EC2x&EG9x&EG25-G
QuecOpen Matrix Keypad Development Guide

LTE Standard Module Series

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About the Document

Revision History

Version	Date	Author	Description
1.0	2020-05-12	Gale GAO/Juson ZHANG	Initial
1.1	2020-05-22	Gale GAO/Juson ZHANG	Added the EC2x&EG9x&EG25-G QuecOpen matrix keypad attachment in the sidebar of PDF document and updated the information of the compilation path (Chapter 4).

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1 Introduction

Quectel LTE Standard modules support QuecOpen®. The feature of independent keyboard is that one key occupies a single I/O port. Its advantage is simple programming and disadvantage is a waste of I/O port. The matrix keyboard is usually arranged in matrix form, and each of the horizontal and vertical line in the intersections are not directly connected, but through a button to connect. The matrix keyboard has the advantage of saving I/O port and the disadvantage of complex programming. Therefore, the matrix keyboard is recommended when the number of keys is over 6. In order to meet the customers' requirement for matrix keypad function, this document provides matrix keypad hardware design, device tree, matrix keypad kernel option and application example. With the help of this document, customers can quickly apply related functions.

1.1. Applicable Modules

Table 1: Applicable Modules

Module Series	Module
EC2x series QuecOpen	EC25 series QuecOpen
	EC21 series QuecOpen
	EC20 R2.1 QuecOpen
EG9x series QuecOpen	EG95 series QuecOpen
	EG91 series QuecOpen
EG25-G QuecOpen	EG25-G QuecOpen

2 Matrix Keypad Hardware Design

The following figure shows the 4 × 4 matrix keyboard which is the common matrix keyboard reference design.

