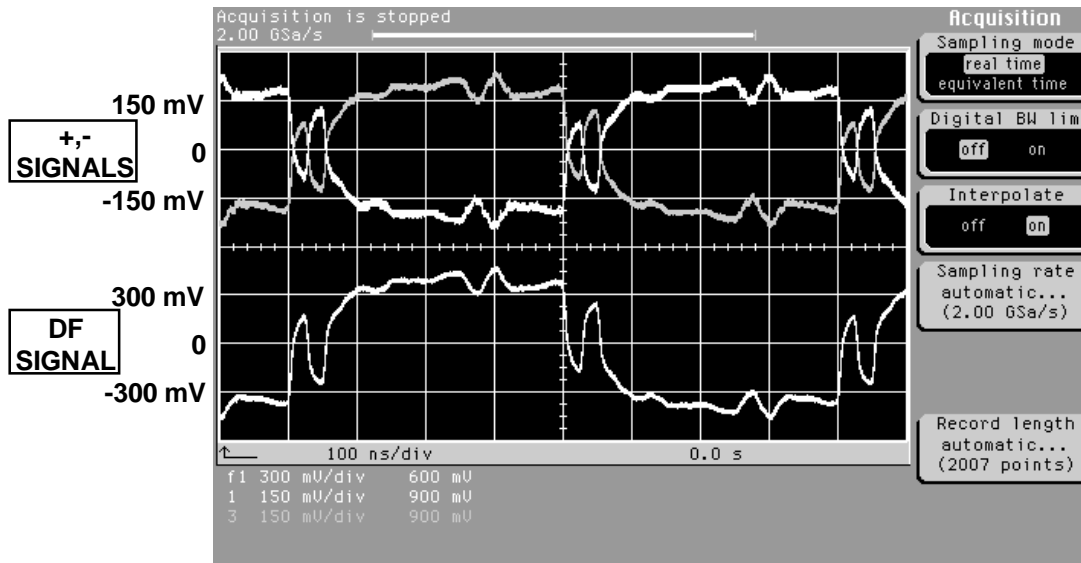
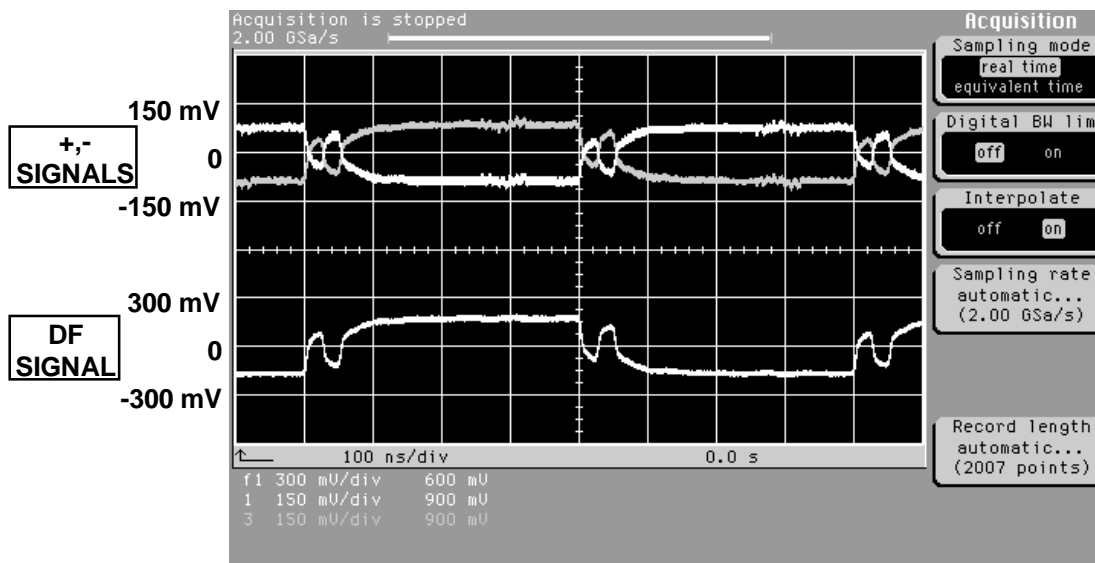


