PRODUCT/PROCESS CHANGE NOTIFICATION

PCN APG-ABD/13/7713
Dated 18 Feb 2013

VIPower M05 - Activation of 8" Wafer Fab Catania as Additional Location

Table 1. Change Implementation Schedule

Forecasted implementation date for change	31-Jul-2013
Forecasted availability date of samples for customer	11-Feb-2013
Forecasted date for **STMicroelectronics** change Qualification Plan results availability	11-Feb-2013
Estimated date of changed product first shipment	31-Jul-2013

Table 2. Change Identification

Product Identification (Product Family/Commercial Product)	see list
Type of change	Waferfab additional location
Reason for change	Service Improvement
Description of the change	In order to improve Capacities and Service 8 inches wafer Fab Catania has been qualified as additional location for VIPower M05 technology products.
Change Product Identification	"V5" traceability code identify 8" wafer fab
Manufacturing Location(s)	1]Catania Ctm8 2]Catania Ctm6

DOCUMENT APPROVAL

Name	Function
Liporace, Nicola	Marketing Manager
Nicoloso, Riccardo	Product Manager
Minerva, Francesco	Q.A. Manager

VIPower M05: Activation of 8" Wafer Fab. Catania as Additional Location.

WHAT

In order to improve Capacities and Service 8 inches wafer Fab Catania has been qualified as additional location for VIPower M05 technology products.

WHO

All the Customers using below list of products.

Part Number	Samples Availability
VND5004ASP30-E / VND5004ASP30TR-E	wk11-2013
VND5004ATR-E	wk09-2013
VND5004BSP30-E / VND5004BSP30TR-E	wk10-2013
VND5004BTR-E	wk11-2013
VNH5019A-E / VNH5019ATR-E	available
VND5E006ASP-E / VND5E006ASPTR-E	wk32-2013
VN5E010AFH-E / VN5E010AFHTR-E	wk32-2013
VN5E010AHTR-E	wk32-2013
VN5E010MH-E / VN5E010MHTR-E	wk32-2013
VN5E010NAHTR-E	wk32-2013
VN5R003H-E / VN5R003HTR-E	wk32-2013

WHEN

Change will be implemented according to the following schedule:

-Qualification results enclosed to this PCN (RR004111CT6025).

-Samples availability: see upon table.

-Tentative Implementation on July 2013

WHERE

Catania 6” (CT6 – CTM6) / Catania 8” (CM5 – CTM8) .

VIPower M0L5 technology transfer from CTM6 Catania (Italy) to CTM8 Catania (Italy)

General Informations	
Commercial Product	**VND5E006ASP-E**
Product Line	VH10
Silicon process technology	VIPower M05
Package	PowerSO16

Locations	
Diffusion fab location	ST CTM8 Catania (Italy)
Assembly plant location	ST Muar (Malaysia)
Test plant location	ST Muar (Malaysia)
Reliability lab location	ST Catania (Italy)

General Informations	
Commercial Product	**VND5004B-E**
Product Line	VH02
Silicon process technology	VIPower M05
Package	PQFN Power 12x12

Locations	
Diffusion fab location	ST CTM8 Catania (Italy)
Assembly plant location	ASE (Korea)
Test plant location	ST Muar (Malaysia)
Reliability lab location	ST Catania (Italy)

Author:
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Product Qualification Eng
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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 **VND5E006ASP-E** (VH10 as ST internal silicon line) and on **VND5004B-E** (VH02 as ST internal silicon line) chosen as test vehicles in order to transfer the VIPower M0L5 technology from ST CTM6 Catania (Italy) 6" wafer fab to ST CTM8 Catania (Italy) 8" wafer fab.

These are multi chip Double High Side Driver products with analog current sense for Automotive Application. The **VND5E006ASP-E** is assembled by ST Muar (Malaysia) in PowerSO-16 package while the **VND5004B-E** is assembled by ASE (Korea) subcontractor in QFPN 12x12 package.

The reliability evaluation was based on three lots, two of them of **VND5E006ASP-E** and one of **VND5004B-E**.

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 for each lot: Preconditioning (PC), Temperature Humidity Bias (THB), Autoclave (AC), Thermal Cycling (TC), High Temperature Storage (HTS), Power Temperature Cycling (PTC), High Temperature Operative Life (HTOL). An ESD characterization (HBM, CDM), the Latch-UP (LU) and Gate Leakage (GL) control were also done as Electrical Verification (test Group E).

1.2 Results

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

The drift analysis performed at T=+25°C examining $I_{OFF@13V}$, $R_{ON1@24V}$, $K_{1\_CK@16V}$ (for **VND5E006ASP-E**) and $I_{OFF@13V}$, $R_{ON1@8V}$ (for **VND5004B-E**), showed a good stability for all the electrical monitored parameters.

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

- 2. Traceability

VND5006ASP-E

Wafer fab information	
Wafer fab manufacturing location	ST CTM6 CATANIA (Italy) as signal part ST CTM8 CATANIA (Italy) as power die
Wafer diameter	6” as signal part, 8” as power die
Silicon process technology	VIPower **M05E signal part**, VIPower **M0L5 power die**
Die finishing back side	VNS8 (signal) Raw silicon, VNS9 (power) Ti-Ni-Au
Die size	VNS8 (signal) 3160x1690, VNS9 (power) 5780x5210 micron
Metal materials/levels	VNS8 (signal) Ti/TiN/Ti/AlSiCu / 2 levels (3.2 micron last level) VNS9 (power) Ti/TiN/TiAlCu/ 1 level (4.7 micron)
Die finishing front side	SiN / Polyimide
Diffusion Lots #	Lot 1: VNS8 (signal) 3104685, VNS9 (power) 5105246 Lot 2: VNS8 (signal) 3117932, VNS9 (power) 5105246

Assembly Information	
Assembly plant location	ST Muar (Malaysia)
Package description	PowerSO_16 FRAME PSO-16 4riv 1-4/5-8fused
Molding compound	SUMITOMO EME-G700LS
Wires bonding materials/diameters	Au 1.3mils (on signal) / Al 12mils (on power)
Die attach material	PREFORM Pb/Ag/Sn 97.5/1.5/1 TAPE ADWILL LE-5000P8AS
Assembly Lots #	Lot1: 991191VS01, Lot2: 991191VT01

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

Reliability Information	
Reliability test execution location	ST Catania (Italy)

VND5004B-E

Wafer fab information	
Wafer fab manufacturing location	ST CTM6 CATANIA (Italy) as signal part ST CTM8 CATANIA (Italy) as power die
Wafer diameter	6” as signal part, 8” as power die
Silicon process technology	VIPower **M05E signal part**, VIPower **M0L5 power die**
Die finishing back side	VNS3 (signal) Ti-Ni-Au, VNI4 (power) Ti-Ni-Au
Die size	VNS3 (signal) 2800x1560, VNI4 (power) 7990x4000 micron
Metal materials/levels	VNS3 (signal) Ti/TiN/TiAlCu / 2 levels (3.2 micron last level) VNI4 (power) Ti/TiN/TiAlCu / 1 level (4.7 micron)
Die finishing front side	VNS3 (signal) SiN / Polyimide, VNI4 (power) Teos + PTeos + SiOn + PIX
Diffusion Lots #	VNS3 (signal) 3120430, VNI4 (power) 5105247

Assembly Information	
Assembly plant location	ASE (Korea)
Package description	PQFN Power 12x12
Molding compound	Sumitomo G700
Wires bonding materials/diameters	Au 1.0mils (on signal) / Al 12mils (on power)
Die attach material	PREFORM Pb/Ag/Sn 95.5/2.5/2 D/A ADHESIVE ABLE 8290
Assembly Lots #	HA131CZA21

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

Reliability Information	
Reliability test execution location	ST Catania (Italy)

- 3. VND5E006ASP-E - Devices characteristics

3.1 Generalities

VND5E006ASP-E

Double channel high-side driver with analog current sense for automotive applications

Features

Max transient supply voltage	V_{CC}	41 V
Operating voltage range	V_{CC}	4.5 to 28 V
Max on-state resistance (per ch.)	R_{ON}	5.5 mΩ
Current limitation (typ)	I_{LIMH}	100 A
Off-state supply current	I_S	2 µA(1)

1. Typical value with all loads connected.

- General
  - Inrush current active management by power limitation
  - Very low standby current
  - 3.0 V CMOS compatible inputs
  - Optimized electromagnetic emissions
  - Very low electromagnetic susceptibility
  - In compliance with the 2002/95/EC european directive
  - Very low current sense leakage
- Diagnostic functions
  - Proportional load current sense
  - High current sense precision for wide currents range
  - Current sense disable
  - Off-state openload detection
  - Output short to V_{CC} detection
  - Overload and short to ground (power limitation) indication
  - Thermal shutdown indication
- Protections
  - Undervoltage shutdown
  - Overvoltage clamp
  - Load current limitation
  - Self limiting of fast thermal transients
  - Protection against loss of ground and loss of V_{CC}
  - Overtemperature shutdown with auto restart (thermal shutdown)

PowerSO-16

  - Reverse battery protected with self switch of the PowerMOS (see *Figure 32*)
  - Electrostatic discharge protection

