



# AN1799 APPLICATION NOTE

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## STR71x GPIO SCANNING A 4x4 MATRIX KEYPAD

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### INTRODUCTION

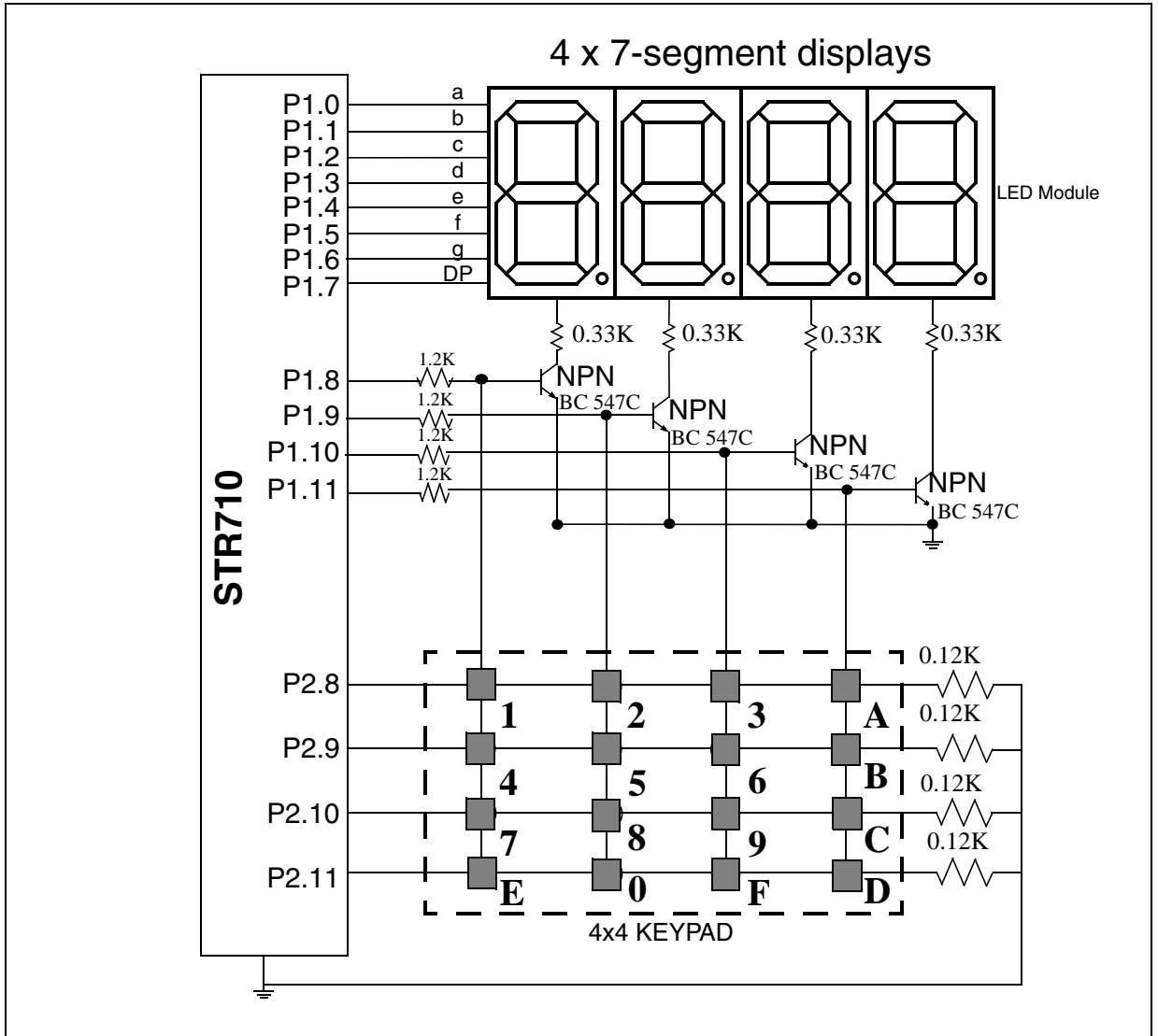
The aim of this application note is to show how to scan the 4x4 matrix keypad multiplexed with a four 7-segment display. The software attached to this application note scans the pressed key and displays it on the multiplexed 7- segment LEDs.

