SNS COLLEGE OF ENGINEERING

Coimbatore-35
An Autonomous Institution

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF MECHATRONICS

19MO504 – INDUSTRIAL ELECTRONCIS
III YEAR V SEM

UNIT 1 – PHASE CONTROLLED CONVERTERS

TOPIC – Construction and working of IGBT

Ms.B.SAJITHA., M.E.,(Ph.D.,)

ASSISTANT PROFESSOR,

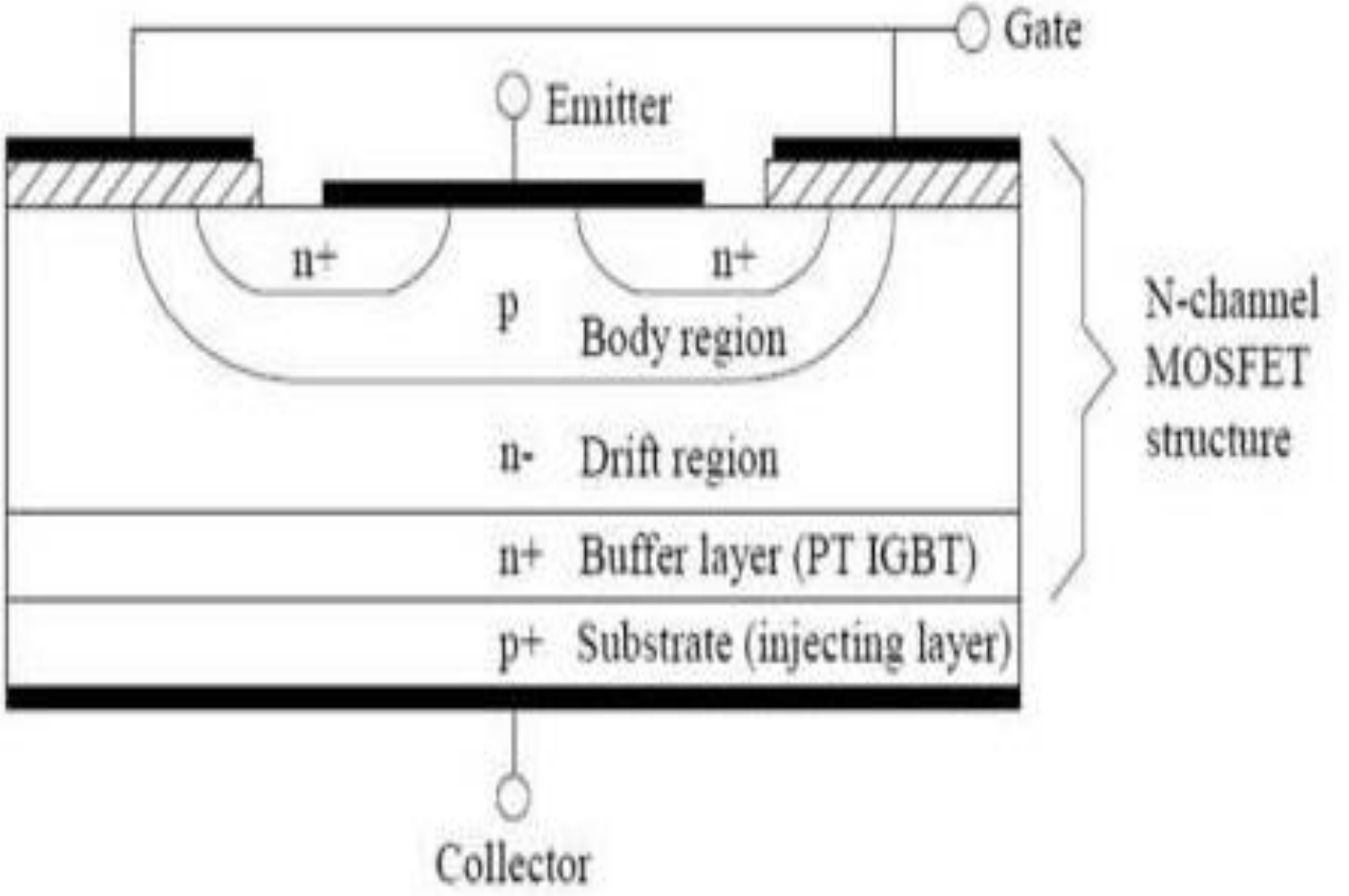
DEPARTMENT OF EEE,

SNSCE, Coimbatore.

