

### DESCRIPTION

The HI-1573 and HI-1574 are low power CMOS dual transceivers designed to meet the requirements of the MIL-STD-1553 specification.

The transmitter section of each bus takes complementary CMOS / TTL Manchester II bi-phase data and converts it to differential voltages suitable for driving the bus isolation transformer. Separate transmitter inhibit control signals are provided for each transmitter.

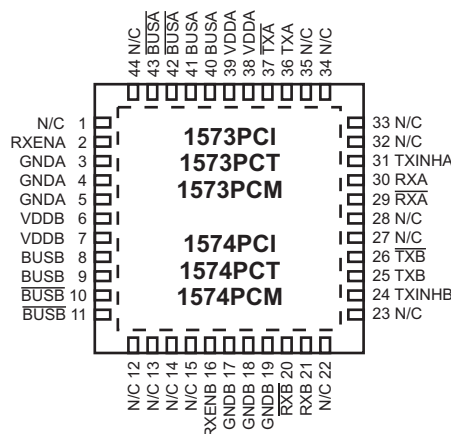
The receiver section of each bus converts the 1553 bus bi-phase differential data to complementary CMOS / TTL data suitable for input to a Manchester decoder. Each receiver has a separate enable input, which forces the receiver outputs to logic "0" (HI-1573) or logic "1" (HI-1574).

To minimize the package size for this function, the transmitter outputs are internally connected to the receiver inputs, so that only two pins are required for connection to each coupling transformer. For designs requiring independent access to transmitter and receiver 1553 signals, please contact your Holt Sales representative.

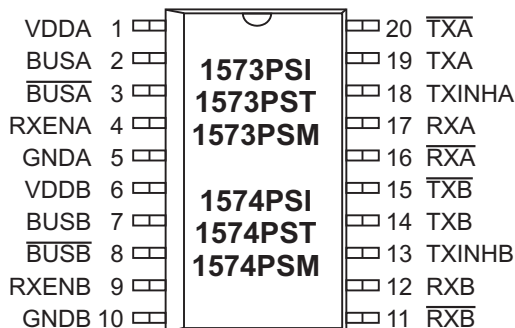
### FEATURES

- Compliant to MIL-STD-1553A and B, ARINC 708A
- 3.3V single supply operation
- Smallest footprint available in 7 mm x 7 mm 44-pin plastic chip-scale package (QFN)
- Available in DIP and small outline (ESOIC) package options
- Industrial and extended temperature ranges
- Industry standard pin configurations

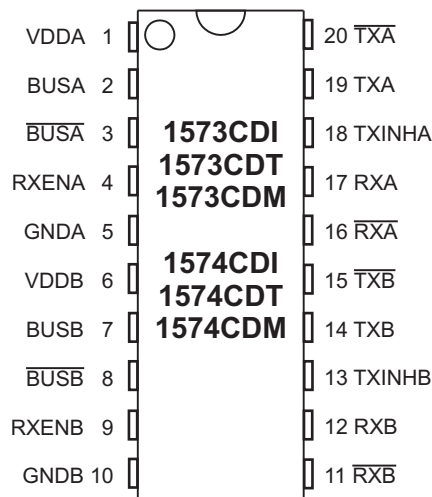
### PIN CONFIGURATIONS



**44 Pin Plastic 7mm x 7mm  
Chip-scale package (QFN)**



**20 Pin Plastic ESOIC - WB package**



**20 Pin Ceramic DIP package**

## PIN DESCRIPTIONS

| PIN<br>(DIP & SOIC) | SYMBOL                   | FUNCTION       | DESCRIPTION   |
|---------------------|--------------------------|----------------|---|
| 1                   | VDDA                     | power supply   | +3.3 volt power for transceiver A   |
| 2                   | BUSA                     | analog         | MIL-STD-1533 bus driver A, positive signal  |
| 3                   | $\overline{\text{BUSA}}$ | analog         | MIL-STD-1553 bus driver A, negative signal  |
| 4                   | RXENA                    | digital input  | Receiver A enable. If low, forces RXA and $\overline{\text{RXA}}$ low (HI-1573) or High (HI-1574) |
| 5                   | GNDA                     | power supply   | Ground for transceiver A  |
| 6                   | Vddb                     | power supply   | +3.3 volt power for transceiver B   |
| 7                   | BUSB                     | analog         | MIL-STD-1533 bus driver B, positive signal  |
| 8                   | $\overline{\text{BUSB}}$ | analog         | MIL-STD-1553 bus driver B, negative signal  |
| 9                   | RXENB                    | digital input  | Receiver B enable. If low, forces RXB and $\overline{\text{RXB}}$ low (HI-1573) or High (HI-1574) |
| 10                  | GNDb                     | power supply   | Ground for transceiver B  |
| 11                  | $\overline{\text{RXB}}$  | digital output | Receiver B output, inverted   |
| 12                  | RXB                      | digital output | Receiver B output, non-inverted   |
| 13                  | TXINHB                   | digital input  | Transmit inhibit, bus B. If high BUSB, $\overline{\text{BUSB}}$ disabled                          |
| 14                  | TXB                      | digital input  | Transmitter B digital data input, non-inverted  |
| 15                  | $\overline{\text{TXB}}$  | digital input  | Transmitter B digital data input, inverted  |
| 16                  | $\overline{\text{RXA}}$  | digital output | Receiver A output, inverted   |
| 17                  | RXA                      | digital output | Receiver A output, non-inverted   |
| 18                  | TXINHA                   | digital input  | Transmit inhibit, bus A. If high BUSA, $\overline{\text{BUSA}}$ disabled                          |
| 19                  | TXA                      | digital input  | Transmitter A digital data input, non-inverted  |
| 20                  | $\overline{\text{TXA}}$  | digital input  | Transmitter A digital data input, inverted  |

## FUNCTIONAL DESCRIPTION

The HI-1573 family of data bus transceivers contains differential voltage source drivers and differential receivers. They are intended for applications using a MIL-STD-1553 A/B data bus. The device produces a trapezoidal output waveform during transmission.

