Al-Mustaqbal University College
Department of Medical Instrumentation Techniques Engineering
Class: Third
Subject: Power Electronics LAB
Lecturer: Dr. Mayasah Al-ghazaly
Lecture: 1

Experiment No.3 DIAC Characteristics

Objective :

To display and study the V-I characteristics of a Diac.

Apparatus used:

1. DC power Supply. 2. DIAC. 3. Voltmeter. 4. Résistance.

Theory :

A diac (is breif of Diode AC) is an important member of the thyristor family and is usually employed for triggering triacs. A diac is a two-electrode bidirectional avalanche diode which can be switched from off-state to the on-state for either polarity of the applied voltage. This is just like **a TRIAC** without gate terminal, as shown in figure. Its equivalent circuit is a pair of inverted four layer diodes. Two schematic symbols are shown in figure. Again the terminal designations are arbitrary since the diac, like triac, is also a bilateral device. The switching from off-state to on-state is achieved by simply exceeding the avalanche break down voltage in either direction. Figure (1) shows the diac symbol and construction.

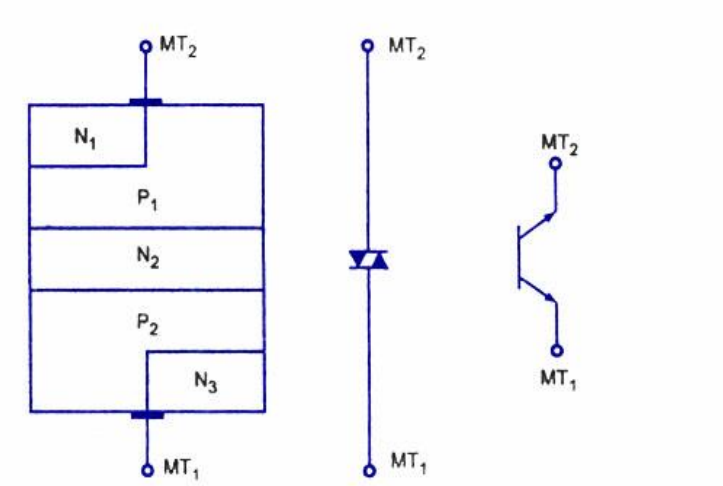

Figure (1) The DIAC symbol and structure.

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Operation of a Diac.

When the terminal MT_2 is positive, the current flow path is P_1-N_2-P_2-N_3 while for positive polarity of terminal MT_1 the current flow path is P_2-N_2-P_1-N_1. The operation of the diac can be explained by imagining it as a two anti series avalanche diodes .

When applied voltage in either polarity is small (less than breakover voltage) a very small amount of current, called the *leakage current,* flows through the device. Leakage current caused due to the drift of electrons and holes in the depletion region, is not sufficient to cause conduction in the device. The device remains in non-conducting mode. However, when the magnitude of the applied voltage exceeds the avalanche breakdown voltage, breakdown takes place and the diac current rises sharply, as shown in the characteristics shown in figure (2).

Diac Characteristics

Volt-ampere characteristic of a diac is shown in figure (2). It resembles the English letter Z because of the symmetrical switching characteristics for either polarity of the applied voltage.

The diac acts like an open-circuit until it's switching or breakover voltage is exceeded. At that point the diac conducts until its current reduces toward zero (below the level of the holding current of the device). The diac, because of its peculiar construction, does not switch sharply into a low voltage condition at a low current level like the SCR or triac. Instead, once it goes into conduction, the diac maintains an almost continuous negative resistance characteristic, that is, voltage decreases with the increase in current. This means that, unlike the SCR and the triac, the diac can not be expected to maintain a low (on) voltage drop until its current falls below a holding current level.

