AN2786
Application note

STEVAL-IHI001V1 demonstration board: washing machine user interface based on the ST7LITE49M and STLED316S

Introduction

The STEVAL-IHI001V1 is a demonstration board designed to simulate the user interface of a modern washing machine.

The board is based on the low-cost 8-bit ST7LITE49M microcontroller equipped with an I²C bus interface, and the STLED316S serial interfaced 6-digit LED controller with key-scan.

The demonstration board is designed to work as a stand-alone application, or as a motherboard for the STEVAL-IHI002V1 daughter board, which features the STMPE1208S capacitive sensing device and can be plugged into the STEVAL-IHI001V1 to operate as a capacitive single touch keyboard.

Contents

1 STLED316S: serial interfaced LED controller with key-scan

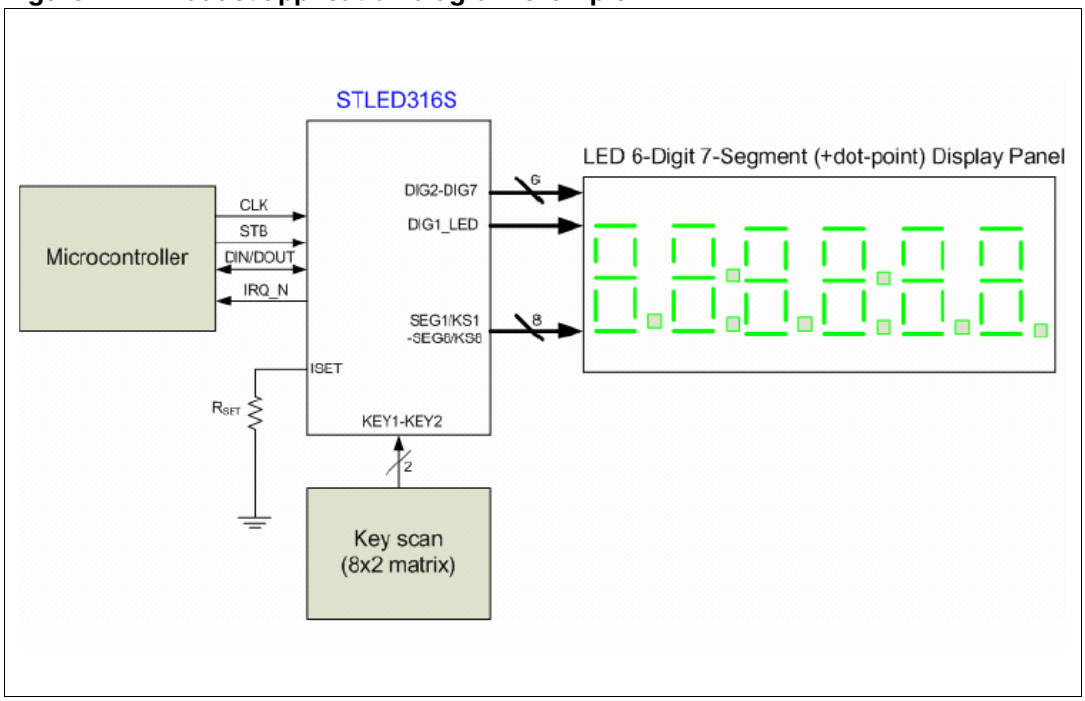
The device used for the washing machine user interface is a compact LED controller and driver. It interfaces with the MCU through a simple 3-wire serial interface.

The STLED316S drives up to 56 LEDs connected in a common anode configuration. Individual digits may be addressed and updated directly, without re-writing the entire display panel.

The maximum segment current is set through a single external resistor (R_{SET}).

Additionally, the STLED316S includes key scanning for an 8x2 key matrix, which automatically scans a matrix of up to 16 keys.

Figure 1. Product application diagram example



The STLED316S is equipped with an internal display RAM memory to store the data transmitted from the MCU through the serial interface.

The device is programmed through a variety of read/write commands that permit the user to set the display panel and manage the keyboard.

To avoid scanning the keyboard repeatedly searching for a pressed key, an additional IRQ signal can be connected to the MCU. An interrupt is generated whenever a key is pressed.

2 Demonstration board application schematic

The demonstration board power supply is designed using a L5970D step-down switching regulator. The input supply voltage may vary in the range of 5 V to 30 VDC, allowing the user to connect a standard AC notebook computer power supply. The input is reverse-polarity protected (D6), and over-voltage protected (TR1).

The power supply output voltage is set at 5 VDC by mean of 2 resistors (R2, R3).

