

## DESCRIPTION

The HI-1579 and HI-1581 are low power CMOS dual transceivers designed to meet the requirements of the MIL-STD-1553 and MIL-STD-1760 specifications.

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.

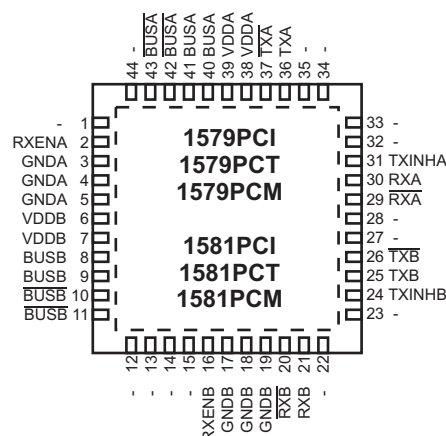
The receiver section of the each bus converts the 1553 bus bi-phase data to complementary CMOS / TTL data suitable for input to a Manchester decoder. Each receiver has a separate enable input, which forces the receiver outputs to logic "0" (HI-1579) or logic 1 (HI-1581).

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.

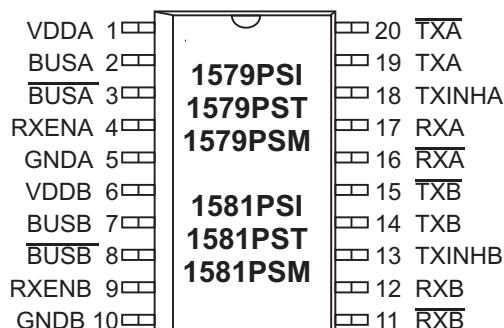
## FEATURES

- Compliant to MIL-STD-1553A and B, MIL-STD-1760 and ARINC 708A
- 3.3V single supply operation
- Smallest footprint available in 7mm x 7mm 44 pin plastic chip-scale package (QFN)
- Industrial and extended temperature ranges
- Industry standard pin configurations