# LVD SCSI SIGNALS

## SIGNALS AT FAR TERMINATOR (NON-BIASING) (27 METERS POINT TO POINT)

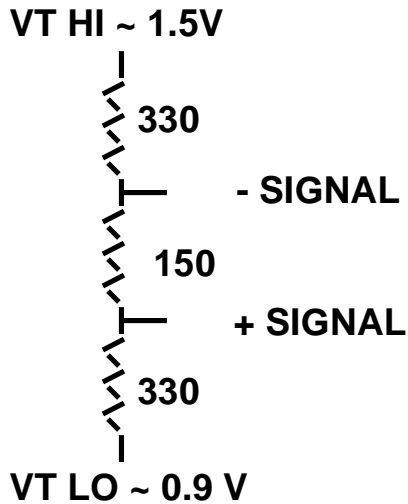


## NO SOURCE END TERMINATION



## SOURCE AND FAR END TERMINATION

# LVD SCSI BIASING TERMINATOR USED FOR TESTS

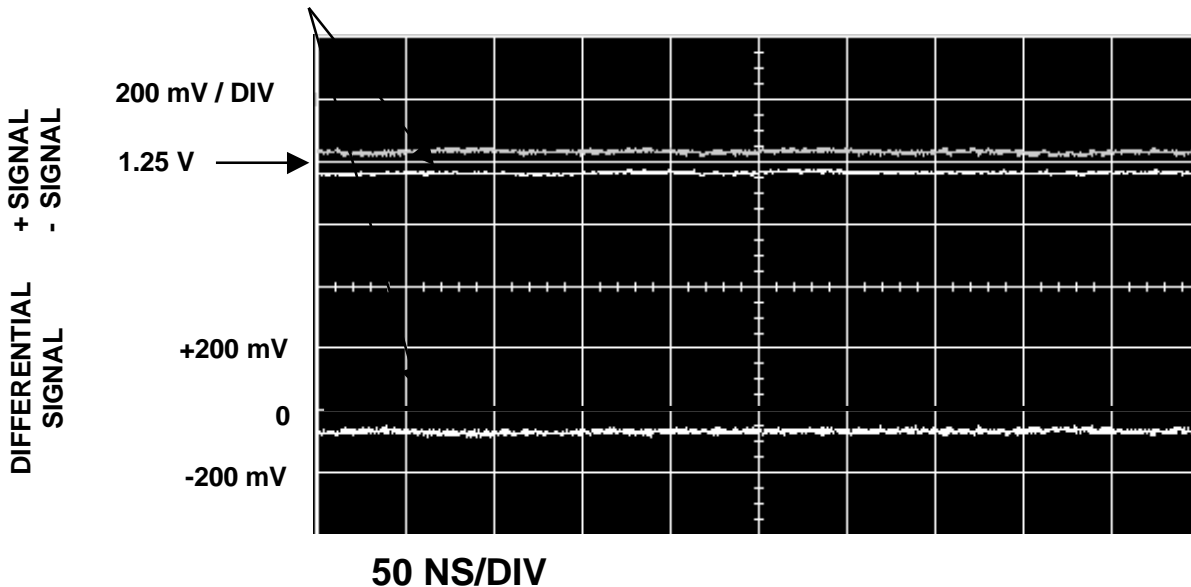


NOMINAL BIAS IS ~ 112 mV

DEVICE LEAKAGE HAS A SIGNIFICANT EFFECT ON THE ACTUAL BIAS VALUE: DRIVER LEAKAGE REDUCES BIAS VALUE TO ~ 82 mV (SHOWN BELOW)

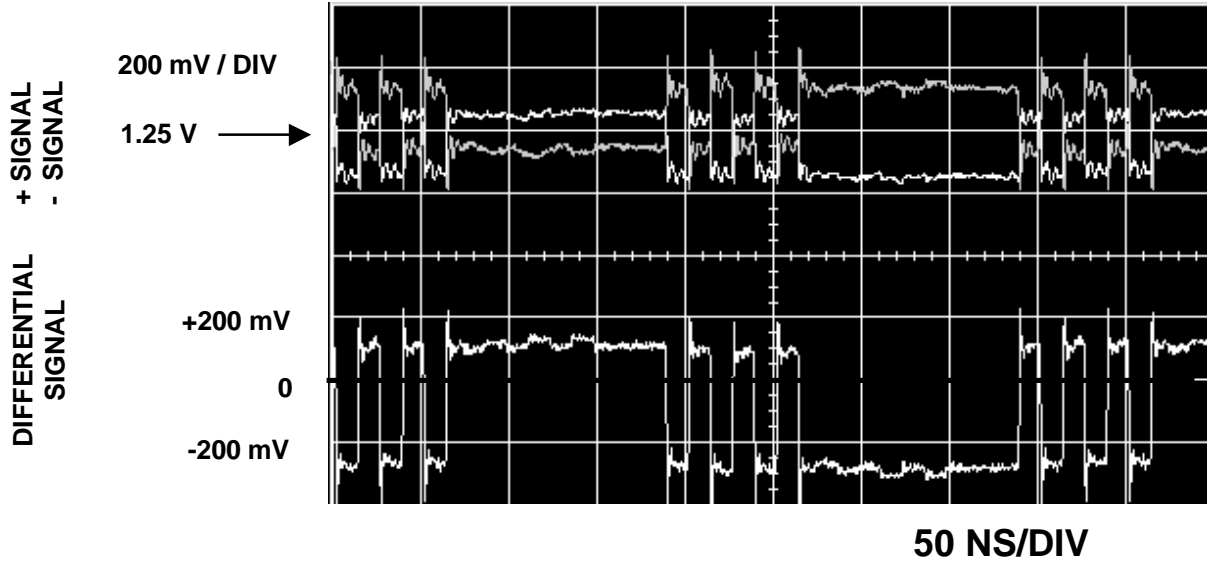
BIAS LEVEL CAN BE CHANGED BY ADJUSTING VT HI AND VT LO

