First Technology
Innovative Solutions

AUTOMOTIVE & SPECIAL PRODUCTS DIVISION

Dielectric Resonators

First Technology's provides the widest array and finest quality dielectric ceramics available anywhere in the world. Our ceramic materials are proven to remain extremely stable over time and temperature

First Technology is an ISO and QS registered company. We provide world-class quality products error free and on time.

Applications:

- Cellular Base Station Filters
- Combiners
- Duplexers
- DRO's
- Satellite Communications
- GPS Antennas
- Wireless Internet

Features:

- Patented threaded mounting mechanism with high temperature support
- Custom designed components
- Custom temperature coefficient
- System design flexibility
- High Q with low loss

Benefits:

- Extremely tight dielectric constant control
- Very rapid turnaround time on prototypes from concept to production
- Eliminates variable component compensation

Quality & Environmental
QS-9000
ISO-14001
Registered

First Technology's line of custom electronic ceramics provide designers with more freedom during the design process by eliminating external temperature compensating devices. Our ceramics are able to intrinsically compensate for temperature and achieve overall temperature drift as low as 0 +/- 0.5 ppm/C by matching the material blend of the ceramic to the surrounding cavity. First Technology has material to match your cavity, whether it is made of Invar, Aluminum or something in between.

Small cavities with high Q can be achieved by applying proper design techniques with First Technology's low loss dielectric material. Most importantly, every cavity will produce close to identical performance due to our stringent in-process controls that virtually eliminate batch-to-batch and lot-to-lot variations. In addition to starting sooner, your production will flow faster and more smoothly with First Technology's ceramics.

First Technology can also provide innovative solutions to supporting the resonator in your design. Our patented threaded support system does not require adhesive, thereby improving quality and reliability, while simplifying your manufacturing process.

Description of Operation

Dielectric resonators function by trapping energy in an extremely small band of frequencies within the confines of the resonator volume. The method of resonance closely approximates that of circular Waveguide. Energy is reflected back into the resonator resulting in negligible radiation losses by presenting a large change in permitivity at the boundary of the resonator. The actual resonant frequency is determined by the mechanical dimensions of the puck. Figure 1 shows examples of various loading methods. Coupling methods for TE 01 are demonstrated in Figure 2.

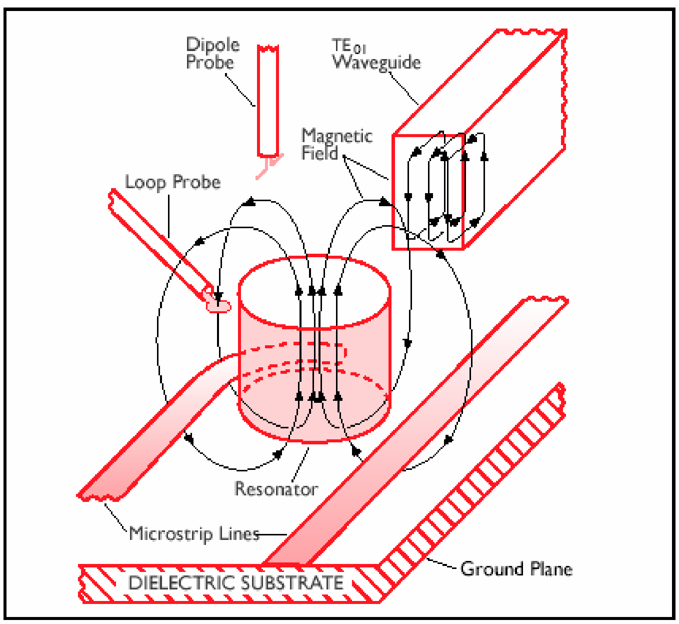


Figure 1 Dielectric Resonators, edited by D. Kajfez and P. Gullion 1986 Artech House, Inc., Norwood, MA 02602

