



8755 W. Higgins Road
Suite 500
Chicago, Illinois USA 60631

May 13th, 2016

RE: PCN # ESU270-38 – SP4022/4023/4024 series new wafer foundry and alternative backend manufacturing location approval

To our valued customers,

In order to support growing demand, and maintain operational excellence, we are expanding our wafer and packaging capacity of SOD-323 products for Ethernet and power line protection. Littelfuse would like to notify you of a newly approved wafer foundry location and two alternative backend locations for the SP4022/4023/4024 series TVS Diode Array (SPA® Diodes) products. The new wafer foundry is located in China, and the two new alternative backend factories both in China are all fully approved. There are no changes to form or function of the finished product.

Qualification efforts are complete and the new factories are online for immediate shipments. Please see the attached documentation for change detail and affected part numbers.

All affected products have been fully qualified in accordance with established performance and reliability criteria. The attached pages summarize the qualification results. Full qualification data and/or samples will be available upon request.

Form, fit, function changes: None
Part number changes: None
Effective date: Aug 13th, 2016 or sooner
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 Tim Micun, Product Manager.

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

Best Regards,

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800 E. Northwest Highway Des Plaines, IL 60016

Product/Process Change Notice (PCN)

PCN#: ESU270-38 **Date:** May 13, 2016

Product Identification:

SP4022/4023/4024 series of TVS Diode Array Products

Implementation Date for Change:

Aug 13, 2016 or sooner

Contact Information

Name: Tim Micun

Title: Product Marketing Manager

Phone #: +1 408 409 3657

Fax#: N/A

E-mail: tmicun@littelfuse.com

Category of Change:

- Assembly Process
- Data Sheet
- Technology
- Discontinuance/Obsolescence
- Equipment
- Manufacturing Site
- Raw Material
- Testing
- Fabrication Process
- Other: _____

Description of Change:

Approve a new wafer foundry location and two alternate backend assembly, test, and packing locations for SP4022/4023/4024 series products. There are no changes to fit, form & function of the finished product. The affected products have been fully qualified in accordance with all established criteria for performance and reliability. All relevant detail is included in the supplemental pages..

Important Dates:

- Qualification Samples Available: May 10, 2016 Last Time Buy:
- Final Qualification Data Available: May 10, 2016
- Date of Final Product Shipment:

Method of Distinguishing Changed Product

- Product Mark,
- Date Code,
- Other, See (8.0) in the succeeding PCN report for details

Demonstrated or Anticipated Impact on Form, Fit, Function or Reliability:

N/A

LF Qualification Plan/Results:

N/A

Customer Acknowledgement of Receipt: Littelfuse requests you acknowledge receipt of this PCN. In your acknowledgement, you can grant approval or request additional information. Littelfuse will assume the change is acceptable if no acknowledgement is received within 30 days of this notice. Lack of any additional response within 90 days of PCN issuance further constitutes acceptance of the change.



PCN Report

ETR # 79284, 80187, 80858

Prepared By : Jordan Hsieh-SPA Product Engineering Manager,
: Ming-Huan Ko-SPA Product Engineer
Date : May/10/2016
Device : SP4022, SP4023 and SP4024 Series Product
Revision : A

1.0 Objective:

The purpose of this project is to change to a new wafer foundry and qualify two alternative assembly locations for SP4022, SP4023 and SP4024 series product. Succeeding pages summarize the physical, electrical and reliability test performed in qualification lot.

