

### Product Overview

The NSiP884x devices are quad-channel digital isolators with integrated isolated DC-DC converter. The isolated DC-DC converter provide up to 500mW output power use on chip transformer. The feedback PWM signal is sent to primary side by a digital isolator based on Novosense capacity isolation technology. The high integrated solution can help to simplify system design and improve reliability. The NSiP884x device is safety certified by UL1577 support 4.5kVrms withstand voltages, while providing high electromagnetic immunity and low emissions. The data rate of the NSiP884x is up to 150Mbps, and the common-mode transient immunity (CMTI) is up to 150kV/us. The NSiP884x devices provide 5V to 5V, 5V to 3.3V, 3.3V to 3.3V conversion mode, the output voltage can be set by SEL pin. The logical level of digital isolators on left side can be set by VDDL pin which can support the application when the supply voltage and I/O voltage level are different.

### Key Features

- Up to 4500Vrms Insulation voltage
- Power supply voltage: 3.3V to 5.5V
- 5V to 5V, 5V to 3.3V, support 100mA load current
- 3.3V to 3.3V, support 60mA load current
- Over current and over temperature protection
- Data rate: DC to 150Mbps
- High CMTI: 150kV/us
- Propagation delay: <15ns
- High system level EMC performance:  
Enhanced system level ESD, EFT, Surge immunity
- Operation temperature: -40°C~125°C
- RoHS-compliant packages:  
SOW16

### Safety Regulatory Approvals

- UL recognition: up to 4500V<sub>rms</sub> for 1 minute per UL1577
- CQC certification per GB4943.1-2011
- CSA component notice 5A
- DIN VDE V 0884-11:2017-01

### Applications

- Industrial automation system
- Isolated SPI, RS232, RS485
- General-purpose multichannel isolation

### Device Information

| Part Number   | Package | Body Size        |
|---------------|---------|------------------|
| NSiP884x-DSWR | SOW16   | 10.30mm × 7.50mm |

### Functional Block Diagrams

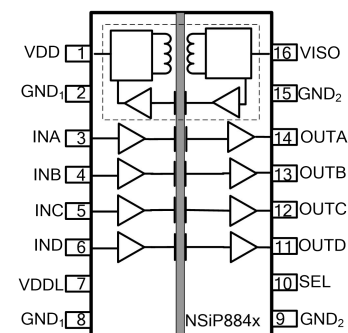


Figure 1. NSiP884x Block Diagram<sup>1</sup>

<sup>1</sup> The isolation channel direction can be either depend on different part number.

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## 1. Pin Configuration And Functions

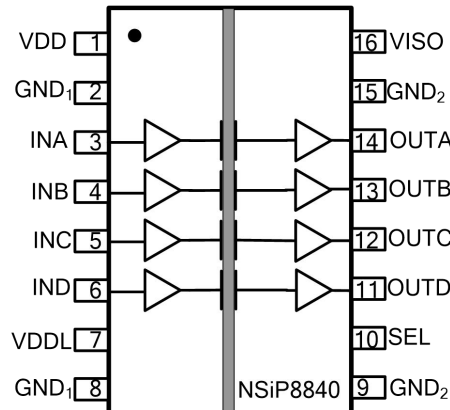


Figure 1.1 NSiP8840 Package

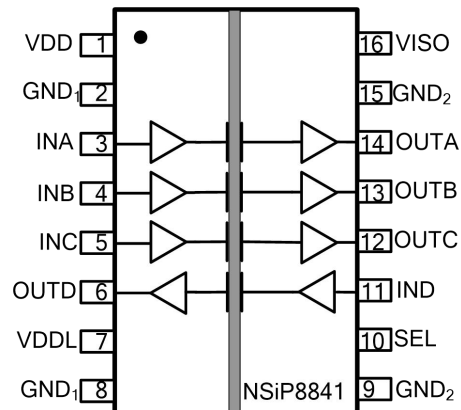


Figure 1.2 NSiP8841 Package

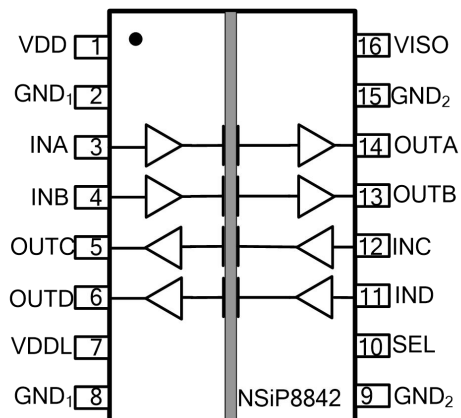


Figure 1.3 NSiP8842 Package

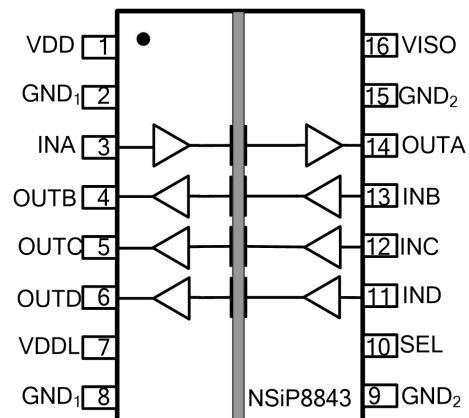


Figure 1.4 NSiP8843 Package

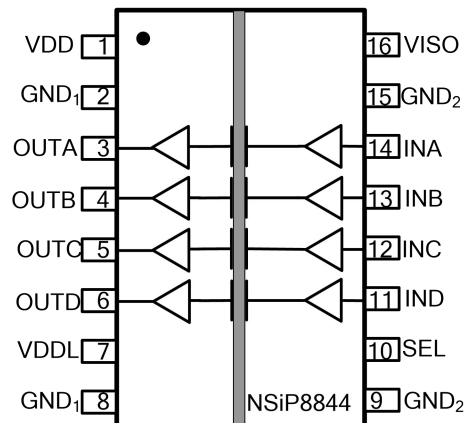


Figure 1.5 NSiP8844 Package

Table1.1 NSiP8840/ NSiP8841/ NSiP8842/ NSiP8843/NSiP8844 Pin Configuration and Description

| <b>NSiP8840<br/>PIN NO.</b> | <b>NSiP8841<br/>PIN NO.</b> | <b>NSiP8842<br/>PIN NO.</b> | <b>NSiP8843<br/>PIN NO.</b> | <b>NSiP8844<br/>PIN NO.</b> | <b>SYMBOL</b> | <b>FUNCTION</b>                                                                                           |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|---------------|-----------------------------------------------------------------------------------------------------------|
| 1                           | 1                           | 1                           | 1                           | 1                           | VDD           | Power Supply for Isolator Side 1                                                                          |
| 2                           | 2                           | 2                           | 2                           | 2                           | GND1          | Ground 1, the ground reference for Isolator Side 1                                                        |
| 3                           | 3                           | 3                           | 3                           | 14                          | INA           | Logic Input A                                                                                             |
| 4                           | 4                           | 4                           | 13                          | 13                          | INB           | Logic Input B                                                                                             |
| 5                           | 5                           | 12                          | 12                          | 12                          | INC           | Logic Input C                                                                                             |
| 6                           | 11                          | 11                          | 11                          | 11                          | IND           | Logic Input D                                                                                             |
| 7                           | 7                           | 7                           | 7                           | 7                           | VDDL          | I/O Power Supply input. Side1 I/O logic level.                                                            |
| 8                           | 8                           | 8                           | 8                           | 8                           | GND1          | Ground 1, the ground reference for Isolator Side 1                                                        |
| 9                           | 9                           | 9                           | 9                           | 9                           | GND2          | Ground 2, the ground reference for Isolator Side 2                                                        |
| 10                          | 10                          | 10                          | 10                          | 10                          | SEL           | VISO output voltage select, VISO=5V when SEL short to VISO, VISO=3.3V when SEL short to GND2 or floating. |
| 11                          | 6                           | 6                           | 6                           | 6                           | OUTD          | Logic Output D                                                                                            |
| 12                          | 12                          | 5                           | 5                           | 5                           | OUTC          | Logic Output C                                                                                            |
| 13                          | 13                          | 13                          | 4                           | 4                           | OUTB          | Logic Output B                                                                                            |
| 14                          | 14                          | 14                          | 14                          | 3                           | OUTA          | Logic Output A                                                                                            |
| 15                          | 15                          | 15                          | 15                          | 15                          | GND2          | Ground 2, the ground reference for Isolator Side 2                                                        |
| 16                          | 16                          | 16                          | 16                          | 16                          | VISO          | Secondary Supply Voltage Output for External Load.                                                        |

