

Littelfuse, Inc. 8755 West Higgins Road, Suite 500 Chicago, IL 60631 USA (773) 628-1000

Jun 21st, 2021

RE: LFPCN 41393 – TVS STD SMF3.3 and SMF4.0 approval of wafer foundry location & wafer size change for productivity improvement

To: Our Valued Customers

Littelfuse would like to notify you of changing wafer foundry location and corresponding wafer size from 5-inch to 6-inch of TVS STD products listed below for productivity improvement. There will be no change to the fit, form, function, quality or reliability of the products.

All affected products have been fully qualified in accordance with established performance and reliability criteria. Please see the attached documentation for qualification results, change details and affected part numbers. Full qualification data and samples will be available upon request.

| Affected Part Numbers | | | | |
|-----------------------|--|--|--|--|
| SMF3.3 SMF3.3-A SMF4. | | | | |

Form, fit, function changes: None Part number changes: None

Effective date: Jan 1st, 2022 and rolling change

Replacement products: N/A

Last time buy: N/A

This notification is for your information and acknowledgement. If you have any other questions or concerns, please contact your local sales team or product team below for further assistance.

We highly value your business and look forward to assisting you whenever possible.

Sincerely,

Jenny Chen Assistant Product Marketing Manager Commercial TVS Products Tel: +86 510 85277701 Ext – 7965 Jchen7@littelfuse.com



800 E. Northwest Highway Des Plaines, IL 60016

Product/Process Change Notice (PCN)

| PCN#: LFPCN #41393 Date: June 2 | 1 st , 2021 Contact Information | | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|--|--|
| Product Identification: | Name: Jenny Chen | | |
| TVS STD Diode SMF3.3, SMF3.3-A, SM | MF4.0 Title: Assistant Product Manager | | |
| Implementation Date for Change: | Phone #: +86 510 85277710 Ext. 7965 | | |
| Jan 1st, 2022 or rolling change | Fax#: N/A | | |
| | E-mail: jchen7@littelfuse.com | | |
| Category of Change: | Description of Change: | | |
| ☐ Assembly Process | Littelfuse would like to notify you of changing wafer foundry location and | | |
| ☐ Data Sheet | coresponding wafer size from 5-inch to 6-inch of TVS STD products listed | | |
| ☐ Technology | for productivity improvement. | | |
| ☐ Discontinuance/Obsolescence | There will be no change to the fit, form, function, quality or reliability of the | | |
| ☐ Equipment | | | |
| | | | |
| Raw Material The electrical performance and datasheet specifications of the affected | | | |
| ☐ Testing | products will remain unchanged. | | |
| ☐ Fabrication Process | | | |
| ☐ Other: | | | |
| | | | |
| Important Dates: | | | |
| Important Dates: Qualification Samples Available: Ava | ailable upon the request | | |
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| ☐ Qualification Samples Available: Available: Available: Ju ☐ Date of Final Product Shipment: | un 17 th 2021, included on the following pages | | |
| ☐ Qualification Samples Available: Available: Available: Available: Juan Date of Final Product Shipment: Method of Distinguishing Changed Product Shipment | un 17 th 2021, included on the following pages | | |
| □ Qualification Samples Available: Available: Available: Juan Date of Final Product Shipment: ■ Method of Distinguishing Changed Practice □ Product Mark, | un 17 th 2021, included on the following pages | | |
| ✓ Qualification Samples Available: Available: Available: June ✓ Final Qualification Data Available: June ✓ Date of Final Product Shipment: ✓ Method of Distinguishing Changed Product Mark, ✓ Date Code, | un 17 th 2021, included on the following pages | | |
| ☐ Qualification Samples Available: Available: Available: Juan Date of Final Product Shipment: ☐ Method of Distinguishing Changed Product Mark, ☐ Date Code, ☐ Other, | un 17 th 2021, included on the following pages | | |
| ☐ Qualification Samples Available: Available: Available: June Date of Final Product Shipment: ☐ Method of Distinguishing Changed Product Mark, ☐ Date Code, ☐ Other, ☐ Demonstrated or Anticipated Impact of Distinguishing Changed Product Mark, | un 17 th 2021, included on the following pages | | |
| □ Qualification Samples Available: Available: Available: Juan Date of Final Product Shipment: ■ Method of Distinguishing Changed Practice Product Mark, □ Date Code, □ Other, Demonstrated or Anticipated Impact of N/A | un 17 th 2021, included on the following pages roduct on Form, Fit, Function or Reliability: | | |
| □ Qualification Samples Available: Available: Available: Juan Date of Final Product Shipment: ■ Method of Distinguishing Changed Practice Product Mark, □ Date Code, □ Other, Demonstrated or Anticipated Impact of N/A LF Qualification Plan/Results: Littelfuse Qualification Report is included. | un 17 th 2021, included on the following pages roduct on Form, Fit, Function or Reliability: | | |
| □ Qualification Samples Available: Available: Available: Juan Final Qualification Data Available: Juan Date of Final Product Shipment: ■ Method of Distinguishing Changed Praduct Mark, □ Product Mark, □ Date Code, □ Other, Demonstrated or Anticipated Impact of N/A LF Qualification Plan/Results: Littelfuse Qualification Report is included Customer Acknowledgement of Recei | un 17th 2021, included on the following pages roduct on Form, Fit, Function or Reliability: d on the following pages. | | |