2.0 Applicable Devices:

| Part Numbers | Part Numbers |
|--------------|----------------|
| SP4022-01FTG | SP4022-01FTG-C |
| SP4023-01FTG | SP4023-01FTG-C |
| SP4024-01FTG | SP4024-01FTG-C |

3.0 Assembly, Process & Material Differences/Changes:

3.1 Wafer Supplier Changes

Change wafer supplier of steering die as below table.

| P/N | SP4022-01FTG, SP4022-01FTG-C, SP4023-01FTG, SP4023-01FTG-C, SP4024-01FTG and SP4024-01FTG-C | | |
|--------------|---|------------|----------|
| Material | Original | New | Changed? |
| Steering Die | Taiwan Base | China Base | Yes |

3.2 Material Changes

Add two alternative backend locations for SP4022-01FTG, SP4022-01FTG-C, SP4023-01FTG, SP4023-01FTG-C, SP4024-01FTG and SP4024-01FTG-C as below table.

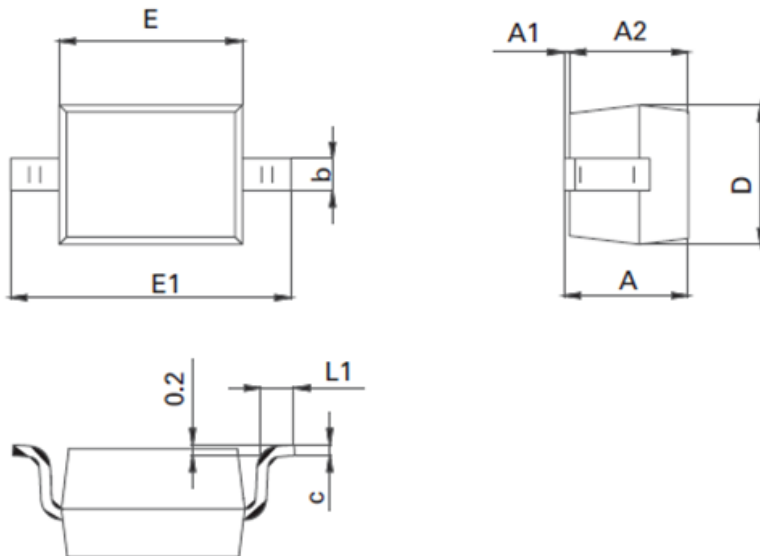
| Material | Original Backend Location | | New Backend Location 1 | | New Backend Location 2 | | Changed? |
|---------------------|---------------------------|--------------------|------------------------|--------------------|------------------------|------------------|----------|
| | Located in China | | Located in China | | Located in China | | |
| | Material Name | Supplier | Material Name | Supplier | Material Name | Supplier | |
| Leadframe | N42 | Shuen Der Industry | N42 | Shuen Der Industry | A42 | ASM | Yes |
| Die Attach Material | 84-1LMISR4 | Henkel | Eutetic | -- | Eutetic | -- | Yes |
| | | | | | EXBOND 833C-LW | Bonotec* | |
| Au Wire | Gold Wire | Heraeus | Gold Wire | MK Electron | Gold Wire | MK Electron | Yes |
| Molding Compound | ELER-8-100HFE | E'Dale | ELER-8-100HFE | E'Dale | EME-G600 | HHCK | Yes |
| Lead Finish | Tin | Yunnan | Tin | ShangHai SinYang | Tin | Suzhou Nuonengda | Yes |

4.0 Packing Method

There will be no changes in the packing method.

5.0 Physical Differences/Changes:

Lead dimension of new backend locations is different with original backend location.





| | Original Supplier | | Alternative Supplier-1 | | Alternative Supplier-2 | |
|----|-------------------|------|------------------------|------|------------------------|------|
| | Min | Max | Min | Max | Min | Max |
| A | 0.80 | 1.00 | -- | 1.00 | -- | 1.00 |
| A1 | 0.00 | 0.10 | 0.02 | 0.10 | 0.00 | 0.10 |
| A2 | 0.80 | 0.90 | -- | 0.90 | 0.80 | 0.90 |
| b | 0.25 | 0.35 | -- | 0.30 | 0.25 | 0.35 |
| c | 0.08 | 0.15 | 0.10 Typical | | 0.08 | 0.15 |
| D | 1.15 | 1.45 | 1.20 | 1.40 | 1.20 | 1.40 |
| E | 1.60 | 1.80 | 1.60 | 1.80 | 1.60 | 1.80 |
| E1 | 2.50 | 2.70 | 2.55 | 2.75 | 2.50 | 2.70 |
| L1 | 0.25 | 0.40 | 0.22 | 0.42 | 0.25 | 0.40 |

