HA1807, HA1813PS ●Voltage Comparator

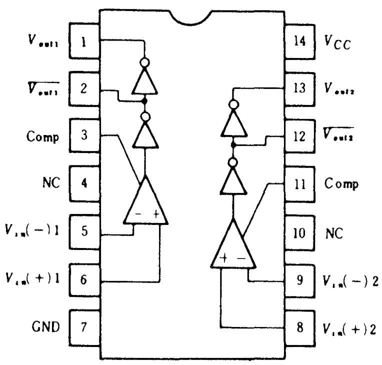
HA1807, Dual Comparator, and HA1813PS, Single Comparator, can be widely applied to control equipments, since they operate with a single power source.

■ FEATURES

- Operate with single power source.
- Provide complementary outputs (Vout and $\overline{\text{Vout}}$) (HA1807)
- Common mode input voltage range is wide.

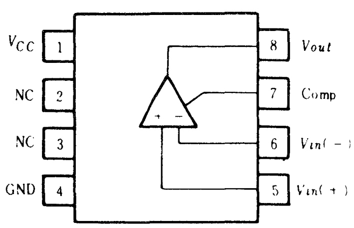
■ PIN ARRANGEMENT

HA1807



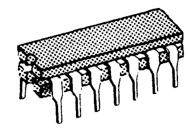
(Top View)

HA1813PS



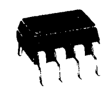
(Top View)

HA1807



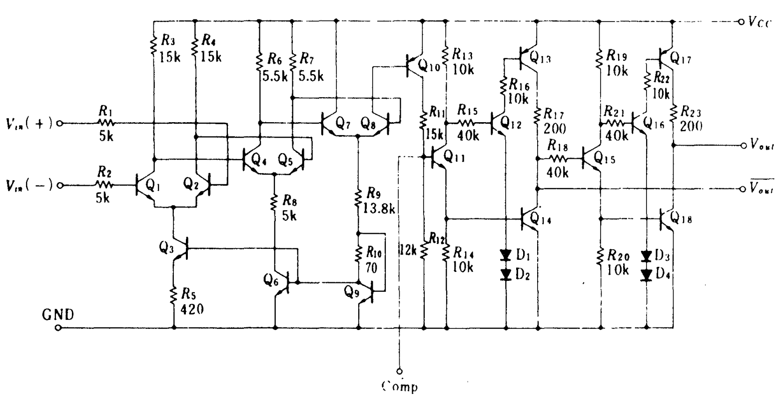
(DG-14)

HA1813PS



(DG-8)

■ CIRCUIT SCHEMATIC



($\overline{V_{out}}$: Only for HA1807)

■ ABSOLUTE MAXIMUM RATINGS ($Ta = 25°C$)

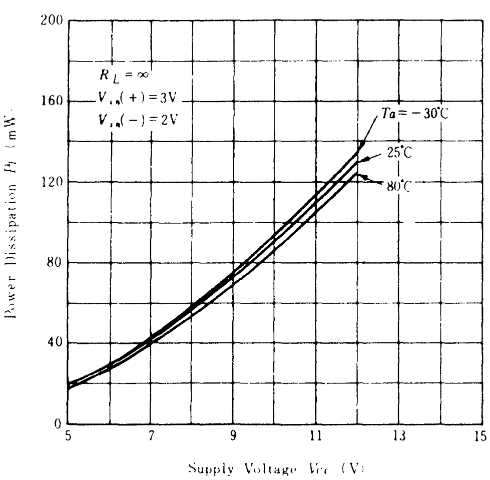
Item	Symbol	HA1807	HA1813PS	Unit
Supply Voltage	V_{CC}	18	18	V
Power Dissipation	P_T*	500	500	mW
Common Mode Input Voltage	V_{CM}	V_{CC}	V_{CC}	V
Differential Input Voltage	$V_{in(diff)}$**	±10	±10	V
Operating Temperature	T_{opr}	−30 to +80	−20 to +75	°C
Storage Temperature	T_{stg}	−65 to +150	55 to +125	°C

Note) * HA1807 : Value at $Ta \leq 70°C$. In case of more than it, 7.6mW/°C derating shall be performed.
HA1813PS : Value at $Ta \leq 50°C$. In case of more than it, 8.3mW/°C derating shall be performed.
** Value at $V_{CC} \geq 10V$. In case of $V_{CC} < 10V$, $V_{in(diff)} \leq V_{CC}$.

