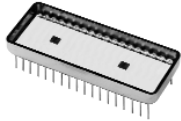


MIL-STD-1553 DATA BUS +5V TRANSCEIVER



DESCRIPTION

The BU-63147/49 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 or Smiths type decoder interface, completely independent dual redundant operation, and small size (36-pin DIP). The receiver section of the BU-63147/49 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.

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**
- **HARRIS or SMITHS I/O Compatibility**

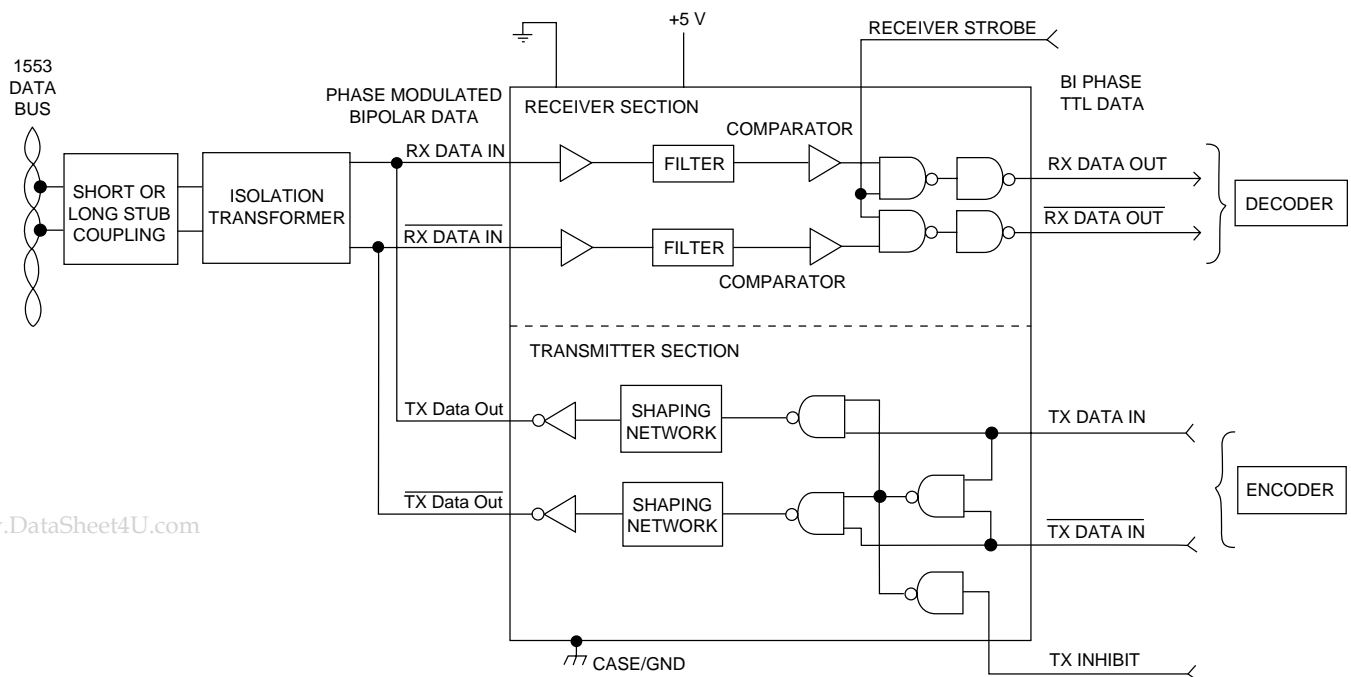


FIGURE 1. BU-63147/49 BLOCK DIAGRAM (one channel shown)

