PRODUCT/PROCESS CHANGE NOTIFICATION

PCN APG-AED/10/5951
Notification Date 10/12/2010

VNH2SP30-E Power-Stripes Rotation

Table 1. Change Implementation Schedule

Forecasted implementation date for change	31-Jan-2011
Forecasted availabillity date of samples for customer	05-Oct-2010
Forecasted date for **STMicroelectronics** change Qualification Plan results availability	05-Oct-2010
Estimated date of changed product first shipment	31-Jan-2011

Table 2. Change Identification

Product Identification (Product Family/Commercial Product)	VNH2SP30-E / VNH2SP30TR-E
Type of change	Product design change
Reason for change	Service Improvement
Description of the change	90 degrees Power-Stripes Rotation has been implemented on VNH2SP30-E i order to improve assembly yield.
Product Line(s) and/or Part Number(s)	See attached
Description of the Qualification Plan	See attached
Change Product Identification	Finished-Good Code
Manufacturing Location(s)	1]St Catania - Italy

Table 3. List of Attachments

Customer Part numbers list	
Qualification Plan results	

- -

Customer Acknowledgement of Receipt	**PCN APG-AED/10/5951**
Please sign and return to STMicroelectronics Sales Office	**Notification Date 10/12/2010**

☐ 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
Nicoloso, Riccardo	Division Product Manager
Parrino, Emanuele	Division Q.A. Manager

Product Change Notification (PCN)

Subject: VNH2SP30-E Power-Stripes Rotation

INVOLVED P&L FAMILY: 30

WHAT: 90 degrees Power-Stripes Rotation has been implemented on VNH2SP30-E

WHY: ServiceImprovement.Improved assembly yield without any change/impact on device specification/electrical characteristics and reliability.

WHO: All the Customers using VNH2SP30-E

WHEN: Change implementation within January 2011.
(According to Jedec standard (JESD46C) we are available to supply new production parts starting from wk47-2010 upon Customer agreement).
Samples are available on demand for immediate shipment.
Qualification results enclosed to this PCN.

WHERE: CT6 F.E. Fab. (Catania).

VNH2SP30TR-E:
Service improvement plan

APG - Automotive Electronics Division

General information

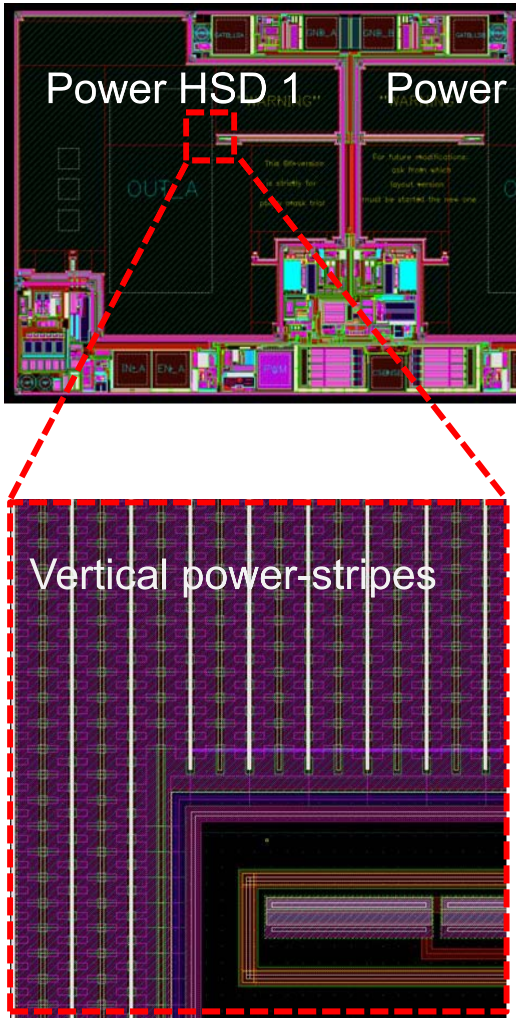
Achieving the goal of service improvement, the VNH2SP30 has been modified introducing a minor silicon re-layout with the aim of maximizing the assembly production yield.

The layout change consists of 90° power-stripes rotation (see next slide).