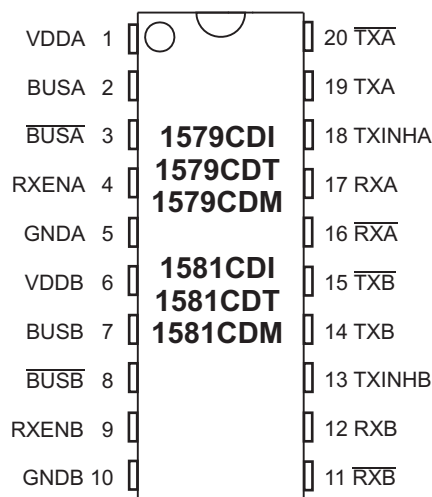
## PIN CONFIGURATIONS



**44 Pin Plastic 7mm x 7mm  
Chip-scale package**



**20 Pin Plastic ESOIC - WB package**



**20 Pin Ceramic DIP package**

## PIN DESCRIPTIONS

| PIN<br>(DIP & SOIC) | PIN<br>(QFN)                                              | SYMBOL                   | FUNCTION       | DESCRIPTION                                                              |
|---------------------|-----------------------------------------------------------|--------------------------|----------------|--------------------------------------------------------------------------|
| 1                   | 38, 39                                                    | VDDA                     | power supply   | +3.3 volt power for transceiver A                                        |
| 2                   | 40, 41                                                    | BUSA                     | analog         | MIL-STD-1533 bus driver A, positive signal                               |
| 3                   | 42, 43                                                    | $\overline{\text{BUSA}}$ | analog         | MIL-STD-1553 bus driver A, negative signal                               |
| 4                   | 2                                                         | RXENA                    | digital input  | Receiver A enable. If low, forces RXA and $\overline{\text{RXA}}$ low    |
| 5                   | 3, 4, 5                                                   | GNDA                     | power supply   | Ground for transceiver A                                                 |
| 6                   | 6, 7                                                      | Vddb                     | power supply   | +3.3 volt power for transceiver B                                        |
| 7                   | 8, 9                                                      | BUSB                     | analog         | MIL-STD-1533 bus driver B, positive signal                               |
| 8                   | 10, 11                                                    | $\overline{\text{BUSB}}$ | analog         | MIL-STD-1553 bus driver B, negative signal                               |
| 9                   | 16                                                        | RXENB                    | digital input  | Receiver B enable. If low, forces RXB and $\overline{\text{RXB}}$ low    |
| 10                  | 17, 18, 19                                                | GNDB                     | power supply   | Ground for transceiver B                                                 |
| 11                  | 20                                                        | $\overline{\text{RXB}}$  | digital output | Receiver B output, inverted                                              |
| 12                  | 21                                                        | RXB                      | digital output | Receiver B output, non-inverted                                          |
| 13                  | 24                                                        | TXINHB                   | digital input  | Transmit inhibit, bus B. If high BUSB, $\overline{\text{BUSB}}$ disabled |
| 14                  | 25                                                        | TXB                      | digital input  | Transmitter B digital data input, non-inverted                           |
| 15                  | 26                                                        | $\overline{\text{TXB}}$  | digital input  | Transmitter B digital data input, inverted                               |
| 16                  | 29                                                        | $\overline{\text{RXA}}$  | digital output | Receiver A output, inverted                                              |
| 17                  | 30                                                        | RXA                      | digital output | Receiver A output, non-inverted                                          |
| 18                  | 31                                                        | TXINHA                   | digital input  | Transmit inhibit, bus A. If high BUSA, $\overline{\text{BUSA}}$ disabled |
| 19                  | 36                                                        | TXA                      | digital input  | Transmitter A digital data input, non-inverted                           |
| 20                  | 37                                                        | $\overline{\text{TXA}}$  | digital input  | Transmitter A digital data input, inverted                               |
| -                   | 1, 12, 13, 14, 15<br>22, 23, 27, 28, 32<br>33, 34, 35, 44 | No<br>Connect            | -              | -                                                                        |

## FUNCTIONAL DESCRIPTION

The HI-1579 family of dual data bus transceivers contains differential voltage source drivers and differential receivers. It is 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 forces 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 re-

ceiver's differential input stage drives a filter and threshold comparator to produce 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-1579 and logic "1" on HI-1581.

