ADVANCED ANALOG

A Division of intech

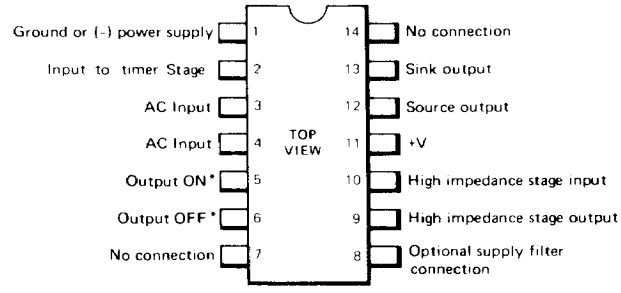
3050
AC DETECTOR

DESCRIPTION

The 3050 monolithic integrated circuit monitors, differentially or single ended, an AC voltage (sine wave, pulse train). If the peak amplitude of the input exceeds an externally preset voltage level, two outputs of opposite polarity change states. ON and OFF time delays are externally adjustable so that outputs can be made to ignore transients or remain on for some time after a signal has disappeared. Operates from 4.5 to 18 volt supply.

PIN DESIGNATION

14 Pin Dual-In-Line



*External delay network.

APPLICATION NOTES

The Intech 3050 is a monolithic integrated circuit which is capable of detecting the presence or absence of AC voltages. The circuit has a built-in 50 mV threshold and adjustable time delays.

The block diagram of the 3050 is shown in Figure 1. Inputs 3 and 4 are fed to a differential pair which is biased with an internal 50 mV voltage source so that the voltage at pin 3 is ower than that at pin 4. If the left-hand side of the differential pair is to conduct, the externally applied AC voltage, therefore, must have a magnitude of at least 50 mV.

The entire circuit, with the exception for the output stage, is fed from a voltage regulator delivering approximately 2. 5 volts.

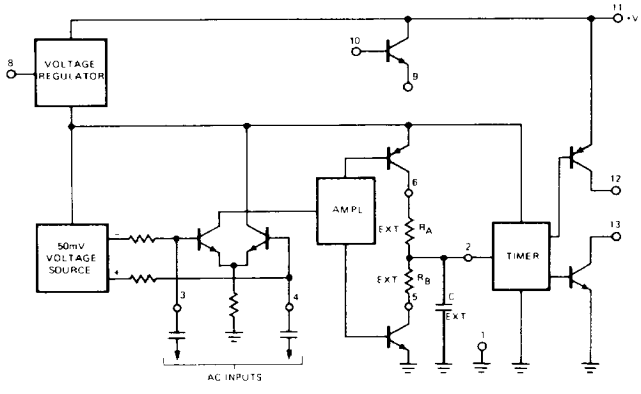


Figure 1: Block Diagram of 3050 AC Detector.

FEATURES

- □ **Differential or single ended**
- □ **Wide frequency range, to 1MHz**
- □ **High input impedance with optional connection**
- □ **Trigger level may be externally adjusted**
- □ **May be set to latch if input exceeds trigger level**
- □ **Sink output TTL compatible**
- □ **Low power drain**
- □ **Single power supply**

APPLICATIONS

- □ **Ringing detector**
- □ **Ripple detector**
- □ **Carrier or modulation detection**
- □ **Transient detector**
- □ **Selective frequency detector**

MAXIMUM RATINGS

Supply Voltage	+ 18V
Output Sink Current	10V
Output Source Current	0.5 mA
Input Trigger Voltage	6V peak
Operating Temperature Range	– 25 °C to + 85 °C
Storage Temperature Range	– 55 °C to + 125 °C

The signal obtained at the collector of the input transistor is further amplified and then fed to a complementary pair of transistors. Without an input signal present, the lower (NPN) transistor (pin 5) is turned on while the upper (PNP) transistor (pin 6) is off. Thus the external capacitor C is charged through RA and the voltage of pin 2 is slowly rising. When it reaches 1/2 of the internal supply voltage (2.5 volts), the timer turns on and both output transistors are activated. With the trigger point set at 1/2 the internal supply voltage, the turn-on time constant becomes

$$t_{on} = 0.69 \times RA \times C.$$

If the signal at the input is present for a sufficient length of time to charge capacitor C to the internal supply voltage, then the discharge time constant is identical to the charged time constant, or

$$t_{off} = 0.69 \times RB \times C.$$

Thus, by changing the relative values of RA and RB any combination of turn-on and turn-off time delay can be effected. Increasing RA requires the input signal to be present for a longer time, that is, it produces a high-frequency cut-off and eliminates any response to transients. Increasing RB means that once the signal has been recognized the output will remain on for a longer time.

