Power semiconductor devices ratings

Device	Type	Voltage Rating (V)	Current Rating (A)	Upper Frequency (kHz)	Switching Time (μs)	On-state resistance [Ω]
Diodes	General	5000	5000	1.0	100.00	0.16m
	High Speed	3000	1000	10.0	2.00	1m
	Schottky	40	60	20.0	0.23	10m
Thyristor (SCR)	Rev. blocking	5000	5000	1.0	200.00	0.25m
	High Speed	1200	1500	10.0	20.00	0.47m
	GATT	1200	400	20.0	8.00	2.24m
	LASCR	6000	1500	0.4	200.00	0.53m
TRIACs		1200	300	0.4	200.00	3.57m
Self-turned-off thyristors	GTO	6000	6000	10.0	15.00	2.5m
	SITH	4000	2200	20.0	6.50	5.75m
	IGCT	4500	3000	20.0	6.50	5m
Power Transistor (BJTs)	Single	400	250	20.0	9.00	4m
		630	50	25.0	1.70	15m
	Darlington	1200	400	10.0	30.00	10m
SITs		1200	300	100.0	0.55	1.2
Power MOSFETs	Single	500	50	100.0	0.60	0.6
		1000	4.7	100.0	0.90	2
IGBTs	Single	1200	1200	30.0	2.00	60m
MCTs	Single	1200	500	20.0	2.20	18m

Legend:

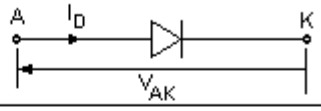
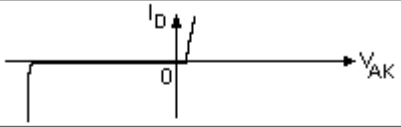
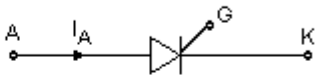
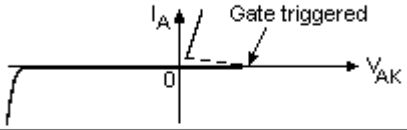
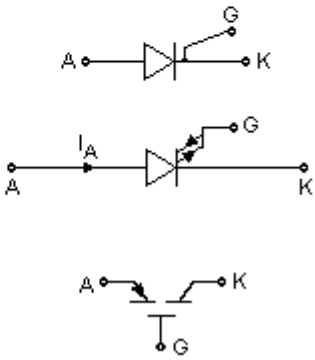
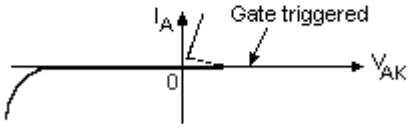
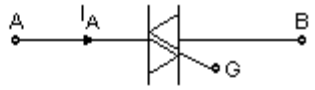
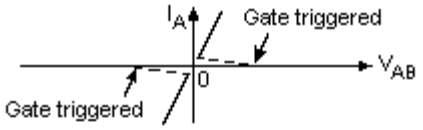
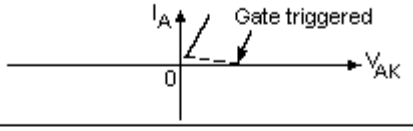
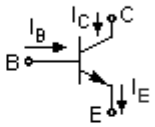
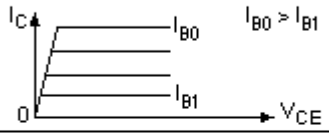
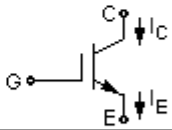
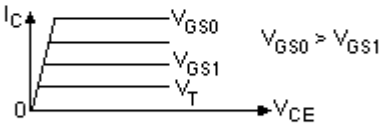
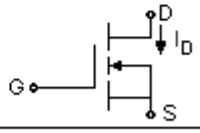
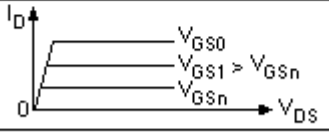
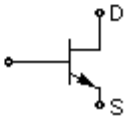
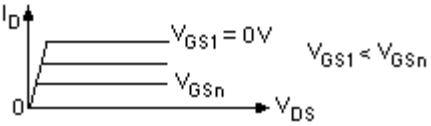
- BJT – Bipolar Junction transistor (1950)
- SCR – Silicon Controlled Rectifier, thyristor (1956)
- GTO – Gate Turn-Off thyristor (1960)
- TRIAC – Bi-directional Triode Thyristor (1963)
- RCT – Reverse Conducting Thyristor (circa 1963)
- GATT – Gate-Assisted turn-off Thyristor (circa 1963)
- MOSFET – Metal-Oxide Field Effect Transistor (1975)
- FCT – Field Controlled Thyristor (1975)
- LASCR – Light Activated SCR (1976)
- ASCR – Asymmetrical SCR (1976)
- IGBT – Insulated gate bipolar transistor (1983)
- SIT – Static induction transistor (circa 1983) (normally “on”)
- SITH - Static induction thyristor (circa 1983) (normally “on”)
- MCT – MOS-Controlled Thyristors (1984)
- FCD – Field-Controlled Diode (1991)
- IGCT – Integrated Gate-Commutated Thyristor (1997)

