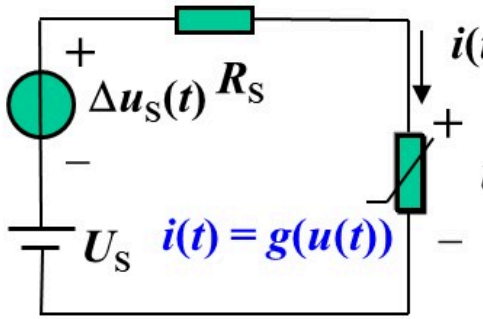
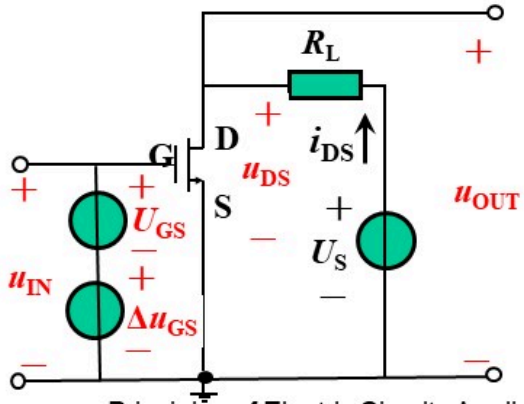
第2次应用介绍课：非线性电阻电路的应用

----(MOSFET构成模拟放大器)

