DIG DUG CUSTOM CHIPS

ØØ Video Ram Addresser - Namco Gate Array

Pin #	Name	Input/Output	EXPLANATION
1	2H	I	SYNC INPUTS
2	4H	I	"
3	8H	I	"
4	16H	I	"
5	32H	I	"
6	64H	I	"
7	128H	I	"
8	256H	I	"
9	8V	I	"
10	16V	I	"
11	32V	I	"
12	64V	I	"
13	128V	I	"
14	Gnd	POWER	
15	AB11	O	2H=Ø=High Z; 2H=1=Active; Ram Addresser
16	AB10	O	"
17	AB9	O	"
18	AB8	O	"
19	AB7	O	"
20	AB6	O	"
21	AB5	O	"
22	AB4	O	"
23	AB3	O	"
24	AB2	O	"
25	AB1	O	"
26	ABØ	O	"
27	FLIP	O	Ø = Normal, 1 = Reverse
28	VCC	POWER	+5V

NOTES: Allows RAM to be addressed by CPU and Sync chain. Requires CPU Address bus to be tri-state during 2H high.

Ø2 Universal Shift Register

Pin #	Name	I/O	EXPLANATION - 4 Bit Mode	8 Bit Mode
1	CK	I	Clock Imput	Clock Imput
2	FLIP	I	O = Normal, 1 = Reverse	Ø = Normal, 1 = Reverse
3	DØ7	I	4 Bit Data For QØ1	8 Bit Data for QØ1
4	DØ6	I		
5	DØ5	I		
6	DØ4	I		
7	DØ3	I	4 Bit Data For QØØ	
8	DØ2	I		
9	DØ1	I		
10	DØØ	I		
11	QØØ	O	DØ3, DØ2, DØ1, DØØ in order	Not use
12	QØ1	O	DØ7, DØ6, DØ5, DØ4 in order	DØ7-DØØ in order
13	MODE	I	Ø = 4 Bit Mode	1 = 8 Bit Mode

Ø2 Universal Shift Register Continued

Pin #	Name	I/O	EXPLANATION - 4 Bit Mode	8 Bit Mode
14	GND	POWER		
15	S/L	I	1 = Shift, Ø = Load	1 = Shift, Ø = Load
16	LDEN	I	Load Enable	Load Enable
17	Q11	O	D17, D16, D15, D14 in order	D17 - D1Ø in order
18	Q1Ø	O	D13, D12, D11, D1Ø in order	Not Used
19	D1Ø	I		
20	D11	I	4 Bit Data	
21	D12	I	For Q1Ø	
22	D13	I		8 Bit Data
23	D14	I		For Q11
24	D15	I	4 Bit Data	
25	D16	I	For Q11	
26	D17	I		
27	CLR	I	CLEAR	CLEAR
28	VCC	POWER	+5V	+5V

NOTES: Can be set up for 4 4-bit parallel to serial converters or 2 8-bit parallel to serial converters. All registers use 1 set of control signals. Can shift either direction.

Ø4 Motion Object Controller

Pin #	Name	I/O	
1	1H	I	Sync Inputs
2	2H	I	Sync Inputs
3	HSYNC	I	Sync Inputs
4	H4	O	Select which 4 of 32 motion object pixels to load into video RAM
5	H8	O	
6	H16	O	
7	RA6	O	Address for Motion Object RAM 2H = Ø = CPU Address 2H = 1 = Motion Data Control
8	RA5	O	
9	RA4	O	
10	RA3	O	
11	RA2	O	
12	RA1	O	
13	RAØ	O	
14	GND	POWER	
15	ABØ	I	CPU Address
16	AB1	I	
17	AB2	I	
18	AB3	I	
19	AB4	I	
20	AB5	I	
21	AB6	I	
22	VPO5	O	Strobe when vertical position is stable (1st)
23	HPO5	O	Strobe when horizontel position is stabel (2nd)
24	OBJEN*	O	2H faster than OBJEN
25	MATCH	I	Vertical line match = Ø
26	SIZE	I	Ø = 16 x 16; 1 = 32 pixel objects
27	OBJEN	O	Generated if MATCH is true (low)
28	VCC	POWER	+5V

NOTE: Generates the strobes and RAM addresses for the motion objects. (MOC 24 style)

Ø6 CUSTOM 5Ø CONTROLLER

Pin #	Name	I/O	EXPLANATION
1	ER/W	0	R/W Signal to Custom 50's
2	EDB7	I/O	Custom 50 Data Bus
3	EDB6	I/O	
4	EDB5	I/O	
5	EDB4	I/O	
6	EDB3	I/O	
7	EDB2	I/O	
8	EDB1	I/O	
9	EDBØ	I/O	
10	ECS3	0	Custom 50 Chip Selects
11	ECS2	0	
12	ECS1	0	
13	ECSØ	0	
14	GND	POWER	
15	C/C	I	1 = Command, Ø = Data (on Data Bus)
16	R/W	I	CPU R/W
17		I	128H (or 64H.HSYNC) Sync input
18	128H	I	Chip Select
19	C5	0	CPU NMI
20	DBØ	I/O	CPU Data Bus
21	DB1	I/O	
22	DB2	I/O	
23	DB3	I/O	
24	DB4	I/O	
25	DB5	I/O	
26	DB6	I/O	
27	DB7	I/O	
28	VCC	POWER	+5V

NOTE: Interfaces between CPU and Custom 50's. (Custom 4 bit microprocessors) Commands and data are transfered via the data bus. C/D selects Command or Data. Part of the Custom 50 Data Bus is Address and part is Data (apparently).

