| **PCN Number:** | 20171220001 | **PCN Date:** | Jan. 5, 2018 |
|---|---|---|---|
| **Title:** | Roadster family Leadframe change to roughened | | |
| **Customer Contact:** | PCN Manager | **Dept:** | Quality Services |
| **Proposed 1st Ship Date:** | July 5, 2018 | **Estimated Sample Availability:** | Date provided at sample request |

**Change Type:**

| | | | | | |
|---|---|---|---|---|---|
| ☐ | Assembly Site | ☐ | Design | ☐ | Wafer Bump Site |
| ☐ | Assembly Process | ☐ | Data Sheet | ☐ | Wafer Bump Material |
| ☒ | Assembly Materials | ☐ | Part number change | ☐ | Wafer Bump Process |
| ☐ | Mechanical Specification | ☐ | Test Site | ☐ | Wafer Fab Site |
| ☐ | Packing/Shipping/Labeling | ☐ | Test Process | ☐ | Wafer Fab Materials |
| | | | | ☐ | Wafer Fab Process |

## PCN Details

**Description of Change:**

Texas Instruments Incorporated is announcing the qualification of a new Leadframe for the Roadster family of devices. The change is from non-roughened Leadframe to single-side roughened leadframe.

| Material | Current | New |
|---|---|---|
| Leadframe | #4221093-0001 non-roughened | #4221093-0002 single-side roughened |

**Reason for Change:**

Improvement of reliability.

**Anticipated impact on Fit, Form, Function, Quality or Reliability (positive / negative):**

None.

**Changes to product identification resulting from this PCN:**

None.

**Product Affected:**

| | |
|---|---|
| LM536023QPWPRQ1 | LM536033QPWPRQ1 |
| LM536023QPWPTQ1 | LM536033QPWPTQ1 |
| LM536025QPWPRQ1 | LM536035QPWPRQ1 |
| LM536025QPWPTQ1 | LM536035QPWPTQ1 |
| LM53602AQPWPRQ1 | LM53603AQPWPRQ1 |
| LM53602AQPWPTQ1 | LM53603AQPWPTQ1 |

TI Information
Selective Disclosure

# Automotive New Product Qualification Summary

(As per AEC-Q100 and JEDEC Guidelines)

## LM53603BQPWPTDN - die revision C2

**Approved 24-Aug-2017**

Updated 11/06/2017-Added QBS Data

**Product Attributes**

| Attributes | Qual Device: LM53603BQPWPDN | QBS Product Reference: LM53603BQPWPDN | QBS Product Reference: LM53603QPWPQ1 | QBS Process Reference: LM43603QPWPQ1 |
|---|---|---|---|---|
| **Automotive Grade Level** | Grade 1 | Grade 1 | Grade 1 | Grade 1 |
| **Operating Temp Range** | -40 to +125 C | -40 to +125 C | -40 to +125 C | -40 to +125 C |
| **Product Function** | Power Management | Power Management | Power Management | Power Management |
| **Wafer Fab Supplier** | DM5-DALLAS | DM5-DALLAS | DM5-DALLAS | DMOS5 |
| **Die Revision** | C2 | C1 | B3 | C1 |
| **Assembly Site** | TAI / TITL | TAI / TITL | TAI / TITL | TAI / TITL |
| **Package Type** | HTSSOP | HTSSOP | HTSSOP | HTSSOP |
| **Package Designator** | PWP | PWP | PWP | PWP |
| **Ball/Lead Count** | 16 | 16 | 16 | 16 |

- QBS: Qual By Similarity
- Qual Device LM53603BQPWPDN is qualified at LEVEL3-260C