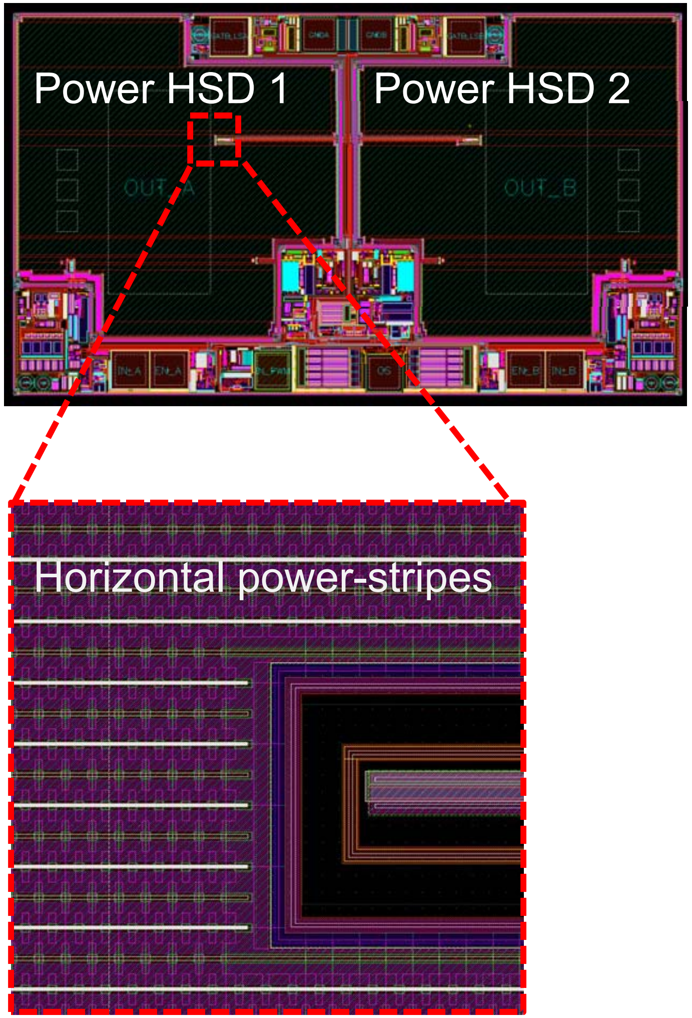
The change represents an important improvement for the production back-end (assembly), that thanks to the re-layout (stripes rotation) optimize the wire-bonding process (no change) securing better linear assembly production.

Layout comparison

OLD Layout: Vertical Power Stripes

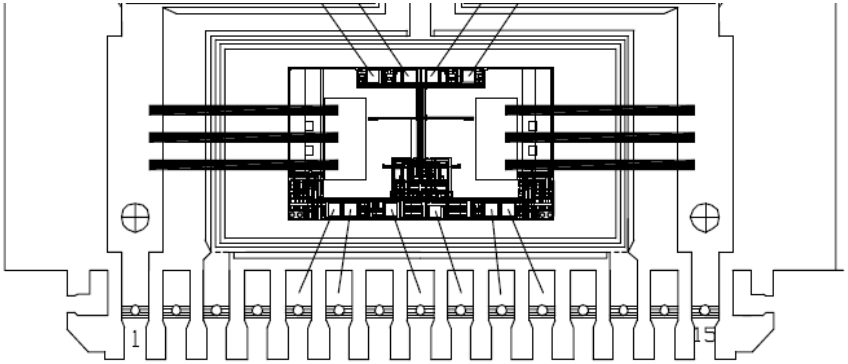


NEW Layout: Horizontal Power Stripes

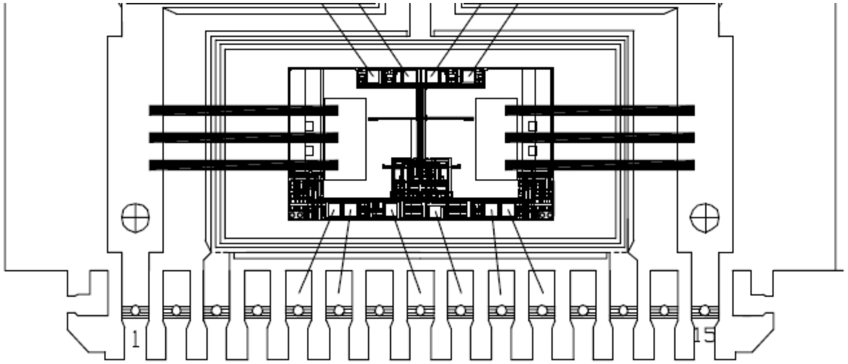


Bonding Diagram

Bond Diagram DO NOT change: assembly improvement is assured by strip rotation only.



