Manual Chemical Decapsulation

EFA Laboratory

Subject:

Example of manual chemical Decapsulation available in ONPY2 for most of products, showing potential to cover external returns as well

Content:

Results with examples

Introduction *(adapted from siliconfareast.com)*

Decapsulation is a failure analysis step performed to open a plastic package to facilitate the inspection, chemical analysis, or electrical examination of the die and the internal features of the package. If the package being opened is hermetic, then the process is referred to as 'delidding' or 'decapping.' The techniques used for decapsulation are very different from those of delidding and decapping.

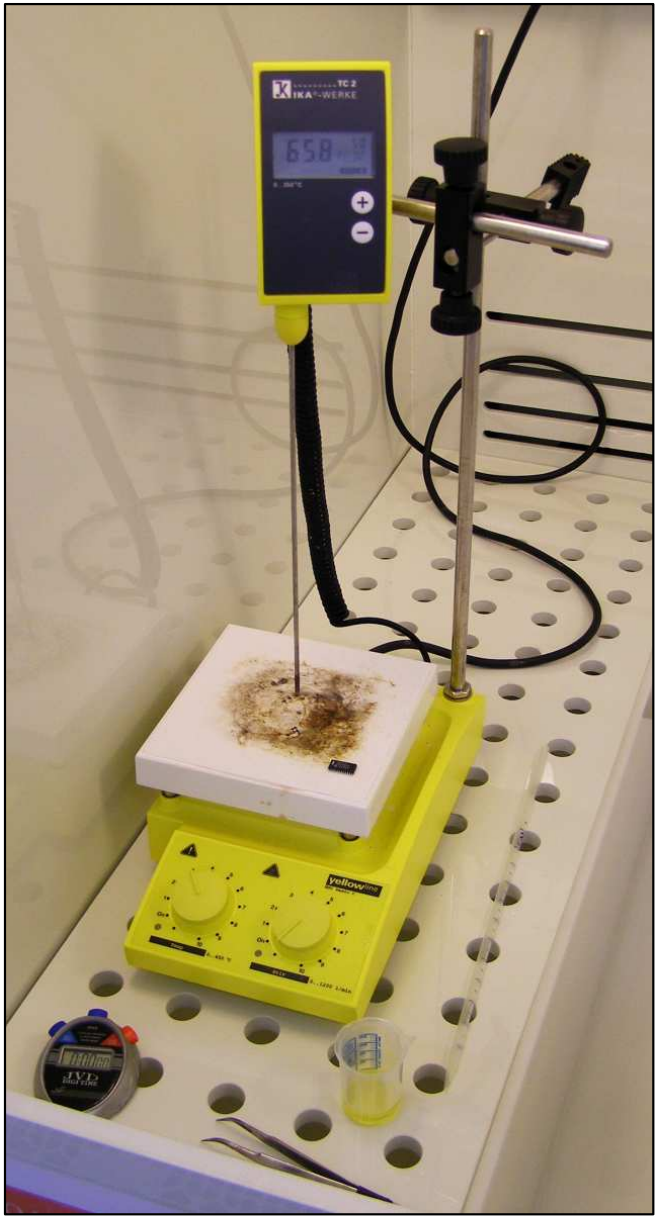
Manual chemical etching consists of manually dispensing some acid on the surface of a package to remove the plastic material covering the die. Red fuming nitric acid (HNO3) or sulfuric acid (H2SO4) is often used for this purpose. A cavity is first milled on the top surface of the package. Red fuming nitric acid heated to about 85-140 deg C or sulfuric acid heated to 140 deg C is then repeatedly dropped into the cavity to remove the plastic material covering the die. When the die has been exposed adequately, the unit is rinsed with acetone then with D/I water, before being blow-dried carefully.

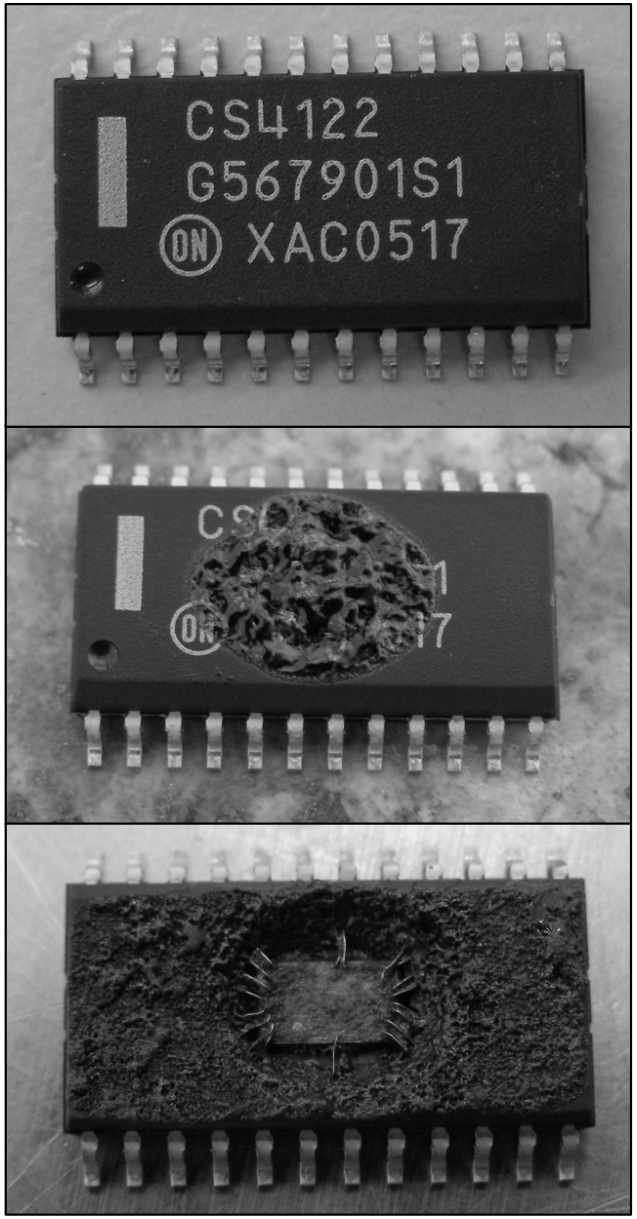
Manual etching may also refer to the process of soaking the package entirely in a beaker of sulfuric acid heated to about 140 deg C. This process will totally destroy the unit, leaving behind the silicon die and bits and pieces of undissolved metal piece parts. This is only used for die backside inspection for cracks.

