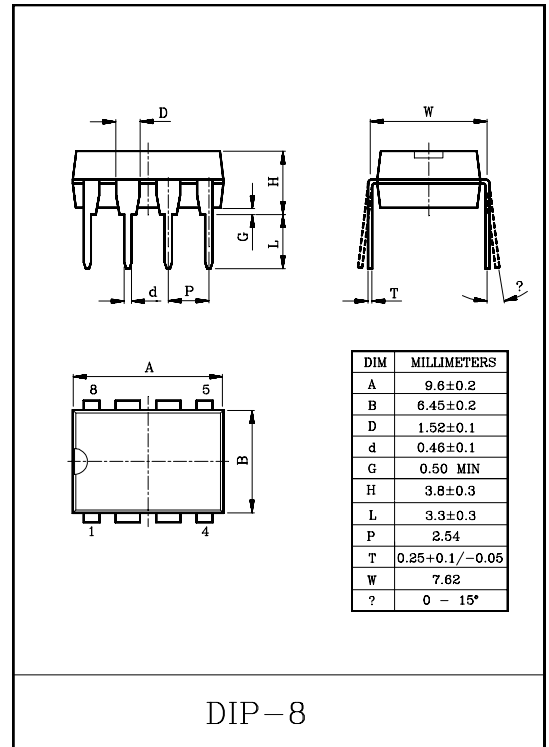


TONE RINGER FOR TELEPHONE

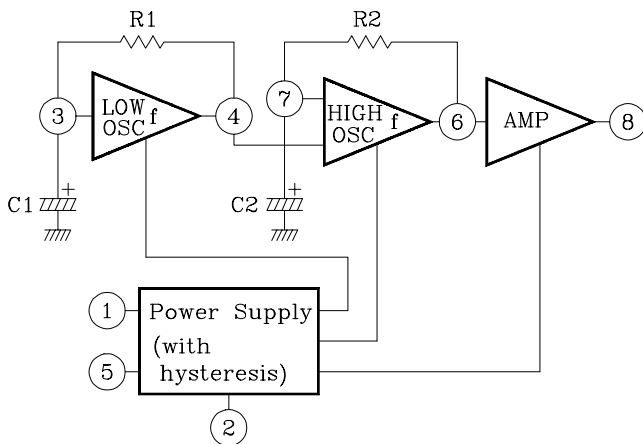
- Small Current Consumption.
- Oscillation Frequency Variable.
- Built-in Threshold Circuits Prevent False Triggering due to Power Noise as Well as 'Chirp' by Rotary Dialling.
- Few External Components.

MAXIMUM RATINGS (Ta=25°C)

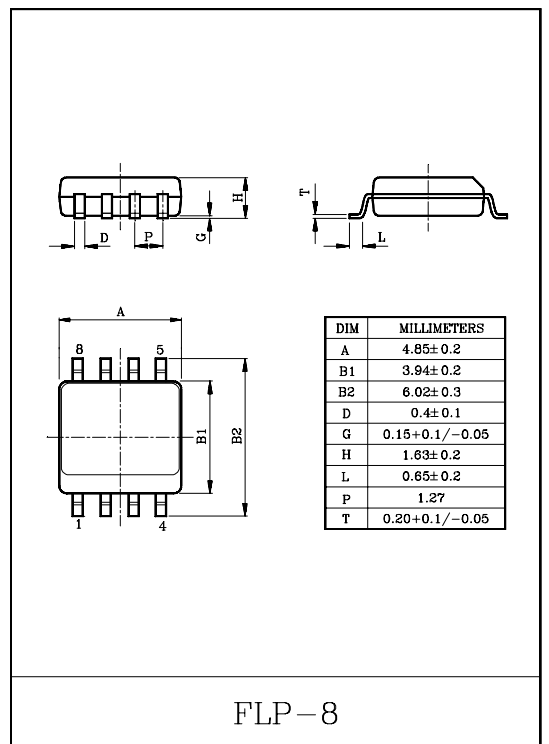
| CHARACTERISTIC | SYMBOL | RATING | UNIT |
|-----------------------|------------------|---------|------|
| Power Supply Voltage | V _{CC} | 30 | V |
| Power Dissipation | P Type | 500 | mW |
| | F Type | 350 | |
| Operating Temperature | T _{opr} | -30~75 | °C |
| Storage Temperature | T _{stg} | -55~150 | °C |



