

lab 5 and 6 SPI and FreeRTOS

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Contents

| | | |
|----------|--|----------|
| 1 | File Index | 1 |
| 1.1 | File List | 1 |
| 2 | File Documentation | 3 |
| 2.1 | src/ConfigPerformance.c File Reference | 3 |
| 2.2 | src/ConfigPerformance.h File Reference | 3 |
| 2.2.1 | Function Documentation | 3 |
| 2.2.1.1 | vHardwareConfigurePerformance() | 3 |
| 2.2.1.2 | vHardwareUseMultiVectoredInterrupts() | 3 |
| 2.3 | src/FreeRTOSConfig.h File Reference | 4 |
| 2.3.1 | Macro Definition Documentation | 5 |
| 2.3.1.1 | configASSERT | 5 |
| 2.3.1.2 | configCHECK_FOR_STACK_OVERFLOW | 5 |
| 2.3.1.3 | configCPU_CLOCK_HZ | 5 |
| 2.3.1.4 | configGENERATE_RUN_TIME_STATS | 5 |
| 2.3.1.5 | configIDLE_SHOULD_YIELD | 5 |
| 2.3.1.6 | configISR_STACK_SIZE | 5 |
| 2.3.1.7 | configKERNEL_INTERRUPT_PRIORITY | 6 |
| 2.3.1.8 | configMAX_CO_ROUTINE_PRIORITIES | 6 |
| 2.3.1.9 | configMAX_PRIORITIES | 6 |
| 2.3.1.10 | configMAX_SYSCALL_INTERRUPT_PRIORITY | 6 |
| 2.3.1.11 | configMAX_TASK_NAME_LEN | 6 |
| 2.3.1.12 | configMINIMAL_STACK_SIZE | 6 |
| 2.3.1.13 | configPERIPHERAL_CLOCK_HZ | 6 |

| | | |
|----------|---|----|
| 2.3.1.14 | configQUEUE_REGISTRY_SIZE | 6 |
| 2.3.1.15 | configTICK_RATE_HZ | 7 |
| 2.3.1.16 | configTIMER_QUEUE_LENGTH | 7 |
| 2.3.1.17 | configTIMER_TASK_PRIORITY | 7 |
| 2.3.1.18 | configTIMER_TASK_STACK_DEPTH | 7 |
| 2.3.1.19 | configTOTAL_HEAP_SIZE | 7 |
| 2.3.1.20 | configUSE_16_BIT_TICKS | 7 |
| 2.3.1.21 | configUSE_APPLICATION_TASK_TAG | 7 |
| 2.3.1.22 | configUSE_CO_ROUTINES | 7 |
| 2.3.1.23 | configUSE_COUNTING_SEMAPHORES | 8 |
| 2.3.1.24 | configUSE_IDLE_HOOK | 8 |
| 2.3.1.25 | configUSE_MALLOC_FAILED_HOOK | 8 |
| 2.3.1.26 | configUSE_MUTEXES | 8 |
| 2.3.1.27 | configUSE_PORT_OPTIMISED_TASK_SELECTION | 8 |
| 2.3.1.28 | configUSE_PREEMPTION | 8 |
| 2.3.1.29 | configUSE_QUEUE_SETS | 8 |
| 2.3.1.30 | configUSE_RECURSIVE_MUTEXES | 8 |
| 2.3.1.31 | configUSE_TICK_HOOK | 9 |
| 2.3.1.32 | configUSE_TIMERS | 9 |
| 2.3.1.33 | configUSE_TRACE_FACILITY | 9 |
| 2.3.1.34 | INCLUDE_eTaskGetState | 9 |
| 2.3.1.35 | INCLUDE_uxTaskGetStackHighWaterMark | 9 |
| 2.3.1.36 | INCLUDE_uxTaskPriorityGet | 9 |
| 2.3.1.37 | INCLUDE_vTaskCleanUpResources | 9 |
| 2.3.1.38 | INCLUDE_vTaskDelay | 9 |
| 2.3.1.39 | INCLUDE_vTaskDelayUntil | 10 |
| 2.3.1.40 | INCLUDE_vTaskDelete | 10 |
| 2.3.1.41 | INCLUDE_vTaskPrioritySet | 10 |
| 2.3.1.42 | INCLUDE_vTaskSuspend | 10 |
| 2.3.1.43 | INCLUDE_xTimerPendFunctionCall | 10 |

