



Beta DC Biasing

-Std. Electricals TG-

-February '98 P1394b meeting-

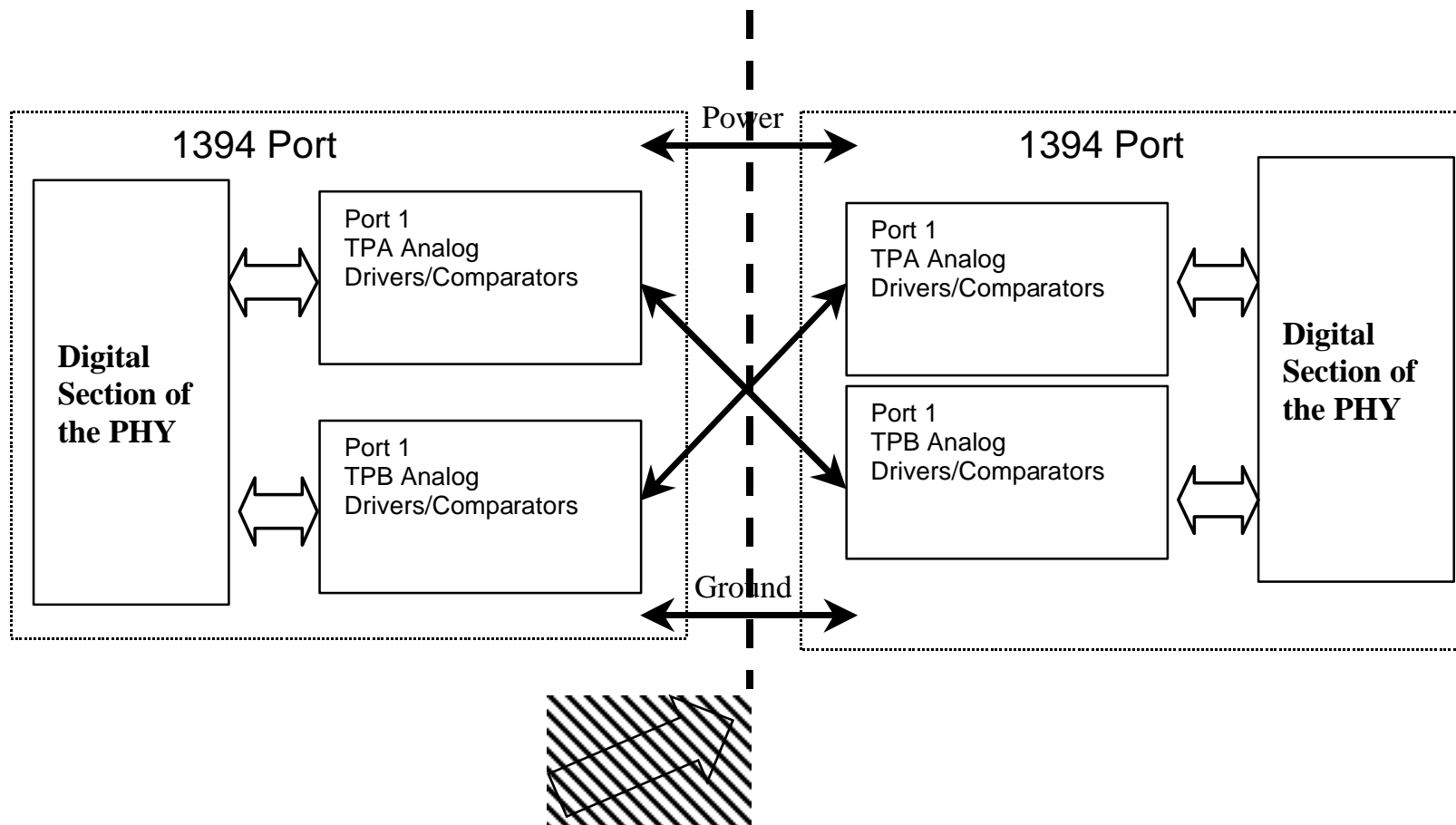


Task Group Activities

- Determine beta mode biasing schemes and parameters
- ◆ Develop specifications for connect/suspend/resume beta toning
- ◆ Self-test modes
 - Simple sanity check
 - Exhaustive stress test
- ◆ Develop system level modeling of signaling

