



# **TSS463B Serial VAN Data Link Controller**

**ATMEL P/N : TSS463B-TERA**

## **PPAP Submission**

Date: 2003 October  
Supplier: Atmel Nantes SA  
  
Address: La Chantrerie  
BP 70602  
44306 NANTES Cedex 3  
France  
Tel : 33(0) 2 40 18 18 18  
Fax : 33(0) 2 40 18 19 20



## Table of Contents

|          |                                                                |           |
|----------|----------------------------------------------------------------|-----------|
| <b>1</b> | <b>DESIGN RECORDS .....</b>                                    | <b>6</b>  |
| 1.1      | PRODUCT SPECIFICATION.....                                     | 6         |
| 1.2      | PACKAGE OUTLINE.....                                           | 6         |
| <b>2</b> | <b>ENGINEERING CHANGE DOCUMENTS .....</b>                      | <b>7</b>  |
| 2.1      | CDC CERTIFICATE OF DESIGN, CONSTRUCTION AND QUALIFICATION..... | 7         |
| 2.1.1    | General Product Information.....                               | 7         |
| 2.1.2    | Process Technology Information.....                            | 7         |
| 2.2      | PRODUCT DESIGN.....                                            | 8         |
| 2.2.1    | Product Design Information.....                                | 8         |
| 2.2.2    | Product Design Validation.....                                 | 8         |
| 2.2.3    | Package Technology Information .....                           | 9         |
| 2.2.4    | Packing Delivery Information.....                              | 10        |
| 2.2.5    | Final Test Information .....                                   | 10        |
| 2.2.6    | Device Cross Section.....                                      | 10        |
| 2.3      | QUALIFICATION AND CHANGE PROCEDURE.....                        | 11        |
| 2.3.1    | Qualification methodology.....                                 | 11        |
| 2.3.2    | Change Procedure.....                                          | 12        |
| 2.3.3    | Qualification test methods.....                                | 13        |
| <b>3</b> | <b>ENGINEERING APPROVAL.....</b>                               | <b>14</b> |
| <b>4</b> | <b>DESIGN FMEA .....</b>                                       | <b>14</b> |
| <b>5</b> | <b>PROCESS FLOW DIAGRAMS .....</b>                             | <b>14</b> |
| 5.1      | WAFER PROCESSING .....                                         | 14        |
| 5.2      | ASSEMBLY .....                                                 | 15        |
| 5.3      | TEST AND PACKING.....                                          | 15        |
| <b>6</b> | <b>PROCESS FMEA .....</b>                                      | <b>15</b> |
| <b>7</b> | <b>DIMENTIONAL RESULTS .....</b>                               | <b>15</b> |
| <b>8</b> | <b>PERFORMANCE TEST RES ULTS .....</b>                         | <b>16</b> |
| 8.1      | QUALIFICATION RESULTS.....                                     | 16        |
| 8.1.1    | Wafer Process Qualification.....                               | 16        |
| 8.1.2    | Package Qualification.....                                     | 16        |
| 8.1.3    | Device Qualification.....                                      | 17        |
| 8.1.4    | Failure Mechanisms and Corrective Actions.....                 | 17        |
| 8.1.5    | Electrical Distribution in Operating Life-Test.....            | 18        |
| 8.1.6    | Reliability Calculation.....                                   | 19        |
| 8.1.7    | ESD Results (HBM) - MIL-STD 883 method 3015.7.....             | 19        |
| 8.1.8    | Latch-up Results.....                                          | 19        |
| 8.2      | PRODUCT CHARACTERIZATION.....                                  | 19        |
| 8.2.1    | Characterization environment.....                              | 19        |
| 8.2.2    | Corner lot's splits.....                                       | 19        |
| 8.2.3    | Results / Parameter capability.....                            | 20        |
| <b>9</b> | <b>INITIAL PROCESS STUDY .....</b>                             | <b>21</b> |



|     |                                          |    |
|-----|------------------------------------------|----|
| 9.1 | SCMOS3 PROCESS (Z92G) .....              | 21 |
| 10  | MEASUREMENT SYSTEM ANALYSIS STUDY .....  | 21 |
| 11  | QUALIFIED LABORATORY DOCUMENTATION ..... | 22 |
| 12  | CONTROL PLAN .....                       | 22 |
| 13  | PART SUBMISSION WARRANT .....            | 23 |
| 14  | APPEARANCE APPROVAL REPORT .....         | 24 |
| 15  | BULK MATERIAL REQUIREMENTS .....         | 24 |
| 16  | SAMPLE PRODUCTION PARTS .....            | 24 |
| 17  | MASTER SAMPLE .....                      | 24 |
| 18  | CHECKING AIDS .....                      | 24 |
| 19  | CUSTOMER-SPECIFIC REQUIREMENTS .....     | 24 |



## Revision history

| Rev | Issue        | Modification Notice                                                                 | Applicable from |
|-----|--------------|-------------------------------------------------------------------------------------|-----------------|
| 0   | 2003 March   | Initial release (preliminary document)                                              | 2003 April      |
| 1   | 2003 June    | Initial release (revised document)                                                  | 2003 June       |
| 2   | 2003 October | Initial release (revised document)<br>- Add of TSS463B rev 4 reliability assessment | 2003 October    |
| 3   | 2003 October | Initial release (revised document)<br>- Add of reliability calculation              | 2003 October    |
|     |              |                                                                                     |                 |
|     |              |                                                                                     |                 |

**PPAP Checklist**

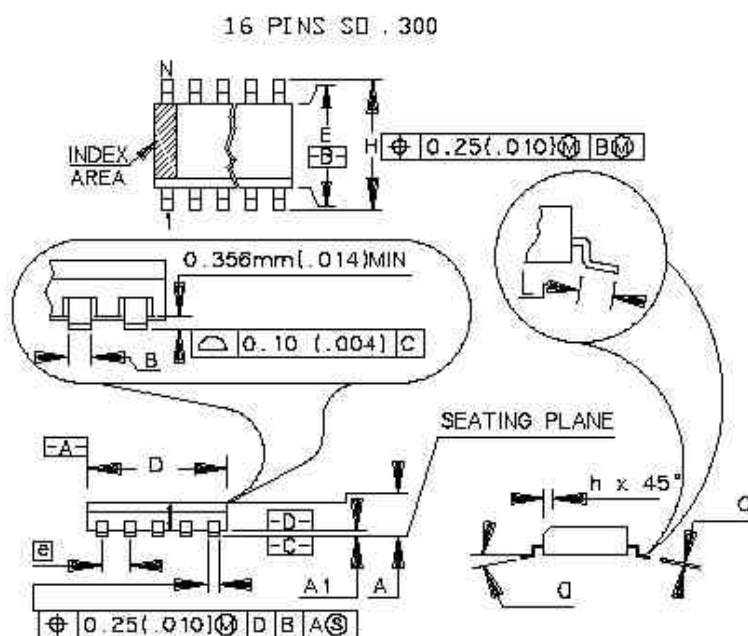
| Requirements                                      | Included                 |
|---------------------------------------------------|--------------------------|
| Table of contents                                 | yes                      |
| PPAP Checklist                                    | yes                      |
| 1. Design Records                                 | yes                      |
| 2. Engineering Change Documents                   | yes                      |
| 3. Engineering Approval                           | yes                      |
| 4. Design FMEA                                    | Project risk analysis    |
| 5. Process Flow Diagrams                          | yes                      |
| 6. Process FMEA                                   | yes                      |
| 7. Dimensional Results                            | Not Applicable           |
| 8. Records of Material / Performance Test Results |                          |
| 8.1 Material Test Records                         | Not applicable to IC     |
| 8.2 Performance Test Records                      | Yes                      |
| 9. Initial Process Study                          | Yes                      |
| 10. Measurement System Analysis Study             | Yes                      |
| 11. Qualified Laboratory Documentation            | Yes                      |
| 12. Control Plan                                  | Yes                      |
| 13. Part Submission Warrant (PSW)                 | Yes                      |
| 14. Appearance Approval Report                    | Not applicable to IC     |
| 15. Bulk Material Requirements Checklist          | Not applicable to IC     |
| 16. Sample Production Parts                       | To be ordered separately |
| 17. Master Sample                                 | Not attached             |
| 18. Checking Aids                                 | Not Applicable           |
| 19. Customer Specific Requirements                | Not attached             |

