

## Standard Products

# ACT4453 Single Supply Dual Transceiver for MIL-STD-1553 A/B, MIL-STD-1760 & SAE-AS15531

www.aeroflex.com/Avionics

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## FEATURES

- Single +5V power supply
- Outstanding MIL-STD-1553 / SAE-AS15531 performance
- Monolithic construction
- Input and output TTL compatible design
- Designed for aerospace and high reliability space applications
- MIL-PRF-38534 compliant devices available
- Aeroflex Plainview is a Class H & K MIL-PRF-38534 manufacturer
- 1.9"L x .78"W, 24 lead, Dual-in-line or Flat package, hermetic package
- Available on DSCC SMD 5962–89522

## GENERAL DESCRIPTION

The radiation tolerant ACT4453 is the next generation monolithic transceiver design which provides full compliance with MIL-STD-1553A/B, MIL-STD-1760 and meets SAE-AS15531 requirements in the smallest packages with low power consumption and single power supply operation. The series performs the front-end analog function of inputting and outputting data through a transformer to the MIL-STD-1553 data bus.

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

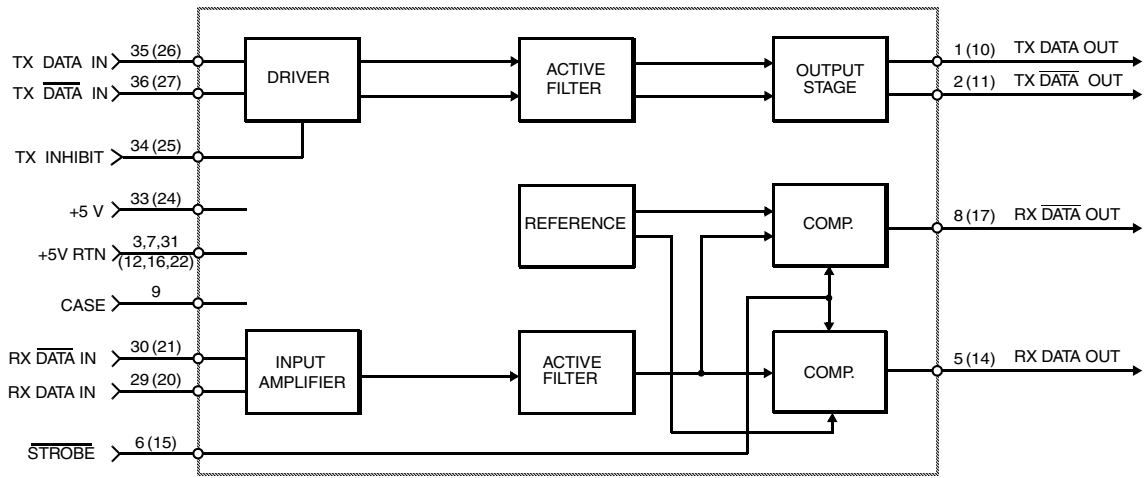
The Transmitter section accepts bi-phase TTL data at the input and when coupled to the data bus with a 1:2.12 ratio transformer the data bus signal is typically 7.0 Volts P-P at A-A' (See Figure 5). When both DATA and  $\overline{\text{DATA}}$  inputs are held low or high, the transmitter output becomes 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" applied to the "INHIBIT" takes priority over the condition of the data inputs and disables the transmitter (See Figure 1 Transmitter Logic Waveform). The Transmitter may be safely operated for an indefinite period with the bus (point A-A') short circuited at 100% duty cycle.

