CHAPTER 7

ENVIRONMENTAL INFORMATION

Environmental information Chapter 7

INTRODUCTION

Nowadays, everyone must accept responsibility for keeping the environment clean, from individuals adopting a responsible attitude to their own waste disposal, however small that may be, to big industries who must take proper precautions to avoid releasing large amounts of damaging waste into the environment.

As a leading electronic components manufacturer, Philips Semiconductors has always regarded environmental protection as a major issue. The electronics industry, like many others, produces its share of toxic and hazardous materials, and we have long made it our policy to follow working practices that cut the chance of these materials passing into the environment to the absolute minimum.

Products supplied by Philips Semiconductors today 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 components receive clear warning of this in the data sheets. And where necessary, the warning notices contain safety precautions and disposal instructions.

This chapter supplements these notices and instructions by providing clear and comprehensive information on the composition of representative examples of discrete packages 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, not only throughout the Philips Semiconductors organization but throughout the semiconductor industry in general.

For additional information on the chemical content of discrete and IC packages, ask your local sales representative for the Philips Semiconductors brochure *Chemical content of semiconductor devices*, order number 9397 750 04906.

EXPLANATION OF THE TABLES

The following pages provide the chemical constituents of representative groups of discrete 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.

The tables contain information about 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 percentages 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). The mass in milligrams (mg), body dimensions in millimeters (mm) and packing quantity are also specified.

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

- metal parts
- crystal
- envelope (plastic, glass or ceramic)
- packing materials.

The device-parts are specified in milligrams (mg). 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. For more detailed information on packing, refer to Chapter 6 Packing Methods.

Metal parts

The composition of the leadframe material is indicated, 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: the die-attach material in all plastic-encapsulationed products contains on average 0.5% Au/AG, which is recoverable on recycling.

Crystal

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.

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 or on biphenyl-epoxy, filled with quartz particles (fused or crystalline) up to approximately 70 mass percent. In all cases (except SOT54), 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 7-5 for explanation).

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 endpins, turnlocks and soft rubber stoppers in the PVC-tubes are now replaced by 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 after use 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 formally. 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 addresses 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 in Figs 1 to 1.

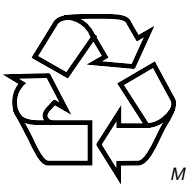

Fig.1 Paper and cardboard.

Fig.2 Polyethylene terephthalate.

Fig.3 Polyethylene, high density.

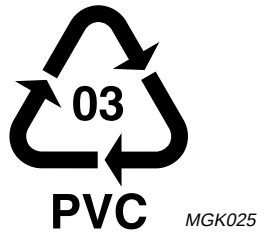

Fig.4 Polyvinylchloride.

Fig.5 Polyethylene, low density.

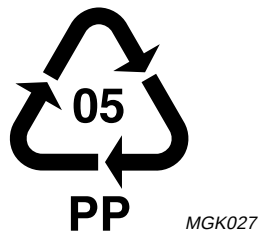

Fig.6 Polypropylene.

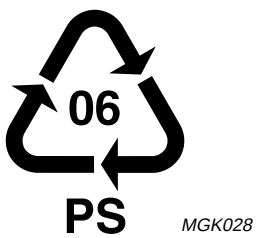

Fig.7 Polystyrene.

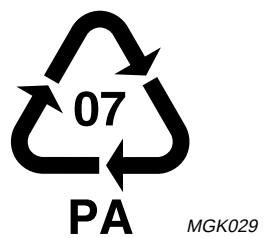

Fig.8 Other plastics. The acronym of the plastic is put under the recycling symbol. In this example: PA = polyamide.

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, electro-magnetic 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

Below are listed the materials and substances that are **not** present in Philips Semiconductors' products and processes(1). This information supplements the chemical contents tables that follow and is provided to enable manufacturers assess the environmental impact of products manufactured by Philips Semiconductors.

