

## DATA SHEET

# SPD1101/SPD1102/SPD1103-111: Sampling Phase Detectors

**NOTE: These products have been discontinued. The Last Time Buy opportunity expires on 12 April 2010.**

## Applications

- Phase-Locked Loops
- Phase-locked VCOs to 22 GHz

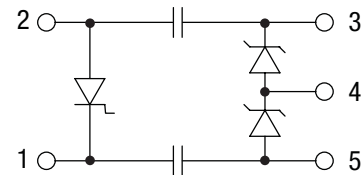
## Features

- Reference frequencies below 50 MHz
- New surface mount package design
- Small footprint: 90 x 110 mils
- Automated Chip-On-Board construction
- Packages rated MSL1, 260 °C per JEDEC J-STD-020

**NEW**



Skyworks Green™ products are RoHS (Restriction of Hazardous Substances)-compliant, conform to the EIA/EICTA/JEITA Joint Industry Guide (JIG) Level A guidelines, are halogen free according to IEC-61249-2-21, and contain <1,000 ppm antimony trioxide in polymeric materials.



**Figure 1. Schematic Diagram**

## Description

Skyworks series of sampling phase detectors consists of a Step Recovery Diode (SRD), a series pair of Schottky mixer diodes, and a pair of coupling capacitors. These Chip-On-Board (COB) components are manufactured using automated pick-and-place techniques to provide surface mountable, small footprint devices with excellent high-frequency, uniform performance. A schematic diagram is shown in Figure 1.

Sampling phase detectors are typically used in systems that lock the output signal of a high-frequency Voltage-Controlled Oscillator (VCO) to a lower frequency, stable reference oscillator output signal. The reference oscillator signal is applied to the SRD, which produces outputs at the harmonics of the reference oscillator frequency.

This comb of harmonics is coupled to the Schottky series pair, which comprises a singly balanced mixer, via the on-board coupling capacitors. The high-frequency signal from the VCO is applied to the center node of the Schottky diode pair. The high-frequency VCO signal is mixed with the harmonics of the low-frequency, stable reference oscillator signal in the Schottky diode pair.

The desired output signal is typically the difference between the frequency signal that is produced by the VCO and the harmonic of the reference oscillator signal nearest to it in frequency. This output is present at pin 4 of the sampling phase detector, along with the other mixer products produced by the other harmonics of the reference oscillator signal and the VCO signal. All of these signals are higher in frequency than the desired output signal.

The desired output signal is selected by an external Low Pass Filter (LPF), and can be used to lock the frequency and the phase of the VCO signal to the stable reference oscillator signal.

**Table 1. SPD Series Absolute Maximum Ratings**

Parameter	Symbol	Minimum	Maximum	Units
Incident power			+27	dBm
Operating temperature	T <sub>A</sub>	–65	+150	°C
Storage temperature	T <sub>STG</sub>	–65	+175	°C

**Note:** Exposure to maximum rating conditions for extended periods may reduce device reliability. There is no damage to device with only one parameter set at the limit and all other parameters set at or below their nominal value. Exceeding any of the limits listed here may result in permanent damage to the device.

**CAUTION:** Although this device is designed to be as robust as possible, Electrostatic Discharge (ESD) can damage this device. This device must be protected at all times from ESD. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD precautions should be used at all times. The SPD series of sampling phase detectors are rated Class 1B Human Body Model (HBM) ESD devices.

**Table 2. SPD Series Electrical Specifications (Note 1)**  
**(T<sub>A</sub> = +25 °C, Per Junction Unless Otherwise Noted)**

Part Number	Microwave Signal Drive Level (dBm)	Schottky Diode				Capacitor	Step Recovery Diode		
		Barrier	V <sub>F</sub> @ 1 mA (mV)	C <sub>J</sub> @ 0 V (pF)	R <sub>T</sub> @ 5 mA (Ω)	C <sub>c</sub> , (pF)	C <sub>J</sub> @ 6 V (pF)	T <sub>L</sub> (ns)	T <sub>T</sub> (ps)
	Typ			Max	Max	Typ	Max	Typ	Typ
SPD1101-111	–3 to 0	Low	270-350	0.1	24	0.5	0.25	10	70
SPD1102-111	0 to +3	Medium	370-550	0.1	24	0.5	0.25	10	70
SPD1103-111	0 to +13	High	600-700	0.1	24	0.5	0.25	10	70

**Note 1:** Performance is guaranteed only under the conditions listed in this Table and is not guaranteed over the full operating or storage temperature ranges. Operation at elevated temperatures may reduce reliability of the device.

## Electrical and Mechanical Specifications

The absolute maximum ratings of the SPD series of sampling phase detectors are provided in Table 1. Electrical specifications are provided in Table 2.

An equivalent circuit diagram for the SPD sampling phase detectors is shown in Figure 2. The typical performance of the SPD1101-111 phase detector is illustrated in Figure 3. Package dimensions are shown in Figure 4.