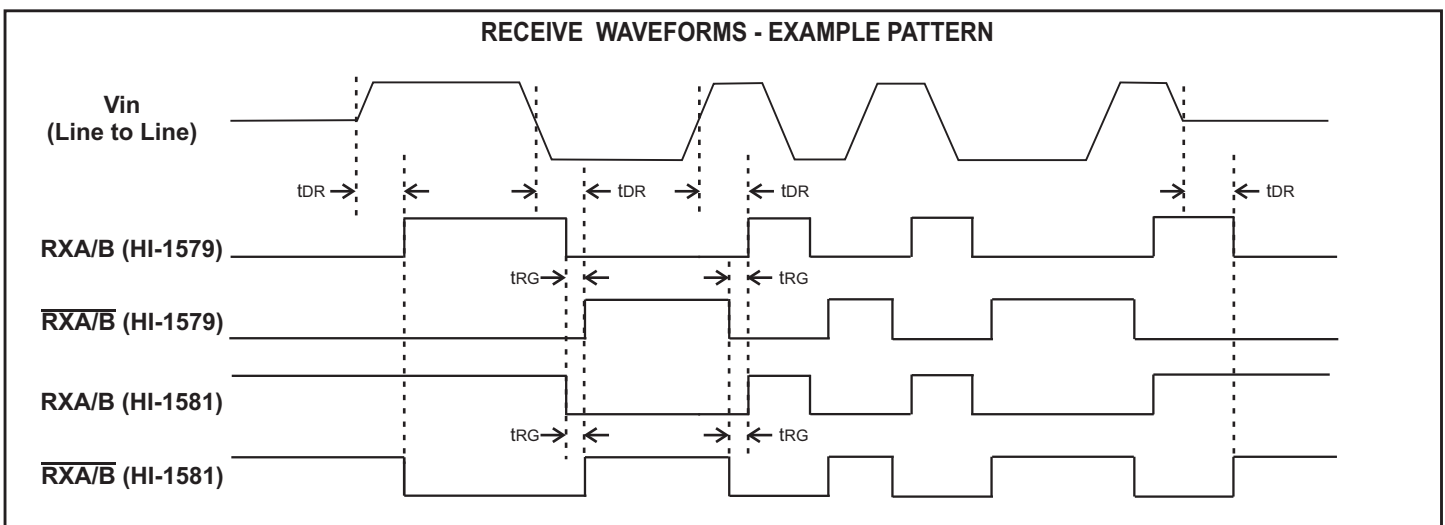
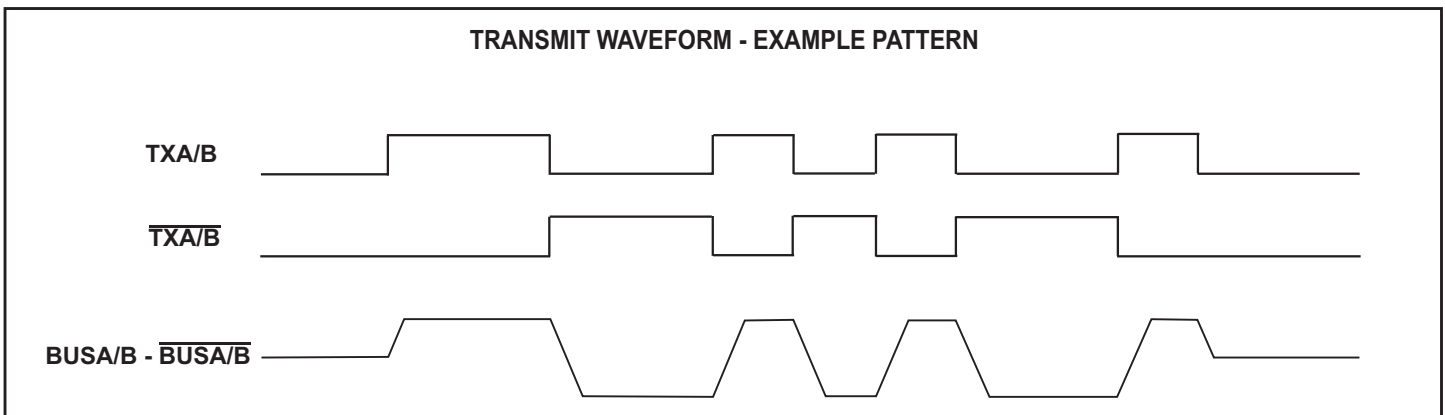
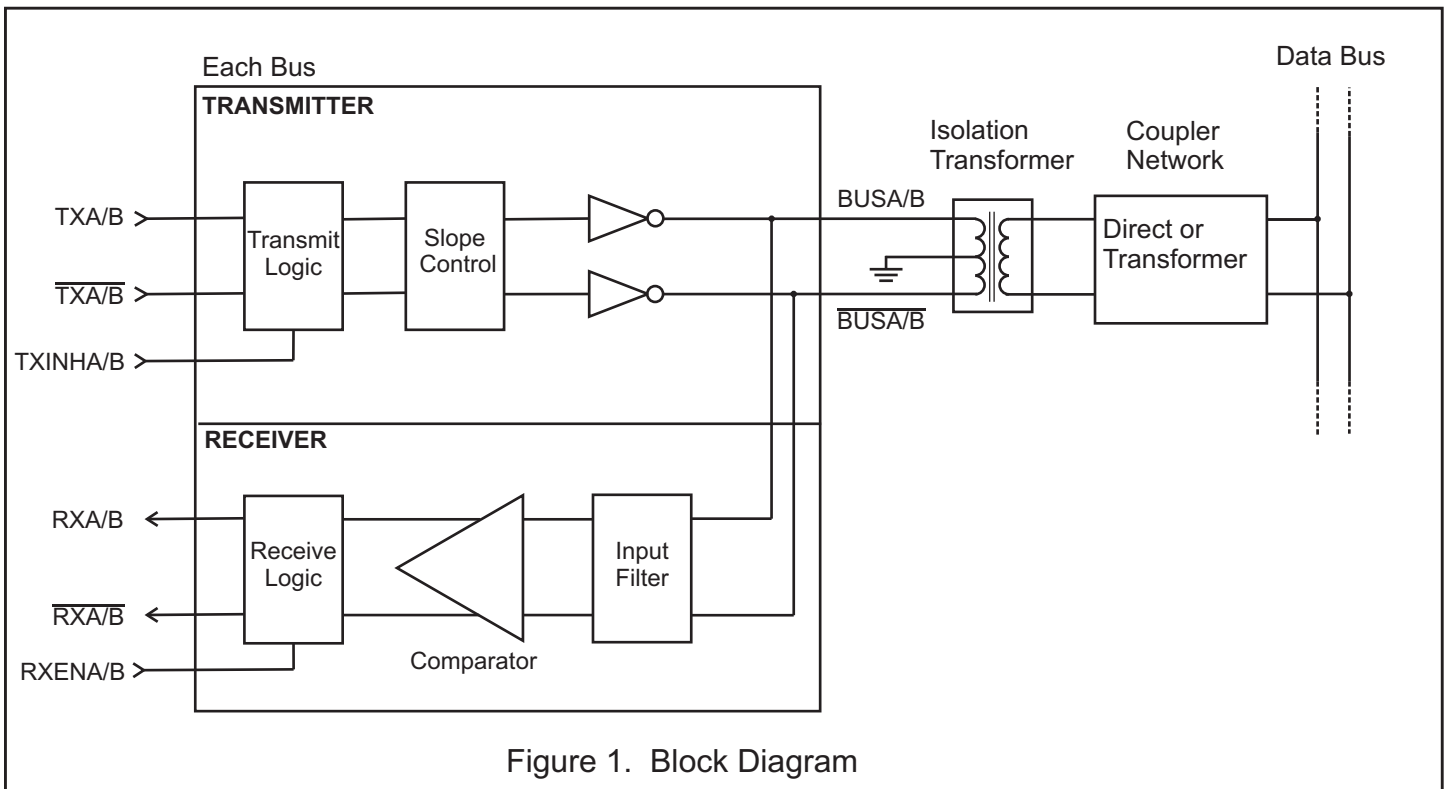
The receiver outputs are forced to the bus idle state (logic "0" for HI-1579 or logic "1" for HI-1581) when the RXENA or RXENB is low.