TABLE 1. BU-63147/49 SPECIFICATIONS				
PARAMETER	MIN	TYP	MAX	UNITS
ABSOLUTE MAXIMUM RATING				
Supply Voltage ■ +5 V (Vcc)	-0.3	5.0	7.0	V
Receiver ■ Input Voltage			20	Vp-p differential
Logic ■ Voltage Input Range	-0.3		Vcc+10%	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 Ω, Measured on Bus ■ Transformer Coupled Across 70 Ω, Measured on Stub: • BU-63147XX-XX0 • BU-63147X3-XX2 (Note 9)	6	7	9	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-63147X3 • BU-63147X4	100 200	150 250	300 300	ns ns
LOGIC				
V _{IH}	2.0			V
V _{IL}			0.8	V
I _{IH} T _x Data In, T _x Inhibit R _x Strobe	20		100	μA
I _{IL} T _x Data In, T _x Inhibit R _x Strobe	-100		-20	μA
V _{OH} (Vcc=4.75V, I _{OH} =max)	2.4			V
V _{OL} (Vcc=4.75V, I _{OL} =max)			0.4	V
I _{OL}	3.4			mA
I _{OH}			-3.4	mA
POWER SUPPLY REQUIREMENTS				
Voltages/Tolerances ■ +5V	4.75	5.0	5.5	V
Current Drain (Total Hybrid) BU-63147/9XX-XX0 • Idle (Both Channels) • 25% Transmitter Duty Cycle (One Channel) • 50% Transmitter Duty Cycle (One Channel) • 100% Transmitter Duty Cycle (One Channel)			100 205 310 520	mA mA mA mA
BU-63147/9X3-XX2 • Idle (Both Channels) • 25% Transmitter Duty Cycle (One Channel) • 50% Transmitter Duty Cycle (One Channel) • 100% Transmitter Duty Cycle (One Channel)			100 216 332 565	mA mA mA mA

TABLE 1. BU-63147/49 SPECIFICATIONS				
PARAMETER	MIN	TYP	MAX	UNITS
POWER DISSIPATION (Note 10)				
Total Hybrid				
BU-63147/9XX-XX0 • Idle (Both Channels) • 25% Transmitter Duty Cycle (One Channel) • 50% Transmitter Duty Cycle (One Channel) • 100% Transmitter Duty Cycle (One Channel)			0.55 0.78 1.00 1.44	W W W W
BU-63147/9X3-XX2 • Idle (Both Channels) • 25% Transmitter Duty Cycle (One Channel) • 50% Transmitter Duty Cycle (One Channel) • 100% Transmitter Duty Cycle (One Channel)			0.55 0.84 1.13 1.70	W W W W
Hottest Die				
BU-63147/9XX-XX0 • Idle (Both Channels) • 25% Transmitter Duty Cycle (One Channel) • 50% Transmitter Duty Cycle (One Channel) • 100% Transmitter Duty Cycle (One Channel)			0.28 0.51 0.75 1.22	W W W W
BU-63147/9X3-XX2 • Idle (Both Channels) • 25% Transmitter Duty Cycle (One Channel) • 50% Transmitter Duty Cycle (One Channel) • 100% Transmitter Duty Cycle (One Channel)			0.28 0.58 0.88 1.48	W W W W
THERMAL				
• Thermal Resistance, Junction-to- Case, Hottest Die (θ _{JC}) • Operating Junction Temperature • Storage Temperature • Lead Temperature (soldering, 10 sec.)	-55 -65		12 150 150 +300	°C/W °C °C °C
PHYSICAL CHARACTERISTICS				
Size 36-Pin DIP			1.895 x 0.775 x 0.210 (48.1 x 19.7 x 5.3)	in. (mm)
36-Lead Flat pack			1.905 x 0.785 x 0.165 (48.4 x 19.9 x 4.2)	in. (mm)
Weight		0.6 (17)		oz (g)

Notes:

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

- (1) Specifications include both transmitter and receiver (assumed tied together externally).
- (2) Impedance parameters are specified directly between pins TX/RX A(B) and TX/RX A(B) hybrid.
- (3) 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.

Notes (continued)

- (4) The specifications are applicable for both unpowered and powered conditions.
- (5) The specifications assume a 2 volt rms balanced, differential, sinusoidal input. The applicable frequency range is 75 kHz to 1 MHz.
- (6) Minimum resistance and maximum capacitance parameters are guaranteed over the operating range, but are not tested.
- (7) 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.
- (8) 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.
- (9) 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 version.
- (10) 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.

