

Microcode

\PH* PH ^ currInt<<2
 \PL* PL ^ currInt<<2

test Din == 011xxxxx
 math Din != x11xxxxx
 jump Din == 111x11xx
 imm Din == 111xxxxx & !jump
 k Din == xxx1xxxx
 zs Din == xxxx11xx
 zd Din == xxxxxx11
 jop Din[4,1:0]
 aluOp Imm ? Din[4:2] : Din[7:5]
 cond Din[3:0]
 \fetch TZ?fetcha:timer

\decodeSkip \decode

test	fetch	test	
Math & zs & zf	skip2	useK?\$zpa,mathzzb:\$zpa,mathzz	note:
Math & !zs & zd	skip1	useK?\$zpa,kmathrz:\$zpa,mathrz	
Math & zs & !zd	skip1	\$zpa,mathzr	
Math & !zs & !zd	fetch	mathrr	
Imm & zd	skip2	mathiz	
Imm & !zd	skip1	mathir	
Jump & jop == 0	skip2	jump	
Jump & jop == 1	skip2	call	
Jump & jop == 2	fetch	fetch	
Jump & jop == 3	fetch	return	
Jump & jop == 4	skip1	\$zpa,jumpz	
Jump & jop == 5	skip1	callz	
Jump & jop == 6	fetch	fetch	
Jump & jop == 7	skip1	\$zpa,table	

\memz svZInd?mem:(svZReg?(svZIO?(1,reg[0]):B):mem)
 \mA SvAluOp[2]?00:SvAluOp[1:0]
 \mL SvAluOp[2]?svAluOp[1:0]:11
 \mCin !svAluOp[2]&svAluOp[0]
 \S {00,svS}
 \D {00,svD}
 \kD prevK ? 0011 : {00,svD}
 \kD2 useK ? 0011 : {00,svD}

label	aAd	bAd	wAd	wReg	dIn	rMem	dOut	wMem	aSel	bSel	logSel	Cin
reset	x	x	PL		1 ?		0 ?		0	0 B	^	0
resetb	x	x	PH		1 ?		0 ?		0	0 B	^	0
resetc	x	x	TL		1 ?		0 ?		0	0 B	^	0
resetd	x	x	TH		1 ?		0 ?		0	0 B	^	0
timer	x	TL	TL		1 ?		0 ?		0	-2 B	B	1

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timerb	x	TH	TH	1 ?	0 ?	0	-2 B	B	1
timerc	x	TL	TL	1 ?	0 ?	0	-2 B	B	0
fetcha	PH*	PL*	PL*	1 ?	1 ?	0	0 B	B	1
fetchb	x	PH*	PH*	1 Inst	0 ?	0	0 B	B	1
fetchc	x	x	x	0 Inst	0 ?	0 x	x	x	x
skipf	PH*	PL*	PL*	1 ?	1 ?	0	0 B	B	1
skipfb	x	PH*	PH*	1 Inst	0 ?	0	0 B	B	1
skipfc	x	x	x	0 Inst	0 ?	0 x	x	x	x
skip2	x	PL*	PL*	1 ?	0 ?	0	0 B	B	1
skip2b	x	PH*	PH*	1 ?	0 ?	0	0 B	B	1
skip1	x	PL*	PL*	1 ?	0 ?	0	0 B	B	1
skip1b	x	PH*	PH*	1 ?	0 ?	0	0 B	B	1
test	x	x	K	1 ?	0 ?	0	0 B	^	tr
mathrr	S	kD	kD2	1 ?	0 ?	0 mA	B	mL	mCir
call	x	PL*	LL	1 ?	0 ?	0	0 B	B	0
callb	x	PH*	LH	1 ?	0 ?	0	0 B	B	0
jump	PH*	PL*	PL*	1 ?	1 ?	0	0 B	B	1
jumpb	x	x	ML	1 PCL	0 ?	0	0 mem	B	0
jumpc	x	x	ML	1 PCL	0 ?	0	0 mem	B	0
jumpd	x	PH*	PH*	1 ?	0 ?	0	0 B	B	1
jumpe	PH*	PL*	x	0 ?	1 ?	0 x	x	x	x
jumpf	x	x	PH*	1 PCH	0 ?	0	0 mem	B	0
jumpg	x	ML	PL*	1 ?	0 ?	0	0 B	B	0
return	x	LL	PL*	1 ?	0 ?	0	0 B	B	0
returnb	x	LH	PH*	1 ?	0 ?	0	0 B	B	0
mathir	PH*	PL*	PL*	1 ?	1 ?	0	0 B	B	1
mathirb	kD	x	D	1 #	0 ?	0 mA	mem	mL	mCir
mathirc	kD	x	D	1 #	0 ?	0 mA	mem	mL	mCir
mathird	x	PH*	PH*	1 ?	0 ?	0	0 B	B	1
zpa	PH*	PL*	PL*	1 ?	1 ?	0	0 B	B	1
zpab	x	x	ZL	1 zpa	0 ?	0	0 mem	B	0
zpac	x	x	ZL	1 zpa	0 ?	0	0 mem	B	0
zpad	x	PH*	PH*	1 ?	0 ?	0	0 B	B	1
zpaе	ZH	ZL	x	0 ?	1 ?	0 x	x	x	x
zpaф	ZH	ZL	x	0 ?	1 ?	0 x	x	x	x
zpag	x	x	ML	1 lowp	0 ?	0	0 mem	B	0
zpah	ZH	ZL	x	0 ?	1 ?	0 x	x	x	x
zpai	x	x	MH	1 highp	0 ?	0	0 mem	B	0
zpai	x	ML	x	0 ?	0 ?	0	0 B	B	1
zpak	ZH	ZL	x	0 ?	0 ML+1	1 x	x	x	x
zpal	ZH	ZL	x	0 ?	0 ML+1	1 x	x	x	x
zpaм	x	MH	x	0 ?	0 ?	0	0 B	B	1
zpan	ZH	ZL	x	0 ?	0 MH+1	1 x	x	x	x
zpaо	MH	ML	x	0 ?	1 ?	0 x	x	x	x