### 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 also connected to a 1:2.5 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 (V <sub>DD</sub> ) | -0.3 V to +5 V      |
| Logic input voltage range         | -0.3 V dc to +3.6 V |
| Receiver differential voltage     | 50 V <sub>p-p</sub> |
| Driver peak output current        | +1.0 A              |
| Reflow Solder Temperature         | 260°C               |
| Junction Temperature              | 175°C               |
| Storage Temperature               | -65°C to +150°C     |

## RECOMMENDED OPERATING CONDITIONS

|                   |                                                                  |
|-------------------|------------------------------------------------------------------|
| Supply Voltage    | V <sub>DD</sub> ..... 3.3V... ±5%                                |
| Temperature Range | Industrial ..... -40°C to +85°C<br>Hi-Temp ..... -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

V<sub>DD</sub> = 3.3 V, GND = 0V, T<sub>A</sub> = Operating Temperature Range (unless otherwise specified).

| PARAMETER                                                                       | SYMBOL           | CONDITION                                  | MIN   | TYP   | MAX  | UNITS            |
|---------------------------------------------------------------------------------|------------------|--------------------------------------------|-------|-------|------|------------------|
| Operating Voltage                                                               | V <sub>DD</sub>  |                                            | 3.15  | 3.30  | 3.45 | V                |
| Total Supply Current                                                            | I <sub>CC1</sub> | Not Transmitting                           |       | 10    | 17   | mA               |
|                                                                                 | I <sub>CC2</sub> | Transmit one bus @ 50% duty cycle          |       | 290   | 320  | mA               |
|                                                                                 | I <sub>CC3</sub> | Transmit one bus @ 100% duty cycle         |       | 590   | 650  | mA               |
| Power Dissipation                                                               | PD <sub>1</sub>  | Not Transmitting                           |       | 0.033 | 0.06 | W                |
|                                                                                 | PD <sub>2</sub>  | Transmit one bus @ 100% duty cycle         |       | 0.86  | 1.1  | W                |
| Min. Input Voltage (HI)                                                         | V <sub>IH</sub>  | Digital inputs                             | 2.0   |       |      | V                |
| Max. Input Voltage (LO)                                                         | V <sub>IL</sub>  | Digital inputs                             |       |       | 30%  | V <sub>DD</sub>  |
| Min. Input Current (HI)                                                         | I <sub>IH</sub>  | Digital inputs                             |       |       | 20   | μA               |
| Max. Input Current (LO)                                                         | I <sub>IL</sub>  | Digital inputs                             | -20   |       |      | μA               |
| Min. Output Voltage (HI)                                                        | V <sub>OH</sub>  | I <sub>OUT</sub> = -1.0mA, Digital outputs | 90%   |       |      | V <sub>DD</sub>  |
| Max. Output Voltage (LO)                                                        | V <sub>OL</sub>  | I <sub>OUT</sub> = 1.0mA, Digital outputs  |       |       | 10%  | V <sub>DD</sub>  |
| <b>RECEIVER (Measured at Point "Ad" in Figure 3 unless otherwise specified)</b> |                  |                                            |       |       |      |                  |
| Input resistance                                                                | R <sub>IN</sub>  | Differential (at chip pins)                | 2     |       |      | Kohm             |
| Input capacitance                                                               | C <sub>IN</sub>  | Differential                               |       |       | 5    | pF               |
| Common mode rejection ratio                                                     | CMRR             |                                            | 40    |       |      | dB               |
| Input Level                                                                     | V <sub>IN</sub>  | Differential                               |       |       | 9    | V <sub>p-p</sub> |
| Input common mode voltage                                                       | V <sub>ICM</sub> |                                            | -10.0 |       | 10.0 | V <sub>pk</sub>  |
| Threshold Voltage - Direct-coupled                                              | Detect           | V <sub>THD</sub>                           | 1.15  |       |      | V <sub>p-p</sub> |
|                                                                                 | No Detect        | V <sub>THND</sub>                          |       |       | 0.28 | V <sub>p-p</sub> |
| Threshold Voltage - Transformer-coupled                                         | Detect           | V <sub>THD</sub>                           | 0.86  |       |      | V <sub>p-p</sub> |
|                                                                                 | No Detect        | V <sub>THND</sub>                          |       |       | 0.20 | V <sub>p-p</sub> |

