Delta Evaluation of Advanced MMIC Process OMMIC D01PH and characterization under H_2 and ambient atmosphere

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INITIAL TEST PROGRAM

Initial test program of the Delta Evaluation OMMIC D01PH process

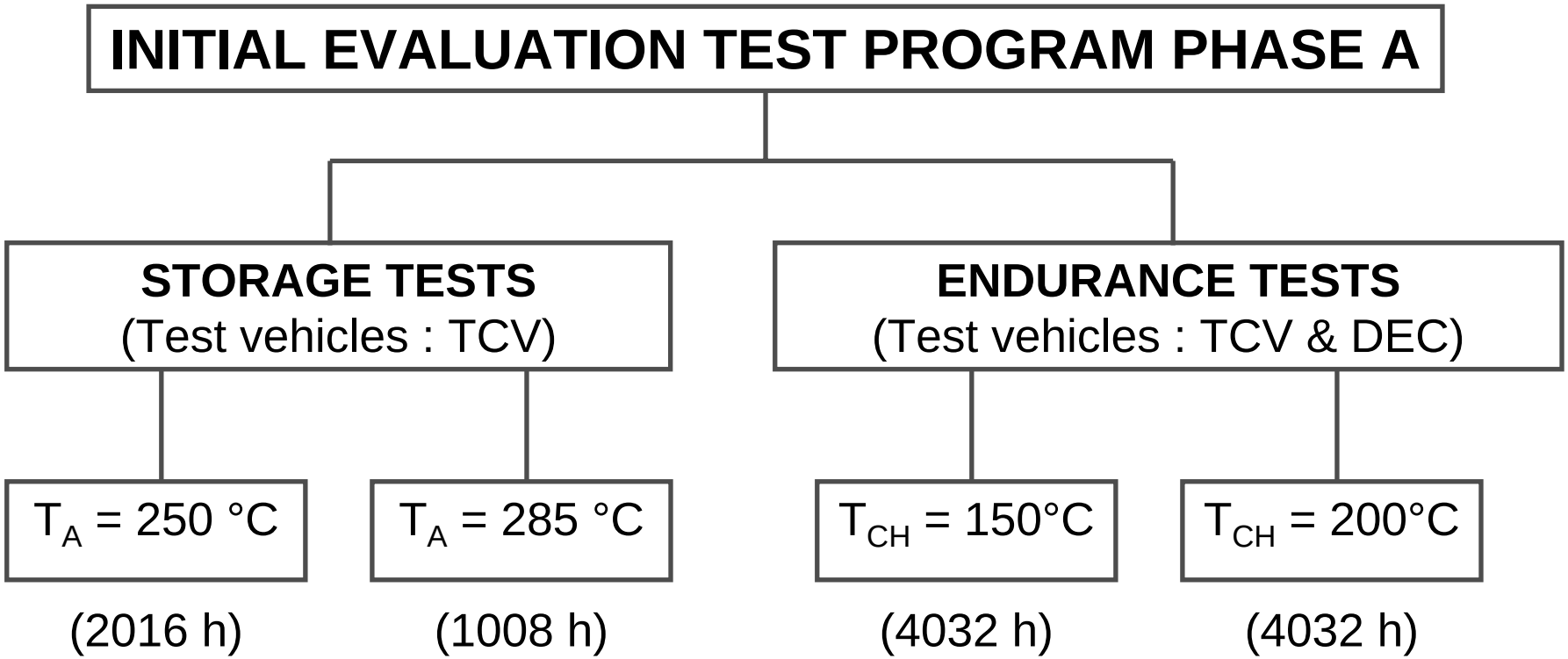
Phase A : Reliability evaluation of the D01PH process

- Storage tests : 250°C, 285°C
- Endurance tests (biasing + high temperature) : 150°C, 200°C

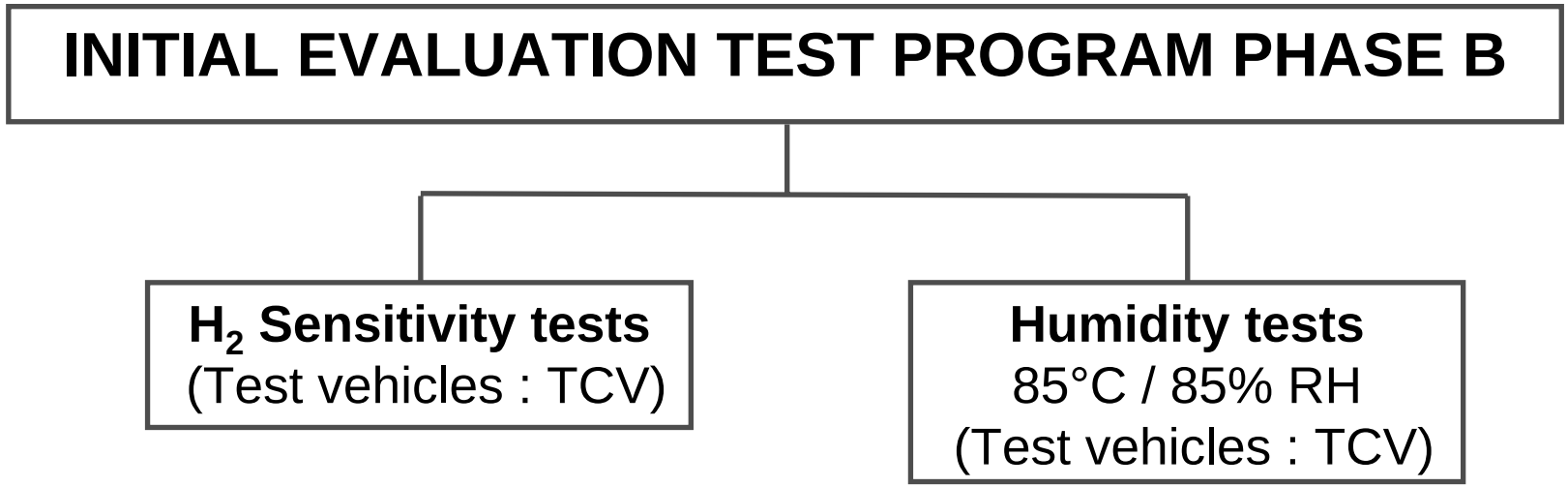
Phase B : D01PH process evaluation under specific atmosphere

- Test under Hydrogen atmosphere
- Test under Humid atmosphere : 85°C/85%RH

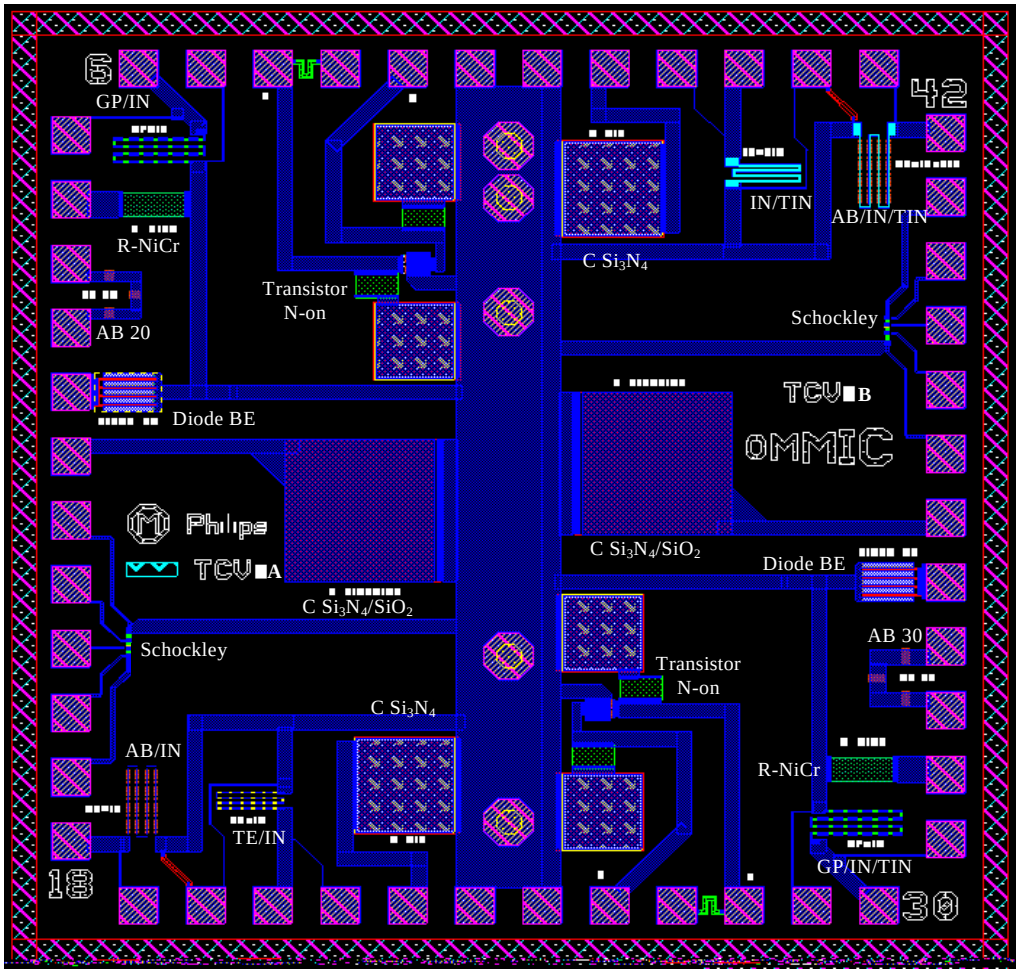
INITIAL TEST PROGRAM PHASE A



INITIAL TEST PROGRAM PHASE B



TECHNOLOGY CHARACTERISATION VEHICLE (TCV)



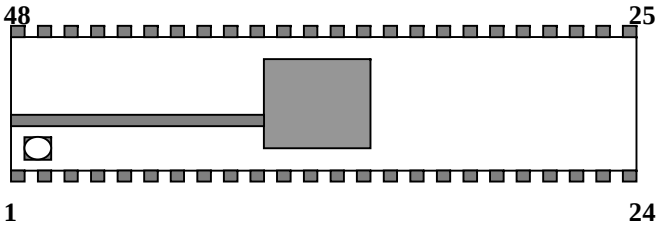
Die size : 2mm x 2mm

2 wafers coming from 2 different batches

TCV die :

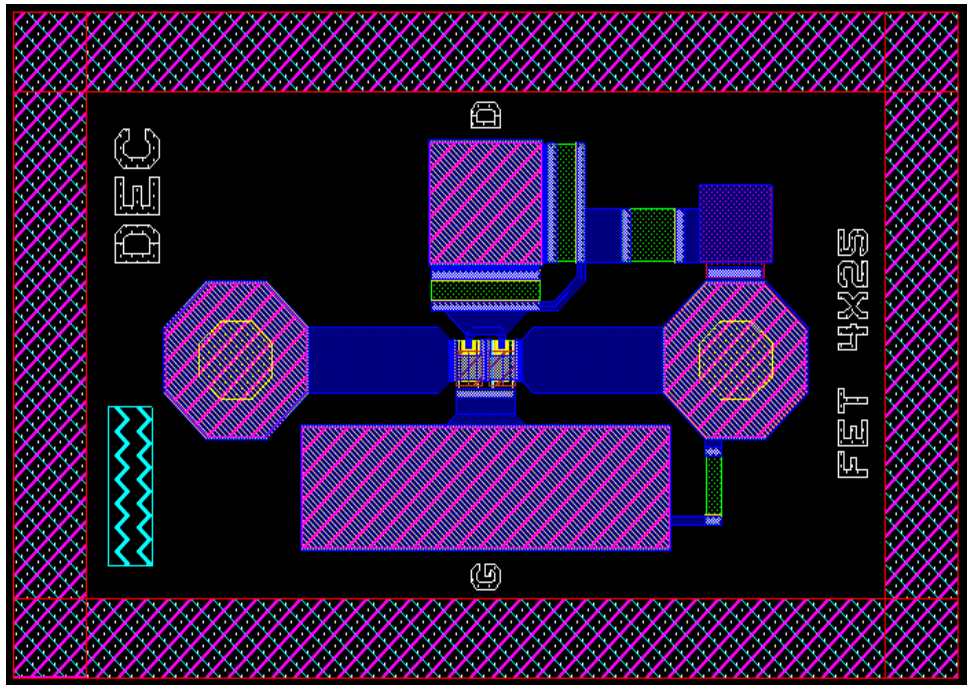
- 4x50µm on-transistors
- metal interconnections
- air bridges
- capacitors
- diodes

