

Erriez Oregon THN128 433MHz temperature sensor library for Arduino
1.1.0

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1 Main Page	1
2 Module Index	5
2.1 Modules	5
3 Class Index	7
3.1 Class List	7
4 File Index	9
4.1 File List	9
5 Module Documentation	11
5.1 data macro's	11
5.1.1 Detailed Description	11
5.1.2 Macro Definition Documentation	11
5.1.2.1 GET_CHANNEL	11
5.1.2.2 GET_CRC	12
5.1.2.3 GET_ROL_ADDR	12
5.1.2.4 GET_TEMP	12
5.1.2.5 LOW_BAT_BIT	12
5.1.2.6 SET_CHANNEL	13
5.1.2.7 SET_CRC	13
5.1.2.8 SET_ROL_ADDR	13
5.1.2.9 SET_TEMP	13
5.1.2.10 SIGN_BIT	13
6 Class Documentation	15
6.1 OregonTHN128Data_t Struct Reference	15
6.1.1 Detailed Description	15
6.1.2 Member Data Documentation	15
6.1.2.1 channel	15
6.1.2.2 lowBattery	16
6.1.2.3 rawData	16
6.1.2.4 rollingAddress	16
6.1.2.5 temperature	16
7 File Documentation	17
7.1 src/ErriezOregonTHN128.c File Reference	17
7.1.1 Detailed Description	18
7.1.2 Function Documentation	18
7.1.2.1 OregonTHN128_CheckCRC()	18
7.1.2.2 OregonTHN128_DataToRaw()	18
7.1.2.3 OregonTHN128_RawToData()	19
7.1.2.4 OregonTHN128_TempToString()	19

7.2 src/ErriezOregonTHN128Receive.c File Reference	20
7.2.1 Detailed Description	21
7.2.2 Enumeration Type Documentation	21
7.2.2.1 RxState_t	21
7.2.3 Function Documentation	21
7.2.3.1 OregonTHN128_Available()	21
7.2.3.2 OregonTHN128_Read()	22
7.2.3.3 OregonTHN128_RxBegin()	22
7.3 src/ErriezOregonTHN128Receive.h File Reference	22
7.3.1 Detailed Description	24
7.3.2 Function Documentation	24
7.3.2.1 OregonTHN128_Available()	24
7.3.2.2 OregonTHN128_Read()	25
7.3.2.3 OregonTHN128_RxBegin()	25
7.4 src/ErriezOregonTHN128Transmit.c File Reference	25
7.4.1 Detailed Description	26
7.4.2 Function Documentation	26
7.4.2.1 OregonTHN128_Transmit()	26
7.4.2.2 OregonTHN128_TxBegin()	27
7.4.2.3 OregonTHN128_TxEnd()	27
7.4.2.4 OregonTHN128_TxRawData()	27
7.5 src/ErriezOregonTHN128Transmit.h File Reference	28
7.5.1 Detailed Description	29
7.5.2 Function Documentation	29
7.5.2.1 OregonTHN128_Transmit()	29
7.5.2.2 OregonTHN128_TxBegin()	29
7.5.2.3 OregonTHN128_TxRawData()	29

Index	31
--------------	-----------

Chapter 1

Main Page

Oregon THN128 433MHz temperature transmit/receive library for Arduino

This is a 433MHz wireless 3-channel Oregon THN128 temperature transmit/receive Arduino library for ATmega328, ESP8266 and ESP32 emulating v1 protocol:

Transmit / receive hardware

This Arduino library is optimized for low-power ATmega328 microcontroller (AVR architectures like `Arduino UNO` and `Pro Mini 3.3V 8MHz` boards).

Temperature transmitter on the left breadboard:

- Pro-Mini 3V3 8MHz.
- Genuine DS18B20 temperature sensor.
- STX802 low-power 433MHz transmitter.

Receiver on the right breadboard:

- SRX882 low-power 433MHz receiver.
- SSD1306 I2C 128x64 OLED display.
- Pro-Mini 3V3 8MHz.

