Dual Conductivity Contact

AMP Incorporated

Presented to SPI-3 Subcommittee
On: March 16, 1998
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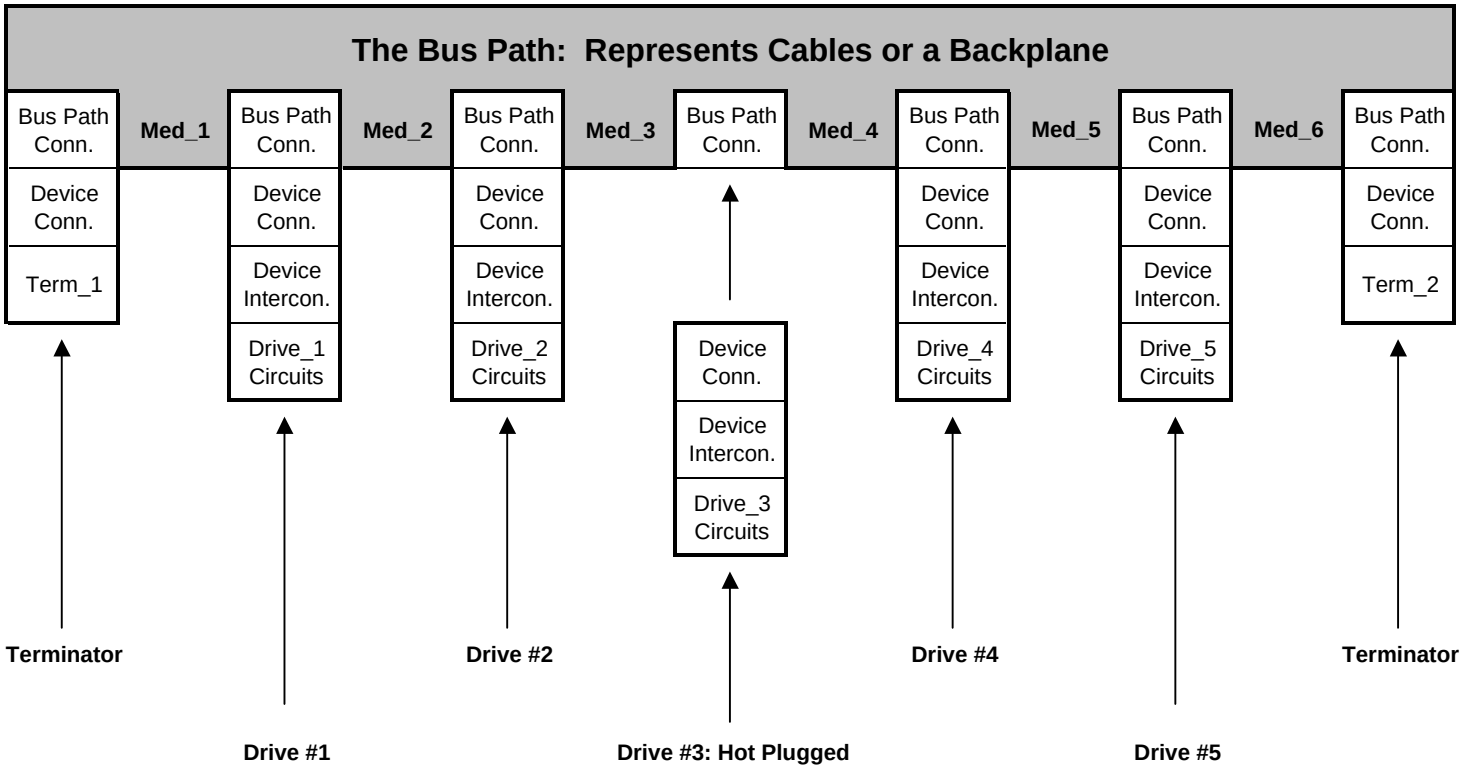
Patent Applied for on this Contact

Dual Conductivity Contact Investigation for SPI-2 SCSI Systems

OBJECT: *Identify* and *Quantify* the *error condition* that can be induced on the *signal lines* when a drive is '*hot-plugged*' into an operating SPI-2 SCSI system.

The work is focused on *but not limited to*, requirements for the *SCA-2 connector* and the *Low Voltage Differential* (LVD) family logic.

