MPD MICROWAVE PRODUCT DIGEST

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World's Smallest Stripline Junction Isolator

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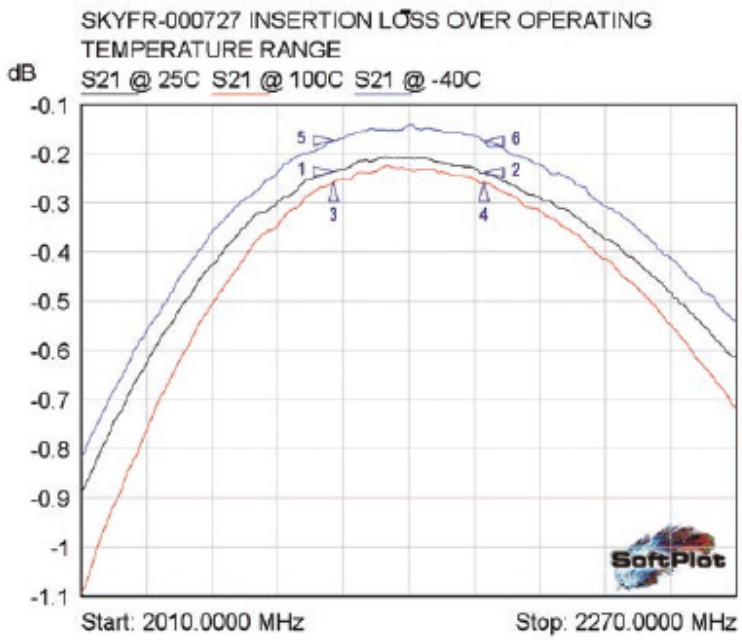
Skyworks has successfully developed the world's smallest stripline junction isolator. The junction size of the SKYFR-000727 is only 10 millimeters (mm) in diameter and has a footprint of less than 144 mm2. It operates in the frequency band 2110 to 2170 megahertz (MHz) and has a typical insertion loss of only 0.20 dB. The device is housed in a surface mount "robust lead" package and shipped in tape-and-reel.

Figure 1: SKYFR-000727 image

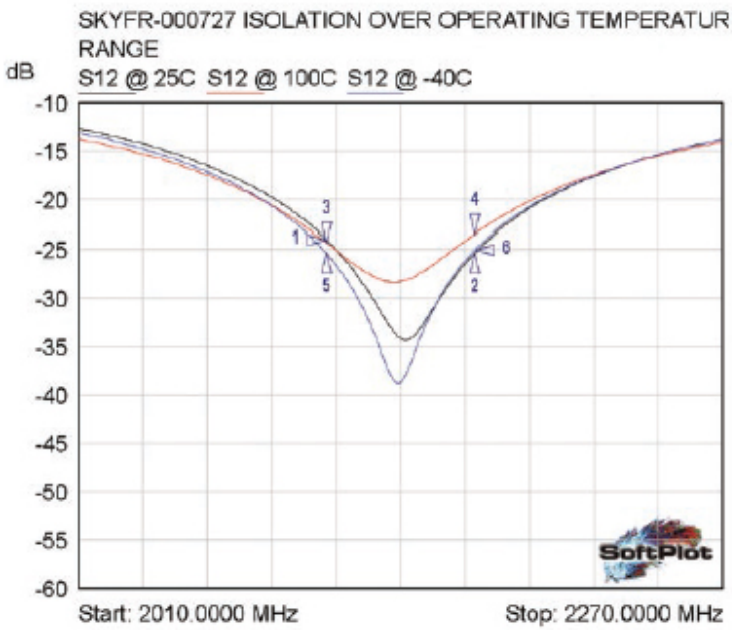
The key to the extremely small junction size is a new high dielectric ferrite material. Skyworks created a new range of materials to enable size reduction of ferrite devices by manipulating the garnet structure to give much higher dielectric constants than previously available. By substituting ions of higher polarizability into the structure while simultaneously keeping magnetocrystalline anisotropy low, it has been possible to achieve low magnetic and dielectric losses without compromising temperature, non-linear and power stability.



