Philips Semiconductors

Chemical content of semiconductor devices 2002/2003

PHILIPS

Let's make things better.

ENVIRONMENTAL SAFETY

Offering maximum benefit – minimum impact
New technologies result in shared benefits for you our customers, balancing maximum technological benefits with minimum environmental impact. This starts with clever chip designs, which result in more compact applications with fewer external components. These chips, moreover, also reduce the consumption of raw materials, reduce packaging sizes and save energy. What's more, as more and more hazardous materials are eliminated from our products, costs of disposal at the end of their useful life get lower, again minimizing environmental impact.

All this is embodied in the concept of eco-design. Eco-designed products are those designed to improve functionality and minimize the environmental impact of a product through all stages of its lifetime, from source material, through the manufacturing process and working life to the end of its useful life. By 2002, 75% of Philips Semiconductors' products will be eco-designed.

Maintaining openness on environmental issues
Today, therefore, it is true to say that products supplied by Philips Semiconductors offer no hazard to the environment in normal operation and when stored according to the instructions given in our data sheets. Inevitably, some products contain substances that are potentially hazardous to health if exposed by accident or misuse, but we ensure that users of these products receive clear warning of this in the data sheets. And where necessary, the warning notices contain safety precautions and disposal instructions.

The present publication is intended to supplement these notices and instructions and to foster an atmosphere of openness on environmental issues. It does this by providing clear and comprehensive information on the composition of representative examples of every product manufactured by Philips Semiconductors. This information should form a basis for answering questions on product safety and disposal and should, moreover, help to increase awareness of these aspects.

In compiling information contained in this publication, every attempt has been made to ensure that it is as complete as possible. If, however, you have any remarks or criticisms, or ideas on how this publication could be improved, please don't hesitate to contact us.

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FOREWORD

AIMS OF THIS PUBLICATION

- To provide information on the composition of products manufactured by Philips Semiconductors
- To provide a basis for answering questions on product safety and disposal
- To give a clear indication of the type of data available in our technical centres

EXPLANATION OF THE TABLES.

The following pages provide the chemical constituents of representative groups of semiconductor components down to minor percentages and traces, as far as these constituents may be important to the use, destruction or disposal of the components.

Philips Semiconductors supplies more than 10 000 types of diode, transistor and integrated circuit. These semiconductors are assembled in some 200 standardized envelopes.

The tables contain information on the materials used in the semiconductor devices themselves and in the packing used for storage, transport and assembly.

Whenever possible, the devices have been grouped into families based on the similarity in composition, construction and packing method. In this way we were able to limit the number of tables. For each group, one representative is specified in mass and composition of its parts.

In many cases, a single envelope type will contain a range of differing leadframes with different die-pad dimensions to accommodate the active devices. This, however, leads to only minor changes in the mass percentages. Different materials or techniques are sometimes used to assemble one envelope type, and whenever possible, alternative materials are included in the tables. In other cases only the standard or high-volume process is described.

Per page, the product family is defined and the types identified by the Philips package code number. Additionally, reference is made to usual names or to the JEDEC code (when applicable). For ICs, the reference is used as the first index, for practical reasons. The mass (grams), body dimensions (mm) and the packing quantity are also specified. All products within each family have similar compositions, quantities may vary.

The table itself shows the composition of the group representative broken down into the device-parts:

- metal parts
- active device
- envelope (plastic, glass or ceramic)
- packing materials

The device-parts are specified in milligrams (mg). The values in general are accurate with a tolerance of 10%, owing to deviations between batches and process variables. For plated materials allow a tolerance of 25%. These figures are as accurate as possible for the group representative shown. Other devices from the same group may differ considerably in mass.

The amount of packing material, specified in grams, per device can be found by dividing the weight of the packing material by the packing quantity.

Metal parts

The composition of the leadframe material is indicated in percentages, when appropriate, by the method commonly used for alloys, e.g.:

- FeNi42 means iron alloy containing 42% of nickel (alloy 42).
- CuZn15 means copper alloy containing 15% zinc (tombac).
- Cu alloy indicates copper with a small amount of alloying elements such as Fe, Ni, Zn or Ag or combinations of some elements.

Note: Part of the leadframe outside the body may be plated with Sn or SnPb to guarantee solderability. It is our intention to eliminate Pb from the solder wherever possible. Most of our DIP products have leads coated with pure tin or with nickel/palladium (Ni/Pd) In other packages the lead content of the coating has been reduced from 20% to 15%.

Active device (die)

The active device is usually a silicon chip doped with very small amounts of elements such as boron, arsenic or phosphorus. The back may be metallized with thin layers of titanium, nickel, platinum, gold or silver to enhance die-bonding to the leadframe. In a number of devices, the contacts to the leadframe are made with gold or aluminium wire.

Note: the die-attach material in all plastic-encapsulated products contains on average 0.5% Au/Ag which is recoverable on recycling.

Envelope

The chip is protected by a glass, ceramic, plastic or metal encapsulation. Glass will contain SiO_2 plus a number of oxides of Ba, K, Pb, Zn and Mn. These elements are, however, immobilized and will not be extracted by acids, unless the glass is ground.

The plastic encapsulation is usually based on ortho cresol novolac (OCN)-epoxy, biphenyl- or multifunctional- epoxy, filled with quartz particles (fused or crystalline) of approximately 70 mass percent. In all cases (except SOT54, LQFPs andTQFPs), antimony trioxide and tetrabromobisphenol-A (TBBA) are present as flame retardants. The TBBA will be incorporated in the epoxy-polymer after curing so that no TBBA is present in the finished device. It has become a *partially brominated epoxy*. The flammability of all moulding compounds rates typically UL94-V0 at 1/8 inch. (see page 6 for explanation).

Environmental Information

Packing material
Cardboard and paper consist mainly of natural fibres. The carbon layer for ESD protection does not hamper the recyclability of the cardboard.

Polyethylene, polypropylene and polystyrene are synthetic polymers made from hydrocarbons.

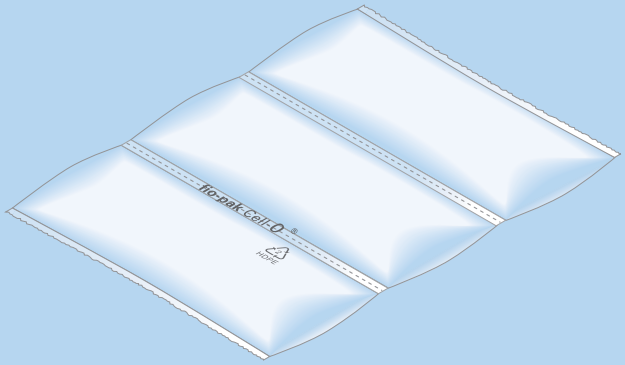
Polyvinylchloride (PVC), a synthetic polymer made from chlorinated hydrocarbons, is used for the tubes in which many semiconductors are packed. PVC is hazardous to the environment when burned under certain, ill-controlled conditions. PVC is, however, readily recyclable when the material is collected separately (as a mono-material). Therefore the application of paper labels, glued on the tubes should be avoided. The endpins and turnlocks are made of PVC to enhance recycling.

Re-use of the polystyrene (PS) reels is encouraged by requesting all our customers to return the reels after use to SemiCycle - a company set up to collect empty reels and sell them back to us. To facilitate this process, our reels are now manufactured as single-piece units instead of the assembled units used formerly. Much lighter than earlier reels, the new reels are more economical to recycle and can be reused an average of 5 times, significantly cutting polystyrene usage.

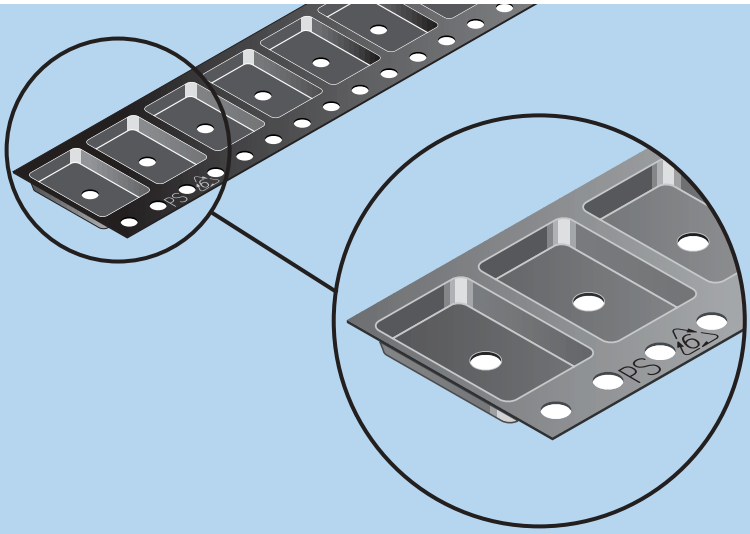
Recycling symbols and the address of your nearest SemiCycle contact are printed on the boxes in which the reels are delivered.

To encourage recycling, Philips Semiconductors marks the packing materials according to ISO 11469 using the recycling symbols shown here:

Paper and cardboard



Polyethylene, high density

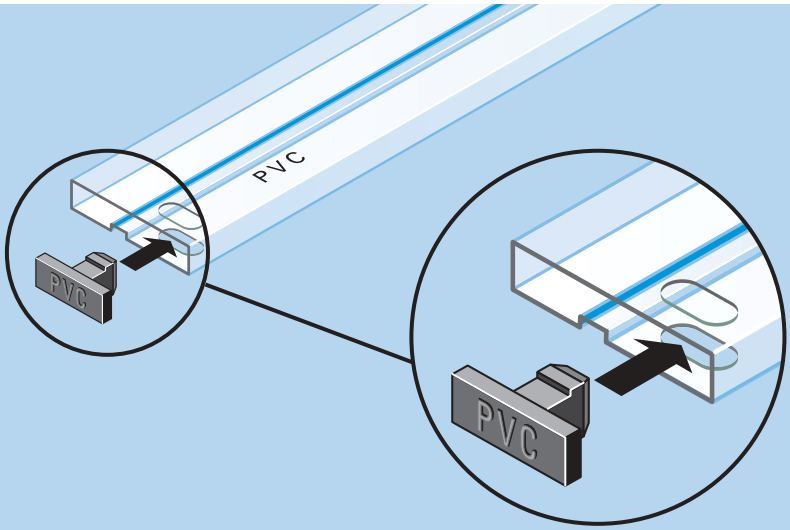


06
PS

Polystyrene

06
PS

Polystyrene



03
PVC

Polyvinylchloride

GENERAL SAFETY REMARKS

Oxygen index

A material's resistance to burning is expressed by its *oxygen index*. This is defined as the minimum concentration of oxygen, expressed as volume per cent, in a mixture of oxygen and nitrogen that will just support flaming combustion of the material initially at room temperature. All plastics used in Philips Semiconductors products are specified with an oxygen index between 28% and 35% meeting international flammability requirements.

The oxygen index is measured using the standard ATSM test method designated D 2863 - 91. This test method has been found applicable for testing various forms of plastic materials, including film and cellular plastic. According to this test, the minimum concentration of oxygen that will just support combustion of the specimen in a mixture of oxygen and nitrogen flowing upward in a test column is measured under equilibrium conditions of candle-like burning. The equilibrium is established by balancing the heat lost to the surroundings with the heat generated from combustion of the specimen as measured either over a specified time of burning or length of specimen burned. The critical oxygen concentration is approached from both sides (i.e. from below and from above) to establish the oxygen index.

Beryllium oxide

Despite our constant improvement of components and processes with respect to environmental demands, some components unavoidably contain substances such as beryllium oxide that, if exposed by accident or misuse, are potentially hazardous to health. Users of the components are informed of the danger by warning notices in the data sheets supporting the components. Obviously, users of these components assume responsibility towards the consumer with respect to safety matters and environmental demands.

All used or obsolete components should be disposed of according to the regulations applying at the disposal location. Depending on the location, electronic components are considered to be 'chemical', 'special' or sometimes 'industrial' waste. Disposal as domestic waste is usually not permitted.

Underwriters Laboratories (UL)

UL is the leading third-party certification organization in the United States and the largest in North America. As a non-profit product-safety testing and certification organization, UL has been evaluating products in the interest of public safety since 1894. The organization specializes in holistic product and company evaluations, including safety, performance, energy efficiency, environmental and public health issues, electromagnetic compatibility, quality and environmental management system registration and inspection services. It also specializes in national and international codes and standards development and harmonization.

The UL mark assures acceptance of products in North America, Europe, Asia Pacific, Asia and around the world through the most extensive network of testing, quality and certification organizations.

UL94 refers to standard "Tests for Flammability of Plastic Materials for Parts in Devices and Appliances" V0 means that the test sample complies with the highest requirements of the test.

SUBSTANCES NOT USED BY PHILIPS SEMICONDUCTORS

SUBSTANCES NOT USED IN PRODUCTS

Appendix I lists the materials and substances that are not present in Philips Semiconductors' products and processes. This information supplements the chemical contents tables that follow and is provided to enable equipment manufacturers to make a complete and confident assessment of the environmental impact of selecting products manufactured by Philips Semiconductors.

SUBSTANCES NOT USED IN MANUFACTURING PROCESSES

Philips Semiconductors has eliminated all Ozone Depleting Substances, referred to as Class I and II in the Montreal Protocol and its amendments. These are listed in Appendix II. This means that our products, in compliance with the US Clean Air Act, do not have to be labelled.

We have also eliminated, voluntarily, the use of chlorinated hydrocarbons such as perchloro-ethylene and trichloro-ethylene from our manufacturing processes.