## RECEIVER

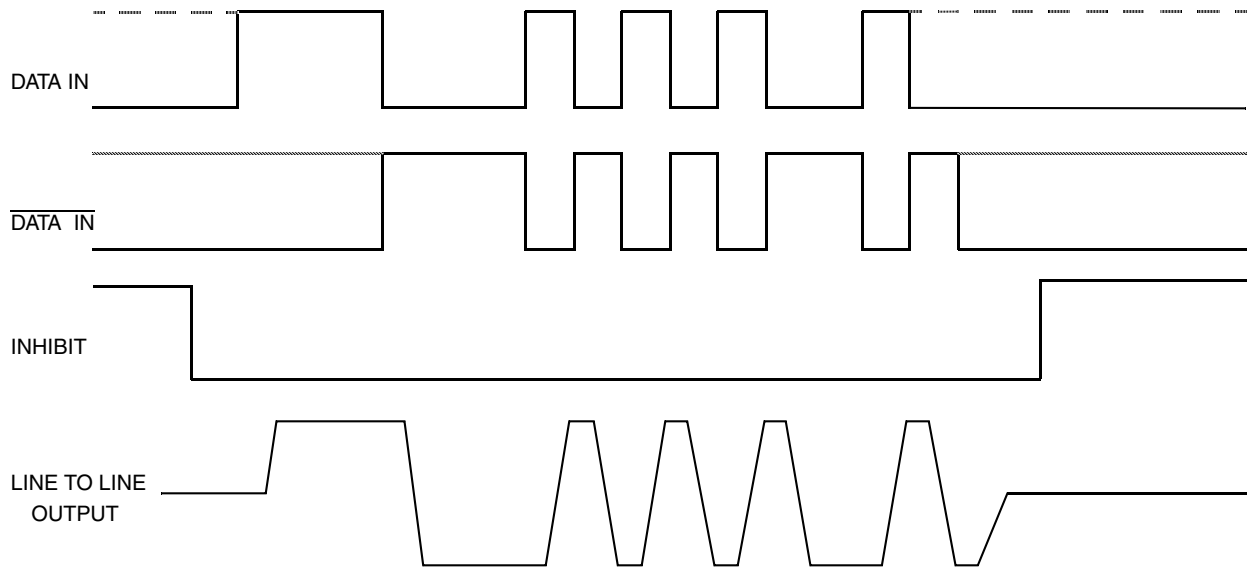
The Receiver section accepts bi-phase differential data at the input and produces two TTL signals at the output. The outputs are DATA and  $\overline{\text{DATA}}$ , and represent positive and negative excursions of the input beyond a pre-determined threshold (See Figure 2 Receiver Logic Waveform).

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 connections).

A low level at the Strobe input inhibits the DATA and  $\overline{\text{DATA}}$  outputs (Pin is internally pulled up).

