

The FUTURE of TECHNOLOGY

Infineon's way to "Green Products"



www.infineon.com/greenproduct



Never stop thinking

Infineon has nearly completed the “Green Conversion”

Ladies and gentlemen,
Dear customers,

JULY 1, 2006, IS GETTING CLOSER; this is the day from which the EU regulation RoHS 2002/95/EC will take effect. Being a landmark decision for the whole electronics industry, the EU regulation has already been translated into national law in most of the EU member states. Forbidding the use of heavy metals such as cadmium, mercury and lead for electronic products – save for a small number of exceptions – the greatest challenge will lie in having to renounce the use of lead in the supply chain, starting from tin-plating of solder joints through lead-free soldering processes in production.

INFINEON INITIATED the project “Green Product” in the year 2000 in order to meet the legal as well as even more stringent quality requirements called for by modified soldering processes. Throughout this development, we have been instrumental in defining new international standards such as JEDEC standard 020C, which describes the modified soldering profiles for lead-free soldering processes.

BECAUSE INFINEON STARTED THIS PROJECT very early on, we consider ourselves “ready today.” As of October 2005, more than 80% of our volume production already conforms to RoHS. This corresponds to the actual requirements of the markets, since for the time being not all production operations have been switched over to the new processes.

DUE TO VARIOUS EXCEPTIONS there will still be a need for non-“green products” after July 1, 2006. Whilst we will do our best to meet this demand in close cooperation with our customers, we do recommend that our customers change their production to processes complying with RoHS as soon as possible in order to avoid limiting themselves to a restricted market niche in the future. “Mainstream” business will be lead-free, and the majority of electronic parts manufactured will follow this mainstream.

FOR CURRENT DATA AND INFORMATION concerning the switchover process at Infineon, please visit our “green” homepage at: www.infineon.com/greenproduct

Sincerely yours,



Bodo Eilken

Overall Project Leader “Green Product”

Taking responsibility – protecting the environment

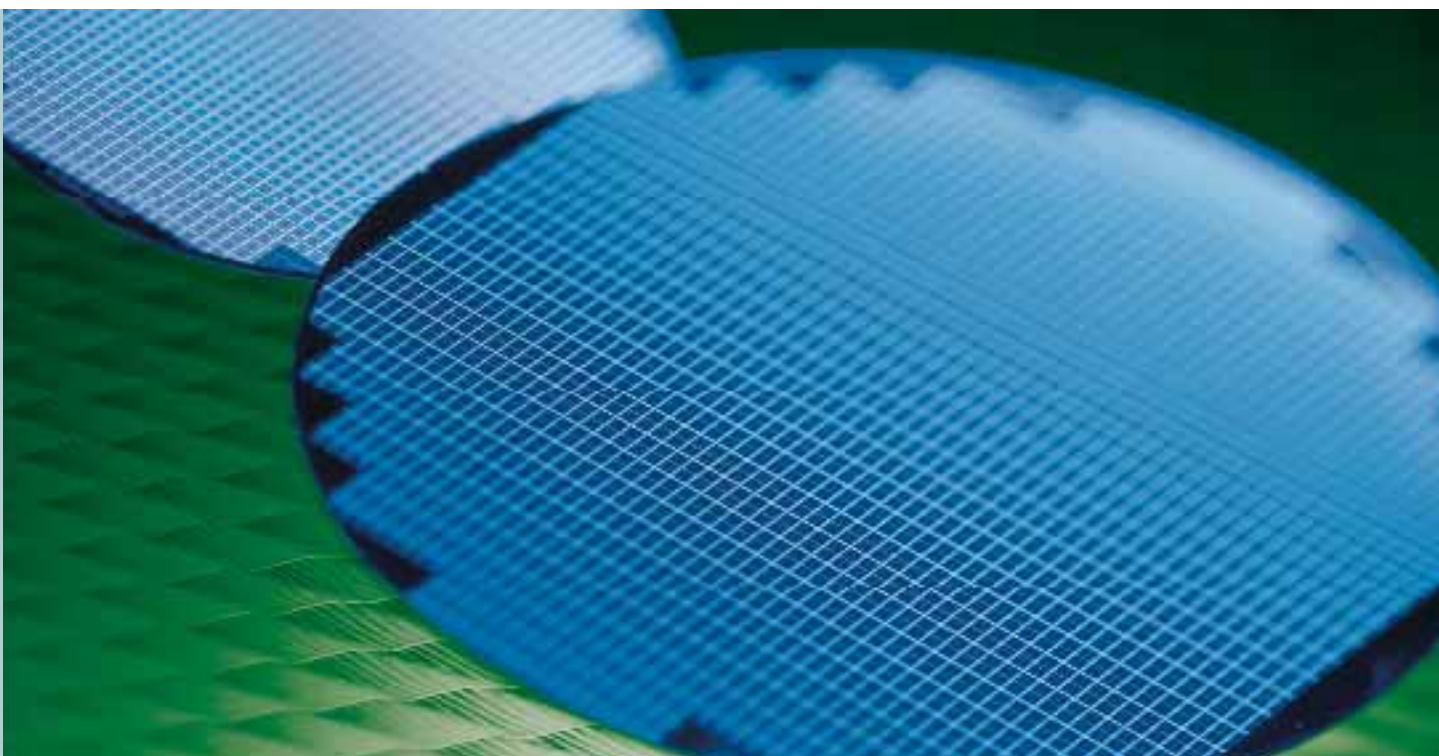
Why go “green”?

