

### Product Overview

NSiP1042 is a high reliability isolated controller area network(CAN) physical layer transceiver with integrated DC to DC converter. The isolated DC-DC converter provides output power using on-chip transformer. The feedback PWM signal is sent to primary side by a digital isolator based on Novosense capacitive isolation technology. Both devices are safety certified by UL1577, supporting 5kVrms insulation withstand voltage, while the high integrated solution can help to simplify system design and improve reliability.

The Bus pins of NSiP1042 are protected from  $\pm 5\text{kV}$  system level ESD to  $\text{GND}_2$  on Bus side. The data rate of the NSiP1042 is up to 5Mbps. The NSiP1042 provides thermal protection and transmit data dominant time out function.

### Key Features

- Up to 5000Vrms Insulation voltage
- Isopower integrated isolated DC-DC converter
- Power supply voltage:  
VDD<sub>1</sub>: 4.5V to 5.5V  
VDDL: 1.8V to 5.5V
- Over current and over temperature protection
- High CMTI:  $\pm 150\text{kV}/\mu\text{s}$
- Data rate: 5Mbps
- Operation temperature:  $-40^\circ\text{C} \sim 105^\circ\text{C}$
- RoHS-compliant packages: SOW20

### Safety Regulatory Approvals

- UL recognition: up to 5000Vrms for 1 minute per UL1577
- CQC certification per GB4943.1-2022
- CSA component notice 5A
- DIN VDE V 0884-11:2017-01

### Applications

- Industrial automation system
- Smart electric meter and water meter
- Security and protection monitoring

### Device Information

| Part Number    | Package | Body Size        |
|----------------|---------|------------------|
| NSiP1042-DSWTR | SOW20   | 12.80mm × 7.50mm |

### Functional Block Diagrams

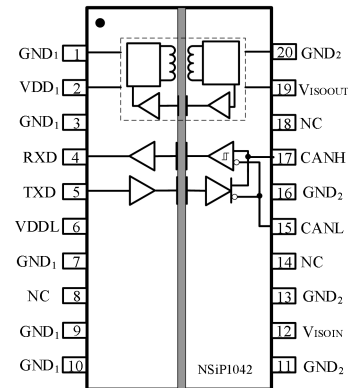


Figure 1. NSiP1042 Block Diagrams

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## 1. Pin Configuration and Functions

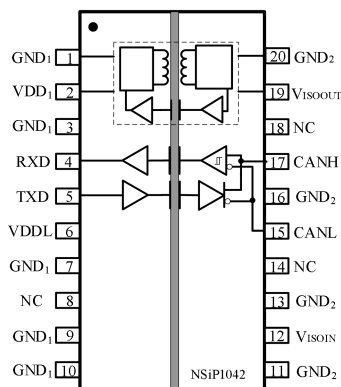


Figure 1.1 NSiP1042 Package

Table1.1 NSiP1042 Pin Configuration and Description

| NSiP1042<br>PIN NO. | SYMBOL             | FUNCTION                                                                                                                                                                                                                                                                              |
|---------------------|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                   | GND <sub>1</sub>   | Ground 1, the ground reference for Isolator Side 1                                                                                                                                                                                                                                    |
| 2                   | VDD <sub>1</sub>   | Power Supply for Isolator Side 1                                                                                                                                                                                                                                                      |
| 3                   | GND <sub>1</sub>   | Ground 1, the ground reference for Isolator Side 1                                                                                                                                                                                                                                    |
| 4                   | RXD                | Receiver output                                                                                                                                                                                                                                                                       |
| 5                   | TXD                | Driver transmit data input                                                                                                                                                                                                                                                            |
| 6                   | VDDL               | I/O Power Supply input. Side1 I/O logic level.                                                                                                                                                                                                                                        |
| 7                   | GND <sub>1</sub>   | Ground 1, the ground reference for Isolator Side 1                                                                                                                                                                                                                                    |
| 8                   | NC                 | Not connected                                                                                                                                                                                                                                                                         |
| 9                   | GND <sub>1</sub>   | Ground 1, the ground reference for Isolator Side 1                                                                                                                                                                                                                                    |
| 10                  | GND <sub>1</sub>   | Ground 1, the ground reference for Isolator Side 1                                                                                                                                                                                                                                    |
| 11                  | GND <sub>2</sub>   | Ground 2, the ground reference for Isolator Side 2                                                                                                                                                                                                                                    |
| 12                  | V <sub>ISOIN</sub> | Isolated power supply input. This pin must be connected externally to V <sub>ISOOUT</sub> . It is recommended this pin have a 0.1 $\mu$ F capacitor to GND <sub>2</sub> (Pin11). Connect this pin through a ferrite bead and short trace length to V <sub>ISOOUT</sub> for operation. |
| 13                  | GND <sub>2</sub>   | Ground 2, the ground reference for Isolator Side 2                                                                                                                                                                                                                                    |
| 14                  | NC                 | Not connected                                                                                                                                                                                                                                                                         |
| 15                  | CANL               | Low-level CAN bus line, when VDD is powered down, Pin CANL is put into a high impedance state to avoid overloading the bus                                                                                                                                                            |
| 16                  | GND <sub>2</sub>   | Ground 2, the ground reference for Isolator Side 2                                                                                                                                                                                                                                    |
| 17                  | CANH               | High-level CAN bus line, when VDD is powered down, Pin CANH is put into a high impedance                                                                                                                                                                                              |

|    |                     |                                                                                                                                                                                                                                                                                               |
|----|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    |                     | state to avoid overloading the bus                                                                                                                                                                                                                                                            |
| 18 | NC                  | Not connected                                                                                                                                                                                                                                                                                 |
| 19 | V <sub>ISOOUT</sub> | Isolated Power Supply Output. This pin must be connected externally to V <sub>ISOIN</sub> . It is recommended this pin have a 0.1 $\mu$ F and 10uF capacitor to GND <sub>2</sub> (Pin20). Connect this pin through a ferrite bead and short trace length to V <sub>ISOIN</sub> for operation. |
| 20 | GND <sub>2</sub>    | Ground 2, the ground reference for Isolator Side 2                                                                                                                                                                                                                                            |