Package : Dual In Line (DIL48)



DIL48 Package	Size (cm^3)
Cavity	0.78 x 0.78 x 0.1
Package	6.1 x 1.55 x 0.21

DYNAMIC EVALUATION CIRCUIT (DEC)

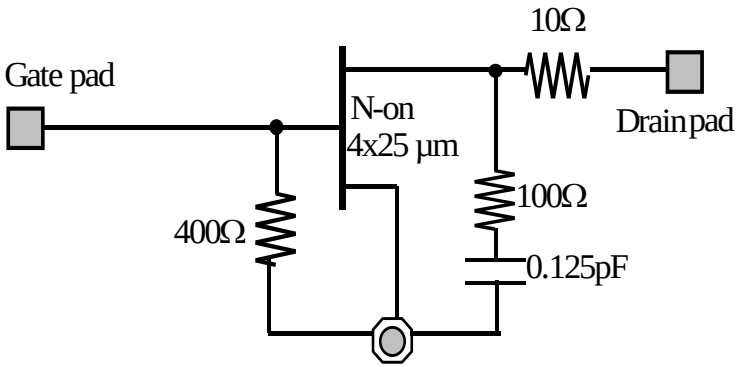


N-on PHEMT (4X25µm)

Die size : 420 x 650 µm^2

2 wafers coming from 2 different batches

Schematic of the DEC



Package : FO92

Package size : 0.18 x 0.18 x 0.04 cm^3

PHASE A : PRELIMINARY TESTS

Objective :

To check that TCV dice mounted in hermetically sealed packages and dedicated to the storage & endurance tests programmed in the phase A will not present Hydrogen signature during the tests

⇒ **To obtain reliability data of D01PH processed dice**

Tests performed :

285°C high temperature storage tests, 100h

Tests structures used :

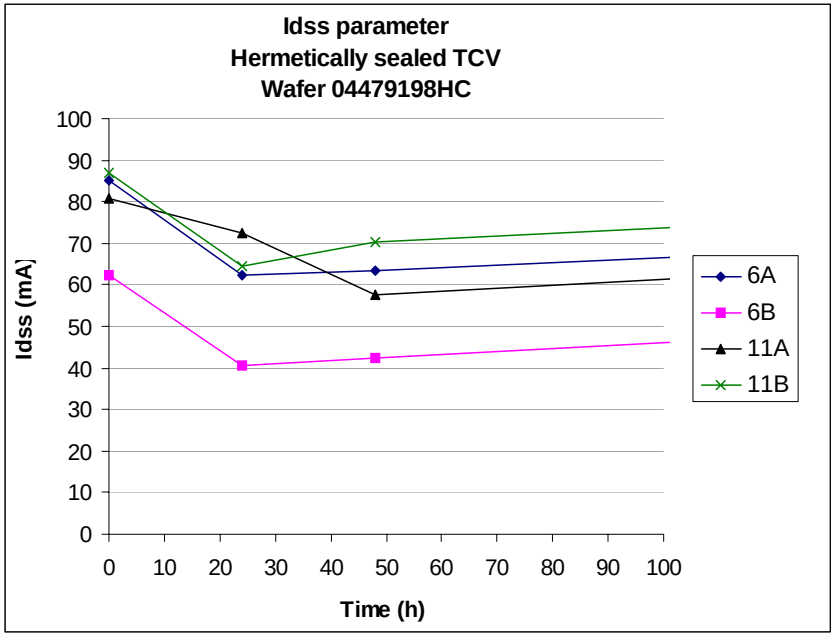
TCV dice mounted in hermetically sealed DIL48 packages

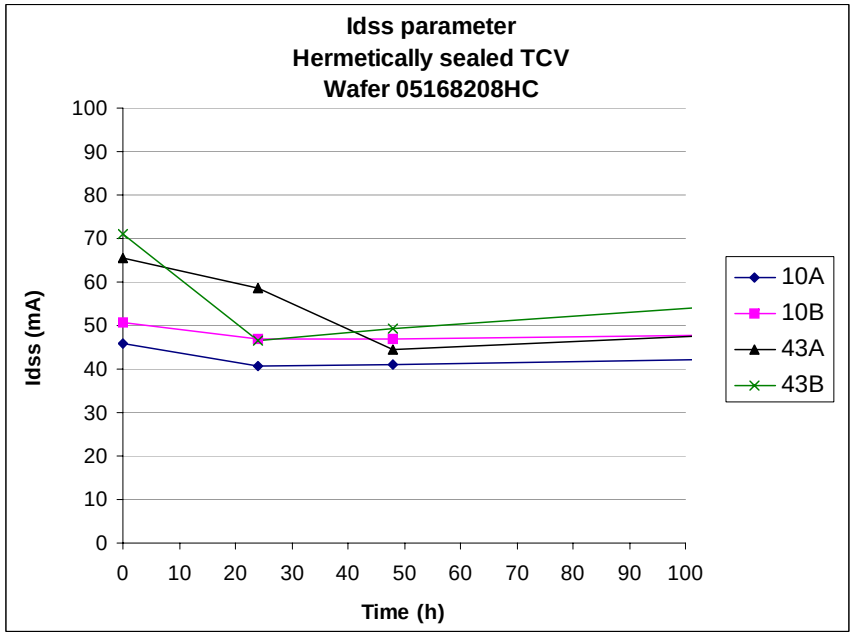
TCV pattern controlled :

4x50µm FET parameters

PHASE A : PRELIMINARY RESULTS

Hermetically sealed TCV results : Evolution of FET I_{DSS} parameter under 285°C high temperature storage



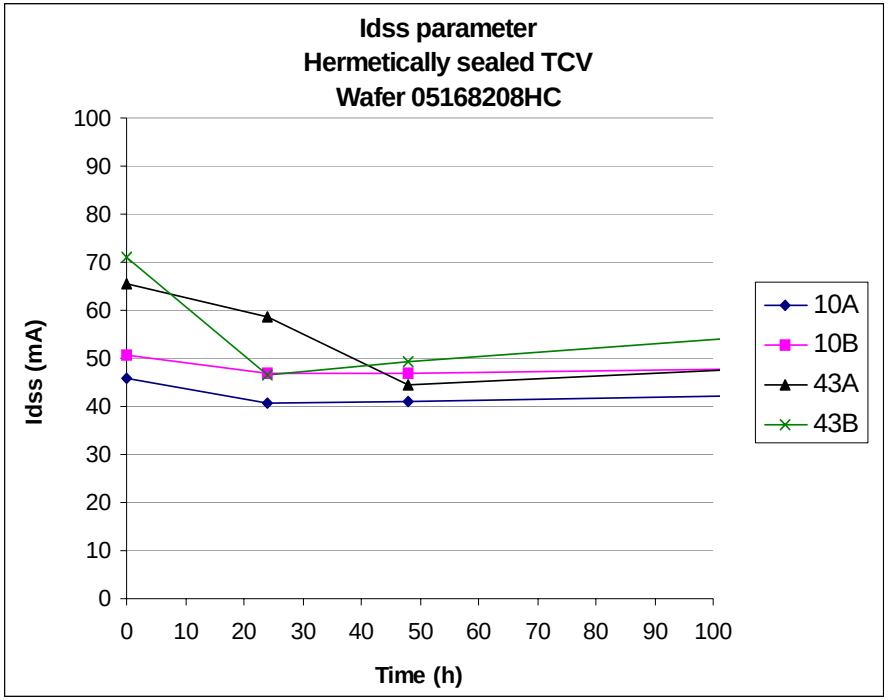


I_{DSS} maximum variation (in absolute value) : 30%

Hydrogen poisoning signature in all the tested TCVs

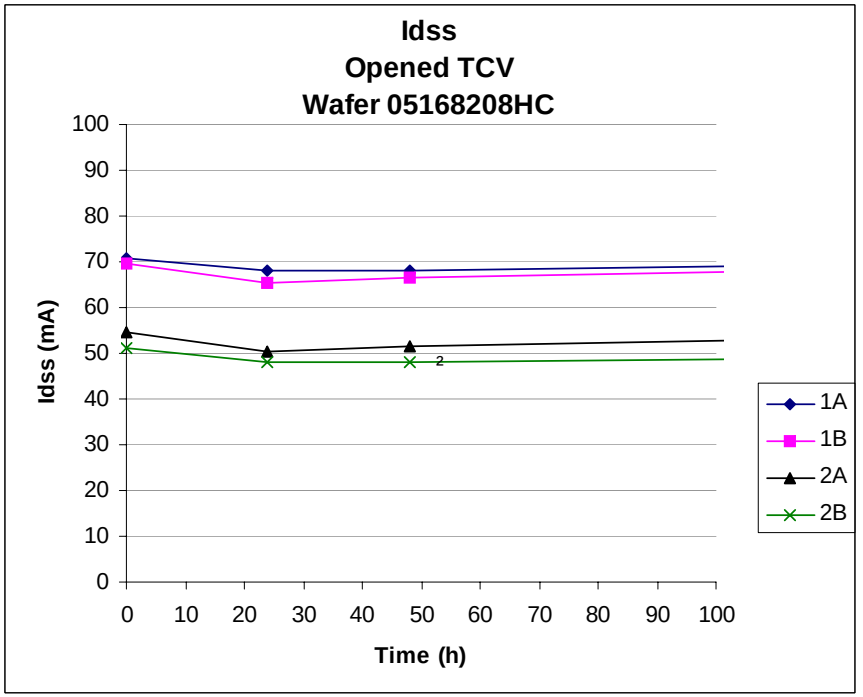
PHASE A : PRELIMINARY RESULTS

Comparison between Hermetically sealed TCV results and opened TCV results



Hermetically sealed TCV

I_{DSS} maximum variation : 30%



Opened TCV

I_{DSS} maximum variation : 5%

MODIFIED DELTA EVALUATION TEST PROGRAM PHASES A & B

Modified test program Phase A

Objectives :

• D01PH process reliability data purchase under storage tests (250°C, 285°C)

• D01PH process reliability evaluation under endurance tests (150°C and 200°C channel temperatures)

(Test structures : opened DIL48 packages and opened FO92 packages)

Modified test program Phase B

Objectives :