Jet etching is the automated version of chemical decapsulation, using a piece of equipment known as a jet etcher. The jet etcher automatically squirts heated acid on the area of the package that needs to be removed. During this process, the area to be etched is usually left exposed while the rest of the package topside is covered by a rubber mask. Jet etchers usually use red fuming nitric acid heated to about 85 deg C. Jet etching is superior to manual etching, being more controlled, efficient, and less messy.

Minimizing Cu corrosion: Fuming HNO3:H2SO4 (4:1)

SOIC-24 Manual Chemical Decapsulation, example





Package: SOIC-24 (PS3)

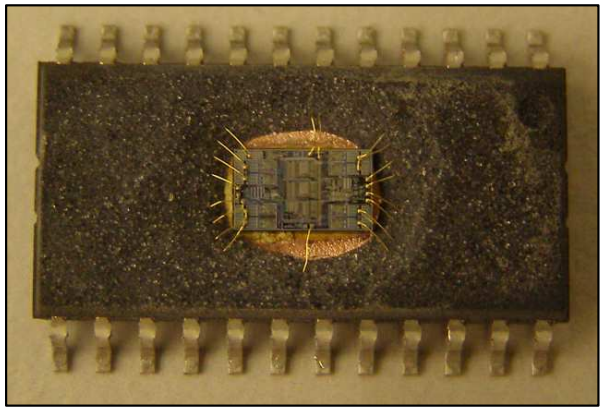
Decapsulation details:

Temperature ~65℃
Chemicals: Fuming HNO3
Etch time: ~5 minutes

Cleaning

Temperature ~21℃
Chemicals: Fuming HNO3
Cleaning Time 20 sec
Stimulation: Ultrasound

