Littelfuse

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Jan. 20th, 2017

RE: LFPCN41245

TO: Our Valued Customers

From: Littelfuse Product Management Team

Subject: LFPCN41245- Axial Package 2nd Assembly Manufacturing Site Approval

This is a notification of 2nd assembly facility approval for some Littelfuse semiconductor axial-packaged products including TVS, SIDACtor and SIDAC. Please refer to attachment for affected parts number list.

Qualification efforts have been completed and all affected products have been fully qualified in accordance with established performance and reliability criteria. Both assembly sites use current Wuxi in-house dies.

We will start implementing this change on Apr 20th 2017. The new facility will begin its shipments starting in May 1st 2017, and customers can expect to start receiving products from that point moving forward. This is a rolling change and you can expect products from both assembly manufacturing sites during the implementation period.

Full qualification data and/or samples will be available upon request.

Form, fit, function and shape changes: Comply to JEDEC standard and datasheet
Part number changes: None
Effective date: Apr 20th 2017
Replacement products: N/A
Last time buy: Mar 1st 2017

This notification is for your information and acknowledgement. If you have any other questions or concerns, please contact Meng Wang, Assistant Product Manager for Axial-Packaged TVS and SIDACtor , contact Jia Zhu for Axial-Packaged SIDAC

We value your business and look forward to assisting you

Best Regards,

Meng Wang

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800 E. Northwest Highway Des Plaines, IL 60016

Product/Process Change Notice (PCN)

PCN#: LFPCN41245 Date: Jan 20th 2017

Product Identification:

Littelfuse semiconductor Axial-Packaged Product

Implementation Date for Change:

Apr 20th 2017

Contact Information

Name: Meng Wang

Title: Assistant Product Manager

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Category of Change:

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

Description of Change:

Littelfuse would notify you the we now have a 2nd manufacture facility qualified a as a Littelfuse alternative assembly ,testing and packing facility for littelfuse semiconductor axial package products DO-41 and DO-201,DO-15 SIDAC and SIDACtor.

There is no electrical parameter change. All relevant details comparison are included in the supplemental qualfication report page

Important Dates:

- ☒ Qualification Samples Available: Jan 20th 2017
- ☐ Last Time Buy: Mar 1st 2017
- ☒ Final Qualification Data Available: Jan 20th 2017
- ☐ Date of Final Product Shipment:

Method of Distinguishing Changed Product

- ☐ Product Mark,
- ☒ Date Code, refer to last page -marking
- ☐ Other,

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

N/A

LF Qualification Plan/Results:

Please refer to supplemental page

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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Shuo Fang Industrial Park
Wuxi, Jiangsu 214142

Product Qualification Report

To: Those Who May Concern

From: Hellen Yang, Senior Product Engineer, Littelfuse.

Date: Jan 16th , 2016

Subject: Manufacturing location changed of DO-41 TVS/ DO-15 SIDACtor & SIDAC/ DO-201 TVS& SIDACtor packages

Purpose:

This report is to inform the successful qualification test results associated with DO-41 TVS/ DO-15 SIDAC & SIDACtor/ DO-201 TVS & SIDACtor product series in outsource plant.

1. Qualification Types (Test Vehicle)

Product Series	Representative Test Sample Part Numbers	Package	Assembly Location
Commercial TVS	P4KE6.8A	DO-41	Outsource
	P4KE91CA		
	P4KE510A		
	LCE24A	DO-201	
	1.5KE6.8A		
	1.5KE510A		
SIDAC	K2000GURP	DO-15	
	K2200GRP		
	K22001GRP		
SIDACtor	P0080GALRP	DO-15	
	P3002GBLRP		
	T10B080B	DO-201	

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2. Qualification Test Items and Result Summary:

Product	Test Category	Description	Sample P/N	Sample Qty	Littelfuse test Ref#	Contents/Conditions	Standard	Result Summary
SIDACtor	Parametric	Electrical Parameters	P0080GALRP	270	89490	V_{BO}, Vdrm , IH, VT		100% meet published spec.
			P3002GBLRP	270	89490			
			T10B080B	270	89490			
	Surge out	surge out 8/20us	P0080GALRP	10	89491	+/- hit, from rated Ipp, 0.1Ipp step		100% passing at Rated IPP
			P3002GBLRP	10	89491			
			T10B080B	10	89491			
		surge out 10/700us	P0080GALRP	10	89491	+/- hit, from rated Ipp, 0.1Ipp step		100% passing at Rated IPP
			P3002GBLRP	10	89491			
			T10B080B	10	89491			
		surge out 10/1000us	P0080GALRP	10	89491	+/- hit, from rated Ipp, 0.1Ipp step		100% passing at Rated IPP
			P3002GBLRP	10	89491			
			T10B080B	10	89491			
	Reliability	DC/AC Blocking (HTRB)	P0080GALRP	77	89490	125℃, 24h at +/-80%Vdrm, AC blocking test with AC peak 80% Vdrm 168/504/1008h	M-1038, Cond. A	0 failure at 1008h
			P3002GBLRP	77	89490			
			T10B080B	77	89490			
		Temp Cycle	P0080GALRP	40	89490	1000cycles, -55°C & +150°C,	M-1051, Cond. F	0 failure at 1000 cycles
			P3002GBLRP	40	89490			
			T10B080B	40	89490			
		H3TRB	P0080GALRP	40	89490	168/504/1008 hours at Tj = 85C/85% RH with device reverse biased at 80% VDRM and not exceed 52V.	EIA/JESD22-A101B	0 failure at 1008h
			P3002GBLRP	40	89490			
			T10B080B	40	89490			
		HTSL	P0080GALRP	40	89490	168/504/1008h at 150°C	JESD22-A103	0 failure at 1008h
			P3002GBLRP	40	89490			
			T10B080B	40	89490			
		Autoclave	P0080GALRP	40	89490	TA = 121 ℃, RH =100% 48/96h	EIA/JESD22-A102B	Pass
			P3002GBLRP	40	89490			
			T10B080B	40	89490			
		Solderability	P0080GALRP	10	89490	Both B and D test methods		0% failure after Solderability
		RSH	P0080GALRP	30	89490	260℃, 10 seconds*3 full	M-2031	0% failure after RSH

Product	Test Category	Description	Sample P/N	Sample Qty	Littelfuse test Ref#	Contents/Conditions	Standard	Result Summary
SIDAC	Parametric	Electrical Parameters	K2000GURP	200	89479	V_{BO}, Vdrm , IH, VT		100% meet published spec.
			K2200GRP	200	89479			
			K2201GRP	200	89479			
		ITRM	K2000GURP	5	89483	TA 125°C, 168hr, ITRM , 5Hz, 10usec Pulse width		pass
			K2200GRP	5	89483			
			K2201GRP	5	89483			
		ITSM	K2000GURP	10	89483	50hz, Single cycle test from rated Ipp, 0.1Ipp step		100% passing at Rated IPP
			K2200GRP	10	89483			
			K2201GRP	10	89483			
	Reliability	AC Blocking (HTRB)	K2000GURP	77	89479	125 , Vpk=Vdrm 168/504/1008h	JESD22- A108	0 failure at 1008h
			K2200GRP	77	89479			
			K2201GRP	77	89479			
		Temp Cycle	K2000GURP	40	89479	1000cycles, -55°C & +150°C, dwell time 15mins, transfer time less than 10sec	JESD22-A104	0 failure
			K2200GRP	40	89479			
			K2201GRP	40	89479			
		H3TRB	K2000GURP	40	89479	H3TRB, 85°C, 85%RH, +DC at 80%VBO min, 1,008hr	JESD22-A101	0 failure at 1008h
			K2200GRP	40	89479			
			K2201GRP	40	89479			
		Autoclave	K2000GURP	40	89479	TA = 121 ℃, RH =100% 48/96h	EIA/JESD22-A102B	Pass
			K2200GRP	40	89479			
			K2201GRP	40	89479			
		RSH	K2000GURP	30	89487	No preheating Bath 260°C, full submerge 10 sec x 2	JESD22- B106	0% failure after RSH
			K2201GRP	30	89487			

Product	Test Category	Description	Sample P/N	Sample	Littelfuse test Ref#	Contents/Conditions	Standard	Result Summary
Commercial TVS	Parametric	Electrical Parameters	P4KE91CA	270	89372	VBR, IR		100% meet published spec.
			P4KE6.8A	270	89372			
			P4KE510A	270	89372			
			LCE24A	270	89639			
			1.5KE510A	270	89372			
			1.5KE6.8A	270	89372			
	Surge Out	10X1000us Surge Out	P4KE91CA	10	89371	+/- 1 hit, from rated IPP, 0.1 IPP step		100% passing at 1.1xRated IPP
			P4KE6.8A	10	89371			
			P4KE510A	10	89371			
			LCE24A	10	89638			
			1.5KE510A	10	89371			
			1.5KE6.8A	10	89371			
			1.5KE62CA	10	89371			

