PRODUCT/PROCESS CHANGE NOTIFICATION

PCN APG-BOD/08/3667
Notification Date 05/16/2008

SOT-223 GREEN COMPOUND HITACHI CEL9240HF10 and YAG LASER MARKING

BOD - CAR BODY

Table 1. Change Implementation Schedule

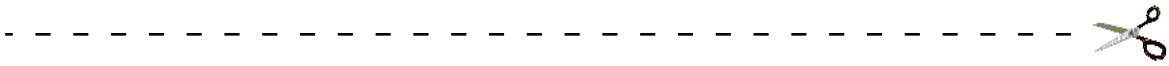
Forecasted implementation date for change	31-Oct-2008
Forecasted availabillity date of samples for customer	09-May-2008
Forecasted date for **STMicroelectronics** change Qualification Plan results availability	09-May-2008
Estimated date of changed product first shipment	31-Oct-2008

Table 2. Change Identification

Product Identification (Product Family/Commercial Product)	See enclosed
Type of change	Package assembly material change
Reason for change	SC CARSEM road-map
Description of the change	CARSEM (subcontractor) will change molding compound on products housed in SOT-223 from SUMITOME EME 6710SJ to HITACHI CEL9240HF10.In the same time YAG laser marking will be implemented instead of actual CO2.
Product Line(s) and/or Part Number(s)	See attached
Description of the Qualification Plan	See attached
Change Product Identification	Datacode
Manufacturing Location(s)	1]Sc Carsem M - Malaysia

Table 3. List of Attachments

Customer Part numbers list	
Qualification Plan results	



Customer Acknowledgement of Receipt	**PCN APG-BOD/08/3667**
Please sign and return to STMicroelectronics Sales Office	**Notification Date 05/16/2008**

☐ Qualification Plan Denied	Name:
☐ Qualification Plan Approved	Title:
	Company:
☐ Change Denied	Date:
☐ Change Approved	Signature:

Remark

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DOCUMENT APPROVAL

Name	Function
Russo, Alfio	Division Marketing Manager
Aparo, Sebastiano	Division Product Manager
Parrino, Emanuele	Division Q.A. Manager

PRODUCT/PROCESS CHANGE NOTIFICATION

Automotive Product Group
Car Body Division
VIPower Business Unit - Catania

Subject: SOT-223 GREEN COMPOUND HITACHI CEL9240HF10 and YAG LASER MARKING.

INVOLVED P&L FAMILY: 30

WHAT: CARSEM (subcontractor) will change molding compound on SOT-223 from SUMITOMO EME 6710SJ to **HITACHI CEL 9240HF10**. In the same time new YAG laser marking will be implemented instead of actual CO2.

WHY: CARSEM subcontractor road-map.

WHO: All Customers using VIPower products housed in SOT-223 package.

WHEN: Change will be implemented in according to the below schedule:

Qualification Report:
-Qualification reports included to this PCN.

Samples Availability:
-Test vehicles samples are already available.
-Samples of other products will be available on demand.

Date of Change and Start Production / 1st Shipment:
-October 2008.
(Shipment may occur prior this date upon Customer agreement according to Jedec JESD46C standard).

WHERE: Plant involved in this change is CARSEM (Malaysia).

AEC_Q100 Rev.G Qualification Plan Results
Green molding compound
Hitachi CEL9240 HF10_Package SOT223

Object: In order to qualify the Green Molding Compound Hitachi CEL9240 HF10 for the VIPower products assembled in package SOT223, both leaded and lead free, were chosen the below test vehicles:

General Information	
Product Line	VN79 (lead free)
Commercial Product	VNN7NV04
Silicon process technology	VIPower M0_3
Package	SOT223

Locations	
Diffusion fab location	ST Catania CT6 (Italy)
Assembly plant location	S.C. Carsem (Malaysia)
Test plant location	ST Shenzen (China)
Reliability lab location	ST Shenzen (China)

General Information	
Product Line	VN73 (lead free)
Commercial Product	VNN1NV04
Silicon process technology	VIPower M0_3
Package	SOT223

Locations	
Diffusion fab location	ST Catania CT6 (Italy)
Assembly plant location	S.C. Carsem (Malaysia)
Test plant location	ST Shenzen (China)
Reliability lab location	ST Shenzen (China)

General Information	
Product Line	VN84 (lead present)
Commercial Product	VNN3NV04
Silicon process technology	VIPower M0_3
Package	SOT223

Locations	
Diffusion fab location	ST Catania CT6 (Italy)
Assembly plant location	S.C. Carsem (Malaysia)
Test plant location	ST Shenzen (China)
Reliability lab location	ST Shenzen (China)

Author:
A.Marmoni
QA and Qualification Team Leader
APG Q&R Catania

ST approved:
E.Parrino
APG Q&R Catania Mng

Reliability and electrical test executed by:
IMS Rel Dept. – APG Support

- Reliability evaluations overview

1.1 Objectives

Aim of this report is to present the results of the reliability evaluations performed on VNN7NV04 (VN79), VNN1NV04 (VN73) and VNN3NV04 (VN84) chosen as test vehicles in order to qualify the Green Molding Compound (halogen free) Hitachi CEL9240 HF10 on VIPower products assembled in package SOT223.

These products are diffused in ST Catania (Italy) and assembled by subcontractor Carsem (Malaysia). The first two vehicles were chosen in lead free configuration while the third was leaded.

