

| PCN Number: | 20240327001.2 | | PCN Date: | March 28, 2024 | | | | | | | | | | | | | | | | | | | |
|---|---|-------------------------------------|---------------------------------------|-------------------------------------|---------------------|------------------|--|--|---------------------|--|--|------------------|---------|----------------|---------------------|---------|----------------|--------|-------|--------|------|------|--------|
| Title: | Qualification of RFAB using qualified Process Technology, Die Revision, and additional Assembly/Test site options | | | | | | | | | | | | | | | | | | | | | | |
| Customer Contact: | Change Management team | | Dept: | Quality Services | | | | | | | | | | | | | | | | | | | |
| Proposed 1st Ship Date: | September 24, 2024 | | Estimated Sample Availability: | April 27, 2024* | | | | | | | | | | | | | | | | | | | |
| *Sample requests received after April 27, 2024 will not be supported. | | | | | | | | | | | | | | | | | | | | | | | |
| Change Type: | | | | | | | | | | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Assembly Site | <input checked="" type="checkbox"/> | Design | <input type="checkbox"/> | Wafer Bump Material | | | | | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Assembly Process | <input type="checkbox"/> | Data Sheet | <input type="checkbox"/> | Wafer Bump Process | | | | | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Assembly Materials | <input type="checkbox"/> | Part number change | <input checked="" type="checkbox"/> | Wafer Fab Site | | | | | | | | | | | | | | | | | | |
| <input type="checkbox"/> | Mechanical Specification | <input checked="" type="checkbox"/> | Test Site | <input checked="" type="checkbox"/> | Wafer Fab Materials | | | | | | | | | | | | | | | | | | |
| <input checked="" type="checkbox"/> | Packing/Shipping/Labeling | <input type="checkbox"/> | Test Process | <input checked="" type="checkbox"/> | Wafer Fab Process | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
| PCN Details | | | | | | | | | | | | | | | | | | | | | | | |
| Description of Change: | | | | | | | | | | | | | | | | | | | | | | | |
| Texas Instruments is pleased to announce the addition of RFAB using the LBC9 qualified process technology and additional Assembly/Test site (CDAT, TIPI) options for the device listed below. | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1"> <thead> <tr> <th colspan="3">Current Fab Site</th> <th colspan="3">Additional Fab Site</th> </tr> <tr> <th>Current Fab Site</th> <th>Process</th> <th>Wafer Diameter</th> <th>Additional Fab Site</th> <th>Process</th> <th>Wafer Diameter</th> </tr> </thead> <tbody> <tr> <td>DL-LIN</td> <td>LBC3S</td> <td>150 mm</td> <td>RFAB</td> <td>LBC9</td> <td>300 mm</td> </tr> </tbody> </table> | | | | | | Current Fab Site | | | Additional Fab Site | | | Current Fab Site | Process | Wafer Diameter | Additional Fab Site | Process | Wafer Diameter | DL-LIN | LBC3S | 150 mm | RFAB | LBC9 | 300 mm |
| Current Fab Site | | | Additional Fab Site | | | | | | | | | | | | | | | | | | | | |
| Current Fab Site | Process | Wafer Diameter | Additional Fab Site | Process | Wafer Diameter | | | | | | | | | | | | | | | | | | |
| DL-LIN | LBC3S | 150 mm | RFAB | LBC9 | 300 mm | | | | | | | | | | | | | | | | | | |
| The die was also changed as a result of the process change. | | | | | | | | | | | | | | | | | | | | | | | |
| Additionally, there will be a BOM options introduced for these devices: | | | | | | | | | | | | | | | | | | | | | | | |
| Group 1 Device BOM table: | | | | | | | | | | | | | | | | | | | | | | | |
| | TIPI (Current) | | TIPI (New) | | CDAT | | | | | | | | | | | | | | | | | | |
| Bond wire composition, diameter | 1.0 mil Cu | | 0.8 mil Cu | | 0.8mil Cu | | | | | | | | | | | | | | | | | | |
| Pin 1 Marking | Stripe | | Dot | | Dot | | | | | | | | | | | | | | | | | | |
| Lead finish | NiPdAu | | NiPdAu or Matte Sn | | Matte Sn | | | | | | | | | | | | | | | | | | |
| Final Wafer Thickness | 267 um | | 152um | | 152um | | | | | | | | | | | | | | | | | | |
| Final Test site | TIPI | | TIPI | | CDAT | | | | | | | | | | | | | | | | | | |
| Probe Site | DL-MOS-4 | | CD-PR | | CD-PR | | | | | | | | | | | | | | | | | | |
| Group 2 Device BOM table: | | | | | | | | | | | | | | | | | | | | | | | |
| | LEN | TIPI | | CDAT | | | | | | | | | | | | | | | | | | | |
| Bond wire composition, diameter | 1.0mil Au | 0.8 mil Cu | | 0.8mil Cu | | | | | | | | | | | | | | | | | | | |
| Pin 1 Marking | Stripe | dot | | Dot | | | | | | | | | | | | | | | | | | | |
| Lead finish | NiPdAu | NiPdAu or Matte Sn | | Matte Sn | | | | | | | | | | | | | | | | | | | |
| Final Wafer Thickness | 267um | 152 um | | 152um | | | | | | | | | | | | | | | | | | | |
| Final Test site | LEN | TIPI | | CDAT | | | | | | | | | | | | | | | | | | | |
| Probe Site | DL-MOS-4 | CD-PR | | CD-PR | | | | | | | | | | | | | | | | | | | |
| Test coverage, insertions, conditions will remain consistent with current testing. | | | | | | | | | | | | | | | | | | | | | | | |
| Qual details are provided in the Qual Data Section. | | | | | | | | | | | | | | | | | | | | | | | |
| Reason for Change: | | | | | | | | | | | | | | | | | | | | | | | |
| These changes are part of our multiyear plan to transition products from our 150-millimeter factories to newer, more efficient manufacturing processes and technologies, underscoring | | | | | | | | | | | | | | | | | | | | | | | |