Microcode

mathiz	PH*	PL*	PL*	1 ?	1 ?	0	0 B	B	1
mathizb	x	reg	K	1 #	0 ?	0	0 memz	B	0
mathizc	x	reg	K	1 #	0 ?	0	0 memz	B	0
mathizd	K	reg	K	1 #	0 ?	0 mA	memz	mL	mCir
mathize	K	reg	K	1 #	0 ?	0 mA	memz	mL	mCir
mathizf	x	PH*	PH*	1 ?	0 ?	0	0 B	B	1
mathizg	x	PH*	PH*	1 ?	0 ?	0	0 B	B	1
mathizo	K	reg	K	1 value	0 ?	0 mA	memz	mL	mCir
mathizp	x	K	x	0 ?	0 ?	0	0 B	B	0
mathizq	MH	ML	x	0 ?	0 K	1 x	x	x	x
mathizr	x	K	reg	1 ?	0 K	0	0 B	B	0
mathizs	x	K	reg	0 ?	0 K	0	0 B	B	0
callz	x	PL*	LL	1 ?	0 ?	0	0 B	B	0
callzb	x	PH*	LH	1 ?	0 ?	0	0 B	B	0
jumpz	x	ML	PL*	1 ?	0 ?	0	0 B	B	0
jumpzb	x	MH	PH*	1 ?	0 ?	0	0 B	B	0
table	LL	reg	ML	1 ?	0 ?	0	0 memz	B	0
tableb	x	LH	MH	1 ?	0 ?	0	0 B	B	1
tablec	x	LH	MH	1 ?	0 ?	0	0 B	B	0
tabled	MH	ML	ML	1 ?	1 ?	0	0 B	B	1
tablee	x	x	PL	1 newPL	0 ?	0	0 mem	B	0
tablef	x	x	PL	1 newPL	0 ?	0	0 mem	B	0
tableg	MH	ML	x	0 ?	1 ?	0 x	x	x	x
tableh	x	MH	MH	1 ?	0 ?	0	0 B	B	1
tablei	x	x	PH	1 newPL	0 ?	0	0 mem	B	0
mathzr	kD	reg	kD2	1 value	0 ?	0 mA	memz	mL	mCir
mathrz	S	reg	K	1 value	0 ?	0 mA	memz	mL	mCir
mathrzb	MH	ML	x	0 ?	0 K	1 x	x	x	x
mathrzc	x	K	reg	1 ?	0 K	0	0 B	B	0
mathrzd	x	K	reg	0 ?	0 K	0	0 B	B	0
kmathrz	S	K	K	1 ?	0 ?	0 mA	B	mL	mCir
mathzz	x	reg	K	1 value	0 ?	0	0 memz	B	0
mathzzb	K	x	K	1 value	0 ?	0 mA	memz	mL	mCir
mathzzc	MH	ML	x	0 ?	0 K	1 x	x	x	x
mathzzd	x	K	reg	1 ?	0 K	0	0 B	B	0
mathzze	x	K	reg	0 ?	0 K	0	0 B	B	0

