Unitrode Products from Texas Instruments

Benchmarq Products from Texas Instruments

Basic Methods for DTE Power Delivery

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Design Example

attempt to show

- Methods of implementation for power, isolation and output control
- leverage existing products
- impact on Enet product
- impact on Enet power infrastructure

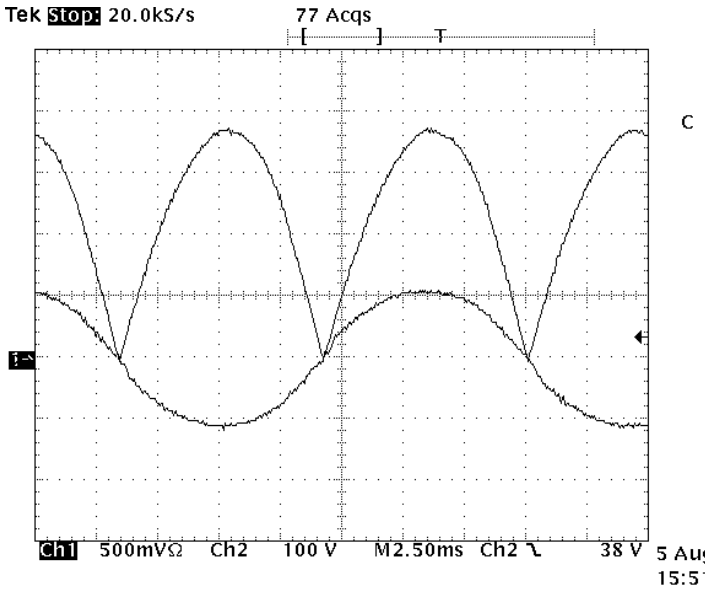
System Specification

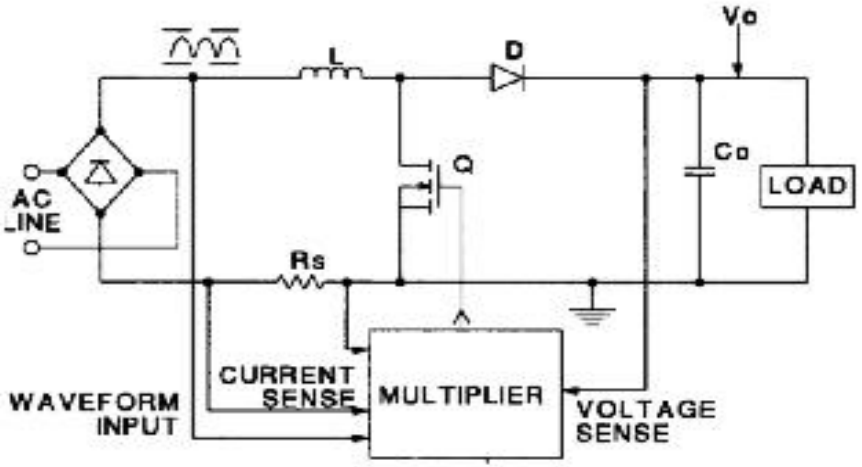
- 16 port 10/100 BASE-T hub (Cisco), added 802.3 power spec. Deliver 15W at 0.3A to DTE.
- Input voltage=90 to 264VAC, wide range AC input
- Output Voltage=55V +- 5%, 52-58Vdc
- Output Current min=300mA per port. 1A max?
- Output Power=240W, 15 Watts x 16 ports
- Input Power < 320W, efficiency of 75% or greater
- Outputs must be controllable via 802.3.
- Outputs individually isolated via 802.3
- IEC950 emissions and safety approvals

Fundamentals

- AC input, at this power level, requires Power Factor Correction. Per IEC950 EN61000-3-2. Takes the wide range AC input and develops 400Vdc. (B+). Boost topology.
- Choose DC-DC converter.
- Choose method of secondary regulation of multiple outputs.
- Choose method of 802.3 output control
- leverage any industry standard products: 48V AC front ends, converter modules, power delivery switches

