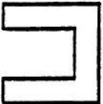


INTEGRATED
CIRCUITS



UNITRODE

FAST SINGLE ENDED SCSI TERMINATOR CONCEPT

ACTIVE NEGATION EMULATOR

MARK JORDAN

SENIOR DESIGN ENGINEER

UNITRODE INTEGRATED CIRCUITS
Merrimack, NH

X3T9.2/92-28

X3T9.2 SCSI PARALLEL INTERFACE
WORKING SUB-GROUP MEETING
HOUSTON 14 JAN 1992

INTEGRATED
CIRCUITS

UNITRODE

UC5601 SCSI ACTIVE TERMINATOR

MARK JORDAN
7/25/91

REGULATOR
OUT

TERM POWER
4.25V - 5.25V
4.75V TYP

1.4V
TYP

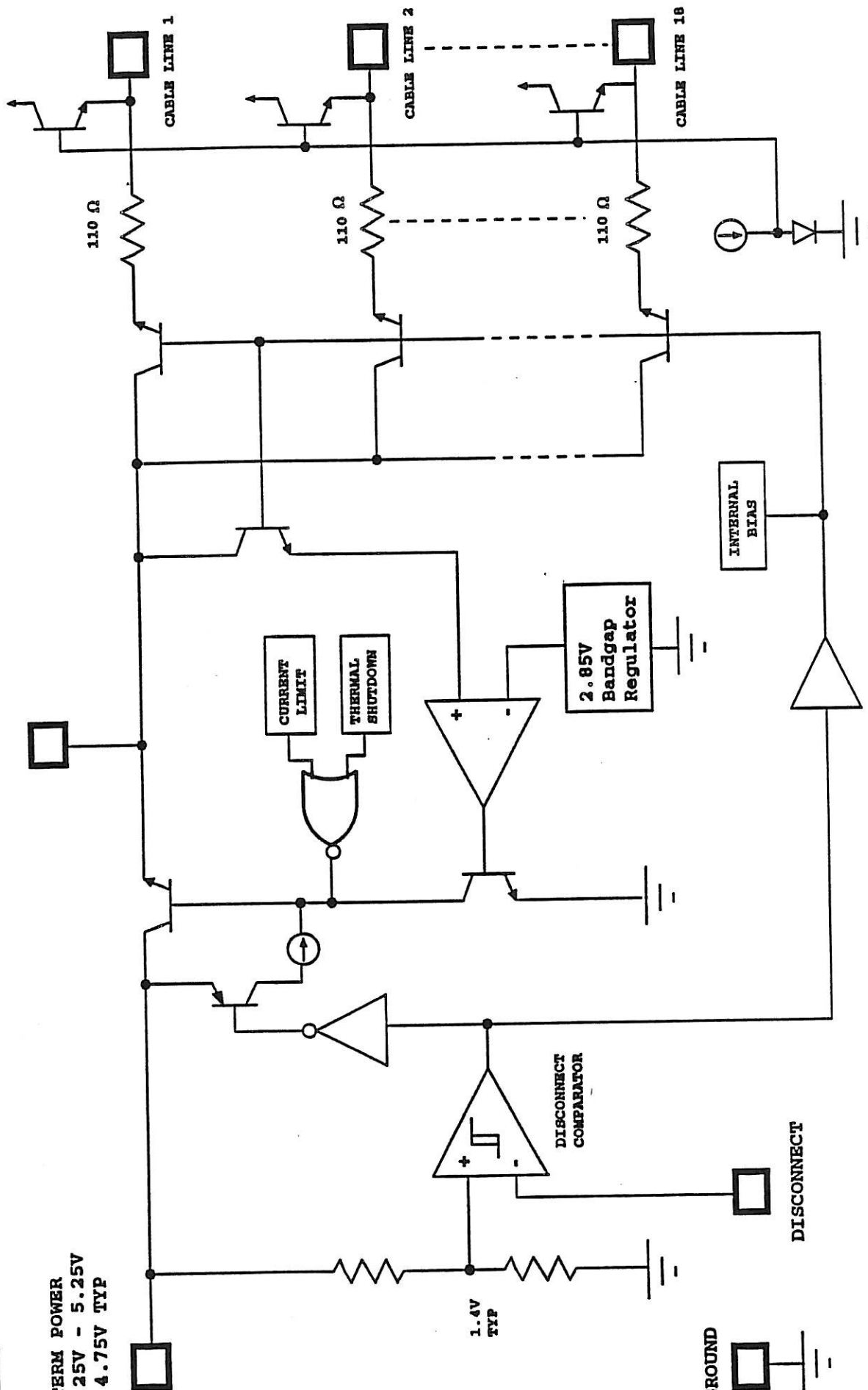
DISCONNECT
COMPARATOR

2.85V
Bandgap
Regulator

INTERNAL
BIAS

DISCONNECT

GROUND



FAST SINGLE ENDED SCSI

THE PROBLEM

MID DRIVING/RECEIVING (BOULAY)

NEGATED LINES USUALLY EXHIBITS A STEP FOR 1 CABLE TIME DELAY

The Step Function for a Boulay Terminator is given by:

$$V_{step\ Mid} = \frac{V_{REG} - V_{ol}}{R_t} Z_0 + V_{ol}$$

$$V_{step\ Mid} = I_o Z_0 + V_{ol}$$

REQ AND ACK LINES ARE EDGE TRIGGERED AND NEED TO EXCEED 2V

> 85 OHM CABLE IS REQUIRED

END DRIVING/RECEIVING (BOULAY)

NEGATED LINES EXHIBIT A STEP FOR 2 CABLE TIME DELAYS

The Step Function for a Boulay Terminator is given by:

$$V_{step\ End} = \frac{2 V_{REG} Z_0 + V_{ol}(R_t - Z_0)}{R_t + Z_0}$$

> 85 OHM CABLE IS REQUIRED TO EXCEED 2.5V

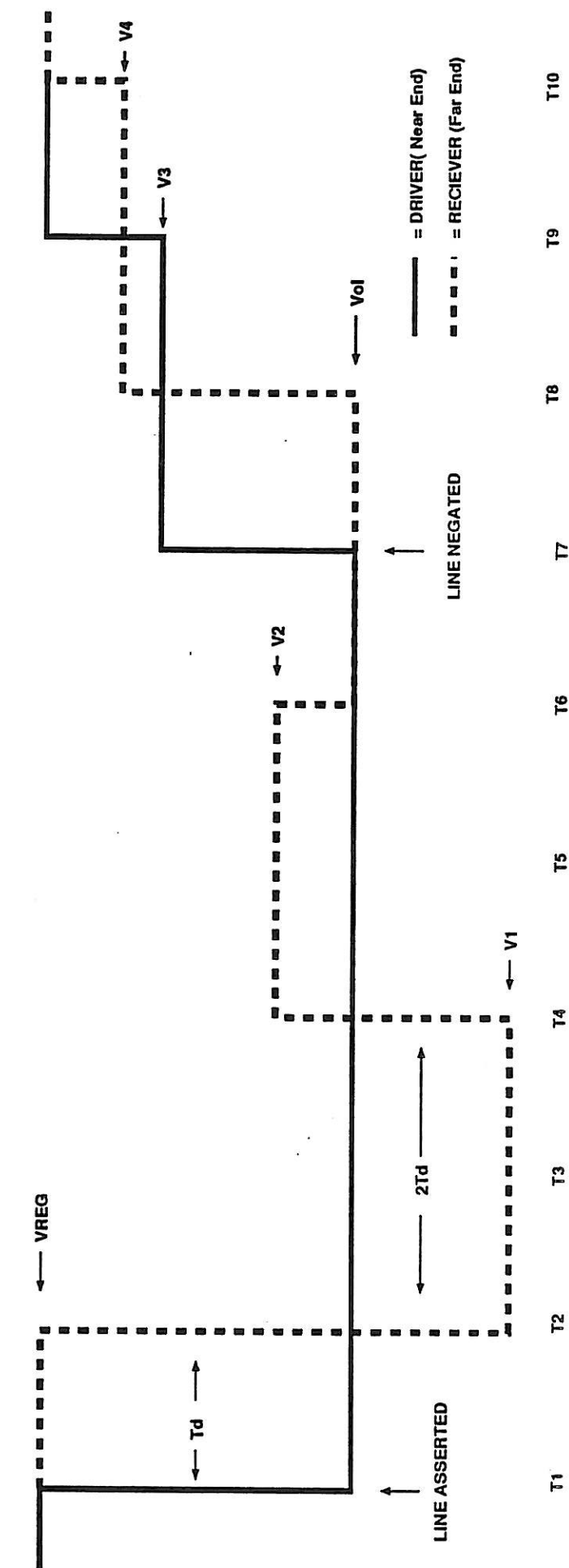
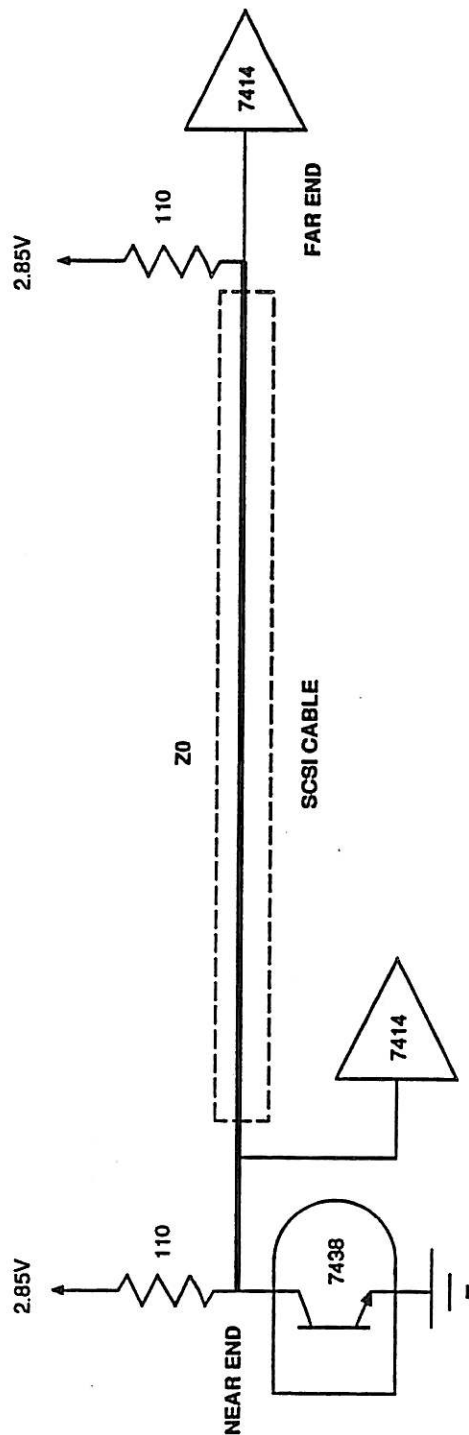
FAST SINGLE ENDED SCSI

FAST SCSI TERMINATOR OBJECTIVE

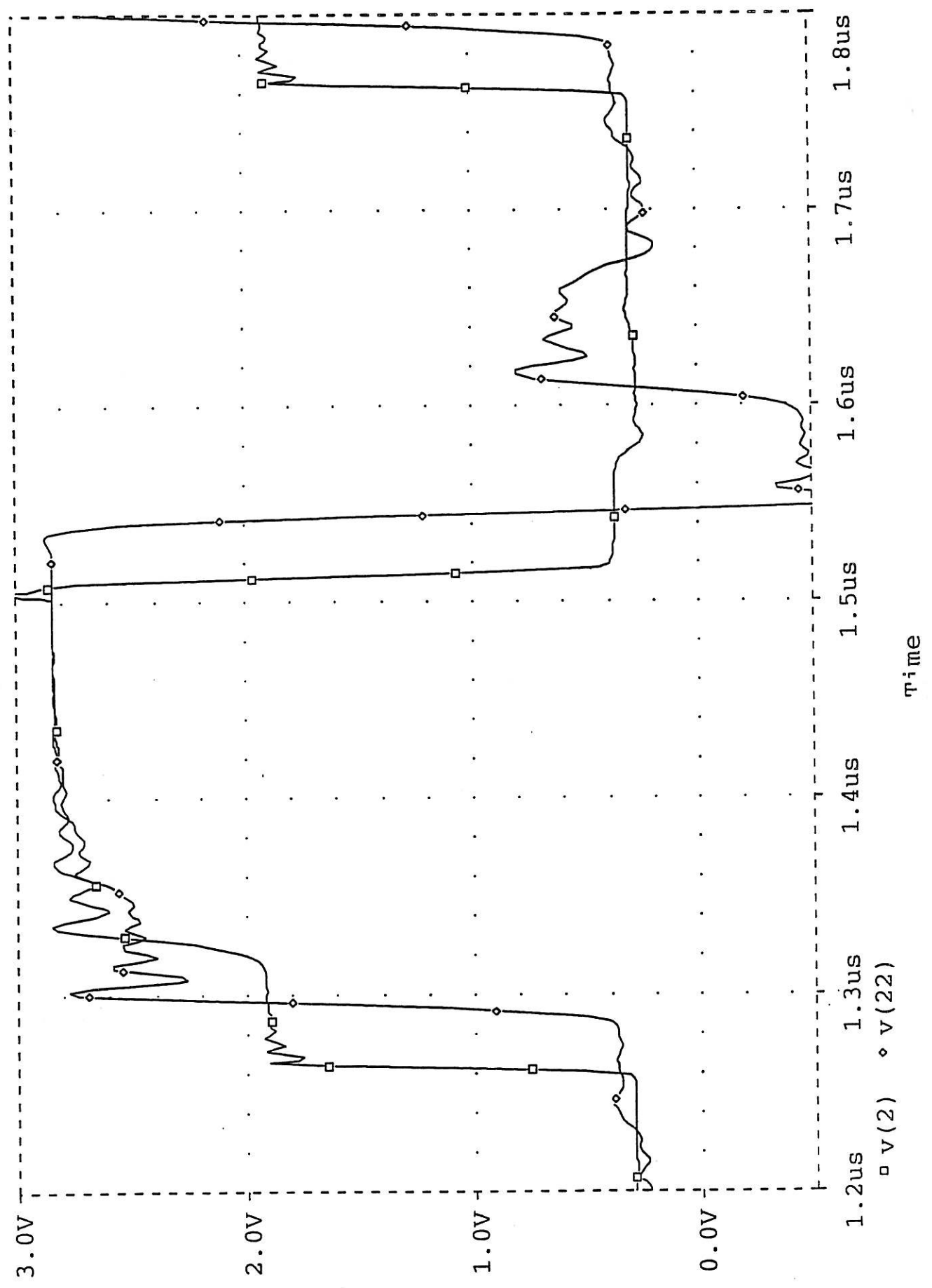
- * BACKWARDS COMPATIBLE WITH SCSI AND SCSI-2
- * ELIMINATE THE NEGATION STEP FROM DRIVING CABLE END
- * DRIVE REQ AND ACK LINES FOR CABLES IMPEDANCES AS LOW AS 60 OHMS
- * SUPPLY ONLY 48mA OF STATIC CURRENT
- * > 10MHZ OPERATION
- * 3.75V OPERATION
- * CLAMPED VOLTAGE LEVELS
- * MINIMAL EXTERNAL COMPONENTS