15: PH	PH*	PH*	PH*
14: PL	?	PL*	PL*
13: MH	MH	MH	MH
12: ML	?	ML	ML
11: iH	?	?	?
10: iL	?	?	?
9: LH	?	LH	LH

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8:	LL	LL	LL	LL
7:	ZH	ZH	?	?
6:	ZL	?	ZL	ZL
5:	TH	?	TH	TH
4:	TL	?	TL	TL
3:	K	K	K	K
2:	Y	?	?	kD2
1:	X	kD	kD	D
0:	W	S	reg	reg

aSel	bSel	logSel	Cin
x	x	x	tr
mA	memz	^	mCir
	-2 mem	mL	1
	0 B	B	0

Microcode

: useK will become prevK at the end of this clock cycle

sA7	sA0	A0	wIR	wFL	next
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x	x	x	0	0 resetb	PH,PL = 0
x	x	x	0	0 resetc	
x	x	x	0	0 resetd	TH,TL = 0
x	x	x	0	0 fetch	

x	x	x	0	0 Z?(TZ?fetcha:timerb):timer	TL -= 1
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Microcode

x	x	x	0	0 timerc	TH -= 1
x	x	x	0	0 timer	TL -= 2
	0	0 x	0	0 C?fetchb:fetchc	
x	x	x	1	0 decode	
x	x	x	1	0 decode	
	0	0 x	0	0 C?skipfb:skipfc	
x	x	x	0	0 decodeSkip	
x	x	x	0	0 decodeSkip	
x	x	x	0	0 C?skip2b:skip1	
x	x	x	0	0 skip1	
x	x	x	0	0 C?skip1b:fetch	
x	x	x	0	0 fetch	
x	x	x	0	0 useK tr?fetch:skipf	
x	x	x	0	1 fetch	
x	x	x	0	0 callb	
x	x	x	0	0 jump	
	0	0 x	0	0 C?jumpb:jumpc	
x	x	x	0	0 jumpd	
x	x	x	0	0 jumpe	
x	x	x	0	0 jumpe	
	0	0 x	0	0 jumpf	
x	x	x	0	0 jumpg	
x	x	x	0	0 fetch	
x	x	x	0	0 returnb	
x	x	x	0	0 fetch	
	0	0 x	0	0 C?mathirb:mathirc	
x	x	x	0	1 mathird	
x	x	x	0	1 fetch	
x	x	x	0	0 fetch	
	0	0 x	0	0 C?zpab:zpac	
x	x	x	0	0 zpad	
x	x	x	0	0 svlnd?zpaf:zpae	
x	x	x	0	0 svlnd?zpaf:zpae	
	0	0 x	0	0 rtn	
	1	1 0	0	0 zpag	
x	x	x	0	0 zpah	
	1	1 1	0	0 zpai	
x	x	x	0	0 svlnc?zpaj:zpao	
x	x	x	0	0 C?zpak:zpal	
	1	1 0	0	0 zpam	
	1	1 0	0	0 zpao	
x	x	x	0	0 zpan	
	1	1 1	0	0 zpao	
x	x	x	0	0 rtn	