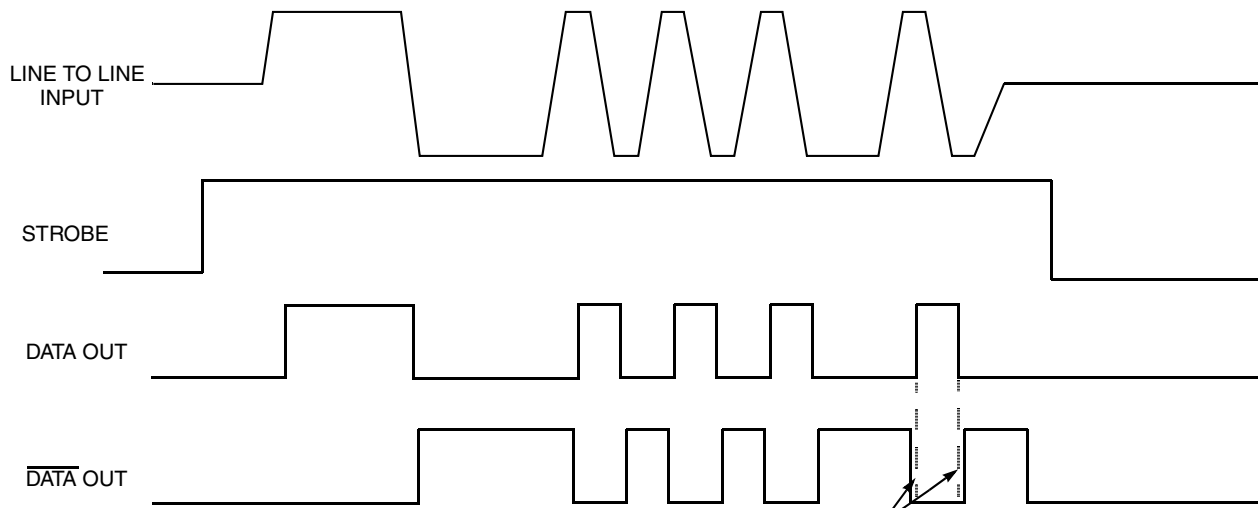


**BLOCK DIAGRAM (WITHOUT TRANSFORMER)  
CHANNEL A (CHANNEL B)**



**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 1 – TRANSMITTER LOGIC WAVEFORMS IDEALIZED \***



\* See Figure 7 for Actual Waveforms

**FIGURE 2 – RECEIVER LOGIC WAVEFORMS IDEALIZED \***

## ABSOLUTE MAXIMUM RATINGS

|  |   |
|--|---|
| Operating case temperature   | -55°C to +125°C   |
| Storage case temperature   | -65°C to +150°C   |
| Power supply voltage   | -0.3VDC to +7.0VDC  |
| Logic input voltage  | -0.3VDC to +5.5VDC  |
| Receiver differential input  | ±10 V   |
| Receiver input voltage (common mode)   | ±5V   |
| Driver peak output current   | 650 mA  |
| Total package power dissipation over the full operating case temperature range | 2.0 Watts<br>(Note: Normal operation conditions require one transmitter on and the other off at any given time) |
| Maximum junction to case temperature   | 10°C  |
| Thermal resistance – Junction to case  | 5°C/W   |
| Package Weight<br>Plug-in<br>Flat Package                                      | 16g (0.564oz)<br>12.5g (0.441oz)  |

## ELECTRICAL CHARACTERISTICS – DRIVER SECTION

### INPUT CHARACTERISTICS, TX DATA IN OR TX DATA IN (Notes 2 & 3 Apply)

| Parameter         | Condition              | Symbol           | Min | Typ  | Max  | Unit |
|-------------------|------------------------|------------------|-----|------|------|------|
| "0" Input Current | V <sub>IN</sub> = 0.4V | I <sub>ILD</sub> | -   | -0.2 | -0.4 | mA   |
| "1" Input Current | V <sub>IN</sub> = 2.7V | I <sub>IHD</sub> | -   | 1    | 40   | μA   |
| "0" Input Voltage |                        | V <sub>ILD</sub> | -   | -    | 0.7  | V    |
| "1" Input Voltage |                        | V <sub>IHD</sub> | 2.0 | -    | -    | V    |

### INHIBIT CHARACTERISTICS

|  |                        |                    |    |      |      |       |
|--|------------------------|--------------------|----|------|------|-------|
| "0" Input Current                                | V <sub>IN</sub> = 0.4V | I <sub>ILI</sub>   | -  | -0.2 | -0.4 | mA    |
| "1" Input Current                                | V <sub>IN</sub> = 2.7V | I <sub>IHI</sub>   | -  | 1.0  | 40   | μA    |
| "0" Input Voltage                                |                        | V <sub>ILI</sub>   | -  | -    | 0.7  | V     |
| "1" Input Voltage                                |                        | V <sub>IHI</sub>   | 2  | -    | -    | V     |
| Delay from TX inhibit, (0→1) to inhibited output |                        | t <sub>DXOFF</sub> | -  | 250  | 450  | nS    |
| Delay from TX inhibit, (1→0) to active output    |                        | t <sub>DXON</sub>  | -  | 150  | 250  | nS    |
| Differential Output Noise, inhibit mode          |                        | V <sub>NOI</sub>   | -  | 2    | 10   | mVp-p |
| Differential Output Impedance (inhibited)        | Note 1                 | Z <sub>OI</sub>    | 2K | -    | -    | Ω     |

### OUTPUT CHARACTERISTICS

|   |                      |                  |     |     |      |                  |
|---|----------------------|------------------|-----|-----|------|------------------|
| Differential output level (Point C-C')  | R <sub>L</sub> = 70Ω | V <sub>O</sub>   | 18  | 21  | 25   | V <sub>p-p</sub> |
| Rise and fall times (10% to 90% of p-p output)  |                      | t <sub>r</sub>   | 100 | 200 | 300  | nS               |
| Output offset at point C-C' on Figure 5, 2.5 μS after midpoint crossing of the parity bit of the last word of a 660μS message | R <sub>L</sub> = 70Ω | V <sub>OS</sub>  | -   | -   | ±250 | mVpeak           |
| Delay from 50% point of TX DATA or TX DATA input to zero crossing of differential signal                                      |                      | t <sub>DTX</sub> | -   | 120 | 250  | nS               |

