Preface
Multi pin count connector for Small Gauge Coaxial Cable (here-after called SGC) was developed first in the world by I-PEX, and it has been delivered for practical and various application in volume production lines in the market. I-PEX’s SGC connector is named CABLINE Series Connector.

During the past a couple of years, the superior properties of the connector with SGC, in terms of high speed signal transmission, EMI reduction, flexibility and bend-ability etc, have generated new application broadly for the Mobile Phone, specifically for LCD panel designed complicated movement as like rotating etc.

This CABLINE settled many technical issues which had been left in FPC application used so far between LCD panel and PCB. They are durability improvement of transmission circuit-lines between LCD panel and PCB in hundreds thousands open / close operation of LCD panel, more miniaturization of hinge and settlement of EMI issue, etc, and it has enabled mobile phone to equip various more functions. This trend of SGC application for mobile phone has spreaded out through world-wide market during recent years.

I-PEX developed SGC connector “CABLINE V”, “CABLINE-SS” and “CABLINE-MS” for the mobile phone and this report intends to show the design concept of I-PEX CABLINE.

High Reliability Termination of Cable / Contact of CABLINE
The center conductor of SGC applied for mobile phone is significantly small as AWG#42, and AWG#44 (7 stranded wires of 0.025mm diameter) and the termination between center conductor and connector contacts requires high reliability joint and productivity in volume production line.

Gang Termination of Multi Contacts / SGC Cables by Pulse Heat
A bunch of SGC cables are arranged in required spacing and laminated with pasted tape and stripped off dielectric materials as shown in Fig-1, and the common ground bar soldered on outside shield of SGC. This is preparative operation before connector termination on SGC. After that, both pre-assembled flat SGC and CABLINE are set on applicator for pulse heat soldering.

Fig-2 shows before and after termination of cable assembly and connector.

Three photos shows overall appearance of terminated area and the cross-sectional parts of contacts and SGC center conductors. Preferable solder fillets are developed around jointed area as shown in these pictures.

Grounding
Common ground bar soldered on SGC outside shield shall be soldered on metal shell of connector developing favorable grounding condition. The metal shell of Plug Connector shall firmly contact with the shell of Receptacle Connector, or metal holddown members when plug and receptacle connectors mated, so that grounding to PCB pattern can be made in the shortest line and it contributes to the improvement of high speed signal transmission and EMI issue. Coincidently, soldering common bar on plug shell generated high retention force of SGC cables.

SGC Bending Durability and Connector Shock Test
Cable bending durability test was conducted in practical application on mobile phone and it passed 200,000 cycles without mechanical and electrical damages. Drop test from 1.7 m showed no mechanical damage and no un-mating between plug and receptacle connectors.
Featuring Merits of CABLINE V

CABLINE V is horizontal type and 1.0mm low profile SMT connector, of which contact spacing is 0.4mm and applied for AWG#42 SGC as shown in Fig-3. The receptacle contact provides two contact-points design and the effective contact length between plug and receptacle shall be 0.7mm as to substantiate high reliability. Locking features of Receptacle and Plug Connectors when mated, provides stable connection. Applicable cable shall be AWG#40 - #46 SGC, AWG#36 Discrete Wire and AWG#40 TwinCoaxial-cables. Table-1 shows cable specification of AWG#42 and #44. AWG#42 SGC is used broadly for practical application of mobile phone in the market. This CABLINE V has been delivered to the market at more than 20 million pieces to date.

Featuring Merits of CABLINE-SS

CABLINE-SS is vertical mating type and 1.65mm mating height SMT connector, of which contact spacing is 0.4mm and applied mainly for AWG#42 SGC as shown in Fig-5. Connector width is small as 3.0mm, which enables Plug Connector with terminated SGC to pass through small hinge hole (refer to Fig-6). It has improved significantly productivity of assembly operation setting harness ass’y on to mobile phone. Quality of harness ass’y after system assembly is as well. Dimple on plug contact provides click feeling in mating operation and keeps stable mating condition. Receptacle contact provides dome type contact surface which shall generate high normal force and high reliable contact performance. Wiping work on contact surface is expected in mating operation to remove foreign substance on contact. Fixing members of Receptacle Connector on PCB is designed large as much as possible to enhance peeling strength from PCB. The bottom of connector does not expose contacts due to molded housing and provides design flexibility of PCB circuits under connector. This CABLINE-SS has been shipped at more than 10 million pieces to date.