Product	Test Category	Description	Sample P/N	Sample	Littelfuse test Ref#	Contents/Conditions	Standard	Result Summary
Commercial TVS	Reliability	DC Blocking (HTRB)	P4KE91CA	77	89372	℃ 150 , VR,168/504/1008h	JESD22-A108	0% failure at 1008 hours
			P4KE6.8A	77	89372			
			P4KE510A	77	89372			
			LCE24A	77	89639			
			1.5KE510A	77	89372			
			1.5KE6.8A	77	89372			
		High Temp Storage (HTSL)	P4KE91CA	40	89372	168/504/1008h at 175°C	JESD22-A103	0% failure at 1008 hours
			P4KE6.8A	40	89372			
			P4KE510A	40	89372			
			LCE24A	40	89639			
			1.5KE510A	40	89372			
			1.5KE6.8A	40	89372			
		Biased Temp & Humidity (H3TRB)	P4KE91CA	40	89372	168/504/1008 hours at Tj = 85C/85% RH with device reverse biased at VDRM.	JESD22-A101	0% failure at 1008 hours
			P4KE6.8A	40	89372			
			P4KE510A	40	89372			
			LCE24A	40	89639			
			1.5KE510A	40	89372			
			1.5KE6.8A	40	89372			
		Autoclave	P4KE510A	40	89372	TA = 121 , RH =100% 48/96h	EIA/JESD22-A102B	0% failure at 96 hours
			LCE24A	40	89639			
			1.5KE510A	40	89372			
		Temp Cycle	P4KE91CA	40	89372	1000cycles, -55°C & +150°C, dwell time 15mins, transfer time less than 10sec	JESD22-A104	0% failure at 1000 cycles
			P4KE6.8A	40	89372			
			P4KE510A	40	89372			
			LCE24A	40	89639			
			1.5KE510A	40	89372			
			1.5KE6.8A	40	89372			
		Resistance to Solder Heat (RSH)	P4KE510A	30	89372	No preheating Bath 260°C, full submerge 10 sec x 2 time	JESD22-B106	0% failure after RSH
			LCE24A	30	89639			
			1.5KE510A	30	89372			

3. Conclusion

According to the above qualification test results, Littelfuse concluded that the product series which completed by outsource passed the all Reliability Test at WTC Lab.
Outsource will be ready to start mass production.

4. MTBF Calculation

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

SIDAC:

Temp ℃	% FR/khrs	MTBF (K)	FITS
30	0.000042	2352587.88	0.43
60	0.001334	74917.70	13.35
80	0.009596	10420.83	95.96
100	0.055840	1790.81	558.41
125	0.393514	254.12	3935.15

SIDACtor:

Temp ℃	% FR/khrs	MTBF (K)	FITS
30	0.000042	2352587.88	0.43
60	0.001334	74917.70	13.35
80	0.009596	10420.83	95.96
100	0.055840	1790.81	558.41
125	0.393514	254.12	3935.15

TVS:

Temp ℃	% FR/khrs	MTBF (K)	FITS
30	0.00000380	26326122.77	0.04
60	0.00011928	838350.21	1.19
80	0.00085754	116612.01	8.58
100	0.00499010	20039.69	49.9
125	0.03516574	2843.68	351.66
150	0.19675727	508.24	1967.57

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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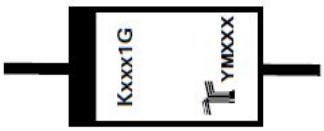
There will be marking change for the products in outsource and just as below:

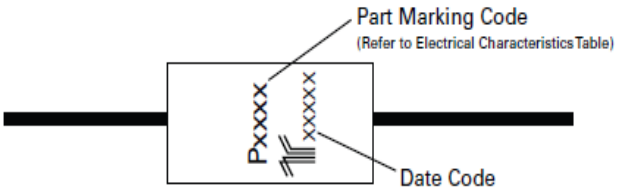
1. **Marking**

1.1 SIDAC:



Will change the trace code marking from YMXXX&XXXXX to YM6XX and number 6 is the location code.

1.2 SIDACtor:



1.3 TVS: no change of date code.