## 2. Absolute Maximum Ratings

| Parameters                           | Symbol           | Min  | Typ | Max      | Unit | Comments |
|--------------------------------------|------------------|------|-----|----------|------|----------|
| Power Supply Voltage                 | VDD <sub>1</sub> | -0.5 |     | 6        | V    |          |
| Maximum Input Voltage                | TXD              | -0.4 |     | VDDL+0.4 | V    |          |
| Driver Output/Receiver Input Voltage | CANH, CANL       | -70  |     | 70       | V    |          |
| RXD Output current                   | I <sub>O</sub>   | -15  |     | 15       | mA   |          |
| Ambient Temperature                  | T <sub>a</sub>   | -40  |     | 105      | °C   |          |
| Storage Temperature                  | T <sub>stg</sub> | -40  |     | 150      | °C   |          |
| Electrostatic discharge              | HBM              |      |     | ±8000    | V    |          |
|                                      | CDM              |      |     | ±2000    | V    |          |

## 3. Recommended Operating Conditions

| Parameters               | Symbol           | Min      | Typ | Max      | Unit |
|--------------------------|------------------|----------|-----|----------|------|
| Power Supply Voltage     | VDD              | 4.5      |     | 5.5      | V    |
|                          | VDDL             | 1.8      |     | 5.5      | V    |
| Operating Temperature    | T <sub>opr</sub> | -40      |     | 105      | °C   |
| High Level Input Voltage | V <sub>IH</sub>  | 0.7*VDDL |     |          | V    |
| Low Level Input Voltage  | V <sub>IL</sub>  |          |     | 0.3*VDDL | V    |
| Data rate                | DR               |          |     | 5        | Mbps |

## 4. Thermal Information

| Parameters                                   | Symbol        | Value | Unit |
|----------------------------------------------|---------------|-------|------|
| IC Junction-to-Air Thermal Resistance        | $\theta_{JA}$ | 68.5  | °C/W |
| Junction-to-top characterization parameter   | $\psi_{JT}$   | 17.1  | °C/W |
| Junction-to-board characterization parameter | $\psi_{JB}$   | 50.9  | °C/W |

## 5. Specifications

### 5.1. DC Electrical Characteristics

(VDD=4.5V~5.5V, VDDL=1.8~5.5V, Ta=-40°C to 105°C. Unless otherwise noted, Typical values are at VDD=VDDL = 5V, Ta = 25°C)

| Parameters                     | Symbol              | Min      | Typ  | Max      | Unit  | Comments                                                                                                       |
|--------------------------------|---------------------|----------|------|----------|-------|----------------------------------------------------------------------------------------------------------------|
| Power supply voltage           | VDD                 | 4.5      |      | 5.5      | V     |                                                                                                                |
|                                | VDDL                | 1.8      |      | 5.5      | V     |                                                                                                                |
| Supply current                 | IDD                 |          | 100  | 180      | mA    | VDD=5V, TXD=0, R <sub>load</sub> =60 Ω                                                                         |
|                                |                     |          | 12.9 | 25       | mA    | VDD=5V, TXD=VDD                                                                                                |
|                                | IDDL                |          | 153  | 1000     | uA    | VDD=VDDL=5V, RL=60Ω TXD=0                                                                                      |
|                                | IDDL                |          | 57   | 500      | uA    | VDD=VDDL=5V, RL=60Ω TXD=VDD                                                                                    |
| Thermal-Shutdown Threshold     | T <sub>TS</sub>     |          | 165  |          | °C    |                                                                                                                |
| Isolated supply voltage        | V <sub>ISOOUT</sub> |          | 5    |          | V     |                                                                                                                |
| Common Mode Transient Immunity | CMTI                | ±100     | ±150 |          | kV/us | See <a href="#">Fig 5.3.10</a>                                                                                 |
| <b>Logic Side</b>              |                     |          |      |          |       |                                                                                                                |
| High level input voltage       | V <sub>IH</sub>     | 0.7*VDDL |      |          | V     | TXD pin                                                                                                        |
| Low level input voltage        | V <sub>IL</sub>     |          |      | 0.3*VDDL | V     | TXD pin                                                                                                        |
| High level input current       | I <sub>IH</sub>     | -1       |      | 1        | uA    | TXD pin                                                                                                        |
| Low level input current        | I <sub>IL</sub>     | -15      |      |          | uA    | TXD pin                                                                                                        |
| Output Voltage High            | V <sub>OH</sub>     | VDDL-0.4 |      |          | V     | I <sub>OH</sub> = -4mA, RXD pin                                                                                |
| Output Voltage Low             | V <sub>OL</sub>     |          |      | 0.4      | V     | I <sub>OL</sub> = 4mA, RXD pin                                                                                 |
| Input Capacitance              | C <sub>IN</sub>     |          | 2    |          | pF    | TXD pin                                                                                                        |
| <b>Driver</b>                  |                     |          |      |          |       |                                                                                                                |
| CANH output voltage (Dominant) | V <sub>OH(D)</sub>  | 2.8      | 3.44 | 4        | V     | V <sub>I</sub> =0V, R <sub>Load</sub> =60 Ω ,see <a href="#">Figure 5.3.1</a> and <a href="#">Figure 5.3.2</a> |
| CANL output voltage            | V <sub>OL(D)</sub>  | 0.8      | 1.33 | 2        | V     | V <sub>I</sub> =0V, R <sub>Load</sub> =60 Ω ,see <a href="#">Figure</a>                                        |