Supported microcontrollers

- ATmega328 AVR designed for low-power
- ESP8266
- ESP32
- Other microcontrollers are not tested and may or may not work

Hardware notes

Supported hardware:

- AVR designed for low-power
- ESP8266
- ESP32
- For low-power transmitters, a `Pro Mini 3V3 8MHz` bare board with ATmega328 microcontroller is highly recommended. The board has no serial interface chip which reduces continuous power consumption. An external FTDI232 - USB serial interface should be connected for serial console / programming. (See red PCB on the picture) The SMD power LED should be desoldered from the Pro Mini to reduce continuous power consumption.
- A transmitter with (protected) 1500mA 18650 battery can operate for at least 6 months with `LowPower.h` functionality implemented. (By sending the temperature every 30 seconds)
- Changing the BOD (Brown Out Detection) fuse to 1.8V allows operation between 1.8 and 4.2V 18650 battery. (Explanation beyond the scope of this project)
- 1 to 3 temperature transmitters are supported, similar to the original Oregon THN128 temperature transmitters.
- Check [list of counterfeit DS18B20 chips](#), because this makes a huge difference in accuracy and read errors at 3.3V. Many DS18B20 chips from Aliexpress are counterfeit and won't work reliable at voltages below 3.3V.
- [NiceRF Wireless Technology Co., Ltd.](#) sells high quality 433MHz transmit (STX802) and receiver modules (STX882) with a good range.
- A 18650 battery (with protection circuit) should be connected directly to the VCC pin (not VIN).
- The voltage regulator can be desoldered from the pro-micro board when not used for more power reduction.

Oregon Protocol

A packet is sent twice:

Data (see header file `ErriezOregonTHN128Receive.h`):

- Byte 0:
 - Bit 0..3: Rolling address (Random value after power cycle)
 - Bit 6..7: Channel: (0 = channel 1 .. 2 = channel 3)
- Byte 1:
 - Bit 0..3: TH3
 - Bit 4..7: TH2
- Byte 2:
 - Bit 0..3: TH1
 - Bit 5: Sign
 - Bit 7: Low battery
- Byte 3:
 - Bit 0..7: CRC

Examples

Please refer to the examples:

- [OregonTHN128 Receive](#)
- [OregonTHN128 Receive SSD1306 OLED](#)
- [OregonTHN128 Transmit random temperature](#)
- [OregonTHN128 Transmit DS1820 1-wire temperature sensor](#)

Library Changes

v1.1.0

The callback function `void delay100ms()` has been removed as this was not compatible with ESP32. The application should change the code to:

```
{c++}
// Send temperature twice with 100ms delay between packets
OregonTHN128_Transmit(&data);
delay(100);
OregonTHN128_Transmit(&data);
```

AVR targets can replace `delay(100)` with LowPower usage:

```
{c++}
LowPower.powerDown(SLEEP_15MS, ADC_OFF, BOD_OFF);
LowPower.powerDown(SLEEP_60MS, ADC_OFF, BOD_OFF);
LowPower.powerDown(SLEEP_15MS, ADC_OFF, BOD_OFF);
```

Saleae Logic Analyzer

[capture](#) from the Oregon THN128 can be opened with <https://www.saleae.com/downloads/>.

Generated Arduino Library Doxygen Documentation

- [Online Doxygen HTML](#)
- [Doxygen PDF](#)

MIT License

This project is published under [MIT license](#) with an additional end user agreement (next section).

End User Agreement :ukraine:

End users shall accept the [End User Agreement](#) holding export restrictions to Russia to stop the WAR before using this project.

Chapter 2

Module Index

2.1 Modules

Here is a list of all modules:

data macro's	11
------------------------	----

Chapter 3

Class Index

3.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

OregonTHN128Data_t	
Data structure	15

Chapter 4

File Index

4.1 File List

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

src/ ErriezOregonTHN128.c	
Oregon THN128 433MHz temperature transmit/receive library for Arduino	17
src/ ErriezOregonTHN128.h	??
src/ ErriezOregonTHN128Receive.c	
Oregon THN128 433MHz temperature transmit/receive library for Arduino	20
src/ ErriezOregonTHN128Receive.h	
Oregon THN128 433MHz temperature receive library for Arduino	22
src/ ErriezOregonTHN128Transmit.c	
Oregon THN128 433MHz temperature transmit library for Arduino	25
src/ ErriezOregonTHN128Transmit.h	
Oregon THN128 433MHz temperature transmit library for Arduino	28

Chapter 5

Module Documentation

5.1 data macro's

Macros

- #define SET_ROL_ADDR(x) (((x) & 0x07) << 0)
- #define GET_ROL_ADDR(x) (((x) & 0x07) << 0)
- #define SET_CHANNEL(x) (((x) - 1) & 0x03) << 6)
- #define GET_CHANNEL(x) (((x) >> 6) & 0x03) + 1)
- #define SET_TEMP(x)
- #define GET_TEMP(x)
- #define SIGN_BIT (1UL << 21)
- #define LOW_BAT_BIT (1UL << 23)
- #define SET_CRC(x) ((uint32_t)(x) << 24)
- #define GET_CRC(x) ((x) >> 24)

5.1.1 Detailed Description

5.1.2 Macro Definition Documentation

5.1.2.1 GET_CHANNEL

```
#define GET_CHANNEL(  
    x ) (((x) >> 6) & 0x03) + 1)
```

Get channel

Definition at line 49 of file ErriezOregonTHN128.c.