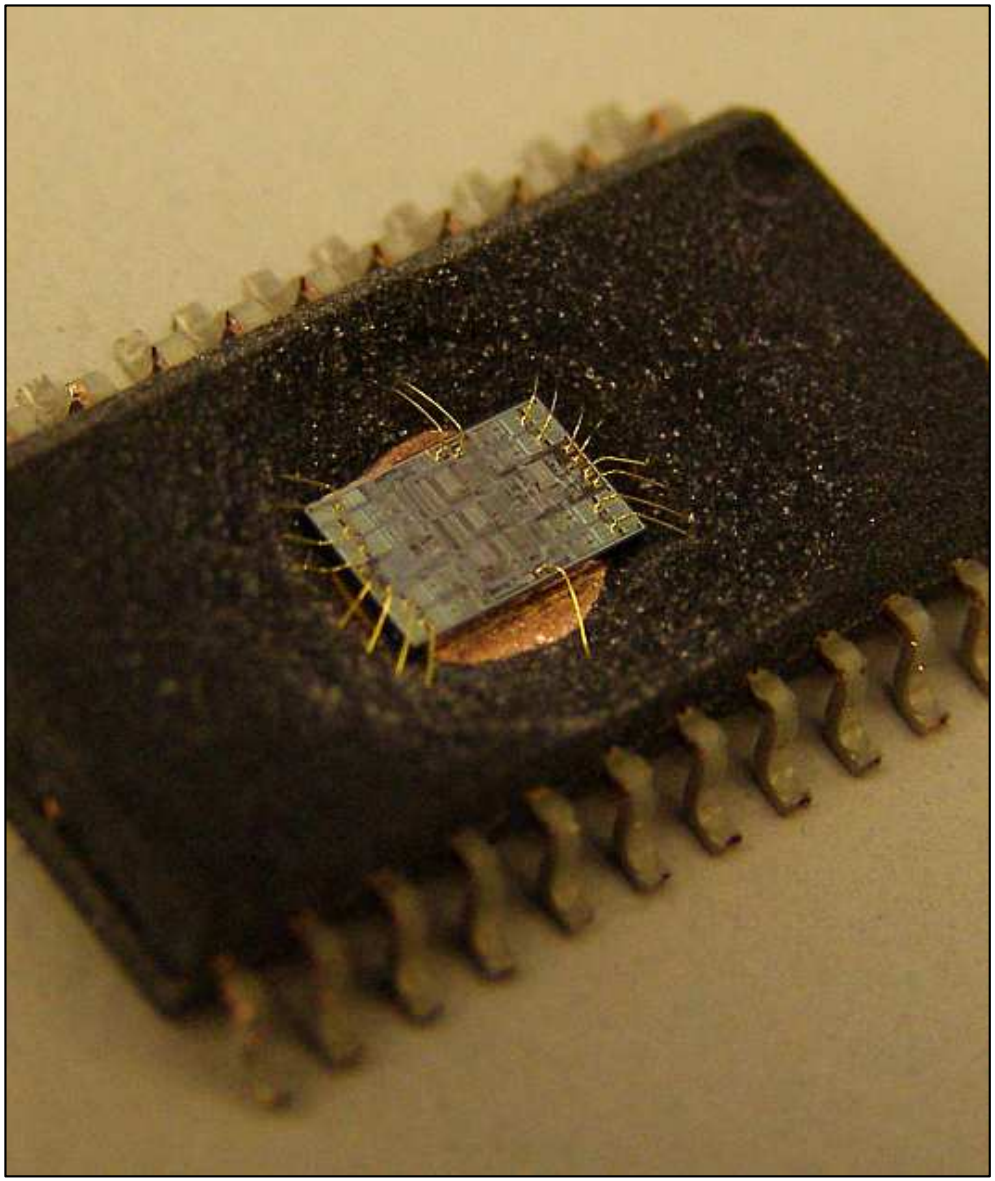
Note: process etches Cu

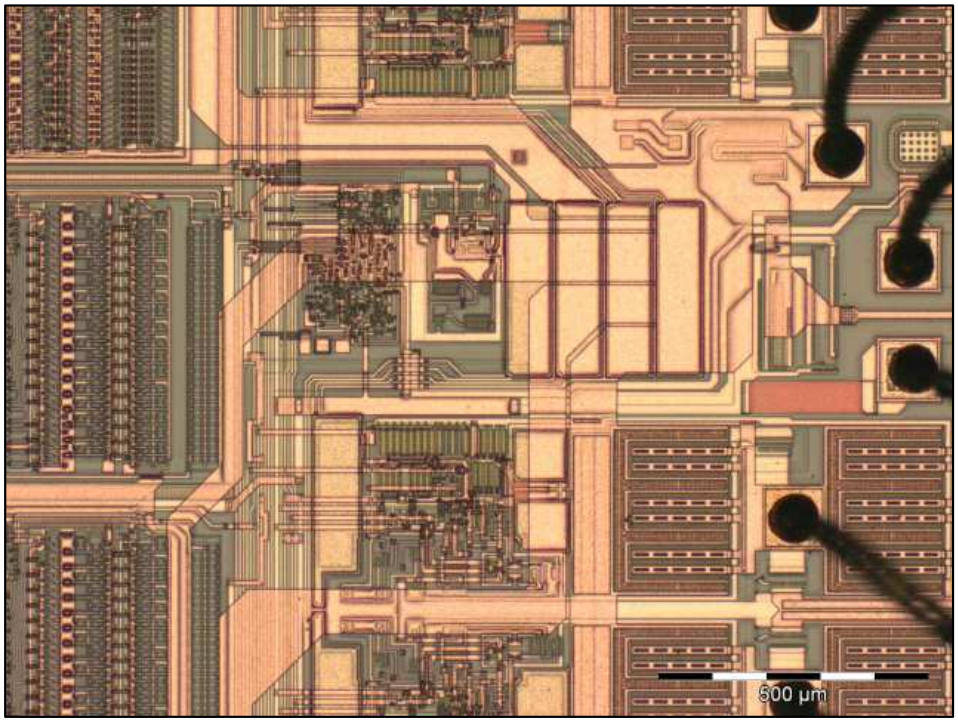


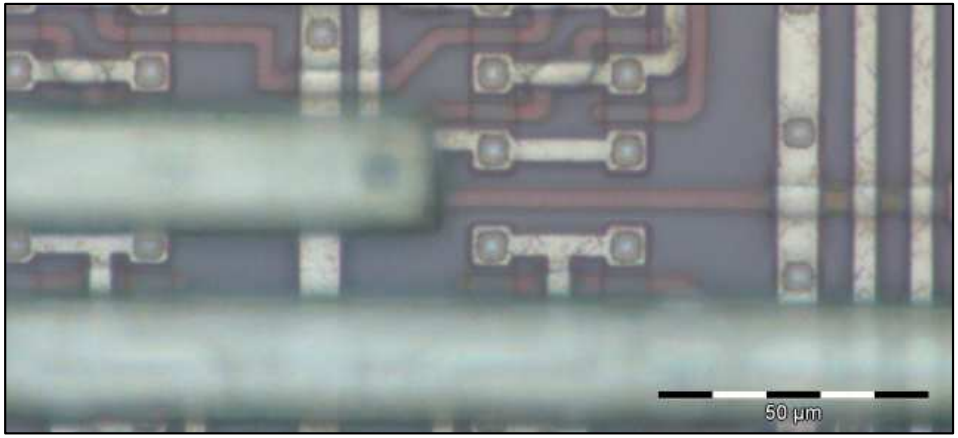
EFA Laboratory
Written by Valentin Kulikov in 29 May 2008, Rev.A

