



AN1799 APPLICATION NOTE

STR71x GPIO SCANNING A 4x4 MATRIX KEYPAD

INTRODUCTION

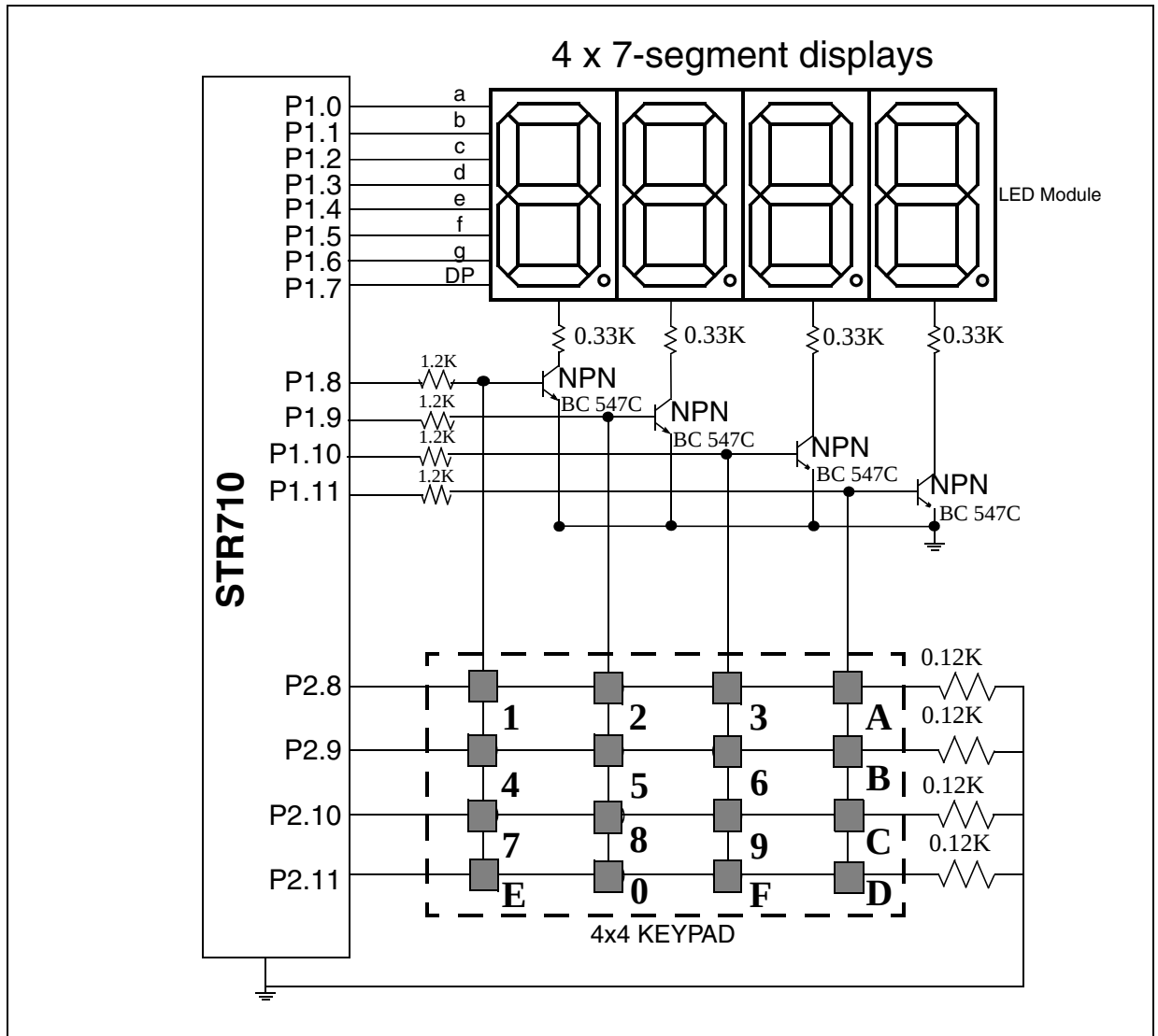
The aim of this application note is to show how to scan the 4x4 matrix keypad multiplexed with a four 7-segment display. The software attached to this application note scans the pressed key and displays it on the multiplexed 7- segment LEDs.

This application note describes how the interrupt capability of the STR710 device is used to offer a better key scan.