According with the AEC_Q100 Rev.G specification for the reliability evaluations the following tests were performed using one lot for each test vehicles: HTOL, HTSL, THB, AC, TC, ES (see details in table below).

The qualification of a green molding compound is also compliant to the Company roadmap towards environmentally friendly components.

1.2 Results

All reliability tests have been completed with positive results; neither functional nor parametric rejects were detected at final electrical testing.

Based on the overall positive results we consider the products qualified from a reliability point of view.

Reliability qualification plan and results performed on one lot for each test vehicles

AEC #	Test Name	STM Test Conditions	Sample Size/ Lots	Results Fails/SS/Lots	Comments
4	**PC** Pre Cond	Preconditioning at Jedec Level 3, store 192 hours at Ta=30ºC, RH=60%, IR reflow (3 times) at 260ºC	Before all trials.		
2	**HTOL** High Temp. Op. Life	Ta=125C, Vcc=28V for 1000 hours	77/3	0/77/3	
3	**HTSL** High Temp. Storage Life	Ta=150ºC for 1000 hours. TST before and after at room and hot temperatures.	77/3	0/77/3	
5	**THB** Temp Humidity Bias	Ta=85ºC, RH=85%, Vcc=24V for 1000 hours	77/3	0/77/3	
6	**AC** Autoclave	Ta=121ºC, Pa=2atm for 96 hours	77/3	0/77/3	
7	**TC** Temp. Cycling	Ta=-65ºC +150ºC for 500 cycles	77/3	0/77/3	
	ENV. SEQ. Enviromental Sequence	**TC** (Ta=-65ºC +150ºC for 100 cycles) + **AC** (Ta=121ºC, Pa=2atm for 96 hours)	50/3	0/50/3	STM additional test

Qualification of New Molding Compound on SOT-223 CARSEM (HITACHI CEL9240HF10)

Construction Analysis

CAR BODY QUALITY

Catania
April 10, 2008

Device information

Product: VNN1NV04-E, VNN7NV04-E, VNN3NV04-E
Line: VN73 , VN79, VN84
Diffusion: CT6 (Catania)
Package: SOT-223
Assembly: CARSEM (Malaysia)

Purpose : To perform a package oriented analysis due to new mold compound change on SOT223 (Hitachi CEL9240HF10). Test vehicles chosen: VN73 , VN79, VN84.

Analysis

Visual Analysis :
No defect

XRay and SAM Analysis:
No defect

Section:
No defect

Dimensional Analysis:
No defect

DIE

Production Line	VN73	VN79	VN84
Die Size	1710X1520um	2540X2130um	2210X1720um
Die Finish Front Side	SiN	SiN	SiN
Die Finish Back Side	TiNiAu	TiNiAu	TiNiAu
Die Thickness (280 ±25um)	270um	277um	271um

DIE SEPARATION

Die Sawing (%)	100%	100%	100%
Die Sawing Quality	Good	Good	Good

FRAME

Raw Material	Copper Alloy
Plating	Ag spot on t-post

DIE ATTACH

Type:Soft[X] Glue[]	Pb/Sn 95%/5%
Preform Thickness	25.4/31 um

WIREBONDING

Wire Material	Au
Wire Diameter	2 mils
Wire Bonding Process	Thermosonic Ball Bonding
Wire Loop Quality	Good (for all wires)
Distance Between Wire/Die	Good (for all wires)
Wire Bond/Pad	Rejected 0/30pcs for each line

MOLDING

Molding Compound	HITACHI CEL9240HF10
Resin Homogeneity	Good

OUTLINE

Analysis Type	Profile Projector
Mechanical Dimension	Rejected 0/10pcs. for each line

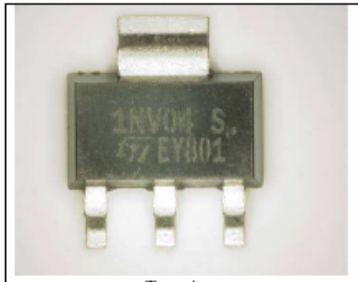
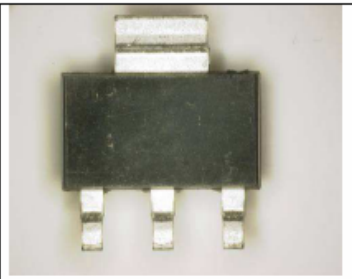
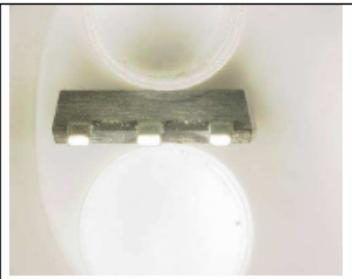
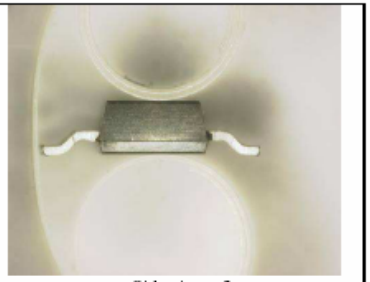
Visual Inspection Defect

Cropping	Rejected 0/30pcs for each line
Molding	Rejected 0/30pcs for each line
Deflashing	Rejected 0/30pcs for each line

SAM

Delamination Die Surface/Resin	Rejected 0/30pcs for each line
Delamination Frame/Resin	Rejected 0/30pcs for each line