## 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 "Ad" in Figure 3 unless otherwise specified) |                     |           |                                                     |      |      |       |
| Output Voltage                                                                     | Direct coupled      | VOUT      | 35 ohm load<br>(Measured at Point "Ad" in Figure 3) | 6.1  | 9.0  | Vp-p  |
|                                                                                    | Transformer coupled | VOUT      | 70 ohm load<br>(Measured at Point "At" in Figure 4) | 20.0 | 27.0 | Vp-p  |
| Output Noise                                                                       |                     | VON       | Differential, inhibited                             |      | 10.0 | mVp-p |
| Output Dynamic Offset Voltage                                                      | Direct coupled      | VDYN      | 35 ohm load<br>(Measured at Point "Ad" in Figure 3) | -90  | 90   | mV    |
|                                                                                    | Transformer coupled | VDYN      | 70 ohm load<br>(Measured at Point "At" in Figure 4) | -250 | 250  | mV    |
| Output Capacitance                                                                 |                     | COUT      | 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                                          | tDR    | From input zero crossing to RXA/B or $\overline{\text{RXA/B}}$            |              |     | 450<br>Note 3 | ns    |
| Receiver gap time                                       | tRG    | Spacing between RXA/B and $\overline{\text{RXA/B}}$ pulses                | 90<br>Note 1 |     | 365<br>Note 2 | ns    |
| Receiver Enable Delay                                   | tREN   | From RXENA/B rising or falling edge to RXA/B or $\overline{\text{RXA/B}}$ |              |     | 40            | ns    |
| <b>TRANSMITTER</b> (Measured at Point "Ad" in Figure 3) |        |                                                                           |              |     |               |       |
| Driver Delay                                            | tDT    | TXA/B, $\overline{\text{TXA/B}}$ to BUSA/B, $\overline{\text{BUSA/B}}$    |              |     | 150           | ns    |
| Rise time                                               | tr     | 35 ohm load                                                               | 100          |     | 300           | ns    |
| Fall Time                                               | tf     | 35 ohm load                                                               | 100          |     | 300           | ns    |
| Inhibit Delay                                           | tDI-H  | Inhibited output                                                          |              |     | 100           | ns    |
|                                                         | tDI-L  | 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.

