# P1394 (Serial Bus)

# Physical Layer for Cable Medium

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Apple Computer
11/7/91

## Physical Channel Features

* High Speed Serial (100 Mbits/sec, 200 Mbits/sec, etc.)

* Thin Flexible Cables and Small Connectors

* Simple Point to Point Connections

* Flexible Topology & Topology Mapping

* Supplies Power (18 watts up to 60 watts)

* Low Power Balanced Differential Twisted Pair Drivers

* No Clock Recovery (Data and Clock Transmitted Separately)

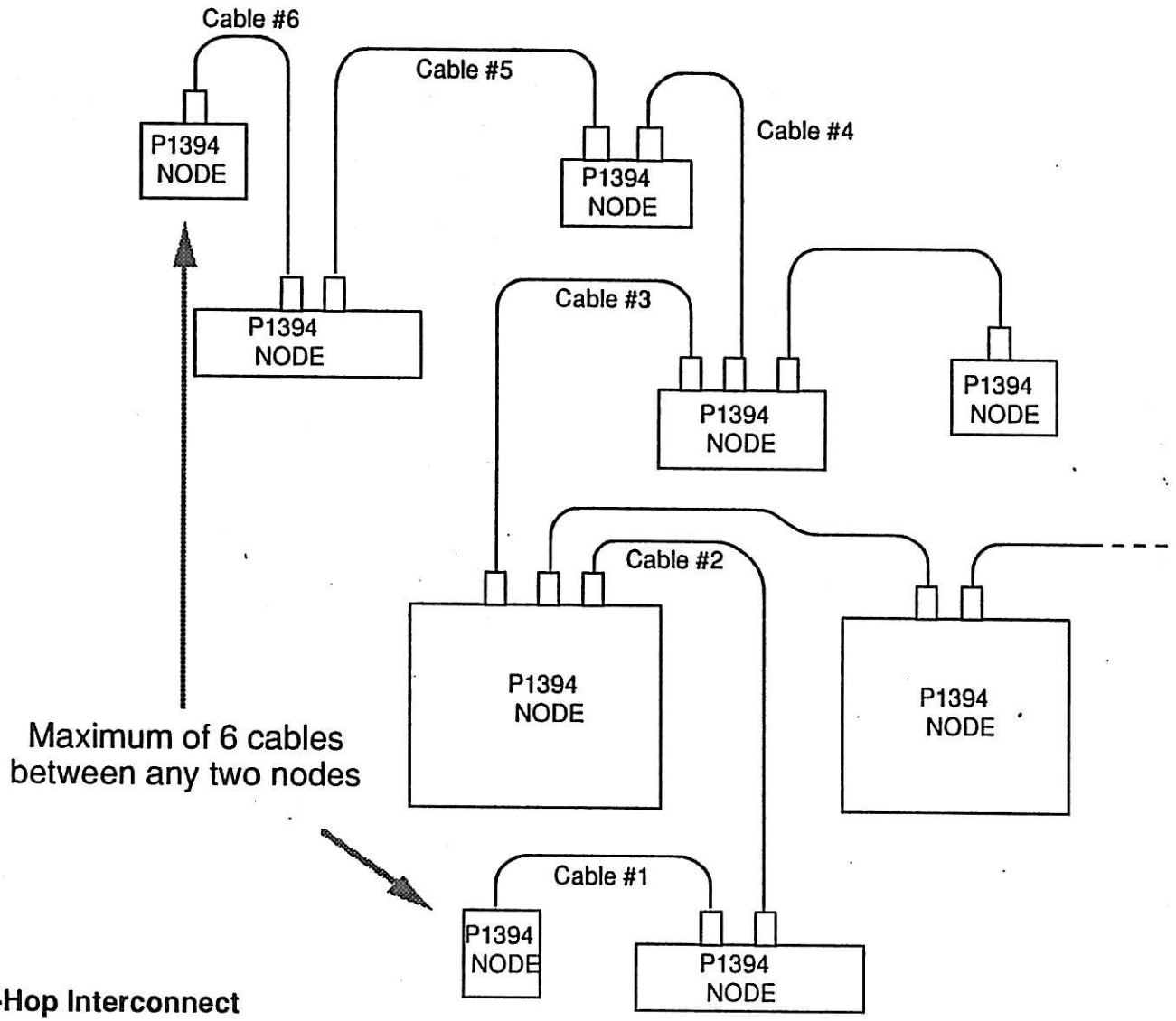
* Good Jitter Margins (Data and Clock ReSyncronized at each Node)