ON Semiconductor
Piestany, Slovakia

SOIC-24 Manual Chemical Decapsulation, Final result







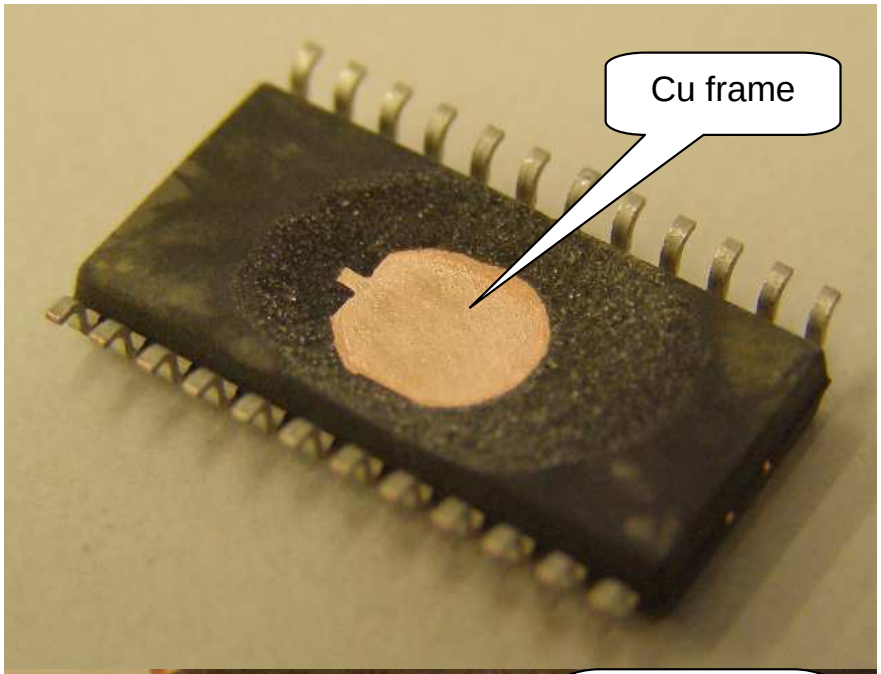
EFA Laboratory

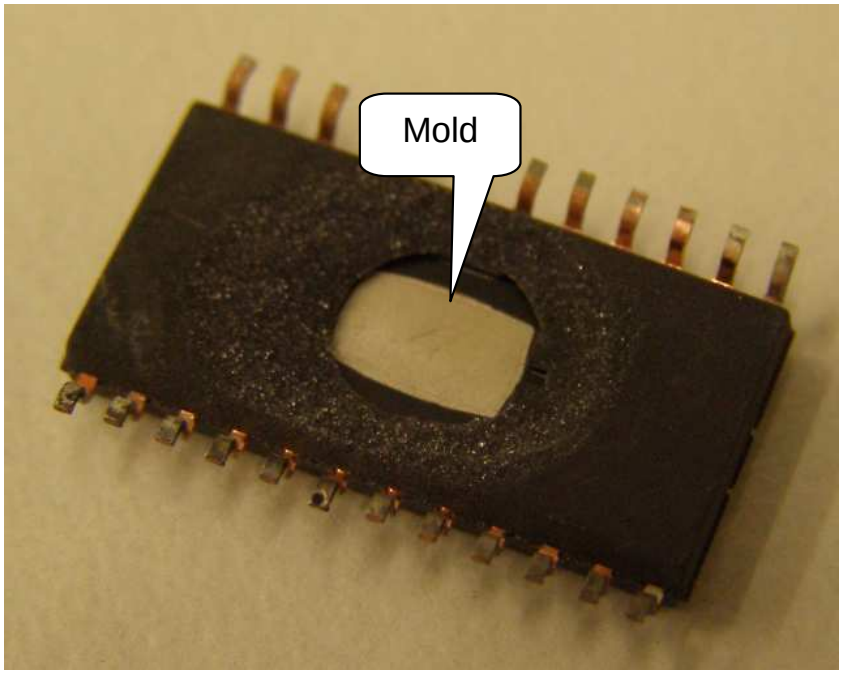
Written by Valentin Kulikov in 29 May 2008, Rev.A