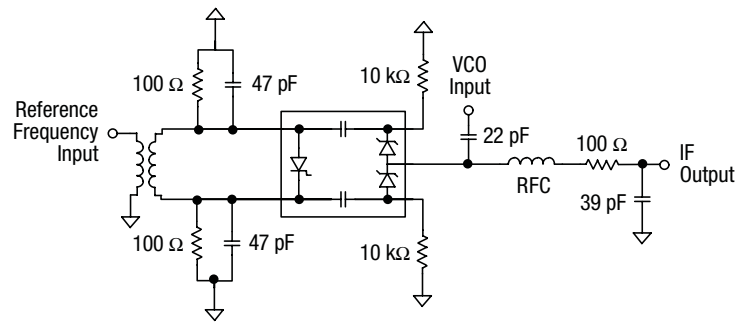
## Package and Handling Information

Instructions on the shipping container label regarding exposure to moisture after the container seal is broken must be followed. Otherwise, problems related to moisture absorption may occur

when the part is subjected to high temperature during solder assembly.

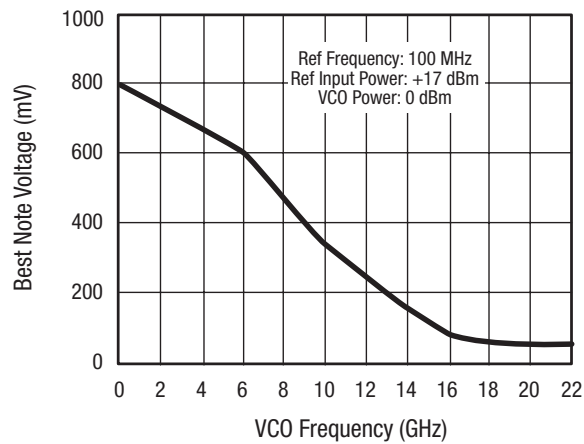
The SPD series of sampling phase detectors is rated to Moisture Sensitivity Level 1 (MSL1) at 260 °C for five seconds. They can be used for lead or lead-free soldering. For additional information, refer to the Skyworks Application Note, *Solder Reflow Information*, document number 200164

Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. Production quantities of this product are shipped in a standard tape and reel format. For packaging details, refer to the Skyworks Application Note *Discrete Devices and IC Switch/Attenuators Tape and Reel Package Orientation*, document number 200083.

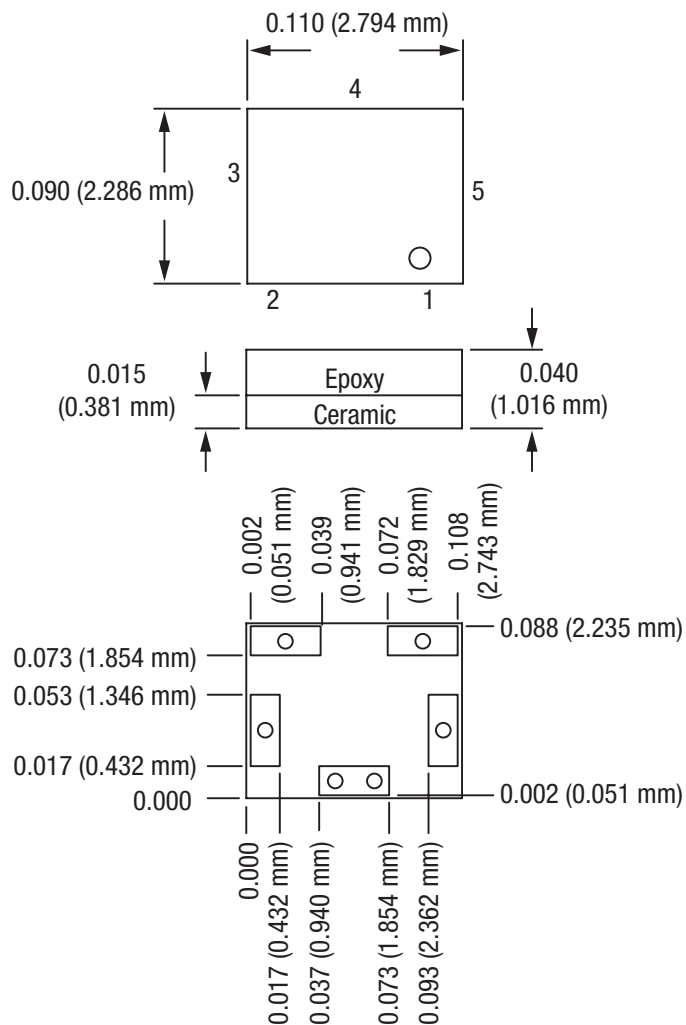


Input transformer must provide a 10:1 step-down impedance ratio

**Figure 2. Equivalent Circuit for SPD Series of Sampling Phase Detectors**



**Figure 3. SPD1101-111: Best Note Voltage vs VCO Frequency**



*Dimensions are in inches (millimeters shown in parentheses)*

### Figure 4. -111 Package Dimensions

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