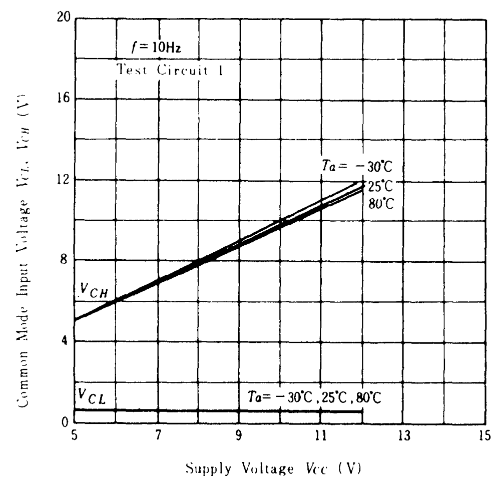
■ ELECTRICAL CHARACTERISTICS ($Ta = 25°C$)

Item	Symbol	Test Condition		min	typ	max	Unit
Input Offset Voltage	V_{IO}	$V_{CC} = 6V$, $V_{CM} = 3V$, $R_S = 50\Omega$		—	1	5	mV
Input Offset Current	I_{IO}	$V_{CC} = 6V$, $V_{CM} = 1.5V$		—	—	150	nA
Voltage Gain	A_V	$V_{CC} = 5.5V$, $f = 10Hz$		75	100	—	dB
Input Bias Current	I_I	$V_{CC} = 6.5V$, $V_{I1} = 2V$, $V_{I2(test)} = 5.5V$		—	0.5	3	μA
Common Mode Input Voltage	V_{CH}	$V_{CC} = 6.5V$, $f = 10Hz$		5.5	6.4	—	V
	V_{CL}			—	0.6	1	V
Output Voltage	V_{OH}	$V_{CC} = 5.5V$	$I_{OH} = -2mA$	4	5.3	—	V
	V_{OL}		$I_{OL} = 10mA$	—	0.2	0.4	V
Power Dissipation	P_T	$V_{CC} = 6.5V$, $V_{I(+)} = 3V$, $V_{I(-)} = 2V$, $R_L = \infty$		—	36	48.8	mW

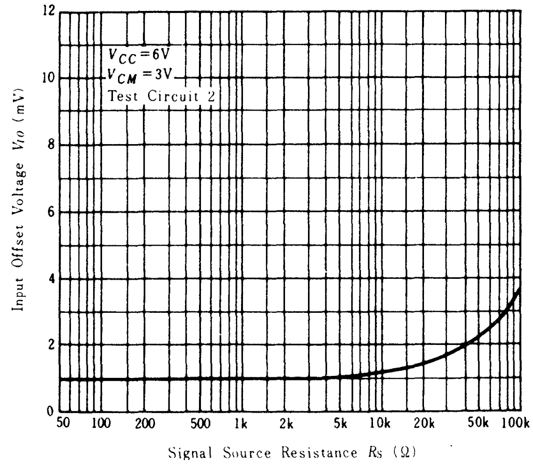
POWER DISSIPATION VS. SUPPLY VOLTAGE



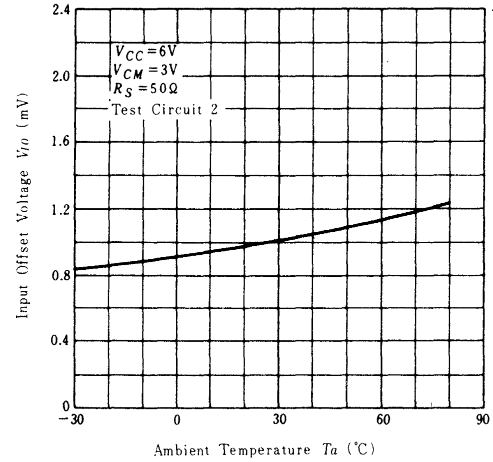
COMMON MODE INPUT VOLTAGE VS. SUPPLY VOLTAGE