Microcode

0	0 x	0	0 prevK?(C?mathizd:mathize):(C?mathizb:mathizc)
0	0 x	0	0 \$zpa,mathizo
0	0 x	0	0 mathizf
x	x	x	0 1 \$zpa,mathizp
x	x	x	0 1 mathizg
x	x	x	0 0 \$zpa,mathizo
x	x	x	0 0 \$zpa,mathizp
x	x	x	0 1 mathizp
x	x	x	0 0 svZReg?(svZIO?mathizs:mathizr):mathizq
x	x	x	0 0 fetch
x	x	x	0 0 fetch
x	x	x	0 0 fetch
x	x	x	0 0 callzb
x	x	x	0 0 \$zpa,jumpz
x	x	x	0 0 jumpzb
x	x	x	0 0 fetch
x	x	x	0 0 C?tableb:tablec
x	x	x	0 0 tabled
x	x	x	0 0 tabled
x	x	x	0 0 C?tablee:tablef
x	x	x	0 0 tableg
x	x	x	0 0 tableh
x	x	x	0 0 tablei
x	x	x	0 0 tableg
x	x	x	0 0 fetch
x	x	x	0 1 fetch
x	x	x	0 1 svZReg?(svZIO?mathrzd:mathrzc):mathrzb
x	x	x	0 0 fetch
x	x	x	0 0 fetch
x	x	x	0 0 fetch
x	x	x	0 1 svZReg?(svZIO?mathrzd:mathrzc):mathrzb
x	x	x	0 0 \$zpa,mathzzb
x	x	x	0 1 svZReg?(svZIO?mathzze:mathzzd):mathzzc
x	x	x	0 0 fetch
x	x	x	0 0 fetch
x	x	x	0 0 fetch

1

ROM

0	0	E3308800	3811608576	reset	K	3 K	3 PL	14	1
1	1	F3308800	4080044032	resetb	K	3 K	3 PH	15	1
2	2	43308800	1127254016	resetc	K	3 K	3 TL	4	1
3	3	53308800	1395689472	resetd	K	3 K	3 TH	5	1
4	4	0	0						
5	5	0	0						
6	6	0	0						
7	7	0	0						
8	8	44311800	1144068096	timer	K	3 TL	4 TL	4	1
9	9	55311800	1429280768	timerb	K	3 TH	5 TH	5	1
10	A	44310800	1144064000	timerc	K	3 TL	4 TL	4	1
11	B	0	0						
12	C	EEF01C00	4008713216	fetcha	PH*	15 PL*	14 PL*	14	1
13	D	FF301900	4281342208	fetchb	K	3 PH*	15 PH*	15	1
14	E	33300100	858784000	fetchc	K	3 K	3 K	3	0
15	F	0	0						
16	10	EEF01C00	4008713216	skipf	PH*	15 PL*	14 PL*	14	1
17	11	FF301800	4281341952	skipfb	K	3 PH*	15 PH*	15	1
18	12	33300000	858783744	skipfc	K	3 K	3 K	3	0
19	13	EE301800	3996129280	skip2	K	3 PL*	14 PL*	14	1
20	14	FF301800	4281341952	skip2b	K	3 PH*	15 PH*	15	1
21	15	EE301800	3996129280	skip1	K	3 PL*	14 PL*	14	1
22	16	FF301800	4281341952	skip1b	K	3 PH*	15 PH*	15	1
23	17	0	0						
24	18	3330B800	858830848	test	K	3 K	3 K	3	1
25	19	0	0						
26	1A	21026810	553805840	mathrr	S	0 kD	1 kD2	2	1
27	1B	0	0						
28	1C	8E300800	2385512448	call	K	3 PL*	14 LL	8	1
29	1D	9F300800	2670725120	callb	K	3 PH*	15 LH	9	1
30	1E	EEF01C00	4008713216	jump	PH*	15 PL*	14 PL*	14	1
31	1F	C3340800	3274967040	jumpb	K	3 K	3 ML	12	1
32	20	C3340800	3274967040	jumpc	K	3 K	3 ML	12	1
33	21	FF301800	4281341952	jumpd	K	3 PH*	15 PH*	15	1
34	22	3EF00400	1055917056	jumpe	PH*	15 PL*	14 K	3	0
35	23	F3340800	4080273408	jumpf	K	3 K	3 PH*	15	1
36	24	EC300800	3962570752	jumpg	K	3 ML	12 PL*	14	1
37	25	0	0						
38	26	E8300800	3895461888	return	K	3 LL	8 PL*	14	1
39	27	F9300800	4180674560	returnb	K	3 LH	9 PH*	15	1
40	28	0	0						
41	29	EEF01C00	4008713216	mathir	PH*	15 PL*	14 PL*	14	1
42	2A	13166810	320235536	mathirb	kD	1 K	3 D	1	1
43	2B	13166810	320235536	mathirc	kD	1 K	3 D	1	1
44	2C	FF301800	4281341952	mathird	K	3 PH*	15 PH*	15	1
45	2D	0	0						
46	2E	EEF01C00	4008713216	zpa	PH*	15 PL*	14 PL*	14	1
47	2F	63340800	1664354304	zpab	K	3 K	3 ZL	6	1
48	30	63340800	1664354304	zpac	K	3 K	3 ZL	6	1
49	31	FF301800	4281341952	zpad	K	3 PH*	15 PH*	15	1
50	32	36700400	913310720	zpa	ZH	7 ZL	6 K	3	0
51	33	367004C0	913310912	zpa	ZH	7 ZL	6 K	3	0
52	34	C3340800	3274967040	zpag	K	3 K	3 ML	12	1