| | | | |
|---|---|---|---|
| our commitment to product longevity and supply continuity. | | | |
| Anticipated impact on Form, Fit, Function, Quality or Reliability (positive / negative): | | | |
| None | | | |
| Impact on Environmental Ratings: | | | |
| Checked boxes indicate the status of environmental ratings following implementation of this change. If below boxes are checked, there are no changes to the associated environmental ratings. | | | |
| RoHS | REACH | Green Status | IEC 62474 |
| <input checked="" type="checkbox"/> No Change | <input checked="" type="checkbox"/> No Change | <input checked="" type="checkbox"/> No Change | <input checked="" type="checkbox"/> No Change |
| Changes to product identification resulting from this PCN: | | | |
| Fab Site Information: | | | |
| Chip Site | Chip Site Origin Code (20L) | Chip Site Country Code (21L) | Chip Site City |
| DL-LIN | DLN | USA | Dallas |
| RFAB | RFB | USA | Richardson |
| Die Rev: | | | |
| Current | | New | |
| Die Rev [2P] | Die Rev [2P] | | |
| B, A | A | | |
| Assembly/Test Site Information: | | | |
| Assembly Site | Assembly Site Origin (22L) | Assembly Country Code (23L) | Assembly City |
| LEN | LIN | TWN | Taichung |
| TIPI | PHI | PHL | Baguio City |
| CDAT | CDA | CHN | Chengdu |
| Sample product shipping label (not actual product label) | | | |
| | | | |
| Product Affected: | | | |
| Group 1 Device list: | | | |
| SN381WDDBVRQ1 | TPS3813K33QDBVRAL | TPS3813K33QDBVRQ1 | TPS3813I50QDBVRQ1 |
| Group 2 Device list: | | | |
| TPS3813K33QDBVRCT2 | | | |

For alternate parts with similar or improved performance, please visit the product page on [TI.com](https://www.ti.com)

**Automotive Qualification Summary
(As per AEC-Q100 Rev. J and JEDEC Guidelines)**

**TPS3813Q1 Automotive Qualification LBC9-RFAB, DBV6-PHI
Approve Date 01-March-2024**

Product Attributes

| Attributes | Qual Device: <u>TPS3813K33QDBVRQ1</u> | QBS Process Reference: <u>BQ79600PWRQ1</u> | QBS Package, Process, Product Reference: <u>PTPS3840PHXXDBVR</u> |
|--------------------------|--|---|---|
| Automotive Grade Level | Grade 1 | Grade 1 | Grade 1 |
| Operating Temp Range (C) | -40 to 125 | -40 to 125 | -40 to 125 |
| Product Function | Power Management | Power Management | Power Management |
| Wafer Fab Supplier | RFAB | RFAB | RFAB |
| Assembly Site | PHI | MLA | PHI |
| Package Group | SOT | TSSOP | SOT |
| Package Designator | DBV | PW | DBV |
| Pin Count | 6 | 16 | 5 |

