

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

Features

- +5 / ±12 Volt Supply Operation
- Low Power Dissipation
- Small Size & Light Weight
- 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

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General Description

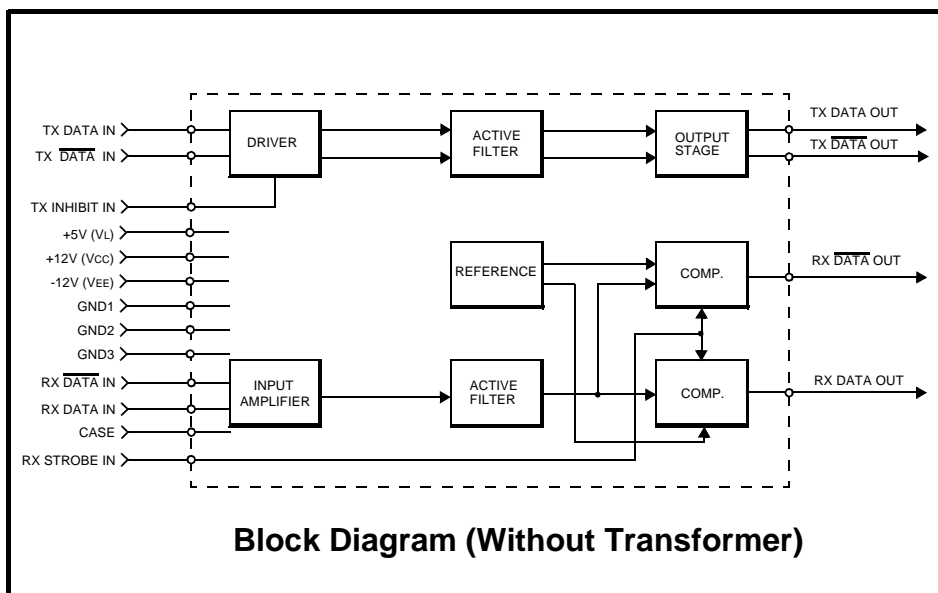
The Aeroflex Circuit Technology ACT 4489 is a next generation monolithic transceiver design which provides full compliance to MIL-STD-1553A/B and 1760 requirements in a small package with low power consumption.

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.

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 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

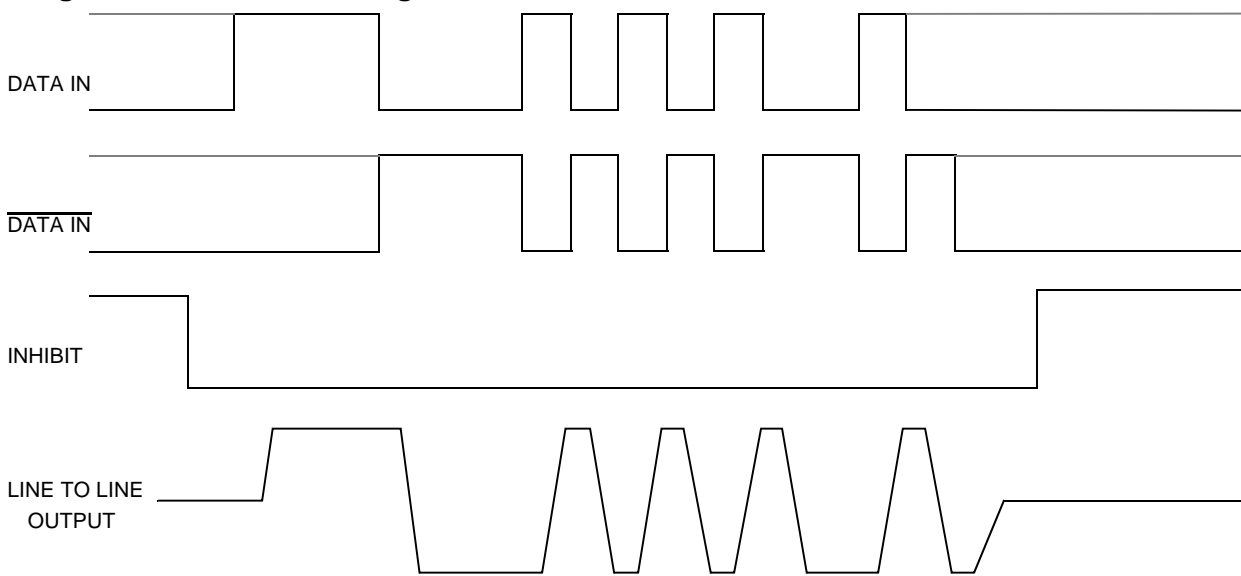
bi-phase differential data at the input and produces two TTL signals at the output. The outputs are DATA and $\overline{\text{DATA}}$, and represent positive and negative excursions of the input beyond a pre-determined threshold (See Receiver Logic Waveform, Figure 2).