BIAS LEVEL ON SAME SCALE AS WAVEFORM PLOTS

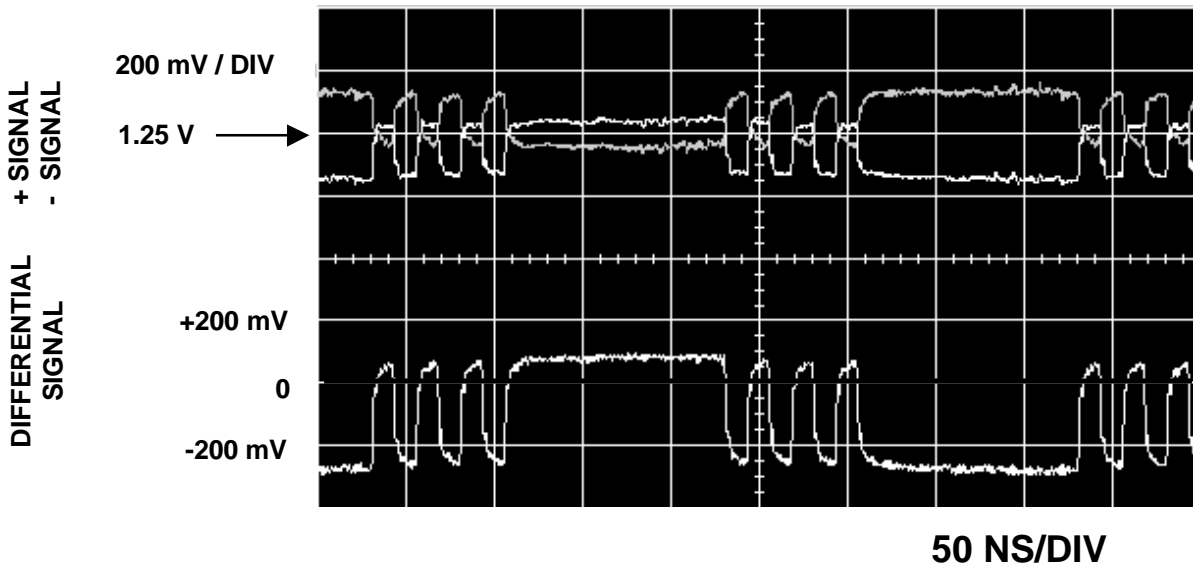


BIASING TERMINATORS ONLY DRIVING LINE

**LVD SCSI WITH ~ 82 mV BIAS FROM TERMINATORS  
SINGLE CURRENT MODE DRIVER  
9 METERS POINT TO POINT**



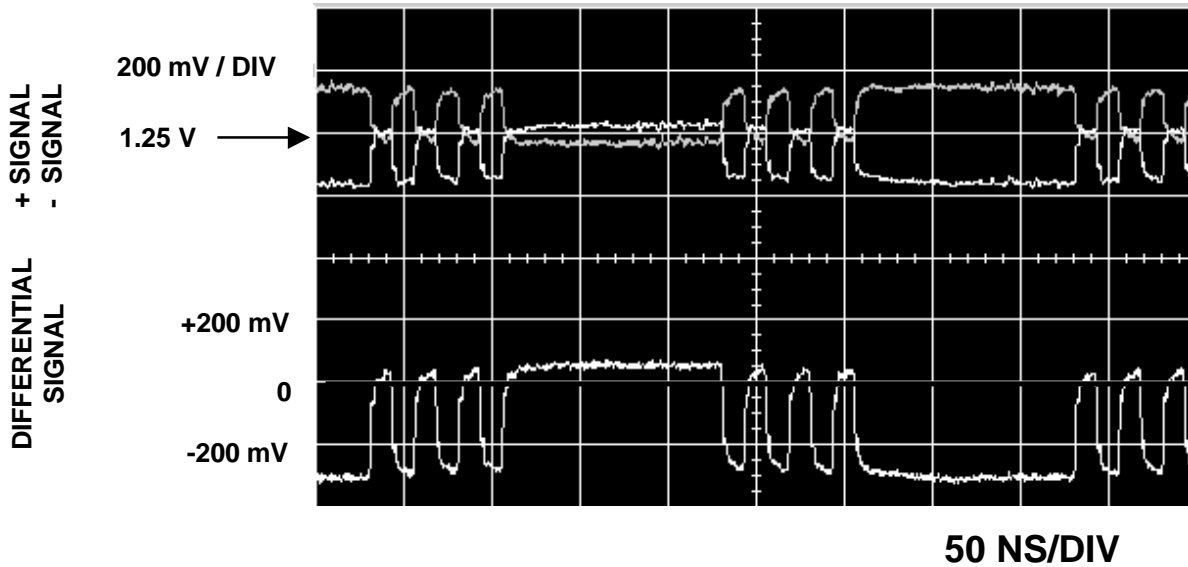
**NEAR DRIVER FAST 40**



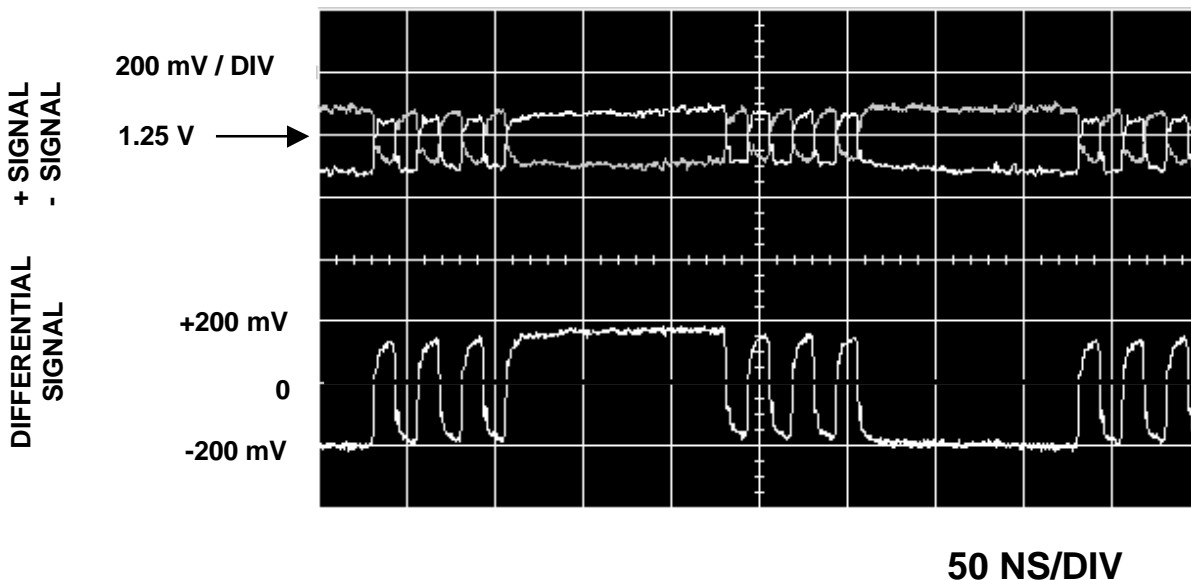
**NEAR FAR TERMINATOR**

## EFFECT OF DIFFERENT TERMINATOR BIAS LEVELS

NOTE THAT LOWERING THE BIAS DRAMATICALLY INCREASES THE NOISE MARGIN FOR DRIVEN SIGNALS (NOT DESIRABLE FOR UNDRIVEN SIGNALS)



