ACT 4454 / 4460 Single Supply Transceivers for MIL-STD-1553A/B & MacAir A3818, A4905, A5232 & A5690

Features

- **Single 5 Volt Supply Operation**
- **Low Power Dissipation**
- **Small Size & Light Weight**
- **Dual Transceivers Save Space & Cost**
- **Outstanding MIL-STD-1553A/B and MacAir A3818, A4905, A5232, A5690 Performance**
- **Processed and Screened to Mil-STD-883 Specs**
- **Radiation Hard Dielectric Isolation Monolithic Construction for Severe Space Environments**
- **Superior High Frequency Line Transient and Input Ripple Rejection**
- **Input and Output TTL Compatible Design**
- **DESC SMD# 5962-92061**

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CIRCUIT TECHNOLOGY
www.aeroflex.com

Case Style
ACT 4454FP
Actual Size

General Description

The Aeroflex Circuit Technology ACT4454 / 4460 series are next generation monolithic transceiver designs which provides full compliance with MIL-STD-1553A/B and MacAir A3818, A5690, A5232 & A4905 requirements in the smallest packages with low power consumption and single power supply operation.

The ACT4454 / 4460 series performs the front-end analog function of inputting and outputting data through a transformer to the MIL-STD-1553 data bus.
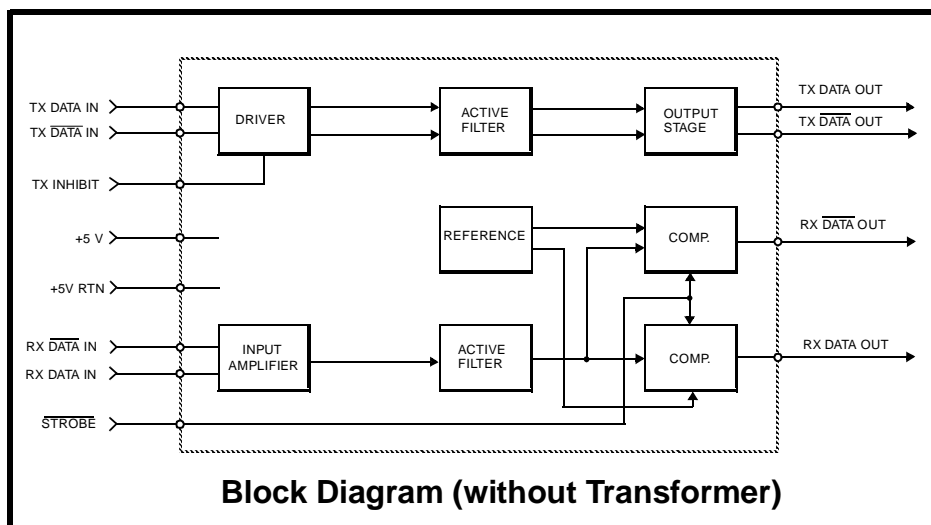
The ACT4454 / 4460 series can be considered a "Universal" Transceiver in that it is compatible with MIL-STD-1553A & B, Macair A-3818, A-4905, A-5232 and A-5690.

Design of these transceivers reflects particular attention to active filter performance. This results in low bit and word error rate with superior waveform purity and minimal zero crossover distortion. Efficient transmitter electrical and thermal design provides low internal power dissipation and heat rise at high as well as low duty cycles.

Each channel of the dual transceiver is completely separate from the other and fully independent. This includes power leads as well as signal lines. Hence, each channel may be connected to a different data bus with no interaction.

Transmitter:

The Transmitter section accepts bi-phase TTL data at the input and

Block Diagram (without Transformer)

TX DATA IN
TX $\overline{DATA}$ IN
TX INHIBIT
+5 V
+5V RTN
RX $\overline{DATA}$ IN
RX DATA IN
$\overline{STROBE}$

DRIVER
ACTIVE FILTER
OUTPUT STAGE
REFERENCE
COMP.
INPUT AMPLIFIER
ACTIVE FILTER
COMP.