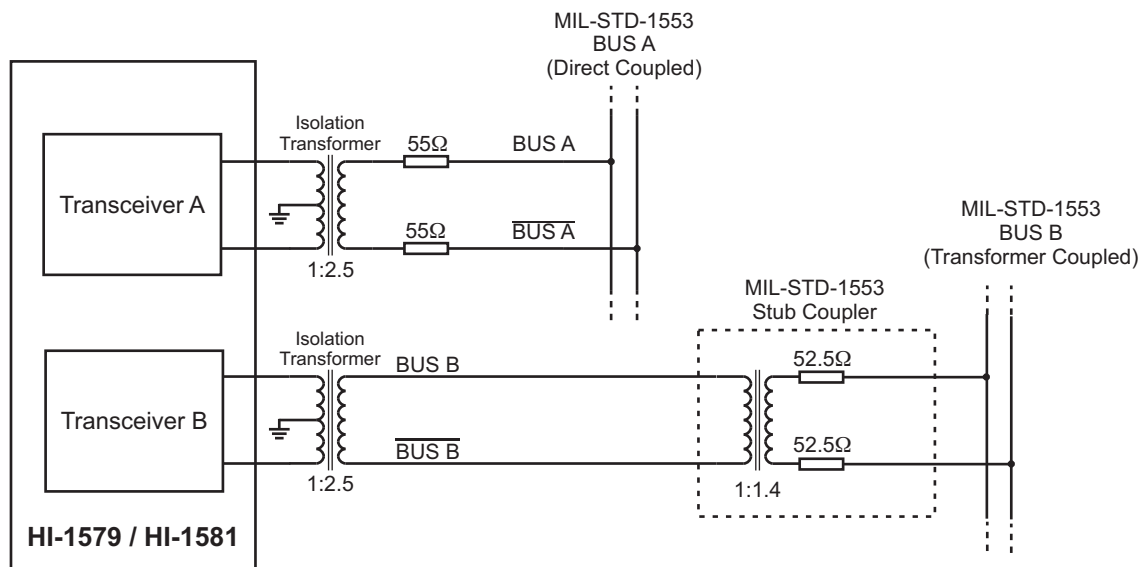
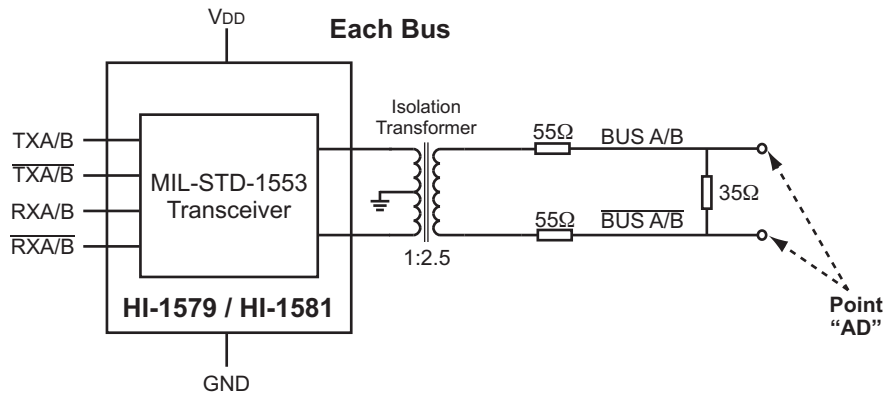
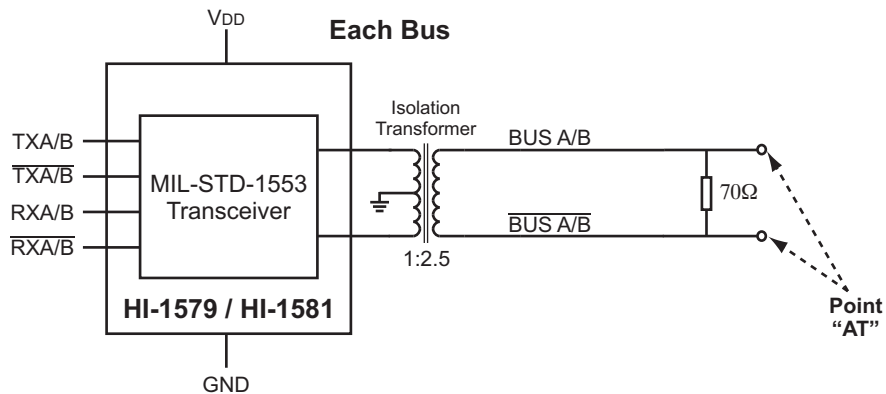


Figure 2. Bus Connection Example using HI-1579 or HI-1581



**Figure 3. Direct Coupled Test Circuit**



**Figure 4. Transformer Coupled Test Circuit**

## HEAT SINK ESOIC & CHIP-SCALE PACKAGES

The HI-1579PSI/T/M and HI-1581PSI/T/M use a 20-pin thermally enhanced SOIC package. The HI-1579PCI/T/M and HI-1581PCI/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 may 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.