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).

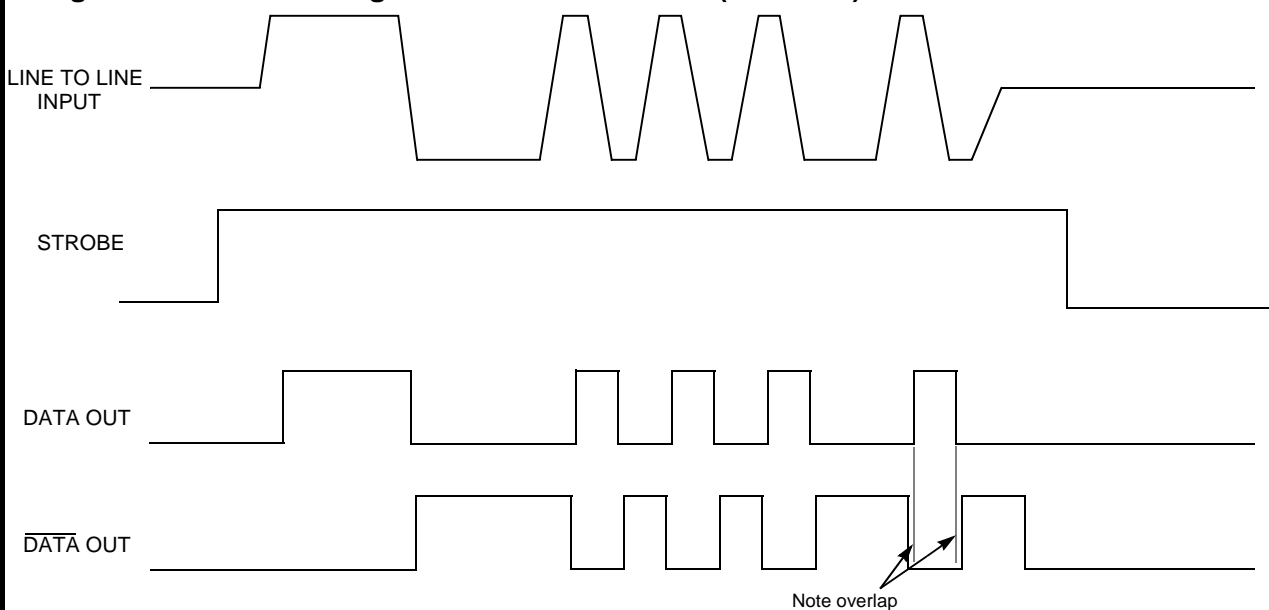
A low level at the RX Strobe input inhibits the DATA and $\overline{\text{DATA}}$ outputs. If unused, a 2K pull-up to +5 Volts is recommended.

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 (ACT4489)



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 |
| 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 | Ma x | 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 | 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 | $I_{OH} = -0.4 \text{ mA}$ | V_{OH} | 2.5 | 3.7 | | V |
| "0" State – Rx Data or Rx $\overline{\text{Data}}$ Output | $I_{OI} = 4 \text{ mA}$ | 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

| | | | | | | |
|--|--|----------------------|------------------|------------------|------------------|---|
| $\pm 12V$ 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 |

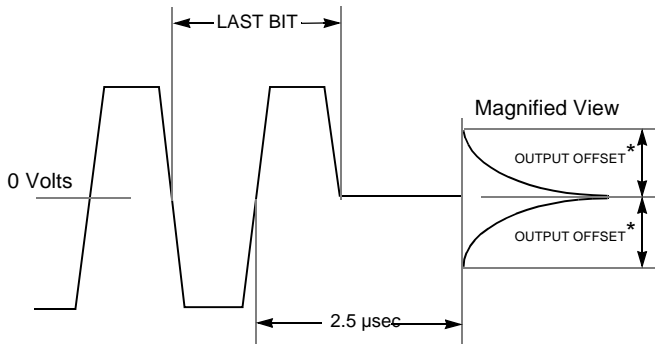
Note 1. Power on or off, measured from 75KHz to 1MHz at point A and transformer self impedance of $3K\Omega$ minimum at 1MHz.