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53	35	367004E0	913310944 zpah	ZH	7 ZL	6 K	3	0
54	36	D3340800	3543402496 zpai	K	3 K	3 MH	13	1
55	37	3C301000	1009782784 zpaj	K	3 ML	12 K	3	0
56	38	367002C0	913310400 zpak	ZH	7 ZL	6 K	3	0
57	39	367002C0	913310400 zpal	ZH	7 ZL	6 K	3	0
58	3A	3D301000	1026560000 zpan	K	3 MH	13 K	3	0
59	3B	367002E0	913310432 zpan	ZH	7 ZL	6 K	3	0
60	3C	3CD00400	1020265472 zpao	MH	13 ML	12 K	3	0
61	3D	0	0					
62	3E	EEF01C00	4008713216 mathiz	PH*	15 PL*	14 PL*	14	1
63	3F	30380800	808978432 mathizb	K	3 reg	0 K	3	1
64	40	30380800	808978432 mathizc	K	3 reg	0 K	3	1
65	41	303A6810	809134096 mathizd	K	3 reg	0 K	3	1
66	42	303A6810	809134096 mathize	K	3 reg	0 K	3	1
67	43	FF301800	4281341952 mathizf	K	3 PH*	15 PH*	15	1
68	44	FF301800	4281341952 mathizg	K	3 PH*	15 PH*	15	1
69	45	303A6810	809134096 mathizo	K	3 reg	0 K	3	1
70	46	33300000	858783744 mathizp	K	3 K	3 K	3	0
71	47	3CD00200	1020264960 mathizq	MH	13 ML	12 K	3	0
72	48	3300800	53479424 mathizr	K	3 K	3 reg	0	1
73	49	3300000	53477376 mathizs	K	3 K	3 reg	0	0
74	4A	0	0					
75	4B	8E300800	2385512448 callz	K	3 PL*	14 LL	8	1
76	4C	9F300800	2670725120 callzb	K	3 PH*	15 LH	9	1
77	4D	EC300800	3962570752 jumpz	K	3 ML	12 PL*	14	1
78	4E	FD300800	4247783424 jumpzb	K	3 MH	13 PH*	15	1
79	4F	0	0					
80	50	C0880800	3230140416 table	LL	8 reg	0 ML	12	1
81	51	D9301800	3643807744 tableb	K	3 LH	9 MH	13	1
82	52	D9300800	3643803648 tablec	K	3 LH	9 MH	13	1
83	53	CCD01C00	3436190720 tabled	MH	13 ML	12 ML	12	1
84	54	E3340800	3811837952 tablee	K	3 K	3 PL	14	1
85	55	E3340800	3811837952 tablef	K	3 K	3 PL	14	1
86	56	3CD00400	1020265472 tableg	MH	13 ML	12 K	3	0
87	57	DD301800	3710916608 tableh	K	3 MH	13 MH	13	1
88	58	F3340800	4080273408 tablei	K	3 K	3 PH	15	1
89	59	3CD00400	1020265472 tablej	MH	13 ML	12 K	3	0
90	5A	F3340800	4080273408 tablek	K	3 K	3 PH	15	1
91	5B	0	0					
92	5C	201A6810	538601488 mathzr	kD	1 reg	0 kD2	2	1
93	5D	0	0					
94	5E	300A6810	805988368 mathrz	S	0 reg	0 K	3	1
95	5F	3CD00200	1020264960 mathrzb	MH	13 ML	12 K	3	0
96	60	3300800	53479424 mathrzc	K	3 K	3 reg	0	1
97	61	3300000	53477376 mathrzd	K	3 K	3 reg	0	0
98	62	33026810	855795728 kmathrz	S	0 K	3 K	3	1
99	63	0	0					
100	64	30380800	808978432 mathzz	K	3 reg	0 K	3	1
101	65	333A6810	859465744 mathzzb	K	3 K	3 K	3	1
102	66	3CD00200	1020264960 mathzzc	MH	13 ML	12 K	3	0
103	67	3300800	53479424 mathzzd	K	3 K	3 reg	0	1
104	68	3300000	53477376 mathzze	K	3 K	3 reg	0	0
105	69	0	0					