Package Overview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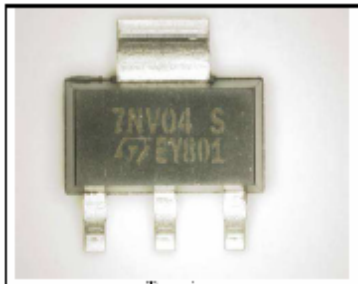	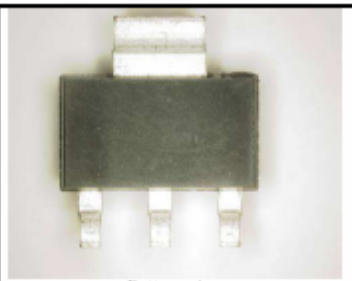	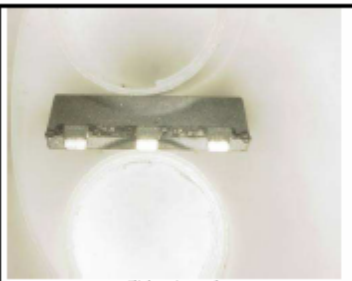	
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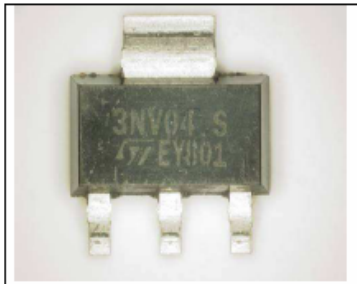
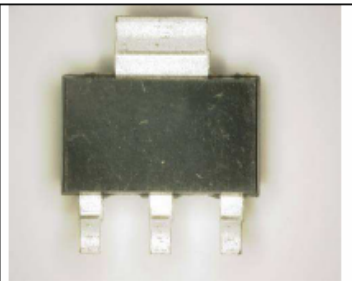
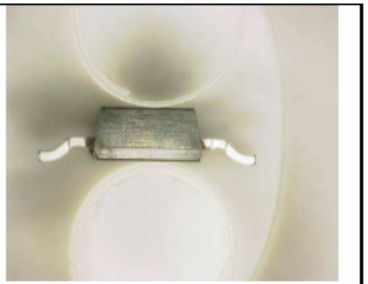
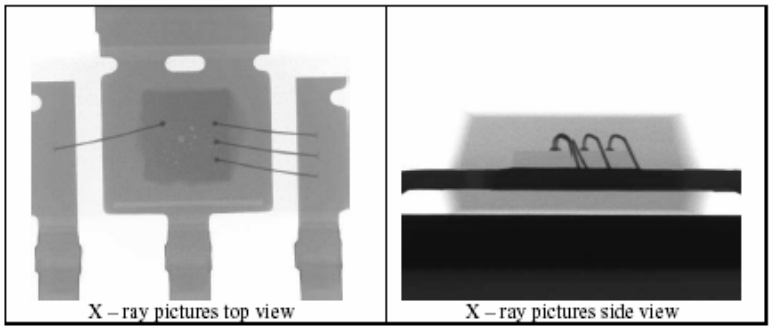
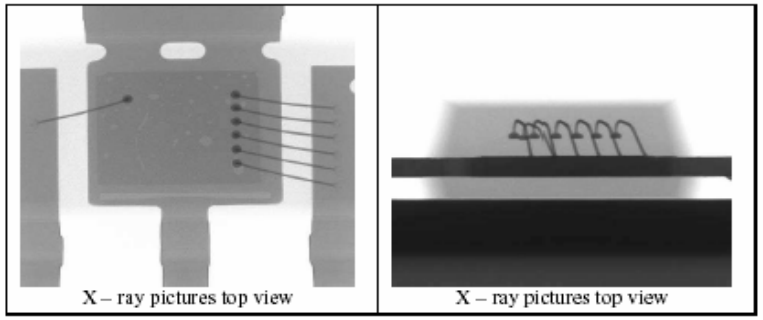
			