5.1.2.2 GET_CRC

```
#define GET_CRC(  
    x ) ((x) >> 24)
```

Get CRC

Definition at line 69 of file ErriezOregonTHN128.c.

5.1.2.3 GET_ROL_ADDR

```
#define GET_ROL_ADDR(  
    x ) (((x) & 0x07) << 0)
```

Get rolling address

Definition at line 44 of file ErriezOregonTHN128.c.

5.1.2.4 GET_TEMP

```
#define GET_TEMP(  
    x )
```

Value:

```
(((((x) >> 16) & 0x0f) * 100) + \  
(((x) >> 12) & 0x0f) * 10) + \  
(((x) >> 8) & 0x0f))
```

Get temperature

Definition at line 56 of file ErriezOregonTHN128.c.

5.1.2.5 LOW_BAT_BIT

```
#define LOW_BAT_BIT (1UL << 23)
```

Low battery bit

Definition at line 64 of file ErriezOregonTHN128.c.

5.1.2.6 SET_CHANNEL

```
#define SET_CHANNEL(  
    x ) (((x) - 1) & 0x03) << 6)
```

Set channel

Definition at line 47 of file ErriezOregonTHN128.c.

5.1.2.7 SET_CRC

```
#define SET_CRC(  
    x ) ((uint32_t)(x) << 24)
```

Set CRC

Definition at line 67 of file ErriezOregonTHN128.c.

5.1.2.8 SET_ROL_ADDR

```
#define SET_ROL_ADDR(  
    x ) ((x) & 0x07) << 0)
```

Set rolling address

Definition at line 42 of file ErriezOregonTHN128.c.

5.1.2.9 SET_TEMP

```
#define SET_TEMP(  
    x )
```

Value:

```
(((((uint32_t)(x) / 100) % 10)) << 16) | \  
(((uint32_t)(x) / 10) % 10) << 12) | \  
((x) % 10) << 8)
```

Set temperature

Definition at line 52 of file ErriezOregonTHN128.c.

5.1.2.10 SIGN_BIT

```
#define SIGN_BIT (1UL << 21)
```

Sign bit

Definition at line 61 of file ErriezOregonTHN128.c.

Chapter 6

Class Documentation

6.1 OregonTHN128Data_t Struct Reference

Data structure.

```
#include <ErriezOregonTHN128.h>
```

Public Attributes

- uint32_t [rawData](#)
- uint8_t [rollingAddress](#)
- uint8_t [channel](#)
- int16_t [temperature](#)
- bool [lowBattery](#)

6.1.1 Detailed Description

Data structure.

Definition at line 63 of file ErriezOregonTHN128.h.

6.1.2 Member Data Documentation

6.1.2.1 channel

```
uint8_t OregonTHN128Data_t::channel
```

Channel

Definition at line 66 of file ErriezOregonTHN128.h.

6.1.2.2 lowBattery

```
bool OregonTHN128Data_t::lowBattery
```

Low battery indication

Definition at line 68 of file ErriezOregonTHN128.h.

6.1.2.3 rawData

```
uint32_t OregonTHN128Data_t::rawData
```

Raw data

Definition at line 64 of file ErriezOregonTHN128.h.

6.1.2.4 rollingAddress

```
uint8_t OregonTHN128Data_t::rollingAddress
```

Rolling address

Definition at line 65 of file ErriezOregonTHN128.h.

6.1.2.5 temperature

```
int16_t OregonTHN128Data_t::temperature
```

Temperature

Definition at line 67 of file ErriezOregonTHN128.h.

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

- src/ErriezOregonTHN128.h

Chapter 7

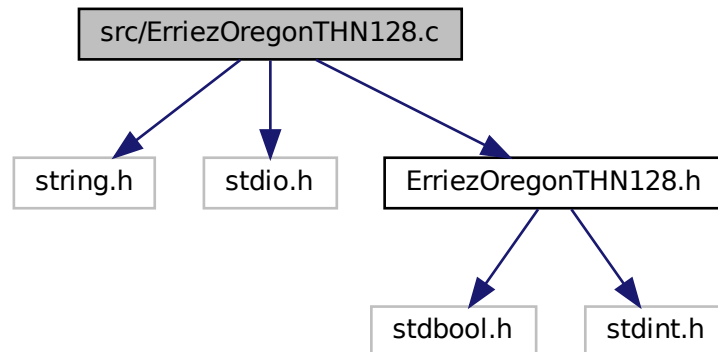
File Documentation

7.1 src/ErriezOregonTHN128.c File Reference

Oregon THN128 433MHz temperature transmit/receive library for Arduino.

```
#include <string.h>
#include <stdio.h>
#include "ErriezOregonTHN128.h"
```