Applications

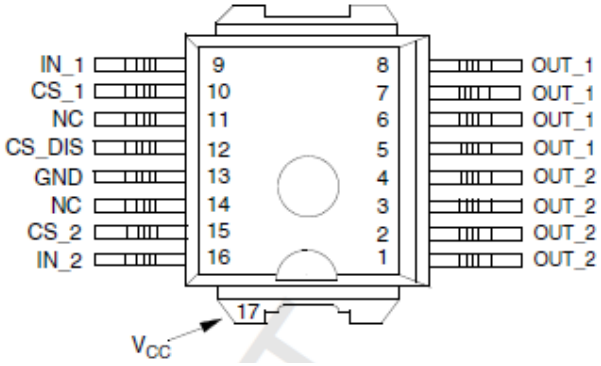
- All types of resistive, inductive and capacitive loads

Description

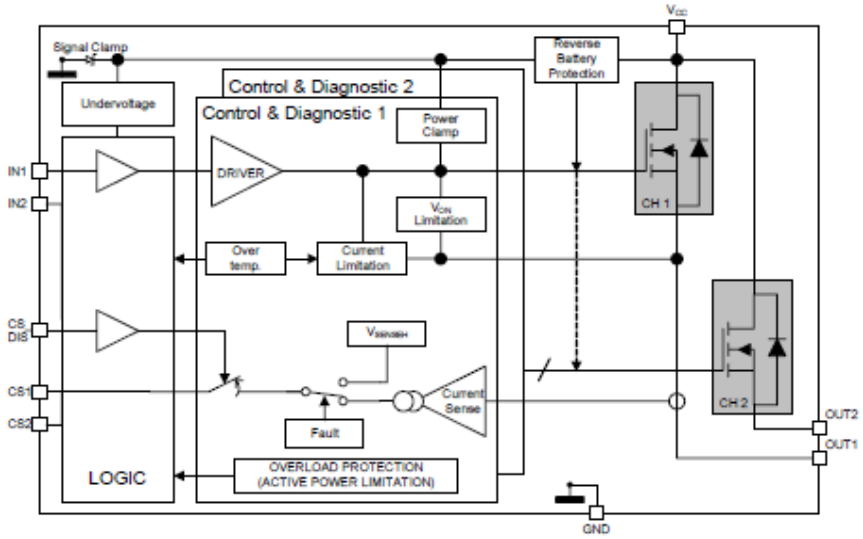
The VND5E006ASP-E is a double channel high-side driver manufactured in the ST proprietary VIPower™ M0-5 technology and housed in the tiny PowerSO-16 package. The VND5E006ASP-E is designed to drive 12 V automotive grounded loads delivering protection, diagnostics and easy 3 V and 5 V CMOS compatible interface with any microcontroller.

The device integrates advanced protective functions such as load current limitation, inrush and overload active management by power limitation, overtemperature shut-off with auto restart and overvoltage active clamp. A dedicated analog current sense pin is associated with every output channel in order to provide enhanced diagnostic functions including fast detection of overload and short-circuit to ground through power limitation indication, overtemperature indication, short-circuit to V_{CC} diagnosis and ON and OFF-state open load detection. The current sensing and diagnostic feedback of the whole device can be disabled by pulling the CS_DIS pin high to allow sharing of the external sense resistor with other similar devices.

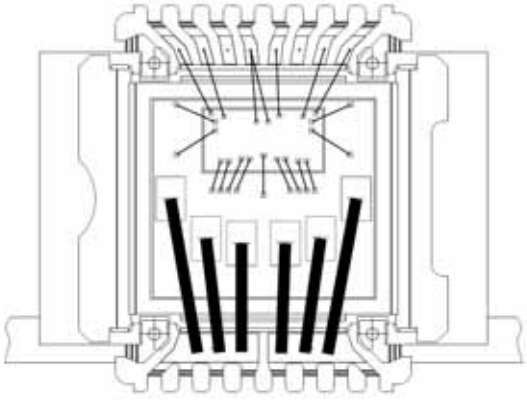
3.2 Pins connection



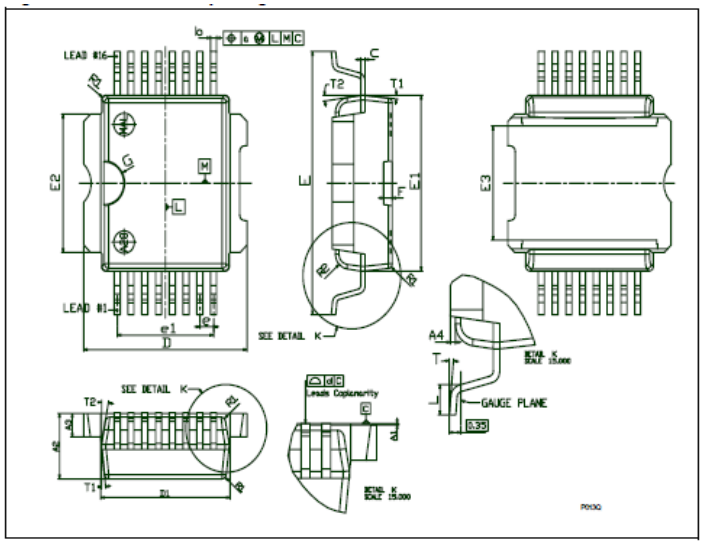
3.3 Blocks diagram



3.4 Bonding diagram



3.5 Package outline/Mechanical data



Dim.	mm		
	Min.	Typ.	Max.
A1	0	0.05	0.1
A2	3.4	3.5	3.6
A3	1.2	1.3	1.4
A4	0.15	0.2	0.25
a		0.2	
b	0.27	0.35	0.43
c	0.23	0.27	0.32
D	9.4	9.5	9.6
D1	7.4	7.5	7.6
d	0	0.05	0.1
E (1)	13.85	14.1	14.35
E1	9.3	9.4	9.5
E2	7.3	7.4	7.5
E3	5.9	6.1	6.3
e		0.8	
e1		5.6	
F		0.5	
G		1.2	
L	0.8	1	1.1
R1			0.25
R2		0.8	
T	2°	5°	8°
T1	6° (typ.)		
T2	10° (typ.)		

- 4. VND5004B-E - Devices characteristics

4.1 Generalities

VND5004B-E
VND5004BSP30-E

Double 4mΩ high side driver with analog current sense for automotive applications

Features

Parameters	Symbol	Value
Max transient supply voltage	V_{CC}	41 V
Operating voltage range	V_{CC}	4.5 to 28 V
Max on-state resistance	R_{ON}	4 mΩ
Current limitation (typ)	I_{LIMH}	100 A
Off-state supply current	I_S	2 µA(1)

1. Typical value with all loads connected.

- General
  - Inrush current active management by power limitation
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  - 3.0 V CMOS compatible input
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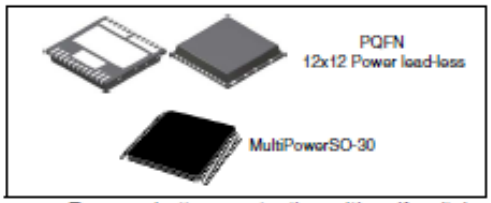
  - In compliance with the 2002/95/EC European directive
- Diagnostic functions
  - Proportional load current sense
  - Current sense disable
  - Thermal shutdown indication
- Protection
  - Undervoltage shutdown
  - Overvoltage clamp
  - Load current limitation
  - Thermal shutdown
  - Self limiting of fast thermal transients
  - Protection against loss of ground and loss of V_{CC}



  - Reverse battery protection with self switch on of the Power MOSFET (see *Figure 22*)
  - Electrostatic discharge protection application
- All types of resistive, inductive and capacitive loads
- Suitable for power management applications

Description

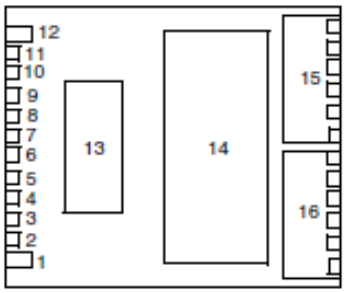
The VND5004BTR-E and VND5004BSP30-E are devices made using STMicroelectronics VIPower technology. They are intended for driving resistive or inductive loads with one side connected to ground. Active V_{CC} pin voltage clamp and load dump protection circuit protect the devices against transients on the Vcc pin (see ISO7637 transient compatibility table). These devices integrate an analog current sense which delivers a current proportional to the load current (according to a known ratio) when CS_DIS is driven low or left open. When CS_DIS is driven high, the CURRENT SENSE pin is high impedance. Output current limitation protects the devices in overload condition. In case of long duration overload, the devices limit the dissipated power to a safe level up to thermal shutdown intervention. Thermal shutdown with automatic restart allows the device to recover normal operation as soon as a fault condition disappears.