## 2. Absolute Maximum Ratings

| <b>Parameters</b>               | <b>Symbol</b>                                                                  | <b>Min</b> | <b>Typ</b> | <b>Max</b>                          | <b>Unit</b> | <b>Comments</b> |
|---------------------------------|--------------------------------------------------------------------------------|------------|------------|-------------------------------------|-------------|-----------------|
| Power Supply Voltage            | VDD                                                                            | -0.5       |            | 6                                   | V           |                 |
| Maximum Input Voltage           | V <sub>INA</sub> , V <sub>INB</sub><br>V <sub>INC</sub> , V <sub>IND</sub>     | -0.4       |            | VCC1 <sup>2</sup> +0.4 <sup>1</sup> | V           |                 |
| Maximum Output Voltage          | V <sub>OUTA</sub> , V <sub>OUTB</sub><br>V <sub>OUTC</sub> , V <sub>OUTD</sub> | -0.4       |            | VCC2 <sup>2</sup> +0.4 <sup>1</sup> | V           |                 |
| Output current                  | I <sub>o</sub>                                                                 | -15        |            | 15                                  | mA          |                 |
| Maximum Surge Isolation Voltage | V <sub>IOSM</sub>                                                              |            |            | 5.3                                 | kV          |                 |
| Operating Temperature           | T <sub>opr</sub>                                                               | -40        |            | 125                                 | °C          |                 |
| Storage Temperature             | T <sub>stg</sub>                                                               | -40        |            | 150                                 | °C          |                 |
| Electrostatic discharge         | HBM                                                                            |            |            | ±6000                               | V           |                 |

|  |     |  |  |       |   |  |
|--|-----|--|--|-------|---|--|
|  | CDM |  |  | ±2000 | V |  |
|--|-----|--|--|-------|---|--|

<sup>1</sup>VCC1 is input side supply,VCC2 is output side supply For the isolator side1,VDDL is the VCCx.

### 3. Recommended Operating Conditions

| Parameters               | Symbol | min                   | typ | max                   | unit |
|--------------------------|--------|-----------------------|-----|-----------------------|------|
| Power Supply Voltage     | VDD    | 3                     |     | 5.5                   | V    |
| Operating Temperature    | Topr   | -40                   |     | 125                   | °C   |
| High Level Input Voltage | VIH    | 0.7*VCC1 <sup>1</sup> |     | VCC1 <sup>1</sup>     | V    |
| Low Level Input Voltage  | VIL    | 0                     |     | 0.3*VCC1 <sup>1</sup> | V    |
| Data rate                | DR     |                       |     | 150                   | Mbps |

<sup>1</sup>VCC1 is input side supply,VCC2 is output side supply For the isolator side1,VDDL is the VCCx.

### 4. Thermal Characteristics

| Parameters                                | Symbol              | SOW16 | Unit |
|-------------------------------------------|---------------------|-------|------|
| IC Junction-to-Air Thermal Resistance     | $\theta_{JA}$       | 56.8  | °C/W |
| Junction-to-case (top) thermal resistance | $\theta_{JC (top)}$ | 15.6  | °C/W |
| Junction-to-board thermal resistance      | $\theta_{JB}$       | 28.5  | °C/W |

## 5. Specifications

### 5.1. Isolated DC/DC Converter Static Specifications

(VDD=4.5V~5.5V, VDDL=1.8V~5.5V,SEL=VISO, Ta=-40°C to 125°C. Unless otherwise noted, Typical values are at VDD =VDDL= 5V, Ta = 25°C)

| Parameters                                  | Symbol                  | Min  | Typ | Max  | Unit | Comments                         |
|---------------------------------------------|-------------------------|------|-----|------|------|----------------------------------|
| Isolated Supply Voltage                     | VISO                    | 4.75 | 5   | 5.25 | V    |                                  |
| Line Regulation                             | V <sub>ISO(LINE)</sub>  |      |     | 2    | mV/V |                                  |
| Load Regulation                             | V <sub>ISO(LOAD)</sub>  |      | 0.2 | 0.5  | %    |                                  |
| Output Ripple                               | V <sub>ISO(RIP)</sub>   |      | 35  |      | mVpp |                                  |
| Output Noise                                | V <sub>ISO(NOISE)</sub> |      | 150 |      | mVpp |                                  |
| Efficiency at maximum load current          | EFF                     | 39   | 50  |      | %    | I <sub>ISO</sub> =100mA,VDDL=VDD |
| Output supply current                       | I <sub>ISO</sub>        | 100  |     |      | mA   |                                  |
| VDD supply current without digital isolator | I <sub>VDD_POWER</sub>  |      | 10  | 20   | mA   | No VISO Load                     |
|                                             |                         |      | 197 | 270  | mA   | I <sub>ISO</sub> =100mA          |

(VDD=4.5V~5.5V, VDDL=1.8V~5.5V,SEL=0V, Ta=-40°C to 125°C. Unless otherwise noted, Typical values are at VDD =VDDL= 5V, Ta = 25°C)

| Parameters | Symbol | Min | Typ | Max | Unit | Comments |
|------------|--------|-----|-----|-----|------|----------|
|------------|--------|-----|-----|-----|------|----------|

|                                             |                         |       |      |       |      |                                   |
|---------------------------------------------|-------------------------|-------|------|-------|------|-----------------------------------|
| Isolated Supply Voltage                     | VISO                    | 3.135 | 3.3  | 3.465 | V    |                                   |
| Line Regulation                             | V <sub>ISO(LINE)</sub>  |       |      | 2     | mV/V |                                   |
| Load Regulation                             | V <sub>ISO(LOAD)</sub>  |       | 0.2  | 0.5   | %    |                                   |
| Output Ripple                               | V <sub>ISO(RIP)</sub>   |       | 35   |       | mVpp |                                   |
| Output Noise                                | V <sub>ISO(NOISE)</sub> |       | 150  |       | mVpp |                                   |
| Efficiency at maximum load current          | EFF                     | 28    | 41.5 |       | %    | I <sub>ISO</sub> =100mA, VDDL=VDD |
| Output supply current                       | I <sub>ISO</sub>        | 100   |      |       | mA   |                                   |
| VDD supply current without digital isolator | I <sub>VDD_POWER</sub>  |       | 8    | 20    | mA   | No VISO Load                      |
|                                             |                         |       | 157  | 230   | mA   | I <sub>ISO</sub> =100mA           |

(VDD=3V~3.6V, VDDL=1.8V~5.5V, SEL=0V, Ta=-40°C to 125°C. Unless otherwise noted, Typical values are at VDD =VDDL= 3.3V, Ta = 25°C)

| Parameters                                  | Symbol                  | Min | Typ | Max | Unit | Comments                         |
|---------------------------------------------|-------------------------|-----|-----|-----|------|----------------------------------|
| Isolated Supply Voltage                     | VISO                    | 3.2 | 3.3 | 3.5 | V    |                                  |
| Line Regulation                             | V <sub>ISO(LINE)</sub>  |     |     | 2   | mV/V |                                  |
| Load Regulation                             | V <sub>ISO(LOAD)</sub>  |     | 0.2 | 2.1 | %    |                                  |
| Output Ripple                               | V <sub>ISO(RIP)</sub>   |     | 40  |     | mVpp |                                  |
| Output Noise                                | V <sub>ISO(NOISE)</sub> |     | 100 |     | mVpp |                                  |
| Efficiency at maximum load current          | EFF                     | 39  | 48  |     | %    | I <sub>ISO</sub> =60mA, VDDL=VDD |
| Output supply current                       | I <sub>ISO</sub>        | 60  |     |     | mA   |                                  |
| VDD supply current without digital isolator | I <sub>VDD_POWER</sub>  |     | 10  | 20  | mA   | No VISO Load                     |
|                                             |                         |     | 123 | 160 | mA   | I <sub>ISO</sub> =100mA          |

## 5.2. Digital Isolator Electrical Characteristics

| Parameters                | Symbol             | Min      | Typ | Max      | Unit | Comments                         |
|---------------------------|--------------------|----------|-----|----------|------|----------------------------------|
| Power on Reset            | V <sub>DDPOR</sub> |          | 2.5 | 3        | V    | POR threshold as during power-up |
|                           | V <sub>DDHYS</sub> |          | 0.2 |          | V    | POR threshold Hysteresis         |
| High Level Input Voltage  | V <sub>IH</sub>    | 0.7*VCC1 |     |          | V    |                                  |
| Low Level Input Voltage   | V <sub>IL</sub>    |          |     | 0.3*VCC1 | V    |                                  |
| High Level Output Voltage | V <sub>OH</sub>    | 0.8*VCC2 |     |          | V    | I <sub>OH</sub> ≥ - 4mA          |
| Low Level Output Voltage  | V <sub>OL</sub>    |          |     | 0.2*VCC2 | V    | I <sub>OL</sub> ≤ 4mA            |
| Output Impedance          | R <sub>out</sub>   |          | 50  |          | ohm  |                                  |

|                                |            |     |     |    |       |  |
|--------------------------------|------------|-----|-----|----|-------|--|
| Input Pull high or low Current | $I_{pull}$ |     | 8   | 15 | uA    |  |
| Common Mode Transient Immunity | CMTI       | 100 | 150 |    | kV/us |  |
| Thermal Shutdown Temperature   |            |     | 165 |    | °C    |  |

<sup>1</sup>VCC1 is input side supply,VCC2 is output side supply For the isolatoe side1,VDDL is the VCCx.