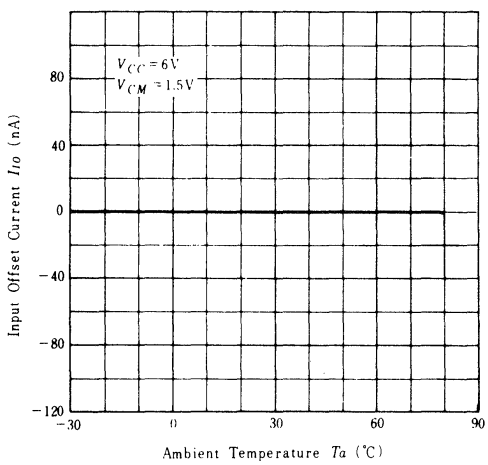
INPUT OFFSET VOLTAGE VS. SIGNAL SOURCE RESISTANCE



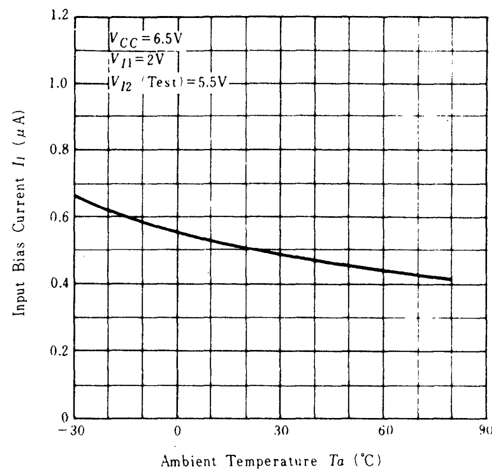
INPUT OFFSET VOLTAGE VS. AMBIENT TEMPERATURE



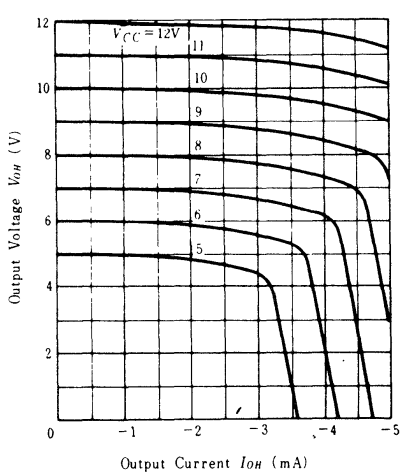
INPUT OFFSET CURRENT VS. AMBIENT TEMPERATURE



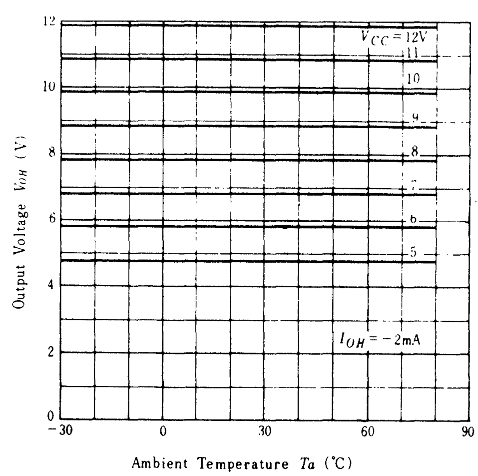
INPUT BIAS CURRENT VS. AMBIENT TEMPERATURE



