

Reliability Evaluation Report

TO220 Jihlin (Xing-Ye)

General Information		Locations	
Product Lines	LX05D6B	Wafer fab	Singapore 6
Product Description	POSITIVE VR 1.5A 5V		
P/N	MZ80*LX05D6B	Assembly plant	STS
Product Group	L7805ABV-DG\$4Z		
Product division	AMG	Reliability Lab	Catania Reliability LAB
Product division	General Purpose Analog & RF		
Package	POWER MANAGEMENT		
Silicon Process technology	TO220 DG		
	HBIP40V		
	Back metallization: Cr/Ni/Au		
General Information		Locations	
Product Lines	LTDA6C2	Wafer fab	Singapore 6
Product Description	SEMI LOWDROP ADJ. VR 1.5A		
P/N	MZ80*LTAD6C2	Assembly plant	STS
Product Group	LD1086BV-DG\$2Z		
Product division	AMG	Reliability Lab	Catania Reliability LAB
Product division	General Purpose Analog & RF		
Package	POWER MANAGEMENT		
Silicon Process technology	TO220 DG		
	B30II		
	Back metallization: Cr/Ni/Ag		
General Information		Locations	
Product Lines	L3171A6	Wafer fab	Singapore 6
Product Description	ADJ. POS. VR @1.5A		
P/N	MZ80*L3171A6	Assembly plant	STS
Product Group	LM317T-DG\$3Z		
Product division	AMG	Reliability Lab	Catania Reliability LAB
Product division	General Purpose Analog & RF		
Package	POWER MANAGEMENT		
Silicon Process technology	TO220 DG		
	BIP (>6um)		
	Back metallization: Cr/Ni/Ag		

DOCUMENT INFORMATION

Version	Date	Pages	Prepared by	Approved by	Comment
1.0	July-2017	8	Alfio Rao	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 Circuits

2 GLOSSARY

DUT	Device Under Test
SS	Sample Size

3 RELIABILITY EVALUATION OVERVIEW

TO220 Jihlin (XingYe) Copper development, comparison with STD frame.

3.1 Objectives

To qualify the Jihlin (Xing-Ye) Copper development for TO220 in ST Shenzhen. The reliability verification has been performed by Test Vehicles

FE

TV1: MZ80*LX05D6B - Cr/Ni/Au - HBIP40V
TV2: MZ80*LTAD6C2 - Cr/Ni/Ag - B30II
TV3: MZ80*L3171A6 - Cr/Ni/Ag - BIP (>6um)

BE

TO220: Jihlin (XingYe) Copper development in ST Shenzhen

In order to cover the FE/BE compatibility with special focus on Back metallization (Cr/Ni/Au and Cr/Ni/Ag), a minimum of 3 assy/diff. lots will be requested.

SAM verification after TC have been requested as additional verification on the interface Die/Frame

3.2 Conclusion

Qualification Plan requirements have been fulfilled without exception. It is stressed that reliability tests have shown that the devices behave correctly against environmental tests (no failure). Moreover, the stability of electrical parameters during the accelerated tests demonstrates the ruggedness of the products and safe operation, which is consequently expected during their lifetime.

4 DEVICE CHARACTERISTICS

4.1 Device description

L78

Positive voltage regulator ICs

Description

The L78 series of three-terminal positive regulators is available in TO-220, TO-220FP, D²PAK and DPAK packages and several fixed output voltages, making it useful in a wide range of applications. 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.

LD1086

1.5 A adjustable and fixed low drop positive voltage regulator

Description

The LD1086 is a low drop voltage regulator capable of providing up to 1.5 A of output current. Dropout is guaranteed at a maximum of 1.2 V at the maximum output current, decreasing at lower loads. The LD1086 is pin-to-pin compatible with older 3-terminal adjustable regulators, but has better performance in terms of drop and output tolerance. Unlike PNP regulators, where a part of the output current is wasted as quiescent current, the LD1086 quiescent current flows into the load, increasing efficiency. Only a 10 μ F (minimum) capacitor is needed for stability. The device is available in a TO-220, D²PAK, D²PAK/A, DPAK or DFN8 (4x4) package. On-chip trimming allows the regulator to reach a very tight output voltage tolerance; within $\pm 1\%$ at 25 °C. The LD1086 is available as automotive grade for adjustable output voltages in the TO-220 and DPAK packages. The PAT, SYL, SBL statistical tests have been performed, and the devices are qualified according to the AEC-Q100 specification for the automotive market in the temperature range of - 40 °C to 125 °C.