(VDD=4.5V~5.5V, VDDL=1.8V~5.5V,SEL=VISO, Ta=-40°C to 125°C. Unless otherwise noted, Typical values are at VDD =VDDL= 5V, Ta = 25°C)

| Parameters     | Symbol       | Min | Typ  | Max | Unit | Comments                                                          |
|----------------|--------------|-----|------|-----|------|-------------------------------------------------------------------|
| Supply current | NSiP8840     |     |      |     |      |                                                                   |
|                | $I_{DD}(Q0)$ |     | 10.3 | 20  | mA   | All Input 0V for NSiP8840W0 or All Input at supply for NSiP8840W1 |
|                | $I_{DD}(Q1)$ |     | 11   | 30  | mA   | All Input at supply for NSiP8840W0 or All Input 0V for NSiP8840W1 |
|                | $I_{DD}(1M)$ |     | 11.6 | 35  | mA   | All Input with 1Mbps, $C_L=15pF$                                  |
|                | NSiP8841     |     |      |     |      |                                                                   |
|                | $I_{DD}(Q0)$ |     | 10.3 | 20  | mA   | All Input 0V for NSiP8841W0 or All Input at supply for NSiP8841W1 |
|                | $I_{DD}(Q1)$ |     | 12.3 | 30  | mA   | All Input at supply for NSiP8841W0 or All Input 0V for NSiP8841W1 |
|                | $I_{DD}(1M)$ |     | 12.7 | 35  | mA   | All Input with 1Mbps, $C_L=15pF$                                  |
|                | NSiP8842     |     |      |     |      |                                                                   |
|                | $I_{DD}(Q0)$ |     | 10.3 | 20  | mA   | All Input 0V for NSiP8842W0 or All Input at supply for NSiP8842W1 |
|                | $I_{DD}(Q1)$ |     | 14.3 | 30  | mA   | All Input at supply for NSiP8842W0 or All Input 0V for NSiP8842W1 |
|                | $I_{DD}(1M)$ |     | 20   | 35  | mA   | All Input with 1Mbps, $C_L=15pF$                                  |
|                | NSiP8843     |     |      |     |      |                                                                   |
|                | $I_{DD}(Q0)$ |     | 10.3 | 20  | mA   | All Input 0V for NSiP8843W0 or All Input at supply for NSiP8843W1 |
|                | $I_{DD}(Q1)$ |     | 16.3 | 30  | mA   | All Input at supply for NSiP8843W0 or All Input 0V for NSiP8843W1 |
|                | $I_{DD}(1M)$ |     | 27.3 | 50  | mA   | All Input with 1Mbps, $C_L=15pF$                                  |
|                | NSiP8844     |     |      |     |      |                                                                   |
|                | $I_{DD}(Q0)$ |     | 10.3 | 20  | mA   | All Input 0V for NSiP8844W0 or All Input at supply for NSiP8844W1 |
|                | $I_{DD}(Q1)$ |     | 18.3 | 30  | mA   | All Input at supply for NSiP8844W0 or All                         |

|                               |              |   |     |     |      |                                  |
|-------------------------------|--------------|---|-----|-----|------|----------------------------------|
|                               |              |   |     |     |      | Input 0V for NSiP8844W1          |
|                               | $I_{DD(1M)}$ |   | 35  | 50  | mA   | All Input with 1Mbps, $C_L=15pF$ |
| Data Rate                     | DR           | 0 |     | 150 | Mbps |                                  |
| Minimum Pulse Width           | PW           |   |     | 5.0 | ns   |                                  |
| Propagation Delay             | $t_{PLH}$    | 5 | 9.0 | 16  | ns   |                                  |
|                               | $t_{PHL}$    | 5 | 9.0 | 16  | ns   |                                  |
| Pulse Width Distortion        | PWD          |   |     | 5.0 | ns   | $ t_{PHL} - t_{PLH} $            |
| Rising Time                   | $t_r$        |   |     | 5.0 | ns   | $C_L = 15pF$                     |
| Falling Time                  | $t_f$        |   |     | 5.0 | ns   | $C_L = 15pF$                     |
| Channel-to-Channel Delay Skew | tSK(c2c)     |   |     | 2.5 | ns   |                                  |
| Part-to-Part Delay Skew       | tSK(p2p)     |   |     | 5.0 | ns   |                                  |

(VDD=4.5V~5.5V, VDDL=1.8V~5.5V, SEL=0V, Ta=-40°C to 125°C. Unless otherwise noted, Typical values are at VDD =VDDL= 5V, Ta = 25°C)

| Parameters     | Symbol       | Min | Typ  | Max | Unit | Comments                                                          |
|----------------|--------------|-----|------|-----|------|-------------------------------------------------------------------|
| Supply current | NSiP8840     |     |      |     |      |                                                                   |
|                | $I_{DD(Q0)}$ |     | 7.8  | 20  | mA   | All Input 0V for NSiP8840W0 or All Input at supply for NSiP8840W1 |
|                | $I_{DD(Q1)}$ |     | 8    | 25  | mA   | All Input at supply for NSiP8840W0 or All Input 0V for NSiP8840W1 |
|                | $I_{DD(1M)}$ |     | 8.78 | 20  | mA   | All Input with 1Mbps, $C_L=15pF$                                  |
|                | NSiP8841     |     |      |     |      |                                                                   |
|                | $I_{DD(Q0)}$ |     | 7.8  | 20  | mA   | All Input 0V for NSiP8841W0 or All Input at supply for NSiP8841W1 |
|                | $I_{DD(Q1)}$ |     | 9.8  | 25  | mA   | All Input at supply for NSiP8841W0 or All Input 0V for NSiP8841W1 |
|                | $I_{DD(1M)}$ |     | 11.7 | 30  | mA   | All Input with 1Mbps, $C_L=15pF$                                  |
|                | NSiP8842     |     |      |     |      |                                                                   |
|                | $I_{DD(Q0)}$ |     | 7.8  | 20  | mA   | All Input 0V for NSiP8842W0 or All Input at supply for NSiP8842W1 |
|                | $I_{DD(Q1)}$ |     | 11.8 | 25  | mA   | All Input at supply for NSiP8842W0 or All Input 0V for NSiP8842W1 |
|                | $I_{DD(1M)}$ |     | 15.3 | 30  | mA   | All Input with 1Mbps, $C_L=15pF$                                  |
|                | NSiP8843     |     |      |     |      |                                                                   |
|                | $I_{DD(Q0)}$ |     | 7.8  | 20  | mA   | All Input 0V for NSiP8843W0 or All                                |

|                               |               |   |      |     |      |                                                                   |
|-------------------------------|---------------|---|------|-----|------|-------------------------------------------------------------------|
|                               |               |   |      |     |      | Input at supply for NSiP8843W1                                    |
|                               | $I_{DD(Q1)}$  |   | 13.8 | 25  | mA   | All Input at supply for NSiP8843W0 or All Input 0V for NSiP8843W1 |
|                               | $I_{DD(1M)}$  |   | 20.3 | 40  | mA   | All Input with 1Mbps, $C_L=15pF$                                  |
|                               | NSiP8844      |   |      |     |      |                                                                   |
|                               | $I_{DD(Q0)}$  |   | 7.8  | 20  | mA   | All Input 0V for NSiP8844W0 or All Input at supply for NSiP8844W1 |
|                               | $I_{DD(Q1)}$  |   | 15.8 | 25  | mA   | All Input at supply for NSiP8844W0 or All Input 0V for NSiP8844W1 |
|                               | $I_{DD(1M)}$  |   | 25.3 | 40  | mA   | All Input with 1Mbps, $C_L=15pF$                                  |
| Data Rate                     | DR            | 0 |      | 150 | Mbps |                                                                   |
| Minimum Pulse Width           | PW            |   |      | 5.0 | ns   |                                                                   |
| Propagation Delay             | $t_{PLH}$     | 5 | 9.0  | 16  | ns   |                                                                   |
|                               | $t_{PHL}$     | 5 | 9.0  | 16  | ns   |                                                                   |
| Pulse Width Distortion        | PWD           |   |      | 5.0 | ns   | $ t_{PHL} - t_{PLH} $                                             |
| Rising Time                   | $t_r$         |   |      | 5.0 | ns   | $C_L = 15pF$                                                      |
| Falling Time                  | $t_f$         |   |      | 5.0 | ns   | $C_L = 15pF$                                                      |
| Channel-to-Channel Delay Skew | $t_{SK(c2c)}$ |   |      | 2.5 | ns   |                                                                   |
| Part-to-Part Delay Skew       | $t_{SK(p2p)}$ |   |      | 5.0 | ns   |                                                                   |