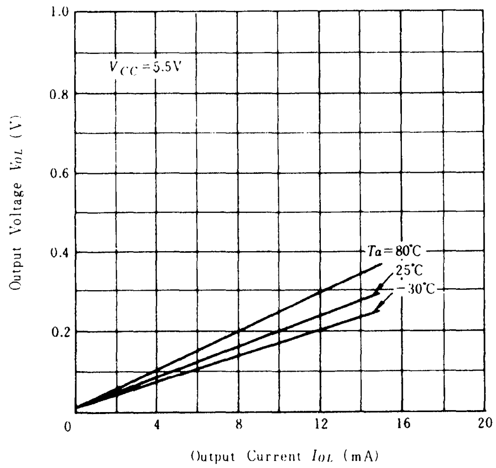
OUTPUT VOLTAGE VS. OUTPUT CURRENT



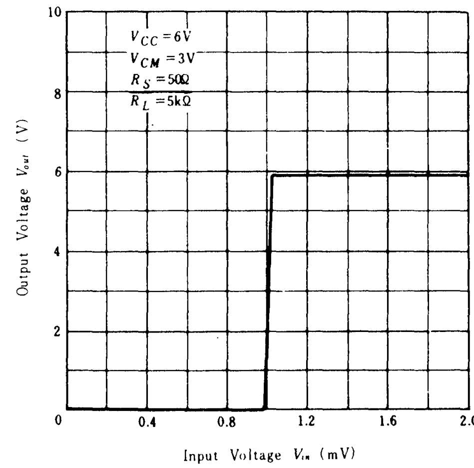
OUTPUT VOLTAGE VS. AMBIENT TEMPERATURE



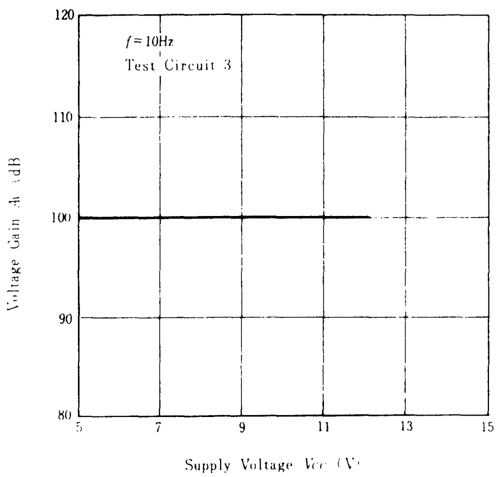
OUTPUT VOLTAGE VS. OUTPUT CURRENT



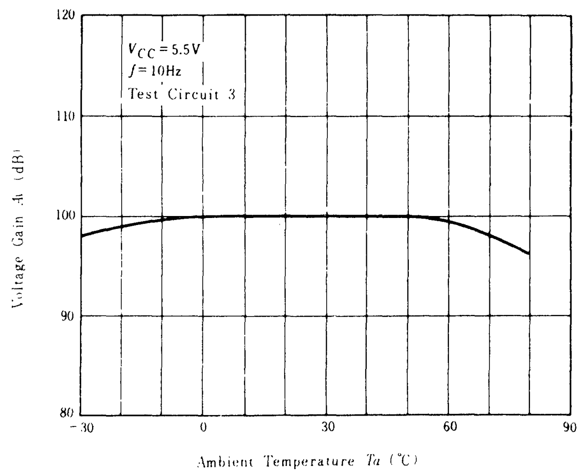
OUTPUT VOLTAGE VS. INPUT VOLTAGE



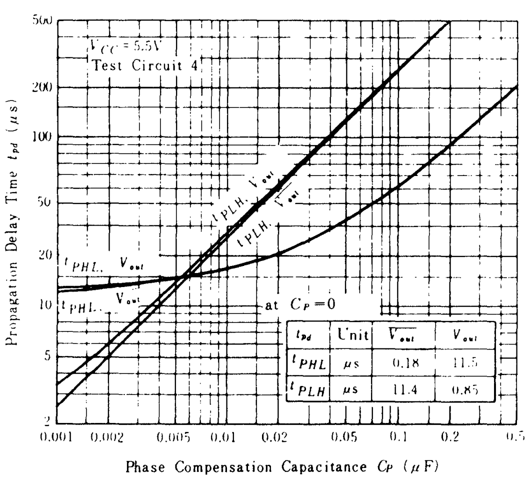
VOLTAGE GAIN VS. SUPPLY VOLTAGE



VOLTAGE GAIN VS. AMBIENT TEMPERATURE



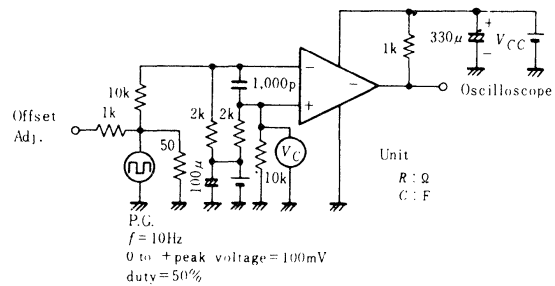
PROPAGATION DELAY TIME VS. PHASE COMPENSATION CAPACITANCE



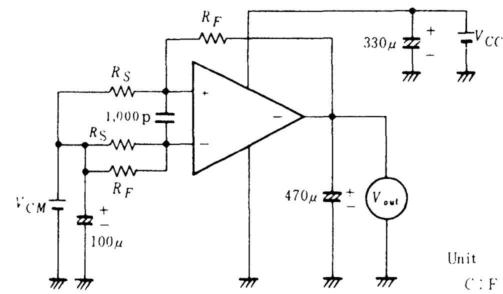
t_{pd}	Unit	$\overline{V_{out}}$	V_{out}
t_{PHL}	μs	0.18	11.5
t_{PLH}	μs	11.4	0.85

■ TEST CIRCUIT

1.



