IEC 60191-4

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Mechanical standardization of semiconductor devices – Part 4: Coding system and classification into forms of package outlines for semiconductor device packages

Normalisation mécanique des dispositifs à semiconducteurs – Partie 4: Système de codification et classification en formes des structures des boîtiers pour dispositifs à semiconducteurs

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

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MECHANICAL STANDARDIZATION OF SEMICONDUCTOR DEVICES –

Part 4: Coding system and classification into forms of package outlines for semiconductor device packages

FOREWORD

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International Standard IEC 60191-4 has been prepared by subcommittee 47D: Semiconductor devices packaging, of IEC technical committee 47: Semiconductor devices.

This third edition cancels and replaces the second edition published in 1999, Amendment 1:2001 and Amendment 2:2002.This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) Material code "S" is added to indicate a silicon based package.
b) Description of "WL" is added to be used for general use.

The text of this standard is based on the following documents:

FDIS	Report on voting
47D/837/FDIS	47D/848/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all the parts in the IEC 60191 series, published under the general title *Mechanical standardization of semiconductor devices*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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MECHANICAL STANDARDIZATION OF SEMICONDUCTOR DEVICES –

Part 4: Coding system and classification into forms of package outlines for semiconductor device packages

1 Scope

This part of IEC 60191 specifies a method for the designation of package outlines and for the classification of forms of package outlines for semiconductor devices and a systematic method for generating universal descriptive designators for semiconductor device packages.

The descriptive designator provides a useful communication tool but has no implied control for assuring package interchangeability.

2 Coding system of package outlines for semiconductor devices

The following coding system will be used in the publications concerning mechanical standardization:

– first: a three-digit serial number (000 to 999);
– second: a single reference letter indicating the form as shown in Table 1;
– third: a two-digit serial number (00 to 99) to indicate a variant of an outline drawing. The use of prefix P to indicate a provisional drawing remains unchanged.

Examples

– 101A00
– 050G13
– P 101F01

3 Classification into forms of package outlines for semiconductor devices

The package outline drawings for semiconductor devices are classified into forms according to the following scheme:

– form A: single-ended
– form B: heat-sink-mounted
– form C: stud-mounted
– form D: axial-leaded
– form E: surface-mounted
– form F: single-ended, heat-sink-mounted
– form G: dual and quad in-line
– form H: axial lead-less.

4 Coding system for semiconductor-device packages

4.1 General

The standard coding system is a method for identifying the physical features of an electronic device package family. The system is predicated upon a minimum two-character designator, which indicates the package outline style. This designator can be extended, through the use of optional, user-selected fields, to provide additional package information such as terminal position and count, terminal form, package shape, and predominant body material.

4.2 New descriptive codes

If a new package that does not conform to one of the designated field character codes is being proposed, a new code may be recommended for standardization.

4.3 Descriptive designators

4.3.1 General remarks

The package outline style code is the only compulsory field within this descriptive designation system. Additional information may be provided using optional prefixes and suffixes described by the system. In general, these fields are independent of one another. Unless otherwise indicated herein, the users of this system may pick and choose which of these fields they wish to implement for their specific application (see Figure 1). The descriptive designator may be extended with additional information, provided this information is separated from the descriptive designator by a slash (/) (see 4.3.7).

NOTE Basic package codes and names are presented in Table B.1.

4.3.2 Minimum descriptive designator

The minimum descriptive designator is a two-letter code that classifies device packages into standard package outline styles. These styles identify general external physical features. Common two-letter descriptive codes or abbreviations are included, such as CC, FP, SO, GA.

Figure A.1 shows two-letter codes for various device package outline styles and depicts examples of each. Table 1 lists the two-letter package-outline-style codes described in Clause 5.

