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April 13th, 2017

RE: LFPCN41259

To: Our Valued Customers.

From: **Littelfuse Product Management Team**

Subject: **TVS Diode LKTAK series alternative assembly line approval**

In order to support growing demand, and maintain operational excellence, we are expanding our packaging capacity of LTKAK product. Littelfuse would like to notify you of a newly approved backend assembly line for LTKAK series TVS Diode products. The new approved 2nd production line is located in Littelfuse Semiconductor Wuxi China. Both current assembly line and newly approved assembly line will support each other for better delivery.

There are no changes on FIT, 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:** July 1st, 2017 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 Meng Wang, Product Manager. We highly value your business and look forward to assisting you whenever possible.

Best Regards

Meng Wang ( Rex Wang)

Product Marketing Manager
Commercial TVS Products
Tel: +86 510 85277701 ext – 7955
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800 E. Northwest Highway Des Plaines, IL 60016

# Product/Process Change Notice (PCN)

**PCN#:** LFPCN41259 Date: April 13th 2017

Product Identification:

LKTAK 2nd assembly line approval

Implementation Date for Change:

July 1st 2017 or sooner

**Contact Information**

Name: Meng Wang

Title: Product Marketing Manager

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E-mail: Mwang3@littelfuse.com

**Category of Change:**

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

**Description of Change:**

In order to support growing demand, and maintain operational excellence Littelfuse would like to seek your approval to release 2nd assembly line located in Littelfuse semiconductor ( Wuxi ) Co,.LTD , China for LTKAK series TVS .

**Important Dates:**

- ☒ Qualification Samples Available: YES
- ☐ Last Time Buy: NA
- ☒ Final Qualification Data Available: YES
- ☐ Date of Final Product Shipment: N/A

**Method of Distinguishing Changed Product**

- ☐ Product Mark, NA
- ☐ Date Code, NA
- ☒ Other, YES

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

**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.

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Littelfuse, WX
East 3# Zhen Fa 6 Road
Shuo Fang Industrial Park
Wuxi, Jiangsu 214142

# Product Qualification Report

To: Those who may concern

From: Changjun Tang, TVS Product Engineer, Littelfuse.

Date: April 10th , 2017

Subject: TVS Diode LTKAK Series Alternative Assembly Line Qualification

## Purpose:

**This report is to inform the successful qualification test results associated with LTKAK6/LTKAK10 product series in Wuxi In-house plant.**

## 1. Qualification Types (Test Vehicle)

| Product Series | Representative Test Sample Part Numbers | Lot Type | Assy Lot | Assembly Location |
|---|---|---|---|---|
| LTKAK | LTKAK6-066C | Control Lot | 7A06ZPEE | Outsource |
| | LTKAK6-066C | Test Lot | 7A14ZPEE | Wuxi In-house |
| | LTKAK6-076C | Test Lot | 7A13ZPEE | Wuxi In-house |
| | LTKAK10-076C | Control Lot | 7A09ZPEE | Outsource |
| | LTKAK10-076C | Test Lot | 7A08ZPEE | Wuxi In-house |
| | LTKAK10-076C | Test Lot | 7A10ZPEE | Wuxi In-house |
| | LTKAK10-076C | Test Lot | 7A11ZPEE | Wuxi In-house |

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## 2. Qualification Test Items and Result Summary:

