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**“SPEDE”  
SPEED TEST  
FUNCTIONAL DESCRIPTION**

P/N 10001004

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## OPERATION

Speed test game consists of four non-latching colored light buttons and a four-digit 7-segment display installed in a box along with display and controller PCBs. Controller board has a buzzer to generate sound signals.

There are three modes of play: Easy Speed Test, Hard Speed Test and a Memory Game. If none of these modes is selected, game will be in demo mode. Red button will activate the display of high scores and the other three select the modes of game.

Each mode of operation and the associated states of the software will be described separately.

Player shall try to press the buttons in correct sequence after game lights them up in random sequence. Player may lag behind by maximum of 10 light flashes after the last light.

Game starts with approximately 1s delay between the light in Easy Speed test mode. Delay decreases along with increasing number of presses and game ends if the sequence becomes incorrect or maximum lag is reached.

Hard Speed test mode is similar to Easy Speed test but starts directly from 100 points (presses) with corresponding (shorter) initial delay.

Game permanently stores the high scores both for speed test and memory game.

Software is implemented using a PIC18F442 microcontroller. 4- digit 7-segment display is driven by SAA1064 which communicates via an I2C bus with the microcontroller.

Unit uses external 12VDC supply for operation.

## SOFTWARE

Software is implemented a state machine. Game is defined by a list of its states, its initial state, and the conditions for each transition.

### SOFTWARE MODULES

Module	Function
main.c	Main program, states
delays.c	delay routines
i2c.c	i2c initialization and write routines
saa1064.c	7- segment driver i2c software interface

### POWER UP SEQUENCE

After power-up needed header files are included:

```
#include <htc.h>
#include <stdlib.h>
#include "math.h"
#include "i2c.h"
#include "saa1064.h"
#include "delays.h"
#include <pic18.h>
```

Following variables and functions are defined:

```
#define MAXSTACK 10 // maximum number of pending button
presses

char next=0;
char previous = 0;
char button_stack[MAXSTACK];
char stacklevel = 0;
char current_buttons = 4;
char last_buttons = 4;
char new_press=0;
char mode=0;
bit memorygame=0;
char apu=0;

void blue(void);
void yellow(void);
void green(void);
void red(void);
void alloff(void);
void litnext(int allnew);
void litbutton(int color);
int decrease_dly(int);
int check_press(void);
int addtostack(int);

-PIC18F442 fuses are defined:

-__CONFIG (1,OSCSDIS & HS & UNPROTECT);
-__CONFIG (2,WDTDIS & BORDIS & PWRTDIS);
```

Set state machine to state 6.

## DISPLAY HIGH SCORES DEMO

State 6.

Initial state.

- Sets delay to initial value of 16000 (corresponds to approximately 1s)
- Displays "speed test high score" and "memory test high score"
- Displays "hit blue button to start easy speed test", "hit yellow button to start hard speed test", "hit green button to start memory test" and "hit red button to display high scores"
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Conditions of transition:

- After messages unconditionally sets state to 0 (Demo)

