```
.CSEG
;*********************************************
;
;    ROUTINE:  GET_KEY + [KEYPAD DIGITAL FILTER]
;                  +RISING EDGE & FALLING EDGE
;    IMPLEMENTING A MULTI-STAGE LOWPASS DFILTER
;
;    EXECUTION TIME:     Apx.  49 CYCLES
;                        16MHz ~3uS
;    CODED BY: OMID KOMPANI
;    IRAN - TEHRAN 2007/06/20  1386-03-30
;*********************************************
.DSEG

RAM_LAST_KEYPAD:                    .BYTE   1
RAM_KEYPAD_TEMP:                    .BYTE   1
RAM_KEYPAD_DFILTER_COUNTER:         .BYTE   1


.CSEG


.EQU    __KEYPAD_PULLUP=PORTE
.EQU    __KEYPAD_DDR=DDRE
.EQU    __KEYPAD_DATABUS=PINE

.DEF    TEMP,R16
.DEF    KEYPAD_TEMP=R17
.DEF    KEYPAD_IN=R18
.DEF    CURRENT_KEYPAD=R10
.DEF    KEYPAD_RISING_EDGE=R11
.DEF    KEYPAD_FALLING_EDGE=R12
.DEF    LAST_KEYPAD=R18


.EQU    __KEYPAD0=0
.EQU    __KEYPAD1=1
.EQU    __KEYPAD2=2
.EQU    __KEYPAD3=3
.EQU    __KEYPAD4=4
.EQU    __KEYPAD5=5
.EQU    __KEYPAD6=6
.EQU    __KEYPAD7=7


GET_KEY:

    CLI
    LDI     TEMP,0  ; SETS THE PORT AS INPUT
    OUT     __KEYPAD_DDR,TEMP
    SER     TEMP
    OUT     __KEYPAD_PULLUP,TEMP
    NOP
    NOP
    IN      KEYPAD_IN,__KEYPAD_DATABUS
    SEI
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    COM     KEYPAD_IN    ; BECAUSE ACTIVE MODE OF KEYPAD IS 0
                         ; FOR Ex. IF U PRESS KEY#0 THE RESULT WILL BE 11111110
                         ; AND AFTER USING COM IT WILL BE 00000001


    _8RAM2REG       RAM_KEYPAD_TEMP,R18 ;BY USING 'AND' INST. WE WILL CHECK INPUTS DURING
    AND     R18,KEYPAD_IN                    ; FILTERING PERIOD
    _8REG2RAM       RAM_KEYPAD_TEMP,R18

    _8RAM2REG       RAM_KEYPAD_DFILTER_COUNTER,R17 ;CHECK IF IT IS THE END OF FILTERING PERIOD
    INC     R17
    CPI     R17,20  ; FOR 1mS KEYPAD SCAN WE CAN USE 20 STAGE DFILTER(20mS RESPONSE TIME TO KEY PRESSING)
    BRNE    EOF_KEYPAD_DFILTER ;
    CLR     R17 ;IF IT IS THE END OF DFILTER RESET THE DFILTER COUNTER
    _8REG2RAM       RAM_KEYPAD_DFILTER_COUNTER,R17

    MOV     CURRENT_KEYPAD,R18 ;THE FILTERED RESULT

    SER     R19     ;RESET THE KEYPAD TEMP. IF SET IT TO ZERO THE RESULT ALWAYS WILL BE ZERO(BECAUSE OF ANDING)
    _8REG2RAM       RAM_KEYPAD_TEMP,R19

    _8RAM2REG       RAM_LAST_KEYPAD,LAST_KEYPAD
    MOV     TEMP,LAST_KEYPAD
; RISING EDGE GENERATOR PROCEDURE
;    I SIMULATE THE PROCEDURE FOR KEY#4(EACH STEP IS THE FILTERED RESULT)
; CONSIDER THAT KEY#4 HAS BEEN PRESSED.
;   STEP:                       1           2           3           4
;   LAST_KEYPAD:            00000000 00010000  00010000  00010000
;   CURRENT_KEYPAD:         00010000 00010000  00010000  00000000 ;KEY#4 HAS BEEN RELEASED. AFTER 4 STEPS
;    EOR LAST,CURRENT:      00010000   00000000     00000000  00010000 ;THE RESULT OF EOR PLACED IN LAST_KEYPAD
;    AND  LAST,CURRENT:     00010000 00000000  00000000  00000000 ; SO WE HAVE ONLY ONE RISING EDGE!!
    EOR     TEMP,CURRENT_KEYPAD
    AND     TEMP,CURRENT_KEYPAD
    MOV     KEYPAD_RISING_EDGE,TEMP ; IT WAS THE RISING EDGE
; FALLING EDGE GENERATOR PROCEDURE
;    I SIMULATE THE PROCEDURE FOR KEY#4(EACH STEP IS THE FILTERED RESULT)
; CONSIDER THAT KEY#4 HAS BEEN PRESSED.
;   STEP:                       1           2           3           4
;   COM LAST_KEYPAD:        11111111 11101111  11101111  11101111
;   COM CURRENT_KEYPAD:     11101111 11101111  11101111  11111111 ;KEY#4 HAS BEEN RELEASED. AFTER 4 STEPS