### TRANSMITTER

Data input to the device's transmitter section is from the complementary CMOS inputs TXA/B and  $\overline{\text{TXA/B}}$ . The transmitter accepts Manchester II bi-phase data and converts it to differential voltages on BUSA/B and  $\overline{\text{BUSA/B}}$ . The transceiver outputs are either direct- or transformer-coupled to the MIL-STD-1553 data bus. Both coupling methods produce a nominal voltage on the bus of 7.5 volts peak to peak.

The transmitter is automatically inhibited and placed in the high impedance state when both TXA/B and  $\overline{\text{TXA/B}}$  are driven with the same logic state. A logic "1" applied to the TXINHA/B input will force the transmitter to the high impedance state, regardless of the state of TXA/B and  $\overline{\text{TXA/B}}$ .

### RECEIVER

The receiver accepts bi-phase differential data from the MIL-STD-1553 bus through the same direct- or transformer-coupled interface as the transmitter.

The receiver's differential input stage drives a filter and threshold comparator that produces CMOS data at the RXA/B and  $\overline{\text{RXA/B}}$  output pins. When the MIL-STD-1553 bus is idle and RXENA or RXENB are high, RXA/B will be logic "0" on HI-1573 and logic "1" on HI-1574.

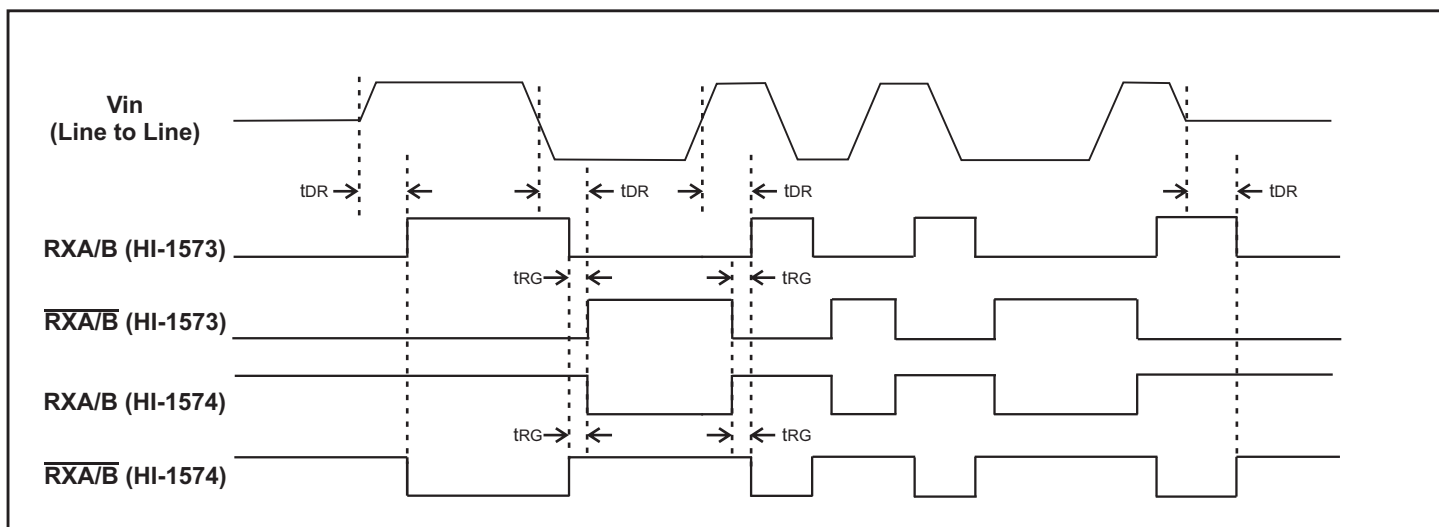
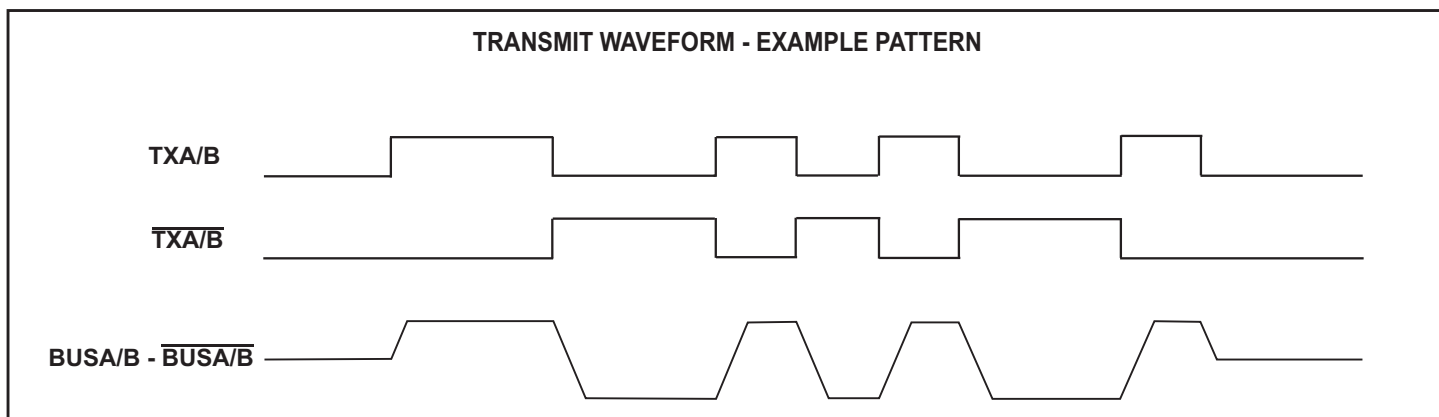
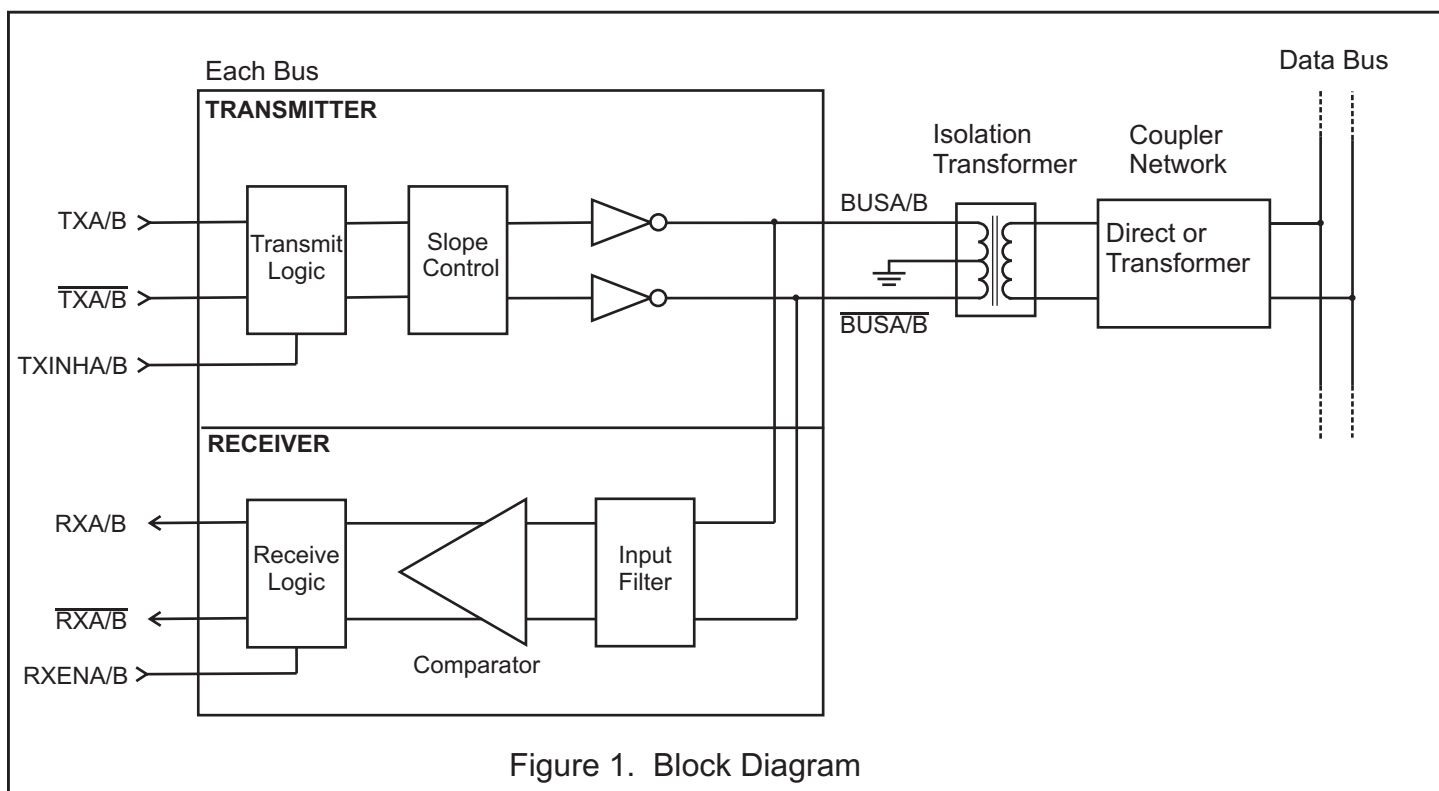
The receiver outputs are forced to the bus idle state (logic "0" on HI-1573 or logic "1" on HI-1574) when RXENA or RXENB is low.

### MIL-STD-1553 BUS INTERFACE

A direct-coupled interface (see Figure 2) uses a 1:2.5 ratio isolation transformer and two 55 ohm isolation resistors between the transformer and the bus. The primary center-tap of the isolation transformer must be connected to GND.