## 1 Design Records

### 1.1 Product Specification

Please refer to ATMEL's Data Sheet: TSS463B VAN Data Link Controller with serial interface  
<http://www.atmel.com/>

### 1.2 Package Outline



|    | MM    |       | INCH |      |
|----|-------|-------|------|------|
| A  | 2.35  | 2.65  | .093 | .104 |
| A1 | 0.10  | 0.30  | .004 | .012 |
| B  | 0.35  | 0.49  | .014 | .019 |
| C  | 0.23  | 0.32  | .009 | .013 |
| D  | 10.10 | 10.50 | .398 | .413 |
| E  | 7.40  | 7.60  | .291 | .299 |
| e  | 1.27  | BSC   | .050 | BSC  |
| H  | 10.00 | 10.65 | .394 | .419 |
| h  | 0.25  | 0.75  | .010 | .029 |
| L  | 0.40  | 1.27  | .016 | .050 |
| N  | 16    |       | 16   |      |
| α  | 0°    |       | 8°   |      |

PACKAGE CODE : N07 - NDB  
 INTERNAL CODE : TE  
 ATMEL NANTES

REV : F DATE : 03-09-90



## **2 Engineering Change Documents**

### **2.1 CDC Certificate of Design, Construction and Qualification**

#### **2.1.1 General Product Information**

Product Name: TSS463B

Function: VAN Data Link Controller

Wafer Process: CMOS 0.5um

Package Type: SO-L.300 16 leads

**Locations:**

|                     |                                     |
|---------------------|-------------------------------------|
| Process Development | Atmel Nantes , France               |
| Product Development | Atmel Nantes , France               |
| Wafer Plant         | Atmel Nantes , France               |
| QC Responsibility   | Atmel Nantes, France                |
| Probe Test          | Atmel Nantes , France               |
| Assembly            | ASE Chung Li, Taiwan                |
|                     | CHIPPAC, China                      |
|                     | AMKOR, Korea                        |
| Final Test          | TSTI Philippines                    |
| Lot Release         | Atmel Nantes, France                |
| Shipment Control    | Global Logistic Center, Philippines |
| Quality Assurance   | Atmel Nantes, France                |
| Reliability Testing | Atmel Nantes, France                |
| Failure Analysis    | Atmel Nantes, France                |

#### **2.1.2 Process Technology Information**

Process Type (Name): Z92 (SCMOS3 : 0.5um Logic CMOS technology)

Base Material: Bulk silicon

    Wafer Thickness (final) 475µm

    Wafer Diameter 150 mm

Number Of Masks 14

Gate Oxide (Logic transistors)

    Material Silicon Dioxide

    Thickness 110 A

**Polysilicon**

|                  |       |
|------------------|-------|
| Number of Layers | 1     |
| Thickness        | 2000A |

**Metal**

|                   |       |
|-------------------|-------|
| Number of Layers  | 3     |
| Material          | AlCu  |
| Layer 1 Thickness | 5150A |
| Layer 2 Thickness | 5150A |
| Layer 3 Thickness | 7650A |

**Passivation**

|           |                            |
|-----------|----------------------------|
| Material  | SiO <sub>2</sub> / Nitride |
| Thickness | 2600A / 6400A              |

## 2.2 Product Design

### 2.2.1 Product Design Information

|                                |                                         |
|--------------------------------|-----------------------------------------|
| Die Size                       | 2200µm * 2790 µm (6.14mm <sup>2</sup> ) |
| Pad Size Opening               | 100µm * 100µm                           |
| Logic Effective Channel Length | 0.5µm                                   |
| Gate Poly Width (min.)         | 0.50µm                                  |
| Gate Poly Spacing (min.)       | 0.60µm                                  |
| Metal 1 Width                  | 0.60µm                                  |
| Metal 1 Spacing                | 0.70µm                                  |
| Metal 2 Width                  | 0.80µm                                  |
| Metal 2 Spacing                | 0.70µm                                  |
| Metal 3 Width                  | 0.80µm                                  |
| Metal 3 Spacing                | 0.70µm                                  |
| Contact size                   | 0.60µm                                  |
| Via 1 size                     | 0.60µm                                  |
| Via 2 size                     | 0.60µm                                  |

### 2.2.2 Product Design Validation

Design validation done according to Atmel Nantes development procedure and documented in the following documents:

|                                |                                                                                              |
|--------------------------------|----------------------------------------------------------------------------------------------|
| <u>VAN protocol assessment</u> | DASSAULT Test Plan Results TSS463B Rev4<br>ATD-TS-GU-R001 – October 2002<br>Laurentiu BIRSAN |
|--------------------------------|----------------------------------------------------------------------------------------------|

|                                           |                                                                             |
|-------------------------------------------|-----------------------------------------------------------------------------|
| <u>Third Party Application assessment</u> | VAN Device TSS463B NSI Test Report<br>DCL-MUX-0077 /V1.0<br>Jacques TELLIER |
|-------------------------------------------|-----------------------------------------------------------------------------|

