BGA Socket Adapter System Provides Reliable Test Equipment Connection for Engine Performance Analysis

THE CHALLENGE
A major electronics test equipment manufacturer developed a new engine control unit test board to calibrate embedded semiconductor automotive engine control devices. These automotive engine control devices are critical to the power train performance of the vehicle and must be accurately calibrated to assure optimum operation of such functions as ignition timing and fuel metering.

The manufacturer had experienced reliability problems with a connector supplied by another vendor and needed to replace it with a dependable connector system that would allow a daughter card to be plugged into the motherboard of the engine control unit test board, plus interface with j-tag test equipment and engine calibration equipment.

THE ADVANCED® SOLUTION
The Ball Grid Array Socket Adapter System developed by Advanced Interconnections fit the manufacturer’s specifications for a connector from the mother board.

The customized BGA Socket Adapter System allowed the manufacturer to solder a 0.50mm pitch BGA semiconductor to the daughter card with less thermal stress than if it was soldered directly to the PC board (see Fig. 1).

Attached to the bottom of the daughter card is Advanced terminal type -737; a style that features solder balls on the top of the adapter allowing it to be soldered to the bottom of the PC board (see Fig. 2). With the adapter system, the daughter card can be plugged into the motherboard.

A 159-position connector designed to ring the BGA device was also reflowed onto the daughter card (see Fig. 3). This ring connector provides the interface to external test and calibration equipment. The standardization of the ring connector on the top of the daughter card allowed this manufacturer to change silicon and keep the same BGA 0.5mm package size for greater diversity in package variations of motherboard footprints.

Continued on reverse side.
Engine control device testing is performed using a dynamometer in a shop environment, as well as on a test track. In order to assure accurate, reliable performance, the manufacturer required that the Advanced BGA Socket Adapter System provide a high insertion force between the adapter and the socket to eliminate the effects of vibration on the connection. The Advanced BGA Socket Adapter System was subjected to a thermal cycle with vibration of 100 cycles at +125°C to -40°C and three-axis mechanical shock to 50Gs to determine that it would withstand rigorous performance requirements. The socket adapter system was also stored at 125°C for 48 hours to test its high temperature performance. In addition, the adapter system was subjected to a Mixed Flowing Gas accelerated aging test to determine the level of contact resistance over the life of the system. All test results met the manufacturer’s performance specifications.

To overcome blind mating issues in this application, Advanced Interconnections modified the standard BGA Socket Adapter System to incorporate custom locating pins and added short and long pins to aid insertion and extraction. (See Fig. 4)

The resulting application of the Advanced BGA Socket Adapter System provides the manufacturer with a compact, reliable connection between engine control devices and the engine analyzer to assure that critical performance data is relayed quickly and accurately.