PRODUCT/PROCESS CHANGE NOTIFICATION

PCN APG-BOD/07/2886
Notification Date 09/20/2007

PowerSSO-12 Package Optimization Strategy

BOD - CAR BODY

Table 1. Change Identification

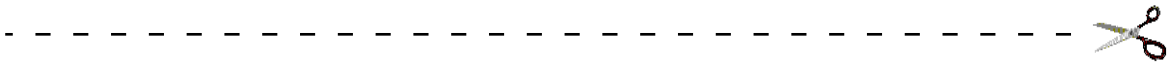
Product Identification (Product Family/Commercial Product)	See enclosed product list
Type of change	Package assembly material change
Reason for change	Quality and Service
Description of the change	Looking at the continuous improvement approach in terms of Quality and Service, ST has decided to rationalize the PowerSSO-12 package migrating to mono-component lead frame options only.
Product Line(s) and/or Part Number(s)	See attached
Description of the Qualification Plan	See attached
Change Product Identification	Symbol "M" added after ecopak logo
Manufacturing Location(s)	1]St Bouskoura 2 - Morocco

Table 2. Change Implementation Schedule

Forecasted implementation date for change	31-Jan-2008
Forecasted availabillity date of samples for customer	13-Sep-2007
Forecasted date for **STMicroelectronics** change Qualification Plan results availability	13-Sep-2007
Estimated date of changed product first shipment	31-Jan-2008

Table 3. List of Attachments

Customer Part numbers list	
Qualification Plan results	



Customer Acknowledgement of Receipt	**PCN APG-BOD/07/2886**
Please sign and return to STMicroelectronics Sales Office	**Notification Date 09/20/2007**

☐ 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

CAR BODY DIVISION - VIPower Business Unit - Catania

Subject: PowerSSO-12 Package Optimization Strategy.

INVOLVED P&L FAMILY: 30

WHAT: Looking at the continuous improvement approach in terms of Quality and Service, ST has decided to rationalize the PowerSSO-12 package migrating to mono-component lead frame options only.

WHY: Reasons for change are:

-Improved quality thanks to better package structure (elimination of slug attach)

-Improved Service and cycle time due multiple lead frame suppliers

-Production capacity aligned to the increased market demand

-Supply chain management improved due to well standardized production flow .

WHO: All Customers using VIPower products housed in PowerSSO-12 package.

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

Qualification report:

-Reliability report included to this PCN.

Samples availability:

-Samples of test vehicles VN5016AJ-E (VNC9), Dual-Gauge lead frame, and VN5050AJ-E (VNL7), Deep-Down-Set lead-frame, are available.

-Samples of other products will be available on demand.

Start production / 1st shipment:

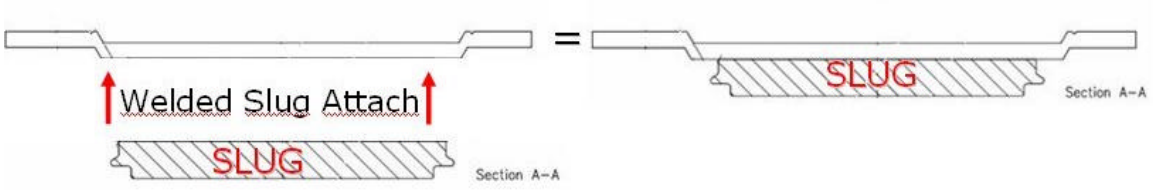
-January 2008.Shipment of changed products may occur prior this date upon Customer agreement (according to Jedec JESD46C standard).

WHERE: Plant involved in this change is ST Bouskoura (Casablanca - Morocco).