Note 2. Power Supplies: ± 12 Volts ± 0.60 V & +5 Volts ± 0.5 V, bypassed by $10 \mu F$ (Tantalum recommended) Capacitor minimum. All measurements & specifications apply over the temperature range of $-55^\circ C$ to $+125^\circ C$ (case temperature) unless otherwise specified.

Note 3. When measured as shown per Figure 5 with ± 10 Volt peak, line to ground, DC to 2MHz

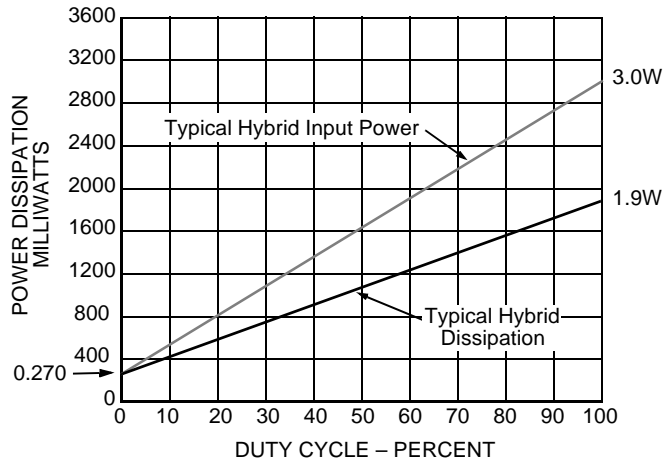
Note 4. Typical power is measured with V_{BUS} at point A = $7 V_{P-P}$

Figure 3 – Transmitter (TX) Output Offset



*Offset measured at point A in Figure 5

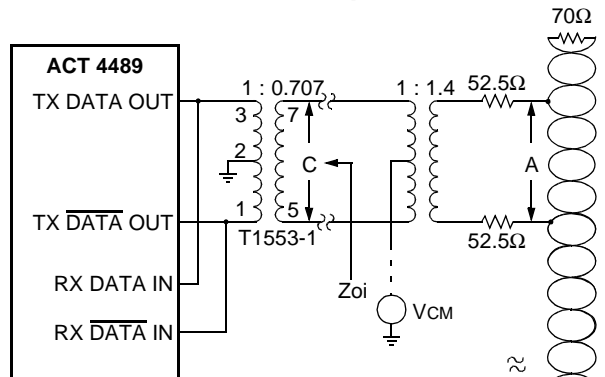
Figure 4 – Hybrid Power Dissipation vs. Duty Cycle



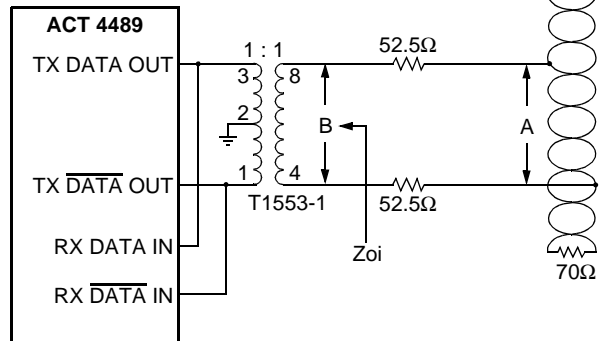
Note: $V_{CC} = +12V$, $V_{EE} = -12V$, $V_L = +5V$, Transformer ratio 1:1, V_{BUS} (point A) at 7VP-P.

