

Electronic-Circuit II

Chap 3 Power Electronics

DIAC & TRIAC

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Course Homepage

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DIAC

The diagram illustrates the DIAC (Diode for AC Switching) device. It shows the symbol, the I-V characteristic curve, and the internal structure. The I-V curve shows a non-linear characteristic with a breakover voltage V_{BO} and a breakover current I_{BR} . The internal structure is a three-layer semiconductor with layers N_1 , P_1 , N_2 , P_2 , and N_3 , and terminals Anode 1 and Anode 2.

- Two terminal device
- Can conduct in either direction
- Three layer low voltage, low current semiconductor switch
- Commonly used to trigger SCRs and TRIACs

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Introduction

- SCR is a unidirectional device (permits current flow only in the anode to cathode direction through it)
- For controlled switching of currents in an AC circuit, in which current flow is bi-directional, two SCRs need to be connected in anti-parallel

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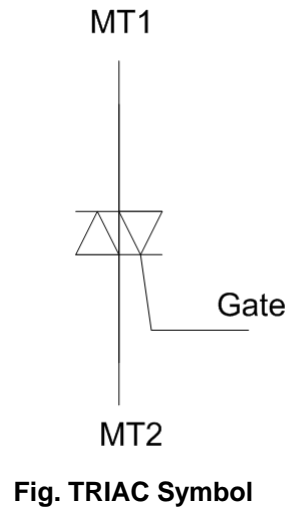
TRIAC

- TRIAC
 - functionally equivalent to two SCRs connected antiparallel
 - MT1 is the Main Terminal 1 and MT2 is the Main terminal 2
 - Switching control terminals are the gate and MT1 irrespective of the direction of current to be switched

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TRIAC contd...

- TRIAC has a complicated structure
- Functionally equivalent to two SCR's connected antiparallel
- Bidirectional device
- Can be triggered when MT2 is +ve w.r.t. MT1 & +ve IG w.r.t. to MT1
- Can also be triggered when MT2 is -ve w.r.t. MT1 & -ve IG w.r.t. to MT1



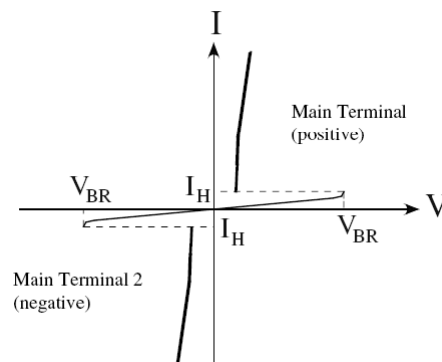
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V-I characteristics of TRIAC

- The breakover voltage of the Triac can be controlled by the application of a positive or negative signal to the gate
- As the magnitude of the gate signal increases, the breakover voltage decreases
- Once the Triac is in the ON state, the gate signal can be removed and the Triac will remain ON until the main current falls below the holding current (I_H) value.



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Light Dimmer Circuit

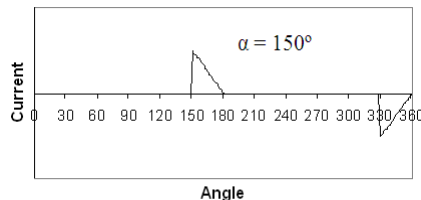
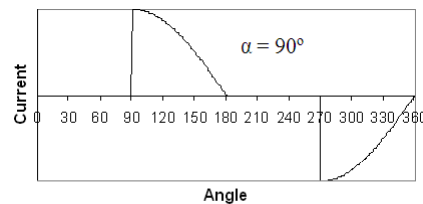
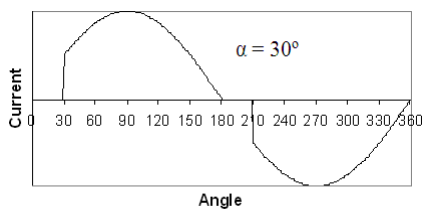
- Light Dimmer regulates power flow to a resistive load such as the light bulbs
- Efficient
- Allows only a portion of the 50 Hz supply current to pass through
- Solid-state light dimmers work by varying the "duty cycle" (on/off time) of the full AC voltage that is applied to the lights being controlled
- Varying the turn-on point, the amount of power getting to the bulb is adjustable, and hence the light output can be controlled

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Light Dimmers contd..



- By adjusting the firing angle of thyristor, the power levels can be adjusted

- Change in firing angle \rightarrow Change in duty cycle \rightarrow Change in amt. of power level \rightarrow change in brightness

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Assignment-2

- Simulate the above circuit in Multisim or Workbench environment and plot the input and output waveforms
- Also, determine the firing angle and conduction angle from the following waveform
- Deadline: Next week

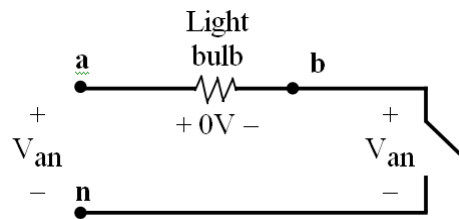
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Light Dimmer Circuit Using a TRIAC

- Firing angle controlled by potentiometer, RC circuit and DIAC

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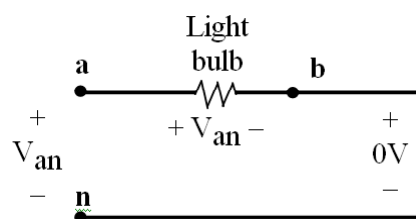
Before firing...



- Before firing triac is an open switch
- Practically no voltage applied across the light bulb
- Small current through resistor R1 is ignored

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After firing...



- After firing triac is a closed switch
- Practically, all of V_{an} is applied across the light bulb

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