Turn-ON Characteristics

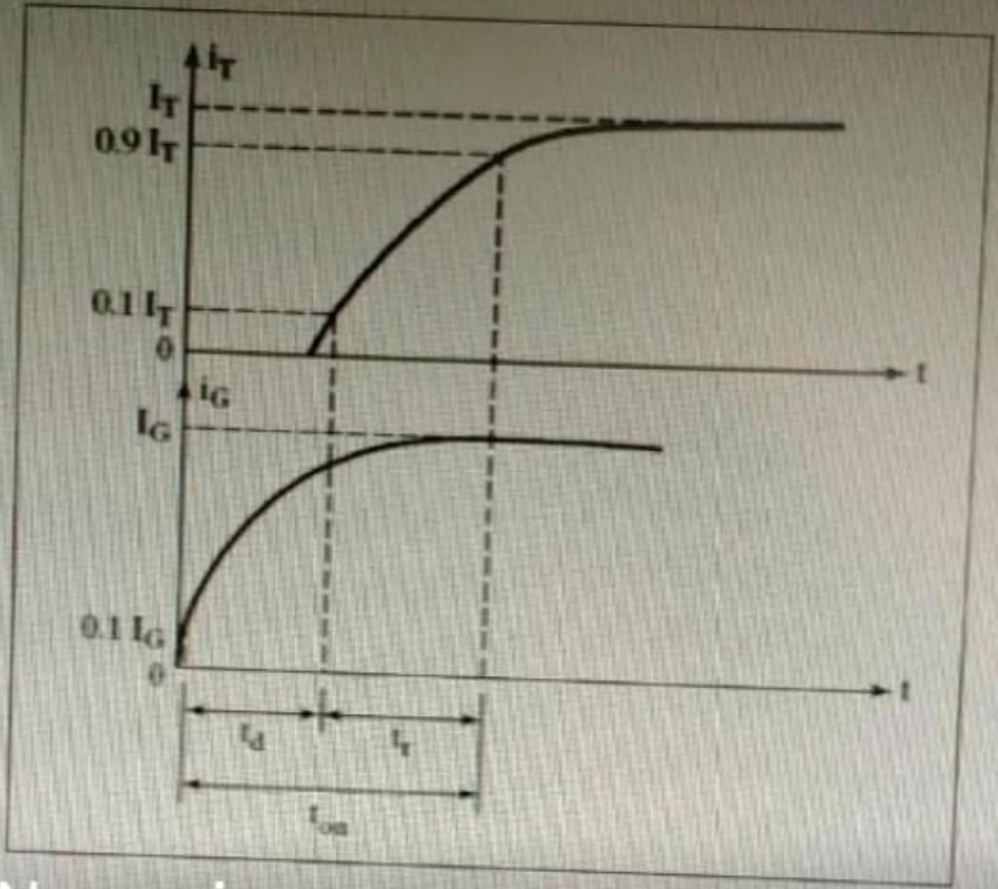
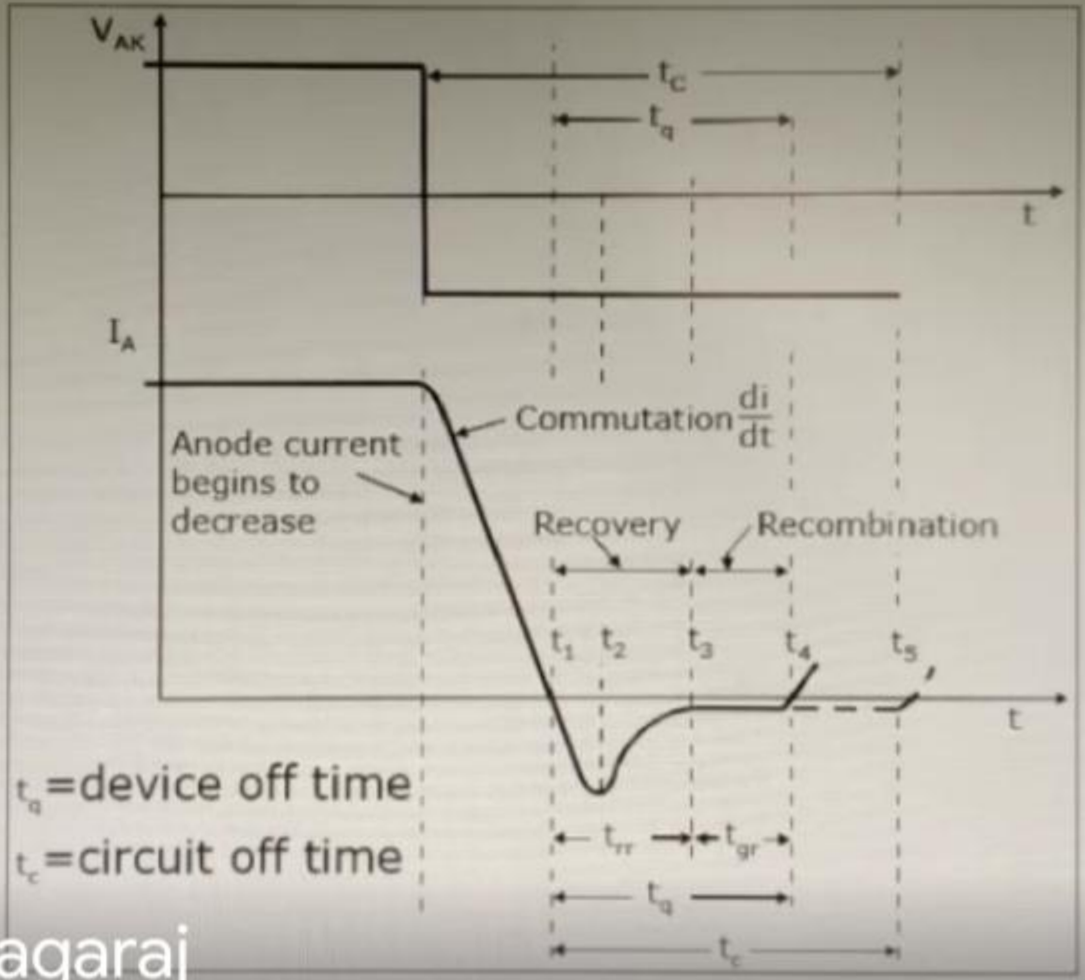