INSULATED GATE BIPOLAR TRANSISTOR (IGBT)

- COMBINES THE BEST QUALITIES OF BOTH **BJT** AND **MOSFET**
- HAS HIGH INPUT IMPEDANCE AS MOSFET AND HAS LOW ON-STATE POWER LOSS AS IN BJT
- OTHER NAMES
  - ✓ **MOSIGT** (METAL OXIDE INSULATED GATE TRANSISTOR),
  - ✓ **COMFET** (CONDUCTIVELY-MODULATED FIELD EFFECT TRANSISTOR),
  - ✓ **GEMFET** (GAIN MODULATED FIELD EFFECT TRANSISTOR),
  - ✓ **IGT** (INSULATED GATE TRANSISTOR)

BASIC STRUCTURE OF IGBT



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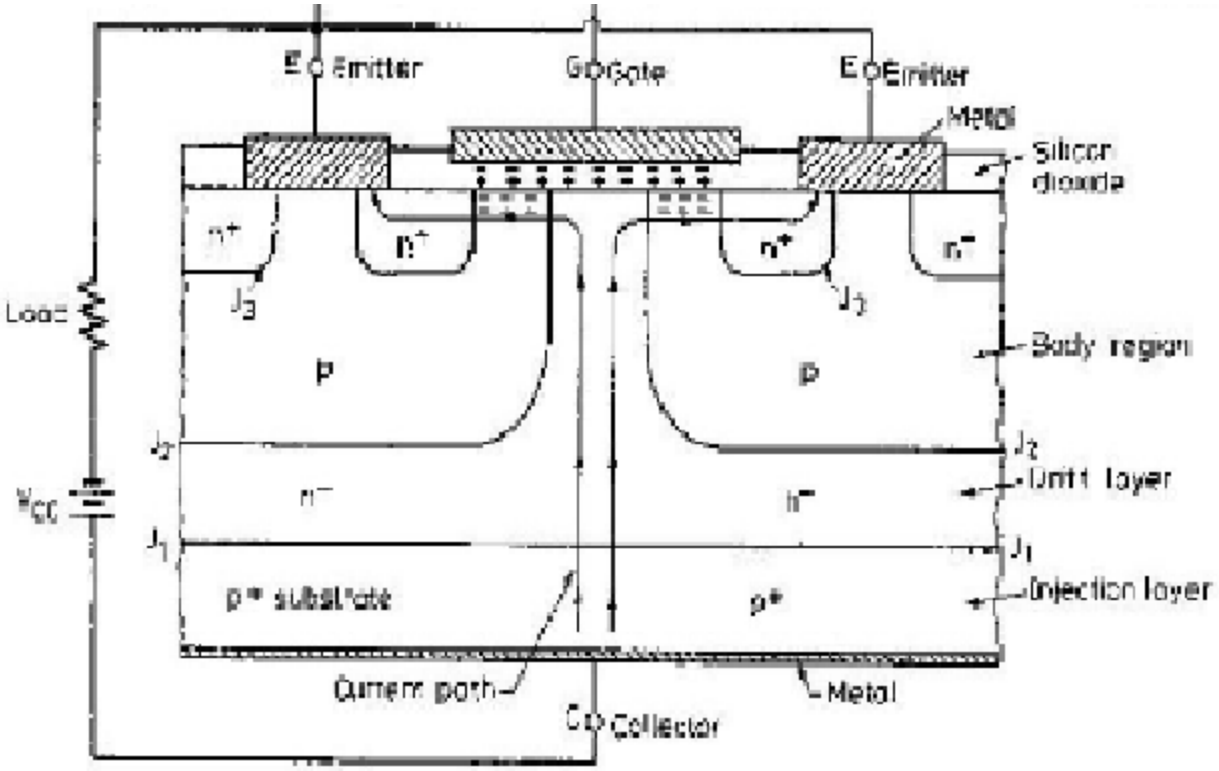
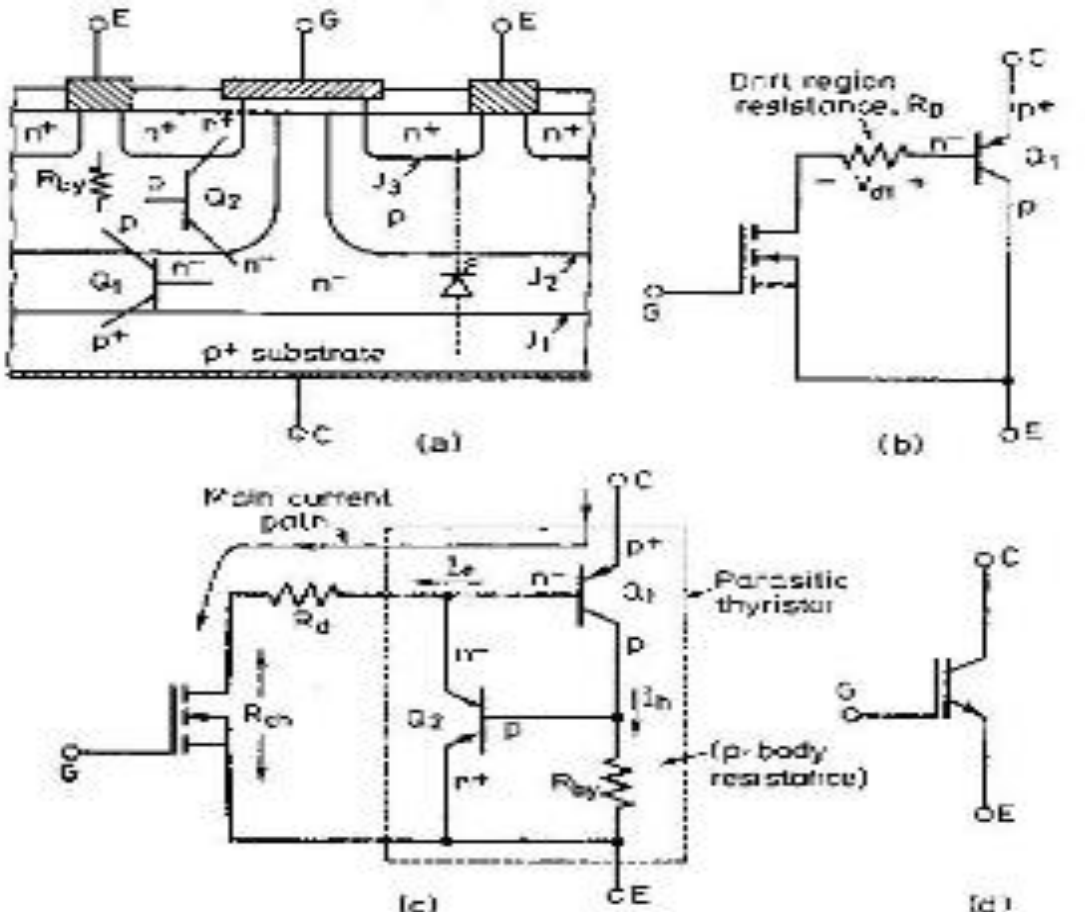


