Back to Reality

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Issues

First Pulse Magnitude

Whose Fault is it?

Asymmetric/Symmetric Current Drive

Which is Better?

Tolerances of Current Sources

Can they Work?

Active Bias Terminators

Why we Need Them?

Do you Remember These?

Picture by Bill Ham, SPI-2 Meeting, June 6, 1996

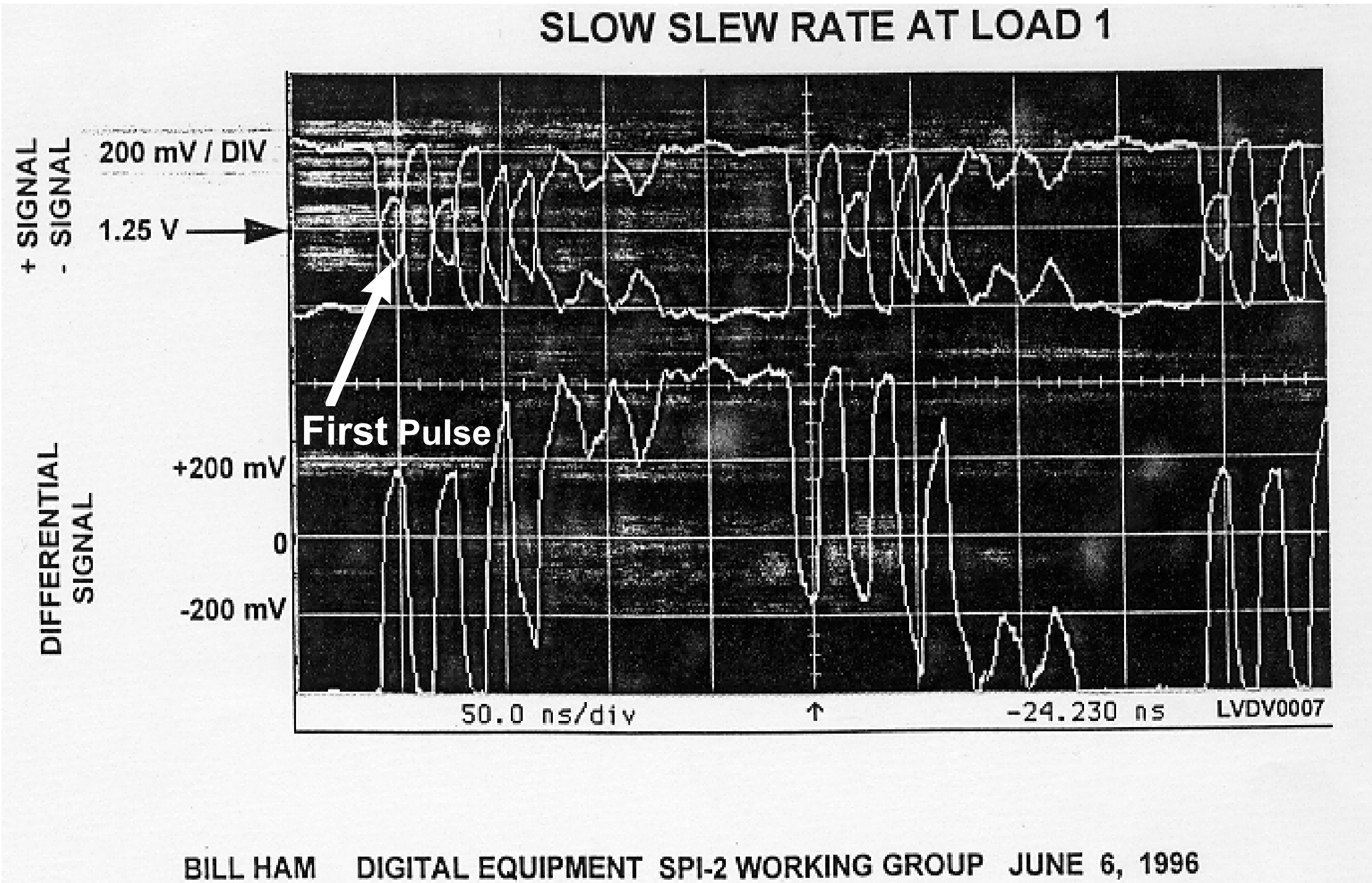
First Pulse Distortion

Symmetric Driver, 150*W *Symmetric Terminator

Fully Loaded Cable

Advanced Warning

Bill Ham's Measurement



Whose Fault is it?