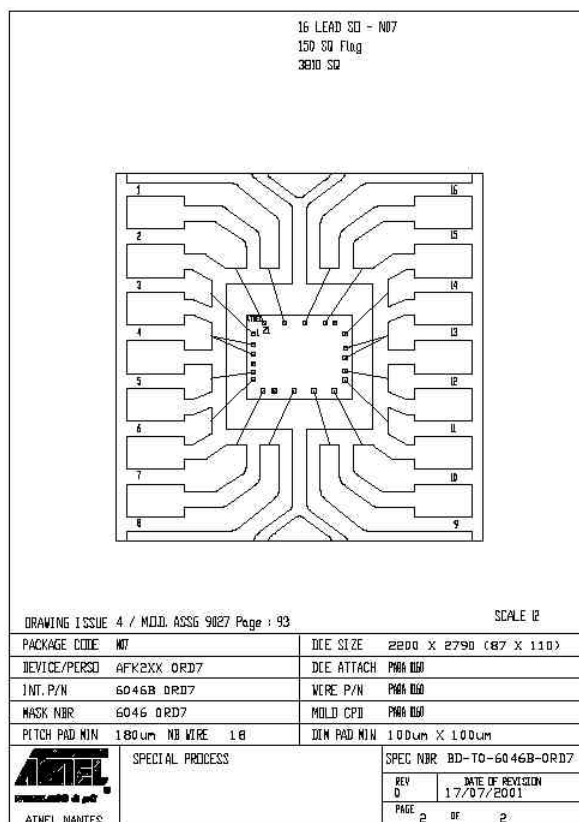
|                       |                                                                              |
|-----------------------|------------------------------------------------------------------------------|
| <u>EMC Evaluation</u> | TSS463B Dynamic Current Analysis<br>APP/LAB/JLL/01/67-0.2<br>Jean Luc LEVANT |
|-----------------------|------------------------------------------------------------------------------|



## 2.2.3 Package Technology Information

|                        |                                        |
|------------------------|----------------------------------------|
| Package weight         | 0.43 g                                 |
| Chip separation method | Sawing                                 |
| Lead frame             |                                        |
| Material               | Cu                                     |
| Thickness              | 10 mils                                |
| Size                   | 270*270 mils <sup>2</sup>              |
| Lead plating           | Electroplated Sn/Pb 85/15              |
| Die attach             |                                        |
| Material               | Silver epoxy                           |
| Type                   | Ablestick 84-1 LMISR4                  |
| Wire bonding           |                                        |
| Material               | Au                                     |
| Diameter               | 1.0 mil                                |
| Method                 | Thermosonic                            |
| Molding                |                                        |
| Material               | NITTO MP8000AN                         |
| Flammability rating    | UL94V-0                                |
| Marking                |                                        |
| Method                 | Printed ink (top) and Laser (back)     |
| Drawing example        | Atmel<br>TSS463B-TERA<br>YYMM Zxxxxxxx |

### Bonding Diagram





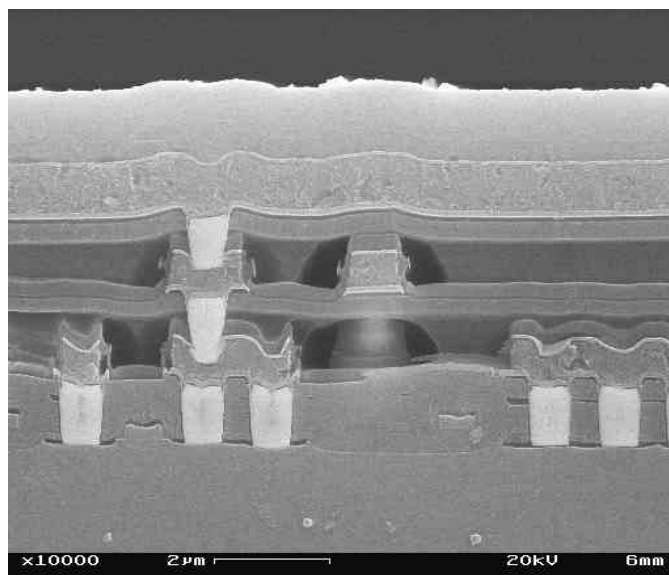
## 2.2.4 Packing Delivery Information

|                    |                                                   |
|--------------------|---------------------------------------------------|
| Dry packing        | No                                                |
| Tube packed        |                                                   |
| Primary            | Tube                                              |
| Material           | Antistatic PVC                                    |
| Number per unit    | 36                                                |
| Secondary          | Box                                               |
| Material           | Cardboard                                         |
| Number per unit    | 1692                                              |
| Labeling (minimum) | Device type, quantity, Date code, Production code |
| Bar coding         | Code 39 to EIA-556-A                              |
| Reel packed        |                                                   |
| Primary            | Reel                                              |
| Material           |                                                   |
| Carrier tape       | Conductive black polystyrene                      |
| Cover tape         | Antistatic film                                   |
| Number per unit    | 1500                                              |
| Secondary          | Box                                               |
| Number per unit    | 1                                                 |
| Labeling (minimum) | Device type, quantity, Date code, Production code |

## 2.2.5 Final Test Information

|                   |                  |
|-------------------|------------------|
| Probe equipment   | NEXTEST Maverick |
| Probe temperature | 125° C           |
| Test equipment    | NEXTEST Maverick |
| Test temperature  | 25° C, 125° C    |

## 2.2.6 Device Cross Section





## **2.3 Qualification and Change Procedure**

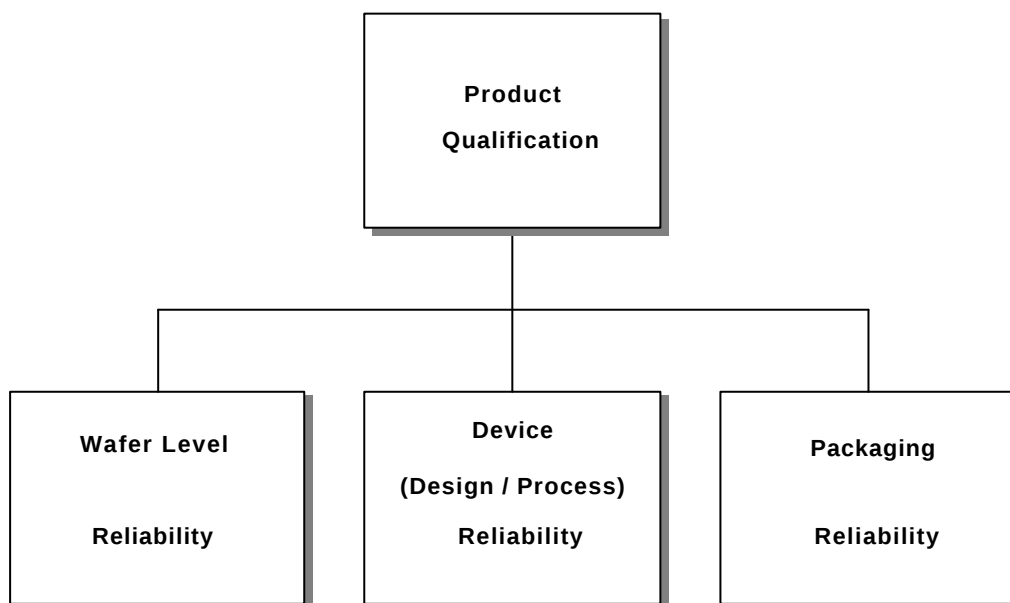
### **2.3.1 Qualification methodology**

All product qualifications are split into three distinct steps as shown below. Before a product is released for use, successful qualification testing are required at wafer, device and package level.

Wafer Level Reliability consists in testing individually basic process modules regarding their well known potential limitations (Electromigration, Hot Carriers Injection, Oxide Breakdown, NVM Data Retention). Each test is performed using a dedicated wafer process structure.

