X3T9.2/91-38

FPT
Forced Perfect Termination

Trung Le

IBM Austin

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IMPEDANCE MISTMATCH

- PROBLEMS IN BUS COMMUNICATIONS
- THE HIGHER THE BANDWIDTH AND THE FASTER THE DEVICES, THE WORSE THE PROBLEM

FORCED PERFECT TERMINATION

- A SELF-TERMINATING LINE
- A DIFFERENT WAY OF LOOKING AT TRANSMISSION LINE TERMINATION

- SCSI problem - signal quality (REQ and ACK lines)
- Variable number of devices
- Multiple breaks/impedance discontinuities
- Multiple reflections
- Voltage stairsteps and other signal distortions
- No good textbook solutions

When a pulse travels down a line, 3 things can happen at the end of the line:

1. *zterm* > *zline* (REFLECTION)

2. *zterm* < *zline* (REFLECTION)

3. *zterm* = *zline* (PERFECT MATCH)

Cases 1 and 2 lead to reflections and signal distortions

Case 3 is difficult to achieve

BACKING INTO A PERFECT TERMINATION

FPT represents a subtle change in design concept

FPT backs into case 3 by forcing the simultaneous existence of of 2 mutually exclusive states (cases 1 and 2) i.e.

IF (a is greater than b)

AND

(a is less than b) THEN

a must be EQUAL to b.

- NUMEROUS POSSIBLE IMPLEMENTATIONS
- BASIC TOPOLOGY:
  - A resistor of impedance higher than the line impedance
  - In line with a diode & a voltage source - The diode ON impedance is much lower than the line impedance

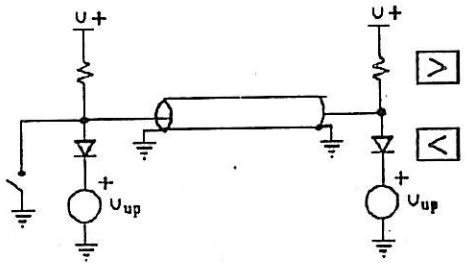

Figure 1. Basic Implementation

- FPT REMOVES THE DISTORTION

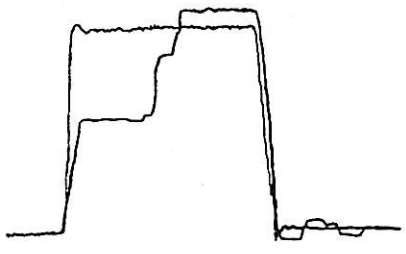

Figure 2. FPT Theoretical Pulse Response

INHERENT PROPERTIES OF FPT

- CABLE IMPEDANCES NEED NOT MATCH TERMINATION IMPEDANCES
- TERMINATION IMPEDANCES CHOSEN TO SATISFY SPEED, POWER AND OTHER REQUIREMENTS
- BUS BANDWIDTH CAN BE EXTENDED
- LESS EXPENSIVE CABLES/CONNECTORS CAN BE USED
- EXTENSION CABLES CAN BE USED
- IMPROVED EMC PERFORMANCE
  - REDUCE PULSE RINGING
  - REDUCE EMI
- LOOSER MANUFACTURING TOLERANCES
  - A 100 OHM LINE WITH A 200 OHM TERMINATION

DIFFERENT CABLES

AND DIFFERENT TERMINATIONS

CAN BE USED

ON A SAME BUS!!!

- PERFORMANCE IMPROVEMENT
- COST SAVINGS

LONG-DISTANCE TRANSMISSION FPT

- FPT CAN BE USED TO TRANSMIT LONGER DISTANCES
- FPT HAS REGENERATIVE POWER
- INTENTIONAL MISMATCH COMPENSATES FOR CABLE LOSS
  - COMPENSATION IS A FUNCTION OF THE LOSS AND THE MISMATCH RATIO
  - PRELIMINARY TEST WITH 100 FT OF TWISTED PAIR CABLE
  - NO DEGRADATION OBSERVED AT END POINTS

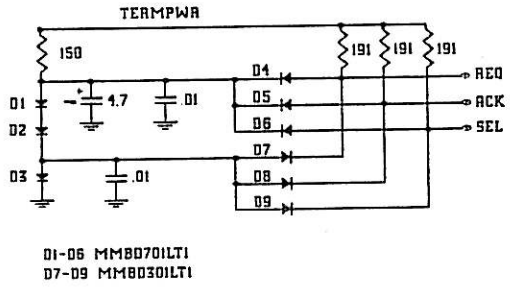

Figure 3. FPT applied to 3 control lines

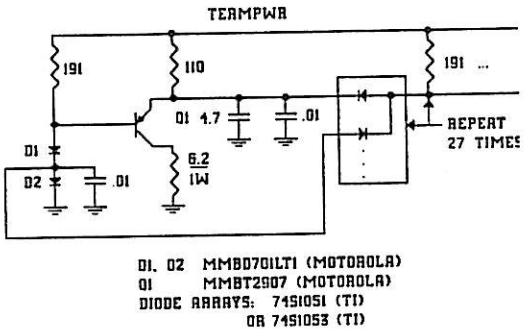

Figure 4. FPT applied to 27 control lines

- THEORY AND IMPLEMENTATION SIMPLE
- APPLICATIONS NOT LIMITED TO SCSI
- SCSI APPLICATIONS
  - CONSTRAINED TO MAKING THE END POINTS PERFECT
  - MIDDLE POINTS NOT PERFECT BUT GOOD ENOUGH
  - SYSTEMS WITH FPT RUN WITHOUT ERRORS
  - DISTRIBUTED TERMINATION?