In a transformer-coupled interface (see Figure 2), the transceiver is connected to a 1:1.79 isolation transformer which in turn is connected to a 1:1.4 coupling transformer. The transformer-coupled method also requires two coupling resistors equal to 75% of the bus characteristic impedance ( $Z_0$ ) between the coupling transformer and the bus.

Figure 3 and Figure 4 show test circuits for measuring electrical characteristics of both direct- and transformer-coupled interfaces respectively. (See electrical characteristics on the following pages).



## ABSOLUTE MAXIMUM RATINGS

|                               |                     |
|-------------------------------|---------------------|
| Supply voltage (VDD)          | -0.3 V to +5 V      |
| Logic input voltage range     | -0.3 V dc to +3.6 V |
| Receiver differential voltage | 50 Vp-p             |
| Driver peak output current    | +1.0 A              |
| Solder Reflow Temperature     | 260°C               |
| Junction Temperature          | 175°C               |
| Storage Temperature           | -65°C to +150°C     |

## RECOMMENDED OPERATING CONDITIONS

|                   |  |
|-------------------|--|
| Supply Voltage    | VDD..... 3.3V... ±5%   |
| Temperature Range | Industrial .....-40°C to +85°C<br>Extended.....-55°C to +125°C |

**NOTE:** Stresses above absolute maximum ratings or outside recommended operating conditions may cause permanent damage to the device. These are stress ratings only. Operation at the limits is not recommended.

## DC ELECTRICAL CHARACTERISTICS

VDD = 3.3 V, GND = 0V, TA = Operating Temperature Range (unless otherwise specified).

| PARAMETER   | SYMBOL | CONDITION  | MIN   | TYP   | MAX   | UNITS |
|---|--------|--|-------|-------|-------|-------|
| Operating Voltage   | VDD    |  | 3.15  | 3.30  | 3.45  | V     |
| Total Supply Current  | ICC1   | Not Transmitting   |       | 10    | 17    | mA    |
|   | ICC2   | Transmit one bus @ 50% duty cycle  |       | 210   | 225   | mA    |
|   | ICC3   | Transmit one bus @ 100% duty cycle   |       | 420   | 450   | mA    |
| Power Dissipation   | PD1    | Not Transmitting   |       | 0.033 | 0.060 | W     |
|   | PD2    | Transmit one bus @ 100% duty cycle   |       | 0.475 | 0.55  | W     |
| Min. Input Voltage (HI)   | VIH    | Digital inputs   | 70%   |       |       | VDD   |
| Max. Input Voltage (LO)   | UIL    | Digital inputs   |       |       | 30%   | VDD   |
| Min. Input Current (HI)   | IIH    | Digital inputs   |       |       | 20    | μA    |
| Max. Input Current (LO)   | IIL    | Digital inputs   | -20   |       |       | μA    |
| Min. Output Voltage (HI)  | VOH    | IOUT = -1.0mA, Digital outputs   | 90%   |       |       | VDD   |
| Max. Output Voltage (LO)  | VOL    | IOUT = 1.0mA, Digital outputs  |       |       | 10%   | VDD   |
| <b>RECEIVER (Measured at Point "Ad" in Figure 3 unless otherwise specified)</b> |        |  |       |       |       |       |
| Input resistance  | RIN    | Differential (at chip pins)  | 20    |       |       | Kohm  |
| Input capacitance   | CIN    | Differential   |       |       | 5     | pF    |
| Common mode rejection ratio   | CMRR   |  | 40    |       |       | dB    |
| Input Level   | VIN    | Differential   |       |       | 9     | Vp-p  |
| Input common mode voltage   | VICM   |  | -10.0 |       | 10.0  | V-pk  |
| Threshold Voltage - Direct-coupled Detect                                       | VTHD   | 1 Mhz Sine Wave<br>Measured at Point "Ad" in Figure 3<br>RXA/B, RXA/B pulse width >70 ns | 1.15  |       |       | Vp-p  |
|   | VTHND  | No pulse at RXA/B, RXA/B   |       |       | 0.28  | Vp-p  |
| Threshold Voltage - Transformer-coupled Detect                                  | VTHD   | 1 MHz Sine Wave<br>Measured at Point "At" in Figure 4<br>RXA/B, RXA/B pulse width >70 ns | 0.86  |       |       | Vp-p  |
|   | VTHND  | No pulse at RXA/B, RXA/B   |       |       | 0.20  | Vp-p  |

## DC ELECTRICAL CHARACTERISTICS (cont.)

VDD = 3.3 V, GND = 0V, TA = Operating Temperature Range (unless otherwise specified).

| PARAMETER  | SYMBOL              | CONDITION        | MIN   | TYP  | MAX  | UNITS |
|--|---------------------|------------------|---|------|------|-------|
| <b>TRANSMITTER</b> (Measured at Point "Ab" in Figure 3 unless otherwise specified) |                     |                  |   |      |      |       |
| Output Voltage   | Direct coupled      | V <sub>OUT</sub> | 35 ohm load<br>(Measured at Point "Ab" in Figure 3) | 6.0  | 9.0  | Vp-p  |
|  | Transformer coupled | V <sub>OUT</sub> | 70 ohm load<br>(Measured at Point "At" in Figure 4) | 18.0 | 27.0 | Vp-p  |
| Output Noise   |                     | V <sub>ON</sub>  | Differential, inhibited                             |      | 10.0 | mVp-p |
| Output Dynamic Offset Voltage  | Direct coupled      | V <sub>DYN</sub> | 35 ohm load<br>(Measured at Point "Ab" in Figure 3) | -90  | 90   | mV    |
|  | Transformer coupled | V <sub>DYN</sub> | 70 ohm load<br>(Measured at Point "At" in Figure 4) | -250 | 250  | mV    |
| Output resistance  |                     | R <sub>OUT</sub> | Differential, not transmitting                      | 10   |      | Kohm  |
| Output Capacitance   |                     | C <sub>OUT</sub> | 1 MHz sine wave                                     |      | 15   | pF    |