(VDD=3V~3.6V, VDDL=1.8V~5.5V, SEL=0V, Ta=-40°C to 125°C. Unless otherwise noted, Typical values are at VDD =VDDL= 3.3V, Ta = 25°C)

| Parameters     | Symbol       | Min | Typ   | Max | Unit | Comments                                                          |
|----------------|--------------|-----|-------|-----|------|-------------------------------------------------------------------|
| Supply current | NSiP8840     |     |       |     |      |                                                                   |
|                | $I_{DD(Q0)}$ |     | 9     | 20  | mA   | All Input 0V for NSiP8840W0 or All Input at supply for NSiP8840W1 |
|                | $I_{DD(Q1)}$ |     | 10    | 25  | mA   | All Input at supply for NSiP8840W0 or All Input 0V for NSiP8840W1 |
|                | $I_{DD(1M)}$ |     | 10    | 30  | mA   | All Input with 1Mbps, $C_L=15pF$                                  |
|                | NSiP8841     |     |       |     |      |                                                                   |
|                | $I_{DD(Q0)}$ |     | 9     | 20  | mA   | All Input 0V for NSiP8841W0 or All Input at supply for NSiP8841W1 |
|                | $I_{DD(Q1)}$ |     | 11.25 | 25  | mA   | All Input at supply for NSiP8841W0 or All Input 0V for NSiP8841W1 |
|                | $I_{DD(1M)}$ |     | 10.14 | 30  | mA   | All Input with 1Mbps, $C_L=15pF$                                  |
|                | NSiP8842     |     |       |     |      |                                                                   |
|                |              |     |       |     |      |                                                                   |

|                               |               |   |       |     |      |                                                                   |
|-------------------------------|---------------|---|-------|-----|------|-------------------------------------------------------------------|
|                               | $I_{DD(Q0)}$  |   | 9     | 20  | mA   | All Input 0V for NSiP8842W0 or All Input at supply for NSiP8842W1 |
|                               | $I_{DD(Q1)}$  |   | 13.5  | 25  | mA   | All Input at supply for NSiP8842W0 or All Input 0V for NSiP8842W1 |
|                               | $I_{DD(1M)}$  |   | 16.5  | 30  | mA   | All Input with 1Mbps, CL=15pF                                     |
|                               | NSiP8843      |   |       |     |      |                                                                   |
|                               | $I_{DD(Q0)}$  |   | 9     | 20  | mA   | All Input 0V for NSiP8843W0 or All Input at supply for NSiP8843W1 |
|                               | $I_{DD(Q1)}$  |   | 15.75 | 25  | mA   | All Input at supply for NSiP8843W0 or All Input 0V for NSiP8843W1 |
|                               | $I_{DD(1M)}$  |   | 21.4  | 50  | mA   | All Input with 1Mbps, CL=15pF                                     |
|                               | NSiP8844      |   |       |     |      |                                                                   |
|                               | $I_{DD(Q0)}$  |   | 9     | 20  | mA   | All Input 0V for NSiP8844W0 or All Input at supply for NSiP8844W1 |
|                               | $I_{DD(Q1)}$  |   | 18    | 30  | mA   | All Input at supply for NSiP8844W0 or All Input 0V for NSiP8844W1 |
|                               | $I_{DD(1M)}$  |   | 26.5  | 50  | mA   | All Input with 1Mbps, CL=15pF                                     |
| Data Rate                     | DR            | 0 |       | 150 | Mbps |                                                                   |
| Minimum Pulse Width           | PW            |   |       | 5.0 | ns   |                                                                   |
| Propagation Delay             | $t_{PLH}$     | 5 | 9.0   | 16  | ns   |                                                                   |
|                               | $t_{PHL}$     | 5 | 9.0   | 16  | ns   |                                                                   |
| Pulse Width Distortion        | PWD           |   |       | 5.0 | ns   | $ t_{PHL} - t_{PLH} $                                             |
| Rising Time                   | $t_r$         |   |       | 5.0 | ns   | $C_L = 15pF$                                                      |
| Falling Time                  | $t_f$         |   |       | 5.0 | ns   | $C_L = 15pF$                                                      |
| Channel-to-Channel Delay Skew | $t_{SK(c2c)}$ |   |       | 2.5 | ns   |                                                                   |
| Part-to-Part Delay Skew       | $t_{SK(p2p)}$ |   |       | 5.0 | ns   |                                                                   |

