



SM39R 系列 **KBI** 功能使用方法

1 適用產品：

1.1 SM39R16A2/ SM39R12A2/ SM39R08A2

2 **KBI** 使用說明：

2.1 共有 4 個 I/O 可致能為 **KBI** 功能 I/O。

2.2 由 Port 0 共 4 個 I/O，分別對應至 4 個獨立的旗標(KBF.0~ KBF.3)，且共用同一個中斷向量位置 (0x5B)。

2.3 可由程式設定為高準位或低準位觸發。

2.4 當觸發訊號輸入至 **KBI** 任一引腳，其對應的旗標將會被設置為"1"，並且進入中斷副程式。

2.5 **KBI** 功能主要可做為 2x2 矩陣式鍵盤掃描，或其它應用。

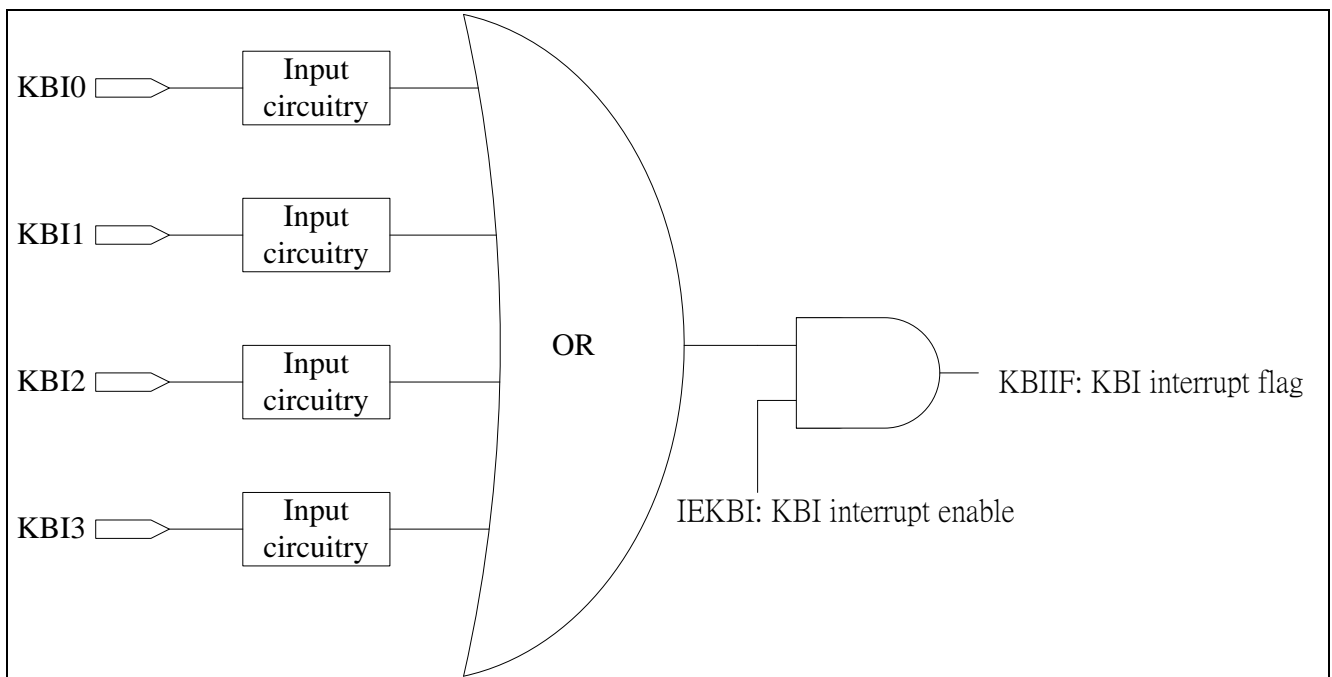


Fig. Interrupts from KBI 4 inputs

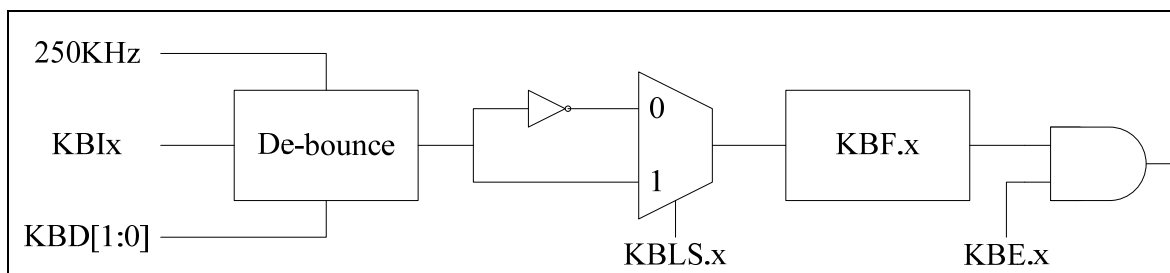


Fig. keyboard input circuitry



2.6 KBI 相關暫存器：

KBI	Description	Direct	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	RESET
KBI function											
KBLS	KBI level selection	93h	-	-	-	-	<i>KBLS3</i>	<i>KBLS2</i>	<i>KBLS1</i>	<i>KBLS0</i>	00H
KBE	KBI input enable	94h	-	-	-	-	<i>KBE3</i>	<i>KBE2</i>	<i>KBE1</i>	<i>KBE0</i>	00H
KBF	KBI flag	95h	-	-	-	-	<i>KBF3</i>	<i>KBF2</i>	<i>KBF1</i>	<i>KBF0</i>	00H
KBD	KBI De-bounce control register	96h	<i>KBDEN</i>	-	-	-	-	-	<i>KBD1</i>	<i>KBD0</i>	00H