SUBSTANCES NOT USED IN PACKING MATERIALS

- Laminates with paper
- Bleached paper
- Polystyrene flakes (EPS)

DISPOSAL AND RECYCLING

DISPOSAL

Old or used products must be disposed of in accordance with national and local regulations.

The products and packing materials must be disposed of as special waste. This is required, in particular, for parts containing environmentally hazardous materials, for example beryllium oxide, present in some RF-devices.

Smaller quantities of material may be disposed of as domestic waste, provided national or local regulations permit this.

RECYCLING

Where legally required, we accept packing materials and products for recycling and/or disposal. However, since the cost of returning these materials to us must be borne by the customers, it is often more cost effective for them to look for a local recycle company. To assist in this we can provide customers with the names and addresses of local recycle companies in their areas.

In many devices precious metals (gold and silver) are present. The content maybe 0.5% or higher.

For the recycling of semiconductor trays, we refer customers to SemiCycle which offers a highly user-friendly recycling service. When contacted, SemiCycle will arrange collection of empty trays at its own expense and ship the trays to its recycling plant located in Shenzhen, China. After processing, the recycled trays are offered for sale to semiconductor manufacturers. For more information on SemiCycle's service, visit the company's web site on www.semicycle.com.

GENERAL WARNINGS

PRODUCTS

Under the specified operating conditions, no hazardous materials will be liberated from the products. The general warnings describe phenomena that can be expected with **abnormal** use (outside the product's specification). For example:

- If a product is exposed to strong acids, metals contained within it may be partially extracted.
- If a product with an epoxy moulded envelope is exposed to organic solvents, these may extract part of the resin contained in the envelope.
- If the product is incinerated, degradation and condensation reactions in the organic material it contains may cause a number of hazardous substances to be released into the air in unpredictable amounts. Moreover, metal oxides will be formed and may be released into the air as dust particles.
- If products with beryllium heatsinks (RF transistors) are damaged, toxic beryllium oxide dust may be released into the air.

PACKING MATERIAL

- With adequate oxygen supply, packing materials will give off mainly carbon dioxide and water if burned. However, if they are burned in a limited oxygen supply (the general case in a fire), hazardous compounds (for example carbon monoxide) may be emitted.
- PVC will form hydrochloric acid gas when incinerated. It will also generate a number of other chlorine compounds, among them the toxic dioxin, when the conditions (temperature, oxygen) are not well controlled.

DISCLAIMER

The information presented in this publication does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice. No liability will be accepted by the publisher for any consequence of its use. Publication thereof does not convey nor imply any license under patent- or other industrial or intellectual property rights.

DISCRETE SEMICONDUCTORS

Glass diodes/rectifiers, leaded

reference	package code	mass (mg)	packing quantity
DO-35	SOD27	137	5000
DO-41	SOD66	345	5000
DO-34	SOD68	118	5000
IT	SOD 81	277	5000
IT	SOD91	121	5000

IT = Implotec™

Glass diodes/rectifiers, SMD

reference	package code	mass (mg)	packing quantity
-	SOD80	35	2500
IT	SOD87	50	2500

IT = Implotec™

Chemical content SOD68

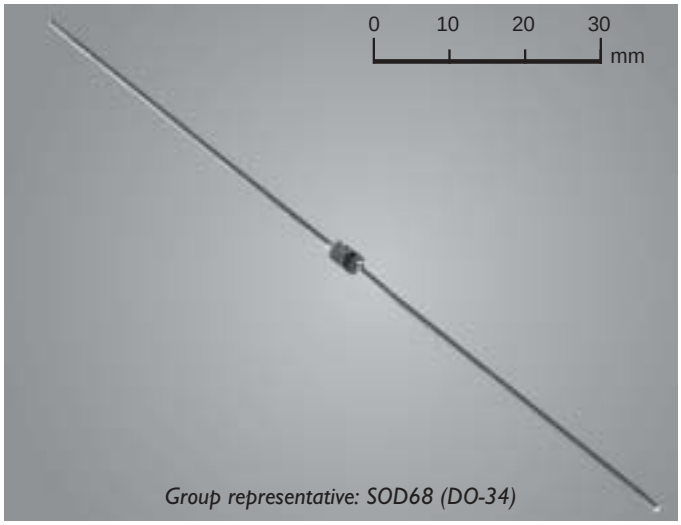
Device part	substance	mass (mg)
stud	FeNi42, cladded with Cu*	10.5
wire	Fe cladded with Cu	88
	SnPb20 plated	2.2
active device	doped Si	0.05
encapsulation	glass	17
	Pb < 58%	
	Sb < 0.5%	
paint/pigment	epoxy copolymer	0.1
Packing material (ammo pack)		**(g)**
box	paper	132
tape	kraft paper	20
tape	polypropylene	19.6
seal	acrylate	0.2

* Mo studs for implosion types

Chemical content SOD87

Device part	substance	mass (mg)
stud	Mo*	19.5
flange	Cu	15.0
	SnPb20 plated	2.5
active device	doped Si	0.4
encapsulation	glass	15.5
	Pb < 54%	
	Sb < 0.5%	
paint/pigment	epoxy copolymer	0.1
Packing material (reel pack)		**(g)**
box	cardboard	56
reel	polystyrene	37
carrier tape	polycarbonate, carbon loaded	18.8
cover tape	polyester	3.3

* SOD80: FeNi42 cladded with Cu



Group representative: SOD68 (DO-34)

Group representative: SOD87

Glass bead rectifiers and stacks

reference	package code	mass (mg)	packing quantity
-	SOD57	356	2500
EHT-stack	SOD61	250	5000
-	SOD64	833	4000
EHT-stack	SOD83	1020	2000
EHT-stack	SOD88	427	5000
EHT-stack	SOD89	1196	2000
–	SOD119	340	5000
–	SOD121	166	8000

Diodes in hermetically-sealed plastic package

reference	package code	mass (mg)	packing quantity
-	SOD107	307	10000
-	SOD118	178	12000
-	SOD125	360	12000

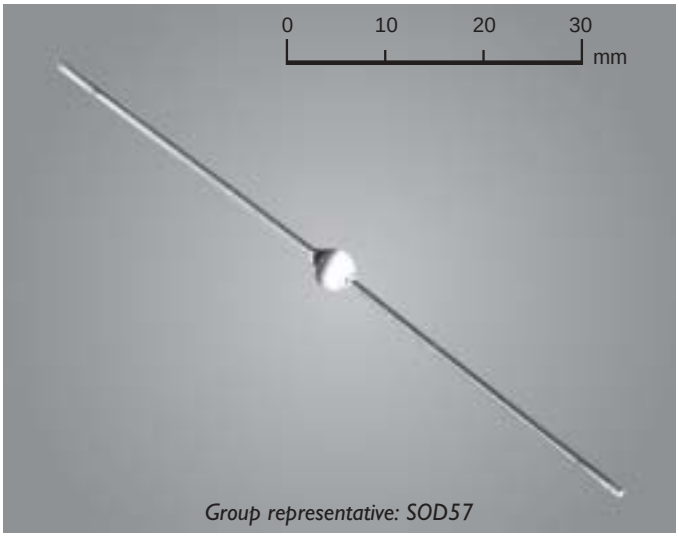
Chemical content SOD57

Device part	substance	mass (mg)
stud	Mo	51
wire	Fe cladded with Cu	251
	SnPb20 plated	2
brazing pellet	AgCu28Ge2Co0.3	1.6
active device	doped Si	1*
encapsulation	glass	50
	Pb < 58%**	
	Sb < 0.5%	
Packing material (ammo pack)		**(g)**
box	paper	552
tape	kraft paper	30
label	paper	4
tape	polypropylene	7
seal	acrylate	0.2

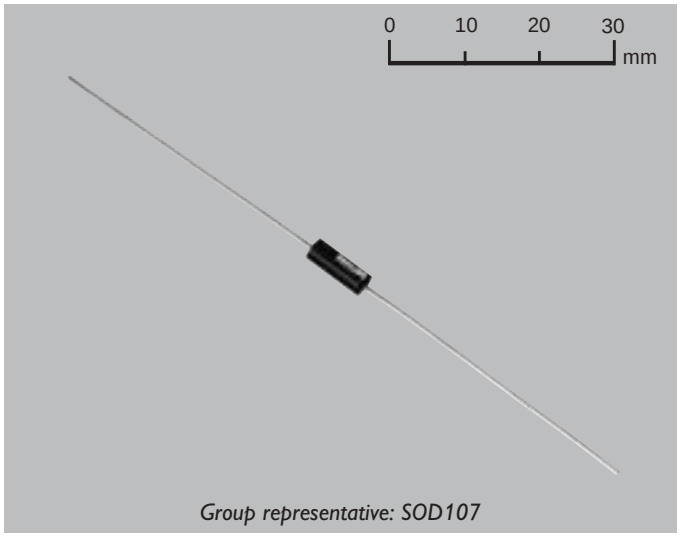
* may be higher for EHT stacks ** in stacks Pb < 6%, ZnO = 59%

Chemical content SOD107

Device part	substance	mass (mg)
wire	Fe cladded with Cu	134
	SnPb15 plated	1.6
stud	Mo	18
brazing pellet	AgCu28Ge2Co0.3	1.5
active device	doped Si	3
encapsulation	zinc borosilicate glass	33
	epoxy	116
Packing material (reel pack)		**(g)**
box	cardboard	56
reel	polystyrene	74
carrier tape	polycarbonate, carbon loaded	22.6
cover tape	polyester	4
labels	paper	2.1
seal	acrylate	0.2



Group representative: SOD57



Group representative: SOD107

Diodes in plastic package, SMD

reference	package code	mass (mg)	packing quantity
-	SOD106	64	1500
-	SOD124	66	1500
-	SOD323	5.0	3000
SC79	SOD523	2.1	3000
-	SOD723	0.9	8000

Small signal ceramic diode, SMD

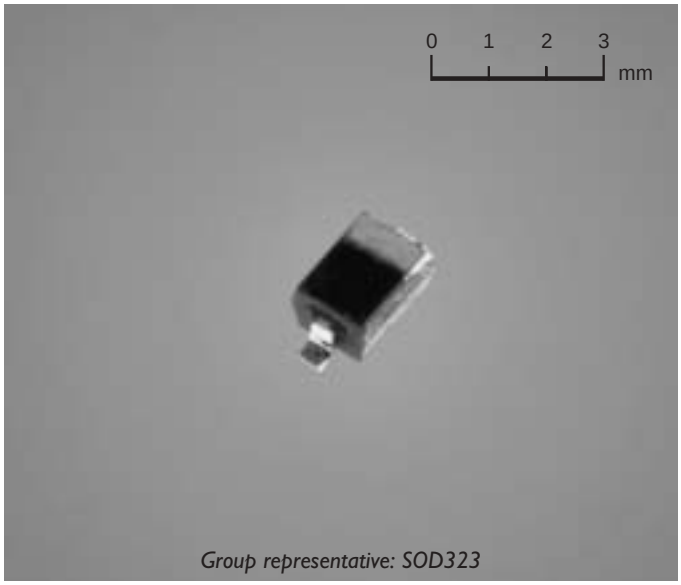
reference	package code	mass (mg)	packing quantity
-	SOD110	10	3000

Chemical content SOD323

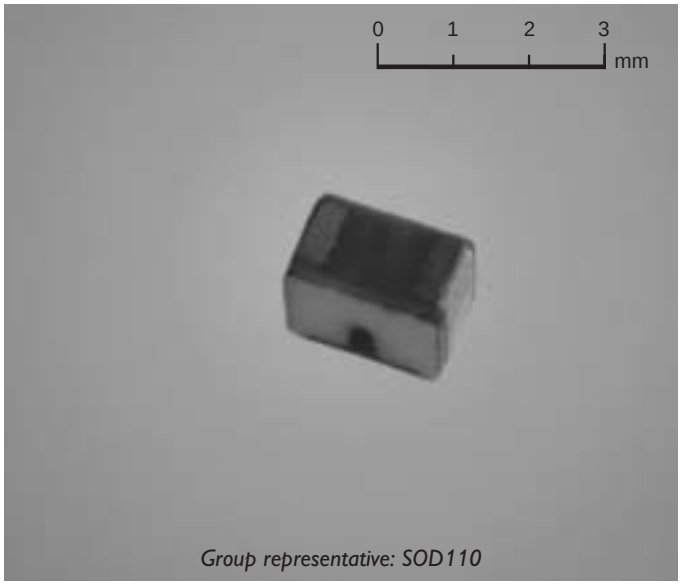
Device part	substance	mass (mg)
leadframe	Cu,	1.23
	SuPb20 plated	0.2
active device	doped Si	0.07
encapsulation	partially brominated epoxy	3.5
	SiO_2 < 72%	
	Sb < 2%	
	Br < 1%	
Packing material (reel pack)		**(g)**
box	cardboard	47
reel	polystyrene	38
carrier tape	polycarbonate,	
	carbon loaded	22.6
cover tape	polyester	4
labels	paper	2.1
seal	acrylate	0.2

Chemical content SOD110

Device part	substance	mass (mg)
envelope	Al_2O_3, SiO_2	8.2
	plated with Cu+SnPb20	1
encapsulation	OCN-epoxy polymer	0.8
	SiO_2 < 70%	
active device	doped Si	< 0.1
Packing material (reel pack)		**(g)**
box	cardboard	56
reel	polystyrene	38
carrier tape	polycarbonate,	
	carbon loaded	22.6
cover tape	polyester	4
labels	paper	2.1
seal	acrylate	0.2



