Snubber capacitors

WHY SNUBBER CAPACITORS?
• Snubber capacitors are essential in a power conversion circuit 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.

- Without RC Snubber

- With RC Snubber

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.
  - 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

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