A NEW BUSBAR EMBEDDED POWER CONVERTER MODULE

Yang Xu
North Carolina State University
Email: yxu17@ncsu.edu
Whole system (bottom view)
Whole system (transparent view)

Half bridge A

Half bridge B
System layer structures
Part 1 – Upper Bus (top view)
Part 1 – Upper Bus (bottom view)

Fabrication Technology:
Traditional DCB
Part 2 - Bridge Configuration (top view)
Part2- Bridge Configuration (bottom)
Part 2 - Bridge Assembly

- Gate terminal
- Gate insulation
- Gate ref/IGBT emitter
- IGBT chip
- Diode chip
- IGBT collector
- Aluminum contact pad
- Interconnect
- Supporting element
- Copper planar interconnect
Part 3 - Lower Bus (V+ bus)

Bottom side

Fabrication Technology:
Traditional DCB

Top side
Temperature simulation

- Assume each of the 8 chips (in this conceptual design) has a power dissipation of 50 W, bottom side is fixed to 20 degree C.
Optional feature-embedded cooling pipe

This is for showing the concept. The real design may have a U shape cooling pipe for each of the half bridge unit.
Optional feature-embedded heat sink
A press in type of assembly will be used for assembling the system by just pressing the upper and lower bus together.
Other options

- Vertical Gate Drive circuit board in top
- Capacitor on top bus
- Heat sink cover all bottom bus
Summary of feature

- Busbar in module
- Busbar as heatsink
- All planar interconnection
- Embedded cooling element
- Optimized capacitor hole location
- Optimized gate terminal location
- Half bridge unit configuration
- Lower bus(heat sink) electrically hot
Advantages

- Super low interconnect inductance
- Double sided cooling for power device
- Very compact design
- Allow gate drive circuit locate extremely close to power semiconductor device
- Can be fabricated and assembled very easily
- Flexible for different topology (single/3 phase VSI)