BOULAY TERMINATOR RESPONSE END CABLE DRIVING

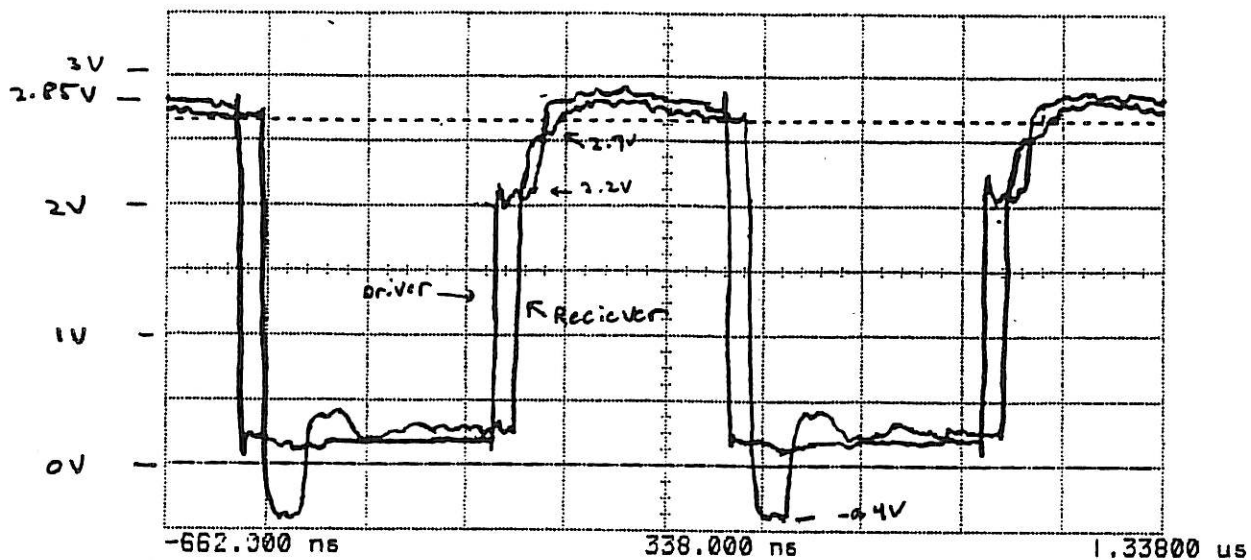
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12/91



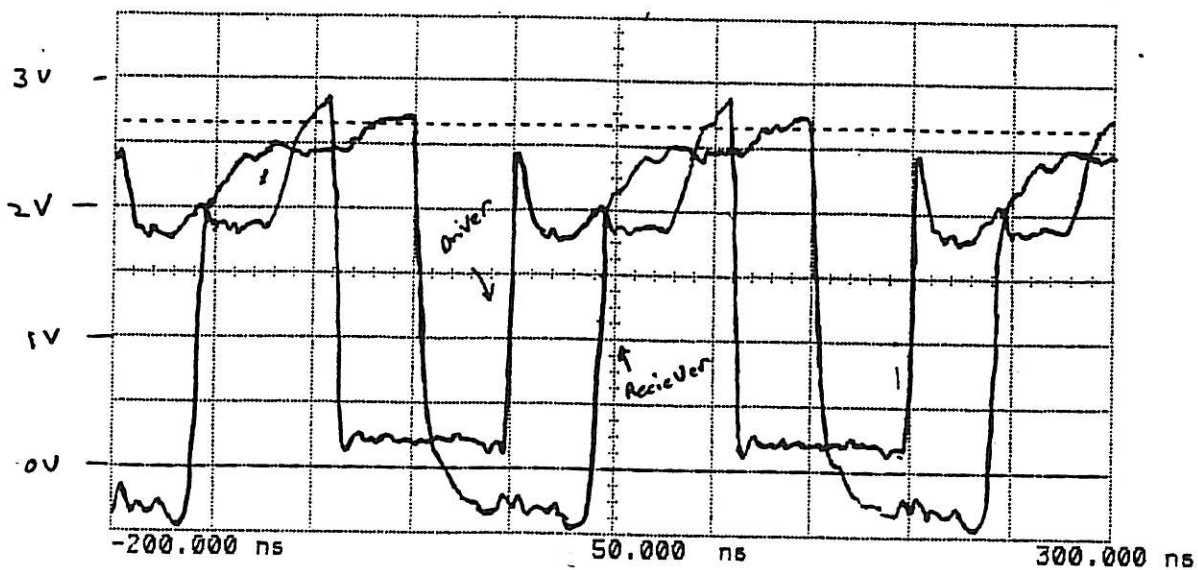
BOULAY TERMINATION DRIVING 20 FEET OF 50 OHM CABLE - 2M12
 Date/Time run: 01/07/92 10:12:14 Temperature: 27.0



BOULAY TERMINATOR (110 ohms to 2.85V) at Both Ends
25 Feet of 50 Line, ~75 ohm Cable 1 MHZ