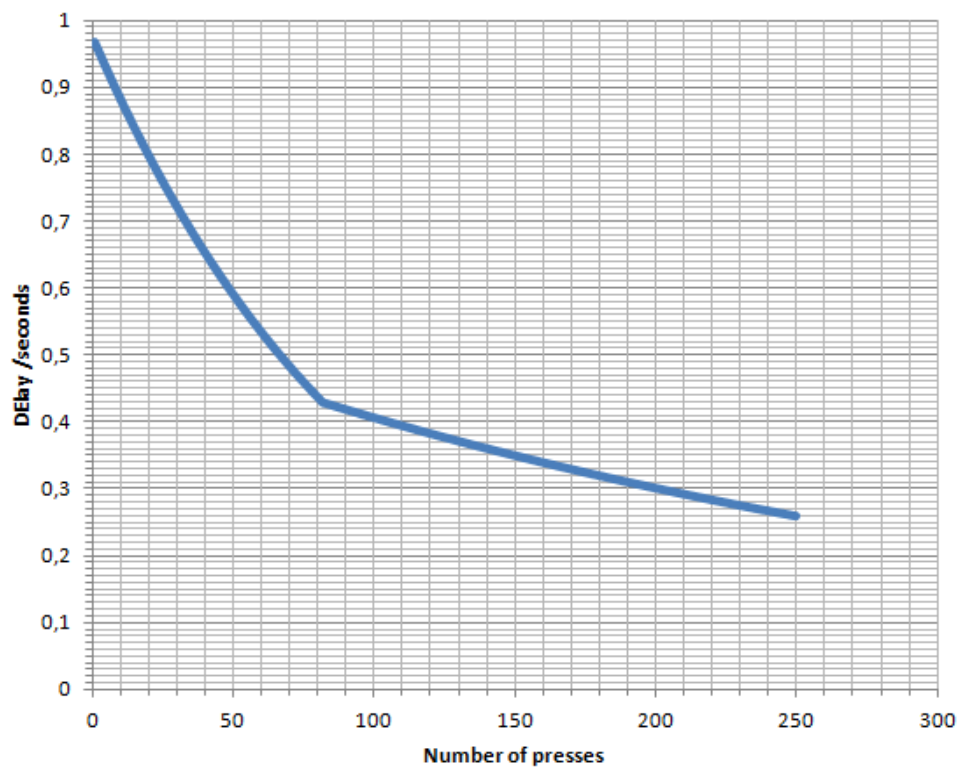
## DEMO

State 0.

