

DC TO mmWAVE

# LTCC Innovations

Product Line Overview

- Industry-Leading Design Capability
- Proprietary Technologies
- Extensive In-Stock Selection
- Fast, Cost-Effective Custom Designs

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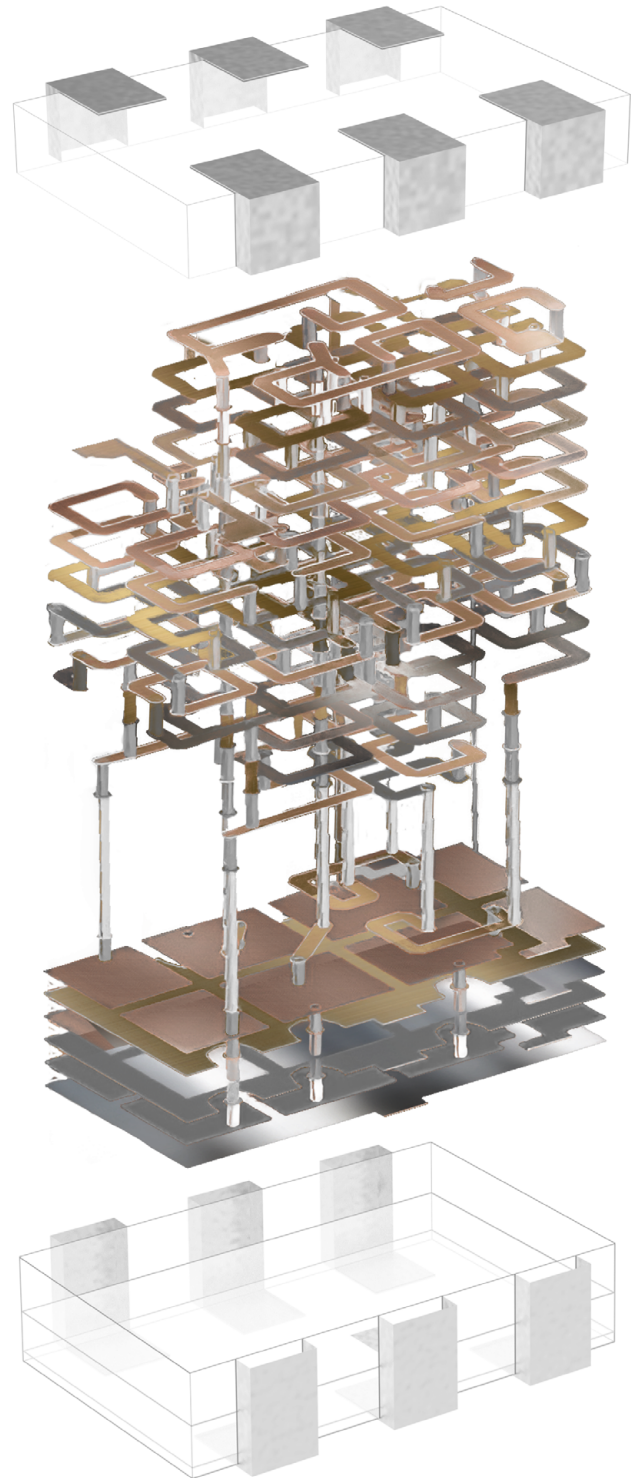
# Product Line Overview

## 20+ Years of Innovation

### Unmatched Performance & Design Capability

LTCC devices are fabricated with capacitors, inductors and distributed structures embedded in multi-layered ceramic substrate and sintered into a single monolithic component. LTCC passives have become a mainstay component technology due to their unique combination of performance, tiny footprint, reliability and cost-effectiveness.

Our design team has the most advanced knowledge of LTCC materials, design methods and fabrication processes in the industry, building on 20+ years of R&D and multiple active patents to deliver unprecedented capabilities for customer designs.