IEN1	Interrupt Enable 1 register	B8H	EXEN2	-	IEIIC	IELVI	<i>IEKBI</i>	IEADC	IESPI	IEPWM	00H
IRCON	Interrupt request register	C0H	EXF2	TF2	IICIF	LVIIF	<i>KBIIF</i>	ADCIF	SPIIF	PWMIF	00H

Mnemonic: KBLS

Address: 93h

7	6	5	4	3	2	1	0	Reset
-	-	-	-	<i>KBLS3</i>	<i>KBLS2</i>	<i>KBLS1</i>	<i>KBLS0</i>	00H

KBLS.3: 觸發準位設定位元 (Keyboard Line 3 level selection bit)

0: 設定為低準位觸發

1: 設定為高準位觸發

KBLS.2: 觸發準位設定位元 (Keyboard Line 2 level selection bit)

0: 設定為低準位觸發

1: 設定為高準位觸發

KBLS.1: 觸發準位設定位元 (Keyboard Line 1 level selection bit)

0: 設定為低準位觸發

1: 設定為高準位觸發

KBLS.0: 觸發準位設定位元 (Keyboard Line 0 level selection bit)

0: 設定為低準位觸發

1: 設定為高準位觸發

Mnemonic: KBE

Address: 94h

7	6	5	4	3	2	1	0	Reset
-	-	-	-	<i>KBE3</i>	<i>KBE2</i>	<i>KBE1</i>	<i>KBE0</i>	00H

KBE.3: 致能位元 (Keyboard Line 3 enable bit)

0: KBI 禁能, 預設為一般的出入埠(GPIO)

1: KBI 致能, 當觸發訊號輸入時, KBF.7 = 1, 會觸發中斷

KBE.2: 致能位元 (Keyboard Line 2 enable bit)

0: KBI 禁能, 預設為一般的出入埠(GPIO)

1: KBI 致能, 當觸發訊號輸入時, KBF.7 = 1, 會觸發中斷

KBE.1: 致能位元 (Keyboard Line 1 enable bit)

0: KBI 禁能, 預設為一般的出入埠(GPIO)