Table 1. Devices summary

Package	Order codes		
	Tube	Tape and reel	Tray
PQFN-12x12 power lead-less	-	VND5004BTR-E	VND5004B-E
MultiPowerSO-30	VND5004BSP30-E	VND5004BSP30TR-E	-

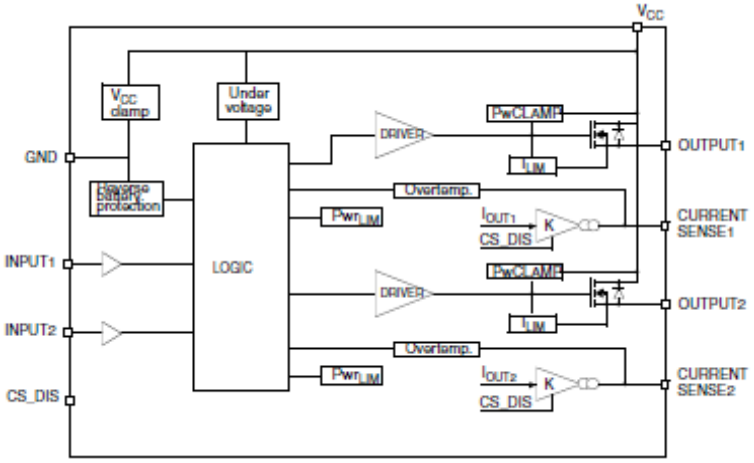
4.2 Pins connection

PQFN -12x12 Power lead - less (bottom view)

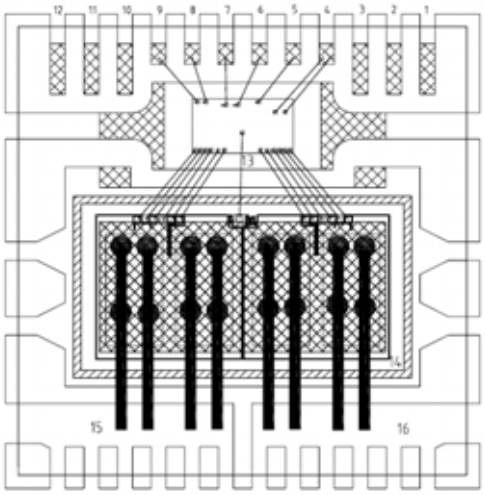


1 NC
2 NC
3 NC
4 GND
5 CS_DIS
6 CURRENT SENSE 2
7 CURRENT SENSE 1
8 INPUT 2
9 INPUT 1
10 NC
11 NC
12 NC
13 FOR TEST ONLY
14 V_{CC}
15 OUTPUT 1
16 OUTPUT 2

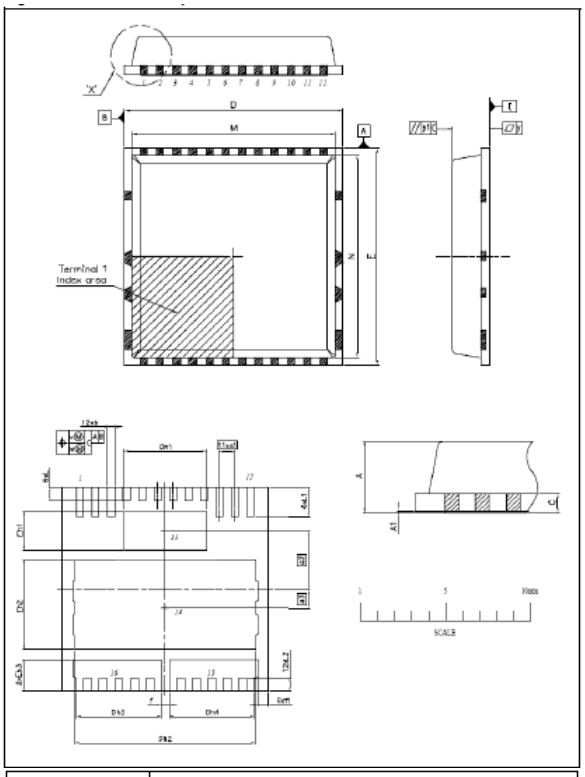
4.3 Blocks diagram



4.4 Bonding diagram



4.5 Package outline/Mechanical data



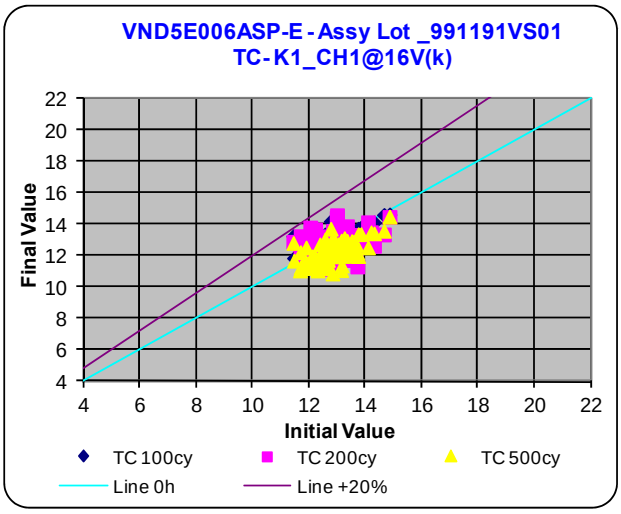
Symbol	Millimeters		
	Min.	Typ.	Max.
A	2		2.2
A1	0		0.05
b	0.35		0.47
C		0.50	
D	11.90		12.10
Dh1	4.65		4.95
Dh2	10.45		10.65
Dh3	4.80		5
Dh4	4.80		5
E	11.90		12.10
Eh1	2.15		2.45
Eh2	5.15		5.45
Eh3	1.70		2
e1		0.90	
e2		3.45	
e3		1.10	
f		0.50	
f1		0.60	
L	0.75		0.95
L1	1.65		1.90
L2	0.76		0.78
M	11.10		11.30
N	11.10		11.30
v		0.1	
w		0.05	
y		0.05	
y1		0.1	

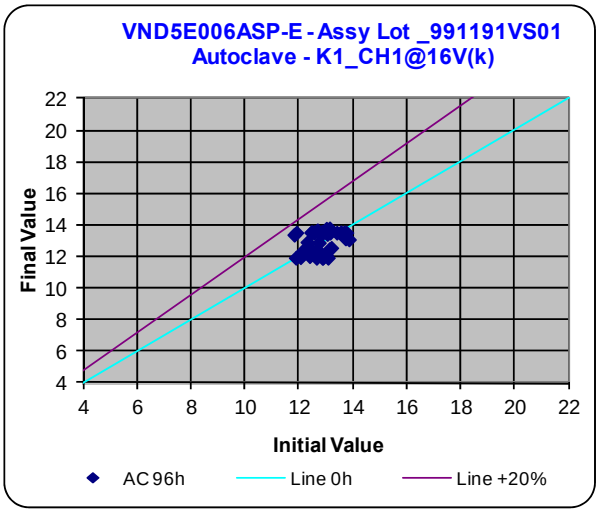
- 5. Reliability qualification plan and results

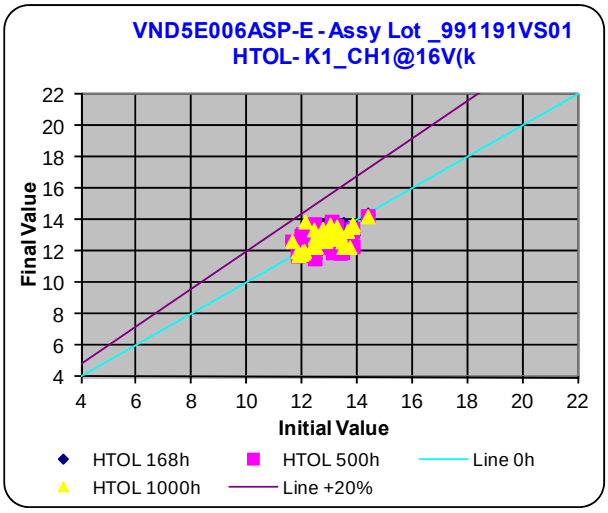
AEC #	Test Name	STM Test Conditions	Sample Size/ Lots	Results Fails/SS/Lots	Comments
A1	**PC** Pre Cond	Preconditioning at Jedec Level 3, store 192 hours at Ta=30ºC, RH=60%, reflow (3 times) at 250ºC	Before THB, AC, TC Reliability executed on units soldered on PCB		
A2	**THB** Temp Humidity Bias	Ta=85ºC, RH=85%, V_{CC}=56V for 1000 hours	77/3	0/77/3	2xVND5E006ASP 1xVND5004B
A3	**AC** Autoclave	Ta=121ºC, Pa=2atm, RH=100% for 96 hours	77/3	0/77/3	2xVND5E006ASP 1xVND5004B
A4	**TC** Temp. Cycling	Ta=-65ºC / +150ºC for 500 cycles	77/3	0/77/3	2xVND5E006ASP 1xVND5004B
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	Only on VND5E006ASP-E
A6	**HTSL** High Temp. Storage Life	Ta=150ºC for 1000 hours. TST before and after at room and hot temperatures.	45/3	0/45/3	2xVND5E006ASP 1xVND5004B
B1	**HTOL** High Temp. Op. Life	Bias Static stress (JESD22-A108): Ta=125ºC, V_{CC}= 56V for 1000 hours	77/3	0/77/3	2xVND5E006ASP 1xVND5004B
E2	**ESD** HBM		15/1	V_{CC}/Output: ±5.0kV CS_DIS/Input: ±4.0kV CS: ±2.0kV	Only on VND5E006ASP-E
E2	**ESD** HBM		3/1	All pins: ±2.0kV	Only on VND5004B-E
E3	**ESD** CDM		6/1	**All pins:** ±750V	Both products
E4	**LU** Latch-Up		6/1	±100mA	
E8	**GL** Gate Leakage		6/1	Passed	