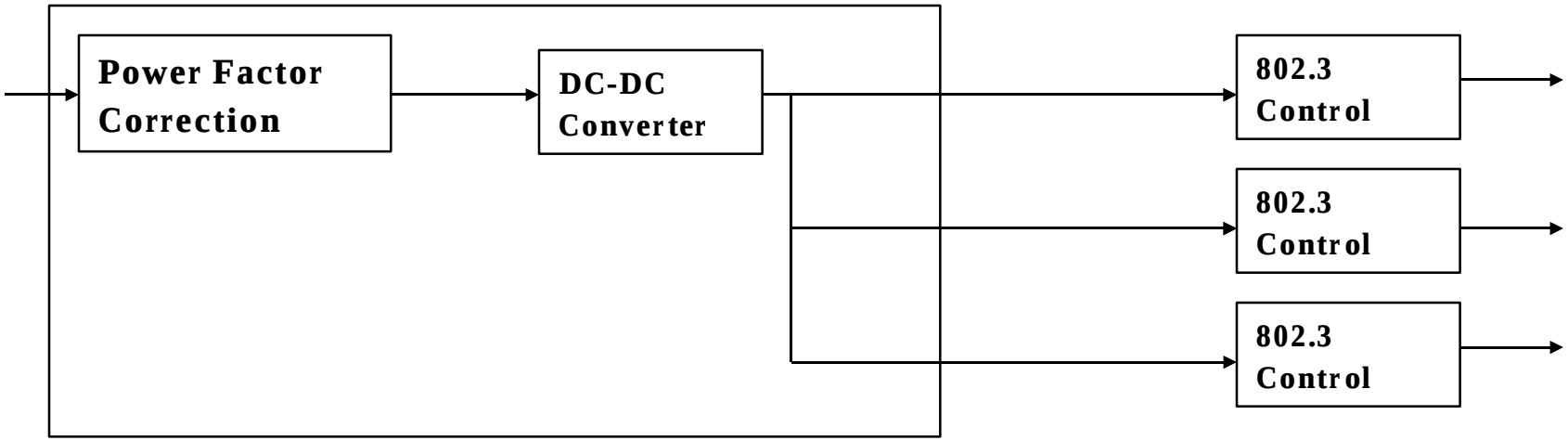
Power Factor Correction





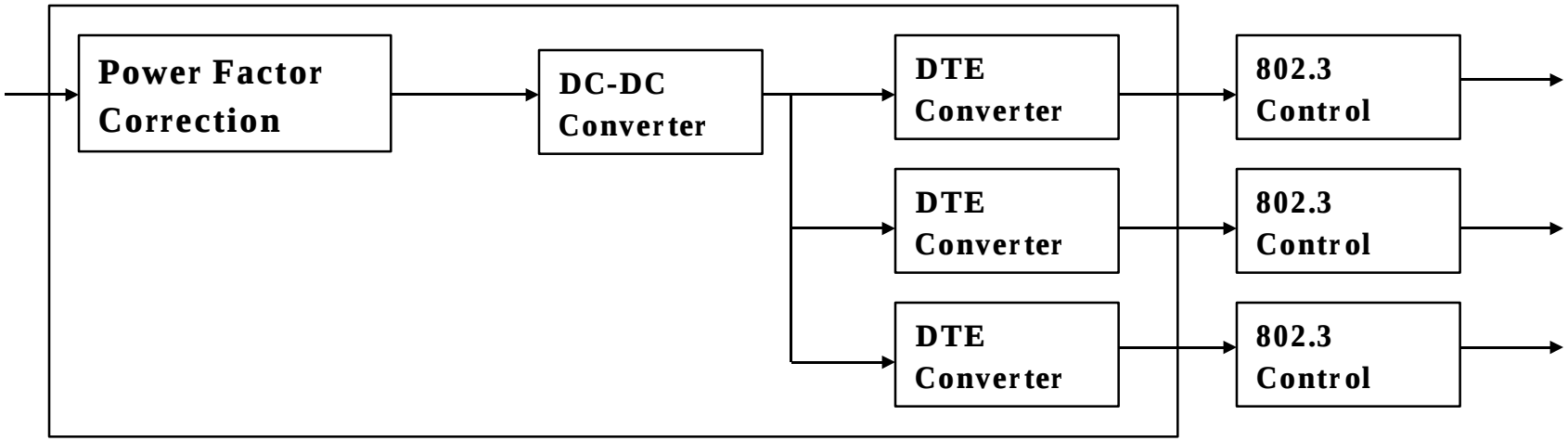
- **Forces sinusoidal input current drawn from the source**
- **not a trivial task, a whole separate power stage.**
- **CV product of Co provides holdup during power glitches**