1: KBI 致能, 當觸發訊號輸入時, KBF.7 = 1, 會觸發中斷

KBE.0: 致能位元 (Keyboard Line 0 enable bit)

0: KBI 禁能, 預設為一般的出入埠(GPIO)

1: KBI 致能, 當觸發訊號輸入時, KBF.7 = 1, 會觸發中斷



Mnemonic: KBF								Address: 95h
7	6	5	4	3	2	1	0	Reset
-	-	-	-	KBF3	KBF2	KBF1	KBF0	00H

KBF.3: KBI 觸發旗標 (Keyboard Line 3 flag)

- 1: 當 KBI3 偵測到輸入訊號時，KBF.3 由硬體設為“1”，並產生 KBI 中斷；
- 0: 必須由軟體清除為“0”

KBF.2: KBI 觸發旗標 (Keyboard Line 2 flag)

- 1: 當 KBI2 偵測到輸入訊號時，KBF.2 由硬體設為“1”，並產生 KBI 中斷；
- 0: 必須由軟體清除為“0”

KBF.1: KBI 觸發旗標 (Keyboard Line 1 flag)

- 1: 當 KBI1 偵測到輸入訊號時，KBF.1 由硬體設為“1”，並產生 KBI 中斷；
- 0: 必須由軟體清除為“0”

KBF.0: KBI 觸發旗標 (Keyboard Line 0 flag)

- 1: 當 KBI0 偵測到輸入訊號時，KBF.0 由硬體設為“1”，並產生 KBI 中斷；
- 0: 必須由軟體清除為“0”

Mnemonic: KBD								Address: 96h
7	6	5	4	3	2	1	0	Reset
KBDEN	-	-	-	-	-	KBD1	KBD0	00H

KBDEN: 除彈跳功能致能位元(Enable KBI de-bounce function).

預設為致能(The default KBI function is enabled).

KBDEN = 0, 致能除彈跳功能

KBDEN = 1, 禁能除彈跳功能

KBD[1:0]: 除彈跳時間設定位元. 若 KBDEN = “0”，則預設為 320 ms.

KBD[1:0] = 00, 除彈跳時間為 320 ms.

KBD[1:0] = 01, 除彈跳時間為 160 ms.

KBD[1:0] = 10, 除彈跳時間為 80 ms.

KBD[1:0] = 11, 除彈跳時間為 40 ms.

Mnemonic: IEN1								Address: B8h
7	6	5	4	3	2	1	0	Reset
EXEN2	-	IEIIC	IELVI	IEKBI	IEADC	IESPI	IEPWM	00H

IEKBI: KBI interrupt enable.

IEKBI = 0 – Disable KBI interrupt.

IEKBI = 1 – Enable KBI interrupt.

Mnemonic: IRCON								Address: C0h
7	6	5	4	3	2	1	0	Reset
EXF2	TF2	IICIF	LVIF	KBIIF	ADCIF	SPIIF	PWMIF	00H

KBIIF: KBI interrupt flag. Must be cleared by software.



2.7 以下是 **KBI** 相對應的中斷向量表：

Table 11-1: Interrupt vectors

Interrupt Request Flags	Interrupt Vector Address	Interrupt Number *(use Keil C Tool)
IE0 – External interrupt 0	0003h	0
TF0 – Timer 0 interrupt	000Bh	1
IE1 – External interrupt 1	0013h	2
TF1 – Timer 1 interrupt	001Bh	3
RI/TI – Serial channel interrupt	0023h	4
TF2/EXF2 – Timer 2 interrupt	002Bh	5
PWMIF – PWM interrupt	0043h	8
SPIIF – SPI interrupt	004Bh	9
ADCIF – A/D converter interrupt	0053h	10
KBIIF – keyboard Interface interrupt	005Bh	11
LVIIIF – Low Voltage Interrupt	0063h	12
IICIF – IIC interrupt	006Bh	13
Comparator interrupt	0093h	18