|                                                            |                     |       |       |      |    |                                                                                                                   |
|------------------------------------------------------------|---------------------|-------|-------|------|----|-------------------------------------------------------------------------------------------------------------------|
| (Dominant)                                                 |                     |       |       |      |    | <a href="#">5.3.1</a> and <a href="#">Figure 5.3.2</a>                                                            |
| CAN bus output voltage<br>(Recessive)                      | V <sub>O(R)</sub>   | 2     | 2.5   | 3    | V  | TXD=VDD <sub>1</sub> , R <sub>Load</sub> =60 Ω ,see <a href="#">Figure 5.3.1</a> and <a href="#">Figure 5.3.2</a> |
| Differential output voltage<br>(Dominant)                  | V <sub>OD(D)</sub>  | 1.5   |       | 3    | V  | TXD=0, RLoad =60 Ω , see <a href="#">Figure 5.3.1</a> and <a href="#">Figure 5.3.2</a>                            |
|                                                            |                     | 1     |       | 3    | V  | TXD=0, R <sub>Load</sub> =45 Ω ,                                                                                  |
| Differential output voltage<br>(Recessive)                 | V <sub>OD(R)</sub>  | -0.12 |       | 0.12 | V  | TXD=VDD <sub>1</sub> , R <sub>Load</sub> =60 Ω                                                                    |
|                                                            |                     | -0.5  |       | 0.5  | V  | TXD=VDD <sub>1</sub> , NO Load                                                                                    |
| Common-mode output voltage                                 | V <sub>OC</sub>     | 2     | 2.5   | 3    | V  |                                                                                                                   |
| Peak-to-peak Common-mode<br>output voltage                 | V <sub>OC(PP)</sub> |       | 250   |      | mV | See <a href="#">Fig 5.3.6</a>                                                                                     |
| Short- circuit output current                              | I <sub>OS</sub>     | -105  | -44.1 |      | mA | CANH=-30V, CANL open, see <a href="#">Figure 5.3.9</a>                                                            |
|                                                            |                     | 0     |       | 10   | mA | CANH=30V, CANL open, see <a href="#">Figure 5.3.9</a>                                                             |
|                                                            |                     | -5    |       | 0    | mA | CANL=-30V, CANH open, see <a href="#">Figure 5.3.9</a>                                                            |
|                                                            |                     |       | 42.5  | 105  | mA | CANL=30V, CANH open, see <a href="#">Figure 5.3.9</a>                                                             |
| <b>Receiver</b>                                            |                     |       |       |      |    |                                                                                                                   |
| Positive-going differential bus<br>input threshold voltage | V <sub>TH+</sub>    |       | 750   | 900  | mV | V <sub>IC</sub> =0 see <a href="#">Figure 5.3.4</a>                                                               |
| Negative-going differential bus<br>input threshold voltage | V <sub>TH-</sub>    | 500   | 650   |      | mV | V <sub>IC</sub> =0 see <a href="#">Figure 5.3.4</a>                                                               |
| Bus Differential input threshold<br>Hysteresis             | V <sub>HYS</sub>    |       | 100   |      | mV |                                                                                                                   |
| Input capacitance to ground                                | C <sub>I</sub>      |       | 13    |      | pF | CANH or CANL                                                                                                      |
| Differential input capacitance                             | C <sub>ID</sub>     |       | 6.5   |      | pF |                                                                                                                   |
| Differential input resistance                              | R <sub>ID</sub>     | 30    |       | 80   | kΩ |                                                                                                                   |
| Input resistance                                           | R <sub>IN</sub>     | 15    | 30    | 40   | kΩ |                                                                                                                   |
| Input resistance matching                                  | R <sub>Imatch</sub> | -3    |       | +3   | %  | CANH=CANL                                                                                                         |
| Common-mode voltage range                                  | V <sub>IC</sub>     | -30   |       | +30  | V  |                                                                                                                   |

## 5.2. Switching Electrical Characteristics

(VDD=4.5V~5.5V, VDDL=1.8~5.5V, Ta=-40°C to 105°C. Unless otherwise noted, Typical values are at VDD=VDDL = 5V, Ta = 25°C)

| Parameters                                             | Symbol         | Min | Typ  | Max  | Unit | Comments                                                                                 |
|--------------------------------------------------------|----------------|-----|------|------|------|------------------------------------------------------------------------------------------|
| Loop delay1                                            | $T_{Loop1}$    |     | 104  | 180  | ns   | Driver input to receiver output, Recessive to Dominant, see <a href="#">Figure 5.3.7</a> |
| Loop delay2                                            | $T_{Loop2}$    |     | 122  | 210  | ns   | Driver input to receiver output, Dominant to Recessive, see <a href="#">Figure 5.3.7</a> |
| <b>Driver</b>                                          |                |     |      |      |      |                                                                                          |
| Propagation delay time, recessive -to- dominant output | $t_{PLHD}$     |     | 77   |      | ns   | <a href="#">Figure 5.3.3</a>                                                             |
| Propagation delay time, dominant -to- recessive output | $t_{PHLD}$     |     | 72   |      | ns   | <a href="#">Figure 5.3.3</a>                                                             |
| Differential output signal rise time                   | $t_{rD}$       |     | 26   |      | ns   | <a href="#">Figure 5.3.3</a>                                                             |
| Differential output signal fall time                   | $t_{fD}$       |     | 40   |      | ns   | <a href="#">Figure 5.3.3</a>                                                             |
| Bus dominant time-out time                             | $t_{TXD\_DTO}$ | 600 | 2000 | 4000 | us   | See <a href="#">Figure 5.3.8</a>                                                         |
| <b>Receiver</b>                                        |                |     |      |      |      |                                                                                          |
| Propagation delay time, low-to-high-level output       | $t_{PLHR}$     |     | 50   |      | ns   | <a href="#">Figure 5.3.5</a>                                                             |
| Propagation delay time, high-to-low-level output       | $t_{PHLR}$     |     | 27   |      | ns   | <a href="#">Figure 5.3.5</a>                                                             |
| RXD signal rise time                                   | $t_{rR}$       |     | 3    |      | ns   | <a href="#">Figure 5.3.5</a>                                                             |
| RXD signal fall time                                   | $t_{fR}$       |     | 3    |      | ns   | <a href="#">Figure 5.3.5</a>                                                             |

