# MIL-STD-1553 DATA BUS +5V TRANSCEIVER
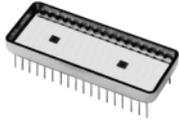
DESCRIPTION

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.

RX DATA OUT and $\overline{\text{RX DATA OUT}}$ These 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**
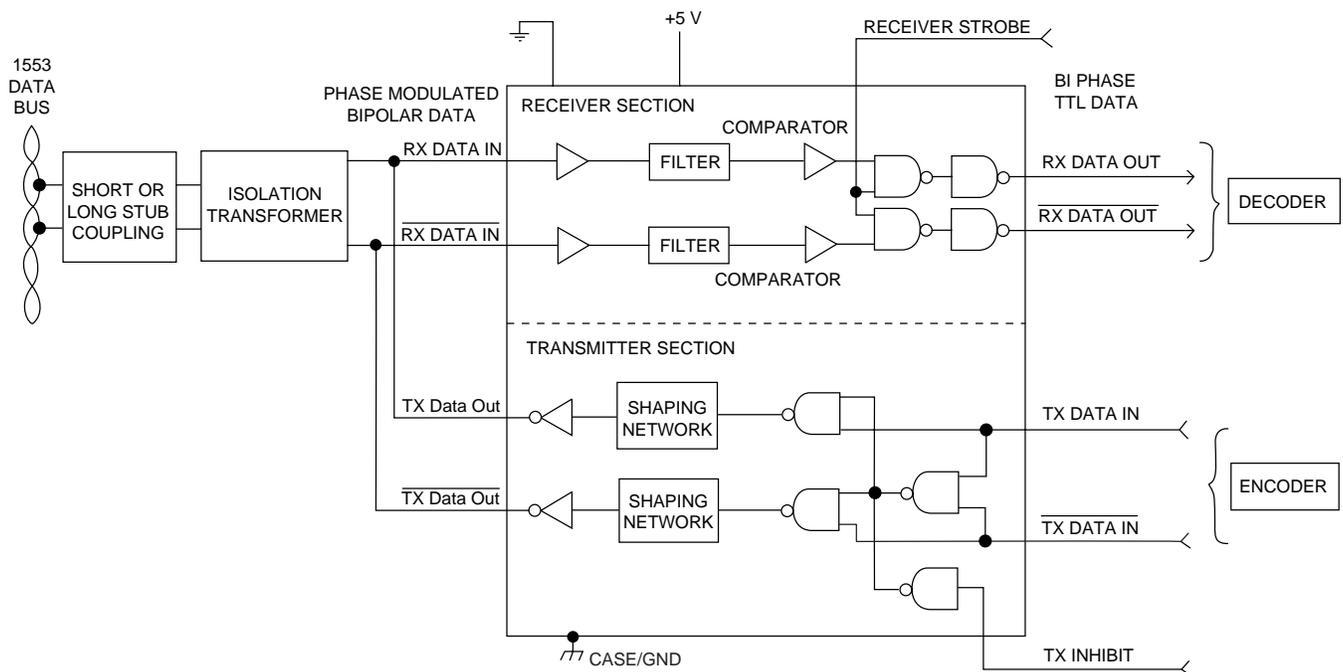
FIGURE 1. BU-63147/49 BLOCK DIAGRAM (one channel shown)