Group representative: SOD323



Group representative: SOD110

Power diodes in plastic package

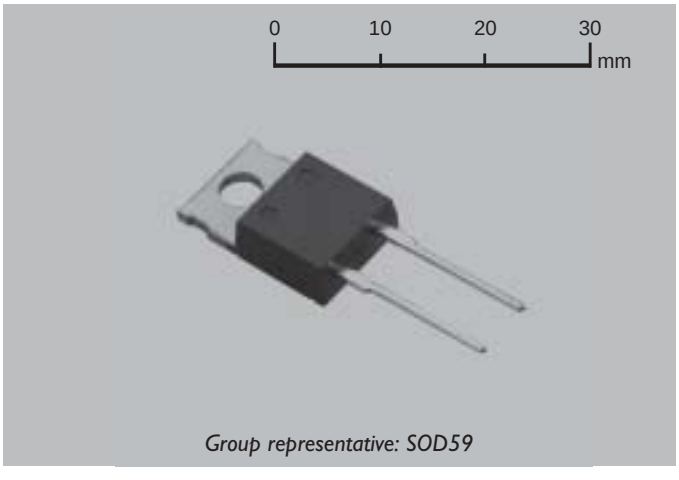
reference	package code	mass (g)	packing quantity
2 lead TO-220	SOD59	1.92	1000
2 lead TO-220 low profile	SOD95	1.50	1000
2 lead TO-220F (SOT186)	SOD100	2.07	1000
2 lead TO-220 (SOT186A)	SOD113	1.97	1000
2 lead SOT399	SOD117	5.77	500

Flange-mounted ceramic RF power transistors (BeO heat spreader)

reference	package code	mass (g)	packing quantity
-	SOT119	5.16	40
-	SOT121B	5.00	40
-	SOT123	3.90	40
-	SOT161	3.50	40
-	SOT171	3.60	40
-	SOT262	8.00	16
-	SOT268	7.40	60
-	SOT273	6.90	60
-	SOT289	8.20	40
-	SOT324	3.58	32

Chemical content SOD59

Device part	substance	mass (mg)
leadframe	Cu	1320
	SnPb30 plated	20
solder pellet	SnAg25Sb10	20
encapsulation	partially brominated epoxy	540
	SiO_2 < 85%	
	Sb < 3%	
	Br < 1.4%	
active device	doped Si	20
Packing material (reel pack)		**(g)**
box	cardboard	123
tubes	polyvinylchloride	700
turn locks	polyvinylchloride	20
labels	paper	15
tape	polypropylene	0.6
seals	Acrylate	0.2

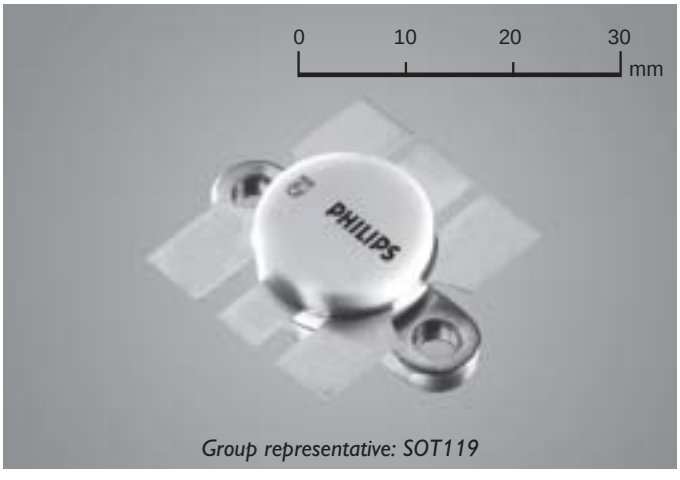


Group representative: SOD59

Chemical content SOT119

Device part	substance	mass (mg)
flange	Cu*	4120
leadframe	FeNi42	270
	Au plated	
brazing alloy	AgCu28	20
encapsulation	Al_2O_3	200
heat spreader	BeO, plated with Mo/Ni/Au	540
active device	doped Si	10
glue	polyimide	40
Packing material (blister pack)		**(g)**
box	cardboard	262
foam	polyethylene	1.2
blisters	polystyrene	114
labels	paper	2
tape	polypropylene	0.1
seal	acrylate	0.5

* some types: WCu15 flange



Group representative: SOT119

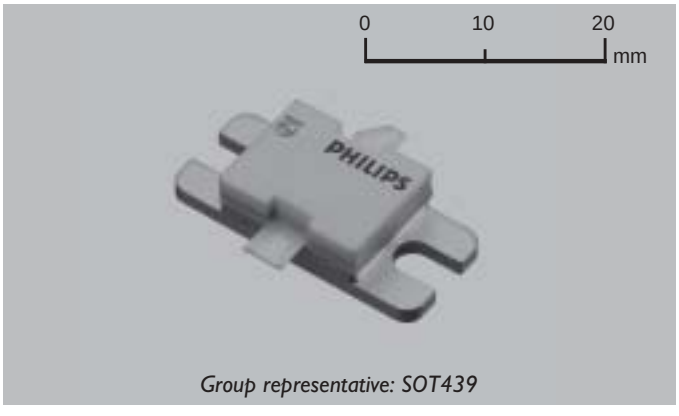
Flange-mounted ceramic RF power transistors (BeO heat spreader)

reference	package code	mass (g)	packing quantity
-	SOT391A	5.0	60
FO238	SOT422	1.79	32
FO239	SOT423	5.93	32
FO229	SOT437	2.70	32
FO91B	SOT439	6.30	32
FO41B	SOT440	1.50	32
FO57	SOT443	6.15	32
FO83	SOT445	1.50	32
FO231	SOT448	7.63	32

Chemical content SOT439

Device part	substance	mass (mg)
flange	Cu*	4815
leadframe	FeNi42	35
	Au plated	
brazing alloy	AgCu28	66
encapsulation	Al_2O_3	636
heat spreader	BeO, plated with Mo/Ni/Au	748
active device	doped Si	5
glue	polyimide	10
Packing material (blister pack)		**(g)**
box	cardboard	232
foam	polyethylene	5
blisters	polystyrene	64
labels	paper	8
tape	polypropylene	0.1
seal	acrylate	1.4

* some types: WCu15 flange



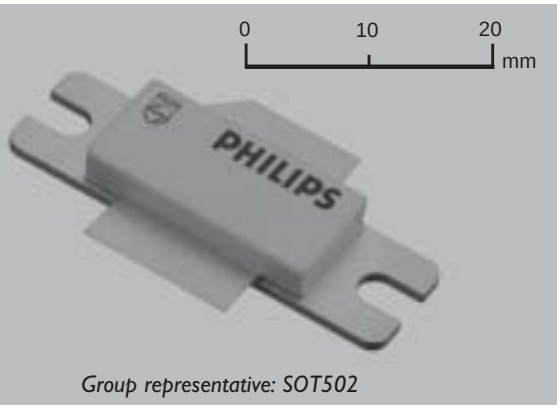
Group representative: SOT439

Flange-mounted ceramic RF power transistors (AlN-heat spreader)

reference	package code	mass (g)	packing quantity
-	SOT390	2.80	60
-	SOT460	10.0	40
-	SOT467	2.94	60
-	SOT468	4.99	60
-	SOT473	6.30	32
-	SOT494	7.76	60
-	SOT502	6.20	60
-	SOT504	2.89	60
-	SOT539	12.25	60
-	SOT540	9.69	60
-	SOT541	7.10	60
-	SOT608	2.40	60

Chemical content SOT502

Device part	substance	mass (mg)
flange	WCu 15	5050
leadframe	FeNi 42 plated with Ni+Au	185
substrate	Al_2O_3	185
cap	ceramic AD96	750
active device	2 dies	20
passive devices	4 capacities	12
glue	Ablestick 551	9
Packing material (reel pack)		**(g)**
box	cardboard carbon-coated	238
foam	polyethylene	7.5
blisters	polystyrene	171
labels	paper	3.1
tape	polypropylene	0.08
seal	acrylate	0.6



Group representative: SOT502

Stud-mounted ceramic RF power transistors

reference	package code	mass (g)	packing quantity
-	SOT120A	3.00	40
-	SOT122A	1.90	40
-	SOT172A	1.40	40
Microwave	SOT442	1.48	40

Ceramic RF transistors in pill package

reference	package code	mass (g)	packing quantity
-	SOT122D	0.70	40
-	SOT172D	0.30	40
-	SOT391	5.40	60
SMD 8 leads	SOT409	0.14	200
-	SOT441	2.00	40
SMD 2 leads	SOT538	0.14	160

Chemical content SOT122A

Device part	substance	mass (mg)
stud*	Cu	800
leadframe	FeNi42** plated with Ni+Au	150
nut	CuZn37, Ni plated	630
brazing alloy	AgCu28	30
encapsulation	Al_2O_3	120
heat spreader	BeO, plated with Mo/Ni/Au	120
active device	doped Si	10
glue	polyimide	40
Packing material (blister pack)		**(g)**
box	cardboard	262
foam	polyethylene	1.2
blisters	polystyrene	114
labels	paper	2
tape	polypropylene	0.1
seal	acrylate	0.5

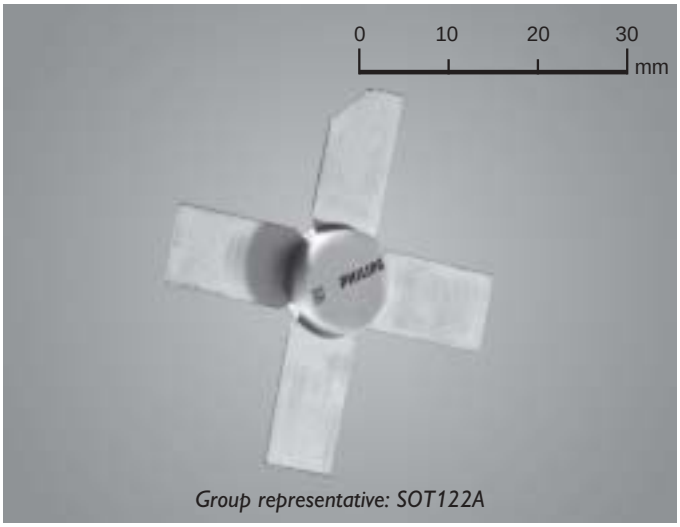
* SOT122C has a disk instead of a stud

** SOT122A2: FeNiCo leadframe

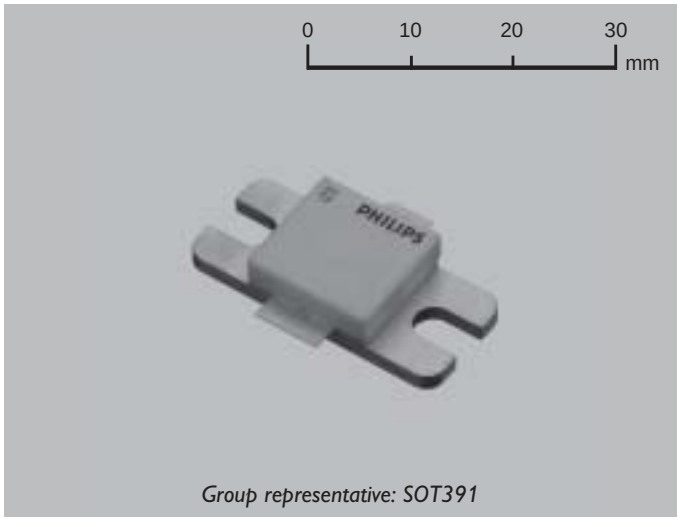
Chemical content SOT391

Device part	substance	mass (mg)
leadframe	FeNi42* goldplated	270
brazing alloy	AgCu28	20
encapsulation	Al_2O_3	500
heat spreader	BeO, plated with Mo/Ni/Au	750
active device	doped Si	70
glue	polyimide	40
Packing material (blister pack)		**(g)**
box	cardboard	263
foam	polyethylene	2
blisters	polystyrene	171
labels	paper	4
tape	polypropylene	1
seal	acrylate	0.6

* FeNiCo in SOT119A1 and SOT289



Group representative: SOT122A



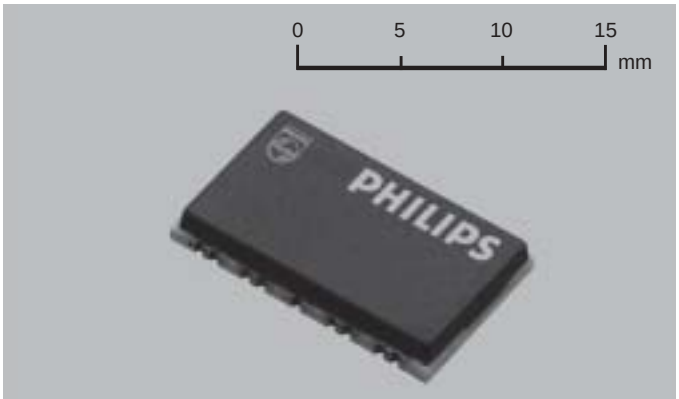
Group representative: SOT391

Ceramic Power Amplifier Modules

reference	package code	mass (g)	packing quantity
-	SOT482	0.36	2000
-	SOT559	0.50	1700
-	SOT596	0.10	2800
-	SOT632	0.31	2400

Chemical content SOT482

Device part	substance	mass (mg)
substrate	Al_2O_3 rear coated Ag/Pt/Pd	270
bond-wire	Au	13
encapsulation	polyphtalamide	50
passive comp.	$BaTiO_3$, Ag	7
active device	doped Si	10
glue		10
Packing material (reel pack)		**(g)**
box	cardboard	174
reel	polystyrene	280
carrier tape	polystyrene	218
cover tape	PET	32
labels	paper	4
bag	polyethylene, Al coated	30
seal	acrylate	0.2