Classification of power semiconductor switching devices

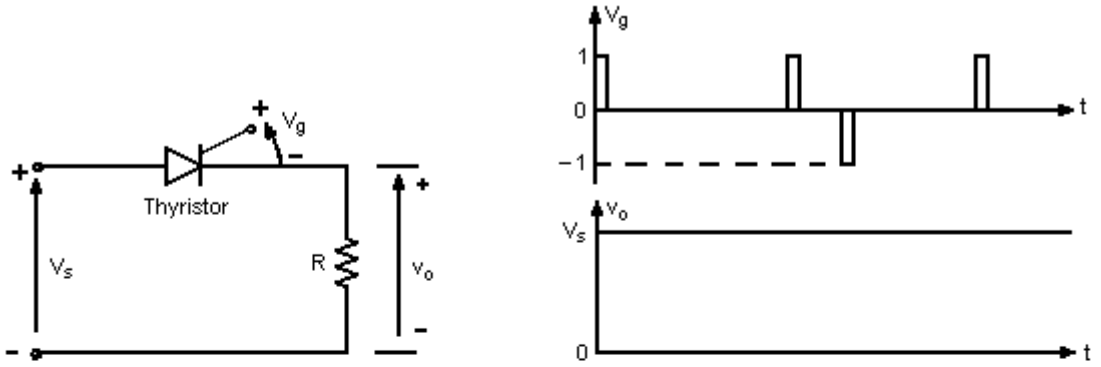
Power semiconductor devices can be classified as follows:

1. Uncontrolled turn on and off (Diode)
2. Controlled turn on and uncontrolled turn off (SCR)
3. Controlled turn on and off characteristics (BJT, MOSFET, GTO, SITH, IGBT, SIT MCT)
4. Continuous gate signal requirement (BJT, MOSFET, IGBT, SIT)
5. Pulse gate requirements (SCR, GTO, MCT)
6. Bipolar voltage-withstanding capability (SCR, GTO)
7. Unipolar voltage-withstanding capability (BJT, MOSFET, GTO, IGBT, MCT)
8. Bidirectional current capability (TRIAC, RCT)
9. Unidirectional current capability (SCR, GTO, BJT, MOSFET, MCT, IGBT, SITH, SIT, Diode)