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	6	7	9	Vp-p
■ Transformer Coupled Across 70 Ω, Measured on Stub:				
• BU-63147XX-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-63147X3	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
T_x Data In, T_x Inhibit R_x Strobe				
I_{IL}	-100		-20	µA
T_x Data In, T_x Inhibit R_x Strobe				
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)			100	mA
• 25% Transmitter Duty Cycle (One Channel)			205	mA
• 50% Transmitter Duty Cycle (One Channel)			310	mA
• 100% Transmitter Duty Cycle (One Channel)			520	mA
BU-63147/9X3-XX2				
• Idle (Both Channels)			100	mA
• 25% Transmitter Duty Cycle (One Channel)			216	mA
• 50% Transmitter Duty Cycle (One Channel)			332	mA
• 100% Transmitter Duty Cycle (One Channel)			565	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)			0.55	W
• 25% Transmitter Duty Cycle (One Channel)			0.78	W
• 50% Transmitter Duty Cycle (One Channel)			1.00	W
• 100% Transmitter Duty Cycle (One Channel)			1.44	W
BU-63147/9X3-XX2				
• Idle (Both Channels)			0.55	W
• 25% Transmitter Duty Cycle (One Channel)			0.84	W
• 50% Transmitter Duty Cycle (One Channel)			1.13	W
• 100% Transmitter Duty Cycle (One Channel)			1.70	W
Hottest Die				
BU-63147/9XX-XX0				
• Idle (Both Channels)			0.28	W
• 25% Transmitter Duty Cycle (One Channel)			0.51	W
• 50% Transmitter Duty Cycle (One Channel)			0.75	W
• 100% Transmitter Duty Cycle (One Channel)			1.22	W
BU-63147/9X3-XX2				
• Idle (Both Channels)			0.28	W
• 25% Transmitter Duty Cycle (One Channel)			0.58	W
• 50% Transmitter Duty Cycle (One Channel)			0.88	W
• 100% Transmitter Duty Cycle (One Channel)			1.48	W
THERMAL				
• Thermal Resistance, Junction-to-Case, Hottest Die (θJC)			25	°C/W
• Operating Junction Temperature	-55		150	°C
• Storage Temperature	-65		150	°C
• Lead Temperature (soldering, 10 sec.)			+300	°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 Flatpack		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.

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 compatability, 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 $\overline{\text{TX DATA OUT}}$ 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 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.

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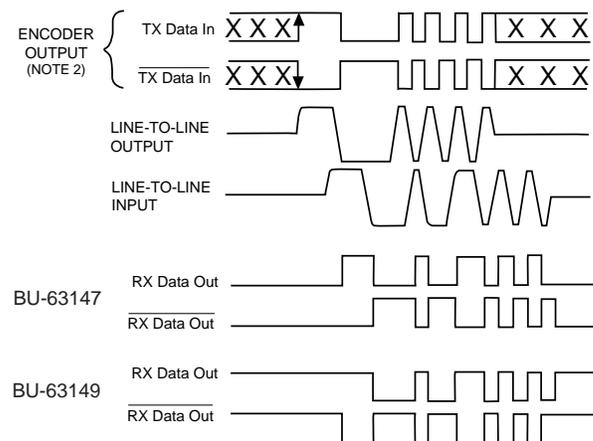
Notes:
(1) TX Data In and RX Data Out are TTL signals.
(2) TX Data In inputs must be at opposite logic levels during transmission, and at the same logic level when not transmitting.
(3) LINE-TO-LINE output voltage is measured between TX Data Out and $\overline{\text{TX Data Out}}$.
(4) LINE-TO-LINE input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

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

SHORT STUB
(DIRECT COUPLED)
1 FT MAX

Z_0(70 to 85Ω)

(1:2.5)

BU-63147/49

TX
$\overline{TX}$
RX
$\overline{RX}$

11.2 VPP

28 VPP

55Ω
55Ω

OR

LONG STUB
(TRANSFORMER
COUPLED)

(1:1.79)   20 FT MAX   (1:1.4)