## ELECTRICAL CHARACTERISTICS – RECEIVER SECTION

| Parameter   | Condition       | Symbol           | Min | Typ | Max | Unit             |
|---|-----------------|------------------|-----|-----|-----|------------------|
| Differential Voltage Range<br>(See Figure 5, point P-P <sup>7</sup> ) | TXFMR<br>2.12:1 | V <sub>IDR</sub> | -   | 14  | 20  | V <sub>p-p</sub> |
| Common Mode Rejection Ratio (Note 3)                                  |                 | CMRR             | 45  | -   | -   | dB               |

### STROBE CHARACTERISTICS (LOGIC "0" INHIBITS OUTPUT)

|                                    |                       |                 |     |      |      |    |
|------------------------------------|-----------------------|-----------------|-----|------|------|----|
| "0" Input Current                  | V <sub>S</sub> = 0.4V | I <sub>IL</sub> | -   | -0.2 | -0.4 | mA |
| "1" Input Current                  | V <sub>S</sub> = 2.7V | I <sub>IH</sub> | -   | 1    | +40  | μA |
| "0" Input Voltage                  |                       | V <sub>IL</sub> | -   | -    | 0.7  | V  |
| "1" Input Voltage                  |                       | V <sub>IH</sub> | 2.0 | -    | -    | V  |
| Strobe Delay (Turn-on or Turn-off) |                       | t <sub>SD</sub> | -   | 50   | 100  | nS |

### THRESHOLD CHARACTERISTICS (SINEWAVE INPUT)

|  |             |                 |      |      |      |                  |
|--|-------------|-----------------|------|------|------|------------------|
| Internal Threshold Voltage (Referred to the bus) | 100KHz-1MHz | V <sub>TH</sub> | 0.60 | 0.82 | 1.10 | V <sub>p-p</sub> |
|--|-------------|-----------------|------|------|------|------------------|

### OUTPUT CHARACTERISTICS, RX DATA AND RX $\overline{\text{DATA}}$

|   |                          |                  |     |      |     |    |
|---|--------------------------|------------------|-----|------|-----|----|
| "1" State   | I <sub>OH</sub> = -0.4mA | V <sub>OH</sub>  | 2.5 | 3.7  | -   | V  |
| "0" State   | I <sub>OL</sub> = -4mA   | V <sub>OL</sub>  | -   | 0.35 | 0.5 | V  |
| Delay, (average) from differential input zero crossings to RX DATA and RX $\overline{\text{DATA}}$ output | 50% points               | t <sub>DRX</sub> | -   | 340  | 500 | nS |

## POWER DATA

### POWER SUPPLY CURRENTS – PER CHANNEL

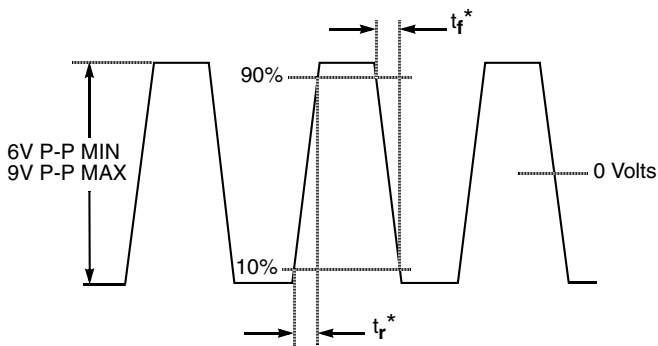
|                     |        |                 |   |     |     |    |
|---------------------|--------|-----------------|---|-----|-----|----|
| Transmitter Standby | Note 4 | I <sub>CC</sub> | - | 18  | 30  | mA |
| 25% Duty Cycle      |        |                 | - | 135 | 195 |    |
| 50% Duty Cycle      |        |                 | - | 250 | 345 |    |
| 100% Duty Cycle     |        |                 | - | 475 | 650 |    |

