

## How to use the evaluation board for the STHV64SW high voltage switch matrix

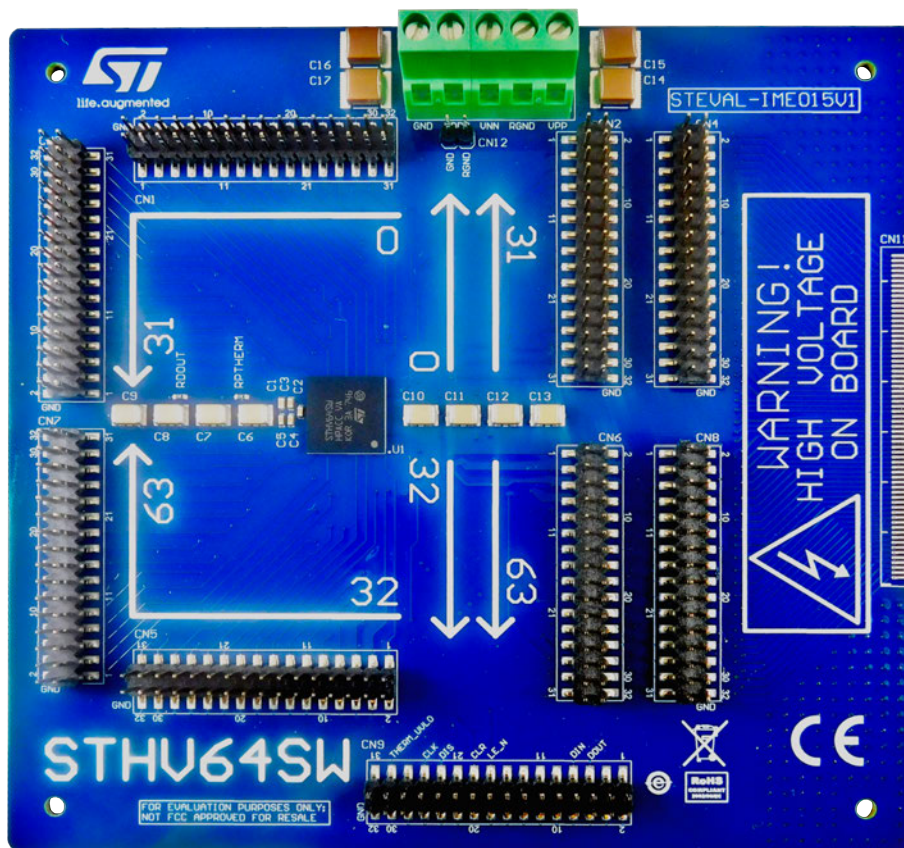
### Introduction

The STEVAL-IME015V1 evaluation board is based on the [STHV64SW](#) high voltage switch matrix, designed for ultrasound imaging applications.

The system can switch 64 independent high voltage channels through switch input and output connections on standard 2.54 mm headers, as well as through digital I/O's. Each channel can be used as a switch for external transmitters or receivers, or to directly drive transducers for low frequency applications.

A standard ultrasound probe connector can be soldered to the board to help evaluate the performance of the STHV64SW device in your application.

**Figure 1. STEVAL-IME015V1 evaluation board**

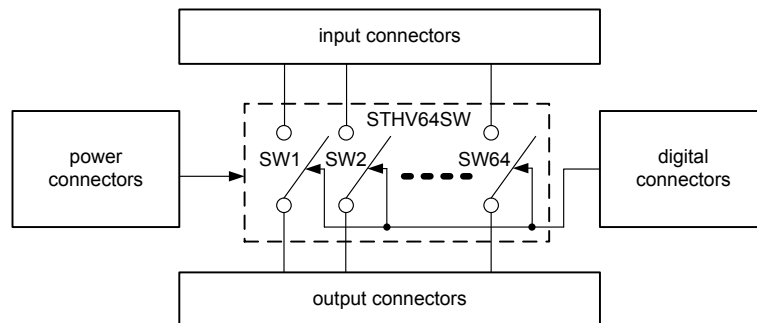


## 1 STEVAL-IME015V1 evaluation board overview

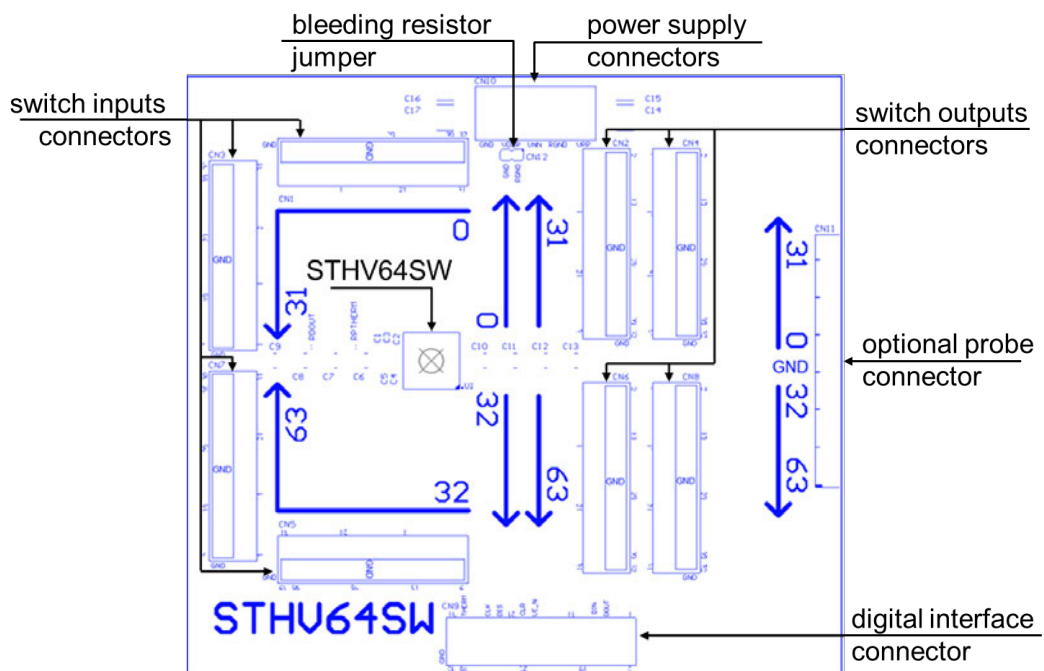
The STEVAL-IME015V1 evaluation board for the [STHV64SW](#) switch matrix device features the following characteristics:

- Suitable for ultrasound imaging applications
- 64 high voltage channels
- Switch input and output header connectors
- High voltage and low voltage connectors to power the [STHV64SW](#)
- Digital input and output header connector
- Optional standard probe connector footprint

**Figure 2. STEVAL-IME015V1 hardware block diagram**

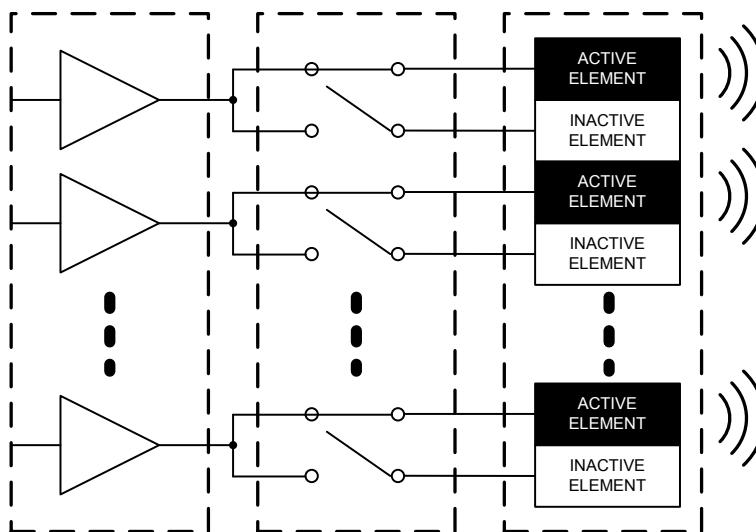


**Figure 3. STEVAL-IME015V1 board layout**



The STHV64SW device is ideal for high voltage channel multiplexing, and can drive a high number of probes. The following figure shows a single STHV64SW connecting a 32-channel Tx/Rx front end to a 64-element probe. The image below shows the connectors, jumpers and other board features.

Figure 4. Typical application block diagram





## 1.1 Power supply

The STEVAL-IME015V1 board is powered through connector CN10:

- VDDP: 3.3V DC
- VPP: positive high voltage, 0 to +200V DC
- VNN: negative high voltage, 0 to -200V DC
- RGND: bleeding resistor ground
- GND: common ground

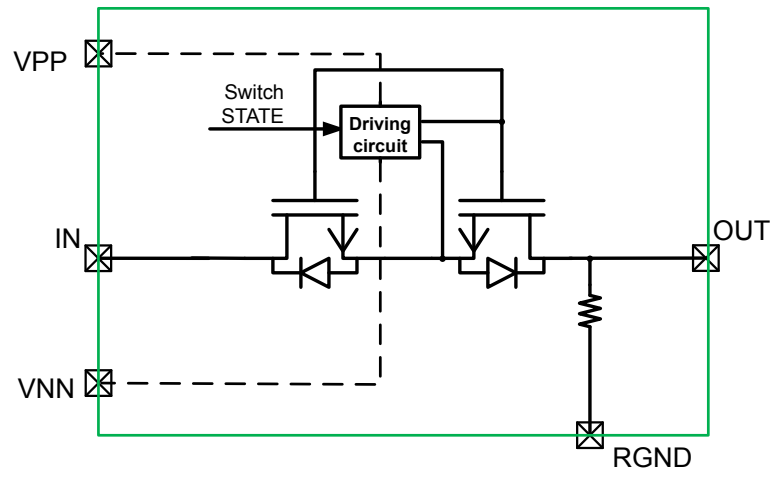
Table 1. Power related jumpers

| Connector | Description   |   |
|-----------|---|---|
| CN12      |  | RGND bleeding resistor ground is available on CN10 connector.<br>Default Setting.   |
|           |  | RGND bleeding resistor ground is shorted at common ground at board level.<br>Do not connect any voltage on RGND CN10 connector. |

## 1.2 STHV64SW switch block

The STHV64SW switch block is implemented with two power transistors and a bleeding resistor connected between output OUT and RGND (a dedicated ground for resistors). All power supply nets are in common for each switch.

Figure 5. STHV64SW switch block



## 2 How to use the board

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The start using the STEVAL-IME015V1 evaluation board, you only need to perform the following steps:

- Step 1.** Attach an appropriate power supply.
- Step 2.** Connect the channel headers to your oscilloscope.
- Step 3.** Connect channel headers to your transmitter, receiver or transducers.
- Step 4.** Connect digital I/Os to a digital controller like an FPGA, MCU or pattern generator.

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### RELATED LINKS

[5 Connectors on page 10](#)

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### 3 Digital interface

The STEVAL-IME015V1 provides full access to all the functional digital I/Os of the [STHV64SW](#) device. The STHV64SW digital interface consists of a serial-input parallel-output 64-bit shift register.

**Table 2. STHV64SW digital interface signals**

| Signal Name | Function  | Maximum operating values |
|-------------|---|--------------------------|
| THERM_UVLO  | Thermal protection and undervoltage lock out output | -0.3 to VDDP + 0.3       |
| CLK         | Clock signal  | -0.3 to VDDP + 0.3       |
| DIS         | Disable signal                                      | -0.3 to VDDP + 0.3       |
| CLR         | Clear signal  | -0.3 to VDDP + 0.3       |
| LE_N        | Latch enable  | -0.3 to VDDP + 0.3       |
| DIN         | Serial interface data in                            | -0.3 to VDDP + 0.3       |
| DOUT        | Serial Interface data out                           | 0.3 to VDDP + 0.3        |