EQUIVALENT CIRCUIT OF IGBT



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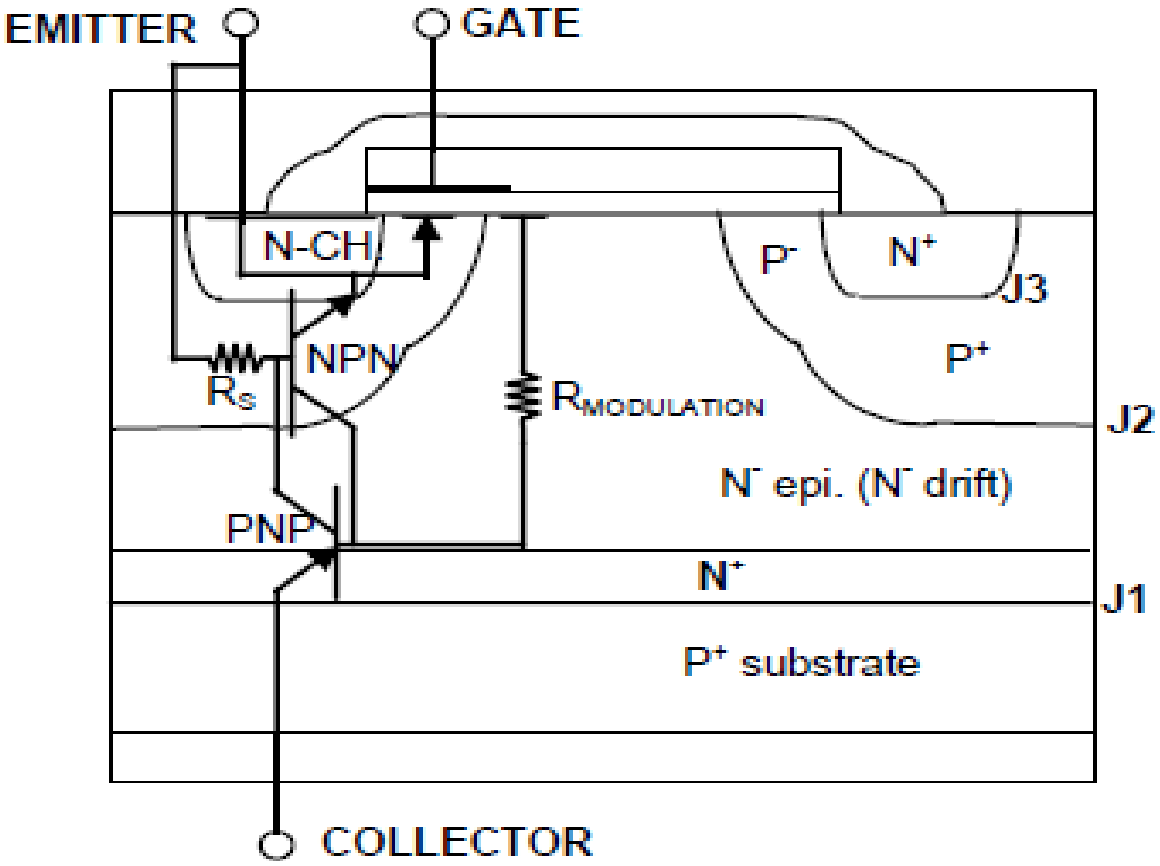

