# SPI serial communication (Transmitter) 1.0.0

Generated by Doxygen 1.8.18

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# **Chapter 1**

# **Data Structure Index**

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Here are the data structures with brief descriptions:	
SPI_ConfigType	Ę

2 Data Structure Index

# Chapter 2

# File Index

# 2.1 File List

Here is a list of all documented files with brief descriptions:

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File Index

# **Chapter 3**

# **Data Structure Documentation**

# 3.1 SPI\_ConfigType Struct Reference

# **Data Fields**

- Clock\_Select cke
  - a user defined datatype to select the SPI clock select configuration
- Polarity polarity
  - a user defined datatype to select the SPI polarity configuration
- · CLK clk
  - a user defined datatype to select the SPI clock configuration
- Mode mode
  - a user defined datatype to select the SPI mode configuration

The documentation for this struct was generated from the following file:

· SPI.h

# **Chapter 4**

# **File Documentation**

## 4.1 DIO.c File Reference

DIO Module Source File for this program.

```
#include "DIO.h"
#include <pic16f877a.h>
```

### **Functions**

• void write\_pin ( uint8 port, uint8 pin, uint8 value)

Brief: This is a function to select certain pin of pins (0->7) of port of ports (A,B,C,D,E) to set the value (LOW, HIGH)

• void toggle\_pin ( uint8 port, uint8 pin)

**Brief:** This is a function to select certain pin of pins (0->7) of port of ports (A,B,C,D,E) to toggle it

• uint8 read\_pin ( uint8 port, uint8 pin)

Brief: This is function to select certain pin of pins (0->7) of port of ports (A,B,C,D,E) to get the value

• void write\_group\_value ( uint8 port, uint8 group, uint8 value)

**Brief:** This is a function to select certain group of groups (FIRST\_GROUP, SECOND\_GROUP) of port of ports (A,B,C,D,E) to set a certain value

• void write\_port\_value ( uint8 port, uint8 value)

**Brief:** This is a function to select certain port of ports (A,B,C,D,E) to set the value (any value)

void write\_port ( uint8 port, uint8 value)

Brief: This is a function to select certain port of ports (A,B,C,D,E) to set the value (LOW, HIGH)

void toggle\_port ( uint8 port)

Brief: This is a function to select certain port of ports (A,B,C,D,E) to toggle it

• void write\_group ( uint8 port, uint8 group, uint8 value)

 ${\it Brief:}$  This is a function to select certain group of groups (FIRST\_GROUP, SECOND\_GROUP) of port of ports (A,B,C,D,E) to set the value (LOW, HIGH)

• void toggle\_group ( uint8 port, uint8 group)

**Brief:** This is a function to select certain group of groups (FIRST\_GROUP, SECOND\_GROUP) of port of ports (A,B,C,D,E) to toggle it

# 4.1.1 Detailed Description

DIO Module Source File for this program.

Author

Nour

Date

27/7/2020

Version

1.0

### 4.1.2 Function Documentation

# 4.1.2.1 write\_pin()

```
void write_pin (
           uint8 port,
           uint8 pin,
           uint8 value )
```

**Brief:** This is a function to select certain pin of pins (0->7) of port of ports (A,B,C,D,E) to set the value (LOW, HIGH)

### **Parameters**

port	uint8 port to select port
pin	uint8 pin to select pin
value	uint8 value to select value

Returns

void

References HIGH, LOW, PORTA\_CONFIG, PORTB\_CONFIG, PORTC\_CONFIG, PORTD\_CONFIG, and PORT  $\leftarrow$  E\_CONFIG.

# 4.1.2.2 toggle\_pin()

```
void toggle_pin (
          uint8 port,
          uint8 pin )
```

4.1 DIO.c File Reference Brief: This is a function to select certain pin of pins (0->7) of port of ports (A,B,C,D,E) to toggle it

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### **Parameters**

port	uint8 port to select port
pin	uint8 pin to select pin

### Returns

void

References PORTA\_CONFIG, PORTB\_CONFIG, PORTC\_CONFIG, PORTD\_CONFIG, and PORTE\_CONFIG.

