

4/25/77

T M S 1 9 6 5 N L A

- PRELIMINARY SPECIFICATION -

TEXAS INSTRUMENTS

TEXAS INSTRUMENTS RESERVES THE RIGHT TO MAKE  
CHANGES AT ANY TIME IN ORDER TO IMPROVE DESIGN  
AND TO SUPPLY THE BEST PRODUCT POSSIBLE.

- 0 Selectable games - tennis, hockey, squash, practice and two rifle shooting games
- 0 625 line T.V. application.
- 0 2 selectable bat size
- 0 2 selectable angles
- 0 2 selectable ball speed
- 0 Automatic scoring and display on T.V. screen, 0 to 15
- 0 Auto or manual ball service
- 0 Realistic sound
- 0 Alternate to AY-3-8500

#### Description

The TMS1965 is a T.V. game LSI utilizing the MOS N-channel 10N-implanted depletion load technology. The single 28 pin dual-in-line plastic package provides a game function which gives active entertainment using a standard domestic television receiver.

#### Operation

An application diagram of the TMS1965 video game system is shown figure 1. The circuit is intended to be battery powered and a minimum number of external components are required to complete the system.

- 0 Sound output (3): This output produces three audio tones, 32ms pulse/976Hz for hit, 32ms pulse/488Hz for boundary reflection and 32ms/1.95KHz tone for scoring.
- 0 Ball angles (5): Leaving this pin unconnected selects two rebound angles ( $\pm 20^\circ$ ), and connecting to Vss selects four rebound angles ( $\pm 20^\circ$  and  $\pm 40^\circ$ )
- 0 Ball output (6): The ball video signal is produced.
- 0 Ball speed (7): When this input is left open, low speed is selected (1.3 sec to traverse the screen). When connected to Vss, the high speed ball is selected (0.6 sec to traverse the screen).
- 0 Manual serve (8): By connecting to Vss the game is programmed for automatic serving. When left open circuit the game stops after each score and the serve is enabled by momentarily connecting to Vss.

- ① Right player output/left player output (9,10): The video signals for the right and left player are produced on separate pins.
- ① Right bat input/left bat input (11,12): An R-C network connected to each of these inputs controls the vertical position of the bats. Use a 10K resistor in series with each pot.
- ① Bat size (13): By leaving this pin unconnected the large bat size is selected, and connecting to Vss selects small bats.
- ① Sync output (16): The vertical and horizontal sync signals are produced.
- ① Clock input (17): The 2.01 MHz master timing clock is fed to this pin. The exact frequency is 2.012160MHz ±1%.
- ① Rifle game 1, rifle game 2, tennis, soccer, squash, practice (18 thru 23): By connecting to Vss the desired game is selected, otherwise these inputs are normally left open.
- ① Score and field output (24): The score and field video signals are produced on this pin.
- ① Reset (25): By connecting momentarily to Vss the score counters are reset and a new game is started. Normally left open circuit.
- ① Shot input (26): This input is driven by a positive pulse output of a mono-stable to indicate a "Shot".
- ① Hit input (27): This input is driven by a positive pulse output of a mono-stable which is triggered by the shot input if the target is on the sights of the rifle.
- ① Vss (2), Vcc (4): Vss is normally ground and positive supply voltage is applied to Vcc.

CONSUMER  
CIRCUITS

TYPE: TMS1965NLA  
VIDEO GAME CIRCUIT

Absolute maximum ratings \*

Voltage applied at any pin with respect ----- 0.3 to +12V  
to Vss pin

Operating free-air temperature range ----- 0°C to +40°C

Storage temperature range ----- -20°C to +70°C

\* Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the "Recommended Operating Conditions" section of this specification is not implied. Exposure to absolute-maximum-rated conditions for external periods may affect device reliability.

Recommended Operating Conditions.

Parameter	Min	TYP	Max	Unit
Power supply voltage, Vcc	6		7	V
Clock input (note 1)				
Frequency	1.99	2.01	2.03	MHz
Logical low level	0		0.5	V
Logical high level	Vcc-2		Vcc	V
Pulse width (note 2)		220		ns
Control inputs				
Logical low level	0		0.5	V
Logical high level	Vcc-2		Vcc	V
Operating free-air temp., Ta	0		40	°C