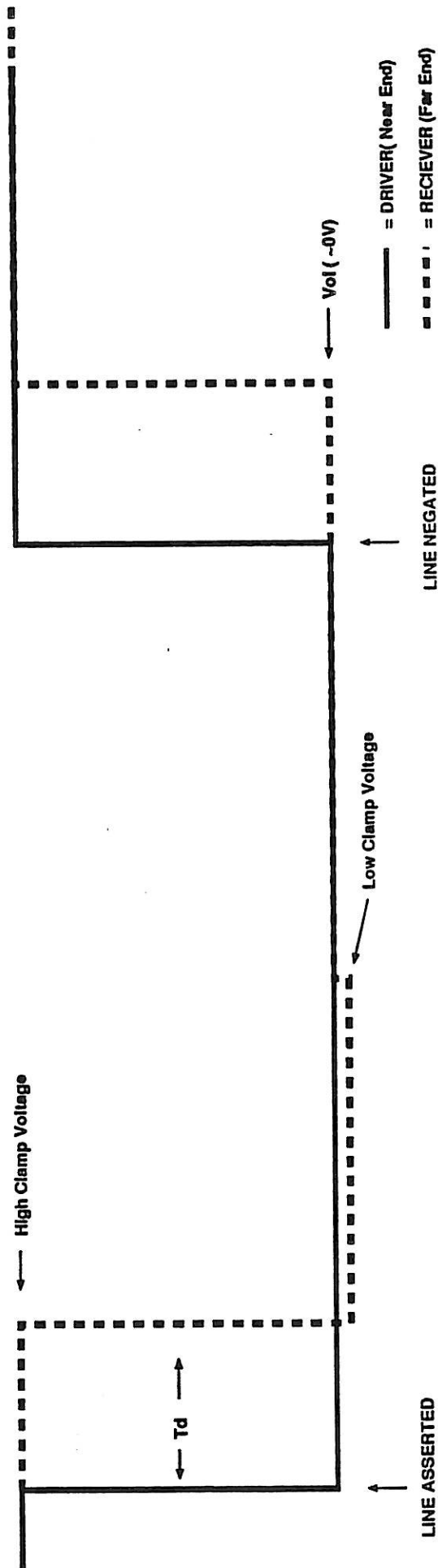
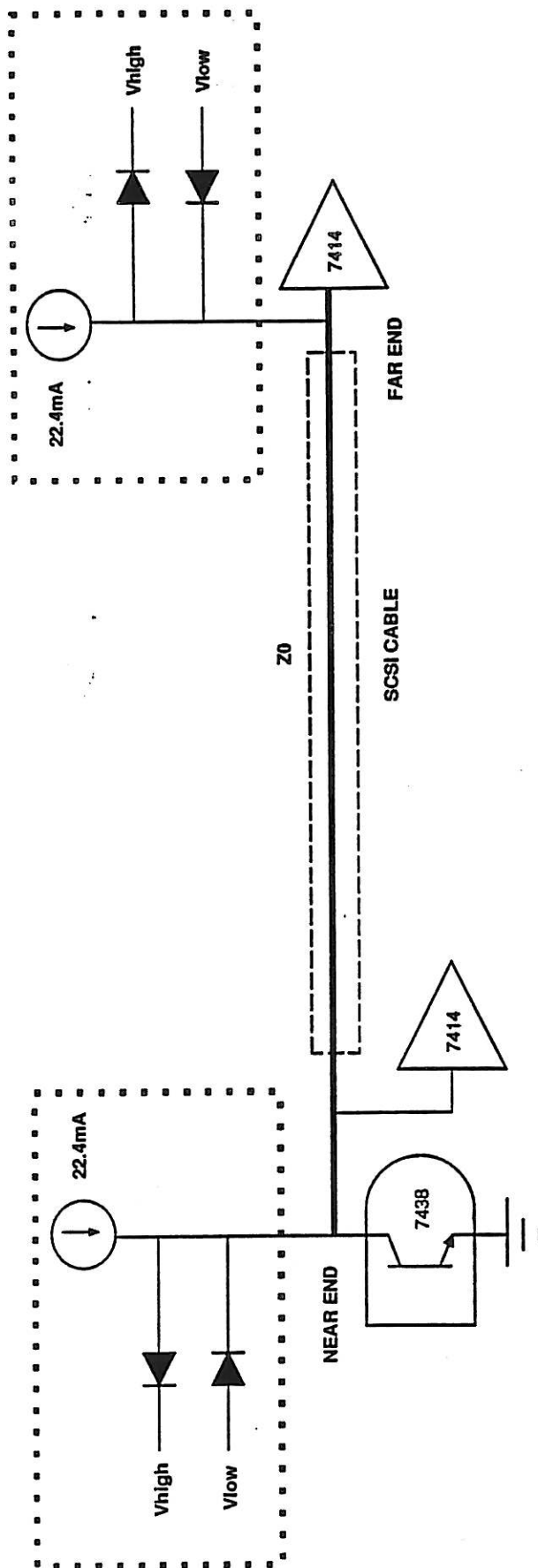


BOULAY TERMINATOR (110 ohms to 2.85V) at Both Ends
25 Feet of 50 Line, ~75 ohm Cable 5 MHZ



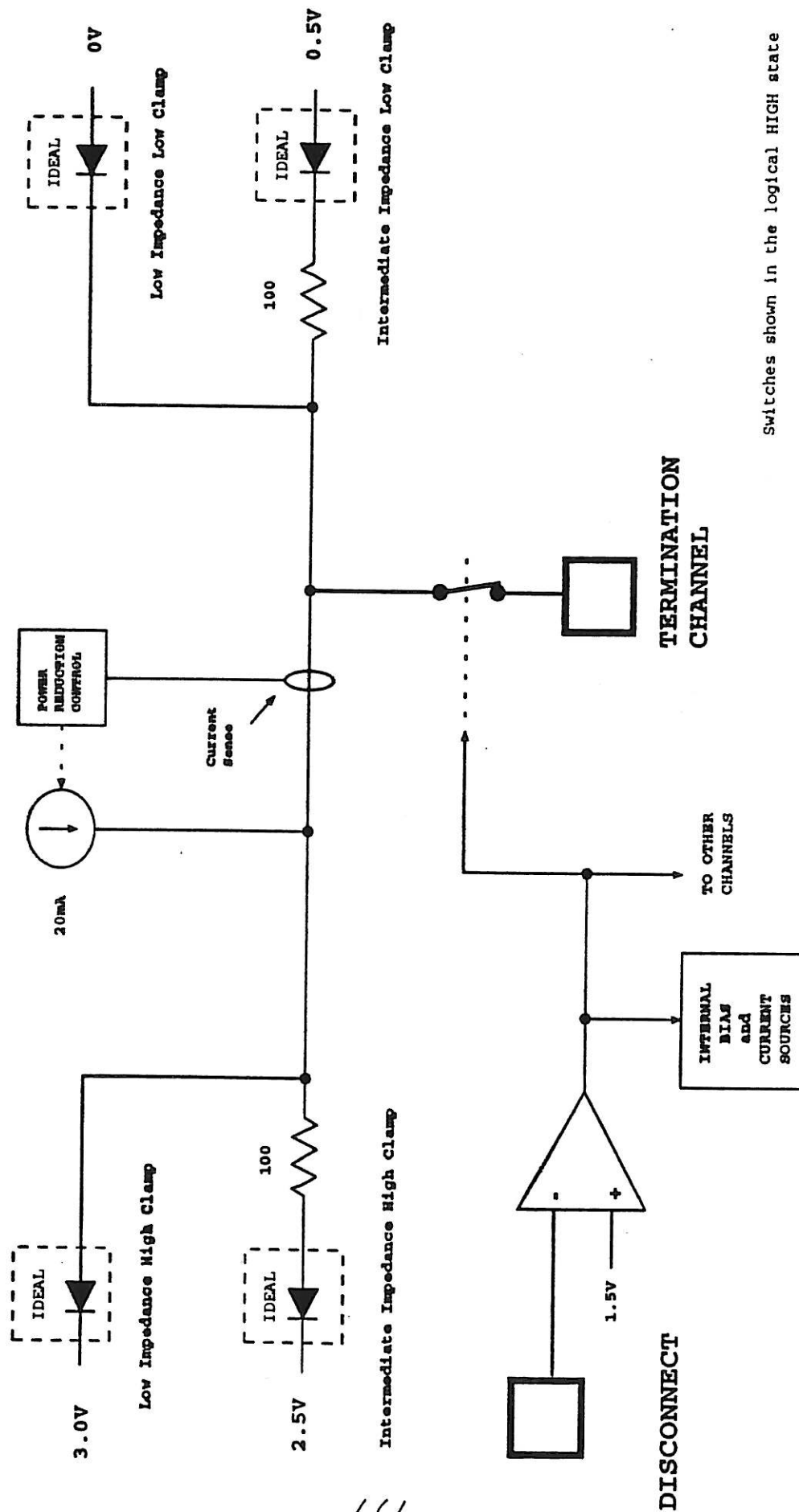
CURRENT SOURCE CLAMPED TERMINATOR END CABLE DRIVING

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T1 T2 T3 T4 T5 T6 T7 T8 T9 T10