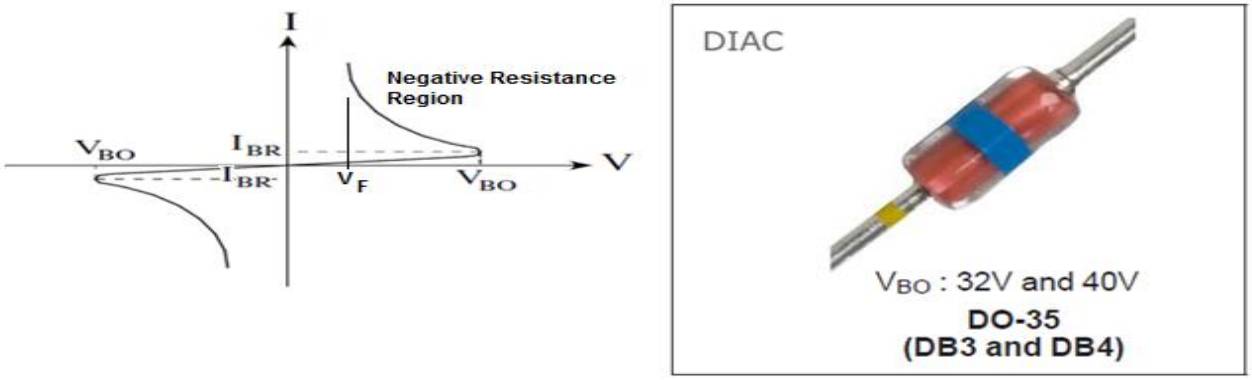

Figure (2) DIAC characteristics.

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Procedure:

1. Connect the circuit as shown in figure (3).
2. Vary the the value of V_{AK} carefully and in steps as in table (1) and read the anode current I_A for each step. Record your results in the table.
3. Sketch your obtained results in graph paper (V_{AK} on the X-axis, and I_A on the Y-axis). The curve obtained represents the diac characteristics in forward region.
4. Repeat steps 2 to 6. Record your results in table (2).

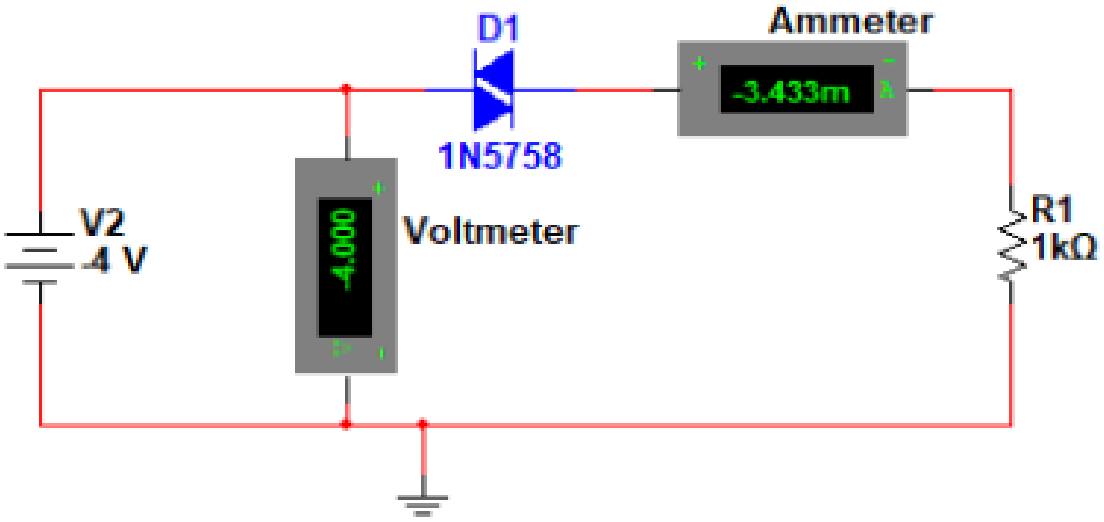

Figure (3) the practical circuit to plot DIAC characteristics on the oscilloscope.

Table (1) Results Obtained for forward characteristics of the Diode.

V_{AK} (V)	0.1	0.2	0.3	0.4	0.5	0.6	0.7	1	2	4	6 to 12
I_A (mA)											

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Table (2) Results Obtained for reverse characteristics of the Diode

Vin (V)	0	-2	-4	-6	-8	-10	-12
V_{AK} (V)							
I_A (mA)							

Discussion:

1. Comment on your results.
2. Compare between the DIAC & Diode.
3. Explain briefly about the regions that the DIAC is passing in them when it transfer from state(off) to state(on)?
4. When the DIAC turns on, the drop voltage will be decrease, why?
5. What are all the practical applications of the DIAC ?
6. Can you equivalent the DIAC and comment?
7. Can you make the DIAC operates as the follow:
   a- with one part only.
   b- one part as a DIAC and the other as a diode .
   c- one part with VBO greater than other, then you can trigger a (TRIAC) with tow difference firing angle in positive & negative part.