KEMET Pulse Discharge Products

High Temperature (200°C), High Voltage (up to 3.5kV) Large Case Size
Detonation Applications

- Electronic Fuses are used extensively in military and civilian applications to detonate explosives.
- Firing capacitors are used in the Fuse circuitry to provide a stored charge and it is this stored energy that detonates the explosive.
- The energy stored within the capacitor is expressed by the equation:

  \[ \text{Energy} = \frac{1}{2} CV^2 \]

  \( C = \text{Capacitance (F)} \), \( V = \text{Voltage} \)

- To achieve high energy density the capacitors must therefore operate at high voltage.
- This energy is typically discharged within a pulse of < 100 nanoseconds.
- KEMET has developed a series of Pulse Detonation capacitors that combine high voltage and high temperature capability that is particularly important for Downhole Applications where temperatures can be 200°C or higher.
Downhole

- Downhole pulse applications such as fireset circuitry require components that can be used deep within the Earth’s surface, in high shock & vibration environments.

- The explosive breaks through a section of piping to allow the flow of oil and gas back up to the surface.

- The firing capacitor must:
  - Survive high dV/dt charging
  - Achieve a high current discharge in a short time
  - Have temperature stable, guaranteed minimum capacitance
  - Have a high minimum voltage breakdown
  - Be reliable at high temperatures (200°C)
KEMET Pulse Detonation Series
High Current Capability

Kemet HT 4540 104 1250V Pulse Discharge Capacitor
Discharge Current Vs. Time (ns)

Kemet HT C0G 4540 Pulse Discharge Capacitor
Discharge Current Vs. Applied Voltage

- 150nF 1000V
- 100nF 1250V
- 68nF 2000V
- 27nF 3000V
- 18nF 3500V
KEMET’s solution is compared to a Competitor with respect to some selected key characteristics below:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>KEMET</th>
<th>Competitor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dielectric</td>
<td>HT C0G</td>
<td>N2200</td>
</tr>
<tr>
<td>Dissipation Factor</td>
<td>≤ 0.1%</td>
<td>≤ 0.1%</td>
</tr>
<tr>
<td>Capacitance Change @ 200°C</td>
<td>+ 0.2%</td>
<td>- 40%</td>
</tr>
<tr>
<td>Capacitance Change @ Applied Voltage</td>
<td>- 0.1%</td>
<td>-10%</td>
</tr>
<tr>
<td>Electrode System</td>
<td>BME Ni</td>
<td>PME Pd/Ag</td>
</tr>
</tbody>
</table>
Comparison of Capacitance

Capacitance Change Vs Temperature @ Applied Voltage

KEMET HT C0G

Competitor N2200
Energy Density Comparison

![Graph showing energy density comparison](image_url)

**1000Vr Pulse Discharge Capacitors @ 200°C**

Energy Density Vs. Applied Voltage

- **KEMET HT C0G 4540 68nF**
- **Competitor N2200 3640 200nF**

**Breakdown**
- HT C0G
- N2200

**Discharge**
- HT C0G
- N2200
KEMET Pulse Detonation Series
Customer Advantage

• These capacitors have high breakdown voltage performance at high temperatures and are rated to 200°C

• No loss of capacitance with high temperature and high voltage results in stable, robust products

• These advantages allow customers to realize higher energy and more consistent detonation resulting in better performance even at temperatures of 200°C
## KEMET Pulse Detonation
### Case Size / Maximum CV Offerings

<table>
<thead>
<tr>
<th>Pulse Voltage</th>
<th>2824</th>
<th>3040</th>
<th>3640</th>
<th>4540</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000V</td>
<td>56nF</td>
<td>100nF</td>
<td>120nF</td>
<td>150nF</td>
</tr>
<tr>
<td>1250V</td>
<td>39nF</td>
<td>68nF</td>
<td>68nF</td>
<td>100nF</td>
</tr>
<tr>
<td>2000V</td>
<td>22nF</td>
<td>39nF</td>
<td>47nF</td>
<td>68nF</td>
</tr>
<tr>
<td>3000V</td>
<td>8.2nF</td>
<td>15nF</td>
<td>18nF</td>
<td>27nF</td>
</tr>
<tr>
<td>3500V</td>
<td>5.6nF</td>
<td>10nF</td>
<td>15nF</td>
<td>18nF</td>
</tr>
</tbody>
</table>
KEMET Pulse Detonation Stacks

Custom stacks are also available on request that allow higher capacitance values within the same pad size.

Lead have been added to larger case sizes for additional robustness.

3640, 47nF, 1000V, 2000C

Stacks of larger cases have been made for higher capacitances.

6560 (3), 470nF, 1000V 2000C Stack
• For more information on other new exciting KEMET products, visit our homepage (kemet.com)