

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

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

AEROFLEX
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www.aeroflex.com/act1.htm

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.

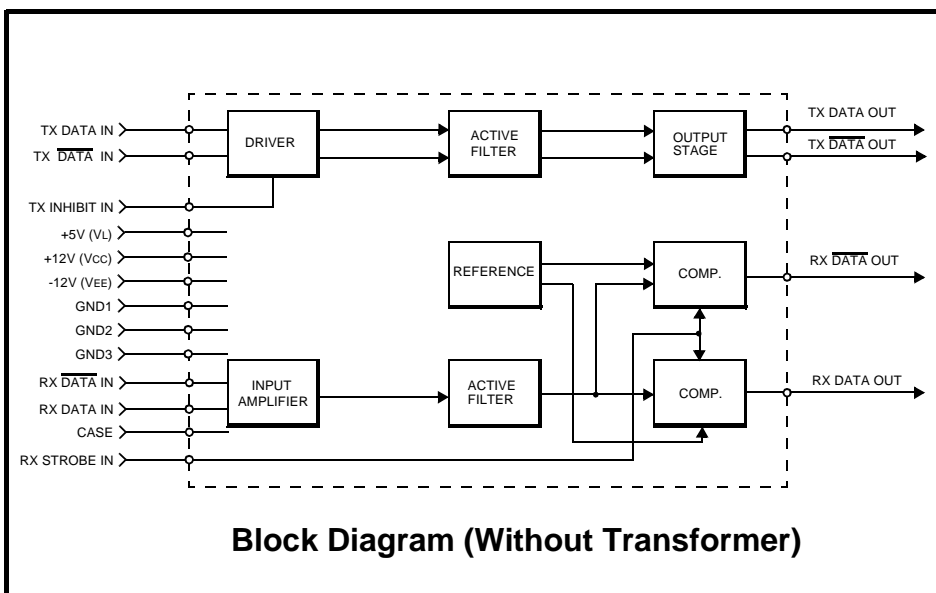
The ACT 4489 series performs the front-end analog function of inputting and outputting data through a transformer to the MIL-STD-1553 data bus.

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:

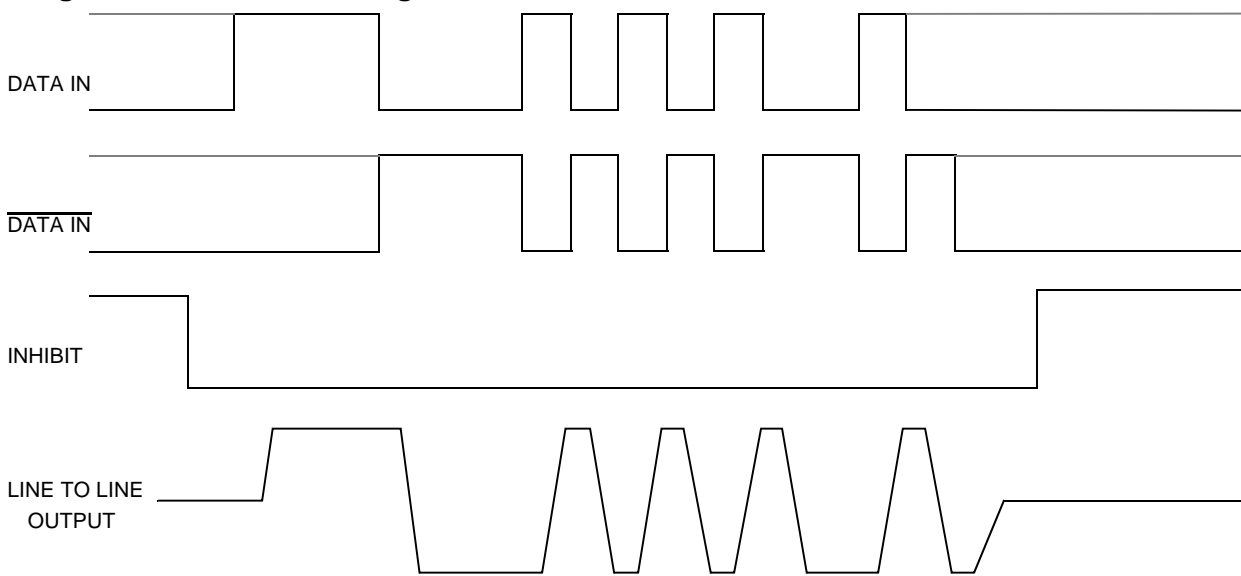
The Receiver section accepts bi-phase differential data at the input and produces two TTL signals at the output. The outputs are DATA and $\overline{\text{DATA}}$, and represent positive and negative excursions of the input beyond a pre-determined threshold (See Receiver Logic Waveform,