* No Coding of Data (NRZ Data and Clock Freq. is Half the Data Bit Rate)

* Variable speed
  Speed code associated with each packet.
  Link interface 2 bits @ 100Mbits/sec.
  4 bits @ 200 Mbits/sec etc.

* Allows for Isolation Barrier at either Cable or Link Interface.

# Topology

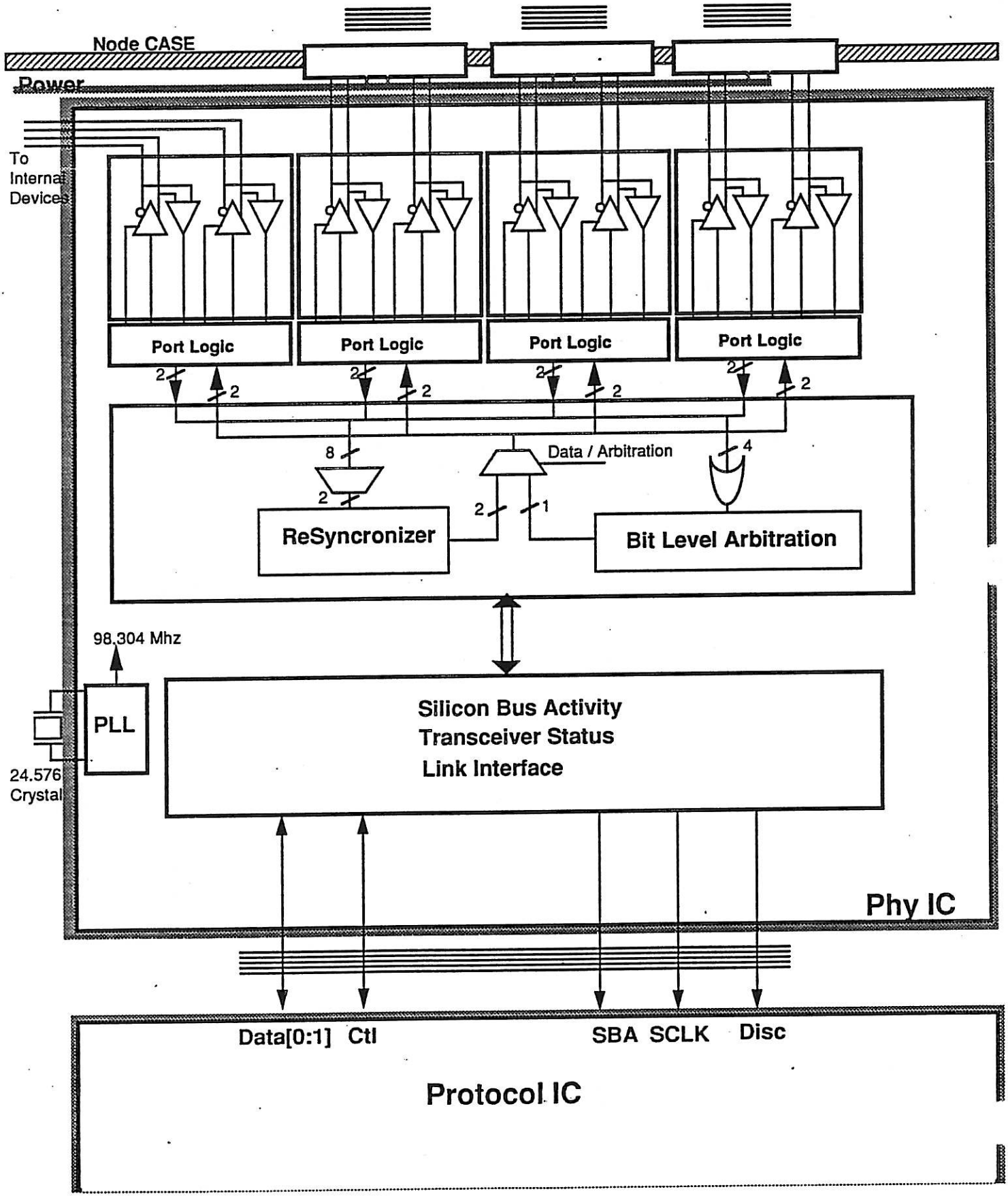



**Branching Multi-Hop Interconnect**

Maximum Round trip delay is 550ns.

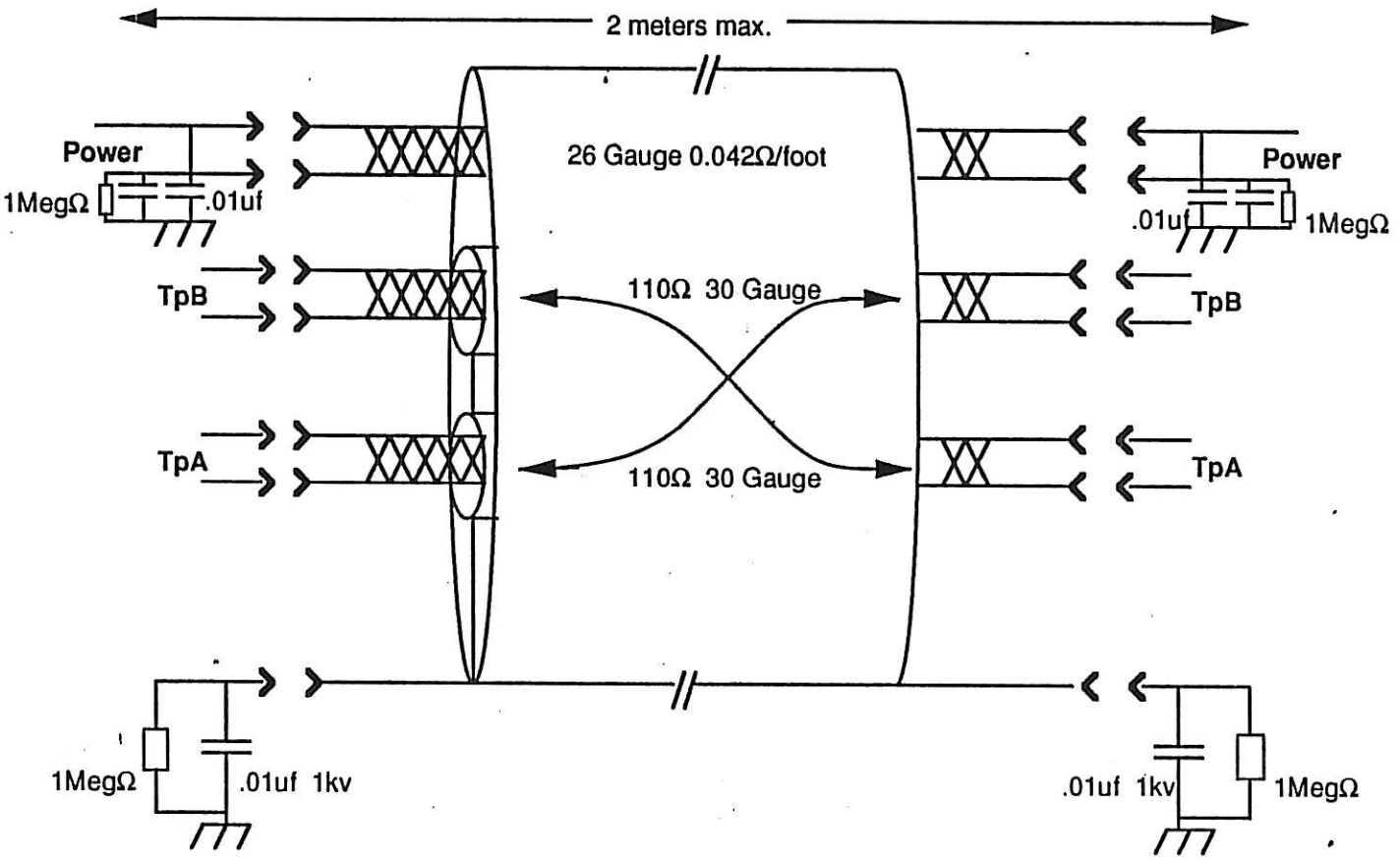
Maximum # of Repeaters (and Cables) allowed between any two nodes is 6.

