

Lab7_Cache

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Chapter 1

README

In this lab, the speed of program execution is increased by speeding up the memory system. To evaluate the performance of the processor and the memory system, a program is used that adds all the elements of the two-dimensional array of integers located in the static RAM. The array sizes are defined by the parameters NUM_ROWS and NUM_COLS. A prefetch module is used.

Chapter 2

File Index

2.1 File List

Here is a list of all files with brief descriptions:

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Chapter 3

File Documentation

3.1 D:/GIT/TheConnectedMCU_Labs/bkarachok/Lab7_Cache/ChrFont0.c File Reference

```
#include <stdint.h>
#include "OLED.h"
```

Variables

- const `BYTE` `rgbOledFont0` []

3.1.1 Variable Documentation

3.1.1.1 `rgbOledFont0`

```
const BYTE rgbOledFont0 []
```

3.2 D:/GIT/TheConnectedMCU_Labs/bkarachok/Lab7_Cache/configuration_bits.c File Reference

3.3 D:/GIT/TheConnectedMCU_Labs/bkarachok/Lab7_Cache/FillPat.c File Reference

```
#include <stdint.h>
#include "OLED.h"
```

Variables

- const [BYTE](#) [rgbFillPat](#) []

3.3.1 Variable Documentation

3.3.1.1 [rgbFillPat](#)

```
const BYTE rgbFillPat []
```

Initial value:

```
= {
    0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
    0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF, 0xFF,
    0xAA, 0x55, 0xAA, 0x55, 0xAA, 0x55, 0xAA, 0x55,
    0x11, 0x44, 0x00, 0x11, 0x44, 0x00, 0x11, 0x44,
    0x92, 0x45, 0x24, 0x92, 0x45, 0x24, 0x92, 0x45,
    0x49, 0x92, 0x24, 0x49, 0x92, 0x24, 0x49, 0x92,
    0x22, 0x11, 0x22, 0x00, 0x22, 0x11, 0x22, 0x00,
    0x11, 0x22, 0x11, 0x00, 0x11, 0x22, 0x11, 0x00
}
```

3.4 D:/GIT/TheConnectedMCU_Labs/bkarachok/Lab7_Cache/main.c File Reference

```
#include <stdint.h>
#include <stdbool.h>
#include "user.h"
```

Functions

- unsigned [Timed_Array_Test_CR](#) (int nr, int nc, int a[][nc], int *ret_sum)
- unsigned [Timed_Array_Test_RC](#) (int nr, int nc, int a[][nc], int *ret_sum)
- int [Pollute_Cache](#) (void)
- int32_t [main](#) (void)

Variables

- int [dummy](#) [D_CACHE_SIZE/sizeof(int)]
- int [aa](#) [NUM_ROWS][NUM_COLS]

3.4.1 Function Documentation

3.4.1.1 main()

```
int32_t main (
    void )
```

3.4.1.2 Pollute_Cache()

```
int Pollute_Cache (
    void )
```

3.4.1.3 Timed_Array_Test_CR()

```
unsigned Timed_Array_Test_CR (
    int nr,
    int nc,
    int a[][nc],
    int * ret_sum )
```

3.4.1.4 Timed_Array_Test_RC()

```
unsigned Timed_Array_Test_RC (
    int nr,
    int nc,
    int a[][nc],
    int * ret_sum )
```

3.4.2 Variable Documentation

3.4.2.1 aa

```
int aa[NUM_ROWS][NUM_COLS]
```

3.4.2.2 dummy

```
int dummy[D_CACHE_SIZE/sizeof(int)]
```

3.5 D:/GIT/TheConnectedMCU_Labs/bkarachok/Lab7_Cache/OLED.c File Reference

```
#include "OLED.h"  
#include "user.h"
```

Macros

- `#define cmdOledDisplayOn 0xAF`
- `#define cmdOledDisplayOff 0xAE`
- `#define cmdOledSegRemap 0xA1`
- `#define cmdOledComDir 0xC8`
- `#define cmdOledComConfig 0xDA`

Functions

- `void OledHostInit ()`
- `void OledDsplInit ()`
- `void OledDvrlInit ()`
- `void OledUpdate ()`
- `void OledHostTerm ()`
- `void OledDevTerm ()`
- `void OledInit ()`