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).

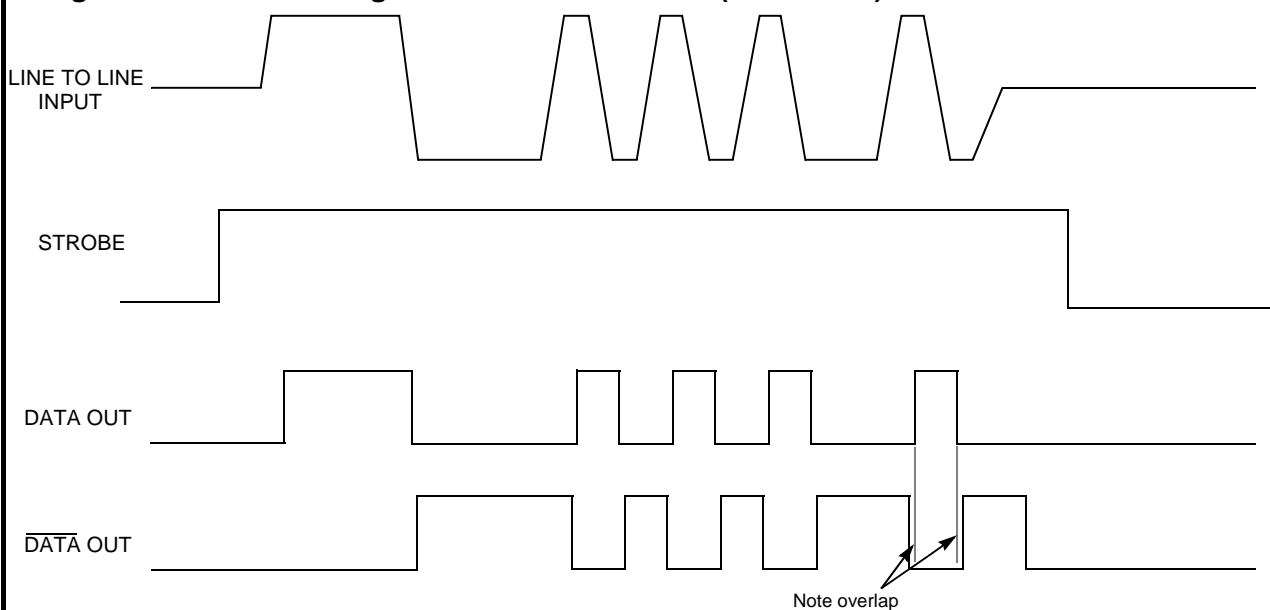
A low level at the RX Strobe input inhibits the DATA and $\overline{\text{DATA}}$ outputs. If unused, a 2K pull-up to +5 Volts is recommended.