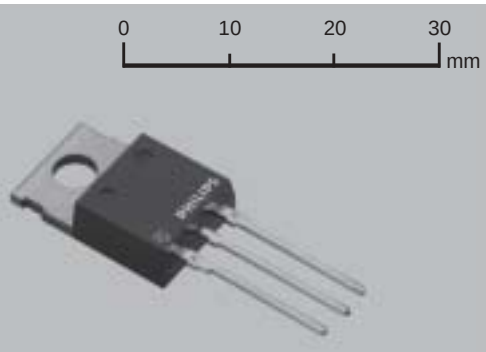
Group representative: SOT482

Power transistors in plastic package

reference	package code	mass (g)	packing quantity
TO-220	SOT78	1.91	1000
-	SOT82	0.75	1000
-	SOT186	2.10	1000
-	SOT186A	2.00	1000
-	SOT199	5.50	500
	SOT226	1.50	1000
pentawatt	SOT263	2.00	1000
5 lead TO220	SOT281	1.55	1000
-	SOT399	5.89	500
3 lead TO247	SOT429	5.42	500
3 lead JUMBO	SOT430	9.90	200
IPAK	SOT533	1.30	3750

Chemical content SOT78

Device part	substance	mass (mg)
leadframe	Cu, Ni plated	1350
	SnPb30 plated	20
solder pellet	SnAg25Sb10	20
encapsulation	partially brominated epoxy SiO_2 < 85% Sb_2O_3 < 3% as Sb TBBA < 1.4% as Br	500
active device	doped Si	20
Packing material (tube pack)		**(g)**
box	cardboard	155
tubes	polyvinylchloride	670
turn locks	polyvinylchloride	23
labels	paper	2.7
tape	polypropylene	0.1
seals	acrylate	0.2



Group representative: SOT78

Surface-mount power transistors in plastic package

reference	package code	mass (g)	packing quantity
-	SOT223	0.12	1000
D2 pack	SOT404	1.49	800
D2 (4 leads)	SOT426	1.46	800
D2 (6 leads)	SOT427	1.49	800
D pack	SOT428	0.35	2500

Magnetic sensor packages

reference	package code	mass (g)	packing quantity
-	SOT453A	0.23	1300
-	SOT453B	1.60	600
-	SOT453C	0.65	800
-	SOT477A	0.24	1300
-	SOT477B	1.61	600
-	SOT477C	0.66	800

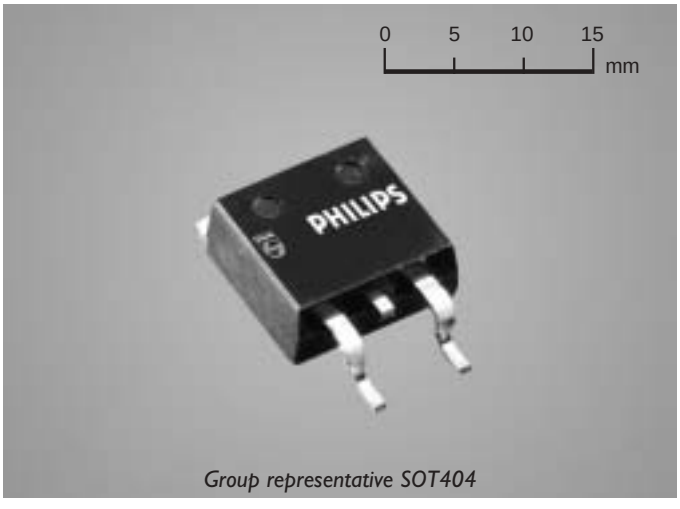
Chemical content SOT404

Device part	substance	mass (mg)
leadframe	Cu, Ni plated	800
	SnPb20 plated	5
solder pellet	SnAg25Sb10*	5
bond wire	Al	50
encapsulation	partially brominated epoxy SiO_2 < 77% Sb_2O_3 < 1% as Sb TBBA < 1.6% as Br	600
active device	doped Si	20
Packing material (reel pack)		**(g)**
box	cardboard	174
reel	polystyrene	325
carrier tape	polystyrene, carbon loaded	119
cover tape	polyester	17
labels	paper	0.8
tape	polypropylene	0.1
seals	acrylate	0.1

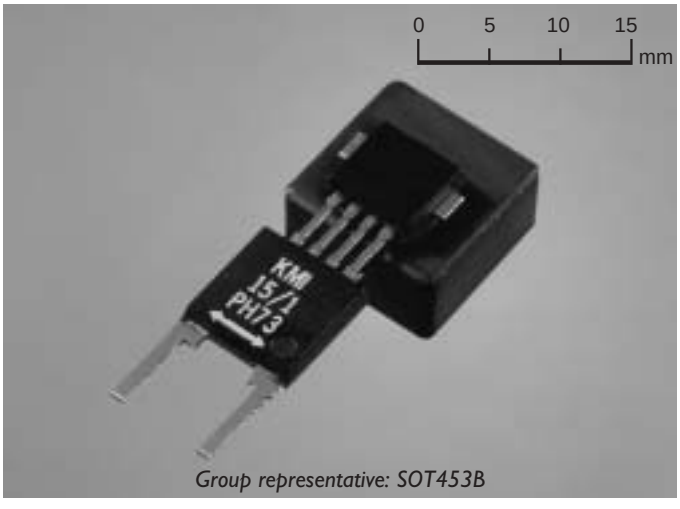
* optional PbSn5 solder pellet

Chemical content SOT453B

Device part	substance	mass (mg)
leadframe	CuZr0.2 with Ag spot	76
bond-wire	Au	<0.2
solder layer	Sn	7
encapsulation	partially brominated epoxy SiO_2 < 72% Sb_2O_3 < 3% as Sb TBBA < 2% as Br	110
glue	for die + magnet	0.8
magnet	$BaFe_{12}O_{19}$	1400
magnetic field sensor device	Si with thin metal films	1.2
active device	doped Si, Al, TiW	5
Packing material (reel pack)		**(g)**
box	cardboard	193
reel	polystyrene	325
carrier tape	polycarbonate, carbon loaded	140
cover tape	PET	19
labels	paper	5
seal	acrylate	1



Group representative SOT404



Group representative: SOT453B

Small-signal transistors and sensors in plastic package

reference	package code	mass (g)	packing quantity
-	SOD70	0.20	1000
TO-92	SOT54	0.25	2000
-	SOT195	0.16	1000

Transistors in plastic package, SMD

reference	package code	mass (mg)	packing quantity
-	SOT23	8	3000
SC62	SOT89	54	1000
-	SOT143	8.7	3000
SC70-3	SOT323	5	3000
-	SOT343	6	3000
SC59	SOT346	8	3000
SC88a	SOT353	5.6	3000
SC88	SOT363	6.4	3000
SC75	SOT416	2.5	3000
SC74	SOT457	11	3000
SC89	SOT490	2.5	4000
-	SOT665	2.8	4000
-	SOT666	2.9	4000

Chemical content SOT54

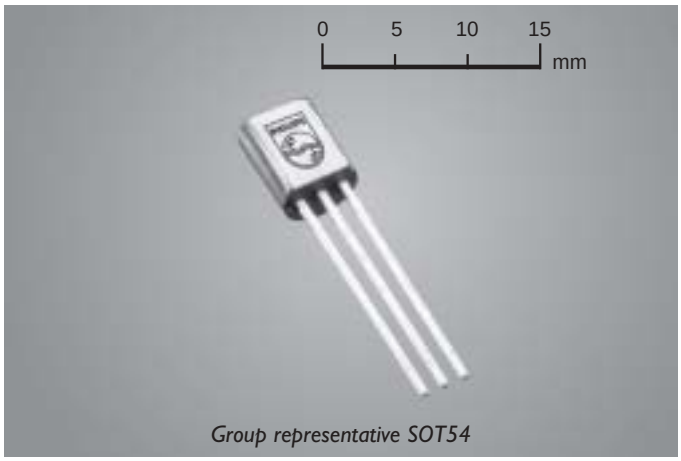
Device part	substance	mass (mg)
leadframe	CuZn15, Co + Au plated	113
	SnPb plated	1.5
active device	doped Si	0.5
encapsulation*	partially brominated epoxy	135
	SiO_2 < 72%	
	Sb_2O_3 < 3% as Sb	
	TBBA < 1.4% as Br	
Packing material (ammo pack)		**(g)**
box	cardboard	97.5
carrier tape	kraft paper	110
buffer	cardboard	20

* alternative: two-shot encapsulation of epoxy and PPS

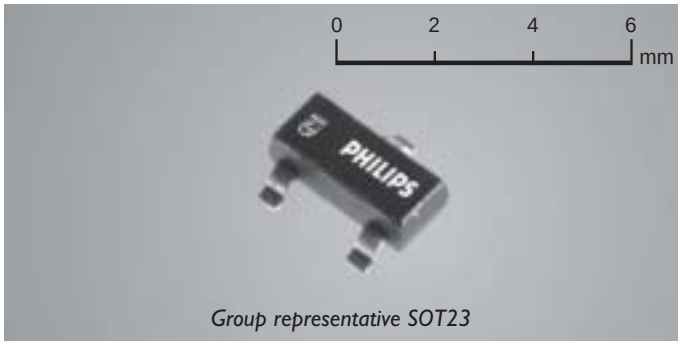
Chemical content SOT23

Device part	substance	mass (mg)
leadframe	FeNi42, Cu plated *	2.54
	SnPb20 plated	0.3
bond wire	Au	0.06
active device	doped Si	0.1
encapsulation	partially brominated epoxy	5.0
	SiO_2 < 72%	
	Sb_2O_3 < 2% as Sb	
	TBBA < 1% as Br	
Packing material (reel pack)		**(g)**
box	cardboard	47
reel	polystyrene	38
carrier tape	polycarbonate, carbon loaded	26
cover tape	polyester	5
labels	paper	2.1
seal	acrylic	0.2

* in some cases (e.g. SOT490) Cu leadframe is applied



Group representative SOT54



Group representative SOT23

MODULES

RF-Modules

reference	package code	mass (g)	packing quantity
-	SOT365	23.17	160
-	SOT501	31.35	100
-	SOT608A	2.40	500
-	SOT649	0.41	1800

CATV-Module

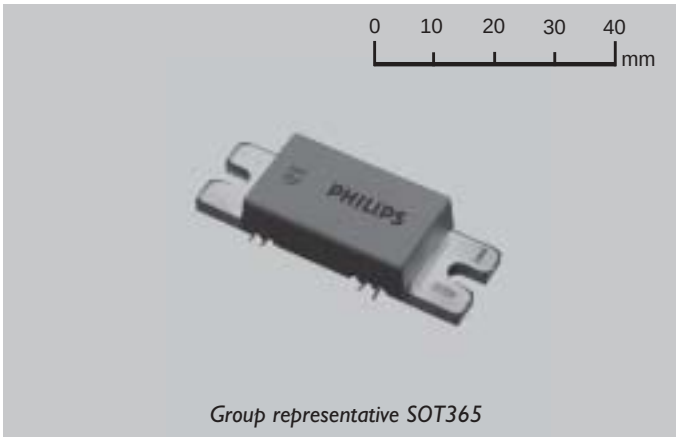
reference	package code	mass (g)	packing quantity
-	SOT115	14.4	100

Chemical content SOT365

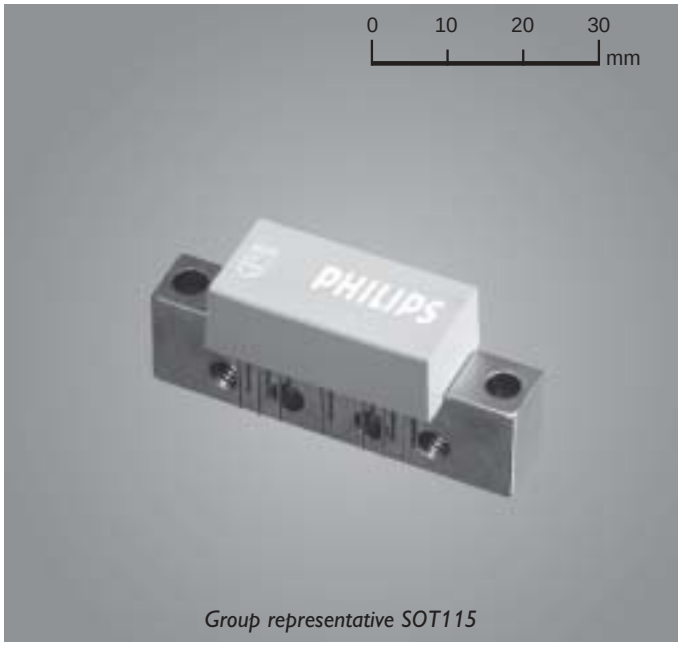
Device part	substance	mass (mg)
heatsink	Cu, Ni/Au plated	19190
leads	Fe, SnPb plated	80
solder	PbIn and SnAg	1120
bond wires	Au	
substrate	Al_2O_3 plated Au, Pt, Ag, Pd	1100
active devices	doped Si, Au metall.	
surface-mount capacitors	$BaTiO_3$, Ag	69
surface-mount resistors	Al_2O_3, Ru, Ni, Sn	54
cap	polyester	1310
glue	silicon rubber	250
Packing material (tube pack)		**(g)**
box/plate	paper	112
blister	polystyrene	123.5
blister	styrene/butadiene copol.	120
tape	polypropylene	0.8
seal	acrylate	0.2

