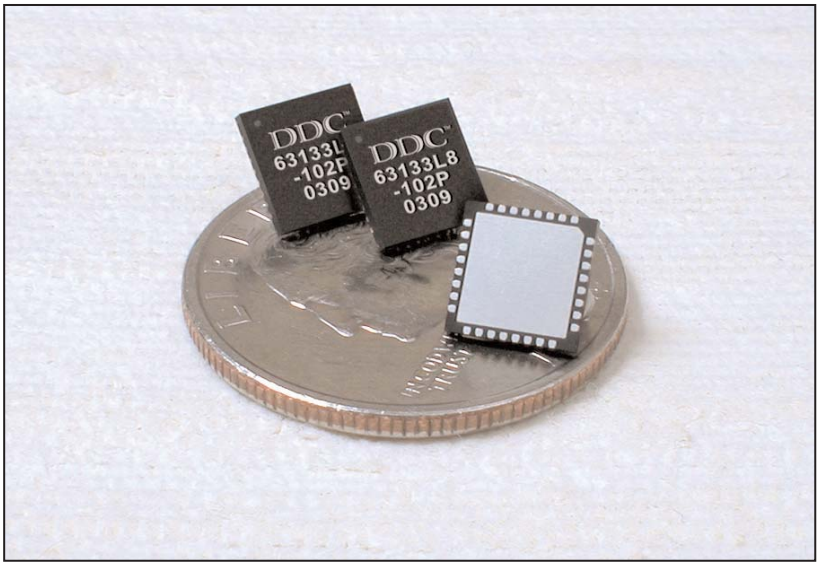
PRELIMINARY

BU-63133L8

MIL-STD-1553 DATA BUS 3.3 VOLT SINGLE TRANSCEIVER



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FEATURES

- World's smallest 3.3V MIL-STD-1553 Transceiver
- Requires Only 3.3V Power Supply
- -55°C to +125°C Operation
- 32-Pad LPCC
- 0.276" x 0.276" (7 X 7 mm) Body and Footprint Size
- 0.039" Inch Maximum Height
- Low Power Consumption
- Sleep Mode Allows Further Power Reduction
- Single Transceiver Allows Full Dual Redundancy

DESCRIPTION

The BU-63133 transceiver is a complete transmitter and receiver conforming fully to MIL-STD-1553A, 1553B, and 1760. The use of two BU-63133 transceivers provides full dual redundancy. Features include: +3.3V power supply voltage, Harris interface type, and a ultra low profile, small footprint, 32-pad Leadless Plastic Chip Carrier package (LPCC). The LPCC package provides an integral, exposed heatsink on the package bottom. This package allows 100% duty cycle operation at 125°C when the heatsink is soldered to an appropriately constructed PCB.

The receiver section of the BU-63133 accepts Manchester II data from a MIL-STD-1553 Data Bus and produces TTL level signals at its outputs: RX DATA OUT and $\overline{\text{RX DATA OUT}}$. These outputs represent positive and negative excursions 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 bipolar TTL signal data at its TX DATA IN and $\overline{\text{TX DATA IN}}$ inputs and produces Manchester II data at the TX DATA OUT and $\overline{\text{TX DATA OUT}}$ outputs.

When used with the recommended transformers, the transmitter typically produces 21 Vp-p for transformer coupled outputs and 7 Vp-p at the bus. An external input, TX INHIBIT, takes priority over the transmitter inputs and disables the transmitter when activated with a logic "1". The ultra small size, +3.3V power supply voltage, and compliance with MIL-STD-1553A, 1553B, and 1760 simplify engineering design, making it an excellent choice for interfacing with any MIL-STD-1553 system.

This Preliminary data sheet provides detailed functional capabilities for product currently in prototype production. These specifications are being provided to allow for electrical design, layout and operation.