Fig 3.7: Turn-on characteristics



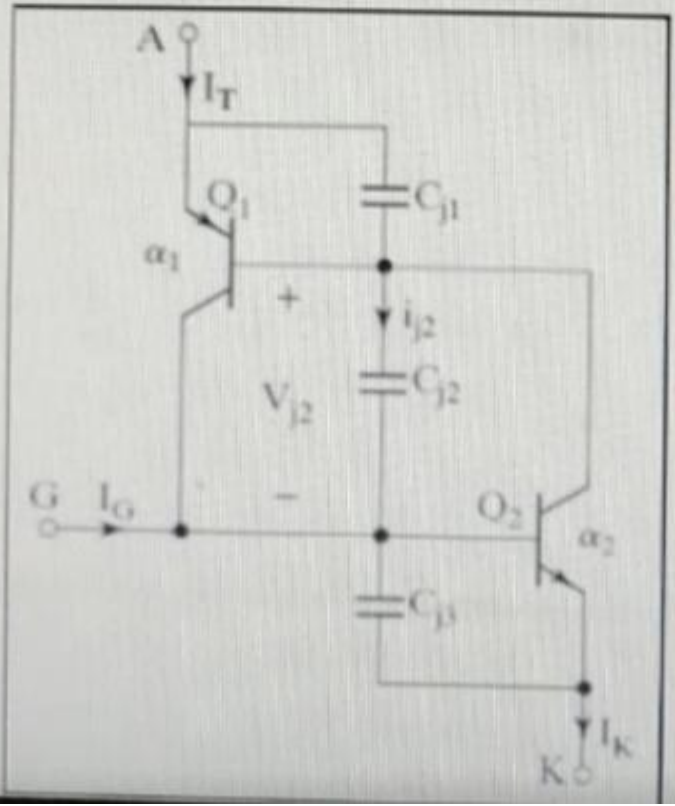
V_{AK}
t_c
t_q
t
I_A
Commutation $\frac{di}{dt}$
Anode current begins to decrease
Recovery
Recombination
t_1 t_2 t_3 t_4 t_5
t
t_q=device off time
t_c=circuit off time
t_{rr}
t_{gr}
t_q
t_c