Substances not used in products

- 4-aminodiphenyl and its salts
- ammonium salts
- arsenic
- asbestos
- benzene
- cadmium and compounds
- chlorinated paraffines
- creosote
- cyantes
- cyanides
- 4,4-diaminophenyl methane
- dibenzofurans
- epichlorhydrine
- ethylene glycol ethers
- formaldehyde
- halogenated aliphatic hydrocarbons
- hydrazine
- mercury and compounds
- N-nitrosoamines
- 2-naphthylamine and its salts
- nickel tetracarbonyl
- N,N-dimethlformamide
- N,N-dimethylacetamide
- oils and greases
- organometallic compounds (e.g. org. tin compounds)
- ozone-depleting compounds
- pentachlorophenol
- phenol compounds
- (nonyl)-phenol ethoxylates
- phtalates
- picric acid
- polybrominated biphenyl oxides (PBBO)
- polybrominated biphenyls (PBB/PBBE)
- polychlorinated triphenyls (PCT)
- polychlorinated napthalenes
- polychlorinated biphenyls (PCB)
- polycyclic compounds
- polyhalogenated dibenzofurans/dioxins
- polyhalogenated bi/triphenyl ethers
- selenium
- tellurium
- tetrabromobenzylimidazole
- tetrabromoethylene
- toluene
- triethylamine
- tris (aziridinyl) phosphinoxide
- tris (2,3-dibromopropyl) phosphate
- vinyl chloride monomer
- xylene

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. 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)

(1) The lists refer to processes used for manufacturing products mentioned in this chapter. For information on other products, contact your sales representative.

Summary of ozone-depleting substances eliminated

Class I substances:

- fully halogenated chloro-fluorocarbons (CFC)
- halons
- carbontetrachloride
- 1,1,1-trichloroethane

Class II substances:

- partially halogenated hydrocarbons (HCFC)

DISPOSAL AND RECYCLING

Disposal

Old or used products must be disposed of in accordance to 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.

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.

GLASS DIODES/RECTIFIERS, LEADED

REFERENCE	PACKAGE CODE[1]	MASS (mg)	BODY (mm)	PACKING QUANTITY
DO-35	SOD27	136	ϕ 1.9 × 4.3	5000
DO-41	SOD66	344	ϕ 2.6 × 4.8	5000
DO-34	SOD68	118	ϕ 1.6 × 3.0	5000
IT[2]	SOD81	277	ϕ 2.2 × 3.8	5000
IT[2]	SOD91	121	ϕ 1.7 × 3.0	5000

Notes

1. All packages have a similar composition, quantities may vary.
2. IT = implosion technology.

Chemical content for group representative SOD68

DEVICE PART	SUBSTANCE	MASS (mg)
stud	FeNi42, cladded with Cu[1]	10.5
wire	Fe cladded with Cu	88
	SnPb20 plated	2.2
active device	doped Si	0.05
encapsulation	glass (Pb < 58%, Sb < 0.5%)	16.8
paint/pigment	epoxy copolymer	0.1

Note

1. Mo studs for implosion types.

PACKING MATERIAL (AMMO PACK)

PACKING PART	SUBSTANCE	MASS (g)
box	paper	53
tape	kraft paper	20
tape	polypropylene	19.6
seal	acrylate	0.2

GLASS DIODES/RECTIFIERS, SMD

REFERENCE	PACKAGE CODE(1)	MASS (mg)	BODY (mm)	PACKING QUANTITY
–	SOD80	35	ϕ 1.5 × 3.5	2500
IT(2)	SOD87	50	ϕ 2.1 × 3.5	2500

Notes

1. All packages have a similar composition, quantities may vary.
2. IT = implosion technology.

Chemical content for group representative SOD87

DEVICE PART	SUBSTANCE	MASS (mg)
stud	Mo(1)	19.5
flange	Cu	15.0
	SnPb20 plated	2.5
active device	doped Si	0.4
encapsulation	glass (Pb < 54%, Sb < 0.5%)	15.5
paint/pigment	epoxy copolymer	0.1

Note

1. SOD80: FeNi42 cladded with Cu.

PACKING MATERIAL (REEL PACK)

