increases positively, then $V_{GS2}$ will increase and $V_{SG1}$ will decrease, resulting in increased output current drive. Likewise, for a negative-going input, $V_{SG1}$ will increase while $V_{GS2}$ will decreases to allow more current to be sunk from the load. Therefore, since the output current drive (both charging and discharging) is changing with the applied input signal, this configuration does not exhibit slew rate limitations. One drawback of this particular class AB configuration is the limited output voltage swing, one threshold from either supply rail.

![Figure 22.31](image)

**Figure 22.31** Implementation of a class AB (or class B) amplifier.

One practical approach to implementing this class AB amplifier is shown below (Figure 22.32), where MOS diodes M4 and M5 provide the “battery” voltages $V_{GG1}$ and $V_{GG2}$. These MOS diodes are biased using the current source device M3 to insure that $V_{GS5}$ and $V_{SG4}$ remain constant during input transients. Note also that in this schematic it is assumed that the input signal has a DC offset appropriate for biasing M6. During input transients, this circuit configuration allows M4 and M5 to “float” up and down accordingly.

To achieve rail-to-rail output voltage swing while maintaining class AB operation, the circuit of Figure 22.33 may be used. This circuit utilizes a floating current source (between transistors M4 and M1) in its biasing scheme. Note that duplicate input current signals are needed to correctly drive this circuit. For increasing $i_{in}$ (going into the circuit), $V_{SG4}$ must decrease and $V_{GS1}$ must increase, forcing M3 to source less current and M4 to sink more current. For decreasing $i_{in}$ the opposite will happen; therefore, class AB operation is achieved. And since M2 and M3 are common-source configured, the output can swing rail-to-rail.
A popular choice for analog sampled-data systems (where large capacitive loads are prevalent) is the amplifier shown in Figure 22.34. This amplifier is sometimes referred to as an operational transconductance amplifier or OTA.

Note that if $v_{in}$ is mid-supply, the biasing scheme (M13-M16) sets up current $I$ in M1-M6 and M9-10, if all the nMOSFETs are identically sized and all
the pMOSFETs are identically sized. Then, if the aspect ratios of output transistors M7-M8 and M11-M12 are sized $K$ times larger than those of M5-M6 and M9-M10, respectively, than the output transistors have current $K \cdot I$ flowing through them. The sizing factor $K$ further enhances the current drive capability of this amplifier. Unfortunately, this particular circuit topology requires a considerable amount of supply voltage.

![Circuit Diagram]

**Figure 22.34** Implementation of a class AB amplifier.