| | | |
|---------|---------------------------------|----|
| 2.3.2 | Function Documentation | 10 |
| 2.3.2.1 | vAssertCalled() | 10 |
| 2.4 | src/main.c File Reference | 11 |
| 2.4.1 | Function Documentation | 11 |
| 2.4.1.1 | _general_exception_handler() | 11 |
| 2.4.1.2 | main() | 11 |
| 2.4.1.3 | vApplicationStackOverflowHook() | 11 |
| 2.4.1.4 | vApplicationTickHook() | 12 |
| 2.4.1.5 | vAssertCalled() | 12 |
| 2.5 | src/user.c File Reference | 12 |
| 2.5.1 | Detailed Description | 13 |
| 2.5.2 | Macro Definition Documentation | 13 |
| 2.5.2.1 | X_center | 13 |
| 2.5.2.2 | X_MAX | 13 |
| 2.5.2.3 | Y_center | 13 |
| 2.5.2.4 | Y_MAX | 13 |
| 2.5.3 | Function Documentation | 13 |
| 2.5.3.1 | DelayMs() | 13 |
| 2.5.3.2 | InitApp() | 14 |
| 2.5.3.3 | InitBIOSGPIO() | 14 |
| 2.5.3.4 | InitGPIO() | 14 |
| 2.5.3.5 | Task1() | 14 |
| 2.5.3.6 | Task2() | 14 |
| 2.5.4 | Variable Documentation | 14 |
| 2.5.4.1 | i | 15 |
| 2.5.4.2 | n | 15 |
| 2.6 | src/user.h File Reference | 15 |
| 2.6.1 | Detailed Description | 16 |
| 2.6.2 | Macro Definition Documentation | 16 |
| 2.6.2.1 | BIOS_LD1_PORT_BIT | 16 |

| | | |
|----------|------------------------|----|
| 2.6.2.2 | BIOS_LD2_PORT_BIT | 16 |
| 2.6.2.3 | BIOS_LD3_PORT_BIT | 16 |
| 2.6.2.4 | BIOS_LD4_PORT_BIT | 16 |
| 2.6.2.5 | BIOS_LD5_PORT_BIT | 16 |
| 2.6.2.6 | BIOS_LD6_PORT_BIT | 17 |
| 2.6.2.7 | BIOS_LD7_PORT_BIT | 17 |
| 2.6.2.8 | BIOS_LD8_PORT_BIT | 17 |
| 2.6.2.9 | BIOS_SW1_PORT_BIT | 17 |
| 2.6.2.10 | BIOS_SW2_PORT_BIT | 17 |
| 2.6.2.11 | BIOS_SW3_PORT_BIT | 17 |
| 2.6.2.12 | BIOS_SW4_PORT_BIT | 17 |
| 2.6.2.13 | BTN1_PORT_BIT | 17 |
| 2.6.2.14 | BTN2_PORT_BIT | 18 |
| 2.6.2.15 | BTN_1_SCHLD | 18 |
| 2.6.2.16 | BTN_2_SCHLD | 18 |
| 2.6.2.17 | BTN_3_SCHLD | 18 |
| 2.6.2.18 | BTN_4_SCHLD | 18 |
| 2.6.2.19 | LD1_PORT_BIT | 18 |
| 2.6.2.20 | LD2_PORT_BIT | 18 |
| 2.6.2.21 | LD3_PORT_BIT | 18 |
| 2.6.2.22 | LD4_PORT_BIT | 19 |
| 2.6.3 | Function Documentation | 19 |
| 2.6.3.1 | DelayMs() | 19 |
| 2.6.3.2 | InitApp() | 19 |
| 2.6.3.3 | Task1() | 19 |
| 2.6.3.4 | Task2() | 19 |
| 2.6.4 | Variable Documentation | 19 |
| 2.6.4.1 | xMutexOLED | 19 |

Chapter 1

File Index

1.1 File List

Here is a list of all files with brief descriptions:

| | |
|---|----|
| src/ ConfigPerformance.c | 3 |
| src/ ConfigPerformance.h | 3 |
| src/ FreeRTOSConfig.h | 4 |
| src/ main.c | 11 |
| src/ user.c | |
| Initialization and system functions | 12 |
| src/ user.h | |
| Definitions, macroses and function prototypes | 15 |

Chapter 2

File Documentation

2.1 src/ConfigPerformance.c File Reference

```
#include "FreeRTOS.h"
#include "ConfigPerformance.h"
Include dependency graph for ConfigPerformance.c:
```

2.2 src/ConfigPerformance.h File Reference

This graph shows which files directly or indirectly include this file:

Functions

- void [vHardwareConfigurePerformance](#) (void)
- void [vHardwareUseMultiVectoredInterrupts](#) (void)

2.2.1 Function Documentation

2.2.1.1 vHardwareConfigurePerformance()

```
void vHardwareConfigurePerformance (
    void )
```

2.2.1.2 vHardwareUseMultiVectoredInterrupts()

```
void vHardwareUseMultiVectoredInterrupts (
    void )
```