Top view	Bottom view	Side view -1	Side view - 2

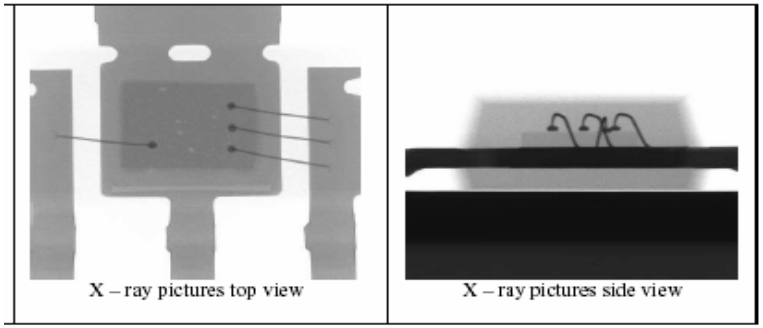
X-ray analysis



VN73

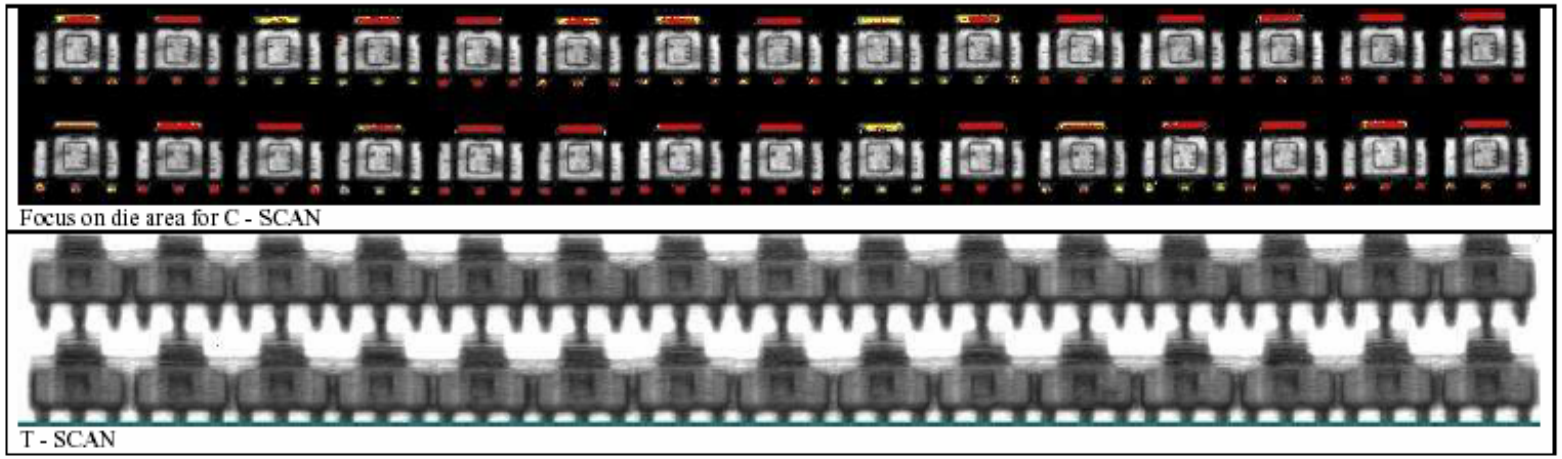


VN79



VN84

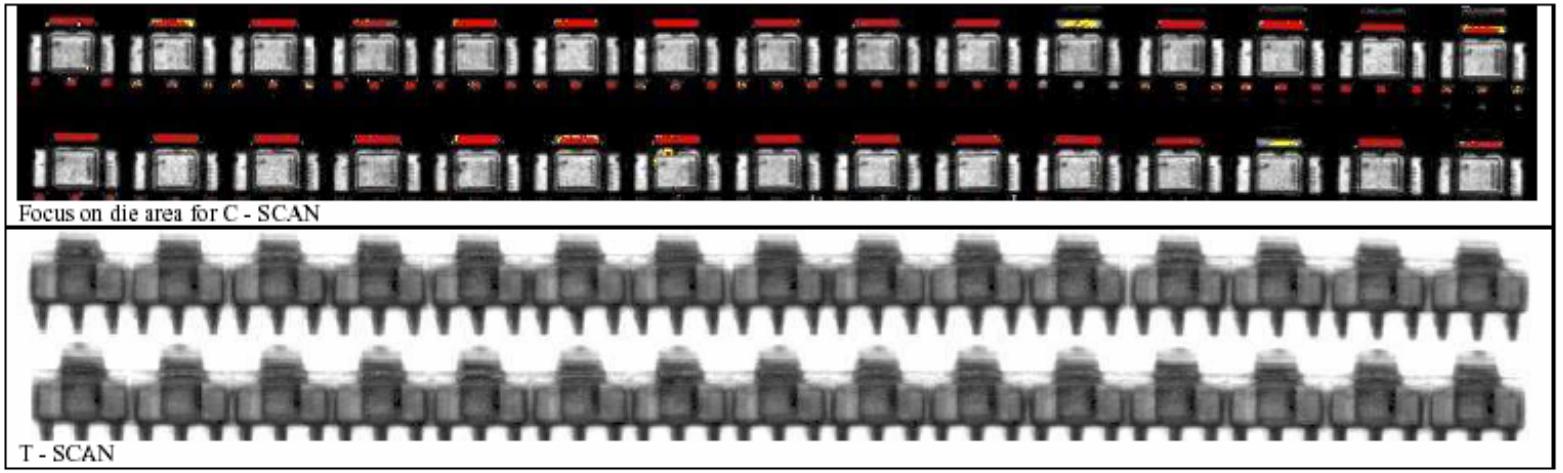
SAM Analysis



VN73

No Delamination on die
No Delamination on leads
No Delamination on die and lead area