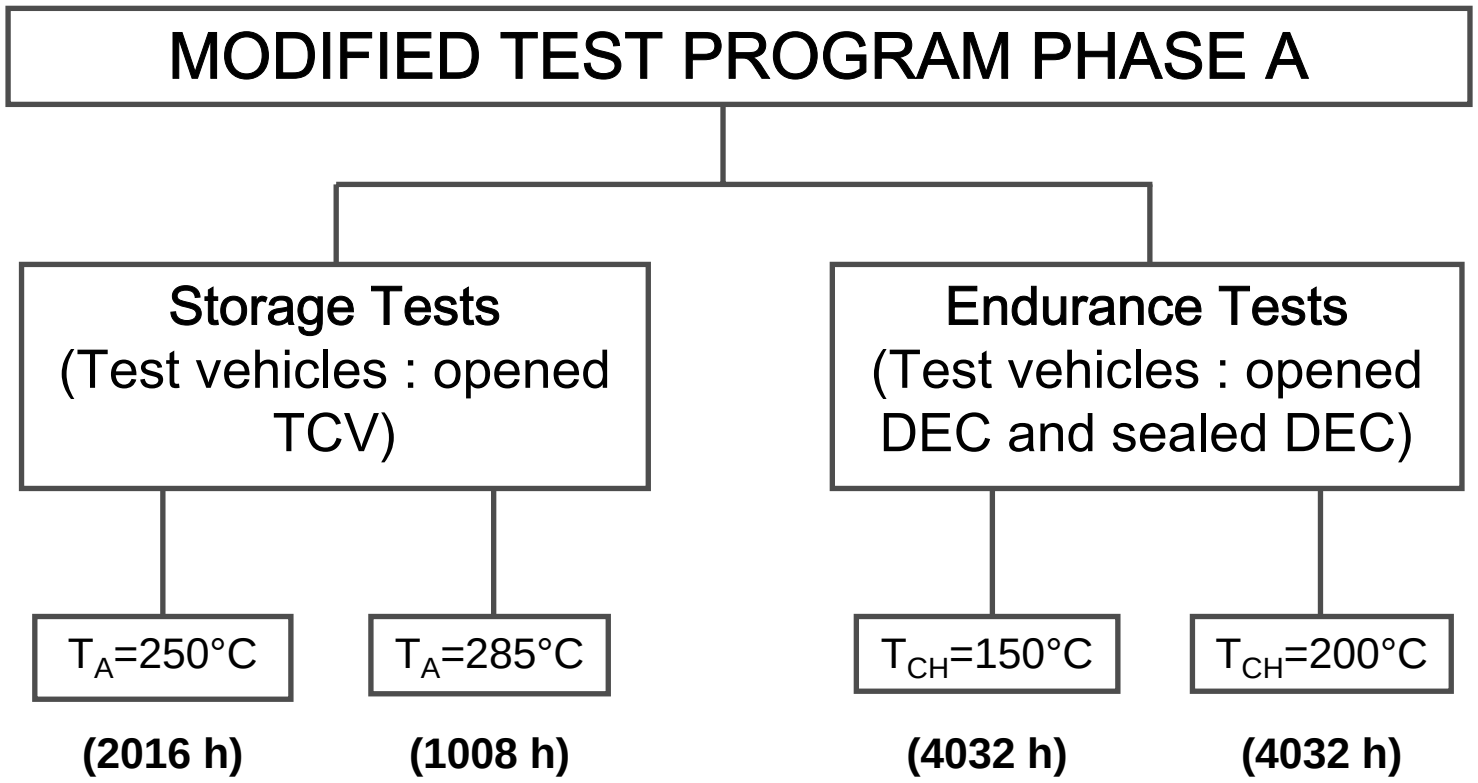
• To find an efficient solution to prevent H_2 poisoning on TCV dice hermetically sealed in DIL48 packages

• Reliability evaluation of D01PH TCV dice mounted in hermetically sealed DIL48 package

• Reliability evaluation of D01PH TCV dice in a humid atmosphere : 85°C/85%RH

(Test structures : opened DIL48 packages)

MODIFIED DELTA EVALUATION TEST PROGRAM PHASES A & B



MODIFIED DELTA EVALUATION TEST PROGRAM PHASES A & B

MODIFIED TEST PROGRAM PHASE B

Tests performed to define an efficient solution to prevent H_2 poisoning in TCV dice

DIL48 package out-gassing tests :
- High Temperature : 175°C, 225°C, 275°C
- Bake-out time : 24h, 48h, 96h, 168h

Efficiency evaluation of two types of H_2 getters :
- Polymer based getter
- Palladium getter

Choice of an Hydrogen getter

Reliability evaluation of TCV dice encapsulated in hermetically sealed DIL48

Storage Tests of TCV with a getter attached to the lid

- T_A=175°C **(1000h)**
- T_A=250°C **(1000h)**

Humidity Tests on TCV mounted in a opened DIL48 package

85°C / 85%RH **(1000h)**

TEST PROGRAM PHASE A : RESULTS

Storage tests results

- TCV (mounted in opened DIL48 packages) stored at 250°C during 2016h
- TCV (mounted in opened DIL48 packages) stored at 285°C during 1008h

Endurance tests results

- DEC (mounted in opened and sealed FO92 packages) stored under biasing at 150°C channel temperature during 4032h
- DEC (mounted in opened and sealed FO92 packages) stored under biasing at 200°C during 4032h

Storage tests results : TCV electrical characterisation

Pattern	Measured Parameter	Description & measurements conditions
GP/IN & GP/IN/TIN metal interco.	R_GP/IN R_GP/IN/TIN	Resistor (15Ω) ; I_{max} = 12 mA
TE / IN metal interco.	R_TE/IN	Resistor (17.5Ω) ; I_{max} = 10 mA
Air bridge (AB 20)	R_AB_20	Resistor (0.5Ω)
Air bridge (AB 30)	R_AB_30	Resistor (0.3Ω)
Air bridge (AB / IN)	R_AB_IN	Resistor (6.51Ω) ; I_{max} = 18 mA
Air bridge (AB / IN / TIN)	R_AB_IN_TIN	Resistor (3Ω) ; I_{max} = 36 mA
Si_3N_4 capacitor	I_{leak}_Si_3N_4	Leakage current at V = +15V
Si_3N_4 / SiO_2 capacitor	I_{leak}_SiO_2	Leakage current at V = +15V
Schockley pattern	RCN	Contact resistance at I_{max} = 2.5mA
NiCr resistor	R_NiCr	Resistor (100Ω) ; I_{max} = 10 mA
IN/TIN metal line	R_IN_TIN	Resistor (2.5Ω) ; I_{max} = 36 mA
Transistor N-on	**V_p**	**Pinch-off voltage : I_{ds} = 1µA/µm, V_{ds} = 1.5V**
	gm_0	**Transconductance : V_{ds} = 1.5V, V_{gs} = 0V**
	I_{dss}	**Drain-source current : V_{gs} = 0V, V_{ds} = 1.5V**
	V_{brgss}	**Break down voltage : I_{gs} = 1µA/µm V_{ds} = 0V**
BE diode	V_{fwd}	Threshold voltage : V for $I_{forward}$ = 1µA/µm
	V_{BR}	Breakdown voltage : I_g = 1µA/µm, V_{ds} = 0V
	I_{rev}	Leakage current : maximum rating < -9V

PHASE A : STORAGE TEST RESULTS

Storage tests results : TCV failure criteria*

Patterns	Failure Criteria	
FET Parameters	I_{DSS}	-10%
	V_P	+10%
	V_{BGD0} & V_{BGS0}	-10%
Metallic Resistors		+10%
Metal Interconnections		+20%

* Values coming from : "A methodology for the space qualification of GaAs MMICs", 3rd issue, CNET - 1992

PHASE A : STORAGE TEST RESULTS

Storage tests results : 2016h at 250°C

Whatever the wafer studied :

- No change in passive elements after 2016h of tests
- FET parameters : no failure (catastrophic or by drift) has been noticed

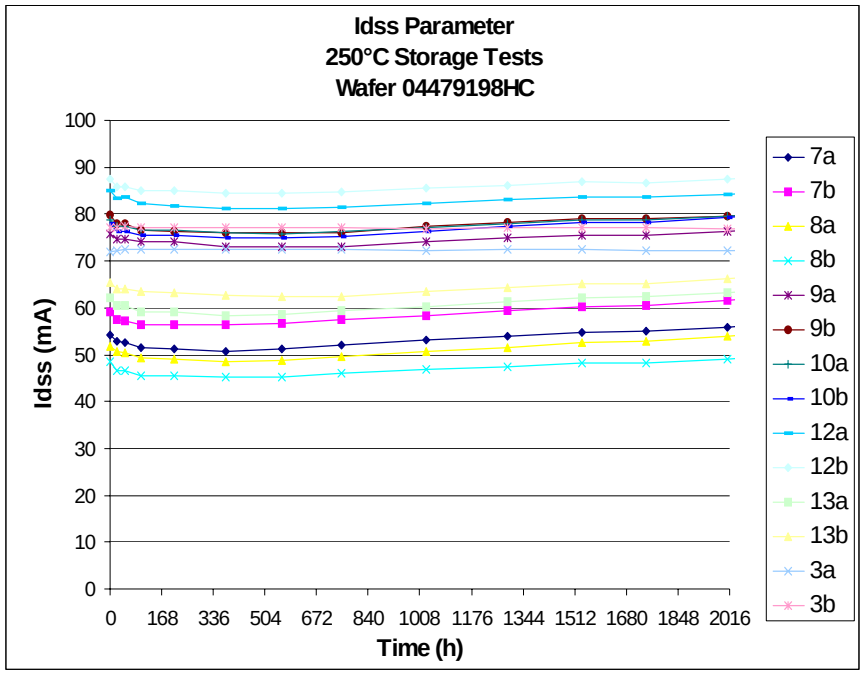
PHASE A : STORAGE TEST RESULTS

Storage tests results : 1008h at 285°C

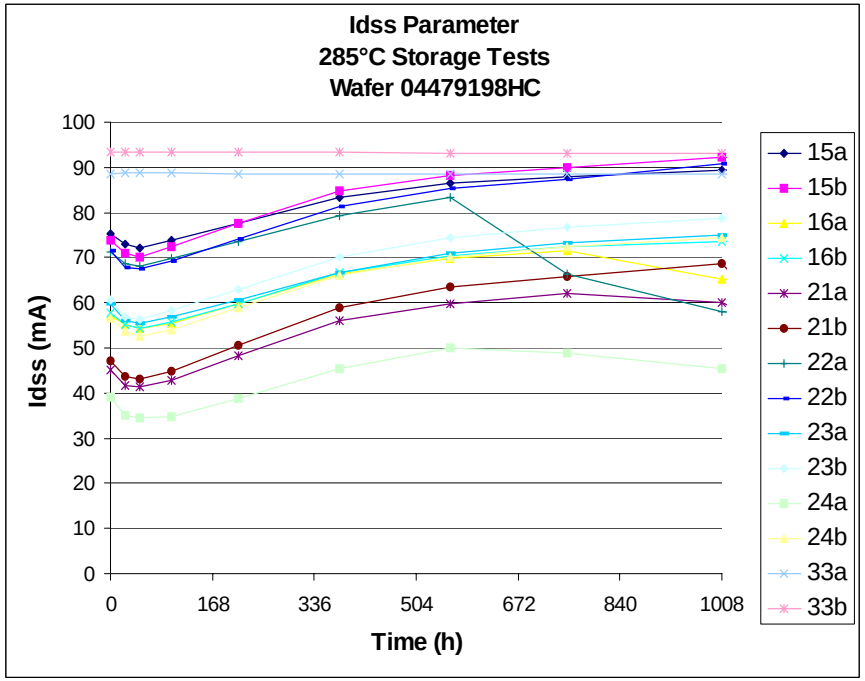
- The first failures appear for the FET parameters after 500h of storage
- The failed FET parameter during 285°C storage tests are :
  - I_{DSS}
  - V_{BRGSS}