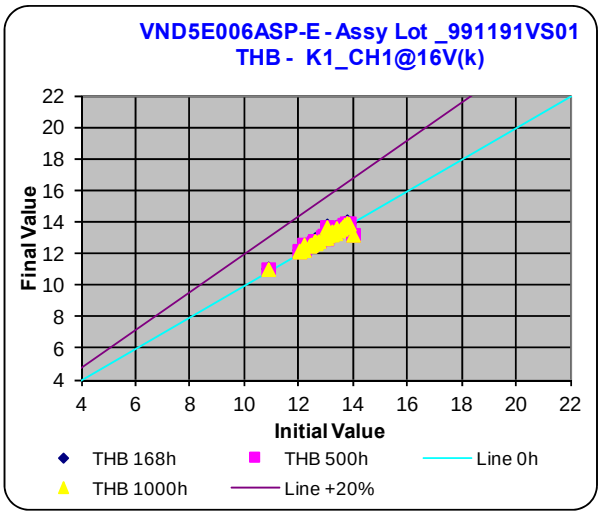
- 6. Electrical drift analysis

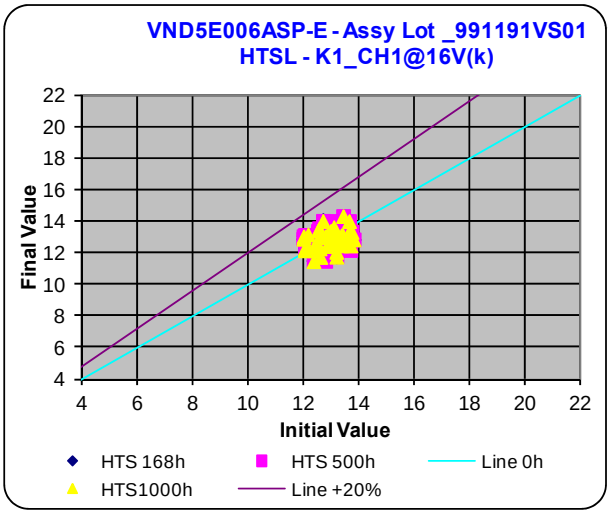
- **Assy Lot_991191VS01**

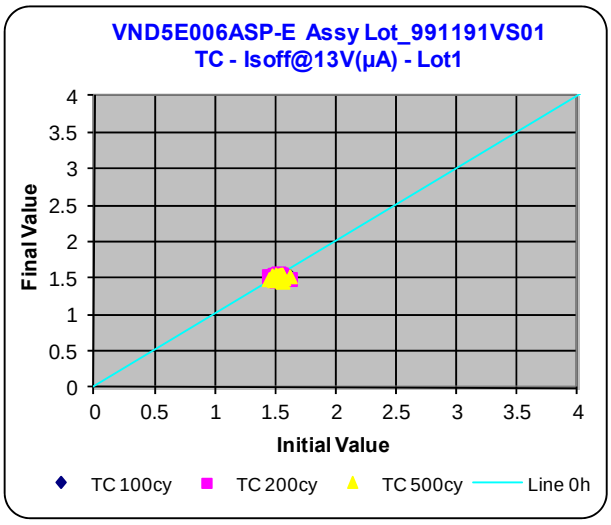


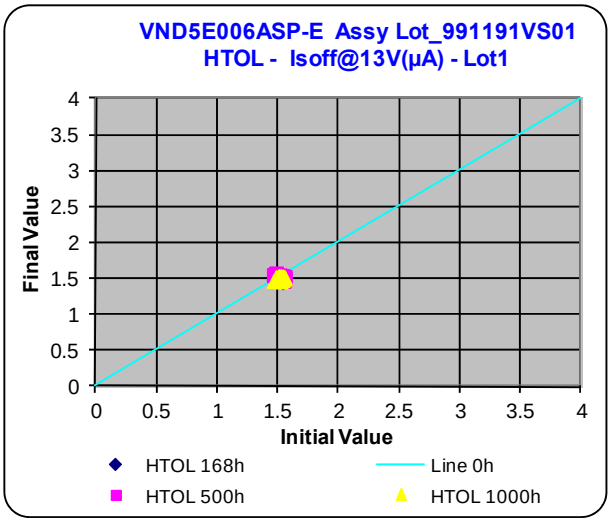


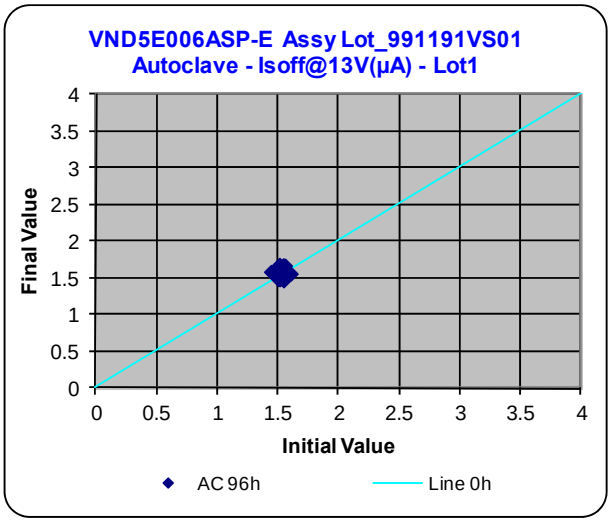


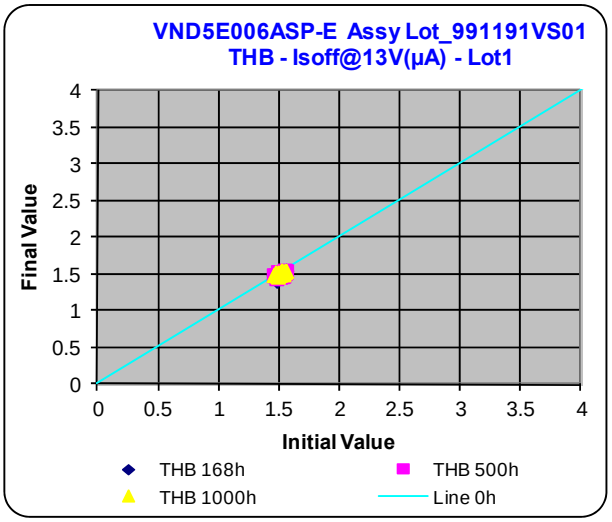


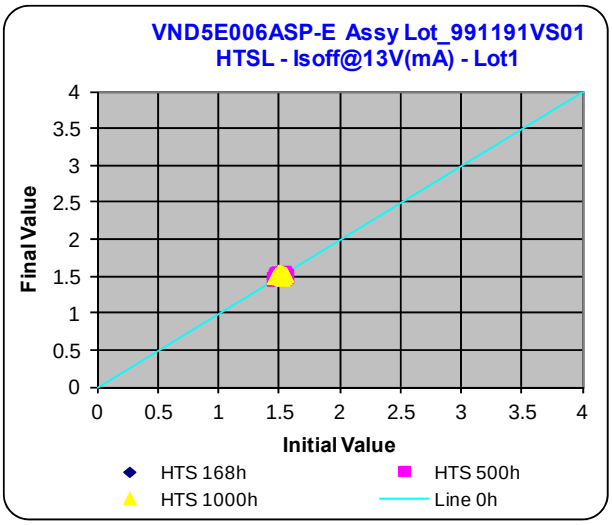


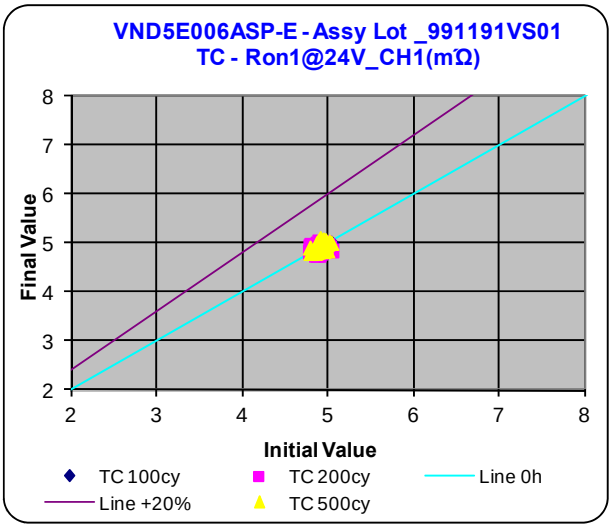

VND5E006ASP-E Assy Lot_991191VS01
TC - Isoff@13V(µA) - Lot1
Final Value
Initial Value
0 0.5 1 1.5 2 2.5 3 3.5 4
TC 100cy
TC 200cy
TC 500cy
Line 0h