Unit: mm

6.0 Reliability Test Results Summary:

| Test Items | Condition | S/S | Results | ETR # |
|--|---|-----|---------|--|
| Precondition | Bake 24hr @ 150°C/ 168hrs 85%rh, 85°C sock/3 times 260°C peak temperature reflow | 320 | 0/320 | ETR 79284 Qualification for new wafer supplier and alternative assembly supplier-1 |
| DC Blocking(HTRB) | Bias = 3.3V Ta = 150°C Duration = 1008 Hours | 80 | 0/77 | |
| Temperature Cycle | Ta = -55°C to +150°C Duration = 1000 Cycles | 80 | 0/77 | |
| Temperature/Humidity (H ³ TRB) | Bias=3.3V Ta = 85°C, 85% RH Duration = 1008 Hours | 80 | 0/77 | |
| Autoclave | Ta = 121°C, 100%RH, 2atm Duration = 96 Hours | 80 | 0/77 | |
| Moisture Sensitivity Level(MSL) | Refer to Precondition Test | 320 | 0/320 | |
| ESD Test | HBM>8kV, MM>400V | 30 | 0/30 | |

| Test Items | Condition | S/S | Results | ETR # |
|--|---|-----|---------|---|
| Precondition | Bake 24hr @ 150°C/ 168hrs 85%rh, 85°C sock/3 times 260°C peak temperature reflow | 640 | 0/640 | ETR 80187, 80858 Qualification for new wafer supplier and alternative assembly supplier-2 |
| DC Blocking(HTRB) | Bias = 3.3V Ta = 150°C Duration = 1008 Hours | 160 | 0/160 | |
| Temperature Cycle | Ta = -55°C to +150°C Duration = 1000 Cycles | 160 | 0/160 | |
| Temperature/Humidity (H ³ TRB) | Bias=3.3V Ta = 85°C, 85% RH Duration = 1008 Hours | 160 | 0/160 | |
| Autoclave | Ta = 121°C, 100%RH, 2atm Duration = 96 Hours | 160 | 0/160 | |
| Moisture Sensitivity Level(MSL) | Refer to Precondition Test | 640 | 0/640 | |
| ESD Test | HBM>8kV, MM>400V | 60 | 0/60 | |


7.0 Electrical Characteristic Summary:

There is no change in electrical characteristics. Characterization data is available upon request.

8.0 Changed Part Identification:

To distinguish different manufacturing locations please refer to labeling information as CAT NO:

Barcode Scanning Result

| | | |
|---|------------------------|----------------|
| (P)PART NO: PSPXXXX-XXXX | HF | Pb Pb- FREE |
| PART DESCRIPTION | CAT NO: * | |
| (Q)Q'TY: QXXXX | (K)PO NO: KXXXXXXXX | |
| (1T)LOT NO: 1TXXXXXX | | |
| (1T)LOT NO:(When necessary) 1TXXXXXX | | |
|  COUNTRY OF ORIGIN" COUNTRY" DATE CODE(MM/DD/YY) | | |

| Original Backend Location | New Backend Location 1 | New Backend Location 2 |
|---------------------------|------------------------|------------------------|
| CAT No : S | CAT No : Y | CAT No : F |



9.0 Recommendations & Conclusions:

Based on the test results, it is determined that the new wafer foundry and alternative assembly locations are qualified and certified for production of Littelfuse® SP4022/SP4023/SP4024 series products.

10.0 Approvals:

Jordan Hsieh
SPA Product Engineering Manager
Littelfuse, Hsinchu