# STISO621

Datasheet

## Dual channel digital isolator




SO8N SO8W

| Product status link |
| --- |
| STISO621 |
| STISO621W |

| Product label |
| --- |
| SUSTAINABLE TECHNOLOGY |

## Features

- Dual channel, digital isolator with 1 – 1 channel directionality
- High data rate up to 100 Mbps
- Wide $t_{amb}$ range operation: - 40ºC to 125ºC
- High common-mode transient: >50k V/µs
- From 3 V to 5.5 V, supply levels
- 3.3 V and 5 V level translation
- Low-power consumption
- Pulse width distortions < 3 ns
- 6k V galvanic isolation in SO8W package
- SO8 narrow and wide package options
- Safety and regulatory approvals
  - UL1577 certified, file number: E362869
  - IEC 60747-17 certified in SO8W package, File number: 5022192-4880-0002/300335
  - $V_{IORM}$ (Maximum repetitive isolation voltage) up to 1.5k $V_{PEAK}$
  - $V_{IOTM}$ (Maximum transient isolation voltage) up to 5k $V_{PEAK}$
  - $V_{IOSM}$ (Maximum surge isolation voltage) up to 6k $V_{PEAK}$
  - $V_{ISO}$ (Isolation withstand voltage) up to 3.5k $V_{RMS}$

## Applications

- Optocoupler replacement in industrial application
- Industrial field bus isolation
- Battery monitor and motor drive
- Size-critical multichannel isolation

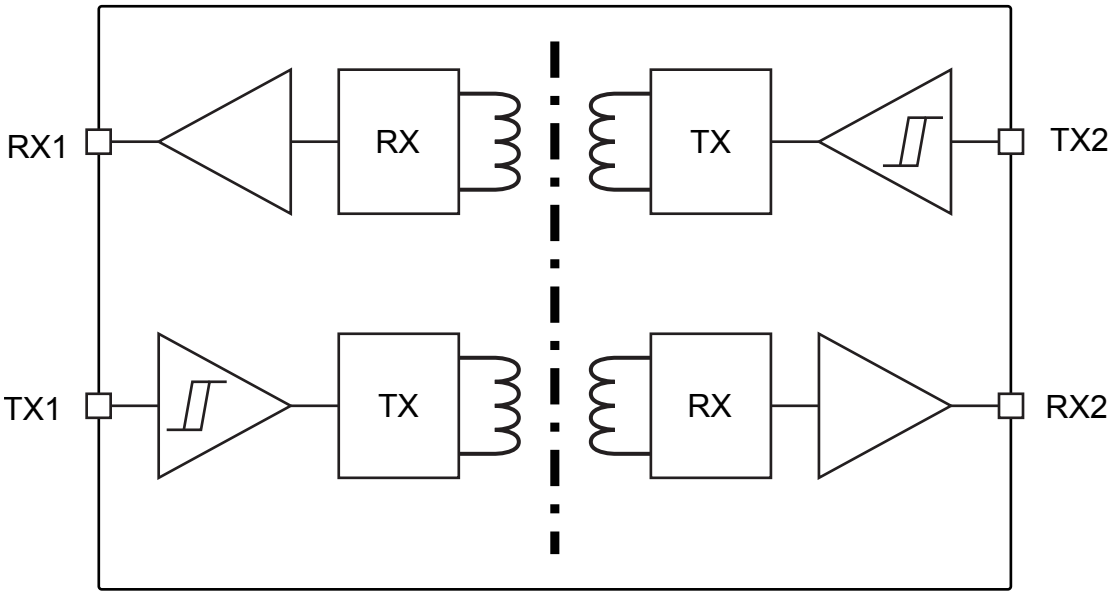
## Description

The STISO621 /STISO621W are dual-channel digital isolators based on the ST thick oxide galvanic isolation technology.

The devices provide two independent channels in the opposite direction with Schmitt trigger input, providing robustness to noise and high speed input/output switching time.

# 1 Block diagram

Figure 1. **Block diagram**



# 2 Electrical data

## 2.1 Absolute maximum ratings

**Table 1. Absolute maximum ratings**

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{DDX}$ | Supply voltage (each side) | -0.3 to 7 | V |
| $V_{IN}$ | Logic input voltage | -0.3 to 7 | V |
| $I_O$ | Output current | 5 | mA |
| $T_j$ | Junction temperature | -40 to 150 | °C |

## 2.2 Electrical sensitivity

**Table 2. ESD protection ratings**

| Symbol | Parameter | Test condition | Class | Value | Unit |
|---|---|---|---|---|---|
| HBM | Human Body Model | Conforming to ANSI/ESDA/JEDEC JS-001-2014 | H2 | +/- 2 | kV |
| CDM | Charge Device Model | All pins<br>Conforming to ANSI/ESDA/JEDEC JS-002-2014 | C2B | +/- 750 | V |
| MM | Machine Model | Conforming to EIA/JESD22-A115-C | NC | +/- 200 | V |

## 2.3 Recommended operating conditions

**Table 3. Recommended operating conditions**

| Symbol | Parameter | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| $V_{DDX}$ | Supply voltage (each side) | 3 | | 5.5 | V |
| $V_{IN}$ | Logic input voltage | 0 | | 5 | V |
| $T_{amb}$ | Ambient temperature | -40 | | 125 | °C |