## AC ELECTRICAL CHARACTERISTICS

VDD = 3.3 V, GND = 0V, TA = Operating Temperature Range (unless otherwise specified).

| PARAMETER   | SYMBOL            | TEST CONDITIONS   | MIN          | TYP | MAX           | UNITS |
|---|-------------------|---|--------------|-----|---------------|-------|
| <b>RECEIVER</b> (Measured at Point "At" in Figure 4)    |                   |   |              |     |               |       |
| Receiver Delay  | t <sub>DR</sub>   | From input zero crossing to RXA/B or $\overline{\text{RXA/B}}$            |              |     | 500<br>Note 3 | ns    |
| Receiver gap time                                       | t <sub>RG</sub>   | Spacing between RXA/B and $\overline{\text{RXA/B}}$ pulses                | 60<br>Note 1 |     | 430<br>Note 2 | ns    |
| Receiver Enable Delay                                   | t <sub>REN</sub>  | From RXENA/B rising or falling edge to RXA/B or $\overline{\text{RXA/B}}$ |              |     | 40            | ns    |
| <b>TRANSMITTER</b> (Measured at Point "Ab" in Figure 3) |                   |   |              |     |               |       |
| Driver Delay  | t <sub>DT</sub>   | TXA/B, $\overline{\text{TXA/B}}$ to BUSA/B, $\overline{\text{BUSA/B}}$    |              |     | 150           | ns    |
| Rise time   | t <sub>r</sub>    | 35 ohm load   | 100          |     | 300           | ns    |
| Fall Time   | t <sub>f</sub>    | 35 ohm load   | 100          |     | 300           | ns    |
| Inhibit Delay   | t <sub>DI-H</sub> | Inhibited output  |              |     | 100           | ns    |
|   | t <sub>DI-L</sub> | Active output   |              |     | 150           | ns    |

Note 1. Measured using a 1 MHz sinusoid, 20 V peak to peak, line to line at point "AT" (Guaranteed but not tested).

Note 2. Measured using a 1 MHz sinusoid, 860 mV peak to peak, line to line at point "AT" (100% tested).

Note 3. Measured using a 1 MHz sinusoid, 860 mV peak to peak, line to line at point "AT". Measured from input zero crossing point.