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 VP-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 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 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 | $I_{OL} = 4 \text{ mA}$ | 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} | | 0 | 1 | mA |
| | | I_{EE} | | 12 | 16 | |
| | | I_L | | 18 | 30 | |
| 25% duty cycle | | I_{CC} | | 58 | 63 | |
| | | I_{EE} | | 12 | 20 | mA |
| | | I_L | | 18 | 30 | |
| 50% duty cycle | | I_{CC} | | 115 | 125 | |
| | | I_{EE} | | 12 | 20 | |
| | | I_L | | 18 | 30 | mA |
| 100% duty cycle | | I_{CC} | | 230 | 250 | |
| | | I_{EE} | | 12 | 20 | |
| | | I_L | | 18 | 30 | |

Power Supply Voltages

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

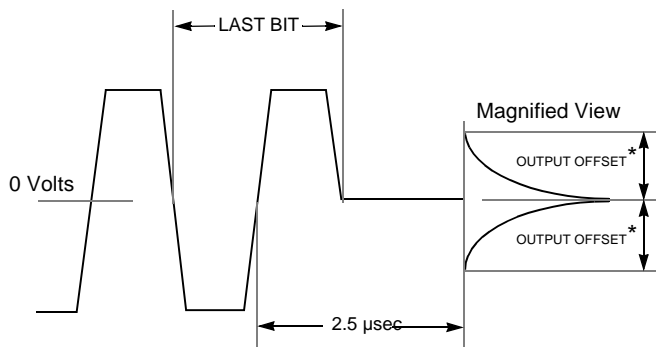
Note 1. Power on or off, measured from 75KHz to 1MHz at point A and transformer self impedance of 3K Ω minimum at 1MHz.

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

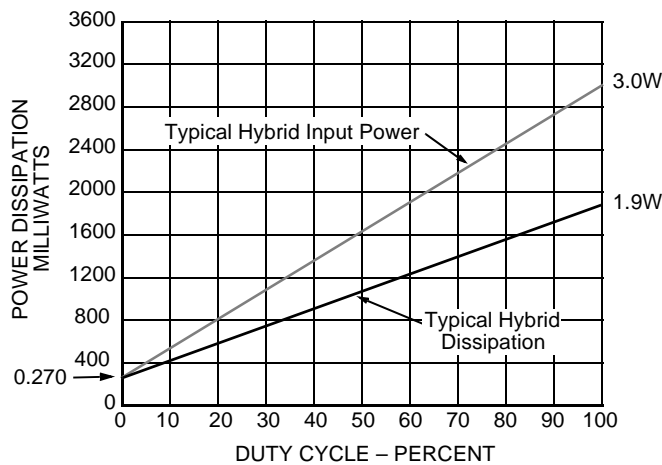
Note 4. Typical power is measured with V_{BUS} at point A = 7 V_{P-P}

Figure 3 – Transmitter (TX) Output Offset



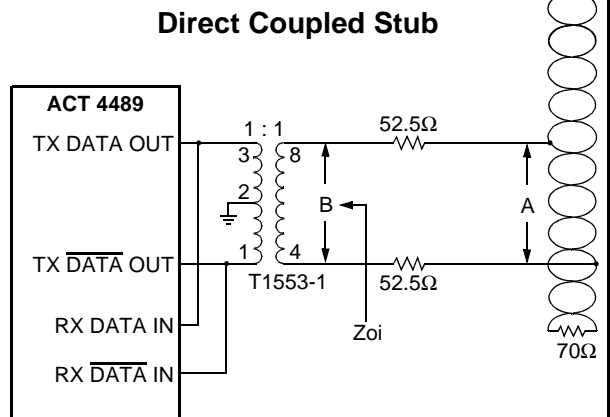
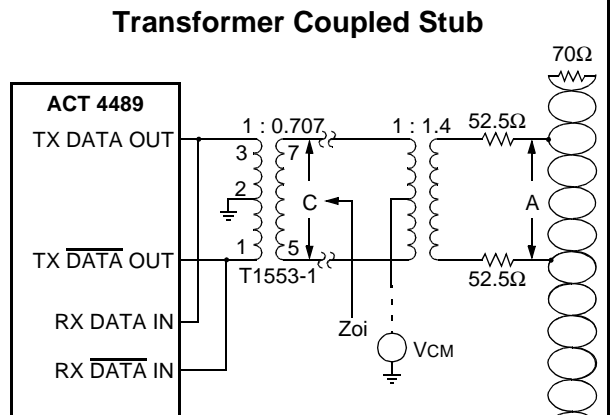
*Offset measured at point A in Figure 5