| Test Category | Description | Part Number | Lot Number | Samples Qty | Littelfuse ETR# | Contents/Conditions | Result |
|---|---|---|---|---|---|---|---|
| Reliability | Pre-conditioning | LTKAK6-066C | 7A06ZPEE | 197 | 92945 | 24hrs 125℃ bake/168hrs 85%RH,85℃ sock/3 times 260℃ peak temperature reflow | 0 failure post test |
| | | LTKAK6-066C | 7A14ZPEE | 197 | 92945 | | |
| | | LTKAK6-076C | 7A13ZPEE | 197 | 92945 | | |
| | | LTKAK10-076C | 7A09ZPEE | 197 | 93157 | | |
| | | LTKAK10-076C | 7A08ZPEE | 197 | 93157 | | |
| | | LTKAK10-076C | 7A10ZPEE | 197 | 93159 | | |
| | | LTKAK10-076C | 7A11ZPEE | 197 | 93159 | | |
| | DC Blocking (HTRB) | LTKAK6-066C | 7A06ZPEE | 77 | 92945 | 125℃,100% rated VR, 1008hrs | 0 failure at 1008 hours |
| | | LTKAK6-066C | 7A14ZPEE | 77 | 92945 | | |
| | | LTKAK6-076C | 7A13ZPEE | 77 | 92945 | | |
| | | LTKAK10-076C | 7A09ZPEE | 77 | 93157 | | |
| | | LTKAK10-076C | 7A08ZPEE | 77 | 93157 | | |
| | | LTKAK10-076C | 7A10ZPEE | 77 | 93159 | | |
| | | LTKAK10-076C | 7A11ZPEE | 77 | 93159 | | |
| | Biased Temp&Humidity (H3TRB) | LTKAK6-066C | 7A06ZPEE | 30 | 92945 | 85℃/85% RH with device reverse biased at 100% of rated VR | 0 failure at 1008 hours |
| | | LTKAK6-066C | 7A14ZPEE | 30 | 92945 | | |
| | | LTKAK6-076C | 7A13ZPEE | 30 | 92945 | | |
| | | LTKAK10-076C | 7A09ZPEE | 30 | 93157 | | |
| | | LTKAK10-076C | 7A08ZPEE | 30 | 93157 | | |
| | | LTKAK10-076C | 7A10ZPEE | 30 | 93159 | | |
| | | LTKAK10-076C | 7A11ZPEE | 30 | 93159 | | |
| | Temperature Cycling | LTKAK6-066C | 7A06ZPEE | 30 | 92945 | -55℃&150℃, 15 minutes dwell 500 cycles | 0 failure at 500 cycles |
| | | LTKAK6-066C | 7A14ZPEE | 30 | 92945 | | |
| | | LTKAK6-076C | 7A13ZPEE | 30 | 92945 | | |
| | | LTKAK10-076C | 7A09ZPEE | 30 | 93157 | | |
| | | LTKAK10-076C | 7A08ZPEE | 30 | 93157 | | |
| | | LTKAK10-076C | 7A10ZPEE | 30 | 93159 | | |
| | | LTKAK10-076C | 7A11ZPEE | 30 | 93159 | | |
| | High Temperature Storage Life (HTSL) | LTKAK6-066C | 7A06ZPEE | 30 | 92945 | Ta=150℃,1008hrs | 0 failure at 1008 hours |
| | | LTKAK6-066C | 7A14ZPEE | 30 | 92945 | | |
| | | LTKAK6-076C | 7A13ZPEE | 30 | 92945 | | |
| | | LTKAK10-076C | 7A09ZPEE | 30 | 93157 | | |
| | | LTKAK10-076C | 7A08ZPEE | 30 | 93157 | | |
| | | LTKAK10-076C | 7A10ZPEE | 30 | 93159 | | |
| | | LTKAK10-076C | 7A11ZPEE | 30 | 93159 | | |
| | Resistance to Solder Heat | LTKAK6-066C | 7A06ZPEE | 30 | 92945 | 260±5℃, 10±1s/3 times | 0 failure after RSH |
| | | LTKAK6-066C | 7A14ZPEE | 30 | 92945 | | |
| | | LTKAK6-076C | 7A13ZPEE | 30 | 92945 | | |
| | | LTKAK10-076C | 7A09ZPEE | 30 | 93157 | | |
| | | LTKAK10-076C | 7A08ZPEE | 30 | 93157 | | |
| | | LTKAK10-076C | 7A10ZPEE | 30 | 93159 | | |
| | | LTKAK10-076C | 7A11ZPEE | 30 | 93159 | | |