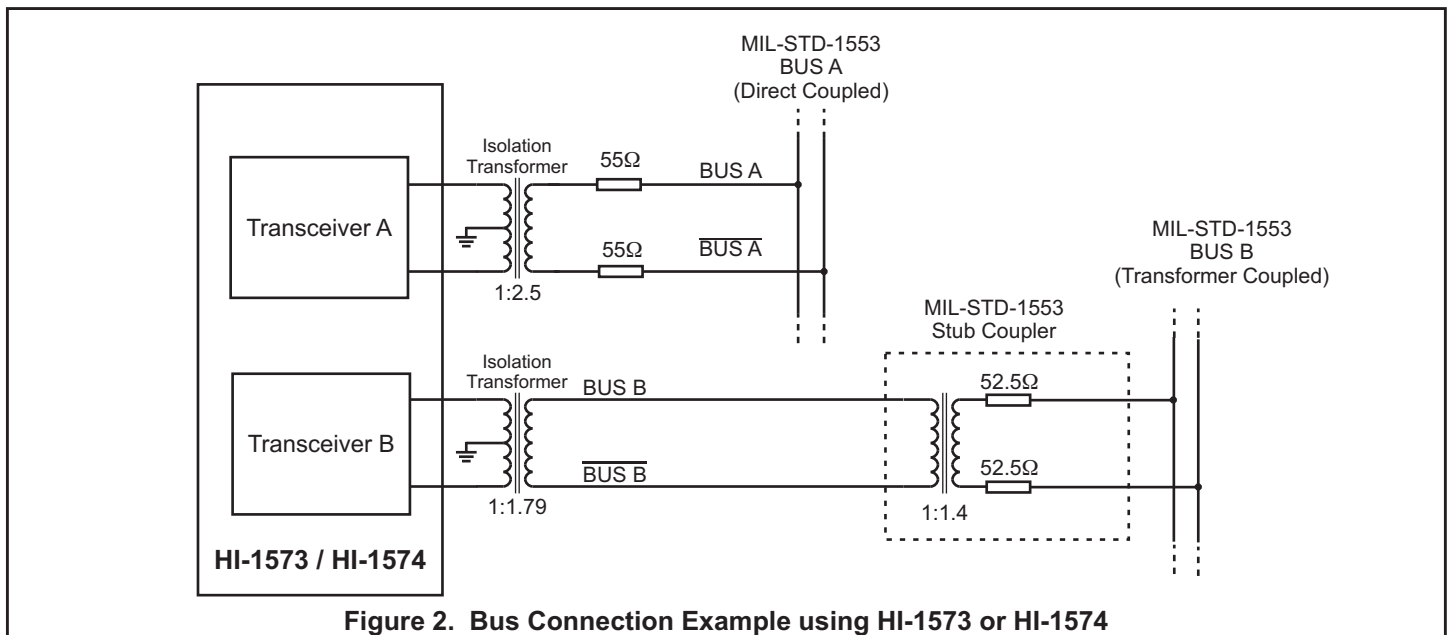
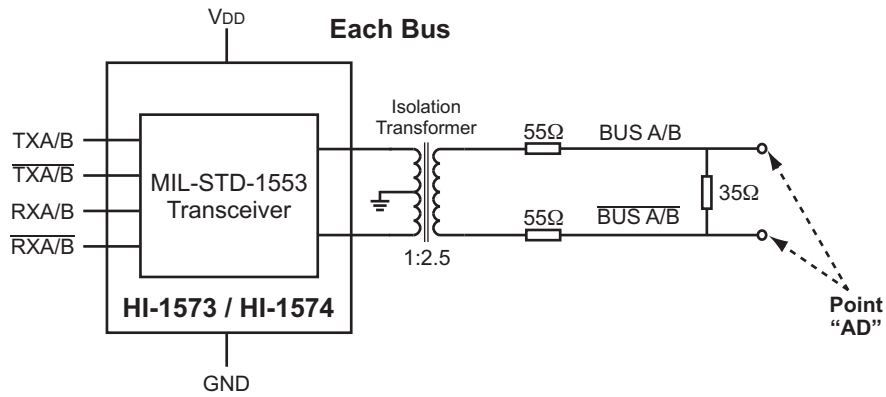
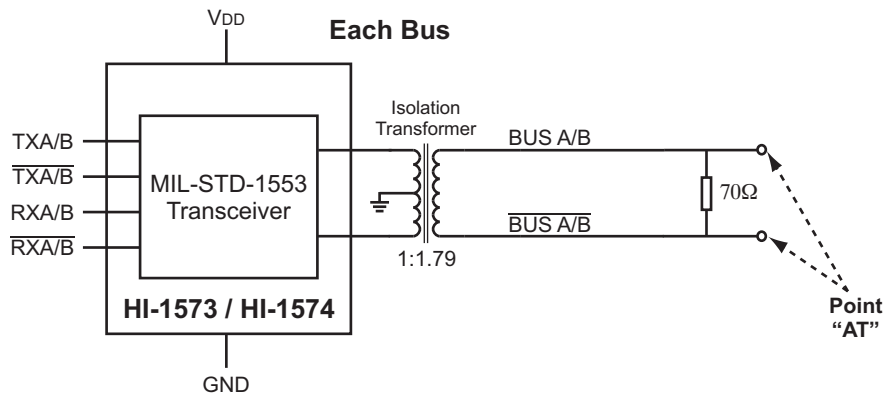


Figure 2. Bus Connection Example using HI-1573 or HI-1574



**Figure 3. Direct Coupled Test Circuit**



**Figure 4. Transformer Coupled Test Circuit**

## HEAT SINK - ESOIC & CHIP-SCALE APPLICATIONS NOTE PACKAGE

Both the HI-1573PSI/T/M and HI-1574PSI/T/M use a 20-pin thermally enhanced SOIC package. The HI-1573PCI/T/M and HI-1574PCI/T/M use a plastic chip-scale package (QFN). These packages include a metal heat sink located on the bottom surface of the device. This heat sink should be soldered down to the printed circuit board for optimum thermal dissipation.

The heat sink is electrically isolated and may be soldered to any convenient power or ground plane.

Holt Applications Note AN-500 provides circuit design notes regarding the use of Holt's family of MIL-STD-1553 transceivers. Layout considerations, as well as recommended interface and protection components are included.

## ORDERING INFORMATION

### HI - 157x PS x x (Plastic)

| PART NUMBER | PACKAGE DESCRIPTION                     |
|-------------|---|
| Blank       | Tin / Lead (Sn / Pb) Solder             |
| F           | 100% Matte Tin (Pb-free RoHS compliant) |

| PART NUMBER | TEMPERATURE RANGE | FLOW | BURN IN |
|-------------|-------------------|------|---------|
| I           | -40°C TO +85°C    | I    | No      |
| T           | -55°C TO +125°C   | T    | No      |
| M           | -55°C TO +125°C   | M    | Yes     |

| PART NUMBER | PACKAGE DESCRIPTION  |
|-------------|--|
| PS          | 20 PIN PLASTIC ESOIC, Thermally Enhanced Wide SOIC w/Heat Sink (20HWE) |

| PART NUMBER | RXENA = 0 |                         | RXENB = 0 |                         |
|-------------|-----------|-------------------------|-----------|-------------------------|
|             | RXA       | $\overline{\text{RXA}}$ | RXB       | $\overline{\text{RXB}}$ |
| 1573        | 0         | 0                       | 0         | 0                       |
| 1574        | 1         | 1                       | 1         | 1                       |

