Reliability Report

Back-metallization Change: From Gold to Silver

T. V.: LD1117STR

General Information	
Product Line	KSAD01
Product Description	Adjustable and fixed low drop positive voltage regulator
P/N	LD1117STR
Product Group	IPD IND.& POWER CONV
Product division	Linear Voltage Regulators & Vref
Packages	SOT 223
Silicon Process technology	BiP > 6um

Locations	
Wafer fab	*SINGAPORE Ang Mo Kio*
Assembly plant	*NANTONG FUJITSU*
Reliability Lab	*CATANIA*
Reliability assessment	pass

DOCUMENT INFORMATION

Version	Date	Pages	Prepared by	Approved by	Comment
1.0	03 Dec-15	7	Giuseppe Failla	Giovanni Presti	Final Report

Note: This report is a summary of the reliability trials performed in good faith by STMicroelectronics in order to evaluate the potential reliability risks during the product life using a set of defined test methods.
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1 APPLICABLE AND REFERENCE DOCUMENTS

Document reference	Short description
JESD47	Stress-Test-Driven Qualification of Integrated Circuit
Reliability Report	REL.6088-230-W-2015 (T.V.: L203)
Reliability Report	REL.6088-298-W-2015 (T.V.: LX05)
Reliability Report	REL.6088-299-W-2015 (T.V.: LUAD)

2 GLOSSARY

DUT	Device Under Test
SS	Sample Size
TV	Test Vehicle

3 RELIABILITY EVALUATION OVERVIEW

3.1 Objectives

Change Process: Back-metallization Change from Gold to Silver

The plan includes the following TVs:

KSAD in SOT223	**GLUE DIE ATTACH**	**NFME**
L203 IN SO16	GLUE DIE ATTACH	BOSKOURA
LUAD in D2PAK	SOFT SOLDER DIE ATTACH	STS
LX05 in TO220 SG	SOFT SOLDER DIE ATTACH	STS

For each TV the comparison between Au and Ag back metallization has been performed during the reliability stresses.

The present report is related to the TV LD1117STR (KSAD line) in SOT 223 (Glue DIE Attach, NANTONG FUJITSU plant)

3.2 Conclusion

Qualification Plan requirements have been fulfilled without exception.
No failure, related to Ag back metallization, has been highlighted. The new Ag back metallization has shown a performance aligned with the STD Au back metallization:

4 DEVICE CHARACTERISTICS

4.1 Device description

The LD1117 is a low drop voltage regulator able to provide up to 800 mA of output current, available even in adjustable version (VREF = 1.25 V). Concerning fixed versions, are offered the following output voltages: 1.2 V, 1.8 V, 2.5 V, 2.85 V, 3.3 V and 5.0 V. High efficiency is assured by NPN pass transistor. In fact in this case, unlike than PNP one, the quiescent current. flows mostly into the load. Only a very common 10 µF minimum capacitor is needed for stability. On chip trimming allows the regulator to reach a very tight output voltage tolerance, within ± 1 % at 25 °C. The adjustable LD1117 is pin to pin compatible with the other standard. Adjustable voltage regulators maintaining the better performances in terms of drop and tolerance.

4.2 Construction note

P/N	KSAD	
	STD Backside (Gold)	**New Backside (Silver)**
Wafer/Die fab. information		
Wafer fab manufacturing location	SINGAPORE Ang Mo Kio	
Technology	BiP > 6um	
Die finishing back side	**CHROMIUM/NICKEL/GOLD**	**CHROMIUM/NICKEL/SILVER**
Die size	1990, 1860 micron	
Passivation type	SiN (nitride)	
Wafer Testing (EWS) information		
Electrical testing manufacturing location	Ang Mo Kio EWS	
Tester	ETS300	
Test program	KSADQAE01	
Assembly information		
Assembly site	NANTONG FUJITSU	
Package description	**SOT 223**	
Molding compound	Epoxy	
Frame	SOT223E 113x108mils	
Die attach material	**GLUE DIE ATTACH**	
Wires bonding materials/diameters	WIRE 1,5 MILS Cu	
Final testing information		
Testing location	NANTONG FUJITSU	
Tester	No Info available	
Test program	KSAD_HIGH CLASS_FUJITSU	

5 TESTS RESULTS SUMMARY

5.1 Test vehicle

Lot #	Tech Code	Process/ Package	Product Line	Comments
1	RFLL*KSADAA6	SOT 223	KSAD01	Au back met.
2				Ag back met.

