XR-DIMM™ Rugged Memory Specification
Background Information

For years, designers of small form factor off-the-shelf embedded CPU boards (both SBCs and COMs) for use in rugged applications with significant resistance to shock and vibration have been faced with difficult design decisions for their main memory. Standard memory expansion interfaces such as DIMM and SO-DIMM memory are not designed for these rugged applications. Therefore, significant concern exists about the use of such standard memory expansion approaches. Industry veterans can recall RFPs, especially for military applications, which specified that SO-DIMM usage was unacceptable.

Designers have responded with two different solutions, each of which has substantial drawbacks. In some cases, an add-on retention mechanism is added to a standard memory expansion installation. Clips, straps, glue or other tie down mechanisms are used to prevent an SO-DIMM from flying out of the socket. However, this approach does not deal with issues relating to the socket itself. Concern continues to exist about movement of the expansion memory module within the socket (typically inexpensive commercial grade used in laptops), causing potential intermittent pin connections that can bring a system down.

Another approach has been to solder memory chips directly to the CPU board. While this approach deals completely with shock and vibration issues, it has three significant drawbacks. The first is the board space consumed by the memory components. As CPU boards shrink in size, this space is extremely valuable. The second is the wide variety in memory requirements for these types of applications. Each memory configuration must be manufactured individually. The manufacturer is either faced with a large number of SKUs for the different memory configurations (and associated forecasting and inventory issues) or restricting the number of products and perhaps not having a memory configuration appropriate for a particular application requirement. Finally, these CPUs can not upgrade their memory capacity after they are manufactured.

The XR-DIMM* approach provides for off-the-shelf, commercially available rugged memory expansion modules of varying capacities, allowing the CPU

* Formerly RS-DIMM

manufacturer to offer multiple memory size solutions to the OEM customer while maintaining a single CPU SKU. Space on the CPU board is limited to the connector and mounting hole locations. And upgrading memory capacity is as simple as swapping memory modules. Enhanced ruggedness is obtained through the use of a high-performance, 240-pin socket connector system and the use of standoffs with screw attachment firmly holding the CPU and memory module together.

When the SFF-SIG Rugged Memory Working Group first convened in July 2010, the group started with a blank sheet of paper. Participants included both memory module suppliers and CPU board suppliers. Chaired by Phan Hoang, VP of Product Design at Virtium Technology, the group first developed a set of goals to measure alternatives and progress against. The group was soon presented with two alternative solutions to the rugged memory problem. One was based around a mezzanine card approach using a pin socket connector similar to that used with COM CPU boards. The second approach used an extended SO-DIMM module with mounting holes added. After much discussion and the realization that the group could only sensibly go forward with a single solution, the group chose the mezzanine pin-socket approach out of concern for movement of a memory module within a commercial grade SO-DIMM socket.

Bits and pieces started to come together into an interim specification. The group decided in October 2010 to “test drive” the proposed implementation by asking SFF-SIG members as well as CPU board suppliers outside SFF-SIG for their feedback on the design. At that time, we discovered a class of small form factor SBCs (Single Board Computers) for which a standard SO-DIMM solution is too large to use. By shrinking the proposed size of our module from 72mm to 67.5mm, we would open the module to a new class of applications, for which size is even more critical than ruggedness.

As the rest of the pieces came together in November and December, the group was pleased that a shock and vibration study of a prototype module on a COM Express CPU passed the ANSI/VITA 47-2005 (R2007) specifications. In January 2011, the six remaining active members of the working group voted unanimously to send the specification to the SFF-SIG voting members for approval and publication.