## 2.4 Electrical characteristics

**Table 4. Electrical characteristics at VDD1 = VDD2 = 5 V**

| Symbol | Parameter | Test condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{DDXon}$ | $V_{DDX}$ on threshold | $V_{DDX}$ rising from 0 V | | | 2.8 | V |
| $V_{DDXhyst}$ | $V_{DDX}$ off hysteresis | $V_{DDX}$ falling from 5 V | | | 0.1 | V |
| IDDX | Supply current | DC | | 1.65 | 2 | mA |
| | | 10 Mbps, $C_L$ = 20 pF | | 3.65 | 5 | mA |
| | | 100 Mbps, $C_L$ = 20 pF | | 18 | 20 | mA |
| $V_{IHL}$ | Low-level Schmitt trigger threshold | Logic input falling Full supply range | 0.8 | | | V |
| $V_{ILH}$ | High-level Schmitt trigger threshold | Logic input rising Full supply range | | | 2 | V |
| $VI_{Hyst}$ | Schmitt trigger input hysteresis | | | | 0.5 | V |
| $V_{OL}$ | Low-level output voltage | $I_{OH}$ = 4 mA | | | 0.4 | V |
| $V_{OH}$ | High-level output voltage | $I_{OL}$ = 4 mA | $V_{DDX}$ – 0.3 | | | V |
| $Z_O$ | Output impedance | | -40% | 50 | +40% | Ω |
| $f_{MAX}$ | Maximum data rate | $V_{IH}$ = 5 V | 100 | | | Mbps |
| $t_r$ | Output rise time | $C_L$ = 15 pF | | 2 | 4 | ns |
| $t_f$ | Output fall time | $C_L$ = 15 pF | | 2 | 4 | ns |
| $t_{DHL}$ | Propagation delay H to L | See Figure 5 | | 25 | 42 | ns |
| $t_{DLH}$ | Propagation delay L to H | See Figure 5 | | 25 | 42 | ns |
| $t_{POWUP}$ | Power-up time | | | | 30 | µs |
| $t_{REFRESH}$ | Refresh time(1) | | | 1 | 2 | µs |
| $t_{WD}$ | Watchdog timeout | | 2 | | 6 | µs |
| PWD | Pulse width distortion \|tDHL–tDLH\| | Full temperature range (2) | | | 3 | ns |
| CMTI | Common-mode transient immunity | (3) | 50 | 65 | | kV/µs |

1. *A refresh function ensures the persistence of the transmitted data across the isolation. The state of TX is periodically transmitted every $t_{REFRESH}$*
2. *Not tested in production. A characterization on a limited number of samples, representing the worst case of production flow, evaluates the limit.*
3. *Not tested in production. A characterization on a limited number of samples and simulations, evaluates the limit.*

*Note:* ***Testing conditions: Typical values are defined at $t_{amb}$ = 25°C and VDD1 = VDD2 = 5 V, minimum and maximum limits applies to the full temperature range (Tested in production at $t_{amb}$ = 25°C. A characterization on a limited quantity of samples, evaluates the limit in the full temperature range), unless otherwise specified.***

**Table 5. Electrical characteristics at VDD1 = VDD2 = 3 V**

| Symbol | Parameter | Test condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{DDXon}$ | $V_{DDX}$ on threshold | $V_{DDX}$ rising from 0 V | | | 2.8 | V |
| $V_{DDXhyst}$ | $V_{DDX}$ off hysteresis | $V_{DDX}$ falling from 5 V | | | 0.1 | V |
| $I_{DDX}$ | Supply current | DC | | 1.5 | 2 | mA |
| | | 10 Mbps, $C_L$ = 20 pF | | 3 | 5 | mA |
| | | 100 Mbps, $C_L$ = 20 pF | | 11 | 20 | mA |
| $V_{IHL}$ | Low-level Schmitt trigger threshold | Logic input falling Full supply range | 0.8 | | | V |
| $V_{ILH}$ | High-level Schmitt trigger threshold | Logic input rising Full supply range | | | 2 | V |
| $V_{IHyst}$ | Schmitt trigger input hysteresis | | | | 0.5 | V |
| $V_{OL}$ | Low-level output voltage | $I_{OH}$ = 4 mA | | | 0.4 | V |
| $V_{OH}$ | High-level output voltage | $I_{OL}$ = 4 mA | VDDX – 0.3 | | | V |
| $Z_O$ | Output impedance | | -40% | 50 | +40% | Ω |
| $f_{MAX}$ | Maximum data rate | $V_{IH}$ = 3.3 V | 100 | | | Mbps |
| $t_r$ | Output rise time | $C_L$ = 15 pF | | 1.5 | 4 | ns |
| $t_f$ | Output fall time | $C_L$ = 15 pF | | 1.5 | 4 | ns |
| $t_{DHL}$ | Propagation delay H to L | See Figure 5 | | 25 | 42 | ns |
| $t_{DLH}$ | Propagation delay L to H | See Figure 5 | | 25 | 42 | ns |
| $t_{POWUP}$ | Power-up time | | | | 30 | µs |
| $t_{REFRESH}$ | Refresh time(1) | | | 1 | 2 | µs |
| $t_{WD}$ | Watchdog timeout | | 2 | | 6 | µs |
| PWD | Pulse width distortion $\lvert t_{DHL}–t_{DLH}\rvert$ | Full temperature range (2) | | | 3 | ns |
| CMTI | Common-mode transient immunity | (3) | 50 | 65 | | kV/µs |

1. *A refresh function ensures the persistence of the transmitted data across the isolation. The state of TX is periodically transmitted every $t_{REFRESH}$*
2. *Not tested in production. A characterization on a limited number of samples, representing the worst case of production flow, evaluates the limit*
3. *Not tested in production. A characterization on a limited number of samples and simulations, evaluates the limit.*

*Note:* ***Testing conditions: Typical values are defined at tamb = 25°C and VDD1 = VDD2 = 3 V, minimum and maximum limits applies to the full temperature range (Tested in production at $t_{amb}$ = 25°C. A characterization on a limited quantity of samples, evaluates the limit in the full temperature range), unless otherwise specified.***

# 3 Thermal data

**Table 6. Thermal data**

| Symbol | Parameter | Max. value | Unit |
|---|---|---|---|
| $R_{th\ j\text{-}\ amb}$ | Thermal resistance, junction to ambient (1) | 97(2) | °C/W |
| $R_{th\ jc\text{-}\ top}$ | Thermal resistance, junction to top case (3) | 47 | °C/W |

1. *As per JESD51-7*
2. *Maximum power dissipation = 670mW (@$T_{amb}$ = 85°C, $T_J$ < 150°C)*
3. *As per JESD51-3*