小扰动



小扰动→(小)待放大信号

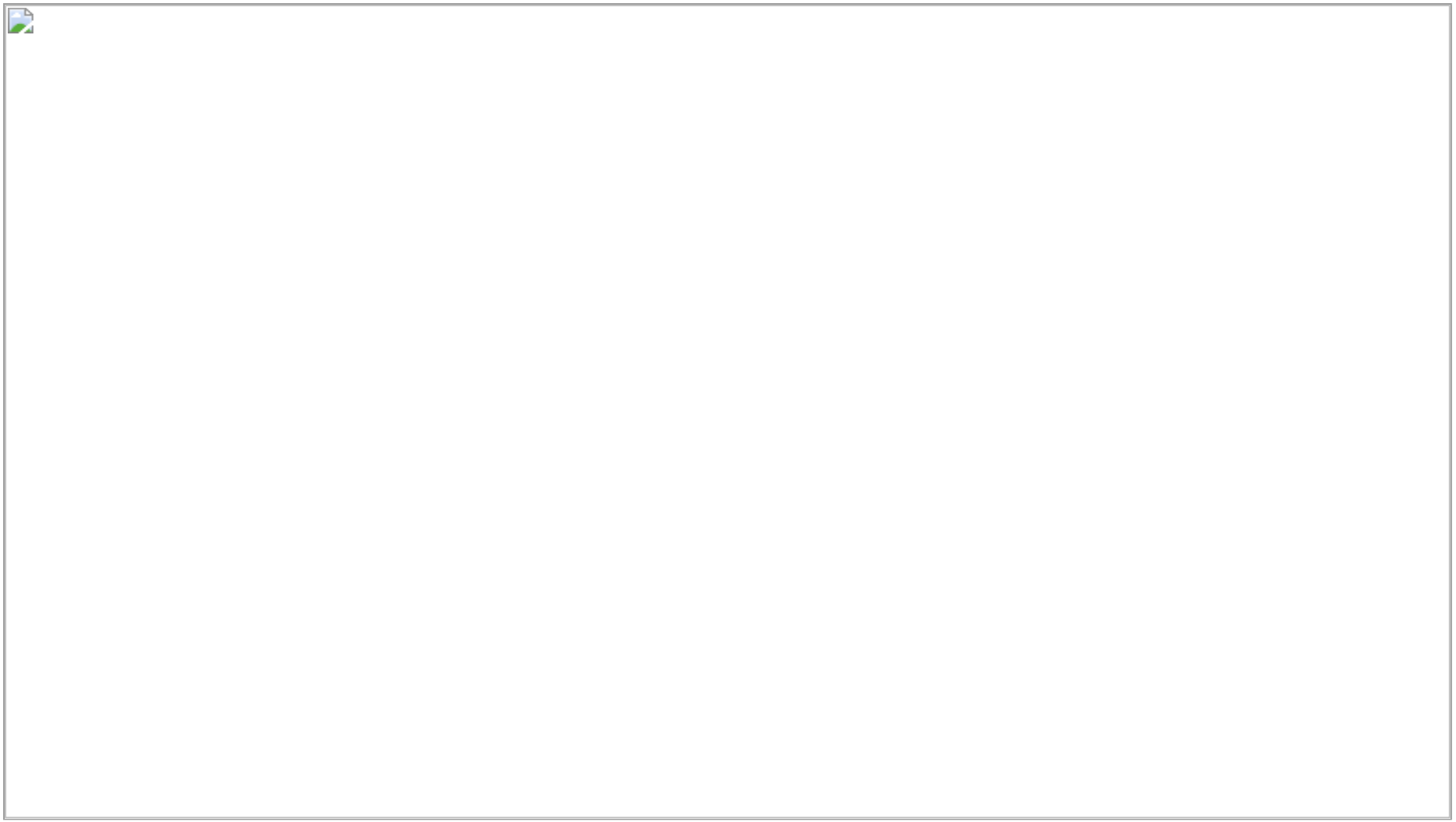


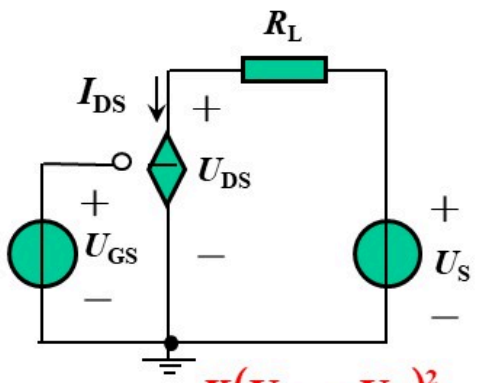
全信号　　直流偏置　(小)待放大信号

$$u_{IN}=u_{GS}=U_{GS}+\Delta u_{GS}$$

$$u_{OUT}=u_{DS}=U_{DS}+\Delta u_{DS}$$

全信号　　直流偏置　(小)放大后信号





$$I_{DS}=\frac{K(U_{GS}-U_T)^2}{2}$$

（1）求直流工作点（解析法）

设MOSFET工作在饱和区

$U_S=10\text{V}$，$U_{GS}=2.5\text{V}$，$K=0.5\text{mA/V}^2$，$U_T=1\text{V}$，$R_L=10\text{k}\Omega$

$$U_{OUT}=U_{DS}=U_S-I_{DS}R_L$$

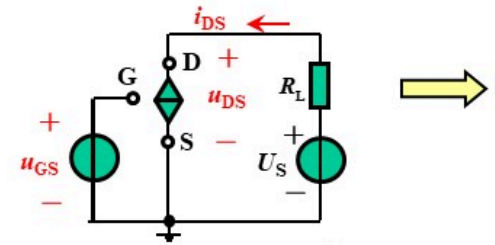
$$U_{OUT}=U_S-\frac{K(U_{GS}-U_T)^2}{2}R_L$$

$$U_{OUT}=U_{DS}=10-\frac{0.5\times(2.5-1)^2}{2}\times 10=4.375\text{V}$$

恒流区工作条件：$0<(U_{GS}-U_T)<U_{DS}$ 满足

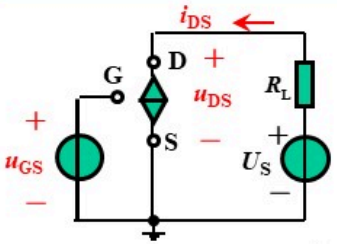
还需验证MOSFET不工作在电阻区(略)

（2）画小信号电路，求小信号解

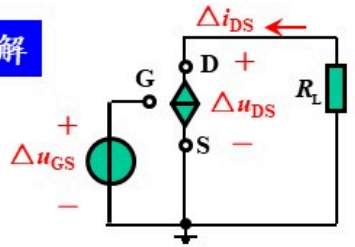


$$i_{DS}=\frac{K\left(u_{GS}-U_T\right)^2}{2}$$

（2）画小信号电路，求小信号解



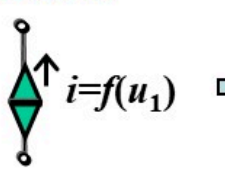
$$i_{DS}=\frac{K\left(u_{GS}-U_T\right)^2}{2}$$