ROM

106	6A	0	0
107	6B	0	0
108	6C	0	0
109	6D	0	0
110	6E	0	0
111	6F	0	0
112	70	0	0
113	71	0	0
114	72	0	0
115	73	0	0
116	74	0	0
117	75	0	0
118	76	0	0
119	77	0	0
120	78	0	0
121	79	0	0
122	7A	0	0
123	7B	0	0
124	7C	0	0
125	7D	0	0
126	7E	0	0
127	7F	0	0

address	hex	data	label	aAd	bAd	wAd	wReg
				23:20	27:24	31:28	11

15: PH	PH*	PH*	PH*
14: PL	?	PL*	PL*
13: MH	MH	MH	MH
12: ML	?	ML	ML
11: iH	?	?	?
10: iL	?	?	?
9: LH	?	LH	LH

ROM

8:	LL	LL	LL	LL
7:	ZH	ZH	?	?
6:	ZL	?	ZL	ZL
5:	TH	?	TH	TH
4:	TL	?	TL	TL
3:	K	K	K	K
2:	Y	?	?	kD2
1:	X	kD	kD	D
0:	W	S	reg	reg

\PH* PH ^ currInt<<2
\PL* PL ^ currInt<<2

test Din == 011xxxxx
math Din != x11xxxxx
jump Din == 111x11xx
imm Din == 111xxxxx & !jump
k Din == xxx1xxxx
zs Din == xxxx11xx
zd Din == xxxxxx11
jop Din[4,1:0]
aluOp Imm ? Din[4:2] : Din[7:5]
cond Din[3:0]
\fetch TZ?fetcha:timer

\decode

test	fetch
Math & zs & zf	skip2
Math & !zs & zd	skip1
Math & zs & !zd	skip1
Math & !zs & !zd	fetch
Imm & zd	skip2
Imm & !zd	skip1
Jump & jop == 0	skip2
Jump & jop == 1	skip2
Jump & jop == 2	fetch
Jump & jop == 3	fetch
Jump & jop == 4	skip1
Jump & jop == 5	skip1
Jump & jop == 6	fetch
Jump & jop == 7	skip1

\memz svZInd?mem:(svZReg?(svZIO?{1,reg[0]}:B):men
\mA SvAluOp[2]?00:SvAluOp[1:0]

ROM

\mL	SvAluOp[2]?svAluOp[1:0]:11
\mCin	!svAluOp[2]&svAluOp[0]
\S	{00,svS}
\D	{00,svD}
\kD	prevK ? 0011 : {00,svD}
\kD2	useK ? 0011 : {00,svD}