### 5.3. Typical Performance Characteristics

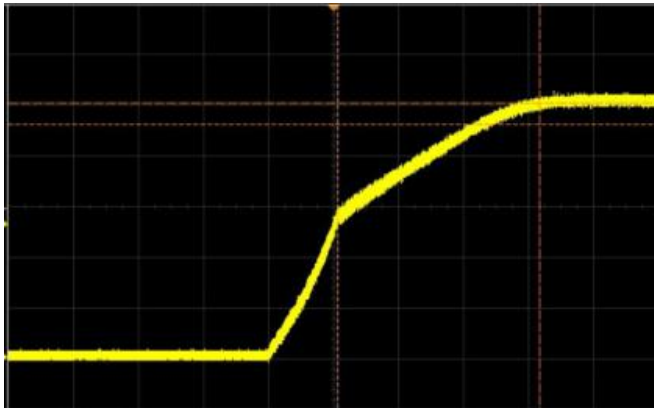


Figure 5.1 Soft start at no load

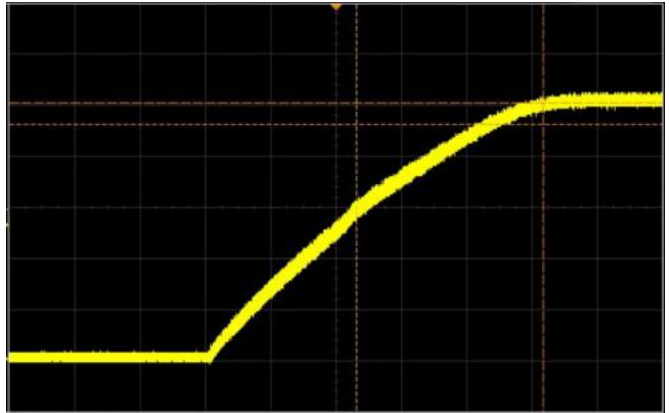


Figure 5.2 Soft start at full load

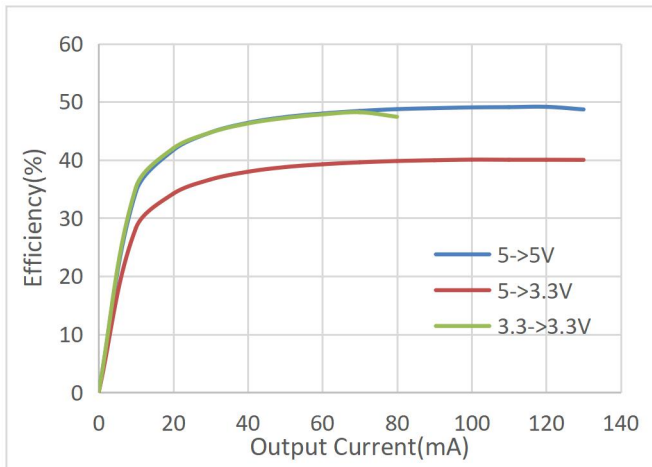


Figure 5.3 Output current vs efficiency

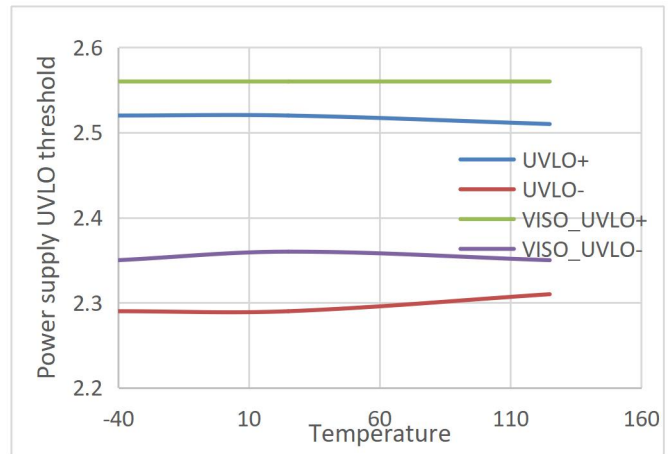


Figure 5.4 Power-Supply Undervoltage Threshold vs Temperature

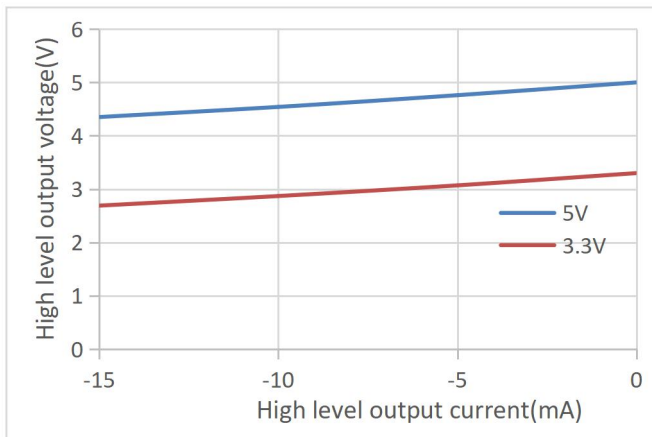


Figure 5.5 High-Level Output Voltage vs Output Current

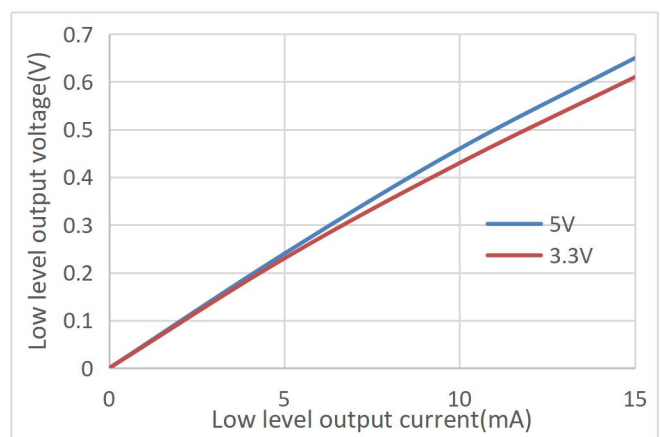


Figure 5.6 Low-Level Output Voltage vs Output Current

## 5.4. Parameter Measurement Information

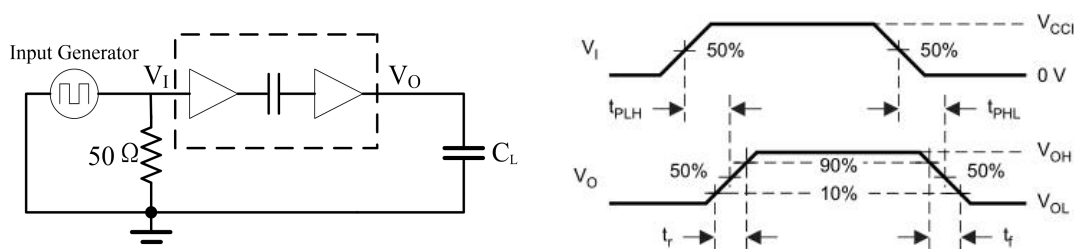


Figure 5.7 Switching Characteristics Test Circuit and Waveform

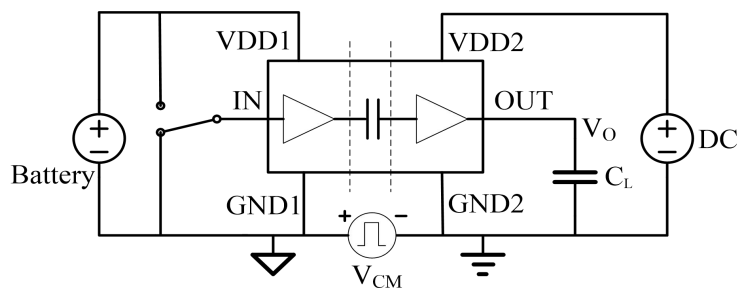


Figure 5.8 Common-Mode Transient Immunity Test Circuit

## 6. High Voltage Feature Description

### 6.1. Insulation And Safety Related Specifications

| Parameters                                      | Symbol | Value | Unit | Comments                                                          |
|-------------------------------------------------|--------|-------|------|-------------------------------------------------------------------|
| Minimum External Air Gap (Clearance)            | L(I01) | 8.0   | mm   | Shortest terminal-to-terminal distance through air                |
| Minimum External Tracking (Creepage)            | L(I02) | 8.0   | mm   | Shortest terminal-to-terminal distance across the package surface |
| Minimum internal gap                            | DTI    | 20    | um   | Distance through insulation                                       |
| Tracking Resistance(Comparative Tracking Index) | CTI    | >400  | V    | DIN EN 60112 (VDE 0303-11); IEC 60112                             |
| Material Group                                  |        | II    |      |                                                                   |

### 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 $\leq 150V_{rms}$    |                |        | I to IV  |      |
| For Rated Mains Voltage $\leq 300V_{rms}$    |                |        | I to III |      |

|                                                           |                                                                                                                                 |             |            |                  |
|-----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-------------|------------|------------------|
| For Rated Mains Voltage $\leq 400V_{rms}$                 |                                                                                                                                 |             | I to III   |                  |
| Climatic Classification                                   |                                                                                                                                 |             | 10/105/21  |                  |
| Pollution Degree per DIN VDE 0110, Table 1                |                                                                                                                                 |             | 2          |                  |
| Maximum repetitive isolation voltage                      |                                                                                                                                 | $V_{IORM}$  | 565        | $V_{peak}$       |
| Maximum Working Isolation Voltage                         | AC voltage                                                                                                                      | $V_{IOWM}$  | 400        | $V_{RMS}$        |
|                                                           | DC voltage                                                                                                                      |             | 565        | $V_{DC}$         |
| Input to Output Test Voltage, Method B1                   | $V_{IORM} \times 1.5 = V_{pd(m)}$ ,<br>100% production test,<br>$t_{ini} = t_m = 1 \text{ sec}$ , $q_{pd} < 5 \text{ pC}$       | $V_{pd(m)}$ | 847        | $V_{peak}$       |
| After Environmental Tests Subgroup 1                      | $V_{IORM} \times 1.2 = V_{pd(m)}$ , $t_{ini} = 60 \text{ sec}$ , $t_m = 10 \text{ sec}$ , $q_{pd} < 5 \text{ pC}$               | $V_{pd(m)}$ | 678        | $V_{peak}$       |
| After Input and /or Safety Test Subgroup 2 and Subgroup 3 | $V_{IORM} \times 1.2 = V_{pd(m)}$ , $t_{ini} = 60 \text{ sec}$ , $t_m = 10 \text{ sec}$ , partial discharge $< 5 \text{ pC}$    | $V_{pd(m)}$ | 678        | $V_{peak}$       |
| Maximum transient isolation voltage                       | $t = 60 \text{ sec}$                                                                                                            | $V_{IOTM}$  | 5300       | $V_{peak}$       |
| Maximum withstanding isolation voltage                    | $V_{TEST} = V_{ISO}$ , $t = 60 \text{ s}$ (qualification); $V_{TEST} = 1.2 \times V_{ISO}$ , $t = 1 \text{ s}$ (100%production) | $V_{ISO}$   | 4500       | $V_{RMS}$        |
| Maximum Surge Isolation Voltage                           | Test method per IEC60065, 1.2/50us waveform, $V_{TEST} = V_{IOSM} \times 1.3$                                                   | $V_{IOSM}$  | 5384       | $V_{peak}$       |
| Isolation resistance                                      | $V_{IO} = 500V$ at $T_{amb} = T_S$                                                                                              | $R_{IO}$    | $>10^9$    | $\Omega$         |
|                                                           | $V_{IO} = 500V$ at $100^\circ\text{C} \leq T_{amb} \leq 125^\circ\text{C}$                                                      |             | $>10^{11}$ | $\Omega$         |
| Isolation capacitance                                     | $f = 1\text{MHz}$                                                                                                               | $C_{IO}$    | 0.6        | pF               |
| Input capacitance                                         |                                                                                                                                 | $C_I$       | 2          | pF               |
| Total Power Dissipation at $25^\circ\text{C}$             |                                                                                                                                 | $P_S$       | 2201       | mW               |
| Safety input, output, or supply current                   | $\theta_{JA} = 56.8^\circ\text{C/W}$ , $V_I = 5.5 \text{ V}$ ,<br>$T_J = 150^\circ\text{C}$ , $T_A = 25^\circ\text{C}$          | $I_S$       | 400        | mA               |
| Case Temperature                                          |                                                                                                                                 | $T_S$       | 150        | $^\circ\text{C}$ |