Variables

- `BYTE rgbOledFont0 []`
- `BYTE rgbOledFontUser []`
- `BYTE rgbFillPat []`
- `int xchOledMax`
- `int ychOledMax`
- `int xcoOledCur`
- `int ycoOledCur`
- `BYTE * pbOledCur`
- `int bnOledCur`
- `BYTE clrOledCur`
- `BYTE * pbOledPatCur`
- `int fOledCharUpdate`
- `int dxcoOledFontCur`
- `int dycoOledFontCur`
- `BYTE * pbOledFontCur`
- `BYTE * pbOledFontUser`

3.5.1 Macro Definition Documentation

3.5.1.1 cmdOledComConfig

```
#define cmdOledComConfig 0xDA
```

3.5.1.2 cmdOledComDir

```
#define cmdOledComDir 0xC8
```

3.5.1.3 cmdOledDisplayOff

```
#define cmdOledDisplayOff 0xAE
```

3.5.1.4 cmdOledDisplayOn

```
#define cmdOledDisplayOn 0xAF
```

3.5.1.5 cmdOledSegRemap

```
#define cmdOledSegRemap 0xA1
```

3.5.2 Function Documentation

3.5.2.1 OledDevTerm()

```
void OledDevTerm ( )
```

3.5.2.2 OledDspInit()

```
void OledDspInit ( )
```

3.5.2.3 OledDvrInit()

```
void OledDvrInit ( )
```

3.5.2.4 OledHostInit()

```
void OledHostInit ( )
```

Function:

Summary:

Description:

Remarks:

3.5.2.5 OledHostTerm()

```
void OledHostTerm ( )
```

3.5.2.6 OledInit()

```
void OledInit ( )
```

Function prototype:

Summary:

Description:

Precondition:

Parameters:

Returns:

Example:

Remarks:

3.5.2.7 OledUpdate()

```
void OledUpdate ( )
```

3.5.3 Variable Documentation

3.5.3.1 bnOledCur

```
int bnOledCur
```

3.5.3.2 clrOledCur

```
BYTE clrOledCur
```

3.5.3.3 dxcoOledFontCur

```
int dxcoOledFontCur
```

3.5.3.4 dycoOledFontCur

```
int dycoOledFontCur
```

3.5.3.5 fOledCharUpdate

```
int fOledCharUpdate
```

3.5.3.6 pbOledCur

```
BYTE* pbOledCur
```

3.5.3.7 pbOledFontCur

```
BYTE* pbOledFontCur
```

3.5.3.8 pbOledFontUser

`BYTE* pbOledFontUser`

3.5.3.9 pbOledPatCur

`BYTE* pbOledPatCur`

3.5.3.10 rgbFillPat

`BYTE rgbFillPat[]`

3.5.3.11 rgbOledFont0

`BYTE rgbOledFont0[]`

3.5.3.12 rgbOledFontUser

`BYTE rgbOledFontUser[]`

3.5.3.13 xchOledMax

`int xchOledMax`

3.5.3.14 xcoOledCur

`int xcoOledCur`

3.5.3.15 ychOledMax

`int ychOledMax`

3.5.3.16 ycoOledCur

```
int ycoOledCur
```

3.6 D:/GIT/TheConnectedMCU_Labs/bkarachok/Lab7_Cache/OLED.h File Reference

```
#include <xc.h>
#include <stdint.h>
```

Macros

- #define [MASK\(x\)](#) (1<<(x))
- #define [prtVddCtrl](#) PORTD
- #define [bitVddCtrl](#) [MASK\(12\)](#)
- #define [prtVbatCtrl](#) PORTD
- #define [bitVbatCtrl](#) [MASK\(15\)](#)
- #define [prtDataCmd](#) PORTD
- #define [bitDataCmd](#) [MASK\(14\)](#)
- #define [prtReset](#) PORTG
- #define [bitReset](#) [MASK\(9\)](#)
- #define [cbOledDispMax](#) 512
- #define [ccolOledMax](#) 128
- #define [crowOledMax](#) 32
- #define [cpagOledMax](#) 4
- #define [cbOledChar](#) 8
- #define [chOledUserMax](#) 0x20
- #define [cbOledFontUser](#) ([chOledUserMax](#)*[cbOledChar](#))
- #define [modOledSet](#) 0
- #define [modOledOr](#) 1
- #define [modOledAnd](#) 2
- #define [modOledXor](#) 3