Include dependency graph for ErriezOregonTHN128.c:



Macros

- `#define SET_ROL_ADDR(x) (((x) & 0x07) << 0)`
- `#define GET_ROL_ADDR(x) (((x) & 0x07) << 0)`
- `#define SET_CHANNEL(x) (((x) - 1) & 0x03) << 6)`
- `#define GET_CHANNEL(x) (((x) >> 6) & 0x03) + 1)`
- `#define SET_TEMP(x)`
- `#define GET_TEMP(x)`
- `#define SIGN_BIT (1UL << 21)`
- `#define LOW_BAT_BIT (1UL << 23)`
- `#define SET_CRC(x) ((uint32_t)(x) << 24)`
- `#define GET_CRC(x) ((x) >> 24)`

Functions

- bool [OregonTHN128_CheckCRC](#) (uint32_t rawData)
Verify checksum.
- void [OregonTHN128_TempToString](#) (char *temperatureStr, uint8_t temperatureStrLen, int16_t temperature)
Convert temperature to string.
- uint32_t [OregonTHN128_DataToRaw](#) ([OregonTHN128Data_t](#) *data)
Convert data structure to 32-bit raw data.
- bool [OregonTHN128_RawToData](#) (uint32_t rawData, [OregonTHN128Data_t](#) *data)
Convert 32-bit raw data to [OregonTHN128Data_t](#) structure.

7.1.1 Detailed Description

Oregon THN128 433MHz temperature transmit/receive library for Arduino.

Source: <https://github.com/Erriez/ErriezOregonTHN128> Documentation: <https://erriez.github.io/ErriezOregonTHN128>

7.1.2 Function Documentation

7.1.2.1 OregonTHN128_CheckCRC()

```
bool OregonTHN128_CheckCRC (
    uint32_t rawData )
```

Verify checksum.

Parameters

<i>rawData</i>	32-bit raw data input
----------------	-----------------------

Returns

true: Success, false: error

Definition at line 101 of file ErriezOregonTHN128.c.

7.1.2.2 OregonTHN128_DataToRaw()

```
uint32_t OregonTHN128_DataToRaw (
    OregonTHN128Data_t * data )
```

Convert data structure to 32-bit raw data.

Parameters

<i>data</i>	Input
-------------	-------

Returns

Output

Definition at line 141 of file ErriezOregonTHN128.c.

7.1.2.3 OregonTHN128_RawToData()

```
bool OregonTHN128_RawToData (
    uint32_t rawData,
    OregonTHN128Data_t * data )
```

Convert 32-bit raw data to [OregonTHN128Data_t](#) structure.

Parameters

<i>rawData</i>	32-bit input
<i>data</i>	output

Returns

CRC true: Success, false: error

Definition at line 180 of file ErriezOregonTHN128.c.

7.1.2.4 OregonTHN128_TempToString()

```
void OregonTHN128_TempToString (
    char * temperatureStr,
    uint8_t temperatureStrLen,
    int16_t temperature )
```

Convert temperature to string.

Parameters

<i>temperatureStr</i>	Character buffer
<i>temperatureStrLen</i>	Size of character buffer
<i>temperature</i>	Input temperature

Definition at line 118 of file ErriezOregonTHN128.c.

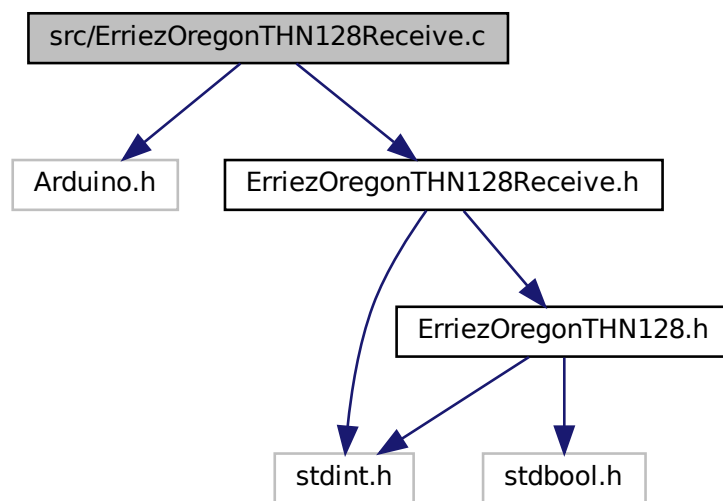
7.2 src/ErriezOregonTHN128Receive.c File Reference

Oregon THN128 433MHz temperature transmit/receive library for Arduino.

```
#include <Arduino.h>
```

```
#include "ErriezOregonTHN128Receive.h"
```

Include dependency graph for ErriezOregonTHN128Receive.c:



Enumerations

- enum `RxState_t` {
`StateSearchSync` = 0, `StateMid0` = 1, `StateMid1` = 2, `StateEnd` = 3,
`StateRxComplete` = 4 }

Receive state.