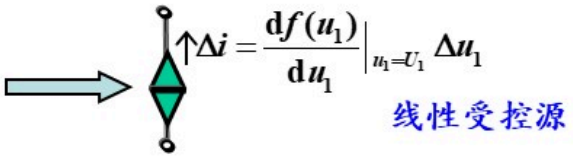


$$\Delta i_{DS}=\frac{\mathrm{d}\left(\dfrac{K\left(u_{GS}-U_T\right)^2}{2}\right)}{\mathrm{d}u_{GS}}\bigg|_{u_{GS}=U_{GS}}\Delta u_{GS}$$

$$\boxed{\Delta i_{DS}=K\left(U_{GS}-U_T\right)\Delta u_{GS}}$$

非线性受控源





线性受控源

单选题 1分

已知MOSFET工作于电流源区，K=0.5mA/V²，U_T=1V，当U_{GS}=1.3V时，其对应的线性受控源关系为Δi_{DS}(A)=____*Δu_{GS}(V)（注意单位）

$$i_{DS}=\frac{K(u_{GS}-U_T)^2}{2}$$

A 0.15 (A/V)

B 0.045 (A/V)

$$\Delta i_{DS}=K(U_{GS}-U_T)\Delta u_{GS}$$

C 0.00015 (A/V)

D 0.000845 (A/V)

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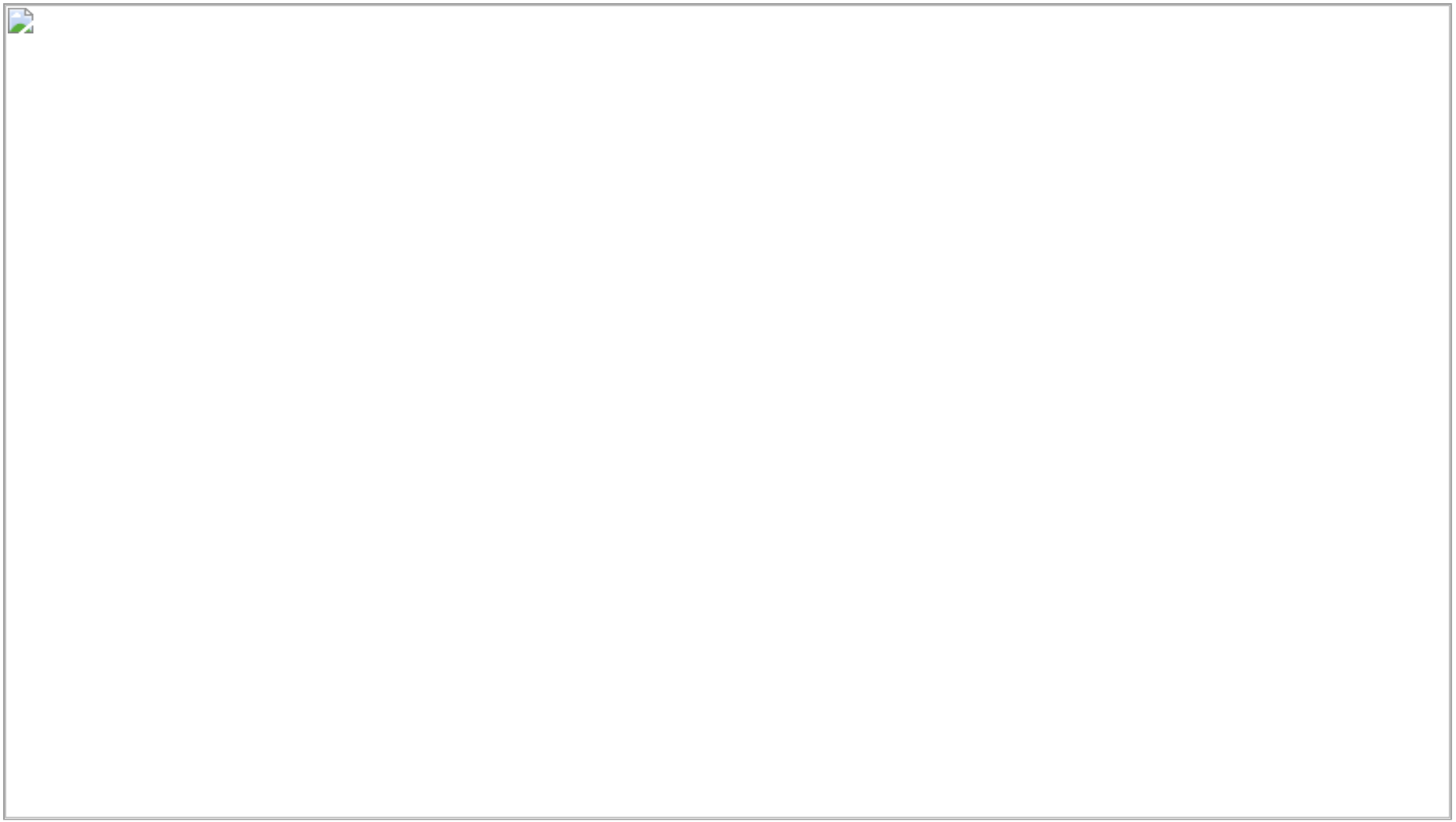
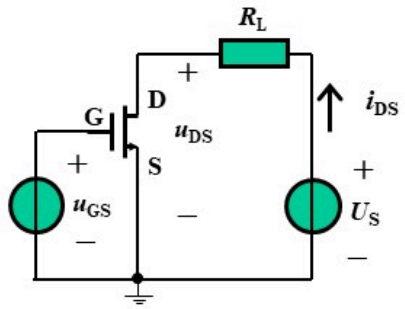


