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

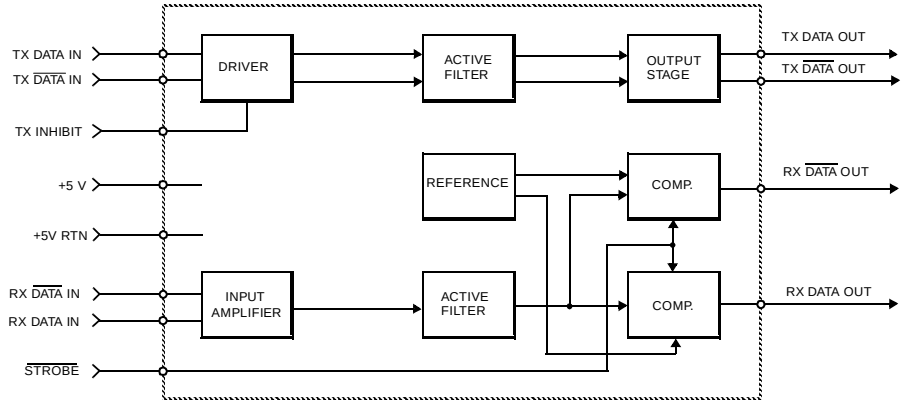
## Features

- **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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**Case Style**
**ACT 4454FP**
**Actual Size**




**Block Diagram (without Transformer)**

## 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

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 $\overline{\text{DATA}}$ 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 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.

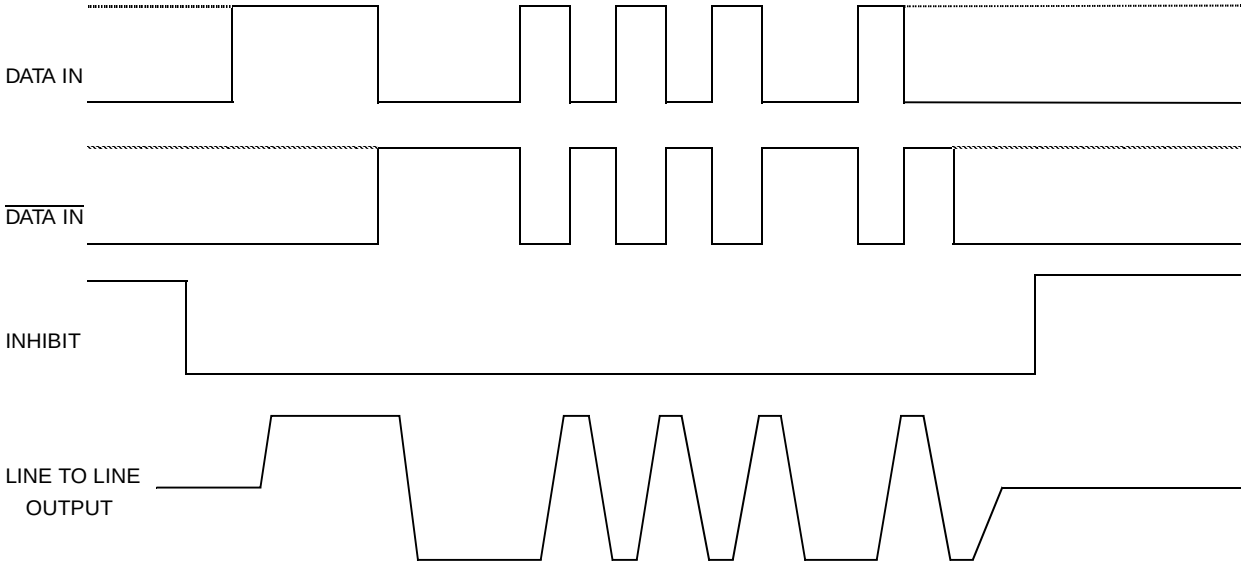
## Receiver:

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

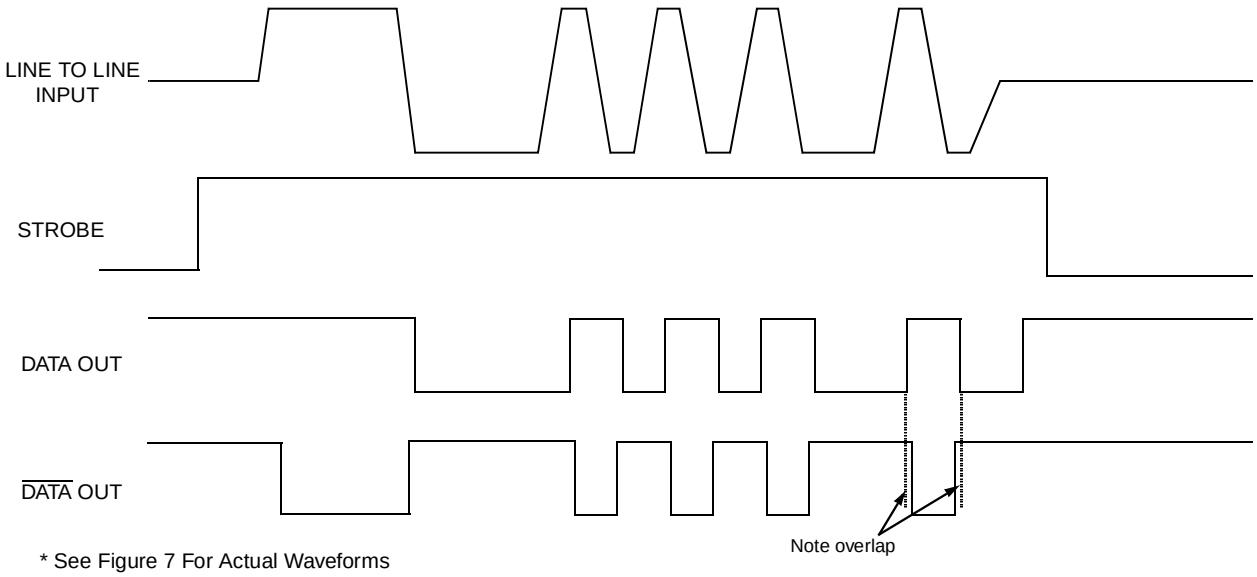
A low level at the Strobe input inhibits the DATA and $\overline{\text{DATA}}$ outputs. If unused, a 2K pull-up to +5 Volts is recommended

**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***




* 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<br>**(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

| | | | | | | |
|---|---|---|---|---|---|---|
| "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

| | | | | | | |
|---|---|---|---|---|---|---|
| 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)

| | | | | | | |
|---|---|---|---|---|---|---|
| "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)

| | | | | | | |
|---|---|---|---|---|---|---|
| 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 $\overline{\text{DATA}}$

| | | | | | | |
|---|---|---|---|---|---|---|
| "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 $\overline{\text{DATA}}$ Output 50% points | | $t_{DRX}$ | | 340 | 500 | nS |

## Power Data

### Power Supply Currents – Per Channel

| | | | | | | |
|---|---|---|---|---|---|---|
| Transmitter Standby | Note 4 | $I_{CC}$ | | 13 | 30 | mA |
| 25% duty cycle | | | | 170 | 200 | |
| 50% duty cycle | | | | 320 | 400 | |
| 100% duty cycle | | | | 700 | 800 | |

### Power Supply Voltage

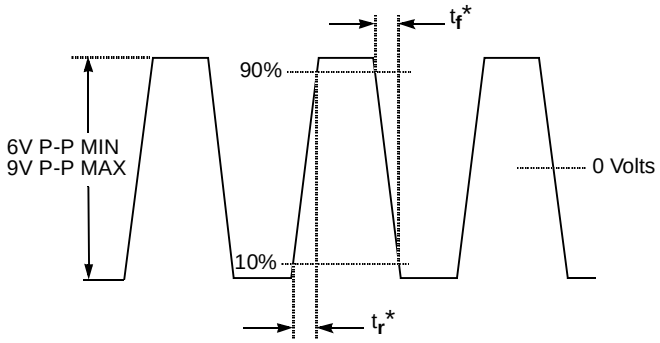
| | | | | | | |
|---|---|---|---|---|---|---|
| Operating Power Supply Voltage Range | | $V_{CC}$ | +4.75 | +5.00 | +5.50 | V |