# 4 Isolation characteristics

**Table 7. Isolation and safety specification (SO8N package)**

| Symbol | Parameter | Test conditions | Value | Unit |
|---|---|---|---|---|
| **General** | | | | |
| CLR | Clearance (minimum external air gap) | Measured from input terminals to output terminals, shortest distance trough air | 4 | mm |
| CPG | Creepage (minimum external tracking) | Measured from input terminals to output terminals, shortest distance path along body | 4 | mm |
| CTI | Comparative tracking index (tracking resistance) | IEC 60112 | ≥ 400 | V |
| - | Material group | According to IEC 60664-1 | II | - |
| - | Overvoltage category per IEC 60664-1 | Rated mains voltages ≤ 150 $V_{RMS}$ | I - IV | - |
| | | Rated mains voltages ≤ 300 $V_{RMS}$ | I - III | - |
| | | Rated mains voltages ≤ 600 $V_{RMS}$ | I - II | - |
| | | Rated mains voltages ≤ 1000 $V_{RMS}$ | I | - |
| **DIN EN IEC 60747-17 (VDE 0884-17)** | | | | |
| $V_{IORM}$ | Maximum repetitive isolation voltage | AC voltage | 1200 | $V_{PEAK}$ |
| $V_{IOWM}$ | Maximum working isolation voltage | AC voltage (sine wave) | 849 | $V_{RMS}$ |
| | | DC voltage | 1200 | $V_{PEAK}$ |
| $V_{PR}$ | Partial discharge test voltage | Method a, type and sample test<br>$t_m$= 10 s<br>Partial discharge < 5 pC | 1920 | $V_{PEAK}$ |
| | | Method b1, 100% production test<br>$t_m$ = 1 s<br>Partial discharge < 5 pC | 2250 | $V_{PEAK}$ |
| $V_{IOTM}$ | Maximum transient isolation voltage | Method a, type and sample test, $t_{ini}$ = 60 s | 4000 | $V_{PEAK}$ |
| $V_{IOTM,test}$ | Transient isolation voltage test | Method b1, 100% production test<br>$V_{IOTM,test} = V_{IOTM} \times 1.2$, $t_{ini}$ = 1 s | 4800 | $V_{PEAK}$ |
| $V_{IMP}$ | Maximum impulse voltage | Type test; tested in air<br>1.2/50 µs waveform per IEC 62368-1 | 4000 | $V_{PEAK}$ |
| $V_{IOSM}$ | Maximum surge isolation voltage | Type test; tested in oil<br>1.2/50 µs waveform per IEC 62368-1<br>$V_{IOSM} \geq V_{IMP} \times 1.3$ | 5200 | $V_{PEAK}$ |
| $R_{IO}$ | Isolation resistance | Type test<br>$V_{IO}$ = 500 V; $T_{amb}$ = 25°C | > $10^{12}$ | Ω |
| | | Type test<br>$V_{IO}$ = 500 V; $T_{amb,max}$= 125°C | > $10^{11}$ | |
| | | Type test<br>$V_{IO}$ = 500 V; $T_{amb} = T_S$ = 150°C | > $10^{9}$ | |
| Parameter definitions and test conditions in accordance to IEC 60747-17 | | | | |

| Symbol | Parameter | Test conditions | Value | Unit |
|---|---|---|---|---|
| **UL 1577** | | | | |
| $V_{ISO}$ | Isolation withstand voltage | 60 s; type test | 2828 / 4000 | $V_{RMS}/V_{PEAK}$ |
| $V_{ISO,test}$ | Isolation voltage test | 1 s; 100% production | 3394 / 4800 | $V_{RMS}/V_{PEAK}$ |
| Recognized under the UL 1577 component recognition program. File number E362869 | | | | |

*Note:* ***For three-phase systems the values in the tables Table 7 and Table 8, refer to the line-to-neutral voltage.***

**Table 8. Isolation and safety specification (SO8W package)**

| Symbol | Parameter | Test conditions | Value | Unit |
|---|---|---|---|---|
| **General** | | | | |
| CLR | Clearance (minimum external air gap) | Measured from input terminals to output terminals, shortest distance trough air | 8 | mm |
| CPG | Creepage (minimum external tracking) | Measured from input terminals to output terminals, shortest distance path along body | 8 | mm |
| CTI | Comparative tracking index (tracking resistance) | IEC 60112 | ≥ 400 | V |
| - | Material group | According to IEC 60664-1 | II | - |
| - | Overvoltage category per IEC 60664-1 | Rated mains voltages ≤ 150 $V_{RMS}$ | I - IV | - |
| | | Rated mains voltages ≤ 300 $V_{RMS}$ | I - III | - |
| | | Rated mains voltages ≤ 600 $V_{RMS}$ | I - II | - |
| | | Rated mains voltages ≤ 1000 $V_{RMS}$ | I | - |
| **DIN EN IEC 60747-17 (VDE 0884-17)** | | | | |
| $V_{IORM}$ | Maximum repetitive isolation voltage | AC voltage | 1500 | $V_{PEAK}$ |
| $V_{IOWM}$ | Maximum working isolation voltage | AC voltage (sine wave) | 1060 | $V_{RMS}$ |
| | | DC voltage | 1500 | $V_{PEAK}$ |
| $V_{PR}$ | Partial discharge test voltage | Method a, type and sample test<br>$t_m$= 10 s<br>Partial discharge < 5 pC | 2400 | $V_{PEAK}$ |
| | | Method b1, 100% production test<br>$t_m$ = 1 s<br>Partial discharge < 5 pC | 2812 | $V_{PEAK}$ |
| $V_{IOTM}$ | Maximum transient isolation voltage | Method a, type and sample test, $t_{ini}$ = 60 s | 5000 | $V_{PEAK}$ |
| $V_{IOTM,test}$ | Transient isolation voltage test | Method b1, 100% production test<br>$V_{IOTM,test} = V_{IOTM} \times 1.2$, $t_{ini}$ = 1 s | 6000 | $V_{PEAK}$ |
| $V_{IMP}$ | Maximum impulse voltage | Type test; tested in air<br>1.2/50 µs waveform per IEC 62368-1 | 4600 | $V_{PEAK}$ |
| $V_{IOSM}$ | Maximum surge isolation voltage | Type test; tested in oil<br>1.2/50 µs waveform per IEC 62368-1<br>$V_{IOSM} \geq V_{IMP} \times 1.3$ | 6000 | $V_{PEAK}$ |
| $R_{IO}$ | Isolation resistance | Type and sample test<br>$V_{IO}$ = 500 V; $T_{amb}$ = 25°C | > $10^{12}$ | Ω |
| | | Type and sample test<br>$V_{IO}$ = 500 V; $T_{amb,max}$ = 125°C | > $10^{11}$ | |
| | | Type and sample test<br>$V_{IO}$ = 500 V; $T_{amb}$ = $T_S$ = 150°C | > $10^{9}$ | |
| Certified according to IEC 60747-17. Certificate number: 5022192-4880-0002/300335 | | | | |

| Symbol | Parameter | Test conditions | Value | Unit |
|---|---|---|---|---|
| **UL 1577** | | | | |
| $V_{ISO}$ | Isolation withstand voltage | 60 s; type test | 3540 / 5000 | $V_{RMS}/V_{PEAK}$ |
| $V_{ISO,test}$ | Isolation voltage test | 1 s; 100% production | 4240 / 6000 | $V_{RMS}/V_{PEAK}$ |
| Recognized under the UL 1577 component recognition program. File number E362869 | | | | |

