

# Pulsed Power



*powerful <sup>\*</sup>ideas at work*



# Pulsed Power

Pulsed Power can be defined as electrical energy that is delivered as single or repeated pulses of relatively short duration, such that the peak power delivered is high but the average power is low.

A characteristic of narrow pulsed power waveforms is the rate of rise of the current. For the semiconductor element used as the switch, this is can be the defining parameter.

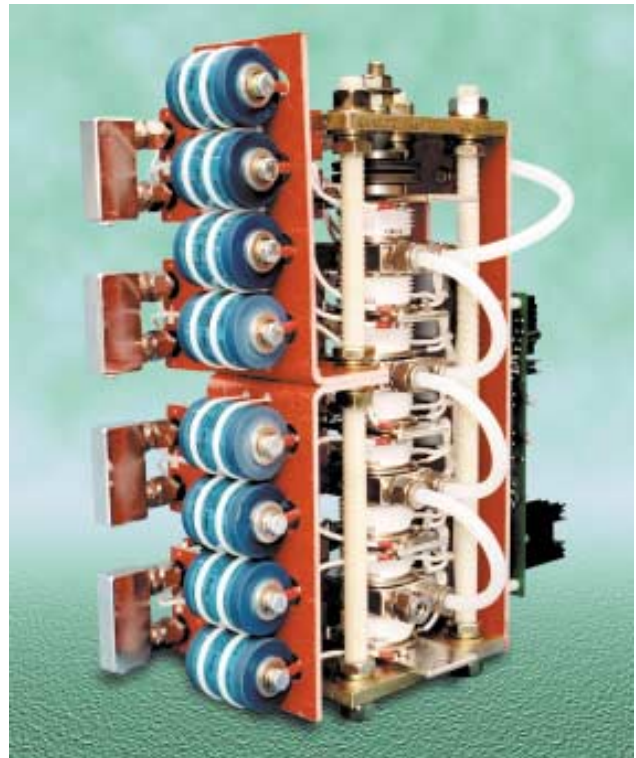
Dynex Semiconductor has addressed these problems by introducing a range of products specifically for applications in pulsed power. These devices are based on the standard catalogue products and share many of their well proven processes and materials but have their characteristics enhanced or modified to give the optimum performance in pulsed circuits.

The diversity of pulsed power applications, ranging from pulse widths of a few microseconds and 100s of kA to several milliseconds

and 10s of kA means that datasheets produced using industry standard methods do not provide the information required to complete a pulsed power design. The choice of semiconductor is not easy. Using an over-specified thyristor means wasted emitter area and consequent higher cost.

An additional complication is that pulsed power applications mean that the semiconductor switch experiences many temperature excursions as the current pulse heats the silicon and then it cools down between each successive pulse. There is a trade off between the magnitude of the temperature excursion and the number of operations of the switch or shot life.

The Dynex Power Electronics Group (PEG) are able to take the essential parameters of an application and determine the best choice of semiconductor. Often this involves actual measurements and the



Pulse power assembly featuring: liquid cooled thyristors and snubber resistors, pulse transformer firing of series connected devices with optical interface

PEG is extensively equipped to reproduce real-life waveforms for collection of data. Our capabilities extend up to peak currents in the region of 500kA and voltages up to 40kV. High repetition rates can be achieved up to a total

dissipation of 50kW.

Most applications will require an assembly of devices in series and/or parallel to achieve the required voltage, peak current, di/dt and shot life. The Power Assembly

## Examples of Dynex's Pulsed Power Technology

| Application                         | Voltage                      | Peak Current (kA) | Waveform                       | di/dt (A/μs) | Frequency   | Semiconductor Device Type          |
|-------------------------------------|------------------------------|-------------------|--------------------------------|--------------|-------------|------------------------------------|
| Plasma Initiation                   | 9kV DC                       | 60                | 2 ms Half sine                 | 100          | Single shot | DCR1673<br>Phase control thyristor |
| H <sub>2</sub> Thyatron Replacement | 17kV DC                      | 3.3               | 2.5μs Trapezoidal              | 7500         | 300Hz       | ACR300<br>Asymmetric thyristor     |
| Sterilization                       | 25kV forward<br>35kV reverse | 4                 | Damped half sine               | 1200         | 30Hz        | MTN939<br>Phase control thyristor  |
| Power Supply Crowbar                | 15kV DC                      | 4                 | 400μs<br>Exponential discharge | 5000         | Single shot | PT40<br>Pulse power thyristor      |
| Laser Megajoule                     | 26kV DC                      | 125               | Damped half sine               | 3200         | Single shot | PT859<br>Pulse power thyristor     |

# Pulsed Power

Complete Solutions (PACS) group within Dynex has over 35 years of experience in the design and construction of assemblies of devices. In this time it has developed a flexible range of heatsinks and clamping systems suitable for all Dynex Pulsed Power devices. Working closely with the PEG, PACS engineers can take the design concept of device type, gate driver, protection and thermal management components and design a finished assembly tailored to the customer's exact requirements.