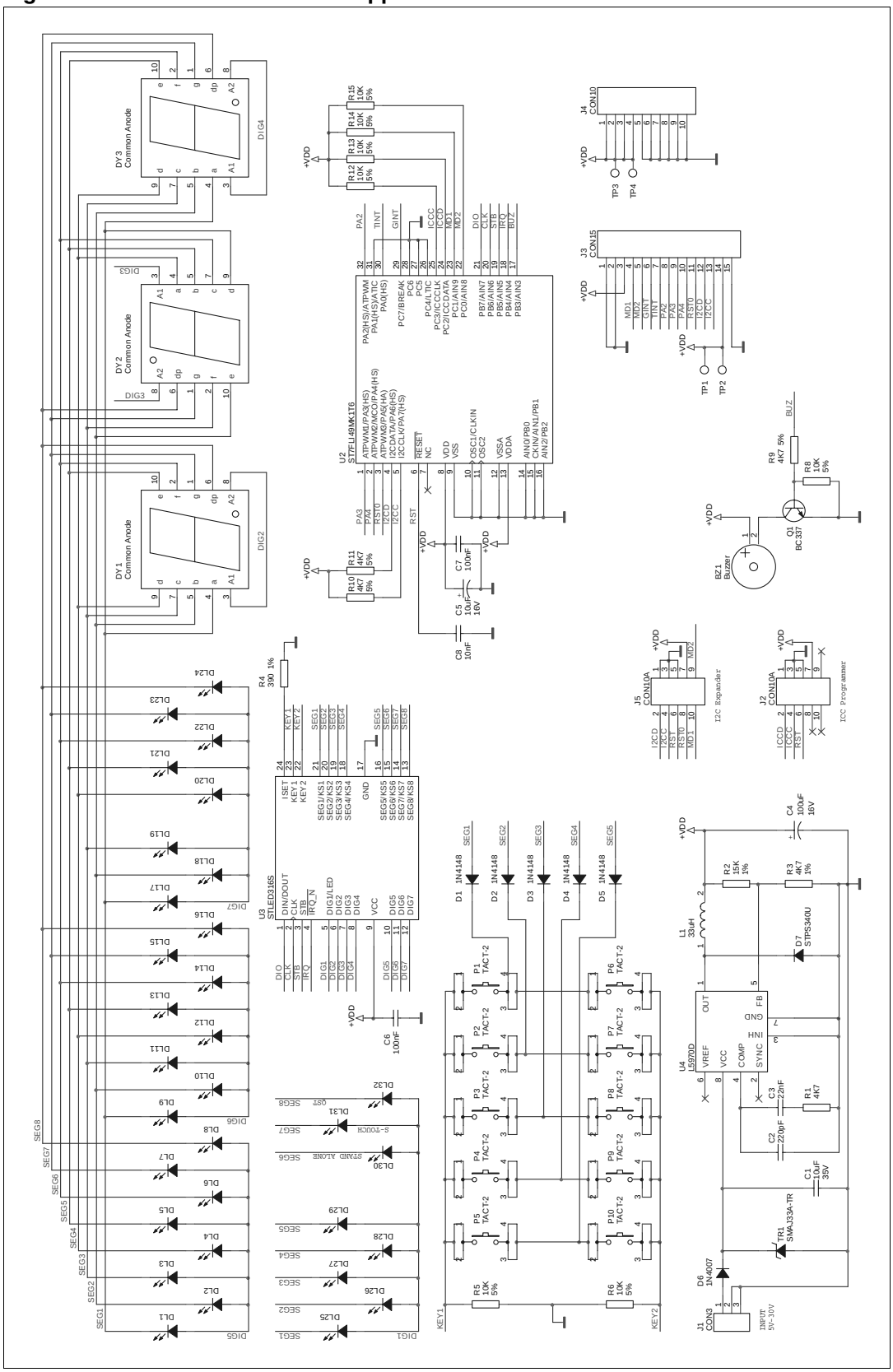
The ST7LITE49M MCU (U2) runs at 8 MHz by means of an internal oscillator, avoiding the need for any external components. Pull-up resistors R10 and R11 are used for the I²C bus, while R12 and R13 prevent the MCU from entering the programming mode unintentionally. Finally, R14 and R15 set the working mode (MD1, MD2 at logic 1 is "standalone mode").

The LEDs, display and keyboard are entirely managed through U3, (STLED316S). 8 segment lines are multiplexed with 7 digit lines, allowing a total of 56 LEDs (in a common anode configuration) to be controlled by a single STLED316S device. R4 sets the LED peak current.

