FA7607P

■ Description

The FA7607P consists of a reference voltage circuit and a comparator. This bipolar IC is used to monitor the open-collector output voltage of a power supply.

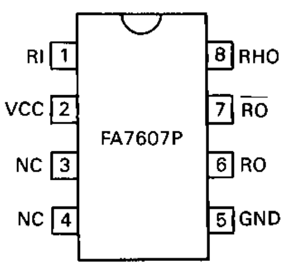
■ Features

- Two built-in output circuit for RESET and $\overline{\text{RESET}}$ signals
- Not many external discrete components are needed. (only two resistors for a standard application circuit)
- Wide operating voltage range (V_{CC} = 4.5 to 40V)
- Stable reference voltage circuit (2.95V typical)
- Stable voltage detection by built-in hysteresis circuit (hysteresis externally adjustable)

■ Applications

- Memory protection of microprocessor-applied system
- Reset signal generation circuit for supply voltage drop and return

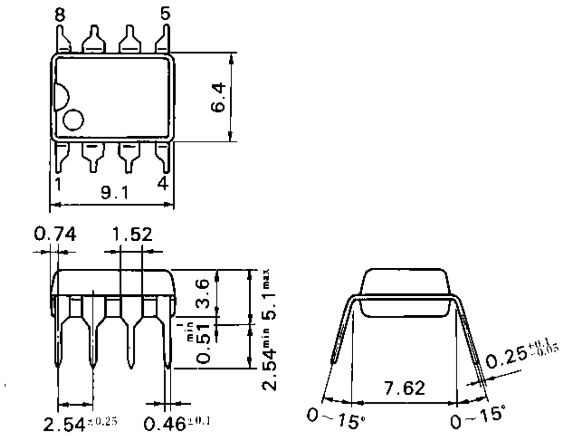
■ Pin assignment



Pin No.	Pin symbol	Description
1	RI	RESET comparator input
2	VCC	Power supply
3	NC	—
4	NC	—
5	GND	Ground
6	RO	RESET Output
7	$\overline{\text{RO}}$	RESET Output
8	RHO	RESET hysteresis output

■ Dimensions, mm

- **DIP-8**



■ Absolute maximum ratings (Ta = 25°C)

Item	Symbol	Rating	Unit
Supply voltage *	V_{CC}	–0.6 to +41	V
Input current	I_{IN}	2	mA
Input voltage	V_{IN}	–0.3 to +6.5	V
Output current	I_O	30	mA
Output voltage	V_O	35	V
Hysteresis circuit output current	$I_{O\ HY}$	1	mA
Power dissipation	P_d	350	mW
Operating temperature	T_{opr}	–20 to +85	°C
Storage temperature	T_{stg}	–30 to +150	°C

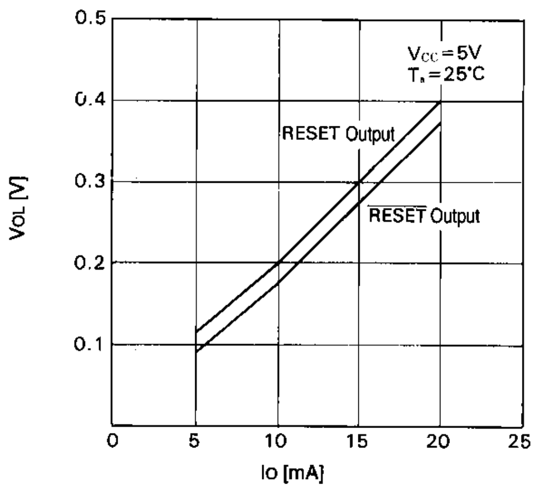
* Recommended operating voltage range: V_{CC} = 4.5 to 40V
Lower limit of voltage detection: 5V

■ Electrical characteristics (Ta = 25°C, V_{CC} = 5V)