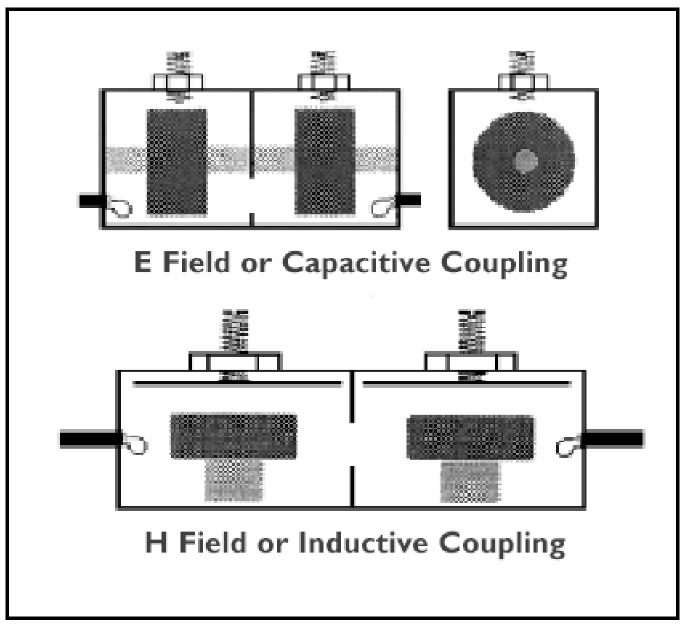
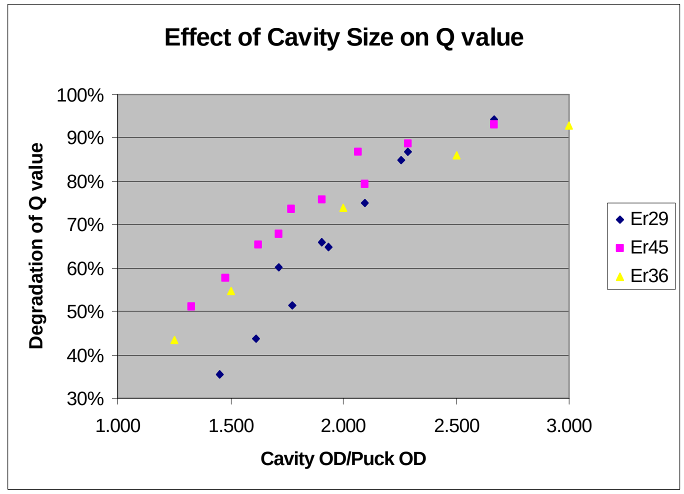


Figure 2

Effect of Cavity

The Dielectric Resonator is dependent on its surroundings for Frequency and Q as well as overall temperature coefficient. Figure 3 shows the effect of cavity size on the overall resonant system. D/d is the diameter of the cavity divided by the diameter of the puck. When D/d reaches a ratio of approximately 3.0, the effect of the cavity is negligible.



Effect of Tuning

The frequency of Dielectric Resonators can be tuned by a tuning plate, a dielectric plug or a dielectric disk, as shown in figure 4. The tuning plate will give a much coarser adjustment relative to the distance with the sacrifice of unloaded Q. The dielectric plug or disk will provide a much finer adjustment to frequency with little effect on unloaded Q.

At 850 MHz, plate tuning will provide approximately 75 MHz of tuning with a corresponding change in Q value of about 50%. Plug and disk tuning over the same frequency will provide tuning of about 30 MHz with less than 5% change in Q and about 70 MHz @ 2000 MHz.

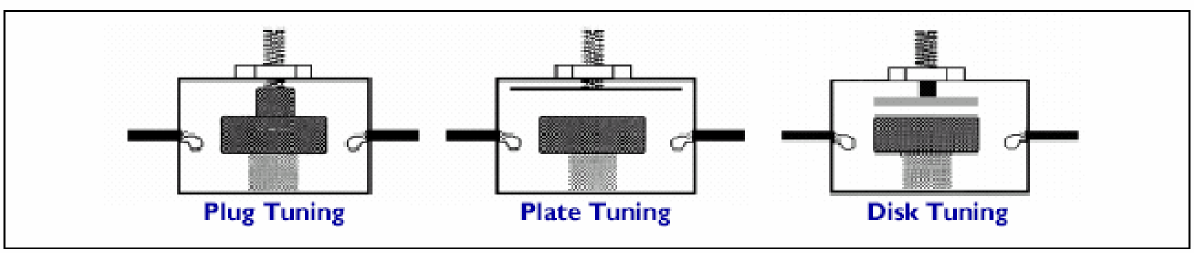


Figure 4

Temperature Coefficient

Figure 5 displays the relative adjustments that can be made to the ceramic blends used by First Technology. First Technology specializes in supplying custom temperature coefficient ceramics.