2.3 src/FreeRTOSConfig.h File Reference

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

Include dependency graph for FreeRTOSConfig.h:

Macros

- #define `configUSE_PREEMPTION` 1
- #define `configUSE_PORT_OPTIMISED_TASK_SELECTION` 1
- #define `configUSE_QUEUE_SETS` 1
- #define `configUSE_IDLE_HOOK` 0
- #define `configUSE_TICK_HOOK` 1
- #define `configTICK_RATE_HZ` ((TickType_t) 1000)
- #define `configCPU_CLOCK_HZ` (200000000UL)
- #define `configPERIPHERAL_CLOCK_HZ` (40000000UL)
- #define `configMAX_PRIORITIES` (8UL)
- #define `configMINIMAL_STACK_SIZE` (190)
- #define `configISR_STACK_SIZE` (400)
- #define `configTOTAL_HEAP_SIZE` ((size_t) 60000)
- #define `configMAX_TASK_NAME_LEN` (16)
- #define `configUSE_TRACE_FACILITY` 0
- #define `configUSE_16_BIT_TICKS` 0
- #define `configIDLE_SHOULD_YIELD` 1
- #define `configUSE_MUTEXES` 1
- #define `configCHECK_FOR_STACK_OVERFLOW` 3 /* Three also checks the system/interrupt stack. */
- #define `configQUEUE_REGISTRY_SIZE` 0
- #define `configUSE_RECURSIVE_MUTEXES` 1
- #define `configUSE_MALLOC_FAILED_HOOK` 0
- #define `configUSE_APPLICATION_TASK_TAG` 0
- #define `configUSE_COUNTING_SEMAPHORES` 1
- #define `configGENERATE_RUN_TIME_STATS` 0
- #define `configUSE_CO_ROUTINES` 0
- #define `configMAX_CO_ROUTINE_PRIORITIES` (2)
- #define `configUSE_TIMERS` 1
- #define `configTIMER_TASK_PRIORITY` (2)
- #define `configTIMER_QUEUE_LENGTH` 5
- #define `configTIMER_TASK_STACK_DEPTH` (configMINIMAL_STACK_SIZE * 2)
- #define `INCLUDE_vTaskPrioritySet` 1
- #define `INCLUDE_uxTaskPriorityGet` 1
- #define `INCLUDE_vTaskDelete` 1
- #define `INCLUDE_vTaskCleanUpResources` 0
- #define `INCLUDE_vTaskSuspend` 1
- #define `INCLUDE_vTaskDelayUntil` 1
- #define `INCLUDE_vTaskDelay` 1
- #define `INCLUDE_uxTaskGetStackHighWaterMark` 1
- #define `INCLUDE_eTaskGetState` 1
- #define `INCLUDE_xTimerPendFunctionCall` 1
- #define `configKERNEL_INTERRUPT_PRIORITY` 0x01
- #define `configMAX_SYSCALL_INTERRUPT_PRIORITY` 0x03
- #define `configASSERT`(x) if ((x) == 0) vAssertCalled(__FILE__, __LINE__)

Functions

- void [vAssertCalled](#) (const char *pcFile, unsigned long ulLine)

2.3.1 Macro Definition Documentation

2.3.1.1 configASSERT

```
#define configASSERT(  
    x ) if( ( x ) == 0 ) vAssertCalled( __FILE__, __LINE__ )
```

2.3.1.2 configCHECK_FOR_STACK_OVERFLOW

```
#define configCHECK_FOR_STACK_OVERFLOW 3 /* Three also checks the system/interrupt stack. */
```

2.3.1.3 configCPU_CLOCK_HZ

```
#define configCPU_CLOCK_HZ ( 200000000UL )
```

2.3.1.4 configGENERATE_RUN_TIME_STATS

```
#define configGENERATE_RUN_TIME_STATS 0
```

2.3.1.5 configIDLE_SHOULD_YIELD

```
#define configIDLE_SHOULD_YIELD 1
```

2.3.1.6 configISR_STACK_SIZE

```
#define configISR_STACK_SIZE ( 400 )
```

2.3.1.7 configKERNEL_INTERRUPT_PRIORITY

```
#define configKERNEL_INTERRUPT_PRIORITY 0x01
```

2.3.1.8 configMAX_CO_ROUTINE_PRIORITIES

```
#define configMAX_CO_ROUTINE_PRIORITIES ( 2 )
```

2.3.1.9 configMAX_PRIORITIES

```
#define configMAX_PRIORITIES ( 8UL )
```

2.3.1.10 configMAX_SYSCALL_INTERRUPT_PRIORITY

```
#define configMAX_SYSCALL_INTERRUPT_PRIORITY 0x03
```