FAST SINGLE ENDED SCSI TERMINATOR

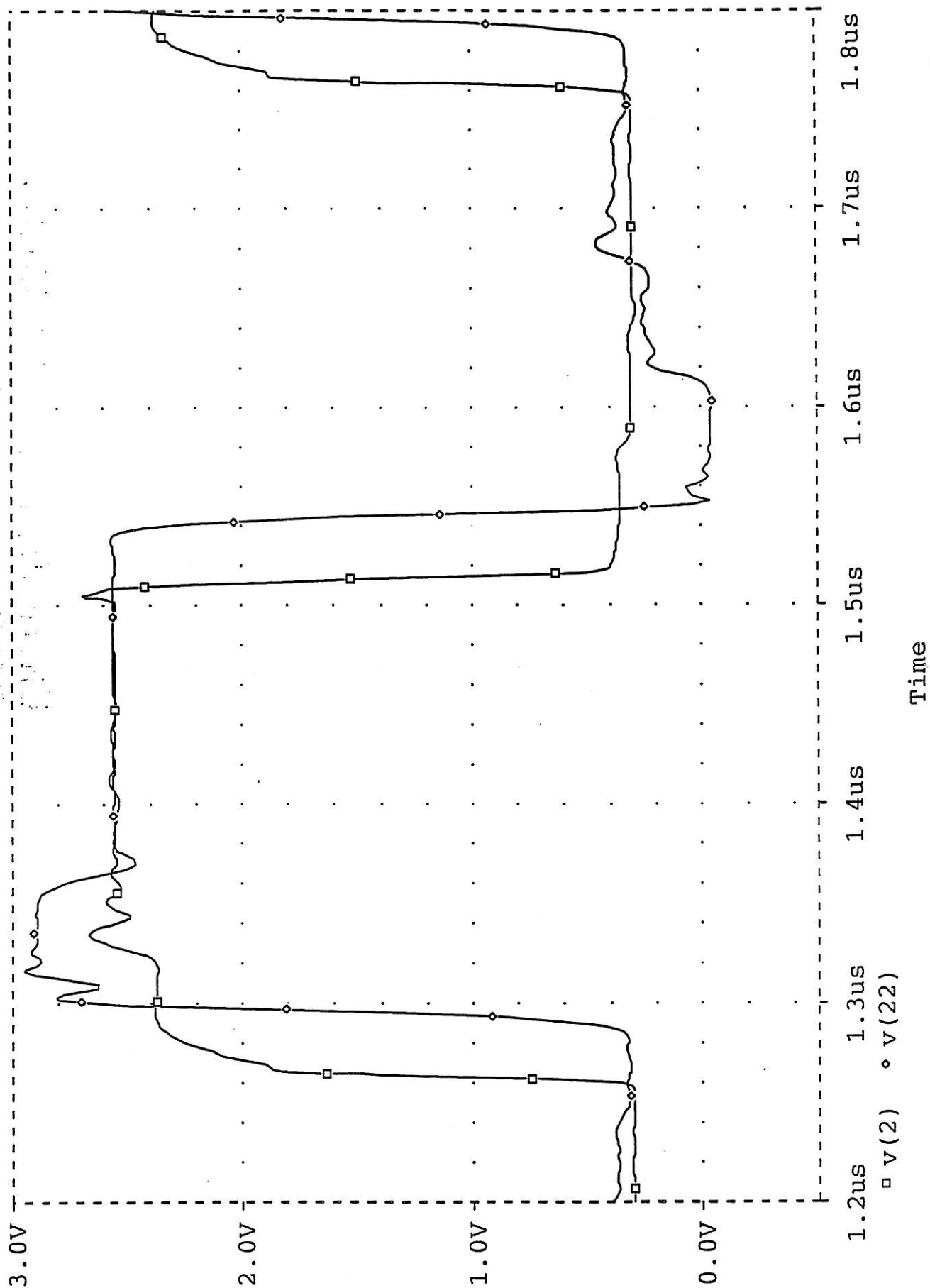


Switches shown in the logical HIGH state

CURRENT SOURCE TERMINATOR DRIVING 20 FEET OF 50 OHM CABLE - 2MHZ

Temperature: 27.0

Date/Time run: 01/07/92 14:51:30

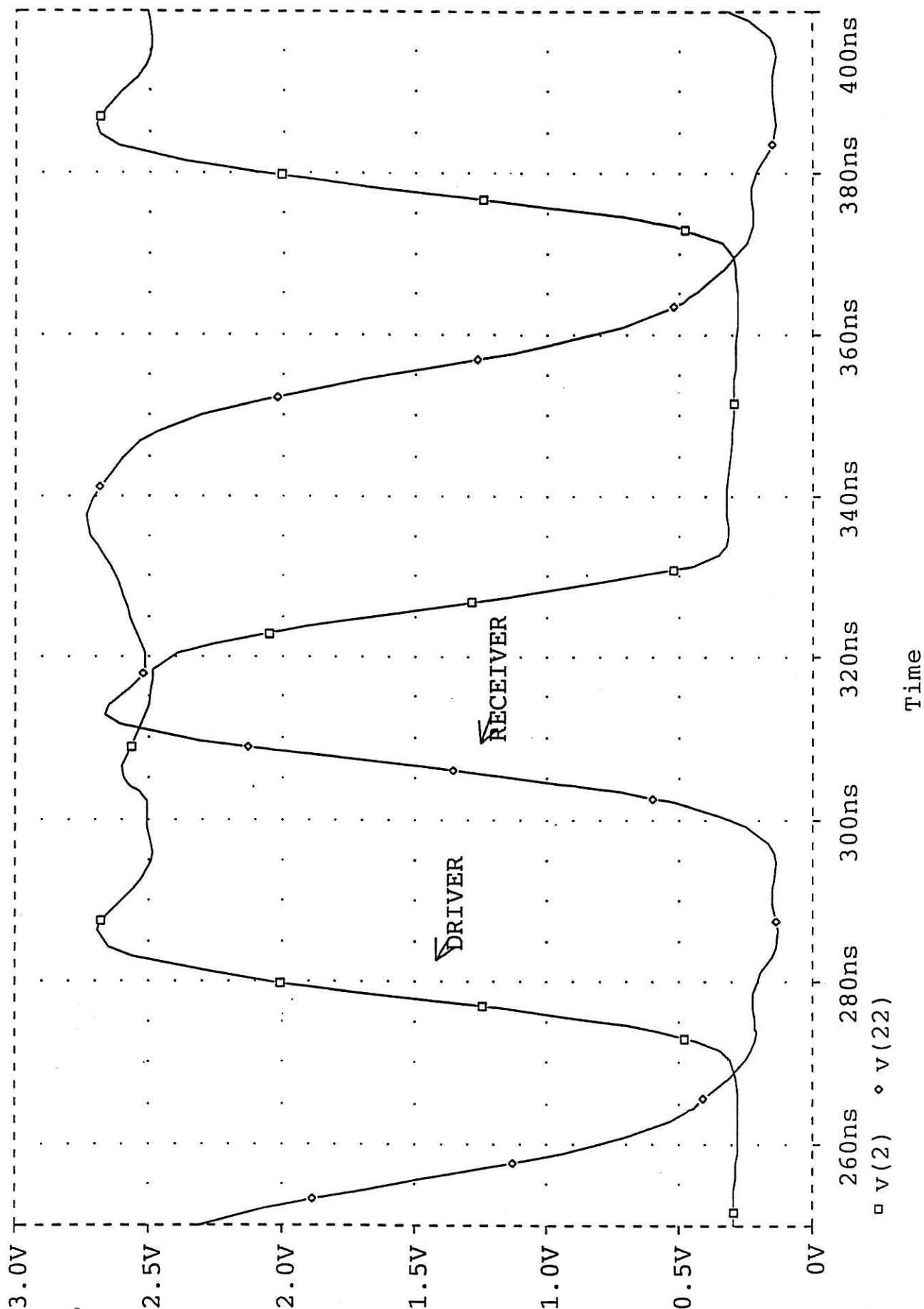


*20' rev4 CURRENT SOURCE TERMINATOR ZO=75 Ohms