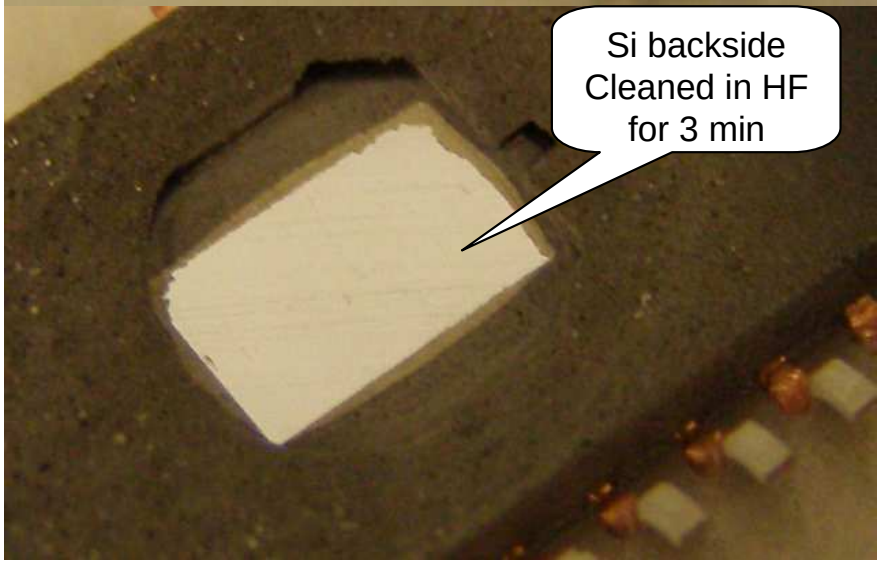
ON Semiconductor

Piestany, Slovakia

SOIC-24 Manual Chemical Decapsulation, Back side preparation







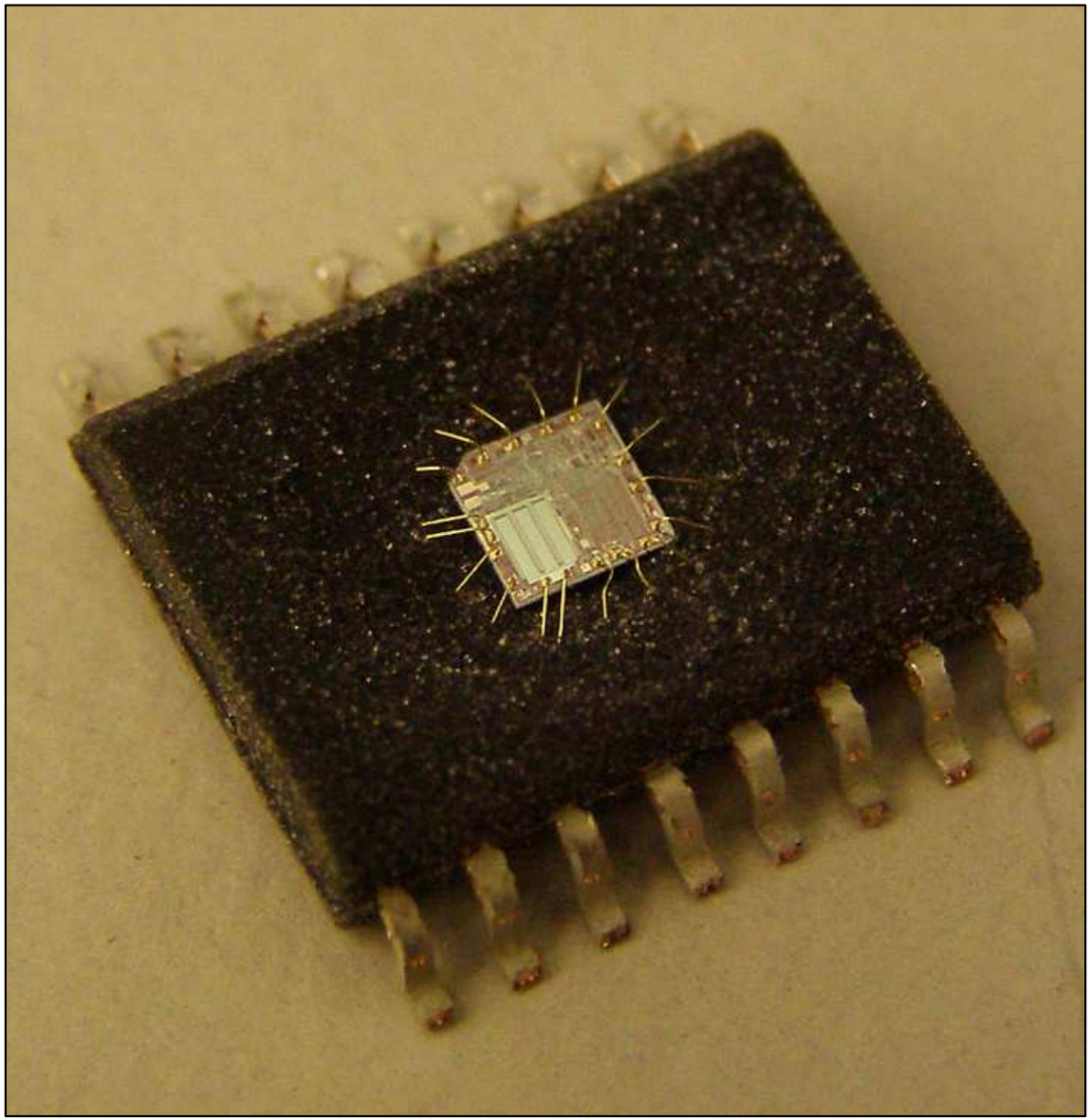
EFA Laboratory

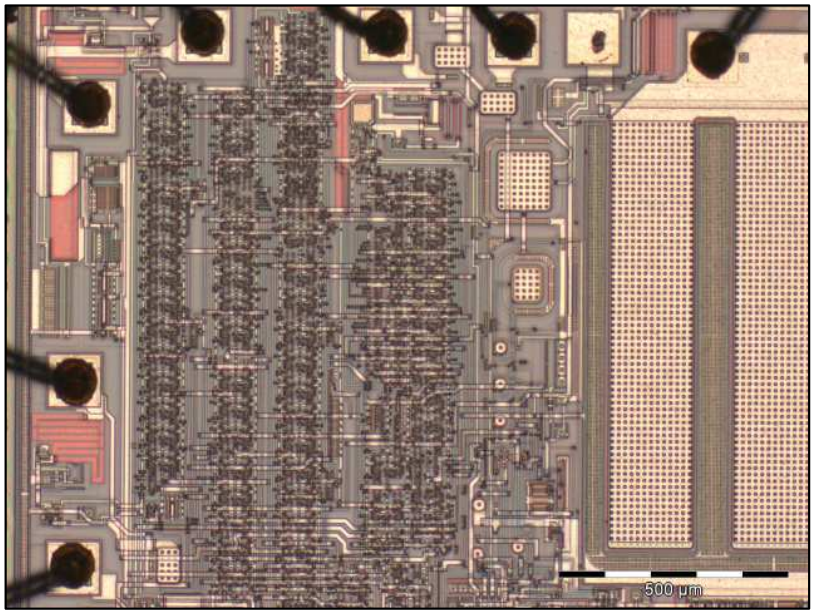
Written by Valentin Kulikov in 29 May 2008, Rev.A