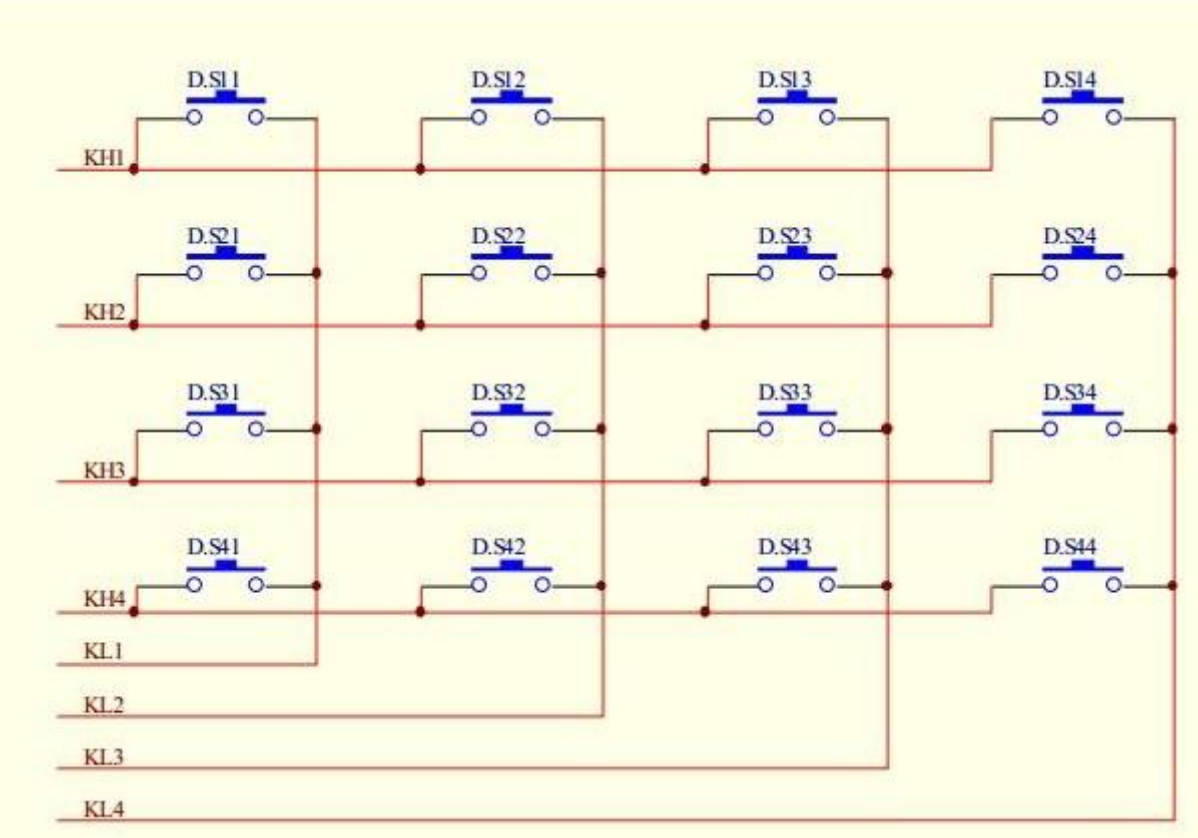


Figure 1: 4 × 4 Matrix Keypad

3 Device Tree And Matrix Keypad

3.1. Add Matrix Keypad Configuration to Device Tree

3.1.1. Attribute Specification

debounce-delay-ms	Time for key anti-shake
col-scan-delay-us	The column scan delay can delay after the key is triggered
linux,wakeup	Support waking up the module by key
row-gpios	GPIO number used in row
col-gpios	GPIO number used in column
linux-keymap	Keycodes for row and column and also for reporting to APP

3.1.2. Function Specification

Row as input pin	Select the I/O that supports interrupt wake-up and keep the default internal drop-down
Colum as output pin	The driver outputs a high level in the default configuration
When edge is triggered	Rising and falling edges will be reported

3.1.3. Reference to Configuration

Configuration Reference	*ql-ol-kernel/msm-3.18/Documentation/devicetree/bindings/input/gpio-matrix-keypad.txt*

3.1.4. Driver Source Codes And File Path

Driver Source Codes	*ql-ol-kernel/msm-3.18/drivers/input/keypad/matrix_keypad.c*
File Path	*Ql-ol-kernel/arch/arm/boot/dts/qcom/mdm9607.dtsi*

Please add the driver source code to the corresponding path according to the operation in the figure below.

```
--- ql-ol-kernel-orig/arch/arm/boot/dts/qcom/mdm9607.dtsi   2018-05-12 19:02:48.000000000 +0800
+++ ql-ol-kernel/arch/arm/boot/dts/qcom/mdm9607.dtsi    2018-06-26 09:33:51.915118760 +0800
@@ -1849,6 +1849,65 @@
        interrupts = <0x0 0xA1 0x0>; /* PMD9607 MPP 2 */
        interrupt-names = "vbus_det_irq";
    };
+
+   matrix-keypad {
+       compatible = "gpio-matrix-keypad";
+       debounce-delay-ms = <20>;
+       col-scan-delay-us = <2>;
+       linux,no-autorepeat;
+       /*linux,clustered_irq = <88>;
+       linux,clustered_irq_flags = <0x1>;*/
+       linux,wakeup;
+
+       row-gpios = <&tlmm_pinmux 3 0
+                &tlmm_pinmux 5 0
+                &tlmm_pinmux 34 0
+                &tlmm_pinmux 42 0
+                &tlmm_pinmux 75 0>;
+
+       col-gpios = <&tlmm_pinmux 0 0
+                &tlmm_pinmux 2 0
+                &tlmm_pinmux 4 0
+                &tlmm_pinmux 10 0
+                &tlmm_pinmux 24 0
+                &tlmm_pinmux 25 0>;
+
+       linux,keymap = <0x00000000  /* 1st col */
+               0x01000001
+               0x02000002
+               0x03000003
+               0x04000004
+
+               0x00010005  /* 2nd col */
+               0x01010006
+               0x02010007
+               0x03010008
+               0x04010009
+
+               0x0002000a
+               0x0102000b
+               0x0202000c
+               0x0302000d
+               0x0402000e
+
+               0x0003000f
+               0x01030010
+               0x02030011
+               0x03030012
+               0x04030013
+
+               0x00040014
+               0x01040015
+               0x02040016
+               0x03040017
+               0x04040018
+
+               0x00050019
+               0x0105001a
+               0x0205001b
+               /*0x0305001c
+               0x0405001d*/>;
+   };
 };

 #include "mdm9607-rpm-regulator.dtsi"
```

Figure 2: Device Tree Configuration

Please refer to ***Chapter 4*** for application example.