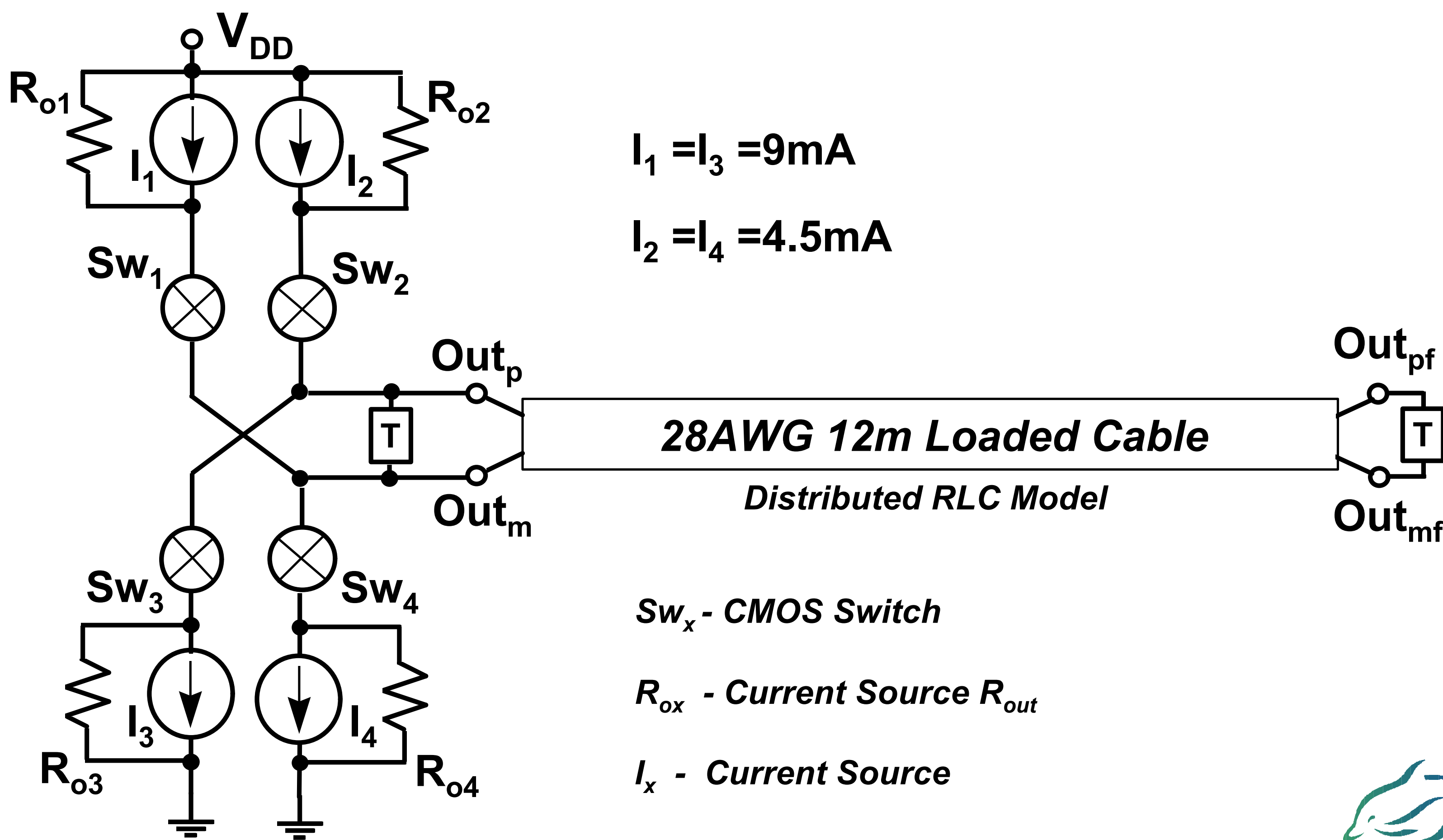
- ***¿ Current Source Drive ?***
- ***¿ Active Terminator ?***
- ***¿ Asymmetric Driver ?***
- ***¿ Symmetric Driver ?***

Whose Fault is it?

(None of the Above)

It s the T<u>RANSMISSION</u> <u>LINE</u>

How to Prove it ?



