

Component Shortages Causing Electronics Manufacturers to "Use All Means Necessary" to Ship Products

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As the electronics manufacturing and assembly industry in the US recovers to some degree from the economic crisis which began in 2008, the challenge of component shortages has risen to the top as one of the stumbling blocks for contract assemblers and captive manufacturers on the recovery road.

There are several reasons for these component shortages some of which include:

- Capacity went off line during the economic meltdown and the ramp up to meet demand from the remaining players has been slow on the rebound. "All of a sudden, you have a particular transistor that was made by three people in the world, and now there are two." Tom Georgens, chief executive of storage-equipment maker NetApp explains. (1)
- Prices were driven so low in the recession that nobody could justify increases in capacity
- Competition for tantalum from other industries, reduced the output of raw material tantalum as demand from large smart phone companies has kept tantalum caps at long lead times

Specifically there are currently component shortages in analog, memory and standard logic ICs as illuminated in Figure (1).

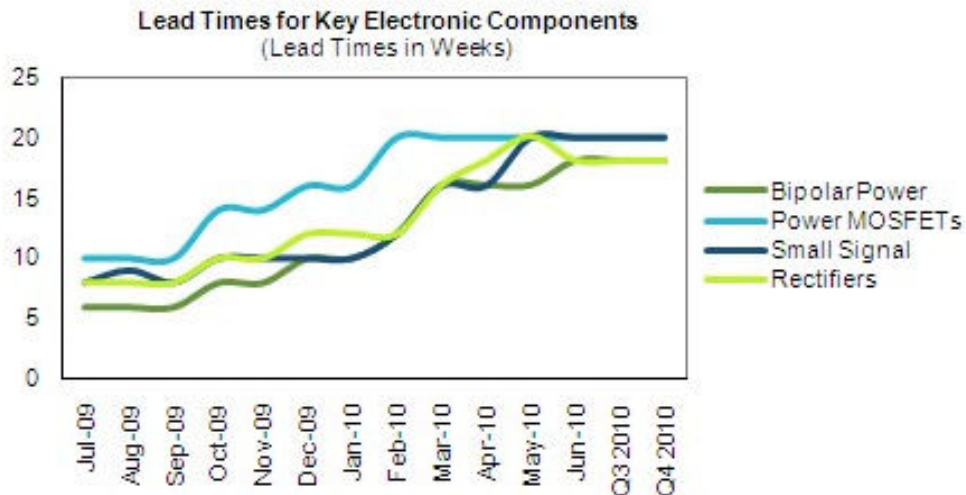


Figure 1-Projected Lead Times of Component Families, Oct 2010 (iSupply)

In lieu of not being able to ship during these extended lead times (20 plus weeks in some cases with no relief foreseen for another 12 months) what is a manufacturer to do to meet their end customer demand? One of the ways demand has been met is by salvaging components from

excess or obsolete or slower moving inventory. However, effective means for component removal needs to be used.

Removal of Electronic Components

By utilizing the correct removal methods as well as the proper component preparation methods which will insure that the components can be placed properly without there being a concern about EOS/ESD damage, MSD damage or thermal cycling or physical damage. In the unfortunate event a board is no longer useful you still may wish to salvage some of the more valuable components for reuse elsewhere. This "somewhere else" is in many cases, with components being in short supply, the product going out the door. There are a variety of factors needing to be considered prior to salvaging components without damaging them to ensure highest yield and without impacting the long term reliability of the PCB assembly the salvaged parts are going on to.

EOS/ESD Procedures.

During the salvaging of components operators need to insure that the necessary processes are in place to prevent the occurrence of electrostatic discharge related defects from destroying the component, even if only a single part is being salvaged from the PCB. Wrist straps should be worn, proper ESD safe working zone environments should be maintained and properly packaging PCBs during their transport prior to removal needs to be maintained. Guidelines as established in either the ANSI/ESD S20.20 or the JSTD-001 are the industry standards for electronic component handling in order to prevent ESD occurrences.

