TIA - Write

\$11 RESP1 - S T R O B E - Reset player 1 horizontal position \$12 RESM0 - S T R O B E - Reset missile 0 horizontal position	Addr	Name	7	6	5	4	3	2	1	0	Function
SO2	\$00	VSYNC	-	-	-	-	-	-	1	-	Vertical sync
S03	\$01	VBLANK	D	L	-	-	-	-	В	-	Vertical blank: Dump I0,I1,I2,I3,
S04	\$02	WSYNC	-	S	Т	R	0	В	Е	-	Wait for start of horizontal sync.
Size of Missile 0	\$03	RSYNC	-	S	Т	R	0	В	Е	-	Reset sync (chip testing).
Size of Missile 1	\$04	NUSIZ0	-	-	M	М	-	P	P	P	
S07	\$05	NUSIZ1	-	-	M	M	-	P	P	P	
SOB COLUPF C C C C C L L L X Colour / Luminance playfield	\$06	COLUP0	С	С	С	С	L	L	L	X	Colour / Luminance player 0
SOP	\$07	COLUP1	С	С	С	С	L	L	L	X	Colour / Luminance player 1
SOA CTRLPF - - B B - P S R Playfield control: Ball size, Playfield priority, Score, Reflect. SOB REFPO - - - 1 - - Reflect player 0 SOC REFPI - - - 1	\$08	COLUPF	С	С	С	С	L	L	L	X	Colour / Luminance playfield
SOB REFPO Color	\$09	COLUBK	С	С	С	С	L	L	L	X	Colour / Luminance background
SOC REFP1 - - - 1 1 - - - Reflect player 1 SOD PFO 1 </td <td>\$0A</td> <td>CTRLPF</td> <td>-</td> <td>-</td> <td>В</td> <td>В</td> <td>-</td> <td>P</td> <td>S</td> <td>R</td> <td></td>	\$0A	CTRLPF	-	-	В	В	-	P	S	R	
SOD	\$0B	REFP0	-	-	-	-	1	-	-	-	Reflect player 0
\$0E PF1	\$0C	REFP1	-	-	-	-	1	-	-	-	Reflect player 1
\$0F PF2	\$0D	PF0	1	1	1	1	-	-	-	-	Playfield register 0 (bits 4-7)
\$10 RESP0 - S T R O B E - Reset player 0 horizontal position \$11 RESP1 - S T R O B E - Reset player 1 horizontal position \$12 RESM0 - S T R O B E - Reset player 1 horizontal position \$13 RESM1 - S T R O B E - Reset missile 0 horizontal position \$14 RESBL - S T R O B E - Reset missile 1 horizontal position \$15 AUDC0 1 1 1 1 1 Audio control channel 0 \$16 AUDC1 1 1 1 1 1 Audio control channel 0 \$17 AUDF0 1 1 1 1 1 Audio frequency channel 0 \$18 AUDF1 1 1 1 1 1 Audio frequency channel 0 \$18 AUDV0 1 1 1 1 1 Audio volume channel 0 \$19 AUDV0 1 1 1 1 1 Audio volume channel 0 \$10 S1A AUDV1 1 1 1 1 1 Craphics player 0 \$11 ENAMO 1 1 1 1 1 Graphics player 0 \$12 ENAMO 1 1 1 1 1 Graphics player 1 \$13 ENAMO 1 1 1 1 1 Enable missile 0 \$14 ENAMO 1 1 1 1 Enable missile 1 \$15 ENAMI 1 1 1 1 Enable missile 1 \$16 ENAMI 1 1 Enable missile 1 \$17 ENAMO 1 1 Enable missile 1 \$18 ENAMI 1 1 Enable missile 1 \$19 ENAMO 1 1 Enable missile 1 \$10 ENAMO	\$0E	PF1	1	1	1	1	1	1	1	1	Playfield register 1 (bits 7-0)