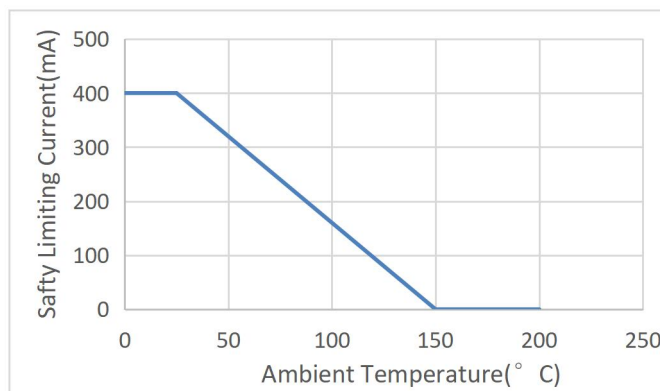


Figure 6.1 NSiP884x Thermal Derating Curve, Dependence of Safety Limiting Values with Case Temperature per DIN VDE V 0884-11

### 6.3. Regulatory Information

The NSiP884x are approved 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 0884-11:2017-01 <sup>2</sup>                                           | Certified by CQC11-471543-2012<br>GB4943.1-2011                 |
| Single Protection,4500V <sub>rms</sub> Isolation voltage | Single Protection, 4500V <sub>rms</sub> Isolation voltage | Basic Insulation 565V <sub>peak</sub> , V <sub>IOSM</sub> =5384V <sub>peak</sub> | Basic insulation at 400V <sub>rms</sub> (565V <sub>peak</sub> ) |
| File (pending)                                           | File (pending)                                            | File (pending)                                                                   | File (pending)                                                  |

## 7. Function Description

### 7.1. Overview

The NSiP884x devices are quad-channel digital isolators with integrated isolated DC-DC converter. The digital isolators are based on Novosense capacity isolation barrier technique. The isolated DC-DC converter provide up to 500mW output power use on chip transformer. The feedback PWM signal is sent to primary side by a digital isolator based on capacity isolation technology. The NSiP884x device are safety certified by UL1577 support 4.5kV<sub>rms</sub> insulation withstand voltages, while providing high electromagnetic immunity and low emissions. The data rate of the NSiP884x is up to 150Mbps, and the common-mode transient immunity (CMTI) is up to 150kV/us. The logical level of digital isolators on left side can be set by VDDL pin which can support the application when the supply voltage and I/O voltage level are different.

The high integrated solution can help to simplify system design and improve reliability. The NSiP884x devices are suitable for the limited PCB space applications. The devices are also suitable for wide temperature application which the most the power module can not support.

### 7.2. Device Functional Modes

The NSiP884x devices provide 5V to 5V, 5V to 3.3V, 3.3V to 3.3V conversion mode, the output voltage can be set by SEL pin. Supply configuration table showed below.

| SEL PIN         | VDD | VISO |
|-----------------|-----|------|
| Shorted to VISO | 5V  | 5V   |

|                             |      |      |
|-----------------------------|------|------|
| Shorted to GND2 or floating | 5V   | 3.3V |
| Shorted to GND2 or floating | 3.3V | 3.3V |

The NSiP884x devices provide four channel digital isolators. The digital isolators have default weak pull up or pull down input status when input is floating as shown in below table.

| Input    | VDD1 status | VDDOUT status | Output                         | Comment               |
|----------|-------------|---------------|--------------------------------|-----------------------|
| H        | Ready       | Ready         | H                              | Normal operation.     |
| L        | Ready       | Ready         | L                              |                       |
| floating | Ready       | Ready         | L(NSiP884xW0)<br>H(NSiP884xW1) | Floating input status |

### 7.3. Emi Considerations

The NSiP884x devices are using on chip transformer, so the power transfer must operate at high frequency allow higher efficiency transfer using the small transformer. This will cause emissions which need to pay attention to PCB layout if the application allow low emission. Please see the application note if needed.

### 7.4. Output Short And Over Temperature Protection

The NSiP884x devices are protected against output short. When the devices detect the output is short, the device will be in Hiccup mode and the transfer power will be limited. So the temperature of the device will be low, and the device is protected.

The NSiP884x devices are also protected against over temperature. When the devices detect the chip is over 165 °C, the device will be shut down until the temperature of the device is below 145 °C.

## 8. Application Note

### 8.1. Typical Application

The NSiP884x requires a 0.1  $\mu$ F and 10 $\mu$ F bypass capacitors between VDD and GND1, VISO and GND2. The capacitor should be placed as close as possible to the package. This is very important for the performance of the device. The figure 8.1 is the basic schematic of NSiP884x and the figure 8.2 is the typical isolated RS485 schematic using NSiP884x.

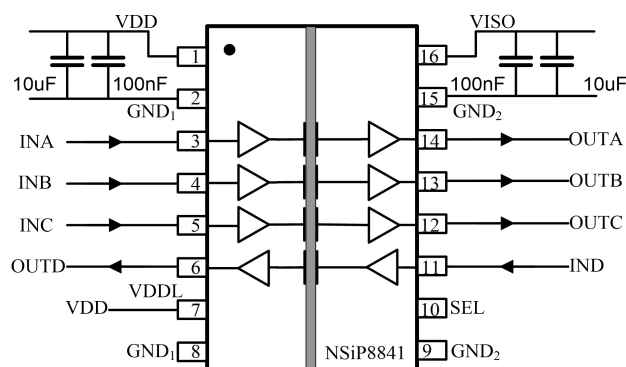


Figure 8.1 Basic schematic of NSiP884x

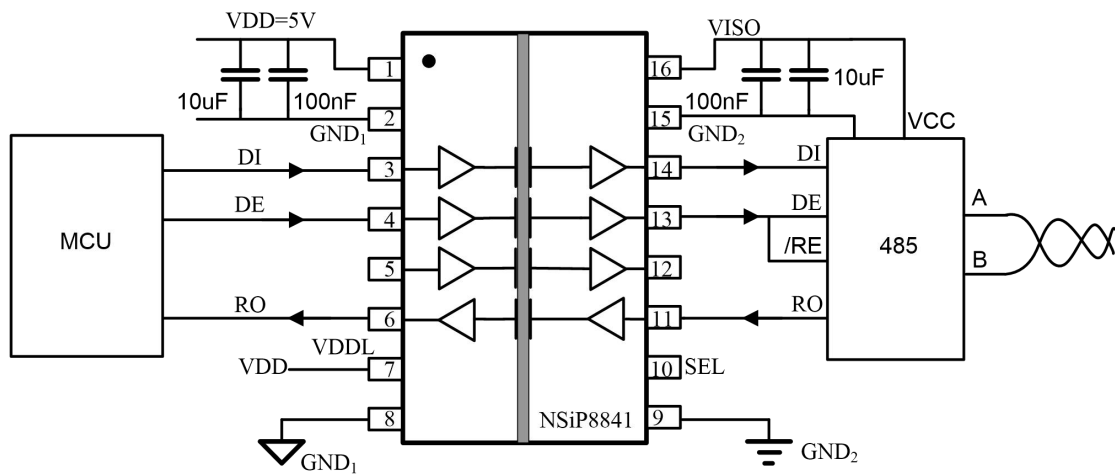


Figure 8.2 Isolated RS485 schematic using NSiP884x

## 8.2. Pcb Layout

The recommended PCB layout shown below. The low ESR capacitor C1 should be closed to PIN1 and PIN2, the distance should be less than 1mm. The low ESR capacitor C3 should be closed to PIN15 and PIN16, the distance should be less than 1mm.

