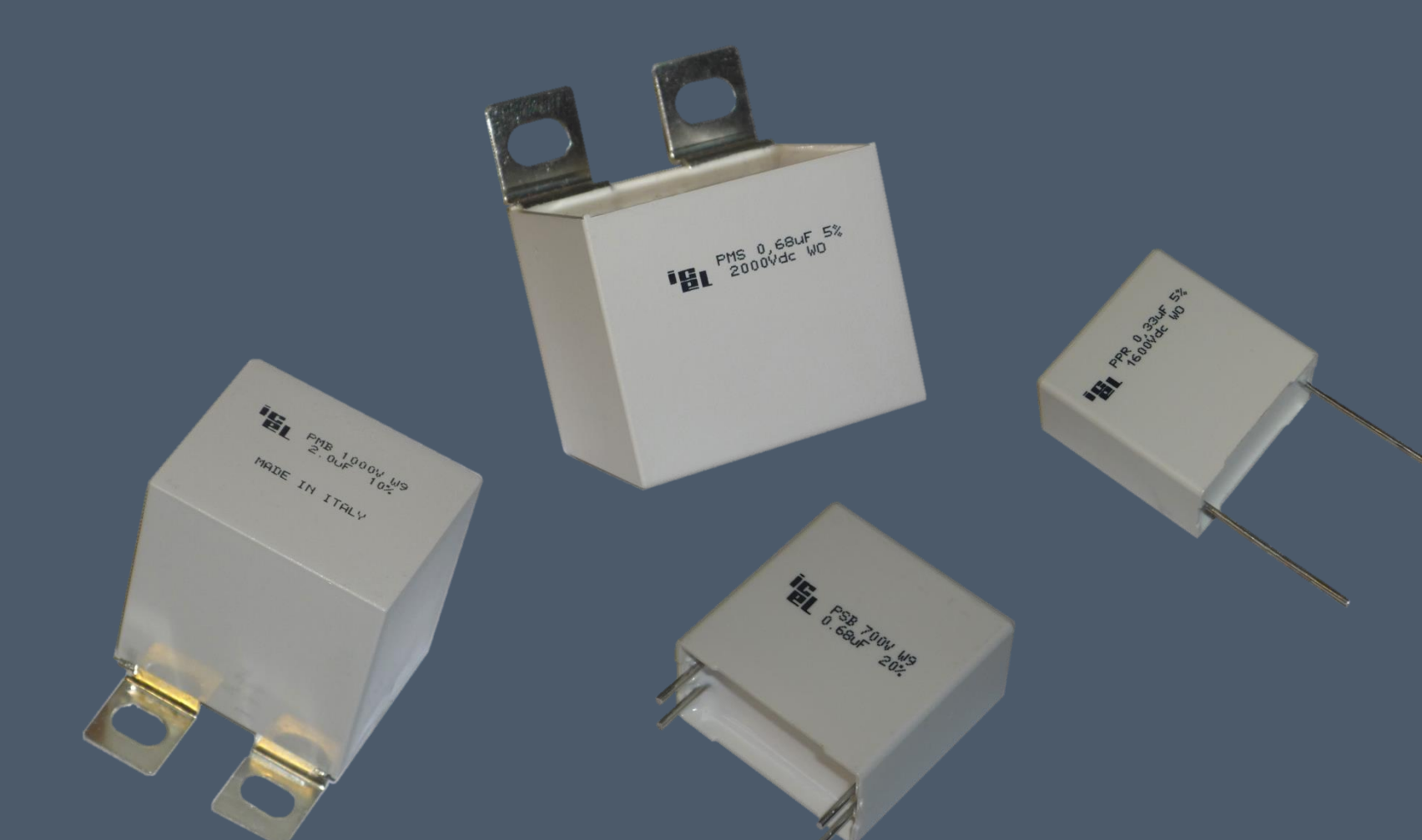


# Application & Technical Support

## Snubber capacitors



### WHY SNUBBER CAPACITORS?

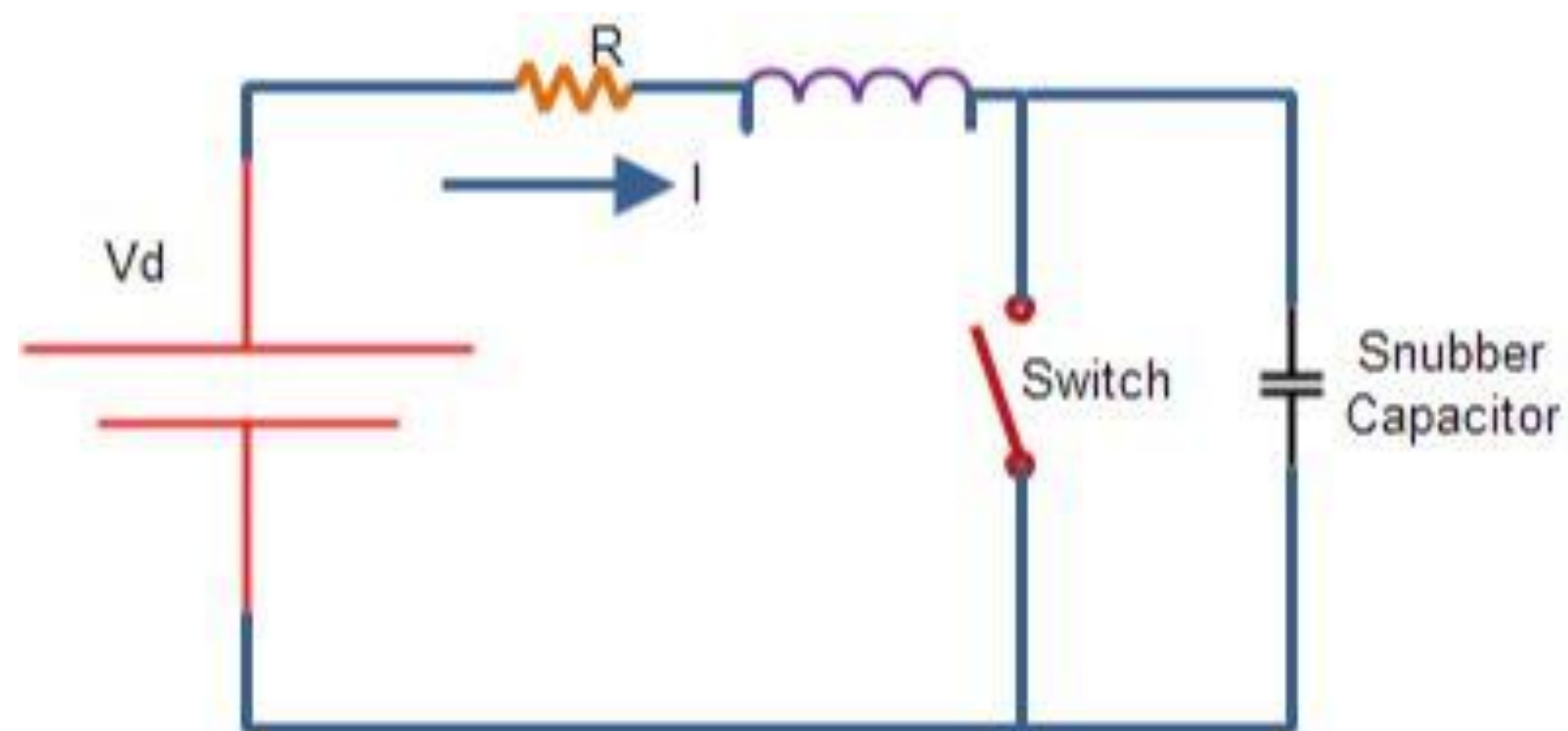
- Snubber capacitors are essential in a *power conversion circuit*
- The main function of the snubbers is to *protect* FETs, IGBTs and other switching devices *from large voltage spikes*, commonly produced during switching operations

### MAIN APPLICATIONS

- The *range of applications* in which snubbers are used is *very wide*
  - reduction or elimination of voltage or current spikes
  - limitation of the  $du/dt$
  - suppression of electromagnetic interference (EMI)
  - losses reduction caused by switching operation
  - shaping of the load lines
  - transfer of power dissipation to resistors or useful loads