- QBS: Qual By Similarity
- Qual Device TPS3813K33QDBVRQ1 is qualified at MSL1 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: <u>TPS3813K33QDBVRQ1</u> | QBS Process Reference: <u>BQ79600PWRQ1</u> | QBS Package, Process, Product Reference: <u>PTPS3840PHXXDBVR</u> |
|--|----|-------------------------------------|-------------|----------|-------------------------------|-------------|------------|--|---|---|
| Test Group A - Accelerated Environment Stress Tests | | | | | | | | | | |
| PC | A1 | JEDEC J-STD-020 JESD22-A113 | 3 | 77 | Preconditioning | MSL1 260C | - | 1/0/0 | - | 3/0/0 |
| PC | A1 | JEDEC J-STD-020 JESD22-A113 | 3 | 77 | Preconditioning | MSL2 260C | - | - | 3/0/0 | - |
| HAST | A2 | JEDEC JESD22-A110 | 3 | 77 | Biased HAST | 130C/85%RH | 96 Hours | - | 3/231/0 | 3/231/0 |
| AC/UHAST | A3 | JEDEC JESD22-A102/JEDEC JESD22-A118 | 3 | 77 | Autoclave | 121C/15psig | 96 Hours | - | 3/231/0 | - |
| AC/UHAST | A3 | JEDEC JESD22-A102/JEDEC JESD22-A118 | 3 | 77 | Unbiased HAST | 130C/85%RH | 96 Hours | 1/77/0 | - | 3/231/0 |
| TC | A4 | JEDEC JESD22-A104 and Appendix 3 | 3 | 77 | Temperature Cycle | -65C/150C | 500 Cycles | 1/77/0 | 3/231/0 | 3/231/0 |
| TC-BP | A4 | MIL-STD883 Method 2011 | 1 | 5 | Post Temp Cycle Bond Pull | - | - | 1/5/0 | - | - |
| HTSL | A6 | JEDEC JESD22-A103 | 1 | 45 | High Temperature Storage Life | 150C | 1000 Hours | 1/77/0 | 3/135/0 | 3/135/0 |

| Type | # | Test Spec | Min Lot Qty | SS / Lot | Test Name | Condition | Duration | Qual Device: <u>TPS3813K33QDBVRQ1</u> | QBS Process Reference: <u>BQ79600PWRQ1</u> | QBS Package, Process, Product Reference: <u>PTPS3840PHXXDBVR</u> |
|--|----|----------------------------|-------------|----------|--|--|------------|---|---|---|
| Test Group B - Accelerated Lifetime Simulation Tests | | | | | | | | | | |
| HTOL | B1 | JEDEC JESD22-A108 | 3 | 77 | Life Test | 125C | 1000 Hours | - | 3/231/0 | 3/231/0 |
| ELFR | B2 | AEC Q100-008 | 3 | 800 | Early Life Failure Rate | 125C | 48 Hours | - | 3/2400/0 | - |
| EDR | B3 | AEC Q100-005 | 1 | 77 | NVM Endurance, Data Retention, and Op Life | Per QSS-009-018 | 1 Step | - | 3/231/0 | - |
| Test Group C - Package Assembly Integrity Tests | | | | | | | | | | |
| WBS | C1 | AEC Q100-001 | 1 | 30 | Wire Bond Shear | Minimum of 5 devices, 30 wires Cpk>1.67 | Wires | 1/30/0 | 3/90/0 | 3/90/0 |
| WBP | C2 | MIL-STD883 Method 2011 | 1 | 30 | Wire Bond Pull | Minimum of 5 devices, 30 wires Cpk>1.67 | Wires | 1/30/0 | 3/90/0 | 3/90/0 |
| SD | C3 | JEDEC J-STD-002 | 1 | 15 | PB Solderability | >95% Lead Coverage | - | - | 1/15/0 | 1/15/0 |
| SD | C3 | JEDEC J-STD-002 | 1 | 15 | PB-Free Solderability | >95% Lead Coverage | - | - | 1/15/0 | 1/15/0 |
| PD | C4 | JEDEC JESD22-B100 and B108 | 3 | 10 | Physical Dimensions | Cpk>1.67 | - | 1/10/0 | 3/30/0 | 3/30/0 |
| Test Group D - Die Fabrication Reliability Tests | | | | | | | | | | |
| EM | D1 | JESD61 | - | - | Electromigration | - | - | Completed Per Process Technology Requirements | Completed Per Process Technology Requirements | Completed Per Process Technology Requirements |