TX DATA OUT
TX $\overline{DATA}$ OUT
RX $\overline{DATA}$ OUT
RX DATA OUT

when coupled to the data bus with a 1:2.5 ratio transformer, isolated on the data bus side with two 52.5 Ohm fault isolation resistors, and loaded by two 70 Ohm terminations, the data bus signal is typically 7.0 volts P-P at A-A' (See Figure 5). When both DATA and DATA inputs are held low or high, the transmitter output becomes a high impedance and is "removed" from the line. In addition, an overriding "INHIBIT input provides for the removal of the transmitter output from the line. A logic "1" applied to the "INHIBIT"

takes priority over the condition of the data inputs and disables the transmitter. (See Transmitter Logic Waveform, Figure 1.) The Transmitter may be safely operated for an indefinite period with the bus (point A-A') short circuited at 100% duty cycle.
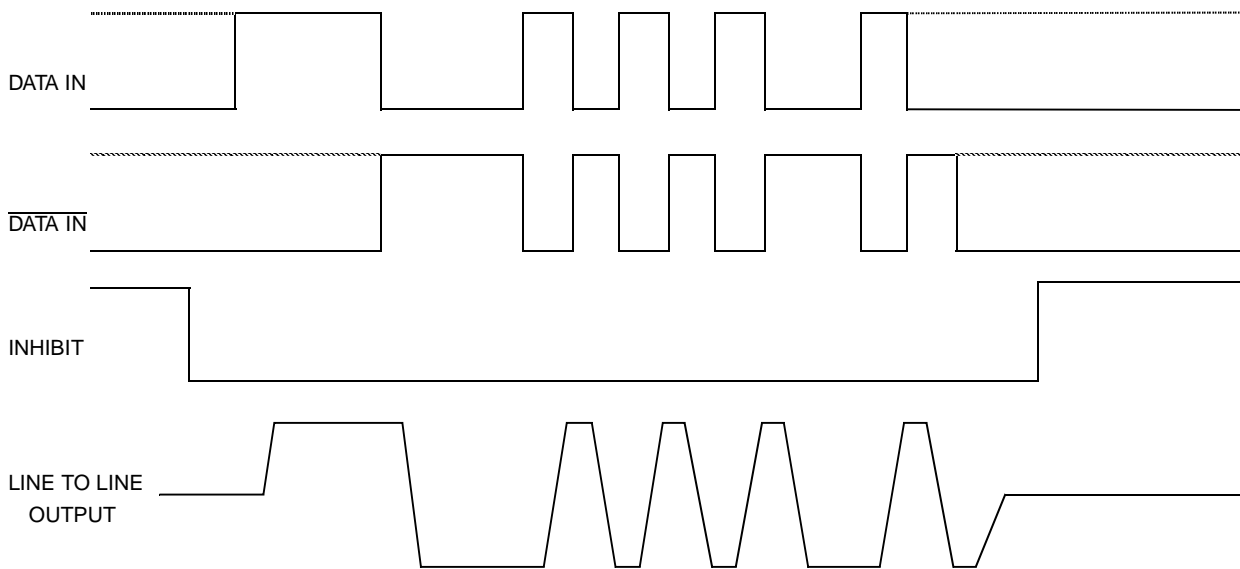
Receiver:

The Receiver section accepts bi-phase differential data at the input and produces two TTL signals at the output. The outputs are DATA and DATA, and represent positive and

negative excursions of the input beyond a pre-determined threshold.(See Receiver Logic Waveform. Figure 2.)

The pre-set internal thresholds will detect data bus signals exceeding 1.20 Volts P-P and reject signals less than 0.6 volts P-P when used with a transformer. (See Figure 5 for transformer data and typical connection.)

A low level at the Strobe input inhibits the DATA and DATA outputs. If unused, a 2K pull-up to +5 Volts is recommended

Figure 1 — Transmitter Logic Waveforms Idealized*

DATA IN

DATA IN

INHIBIT

LINE TO LINE OUTPUT

Note: DATA and DATA inputs must be complementary waveforms or 50% duty cycle average, with no delays between them, and must be in the same state during off times (both high or low).

