■ ABSTRACT

The second generation (2G) wireless phone will soon be history, replaced by the 3G handset offering a range of new features, including improved Internet and e-mail access, and many of the features of a personal digital assistant (PDA). The growth of wireless applications, combined with these new features, continues to challenge radio frequency (RF) designers to incorporate more functions into a smaller space while at the same time increasing battery life, improving display quality, lowering cost and achieving new levels of manufacturing robustness.

■ FEATURES

- Low dielectric constant and low dielectric loss
- Low Circuit Resistance and low profile
- High density module and ability to embed multiple layers of resistors in a multilayer structure
- High Reliable and ideally suited for high frequency applications

■ APPLICATIONS

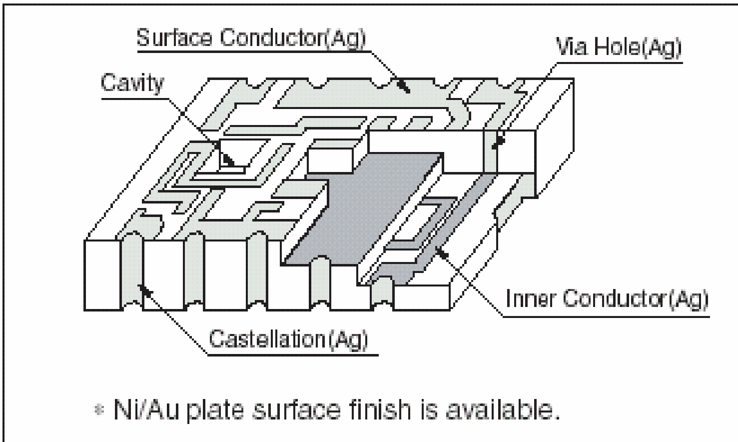
- Telecommunication equipment such as Fax, Modem and ISDN
- High radio frequency equipment, such as cellular phone, PDA, etc.
- Telecom devices, such as RF power amplifier, antenna switch module, VCO and RF modules
- High reliability and medical products

■ LTCC PRODUCTION PROCESS

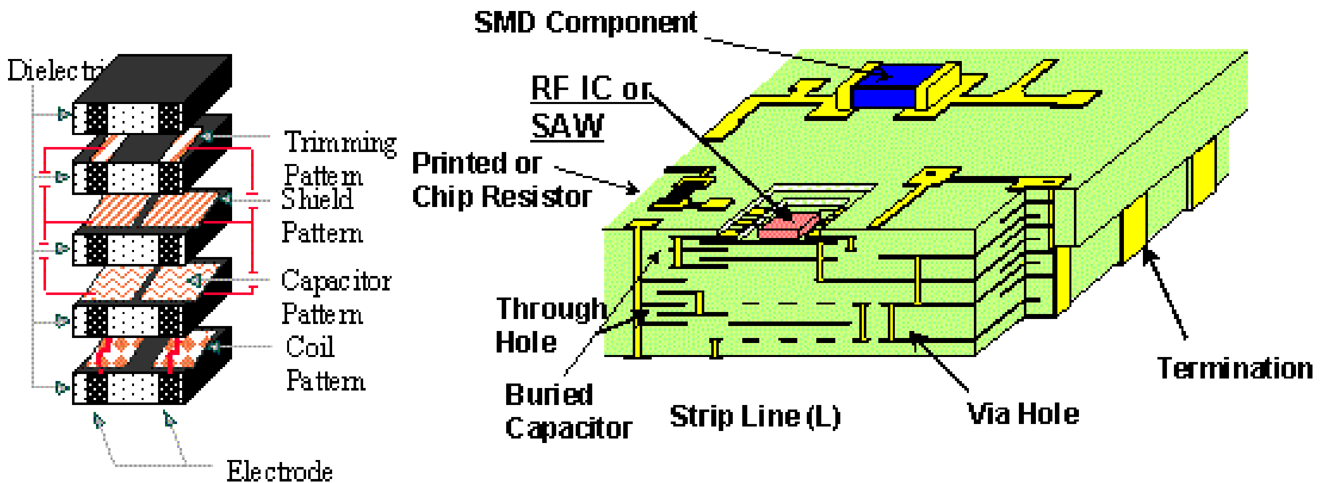
LTCC can be defined as a multilayer circuit fabricated by laminating single green sheets(term for unfired tapes: Green Tape) with printed conductor lines etc. on the surface on top of each other and firing them all together in one step. This process is almost similar to that of HTCC, but the big advantage of the LTCC system is the possibility to use low resistivity conductors like silver, gold, copper and alloys with palladium and platinum instead of tungsten and molybdenum; the separation between this two (different) technologies is defined with the firing temperature: in excess of 1000°C for HTCC and below for LTCC (mostly 850 to 875°C, what makes it possible to use silver for conductor lines etc.). It is also possible to integrate passive elements like resistors, capacitors and inductors into the substrate. Resistors are processed with the help of special pastes, which have to be printed on the tape just like conductor lines and have to be post- or co-fired.

