

# Cavity Packages for Volume MEMS Applications

**MEMS is a dynamic and fast growing market segment that has a broad landscape of packaging needs with not many agreed upon industry standards.**

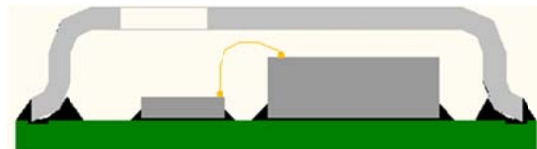
There are many reoccurring requirements that the MEMS manufacturer demands from a high volume cavity package. First the cavity package must protect fragile MEMS features from external forces while still allowing them access to the external atmosphere.

The cavity package is used to de-couple the MEMS die from the thermal and mechanical effects of the second level assembly and the final application. The solution must be flexible in design and allow System in Package concepts. While having these attributes, the cavity package must be able to meet rigorous reliability standards as per JEDEC and others. And of course the constant challenge for any volume package solution, this all must be accomplished while at the same time be cost effective and competitive.

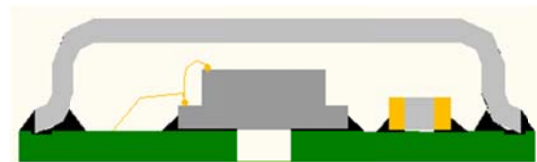
The two most common types of semiconductor packages used for MEMS cavity packaging are the leadframe based QFN and the laminate substrate based Ball Grid Array (BGA) / Land Grid Array (LGA). One direction that has begun to take a foothold in the industry's push for a high volume solution is the use of the LGA style package as the foundation for the MEMS cavity package.

Three LGA based solutions have been introduced to the industry as high volume solutions for MEMS cavity packaging. The basic formats are the LGA Formed Lid Package (LGA-FLP), the LGA Molded Cavity Package (LGA-MCP) and the LGA Molded Lid Package (LGA-MLP). Each has unique attributes that make them strong solutions for specific MEMS devices and applications. The assembly and test infrastructure for LGA based packages is very mature and the processing in strip format provides improved volume throughput and the cost savings associated with high volume processing. The accepted standard material sets are also very mature and are used by many subcontract assembly and test services (SATS) providers in many countries and regions worldwide.

**The LGA-formed lid package** has a stamped metal lid that may or may not have a pressure port depending on the specific application. Options for this package include multiple die and stacked die designs, standard wirebond or flip chip die bonding. Other options include the additions of passives and other components used for system-in-package (SIP) solutions.



**LGA FLP with multi die and top port**

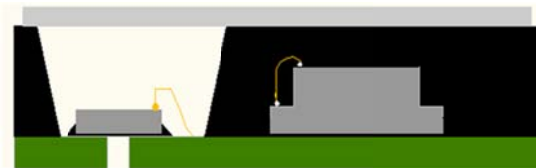


**LGA FLP system-in-package with bottom port**

**The LGA-molded cavity package** uses a BGA style molding system with a cavity vacuum tool to create a custom package where die can be either molded or placed into a cavity created by the mold and enclosed by a flat metal, plastic or glass lid. For multiple die applications, each die can have a custom environment. Options for the LGA-MCP package are multiple and/or stacked die, wirebond or flip chip, passive components for SIPs, full die coat and top or bottom ports.



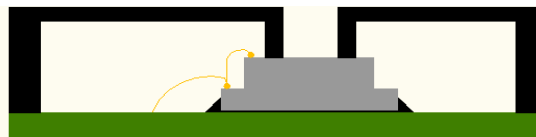
LGA-MCP System-in-package with custom cavity and top port



LGA-MCP stacked die with custom cavity and bottom port

**The LGA-molded lid package** has a custom molded lid that can be more complex than a metal stamped lid. Also unlike the LGA Metal Lid Package, this finished package has square sides.

Similar to the other two cavity package solutions, this package can have multiple and/or stacked die, wirebond or flip chip die connection, passives for SIPs, ports on the top and bottom of the package.



LGA-MLP stacked die package with custom cavity and top port



LGA-MLP system-in-package with bottom port

The three LGA based cavity packages described can all meet the stringent requirements of the common reliability tests for standard package types.

They pass moisture sensitivity level 2a which is a pre-bake for 24 hours at 125°C, TH at 60/60 for 120 hours and three reflows at 260°C. They pass Temperature Humidity and THB 85/85 for 1000 hours as well as Temperature Cycle from -65 to +150 degrees (500 cycles). The test for High Temp Storage at 150°C is also able to be passed at 1000 hours. However, because of the nature of these types of packages, they are not able to pass Thermal Shock – Liquid to Liquid.

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