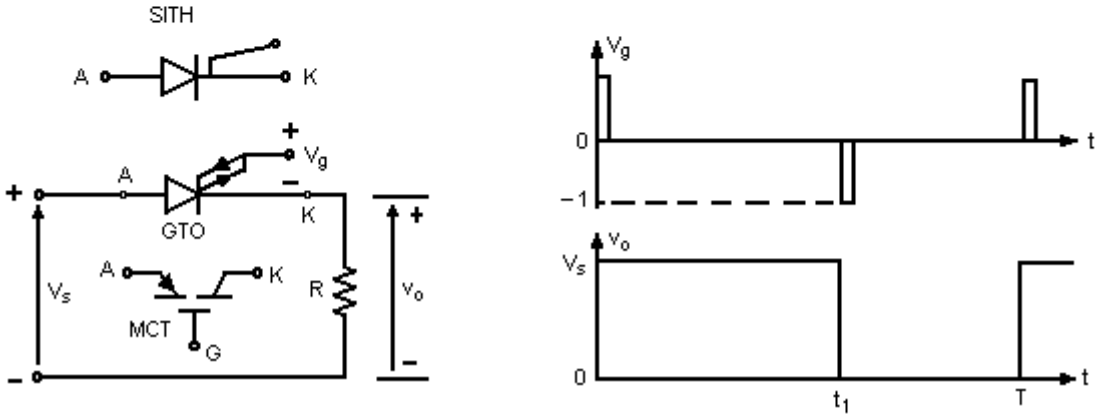
Characteristics and symbols of some power devices

Devices	Symbols	Characteristics
Diode		
Thyristor		
SITH GTO MCT		
TRIAC		
LASCR		
NPN BJT		
IGBT		
N-Channel MOSFET		
SIT		

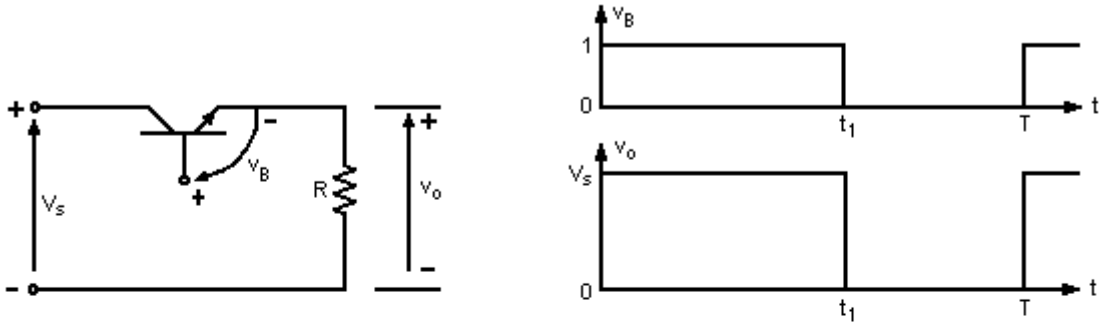
Control characteristics of power devices



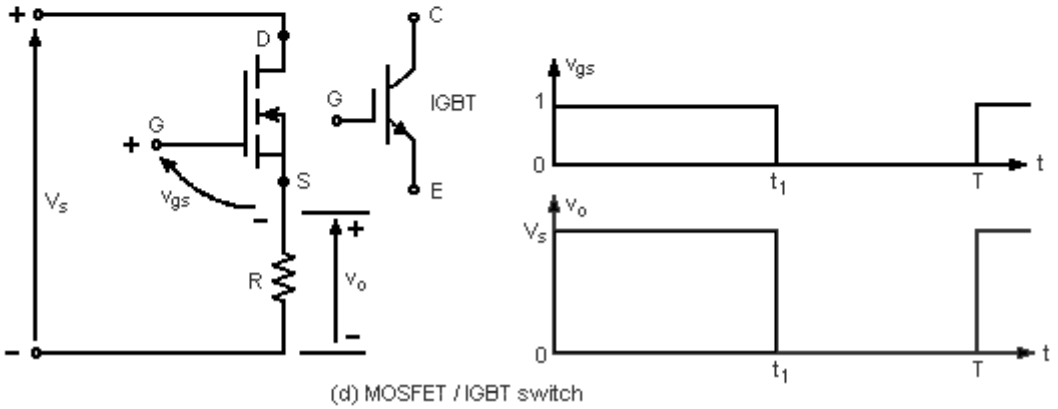
(a) Thyristor switch



(b) GTO/MCT/SITH switch (For MCT, the polarity of V_g is reversed as shown)