1 HARDWARE LAYOUT

A 4x4 keypad can be very easily interfaced to the STR710's PORT1 & PORT2 ([Figure 1](#)). Eight lines (P1.0 - 7) are assigned to LED segments. Four lines (P1.8 - 11) are used to drive and select the 7-segment displays through sink transistors. The same lines are used for pressed key checking. Keypad rows are connected with pull-down resistors to the four external interrupts pins (P2.8 - 11).

Figure 1. Multiplexing matrixed keypad with four 7-segment displays



2 STR710 CONFIGURATION

This part is dedicated to show the STR710 Microcontroller configuration. The STR710 is used since it offers the possibility to use external interrupts.

2.1 GPIO PORT CONFIGURATION

Rows are connected to P2.8-11 pins configured as Input Pull Up /Pull Down Weak Push-Pull mode. For the columns, the sink transistors base pins are connected to P1.8-11 pins configured as Output Push-Pull. External interrupts are triggered by a high level applied to a pin of P2.8-11 (caused by a pressed key), they generate an interrupt on the external interrupt (XTI) channel and can wakeup the system from STOP mode.

P1.0-7 configured as Output Push-Pull to send the value of the pressed key to the desired 7 segment display.

2.2 XTI CONFIGURATION

The External Interrupts Unit (XTI) manages 14 external interrupt lines.

In this application the XTI is configured to generate interrupts when a rising edge is detected on line 2-5; any transition from low to high level on the P2.8-11 pins will trigger an external interrupt.

3 SOFTWARE

3.1 KEYPAD

The keypad used is a 4x4 matrixed keypad. Rows are connected to the P2.8-11 pins configured as Input Pull Up /Pull Down Weak Push-Pull mode and pulled low through pull-down resistors. Columns are connected to the P1.8-11 pins configured as Output Push-Pull.

Biasing is achieved by setting high (3.3 V) each row for 5 ms duration every 20 ms. This gives an update rate of 50 Hz. The 5 ms time-base can be generated using a timer overflow interrupt.

When a key is pressed, a rising edge is applied to the row the key belong. The MCU executes the XTI IRQ handler routine and decodes the pressed key ([Table 1](#)).

The keypad is coded as follows:

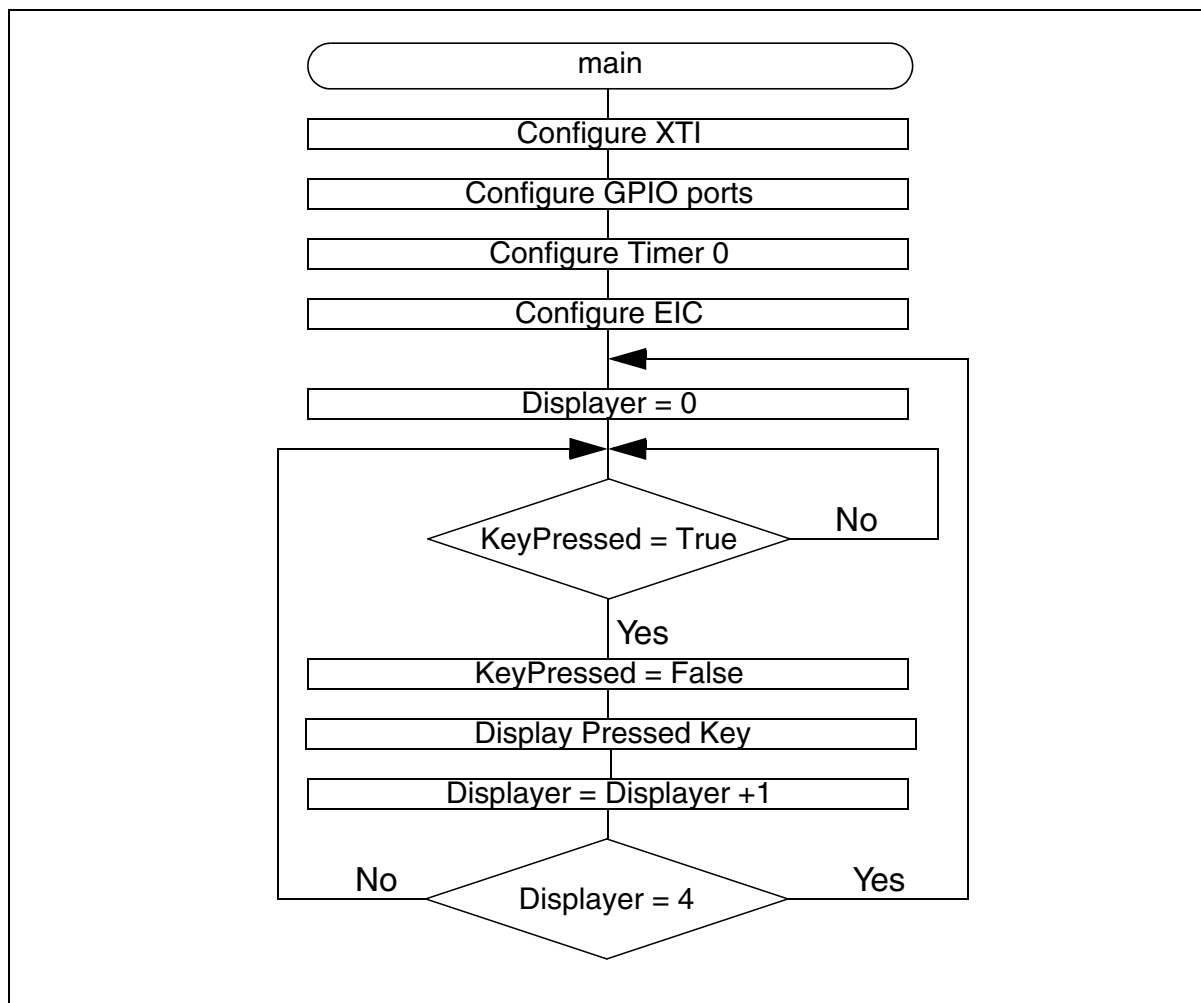
Table 1. Key codes

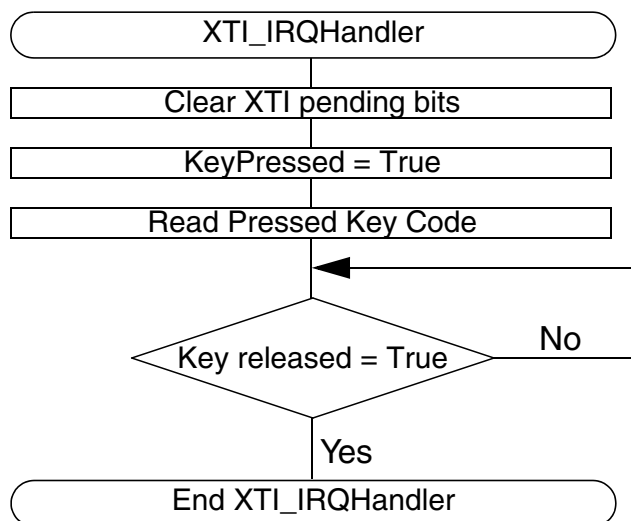
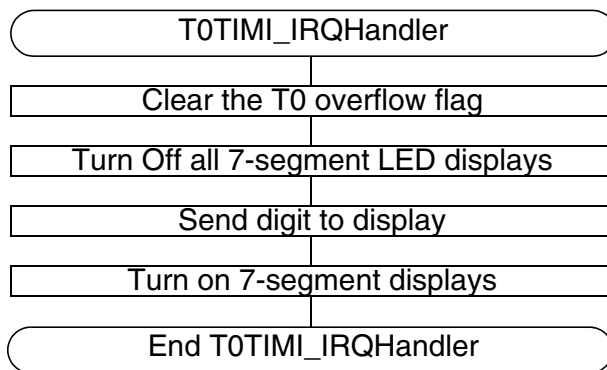
Key	Row value	Column value	Key Code
0	0x0800	0x0400	0x84
1	0x0100	0x0800	0x18
2	0x0100	0x0400	0x14
3	0x0100	0x0200	0x12
4	0x0200	0x0800	0x28
5	0x0200	0x0400	0x24
6	0x0200	0x0200	0x22
7	0x0400	0x0800	0x48
8	0x0400	0x0400	0x44
9	0x0400	0x0200	0x42
A	0x0100	0x0100	0x11
B	0x0200	0x0100	0x21
C	0x0400	0x0100	0x41
D	0x0800	0x0100	0x81
E	0x0800	0x0800	0x88
F	0x0800	0x0200	0x82

3.2 DISPLAYS

Depending on which display is selected, and using a Hexadecimal to 7-segment display correspondance table, the corresponding key code is extracted, then decoded to a 7-segment display and finally sent to the 7-segment LED display.

3.3 FLOWCHARTS





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