

Erriez Oregon THN128 433MHz temperature sensor library for Arduino  
1.1.0

Generated by Doxygen 1.8.17



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# 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:

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## Chapter 3

# Class Index

### 3.1 Class List

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

<a href="#">OregonTHN128Data_t</a>	
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## Chapter 4

# File Index

### 4.1 File List

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

src/ <a href="#">ErriezOregonTHN128.c</a>	
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src/ <b>ErriezOregonTHN128.h</b> . . . . .	<b>??</b>
src/ <a href="#">ErriezOregonTHN128Receive.c</a>	
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## 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

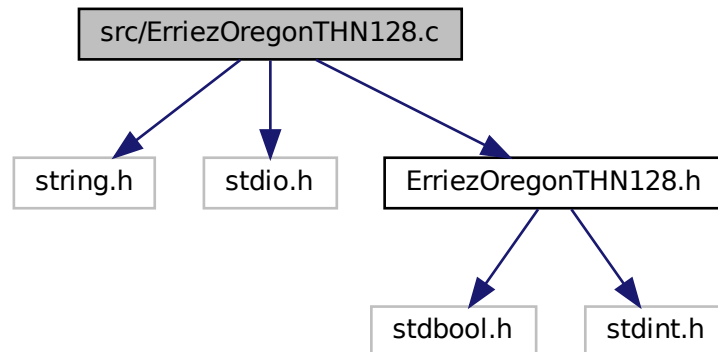
# File Documentation

### 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.

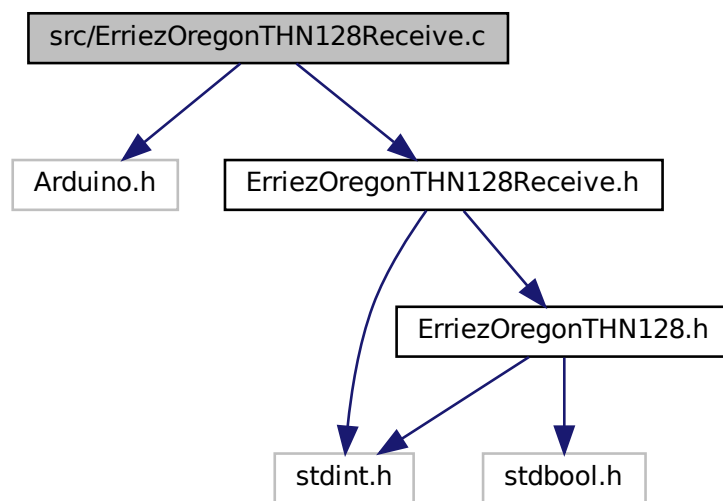
## 7.2 src/ErriezOregonTHN128Receive.c File Reference

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 <a href="#">OregonTHN128Data_t</a> 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>	
------------------	--

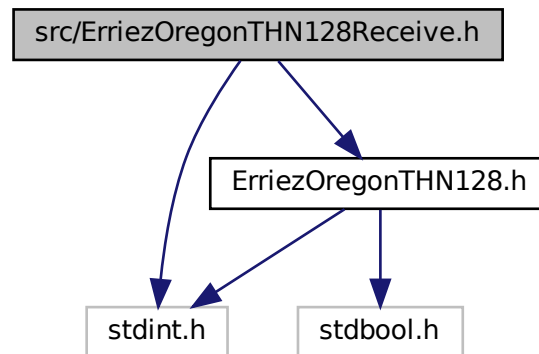
Definition at line 324 of file `ErriezOregonTHN128Receive.c`.

## 7.3 src/ErriezOregonTHN128Receive.h File Reference

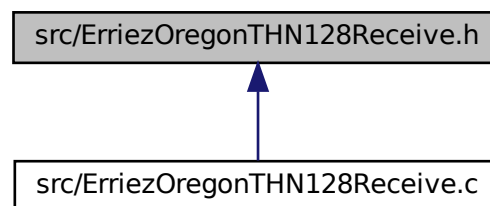
Oregon THN128 433MHz temperature receive library for Arduino.

```
#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.*



## 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 <a href="#">OregonTHN128Data_t</a> 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

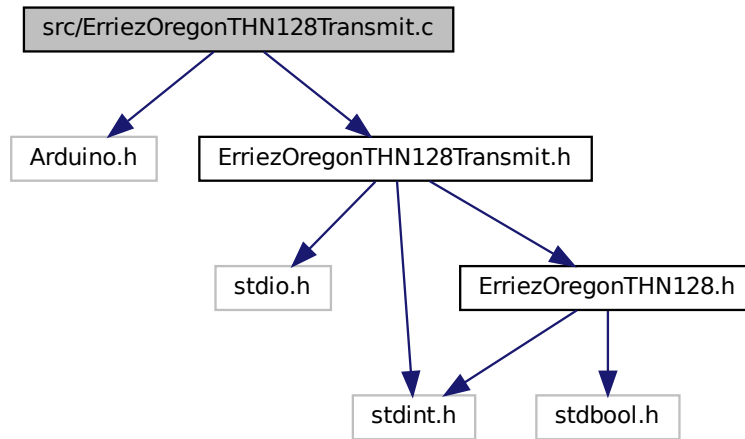
<i>extIntPin</i>	
------------------	--

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**

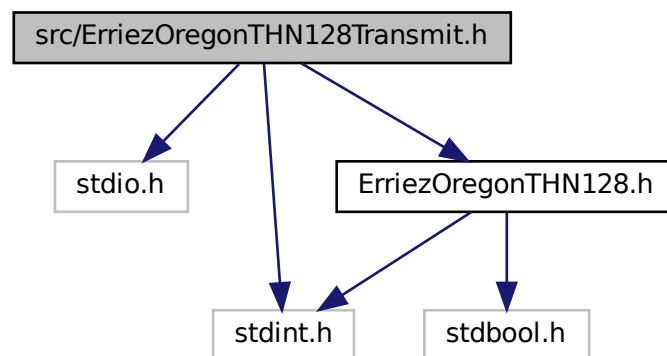
<i>rawData</i>	32-bit raw data input
----------------	-----------------------

Definition at line 270 of file ErriezOregonTHN128Transmit.c.

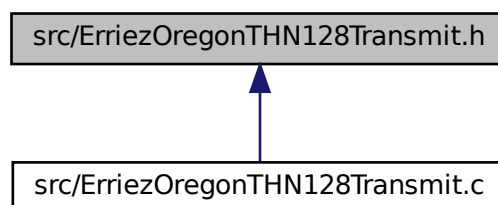
## 7.5 src/ErriezOregonTHN128Transmit.h File Reference

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.

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