DTE Power via MDI

Power Feeding Alternatives

Joint Presentation By:

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Assumptions:

- Load should be connected between two pairs
- Range of applications will dependant on amount of power available

Power Feeding Alternatives

- Out-of-Band (7&8, 4&5)
- In-Band (3&6, 1&2)
  - Phantom feeding
  - Parallel feeding
  - Common Mode feeding with Capacitors
- All Pairs

Available Power

Over a Single Class D Channel Wire Pair

Physical limitations

- Cables - Class D Category 5 - Limited to 80Vdc
  (some manufacturers do not rate max DC voltage)
- Connectors - RJ45 Rated for 250V/1.5A
- Connecting Hardware - PCB traces will support 250mA

Safety & Marketing Considerations

- Safety Standards rate voltages below 60Vdc as SELV
- We estimate a strong preference to 24Vdc or 48Vdc
- 24/48V can be supported by battery backup

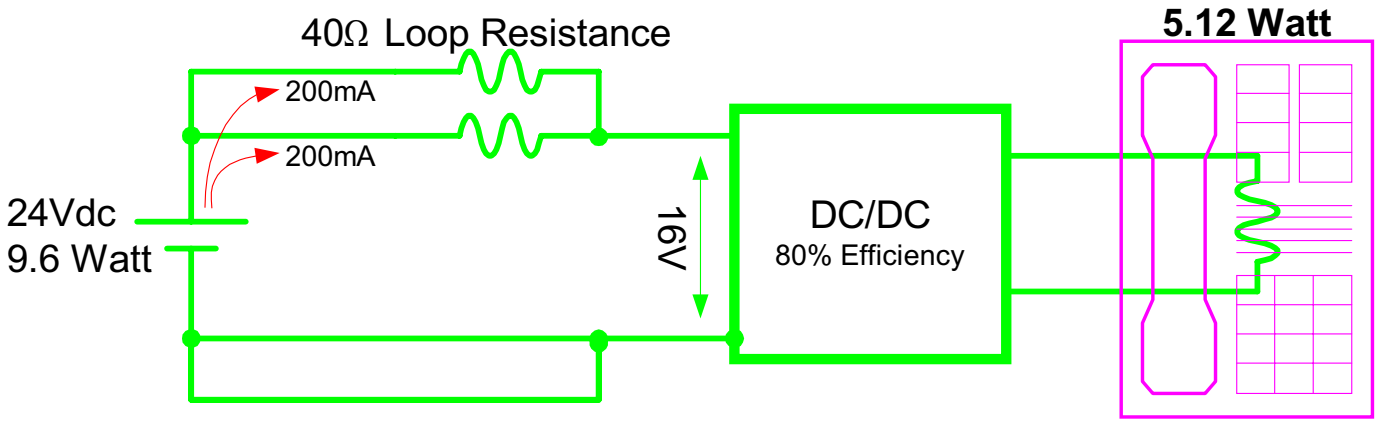
Infrastructure

- Channel Maximum Resistance 40 Ohm (typically less than 20 Ohm)
  Including horizontal cable, patch cabling, connectors & connecting hardware

Available Power Over Cat 5 Cabling Plant

Assume:

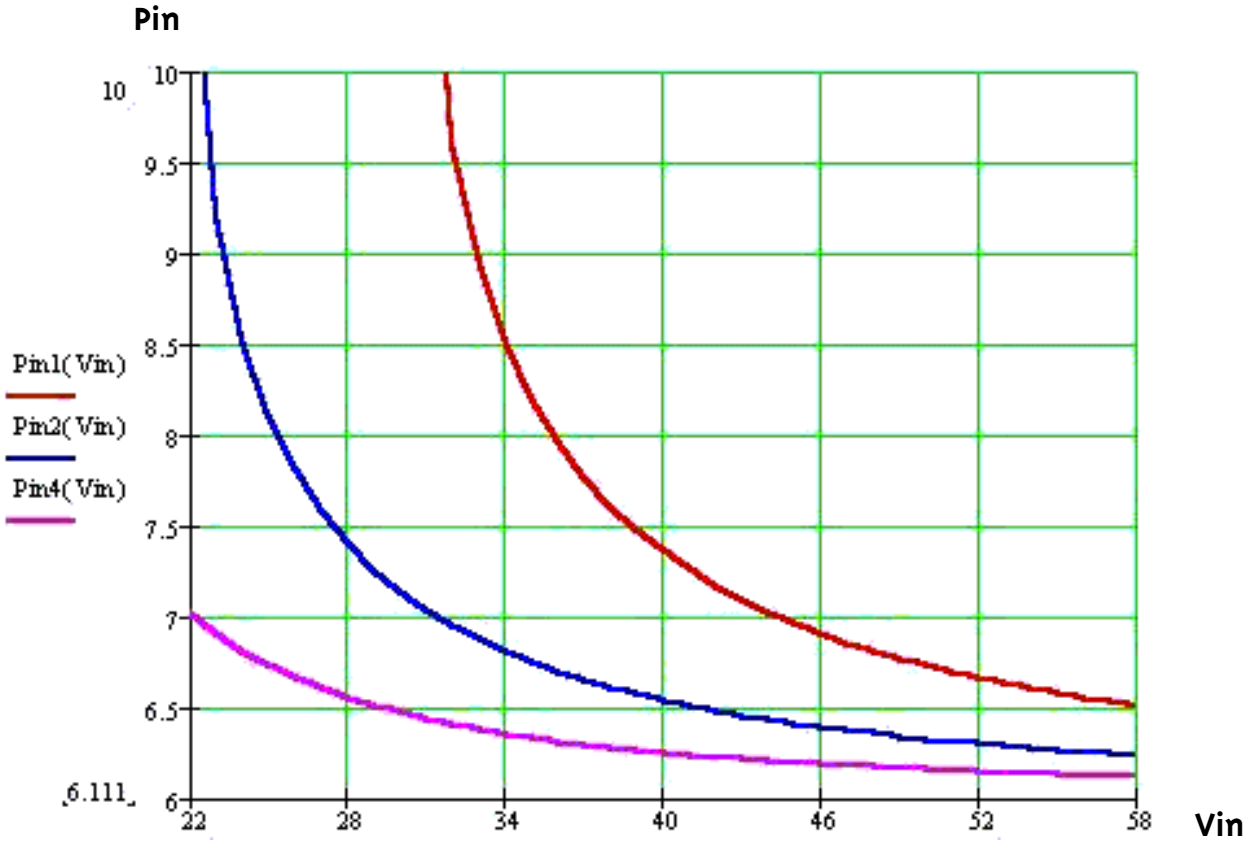
- **24Vdc/400mA Input (200mA on each pair)**
- **80% DC/DC Efficiency**
- **40 Ohm Maximum Channel Resistance**
- **Dual Twisted Pair Feeding**



- **Maximum available power to DTE using two pairs = 5.12 Watt**
- **Maximum available power to DTE using four pairs = 10.24 Watt**

Required Source Power to Feed a 6 Watt DTE

Using:
- Single wire pare
- Dual wire pair
- Quad wire pair



Required Source to Power a 6W DTE

$$Pload := 6$$

$$line\_impidance := 40 \quad \text{100m UTP Single Pair m ax. impidance}$$

$$Pin1(Vin) := \frac{Vin}{(2 \cdot line\_impidance)} \cdot \left[Vin - \left(Vin^2 - 4 \cdot line\_impidance \cdot Pload \right)^{\left(\frac{1}{2}\right)} \right]$$

$$Pin2(Vin) := \frac{Vin}{\left(2 \cdot \frac{line\_impidance}{2}\right)} \cdot \left[Vin - \left(Vin^2 - 4 \cdot \frac{line\_impidance}{2} \cdot Pload \right)^{\left(\frac{1}{2}\right)} \right]$$

$$Pin4(Vin) := \frac{Vin}{\left(2 \cdot \frac{line\_impidance}{4}\right)} \cdot \left[Vin - \left(Vin^2 - 4 \cdot \frac{line\_impidance}{4} \cdot Pload \right)^{\left(\frac{1}{2}\right)} \right]$$

In-Band Technical Challenges

- Degradation of link performance:
  - Near end & alien crosstalk via DC supply bus
  - Channel attenuation, S/N
  - Link balance
  - Susceptibility to radiated & conducted common & differential mode noise
  - Link impedance matching
  - Currents via transformers due to unbalance pairs
- Protection of ordinary (non MDI powered) DTE

Out-of-Band Feeding Technical Challenges

- Detection & Protection of "Bob Smith" terminations (relatively simple)
- Maintaining FCC Class B compliance by maintaining termination on mid point insertion

Comments

- Complexity, Cost & Time-to-Market of In-Band Feeding Will be Higher
- Justified only where:
  - 2 Pairs Installations
  - Future 1000base-T to DTE
  - 4 pair could be used for high power applications

Question

- **Should the standard be scalable to allow two *and* four pair feeding?**