Device reliability is covering either dice design and processing aspects. The tests are performed on device under qualification, and generic data may also be considered for reliability calculation.

For each package type proposed in the Datasheet, it is verified that qualification data are available. If not qualification tests are carried out for the new package types. At least one package type is selected to verify packaging reliability of the device under qualification.





### 2.3.2 Change Procedure

All changes are controlled by ECN (Engineering Change Notice). Major changes are notified to customers using products affected by the change.

Major changes are defined as changes which may affect the electrical and/or mechanical product specification. The following checklist provides the minimum list of items to be considered.

| 1   | General Changes                       |
|-----|---------------------------------------|
| 1-1 | Manufacturing line                    |
| 1-2 | Sequence of fabrication process cycle |
| 1-3 | Material type                         |
| 1-4 | Electrical parameter                  |
| 1-5 | External physical dimension           |
| 1-6 | Die size                              |

| 2   | Changes Specific to Wafer Fabrication |
|-----|---------------------------------------|
| 2-1 | Doping method                         |
| 2-2 | Gate oxide formation method           |
| 2-3 | Equipment change                      |
| 2-4 | Layer Thickness                       |
| 2-5 | Module dimensions                     |

| 3   | Changes Specific to Assembly     |
|-----|----------------------------------|
| 3-1 | Sawing method                    |
| 3-2 | Die attach method                |
| 3-3 | Wiring method                    |
| 3-4 | Molding process                  |
| 3-5 | Lead finish / MSL classification |

| 4   | Changes Specific to Test |
|-----|--------------------------|
| 4-1 | Specification limit      |
| 4-2 | Test coverage reduction  |
| 4-2 | Product identification   |
| 4-3 | Final conditioning       |



### 2.3.3 Qualification test methods

General Requirements for Plastic Encapsulated CMOS Ics.

| Standard                     | Test Description                                                                        | Acceptance     |
|------------------------------|-----------------------------------------------------------------------------------------|----------------|
| MIL-STD 883<br>Method 1005   | <b>Electrical Life Test (Early Failure Rate)</b><br>48 hours 140°C                      | 0/800 - 48h    |
| MIL-STD 883<br>Method 1005   | <b>Electrical Life Test (Latent Failure Rate)</b><br>1000 hours 140°C Dynamic or Static | 0/77 - 1000h   |
| MIL-STD 883<br>Method 3015.7 | <b>Electrostatic Discharge HBM</b><br>+/-2000v 1.5kOhm/100pF/3 pulses                   | 0/3 per level  |
| JEDEC 78                     | <b>Latch up</b><br>50mW power injection, 50% overvoltage @125°C                         | 0/5 per stress |
| AEC Q100<br>Method 005       | <b>NVM Endurance</b><br>Program Erase Cycles 125°C                                      | 0/77 - 100kc   |
| AEC Q100<br>Method 005       | <b>NVM Data Retention</b><br>High Temperature Storage 165°C                             | 0/77 - 1000h   |
| MIL-STD 883<br>Method 1010   | <b>Temperature Cycling</b><br>1000 cycles -65°C/150°C air/air                           | 0/77 - 500c    |
| EIA<br>JESD22-A110           | <b>Autoclave</b><br>96 hours 130°C/85%RH                                                | 0/77 - 96h     |
| EIA<br>JESD22-A101           | <b>85/85 Humidity Test</b><br>1000 hours 85°C/85%RH                                     | 0/77 - 1000h   |
| EIA<br>JESD22-A110           | <b>HAST</b><br>96 hours 130°C/85%RH/biased                                              | 0/50 - 96h     |
| EIA<br>JESD20                | <b>Preconditioning</b><br>Soldering Stress 220°C/235°C/3 times                          | 0/11 per class |
| MIL-STD 883<br>Method 2003   | <b>Solderability</b>                                                                    | 0/3            |
| MIL-STD 883<br>Method 2015   | <b>Marking Permanency</b>                                                               | 0/5            |



### **3 Engineering Approval**

TSS463B is qualified since 2003 March

Released to production review was done in 2003 May

Release to Production is approved by:

- Head of Technical Center
- Project Leader
- Product Engineering
- Operation Back-end
- Operation Front-end
- Quality Management
- Marketing
- Business Planning

### **4 Design FMEA**

Project Risk Analysis has been initiated at Feasibility stage and followed under Project Leader responsibility, all over project development stages.

Project Risk Analysis report may be consulted in Atmel Nantes upon request.

### **5 Process Flow Diagrams**

#### **5.1 Wafer Processing**

1. Incoming inspection of silicon wafers
2. Locos (Z92) Isolation
3. MOS N-Well implants and N Well diffusion
4. MOS P-Well Implants
5. MOS Gate oxidation
6. Polysilicon deposition and MOS gate definition
7. MOS Implants with Spacer definition
8. Salicide Hard mask definition
9. Salicide module
10. ILD deposition and SOG planarization
11. Contact etching and Plug1 filling
12. Metal 1 deposition and etching
13. IMD1 and REB planarization
14. Via1 etching and Plug2 filling
15. Metal 2 deposition and etching
16. IMD2 and REB planarization
17. Via2 etching and Plug3 filling



18. Metal 3 deposition and etching
19. Passivation deposition and Pad etching
20. E-Test
21. Back grinding
22. Wafer sort

## **5.2 Assembly**

1. Wafer mount
2. Wafer saw
3. First optical
4. Die bonding
5. Wire bonding
6. Molding
7. Solder plating
8. Top marking
9. Trim and form
10. Final visual inspection

## **5.3 Test and Packing**

1. Room temperature initial test
2. Final quality checks
3. Packing

## **6 Process FMEA**

Process FMEA for 0.5um Z92 may be consulted in Atmel Nantes upon request.

## **7 Dimentional Results**

SO-L.300 16 leads package comply with JEDEC standard outline.

Package dimensions were checked during Package Qualification.



## 8 Performance Test Results

### 8.1 Qualification Results

#### 8.1.1 Wafer Process Qualification

ATMEL 0.5µm SCMO3 wafer process is qualified since 1997, September.