Figure 2 — Receiver Logic Waveforms Idealized*

LINE TO LINE INPUT

STROBE

DATA OUT

DATA OUT

Note overlap
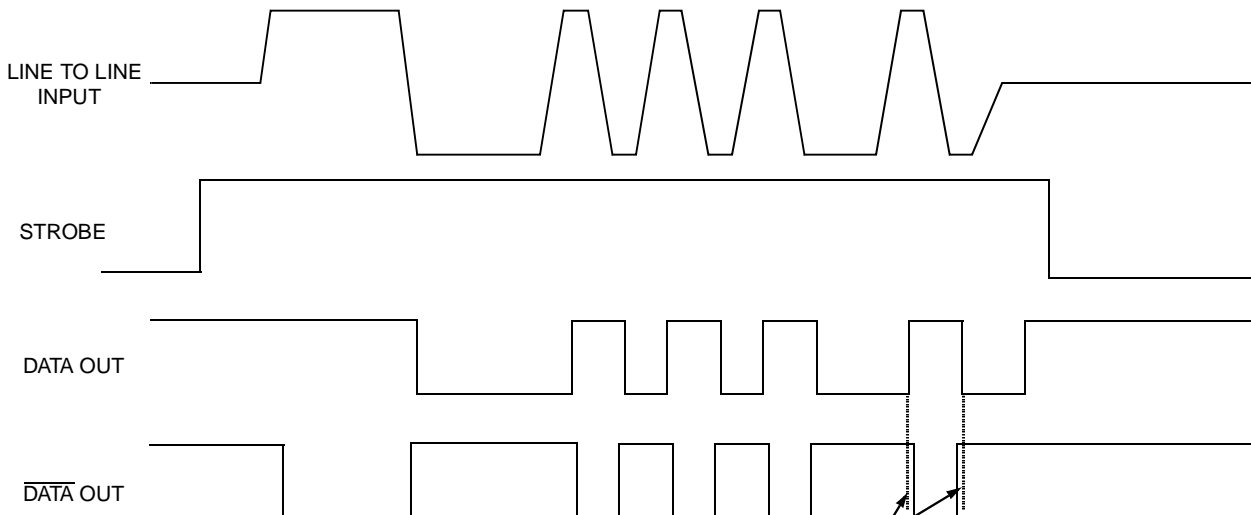
* See Figure 7 For Actual Waveforms

Absolute Maximum Ratings

Operating case temperature	-55°C to +125°C
Storage case temperature	-65°C to +150°C
Power supply voltage	-0.3 V to +7.0 V
Logic input voltage	-0.3 V to +5.5 V
Receiver differential input	±10 V
Receiver input voltage (common mode)	±5 V
Driver peak output current	800 mA
Total package power dissipation over the full operating case temperature rise	2 Watts **(Note: Normal operation conditions require one transceiver on and the other off.)**
Maximum junction to case temperature	10°C
Thermal resistance – junction to case	5°C/W

Electrical Characteristics — Driver Section

Input Characteristics, TX DATA in or TX $\overline{\text{DATA}}$ in (Notes 2 & 3 apply)

Parameter	Condition	Symbol	Min	Typ	Max	Unit
"0" Input Current	V_{IN} = 0.4 V	I_{ILD}		-0.2	-0.4	mA
"1" Input Current	V_{IN} = 2.7 V	I_{IHD}		1	40	µA
"0" Input Voltage		V_{ILD}			0.7	V
"1" Input Voltage		V_{IHD}	2.0			V

Inhibit Characteristics

Parameter	Condition	Symbol	Min	Typ	Max	Unit
"0" Input Current	V_{IN}=0.4V	I_{ILI}		-0.2	-0.4	mA
"1" Input Current	V_{IN}=2.7V	I_{IHI}		1.0	40	µA
"0" Input Voltage		V_{ILI}			0.7	V
"1" Input Voltage		V_{IHI}	2.0			V
Delay from TX inhibit, (0→1) to inhibited output		t_{DXOFF}		250	450	nS
Delay from TX inhibit, (1→0) to active output		t_{DXON}		150	450	nS
Differential output noise, inhibit mode		V_{NOI}		2	10	mV_{P-P}
Differential output impedance (inhibited)	Note 1	Z_{OI}	2K			Ω

Output Characteristics

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Differential output level	R_L=35 Ω	V_O	6.3	7.0	7.7	V_{P-P}
Rise and fall times(10% to 90% of P-P output)		t_r	200	250	300	nS
Output offset at point A-A' on Figure 5, 2.5µS after midpoint crossing of the parity bit of the last word of a 660µS message	R_L=35 Ω	V_{OS}			± 90	mV peak
Delay from 50% point of TX DATA or TX $\overline{\text{DATA}}$ input to zero crossing of differential signal		t_{DTX}		290	400	nS

Note 1. Power on or off, measured from 75KHz to 1MHz at point A-A' and transformer self impedance of 3KΩ minimum