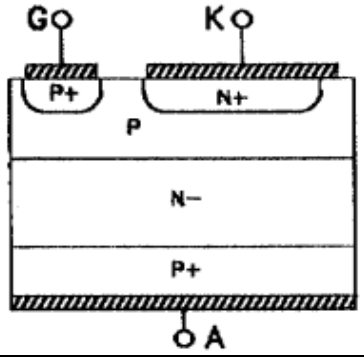
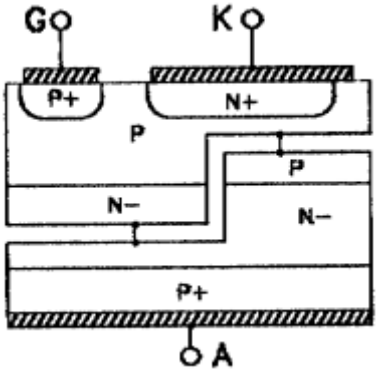
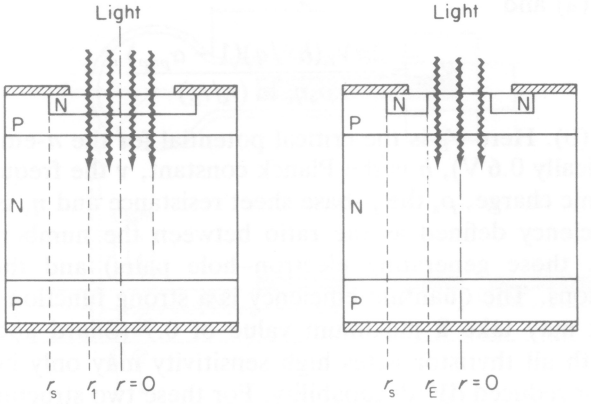
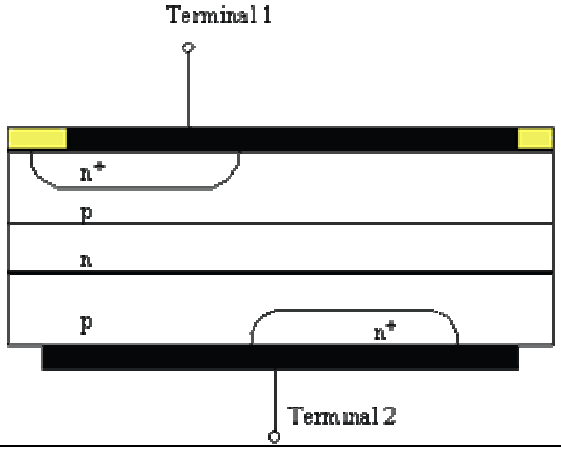