**Table 3. STHV64SW digital interface truth table**

| D0  | D1  | ... | D63 | D64 | LE_n | CLR | DIS | SW0  | SW1 | ..  | SW63 | SW64 |
|-----|-----|-----|-----|-----|------|-----|-----|--|-----|-----|------|------|
| L   | -   |     | -   | -   | L    | L   | L   | OFF  | -   |     | -    | -    |
| H   | -   |     | -   | -   | L    | L   | L   | ON   | -   |     | -    | -    |
| -   | L   |     | -   | -   | L    | L   | L   | -  | OFF |     | -    | -    |
| -   | H   |     | -   | -   | L    | L   | L   | -  | ON  |     | -    | -    |
| -   | -   |     | -   | -   | L    | L   | L   | -  | -   |     | -    | -    |
| ... | ... |     | ... |     |      |     |     |  |     | ... |      | ...  |
| -   | -   |     | -   | -   | L    | L   | L   | -  | -   |     | -    | -    |
| -   | -   |     | L   | -   | L    | L   | L   | -  | -   |     | OFF  | -    |
| -   | -   |     | H   | -   | L    | L   | L   | -  | -   |     | ON   | -    |
| -   | -   |     | -   | L   | L    | L   | L   | -  | -   |     | -    | OFF  |
| -   | -   |     | -   | H   | L    | L   | L   | -  | -   |     | -    | ON   |
| X   | X   | X   | X   | X   | H    | L   | L   | HOLD PREVIOUS STATE                            |     |     |      |      |
| X   | X   | X   | X   | X   | X    | H   | L   | ALL SWITCHES OFF                               |     |     |      |      |
| X   | X   | X   | X   | X   | X    | X   | H   | ALL SWITCHES OFF / no chip current consumption |     |     |      |      |

Figure 6. STHV64SW timing diagram

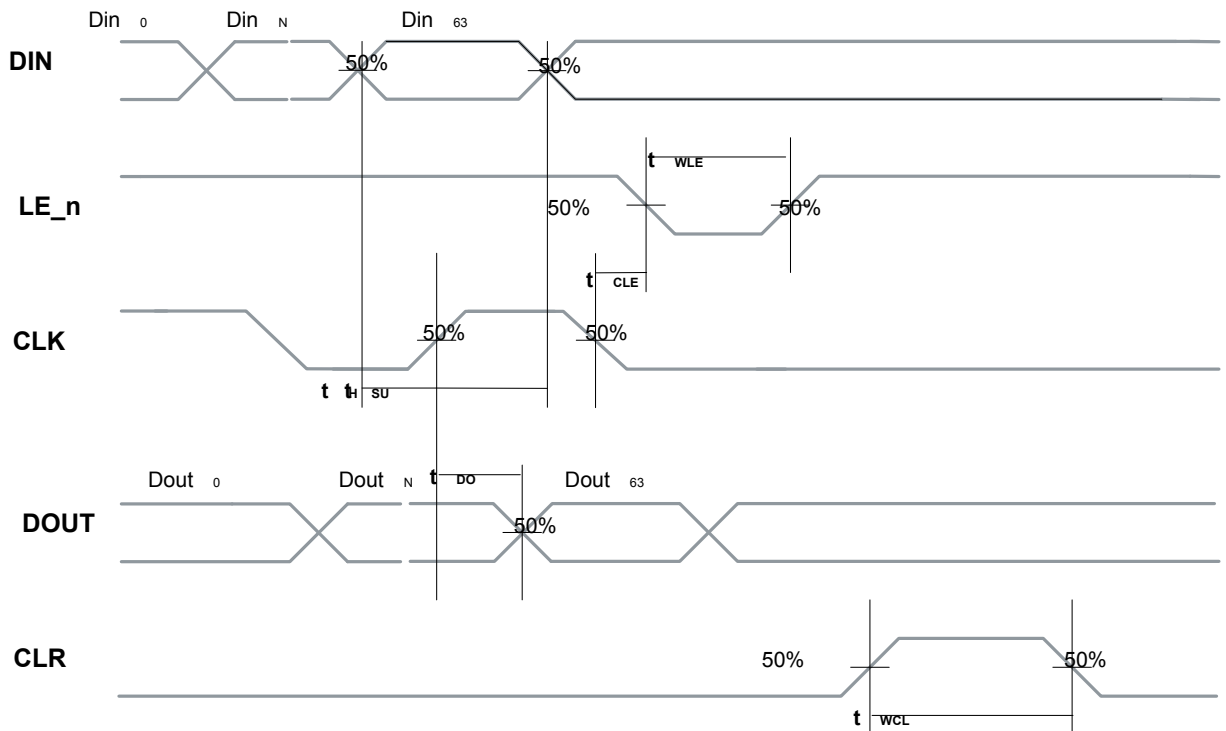
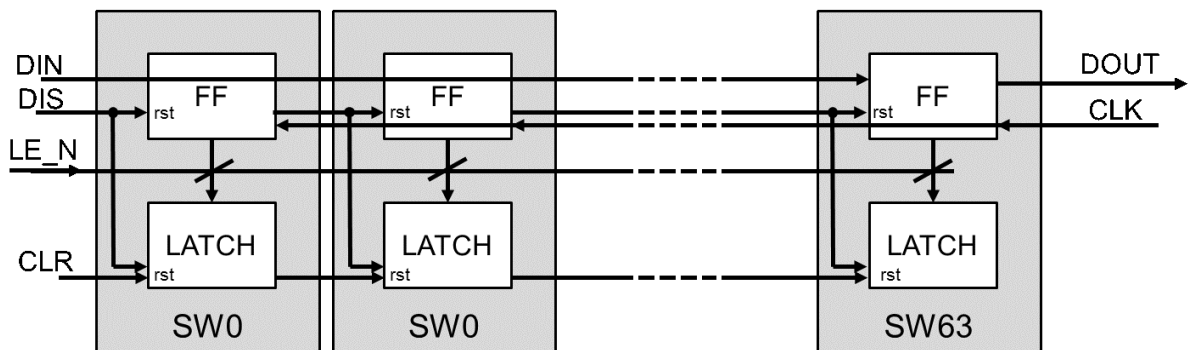


Figure 7. STHV64SW digital interface block diagram



Digital interface minimum required signals:

- DIN – Data In
  - 1 for ON-STATE
  - 0 for OFF-STATE
- CLK – Clock Signal
  - 20 MHz typical freq.
- LE\_N – Latch Enable (Active LOW)
  - Allows writing the status in the switch latch to turn the switch on or off

Digital interface optional signals

- DOUT – Data Out
  - Available for daisy-chain connection of 2 or more STHV64SW devices. Can be left floating when not used.
- CLR – Clear Signals (Active HIGH)
  - Resets the Latches to 0 (switches OFF), allowing the previous state to be left in the FF, available to be written again in the Latches through LE\_N. To be left to GND when not used.