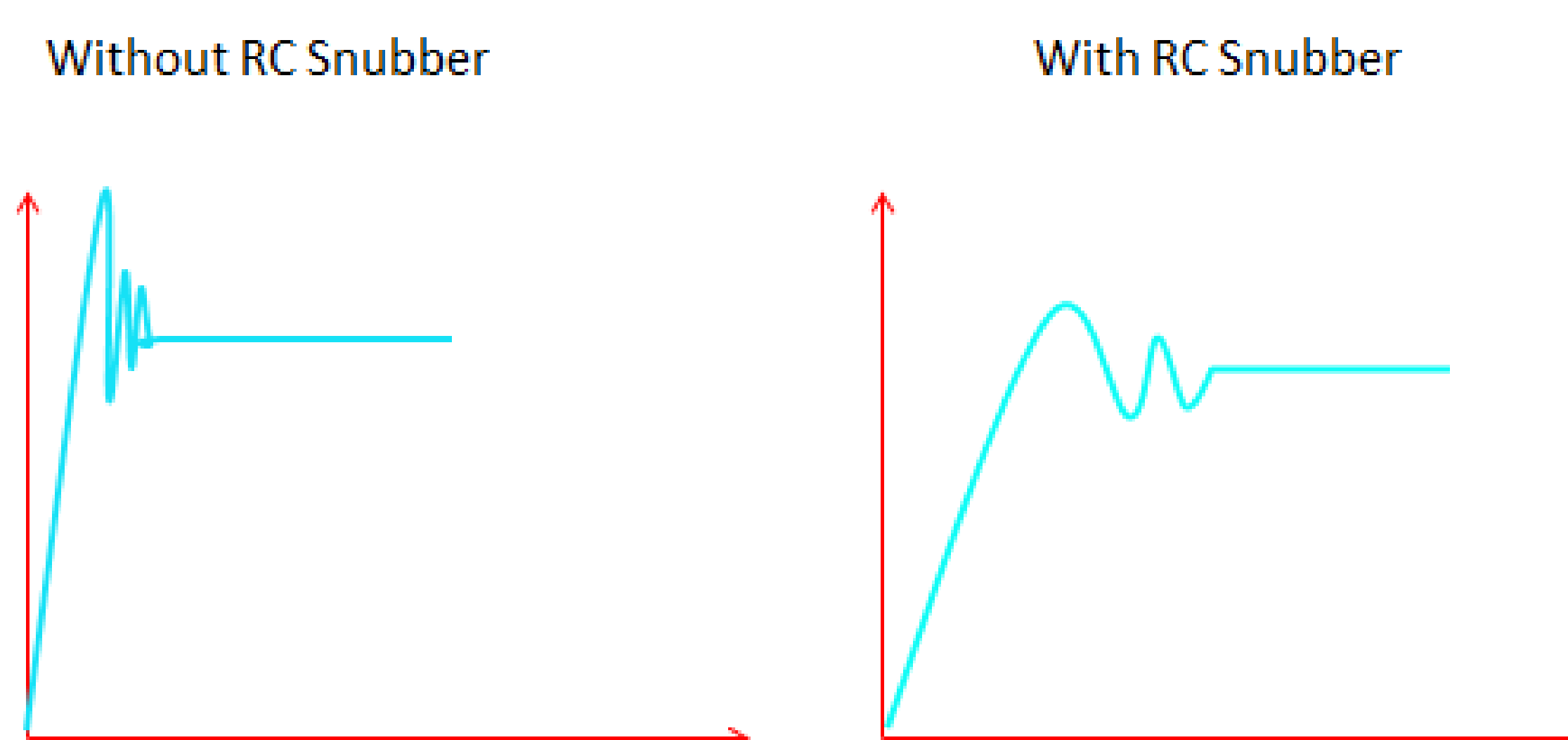
### FUNCTIONALITY

- A “hard switching” operation subjects a switch to voltage and current stress and causes high switching loss
  - the presence of *parasitic inductance* increases this stress further
- The electronic circuits of *motor drives, lamp ballasts, power converters, and other power devices* may be different, most have common switch-diode-inductor networks and waveforms
  - same snubber requirements since the behavior of the fundamental network is identical
- Most of today’s high voltage inverter circuits use *IGBTs* as the switching devices
  - IGBTs can switch high currents within short time frames, so they are exposed to potentially harmful voltage transients and therefore *require protection circuits*



### PLASTIC FILM SNUBBER CAPACITORS

- Snubber circuits are exposed to high stress, so the capacitors used in such circuits are subjected to and *must withstand high  $du/dt$  and extremely high values of peak and rms current*
- *Plastic film capacitors* are widely used for snubber applications, for both high power and low power circuits



### MATERIALS AND CONSTRUCTION

- Most snubber capacitors are designed with *polypropylene* material
  - *low-loss dielectric* material, suitable for designing capacitors for use in both low and high pulse applications
- The properties of a film capacitor are significantly dependent on the construction technology used
- Polypropylene *film/foil, metallized film* and *double-sided metallized film* are commonly used as snubber capacitors
  - *lug terminals* execution available for direct mounting on IGBT modules and busbars
  - a combination of metallized film and discrete foil can also be considered