Functions

- void `rfPinChange` (void)
RF pin level change.
- void `OregonTHN128_RxBegin` (uint8_t extIntPin)
Initialize receiver pin.
- void `OregonTHN128_RxEnable` ()
Receive enable.
- void `OregonTHN128_RxDisable` ()
Receive disable.
- bool `OregonTHN128_Available` ()
Check if data received.
- bool `OregonTHN128_Read` (OregonTHN128Data_t *data)
Read data.

7.2.1 Detailed Description

Oregon THN128 433MHz temperature transmit/receive library for Arduino.

Source: <https://github.com/Erriez/ErriezOregonTHN128> Documentation: <https://erriez.github.io/ErriezOregonTHN128>

7.2.2 Enumeration Type Documentation

7.2.2.1 RxState_t

enum `RxState_t`

Receive state.

Enumerator

StateSearchSync	Search for sync
StateMid0	Sample at the middle of a pulse part 1
StateMid1	Sample at the middle of a pulse part 2
StateEnd	Sample at the end of a pulse to store bit
StateRxComplete	Receive complete

Definition at line 44 of file ErriezOregonTHN128Receive.c.

7.2.3 Function Documentation

7.2.3.1 OregonTHN128_Available()

`bool OregonTHN128_Available ()`

Check if data received.

Return values

<i>true</i>	Data received
<i>false</i>	No data available

Definition at line 358 of file ErriezOregonTHN128Receive.c.

7.2.3.2 OregonTHN128_Read()

```
bool OregonTHN128_Read (
    OregonTHN128Data_t * data )
```

Read data.

Parameters

<i>data</i>	Structure OregonTHN128Data_t output
-------------	---

Return values

<i>true</i>	Data received
<i>false</i>	No data available

Definition at line 373 of file `ErriezOregonTHN128Receive.c`.

7.2.3.3 OregonTHN128_RxBegin()

```
void OregonTHN128_RxBegin (
    uint8_t extIntPin )
```

Initialize receiver pin.

Connect RX pin to an external interrupt pin such as INT0 (D2) or INT1 (D3)

Parameters

<i>extIntPin</i>	
------------------	--

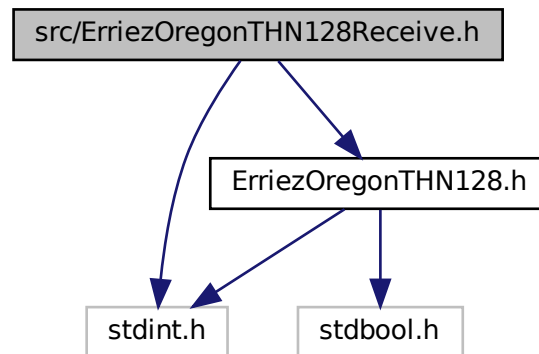
Definition at line 324 of file `ErriezOregonTHN128Receive.c`.

7.3 src/ErriezOregonTHN128Receive.h File Reference

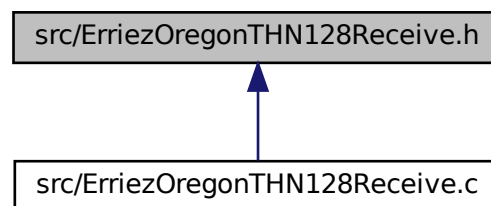
Oregon THN128 433MHz temperature receive library for Arduino.

```
#include <stdint.h>
#include "ErriezOregonTHN128.h"
```

Include dependency graph for ErriezOregonTHN128Receive.h:



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



Functions

- void `OregonTHN128_RxBegin` (uint8_t extIntPin)
Initialize receiver pin.
- void `OregonTHN128_RxEnable` ()
Receive enable.
- void `OregonTHN128_RxDisable` ()
Receive disable.
- bool `OregonTHN128_Available` (void)
Check if data received.
- bool `OregonTHN128_Read` (OregonTHN128Data_t *data)
Read data.

7.3.1 Detailed Description

Oregon THN128 433MHz temperature receive library for Arduino.