## The World's Widest Selection

### 750+ Models In Stock & Counting

- Couplers
- Filters
- Integrated Balun-Filters
- Splitter/Combiners
- Thru-Lines
- Transformers & Baluns

# Key Technology Advantages



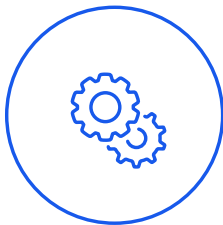
## PERFORMANCE

- Broadband operating range (VHF to mmWave)
- Suitable to implement all available forms of circuits – lumped, distributed and cavities (SIW)
- Excellent power handling in package sizes as small as 0202



## PRACTICAL FEATURES

- No packaging needed
- Surface mount devices
- Unparalleled miniaturization
- Rugged, monolithic construction meets reliability standards for military, space, cryogenic operation, high vibration & high-temperature environments



## ECONOMICS

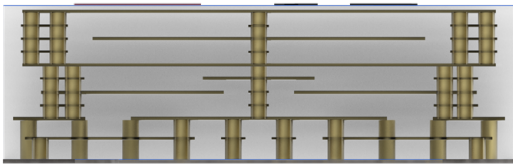
- Medium (1000's) to high (millions) production volume versatility
- Cost structures
- Low NREs for custom designs
- Fast design times and lead times

# Recent Advancements



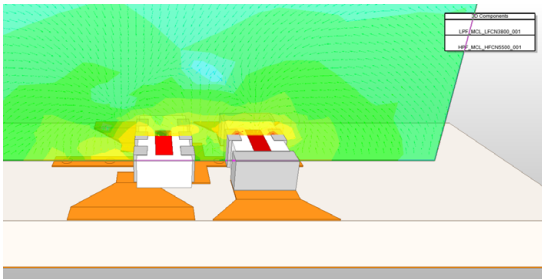
## PROPRIETARY MATERIAL SYSTEMS

- Shift toward ceramic powders and conductive pastes that yield dk values closer to organic substrate values
- Dielectrics with smoother surfaces & lower permittivity
- Better insertion loss at higher frequency



## NOVEL CIRCUIT TOPOLOGIES

- Migration from Lumped L-C to distributed topologies
- Higher-Q resonators
- SIW approaches
- Higher frequencies to mmWave
- Higher filter stopband rejection up to 100 dB



## MATERIAL MODELLING & SIMULATION TECHNIQUES

- Advanced material characterization data in electrical, mechanical & environmental domains
- Higher fidelity between simulation and measurement
- Faster design cycles
- More affordable custom designs

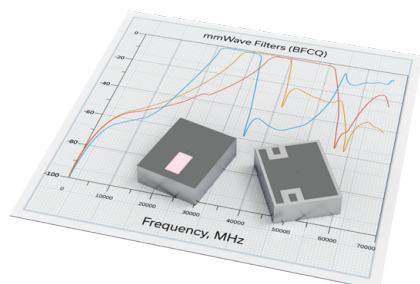
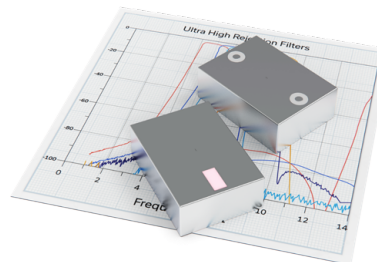
# LTCC Filters

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## Ultra-High Rejection

- Rejection floor down to 100+ dB
- Excellent selectivity
- Built-in shielding
- 1812 package style
- Patent pending

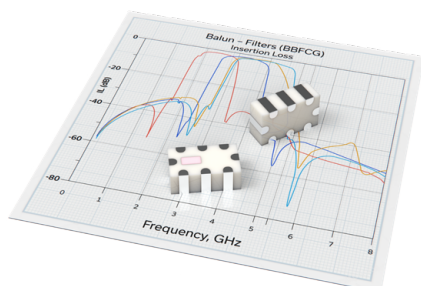
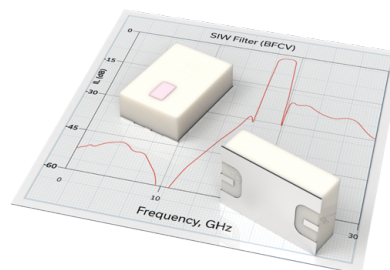


