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Switch matrix usage on LPC86x

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Document Information

Information	Content
Keywords	LPC86x, GPIO
Abstract	The switch matrix is a feature which can flexibly assign the internal signals to external pins. Most digital functions can be assigned to any GPIO pins by the switch matrix.

1 Introduction

The switch matrix is a feature which can flexibly assign the internal signals to external pins. Most digital functions can be assigned to any GPIO pins by the switch matrix. The switch matrix can be configured to movable or fixed-pin functions. You can use this feature to assign different functions to external pins according to your requirements.

2 Switch matrix configuration

The switch matrix can assign pins using movable or fixed-pin functions. Most functions can be assigned through the switch matrix to any external pin, except for the power-supply voltage and ground. These functions are called movable functions.

There are also some functions can only be assigned to a particular external pin, such as XTALIN/XTALOUT or some analog peripheral functions. These functions are called fixed-pin functions.

Figure 1 shows the functional blocks of the switch matrix.

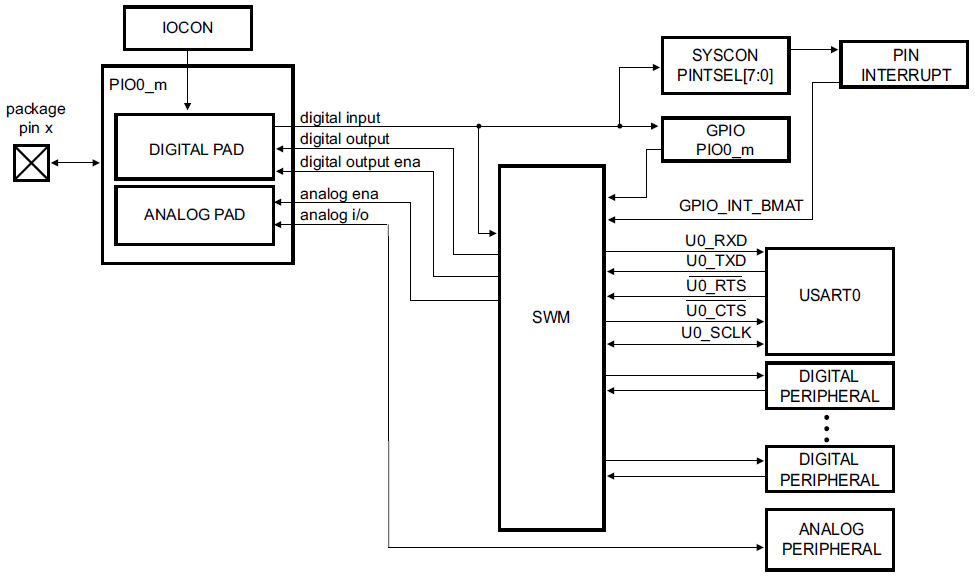

Figure 1. Switch matrix function diagram

2.1 Movable functions

Most peripherals' functions can be assigned to any external pin, such as UART. Figure 2 shows how to assign the U0_RXD and U0_TXD functions to external pins.

1. Decide which GPIO pin would be used as U0_RXD and U0_TXD. Figure 2 shows that PIO0_12 and PIO0_8 will be connected to U0_RXD and U0_TXD.
2. The XTALIN was assigned to PIO0_8 by a fixed-pin function. It is necessary to set the PINENABLE0 bit 10 = 1 to confirm that the XTALIN function was disabled.
3. Find the pin assign register 0, which was used to configure the UART0 function pins. Set the PINASSIGN0 bits 7:0 = 0x8 and the PINASSIGN0 bits 15:8 = 0xC.