PRODUCT/PROCESS CHANGE NOTIFICATION

PowerSSO-12 Current Lead Frame Option

Current PowerSSO-12 is manufactured using bi-component lead frame with the so called “slug attach” process, see below details:

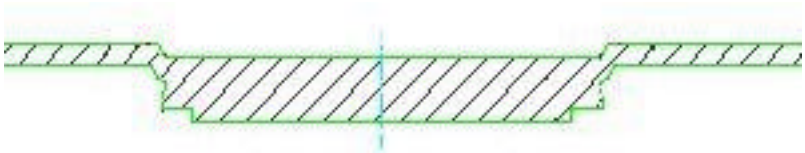


SLUG ATTACHED Lead frame section

New Mono-component lead frame

Two options of mono-component lead frame will replace all the existing slug attach ones depending on the die size to be housed:

“Dual Gauge” for large dice
Exposed pad is obtained by increasing the thickness of the frame;
the die pad size is unchanged compared to the “slug attach”



DUAL GAUGE Lead frame section

“Deep Down-set” (mono thickness) for small dice
Exposed pad is obtained by depressing the frame; due to the increased bending, the die pad size is reduced

DEEP DOWN SET Lead frame section

PRODUCT/PROCESS CHANGE NOTIFICATION

Products migrating to mono component Dual Gauge Lead Frame

P/N	Internal Ref. line	Current status	Final status	Samples Availability
VN5016AJ-E*	VNC9	Slug attached	Dual gauge	available
VN5025AJ-E	VNJ6	Slug attached	Dual gauge	on demand
VND5050AJ-E	VNI8	Slug attached	Dual gauge	on demand
VND5050J-E	VNI9	Slug attached	Dual gauge	on demand
VND5160J-E	VNG2	Slug attached	Dual gauge	on demand
VND5160J-65-E	VNG2	Slug attached	Dual gauge	on demand
VND810PEP-E	VNE4	Slug attached	Dual gauge	on demand
VN750PEP-E	VNE7	Slug attached	Dual gauge	on demand
VNQ500PEP-E	VNF6	Slug attached	Dual gauge	on demand
VND5E050J-E	VNP3	Slug attached	Dual gauge	on demand

*Test Vehicle of Dual Gauge lead frame qualification.

Products migrating to mono component Deep Down Set Lead Frame

P/N	Internal Ref. line	Current status	Final status	Samples Availability
VN5050J-E	VNJ4	Slug attached	Deep Down Set	on demand**
VND5160AJ-E	VNK6	Slug attached	Deep Down Set	on demand**