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

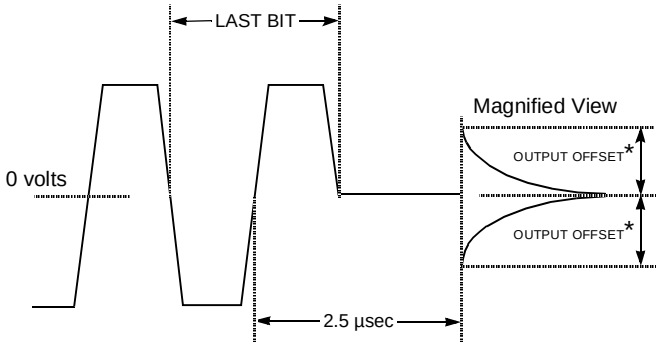
Note 4: Typical power is measured with $V_{bus}$ at point A-A' = 7.0 $V_{P-P}$

**Figure 3 – Transmitter (TX) Output Wave Form**



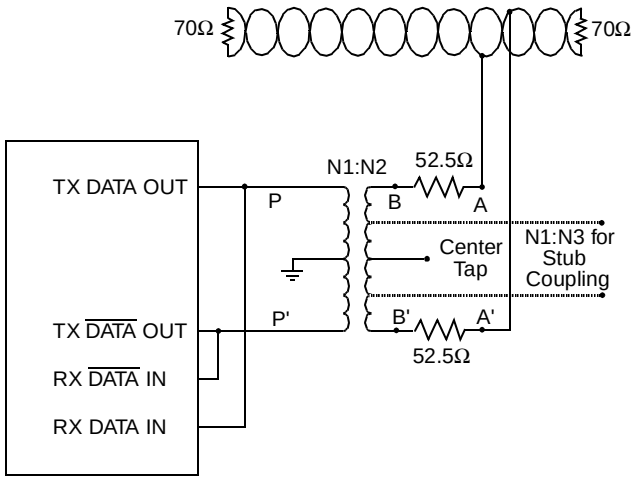

* Rise and fall times measured at point A-A' in Figure 5

**Figure 4 – Transmitter (TX) Output Offset**



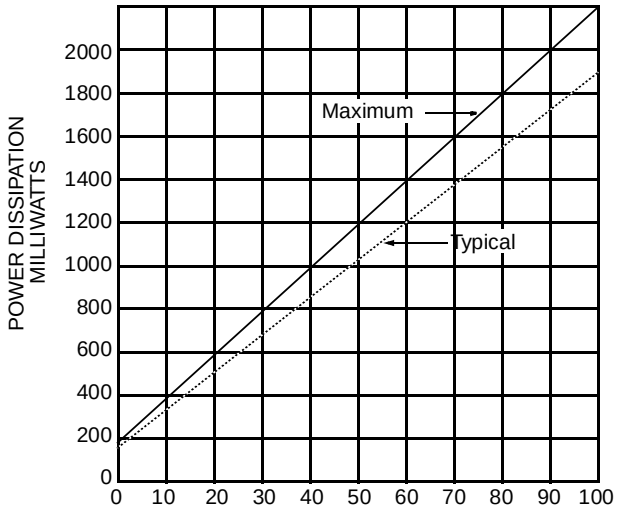

*Offset measured at point A-A' in Figure 5

**Figure 5 – Typical Direct Transformer Connection**




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)**




