



## STMPE811 PCB design guideline

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### **Introduction**

This application note provides information on the design of a PCB for the STMPE811 touchscreen controller, the power connection, routing of the touchscreen tracks and the configuration of some pins.

For additional information, please refer to the STMPE811 datasheet.

# 1 Power connection

The implementation and layout of the power connection's section is fundamental for the correct operation of the STMPE811 touchscreen controller.

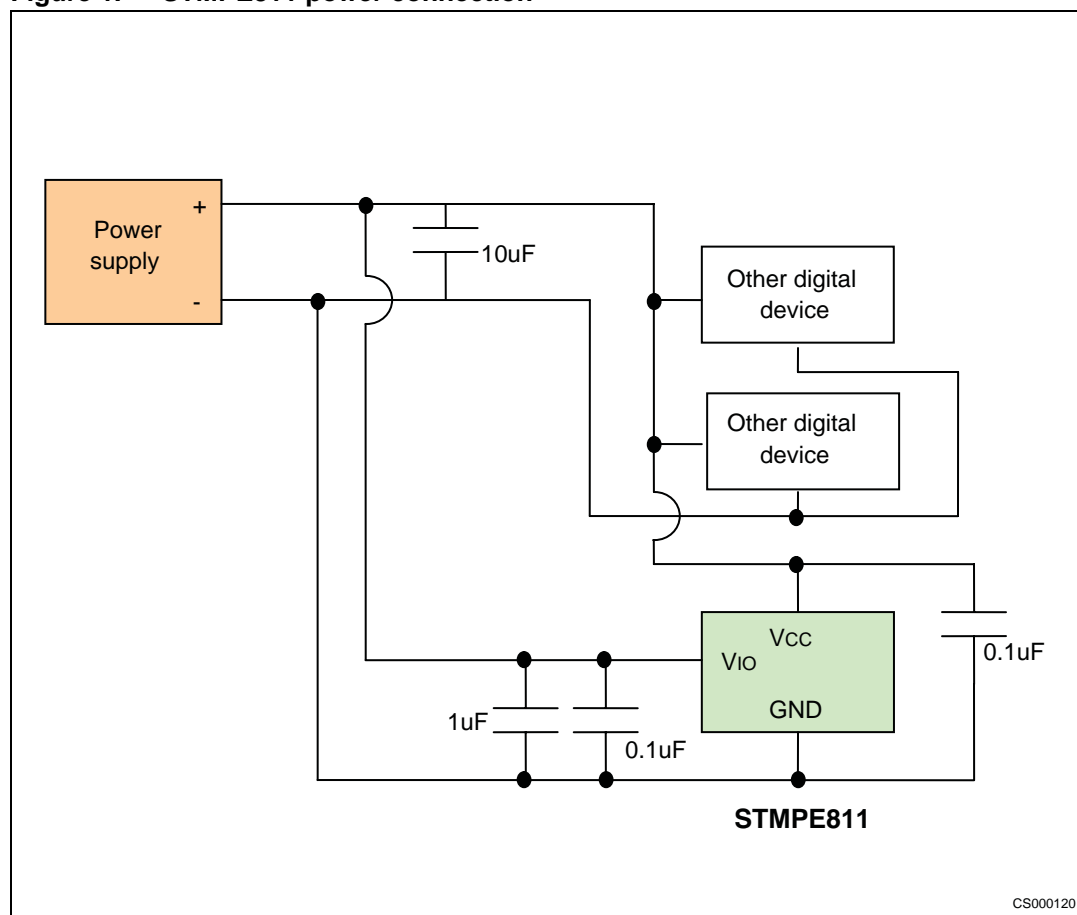
The STMPE811 device is equipped with a 12-bit ADC that is used during the touchscreen controller, temperature sensor and auxiliary voltage measurement operations.

The analog blocks require a clean and stable supply voltage in order to operate in optimum performance. In the STMPE811, the supply pins for the analog blocks and the digital core are separated. This is to avoid the noise typically generated by the digital core and thus affecting the measurement performed by the ADC.