### POWER SUPPLY VOLTAGE

|                                      |  |                 |       |       |       |   |
|--------------------------------------|--|-----------------|-------|-------|-------|---|
| Operating Power Supply Voltage Range |  | V <sub>CC</sub> | +4.75 | +5.00 | +5.50 | V |
|--------------------------------------|--|-----------------|-------|-------|-------|---|

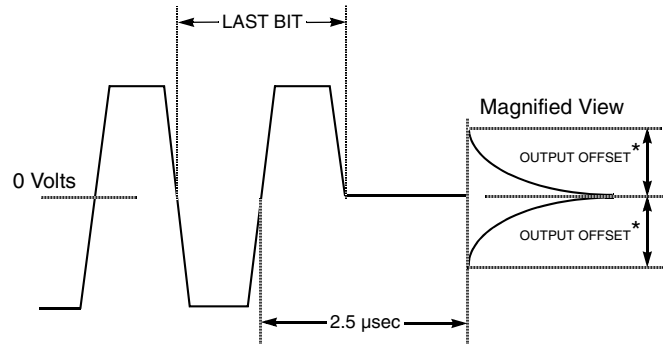
#### NOTES:

- Power on or off, measured from 75KHz to 1MHz at point A-A' and transformer self impedance of 3KΩ minimum.
- V<sub>CC</sub> = 5 Volts ±0.5 V, bypassed by 6.8 μF (Tantalum recommended) Capacitor minimum. All measurements & specifications apply over the temperature range of -55°C to +125°C (case temperature) unless otherwise specified.
- When measured at point A-A' with ± 10 Volt peak, line to ground, DC to 2MHz.
- Typical power is measured with V<sub>bus</sub> at point A-A' = 7.0 V<sub>p-p</sub>.



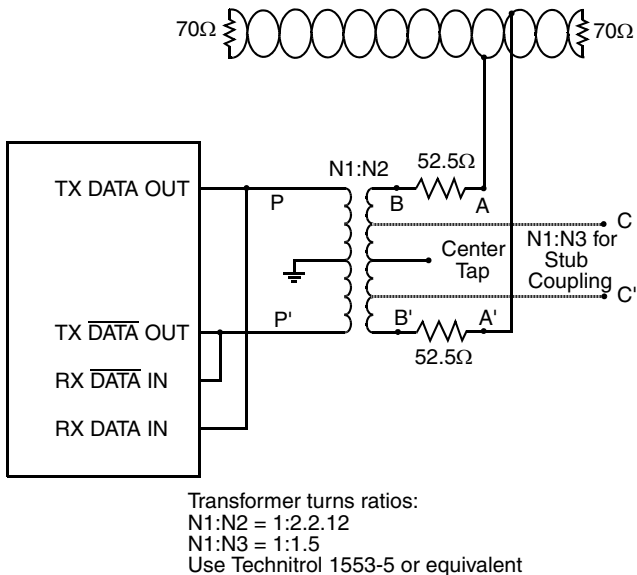
\* Rise and fall times measured at point A-A' in Figure 5