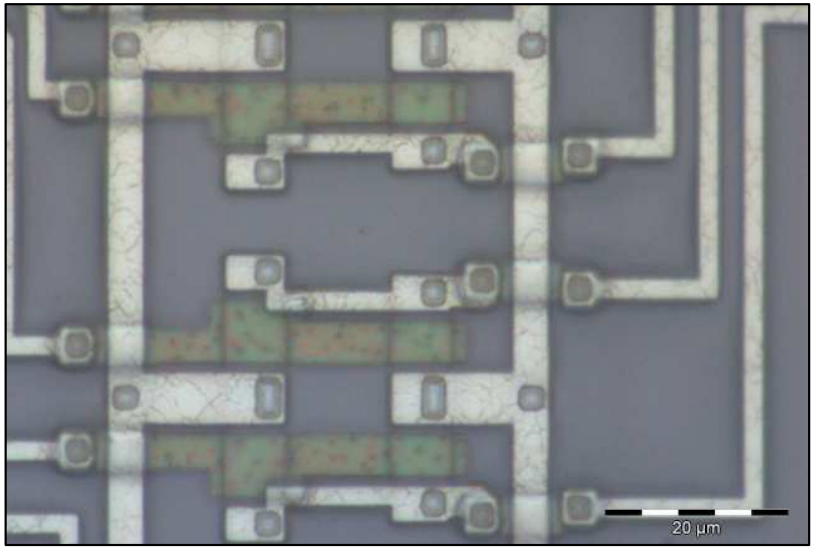
ON Semiconductor

Piestany, Slovakia

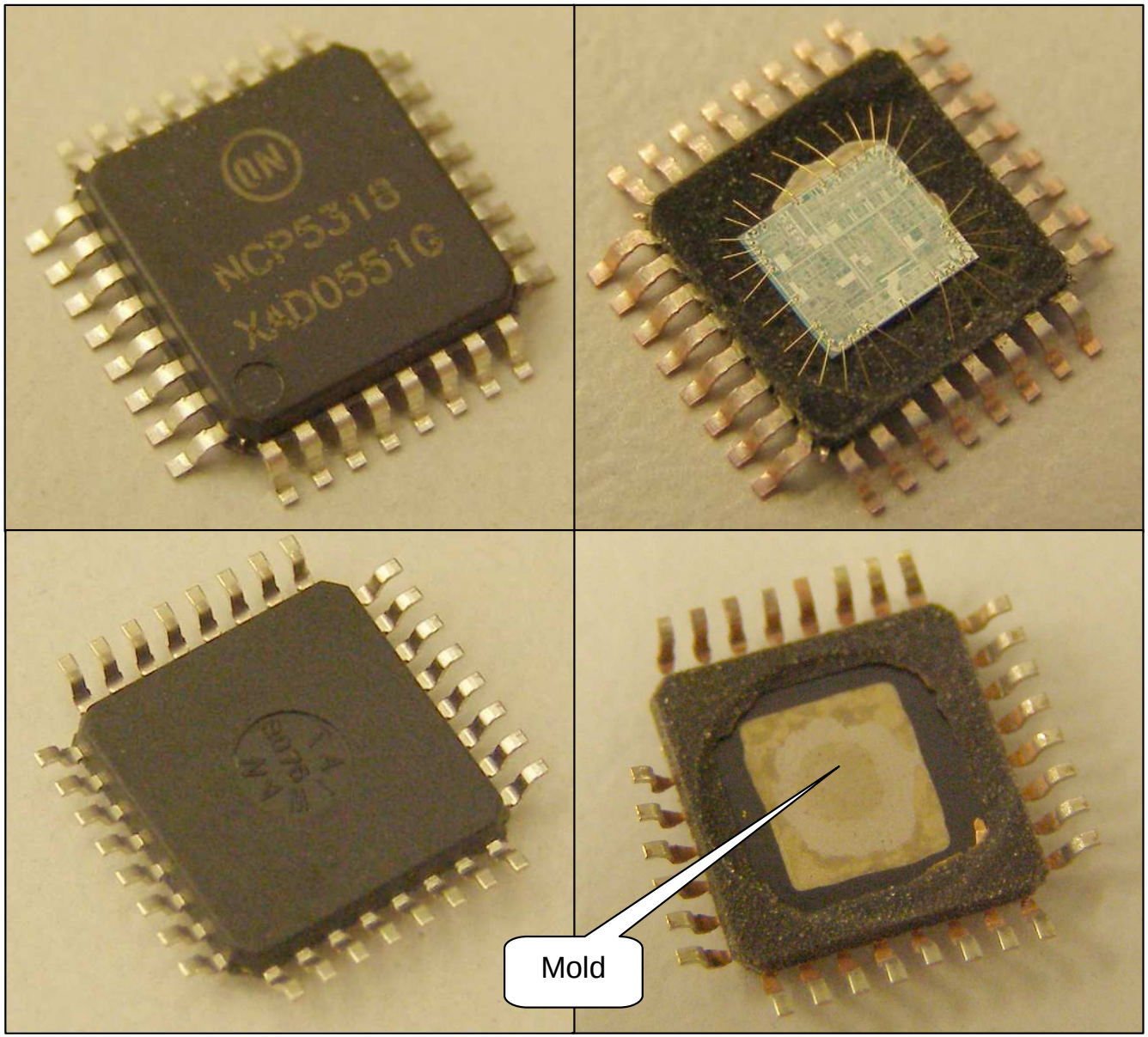
SOIC-16 Manual Chemical Decapsulation, Final result







32 LEAD LQFP 7x7 Manual Chemical Decapsulation, Final result



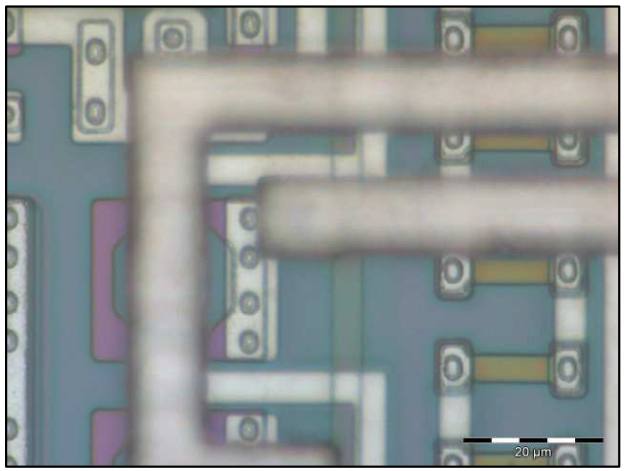
Package: LQFP 32 pin
Part: NCP5318 (BIP18V)

Decapsulation details:
Temperature ~65℃
Chemicals: Fuming HNO3
Etch time: ~5 minutes

Cleaning
Temperature ~21℃
Chemicals: Acetone
Cleaning Time 20 sec
Stimulation: Ultrasound

