



ZYWYN CORPORATION

Reliability Qualification Report

ZSP44xx EL Metal Gate Product Family

Date: August 6, 2004

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Revision: 1.1

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Reliability Life Test Result

Life Test

Life Testing is performed to determine if device has any fundamental reliability related failure mechanisms, which can be divided into 4 main groups:

- Process or die related failures, such as oxide-related defects, metallization-related defects and diffusion-related defects.
- Assembly-related defects such as wire bonding or package-related failures.
- Design-related defects.
- Miscellaneous, undetermined or application-induced failures.

Life Test Result

Product Family:	Electroluminescent Lamp Driver
Device Type:	ZSP4412A/ZSP4422A/ZSP4423/ZSP4425
Mask Sets:	MS131/MS129/MS130/MS133
Process:	Zywyn Metal Gate High Voltage BiCMOS Process
Wafer Manufacturer:	Episil Technologies, Inc.
Package Type:	8L NSOIC
Package Manufacturer:	Lingsen Precision Industries, Ltd.
Die Attach Adhesive:	84-1LMISR4
Bond Wire:	NL5 1.0 mil
Test:	HTOL 500 hrs, 3.0V Dynamic Burn-In @125°C
Reference Standard:	Mil-Std-883
Pass/Fail Criteria:	Electrical QA testing to datasheet limits at 25°C before and after stress.

Summary:

Device Type	HTOL Test	Lot Number	Date Completed	Burn-In Temperature (°C)	Sample Size	No. of Fails
ZSP4425	500 hr @ 3.0V	B3829D80A	11/26/03	125	10	0
ZSP4425	500 hr @ 3.0V	B3829D80B	12/25/03	125	10	0

FIT Rate Calculation

The FIT (failures in time) is calculated as follows,

$$FR \text{ (Chi-squared)} = \chi^2_{2n+2} / (2 \times AF \times \text{device-hours}) \times 10^9$$

where AF is the acceleration factor and n is the number of failures. The value is highly dependent on the following:

1. Life test conditions (duration, temperature, sample size and number of failures)
2. Activation energy of the potential failure modes

The weighted activation energy, E_a , of observed failure mechanisms of Zywyn products has been determined to be 0.8eV.

Based on the above criteria, the FIT rates at 25°C, 55°C, and 70°C operation at both 60% and 90% confidence levels for Zywyn's Metal Gate High Voltage BiCMOS process products have been calculated and are listed below.

Confidence Level	+25°C	+55°C	+75°C
60%	97.2	1176.1	4881.9
90%	244.2	2954.7	12264.6

1 FIT = 1 failure per billion device hours

ESD Test Results

14 units were submitted for Machine Model ESD test.

All 14 units passed the Machine Model ESD test at $\pm 200V$. A subsequent QA testing of the parts showed the devices met the functional test specifications.

Summary:

Device Type	ESD Test	Lot Number	Date Completed	Sample Size	No. of Fails
ZSP4422A	$\pm 200V$ Machine Model	B3903E76D	01/16/04	14	0

Temp Cycle Test Result

25 units were submitted for Temperature Cycling Test at Lingsen Precision Industries (LPI), Taiwan.

All 25 units passed the Preconditioning Level 3 and subsequent Temperature Cycling Test. A final QA testing of the 25 devices showed all test units met the Zywyn datasheet electrical specifications. The relevant report from LPI is attached for reference.

Summary:

Device Type	Test	Lot Number	Date Completed	Sample Size	No. of Fails
ZSP4422ACN	Preconditioning Level 3	B3903E76D	03/12/04	25	0
ZSP4422ACN	Temp Cycle -65°C/10min ~ +150°C/10min 24 Cycles	B3903E76D	03/12/04	25	0

Temp Humidity Bias Test Result

Test I

A total of 10 units of ZSP4422ACN and 10 units of ZSP4423CU were submitted for Temperature Humidity Bias Test (THB) at 85°C/85% R.H./3.0V for 240 hours. A final QA testing of the 20 devices showed all test units met the Zywyn datasheet electrical specifications.