Before



After

Conclusion

VNH2SP30 power-stripes rotation guarantees higher assembly production yield, for delivery service improvement, without any change/impact on the specification/electrical characteristics and/or device reliability (as confirmed by the enclosed documentation).

STMicroelectronics is planning to migrate the production on the new version starting from wk47-2010 upon Customer agreement.

VNH2SP30-E (VNH2)
Silicon re-layout qualification – Power strips rotation

General Informations	
Commercial Product	**VNH2SP30-E**
Product Line	VNH2
Silicon process technology	VIPower M0_3.5
Package	MultiPowerSO_30

Locations	
Diffusion fab location	ST CT6 Catania (Italy)
Assembly plant location	ST Muar (Malaysia)
Test plant location	ST Muar (Malaysia)
Reliability lab location	ST Catania (Italy)

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

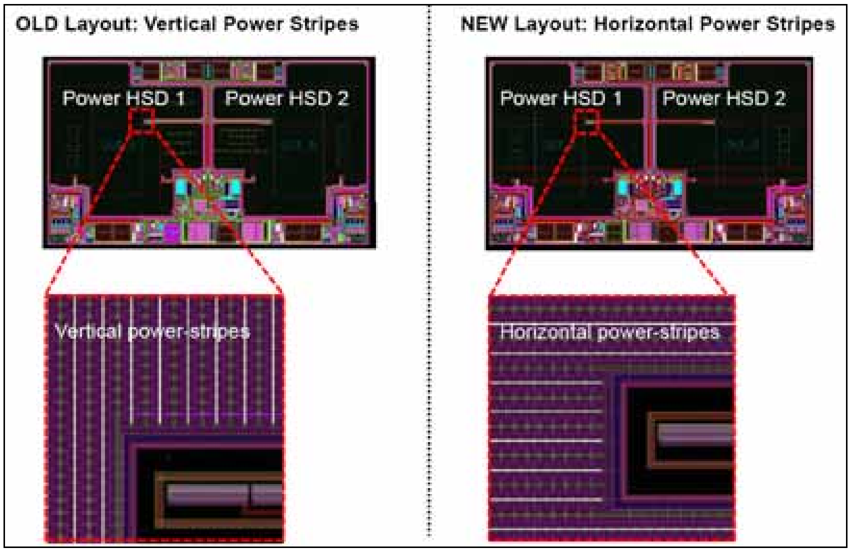
Reliability and electrical test executed by:
S. Di Stefano
Rel. Eng.
APM Rel Dept. – APG Support

Table of contents

- 1. Reliability evaluations overview

1.1 Objectives

Aim of this report is to present the results of the reliability evaluations performed on **VNH2SP30-E** (VNH2) in order to qualify the Power stripes rotation of 90° as silicon re-layout to optimize the wire bonding process with the aim of maximizing the production yield:



This product is a Fully integrated H-bridge Motor Driver for Automotive Applications that incorporates a dual monolithic High Side Driver designed in VIPower M0_3.5 technology and two Low Side Switches. The product is diffused in ST CT6 Catania (Italy) 6" wafer fab and the three dice are assembled by ST Muar (Malaysia) in MultiPowerSO_30 Chip to Chip package.

Applying a family approach the reliability evaluation was based on one lot and according with the **AEC_Q100 Rev.G** specification for the Accelerated Environment Stress (test Group A) and the Accelerated Lifetime Simulation (test Group B) the following tests were performed: Preconditioning (PC), Temperature Humidity Bias (THB), Autoclave (AC), Thermal Cycling (TC), High Temperature Storage (HTS), Power Temperature Cycling (PTC), High Temperature Operative Life (HTOL).

1.2 Results

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

The Wire Bond Pull/Shear tests (WBP, WBS) as Package Assembly Integrity (test Group C) didn't pointed out neither abnormal break loads nor forbidden failure modes.