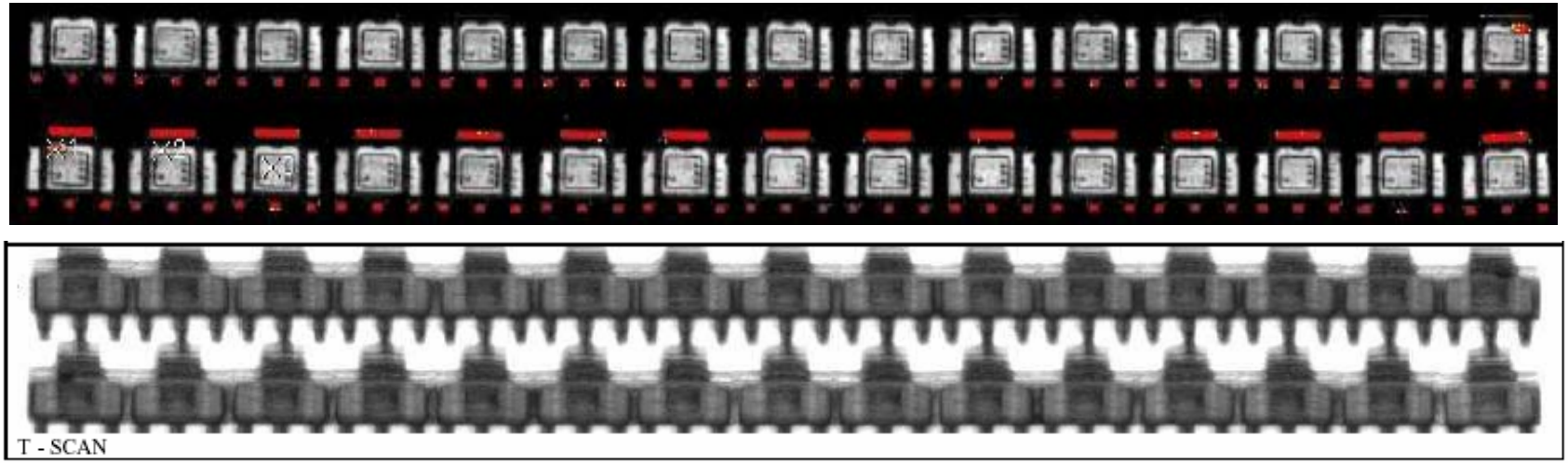
SAM Analysis



VN79

No Delamination on die
No Delamination on leads
No Delamination on die and lead area

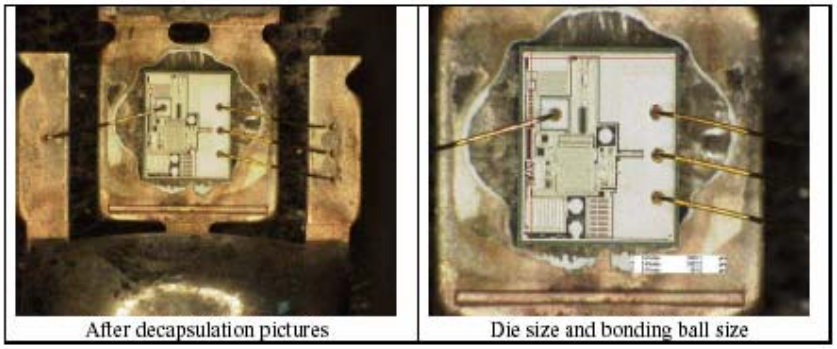
SAM Analysis



VN84

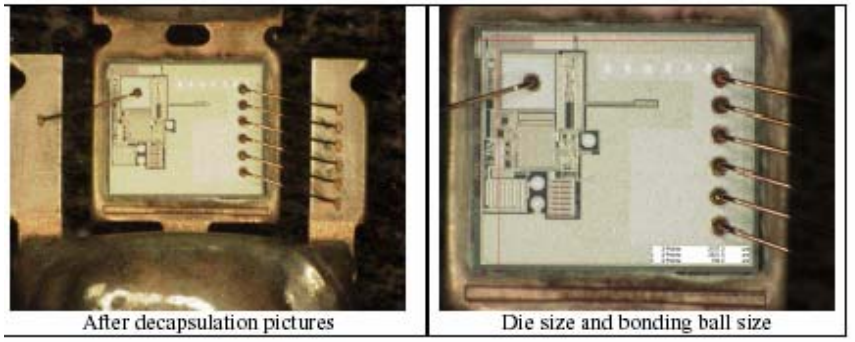
No Delamination on die
No Delamination on leads
No Delamination on die and lead area

Dice Overview



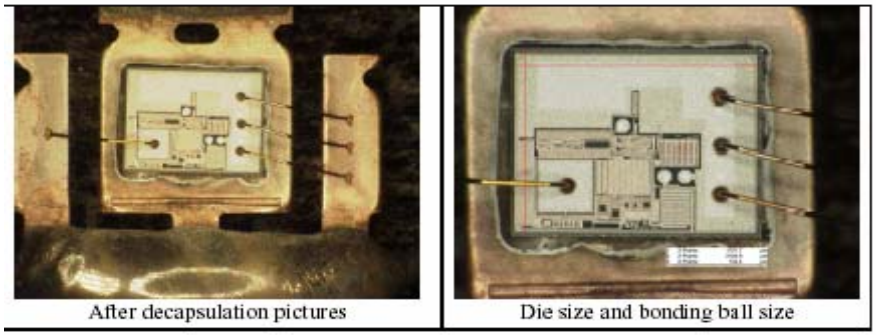
After decapsulation pictures | Die size and bonding ball size

