

## Reliability Report

### *Subcon Qualification*

***TVs: L7805CD2T & LM317D2T***

***D2pak package Cu wire in Ase Weihai***

General Information	
<b>Product Lines</b>	XL05
<b>Product Description</b>	POSITIVE VR 1.5A 5V
<b>P/N</b>	L7805CD2T-TR
<b>Product Group</b>	AMG
<b>Product division</b>	General Purpose Analog & RF POWER MANAGEMENT
<b>Package</b>	D2PAK
<b>Silicon Process technology</b>	HBIP40V Back metallization: Cr/Ni/Ag

Locations	
<b>Wafer fab</b>	Singapore 6
<b>Assembly plant</b>	ASE WEIHAI
<b>Reliability Lab</b>	Catania Reliability LAB
<b>Reliability assessment</b>	Pass

General Information	
<b>Product Lines</b>	L317
<b>Product Description</b>	ADJ. POS. VR @1.5A
<b>P/N</b>	LM317D2T-TR
<b>Product Group</b>	AMG
<b>Product division</b>	General Purpose Analog & RF POWER MANAGEMENT
<b>Package</b>	D2PAK
<b>Silicon Process technology</b>	BIP (>6um) Back metallization: Cr/Ni/Ag

### DOCUMENT INFORMATION

Version	Date	Pages	Prepared by	Approved by	Comment
1.0	February 2018	8	Giuseppe Giacobello	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.

This report does not imply for STMicroelectronics expressly or implicitly any contractual obligations other than as set forth in STMicroelectronics general terms and conditions of Sale. This report and its contents shall not be disclosed to a third party without previous written agreement from STMicroelectronics.

## TABLE OF CONTENTS

<b>1</b>	<b>APPLICABLE AND REFERENCE DOCUMENTS .....</b>	<b>3</b>
<b>2</b>	<b>GLOSSARY .....</b>	<b>3</b>
<b>3</b>	<b>RELIABILITY EVALUATION OVERVIEW .....</b>	<b>3</b>
3.1	OBJECTIVES .....	3
3.2	CONCLUSION .....	3
<b>4</b>	<b>DEVICE CHARACTERISTICS .....</b>	<b>4</b>
4.1	DEVICE DESCRIPTION .....	4
4.2	CONSTRUCTION NOTE .....	5
<b>5</b>	<b>TESTS RESULTS SUMMARY .....</b>	<b>6</b>
5.1	TEST VEHICLE .....	6
5.2	TEST PLAN AND RESULTS SUMMARY .....	6
<b>6</b>	<b>ANNEXES .....</b>	<b>7</b>
6.1	DEVICE DETAILS .....	7
6.2	TESTS DESCRIPTION .....	8

## **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
TV	Test Vehicle

## **3 RELIABILITY EVALUATION OVERVIEW**

### **3.1 Objectives**

To qualify the D2PAK in ASE Weihai.

#### **FE**

TV1: XL05 - Cr/Ni/Ag - HBIP40  
TV2: L317 - Cr/Ni/Ag - BIP (>6um)

#### **BE**

D2PAK in ASE Weihai

**3 cumulative different qualification Lots are requested**

### **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**

## **LM317**

1.2 V to 37 V adjustable voltage regulators

### **Description**



The LM217, LM317 are monolithic integrated circuits in TO-220, TO-220FP and D<sup>2</sup>PAK 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.

## **L78**

Positive voltage regulator ICs

### **Description**



The L78 series of three-terminal positive regulators is available in TO-220, TO-220FP, D<sup>2</sup>PAK 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.

## 4.2 Construction note

	L317	XL05
<b>Wafer/Die fab. information</b>		
Wafer fab manufacturing location	AMK 6	AMK 6
Technology	BiP > 6um	HBIP40
Die finishing back side	Cr/Ni/Ag	Cr/Ni/Ag
Die size	2,410, 1,920 micron	1,320, 1,630 micron
Passivation type	SiN (nitride)	P-VAPOX/NITRIDE
<b>Wafer Testing (EWS) information</b>		
Electrical testing manufacturing location	Ang Mo Kio EWS	Ang Mo Kio EWS
Tester	ETS300	ETS300
Test program	L317QAE01	LX05B6D01
<b>Assembly information</b>		
Assembly site	ASE Weihai	ASE Weihai
Package description	D2PACK	D2PACK
Mold Compound	Epoxy	Epoxy
Frame material	TO263 IDF Dual Gage Bar	TO263 IDF Dual Gage Bar
Die attach material	Soft solder	Soft solder
Wires bonding materials/diameters	2mil Cu wire	2mil Cu wire
<b>Final testing information</b>		
Testing location	ASE Weihai	ASE Weihai
Tester	AZ400S	AZ400S
Test program	L317_LM317D2T_V1.0_ASE	XL05_L7805CD_V1.0_ASEW

## 5 TESTS RESULTS SUMMARY

### 5.1 Test vehicle

Lot #	Package	Product Line	Part number
1	D2PAK	L31701	LM317D2T-TR
2		XL0501	L7805CD2T-TR
3		L31701	LM317D2T-TR

### 5.2 Test plan and results summary

 P/N: [LM317D2T-TR](#)

 P/N: [L7805CD2T-TR](#)

