

Great Things Come in Small (Outline) Packages

By Shane Timmons - Product Marketing Manager, Diodes Incorporated

The Trend for Smaller Packages Continues

Gordon Moore's prescient prediction of the ever-growing density of components on integrated circuits (ICs) continues to be proved right. Even if the recent growth is slowing down, the trend towards smaller packages continues apace.

Of course, the journey towards miniaturization has been driven over the decades by the need to pack more functionality and capability into less space, which is especially important with the increasing numbers of "wearable" and mobile devices. More recently, there is an emergence of the Internet of Things (IoT), the Industrial Internet of Things (IIoT), and the virtually insatiable demand for high-performance devices with tiny footprints.

Supplying semiconductor components in packaged form not only protects the die inside but also provides a more convenient way of handling the components and using them in automated manufacturing processes. There is now a vast range of small outline packages (SOPs) on the market, including the very small outline package (VSOP), which typically measures between 3mm and 10mm in body width and 1.2mm to 1.25mm in height.

The Popular Flat Package

Because small packages enable smaller products to be developed, over the years the trend in surface-mounted devices (SMDs) has led to the creation of several ingenious solutions, including no-lead flat packaging. Of all the small package types available, the "flat package" is growing in popularity. One of the most in-demand discrete packages from Diodes Incorporated that feeds this developing market is the high current density PowerDI series. With a typical package height of just 0.98mm and a typical overall PCB footprint of 6.6mm², the PowerDI123 package takes up less than half the board space of similar packages yet delivers higher power dissipation. The package is particularly suited to automotive applications where robustness, high-surge capability, and superior performance need to sit alongside minimal component size.

Indeed, Diodes has been at the forefront of small package development and manufacturing for many years and offers an industry-leading portfolio of devices with the smallest of footprints. For example, improvements in both lead design and underside thermal pads mean that devices that were once available in a 6.5mm x 7mm SOT223 (small-outline transistor) can now fit on the same footprint area that an SOT323 (2.1mm x 2.15mm) occupies. One popular Diodes device is the 40V DMTH4008LDFWQ, an automotive-compliant MOSFET that is packaged in the tiny DFN2020 (dual flat no lead, 2mm x 2mm). Taking up less than 10% of the area on a PCB that a traditional SOT223 package requires, this kind of miniature MOSFET brings greater power density to many automotive applications, including DC-DC converters, LED backlighting, and advanced driver assistant systems (ADASs). Consequently, with this

MOSFET the internal dissipation losses are reduced by 20% compared to similar devices, which improves design flexibility and boosts efficiency considerably.

Diodes strives to maintain customer choice and flexibility by offering parts in more than one package option. For example, a new series of Zener diodes—the DZ9FxxS92—comes in the ultra-low profile surface-mountable SOD923 package. The same part can also be obtained in the GDZxxLP3 series of Zener diodes in the minuscule and leadless surface mountable X3-DFN0603-2 package. The leadless device occupies only 40% of the footprint of the leaded part, freeing up 60% board space.

Watch this Space

The rate of miniaturization may be slowing but space is still the final frontier. We can expect to see a great many developments in small outline packaging in the coming years. Diodes will continue to lead the way in advanced packaging in this sector, notably for discrete and analog devices.

By taking up minimal space on a PCB, the compactness of all these components—and an extensive range of others from Diodes—means that designers of mobile electronics products can be confident that maximum system performance can still be delivered without compromising on form-factor.

Further information on the range of products from Diodes Incorporated is available [online](#).