PCN Report

Prepared By : Shirley Zhao-Foundry Operation Manager

Wilson Wu-Outsourced Product Engineer

Date : 6/17/2021

Device : SOD123-FL Package SMF3.3 SMF4.0

Revision : A

1.0 Objective:

The purpose of this project is to qualify an alternate foundry location and corresponding wafer size change from 5-inch to 6-inch for TVS STD products listed below. Succeeding pages summarize the physical, electrical and reliability test performed in qualification lots.

2.0 Applicable Devices:

| Affected Part Numbers | | | | |
|-----------------------|--------|--|--|--|
| SMF3.3 | SMF4.0 | | | |

3.0 Assembly, Process & Material Differences/Changes:

3.1 Assembly and Process Changes

| | Current Alternate | |
|-------------------|----------------------------|-----------------------------|
| Foundry Location | 150 Kinoko-cho, Ibara-shi, | 6833 Kinoko-cho, Ibara-shi, |
| Foundry Location | Okayma, Japan | Okayama, Japan |
| Wafer Size | 5-inch | 6-inch |
| Top Metallization | TiNiAg/TiAg | TiAg |

There are no other significant changes in the assembly and process method.

3.2 Material Changes

No change of BOM

4.0 Packing Method

There will be no changes in the packing method.

5.0 Physical Differences/Changes:

There is no change in mechanical specification or package outline dimension (POD).



6.0 Reliability Test Results Summary:

| Test Items | Condition | S/S | Results | ETR# |
|-----------------------------------------------|------------------------------------------------------------------|-----|---------|-----------|
| Pre-conditioning | JESD22-A113 | 240 | 0/240 | |
| DC Blocking(HTRB) | Bias = rated VR, Ta = 150°C or 125°C Duration = 1008 Hours | 154 | 0/154 | |
| Temperature Cycle | Ta = -55°C to +150°C Duration = 1000 Cycles | 80 | 0/80 | |
| Temperature/Humidity | Ta = 85°C, 85% RH Duration = 1008 Hours | 80 | 0/80 | ETR152832 |
| Unbiased Highly Accelerated Stress Test | Ta = 130°C, 85%RH, 2ATM Duration = 96 Hours | 80 | 0/80 | |
| Resistance to Solder Heat | 260°C,10 sec M-2031 | 60 | 0/60 | |
| Moisture Sensitivity Level(MSL) | Per Jedec J-STD-020D Level 1 | 44 | 0/44 | |

Remark:

- 1. Tests are conducted without a bias condition unless otherwise stated.
- 2. Reliability data from product tests that is representative of similar products having structural similarity, commonality of production processes and product technology will be generically applied to those products.
- 3. Tests are conducted on SMF3.3 and SMF4.0.

Estimate of Failure Rate, MTBF, FITS for a Given Operation Temperature

| Temp ℃ | % FR/khrs | MTBF (K) | FITS |
|--------|------------|------------|----------|
| 30 | 0.00002279 | 4387687.18 | 0.23 |
| 60 | 0.00071569 | 139725.04 | 7.16 |
| 80 | 0.00514527 | 19435.34 | 51.45 |
| 100 | 0.02994058 | 3339.95 | 299.41 |
| 125 | 0.21099443 | 473.95 | 2109.94 |
| 150 | 1.18054361 | 84.71 | 11805.44 |

4. The Mean-Time-Between-Failure (MTBF) in hours and the percent failure rate per 1000 hours (%FR/khr) are computed at a 60% confidence level using the chi square method and the Arrhenius derating model for various junction operating temperatures. For the calculations, a value of 1 eV was used for the activation energy.

7.0 Electrical Characteristic Summary:

There is no change in electrical characteristics.

| Test Items | Condition | S/S | Results | ETR# |
|-----------------|---------------------------------------------|-----|---------|-----------|
| Parametric | V _{BR} , I _R | 20 | 0/20 | |
| VF | Datasheet condition | 20 | 0/20 | ETD450007 |
| Surge Out test | 1 hit, at 25°C from rated IPP, 0.1 IPP step | 20 | 0/20 | ETR152837 |
| Surge Life test | 1 hit,30 hits, 1.0IPP | 20 | 0/20 | |



8.0 Changed Part Identification:

There is no Part used in affected products.

9.0 Recommendations & Conclusions:

Based on the test results, it is determined that the alternative foundry location is qualified and certified for production of all Littelfuse SMF3.3 and SMF4.0 products.

10.0 Approvals:

Shirley Zhao Foundry Operation Manager Littelfuse, Shanghai <u>Peter Liu</u>
Asia OSAT Product Engineering Manager
Littelfuse, Wuxi