INTRODUCTION

The BU-63147/49 is a dual redundant transmitter and receiver packaged in a 36-pin DDIP. 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-63147/49 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 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 TX DATA IN to the same logic level. The operating modes are shown in TABLE 2.

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.

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

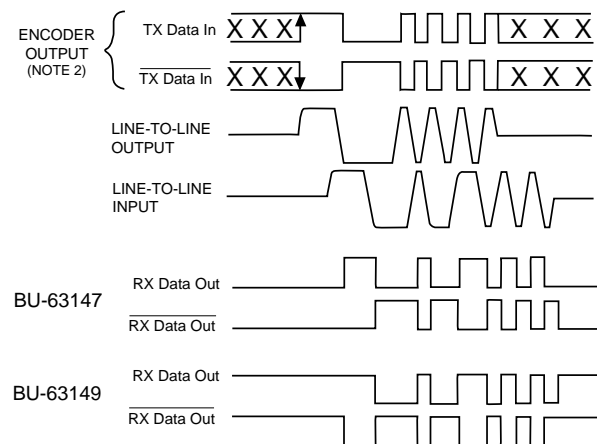
The receiver section accepts data from a MIL-STD-1553 Data Bus when coupled to the Data Bus as shown in FIGURE 3. This data is converted to bi-phase TTL and furnished to RX DATA OUT and RX DATA OUT.

When STROBE is high data passes through the receiver to RX DATA OUT and RX DATA OUT. Applying a low to STROBE disables the receiver output terminals.

As illustrated in FIGURE 2, the receiver in the BU-65147 provides compatibility to the Harris decoder, while the BU-63149 provides compatibility to the Smiths decoder.

WAVEFORMS

FIGURE 2 illustrates the BU-63147 with Harris type decoder interface and the BU-63149 with Smiths 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 TX Data Out.
 - (4) LINE-TO-LINE input voltage is measured on the Data Bus.

FIGURE 2. WAVEFORMS FOR HARRIS/SMITHS TYPE ENCODER/DECODERS

TRANSFORMERS

In selecting isolation transformers to be used with the BU-63147/49, 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-63147/49 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 3 provides a listing of many of these transformers.

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

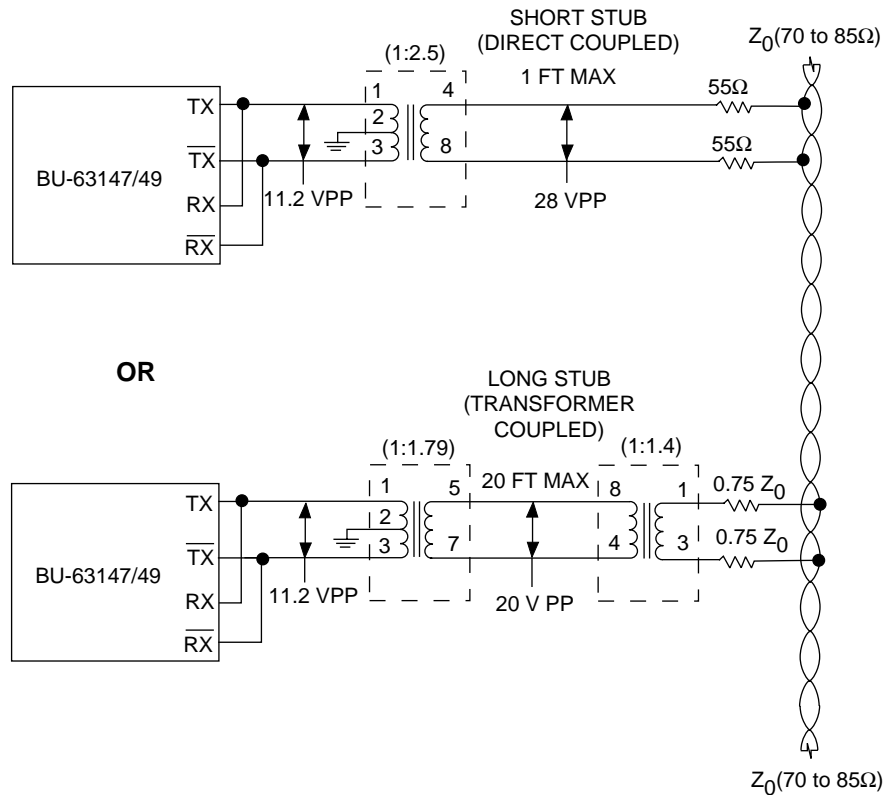
TABLE 3. BTTC TRANSFORMERS FOR USE WITH BU-63147/49