PHASE A : STORAGE TEST RESULTS

250°C & 285°C storage tests results : I_{DSS} parameter - 04479198HC Wafer



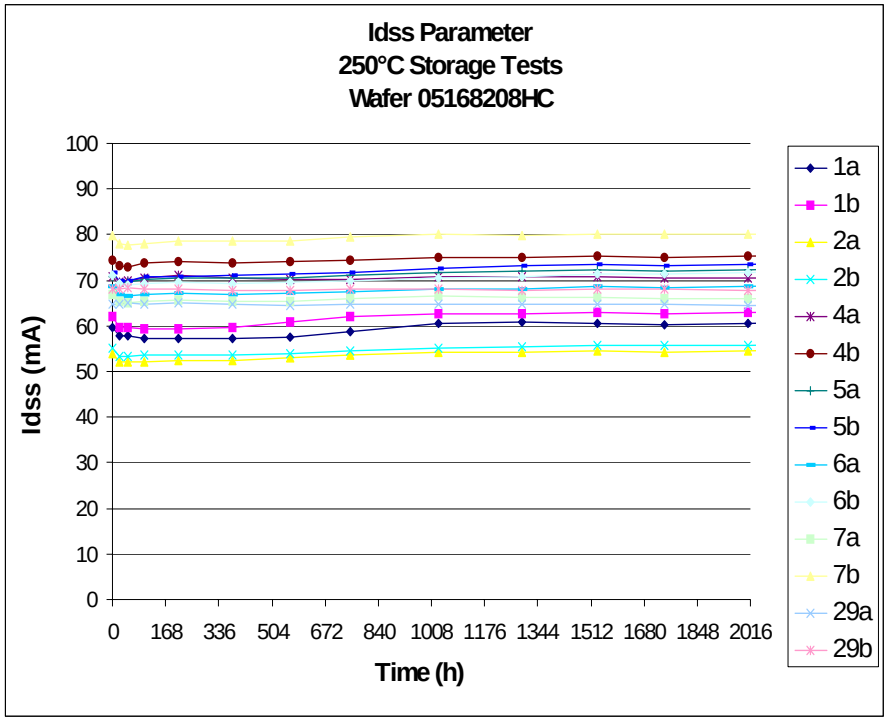
250°C TCV storage test : 2016h



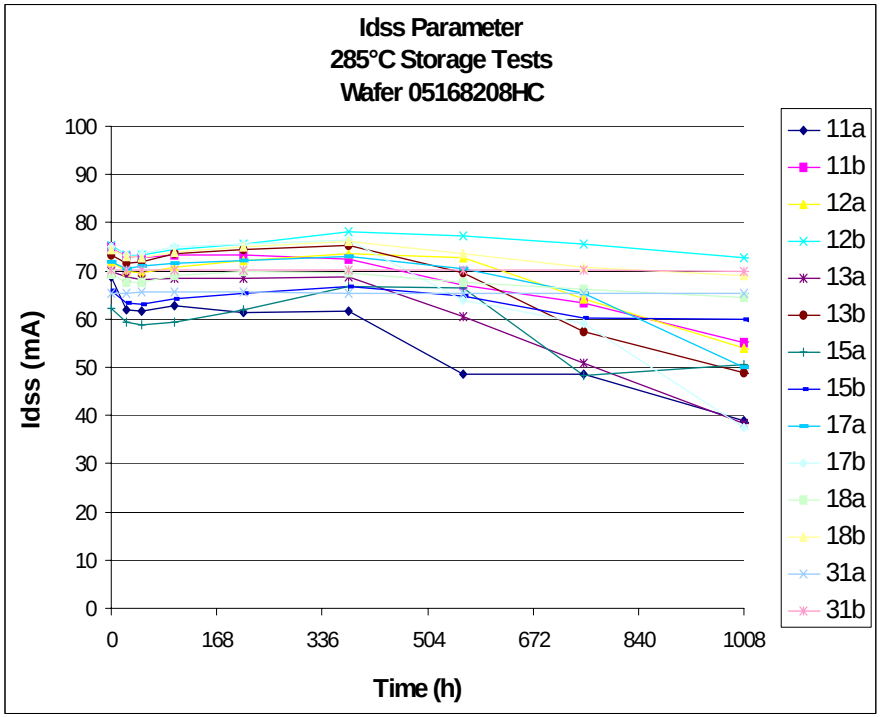
285°C TCV storage test : 1008h

PHASE A : STORAGE TEST RESULTS

250°C & 285°C storage tests results : I_{DSS} parameter - 05168208HC Wafer



250°C TCV storage test : 2016h



285°C TCV storage test : 1008h

PHASE A : STORAGE TEST RESULTS

Reliability data calculated from storage tests at 250°C & 285°C :

⇨ *Activation Energy (E_A)*

Measured Parameter	Activation energy associated (E_A)
4x50µm On-Transistor	***E_A = 1.2 eV*** (calculated from the I_{DSS} variation during storage tests at 250°C & 285°C)
GP / IN metal interconnection	E_A = 1.8 eV
GP/IN/TIN metal interconnection	E_A = 1.8 eV
Air bridge (AB / IN / TIN)	E_A = 1.4 eV
Si_3N_4 capacitor	E_A = 1.3 eV
Si_3N_4 / SiO_2 capacitor	E_A = 1.2 eV
Schockley pattern	E_A > 1.1 eV
NiCr resistor	E_A = 1.9 eV
IN/TIN metal line	E_A = 1.3. eV

The **1.2 eV activation energy** calculated for the 4x50µm FET corresponds to a **median life in excess of 2.10^8 years in ambient conditions**

PHASE A : ENDURANCE TEST RESULTS

Endurance tests results : DEC biasing conditions & DEC electrical characterisation

- *Biasing conditions :*
  - Pinch off voltage : V_P at I_{DS} = 1mA/mm & V_{DS} = 1.5V
  - Drain-Source current : I_{DSS} at V_{GS} = 0V & V_{DS} = 1.5V
  - Minimum noise figure : NF_{MIN} at F = 12 GHz, V_{DS} = 3V & V_{GS} tuned for I_{DS} = 1/3 I_{DSS}

- *DEC electrical characterisation :*

Parameter	Measurements conditions
V_p	Pinch-off voltage : I_{ds} = 1mA/mm, V_{ds} = 1.5V
I_{dss}	Drain-source current : V_{gs} = 0V, V_{ds} = 1.5V
V_{brgss}	Break down voltage : 1µA/µm, V_{ds} = 0V
NF min	Minimum noise figure : V_{ds} = 3V, V_{gs} tuned for I_{ds} = 1/3 I_{dss} at 12 or 18 GHz
Ga	Associated gain : measurements conditions similar to NF min

PHASE A : ENDURANCE TEST RESULTS

Endurance tests results :

- Endurance tests have been performed on opened DECs & hermetically sealed DECs

- ***DEC failure criteria****

Patterns	Failure Criteria	
FET Parameters	I_{DSS}	-10%
	V_P	+10%
	V_{BGD0} & V_{BGS0}	-10%
	NFmin at 12GHz	+0.5dB
	Associated Gain at 12GHz	-.5dB

* Values coming from : "A methodology for the space qualification of GaAs MMICs", 3rd issue, CNET - 1992

PHASE A : ENDURANCE TEST RESULTS

Endurance tests results : 4032h at 150°C & 200°C channel temperature

DEC tested in opened packages :

• No failure (catastrophic or by drift) has been noticed on all the DEC parameters checked after 4032h of endurance tests

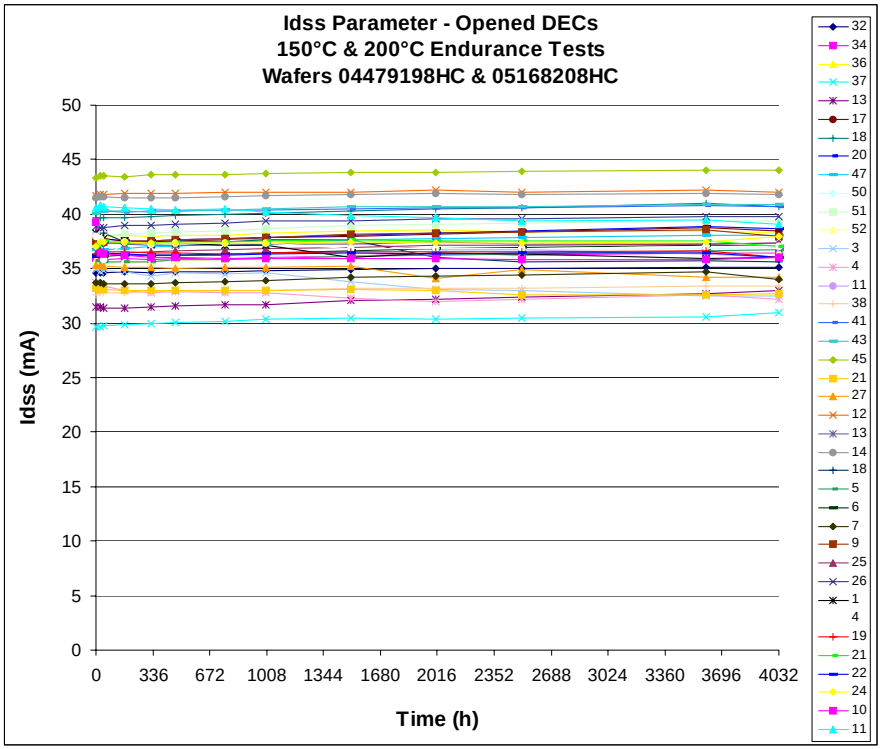
DEC tested in hermetically sealed FO92 packages :

• Sudden drift failures (in the range of 25% - 30% for the I_{DSS} & V_P parameters) have been noticed on 5 DECs during the endurance tests

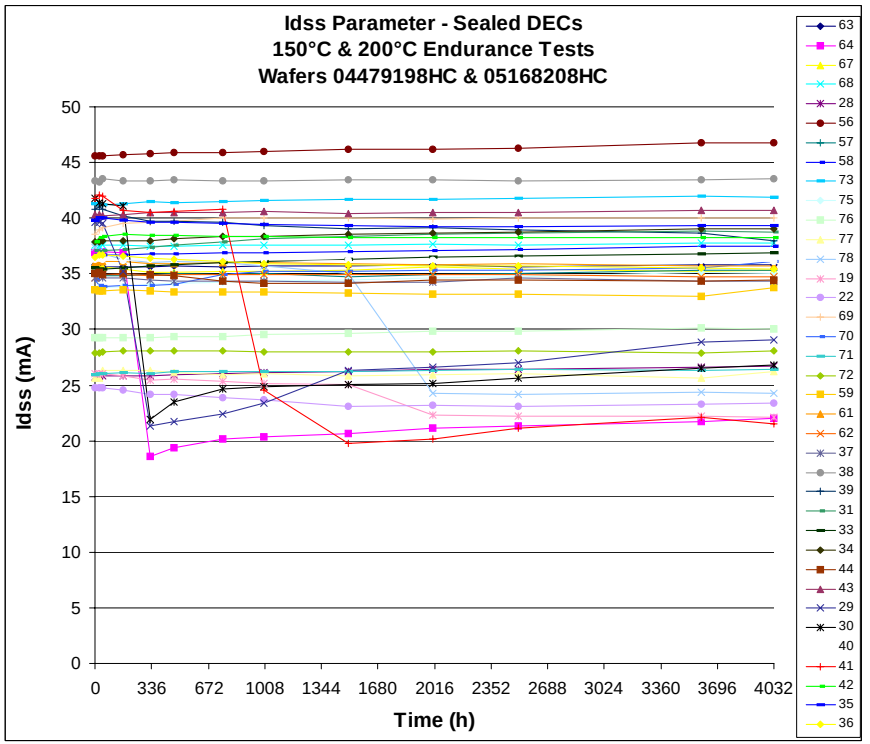
• These failure are not linked to one particular biasing or to one specific endurance temperature but are clearly the signature of the dice Hydrogen poisoning

PHASE A : ENDURANCE TEST RESULTS

150°C & 200°C Endurance tests results : I_{DSS} parameter



DEC I_{DSS} parameter – Opened package
150°C & 200°C endurance tests
04479198HC & 05168208HC Wafers
All biasing conditions merged



DEC I_{DSS} parameter – Sealed package
150°C & 200°C endurance tests
04479198HC & 05168208HC Wafers
All biasing conditions merged

PHASE A : CONCLUSION

250°C & 285°C Storage tests results :

- The results obtained on TCVs stored at 250°C & 285°C showed that the activation energy of the tested elements varies between 1.2eV & 1.8eV

- The lower activation energy (1.2eV) has been calculated for the 4x50µm on-transistor I_{DSS} parameter and corresponds to a median life in excess of 2.10^8 years in ambient conditions

150°C & 200°C Endurance tests results :

- Some DEC samples tested in hermetically sealed FO92 packages exhibited a degradation by "Hydrogen poisoning" due to the presence of H_2 inside the package

- All DEC samples mounted in open packages successfully passed 4032h of endurance tests without any degradation whatever the temperature and the biasing conditions used

TEST PROGRAM PHASE B : RESULTS

Test program phase B :