5.2 Test plan and results summary

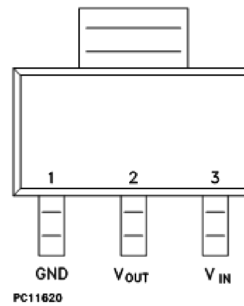
Test	PC	Std ref.	Conditions		Steps	Failure/SS		Note
						Backside AU	Backside AG	
Package Oriented Tests								
PC		JESD22 A-113	Drying 24 H @ 125°C Store 168 H @ Ta=85°C Rh=85% Oven Reflow @ Tpeak=260°C 3 times		Final	Pass	Pass	
AC	Y	JESD22 A-102	Pa=2Atm / Ta=121°C		96h	0/77	0/77	
					168h	0/77	0/77	
TC	Y	JESD22 A-104	Ta = -65°C to 150°C		100cy	0/77	0/77	
					300cy	0/77	0/77	
					500cy	0/77	0/77	

No failure related to Ag back metallization has been highlighted. The new Ag back metallization has shown a performance aligned with the STD Au back metallization:

6 ANNEXES

6.1 Device details

6.1.1 Pin connection



SOT-223

6.2 Tests Description

Test name	Description	Purpose
Package Oriented		
PC Preconditioning	The device is submitted to a typical temperature profile used for surface mounting devices, after a controlled moisture absorption.	As stand-alone test: to investigate the moisture sensitivity level. As preconditioning before other reliability tests: to verify that the surface mounting stress does not impact on the subsequent reliability performance. The typical failure modes are "pop corn" effect and delamination.
TC Temperature Cycling	The device is submitted to cycled temperature excursions, between a hot and a cold chamber in air atmosphere.	To investigate failure modes related to the thermo-mechanical stress induced by the different thermal expansion of the materials interacting in the die-package system. Typical failure modes are linked to metal displacement, dielectric cracking, molding compound delamination, wire-bonds failure, die-attach layer degradation.
AC Auto Clave (Pressure Pot)	The device is stored in saturated steam, at fixed and controlled conditions of pressure and temperature.	To investigate corrosion phenomena affecting die or package materials, related to chemical contamination and package hermeticity.

IPD (Industrial & Power Discrete Group)

Industrial Power Conversion

Linear Voltage Regulators & Vref

Quality and Reliability

REL.6088-298-W-2015

Reliability Report

Back-metallization Change: From Gold to Silver

T. V.:L7805CV

General Information	
Product Line	LX0501
Product Description	Positive voltage regulator ICs
P/N	L7805CV
Product Group	IPD IND.& POWER CONV
Product division	Linear Voltage Regulators & Vref
Packages	TO220 - SINGLE GAUGE
Silicon Process technology	HBIP40V

Locations	
Wafer fab	*SINGAPORE Ang Mo Kio*
Assembly plant	*SHENZHEN*
Reliability Lab	*CATANIA*
Reliability assessment	*Pass*

DOCUMENT INFORMATION

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1.0	03 Dec-15	7	Giuseppe Failla	Giovanni Presti	Final Report

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1 APPLICABLE AND REFERENCE DOCUMENTS

Document reference	Short description
JESD47	Stress-Test-Driven Qualification of Integrated Circuit
Reliability Report	REL.6088-230-W-2015 (T.V.: L203)
Reliability Report	REL.6088-299-W-2015 (T.V.: LUAD)
Reliability Report	REL.6088-300-W-2015 (T.V.: KSAD)

2 GLOSSARY

DUT	Device Under Test
SS	Sample Size
TV	Test Vehicle

3 RELIABILITY EVALUATION OVERVIEW

3.1 Objectives

Change Process: Change Backmetallization from Gold to Silver

The plan includes the following TVs:

KSAD in SOT223 – GLUE DIE ATTACH NFME

L203 IN SO16 - – GLUE DIE ATTACH BOSKOURA

LUAD in D2PAK – SOFT SOLDER DIE ATTACH STS

LX05 in TO220 SG - – SOFT SOLDER DIE ATTACH STS

For each TV the comparison between Au and Ag back metallization have been performed.

