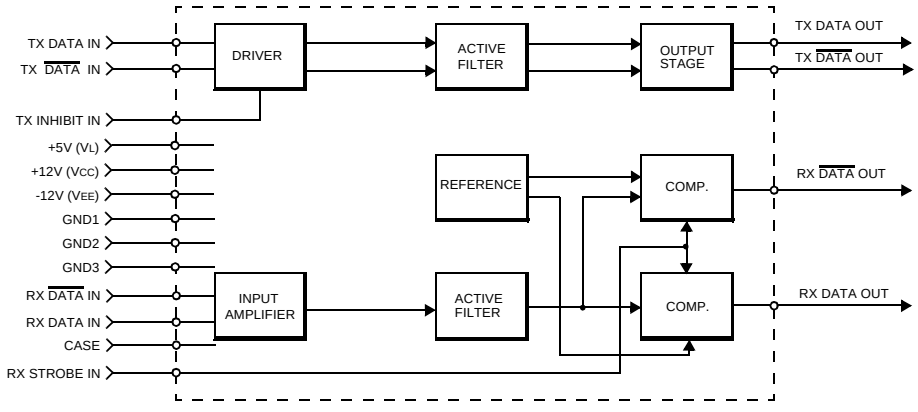
ACT 4489 DUAL TRANSCEIVER FOR MIL-STD-1553/1760

AEROFLEX
CIRCUIT TECHNOLOGY
www.aeroflex.com/act1.htm

Features

- **+5 / ±12 Volt Supply Operation**
- **Low Power Dissipation**
- **Small Size & Light Weight**
- **Dual Transceivers Saves Space & Cost**
- **Outstanding MIL-STD-1553 performance**
- **Radiation Hard Dielectric Isolation Monolithic Construction for Severe Environments**
- **Superior High Frequency Line Transient and Input Ripple Rejection**
- **Input and Output TTL Compatible Design**
- **Processed and Screened to MIL-STD-883 Specs**
- **MIL-PRF-38534 Compliant Devices Available**



Block Diagram (Without Transformer)

General Description

The Aeroflex Circuit Technology ACT 4489 is a next generation monolithic transceiver design which provides full compliance to MIL-STD-1553A/B and 1760 requirements in a small package with low power consumption.

The ACT 4489 series performs the front-end analog function of inputting and outputting data through a transformer to the MIL-STD-1553 data bus.

Design of this transceiver 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 when coupled to the data bus with a 1:1 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 Volts P-P at point A (See Figure 5). When both DATA and $\overline{\text{DATA}}$ 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" signal 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) short circuited at 100% duty cycle.

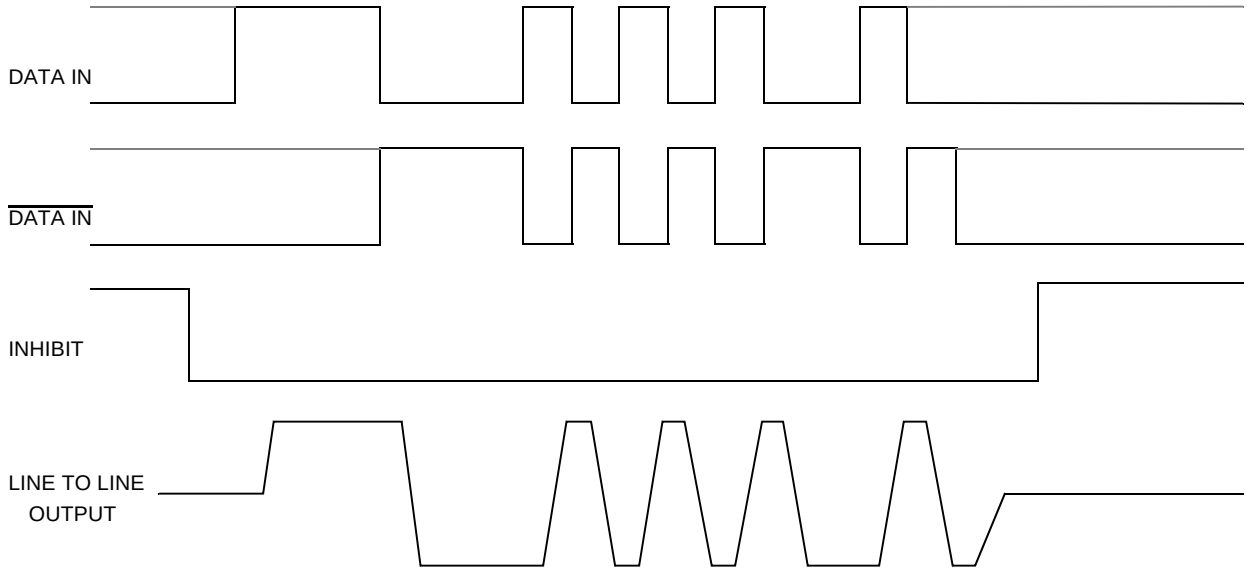
Receiver:

The Receiver section accepts bi-phase differential data at the input and produces two TTL signals at the output. The outputs are DATA and $\overline{\text{DATA}}$, 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, point A Figure 5, 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).

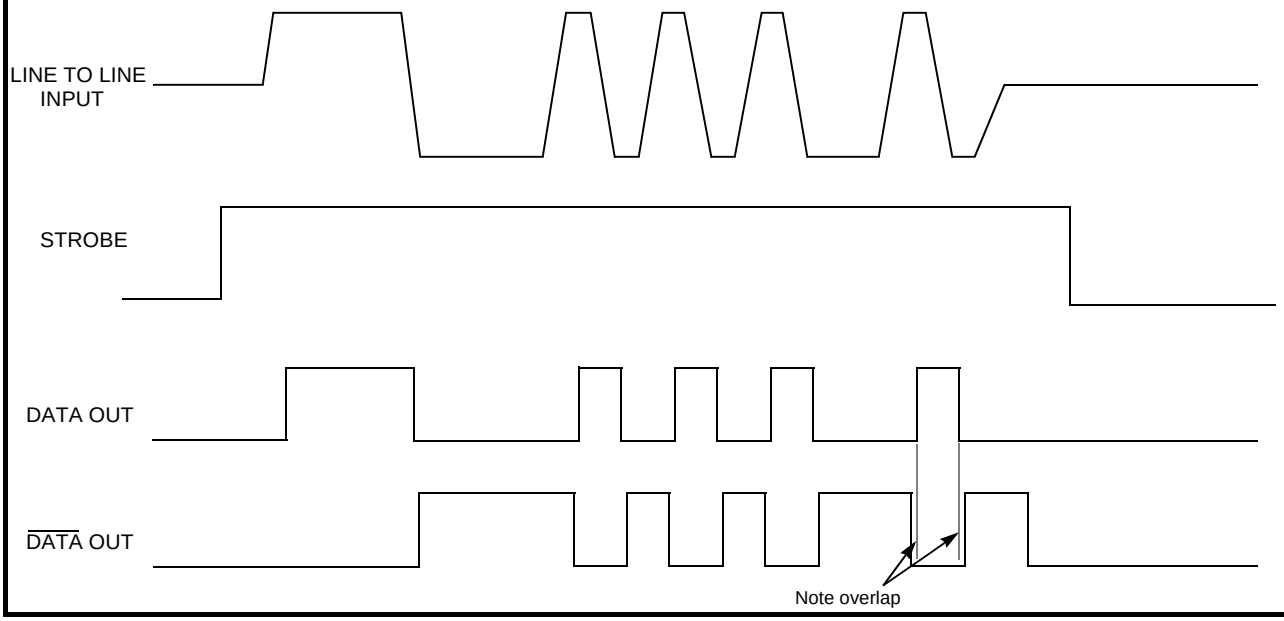
A low level at the RX Strobe input inhibits the DATA and $\overline{\text{DATA}}$ outputs. If unused, a 2K pull-up to +5 Volts is recommended.

