An Advanced Power Processor
For Utility Grid Infrastructure

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Advanced Power Processors

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Utility Grid Infrastructure Challenges

- Load growth
- Power quality
- Renewable energy integration
- Response to fault events
- Grid security and communications
- Aging legacy/electro-magnetic infrastructure
- Operational and maintenance costs
Why use an Advanced Power Processor?

• Our energy infrastructure needs technologies that provide:
  • Higher efficiency, faster speed systems for power flow control – not just switches
  • Higher power density
  • Reliability
  • Automation and active communication
• Needs to be applicable across all sectors of grid, including all T&D applications
Advanced Power Processor Features

- Advanced Power Processor: a versatile and scalable device that integrates power chips, thermal management and control software in a compact and affordable package
- Converts electrical power from one form to another
- Conforms to industry standards
- Affordable and scalable
- Robust
- Multiple functionality
SGTO-based Power Processor Details

• Modular, standardized design, scalable across range of T&D applications

• Power Processor block with embedded high-efficiency, high-speed, high power density solid state devices

• Block includes thermal management system, built-in controls and diagnostics

• Standard block rated at 5kV, 600A

• Compact: 22” x 9” x 7”, 60 lbs
Reliability and High Power Density

- Utilize SGTO power-electronics devices for high-speed, compact assemblies
- SGTO brings 10x speed, half the losses of legacy devices
- Packaging improves reliability, junction temperature > 125ºC

Future: Symmetric SGTOs under development – will provide same performance in half the size
Advanced Power Processor Applications

- Transfer Switches
  - Replace traditional electro-mechanical switches
  - Allow for seamless renewable energy integration
- Current Limiters
  - Provide mechanism to respond to load growth
Transfer Switch Application

• Go beyond mere switching
• Rapid load transfer: switching time = 100 µs
• Transfer all three phases simultaneously
• Transfers independent of phase angle
Transfer Switch Overview

- 15kV, 600A system:
  60” (h) x 40” (w) x 28” (d)
- Forced air cooling
- 1/3 the volume of thyristor based units
- Remote communications interface
- Boost grid security, integrity
Current Limiter Application

• As load grows, available fault current increases
• Either upgrade protection schemes or limit fault current
• Current Limiters can dynamically insert additional impedance in event of fault

138 kV system equivalent

One fault location most severe case

East 75th Street Substation

York Substation
Current Limiter Operation

- Real time response to fault current events (in about 4 µs)
- Divert current to high impedance path in about 30 µs
- Current continues to flow for 30 cycles, allowing downstream breakers to trip.
- Real time monitoring and diagnostics
- Local and remote operator interfaces
Current Limiter Application

- SGTO-based Power Processor embedded in Current Limiter:

12’ (h) x 22’ (w) x 7’ (d)

36,000 lbs
Advanced Power Processor Summary

- Applications in Transmission and Distribution infrastructure, defense and transportation environments
- Delivers enhanced efficiency, greater load capacity, higher power density, higher speed, higher reliability, power flow control
- Mitigates several limitations and challenges faced by present system
  - Fault currents
  - Distributed generation
Questions?

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