**Standard Products**

# ACT4445 Transceiver for MIL-STD-1553 in a Chipscale Package

**www.aeroflex.com/Avionics**

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## Features

- Transceiver meets MIL-STD-1553A & B
- Bipolar Supply ±15V, Logic Supply +5V
- Replacement for ACT4487
- Current source output
- Monolithic construction
- Designed for commercial, industrial and aerospace applications
- Miniature Chipscale Package Bumped Chip Carrier™ (BCC++)

Note: BCC++ and Bumped Chip Carrier are Trademarks of Fujitsu Ltd.

## DESCRIPTION

The Aeroflex Plainview ACT 4445 is a monolithic transceiver that provides full compliance to MIL-STD-1553A/B requirements in a small package, with low power consumption.

The ACT 4445 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

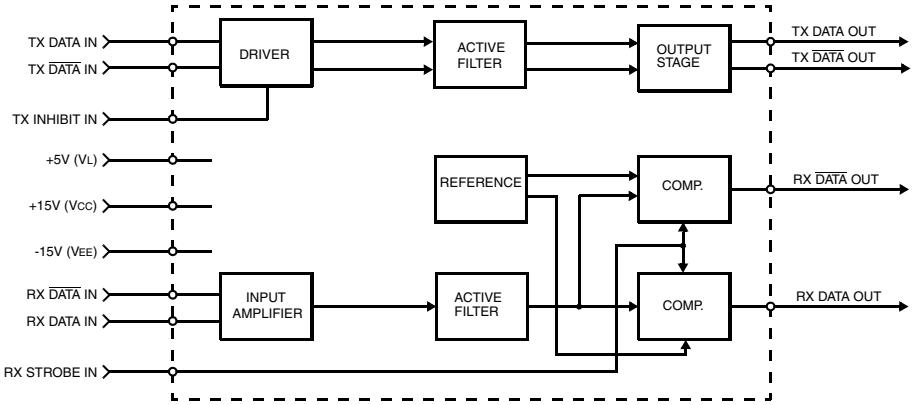
The Transmitter section accepts bi-phase TTL data at the input and when coupled to the data bus with a 1.4:1 transformer the data bus signal produced is 7.5 Volts typical P-P at Point A (See Figure 3 or 4). When both DATA and DATA inputs are held low or high, the transmitter output becomes a high impedance 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

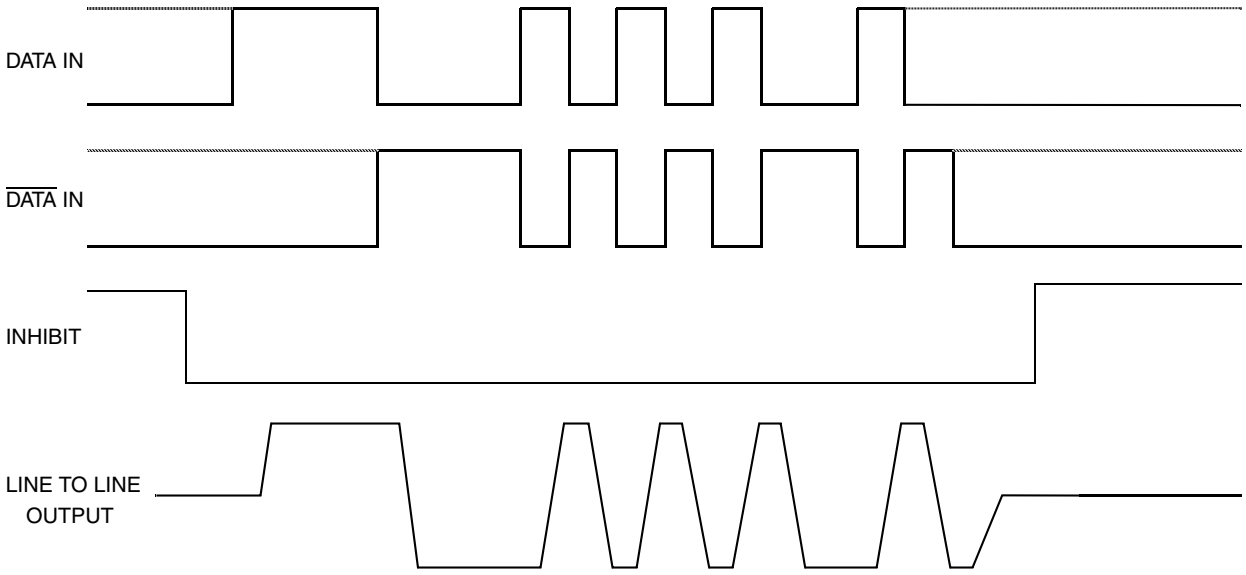
The Receiver section accepts bi-phase differential data at the input and produces two TTL signals at the output. The outputs are DATA and $\overline{\text{DATA}}$, and represent positive and negative excursions of the input beyond a pre-determined threshold (See Receiver Logic Waveforms - Figure 2).