Figure 1 — Transmitter Logic Waveforms Idealized



Note: DATA and $\overline{\text{DATA}}$ 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 (ACT4489D)



Absolute Maximum Ratings

Operating case temperature	-55°C to +125°C
Storage case temperature	-65°C to +150°C
Power supply voltage V_{CC} V_{EE} V_L	 -0.3 V to +18 V +0.3 V to-18 V -0.3 V to +7.0 V
Logic input voltage	-0.3 V to +5.5 V
Receiver differential input	±40 V_{P-P}
Receiver input voltage (common mode)	±10 V
Driver peak output current	300 mA
Total package power dissipation over the full operating case temperature rise	2.5 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	4°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}		-0.1	-0.2	mA
"1" Input Current	V_{IN} = 2.7 V	I_{IHD}		1	40	µA
"0" Input Voltage		V_{IHD}			0.7	V
"1" Input Voltage		V_{IHD}	2.0			V

Inhibit Characteristics

"0" Input Current	V_{IN} = 0.4 V	I_{ILI}		-0.1	-0.2	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	From mid pt inhibit to ±1.2V pt B, See Figure 5	t_{DXOFF}		175	225	nS
Delay from TX inhibit, (1→0) to active output		t_{DXON}		90	150	nS
Differential output noise, inhibit mode		V_{NOI}		2	10	mV_{P-P}
Differential output impedance (inhibited) Note 1 See Figure 5	Point B	Z_{OI}	2K			Ω
	Point C	Z_{OI}	1K			Ω

Output Characteristics

Differential output level, See Figure 5 See Figure 5	Point A	V_O	6	7	9	V_{P-P}
Rise and fall times(10% to 90% at pt A output) See Figure 5	Point A	t_r	100	160	300	nS
Output offset, Figure 3, 2.5µS after midpoint crossing of the parity bit of the last word of a 660µS message See Figure 5	Point A	V_{OS}			± 90	mV peak
Delay from 50% point of TX DATA or TX $\overline{\text{DATA}}$ input to zero crossing of differential signal. See Fig 5	Point A	t_{DXT}		100	200	nS

Electrical Characteristics — Receiver Section

Parameter	Condition	Symbol	Min	Typ	Max	Unit
Differential Receiver Input Voltage Range (See Figure 5, Point B)	TXFMR 1:1	V_{IDR}			40	V_{P-P}
Common Mode Rejection Ratio (Note 3)		CMRR	45			dB
"1" State – Rx Data or Rx $\overline{\text{Data}}$ Output	I_{OH} = -0.4 mA	V_{OH}	2.5	3.7		V
"0" State – Rx Data or Rx $\overline{\text{Data}}$ Output	I_{OI} = 4 mA	V_{OL}		0.35	0.5	V
Delay (average) from Differential Input Zero Crossings to RX DATA and RX $\overline{\text{DATA}}$ Output 50% points		t_{DXT}		270	400	nS
Input Threshold Voltage (referred to the bus)	100KHz–1MHz	V_{TH}	0.60	0.75	1.20	V_{P-P}

Strobe Characteristics (Logic "0" Inhibits Output)

"0" Input Current	V_S=0.4V	I_{IL}		-0.1	-0.2	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

Power Data

Power Supply Currents – Per Channel – See Figure 4

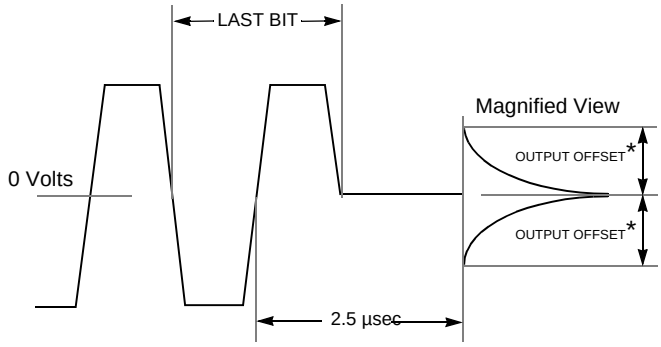
Transmitter Standby		I_{CC} I_{EE} I_L		0 12 18	1 16 30	mA
25% duty cycle		I_{CC} I_{EE} I_L		58 12 18	63 20 30	
50% duty cycle		I_{CC} I_{EE} I_L		115 12 18	125 20 30	
100% duty cycle		I_{CC} I_{EE} I_L		230 12 18	250 20 30	