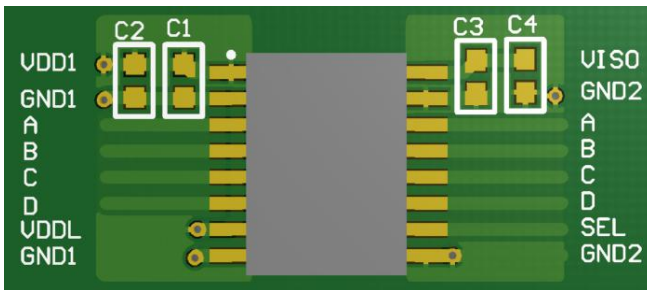


Figure 8.3 Recommended PCB Layout — Top Layer

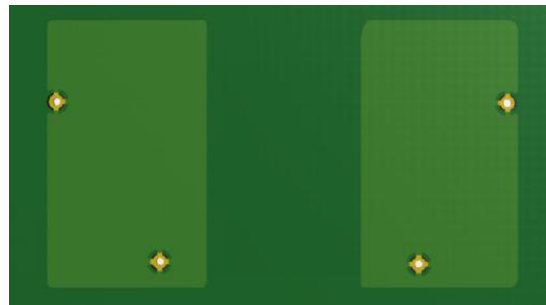


Figure 8.4 Recommended PCB Layout — Bottom Layer

## 9. Package Information

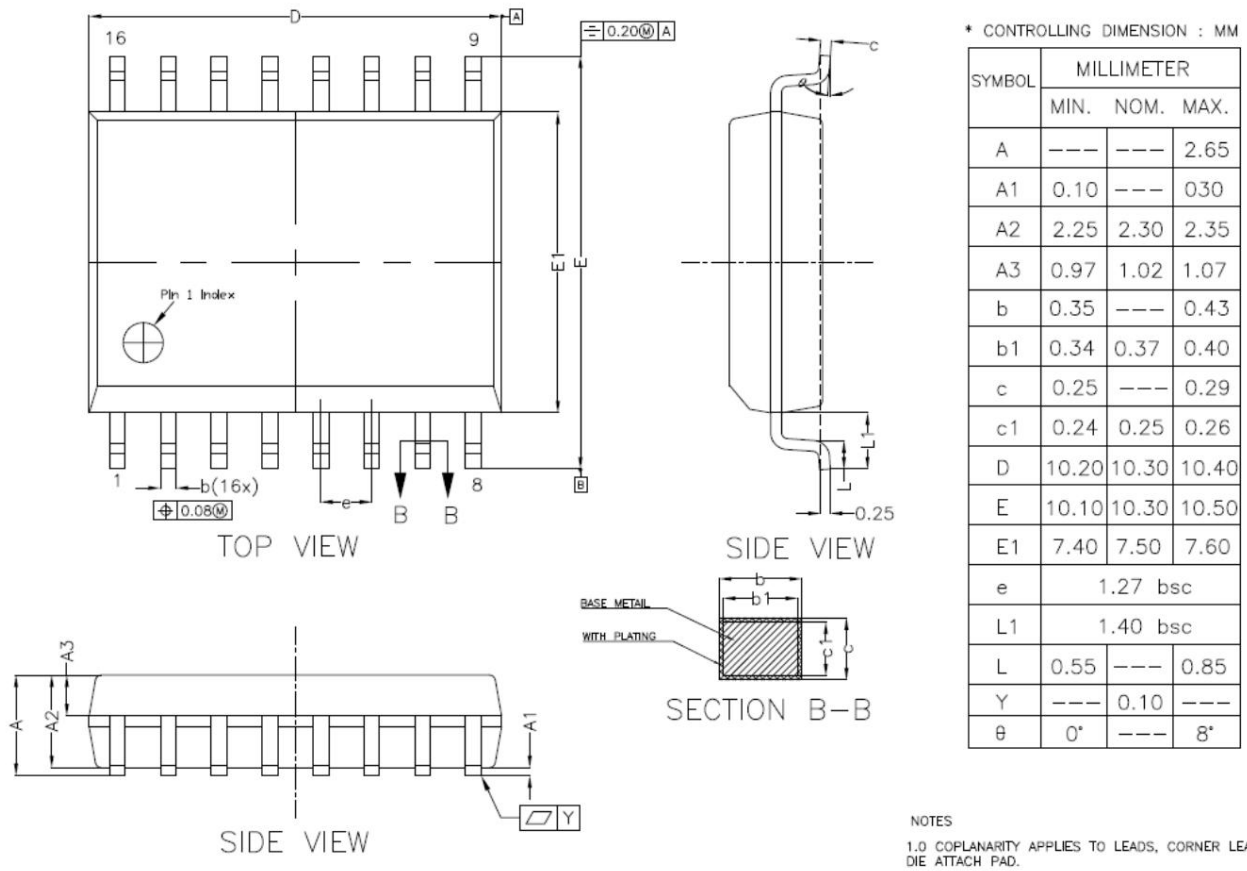
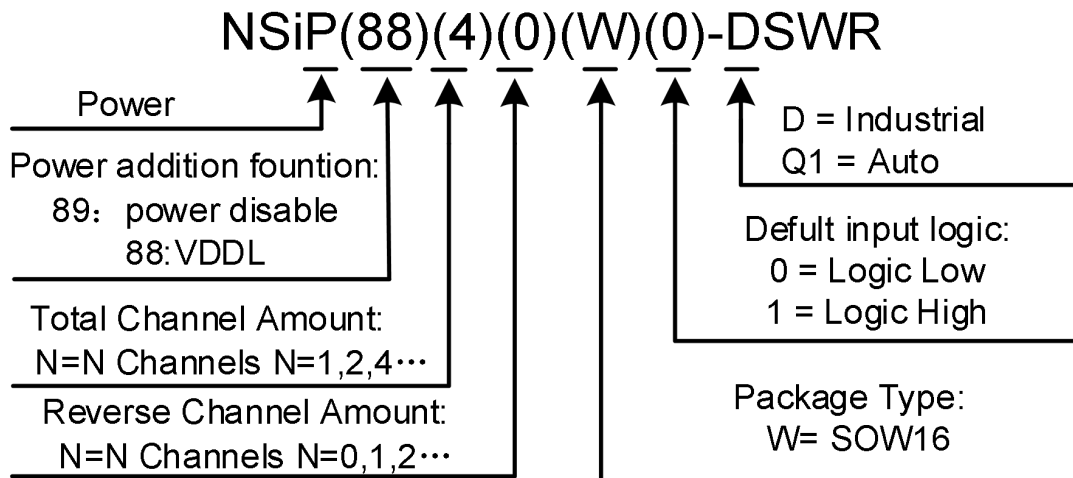


Figure 9.1 SOW16 Package Shape and Dimension in millimeters

## 10. Order Information

| Part Number     | Isolation Rating (kV) | Number of side 1 inputs | Number of side 2 inputs | Max Data Rate (Mbps) | Default input logic | Temperature  | MSL | Package Type   | Package Drawing | SPQ  |
|-----------------|-----------------------|-------------------------|-------------------------|----------------------|---------------------|--------------|-----|----------------|-----------------|------|
| NSiP8840W0-DSWR | 4.5                   | 4                       | 0                       | 150                  | Low                 | -40 to 125°C | 3   | SOP16 (300mil) | SOW16           | 1000 |
| NSiP8840W1-DSWR | 4.5                   | 4                       | 0                       | 150                  | High                | -40 to 125°C | 3   | SOP16 (300mil) | SOW16           | 1000 |
| NSiP8841W0-DSWR | 4.5                   | 3                       | 1                       | 150                  | Low                 | -40 to 125°C | 3   | SOP16 (300mil) | SOW16           | 1000 |
| NSiP8841W1-DSWR | 4.5                   | 3                       | 1                       | 150                  | High                | -40 to 125°C | 3   | SOP16 (300mil) | SOW16           | 1000 |
| NSiP8842W0-DSWR | 4.5                   | 2                       | 2                       | 150                  | Low                 | -40 to 125°C | 3   | SOP16 (300mil) | SOW16           | 1000 |
| NSiP8842W1-DSWR | 4.5                   | 2                       | 2                       | 150                  | High                | -40 to 125°C | 3   | SOP16 (300mil) | SOW16           | 1000 |
| NSiP8843W0-DSWR | 4.5                   | 1                       | 3                       | 150                  | Low                 | -40 to 125°C | 3   | SOP16 (300mil) | SOW16           | 1000 |
| NSiP8843W1-DSWR | 4.5                   | 1                       | 3                       | 150                  | High                | -40 to 125°C | 3   | SOP16 (300mil) | SOW16           | 1000 |
| NSiP8844W0-DSWR | 4.5                   | 0                       | 4                       | 150                  | Low                 | -40 to 125°C | 3   | SOP16 (300mil) | SOW16           | 1000 |
| NSiP8844W1-DSWR | 4.5                   | 0                       | 4                       | 150                  | High                | -40 to 125°C | 3   | SOP16 (300mil) | SOW16           | 1000 |