Mkr	Trace	X-Axis	Value	Notes
1	S21 @ 25C	2110.0000 MHz	-0.24 dB	
2	S21 @ 25C	2170.0000 MHz	-0.24 dB	
3	S21 @ 100C	2110.0000 MHz	-0.26 dB	
4	S21 @ 100C	2170.0000 MHz	-0.26 dB	
5	S21 @ -40C	2110.0000 MHz	-0.17 dB	
6	S21 @ -40C	2170.0000 MHz	-0.18 dB	

Figure 2: SKYFR-000727 insertion loss over operating temperature range

Magnetizations of up to 1850 Gauss are possible with this new range of materials, with dielectric constants up to 31. New nano-level powder processing techniques are an integral part of the manufacture of these materials. Patents on all aspects of the design, manufacture and application of these materials are pending.



Mkr	Trace	X-Axis	Value	Notes
1 ▽	S12 @ 25C	2110.0000 MHz	-24.03 dB	
2 ▽	S12 @ 25C	2170.0000 MHz	-25.37 dB	
3 ▽	S12 @ 100C	2110.0000 MHz	-24.32 dB	
4 ▽	S12 @ 100C	2170.0000 MHz	-23.45 dB	
5 ▽	S12 @ -40C	2110.0000 MHz	-25.43 dB	
6 ▽	S12 @ -40C	2170.0000 MHz	-25.07 dB	

Figure 3: SKYFR-000727 isolation over operating temperature range

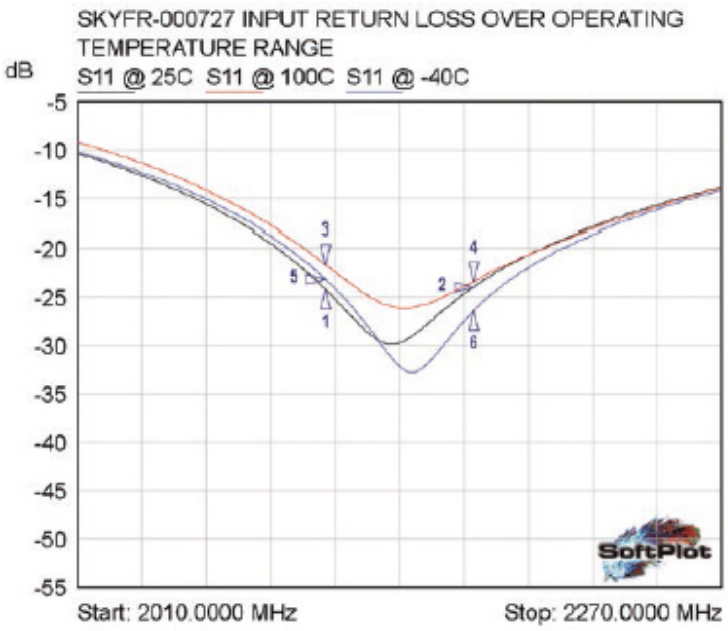
The SKYFR-000727 is a single junction isolator in a 10 mm diameter housing (see **Figure 1**), designed to operate in the standard band of 2110 to 2170 MHz. This isolator can achieve insertion loss performance of 0.20 dB typical and is specified to 0.30 dB maximum over the operating temperature range of -40 to +100°C. The isolation and the return loss are typically 23 dB at room temperature.

The intermodulation distortion (IMD) performance is 60 dBc typical with two 15W CW tones. See **Table 1** for IMD data.