1. Reliability evaluation of D01PH processed TCV dice hermetically sealed in DIL48 package

1.A : Tests performed to define an efficient solution to prevent H_2 poisoning in TCV dice hermetically sealed in DIL48 packages :

- DIL48 package out-gassing : test of different high temperature and different bake-out time

- Efficiency evaluation of 2 types of Hydrogen getters

1.B : Storage test results of hermetically TCV sealed in DIL48 package : 1000h at 175°C & 1000h at 250°C

2. Reliability evaluation of D01PH processed TCV dice in a humid atmosphere

- Test of TCV dice (biased or no biased) mounted in opened packages at 85°C/85%RH during 1000h

TEST PROGRAM PHASE B : RESULTS

1.A : Tests performed to define an efficient solution to prevent H_2 poisoning in TCV dice hermetically sealed in DIL48 packages :

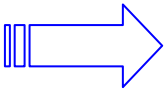
- **Influence of the temperature** on H_2 removal efficiency : test of 3 high temperature out-gassing conditions
  - 24h at 175°C under vacuum (40 mTorr)
  - 24h at 225°C under vacuum
  - 24h at 275°C under vacuum

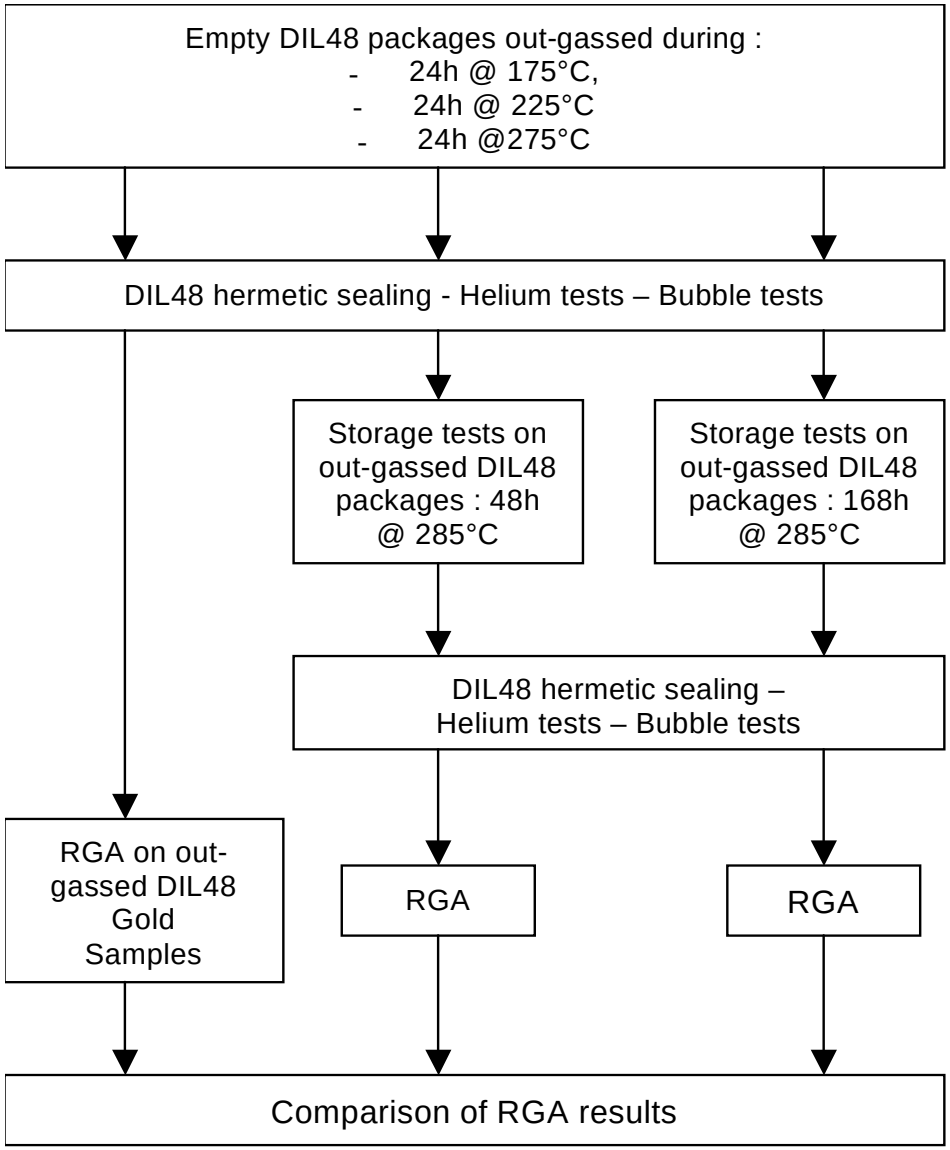
- **Influence of the bake-out time** on H_2 removal efficiency : test of 3 out-gassing conditions
  - 48h at 250°C under vacuum
  - 96h at 250°C under vacuum
  - 168h at 250°C under vacuum

- **Efficiency assessment :** Residual Gas Analysis (RGA) associated with fine and gross leak tests

TEST PROGRAM PHASE B : RESULTS

Influence of the *temperature* on H_2 removal efficiency : Tests description





TEST PROGRAM PHASE B : RESULTS

Influence of the temperature on H_2 removal efficiency : RGA Results

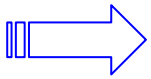
DIL48 out-gassing conditions	DIL48 storage conditions	RGA results : % of H_2
No out-gassing	Ambient	0.27%
	48h @ 285°C	4.01%
	168h @285°C	3.94%
24h @ 175°C under vacuum	Ambient	0.37%
	48h @ 285°C	4.4%
	168h @285°C	3.57%
24h @ 225°C under vacuum	Ambient	0.4%
	48h @ 285°C	4.38%
	168h @285°C	3.87%
24h @ 275°C under vacuum	Ambient	0.22%
	48h @ 285°C	4.75%
	168h @285°C	3.6%

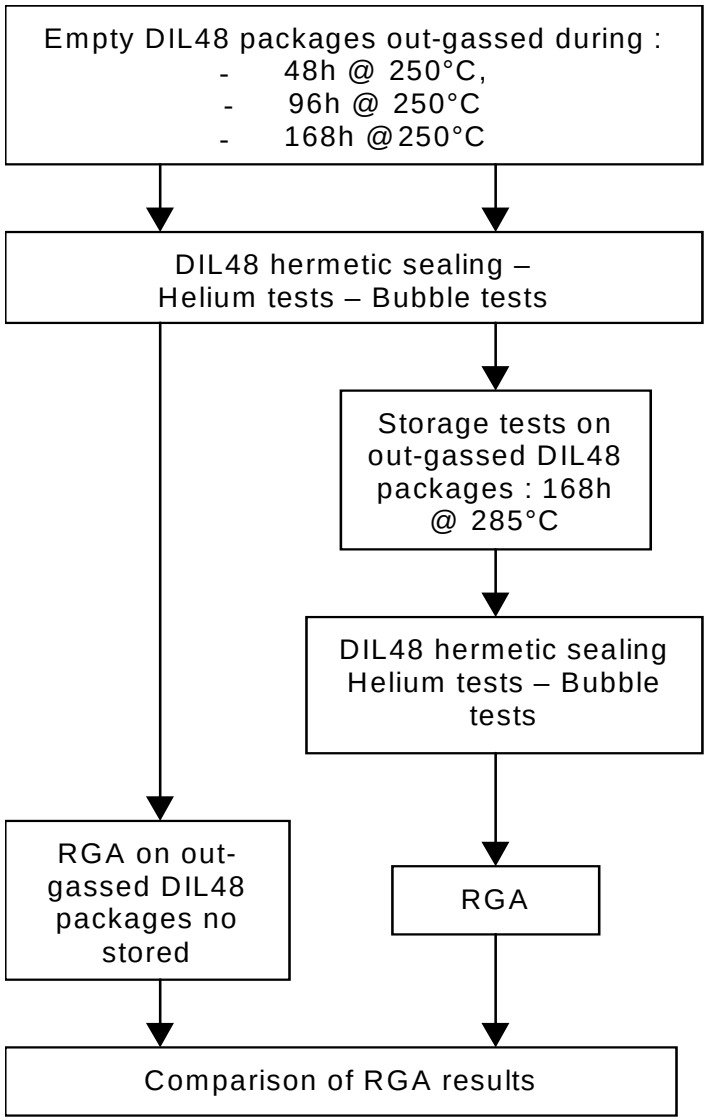
- **DIL48 packages stored at high temperature : ≈ 4% of H_2**
- **DIL48 packages stored at ambient temperature : ≈ 0.4% of H_2**

⇨ **24h vacuum out-gassing conditions up to 275°C have no effect for removing H_2 trapped in DIL48 package material**

TEST PROGRAM PHASE B : RESULTS

Influence of the *bake-out time* on H_2 removal efficiency : Tests description





TEST PROGRAM PHASE B : RESULTS

Influence of the bake-out time on H_2 removal efficiency : RGA Results

DIL48 out-gassing conditions	DIL48 storage conditions	RGA results : % of H_2
48h @ 250°C under vacuum	No storage	0.45%
	168h @285°C	4.02%
96h @ 250°C under vacuum	No storage	0.48%
	168h @285°C	3.46%
168h @ 250°C under vacuum	No storage	0.35%
	168h @285°C	3.6%

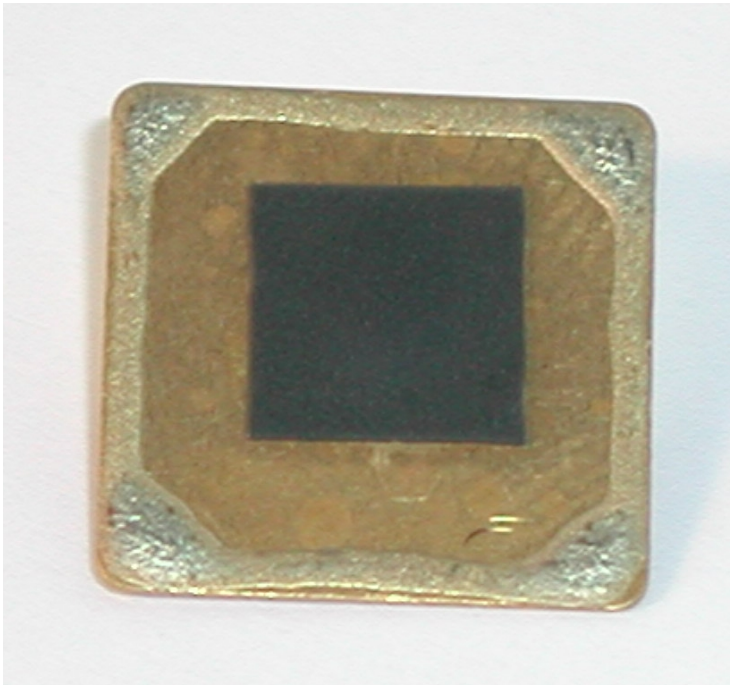
- **DIL48 packages stored at high temperature : ≈ 4% of H_2**
- **DIL48 packages stored at ambient temperature : ≈ 0.4% of H_2**

⇨ **24h at 275°C and 168h at 250°C do not remove all the H_2 trapped in DIL48 packages**

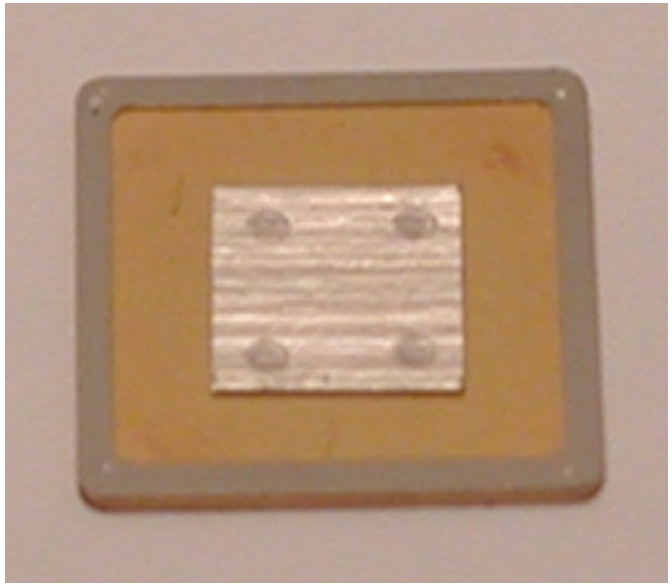
TEST PROGRAM PHASE B : RESULTS

1.B : Hydrogen getter efficiency results

- 2 hydrogen getters tested : Polymer based getter & Palladium getter
- Dimensions : 6mm x 6mm x 0.2mm



