



Plastic Encapsulated Microcircuit (PEM)

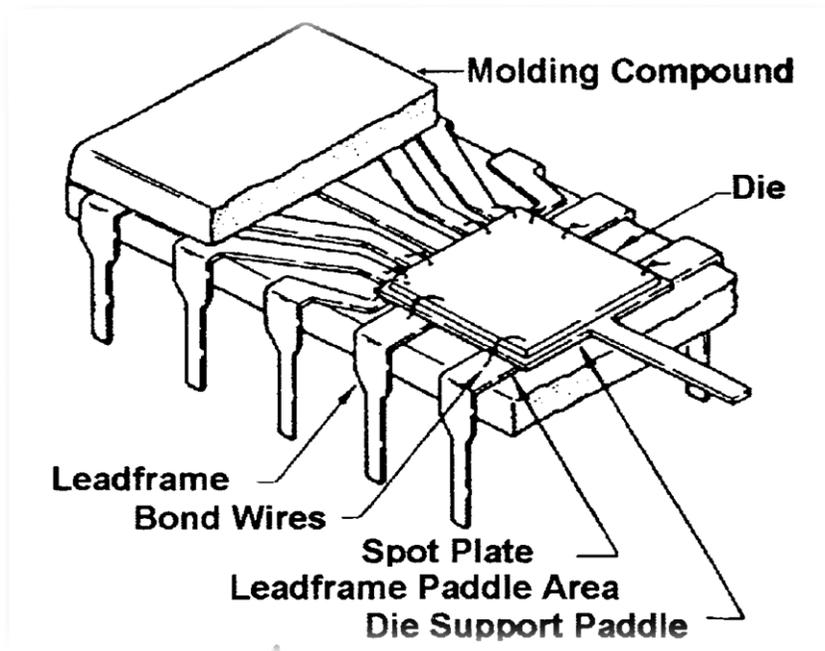
A PEM's official definition is organic packaging material, either transfer molded or coated, for environmental protection. This material is in direct contact with the active element or an inorganic barrier layer. This is in contrast to metal or ceramic packaging, which has a hermetically sealed cavity and no active element or organic barrier interface with the package material. The vast majority of PEM usage has been in commercial, telecommunication, automotive and industrial applications.

The major advantages that can be gained from their use are:

- Greater availability (especially surface mount packaging)
- Lighter weight
- Lower cost (high volume procurement)

Concerns associated with their increased usage, especially military, include:

- Uncertainty regarding their long term reliability in harsh environments
- Lack of reliability/quality assurance procedures
- Insufficient military environment reliability data (operating and storage)
- Existing OEM procurement expertise

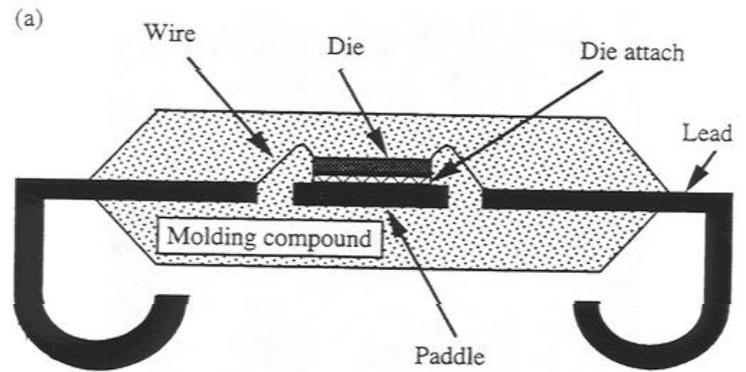


To the left and below you will see two views of what the internal construction of a PEM might look like. Every PEM should have these basic components. They may look a little different depending on the type of PEM device you are working with.



In each of these images you see:

- 1) **Leadframes:** the metal structure inside a chip package that carry signals from the die to the outside
- 2) **Bondwires/wires:** thin metal wire that carries the signals/current from the leadframes to the die/integrated circuit (IC)



- 3) **Die/integrated circuit:** is a set of electronic circuits on one small plate ("chip") of semiconductor material, normally silicon
- 4) **Die attach:** the material that attaches the die to the paddle/heatsink for support, normally some kind of adhesive epoxy
- 5) **Paddle/heatsink:** the main purpose is to support and hold all the components together before and while the plastic is injection molded around it (a heatsink is an exposed paddle designed to conduct the heat generated by the die out of the package)
- 6) **Molding compound:** the plastic material that is used to seal in place and protect all of the internal components

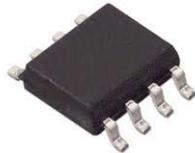


There are many different types of PEM's. Some examples are listed below.

SOT: Small Outline Transistor

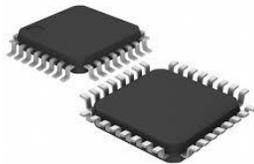


SOIC: Small Outline Integrated Circuit



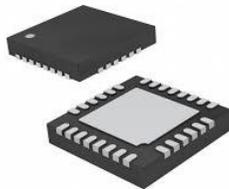
Variations of this part type include TSOP (thin small outline package), SSOP (shrink small outline package), TSSOP (thin shrink small outline package), and MSOP (micro small outline package)

QFP: Quad Flat Package



Variations of this part type include TQFP (thin quad flat package) and PQFP (plastic quad flat package)

QFN: Quad Flat No-lead Package



Variations of this part type include TQFN (thin quad flat no-lead package) and DFN (dual flat no-lead package)



PLCC: Plastic Leaded Chip Carrier



DIP: Dual In-line Package



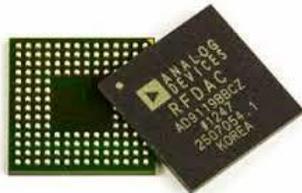
Can also be called a PDIP (plastic dual in-line package)

BGA: Ball Grid Array



Variations of this part type include FBGA (fine ball grid array)

CSP: Chip Scale Package



D-Pak: Discrete Package



Variations of this part type include D2Pak (larger version of the dpak) and TO (largest versions of a dpak)