**Test vehicle of Deep Down Set lead frame:VN5050AJ-E (VNL7) samples available.

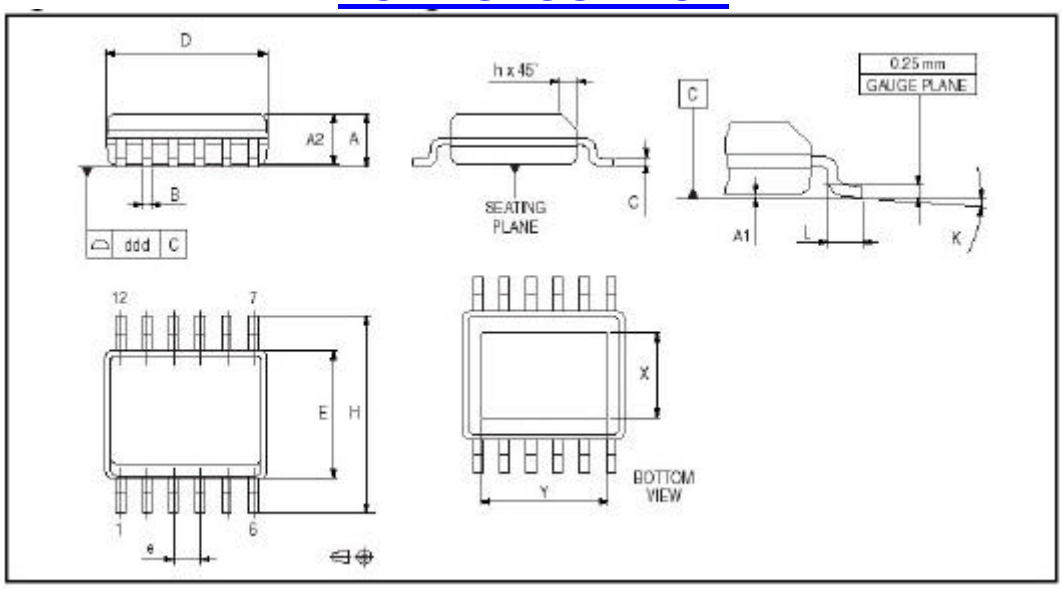
PRODUCT/PROCESS CHANGE NOTIFICATION

POA

Package **O**utline **A**ssembly remains unchanged from Slug Attached to Dual Gauge.
On Deep Down Set option, due to depression of the frame, exposed pad (TAB) only has been changed (see X and Y values).

On both versions, full mounting compatibility to the previous is maintained.

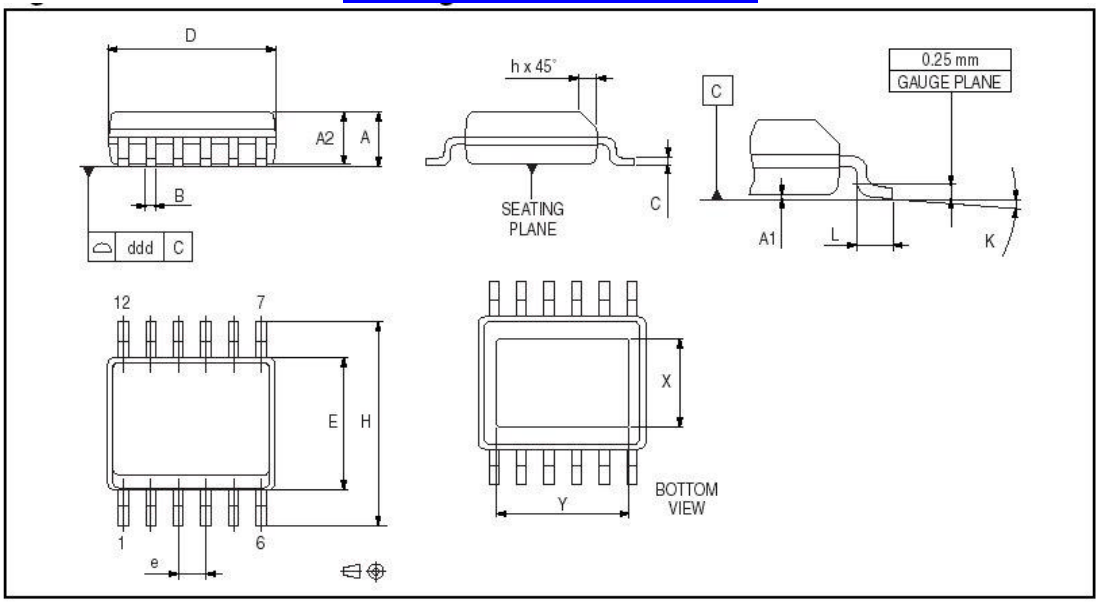
DUAL GAUGE POA



Symbol	millimeters		
	Min	Typ	Max
A	1.250		1.620
A1	0.000		0.100
A2	1.100		1.650
B	0.230		0.410
C	0.190		0.250
D	4.800		5.000
E	3.800		4.000
e		0.800	
H	5.800		6.200
h	0.250		0.500
L	0.400		1.270
k	0°		8°
X	1.900		2.500
Y	3.600		4.200
ddd			0.100

PRODUCT/PROCESS CHANGE NOTIFICATION

Deep Down Set POA



Symbol	millimeters		
	Min	Typ	Max
A	1.250		1.620
A1	0.000		0.100
A2	1.100		1.650
B	0.230		0.410
C	0.190		0.250
D	4.800		5.000
E	3.800		4.000
e		0.800	
H	5.800		6.200
h	0.250		0.500
L	0.400		1.270
k	0°		8°
X	2.200		2.800
Y	2.900		3.500
ddd			0.100

PRODUCT/PROCESS CHANGE NOTIFICATION

PIN OUT CONFIGURATION

DUAL GAUGE

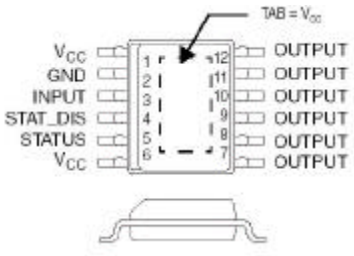
No pin-out changes respect to slug attach.