#### 8.1.2 Package Qualification

Package qualification measurements carried out on VAN DLC devices are detailed in the table below:

| Lots                | Device Type                           | Test Description                     | Step              | Result                     | Comment                                                                                       |
|---------------------|---------------------------------------|--------------------------------------|-------------------|----------------------------|-----------------------------------------------------------------------------------------------|
| Z40807C             | TSS463B<br>SO-L.300 16<br>AMKOR K     | 85/85 Humidity                       | 500h<br>1000h     | 0/77<br>0/77               | Post preconditioning level1                                                                   |
|                     |                                       | Thermal Cycles                       | 500c<br><br>1000c | 0/77<br>0/5<br>0/5<br>0/72 | Post preconditioning level1<br>Ball shear cpk:1.70 (30 pads)<br>Wire pull cpk:2.35 (30 wires) |
|                     |                                       | HAST after Thermal Shocks            | 96h               | 0/77                       | Post preconditioning level1                                                                   |
|                     |                                       | High Temperature Storage 165°C       | 500h<br>1000h     | 0/77<br>0/77               |                                                                                               |
|                     |                                       | Moisture sensitivity JESD20 – level1 | CSAM<br>Elect     | 0/11<br>0/231              |                                                                                               |
|                     |                                       |                                      |                   |                            |                                                                                               |
| Z41393J             | TSS461E<br>SO-L.300 24<br>AMKOR K     | 85/85 Humidity                       | 500h<br>1000h     | 0/50<br>0/50               | Post preconditioning level1                                                                   |
|                     |                                       | Thermal Cycles                       | 500c<br>1000c     | 0/50<br>0/72               | Post preconditioning level1                                                                   |
|                     |                                       | HAST after Thermal Shocks            | 96h               | 0/77                       | Post preconditioning level1                                                                   |
|                     |                                       | High Temperature Storage 165°C       | 500h<br>1000h     | 0/50<br>0/50               |                                                                                               |
|                     |                                       | Moisture sensitivity JESD20 – level1 | CSAM<br>Elect     | 0/11<br>0/231              |                                                                                               |
|                     |                                       |                                      |                   |                            |                                                                                               |
| Z45925A<br>(Note 1) | TSS463B rev4<br>SO-L.300 16<br>ASE CL | 85/85 Humidity                       | 500h<br>1000h     | 0/77<br>0/77               | Post preconditioning level1                                                                   |
|                     |                                       | Thermal Cycles                       | 500c<br>1000c     | 0/77<br>0/77               | Post preconditioning level1<br>WP-Cpk= 1.67, BS-Cpk=1.89                                      |
|                     |                                       | HAST after Thermal Shocks            | 96h               | 0/77                       | Post preconditioning level1                                                                   |
|                     |                                       | Moisture sensitivity JESD20 – level1 | CSAM<br>Elect     | 0/11<br>0/231              |                                                                                               |
|                     |                                       | High Temperature Storage 165°C       | 500h<br>1000h     | 0/77<br>0/77               |                                                                                               |
|                     |                                       |                                      |                   |                            |                                                                                               |



Additional assembly qualification reports are available under the following references:

- ASE Chung Li : QR0813 (2002/09/23)
- CHIPPAC China : QR0726 (2002/05/13)

### 8.1.3 Device Qualification

Device qualification is based upon HTOL results of 3 lots as detailed in the table below:

| Lot                 | Device Type                           | Test Description                     | Step          | Result         | Comment |
|---------------------|---------------------------------------|--------------------------------------|---------------|----------------|---------|
| Z40807C             | TSS463B<br>SO-L.300 16<br>AMKOR K     | EFR Dynamic Life Test<br>140°C/5.75v | 48h           | 0/774          |         |
|                     |                                       | LFR Life Test<br>140°C/5.75v         | 500h<br>1000h | 0/77<br>0/77   |         |
|                     |                                       |                                      |               |                |         |
| Z41393J             | TSS461E<br>SO-L.300 24<br>AMKOR K     | EFR Dynamic Life Test<br>140°C/5.75v | 48h           | 0/795          |         |
|                     |                                       | LFR Life Test<br>140°C/5.75v         | 500h<br>1000h | 0/77<br>0/77   |         |
|                     |                                       |                                      |               |                |         |
| Z45925A<br>(Note 1) | TSS463B rev4<br>SO-L.300 16<br>ASE CL | EFR Dynamic Life Test<br>140°C/5.75v | 48h           | 0/800          |         |
|                     |                                       | LFR Life Test<br>140°C/5.75v         | 500h<br>1000h | 0/100<br>0/100 |         |
|                     |                                       |                                      |               |                |         |

Note 1:

In this revision of the TSS463B PPAP, are reported the reliability results of the final production version of the circuit (Rev 4 design). The measurements have been carried out on lot Z45925A DC0327.

### 8.1.4 Failure Mechanisms and Corrective Actions

No failure mechanism reported in this document.

The table here below presents additional Reliability Monitor Data performed during the first quarter of 2003.

| Lot     | Device Type                        | Test Description                        | Step          | Result        | Comment                                           |
|---------|------------------------------------|-----------------------------------------|---------------|---------------|---------------------------------------------------|
| Z44574F | TSSIO16E<br>SO-L.300 28<br>AMKOR K | EFR Dynamic Life Test<br>140°C/5.75v    | 48h           | 0/300         |                                                   |
|         |                                    | LFR Life Test<br>140°C/5.75v            | 500h<br>1000h | 0/77<br>0/77  |                                                   |
|         |                                    | Moisture sensitivity<br>JESD20 – level1 | CSAM<br>Elect | 0/11<br>0/150 |                                                   |
|         |                                    | 85/85 Humidity                          | 500h<br>1000h | 0/50          | Post preconditioning level1<br>(Test in progress) |
|         |                                    | Thermal Cycles                          | 500c<br>1000c | 0/50<br>0/50  | Post preconditioning level1                       |
|         |                                    | Autoclave post Thermal<br>Shocks        | 96h           | 0/50          | Post preconditioning level1                       |
|         |                                    |                                         |               |               |                                                   |



### 8.1.5 Electrical Distribution in Operating Life-Test

In order to assess the drift of product performance under HTOL stress 30 parts have been submitted to 1000 hours 140°C/5.75V aging. All specified AC and DC Parameters have been recorded prior (initial) and post stress (final) for the lot Z41521. The table below summarizes the results with total drift ratio and final Cpk.

No significant drift noticed after HTOL aging. Final Cpk values are higher than 1.33.

HTOL performance records for the rev 4 design (lot Z45925A) have been included in the table as well. The records do not indicate any change in the performance of the circuit.

| Symbol    | Parameter            | Specification | Vcc (*) | Typical | Initial | Final | Drift (%) | Cpk  | Z45925A |
|-----------|----------------------|---------------|---------|---------|---------|-------|-----------|------|---------|
| ICCSB     | Static Consumption   | 50uA max      | 5.5V    | 0.050   | 0.049   | 0.046 | -6.1      | >20  | 0.051   |
| ICCOP     | Active Consumption   | 9 mA max      | 5.5V    | 2.20    | 2.23    | 2.25  | 0.9       | >20  | 2.24    |
| VIL CMOS  | Input Low Level      | 1.5V min      | 4.5V    | 1.51    | 1.51    | 1.54  | 2.0       | 1.6  | 1.63    |
| VIL1      | XTAL 1 Low Level     | 1.5V min      | 4.5V    | 1.66    | 1.70    | 1.69  | 0.6       | 3.4  | 1.70    |
| VIH CMOS  | Input High Level     | 3.5V max      | 5.5V    | 3.16    | 3.12    | 3.23  | 3.5       | 1.5  | 3.11    |
| VIH1      | XTAL 1 In High Level | 3.5V max      | 5.5V    | 3.15    | 3.11    | 3.21  | 3.2       | 1.6  | 3.10    |
| VOL TXD   | TXD Out Low Level    | 0.4V max      | 4.5V    | 0.22    | 0.21    | 0.23  | 9.5       | 10.2 | 0.23    |
| VOL INTB  | INTB Out Low Level   | 0.4V max      | 4.5V    | 0.22    | 0.21    | 0.23  | 9.5       | 9.3  | 0.24    |
| VOH TXD   | TXD Out High Level   | 2.4V min      | 4.5V    | 4.1     | 4.0     | 4.0   | 0.0       | 3.7  | 4.0     |
| IIL RESET | RESET Low Leakage    | 78.5uA max    | 5.5V    | 20.6    | 21.3    | 22.6  | 6.1       | >20  | 20.8    |
| TCYC      | Cycle Time SPI       | 250ns max     | 4.5V    | 9.3     | 9.3     | 9.4   | 1.1       | >20  | 9.3     |
| TW SCKH   | Clock High Time      | 100ns max     | 4.5V    | 3.41    | 3.41    | 3.47  | 1.8       | >20  | 3.41    |
| TW SCKL   | Clock Low Time       | 100ns max     | 4.5V    | 5.9     | 5.9     | 5.9   | 0.0       | >20  | 5.9     |
| TSU       | Data Setup Time      | 40ns max      | 4.5V    | 0.80    | 0.80    | 0.86  | 7.5       | >20  | 0.79    |
| TH        | Data Hold Time       | 40ns max      | 5.5V    | -0.52   | -0.52   | .052  | 0.0       | >20  | -0.52   |
| TV        | Enable to Data Valid | 60ns max      | 4.5V    | 30.1    | 32.6    | 31.5  | -3.4      | 7.5  | 31.6    |