DC converter-no post regulation



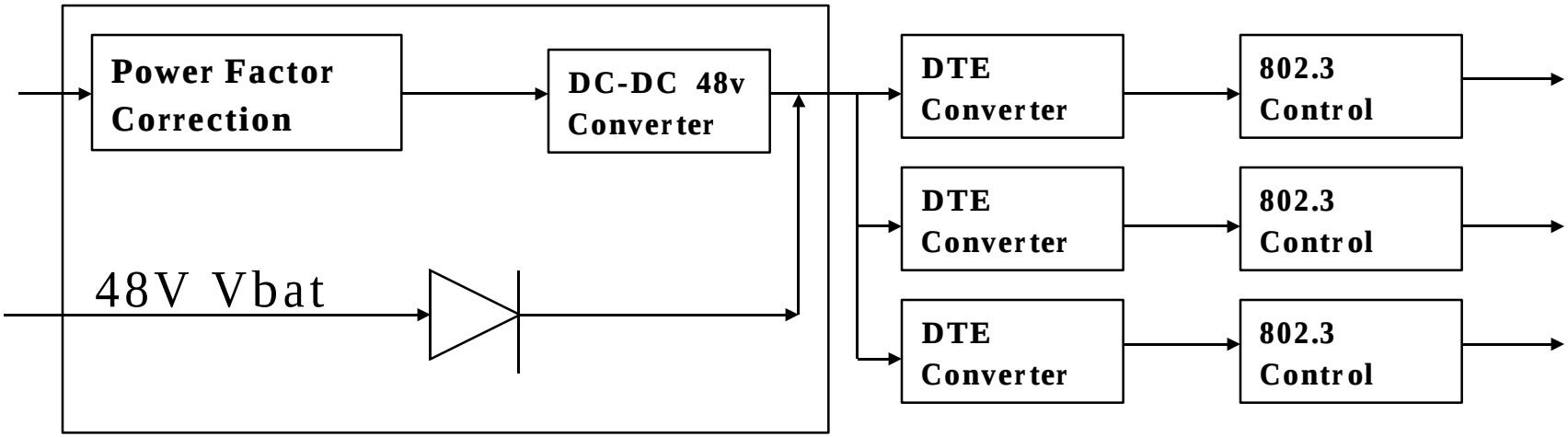
- Black Box supply for AC input to individual 48V outputs
- 20% or better regulation very hard to do without post regulation on a multiple output power supply. 50V 20%, 40-60v. Selv limit.
- 802.3 control done on the planars

DC converter-post regulation



- Black Box supply for AC input to individual, isolated, outputs, 55V 5% . +-3V, not industry standard, YET.
- DTE converter depends on the regulation spec. Some form of post regulation will be required for 55v at 5% .
- 802.3 control done on the planar

DC converter-post regulation



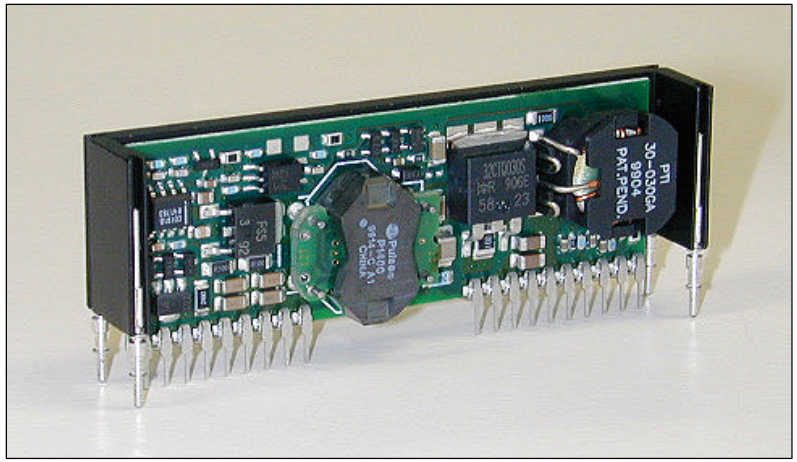
- **Black Box supply for AC input to single 48V output, INDUSTRY STANDARD**
- **DTE converter required for 48v input to 55v 5% isolated.**
- **DTE converter can be done with STANDARD Telecom type modules on the planar or discrete.**
- **Port to Port isolation done at the DTE converter**
- **802.3 control done on the planar or in the DTE converter.**