Typedefs

- typedef uint8_t [BYTE](#)

Functions

- void [OledInit](#) ()
- void [OledDvrlInit](#) ()
- void [OledTerm](#) ()
- void [OledDisplayOn](#) ()
- void [OledDisplayOff](#) ()
- void [OledClear](#) ()
- void [OledClearBuffer](#) ()
- void [OledUpdate](#) ()

Variables

- `BYTE rgbOledBmp [cbOledDispMax]`

3.6.1 Macro Definition Documentation

3.6.1.1 bitDataCmd

```
#define bitDataCmd MASK(14)
```

3.6.1.2 bitReset

```
#define bitReset MASK(9)
```

3.6.1.3 bitVbatCtrl

```
#define bitVbatCtrl MASK(15)
```

3.6.1.4 bitVddCtrl

```
#define bitVddCtrl MASK(12)
```

3.6.1.5 cbOledChar

```
#define cbOledChar 8
```

3.6.1.6 cbOledDispMax

```
#define cbOledDispMax 512
```


3.6.1.7 cbOledFontUser

```
#define cbOledFontUser (chOledUserMax*cbOledChar)
```

3.6.1.8 ccolOledMax

```
#define ccolOledMax 128
```

3.6.1.9 chOledUserMax

```
#define chOledUserMax 0x20
```

3.6.1.10 cpagOledMax

```
#define cpagOledMax 4
```

3.6.1.11 crowOledMax

```
#define crowOledMax 32
```

3.6.1.12 MASK

```
#define MASK(  
    x ) (1<<(x))
```

3.6.1.13 modOledAnd

```
#define modOledAnd 2
```

3.6.1.14 modOledOr

```
#define modOledOr 1
```

3.6.1.15 modOledSet

```
#define modOledSet 0
```

3.6.1.16 modOledXor

```
#define modOledXor 3
```

3.6.1.17 prtDataCmd

```
#define prtDataCmd PORTD
```

3.6.1.18 prtReset

```
#define prtReset PORTG
```

3.6.1.19 prtVbatCtrl

```
#define prtVbatCtrl PORTD
```

3.6.1.20 prtVddCtrl

```
#define prtVddCtrl PORTD
```

3.6.2 Typedef Documentation

3.6.2.1 BYTE

```
typedef uint8_t BYTE
```

3.6.3 Function Documentation

3.6.3.1 OledClear()

```
void OledClear ( )
```

3.6.3.2 OledClearBuffer()

```
void OledClearBuffer ( )
```

3.6.3.3 OledDisplayOff()

```
void OledDisplayOff ( )
```

3.6.3.4 OledDisplayOn()

```
void OledDisplayOn ( )
```

3.6.3.5 OledDvrInit()

```
void OledDvrInit ( )
```

3.6.3.6 OledInit()

```
void OledInit ( )
```

Function prototype:

Summary:

Description:

Precondition:

Parameters:

Returns:

Example:

Remarks:

3.6.3.7 OledTerm()

```
void OledTerm ( )
```

3.6.3.8 OledUpdate()

```
void OledUpdate ( )
```

3.6.4 Variable Documentation

3.6.4.1 rgbOledBmp

```
BYTE rgbOledBmp[cbOledDispMax]
```

3.7 D:/GIT/TheConnectedMCU_Labs/bkarachok/Lab7_Cache/OledChar.c File Reference

```
#include <inttypes.h>
#include "OLED.h"
#include "OledChar.h"
#include "OledGrph.h"
```

Functions

- void `OledDrawGlyph` (char ch)
- void `OledAdvanceCursor` ()
- void `OledSetCursor` (int xch, int ych)
- void `OledGetCursor` (int *pxch, int *pych)
- int `OledDefUserChar` (char ch, BYTE *pbDef)
- void `OledSetCharUpdate` (int f)
- int `OledGetCharUpdate` ()
- void `OledPutChar` (char ch)
- void `OledPutString` (char *sz)

