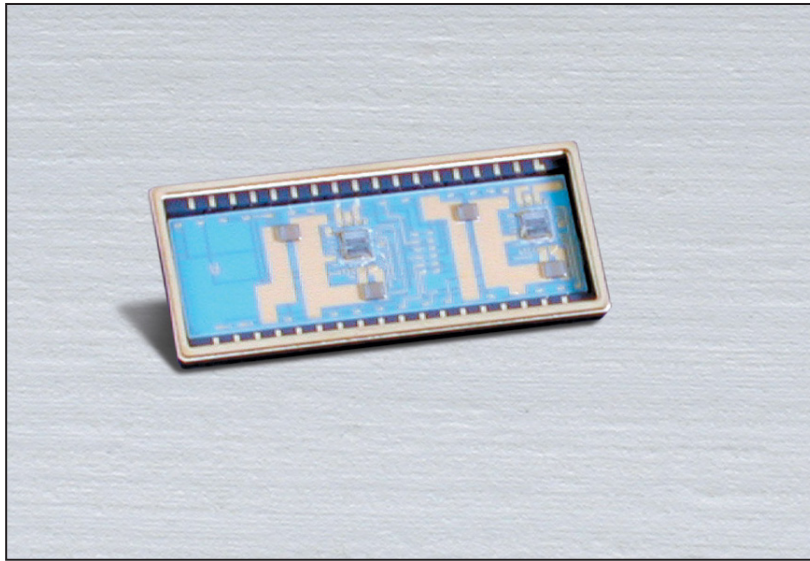


BU-63147 and BU-63157 MIL-STD-1553 DATA BUS +5V DUAL TRANSCEIVER



DESCRIPTION

The BU-63147/157 transceiver is a complete dual transmitter and receiver pair conforming fully to MIL-STD-1553A and 1553B. Features include: monolithic design, +5V power supply voltage, Harris type decoder interface, completely independent dual redundant operation, and small size (36-pin DIP or flat pack). The receiver section of the BU-63147/157 series accepts phase-modulated bipolar data from a MIL-STD-1553 Data Bus and produces TTL Signal data at its output.

The RX DATA OUT and $\overline{\text{RX DATA OUT}}$ outputs represent positive and negative variations of the input data signals beyond an internally fixed threshold level. An external STROBE input enables or disables the receiver's outputs.

The transmitter section accepts bi-phase TTL signal data at its TX DATA IN and $\overline{\text{TX DATA IN}}$ inputs and produces phase-modulated bipolar data at the TX DATA OUT and $\overline{\text{TX DATA OUT}}$ outputs. The transmitter's output voltage level is typically about 11Vpp. An external input, INHIBIT, takes priority over the transmitter inputs and disables the transmitter when activated with a logic "1".

The small size, +5V power supply voltage, and compliance with MIL-STD-1553 simplify engineering design, making it an excellent choice for interfacing with any MIL-STD-1553 system.

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has...



FEATURES

- +5V Power Supply
- Low Power
- Conforms Fully To MIL-STD-1553A and 1553B
- Dual Transceiver
- Available with MIL-STD-1760 Compliant Transmitter Voltage
- Available with McAir Compatible Waveform
- 36-Pin DIP or Flat Pack
- HARRIS I/O Compatibility
- Radiation Tolerant Version Available

FOR MORE INFORMATION CONTACT:

Technical Support:
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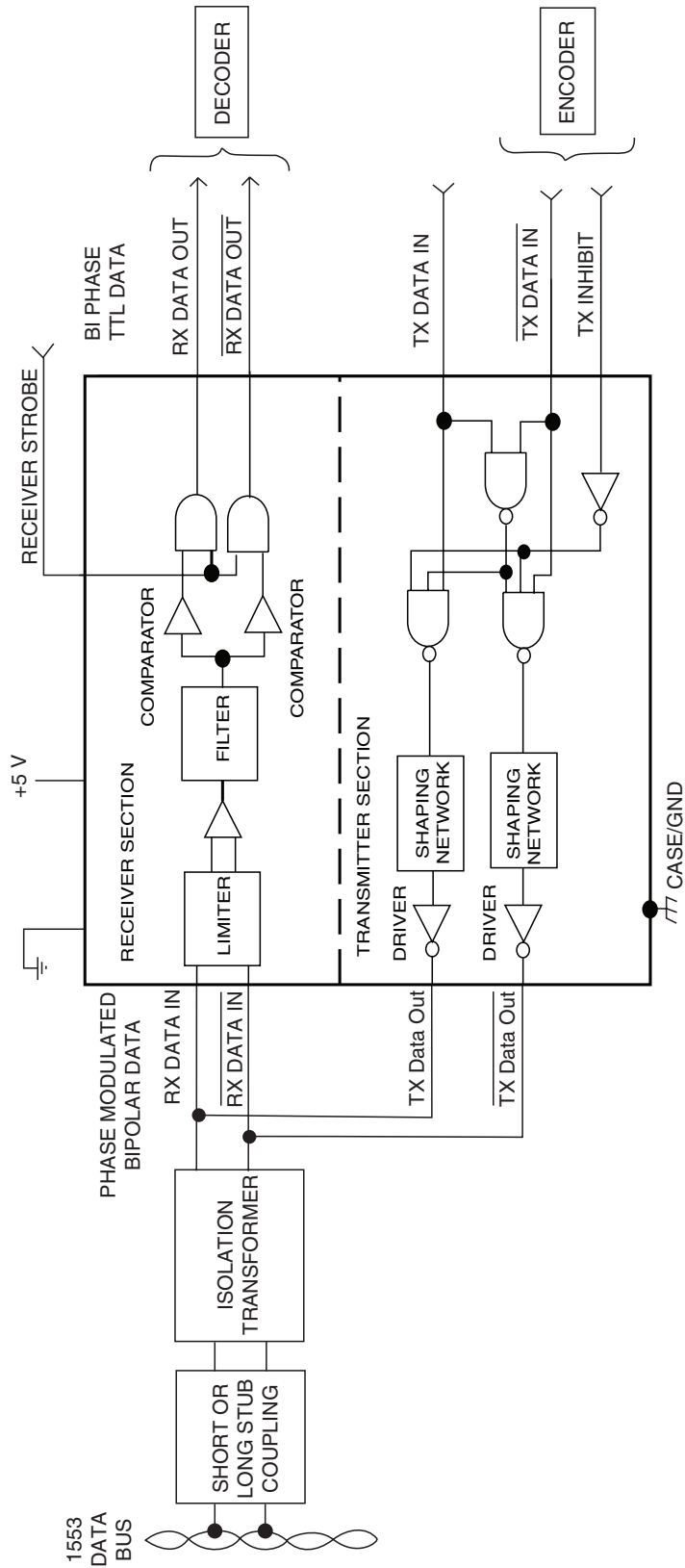


FIGURE 1. BU-63147/-157 BLOCK DIAGRAM (ONE CHANNEL SHOWN)

TABLE 1. BU-63147/157 SPECIFICATIONS

PARAMETER	MIN	TYP	MAX	UNITS
ABSOLUTE MAXIMUM RATING				
Supply Voltage				
• +5 V (Vcc)	-0.3	5.0	7.0	V
Receiver				
• Input Voltage (differential)			20	Vp-p
Logic				
• Voltage Input Range	-0.3		Vcc+10%	V
MIL-STD-1553 Signals				
• Powered Input Range (Note 11)	-5V_XCVR - 0.3		5V_XCVR + 0.3	V
• Unpowered Input Range	-1.5		+1.5	V
RECEIVER				
Differential Input Resistance (Notes 1-6)	2.5			kohm
Differential Input Capacitance (Notes 1-6)			5	pF
Threshold Level (Note 7)	0.20		0.860	Vp-p
Common Mode Voltage (Note 8)			10	Vpeak
TRANSMITTER				
Differential Output Voltage				
• Direct Coupled Across 35 ohms, Measured on Bus	6	7	9	Vp-p
• Transformer Coupled Across 70 ohms, Measured on Stub:				
• BU-63147/157XX-XX0	18	20	27	Vp-p
• BU-63147X3-XX2 (Note 9)	20	22	27	Vp-p
Output Noise, Differential (Direct Coupled)			10	mVp-p, diff
Output Offset Voltage, Transformer Coupled Across 70 ohms	-250	150	250	mVp-p, diff
Rise/Fall Time				
• BU-63147/157X3	100	150	300	ns
• BU-63147X4	200	250	300	ns
LOGIC				
V _{IH}	2.0			V
V _{IL}			0.8	V
I _{IH}	20		100	μA
Tx Data In, Tx Inhibit, Rx Strobe				
I _{IL}	-100		-20	μA
Tx Data In, Tx Inhibit, Rx Strobe				
V _{OH} (Vcc=4.75V, I _{OH} =max)	2.4			V
V _{OL} (Vcc=4.75V, I _{OH} =max)			0.4	V
I _{OL}	3.4			mA
I _{OH}			-3.4	mA
POWER SUPPLY REQUIREMENTS				
Voltages/Tolerances				
• +5V	4.75	5.0	5.25	V
Current Drain (Total Hybrid)				
BU-63147/157/XX-XX0				
• Idle (Both Channels)		80	100	mA
• 25% Transmitter Duty Cycle (One Channel)		199	229	mA
• 50% Transmitter Duty Cycle (One Channel)		286	348	mA
• 100% Transmitter Duty Cycle (One Channel)		455	535	mA
BU-63147/X3-XX2				
• Idle (Both Channels)		80	100	mA
• 25% Transmitter Duty Cycle (One Channel)		210	240	mA
• 50% Transmitter Duty Cycle (One Channel)		308	370	mA
• 100% Transmitter Duty Cycle (One Channel)		500	580	mA

