

```
1  /*
2   * ic_test_ident.c
3   *
4   * Created: 3/4/2021 6:59:47 PM
5   * Author : Judah Ben-Eliezer
6   */
7
8  #define F_CPU 4000000UL
9
10 #include <avr/io.h>
11 #include <util/delay.h>
12
13 #define IN_COMB_00 0x00
14 #define IN_COMB_01 0x55
15 #define IN_COMB_10 0xAA
16 #define IN_COMB_11 0xFF
17 #define DIP_SW_gm 0xE0
18 #define START_PB_bm 0x08
19 #define BARGRAPH_gm 0x07
20 #define TIP_bm 0x04
21 #define PASS_bm 0x01
22 #define FAIL_bm 0x02
23 #define A_GATES_OUT_gm 0x1F
24 #define B_GATES_OUT_gm 0x30
25 #define PA_setup_gm 0x07
26 #define PB_setup_gm 0xCF
27 #define PC_setup_gm 0xFF
28 #define PD_setup_gm 0x07
29 #define PE_setup_gm 0x0F
30 #define PF_setup_gm 0xF7
31
32 const uint8_t stimulus[] = {IN_COMB_00, IN_COMB_01, IN_COMB_10, IN_COMB_11};
33
34 const uint8_t verify[5][4] = {{0x0F, 0x0F, 0x0F, 0x00},
35                                {0x00, 0x00, 0x00, 0x0F},
36                                {0x00, 0x0F, 0x0F, 0x0F},
37                                {0x00, 0x0F, 0x0F, 0x00},
38                                {0x0F, 0x0F, 0x0F, 0x00}};
39
40 uint8_t gate_type;
41
42 uint8_t i, j;
43
44 uint8_t test(uint8_t gate) {
45     //turn DUT pin 14 on
46     PORTE_OUT |= PIN3_bm;
47
48     for (i = 0; i < 4; ++i) {
49         PORTC_OUT = stimulus[i];
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50
51     _delay_loop_1(2);
52
53     uint8_t a_in = (PORTA_IN & A_GATES_OUT_gm) >> 3 & 0x03;
54     uint8_t b_in = (PORTB_IN & B_GATES_OUT_gm) >> 2 & 0x0C;
55
56     if (!((a_in | b_in) == verify[gate][i])) break;
57
58 }
59
60 if (i == 4) return 1;
61 else return 0;
62
63
64 }
65
66 uint8_t identify() {
67
68     for (j = 0; j < 4; ++j) {
69         if (test(j) == 1) return j;
70     }
71     //enable pullups
72     PORTA_PIN4CTRL |= PORT_PULLUPEN_bm;
73     PORTA_PIN3CTRL |= PORT_PULLUPEN_bm;
74     PORTB_PIN5CTRL |= PORT_PULLUPEN_bm;
75     PORTB_PIN4CTRL |= PORT_PULLUPEN_bm;
76     if (test(4) == 1) {
77         PORTA_PIN4CTRL &= ~PORT_PULLUPEN_bm;
78         PORTA_PIN3CTRL &= ~PORT_PULLUPEN_bm;
79         PORTB_PIN5CTRL &= ~PORT_PULLUPEN_bm;
80         PORTB_PIN4CTRL &= ~PORT_PULLUPEN_bm;
81         return 4;
82     }
83
84
85     return 7;
86 }
87
88 int main(void)
89 {
90     PORTA_DIRSET &= PA_setup_gm;
91     PORTB_DIRSET &= PB_setup_gm;
92     PORTC_DIRSET |= PC_setup_gm;
93     PORTD_DIRSET |= PD_setup_gm;
94     PORTE_DIRSET |= PE_setup_gm;
95     PORTF_DIRSET &= PF_setup_gm;
96
97     PORTA_PIN7CTRL |= PORT_PULLUPEN_bm;
98     PORTA_PIN6CTRL |= PORT_PULLUPEN_bm;
```

```
99     PORTA_PIN5CTRL |= PORT_PULLUPEN_bm;
100    PORTA_PIN4CTRL |= PORT_PULLUPEN_bm;
101    PORTA_PIN3CTRL |= PORT_PULLUPEN_bm;
102    PORTF_PIN3CTRL |= PORT_PULLUPEN_bm;
103
104    PORTD_OUT = ~BARGRAPH_gm;
105    PORTE_OUT &= ~(TIP_bm | PASS_bm | FAIL_bm);
106    _delay_ms(1000);
107    PORTD_OUT |= BARGRAPH_gm;
108    PORTE_OUT |= TIP_bm | PASS_bm | FAIL_bm;
109
110    while (1)
111    {
112        if ((PORTF_IN & START_PB_bm) != 0) continue;
113
114        PORTD_OUT = BARGRAPH_gm;
115
116        PORTE_OUT = ~TIP_bm;
117
118        gate_type = ~(PORTA_IN | 0x1F) >> 5 & 0x07;
119
120        PORTD_OUT &= ~(gate_type & BARGRAPH_gm);
121
122        if (gate_type == 0x04) {
123            //enable pullups
124            PORTA_PIN4CTRL |= PORT_PULLUPEN_bm;
125            PORTA_PIN3CTRL |= PORT_PULLUPEN_bm;
126            PORTB_PIN5CTRL |= PORT_PULLUPEN_bm;
127            PORTB_PIN4CTRL |= PORT_PULLUPEN_bm;
128            if (test(gate_type) == 1) PORTE_OUT &= ~PASS_bm;
129            else PORTE_OUT &= ~FAIL_bm;
130            PORTA_PIN4CTRL &= ~PORT_PULLUPEN_bm;
131            PORTA_PIN3CTRL &= ~PORT_PULLUPEN_bm;
132            PORTB_PIN5CTRL &= ~PORT_PULLUPEN_bm;
133            PORTB_PIN4CTRL &= ~PORT_PULLUPEN_bm;
134        } else if (gate_type == 0x07) {
135            gate_type = identify();
136        } else {
137            if (test(gate_type) == 1) PORTE_OUT &= ~PASS_bm;
138            else PORTE_OUT &= ~FAIL_bm;
139        }
140
141        PORTC_OUT = stimulus[0];
142
143        PORTE_OUT |= TIP_bm;
144
145        PORTD_OUT = ~(gate_type & BARGRAPH_gm);
146
147        //turn DUT pin 14 off
```

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```
148         PORTE_OUT &= ~PIN3_bm;
149     }
150
151     return 0;
152 }
153
154
```