VT Labs (OPC) Private Limited

Next Generation Power Conversion Technology for Data Centers

Company

- The aim of VT Labs is to develop the next generation of power conversion products. The recently developed Dual Drive T Switch converter architecture significantly enhances the performance envelope of power converters delivering efficiency improvements, cost savings and higher reliability for customers.

Value Proposition

- The patented Dual Drive T Switch (DDTS) architecture redefines the power topology of data centres resulting in a lower PUE (Power Usage Effectiveness) ratio with significant cost savings, greater reliability and a reduced ecological footprint.

Features

- The DDTS system is a single converter system. The raw AC input to the regulated DC output for the server load is handled by a **SINGLE** converter.
- The elimination of multiple converters from AC input to server load leads to **SIGNIFICANT** electrical cost savings.
- This architecture **ELIMINATES** the requirement of a battery backed UPS system and its associated costs.

Features

- The holdup time is sufficient for secondary power sources to come online without causing any interruption to normal operation during power failure.
- This is a distributed power topology with each server rack having its own DDTS converters.
- The distributed architecture means that there cannot be a single point of system wide failure.

Features

- A GREEN technology as batteries are totally ELIMINATED along with their maintenance, replacement and recycling costs.
- There is no transfer time. The DDTS converter operates continuously using its internal capacitors. The reliability is better than a double conversion UPS.
- Fully solid state design.

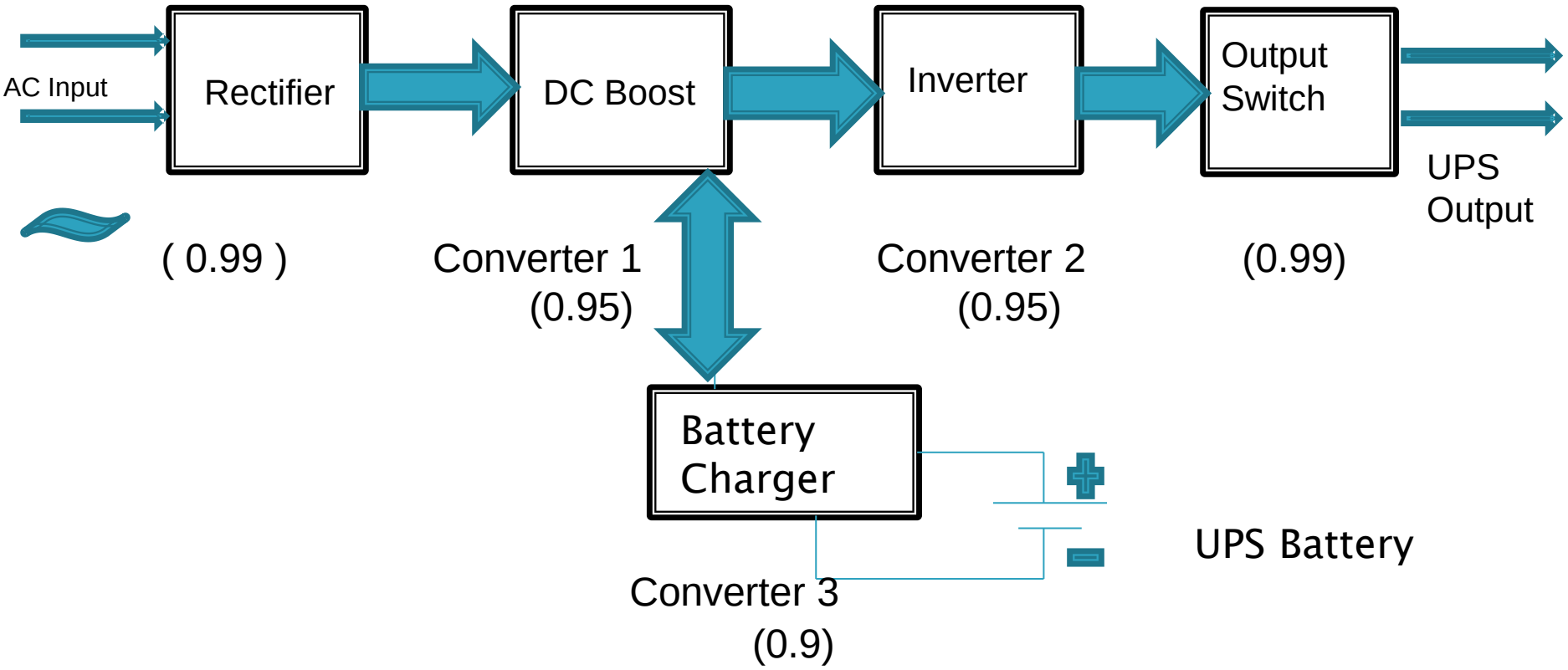
Features

- Fully EMI/EMC compliant architecture. There is NO additional switching noise in ANY mode of operation of the DDTS converter vis a vis a traditional SMPS.

