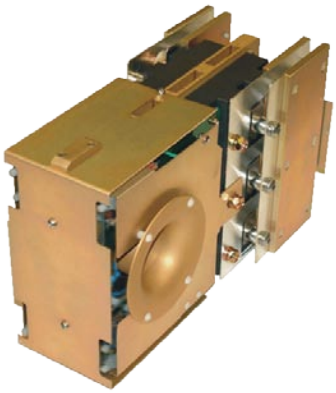
DIVERSIFIED TECHNOLOGIES, INC.®

PRODUCT BRIEF

PowerMod Technology Breakthrough Brings High Availability to High Power Electronics

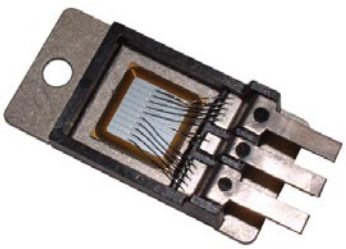
PowerMod™

PowerMod Technology



Switch plates are used in high-current applications, such as particle accelerators. This switch plate is rated at 4.5 kV, 3.5 kA.

Switch modules handle lower current applications, such some radar transmitters. These modules are rated at 5-10 kV, 10-50 A.



The pulsed power transistor (PPT), developed in association with a leading electronics manufacturer, is a key building block for DTI's solid-state switches. PPTs are optimized for pulsed power applications.

DTI's PowerMod™solid-state switches are built from a series stack of FETs, IGBTs, or Pulsed Power Transistors (PPTs) configured for very high voltage standoff, and operated as a single ideal switch. Highly synchronized gate drives ensure the load on the switch is shared equally between devices. The entire switch can be closed or opened in less than a microsecond, safely removing stored energy from the load during an arc. Each switch operates fully isolated from ground, and can open without damage under fault currents up to 10 kA.

Switch modules and plates are controlled at ground with a simple magnetically coupled loop and are easy to operate in floating high voltage circuits. They require no ancillary high-voltage isolated power and operate fully on or fully off, greatly easing high-voltage management when compared to conventional floating decks and ancillary circuitry.

PowerMod solid-state switches offer nearly ideal switching behavior. Less than 1 mA of leakage current is present when the switch is open. When closed, the voltage drop across the switch is less than 3 V/ kV. Switching can occur in as little as 50 nanoseconds, and pulse repetition frequencies up to 30 kHz can be achieved. Pulsewidths are variable on a pulse-to-pulse basis from 1 microsecond to DC. Switches require only 110 V AC power for operation, and accept pulse commands via fiber optic link. Fiber optic outputs are provided for status monitoring. Switches can utilize existing voltage and current monitoring and control circuits, or circuits can be provided by DTI as part of the switch assembly. The entire switch can float at up to 200 kV where required.

Technology Comparison

	PowerMod™ Solid-State Switches	Vacuum Tubes (Triodes, Tetrodes)
Reliability	**Tens of thousands of hours**	Thousands of hours
Voltage Range	**Up to 200 kV with multiple modules in series**	< 100 kV, typically tens of kV
Current Range	**Up to 5 kA**	1 - 200 A opening & closing
PRF	**DC - 400 kHz**	DC - 5 kHz
Efficiency	**> 95% (load dependent)**	80 - 90% peak
Switching Speed	**> 50 ns**	10 ns - 500 ns
Infrastructure Requirements	**None**	• Filament/grid supplies • Tube sockets • Active cooling • Protection circuits

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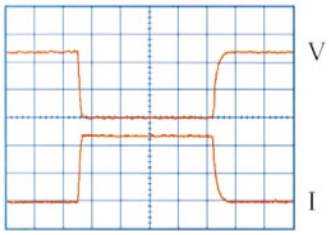
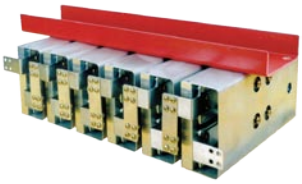
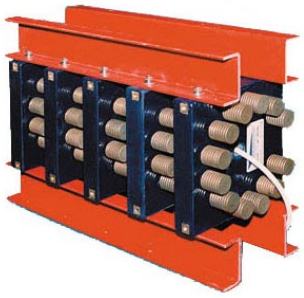
A PowerMod™ solid-state switch can be employed as an “opening switch”, an alternative to the protective vacuum tube crowbar found in sophisticated high voltage, high power radar transmitters and accelerators. An opening switch opens in less than a microsecond when an arc is sensed, yet can be closed immediately. Because the energy-storage capacitor does not discharge during an arc, high voltage (and RF) can be turned on again immediately after the arc clears. In addition, no series resistor is required in the system, so using a solid-state opening-switch yields high circuit efficiency, and lower life cycle costs. In addition, DTI’s solid-state opening switch uses no hazardous elements such as found in mercury-containing ignitrons.



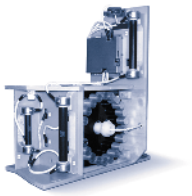
Very fast pulse rise and fall times and low ripple, produce a nearly ideal flat-top pulse. 20kV, 100A, 1 µs/cm. Upper trace voltage, lower trace current.

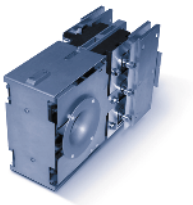


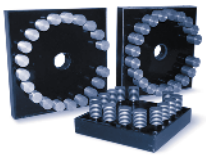
High current switch plate assemblies such as this 20 kV, 1500 A unit replace thyratrons, PFNs, and crowbars in particle accelerators, x-ray systems, and e-beams.

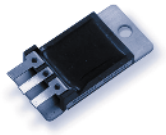


Switch module assemblies, such as this 45 kV, 30 A unit are used in radar systems, light sources, and other low current applications.









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