| Test Category | Description | Part Number | Lot Number | Samples Qty | Littelfuse ETR# | Contents/Conditions | Result |
|---|---|---|---|---|---|---|---|
| Parametric | Electrical Parameters | LTKAK6-066C | 7A06ZPEE | 217 | 92945 | VBR,IR | 100% meet published spec |
| | | LTKAK6-066C | 7A14ZPEE | 217 | 92945 | | |
| | | LTKAK6-076C | 7A13ZPEE | 217 | 92945 | | |
| | | LTKAK10-076C | 7A09ZPEE | 217 | 93157 | | |
| | | LTKAK10-076C | 7A08ZPEE | 217 | 93157 | | |
| | | LTKAK10-076C | 7A10ZPEE | 217 | 93159 | | |
| | | LTKAK10-076C | 7A11ZPEE | 217 | 93159 | | |
| | 8/20us Surge Out | LTKAK6-066C | 7A06ZPEE | 10 | 93009 | +/- 1hit, from 100% rated IPP, 0.1IPP step | 100% passing at 1.1xRated IPP |
| | | LTKAK6-066C | 7A14ZPEE | 10 | 93009 | | |
| | | LTKAK6-076C | 7A13ZPEE | 10 | 93009 | | |
| | | LTKAK10-076C | 7A09ZPEE | 10 | 93161 | | |
| | | LTKAK10-076C | 7A08ZPEE | 10 | 93161 | | |
| | | LTKAK10-076C | 7A10ZPEE | 10 | 93161 | | |
| | | LTKAK10-076C | 7A11ZPEE | 10 | 93161 | | |
| | 10/350us Surge Out | LTKAK6-066C | 7A06ZPEE | 10 | 93008 | +/- 1hit, from 100% rated Minimum IPP, 0.1IPP step | 100% passing at 1.1xRated IPP |
| | | LTKAK6-066C | 7A14ZPEE | 10 | 93008 | | |
| | | LTKAK6-076C | 7A13ZPEE | 10 | 93008 | | |
| | | LTKAK10-076C | 7A09ZPEE | 10 | 93160 | | |
| | | LTKAK10-076C | 7A08ZPEE | 10 | 93160 | | |
| | | LTKAK10-076C | 7A10ZPEE | 10 | 93160 | | |
| | | LTKAK10-076C | 7A11ZPEE | 10 | 93160 | | |
| | 8/20us Surge Life | LTKAK6-066C | 7A06ZPEE | 10 | 93009 | 100% rated IPP, Continually surge to 30 hits | 0 failure after surge life |
| | | LTKAK6-066C | 7A14ZPEE | 10 | 93009 | | |
| | | LTKAK6-076C | 7A13ZPEE | 10 | 93009 | | |
| | | LTKAK10-076C | 7A09ZPEE | 10 | 93161 | | |
| | | LTKAK10-076C | 7A08ZPEE | 10 | 93161 | | |
| | | LTKAK10-076C | 7A10ZPEE | 10 | 93161 | | |
| | | LTKAK10-076C | 7A11ZPEE | 10 | 93161 | | |
| | 10/350us Surge Life | LTKAK6-066C | 7A06ZPEE | 10 | 93008 | 100% rated IPP, Continually surge to 30 hits | 0 failure after surge life |
| | | LTKAK6-066C | 7A14ZPEE | 10 | 93008 | | |
| | | LTKAK6-076C | 7A13ZPEE | 10 | 93008 | | |
| | | LTKAK10-076C | 7A09ZPEE | 10 | 93160 | | |
| | | LTKAK10-076C | 7A08ZPEE | 10 | 93160 | | |
| | | LTKAK10-076C | 7A10ZPEE | 10 | 93160 | | |
| | | LTKAK10-076C | 7A11ZPEE | 10 | 93160 | | |

## 3. MTBF Calculation

Estimate of Failure Rate, MTBF, FITS for a Given Operation Temperature **(See note)**

| Temp ℃ | % FR/khrs | MTBF (K) | FITS |
|---|---|---|---|
| **30** | 0.00013 | 784196.0 | 1.28 |
| **60** | 0.00400 | 24972.6 | 40.04 |
| **80** | 0.02879 | 3473.6 | 287.88 |
| **100** | 0.16752 | 596.9 | 1675.22 |
| **125** | 1.18054 | 84.7 | 11805.44 |

Note: The **M**ean-**T**ime-**B**etween-**F**ailure (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.

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## 4. FAB Process & Material Differences/Changes:

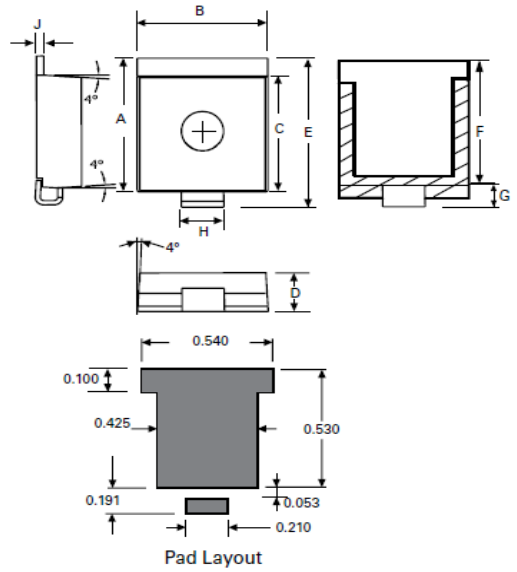
4.1 For LTKAK10 series, optimize the chip design
4.2 No significant changes in the assembly and process method for all LTKAK series.