Polymer Based getter
attached to the lid
(H2-3000 Cookson Product)



Palladium getter
attached to the lid
(Hi-Rel Product)

TEST PROGRAM PHASE B : RESULTS

Storage tests : 1000 h at 250°C

- D01PH processed TCV dice encapsulated in hermetically sealed DIL48 packages with a **Polymer based getter attached to the lid**
- D01PH processed TCV dice encapsulated in hermetically sealed DIL48 packages with a **Palladium getter attached to the lid**
- Use of non out-gassed DIL48 packages

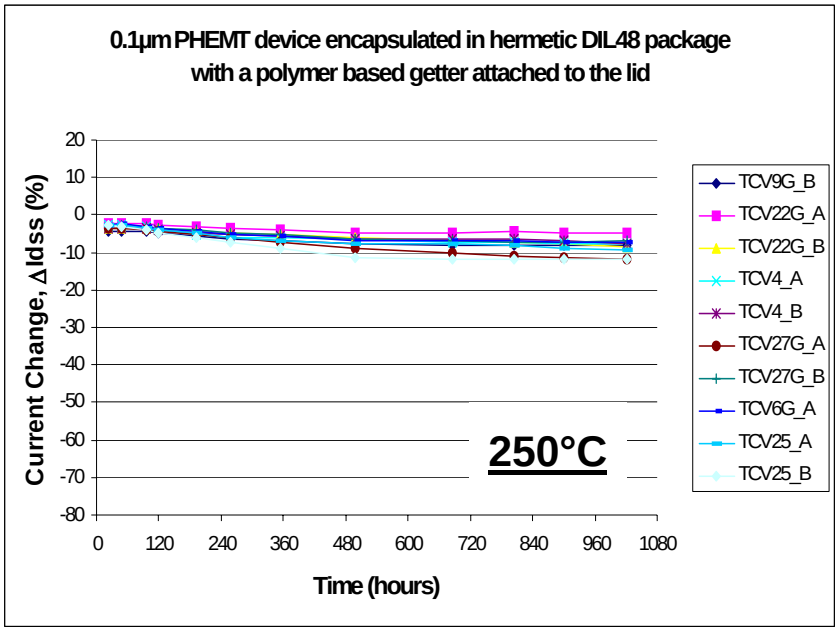
TEST PROGRAM PHASE B : RESULTS

Storage tests : 1000 h at 250°C

- All TCV Patterns controlled :
  - As expected, no change in passive elements after 1000 hours
  - The most sensitive parameter to H_2 poisoning are :
    - I_{DSS}, V_P
    - 4x50µm transistor parameters presented below

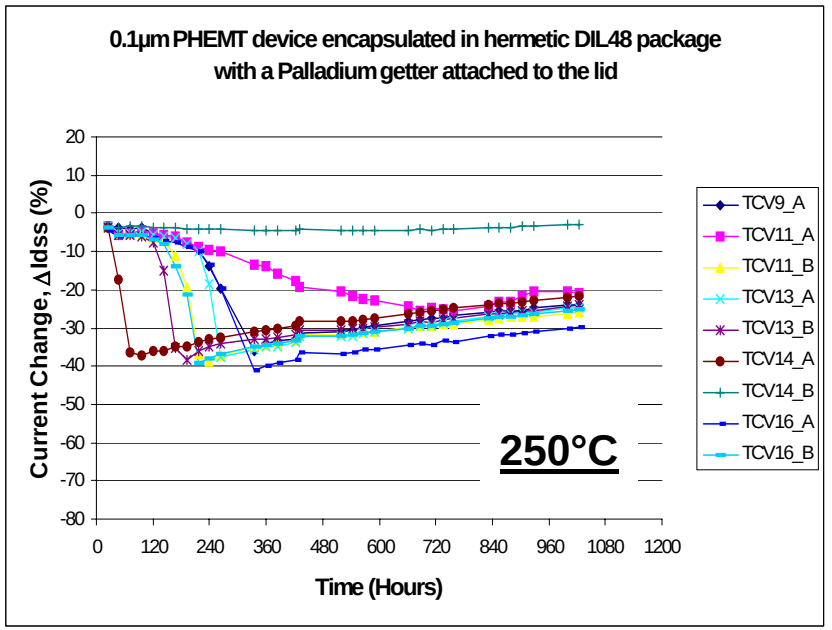
TEST PROGRAM PHASE B : RESULTS

Storage tests : I_{DSS} parameter results



TCV hermetically sealed in a DIL48 package with a **polymer based getter** attached to the lid

ΔI_{DSSmax} = -11%

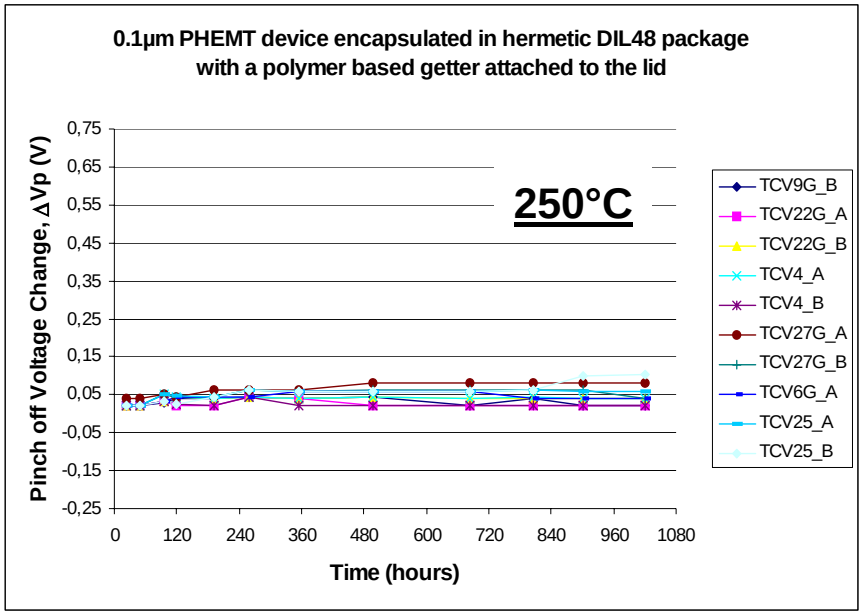


TCV hermetically sealed in a DIL48 package with a **Palladium getter** attached to the lid

ΔI_{DSSmax} = -40%

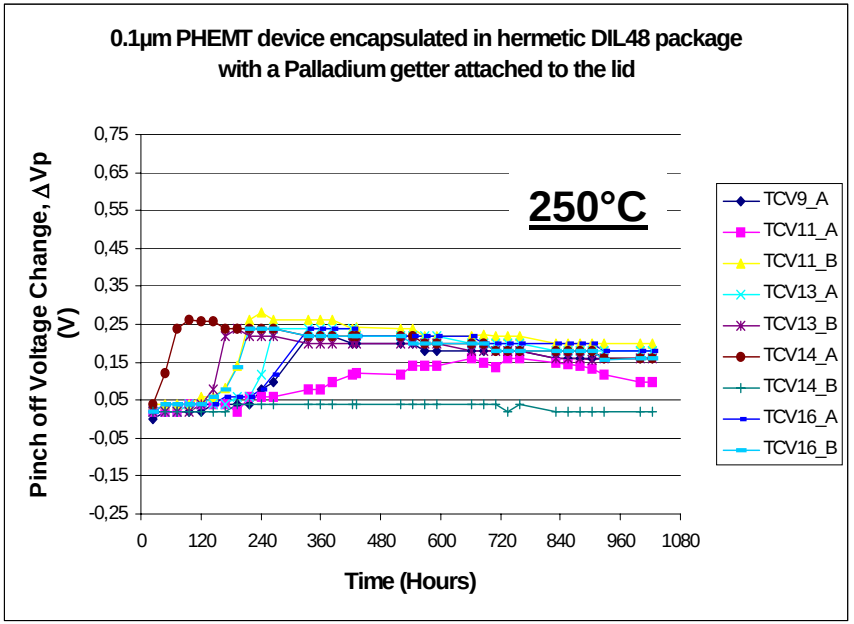
TEST PROGRAM PHASE B : RESULTS

Storage tests : V_P parameter results



TCV hermetically sealed in a DIL48 package with a **Polymer based getter** attached to the lid

ΔV_{Pmax} = 0.08V



TCV hermetically sealed in a DIL48 package with a **Palladium getter** attached to the lid

ΔV_{Pmax} = 0.25V

TEST PROGRAM PHASE B : RESULTS

The tests performed to define an efficient solution to prevent H_2 poisoning in TCV dice hermetically sealed in DIL48 packages show that :

- The different DIL48 package out-gassing conditions tested have no effect on the Hydrogen removal, whatever the high temperature (175°C, 225°C, 250°C & 275°C) and the bake-out time tested (24h, 48h, 96h & 168h)

- The Polymer based getter is a good solution to efficiently absorb Hydrogen trapped in DIL48 packages while the Palladium getter is not a successful solution

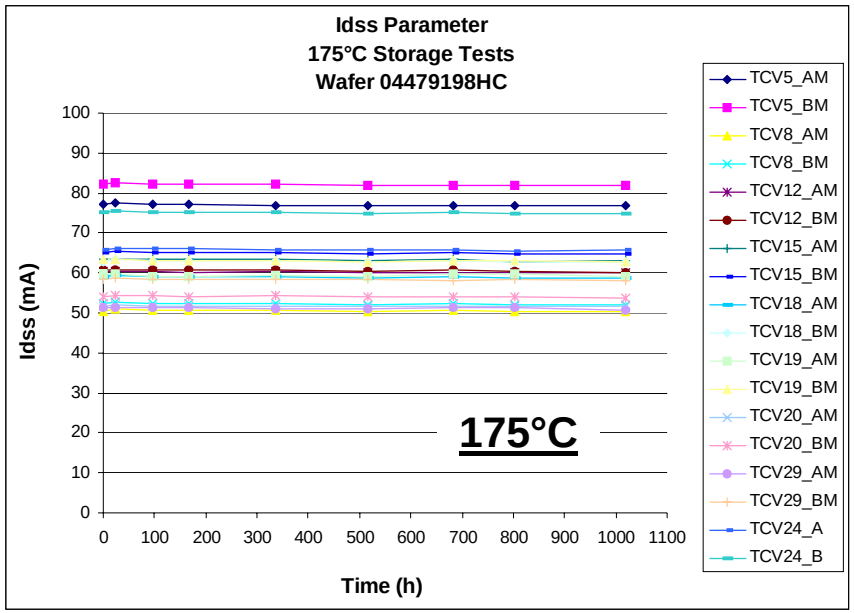
TEST PROGRAM PHASE B : RESULTS

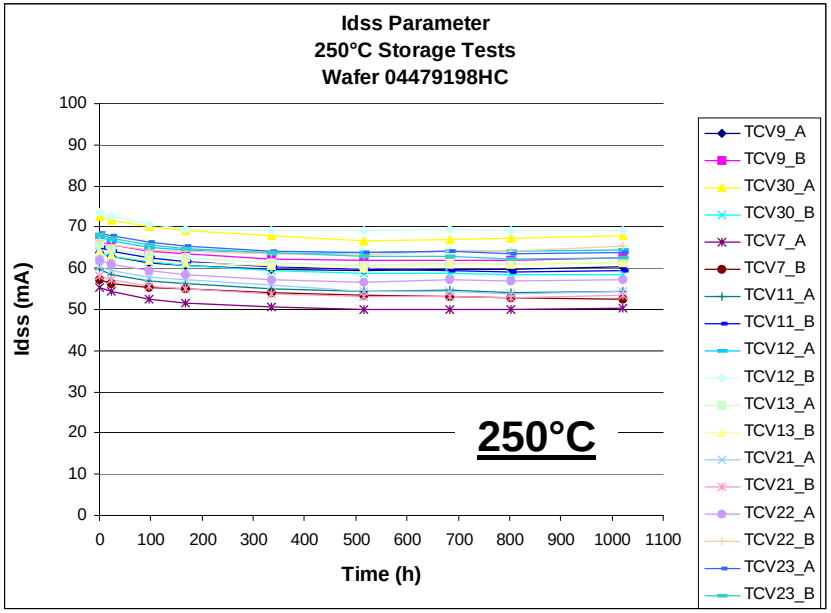
1.B : Storage test results of hermetically TCV sealed in DIL48 package with a polymer based getter attached to the lid : 1000h at 175°C & 1000h at 250°C