$I_1 = I_3 = 9mA$

$I_2 = I_4 = 4.5mA$

Sw_x - CMOS Switch

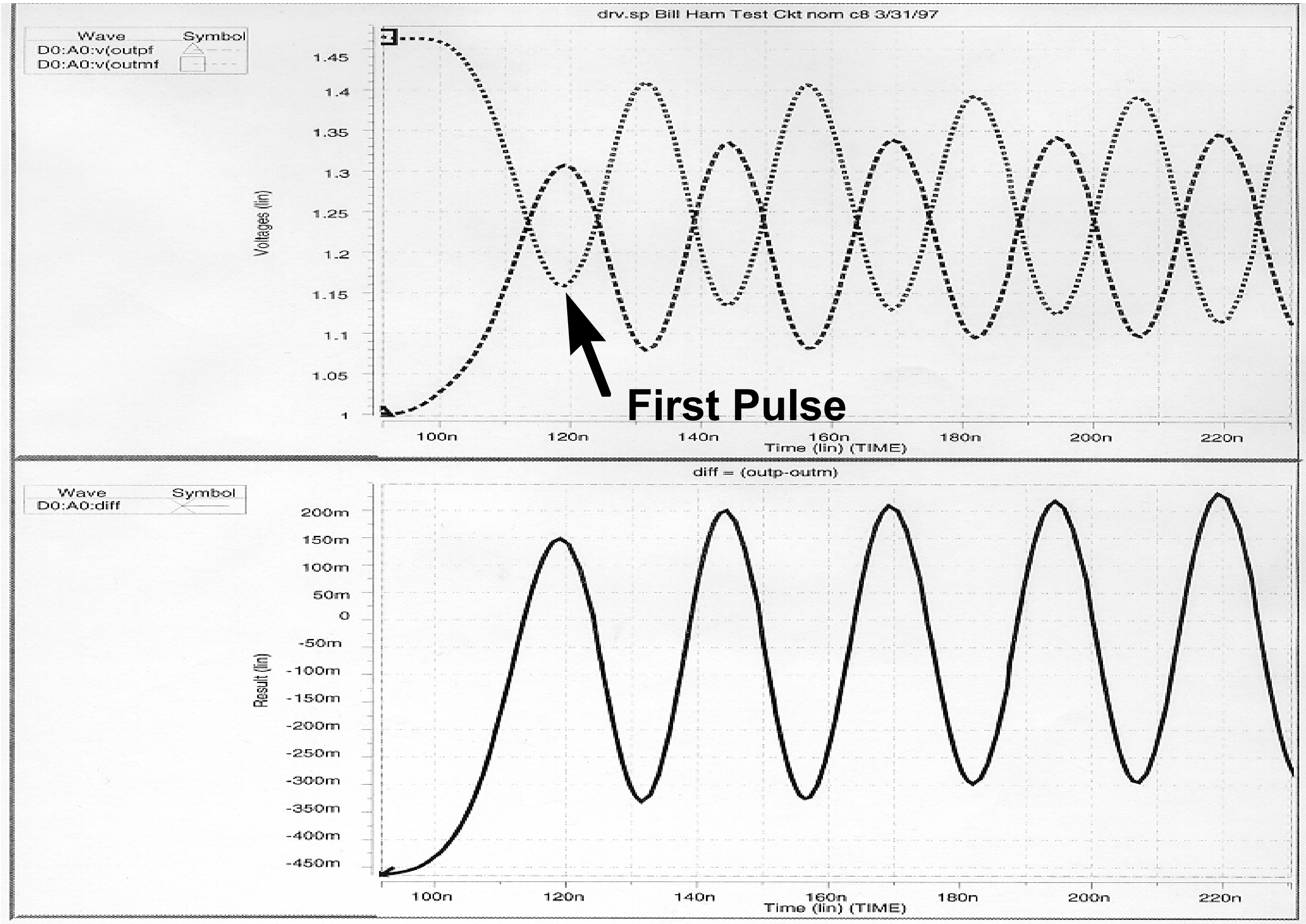
R_{ox} - Current Source R_{out}

I_x - Current Source

T - Balanced Terminator

SYMBIOS LOGIC

Bill Ham's Test Ckt



Hspice Simulation of First Pulse

Which is Better?

Asymmetric Current Driver

or

Symmetric Current Driver ?

Measured data - verified by simulation results

proves that symmetric drive offers no advantage

over present asymmetric drive

SYMBIOS LOGIC

Active Terminator Benefits

- **Built-in Bias for Fail-Safe Operation**
- **Common-Mode Drive / Sink Current**
- **Controlled Impedance**
- **Low Capacitance**
- **Simpler Receiver Circuitry**
- **Even without Bias, Active Terminator Needed**

SYMBIOS LOGIC

Why Terminator Bias?

Provides Fail-Safe Operation

Symmetric Signal is Achievable

Balanced Receiver - Low Skew

No Complex Dual Receiver

SYMBIOS LOGIC

Receiver Sensitivity

Typical $V_{in\ DIFF}$ = 400mV (No Load)

Worst Case $V_{in\ DIFF}$ = 60mV (Loaded Cable)