DSA 602 DIGITIZING SIGNAL ANALYZER
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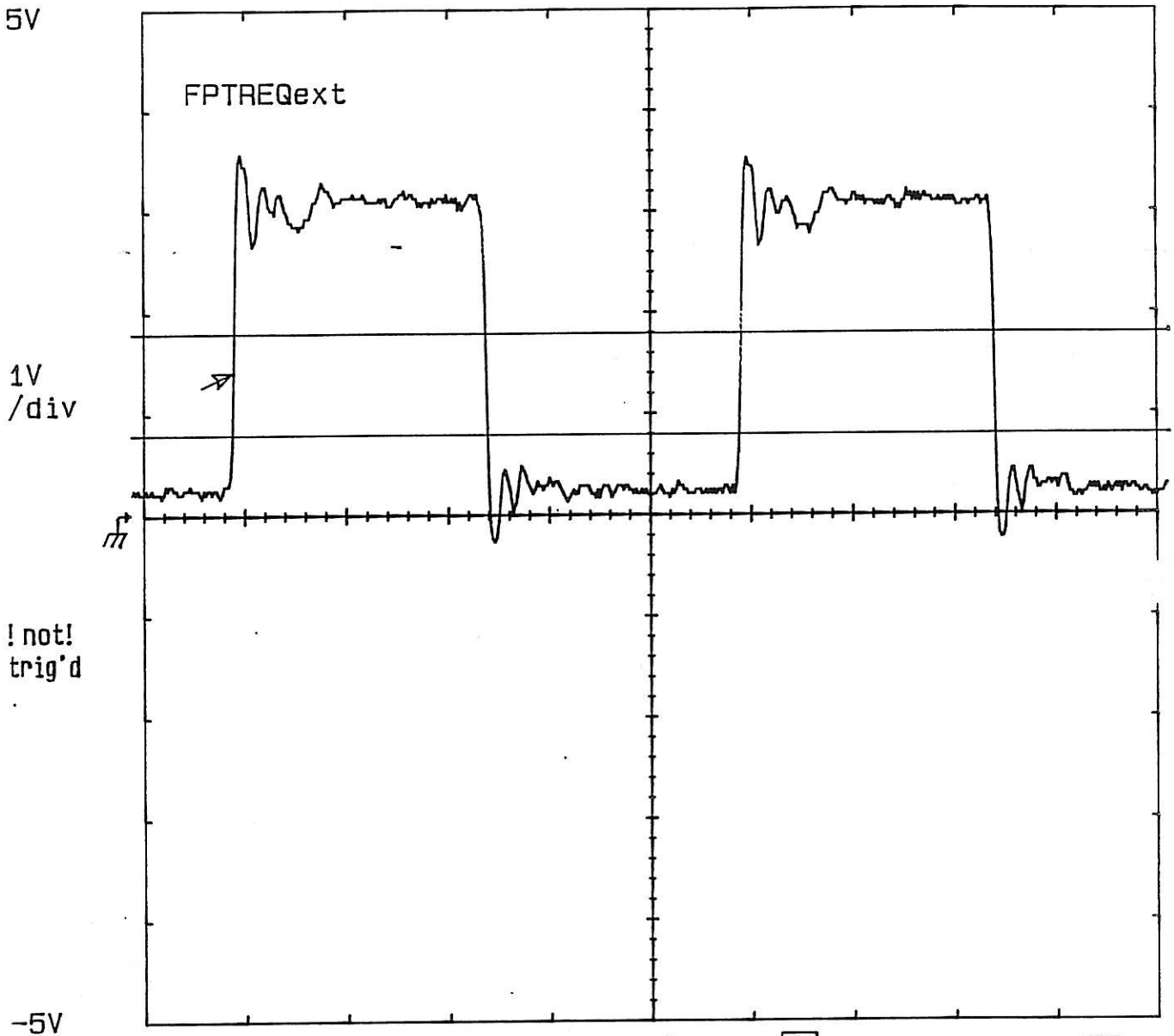

v1= 800.0mV v2= 1.800V Δv= 1.000V	Cursor Type Horizontal Bars	Page to Previous Menu	Rem Wfm 1 L1 Main
	Cursor 1 800.0mV		Cursor 2 1.800V

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