Source: <https://github.com/Erriez/ErriezOregonTHN128> Documentation: <https://erriez.github.io/ErriezOregonTHN128>

Protocol:

Transmit temperature twice every 30 seconds:

Bit: 0 7 0 7 0 7 0 7 +---+ +---+ +---+ +---+ +---+ +---+ +---+ +---+ | PREA | SYNC | Byte 0 | Byte 1 | Byte 2 | Byte 3 |
| PREA | SYNC | Byte 0 | ... +---+ +---+ +---+ +---+ +---+ +---+ +---+ +---+ | <----- 144ms -----
--> | <- 100ms -> | 30 sec

Logic '0': Logic '1': +---+ +---+ | | +---+ +---+ 1400 1500 1500 1400 (us)

PREA: Preamble 12x logic '1', 3000us low

SYNC: +-----+ | |

- +-----+ 5500us 5500us

Byte 0:

- Bit 0..3: Rolling address (Random value after power cycle)
- Bit 6..7: Channel: (0 = channel 1 .. 2 = channel 3)

Byte 1:

- Bit 0..3: TH3
- Bit 4..7: TH2

Byte 2:

- Bit 0..3: TH1
- Bit 5: Sign
- Bit 7: Low battery

Byte 3:

- Bit 0..7: CRC

Example: Rolling address = 5, channel = 1, temperature = 27.8 `C, low battery = false TH1 = 2, TH2 = 7, TH3 = 8:
Byte 0: 0x05 Byte 1: 0x78 Byte 2: 0x02 Byte 3: 0x7f

Bits in time: PRE=1 S B0=0x05 B1=0x78 B2=0x02 B3=0x7f 111111111111 S 10100000 00011110 01000000 11111110

7.3.2 Function Documentation

7.3.2.1 OregonTHN128_Available()

```
bool OregonTHN128_Available ( )
```

Check if data received.

Return values

<i>true</i>	Data received
<i>false</i>	No data available

Definition at line 358 of file ErriezOregonTHN128Receive.c.

7.3.2.2 OregonTHN128_Read()

```
bool OregonTHN128_Read (
    OregonTHN128Data_t * data )
```

Read data.

Parameters

<i>data</i>	Structure OregonTHN128Data_t output
-------------	---

Return values

<i>true</i>	Data received
<i>false</i>	No data available

Definition at line 373 of file ErriezOregonTHN128Receive.c.

7.3.2.3 OregonTHN128_RxBegin()

```
void OregonTHN128_RxBegin (
    uint8_t extIntPin )
```

Initialize receiver pin.

Connect RX pin to an external interrupt pin such as INT0 (D2) or INT1 (D3)

Parameters

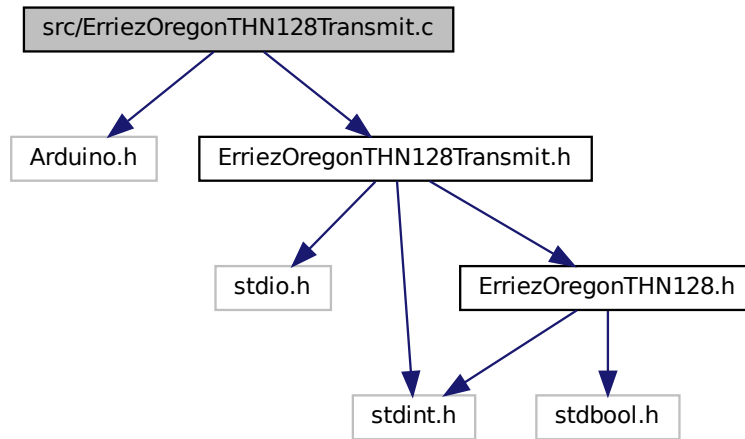
<i>extIntPin</i>	
------------------	--

Definition at line 324 of file ErriezOregonTHN128Receive.c.

7.4 src/ErriezOregonTHN128Transmit.c File Reference

Oregon THN128 433MHz temperature transmit library for Arduino.

```
#include <Arduino.h>
#include "ErriezOregonTHN128Transmit.h"
Include dependency graph for ErriezOregonTHN128Transmit.c:
```



Functions

- void [OregonTHN128_TxBegin](#) (uint8_t rfTxPin)
Transmit begin.
- void [OregonTHN128_TxEnd](#) (void)
Disable transmit.
- void [OregonTHN128_TxRawData](#) (uint32_t rawData)
Transmit data.
- void [OregonTHN128_Transmit](#) ([OregonTHN128Data_t](#) *data)
Transmit Transmit data.

7.4.1 Detailed Description

Oregon THN128 433MHz temperature transmit library for Arduino.

Source: <https://github.com/Erriez/ErriezOregonTHN128> Documentation: <https://erriez.github.io/ErriezOregonTHN128>

7.4.2 Function Documentation

7.4.2.1 OregonTHN128_Transmit()

```
void OregonTHN128_Transmit (
    OregonTHN128Data_t * data )
```

Transmit Transmit data.