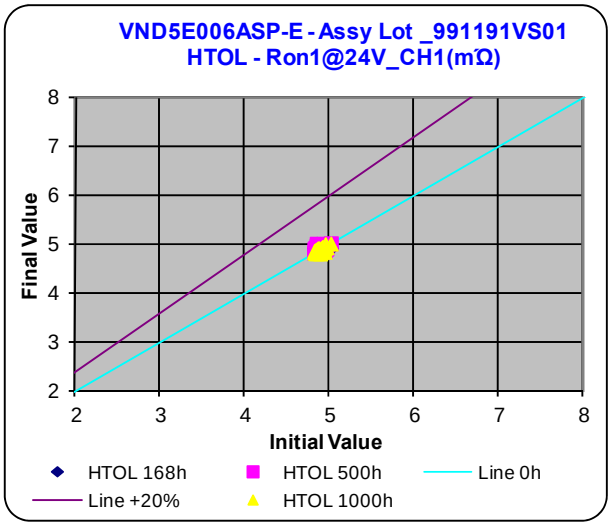

VND5E006ASP-E Assy Lot_991191VS01
HTOL - Isoff@13V(µA) - Lot1
Final Value
Initial Value
0 0.5 1 1.5 2 2.5 3 3.5 4
HTOL 168h
Line 0h
HTOL 500h
HTOL 1000h

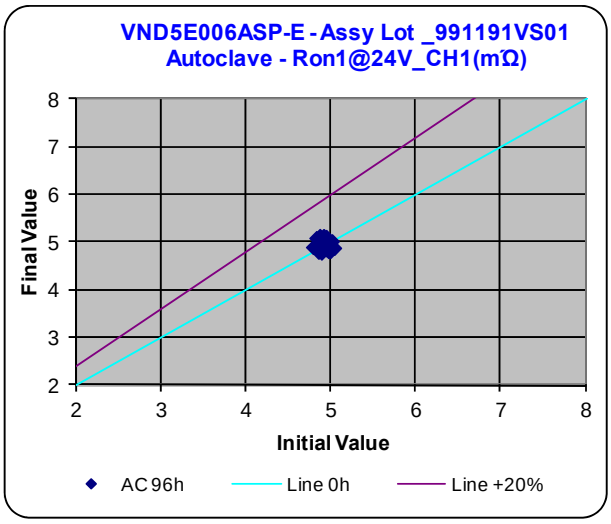

VND5E006ASP-E Assy Lot_991191VS01
Autoclave - Isoff@13V(µA) - Lot1
Final Value
Initial Value
0 0.5 1 1.5 2 2.5 3 3.5 4
AC 96h
Line 0h

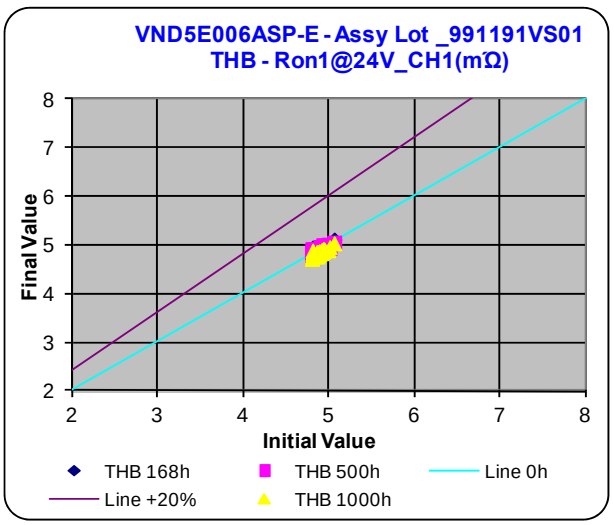

VND5E006ASP-E Assy Lot_991191VS01
THB - Isoff@13V(µA) - Lot1
Final Value
Initial Value
0 0.5 1 1.5 2 2.5 3 3.5 4
THB 168h
THB 500h
THB 1000h
Line 0h

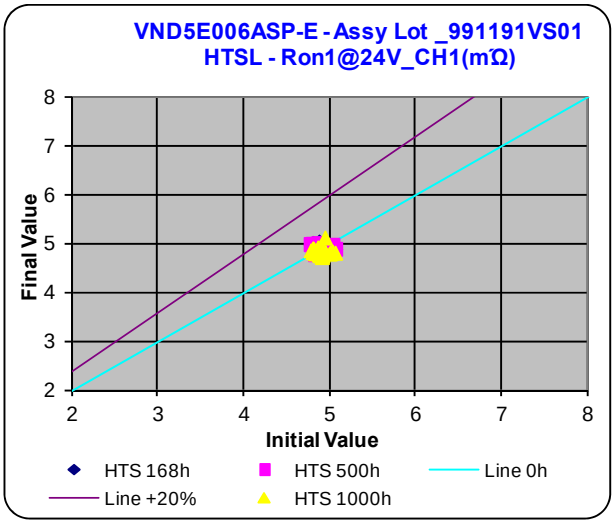

VND5E006ASP-E Assy Lot_991191VS01
HTSL - Isoff@13V(mA) - Lot1
Final Value
Initial Value
0 0.5 1 1.5 2 2.5 3 3.5 4
HTS 168h
HTS 500h
HTS 1000h
Line 0h


VND5E006ASP-E - Assy Lot _991191VS01
TC - Ron1@24V_CH1(mΩ)
Final Value
Initial Value
TC 100cy
TC 200cy
Line 0h
Line +20%
TC 500cy

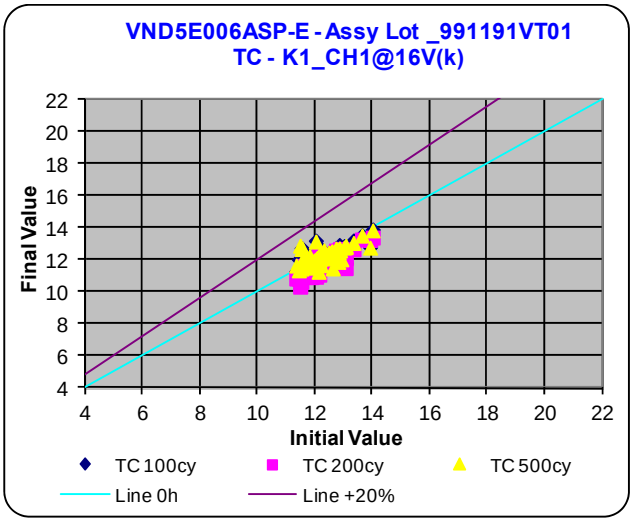

VND5E006ASP-E - Assy Lot _991191VS01
HTOL - Ron1@24V_CH1(mΩ)
Final Value
Initial Value
HTOL 168h
HTOL 500h
Line 0h
Line +20%
HTOL 1000h

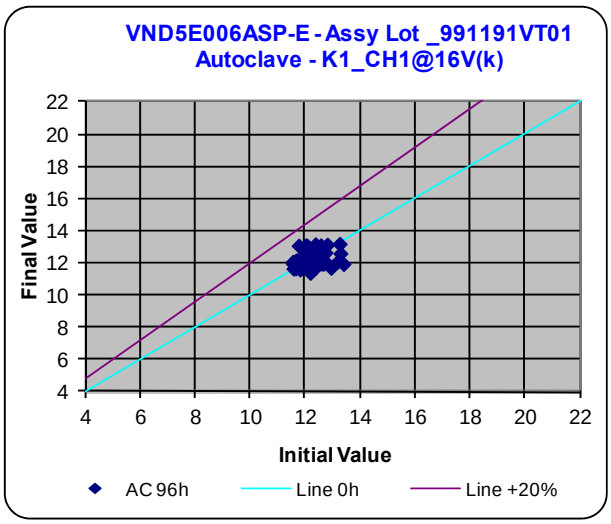

VND5E006ASP-E - Assy Lot _991191VS01
Autoclave - Ron1@24V_CH1(mΩ)
Final Value
Initial Value
AC 96h
Line 0h
Line +20%

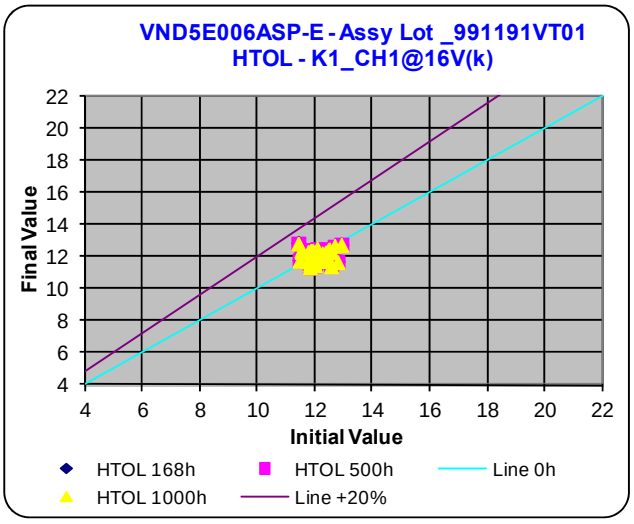

VND5E006ASP-E - Assy Lot _991191VS01
THB - Ron1@24V_CH1(mΩ)
Final Value
Initial Value
THB 168h
THB 500h
Line 0h
Line +20%
THB 1000h