BU-63147/49

TX
$\overline{TX}$
RX
$\overline{RX}$

20 V PP

0.75 Z_0
0.75 Z_0

Z_0(70 to 85Ω)
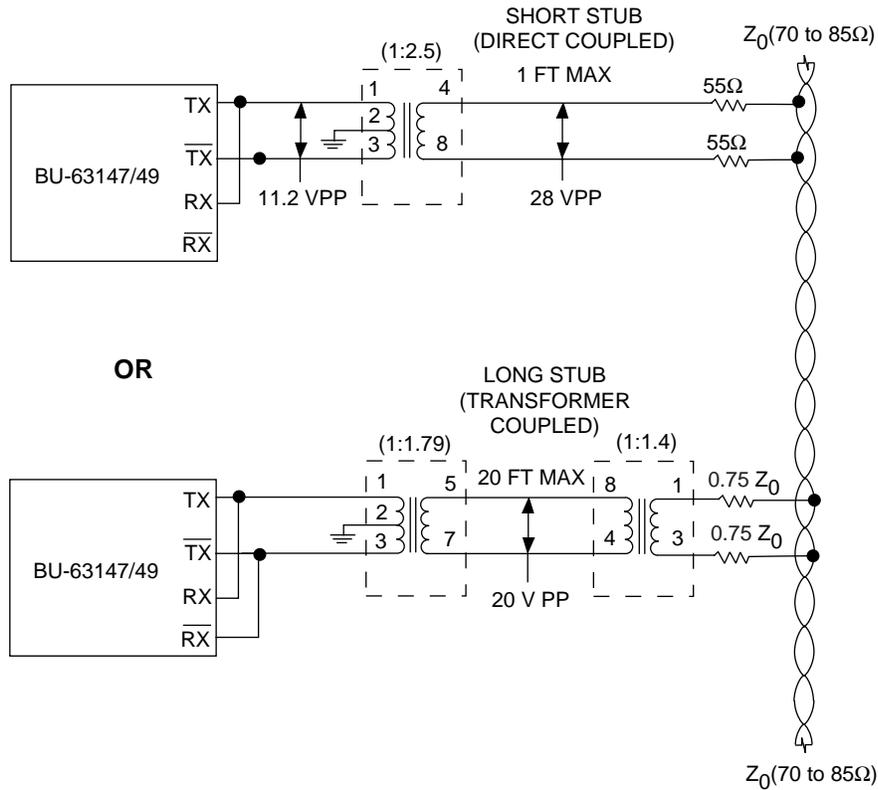
Notes:
One half of dual transceivers shown.

FIGURE 3. INTERFACE TO 1553 BUS

PULSE TRANSFORMERS

Interfacing the BU-63147/49 to a MIL-STD-1553 bus requires a pair of pulse transformers. Beta Transformer Technology Corporation (BTTC), a subsidiary of DDC, manufactures trans-formers in a variety of mechanical configurations with the required turns ratios of 1:2.5 direct coupled, or 1:1.79 trans-former coupled. Table 3 provides a listing of many of these. For further information, contact BTTC at 631-244-7393 or at www.bttc-beta.com.

NOTES:

1.   For the BU-63147/49X**4**-XX**0** versions, which include McAIR compatible transceivers, **only** the B-3818 or B-3819 transformers (shown in **bold** in the table) may be used.

2.   For the BU-63147/49X3-XXX versions with 1553B (and possibly 1760) transceivers, **any** of the other transformers listed may be used.

3.   There are **no** BU-63147/49X4-XX2 versions.

TABLE 3. RECOMMENDED BTTC TRANSFORMERS FOR USE WITH BU-63147/49 TRANSCEIVERS	
TRANSFORMER CONFIGURATION	**BTTC PART NO.**
Single epoxy transformer, through-hole, 0.625 X 0.625, 0.250" max height	B-3226
Single epoxy transformer, through-hole, 0.625 X 0.625, 0.220" max height. **(May be used with BU-63147/49X4-XX0 version.)**	**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 version.)**	**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
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
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

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	$\overline{\text{TX Data In A}}$

DOT
IDENTIFIES
PIN 1

0.1± 0.01
(2.5±0.3)

0.09± 0.01
(2.3±0.25)

0.775± 0.005
(19.7±0.13)

1   BOTTOM VIEW   18

36   19

0.086 TYP (2.2)
RADIUS

1.895 ±0.005
(48.13 ±0.13)