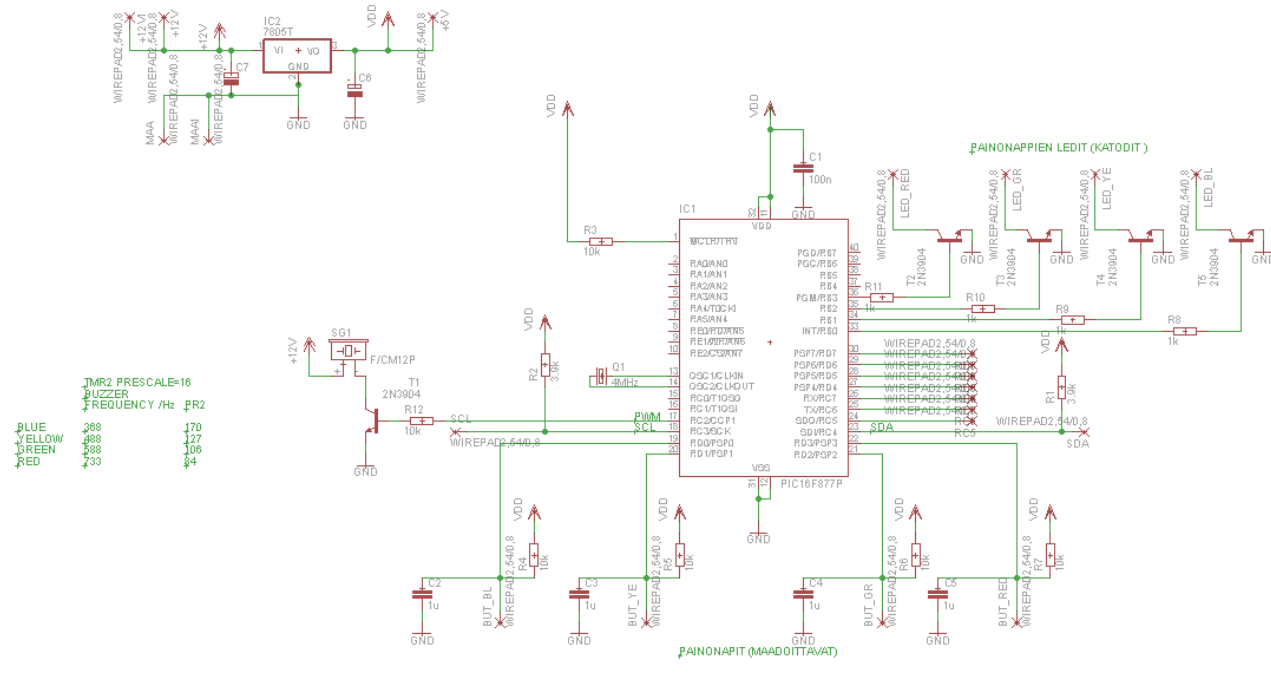
Conditions of transition

<b>GAME</b>	State 1 Conditions of transition
<b>GAME OVER</b>	State 2 Conditions of transition
<b>HIGH SCORE</b>	State 3 Conditions of transition
<b>MEMORY GAME</b>	State 4 Conditions of transition
<b>INIT</b>	State 5 Conditions of transition
<b>DELAY</b>	

**Delay between flashes as function of presses**



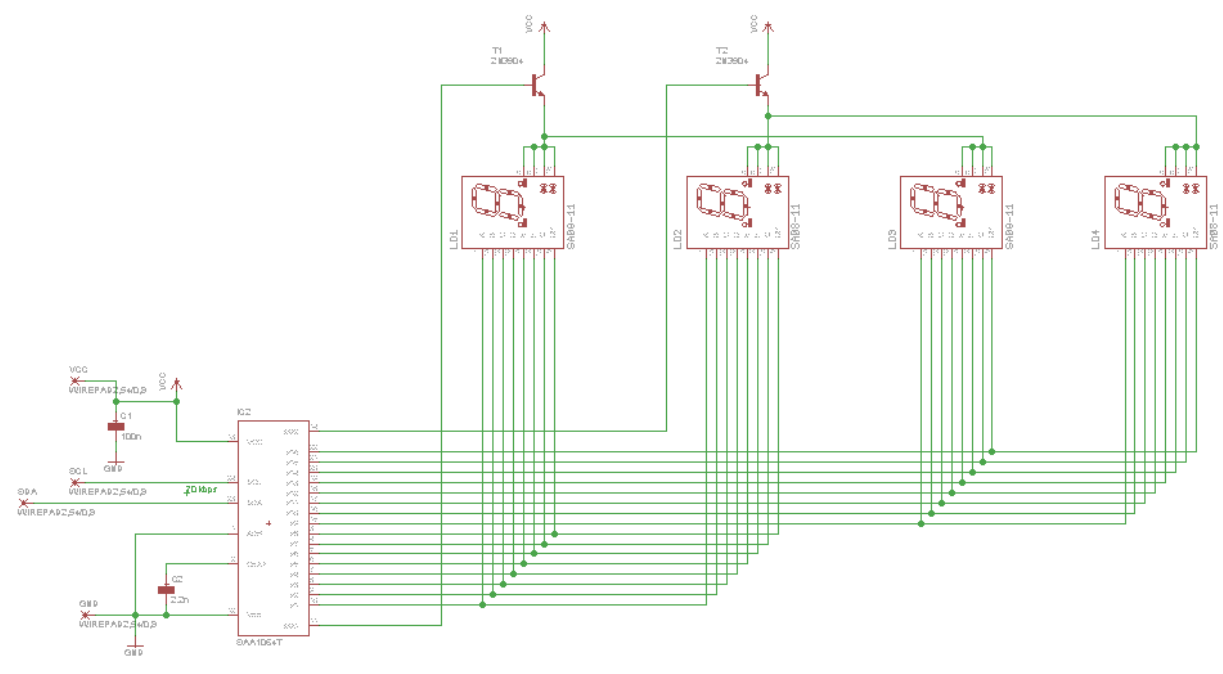
**SCHEMATIC**



```

JMR2 PRESCALE=16
BUZZER
FREQUENCY /Hz PR2
BLUE 268 170
YELLOW 488 127
GREEN 368 106
RED 733 84