2.3.1.11 configMAX_TASK_NAME_LEN

```
#define configMAX_TASK_NAME_LEN ( 16 )
```

2.3.1.12 configMINIMAL_STACK_SIZE

```
#define configMINIMAL_STACK_SIZE ( 190 )
```

2.3.1.13 configPERIPHERAL_CLOCK_HZ

```
#define configPERIPHERAL_CLOCK_HZ ( 4000000UL )
```

2.3.1.14 configQUEUE_REGISTRY_SIZE

```
#define configQUEUE_REGISTRY_SIZE 0
```

2.3.1.15 configTICK_RATE_HZ

```
#define configTICK_RATE_HZ ( ( TickType_t ) 1000 )
```

2.3.1.16 configTIMER_QUEUE_LENGTH

```
#define configTIMER_QUEUE_LENGTH 5
```

2.3.1.17 configTIMER_TASK_PRIORITY

```
#define configTIMER_TASK_PRIORITY ( 2 )
```

2.3.1.18 configTIMER_TASK_STACK_DEPTH

```
#define configTIMER_TASK_STACK_DEPTH ( configMINIMAL_STACK_SIZE * 2 )
```

2.3.1.19 configTOTAL_HEAP_SIZE

```
#define configTOTAL_HEAP_SIZE ( ( size_t ) 60000 )
```

2.3.1.20 configUSE_16_BIT_TICKS

```
#define configUSE_16_BIT_TICKS 0
```

2.3.1.21 configUSE_APPLICATION_TASK_TAG

```
#define configUSE_APPLICATION_TASK_TAG 0
```

2.3.1.22 configUSE_CO_ROUTINES

```
#define configUSE_CO_ROUTINES 0
```

2.3.1.23 configUSE_COUNTING_SEMAPHORES

```
#define configUSE_COUNTING_SEMAPHORES 1
```

2.3.1.24 configUSE_IDLE_HOOK

```
#define configUSE_IDLE_HOOK 0
```

2.3.1.25 configUSE_MALLOC_FAILED_HOOK

```
#define configUSE_MALLOC_FAILED_HOOK 0
```

2.3.1.26 configUSE_MUTEXES

```
#define configUSE_MUTEXES 1
```

2.3.1.27 configUSE_PORT_OPTIMISED_TASK_SELECTION

```
#define configUSE_PORT_OPTIMISED_TASK_SELECTION 1
```

2.3.1.28 configUSE_PREEMPTION

```
#define configUSE_PREEMPTION 1
```

2.3.1.29 configUSE_QUEUE_SETS

```
#define configUSE_QUEUE_SETS 1
```

2.3.1.30 configUSE_RECURSIVE_MUTEXES

```
#define configUSE_RECURSIVE_MUTEXES 1
```

2.3.1.31 configUSE_TICK_HOOK

```
#define configUSE_TICK_HOOK 1
```

2.3.1.32 configUSE_TIMERS

```
#define configUSE_TIMERS 1
```

2.3.1.33 configUSE_TRACE_FACILITY

```
#define configUSE_TRACE_FACILITY 0
```

2.3.1.34 INCLUDE_eTaskGetState

```
#define INCLUDE_eTaskGetState 1
```

2.3.1.35 INCLUDE_uxTaskGetStackHighWaterMark

```
#define INCLUDE_uxTaskGetStackHighWaterMark 1
```

2.3.1.36 INCLUDE_uxTaskPriorityGet

```
#define INCLUDE_uxTaskPriorityGet 1
```

2.3.1.37 INCLUDE_vTaskCleanUpResources

```
#define INCLUDE_vTaskCleanUpResources 0
```

2.3.1.38 INCLUDE_vTaskDelay

```
#define INCLUDE_vTaskDelay 1
```

2.3.1.39 INCLUDE_vTaskDelayUntil

```
#define INCLUDE_vTaskDelayUntil 1
```

2.3.1.40 INCLUDE_vTaskDelete

```
#define INCLUDE_vTaskDelete 1
```

2.3.1.41 INCLUDE_vTaskPrioritySet

```
#define INCLUDE_vTaskPrioritySet 1
```

2.3.1.42 INCLUDE_vTaskSuspend

```
#define INCLUDE_vTaskSuspend 1
```

2.3.1.43 INCLUDE_xTimerPendFunctionCall

```
#define INCLUDE_xTimerPendFunctionCall 1
```

2.3.2 Function Documentation

2.3.2.1 vAssertCalled()

```
void vAssertCalled (
    const char * pcFile,
    unsigned long ulLine )
```


2.4 src/main.c File Reference

```
#include "FreeRTOS.h"
#include "task.h"
#include "semphr.h"
#include "queue.h"
#include "user.h"
#include "OLED.h"
#include "OLED/OledChar.h"
#include "OLED/OledGrph.h"
#include "UART.h"
#include "ConfigPerformance.h"
Include dependency graph for main.c:
```

Functions

- int [main](#) (void)
- void [vApplicationStackOverflowHook](#) (TaskHandle_t pxTask, char *pcTaskName)
- void [vApplicationTickHook](#) (void)
- void [vAssertCalled](#) (const char *pcFile, unsigned long ulLine)
- void [_general_exception_handler](#) (void)

2.4.1 Function Documentation

2.4.1.1 [_general_exception_handler\(\)](#)

```
void _general_exception_handler (
    void )
```

2.4.1.2 [main\(\)](#)

```
int main (
    void )
```

Create the demo tasks then start the scheduler.