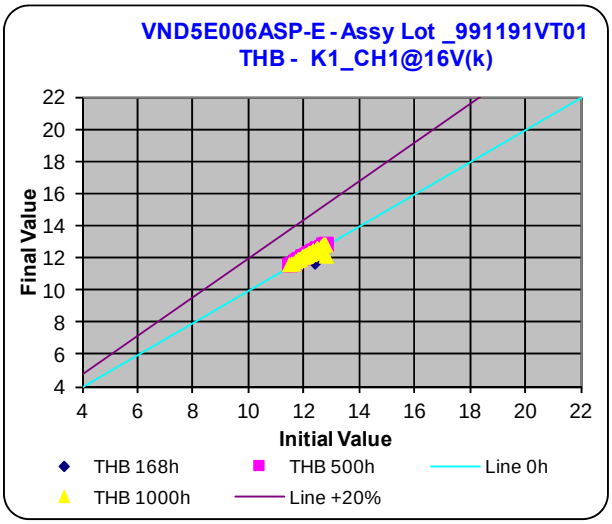

VND5E006ASP-E - Assy Lot _991191VS01
HTSL - Ron1@24V_CH1(mΩ)
Final Value
Initial Value
HTS 168h
HTS 500h
Line 0h
Line +20%
HTS 1000h

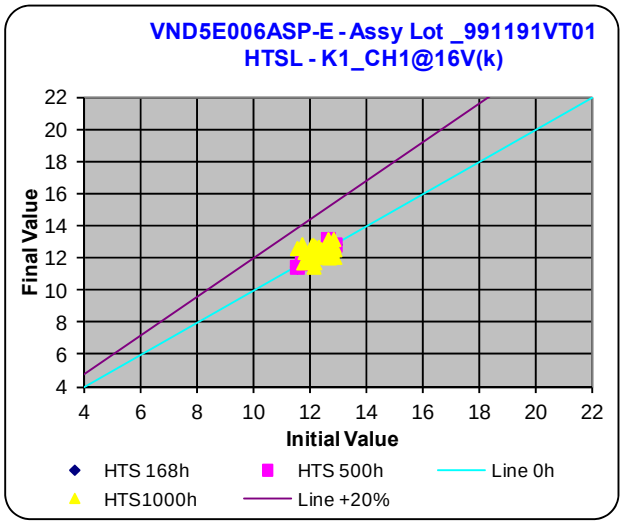
- **Assy Lot_991191VT01**

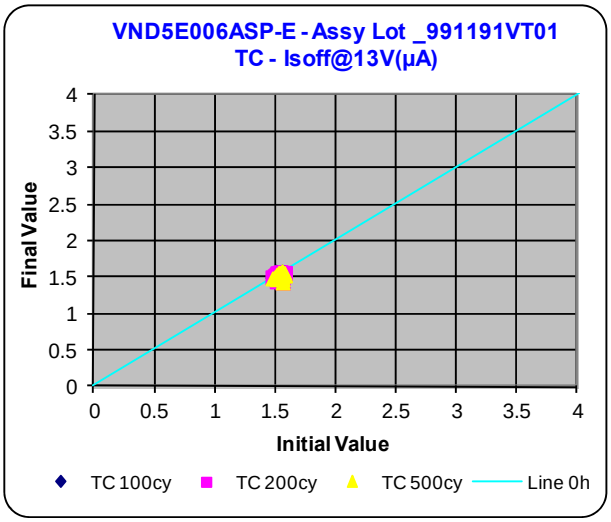


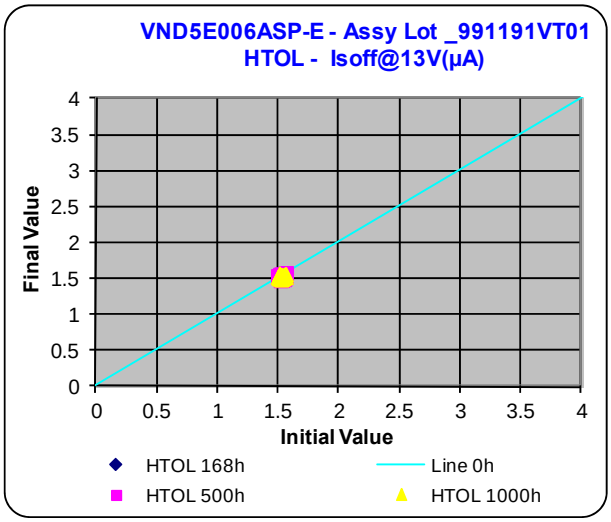


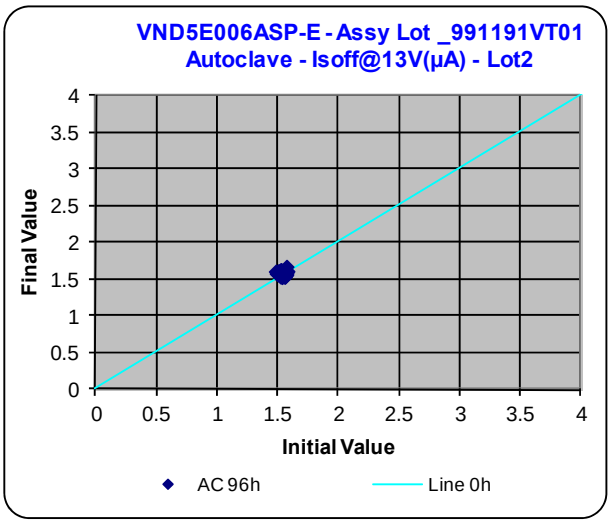


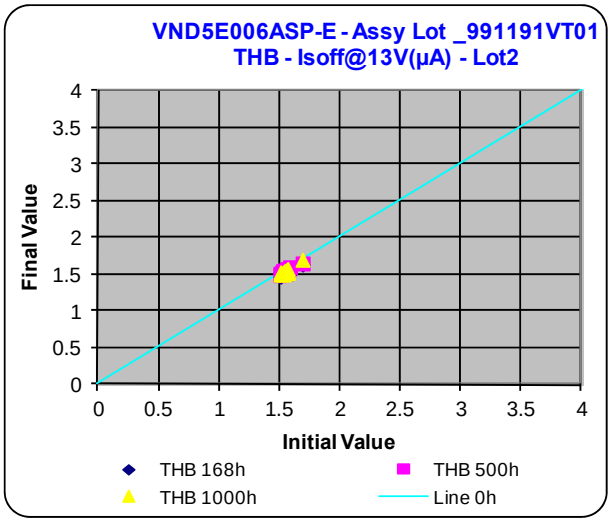


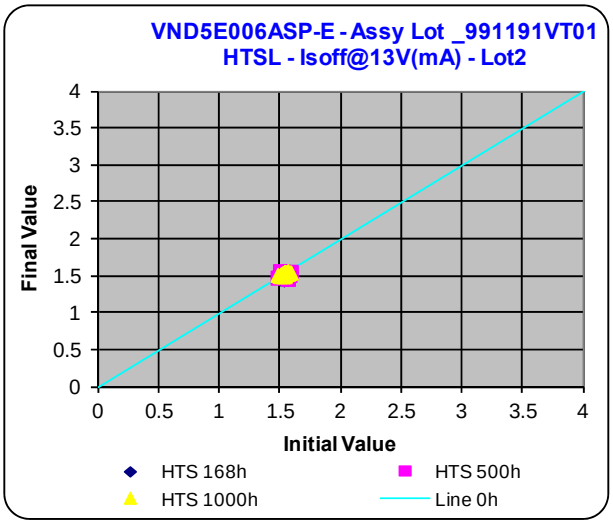


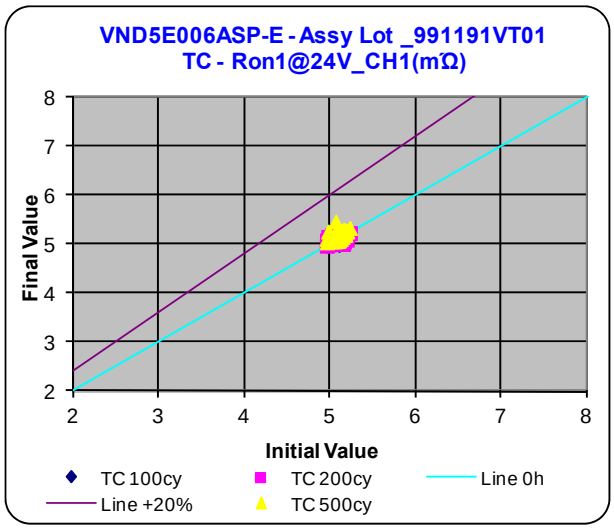

VND5E006ASP-E - Assy Lot _991191VT01
TC - Isoff@13V(µA)
Final Value
Initial Value
TC 100cy
TC 200cy
TC 500cy
Line 0h

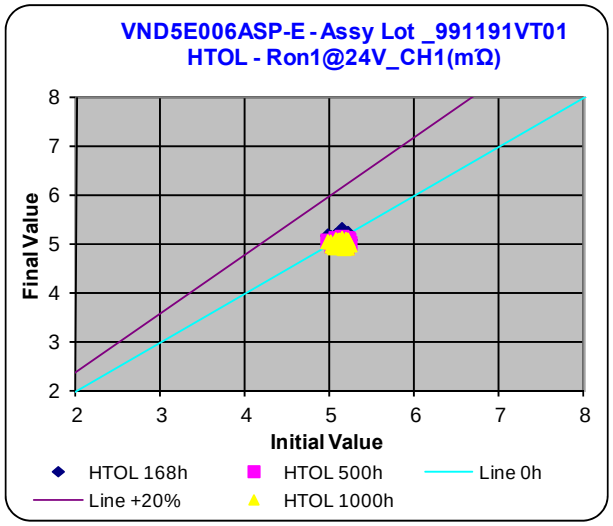

VND5E006ASP-E - Assy Lot _991191VT01
HTOL - Isoff@13V(µA)
Final Value
Initial Value
HTOL 168h
HTOL 500h
Line 0h
HTOL 1000h