- DIS – Disable (Active HIGH)
  - It resets the logic, and both Latches and FF. They all go to 0. To be left to GND during operation.



## 4 Operating conditions

Unless otherwise specified, VPP = 100 V, VNN = -100 V, VDDP = 3.3 V, RGND = 0 V, Tamb = 25 °C.

**Table 4. Operating DC supply voltages**

| Symbol | Parameter                        | Min. | Typ. | Max.         | Value |
|--------|----------------------------------|------|------|--------------|-------|
| VDDP   | Positive supply voltage          | +2.7 | +3.3 | +3.6         | V     |
| VNN    | Negative supply voltage          | 0    | -100 | -200         | V     |
| VPP    | Positive logic voltage           | 0    | +100 | +200         | V     |
| RGND   | Bleeding resistor ground voltage | 0    | 0    | VPP>RGND>VNN | V     |

**Table 5. Current consumption**

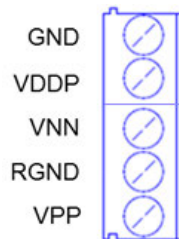
| Symbol    | Parameter                     | Condition        | Min. | Typ. | Max. | Units |
|-----------|-------------------------------|------------------|------|------|------|-------|
| IVPPQON   | Quiescent VPP supply current  | All switches on  |      | 120  | 180  | µA    |
| IVNNQON   | Quiescent VNN supply current  | All switches on  |      | 70   | 110  | µA    |
| IVDDPQON  | Quiescent VDDP supply current | All switches on  |      | 930  | 1100 | µA    |
| IVPPQOFF  | Quiescent VPP supply current  | All switches off |      |      | 50   | nA    |
| IVNNQOFF  | Quiescent VNN supply current  | All switches off | 1.6  | 2.3  | 3.5  | µA    |
| IVDDPQOFF | Quiescent VDDP supply current | All switches off |      | 780  | 820  | µA    |

## 5 Connectors

### 5.1 Power supply connector

The STEVAL-IME015V1 is powered through connector CN10.

Figure 8. Power supply connector CN10



The suggested power up sequence to minimize the risk of damage to user devices attached to STEVAL-IME015V1 is the following:

1. VDDP
2. VPP or VNN
3. VNN or VPP

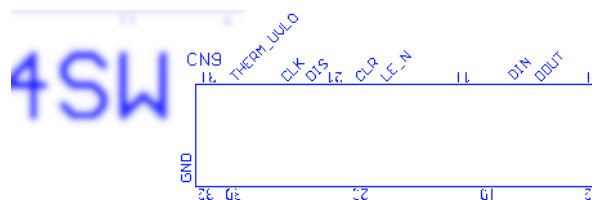
Table 6. Power supply connector pinout

| PIN Number | Pin name (STHV64SW) |
|------------|---------------------|
| 1          | GND                 |
| 2          | VDDP                |
| 3          | VNN                 |
| 4          | RGND                |
| 5          | VPP                 |

### 5.2 Digital interface connector

The [STHV64SW](#) signals are on the upper side of the digital interface connector (CN9), and common ground pins are on the lower side.

Figure 9. Digital interface connector CN9



The following table shows pinout for the [STHV64SW](#) signals on connector CN9. All the other pins of the connector are connected to ground.

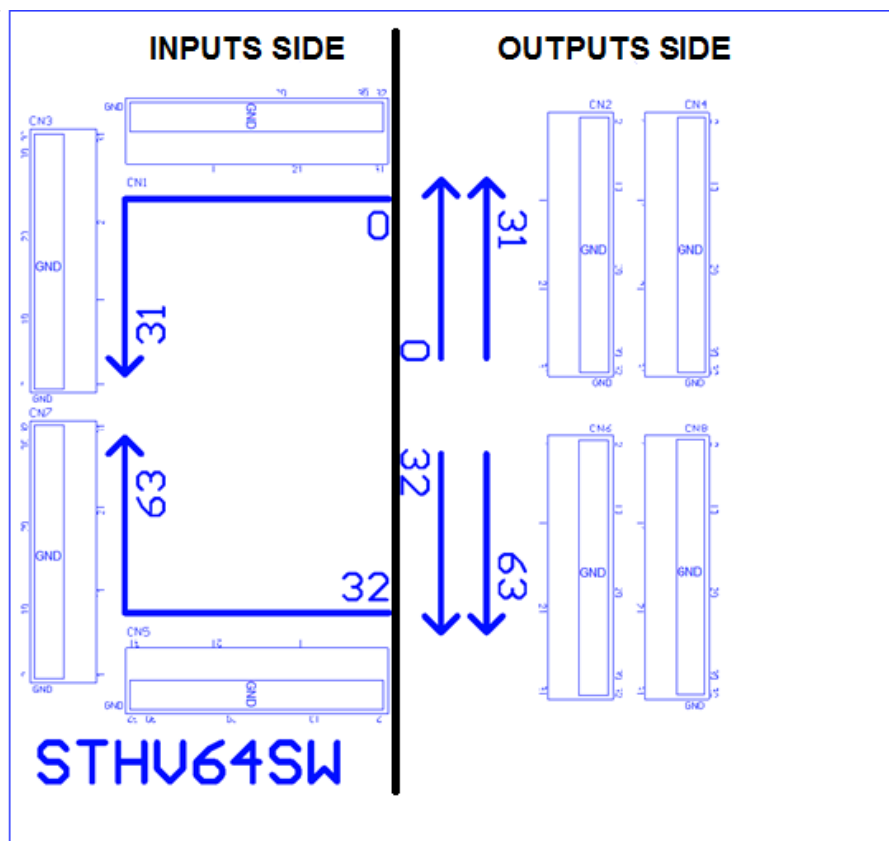
**Table 7. Digital interface pin out**

| PIN Number | PIN Number(STHV64SW) |
|------------|----------------------|
| 5          | DOUT                 |
| 7          | DIN                  |
| 17         | LE_N                 |
| 19         | CLR                  |
| 23         | DIS                  |
| 25         | CLK                  |
| 29         | THERM_UVLO           |

### 5.3 Switch I/O connectors

There are 8 **STHV64SW** switch I/Os 32-pin connectors in standard 2.54 mm headers: 4 input and 4 output. Each connector has 16 **STHV64SW** signals and 16 ground pins.