2.4.1.3 [vApplicationStackOverflowHook\(\)](#)

```
void vApplicationStackOverflowHook (
    TaskHandle_t pxTask,
    char * pcTaskName )
```

2.4.1.4 vApplicationTickHook()

```
void vApplicationTickHook (
    void )
```

2.4.1.5 vAssertCalled()

```
void vAssertCalled (
    const char * pcFile,
    unsigned long ulLine )
```

2.5 src/user.c File Reference

initialization and system functions

```
#include <xc.h>
#include <stdint.h>
#include <sys/attrs.h>
#include "FreeRTOS.h"
#include "task.h"
#include "semphr.h"
#include "user.h"
#include "OLED.h"
#include "OledChar.h"
#include "OledGrph.h"
#include "UART.h"
#include <string.h>
#include <stdlib.h>
```

Include dependency graph for user.c:

Macros

- `#define X_MAX 128`
- `#define Y_MAX 28`
- `#define X_center 64`
- `#define Y_center 14`

Functions

- void `InitGPIO` (void)
GPIO initialization for board, Initialization for buttons and LEDs Disabling analog mode and setting pins directions.
- void `InitBIOSGPIO` (void)
GPIO initialization for schield, Initialization for buttons and LEDs Disabling analog mode and setting pins directions.
- void `InitApp` (void)
App initialization, Calling initialization functions for GPIO and OLED Basic OLED configuration.
- void `Task1` (void *pvParameters)
Task #1, takes semaphore and than outputs text to the OLED.
- void `Task2` (void *pvParameters)
Task #2, takes semaphore and than outputs text to the OLED.
- void `DelayMs` (int t)

Variables

- volatile int `n`
- volatile int `i` =0

2.5.1 Detailed Description

initialization and system functions

2.5.2 Macro Definition Documentation

2.5.2.1 X_center

```
#define X_center 64
```

2.5.2.2 X_MAX

```
#define X_MAX 128
```

2.5.2.3 Y_center

```
#define Y_center 14
```

2.5.2.4 Y_MAX

```
#define Y_MAX 28
```

2.5.3 Function Documentation

2.5.3.1 DelayMs()

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

2.5.3.2 InitApp()

```
void InitApp (  
    void )
```

App initialization, Calling initialization functions for GPIO and OLED Basic OLED configuration.

2.5.3.3 InitBIOSGPIO()

```
void InitBIOSGPIO (  
    void )
```

GPIO initialization for schield, Initialization for buttons and LEDs Disabling analog mode and setting pins directions.

2.5.3.4 InitGPIO()

```
void InitGPIO (  
    void )
```

GPIO initialization for board, Initialization for buttons and LEDs Disabling analog mode and setting pins directions.

2.5.3.5 Task1()

```
void Task1 (  
    void * pvParameters )
```

Task #1, takes semaphore and than outputs text to the OLED.

2.5.3.6 Task2()

```
void Task2 (  
    void * pvParameters )
```

Task #2, takes semaphore and than outputs text to the OLED.

2.5.4 Variable Documentation

2.5.4.1 i

```
volatile int i =0
```

2.5.4.2 n

```
volatile int n
```

2.6 src/user.h File Reference

contains definitions, macroses and function prototypes

```
#include "FreeRTOS.h"
#include "semphr.h"
```

Include dependency graph for user.h: This graph shows which files directly or indirectly include this file:

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 [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 [BTN_1_SCHLD](#) PORTGbits.RG7
- #define [BTN_2_SCHLD](#) PORTDbits.RD5
- #define [BTN_3_SCHLD](#) PORTFbits.RF1
- #define [BTN_4_SCHLD](#) 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)
App initialization, Calling initialization functions for GPIO and OLED Basic OLED configuration.
- void [Task1](#) (void *pvParameters)
Task #1, takes semaphore and than outputs text to the OLED.
- void [Task2](#) (void *pvParameters)
Task #2, takes semaphore and than outputs text to the OLED.
- void [DelayMs](#) (int t)

Variables

- SemaphoreHandle_t [xMutexOLED](#)