Worst Case Process, Temp & Supply Voltage

Low Skew Critical

SYMBIOS LOGIC

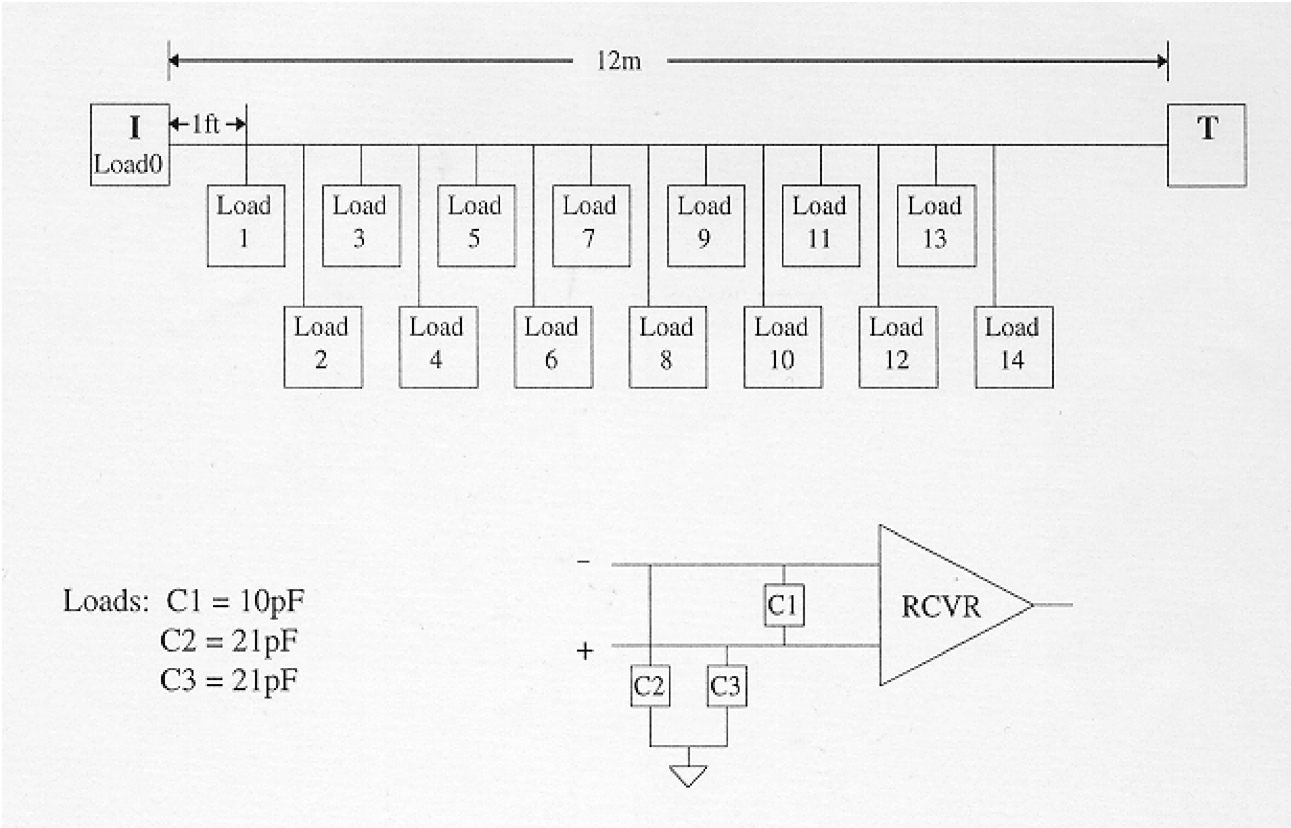
Current Source Drivers Issues

Current Mirror Match

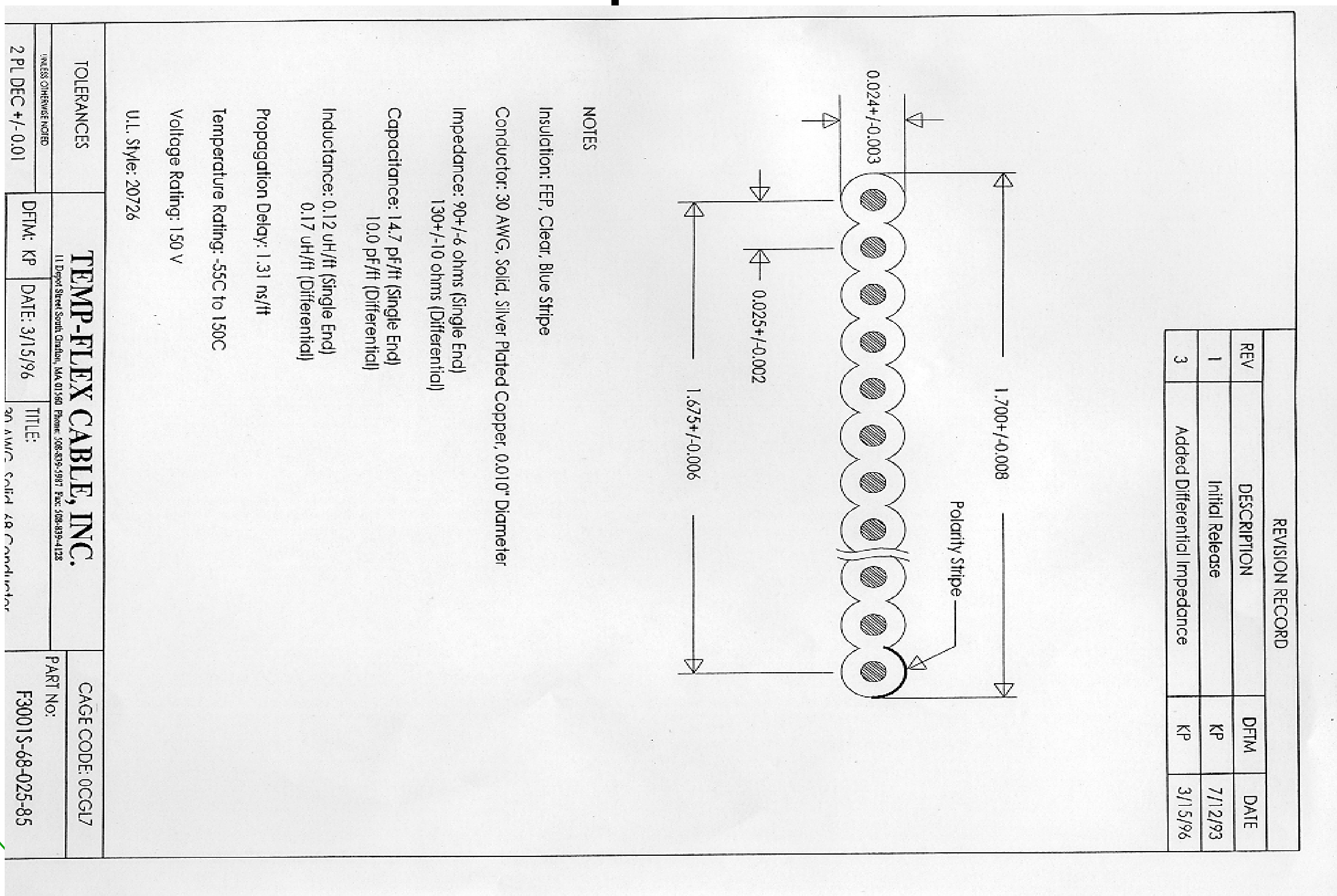
I_{DP} versus I_{DN} Match