PACKING PART	SUBSTANCE	MASS (g)
box	cardboard	56
reel	polystyrene	39
carrier tape	polycarbonate, carbon loaded	18.8
cover tape	polyester	3.3

GLASS-BEAD RECTIFIERS AND STACKS

REFERENCE	PACKAGE CODE(1)	MASS (mg)	BODY (mm)	PACKING QUANTITY
–	SOD57	356	ϕ 3.8 × 4.6	2500
EHT-stack	SOD61	250	ϕ 3.0 × 12.5 max.(2)	5000
–	SOD64	833	ϕ 4.5 × 5.0	4000
EHT-stack	SOD83	1020	ϕ 4.5 × 12.5 max.(2)	2000
EHT-stack	SOD88	427	ϕ 3.8 × 12.5 max.(2)	5000
EHT-stack	SOD89	1196	ϕ 5.5 × 12.5 max.(2)	2000
-	SOD116	190	ϕ 2.5 × 13.5 max.	5000
-	SOD118A	178	ϕ 2.5 × 6.5	5000

Notes

1. All packages have a similar composition, quantities may vary.
2. Body length depends on reverse voltage and may be less than given here.

Chemical content for group representative SOD57

DEVICE PART	SUBSTANCE	MASS (mg)
stud	Mo	51
wire	Fe cladded with Cu	252
	SnPb20 plated	2
active device	doped Si	1(1)
encapsulation	glass (Pb < 58%(2), Sb < 0.5%)	50

Note

1. May be greater for EHT stacks.
2. In stacks Pb < 6%, ZnO = 59%.

PACKING MATERIAL (AMMO PACK)

PACKING PART	SUBSTANCE	MASS (g)
box	paper	53
reel	paper	25
tape	kraft paper	30
label	paper	0.8
seal	acrylate	0.2

DIODES IN PLASTIC PACKAGE, SMD

REFERENCE	PACKAGE CODE(1)	MASS (mg)	BODY (mm)	PACKING QUANTITY
–	SOD106	66	$4.7 \times 2.5 \times 2.6$	1500
–	SOD323	4.8	$1.7 \times 1.3 \times 0.9$	3000
SC-79	SOD523	1.6	$1.3 \times 0.8 \times 0.6$	3000

Note

1. All packages have a similar composition, quantities may vary.

Chemical content for group representative SOD323

DEVICE PART	SUBSTANCE	MASS (mg)
leadframe	Cu, SnPb20 plated	1.23
active device	doped Si	0.07
encapsulation	OCN-epoxy polymer (SiO_2 < 72%, Sb < 2%, Br < 1%)	3.5

PACKING MATERIAL (REEL PACK)

PACKING PART	SUBSTANCE	MASS (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

SMALL SIGNAL CERAMIC DIODE, SMD

REFERENCE	PACKAGE CODE	MASS (mg)	BODY (mm)	PACKING QUANTITY
–	SOD110	10	$2.0 \times 1.25 \times 1.45$	3000

Chemical content for group representative SOD110

DEVICE PART	SUBSTANCE	MASS (mg)
envelope	Al_2O_3, SiO_2	8.2
	plated with Cu+SnPb20	1
encapsulation	OCN-epoxy polymer (SiO_2 < 70%)	0.8
active device	doped Si	< 0.1

PACKING MATERIAL (REEL PACK)

PACKING PART	SUBSTANCE	MASS (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

FLANGE-MOUNTED CERAMIC RF POWER TRANSISTORS

REFERENCE	PACKAGE CODE(1)	MASS (g)	BODY (mm)	PACKING QUANTITY
–	SOT119	5.20	13.0 × 25.2 × 7.5	40
–	SOT121	5.00	13.0 × 25.2 × 7.5	40
–	SOT123	3.90	9.8 × 25.2 × 7.5	40
–	SOT160	4.86	9.8 × 25.2 × 7.5	75
–	SOT161	3.50	10.2 × 25.2 × 7.5	40
–	SOT171	3.60	5.9 × 25.2 × 7.0	40
–	SOT262	8.00	10.4 × 34.3 × 5.8	16
–	SOT273	6.90	10.4 × 25.0 × 7.2	60
–	SOT289	8.20	11.8 × 28.1 × 4.6	40
–	SOT324	3.58	6.4 × 19.0 × 4.5	32