;    EOR LAST,CURRENT:      00010000   00000000     00000000  00010000 ;THE RESULT OF EOR PLACED IN LAST_KEYPAD
;    AND  LAST,CURRENT:     00000000 00000000  00000000  00010000 ; SO WE HAVE ONLY ONE FALLING EDGE!!

    MOV     TEMP,CURRENT_KEYPAD
    COM     LAST_KEYPAD
    COM     TEMP
    EOR     LAST_KEYPAD,TEMP
    AND     LAST_KEYPAD,TEMP
    MOV     R12,LAST_KEYPAD
    _8REG2RAM       RAM_LAST_KEYPAD,LAST_KEYPAD

    RJMP    KEY_PROCESS


EOF_KEYPAD_DFILTER:

    _8REG2RAM       RAM_KEYPAD_DFILTER_COUNTER,R17
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    RET




KEY_PROCESS:
;*********************************************************
;/////////////////////////////////////////////////////////
;    START OF KEYPAD EVENT HANDLERS
;\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\
;*********************************************************
;
;    K   KK  EEEEEEE  Y       Y
;    K  K      E           Y      Y
;    K K       E            Y   Y
;    KK        E              Y Y
;    KK        EEEEEEE         Y
;    K K       E               Y
;    K  K      E               Y
;    K  KK     E               Y
;    K     K   EEEEEEE        Y
;
;---------------------------------------
;                                      ;
;    RISING EDGE EVENT OF KEYPADS      ;
;                                      ;
;---------------------------------------

    _IF_BIT_SET_RCALL           R11,__KEYPAD0,ON_KEYPAD0_REDGE
    _IF_BIT_SET_RCALL           R11,__KEYPAD1,ON_KEYPAD1_REDGE
    _IF_BIT_SET_RCALL           R11,__KEYPAD2,ON_KEYPAD2_REDGE
    _IF_BIT_SET_RCALL           R11,__KEYPAD3,ON_KEYPAD3_REDGE
    _IF_BIT_SET_RCALL           R11,__KEYPAD4,ON_KEYPAD4_REDGE
    _IF_BIT_SET_RCALL           R11,__KEYPAD5,ON_KEYPAD5_REDGE
    _IF_BIT_SET_RCALL           R11,__KEYPAD6,ON_KEYPAD6_REDGE
    _IF_BIT_SET_RCALL           R11,__KEYPAD7,ON_KEYPAD7_REDGE

;--------------------------------
;                                      ;
; FALING EDGE EVENT OF KEYPADS  ;
;                                      ;
;--------------------------------
;    _IF_BIT_SET_RCALL          R12,__KEYPAD0,ON_KEYPAD0_FEDGE
;    _IF_BIT_SET_RCALL          R12,__KEYPAD1,ON_KEYPAD1_FEDGE
    _IF_BIT_SET_RCALL           R12,__KEYPAD2,ON_KEYPAD2_FEDGE
    _IF_BIT_SET_RCALL           R12,__KEYPAD3,ON_KEYPAD3_FEDGE
;    _IF_BIT_SET_RCALL          R12,__KEYPAD4,ON_KEYPAD4_FEDGE
    _IF_BIT_SET_RCALL           R12,__KEYPAD5,ON_KEYPAD5_FEDGE
;    _IF_BIT_SET_RCALL          R12,__KEYPAD6,ON_KEYPAD6_FEDGE
;    _IF_BIT_SET_RCALL          R12,__KEYPAD7,ON_KEYPAD7_FEDGE


;--------------------------------
;                                      ;
; KEYPAD DOWN EVENT              ;
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;                                       ;
;-------------------------------
     _IF_BIT_SET_RCALL             R10,__KEYPAD0,ON_KEYPAD0_PRESSED
     _IF_BIT_SET_RCALL             R10,__KEYPAD1,ON_KEYPAD1_PRESSED
;    _IF_BIT_SET_RCALL             R10,__KEYPAD2,ON_KEYPAD2_PRESSED
;    _IF_BIT_SET_RCALL             R10,__KEYPAD3,ON_KEYPAD3_PRESSED
     _IF_BIT_SET_RCALL             R10,__KEYPAD4,ON_KEYPAD4_PRESSED
;    _IF_BIT_SET_RCALL             R10,__KEYPAD5,ON_KEYPAD5_PRESSED
;    _IF_BIT_SET_RCALL             R10,__KEYPAD6,ON_KEYPAD6_PRESSED
;    _IF_BIT_SET_RCALL             R10,__KEYPAD7,ON_KEYPAD7_PRESSED


;-------------------------------
;                                       ;