Identical Challenge for Symmetric or Asymmetric Drivers

Test Setup

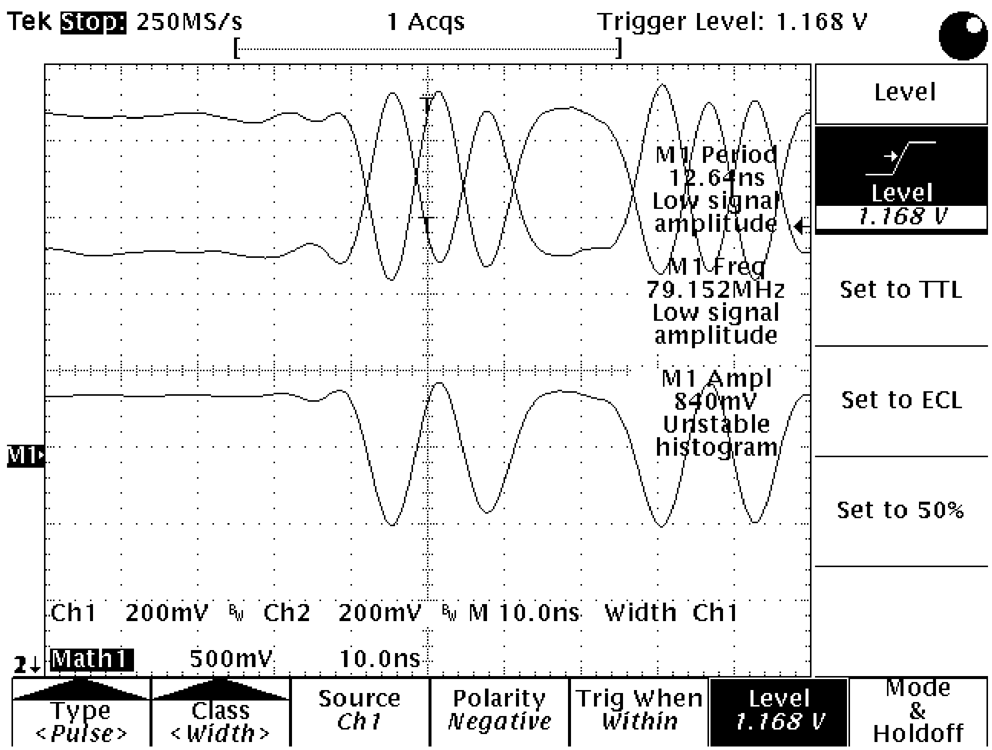

12m
I
Load0
1ft
T
Load 1
Load 3
Load 5
Load 7
Load 9
Load 11
Load 13
Load 2
Load 4
Load 6
Load 8
Load 10
Load 12
Load 14
Loads: C1 = 10pF
C2 = 21pF
C3 = 21pF
-
+
C1
C2
C3
RCVR