■ LTCC STRUCTURE

LTCC Structure



From the outside, it looks like a block of ceramic. If you could see inside this small block of ceramic, you would see a complex integrated 3D passive circuit. If you looked behind this device, you would see a company that leads the industry in the design and volume production of LTCC multilayer devices. All of which utilized the similar ceramic Multilayer process technologies that have helped us deliver over a trillion ceramic chip capacitors and inductors to that same market over the last 20 years.



Example of LC Filter LTCC struture.
Chip sizes ranging from 2mm x 1.25mm up to 3.2mm x 1.6mm.

Cross sectional view of high level custom LTCC integration structure example.
Device sizes ranging from 3.2mm x 2.5mm to 10mm x 6.3mm

■ LTCC TECHNOLOGY

The features of LTCC Technology is able to offer many benefits and avoid disadvantages as follow:

- High Density Module

  Miniature modules are realized by inner layer circuitry with fine lines and very small via holes.
- Low Circuit Resistance

  Low circuit impedance is achieved by the use of silver as inner conductor material.
- Low Profile

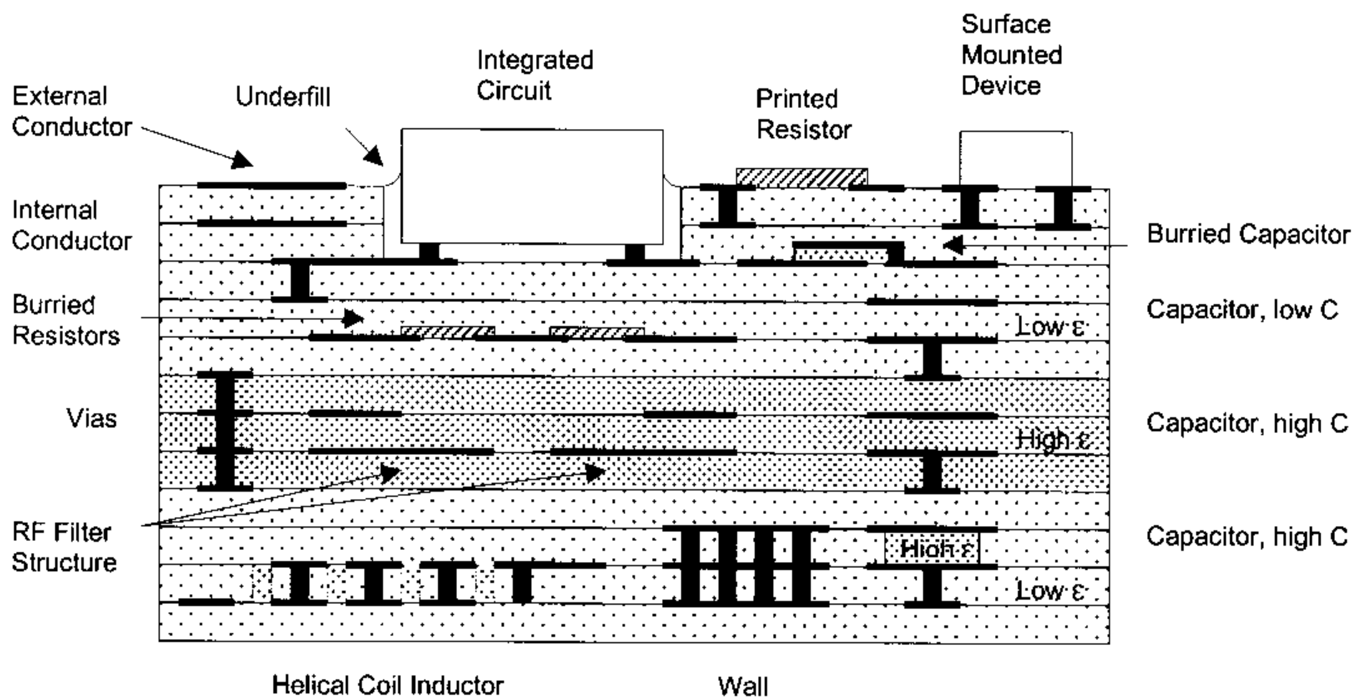
  Low profile modules can be achieved by the use of cavity and castellation structure.
- Higher Reliability in Structure