Electrical Characteristics — Receiver Section

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Differential Receiver Input Voltage Range (See Figure 5, point P–P')	TXFMR 2.5:1	V_{IDR}		14	20	V_{P-P}
Common Mode Rejection Ratio (Note 3)		CMRR	45			dB

Strobe Characteristics (Logic "O" Inhibits Output)

	Condition	Symbol	Min	Typ	Max	Unit
"0" Input Current	V_S=0.4 V	I_{IL}		-0.2	-0.4	mA
"1" Input Current	V_S=2.7V	I_{IH}		1	+40	µA
"0" Input Voltage		V_{IL}			0.7	V
"1" Input Voltage		V_{IH}	2.0			V
Strobe Delay (Turn-on or Turn-off)		t_{SD}		50	100	nS

Threshold Characteristics (Sinewave Input)

	Condition	Symbol	Min	Typ	Max	Unit
Input Threshold Voltage (referred to the bus)	100KHz–1MHz	V_{TH}	0.60	0.82	1.10	V_{P-P}

Output Characteristics – RX DATA and RX $\overline{DATA}$

	Condition	Symbol	Min	Typ	Max	Unit
"1" State	I_{OH} = -0.4 mA	V_{OH}	2.5	3.7		V
"0" State	I_{OL} = -4.0 mA	V_{OL}		0.35	0.5	V
Delay, (average) from Differential Input Zero Crossings to RX DATA and RX $\overline{DATA}$ Output 50% points		t_{DRX}		340	500	nS

Power Data

Power Supply Currents – Per Channel

	Condition	Symbol	Min	Typ	Max	Unit
Transmitter Standby				13	30	
25% duty cycle	Note 4	I_{CC}		170	200	mA
50% duty cycle				320	400	
100% duty cycle				700	800	

Power Supply Voltage

	Condition	Symbol	Min	Typ	Max	Unit
Operating Power Supply Voltage Range		V_{CC}	+4.75	+5.00	+5.50	V

Note 2: V_{cc} = 5 Volts ±0.1 V, bypassed by 2.2 µF (Tantalum recommended) Capacitor minimum. All measurements & specifications apply over the temperature range of -55°C to +125°C (case temperature) unless otherwise specified.

Note 3:   When measured at point A-A' with ± 10 Volt peak, line to ground, DC to 2MHz

Note 4:   Typical power is measured with V_{bus} at point A-A' = 7.0 V_{P-P}
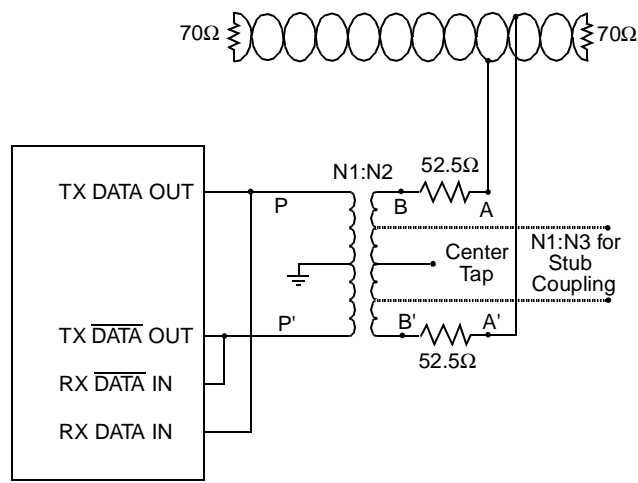
Figure 3 – Transmitter (TX) Output Wave Form

