

Circuit description

The LM 339 is a quad voltage comparator with open collector outputs.

Comparator U1a is configured as a Schmitt Trigger; it has hysteresis due to positive feedback via R_a and R₄.

The positive going threshold is set by R₅ and R_b. If the voltage V_{in} is below the lower threshold, then the output of U1b is since the output of the U1a is open.

The negative going threshold is set by R_a and R₄.

Thus there is no interaction when adjusting R_a and R_b.

The supply voltage is shifted by about 18 volt by Z1.

The Zener diode eliminates the error that can occur due to the "voltage multiplication effect" that can occur if a resistor is used in lieu of Z1.

Thus any change in the 36 volt supply voltage is shifted (without attenuation) to the junction of Z1, R1 & R2.

When the voltage at the cathode of Z1 reaches about 40.5 volt, the voltage V_{in} will be about 22.5 volt which is the upper threshold of the of the Schmitt Trigger.

Alternator noise will be attenuated by the Low Pass Filter formed by R1 & C1.

The 3 dB point as at about 7.2 Hz.

After a brief delay (about 0.1 second) due to R1 & C1, the voltage at + input of U1a will reach the trigger level & so the output of U1a, will fall rapidly due to the positive feedback to approximately 0 volt.

The other 3 comparators are referenced to about 4.9 volt due to the voltage divider formed by resistors R7 and R8.

Therefore the outputs of these 3 comparators will change as the voltage V₁ passes through 4.9 volt.

The output of U1b will go high and the output of U1a will go low.

Consequently the threshold level of U1a will fall to about 21 volt.

The output of U1c will go low & turn on the LED.

Circuit description

The output of U1d will go high thus turning the FET Q1 on which operates the relay.

When the voltage at the cathode of Z1 decreases about 39 volt, the voltage V_{in} will be about 21 volt which is the lower threshold of the of the Schmitt Trigger.

Thus, after the brief delay due to R1 & C1, V1 will go High, V2 will go Low; the LED will go off & the relay will release.

Hence the circuit returns to its initial state.