The power connection to the STMPE811 device should be taken into consideration during the PCB design, especially the supply line to  $V_{IO}$ . Star connection to  $V_{IO}$  is recommended and in the PCB, it is recommended to separate the lines supplying  $V_{CC}$  and  $V_{IO}$ .

*Figure 1* shows the recommended power connection to STMPE811.

**Figure 1. STMPE811 power connection**



## 1.1 Touchscreen tracks

The touchscreen tracks (X+, X-, Y+, Y-) are sensitive lines. Noise may be captured by the touchscreen tracks if the line is too long and if placed nearby noisy lines, for example the digital data lines and the I<sup>2</sup>C/SPI lines.

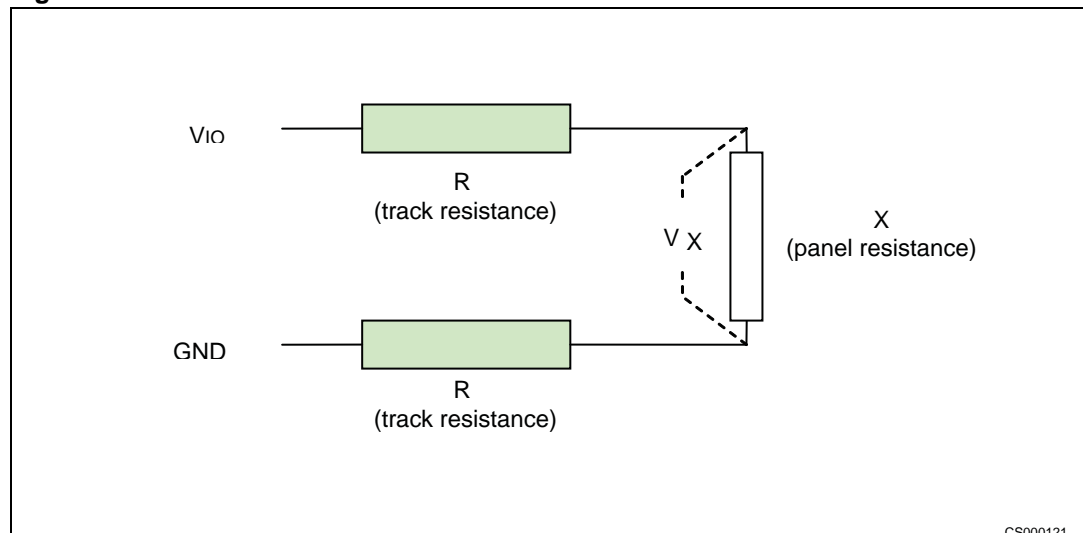
Although there is no recommended standard for track sizes, tracks that are too long reduce the resolution of the touchscreen controller. As a matter of fact, long tracks introduce a voltage drop during the measurement cycle at the terminal of the touchscreen panel.

### 1.1.1 Track resistance

Any track will have a certain amount of resistance, thus reducing the effective resolution of the touchscreen controller.

During the measurement, the current flows to the touchscreen panel through the tracks. If the resistance is too high, the voltage in the panel terminal is no longer at the same level as V<sub>IO</sub> and GND.

**Figure 2. Track resistance reduces effective resolution of touchscreen controller**



From [Figure 2](#) it can be seen that, during the measurement cycle, the device bias the touchscreen panel with the V<sub>IO</sub> voltage.

Due to the track resistance, the voltage at panel's terminals is:

$$V_x = \frac{X}{X + 2R} V_{IO}$$

Hence, the effective resolution is reduced by the same factor as well. The track resistance may be reduced by designing the track as short as possible with a reasonable width.