# Phy Chip Block Diagram

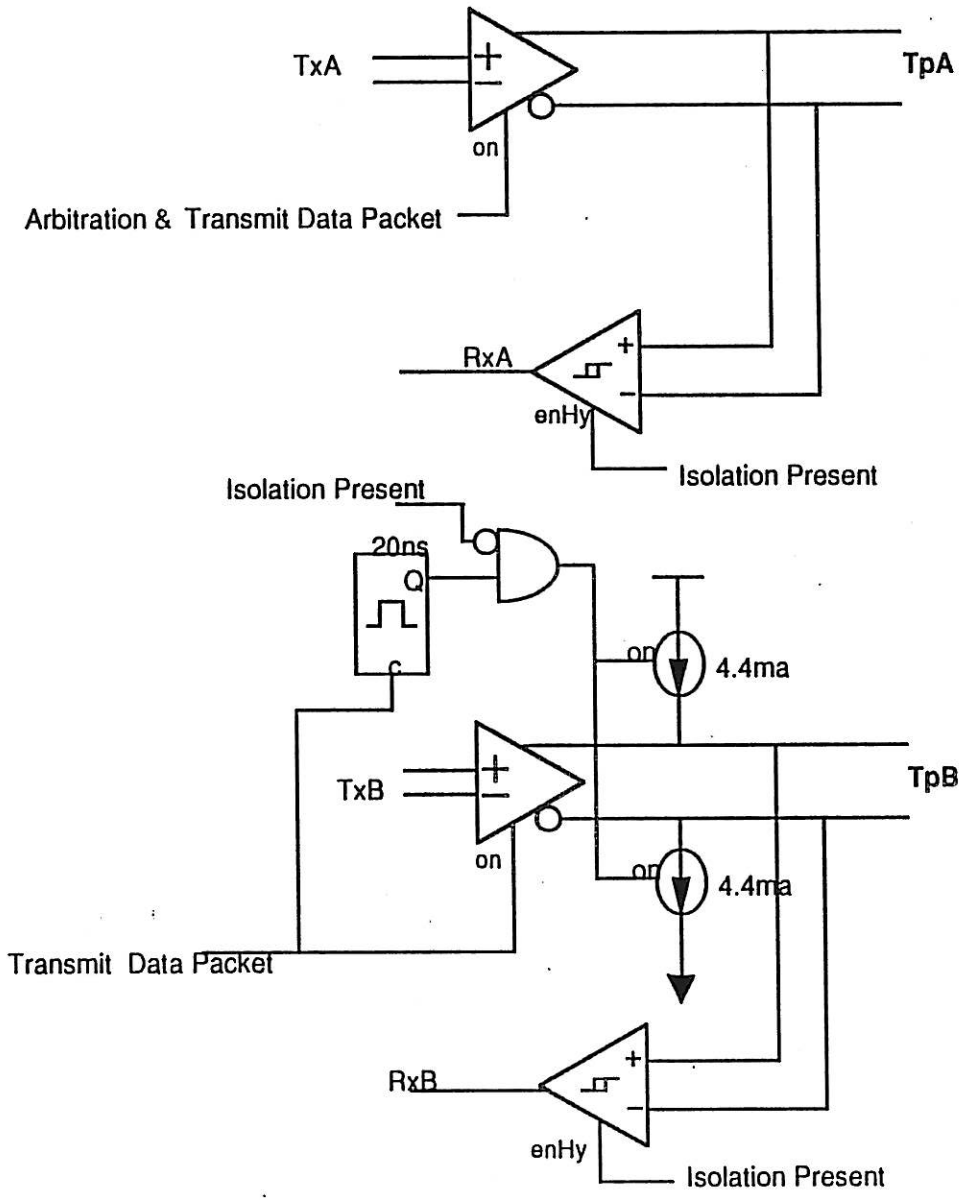



*All Isolation Barriers are optional.

# Cable


2 meters max.
Power
1MegΩ
.01uf
TpB
TpA
26 Gauge 0.042Ω/foot
110Ω 30 Gauge
110Ω 30 Gauge
Power
.01uf
1MegΩ
TpB
TpA
1MegΩ
.01uf 1kv
.01uf 1kv
1MegΩ

