Video Pong
For one or two players

Glen Kleinschmidt
August 2019

www.glensstuff.com
In a nutshell:

A “Pong” paddle-and-ball “computer” game that produces a high quality, clean and crisp video display on a PAL composite colour video monitor. The circuity is 100% discrete, using generic semiconductors and is built entirely "dead bug" style over a large sheet of lacquered copper laminate.

Some features:

- P.A.L. composite colour video signal generation
- One (practice) and two player modes
- 1.5 digit on-screen digital score counters (first player to 19 wins)
- Realistic synthesised percussive ball-thwacking sounds
- Simulated stereo sound with auto-panning that tracks the ball
- 431 bipolar transistors, 6 junction field-effect transistors & 826 silicon diodes

Player one controls the paddle on the left and player two the paddle on the right. In Practice mode the machine takes control of the paddle on the right.

The hand controllers are just so called “zippy” or “jiffy” boxes each with a potentiometer and knob and a push-button which is pressed to serve the ball. The position of a controller’s potentiometer determines the vertical position of the respective paddle on the screen.

The moving ball automatically bounces off the vertical boundaries and the goal of each player is to keep the ball inside the court. The velocity of the ball begins at a slow and easy rate but in order to ensure that a match cannot last forever, from the start of play the ball velocity linearly speeds up until it reaches a speed that most would have difficulty keeping up with for very long.

The angle at which the ball bounces off a paddle depends on where it hits the paddle. If the ball is hit with the centre of the paddle, it will bounce off at an angle of 90 degrees, but if the ball is hit with the either the upper or the lower quarter of a paddle it will bounce off with approximately twice the vertical-movement velocity.

If either player misses the ball the match ends with buzz, their opponents score counter is incremented and the ball is automatically returned to the centre of the court where it remains stationary until either player presses the "serve ball" button on their controller to commence a new match. The score counters can be reset back to zero at any time by pressing the “reset” button on the control panel.
When either player wins a game by reaching the maximum score of 19 an “end of game” chime will sound until the counters are reset back to zero.

The size of the paddles can be either large or small, selected by a switch on the control panel. Large paddles obviously make the game easier as the ball isn’t as difficult to hit.

In single player mode, the machine is an invincible opponent. Since the velocity of the ball will eventually become too fast for a human player to keep up with for too long, the skill of the player here is gauged by how long he or she can keep a match going.

The percussive “boink” sounds that are made whenever the ball rebounds off the boundaries and paddles are continuously stereo-panned (by a pair of VCAs) between the left and right audio channels depending on the horizontal position of the ball, giving a neat simulated stereo effect.

A link to a Youtube video of the machine in action:

https://www.youtube.com/watch?v=Neky4fdaLhM

Well, that’s it, I guess. Some pictures follow along with the complete schematic diagrams for those with a couple of hours to spare who therefore might wish to build their own.

Happy soldering!
MASTER TIMING OSCILLATOR

UNLESS OTHERWISE STATED:
ALL NPN = BC550C
ALL DIODES = 1N4148
* NPO/COG OR MICA

8.5-100pF ADJUST 500 KHz

+5V

100nF

100nF

100nF

100nF

100nF

100nF

100nF

100nF

100nF

100nF

100nF

100nF

100nF

100nF
VELOCITY INTEGRATOR

+15V

Q1

Q2

Q3

Q4

Q5

Q6

Q7

10k

10k

220k

1k

47μF TANT.

10k

20k

30k

100nF

100nF

560pF

100k

ALL NPN = BC550C
ALL PNP = BC5460C
ALL DIODES = 1N4148

DISCHARGE

SET MAX. BALL SPEED

VELOCITY INTEGRATOR

SET MAX. BALL SPEED

(+) VELOCITY

(-) VELOCITY

(-) VELOCITY
BALL VERTICAL MOVEMENT

VERTICAL DIRECTION FLIP-FLOP

VERTICAL MOVEMENT INTEGRATOR

BALL-TO-BOUNDARY VIDEO COLLISION DETECTION

UNLESS OTHERWISE STATED:
ALL NPN = BC550C
ALL PNP = BC550C
ALL JFET = 2N5484
ALL DIODES = 1N4148
* POLYESTER
BALL DEFLECTION ANGLE CONTROL

INITIAL CONDITION

ALL DIODES = 1N4148

VERTICAL_SPEED_X2

BALL DEFLECTION ANGLE CONTROL

PULSE_LEFT_PADDLE_HIT

PADDLE_LEFT_CENTER

PADDLE_RIGHT_CENTER

PULSE_RIGHT_PADDLE_HIT

INDEX: 1k

INDEX: 10k

INDEX: 100nF

INDEX: 1nF

INDEX: 20k
COMPOSITE VIDEO GENERATION

CHROMA CARRIER GATE - YELLOW

CHROMA CARRIER GATE - GREEN

CHROMA CARRIER GATE - RED

CHROMA CARRIER GATE - COLOUR BURST

CHROMA CARRIER GATE - RED

CHROMINANCE CARRIER GATE - GREEN

CHROMINANCE CARRIER GATE - YELLOW

CHROMINANCE CARRIER GATE - RED

CHROMINANCE CARRIER GATE - COLOUR BURST

LUMINANCE MATRIX FOR COLOUR VIDEO SIGNAL

MONOCHROME COMPOSITE VIDEO

HORIZONTAL SYNC PULSE

PHASE ALTERNATE LINE TOGGLE FLIP-FLOP AND GATE

4.4336 MHz QUADRATURE GENERATOR

MASTER OSCILLATOR, BUFFER AND SQUARER

Y = 0.3R + 0.59G + 0.11B
PERCUSSIVE (BALL COLLISION) NOTE GENERATORS

AUDIO SIGNAL MIXING AMPLIFIER AND LINE-LEVEL OUTPUT BUFFERS

MISSED-BALL BUZZER GATE

END-OF-GAME CHIME GENERATOR

STEREO AUTO-PANNING CIRCUIT (V.C.A.)

AUDI0 CIRCUITS