European LVDS Driver Development and ESCC Evaluation and Qualification – an update

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Quick introduction

▼ ESA Contract (ECI phase 3)
▼ 24 month development in three phases:
  – Definition and preliminary design
  – Design, prototype manufacture, test (current)
  – ECSS qualification
▼ Development and ESCC Qualification of 2 LVDS ICs:
  – Dual Transceiver, 16 pin (type: National Semi. DS90LV049Q)
  – 4x4 Cross-Point Switch, 40 pin (type: Texas Instrument SN65LVDS125a)
▼ Based on technologies and companies with space heritage
  – Rad Hard CMOS
  – Hermetic sealed ceramic flat package
  – ESCC assembly and test
Consortium

▼ Aeroflex Gaiser
  – Requirement Definition
  – Package development
  – IC Assembly
  – System Validation
  – Evaluation board development and manufacturing
  – Radiation Testing
  – Product Documentation
  – ESCC Evaluation and Qualification
  – Commercialization of the product

▼ IMEC
  – IC Design and Verification
  – Management of Wafer production

▼ Hirex Engineering
  – Functional and Electrical validation testing
  – ESCC Evaluation testing and Screening testing
  – ESCC Qualification testing
Project team

- Project Manager
  - Sandi Hablin

- Contract Manager
  - Per Danielsson

- Component Engineering
  - Fredrik Sturesson

- Hardware Engineering

- Product Assurance
  - Fredrik Sturesson

- HiRes
  - Technical Manager
    - Jean-Francois Pascal

- IMEC
  - Project Manager
    - Jan Wouters

- IMEC
  - Quality Manager
    - Yannick Soler

- IMEC
  - Manufacturing Manager
    - Paul Malaise

- IMEC
  - Design Manager
    - Geert Thys
Key features

- TIA/EIA-644 compliant LVDS inputs and outputs
- 3.3V single supply
- 3.3V LVTTL compatible input / output
- Up to 400 Mbps switching rates
- Tri-state output control

- Robust design, ESD, voltage tolerance, failsafe,冷 sparing
- Radiation hard
Robustness (1/2)

- **ESD robustness**
  - 8 kV HBM ESD Level

- **Overvoltage tolerant (transients)**
  - Supply: -0.5V / 4.6V
  - LVTTTL: -1V / +6V
  - LVDS: -5V / 6V

Low risk of failure propagation at overvoltage, powered and un-powered.
Robustness (2/2)

▼ Receiver Extended Common Mode Input
   – -4V / +5V

▼ Receiver with Active Failsafe Operation
   – High state at floating or shortened inputs

▼ Cold Spare outputs
   – For cold spare redundancy in multi-point systems

▼ 5V tolerant TTL inputs
Radiation

▼ TID hard
  > 300 krad(si)

▼ SEL immune
  > 110 MeV-cm²/mg

▼ SEU/SET immune
  > 80 MeV-cm²/mg

by proven Rad Hard CMOS technology
Library extension for DARE 180 nm

- Receiver Extended Common Mode Input
- Receiver Failsafe Operation
- Cold Spare Functionality
- 8 kV HBM ESD Level
- Single Supply Capability
- Removal of External Resistor Requirement
The LVDS IC devices

- Dual Transceiver LVDS IC features the following pin types and counts (16 pins in total):
  - LVDS receiver pairs (+/-) 2 (2 pins each)
  - LVDS transmitter pairs (+/-) 2 (2 pins each)
  - LVTTL receiver output 2
  - LVTTL transmitter input 2
  - LVTTL enable (positive/negative) 2
  - Supply 2

- The 4x4 Cross-point Switch features the following pin types and counts (38 pins in total):
  - LVDS receiver pairs (+/-) 4 (2 pins each)
  - LVDS transmitter pairs (+/-) 4 (2 pins each)
  - LVTTL selectors 8
  - LVTTL enables 4
  - Supply 10
Dual LVDS Transceiver