| Type | # | Test Spec | Min Lot Qty | SS / Lot | Test Name | Condition | Duration | Qual Device: <u>TPS3813K33QDBVRQ1</u> | QBS Process Reference: <u>BQ79600PWRQ1</u> | QBS Package, Process, Product Reference: <u>PTPS3840PHXXDBVR</u> |
|--|----|--------------|-------------|----------|-------------------------------------|---------------------------------|------------|---|---|---|
| Tddb | D2 | JESD35 | - | - | Time Dependent Dielectric Breakdown | - | - | Completed Per Process Technology Requirements | Completed Per Process Technology Requirements | Completed Per Process Technology Requirements |
| HCI | D3 | JESD60 & 28 | - | - | Hot Carrier Injection | - | - | Completed Per Process Technology Requirements | Completed Per Process Technology Requirements | Completed Per Process Technology Requirements |
| BTI | D4 | - | - | - | Bias Temperature Instability | - | - | Completed Per Process Technology Requirements | Completed Per Process Technology Requirements | Completed Per Process Technology Requirements |
| SM | D5 | - | - | - | Stress Migration | - | - | Completed Per Process Technology Requirements | Completed Per Process Technology Requirements | Completed Per Process Technology Requirements |
| Test Group E - Electrical Verification Tests | | | | | | | | | | |
| ESD | E2 | AEC Q100-002 | 1 | 3 | ESD HBM | - | 2000 Volts | 1/3/0 | - | 1/3/0 |
| ESD | E3 | AEC Q100-011 | 1 | 3 | ESD CDM | - | 500 Volts | 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 |
| ED | E5 | AEC Q100-009 | 3 | 30 | Electrical Distributions | Cpk>1.67 Room, hot, and cold | - | 3/90/0 | 2/60/0 | 3/90/0 |
| Additional Tests | | | | | | | | | | |

- Preconditioning was performed for Autoclave, Unbiased HAST, THB/Biased HAST, Temperature Cycle, Thermal Shock, and HTSL, as applicable
- The following are equivalent HTOL options based on an activation energy of 0.7eV : 125C/1k Hours, 140C/480 Hours, 150C/300 Hours, and 155C/240 Hours
- The following are equivalent HTSL options based on an activation energy of 0.7eV : 150C/1k Hours, and 170C/420 Hours
- The following are equivalent Temp Cycle options per JESD47 : -55C/125C/700 Cycles and -65C/150C/500 Cycles

Ambient Operating Temperature by Automotive Grade Level:

- Grade 0 (or E): -40C to +150C
- Grade 1 (or Q): -40C to +125C
- Grade 2 (or T): -40C to +105C
- Grade 3 (or I): -40C to +85C

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

Quality and Environmental data is available at TI's external Web site: <http://www.ti.com/>

TI Qualification ID: R-NPD-2301-019

TI Information
Selective Disclosure

**Automotive Qualification Summary
(As per AEC and JEDEC Guidelines)**

**Q006 SOT at PHI
Approve Date 01-March-2024**

| Attributes | Qual Device: | QBS Process Reference: | QBS Package, Process, Product Reference: |
|--------------------------|--------------------------|------------------------|--|
| | <u>TPS3813K33QDBVRQ1</u> | <u>BQ79600PWRQ1</u> | <u>PTPS3840PHXXDBVR</u> |
| Automotive Grade Level | Grade 1 | Grade 1 | Grade 1 |
| Operating Temp Range (C) | -40 to 125 | -40 to 125 | -40 to 125 |
| Product Function | Power Management | Power Management | Power Management |
| Wafer Fab Supplier | RFAB | RFAB | RFAB |
| Assembly Site | PHI | MLA | PHI |
| Package Group | SOT | TSSOP | SOT |
| Package Designator | DBV | PW | DBV |
| Pin Count | 6 | 16 | 5 |