- All TCV Patterns controlled
- As expected, no change in passive elements has been noticed after 1000h at 175°C and 1000h at 250°C
- FET parameters : no failure (catastrophic or by drift) has been noticed whatever the wafer studied and the storage performed

TEST PROGRAM PHASE B : RESULTS

175°C & 250°C storage tests results : I_{DSS} parameter - 04479198HC Wafer





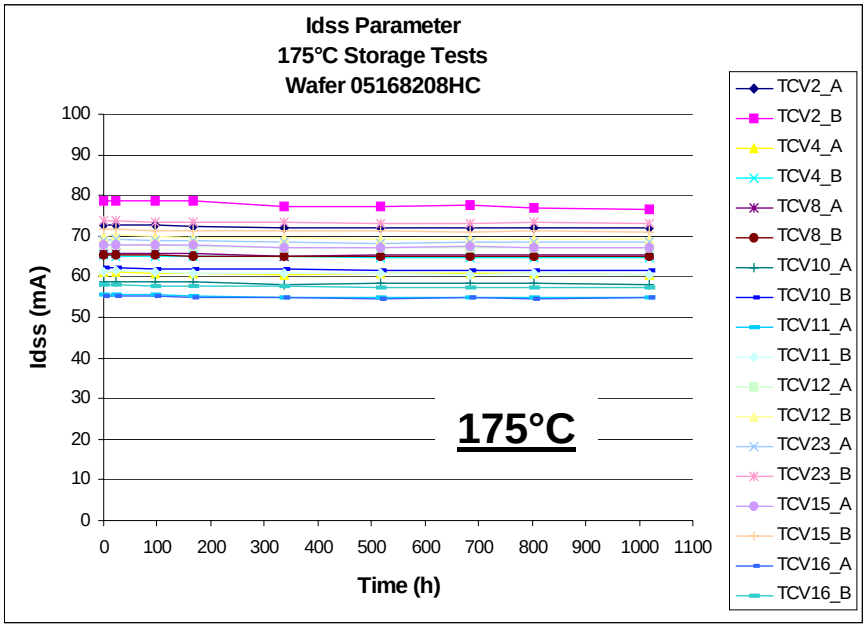
TCV hermetically sealed in a DIL48 package with a

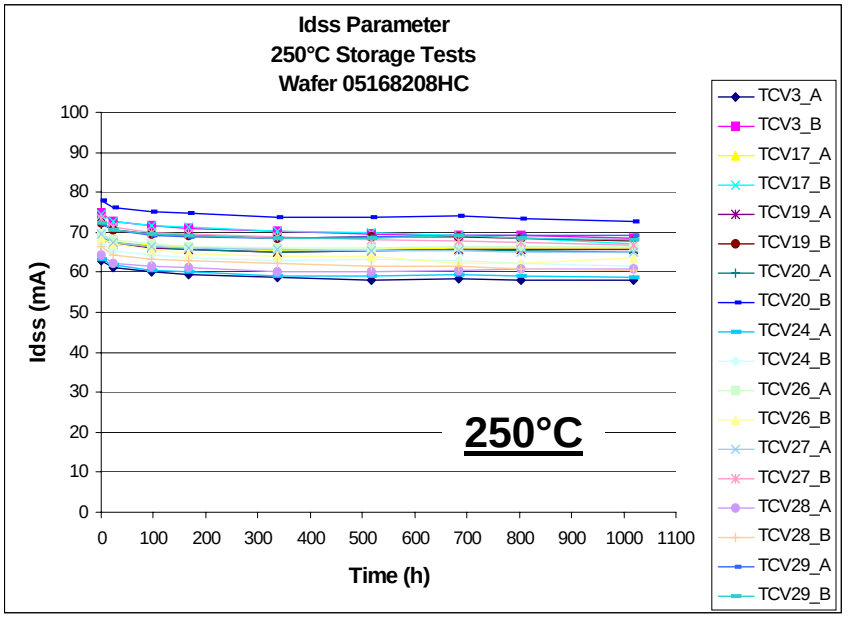
Polymer Based getter attached to the lid

ΔI_{DSSmax} **= -9%**

TEST PROGRAM PHASE B : RESULTS

175°C & 250°C storage tests results : I_{DSS} parameter - 05168208HC Wafer





TCV hermetically sealed in a DIL48 package with a

Polymer Based getter attached to the lid

ΔI_{DSSmax} **= -9%**

TEST PROGRAM PHASE B : RESULTS

- All the D01PH processed TCV dice encapsulated in hermetically sealed DIL48 packages with a H2-3000 polymer based getter attached to the lid successfully passed 1000h of storage tests without any degradation whatever the temperature used (175°C and 250°C)

- These results have to be confirmed by performing high temperature storage tests on MMICs hermetically sealed in specific packages with the same polymer based getter attached to the lid

- The same storage tests have now to be performed on ED02AH TCV dice hermetically sealed in DIL48 package with a getter attached to the lid in order to validate the solution proposed to prevent Hydrogen poisoning when using OMMIC processed dice

TEST PROGRAM PHASE B : RESULTS

2 : Reliability evaluation of D01PH processed TCV dice in a humid atmosphere :

- 3 humidity test series have been performed :
  - 857h at 85°C/85%RH
  - 1121h at 85°C/85%RH
  - 1143h at 85°C/85%RH
- Test vehicles tested : TCV dice, coming from 2 different wafers, biased or no biased and mounted in opened packages
- Biasing conditions for the 4x50µm on-transistor :
  - I_{DSS} at V_{GS} = 0V & V_{DS} = 1.5V

  (Resistors, capacitors and diodes have not been biased during the tests)
- The humidity tests have been carried out at ESTEC

Humidity test results : TCV electrical characterisation

Pattern	Measured Parameter	Description & measurements conditions
GP/IN & GP/IN/TIN metal interco.	R_GP/IN R_GP/IN/TIN	Resistor (15Ω) ; I_{max} = 12 mA
TE / IN metal interco.	R_TE/IN	Resistor (17.5Ω) ; I_{max} = 10 mA
Air bridge (AB 20)	R_AB_20	Resistor (0.5Ω)
Air bridge (AB 30)	R_AB_30	Resistor (0.3Ω)
Air bridge (AB / IN)	R_AB_IN	Resistor (6.51Ω) ; I_{max} = 18 mA
Air bridge (AB / IN / TIN)	R_AB_IN_TIN	Resistor (3Ω) ; I_{max} = 36 mA
Si_3N_4 capacitor	I_{leak}_Si_3N_4	Leakage current at V = +15V
Si_3N_4 / SiO_2 capacitor	I_{leak}_SiO_2	Leakage current at V = +15V
Schockley pattern	RCN	Contact resistance at I_{max} = 2.5mA
NiCr resistor	R_NiCr	Resistor (100Ω) ; I_{max} = 10 mA
IN/TIN metal line	R_IN_TIN	Resistor (2.5Ω) ; I_{max} = 36 mA
Transistor N-on	**V_p**	**Pinch-off voltage : I_{ds} = 1µA/µm, V_{ds} = 1.5V**
	gm_0	**Transconductance : V_{ds} = 1.5V, V_{gs} = 0V**
	I_{dss}	**Drain-source current : V_{gs} = 0V, V_{ds} = 1.5V**
	V_{brgss}	**Break down voltage : I_{gs} = 1µA/µm V_{ds} = 0V**
BE diode	V_{fwd}	Threshold voltage : V for $I_{forward}$ = 1µA/µm
	V_{BR}	Breakdown voltage : I_g = 1µA/µm, V_{ds} = 0V
	I_{rev}	Leakage current : maximum rating < -9V

TEST PROGRAM PHASE B : RESULTS

Humidity test results

➢ Whatever the 1000h of humidity tests performed and whatever the wafer studied, no change has been noticed on :

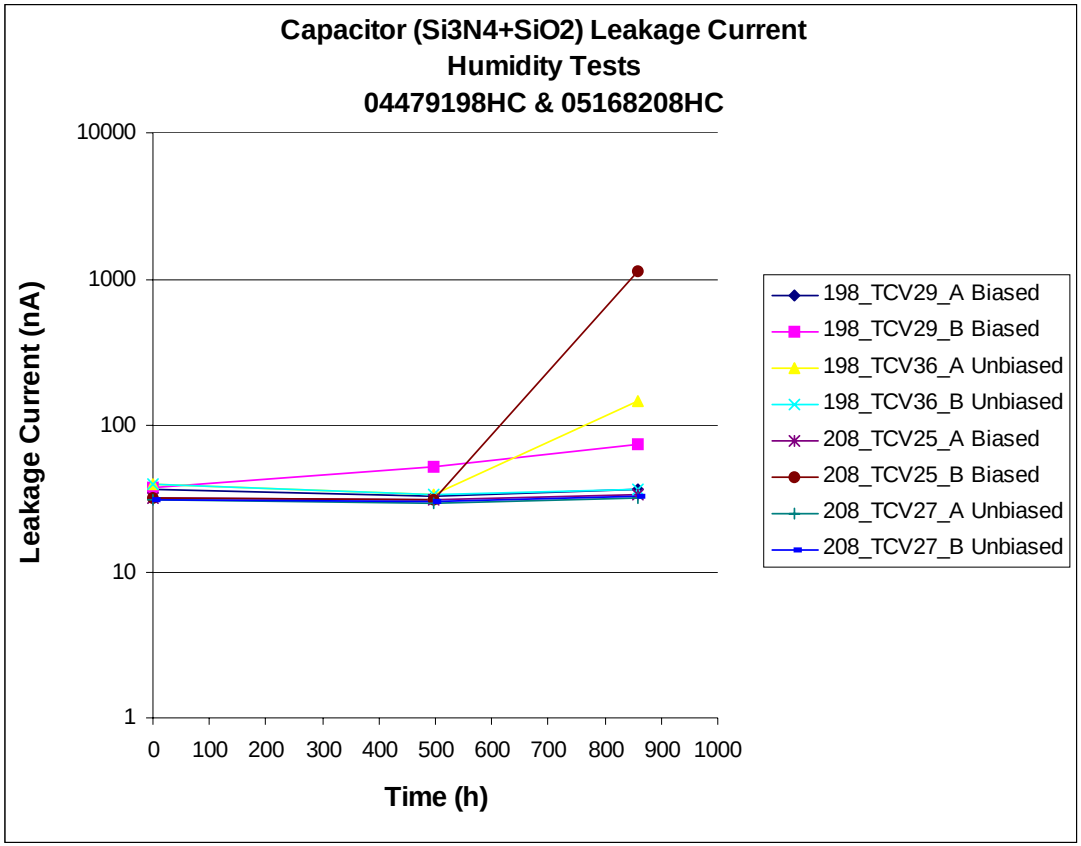
- the interconnections, the resistors, the air bridges
- the Si_3N_4 capacitors
- the 4x100µm BE Diodes

➢ Failures appear during the humidity tests for :