TABLE 1. BU-63147/157 SPECIFICATIONS (CONT.)

PARAMETER	MIN	TYP	MAX	UNITS
POWER DISSIPATION (NOTE 10)				
Total Hybrid				
BU-63147/157/XX-XX0				
• Idle (Both Channels)		0.4	0.5	W
• 25% Transmitter Duty Cycle (One Channel)		0.65	0.8	W
• 50% Transmitter Duty Cycle (One Channel)		0.73	1.04	W
• 100% Transmitter Duty Cycle (One Channel)		0.88	1.28	W
BU-63147/X3-XX2				
• Idle (Both Channels)		0.4	0.5	W
• 25% Transmitter Duty Cycle (One Channel)		0.7	0.85	W
• 50% Transmitter Duty Cycle (One Channel)		0.84	1.15	W
• 100% Transmitter Duty Cycle (One Channel)		1.1	1.50	W
Hottest Die				
BU-63147/157/XX-XX0				
• Idle (One Channel)		0.2	0.25	W
• 25% Transmitter Duty Cycle (One Channel)		0.43	0.6	W
• 50% Transmitter Duty Cycle (One Channel)		0.59	0.84	W
• 100% Transmitter Duty Cycle (One Channel)		0.78	1.13	W
BU-63147/X3-XX2				
• Idle (One Channel)		0.2	0.25	W
• 25% Transmitter Duty Cycle (One Channel)		0.48	0.65	W
• 50% Transmitter Duty Cycle (One Channel)		0.7	0.95	W
• 100% Transmitter Duty Cycle (One Channel)		1.00	1.35	W
THERMAL				
• Thermal Resistance, Junction-to-Case, Hottest Die (θ_{jc})			12	$^{\circ}\text{C}/\text{W}$
• Operating Junction Temperature	-55		150	$^{\circ}\text{C}$
• Storage Temperature	-65		150	$^{\circ}\text{C}$
• Lead Temperature (soldering, 10 sec.)			+300	$^{\circ}\text{C}$
PHYSICAL CHARACTERISTICS				
Size				
36-Pin DIP				
		1.900 x .800 x .205 (48.26 x 20.32 x 5.21)		in. (mm)
36-Lead Flat pack				
		1.900 x .800 x .200 (48.26 x 20.32 x 5.08)		in. (mm)
Weight				
		0.6 (17)		oz (g)

Notes:

Notes 1 through 6 are applicable to the Receiver Differential Resistance and Differential Capacitance specifications:

- Specifications include both transmitter and receiver (assumed tied together externally).
- Impedance parameters are specified directly between pins TX/RX A(B) and TX/RX A(B) hybrid.
- It is assumed that all power and ground inputs to the hybrid are connected and that the hybrid case is connected to ground for the impedance measurement.
- The specifications are applicable for both unpowered and powered conditions.
- The specifications assume a 2 volt rms balanced, differential, sinusoidal input. The applicable frequency range is 75 kHz to 1 MHz.
- Minimum resistance and maximum capacitance parameters are guaranteed over the operating range, but are not tested.
- The Threshold Level, as referred to in this specification, is meant to be the maximum peak-to-peak voltage (measured on the data bus) that can be applied to the receiver's input without causing the output to change from the OFF state.
- Assumes a common mode voltage within the frequency range of dc to 2 MHz, applied to pins of the isolation transformer on the stub side (either direct or transformer coupled), and referenced to transceiver ground. Transformer must be a DDC recommended transformer or other transformer that provides an equivalent minimum CMRR.
- MIL-STD-1760 requires minimum output voltage of 20 Vp-p on the stub connection. The -XX2 option is **not** available for the BU-63147X4 or BU-63157 versions.
- Power dissipation specifications assume a transformer coupled configuration, with external dissipation (while transmitting) of 0.14 watts for the active isolation transformer, 0.08 watts for the active coupling transformer, 0.45 watts for each of the two bus isolation resistors, and 0.15 watts for each of the two bus termination resistors.
- Assuming the use of isolation transformers with the turns ratios shown in Figure 3 and in the absence of common mode signal on the 1553 stub, this equates to a nominal stub voltage of 38 Volts_{PK-10-PK} transformer-coupled, or 53 Volts_{PK-10-PK} direct-coupled.