### 8.1.6 Reliability Calculation

Reliability calculation requires a large base of measurement data in prospect of targeting the objectives of Automotive Market. Therefore the data source is enlarged to 2003 records of digital 0.5um Nantes products.

|                     | Sample size | Failures | Failure Rate | Projected Failure Rate | Unit |
|---------------------|-------------|----------|--------------|------------------------|------|
| Early Life Failures | 1.9E6       | 7        | 4            | 3                      | PPM  |
| Latent Failures     | 2880E3      | 0        | 2            | 1                      | FIT  |

### 8.1.7 ESD Results (HBM) - MIL-STD 883 method 3015.7

| Lot     | Device Type                       | Test Description | Step                    | Result            | Comment                                            |
|---------|-----------------------------------|------------------|-------------------------|-------------------|----------------------------------------------------|
| Z40807C | TSS463B<br>SO-L.300 16<br>AMKOR K | ESD HBM          | 2000v<br>3000v<br>4000v | 0/3<br>0/3<br>0/3 | Class 3 of MIL STD 883<br>Method 3015<br>(ESD0113) |

### 8.1.8 Latch-up Results

| Lot     | Device Type                       | Test Description                            | Step        | Result     | Comment                                      |
|---------|-----------------------------------|---------------------------------------------|-------------|------------|----------------------------------------------|
| Z40807C | TSS463B<br>SO-L.300 16<br>AMKOR K | LATCH-UP<br>Power Injection<br>Over voltage | 50mw<br>10v | 0/5<br>0/5 | Latch-up free<br>(min value: 180mW at 125°C) |

## 8.2 Product Characterization

### 8.2.1 Characterization environment

**Tester:** Sentry 15  
**Lot:** Z43525  
**Process:** Z92  
**Perso Code:** ORD7 (design Rev 4)  
**Assy package:** TE (SO-L.300 16 leads)

### 8.2.2 Corner lot's splits

In order to characterize the product with the maximum excursion of the process, corner run splits have been manufactured using :



- Variations on LeffP and LeffN
- Variations on VTP and VTN

The sample size is 3 parts per corner plus 6 parts in the group of typical values (Total 21 parts).

## 8.2.3 Results / Parameter capability

All specified AC and DC Parameters have been characterized for Rev 4 design version. They present Cpk values higher than 1.6. The comparison of Rev 1 and Rev 4 characteristics does not point out any difference.

Characterization results have been submitted to a detailed customer review (TSS463B Test Review) held in Nantes on 27/11/2001.

The next table provides the main product characteristics based upon Mask 6046 Rev 4 evaluation results.

All TSS463B AC parameters are reported in this table.

| Symbol    | Parameter            | Specification (1) | Vcc (*) | Temp (*) | Average | Cpk  |
|-----------|----------------------|-------------------|---------|----------|---------|------|
| ICCSB     | Static Consumption   | 50uA max          | 5.5V    | 125      | 2.9uA   | 9.6  |
| ICCOP     | Active Consumption   | 9 mA max          | 5.5V    | -40      | 2.7mA   | > 20 |
| VIL CMOS  | Input Low Level      | 1.5V min          | 4.5V    | -40      | 1,6V    | 1.61 |
| VIL1      | XTAL 1 Low Level     | 1.5V min          | 4.5V    | -40      | 1,7V    | 4.0  |
| VIH CMOS  | Input High Level     | 3.5V max          | 5.5V    | -40      | 3.2V    | 5.7  |
| VIH1      | XTAL 1 In High Level | 3.5V max          | 5.5V    | -40      | 3.2V    | 4.7  |
| VOL TXD   | TXD Out Low Level    | 0.4V max          | 4.5V    | 125      | 0.22V   | 18.0 |
| VOL INTB  | INTB Out Low Level   | 0.4V max          | 4.5V    | 125      | 0.23V   | 12.3 |
| VOH TXD   | TXD Out High Level   | 2.4V min          | 4.5V    | 125      | 3.9V    | > 20 |
| IIL RESET | RESET Low Leakage    | 78.5uA max        | 5.5V    | -40      | 26.5uA  | > 20 |
| TCYC      | Cycle Time SPI       | 250ns max         | 4.5V    | 125      | 10ns    | > 20 |
| TW SCKH   | Clock High Time      | 100ns max         | 4.5V    | 125      | 5.5ns   | 14.7 |
| TW SCKL   | Clock Low Time       | 100ns max         | 4.5V    | 125      | 5.9ns   | >20  |
| TSU       | Data Setup Time      | 40ns max          | 4.5V    | 125      | 0.8ns   | >20  |
| TH        | Data Hold Time       | 40ns max          | 5.5V    | -40      | -0.5ns  | >20  |
| TV        | Enable to Data Valid | 60ns max          | 4.5V    | 125      | 36.7ns  | 14.1 |

(\*) worst case condition

## 9 Initial Process Study

### 9.1 SCMOS3 process (Z92G)

Parameters controlled during Electrical Test :

NMOS/PMOS :junction Breakdown Voltage, Threshold voltage, electrical width & length, Thin oxide Breakdown Voltage, Sub-threshold current.