LM317

1.2 V to 37 V adjustable voltage regulators

Description

The LM217, LM317 are monolithic integrated circuits in TO-220, TO-220FP and D²PAK packages intended for use as positive adjustable voltage regulators. They are designed to supply more than 1.5 A of load current with an output voltage adjustable over a 1.2 to 37 V range. The nominal output voltage is selected by means of a resistive divider, making the device exceptionally easy to use and eliminating the stocking of many fixed regulators.



AMG (Analog and MEMS Group)
General Purpose Analog & RF Division
Power Management
Quality and Reliability

REL.6088.206-W-17

4.2 Construction note

		P/N:L7805ABV		P/N:LD1086BV		P/N:LM317T	
Wafer/Die fab. information							
Wafer fab manufacturing location		SINGAPORE 6					
Technology		HBIP40V		BIP PROJ & DE		BIP (>6um)	
Process family		HBIP40V P+ option		B30II (12/1m)		AT/ (8/1m)	
Die finishing back side		CHROMIUM/NICKEL/GOLD		Cr/Ni/Ag			
Die size		1,320, 1,630 micron		2,320, 2,340 micron		2,410, 1,920 micron	
Die finish front:		P-VAPOX/NITRIDE		SiN (nitride)			
Wafer Testing (EWS) information							
Electrical testing manufacturing location		Ang Mo Kio EWS					
Tester		ETS300		QT200		ETS300	
Test program		LX05B6D01		LTxx		L317QAE01.	
Assembly information							
Assembly site		ST SHENZHEN -CHINA					
Package description		TO 220 CU Wire on CU					
Molding compound		Epoxy					
Frame material		FRAME TO220 Mon Cu OpH/N 20u BARE COPPER					
Frame Type		TO220 DG Jihlin Xing-Ye Copper Frame	TO220 DG STD FRAME	TO220 DG Jihlin Xing-Ye Copper Frame	TO220 DG STD FRAME	TO220 DG Jihlin Xing-Ye Copper Frame	TO220 DG STD FRAME
Die attach material		PREFORM					
Wires bonding materials/diameters		WIRE Cu D2					
Final testing information							
Testing location		SHENZHEN B/E					
Tester		QT200		IPTester		QT200	
Test program		L78Z_4.7_STS.cts		LTxx		L317_27.Cts	

5 TESTS RESULTS SUMMARY

5.1 Test vehicle

Lot #	Raw line Commercial product	Package	Comments
1	JL7805ABV-DG\$4Z	TO220 DG Jihlin Xing-Ye Copper Frame	Cr/Ni/Au - HBIP40V
2	JLD1086BV-DG\$2Z		Cr/Ni/Ag - B30II
3	JLM317T-DG\$3Z		Cr/Ni/Ag - BIP (>6um)
4	L7805ABV-DG\$4Z	TO220 DG STD FRAME	Cr/Ni/Au - HBIP40V
5	LD1086BV-DG\$2Z		Cr/Ni/Ag - B30II
6	LM317T-DG\$3Z		Cr/Ni/Ag - BIP (>6um)



5.2 Test plan and results summary

Test	PC	Std ref.	Conditions		Step	Jihlin (Xing-Ye) Copper Frame			STD FRAME			Note
						Lot 1	Lot 2	Lot 3	Lot 4 STD	Lot 5STD	Lot 6 STD	
						JL7805ABV Cr/Ni/Au HBIP40V	JLD1086BV Cr/Ni/Ag B30II	JLM317T Cr/Ni/Ag BIP(>6um)	L7805ABV Cr/Ni/Au HBIP40V	LD1086BV Cr/Ni/Ag B30II	LM317T Cr/Ni/Ag BIP(>6um)	
Die Oriented Tests												
HTSL	N	JESD22 A-103	Ta= 150° C		168 H	0/ 25	0/ 25	0/ 25	0/ 25	0/ 25	0/ 25	
					500 H	0/ 25	0/ 25	0/ 25	0/ 25	0/ 25	0/ 25	
					1000 H	0/ 25	0/ 25	0/ 25	0/ 25	0/ 25	0/ 25	
Package Oriented Tests												
AC	N	JESD22 A-102	Pa= 2 Atm / Ta= 121° C		168 h	0/ 25	0/ 25	0/ 25	0/ 25	0/ 25	0/ 25	(1)
TC	N	JESD22 A-104	Ta= -65° C to 150° C		100cy	0/ 25	0/ 25	0/ 25	0/ 25	0/ 25	0/ 25	
					200cy	0/ 25	0/ 25	0/ 25	0/ 25	0/ 25	0/ 25	
					500 cy	0/ 25	0/ 25	0/ 25	0/ 25	0/ 25	0/ 25	
Other Tests												
CA	N		Construction Analysis					Pass				

