Deutscher Akkreditierungs Rat
DAR
DAT-P-002/91-02

# Center for Quality Engineering

# Test Report No.: A0MY0001

| **Order No.:** A0MY | **Pages:** 10 | **Munich,** |
|---|---|---|

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| | |
|---|---|
| Client: | Infineon Technologies AG<br>AIM QM RPT 2 |
| Equipment Under Test: | TVS Diodes DSL70 |
| Manufacturer: | Infineon Technologies AG |
| Task: | Burst- und Surge-Tests according to customer specification |
| Test Specifications: | Burst test according to EN 61000-4-4: 2004<br>Surge test according to EN 61000-4-5: 1995 + A1:2001 |
| Result: | Requirements of the above mentioned specifications are fulfilled for all test levels.<br>EN 61000-4-4: withstand voltage 4400 V<br>EN 61000-4-5: withstand current 27 A |

The results relate only to the items tested as described in this test report.

| **approved by:** | **Date** | **Signature** |
|---|---|---|
| Dr. Jung<br>Manager Overvoltage | Sep 19, 2007 | Mathias J. |
| Bauer<br>Manager EMC | Sep 19, 2007 | Josef Bauer |

This document was signed electronically.

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# 1 Summary

Burst- und Surge-Tests according to customer specification were performed at the following type of TVS diode:

- DSL70

## 1.1 Burst-Test according to EN 61000-4-4

- **Test of each diode separately,**
  **– each 12 TVS diodes DSL70 per voltage level**

| Voltage | Impulse | Duration | Frequency | Result |
|---|---|---|---|---|
| ±2000 V | 5/50 ns | 1 min. | 5 kHz | passed |
| ±2500 V | 5/50 ns | 1 min. | 5 kHz | passed |
| ±3000 V | 5/50 ns | 1 min. | 5 kHz | passed |
| ±3500 V | 5/50 ns | 1 min. | 5 kHz | passed |
| ±4000 V | 5/50 ns | 1 min. | 5 kHz | passed |
| ±4400 V | 5/50 ns | 1 min. | 5 kHz | passed |

Remark: Functional test after the Burst tests passed for all test levels.

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## 1.2 Surge-Test according to EN 61000-4-5

- **Test of each diode separately,**
  **– each 12 TVS diodes DSL70 per current level**

| Current | Impulse | Number of Surges | Repetition Rate | Result |
|---|---|---|---|---|
| ±20 A | 8/20 µs | 10, alternating | 1 surge / min. | passed |
| ±22 A | 8/20 µs | 10, alternating | 1 surge / min. | passed |
| ±24 A | 8/20 µs | 10, alternating | 1 surge / min. | passed |
| ±26 A | 8/20 µs | 10, alternating | 1 surge / min. | passed |
| ±27 A | 8/20 µs | 10, alternating | 1 surge / min. | passed |

Remark: Functional test after the Surge tests passed for all test levels.

Translation

DATech Deutsche Akkreditierungsstelle Technik GmbH
Signatory of the Multilateral Agreement of EA and ILAC for the mutual recognition

represented in the

# Deutschen AkkreditierungsRat

# Accreditation

The **DATech German Accreditation Body Technology GmbH** confirms that the Testing Laboratory

**Nokia Siemens Networks GmbH & Co. KG**
**Center for Quality Engineering**
**Hofmannstraße 51**

**D- 81359 München**

is competent under the terms of DIN EN ISO/IEC 17025 to carry out testing in the fields of

**Mobile Radio Communication (base stations), Signaling System No. 7, Signaling Voice over IP, Interfaces of Telecommunication Equipment, Electromagnetical Compatibility (EMC), Safety of Electrical Appliances, Electromechanical Components, Passive Fiber Optic Components, Low-voltage Switchgear and Controlgear Assemblies, Basic Environmental Testing Procedures**

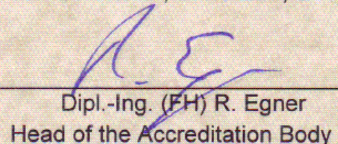
according to the annexed list of standards and specifications.