In the extreme, it is possible to eliminate one or both of the resistors. For example, if none of the external components, RA, RB, or C are used, time delays of only a few nanoseconds are present. If RB is made zero then the turn-off delay is extremely small. Similarly if RA is zero, then signals with extremely short duration will turn on the outputs and the outputs will remain on for the time constant set by RB and C.

An additional transistor has been incorporated into the circuit so that the input impedance can be increased to several hundred kilohms.

The typical performance of the 3050 is shown in Figures 7 through 12.

APPLICATIONS

A very simple applications configuration is shown in Figure 2. A single-ended AC input is used at pin 3. The circuit is connected so that it has turn-on delay only. The turn-on delay is approximately 100 ms, so that it eliminates transients. Only the sink input is used which is tied to the positive supply voltage from an external load resistor. This circuit will produce a 5-volt pulse each time the input signal exceeds 50 mV, delayed by the turn-on time constant.

Figure 3 shows a similar configuration where turn-off delay is used instead of turn-on delay. The voltage at the timer input (pin 2) will therefore rise very rapidly as the signal exceeds the threshold. The timer then remains

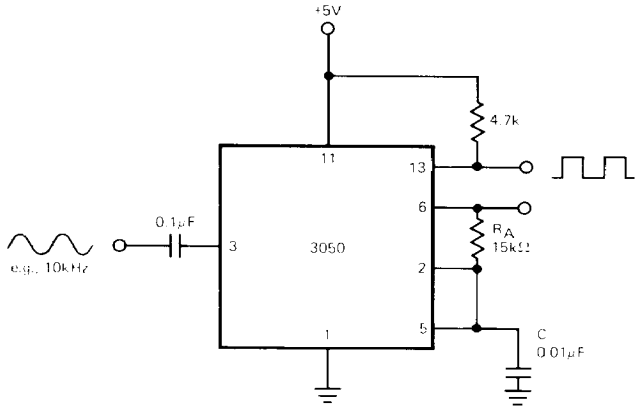


Figure 2: Single Ended AC Input and Turn-on Delay Only.

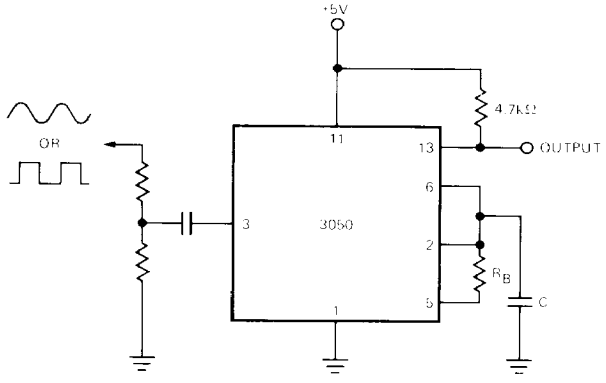


Figure 3: Single Ended Input and Turn-off Delay Only.

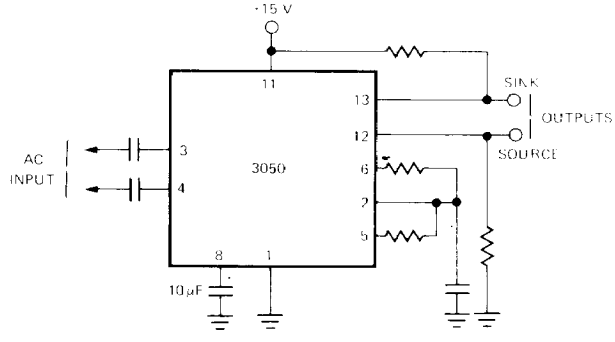


Figure 4: Differential Input, Turn-on and Turn-Off Delay, Sink, Source Outputs.

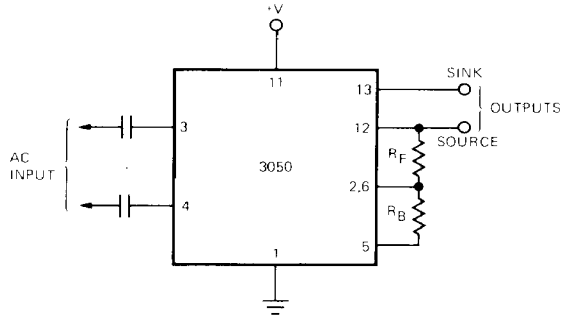


Figure 5: AC Detector with Memory.

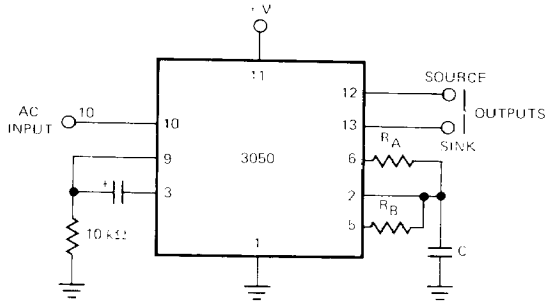


Figure 6: Input Impedance (Single Ended) increased to above 100 kΩ.

