# TRIAC characteristics

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***Abstract*- The aim of the experiment is to determine the characteristics of TRIAC.**

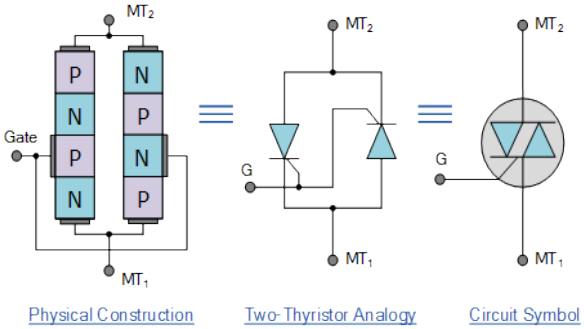
## I. OBJECTIVE

The objective of the experiment is to determine the characteristics of TRIAC.

## II. APPROACH

### A. DEVICE:

The TRIAC is a 4-layer, PNPN in the positive direction and a NPNP in the negative direction, three-terminal bidirectional device that blocks current in its "OFF" state acting like an open-circuit switch, but unlike a conventional thyristor, the triac can conduct current in either direction when triggered by a single gate pulse.

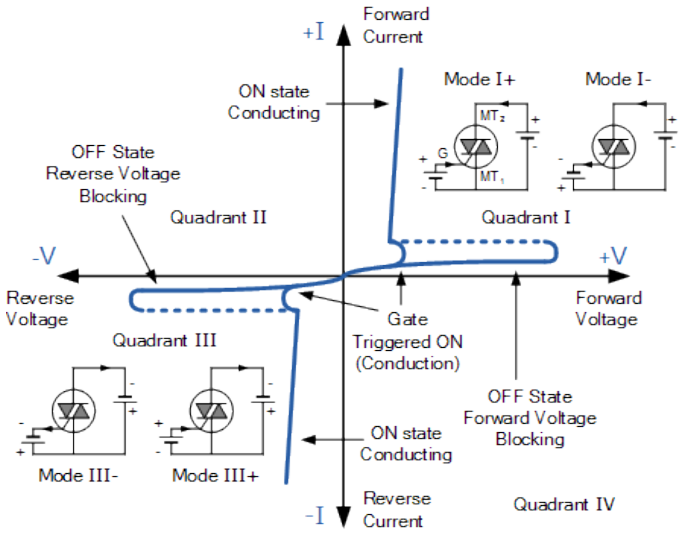



### B. MODES OF OPERATION:

Then a triac has four possible triggering modes of operation as follows.

- I + Mode = MT2 current positive (+ve), Gate current positive (+ve)
- I – Mode = MT2 current positive (+ve), Gate current negative (-ve)
- III + Mode = MT2 current negative (-ve), Gate current positive (+ve)
- III –Mode = MT2 current negative (-ve), Gate current negative (-ve)

And these four modes in which a triac can be operated are shown using the triacs I-V characteristics curves.




pulse width modulation waveform

In Quadrant I, the triac is usually triggered into conduction by a positive gate current, labelled above as mode I+. But it can also be triggered by a negative gate current, mode I–. Similarly, in Quadrant III, triggering with a negative gate current, –IG is also common, mode III– along with mode III+. Modes I– and III+ are, however, less sensitive configurations requiring a greater gate current to cause triggering than the more common triac triggering modes of I+ and III–.

The gate current across the TRIAC can be measured through the ammeter. If there is no gate voltage, still the TRIAC will trigger but then the voltage across the TRIAC should be very high. The current through the MT2 will be very small, but as the TRIAC goes into conduction the current through the terminal increases drastically and then after a point becomes linear with voltage. The voltage, when the TRIAC is in OFF state is known as Forward Blocking Voltage. Once this much voltage is achieved, then the TRIAC goes into

conduction with the help of gate current.
Also, just like silicon controlled rectifiers (SCR's), triac's also require a minimum holding current IH to maintain conduction at the waveforms cross over point. Then even though the two thyristors are combined into one single triac device, they still exhibit individual electrical characteristics such as different breakdown voltages, holding currents and trigger voltage levels exactly the same as we would expect from a single SCR device.

