

Standard Linear & Logic Semiconductor Marking Guidelines

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ABSTRACT

The Texas Instruments Standard Linear & Logic (SLL) business group uses complex methods to assign device topside marking. These methods ensure that correct component identification is applied at each factory location. End users of the standard components often need to peruse many TI and industry publications to understand the markings. This application report combines topside-marking guidelines and package-outline examples in one document.

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Introduction

This application report describes the guidelines used by SLL to mark semiconductor packages. This document provides customers the answers to the most frequently asked questions and allows them to review the rules used in marking TI devices. Internet web addresses of available tools also are provided.

Background

The marking of microcircuits originates in military specifications. MIL-M-38510 defines general rules for marking devices used in most military applications. Some of the requirements of MIL-M-38510 are package index identifier, part identification, chip identification code, manufacturer's identification code, manufacturer's designation, country of origin, device type, device class, drawing designator, case outline, and many others. TI marking specifications are based on some of the same requirements.

Standards for Topside Marking of Semiconductor Components

Commercial marking specifications are an outgrowth of the military applications. The marking placed on each component provides important information about how and where the device was manufactured and about the materials used in the manufacturing process.

TI defines marking requirements in its internal specification system for each unique device. The assignment of specific device marking is defined by technology namerules, the specific electronic function, and the assigned package namerules. The standard component-identification requirements are defined in TI quality-system specifications. The quality requirements for the component, as marked, are defined in the specific package family quality specifications.

TI standard marking contains the following items:

- TI logo
- Lot trace code (LTC)
- Device name (or abbreviation or code)
- Pin 1 identifier (if not a mechanical feature of the package)

The TI logo is used as the company identifier for most marking applications. In some cases, due to component size, TI is used in place of the TI logo. Some components are so small that no company identifier is used.

The LTC is used in TI marking if space permits, and contains the following information:

- Date of manufacture by year (Y) and month (M) the lot started in assembly
- Specific assembly-lot code (LLLL) (sequential alphanumeric identification assigned when the lot started in assembly)

For some assembly subcontractors, the assembly-lot code characters are ZLLL. The Z *always* is the leading character and is reserved to ensure that only specific subcontractors use it. The remaining characters (LLL) are assigned and used by the specific subcontractor for lot-genealogy purpose.

- Site of manufacture code (S)

The LTC provides a means of tracing an individual marked component to the assembly site, the assembly-lot number, the wafer-fabrication site, and the specific wafer-fabrication lot number.

The LTC for each manufacturing lot is generated when the lot starts assembly, and is printed as part of the marking diagram on the specific-lot factory traveler. Figure 1 illustrates a typical traveler marking diagram.

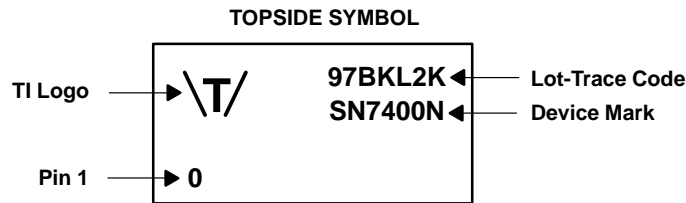


Figure 1. Typical Text Printed on the Lot Traveler

Package Technology Marking Restrictions

The demand for smaller and lighter systems applications, coupled with the increasing complexity of electronic technologies and functions, has produced an antagonistic relationship between the technology device identifiers and the available surface area on the devices for marking. While device names have more characters, typically, the package is shrinking. Figure 2 is an example of standard marking for the SN7400N device.



Figure 2. Standard Marking

Recent technology names are more complex. It is not uncommon for device names to exceed 20 characters. If the number of characters in the device name exceeds the maximum characters allowed on a single line for the particular package, the device name must be abbreviated or coded. Figure 3 shows the result if a device name is too long. The SN74ALVCHR162269A DGGR is shortened by omitting the prefix (SN74) and the suffix (DGGR) to allow an abbreviated mark, but the technology and function can be identified easily.



Figure 3. Typical Abbreviated Device Marking

If the package is even smaller, the package marking is coded. Figure 4 shows a typical coded marking.

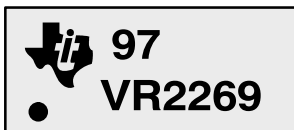


Figure 4. Coded Marking

In this example, the LTC is shortened to only the year and month of manufacture. The device name is coded in very short form. If possible, the code contains some of the technology characters.

Using coded symbology also can complicate lot genealogy. If a problem is discovered involving *one* device produced in this year and month, and lot identification is not evident, *all* lots of this device type produced during this month are quarantined.

Typical Applications of Each Marking Format

SLL uses three standard marking formats, which are the preferred formats for all standard catalog devices. Use of these standard formats is encouraged, even if customers require special content.

Format 1 – Standard two-line marking

Format 2 – Standard three-line marking

Format 3 – Two-line marking for very small packages

Format 1 (see Figure 5) is the preferred format for all marking and is used on all packages where space is not a limiting factor. Key features of this format are that it allows the use of the full TI logo, the full LTC, and the full device name as ordered. Lot genealogy can be traced to a single assembly lot at a single site, and the component is marked with the actual device name as ordered by the customer.



Figure 5. Generic Marking Standard, Format 1

Format 2 (see Figure 6) is used on packages that are too small for Format 1. This format allows use of the full LTC and maintains the lot-genealogy capability of Format 1. The device name can be abbreviated or coded, depending on the technology/function and package used.