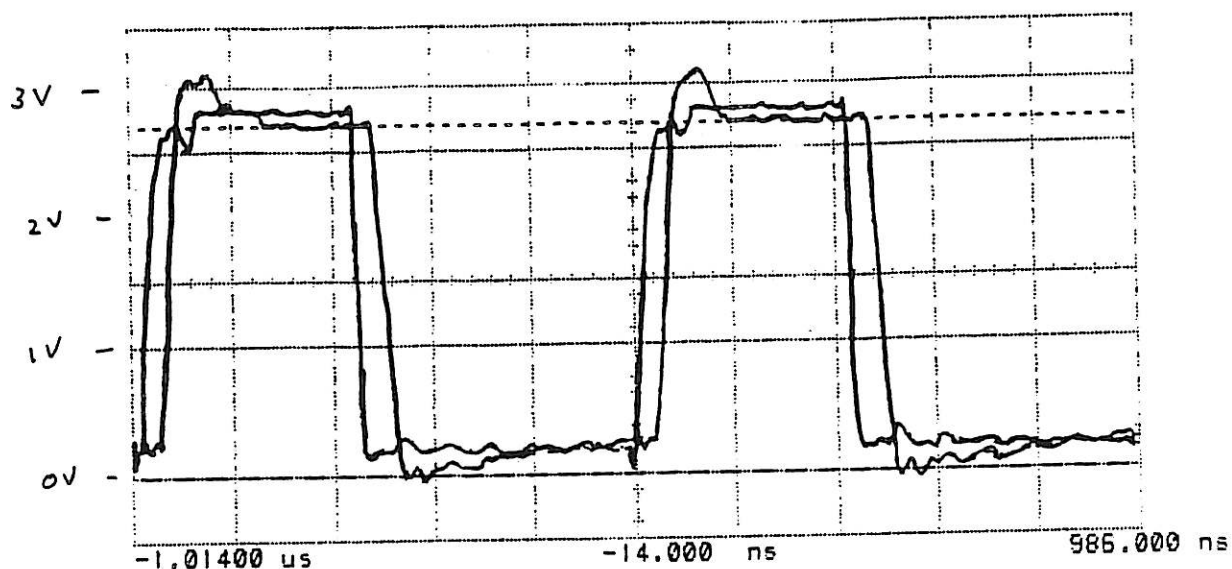
Date/Time run: 01/02/92 09:52:43

Temperature: 27.0

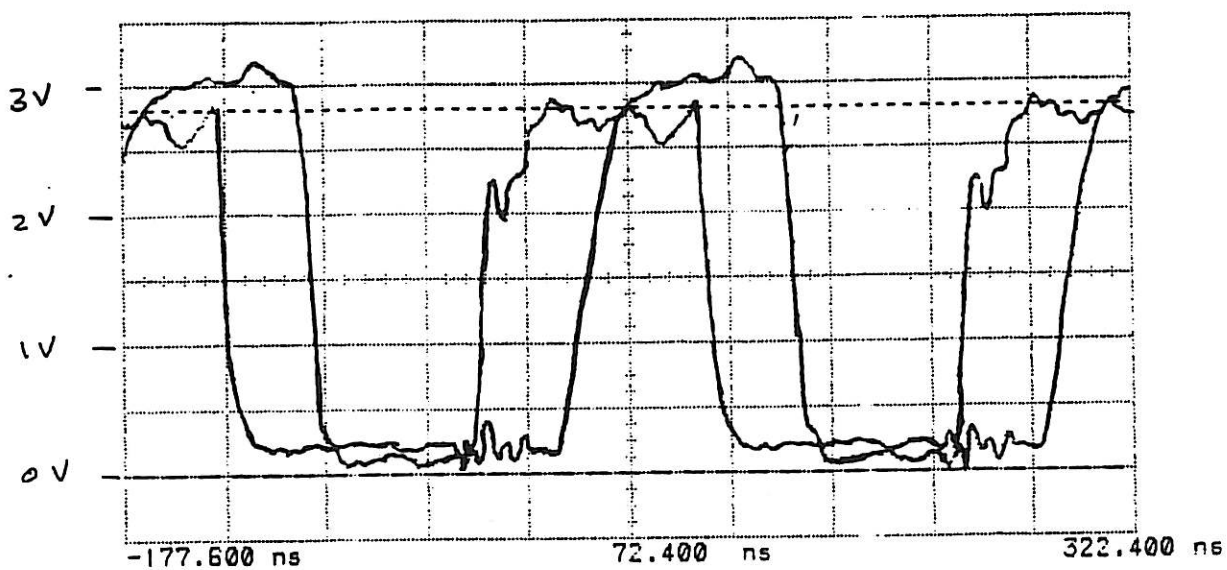
10 MHz



CURRENT SOURCE TERMINATOR at Both Ends
25 Feet of 50 Line, ~75 ohm Cable **1 MHZ**



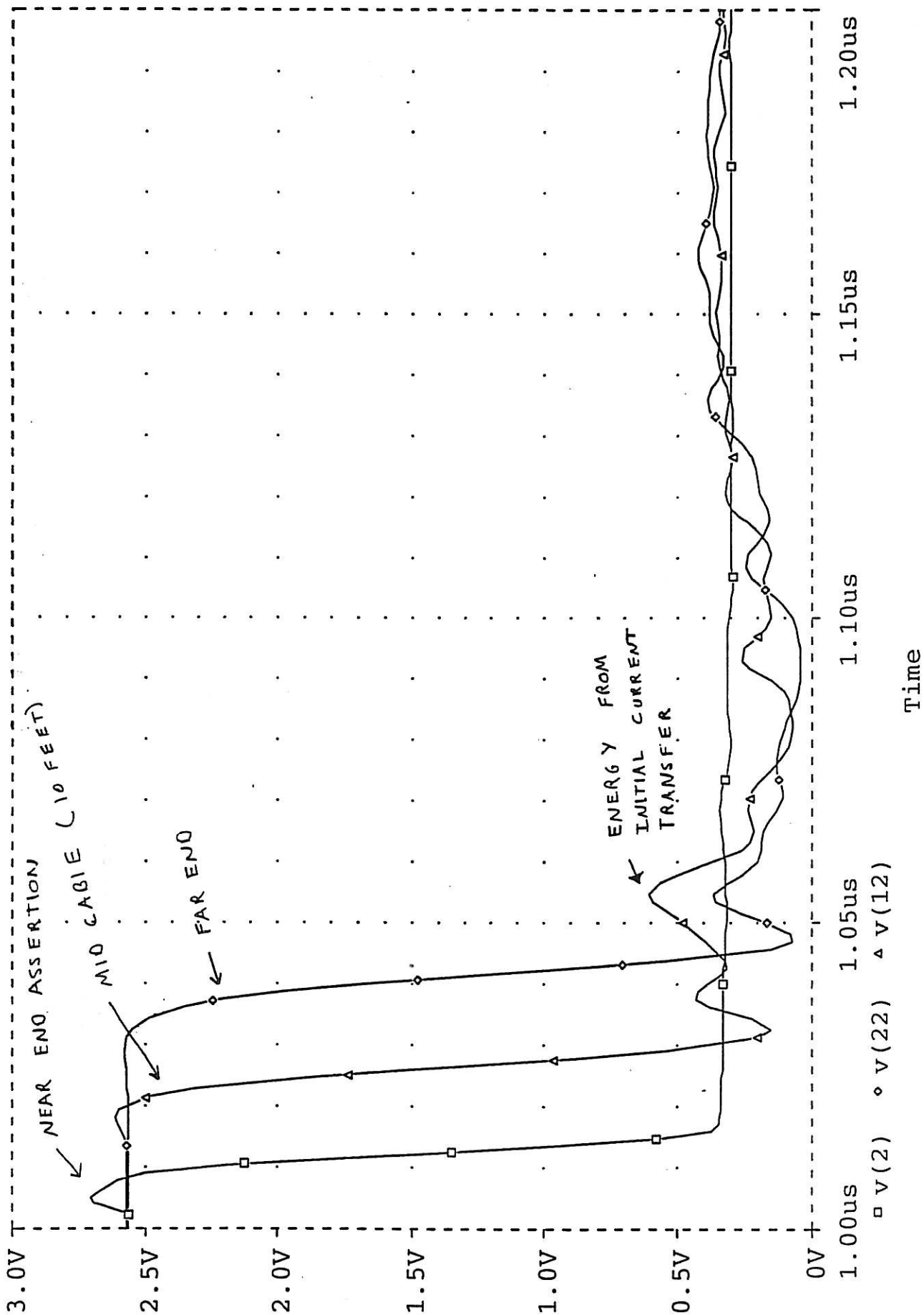
CURRENT SOURCE TERMINATOR at Both Ends
25 Feet of 50 Line, ~75 ohm Cable **5 MHZ**