DEEP-DOWNSET

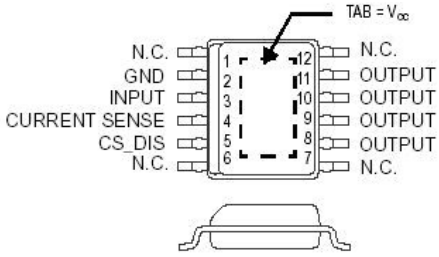
VN5050J-E and VN5050AJ-E:

- PIN# 1 and 6, previously connected to Vcc are NOT CONNECTED.

- PIN# 7 and 12, previously connected to OUTPUT are NOT CONNECTED.

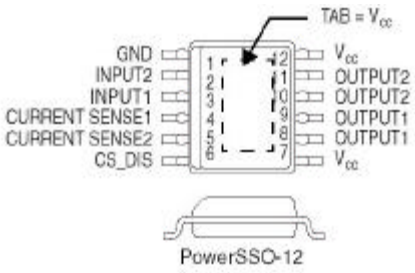


before change

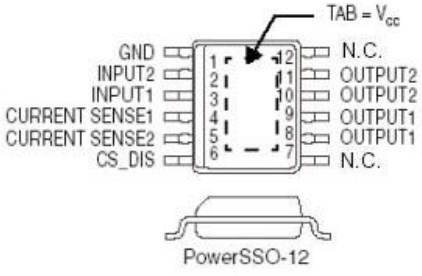


after change

VND5160AJ-E:
- PIN # 7 and 12, previously connected to Vcc are NOT CONNECTED.



before change

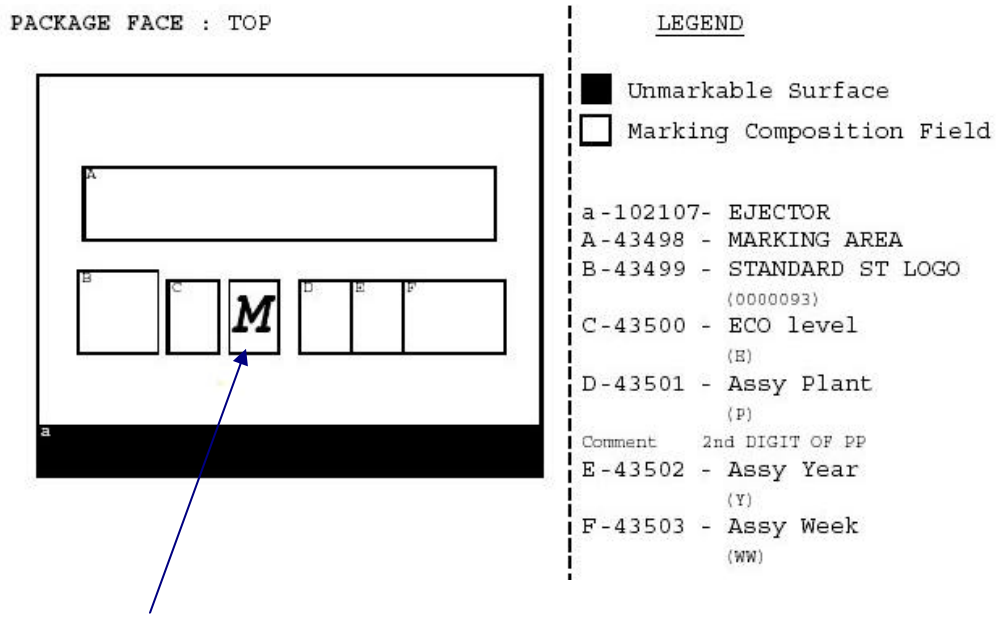


after change

PRODUCT/PROCESS CHANGE NOTIFICATION

Marking

No marking change.
During the transition phase, devices with mono component lead frame versions will be distinguishable by an added symbol "M" after Ecopack ® logo (see below).