The arrows printed on the evaluation board show the order and the direction of the **STHV64SW** pinout: 0 represents IN/OUT0, 31 represents IN/OUT31, and so on.

**Figure 10. Switch I/O connectors CN1 to CN8**


The following table provides the **STHV64SW** pinout on all the I/O connectors; all other signals of the I/O connectors are connected to ground.

**Table 8. Switches I/Os connectors pin out**

| PIN Number | PIN Number(STHV64SW) | Connector | PIN Number | PIN Number(STHV64SW) | Connector |
|------------|----------------------|-----------|------------|----------------------|-----------|
| 1          | IN15                 | CN1       | 1          | OUT15                | CN2       |
| 3          | IN14                 |           | 3          | OUT14                |           |
| 5          | IN13                 |           | 5          | OUT13                |           |
| 7          | IN12                 |           | 7          | OUT12                |           |
| 9          | IN11                 |           | 9          | OUT11                |           |
| 11         | IN10                 |           | 11         | OUT10                |           |
| 13         | IN9                  |           | 13         | OUT9                 |           |
| 15         | IN8                  |           | 15         | OUT8                 |           |
| 17         | IN7                  |           | 17         | OUT7                 |           |
| 19         | IN6                  |           | 19         | OUT6                 |           |
| 21         | IN5                  |           | 21         | OUT5                 |           |
| 23         | IN4                  |           | 23         | OUT4                 |           |
| 25         | IN3                  |           | 25         | OUT3                 |           |
| 27         | IN2                  |           | 27         | OUT2                 |           |
| 29         | IN1                  |           | 29         | OUT1                 |           |
| 31         | IN0                  |           | 31         | OUT0                 |           |
| 1          | IN31                 | CN3       | 1          | OUT31                | CN4       |
| 3          | IN30                 |           | 3          | OUT30                |           |
| 5          | IN29                 |           | 5          | OUT29                |           |
| 7          | IN28                 |           | 7          | OUT28                |           |
| 9          | IN27                 |           | 9          | OUT27                |           |
| 11         | IN26                 |           | 11         | OUT26                |           |
| 13         | IN25                 |           | 13         | OUT25                |           |
| 15         | IN24                 |           | 15         | OUT24                |           |
| 17         | IN23                 |           | 17         | OUT23                |           |
| 19         | IN22                 |           | 19         | OUT22                |           |
| 21         | IN21                 |           | 21         | OUT21                |           |
| 23         | IN20                 |           | 23         | OUT20                |           |
| 25         | IN19                 |           | 25         | OUT19                |           |
| 27         | IN18                 |           | 27         | OUT18                |           |
| 29         | IN17                 |           | 29         | OUT17                |           |
| 31         | IN16                 |           | 31         | OUT16                |           |

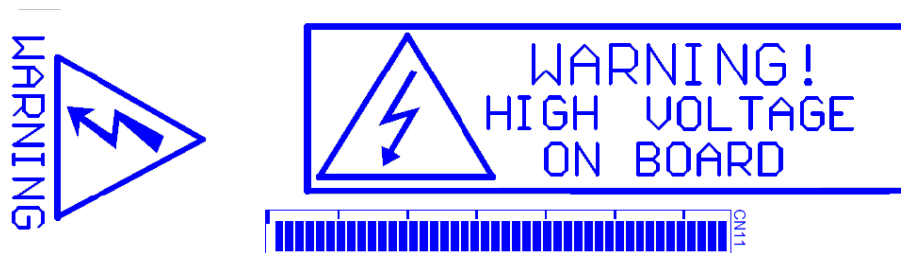
| PIN Number | PIN Number(STHV64SW) | Connector | PIN Number | PIN Number(STHV64SW) | Connector |
|------------|----------------------|-----------|------------|----------------------|-----------|
| 1          | IN32                 | CN5       | 1          | OUT32                | CN6       |
| 3          | IN33                 |           | 3          | OUT33                |           |
| 5          | IN34                 |           | 5          | OUT34                |           |
| 7          | IN35                 |           | 7          | OUT35                |           |
| 9          | IN36                 |           | 9          | OUT36                |           |
| 11         | IN37                 |           | 11         | OUT37                |           |
| 13         | IN38                 |           | 13         | OUT38                |           |
| 15         | IN39                 |           | 15         | OUT39                |           |
| 17         | IN40                 |           | 17         | OUT40                |           |
| 19         | IN41                 |           | 19         | OUT41                |           |
| 21         | IN42                 |           | 21         | OUT42                |           |
| 23         | IN43                 |           | 23         | OUT43                |           |
| 25         | IN44                 |           | 25         | OUT44                |           |
| 27         | IN45                 |           | 27         | OUT45                |           |
| 29         | IN46                 |           | 29         | OUT46                |           |
| 31         | IN47                 | 31        | OUT47      |                      |           |
| 1          | IN48                 | CN7       | 1          | OUT48                | CN8       |
| 3          | IN49                 |           | 3          | OUT49                |           |
| 5          | IN50                 |           | 5          | OUT50                |           |
| 7          | IN51                 |           | 7          | OUT51                |           |
| 9          | IN52                 |           | 9          | OUT52                |           |
| 11         | IN53                 |           | 11         | OUT53                |           |
| 13         | IN54                 |           | 13         | OUT54                |           |
| 15         | IN55                 |           | 15         | OUT55                |           |
| 17         | IN56                 |           | 17         | OUT56                |           |
| 19         | IN57                 |           | 19         | OUT57                |           |
| 21         | IN58                 |           | 21         | OUT58                |           |
| 23         | IN59                 |           | 23         | OUT59                |           |
| 25         | IN60                 |           | 25         | OUT60                |           |
| 27         | IN61                 |           | 27         | OUT61                |           |
| 29         | IN62                 | 29        | OUT62      |                      |           |
| 31         | IN63                 | 31        | OUT63      |                      |           |

## 5.4 Optional standard probe connector

STEVAL-IME015V1 evaluation board is designed to allow direct connection with an ultrasound probe through a standard medical HDR TC-ZIF 260-pin connector. The connector is not included on the board, but the footprint is available so users can solder any compatible connector.