Summary:

Device Type	THB Test	Lot Number	Date Completed	Sample Size	No. of Fails
ZSP4422ACN	85°C/85%/3.0V/240hr	B3903E76D	02/25/04	5	0
ZSP4422ACN	85°C/85%/3.0V/240hr	B3903E76D	03/10/04	5	0
ZSP4423CU	85°C/85%/3.0V/240hr	B3903E76C	02/25/04	5	0
ZSP4423CU	85°C/85%/3.0V/240hr	B3903E76C	03/10/04	5	0

Test II

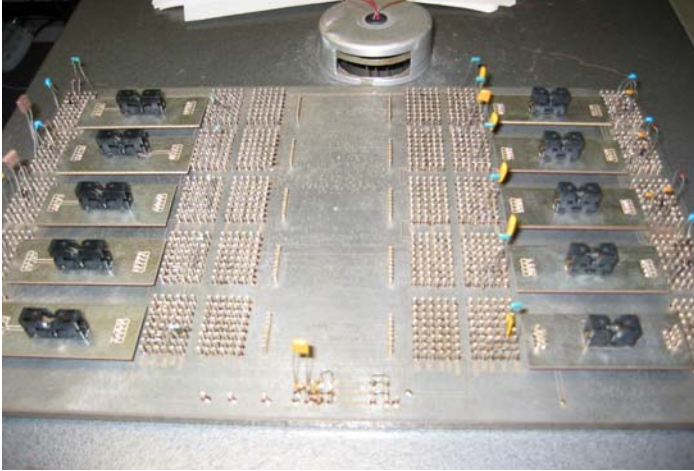
A total of 5 units of ZSP4422ACN and 5 units of ZSP4423CU were submitted for Temperature Humidity Bias Test (THB) at 85°C/85% R.H./3.0V for 1000 hours. A final QA testing of the 10 devices at 500-hour and 1000-hour read points showed all test units met the Zywyn datasheet electrical specifications.

Summary:

Device Type	THB Test	Read Point	Lot Number	Date Completed	Sample Size	No. of Fails
ZSP4422ACN	85°C/85%/3.0V	500 hr	B3903E76D	07/15/04	5	0
ZSP4422ACN	85°C/85%/3.0V	1000 hr	B3903E76D	08/05/04	5	0
ZSP4423CU	85°C/85%/3.0V	500 hr	B3903E76C	07/15/04	5	0
ZSP4423CU	85°C/85%/3.0V	1000 hr	B3903E76C	08/05/04	5	0

Appendix 1

Burn-in Board and Burn-in Equipment:



Burn-in Board used for Dynamic Life Test



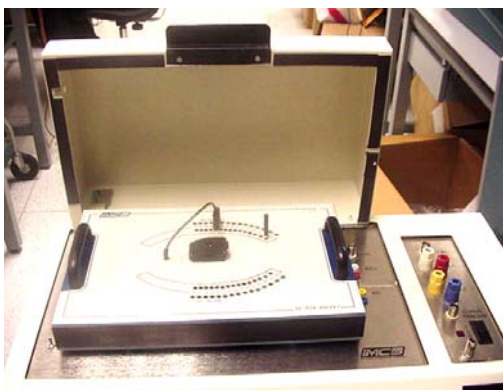
Burn-in oven used for Dynamic Life and Humidity Test

Appendix 2

ESD Tester Equipment:



Front view of the iMCS model#700



**Front view of the iMCS model#700
ESD tester with lid open**



**Back view of the ESD tester with
Machine model/Pulse model being used**

Appendix 3

Temp Cycle Test Report provided by Lingsen Precision Industries Taiwan, is attached for reference.



