85.42 - Electronic integrated circuits.

- Electronic integrated circuits :

8542.31 - - Processors and controllers, whether or not combined with memories, converters, logic circuits, amplifiers, clock and timing circuits, or other circuits

8542.32 - - Memories

8542.33 - - Amplifiers

8542.39 - - Other

8542.90 - Parts

The articles of this heading are defined in Note 9 (b) to the Chapter.

Electronic integrated circuits are devices having a high passive and active element or component density, which are regarded as single units (see Explanatory Note to heading 85.34, first paragraph concerning elements or components to be regarded as "passive" or "active"). However, electronic circuits containing only passive elements are **excluded** from this heading.

Unlike electronic integrated circuits, discrete components may have a single active electrical function (semiconductor devices defined by Note 9 (a) to Chapter 85) or a single passive electrical function (resistors, capacitors, inductances, etc.). Discrete components are indivisible and are the basic electronic construction components in a system.

However, components consisting of several electric circuit elements and having multiple electrical functions, such as integrated circuits, are not considered as discrete components.

Electronic integrated circuits include memories (e.g., DRAMS, SRAMs, PROMS, EPROMS, EEPROMS (or E^2PROMS)), microcontrollers, control circuits, logic circuits, gate arrays, interface circuits, etc.

Electronic integrated circuits include :

(I) **Monolithic integrated circuits**.

These are microcircuits in which the circuit elements (diodes, transistors, resistors, capacitors, inductances, etc.) are created in the mass (essentially) and on the surface of a semiconductor material (doped silicon, for example) and are therefore inseparably associated. Monolithic integrated circuits may be digital, linear (analogue) or digital-analogue.

Monolithic integrated circuits may be presented :

(i) Mounted, i.e., with their terminals or leads, whether or not encased in ceramic, metal or plastics. The casings may be cylindrical, in the form of parallelepipeds, etc.

(ii) Unmounted, i.e., as chips, usually rectangular, with sides generally measuring a few millimetres.

(iii) In the form of undiced wafers (i.e., not yet cut into chips).

Monolithic integrated circuits include :

(i) Metal oxide semiconductors (MOS technology).

(ii) Circuits obtained by bipolar technology.

(iii) Circuits obtained by a combination of bipolar and MOS technologies (BIMOS technology).

Metal oxide semiconductor (MOS), especially complementary metal oxide semiconductor (CMOS), and bipolar technologies are the "generic" technologies involved in the manufacture of transistors. As the basic components of monolithic integrated circuits, these transistors give the integrated circuit its identity. Bipolar circuits are preferred for systems where maximum logic speed is sought. On the other hand, MOS circuits are preferred for systems in which a high component density and low energy requirements are desirable. Further, CMOS circuits have the lowest energy requirements. Thus, they are preferred in applications where power supply is limited or where cooling problems are expected. The complementary relationship between bipolar and MOS technologies is even more apparent in the BICMOS technology, which combines the speed of bipolar circuits with the high integration and low power consumption of CMOS circuits.

(II) **Hybrid integrated circuits**.

These are microcircuits built up on an insulating substrate on which a thin or thick film circuit has been formed. This process allows certain passive elements (resistors, capacitors, inductances, etc.) to be produced at the same time. However, to become a hybrid integrated circuit of this heading, semiconductors must be incorporated and mounted on the surface, either in the form of chips, whether or not encased, or as encased semiconductors (e.g., in specially designed miniature casings). Hybrid integrated circuits may also contain separately produced passive elements which are incorporated into the basic film circuit in the same way as the semiconductors. Usually these passive elements are components such as capacitors, resistors or inductors in the form of chips.

Substrates made up of several layers, generally ceramic, heat-bonded together to form a compact assembly, are to be taken to form a single substrate within the meaning of Note 9 (b) (ii) to this Chapter.

The components forming a hybrid integrated circuit must be combined **to all intents and purposes indivisibly**, i.e., though some of the elements could theoretically be removed and replaced, this would be a long and delicate task which would be uneconomic under normal manufacturing conditions.

(III) **Multichip integrated circuits**.

These consist of two or more interconnected monolithic integrated circuits combined to all intents and purposes indivisibly, whether or not on one or more insulating substrates, with or without leadframes, but with no other active or passive circuit elements.

Multichip integrated circuits generally come in the following configurations :

- Two or more monolithic integrated circuits mounted side by side;

- Two or more monolithic integrated circuits stacked one upon the other;
- Combinations of the configurations above consisting of three or more monolithic integrated circuits.

These monolithic integrated circuits are combined and interconnected into a single body and may be packaged through encapsulation or otherwise. They are combined to all intents and purposes indivisibly, i.e., though some of the elements could theoretically be removed and replaced, this would be a long and delicate task which would be uneconomic under normal manufacturing conditions.