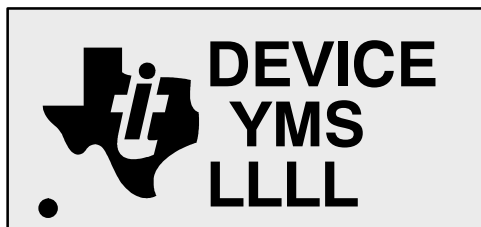


Figure 6. Generic Marking Standard, Format 2

Format 3 (see Figure 7) is used only on smaller packages where neither Format 1 or Format 2 is feasible. This format loses the full LTC and decreases lot-genealogy capability (from the individual component) to *all* lots of a device type in a specific year and month.



Figure 7. Generic Marking Standard, Format 3

Additional special formats are used on very small packages, such as SOT/TO. The format is tailored to the specific package. Figure 8 shows one special format, for the DBV package.

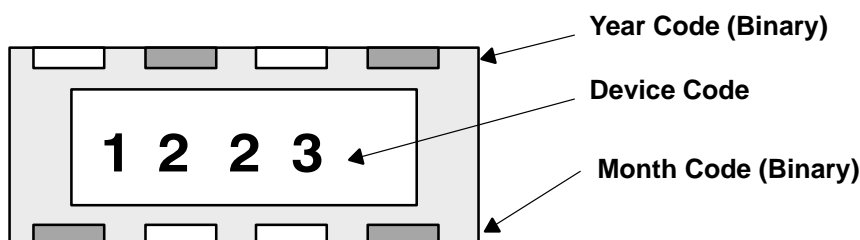


Figure 8. Generic Special Marking Format for the DBV Package

In this example, the year and month are binary codes along the edges of the device (year is 5 for 1995, and month is 9 for September).

The device code is four characters where:

Character 1 = Technology code

Characters 2 and 3 = Device function code (two characters)

Character 3 = Wafer fabrication and assembly site (combination) code

Device Marking Assignment

SLL has defined naming rules (namerules) that determine the marking applied to a specific standard catalog device. There are three namerules for each technology: A, B, and C. Standard pin/package configurations have a unique namerule and format assigned.

An example of a device/technology namerule for an SN74ABT device is:

NAMERULE A	NAMERULE B	NAMERULE C
SN74ABT***	ABT***	AB***

The asterisks are wild-card characters for the specific device function.

Device namerule A uses the entire device name, including any prefixes and the package designator:

DEVICE NAME	MARKING
SN74ABT245N	SN74ABT245N

The N package is assigned to namerule A and format 1.

Device namerule B omits the prefix and package designator from the device name:

DEVICE NAME	MARKING
SN74ABT245DW	ABT245

The 20-pin DW package is assigned to namerule B, format 1.

Device namerule C codes the device name:

DEVICE NAME	MARKING
SN74ABT245PWR	AB245

The 20-pin PW package is assigned to namerule C, format 2.

Device revisions are included as a part of the device marking, for example:

NAMERULE	DEVICE NAME	MARKING
A	SN74ABT245AN	SN74ABT245AN
B	SN74ABT245ADW	ABT245A
C	SN74ABT245APWR	AB245A

Namerule C needs further explanation. Device functions with three numbers (e.g., 245 in the examples above) also apply to device functions with fewer than three numbers.

For example, for namerule set SN74HCT*** HCT*** HT***
an SN74HCT**04**PWR device is marked HT**04**.

Conversely, device namerules with three numbers *do not necessarily apply* to device names with *more than three numbers*.

For example, for namerule set SN74ABT*** ABT*** AB***
an SN74ABT**245**PWR device is marked AB**245**.

However, a device such as SN74ABT**2245**PWR *is not* marked AB**2245**.

A different namerule applies to SN74ABT2*** devices.

For example, for namerule set SN74ABT2*** ABT2*** AA***
the SN74ABT**2245**PWR is marked **AA245**.

Some packages, because of their very small size, have special namerules and formats. The SOT packages (DBV, DCK, and PK) are examples of these special assignments. Each special namerule has a separate listing of the rules for the specific technology, package, and function combinations.

Web Address of Marking Guidelines

The main page of the SLL marking guidelines is:

<http://focus.ti.com/pdfs/logic/logicpkginfo.pdf>

This page contains links to other marking web pages and provides a brief explanation of how to determine the correct marking for a particular device.

For example:

1. To find the device name marking for the SN74ABT245N device in the Package Namerule Assignments table, find 20 PIN PDIP (N) and the corresponding NAMERULE A.
2. In the Device Namerules table, look in the A column to find the device technology (e.g., SN74ABT***), and note that this device uses the entire device name and the package code (N). Therefore, the device name marking on the device is: SN74ABT245N.

The page also contains the package namerule and format assignments by pin and package, the device/technology namerule definitions, the special namerule and format defined for the 5-pin DBV package, package moisture sensitivity levels, and standard pack quantities for logic products.

Conclusion

The SLL marking assignments provide unique identification for each device. The advent of more complex technologies, and the corresponding lengthening of the technology name, is making it difficult to assign intuitive marking. This, in turn, requires more marking assignments to be coded. Coded marking requires more details to be available to customers to ensure that the correct product is purchased for customers' applications. The marking on the device package is the link to the component's complete identification and its process history.

Glossary

SLL	Standard Linear & Logic, a TI strategic business entity
Marking	The characters physically marked on the topside of each device
Pin/Pkg	The number of pins on a particular package
Namerule	A set of marking guidelines for a specific technology that defines the marking for specific devices in specific package outlines

References

1. MIL-M-38510 Marking historical requirements

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