The following figure shows the STHV64SW output channel routings to connector CN11.

Figure 11. Standard probe connector CN11



The following table shows the STHV64SW pinout for CN11, all other pins of the CN11 connector are connected to ground.

Table 9. Standard probe connector pinout

| PIN Number | PIN Number(STHV64SW) | PIN Number | PIN Number(STHV64SW) |
|------------|----------------------|------------|----------------------|
| 1          | OUT63                | 2          | OUT62                |
| 3          | OUT61                | 4          | OUT60                |
| 5          | OUT59                | 6          | OUT58                |
| 7          | OUT57                | 8          | OUT56                |
| 9          | OUT55                | 10         | OUT54                |
| 11         | OUT53                | 12         | OUT52                |
| 13         | OUT51                | 14         | OUT50                |
| 15         | OUT49                | 16         | OUT48                |
| 17         | OUT47                | 18         | OUT46                |
| 19         | OUT45                | 20         | OUT44                |
| 21         | OUT43                | 22         | OUT42                |
| 23         | OUT41                | 24         | OUT40                |
| 25         | OUT39                | 26         | OUT38                |
| 27         | OUT37                | 28         | OUT36                |
| 29         | OUT35                | 30         | OUT34                |
| 31         | OUT33                | 32         | OUT32                |
| 34         | OUT0                 | 35         | OUT1                 |
| 36         | OUT2                 | 37         | OUT3                 |
| 38         | OUT4                 | 39         | OUT5                 |
| 40         | OUT6                 | 41         | OUT7                 |
| 42         | OUT8                 | 43         | OUT9                 |
| 44         | OUT10                | 45         | OUT11                |
| 46         | OUT12                | 47         | OUT13                |
| 48         | OUT14                | 49         | OUT15                |
| 50         | OUT16                | 51         | OUT17                |
| 52         | OUT18                | 53         | OUT19                |
| 54         | OUT20                | 55         | OUT21                |
| 56         | OUT22                | 57         | OUT23                |
| 58         | OUT24                | 59         | OUT25                |

| PIN Number | PIN Number(STHV64SW) | PIN Number | PIN Number(STHV64SW) |
|------------|----------------------|------------|----------------------|
| 60         | OUT26                | 61         | OUT27                |
| 62         | OUT28                | 63         | OUT29                |
| 64         | OUT30                | 65         | OUT31                |