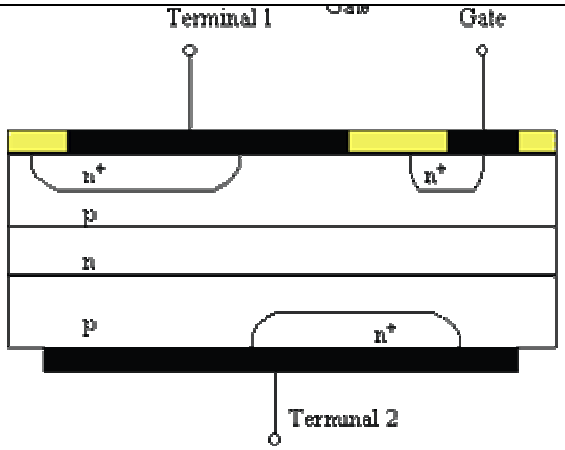
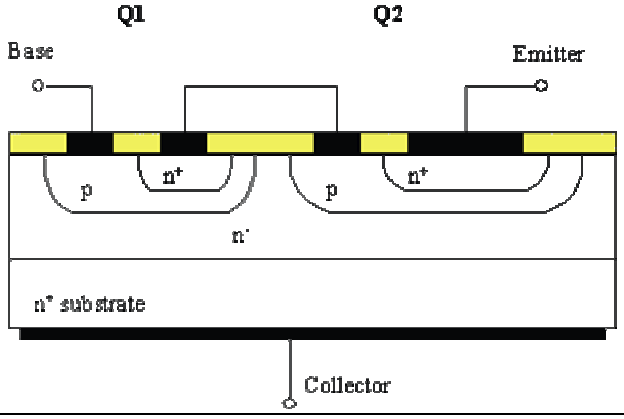
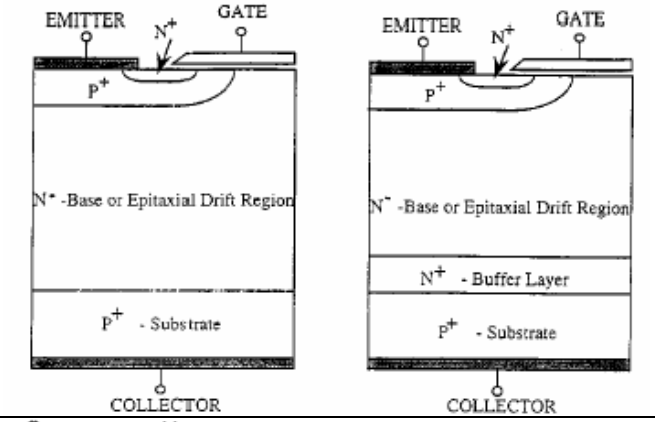
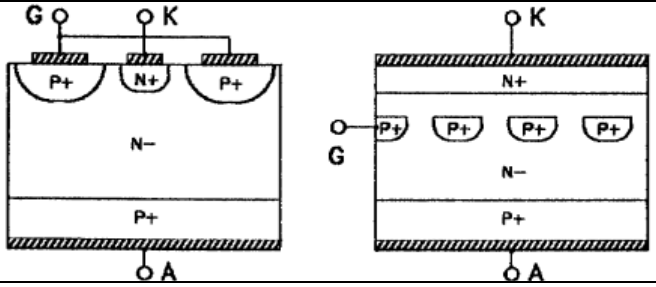
(c) Transistor switch

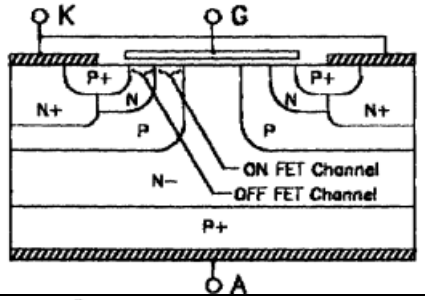
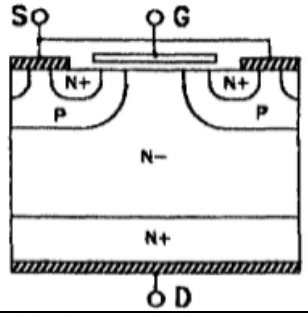
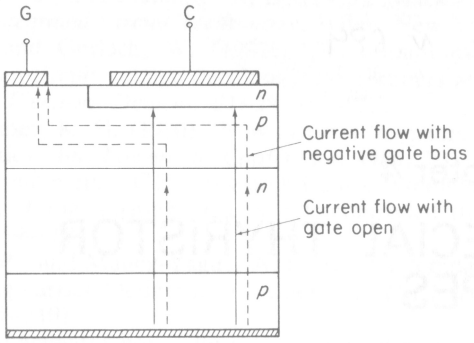


(d) MOSFET / IGBT switch

Structure of some power devices

Device	Structure
Thyristor (SCR)	
GTO	
LASCR	
DIAC	

TRIAC	
BJT (Darlington)	
IGBT	
FCD	

MCT	
MOSFET	
GATT	
FCT