BLOCK DIAGRAM

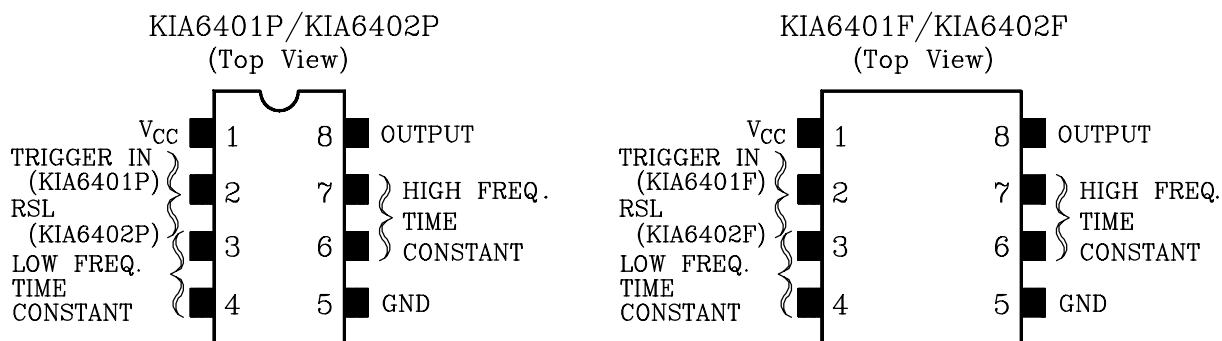


Note: R1,R2,C1, and C2 are parts externally mounted.



KIA6401P/F, KIA6402P/F

PIN CONNECTION



ELECTRICAL CHARACTERISTICS (Ta=25°C)

| CHARACTERISTICS | SYMBOL | TEST CIRCUIT | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|--|-------------------|-----------------|---|------|------|------|------|
| Operating Voltage | V _{OPR} | - | | - | - | 29 | V |
| Initiation Supply Voltage | V _{SI} | - | (Note 1) | 17 | 19 | 21 | V |
| Sustaining Supply Voltage | V _{SUS} | - | (Note 2) | 10.5 | 12 | - | V |
| Initiation Current Consumption | I _{SI} | - | No Load | 1.4 | 3.3 | 4.2 | mA |
| Sustaining Current Consumption | I _{SUS} | - | | 0.7 | 1.4 | 2.5 | |
| Oscillation Frequency (Note 3) | f _L | - | C ₁ =0.47μF, R ₁ =165kΩ | 9 | 10 | 11 | Hz |
| | f _{H1} | - | C ₂ =6800pF, R ₂ =191kΩ | 461 | 512 | 563 | |
| | f _{H2} | - | | 576 | 640 | 703 | |
| Output Voltage | "H" Level | V _{OH} | V _{CC} =24V, I _{OH} =-10mA PIN 7=GND | 20.0 | 21.5 | 22.5 | V |
| | "L" Level | V _{OL} | V _{CC} =24V, I _{OL} =10mA PIN 7=7V | 0.7 | 1.0 | 2.0 | |
| Trigger IN Terminal Operating Voltage (KIA6401P/F) | V _{Trig} | - | V _{CC} =15V, I(PIN)=100μA | 7.8 | 10 | 11.5 | V |

Note 1. Initiation Supply Voltage (V_{si}) is a supply voltage required to start oscillation of the tone ringer.

2. Sustaining Supply Voltage (V_{sus}) is a supply voltage required to maintain oscillation of the tone ringer.

3. Oscillation frequency is determined by the following equations 1,2, and 3:

$$(1) f_L = 1/1.234 \cdot R_1 \cdot C_1 \text{ (Hz)} \quad (2) f_{H1} = 1/1.515 \cdot R_2 \cdot C_2 \text{ (Hz)} \quad (3) f_{H2} = 1.24 \cdot f_{H1} \text{ (Hz)}$$

KIA6401P/F, KIA6402P/F

METHOD OF USING PIN ②

1. KIA6401P/F METHOD OF USING TRIGGER IN

Usually PIN ② is used at an open state, but in the KIA6401P/F the TRIGGER IN terminal can prohibit oscillation and also can change the initiation supply voltage (V_{si}).

When the KIA6401P/F is oscillating ($V_{sus} < V_s$), if PIN ② is connected to GND as shown in Fig. 1a, the KIA6401P/F can stop oscillating. Further, the oscillation of the KIA6401P/F can be stopped by connecting PIN ② to voltage V_I through the resistor R_I as shown in Fig. 1b.

In case of $V_{sus} < V_s - V_{si}$, the oscillation of the KIA6401P/F can be started by forcing a current I_E ($4\mu A < I_E < 1mA$) into PIN ②.

Oscillation can be started under a lower supply voltage than the initiation supply voltage at the time when PIN ② is used at an open state as shown in Fig. 2a.

Further, the initiation supply voltage (V_{si}) can be changed by using a zener diode as shown in Fig. 2b.