Variables

- int `xcoOledCur`
- int `ycoOledCur`
- BYTE * `pbOledCur`
- BYTE `mskOledCur`
- int `bnOledCur`
- int `fOledCharUpdate`
- BYTE `rgbOledBmp` []
- int `dxcoOledFontCur`
- int `dycoOledFontCur`
- BYTE * `pbOledFontCur`
- BYTE * `pbOledFontUser`
- int `xchOledCur`
- int `ychOledCur`
- int `xchOledMax`
- int `ychOledMax`
- BYTE * `pbOledFontExt`
- BYTE `rgbOledFontUser` [`cbOledFontUser`]

3.7.1 Function Documentation

3.7.1.1 `OledAdvanceCursor()`

```
void OledAdvanceCursor ( )
```

3.7.1.2 `OledDefUserChar()`

```
int OledDefUserChar (
    char ch,
    BYTE * pbDef )
```

3.7.1.3 OledDrawGlyph()

```
void OledDrawGlyph (
    char ch )
```

3.7.1.4 OledGetCharUpdate()

```
int OledGetCharUpdate ( )
```

3.7.1.5 OledGetCursor()

```
void OledGetCursor (
    int * pxch,
    int * pych )
```

3.7.1.6 OledPutChar()

```
void OledPutChar (
    char ch )
```

3.7.1.7 OledPutString()

```
void OledPutString (
    char * sz )
```

3.7.1.8 OledSetCharUpdate()

```
void OledSetCharUpdate (
    int f )
```

3.7.1.9 OledSetCursor()

```
void OledSetCursor (
    int xch,
    int ych )
```

3.7.2 Variable Documentation

3.7.2.1 bnOledCur

```
int bnOledCur
```

3.7.2.2 dxcoOledFontCur

```
int dxcoOledFontCur
```

3.7.2.3 dycoOledFontCur

```
int dycoOledFontCur
```

3.7.2.4 fOledCharUpdate

```
int fOledCharUpdate
```

3.7.2.5 mskOledCur

```
BYTE mskOledCur
```

3.7.2.6 pbOledCur

```
BYTE* pbOledCur
```

3.7.2.7 pbOledFontCur

```
BYTE* pbOledFontCur
```

3.7.2.8 pbOledFontExt

`BYTE* pbOledFontExt`

3.7.2.9 pbOledFontUser

`BYTE* pbOledFontUser`

3.7.2.10 rgbOledBmp

`BYTE rgbOledBmp[]`

3.7.2.11 rgbOledFontUser

`BYTE rgbOledFontUser[cbOledFontUser]`

3.7.2.12 xchOledCur

`int xchOledCur`

3.7.2.13 xchOledMax

`int xchOledMax`

3.7.2.14 xcoOledCur

`int xcoOledCur`

3.7.2.15 ychOledCur

`int ychOledCur`

3.7.2.16 ychOledMax

```
int ychOledMax
```

3.7.2.17 ycoOledCur

```
int ycoOledCur
```

3.8 D:/GIT/TheConnectedMCU_Labs/bkarachok/Lab7_Cache/OledChar.h File Reference

Functions

- void [OledSetCursor](#) (int xch, int ych)
- void [OledGetCursor](#) (int *pxcy, int *pych)
- int [OledDefUserChar](#) (char ch, uint8_t *pbDef)
- void [OledSetCharUpdate](#) (int f)
- int [OledGetCharUpdate](#) ()
- void [OledPutChar](#) (char ch)
- void [OledPutString](#) (char *sz)

3.8.1 Function Documentation

3.8.1.1 OledDefUserChar()

```
int OledDefUserChar (  
    char ch,  
    uint8_t * pbDef )
```

3.8.1.2 OledGetCharUpdate()

```
int OledGetCharUpdate ( )
```

3.8.1.3 OledGetCursor()

```
void OledGetCursor (  
    int * pxcy,  
    int * pych )
```

3.8.1.4 OledPutChar()

```
void OledPutChar (
    char ch )
```

3.8.1.5 OledPutString()

```
void OledPutString (
    char * sz )
```

3.8.1.6 OledSetCharUpdate()

```
void OledSetCharUpdate (
    int f )
```

3.8.1.7 OledSetCursor()

```
void OledSetCursor (
    int xch,
    int ych )
```

3.9 D:/GIT/TheConnectedMCU_Labs/bkarachok/Lab7_Cache/OledGrph.c File Reference

```
#include <stdint.h>
#include "OLED.h"
```