2.6.1 Detailed Description

contains definitions, macroses and function prototypes

2.6.2 Macro Definition Documentation

2.6.2.1 BIOS_LD1_PORT_BIT

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

2.6.2.2 BIOS_LD2_PORT_BIT

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

2.6.2.3 BIOS_LD3_PORT_BIT

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

2.6.2.4 BIOS_LD4_PORT_BIT

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

2.6.2.5 BIOS_LD5_PORT_BIT

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

2.6.2.6 BIOS_LD6_PORT_BIT

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

2.6.2.7 BIOS_LD7_PORT_BIT

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

2.6.2.8 BIOS_LD8_PORT_BIT

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

2.6.2.9 BIOS_SW1_PORT_BIT

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

2.6.2.10 BIOS_SW2_PORT_BIT

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

2.6.2.11 BIOS_SW3_PORT_BIT

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

2.6.2.12 BIOS_SW4_PORT_BIT

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

2.6.2.13 BTN1_PORT_BIT

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

2.6.2.14 BTN2_PORT_BIT

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

2.6.2.15 BTN_1_SCHLD

```
#define BTN_1_SCHLD PORTGbits.RG7
```

2.6.2.16 BTN_2_SCHLD

```
#define BTN_2_SCHLD PORTDbits.RD5
```

2.6.2.17 BTN_3_SCHLD

```
#define BTN_3_SCHLD PORTFbits.RF1
```

2.6.2.18 BTN_4_SCHLD

```
#define BTN_4_SCHLD PORTAbits.RA2
```

2.6.2.19 LD1_PORT_BIT

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

2.6.2.20 LD2_PORT_BIT

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

2.6.2.21 LD3_PORT_BIT

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


2.6.2.22 LD4_PORT_BIT

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

2.6.3 Function Documentation

2.6.3.1 DelayMs()

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

2.6.3.2 InitApp()

```
void InitApp (  
    void )
```

App initialization, Calling initialization functions for GPIO and OLED Basic OLED configuration.

2.6.3.3 Task1()

```
void Task1 (  
    void * pvParameters )
```

Task #1, takes semaphore and than outputs text to the OLED.

2.6.3.4 Task2()

```
void Task2 (  
    void * pvParameters )
```

Task #2, takes semaphore and than outputs text to the OLED.

2.6.4 Variable Documentation

2.6.4.1 xMutexOLED

```
SemaphoreHandle_t xMutexOLED
```


Index

`_general_exception_handler`
 `main.c`, [11](#)

`BIOS_LD1_PORT_BIT`
 `user.h`, [16](#)

`BIOS_LD2_PORT_BIT`
 `user.h`, [16](#)

`BIOS_LD3_PORT_BIT`
 `user.h`, [16](#)

`BIOS_LD4_PORT_BIT`
 `user.h`, [16](#)

`BIOS_LD5_PORT_BIT`
 `user.h`, [16](#)

`BIOS_LD6_PORT_BIT`
 `user.h`, [16](#)

`BIOS_LD7_PORT_BIT`
 `user.h`, [17](#)

`BIOS_LD8_PORT_BIT`
 `user.h`, [17](#)

`BIOS_SW1_PORT_BIT`
 `user.h`, [17](#)

`BIOS_SW2_PORT_BIT`
 `user.h`, [17](#)

`BIOS_SW3_PORT_BIT`
 `user.h`, [17](#)

`BIOS_SW4_PORT_BIT`
 `user.h`, [17](#)

`BTN1_PORT_BIT`
 `user.h`, [17](#)

`BTN2_PORT_BIT`
 `user.h`, [17](#)

`BTN_1_SCHLD`
 `user.h`, [18](#)

`BTN_2_SCHLD`
 `user.h`, [18](#)

`BTN_3_SCHLD`
 `user.h`, [18](#)

`BTN_4_SCHLD`
 `user.h`, [18](#)

`configASSERT`
 `FreeRTOSConfig.h`, [5](#)

`configCHECK_FOR_STACK_OVERFLOW`
 `FreeRTOSConfig.h`, [5](#)

`configCPU_CLOCK_HZ`
 `FreeRTOSConfig.h`, [5](#)

`configGENERATE_RUN_TIME_STATS`
 `FreeRTOSConfig.h`, [5](#)

`configIDLE_SHOULD_YIELD`
 `FreeRTOSConfig.h`, [5](#)

`configISR_STACK_SIZE`
 `FreeRTOSConfig.h`, [5](#)

`configKERNEL_INTERRUPT_PRIORITY`
 `FreeRTOSConfig.h`, [5](#)

`configMAX_CO_ROUTINE_PRIORITIES`
 `FreeRTOSConfig.h`, [6](#)

`configMAX_PRIORITIES`
 `FreeRTOSConfig.h`, [6](#)