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: TPS3813K33QDBVRQ1 | QBS Reference: BQ79600PWRQ1 | QBS Reference: PTPS3840PHXXDBVR |
|---|--------|-----------------------------|-------------|----------|---------------------------------------|---------------------------|-----------|-----------------------------------|--------------------------------|------------------------------------|
| Test Group A - Accelerated Environment Stress Tests | | | | | | | | | | |
| PC | A1 | JEDEC J-STD-020 JESD22-A113 | 3 | 77 | Preconditioning | MSL1 260C | - | - | - | 3/0/0 |
| PC | A1 | JEDEC J-STD-020 JESD22-A113 | 3 | 77 | Preconditioning | MSL2 260C | - | - | 3/0/0 | - |
| PC | A1.1 | - | 3 | 22 | SAM Precon Pre | Review for delamination | - | - | - | 3/66/0 |
| PC | A1.2 | - | 3 | 22 | SAM Precon Post | Review for delamination | - | - | - | 3/66/0 |
| HAST | A2.1 | JEDEC JESD22-A110 | 3 | 77 | Biased HAST | 130C/85%RH | 96 Hours | - | 3/231/0 | 3/231/0 |
| HAST | A2.1.2 | - | 3 | 1 | Cross Section, post bHAST, 1X | Post stress cross section | Completed | - | - | 3/3/0 |
| HAST | A2.1.3 | - | 3 | 3 | Wire Bond Shear, post bHAST, 1X | Post stress | - | - | - | 3/9/0 |
| HAST | A2.1.4 | - | 3 | 3 | Bond Pull over Stitch, post bHAST, 1X | Post stress | - | - | - | 3/9/0 |
| HAST | A2.1.5 | - | 3 | 3 | Bond Pull over Ball, post bHAST, 1X | Post stress | - | - | - | 3/9/0 |
| HAST | A2.2 | JEDEC JESD22-A110 | 3 | 70 | Biased HAST | 130C/85%RH | 192 Hours | - | 3/210/0 | 3/231/0 |
| HAST | A2.2.1 | - | 3 | 22 | SAM Analysis, post bHAST 2X | Review for delamination | Completed | - | 3/66/0 | 3/66/0 |
| HAST | A2.2.2 | - | 3 | 1 | Cross Section, post bHAST, 2X | Post stress cross section | Completed | - | 3/3/0 | 3/3/0 |

| Type | # | Test Spec | Min Lot Qty | SS / Lot | Test Name | Condition | Duration | Qual Device: TPS3813K33QDBVRQ1 | QBS Reference: BQ79600PWRQ1 | QBS Reference: PTPS3840PHXXDBVR |
|------|--------|----------------------------------|-------------|----------|---------------------------------------|---------------------------|-------------|-----------------------------------|--------------------------------|------------------------------------|
| HAST | A2.2.3 | - | 3 | 3 | Wire Bond Shear, post bHAST, 2X | Post stress | - | - | 3/9/0 | 3/9/0 |
| HAST | A2.2.4 | - | 3 | 3 | Bond Pull over Stitch, post bHAST, 2X | Post stress | - | - | 3/9/0 | 3/9/0 |
| HAST | A2.2.5 | - | 3 | 3 | Bond Pull over Ball, post bHAST, 2X | Post stress | - | - | 3/9/0 | 3/9/0 |
| TC | A4.1 | JEDEC JESD22-A104 and Appendix 3 | 3 | 77 | Temperature Cycle | -65C/150C | 500 Cycles | - | 3/231/0 | 3/231/0 |
| TC | A4.1.1 | - | 3 | 22 | SAM Analysis, post TC 1X | Review for delamination | Completed | - | 3/66/0 | 3/66/0 |
| TC | A4.1.2 | - | 3 | 1 | Cross Section, post TC, 1X | Post stress cross section | Completed | - | - | 3/3/0 |
| TC | A4.1.3 | - | 3 | 3 | Wire Bond Shear, post TC, 1X | Post stress | - | - | - | 3/9/0 |
| TC | A4.1.4 | - | 3 | 3 | Bond Pull over Stitch, post TC, 1X | Post stress | - | - | - | 3/9/0 |
| TC | A4.1.5 | - | 3 | 3 | Bond Pull over Ball, post TC, 1X | Post stress | - | - | - | 3/9/0 |
| TC | A4.2 | JEDEC JESD22-A104 and Appendix 3 | 3 | 70 | Temperature Cycle | -65C/150C | 1000 Cycles | - | 3/210/0 | 3/231/0 |
| TC | A4.2.1 | - | 3 | 22 | SAM Analysis, post TC, 2X | Review for delamination | Completed | - | 3/66/0 | 3/66/0 |
| TC | A4.2.2 | - | 3 | 1 | Cross Section, post TC, 2X | Post stress cross section | Completed | - | 3/3/0 | 3/3/0 |