The accreditation is valid until: **December 14th, 2009**

The annex is deemed part of this certificate and comprises **49** pages.

DAR-Registration No.: **DAT-P-002/91-02**

Frankfurt/Main, June 25th, 2007



Dipl.-Ing. (FH) R. Egner
Head of the Accreditation Body

Member in EA, ILAC, IAF

Translation for information purposes only. The German Accreditation Certificate is authoritative.

See notes overleaf

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# 2 References

## 2.1 Specifications

EN 61000-4-4: 2004
EN 61000-4-5: 1995 + A1:2001

## 2.2 Glossary of Terms

None

## 2.3 Bibliographical Data

None

# 3 General Information

## 3.1 Identification of Client

Infineon Technologies AG
AIM QM RPT 2
Wernerwerkstr. 2
93049 Regensburg
Martina Miethe

## 3.2 Test Laboratory

Center for Quality Engineering
Nokia Siemens Networks GmbH & Co. KG
Hofmannstraße 51
81359 München

## 3.3 Time Schedule

Delivery of EUT: Aug 09, 2007
Start of test: Aug 24, 2007
End of test: Sep 19, 2007

## 3.4 Participants

| Name | Function | Phone | E-Mail |
|---|---|---|---|
| Dr. Mathias Jung | Editor | +49 89 722-38245 | mathias.jung@nsn.com |
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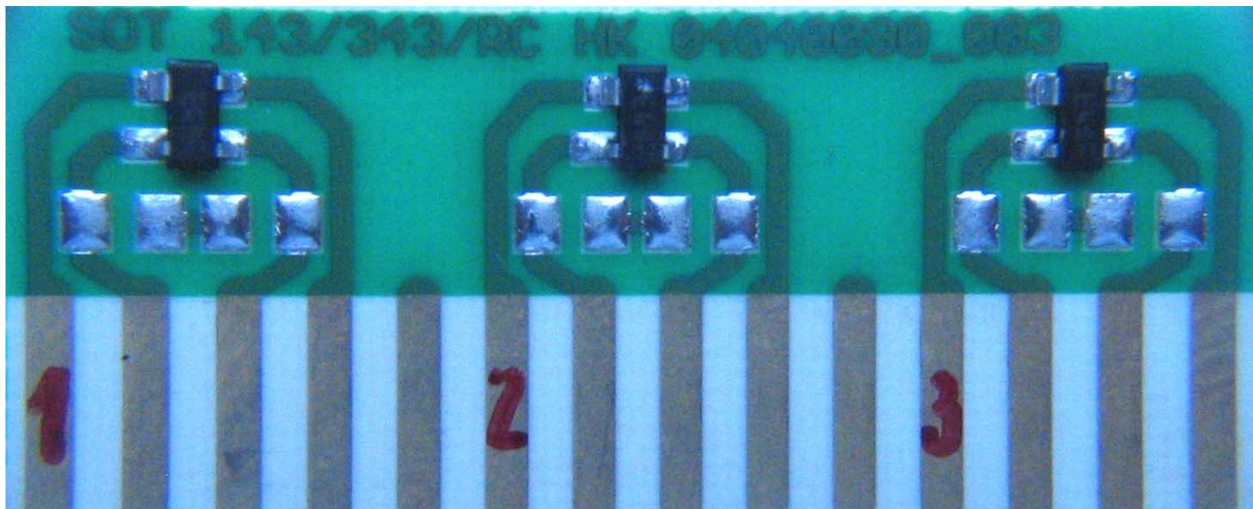
# 4 Equipment Under Test

**EUT:** TVS Diode
Type: DSL70
Die Name: D0194H
Charge/Lot: VC706190.34
Package: SOT-143-4-10

The TVS diodes are assembled to each 3 pieces on 48 PCB´s SOT143/343/RC, which are marked with p13KL #1…12 respectively p13kl #1…8 and p13MN #1…8 (samples for burst tests) and p13OP #1…12 respectively p13op #1…8 (samples for surge tests).