Table 1: SKYFR-000727 Intermodulation Distortion

F1 (MHz), 15 W	F2 (MHz), 15 W	Measured (MHz)	IMD@25°C (dBc)
2110	2111	2112	68
2110	2111	2109	65
2140	2141	2142	69
2140	2141	2139	66
2169	2170	2171	68
2169	2170	2168	64

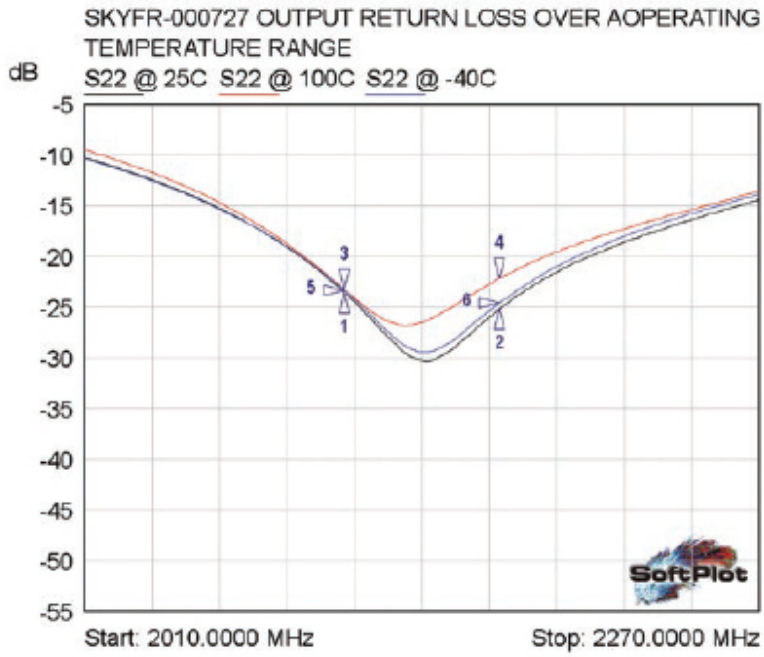
Skyworks' patented "robust lead" package allows the circulator to be populated onto the customer's printed circuit board (PCB) using modern surface-mount technology. The package uses a unique vertical lead to connect the center conductor of the circulator to the customer's PCB. The silver plated lead is firmly encased inside a high temperature plastic, insuring a robust design and excellent co-planarity. The main body of the device is also silver plated for excellent solderability and can be attached to the PCB using a standard reflow profile. The robust lead isolator is shipped in tape-and- reel for automated placement.



Mkr	Trace	X-Axis	Value	Notes
1	S11 @ 25C	2110.0000 MHz	-24.23 dB	
2	S11 @ 25C	2170.0000 MHz	-23.95 dB	
3	S11 @ 100C	2110.0000 MHz	-21.63 dB	
4	S11 @ 100C	2170.0000 MHz	-23.39 dB	
5	S11 @ -40C	2110.0000 MHz	-23.13 dB	
6	S11 @ -40C	2170.0000 MHz	-26.38 dB	

Figure 4: SKYFR-000727 input return loss over operating temperature range

The surface-mount robust lead isolator is extremely reliable, which has been confirmed by reliability testing — including thermal shock, humidity, vibration and high temperature soak. The part will also withstand up to 50 Watt (W) average CW radio frequency power when mounted on a PCB with good thermal grounding. The isolator includes an aluminum nitride termination and can handle up to 30 W of reverse power.



Mkr	Trace	X-Axis	Value	Notes
1	S22 @ 25C	2110.0000 MHz	-23.54 dB	
2	S22 @ 25C	2170.0000 MHz	-25.16 dB	
3	S22 @ 100C	2110.0000 MHz	-23.24 dB	
4	S22 @ 100C	2170.0000 MHz	-22.15 dB	
5	S22 @ -40C	2110.0000 MHz	-23.31 dB	
6	S22 @ -40C	2170.0000 MHz	-24.57 dB	

Figure 5: SKYFR-000727 output return loss over operating temperature range

Figures 2, 3, 4 and 5 show the s parameter performance of the SKYFR-000727 over the operating temperature range. The extremely small size is the result of new magnetic materials developed by Skyworks for exclusive use. The device is housed in a surface mount “robust lead” package and shipped on tape-and-reel, making it ideal for today’s surface-mount assembly processes. Skyworks is currently developing a wide range of 10 mm isolators for many of the wireless infrastructure frequency bands.

For more information, please visit www.skyworksinc.com.

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