BIAS ~ 125 mV

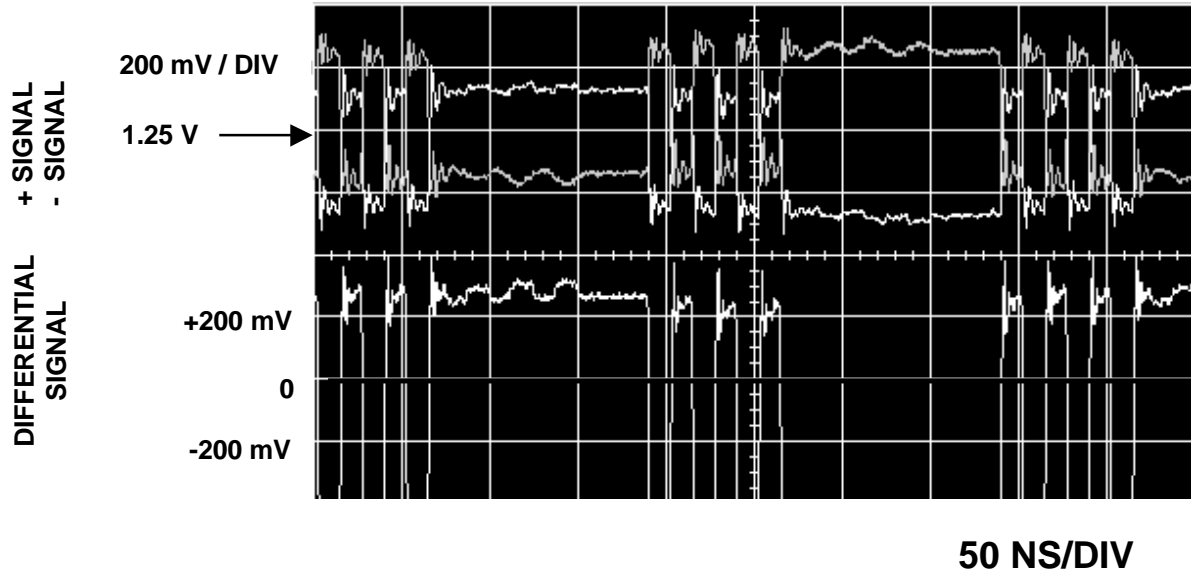


BIAS ~ 10 mV

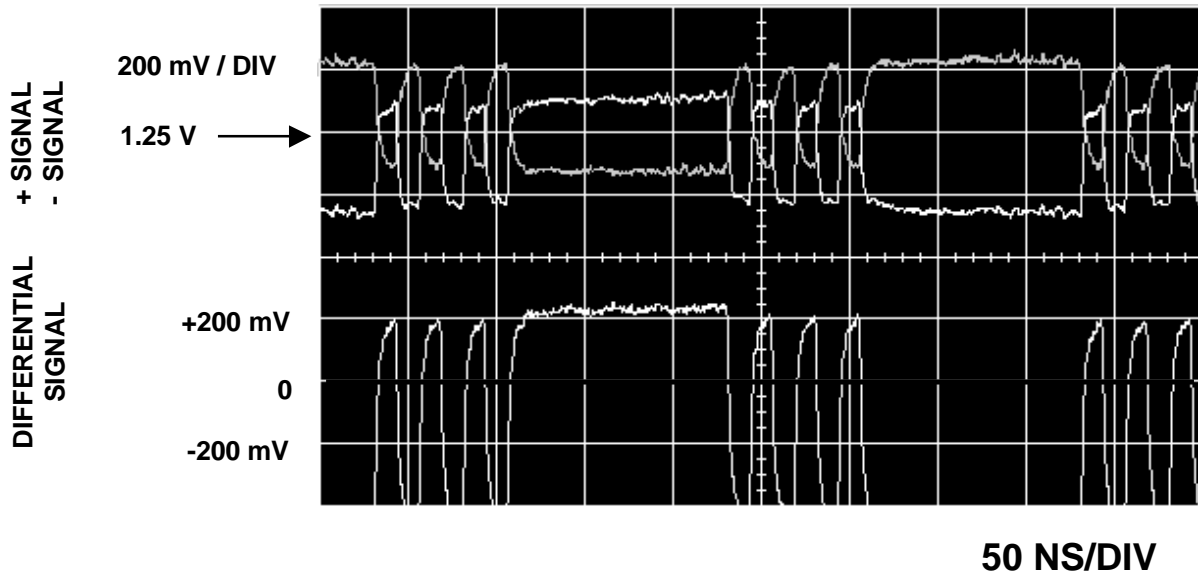
SINGLE STRENGTH DRIVERS; AT FAR END OF 9 METER BUS