## APPLICATIONS NOTE

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 - 15xx xx x x -xx (Plastic)

| PART NUMBER | PACKING                         |
|-------------|---------------------------------|
| Blank       | Tubes                           |
| -TR         | Tape and Reel (500 pieces/reel) |

| PART NUMBER | LEAD FINISH                             |
|-------------|-----------------------------------------|
| 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                                                    |
|-------------|------------------------------------------------------------------------|
| PC          | 44 PIN PLASTIC CHIP-SCALE PACKAGE QFN (44PCS)                          |
| PS          | 20 PIN PLASTIC ESOIC, Thermally Enhanced Wide SOIC w/Heat Sink (20HWE) |

| PART NUMBER | RXENA = 0 |                  | RXENB = 0 |                  |
|-------------|-----------|------------------|-----------|------------------|
|             | RXA       | $\overline{RXA}$ | RXB       | $\overline{RXB}$ |
| 1579        | 0         | 0                | 0         | 0                |
| 1581        | 1         | 1                | 1         | 1                |

### HI - 15xxCD 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       | $\overline{RXA}$ | RXB       | $\overline{RXB}$ |                                      |
| 1579        | 0         | 0                | 0         | 0                | 20 PIN CERAMIC SIDE BRAZED DIP (20C) |
| 1581        | 1         | 1                | 1         | 1                | 20 PIN CERAMIC SIDE BRAZED DIP (20C) |

## RECOMMENDED TRANSFORMERS

The HI-1579 and HI-1581 transceivers have been characterized for compliance with the electrical requirements of MIL-STD-1553 when used with the following

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

| MANUFACTURER     | PART NUMBER | APPLICATION   | TURNS RATIO  | DIMENSIONS                |
|------------------|-------------|---------------|--------------|---------------------------|
| Premier Magnetix | PM-DB2791S  | Isolation     | Single 1:2.5 | .400 x .400 x .185 inches |
| Premier Magnetix | PM-DB2756   | Isolation     | Dual 1:2.5   | .930 x .575 x .185 inches |
| Premier Magnetix | PM-DB2702   | Stub coupling | 1:1.4        | .625 x .625 x .250 inches |