The present report is related to the TV LX05 in TO220 S.G. (PREFORM DIE Attach, SHENZHEN plant)

3.2 Conclusion

Qualification Plan requirements have been fulfilled without exception.
The reliability evaluation on Present test vehicle LX05 in TO220 SG is positive.

4 DEVICE CHARACTERISTICS

4.1 Device description

The L78 series of three-terminal positive regulators.
These regulators can provide local on-card regulation, eliminating the distribution problems associated with single point regulation. Each type embeds internal current limiting, thermal shut-down and safe area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1 A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltage and currents.

4.2 Construction note

P/N	L7805CV	
	STD Backside (Gold)	New Backside (Silver)
Wafer/Die fab. information		
Wafer fab manufacturing location	SINGAPORE Ang Mo Kio	
Technology	HBIP40V	
Die finishing back side	**CHROMIUM/NICKEL/GOLD**	**CHROMIUM/NICKEL/SILVER**
Die size	1320, 1630 micron	
Passivation type	P-VAPOX/NITRIDE	
Wafer Testing (EWS) information		
Electrical testing manufacturing location	Ang Mo Kio EWS	
Tester	ETS300	
Test program	LX05B6D01	
Assembly information		
Assembly site	SHENZHEN B/E	
Package description	**TO220 - SG**	
Molding compound	EPOXY	
Frame material	FRAME TO220 SG LCC Ve1 OpD/E Bare copper	
Die attach material	**PREFORM**	
Wires bonding materials/diameters	WIRE Cu D2	
Final testing information		
Testing location	SHENZHEN B/E	
Tester	QT200	
Test program	L78FA05.CTS	

5 TESTS RESULTS SUMMARY

5.1 Test vehicle

Lot #	Tech Code	Process/ Package	Product Line	Comments
1	MZ)K*LX05B6D	TO220 - SG	LX0501	Au back met.
2				Ag back met.

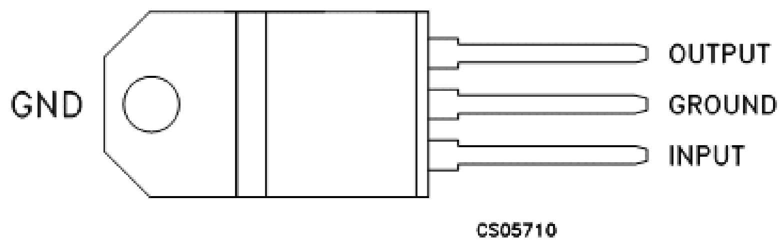
5.2 Test plan and results summary

Test		Std ref.	Conditions		Steps	Failure/SS		Note
						Backside AU	Backside AG	
Package Oriented Tests								
AC		JESD22 A-102	Pa=2Atm / Ta=121°C		96h	0/77	0/77	
TC		JESD22 A-104	Ta = -65°C to 150°C		100cy	0/77	0/77	
					300cy	0/77	0/77	
					500cy	0/77	0/77	

6 ANNEXES

6.1 Device details

6.1.1 Pin connection



TO-220

6.2 Tests Description

Test name	Description	Purpose
Package Oriented		
TC Temperature Cycling	The device is submitted to cycled temperature excursions, between a hot and a cold chamber in air atmosphere.	To investigate failure modes related to the thermo-mechanical stress induced by the different thermal expansion of the materials interacting in the die-package system. Typical failure modes are linked to metal displacement, dielectric cracking, molding compound delamination, wire-bonds failure, die-attach layer degradation.
AC Auto Clave (Pressure Pot)	The device is stored in saturated steam, at fixed and controlled conditions of pressure and temperature.	To investigate corrosion phenomena affecting die or package materials, related to chemical contamination and package hermeticity.