MSD procedures.

When removing components from the PCB, proper moisture handling procedures per JSTD-033 and JSTD-20 will prevent the removed devices from delaminating or "popcorning" and therefore become unusable. From a practical standpoint this means that components, if they are moisture sensitive, need to be "baked out" per the MSD guidelines to make sure that entrapped moisture does not de-encapsulate the package upon heating and wire bonds from the die to the lead frame remain intact during their removal. This may also limit the methods used for component removal.

Correct thermal profile.

It is always a good idea to know the maximum temperature rating of the components being removed (found on the vendor's data sheet). For example, if removal is being done on a tin-lead soldered component then it will likely have a rating on the 230-240°C range. This means that removal of this component needs to be at a peak temperature below this rated device temperature. Also there are some components which have a softening point below that of the liquidus temperature of the solder thereby potentially damaging the component. This is especially true of batteries, tantalum caps and connectors. These components can explode or deform if heated for too long a period of time or to too high a temperature.

Proper part handling. When the devices have been salvaged successfully and carefully from the PCB they need to make to the end use area by being carefully handled. Pins on connector headers need to be properly protected, glass covered display screens need to be secured so that they do not crack or get dropped. Guidelines as stipulated in JSTD-001 should be followed when handling electronic assemblies to insure that the salvaged components are protected.

Proper packaging. Going hand-in-hand with the proper handling of the salvaged components is their packaging for protection when shipping back and forth from the point of salvaging to the point of use (repair center or contract manufacturer). Not only should the proper ESD packaging being employed so that latent static charges do not destroy any of the components, but MSD protection should continue. Proper sealing of the moisture barrier bag, inclusion of both a desiccant and moisture indicator card are all part of good packaging practices. BGAs and other parts should be packaged in the proper trays so that the packages and the attached solder balls are protected.

Remarking of component

After a component has been salvaged, consideration to component lot traceability needs to be given. Components which have been salvaged may need a new lot code or special marking indicated that they were salvaged. This can be done by numerous methods including laser, inkjet or other marking means.

Tape and reel

After salvaging the components from an existing PCB, parts may need to be re-attached to a new PCB using automated assembly equipment and therefore need to be packaged on tape and reel. Prior to this taking place the salvaging party may be responsible for ensuring that the component leads be re-tinned in order to have a solderable surface. In addition, the lead co planarity, straightness and z axis tolerance may need to be compensated for by straightening the leads followed by optical inspection to make sure the parts are in tolerance with either the pick and place machines' capabilities or the appropriate JEDEC mechanical component specifications

"Work Arounds" for Electronic Components

There are several "work arounds" when a component in the right package style is not available. Many times this requires ingenuity from either the component or process engineer in order to "fill the gap" of the lack of part availability.

Conformal Coating, Underfilled Device

The impact conformal coating and under-fill have on the component salvaging process can be significant. The coating stripping and removal process, if not done carefully, can potentially damage the component. It is also important to determine the overall area of the component that the coating must be removed from. In most cases the area of removal is relegated to the solderable surface of the component lead, not the component body. Underfilled components must be carefully removed as many time the only method available is controlled temperature

and mechanical force. Applying too much force can damage the part during the removal process.

While all of the “work arounds” which have been used by manufacturing engineers could not possibly be listed, several examples will show some of the measures which can be employed in utilizing available components in order to get products shipped to end customers. In the example of Figure 1 components can be “dead bugged”, that is either flipped over their backs in order to expose the leads away from the PCB and solder these leads to the correct lands on the PCB. The component itself is normally adhered to the board using some type of adhesive. Jumper wires are wired from the leads to connection points following IPC7711/21 guidelines.