Functions

- void [OledMoveDown](#) ()
- void [OledMoveUp](#) ()
- void [OledMoveRight](#) ()
- void [OledMoveLeft](#) ()
- [BYTE OledRopSet](#) ([BYTE bPix](#), [BYTE bDsp](#), [BYTE mskPix](#))
- [BYTE OledRopOr](#) ([BYTE bPix](#), [BYTE bDsp](#), [BYTE mskPix](#))
- [BYTE OledRopAnd](#) ([BYTE bPix](#), [BYTE bDsp](#), [BYTE mskPix](#))
- [BYTE OledRopXor](#) ([BYTE bPix](#), [BYTE bDsp](#), [BYTE mskPix](#))
- int [OledClampXco](#) (int xco)
- int [OledClampYco](#) (int yco)
- void [OledMoveTo](#) (int xco, int yco)
- void [OledGetPos](#) (int *pxco, int *pyco)
- void [OledSetDrawColor](#) ([BYTE clr](#))

- `BYTE * OledGetStdPattern` (int ipat)
- `void OledSetFillPattern` (BYTE *pbPat)
- `void OledSetDrawMode` (int mod)
- `int OledGetDrawMode` ()
- `void OledDrawPixel` ()
- `BYTE OledGetPixel` ()
- `void OledLineTo` (int xco, int yco)
- `void OledDrawRect` (int xco, int yco)
- `void OledFillRect` (int xco, int yco)
- `void OledGetBmp` (int dxco, int dyco, BYTE *pbBits)
- `void OledPutBmp` (int dxco, int dyco, BYTE *pbBits)
- `void OledDrawChar` (char ch)
- `void OledDrawString` (char *sz)

Variables

- `int xcoOledCur`
- `int ycoOledCur`
- `BYTE * pbOledCur`
- `BYTE rgbOledBmp []`
- `BYTE rgbFillPat []`
- `int bnOledCur`
- `BYTE clrOledCur`
- `BYTE * pbOledPatCur`
- `BYTE * pbOledFontUser`
- `BYTE * pbOledFontCur`
- `int dxcoOledFontCur`
- `int dycoOledFontCur`
- `BYTE(* pfnDoRop)(BYTE bPix, BYTE bDsp, BYTE mskPix)`
- `int modOledCur`