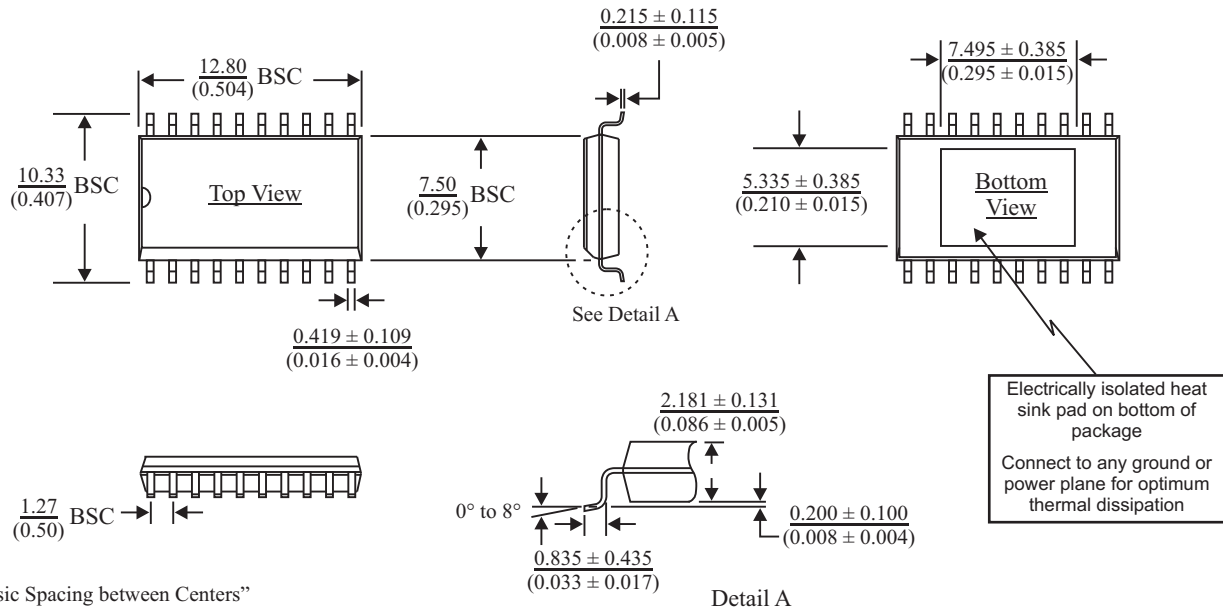
## REVISION HISTORY

| Document | Rev. | Date     | Description of Change                                                                                                                                                                                                                                                                    |
|----------|------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DS1579   | F    | 07/24/09 | Correct typographical errors in package dimensions. Clarified available temperature ranges.                                                                                                                                                                                              |
|          | G    | 10/5/09  | Clarified status of RXA/B and $\overline{RXA/B}$ pins in bus idle state when RXENA or RXENB are high (logic "1").<br>Clarified nomenclature of chip-scale package as QFN. Added 'M' flow option for QFN package ('PCM' package option).<br>Updated datasheet to include HI-1581 variant. |
|          | H    | 01/26/10 | Corrected dynamic current and power dissipation values.                                                                                                                                                                                                                                  |
|          | I    | 02/01/10 | Revised Thermal Characteristic table to correspond to correct dynamic currents and power dissipation values.                                                                                                                                                                             |
|          | J    | 08/18/10 | Revised DC Electrical Characteristics table to correspond to actual measured values. Revised Bus Connection and Test Circuit Diagrams. Revised SOIC package standoff dimension.                                                                                                          |
|          | K    | 05/23/13 | Revised text in functional description to improve clarity. Added more detail to AC timing parameter table. Removed reference to non-preferred transformers Updated package drawings.                                                                                                     |
|          | L    | 05/14/14 | Correct typos in Figure references on pages 4 & 5. Update reflow solder temperature. Correct mistake in Figure 2. Update package drawings.                                                                                                                                               |
|          | M    | 04/09/15 | Corrected Figures 2 and 3. Added notes for Receiver Gap Time in AC Characteristics. Other minor clarifications.                                                                                                                                                                          |
|          | N    | 01/13/16 | Update Pin Descriptions for QFN package. Add Tape and Reel option for plastic packages.                                                                                                                                                                                                  |
|          | O    | 07/29/16 | Update "DC Electrical Characteristics" table: change VIH to 2.0V min.                                                                                                                                                                                                                    |
|          | P    | 02/06/17 | Remove Thermal Characteristics Table. See website for thermal resistance data. Correct minor typos.                                                                                                                                                                                      |
|          | Q    | 06/06/17 | Update Power Dissipation and Power Supply Current parameters.                                                                                                                                                                                                                            |
|          | R    | 11/29/17 | Correct typo in DC Electrical Characteristics Table; VOL incorrectly labeled as VIH.                                                                                                                                                                                                     |

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

millimeters (inches)

Package Type: 20HWE

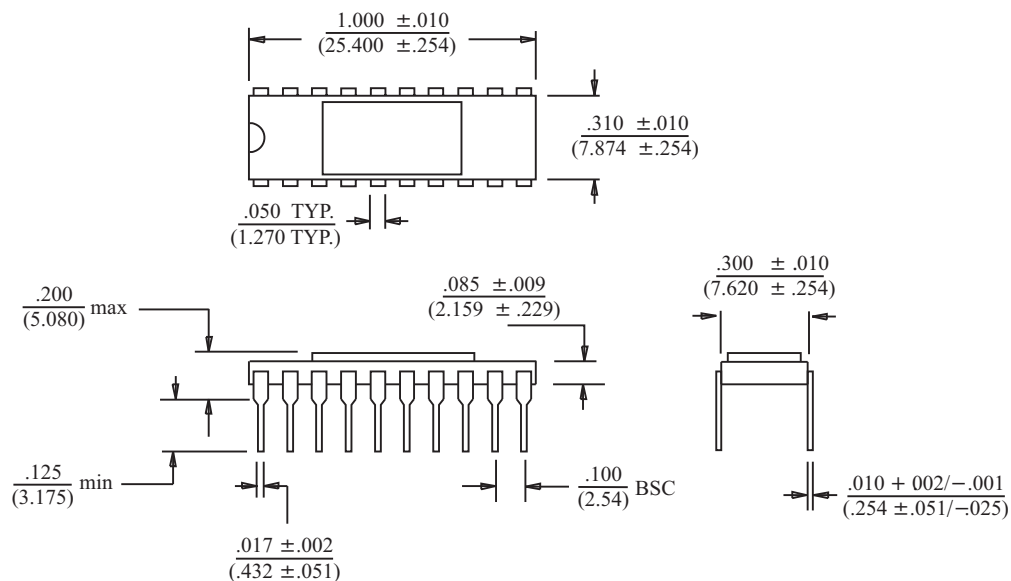


BSC = "Basic Spacing between Centers"  
is theoretical true position dimension and  
has no tolerance. (JEDEC Standard 95)

### 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