TABLE 2. BU-63157 RADIATION SPECIFICATIONS*

PART NUMBER	TOTAL DOSE	SINGLE EVENT LATCHUP
BU-63157X3	100 KRAD	IMMUNE

*Note: Radiation parameters specified on this data sheet are derived from initial qualification testing by DDC and published data from ASIC manufacturers. These devices have not been evaluated for compliance to the RHA requirements stipulated in MIL-PRF-38534, Appendix G.

TABLE 3. HIGH RELIABILITY SCREENING OPTIONS FOR BU-63157

ELEMENT EVALUATION	METHOD
Visual Inspection: Integrated Circuits Transistor & Diodes Passive Components	MIL-STD-883, Method 2010 Condition A MIL-STD-750, Method 2072 and 2073 MIL-STD-883, Method 2032 Class S
SEM Analysis for Integrated Circuits	MIL-STD-883, Method 2018
Element Evaluation: Visual, Electrical, Wire Bondability, 24-Hour Stabilization Bake, 10 Temperature Cycles, 5000 g's constant acceleration, 240-Hour Powered Burn-In and 1000-Hour Life Test (Burn-In and 1000-Hour Life Test are Only Required for Active Components.)	MIL-PRF-38534
ASSEMBLY & TEST	
Particle Impact Noise Detection (PIND)	MIL-STD-883, Method 2020 Condition A
320-Hour Burn-In (Standard on this device)	MIL-STD-883, Method 1015
100% Non-Destructive Wirebond Pull (Standard on this device)	MIL-STD-883, Method 2023
Radiographic (X-Ray) Analysis	MIL-STD-883, Method 2012
QCI TESTING	
Extended Temperature Cycling: 20 Cycles Including Radiographic (X-Ray) Testing	MIL-STD-883, Method 1010 Condition C and MIL-STD-883, Method 2012
Moisture Content Limit of 5000 PPM	MIL-STD-883, Method 1018

INTRODUCTION

The BU-63147/157 is a dual redundant transmitter and receiver packaged in a 36-pin DDIP or flat pack. It is directly compatible to Harris 15530 encoder/decoder and has internal (factory preset) threshold levels. The dual transceiver only requires +5V power and conforms to MIL-STD-1553A and 1553B. For McAir compatibility, versions are available with rise/fall times of 200 to 300 nsec.

Figure 3 illustrates the connection between a BU-63147/157 transceiver and a MIL-STD-1553 Data Bus. After transformer isolating the transceiver, it can be either direct coupled (short stub) or transformer coupled (long stub) to the Data Bus.

TRANSMIT OPERATING MODE

The transmitter section accepts encoded TTL data and converts it to phase-modulated bipolar form using a waveshaping network and driver circuits. The driver outputs TX DATA OUT and $\overline{\text{TX DATA OUT}}$ are transformer coupled to the Data Bus.

The transmitter output terminals can be put into a high impedance state by setting INHIBIT high, or setting TX DATA IN and $\overline{\text{TX DATA IN}}$ to the same logic level. The operating TX modes are shown in TABLE 4.

The transceivers are able to operate in a “wraparound” mode. This allows output data to be monitored by the receiver section and returned to the decoder where it is checked for errors.

TABLE 4. TRANSMIT OPERATING MODE

TX DATA IN	$\overline{\text{TX DATA IN}}$	TX INHIBIT	DRIVER OUTPUT
X	X	H	OFF (NOTE)
0	0	X	OFF
0	1	L	$\overline{\text{TX DATA OUT}}$ ON, TX DATA OUT OFF
1	0	L	TX DATA OUT ON, $\overline{\text{TX DATA OUT}}$ OFF
1	1	X	OFF

NOTE: DRIVER OUTPUT terminals are in the high impedance mode during OFF time, independent of INHIBIT status.

