AN2843
Application note

STEVAL-IHI002V1, capacitive touch-sensing keyboard based on the STMPE1208S

Introduction

The STEVAL-IHI002V1 is a demonstration board designed to modernize, or even fully replace, a conventional mechanical keyboard.

The demonstration board is based on the STMPE1208S 12-bit GPIO expander with an additional 12-channel capacitive sensor, which is capable of interfacing a main MCU through an I²C bus. The demonstration board is designed to work as a daughterboard for the STEVAL-IHI001V1 demonstration board (washing machine user interface).

Once connected, the STEVAL-IHI002V1 will be automatically detected by the motherboard, replacing the mechanical keys with a wheel, a slider and 5 buttons.

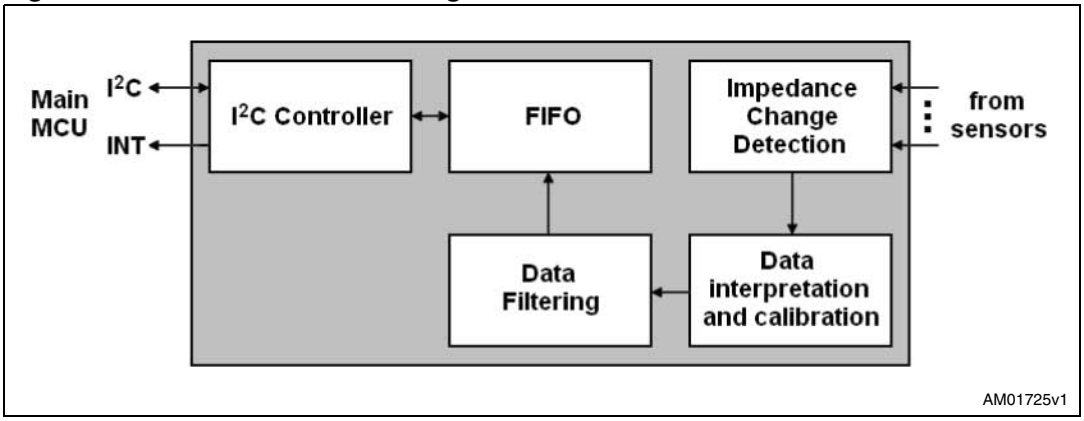
Contents

1 STMPE1208S: 12-channel capacitive touchkey controller

The STMPE1208S is a 12-bit GPIO device with additional 12-channel capacitive sensors, which is capable of interfacing a main MCU through an I²C bus.

The sensors in the device detect finger contact through the additional capacitance introduced to the sensor, providing fast and accurate results at very low power consumption.

Figure 1. STMPE1208S block diagram



When a sensor is touched, the increase in capacitance causes a delay in the clock signal on the relevant sensing pin. The signal is then compared with a reference clock. The difference is a direct representation of the additional capacitance introduced by the finger touch.

Environment factors, such as temperature and humidity, can affect the measured capacitance value. The calibration unit ensures consistent key sensitivity, even in the presence of significant shifts in temperature, humidity, device lot and PCB characteristics.

The output from the calibration unit provides an instantaneous touch/no-touch status. This signal is sent to the data filtering stage, which is made up of an integration unit, a filter unit and a noise filtering unit.

The sensors can be affected by high-frequency noise if working near highly emissive circuits such as a DC-DC converters or PWM controllers. The noise filtering helps the device distinguish between a real touch or an emission-related false touch.

The STMPE1208S communicates with a main MCU through an I²C bus interface. It is configured as a slave device, and supports both standard mode (up to 100 Kbps) and fast mode (up to 400 Kbps), as well as 7-bit and 10-bit addressing modes.