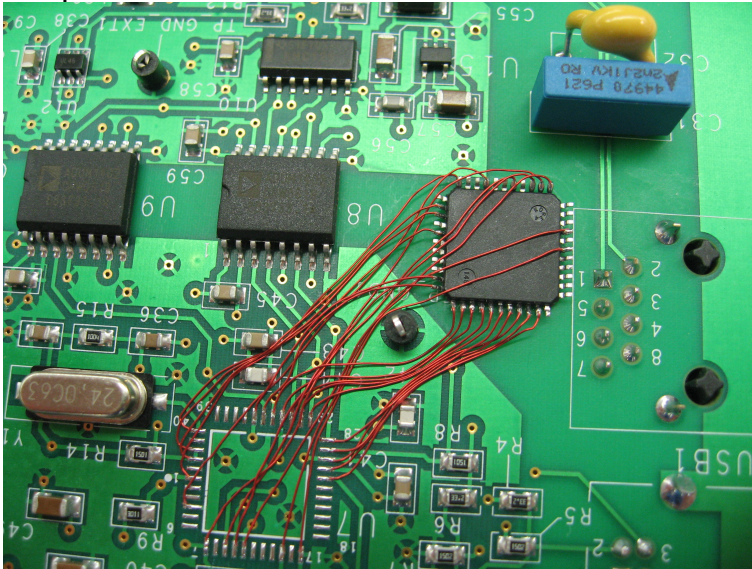


Figure 2-"Dead Bug" Component Workaround Example (BEST Inc.)

Figure 2 is an example of how components can be “piggy backed” and stacked one upon the other to get alternate values of capacitance or resistance when the right values are not at hand.

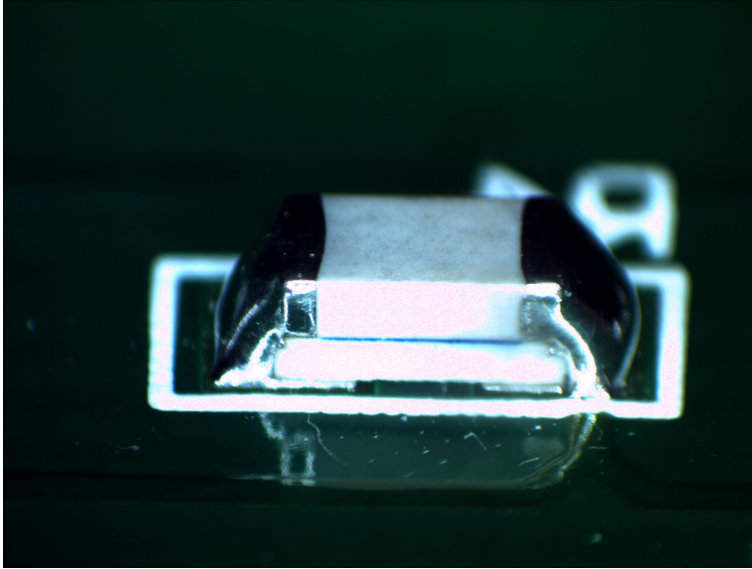


Figure 3-Component "Piggy Backing" (BEST Inc)

Lastly, Figure 3 is a picture of a modified SOT package which has had its ground tab partially removed as well as the leads being bent to a gullwing-like shape. This component is then placed on to tape and read prior to be mounted onto the PCB as an SMT component.



Figure 4-Throughhole to SMT Device Modification of Voltage Regulator (BEST Inc)

While there are numerous workarounds to get electronics assemblers through some part shortages, salvaging components from already-assembled PCBs may be another option. In the salvaging option you need very skilled operators to take due care in handling, transporting and packaging the components so that they can be effectively used. Through the creativity of process, component and SMT engineers creative workarounds to part shortage situations can occur. However, when creating workarounds consideration to device reliability needs to be tested in order to ensure that the device meets end use environment usage.

References:

- (1) Georgina Prodhan, (May 24, 2010) "Electronic Component Shortages May Last Through 2011", Reuters Business Section
- (2) Dana Mattioli , (June 8 2010), "Telecom Supply Strained", Wall Street Journal, Business Tehnology 1D
- (3) (2005) IPC 7711/21 Rework of Electronic Assemblies/Repair and Modification of Printed boards and Electronic Assemblies, IPC