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

- 2. Traceability

Wafer fab information	
Wafer fab manufacturing location	ST CT6 CATANIA (Italy)
Wafer diameter (inches)	6
Silicon process technology	VIPower M0_5E
Die finishing back side	Ti-Ni-Au
Die size (micron)	High Side Driver (VNA3 as ST internal silicon line): 3850 x 6660 Low Side Driver (E33V as ST internal silicon line): 4890 x 3890
Metal levels / materials	High Side Driver (VNA3): 1 level / AlSi (3.2 µm) Low Side Driver (E33V): 1 level / AlSi (4.5 µm)
Die finishing front side	SiN
Diffusion Lots #	High Side Driver (VNA3): 3027946 Low Side Driver (E33V): 3008696

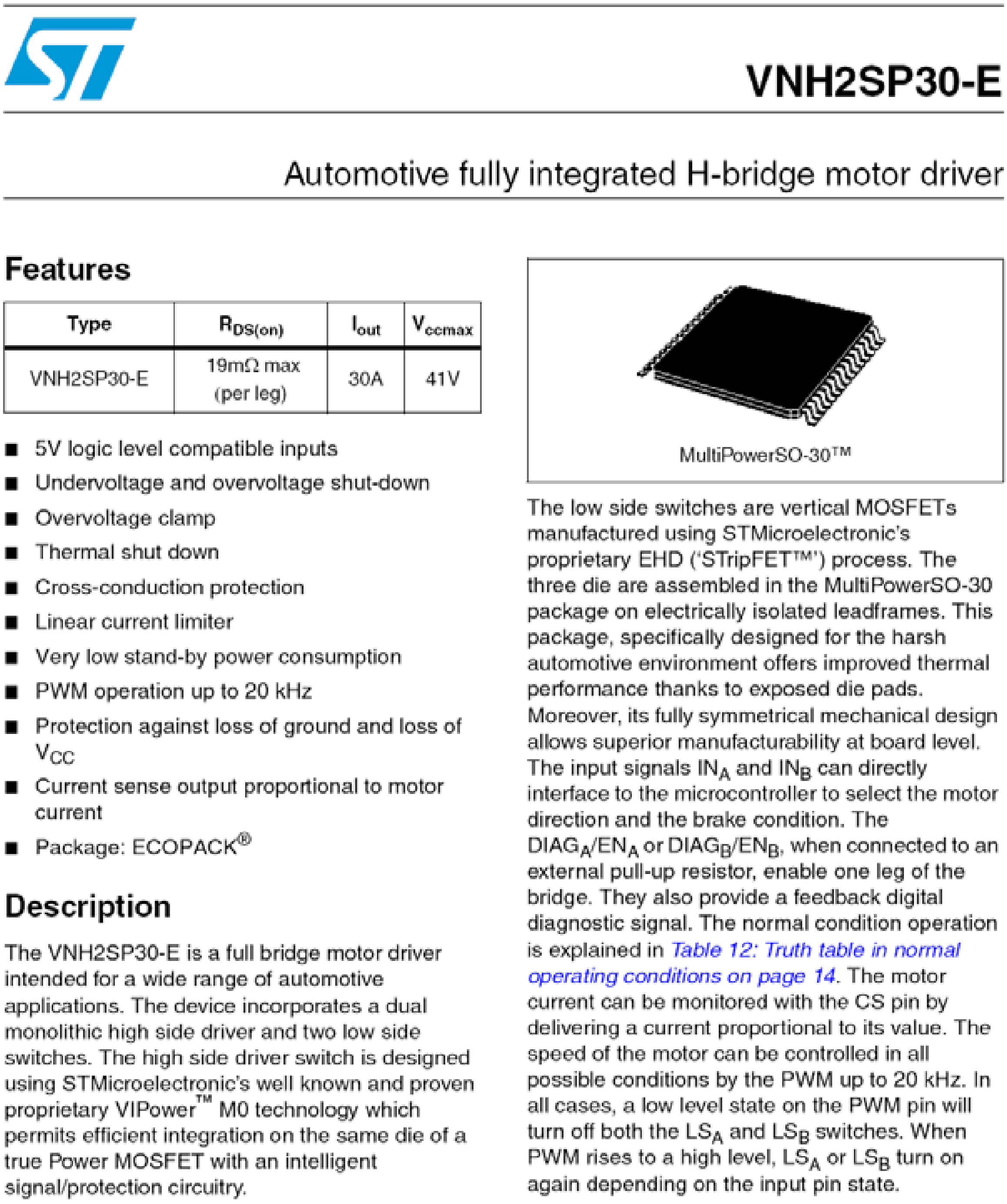
Assembly Information	
Assembly plant location	ST Muar (Malaysia)
Package description	MultiPowerSO_30
Molding compound	Resin SUMITOMO EME-G600C
Wires bonding materials/diameters	Au 1.2mils (on signal pads) / Al 10mils (on power pads)
Die attach material	Preform Pb/Ag/Sn 97.5/1.5/1
Assembly Lots #	990370HW01