Ø7 SYNC GENERATOR

Pin #	Name	I/O	EXPLANATION
1	CK	I	6MHZ Input
2	1H	0	Horizontal Outputs
3	2H	0	
4	4H	0	
5	8H	0	
6	16H	0	
7	32H	0	
8	64H	0	
9	128H	0	
10	256H	0	
11	HBLANK	0	
12	HSYNC	0	
13	HRESET	I/O	Used to synchronize 2 chips (O.C.)
14	GND	POWER	
15	TEST2	I	Ø = Normal
16	VRESET	I/O	Used to sync. two chips (open collector)
17	VSYNC	0	Vertical Outputs
18	VBLANK	0	

Ø7 SYNC GENERATOR CONTINUED

Pin #	Name	I/O	EXPLANATION
19	TEST1	I	1 = Normal
20	128V	O	Vertical Outputs
21	64V	O	
22	32V	O	
23	16V	O	
24	8V	O	
25	4V	O	
26	2V	O	
27	1V	O	
28	VCC	POWER	+5V

NOTE: Takes 6 MHZ and generates all Horizontal & Vertical timing signals. More than 1 can be used in a system using $\overline{\text{HRESET}}$ and $\overline{\text{VRESET}}$.

51 Coin I/O Controller

Pin #	Name	I/O	Explanation
1	EXTAL	I	External clock input ($2\overline{H}$ normally) (max 2Mhz)
2	$\overline{\text{XTAL}}$	I	N.C.
3	$\overline{\text{RESET}}$	I	Reset signal
4	$\overline{\text{IRQ}}$	I	Chip select
5	SO	O	Lockout cord signal
6	SI	?	? Not used on D.D.
7	SC/TO	?	? Not used on D.D.
8	TC	I	$\overline{\text{VBLANK}}$
9	PØ	O	Lamp z output
10	P1	O	Lamp 1 output
11	P2	O	Coin Counter 2 output
12	P3	O	Coin Counter 1 output
13	EDBØ	I/O	Custom 50 BUS
14	EDB1	I/O	
15	EDB2	I/O	
16	EDB3	I/O	
17	EDB4	I/O	
18	EDB5	I/O	
19	EDB6	I/O	
20	EDB7	I/O	
21	GND	POWER	
22	RØ	I	Player 1 Up
23	R1	I	Right
24	R2	I	Down
25	R3	I	Left
26	R4	I	Player 2 Up
27	R5	I	Right
28	R6	I	Down
29	R7	I	Left
30	R8	I	Player 1 Shoot
31	R9	I	Player 2 Shoot
32	R10	I	Player 1 Start
33	R11	I	Player 2 Start
34	R12	I	Coin 1

51 Coin I/O Controller Continued

Pin #	Name	I/O	Explanation
35	R13	I	Coin 2
36	R14	I	Service (Anx Coin Input)
37	R15	I	Test
38	KØ	?	Address?
39	K1	?	
40	K2	?	
41	K3	I	R/$\overline{W}$ Input
42	VCC	POWER	+5V

NOTE: This custom microporcessor handles I/O (R/$\overline{W}$)

53 Steering Controller

Pin #	Name	I/O	Explanation
1	EXTAL	I	External clock input (2$\overline{H}$ normally) (max 2Mhz)
2	XTAL	I	N.C.
3	$\overline{RESET}$	I	Reset signal
4	$\overline{IRQ}$	I	Chip select
5	SO		Not used on Dig Dug
6	$\overline{S1}$		
7	SC/$\overline{TO}$		
8	$\overline{TC}$		
9	PØ	O	Mode determines function. Not used on Dig Dug
10	P1	O	
11	P2	O	
12	P3	O	
13	EDBØ	I/O	Custom 50 data Bus. 16 switches read in Dig Dug (mode 7), other things read in other modes.
14	EDB1	I/O	
15	EDB2	I/O	
16	EDB3	I/O	
17	EDB4	I/O	
18	EDB5	I/O	
19	EDB6	I/O	
20	EDB7	I/O	
21	GND	I	Power
22	RØ	I	Reads switches, keyboards (ASCII), & different things for different modes.
23	R1	I	
24	R2	I	
25	R3	I	
26	R4	I	
27	R5	I	
28	R6	I	
29	R7	I	
30	R8	I	
31	R9	I	
32	R10	I	
33	R11	I	
34	R12	I	
35	R13	I	
36	R14	I	
37	R15	I	

53 Steering Controller Continued

Pin #	Name	I/O	Explanation
38	K0	I	Mode Select
39	K1	I	
40	K2	I	
41	K3	I	
42	VCC	POWER	+5V

NOTE: This custom microprocessor handles inputs (for Dig Dug). It also can apparently scan keyboards and handle steering controls. 8 different modes.