### 5.3. Parameter Measurement Information

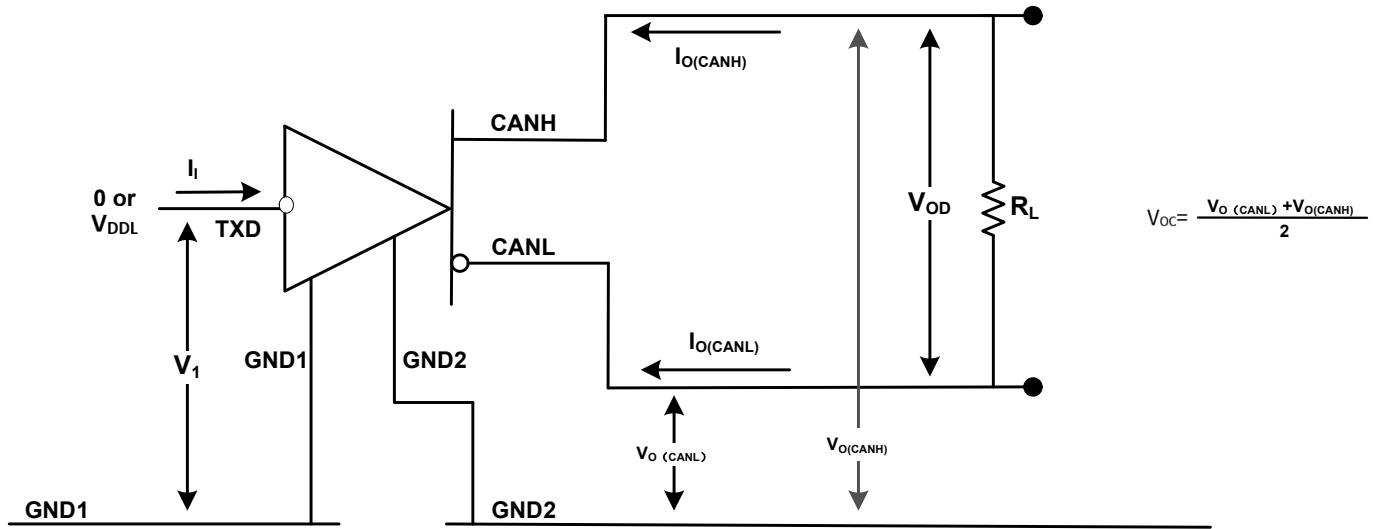


Figure 5.3.1. Driver Voltage, Current and Test Definitions

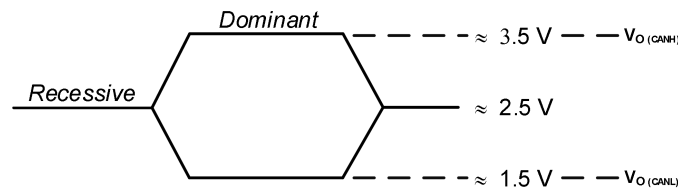
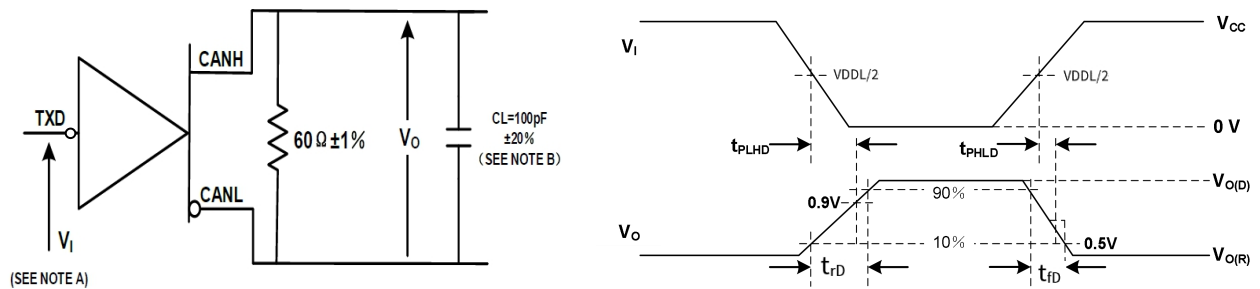


Figure 5.3.2. Bus Logic State Voltage Definitions



Note: A. The input pulse is supplied by a generator having the following characteristics: Pulse Repeat Rate  $\leq 125\text{ kHz}$ , 50% duty cycle  $t_r \leq 6\text{ ns}$ ,  $t_f \leq 6\text{ ns}$ ,  $Z_0 = 50\ \Omega$ .

B. CL includes instrumentation and fixture capacitance within  $\pm 20\%$ .

Figure 5.3.3. Driver Test Circuit and Voltage Waveform

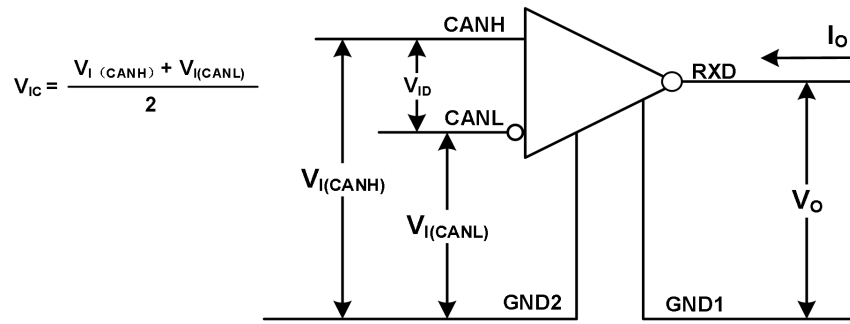
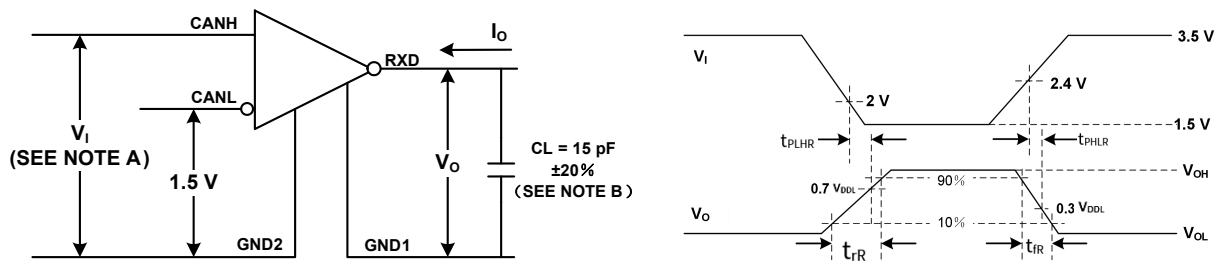


Figure 5.3.4. Receiver Voltage and Current Definitions



Note: A. The input pulse is supplied by a generator having the following characteristics: Pulse Repeat Rate  $\leq 125$  kHz, 50% duty cycle,  $t_r \leq 6$  ns,  $t_f \leq 6$  ns,  $Z_o = 50 \Omega$ .