`configMAX_SYSCALL_INTERRUPT_PRIORITY`
 `FreeRTOSConfig.h`, [6](#)

`configMAX_TASK_NAME_LEN`
 `FreeRTOSConfig.h`, [6](#)

`configMINIMAL_STACK_SIZE`
 `FreeRTOSConfig.h`, [6](#)

`configPERIPHERAL_CLOCK_HZ`
 `FreeRTOSConfig.h`, [6](#)

`ConfigPerformance.h`
 `vHardwareConfigurePerformance`, [3](#)
 `vHardwareUseMultiVectoredInterrupts`, [3](#)

`configQUEUE_REGISTRY_SIZE`
 `FreeRTOSConfig.h`, [6](#)

`configTICK_RATE_HZ`
 `FreeRTOSConfig.h`, [6](#)

`configTIMER_QUEUE_LENGTH`
 `FreeRTOSConfig.h`, [7](#)

`configTIMER_TASK_PRIORITY`
 `FreeRTOSConfig.h`, [7](#)

`configTIMER_TASK_STACK_DEPTH`
 `FreeRTOSConfig.h`, [7](#)

`configTOTAL_HEAP_SIZE`
 `FreeRTOSConfig.h`, [7](#)

`configUSE_16_BIT_TICKS`
 `FreeRTOSConfig.h`, [7](#)

`configUSE_APPLICATION_TASK_TAG`
 `FreeRTOSConfig.h`, [7](#)

`configUSE_CO_ROUTINES`
 `FreeRTOSConfig.h`, [7](#)

`configUSE_COUNTING_SEMAPHORES`
 `FreeRTOSConfig.h`, [7](#)

`configUSE_IDLE_HOOK`
 `FreeRTOSConfig.h`, [8](#)

`configUSE_MALLOC_FAILED_HOOK`
 `FreeRTOSConfig.h`, [8](#)

`configUSE_MUTEXES`
 `FreeRTOSConfig.h`, [8](#)

`configUSE_PORT_OPTIMISED_TASK_SELECTION`
 `FreeRTOSConfig.h`, [8](#)

`configUSE_PREEMPTION`
 `FreeRTOSConfig.h`, [8](#)

- configUSE_QUEUE_SETS
 - FreeRTOSConfig.h, 8
- configUSE_RECURSIVE_MUTEXES
 - FreeRTOSConfig.h, 8
- configUSE_TICK_HOOK
 - FreeRTOSConfig.h, 8
- configUSE_TIMERS
 - FreeRTOSConfig.h, 9
- configUSE_TRACE_FACILITY
 - FreeRTOSConfig.h, 9
- DelayMs
 - user.c, 13
 - user.h, 19
- FreeRTOSConfig.h
 - configASSERT, 5
 - configCHECK_FOR_STACK_OVERFLOW, 5
 - configCPU_CLOCK_HZ, 5
 - configGENERATE_RUN_TIME_STATS, 5
 - configIDLE_SHOULD_YIELD, 5
 - configISR_STACK_SIZE, 5
 - configKERNEL_INTERRUPT_PRIORITY, 5
 - configMAX_CO_ROUTINE_PRIORITIES, 6
 - configMAX_PRIORITIES, 6
 - configMAX_SYSCALL_INTERRUPT_PRIORITY, 6
 - configMAX_TASK_NAME_LEN, 6
 - configMINIMAL_STACK_SIZE, 6
 - configPERIPHERAL_CLOCK_HZ, 6
 - configQUEUE_REGISTRY_SIZE, 6
 - configTICK_RATE_HZ, 6
 - configTIMER_QUEUE_LENGTH, 7
 - configTIMER_TASK_PRIORITY, 7
 - configTIMER_TASK_STACK_DEPTH, 7
 - configTOTAL_HEAP_SIZE, 7
 - configUSE_16_BIT_TICKS, 7
 - configUSE_APPLICATION_TASK_TAG, 7
 - configUSE_CO_ROUTINES, 7
 - configUSE_COUNTING_SEMAPHORES, 7
 - configUSE_IDLE_HOOK, 8
 - configUSE_MALLOC_FAILED_HOOK, 8
 - configUSE_MUTEXES, 8
 - configUSE_PORT_OPTIMISED_TASK_SELECTION, 8
 - configUSE_PREEMPTION, 8
 - configUSE_QUEUE_SETS, 8
 - configUSE_RECURSIVE_MUTEXES, 8
 - configUSE_TICK_HOOK, 8
 - configUSE_TIMERS, 9
 - configUSE_TRACE_FACILITY, 9
 - INCLUDE_eTaskGetState, 9
 - INCLUDE_uxTaskGetStackHighWaterMark, 9
 - INCLUDE_uxTaskPriorityGet, 9
 - INCLUDE_vTaskCleanUpResources, 9
 - INCLUDE_vTaskDelay, 9
 - INCLUDE_vTaskDelayUntil, 9
 - INCLUDE_vTaskDelete, 10
 - INCLUDE_vTaskPrioritySet, 10
 - INCLUDE_vTaskSuspend, 10
- INCLUDE_xTimerPendFunctionCall, 10
- vAssertCalled, 10
- i
 - user.c, 14
- INCLUDE_eTaskGetState
 - FreeRTOSConfig.h, 9
- INCLUDE_uxTaskGetStackHighWaterMark
 - FreeRTOSConfig.h, 9
- INCLUDE_uxTaskPriorityGet
 - FreeRTOSConfig.h, 9
- INCLUDE_vTaskCleanUpResources
 - FreeRTOSConfig.h, 9
- INCLUDE_vTaskDelay
 - FreeRTOSConfig.h, 9
- INCLUDE_vTaskDelayUntil
 - FreeRTOSConfig.h, 9
- INCLUDE_vTaskDelete
 - FreeRTOSConfig.h, 10
- INCLUDE_vTaskPrioritySet
 - FreeRTOSConfig.h, 10
- INCLUDE_vTaskSuspend
 - FreeRTOSConfig.h, 10
- INCLUDE_xTimerPendFunctionCall
 - FreeRTOSConfig.h, 10
- InitApp
 - user.c, 13
 - user.h, 19
- InitBIOSGPIO
 - user.c, 14
- InitGPIO
 - user.c, 14
- LD1_PORT_BIT
 - user.h, 18
- LD2_PORT_BIT
 - user.h, 18
- LD3_PORT_BIT
 - user.h, 18
- LD4_PORT_BIT
 - user.h, 18
- main
 - main.c, 11
- main.c
 - _general_exception_handler, 11
 - main, 11
 - vApplicationStackOverflowHook, 11
 - vApplicationTickHook, 11
 - vAssertCalled, 12
- n
 - user.c, 15
- src/ConfigPerformance.c, 3
- src/ConfigPerformance.h, 3
- src/FreeRTOSConfig.h, 4
- src/main.c, 11
- src/user.c, 12