# EFFECTS OF INCREASING DRIVER STRENGTH DOUBLE DRIVERS USED

NOTE GOOD NOISE MARGIN EVEN WITH STRONG BIAS



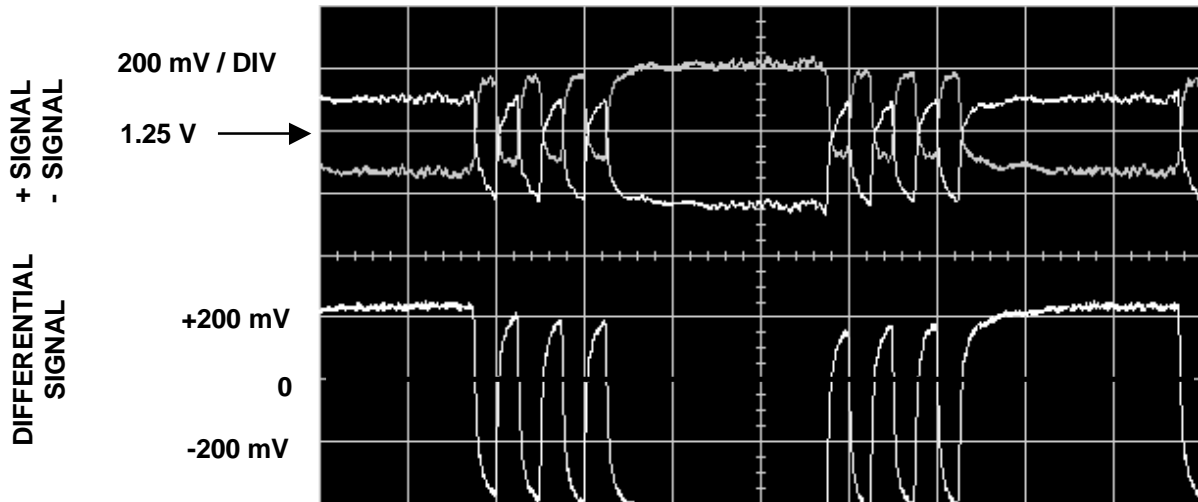
NEAR DRIVER



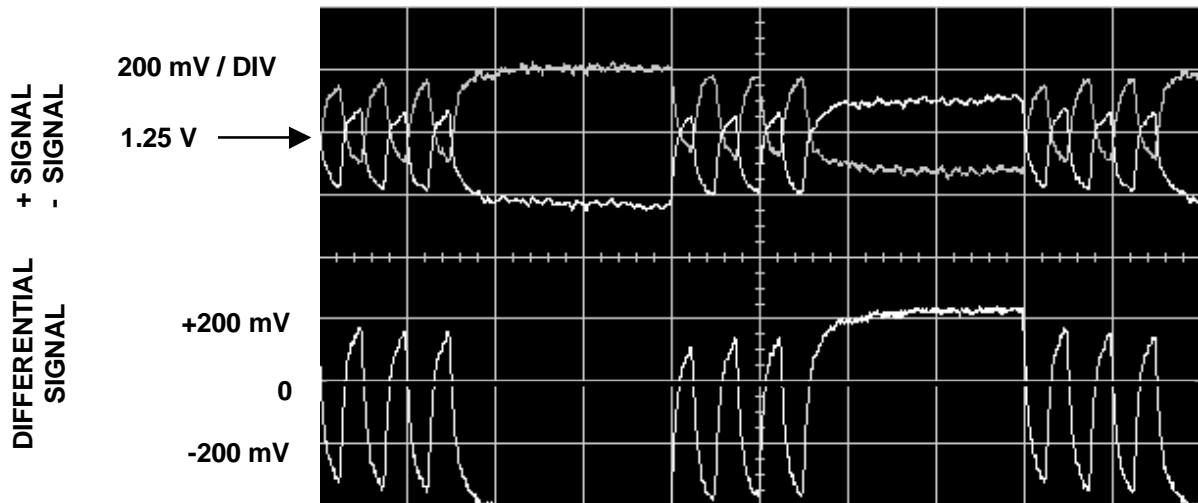
NEAR FAR END

9 METER POINT TO POINT; 125 mV TERMINATOR BIAS

# DOUBLE STRENGTH DRIVERS ON 27 METER CABLES



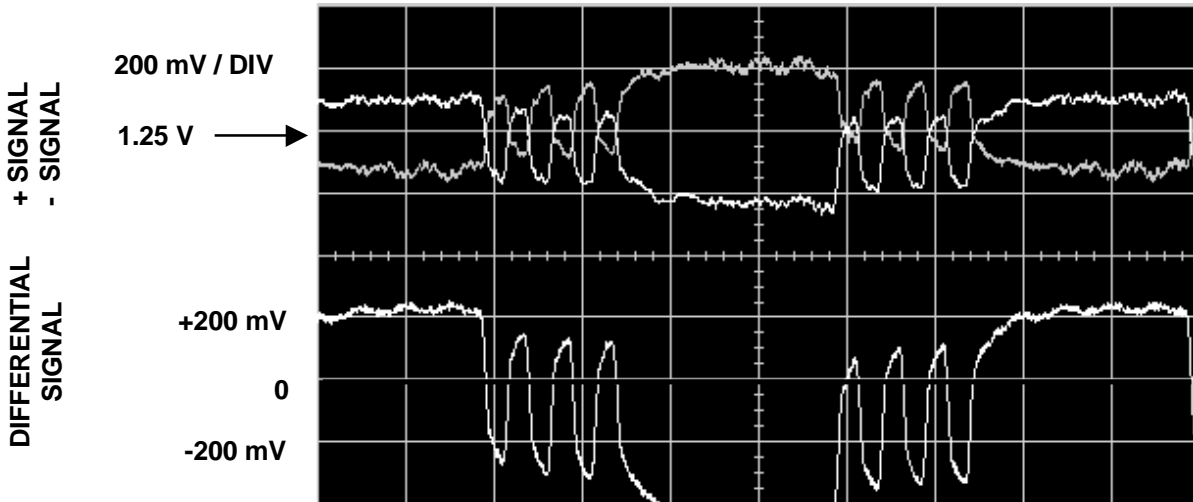
## FAST 20 "CLOCK-LIKE" SIGNALS (100 NS/DIV)



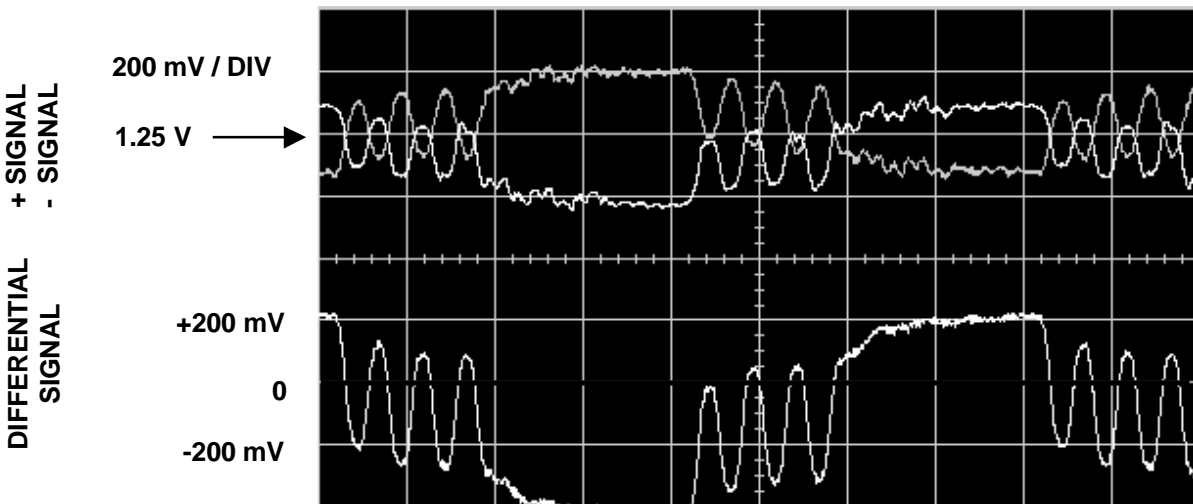
## FAST 40 "CLOCK-LIKE" SIGNALS (50 NS/DIV)