Cable Specification



Fast-80 Transfer

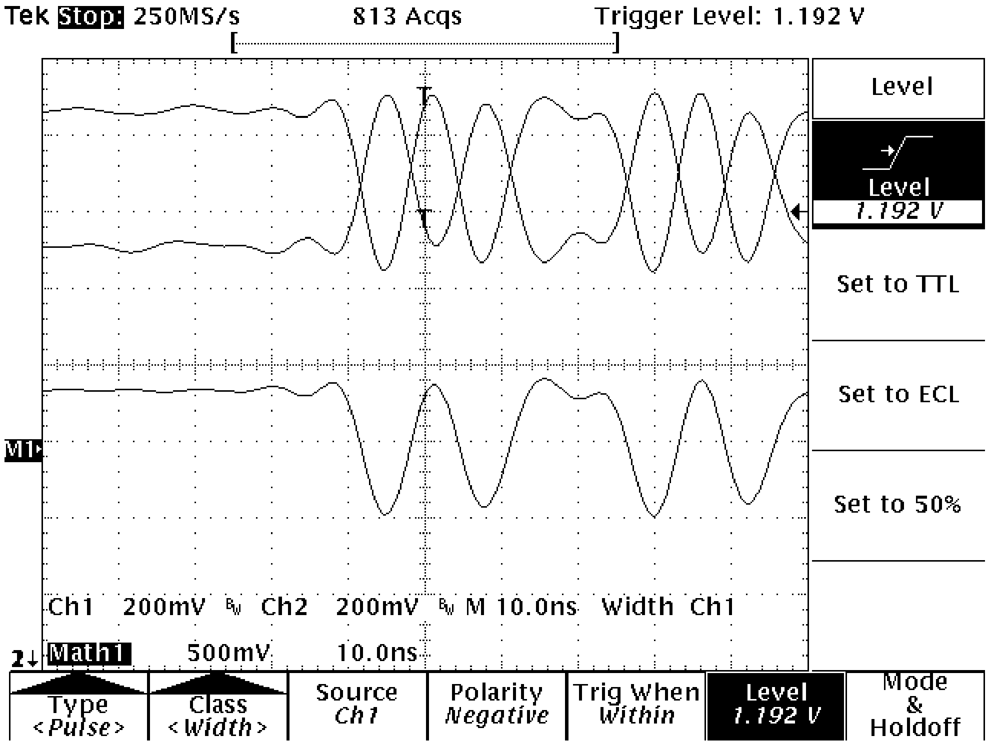
@ Driver REQ - No Load



I_{ASSERT} / I_{NEGATE} = 9mA / 4.5mA

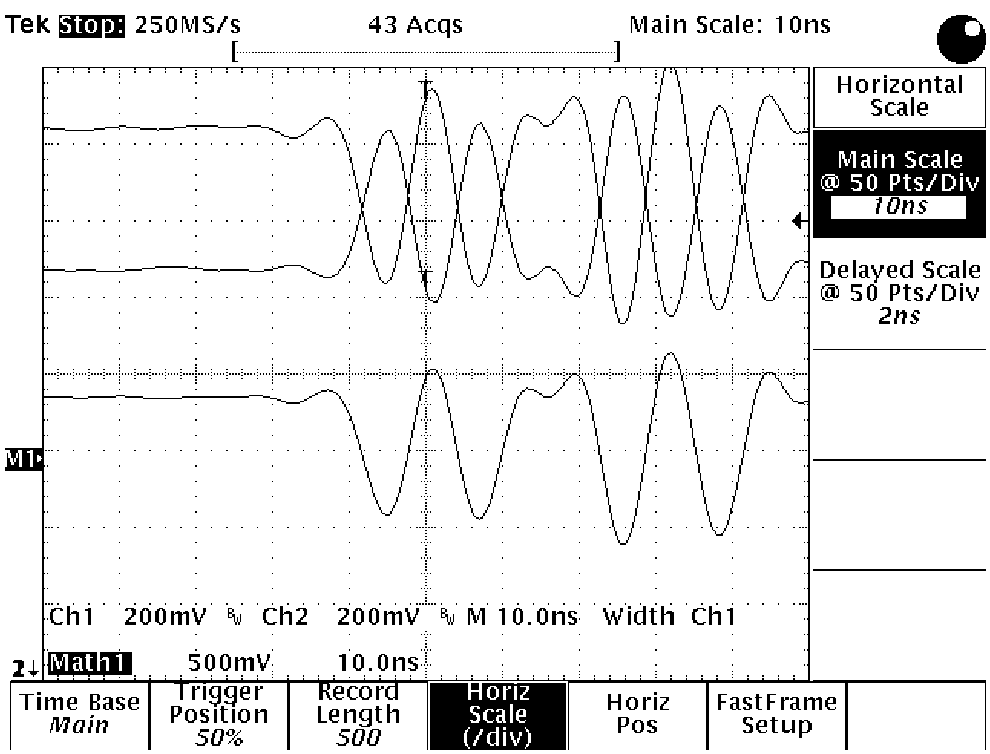
Fast-80 Transfer

@ Driver REQ - 15 Loads



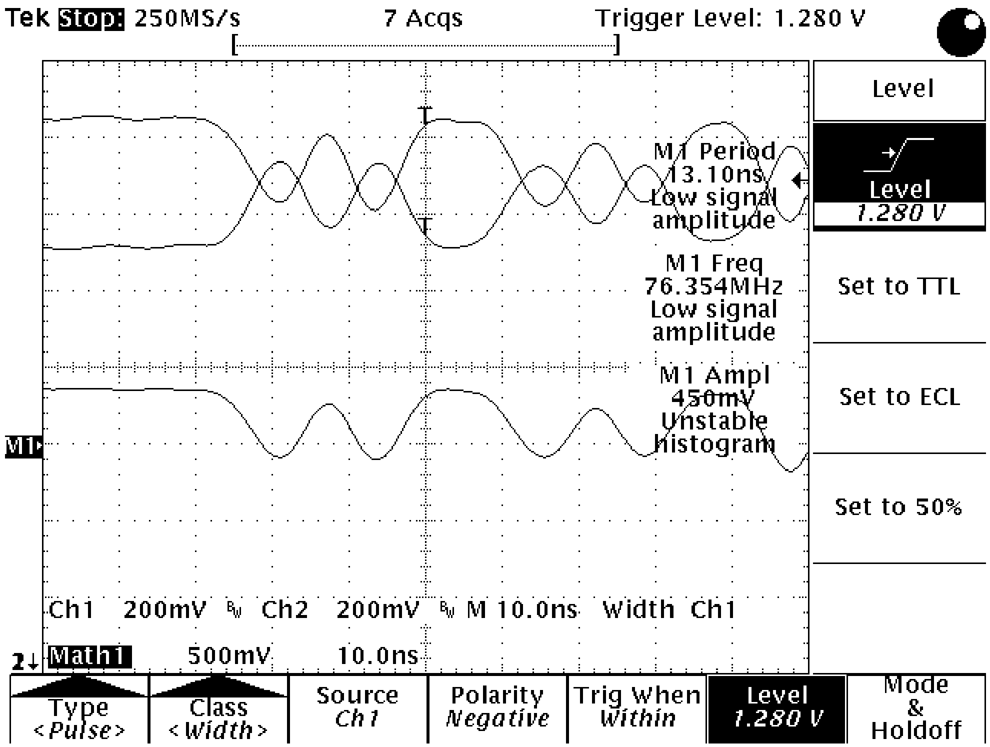
Fast-80 Transfer

@ Driver ACK - 15 Loads



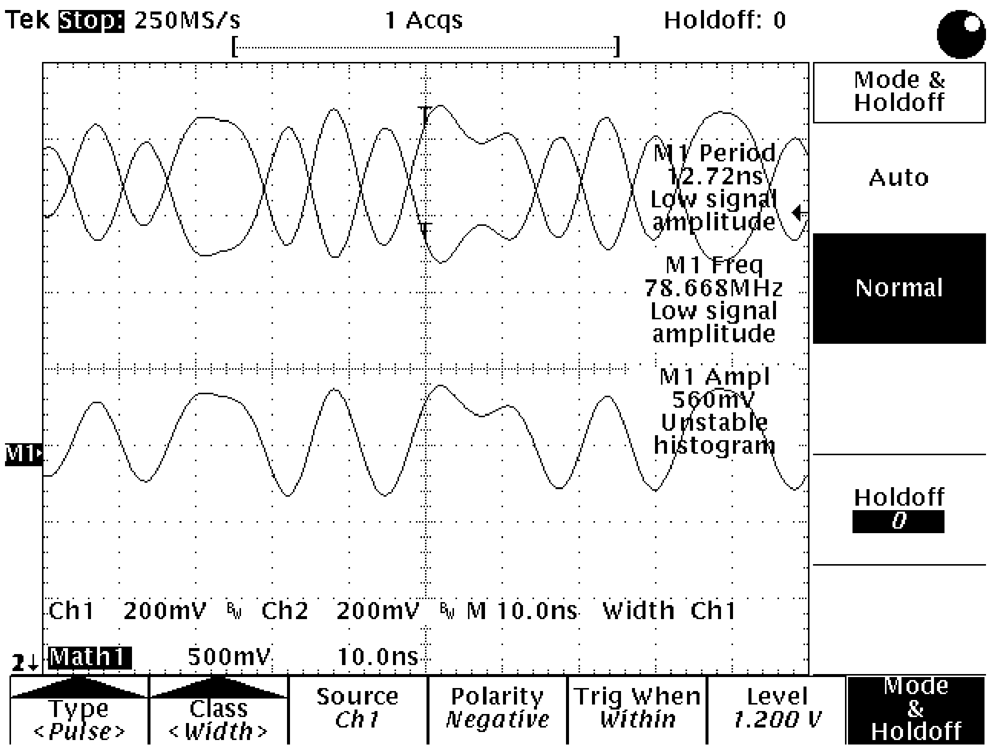
Fast-80 Transfer

REQ @ Load 0



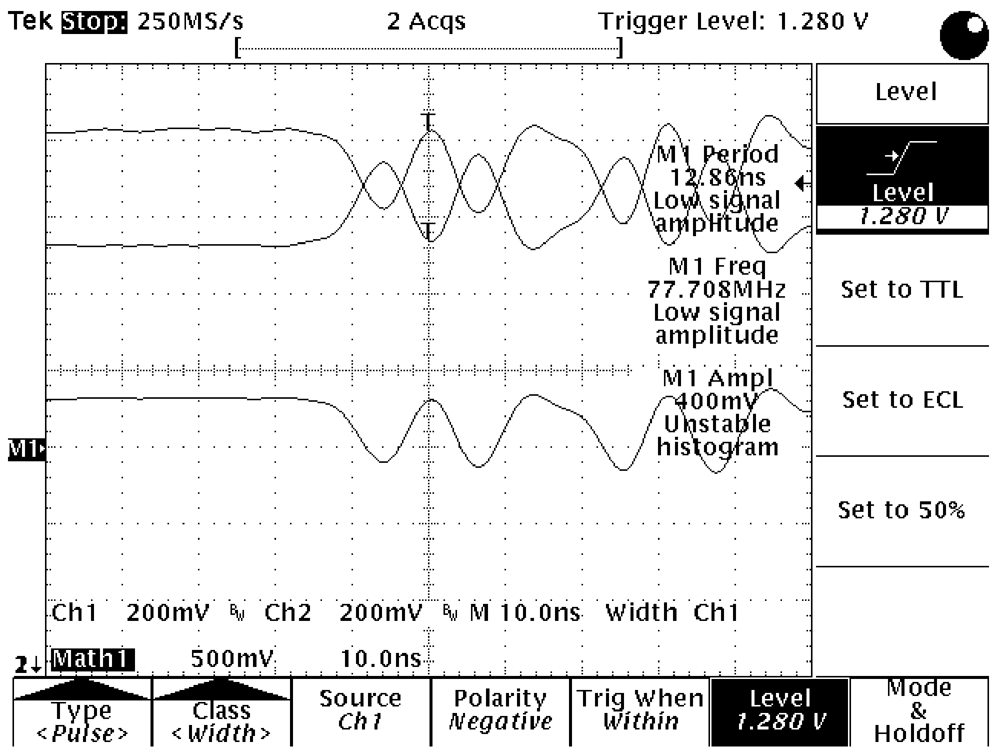
Fast-80 Transfer

REQ @ Load 12