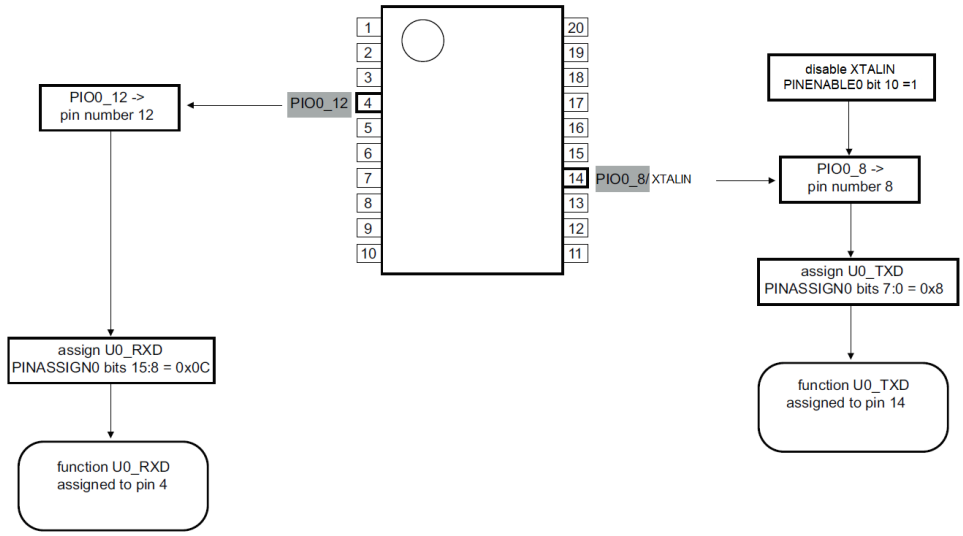

Figure 2. Movable pin assignment example

Table 1. Movable pin assignment register

Bit	Symbol	Description	Reset value
7:0	U0_TXD_O	U0_TXD function assignment. The value is the pin number to be assigned to this function. The following pins are available: PIO0_0 (= 0) to PIO0_31 (= 0x1F) and from PIO1_0 (= 0x20) to PIO1_21(= 0x35).	0xFF
15:8	U0_RXD_I	U0_RXD function assignment. The value is the pin number to be assigned to this function. The following pins are available: PIO0_0 (= 0) to PIO0_31 (= 0x1F) and from PIO1_0 (= 0x20) to PIO1_21(= 0x35).	0xFF
23:16	U0_RTS_O	U0_RTS function assignment. The value is the pin number to be assigned to this function. The following pins are available: PIO0_0 (= 0) to PIO0_31 (= 0x1F) and from PIO1_0 (= 0x20) to PIO1_21(= 0x35).	0xFF
31:24	U0_CTS_I	U0_CTS function assignment. The value is the pin number to be assigned to this function. The following pins are available: PIO0_0 (= 0) to PIO0_31 (= 0x1F) and from PIO1_0 (= 0x20) to PIO1_21(= 0x35).	0xFF

The switch matrix can make one digital output function control one or more digital inputs by setting the same pin number in the PINASSIGN register bit fields for the output and inputs.

For example, you can assign U0_RXD and U0_TXD to PIO0_1 by setting the PINASSIGN0 bits 7:0 = 0x1 and bits 15:8 = 0x1. The UART0 loopback mode can be tested without an external pin connection.