6V P-P MIN
9V P-P MAX

90%

10%

t_f*

t_r*

0 Volts
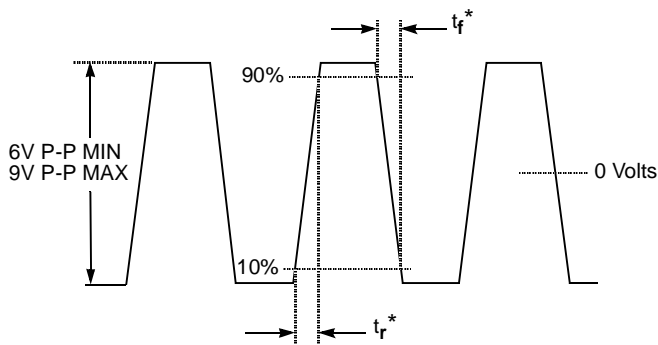
* Rise and fall times measured at point A-A' in Figure 5

Figure 4 – Transmitter (TX) Output Offset

LAST BIT

0 volts

Magnified View

OUTPUT OFFSET*

OUTPUT OFFSET*

2.5 μsec
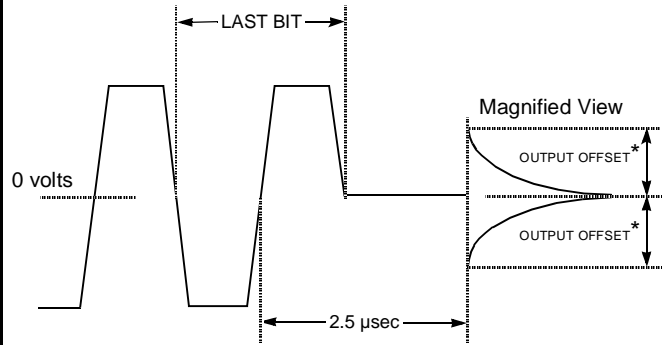
*Offset measured at point A-A' in Figure 5

Figure 5 – Typical Direct Transformer Connection

70Ω   70Ω

TX DATA OUT

P

N1:N2

B

52.5Ω

A

Center
Tap

N1:N3 for
Stub
Coupling

TX DATA OUT

P'

B'

52.5Ω

A'

RX DATA IN

RX DATA IN

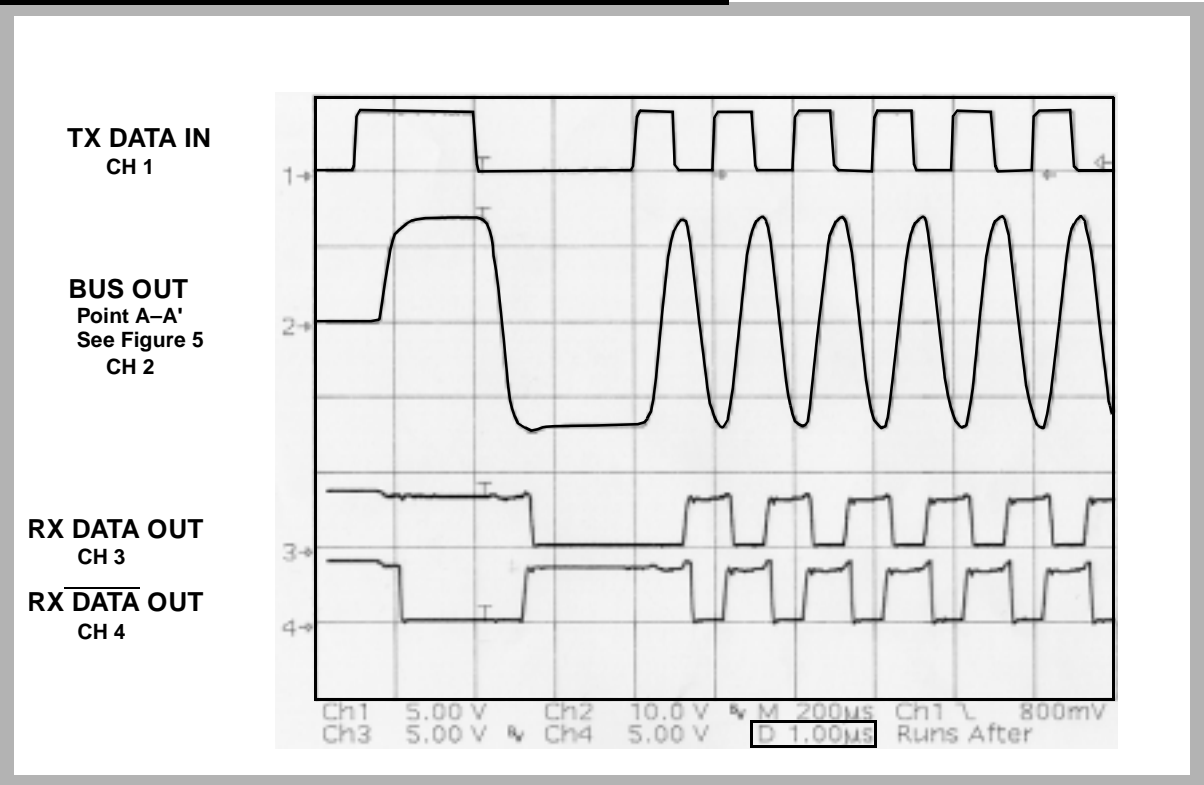Transformer turns ratios:
N1:N2 = 1:2.5
N1:N3 = 1:1.77
Use Technitrol 1553-45 or equivalent