RECEIVER OPERATING MODE

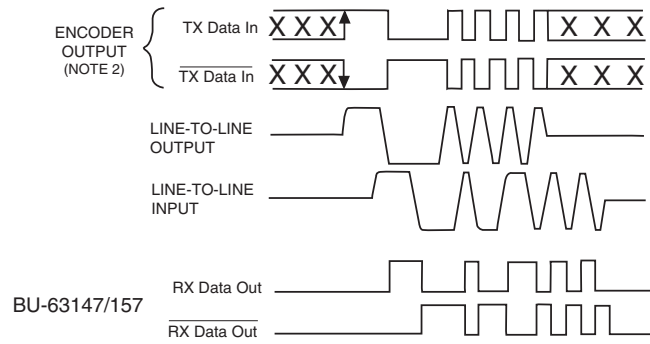
The receiver section accepts data from a MIL-STD-1553 Data Bus when coupled to the Data Bus as shown in FIGURE 3. This data is converted to bi-phase TTL and furnished to RX DATA OUT and $\overline{\text{RX DATA OUT}}$.

When STROBE is high data passes through the receiver to RX DATA OUT and $\overline{\text{RX DATA OUT}}$. Applying a low to STROBE disables the receiver output terminals.

As illustrated in FIGURE 2, the receiver in the BU-65147/157 provides compatibility to the Harris decoder.

WAVEFORMS

FIGURE 2 illustrates the BU-63147/157 with Harris type decoder interface. Note that DATA and $\overline{\text{DATA}}$ inputs must be complementary waveforms with a 50% duty cycle.



Notes:

- (1) TX Data In and RX Data Out are TTL signals.
- (2) TX Data In inputs must be at opposite logic levels during transmission, and at the same logic level when not transmitting.
- (3) LINE-TO-LINE output voltage is measured between TX Data Out and $\overline{\text{TX Data Out}}$.
- (4) LINE-TO-LINE input voltage is measured on the Data Bus.

FIGURE 2. WAVEFORMS FOR HARRIS TYPE ENCODER/DECODERS

TRANSFORMERS

In selecting isolation transformers to be used with the BU-63147/157, there is a limitation on the maximum amount of leakage inductance. If this limit is exceeded, the transmitter rise and fall times may increase, possibly causing the bus amplitude to fall below the minimum level required by MIL-STD-1553. In addition, an excessive leakage imbalance may result in a transformer dynamic offset that exceeds 1553 specifications.

The maximum allowable leakage inductance is 6.0 μ H, and is measured as follows:

The side of the transformer that connects to the BU-63147/157 is defined as the "primary" winding. If one side of the primary is shorted to the primary center-tap, the inductance should be measured across the "secondary" (stub side) winding. This

inductance must be less than 6.0 μ H. Similarly, if the other side of the primary is shorted to the primary center-tap, the inductance measured across the "secondary" (stub side) winding must also be less than 6.0 μ H.

The difference between these two measurements is the "differential" leakage inductance. This value must be less than 1.0 μ H.

Beta Transformer Technology Corporation (BTTC), a subsidiary of DDC, manufactures transformers in a variety of mechanical configurations with the required turns ratios of 1:2.5 direct coupled, and 1:1.79 transformer coupled. TABLE 5 provides a listing of many of these transformers.

For further information, contact BTTC at 631-244-7393 or at www.btcc-beta.com.

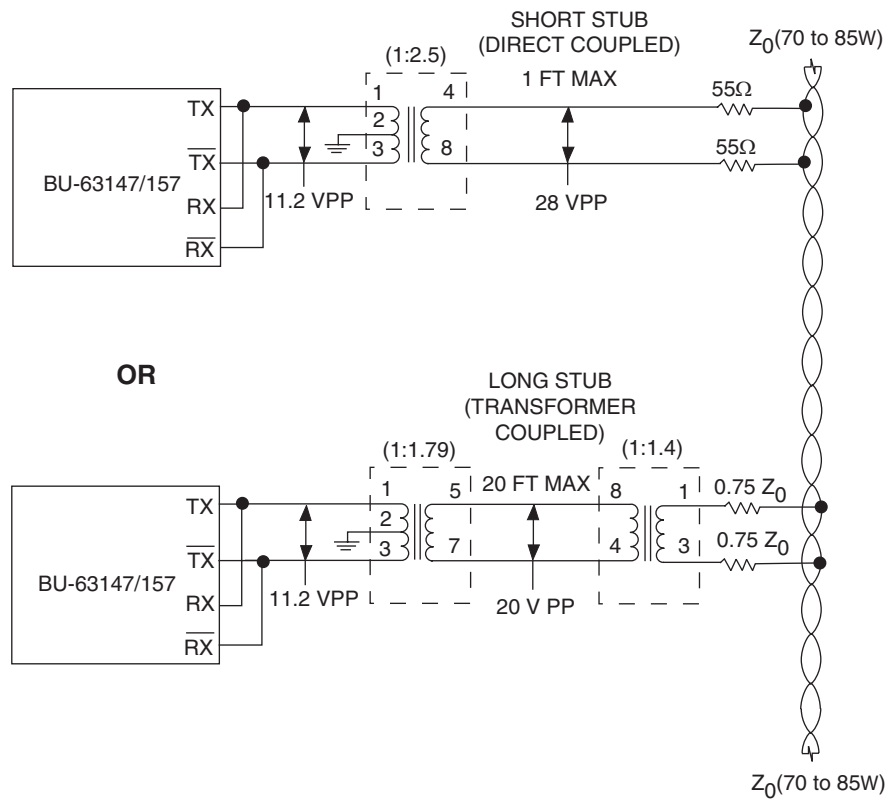
TABLE 5. BTTC TRANSFORMERS FOR USE WITH BU-63147/157