| Type | # | Test Spec | Min Lot Qty | SS / Lot | Test Name | Condition | Duration | Qual Device: TPS3813K33QDBVRQ1 | QBS Reference: BQ79600PWRQ1 | QBS Reference: PTPS3840PHXXDBVR |
|---|--------|------------------------|-------------|----------|------------------------------------|---|------------|-----------------------------------|--------------------------------|------------------------------------|
| TC | A4.2.3 | - | 3 | 3 | Wire Bond Shear, post TC, 2X | Post stress | - | - | 3/9/0 | 3/9/0 |
| TC | A4.2.4 | - | 3 | 3 | Bond Pull over Stitch, post TC, 2X | Post stress | - | - | 3/9/0 | 3/9/0 |
| TC | A4.2.5 | - | 3 | 3 | Bond Pull over Ball, post TC, 2X | Post stress | - | - | 3/9/0 | 3/9/0 |
| HTSL | A6.1 | JEDEC JESD22-A103 | 3 | 45 | High Temperature Storage Life | 150C | 1000 Hours | - | 3/135/0 | 3/135/0 |
| HTSL | A6.1.1 | - | 3 | 1 | Cross Section, post HTSL, 1X | Post stress cross section | Completed | - | - | 3/3/0 |
| HTSL | A6.2 | JEDEC JESD22-A103 | 3 | 44 | High Temperature Storage Life | 150C | 2000 Hours | - | 3/132/0 | 3/135/0 |
| HTSL | A6.2.1 | - | 3 | 1 | Cross Section, post HTSL, 2X | Post stress cross section | Completed | - | 3/3/0 | 3/3/0 |
| Test Group C - Package Assembly Integrity Tests | | | | | | | | | | |
| WBS | C1 | AEC Q100-001 | 1 | 30 | Wire Bond Shear | Minimum of 5 devices, 30 wires Cpk>1.67 | Wires | 1/30/0 | 3/90/0 | 3/90/0 |
| WBP | C2 | MIL-STD883 Method 2011 | 1 | 30 | Wire Bond Pull | Minimum of 5 devices, 30 wires Cpk>1.67 | Wires | 1/30/0 | 3/90/0 | 3/90/0 |

- QBS: Qual By Similarity
- Qual Device TPS3813K33QDBVRQ1 is qualified at MSL1 260C
- Preconditioning was performed for Autoclave, Unbiased HAST, THB/Biased HAST, Temperature Cycle, Thermal Shock, and HTSL, as applicable
- The following are equivalent HTOL options based on an activation energy of 0.7eV : 125C/1k Hours, 140C/480 Hours, 150C/300 Hours, and 155C/240 Hours
- The following are equivalent HTSL options based on an activation energy of 0.7eV : 150C/1k Hours, and 170C/420 Hours
- The following are equivalent Temp Cycle options per JESD47 : -55C/125C/700 Cycles and -65C/150C/500 Cycles

Ambient Operating Temperature by Automotive Grade Level:

- Grade 0 (or E): -40C to +150C
- Grade 1 (or Q): -40C to +125C
- Grade 2 (or T): -40C to +105C
- Grade 3 (or I) : -40C to +85C

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

Quality and Environmental data is available at TI's external Web site: <http://www.ti.com/>

TI Qualification ID: R-NPD-2301-019

Automotive Qualification Summary
(As per AEC-Q100 Rev. J and JEDEC Guidelines)

TPS3813Q1 Automotive Qualification LBC9-RFAB, DBV6-CDAT
Approve Date 01-March-2024

