MOSFET Regions

Electrical Engineering

Cut-off, ohmic and saturation for a field-effect device, and the naming trap.

A MOSFET is off below threshold, resistive while V_DS is small, and a current source past pinch-off.

$V_{ov} = V_{GS} - V_{th}$ · Saturated: $I_D = \frac{1}{2} k V_{ov}^2$

V_GS below V_th Leakage only.	**Cut-off**
V_DS under V_ov Switch region.	**Ohmic, R_DS(on)**
V_DS over V_ov Amplifier region.	**I_D set by V_GS**

THE COMMON MISTAKE

× Driving a standard MOSFET from 3.3 V logic

✓ Reading R_DS(on) at the gate voltage available

R_DS(on) is quoted at 10 V of gate drive. At 3.3 V a standard part is barely on, and it overheats as a switch.

Naming trap: a bipolar transistor saturates when fully on, a MOSFET when acting as a current source. Opposite ends.