### 4.1.2.3 read\_pin()

Brief: This is function to select certain pin of pins (0->7) of port of ports (A,B,C,D,E) to get the value

### **Parameters**

port	uint8 port to select port
pin	uint8 pin to select pin

### Returns

uint8 to get value of pin

References PORTA\_CONFIG, PORTB\_CONFIG, PORTC\_CONFIG, PORTD\_CONFIG, and PORTE\_CONFIG.

### 4.1.2.4 write\_group\_value()

**Brief:** This is a function to select certain group of groups (FIRST\_GROUP, SECOND\_GROUP) of port of ports (A,B,C,D,E) to set a certain value

## **Parameters**

port	uint8 port to select port
group	uint8 group to select group
value	uint8 value to select value

4.1 DIO.c File Reference

### Returns

void

References PORTA\_CONFIG, PORTB\_CONFIG, PORTC\_CONFIG, PORTD\_CONFIG, and PORTE\_CONFIG.

# 4.1.2.5 write\_port\_value()

```
void write_port_value (
          uint8 port,
          uint8 value )
```

**Brief:** This is a function to select certain port of ports (A,B,C,D,E) to set the value (any value)

### **Parameters**

port	uint8 port to select port
value	uint8 value to select value

### Returns

void

References PORTA\_CONFIG, PORTB\_CONFIG, PORTC\_CONFIG, PORTD\_CONFIG, and PORTE\_CONFIG.

# 4.1.2.6 write\_port()

```
void write_port (
          uint8 port,
          uint8 value )
```

Brief: This is a function to select certain port of ports (A,B,C,D,E) to set the value (LOW, HIGH)

# **Parameters**

	port	uint8 port to select port
ſ	value	uint8 value to select value

### Returns

void

References HIGH, LOW, PORTA\_CONFIG, PORTB\_CONFIG, PORTC\_CONFIG, PORTD\_CONFIG, and PORT  $\leftarrow$  E\_CONFIG.

# 4.1.2.7 toggle\_port()

```
void toggle_port (
     uint8 port )
```

Brief: This is a function to select certain port of ports (A,B,C,D,E) to toggle it

### **Parameters**

port	uint8 port to select port
------	---------------------------

### Returns

void

References PORTA\_CONFIG, PORTB\_CONFIG, PORTC\_CONFIG, PORTD\_CONFIG, and PORTE\_CONFIG.

### 4.1.2.8 write\_group()

```
void write_group (
          uint8 port,
          uint8 group,
          uint8 value )
```

**Brief:** This is a function to select certain group of groups (FIRST\_GROUP, SECOND\_GROUP) of port of ports (A,B,C,D,E) to set the value (LOW, HIGH)

### **Parameters**

port	uint8 port to select port
group	uint8 group to select group
value	uint8 value to select value

# Returns

void

References HIGH, LOW, PORTB CONFIG, PORTC CONFIG, and PORTD CONFIG.

### 4.1.2.9 toggle\_group()

```
void toggle_group (
           uint8 port,
           uint8 group )
```

**Brief:** This is a function to select certain group of groups (FIRST\_GROUP, SECOND\_GROUP) of port of ports (A,B,C,D,E) to toggle it

4.2 DIO.h File Reference 13

#### **Parameters**

port	uint8 port to select port
group	uint8 group to select group

### Returns

void

References PORTB\_CONFIG, PORTC\_CONFIG, and PORTD\_CONFIG.

# 4.2 DIO.h File Reference

DIO Module Header File for this program.

```
#include "std_types.h"
#include "PORT_config.h"
#include "PIN_config.h"
```

### **Functions**

• void write\_pin ( uint8 port, uint8 pin, uint8 value)

Brief: This is a function to select certain pin of pins (0->7) of port of ports (A,B,C,D,E) to set the value (LOW, HIGH)

• void toggle\_pin ( uint8 port, uint8 pin)

Brief: This is a function to select certain pin of pins (0->7) of port of ports (A,B,C,D,E) to toggle it

uint8 read\_pin ( uint8 port, uint8 pin)

Brief: This is function to select certain pin of pins (0->7) of port of ports (A,B,C,D,E) to get the value

• void write group value ( uint8 port, uint8 group, uint8 value)