Insulating substrates of the multichip integrated circuits may incorporate electrically conductive regions. These regions may be composed of specific materials or formed in specific shapes to provide passive functions by means other than discrete circuit elements. Where conductive regions are present in the substrate, they are typically relied upon as a means by which the monolithic integrated circuits are interconnected. These substrates may also be referred to as "interposers" or "spacers" when placed above the bottom-most chip or die.

Monolithic integrated circuits are interconnected by a variety of means, such as adhesives, wire bonds, or "flip chip" technology.

(IV) **Multi-component integrated circuits (MCOs).**

These are combinations of the circuits and elements mentioned in Note 9 (b) (iv) to this Chapter.

Multi-component integrated circuits (MCOs) are a combination of one or more monolithic, hybrid, or multi-chip integrated circuits with either silicon based sensors, actuators, oscillators, resonators and combinations thereof, or one or more components performing the functions of articles classifiable under heading 85.32, 85.33, 85.41 or inductors classifiable under heading 85.04.

This includes the possibility that MCOs also can contain MCOs as long as they meet the conditions of the Note 9 (b) (iv) to Chapter 85.

All separate (tradeable) units, which are not classifiable under 85.32, 85.33, 85.04, 85.41 or which do not fall under the definition of silicon based sensors, actuators, resonators, oscillators and combinations thereof are **excluded** from the definition of an MCO (e.g., transformers (heading 85.04) or magnets (heading 85.05)).

However, other different elements that are not mentioned but which are intrinsically or necessarily part of a MCO (or of IC packages), such as substrates whether or not functioning as printed circuits, gold wires or conductive regions, or are necessary for the construction and function, e.g. mold compound or lead frames, are accepted parts/elements of the MCO.

The integrated circuits and components forming a MCO are combined and interconnected physically, electrically or optically into or onto a single body (a component existing as particular or independent technical unit with common connection to the outside world through pins, leads, balls, lands, bumps, or pads) whether or not on one or more insulating substrates, with or without lead frames, and may be packaged through encapsulation or otherwise.

The components must be combined to all intents and purposes indivisibly, i.e., though some of the elements could theoretically be removed and replaced, this would be uneconomical under normal manufacturing conditions.

The MCOs are often intended for mounting with their terminals or leads in, or on, a supporting carrier (e.g., printed circuit boards (PCBs) or other carriers, such as thick-film, thin-film, insulated metal substrates, etc.) or connecting to an electric interface. Packages of the MCOs can be made of several materials, have various designs and forms, and can protect the unit from mechanical and environmental influences.

The MCOs can have different features (e.g., a package can be solid, or have holes, windows or membranes) or attachments that are necessary for specific functions. The MCOs use these different features and attachments to receive input from outside supplied physical or chemical quantities and process these data for output in relation with silicon-based sensors, actuators, oscillators, resonators.

They can be used in a variety of applications, including computer, communication (e.g., telephones for cellular networks), consumer, industrial or automotive applications.

The heading **excludes** film circuits consisting solely of passive elements (**heading 85.34**).

This heading **does not include** solid-state non-volatile storage devices, "smart cards" and other media for the recording of sound or of other phenomena (see **heading 85.23** and Note 5 to this Chapter).

°
° °

Except for the combinations (to all intents and purposes indivisible) referred to in Parts (II), (III) and (IV) above concerning hybrid integrated circuits, multichip integrated circuits and multi-component integrated circuits (MCOs), the heading also **excludes** assemblies formed by :

(a) Mounting one or more discrete components on a support formed, for example, by a printed circuit;

(b) Adding one or more other devices, such as diodes, transformers, or resistors to an electronic microcircuit;

(c) Combinations of discrete components or combinations of electronic microcircuits other than multichip-type or multi-component-type integrated circuits.

(d) Combinations of one or more monolithic, hybrid, multi-chip, or multi-component integrated circuits with components not mentioned in Note 9 (b) (iv) to this Chapter (e.g., transformers (heading 85.04) or magnets (heading 85.05)).

Such assemblies are classified as follows :

(i) Assemblies which constitute a complete machine or appliance (or one classified as complete), in the heading appropriate to the machine or appliance;

(ii) Other assemblies, in accordance with the provisions for the classification of machine parts (Notes 2 (b) and 2 (c) to Section XVI, in particular).

This is the case, in particular, for certain electronic memory modules (e.g., SIMMs (Single In-line Memory Modules) and DIMMs (Dual In-line Memory Modules)). Those modules are to be classified by application of Note 2 to Section XVI. (See the General Explanatory Note to this Chapter).

* * *

PARTS

Subject to the general provisions regarding the classification of parts (see the General Explanatory Note to Section XVI), parts of the goods of this heading are classified here.