TRANSFORMER CONFIGURATION	BTTC PART NO.
Single epoxy transformer, through-hole, 0.625" X 0.625", 0.250" max height	B-3067 B-3226
Single epoxy transformer, through-hole, 0.625" X 0.625", 0.220" max height. May be used with BU-63147/49X4-XX0 versions.	B-3818
Single epoxy transformer, flat pack, 0.625" X 0.625", 0.275" max height	B-3231
Single epoxy transformer, surface mount, 0.625" X 0.625", 0.275" max height	B-3227
Single epoxy transformer, surface mount, hi-temp solder, 0.625" X 0.625", 0.220" max height. May be used with BU-63147/49X4-XX0 versions.	B-3819
Single epoxy transformer, flat pack, 0.625" X 0.625", 0.150" max height	LPB-5014
Single epoxy transformer, surface mount, 0.625" X 0.625", 0.150" max height	LPB-5015
Single epoxy transformer, through hole, transformer coupled only, 0.500" X 0.350", 0.250" max height	B-3229
Dual epoxy transformer, twin stacked, 0.625" X 0.625", 0.280" max height	TST-9007
Dual epoxy transformer, twin stacked, surface mount, 0.625" X 0.625", 0.280" max height	TST-9017
Dual epoxy transformer, twin stacked, flat pack, 0.625" X 0.625", 0.280" max height	TST-9027
Dual epoxy transformer, side by side, through-hole, 0.930" X 0.630", 0.155" max height	B-3300
Dual epoxy transformer, side by side, flat pack, 0.930" X 0.630", 0.155" max height	B-3261
Dual epoxy transformer, side by side, surface mount, 0.930" X 0.630", 0.155" max height	B-3310
Dual epoxy transformer, side by side, surface mount, 1.410" X 0.750", 0.130" max height	DLP-7115 (see note 2)
Single metal transformer, hermetically sealed, flat pack, 0.630" X 0.630", 0.175" max height	HLP-6014
Single metal transformer, hermetically sealed, surface mount, 0.630" X 0.630", 0.175" max height	HLP-6015
NOT RECOMMENDED	DLP-7014 SLP-8007 SLP-8024

Notes:

1. For the BU-63147/49X4-XX0 versions (McAir-compatible transceivers) only the B-3818 or B-3819 transformers (shown in **bold** in the table) may be used.
2. DLP-7115 operates to +105°C max. All other transformers listed operate to +130°C max.