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***

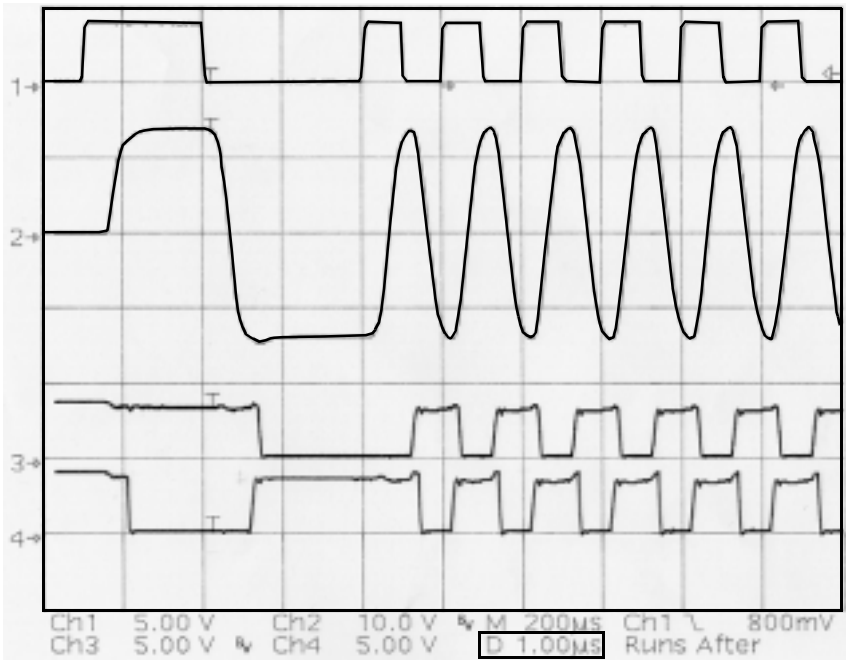
***START OF WORD – 33 WORD TRANSMISSION***

**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**




***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**

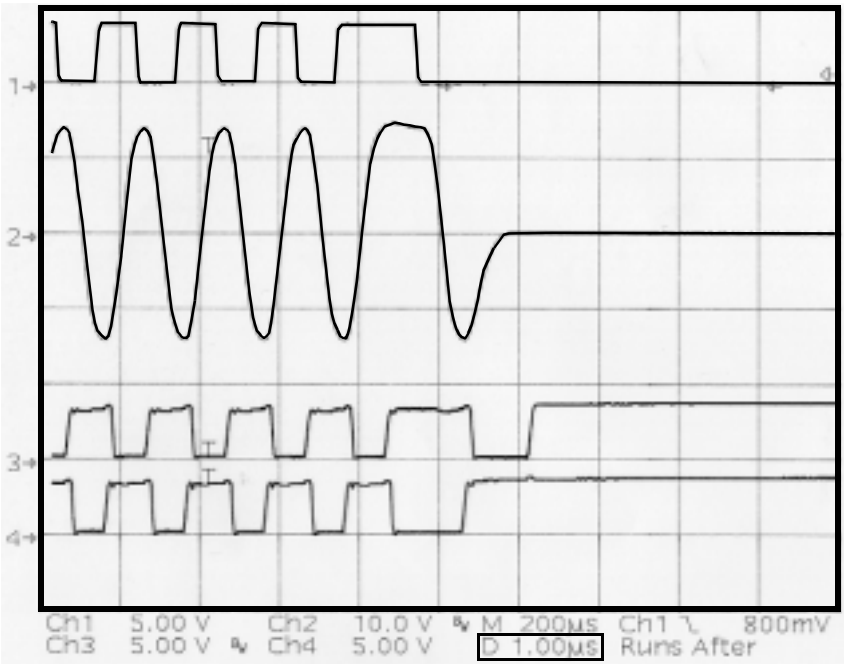


**Figure 8 – Pin Numbers & Functions**

| 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 |

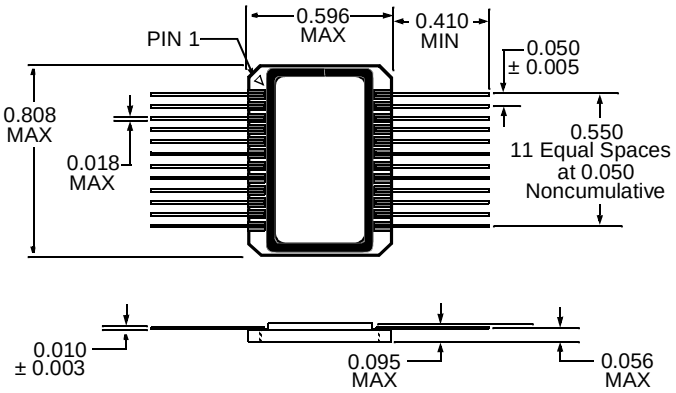
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## Configurations and Ordering Information

| 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.