V_{si} is determined by the following formula:

$$V_{si} = V_{Trig} + V_Z + 4R_E$$

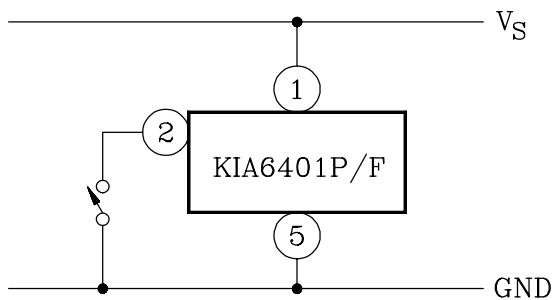


Fig. 1a

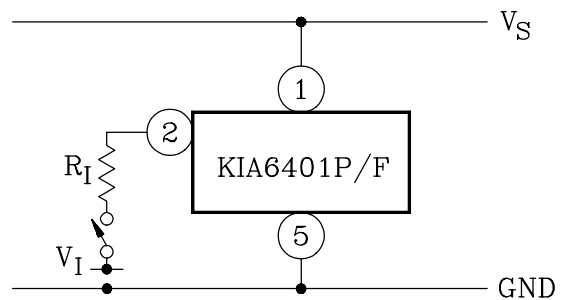
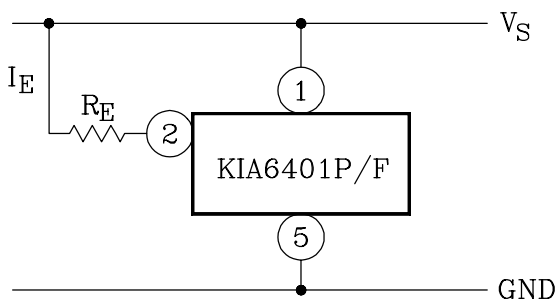


Fig. 1b $0 \leq V_I \leq 0.5V$
 $0 \leq R_I \leq 20k\Omega$



$$10k\Omega < R_E < \frac{(V_S - 10)}{4} \text{ (M}\Omega\text{)}$$

Fig. 2a

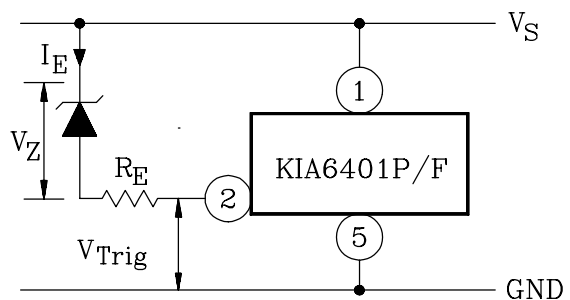


Fig. 2b

KIA6401P/F, KIA6402P/F

2. KIA6402P/F METHOD OF USING R_{SL}

In the KIA6402P/F the initiation supply current (I_{Si}) can be changed by using the R_{SL} terminal. The resistor R_{SL} is connected to GND from PIN② as shown in Fig. 3.

Further, the initiation supply current (I_{Si}) can be changed by changing the value of R_{SL} . Fig. 4 shows the graph of V_S - I_S characteristic at the time when R_{SL} has been changed to three values. The V_S - I_S characteristic at the time when $R_{SL}=6.8k\Omega$ coincides with that at the time when PIN② of the KIA6401P/F has been used at an open state.