*The CQE internal numbering of diodes on the PCB is given in the following picture.*

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# 5 Test Equipment

## 5.1 Test Facility

The surge tests were performed in the Laboratory of Overvoltage, COO RTP CQE COC1 SDE.
The burst tests were performed in the Laboratory of EMC, COO RTP CQE COC1 SDE.

The following table shows the environmental conditions:

| Ambient temperature | Relative humidity | Barometric pressure |
|---|---|---|
| 21 °C – 23 °C | 50 % – 60 % | 101 kPa – 103 kPa |

## 5.2 Measuring Equipment

| Label | Equipment | Type | Specifications / Remarks | Calibration | | |
|---|---|---|---|---|---|---|
| | | | | State | Last | Next |
| P0592 | Burst Generator | SFT 4000 | 230 V / 16 A, programmable /<br>0.2 - 4.4 kV, 0.1 - 500 kHz Rep. | cal | 03 / 2006 | 03 / 2009 |
| N327 | Impulse Generator | CWG 10-703 | 1.2/50 µs; 8/20 µs; 0 - 10 kV; 1 Ω / 2 Ω | cpu | | |
| N767 | Coupling Network | – | 12x 100 Ω | cnn | | |
| N871 | Coupling Network | – | 16x 8.3 Ω *(8x 8.3 Ω used in parallel)* | cnn | | |
| N749 | Oscilloscope | LT344 | 500 MHz, printer, floppy disc | cal | 03 / 2007 | 03 / 2008 |
| N401 | Current Probe | 411 | 50 Ω ; 1 Hz - 20 MHz; 5 $kA_{pk}$; 50 $A_{rms}$ | cal | 03 / 2006 | 03 / 2008 |
| O601 | Voltage Probe | PP006 | 500 MHz; 10 MΩ | cal | 08 / 2006 | 08 / 2007 |

*cal: calibrated – chk: checked – cpu: check prior to use – ind: for indication only – cnn: calibration not necessary*

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## 5.3 Measurement Uncertainty

As far as the underlying standards include requirements concerning the uncertainty of measuring instruments or measuring methods, they are met.

The expanded measurement uncertainty of the measuring chain was calculated for all tests according to the “ISO Guide to the expression of uncertainty in measurement (GUM)”. The results are documented in an “internal controlled document” at CQE archives.

The measuring accuracy for all measuring devices is given in their technical description. The measuring instruments, including any accessories, are calibrated respectively verified to ensure the necessary accuracy. Depending on the kind of measuring equipment it is checked within regular intervals or directly before the measurement is performed. Adjustments are made and correction factors applied to measured data in accordance with the specifications of the specific instrument.

The expanded measurement instrumentation uncertainty of our Test Laboratory meets the requirements of IEC CISPR 16-4-2 (2003-11) “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4-2: Uncertainties, statistics and limit modelling – Uncertainty in EMC measurements” for all listed tests.

# 6 Test Specifications and Results

The test results in the report refer exclusively to the test object described in section 0 and the test period in section 3.3.

## 6.1 Burst-Test

- Test-Setup according to specification EN 61000-4-4 (refer to Figure 6-1)
  - Test of 28 samples (PCB; each PCB contains 3 pieces of TVS diode DSL70)
  - Test of 12 TVS diodes (4 samples) per voltage level, test level 4400 V was tested with 24 diodes
  - Test of each TVS diode separately