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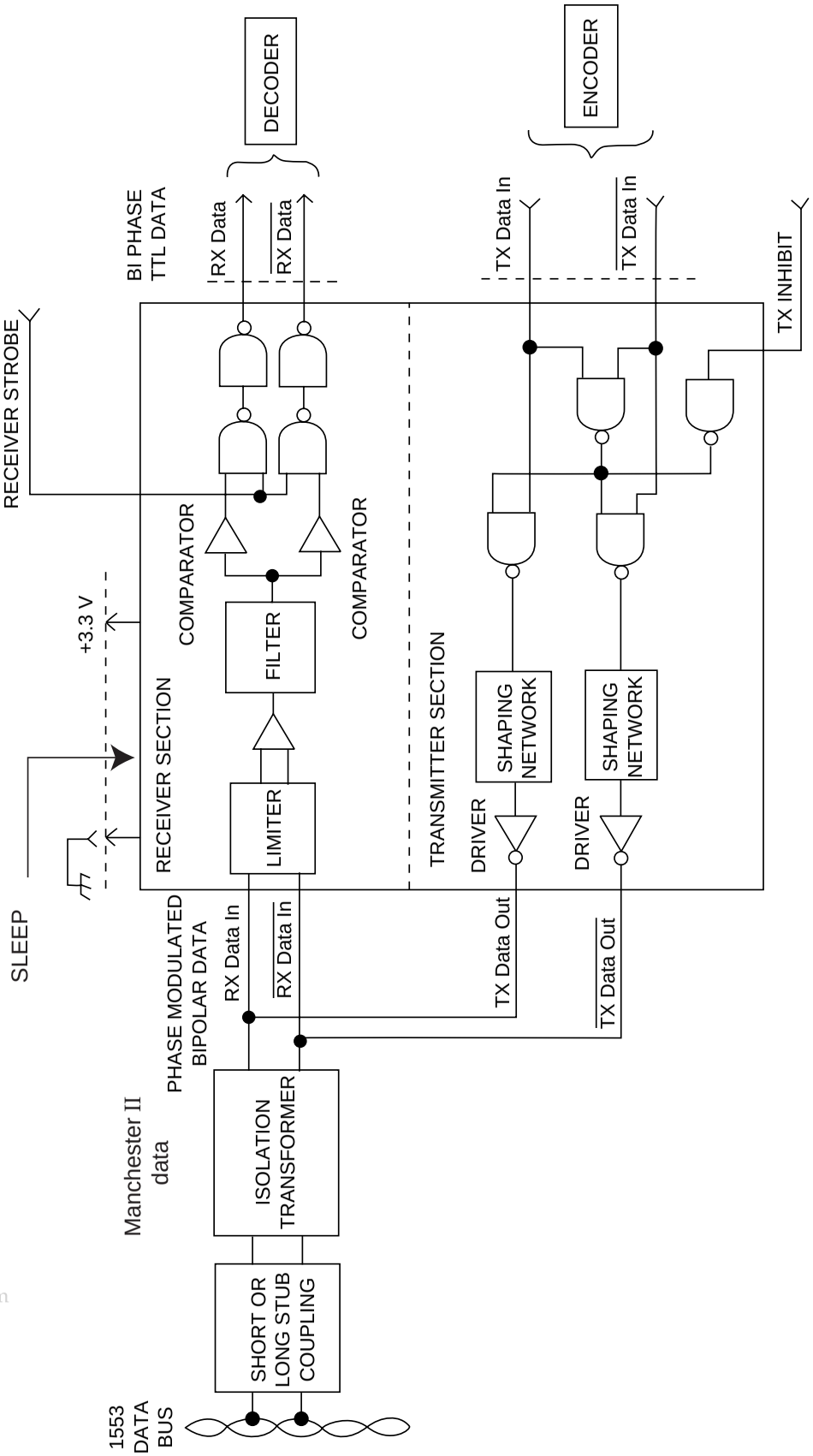