(1): Statistical SAM at 0h and after 500cy with special focus on back metallization and Frame interface had positive results.

6 ANNEXES

6.1 Tests Description

Test name	Description	Purpose
Die Oriented		
HTSL High Temperature Storage Life	The device is stored in unbiased condition at the max. temperature allowed by the package materials, sometimes higher than the max. operative temperature.	To investigate the failure mechanisms activated by high temperature, typically wire-bonds solder joint ageing, data retention faults, metal stress-voiding.
Package Oriented		
PP Pressure Pot	The device is stored at controlled conditions of ambient temperature and relative humidity.	To evaluate the package moisture resistance.
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.
Other		
CA	CA: Construction Analysis	

Reliability Evaluation Report

TO220 SDC (Luoyang)

General Information	
Product Lines	LX05D6B
Product Description	POSITIVE VR 1.5A 5V
P/N	MZ80*LX05D6B
Product Group	L7805ABV-DG\$4Z
Product Group	AMG
Product division	General Purpose Analog & RF
Package	POWER MANAGEMENT
Silicon Process technology	TO220 DG
	HBIP40V
	Back metallization: Cr/Ni/Au

General Information	
Product Lines	LTDA6C2
Product Description	SEMI LOWDROP ADJ. VR 1.5A
P/N	MZ80*LTDA6C2
Product Group	LD1086BV-DG\$2Z
Product Group	AMG
Product division	General Purpose Analog & RF
Package	POWER MANAGEMENT
Silicon Process technology	TO220 DG
	B30II
	Back metallization: Cr/Ni/Ag

General Information	
Product Lines	L3171A6
Product Description	ADJ. POS. VR @1.5A
P/N	MZ80*L3171A6
Product Group	LM317T-DG\$3Z
Product Group	AMG
Product division	General Purpose Analog & RF
Package	POWER MANAGEMENT
Silicon Process technology	TO220 DG
	BIP (>6um)
	Back metallization: Cr/Ni/Ag

Locations	
Wafer fab	Singapore 6
Assembly plant	STS
Reliability Lab	Catania Reliability LAB

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3.1 Objectives

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TV2: MZ80*LTAD6C2 - Cr/Ni/Ag - B30II
TV3: MZ80*L3171A6 - Cr/Ni/Ag - BIP (>6um)

BE

TO220: SDC (Luoyang) Copper development in ST Shenzhen
In order to cover the FE/BE compatibility with special focus on Back metallization (Cr/Ni/Au and Cr/Ni/Ag), a minimum of 3 assy/diff. lots will be requested.

SAM verification after TC have been requested as additional verification on the interface Die/Frame

3.2 Conclusion

Qualification Plan requirements have been fulfilled without exception. It is stressed that reliability tests have shown that the devices behave correctly against environmental tests (no failure). Moreover, the stability of electrical parameters during the accelerated tests demonstrates the ruggedness of the products and safe operation, which is consequently expected during their lifetime.

4 DEVICE CHARACTERISTICS

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LM317

1.2 V to 37 V adjustable voltage regulators

Description

The LM217, LM317 are monolithic integrated circuits in TO-220, TO-220FP and D²PAK packages intended for use as positive adjustable voltage regulators. They are designed to supply more than 1.5 A of load current with an output voltage adjustable over a 1.2 to 37 V range. The nominal output voltage is selected by means of a resistive divider, making the device exceptionally easy to use and eliminating the stocking of many fixed regulators.