The pre-set internal thresholds will detect data bus signals, Point A Figure 3 or 4, exceeding 1.20 Volts P-P and reject signals less than 0.6 Volts P-P when used with a transformer (See Figure 3 or 4 for transformer data and typical connection).

A low level at the RX Strobe input inhibits the DATA and $\overline{\text{DATA}}$ outputs. If unused RX Strobe is internally pulled high.

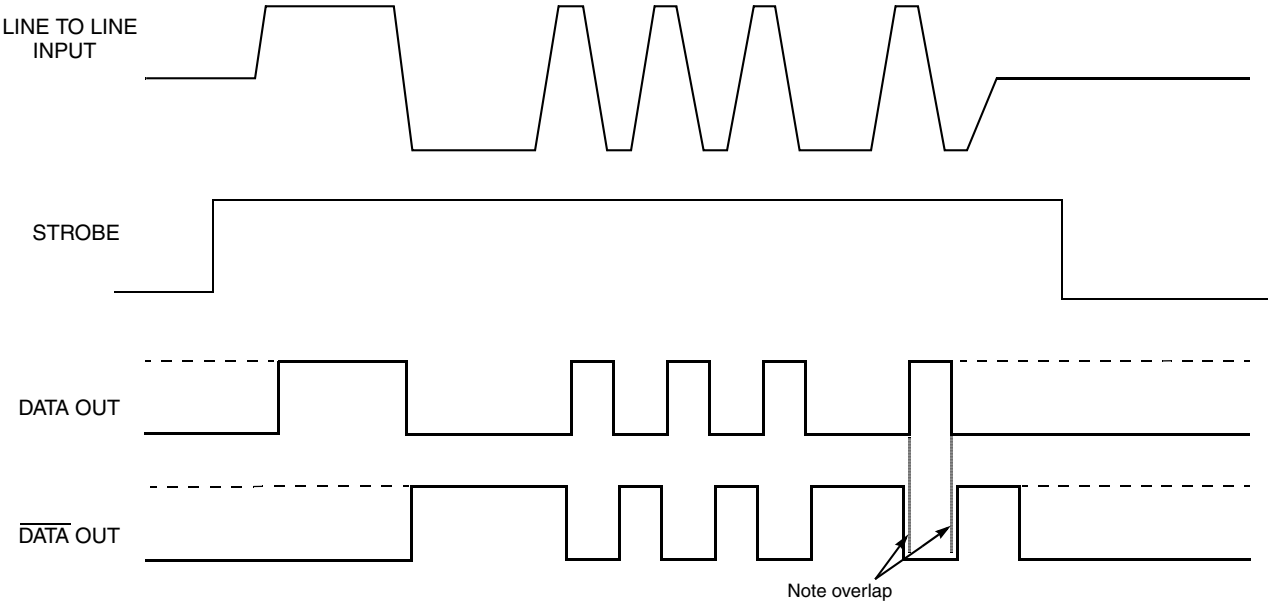



## BLOCK DIAGRAM (WITHOUT TRANSFORMER)




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 1 - TRANSMITTER LOGIC WAVEFORMS