ROM

0	0	0	0B	0^	2	0	0	0	0	0	0	0+1	
0	0	0	0B	0^	2	0	0	0	0	0	0	0+1	
0	0	0	0B	0^	2	0	0	0	0	0	0	0+1	
0	0	0	0B	0^	2	0	0	0	0	0	0	0	8
0	0	-2	1B	0B	0	1	1	0	0	0	0	0	
0	0	-2	1B	0B	0	1	1	0	0	0	0	0+1	
0	0	-2	1B	0B	0	0	0	0	0	0	0	0	8
1	0	0	0B	0B	0	1	1	0	0	0	0	0+1,+2	
0	0	0	0B	0B	0	1	1	0	0	0	1	0	
0	0	0	0B	0B	0	0	0	0	0	0	1	0	
1	0	0	0B	0B	0	1	1	0	0	0	0	0+1,+2	
0	0	0	0B	0B	0	1	1	0	0	0	0	0	
0	0	0	0B	0B	0	0	0	0	0	0	0	0	
0	0	0	0B	0B	0	1	1	0	0	0	0	0+1,+2	
0	0	0	0B	0B	0	1	1	0	0	0	0	0+1	
0	0	0	0B	0B	0	1	1	0	0	0	0	0	
0	0	0	0B	0B	0	1	1	0	0	0	0	0	8
0	0	0	0B	0^	2tr		3	0	0	0	0	0	
0	0mA		2B	0mL	1 mCir	2	0	0	0	0	0	1	8
0	0	0	0B	0B	0	0	0	0	0	0	0	0+1	
0	0	0	0B	0B	0	0	0	0	0	0	0	0+1	
1	0	0	0B	0B	0	1	1	0	0	0	0	0+1,+2	
0	0	0	0mem	1B	0	0	0	0	0	0	0	0+2	
0	0	0	0mem	1B	0	0	0	0	0	0	0	0+2	
0	0	0	0B	0B	0	1	1	0	0	0	0	0+1	
1	0	0	0B	0B	0	0	0	0	0	0	0	0+1	
0	0	0	0mem	1B	0	0	0	0	0	0	0	0+1	
0	0	0	0B	0B	0	0	0	0	0	0	0	0	8
0	0	0	0B	0B	0	0	0	0	0	0	0	0+1	
0	0	0	0B	0B	0	0	0	0	0	0	0	0	8
1	0	0	0B	0B	0	1	1	0	0	0	0	0+1,+2	
0	0mA		2mem	1mL	1 mCir	2	0	0	0	0	0	1+2	
0	0mA		2mem	1mL	1 mCir	2	0	0	0	0	0	1	8
0	0	0	0B	0B	0	1	1	0	0	0	0	0	8
1	0	0	0B	0B	0	1	1	0	0	0	0	0+1,+2	
0	0	0	0mem	1B	0	0	0	0	0	0	0	0+2	
0	0	0	0mem	1B	0	0	0	0	0	0	0	0+3,+2	
0	0	0	0B	0B	0	1	1	0	0	0	0	0+2,+1	
1	0	0	0B	0B	0	0	0	0	0	0	0	0	
1	0	0	0B	0B	0	0	0	1	1	0	0	0+1	
0	0	0	0mem	1B	0	0	0	0	0	0	0	0+1	

ROM

1	0	0	0B	0B	0	0	0	1	1	1	0	0+1
0	0	0	0 mem	1B	0	0	0	0	0	0	0	0+1,+5
0	0	0	0B	0B	0	1	1	0	0	0	0	0+1,+2
0	1	0	0B	0B	0	0	0	1	1	0	0	0+2
0	1	0	0B	0B	0	0	0	1	1	0	0	0+3
0	0	0	0B	0B	0	1	1	0	0	0	0	0+1
0	1	0	0B	0B	0	0	0	1	1	1	0	0+1
1	0	0	0B	0B	0	0	0	0	0	0	0	0
1	0	0	0B	0B	0	1	1	0	0	0	0	0+3,+4,+1,+
0	0	0	0 memz	2B	0	0	0	0	0	0	0	0\$+6
0	0	0	0 memz	2B	0	0	0	0	0	0	0	0+3
0	0 mA		2 memz	2 mL	1 mCir	2	0	0	0	0	0	1\$+5
0	0 mA		2 memz	2 mL	1 mCir	2	0	0	0	0	0	1+2
0	0	0	0B	0B	0	1	1	0	0	0	0	0\$+2
0	0	0	0B	0B	0	1	1	0	0	0	0	0\$+2
0	0 mA		2 memz	2 mL	1 mCir	2	0	0	0	0	0	1+1
0	0	0	0B	0B	0	0	0	0	0	0	0	0+3,+2,+1,+
0	1	0	0B	0B	0	0	0	0	0	0	0	8
0	0	0	0B	0B	0	0	0	0	0	0	0	8
0	0	0	0B	0B	0	0	0	0	0	0	0	8
0	0	0	0B	0B	0	0	0	0	0	0	0	0+1
0	0	0	0B	0B	0	0	0	0	0	0	0	0\$+1
0	0	0	0B	0B	0	0	0	0	0	0	0	0+1
0	0	0	0B	0B	0	0	0	0	0	0	0	8
0	0	0	0 memz	2B	0	0	0	0	0	0	0	0+1,+2
0	0	0	0B	0B	0	1	1	0	0	0	0	0+2
0	0	0	0B	0B	0	0	0	0	0	0	0	0+1
1	0	0	0B	0B	0	1	1	0	0	0	0	0+1,+2
0	0	0	0 mem	1B	0	0	0	0	0	0	0	0+2
0	0	0	0 mem	1B	0	0	0	0	0	0	0	0+2
1	0	0	0B	0B	0	0	0	0	0	0	0	0+2
0	0	0	0B	0B	0	1	1	0	0	0	0	0+2
0	0	0	0 mem	1B	0	0	0	0	0	0	0	8
1	0	0	0B	0B	0	0	0	0	0	0	0	0+1
0	0	0	0 mem	1B	0	0	0	0	0	0	0	8
0	0 mA		2 memz	2 mL	1 mCir	2	0	0	0	0	1	8
0	0 mA		2 memz	2 mL	1 mCir	2	0	0	0	0	1+3,+2,+1,+	
0	1	0	0B	0B	0	0	0	0	0	0	0	8
0	0	0	0B	0B	0	0	0	0	0	0	0	8
0	0	0	0B	0B	0	0	0	0	0	0	0	8
0	0 mA		2B	0 mL	1 mCir	2	0	0	0	0	1-1,-2,-3,-3	
0	0	0	0 memz	2B	0	0	0	0	0	0	0	0\$+1
0	0 mA		2 memz	2 mL	1 mCir	2	0	0	0	0	1+3,+2,+1,+	
0	1	0	0B	0B	0	0	0	0	0	0	0	8
0	0	0	0B	0B	0	0	0	0	0	0	0	8
0	0	0	0B	0B	0	0	0	0	0	0	0	8

