Assuring Midspan Dominance During Detection

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A Typical Near-Future Scenario

- A customer already has Af-endspans.
- They want to use a new At-PD that requires about 20W.
  - This falls in the range of “medium” power on 2P. So the PD has a SS input structure like an Af-PD.
- The customer buys an At-midspan that can source 30W per port.
- When they hook it all up, they find the PD *doesn’t power up*. But an LED on the PD is lit, indicating insufficient PSE power.

The Problem

- If an Af-endspan and At-midspan are connected to the same SS PD, which one will successfully detect and apply power? Which one *wins* the detection battle?
- It could be either. But more likely the endspan wins since the midspan has a back-off time.
- *That's no good!* If a customer buys a nice new At-midspan they expect it to *work*.
- We need a means to assure the At-midspan wins the detection battle every time.

Possible Solutions

- Simply require the user to disable power on the endspan ports via command line interface?
  Works and is low-cost, but not plug-and-play. Might be prone to operator error.
- Require midspans to use higher voltage than endspans during detection?
  Nope, this can't ever work. Do the math.
- Add some kind of circuit to the midspan which inhibits the endspan detection process?
  Maybe, if it's really low-cost and simple. Let's take a look:

Endspan Detection Inhibitor

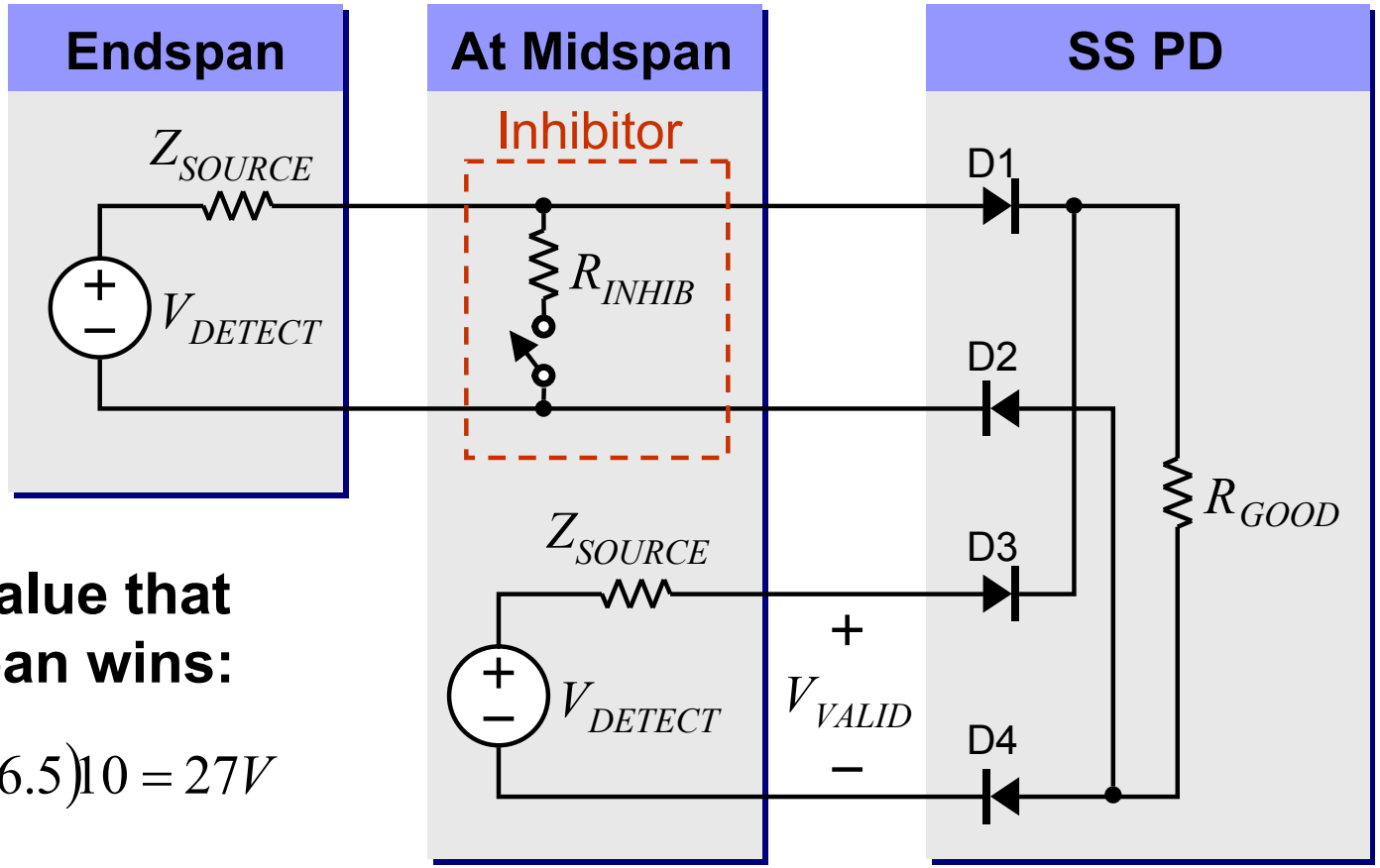
From 802.3af:

$Z_{SOURCE} \geq 45k$

$10V \geq V_{VALID} \geq 2.8V$

$26.5k \geq R_{GOOD} \geq 19k$

$30V \geq V_{DETECT}$ (OC)



Largest resistor value that guarantees midspan wins:

$$V_{DETECT} \leq (1 + 45/26.5)10 = 27V$$

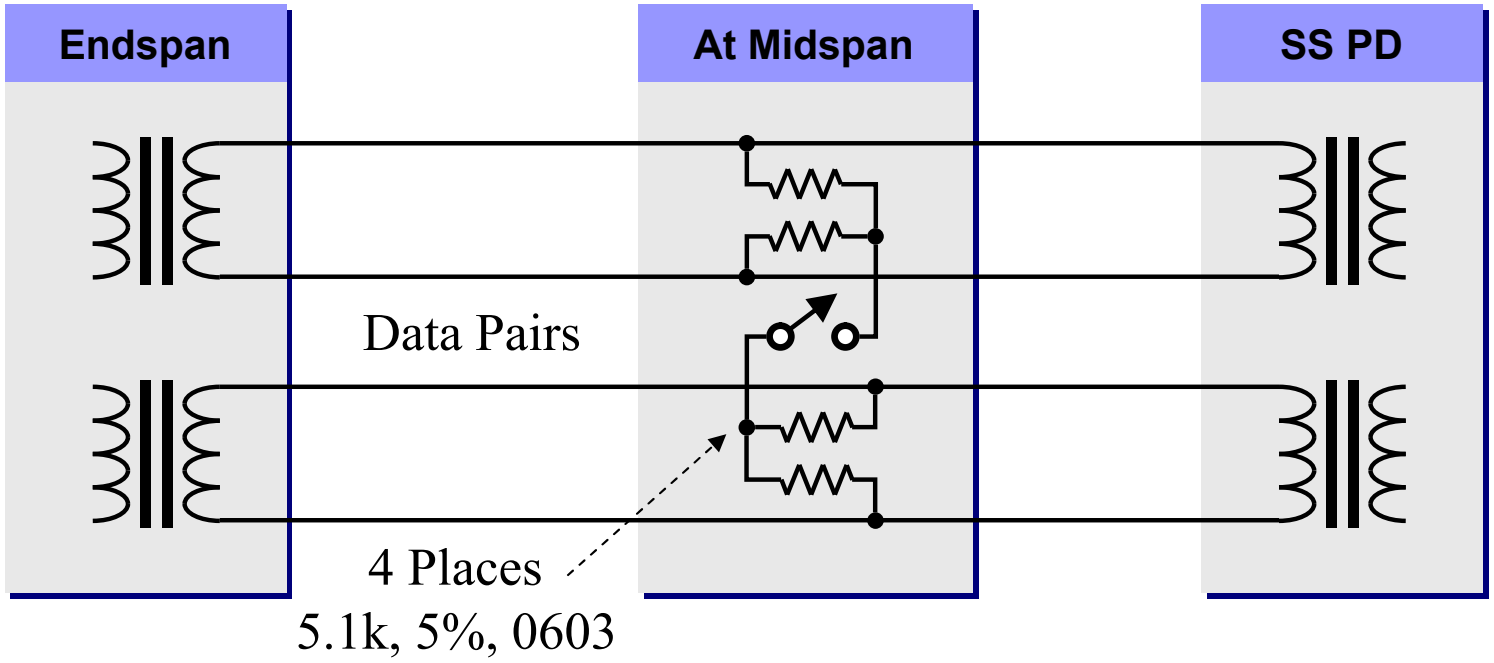
$$R_{INHIB} \leq \frac{45k}{(27/2.8) - 1} = 5.2k$$

How Does it Work?

- When the switch is closed, it does two things:
  - Allows the midspan to detect without interference.
    - R_{INHIB} pulls endspan voltage below 2.8V.
    - Midspan voltage > 2.8V while it attempts detection.
    - Therefore D1 and D2 are reverse biased, temporarily removing the endspan from the circuit.
  - Presents invalid detection signature to the endspan.
- 802.3af requires a back-off period for midspans but not endspans. (See 33.2.3.1.) Without this inhibitor circuit there is no guarantee that the midspan *ever* gets a chance to detect the PD.

Will it Affect Data Integrity?

- No. If laid out properly reflections will be negligible.
  - 10.2k (line-to-line within each pair) >> 100 Ohm characteristic impedance of CAT-5 cable.
  - Small resistors can to be placed directly on traces to avoid stubs.