Note 1: Maximum clock source impedance of 1K to Vcc or Vss

CONSUMER  
CIRCUITS

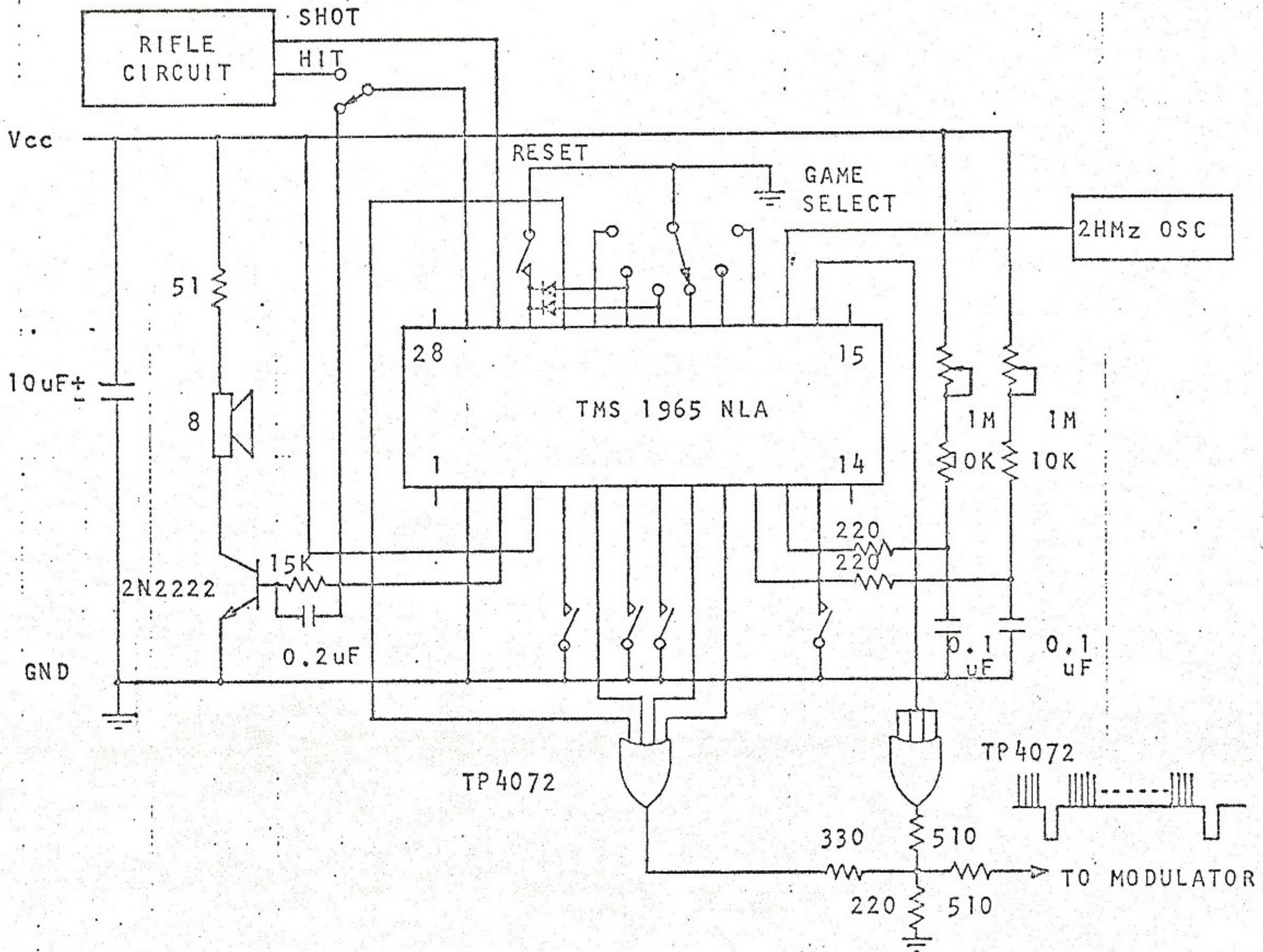
TYPE: TMS1965NLA  
VIDEO GAME CIRCUIT

Electrical characteristics at  $T_a = 25^\circ\text{C}$ ,  $V_{cc} = 6.0\text{V}$   
(Unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Clock input					
Capacitance	$V_{in}=0\text{V}$ , $f=1\text{MHz}$	10			pF
Leakage		100			$\mu\text{A}$
Control inputs					
Input impedance	Pull up to $V_{cc}$	1.0			M ohm
Rifle impedance	Pull down to $V_{ss}$	1.0			M ohm
Outputs					
Logical low level	$I_{out}=0.5\text{mA}$			1.0	V
Logical high level	$I_{out}=0.1\text{mA}$	$V_{cc}-2$			V
Power supply current	$V_{cc}=8.5\text{V}$	40	60		mA