Product Attributes

| Attributes | Qual Device: TPS3813K33QDBVRQ1 | QBS Process Reference: BQ79600PWRQ1 | QBS Package Reference: TPS3840PH30DBVRQ1 | QBS Product Reference: TPS3813K33QDBVRQ1 |
|--------------------------|-----------------------------------|--|---|---|
| Automotive Grade Level | Grade 1 | Grade 1 | Grade 1 | Grade 1 |
| Operating Temp Range (C) | -40 to 125 | -40 to 125 | -40 to 125 | -40 to 125 |
| Product Function | Power Management | Power Management | Power Management | Power Management |
| Wafer Fab Supplier | RFAB | RFAB | RFAB | RFAB |
| Assembly Site | CDAT | MLA | CDAT | PHI |
| Package Group | SOT | TSSOP | SOT | SOT |
| Package Designator | DBV | PW | DBV | DBV |
| Pin Count | 6 | 16 | 5 | 6 |

- QBS: Qual By Similarity
- Qual Device TPS3813K33QDBVRQ1 is qualified at MSL1 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: TPS3813K33QDBVRQ1 | QBS Process Reference: BQ79600PWRQ1 | QBS Package Reference: TPS3840PH30DBVRQ1 | QBS Product Reference: TPS3813K33QDBVRQ1 |
|---|----|-------------------------------------|-------------|----------|--|-----------------|------------|-----------------------------------|--|---|---|
| Test Group A - Accelerated Environment Stress Tests | | | | | | | | | | | |
| PC | A1 | JEDEC J-STD-020 JESD22-A113 | 3 | 77 | Preconditioning | MSL1 260C | - | 1/0/0 | - | 3/0/0 | 1/0/0 |
| PC | A1 | JEDEC J-STD-020 JESD22-A113 | 3 | 77 | Preconditioning | MSL2 260C | - | - | 3/0/0 | - | - |
| HAST | A2 | JEDEC JESD22-A110 | 3 | 77 | Biased HAST | 130C/85%RH | 96 Hours | - | 3/231/0 | 3/231/0 | - |
| AC/UHAST | A3 | JEDEC JESD22-A102/JEDEC JESD22-A118 | 3 | 77 | Autoclave | 121C/15psig | 96 Hours | - | 3/231/0 | 3/231/0 | - |
| AC/UHAST | A3 | JEDEC JESD22-A102/JEDEC JESD22-A118 | 3 | 77 | Unbiased HAST | 130C/85%RH | 96 Hours | 1/77/0 | - | - | 1/77/0 |
| TC | A4 | JEDEC JESD22-A104 and Appendix 3 | 3 | 77 | Temperature Cycle | -65C/150C | 500 Cycles | 1/77/0 | 3/231/0 | 3/231/0 | 1/77/0 |
| TC-BP | A4 | MIL-STD883 Method 2011 | 1 | 5 | Post Temp Cycle Bond Pull | - | - | 1/5/0 | - | 1/5/0 | 1/5/0 |
| HTSL | A6 | JEDEC JESD22-A103 | 1 | 45 | High Temperature Storage Life | 150C | 1000 Hours | 1/77/0 | 3/135/0 | 3/135/0 | 1/77/0 |
| Test Group B - Accelerated Lifetime Simulation Tests | | | | | | | | | | | |
| HTOL | B1 | JEDEC JESD22-A108 | 3 | 77 | Life Test | 125C | 1000 Hours | - | 3/231/0 | 3/231/0 | - |
| ELFR | B2 | AEC Q100-008 | 3 | 800 | Early Life Failure Rate | 125C | 48 Hours | - | 3/2400/0 | - | - |
| EDR | B3 | AEC Q100-005 | 1 | 77 | NVM Endurance, Data Retention, and Op Life | Per QSS-009-018 | 1 Step | - | 3/231/0 | - | - |