The TRIAC is an ideal device to use for AC switching applications because it can control the current flow over both halves of an alternating cycle. A thyristor is only able to control them over one half of a cycle. During the remaining half no conduction occurs and accordingly only half the waveform can be utilised.

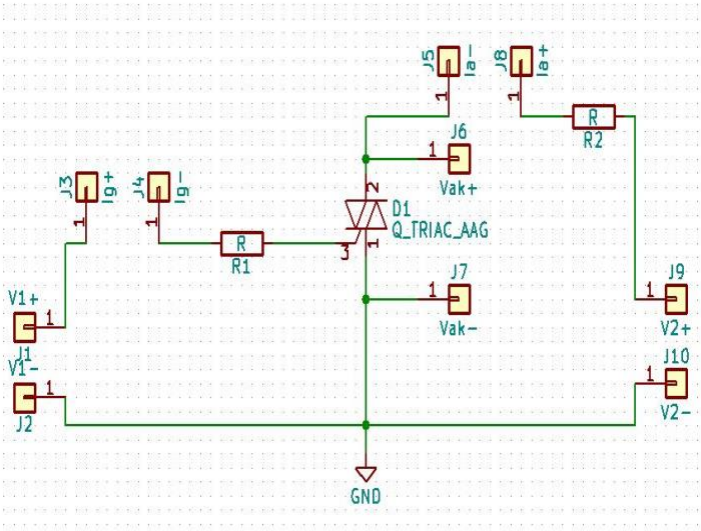
## III. EDA TOOL USED

The EDA tool use by us is Kicad.

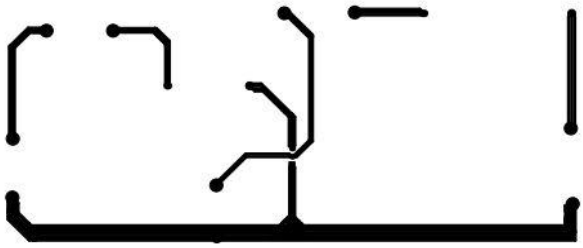
Kicad is an open source EDA tool which is used by us to design the schematic and layout of the pcb.

We have also it for routing tracks on our pcb.

## IV. SCHEMATIC




## V. PCB LAYOUT



## VI. BILL OF MATERIALS

| Components | Cost(rs) | Quantity | Total(rs) |
|---|---|---|---|
| BT136 | 15 | 1 | 15 |
| 1K,10W | 2 | 1 | 2 |
| Diode | 2 | 1 | 2 |
| **Total(rs)** | | | **19** |

## VII. CONCLUSION

Thus, the characteristics of the TRIACs were observed. It was observed that the with small amount of gate current, a large current can be controlled by the triac. This is helpful in variety of applications where we require power switching.
However, one of the drawbacks of the TRIAC is that it does not switch symmetrically. It will often have an offset, switching at different gate voltages for each half of the cycle. This creates additional harmonics and also provides an imbalance in the system
In order to improve the switching of the current waveform and ensure it is more symmetrical is to use a device external to the TRIAC to time the triggering pulse. Typical triac has the following voltage/current values:

| | |
|---|---|
| Instantaneous on-state voltage | 1.5 Volts |
| On-state current | 25 Amperes |
| Holding current, $I_H$ | 75 Milli Amperes |
| Average triggering current, $I_G$ | 5 Milli Amperes |

## VIII. APPLICATIONS

TRIACs are widely used in AC power control applications. They are able to switch high voltages and

high levels of current, and over both parts of an AC waveform. This makes triac circuits ideal for use in a variety of applications where power switching is needed. However, they tend not to be used in high power switching applications - one of the reasons for this is the non-symmetrical switching characteristics. For high power applications this creates a number of difficulties, especially with electromagnetic interference.

However, TRIACs are still used for many electrical switching applications:

- Domestic light dimmers
- Electric fan speed controls
- Small motor controls
- Control of small AC powered domestic appliances

**REFRENCES:**


1) **https://en.wikipedia.org/wiki/TRIAC**
2) **https://inderjitsingh87.weebly.com/electronic-devices-2016.html**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