3.9.1 Function Documentation

3.9.1.1 OledClampXco()

```
int OledClampXco (  
    int xco )
```

3.9.1.2 OledClampYco()

```
int OledClampYco (  
    int yco )
```

3.9.1.3 OledDrawChar()

```
void OledDrawChar (
    char ch )
```

3.9.1.4 OledDrawPixel()

```
void OledDrawPixel ( )
```

3.9.1.5 OledDrawRect()

```
void OledDrawRect (
    int xco,
    int yco )
```

3.9.1.6 OledDrawString()

```
void OledDrawString (
    char * sz )
```

3.9.1.7 OledFillRect()

```
void OledFillRect (
    int xco,
    int yco )
```

3.9.1.8 OledGetBmp()

```
void OledGetBmp (
    int dxco,
    int dyco,
    BYTE * pbBits )
```

3.9.1.9 OledGetDrawMode()

```
int OledGetDrawMode ( )
```

3.9.1.10 OledGetPixel()

```
BYTE OledGetPixel ( )
```

3.9.1.11 OledGetPos()

```
void OledGetPos (
    int * pxco,
    int * pyco )
```

3.9.1.12 OledGetStdPattern()

```
BYTE* OledGetStdPattern (
    int ipat )
```

3.9.1.13 OledLineTo()

```
void OledLineTo (
    int xco,
    int yco )
```

3.9.1.14 OledMoveDown()

```
void OledMoveDown ( )
```

3.9.1.15 OledMoveLeft()

```
void OledMoveLeft ( )
```

3.9.1.16 OledMoveRight()

```
void OledMoveRight ( )
```

3.9.1.17 OledMoveTo()

```
void OledMoveTo (
    int xco,
    int yco )
```

3.9.1.18 OledMoveUp()

```
void OledMoveUp ( )
```

3.9.1.19 OledPutBmp()

```
void OledPutBmp (
    int dxco,
    int dyco,
    BYTE * pbBits )
```

3.9.1.20 OledRopAnd()

```
BYTE OledRopAnd (
    BYTE bPix,
    BYTE bDsp,
    BYTE msKPix )
```

3.9.1.21 OledRopOr()

```
BYTE OledRopOr (
    BYTE bPix,
    BYTE bDsp,
    BYTE msKPix )
```

3.9.1.22 OledRopSet()

```
BYTE OledRopSet (
    BYTE bPix,
    BYTE bDsp,
    BYTE mskPix )
```

3.9.1.23 OledRopXor()

```
BYTE OledRopXor (
    BYTE bPix,
    BYTE bDsp,
    BYTE mskPix )
```

3.9.1.24 OledSetDrawColor()

```
void OledSetDrawColor (
    BYTE clr )
```

3.9.1.25 OledSetDrawMode()

```
void OledSetDrawMode (
    int mod )
```

3.9.1.26 OledSetFillPattern()

```
void OledSetFillPattern (
    BYTE * pbPat )
```

3.9.2 Variable Documentation

3.9.2.1 bnOledCur

```
int bnOledCur
```

3.9.2.2 clrOledCur

BYTE clrOledCur

3.9.2.3 dxcoOledFontCur

int dxcoOledFontCur

3.9.2.4 dycoOledFontCur

int dycoOledFontCur

3.9.2.5 modOledCur

int modOledCur

3.9.2.6 pbOledCur

BYTE* pbOledCur

3.9.2.7 pbOledFontCur

BYTE* pbOledFontCur

3.9.2.8 pbOledFontUser

BYTE* pbOledFontUser

3.9.2.9 pbOledPatCur

BYTE* pbOledPatCur

3.9.2.10 pfnDoRop

```
BYTE (* pfnDoRop) (BYTE bPix, BYTE bDsp, BYTE mskPix)
```

3.9.2.11 rgbFillPat

```
BYTE rgbFillPat[ ]
```

3.9.2.12 rgbOledBmp

```
BYTE rgbOledBmp[ ]
```

3.9.2.13 xcoOledCur

```
int xcoOledCur
```

3.9.2.14 ycoOledCur

```
int ycoOledCur
```

3.10 D:/GIT/TheConnectedMCU_Labs/bkarachok/Lab7_Cache/OledGrph.h File Reference

Functions

- void [OledSetDrawColor](#) (uint8_t clr)
- void [OledSetDrawMode](#) (int mod)
- int [OledGetDrawMode](#) ()
- uint8_t * [OledGetStdPattern](#) (int ipat)
- void [OledSetFillPattern](#) (uint8_t *pbPat)
- void [OledMoveTo](#) (int xco, int yco)
- void [OledGetPos](#) (int *pxco, int *pyco)
- void [OledDrawPixel](#) ()
- uint8_t [OledGetPixel](#) ()
- void [OledLineTo](#) (int xco, int yco)
- void [OledDrawRect](#) (int xco, int yco)
- void [OledFillRect](#) (int xco, int yco)
- void [OledGetBmp](#) (int dxco, int dyco, uint8_t *pbBmp)
- void [OledPutBmp](#) (int dxco, int dyco, uint8_t *pbBmp)
- void [OledDrawChar](#) (char ch)
- void [OledDrawString](#) (char *sz)