Note

1. All packages have a similar composition, quantities may vary.

Chemical content for group representative SOD119

DEVICE PART	SUBSTANCE	MASS (mg)
flange	Cu(1)	4120
leadframe	FeNi42(2)	270
brazing alloy	AgCu28	20
encapsulation	Al_2O_3	200
heat spreader	BeO, plated with Mo/Ni/Au	540
active device	doped Si	10
glue	polyamide	40

Notes

1. In some types: WCu15 flange.
2. In SOT119A1 and SOT289: FeNiCo leadframe.

PACKING MATERIAL (BLISTER PACK)

PACKING PART	SUBSTANCE	MASS (g)
box	cardboard	157
foam	polyethylene	27.2
blisters	polystyrene	46
labels	paper	0.8
tape	polypropylene	1
seal	acrylate	0.2

STUD-MOUNTED CERAMIC RF POWER TRANSISTORS

REFERENCE	PACKAGE CODE(1)	MASS (g)	BODY (mm)	PACKING QUANTITY
–	SOT120A	3.00	ϕ 9.8 × 18.8	40
–	SOT122A	1.90	ϕ 7.6 × 17.0	40
–	SOT147	11.40	ϕ 13.0 × 20.9	40
–	SOT172A	1.40	ϕ 5.4 × 16.0	40

Note

1. All packages have a similar composition, quantities may vary.

Chemical content for group representative SOD122A

DEVICE PART	SUBSTANCE	MASS (mg)
stud	Cu	800
leadframe	FeNi42(1)	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	polyamide	40

Notes

1. SOT122A2: FeNiCo leadframe.

PACKING MATERIAL (BLISTER PACK)

PACKING PART	SUBSTANCE	MASS (g)
box	cardboard	157
foam	polyethylene	27.2
blisters	polystyrene	46
labels	paper	0.8
tape	polypropylene	1
seal	acrylate	0.2

CERAMIC RF POWER TRANSISTORS IN PILL PACKAGE

REFERENCE	PACKAGE CODE(1)	MASS (g)	BODY (mm)	PACKING QUANTITY
–	SOT119D	1.60	ϕ 13.0 × 4.5	40
–	SOT122D	0.70	ϕ 7.6 × 4.1	40
–	SOT172D	0.30	ϕ 5.4 × 3.6	40

Note

1. Ceramic packages without flange or stud (so called “pill”-packages) have a similar composition, quantities may vary.

Chemical content for group representative SOD119D

DEVICE PART	SUBSTANCE	MASS (mg)
leadframe	FeNi42(1)	370
brazing alloy	AgCu28	30
encapsulation	Al_2O_3	320
heat spreader	BeO, plated with Mo/Ni/Au	850
active device	doped Si	10
glue	polyamide	20

Note

1. FeNiCo in SOT119A1.

PACKING MATERIAL (BLISTER PACK)

PACKING PART	SUBSTANCE	MASS (g)
box	cardboard	157
foam	polyethylene	27.2
blisters	polystyrene	46
labels	paper	0.8
tape	polypropylene	1
seal	acrylate	0.2

POWER TRANSISTORS IN PLASTIC PACKAGE

REFERENCE	PACKAGE CODE(1)	MASS (g)	BODY (mm)	PACKING QUANTITY
TO-220	SOT78	1.950	$10.3 \times 9.9 \times 4.5$	1000
–	SOT82	0.750	$11.1 \times 7.8 \times 2.8$	1000
–	SOT93	4.930	$15.2 \times 12.7 \times 4.6$	500
–	SOT186	1.950	$10.2 \times 9.5 \times 4.6$	1000
–	SOT186A	2.500	$10.3 \times 9.4 \times 4.6$	1000
–	SOT199	5.500	$15.3 \times 21.5 \times 5.2$	500
pentawatt	SOT263	1.700	$10.3 \times 9.5 \times 4.5$	1000
–	SOT399	5.890	$16 \times 27 \times 5.8$	500

