

DATA SHEET

# PD4W09-59LF: 0.81-0.96 GHz Four-Way 0° Power Splitter/Combiner

## Applications

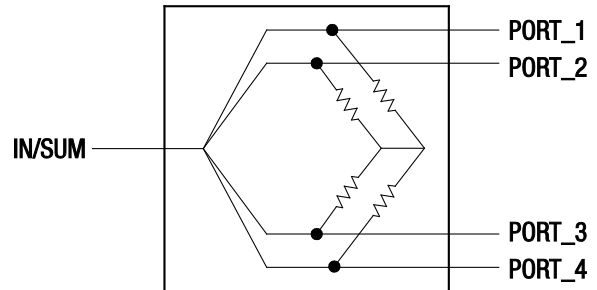
- Cellular radios
- Transmitters/receivers

## Features

- Low loss
- High isolation
- Good I/O match
- Excellent phase/amplitude balance
- MSOP-8 (8-pin, 3 x 3 mm) package (MSL1, 260 °C per JEDEC J-STD-020)



Skyworks Green™ products are compliant with all applicable legislation and are halogen-free. For additional information, refer to *Skyworks Definition of Green™*, document number SQ04-0074.



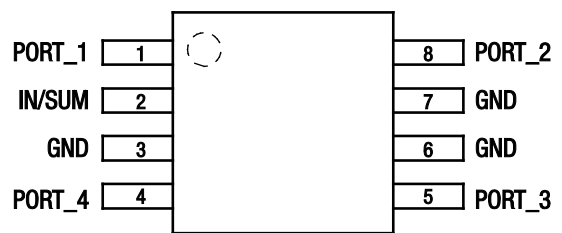
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Figure 1. PD4W09-59LF Block Diagram

## Description

The PD4W09-59LF is a monolithic, four-way in-phase hybrid junction tuned for the 0.81 GHz to 0.96 GHz band. The device offers low loss, high isolation, good input/output matching and exceptional phase/amplitude balance.

A functional block diagram is shown in Figure 1. The pin configuration and package are shown in Figure 2. Signal pin assignments and functional pin descriptions are provided in Table 1.



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Figure 2. PD4W09-59LF Pinout – 8-Pin MSOP-8 (Top View)

**Table 1. PD4W09-59LF Signal Descriptions**

Pin #	Name	Description	Pin #	Name	Description
1	PORT_1	RF port 1	5	PORT_3	RF port 3
2	IN/SUM	Common input or summing RF port	6	GND	Ground
3	GND	Ground	7	GND	Ground
4	PORT_4	RF port 4	8	PORT_2	RF port 2

**Table 2. PD4W09-59LF Absolute Maximum Ratings (Note 1)**

Parameter	Symbol	Minimum	Maximum	Units
Input power, CW	P <sub>IN</sub>		1.500 (Note 2)	W
			0.375 (Note 3)	W
Storage temperature	T <sub>STG</sub>	-65	+150	°C
Operating temperature	T <sub>OP</sub>	-40	+85	°C

**Note 1:** 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.

**Note 2:** When used as a power divider with a 2.0:1 maximum VSWR on all ports.

**Note 3:** When used as a power combiner with a 2.0:1 maximum VSWR on all ports.

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**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.

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**Table 3. PD4W09-59LF Series Electrical Specifications (Note 1)**  
**(T<sub>OP</sub> = +25 °C, Characteristic Impedance [Z<sub>0</sub>] = 50 Ω, Unless Otherwise Noted)**

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Frequency range	f		0.81		0.96	GHz
Insertion loss less6 dB split	IL			1.3	1.5	dB
Isolation	Iso		20	23		dB
Input VSWR	VSWR	IN/SUM port		1.2:1	1.5:1	-
Output VSWR	VSWR	PORT_1, PORT_2, PORT_3, PORT_4		1.2:1	1.5:1	-
Amplitude balance				±0.4	±0.6	dB
Phase balance				±6	±8	deg

**Note 1:** Performance is guaranteed only under the conditions listed in this Table.

### Electrical and Mechanical Specifications

The absolute maximum ratings of the PD4W09-59LF are provided in Table 2. Electrical specifications are provided in Table 3.

Typical performance characteristics are shown in Figures 3 through 8.

### Package Dimensions

The PCB layout footprint for the PD4W09-59LF is provided in Figure 9. Package dimensions for the 8-pin MSOP-8 are shown in Figure 10, and tape and reel dimensions are provided in Figure 11.

### 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 PD4W09-59LF is rated to Moisture Sensitivity Level 1 (MSL1) at 260 °C. It 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.