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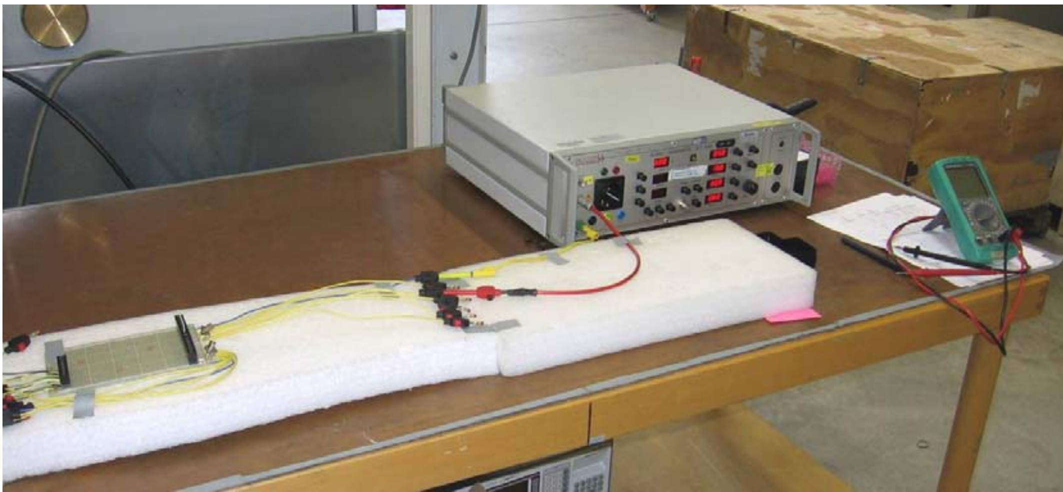

**Figure 6-1: Test-Setup for the Burst tests**

Result

| Voltage | Impulse | Duration | Frequency | Piece | Failure |
|---|---|---|---|---|---|
| ±2000 V | 5/50 ns | 1 min. | 5 kHz | 12 | 0 |
| ±2500 V | 5/50 ns | 1 min. | 5 kHz | 12 | 0 |
| ±3000 V | 5/50 ns | 1 min. | 5 kHz | 12[1] | 0 |
| ±3500 V | 5/50 ns | 1 min. | 5 kHz | 12 | 0 |
| ±4000 V | 5/50 ns | 1 min. | 5 kHz | 12 | 0 |
| ±4400 V | 5/50 ns | 1 min. | 5 kHz | 24 | 0 |

Remark: Functional test after the burst tests passed for all TVS diodes.

[1] Pin 2 of diode 2 on the PCB #10 is not soldered.

## 6.2 Surge-Test

- Test-Setup according to specification EN 61000-4-5

  – Test of 20 samples (PCB; each PCB contains 3 pieces of TVS diode DSL70)
  – Test of 12 TVS diodes (4 samples) per voltage level
  – Test of each TVS diode separately

Result

| Current | Impulse | Repetition Rate | Number of Surges | Piece | Failure |
|---|---|---|---|---|---|
| 20 A | 8/20 µs | 1 surge / min. | 10, alternating | 12 | 0 |
| 22 A | 8/20 µs | 1 surge / min. | 10, alternating | 12 | 0 |
| 24 A | 8/20 µs | 1 surge / min. | 10, alternating | 12 | 0 |
| 26 A | 8/20 µs | 1 surge / min. | 10, alternating | 12 | 0 |
| 27 A | 8/20 µs | 1 surge / min. | 10, alternating | 12 | 0 |

Remark: Functional test after the surge tests passed for all TVS diodes.

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# 7 Enclosure

The following oscillograms show the applied current surges of waveshape 8/20 μs and the voltage drop across the tested diodes.

Because the DSL70 is a TVS diodes array the forward voltage drop changes the polarity (positive edge from -0.7 V to +0.7 V respectively negative edge from +0.7 V to -0.7 V) with change of current polarity at the end of current wave.

