4-1 元件特性及操作

範例 1

Draw the circuit symbol and label the nodes' name:

⑴zener diode.

⑵pnp BJT.

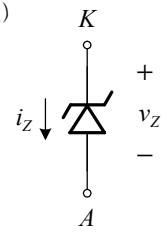
⑶enhancement n-channel MOSFET.

⑷depletion p-channel MOSFET.

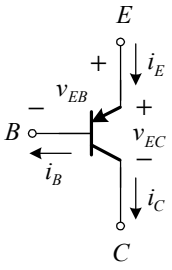
⑸p-channel JFET $(4\times5=20)$. [93中央光電所、95中央光電所]

【解析】

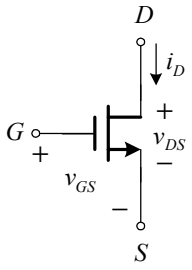
⑴



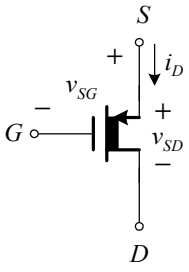
⑵



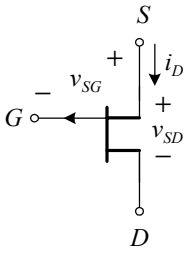
⑶



⑷



⑸



元件特性

範例 2

Explain and compare the functions of BJT and FET. [96中山光電所]

【解析】

⑴FET作爲開關時，工作在截止區和三極區。

⑵BJT作爲開關時，工作在截止區和飽和區。

⑶BJT爲雙載元件不具對稱性，FET爲單載子元件具有對稱性。

⑷BJT爲電流控制電流源，FET爲電壓控制電流源型元件。

範例 3

What are the differences with regard to the operation principle between a BJT and a FET? [92中山光電所、97交大奈米所]

【解析】

⑴BJT操作原理

BJT	截止區	順向主動區	逆向主動區	飽和區
射極接面	OFF	ON	OFF	ON
集極接面	OFF	OFF	ON	ON

射極接面ON：$\left|V_{BE(cut\ in)}\right|=0.5\ (\text{V})$，$\left|V_{BE(on)}\right|=0.7\ (\text{V})$

集極接面ON：$\left|V_{BC(cut\ in)}\right|=0.4\ (\text{V})$，$\left|V_{BC(on)}\right|=0.5\ (\text{V})$

⑵FET操作原理

FET	截止區	飽和區	三極區
源極通道	OFF	ON	ON
汲極通道	OFF	OFF	ON

源極通道ON：$\left|V_{GS(cut\ in)}\right|=\left|V_t\right|$

汲極通道ON：$\left|V_{GD(cut\ in)}\right|=\left|V_t\right|$

範例 4

Choose the Enhancement-type of the following device:

(A)NMOS with $V_t=+1\ \text{V}$ (B)NMOS $V_t=-1\ \text{V}$ (C)PMOS with $V_t=+1\ \text{V}$

(D)PMOS with $V_t=-1\ \text{V}$ (E)P-channel JFET. [91元智電機／通訊所]

【解析】

增強型MOSFET

NMOS, $V_t > 0$

PMOS, $V_t < 0$

故選(A)、(D)。

範例 5

When operated in cutoff and non-saturation region, the FET acts like:
(A)a linear amplifier (B)a switch (C)a variable capacitor (D)a variable resistor. [92清大電子所]

【解析】

(B)

範例 6

Which device in the following is most suitable to make a simple and stable voltage reference circuity?
(A)BJT (B)NMOSFET (C)PMOSFET (D)JFET (E)GaAs MESFET.
[93台大電信／電子（甲）／電機所（甲）]

【解析】

(E)

電流方程式

範例 7

(1)Please draw the cross-section of an enhancement-type NMOS transistor.
(2)Please do the derivation of the i_D-v_{DS} relationship (i.e. the i_D-v_{DS} expressions) with and without considering the finite output resistance in saturation. [96中山電機所（甲乙戊）]