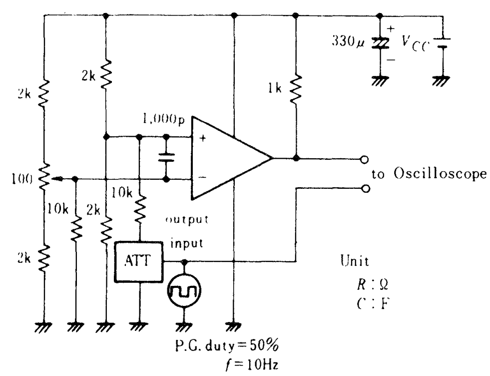
2.



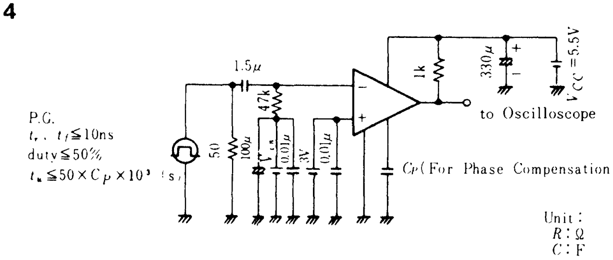
$R_S \leqq R_F/100$ $\quad V_{CM} = V_{CC}/2$

$$V_{IO} = \frac{R_S(V_{out} - V_{CM})}{R_F + R_S} \ (V)$$

3.

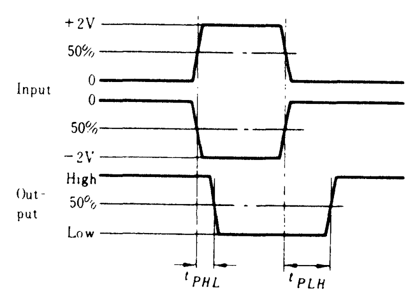


4



Output	V_{in} (V)	v_{in} (V)
V_{out}	4	−2
V_{out}	2	+2

RESPONSE WAVEFORM



■ HA1807 APPLICATION

HA1807 operates with dual comparator and a power source. The operating supply voltage range is wide, 5 to 8V, and the output is a complementary output with two stages of gate connected in cascade.

1. Waveform Conversion Circuit

Fig. 1 shows a waveform conversion circuit. The input voltage range is maximum at Rs = R1 and Vs = Vcc, and the output is inverted at the time when the input is zero-crossed.

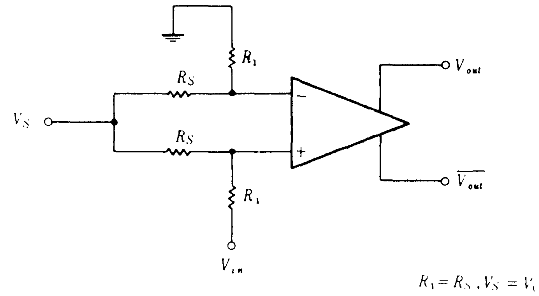
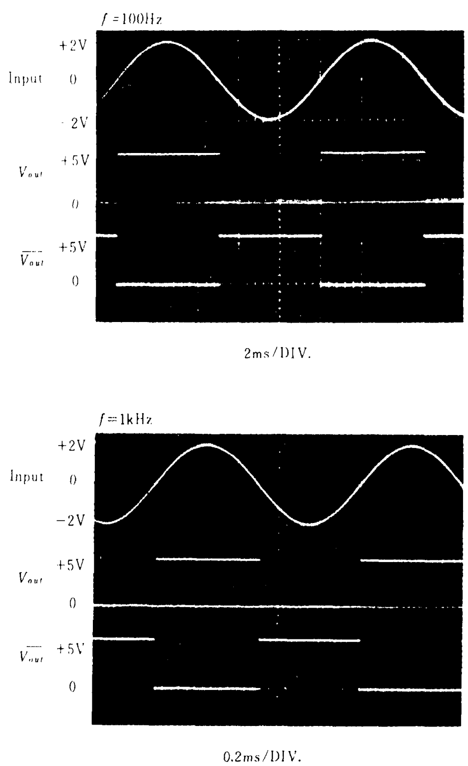