Reliability Test Report

可靠度試驗報告

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I. Reliability Test Item 試驗名稱

Preconditioning Level 3

II. Sample Information 產品資料

Customer	ZYW	Month	2/2004
Package Type	8L SOP	Leadframe	80X80 C194AG
Run No.	E3B117	Mold Compound	EME-6600CSP
Device Type	ZSP4422A CN	Au Wire	GL-21.3mil
Lot No.	B3903E76D	Epoxy	84-1LMISR4
Request No.	93044	Die coating	N/A
Lead Plating	Sn/Pb 85/15	Received Date	2/6/2004
Die size	For qual lot only	Remark	N/A

III. Test Conditions 試驗條件

Sample Plan N=25 AC=0, RE=1

Precondition Level Level 3

Test Condition TC 5cycles→Bake 125°C/24hrs→Soak 30°C/60% R.H./192hrs→
IR Reflow 235°C 3cycles

Test Timing PPCM New Package Customer Requirement
 Material / process change Others

IV. Test Result

試驗結果 Accept 合格 Reject 不合格

Criteria	Description	Failure/total	Result
Visual Inspection	Package crack or flatness out of spec.	0/25	AC
Electrical Test	The devices must pass electrical test or open/short test Program Name : O/S E3B117.SRC	0/25	AC
C-SAM inspection	No delamination on the die surface.		Ref.
Others			

V. Remark 備註 : 1. The test results only apply to the device under test, and no part of this report may be abstracted or reproduced.

本報告僅對送測樣品負責，且分離使用無效。

Approved By : _____ Checked By : _____ Prepared By : Lynn Wen

Date : _____ Date : _____ Date : _____



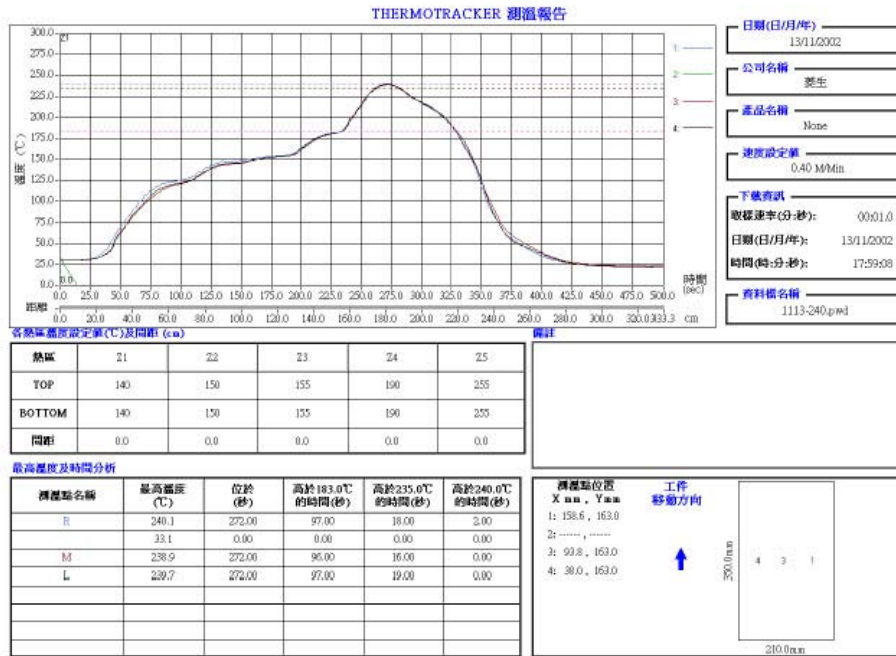
Reliability Test Report

可靠度試驗報告

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Attachment 附件





Reliability Test Report

可靠度試驗報告

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Attachment 附件---C-SAM photo before and after Precondition Level 3 (IR 235°C)