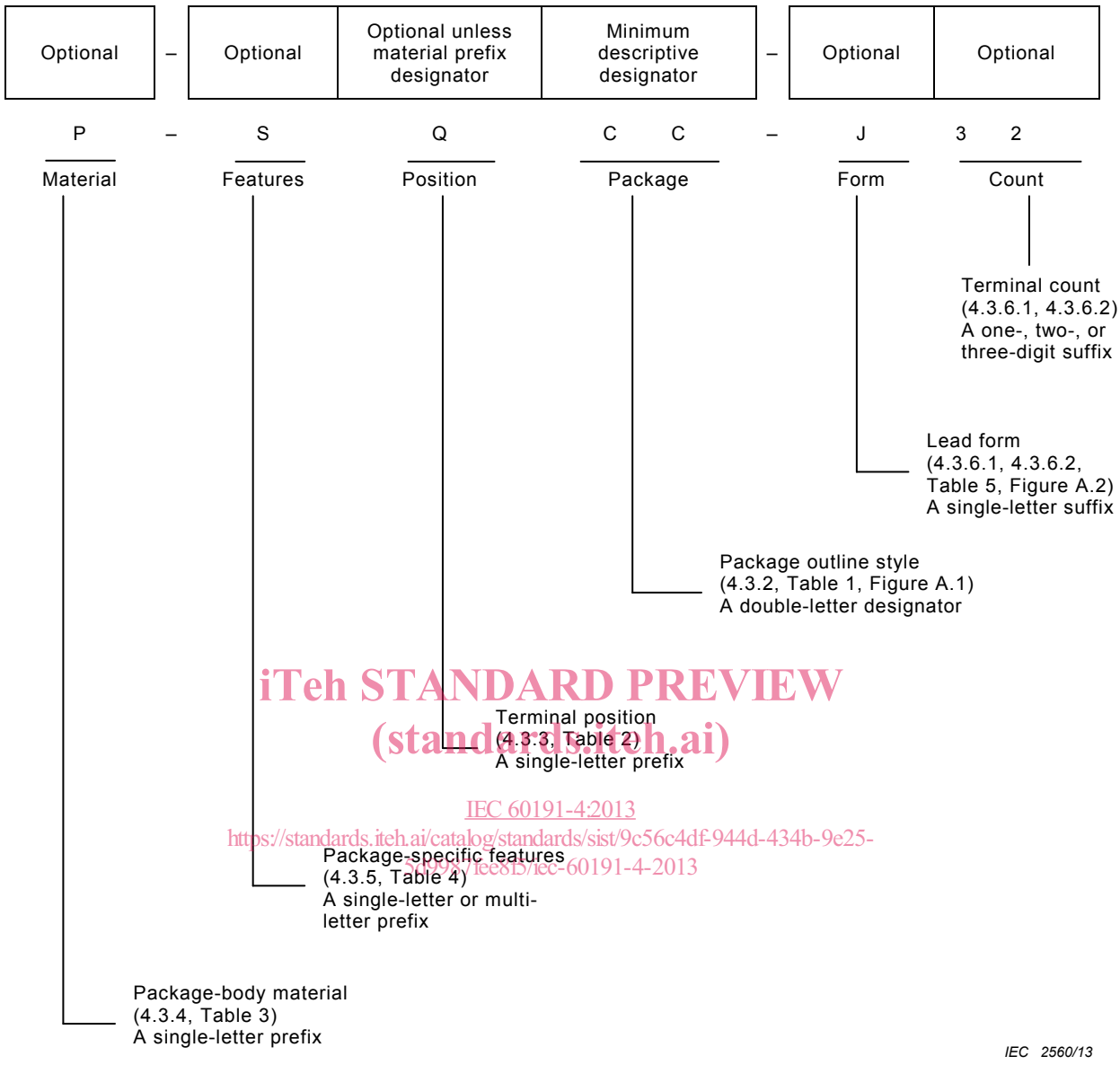

Figure 1 – Descriptive coding for semiconductor device packages

Table 1 – Package-outline-style codes

Form	Code	Outline style
E	CC	Chip-carrier package
B	CP	Clamped package (press-pack)
A	CY	Cylinder or can package
D/E	DB	Disk-button package
F	FM	Flange-mount package
A	FO	Fibre optic device package
E	FP	Flatpack package
G	GA	Grid-array package
G	IL	In-line package. **The preferred designator is IP.**
G	IP	In-line package or inserted package. **Restrict to DIP/SIP/ZIP.**
D/H	LF	Long-form horizontal package
	MA	Microelectronic assembly
B	MP	Power module package
	MW	Microwave package
B	PF	Press-fit package
C	PM	Post-(stud-) mount package
E	SO*	Small-outline package
A	SS	Special-shape package
	UC	Uncased chip
	VP	Vertical surface-mount package
	XA-XZ	Non-defined family; vendor or user option
* Industry practice sometimes uses "P" for "package" in the location normally occupied by this field (except that there is no preceding hyphen), for example SOP.		