Mike Teener has suggested using the Copperheads reflector

Block Level Diagram of Two Phys Connected by a 1394 Cable

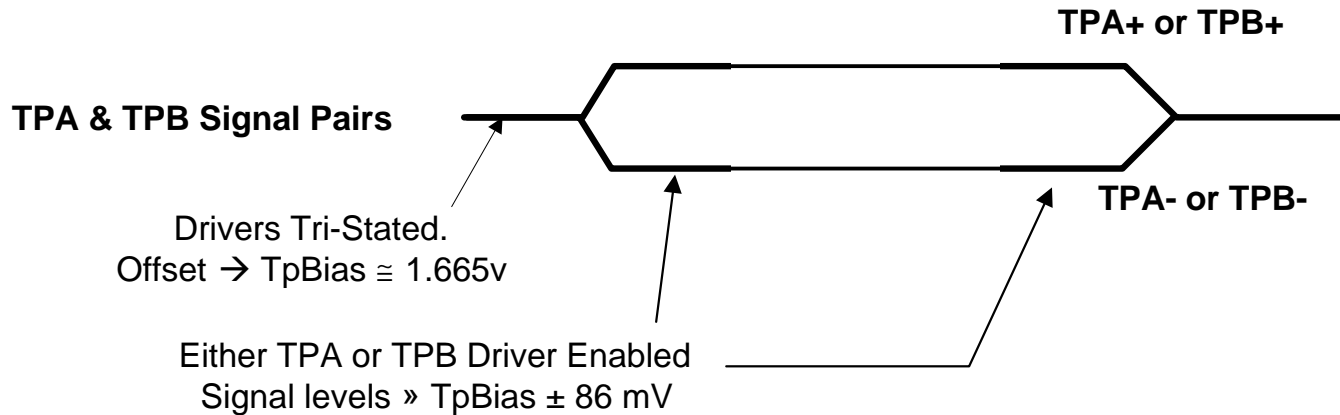
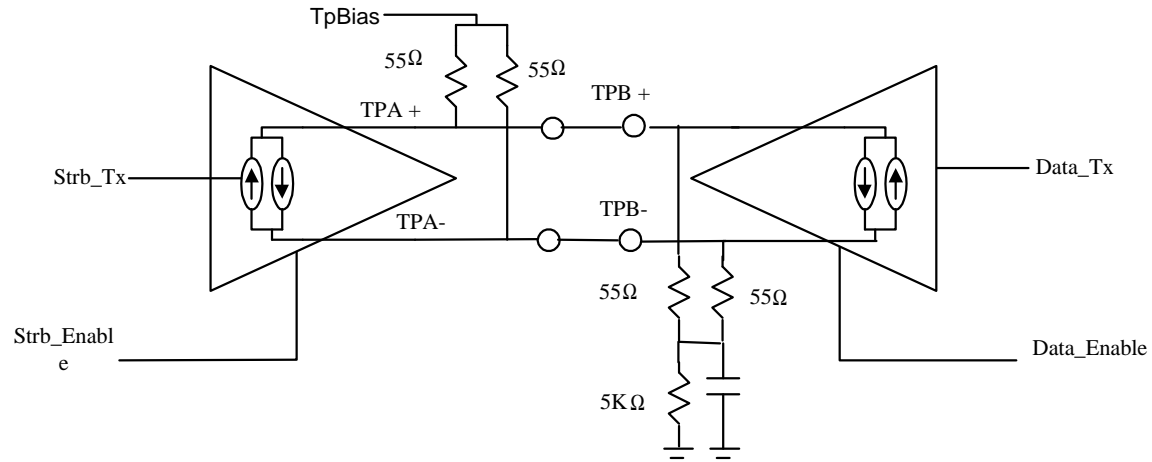


Problem: P1394b interfaces may be 1) DC coupled, 2) AC coupled, or, 3) interfaced to some other circuit with unusual biasing features (e.g., electro-optics)