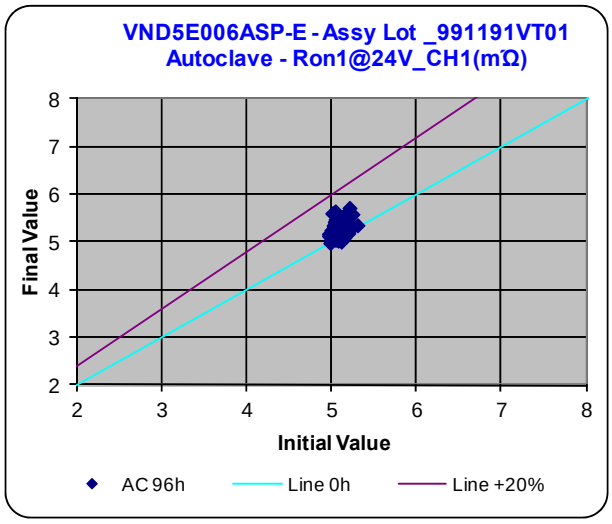

VND5E006ASP-E - Assy Lot _991191VT01
Autoclave - Isoff@13V(µA) - Lot2
Final Value
Initial Value
AC 96h
Line 0h

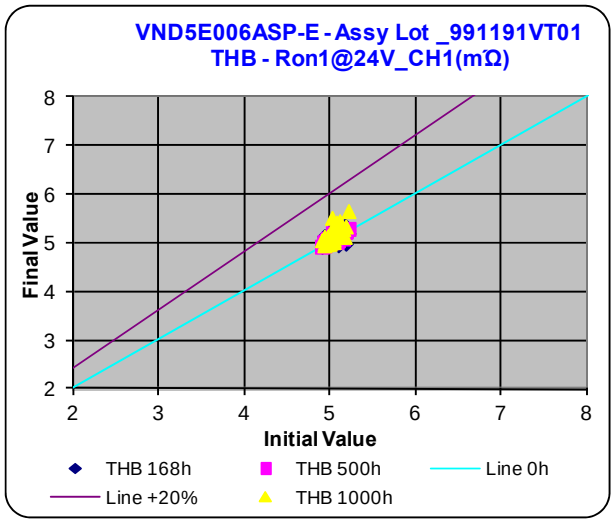

VND5E006ASP-E - Assy Lot _991191VT01
THB - Isoff@13V(µA) - Lot2
Final Value
Initial Value
THB 168h
THB 500h
THB 1000h
Line 0h

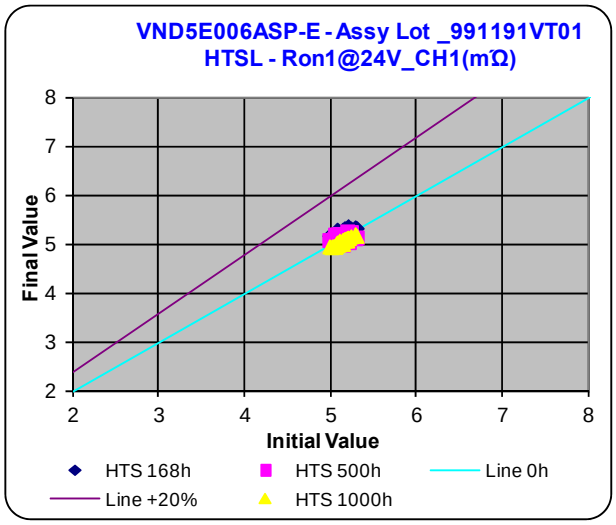

VND5E006ASP-E - Assy Lot _991191VT01
HTSL - Isoff@13V(mA) - Lot2
Final Value
Initial Value
HTS 168h
HTS 500h
HTS 1000h
Line 0h


VND5E006ASP-E - Assy Lot _991191VT01
TC - Ron1@24V_CH1(mΩ)
Final Value
Initial Value
TC 100cy
TC 200cy
Line 0h
Line +20%
TC 500cy

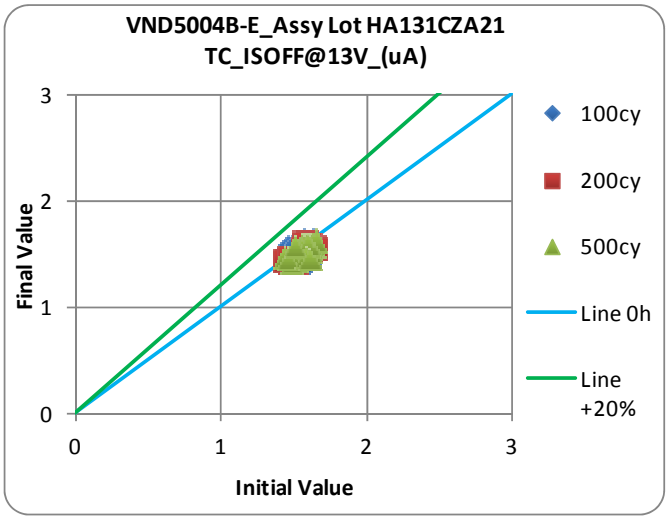

VND5E006ASP-E - Assy Lot _991191VT01
HTOL - Ron1@24V_CH1(mΩ)
Final Value
Initial Value
HTOL 168h
HTOL 500h
Line 0h
Line +20%
HTOL 1000h

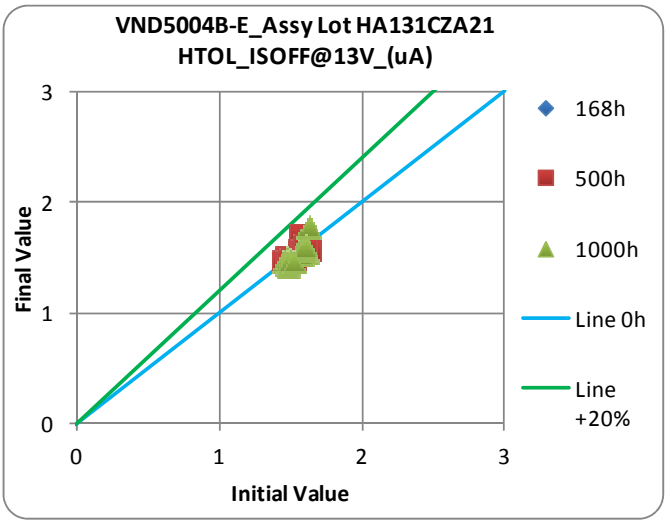

VND5E006ASP-E - Assy Lot _991191VT01
Autoclave - Ron1@24V_CH1(mΩ)
Final Value
Initial Value
AC 96h
Line 0h
Line +20%

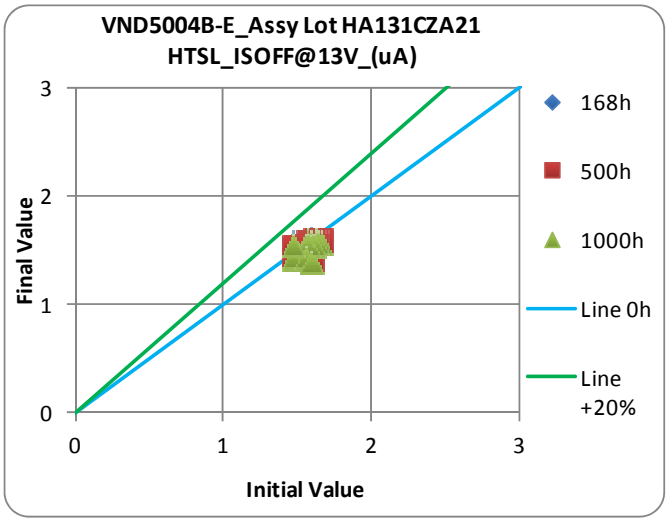

VND5E006ASP-E - Assy Lot _991191VT01
THB - Ron1@24V_CH1(mΩ)
Final Value
Initial Value
THB 168h
THB 500h
Line 0h
Line +20%
THB 1000h

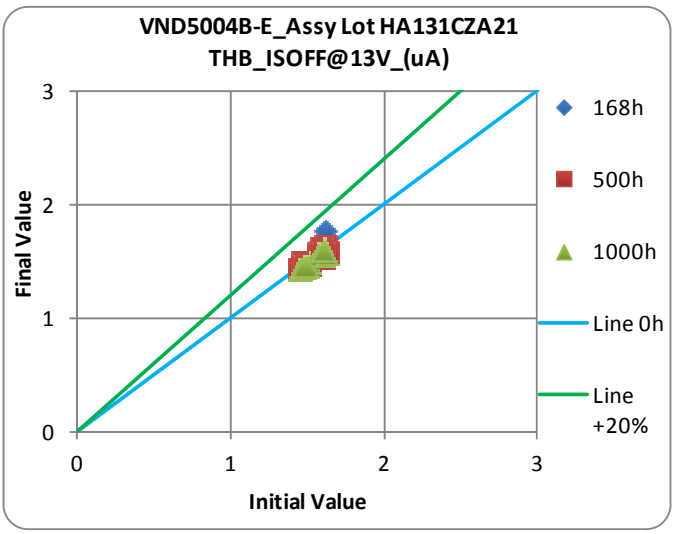

VND5E006ASP-E - Assy Lot _991191VT01
HTSL - Ron1@24V_CH1(mΩ)
Final Value
Initial Value
HTS 168h
HTS 500h
Line 0h
Line +20%
HTS 1000h

