

# Advances in Glass-To-Metal-Seal technology

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**Abstract** *It's been 20 years since the industry has seen the rise of Glass-To-Metal-Seals in various forms. This paper sheds light on the advances made by Schott to sustain the age-old technology through the next decade.*

## Introduction

It's been 20 years since the onset of the Glass-To-Metal-Seal (GTMS) technology in the field of electronics. Discrete components, transistor packages, transceivers, IR sensors, pressure sensors, to most recent FTTx applications have benefited from it.

With its use came the belief that someday a disruptive technology better than GTMS will come about and replace it completely. There have been multiple attempts but none so flexible and affordable that it could unseat the ruling champion. Every decade most experts gave GTMS 3 – 5 more years to live and yet the very people keep buying them decade after decade. In this paper we would like to bring to your attention the ever-evolving GTMS technology and advances made by Schott in order to sustain this technology and propel it forward.

## Why GTMS?

Why do engineers like GTMS packages? Well the answer is simple and lies in the fact that MOST of these packages are round, cheap, flexible & reliable.

The fact that a circular object is much easy to work with and manufacture is a universal truth. With the evolution of stamping technology and alloys matched to semiconductor materials, which are used in the electronics industry, these packages could take on any shape and size depending on the need of the user.

The easy and mass production techniques like stamping and deep drawing makes the raw materials much cheaper as compared to any competition.

Finally the maturity of this technology is at its peak and yields well over 90% are not a wonder anymore rather more a status quo required to sustain a profitable business.

Other facts, which speak in support of the technology, are standardization & hermeticity. The secret to success in the optoelectronics industry has always been smart designs, may it be in the field of RF or optics. This in turn lead to a ever evolving and highly diversified market driven by a competitive breed of engineers set out to out do each other. Standardization is a nothing but a dream in this world. Hermeticity is another major need of the telecom / datacom industry. Typical lasers and advanced

photodiodes cannot achieve the necessary performance without it. This need can be well satisfied by a simple GTMS package, as it does not outgass over its lifetime on the contrary to its competing technologies.

## Challenges

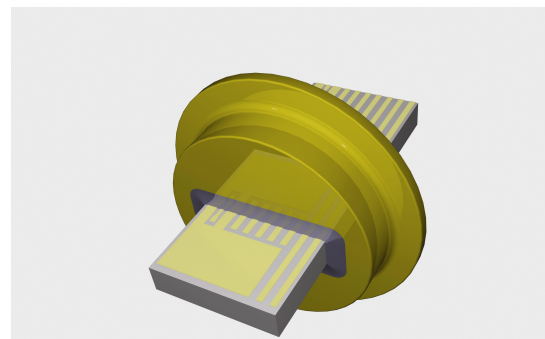
The real threat to the survival of the GTMS industry is miniaturization, increasing numbers of input/outputs and integration. Over the years most industries have seen the shrinkage of electronics drastically and consequently the size and form factor of the packages holding them.

Also, competing technologies like Silicon optical bench or similar techniques offer hybrid integration in form of photodiodes or thermistors which is difficult in the GTMS world.

Nevertheless Schott Electronic Packaging has made advances in this direction to overcome the limitations while accenting the advantages.

## Advances made:

In order to address the biggest issue of the higher number of I/O's a new package design called the "CerTO" was designed and manufactured at Schott. This design utilizes all the benefits and cost advantages of TO manufacturing, screen printing, thermal properties of ceramics.



*Proposed CerTO design in TO46 format with 9 traces  
(preliminary design)*

The CerTO was exclusively designed to address the edge emitting type laser packaging. This package not only provides the perpendicular edge needed to mount the laser but also provides the higher number

of I/O's needed by utilizing screen printing on ceramic technology. The thermal properties of the ceramic utilized for the feedthrough could only be an advantage while its coplanar design makes this package useful far beyond the 20GHz range, where a normal TO is limited to 8GHz.

The ultimate advantage also lies in the fact that the trace pattern on the ceramic can be altered as needed by different designers allowing for diversified range of designs. Flexibility can also be added by attachment of exotic materials like CuW, CuMo for heat sinking purposes.

On the optics side of things, Schott has contributed actively with higher refractive index glass materials over the past decades, which has benefited the industry in multiple ways. Typical uses could be sited in the form of ball lens caps, window caps, etc. With recent improvements in the optics world in order to achieve higher efficiency for the packaged devices more and more people are relying on higher refractive indices of glasses and clever optics designs. To enable the designers and empower them with design flexibility, Schott offers the entire standard set of Schott glasses in the forms of lens or window material sealed into metal cans of choice. These in turn need suitable frit glass to join the glass to metal hermetically, which is developed and manufactured in house. The recent addition of Silicon lenses in the form of ball lens or plano-convex lens is worth a special mention. This concept utilizes the flexibility and mature manufacturing techniques from the semiconductor world and GTMS world to create a extremely powerful tool for the optics designers of today. High coupling efficiencies of 90% can be achieved using this concept.

The two examples mentioned here with the innovation in the world of RF and optics are just the examples highlighting Schott's ingenuity in the field. Many more designs are already accepted, being developed or sketched.

### Who is competing?

There are a lot of competing technologies available in the market today. But most lack the reliability, simplicity and the maturity of the GTMS world.

One of the most mature competing technology is definitely all ceramic packages. Though ceramic is similar to glass and can be metallised to function just like a metal, it still has a lot of disadvantages.

There are a few companies out there who want to propose local hermeticity, integrated packaging, performance, etc at premium prices. None of these attempts come as close as ceramics.

All ceramic packages bring forth advantages like thermal conductivity, matched thermal expansions, etc., but it also suffers from effects of high temperature processing, shrinkage, costs and difficulty with plating layers. Finally the cost structures of a ceramic could only make things more expensive for the end user.

Understanding the ceramics, investing in facilities and experts in the field has led to a very fruitful breed of products at Schott, which bring the advantages of the ceramic world into the opto electronic packaging world, examples of such packages being the CerTO, CerTMS and few other developments in the making.

This serves as the prime example, which could shed some light on potential developments using the new technologies in conjunction with the mature GTMS platforms to prove their worth and gain acceptance.

### Conclusions

GTMS has no doubt seen its hay days and will eventually reach its rightful end, but when and how cannot be predicted. As discussed here, it is quite clear that without standardization in the industry, newer concepts would not survive in this extremely price sensitive market.

A new standard can be set only when GTMS powerhouses like Schott take the design to the next level and come up with standard packages that could be used by anyone and everyone for most purposes. This requires a closer and tighter work relationship with design engineers at the customer and at Schott.

A vast think tank which could hold the solutions to most problems in the industry and propose a general solution could be the first unique step towards standardization which could eventually pave the way for the next generation packaging technologies while utilizing the available techniques to the max. This could very well lead to that bridge which could close the gap between GTMS and the next generation packaging technology making the transition smooth.