```

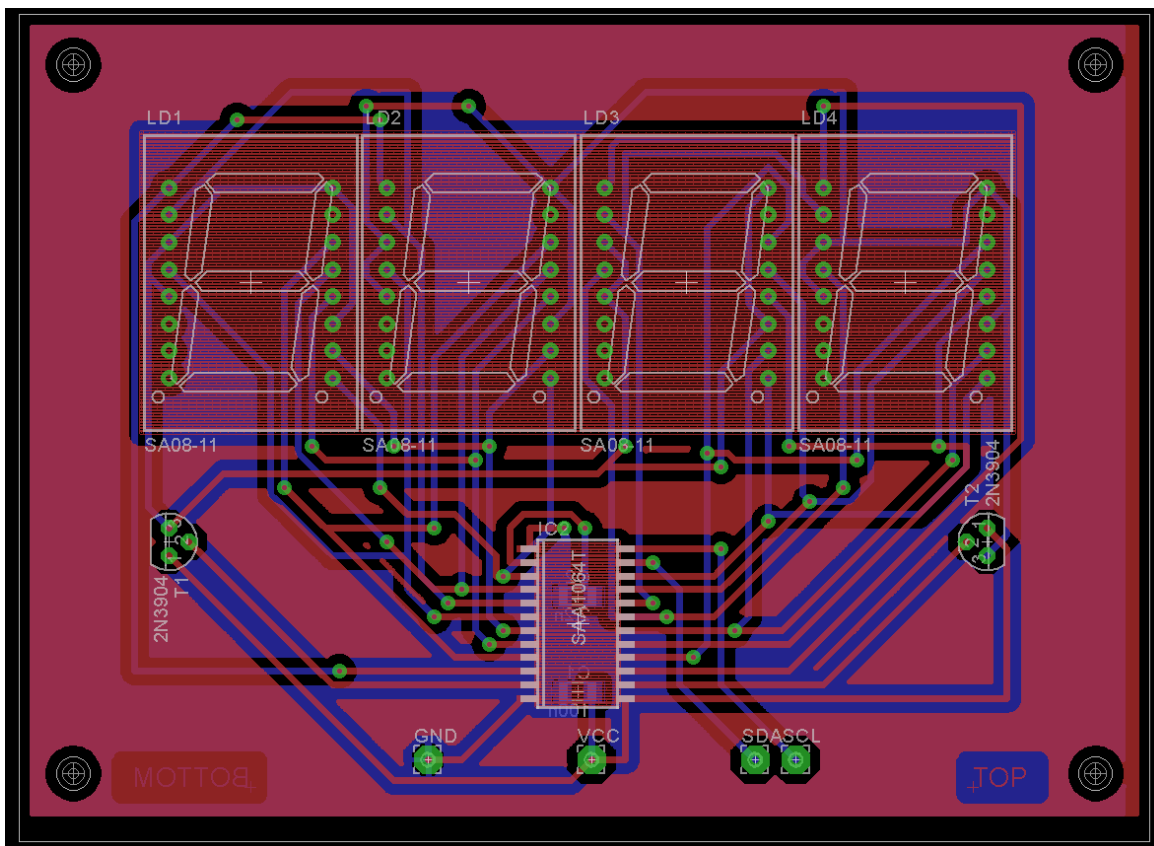


Microcontroller  
7-segment driver:

PIC18F422 DIP 40  
SAA1064T

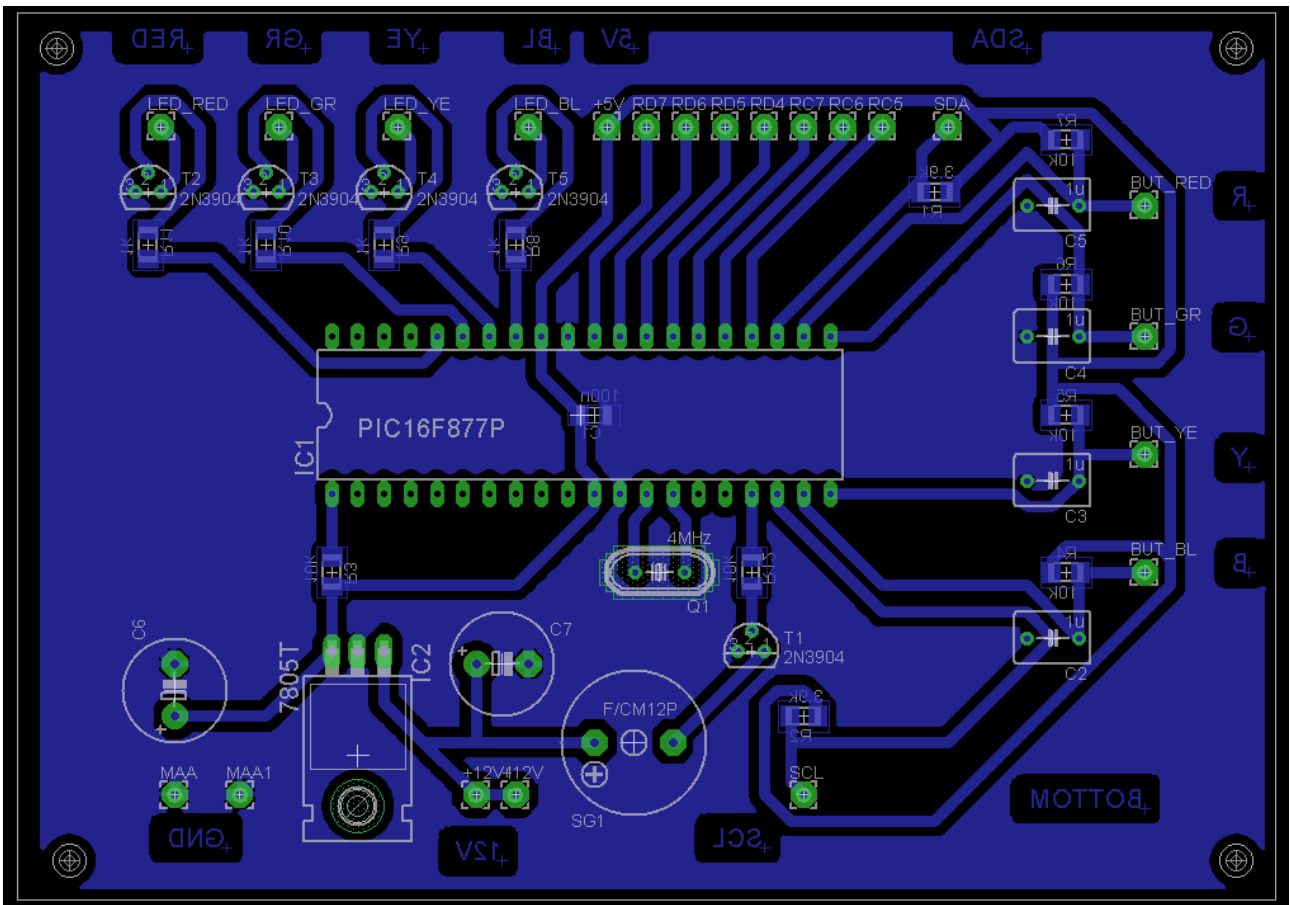
7-segment displays:	Kingbright SA08-11SRWA (Common anode)
Crystal:	4 MHz
Buzzer:	
Light buttons:	
Led lamps:	T10 base

## PCBS



## DISPLAY BOARD TERMINALS

VCC:	5V supply to display board
GND:	Ground
SCL:	I2C signal clock
SDA:	I2C signal data



### CONTROLLER BOARD TERMINALS

12V:	+12V supply to controller board and led lamp anodes
5V:	5V supply to display board
GND:	Ground
SCL:	I2C signal clock
SDA:	I2C signal data
LED_RED,-LED_BL:	Light button led lamp cathodes, lamps have internal current limit resistors
BUT_RED-BUT_BL:	Light button switches, NO, Commons connected to GND



		Yksikkö
ÄÄRIMITAT (p x l x k)	55 x 71.9 x 26	mm
PAINO	100	g
SYÖTTÖJÄNNITE:	12	VDC
MAX VIRTÄ (jatkuva, per puoli)		A
MAX TEHO	3	W
MIKROKONTROLLERI / OHJELMAVERSIO	PIC18F442	31.12.2017
SOFTWARE DEVELOPMENT PLATFORM/ LANGUAGE	MPLAB IDE/ HITECH C-compiler	