B.  $C_L$  includes instrumentation and fixture capacitance within  $\pm 20\%$ .

Figure 5.3.5. Receiver Test Circuit and Voltage Waveform

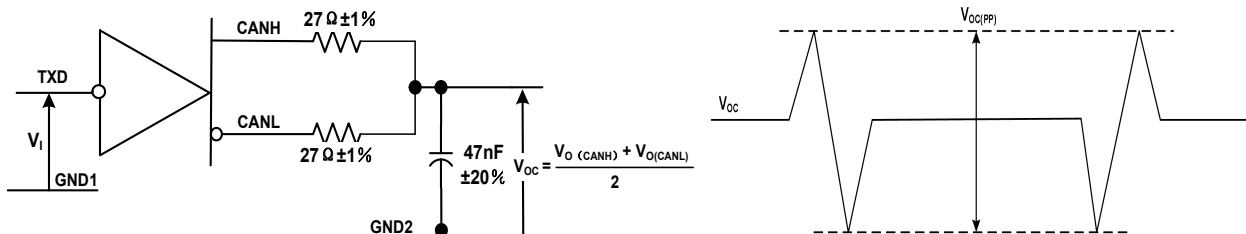


Figure 5.3.6. Peak-to-Peak Output Voltage Test Circuit and Waveform

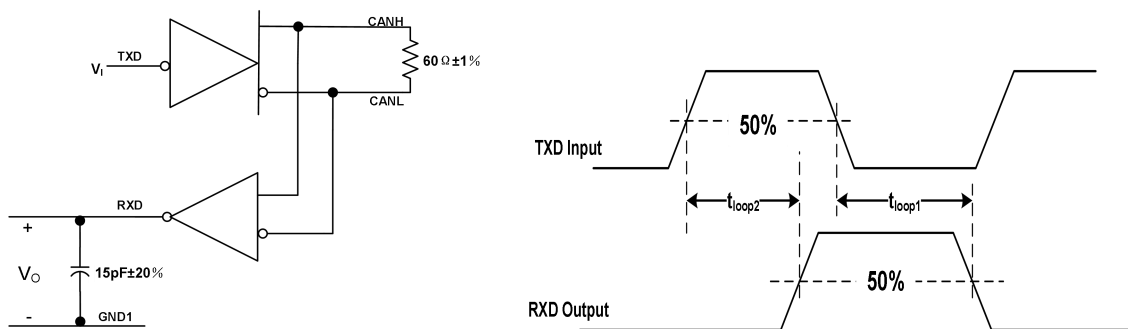
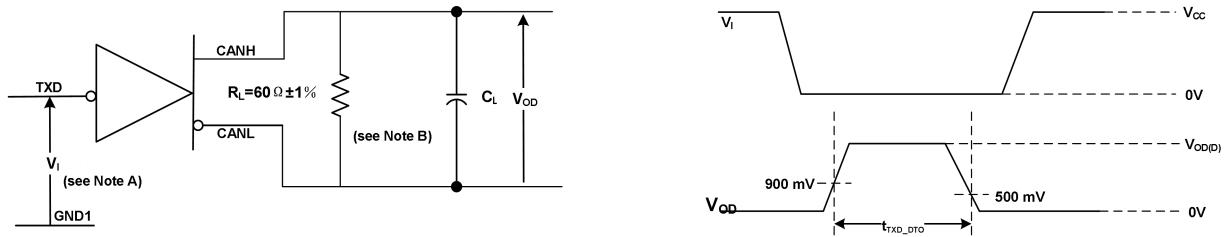


Figure 5.3.7.  $t_{LOOP}$  Test Circuit and Voltage Waveform



A. The input pulse is supplied by a generator having the following characteristics:  $PRR \leq 125$  kHz, 50% duty cycle,  $t_r \leq 6$  ns,  $t_f \leq 6$  ns,  $Z_0 = 50 \Omega$ .

B.  $C_L$  includes instrumentation and fixture capacitance within  $\pm 20\%$ .

Figure 5.3.8. Dominant Time-out Test Circuit and Voltage Waveform

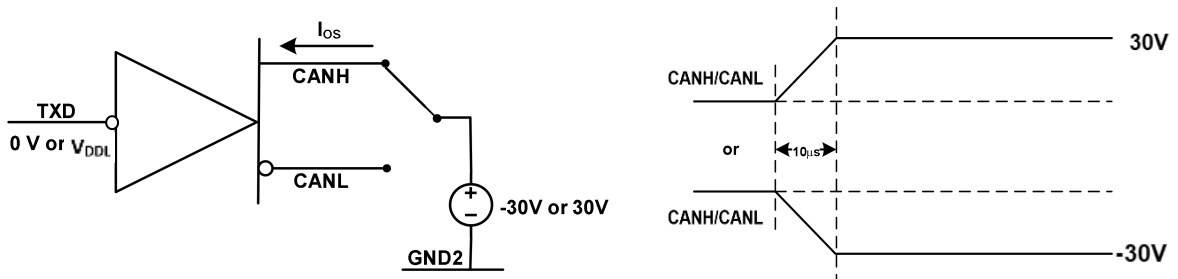


Figure 5.3.9. Driver Short-Circuit Current Test Circuit and Waveform

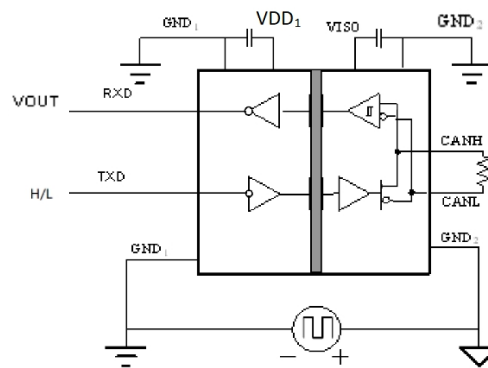


Figure 5.3.10 Common-Mode Transient Immunity Test Circuit

## 6. High Voltage Feature Description

### 6.1. Insulation And Safety Related Specifications

| Parameters                                       | Symbol | Value | Unit | Comments                                                                |
|--------------------------------------------------|--------|-------|------|-------------------------------------------------------------------------|
| Minimum External Air Gap (Clearance)             | CLR    | 8.0   | mm   | Shortest terminal-to-terminal distance through air                      |
| Minimum External Tracking (Creepage)             | CPG    | 8.0   | mm   | Shortest terminal-to-terminal distance across the package surface       |
| Minimum internal gap                             | DTI    | 16    | um   | Minimum internal gap (internal clearance – capacitive signal isolation) |
|                                                  |        | 100   | um   | Minimum internal gap (internal clearance – transformer power isolation) |
| Tracking Resistance (Comparative Tracking Index) | CTI    | >600  | V    | DIN EN 60112 (VDE 0303-11); IEC 60112                                   |
| Material Group                                   |        | I     |      |                                                                         |

