Through-Hole Versus SMD Components

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INTRODUCTION

There are two main methods for mounting components onto a PCB: through-hole mounting and surface mounting.

WHY THROUGH-HOLE?

Most electronic gadgets are designed to interface with humans, and we humans are very abusive to most electronic devices. We drop them, poke them, open and close them, and in general feed stuff into and out of them.

It is well understood that a through-hole connection to the PCB is mechanically stronger than most surface-mount connections. By comparison, the strength of the bond that holds a surface-mount component to the PCB is limited to the strength of the solder joint that holds it to the surface of the laminate. As parts get smaller, so does the amount of solder and thus the strength of the bond.

Through-hole components are best used for high reliability products that require stronger connections between layers. While surface-mount devices (SMDs) are secured only by solder on the surface of the board, through-hole component leads run through the board, allowing the components to withstand more environmental stress. This is why through-hole technology is commonly used in military, automobile, and aerospace products that may experience extreme accelerations, collisions, or high temperatures. Through-hole technology is also useful in test and prototyping applications that sometimes require manual adjustment and replacement.

DISADVANTAGES OF SMDS

1. Manual prototype assembly or component-level repair is more difficult
2. SMDs cannot be used directly with breadboards
3. SMD solder connections may be damaged by potting compounds going through thermal cycling
4. SMDs are unsuitable for large, high power, or high voltage parts, such as in power circuitry
5. Surface mounting is unsuitable as the sole attachment method for components that are subject to frequent mechanical stress

BENEFITS OF NOT CHOOSING SMDS

One of the biggest advantages of through-hole mounting is that it provides such strong mechanical bonds over other techniques. Despite the fact that surface-mount technology has, by and large, replaced through-hole mounting, the latter best enables engineers and manufacturers to deal with components that will undergo mechanical stress as the result of this mechanical bond. As an example, connectors or heavy components like transformers are generally better suited to through-hole mounting.

Through-hole capacitors show two major benefits compared to SMDs: a higher temperature resistance and a higher resistance against mechanical stress. Due to use of lead wires, twists and / or vibrations of the PCB cause lower harm to the chip capacitor, which prevents breakage and other defects. Hence, the lead wires take over a shock-absorbing function. It is also possible to assemble the leaded MLCCs without having a PCB to save space. For instance, they may be welded onto lead frames and finally overmolded with plastics. This could be beneficial for sensors used in automobiles, DC motors, or cable harnesses.