**Brief:** This is a function to select certain group of groups (FIRST\_GROUP, SECOND\_GROUP) of port of ports (A,B,C,D,E) to set a certain value

void write\_port ( uint8 port, uint8 value)

Brief: This is a function to select certain port of ports (A,B,C,D,E) to set the value (LOW, HIGH)

• void toggle\_port ( uint8 port)

Brief: This is a function to select certain port of ports (A,B,C,D,E) to toggle it

void write\_group ( uint8 port, uint8 group, uint8 value)

**Brief:** This is a function to select certain group of groups (FIRST\_GROUP, SECOND\_GROUP) of port of ports (A,B,C,D,E) to set the value (LOW, HIGH)

void toggle\_group ( uint8 port, uint8 group)

**Brief:** This is a function to select certain group of groups (FIRST\_GROUP, SECOND\_GROUP) of port of ports (A,B,C,D,E) to toggle it

• void write port value ( uint8 port, uint8 value)

Brief: This is a function to select certain port of ports (A,B,C,D,E) to set the value (any value)

# 4.2.1 Detailed Description

DIO Module Header File for this program.

Author

Nour

Date

27/7/2020

Version

1.0

### 4.2.2 Function Documentation

# 4.2.2.1 write\_pin()

**Brief:** This is a function to select certain pin of pins (0->7) of port of ports (A,B,C,D,E) to set the value (LOW, HIGH)

### **Parameters**

port	uint8 port to select port
pin	uint8 pin to select pin
value	uint8 value to select value

Returns

void

References HIGH, LOW, PORTA\_CONFIG, PORTB\_CONFIG, PORTC\_CONFIG, PORTD\_CONFIG, and PORT  $\leftarrow$  E\_CONFIG.

# 4.2.2.2 toggle\_pin()

```
void toggle_pin (
          uint8 port,
          uint8 pin )
```

4.2 DIO.h File Reference 15 Brief: This is a function to select certain pin of pins (0->7) of port of ports (A,B,C,D,E) to toggle it

### **Parameters**

port	uint8 port to select port
pin	uint8 pin to select pin

### Returns

void

References PORTA\_CONFIG, PORTB\_CONFIG, PORTC\_CONFIG, PORTD\_CONFIG, and PORTE\_CONFIG.

### 4.2.2.3 read\_pin()

Brief: This is function to select certain pin of pins (0->7) of port of ports (A,B,C,D,E) to get the value

### **Parameters**

port	uint8 port to select port
pin	uint8 pin to select pin

### Returns

uint8 to get value of pin

 $References\ PORTA\_CONFIG,\ PORTB\_CONFIG,\ PORTC\_CONFIG,\ PORTD\_CONFIG,\ and\ PORTE\_CONFIG.$ 

### 4.2.2.4 write\_group\_value()

**Brief:** This is a function to select certain group of groups (FIRST\_GROUP, SECOND\_GROUP) of port of ports (A,B,C,D,E) to set a certain value

## **Parameters**

port	uint8 port to select port
group	uint8 group to select group
value	uint8 value to select value

4.2 DIO.h File Reference

### Returns

void

References PORTA\_CONFIG, PORTB\_CONFIG, PORTC\_CONFIG, PORTD\_CONFIG, and PORTE\_CONFIG.

# 4.2.2.5 write\_port()

```
void write_port (
          uint8 port,
          uint8 value )
```

Brief: This is a function to select certain port of ports (A,B,C,D,E) to set the value (LOW, HIGH)

### **Parameters**

ŗ	oort	uint8 port to select port
ı	⁄alue	uint8 value to select value

### Returns

void

References HIGH, LOW, PORTA\_CONFIG, PORTB\_CONFIG, PORTC\_CONFIG, PORTD\_CONFIG, and PORT  $\leftarrow$  E\_CONFIG.

# 4.2.2.6 toggle\_port()

```
void toggle_port (
     uint8 port )
```

Brief: This is a function to select certain port of ports (A,B,C,D,E) to toggle it

# **Parameters**

port	uint8 port to select port

### Returns

void

References PORTA\_CONFIG, PORTB\_CONFIG, PORTC\_CONFIG, PORTD\_CONFIG, and PORTE\_CONFIG.