Note

1. All packages have a similar composition, quantities may vary.

Chemical content for group representative SOT93

DEVICE PART	SUBSTANCE	MASS (mg)
leadframe	Cu	3950
	SnPb30 plated	20
solder pellet	SnAg25Sb10	25
encapsulation	OCN-epoxy polymer (SiO_2 < 72%, Sb < 3%, Br < 1%)	920
active device	doped Si	15

PACKING MATERIAL (TUBE PACK)

PACKING PART	SUBSTANCE	MASS (g)
box	cardboard	123
tubes	polyvinylchloride	700
turn locks	polyvinylchloride	20
labels	paper	15
tape	polypropylene	0.6
seal	acrylate	0.2

SURFACE-MOUNT POWER TRANSISTORS IN PLASTIC PACKAGE

REFERENCE	PACKAGE CODE(1)	MASS (g)	BODY (mm)	PACKING QUANTITY
D2-PAK	SOT404	1.43	10.3 × 9.5 × 4.5	800
–	SOT426	1.46	10.3 × 9.5 × 4.5	800
–	SOT427	1.49	10.3 × 9.5 × 4.5	800
D-PAK	SOT428	0.33	6.2 × 6.7× 2.4	2500
TO-247	SOT429	5.42	15.5 × 20.5× 5.0	500

Note

1. All packages have a similar composition, quantities may vary.

Chemical content for group representative SOT404

DEVICE PART	SUBSTANCE	MASS (mg)
leadframe	Cu, Ni plated	422
solder pellet	SnAg25Sb10(1)	
encapsulation	OCN-epoxy polymer (SiO_2 < 72%, Sb < 3%, Br < 1%)	120
active device	doped Si	

Note

1. Optional PbSn5 solder pellet.

PACKING MATERIAL (REEL PACK)

PACKING PART	SUBSTANCE	MASS (g)
box	cardboard	180
reel	polystyrene	325
carrier tape	polystyrene, carbon loaded	200
cover tape	polyester	13.7
labels	paper	2.1
tape	polypropylene	0.6
seal	acrylate	0.2

MAGNETIC SENSOR PACKAGES

REFERENCE	PACKAGE CODE(1)	MASS (mg)	BODY (mm)	PACKING QUANTITY
–	SOT453A	230	$18.0 \times 4.4 \times 1.6$	1000
–	SOT453B	1600	$18.0 \times 8.2 \times 7.0$	750
–	SOT453C	645	$18.0 \times 4.4 \times 4.5$	750

Note

1. All packages have a similar composition, quantities may vary.

Chemical content for group representative SOT453B

DEVICE PART	SUBSTANCE	MASS (mg)
leadframe	CuZr0.2 with Ag spot	76
bond-wire	Au	<0.2
solder layer	Sn	7
encapsulation	OCN-epoxy polymer (SiO_2 < 72%, Sb < 3%, Br < 2%)	110
magnet	$BaFe_{12}O_{19}$	1400
magnetic field sensor device	Si with thin metal films	1.2
active device	doped Si, Al, TiW	4.8

PACKING MATERIAL (REEL PACK)

PACKING PART	SUBSTANCE	MASS (g)
box	cardboard	300
reel	polystyrene	350
carrier tape	polystyrene, carbon loaded	140
cover tape	polyester	24
labels	paper	5
seal	acrylate	1

MEDIUM-POWER TRANSISTORS IN PLASTIC PACKAGE

REFERENCE	PACKAGE CODE(1)	MASS (g)	BODY (mm)	PACKING QUANTITY
TO-126	SOT32	0.694	$11.1 \times 7.8 \times 2.8$	1000
TO-202	SOT128	1.528	$11.1 \times 7.8 \times 2.7$	1000