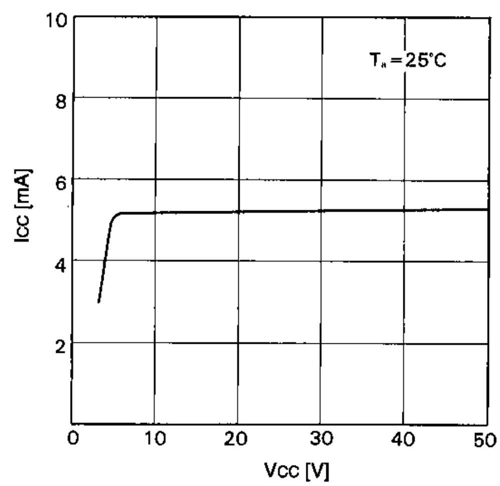
Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Input current	I_{IN}				5	μA
H-level input threshold voltage	V_{THH}		2.80	2.95	3.10	V
L-level input threshold voltage	V_{THL}		2.67	2.82	2.96	V
Internal circuit hysteresis voltage	dv		0.10	0.13	0.17	V
L-level output voltage	V_{OL1}	I_O = 5mA			0.20	V
	V_{OL2}	I_O = 10mA			0.25	V
L-level hysteresis output voltage	$V_{OL\ HY}$	I_O = 1mA			0.40	V
$\overline{Ro}$ output current	$I_{O\ R1}$	V_{OL} = 1V	4.0			mA
	$I_{O\ R2}$	V_{OL} = 1V	10.0			mA
	$I_{O\ R3}$	V_{OL} = 1V	20.0			mA
Ro output current	I_{OR}	V_{OL} = 1V	10.0			mA
Supply current	I_{CC}	V_{IN} = 0V	2.0		8.0	mA
Temperature coefficient of reference voltage		–20 to +85°C		0.02	0.05	%/°C

■ Characteristic curves (Ta = 25°C)

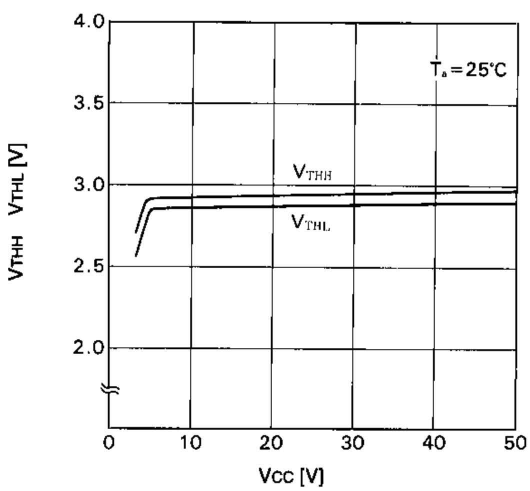
L-level output voltage (VOL) vs. output current (Io)



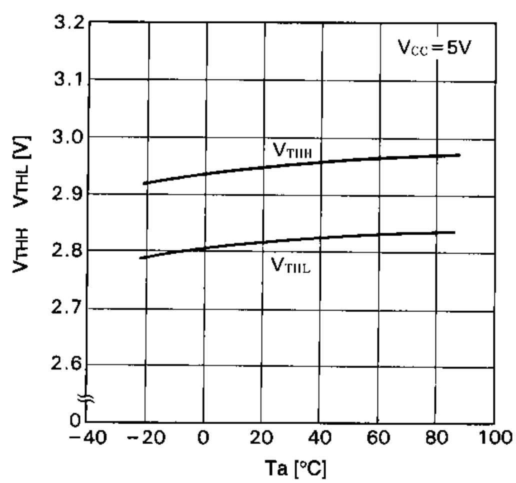
Supply current (Icc) vs. supply voltage (Vcc)