\$11 RESP1 - S T R O B E - Reset player 1 horizontal position \$12 RESMO - S T R O B E - Reset missile 0 horizontal position \$13 RESM1 - S T R O B E - Reset missile 1 horizontal position \$14 RESBL - S T R O B E - Reset missile 1 horizontal position \$15 AUDCO 1 1 1 1 1 Audio control channel 0 \$16 AUDC1 1 1 1 1 1 Audio control channel 1 \$17 AUDFO 1 1 1 1 1 Audio frequency channel 0 \$18 AUDF1 1 1 1 1 1 Audio frequency channel 1 \$19 AUDVO 1 1 1 1 1 Audio frequency channel 0 \$18 AUDV1 1 1 1 1 1 Audio volume channel 0 \$19 AUDVO 1 1 1 1 1 1 Audio volume channel 1 \$19 AUDVO 1 1 1 1 1 1 Graphics player 0 \$10 GRP1 1 1 1 1 1 1 1 1 Graphics player 0 \$11 GRP1 1 1 1 1 1 1 1 1 Graphics player 1 \$12 ENAMO 1 1 1 1 1 Graphics player 1 \$13 ENAMO 1 1 1 1 1 Enable missile 0 \$14 ENAMO 1 1 1 1 1 Enable missile 1 \$15 ENABL 1 1 1 Enable missile 1 \$16 GRP1 1 1 1 1 1 1 1 1 1 Enable missile 1 \$17 ENABL 1 1 1 Enable missile 1 \$18 ENABL 1 1 Enable missile 1 \$19 ENAMO 1 1 1 1 1 1 1 1 1 1 Enable missile 1 \$19 ENAMO 1 1 1 1 1 1 1 1 1 Enable missile 1 \$20 HMPO 1 1 1 1 1 1 1 1 1 Enable missile 1 \$21 HMPI 1 1 1 1 1 1 1 1 1 Enable missile 0 \$22 HMMO 1 1 1 1 1 1 1 1 1 1 Enable missile 0 \$23 HMMI 1 1 1 1 1 1 1 1 1 1 1 Enable missile 0 \$24 HMBL 1 1 1 1 1 1 1 1 1 1 1 1 Enable missile 0 \$25 VDELPO 1 1 Enable missile 0 \$26 VDELPI 1 1 Enable missile 1 Vertical delay player 0 \$27 VDELBL 1 1 Enable missile 1 to player 1 \$28 RESMPO 1 1 Enable missile 1 to player 1 \$29 RESMPI 1 1 Enable missile 1 to player 1	\$0F	PF2	1	1	1	1	1	1	1	1	Playfield register 2 (bits 0-7)
\$12 RESMO - S T R O B E - Reset missile 1 horizontal position \$13 RESM1 - S T R O B E - Reset missile 1 horizontal position \$14 RESBL - S T R O B E - Reset missile 1 horizontal position. \$15 AUDCO 1 1 1 1 1 Audio control channel 0 \$16 AUDC1 1 1 1 1 1 Audio control channel 1 \$17 AUDFO 1 1 1 1 1 Audio frequency channel 0 \$18 AUDF1 1 1 1 1 1 Audio frequency channel 0 \$18 AUDVO 1 1 1 1 1 Audio volume channel 1 \$19 AUDVO 1 1 1 1 1 Audio volume channel 0 \$1A AUDV1 1 1 1 1 1 Audio volume channel 1 \$1B GRPO 1 1 1 1 1 1 1 1 Graphics player 0 \$1C GRP1 1 1 1 1 1 1 1 Graphics player 1 \$1D ENAMO 1 1 1 1 Graphics player 1 \$1D ENAMO 1 1 1 1 1 Graphics player 1 \$1E ENAM1 1 1 1 1 1 Enable missile 0 \$1E ENAM1 1 1 1 1 1 Enable missile 1 \$20 HMPO 1 1 1 1 1 1 1 1 Enable ball. \$20 HMPO 1 1 1 1 1 1 1 1 Enable ball. \$21 