Chemical content SOT115

Device part	substance	mass (mg)
heatsink	Al, Ni-plated	8000
leads	CuSn8, Au plated	200
solder	PbIn and SnAg	1000
bond wires	Au	60
alumina + thin film substrate	Al_2O_3 Au, Ni, Cr, Cu,	800
active devices	doped Si, Au metal.	60
surface-mount capacitors	$BaTiO_3$, Ag	1500
cap	PET	2200
glue	silicon rubber	600
Packing material (blister pack)		**(g)**
box	cardboard	707
blisters	polystyrene	124
label	paper	4
seal	acrylate	0.2



Group representative SOT365



Group representative SOT115

INTEGRATED CIRCUITS

Integrated circuits on wafer

reference (ø)	package code	mass (g)	packing quantity
100 mm	none	11.6	50
125 mm	none	18	50
150 mm	none	26	50
200 mm	none	46	25

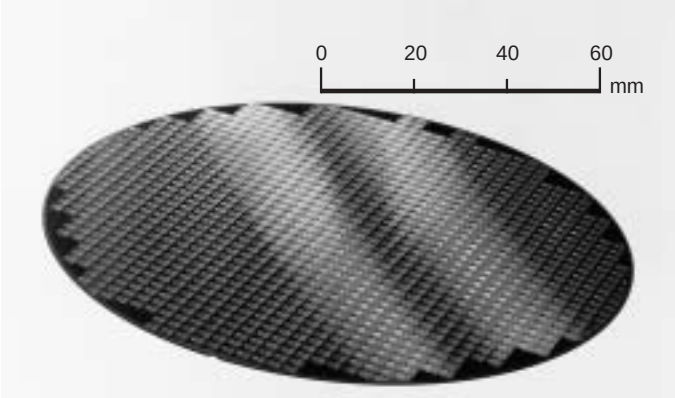
Dual in-line packages

reference	package code	mass (g)	packing quantity
DIP8	SOT97	0.48	2000
DIP14	SOT27	1.09	1000
DIP16	SOT38	0.95	1000
DIP18	SOT102	1.21	800
DIP20	SOT146	1.27	720
DIP24	SOT101	3.65	360
DIP24	SOT222	1.66	600
DIP28	SOT117	4.22	312
DIP40	SOT129	6.21	216
DIP48	SOT240	7.70	168

Chemical content

Packing material for 125 mm wafers		(g)
box	cardboard	343
tray	cardboard	226
wafer carrier	polypropylene	1030
bags	polyethylene	46
QA seal	acrylate	0.15
Adhesive tape	polypropylene	1.0
label	paper	3.5

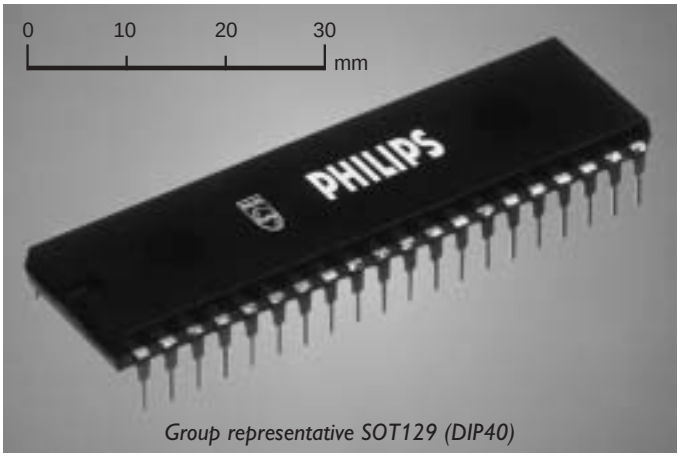
Non assembled ICs are increasingly supplied to customers either on film-frame carriers or in unsawn wafers.
We include in this publication information on the packing quantities involved in the supply of these wafers.
The number of dies per wafer depends on the type.
The composition is doped silicon in all cases.
The thickness of the wafers may vary to meet application or requirement. The mass indicated is for the standard thickness of 525 µm. With lower thickness the weight decreases accordingly.



Chemical content SOT129

Device part	substance	mass (mg)
leadframe	Cu-alloy*	1294
	Sn plated**	20
bond wire	Au	5
active device	doped Si	30
encapsulation	partially brominated epoxy	4870
	$SiO_2 \approx 80\%$	
	$Sb_2O_3 < 4\%$ as Sb	
	TBBA < 1% as Br	
Packing material (tube pack)		**(g)**
box	cardboard, carbon coated	145
tubes	polyvinylchloride	960
end pins	polyvinylchloride	5.8
strap	polypropylene	0.7
labels	paper	1.7
seal	acrylate	0.2

*alternative: FeNi42 leadframe. **alternative NiPd lead finish



Group representative SOT129 (DIP40)

Shrink dual in-line packages

reference	package code	mass (g)	packing quantity
SDIP24	SOT234	1.65	1000
SDIP32	SOT232	2.20	760
SDIP42	SOT270	4.51	420
SDIP52	SOT247	5.60	330
SDIP56	SOT400	6.06	300
SDIP64	SOT274	9.00	160

Single in-line medium power packages

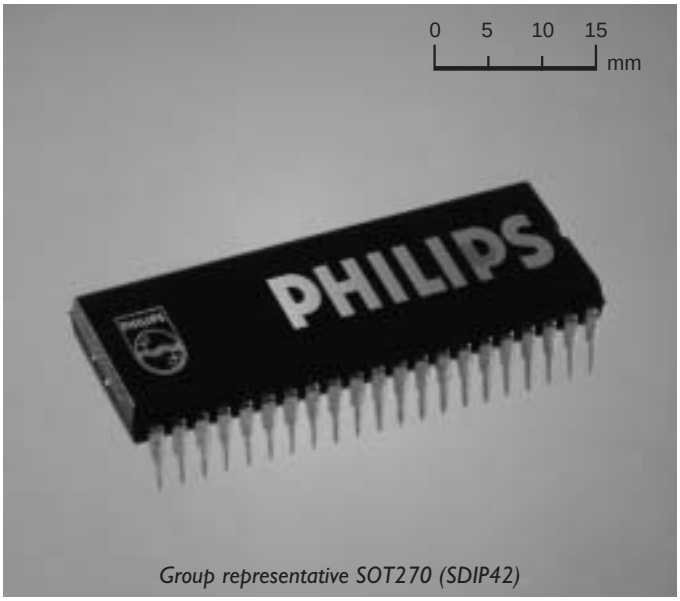
reference	package code	mass (g)	packing quantity
DBS9MPF	SOT111	1.75	748
RBS9MPF	SOT352	1.75	924
SIL9MP	SOT142	1.39	748
SIL9MPF	SOT110	1.75	748

Chemical content SOT270

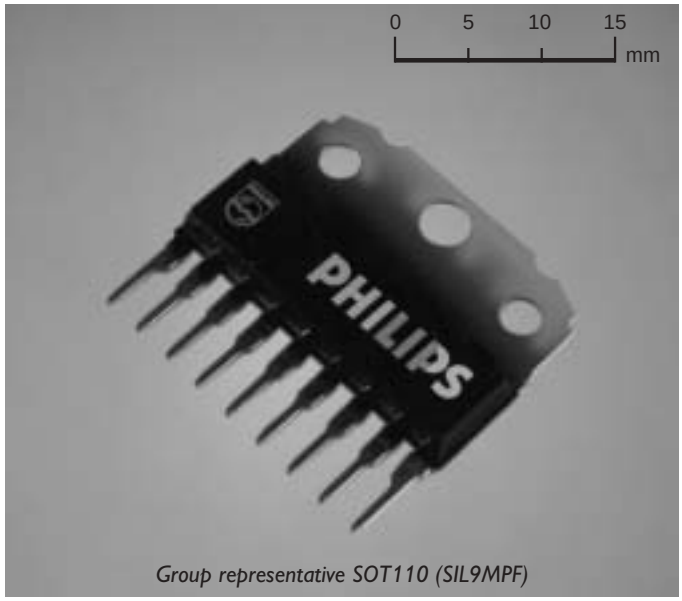
Device part	substance	mass (mg)
leadframe	Cu alloy	1000
	Sn plated	20
bond wire	Au	2
active device	doped Si	30
encapsulation	partially brominated epoxy	3520
	$SiO_2 \approx 80\%$	
	$Sb_2O_3 < 4\%$ as Sb	
	TBBA < 0.6% as Br	
Packing material (tube pack)		**(g)**
box	cardboard, carbon coated	193
tubes	polyvinylchloride	927
end pins	polyvinylchloride	7.2
strap	polypropylene	0.7
labels	paper	1.7
seal	acrylate	0.2

Chemical content SOT110

Device part	substance	mass (mg)
leadframe	Cu alloy	1000
	Sn plated	20
active device	doped Si	30
encapsulation	partially brominated epoxy	700
	$SiO_2 \approx 80\%$	
	$Sb_2O_3 < 4\%$ as Sb	
	TBBA < 0.6% as Br	
Packing material (tube pack)		**(g)**
box	cardboard, carbon coated	145
tubes	polyvinylchloride	1694
end pins	polyvinylchloride	28
foam	polyethylene	8.3
strap	polypropylene	0.7
labels	paper	1.8
seal	acrylate	0.2



Group representative SOT270 (SDIP42)



Group representative SOT110 (SIL9MPF)

Single in-line power packages

reference	package code	mass (g)	packing quantity
DBS9P	SOT157	4.31	552
DBS13P	SOT141	4.70	552
DBS17P	SOT243	4.67	552
DBS17P	SOT475	4.67	552
DBS23P	SOT411	5.98	432
DBS27P	SOT521	6.0	432
RDBS13P	SOT462	4.7	552
RDBS13P	SOT528	4.7	552
SIL9P	SOT131	4.33	552
SIL13P	SOT193	4.7	552
TBS13P	SOT578	4.7	552

Single in-line power packages with exposed die-pad

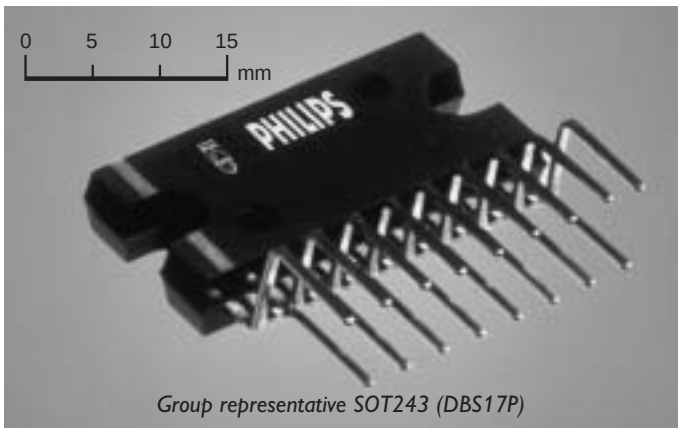
reference	package code	mass (g)	packing quantity
DBS7P	SOT524	1.4	864
DBS9P	SOT523	1.5	864

Chemical content SOT243

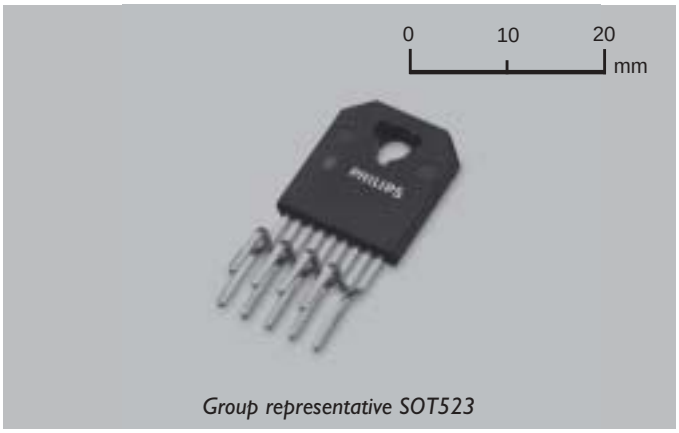
Device part	substance	mass (mg)
leadframe	Cu alloy	900
	Ni+Sn plated	20
heatsink	Cu	2350
soft solder	SnAg25Sb10	25
active device	doped Si	30
encapsulation	partially brominated epoxy	1375
	$SiO_2 \approx 80\%$	
	$Sb_2O_3 < 4\%$ as Sb	
	TBBA < 0.6% as Br	
Packing material (tube pack)		**(g)**
box	cardboard, carbon coated	193
tubes	polyvinylchloride	965
end plugs	polyvinylchloride	58
strap	polypropylene	0.7
labels	paper	1.7
seal	acrylate	0.2

Chemical content SOT523

Device part	substance	mass (mg)
leadframe	Cu	800
	Sn plated	9
bond wire	Au	2
active device	doped Si	7
encapsulation	partially brominated epoxy	658
	$SiO_2 \approx 80\%$	
	$Sb_2O_3 < 4\%$ as Sb	
	TBBA < 1% as Br	
Packing material (tube pack)		**(g)**
box	cardboard, carbon coated	259
tubes	polyvinylchloride	960
end plugs	polyvinylchloride	24
strap	polypropylene	1
labels	paper	1
seal	acrylate	0.2



Group representative SOT243 (DBS17P)