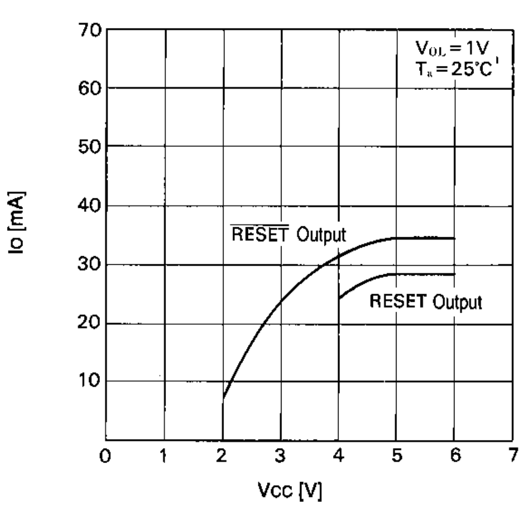
Input threshold voltage (VTH) vs. supply voltage (Vcc)



Input threshold voltage (VTH) vs. ambient temperature (Ta)



Output current (Io) vs. supply voltage (Vcc)



■ Explanation of circuits

Figure 1 shows the block diagram of the FA7607P bipolar IC. This IC mainly consists of a reference voltage circuit and a comparator. The comparator is designed not to malfunction even when the supply voltage is below the normal voltage range (about 2 to 4.5V). See Fig. 3 for the standard application circuit. The supply voltage V_{IN} is divided by a voltage divider consisting of two external resistors (Ra and Rb) and is applied to the input terminal (RI). The supply voltage is also connected to the power supply terminal V_{CC} directly. Figure 2 shows variation of the supply voltage V_{IN} and changes of the RESET and $\overline{\text{RESET}}$ output statuses.
The reset signal stop level V_{RIH} the supply voltage reaches after an increase can be calculated by the formula of (1). The RESET signal output transistor remains OFF and the $\overline{\text{RESET}}$ signal output transistor remains ON until the supply voltage exceeds the level.
The reset signal start level V_{RIL} the supply voltage reaches after a decrease can be calculated by the formula of (2). Once the supply voltage goes lower than this level, the RESET signal output transistor goes OFF and the $\overline{\text{RESET}}$ signal output tra5nsistor goes ON.
At power-on, the reset signals should be output until the supply voltage of the system reaches the normal level. If the supply voltage becomes low, the reset signal should be issued within the normal supply voltage range of the system. Therefore, the high and low voltage levels (V_{RIH} and V_{RIL}) should be set higher than the supply voltage level (V_S) where normal system operations are guaranteed.
This IC has a hysteresis characteristic of about 5%. By adding an external resistor Rh, the hysteresis voltage width can be increased and adjusted. The high and low voltage levels (V_{RIH} and V_{RIL}) can be calculated by the formulas of (3) and (4).

$V_{RIH} = V_{THH} \bullet (Ra + Rb)/Rb$ ....(1)
$V_{RIL} = V_{THL} \bullet (Ra + Rb)/Rb$ ....(2)
$V_{RIH} = V_{THH} \bullet (Ra \bullet Rb + Ra \bullet Rh + Rb \bullet Rh) / (Rb \bullet Rh)$ ..(3)
$V_{RIL} = V_{THL} \bullet (Ra + Rb)/Rb$ ....(4)
Where, V_{THH}=2.95V (typical) and V_{THL}=2.82V (typical)