6 Schematics

Figure 12. STEVAL-IME015V1 schematics CN1-CN2

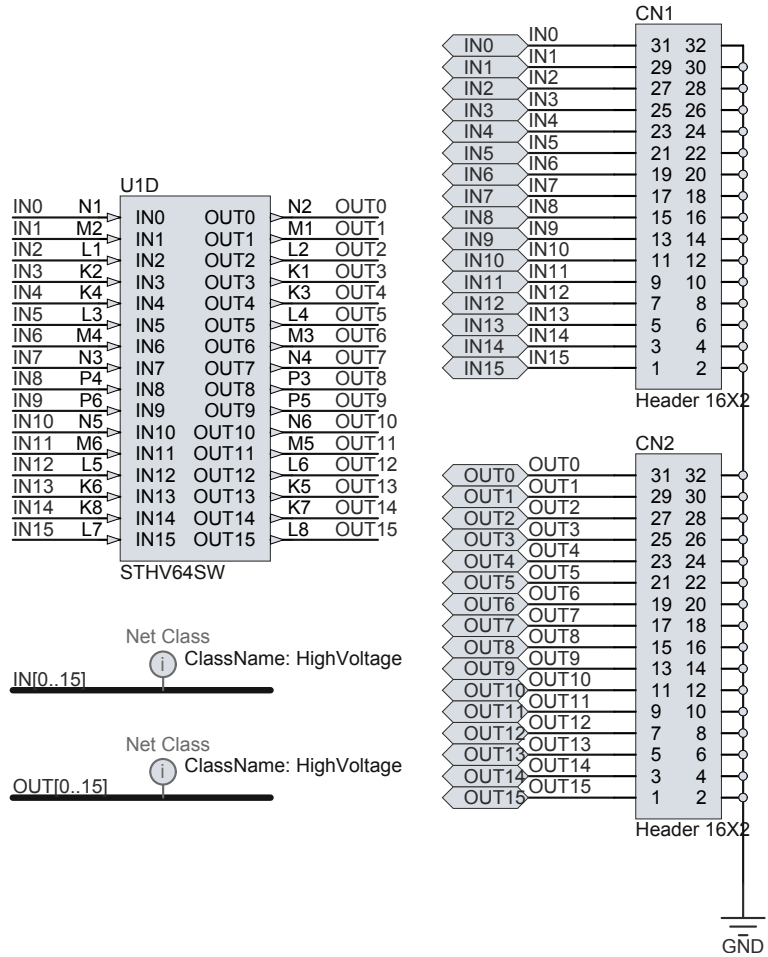




Figure 13. STEVAL-IME015V1 schematics CN3-CN4

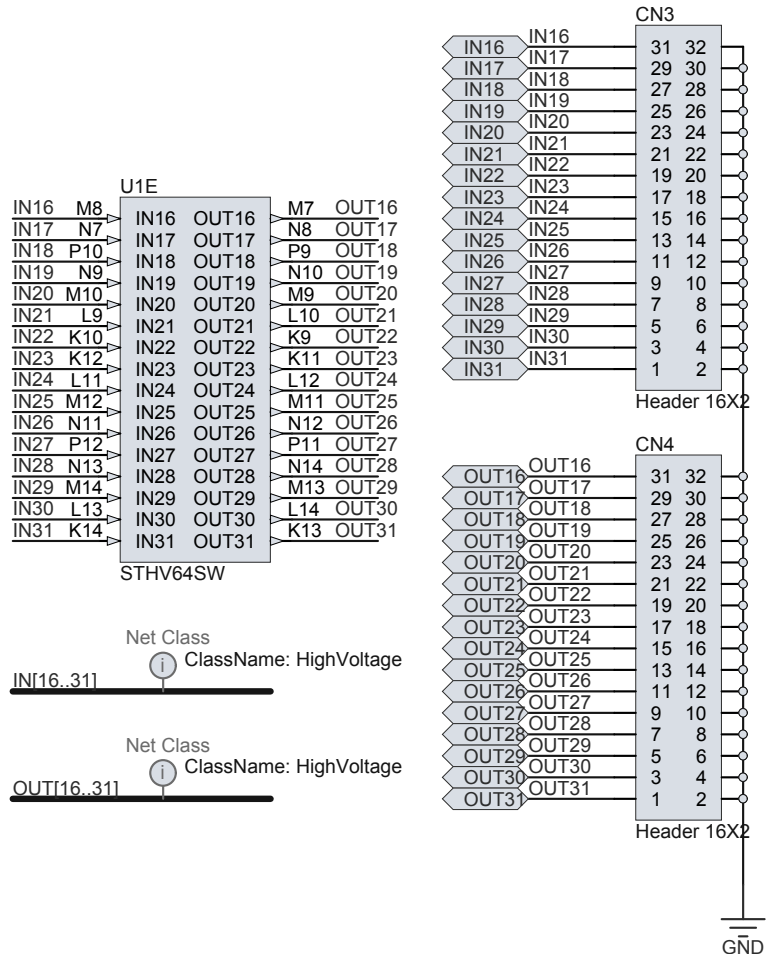


Figure 14. STEVAL-IME015V1 schematics CN5-CN6

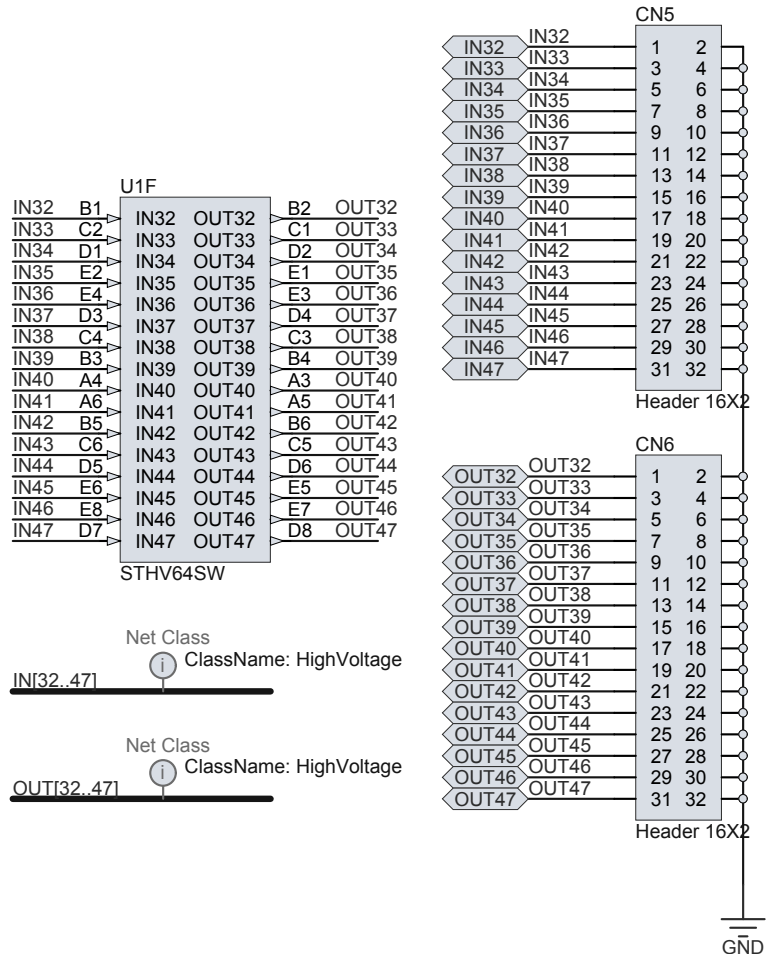


Figure 15. STEVAL-IME015V1 schematics CN7-CN8

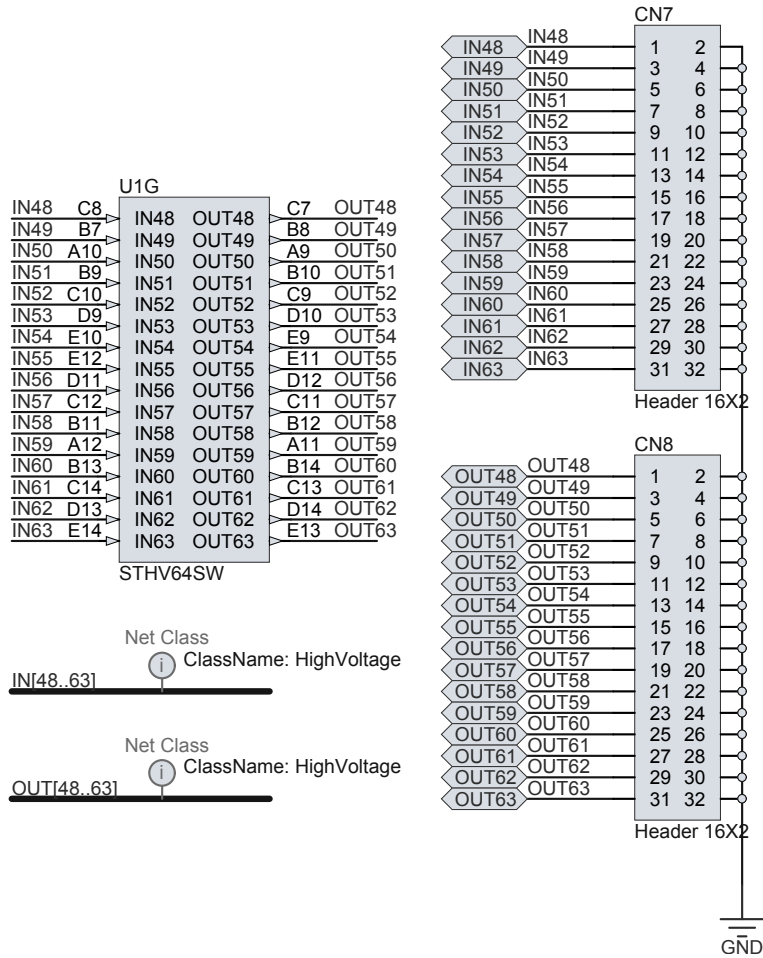


Figure 16. STEVAL-IME015V1 schematics CN9-CN12