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:

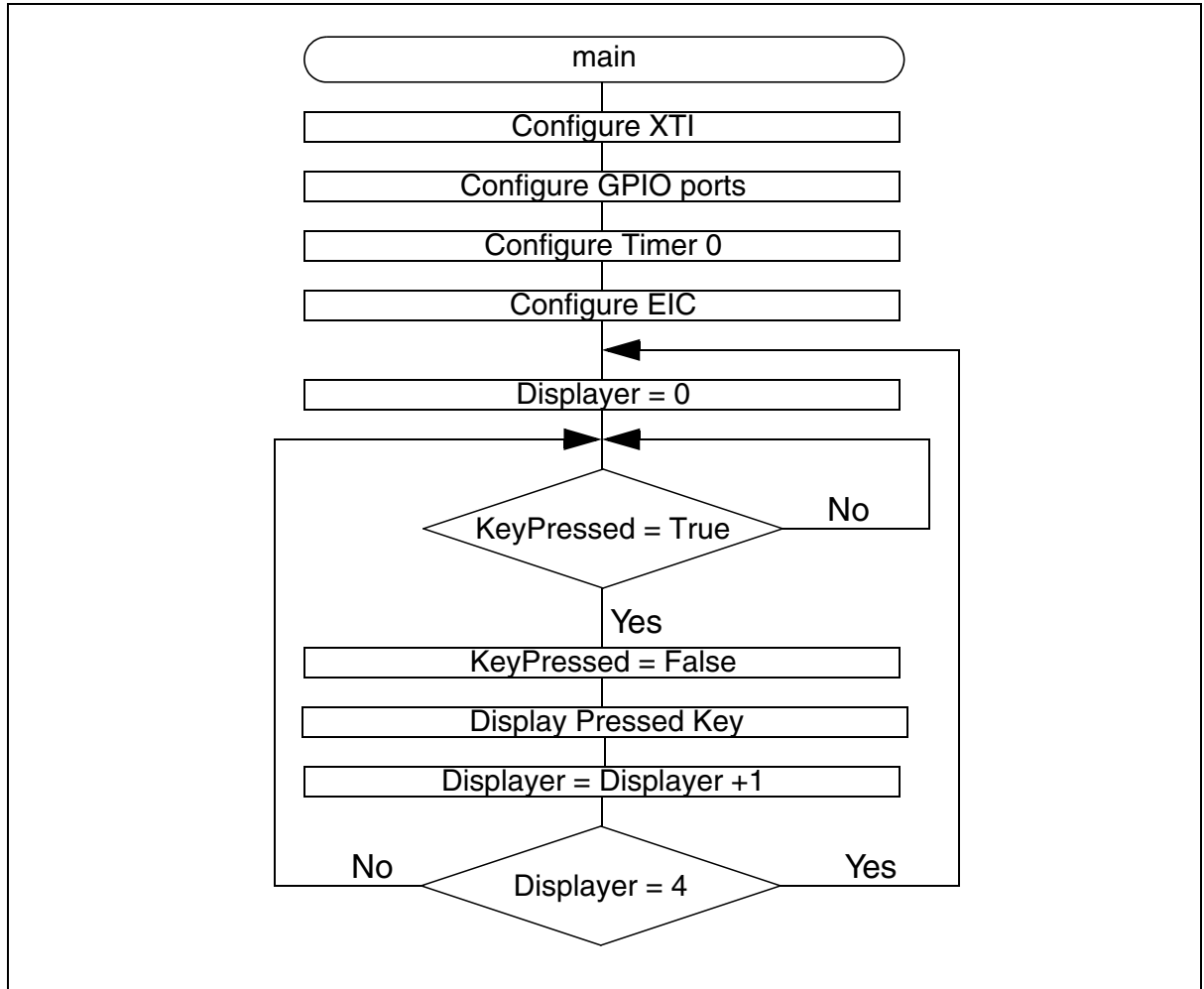
**Table 1. Key codes**

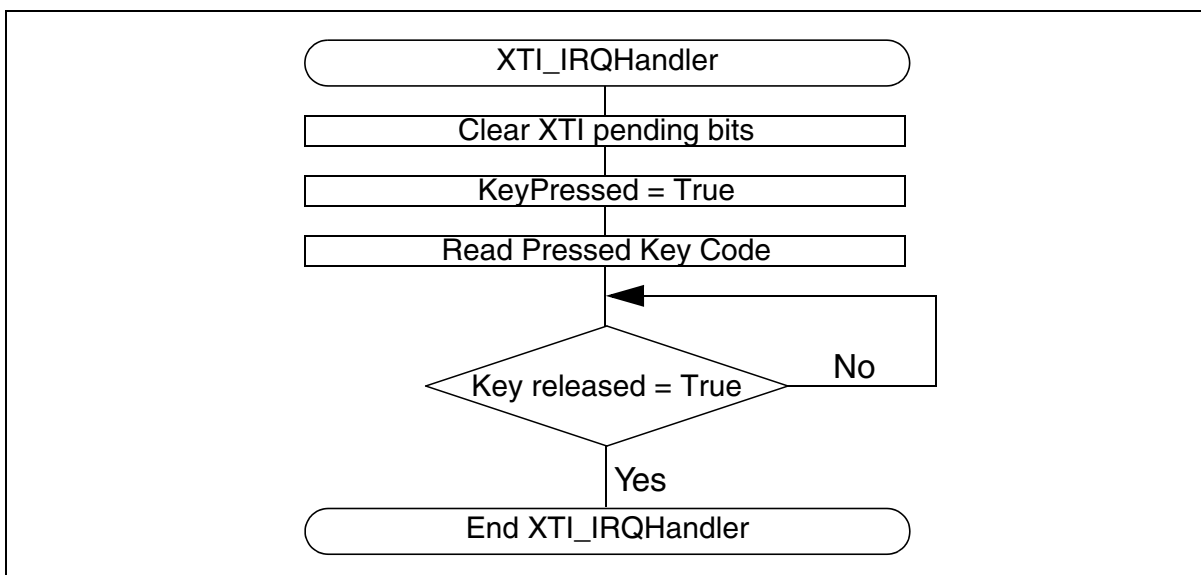
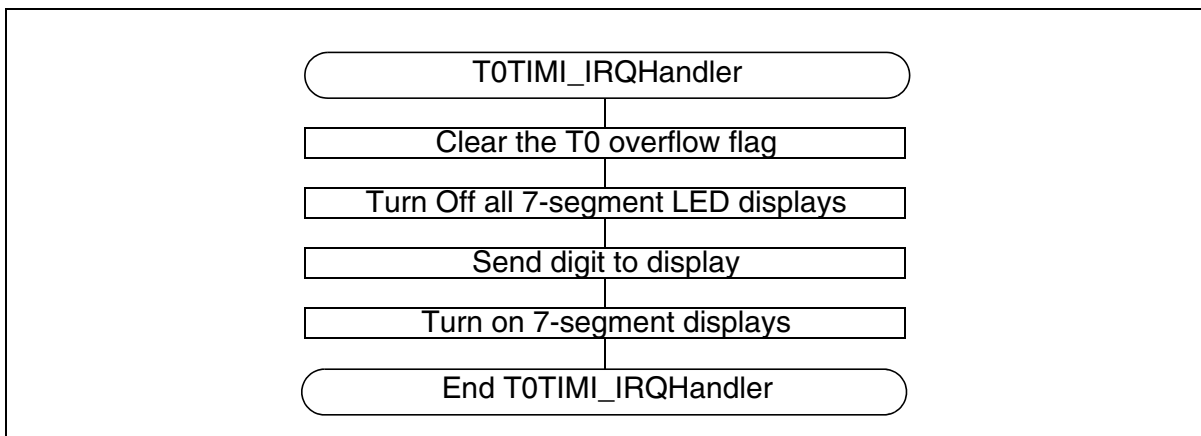
Key	Row value	Column value	Key Code
0	0x0800	0x0400	0x84
1	0x0100	0x0800	0x18
2	0x0100	0x0400	0x14
3	0x0100	0x0200	0x12
4	0x0200	0x0800	0x28
5	0x0200	0x0400	0x24
6	0x0200	0x0200	0x22
7	0x0400	0x0800	0x48
8	0x0400	0x0400	0x44
9	0x0400	0x0200	0x42
A	0x0100	0x0100	0x11
B	0x0200	0x0100	0x21
C	0x0400	0x0100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