The application should call [OregonTHN128_TxRawData\(\)](#) twice at 100ms interval.

Parameters

<i>data</i>	Oregon THN128 input structure
-------------	-------------------------------

Definition at line 292 of file ErriezOregonTHN128Transmit.c.

7.4.2.2 OregonTHN128_TxBegin()

```
void OregonTHN128_TxBegin (  
    uint8_t rfTxPin )
```

Transmit begin.

Connect rfTxPin to any DIGITAL pin

Parameters

<i>rfTxPin</i>	Arduino transmit pin
----------------	----------------------

Definition at line 248 of file ErriezOregonTHN128Transmit.c.

7.4.2.3 OregonTHN128_TxEnd()

```
void OregonTHN128_TxEnd (  
    void )
```

Disable transmit.

Set transmit pin to input

Definition at line 259 of file ErriezOregonTHN128Transmit.c.

7.4.2.4 OregonTHN128_TxRawData()

```
void OregonTHN128_TxRawData (  
    uint32_t rawData )
```

Transmit data.

Parameters

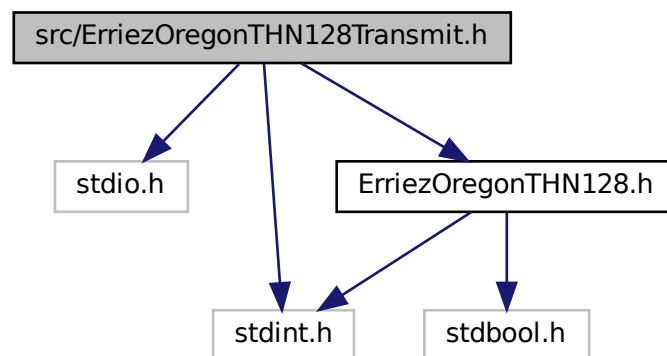
<i>rawData</i>	32-bit raw data input
----------------	-----------------------

Definition at line 270 of file ErriezOregonTHN128Transmit.c.

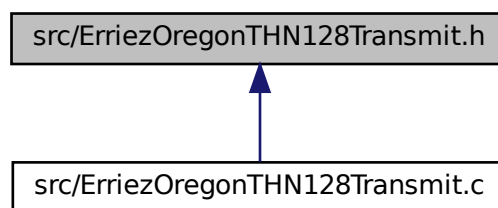
7.5 src/ErriezOregonTHN128Transmit.h File Reference

Oregon THN128 433MHz temperature transmit library for Arduino.

```
#include <stdio.h>
#include <stdint.h>
#include "ErriezOregonTHN128.h"
Include dependency graph for ErriezOregonTHN128Transmit.h:
```



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



Functions

- void `OregonTHN128_TxBegin` (uint8_t rTxPin)
Transmit begin.
- void `OregonTHN128_TxRawData` (uint32_t rawData)
Transmit data.
- void `OregonTHN128_Transmit` (OregonTHN128Data_t *data)
Transmit Transmit data.

7.5.1 Detailed Description

Oregon THN128 433MHz temperature transmit library for Arduino.

Source: <https://github.com/Erriez/ErriezOregonTHN128> Documentation: <https://erriez.github.io/ErriezOregonTHN128>

7.5.2 Function Documentation

7.5.2.1 OregonTHN128_Transmit()

```
void OregonTHN128_Transmit (
    OregonTHN128Data_t * data )
```

Transmit Transmit data.

The application should call [OregonTHN128_TxRawData\(\)](#) twice at 100ms interval.

Parameters

<i>data</i>	Oregon THN128 input structure
-------------	-------------------------------

Definition at line 292 of file ErriezOregonTHN128Transmit.c.

7.5.2.2 OregonTHN128_TxBegin()

```
void OregonTHN128_TxBegin (
    uint8_t rfTxPin )
```

Transmit begin.

Connect rfTxPin to any DIGITAL pin

Parameters

<i>rfTxPin</i>	Arduino transmit pin
----------------	----------------------

Definition at line 248 of file ErriezOregonTHN128Transmit.c.

7.5.2.3 OregonTHN128_TxRawData()

```
void OregonTHN128_TxRawData (
    uint32_t rawData )
```

Transmit data.

Parameters

<i>rawData</i>	32-bit raw data input
----------------	-----------------------

Definition at line 270 of file ErriezOregonTHN128Transmit.c.