Pin Assignment

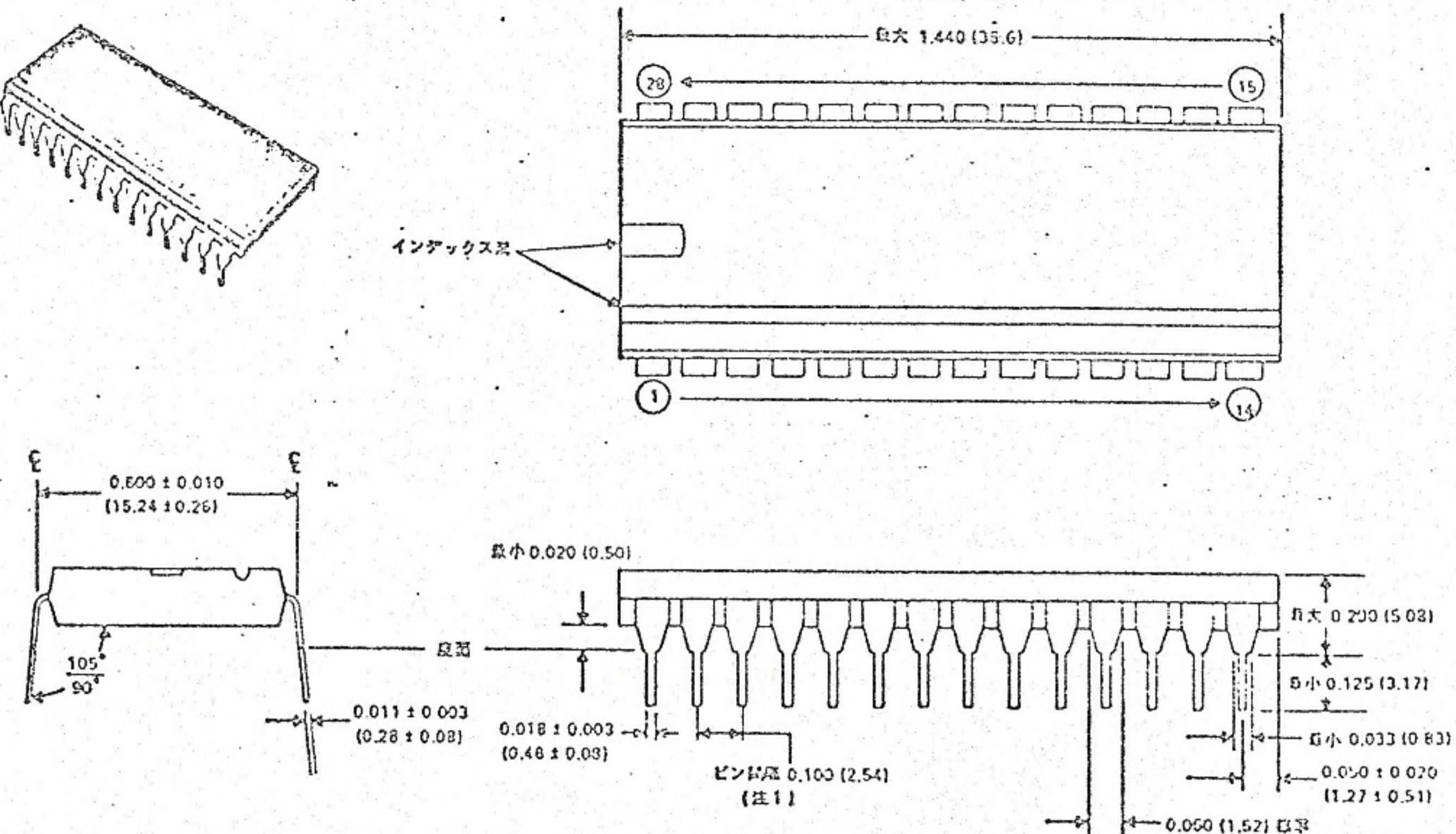
1 NC	15 NC
2 VSS (ground)	16 SYNC OUTPUT
3 SOUND OUTPUT	17 CLOCK INPUT
4 $V_{cc}$	18 RIFLE 1
5 BALL ANGLES INPUT	19 RIFLE 2
6 BALL OUTPUT	20 TENNIS
7 BALL SPEED INPUT	21 HOCKEY
8 MANUAL SERVE INPUT	22 SQUASH
9 RIGHT PLAYER OUTPUT	23 PRACTICE
10 LEFT PLAYER OUTPUT	24 SCORE AND FIELD OUTPUT
11 RIGHT PLAYER INPUT	25 RESET INPUT
12 LEFT PLAYER INPUT	26 SHOT INPUT
13 BAT SIZE INPUT	27 HIT INPUT
14 NC	28 NC



### FIGURE 1 SYSTEM DIAGRAM

## Mechanical data

600 mil plastic dual-in-line package



注1.各ピンの中心部はその基板位置の 0.010インチ(0.25mm)以内とする。  
(寸法はすべてインチ表示。右側内は日本語のための単位である)

400 mil plastic dual-in-line package

