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Sep, 1st, 2014

RE: LFPCN41220

To: Our Valued Customers.

From: Littelfuse Product Management Team

Subject: Littelfuse DO-214AC Package Process Upgrade – matrix lead-frame design

Similar to LFPCN41196 issued last year in which Littelfuse migrated DO-214AB package from single strip design to matrix lead frame design (Automation Structure), This PCN is to upgrade another package DO-214AC to be matrix lead-frame design.

This new matrix design in DO-214AC packages will allow Littelfuse to align the same matrix structure design using among full DO-214AC series products, existing DO-214AA as well as DO-214AB products.

The matrix lead frame structure design will contribute great improvement in terms of automation, quality, productivity increasing as well as capacity expansion

The scope of change will cover full DO-214AC packages from Semiconductor Business Unit (SBU) products including SIDACTor® devices, SIDAC and Commodity TVS, Please refer to attachment for details and affected PNs.

There are no changes to fit, form, and function of the finished product. Qualification efforts are completed. Please see the attached documentation 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: Dec, 1st, 2014
Replacement Products: N/A
Last Time Buy: N/A

If you have any other question or concerns, please contact Littelfuse® local sales representative, or Meng Wang, Assistant Product Manager for further assistance.

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

Best Regards,

Meng Wang

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Product/Process Change Notice (PCN)

PCN#: LFPCN41220 **Date:** Sep 1st 2014

Product Identification:

DO-214AC Package Products

Implementation Date for Change:

Dec 1st 2014

Contact Information

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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:

Through this PCN after upgrading DO-214AC to Matrix Lead frame design. Littelfuse upgraded all DO-214 package products among Semiconductor Business Unit (SBU) surface mount type to matrix lead frame design, which is more efficient, better product repeatability, and better uniform through automation, thus Littelfuse can deliver more reliable device to customer.

Littelfuse will begin to implement this upgrade in Dec 1st 2014 and followed migrations period and will be fully Matrix lead frame structure by June 30th 2015

Important Dates:

- Qualification Samples Available: Sep 1th 2014
- Last Time Buy: N/A
- Final Qualification Data Available: Sep 1th 2014
- Date of Final Product Shipment: N/A

Method of Distinguishing Changed Product

- Product Mark, N/A
- Date Code, 4Lxxx
- Other,

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

N/A

LF Qualification Plan/Results:

available on Sep 1th 2014, see attached next 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.

Littelfuse, WX
East 1# Zhen Fa 6 Road
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Product Qualification Report

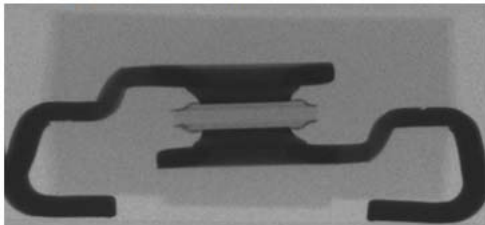
To: Those who may concern
From: Product Engineering, Littelfuse, WX
Date: Aug. 27, 2014 - Rev 0.0
Subject: **Qualification Report for Littelfuse TVS/SIDACtor/SIDAC DO-214AC Matrix lead frame Structure**

Purpose:

This report is to inform the successful LF Commodity TVS/SIDACtor/SIDAC DO-214AC Matrix lead frame Structure qualification test results

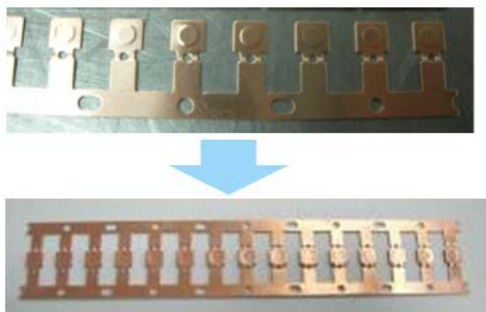
Change demonstration

X-ray Single strip Structure(old):