4.3.3 Terminal-position prefix

The two-letter, package-outline-style code may be supplemented with a single-letter prefix that identifies the physical terminal positions or, if applicable, the interconnect land pattern. Examples of three-letter designators include common acronyms or abbreviations, such as DIP, LCC (QCC preferred), PGA, QFP, SIP, ZIP.

NOTE 1 A terminal is defined as an externally available point of connection.

NOTE 2 The proper terminal-position prefix is determined by the interconnect land structure. For example, the code for a single row of terminals formed into a staggered configuration would be "Z".

Table 2 gives a list of one-letter, terminal-position prefix codes.

4.3.4 Package-body-material prefix

The three-letter descriptive designator (see 4.3.2) may be further supplemented by a single-letter prefix that identifies the predominant package-body material. This prefix shall not be used unless the terminal-position prefix described in 4.3.2 is also used. Examples of such four-letter descriptive designators include common acronyms or abbreviations, such as CDIP, PDIP, PLCC (PQCC preferred), MELF, PQFP.

Table 3 gives a list of one-letter package-body-material prefix codes.

If the package-body material is other than one of those defined in Table 3, the letter "X" shall be used within the descriptive designator to signify a special or new material and shall later be replaced with an IEC-approved code.

4.3.5 Package-specific feature prefix

Package-specific features may be described through the use of a multiletter prefix. The package-specific feature prefix shall be set off from the following portion of the descriptive designator by a dash (–).

Table 4 gives a list of package-specific feature prefix codes. Figure 2 shows the relationship of codes to profile and pitch.

4.3.6 Lead-form and terminal-count suffixes

4.3.6.1 General lead-form and number of terminals

The general lead form (or terminal shape) and/or the number of terminals on a package may be described through the use of two fields, the lead-form suffix and the terminal-count suffix. These two fields shall be set off from the preceding portion of the descriptive designator by a dash (–).

Users of this system may choose to use the lead-form suffix, or the terminal-count suffix, or both. If the lead-form suffix is used in conjunction with the terminal-count suffix, it shall precede the terminal-count suffix.

Table 2 – Terminal-position prefixes

Code	Name	Position [a) b)]
A	Axial	Terminals extend from both ends in the direction of the major axis of a cylindrical or elliptical package
B	Bottom	Terminals extend from the bottom of the package
D	Double	Terminals are on opposite sides of a square or rectangular package or located in two parallel rows
E	End	Terminals are package endcaps having a circular or elliptical cross-section
L	Lateral	Terminals are on the four sides of a square or rectangular package **The preferred name is "quad", code Q**
P	Perpendicular	Terminals are perpendicular to the seating plane on a square or rectangular package. **Restrict to PGA family**
Q	Quad	Terminals are on four sides of a square or rectangular package or located in four parallel rows
R	Radial	Terminals extended radially from the periphery of a cylindrical or spherical package
S	Single	Terminals are on one surface of a square or rectangular package in a single row
T	Triple	Terminals are on three sides of a square or rectangular package
U	Upper	Terminals are perpendicular to and opposite the seating plane, and are on one surface of a package
X	Other	Terminal positions are other than those described
Z	Zig-zag	Terminals are on one surface of a square or rectangular package arranged in a staggered configuration

a) These descriptions assume the seating plane in the bottom of the package.

b) Reference to package shape does not take into account flanges, notches or other irregularities.