### 6.2. DIN VDE V 0884-11 (VDE V 0884-11) :2017-01 INSULATION CHARATERISTICS

| Description                                   | Test Condition                                                                                                          | Symbol      | Value     | Unit       |
|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|-------------|-----------|------------|
| Installation Classification per DIN VDE 0110  |                                                                                                                         |             |           |            |
| For Rated Mains Voltage $\leq 150\text{Vrms}$ |                                                                                                                         |             | I to IV   |            |
| For Rated Mains Voltage $\leq 300\text{Vrms}$ |                                                                                                                         |             | I to IV   |            |
| For Rated Mains Voltage $\leq 600\text{Vrms}$ |                                                                                                                         |             | I to III  |            |
| Climatic Classification                       |                                                                                                                         |             | 40/105/21 |            |
| Pollution Degree per DIN VDE 0110, Table 1    |                                                                                                                         |             | 2         |            |
| Maximum repetitive isolation voltage          | AC voltage(bipolar)                                                                                                     | $V_{IORM}$  | 1166      | $V_{peak}$ |
| Maximum working isolation voltage             | AC Voltage (TDDB) test                                                                                                  | $V_{IOWM}$  | 824       | $V_{rms}$  |
|                                               | DC Voltage                                                                                                              | $V_{IOWM}$  | 1166      | $V_{DC}$   |
| Input to Output Test Voltage, Method B1       | $V_{IORM} \times 1.5 = V_{pd(m)}$ , 100% production test,<br>$t_{ini} = t_m = 1 \text{ sec}$ , partial discharge < 5 pC | $V_{pd(m)}$ | 1749      | $V_{peak}$ |
| Input to Output Test Voltage, Method A        |                                                                                                                         |             |           |            |
| After Environmental Tests Subgroup 1          | $V_{IORM} \times 1.2 = V_{pd(m)}$ , $t_{ini} = 60 \text{ sec}$ , $t_m = 10 \text{ sec}$ , partial                       | $V_{pd(m)}$ | 1399      | $V_{peak}$ |

|                                                           |                                                                                                                       |             |         |            |
|-----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|-------------|---------|------------|
|                                                           | discharge < 5 pC                                                                                                      |             |         |            |
| After Input and /or Safety Test Subgroup 2 and Subgroup 3 | $V_{IORM} \times 1.2 = V_{pd(m)}$ , $t_{ini} = 60$ sec, $t_m = 10$ sec, partial discharge < 5 pC                      | $V_{pd(m)}$ | 1399    | Vpeak      |
| Maximum transient isolation voltage                       | $V_{TEST} = V_{IOTM}$ ; $t = 60$ s (qualification);<br>$V_{TEST} = 1.2 \times V_{IOTM}$ ; $t = 1$ s (100% production) | $V_{IOTM}$  | 7000    | Vpeak      |
| Maximum Surge Isolation Voltage                           | Test method per IEC60065, 1.2/50us waveform, $V_{TEST} = 1.3 \times V_{IOSM}$                                         | $V_{IOSM}$  | 5384    | Vpeak      |
| Isolation resistance                                      | $V_{IO} = 500V$                                                                                                       | $R_{IO}$    | $>10^9$ | $\Omega$   |
| Isolation capacitance                                     | $f = 1MHz$                                                                                                            | $C_{IO}$    | 0.6     | pF         |
| Total Power Dissipation at 25 °C                          |                                                                                                                       | $P_s$       | 1459    | mW         |
| Safety input, output, or supply current                   | $\theta_{JA} = 68.5^\circ C/W$ , $V_I = 5.5 V$ , $T_J = 125^\circ C$ , $T_A = 25^\circ C$                             | $I_s$       | 265     | mA         |
| Maximum safety temperature                                |                                                                                                                       | $T_s$       | 125     | $^\circ C$ |

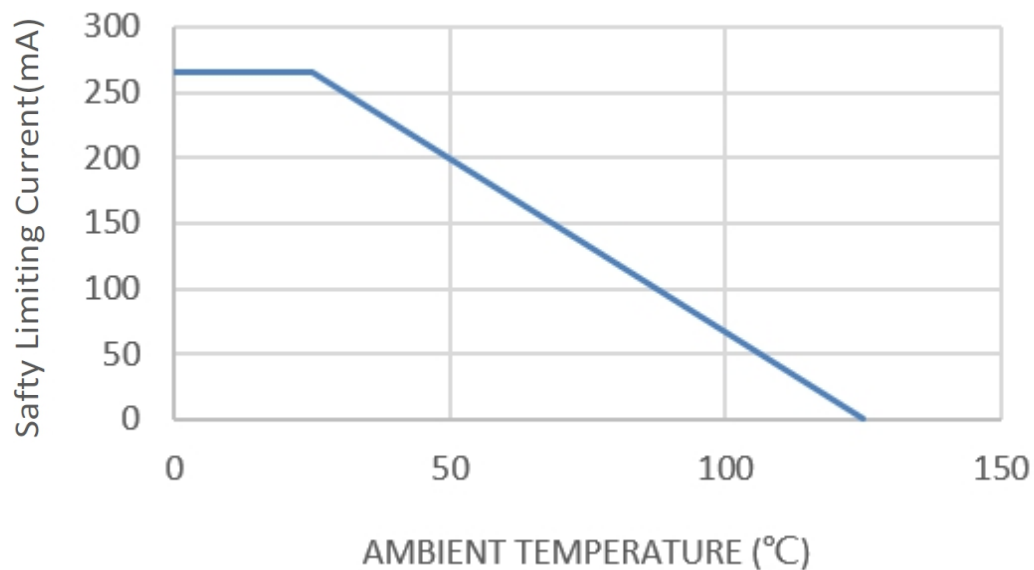


Figure 6.1 NSiP1042 Thermal Derating Curve, Dependence of Safety Limiting Values with Case Temperature per DIN VDE V 0884-11

### 6.3. Regulatory Information

The NSiP1042 are approved or pending approval by the organizations listed in table.

| CUL                                                       |                                                           | VDE                                                                                  | CQC                                             |
|-----------------------------------------------------------|-----------------------------------------------------------|--------------------------------------------------------------------------------------|-------------------------------------------------|
| UL 1577 Component Recognition Program <sup>1</sup>        | Approved under CSA Component Acceptance Notice 5A         | DIN VDE V 0884-11(VDE V 0884-11):2017-01 <sup>2</sup>                                | Certified by CQC11-471543-2022<br>GB4943.1-2022 |
| Single Protection, 5000V <sub>RMS</sub> Isolation voltage | Single Protection, 5000V <sub>RMS</sub> Isolation voltage | Basic Insulation 1166V <sub>PEAK</sub> ,<br>V <sub>IOSM</sub> =5384V <sub>PEAK</sub> | Basic insulation                                |
| File (pending)                                            | File (pending)                                            | File (pending)                                                                       | File (pending)                                  |

## 7. Function Description

The NSiP1042 is an isolated CAN transceiver which is fully compatible with the ISO11898-2 standard. The NSiP1042 is a high reliability isolated controller area network(CAN) physical layer transceiver with integrated DC to DC converter. The digital isolator is SiO<sub>2</sub> isolation based on Novosense capacity isolation technology. The high integrated solution can help to simplify system design and improve reliability. The NSiP1042 device is safety certified by UL1577, supporting 5kVrms insulation withstand voltages. The NSiP1042 provides high electromagnetic immunity and low emission. The data rate of the NSiP1042 is up to 5Mbps. The NSiP1042 provides thermal protection and transmit data dominant time out function.