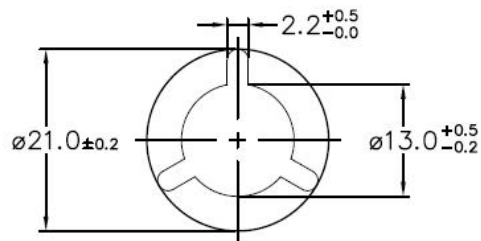
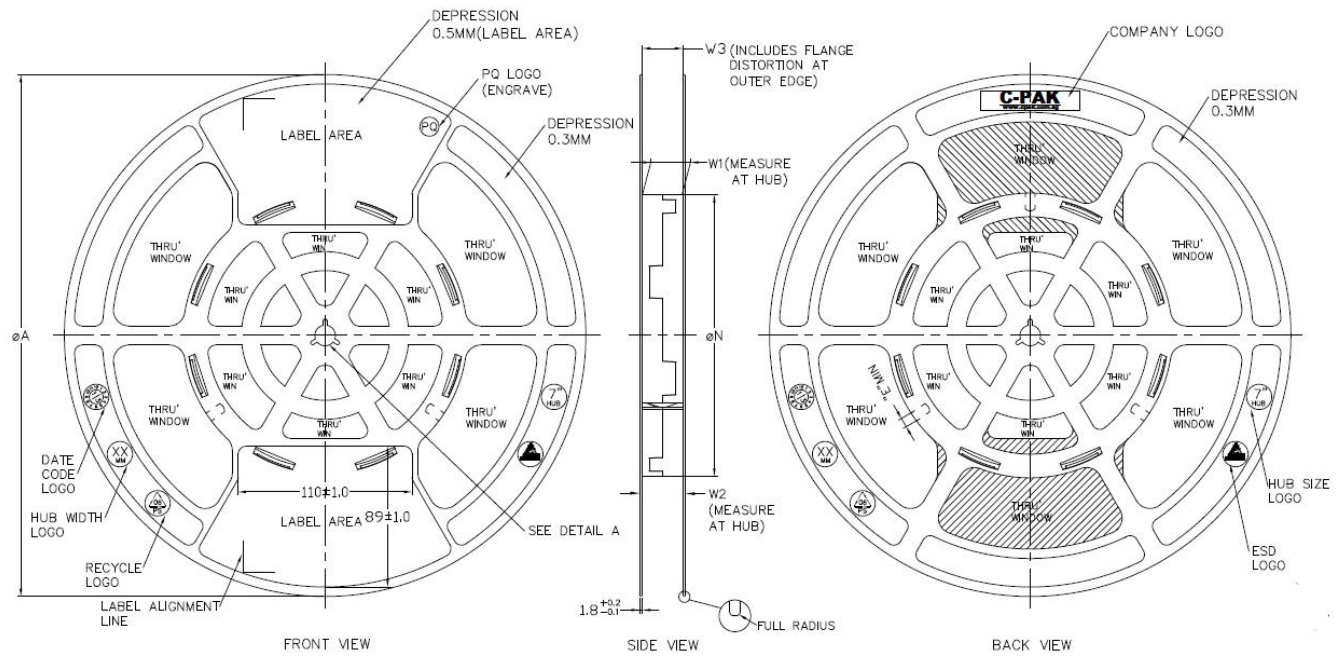
Part Number Rule:



## 11. Documentation Support

| Part Number | Product Folder             | Datasheet                  | Technical Documents        | Isolator selection guide   |
|-------------|----------------------------|----------------------------|----------------------------|----------------------------|
| NSiP884x    | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> | <a href="#">Click here</a> |

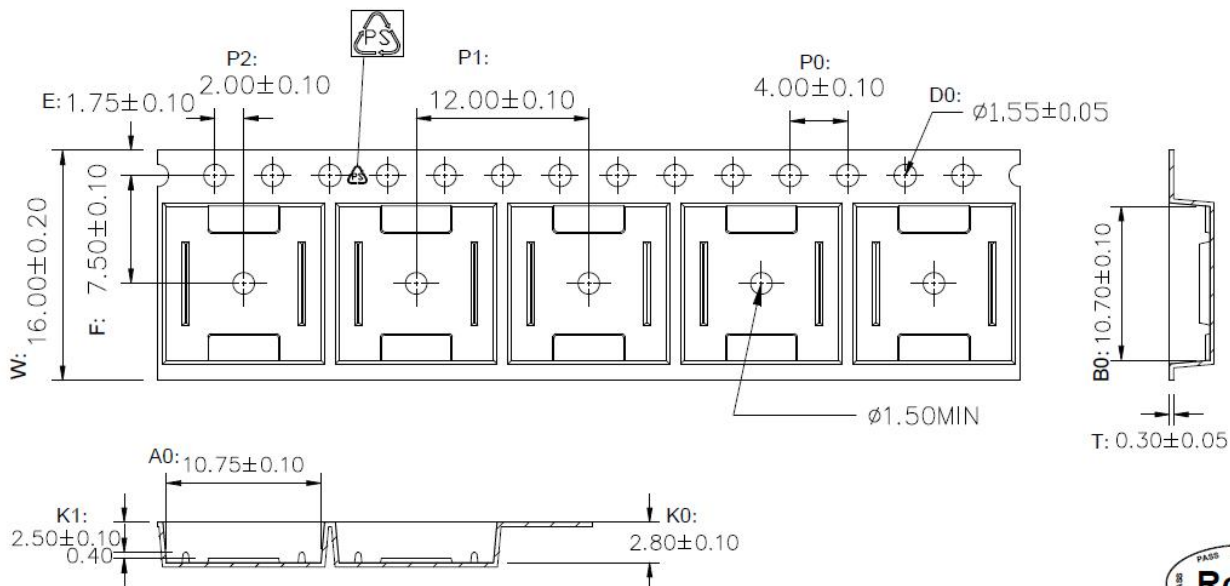
## 12. Tape And Reel Information



ARBOR HOLE  
DETAIL A  
SCALE : 3:1

| PRODUCT SPECIFICATION |            |            |                                      |             |                                                               |            |
|-----------------------|------------|------------|--------------------------------------|-------------|---------------------------------------------------------------|------------|
| TAPE WIDTH            | ØA<br>±2.0 | ØN<br>±2.0 | W1                                   | W2<br>(MAX) | W3                                                            | E<br>(MIN) |
| 08MM                  | 330        | 178        | 8.4 <sup>+1.5</sup> <sub>-0.0</sub>  | 14.4        | SMALL<br>ACCOMMODATE<br>TAPE WIDTH<br>WITHOUT<br>INTERFERENCE | 5.5        |
| 12MM                  | 330        | 178        | 12.4 <sup>+2.0</sup> <sub>-0.0</sub> | 18.4        |                                                               | 5.5        |
| 16MM                  | 330        | 178        | 16.4 <sup>+2.0</sup> <sub>-0.0</sub> | 22.4        |                                                               | 5.5        |
| 24MM                  | 330        | 178        | 24.4 <sup>+2.0</sup> <sub>-0.0</sub> | 30.4        |                                                               | 5.5        |
| 32MM                  | 330        | 178        | 32.4 <sup>+2.0</sup> <sub>-0.0</sub> | 38.4        |                                                               | 5.5        |

| SURFACE RESISTIVITY |                                         |                      |            |
|---------------------|-----------------------------------------|----------------------|------------|
| LEGEND              | SR RANGE                                | TYPE                 | COLOUR     |
| A                   | BELOW 10 <sup>12</sup>                  | ANTISTATIC           | ALL TYPES  |
| B                   | 10 <sup>6</sup> TO 10 <sup>11</sup>     | STATIC DISSIPATIVE   | BLACK ONLY |
| C                   | 10 <sup>5</sup> & BELOW 10 <sup>5</sup> | CONDUCTIVE (GENERIC) | BLACK ONLY |
| E                   | 10 <sup>9</sup> TO 10 <sup>11</sup>     | ANTISTATIC (COATED)  | ALL TYPES  |



1. 10 sprocket hole pitch cumulative tolerance  $\pm 0.20$ .
2. Carrier camber is within 1 mm in 250 mm.
3. Material : Black Conductive Polystyrene Alloy .
4. All dimensions meet EIA-481 requirements.
5. Thickness :  $0.30 \pm 0.05$ mm.
6. Packing length per 22" reel : 378 Meters.(復巻 N=122)
7. Component load per 13" reel : 1000 pcs.
8. Surface resistivity :  $10^5 \sim 10^{10} \Omega/\square$



|    |            |
|----|------------|
| W  | 16.00±0.20 |
| A0 | 10.75±0.10 |
| B0 | 10.70±0.10 |
| K0 | 2.80±0.10  |
| K1 | 2.50±0.10  |

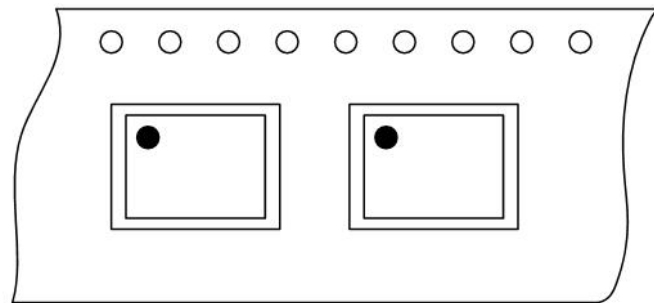
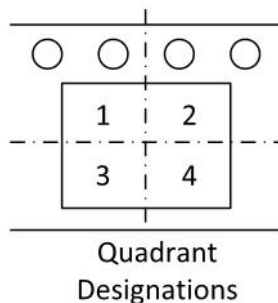


Figure 12.1 Tape and Reel Information of SOW16

## 13. Revision History

| Revision | Description     | Date      |
|----------|-----------------|-----------|
| 1.0      | Initial version | 2021/3/28 |