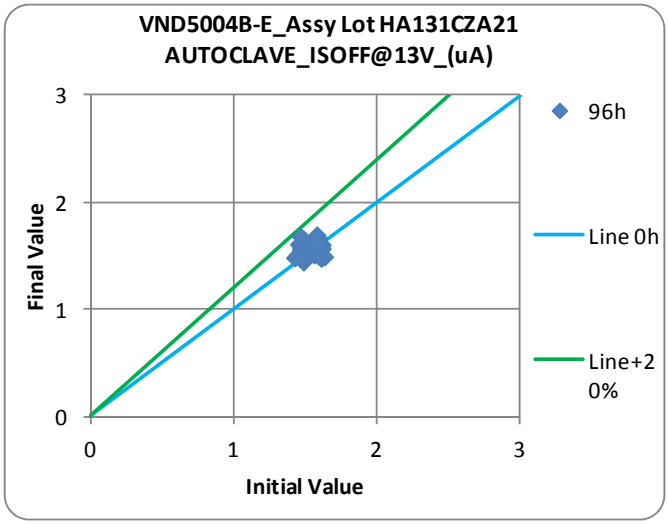
- **Assy Lot_HA131CZA21**

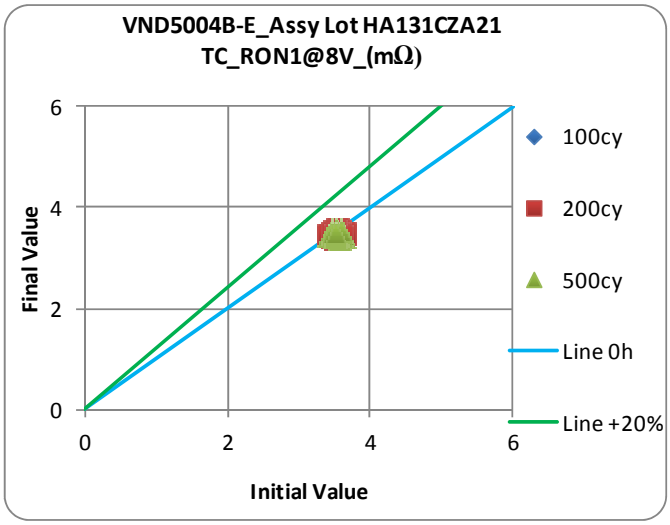


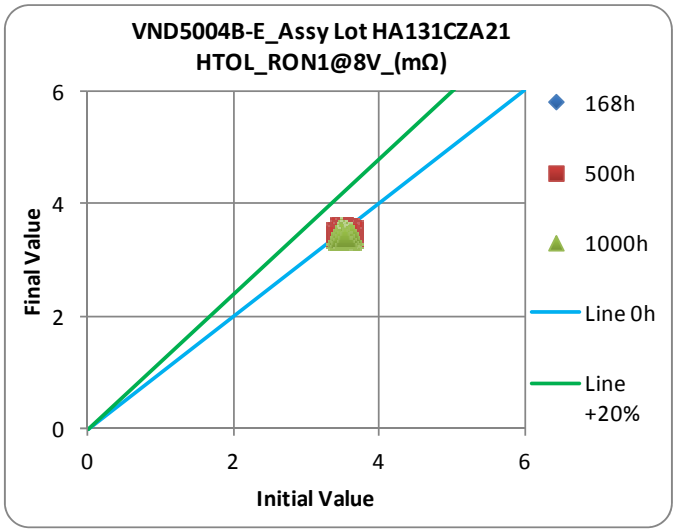


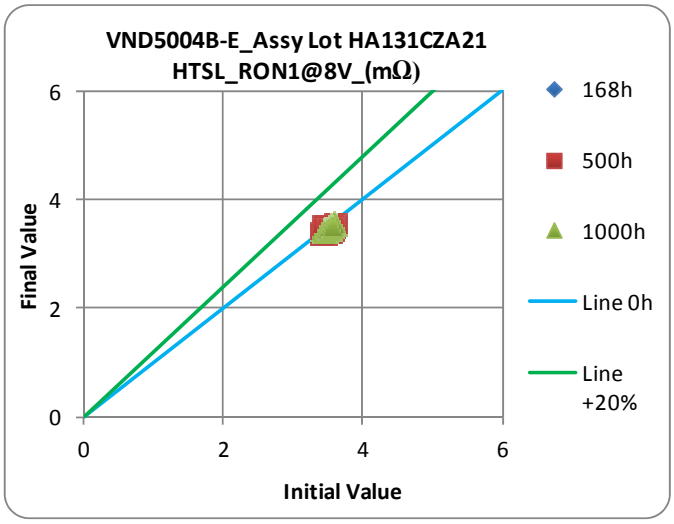


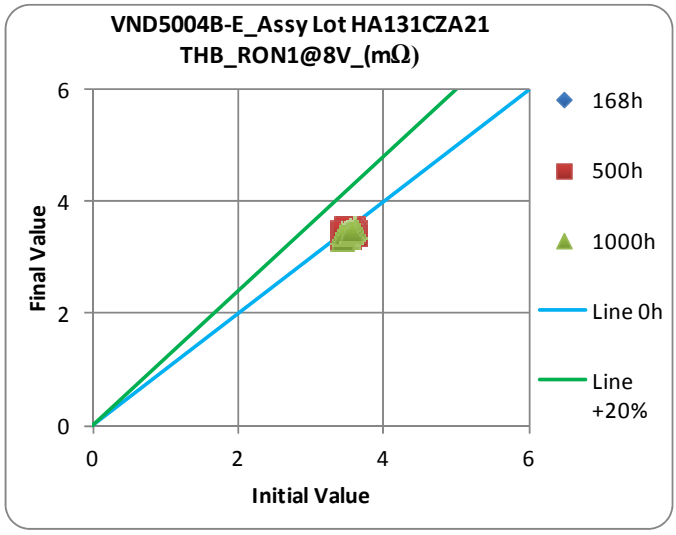


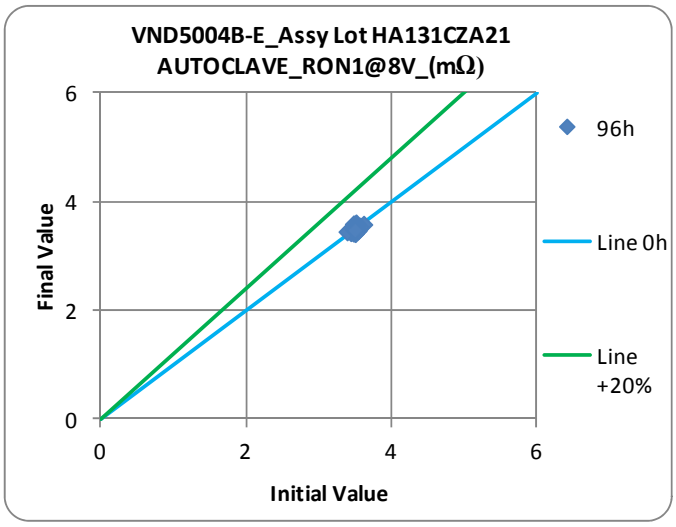



VND5004B-E_Assy Lot HA131CZA21
TC_RON1@8V_(mΩ)
Final Value
Initial Value
100cy
200cy
500cy
Line 0h
Line +20%


VND5004B-E_Assy Lot HA131CZA21
HTOL_RON1@8V_(mΩ)
Final Value
Initial Value
168h
500h
1000h
Line 0h
Line +20%


VND5004B-E_Assy Lot HA131CZA21
HTSL_RON1@8V_(mΩ)
Final Value
Initial Value
168h
500h
1000h
Line 0h
Line +20%


VND5004B-E_Assy Lot HA131CZA21
THB_RON1@8V_(mΩ)
Final Value
Initial Value
168h
500h
1000h
Line 0h
Line +20%


VND5004B-E_Assy Lot HA131CZA21
AUTOCLAVE_RON1@8V_(mΩ)
Final Value
Initial Value
96h
Line 0h
Line +20%

Public Products List

PCN Title : VIPower M05 - Activation of 8" Wafer Fab Catania as Additional Location
PCN Reference : APG-ABD/13/7713
PCN Created on : 15-FEB-2013

Subject : Public Products List

Dear Customer,

Please find below the Standard Public Products List impacted by the change:

ST COMMERCIAL PRODUCT

VN5E010AHTR-E	VN5E010MH-E	VN5E010MHTR-E
VN5R003H-E	VN5R003HTR-E	VND5004ASP30-E
VND5004ASP30TR-E	VND5004ATR-E	VND5004BSP30-E
VND5004BSP30TR-E	VND5004BTR-E	VND5E006ASP-E
VND5E006ASPTR-E	VNH5019A-E	

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