第3步：合成

$$u_{OUT}=U_{OUT}+\Delta u_{OUT}$$

$$U_{OUT}=U_S-\frac{K\left(U_{GS}-U_T\right)^2}{2}R_L$$

$$\Delta u_{OUT}=-K\left(U_{GS}-U_T\right)R_L\Delta u_{IN}$$

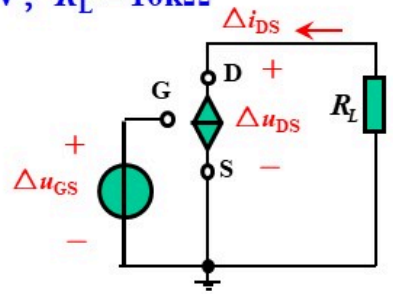


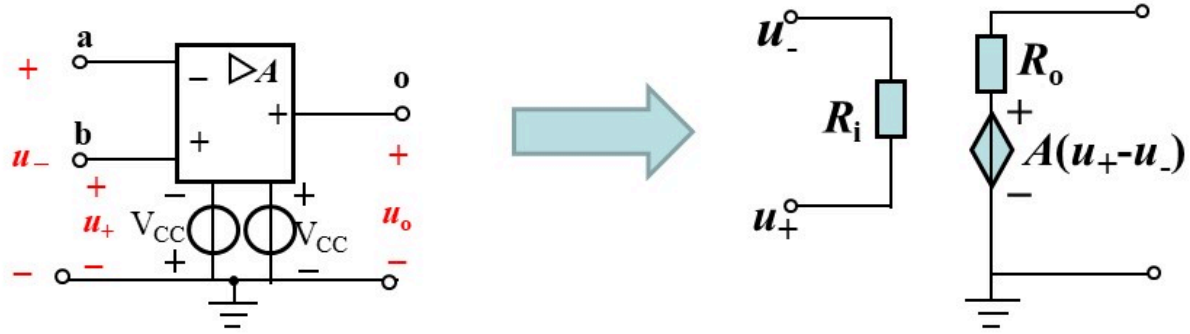
$U_S=10\text{V}$，$U_{GS}=2.5\text{V}$，$K=0.5\text{mA/V}^2$，$U_T=1\text{V}$，$R_L=10\text{k}\Omega$