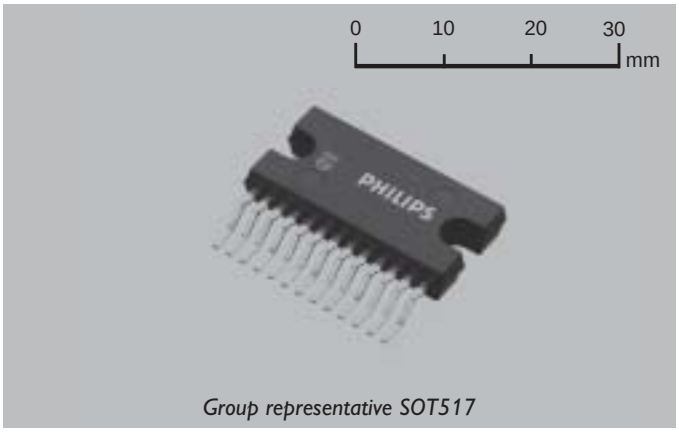
Group representative SOT523

Surface-mount single in-line power packages

reference	package code	mass (g)	packing quantity
SMS9P	SOT354	4.64	500
SMS13P	SOT517	4.71	500

Chemical content SOT517

Device part	substance	mass (mg)
leadframe	Cu alloy,	900
	SnPb15 plated	27
heatsink	Cu	2350
die attach	SnAg28Sb10	25
bond wire	Au	1
active device	doped Si	31
encapsulation	partially brominated epoxy	1375
	$SiO_2 \approx 80\%$	
	$Sb_2O_3 < 4\%$ as Sb	
	TBBA < 1% as Br	
Packing material (reel pack, dry packed)		**(g)**
box	cardboard, carbon coated	227
reel	PPE	302
carrier tape	polystyrene, carbon loaded	217
cover tape	PET	30
dry agent	alumina silicate	85
humidity indicator	paper+CoCl2	1.2
bag	Polyethylene Al coated	67
labels	paper	4
seal	acrylate	0.2



Group representative SOT517

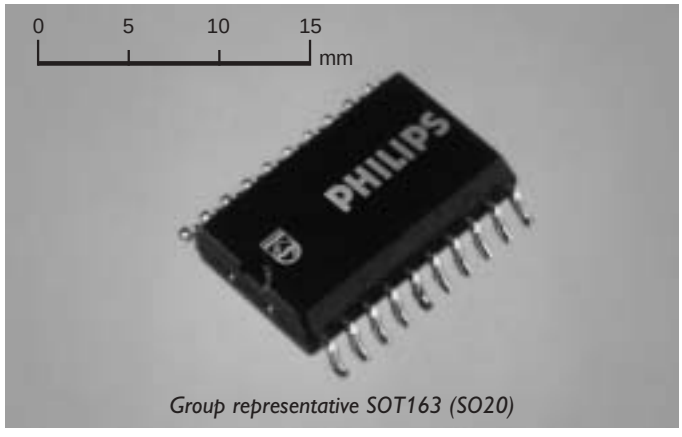
Small outline packages

reference	package code	mass (g)	packing quantity
SO8	SOT96	0.08	2500
SO8	SOT176	0.31	1000
SO14	SOT108	0.13	2500
SO16	SOT109	0.15	2500
SO16	SOT162	0.39	1000
SO20	SOT163	0.52	2000
SO24	SOT137	0.62	1000
SO28	SOT136	0.72	1000
SO32	SOT287	0.83	1000
VSO40	SOT158	0.58	500
VSO56	SOT190	1.31	500

Chemical content SOT163

Device part	substance	mass (mg)
leadframe	Cu alloy*	130
	SnPb15 plated	5
bond wire	Au	0.4
active device	doped Si	15
encapsulation	partially brominated epoxy	370
	$SiO_2 \approx 80\%$	
	$Sb_2O_3 < 4\%$ as Sb	
	TBBA < 1% as Br	
Packing material (reel pack)		**(g)**
box	cardboard, carbon coated	174
reel	polystyrene	339
carrier tape	polystyrene, carbon loaded	219
cover tape	polyester	32
labels	paper	1
seal	acrylate	0.2

* VSOs have FeNi42 leadframe



Group representative SOT163 (SO20)

Shrink small outline packages

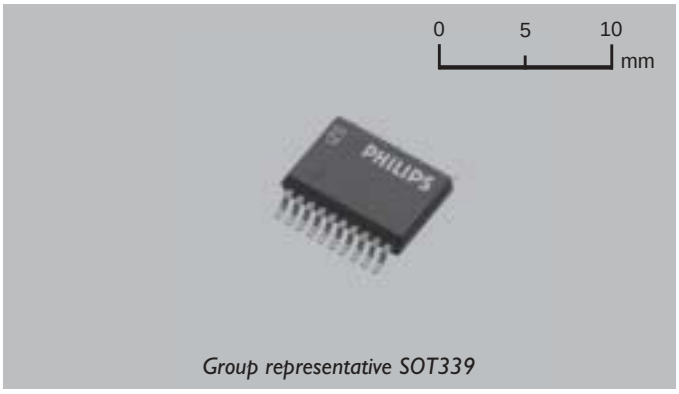
reference	package code	mass (g)	packing quantity
SSOP14	SOT337	0.15	2000
SSOP16	SOT338	0.15	2000
SSOP16	SOT369	0.17	2500
SSOP16	SOT519	0.08	2500
SSOP20	SOT266	0.10	2500
SSOP20	SOT339	0.16	1000
SSOP24	SOT340	0.18	1000
SSOP24	SOT556	0.13	2500
SSOP28	SOT341	0.24	2000
SSOP48	SOT370	0.61	1000
SSOP56	SOT371	0.70	1000

Thin shrink small outline packages

reference	package code	mass (g)	packing quantity
TSSOP8	SOT505	0.03	2500
TSSOP10	SOT552	0.03	2500
TSSOP14	SOT402	0.07	2500
TSSOP16	SOT403	0.07	2500
TSSOP20	SOT360	0.09	2500
TSSOP24	SOT355	0.10	2500
TSSOP28	SOT361	0.12	1275
TSSOP32	SOT487	0.17	2000
TSSOP48	SOT362	0.19	2000
TSSOP56	SOT364	0.22	2000
HTSSOP20	SOT527	0.07	2500
HTSSOP32	SOT549	0.16	2500

Chemical content SOT339

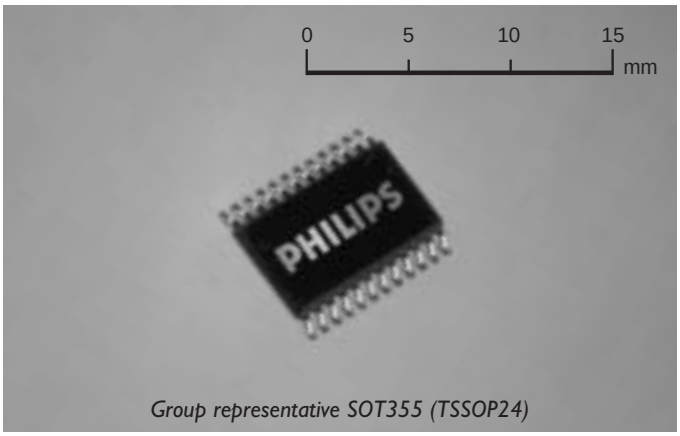
Device part	substance	mass (mg)
leadframe	Cu alloy	40
	SnPb15 plated	5
bond wire	Au	0.8
active device	doped Si	3
encapsulation	partially brominated epoxy	107
	$SiO_2 \approx 80\%$	
	$Sb_2O_3 < 4\%$ as Sb	
	TBBA < 1% as Br	
Packing material (reel pack)		**(g)**
box	cardboard, carbon coated	174
reel	polystyrene	253
carrier tape	polystyrene, carbon loaded	73
cover tape	PET	11
labels	paper	1
seal	acrylate	0.2



Group representative SOT339

Chemical content SOT355

Device part	substance	mass (mg)
leadframe	Cu alloy	30
	SnPb15 plated	2
bond wire	Au	0.6
active device	doped Si	20
encapsulation	partially brominated epoxy	48
	Similar composition to SOT339	
Packing material (reel pack, dry packed)		**(g)**
box	cardboard	174
reel	polystyrene	343
carrier tape	polystyrene, carbon loaded	119
cover tape	polyester	17
bag	aluminium laminated polyethylene	60
dry agent	alumina silicate	85
humidity ind.	paper + $CoCl_2$	1.2
labels	paper	3.7



Group representative SOT355 (TSSOP24)

Heatsink small outline packages

reference	package code	mass (g)	packing quantity
HSOP20	SOT397	2.06	500
HSOP20	SOT418	2.05	500

Plastic leaded chip carrier packages

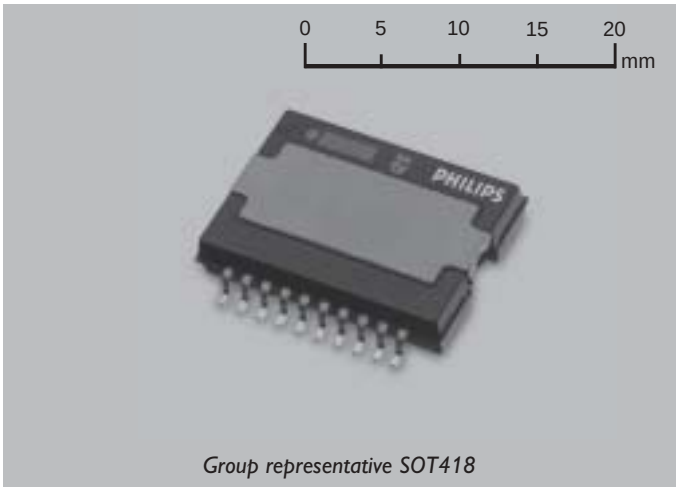
reference	package code	mass (g)	packing quantity
PLCC28	SOT261	1.17	2368
PLCC44	SOT187	2.28	1300
PLCC52	SOT238	2.92	1012
PLCC68	SOT188	2.26	648
PLCC84	SOT189	6.66	420

Chemical content SOT418

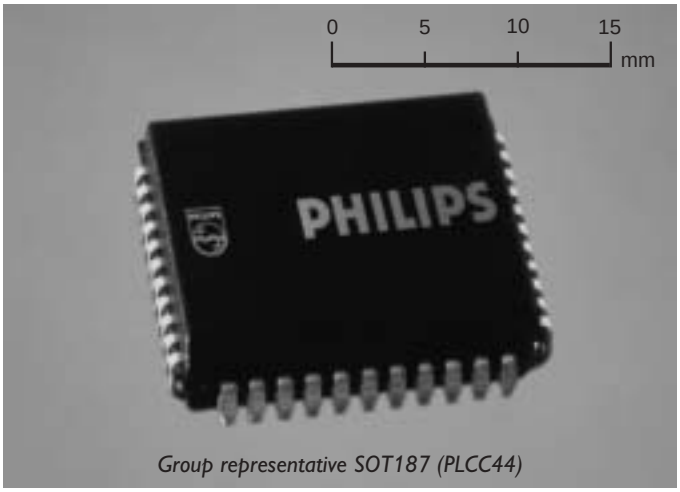
Device part	substance	mass (mg)
leadframe	Cu alloy	130
	plated SnPb15	13
heatsink	Cu	1190
active device	doped Si	30
chip coating	silicone gel	10
encapsulation	partially brominated epoxy	700
	$SiO_2 \approx 80\%$	
	$Sb_2O_3 < 4\%$ as Sb	
	TBBA < 1% as Br	
Packing material (reel pack, dry packed)		**(g)**
box	cardboard, carbon coated	193
reel	PPE	270
carrier tape	polystyrene, carbon loaded	95
cover tape	PET	14
bag	aluminium laminated polyethylene	60
dry agent	alumina silicate	85
humidity ind.	paper $+CoCl_2$	1.2
guard band	fibre board	21
labels	paper	4

Chemical content SOT187

Device part	substance	mass (mg)
leadframe	Cu alloy	390
	SnPb15 plated	25
active device	doped Si	70
chip coating	silicone gel	25
encapsulation	partially brominated epoxy	1770
	$SiO_2 \approx 80\%$	
	$Sb_2O_3 < 4\%$ as Sb	
	TBBA < 1% as Br	
Packing material (tube pack)		**(g)**
box	cardboard, carbon coated	145
tubes	polyvinylchloride	1050
end plugs	polyvinylchloride	135
strap	polypropylene	0.7
labels	paper	1.8
seal	acrylate	0.2



Group representative SOT418



Group representative SOT187 (PLCC44)

Plastic leadless module carrier packages

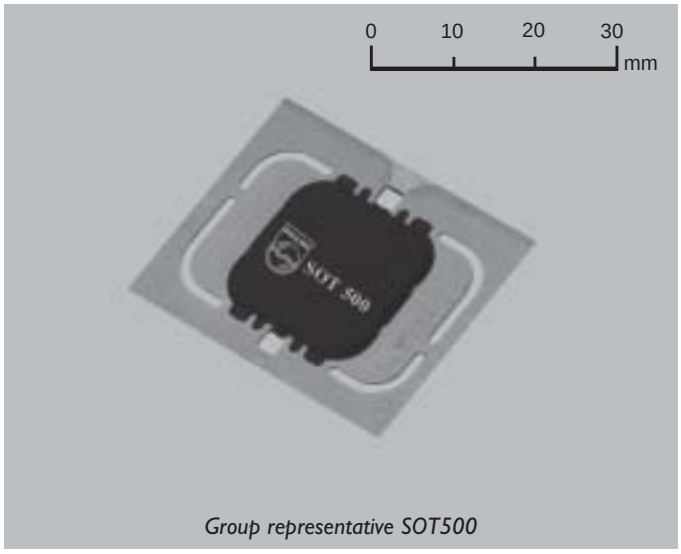
reference	package code	mass (g)	packing quantity
PLLMC-stick I	SOT385	0.42	5000
PLLMC-stick II	SOT408	0.48	5000
PLLMC 05	SOT500	0.13	17500