## FIGURE 2 - RECEIVER LOGIC WAVEFORMS
## NORMALLY HIGH OR LOW OUTPUT IN STANDBY (SEE FIGURE 3 OR 4)

## ABSOLUTE MAXIMUM RATINGS

| | |
|---|---|
| Operating Case Temperature | -40°C to +85°C |
| Storage Case Temperature | -65°C to +150°C |
| Power supply voltage<br>VCC<br>VEE<br>VL | <br>-0.3 to +18 VDC<br>+0.3 to -18 VDC<br>-0.3 to +7.0 VDC |
| Logic Input Voltage | -0.3 V to +5.5 VDC |
| Receiver Differential Input | ±40 V |
| Receiver Input Voltage (Common Mode) | ±10V |
| Driver Peak Output Current | 200 mA |
| Total Package Power Dissipation over the Full Operating Case Temperature Range | 2.5 Watts |
| Maximum Junction to Case Temperature | 2.5°C |
| Thermal Resistance – Junction to Case | 1°C/W |

## ELECTRICAL CHARACTERISTICS – DRIVER SECTION 2/ 3/

### INPUT CHARACTERISTICS, TX DATA IN OR TX $\overline{\text{DATA}}$ IN

| 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 | - | $V_{ILD}$ | - | - | 0.7 | V |
| "1" Input Voltage | - | $V_{IHD}$ | 2.0 | - | - | V |

### INHIBIT CHARACTERISTICS

| | | | | | | |
|---|---|---|---|---|---|---|
| "0" Input Current | VIN = 0.4 V | $I_{ILI}$ | - | -0.2 | -0.4 | mA |
| "1" Input Current | Vin = 2.7V | $I_{IHI}$ | - | 1.0 | 40 | µA |
| "0" Input Voltage | | $V_{ILI}$ | - | - | 0.7 | V |
| "1" Input Voltage | | $V_{IHI}$ | 2 | - | - | V |
| Delay from TX inhibit, (0→1) to inhibited output | From mid point inhibit to ±1.2V Point A, See Figure 3 or 4 | $t_{DXOFF}$ | - | 300 | 500 | nS |
| Delay from TX inhibit, (1→0) to active output | | $t_{DXON}$ | - | 300 | 500 | nS |
| Differential output noise, inhibit mode | | $V_{NOI}$ | - | 0.8 | 10 | mVP-P |
| Differential output impedance (inhibited) (Note 1) See Figure 3 or 4. | Point A | $Z_{OI}$ | 2K | - | - | Ω |

### OUTPUT CHARACTERISTICS

| | | | | | | |
|---|---|---|---|---|---|---|
| Differential output level | Figure 3 or 4 Point A | VO | 6 | 7.5 | 9 | VP-P |
| Rise and Fall times (10% to 90% at Point A output) | | tR & tF | 100 | 160 | 300 | nS |
| Output offset, Figure 5, 2.5µS after midpoint crossing of the parity bit of the last word of a 660µS message | | VOS | - | - | ± 90 | mVPK |
| Delay from 50% point of TX DATA or TX $\overline{\text{DATA}}$ input to zero crossing of differential signal | | tDXT | - | 100 | 200 | nS |