src/user.h, [15](#)

Task1

- user.c, [14](#)
- user.h, [19](#)

Task2

- user.c, [14](#)
- user.h, [19](#)

user.c

- DelayMs, [13](#)
- i, [14](#)
- InitApp, [13](#)
- InitBIOSGPIO, [14](#)
- InitGPIO, [14](#)
- n, [15](#)
- Task1, [14](#)
- Task2, [14](#)
- X_MAX, [13](#)
- X_center, [13](#)
- Y_MAX, [13](#)
- Y_center, [13](#)

user.h

- BIOS_LD1_PORT_BIT, [16](#)
- BIOS_LD2_PORT_BIT, [16](#)
- BIOS_LD3_PORT_BIT, [16](#)
- BIOS_LD4_PORT_BIT, [16](#)
- BIOS_LD5_PORT_BIT, [16](#)
- BIOS_LD6_PORT_BIT, [16](#)
- BIOS_LD7_PORT_BIT, [17](#)
- BIOS_LD8_PORT_BIT, [17](#)
- BIOS_SW1_PORT_BIT, [17](#)
- BIOS_SW2_PORT_BIT, [17](#)
- BIOS_SW3_PORT_BIT, [17](#)
- BIOS_SW4_PORT_BIT, [17](#)
- BTN1_PORT_BIT, [17](#)
- BTN2_PORT_BIT, [17](#)
- BTN_1_SCHLD, [18](#)
- BTN_2_SCHLD, [18](#)
- BTN_3_SCHLD, [18](#)
- BTN_4_SCHLD, [18](#)
- DelayMs, [19](#)
- InitApp, [19](#)
- LD1_PORT_BIT, [18](#)
- LD2_PORT_BIT, [18](#)
- LD3_PORT_BIT, [18](#)
- LD4_PORT_BIT, [18](#)
- Task1, [19](#)
- Task2, [19](#)
- xMutexOLED, [19](#)

ConfigPerformance.h, [3](#)

vHardwareUseMultiVectoredInterrupts

- ConfigPerformance.h, [3](#)

X_MAX

- user.c, [13](#)

X_center

- user.c, [13](#)

xMutexOLED

- user.h, [19](#)

Y_MAX

- user.c, [13](#)

Y_center

- user.c, [13](#)

vApplicationStackOverflowHook

- main.c, [11](#)

vApplicationTickHook

- main.c, [11](#)

vAssertCalled

- FreeRTOSConfig.h, [10](#)
- main.c, [12](#)

vHardwareConfigurePerformance