Table 3 – Prefixes for predominant package-body material

Code	Material
C	Ceramic, metal-sealed co-fired
G	Ceramic, glass-sealed
L	Glass
M	Metal
P	Plastic (including epoxy)
S	Silicon
T	Tape
X	Other

Table 4 – Prefixes for package-specific features

Order	Functional classification	Code	Package-specific feature
1	Outline addition	H	Integral heat slug
		D	Transparent window
		P	Piggyback or Terminal for stack
2	Seating height	None	Standard profile (1,70 mm < none)
		L	Low profile (1,20 mm < L ≤ 1,70 mm)
		T	Thin profile (1,00 mm < T ≤ 1,20 mm)
		V	Very thin profile (0,80 mm < V ≤ 1,00 mm)
		W	Very, very thin profile (0,65 mm < W ≤ 0,80 mm)
		U	Ultra thin profile (0,50 mm < U ≤ 0,65 mm)
		X	Extremely thin profile (X ≤ 0,50 mm)
3	Terminal pitch and position	S	Shrink pitch (< basic pitch) (restricted to DIP, SIP, SOP families) SDIP (1,778 mm pitch) SZIP (1,778 mm and 1,27 mm pitch) SSOP (1,0 mm, 0,8 mm, 0,65 mm, 0,5 mm and 0,4 mm pitch)
		F	Fine pitch (QFP at ≤ 0,50 mm pitch and ≤ 0,80 mm pitch for BGA and LGA)
		I	Interstitial pitch (staggered leads)

X ≤ 0,50 mm < U ≤ 0,65 mm < W ≤ 0,80 mm < V ≤ 1,00 mm

< T ≤ 1,20 mm < L ≤ 1,70 mm < No code

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Figure 2 – Relationship of codes to profile

4.3.6.2 Lead-form suffix

The lead-form suffix is a one-letter suffix that identifies the standard form or shape of the lead. Table 5 gives a list of one-letter, lead-form suffix codes.

If more than one type of terminal is present, the terminals carrying the principal current determine the lead-form code. If one of these terminals is a mounting stud or flange, its shape

shall not govern the choice of lead-form (or terminal-shape) suffix because that has already been described by the package-outline-style code. If the lead form is other than one of those defined in Table 5, the letter "X" shall be used within the descriptive designator to signify a special or new lead form and shall later be replaced with an IEC-approved code. Examples are illustrated in Figure A.2.

4.3.6.3 Terminal-count suffix

The terminal-count suffix is a numeric field used to identify the number of terminals on the device package. If there is more than one type of terminal, the terminal count shall include only those terminals that were used to determine the lead-form suffix in accordance with 4.3.6.1. If the terminal count (including terminals not used) is less than the number of available terminal positions, the latter may be added in parentheses, for example 20(26) and 168(289).

4.3.7 Detailed information field

A slash (/), followed by a supplemental one- to twenty-character detailed information field, may be added to the descriptive designator. The field may contain the IEC designation or some other user-specified coding scheme.

The slash (/) shall signify the beginning of the supplementary detailed information field. There shall be no space character between the slash (/) and adjacent fields.

Table 5 – Suffixes for lead form (or terminal shape)

Code	Form/shape	Description (see Figure A.2)
A	Screw	A threaded hole for a screw on the top of the package
B	Butt or ball	A short lead or solder ball intended for attachment perpendicular to the land structure
C	C-bend	A "C"-shaped compliant or non-compliant lead bent down and under the body of the package
D	Solder lug	A lug terminal on the package
E	Fast-on plug	A fast-on plug extending from the body of the package
F	Flat	A compliant or non-compliant, non-formed flat lead that extends away from the body of the package
G	Gull wing	A compliant lead bent down from the body of the package with a foot at the end pointing away from the package
H	High-current cable	A lug terminal at the end of a flexible lead
I	Insulated	A flat lead formed by depositing a thin conductor on a supporting insulating film
J	"J" bend	A "J"-shaped compliant lead bent down and back under the body of the package
L	"L" bend	An "L"-shaped compliant lead intended for surface mounting
N	No lead	Metallized terminal pads located on the body of the package
P*	Pin or peg	A tempered lead extending from the body of the package and intended for attachment to a plated through-hole in the land structure
Q	Quick-connect	A tab-like terminal extending from the body of the package
R	Wrap-around	A metallized non-compliant terminal wrapped around the package body
S	"S" bend	An "S"-shaped compliant lead bent under the body of the package
T	Through-hole	A terminal with flat or V-shaped cross-section intended for attachment to a plated through-hole in the land structure
U	"J" inverted	A "J"-shaped compliant or non-compliant lead bent down from the body of the package with the curved end pointing away from the package
W	Wire	An untempered wire lead extending from the body of the package
X	Other	A lead form or terminal shape other than those defined
Y	Screw	A threaded hole
* Industry practice sometimes uses "P" for "package" in the location normally occupied by this field (except that there is no preceding hyphen), for example SOP.		