## Typical Applications

### 1. Connection of energy storage medium to a low inductance load:

- Pulsed laser power supplies
- Paint stripping
- Rock crushers
- Sterilisers for dry foods, liquids and medicines
- Virus inactivation
- De-fouling ships hulls
- Metal forming
- Rail guns
- Aircraft launchers
- De-scaling pipes
- High-current electron beams for modification of materials
- Purification of water and gases
- X-ray flash technology

### 2. By-passing / protecting a load:

- Crowbar

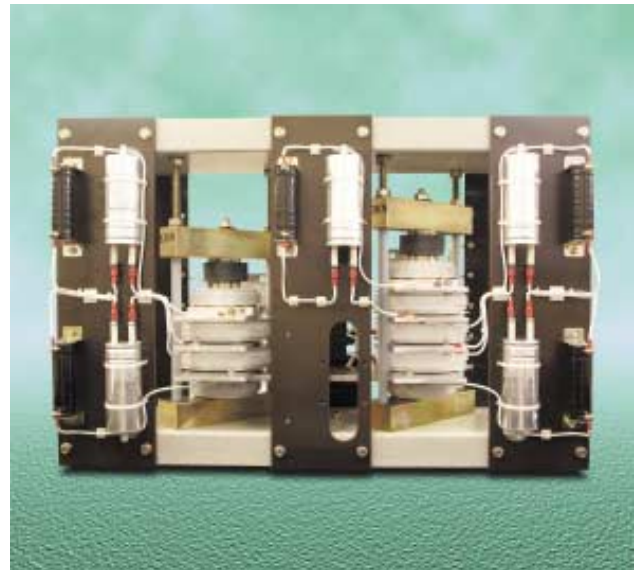
### 3. General Thyatron and Ignitron replacement:

Advantages over other Switching Technologies (Ignitron, Thyatron)

- No (or very low) standby power – no heaters or grid bias required
- No toxic materials such as mercury
- Can be used in any physical orientation
- Better shock and vibration potential
- Long shot life with proper design
- Can be easily fitted as a “high side” switch
- High average current rating
- No maintenance required

For further information on PACS capabilities please see our website [http://www.dynexsemi.com/products/power\\_assembly/index.htm](http://www.dynexsemi.com/products/power_assembly/index.htm) or request a copy of the Power Assembly Complete Solutions flier from your nearest representative, distributor or sales office.

To discuss your pulsed power application please E-mail your contact and application information to [power\\_solutions@dynexsemi.com](mailto:power_solutions@dynexsemi.com) or contact your nearest representative, distributor or sales office.



Pulsed power assembly of five series connected thyristors with snubber resistors and capacitors. The assembly is designed for a restricted height.



Low inductance co-axial assembly for single shot duty. D.C. voltage sharing resistors are fitted between each level.

# Contact Us

## **Benelux, Italy & Switzerland:**

Tel: +33 (0)1 64 66 42 17

Fax: +33 (0)1 64 66 42 19

## **France:**

Tel: (01) 64 66 42 17, (02) 47 55 75 53

Fax: (01) 64 66 42 19, (02) 47 55 75 59

## **Germany, UK & Northern Europe:**

Tel: +44 (0)1522 502 753 / 502 901

Fax: +44 (0)1522 500 020

## **North America:**

Eastern Region, Tel: (440) 259-2060. Fax: (440) 259-2059

Western Region, Tel: (949) 733-3005. Fax: (949) 733-2986

## **Rest of World:**

Tel: +44 1522 502 753 / 502 901

Fax: +44 1522 500 020

e-mail: [power\\_solutions@dynexsemi.com](mailto:power_solutions@dynexsemi.com)

website: [www.dynexsemi.com](http://www.dynexsemi.com)

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