## ELECTRICAL CHARACTERISTICS – RECEIVER SECTION

| Parameter | Condition | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Differential Receiver Input Voltage Range (See Figure 3 or 4, Point A) | TXFMR 1.4:1 | $V_{IDR}$ | - | - | 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 | $V_S$ = 0.4 V | $I_{IL}$ | - | -0.1 | -0.2 | mA |
| "1" Input Current | $V_S$ = 2.7 V | $I_{IH}$ | - | 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 6

| Duty Cycle | Condition | Symbol | Typ | Max | Unit |
|---|---|---|---|---|---|
| Transmitter Standby | | $I_{CC}$<br>$I_{EE}$<br>$I_L$ | 0<br>12<br>18 | 1<br>16<br>30 | mA |
| 25% | | $I_{CC}$<br>$I_{EE}$<br>$I_L$ | 45<br>12<br>18 | 50<br>20<br>30 | |
| 50% | | $I_{CC}$<br>$I_{EE}$<br>$I_L$ | 90<br>12<br>18 | 100<br>20<br>30 | |
| 100% | | $I_{CC}$<br>$I_{EE}$<br>$I_L$ | 180<br>12<br>18 | 200<br>20<br>30 | |

## RECOMMENDED POWER SUPPLY VOLTAGE RANGE

| | |
|---|---|
| $V_{CC}$ | +14.25 to +15.75 Volts |
| $V_{EE}$ | -14.25 to -15.75 Volts |
| $V_L$ | +4.75 to +5.25 Volts |

Notes:
1. Power on or off, measured from 75KHz to 1MHz at Point A and transformer self impedance of 3KΩ minimum at 1MHz.
2. Power Supplies: ±15$V_{DC}$ ±0.75$V_{DC}$ & +5$V_{DC}$ ±0.25$V_{DC}$, bypassed by 10 µF (Tantalum recommended) Capacitor minimum. All measurements & specifications apply over the temperature range of -40°C to +85°C (case temperature) unless otherwise specified.
3. When measured as shown per Figure 3 or 4 with ± 10$V_{PK}$, line to ground, DC to 2MHz
4. Typical power is measured with $V_{BUS}$ at Point A = 7.5$V_{P-P}$