POINT TO POINT; 111 mV BIAS; NEAR FAR TERMINATOR

# DOUBLE DRIVERS ON HEAVILY LOADED 27 METER BUS



## FAST 20 "CLOCK-LIKE" SIGNALS (100 NS/DIV)

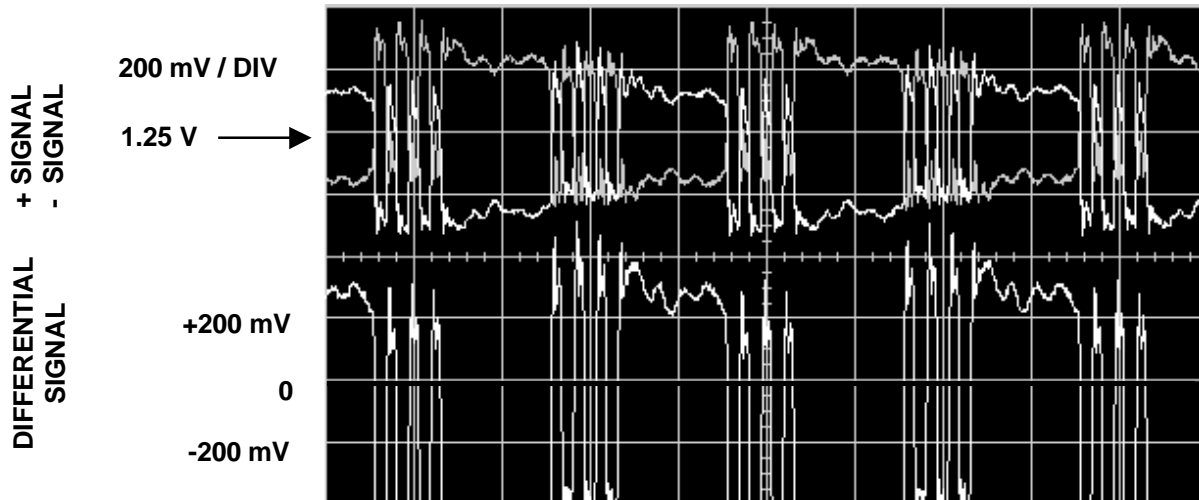


## FAST 40 "CLOCK-LIKE" SIGNALS (50 NS/DIV)

DATA AT FAR TERMINATOR; BIAS 111 mV; 13 HPDF LOADS  
NEAR FAR TERMINATOR

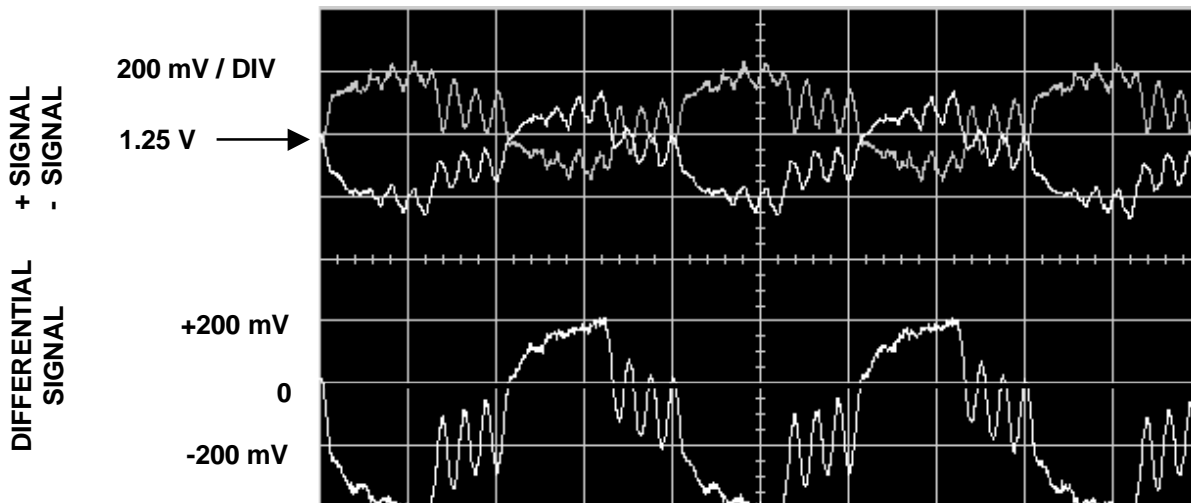
## FAST 80 ON HEAVILY LOADED 27 METER BUS

THIS CONDITION CANNOT WORK AT THIS LENGTH  
UNDER ANY TERMINATOR BIAS CONDITIONS  
UNLESS "CLOCK" IS MUCH MORE REGULAR



50 NS/DIV

NEAR DRIVER



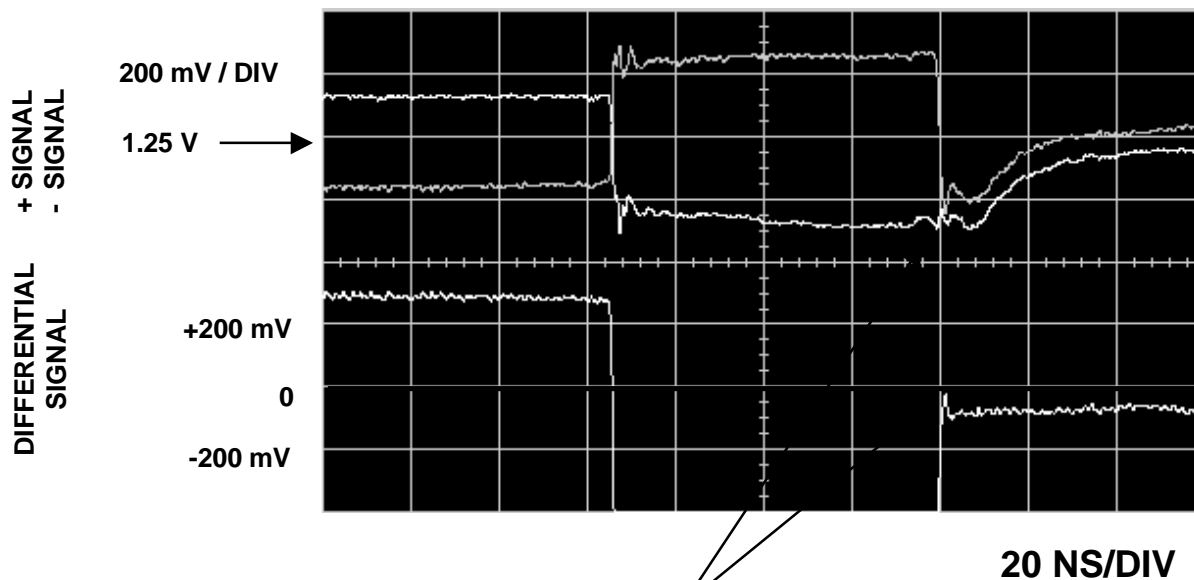
50 NS/DIV

NEAR FAR END TERMINATOR

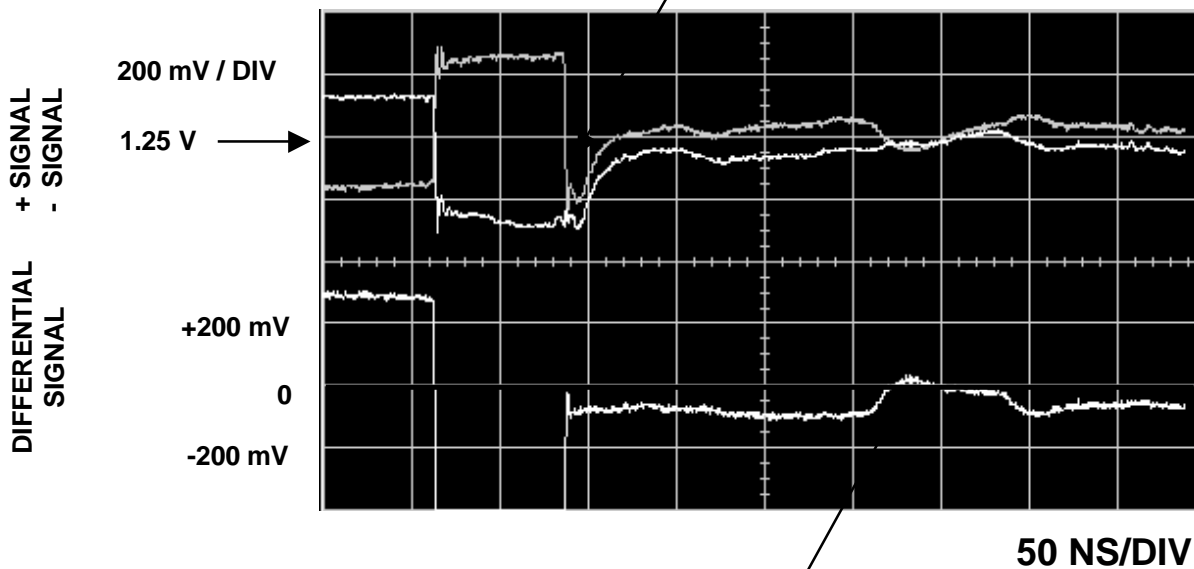
DOUBLE DRIVERS; 111 mV BIAS; 13 LOADS NEAR FAR TERMINATOR