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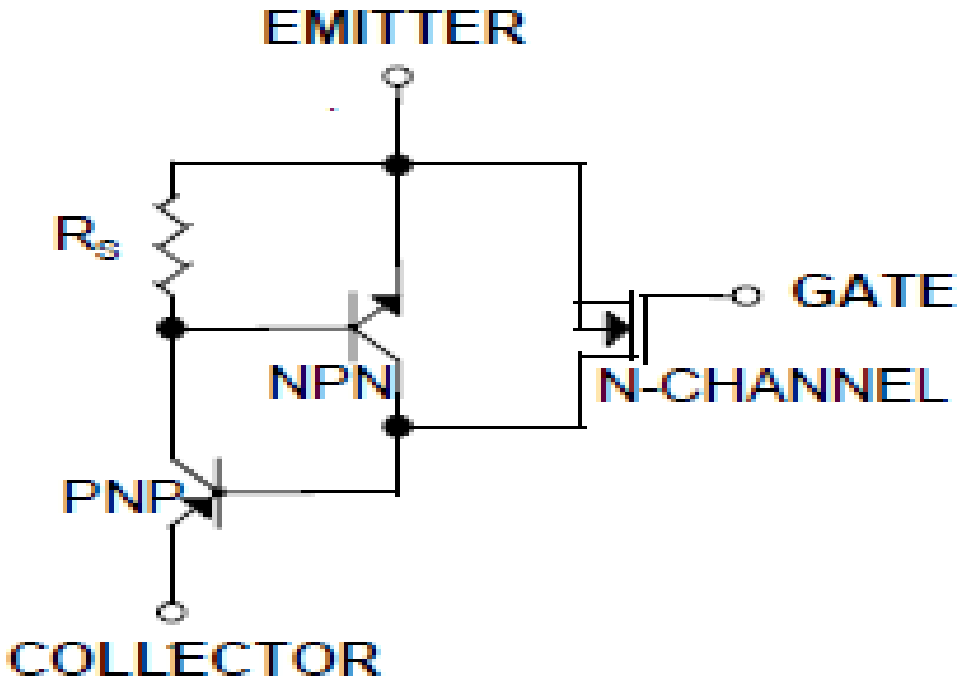