- The rated life of a DDTS converter is **20 years @25C.**

- Unlimited number of discharge and charge events can be handled during its 20 year life.

UPS Data Center Implementation (N+2)



Note : Figures in parenthesis indicate efficiencies of the respective block

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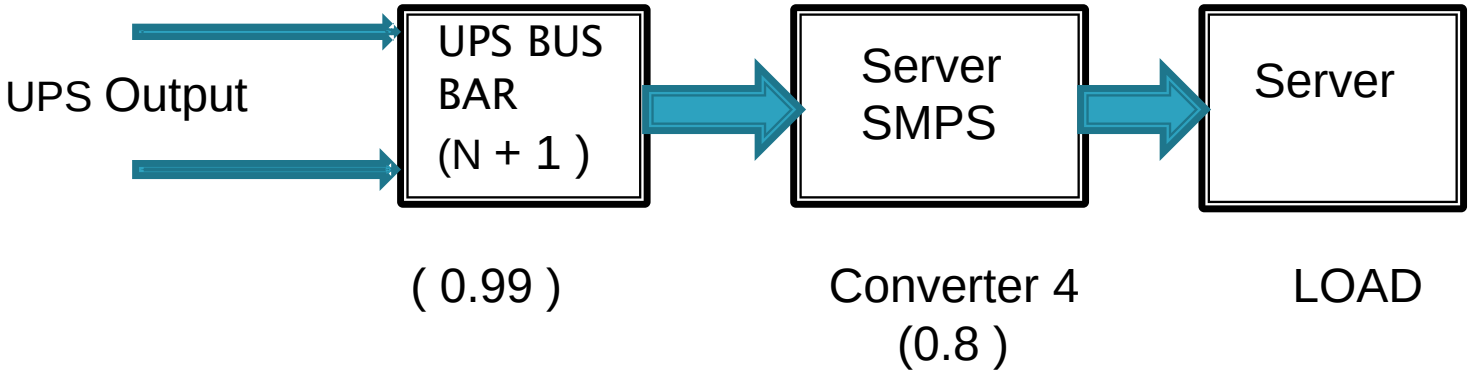


Maximum overall efficiency of UPS based system: Rectifier x Converter 1 x Converter 2 x Output Switch x Bus Bar x Converter 4 = 0.99 x 0.95 x.095 x .99 x 0.99 x 0.8 = 0.70

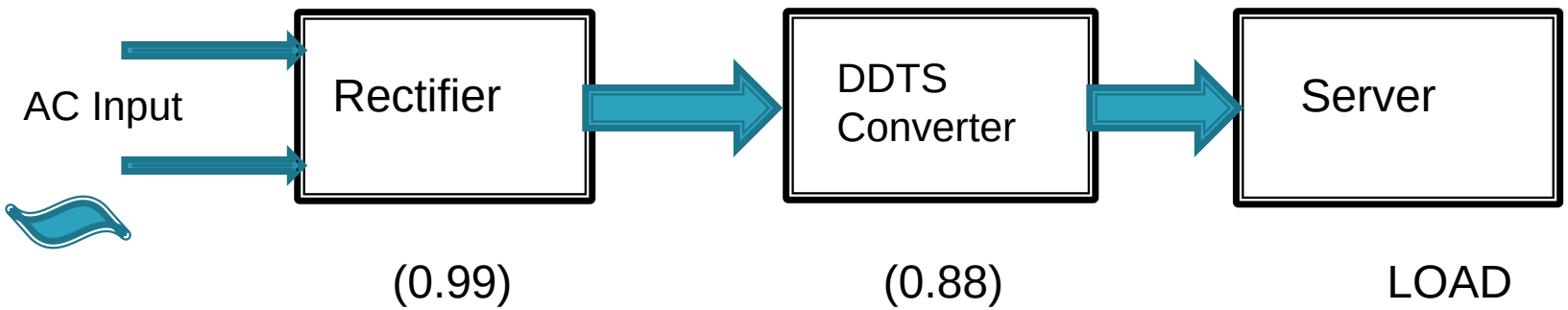
The maximum overall efficiency of a UPS based will not exceed 70% due **MULTIPLE** converters operating from the raw AC input to the compute server load.