# EFFECTS OF TRANSITIONING FROM DRIVEN TO UNDRIVEN AND VICE VERSA: NEGATION TO HI Z



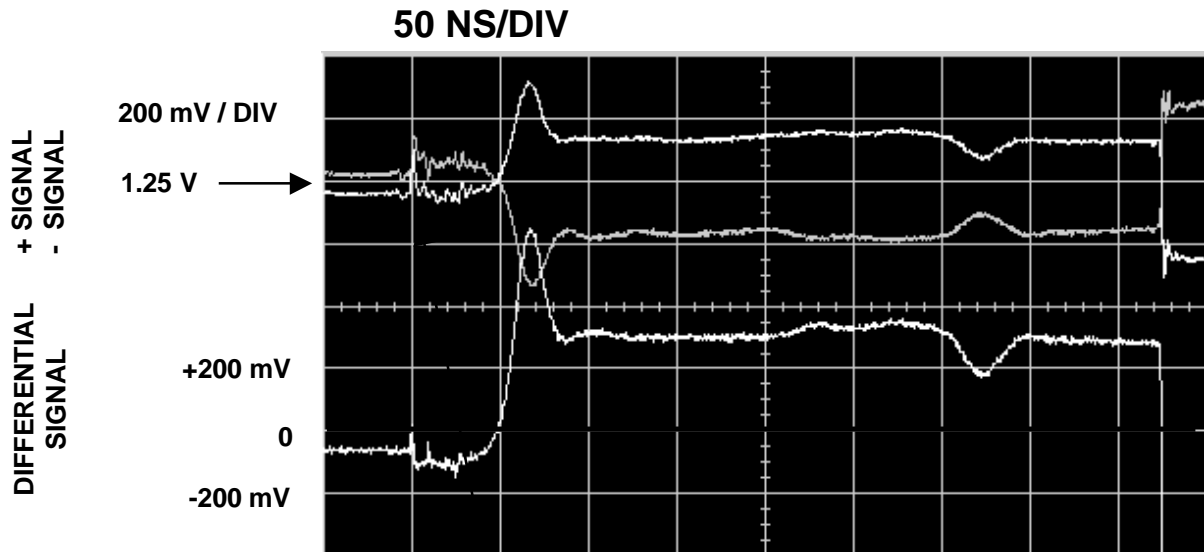
NEGATION TO  
HI Z TRANSITION



REFLECTION CAUSES  
FALSE ASSERTION

DOUBLE DRIVER; 111 mV BIAS; DATA NEAR DRIVER;  
27 METERS HEAVILY LOADED NEAR FAR TERMINATOR

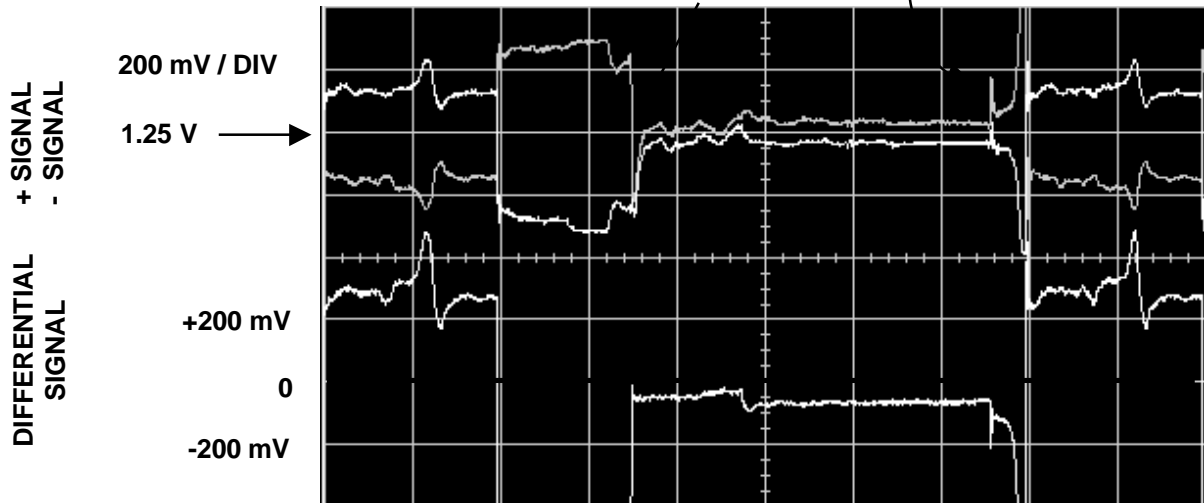
# TRANSITIONS RELATED TO HI Z STATES



HI Z TO  
ASSERTION

NEGATION  
TO HI Z

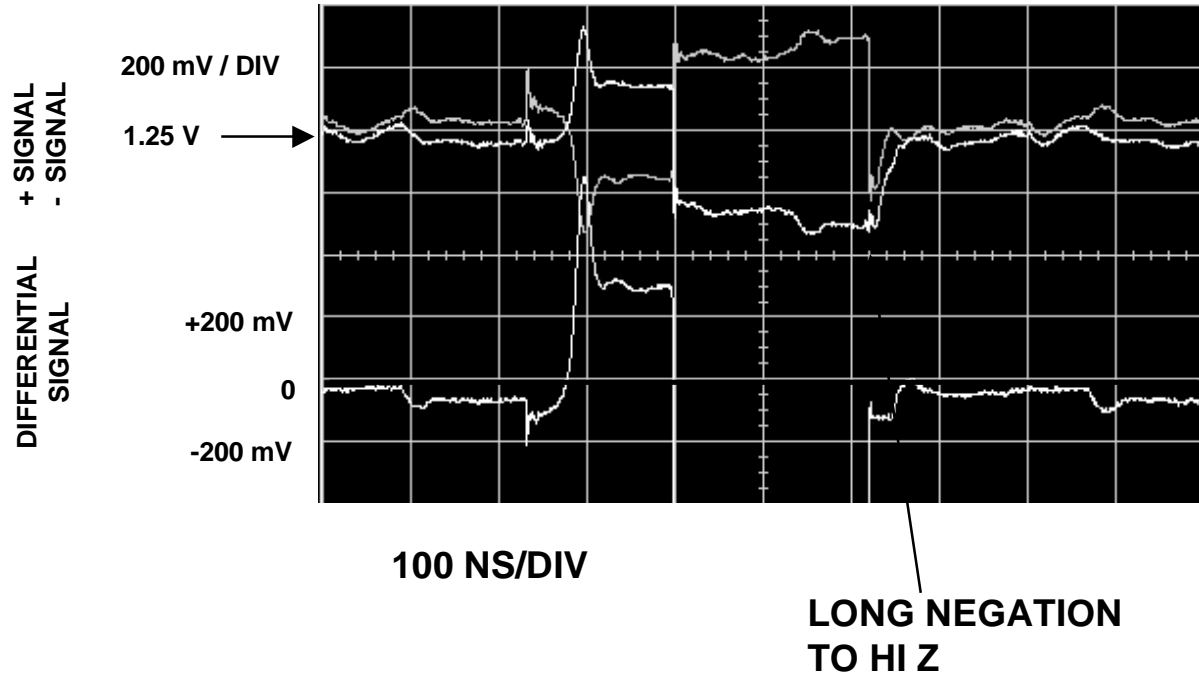
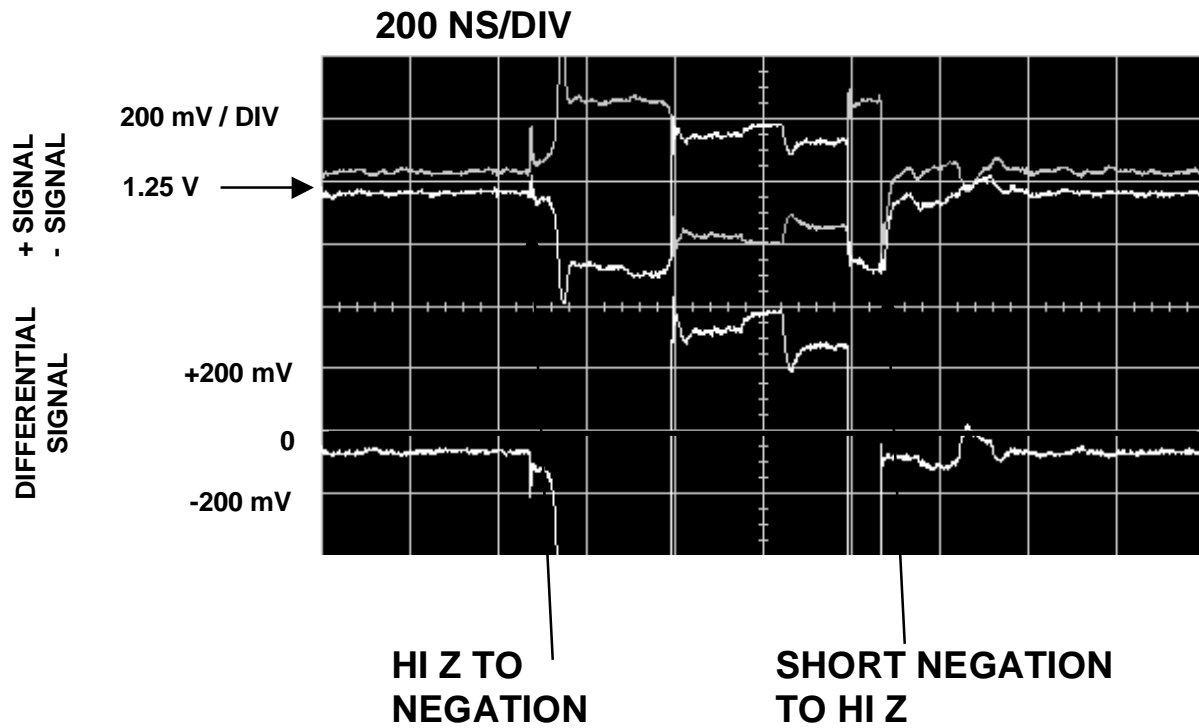
HI Z TO SHORT  
NEGATION



200 NS/DIV

DOUBLE DRIVERS; 27 METERS LOADED BUS; 111 mV BIAS;  
NEAR DRIVER; SLOW SPEED DATA

# MORE TRANSITIONS RELATED TO HI Z STATES



DOUBLE DRIVERS; 27 METERS LOADED BUS; 111 mV BIAS;  
NEAR DRIVER; SLOW SPEED DATA

## **CONCLUSIONS??**

- **BIAS TERMINATION REQUIRES EITHER A SIGNIFICANT SIGNAL INCREASE OVER THE TIA LVDS LEVELS OR ASYMMETRICAL DRIVERS TO MAKE EVEN 9 METERS**
- **WHEN USED WITH BIAS TERMINATORS ASYMMETRICAL DRIVERS OFFER A LARGE INCREASE IN NOISE MARGIN AND A SUBSTANTIAL REDUCTION IN POWER FOR EQUIVALENT CONFIGURATIONS**
- **THE DIFFERENCE BETWEEN CURRENT MODE AND VOLTAGE MODE DRIVERS NEEDS TO BE CAREFULLY CONSIDERED IN DEVELOPING THE SPECIFICATIONS**
- **REFLECTIONS AND UNPREDICTABLE BEHAVIOR AFTER NEGATION TO HI Z TRANSITIONS REQUIRE A BUS SETTLE DELAY -- WE SHOULD NOT TRY TO ELIMINATE THE GLITCHES**
- **IT APPEARS LIKELY THAT FAST 80 WILL BE LIMITED TO LESS THAN 25 METERS UNLESS WE CAN MAKE THE "CLOCKS" MORE REGULAR**