Package : SOP008

Run No. : E3B117

EMC : EME-6600CSP

Accept _____

Reject _____

Fig.1 Before Precondition

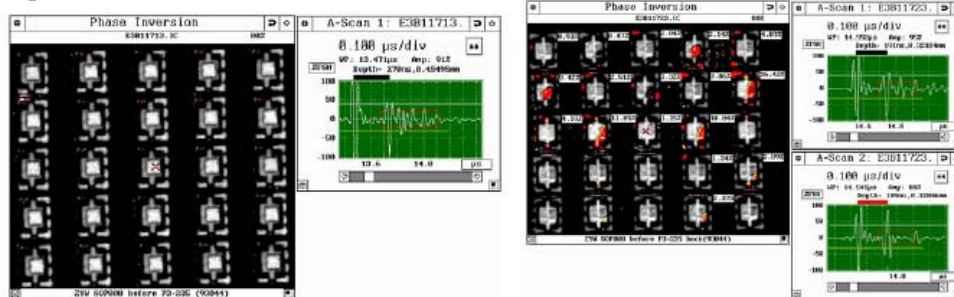
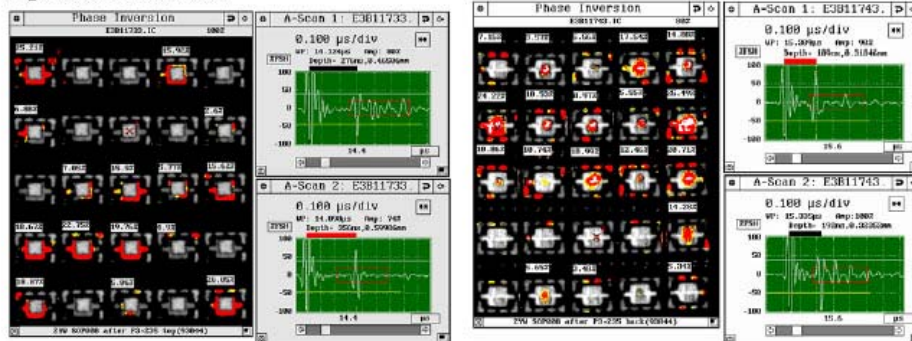


Fig.2 After Precondition





Reliability Test Report

可靠度試驗報告

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I. Reliability Test Item 試驗名稱

Temperature Cycling Test

II. Sample Information 產品資料

Customer	ZYW	Month	2/2004
Package Type	8L SOP	Leadframe	80X80 C194AG
Run No.	E3B117	Mold Compound	EME-6600CSP
Device Type	ZSP4422A CN	Au Wire	GL-21.3mil
Lot No.	B3903E76D	Epoxy	84-1LMISR4
Request No.	93044	Die coating	N/A
Lead Plating	Sn/Pb 85/15	Received Date	2/06/2004
Die size	For qual lot only	Remark	N/A

III. Test Conditions 試驗條件

Sample Plan N=25 AC=0, RE=1

Precondition Level Level 3+235°C

Test Condition -65°C/10min~+150°C/10min, 24cycles

Test Timing PPCM New Package Customer Requirement
Material / process change Others

IV. Test Result

試驗結果 Accept 合格 Reject 不合格

Criteria	Description	Failure/total	Result
Visual Inspection	Package crack or flatness out of spec.	0/25	AC
Electrical Test	The devices must pass electrical test or open/short test Program Name : Function test by customer	0/25	AC
C-SAM inspection	No delamination on the die surface.	N/A	N/A
Others			

V. Remark 備註 : 1.The test results only apply to the device under test, and no part of this report may be abstracted or reproduced.

本報告僅對送測樣品負責，且分離使用無效。

Approved By : _____ Checked By : _____ Prepared By : Lynn Wen
Date : _____ Date : _____ Date : 3/12/2004

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651300-04-05



Reliability Test Report

可靠度試驗報告

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Attachment 附件---C-SAM photo after TCT 24cycles

Package : SOP008

Run No. : E3B117

EMC : EME-6600CSP

Accept _____

Reject _____

Fig.1 After TCT 24cycles