## ORDERING INFORMATION

### HI - 157x PC x x (Plastic)

| PART NUMBER | PACKAGE DESCRIPTION             |
|-------------|---------------------------------|
| Blank       | NiPdAu                          |
| F           | NiPdAu (Pb-free RoHS compliant) |

| PART NUMBER | TEMPERATURE RANGE | FLOW | BURN IN |
|-------------|-------------------|------|---------|
| I           | -40°C TO +85°C    | I    | No      |
| T           | -55°C TO +125°C   | T    | No      |
| M           | -55°C TO +125°C   | M    | Yes     |

| PART NUMBER | PACKAGE DESCRIPTION                           |
|-------------|---|
| PC          | 44 PIN PLASTIC CHIP-SCALE PACKAGE QFN (44PCS) |

| PART NUMBER | RXENA = 0 |      | RXENB = 0 |      |
|-------------|-----------|------|-----------|------|
|             | RXA       | RXA̅ | RXB       | RXB̅ |
| 1573        | 0         | 0    | 0         | 0    |
| 1574        | 1         | 1    | 1         | 1    |

### HI - 157xCD x (Ceramic)

| PART NUMBER | TEMPERATURE RANGE | FLOW | BURN IN | LEAD FINISH                    |
|-------------|-------------------|------|---------|--------------------------------|
| I           | -40°C TO +85°C    | I    | No      | Gold (Pb-free, RoHS compliant) |
| T           | -55°C TO +125°C   | T    | No      | Gold (Pb-free, RoHS compliant) |
| M           | -55°C TO +125°C   | M    | Yes     | Tin / Lead (Sn / Pb) Solder    |

| PART NUMBER | RXENA = 0 |      | RXENB = 0 |      | PACKAGE DESCRIPTION                  |
|-------------|-----------|------|-----------|------|--------------------------------------|
|             | RXA       | RXA̅ | RXB       | RXB̅ |                                      |
| 1573        | 0         | 0    | 0         | 0    | 20 PIN CERAMIC SIDE BRAZED DIP (20C) |
| 1574        | 1         | 1    | 1         | 1    | 20 PIN CERAMIC SIDE BRAZED DIP (20C) |



## RECOMMENDED TRANSFORMERS

The HI-1573 and HI-1574 transceivers have been characterized for compliance with the electrical requirements of MIL-STD-1553 when used with the following

transformers. Holt recommends the Premier Magnetics parts as offering the best combination of electrical performance, low cost and small footprint.

| MANUFACTURER      | PART NUMBER | APPLICATION   | TURNS RATIO(S)           | DIMENSIONS                |
|-------------------|-------------|---------------|--------------------------|---------------------------|
| Premier Magnetics | PM-DB2725EX | Isolation     | Dual ratio 1:1.79, 1:2.5 | 0.4 x 0.4 x 0.242 inches  |
| Premier Magnetics | PM-DB2702   | Stub coupling | 1:1.4                    | .625 x .625 x .250 inches |
| Premier Magnetics | PM-DB-2791S | Isolation     | 1:2.5                    | 0.4 x 0.4 x 0.185 inches  |
| Premier Magnetics | PM-DB-2795S | Isolation     | 1:1.79                   | 0.4 x 0.4 x 0.185 inches  |
| Premier Magnetics | PM-DB-2798S | Isolation     | Dual ratio 1:1.79, 1:2.5 | 0.4 x 0.4 x 0.185 inches  |
| Premier Magnetics | PM-DB-2762  | Isolation     | Dual core 1:2.5          | 0.4 x 0.4 x 0.320 inches  |
| Premier Magnetics | PM-DB-2766  | Isolation     | Dual core 1:1.79         | 0.4 x 0.4 x 0.320 inches  |