Note

1. All packages have a similar composition, quantities may vary.

Chemical content for group representative SOT128

DEVICE PART	SUBSTANCE	MASS (mg)
leadframe	Cu, Co + Au plated	863
	SnPb plated	15
active device	doped Si	10
encapsulation	silica filled epoxy plastic (Sb < 3%, Br < 2%)	640

PACKING MATERIAL (TUBE PACK)

PACKING PART	SUBSTANCE	MASS (g)
box	cardboard	123
tubes	polyvinylchloride	836
end stops	polyvinylchloride	38
labels	paper	15
tape	polypropylene	0.6
seal	acrylate	0.2

SMALL-SIGNAL TRANSISTORS AND SENSORS IN PLASTIC PACKAGE

REFERENCE	PACKAGE CODE	MASS (g)	BODY (mm)	PACKING QUANTITY
–	SOD70	0.2	ϕ 4.4 × 5.0	1000
TO-92	SOT54	0.250	ϕ 4.8 × 5.2	2000
–	SOT195	0.166	5.0 × 4.4 × 1.6	1000

Chemical content for group representative SOT54

DEVICE PART	SUBSTANCE	MASS (mg)
leadframe	CuZn15, Co + Au plated	113
	SnPb plated	1.5
active device	doped Si	0.5
encapsulation(1)	OCN-epoxy polymer (SiO_2 < 72%, Sb < 4%, Br < 0.6%)	135

Note

1. Alternative: two-shot encapsulation of epoxy and PPS.

PACKING MATERIAL (AMMO PACK)

PACKING PART	SUBSTANCE	MASS (g)
box	cardboard	97.5
carrier tape	kraft paper	110
buffer	cardboard	20

TRANSISTORS IN METAL PACKAGE

REFERENCE	PACKAGE CODE(1)	MASS (g)	BODY (mm)	PACKING QUANTITY
TO-39	SOT5	0.97	ϕ 8.5 × 6.6	1000
TO-18	SOT18	0.31	ϕ 4.8 × 5.3	5000

Note

1. All packages have a similar composition, quantities may vary.

Chemical content for group representative SOT18

DEVICE PART	SUBSTANCE	MASS (mg)
metal envelope + leads	FeNi28Co18	240
wires + solder	Au	2
solder layer	Sn	5
part of encapsulation	glass	62
active device	doped Si	1

PACKING MATERIAL (BULK PACK)

PACKING PART	SUBSTANCE	MASS (g)
box	cardboard	125.4
bag	polyethylene	14.5
label	paper	1.4

TRANSISTORS IN PLASTIC PACKAGE, SMD

REFERENCE	PACKAGE CODE(1)	MASS (mg)	BODY (mm)	PACKING QUANTITY
–	SOT23	8	2.9 × 1.3 × 0.9	3000
–	SOT89	50	4.5 × 2.5 × 1.5	1000
–	SOT143	8	2.9 × 1.3 × 0.9	3000
–	SOT223	124	6.5 × 3.5 × 1.6	1000
SC70-3	SOT323	5	2.0 × 1.3 × 0.9	3000
–	SOT343	6	2.0 × 1.3 × 0.9	3000
SC-59	SOT346	8	2.9 × 1.3 × 1.5	3000
SC70-5	SOT353	5	2.0 × 1.3 × 0.9	3000
SC70-6	SOT363	5	2.0 × 1.3 × 0.9	3000
SC-75	SOT416	2.5	1.6 × 0.8× 0.8	3000
SC-74	SOT457	11	2.9 × 1.0 × 1.5	3000

Note

1. All packages have a similar composition, quantities may vary.

Chemical content for group representiveSOT23

DEVICE PART	SUBSTANCE	MASS (mg)
leadframe	FeNi42(1)	2.6
	SnPb20 plated	0.3
active device	doped Si	0.1
encapsulation	OCN-epoxy polymer (SiO_2 < 72%, Sb < 2%, Br < 1%)	5.0

Note

1. Optional: copper-plated NiFe leadframe.

PACKING MATERIAL (REEL PACK)

PACKING PART	SUBSTANCE	Mass (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

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