SCA-2 Server Drive Array System Model
with 5 Hot swappable Drives and separate Terminations



Definition of the Problem:

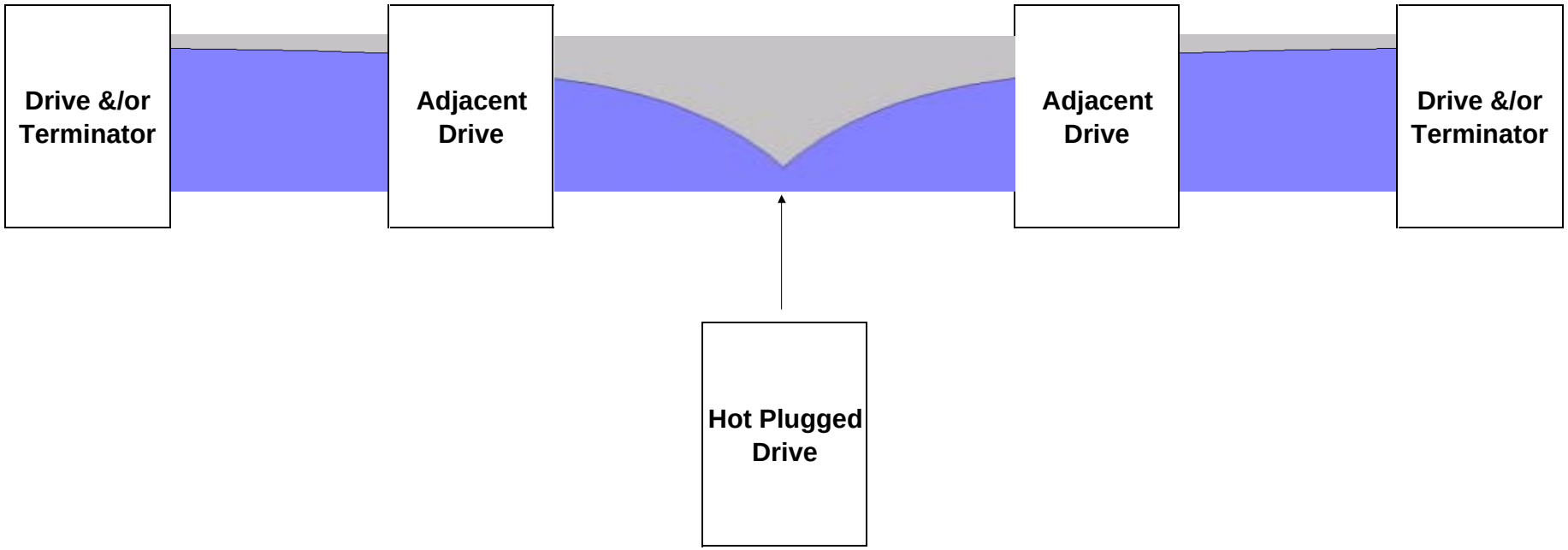
When a new drive is hot-plugged into an operating drive array, some receivers may detect errors.

With the previous system (HVD) there are voltage dips on the bus signal lines of several hundred millivolts.

Interpretation:

The uncharged drive input capacitances pull enough energy out of the system (Bus) to cause voltage errors on other drives.

Bus Path (Media) Showing Energy Depletion on a Signal Line



Proposed Solution:

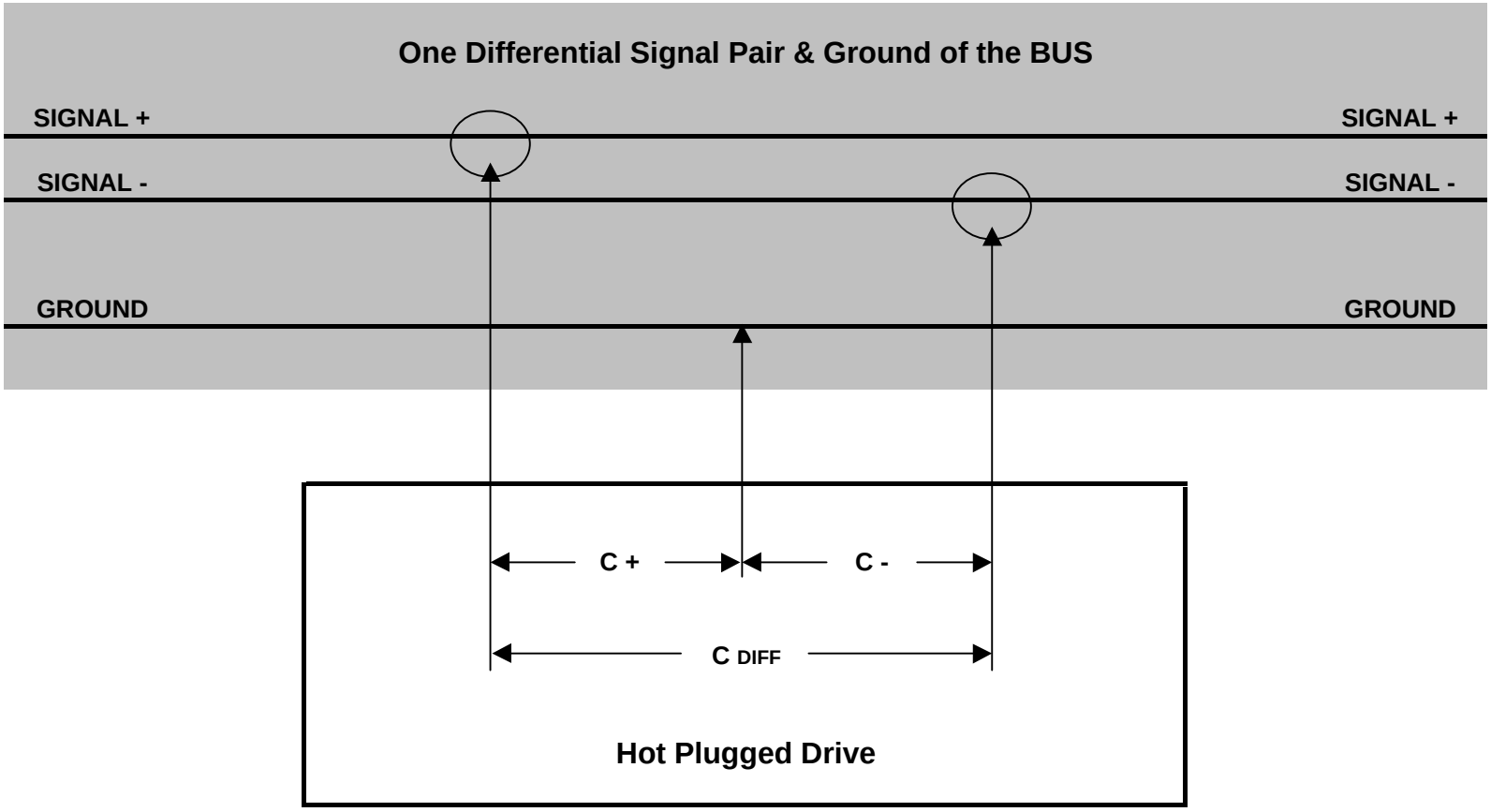
Make a very high resistance connection at the first instant of 'contact' and then drop to the milliohm range as the connector is fully engaged.

This sounds reasonable.

Resistance will limit the energy transfer.

- **Before simulation can be trusted to evaluate the *solution*, the *problem* must be demonstrated.**

Hot Plugged Drive Mating to the Bus



Everything the Standard covered was set to the worst case.

***Imbalance* is not the cause of the problem.**

The Contacting Switch Model …

- **It was confirmed that *'contact'* was *effectively* instantaneous.**

- **But do both contacts make *'contact'* at the same instant?**

  Not likely.

  How far apart can the *'contact'* time be?

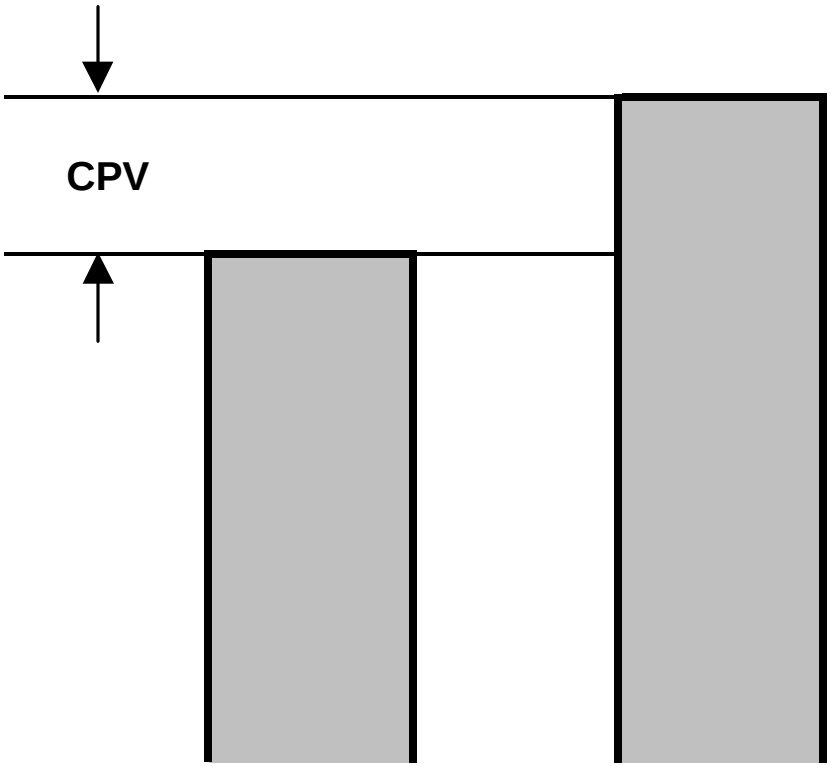
Time Difference between *'contact'* instants

