2

100000sw oo011mmm disp data Format	Examples	Microprocessor	Clocks
SBB reg,imm	**SBB CX,3** **SBB DI,1AH** **SBB DL,34H** SBB EDX,1345H **SBB CX,1834H**		
		80286	3
		80386	2
		80486	1
		Pentium	1 or 3
SBB mem,imm	**SBB DATAS,3** SBB BYTE PTR[EDI],1AH SBB DADDY,34H SBB LIST,'A' SBB TOAD,1834H		
		80286	7
		80386	7
		80486	3
		Pentium	1 or 3
0001110w data Format	Examples	Microprocessor	Clocks
SBB acc,imm	**SBB AX,3** **SBB AL,1AH** **SBB AH,34H** SBB EAX,1345H **SBB AL,'Y'**		
		80286	3
		80386	2
		80486	1
		Pentium	1
1010111w Format	Examples	O D I T S Z A P C * * * * * * * * * Microprocessor	Clocks
SCASB **SCASW** SCASD	**SCASB** **SCASW** SCASD SCAS DATAF **REP SCASB**		
		80286	7
		80386	7
		80486	6
		Pentium	4

SETcondition Conditional set

00001111 1001cccc oo000mmm

Format	Examples	Microprocessor	Clocks
SETcnd reg8	SETA BL SETB CH SETG DL SETE BH SETZ AL	8086	—
		8088	—
		80286	—
		80386	4
		80486	3
		Pentium	1 or 2
SETcnd mem8	SETE DATAK SETAE LESS_OR_SO	8086	—
		8088	—
		80286	—
		80386	5
		80486	3
		Pentium	1 or 2

Condition Codes	Mnemonic	Flag	Description
0000	SETO	O = 1	Set if overflow
0001	SETNO	O = 0	Set if no overflow
0010	SETB/SETAE	C = 1	Set if below
0011	SETAE/SETNB	C = 0	Set if above or equal
0100	SETE/SETZ	Z = 1	Set if equal/zero
0101	SETNE/SETNZ	Z = 0	Set if not equal/zero
0110	SETBE/SETNA	C = 1 + Z = 1	Set if below or equal
0111	SETA/SETNBE	C = 0 • Z = 0	Set if above
1000	SETS	S = 1	Set if sign
1001	SETNS	S = 0	Set if no sign
1010	SETP/SETPE	P = 1	Set if parity
1011	SETNP/SETPO	P = 0	Set if no parity
1100	SETL/SETNGE	S • O	Set if less than
1101	SETGE/SETNL	S = 0	Set if greater than or equal
1110	SETLE/SETNG	Z = 1 + S • O	Set if less than or equal
1111	SETG/SETNLE	Z = 0 + S = O	Set if greater than

SGDT/SIDT/SLDT	Store descriptor table registers		
00001111 00000001 oo000mmm disp Format	Examples	Microprocessor	Clocks
SGDT mem	SGDT MEMORY SGDT GLOBAL	8086	—
		8088	—
		80286	11
		80386	9
		80486	10
		Pentium	4
00001111 00000001 oo001mmm disp Format	Examples	Microprocessor	Clocks
SIDT mem	SIDT DATAS SIDT INTERRUPT	8086	—
		8088	—
		80286	12
		80386	9
		80486	10
		Pentium	4
00001111 00000000 oo000mmm disp Format	Examples	Microprocessor	Clocks
SLDT reg	SLDT CX SLDT DX	8086	—
		8088	—
		80286	2
		80386	2
		80486	2
		Pentium	2
SLDT mem	SLDT NUMBS SLDT LOCALS	8086	—
		8088	—
		80286	3
		80386	2
		80486	3
		Pentium	2

SHLD/SHRD Double precision shift			
00001111 10100100 oorrrmmm disp data		O D I T S Z A P C ? * * ? * *	
Format	Examples	Microprocessor	Clocks
SHLD reg,reg,imm	SHLD AX,CX,10 SHLD DX,BX,8 SHLD CX,DX,2	8086	—
		8088	—
		80286	—
		80386	3
		80486	2
		Pentium	4
SHLD mem,reg,imm	SHLD DATAQ,CX,8	8086	—
		8088	—
		80286	—
		80386	7
		80486	3
		Pentium	4
00001111 10101100 oorrrmmm disp data Format	Examples	Microprocessor	Clocks
SHRD reg,reg,imm	SHRD CX,DX,2	8086	—
		8088	—
		80286	—
		80386	3
		80486	2
		Pentium	4
SHRD mem,reg,imm	SHRD DATAZ,DX,4	8086	—
		8088	—
		80286	—
		80386	7
		80486	2
		Pentium	4