Quad flat packages

reference	package code	mass (g)	packing quantity
QFP44	SOT205	1.14	420
QFP44	SOT307	0.51	480
QFP64	SOT319	1.72	330
QFP64	SOT393	1.12	420
QFP80	SOT310	1.90	330
QFP80	SOT318	1.82	330
QFP100	SOT317	1.74	330
QFP100	SOT382	1.64	330
QFP120	SOT349	5.10	120
QFP128	SOT320	5.10	120
QFP160	SOT322	5.10	120

Chemical content SOT500

Device part	substance	mass (mg)
leadframe	Cu-alloy	30
bond wire	Au	1
active device	doped Si	12
encapsulation	partially brominated epoxy	13
	$SiO_2 \approx 80\%$	
	$Sb_2O_3 < 4\%$ as Sb	
	TBBA < 1% as Br	
Packing material (reel pack)		**(g)**
box	cardboard, carbon coated	193
reel	polystyrene, carbon loaded	266
strap	polypropylene	0.1
labels	paper	1.7
seal	acryl	0.2

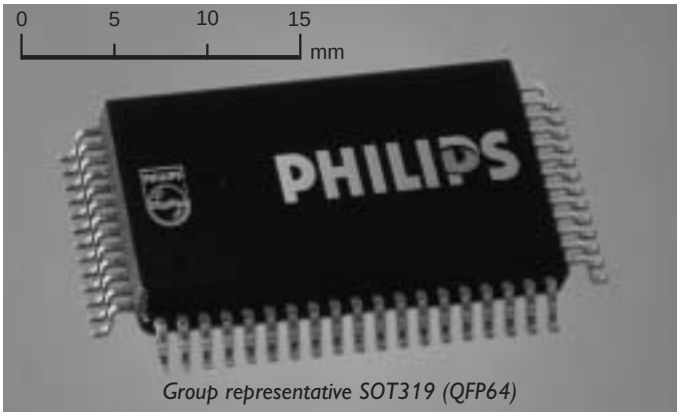


Group representative SOT500

Chemical content SOT319

Device part	substance	mass (mg)
leadframe	Cu-alloy*	320
	SnPb15 plated	10
active device	doped Si	20
bond wire	Au	3
chip coating	silicone gel**	10
encapsulation	Similar composition to SOT500	1360
Packing material (tray pack/dry packed)		**(g)**
box	cardboard	113
JEDEC trays	copolymer, carbon loaded	648
bag	aluminium laminated polyethylene	35
drying agent	alumina silicate	85
humidity ind.	paper + $CoCl_2$	1.2
strap	polypropylene	6
labels	paper	2.6
seal	acrylate	0.2

* optional: Cu-alloy leadframe ** not used in all packages



Group representative SOT319 (QFP64)

Shrink or thin quad flat packages

reference	package code	mass (g)	packing quantity
SQFP128	SOT387	1.30	330
SQFP208	SOT316	5.07	120
TQFP44	SOT376	0.27	800
TQFP64	SOT357	0.27	800
TQFP80	SOT375	0.40	595
TQFP100	SOT386	0.50	450
HTQFP32	SOT547	0.07	1800
HTQFP48	SOT545	0.15	1250
HTQFP80	SOT513	0.50	450

Low profile, shrink or thin quad flat packages

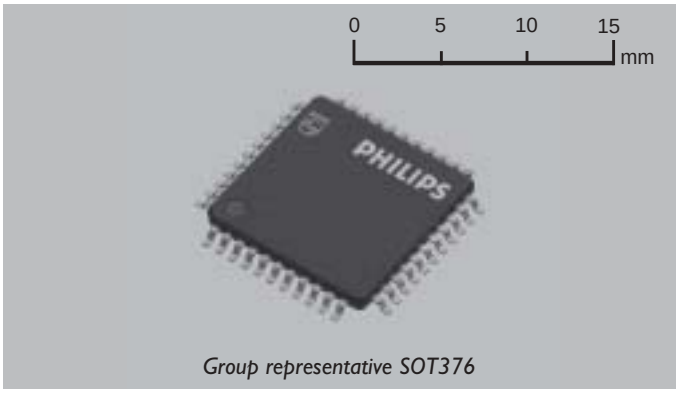
reference	package code	mass (g)	packing quantity
LQFP32	SOT358	0.18	2000
LQFP32	SOT401	0.09	2000
LQFP44	SOT389	0.33	1500
LQFP48	SOT313	1.82	2000
LQFP64	SOT314	4.50	1500
LQFP64	SOT414	1.82	2000
LQFP80	SOT315	0.45	1000
LQFP100	SOT407	0.65	1000
LQFP128	SOT420	0.70	1000
LQFP128	SOT425	0.80	1000
LQFP144	SOT486	1.25	750
LQFP160	SOT435	1.80	200
LQFP176	SOT506	1.87	200
LQFP208	SOT459	2.48	180

Chemical content SOT376

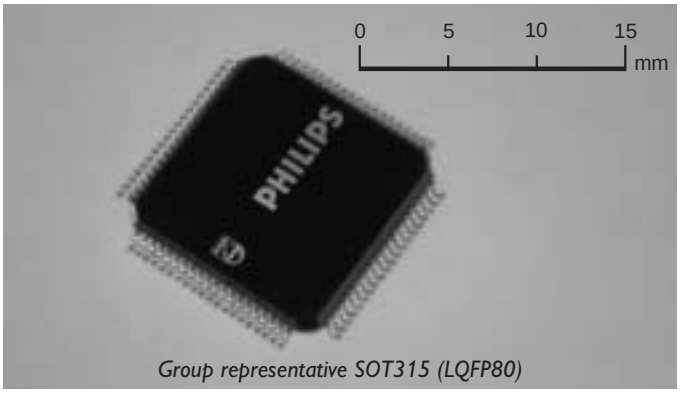
Device part	substance	mass (mg)
leadframe	Cu alloy	90
	SnPb15 plated	15
active device	doped Si	8
encapsulation	epoxy polymer	180
	$SiO_2 \approx 85\%$	
Packing material (reel pack/dry packed)		**(g)**
box	cardboard, carbon coated	113
tray	polystyrene	906
bag	aluminium laminated polyethylene	35
drying agent	alumina silicate	85
humidity ind.	paper + CoCl	1.2
labels	paper	1
strap	polypropylene	6
seal	acrylate	0.2

Chemical content SOT315

Device part	substance	mass (mg)
leadframe	Cu alloy	140
	SnPb15 plated	50
active device	doped Si	40
encapsulation	Similar composition to SOT376	220
Packing material (reel pack/dry packed)		**(g)**
box	cardboard	193
reel	polystyrene	270
bag	aluminium laminated polyethylene	60
drying agent	alumina silicate	85
humidity ind.	paper + $CoCl_2$	1.2
carrier tape	polystyrene	183
covertape	polyester	27
labels	paper	3.7



Group representative SOT376



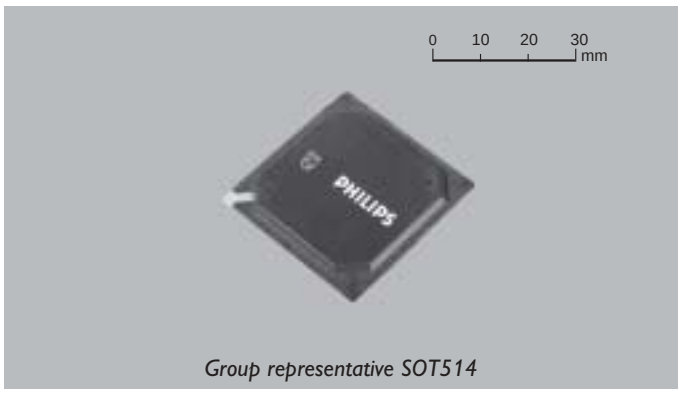
Group representative SOT315 (LQFP80)

Plastic ball grid array packages

reference	package code	mass (g)	packing quantity
BGA156	SOT472	0.49	630
BGA256	SOT471	2.24	200
BGA292	SOT489	2.78	200
BGA388	SOT532	3.98	120
BGA492	SOT514	4.54	120
BGA596	SOT587	5.95	105
BGA658	SOT623	6.07	105

Chemical content SOT514

Device part	substance	mass (mg)
substrate	glass-filled epoxy with Cu, Ni, Au plated pattern	2059
solderballs	SnPb37	0.945
encapsulation	partially brominated epoxy $SiO_2 \approx 80\%$ $Sb_2O_3 < 4\%$ as Sb TBBA < 1% as Br	1449
die-attach	Ag-filled epoxy	72
active device	doped silicon	15
Packing material (tray pack, dry packed)		**(g)**
box	cardboard	113
JEDEC trays	copolymer, carbon loaded	708
bag	aluminium laminated polyethylene	35
drying agent	alumina silicate	85
humidity ind.	paper + $CoCl_2$	1.2
strap	polypropylene	6
labels	paper	1
seal	acrylate	0.2



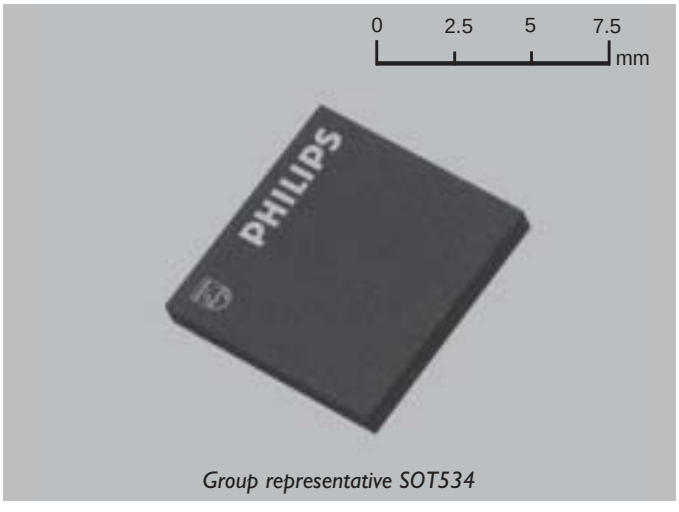
Group representative SOT514

Low-profile fine-pitch ball grid array packages

reference	package code	mass (g)	packing quantity
LFBGA64	SOT534	0.16	1740
LFBGA96	SOT536	0.19	1425
LFBGA114	SOT537	0.23	920

Chemical content SOT534

Device part	substance	mass (mg)
substrate	glass-filled epoxy with Cu, Ni, Au plated pattern	49
solder balls	SnPb37	17
bond wire	Au	2
encapsulation	partially brominated epoxy $SiO_2 \approx 80\%$ $Sb_2O_3 < 4\%$ as Sb TBBA < 1% as Br	78
die-attach	Ag-filled epoxy	1
active device	doped silicon	13
Packing material (tray pack/dry packed)		**(g)**
box	cardboard, carbon coated	113
JEDEC trays	copolymer, carbon loaded	1152
bag	aluminium laminated polyethylene	35
drying agent	alumina silicate	85
humidity ind.	paper + $CoCl_2$	1.2
strap	polypropylene	6
labels	paper	1
seal	acrylate	0.2



Group representative SOT534

APPENDICES

APPENDIX I

SUBSTANCES NOT USED IN PHILIPS SEMICONDUCTORS' PRODUCTS

Material	CAS number
Acetamide	
Acrylonitrile	
Asbestos materials	
Asbestos	1332-21-4
Actinolite	77536-66-4
Amosite (Grunerite)	12172-73-5
Anthophyllite	77536-67-5
Chrysotile	12001-29-5
Crocidolite	12001-28-4
Tremolite	77536-68-6
Azo-based materials	
Benzidene and its salts	92-87-5
4-Aminodiphenyl and its salts	92-67-1
4-Chloro-o-toluidine (4-chloro-2-methylaniline)	95-69-2
2-Naphthylamine	91-59-8
o-Aminoazotoluene	97-56-3
2-Amino-4-nitrotoluene	99-55-8
p-Chloroaniline	106-47-8
2,4-Diaminoanisole	615-05-4
4,4'-Diaminodiphenylmethane	101-77-9
3,3'-Dichlorobenzidene	91-94-1
3,3'-Dimethoxybenzidine	119-90-4
3,3,'-Dimethylbenzidene	119-93-7
3,3'-Dimethyl-4,4' diaminodiphenylmethane	838-88-0
p-Cresidene (5-Methyl-o-Anisidine)	120-71-8
4,4'Methylenebis-(2-chloroaniline)	101-14-4
4,4'-Oxydianiline	101-80-4
4,4'-Thiodianilene (4,4'-thiobisbenzenamine)	139-65-1
o-Toluidine	95-53-4
2,4-Toluylenediamine (toluene- 2,4-diamine)	95-80-7
2,4,5-Trimethylaniline	137-17-7
Benzene	71-43-2
Chlorinated fluorocarbons (CFC)	See appendix II
Chlorinated hydrocarbons (CHC)	See appendix II
Chloroparaffins	8029-39-8
Creosote	8001-58-9
Cyanates	Various
Cyanides	Various
Dibenzofurans	Various
Epichlorhydrine	106-89-8