Select Velocity Range:

Maximum		Minimum
2.0	**Ft/sec**	0.2
0.0240	**mils/usec**	0.0024

Contact Point Variation (CPV):

Minimum		Maximum
1.0	**mils**	5.0
41.67	**usec**	2083.33



One connection at a time produced the correct results.

- The model is validated.
- The problem is understood.
- Now the solution can be developed.

Dimensional Analysis for Insulated Contact Area

Select Velocity Range:

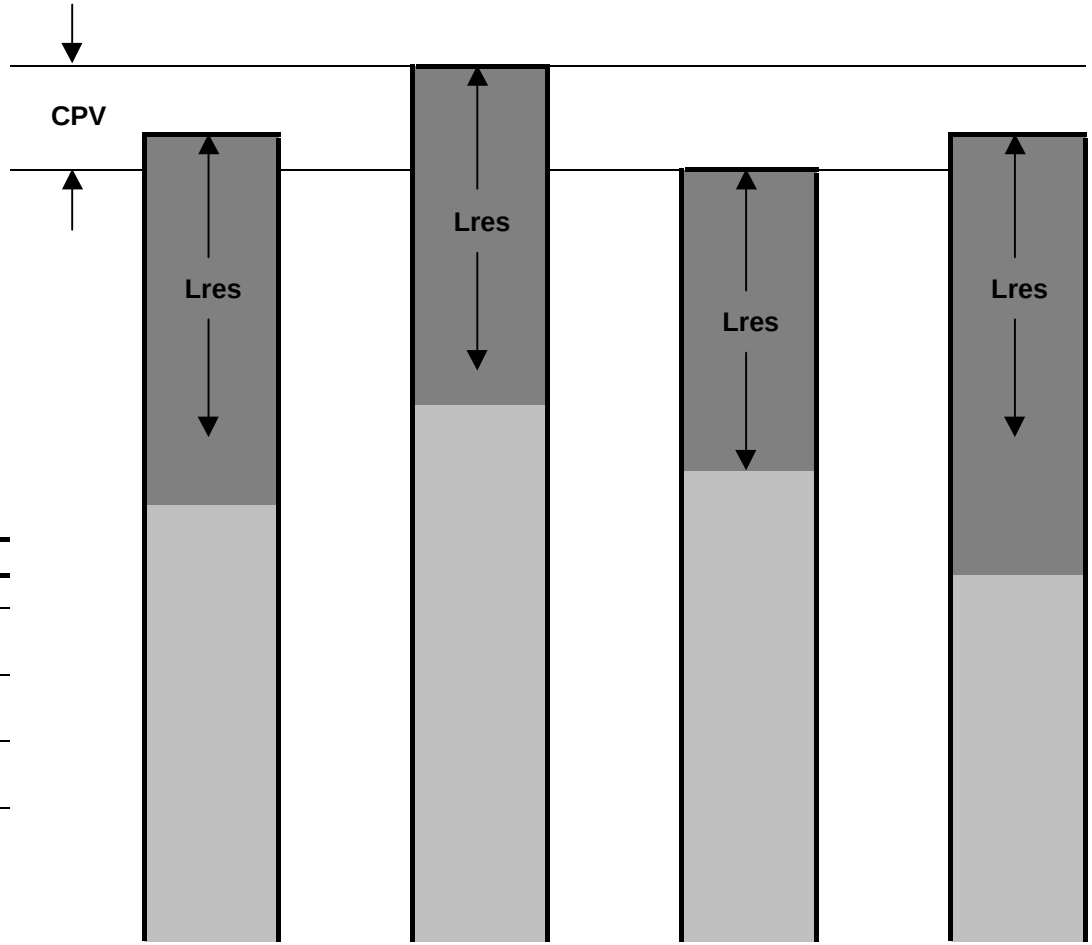
Maximum		Minimum
2.0	**Ft/sec**	0.2
0.0240	**mils/usec**	0.0024