FIGURE 1. BU-63133 BLOCK DIAGRAM

TABLE 1. BU-63133L8 SPECIFICATIONS

PARAMETER	MIN	TYP	MAX	UNITS
ABSOLUTE MAXIMUM RATINGS				
Supply Voltage				
+3.3 V	-0.3		4.5	Vdc
RECEIVER				
Differential Input Resistance (Notes 1-6)	20			kOhm
Differential Input Capacitance (Notes 1-6, 14)			50	pF
Threshold voltage, transformer Coupled, Measured on Stub (Note 7)	0.200		0.860	Vp-p
Common-Mode Voltage (Note 8)			10	Vpeak
TRANSMITTER				
Differential Output Voltage				
Direct Coupled Across 35 Ohm, Measured on bus	6	7.1	9	Vp-p
Transformer Coupled Across 70 Ohm, Measured on Stub (Note 9)	20	21	27	Vp-p
Output Noise, differential (Direct coupled)			10	mVp-p
Output Offset Voltage, transformer Coupled Across 70 Ohm	-250		250	mVp
Rise/Fall Time	100	150	300	ns
LOGIC				
V_{IH}	0.7 x Vcc			V
V_{IL}			0.3 x Vcc	V
I_{IH} (TXIN, $\overline{TXIN}$, TXINHIBIT, SLEEP)	20		100	µA
I_{IH} (STROBE)			0	µA
I_{IL} (TXIN, $\overline{TXIN}$, TXINHIBIT, SLEEP)	0			µA
I_{IL} (STROBE)	-100		-20	µA
V_{OH} (I_{OH}=max)	Vcc - 0.4			V
V_{OL} (I_{OL}=min)			0.4	V
I_{OL}	2.0			mA
I_{OH}			-2.0	mA
POWER SUPPLY REQUIREMENTS				
Voltages/Tolerance				
+3.3V	3.15	3.3	3.45	V
Current Drain (Note 10)				
BU-63133G8-XX2				
• SLEEP asserted			6	mA
• Idle			33	mA
• 25% Duty Transmitter Cycle			225	mA
• 50% Duty Transmitter Cycle			417	mA
• 100% Duty Transmitter Cycle			800	mA
POWER DISSIPATION (NOTE 10 AND 11)				
• SLEEP asserted			0.02	W
• Idle			0.11	W
• 25% Duty Transmitter Cycle			0.43	W
• 50% Duty Transmitter Cycle			0.75	W
• 100% Duty Transmitter Cycle			1.40	W
THERMAL				
Thermal Resistance, Junction-to-Board (Note 13)		11.9	TBD	°C/W
Heat sink soldered to PC board (2s2p - JESD51-5)				
Operating Case Bottom Temperature	-55		+125	°C
Operating Junction Temperature	-55		+150	°C
Storage Temperature	-65		+150	°C
Pad Temperature (soldering, 10 sec.)			+300	°C
PHYSICAL CHARACTERISTICS				
Package Body Size	0.280 X 0.280 X 0.039 MAX			in.
32-pad LPCC	(7.1 x 7.1 x 1.0)			(mm)
Weight	0.0049			oz
	(0.14)			(g)

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 with no transformer).
(2) Impedance parameters are specified directly between pins TX/RX A(B) and TX/RX A(B) of the package.
(3) It is assumed that all power and ground inputs to the package are connected.
(4) The specifications are applicable for both unpowered and powered conditions.
(5) The specifications assume a 1.5-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 stub) that can be applied to the receiver's input without causing the output to change from the OFF state.
TABLE 1 Notes (Continued):
(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 hybrid 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 20Vp-p on the stub connection
(10) Current drain and power dissipation specifications are preliminary and subject to change.
(11) Power dissipation specifications assume a transformer coupled configuration with external dissipation (while transmitting with 100% duty cycle) of 1.25W, which is composed of 0.14 watts for the active isolation transformer, 0.08 watts for the active bus 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.
(12) Uses BETA Transformer Technology Corporation, B-3372/LVB-4203 transformer for Stub coupling or B-3383/LVB4103 transformer for direct coupled configurations. (Refer to BETA's web page www.bttc-beta.com)
(13) Thermal resistance specifications are preliminary and subject to change and are with 16 vias connecting heat slug to PCB internal plane. Each via is 0.3 mm diameter and 0.035 mm plating. Refer to JEDEC standard JESD51-9 for detailed PCB construction.
(14) The effective input capacitance, as seen from the 1553 bus, is reduced by the square of the turns ratio of the coupling transformer.

DEVICE OPERATION

When the SLEEP input is asserted (logic "1"), the BU-63133 disables it's transmitter (both outputs go to a high impedance state) and receiver (both receiver outputs go to logic "0") and goes into a power saving mode. If the SLEEP function is not needed, this pin may be tied low.

