



## HEAVY ION SINGLE EVENT EFFECTS RADIATION TEST REPORT

**Part Type : M27C512**

**(64Kb x8) UV EPROM**

**Manufacturer : STMicroelectronics**

**Report Reference : ESA\_QCA0414S\_C**

**Issue : 01**


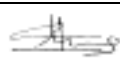
**Date : September 7, 2004**

**ESA Contract No 13528/99/NL/MV COO-16 dated 05/01/04**

European Space Agency Contract Report

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<b>HIREX Engineering</b>	<b>Single Event Effects Radiation Test Report</b>		Ref. : HRX/SEE/0117 Issue : 01
Part Type :	M27C512	Manufacturer :	STMicroelectronics

# **Heavy ion SEL characterization of M27C512, (64Kb x8) UV EPROM**

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## 1 Abstract

Under ESA Contract No 13528/99/NL/MV COO-16 dated 05/01/04 covering "Radiation Evaluation of COTS Semiconductor Components: "Radiation evaluation of parts for the ATV project", the STMicroelectronics, M27C512, (64Kb x8) UV EPROM was radiation assessed.

Heavy ion radiation results, focusing on Single Event Latchup (SEL) effects, are reported in this report.

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## 2 INTRODUCTION

This report presents the results of a Single Event Effects (SEE) test program carried out on M27C512, (64Kb x8) UV EPROM , from STMicroelectronics.

Test was conducted on 2 flight lot samples delivered by the ESA ATV project.

These devices were used during heavy ion tests carried out at the European Heavy Ion Irradiation Facility (HIF) at Cyclone, Université Catholique de Louvain – April 2004.

This work was performed for ESA/ESTEC under ESA Contract No 13528/99/NL/MV COO-16 dated 05/01/04.

## 3 REFERENCE DOCUMENTS

RD1. M27C512 data sheet

RD2. Annex 3 of ATV/MMS/EPG/FX/026.04 dated 13/02/0-4

RD3. Single Event Effects Test method and Guidelines ESA/SCC basic specification No 25100

RD4. The Heavy Ion Irradiation Facility at CYCLONE, UCL document, Centre de Recherches du Cyclotron (IEEE NSREC'96, Workshop Record, Indian Wells, California, 1996)

## 4 DEVICE INFORMATION

### 4.1 M27C512

The M27C512 is a (64Kb x8) UV EPROM in a FDIP28W (Window cerdip) package.

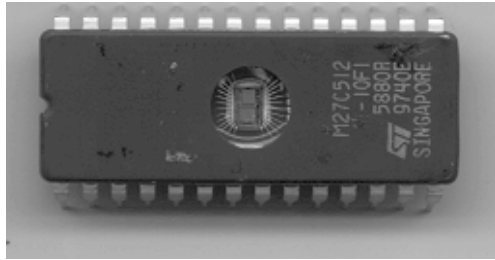
Relevant device identification information is presented here after and photos of device with die identification and die dimensions are shown in Figure 1.

Part type:	M27C512
Manufacturer:	STMicroelectronics
Package:	28-Pin Cerdip
Quality Level:	flight samples
Date Code:	9740E
Top marking:	see photo in Figure 1

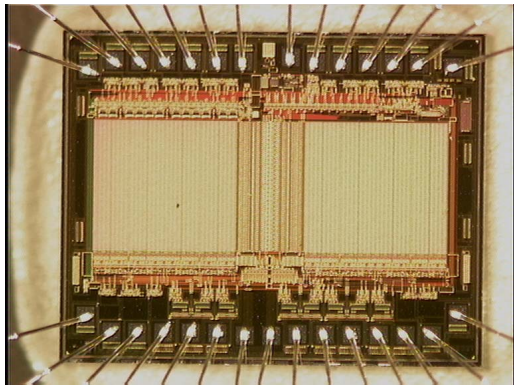
### 4.2 Sample preparation

Three samples were delidded mechanically.