3.10.1 Function Documentation

3.10.1.1 OledDrawChar()

```
void OledDrawChar (
    char ch )
```

3.10.1.2 OledDrawPixel()

```
void OledDrawPixel ( )
```

3.10.1.3 OledDrawRect()

```
void OledDrawRect (
    int xco,
    int yco )
```

3.10.1.4 OledDrawString()

```
void OledDrawString (
    char * sz )
```

3.10.1.5 OledFillRect()

```
void OledFillRect (
    int xco,
    int yco )
```

3.10.1.6 OledGetBmp()

```
void OledGetBmp (
    int dxco,
    int dyco,
    uint8_t * pbBmp )
```

3.10.1.7 OledGetDrawMode()

```
int OledGetDrawMode ( )
```

3.10.1.8 OledGetPixel()

```
uint8_t OledGetPixel ( )
```

3.10.1.9 OledGetPos()

```
void OledGetPos (
    int * pxco,
    int * pyco )
```

3.10.1.10 OledGetStdPattern()

```
uint8_t* OledGetStdPattern (
    int ipat )
```

3.10.1.11 OledLineTo()

```
void OledLineTo (
    int xco,
    int yco )
```

3.10.1.12 OledMoveTo()

```
void OledMoveTo (
    int xco,
    int yco )
```

3.10.1.13 OledPutBmp()

```
void OledPutBmp (
    int dxco,
    int dyco,
    uint8_t * pbBmp )
```

3.10.1.14 OledSetDrawColor()

```
void OledSetDrawColor (
    uint8_t clr )
```

3.10.1.15 OledSetDrawMode()

```
void OledSetDrawMode (
    int mod )
```

3.10.1.16 OledSetFillPattern()

```
void OledSetFillPattern (
    uint8_t * pbPat )
```

3.11 D:/GIT/TheConnectedMCU_Labs/bkarachok/Lab7_Cache/README.md File Reference

3.12 D:/GIT/TheConnectedMCU_Labs/bkarachok/Lab7_Cache/SPI.c File Reference

```
#include <stdint.h>
#include "OLED.h"
```

Functions

- void [OledPutBuffer](#) (int cb, [BYTE](#) *rgbTx)
- [BYTE](#) [Spi2PutByte](#) ([BYTE](#) bVal)

3.12.1 Function Documentation

3.12.1.1 OledPutBuffer()

```
void OledPutBuffer (
    int cb,
    BYTE * rgbTx )
```

Function:

Summary:

Description:

Remarks:

3.12.1.2 Spi2PutByte()

```
BYTE Spi2PutByte (
    BYTE bVal )
```

3.13 D:/GIT/TheConnectedMCU_Labs/bkarachok/Lab7_Cache/user.c File Reference

```
#include <stdint.h>
#include <stdbool.h>
#include "user.h"
#include <sys/attrs.h>
```

Functions

- void [DelayMs](#) (int t)
- void [InitGPIO](#) (void)
- void [InitBIOS](#) (void)
- void [InitTimer2](#) (void)
- void [InitApp](#) (void)

3.13.1 Function Documentation

3.13.1.1 DelayMs()

```
void DelayMs (
    int t )
```

3.13.1.2 InitApp()

```
void InitApp (
    void )
```

3.13.1.3 InitBIOS()

```
void InitBIOS (
    void )
```

3.13.1.4 InitGPIO()

```
void InitGPIO (
    void )
```

3.13.1.5 InitTimer2()

```
void InitTimer2 (
    void )
```

3.14 D:/GIT/TheConnectedMCU_Labs/bkarachok/Lab7_Cache/user.h File Reference

```
#include <stdint.h>
```

Macros

- `#define LD1_PORT_BIT` LATGbits.LATG6
- `#define LD2_PORT_BIT` LATDbits.LATD4
- `#define LD3_PORT_BIT` LATBbits.LATB11
- `#define LD4_PORT_BIT` LATGbits.LATG15
- `#define BTN1_PORT_BIT` PORTAbits.RA5
- `#define BTN2_PORT_BIT` PORTAbits.RA4
- `#define CPU_TEMP_ADC_CHANNEL` (42)
- `#define BIOS_LD1_PORT_BIT` LATEbits.LATE0
- `#define BIOS_LD2_PORT_BIT` LATEbits.LATE1
- `#define BIOS_LD3_PORT_BIT` LATEbits.LATE2
- `#define BIOS_LD4_PORT_BIT` LATEbits.LATE3
- `#define BIOS_LD5_PORT_BIT` LATEbits.LATE4
- `#define BIOS_LD6_PORT_BIT` LATEbits.LATE5
- `#define BIOS_LD7_PORT_BIT` LATEbits.LATE6
- `#define BIOS_LD8_PORT_BIT` LATEbits.LATE7
- `#define BIOS_BTN1_PORT_BIT` PORTGbits.RG7
- `#define BIOS_BTN2_PORT_BIT` PORTDbits.RD5
- `#define BIOS_BTN3_PORT_BIT` PORTFbits.RF1
- `#define BIOS_BTN4_PORT_BIT` PORTAbits.RA2
- `#define BIOS_SW1_PORT_BIT` PORTEbits.RE8
- `#define BIOS_SW2_PORT_BIT` PORTEbits.RE9
- `#define BIOS_SW3_PORT_BIT` PORTAbits.RA14
- `#define BIOS_SW4_PORT_BIT` PORTCbits.RC1