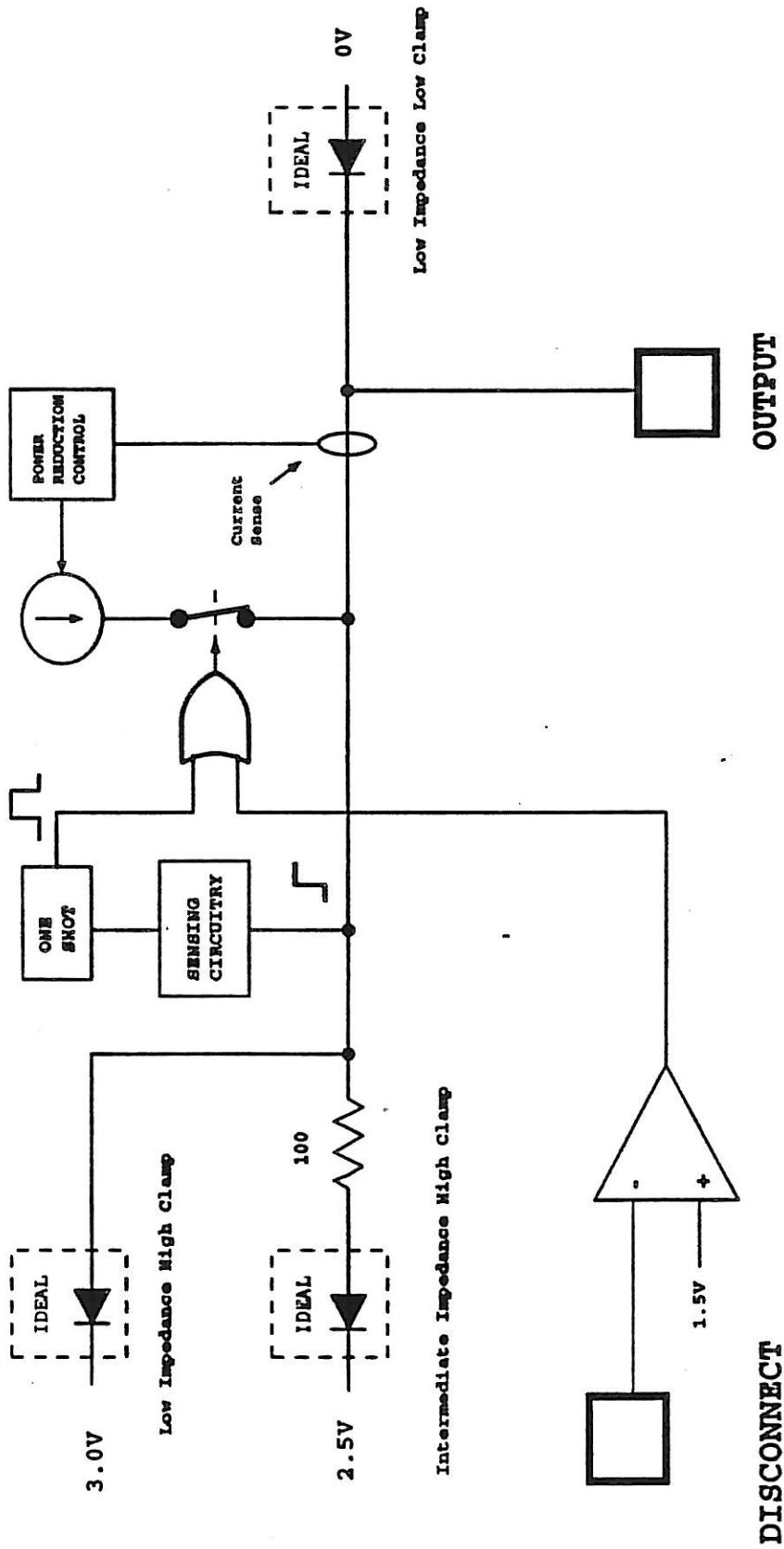


END CABLE ASSERTION - 75 OHM CABLE - MID CABLE GLITCH

Temperature: 27.0

Date/Time run: 01/09/92 16:44:52

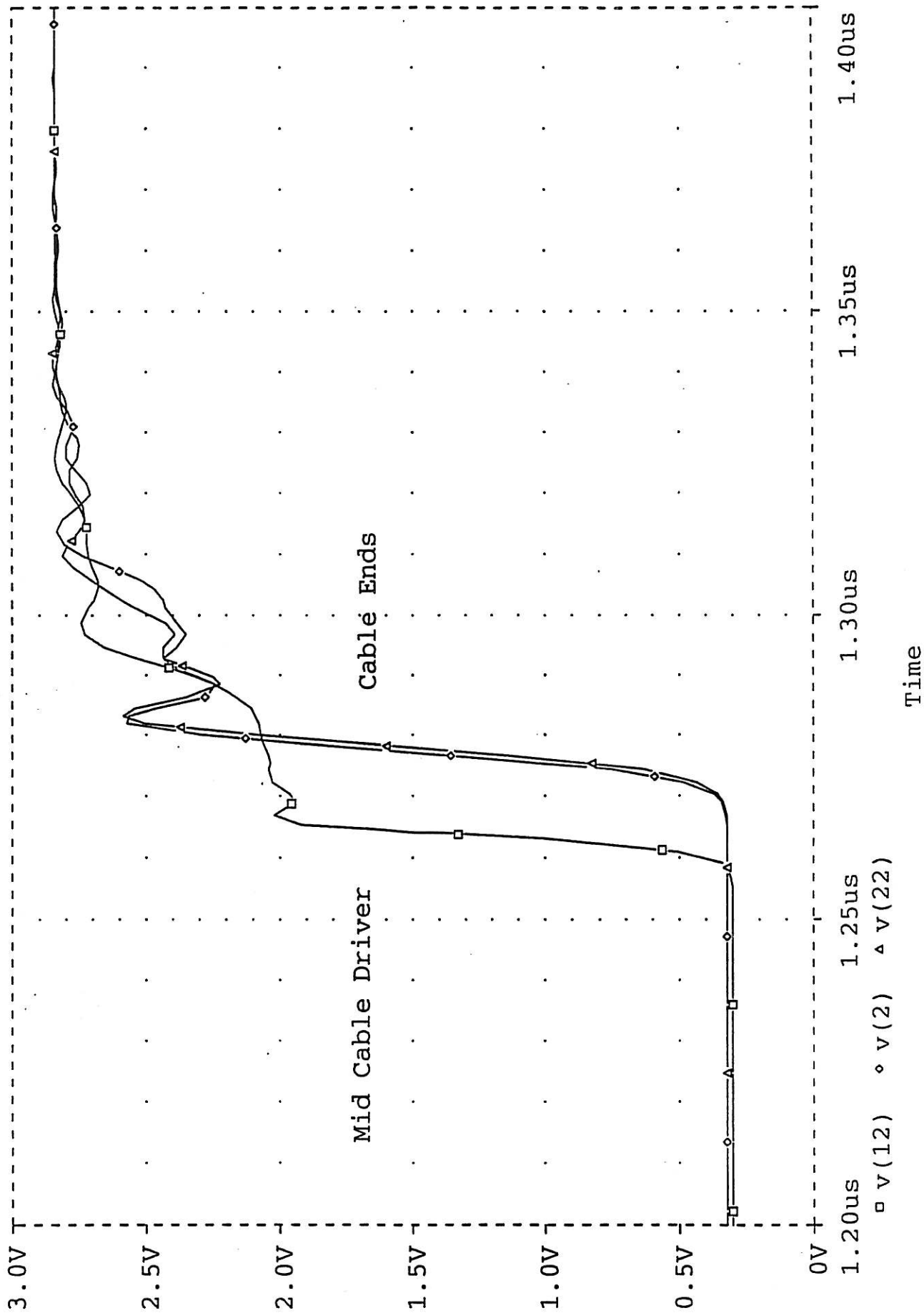




BOULAY TERMINATOR DRIVING 20 FEET OF 75OHM CABLE- MIDPOINT

Date/Time run: 01/08/92 12:00:00

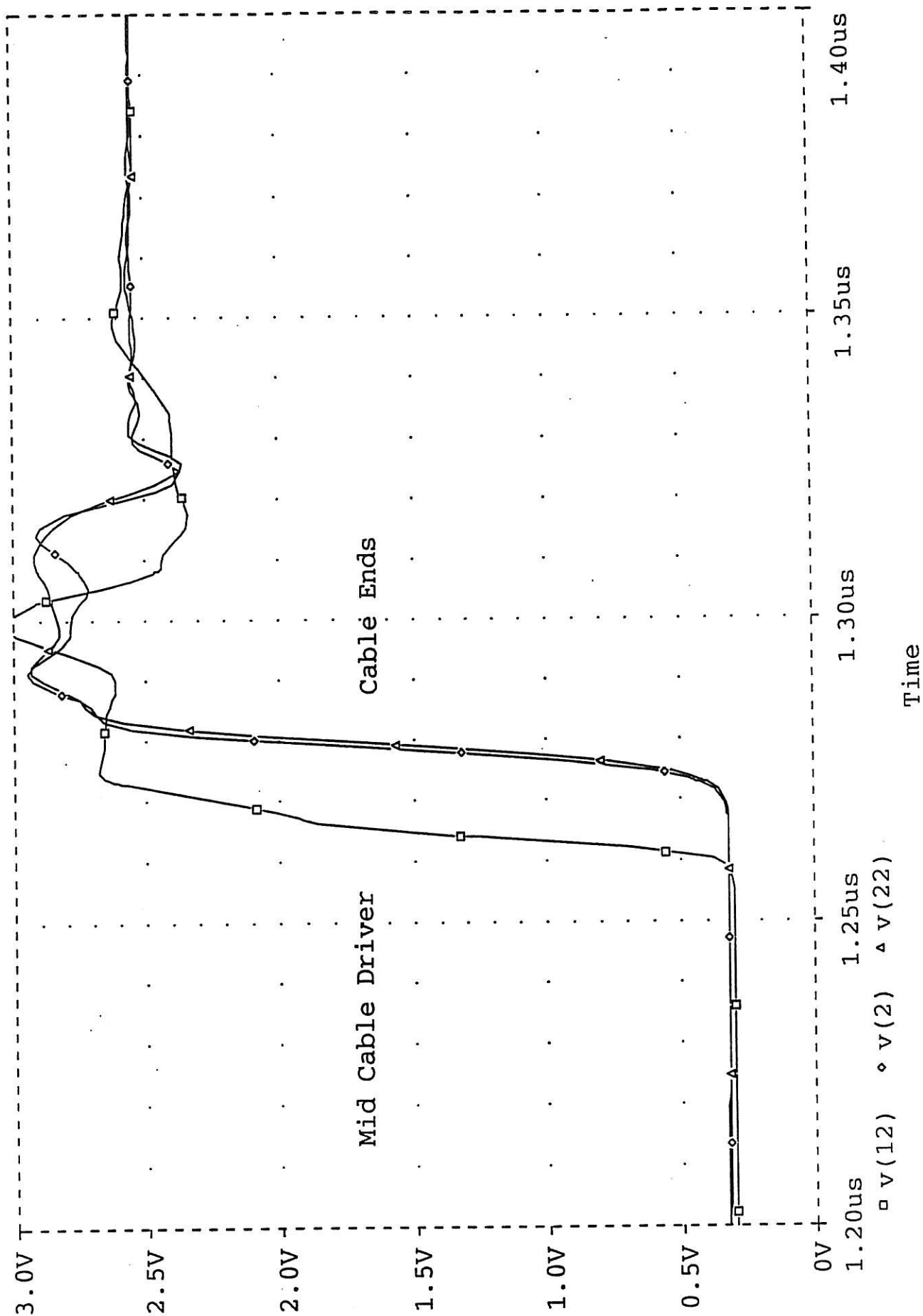
Temperature: 27.0



CURRENT BOOST CIRCUIT - 20 FEET OF 75 OHM CABLE - DRIVING MID-CABLE

Temperature: 27.0

Date/Time run: 01/08/92 13:06:15



FAST SINGLE ENDED SCSI

CONCLUSION

A CURRENT SOURCE CLAMPED TERMINATOR ELIMINATES THE END ASSERTION STEP FOR CABLES AS LOW AS 60 OHMS, WHILE MAINTAINING A MAXIMUM CURRENT OF 48 mA

THE MID CABLE GLITCH OBSERVED NEEDS TO BE RESOLVED. PRELIMINARY INVESTIGATION SHOWS A MODIFICATION OF THE ASSERTION ENERGY TRANSFER REDUCES THE PROBLEM DRAMATICALLY

AN ACTIVE NEGATION EMULATOR WOULD MAINTAIN BACKWARDS COMPATIBILITY WHILE DECREASING THE SUSCEPTIBILITY TO RINGING

A SOPHISTICATED NON-LINEAR SOLUTION IS REQUIRED TO INCREASE DATA RATES WHILE MAINTAINING BACKWARDS COMPATIBILITY AND ALLOW A WIDE RANGE OF CABLE IMPEDANCES