greater than SCR turn off time t_q.

Thyristor Turn ON

- **Thermal Turn on:** If the temperature of the thyristor is high, there will be an increase in charge carriers which would increase the leakage current. This would cause an increase in $\alpha_1 \& \alpha_2$ and the thyristor may turn on. This type of turn on many cause thermal run away and is usually avoided.
- **Light:** If light be allowed to fall on the junctions of a thyristor, charge carrier concentration would increase which may turn on the SCR.
- **LASCR:** Light activated SCRs are turned on by allowing light to strike the silicon wafer.
- **High Voltage Triggering:** This is triggering without application of gate voltage with only application of a large voltage across the anode-cathode such that it is greater than the forward breakdown voltage V_{BO}. This type of turn on is destructive and should be avoided.
- **Gate Triggering:** Gate triggering is the method practically employed to turn-on the thyristor. Gate triggering will be discussed in detail later.
- $\frac{dv}{dt}$ **Triggering:** Under transient conditions, the capacitances of the p-n junction will influence the characteristics of a thyristor. If the

The manufacturers specify the allowable $\frac{dv}{dt}$.



$\frac{dv}{dt}$ **Triggering:** Under transient conditions, the capacitances of the p-n junction wi

influence the characteristics of a thyristor. If the thyristor is in the blocking state, rapidly rising voltage applied across the device would cause a high current to flow through the device resulting in turn-on. If i_{j_2} is the current throught the junction j_2 an C_{j_2} is the junction capacitance and V_{j_2} is the voltage across j_2, then

$$i_{j_2} = \frac{dq_2}{dt} = \frac{d}{dt}\left(C_{j_2} V_{j_2}\right) = \frac{C_{j_2} dV_{J2}}{dt} + V_{j_2}\frac{dC_{j_2}}{dt}$$

Thyristor Ratings

First Subscript	Second Subscript	Third Subscript
D → off state	W → working	M → Peak Value
T→ON state	R → Repetitive	
F → Forward	S →Surge or non-repetitive	
R → Reverse		

VOLTAGE RATINGS

V_{DWM} : This specifies the peak off state working forward voltage of the device. This specifies the maximum forward off state voltage which the thyristor can withstand during its working.

V_{DSM} : This is the peak off state surge / non-repetitive forward voltage that will oc
the thyristor.

V_{RWM} : This the peak reverse working voltage that the thyristor can withstand in th
direction.

V_{RRM} : It is the peak repetitive reverse voltage. It is defined as the maximum p
instantaneous value of repetitive applied reverse voltage that the thyristor can
reverse direction.

PradeepmysurNagaraj

$\frac{dv}{dt}$ rating: This is the maximum rate of rise of anode voltage that the SCR has to withstand and which will not trigger the device without gate signal (refer $\frac{dv}{dt}$ triggering).

Current Rating

$I_{Taverage}$: This is the on state average current which is specified at a particular temperature.

I_{TRMS} : This is the on-state RMS current.

Latching current, I_L : After the SCR has switched on, there is a minimum current required to sustain conduction. This current is called the latching current. I_L associated with turn on and is usually greater than holding current.