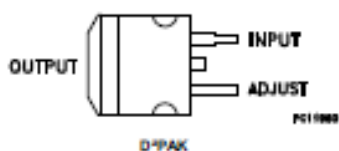
Test	PC	Std ref.	Conditions	SS	Steps	Failure/SS			Note
						Lot 1	Lot 2	Lot 3	
						LM317 BIP(>6um)	L7805 HBIP40V	LM317 BIP(>6um)	
Die Oriented Tests									
HTOL	N	JESD22 A-108	Tj= 125° C, BIAS= 40 V	77	168 h	0/ 77			
					500 h	0/ 77			
					1000 h	0/ 77			
HTOL	N	JESD22 A-108	Tj= 125° C, BIAS= 35 V	77	168 h		0/ 77		
					500 h		0/ 77		
					1000 h		0/ 77		
HTSL	N	JESD22 A-103	Ta= 150° C	75	168 h	0/ 25	0/ 25	0/ 25	
					500 h	0/ 25	0/ 25	0/ 25	
					1000 h	0/ 25	0/ 25	0/ 25	
Package Oriented Tests									
PC		JESD22 A-113	Drying 24 H @ 125°C Store 168 H @ Ta=85°C Rh=85% Oven Reflow @ Tpeak=245°C 3 times			Final	Final	Final	
AC	Y	JESD22 A-102	Pa=2 Atm / Ta= 121° C	75	96 h	0/ 25	0/ 25	0/ 25	
TC	Y	JESD22 A-104	Ta= - 65° C to 150° C	75	100 cy	0/ 25	0/ 25	0/ 25	
					200 cy	0/ 25	0/ 25	0/ 25	
					500 cy	0/ 25	0/ 25	0/ 25	
THB	Y	JESD22 A-101	Ta= 85° C, RH= 85%, BIAS= 24 V	75	168 h	0/ 25	0/ 25	0/ 25	
					500 h	0/ 25	0/ 25	0/ 25	
					1000 h	0/ 25	0/ 25	0/ 25	
Other Tests									
ESD	N	JESD22 C101	CDM	3	500 V	Pass	Pass		
				3	250 V	Pass	Pass		
CA	N		Construction Analysis			Pass	Pass		

## 6 ANNEXES

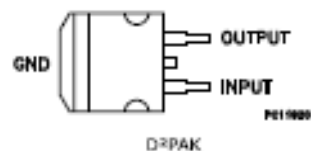
### 6.1 Device details

#### 6.1.1 Pin configuration

Pin connection (top view D2PAK for LM317)

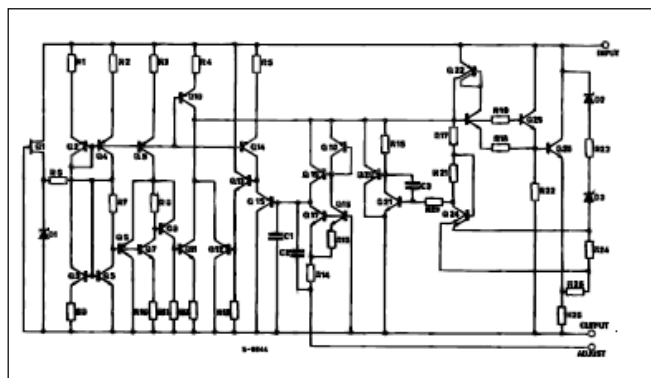


Pin connection (top view D2PAK for L78)

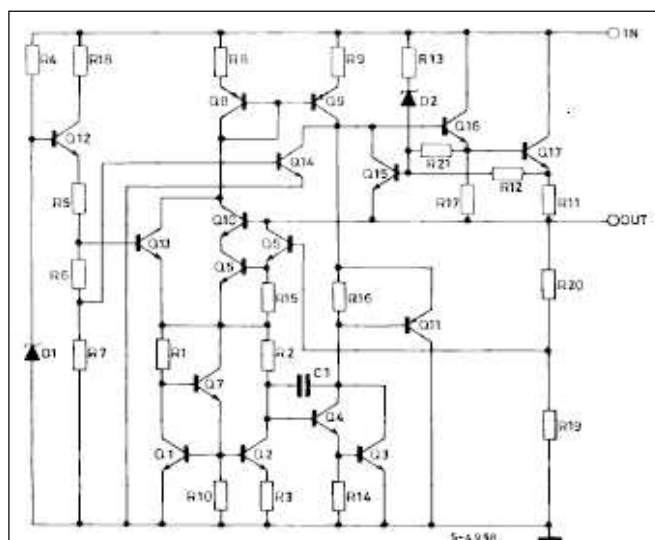


#### 6.1.2 Block diagram

Schematic diagram for LM317



Schematic diagram for L78



## 6.2 Tests Description

Test name	Description	Purpose
<b>Die Oriented</b>		
<b>HTOL</b> High Temperature Operating Life	The device is stressed in static or dynamic configuration, approaching the operative max. absolute ratings in terms of junction temperature and bias condition.	To determine the effects of bias conditions and temperature on solid state devices over time. It simulates the devices' operating condition in an accelerated way. The typical failure modes are related to, silicon degradation, wire-bonds degradation, oxide faults.
<b>HTSL</b> 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.
<b>Package Oriented</b>		
<b>PC</b> 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.
<b>AC</b> 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.
<b>TC</b> 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.
<b>THB</b> Temperature Humidity Bias	The device is biased in static configuration minimizing its internal power dissipation, and stored at controlled conditions of ambient temperature and relative humidity.	To evaluate the package moisture resistance with electrical field applied, both electrolytic and galvanic corrosion are put in evidence.
<b>Other</b>		
<b>ESD</b> Electro Static Discharge	The device is submitted to a high voltage peak on all his pins simulating ESD stress according to different simulation models. <b>CDM:</b> Charged Device Model	To classify the device according to his susceptibility to damage or degradation by exposure to electrostatic discharge.
<b>CA</b> Construction Analysis	Construction Analysis	To verify the physical product conformity