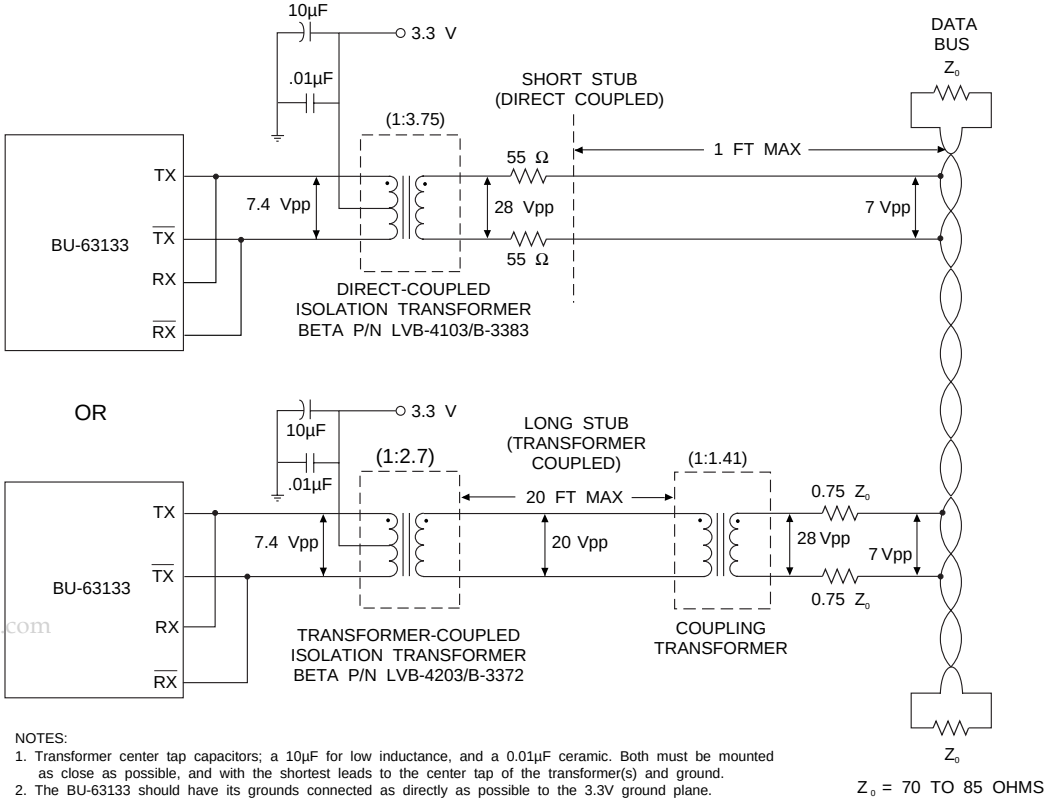
Applying a logic "1" to the STROBE input allows data to pass through to the receiver outputs. Applying a logic "0" to the STROBE input turns the receiver outputs OFF (both receiver outputs go to logic "0"). In addition, the receiver outputs are at a logic "0" when no signal is being received, which is directly compatible with a "Harris" type of encoder/decoder.

When the TX INHIBIT input is asserted (logic "1"), or when both TX Data inputs are at the same logic level, the BU-63133 disables it's transmitter, and both TX Data outputs go to a high impedance state.

1553 BUS INTERFACE AND LAYOUT CONSIDERATIONS

FIGURE 2 illustrates the interface between the BU-63133 and a MIL-STD-1553 bus. Connections for both direct (short stub) and transformer (long stub) coupling, as well as the peak-to-peak voltage levels at various points (when transmitting), are indicated in the diagram. Note that the diagrams do not indicate the RX/$\overline{RX}$ pins, which have to be connected to the TX/$\overline{TX}$ pins and the transformer primaries.

The isolation transformers for the BU-63133 series contain only one set of output windings. Different isolation transformers are



NOTES:
1. Transformer center tap capacitors; a 10µF for low inductance, and a 0.01µF ceramic. Both must be mounted as close as possible, and with the shortest leads to the center tap of the transformer(s) and ground.
2. The BU-63133 should have its grounds connected as directly as possible to the 3.3V ground plane.

FIGURE 2. BU-63133 INTERFACE TO A MIL-STD-1553 BUS

required for a direct or transformer coupled, MIL-STD-1553 Bus implementation.

The center tap of the primary winding (the side of the transformer that connects to the BU-63133) must be directly connected to the 3.3V plane. Additionally, a 10µF low inductance tantalum capacitor and 0.01µF ceramic capacitor must be mounted as close as possible and with the shortest leads to the center tap of the transformer(s) and ground plane.