VN73



After decapsulation pictures | Die size and bonding ball size

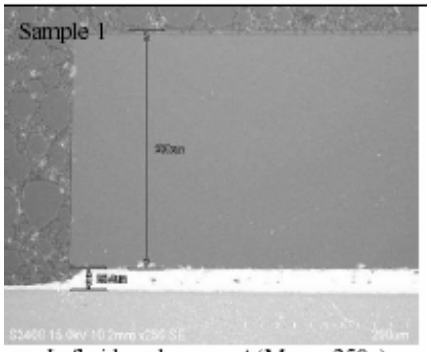
VN79



After decapsulation pictures | Die size and bonding ball size

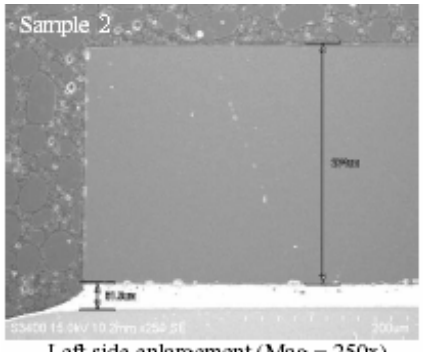
VN84

Section overview



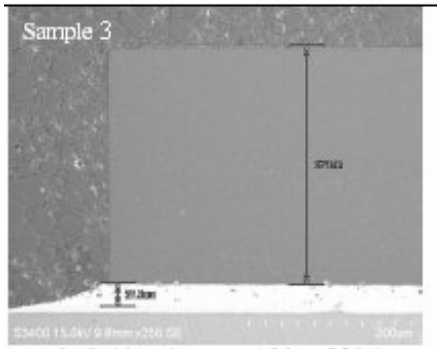
Left side enlargement (Mag = 250x)
Die thickness:270um
Preform thickness: 25.4um

VN73



Left side enlargement (Mag = 250x)
Die thickness:277um
Preform thickness: 31um

VN79



Left side enlargement(Mag=250x)
Die thickness:271um
Preform thickness: 27um

VN84

Wire-pull and ball-shear tests

VN73 (2 mils Au wire LSL 15 g)

Refer to spec: 0018726 — Sample size: 30 wires

No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Wire pull value (g)	29.775	27.825	30.423	30.206	28.959	28.998	28.838	30.34	28.469	29.215	29.322	30.388	28.413	29.101	29.316
No.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Wire pull value (g)	29.577	29.553	30.67	30.075	28.273	27.686	28.391	27.972	28.7	28.367	28.674	29.806	28.242	30.14	28.623
CPK	5.540724														
Failure mode	Wire break and ball neck break														

VN73 (2 m ils Au wire LSL 55.9 g)

Refer to spec: 0018726 — Sample size: 30 balls

No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Wire pull value (g)	160.17	160.53	147.02	153.11	155.71	156.54	166.85	145.67	169.83	153.61	152.87	137.64	147.55	159.63	138.81
No.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Wire pull value (g)	144.86	140.97	143.3	130.79	127.9	143.17	149.69	156.38	142.95	145.15	145.5	144.16	134.61	149.29	165.03
CPK	2.047083														
Failure mode	Aluminium shear														

Wire-pull and ball-shear tests

VN79 (2 mils Au wire LSL 15 g)

Refer to spec: 0018726 — Sample size: 30 wires

No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Wire pull value (g)	29.824	28.451	29.961	29.484	29.345	28.917	28.758	28.065	29.654	31.258	29.424	29.74	30.078	30.605	32.099
No.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Wire pull value (g)	30.343	29.313	30.324	30.923	29.497	29.456	30.6	31.717	30.859	32.437	30.115	30.659	29.958	31.818	31.928
CPK	4.6847975														
Failure mode	Wire break and ball neck break														

VN79 (2 mils Au wire LSL 55.9 g)

Refer to spec: 0018726 — Sample size: 30 balls

No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Wire pull value (g)	156.94	144.39	146.4	149.36	149	139.78	140.45	168.75	153.47	166.36	147.07	140.65	146.43	162.31	159.32
No.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Wire pull value (g)	154.31	145.07	130.63	138.33	129.05	122.04	147.27	145.07	145.24	152.55	149.18	154.8	116.47	139.44	153.42
CPK	1.719161														
Failure mode	Aluminium shear														

Wire-pull and ball-shear tests

VN84 (2 mils Au wireLSL 15 g)

Refer to spec: 0018726 Sample size: 30 balls

No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Wire pull value (g)	156.94	144.39	146.4	149.36	149	139.78	140.45	168.75	153.47	166.36	147.07	140.65	146.43	162.31	159.32
No.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Wire pull value (g)	154.31	145.07	130.63	138.33	129.05	122.04	147.27	145.07	145.24	152.55	149.18	154.8	116.47	139.44	153.42
CPK	1.719161														
Failure mode	Aluminium shear														

VN84 (2 mils Au wire LSL 55.9 g)

Refer to spec: 0018726 Sample size: 30 balls

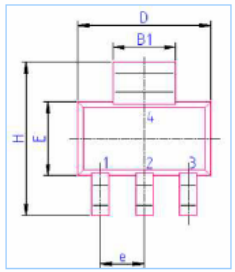
No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Wire pull value (g)	158.82	150.53	147.8	151.57	154.2	143.9	157.85	154.51	158.01	138.4	143.19	171.18	130.19	150.21	135.07
No.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Wire pull value (g)	151.15	155.83	153.12	148.15	144.98	160.03	159.26	143.51	154.33	145.71	155.09	154.85	164.28	149.56	168.77
CPK	1.80789														
Failure mode	Aluminium shear														

