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# IPC-7912

## Calculation of DPMO and Manufacturing Indices for Printed Board Assemblies

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A standard developed by IPC

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# Calculation of DPMO and Manufacturing Indices for Printed Board Assemblies

## 1 OVERVIEW

**1.1 Scope** This document is intended to define standard methods for the categorization of defects related to electronic printed board assemblies (PBAs). This document will provide consistent methodologies for calculating the following benchmark indices:

- Defects Per Million Opportunities Index (DPMO Index).
- Component DPMO.
- Placement DPMO.
- Termination DPMO.
- Overall Manufacturing Index (OMI).

Both DPMO and OMI imply a measurement taken on completed product.

This document is intended to be used in conjunction with IPC/EIA J-STD-001. Figure 4-1 provides users with a graphical representation of DPMO and OMI.

This document is for benchmarking and is NOT intended to describe how to track or otherwise log defect types or drive corrective action. In-process DPMO is outside the scope of this document.

**Note:** The intent of this document is to define “how” to arrive at several DPMO related indices. There is no intent to dictate the “number” of assemblies or data points that are needed to calculate these indices. Users of this document are cautioned when comparing one manufacturer’s indices to one another due to differences in assembly complexity and the amount of data that may have been used in a computation.

**1.2 Purpose** To define a consistent method for calculating DPMO and OMI on completed electronic assemblies in order to benchmark the electronic assembly process.

- The assumption is that each printed board assembly that is inspected will be 100% inspected for all defects identified in Appendix B and only inspected PBAs will be used to determine opportunity count.
- An assumption of 100% inspection efficiency is made.

### 1.3 Terms and Definitions

**1.3.1 DPMO** (Defects per Million Opportunities) is defined as the number of defects divided by the number of defect opportunities, multiplied by 1,000,000.

**1.3.2 DPMO Index** DPMO Index is defined as the total number of defects on a completed assembly divided by the total number of opportunities for that assembly, multiplied by 1,000,000.

**1.3.3 OMI** Overall Manufacturing Index is an alternative index that combines component, placement and termination defect rates in an unweighted manner to an aggregate number.

## 2 APPLICABLE DOCUMENTS<sup>1</sup>

**IPC/EIA J-STD-001** Requirements for Soldered Electrical and Electronic Assemblies

**IPC-A-610** Acceptability of Electronic Assemblies

## 3 CATEGORIZATION OF OPPORTUNITIES AND DEFECTS

**3.1 Component Opportunities ( $o_c$ )** The term “component” is defined as each device or piece of hardware that may be assembled onto a printed wire board (PWB). Solder, glue dots, and other similar assembly materials are not to be included in this DPMO calculation. The PWB is considered to be one component.

The total opportunity count for each “component” is one. An electronic component with multiple leads still counts as one. Processes, such as cleaning operations, do not add component opportunity counts. The finished PWA is not an opportunity.

**3.2 Component Defect ( $d_c$ )** A component defect is damage to a component exceeding the limits of the component specification, or those described in IPC/EIA J-STD-001 or IPC-A-610, and/or damage that results in non-usability of that component. Component defects include both visible defects and non-visible defects (physical/electrical). Even though a component may have more than one component defect; any one or combination of multiple component defects on any single component will have a maximum defect count of one for that component.

**Example:** A component could be both dimensionally incorrect and have major surface flaws, however, these result in a defect count of one.

**3.3 Placement Opportunity ( $o_p$ )** The term “placement” refers to the presence and/or positioning of any component on a PWB. The PWB does not have a placement opportunity. Therefore, the number of placements will be one less

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