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**Photo 1 – Top marking**

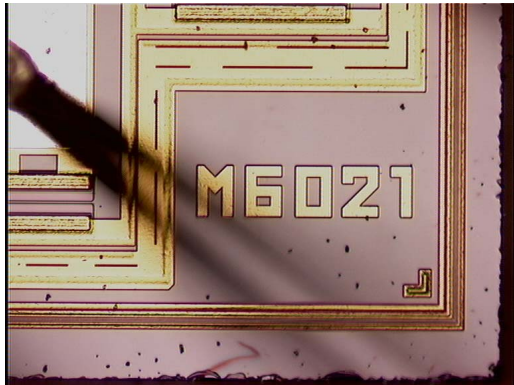


**Photo 2 – die, full view**

Die dimensions:  
3.2 mm x 2.5 mm



**Photo 3 – die, marking, detail 1**



**Photo 4 – die, marking, detail 2**

**Figure 1 – M27C512 sample identification**

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## 5 Test Definition

### 5.1 Test Set-up

Device is biased in a standby mode with CS and OE tied to the 5V DUT power supply with pull-up resistors of 10 kOhms.

DUT supply current is monitored to detect any SEL occurrence.

## 6 UCL TEST FACILITY

Test at the cyclotron accelerator was performed at Université de Louvain (UCL) in Louvain-La-Neuve (Belgium) under HIREX Engineering responsibility.

### 6.1 Beam Source

In collaboration with the European Space Agency (ESA), the needed equipment for single events studies using heavy ions was built and installed on the HIF beam line in the experimental hall of Louvain-La-Neuve cyclotron.

CYCLONE is a multi particle, variable energy, cyclotron capable of accelerating protons (up to 75 MeV), alpha particles and heavy ions. For the heavy ions, the covered energy range is between 0.6 MeV/AMU and 27.5 MeV/AMU. For these ions, the maximal energy can be determined by the formula:

$$110 Q^2/M,$$

where Q is the ion charge state, and M is the mass in Atomic Mass Units.

The heavy ions are produced in a double stage Electron Cyclotron Resonance (ECR) source. Such a source allows producing highly charged ions and ion "cocktails". These are composed of ions with the same or very close M/Q ratios. The cocktail ions are injected in the cyclotron, accelerated at the same time and extracted separately by a fine tuning of the magnetic field or a slight changing of the RF frequency. This method is very convenient for a quick change of ion (in a few minutes) which is equivalent to a LET variation.

### 6.2 Dosimetry

The current UCL Cyclotron dosimetry system and procedures were used.

### 6.3 Used ions

The UCL ions used are listed in the table below.

Ion	Energy	LET	Range (Si)
	(MeV)	(MeV.cm <sup>2</sup> /mg)	μm
<sup>132</sup> Xe <sup>26+</sup>	459	55.9	43

**Table 1- UCL ions and features thereof**

### 6.4 Beam set-up

The use of a tilt angle allows for additional effective LET values.

For each run, the following information is given in the detailed results tables provided in the next paragraph (paragraph 7) :

- Run Number
- Device S/N
- Ion type
- Tilt angle
- LET
- Fluence
- Test Duration
- Averaged flux
- SELs

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## 7 RESULTS

The detailed results are presented in Table 2.

No SEL could be detected at a LET of 111.8 MeV/(mg/cm<sup>2</sup>).

**Table 2 – Detailed results per run**

Run #	Device S/N	Ion	Tilt angle (deg.)	LETeff MeV/(mg/cm <sup>2</sup> )	Fluence (#/cm <sup>2</sup> )	IradTime (s)	MeanFlux (#/cm <sup>2</sup> *s)	SEL
Run1	1	<sup>132</sup> Xe <sup>26+</sup>	0	55.9	1 E+06	496	2016	0
Run2	1	<sup>132</sup> Xe <sup>26+</sup>	60	111.8	1 E+06	507	1972	0
Run3	2	<sup>132</sup> Xe <sup>26+</sup>	60	111.8	1 E+06	563	1776	0

## 8 CONCLUSION

Heavy ion tests were conducted on 2 flight lot parts for the ATV project, M27C512, (64Kb x8) UV EPROM from STMicroelectronics, using the heavy ions available at the European Heavy Ion Irradiation Facility (HIF) at Cyclone, Université Catholique de Louvain, Belgium.

No SEL could be detected up to LET value of 111.8MeV/(mg/cm<sup>2</sup>) and a fluence of 1 E+06#/cm<sup>2</sup>.