*See Keil C about C51 User's Guide about Interrupt Function description

KBI 中斷應用的參考程式：

Description	<ol style="list-style-type: none"> 1. KBI I/O 全部致能，Ch.0/Ch.1 高準位偵測 Ch.2/Ch.3 低準位偵測 2. De-bounce 時間為 40ms
C 語言	<pre>//===== // SYNCMOS TECHNOLOGY //===== #include "SM39R16A2.h" #include " SM39R16A2_KBI.h " #define KBI_VECTOR 11 //KBI Interrupt Vevtor #define d_KBLS 0x03 //KBI Low/High level detection selection (0~0x0F) #define d_KBEX 0x0F //KBI Input Enable (0~0x0F) #define d_KBDEN 0x00 //KBI De-bounce Function Enable #define d_KBDS 0x03 //KBD[1:0] KBI De-bounce Time Selection (0~3) #define d_KBIIE 0x01 //KBI Interrupt Enable bit void KBI_initialize(void) //Initialize KBI { EA=0; //Disable All Interrupt Function IEKBI=(d_KBIIE); //Enable KBI Interrupt Function KBD=(d_KBDEN<<7) (d_KBDS); //Enable KBI De-bounce and De-bounce Time Function</pre>

Specifications subject to change without notice, contact your sales representatives for the most recent information.



```
KBLS=(d_KBLS);           //KBI Input High/Low Level Select
KBE=(d_KBEX);            //KBI Input Channel Enable
EA=1;                    //Enable All Interrupt
}
//-----//
void KBI_Disable(void)
{
    IEKBI=0;              //Disable KBI Interrupt
    KBE=0;                //Disable KBI Function
}
//-----//
void KBI_ISR(void) interrupt KBI_VECTOR //KBI Interrupt Subroutine
{
    switch(KBF)           //Decision Occur Channel Flag (KBF)
    {
        case 0x08:        //KBI Channel 3 Occur Interrupt(KBF3)
            P1_3=0;
            break;
        case 0x04:        //KBI Channel 2 Occur Interrupt(KBF2)
            P1_2=0;
            break;
        case 0x02:        //KBI Channel 1 Occur Interrupt(KBF1)
            P1_1=0;
            break;
        case 0x01:        //KBI Channel 0 Occur Interrupt(KBF0)
            P1_0=0;
            break;
    }
    KBF=0;
    ///KBIIF=0; //Hardware Clear KBI Flag
}
void main(void)          //Main Function Start
{
    KBI_initialize(); //Call KBI Initial Subroutine
    while(1);
    //KBI_Disable();
}
```



Description	<ol style="list-style-type: none"> 1. KBI I/O 全部致能 Ch.0~3 高準位偵測 De-bounce 時間為 320ms 2. 當外部觸發訊號至 KBI I/O 時產生中斷，並將結果顯示於 Port1
匯編	<pre> //===== // SYNCMOS TECHNOLOGY //===== SFR KBLS = 0x93; ;Keyboard level selector register SFR KBE = 0x94; ;Keyboard input enable register SFR KBF = 0x95; ;Keyboard interrupt flag register SFR KBD = 0x96; ;de-bounce mechanism select SFR IEN0 = 0xA8; SFR IEN1 = 0xB8; SFR IRCON = 0xC0; ORG 0000H JMP BEGIN ORG 005BH JMP KBI_INT ;===== ;KBI INTERRUPT INIT ROUTINE ;===== BEGIN: MOV IEN0,#80H ;EA =1 MOV IEN1,#08H ;IEKBI =1 MOV KBD,#00H ;KBI de-bounce function and set de-bounce time is 320 ms. MOV KBLS,#0FFH ;High level detect ; MOV KBLS,#00H ;Low level detect MOV KBE,#0FFH ;KBI all pin enable MOV KBF,#00H ;KBI all flag clear JMP START ;===== ;MAIN ;===== START: JMP START ;===== ;KBI INTERRUPT ROUTINE ;===== KBI_INT: MOV P1,KBF MOV KBF,#00H ANL IRCON,#08H RETI END </pre>

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