**FIGURE 3 – TRANSMITTER (TX) OUTPUT WAVEFORM**

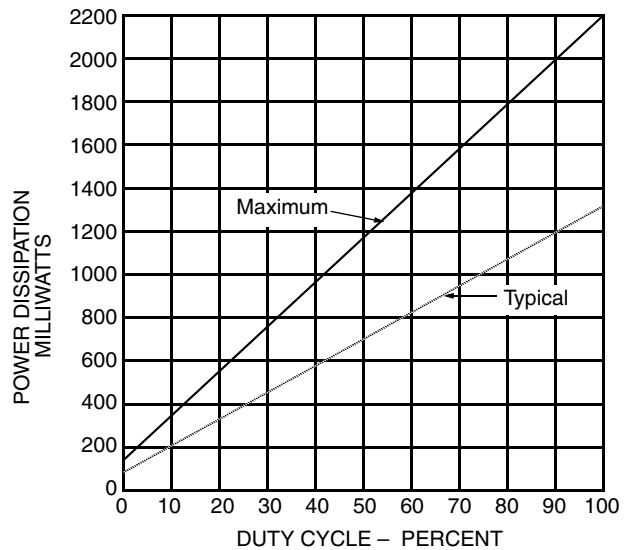


\*Offset measured at point C-C' in Figure 5

**FIGURE 4 – TRANSMITTER (TX) OUTPUT OFFSET**



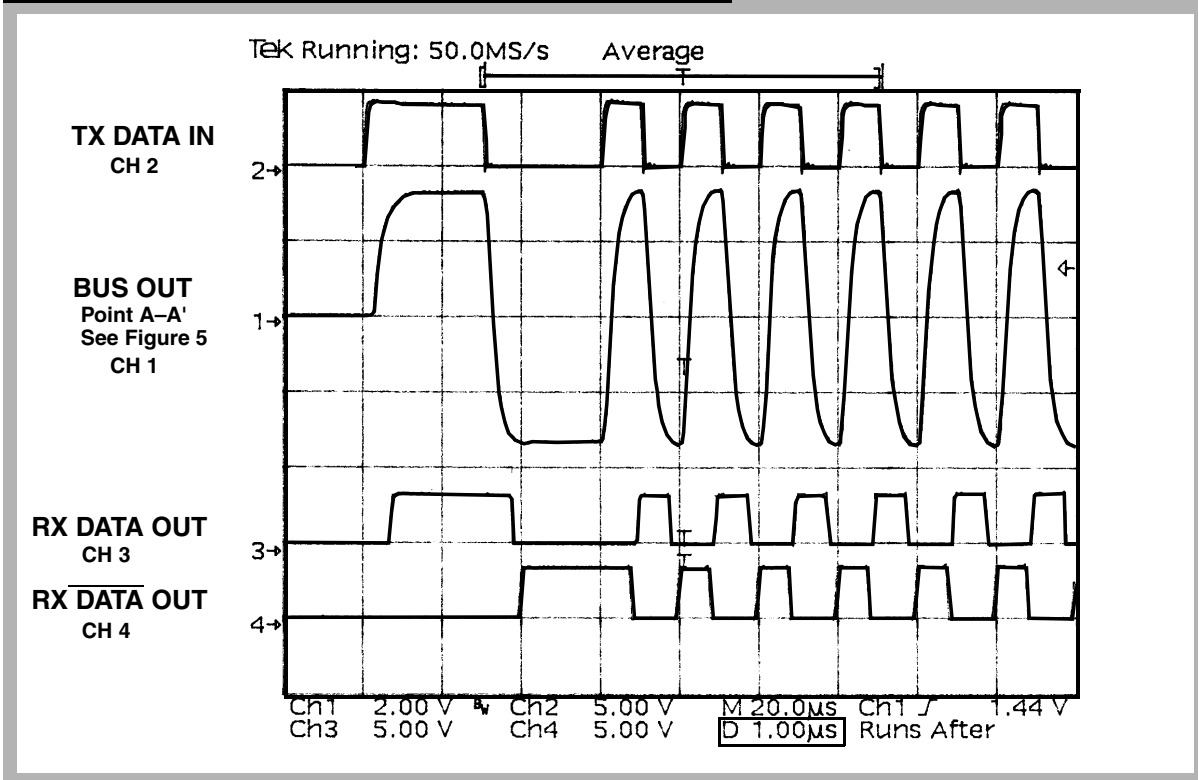
**FIGURE 5 – TYPICAL TRANSFORMER DIRECT CONNECTION**