## Qualification Results

Data Displayed as: Number of lots / Total sample size / Total failed

| Type | # | Test Spec | Min Lot Qty | SS/ Lot | Test Name / Condition | Duration | Qual Device: LM53603BQPWPDN | QBS Product Reference: LM53603BQPWPDN | QBS Product Reference: LM53603QPWPQ1 | QBS Process Reference: LM43603QPWPQ1 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Test Group A – Accelerated Environment Stress Tests** | | | | | | | | | | |
| PC | A1 | JEDEC J-STD-020 JESD22-A113 | 3 | 77 | Preconditioning | Level 3-260C | - | 3/693/0 | - | 3/969/0 |
| HAST | A2 | JEDEC JESD22-A110 | 3 | 77 | Biased HAST, 110C/85%RH | 264 Hours | - | - | - | 3/231/0 |
| HAST | A2 | JEDEC JESD22-A110 | 3 | 77 | Biased HAST, 130C/85%RH | 96 Hours | - | 3/231/2 [a] | - | - |
| AC | A3 | JEDEC JESD22-A102 | 3 | 77 | Autoclave 121C | 96 Hours | - | 3/231/0 | - | 3/231/0 |
| TC | A4 | JEDEC JESD22-A104 and Appendix 3 | 3 | 77 | Temperature Cycle, -65/150C | 500 Cycles | - | 3/231/0 | - | 2/154/0 |
| TC-BP | A4 | MIL-STD883 Method 2011 | 3 | 30 | Post Temp. Cycle Bond Pull | Cpk >1.67 | - | 1/5/0 | - | 1/10/0 |
| PTC | A5 | JEDEC JESD22-A105 | 1 | 45 | Power Temperature Cycle | 10000 Cycles | - | - | - | 3/231/0 |
| PTC | A5 | JEDEC JESD22-A105 | 1 | 45 | Power Temperature Cycle, -40/125C | 1000 Cycles | - | 1/45/0 | - | 1/45/0 |
| HTSL | A6 | JEDEC JESD22-A103 | 1 | 45 | High Temp. Storage Bake, 150C | 1000 Hours | - | 1/77/0 | - | - |
| **Test Group B – Accelerated Lifetime Simulation Tests** | | | | | | | | | | |
| HTOL | B1 | JEDEC JESD22-A108 | 3 | 77 | Life Test, 150C | 408 Hours | 1/77/0 | - | 1/77/0 | 3/231/1 [b] |
| ELFR | B2 | AEC Q100- | 3 | 800 | Early Life Failure Rate, | 24 Hours | - | - | - | 3/2400/4 [b] |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 008 | | | 150C | | | | | |
| EDR | B3 | AEC Q100-005 | 3 | 77 | NVM Endurance, Data Retention, and Operational Life | 150C x 1000 hours | - | - | - | 3/231/0 |
| **Test Group C – Package Assembly Integrity Tests** | | | | | | | | | | |
| WBS | C1 | AEC Q100-001 | 1 | 30 | Bond Shear (Cpk>1.67) | Wires | - | Pass | - | - |
| WBP | C2 | MIL-STD883 Method 2011 | 1 | 30 | Bond Pull (Cpk>1.67) | Wires | - | Pass | - | - |
| SD | C3 | JEDEC JESD22-B102 | 1 | 15 | Solderability (>95% Lead Coverage) | Pb-Free | - | Pass | - | - |
| PD | C4 | JEDEC JESD22-B100 and B108 | 3 | 10 | Physical Dimensions (Cpk>1.33 Ppk>1.67) | -- | - | Pass | - | - |
| PD | C4 | JEDEC JESD22-B100 and B108 | 3 | 10 | Physical Dimensions (Cpk>1.67) | -- | - | Pass | - | - |
| **Test Group D – Die Fabrication Reliability Tests** | | | | | | | | | | |
| EM | D1 | JESD61 | - | - | Electro migration | -- | Completed Per Process Technology Requirements | - | - | - |
| TDDB | D2 | JESD35 | - | - | Time Dependent Dielectric Breakdown | -- | Completed Per Process Technology Requirements | - | - | - |
| HCI | D3 | JESD60 & 28 | - | - | Hot Injection Carrier | -- | Completed Per Process Technology Requirements | - | - | - |
| NBTI | D4 | - | - | - | Negative Bias Temperature Instability | -- | Completed Per Process Technology Requirements | - | - | - |
| SM | D5 | - | - | - | Stress Migration | -- | Completed Per Process Technology Requirements | - | - | - |
| **Test Group E – Electrical Verification Tests** | | | | | | | | | | |
| HBM | E2 | AEC Q100-002 | 1 | 3 | ESD – HBM | 2500 V | 1/3/0 | - | 1/3/0 | 1/3/0 |
| CDM | E3 | AEC Q100-011 | 1 | 3 | ESD - CDM | 1000 V | 1/3/0 | - | 1/3/0 | 1/3/0 |
| LU | E4 | AEC Q100-004 | 1 | 6 | Latch-up | (Per AEC Q100-004) | 1/6/0 | - | 1/6/0 | 1/6/0 |
| ED | E5 | AEC Q100-009 | 3 | 30 | Electrical Distributions | Cpk>1.67 Room, Hot, & Cold | Pass | Pass | Pass | Pass |

**Reject dispositioning**

**[a]** 2 EOS failures were due to a failure in the BHAST hardware. This was discounted as not being related to the product reliability

**[b]** 5 failures due to inadvertent electrical overstress of an ESD protection diode between the EN & VIN pins. Root cause was incorrect HTOL hardware configuration where EN pin could be more positive than VIN during operational life test. This condition would turn on the ESD protection circuit during HTOL leading to burn out of the circuit. EN > VIN is an invalid datasheet condition.

**A1 (PC): Preconditioning:**
Performed for THB, Biased HAST, AC, uHAST &TC samples, as applicable.
**Ambient Operating Temperature by Automotive Grade Level:**
Grade 0 (or E): -40°C to +150°C
Grade 1 (or Q): -40°C to +125°C
Grade 2 (or T): -40°C to +105°C
Grade 3 (or I) : -40°C to +85°C
**E1 (TEST): Electrical test temperatures of Qual samples (High temperature according to Grade level):**
Room/Hot/Cold : HTOL, ED
Room/Hot : THB / HAST, TC / PTC, HTSL, ELFR, ESD & LU
Room : AC/uHAST

**Green/Pb-free Status:**
Qualified Pb-Free(SMT) and Green

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