**Table 9. Safety limits**

| Symbol | Parameter | Test condition | Max | Unit |
|---|---|---|---|---|
| $I_S$ | Safety input, output, or supply current | $R_{thja}$ [(1)]= 115 °C/W, Vi = 5.5 V, $t_j$ = 150°C, $t_{amb}$ = 25°C | 197.6 | mA |
| | | $R_{thja}$ [(1)]= 115 °C/W, Vi = 3.6 V, $t_j$ = 150°C, $t_{amb}$ = 25°C | 301.9 | |
| $P_S$ | Safety input, output, or total power | $R_{thja}$ [(1)]= 115 °C/W, $t_j$ = 150°C, $t_{amb}$ = 25°C | 1087 | mW |
| $T_S$ | Maximum safety temperature | | 150 | °C |

1. *Evaluated on 2 s board in natural convection @ $t_{amb}$ = 25°C*

*Note:* ***Safety limitings are aimed at minimizing potential damage to the isolation barrier upon failure of input or output circuitry. Without current limiting, excessive power dissipation might damage the die and the isolation barrier consequently. The maximum limits of $P_S$ and $I_S$ should not be exceeded. These limits vary with the ambient temperature $T_A$, according to the related derating curves***

**Figure 2. Thermal derating curve for current safety limiting**

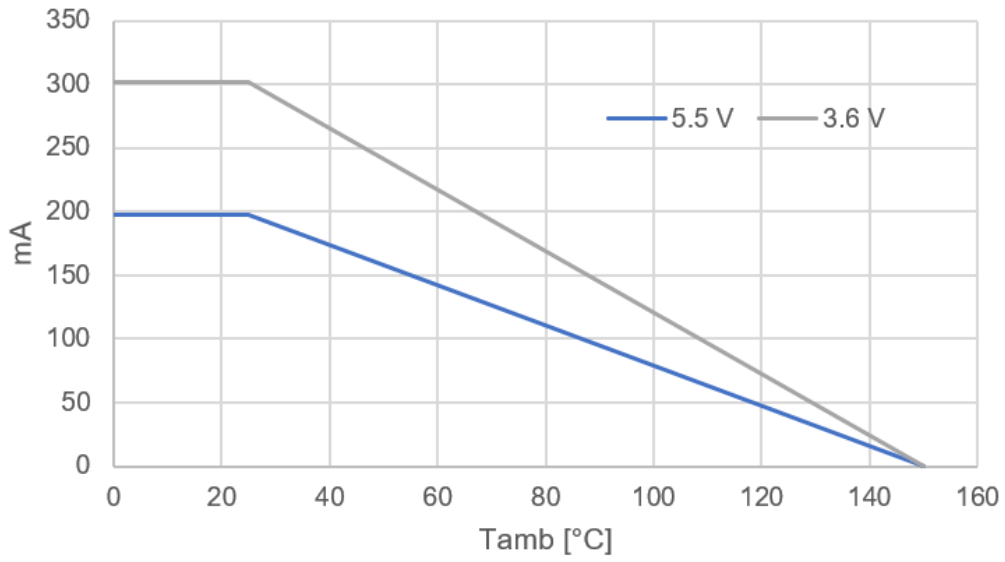
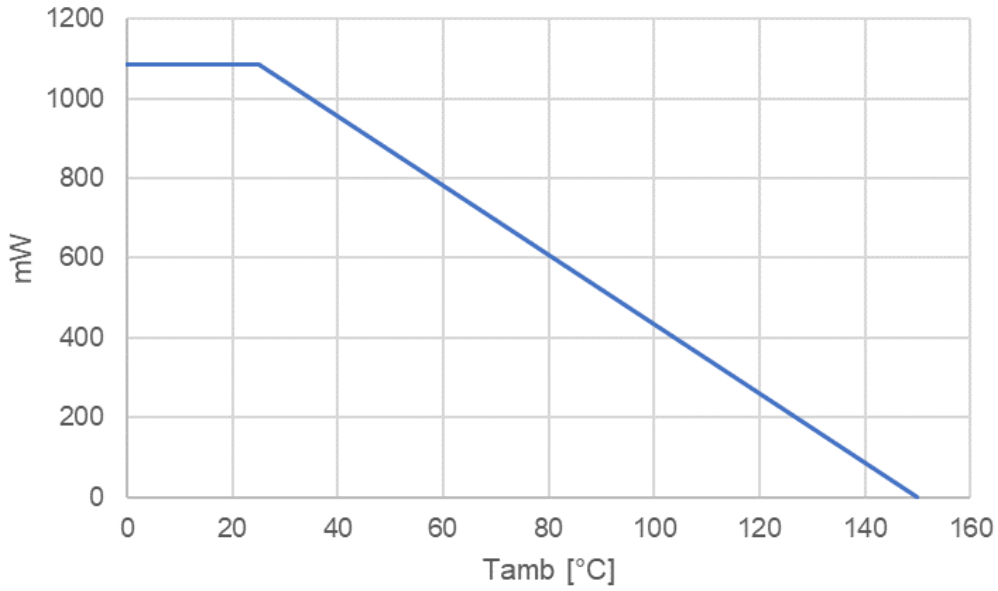
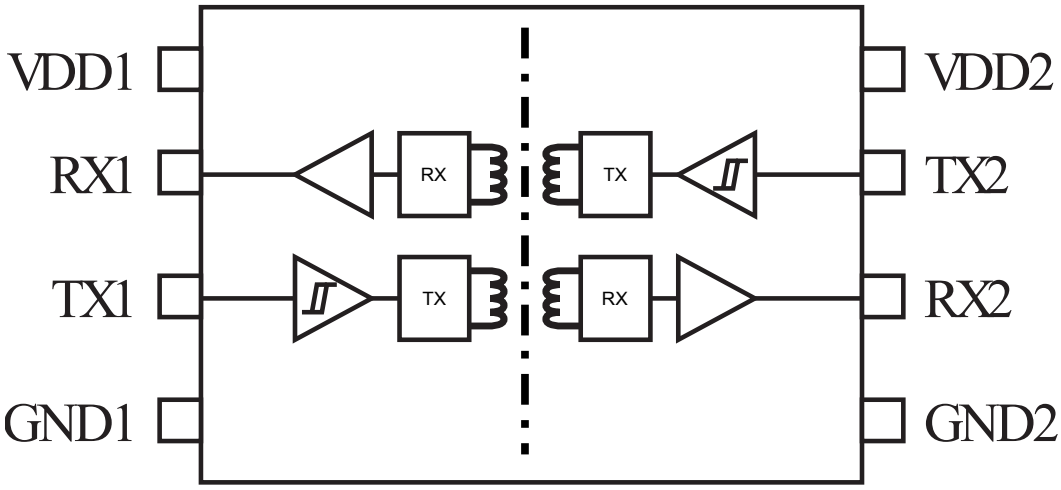