Communication between the MCU and the STLED316S is achieved by means of 3 pins: data input/output (DIO), clock (CLK) and strobe (STB). An extra IRQ pin generates an interrupt request any time a key on the keyboard is pressed.

The demonstration board is equipped with connectors J3 and J4 to allow connection to the STEVAL-IHI002V1 daughter demonstration board. The board is also equipped with ICC programming connector J2 to program the MCU in-circuit. An extra I²C bus connector (J5) is foreseen to eventually connect other boards or devices via I²C bus.

Figure 2. Demonstration board application schematic



3 Bill of material

Table 1. Bill of material

Item	Qty	Reference	Part	Manufacturer
1	1	BZ1	Buzzer KPE242	
2	1	C1	10 µF 35 V SMD	EPCOS
3	1	C5	10 µF 10 V SMD	EPCOS
4	1	C2	220 pF 0805 SMD	
5	1	C3	22 nF 0805 SMD	
6	1	C4	100 µF 16 V SMD	EPCOS
7	2	C6, C7	100 nF 0805 SMD	
8	1	C8	10 nF 0805 SMD	
9	32	DL1-DL32	L-LTL4231N	
10	3	DY1, DY2, DY3	HD-A552RD common anode	
11	5	D1, D2, D3, D4, D5	1N4148 DO-35	
12	1	D6	1N4007 DO-41	
13	1	D7	STPS340U	STMicroelectronics
14	1	J1	K375A connector	
15	2	J2, J5	MLW10G 10 pin connector	
16	1	J3	BL815G 15 pin connector	
17	1	J4	BL810G 10 pin connector	
18	1	L1	DO3316P-333MLB 33 µH	Coilcraft
19	10	P1-P10	P-B1720C push-button	
20	1	Q1	BC337 TO-92	
21	3	R1, R10, R11	4K7 0805 SMD	
22	2	R3, R9	4K7 1206 SMD	
23	1	R2	15 kΩ 1206 SMD	
24	1	R4	390 1206 SMD	
25	3	R5, R6, R8	10 kΩ 1206 SMD	
26	4	R12, R13, R14, R15	10 kΩ 0805 SMD	
27	1	TR1	SMAJ33A-TR Transil™	STMicroelectronics
28	1	U2	ST7FLI49MK1T6	STMicroelectronics
29	1	U3	STLED316SMTR	STMicroelectronics
30	1	U4	L5970D	STMicroelectronics

4 STEVAL-IHI001V1 demonstration board photos

Figure 3. Front view

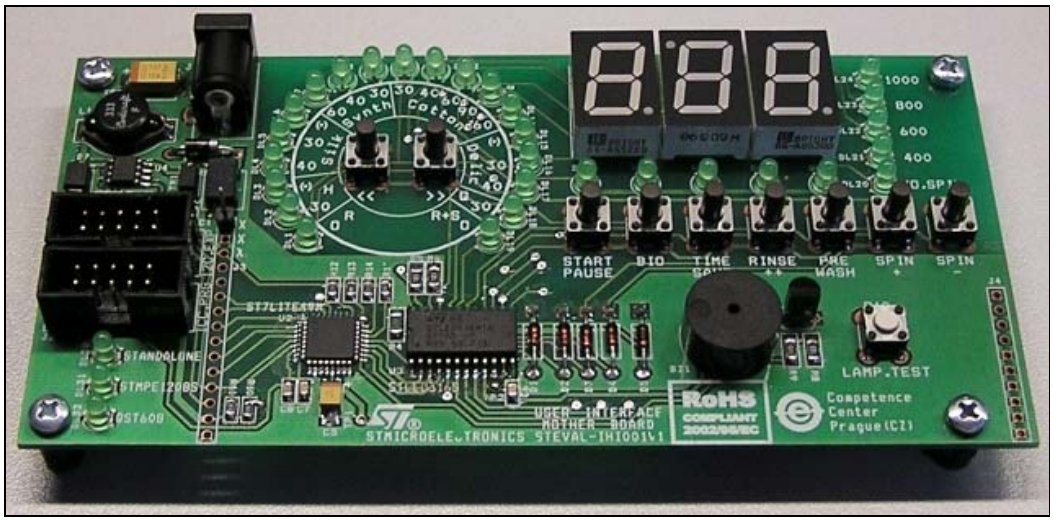


Figure 4. Angle view

5 References and related materials

For further information related to the functionality of the devices mentioned in this application note, please refer to the following documents:

1. ST7LITE49M datasheet
2. STLED316S datasheet
3. L5970D datasheet

6 Revision history

Table 2. Document revision history

Date	Revision	Changes
16-Jun-2008	1	Initial release.