Additional symbol "M" distinguish the mono component lead frames

Test Vehicles Qualification Reports

VN5016AJ-E (VNC9) has been chosen as family test vehicle for products housed in PowerSSO-12 Dual-Gauge lead-frame.

VN5050AJ-E (VNL7) has been chosen as family test vehicle for products housed in PowerSSO-12 Deep-Down-Set lead-frame.

Here below the relevant Qualification Reports.

Construction analysis is available on demand.

Products in PowerSSO-12 not inserted in the above mentioned list are already qualified with Dual Gauge or Deep Down Set Lead Frame.

Reliability Report

PowerSSO-12 New Frame Dual Gauge Qualification
Test vehicle VN5016AJ-E - VNC9

General Information	
Product Line	*: VNC9*
Product Description	*: VIPower M0_A5*
Finished Good Code	*: VN5016AJ-E*
Product division	*: BODY*
Package	*: PowerSSO-12*
Silicon process technology	*: VIPOWER*

Locations	
Wafer fab location	*: CATANIA L1 6*
Assembly plant location	: ST BOUSKOURA - MOROCCO

Issued by:
A. Marmoni – APG Q&R Catania

Reliability and electrical test executed by:
G. Foti – MPA Reliability Dpt, APG support

TABLE OF CONTENTS

1 APPLICABLE AND REFERENCE DOCUMENTS

Document reference	Short description
AEC-Q100	: Stress test qualification for integrated circuits
SOP 2.6.10	: General product qualification procedure
SOP 2.6.11	: Program management fro product qualification
SOP 2.6.12	: Design criteria for product qualification
SOP 2.6.14	: Reliability requirements for product qualification
SOP 2.6.19	: Process maturity level
SOP 2.6.2	: Process qualification and transfer management
SOP 2.6.20	: New process / New product qualification
SOP 2.6.7	: Product maturity level
SOP 2.6.9	: Package and process maturity management in Back End
SOP 2.7.5	: Automotive products definition and status

2 TEST GLOSSARY (INCLUDING PLAN)

TEST NAME	DESCRIPTION	NOTE	PLAN
PC (JLn)	Preconditioning (solder simulation)	1	YES
TC	Temperature Cycling		YES
HTSL	High Temperature Storage Life		YES
ES	Environmental Sequence	2	YES
WBP	Wire Bond Pull	3	
WBS	Wire Bond Share	3	

NOTE:
1) To be done before HTOL, PTC, THB, AC, TC
2) AC+TC sequence
3) Executed pre and post TC

3 RELIABILITY EVALUATION OVERVIEW

3.1 Objectives

Aim of this report is to present the results of the reliability evaluation performed on *VNC9* in order to qualify the new frame denominated Dual Gauge on package PowerSSO-12.

VNC9 is processed in *VIPOWER* diffused in *CATANIA CT 6* and assembled in *PowerSSO-12* in *ST BOUSKOURA - MOROCCO*.
For the reliability evaluation the following tests were executed:
ES, HTS, TC.

3.2 Conclusions

All reliability tests have been completed successfully. Parameter drift analysis performed on good samples submitted to die oriented test showed a good stability of the main electrical monitored parameters.
Package oriented tests have not put in evidence any criticality.

On the basis of the overall results it is possible to conclude that the new frame denominated Dual Gauge on package PowerSSO-12 can be considered qualified from a reliability point of view.