TABLE 4. BU-63147/49 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

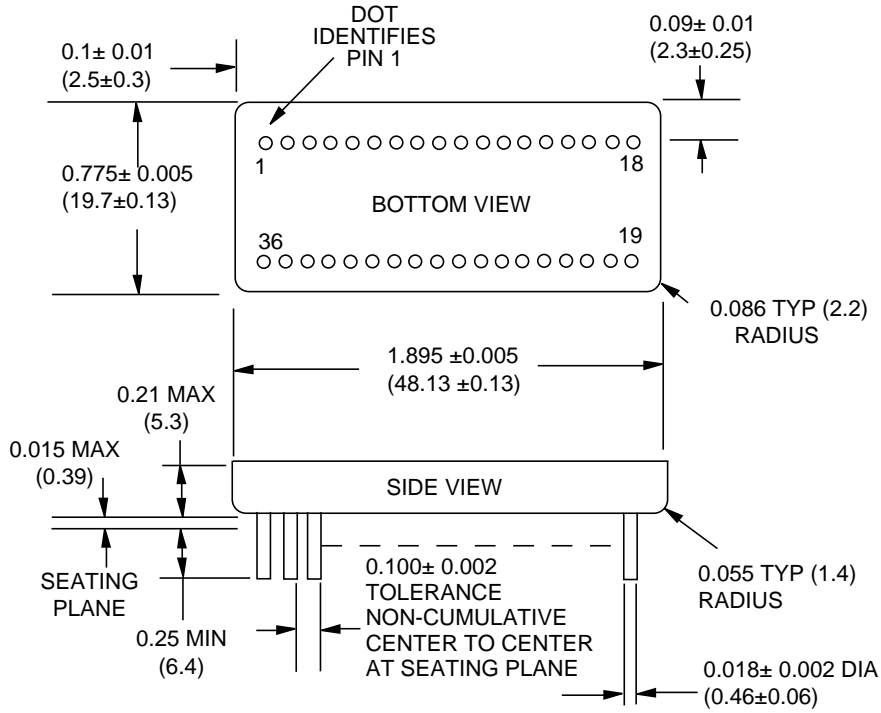


FIGURE 4. BU-63147D3/D4 and BU-63149D3/D4 MECHANICAL OUTLINE, DIP

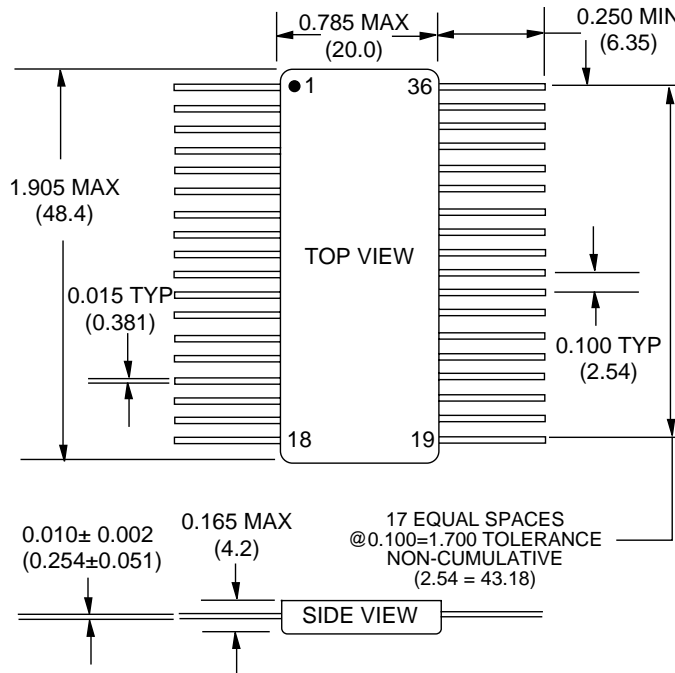


FIGURE 5. BU-63147F3/F4 and BU-63149F3/F4 MECHANICAL OUTLINE, FLAT PACK

ORDERING INFORMATION

BU-63147D3-120X

Supplemental Process Requirements:

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

Test Criteria:

- 0 = Standard Testing
- 2 = MIL-STD-1760 Amplitude Compliant
(Note: The -XX2 option is **not** available for the BU-63147/49X4 version.)

Process Requirements:

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

Package Type:

- D = DIP Package
- F = Flat Pack

Base Product Type:

- BU-63147 = 5V Dual Transceiver, HARRIS Compatible
- BU-63149 = 5V Dual Transceiver, SMITHS Compatible

*Standard DDC Processing with burn-in and full temperature test, see table below.

STANDARD DDC PROCESSING		
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	A
BURN-IN	1015, Table 1	—

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