High Current PCBs
System Integration of Busbars and Electronics

Dr. Christoph Lehnberger
ANDUS ELECTRONIC GmbH, Berlin

1st International Conference
September 28th - 29th, 2011
Nuremberg, Germany

Profile of ANDUS: Our Motto
Where your ideas become reality
Profile of Our Capabilities

Production
High-End PCBs and Express Prototypes

Location
Berlin

Foundation
1969

Employees
64

Service
Technology Development and Advice

Content

1 Overview of Power PCBs
2 Motivation for Busbars in PCBs
3 Basic Technology
4 Technology Variations
5 Examples
Content

1 Overview of Power PCBs
2 Motivation for Busbars in PCBs
3 Basic Technology
4 Technology Variations
5 Examples

1 Overview of Power PCBs

► Standard PCBs with increased copper thickness up to 400 µm

► Leveling conductor gaps by special filling paste to obtain flat surfaces

► Iceberg Technology with different copper thicknesses on one layer

► X-Cool™ technology with embedded massive copper busbars
1 Overview of Power PCBs (continued)

► Wirelaid Technology with embedded wires in multilayer

► Selective areas with incorporated thick copper PCB (Schweizer El. AG)

► IMS substrates: e.g. special material 320x LED by ANDUS

Goal: 320x 1W

► External heat sink

► Embedded heat sink

Content

1 Overview of Power PCBs

2 Motivation for Busbars in PCBs

3 Basic Technology

4 Technology Variations

5 Examples
2 Motivation for Busbars in PCBs

Efficient handling of high currents combined with electronic control

There are a number of PCB technologies for high currents.

Most methods show insufficient conductor cross sections between PCB layers and components or cables.

The new X-Cool technology supplies maximum conductor cross section at any interface.
2 Motivation for Busbars in PCBs

Additional requirements:

- Standard SMD production processes
- High degree of freedom for electronic design
- Reduction of mounting effort, material and time
3 Basic Technology

Embedded copper bars

Idea: Integration of copper parts of \( \geq 1 \) mm thickness into PCBs

Production steps:

1. Preparation of copper parts by etching, milling or punching, depending on quantity, size and shape
2. Milling frames
3. Multilayer lamination

Final production: drilling, plating, patterning, coating, milling, testing.
3 Basic Technology

General design rules for copper bars, to be adapted to any single project.

A Line width ≥ 2.0 mm
B Clearance ≥ 2.0 mm
C Edge distance ≥ 0 mm
D Minimum Drill ≥ 0.8 mm

Content

1 Overview of Power PCBs
2 Motivation for Busbars in PCBs
3 Basic Technology
4 Technology Variations
5 Examples
4 Technology Variations

Variation 1: Direct contact to SMT components

Advantages:
- direct **high current** access to SMD components
- direct **heat sink** contact
- maximum **cross section** of any interconnect

Example: 16 parallel D2Paks
4 Technology Variations

**Variation 2: Peripheral leads**

Copper bars can be lead out of PCBs for easier connection reasons.

**Variation 3: Reliable copper inlays**

Insertion of copper parts during multilayer process with access from both sides of the PCB.

- Freedom of location and size of inlay:
4 Technology Variations

Variation 3 (continued): Reliable copper inlays

Conventional inlay

Embedded inlay

Mechanical stress when coin is fitted in.

No contact to electrical layers.

Variation 4: Single sided version

Heat sink for direct cooling without isolation gap. Especially for high power LEDs up to 10W.
Content

1 Overview of Power PCBs
2 Motivation for Busbars in PCBs
3 Basic Technology
4 Technology Variations
5 Examples

5 Examples

Automotive application
5 Examples

Planar transformer

Automotive application:

Wire bonding of bare chips onto uncovered copper bars.
5 Examples

2x 1 mm copper layers

Avionics (sorry, confidential)
5 Examples

Main Message:

Save mounting material, space and time

before → after re-design

sorry, just wildcard pictures

Thank you for your attention!

High currents by busbars in PCBs

© ANDUS ELECTRONIC GmbH Berlin
www.andus.de

Dr. Christoph Lehnberger
+49 30 610006-81

c.lehnberger@andus.de