Material	CAS number
Ethylene glycol ethers	
2-Ethoxyethanol	110-80-5
2-Ethoxyethyl acetate	111-15-9
2-Methoxyethanol	109-86-4
2-Methoxyethyl acetate	110-49-6
Diethylene glycol dimethyl ether	111-96-6
Aroclor 1254	11097-69-1
Terphenyls	26140-60-3
Formaldehyde	50-00-0
Halogenated dioxins and furans	Various
Hydrazine	302-01-2
Metals & compounds	
Cadmium	7440-43-9
Chromium VI	7440-47-3
Mercury	7439-97-6
Nickel tetracarbonyl	13463-39-3
Selenium	7782-49-2
Tellurium	13494-80-9
N-nitrosoamines	Various
N,N-dimethylformamide	68-12-2
Oils and greases	Various
Organometallic compounds (e.g. org. tin compounds)	Various
Organophosphorous compounds	
Triaryl phosphates	Various
Trimethyl phosphates	512-56-1
Triphenyl phosphates	115-86-6
Bisphenol A diphenylphosphate	Various
Resourcinol diphosphate	57583-54-7
Ozone depleting substances	See appendix II
Pentachlorophenol	87-86-5
Phenol compounds	Various
(Nonyl)-phenol ethoxylates	Various
Phthalates	
Diisononyl phthalate (DINP)	28553-12-0
Di-sec-octyl phthalate (DEHP)	117-81-7
Dibutyl phthalate (DBP)	84-74-2
Diisodecyl phthalate	26761-40-0
Bis(n-octyl) phthalate (DNOP)	117-84-0
Butyl benzyl phthalate (BBP)	85-68-7
Picric acid	88-89-1

Material	CAS number
Polybrominated biphenyls (PBBs) and their ethers (PBBE or PBDE)/oxides (PBBO)	
Bromobiphenyl and its ethers	
- 2-Bromobiphenyl	2052-07-5
- 3-Bromobiphenyl	2113-57-7
- 4-Bromobiphenyl	92-66-0
- Ether	101-55-3
Decabromobiphenyl and its ethers	
- Decabromobiphenyl	13654-09-6
- Ether	1163-19-5
Dibromobiphenyl and its ethers	
- Dibromobiphenyl	92-86-4
- Ether	2050-47-7
Heptabromobiphenylether	68928-80-3
Hexabromobiphenyl and its ethers	
- Hexabromobiphenyl	59080-40-9
- hexabromo-1,1'-biphenyl	36355-01-8
- Firemaster FF-1	67774-32-7
- Ether	36483-60-0
Nonabromobiphenylether	63936-56-1
Octabromobiphenyl and its ethers	
- Octabromobiphenyl	61288-13-9
- Ether	32536-52-0
Pentabromobiphenyl ether	32534-81-9
Polybrominated biphenyls	59536-65-1
Tetrabromobiphenyl and its ethers	
- Tetrabromobiphenyl	40088-45-7
- Ether	40088-47-9
Tribromobiphenyl ether	49690-94-0
Polychlorinated bi/triphenyls (PCB and PCT)	Various
Polychlorinated napthalenes	Various
Polycyclic aromatic hydrocarbons (PAH)	Various
Tetrabromoethene	79-28-7
Toluene	108-88-3
Triethylamine	121-44-8
Vinyl chloride monomer	75-01-4
Xylene	1330-20-7

APPENDIX II

SUBSTANCES NOT USED IN PHILIPS SEMICONDUCTORS' PROCESSES

Class I	CAS number
Ozone depleting substances/isomers*	
Trichlorofluoromethane (CFC 11)	75-69-4
Dichlorodifluoromethane (CFC12)	75-71-8
Chlorotrifluoromethane (CFC 13)	75-72-9
Pentachlorofluoroethane (CFC 111)	354-56-3
Tetrachlorodifluoroethane (CFC 112)	76-12-0
Trichlorotrifluoroethane (CFC 113)	354-58-5
1,1,2 Trichlorotrifluoroethane	76-13-1
Dichlorotetrafluoroethane (CFC 114)	76-14-2
Monochloropentafluoroethane (CFC 115)	76-15-3
Heptachlorofluoropropane (CFC 211)	422-78-6
	135401-87-5
Hexachlorodifluoropropane (CFC 212)	3182-26-1
Pentachlorotrifluoropropane (CFC 213)	2354-06-5
	134237-31-3
Tetrachlorotetrafluoropropane (CFC 214)	29255-31-0
1,1,1,3-Tetrachlorotetrafluoropropane	2268-46-4
Trichloropentafluoropropane (CFC 215)	1599-41-3
1,1,1-Trichloropentafluoropropane	4259-43-2
1,2,3-Trichloropentafluoropropane	76-17-5
Dichlorohexafluoropropane (CFC 216)	661-97-2
Monochloroheptafluoropropane (CFC 217)	422-86-6
Bromochlorodifluoromethane (Halon 1211)	353-59-3
Bromotrifluoromethane (Halon 1301)	75-63-8
Dibromotetrafluoroethane (Halon 2402)	124-73-2
Carbon tetrachloride (tetrachloromethane)	56-23-5
1,1,1, - Trichloroethane (methyl chloroform) and its isomers except 1,1,2-trichloroethane	71-55-6
Bromomethane (methyl bromide)	74-83-9
Bromodifluoromethane and isomers (HBFCs)	1511-62-2

*Please note: These materials may contain isomers that are not listed here. Isomers with CAS numbers have been included when available.

Class II	CAS number
Hydrochlorofluorocarbons/ isomers*	
Dichlorofluoromethane (HCFC 21)	75-43-4
Chlorodifluoromethane (HCFC 22)	75-45-6
Chlorofluoromethane (HCFC 31)	593-70-4
Tetrachlorofluoroethane (HCFC 121)	134237-32-4
1,1,1,2-tetrachloro-2-fluoroethane (HCFC 121a)	354-11-0
1,1,2,2-tetracloro-1-fluoroethane	354-14-3
Trichlorodifluoroethane (HCFC 122)	41834-16-6
1,2,2-trichloro-1,1-difluoroethane	354-21-2
Dichlorotrifluoroethane(HCFC 123)	34077-87-7
Dichloro-1,1,2-trifluoroethane	90454-18-5
2,2-dichloro-1,1,1-trifluroethane	306-83-2
1,2-dichloro-1,1,2-trifluroethane (HCFC-123a)	354-23-4
1,1-dichloro-1,2,2-trifluroethane (HCFC-123b)	812-04-4
2,2-dichloro-1,1,2-trifluroethane (HCFC-123b)	812-04-4
Chlorotetrafluoroethane (HCFC 124)	63938-10-3
2-chloro-1,1,1,2-tetrafluoroethane	2837-89-0
1-chloro-1,1,2,2-tetrafluoroethane (HCFC 124a)	354-25-6
Trichlorofluoroethane (HCFC 131)	27154-33-2;(134237-34-6)
1-Fluoro-1,2,2-trichloroethane	359-28-4
1,1,1-trichloro-2-fluoroethane (HCFC131b)	811-95-0
Dichlorodifluoroethane (HCFC 132)	25915-78-0
1,2-dichloro-1,1-difluoroethane (HCFC 132b)	1649-08-7
1,1-dichloro-1,2-difluoroethane (HFCF 132c)	1842-05-3
1,1-dichloro-2,2-difluoroethane	471-43-2
1,2-dichloro-1,2-difluoroethane	431-06-1
Chlorotrifluoroethane (HCFC 133)	1330-45-6
1-chloro-1,2,2-trifluoroethane	1330-45-6
2-chloro-1,1,1-trifluoroethane (HCFC-133a)	75-88-7
Dichlorofluoroethane(HCFC 141)	1717-00-6; (25167-88-8)
1,1-dichloro-1-fluoroethane (HCFC-141b)	1717-00-6
1,2-dichloro-1-fluoroethane	430-57-9
Chlorodifluoroethane (HCFC 142)	25497-29-4
1-chloro-1,1-difluoroethane (HCFC142b)	75-68-3
1-chloro-1,2-difluoroethane (HCFC142a)	25497-29-4
Hexachlorofluoropropane (HCFC 221)	134237-35-7
Pentachlorodifluoropropane (HCFC 222)	134237-36-8
Tetrachlorotrifluropropane (HCFC 223)	134237-37-9
Trichlorotetrafluoropropane (HCFC 224)	134237-38-0
Dichloropentafluoropropane, (Ethyne, fluoro-) (HCFC 225)	127564-92-5; (2713-09-9)
2,2-Dichloro-1,1,1,3,3-pentafluoropropane (HCFC 225aa)	128903-21-9
2,3-Dichloro-1,1,1,2,3-pentafluoropropane (HCFC 225ba)	422-48-0
1,2-Dichloro-1,1,2,3,3-pentafluoropropane (HCFC 225bb)	422-44-6
3,3-Dichloro-1,1,1,2,2-pentafluoropropane (HCFC 225ca)	422-56-0
1,3-Dichloro-1,1,2,2,3-pentafluoropropane (HCFC 225cb)	507-55-1
1,1-Dichloro-1,2,2,3,3-pentafluoropropane (HCFC 225cc)	13474-88-9
1,2-Dichloro-1,1,3,3,3-pentafluoropropane (HCFC 225da)	431-86-7

Class II	CAS number
1,3-Dichloro-1,1,2,3,3-pentafluoropropane (HCFC 225ea)	136013-79-1
1,1-Dichloro-1,2,3,3,3-pentafluoropropane (HCFC 225eb)	111512-56-2
Chlorohexafluoropropane (HCFC 226)	134308-72-8
Pentachlorofluoropropane (HCFC 231)	134190-48-0
Tetrachlorodifluoropropane (HCFC 232)	134237-39-1
Trichlorotrifluoropropane (HCFC 233)	134237-40-4
1,1,1-Trichloro-3,3,3-trifluoropropane	7125-83-9
Dichlorotetrafluoropropane (HCFC 234)	127564-83-4
Chloropentafluoropropane (HCFC 235)	134237-41-5
1-Chloro-1,1,3,3,3-pentafluoropropane	460-92-4
Tetrachlorofluoropropane (HCFC 241)	134190-49-1
Trichlorodifluoropropane (HCFC 242)	134237-42-6
Dichlorotrifluoropropane (HCFC 243)	134237-43-7
1,1-dichloro-1,2,2-trifluoropropane	7125-99-7
2,3-dichloro-1,1,1-trifluoropropane	338-75-0
3,3-Dichloro-1,1,1-trifluoropropane	460-69-5
Chlorotetrafluoropropane (HCFC 244)	134190-50-4
3-chloro-1,1,2,2-tetrafluoropropane	679-85-6
Trichlorofluoropropane (HCFC 251)	134190-51-5
1,1,3-trichloro-1-fluoropropane	818-99-5
Dichlorodifluoropropane (HCFC 252)	134190-52-6
Chlorotrifluoropropane (HCFC 253)	134237-44-8
3-chloro-1,1,1-trifluoropropane (HCFC 253fb)	460-35-5
Dichlorofluoropropane (HCFC 261)	134237-45-9
1,1-dichloro-1-fluoropropane	7799-56-6
Chlorodifluoropropane (HCFC 262)	134190-53-7
2-chloro-1,3-difluoropropane	102738-79-4
Chlorofluoropropane (HCFC 271)	134190-54-8
2-chloro-2-fluoropropane	420-44-0

*Please note: These materials may contain isomers that are not listed here. Isomers with CAS numbers have been included when available.

Chlorinated hydro carbons (CHC)	CAS-number
Dichloro methane, methylene chloride, CH2Cl2	75-09-2
Trichloro methane, chloroform, CHCl3	67-66-3
Trichloro ethylene, C2HCl3	79-01-6
Tetra chloro ethylene, perchloro ethylene, C2Cl4	127-18-4
1,1,2,2-tetrachloro ethane C2H2Cl4	79-34-5
1,1,1,2- tetrachloro ethane C2H2Cl4	630-20-6
Pentachloro ethane C2HCl5	76-01-7
1,1-dichloro ethylene	75-35-4
1,1,1-trichloro ethylene	71-55-6
1,1,2-trichloro ethylene	79-00-5

APPENDIX III

SUBSTANCES USED IN PHILIPS SEMICONDUCTORS' PRODUCTS

Material	CAS number
Aluminum (Al)	7429-90-5
Aluminum oxide (Al_2O_3)	1344-28-1
Antimony (Sb)	7440-36-0
Antimony trioxid (Sb_2O_3)	1309-64-4
Barium titanate ($BaTiO_3$)	12047-27-7
Beryllium oxide (BeO)	1304-56-9
Cobalt (Co)	7440-48-4
Copper (Cu)	7440-50-8
Germanium (Ge)	7440-56-4
Gold (Au)	7440-57-5
Iron (Fe)	7439-89-6
Lead (Pb)	7439-92-1
Molybdenum (Mo)	7439-98-7
Nickel (Ni)	7440-02-0
Palladium (Pd)	7440-05-3
Platinum (Pt)	7440-06-4
Silicon (Si)	7440-21-3
Silicon dioxide (SiO_2)	14808-60-7
Silicone gel	63148-62-9
Silver (Ag)	7440-22-4
Tetrabromo bisphenol-A	79-94-7
Tin (Sn)	7440-31-5
Titanium (Ti)	7440-32-6
Tungsten (W)	7440-33-7
Zinc (Zn)	7440-66-6
Zirconium (Zr)	7440-67-7

GLOSSARY

ESD	Electro Static Discharge
JEDEC	Joint Electron Device Engineering Council (now known as JEDEC Solid State Technology Association)
PET	Poly Ethylene Terephthalate
PPE	Poly Propylene Ether
SOD	Standard Outline Diode
SOT	Standard Outline Transistor
TBBA	Tetrabromobisphenol-A
UL	Underwriters Laboratories Inc.

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