5 Coding system of package-outline styles

– **CC, chip carrier:** A low-profile package whose chip cavity or mounting area occupies a major portion of the package area and whose terminals consist of metal pad surfaces (on the leadless versions) or leads formed around the sides and under the package or out from the package (on leaded versions).

NOTE 1 The body of the chip carrier, usually square or of low aspect ratio, is similar to that of a flatpack.

NOTE 2 When leads extend out from the package, the preferred term is "flatpack" (see FP).

– **CP, clamped package (press-pack):** Package, for high-current devices, in the form of a cylinder with a plane, circular, high-current terminal at each end, intended to be clamped against or between two busbars acting as heat sinks.

– **CY, cylinder or can:** Generally cylindrical package. It usually has terminals that exit from one end, parallel to the central axis of the package and is mounted perpendicular to the seating plane.

– **DB, disk-button:** Low-profile package that looks like a disk or button. It usually has terminals that exit radially from the periphery of the package like the spokes of a wheel or from the disk centre. Terminals may be formed into a variety of shapes.

– **FO, fibre optic:** Microcircuit package that has one or more fibre-optic connectors. Its terminals may exit from, or attach to, any surface of the package and may be formed in a variety of lead shapes.

NOTE 3 The fibre-optic connectors are considered to be terminals.

– **FM, flange mount:** Package that has a flange-mounted heat sink that is an integral part of the package and provides mechanical mounting to a packaging interconnect structure or cold plate. It usually has terminals that exit from, or attach to, any surface of the package in a variety of forms.

– **FP, flatpack:** Low-profile package whose leads project parallel to, and are designed primarily to be attached parallel to, the seating plane.

NOTE 4 The leads originate typically at either two or four sides of a package.

NOTE 5 The body of the flatpack is similar to that of a chip carrier.

NOTE 6 Leads can be formed generally away from the package body. If the leads are formed back towards the package body, the correct term is "chip carrier" (see CC).

– **GA, grid array:** Low-profile package whose terminals are located on one surface in a matrix of at least three rows and three columns; terminals may be missing from some row-column intersections.

– **IP (or IL), in-line package:** Rectangular package having one row or two or more parallel rows of leads designed primarily for insertion mounting perpendicular to the seating plane.

NOTE 7 The leads can all emerge from a single side or from two parallel sides with the leads formed to produce parallel rows.

NOTE 8 The preferred code is "IP".

– **LF, (long-form) package:** Cylindrical or elliptical tubular package having terminal end-caps or axial leads. Its long-form body is usually mounted parallel to the mounting plane.

– **MA, microelectronic assembly:** Assembly of unpackaged (uncased) microcircuits and/or packaged microcircuits, which may also include discrete devices, so constructed on a packaging interconnect structure that for the purpose of specification, testing, commerce, and maintenance, the package is considered to be an indivisible component. The passive and/or active discrete and microelectronic devices may be mounted on either one or two sides of the packaging interconnect structure, and the external terminals usually exit from one side of the assembly. A variety of package sizes, shapes, and external terminal forms are possible.

– **MP, (power) module package:** Package designed for housing two or more power semiconductor chips having a mounting base which is not a terminal, and several screw and/or fast-on or pin terminals on the surface opposite the mounting base.

– **MW, microwave package:** Package specially designed to provide device operation at microwave frequencies.

NOTE 9 "Specially designed" includes, but is not limited to, microwave cavities or terminals with controlled common-element impedance.

– **PF, press fit:** Round or elliptical package whose mechanical mounting area is pressed into the packaging interconnect structure or cold plate for purposes of thermal and electrical connection. Its external terminals may take on a variety of forms.

– **PM, post or stud mount:** Package whose mechanical mounting device is a threaded stud, threaded hole, or post for mounting to the packaging and interconnect structure or cold plate. A variety of package shapes and external terminal forms are possible.

– **SO, small outline:** Low-profile rectangular surface-mount component package. Its chip (die) is bonded to an inner land contact area, primarily a lead frame. External terminals exit parallel to the seating plane on two opposite sides of the moulded, flat package.