HMP1 1 1 1 1 1 1 1 1 Enable ball. \$22 HMMO 1 1 1 1 1 1 1 1 1 Enable ball \$23 HMM1 1 1 1 1 1 1 1 1 1 1 1 1 Vertical delay player 0 \$24 HMBL 1 1 1 1 1 1 1 1 Vertical delay player 0 \$25 VDELPO 1 Vertical delay player 1 \$28 RESMPO 1 Vertical delay player 1 \$28 RESMPO 1 RESET MISSILE 1 To player 1 \$29 RESMP1 1 RESET MISSILE 1 To player 1 \$20 RESMPO 1 RESET MISSILE 1 To player 1 \$21 RESET MISSILE 1 To player 1 \$22 RESMPO 1 RESET MISSILE 1 To player 1 \$28 RESMPO 1 RESET MISSILE 1 To player 1	\$10	RESP0	-	s	Т	R	О	В	E	-	Reset player 0 horizontal position.
\$13 RESM1	\$11	RESP1	-	S	Т	R	0	В	Е	-	Reset player 1 horizontal position.
\$14 RESBL - S T R O B E - Reset ball horizontal position. \$15 AUDCO 1 1 1 1 1 Audio control channel 0 \$16 AUDC1 1 1 1 1 1 Audio control channel 1 \$17 AUDFO 1 1 1 1 1 Audio frequency channel 0 \$18 AUDF1 1 1 1 1 1 Audio frequency channel 0 \$18 AUDVO 1 1 1 1 1 Audio volume channel 1 \$19 AUDVO 1 1 1 1 1 Audio volume channel 0 \$1A AUDV1 1 1 1 1 1 Audio volume channel 0 \$1B GRPO 1 1 1 1 1 1 1 1 1 1 Graphics player 0 \$1C GRP1 1 1 1 1 1 1 1 1 1 1 Graphics player 0 \$1D ENAMO 1 1 1 1 Graphics player 1 \$1D ENAMO 1 1 Enable missile 0 \$1E ENAMI 1 1 Enable missile 1 \$1F ENABL 1 1 Enable ball. \$20 HMPO 1 1 1 1 1 1 1 1 Enable ball. \$21 HMP1 1 1 1 1 1 1 1 1 Enable ball. \$22 HMMO 1 1 1 1 1 1 1 1 1 1 Enable ball. \$23 HMM1 1 1 1 1 1 1 1 1 1 1 1 1 1 Enable motion player 0 \$24 HMBL 1 1 1 1 1 1 1 1 1 1 1 1 Vertical delay player 0 \$25 VDELPO 1 Vertical delay player 0 \$26 VDELPI 1 Vertical delay player 1 \$28 RESMPO 1 Vertical delay player 0 \$29 RESMP1 1 R O B E - Apply horizontal motion.	\$12	RESM0	-	S	Т	R	0	В	Е	-	Reset missile 0 horizontal position.
\$15 AUDCO	\$13	RESM1	-	s	Т	R	0	В	Е	-	Reset missile 1 horizontal position.
\$16	\$14	RESBL	-	s	Т	R	0	В	Е	-	Reset ball horizontal position.
\$17 AUDFO	\$15	AUDC0	-	-	-	-	1	1	1	1	Audio control channel 0
\$18 AUDF1 1 1 1 1 1 Audio frequency channel 1 \$19 AUDV0 1 1 1 1 1 Audio volume channel 0 \$1A AUDV1 1 1 1 1 1 Audio volume channel 0 \$1B GRP0	\$16	AUDC1	-	-	-	-	1	1	1	1	Audio control channel 1
\$19 AUDV0 1 1 1 1 Audio volume channel 0 \$1A AUDV1 1 1 1 1 1 Audio volume channel 1 \$1B GRP0	\$17	AUDF0	-	-	-	1	1	1	1	1	Audio frequency channel 0
\$1A AUDV1 1 1 1 1 Audio volume channel 1 \$1B GRP0	\$18	AUDF1	-	-	-	1	1	1	1	1	Audio frequency channel 1