Realistically a N + 2 UPS system will deliver an overall efficiency of 65% to 70%.

Note : Figures in parenthesis indicate efficiencies of the respective blocks.

DDTS Data Center Implementation

Single Conversion System



The optimum efficiency of a DDTS conversion system is: **0.99 x 0.88 = 0.87**

The realistic efficiency of a DDTS conversion system would be from **85% to 86%.**

Note: Figure in parenthesis indicate efficiencies of the respective blocks.

Cost Saving of DDTS System Compared to UPS System

Single Converter Electricity Savings

Assume efficiency of DDTS system: 85% (worst case)

Assume efficiency of UPS system: 70% (best case)

Assume typical load of 220W per server in a data center with 10,000 servers.

Total Load: 220W x 10,000 = 2200KW

Cost Saving of DDTS System Compared to UPS System

AC Input Power with UPS System : 2200KW/0.70 = 3143KW

AC Input Power with DDTS system: 2200KW/0.85 = 2588KW

Reduction in power consumption with DDTS system: 3143KW – 2588KW = 555KW

for a 10,000 server installation as noted above.

Cost Saving of DDTS System Compared to UPS System

Reduction in Electricity consumption: 555KW x 24 x 365 = 4,861,800KW-hr in a year

Assuming electricity @ USD $0.11/KW-hr

Amount Saved: 4,861,800 x 0.11 = USD $543,798 in a year - (i)

(OR)

543,798/12 = USD $44,566.50 per Month

Cost Saving of DDTS System Compared to UPS System

UPS Cooling Cost Savings

- Assume 60% UPS average load. The UPS load is 4000KVA x 0.6 = 2400KVA
- Assume that the UPS is 89% efficient. The input power to the UPS is 2400KVA/0.89 = 2700KVA = 2700KW (Assume input power factor is 1)
- The power lost as heat is 2700KW – 2400KW = 300KW

Cost Saving of DDTS System Compared to UPS System

- Cooling required for 300KW: 300KW x 3412 = 1,023,600 BTU-Hr
- 12000 BTU-Hr corresponds to one ton of cooling. The Cooling equipment required would be of 85.3 tons capacity (Approximate to 86 tons).
- Each ton of cooling takes approximately 1KW-hr

Cost Saving of DDTS System Compared to UPS System

- Total Power Consumption: 86 tons x 1KW-hr = 86KW-hr.
- Total Power Consumption in a year: 86KW-hr x 24 x 365 = 753,360 KW-hr units per year.
- Assume Electricity cost @ USD $0.11/KW-hr
- Annual Electricity cost: 753,360 x 0.11/KW-hr = **USD $ 82,870 – (ii)**

Cost Saving of DDTS System Compared to UPS System

Battery Replacement Costs and UPS Maintenance Cost

- Batteries required for 4000KVA (N+2) UPS: 12V@130 Amp-hr sealed VRLA maintenance free.
- Backup time: 15 minutes.
- No. of batteries required: 5000KVA/(12 x 130 x 4) = 800 batteries
- Cost of replacing 800 batteries @ USD $150 per battery : USD $120,000

Cost Saving of DDTS System Compared to UPS System

- In a 10 year duration the batteries will be replaced twice (once every three years). Total battery replacement cost: $ 120,000 x 2 = USD $240,000.
- Per year battery replacement cost: 240,000/10 = USD $ 24,000 – (iii)
- Annual Maintenance cost for a 500KVA UPS: USD $12,000.
- Annual Maintenance cost for 10 500KVA UPS'es : USD $12,000 x 10 = USD $120,000 – (iv)

Cost Saving of DDTS System Compared to UPS System

Total Annual Cost Savings with the DDTS system

- Electricity Cost Savings (i) + UPS Cooling Cost Savings (ii) + Battery Replacement cost (iii) + UPS Maintenance cost savings (iv): USD $543,798 + USD $82,870 + USD $24,000 + USD $ 120,000 = **USD $ 770,668**
- **Yearly Saving = USD $770,668**
- **Annual Decrease of 23% in Operating Expense.**
- **Monthly saving = USD $64,222**