Differential Driver Operation

Operation of the differential TX_Data & TX_Strobe drivers

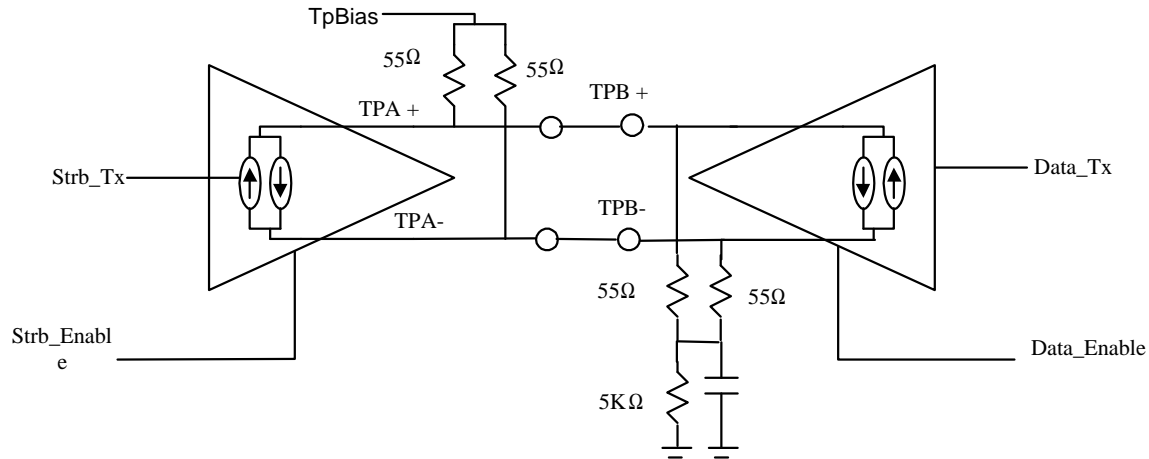
- Push-pull current source. Transmitter knows nothing of voltage!
- Should not move the common mode voltage!!!
- Spec states 172mV - 265mV differential output (w/ load)
- Presence of Speed Signal and VG currents set common mode range to 0.523V - 2.525V.
- TPB Transmitter specifies the port's minimum supply voltage.