0.21 MAX
(5.3)

0.015 MAX
(0.39)

SIDE VIEW

SEATING
PLANE

0.100± 0.002
TOLERANCE
NON-CUMULATIVE
CENTER TO CENTER
AT SEATING PLANE

0.055 TYP (1.4)
RADIUS

0.25 MIN
(6.4)

0.018± 0.002 DIA
(0.46±0.06)
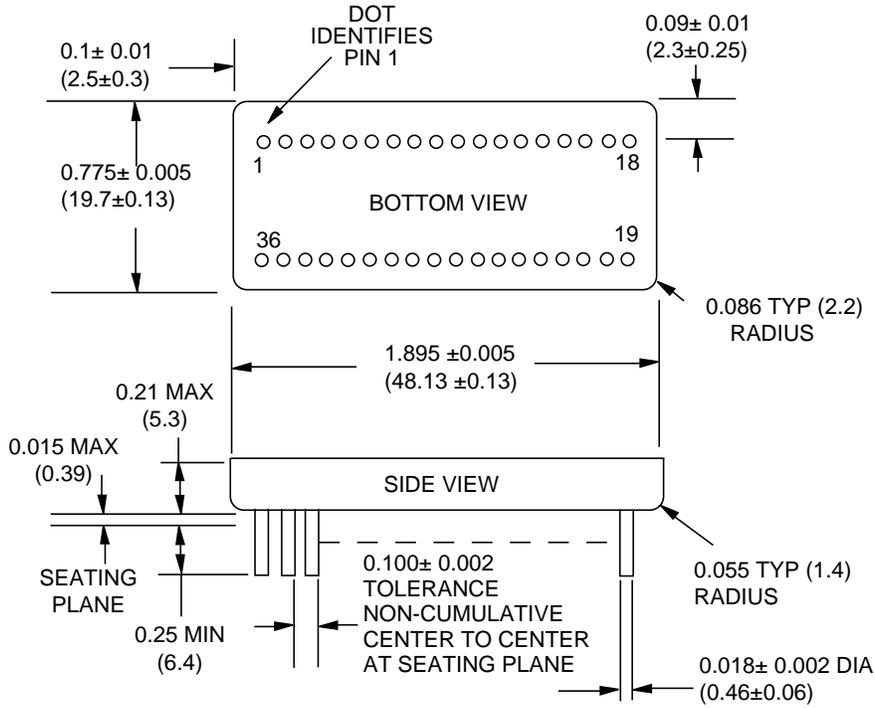
FIGURE 4. BU-63147D3/D4 and BU-63149D3/D4 MECHANICAL OUTLINE, DIP

0.785 MAX
(20.0)

0.250 MIN
(6.35)

1.905 MAX
(48.4)

●1   36

0.015 TYP
(0.381)

TOP VIEW

0.100 TYP
(2.54)

18   19

0.010± 0.002
(0.254±0.051)

0.165 MAX
(4.2)

17 EQUAL SPACES
@0.100=1.700 TOLERANCE
NON-CUMULATIVE
(2.54 = 43.18)

SIDE VIEW
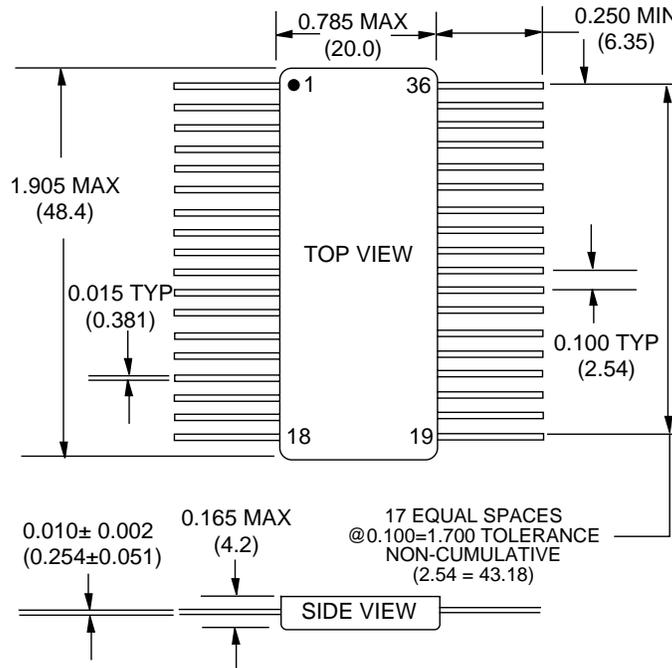
FIGURE 5. BU-63147F3/F4 and BU-63149F3/F4 MECHANICAL OUTLINE, FLATPACK

6

ORDERING INFORMATION

BU-63147D3-120X

Supplemental Process Requirements:
S = Pre-Cap Source Inspection
L = Pull Test
Q = Pull Text 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 = Rise/Fall times = 100 to 300 ns
4 = Rise/Fall times = 200 to 300 ns

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	—

The information in this data sheet is believed to be accurate; however, no responsibility is
assumed by Data Device Corporation for its use, and no license or rights are
granted by implication or otherwise in connection therewith.
Specifications are subject to change without notice.

DDC
®Data Device Corporation

105 Wilbur Place, Bohemia, New York 11716-2482

UL
®

DATA DEVICE CORPORATION
REGISTERED TO ISO 9001
FILE NO. A5976

A 04/00-500

PRINTED IN THE U.S.A.