Figure 3. **Thermal derating curve for power safety limiting**



# 5 Pin connection

Figure 4. **Pin connection (top view)**



# 6 Pin list

Table 10. **Pin description**

| N. | Name | Type | Function |
|---|---|---|---|
| 1 | VDD1 | Supply | Supply voltage side 1 |
| 2 | RX1 | Logic output | Receive data side 1 |
| 3 | TX1 | Logic input | Transmit data side 1 |
| 4 | GND1 | Ground | Ground side 1 |
| 5 | GND2 | Ground | Ground side 2 |
| 6 | RX2 | Logic output | Receive data side 2 |
| 7 | TX2 | Logic input | Transmit data side 2 |
| 8 | VDD2 | Supply | Supply voltage side 2 |

# 7 Device description

The STISO621 is a dual high-speed isolated communication channel. It integrates one channel for each communication direction and provides low levels of pulse width distortion in the full operation range.

## 7.1 Device operation

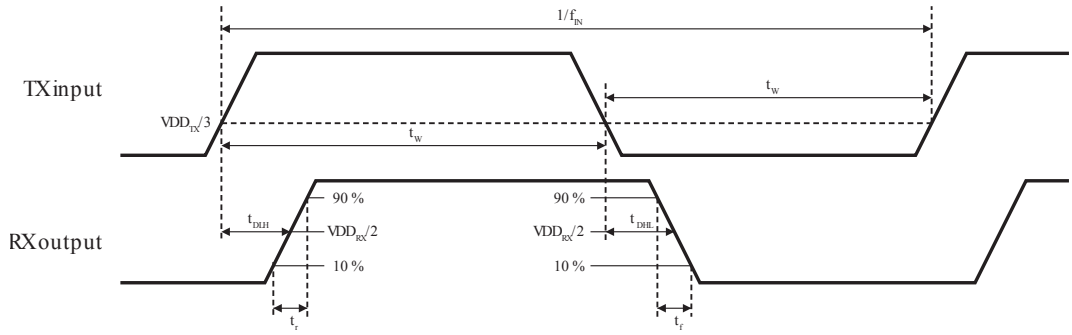
The device operation is described in the following table:

**Table 11. Device operation table**

| VDD1 | VDD2 | TX1 | RX2 | TX2 | RX1 |
|---|---|---|---|---|---|
| Above UVLO | Above UVLO | H | H | H | H |
| | | L | L | H | H |
| | | H | H | L | L |
| | | L | L | L | L |
| Below UVLO | Above UVLO | X | L(1) | X | Unknown |
| Above UVLO | Below UVLO | X | Unknown | X | L(1) |
| Below UVLO | Below UVLO | X | Unknown | X | Unknown |

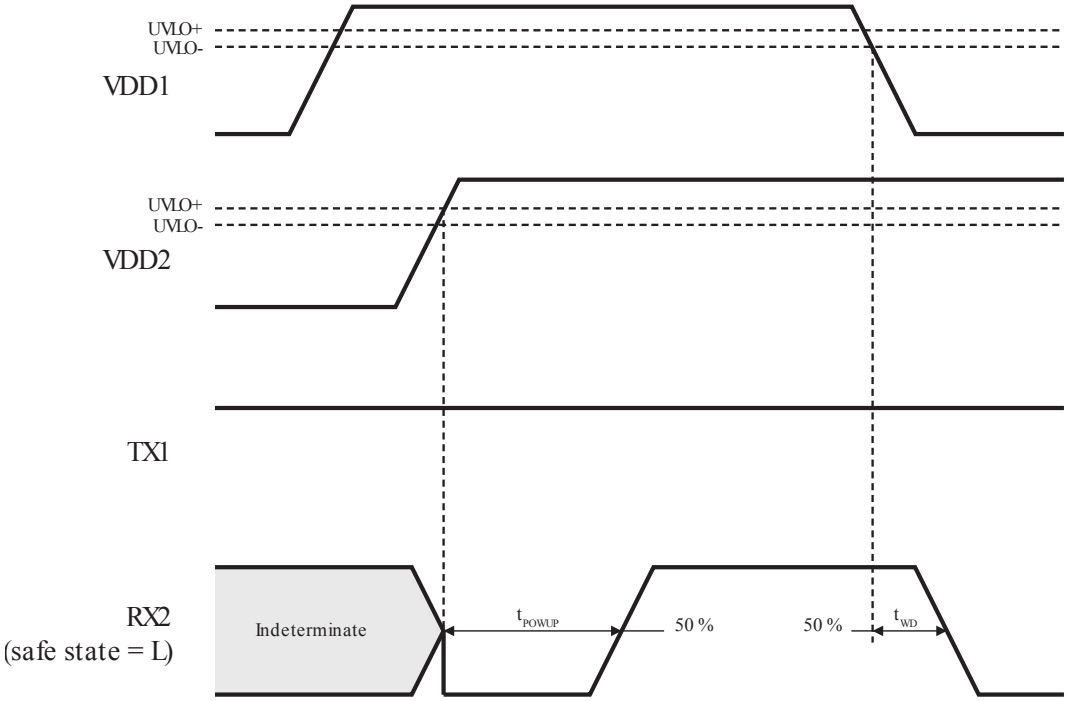
1. *A safe state is imposed by default after the watchdog timeout.*

**Figure 5. Timing diagram**




In Figure 5, $t_W$ is the minimum pulse width of the TX pulse, so that the internal logic circuitry doesn't filter the pulse itself. According to the $f_{MAX}$ in Table 4 and Table 5, this value is $t_{W,min} \geq 10ns$.