Final Testing Information	
Electrical testing manufacturing location	ST Muar (Malaysia)

Reliability Information	
Reliability test execution location	ST Catania (Italy)

- 3. Devices characteristics

3.1 Generalities



VNH2SP30-E

Automotive fully integrated H-bridge motor driver

Features

Type	$R_{DS(on)}$	I_{out}	V_{ccmax}
VNH2SP30-E	19mΩ max (per leg)	30A	41V

- 5V logic level compatible inputs
- Undervoltage and overvoltage shut-down
- Overvoltage clamp
- Thermal shut down
- Cross-conduction protection
- Linear current limiter
- Very low stand-by power consumption
- PWM operation up to 20 kHz
- Protection against loss of ground and loss of V_{CC}
- Current sense output proportional to motor current
- Package: ECOPACK®

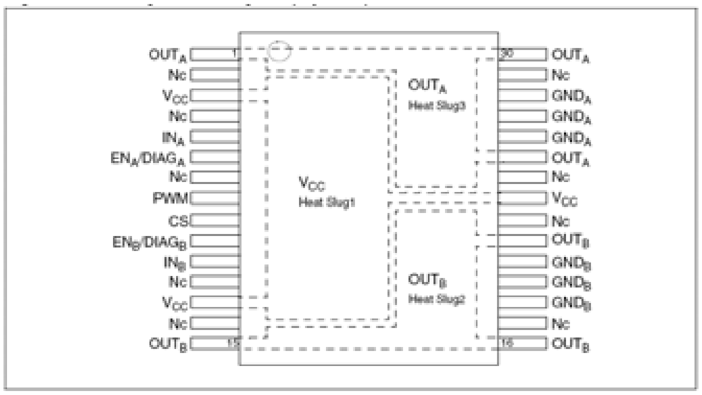
Description

The VNH2SP30-E is a full bridge motor driver intended for a wide range of automotive applications. The device incorporates a dual monolithic high side driver and two low side switches. The high side driver switch is designed using STMicroelectronic's well known and proven proprietary VIPower™ M0 technology which permits efficient integration on the same die of a true Power MOSFET with an intelligent signal/protection circuitry.