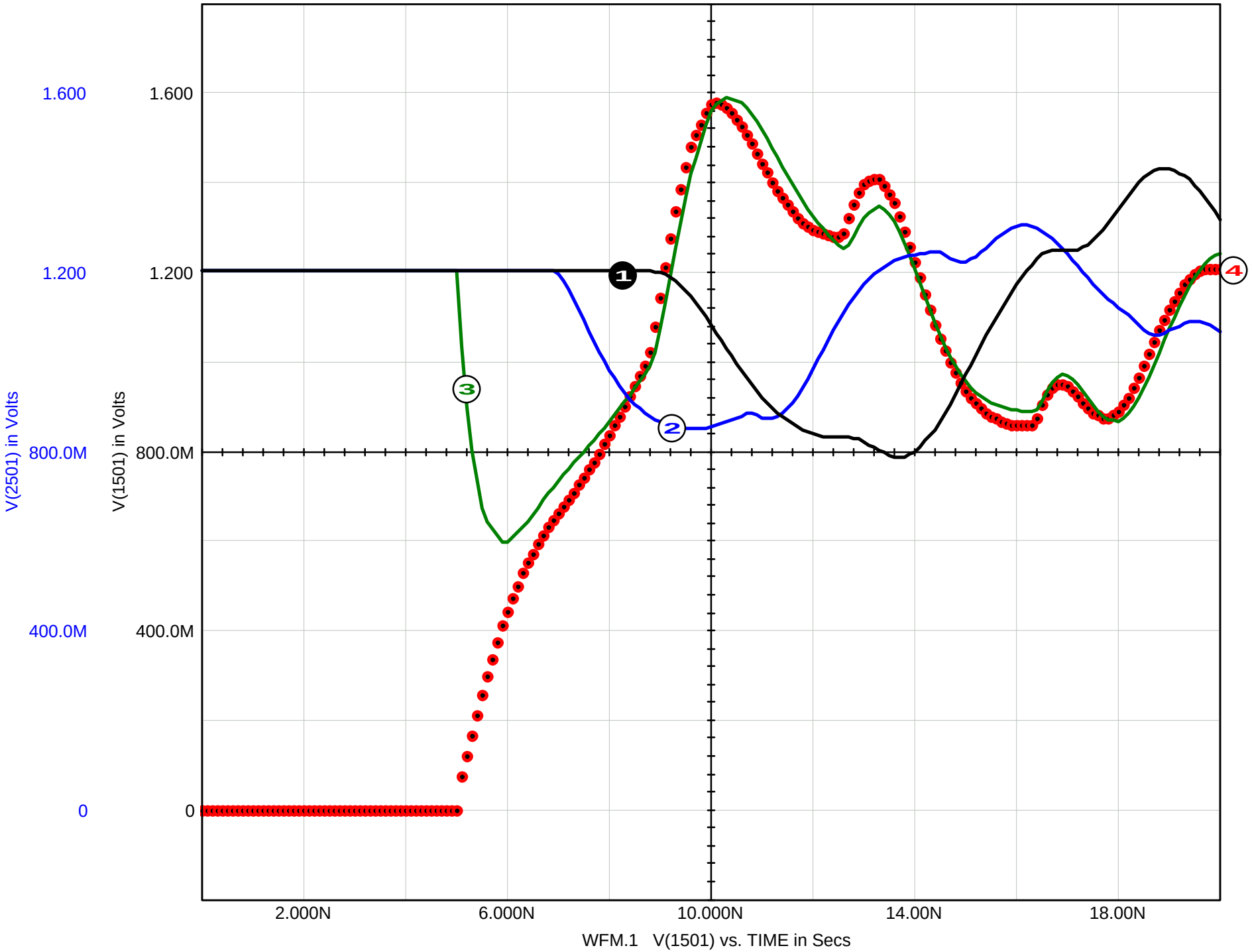
Contact Point Variation (CPV):