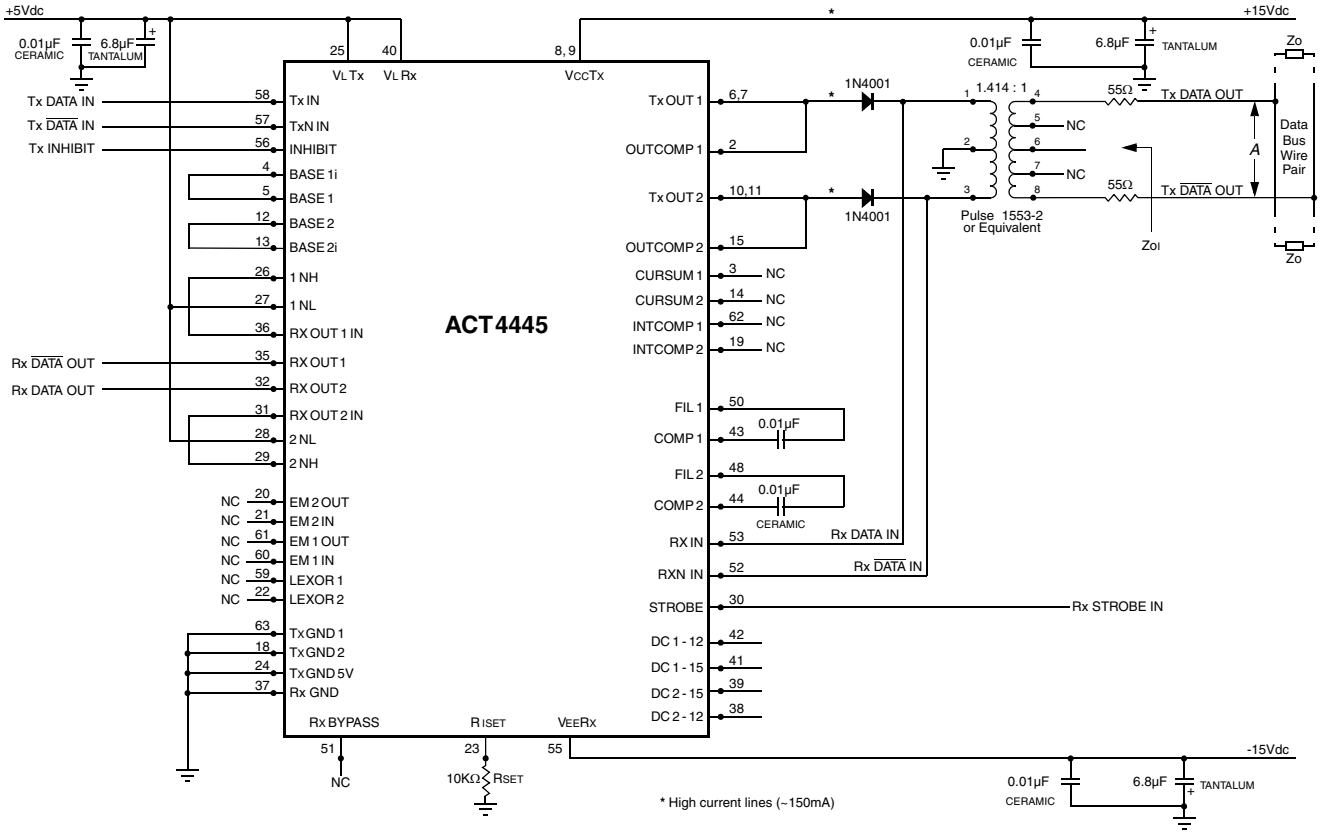



**FIGURE 3 – TYPICAL CONNECTIONS – DATABUS INTERFACE, DIRECT COUPLED STUB, NORMALLY HIGH RECEIVER IDLE STATE**

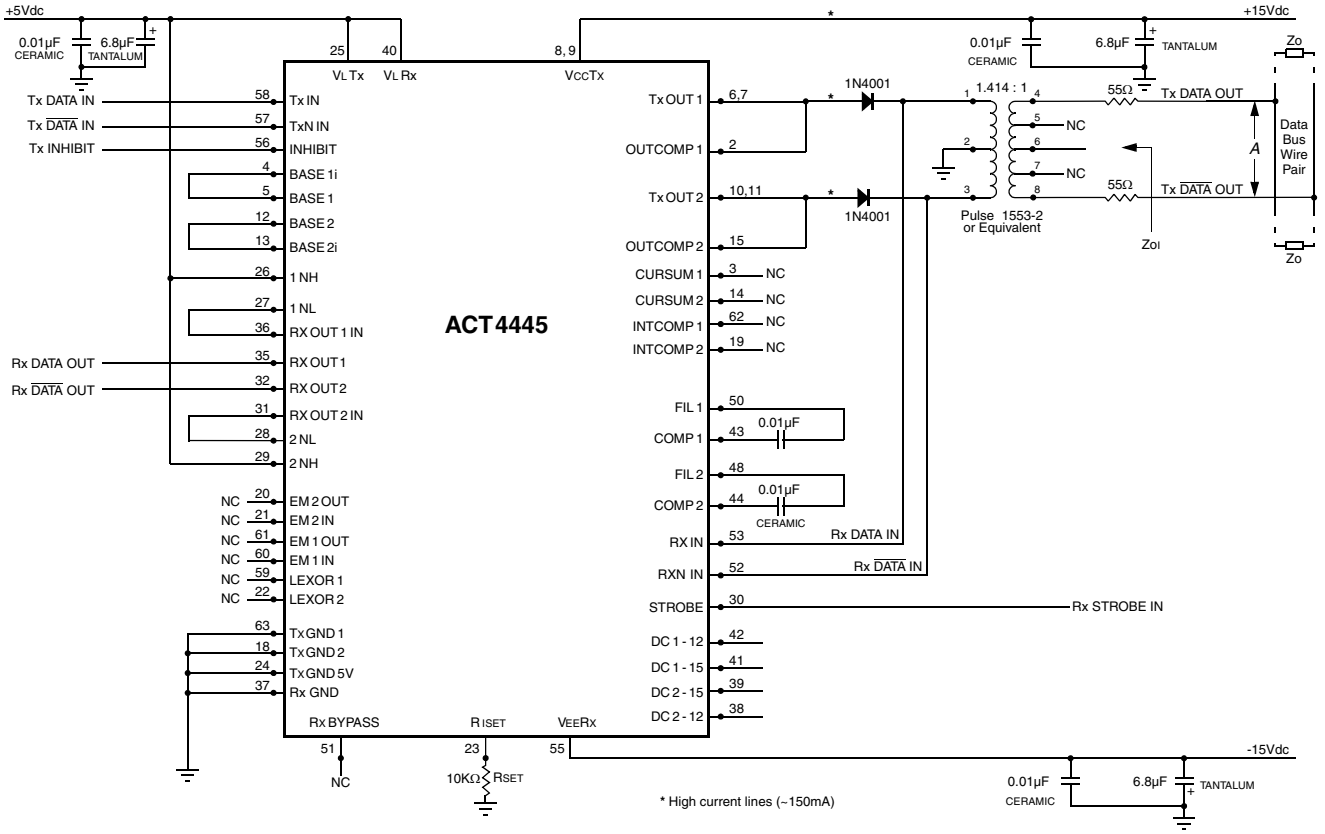
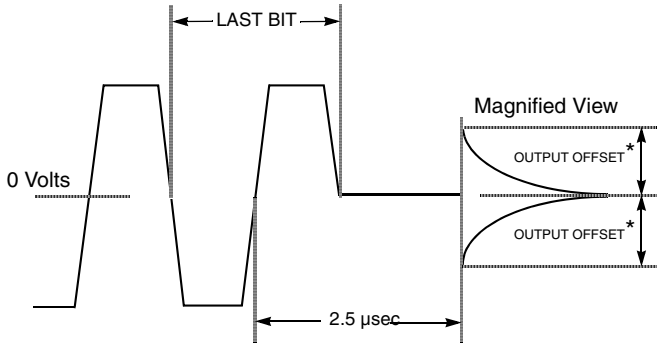
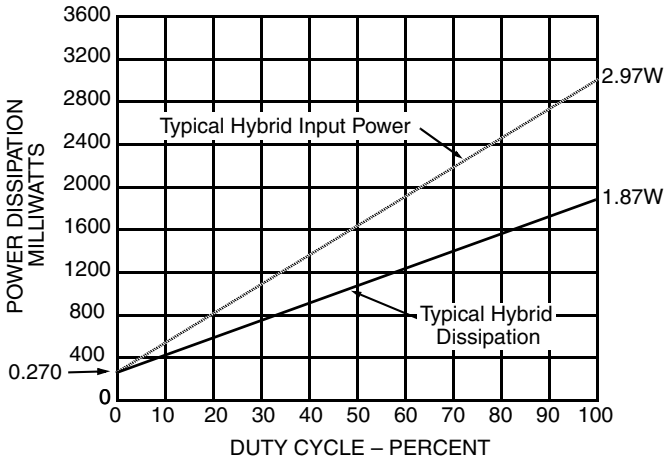



**FIGURE 4 – TYPICAL CONNECTIONS – DATABUS INTERFACE, DIRECT COUPLED STUB, NORMALLY LOW RECEIVER IDLE STATE**




*Offset measured at Point A in Figure 3 or 4

**FIGURE 5 – TRANSMITTER (TX) OUTPUT WAVE FORM**




Note: $V_{CC}$= +15$V_{DC}$, $V_{EE}$ = -15$V_{DC}$, $V_L$= +5$V_{DC}$, Transformer ratio 1.4:1, $V_{BUS}$ (Figure 3 or 4 - Point A) at 7.5$V_{P-P}$.