### 4.2.2.7 write\_group()

```
void write_group (
          uint8 port,
          uint8 group,
          uint8 value )
```

**Brief:** This is a function to select certain group of groups (FIRST\_GROUP, SECOND\_GROUP) of port of ports (A,B,C,D,E) to set the value (LOW, HIGH)

### **Parameters**

port	uint8 port to select port
group	uint8 group to select group
value	uint8 value to select value

### Returns

void

References HIGH, LOW, PORTB\_CONFIG, PORTC\_CONFIG, and PORTD\_CONFIG.

# 4.2.2.8 toggle\_group()

```
void toggle_group (
           uint8 port,
           uint8 group )
```

 $\textbf{Brief:} \ \, \textbf{This is a function to select certain group of groups (FIRST\_GROUP \, , \, \textbf{SECOND\_GROUP)} \, \, \textbf{of ports} \, \, \\ \textbf{(A,B,C,D,E)} \, \, \textbf{to toggle it} \, \, \textbf{(A,B,C,D,E)} \, \, \textbf{(A,B,C,D,E)}$ 

### **Parameters**

port	uint8 port to select port
group	uint8 group to select group

### Returns

void

References PORTB\_CONFIG, PORTC\_CONFIG, and PORTD\_CONFIG.

# 4.2.2.9 write\_port\_value()

**Brief:** This is a function to select certain port of ports (A,B,C,D,E) to set the value (any value)

### **Parameters**

port	uint8 port to select port
value	uint8 value to select value

### Returns

void

References PORTA\_CONFIG, PORTB\_CONFIG, PORTC\_CONFIG, PORTD\_CONFIG, and PORTE\_CONFIG.

# 4.3 interrupts.c File Reference

interrupts Module Source File for this program

```
#include <pic16f877a.h>
#include "std_types.h"
```

### **Functions**

• void interrupt ISR (void)

# **Variables**

uint8 receive\_data

# 4.3.1 Detailed Description

interrupts Module Source File for this program

**Author** 

Nour

Date

17/9/2020

Version

1.0

# 4.4 interrupts.h File Reference

interrupts Module Header File for this program

# **Variables**

· uint8 receive\_data

# 4.4.1 Detailed Description

interrupts Module Header File for this program

**Author** 

Nour

Date

17/9/2020

Version

1.0

# 4.5 PIN\_config.h File Reference

PIN\_config Module Header File for this program.

### **Macros**

• #define PIN0 0x01

a preprocessor to define pin0

• #define **PIN1** 0x02

a preprocessor to define pin1

• #define PIN2 0x04

a preprocessor to define pin2

• #define PIN3 0x08

a preprocessor to define pin3

• #define PIN4 0x10

a preprocessor to define pin4

• #define PIN5 0x20

a preprocessor to define pin5

• #define PIN6 0x40

a preprocessor to define pin6

#define PIN7 0x80

a preprocessor to define pin7

• #define **FIRST\_GROUP** 0x0F

a preprocessor to define first group

• #define **SECOND\_GROUP** 0xF0

a preprocessor to define second group

4.6 PORT.c File Reference 21

# 4.5.1 Detailed Description

PIN\_config Module Header File for this program.

**Author** 

Nour

Date

27/7/2020

Version

1.0

# 4.6 PORT.c File Reference

PORT Module Source File for this program.

```
#include "PORT.h"
#include <pic16f877a.h>
```

### **Functions**

• void set\_pin\_direction ( uint8 port, uint8 pin, uint8 direction)

**Brief:** This is a function to select certain pin of pins (0->7) of port of ports (A,B,C,D,E) to set the direction (INPUT, OUTPUT)

• void set\_port\_direction ( uint8 port, uint8 direction)

**Brief:** This is a function to select certain port of ports (A,B,C,D,E) to set the direction (INPUT, OUTPUT)

• void set\_group\_direction ( uint8 port, uint8 group, uint8 direction)

**Brief:** This is a function to select certain group of groups (FIRST\_GROUP, SECOND\_GROUP) of port of ports (A,B,C,D,E) to set the direction (INPUT, OUTPUT)

# 4.6.1 Detailed Description

PORT Module Source File for this program.