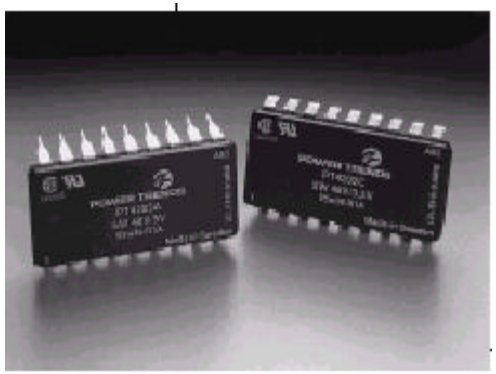
Offline Modules presently available

- Vicor, Artesyn, others-modular, small size, higher cost
- OEM PS-black box, larger size, PC class, Delta, Liteon, Astec, Artesyn
- OEM PS-telecom, Lorain, Lucent, Artesyn

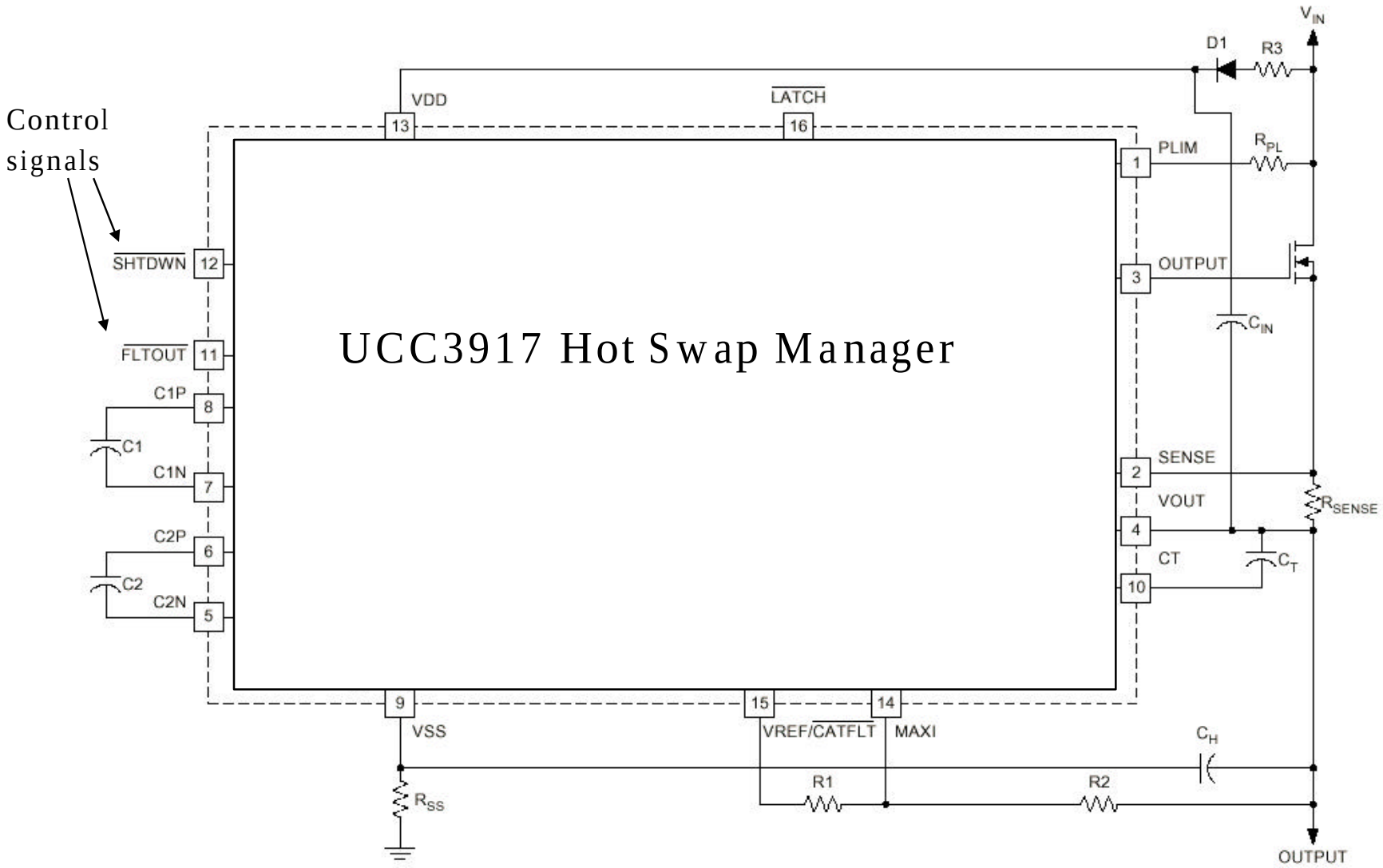
Isolated DC-DC modules

- Lucent, Power Trends TI, Artesyn, Ericsson, Lamda, IPD, Syncor/Delta
- 48V input to 5/3.3v etc output.





802.3 Control



802.3 Control

- Existing product, Several suppliers
- Controls: (*better than a relay)
  - *maximum surge current to load
  - *slew rate of current ramp to load
  - *overload protection with timeout delay and retry
  - user signals for on off control-isolated (w/optos)
  - *output showing fault status.
- Used extensively for HOT SWAP applications in telecom.
- Presently can not detect a minimum load. Added circuitry
- How will it talk to the PHY? What signals and boundaries to cross.
- Could affect detection scheme, FET body diode.

Mechanical Example

HP 10BaseT Hub-16M 16 port

- **Input voltage 100 to 240 VAC, 30W**
- **Supports optional Cisco Redundant Power System**
- **Input Current 0.3A**
- **(H x W x D)1.7 x 16.8 x 9.4 in.**

  268 cubic in
- **Weight 8 lb 7 oz (7.43 kg)**

Mechanical Example

POWERED HP 10BaseT Hub-16M 16 port

- **Input voltage 100 to 240 VAC, NOW = 400W**
- **Supports optional Cisco Redundant Power System?**
- **Input Current 0.3A NOW = 3.2A/7.6A max**