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

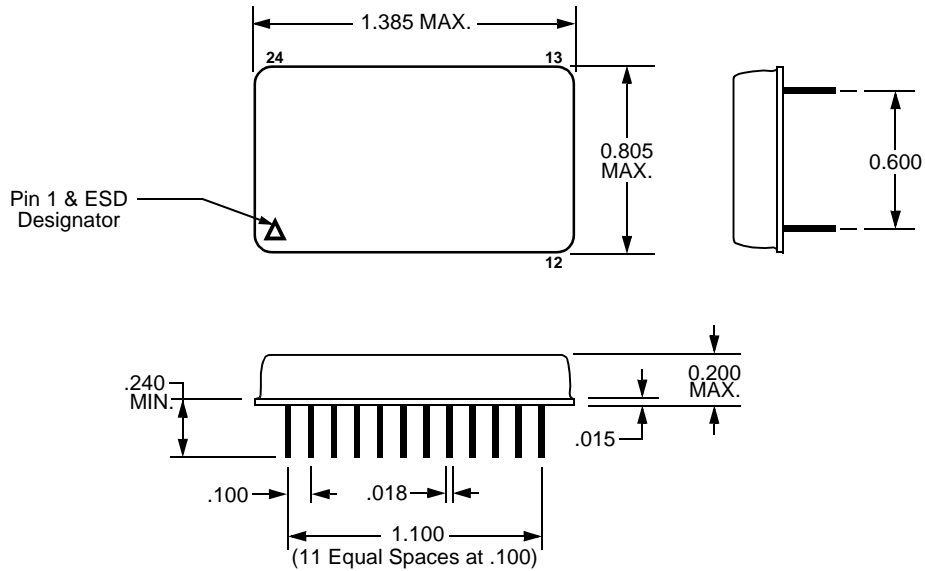
| ACT Model # / Ordering Part # | Case Style | DESC Number | Rx Standby |
|-------------------------------|--------------|-------------|---------------|
| ACT 4489 | Plug In | TBA | Normally Low |
| ACT 4489-I | Plug In | TBA | Normally High |
| ACT 4489-F | Flat Package | TBA | Normally Low |
| ACT 4489-FI | Flat Package | TBA | Normally High |

Specifications subject to change without notice.

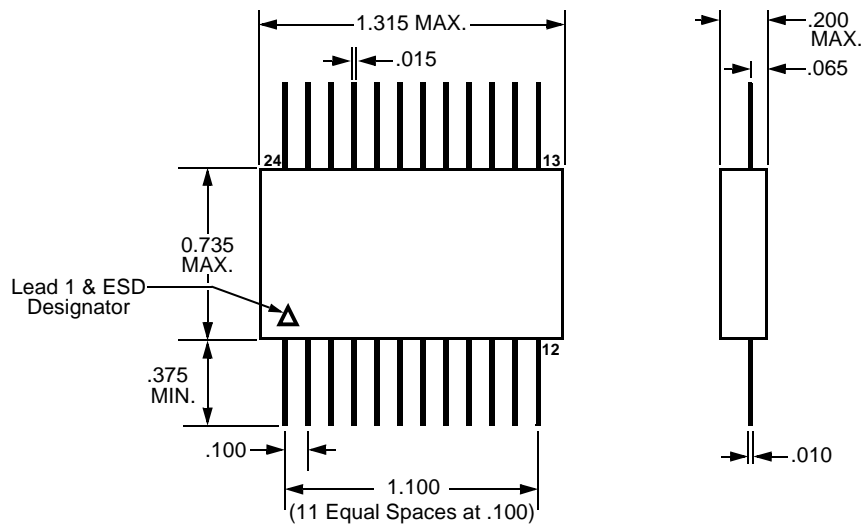
Figure 6 – Lead Numbers & Functions

| ACT4489 | |
|---------|---------------------------------|
| Pin # | Function |
| 1 | TX DATA OUT |
| 2 | TX $\overline{\text{DATA}}$ OUT |
| 3 | GROUND |
| 4 | NC |
| 5 | NC |
| 6 | NC |
| 7 | RX DATA OUT |
| 8 | STROBE |
| 9 | GROUND |
| 10 | RX $\overline{\text{DATA}}$ OUT |
| 11 | NC |
| 12 | NC |
| 13 | Vcc |
| 14 | NC |
| 15 | RX DATA IN |
| 16 | RX $\overline{\text{DATA}}$ IN |
| 17 | NC |
| 18 | CASE |
| 19 | VEE |
| 20 | +5 V |
| 21 | TX INHIBIT |
| 22 | TX DATA IN |
| 23 | TX $\overline{\text{DATA}}$ IN |
| 24 | NC |

Plug In Package Outline



Flat Package Outline



Aeroflex Circuit Technology
 35 South Service Road
 Plainview New York 11830
www.aeroflex.com/act1.htm

Telephone: (516) 694-6700
FAX: (516) 694-6715
Toll Free Inquiries: (800) THE-1553
E-Mail: sales-act@eroflex.com