Featuring Merits of CABLINE-MS

The design concept of CABLINE-MS is same as CABLINE-SS, but much smaller to pass through smaller hinge hole as 3.2mm diameter. (refer to Fig-7, hole size comparison) CABLINE-MS is vertical mating type and 1.60mm mating height SMT connector, of which contact spacing is 0.3mm and applied for AWG#44 SGC as shown in Fig-8. In order to make sure for mating operation, Receptacle Connector provides lead-in design on both sides enabling Plug Connector mating easily in visual confirmation. Receptacle contact is designed with two points contact area as shown in Fig-9 and it provides redundancy for contact reliability-up eliminating disconnection due to possible foreign material or other contamination. The contact areas of both connector contacts and metallic shell ground are provided dimple which ensures click feeling in mating and stable contact condition in use. No matter how connector size is reduced totally to 1.60mm with height and 2.36mm with width in comparison with CABLINE-SS, the effective contact length is kept 0.3mm and no contact exposure to PCB surface because the bottom of connector is molded. This connector is being employed by major mobile phone makers to date and scheduled to start volume production from Oct. 2005.

Featuring Merits of CABLINE V

CABLINE V is horizontal type and 1.0mm low profile SMT connector, of which contact spacing is 0.4mm and applied for AWG#42 SGC as shown in Fig-3. The receptacle contact provides two contact-points design and the effective contact length between plug and receptacle shall be 0.7mm as to substantiate high reliability. Locking features of Receptacle and Plug Connectors when mated, provides stable connection. Applicable cable shall be AWG#40 - #46 SGC, AWG#36 Discrete Wire and AWG#40 TwinCoaxial-cables. Table-1 shows cable specification of AWG#42 and #44. AWG#42 SGC is used broadly for practical application of mobile phone in the market. This CABLINE V has been delivered to the market at more than 20 million pieces to date.

Featuring Merits of CABLINE-SS

CABLINE-SS is vertical mating type and 1.65mm mating height SMT connector, of which contact spacing is 0.4mm and applied mainly for AWG#42 SGC as shown in Fig-5. Connector width is small as 3.0mm, which enables Plug Connector with terminated SGC to pass through small hinge hole (refer to Fig-6). It has improved significantly productivity of assembly operation setting harness ass’y on to mobile phone. Quality of harness ass’y after system assembly is as well. Dimple on plug contact provides click feeling in mating operation and keeps stable mating condition. Receptacle contact provides dome type contact surface which shall generate high normal force and high reliable contact performance. Wiping work on contact surface is expected in mating operation to remove foreign substance on contact. Fixing members of Receptacle Connector on PCB is designed large as much as possible to enhance peeling strength from PCB. The bottom of connector does not expose contacts due to molded housing and provides design flexibility of PCB circuits under connector. This CABLINE-SS has been shipped at more than 10 million pieces to date.

Featuring Merits of CABLINE-MS

The design concept of CABLINE-MS is same as CABLINE-SS, but much smaller to pass through smaller hinge hole as 3.2mm diameter. (refer to Fig-7, hole size comparison) CABLINE-MS is vertical mating type and 1.60mm mating height SMT connector, of which contact spacing is 0.3mm and applied for AWG#44 SGC as shown in Fig-8. In order to make sure for mating operation, Receptacle Connector provides lead-in design on both sides enabling Plug Connector mating easily in visual confirmation. Receptacle contact is designed with two points contact area as shown in Fig-9 and it provides redundancy for contact reliability-up eliminating disconnection due to possible foreign material or other contamination. The contact areas of both connector contacts and metallic shell ground are provided dimple which ensures click feeling in mating and stable contact condition in use. No matter how connector size is reduced totally to 1.60mm with height and 2.36mm with width in comparison with CABLINE-SS, the effective contact length is kept 0.3mm and no contact exposure to PCB surface because the bottom of connector is molded. This connector is being employed by major mobile phone makers to date and scheduled to start volume production from Oct. 2005.

From Now

Differential Signal Transmission is considered for LCD drive protocol of mobile phone in near future and signal speed shall be required more high speed. Accordingly, new connector, with both characteristic impedance and grounding performance would be required, and the total signal transmission system not only by this new connector and but also by SGC shall be highly required highly as well. Based on the above market trend, I-PLEX plans to develop new CABLINE connectors focusing on more high performance for high speed, more miniaturized, more friendly use and more reliable.