Furthermore, when the transmitter is transmitting, large currents will flow from the 3.3V plane, into the transformer center tap, through the primaries, into the TX pins and then out through the transceiver ground pins into the ground plane. The traces in this path should be sized accordingly and the connections to the ground plane should be as short as possible. Note that the heatsink on the bottom of the package is also ground.

In addition, it is recommended that the BU-63133 itself be bypassed with a 10µF low inductance tantalum capacitor and 0.01µF ceramic capacitor. These capacitors should be located as close to the Vcc and GND pins as possible.

TRANSFORMERS

In selecting isolation transformers to be used with the BU-63133, 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 a function of the coupling method and is measured as follows:

The side of the transformer that connects to the BU-63133 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 5.0 µH (Transformer Coupled) and 10.0 µH (Direct Coupled). 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 5.0 µH (Transformer Coupled) and 10.0 µH (Direct Coupled).

The difference between these two measurements is the "differential" leakage inductance. This value must be less than 1.0 µH (Transformer Coupled) and 2.0 µH (Direct Coupled).

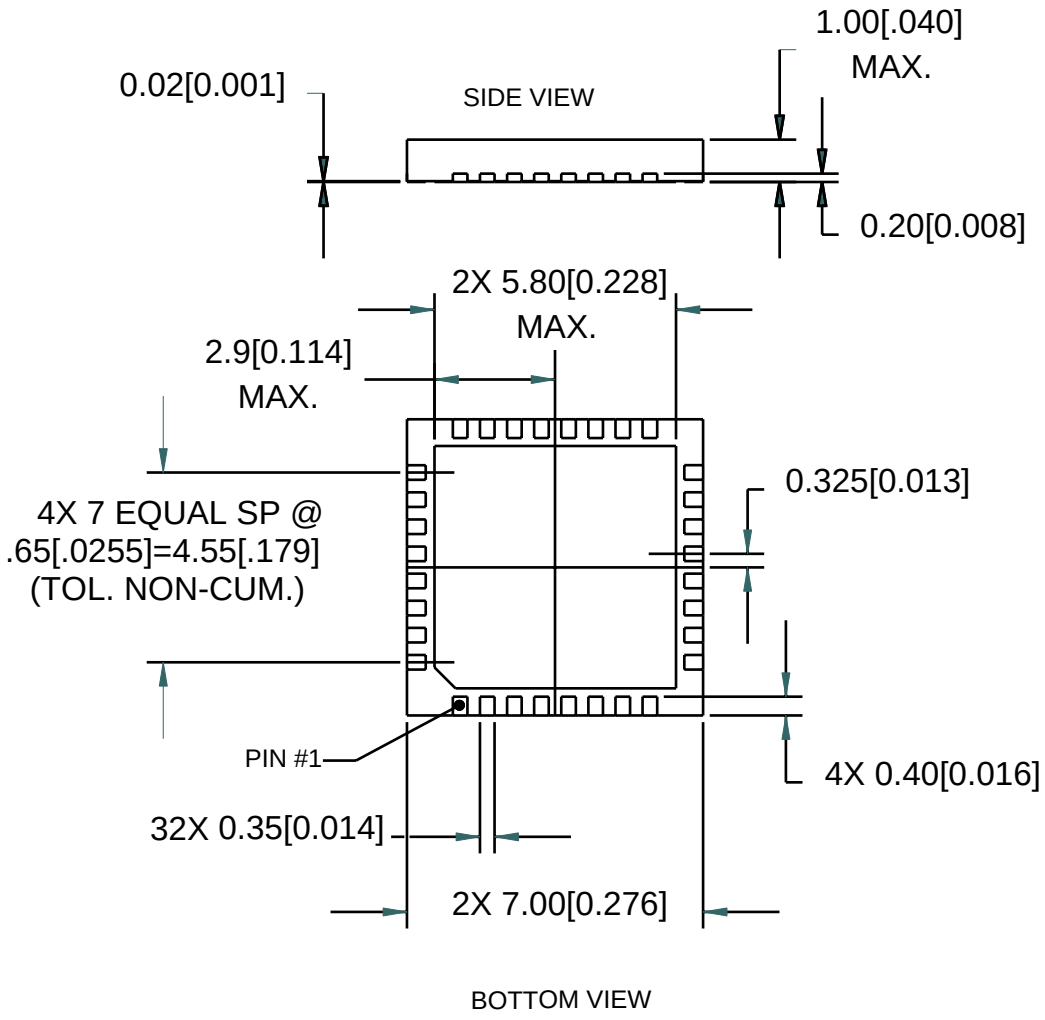
Beta Transformer Technology Corporation (BTTC), a subsidiary of DDC, manufactures transformers in a variety of mechanical configurations with the required turns ratios of 1:3.75 for direct coupled, and 1:2.7 for transformer coupled configurations. TABLE 2 provides a listing of the transformers available.