**Functionality compatibility:**
- NSC DS90LV049Q
- Ideal for Space Wire: "one channel, one package"

**Ceramic flat package (baseline):**
- 16 leads bottom brazed
- 1.27 mm pitch
- 10.5 mm x 7.5 mm x 2.2 mm
- Modified cavity and layout
Dual LVDS Transceiver - alternative

SN65LVDS050D (Marked as LVDS050)
SN65LVDS050PW (Marked as LVDS050)
(TOP VIEW)

1B  1  16  V CC
1A  2  15  1D
1R  3  14  1Y
RE  4  13  1Z
2R  5  12  DE
2A  6  11  2Z
2B  7  10  2Y
GND  8  9  2D

1D  15
DE  12
1Y  11
1Z  10
2D  9
2Y  14
2Z  13
1Y  14
1Z  13
2Y  10
2Z  9
1A  12
1B  11
2A  10
2B  9

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Functionality and pin compatibility:
- TI SN65LVDS125A

Ceramic flat package (baseline):
- 40 leads bottom brazed
- 0.635 mm pitch
- New package development
Configuration Examples:

- Selection with S10-S41
**Feedback: 4x4 Cross-point Switch**

<table>
<thead>
<tr>
<th>SNLVDS125A</th>
<th>UT54LVDM288</th>
<th>UT54LVDM328</th>
<th>DS90LV049Q &amp; UT54LVDM055</th>
<th>UT54LVDS031</th>
<th>UT54LVDS032</th>
<th>Custom</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single 4x4 crosspoint</td>
<td>Quad 2x2 crosspoint</td>
<td>Octal repeater</td>
<td>Dual Rx &amp; Tx</td>
<td>Quad Tx</td>
<td>Quad Rx</td>
<td>Redundant Rx &amp; Tx</td>
</tr>
<tr>
<td>Single</td>
<td>Dual</td>
<td>Quad</td>
<td>Dual</td>
<td>Quad</td>
<td>Quad</td>
<td>Dual</td>
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<tr>
<td>LVDS TX</td>
<td>“00”</td>
<td>“00”</td>
<td>“01”</td>
<td>“10”</td>
<td>“10”</td>
<td>“10”</td>
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<tr>
<td>LVDS RX</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>4</td>
<td>4</td>
<td>8</td>
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<tr>
<td>LVTTL DATA IN</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>4</td>
<td>4</td>
<td>4</td>
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<tr>
<td>LVTTL DATA OUT</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>ENABLE</td>
<td>4</td>
<td>4</td>
<td>4 (not 1)</td>
<td>2</td>
<td>4</td>
<td>4 (not 1+1)</td>
</tr>
<tr>
<td>SELECT</td>
<td>8</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>6</td>
<td>6</td>
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<tr>
<td>GND</td>
<td>6</td>
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<tr>
<td>VCC</td>
<td>4</td>
<td>4</td>
<td>4</td>
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</tbody>
</table>

![Diagram of SN65LVDS125A 4x4 Cross-Point Switch](image)
Schedule

▼ Dual transceiver / receiver
  – CDR#1 21\textsuperscript{st} of February 2013
  – Wafer production 8\textsuperscript{th} of April 2013
  – Prototypes available August 2013
  – Prototype boards available August 2013
  ...
  – ESCC qualification och ESCC QPL October 2014

▼ 4x4 cross-point switch
  – CDR#2 August 2013
  – Wafer production September 2013
  – Prototypes available February 2014
  – Prototype boards available February 2014
  ...
  – ESCC qualification och ESCC QPL October 2014
Aeroflex Gaisler and space components

▼ GR712RC, Dual Core LEON3FT processor
  – 240 pin CQFP
  – Prototypes Q2 2011
  – MIL-STD-883 space flow Q2 2013

▼ SpaceWire Router
  – 256 pin CQFP
  – Prototypes Q3 2013
  – ESCC 9000 Q4 2014

▼ LVDS components
  – 16 pin FP & 40 pin FP
  – Prototyper Q3 2013 / Q1 2014
  – ESCC qualification Q3 2014
Contact information

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