AS A LEADING SEMICONDUCTOR SUPPLIER who is aware of the environmental aspects of production, Infineon Technologies is moving towards working exclusively with new environmentally friendly materials in the manufacture of its products.

OUR DECISION TO TAKE THIS STEP has been motivated by both market demand and legal necessity. Our customers have been requesting lead-free products which can withstand the higher solder temperatures. The European parliament, in tune with similar environmental initiatives worldwide, has initiated the WEEE (Waste Electrical and Electronic Equipment) and RoHS (Restriction of the Use of Hazardous Substances) directives. Our goal is to serve customer requests and fulfill legal demands with maximum efficiency and for complete customer satisfaction.

What is “green”?

ACCORDING TO Infineon Technologies’ nomenclature, a product that is produced using materials containing less than 1,000 ppm lead (Pb) content can be referred to as a “green product” which is RoHS compliant. Beyond this our aim also is to use only mold compounds and substrate materials that contain less than 900 ppm of chlorine and bromine (Cl+Br) and to avoid the use of brominated flame retardants where technically/economically possible.





Going “green”: from idea to action

EU directives

THE EUROPEAN COMMISSION has adopted a legislation designed to prevent both the generation of hazardous waste and to limit the build-up of electrical waste in general.

THE RoHS DIRECTIVE, to be implemented by 1 July, 2006, aims at prohibiting the use of hazardous materials in Electrical and Electronic Equipment (EEE). The RoHS mandates that companies limit their use of certain hazardous materials, such as lead and halogens, PBB (Poly Brominated Biphenyls) and PBDE (Poly Brominated Diphenyl Ethers). As Infineon Technologies presently does not use halogens, the RoHS only affects the lead content of our products. Exemptions within the directive are adopted by Infineon Technologies.

THE WEEE DIRECTIVE, to be implemented by 1 January, 2007, is mainly concerned with setting up and regulating an EU-wide system to recycle EEE. The WEEE names certain target values for a minimal percentage of recycled volume. Also mentioned are materials and parts “to be recycled separately.” For example, “plastics containing brominated flame retardants” are to be recycled separately. The WEEE affects the flame retardant of mold compounds and substrates used by Infineon Technologies.

BOTH DIRECTIVES have been adopted into national law of most EU member states at present.

Conversion road map

INFINEON had performed the major conversion to green products by 2004. More than 80% of our product spectrum is available as RoHS compliant today.

BASIS FOR OUR CONVERSION STRATEGY is the technical compatibility (a combination of lead-based and lead-free processes) of the green and non-green products which has already been proven effective in several trials. Infineon's customers will benefit by joining us in using the road map, as they will be able to take advantage of the full compatibility and a smooth transition, resulting in minimum efforts for conversion. The latest road map for conversion can be found at: <http://www.infineon.com/greenproduct>

Technology portfolio



Memory

- DRAM
- eDRAM
- Nonvolatile Memory
- Various Future Memory Technologies under review and development



CMOS

- Digital CMOS
- Analog/Mixed Signal
- eNVM
- eFlash/EEPROM



RF/Bipolar

- RF BICMOS
- Bipolar IC
- Bipolar Discretes
- Bipolar MMIC



Power/Analog

- Bipolar
- Analog
- Smart Power
- Smart (SmartMOS CD)
- SiC Devices
- DMOS (OptiMOS)
- HV-DMOS (CoolMOS)
- IGBT
- Fast Recovery Diodes



MEMS

- Temperature
- Hall
- Pressure
- Inertia
- RF MEMs

“Green Conversion” – streamlining our processes

Compatibility

LEAD-FREE PLATED PRODUCTS can be assembled with both lead-free and lead bearing solder pastes, while board level reliability is determined by the solder paste rather than by the component finish. This has been investigated in studies by Infineon and several institutes. Billions of parts have already been shipped to the market.