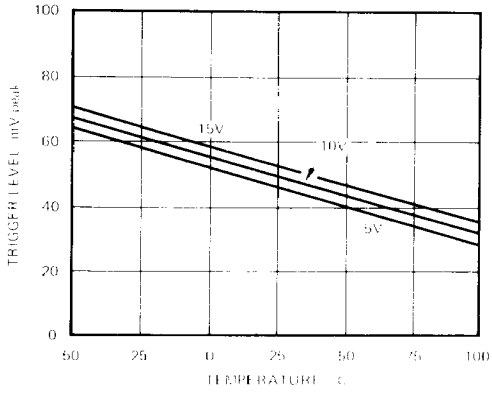


Figure 7: Current Consumption vs. Supply Voltage.

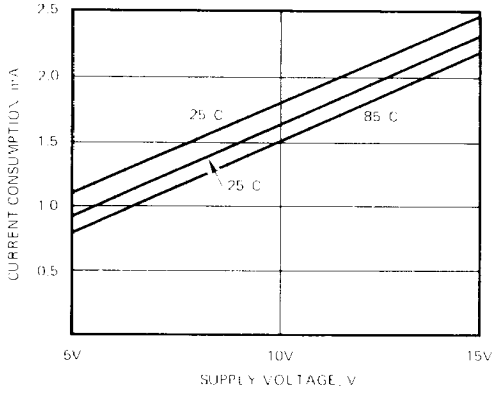


Figure 8: Input Trigger Level vs. Temperature.

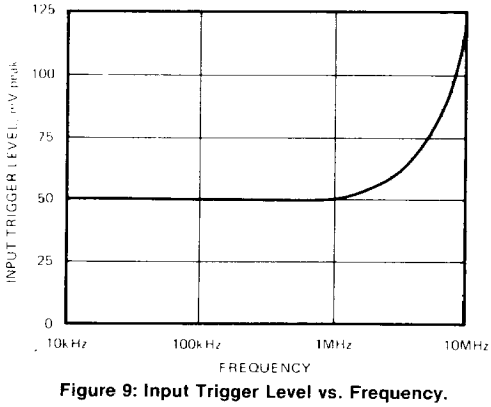


Figure 9: Input Trigger Level vs. Frequency.

on for a time constant of $0.69 \times RB \times C$. The output therefore, goes low as soon as the input signal is present and remains low as long as pulses or any kind of waveforms are appearing at the input with the time constant of less than that set for the timer. The output signal is therefore a DC voltage.

Also notice the voltage divider at the input. Such a divider can be used if it is desirable to set the threshold of the timer at a level higher than the built-in 50 mV.

If it is desirable to measure an AC voltage between two points different from ground, the input configuration shown in Figure 4 is used. *In all of these applications the value of the input coupling capacitor must be chosen so its impedance at the measured frequency is less than 5 kilohms.*

Figure 4 also shows a connection for using both the sink and the source output simultaneously and a mixture of turn-on and turn-off time delay.

The 3050 has a built-in diode network at the input to protect the circuit from DC overloading. If the circuit is to respond to very large AC voltages at the input, yet the input threshold is to be a relative low level, the capacitor connected between pin 8 and ground helps to stabilize the internal regulated voltage and therefore makes the circuit capable of absorbing very large AC signals at the input.

Figure 5 shows a configuration which causes the circuit to latch the first time the input exceeds the threshold. This circuit produces a memory which remains as long as the supply voltage is applied. This effect is produced simply by providing positive feedback from the source output to the timer. The resistor ratio must be such that with input 12 high, the voltage at pins 2 and 6 exceeds 2 volts. Therefore, the value of RF increases with increasing supply voltage. The total current drawn through this change should not exceed 0.5 mA.

A final configuration is shown in Figure 6. Here the additional transistor is used to increase the input impedance to several hundred kilohms. The input must have a DC level of greater than 1 volt and less than the supply voltage.

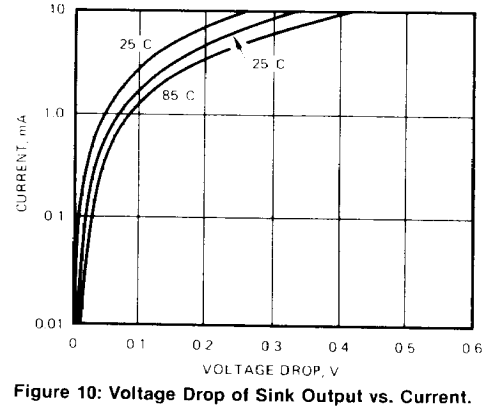


Figure 10: Voltage Drop of Sink Output vs. Current.