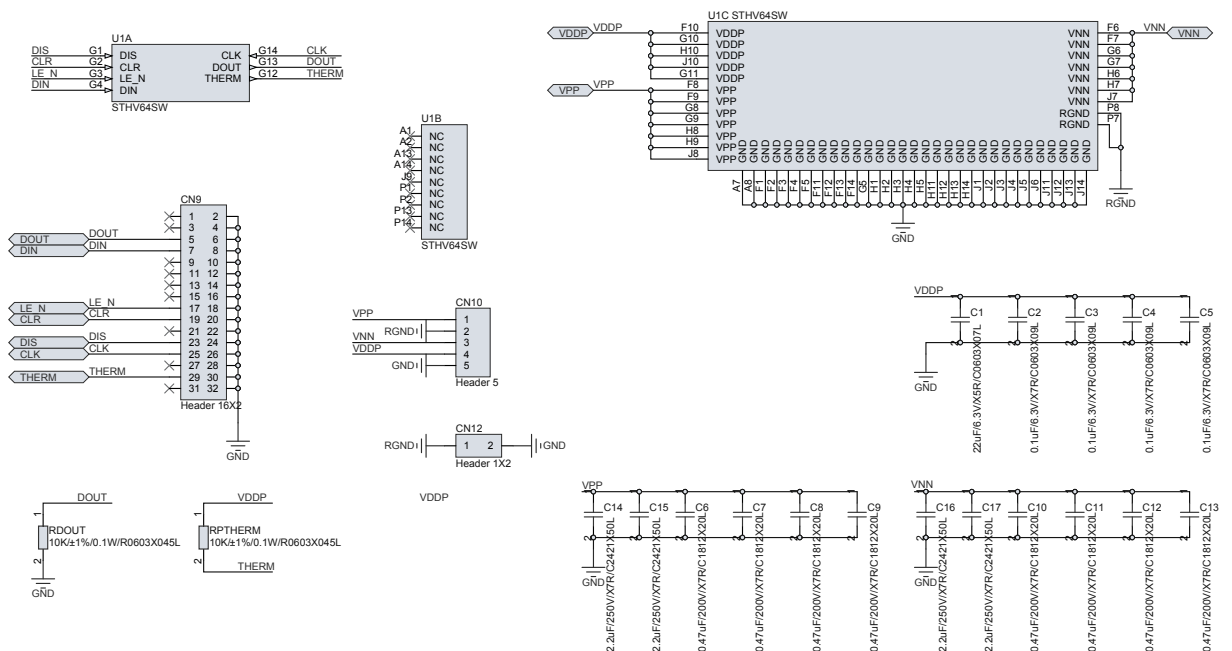
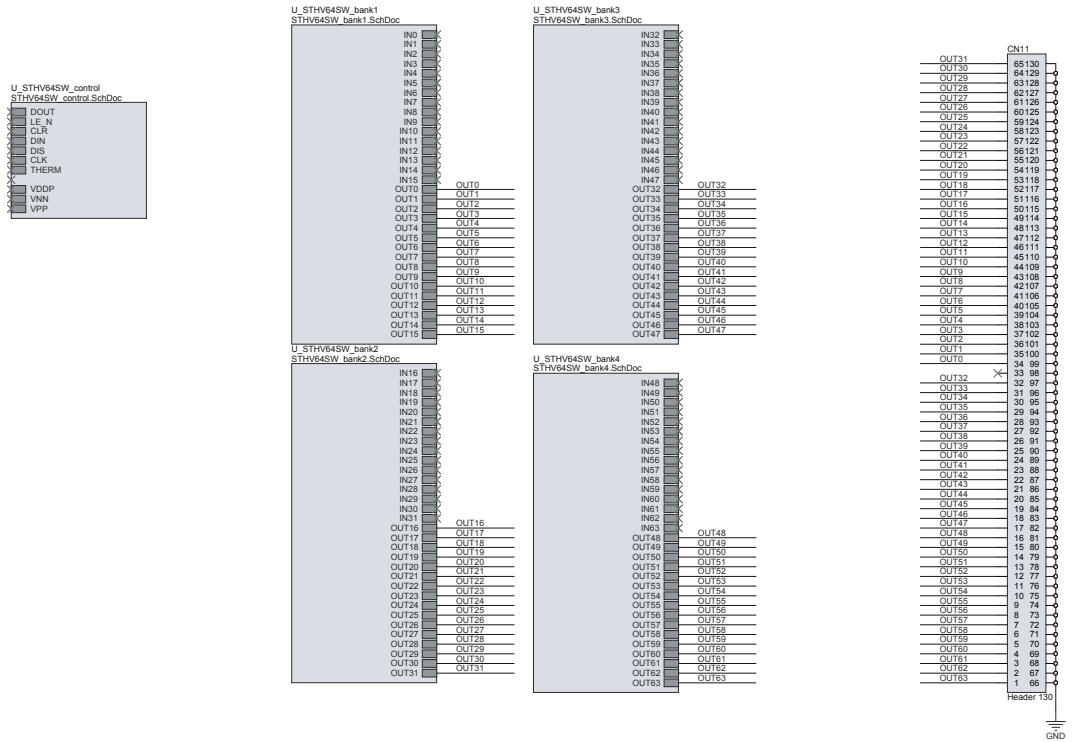


Figure 17. STEVAL-IME015V1 schematics CN11



## Revision history

**Table 10. Document revision history**

| Date        | Version | Changes          |
|-------------|---------|------------------|
| 04-Dec-2018 | 1       | Initial release. |

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