## 5. Physical Differences/Changes

5.1 Add detail dimension specification of Heatsink(L,M,N dimension)
5.2 Correct G dimension

Current physical dimensions on published datasheet:

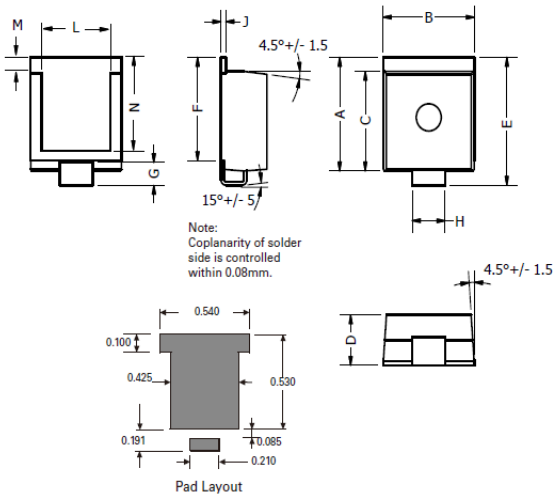
**Dimensions — SMTO-218 Tab**




| Dimension | Inches | | Millimeters | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 0.621 | 0.655 | 15.78 | 16.63 |
| B | 0.529 | 0.594 | 13.43 | 15.09 |
| C | 0.544 | 0.561 | 13.83 | 14.24 |
| D | 0.273 | 0.285 | 6.94 | 7.24 |
| E | 0.702 | 0.737 | 17.82 | 18.72 |
| F | 0.567 | 0.581 | 14.40 | 14.76 |
| G | 0.074 | 0.104 | 1.88 | 2.64 |
| H | 0.193 | 0.222 | 4.89 | 5.65 |
| J | 0.028 | 0.033 | 0.72 | 0.85 |

Future physical dimensions in published datasheet:

**Dimensions — SMTO-218 Tab**




| Dimension | Inches | | Millimeters | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 0.621 | 0.655 | 15.78 | 16.63 |
| B | 0.529 | 0.594 | 13.43 | 15.09 |
| C | 0.544 | 0.561 | 13.83 | 14.24 |
| D | 0.273 | 0.285 | 6.94 | 7.24 |
| E | 0.702 | 0.737 | 17.82 | 18.72 |
| F | 0.567 | 0.587 | 14.40 | 14.90 |
| G | 0.087 | 0.126 | 2.20 | 3.20 |
| H | 0.193 | 0.222 | 4.89 | 5.65 |
| J | 0.028 | 0.033 | 0.72 | 0.85 |
| L | 0.400 | 0.440 | 10.17 | 11.17 |
| M | 0.073 | 0.112 | 1.85 | 2.85 |
| N | 0.510 | 0.533 | 12.95 | 13.55 |

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## 6. Electrical Characteristic Change:

### 6.1 Update LTKAK6 series 10/350us Surge $I_{PP}$ Current:

**Electrical Characteristics** ($T_A$=25°C unless otherwise noted)

| Part Numbers | Standoff Voltage ($V_{SO}$) (V) | Max. Reverse Leakage ($I_R$) @$V_{SO}$ (µA) | Reverse Breakdown Voltage ($V_{BR}$) @ $I_T$ | | Test Current $I_T$ | Max. Clamping Voltage $V_{CL}$ @ Peak Pulse Current ($I_{PP}$) | | | | | Max. Temp Coefficient of $V_{BR}$ | Max. Capacitance 0 Bias 10kHz |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min Volts | Max Volts | (mA) | $V_{CL}$ Volts | $I_{PP}$ (8/20µS) (A) | | $I_{PP}$ (10/350µS) (A) | | (%/°C) | (nF) |
| | | | | | | | min | typ | min | typ | | |
| LTKAK6-058C | 58 | 10 | 64 | 70 | 10 | 110 | 6,000 | - | 1,000 | - | 0.1 | 6.5 |
| LTKAK6-066C | 66 | 10 | 72 | 80 | 10 | 120 | 6,000 | - | 600 | - | 0.1 | 5.5 |
| LTKAK6-076C | 76 | 10 | 85 | 95 | 10 | 140 | 6,000 | 9,500 | 1,100 | - | 0.1 | 4.5 |

