Smart Battery Switch Demonstrator (SBS)

September 2014
Smart Battery Switch Demonstrator
Power Distribution System Innovation

- **Independent power networks**
- **Delay / timing functionality**
- **Peak current management**
- **Partial powernet activation**
- **Independent failure management**
- **Quiescent current management**

- **High current load disconnect**
- **Avoid corrosion / electro-migration**
- **Failure / safety disconnect**
- **Optional high-current electronic fuse**

- **Replacement of pyro-electric switch**
- **Resettable high current cable shutdown**
- **Avoid corrosion / electro-migration**
- **Jumpstart reverse battery blocking**
- **Optional smart starter control function**

\[ V_{\text{bat}} \]

- **SBS4**
  - Pre-fuse box
  - KL30g1
  - ECU
  - loads

- **SBS3**
  - Pre-fuse box
  - KL30g2

- **SBS2**
  - High current load disconnect

- **SBS1**
  - Generator/starter cable protection

- **Battery**
  - IBS
  - S
  - G

**SBS: Smart Battery Switch**

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Electronic replacement of the Pyro-electric SBK

- Same current handling
- Similar size
- Switch at any time

A joint high current system demonstrator project of Infineon Technologies and Schweizer Electronic
Smart Battery Switch Demonstrator
Technical Realization

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Smart Battery Switch Demonstrator
TO-Leadless MOSFET & PCB Inlay Technology

High current system approach, combining
- High current MOSFET technology
- High current PCB Inlay technology

2mm Cu-Inlay
thermal-vias

planar backside for optional cooling
Smart Battery Switch Demonstrator
Main Features

■ Description

Electronic high current battery disconnect, built up with the new ultra low ohmic TO-Leadless MOSFETs in combination with an innovative Inlay PCB technology

■ Key features

□ **400A** static current
□ **1800A** starter current (thermal limited)
□ **4500A** short circuit shutdown
□ **7200A** peak current (40µs at 125°C)

□ **0.082mΩ** typ MOSFET resistor (25°C)
□ **0.112mΩ** typ Terminal-Terminal resistor
□ 4.7K/W thermal resistor
□ 36K temperature rise at 250A DC

■ Main Applications

□ Replacement of pyro-electric battery disconnect switches (SBK)
□ Resettable failure current shutdown (electro-migration, corrosion)
□ Safety switch for high current loads (EPS, engine fan, chassis control, …)
□ Quiescent current optimization (parking, transport, seasonal use, …)
□ Partial power networks (electric vehicle charging, living/working in the car, …)

■ Customer Benefits

□ Very compact design, ready to use
□ Lowest terminal-terminal resistor due to newest technologies (MOSFET and PCB)
□ Minimum passive cooling via terminal/cable
□ Low cost approach
Smart Battery Switch Demonstrator
Measurement Results

**Description**

Measurement results at the Smart Battery Switch, sitting directly on the battery terminal, 50mm² cable at the output, free air convection, ambient temperature is 26°C and the measurements are done after a thermal settling time of ~30min.

<table>
<thead>
<tr>
<th>Current [A]</th>
<th>MOSFETs</th>
<th>Terminal-to-Terminal</th>
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<tbody>
<tr>
<td>50</td>
<td>4.1</td>
<td>82</td>
</tr>
<tr>
<td>100</td>
<td>8.2</td>
<td>82</td>
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<tr>
<td>250</td>
<td>22.9</td>
<td>92</td>
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<tr>
<td>400</td>
<td>43.4</td>
<td>108</td>
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</table>
Smart Battery Switch Demonstrator
Thermal Inspection

250A  10min

400A  2.5min
TO-Leadless Package H_PSOF

Package Topology and Solder Joint Control

Trapezoid groove = guaranteed wetting

Exposed Cu = no guaranteed wetting

Sn plated but no guaranteed wetting due to mold flashes

Sn plated = guaranteed wetting

Exposed Cu = no guaranteed wetting

Sn plated but no guaranteed wetting due to mold flashes
TOLL - Infineon’s latest PowerMOS Package
40V TOLL Product Portfolio

<table>
<thead>
<tr>
<th>Product Name</th>
<th>max $R_{DSon}$ [mOhm]</th>
<th>$I_D$ [A]</th>
<th>LL/NL</th>
<th>$R_{thJC}$ [K/W]</th>
<th>Status</th>
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<tr>
<td>IPLU300N04S4-R8</td>
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<td>NL</td>
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<td>QS-available</td>
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</table>
High Current PCB Copper Inlay Technology

- Multilayer PCB combined with thick Cu Inlays
- Highest current capability and low resistance
- Excellent thermal resistance and heat spreading
- High mechanical stability
- Automotive qualified

2mm Cu-Inlay

thermal-vias

2mm Cu-Inlays
ENERGY EFFICIENCY
MOBILITY
SECURITY

Innovative semiconductor solutions for energy efficiency, mobility and security.