Figure 6 – Power Dissipation vs. Duty Cycle (Total hybrid with one channel transmitting and the other not powered)

POWER DISSIPATION
MILLIWATTS

2000
1800
1600
1400
1200
1000
800
600
400
200
0

0 10 20 30 40 50 60 70 80 90 100

Maximum

Typical

DUTY CYCLE – PERCENT
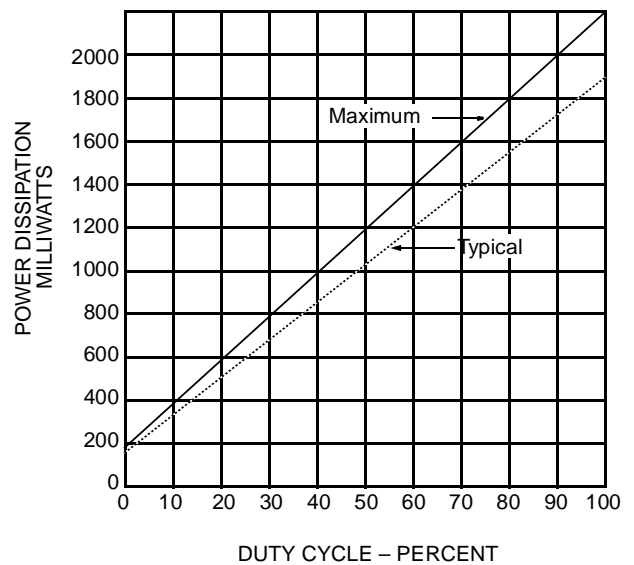
Note: Vcc = 5V, Transformer ratio 1:2.5, V_{bus} (pt A-A') at 7.0 Volts P-P

Figure 7 *ACTUAL HYBRID WAVEFORMS* — 25°C TYPICAL*

START OF WORD – 33 WORD TRANSMISSION

TX DATA IN
CH 1

BUS OUT
Point A–A'
See Figure 5
CH 2

RX DATA OUT
CH 3

RX $\overline{\text{DATA}}$ OUT
CH 4

Ch1 5.00 V   Ch2 10.0 V   M 200µs   Ch1   800mV
Ch3 5.00 V   Ch4 5.00 V   D 1.00µs Runs After