**FIGURE 6 – TYPICAL HYBRID POWER DISSIPATION vs DUTY CYCLE**

## PACKAGE PIN OUT DESCRIPTION - ACT4445

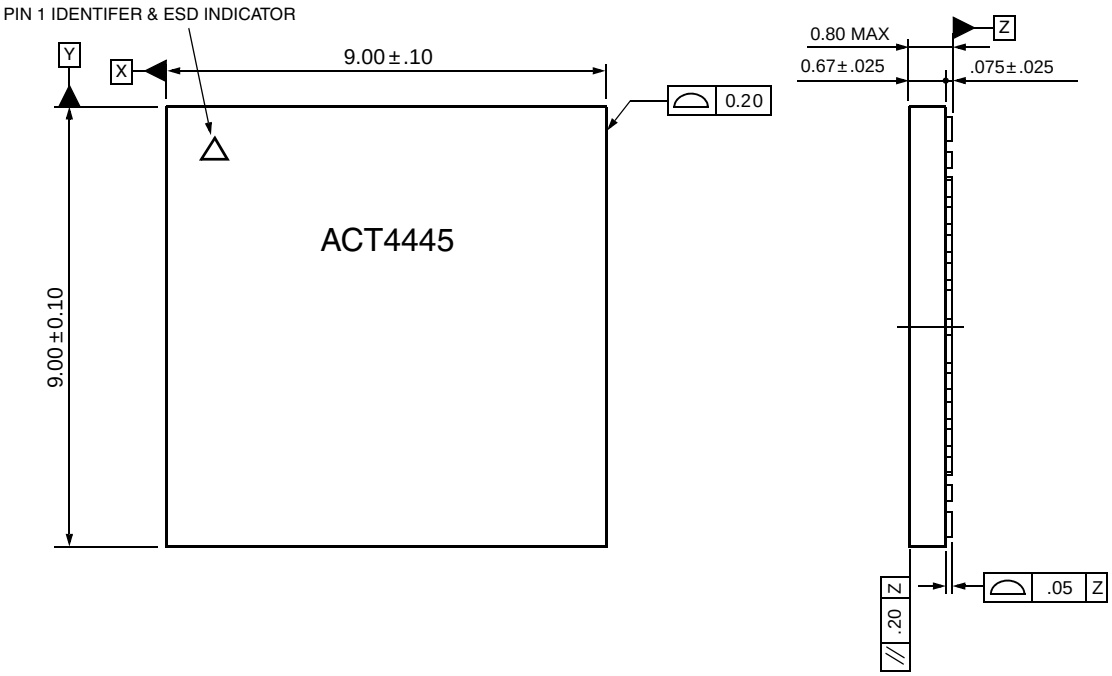
| Pin # | Function | Pin # | Function |
|---|---|---|---|
| 1 | NC | 33 | NC |
| 2 | OUTCOMP 1 | 34 | NC |
| 3 | CURSUM1 | 35 | RXOUT 1 |
| 4 | BASE 1i | 36 | RXOUT 1 IN |
| 5 | BASE 1 | 37 | RX GND |
| 6 | TXOUT 1* | 38 | DC2 - 12 |
| 7 | TXOUT 1* | 39 | DC2 - 15 |
| 8 | VCCTX* | 40 | VL RX |
| 9 | VCCTX* | 41 | DC1 - 15 |
| 10 | TXOUT 2* | 42 | DC1 - 12 |
| 11 | TXOUT 2* | 43 | COMP 1 |
| 12 | BASE 2 | 44 | COMP 2 |
| 13 | BASE 2i | 45 | NC |
| 14 | CURSUM 2 | 46 | NC |
| 15 | OUTCOMP 2 | 47 | NC |
| 16 | NC | 48 | FIL 2 |
| 17 | NC | 49 | NC |
| 18 | TX GND 2 | 50 | FIL 1 |
| 19 | INTCOMP 2 | 51 | RXBYPASS |
| 20 | EM2 OUT | 52 | RXN IN |
| 21 | EM2 IN | 53 | RX IN |
| 22 | IEXOR 2 | 54 | NC |
| 23 | R ISET | 55 | VEERX |
| 24 | TX GND 5V | 56 | INHIBIT |
| 25 | VL TX | 57 | TXN IN |
| 26 | 1NH | 58 | TX IN |
| 27 | 1NL | 59 | IEXOR 1 |
| 28 | 2 NL | 60 | EM1 IN |
| 29 | 2 NH | 61 | EM1 OUT |
| 30 | STROBE | 62 | INTCOMP 1 |
| 31 | RXOUT 2 IN | 63 | TX GND 1 |
| 32 | RXOUT 2 | 64 | NC |