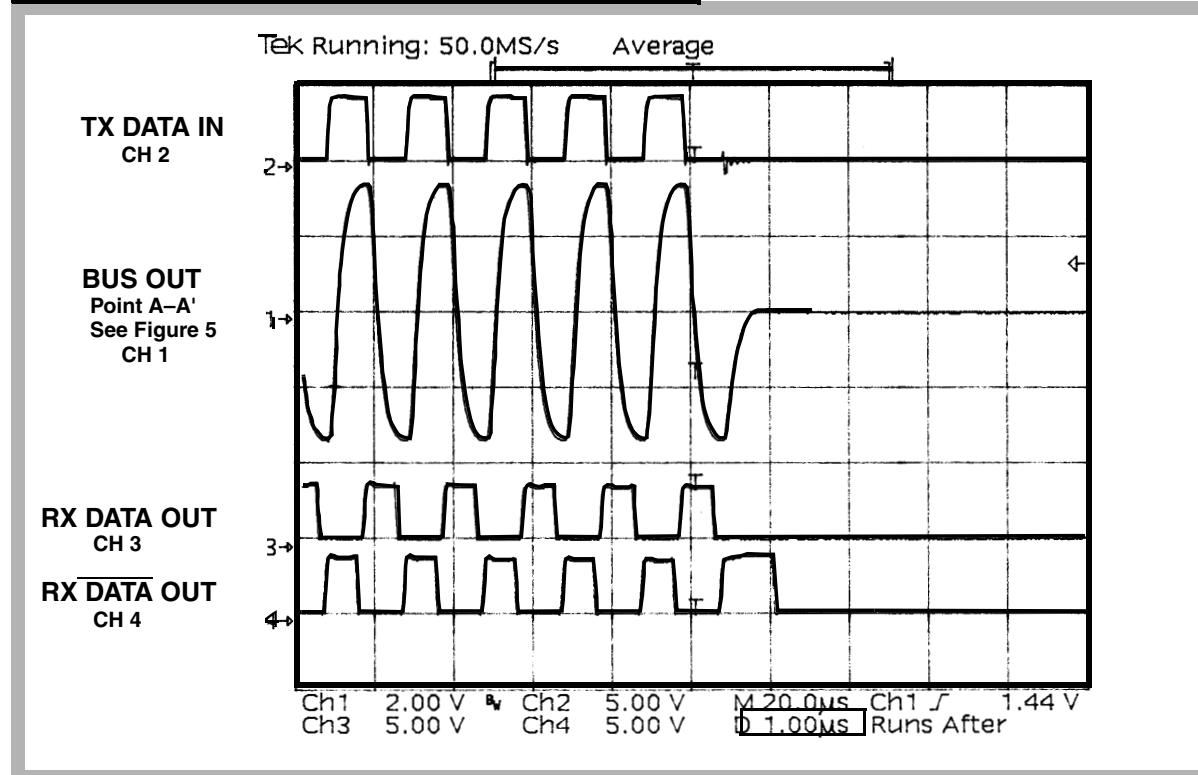
Note:  $V_{cc} = +5V_{dc}$ , Transformer ratio 1:2.12,  $V_{bus}$  (Pt A-A') at 7.5V P-P.

**FIGURE 6 – POWER DISSIPATION VS. DUTY CYCLE**  
 (Total, hybrid with one channel transmitting and the other not powered)

**START OF WORD – 33 WORD TRANSMISSION**



**END OF WORD – 33 WORD TRANSMISSION**

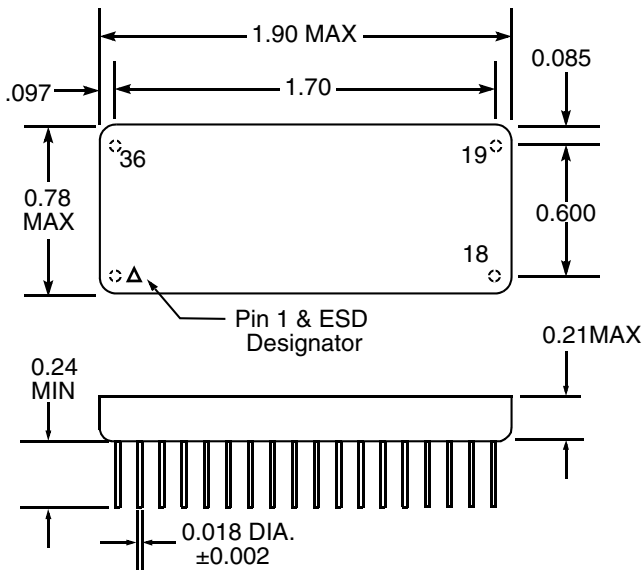


\* Oscilloscope used is a TEK TDS540 with Probe 6139A.