  Higher environmental temperature reliability by selecting materials which suitably match thermal expansion coefficient with mounted components.
- Improved Electro-magnetic Compatibility

  Effective for reducing electro-magnetic radiation for its feasibility to build ground or shield in the internal layer
- Suited for High Frequency Circuit

  For its high dielectric constant of ceramic materials, it is suited for high frequency application where distributed constant circuitry is utilized.
- Dust Free

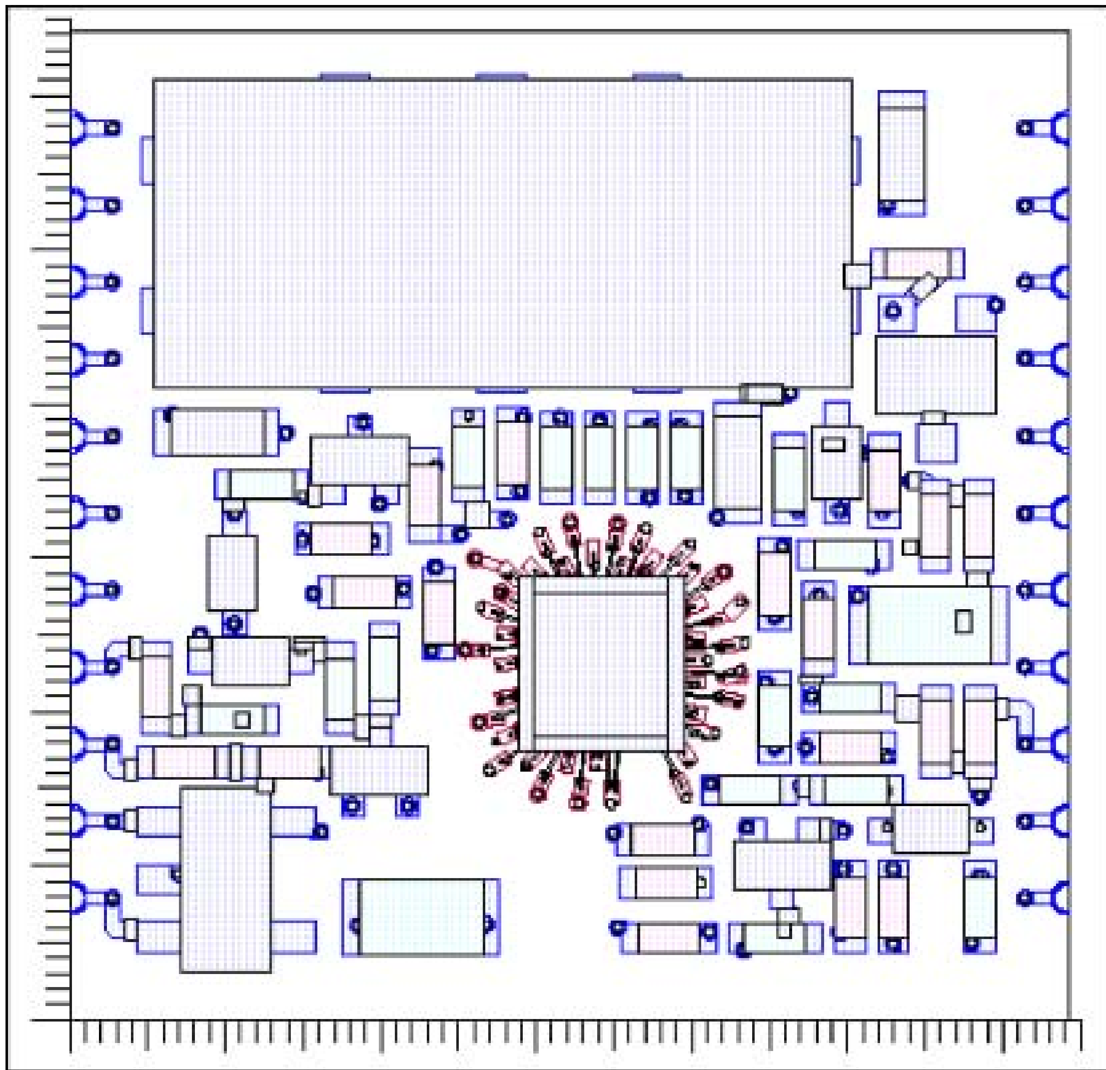
  Unlike an organic printed circuit board, LTCC ceramic board does not accompany dust which leads to cleaner environment.