Power Supply Voltages

±12V Operating Power Supply Voltage Range		V_{CC} V_{EE}	+11.40 -11.40	+12.00 -12.00	+12.60 -12.60	V
+5V Operating Power Supply Voltage Range)		V_L	+4.50	+5.00	+5.50	V

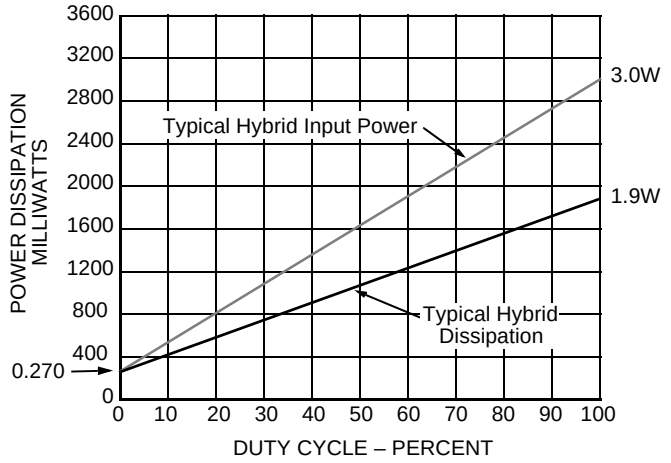
Note 1. Power on or off, measured from 75KHz to 1MHz at point A and transformer self impedance of 3KΩ minimum at 1MHz.
Note 2. Power Supplies: ±12 Volts ±0.60 V & +5 Volts ±0.5 V, bypassed by 10 µF (Tantalum recommended) Capacitor minimum. All measurements & specifications apply over the temperature range of -55°C to +125°C (case temperature) unless otherwise specified.
Note 3. When measured as shown per Figure 5 with ± 10 Volt peak, line to ground, DC to 2MHz
Note 4. Typical power is measured with V_{BUS} at point A = 7 V_{P-P}

Figure 3 – Transmitter (TX) Output Offset



*Offset measured at point A in Figure 5

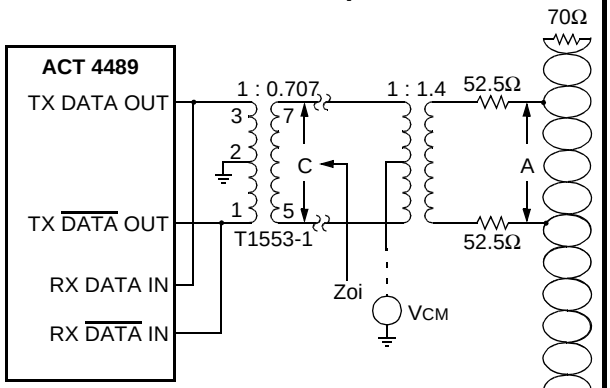
Figure 4 – Hybrid Power Dissipation vs. Duty Cycle
(Total hybrid with one channel transmitting and the other not powered – 100% Duty Cycle)



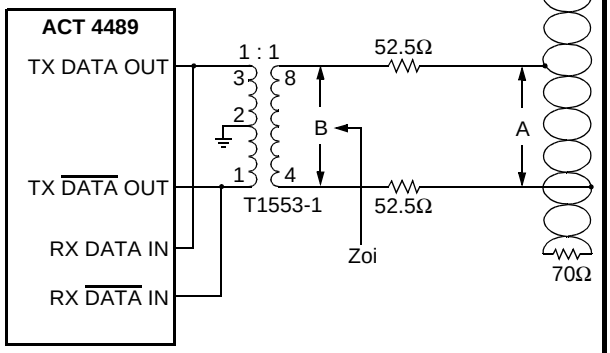
Note: Vcc= +12V, V_{EE} = -12V, V_L= +5V, Transformer ratio 1:1, V_{BUS} (point A) at 7VP-P.