- **(H x W x D)1.7 x 16.8 x 9.4 in. Now add 200 cubic inches**

  268 cubic in.
- **Weight 8 lb 7 oz (7.43 kg) Now add 8 lbs**
- Delta Products DPS-420GB 400W power supply with PFC-OEM

Mechanical Concerns

- Doubles the Box Size
- Doubles the box weight
- Increases thermal cooling requirements of service room
- Impacts AC voltage wiring
- Box now requires a fan, noise and reliability issues
- What about redundant power?

48V Input

- Power Trends PT4560 series modules, on planar
- Power max = 30W 25C, 20W 85C Pout=15W 55V 300mA.
- 85% Efficiency, 2.25 W dissipation, better!
- Size: 3 x 1 x .5 inches, 1.75 cubic inches
- 16 required, approx. 30 cubic inches increase, 36W into box, cooling still needed. 80W into box with AC input
- Use with AC input module for AC infrastructure.

48V Input-advantages

- **Less impact on total Volume**
- **Use 48V distribution and redundancy standards**
- **modules provide easy integration of on off control, isolation and individual regulation**
- **Leverage and expand existing product base**

Conclusions

- Powering can be done with relatively standard building blocks
  - Don’t reinvent the wheel. Quicker time to market.
- Adding power to system can change installation greatly
  - maximum power to all ports? Possible tiered approach.
  - Method similar to device bay. Power reporting ID?
  - Mid Span insertion leaves base installation intact
- Detection mechanism can be affected by power delivery method. Must converge on a solution.