BTTC PART NUMBER	# OF CHANNELS, CONFIGURATION	COUPLING RATIO DESCRIPTION	COUPLING RATIO (1:X)	MOUNTING	MAX HEIGHT	WIDTH (INCLUDING LEADS)	LENGTH (INCLUDING LEADS)
MLP-2005	Single	Direct	(1:2.5)	SMT	0.185"	0.4"	0.52"
MLP-3005	Single	Direct	(1:2.5)	Through Hole	0.185"	0.4"	0.4"
B-3230 (-30) #	Single	Direct	(1:2.5)	Through Hole	0.25"	0.35"	0.5"
MLP-2205	Single	Transformer	(1:1.79)	SMT	0.185"	0.4"	0.52"
MLP-3205	Single	Transformer	(1:1.79)	Through Hole	0.185"	0.4"	0.4"
B-3229 (-29) #	Single	Transformer	(1:1.79)	Through Hole	0.25"	0.35"	0.5"
HLP-6015 #	Single	Direct & Transformer	(1:2.5) & (1:1.79)	SMT	0.19"	0.63"	1.13"
B-3227 (-27) #	Single	Direct & Transformer	(1:2.5) & (1:1.79)	SMT	0.29"	0.63"	1.13"
MLP-3305	Single	Direct & Transformer	(1:2.5) & (1:1.79)	Through Hole	0.185"	0.4"	0.4"
B-3226 (-26) #	Single	Direct & Transformer	(1:2.5) & (1:1.79)	Through Hole	0.25"	0.625"	0.625"
HLP-6014 #	Single	Direct & Transformer	(1:2.5) & (1:1.79)	Flat Pack	0.19"	0.63"	1.13"
B-3231 (-31) #	Single	Direct & Transformer	(1:2.5) & (1:1.79)	Flat Pack	0.29"	0.63"	1.13"
DSS-2005	Dual (Side-by-Side)	Direct	(1:2.5)	SMT	0.13"	0.72"	0.96"
DSS-2205	Dual (Side-by-Side)	Transformer	(1:1.79)	SMT	0.13"	0.72"	0.96"
DSS-1005	Dual (Side-by-Side)	Direct & Transformer	(1:2.5) & (1:1.79)	SMT	0.165"	0.72"	0.96"
TSM-2005	Dual (Stacked)	Direct	(1:2.5)	SMT	0.32"	0.4"	0.52"
TSM-2205	Dual (Stacked)	Transformer	(1:1.79)	SMT	0.32"	0.4"	0.52"
TST-9117 #	Dual (Stacked)	Direct & Transformer	(1:2.5) & (1:1.79)	SMT	0.335"	1.125"	1.125"
TST-9107 #	Dual (Stacked)	Direct & Transformer	(1:2.5) & (1:1.79)	Through Hole	0.335"	0.625"	0.625"
TST-9127 #	Dual (Stacked)	Direct & Transformer	(1:2.5) & (1:1.79)	Flat Pack	0.335"	0.625"	0.625"

Notes:

1. All Transformers in the table above can be used with BU-6XXXXX3/6 (1553B transceivers).
2. Transformers identified with "#" in the table above are not recommended for use with the BU-6XXXXX4 (McAir-Compatable transceivers)

TABLE 6. BU-63147/157 PIN LISTING			
PIN	FUNCTION	PIN	FUNCTION
1	TX Data Out A	19	NC
2	$\overline{\text{TX}}$ Data Out A	20	RX Data In B
3	GND A	21	$\overline{\text{RX}}$ Data In B
4	NC	22	GND B
5	RX Data Out A	23	NC
6	RX Strobe A	24	+5 VDC B
7	GND A	25	TX Inhibit B
8	$\overline{\text{RX}}$ Data Out A	26	TX Data In B
9	GND (case)	27	$\overline{\text{TX}}$ Data In B
10	TX Data Out B	28	NC
11	$\overline{\text{TX}}$ Data Out B	29	RX Data In A
12	GND B	30	$\overline{\text{RX}}$ Data In A
13	NC	31	GND A
14	RX Data Out B	32	NC
15	RX Strobe B	33	+5 VDC A
16	GND B	34	TX Inhibit A
17	$\overline{\text{RX}}$ Data Out B	35	TX Data In A
18	NC	36	$\overline{\text{TX}}$ Data In A



Notes:
One half of dual transceivers shown.