END OF WORD – 33 WORD TRANSMISSION

TX DATA IN
CH 1

BUS OUT
Point A–A'
See Figure 5
CH 2

RX DATA OUT
CH 3

RX $\overline{\text{DATA}}$ OUT
CH 4

Ch1 5.00 V   Ch2 10.0 V   M 200µs   Ch1   800mV
Ch3 5.00 V   Ch4 5.00 V   D 1.00µs Runs After
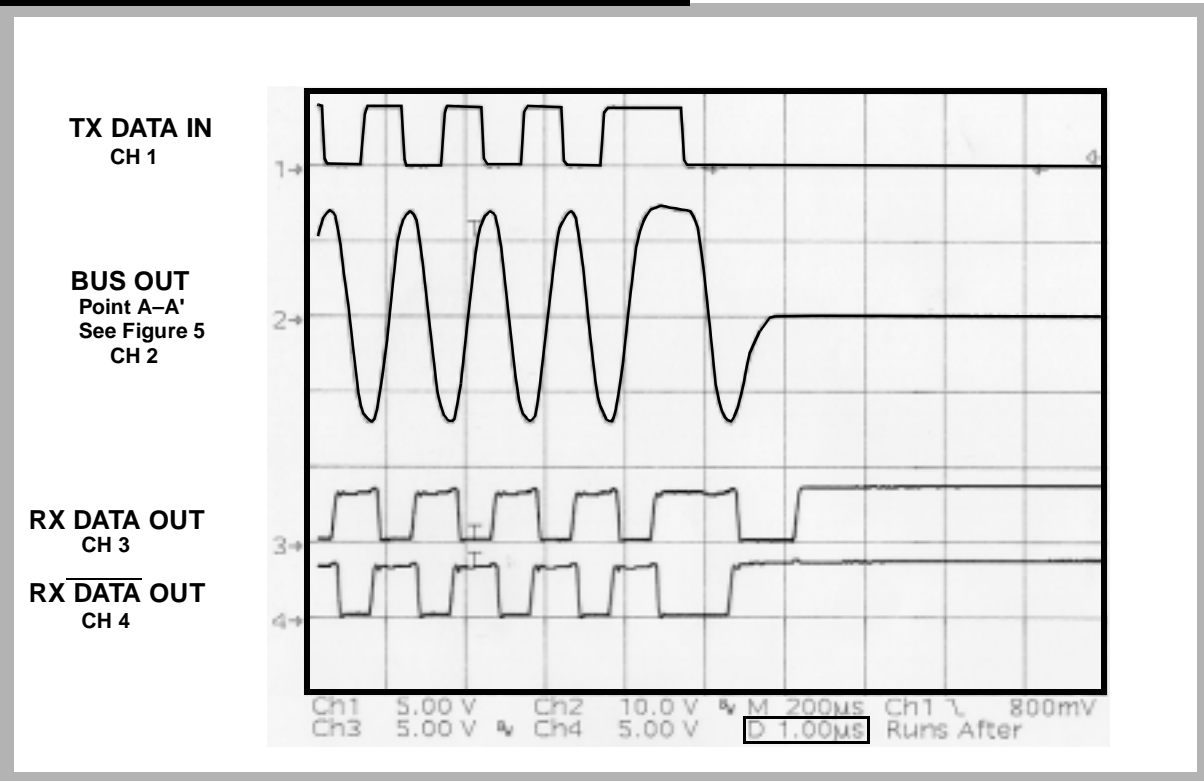
Figure 8 – Pin Numbers & Functions

Pin #	Function	Channel
**ACT4454/4460**		

Pin #	Function	Channel
1	TX DATA OUT/RX DATA IN	A
2	TX $\overline{\text{DATA}}$ OUT/RX $\overline{\text{DATA}}$ IN	A
3	GROUND 1	A
4	RX DATA OUT	A
5	STROBE	A
6	RX $\overline{\text{DATA}}$ OUT	A
7	TX DATA OUT/RX DATA IN	B
8	TX $\overline{\text{DATA}}$ OUT/RX $\overline{\text{DATA}}$ IN	B
9	GROUND 1	B
10	RX DATA OUT	B
11	STROBE	B
12	RX $\overline{\text{DATA}}$ OUT	B
13	GROUND 2	B
14	+5V	B
15	GROUND 3	B
16	INHIBIT	B
17	TX DATA IN	B
18	TX $\overline{\text{DATA}}$ IN	B
19	GROUND 2	A
20	+5V	A
21	GROUND 3	A
22	INHIBIT	A
23	TX DATA IN	A
24	TX $\overline{\text{DATA}}$ IN	A

Configurations and Ordering Information

Model No. 1/	DESC No. 2/	Receiver Data level	Case	Configuration
ACT 4454	5962-920610HZX	Normally High Rx	Flat Package	Dual
ACT 4460	5962-92061HZX	Normally Low Rx	Flat Package	Dual

1/ Consult Factory for different temperature ranges and commercial quality levels.

2/ For space product assurance level substitute K for H. For solder dip substitute A for X. For gold plated leads substitute C for X.

Model ACT4454/4460 Flat Package
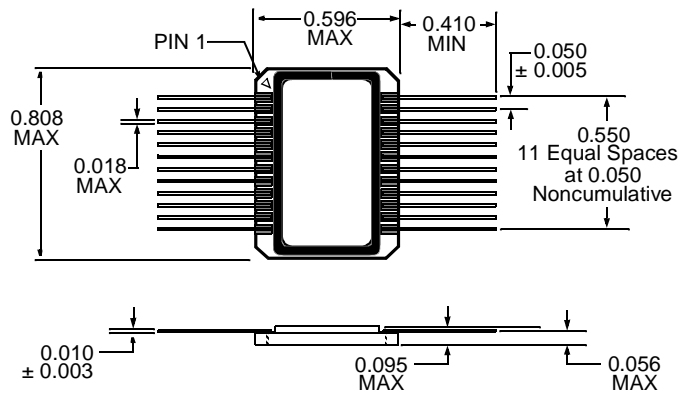
Notes
1. Dimensions shown are in inches
2. Pins are equally spaced at 0.100±0.002 tolerance, non-cumulative, each row

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Specifications subject to change without notice.