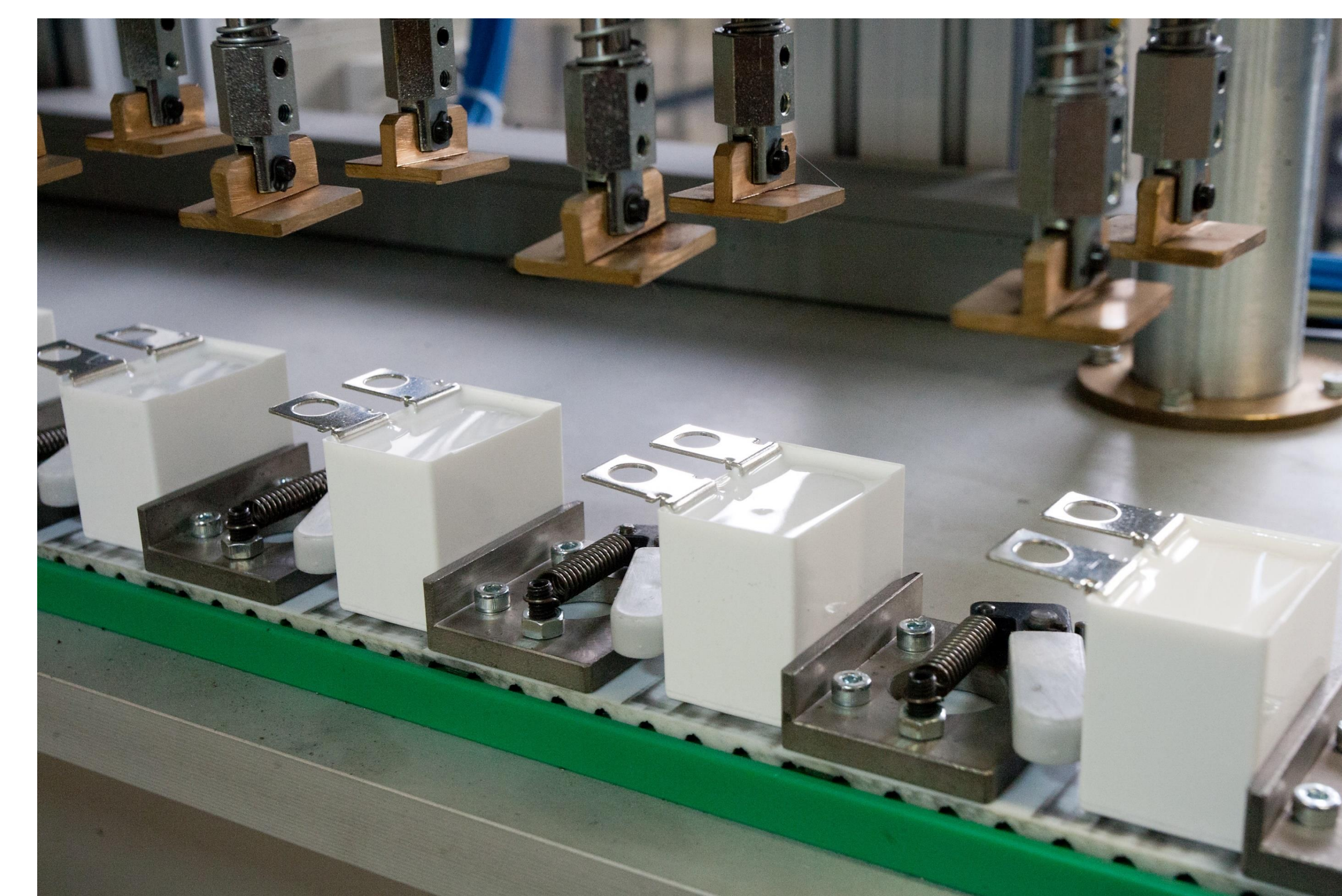
### PROPERTIES AND CHARACTERISTICS

- Polypropylene snubber capacitors offer *high tolerance and stability*, together with *high voltage and current withstanding*
  - changes in temperature or applied voltage have minimal effects on the performance characteristics
  - low and virtually linear temperature coefficient
  - very stable capacitance
  - low equivalent series inductance (ESL) and low equivalent series resistance (ESR)

### ICEL PRODUCTS - SNUBBER

- *Boxed – LUGS execution* for direct mounting on IGBTs
  - *PMB/RMB*★ – high pulse, high current, low ESR
  - *PMS* – medium pulse, high current, low ESR
- *Boxed – PINS execution*
  - *PPR/PPB*★ – high performance, high pulse, high frequency
  - *PSB/RSB*★ – high pulse, high current
  - *PHS* – medium-high pulse, high current
- *Axial execution*
  - *PPA*★ – high pulse
  - *PPS* – medium-high pulse
  - *PWS* – film foil snubber, very high pulse, low losses

★ recommended



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