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

TABLE 2. BTTC TRANSFORMERS FOR USE WITH BU-63133

TRANSFORMER CONFIGURATION	COUPLING TYPE	DIMENSIONS (INCHES)	TEMPERATURE RATING (°C MAX)	BTTC PART NUMBER NEW / OLD
Single epoxy, through-hole	direct	0.625 X 0.630, 0.300 max height	+130	LVB-4103 / B-3383
Single epoxy, through-hole	transformer	0.625 X 0.630, 0.300 max height	+130	LVB-4203 / B-3372
Single epoxy, surface mount	transformer	0.625 X 0.625, 0.130 max height	+85	LVB-4213 / B-3389
Single epoxy, surface mount	direct	0.625 X 0.625, 0.130 max height	+85	LVB-4113 / B-3390
Single epoxy, surface mount	transformer	0.625 X 0.630, 0.300 max height	+130	LVB-4223 / B-3391
Single epoxy, surface mount	direct	0.625 X 0.630, 0.300 max height	+130	LVB-4123 / B-3392

Note: Surface mount body package size does not include leads.



DIMENSIONS ARE IN INCHES (MM)

FIGURE 3. BU-63133 MECHANICAL OUTLINE

TABLE 3. BU-63133 PAD SIGNAL DESCRIPTIONS		
PAD NUMBER	NAME	DESCRIPTION
1	$\overline{\text{TX DATA OUT}}$	Inverted transmitter output
2	Vcc	+3.3 volt power in
3	GROUND	Ground
4	SLEEP	Sleep mode input
5	Factory Test Point	No connection
6	Factory Test Point	No connection
7	Vcc	+3.3 volt power in
8	RX DATA	Receiver output
9	STROBE	Receiver strobe input
10	$\overline{\text{RX DATA}}$	Inverted receiver output
11	Factory Test Point	No connection
12	Vcc	+3.3 volt power in
13	Vcc	+3.3 volt power in
14	GROUND	Ground
15	GROUND	Ground
16	RX DATA IN	Receiver input
17	$\overline{\text{RX DATA IN}}$	Inverted receiver input
18	TX INHIBIT	Transmitter inhibit input
19	$\overline{\text{TX DATA IN}}$	Inverted transmitter input
20	TX DATA IN	Transmitter input
21	GROUND	Ground
22	Vcc	+3.3 volt power in
23	TX DATA OUT	Transmitter output
24	Factory Test Point	No connection
25	GROUND	Ground
26	TX DATA OUT	Transmitter output
27	GROUND	Ground
28	TX DATA OUT	Transmitter output
29	$\overline{\text{TX DATA OUT}}$	Inverted transmitter output
30	GROUND	Ground
31	$\overline{\text{TX DATA OUT}}$	Inverted transmitter output
32	GROUND	Ground

Notes:
1. The heatsink on the package bottom is grounded.
2. Connect the three pads of each of the TX DATA OUT phases together to ensure sufficient current capacity.

BU-63133 L 8 - 1 0 2

Test Criteria:
2 = MIL-STD-1760 Amplitude Compliant

Process Requirements:
0 = Standard DDC Processing, no Burn-In

Temperature Grade/Data Requirements:
1 = -55°C to +125°C

Voltage/Transceiver Option:
8 = +3.3 volt, rise/fall times = 100 to 300 ns (-1553B)

Package Type:
L = 32-Pad Leadless Plastic Chip Carrier

Product Type:
BU-63133 = Single +3.3V Plastic LPCC Transceiver

Please visit our web site at **www.ddc-web.com** for the latest information.

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