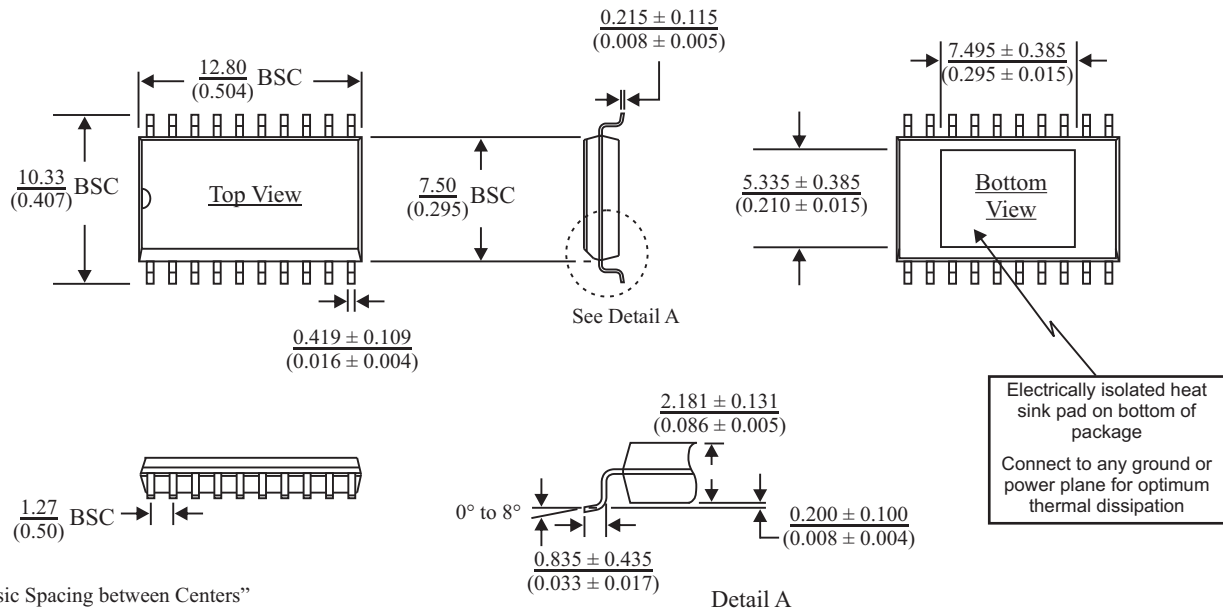
## REVISION HISTORY

| Document | Rev. | Date       | Description of Change  |
|----------|------|------------|--|
| DS1573   | L    | 09/26/08   | Clarification of transmitter and receiver functions in Description, clarification of available temperature ranges, and corrected a dimension in Recommended Transformers table.  |
|          | M    | 04/13/09   | Add 'M' Flow option to chip-scale package (QFN). Clarify nomenclature of chip-scale package as QFN.  |
|          | N    | 07/24/09   | Correct typographical errors in package dimensions.  |
|          | O    | 10/13/09   | Clarified status of RXA/B and $\overline{\text{RXA/B}}$ pins in bus idle state when RXENA or RXENB are high (logic "1").   |
|          | P    | 01/26/12   | Fix typos in tRG and tDT descriptions in AC characteristics table. Added latest Premier Magnetics transformer recommendations. Remove Technotrol transformer recommendations.  |
|          | Q    | 06/20/13   | Updated functional description text for clarity. Revised figures 2,3, and 4. Updated package drawings.   |
|          | R    | 05/21/14   | Updated Figure 2 and package drawings.   |
|          | S    | 04/09/15   | Correct Figures 2 and 3. Other minor clarifications.   |
|          | T    | 06/06/17   | Update Power Dissipation and Power Supply Current parameters.  |
|          | U    | 11/29/17   | Correct typo in DC Electrical Characteristics Table; VOL incorrectly labeled as VIH. Remove Power Dissipation from Absolute Maximum Ratings Table. Remove Thermal Characteristics Table. Refer to website for thermal resistance data. |
|          | V    | 08/25/2020 | Update QFN package lead finish to NiPdAu.  |
|          | W    | 10/04/2023 | Correct typo in Input Common Mode Voltage specification (VICM) in "DC Electrical Characteristics" from $\pm 5$ V-pk to $\pm 10$ V-pk.  |
|          | X    | 06/14/2024 | Correct timing of HI-1574 RXA/B and $\overline{\text{RXA/B}}$ waveforms.   |

### 20-PIN PLASTIC SMALL OUTLINE (ESOC) - WB (Wide Body, Thermally Enhanced)

millimeters (inches)

Package Type: 20HWE

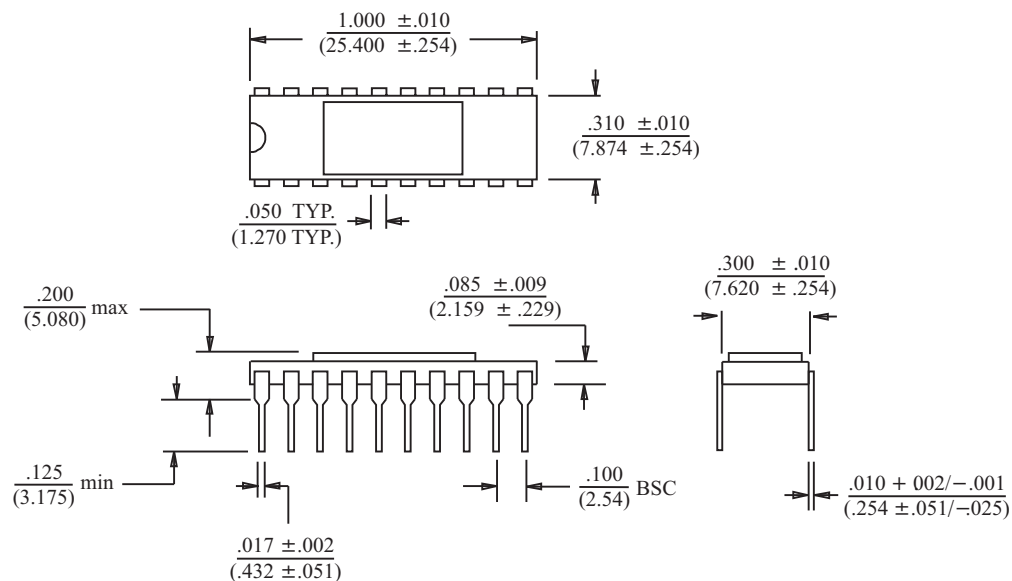


BSC = "Basic Spacing between Centers" is theoretical true position dimension and has no tolerance. (JEDEC Standard 95)

### 20-PIN CERAMIC SIDE-BRAZED DIP

inches (millimeters)

Package Type: 20C



BSC = "Basic Spacing between Centers" is theoretical true position dimension and has no tolerance. (JEDEC Standard 95)

**44-PIN PLASTIC CHIP-SCALE PACKAGE (QFN)**

*millimeters (inches)*

Package Type: 44PCS