Index

channel
 OregonTHN128Data_t, [15](#)

data macro's, [11](#)
 GET_CHANNEL, [11](#)
 GET_CRC, [11](#)
 GET_ROL_ADDR, [12](#)
 GET_TEMP, [12](#)
 LOW_BAT_BIT, [12](#)
 SET_CHANNEL, [12](#)
 SET_CRC, [13](#)
 SET_ROL_ADDR, [13](#)
 SET_TEMP, [13](#)
 SIGN_BIT, [13](#)

ErriezOregonTHN128.c
 OregonTHN128_CheckCRC, [18](#)
 OregonTHN128_DataToRaw, [18](#)
 OregonTHN128_RawToData, [19](#)
 OregonTHN128_TempToString, [19](#)

ErriezOregonTHN128Receive.c
 OregonTHN128_Available, [21](#)
 OregonTHN128_Read, [21](#)
 OregonTHN128_RxBegin, [22](#)
 RxState_t, [21](#)
 StateEnd, [21](#)
 StateMid0, [21](#)
 StateMid1, [21](#)
 StateRxComplete, [21](#)
 StateSearchSync, [21](#)

ErriezOregonTHN128Receive.h
 OregonTHN128_Available, [24](#)
 OregonTHN128_Read, [25](#)
 OregonTHN128_RxBegin, [25](#)

ErriezOregonTHN128Transmit.c
 OregonTHN128_Transmit, [26](#)
 OregonTHN128_TxBegin, [27](#)
 OregonTHN128_TxEnd, [27](#)
 OregonTHN128_TxRawData, [27](#)

ErriezOregonTHN128Transmit.h
 OregonTHN128_Transmit, [29](#)
 OregonTHN128_TxBegin, [29](#)
 OregonTHN128_TxRawData, [29](#)

GET_CHANNEL
 data macro's, [11](#)

GET_CRC
 data macro's, [11](#)

GET_ROL_ADDR
 data macro's, [12](#)

GET_TEMP
 data macro's, [12](#)

LOW_BAT_BIT
 data macro's, [12](#)

lowBattery
 OregonTHN128Data_t, [15](#)

OregonTHN128_Available
 ErriezOregonTHN128Receive.c, [21](#)
 ErriezOregonTHN128Receive.h, [24](#)

OregonTHN128_CheckCRC
 ErriezOregonTHN128.c, [18](#)

OregonTHN128_DataToRaw
 ErriezOregonTHN128.c, [18](#)

OregonTHN128_RawToData
 ErriezOregonTHN128.c, [19](#)

OregonTHN128_Read
 ErriezOregonTHN128Receive.c, [21](#)
 ErriezOregonTHN128Receive.h, [25](#)

OregonTHN128_RxBegin
 ErriezOregonTHN128Receive.c, [22](#)
 ErriezOregonTHN128Receive.h, [25](#)

OregonTHN128_TempToString
 ErriezOregonTHN128.c, [19](#)

OregonTHN128_Transmit
 ErriezOregonTHN128Transmit.c, [26](#)
 ErriezOregonTHN128Transmit.h, [29](#)

OregonTHN128_TxBegin
 ErriezOregonTHN128Transmit.c, [27](#)
 ErriezOregonTHN128Transmit.h, [29](#)

OregonTHN128_TxEnd
 ErriezOregonTHN128Transmit.c, [27](#)

OregonTHN128_TxRawData
 ErriezOregonTHN128Transmit.c, [27](#)
 ErriezOregonTHN128Transmit.h, [29](#)

OregonTHN128Data_t, [15](#)
 channel, [15](#)
 lowBattery, [15](#)
 rawData, [16](#)
 rollingAddress, [16](#)
 temperature, [16](#)

rawData
 OregonTHN128Data_t, [16](#)

rollingAddress
 OregonTHN128Data_t, [16](#)

RxState_t
 ErriezOregonTHN128Receive.c, [21](#)

SET_CHANNEL

- data macro's, [12](#)
- SET_CRC
 - data macro's, [13](#)
- SET_ROL_ADDR
 - data macro's, [13](#)
- SET_TEMP
 - data macro's, [13](#)
- SIGN_BIT
 - data macro's, [13](#)
- src/ErriezOregonTHN128.c, [17](#)
- src/ErriezOregonTHN128Receive.c, [20](#)
- src/ErriezOregonTHN128Receive.h, [22](#)
- src/ErriezOregonTHN128Transmit.c, [25](#)
- src/ErriezOregonTHN128Transmit.h, [28](#)
- StateEnd
 - ErriezOregonTHN128Receive.c, [21](#)
- StateMid0
 - ErriezOregonTHN128Receive.c, [21](#)
- StateMid1
 - ErriezOregonTHN128Receive.c, [21](#)
- StateRxComplete
 - ErriezOregonTHN128Receive.c, [21](#)
- StateSearchSync
 - ErriezOregonTHN128Receive.c, [21](#)
- temperature
 - OregonTHN128Data_t, [16](#)