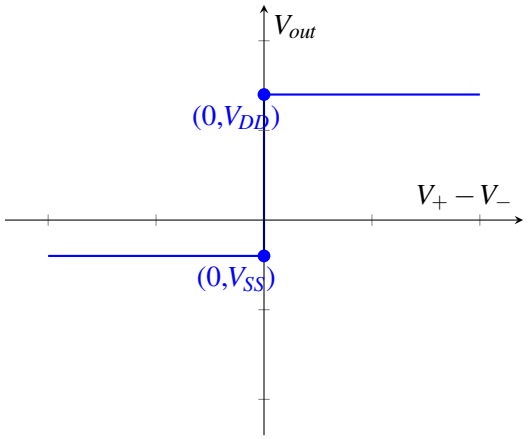
EECS 16A Designing Information Devices and Systems I
Fall 2020 Lecture Notes Note 17C

17.1 Comparators in EECS 16A and in Practice

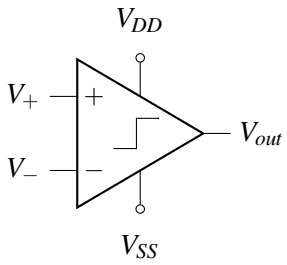
In Note 17, we used an ideal op-amp connected in open loop to function as a comparator for our capacitive touchscreen design. Even though for ideal op-amps which have infinite open loop gain, A, this is okay to do, in practice circuit designers rarely use op-amps as comparators. Since op-amps are optimized for linear signal amplification with output voltages always staying between the supply rails (V_{DD}, V_{SS}), and for stability, they tend to be very slow when having to resolve a small input difference into a large digital output (V_{DD} or V_{SS}).

Dedicated comparators, by contrast, are special, distinct components designed to output only the supply voltages, (V_{DD} or V_{SS}), and are preferred to op-amps for their faster operation. The plot of input and output voltages for a comparator is identical to that of an ideal op-amp in the comparator configuration, shown in Note 17 and repeated here for convenience.



For any ideal comparator, (just like for any ideal op-amp), when $V_+ < V_-$ ($V_+ - V_- < 0$), we have V_{out} equals V_{SS}; when $V_+ - V_- > 0$, we have V_{out} equals V_{DD}.

The circuit symbol for a comparator is shown below:



In summary, in the context of this class we will say that *ideal* op-amps can operate as *ideal* comparators. Keep in mind though, that the actual circuit design and implementation of these two circuit blocks (more of which you can see in classes like EE 105, EE140 and EE141) are fundamentally different.