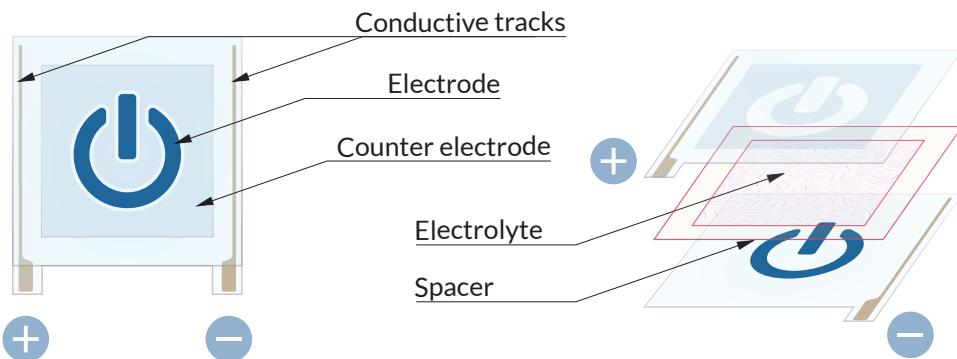
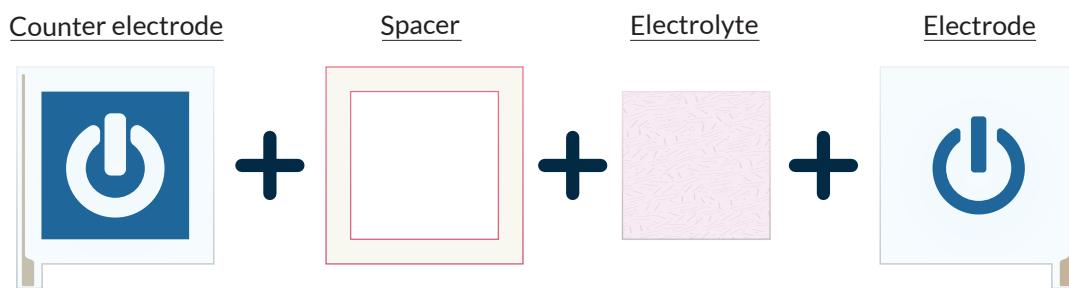


### 1. Vertical display



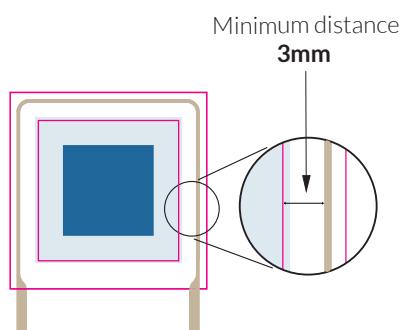
#### 1.1. Display layers



Vertical displays have a sandwich-like structure, in which one electrode is on the bottom substrate and the second electrode is on the top substrate. A bi-adhesive spacer frame is placed between the substrates and a layer of electrolyte material, which occupies the area defined by the spacer frame, functions as an ion conductor between the electrode and counter electrode.

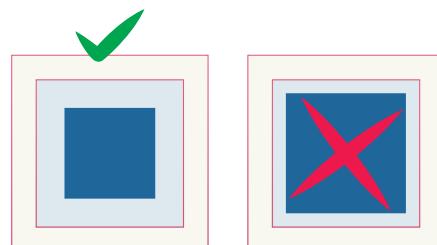
#### 1.2. Design rules

##### 1.2.1. Spacer frame



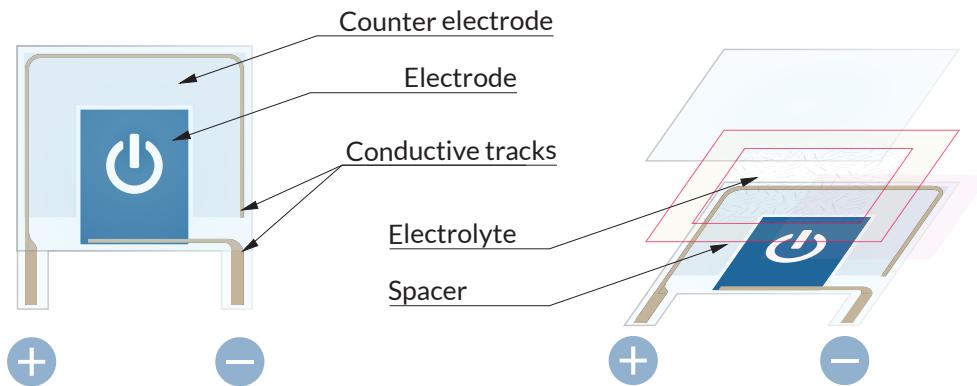
The minimum distance between the electrolyte layer and the conductive tracks is 3 mm, to avoid contact between the conductive material and the electrolyte. The minimum width of the pre-cut bi-adhesive spacer frame should be 5 mm.