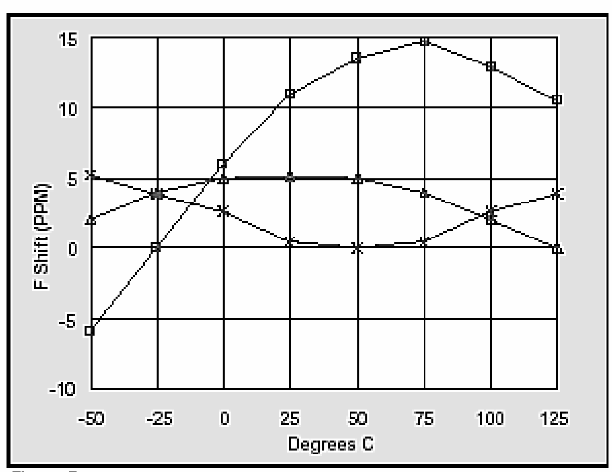


Figure 5

Specifications

Product Family	Material Designation	Dielectric Constant	Temperature Coefficient	Unloaded Q	Useful Freq Range (GHz)
Er21	E21P15	20.5 +/-1.5	+2.5 +/-1.5	>20,000 @ 3GHz	1.8 – 40
HQ29	E29N10	28.75 +/-0.5	-1.2 +/-0.5	>40,000 @ 3GHz	1.8 – 20
	E29NP0	28.85 +/-0.5	+0.0 +/-0.5	>40,000 @ 3GHz	1.8 – 20
	PHQ29	28.95 +/-0.5	+1.5 +/-0.5	>40,000 @ 3GHz	1.8 – 20
	E29P20	29.05 +/-0.5	+2.0 +/-0.5	>40,000 @ 3GHz	1.8 – 20
HQ34	E34NP0	34.0 +/-0.3	+0.0 +/-0.5	>25,000 @ 3.5 GHz	1.8 – 20
	E34P20	34.4 +/-0.3	+2.0 +/-0.5	>25,000 @ 3.5 GHz	1.8 – 20
Er36	PMA15	34.95 +/-0.3	-1.5 +/-0.5	>13,000 @ 3.5 GHz	0.8 – 10
	PA4	34.80 +/-0.3	+0.4 +/-0.5	>13,000 @ 3.5 GHz	0.8 – 10
	PA12	35.85 +/-0.3	+1.2 +/-0.5	>13,000 @ 3.5 GHz	0.8 – 10
	PA27	35.95 +/-0.3	+2.7 +/-0.5	>13,000 @ 3.5 GHz	0.8 – 10
Er45	E45N35	44.5 +/-0.5	-3.5 +/-0.5	>15,000 @ 3 GHz	0.6 – 5
	E45N3	45.1 +/-0.5	-0.3 +/-0.5	>15,000 @ 3 GHz	0.6 – 5
	E45P7	45.3 +/-0.5	+0.7 +/-0.5	>15,000 @ 3 GHz	0.6 – 5
	E45P20	45.5 +/-0.5	+2.0 +/-0.5	>15,000 @ 3 GHz	0.6 – 5
Er80	E80N25	80.5 +/-1	-2.5 +/-1.0	>10,000 @ 1 GHz	0.6 – 3
	E80NP0	80.8 +/-1	+0.0 +/-1.0	>10,000 @ 1 GHz	0.6 – 3
	E80P15	81.0 +/-1	+1.5 +/-1.0	>10,000 @ 1 GHz	0.6 – 3

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