NC = No Connect

* High Current Line (~100mA)

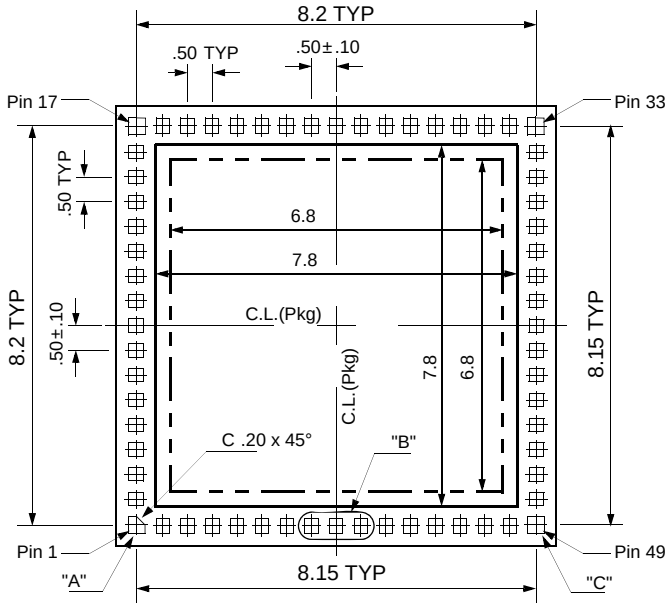
# PACKAGE DESCRIPTION

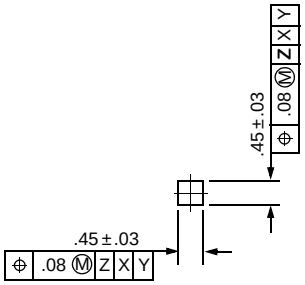
TOP VIEW



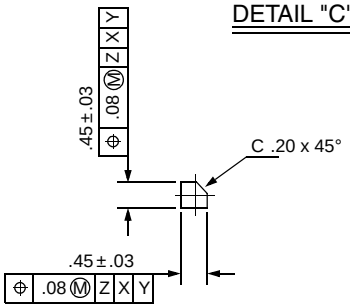

| mm | Inches |
|---|---|
| 9 | .354 |
| 8.2 | .323 |
| 8.15 | .321 |
| 0.8 | .0315 |
| 0.67 | .026 |
| 0.5 | .020 |
| 0.45 | .018 |
| 0.3 | .012 |
| 0.2 | .008 |
| 0.1 | .00394 |
| 0.08 | .00315 |
| 0.075 | .00295 |
| 0.05 | .002 |
| 0.03 | .0012 |
| 0.025 | .001 |
| 0.020 | .0008 |

BOTTOM VIEW

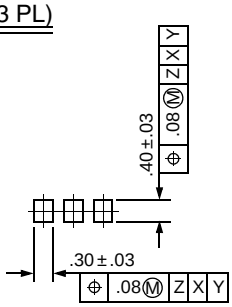



DETAIL "C" (3 PL)




DETAIL "A"




DETAIL "B" (60 PL)

Note
1. Dimensions in millimeters

## CONFIGURATIONS AND ORDERING INFORMATION

| Model No. | Screening Level | Receiver and Transmitter Data Levels | Package |
|---|---|---|---|
| ACT4445 | Industrial Temperature<br>-40°C to +85°C | User Configurable<br>(See Figure 3 & 4) | 64 Bump Chip Carrier |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