Package Converter Compliments Chip Obsolescence

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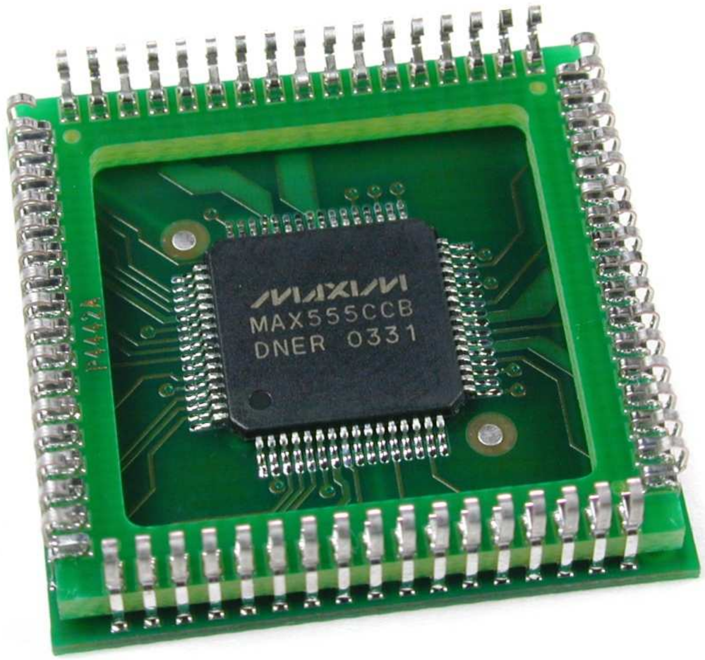
The Semiconductor industry enabling today's electronics market place is widely disseminated between multiple customer factions such as consumer electronics, telecommunications, automotive, medical devices, military, aerospace, industrial controls, embedded computing and other industries. A component's life cycle for each industry varies drastically from 6 months to 10 years. The Semiconductor industry governed by realization of "Moore's law" states doubling of the number of devices (or gates) per integrated circuit will occur, within a given geometric area, on regular 18 month intervals. This requires new processes, capital equipment, and new materials for next generation devices every two years. Inadvertently, it becomes expensive to maintain old equipment and processes which leads to chip obsolescence. Unavailability of chips primarily affects military electronics as the average life cycle of military hardware sometimes exceeds 10 years. A proactive approach permits a modular system for component upgrades. This typically involves microprocessor/micro controller device types. A modular system is not an economical option for all other components such as voltage regulators, analog to digital converters and ASIC devices. The reactive approach calls for lifetime buys, substitute devices, adapters with alternate devices or a complete redesign. Estimating lifetime buys has considerable risk and is prone to errors. A complete redesign is typically not an option as it consumes many design resources, includes additional approval and validation cycles and adds revised manufacturing costs. Substitute devices or adapters to convert alternate devices are the best possible options for chip obsolescence problems.

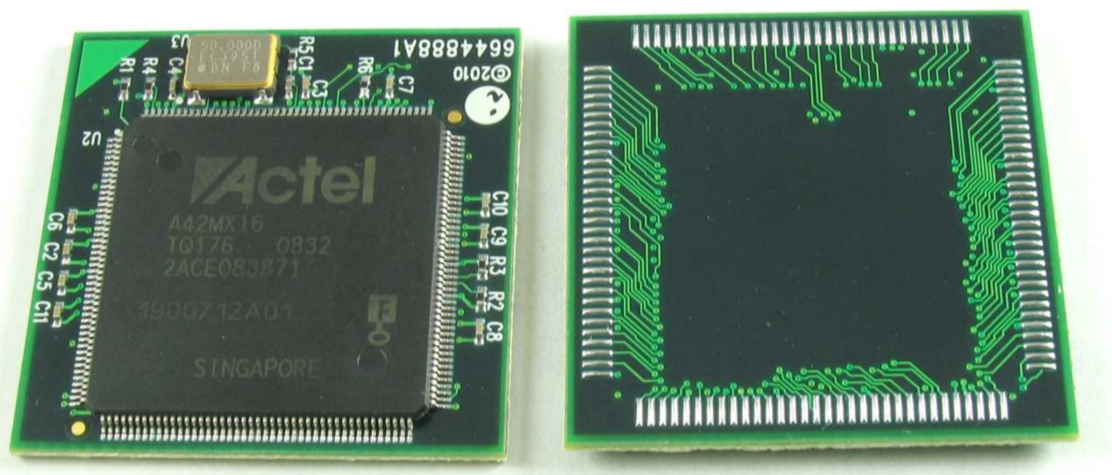
Substitute devices with alternate packaging formats require a simple package converter. Converting the footprint of an IC package to that of another type or size of package is required in many situations. The semiconductor industry has all but completely move away from older through hole packages such as DIP, PGA, etc. and has replaced them with Surface Mount (SMT) packages such as QFP, BGA, CSP, WLP and QFN over the past 25 years. Often a manufacturer will find a device that has been procured for years is suddenly no longer available in the package the system board was designed for. Unless the often expensive board is redesigned and re-spun, a package converter is needed to fulfill an immediate requirement. Very often, these adapters consist of a simple PCB with 1:1 pin mapping from the new package to the old.