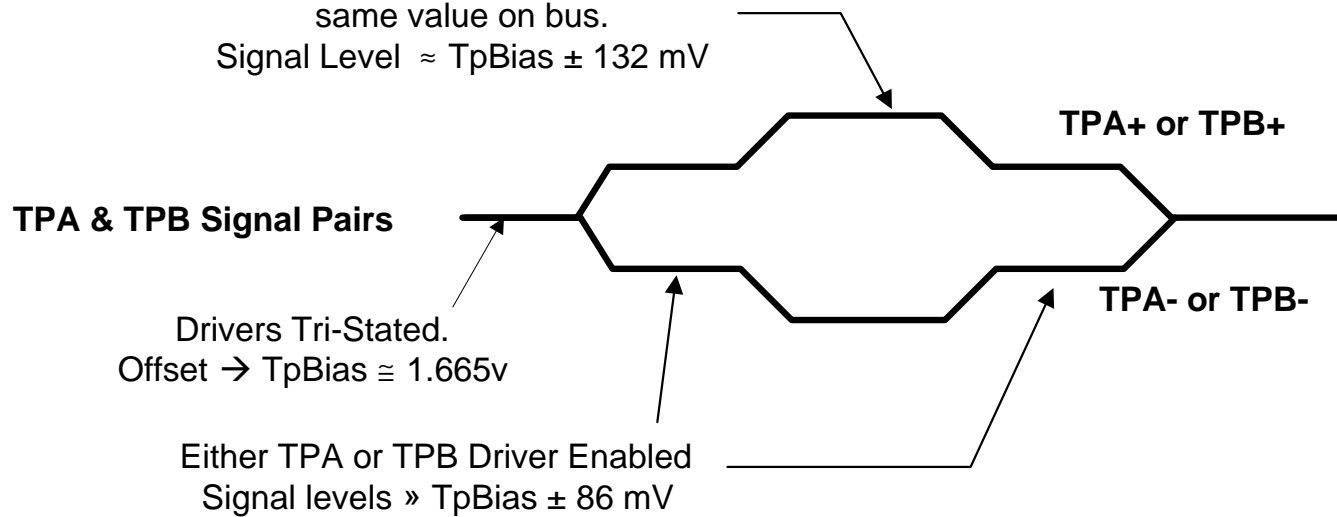


Differential Driver Operation

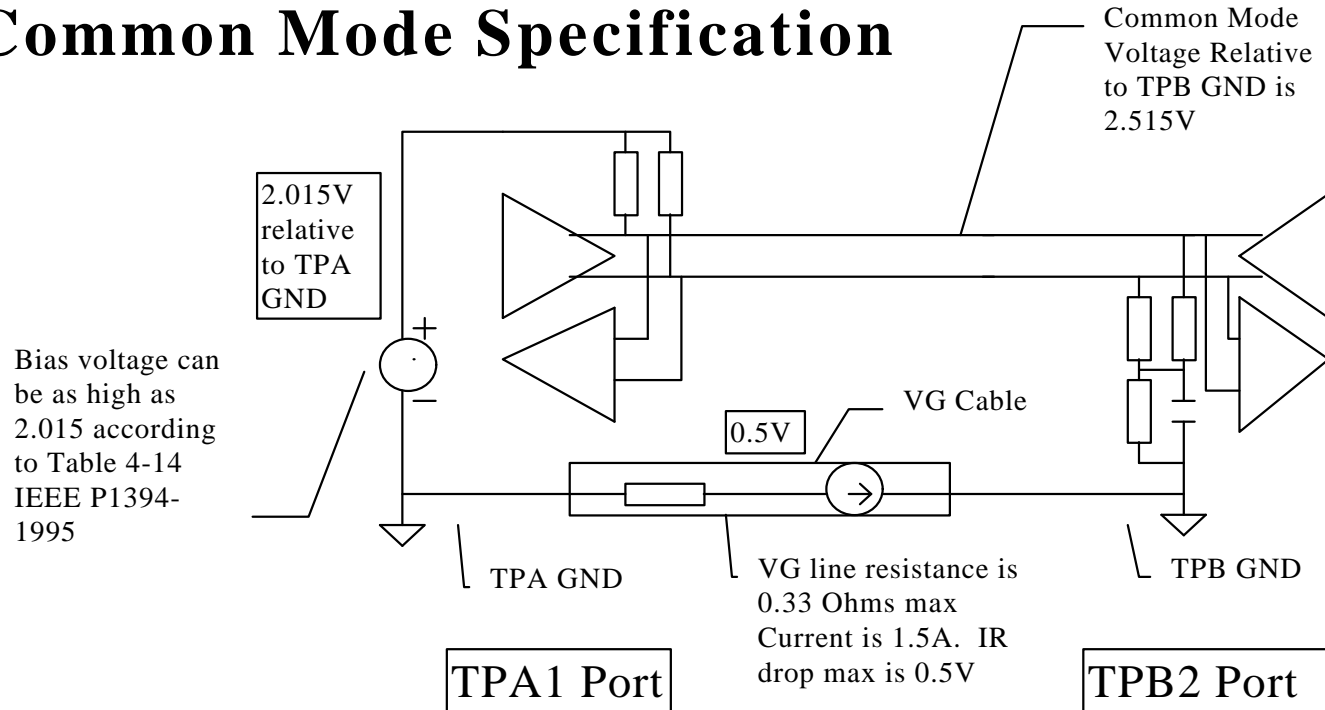
Operation of the differential TX_Data & TX_Strobe drivers



Both TPA & TPB Enabled and driving same value on bus.
Signal Level \approx TpBias \pm 132 mV



Common Mode Specification



Port	Min CM Voltage	Max CM Voltage
TPA	1.030V	2.015V
TPB	0.523V	2.515V

◆ **TPA is the source of the common mode voltage. Due to differences in ground potential, TPB must be designed to function under an expanded common mode range.**



Beta DC Bias Assumptions

- ◆ **TpBias is disabled in beta mode and in startup mode**
- ◆ **TPB (beta transmitter) sets the common mode voltage**
 - **Simplifies transmitter circuit design**
 - » Most analog designers are more comfortable with large common mode variations on receivers than on transmitters
 - **Implication:**
 - » The receiver must tolerate a large common mode voltage input range due to ground shifts for DC coupling
- ◆ **The transmitter is a current steering device and needs at least 0.5 volt on the output terminals to be in saturation**
- ◆ **For AC coupled situation the receiver must provide its own biasing**
 - **Optionally include a high impedance network to allow DC coupled systems to overdrive the receiver's self bias**



3.3 Volt CMOS Proposal

◆ Transmitter bias

- Transmitter provides bias
- $V_{high} = 2.1 \text{ V}$
- $V_{cm} = 1.4 - 1.7 \text{ V}$
- $V_{low} = 1.0 \text{ V}$.

◆ Receiver bias

- Receiver only provides bias for AC coupling
- $V_{high} = 2.6 \text{ V}$
- $V_{cm} = 0.9 - 2.1 \text{ V}$
- $V_{low} = 0.5 \text{ V}$

◆ These numbers are necessary for bilingual operation



2.5 Volt CMOS Proposal

◆ Transmitter bias

- Transmitter provides bias
- $V_{high} = 1.6 \text{ V}$
- $V_{cm} = 0.9 - 1.2 \text{ V}$
- $V_{low} = 0.5 \text{ V}$.

◆ Receiver bias

- Receiver only provides bias for AC coupling
- $V_{high} = 2.1 \text{ V}$
- $V_{cm} = 0.4 - 1.7 \text{ V}$
- $V_{low} = 0 \text{ V}$

◆ These numbers assume beta mode only operation



Task Group Input

- ◆ TpBias may be turned on TPA while TPB is toning. Need for a corner case in the upstarts state machine.
- ◆ Make sure that the high impedance receiver bias network won't screw up speed code signaling.