\$1B GRP0	\$19	AUDV0	-	-	-	-	1	1	1	1	Audio volume channel 0
\$1C GRP1	\$1A	AUDV1	-	-	-	-	1	1	1	1	Audio volume channel 1
\$1D ENAMO 1 - Enable missile 0 \$1E ENAM1 1 - Enable missile 1 \$1F ENABL 1 - Enable missile 1 \$20 HMP0	\$1B	GRP0	1	1	1	1	1	1	1	1	Graphics player 0
\$1E ENAM1 - </td <td>\$1C</td> <td>GRP1</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>Graphics player 1</td>	\$1C	GRP1	1	1	1	1	1	1	1	1	Graphics player 1
\$1F ENABL - </td <td>\$1D</td> <td>ENAM0</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>1</td> <td>-</td> <td>Enable missile 0</td>	\$1D	ENAM0	-	-	-	-	-	-	1	-	Enable missile 0
\$20	\$1E	ENAM1	-	-	-	-	-	-	1	-	Enable missile 1
\$21 HMP1	\$1F	ENABL	-	-	-	-	-	-	1	-	Enable ball.
\$22 HMM0	\$20	HMP0	1	1	1	1	-	-	-	-	Horizontal fine motion player 0
\$23 HMM1 2 - <td>\$21</td> <td>HMP1</td> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>Horizontal fine motion player 1</td>	\$21	HMP1	1	1	1	1	-	-	-	-	Horizontal fine motion player 1
\$23 HMM1 1 <td></td> <td></td> <td></td> <td></td> <td></td> <td>1</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td></td>						1	-	-	-	-	
\$24 HMBL						1	-	-	-	-	Horizontal fine motion missile 1
\$25 VDELP0 1 Vertical delay player 0 \$26 VDELP1 1 Vertical delay player 1 \$27 VDELBL 1 Vertical delay player 1 \$28 RESMP0 1 Vertical delay ball \$28 RESMP0 1 RESET missile 0 to player 0 \$29 RESMP1 1 - Reset missile 1 to player 1 \$2A HMOVE - S T R O B E - Apply horizontal motion.							-	-	-	-	
\$26 VDELP1 1 Vertical delay player 1 \$27 VDELBL 1 Vertical delay ball \$28 RESMP0 1 - Reset missile 0 to player 0 \$29 RESMP1 1 - Reset missile 1 to player 1 \$2A HMOVE - S T R O B E - Apply horizontal motion.			-	-	-	-	-	-	-	1	
\$27 VDELBL - - - - - 1 Vertical delay ball \$28 RESMP0 - - - - - 1 - Reset missile 0 to player 0 \$29 RESMP1 - - - - 1 - Reset missile 1 to player 1 \$2A HMOVE - S T R O B E - Apply horizontal motion.			-	-	-	-	-				
\$28 RESMP0 - - - - - 1 - Reset missile 0 to player 0 \$29 RESMP1 - - - - - 1 - Reset missile 1 to player 1 \$2A HMOVE - S T R O B E - Apply horizontal motion.				-	-	-	-				
\$29 RESMP1 1 - Reset missile 1 to player 1 \$2A HMOVE - S T R O B E - Apply horizontal motion.				-	-	-	-		1		
\$2A HMOVE - S T R O B E - Apply horizontal motion.			_	-	_	-	_	_		_	
			-	S	Т	R	0	В			
and the second s											
\$2C CXCLR - S T R O B E - Clear collision latches											