**Future:**

**Electrical Characteristics** ($T_A$=25°C unless otherwise noted)

| Part Numbers | Standoff Voltage ($V_{SO}$) (V) | Max. Reverse Leakage ($I_R$) @$V_{SO}$ (µA) | Reverse Breakdown Voltage ($V_{BR}$) @ $I_T$ | | Test Current $I_T$ | Max. Clamping Voltage $V_C$ @ $I_{PP}$ | Max. Temp Coefficient of $V_{BR}$ | Max. Capacitance 0 Bias 10kHz |
|---|---|---|---|---|---|---|---|---|
| | | | Min Volts | Max Volts | (mA) | Volts | (%/°C) | (nF) |
| LTKAK6-058C | 58 | 10 | 64 | 70 | 10 | 110 | 0.1 | 6.5 |
| LTKAK6-066C | 66 | 10 | 72 | 80 | 10 | 120 | 0.1 | 5.5 |
| LTKAK6-076C | 76 | 10 | 85 | 95 | 10 | 140 | 0.1 | 4.5 |

**Note:** Using 8/20µS wave shaped defined in IEC 61000-4-5.

**Surge Ratings**

| Part Numbers | Max. Peak Pulse Current ($I_{PP}$) | | |
|---|---|---|---|
| | (8/20µS) (A) | (10/350µS) (A) | (10/1000µS) (A) |
| | min | min | min |
| LTKAK6-058C | 6,000 | 900 | 430 |
| LTKAK6-066C | 6,000 | 900 | 430 |
| LTKAK6-076C | 6,000 | 900 | 430 |

### 6.1 Update LTKAK6 series 10/350us Surge $I_{PP}$ Current:

**Electrical Characteristics**

| Part Numbers | Standoff Voltage ($V_{SO}$) (V) | Max. Reverse Leakage ($I_R$) @$V_{SO}$ (µA) | Reverse Breakdown Voltage ($V_{BR}$) @ $I_T$ | | Test Current $I_T$ | Max. Clamping Voltage $V_{CL}$ @ Peak Pulse Current ($I_{PP}$) | | | | | Max. Temp Coefficient of $V_{BR}$ | Max. Capacitance 0 Bias 10kHz |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min Volts | Max Volts | (mA) | $V_{CL}$ Volts | $I_{PP}$ (8/20µS) (A) | | $I_{PP}$ (10/350µS) (A) | | (%/°C) | (nF) |
| | | | | | | | min | typ | min | typ | | |
| LTKAK10-058C | 58 | 10 | 64 | 70 | 10 | 110 | 10,000 | - | - | - | 0.1 | 8.5 |
| LTKAK10-066C | 66 | 10 | 72 | 80 | 10 | 120 | 10,000 | 13,000 | 800 | - | 0.1 | 7.5 |
| LTKAK10-076C | 76 | 10 | 85 | 95 | 10 | 140 | 10,000 | 12,000 | 450 | - | 0.1 | 6.5 |

**Future:**

**Electrical Characteristics**

| Part Numbers | Standoff Voltage ($V_{SO}$) (V) | Max. Reverse Leakage ($I_R$) @$V_{SO}$ (µA) | Reverse Breakdown Voltage ($V_{BR}$) @ $I_T$ | | Test Current $I_T$ | Max. Clamping Voltage $V_{CL}$ @ Peak Pulse Current ($I_{PP}$) | | | | Max. Temp Coefficient of $V_{BR}$ | Max. Capacitance 0 Bias 10kHz |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Min Volts | Max Volts | (mA) | $V_{CL}$ Volts | $I_{PP}$ (8/20µS) (A) | $I_{PP}$ (10/350µS) (A) | | (%/°C) | (nF) |
| | | | | | | | min | min | typ | | |
| LTKAK10-058C | 58 | 10 | 64 | 70 | 10 | 110 | 10,000 | 1,400 | 1,700 | 0.1 | 8.5 |
| LTKAK10-066C | 66 | 10 | 72 | 80 | 10 | 120 | 10,000 | 950 | 1,100 | 0.1 | 7.5 |
| LTKAK10-076C | 76 | 10 | 85 | 95 | 10 | 140 | 10,000 | 950 | 1,100 | 0.1 | 6.5 |
| LTKAK10-080C | 80 | 10 | 89 | 100 | 10 | 150 | 10,000 | 900 | 1,100 | 0.1 | 6.5 |
| LTKAK10-086C | 86 | 10 | 95 | 105 | 10 | 157 | 10,000 | 900 | 1,100 | 0.1 | 6.5 |

## 7. Conclusion

**According to the above qualification test results, Littelfuse concluded that LTKAK product series which manufactured in LF Wuxi in-house plant have passed all Reliability Test at WTC Lab.**
**Littelfuse Wuxi in-house will be ready to start mass production.**

## Supplement –

**Marking demonstration for Wuxi made parts and our current subcontractor manufacturing made parts**

Wuxi parts use Character and subcontractor manufacturing use number