**Author** 

Nour

Date

27/7/2020

Version

1.0

# 4.6.2 Function Documentation

# 4.6.2.1 set\_pin\_direction()

**Brief:** This is a function to select certain pin of pins (0->7) of port of ports (A,B,C,D,E) to set the direction (INPUT, OUTPUT)

### **Parameters**

port	uint8 port to select port
pin	uint8 pin to select pin
direction	uint8 direction to select direction

### Returns

void

References INPUT, OUTPUT, PORTA\_CONFIG, PORTB\_CONFIG, PORTC\_CONFIG, PORTD\_CONFIG, and  $P \leftarrow ORTE\_CONFIG$ .

# 4.6.2.2 set\_port\_direction()

```
void set_port_direction (
          uint8 port,
          uint8 direction )
```

Brief: This is a function to select certain port of ports (A,B,C,D,E) to set the direction (INPUT, OUTPUT)

### **Parameters**

port	uint8 port to select port
direction	uint8 direction to select direction

## Returns

void

4.7 PORT.h File Reference 23

### 4.6.2.3 set\_group\_direction()

```
void set_group_direction (
          uint8 port,
          uint8 group,
          uint8 direction )
```

**Brief:** This is a function to select certain group of groups (FIRST\_GROUP, SECOND\_GROUP) of port of ports (A,B,C,D,E) to set the direction (INPUT, OUTPUT)

### **Parameters**

port	uint8 port to select port
group	uint8 group to select group
direction	uint8 direction to select direction

### Returns

void

References INPUT, OUTPUT, PORTB\_CONFIG, PORTC\_CONFIG, and PORTD\_CONFIG.

# 4.7 PORT.h File Reference

PORT Module Header File for this program.

```
#include "std_types.h"
#include "PORT_config.h"
#include "PIN_config.h"
```

### **Functions**

• void set\_pin\_direction ( uint8 port, uint8 pin, uint8 direction)

**Brief:** This is a function to select certain pin of pins (0->7) of port of ports (A,B,C,D,E) to set the direction (INPUT, OUTPUT)

• void set\_port\_direction ( uint8 port, uint8 direction)

**Brief:** This is a function to select certain port of ports (A,B,C,D,E) to set the direction (INPUT, OUTPUT)

• void set\_group\_direction ( uint8 port, uint8 group, uint8 direction)

**Brief:** This is a function to select certain group of groups (FIRST\_GROUP, SECOND\_GROUP) of port of ports (A,B,C,D,E) to set the direction (INPUT, OUTPUT)

# 4.7.1 Detailed Description

PORT Module Header File for this program.

Author

Nour

Date

27/7/2020

Version

1.0

# 4.7.2 Function Documentation

# 4.7.2.1 set\_pin\_direction()

**Brief:** This is a function to select certain pin of pins (0->7) of port of ports (A,B,C,D,E) to set the direction (INPUT, OUTPUT)

### **Parameters**

port	uint8 port to select port
pin	uint8 pin to select pin
direction	uint8 direction to select direction

### Returns

void

References INPUT, OUTPUT, PORTA\_CONFIG, PORTB\_CONFIG, PORTC\_CONFIG, PORTD\_CONFIG, and  $P \leftarrow ORTE\_CONFIG$ .

# 4.7.2.2 set\_port\_direction()

```
void set_port_direction (
          uint8 port,
          uint8 direction )
```

Brief: This is a function to select certain port of ports (A,B,C,D,E) to set the direction (INPUT, OUTPUT)

### **Parameters**

port	uint8 port to select port
direction	uint8 direction to select direction

## Returns

void

### 4.7.2.3 set\_group\_direction()

**Brief:** This is a function to select certain group of groups (FIRST\_GROUP, SECOND\_GROUP) of port of ports (A,B,C,D,E) to set the direction (INPUT, OUTPUT)

### **Parameters**

port	uint8 port to select port
group	uint8 group to select group
direction	uint8 direction to select direction

### Returns

void

References INPUT, OUTPUT, PORTB\_CONFIG, PORTC\_CONFIG, and PORTD\_CONFIG.