Fast-80 Transfer

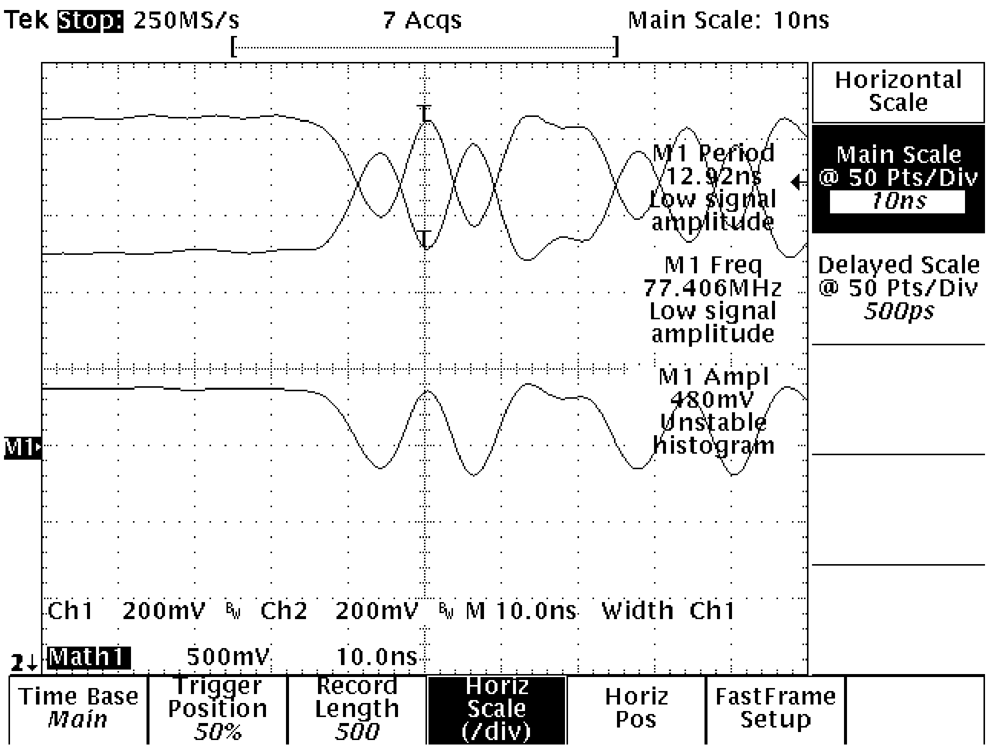
I_{AS}/I_{NEG} = 8mA/4mA



REQ @ Load 1

Fast-80 Transfer

I_{AS}/I_{NEG} = 10mA/5mA



REQ @ Load 1

LVD Power

<u>Asymmetric Drive</u>: V_{diff}=400mV, Z_o =120Ω
V_{BIAS} =120mV

Iassert = 8.667mA
⇨ P_D =(3.3-0.4)V * 8.667mA = 25.13mW

Inegate = 4.667mA
⇨ P_D =(3.3-0.4)V *4.667mA =13.53mW

<u>Total Average Power = 19.33mW</u>

SYMBIOS LOGIC

LVD Power

<u>Symmetric Drive</u>: V_{diff}=400mV, Z_o =120Ω

Iassert = 6.67mA

⇨ P_D =(3.3-0.4)V *6.67mA =19.33mW

Inegate =6.67mA

⇨ P_D =(3.3-0.4)V *6.67mA =19.33mW

<u>Total Average Power = 19.33mW</u>

SYMBIOS LOGIC

Symmetric Driver ?

No Advantage in Performance

No Fail-Safe Operation

Identical Power Dissipation

Increased Receiver Complexity

Beyond Fast-80

Cable Length

Number of Loads

Receiver Sensitivity

Cable Media

Protocol Issues

If Symmetric Driver has Merit Beyond Fast-80, the Transition Need Not to be Disruptive

SYMBIOS LOGIC