$$u_{OUT}=4.375-7.5\Delta u_{IN}$$

见仿真

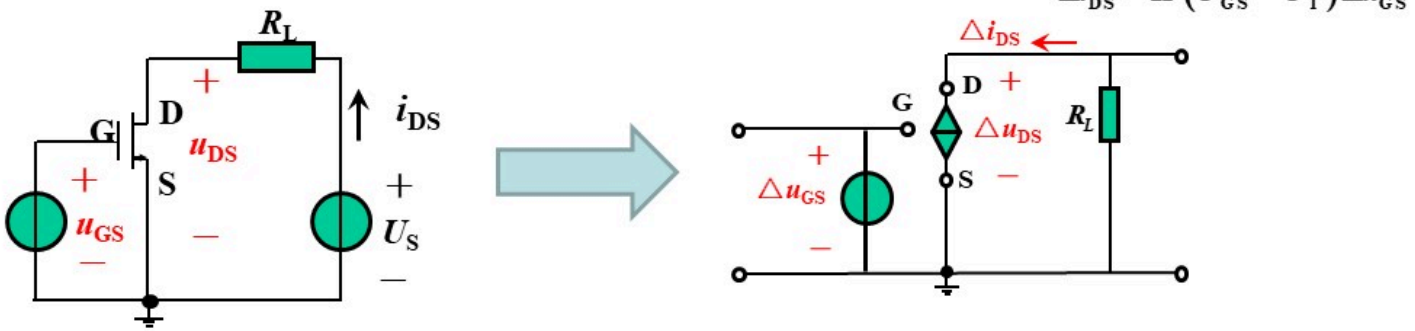
再论no free lunch



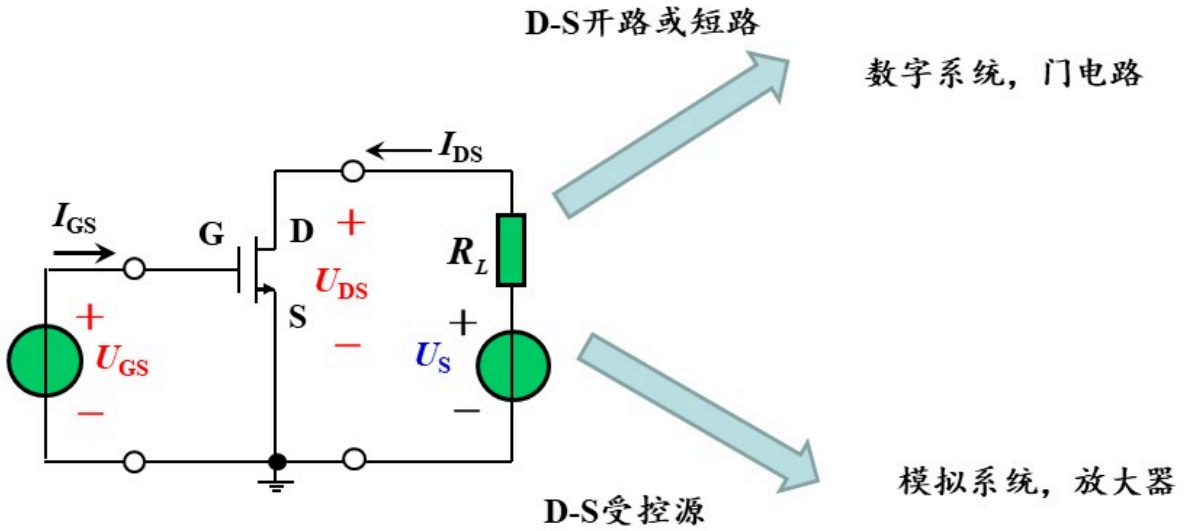


直流电源去哪啦?

$$\Delta i_{DS} = K\left(U_{GS} - U_T\right)\Delta u_{GS}$$



回顾一下MOSFET



让我们来看一看2020年旗舰手机的显示屏

型号	显示屏
iPhone 11	Liquid 视网膜高清显示屏 6.1 英寸 LCD 屏
iPhone 11 Pro Max	超视网膜 XDR 显示屏 5.8 英寸或 6.5 英寸 OLED 屏
Galaxy S20+	动态 AMOLED 2X 动感十足的观看体验 一手掌握
华为Mate 30 Pro	88° 超曲面OLED环幕屏*1 环幕视界， 侧屏触控自在掌握
小米 10 Pro	定制三星 AMOLED 高端双曲面 90Hz刷新率+180Hz采样率 刷新屏幕体验

AMOLED
是一种OLED