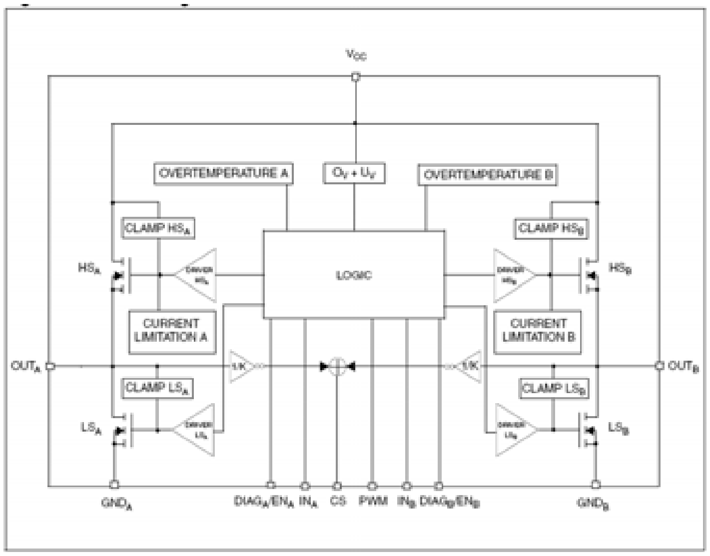
MultiPowerSO-30™

The low side switches are vertical MOSFETs manufactured using STMicroelectronic's proprietary EHD ('STripFET™') process. The three die are assembled in the MultiPowerSO-30 package on electrically isolated leadframes. This package, specifically designed for the harsh automotive environment offers improved thermal performance thanks to exposed die pads. Moreover, its fully symmetrical mechanical design allows superior manufacturability at board level. The input signals IN_A and IN_B can directly interface to the microcontroller to select the motor direction and the brake condition. The $DIAG_A/EN_A$ or $DIAG_B/EN_B$, when connected to an external pull-up resistor, enable one leg of the bridge. They also provide a feedback digital diagnostic signal. The normal condition operation is explained in *Table 12: Truth table in normal operating conditions on page 14*. The motor current can be monitored with the CS pin by delivering a current proportional to its value. The speed of the motor can be controlled in all possible conditions by the PWM up to 20 kHz. In all cases, a low level state on the PWM pin will turn off both the LS_A and LS_B switches. When PWM rises to a high level, LS_A or LS_B turn on again depending on the input pin state.