### Typical Performance Characteristics

(Top = +25 °C, Characteristic Impedance [Z<sub>0</sub>] = 50 Ω, Unless Otherwise Noted)

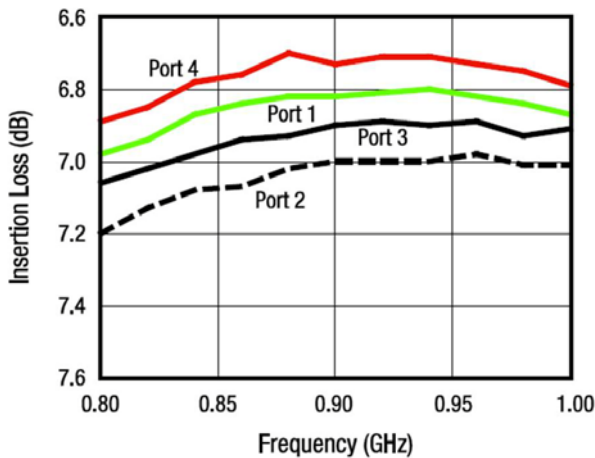


Figure 3. Insertion Loss vs Frequency

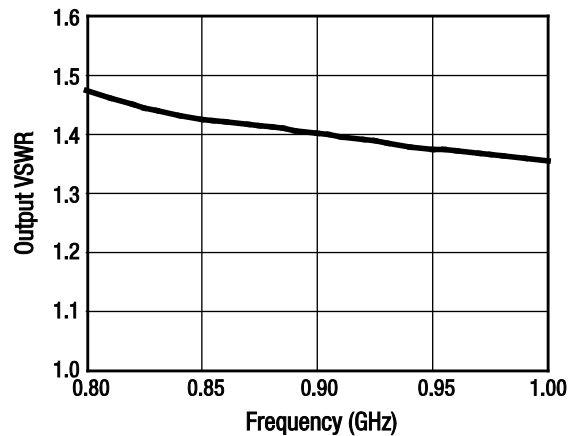


Figure 4. Output VSWR vs Frequency

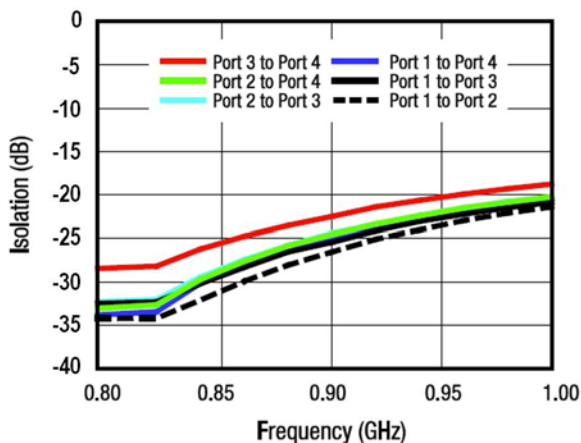


Figure 5. Isolation vs Frequency

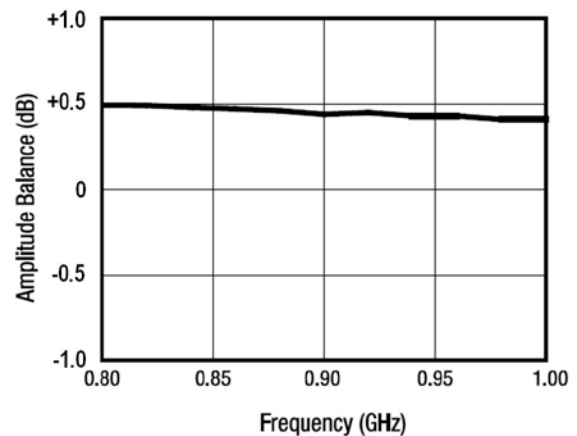


Figure 6. Amplitude Balance vs Frequency

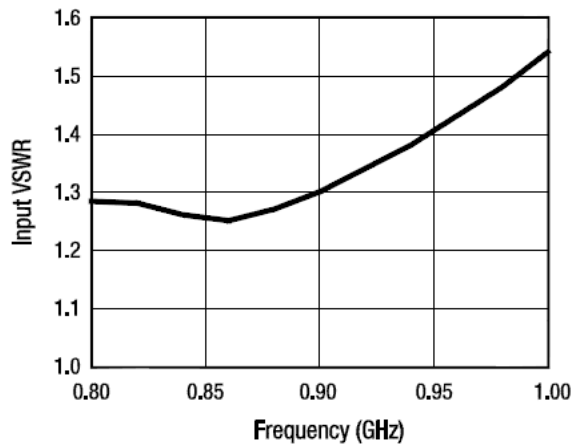


Figure 7. Input VSWR vs Frequency

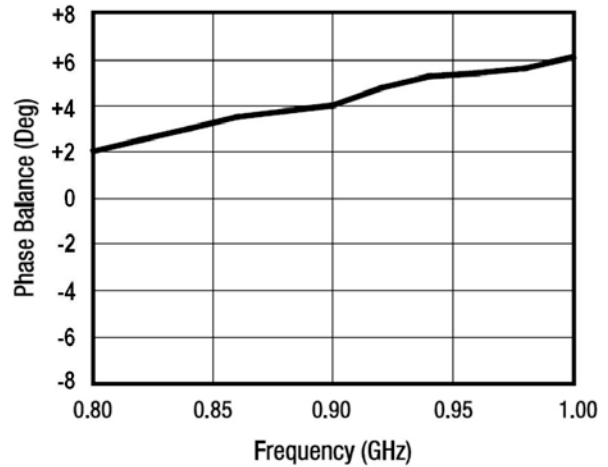


Figure 8. Phase Balance vs Frequency

### Evaluation Board Description

The PD4W09-59LF Evaluation Board is used to test the performance of the PD4W09-59LF power splitter/combiner. An assembly drawing for the Evaluation Board is shown in Figure 9. The Evaluation Board layer detail is shown in Figure 10.

### Package Dimensions

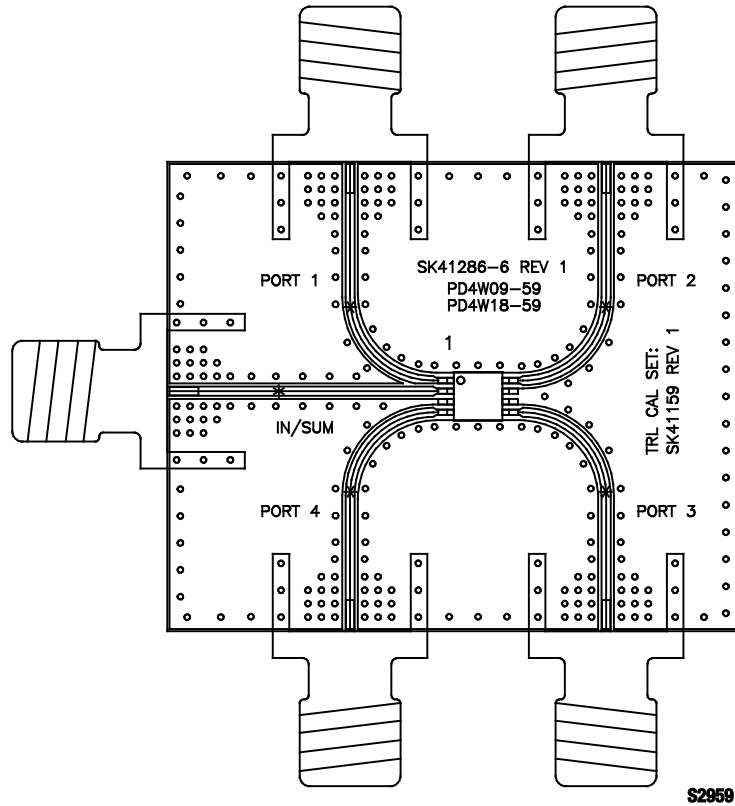