00001111 10100101 oorrrmmm disp Format	Examples	Microprocessor	Clocks
SHLD reg,reg,CL	SHLD BX,DX,CL	8086	—
		8088	—
		80286	—
		80386	3
		80486	3
		Pentium	4 or 5
SHLD mem,reg,CL	SHLD DATAZ,DX,CL	8086	—
		8088	—
		80286	—
		80386	7
		80486	3
		Pentium	4 or 5
00001111 10101101 oorrrmmm disp Format	Examples	Microprocessor	Clocks
SHRD reg,reg,CL	SHRD AX,DX,CL	8086	—
		8088	—
		80286	—
		80386	3
		80486	3
		Pentium	4 or 5
SHRD mem,reg,CL	SHRD DATAZ,DX,CL	8086	—
		8088	—
		80286	—
		80386	7
		80486	3
		Pentium	4 or 5

SMSW	Store machine status word (80286)		
00001111 00000001 oo100mmm disp Format	Examples	Microprocessor	Clocks
SMSW reg	SMSW AX SMSW DX SMSW BP	8086	—
		8088	—
		80286	2
		80386	10
		80486	2
		Pentium	4
SMSW mem	SMSW DATAQ	8086	—
		8088	—
		80286	3
		80386	3
		80486	3
		Pentium	4
11111001 Example		O D I T S Z A P C 1 Microprocessor	Clocks
STC			
		80286	2
		80386	2
		80486	2
		Pentium	2

STD Set direction flag

11111101

O D I T S Z A P C
1

Example	Microprocessor	Clocks
STD	8086/8088	2
	8088	4
	80286	2
	80386	2
	80486	2
	Pentium	2

STI Set interrupt flag

11111011

O D I T S Z A P C
1

Example	Microprocessor	Clocks
STI	8086/8088	2
	8088	4
	80286	2
	80386	3
	80486	5
	Pentium	7

Store byte or word string

1010101w

Format	Examples	Microprocessor	Clocks
STOSB **STOSW** STOSD	**STOSB** **STOSW** STOSD STOS DATA_LIST **REP STOSB**	8086/8088	11
		8088	15
		80286	3
		80386	40
		80486	5
		Pentium	3

STR	Store task register		
00001111 00000000 oo001mmm disp			
Format	Examples	Microprocessor	Clocks
STR reg	STR AX STR DX STR BP	8086	—
		8088	—
		80286	2
		80386	2
		80486	2
		Pentium	2
STR mem	STR DATA3	8086	—
		8088	—
		80286	2
		80386	2
		80486	2
		Pentium	2

000101dw oorrrmmm disp		O D I T *	S Z A P C * * * * *
Format	Examples	Microprocessor	Clocks

SUB reg,reg	**SUB CL,DL**
	SUB AX,DX
	SUB CH,CL
	SUB EAX,EBX
	SUB ESI,EDI		

		80286	2
		80386	2
		80486	1
		Pentium	1 or 2

SUB mem,reg	**SUB DATAJ,CL**
	SUB BYTES,CX
	SUB NUMBS,ECX
	SUB [EAX],CX
		80286	7

		80386	6
		80486	3
		Pentium	1 or 3

SUB reg,mem	**SUB CL,DATAL**
	SUB CX,BYTES
	SUB ECX,NUMBS
	SUB DX,[EBX+EDI]
		80286	7

		80386	7
		80486	2
		Pentium	1 or 2
100000sw oo101mmm disp data Format	Examples	Microprocessor	Clocks

SUB reg,imm	**SUB CX,3**
	SUB DI,1AH
	SUB DL,34H
	SUB EDX,1345H
	SUB CX,1834H
		80286	3

		80386	2
		80486	1
		Pentium	1 or 3
SUB mem,imm	**SUB DATAS,3** SUB BYTE PTR[EDI],1AH **SUB DADDY,34H** **SUB LIST,'A'** **SUB TOAD,1834H**	80286	7
		80386	7
		80486	3
		Pentium	1 or 3

0010110w data Format	Examples	Microprocessor	Clocks
SUB acc,imm	**SUB AL,3** **SUB AX,1AH** SUB EAX,34H	8086	4
		8088	4
		80286	3
		80386	2
		80486	1
		Pentium	1

TEST Test operands (logical compare) [illegible]

1000001w oorrrmmm disp Format	Examples	O D I T S Z A P C 0 * * ? * 0 Microprocessor	Clocks
TEST reg,reg	**TEST CL,DL** **TEST BX,DX** **TEST DH,CL** TEST EBP,EBX TEST EAX,EDI	8086	5
		8088	5
		80286	2
		80386	2
		80486	1
		Pentium	1 or 2
TEST mem,reg **reg,mem**	**TEST DATAJ,CL** **TEST BYTES,CX** TEST NUMBS,ECX TEST [EAX],CX **TEST CL,POPS**	8086	9 + ea
		8088	13 + ea
		80286	6
		80386	5
		80486	2
		Pentium	1 or 2