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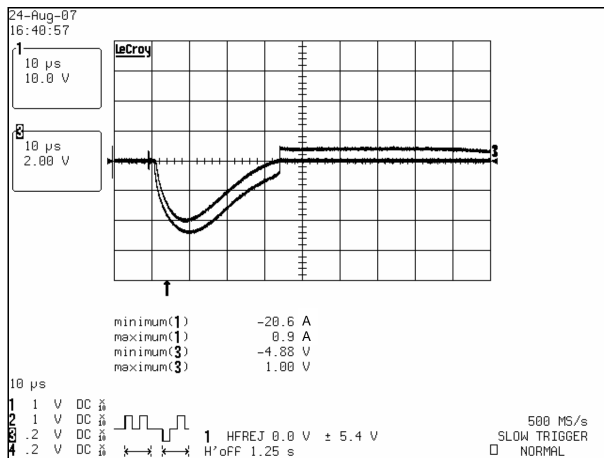
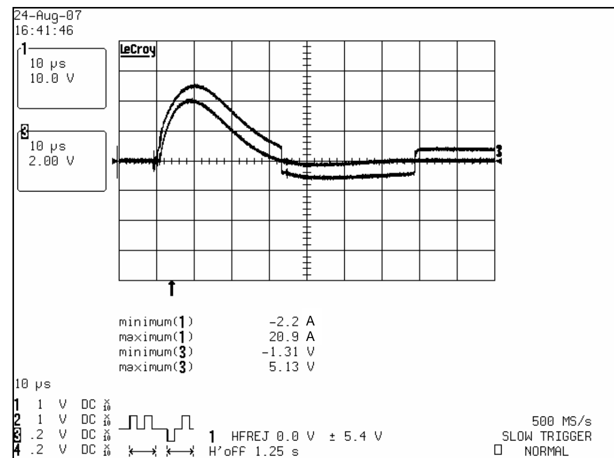
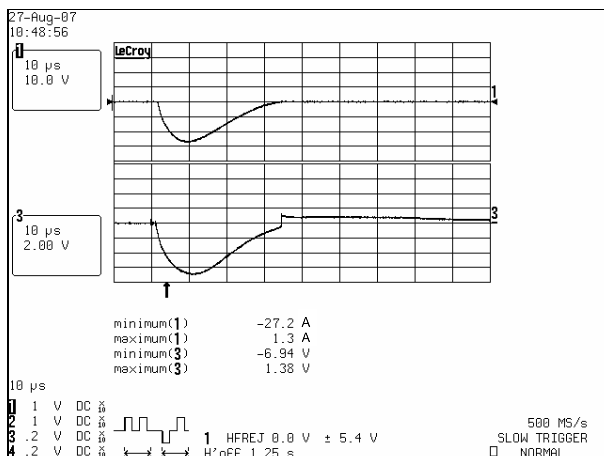


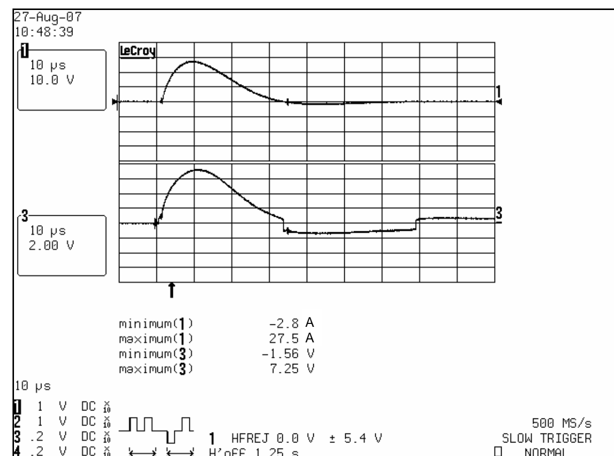

Ch 1: Current Surge -20 A, wave shape 8/20 μs
Ch 3: Voltage drop across the diode




Ch 1: Current Surge +20 A, wave shape 8/20 μs
Ch 3: Voltage drop across the diode




Ch 1: Current Surge -27 A, wave shape 8/20 μs
Ch 3: Voltage drop across the diode




Ch 1: Current Surge +27 A, wave shape 8/20 μs
Ch 3: Voltage drop across the diode

The peak forward voltages are in the range from 5 V at 20 A up to 9 V at 27 A approximately.

*There was no destruction of TVS diodes.*