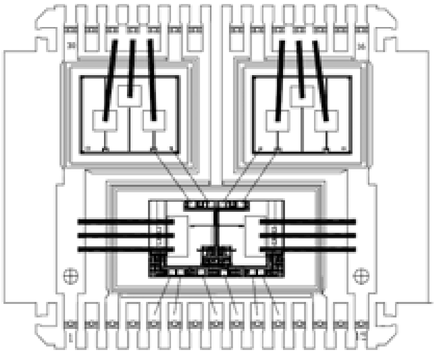
3.2 Pins connection



3.3 Blocks diagram

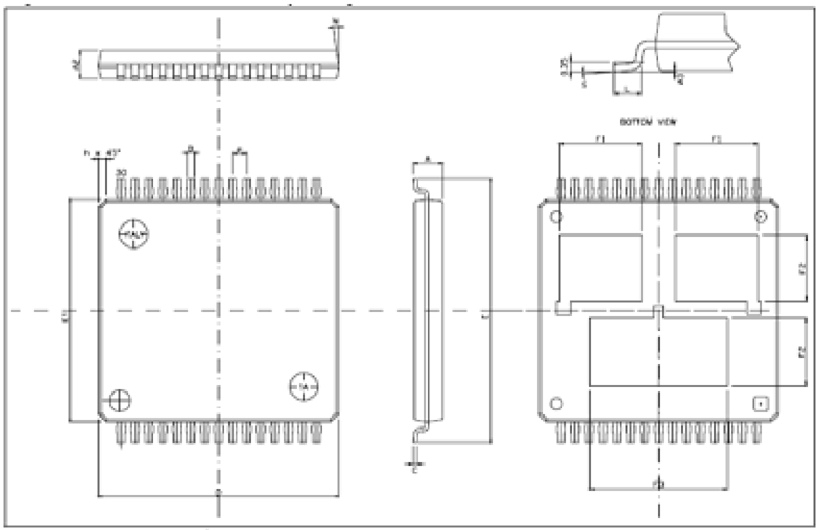


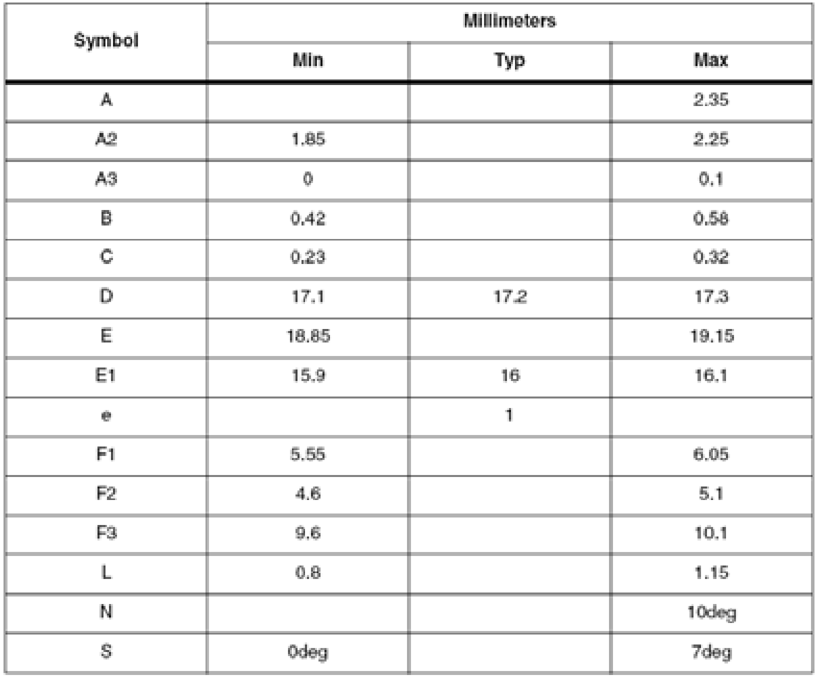
3.4 Bonding diagram



The bonding diagram don’t change at all before and after the Power strips rotation

3.5 Package outline/Mechanical data



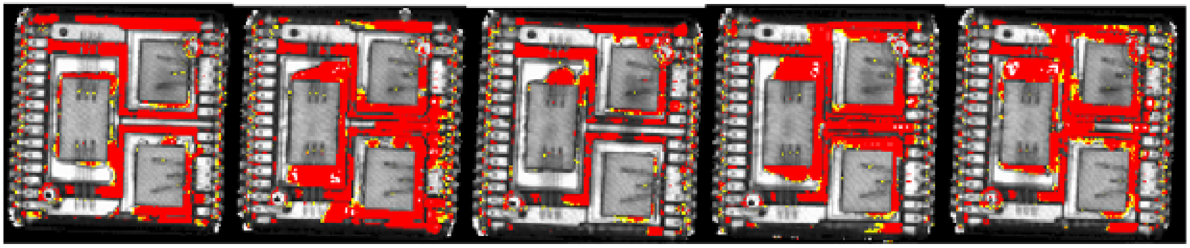


Symbol	Millimeters		
	Min	Typ	Max
A			2.35
A2	1.85		2.25
A3	0		0.1
B	0.42		0.58
C	0.23		0.32
D	17.1	17.2	17.3
E	18.85		19.15
E1	15.9	16	16.1
e		1	
F1	5.55		6.05
F2	4.6		5.1
F3	9.6		10.1
L	0.8		1.15
N			10deg
S	0deg		7deg

- 4. Reliability qualification plan and results

AEC #	Test Name	STM Test Conditions	Sample Size/ Lots	Results Fails/SS/Lots	Comments
A1	**PC** Pre Cond	Preconditioning at Jedec Level 3, store 192 hours at Ta=30ºC, RH=60%, reflow (3 times) at 260ºC	Before THB, AC, TC, PTC. Reliability executed on units soldered on PCB		
A2	**THB** Temp Humidity Bias	Ta=85ºC, RH=85%, Vcc=24V for 1000 hours	77/1	0/77/1	
A3	**AC** Autoclave	Ta=121ºC, Pa=2atm, RH=100% for 96 hours	77/1	0/77/1	
A4	**TC** Temp. Cycling	Ta=-65ºC / +150ºC for 500 cycles	77/1	0/77/1	
A5	**PTC** Power Temp. Cycling	Per JA105. Ta=-40ºC / +125ºC for 1000 cycles. Test before and after at room and hot temperatures.	45/1	0/45/1	
A6	**HTSL** High Temp. Storage Life	Ta=150ºC for 1000 hours. TST before and after at room and hot temperatures.	45/1	0/45/1	
B1	**HTOL** High Temp. Op. Life	Bias Static stress (JESD22-A108): Ta=125ºC, Vcc=28V for 1000 hours	77/1	0/77/1	
C1	**WBS** Wire Bond Shear	Per AEC-Q100-001. See Appendix 3 procedure. 0 and Ppk >= 1.66 or Cpk >= 1.33	30 bonds from minimum 5 of units from 1 lot	Passed	
C2	**WBP** Wire Bond Pull	Per MIL-STD883, M2011 Condition C or D. 0 and Ppk >= 1.66 or Cpk >= 1.33	30 bonds from minimum 5 of units from 1 lot	Passed	

- 5. Scanning Acoustic Microscopy (SAM)



No die-resin delamination was observed at SAM analysis performed on units after 500 Temperature Cycling.

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