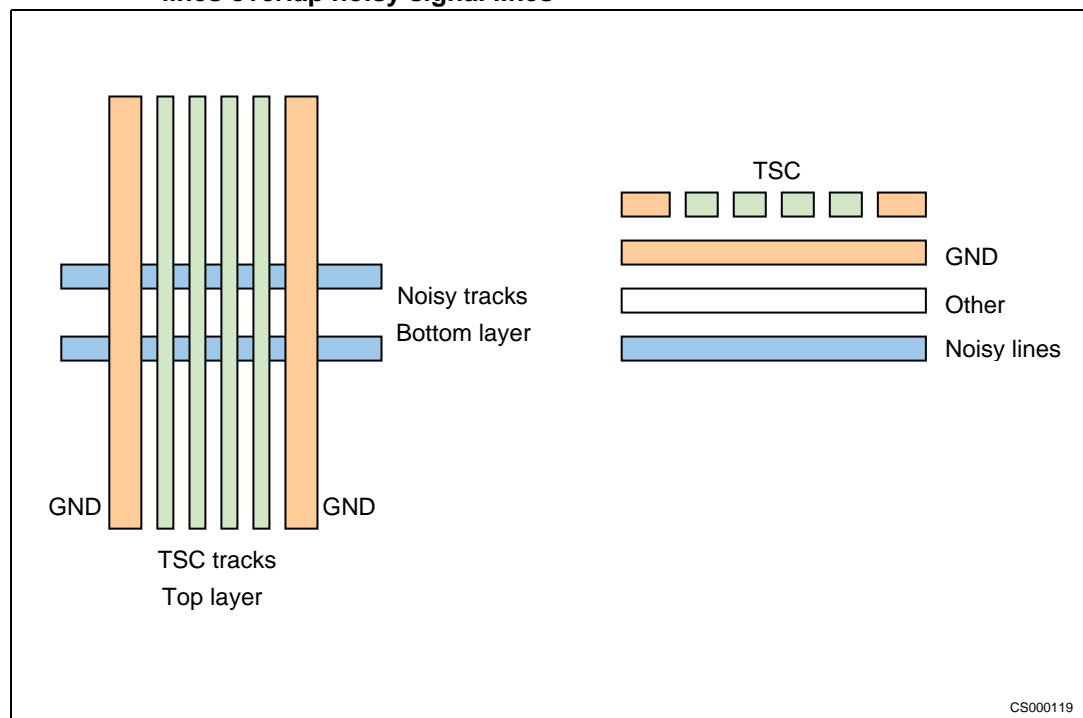
## 1.2 Noise prevention

Noise may be coupled to the tracks connecting the touchscreen and this should be prevented as much as possible.

Two practices may be applied:

- a) Prevent the tracks overlap with other noisy signal tracks, such as I2C/SPI lines and digital data lines. If the overlap is not avoidable, GND lines separation between touch screen lines and noisy lines is recommended (in more than 2 layers PCB).
- b) Put GND shielding at each side of touch screen tracks routing.

**Figure 3. GND separator is recommended when the touchscreen controller (TSC) lines overlap noisy signal lines**



## 1.3 Noise filter

A filtering capacitor can be placed on the touchscreen tracks to further suppress the noise. In this case, the best location for the filtering capacitor is as near as possible to the IC.

The values recommended for the filtering capacitor are:

1. 1-2 nF for an LCD less than 6 inches
2. 5-10 nF for an LCD bigger than 6 inches

The Settling time and Touch detect delay registers must be set correctly to adapt to the filtering capacitor, otherwise the touchscreen controller may not work properly. Additional information is found in the STMPE811 datasheet.

## 2 Configuration pins

During power-up, STMPE811 latches the value of two pins to determine the mode of operation.

These pins are:

- N1 pin
- A0/data out

### IN1 pin

The IN1 pin value during power-up determines the communication protocol used by STMPE811. The '0' value in IN1 sets the device in I<sup>2</sup>C mode, while '1' sets the device in SPI mode.

If IN1 is unused during the operation of the device, the PCB designer may short this pin to either GND or V<sub>IO</sub> to select the communication protocol. During the device operation, this pin must be always set as input to avoid contention.

If IN1 is used as I/O during operation, a weak pull-up or pull down of 50 kΩ is recommended.

### A0/data out pin

If the STMPE811 is using the I<sup>2</sup>C mode, this A0/data out pin has to be initialized to either V<sub>IO</sub> or GND to define the slave address used by the device. User may put 10 kΩ pull-up or pull-down resistor, or just short it to V<sub>IO</sub> or GND.

### 3 Revision history

**Table 1. Document revision history**

Date	Revision	Changes
07-Jul-2008	1	Initial release.

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