



Murata Fine Tunes Part Features to Suit Today's TV Tuner

The company developed a balanced-to-balanced transformer with low loss and high CMRR while exceeding its size limitations, which proved beneficial for compact TV tuners.

In Japan, digital broadcasting started in December 2003 using the Integrated Services Digital Broadcasting Terrestrial (ISDB-T) system and the complete shutoff of analog broadcasting is scheduled in July 2011, leading to heightened migration to digital TV services.

Capitalizing on the benefits of the digital broadcasting system, the market for mobile reception is also growing at a fast pace. While one-seg mobile broadcasting has become more popular in Japan, a much wider use of the Digital Video Broadcasting-Handheld (DVB-H) system is expected overseas.

Amid these trends, the tuner module technology is undergoing rapid development, which is the key to digital broadcasting reception. With the evolution of the tuner circuit IC manufacturing technology, today's tuner modules are being called to exhibit high performance, low power consumption, and to feature smaller size and profile. Thus, scaling down the size and profile of various components inside a tuner module increasingly becomes significant.

A circuit design that allows the tuner circuit to efficiently transmit signals received by an antenna is also important. In designing the tuner circuit, it may be necessary to convert the input signals in order to match them with the equilibrium input circuit of an IC for some radio frequency integrated circuit (RFIC) specifications. Normally, when a un-equilibrium circuit (from antenna to RFIC) is directly connected to an equilibrium circuit (inside RFIC), the signals are lost at the portion where they are connected. Therefore, a signal between un-equilibrium and equilibrium circuits must be converted, and this function is performed by balanced-to-unbalanced transformers.

These parts have been used in various receiver circuits for some time already.

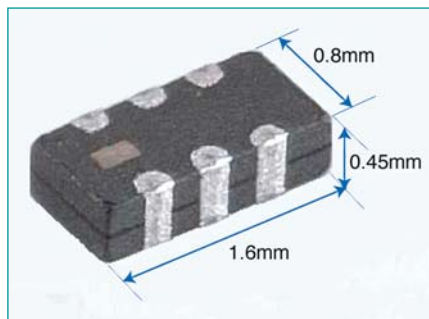


Photo 1: External appearance of the DXP18BN Series

A unit is larger than 8sq.mm, and generally has a structure where the lead wire is intricately passed through and wound around the spectacle-shaped ferrite core. Conventional balanced-to-unbalanced transformers are large and expensive, and their high-frequency characteristics vary significantly. For this reason, balanced-to-unbalanced transformers are not suitable for today's smaller tuner modules, for example those used for ISDB-T and DVB-H systems installed in mobile devices.

Resolves Size Limitation

Murata Manufacturing Co., Ltd. has started mass production of its ultrasmall balanced-to-unbalanced transformer, the DXP18BN Series, which is highly suitable for small TV tuners. The DXP18BN Series has a frequency range of 50 to 870MHz, which can be used for both analog and digital broadcasting. The small and low profile DXP18BN Series measures $1.6 \times 0.8 \times 0.45$ mm and has a mounting space that is less than 1/50 of con-

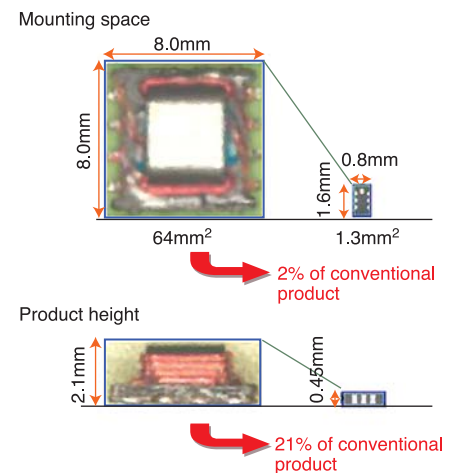


Fig. 1: Comparison between the conventional wire wound balanced-to-unbalanced transformer and the DXP18BN

ventional wire wound balanced-to-unbalanced transformers. The DXP18BN Series is equipped with an impedance conversion function and is designed to eliminate impedance mismatch in a tuner.

Photo 1 shows the external appearance of DXP18BN while Figure 1 shows comparative images of the conventional wire wound balanced-to-unbalanced transformer and the DXP18BN Series.

In Table 1, the products in DXP18BN Series as well as their respective characteristics are presented. As indicated, the DXP18BN is extremely small but assures a low signal loss in wide frequency bands and a high common mode rejection ratio (CMRR) of output signals. The CMRR is the ratio of in-phase signals included in differential signals. When the CMRR is

Table 1: List of specifications of the DXP18BN

Part No.	Input impedance value	Output impedance value	Applicable frequency range	Insertion loss	CMRR
DXP18BN5014T	50Ω	200Ω	50~870MHz	1.5dB or less	25dB or more
DXP18BN5014H	50Ω	200Ω	470~790MHz	1.2dB or less	25dB or more
DXP18BN7514T	75Ω	300Ω	50~870MHz	1.5dB or less	25dB or more