Figure 6. **Timing diagram–power up and power down**

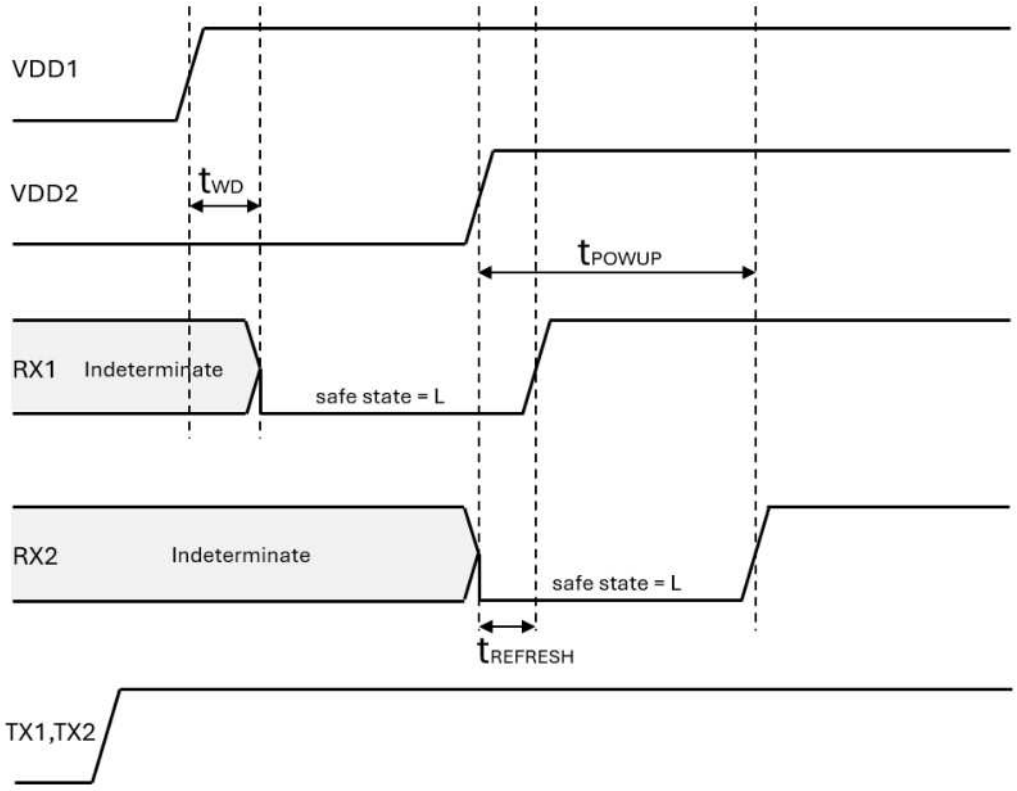



In Figure 6, $t_{POWUP}$ is the power-up time after that the device is operative as reported in Table 11 when VDD1 and VDD2 are both above the UVLO (normal operation).

## 7.2 Watchdog and safe state

A watchdog function is present to set the output in a safe state if no data are received from one side to another for a time longer than $t_{WD}$. A typical application of this function is at the start-up of STISO621. If the supply of one side rises slower than the other one, the output of the faster side is set to the safe state until the other side is in off state. A logic level low is forced as safe state: see Figure 7. Another condition is when the supply of one side is suddenly missing.

**Figure 7. Watchdog**



# 8 Package mechanical data

Table 12. **SO8 wide package dimensions**

| Symbol | Min. | Nom. | Max. | Note |
|---|---|---|---|---|
| A | 2.34 | | 2.64 | |
| A1 | 0.10 | | 0.30 | |
| b | 0.30 | | 0.51 | |
| c | 0.20 | | 0.33 | |
| D | 5.64 | | 6.05 | |
| e | | 1.27 BSC | | |
| E1 | 7.39 | | 7.59 | |
| E | 10.11 | | 10.52 | |
| L | 0.61 | | 0.91 | |
| h | 0.25 | | 0.76 | |
| θ | 0° | | 8° | |
| aaa | | 0.25 | | |
| bbb | | 0.25 | | |
| ccc | | 0.10 | | |