# 4.8 PORT\_config.h File Reference

PORT config Module Header File for this program.

### **Macros**

#define PORTA CONFIG 1

a preprocessor to define portA

• #define PORTB\_CONFIG 2

a preprocessor to define portB

• #define PORTC CONFIG 3

a preprocessor to define portC

• #define PORTD\_CONFIG 4

a preprocessor to define portD#define PORTE\_CONFIG 5

a preprocessor to define portE

# 4.8.1 Detailed Description

PORT\_config Module Header File for this program.

**Author** 

Nour

Date

27/7/2020

Version

1.0

# 4.9 SPI.c File Reference

SPI Module Source File for this program.

```
#include <pic16f877a.h>
#include "SPI.h"
#include "PORT.h"
```

# **Functions**

```
    void SPI_init (SPI_ConfigType *Config_Ptr)
        Brief: This is SPI Module Initialization Function

    void SPI_Transmit (uint8 data)
    Brief: This is function to transmit data using SPI
```

# 4.9.1 Detailed Description

SPI Module Source File for this program.

**Author** 

Nour

Date

29/9/2020

Version

1.0

# 4.9.2 Function Documentation

```
4.9.2.1 SPI_init()
```

Brief: This is SPI Module Initialization Function

**Parameters** 

Config\_Ptr | SPI\_ConfigType (p. 5) \* Config\_Ptr to select Config\_Ptr

4.10 SPI.h File Reference 27

Returns

void

# 4.9.2.2 SPI\_Transmit()

```
void SPI_Transmit (
     uint8 data )
```

Brief: This is function to transmit data using SPI

**Parameters** 

data uint8 data to select transmitted data

Returns

void

# 4.10 SPI.h File Reference

SPI Module Header File for this program.

```
#include "std_types.h"
```

### **Data Structures**

struct SPI\_ConfigType

# **Enumerations**

- enum Clock\_Select { \_0, \_1 }
- enum **Polarity** { \_\_0, \_\_1 }
- enum CLK {

• enum Mode { TX, RX }

# **Functions**

# SPI\_ConfigType

SPI\_ConfigTypee responsible for dynamic configuration of SPI module

- void **SPI\_init** ( **SPI\_ConfigType** \*Config\_Ptr)
  - Brief: This is SPI Module Initialization Function
- void SPI\_Transmit ( uint8 data)

Brief: This is function to transmit data using SPI

# 4.10.1 Detailed Description

SPI Module Header File for this program.

Author

Nour

Date

29/9/2020

Version

1.0

### 4.10.2 Function Documentation

# 4.10.2.1 SPI\_init()

Brief: This is SPI Module Initialization Function

**Parameters** 

```
Config_Ptr | SPI_ConfigType (p. 5) * Config_Ptr to select Config_Ptr
```

Returns

void

### 4.10.2.2 SPI\_Transmit()

```
void SPI_Transmit (
     uint8 data )
```

Brief: This is function to transmit data using SPI

**Parameters** 

data uint8 data to select transmitted data

Returns

void

# 4.11 std\_types.h File Reference

Standard Types Header File for this program.

### **Macros**

• #define LOW 0u

a preprocessor to define low

• #define **HIGH** 1u

a preprocessor to define high

• #define FALSE 0u

a preprocessor to define false

• #define TRUE 1u

a preprocessor to define true

• #define INPUT 1u

a preprocessor to define input

• #define OUTPUT 0u

a preprocessor to define output

• #define NULL\_PTR (void \*)0

a preprocessor to define null pointer

# **Typedefs**

typedef unsigned char uint8

a user defined datatype to define uint8

• typedef unsigned short uint16

a user defined datatype to define uint16

• typedef unsigned long uint32

a user defined datatype to define uint32

# 4.11.1 Detailed Description

Standard Types Header File for this program.

**Author** 

Nour

Date

16/9/2019

Version

1.0

# 4.12 TX.c File Reference

TX Source File for this program.

```
#include <xc.h>
#include "SPI.h"
#include "DIO.h"
#include "PORT.h"
```

# **Functions**

• void main (void)

# 4.12.1 Detailed Description

TX Source File for this program.

Author

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Date

17/9/2020

Version

1.0