FIGURE 3. INTERFACE TO 1553 BUS

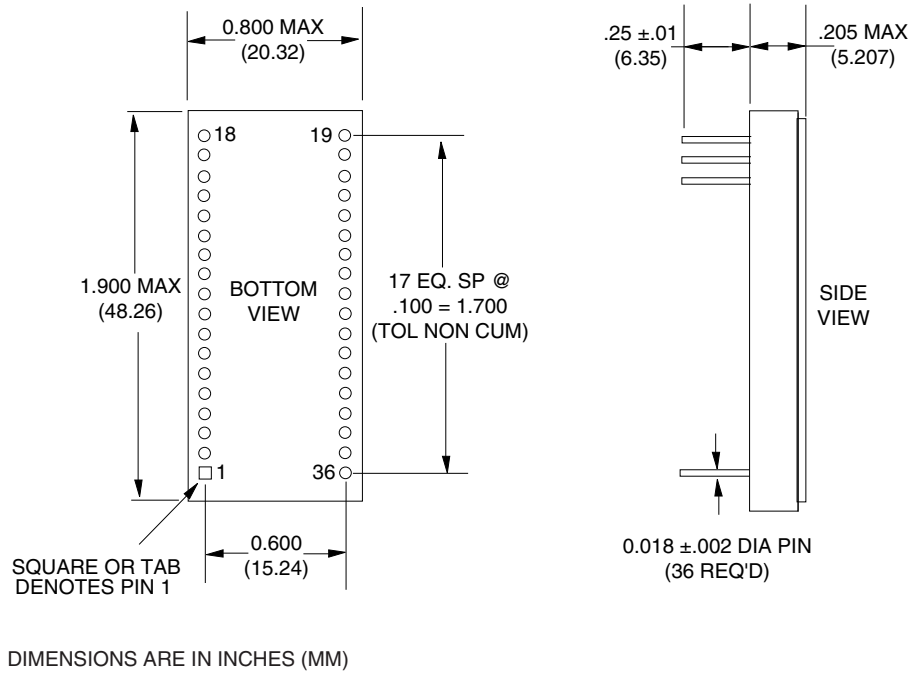


FIGURE 4. BU-63147/157DX MECHANICAL OUTLINE, DIP

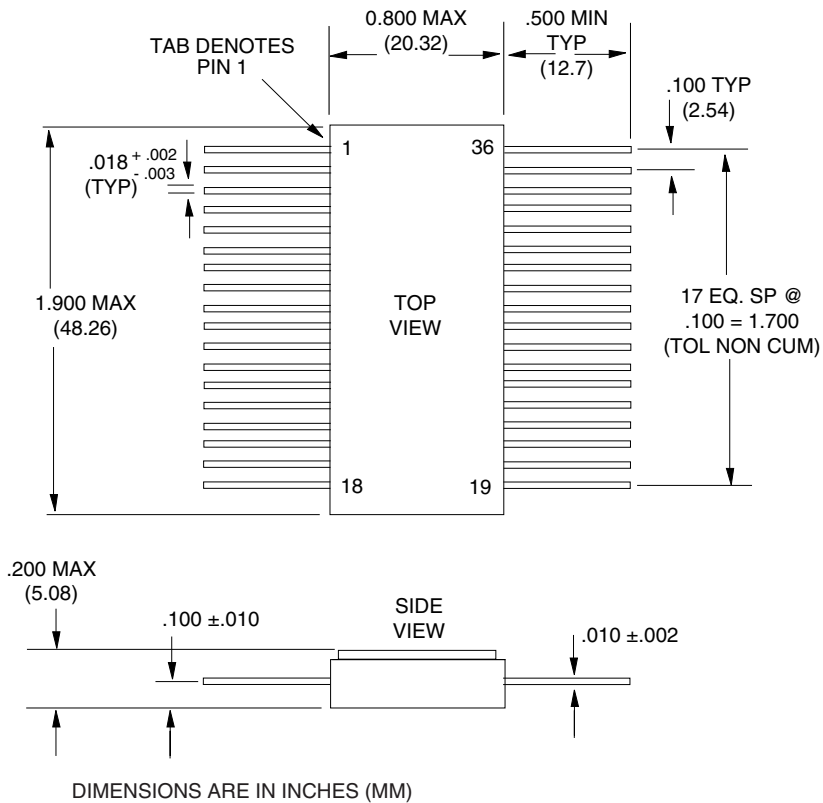


FIGURE 5. BU-63147/157FX MECHANICAL OUTLINE, FLAT PACK

ORDERING INFORMATION

BU-6314XD3-120X

Supplemental Process Requirements:

- S = Pre-Cap Source Inspection
- L = 100% Pull Test (Standard on BU-63157)
- Q = 100% Pull Test and Pre-Cap Source Inspection
- K = One Lot Date Code
- W = One Lot Date Code and Pre-Cap Source Inspection
- Y = One Lot Date Code and 100% Pull Test
- Z = One Lot Date Code, Pre-Cap Source Inspection, and 100% Pull Test
- Blank = None of the above

Test Criteria:

- 0 = Standard Testing
- 1 = X-Ray
- 2 = MIL-STD-1760 Amplitude Compliant
(Note: The -XX2 option is not available for the BU-63147/X4 version or BU-63157.)
- 3 = MIL-STD-1760 and X-Ray
(Note: The -XX3 option is not available for the BU-63147/X4 version.)

Process Requirements:

- 0 = Standard DDC Processing, no Burn-In
- 1 = MIL-PRF-38534 Compliant (notes 2, 3)
- 2 = B (note 1)
- 3 = MIL-PRF-38534 Compliant (notes 2, 3) with PIND Testing
- 4 = MIL-PRF-38534 Compliant (notes 2, 3) with Solder Dip
- 5 = MIL-PRF-38534 Compliant (notes 2, 3) with PIND Testing and Solder Dip
- 6 = B (note 1) with PIND Testing
- 7 = B (note 1) with Solder Dip
- 8 = B (note 1) with PIND Testing and Solder Dip
- 9 = Standard DDC Processing with Solder Dip, no Burn-In

Temperature Grade/Data Requirements:

- 1 = -55°C to +125°C
- 2 = -40°C to +85°C
- 3 = 0°C to +70°C
- 4 = -55°C to +125°C with Variables Test Data
- 5 = -40°C to +85°C with Variables Test Data