Figure 8. **SO8 wide package drawings**

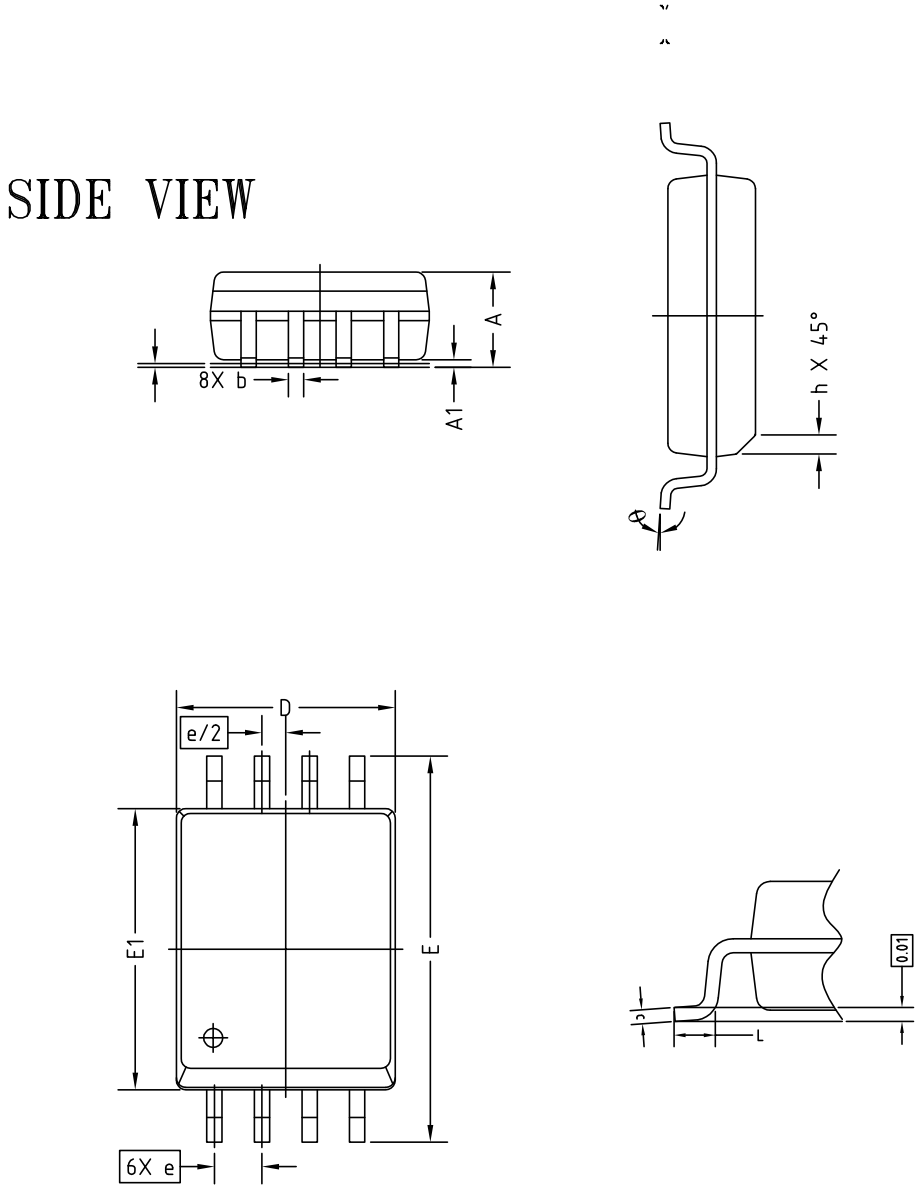


Figure 9. **SO8 wide package recommended footprint**

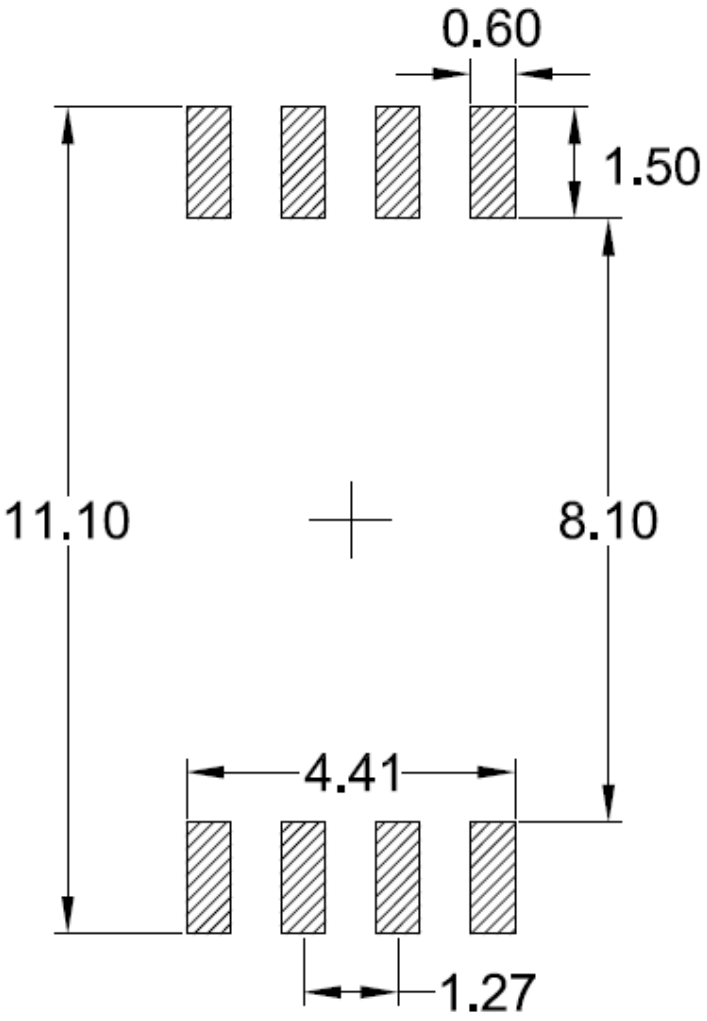


Table 13. **SO8 narrow package dimensions**

| Symbol | Min. | Nom. | Max. |
|---|---|---|---|
| A | 1.35 | | 1.75 |
| A1 | 0.10 | | 0.25 |
| b | 0.35 | | 0.49 |
| c | 0.19 | | 0.25 |
| D | 4.80 | | 5.00 |
| e | | 1.27BSC | |
| E1 | 3.80 | | 4.00 |
| E | 5.80 | | 6.20 |
| L | 0.40 | | 1.25 |
| h | 0.25 | | 0.50 |
| θ | 0° | | 7° |
| Θ1 | 2° | | 12° |
| aaa | | 0.25 | |
| bbb | | 0.25 | |
| ccc | | 0.10 | |