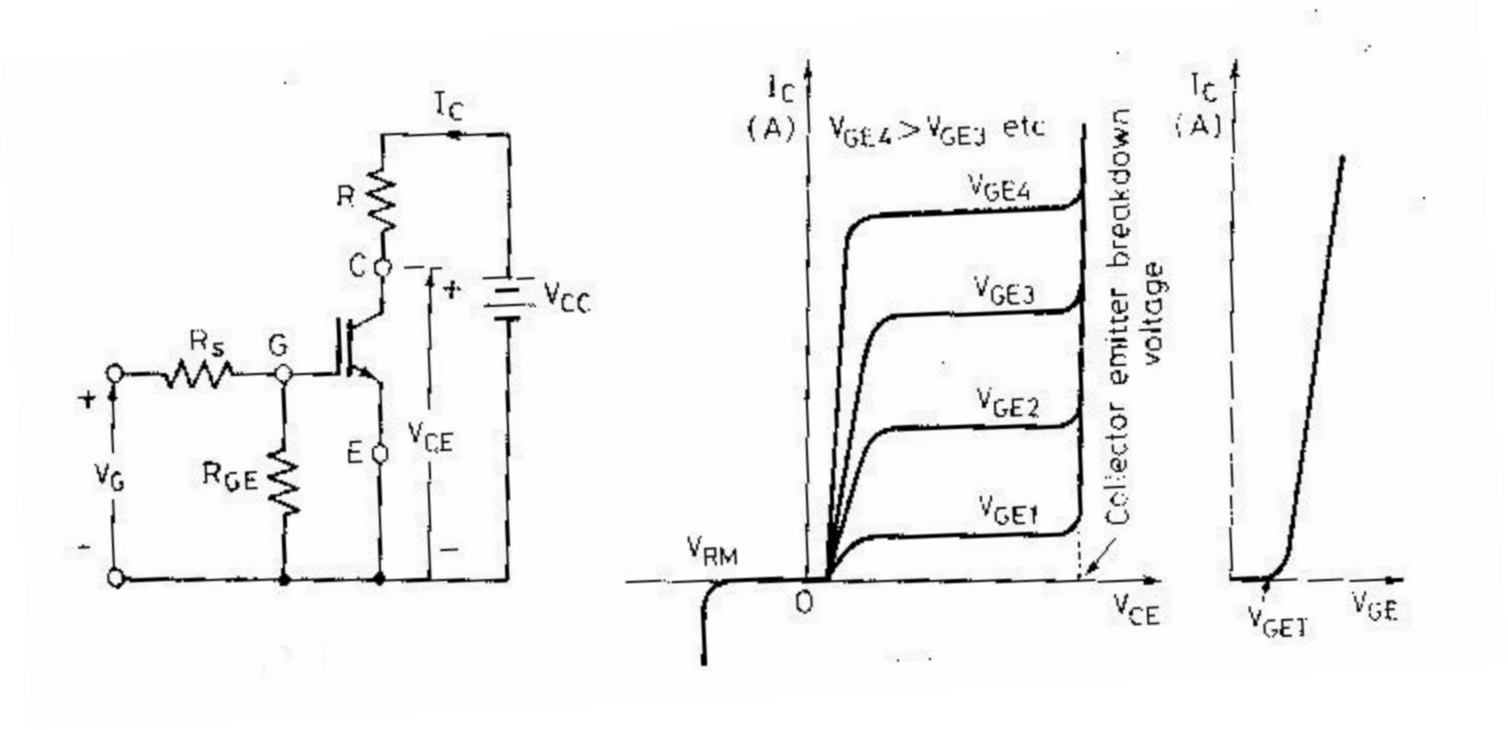
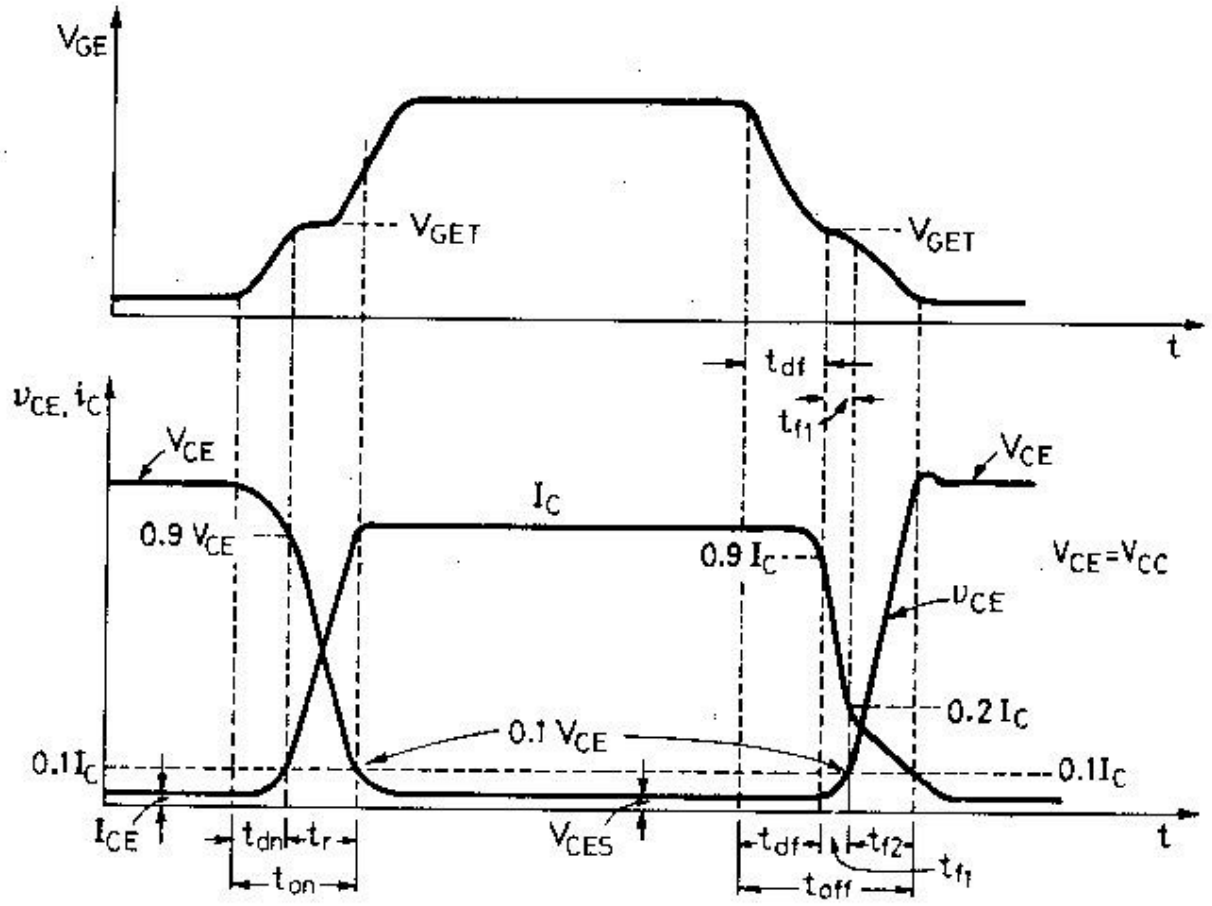