# Cable Interface Port




**Packet Transmission TPA**

**idle out - arb out - clock out - idle out**

**Packet Reception on TPA**

**idle out - arb out - mode in - data in - idle out**

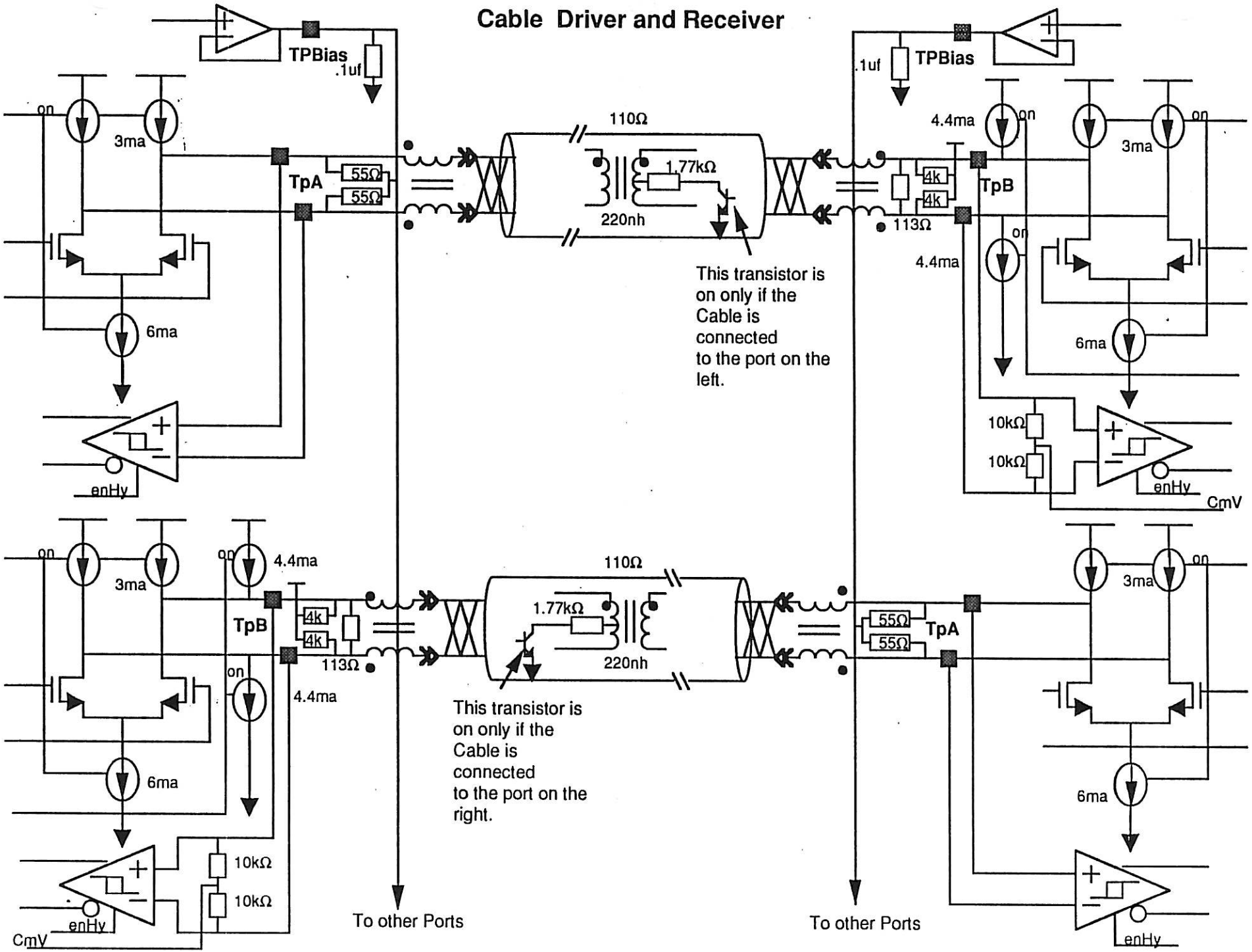
**Packet Transmission TPB**

idle in - arb in - mode out - data out - idle in

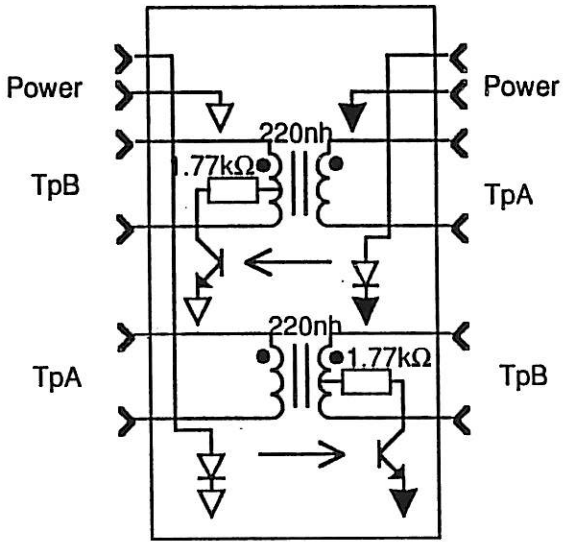
**Packet Reception on TPB**

idle in - arb in - clock in - idle in

# Cable Driver and Receiver



# Cable Isolation Barrier



# Physical Channel Specifications

* Differential Signal Level +/- 165mv (+/- 3ma)

* Rise and Fall Times 2.5ns

* Input Hysteresis +/- 100 mv

* Input Common Mode Range 2.2 to 4.6 volts

* Jitter Budget @ 100 Mbit/sec :

Transmit Jitter : +/- .3 ns
Cable : Reflections +/- .16 ns
Intersymbol +/- .05ns
Delay Difference +/- .12ns
Cable with Isolation Barrier : Reflections +/- .25 ns
Intersymbol +/- .5 ns
Receiver Offset : +/- .35ns (Receiver 2u Channel Lengths)
Flip Flop Setup Time : 1ns max. ( 1u Process) → .3ns

Jitter Budget Margin : Cable without Isolation Barrier - 2.9 ns (58% of budget)
Cable with Isolation Barrier - 2.3ns (46% of budget)