Figure 10. **SO8 narrow package drawings**

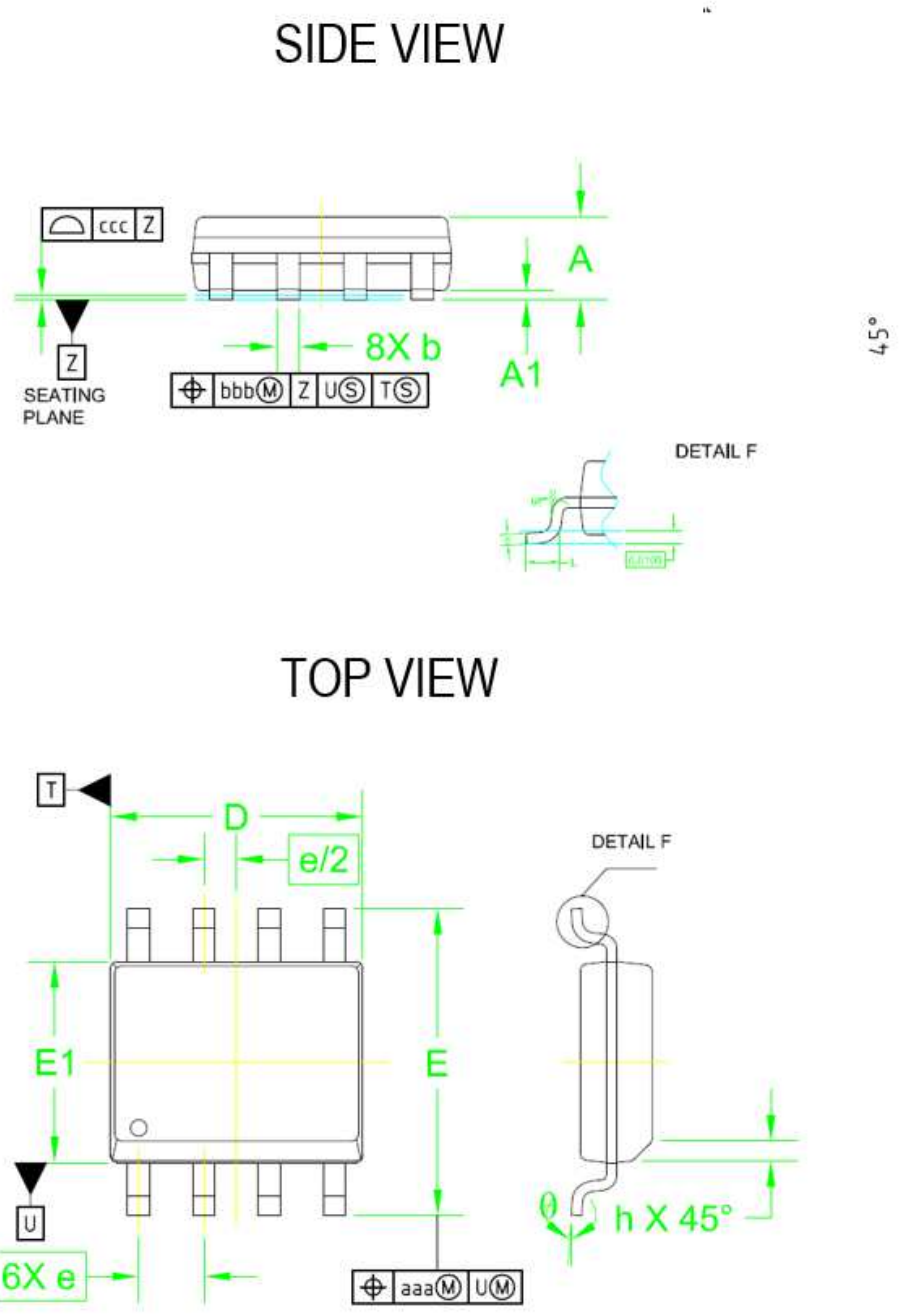
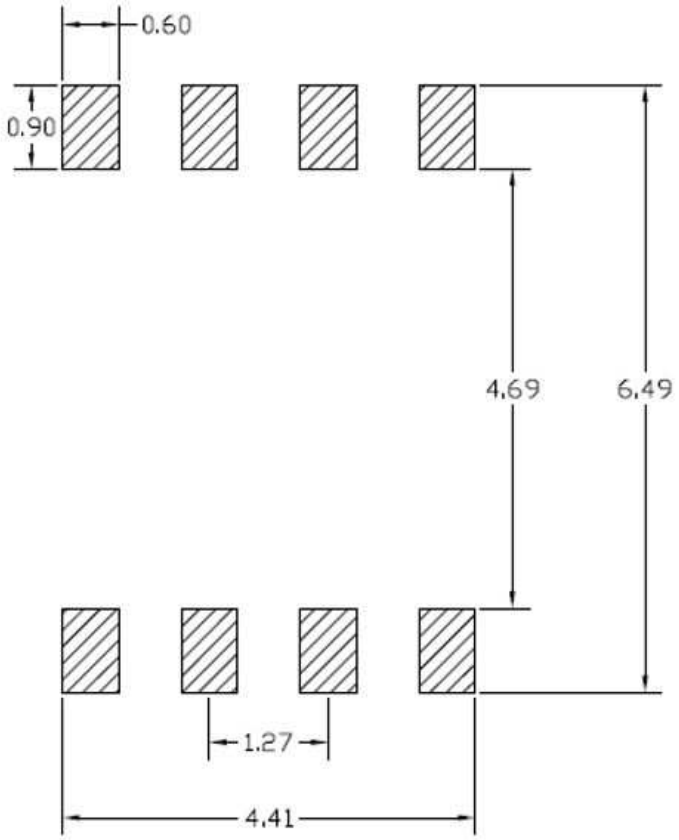


Figure 11. **SO8 narrow package recommended footprint**



# 9 Order information

Table 14. **Order information**

| Order code | Package | Packing |
|---|---|---|
| STISO621W | S08 wide body | Tube |
| STISO621WTR | S08 wide body | Tape & reel |
| STISO621 | S08 narrow body | Tube |
| STISO621TR | S08 narrow body | Tape & reel |

## Revision history

Table 15. **Document revision history**

| Date | Version | Changes |
|---|---|---|
| 03-Aug-2020 | 1 | Initial release. |
| 23-Mar-2020 | 2 | SO8 narrow body package option added. |
| 09-May-2022 | 3 | Updated Figure 1 and Figure 4 |
| 19-Oct-2022 | 4 | Added UL certification; changed cover image; added STISO621W link. |
| 13-Jan-2025 | 5 | Front page: added reference to IEC 60747-17 certification and isolation ratings values; formatting changes for Table 4 and Table 5; in these tables added also a footnote regarding $t_{REFRESH}$ parameter. Added Table 6 with package thermal data. In section 4 Table 7 and Table 8 replaced with new tables each referred to the package version. Added Table 9 with safety limits reported and also Figure 2 , Figure 3 as derating curves. In section 7.1 added a description of parameters $t_W$ in Figure 5 and $t_{POWUP}$ in Figure 6. Added section 7.2 with Figure 7. Formatting changes for Table 10 , Table 11 , Table 12 , Table 13 , Table 14. |

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