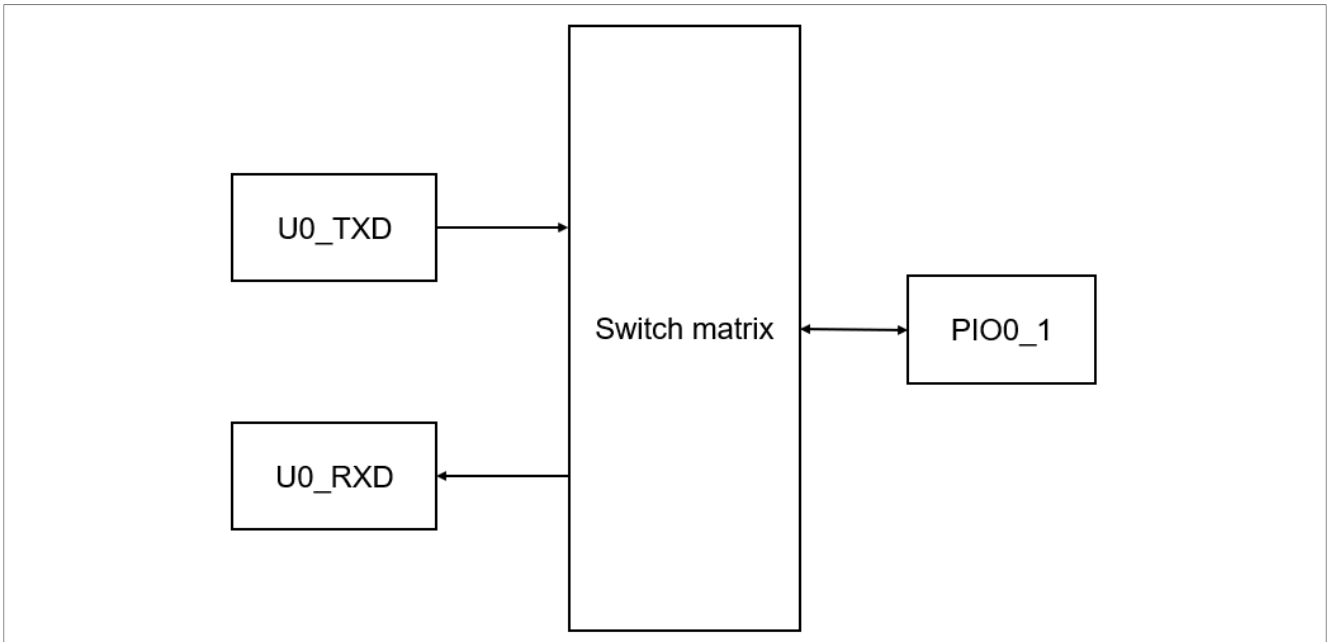

Figure 3. Switch matrix usage example

The switch matrix can also connect one input signal on a pin to multiple internal inputs by setting the same pin number in more than one PINASSIGN register.

But the switch matrix cannot connect more than one output or bi-directional function to a pin, as shown in Figure 4.

The PIO0_4 pin triggers a wakeup from a deep power-down mode. If the part must wake up from a deep power-down mode via an external pin, do not assign any movable functions to this pin.

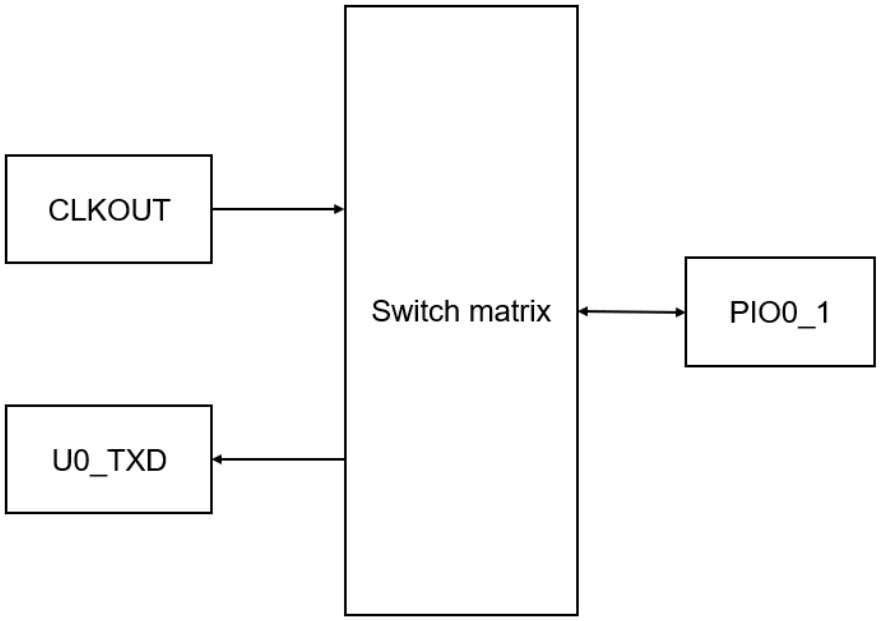

Figure 4. Switch matrix usage example

2.2 Fixed-pin functions

As shown in Figure 1, there are also some peripherals functions that cannot be assigned to movable pins. They require pins with special characteristics and cannot be moved to other physical pins. These functions are mapped to a fixed port pin, such as oscillator pins and analog peripherals.

When you want to assign these functions to fixed external pins, you can set the PINENABLE register to enable the function pin.

For example, if you want to enable the ACMP_I2 function, set the PINENABLE0 bit 1 = 0 and ACMPI_2 will be connected to PIO0_1.

Table 2. Fixed-pin configuration register

Bit	Symbol	Value	Description	Reset value
1	ACMP_I2		ACMP_I2 function select	1
		0	ACMP_I2 enabled on pin PIO0_1	
		1	ACMP_I2 disabled	
2	ACMP_I3		ACMP_I3 function select.	1
		0	ACMP_I3 enabled on pin PIO0_14.	
		1	ACMP_I3 disabled.	
3	ACMP_I4		ACMP_I4 function select.	1
		0	ACMP_I4 enabled on pin PIO0_23.	