;KEYPAD UP EVENT                   ;
;                                       ;
;-------------------------------

;    _IF_BIT_NOTSET_RCALL               R10,__KEYPAD0,ON_KEYPAD0_RELEASED
;    _IF_BIT_NOTSET_RCALL               R10,__KEYPAD1,ON_KEYPAD1_RELEASED
;    _IF_BIT_NOTSET_RCALL               R10,__KEYPAD2,ON_KEYPAD2_RELEASED
;    _IF_BIT_NOTSET_RCALL               R10,__KEYPAD3,ON_KEYPAD3_RELEASED
;    _IF_BIT_NOTSET_RCALL               R10,__KEYPAD4,ON_KEYPAD4_RELEASED
;    _IF_BIT_NOTSET_RCALL               R10,__KEYPAD5,ON_KEYPAD5_RELEASED
;    _IF_BIT_NOTSET_RCALL               R10,__KEYPAD6,ON_KEYPAD6_RELEASED
;    _IF_BIT_NOTSET_RCALL               R10,__KEYPAD7,ON_KEYPAD7_RELEASED


;*********************************************************
;/////////////////////////////////////////////////////////
;    END OF KEY PROCESS SECTION
;\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\
;*********************************************************

     RET

;-.-.-.-.-.-.-.-.-.-.-.-.-.-.-.-.-.-.-.-.-.-.-.-.-.-.-.-.-.
;*********************************************************
;/////////////////////////////////////////////////////////
;    KEYPAD ROUTINES
;\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\
;*********************************************************
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;****************************************
;***************************************
;
;    KEY#0
;
;***************************************
;****************************************
ON_KEYPAD0_REDGE:

     RET
;****************************************
;***************************************
```

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;
;    KEY#1
;
;***************************************
;***************************************
ON_KEYPAD1_REDGE:

     RET


;***************************************
;***************************************
;
;    KEY#2
;***************************************
;***************************************
ON_KEYPAD2_REDGE:


     RET
;***************************************
;***************************************
;
;
;
;***************************************
;***************************************
ON_KEYPAD3_REDGE:

     RET
;***************************************
;***************************************
;
;
;
;***************************************
;***************************************
ON_KEYPAD4_REDGE:

     RET
;***************************************
;***************************************
;
;
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;***************************************
;***************************************

ON_KEYPAD5_REDGE:


     RET
;***************************************
;***************************************
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;
;**************************************
;**************************************

ON_KEYPAD6_REDGE:

    RET
;**************************************
;**************************************
;
;
;
;
;**************************************
;**************************************

ON_KEYPAD7_REDGE:

    RET

;**************************************
;**************************************
;

ON_KEYPAD2_FEDGE:


    RET


ON_KEYPAD3_FEDGE:

    RET
;**************************************
;**************************************
ON_KEYPAD0_PRESSED:

    RET



ON_KEYPAD1_PRESSED:

    RET




ON_KEYPAD4_PRESSED:


    RET
```