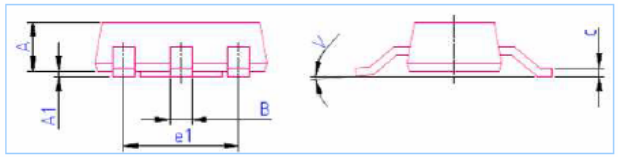
Phisical dimensions

VN73
Sample size 10 pcs
refer to spec 0046067

	Dimensions									
Parameter	**Unit 1**	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**	**Unit 6**	**Unit 7**	**Unit 8**	**Unit 9**	**Unit10**
A	1.633	1.624	1.616	1.618	1.619	1.601	1.609	1.602	1.598	1.598
B	0.719	0.728	0.708	0.719	0.714	0.726	0.723	0.726	0.707	0.741
B1	3.11	3.1	3.1	3.094	3.109	3.116	3.097	3.108	3.119	3.111
c	0.288	0.292	0.302	0.29	0.312	0.314	0.316	0.308	0.301	0.301
D	0.497	6.497	6.496	0.489	6.491	6.487	6.478	6.481	6.479	6.495
e	2.298	2.302	2.301	2.302	2.292	2.309	2.308	2.297	2.307	2.29
e1	4.607	4.597	4.608	4.593	4.6	4.608	4.605	4.604	4.591	4.601
E	3.557	3.516	3.529	3.523	3.49	3.613	3.549	3.548	3.451	3.491
H	7.012	7.057	7.042	7.012	7.011	7.016	7.008	7.002	7.007	7.002
V	3.8	2.9	2	2.7	2.4	3.1	2.9	2.8	3	2.7
A1	0.069	0.044	0.071	0.046	0.078	0.042	0.048	0.047	0.054	0.077

Symbol	millimeters		
	Min.	Typ.	Max.
A			1.8
B	0.6	0.7	0.85
B1	2.9	3	3.15
c	0.24	0.26	0.35
D	6.3	6.5	6.7
e		2.3	
e1		4.6	
E	3.3	3.5	3.7
H	6.7	7	7.3
V	10 (max)		
A1	0.02		0.1



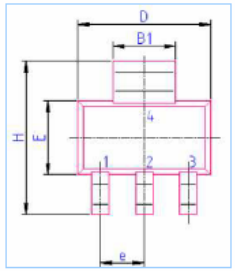


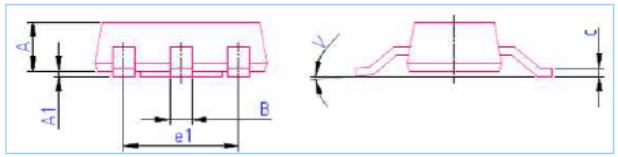
Phisical dimensions

VN79
Sample size 10 pcs
refer to spec 0046067

	Dimensions									
Parameters	**Unit 1**	**Unit 2**	**Unit 3**	**Unit 4**	**Unit 5**	**Unit 6**	**Unit 7**	**Unit 8**	**Unit 9**	**Unit10**
A	1.624	1.616	1.633	1.6	1.6	1.604	1.614	1.617	1.623	1.606
B	0.72	0.717	0.718	0.7	0.708	0.697	0.714	0.7	0.72	0.709
B1	3.11	3.119	3.131	3.102	3.119	3.112	3.107	3.1	3.094	3.108
c	0.309	0.308	0.315	0.315	0.306	0.319	0.313	0.302	0.293	0.316
D	6.48	6.486	6.48	6.482	6.483	6.476	6.496	6.481	6.492	6.484
e	2.306	2.304	2.286	2.305	2.303	2.308	2.306	2.303	2.3	2.288
e1	4.609	4.626	4.592	4.597	4.591	4.594	4.602	4.598	4.607	4.6
E	3.471	3.507	3.541	3.583	3.577	3.551	3.542	3.526	3.462	3.548
H	7.049	7.005	7.054	7.047	7.074	7.002	7.051	7.044	7.054	7.014
V	2.1	2.4	2	3	1.7	2.5	1.7	2.5	2.4	2.8
A1	0.065	0.062	0.064	0.058	0.069	0.079	0.061	0.023	0.052	0.045

Symbol	millimeters		
	Min.	Typ.	Max.
A			1.8
B	0.6	0.7	0.85
B1	2.9	3	3.15
c	0.24	0.26	0.35
D	6.3	6.5	6.7
e		2.3	
e1		4.6	
E	3.3	3.5	3.7
H	6.7	7	7.3
V	10 (max)		
A1	0.02		0.1



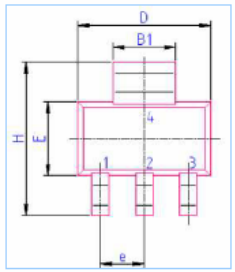


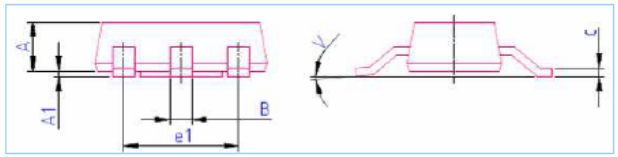
Phisical dimensions

VN84
Sample size 10 pcs
refer to spec 0046067

This Report	Dimensions									
	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit10
A	1.603	1.58	1.608	1.566	1.6	1.597	1.606	1.573	1.569	1.626
B	0.717	1.718	0.719	0.709	0.713	0.726	0.722	0.733	0.706	0.702
B1	3.095	3.101	3.101	3.118	3.091	3.118	3.106	3.117	3.086	3.097
c	0.299	0.312	0.316	0.311	0.3	0.32	0.309	0.306	0.301	0.313
D	6.485	6.497	6.504	6.486	6.496	6.483	6.492	6.498	6.481	6.492
e	2.291	2.292	2.303	2.292	2.307	2.291	2.29	2.291	2.291	2.306
e1	4.596	4.603	4.58	4.629	4.61	4.602	4.607	4.605	4.61	4.598
E	3.529	3.486	3.481	3.549	3.499	3.465	3.543	3.529	3.559	3.518
H	6.985	6.963	6.984	6.988	6.989	6.978	6.972	6.975	6.978	6.989
V	2.1	2	3.5	4	3.7	3.4	2.3	1.8	3.6	3.4
A1	0.042	0.038	0.041	0.029	0.049	0.042	0.03	0.033	0.036	0.059