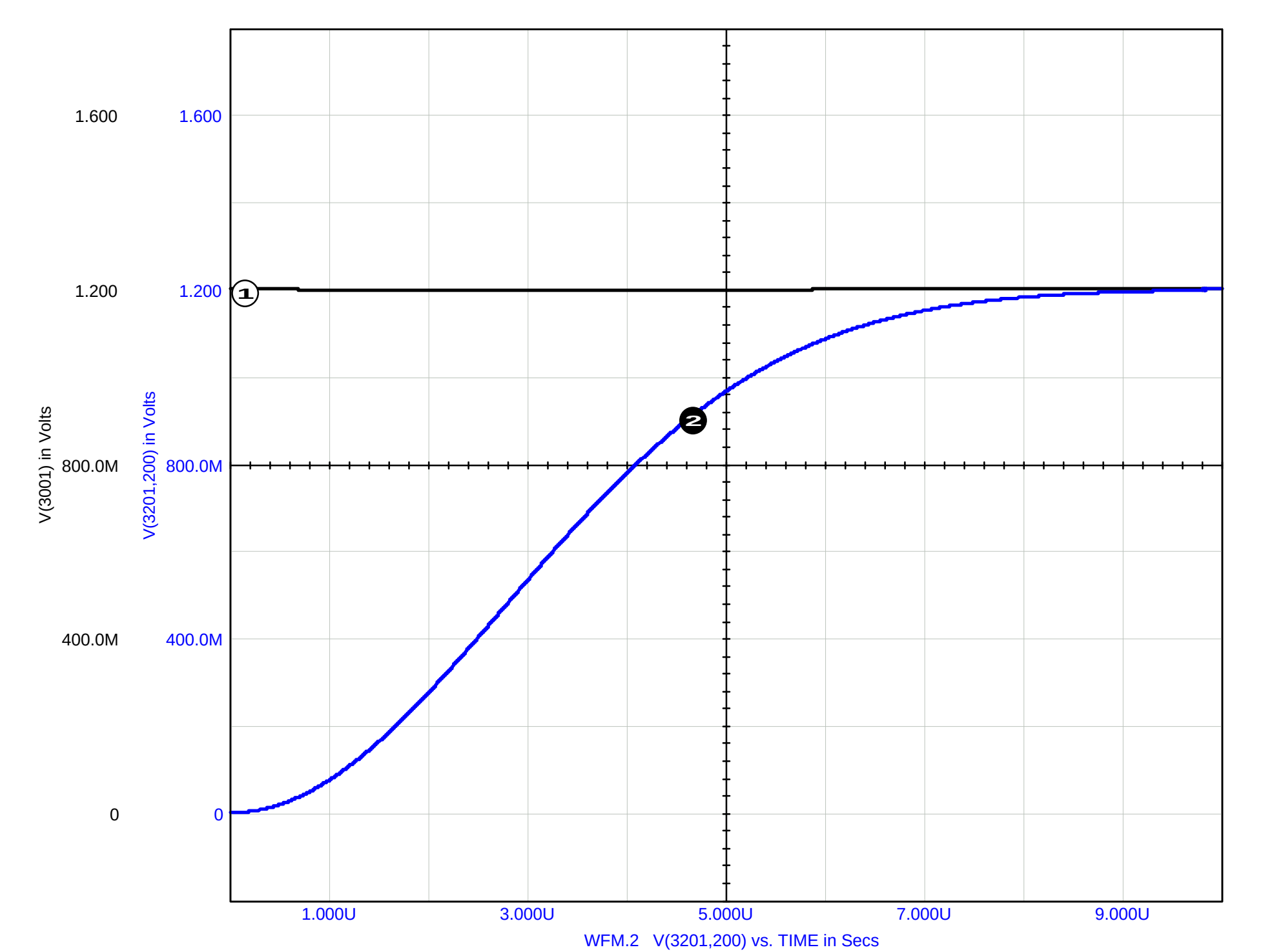
Minimum		Maximum
1.0	**mils**	5.0
41.67	**usec**	2083.33

Length of High Resistance (Lres):

	Based on 30mv max. DeltaV		
Rsnub.	**Minimum**		**Maximum**
Low	6.270	**usec**	
	0.150	**mils**	No Limit
Med.	62.70	**usec**	
	1.505	**mils**	No Limit
High	627.0	**usec**	
	15.048	**mils**	No Limit




1.600
1.200
800.0M
400.0M
0
V(2501) in Volts
1.600
1.200
800.0M
400.0M
0
V(1501) in Volts
1
2
3
4
2.000N
6.000N
10.000N
14.00N
18.00N
WFM.1 V(1501) vs. TIME in Secs



AMP Incorporated -- May 8, 1998: 10 microsecond Full Quiet Mate P