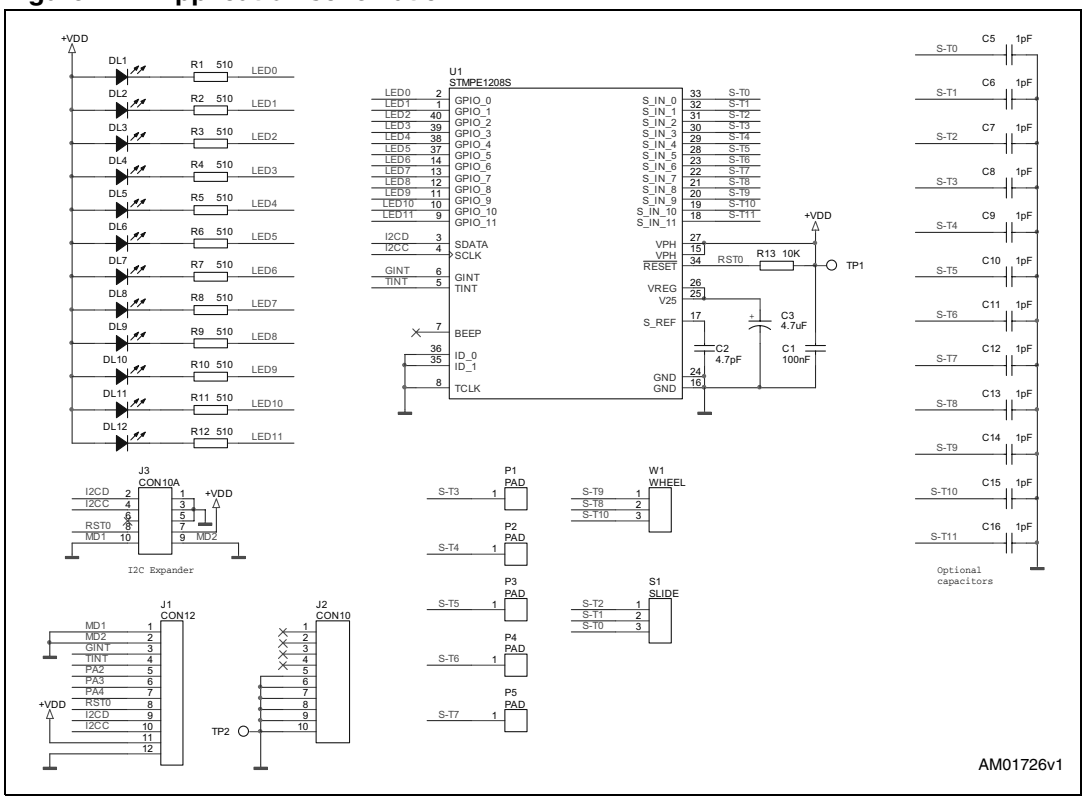
The device can manage 2 types of interrupt events: a general interrupt related to the GPIO ports, and a touch interrupt which occurs when touching a sensor.

2 Application schematic

The STEVAL-IHI002V1 is a daughterboard intended to be connected to the STEVAL-IHI001V1 demonstration board (please refer to user manual UM0557 for further information). The +5 VDC (VDD) power supply is provided by the STEVAL-IHI001V1 demonstration board through connectors J1 and J2. The STMPE1208S needs only a few capacitors to run properly: a decoupling capacitor (C1), a reference capacitor (C2), and a capacitor to stabilize the internal voltage regulator (C3).

The reset pin is pulled up by a resistor and is directly controlled by the main MCU. The STMPE1208S communicates with the main MCU via an I²C bus. ID_0 and ID_1 set the device address. Interrupt events GINT and TINT are sent to the main MCU as well. The slider is designed using 3 capacitive sensing pins (S-T0, S-T1, S-T2). The wheel is also implemented using 3 capacitive sensing pins (S-T8, S-T9, S-T10). Each button is connected to a single capacitive sensing pin, from S-T3 to S-T7, for a total of 5 buttons. The graphic design of the slider, the wheel, and the 5 buttons is generated directly on the PCB surface through modeling of the copper area. The corrective capacitors C5-C16 are optional. Their values are in the range of very few pF. They are necessary in cases where the PCB routes between the capacitive sensing keys and the STMPE1208S are too long and vary significantly from one to the other. Such corrective capacitors have not been mounted in the STEVAL-IHI002V1. The GPIO ports are set as outputs and connected to 12 LEDs through a series resistor. Each LED is an image of the respective capacitive sensing pin. This means the LED will turn-on as soon as a touch is detected. The demonstration board is equipped with connector J3 to allow an external board other than the STEVAL-IHI001V1 to be connected to the STMPE1208S via I²C bus.

Figure 2. Application schematic



3 Bill of material

Table 1. Bill of material

Item	Quantity	Reference	Part number	Manufacturer
1	1	C1	100 nF 0805 SMD	
2	1	C2	4.7 pF 0805 SMD	
3	1	C3	4.7 µF 10 V SMD	
4	12	DL1-DL12	LED 1206 - green	
5	1	J1	PIN strip 12x	
6	1	J2	PIN strip 10x	
7	12	R1-R12	510 W 0805 SMD	
8	1	R13	10 kW 0805 SMD	
9	1	U1	STMPE1208S	STMicroelectronics