Functions

- void `InitApp` (void)
- void `DelayMs` (int t)
- int `Timing_Test_Code` (int *a, int *b, int len)

3.14.1 Macro Definition Documentation

3.14.1.1 BIOS_BTN1_PORT_BIT

```
#define BIOS_BTN1_PORT_BIT PORTGbits.RG7
```

3.14.1.2 BIOS_BTN2_PORT_BIT

```
#define BIOS_BTN2_PORT_BIT PORTDbits.RD5
```

3.14.1.3 BIOS_BTN3_PORT_BIT

```
#define BIOS_BTN3_PORT_BIT PORTFbits.RF1
```

3.14.1.4 BIOS_BTN4_PORT_BIT

```
#define BIOS_BTN4_PORT_BIT PORTAbits.RA2
```

3.14.1.5 BIOS_LD1_PORT_BIT

```
#define BIOS_LD1_PORT_BIT LATEbits.LATE0
```

3.14.1.6 BIOS_LD2_PORT_BIT

```
#define BIOS_LD2_PORT_BIT LATEbits.LATE1
```

3.14.1.7 BIOS_LD3_PORT_BIT

```
#define BIOS_LD3_PORT_BIT LATEbits.LATE2
```

3.14.1.8 BIOS_LD4_PORT_BIT

```
#define BIOS_LD4_PORT_BIT LATEbits.LATE3
```

3.14.1.9 BIOS_LD5_PORT_BIT

```
#define BIOS_LD5_PORT_BIT LATEbits.LATE4
```

3.14.1.10 BIOS_LD6_PORT_BIT

```
#define BIOS_LD6_PORT_BIT LATEbits.LATE5
```

3.14.1.11 BIOS_LD7_PORT_BIT

```
#define BIOS_LD7_PORT_BIT LATEbits.LATE6
```

3.14.1.12 BIOS_LD8_PORT_BIT

```
#define BIOS_LD8_PORT_BIT LATEbits.LATE7
```

3.14.1.13 BIOS_SW1_PORT_BIT

```
#define BIOS_SW1_PORT_BIT PORTEbits.RE8
```

3.14.1.14 BIOS_SW2_PORT_BIT

```
#define BIOS_SW2_PORT_BIT PORTEbits.RE9
```

3.14.1.15 BIOS_SW3_PORT_BIT

```
#define BIOS_SW3_PORT_BIT PORTAbits.RA14
```


3.14.1.16 BIOS_SW4_PORT_BIT

```
#define BIOS_SW4_PORT_BIT PORTCbits.RC1
```

3.14.1.17 BTN1_PORT_BIT

```
#define BTN1_PORT_BIT PORTAbits.RA5
```

3.14.1.18 BTN2_PORT_BIT

```
#define BTN2_PORT_BIT PORTAbits.RA4
```

3.14.1.19 CPU_TEMP_ADC_CHANNEL

```
#define CPU_TEMP_ADC_CHANNEL (42)
```

3.14.1.20 LD1_PORT_BIT

```
#define LD1_PORT_BIT LATGbits.LATG6
```

3.14.1.21 LD2_PORT_BIT

```
#define LD2_PORT_BIT LATDbits.LATD4
```

3.14.1.22 LD3_PORT_BIT

```
#define LD3_PORT_BIT LATBbits.LATB11
```

3.14.1.23 LD4_PORT_BIT

```
#define LD4_PORT_BIT LATGbits.LATG15
```

3.14.2 Function Documentation

3.14.2.1 DelayMs()

```
void DelayMs (  
    int t )
```

3.14.2.2 InitApp()

```
void InitApp (  
    void )
```

3.14.2.3 Timing_Test_Code()

```
int Timing_Test_Code (  
    int * a,  
    int * b,  
    int len )
```

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