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P/N	LD1117STR
Product Group	IPD
Product division	IND.& POWER CONV Linear Voltage Regulators & Vref
Packages	SOT 223
Silicon Process technology	BiP > 6um

Locations	
Wafer fab	*SINGAPORE Ang Mo Kio*
Assembly plant	*NANTONG FUJITSU*
Reliability Lab	*CATANIA*
Reliability assessment	pass

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3 RELIABILITY EVALUATION OVERVIEW

3.1 Objectives

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LUAD in D2PAK	SOFT SOLDER DIE ATTACH	STS
LX05 in TO220 SG	SOFT SOLDER DIE ATTACH	STS

For each TV the comparison between Au and Ag back metallization has been performed during the reliability stresses.

The present report is related to the TV LD1117STR (KSAD line) in SOT 223 (Glue DIE Attach, NANTONG FUJITSU plant)

3.2 Conclusion

Qualification Plan requirements have been fulfilled without exception.
No failure, related to Ag back metallization, has been highlighted. The new Ag back metallization has shown a performance aligned with the STD Au back metallization:

4 DEVICE CHARACTERISTICS

4.1 Device description

The LD1117 is a low drop voltage regulator able to provide up to 800 mA of output current, available even in adjustable version (VREF = 1.25 V). Concerning fixed versions, are offered the following output voltages: 1.2 V, 1.8 V, 2.5 V, 2.85 V, 3.3 V and 5.0 V. High efficiency is assured by NPN pass transistor. In fact in this case, unlike than PNP one, the quiescent current. flows mostly into the load. Only a very common 10 µF minimum capacitor is needed for stability. On chip trimming allows the regulator to reach a very tight output voltage tolerance, within ± 1 % at 25 °C. The adjustable LD1117 is pin to pin compatible with the other standard. Adjustable voltage regulators maintaining the better performances in terms of drop and tolerance.

4.2 Construction note

P/N	KSAD	
	STD Backside (Gold)	New Backside (Silver)
Wafer/Die fab. information		
Wafer fab manufacturing location	SINGAPORE Ang Mo Kio	
Technology	BiP > 6um	
Die finishing back side	**CHROMIUM/NICKEL/GOLD**	**CHROMIUM/NICKEL/SILVER**
Die size	1990, 1860 micron	
Passivation type	SiN (nitride)	
Wafer Testing (EWS) information		
Electrical testing manufacturing location	Ang Mo Kio EWS	
Tester	ETS300	
Test program	KSADQAE01	
Assembly information		
Assembly site	NANTONG FUJITSU	
Package description	**SOT 223**	
Molding compound	Epoxy	
Frame	SOT223E 113x108mils	
Die attach material	**GLUE DIE ATTACH**	
Wires bonding materials/diameters	WIRE 1,5 MILS Cu	
Final testing information		
Testing location	NANTONG FUJITSU	
Tester	No Info available	
Test program	KSAD_HIGH CLASS_FUJITSU	

5 TESTS RESULTS SUMMARY

5.1 Test vehicle

Lot #	Tech Code	Process/ Package	Product Line	Comments
1	RFLL*KSADAA6	SOT 223	KSAD01	Au back met.
2				Ag back met.

5.2 Test plan and results summary

Test	PC	Std ref.	Conditions		Steps	Failure/SS		Note
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Package Oriented Tests								
PC		JESD22 A-113	Drying 24 H @ 125°C Store 168 H @ Ta=85°C Rh=85% Oven Reflow @ Tpeak=260°C 3 times		Final	Pass	Pass	
AC	Y	JESD22 A-102	Pa=2Atm / Ta=121°C		96h	0/77	0/77	
					168h	0/77	0/77	
TC	Y	JESD22 A-104	Ta = -65°C to 150°C		100cy	0/77	0/77	
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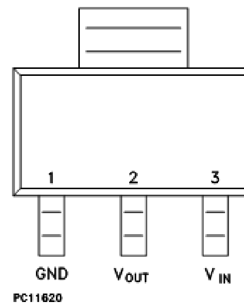
6.1 Device details

6.1.1 Pin connection



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Test name	Description	Purpose
Package Oriented		
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