

DETONATION CAPACITORS AND EFI



Explosives are dangerous by design. For applications involving detonation, like munition and down-hole exploration, explosives should be built to avoid unintentional or premature detonation caused by any rise in temperature or shock. These applications require a number of specialty components including capacitors that discharge high energy at temperatures up to 200°C.

Typically, detonation capacitors initiate an explosion by delivering a pulse of energy that's previously charged up and stored in the ceramic field between the capacitor plates. Then, the stored energy is released through the electrodes. Pulse energy capacitors are built specifically to handle reliable operation under single or multiple pulse conditions. They employ a method of detonation that requires firing into exploding foil initiators (EFI) to avoid premature explosion.

As seen in [Patent No. 4602565](#), a capacitor EFI device features a capacitor and bleed resistor connected across an EFI initiator by an over-voltage gap switch. When the voltage of the capacitor reaches the breakdown voltage of the switch, the capacitor discharges its stored energy through the switch to the EFI. The key to EFI is the secondary explosive. The expanding plasma from the secondary explosion drives the thin metal (or plastic) foil across the over-voltage gap switch, and the high velocity impact of the metal foil delivers the energy and shock needed to initiate detonation. It takes a specific capacitor to provide the electrical energy needed to trigger propulsion through the gap; a standard MLCC capacitor isn't sufficient. The accompanying bleed resistor serves to discharge the device in the event that the application malfunctions or the team aborts the assignment.

In mission-critical detonation applications, capacitors are single-use; it's important to perform high-reliability pulse screening tests at temperature extremes up to 200 °C to ensure functionality when it matters most. Pulse energy testing requires up to 50 pulses at the rated voltage of the capacitor; during testing, the capacitor repeatedly stores and discharges energy until the requirement of 50 pulse cycles has been met.

Knowles Precision Devices (KPD) offers a variety of rigorously tested [pulse energy capacitors](#) depending on your size, termination, voltage level, capacitance, and lead style needs. For additional protection, KPD offers bleed resistors, at various resistance values, to slowly bleed out the charge in the event of application malfunction.

[Contact our applications engineering team](#) to discuss your upcoming project and how we can support your unique design needs.

If you need help selecting from our portfolio please contact us and we can guide you through the selection process.



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