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



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

Figure 5 – Typical 1553 Bus Connections



Transformer Model use Technitrol Part# 1553-1 or equivalent

Configurations and Ordering Information

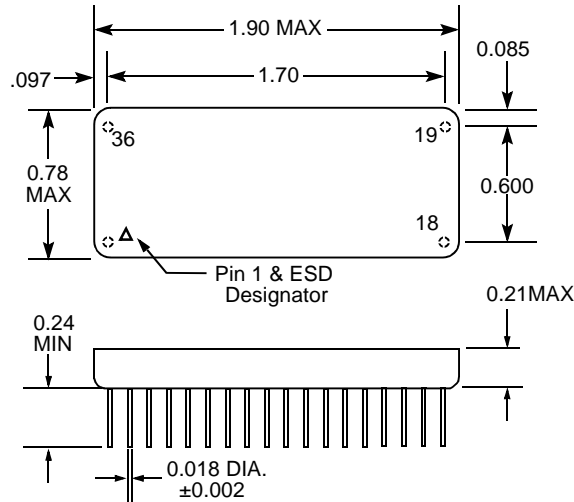
| ACT Model # / Ordering Part # | Case Style | DESC Number | Rx Standby |
|-------------------------------|------------|-------------|---------------|
| ACT 4489-D | DIP | TBA | Normally Low |
| ACT 4489-DI | DIP | TBA | Normally High |
| ACT 4489-DF | FP | TBA | Normally Low |
| ACT 4489-DFI | FP |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

Specifications subject to change without notice.

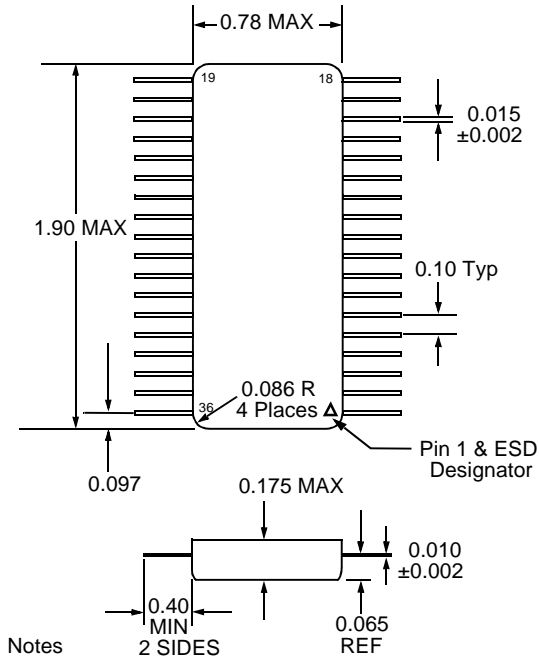
Figure 6 – Lead Numbers & Functions

| 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 | Vcc | B |
| 20 | RX DATA IN | B |
| 21 | RX $\overline{\text{DATA}}$ IN | B |
| 22 | GROUND 3 | B |
| 23 | VEE | B |
| 24 | +5 V (VL) | B |
| 25 | INHIBIT | B |
| 26 | TX DATA IN | B |
| 27 | TX $\overline{\text{DATA}}$ IN | B |
| 28 | Vcc | A |
| 29 | RX DATA IN | A |
| 30 | RX $\overline{\text{DATA}}$ IN | A |
| 31 | GROUND 3 | A |
| 32 | VEE | A |
| 33 | +5 V (VL) | 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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