Fig.1 Wave form Converter

Fig. 2 shows Input and Output Waveforms at Vs = Vcc = 6.0V and R1 = Rs = 100kΩ.



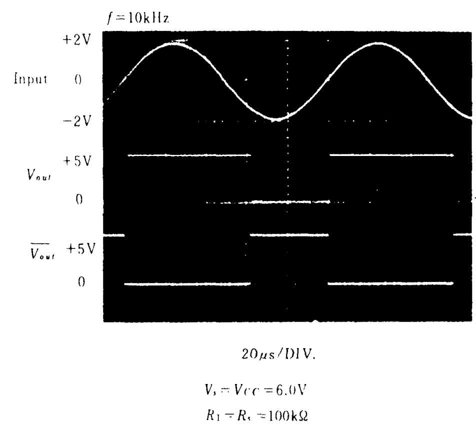


Fig.2 Operation Waveform of Waveform Converter

2. Schmitt Trigger Circuit

Schmitt Trigger Circuit is a circuit with hysteresis on the input and output characteristics by applying a positive feed-back. Fig. 3 show a Schmitt Trigger Circuit.

Fig. 4 shows an example of the Schmitt Trigger Circuit Operation.

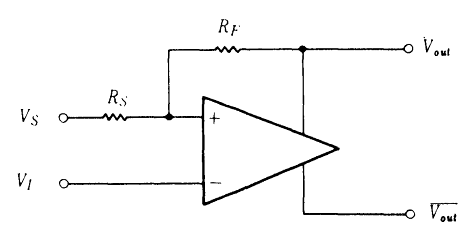


Fig.3 Schmitt Trigger Circuit

Fig.4 Shows an example of the Schmitt Trigger Circuit Operation

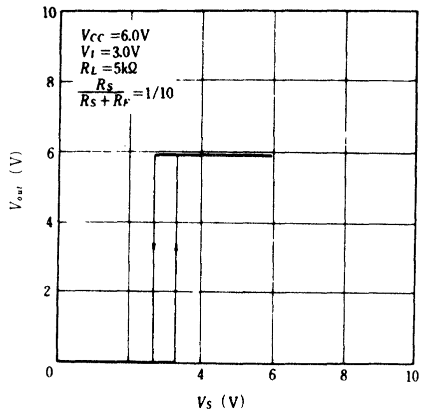


Fig.4(a) Operation Waveform of Schmitt Trigger Circuit (V_{out} − V_S)

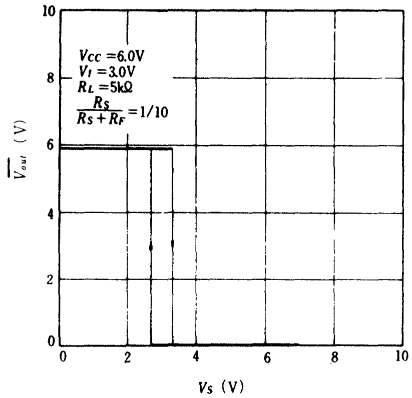


Fig.4(b) Operation Waveform of Schmitt Trigger Circuit ($\overline{V_{out}}$ − V_S)

3. Window Type Comparator

A window type comparator has two reference voltages. The output voltage level is determined according to that whether the voltage is smaller or larger than the two reference voltages.

Fig. 5 shows a circuit of window type comparator, and Fig. 6 shows an example of the operation.