- 6 = Custom Part (Reserved)
- 7 = Custom Part (Reserved)
- 8 = 0°C to +70°C with Variables Test Data

Rise/Fall Times Option:

- 3 = + 5 Volt, rise/fall times = 100 to 300 ns (-1553B)
- 4 = + 5 Volt, rise/fall times = 200 to 300 ns (-1553B and McAir compatible)(not available with Test Criteria Option "2" MIL-STD-1760 Amplitude Compliant or BU-63157)

Package Type:

- D = DIP Package
- F = Flat Pack

Base Product Type:

- BU-63147 = 5V Dual Transceiver, HARRIS Compatible
- BU-63157 = 5V RAD-Tolerant, Dual Transceiver, Harris Compatible

Notes:

1. Standard DDC processing with burn-in and full temperature test. See table on next page.
2. MIL-PRF-38534 product grading is designated with the following dash numbers:
 - Class H is a -11X, 13X, 14X, 15X, 41X, 43X, 44X, 45X
 - Class G is a -21X, 23X, 24X, 25X, 51X, 53X, 54X, 55X
 - Class D is a -31X, 33X, 34X, 35X, 81X, 83X, 84X, 85X
3. Standard processing on BU-63157 includes 320 hours of burn-in and 100% non-destruct pull-test (SEE Table 3).
4. The above products contain tin-lead solder finish as applicable to solder dip requirements.

STANDARD DDC PROCESSING FOR HYBRID AND MONOLITHIC HERMETIC PRODUCTS		
TEST	MIL-STD-883	
	METHOD(S)	CONDITION(S)
INSPECTION	2009, 2010, 2017, and 2032	—
SEAL	1014	A and C
TEMPERATURE CYCLE	1010	C
CONSTANT ACCELERATION	2001	3000g
BURN-IN	1015 (note 1), 1030 (note 2)	TABLE 1

Notes:

1. For Process Requirement "B*" (refer to ordering information), devices may be non-compliant with MIL-STD-883, Test Method 1015, Paragraph 3.2. Contact factory for details.
2. When applicable.

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