Modules for Mobile Applications

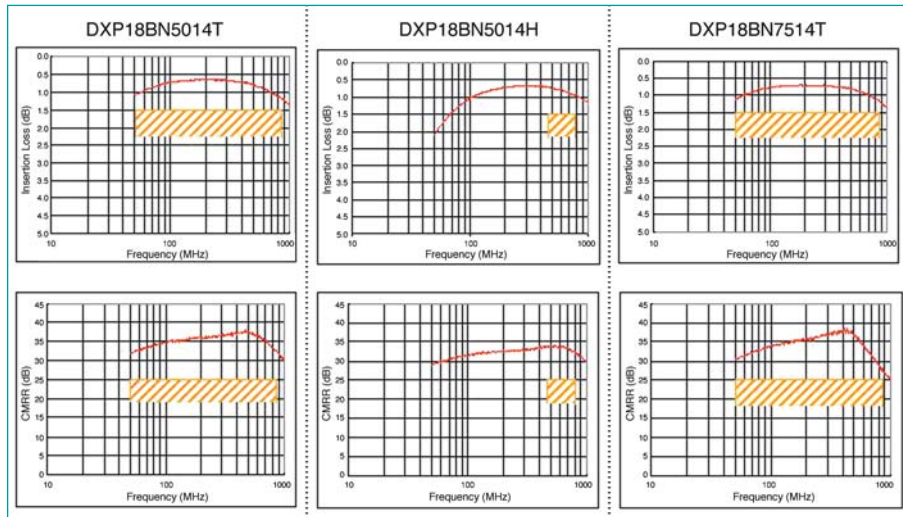


Fig. 2: Frequency characteristics of the DXP18BN

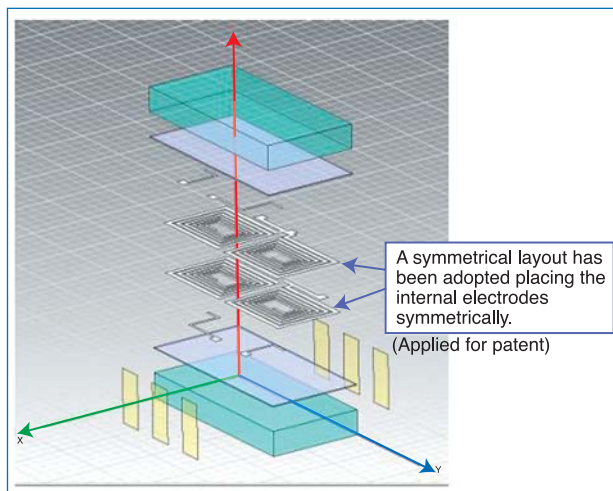


Fig. 3: Internal structure of the DXP18BN

high, it means that there is less phase difference and amplitude difference between the output signals. When the CMRR is 30dB, the phase difference will be 3° and the amplitude difference will be about 0.2dB.

In the case of the DXP18BN Series, the CMRR values indicate it has a performance equal or higher than a conventional wire wound balanced-to-unbalanced transformer. Variations in the internal circuits of the DXP18BN Series have been reduced to between 2 to 3µm using photolithographic processing technology, allowing it to feature low loss and high CMRR evenly in wide frequency bands.

Meet Required Characteristics

In regular tuner circuits, a balanced-to-unbalanced transformer is installed pre-

ceding the RF amplifier. Therefore, any loss produced in the balanced-to-unbalanced transformer immediately degrades the tuner sensitivity. For that reason, balanced-to-unbalanced transformers are demanded to have low loss quality. When the CMRR of the signals is low after they pass through the balanced-to-unbalanced transformer, these signals will become distorted when amplified using the RF amplifier, thus degrading tuner sensitivity. Therefore, balanced-to-unbal-

anced transformers with high CMRR are also demanded.

Murata recently developed a small, high-performance balanced-to-unbalanced transformer circuit design technology for the DXP18BN Series, in addition to the company's original photolithographic processing technology and high coupling coil circuit and structural design technology that were developed earlier for film-type common mode choke coils. Using these technologies, Murata has implemented the required characteristics of small and low-profile balanced-to-unbalanced transformers.

Among the significant points of the new DXP18BN Series' circuit design include the reduction of the circuit parasitic inductance and floating capacity to a minimum, as well as the optimization of each parameter, configuring the in-

ternal circuits with the adoption of a symmetrical layout for these circuits. Additionally, Murata has achieved one of the industry's smallest balanced-to-unbalanced transformers with low loss and high CMRR by combining a new technology with the company's own high-precision photolithographic processing technology. Murata realized a product that can be used for a small tuner module to be installed in compact mobile equipment.

Figure 2 shows the frequency characteristics of the DXP18BN Series while Figure 3 shows its internal configuration.

Next in Line

In order to keep pace with the growth in demand for small tuners used in flat TV sets as well as smaller mobile equipment, the focus of component manufacturers is to produce smaller and lower-profile balanced-to-unbalanced transformers. Murata, for its part, has brought to the market, the ultrasmall DXP18BN Series.

The DXP18BN Series adopts Murata's original balanced-to-unbalanced transformer circuit design technology and photolithographic processing technology to achieve low loss and high CMRR in wide bands, making great contributions to the creation of smaller and higher performance TV tuners.

With the expected demand for increased performance of TV tuners, Murata will continue to expand the DXP Series lineup focusing on: decreasing size and profile for installation in next-generation ultrasmall TV modules; lowering loss and increasing CMRR in order to improve the sensitivity of a TV tuner, and improving the range of the frequency band to expand the DXP Series applications.

Murata will continue its research and development into making smaller and higher performance components. The company will contribute to creating an environment where everybody can watch television at any time and in any place.

About This Article:

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