Cu etch (backside)
HCl + H2O2, ~10 minutes

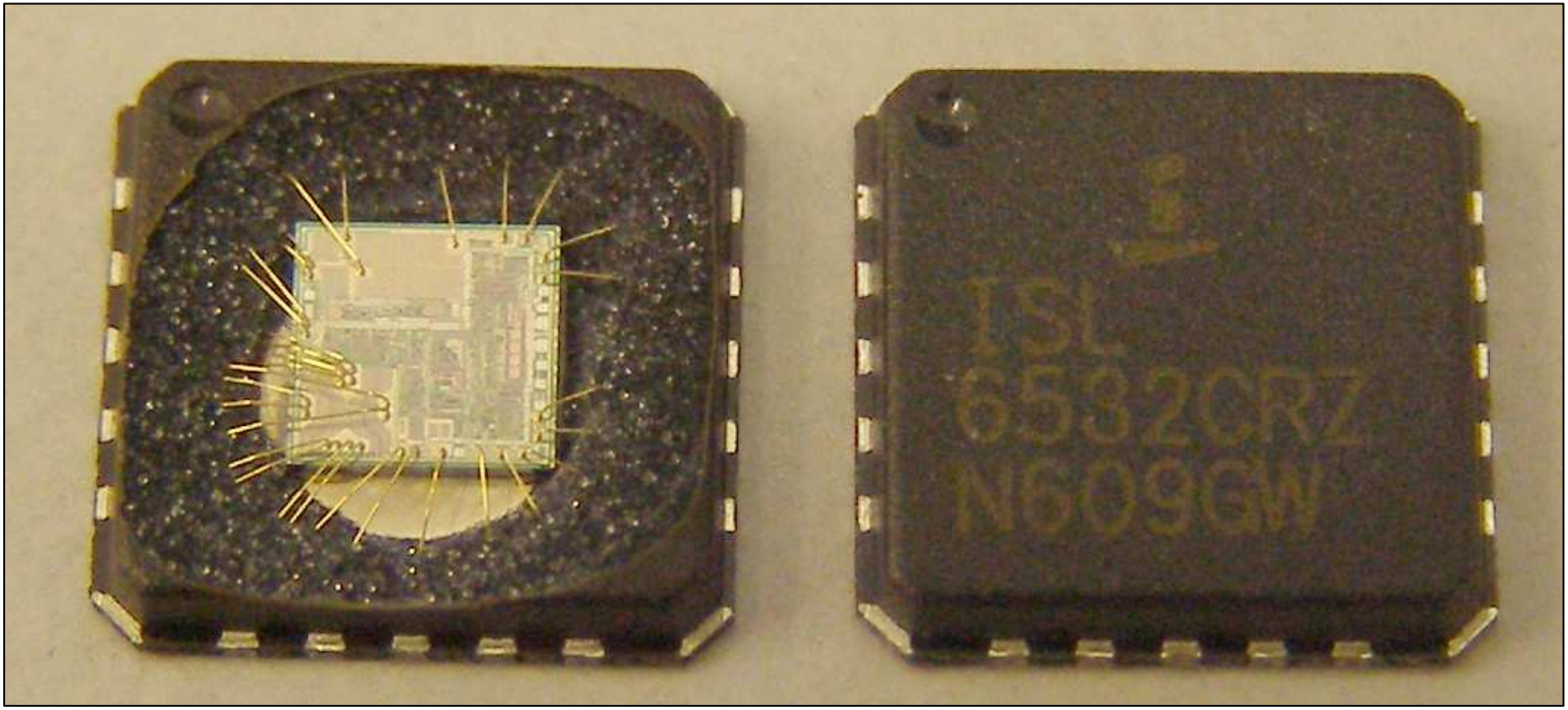
Note: Backside, visible mold compound, Cu frame etched away



EFA Laboratory
Written by Valentin Kulikov in 29 May 2008, Rev.A

ON Semiconductor
Piestany, Slovakia

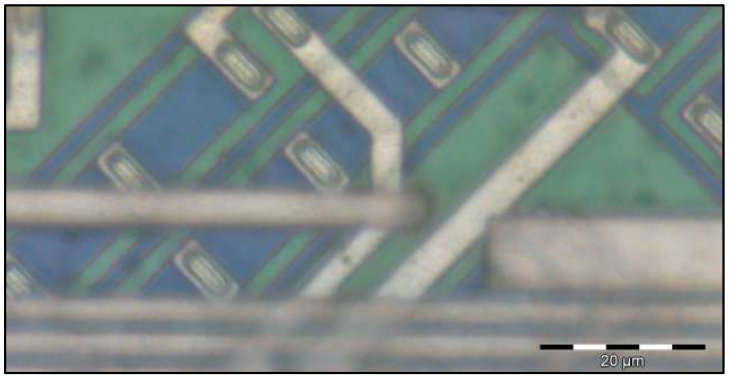
20 QFN Manual Chemical Decapsulation, Final result



Package: 20 Ld QFN
Part: ISL6532

Decapsulation details:
Temperature ~65℃
Chemicals: Fuming HNO3
Etch time: ~5 minutes

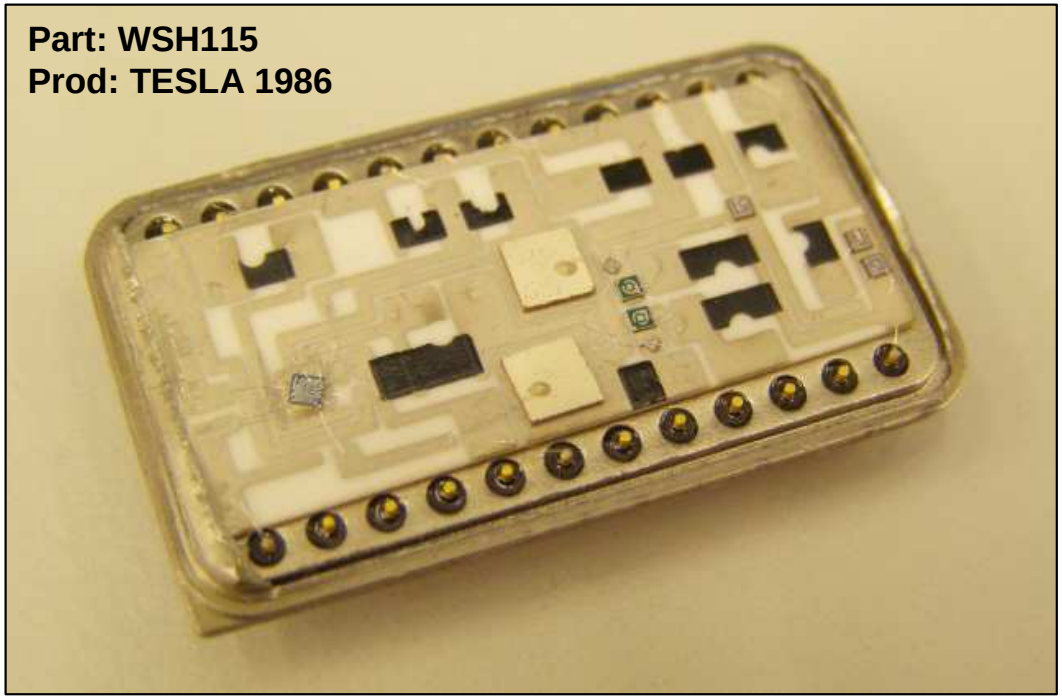
Cleaning
Temperature ~21℃
Chemicals: Acetone
Cleaning Time 20 sec
Stimulation: Ultrasound