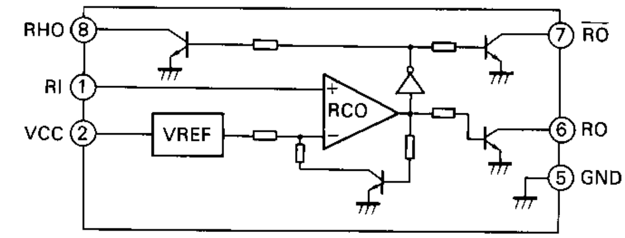


Fig. 1 Block diagram

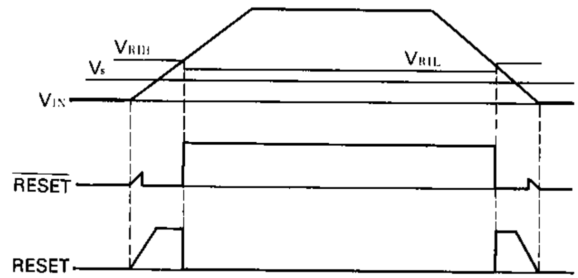


Fig. 2 Timing chart

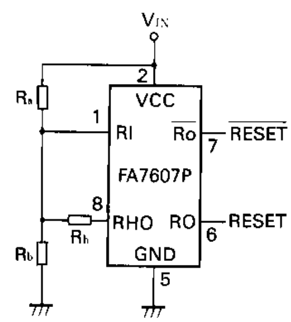


Fig. 3 Standard application circuit

■ Application circuits

1. Basic connections

The standard application circuit requires only two resistors outside the IC. This is shown in Fig. 3. However, since the output stage is an open collector, the system may require a pull-up resistor.

2. Delay circuit

As explained before, the RESET and $\overline{\text{RESET}}$ signal timings depend on the rise and fall characteristics of the supply voltage. If appropriate timings (especially, output delays) cannot be obtained only by the characteristics, they may need to be set on the FA7607P. Fig. 4 shows an example of application. The delays (td1 and td2) can be calculated by the formulas of (5) and (6).

$$t_{d1} = -C \bullet \left(\frac{R_a \bullet R_b}{R_a + R_b} \right) \bullet \ln \left(1 - \frac{T_{THH}}{V_{IN}} \bullet \frac{R_a + R_b}{R_b} \right) \quad \text{............ (5)}$$

$$t_{d2} = -C \bullet \left(\frac{R_a \bullet R_b}{R_a + R_b} \right) \bullet \ln \left(\frac{T_{THL}}{V_{IN}} \bullet \frac{R_a + R_b}{R_b} \right) \quad \text{.................... (6)}$$

Where, V_{THH} = 2.95V (typical) and V_{THH} = 2.82 (typical)

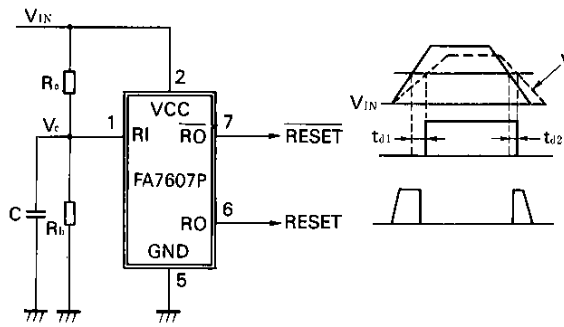


Fig. 4 Delay circuit

3. Astable multivibrator circuit

Figure 5 shows how to create an astable multivibrator circuit with the FA7607P. The output transistor ON time, ton, and OFF time, toff, can be calculated by the formulas of (7) to (9).

$$t_{on} = -C \bullet R \bullet \ln (V_{THL}/V_{THH}) \quad \text{.. (7)}$$

$$t_{off} = -C \bullet (R + R_L) \bullet \ln \left(1 - \frac{T_{THH} - V_{THL}}{V_{CC} - V_{THL}} \right) \quad \text{.............. (8)}$$

$$t = t_{on} + t_{off} \quad \text{.. (9)}$$

Where, V_{THH} = 2.95V (typical) and V_{THL} = 2.82V (typical)

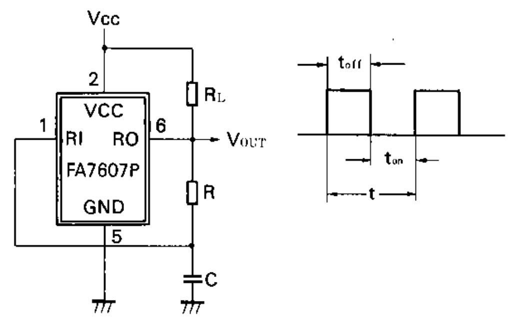


Fig. 5 Astable multivibrator circuit

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