SPECIFICATIONS ($T_A = 25°C$, $V_{CC} = +5$ to $+15V$)

PARAMETER	MIN	TYP	MAX	UNIT
Supply Voltage Range	4.5		18	V
Supply Current				
$V_{CC} = 5V$, no input		1	3	mA
$V_{CC} = 15V$, no input		2.5	6	mA
Input Impedance				
Optional Connection*		100		kΩ
Input Trigger Level				
At 1 kHz	25		50	mV
Maximum Frequency**		1		MHz
Timing Range**	0.01		1000	μs
Input Current to Comparator				
Pin 3 or 3		1	5	μA
Output Sink				
ON voltage drop at 10 mA		0.3	0.7	V
OFF leakage current at 15V		0.1	10	μA
Output Source				
ON voltage drop at 0.5 mA		0.2	0.6	V
OFF leakage current at 15V		0.1	10	μA
Operating Temperature	−25		+85	°C
Storage Temperature	−55		+125	°C

Note: *Measured using Figure 6.

**Measured using Figure 4.

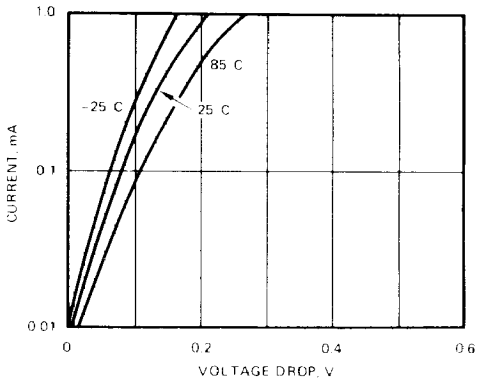


Figure 11: Voltage Drop of Source Output vs. Current.

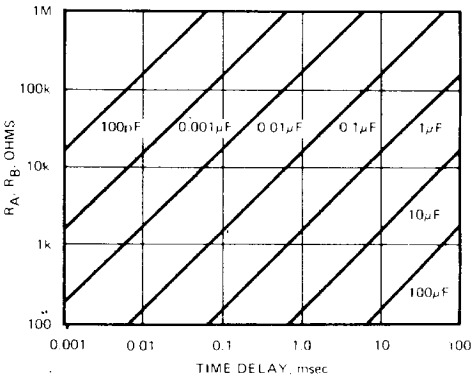
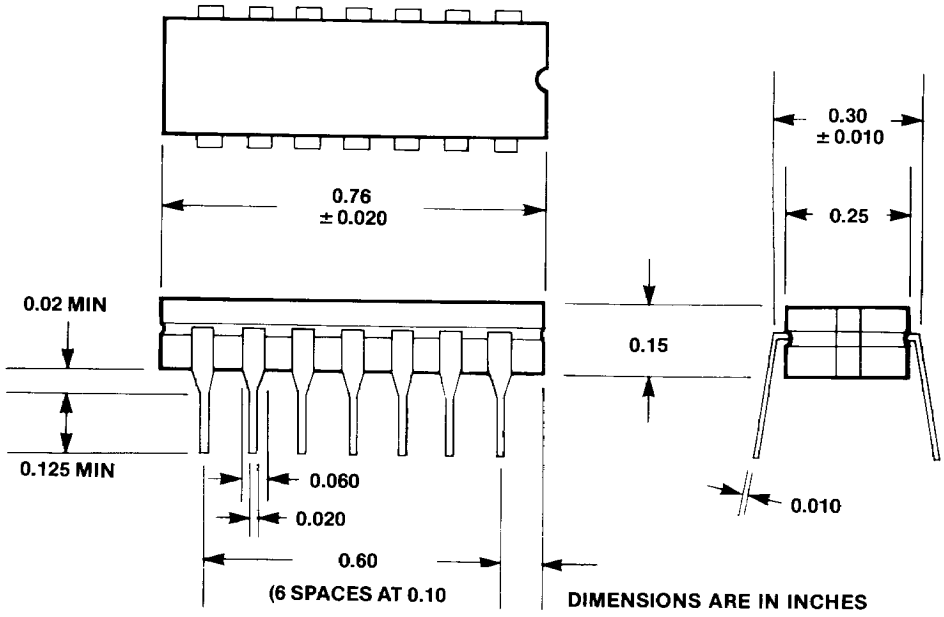


Figure 12: Nomograph for the Selection of R_A, R_B, and C ($t = 0.69 \cdot R \cdot C$)

MECHANICAL OUTLINE



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