Symbol	millimeters		
	Min.	Typ.	Max.
A			1.8
B	0.6	0.7	0.85
B1	2.9	3	3.15
c	0.24	0.26	0.35
D	6.3	6.5	6.7
e		2.3	
e1		4.6	
E	3.3	3.5	3.7
H	6.7	7	7.3
V	10 (max)		
A1	0.02		0.1





Marking Comparison Analysis
SOT-223 CARSEM
(Co2 vs YAG laser-mark)

CAR BODY QUALITY

Catania
April 15, 2008

Device information

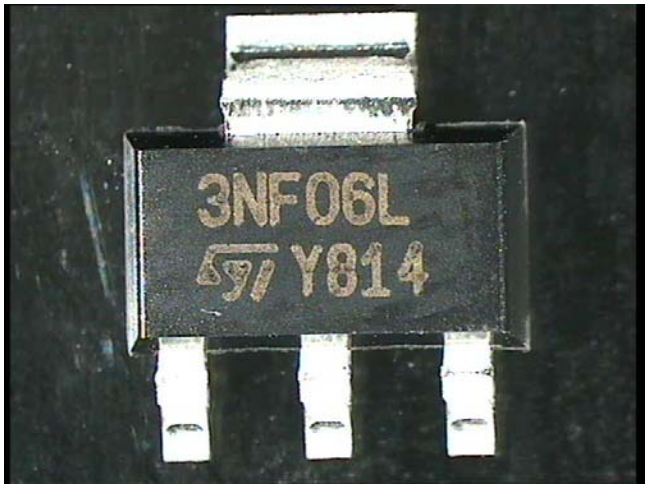
Product: 3NF06L (CO2 and YAG laser marking)
Package: SOT-223
Assembly: CARSEM (Malaysia)

Purpose : Comparison analisys on laser marking performed with CO2 and YAG laser equipment.

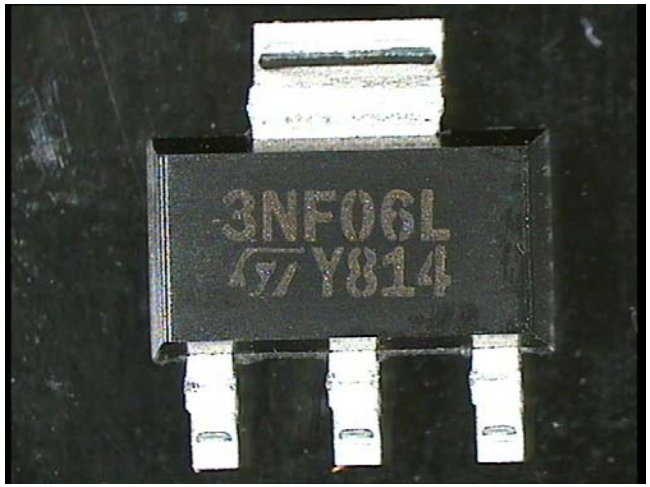
Results: No difference observed.
Both marking are inside ST spec. 0093013

SOT-223 Laser Marking Equipment Change
Marking comparison

New
Yag laser

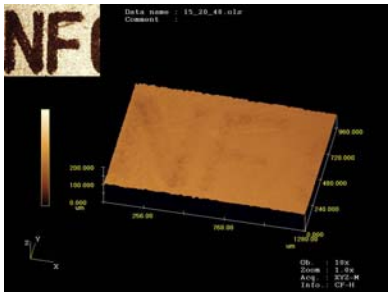


Actual
CO2 laser



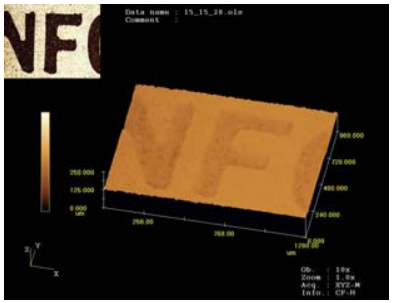
SOT-223 Laser Marking Equipment Change
Marking comparison

New
Yag laser



#	Judge	Length[µm	dZ[µm]
1	good	116.310	-6.048
2	good	107.616	-11.180
3	good	140.801	-6.612
4	good	169.309	-10.400
5	good	112.770	-10.500

Actual
CO2 laser



#	Judge	Length[µm	dZ[µm]
1	good	104.118	-27.216
2	good	111.250	-24.108
3	good	127.555	-15.400
4	good	126.473	-6.376
5	good	126.306	-6.116

Laser marking width: 100 ÷ 200um
Laser marking depth: 6 ÷ 40 um
Spec. 0093013

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