- Si_3N_4 + SiO_2 capacitors
- FET parameter : V_P

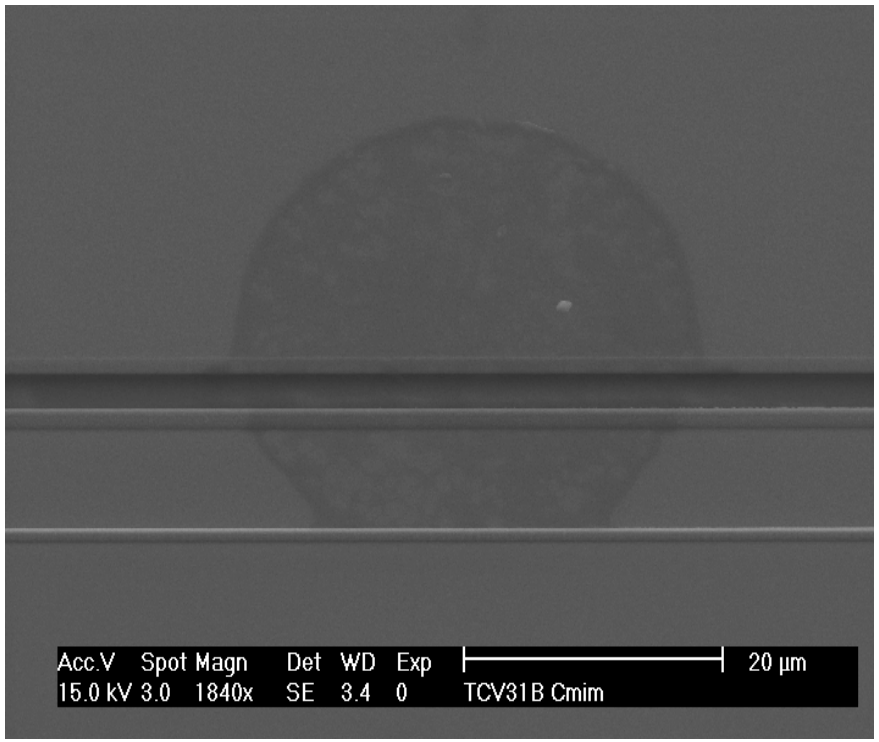
TEST PROGRAM PHASE B : RESULTS

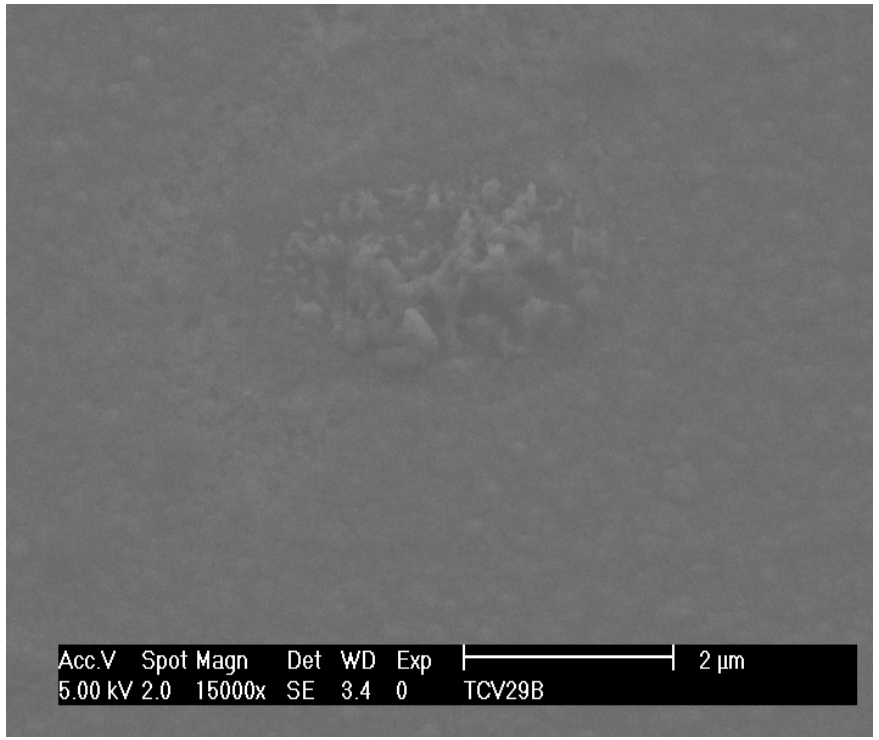
Typical Si_3N_4 + SiO_2 capacitors failure



Capacitor leakage current increased by more than 100% after the 1000h of humidity tests

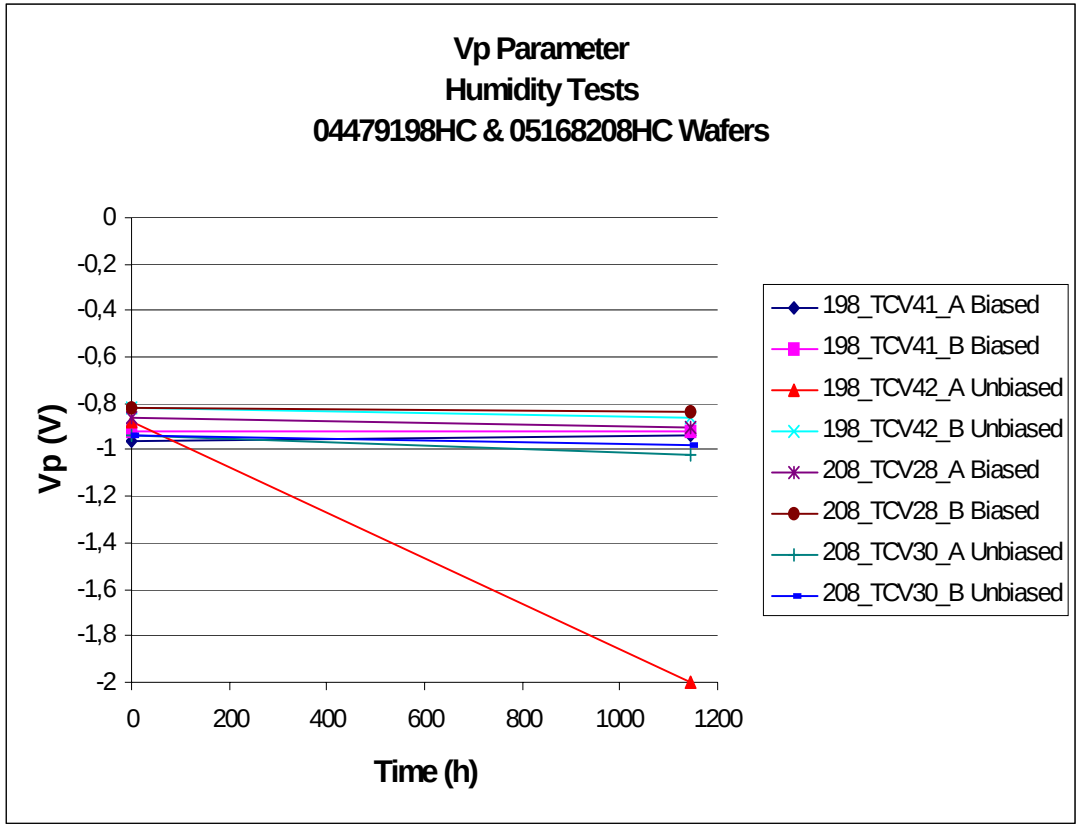
SEM analysis of failed Si_3N_4 + SiO_2





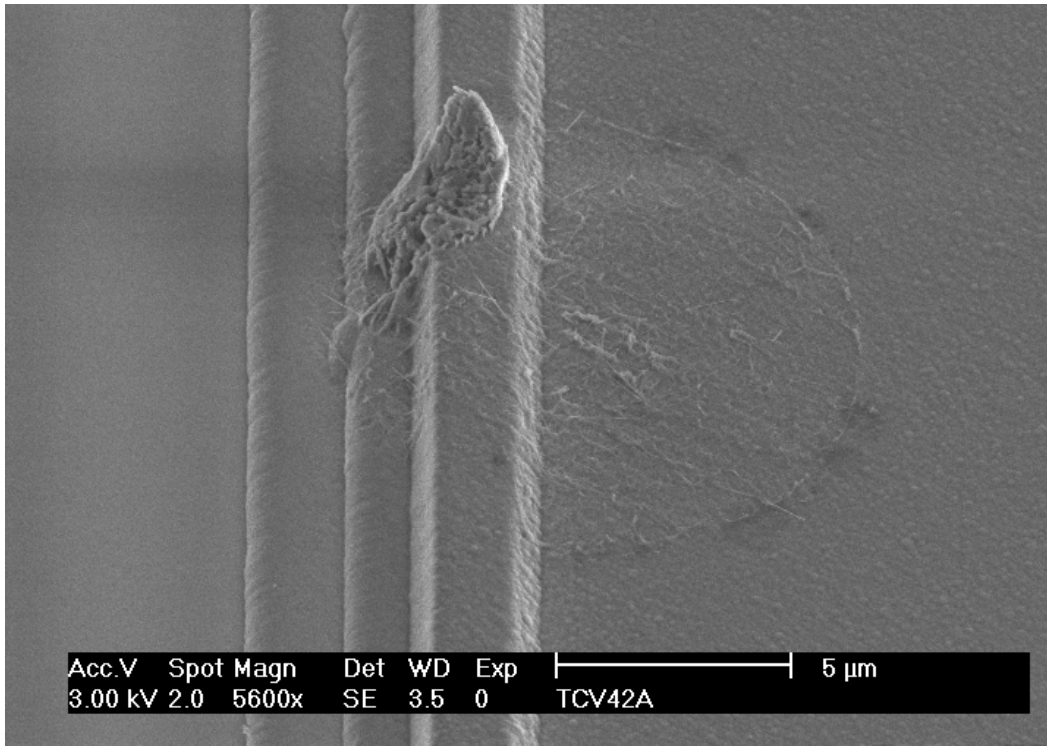
TEST PROGRAM PHASE B : RESULTS

Typical FET failure



Catastrophic degradation of the V_P parameter after the 1000h of humidity tests

SEM analysis of failed transistors



Failure due to a defective capacitor located between the transistor gate and the ground

CONCLUSION : PHASE A

Test program phase A : 250°C & 285°C Storage tests results

- The results obtained on opened TCVs stored at 250°C & 285°C showed a good reliability : the activation energy of the tested elements varies between 1.2eV & 1.8eV

- The lower activation energy (1.2eV) has been calculated for the 4x50µm on-transistor I_{DSS} parameter and corresponds to a median life in excess of 2.10^8 years in ambient conditions

Test program phase A : 150°C & 200°C Endurance tests results

- Some DEC samples tested in hermetically sealed FO92 packages exhibited a degradation by "Hydrogen poisoning" due to the presence of H_2 inside the package

- All DEC samples mounted in open packages successfully passed 4032h of endurance tests without any degradation whatever the temperature and the biasing conditions used

CONCLUSION : PHASE B

Test program phase B : Hydrogen getter efficiency

➢ The methods tested to prevent Hydrogen poisoning in DIL48 hermetically sealed package show that :

- the out-gassing conditions tested are not an efficient solution to remove the Hydrogen trapped in the package material

- the H2-3000 polymer based getter is a good solution to prevent Hydrogen poisoning in D01PH processed dice

➢ More experiments have to be performed :

- to evaluate the efficiency of such a polymer-based getter on ED02AH processed dice mounted in DIL48 package

- to evaluate the efficiency of the H2-3000 polymer based getter on MMIC (using D01PH or ED02AH process) encapsulated in specific packages

- to test getters from other suppliers

CONCLUSION : PHASE B

Test program phase B : Humidity test results

- From 85°C/85%RH 1000h humidity tests, it appears :
  - Only MIM capacitors are sensitive to moisture
  - No degradation is observed for active devices

- FIB analysis to determine where the defect has been initiated in the MIM capacitor