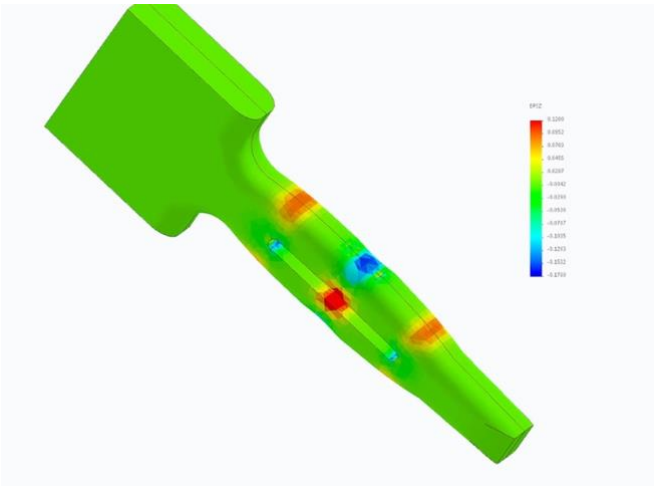
New Autosplice 0.4 mm Press-Fit Technology

Overview: The eye-of-the-needle (EON) press-fit terminal, which is designed to replace soldered terminals on printed circuit boards, has been in production at Autosplice for over a decade in 0.64mm and 0.81mm versions. A 0.4mm version is currently undergoing testing and is scheduled for release in the first quarter, 2019.

How Press-fits Work: The EON press-fit zone is notable for ensuring a reliable connection between the terminal and the plated-through-hole (PTH) of a printed circuit board (PCB) under severe automotive applications. These applications include temperature cycling from -40^{o}C to 175^{o}C, high humidity, dry heat, and vibration and harshness that are associated with vehicle sprung conditions. The key to achieving reliability under these conditions is the formation of a gas-tight seal at the interface between the compliant zone of the terminal and the plated-through-hole. (See cross-section through gas-tight contact interface in accompanying photo.) The contact interface is literally sealed off from the surrounding environment to the extent that it is impenetrable by high humidity or corrosive gas pollutants, and thus not available for formation of surface oxides. Oxides are responsible for causing high contact resistance, which may lead to system instability and possibly system failure. The gas-tight seal is maintained by high normal forces that range from around 25,000g for the Autosplice 0.81mm press-fit to around 4,000g for the Autosplice 0.40mm press-fit. (The Autosplice 0.64mm press-fit clocks in around 8,000g.) [All quoted normal forces are for nominal PTH sizes, and for tin systems.] These are extremely high normal forces, when compared with normal forces of between 100g and 200g for a typical blade-receptacle tin contact system.



The 0.4mm Press-fit: The all-new 0.4mm EON press-fit zone is designed to work with the now industry-standard plated-through-hole size of 0.60±0.05mm. The press-fit zone achieves optimum retention strength at each end of the PTH size range by employing a combination of elastic and plastic deformation, which is biased towards the former at the lower end of the PTH size range, and towards the latter at the higher end of the PTH size range. At no point is the elongation allowed to exceed the material limit, to eliminate the likelihood of micro-crack formation. Autosplice has elected to standardize the press-fit material to the high-performance CuNiSi (C19010), but will offer CuSn4 and CuSn6 if required. Additionally, the terminal will be offered in standard and reduced tin plating. The latter is especially relevant in high-density terminal applications to reduce the likelihood of tin whiskering.

Finite element analysis (FEA) was used to create the original 0.4mm press-fit design, utilizing an FEA model that was calibrated with the Autosplice 0.64mm press-fit terminal, for which test and control plan data is readily available. The 0.4mm design was then refined by laboratory testing to achieve the current design, which exceeds all published automotive Tier 1 requirements. (See strain model shown in accompanying picture.)

Tooling & Assembly of the 0.4mm Press-fit Terminal: The compliant eye of the 0.4mm press-fit is a scant 0.3mm at its widest section, which results in a stamping die eye punch that is extremely small. Extra care is taken to ensure protection of the eye punches, including precision piloting of the strip through the die, tight punch-to-die tolerances, efficient removal of eye slugs, proper strip lubrication, etc. Assembly of the 0.4mm press-fit terminals to printed circuit boards can be efficiently accomplished with an Autosplice insertion machine and a custom-designed insertion head, or with any proprietary insertion system that can accommodate a custom insertion head.

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