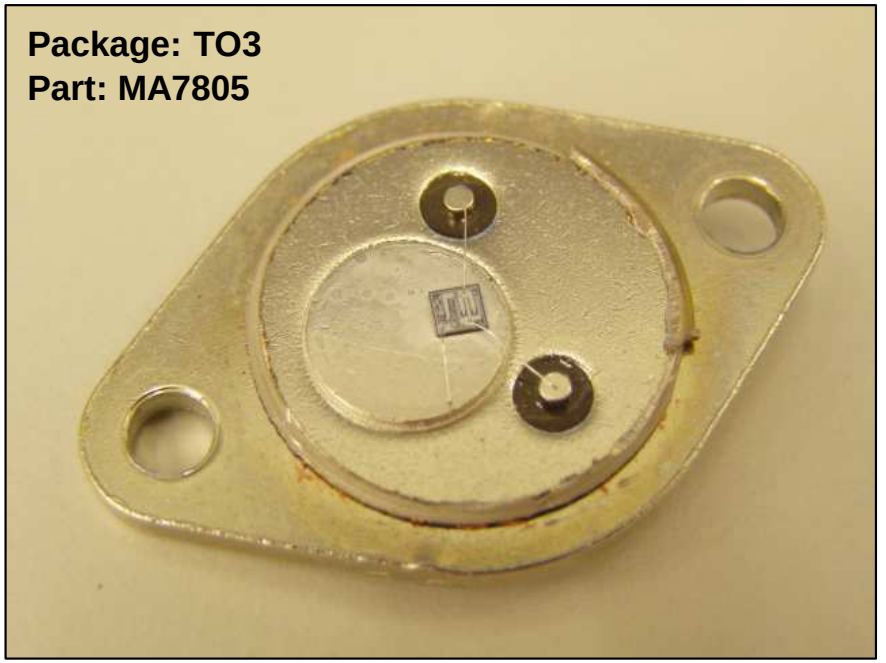


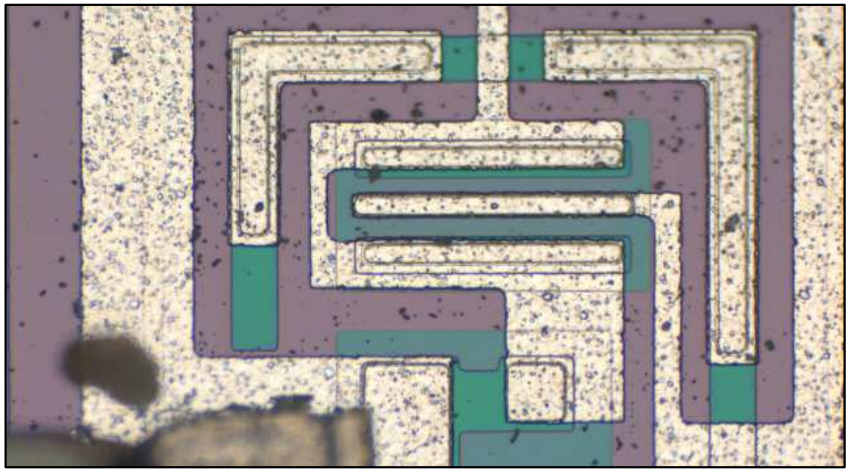
EFA Laboratory
Written by Valentin Kulikov in 29 May 2008, Rev.A

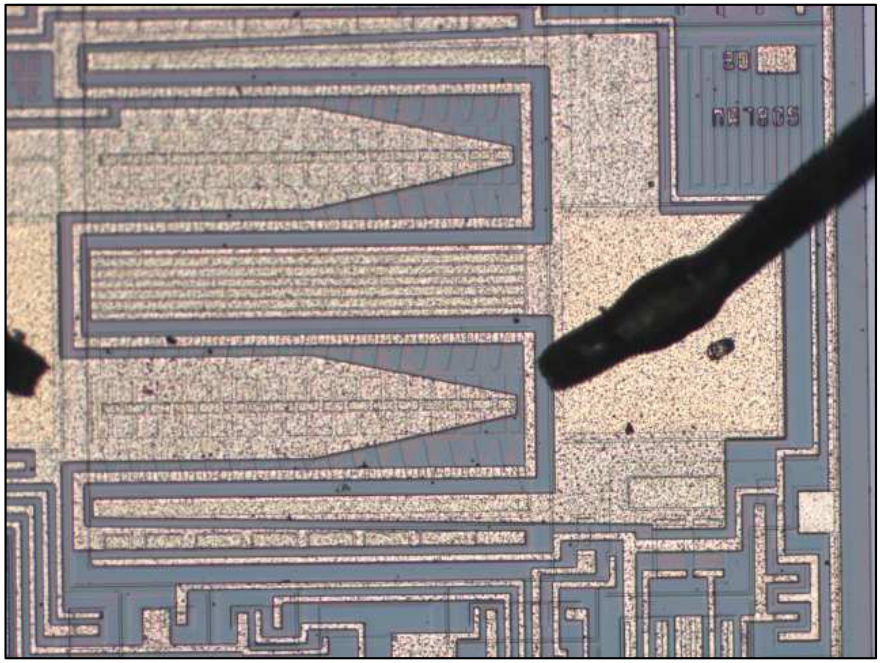
ON Semiconductor
Piestany, Slovakia

Delidding examples, Final result









Summary

This short report shows:

- Simple process how to decapsulate assembled units in ONPY2 for front side as well as for backside analysis.
- Availability to analyze assembled units directly in EFA Laboratory without need for decap. tool
- Opens way to EFA Lab. for external customers with packaged samples for FA

Package Kit involved in this report

- N02796D048 FRAME 0024SC004G01 SOP300 24L RING .170X.210
- EPXY H00144A063 CRM-1064MB 35G/10CC
- WIRE B24082A006 WIRE AU .00128 +/-.00003
- MOLD MCMP8000A027 MP-8000MH 14X6.8G