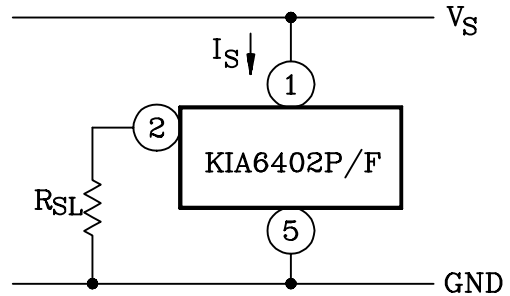
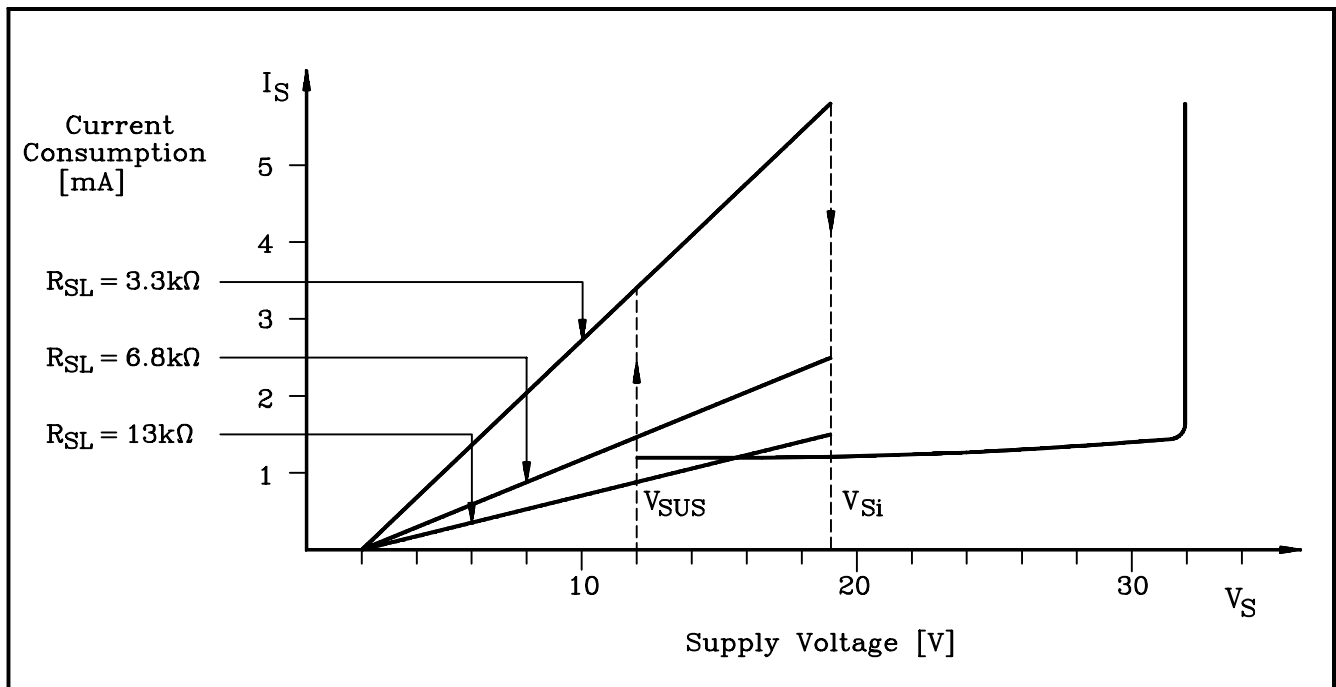


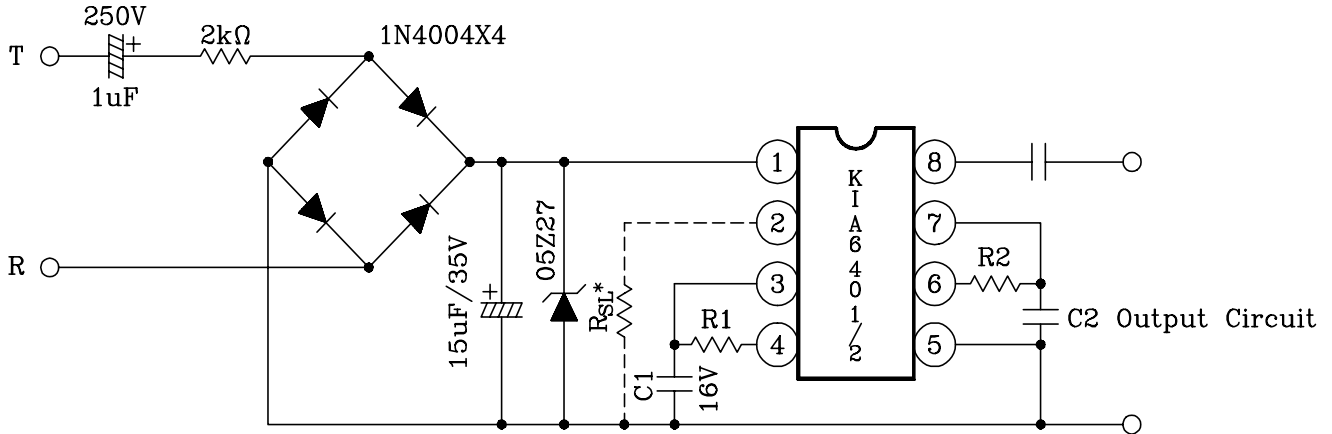
Fig. 3

KIA6402P/F SUPPLY VOLTAGE – CURRENT CONSUMPTION



KIA6401P/F, KIA6402P/F

APPLICATION CIRCUIT OF TONE RINGER



* Use for KIA6402P/F

$$R1, C1 \quad f_L = 1/1.234 \cdot R1 \cdot C1$$

$$f_{H1} = 1/1.515 \cdot R2 \cdot C2$$

$$f_{H2} = 1.24 f_{H1}$$

* Example $R1 = 165k\Omega$ $R2 = 191k\Omega$
 $C1 = 0.47\mu F$ $C2 = 0.0068\mu F$

$$f_{Low} \approx 10Hz \quad f_{H1GH1} \approx 500Hz$$

$$f_{H1GH2} \approx 630Hz$$

Example of Output Circuit