| Type | # | Test Spec | Min Lot Qty | SS / Lot | Test Name | Condition | Duration | Qual Device: TPS3813K33QDBVRQ1 | QBS Process Reference: BQ79600PWRQ1 | QBS Package Reference: TPS3840PH30DBVRQ1 | QBS Product Reference: TPS3813K33QDBVRQ1 |
|--|----|----------------------------|-------------|----------|-------------------------------------|--|------------|---|---|---|---|
| Test Group C - Package Assembly Integrity Tests | | | | | | | | | | | |
| WBS | C1 | AEC Q100-001 | 1 | 30 | Wire Bond Shear | Minimum of 5 devices, 30 wires Cpk>1.67 | Wires | 1/30/0 | 3/90/0 | 3/90/0 | 1/30/0 |
| WBP | C2 | MIL-STD883 Method 2011 | 1 | 30 | Wire Bond Pull | Minimum of 5 devices, 30 wires Cpk>1.67 | Wires | 1/30/0 | 3/90/0 | 3/90/0 | 1/30/0 |
| SD | C3 | JEDEC J-STD-002 | 1 | 15 | PB Solderability | >95% Lead Coverage | - | - | 1/15/0 | 1/15/0 | - |
| SD | C3 | JEDEC J-STD-002 | 1 | 15 | PB-Free Solderability | >95% Lead Coverage | - | - | 1/15/0 | 1/15/0 | - |
| PD | C4 | JEDEC JESD22-B100 and B108 | 3 | 10 | Physical Dimensions | Cpk>1.67 | - | 1/10/0 | 3/30/0 | 3/30/0 | 1/10/0 |
| Test Group D - Die Fabrication Reliability Tests | | | | | | | | | | | |
| EM | D1 | JESD61 | - | - | Electromigration | - | - | Completed Per Process Technology Requirements | Completed Per Process Technology Requirements | Completed Per Process Technology Requirements | Completed Per Process Technology Requirements |
| TDDb | D2 | JESD35 | - | - | Time Dependent Dielectric Breakdown | - | - | Completed Per Process Technology Requirements | Completed Per Process Technology Requirements | Completed Per Process Technology Requirements | Completed Per Process Technology Requirements |
| HCI | D3 | JESD60 & 28 | - | - | Hot Carrier Injection | - | - | Completed Per Process Technology Requirements | Completed Per Process Technology Requirements | Completed Per Process Technology Requirements | Completed Per Process Technology Requirements |
| BTI | D4 | - | - | - | Bias Temperature Instability | - | - | Completed Per Process Technology Requirements | Completed Per Process Technology Requirements | Completed Per Process Technology Requirements | Completed Per Process Technology Requirements |
| SM | D5 | - | - | - | Stress Migration | - | - | Completed Per Process Technology Requirements | Completed Per Process Technology Requirements | Completed Per Process Technology Requirements | Completed Per Process Technology Requirements |
| Test Group E - Electrical Verification Tests | | | | | | | | | | | |
| Type | # | Test Spec | Min Lot Qty | SS / Lot | Test Name | Condition | Duration | Qual Device: TPS3813K33QDBVRQ1 | QBS Process Reference: BQ79600PWRQ1 | QBS Package Reference: TPS3840PH30DBVRQ1 | QBS Product Reference: TPS3813K33QDBVRQ1 |
| ESD | E2 | AEC Q100-002 | 1 | 3 | ESD HBM | - | 2000 Volts | - | - | - | 1/3/0 |
| ESD | E3 | AEC Q100-011 | 1 | 3 | ESD CDM | - | 500 Volts | - | - | - | 1/3/0 |
| LU | E4 | AEC Q100-004 | 1 | 6 | Latch-Up | Per AEC Q100-004 | - | - | - | - | 1/6/0 |
| ED | E5 | AEC Q100-009 | 3 | 30 | Electrical Distributions | Cpk>1.67 Room, hot, and cold | - | - | 2/60/0 | 3/90/0 | 3/90/0 |
| Additional Tests | | | | | | | | | | | |

- Preconditioning was performed for Autoclave, Unbiased HAST, THB/Biased HAST, Temperature Cycle, Thermal Shock, and HTSL, as applicable
- The following are equivalent HTOL options based on an activation energy of 0.7eV : 125C/1k Hours, 140C/480 Hours, 150C/300 Hours, and 155C/240 Hours
- The following are equivalent HTSL options based on an activation energy of 0.7eV : 150C/1k Hours, and 170C/420 Hours
- The following are equivalent Temp Cycle options per JESD47 : -55C/125C/700 Cycles and -65C/150C/500 Cycles

Ambient Operating Temperature by Automotive Grade Level:

- Grade 0 (or E): -40C to +150C
- Grade 1 (or Q): -40C to +125C
- Grade 2 (or T): -40C to +105C
- Grade 3 (or I): -40C to +85C

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

Quality and Environmental data is available at TT's external Web site: <http://www.ti.com/>

TI Qualification ID: R-NPD-2301-020

ZVEI ID: SEM-DE-03, SEM-PW-02, SEM-PW-03, SEM-PW-09, SEM-PW-13, SEM-PA-05, SEM-PA-08, SEM-PA-13, SEM-PA-18, SEM-PS-04, SEM-TF-01

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