PRODUCTS WITH LEAD-FREE SOLDER BALLS (BGA-packages) might need adjustments if the reflow process is done with lead-based solder paste. Therefore conversion of BGAs will be done in close contact with the customers. More details will be published in the product/process change notification (PCN).

“Green materials”:

- Lead-free solder balls: SnAgCu
(Products with BGA packages)
- Lead-free plating: pure Sn (matt)
(Products with leadframe packages)
- Halogen-free materials

Compatibility L/F packages*

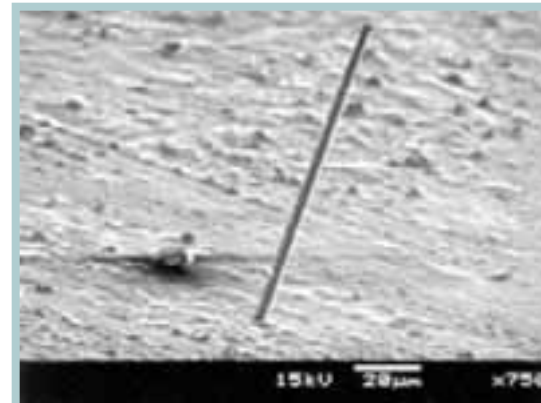
		customer →	
supplier ↓		Pb solder (215 – 240 °C)	Pb-free solder (235 – 260 °C)
		Increase temp. by approximately 20 °C	
Pb device	Some decades' experience of board assembly		Processability: OK Solderability: OK Reliability: OK <small>(NCMS, IDEALS report, internal evaluations)</small>
Pb-free device	Processability: OK Solderability: OK Reliability: OK		Processability: OK Solderability: OK Reliability: OK

* Compatibility is generally given as per the above table.

Individual solder material, board configuration and process parameters may result in restrictions.

Tin plating

PURE TIN (Sn) is an environmentally friendly alternative to lead. However, using pure tin is often seen as a riskier process due to the possibility of whisker growth. Whisker growth, a process in which a single crystal of tin grows spontaneously from a tinned surface, is most likely to occur in the period of time after galvanic plating and before the reflow process. Infineon has addressed the whisker problem and has defined whisker criteria and process steps (e.g. annealing at 150°C for 1 h) in order to avoid whisker risk.



Solderability

DURING THE INTERNAL EVALUATION PHASE to select possible “green materials,” Infineon placed utmost importance on the solderability of the given material. Multiple trials have proven good solderability of Sn finish and SnAgCu balls. Dip & look and wetting balance have shown good results for each possible combination of both lead-based and lead-free materials in the appropriate temperature range.

THE SOLDER JOINT RELIABILITY, or second level reliability, has also been evaluated. Positive effects in temperature cycle resistivity have been found. Test boards with a selection of typical leaded, non-leaded, area arrays and power packages did not show any electrical or mechanical failure even after 2,000 temperature cycles between -40°C and $+125^{\circ}\text{C}$. This is valid for Sn plating and SnAgCu balls in fast and slow ramp rate for temperature cycling, and also for the typical mechanical shock and vibration test.

Want more info?

Internet: <http://www.infineon.com/greenproduct>

For product-specific questions, please contact your sales partner.

Package reliability

CUSTOMERS ARE STARTING TO USE lead-free solder paste (SnAgCu) that in most cases needs a more than 20°C hotter reflow process than SnPb paste. Therefore, it is necessary that components are able to withstand these new requirements. One of the criteria for package reliability is the MSL classification regarding board assembly. The PC/JEDEC J/STD-020C defines the testing procedure for these new lead-free requirements. This has resulted in new Moisture Sensitivity Levels (MSL) based on 245°C and 260°C peak temperatures, opposed to the former peak temperatures of $220^{\circ}\text{C}/235^{\circ}\text{C}$. The individual MSL class for Pb-free board assembly may differ from the existing one.