Device upgrades is yet another area where package conversion is required. When company ABC releases the new revised version of Processor 123, it probably won't be in the same package/pin out configuration. Often a simple package converter allows the end user to take advantage of the enhanced performance of the new device without having to modify their target board enabling huge cost savings as well as an improved time-to-market.

Fixing target board problems, due to wrong device pin out, is another function of package converters. To err is human, to adapt is divine. Package converters, often called 'Fix adapters' due to this particular scenario, can be made in many configurations and are usually specific to the design error that was made.



Let us consider a few examples of package converters and how they helped solve chip obsolescence issues. The MAX555 is an advanced, monolithic, 12-bit digital-to-analog converter (DAC) manufactured by Maxim in a 68 pin PLCC package. MAX555 is designed for signal-reconstruction applications. Technological advancements required MAX555 be manufactured in a 64-pin TQFP package with an exposed paddle for enhanced thermal dissipation lowering thermal resistance from 28°C/W to 25°C/W. Moving from a PLCC to a TQFP package changed the die orientation within the package from 'cavity-down' to 'cavity-up', causing the pin out to change. MAX555 is only available in the TQFP package causing applications boards, with the PLCC pattern, to be redesigned or adapted using package converters. A simple two layer board, designed with a TQFP pattern in the middle and the PLCC pattern around it, routed signals between the TQPF pads and PLCC J-leads emulating the PLCC package on the base of the converter. A space efficient design was achieved by mounting the upgraded MAX555 TQFP package component to the bottom side of the converter board. Because the die placement in the TQFP chip is flipped from its orientation in the PLCC package, bottom mounting also provided the shortest signal length possible from TQFP leads to adapter j-leads. The package converter with the MAX555 device could now easily mount to a target board's 68 pin PLCC land pattern. The compact design enables high volume production readiness as it can be loaded into tubes, placed in trays or in tape and reel for pick and place equipment. The converter board can also be made with a separate ground plane to isolate the digital bus from top side traces while supporting efficient heat dissipation. The adapter was designed with a recommendation from Maxim that the traces routed beneath the TQFP package maintain a desired 50Ω transmission line impedance for optimum signal integrity. A ground plane on a layer adjacent to these traces facilitated this controlled impedance requirement. Furthermore, clock signals were routed as differential pairs and were isolated from the digital bus traces by at least two trace widths to ensure a clean clock source. Enabling all these PCB features on a target board would have required significant design resources and manufacturing costs. Making these features on a small converter board proved cost efficient and allowed seamless transition into the end product usage without re-spinning the target board.



Another example involved replacement of a Bus Gate Array ASIC. The component that had become obsolete was an ASIC that was packaged in a 128-Pin PQFP (0.8mm pitch) Package. The 128-Pin PQFP component shape occupied a 35mm X 35mm space on the PCB. If needed, each side of the component footprint was expandable by 3mm. This provided a maximum surface area of 41mm X 41mm for the package converter outline. Because of the mechanical dimensions of the module assembly, no component on the mother board could exceed a height of 12.7mm (0.5”). This meant the new device with package converter had to be less than 12.7mm. 5V-only CPLD (Complex Programmable Logic Device) component availability was scarce, but fortunately Actel still manufactured a series of CPLD parts that met the customer requirements; the 42MX Series . The specific component, that was targeted, was the A42MX16 part in a 176-Pin TQFP (0.5mm pitch) Package. The bottom side was designed to have connections for the 128-Pin PQFP and the top side was designed to have the 176-Pin TQFP package. In addition to the 176-Pin TQFP component on the top side, an SMD Clock Oscillator (5mm X 7mm Package) and a few resistor and capacitor components designated by customer were present. Larger 0603 passive component were utilized due to the larger 41mm X 41mm adapter outline. Rather than using a gull-wing type lead technology, ‘solder column’ technology was used to interface package converter to the target board accommodating the overall height restriction. The relatively inexpensive solder column technology is similar to the BGA interface but uses shaped solder instead of round solder balls to match the target board land pattern.

When availability or performance of a given IC becomes an issue, using a package converter with substitute device(s) without redesign of the target system is the most economical and time saving option. Technology advancements such as shaped solder, J-lead, edge routing, micro blind/buried vias, flex PCB, embedded capacitor/resistor facilitate the use of adapters to solve any type of constraints faced by end products. Adapters can be manufactured as RoHS or non-RoHS compliant depending on end usage restrictions. Simple or Complex adapters increase the average component life cycle to align with end product life cycle which is a must for military electronics applications.

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