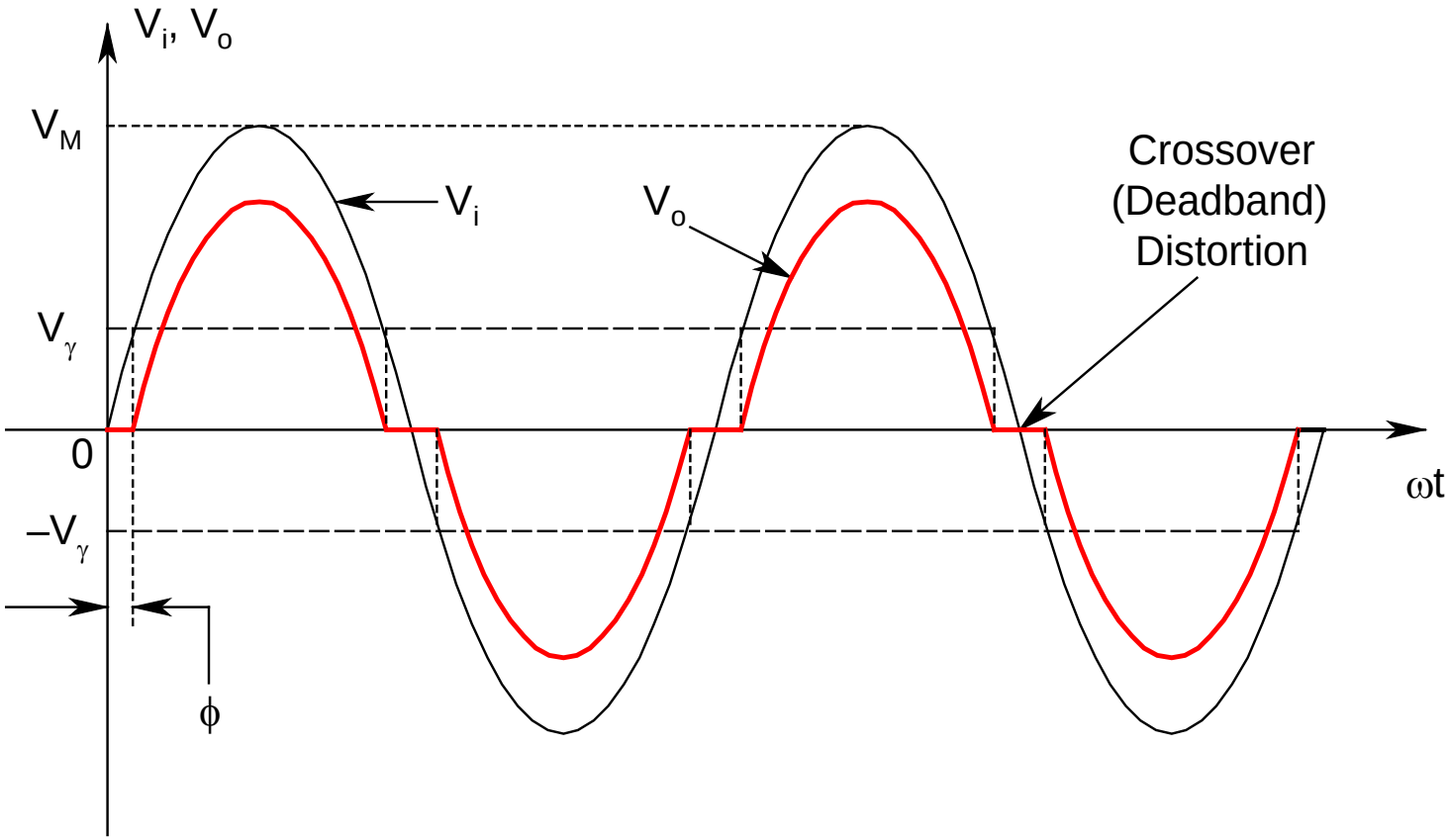


Crossover Distortion

➢ *Crossover Distortion*:

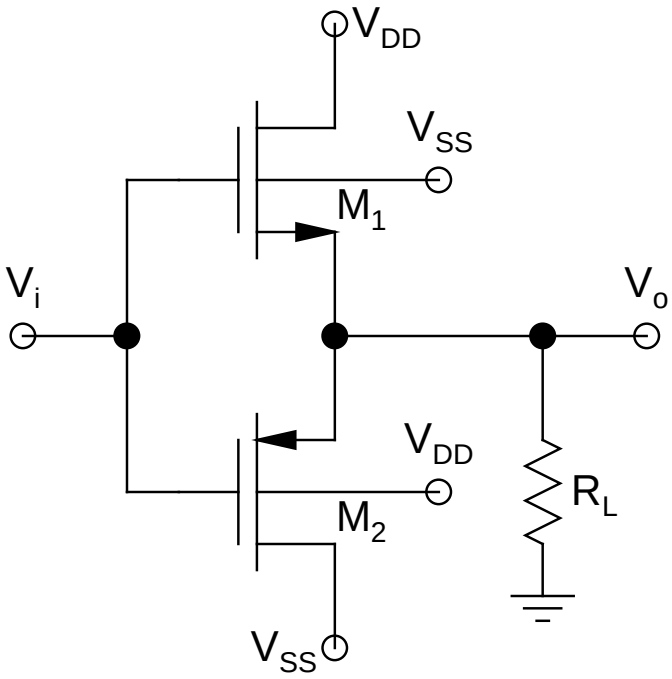
- *Quantified by* ϕ (refer to the diagram)
- *Expressed as*:

  $\phi = \sin^{-1}(V_\gamma / V_M)$

  V_M: *Amplitude of the input signal*
- *Appears four times over a complete cycle*
- *Parameterized* by a term known as the *Total Crossover Distortion* (*TCD*), *expressed in percent*:

  $TCD = (2\phi/\pi)\times 100\%$
- *This distortion becomes more acute as* $V_M \downarrow$
- *For* $V_M \leq V_\gamma$, *no output* ($V_o = 0$ *always*)

- ***MOS Implementation*:**
  - ***Working principle absolutely similar to BJT implementation***
  - ***Only exception that V_γ replaced by V_{TN} and V_{TP}***
  - ***Q-point*: $V_i = V_o = 0$**
  - ***Both devices suffer from body effect issue***



Circuit Schematic

- ***V_{TN} and V_{TP} function of V_o***

  $\Rightarrow$ ***VTC significantly nonlinear***

  $\Rightarrow$ ***Output shows more distortion***

- ***V_i can't be more than V_{DD} or less than V_{SS}***

  $\Rightarrow$ ***V_o can't have rail-to-rail swing***

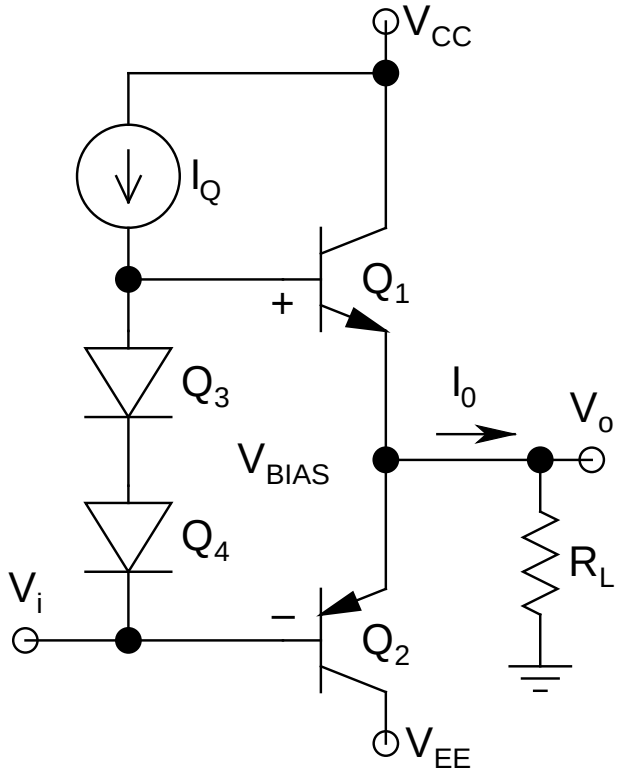
- Also, ***MOS devices*** are ***inherently much poorer*** than their ***BJT counterparts*** in terms of ***current carrying capability***

  $\Rightarrow$ ***Makes this stage quite a poor choice***
  (***needs extremely large W/L ratios***)

- ***Class AB Push-Pull Output Stage***:
  - In a ***Class B*** stage, ***Crossover Distortion*** arises because the transistors are ***absolutely cold*** in the ***standby state***, i.e., ***dead off***
  - If instead, these are ***prebiased*** at the ***verge of conduction***, ***but not quite turned on***, then a ***slight swing*** of the ***input either way*** can make ***one of these transistors turn on*** and ***either supply current to the load*** or ***pull current away from the load***
  - ***This is the whole idea behind a Class AB stage***

- ***Either of the output transistors remain on for complete half cycles***
- Thus, it's a ***mixture of Class A and Class B operation***
- Hence, it's called ***Class AB Push-Pull Stage***
- ***Eliminates Crossover Distortion completely***
- ***Obvious fallout***:
  - ***Dissipation of standby power***
- ***Extremely popular topology and widely used***
- ***Efficiency drops slightly as compared to a pure Class B stage***

- ***BJT Implementation***:
  - ***Needs additional circuitry*** (I_Q-Q_3-Q_4)
  - Q_3-Q_4 ***diode-connected*** transistors and both are ***biased by the same current*** I_Q
  - This produces a ***DC bias*** V_{BIAS} between the ***bases*** of Q_1-Q_2



Circuit Schematic