4 STEVAL-IHI002V1 demonstration board photos

Figure 3. Top view

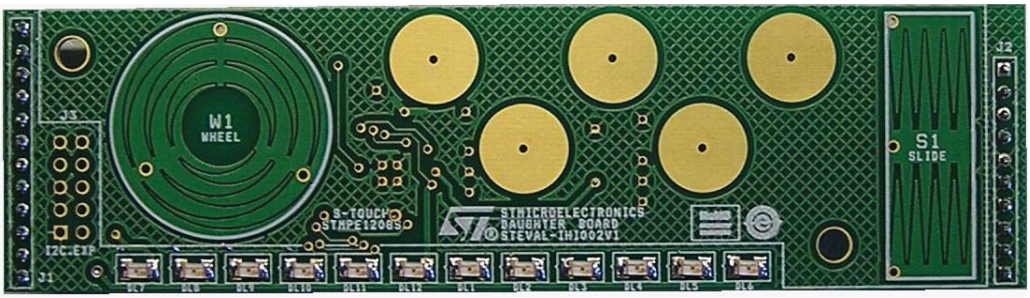


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Figure 4. Bottom view

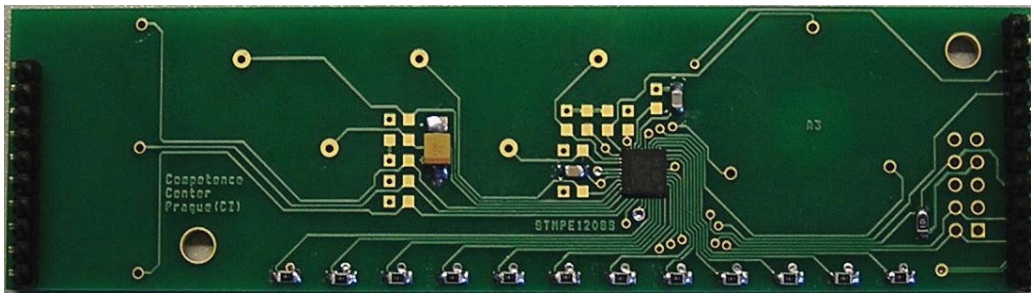

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Figure 5. STEVAL-IHI002V1 connected to the STEVAL-IHI001V1

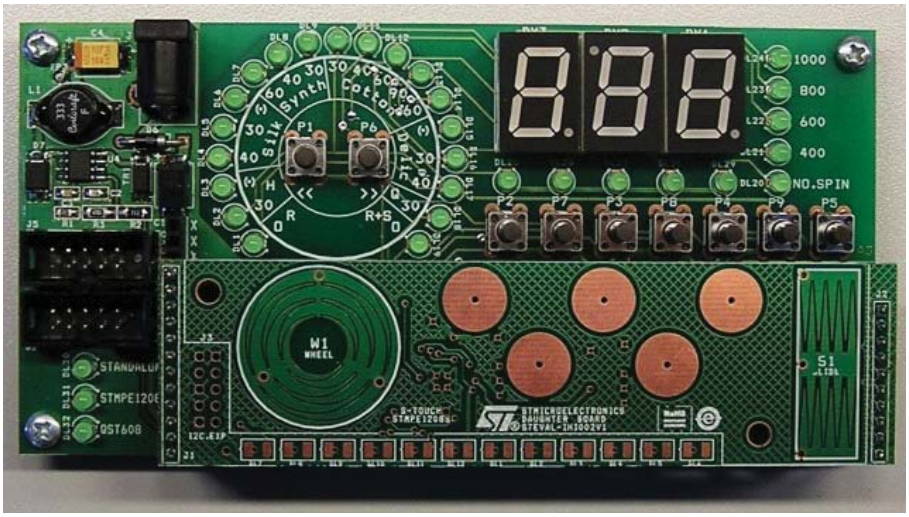

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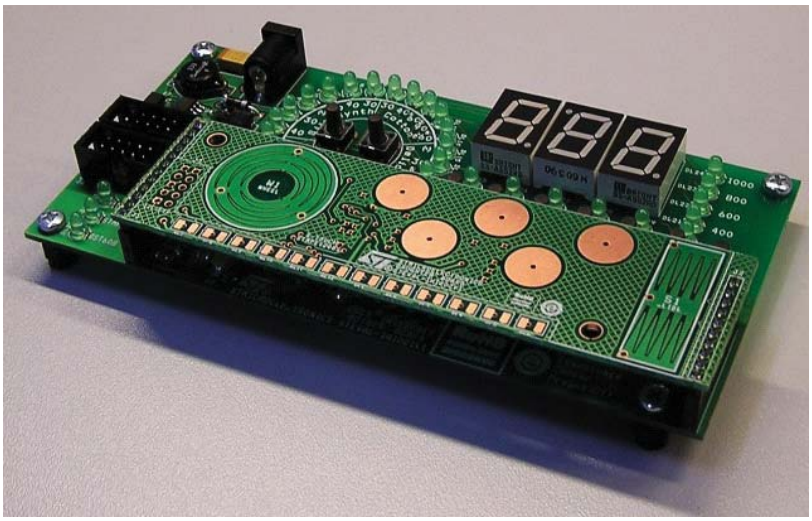
Figure 6. Angle view



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5 Revision history

Table 2. Document revision history

Date	Revision	Changes
21-Jan-2009	1	Initial release
09-Nov-2009	2	Changed the title of *Section 1* to “STMPE1208S: 12-channel capacitive touchkey controller”