### 7.1. Device Functional Modes

| TXD  | CANH | CANL | BUS STATE |
|------|------|------|-----------|
| L    | H    | L    | Dominant  |
| H    | Z    | Z    | Recessive |
| Open | Z    | Z    | Recessive |

<sup>1</sup> H= high level; L=low level; Z= common mode(recessive) bias to V<sub>ISOIN</sub>/2

Table 7.1. Driver Function Table

| V <sub>ID</sub> =CANH-CANL   | RXD | BUS STATE |
|------------------------------|-----|-----------|
| V <sub>ID</sub> ≥ 0.9V       | L   | Dominant  |
| 0.5 < V <sub>ID</sub> < 0.9V | X   | Uncertain |
| V <sub>ID</sub> ≤ 0.5V       | H   | Recessive |
| Open                         | H   | Recessive |

<sup>1</sup> H= high level; L=low level; X= uncertain

Table 7.2. Receiver Function Table

### 7.2. TXD dominant time-out function

A 'TXD dominant time-out' timer circuit prevents the bus lines from being driven to a permanent dominant state (blocking all network communication) if pin TXD is forced permanently LOW by a hardware and/or software application failure. The timer is triggered by a negative edge on pin TXD.

If the duration of the LOW level on pin TXD exceeds the internal timer value ( $t_{\text{TXD\_DTO}}$ ), the transmitter is disabled, driving the bus lines into a recessive state. The timer is reset by a positive edge on pin TXD.

### 7.3. Current Protection

A current-limiting circuit protects the transmitter output stage from damage caused by accidental short-circuit to either positive or negative supply voltage, although power dissipation increases during this fault condition.

### 7.4. Over Temperature Protection

The NSiP1042 is protected against over-temperature conditions. When the chip is over 165°C, it will be shut down until the temperature of below 145°C.

## 8. Application Note

### 8.1. Layout Considerations

The NSiP1042 require a  $10\ \mu\text{F} + 0.1\ \mu\text{F}$  bypass capacitor between  $\text{VDD}_1$  and  $\text{GND}_1$ ,  $10\ \mu\text{F} + 0.1\ \mu\text{F}$  bypass capacitor between  $\text{V}_{\text{ISOOUT}}$  and  $\text{GND}_2$ . The capacitor should be placed as close as possible to the package. To eliminate line reflections, each cable end is terminated with a resistor, whose value matches the characteristic impedance of the cable. It's good practice to place the bus connectors and termination resistor as close as possible to the CANH and CANL pins.