Table 2. Fixed-pin configuration register...*continued*

Bit	Symbol	Value	Description	Reset value
		1	ACMP_I4 disabled.	
4	ACMP_I5		ACMP_I5 function select.	1
		0	ACMP_I5 enabled on pin PIO0_30.	
		1	ACMP_I5 disabled.	

2.3 FlexTimer pin assignment

The FlexTimer functions can be assigned to some particular pins using the switch matrix. As shown in Table 3, each FlexTimer function has four pin selections and these selections can assign functions to the particular pins. You can select which pin is connected to the FlexTimer function by programming the FlexTimer pin-assign register (FTM_PINASSIGN0) bits.

As shown in Table 4, every two bits in the FTM_PINASSIGN0 register can configure one FlexTimer function pin. The bit value corresponds to the selection number in Table 3. If the FTM_PINASSIGN0 bit is 1:0 = 0x00, the selection number is 0.

For example, if you need to connect FTM0_CH0 to PIO1_1, you can set the FTM_PINASSIGN0 bits 3:2 = 0x01.

Table 3. FlexTimer pin assignments

Function name	Type	Selection 0	Selection 1	Selection 2	Selection 3
FTM0_EXTCLK	I	P0_24	P0_30	-	Not connected
FTM0_CH0	I/O	P0_17	P1_1	-	Not connected
FTM0_CH1	I/O	P0_18	P1_2	P0_16	Not connected
FTM0_CH2	I/O	P0_19	P1_3	P1_2	Not connected
FTM0_CH3	I/O	P0_20	P1_4	P0_27	Not connected
FTM0_CH4	I/O	P0_21	P1_5	P0_25	Not connected
FTM0_CH5	I/O	P0_22	P1_6	P0_24	Not connected
FTM0_FAULT0	I	P0_10	P1_7	P0_28	Not connected
FTM0_FAULT1	I	P0_11	P1_12	P1_3	Not connected
FTM0_FAULT2	I	P0_13	P1_13	-	Not connected
FTM0_FAULT3	I	P0_23	P1_14	-	Not connected
FTM1_ EXTCLK	I	P0_25	P0_29	-	Not connected
FTM1_CH0	I/O	P0_15	P1_8	-	Not connected
FTM1_CH1	I/O	P0_16	P1_9	-	Not connected
FTM1_CH2	I/O	P0_26	P0_31	-	Not connected
FTM1_CH3	I/O	P0_27	P1_0	-	Not connected
FTM1_QD_PHA	I	P0_24	P0_29	-	Not connected
FTM1_QD_PHB	I	P0_25	P0_30	-	Not connected

Table 4. FlexTimer assignment register

Bit	Symbol	Description	Reset value
1:0	FTM0_EXTCLK	Assign movable function FTM0_EXTCLK	0xFF
		00 = Selection 0 function pins	
		01 = Selection 1 function pins	
		10 = Selection 2 function pins	
		11 = Selection 3 function pins	
		See Table 126 “Flextimer pin assignments”	
3:2	FTM0_CH0	Assign movable function FTM0_CH0	0xFF
5:4	FTM0_CH1	Assign movable function FTM0_CH1	0xFF
7:6	FTM0_CH2	Assign movable function FTM0_CH2	0xFF
9:8	FTM0_CH3	Assign movable function FTM0_CH3	0xFF
11:10	FTM0_CH4	Assign movable function FTM0_CH4	0xFF
13:12	FTM0_CH5	Assign movable function FTM0_CH5	0xFF
15:14	FTM0_FAULT0	Assign movable function FTM0_FAULT0	0xFF
17:16	FTM0_FAULT1	Assign movable function FTM0_FAULT1	0xFF
19:18	FTM0_FAULT2	Assign movable function FTM0_FAULT2	0xFF
21:20	FTM0_FAULT3	Assign movable function FTM0_FAULT3	0xFF
23:22	FTM1_EXTCLK	Assign movable function FTM0_ EXTCLK	0xFF
25:24	FTM1_CH0	Assign movable function FTM1_CH0	0xFF
27:26	FTM1_CH1	Assign movable function FTM1_CH1	0xFF
29:28	FTM1_CH2	Assign movable function FTM1_CH2	0xFF
31:30	FTM1_CH3	Assign movable function FTM1_CH3	0xFF

3 Revision history

Table 5 summarizes the revisions to this document.

Table 5. Revision history

Revision number	Date	Substantive changes
0	10 May 2023	Initial release

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