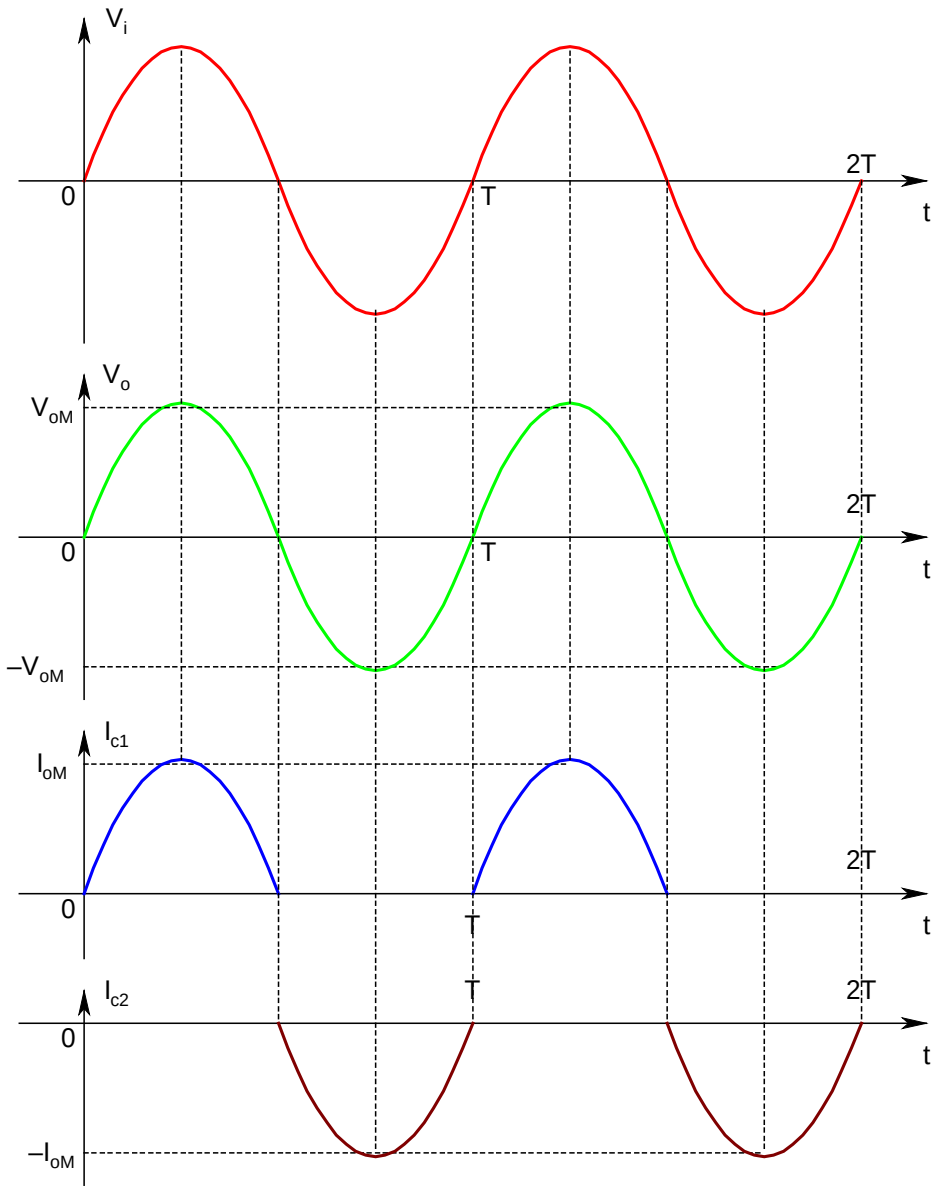
➢ *Power Output and Efficiency*:

- Refer to the figure in the next slide
  - ❖ *The constant offset of $|V_{EB2}|$ is neglected*
- ***Both transistors are not ON over the entire cycle***
  - ❖ ***Q_1 takes care of the positive half cycle***
  - ❖ ***Q_2 takes care of the negative half cycle***
- V_{oM}: ***Maximum value of V_o***
  - ❖ ***Maximum possible swing between $[V_{CC} - V_{CE1}(HS)]$ and $[V_{EE} + V_{EC2}(HS)]$***
- I_{oM}: ***Maximum value of load current*** $(= V_{oM}/R_L)$
- ***Average rms power P_L delivered to load***:

$$P_L = \frac{V_{oM}}{\sqrt{2}} \times \frac{I_{oM}}{\sqrt{2}} = \frac{V_{oM}^2}{2R_L}$$


V_i
0
T
2T
t
V_o
V_{oM}
0
T
2T
t
$-V_{oM}$
I_{c1}
I_{oM}
0
T
2T
t
I_{c2}
T
2T
0
t
$-I_{oM}$

- Now, we need to calculate the ***power supplied to the stage by the power supplies***
- The ***average current I_{supply} drawn by Q_1 from V_{CC}*** (***happens only during the positive half cycle***):

$$I_{supply} = \frac{1}{T}\int_0^T I_{c1}(t)dt = \frac{1}{2\pi}\int_0^{\pi} I_{oM}\sin\theta d\theta = \frac{I_{oM}}{\pi} = \frac{V_{oM}}{\pi R_L}$$

- ***The same current will also be pushed by Q_2 to V_{EE} ($= -V_{CC}$) during the negative half cycle***
- ***Thus, over a complete cycle, the average supply power P_{supply} drawn from the power supplies***:

$$P_{supply} = 2V_{CC}I_{supply} = 2V_{CC}V_{oM}/(\pi R_L)$$

- Thus, the ***power conversion efficiency*** (η):

$$\eta = \frac{P_L}{P_{supply}} = \frac{V_{oM}^2 / (2R_L)}{2V_{CC}V_{oM} / (\pi R_L)} = \frac{\pi V_{oM}}{4V_{CC}}$$

- ***η directly proportional to V_{oM}***, and ***independent of R_L***

  $\Rightarrow$ ***Significant advantage***

- Also, ***$V_{oM}(max) \approx V_{CC}$***

  $\Rightarrow$ ***$\eta_{max} = \pi/4 = 0.785$ (or 78.5%)***

- ***This value may not be attainable in practice***
  - ***For $V_{oM} = -V_{CC}$, V_i has to be less than $-V_{CC}$***, which ***may not be practically achievable***
  - This analysis ***neglects the standby power*** (***quite small though***) $\Rightarrow$ ***Inclusion of this term will reduce η_{max}***