## mmWave Passbands

- Passbands to 50+ GHz
- The industry's widest selection of LTCC filters optimized for 5G FR2 bands
- Growing selection of models for Ku- and Ka-band Satcom downlink
- 1812 & 1008 package styles

## Substrate Integrated Waveguide

- First commercially available SIW LTCC filter in the industry
- Narrow bandwidth (~5%) and good selectivity
- Internally shielded to prevent detuning
- 1210 package style



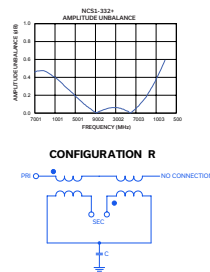
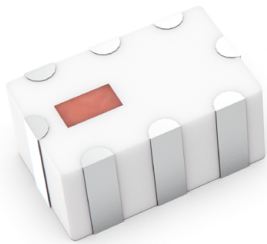
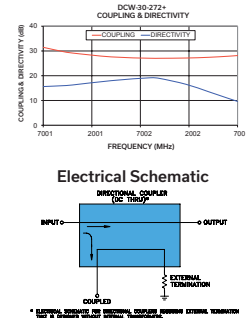
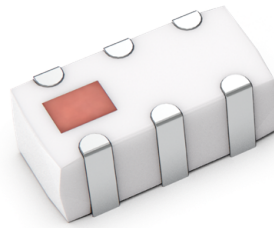
## Integrated Balun-Bandpass Filters

- Combine balun transformer and bandpass filter in a single device
- Saves space and simplifies board layouts in ADCs, DACs and other circuits
- 1210, 1008 & 0805 package styles

# More Passive Devices

## Couplers

- Coupling from 6 to 30 dB
- Directional & bi-directional models
- Footprint as small as 0603

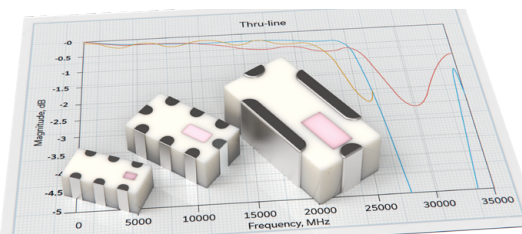
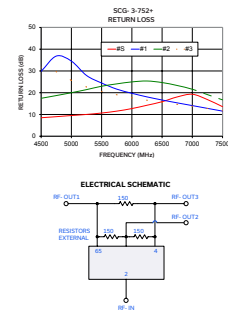


## Balun Transformers

- Wideband performance up to 18 GHz
- Impedance ratios from 1 to 4
- Power handling up to 3W
- Footprint as small as 0402

## Splitter/Combiners

- 2-, 3-, and 4-way designs
- Power handling up to 20W
- Footprint as small as 0805

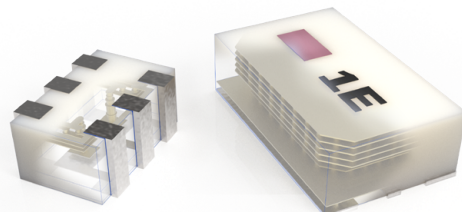


## Thru-Lines

- Wideband, low loss performance up to 33 GHz
- Compatible options for 1812, 1210, 1206, 0805, 0603 standard footprint sizes
- Ideal as filter placeholders anywhere in your signal chain

## Custom Designs

- Custom product development
- 3D simulation models for evaluation
- Upscreening for space & hi-rel
- DC leakage testing
- Lead finishing & plating



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