NUSIZ0 / NUSIZ1

110	110012071100121											
Bit 2	Bit 1	Bit 0		Clocks								Description
0	0	0										One copy
0	0	1										Two copies - close
0	1	0										Two copies - medium
0	1	1										Three copies - close
1	0	0										Two copies - wide
1	0	1										Double size player
1	1	0										Three copies - medium
1	1	1										Quad size

TIA- Read

Addr	Name	7	6	5	4	3	2	1	0	Function
\$00	CXM0P	1	1	-	-	-	-	-	-	Read collision: 7: M0 P1, 6: M0 P1
\$01	CXM1P	1	1	-	-	-	-	-	-	Read collision: 7: M1 P0, 6: M1 P1
\$02	CXP0FB	1	1	-	-	-	-	-	-	Read collision: 7: P0 PF, 6: P0 BL
\$03	CXP1FB	1	1	-	-	-	-	-	-	Read collision: 7: P1 PF, 6: P1 BL
\$04	CXM0FB	1	1	-	-	-	-	-	-	Read collision: 7: M0 PF, 6: M0 BL
\$05	CXM1FB	1	1	-	-	-	-	-	-	Read collision: 7: M1 PF, 6: M1 BL
\$06	CXBLPF	1	-	-	-	-	-	-	-	Read collision: 7: BL PF
\$07	CXPPMM	1	1	-	-	-	-	-	-	Read collision: 7: P0 P1, 6: M0 M1
\$08	INPT0	1	-	-	-	-	-	-	-	Read POT port 0 (paddle 0)
\$09	INPT1	1	-	-	-	-	-	-	-	Read POT port 1 (paddle 0)
\$0A	INPT2	1	-	-	-	-	-	-	-	Read POT port 2 (paddle 0)
\$0B	INPT3	1	-	-	-	-	-	-	-	Read POT port 3 (paddle 0)
\$0C	INPT4	1	-	-	-	-	-	-	-	Read input 0 (joystick left fire)
\$0D	INPT5	1	-	-	-	-	-	-	-	Read input 1 (joystick right fire)

RIOT

Addr	Name	7	6	5	4	3	2	1	0	Function
\$280	SWCHA	1	1	1	1	1	1	1	1	Port A Data (Joystick / Controllers)
\$281	SWACNT	1	1	1	1	1	1	1	1	Port A Control (DDR) (write only)
\$282	SWCHB	1	1	1	1	1	1	1	1	Port B Data (Console Switches)
\$283	SWBCNT	1	1	1	1	1	1	1	1	Port B Control (DDR) (write only)
\$284	INTIM	1	1	1	1	1	1	1	1	Timer (read only)
\$294	TIM1T	1	1	1	1	1	1	1	1	Set timer 1 clock interval (write)
\$295	TIM8T	1	1	1	1	1	1	1	1	Set timer 8 clock intervals (write)
\$296	TIM64T	1	1	1	1	1	1	1	1	Set timer 64 clock intervals (write)
\$297	TIM1024T	1	1	1	1	1	1	1	1	Set timer 1K clock intervals (write)

SWCHA

Bit	Direction	Player
7	Right	Left (P0)
6	Left	Left (P0)
5	Down	Left (P0)
4	Up	Left (P0)
3	Right	Right (P1)
2	Left	Right (P1)
1	Down	Right (P1)
0	Up	Right (P1)

SWCHB

Bit	Switch	Description
7	Right (P1) difficulty	0 = (B)eginner/Easy/Novice, 1= (A)dvance/Normal/Pro
6	Left (P0) difficulty	0 = (B)eginner/Easy/Novice, 1= (A)dvance/Normal/Pro
5	Unused	Unused
4	Unused	Unused
3	Colour / B&W	0 = B&W, 1 = Colour (SECAM hard wired to ground)
2	Unused	Unused
1	Select	0 = Depressed
0	Reset	0 = Depressed

RAM - \$FF to \$80, STACK \$FF down to \$80.

ROM - \$F000 to \$F3FF (4KB) shadow at any address with bit 12 set e.g. \$1000, \$3000, etc.

CPU Vectors

Address	Vector
\$FFFA/\$FFFB	NMI
\$FFFC/FFFD	Reset
\$FFFE/FFFF	IRQ/BRK