4.2 Construction note

	P/N:L7805ABV		P/N:LD1086BV		P/N:LM317T	
Wafer/Die fab. information						
Wafer fab manufacturing location	SINGAPORE 6					
Technology	HBIP40V		BIP PROJ & DE		BIP (>6um)	
Process family	HBIP40V P+ option		B30II (12/1m)		AT/ (8/1m)	
Die finishing back side	CHROMIUM/NICKEL/GOLD		Cr/Ni/Ag			
Die size	1,320, 1,630 micron		2,320, 2,340 micron		2,410, 1,920 micron	
Die finish front:	P-VAPOX/NITRIDE		SiN (nitride)			
Wafer Testing (EWS) information						
Electrical testing manufacturing location	Ang Mo Kio EWS					
Tester	ETS300		QT200		ETS300	
Test program	LX05B6D01		LTxx		L317QAE01.	
Assembly information						
Assembly site	ST SHENZHEN -CHINA					
Package description	TO 220 CU Wire on CU					
Molding compound	Epoxy					
Frame material	FRAME TO220 BARE COPPER					
Frame Type	TO220 DG SDC Luoyang Copper Frame	TO220 DG STD FRAME	TO220 DG SDC Luoyang Copper Frame	TO220 DG STD FRAME	TO220 DG SDC Luoyang Copper Frame	TO220 DG STD FRAME
Die attach material	PREFORM					
Wires bonding materials/diameters	WIRE Cu D2					
Final testing information						
Testing location	SHENZHEN B/E					
Tester	QT200		IPTester		QT200	
Test program	L78Z_4.7_STS.cts		LTxx		L317_27.Cts	

5 TESTS RESULTS SUMMARY

5.1 Test vehicle

Lot #	Raw line Commercial product	Package	Comments
1	SL7805ABV-DG\$4Z	TO220 DG SDC Luoyang Copper Frame	Cr/Ni/Au - HBIP40V
2	SLD1086BV-DG\$2Z		Cr/Ni/Ag - B30II
3	SLM317T-DG\$3Z		Cr/Ni/Ag - BIP (>6um)
4	L7805ABV-DG\$4Z	TO220 DG STD FRAME	Cr/Ni/Au - HBIP40V
5	LD1086BV-DG\$2Z		Cr/Ni/Ag - B30II
6	LM317T-DG\$3Z		Cr/Ni/Ag - BIP (>6um)

5.2 Test plan and results summary

					SDC (Luoyang) Copper Frame			STD FRAME			Note
Test	PC	Std ref.	Conditions	Step	Lot 1	Lot 2	Lot 3	Lot 4 STD	Lot 5STD	Lot 6 STD	
					SL7805ABV Cr/Ni/Au HBIP40V	SLD1086BV Cr/Ni/Ag B30II	SLM317T Cr/Ni/Ag BIP(>6um)	L7805ABV Cr/Ni/Au HBIP40V	LD1086BV Cr/Ni/Ag B30II	LM317T Cr/Ni/Ag BIP(>6um)	
Die Oriented Tests											
HTSL	N	JESD22 A-103	Ta= 150° C		168 H	0/ 25	0/ 25	0/ 25	0/ 25	0/ 25	0/ 25
					500 H	0/ 25	0/ 25	0/ 25	0/ 25	0/ 25	0/ 25
					1000 H	0/ 25	0/ 25	0/ 25	0/ 25	0/ 25	0/ 25
Package Oriented Tests											
AC	N	JESD22 A-102	Pa= 2 Atm / Ta= 121° C		168 h	0/ 25	0/ 25	0/ 25	0/ 25	0/ 25	0/ 25
TC	N	JESD22 A-104	Ta= -65° C to 150° C		100cy	0/ 25	0/ 25	0/ 25	0/ 25	0/ 25	0/ 25
					200cy	0/ 25	0/ 25	0/ 25	0/ 25	0/ 25	0/ 25
					500 cy	0/ 25	0/ 25	0/ 25	0/ 25	0/ 25	0/ 25
Other Tests											
CA	N		Construction Analysis				Pass				

(1): Statistical SAM at 0h and after 500cy with special focus on back metallization and Frame interface.

6 ANNEXES

6.1 Tests Description

Test name	Description	Purpose
Die Oriented		
HTSL High Temperature Storage Life	The device is stored in unbiased condition at the max. temperature allowed by the package materials, sometimes higher than the max. operative temperature.	To investigate the failure mechanisms activated by high temperature, typically wire-bonds solder joint ageing, data retention faults, metal stress-voiding.
Package Oriented		
PP Pressure Pot	The device is stored at controlled conditions of ambient temperature and relative humidity.	To evaluate the package moisture resistance.
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.
Other		
CA	CA: Construction Analysis	