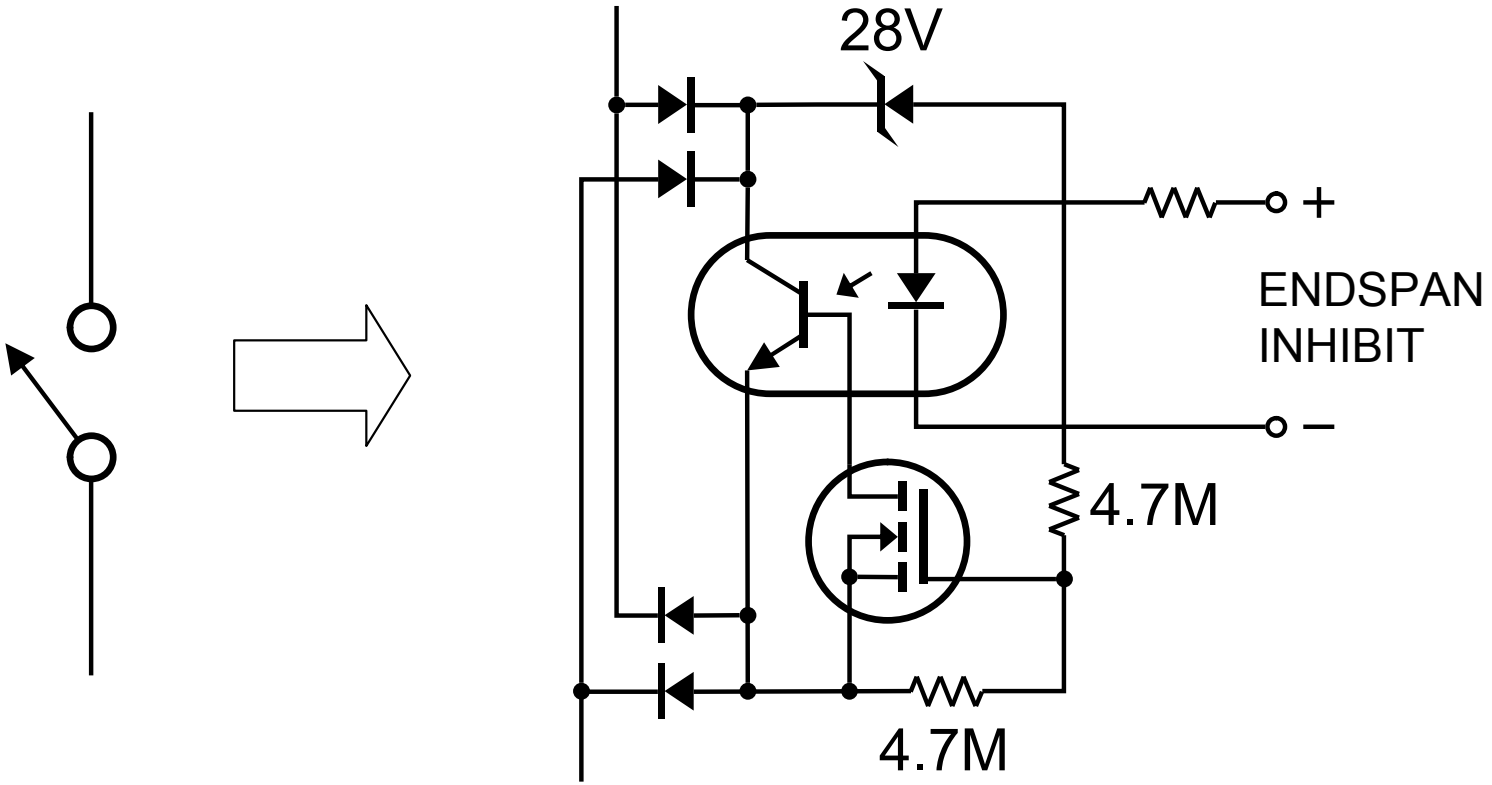
But the PD Needs to Help

- For some time the Task Force has had a tentative plan to meet objective 7:
  - A PD which can't be powered by an Af-PSE will power-up as Class 0, but then only draw enough power to light an LED to indicate insufficient power.
- This will have to change:
  - The endspan still gets a chance to power the PD. If it's successful, then it powers up and we're *stuck* until someone physically disconnects the PD.
  - The solution is for the PD to turn itself off if it knows the PSE is an Af (maybe after flashing the LED). This gives the midspan another chance. Eventually the midspan must win.

Switch Requirements

- Overvoltage lockout. Switch must not close while endspan powers PD.
  - Avoids current pulses that could look like DC_MPS.
  - Avoids overheating resistors.
- R_{OFF} >> Z_{AC2} to avoid AC_MPS problems.
- Isolation from chassis and other port circuits.
- Works independent of voltage polarity.
- Low cost.
- Does not require a power supply

A Possible Switch Circuit



Summary

- The scenario where a customer buys an At-midspan to supplant an Af-endspan will likely be common.
  - Setup won't work if the Af-endspan detects the PD before the At-midspan, which is likely.
  - Therefore we need some method to assure the midspan dominates the detection process.
- A method was presented to fix this problem.
  - Allows midspan to temporarily prevent the endspan from detecting the PD.
  - Assures midspan gets the opportunity to detect the PD.
  - Increases cost of midspan, but hopefully not significantly.