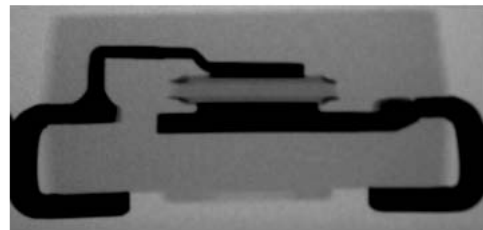


1. Double lead frames:

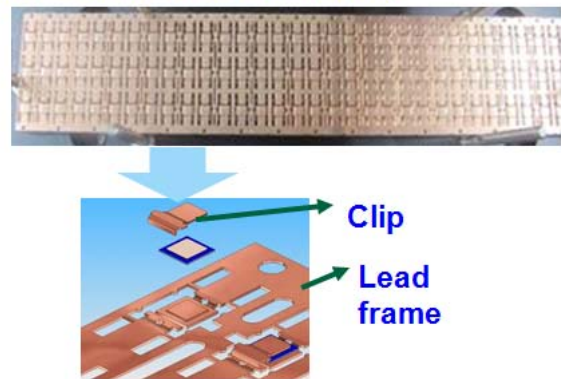
Top lead frame is same as bottom lead frame
as below:



X-Ray Matrix Lead frame Structure(new)



1. Matrix lead frame + Clip



1. Qualification Types (Test Vehicle)

Product Package	Product Series	Representative Test Sample Part Numbers
DO-214AC	TVS	SMAJ70CA
		SMAJ300A
		P4SMA300A
		SMAJ300CA
		SMAJ5.0A
	SIDACTor	P833P0080S1BLRP
		P3100S1BLRP
	SIDAC	K2000S1URP

2. Qualification Test Items and Result Summary:

SIDACTor

Test Category	Description	Sample P/N	Sample Qty	Littelfuse test Ref#	Contents/Conditions	Result Summary
Parametric	Electrical Parameters	P833P0080S1BLRP	30	60506	V _{BO} , V _{drm} , IH, VT	100% meet published spec.
		P3100S1BLRP	30	60514		
	surge out 8*20us	P833P0080S1BLRP	10	60506	+/- hit, from rated Ipp, 0.1Ipp step	100% passing at Rated IPP
		P3100S1BLRP	10	60514		
	surge out 10*700us	P833P0080S1BLRP	10	60506	+/- hit, from rated Ipp, 0.1Ipp step	100% passing at Rated IPP
		P3100S1BLRP	10	60514		
surge out 10*1000us	P833P0080S1BLRP	10	60506	+/- hit, from rated Ipp, 0.1Ipp step	100% passing at Rated IPP	
	P3100S1BLRP	10	60514			
Reliability	Pre-condition	P833P0080S1BLRP	120	60503	SMD qualification parts for TC,AC,H3TRB	Follow JESD22-A113D
		P3100S1BLRP	120	60510		
	DC/AC Blocking (HTRB)	P833P0080S1BLRP	77	60503	125°C, 24h at +/-80%V _{drm} , AC blocking test with AC peak 80% V _{drm} 168/504/1008h	0 failure at 1008h
		P3100S1BLRP	77	60510		
	HTSL	P833P0080S1BLRP	40	60503	168/504/1008h at 150°C +preconditioning	0 failure at 1008h
		P3100S1BLRP	40	60510		
	Temp Cycle	P833P0080S1BLRP	40	60503	100cycles, -65°C & +150°C,	0 failure
		P3100S1BLRP	40	60510		
	(H3TRB)	P833P0080S1BLRP	40	60503	168/504/1008 hours at T _j = 85C/85% RH with device reverse biased at 80% V _{DRM} and not exceed 52V.	0 failure at 1008h
		P3100S1BLRP	40	60510		
	Autoclave	P833P0080S1BLRP	40	60503	TA = 121°C, RH =100% 48/96h	Pass
		P3100S1BLRP	40	60510		
	MSL	P833P0080S1BLRP	10	60503	Per JEDEC-J-STD-020C, Level1	Pass
		P3100S1BLRP	10	60510		
RSH	P833P0080S1BLRP	30	60503	260°C, 10 seconds*3 full submerge	0% failure after RSH	
	P3100S1BLRP	30	60510			

TVS:

Test Category	Description	Sample P/N	Sample Qty	Littelfuse test Ref#	Contents/Conditions	Result Summary
Parametric	Electrical Parameters	SMAJ70CA	600	60500	V _{BR} , I _R	100% meet published spec.
		SMAJ300A	600	60516		
		P4SMA300A	600	60538		
		SMAJ300CA	600	60546		
		SMAJ5.0A	600	60661		
Surge IPP test	10X1000us Surge Test	SMAJ70CA	600	60500	+/- 1 hit, at rated IPP	100% passing at Rated IPP
		SMAJ300A	600	60516		
		P4SMA300A	600	60538		
		SMAJ300CA	600	60546		
		SMAJ5.0A	600	60661		
Reliability Test	Pre-condition (PC)	SMAJ70CA	231	60500	SMD qualification parts for TC,AC,H3TRB	Follow JESD22-A113D, 0 failure
		SMAJ300A	231	60516		
		P4SMA300A	231	60538		
		SMAJ300CA	231	60546		
		SMAJ5.0A	231	60661		
	DC Blocking (HTRB)	SMAJ70CA	77	60500	150°C, DC bias=100% of V _R spec	Follow JESD22-A108, 0 failure at 1008hrs
		SMAJ300A	77	60516		
		P4SMA300A	77	60538		
		SMAJ300CA	77	60546		
		SMAJ5.0A	77	60661		
	High Temp Storage (HTSL)	SMAJ70CA	77	60500	150°C, no bias	Follow JESD22-A103, 0 failure at 1008hrs
		SMAJ300A	77	60516		
		P4SMA300A	77	60538		
		SMAJ300CA	77	60546		
		SMAJ5.0A	77	60661		
	Biased Temp & Humidity (H3TRB)	SMAJ70CA	77	60500	85°C, 85%,RH DC bias=100% of V _R spec	Follow JESD22-A101, 0 failure at 1008hrs
		SMAJ300A	77	60516		
		P4SMA300A	77	60538		
		SMAJ300CA	77	60546		
		SMAJ5.0A	77	60661		
	Temp Cycle	SMAJ70CA	77	60500	-55°C & 150°C (air to air)	Follow JESD22-A104, 0 failure at 1000cycles
		SMAJ300A	77	60516		
		P4SMA300A	77	60538		
		SMAJ300CA	77	60546		
		SMAJ5.0A	77	60661		
	Autoclave	SMAJ70CA	77	60500	T _A = 121°C, RH =100%, 15psig	Follow JESD22-A102, 0 failure at 96hrs
		SMAJ300A	77	60516		
		P4SMA300A	77	60538		
SMAJ300CA		77	60546			
SMAJ5.0A		77	60661			
MSL	MSL	SMAJ70CA	77	60500	Follow JEDEC J-STD-020D, MSL 1	Pass
		SMAJ300A	77	60516		
		P4SMA300A	77	60538		
		SMAJ300CA	77	60546		
		SMAJ5.0A	77	60661		
		SMAJ70CA	77	60500		
RSH	RSH	SMAJ70CA	77	60500	260°C, 10 seconds	Follow JESD22-B106

SIDAC:

Test Category	Description	Sample P/N	Sample Qty	Littelfuse test Ref#	Contents/Conditions	Standard	Result Summary
Parametric	Electrical	K2000S1URP	362	60506	V _{bo} , V _{drm} , I _H , V _T		100% meet published
	ITRM	K2000S1URP	10	60506	TA 125°C, 168hr, ITRM = 160A+10/-0Apeak, 5Hz, 10usec Pulse width		pass
	ITSM	K2000S1URP	5	62164	50hz, Single cycle test from rated Ipp, 0.1pp step		100% passing at Rated IPP
Reliability	Pre-condition	K2000S1URP	120	60506	SMD qualification parts for TC,AC,H3TRB	JESD22-A113D	pass
	AC Blocking (HTRB)	K2000S1URP	77	60506	125°C, V _{pk} =V _{drm} 168/504/1008h	JESD22- A108	0 failure at 1008h
	HTSL	K2000S1URP	40	60506	168/504/1008h at 150°C	JESD22-A103	0 failure at 1008h
	Temp Cycle	K2000S1URP	40	60506	100cycles, -40°C & +150°C, dwell time 15mins, transfer time less than 10sec	JESD22-A104	0 failure
	H3TRB	K2000S1URP	40	60506	H3TRB, 85°C, 85%RH, +DC at 80%VBO min, 1,008hr	JESD22-A101	0 failure at 1008h
	RSH	K2000S1URP	30	60506	No preheating Bath 260°C, full submerge 10 sec x 2 time	JESD22- B106	0% failure after RSH

3. MTBF Calculation

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

Temp °C	% FR/khrs	MTBF (K)	FITS
30	0.000455821	2193844	0.46
60	0.014313827	69863	14.31
80	0.102905353	9718	102.91
100	0.59881152	1670	598.81
125	4.219888592	237	4219.89
150	23.61087256	42	23610.87

Note: 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.

4. Conclusion

According to the above qualification test results, Littelfuse concluded that TVS/SIDACtor/SIDAC DO-214AC Matrix lead frame structure have passed Qualification test at WTC Lab, which is approved to release for mass production.