Figure 5 – Typical 1553 Bus Connections

Transformer Coupled Stub



Direct Coupled Stub



Transformer Model use Technitrol Part# 1553-1 or equivalent

Configurations and Ordering Information

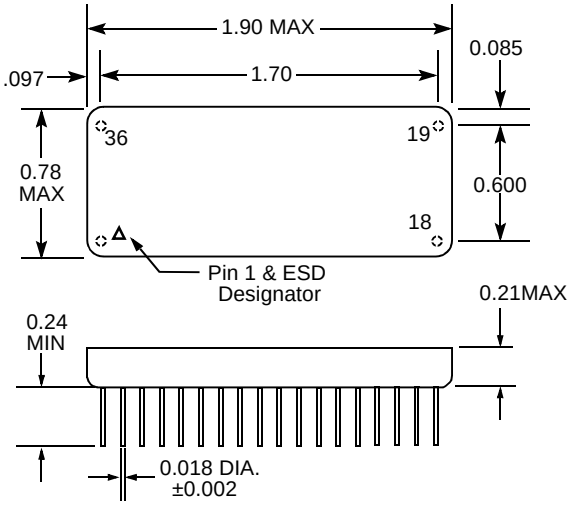
ACT Model # / Ordering Part #	Case Style	DESC Number	Rx Standby
ACT 4489-D	DIP	TBA	Normally Low
ACT 4489-DI	DIP	TBA	Normally High
ACT 4489-DF	FP	TBA	Normally Low
ACT 4489-DFI	FP	TBA	Normally High

Specifications subject to change without notice.

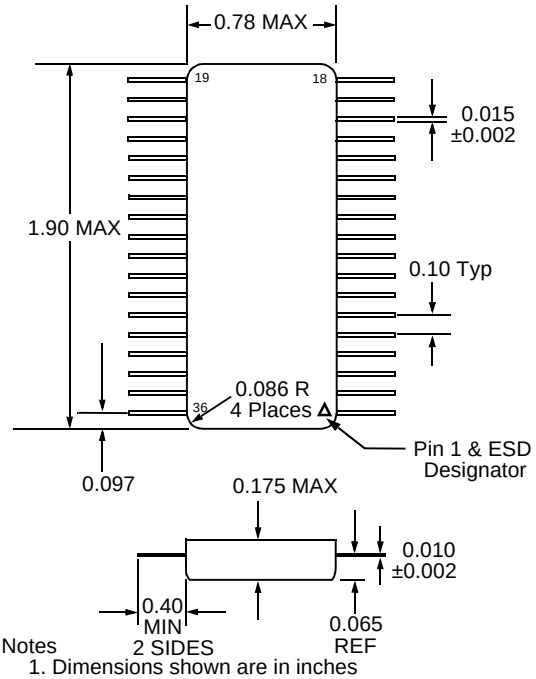
Figure 6 – Lead Numbers & Functions

ACT4489		
Pin #	**Function**	**Channel**
1	TX DATA OUT	A
2	TX $\overline{\text{DATA}}$ OUT	A
3	GROUND 1	A
4	NC	
5	RX DATA OUT	A
6	STROBE	A
7	GROUND 2	A
8	RX $\overline{\text{DATA}}$ OUT	A
9	CASE	
10	TX DATA OUT	B
11	TX $\overline{\text{DATA}}$ OUT	B
12	GROUND 1	B
13	NC	
14	RX DATA OUT	B
15	STROBE	B
16	GROUND 2	B
17	RX $\overline{\text{DATA}}$ OUT	B
18	NC	
19	V_{CC}	B
20	RX DATA IN	B
21	RX $\overline{\text{DATA}}$ IN	B
22	GROUND 3	B
23	V_{EE}	B
24	+5 V (V_L)	B
25	INHIBIT	B
26	TX DATA IN	B
27	TX $\overline{\text{DATA}}$ IN	B
28	V_{CC}	A
29	RX DATA IN	A
30	RX $\overline{\text{DATA}}$ IN	A
31	GROUND 3	A
32	V_{EE}	A
33	+5 V (V_L)	A
34	INHIBIT	A
35	TX DATA IN	A
36	TX $\overline{\text{DATA}}$ IN	A

Model ACT4489 Dual In Line



Model ACT4489 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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