4 TESTS RESULTS SUMMARY

4.1 Results summary

Test		Test GLOSSARY (Including Plan)						
N	TEST NAME	PREC	CONDITIONS [SPEC]	STEPS	RESULTS			NOTES
					LOT 1	LOT 2	LOT 3	
1	**ES**	**Y**	JEDEC MSL = 3 REFLOW PROFILE = Ecopack (Tmax=260°C) LF Reference specification = ST 0061692	96 H	0/77	0/77	0/77	
2	**ES**	**Y**	JEDEC MSL = 3 REFLOW PROFILE = Ecopack (Tmax=260°C) LF Reference specification = ST 0061692	100 Cy	0/77	0/77	0/77	
3	**HTS**	**Y**	JEDEC MSL = 3 REFLOW PROFILE = Ecopack (Tmax=260°C) LF Ta = 150 Reference specification = JESD22-A103	500 H	0/45	0/45	0/45	
				1000 H	0/45	0/45	0/45	
4	**TC**	**Y**	JEDEC MSL = 3 REFLOW PROFILE = Ecopack (Tmax=260°C) LF Low Ta = -65 High Ta = 150 Reference specification = JESD22-A104	500 Cy	0/77	0/77	0/77	
				1000 Cy	0/77	0/77	0/77	

5 TESTS DESCRIPTION & DETAILED RESULTS

5.1 Die and Package tests description

TEST NAME	DESCRIPTION	PURPOSE
PC (JLn): Preconditioning (solder simulation) mounting simulation	The device is submitted to a typical temperature profile used for surface mounting, after a controlled moisture absorption.	*As stand-alone test:* to investigate the level of moisture sensitivity. *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 Cycles Test	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, moulding compound delamination, wire-bonds failure, die-attach layer degradation.
PP2A: Pressure Pot Test	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.
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.
ES: Environmental Sequence	The device is submitted in sequence to TCT and PPT, sometimes preceded by JLn preconditioning.	To simulate the actual combination of environmental stresses interacting in the field application. The typical failure modes are those reported for JLn, TCT and PPT .
WBP: Wire Bond Pull	The wire is submitted to a pulling force (approximately normal to the surface of the die) able to achieve wire break or interface separation between ball/pad or sticth/lead.	To investigate and measure the integrity and robustness of the interface between wire and die or lead metallizations.
WBS: Wire Bond Shear	The ball bond is submitted to a shear force (parallel to the pad area) able to cause the separation of the bonding surface between ball bond and pad area.	To investigate and measure the integrity and robustness of the bonding surface between ball bond and pad area.

CAR BODY DIVISION – Catania

Reliability Evaluation Plan on VN5050AJ-E
M05 Technology

Line: VNL7 **Package:PSSO-12 (Deep Down-Set)**

Test	Conditions	S.S.	Requirement
PRECONDITIONING OF SMD DEVICES BEFORE ALL TRIALS	DRYNG 24H @ 125°C STORE 192H @ TA=30° RH=60% I. R. REFLOW @ 260°C		Parameter deviation within spec. limits at end of preconditioning
H.T.S.	TA=150°C	77x1 Lot	Parameter deviation within spec. limits at 1000h
T.H.B.	*D.U.T. PRECONDITIONED* TA=85°C – RH=85% VCC= 24V	77x1 Lot	Parameter deviation within spec. limits at 1000h
H.T.B.	Ta= 125°C – VCC=28V	77x1 Lot	Parameter deviation within spec. limits at 1000h
PRESSURE POT	TA=121°C – PA=2ATM	77x1 Lot	Parameter deviation within spec. limits at 96h
THERMAL CYCLES AIR TO AIR	*D.U.T. PRECONDITIONED* TA=-65°C TO 150°C 1 HOUR/CYCLE	77x1 Lot	Parameter deviation within spec. limits at 500cycles
SMD MOISTURE INDUCED STRESS	DRYNG 24H @ TA= 125°C STORE 192H @ TA=30° RH=60% I. R. REFLOW @ 260°C	25x1 Lot	Parameter deviation within spec. limits at end of test
ENVIRONMENTAL SEQUENCE	*D.U.T. PRECONDITIONED* 100 THERMAL CYCLES+ 96H PP	50x1 Lot	Parameter deviation within spec. limits at end of test

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