IPC-2316

Design Guide for Embedded Passive Device Printed Boards

Developed by the Embedded Devices Design Subcommittee (D-51) of the Embedded Components Committee (D-30) of IPC

Users of this publication are encouraged to participate in the development of future revisions.

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Design Guide for Embedded Passive Device Printed Boards

1 SCOPE

1.1 Statement of Scope This document is a guide to established and emerging embedded passive materials and technologies. It should not be used as an endorsement of any particular material or company product.

1.2 Purpose The purpose of this document is to give users and designers of printed boards the necessary information for incorporating embedded passive components into their applications. In addition, it also assists the user in understanding some of the physical and thermal characteristics of the embedded component materials so that their designs can achieve maximum stability and performance.

1.3 Terms and Definitions Terms and definitions shall be in accordance with IPC-T-50 and as stated herein.

Passive Components – Passive components usually refer to resistors, capacitors and inductors but can also include thermistors, varistors, transformers, temperature sensors, and almost any nonswitching analog device that perform the following functions:

- Provide or absorb energy to maintain a constant voltage or current.
- Filter signals to provide safe signals to other circuits.
- Control impedance.
- Sense signals to transmit information to other circuits.
- Delay or synchronize signals to provide timing to other circuits.

Discrete – A single passive element in its own leaded or surface mount technology (SMT) package. Figure 1-1 shows an example of a single resistor, capacitor, or inductor in a 0402 size (generally defined as a 1.0 mm by 0.5 mm [0.040 in by 0.020 in] package). The majority of discrete passives have two electrical contacts that are also used for soldering to the board.

Passive Array – A passive array comprises multiple passive components of like function, which are formed on the surface of a separate substrate and packaged in a single SMT case (see Figure 1-2). The case is then mounted on the primary interconnect substrate of the system. Examples include an array of capacitors or an array of resistors.

Passive Networks – Passive networks comprise multiple passive components of more than one function, which are formed on the surface of a separate substrate and packaged in a single SMT case. The case is then mounted on the primary interconnect substrate of the system. These passive networks typically have some internal connections to form simple functions such as terminators or filters.

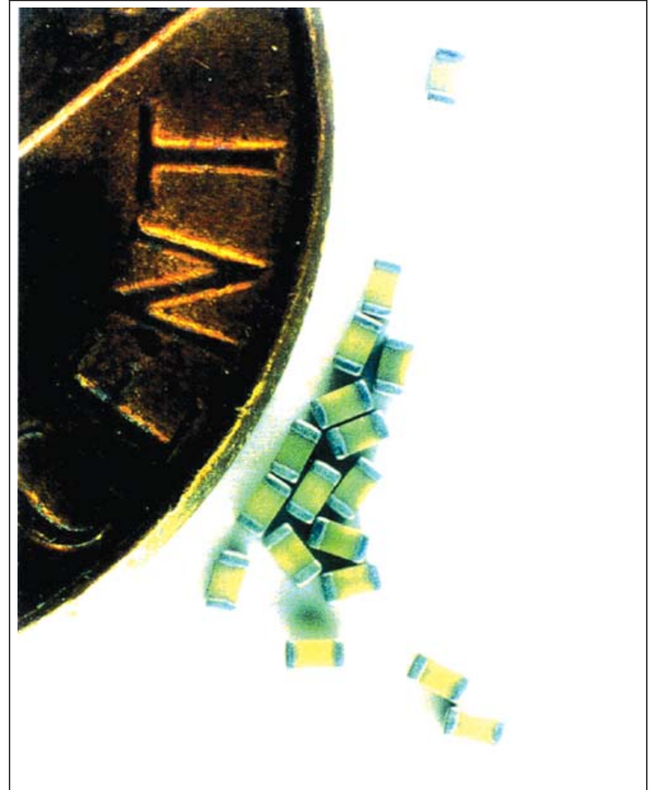

Figure 1-1 Discrete Passives

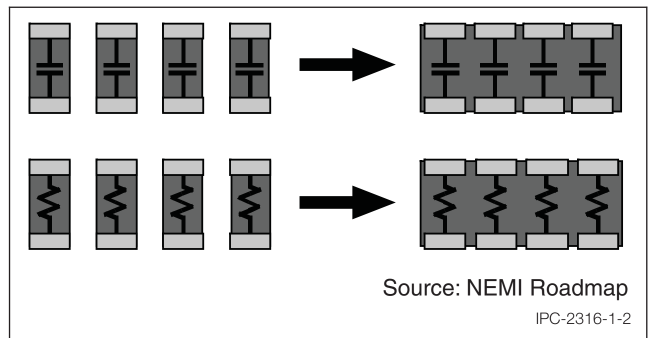

Figure 1-2 Passive Arrays

Integrated Passive Component – Multiple passive components that share a substrate and package. Integrated passive components may be housed inside the layers of the primary interconnect substrate, which would give them the subdesignation of an *embedded passive component.* Alternately, these components may be on the surface of a separate substrate that is then placed in an enclosure and