ROM

rMem	wMem	aSel	bSel	logSel	Cin	sA7	sA0	A0	wIR	wFL	relJump
10	09	17:16	19:18	15:14	13:12	07	06	05	08	04	03:00

0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

ROM

aSel	bSel	logSel	Cin
x	x	x	tr
mA	memz	^	mCin
-2	mem	mL	1
0	B	B	0

\decode

test

useK?\$zpa,mathzzb:\$zpa,mathzz

useK?\$zpa,kmathrz:\$zpa,mathrz

\$zpa,mathzr

mathrr

mathiz

mathir

jump

call

fetch

return

\$zpa,jumpz

callz

fetch

\$zpa,table

note: useK will become prevK at the end of th

n)

ROM

resetb
resetc
resetd
fetch

Z?(TZ?fetcha:timerb):timer
timerc
timer (fetch with TZ=0)

C?fetchb:fetchc
decode
decode

C?skipfb:skipfc
decodeSkip
decodeSkip
C?skip2b:skip1
skip1
C?skip1b:fetch
fetch

useK|tr?fetch:skipf

fetch

callb
jump
C?jumpb:jumpc
jumpd
jumpe
jumpe
jumpe
jumpf
jumpg
fetch

returnb
fetch

C?mathirb:mathirc
mathird
fetch
fetch

C?zpab:zpac
zpad
svlnd?zpaf:zpa
svlnd?zpaf:zpa
rtn
zpag
zpah

ROM

zpai
svInc?zpaj:zpao
C?zpak:zpal
zpam
zpao
zpan
zpao
rtn

prevK?(C?mathizd:mathize):(C?mathizb:mathizc)
\$zpa,mathizo
mathizf
\$zpa,mathizp
mathizg
\$zpa,mathizo
\$zpa,mathizp
mathizp
svZReg?(svZIO?mathizs:mathizr):mathizq
fetch
fetch
fetch

callzb
\$zpa,jumpz
jumpzb
fetch

C?tableb:tablec
tabled
tabled
C?tablee:tablef
tableg
tableh
tablei
tablej
fetch
tablek
fetch

fetch

svZReg?(svZIO?mathrzd:mathrzc):mathrzb
fetch
fetch
fetch
svZReg?(svZIO?mathrzd:mathrzc):mathrzb

\$zpa,mathzzb
svZReg?(svZIO?mathzze:mathzzd):mathzzc
fetch
fetch
fetch

ROM

next

Z?(TZ?fetcha:timerb):timer

C?b:c

useK|tr?fetch:skipf

svInd?b:c

prevK?(C?mathizd:mathize):(C?mathizb:mathizc)

\$zpa,mathzzb

rtn

decode

decodeSkip

timer+(TZ<<2)

ROM

is clock cycle