##### 1.2.2. Electrodes

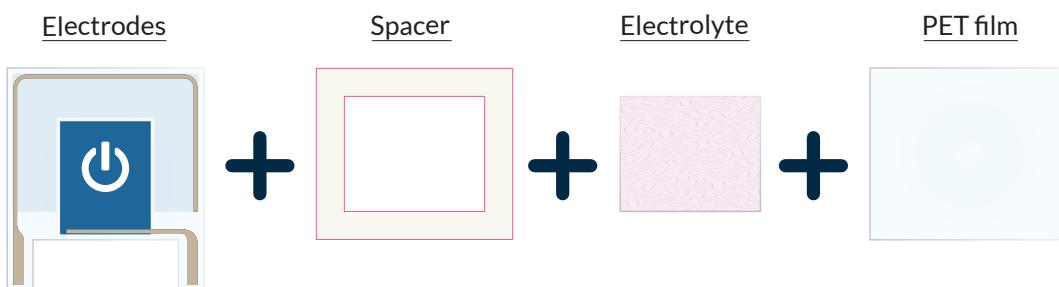


The active areas of both electrodes should be similar, i.e. have approximately the same total area of printed electrochromic ink; a slightly larger counter electrode printed area is also acceptable.

## 2. Co-planar display



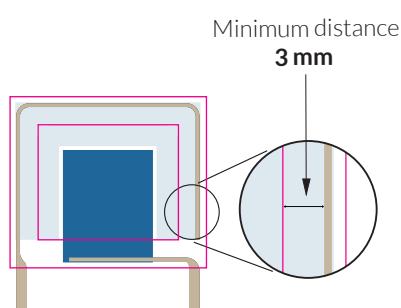
### 2.1. Display layers



Co-planar displays have 2 electrodes printed side by side on the same substrate. A bi-adhesive spacer frame is placed on top of the bottom substrate where the 2 electrodes are printed, and a layer of electrolyte material, which occupies the area defined by the spacer frame, functions as an ion conductor between the electrode and counter electrode. The structure is laminated with a protective top substrate (PET film), which encapsulates the device.

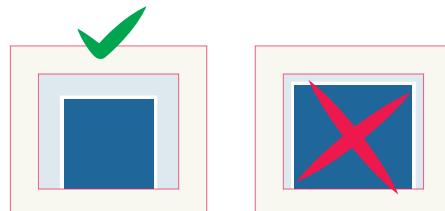
### 2.2. Design rules

#### 2.2.1. Spacer frame



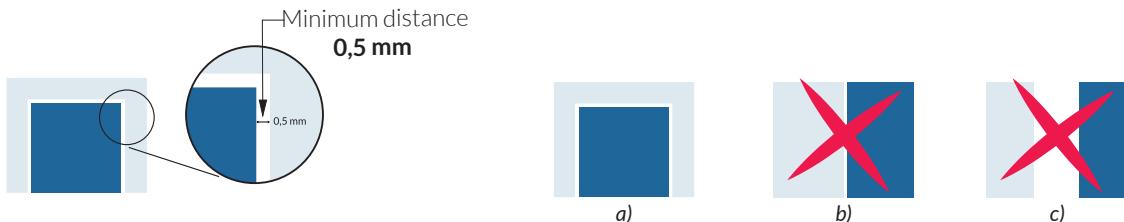
The minimum distance between the electrolyte layer and the conductive tracks is 3 mm, to avoid contact between the conductive material and the electrolyte. The minimum width of the pre-cut bi-adhesive spacer frame should be 5 mm.

#### 2.2.2. Electrodes



The active areas of both electrodes should be similar, i.e. have approximately the same total area of printed electrochromic ink; a slightly larger counter electrode printed area is also acceptable.

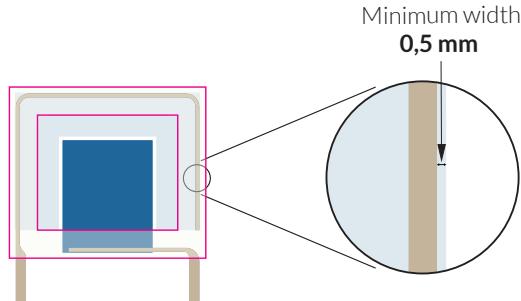
### 2.2.3. Spacing electrodes



In co-planar displays there needs to be a gap between the electrode and counter electrode, to avoid short circuits. This gap must not be less than 0,5 mm.

As stated in 2.2.2, the active areas of the electrodes should be balanced (similar areas or a slightly larger counter electrode). In addition, for a co-planar display to function properly the following should be taken into account: 1) for best performance, the counter electrode area should be "wrapped" around the working electrode(s) as seen on image a) above; 2) displays designed with side by side areas, such as the example in image b) above will work, but their performance will not be optimal; and 3) as shown in image c) above, too much space between the electrodes will result in a poorly functioning display.

### 2.2.4. Conductive tracks



When designing co-planar displays in which the bottom substrate is not conductive (such as PET film), the conductive tracks must always be in contact with their respective electrode for the display to function, as shown in the image above. More specifically, the conductive tracks should be printed on top of the electrochromic ink in a manner that ensures an overlap between the 2 inks. To ensure this overlap, a small margin of the electrochromic ink should be left on the outer side of the printed conductive track, with a minimum width of 0,5 mm, as seen above. The width of the conductive tracks can vary and should be adjusted based on the available printing capabilities, the size of the display and design constraints. There are no strict guidelines for this.

You can find information about our electrochromic kits at:  
[www.ynvisible.com/ec-kit](http://www.ynvisible.com/ec-kit)