3.2. Enable Matrix Keypad Kernel Option

Please execute the following commands to enable matrix keypad Kernel option:

```
ql-ol-sdk$ make kernel_menuconfig
ql-ol-sdk$ make kernel
```

Please run the make kernel_menuconfig to open the configuration as prompted in the figure below then save and exit.

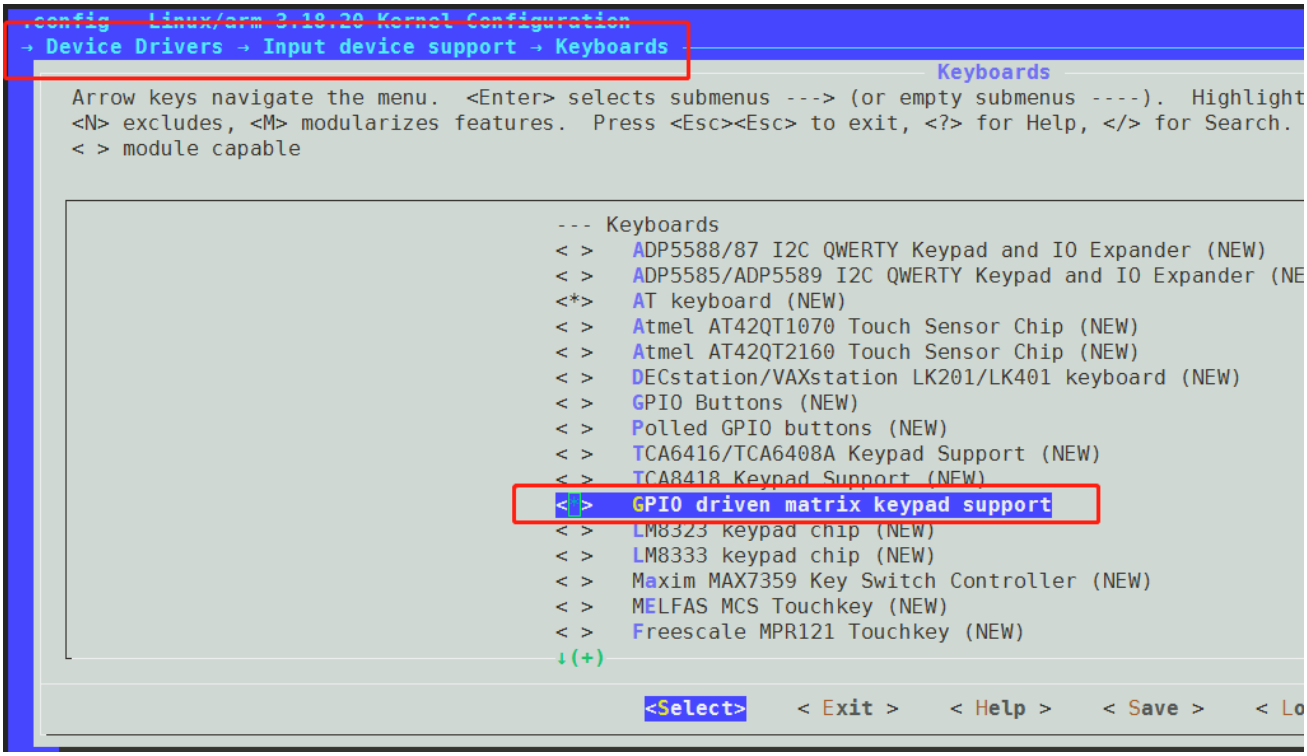
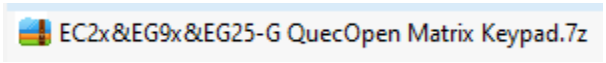


Figure 3: Make Kernel_Menuconfig Configuration System Interface

4 Application Example

The directory of the *matrix_keyboard* in the *EC2x&EG9x&EG25-G QuecOpen Matrix Keyboard* attachment which is attached in the sidebar of the document needs to be copied to the path *ql-ol-extsdk/example* for compilation, and then put the executable program to the module for testing. When the key is triggered, the key code is reported, and it can also be reported under sleep state.



5 Appendix A Reference

Table 2: Terms and Abbreviations

Abbreviation	Description
APP	Application
GPIO	General-purpose input/output
I/O	Input/Output