■ LTCC MODULE

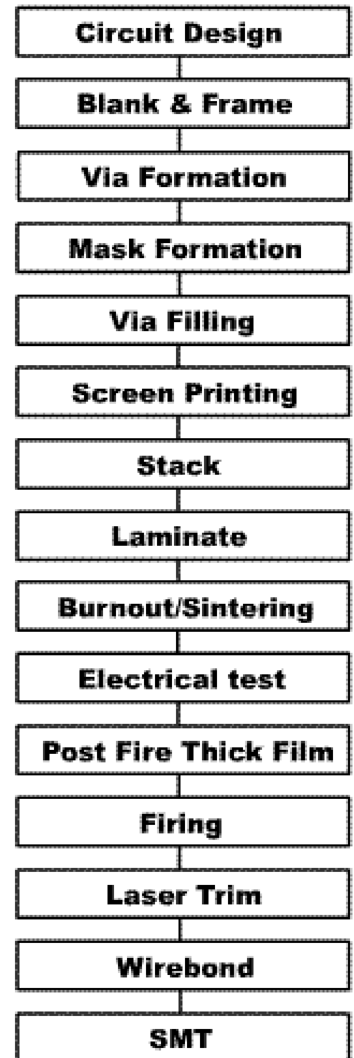
The module consists of 10 layers using Heraeus CT700 Tape. The module measures 642.5 X 642.5 mils. The height is X. The I/O ports are castellated leads with a 50-mil pitch. Most of the resistors and capacitors are 0402 vintage. The LMX3162 is directly attached and wire bonded to the LTCC substrate. By far the largest component on the module is the SAW filter.

Top-Level drawing of the LTCC module



■ LTCC MCM MODULE PRODUCTION

Low Temperature Cofire Ceramic (LTCC)



The use of LTCC to fabricate high density reliable MCM-C integral packaging has become standard practice. LTCC's parallel processing capability facilitates rapid turnaround times with reduces cost on packages with large layer counts. Product employing four mil lines and spaces is being produced on a regular basis and three mil lines and spaces is possible. The use of cavities and thermal via arrays can be used to provide thermal conductivity comparable to that of tape transfer and thick film on alumina.

Buried passive components like resistors, inductors, capacitors, and various filter types have been implemented successfully. High frequency inductors are common and buried capacitor dielectrics with K's of 1000 have been tested. Buried resistors may be incorporated to form RC and LRC circuits.

■ INQUIRY AND CONTACT

Your inquiry is greatly appreciated, please enclose your design and requirements to us for a prompt service and competitive offer.

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