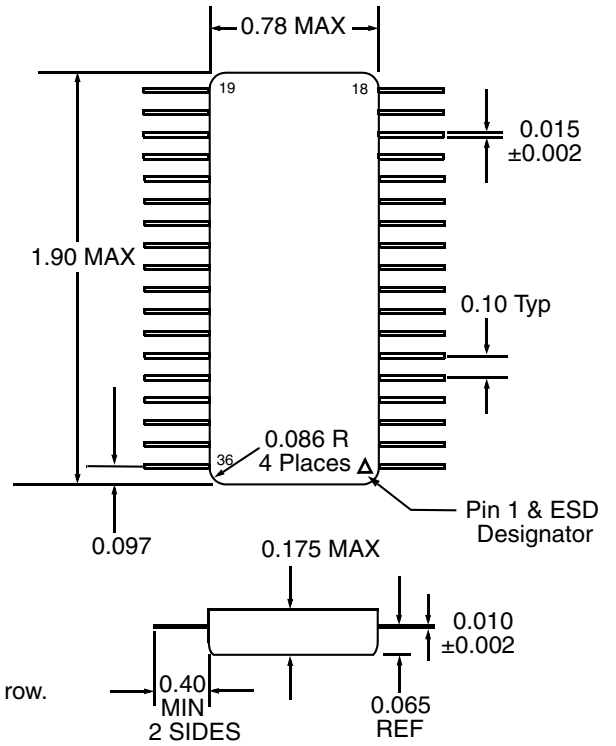
**FIGURE 7 ACTUAL HYBRID WAVEFORMS \* – 25°C TYPICAL**

## PACKAGE OUTLINES

**Model ACT4453 Dual In Line**



**Model ACT4453-2 Flat Pack**



**Notes**

1. Dimensions shown are in inches
2. Pins are equally spaced at  $0.100 \pm 0.002$  tolerance, non-cumulative, each row.

## PIN NUMBERS & FUNCTIONS

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

## ORDERING INFORMATION

| MODEL                              | DSCC SMD #                         | SCREENING   | PACKAGE      |
|------------------------------------|------------------------------------|---|--------------|
| ACT 4453-7                         | -                                  | Commercial Flow, +25°C testing only   | Dual in Line |
| ACT 4453-2-7                       | -                                  |   | Flat Package |
| ACT 4453                           | -                                  | Military Temperature, -55°C to +125°C<br>Screened in accordance with MIL-PRF-38534, Class H | Dual in Line |
| ACT 4453-2                         | -                                  |   | Flat Package |
| ACT-4453-001-4<br>ACT-4453-001-5   | 5962-8952211XC<br>5962-8952211XA   | In accordance with DSCC SMD 5962-89522, Class H   | Dual in Line |
| ACT-4453-001-4S<br>ACT-4453-001-5S | 5962-8952211KXC<br>5962-8952211KXA | In accordance with DSCC SMD 5962-89522, Class K   |              |
| ACT-4453-201-4<br>ACT-4453-201-5   | 5962-8952211YC<br>5962-8952211YA   | In accordance with DSCC SMD 5962-89522, Class H   | Flat Package |
| ACT-4453-201-4S<br>ACT-4453-201-5S | 5962-8952211KYC<br>5962-8952211KYA | In accordance with DSCC SMD 5962-89522, Class K   |              |
| ACT-4453-001-1<br>ACT-4453-001-2   | 5962-8952212XC<br>5962-8952212XA   | In accordance with DSCC SMD 5962-89522, Class H   | Dual in Line |
| ACT-4453-001-1S<br>ACT-4453-001-2S | 5962-8952212KXC<br>5962-8952212KXA | In accordance with DSCC SMD 5962-89522, Class K   |              |
| ACT-4453-201-1<br>ACT-4453-201-2   | 5962-8952212YC<br>5962-8952212YA   | In accordance with DSCC SMD 5962-89522, Class H   | Flat Package |
| ACT-4453-201-1S<br>ACT-4453-201-2S | 5962-8952212KYC<br>5962-8952212KYA | In accordance with DSCC SMD 5962-89522, Class K   |              |

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