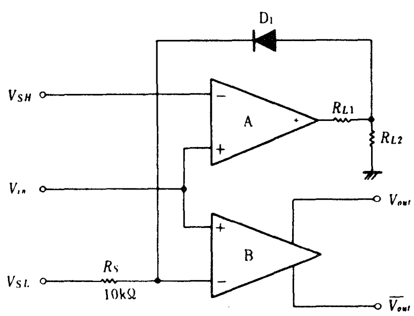


Fig.5 Window Type Comparator

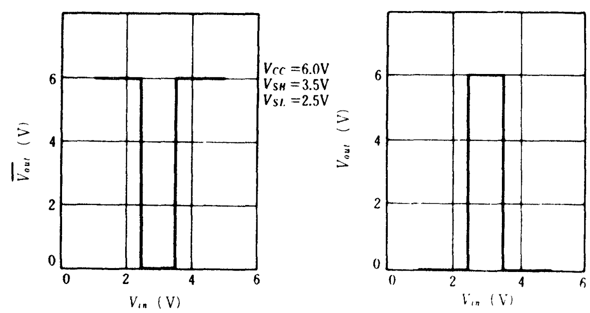


Fig.6 Operation Waveform of Window Type Comparator

4. Bistable Circuit

Fig. 7 shows a Bistable Circuit (R-S Flip-Flop Circuit), and Fig. 8 shows an example of the operation.

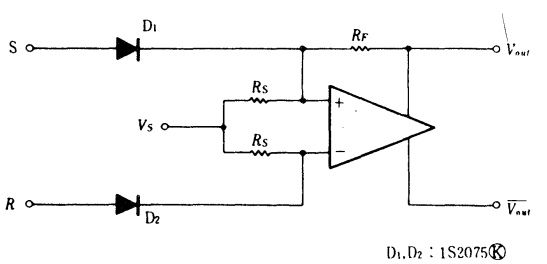
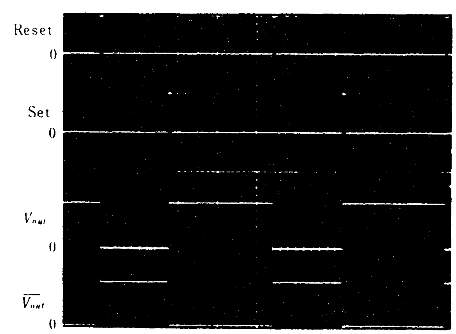


Fig.7 Bistable Circuit



Y-axis : 5V/div V_{CC} = 6.0V, V_S = 3.0V

X-axis : 2ms/div R_S = 10kΩ, R_F = 20kΩ

Fig.8 Operation Waveform of Bistable Circuit

HITACHI

5. Parallel Comparing A/D Converter

Fig. 9 and Fig. 10 show circuits of the parallel comparing A/D converters in which the comparator is applied. In this case, the output is converted to BCD (Binary Coded Decimal). This A/D converter can not be used suitably for a precise converter, but it has the features such as high speed conversion and a simple block diagram.

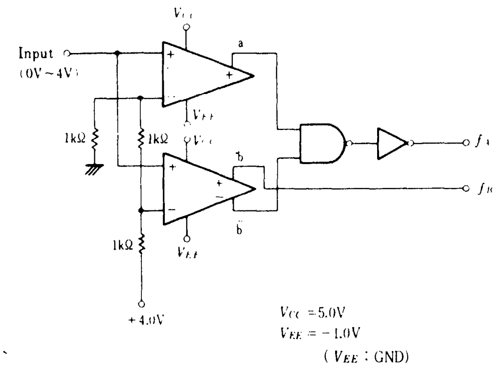


Fig.9 3 Split & 2 Bit A/D Converter

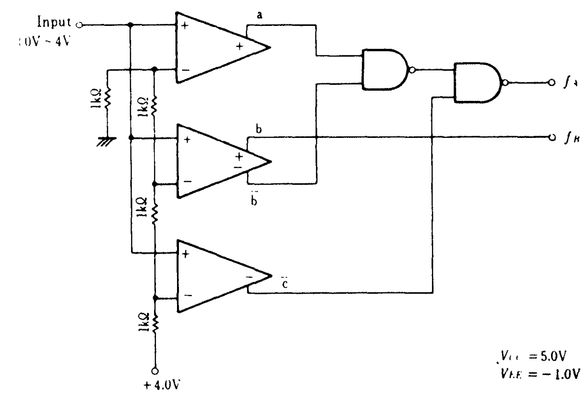


Fig.10 4 Split & 2 Bit A/D Converter