

# Solid State Transformer (SST) Spec Brochure

Data Center Power Supply Solution



The SST power supply solution is the optimal power architecture for next-generation data centers - Delivering efficiency, reliability, scalability, and sustainability in one platform.

PDM is a preferred provider of XD | GE Solid State Transformers (SST) which uses three-stage topology that delivers unidirectional power flow and provides higher efficiency and power density within a smaller footprint.

### SST Core Technical Advantages

As the core equipment of the "Silicon-based Revolution" in power systems, the SST offers significant general advantages over traditional power supply solutions:

- **High Efficiency and Energy Saving:** High energy efficiency up to **97.8%**. Eliminates power frequency transformers, resulting in zero no-load loss. Soft-switching technology combined with intelligent cooling design significantly reduces operational energy consumption.
- **Compact and Flexible:** High-frequency design reduces volume by more than 60%. The modular structure supports flexible capacity expansion, and the field installation cycle is shortened by 70%.
- **Excellent Power Quality:** Input current Total Harmonic Distortion (THDi)  $\leq 3\%$ , voltage regulation accuracy  $\leq \pm 1\%$ . No additional APF/SVG configuration is required.
- **Multi-source Integration:** Suitable for hybrid or multi-scenario access including wind, solar, storage, and charging piles. Supports integrated operation of "Source-Grid-Load-Storage."
- **Strong Grid Adaptability:** Compatible with LVRT/HVRT (Low/High Voltage Ride Through) and reactive power compensation scenarios. Grid-forming technology provides voltage support and active inertia.

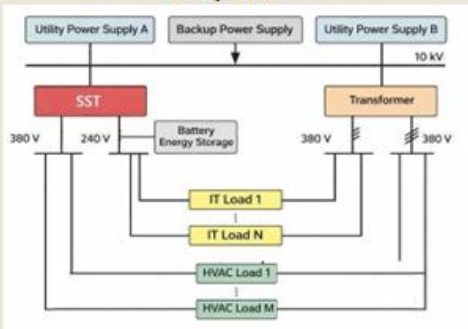
The SST architecture provides low-voltage DC power distribution interfaces, enabling easy integration of green energy and energy storage. It simplifies the power supply path to IT loads and effectively improves access efficiency while reducing overall system costs.

## SST Power Supply Architecture

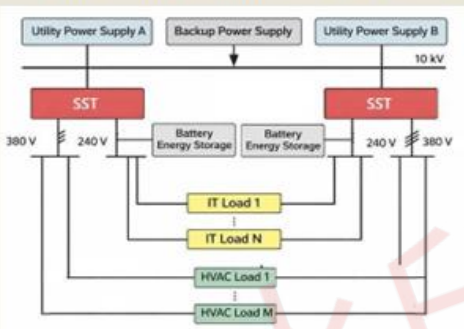
SST Technical Architecture consisting of ISOP modular isolated topology; 500 Hz rectifier H-bridge + 10 kHz SRC; 30 power modules (including 3 redundant modules); 10 modules per phase (1 redundant per phase)

### Data Center SST Power Supply Architect

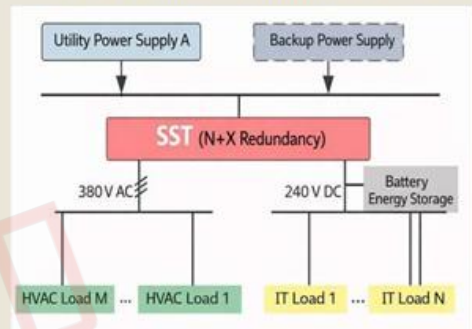
#### A level data center SST+Grid Supplied 2N System



#### A level data center SST-2N System



#### B level and C level data center



### Redundancy & Reliability Design Features:

- Component design margin  $\geq 1.3\times$
- Module rated power: 100 kW
- System rated power: 2.4 MW
- Maximum capacity with redundancy: 3 MW
- Overall system redundancy: 25%

### Design Features:

- Electrical isolation
- High voltage regulation accuracy
- ZVS operation for high efficiency
- Optimized airflow and thermal design

The floor space is significantly optimized compared with conventional UPS solutions. For future higher-power cabinets, the design can continuously improve cabinet utilization and increase overall benefits.

Comparison: SST vs. Traditional Power Supply Schemes

|                          | SST                                                                                                              | HVDC                                        | UPS                                         |
|--------------------------|------------------------------------------------------------------------------------------------------------------|---------------------------------------------|---------------------------------------------|
| Full-Chain Efficiency    | 97.8%                                                                                                            | 88.9%                                       | 85.8%                                       |
| Footprint                | 40%                                                                                                              | 90%                                         | 100%                                        |
| On-site installation     | Cabinet-based layout with flexible installation                                                                  | Constrained by power-frequency transformers | Constrained by power-frequency transformers |
| Flexibility              | Modular design adaptable to customized scenarios                                                                 | Constrained by power-frequency transformers | Constrained by power-frequency transformers |
| Integration Level        | Highly integrated and compatible with APF/SVG functions                                                          | Low level of integration                    | Low level of integration                    |
| Green Energy Integration | Equipped with high-efficiency interfaces                                                                         | No interfaces available                     | No interfaces available                     |
| Grid Adaptability        | Supports high- and low-voltage ride-through, active reactive power compensation, and other application scenarios | Not supported                               | Not supported                               |

**STT Solution Simplifying Complexity:** Factory-prefabricated installation and commissioning significantly reduce on-site work; busbar connections simplify on-site wiring and eliminate construction risks.