### 8.2. Typical Application

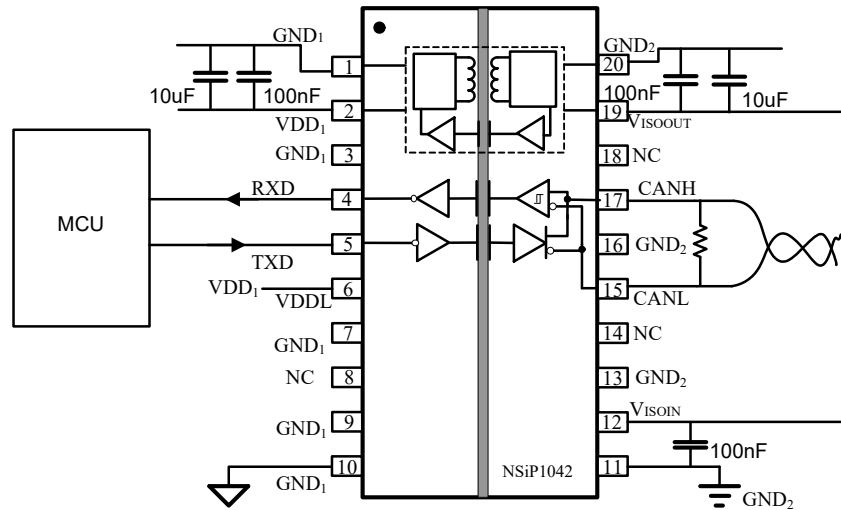


Figure 8.1 NSiP1042 typical application circuit

## 9. Package Information

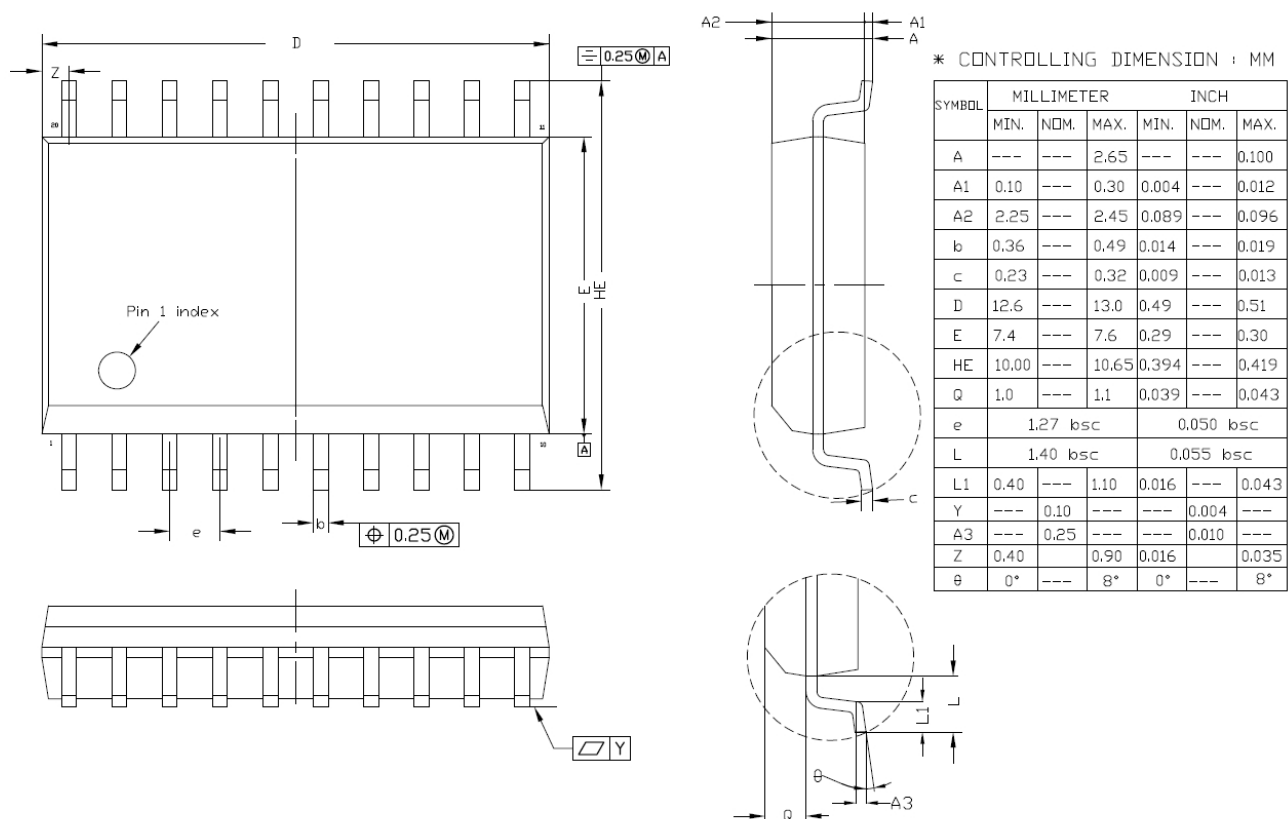


Figure 9.1 SOW20 Package Shape and Dimension in millimeters

## 10. Order Information

| Part Number    | Isolation Rating (kVrms) | Max Data Rate (Mbps) | MSL | Temperature  | Package Type  | Package Drawing | SPQ  |
|----------------|--------------------------|----------------------|-----|--------------|---------------|-----------------|------|
| NSiP1042-DSWTR | 5                        | 5                    | 3   | -40 to 105°C | SOP20(300mil) | SOW20           | 1000 |

## 11. Documentation Support

| Part Number | Product Folder | Datasheet | Application Note |
|-------------|----------------|-----------|------------------|
| NSiP1042    | Tbd            | Tbd       | Tbd              |

## 12. Tape And Reel Information

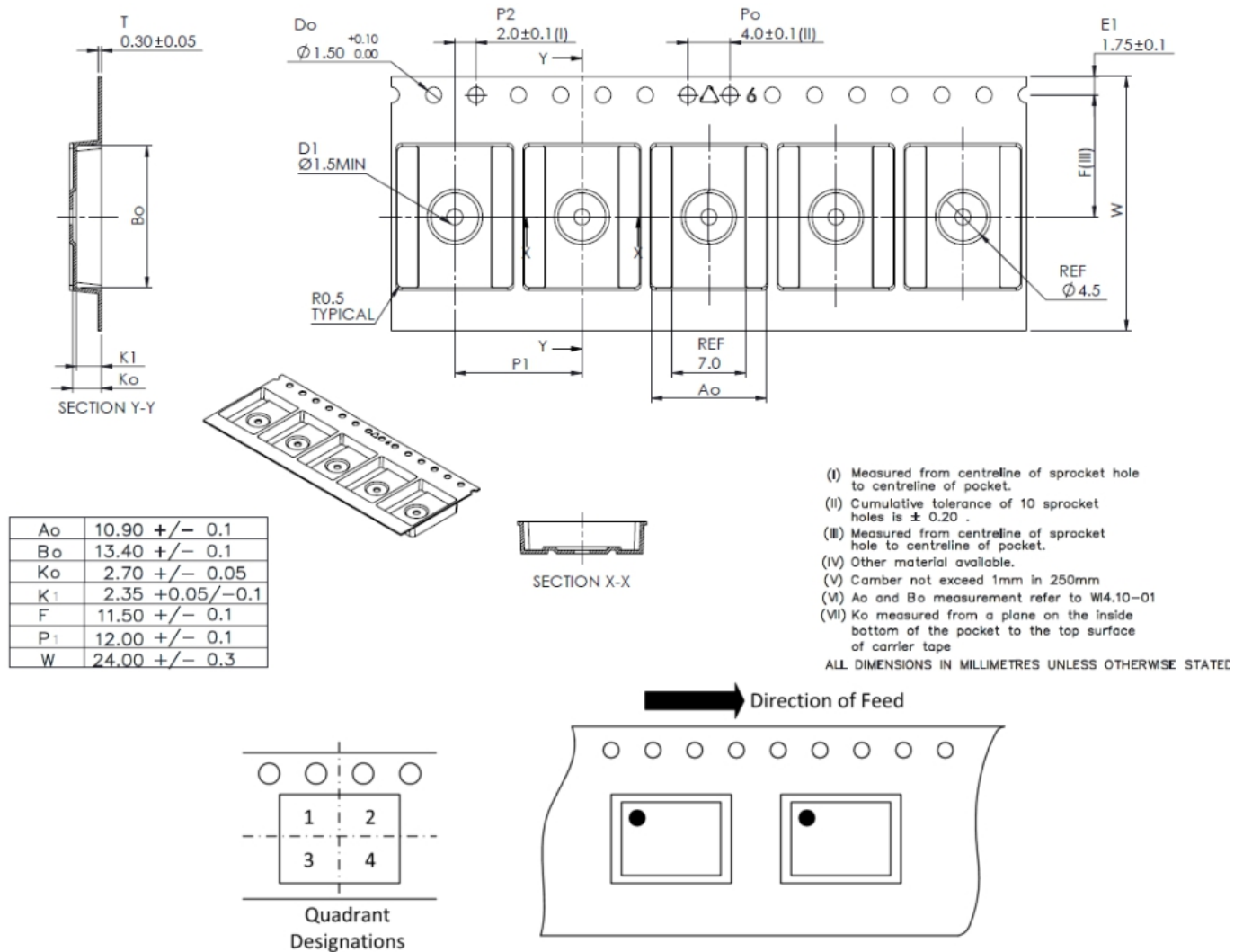


Figure 12.1 Tape and Reel Information of SOW20

## 13. Revision History

| Revision | Description     | Date       |
|----------|-----------------|------------|
| 1.0      | Initial version | 2022/12/28 |

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