SIZE STILL MATTERS IN FUTURE HANDSETS

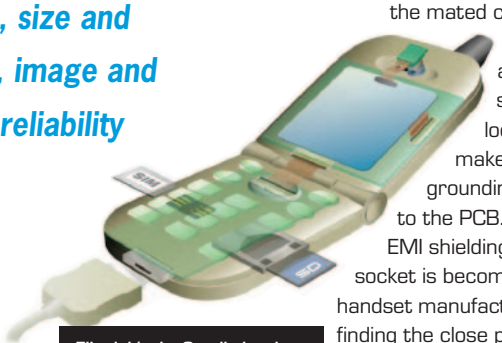
Cynics and stand-up comedians may lampoon today's tiny mobile phones. Miniaturisation will continue: having seen that a basic telephone can fit easily into a shirt pocket, the market now wants more than a basic telephone. Cramming in features such as streaming video, MP3 audio, WAP, Bluetooth/wi-fi, digital photography and more intensifies the packaging challenges facing handset designers.

Designers targeting 3G handsets must pull off an almost-impossible trick. Modern applications typically demand a larger screen. They are also more power-hungry and require a large and more powerful battery to maintain talk-time. Extra components are necessary to quickly implement cutting edge capabilities while chipset vendors work on an integrated solution for the next generation. Additional hardware such as a camera or removable media must also be catered for, but designers must meet these requirements without making the handset appreciably larger overall.

To achieve this, other items on the bill of materials must shrink even further. For example, designers are not only using thinner PCBs and smaller FPCs (flexible printed circuits), but also demanding miniaturised interconnects throughout the handset. These include board-to-board and board-to-FPC connectors, as well as SIM card connectors and flash card sockets.

End-users barely even think about the connectors lurking within next-generation mobile handsets, yet they have a profound impact on the issues that do concern them: supported features, size and weight, battery life, image and sound quality, and reliability

There are additional constraints. As the typical operating voltage falls from 3.3 to 1.8V, signal integrity is more difficult to maintain. This is exacerbated by the handset's increased functional density, which forces sensitive signals, such as video signals, to pass closer to the handset's RF stage. As a result, EMI shielding is becoming a desirable feature for many more components within the handset.



Flippin' 'eck : Small size does not mean less storage

SIM card sockets

The need to maximise battery capacity is squeezing the available space for the SIM card socket, which is usually positioned underneath the battery on the reverse of the handset. Handset manufacturers now favour sockets whose height above the PCB is little more than the thickness of the SIM card itself. JAE, for example, has achieved a 2mm profile by stamping the card cover from thin-gauge steel in order to reduce the height of the mated connector. The metal cover also acts as the EMI shield: when locked, the cover makes contact against grounding pins soldered to the PCB.

EMI shielding for the SIM socket is becoming a concern for handset manufacturers, who are finding the close proximity of the RF components a potential hazard for the SIM.

Small flash card standards

To better sell the value of 2.5G and 3G services to consumers, handset developers are migrating many new functions onto the handset platform. Technologies for taking, storing and exchanging digital images and digital music, for example, feature prominently on handsets entering the market today. Removable storage such as Secure Digital (SD) or MultiMediaCard (MMC), and their smaller format successors Mini SD and reduced size MMC (RS-MMC), is necessary to make best use of these features.

Today, most flash cards must be extracted from the handset by first removing the back cover and battery. This is inconvenient, and as greater numbers of consumers tune in to the opportunities flash cards present to store, manage and share pictures, messages, music and more, handsets must make card-swapping easier and less fraught. The first handsets are now entering the market using JAE's externally accessible MMC socket for mobile applications. The socket has a door that stops debris or moisture entering the phone by locking flush with the surface of the handset. The door also matches the handset's external colour and surface finish. The

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Externally accessible MMC sockets are more convenient than today's flash cards

connectors are delivered to the handset manufacturer as complete units, with the colour-matched door attached.

In the future, flash card connectors for mobile applications will migrate toward the half-size Mini SD and RS-MMC formats, and will feature a door instead of the standard push-push mating that demands the back of the phone is removed.

Board-to-board and FPC connectors

As handset designers seek to size-reduce multi-board handset designs, board spacing is influenced by the height of functional components such as electrolytic capacitors, and by the board separation permitted by board-to-board connectors. The PCB industry is working hard to develop thinner gauge FR4 materials that will reduce PCB thickness to 1.0mm and later 0.6mm. Lower profile board-to-board connectors are therefore also needed to make the most of the advantages on offer.

Today, designers can choose a board-to-board connector with 0.5mm pitch and 1.5mm mated height for maximum robustness. A new sister component, the JAE AA03-series, enables slimmer handsets by reducing the board spacing to 1.0mm, with a 0.4mm pitch. Other variants support FPC to PCB connection, to connect the LCD display and handset camera. To address the differing requirements of the such components within the smallest possible physical dimensions, a useful connector format will offer choices of 40 or 60 contacts typically required for LCD interconnects, as well as a 20 contact version sufficient to connect to a camera integrated on the handset.

When size-reducing connectors for these applications, it is also important to keep sight of the vital mechanical properties required of a board-to-board or cable-to-board connector. For instance, JAE has developed a mating system that provides two points of electrical contact for each conductor, and is sprung to maintain a positive contact force that ensures a more robust connection. This enables the connector system to meet the target contact pitch and overall profile, and simultaneously to satisfy the market's need for reduced susceptibility to shock and vibration. When developing a handset, a failure to pass a mechanical requirement, such as a drop test, increases project costs and time-to-market out of all proportion to the incremental extra cost of specifying a high quality connector.

Mechanical robustness is also important when considering FPC interconnects. The latest FPC connectors have now reached 0.3mm contact pitch, and are 0.9mm high. A soft bar that clamps onto the flat flex cable enhances cable retention. The soft bar applies an optimal force to retain but not crush the cable, which is typically a flat flex or micro-coaxial type. FPC connectors frequently arrange contacts in multiple rows, which maximises the distance between adjacent connections on the flexible printed circuit. This allows maximum yield from standard SMT manufacturing processes, by reducing the risk of soldering problems such as bridging, or poor placement of the connector by automatic pick and place equipment. Locating these contacts underneath the connector body minimises the connector footprint.

Despite almost two decades of mobile handset evolution, the pressure to miniaturise key hardware components remains intense. If anything, this pressure is even greater, as handset developers must now achieve significantly higher functional density than was ever contemplated for first and second-generation phones. Cost pressures are also more severe in the 2.5/3G era, as the full force of the consumer market erodes selling prices and imposes shorter lifetimes for each new design.

FPC interconnects have reached 0.3mm contact pitch and 0.9mm height

Among these components, high performance interconnects play an important role. Advanced design features and precision manufacturing techniques allow robust and highly miniaturised new connector formats, capable of supporting high speed signals where required, and of maintaining high signal integrity throughout.

Even though typical end-users barely even think about the connectors lurking within next generation handsets, these components have a profound impact on the issues that do concern them: supported features, size and weight, battery life, image and sound quality, and reliability.

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