**Integration of Multiple Functions:** The SST data center power solution integrates MV/LV conversion and some protection functions, reducing the need for separate traditional transformers, external LV switchgear, and oversized UPS systems. The SST replaces active components with passive ones, and passive control with active control. Enables flexible adjustment of reactive power, harmonics, and other power quality parameters without the need for additional APF/SVG equipment.

**SST Superiority:** SSTs offer advantages over traditional transformers in efficiency, volume, and flexibility, making them a promising solution for diverse power applications like data centers and renewables. The 800V DC + SST architecture is gaining traction in AI/data center designs.

### AC 13.8 kV to DC 800V/400V Data Center Power Supply

|   |                  |                      |
|---|------------------|----------------------|
| 1 | Input Voltage    | 13.8 kV AC           |
| 2 | Rated Power      | 3.0 / 1.5 / 1.5 MVA  |
| 3 | Output Voltage   | 800 / 800 / 400 V DC |
| 4 | Cooling Method   | Air cooling          |
| 5 | Noise Level      | ≤ 75 dB              |
| 6 | Arrangement Type | Indoor cabinet       |

The current design of the medium-voltage direct-supply DC power system provides unidirectional power flow, from 13.8 kV AC to the low-voltage DC side at 800V/400V.

### Data Center Power Supply Solution Description

#### *Operating Environment*

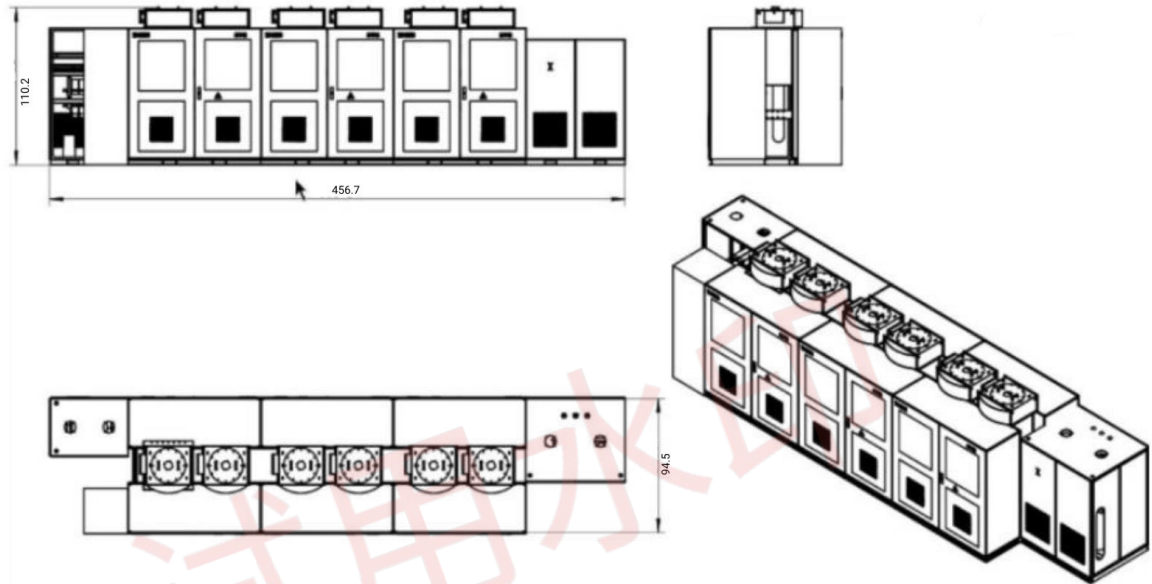
- Operating temperature: -5°C to 45°C
- Relative humidity: ≤ 90%
- Vibration intensity: not more than 0.5 g (acceleration)
- Altitude: below 2000 m

#### *Medium-Voltage Direct-Supply DC Power Topology and Principle*

- The three sets of data center power supplies use the same topology. The DC power system consists of a high-voltage start-up cabinet, power cabinet, control cabinet, and low-voltage DC interface cabinet.

## Dimensions of the Data Center DC Power Supply

- **38' x 8' x 9'** (L x W x H)
- The total weight of the complete equipment set is approximately **~13 tons**



## Scope of Supply

The equipment supply list is as follows:

| No. | Name                             | Quantity |
|-----|----------------------------------|----------|
| 1   | AC start-up device               | 1 set    |
| 2   | Power cabinet                    | 1 set    |
| 3   | Control cabinet                  | 1 set    |
| 4   | Low-voltage DC interface cabinet | 1 set    |

It is recommended to configure energy-storage DC/DC converters on the low-voltage side.

At present, there is no unified industry requirement for battery capacity. Considering load fluctuations, high power, and other factors, extending the backup time can enhance system resilience and mitigate load impacts.

The SST solution outperforms existing technology in functionality and performance metrics, making it the optimal choice for data center power supply systems.

**PDM is a preferred provider of XD|GE Solid State Transformers (SST) offered in 60Hz for the North American market.**