Sheet Resistance : N+, P+, WELL, PolyN, PolyP, Unsalicided Poly

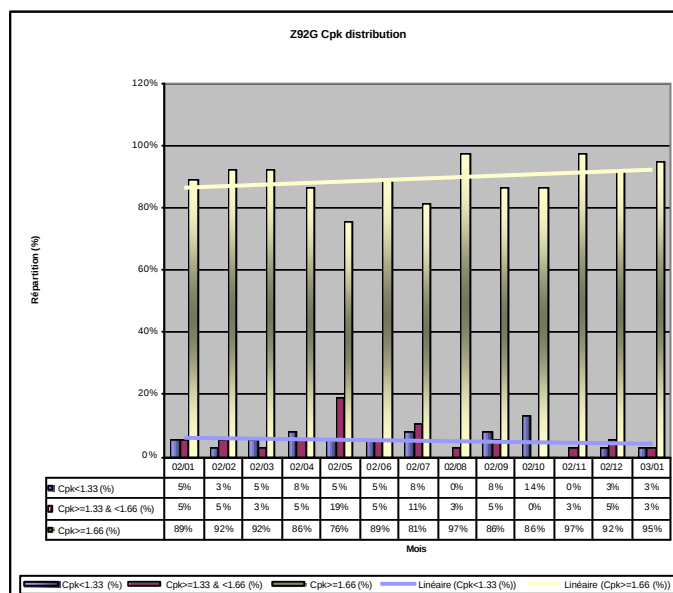
Metal continuity / isolation: metal1, metal2, metal3

Contacts/ Vias1 & Vias2 resistance

Contacts Breakdown Voltage

Salicide isolation

Cpk history (Last update 23/01/2003) :



## 10 Measurement System Analysis Study

Repeatability and Reproducibility tests are performed on all the manufacturing equipments.

Critical parameters and equipments are followed under SPC system. In addition Equipment performance is assessed by GRR and through regular maintenance activity.



## 11 Qualified Laboratory Documentation

### Internal Lab – COMPLIANT QS-9000 3<sup>rd</sup> edition

|                         | Scope                                                                               |
|-------------------------|-------------------------------------------------------------------------------------|
| Application Lab         | Check the functionality of products to customer applications                        |
| Calibration Lab         | Standard Gage Calibration                                                           |
| Characterization Lab    | Product and process characterization before completing industrialization            |
| Chemical Lab            | Incoming inspection on chemical products and process monitoring on DI water , gases |
| Environmental Lab       | Product Reliability Testing                                                         |
| Technology Analysis Lab | Failure Analysis and Yield enhancement                                              |

## 12 Control Plan

Control plan is composed of the following:

- Wafer fab Control Plan for Z92G process
- Assembly Control Plan
- Test Control Plan

Front-end and Back-end operation control plans may be consulted in Atmel Nantes upon request.

Test Control Plan:

| <div></div> <div>CONTROL PLAN</div> |                                    |                   |                                   |                     |                 |         |                    |                                  |                                           |     |       |                                  |  |  |  |                                                 |               |                             |  |                                             |  |  |  |  |
|------------------------------------------------------------------------------------------------------------------------|------------------------------------|-------------------|-----------------------------------|---------------------|-----------------|---------|--------------------|----------------------------------|-------------------------------------------|-----|-------|----------------------------------|--|--|--|-------------------------------------------------|---------------|-----------------------------|--|---------------------------------------------|--|--|--|--|
| Prototype :                                                                                                            |                                    | Pre-launch :      |                                   | Production :        |                 | X       |                    | Key Contacts /Phone :            |                                           |     |       | P.LECUIER                        |  |  |  | Date (Orig.) :<br>24/03/2003                    |               | Date (Rev.) :<br>24/03/2003 |  |                                             |  |  |  |  |
| Control Plan Number                                                                                                    |                                    | TSS463B_TEST_FLOW |                                   |                     |                 |         |                    |                                  |                                           |     |       |                                  |  |  |  |                                                 |               |                             |  |                                             |  |  |  |  |
| Part Number /Latest Change Level                                                                                       |                                    |                   |                                   |                     |                 |         |                    | Core team : VANUATU / G.COIGNARD |                                           |     |       |                                  |  |  |  | Customer Engineering Approval /Date ( if req'd) |               |                             |  |                                             |  |  |  |  |
| Part Name /Description : VAN DATALINK CONTROLLER WITH SERIAL INTERFACE                                                 |                                    |                   |                                   |                     |                 |         |                    | Supplier /Plant Approval /Date   |                                           |     |       |                                  |  |  |  | ECN and TRB approval                            |               |                             |  | Customer Quality Approval /Date ( if req'd) |  |  |  |  |
| Supplier /Plant : ATMEL MCU NANTES                                                                                     |                                    |                   |                                   | Supplier Code : RD7 |                 |         |                    | Other Approval/Date ( if req'd)  |                                           |     |       |                                  |  |  |  | Other Approval/Date ( if req'd)                 |               |                             |  |                                             |  |  |  |  |
| Part Process Number                                                                                                    | Process name/operation description |                   | Machine, device,jig,tools for Mfg |                     | Characteristics |         |                    | Special characteristics          | Methods                                   |     |       |                                  |  |  |  |                                                 | Reaction Plan |                             |  |                                             |  |  |  |  |
|                                                                                                                        |                                    |                   |                                   |                     | N°              | Product | Process            |                                  | Product/ Process Specification/ Tolerance |     |       | Evaluation Measurement Technique |  |  |  | Sample                                          |               | Control Method              |  |                                             |  |  |  |  |
|                                                                                                                        |                                    |                   |                                   |                     |                 |         |                    |                                  | Min                                       | Max | Unit  |                                  |  |  |  | Size                                            | Freq          |                             |  |                                             |  |  |  |  |
| 1                                                                                                                      | E-TEST                             |                   | KLA                               |                     | 360             | KERF    | PERFORMANCE        | Y                                | 0                                         | 2   | SPEC  | PROCESS TEST MODULE MEASUREMENT  |  |  |  | 5 x 5                                           | 100%          | SPC                         |  | PAC                                         |  |  |  |  |
| 2                                                                                                                      | PROBE                              |                   | NEXTTEST MAVERICK                 |                     | 890C            | WAFER   | SORTING            | N                                | -                                         | 0   | SPEC  | 125°C DICE PROBING               |  |  |  | 100%                                            | 100%          | Go / Nogo                   |  | PAC                                         |  |  |  |  |
| 3                                                                                                                      | WAFER SORT                         |                   | POST PROBING YIELD VERIFICATION   |                     | IFA             | WAFER   | OUTLIERS SCREENING | N                                | -3 STD                                    | -   | avg Y | YIELD RECORDS VERIFICATION       |  |  |  | 100%                                            | 100%          | Go / Nogo                   |  | PAC                                         |  |  |  |  |
| 4                                                                                                                      | FINAL TEST                         |                   | NEXTTEST MAVERICK                 |                     | 6000            | FG      | SORTING            | N                                | -                                         | 0   | SPEC  | 25°C FINAL TESTING               |  |  |  | 100%                                            | 100%          | Go / Nogo                   |  | SSTQA                                       |  |  |  |  |
| 5                                                                                                                      | QA GATE                            |                   | NEXTTEST MAVERICK                 |                     | 6800            | FG      | CONTROL            | N                                | -                                         | 0   | SPEC  | 125°C ELECTRICAL CONTROL         |  |  |  | 200p                                            | 100%          | AQL = 0,065                 |  | SSTQA                                       |  |  |  |  |
| 6                                                                                                                      | T&R INSPECTION                     |                   | STS65                             |                     | 8000            | FG      | VISUAL EXAMINATION | N                                | -                                         | 4   | mls   | COPLANARITY AUTOMATIC INSPECTION |  |  |  | 100%                                            | 100%          | Go / Nogo                   |  | SSTQA                                       |  |  |  |  |