V-I AND TRANSFER CHARACTERISTICS OF IGBT



SWITCHING CHARACTERISTICS OF IGBT



APPLICATIONS OF IGBT

- DC AND AC MOTOR DRIVES
- UPS SYSTEMS,POWER SUPPLIES
- DRIVES FOR SOLENOIDS,RELAYS AND CONTACTORS

COMPARISON OF IGBT WITH MOSFET

S.No	MOSFET	IGBT
1.	THREE TERMINALS ARE GATE,SOURCE AND DRAIN	THREE TERMINALS ARE GATE,EMITTER AND COLLECTOR
2.	HIGH INPUT IMPEDANCE	HIGH INPUT IMPEDANCE
3.	VOLTAGE CONTROLLED DEVICE	VOLTAGE CONTROLLED DEVICE
4.	RATINGS AVAILABLE UPTO 500V,140A	RATINGS AVAILABLE UPTO 1200V,500A
5.	OPERATING FREQUENCY IS UPTO I MHz	OPERATING FREQUENCY IS UPTO 50KHz
6.	WITH RISE IN TEMPERATURE,THE INCREASE IN ON-STATE RESISTANCE IN MOSFET IS MORE PRONOUNCED THAN IGBT.SO, ON-STATE VOLTAGE DROP AND LOSSES RISE RAPIDLY IN MOSFET THAN IN IGBT ITH RISE IN TEMPERATURE.	
7.	WITH RISE IN VOLTAGE,THE INCREMENT IN ON-STATE VOLTAGE DROP IS MORE DOMINANT IN MOSFET THAN IT IS IN IGBT.THIS MEANS IGBTs CAN BE DESIGNED FOR HIGHER VOLTAGE RATINGS THAN MOSFETs.	

Assessment

Q1. What is the primary advantage of an IGBT over a MOSFET?

•A) Higher switching speed

•B) Lower switching losses

•C) Ability to handle higher current

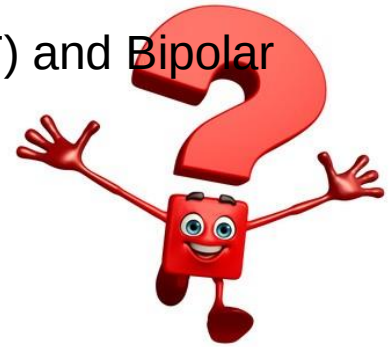
•D) Lower gate drive power requirement

Answer: C) Ability to handle higher current

Q2. The IGBT is a combination of which two types of transistors?

•A) Bipolar Junction Transistor (BJT) and Thyristor

•B) Metal-Oxide-Semiconductor Field-Effect Transistor (MOSFET) and Bipolar Junction Transistor (BJT)



•C) Field-Effect Transistor (FET) and Thyristor

•D) Junction Field-Effect Transistor (JFET) and BJT

Answer: B) Metal-Oxide-Semiconductor Field-Effect Transistor (MOSFET) and Bipolar Junction Transistor (BJT)

References

1. https://www.electronics-tutorials.ws/power/single-phase-rectification.html
2. https://www.tutorialspoint.com/power_electronics/power_electronics_introduction.htm#:~:text=Power%20Electronics%20refers%20to%20the,efficiency%20and%20reliability%20is%20100%25