## 13 Part Submission Warrant

|                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                             |                                                                                                                        |             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------|-------------|
| Part Name <b>TSS463B</b>                                                                                                                                                                                                                                                                                                                                                                                                             |                                             | Part Number <b>TSS463B-ITERA</b>                                                                                       |             |
| Safety and/or Government Regulation <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No                                                                                                                                                                                                                                                                                                                              |                                             | Engineering Drawing Change Level _____                                                                                 | Dated _____ |
| Additional Engineering Changes _____                                                                                                                                                                                                                                                                                                                                                                                                 |                                             |                                                                                                                        | Dated _____ |
| Shown on Drawing No. _____                                                                                                                                                                                                                                                                                                                                                                                                           | Purchase Order No. _____                    | Weight _____                                                                                                           | kg          |
| Checking Aid No. _____                                                                                                                                                                                                                                                                                                                                                                                                               | Engineering Change Level _____              |                                                                                                                        | Dated _____ |
| <b>SUPPLIER MANUFACTURING INFORMATION</b>                                                                                                                                                                                                                                                                                                                                                                                            |                                             | <b>SUBMISSION INFORMATION</b>                                                                                          |             |
| Supplier Name <b>ATMEL Nantes SA</b>                                                                                                                                                                                                                                                                                                                                                                                                 |                                             | <input type="checkbox"/> Dimensional <input type="checkbox"/> Materials/Functional <input type="checkbox"/> Appearance |             |
| Supplier Code _____                                                                                                                                                                                                                                                                                                                                                                                                                  |                                             | Customer Name/Division _____                                                                                           |             |
| Street Address <b>La Chantrerie Route de Gachet BP 70602</b>                                                                                                                                                                                                                                                                                                                                                                         |                                             | Buyer/Buyer Code _____                                                                                                 |             |
| City/State/Postal Code <b>44306 Nantes Cedex 3 FRANCE</b>                                                                                                                                                                                                                                                                                                                                                                            |                                             | Application _____                                                                                                      |             |
| <b>REASON FOR SUBMISSION</b>                                                                                                                                                                                                                                                                                                                                                                                                         |                                             |                                                                                                                        |             |
| <input type="checkbox"/> Initial Submission                                                                                                                                                                                                                                                                                                                                                                                          |                                             | <input type="checkbox"/> Change to Optional Construction or Material                                                   |             |
| <input checked="" type="checkbox"/> Engineering Change(s)                                                                                                                                                                                                                                                                                                                                                                            |                                             | <input type="checkbox"/> Sub-Supplier or Material Source Change                                                        |             |
| <input type="checkbox"/> Tooling: Transfer, Replacement, Refurbishment, or additional                                                                                                                                                                                                                                                                                                                                                |                                             | <input type="checkbox"/> Change in Part Processing                                                                     |             |
| <input type="checkbox"/> Correction of Discrepancy                                                                                                                                                                                                                                                                                                                                                                                   |                                             | <input type="checkbox"/> Parts Produced at Additional Location                                                         |             |
| <input type="checkbox"/> Other - please specify _____                                                                                                                                                                                                                                                                                                                                                                                |                                             |                                                                                                                        |             |
| <b>REQUESTED SUBMISSION LEVEL (Check one)</b>                                                                                                                                                                                                                                                                                                                                                                                        |                                             |                                                                                                                        |             |
| <input type="checkbox"/> Level 1 - Warrant, Appearance Approval Report (for designated appearance items only).                                                                                                                                                                                                                                                                                                                       |                                             |                                                                                                                        |             |
| <input type="checkbox"/> Level 2 - Warrant, Parts, Drawings, Inspection Results, Laboratory and Functional Results, Appearance Approval Report.                                                                                                                                                                                                                                                                                      |                                             |                                                                                                                        |             |
| <input checked="" type="checkbox"/> Level 3 - At Customer Location - Warrant, Parts, Drawings, Inspection Results, Laboratory and Functional Results, Appearance Approval Report, Process Capability Results, Capability Study, Process Control Plan, Gage Study, FMEA.                                                                                                                                                              |                                             |                                                                                                                        |             |
| <input type="checkbox"/> Level 4 - Per Level 3, but without parts.                                                                                                                                                                                                                                                                                                                                                                   |                                             |                                                                                                                        |             |
| <input type="checkbox"/> Level 5 - At Supplier Location - Warrant, Parts, Drawings, Inspection Results, Laboratory and Functional Results, Appearance Approval Report, Process Capability Results, Capability Study, Process Control Plan, Gage Study, FMEA.                                                                                                                                                                         |                                             |                                                                                                                        |             |
| <b>SUBMISSION RESULTS</b>                                                                                                                                                                                                                                                                                                                                                                                                            |                                             |                                                                                                                        |             |
| The results for <input checked="" type="checkbox"/> dimensional measurements <input checked="" type="checkbox"/> material and functional tests and <input checked="" type="checkbox"/> appearance criteria and <input checked="" type="checkbox"/> statistical process package meet all drawing and specification requirements: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No (If "No" - Explanation Required) |                                             |                                                                                                                        |             |
| <b>DECLARATION</b>                                                                                                                                                                                                                                                                                                                                                                                                                   |                                             |                                                                                                                        |             |
| I affirm that the samples represented by this warrant are representative of our parts and have been made to the applicable customer drawings and specifications and in the case of production samples, are made from specified materials on regular production tooling with no operations other than the regular production process. I have noted any deviations from this declaration below:                                        |                                             |                                                                                                                        |             |
| EXPLANATION/COMMENTS:                                                                                                                                                                                                                                                                                                                                                                                                                |                                             |                                                                                                                        |             |
| Print Name <b>Pascal LECUYER</b>                                                                                                                                                                                                                                                                                                                                                                                                     | Title <b>Products Qualification Manager</b> | Phone No. <b>33 2 4018 1773</b>                                                                                        |             |
| Supplier Authorized Signature _____                                                                                                                                                                                                                                                                                                                                                                                                  |                                             | Date _____                                                                                                             |             |
| <b>FOR CUSTOMER USE ONLY</b>                                                                                                                                                                                                                                                                                                                                                                                                         |                                             |                                                                                                                        |             |
| Part Disposition <input type="checkbox"/> Approved <input type="checkbox"/> Rejected <input type="checkbox"/> Other _____                                                                                                                                                                                                                                                                                                            |                                             |                                                                                                                        |             |
| Customer Name _____                                                                                                                                                                                                                                                                                                                                                                                                                  | Customer Signature _____                    | Date _____                                                                                                             |             |



## **14 Appearance Approval Report**

Not Applicable for IC

## **15 Bulk Material Requirements**

Not Applicable for IC

## **16 Sample Production Parts**

Not attached, delivered previously

## **17 Master Sample**

Not attached.

## **18 Checking Aids**

Not applicable

## **19 Customer-Specific Requirements**

Not attached.