The PCB layout footprint for the PD4W09-59LF is shown in Figure 11. Typical case markings are shown in Figure 12. Package dimensions for the 8-pin MSOP-8 are shown in Figure 13, and tape and reel dimensions are provided in Figure 14.

### 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 PD4W09-59LF is rated to Moisture Sensitivity Level 1 (MSL1) at 260 °C. It 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.

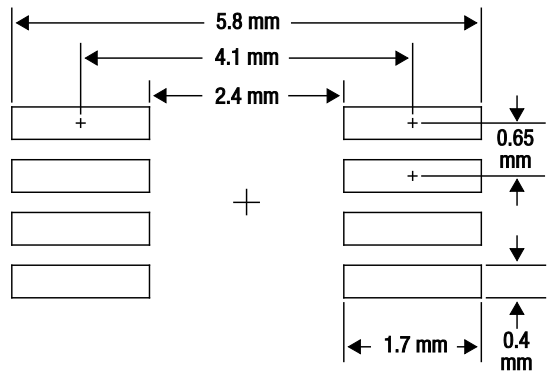


Cross Section	Name	Thickness (in)	Material
	Top Soldermask		
	L1	(0.0028)	Cu foil
	Laminate	0.012 ± 0.0006	Rogers RO4003C Core
	L2	(0.0014)	Cu foil
	Laminate	(Note 1)	FR4 Prepreg
	L3	(0.0014)	Cu foil
	Laminate	0.010 ± 0.0006	FR4 Core
	L4	(0.0028)	Cu foil
	Bottom Soldermask		

Note 1: Adjust this thickness to meet total thickness goal of 0.062 ± 0.005 inches.

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Figure 10. PD4W09-59LF Evaluation Board Layer Detail



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Figure 11. PD4W09-59LF PCB Layout Footprint

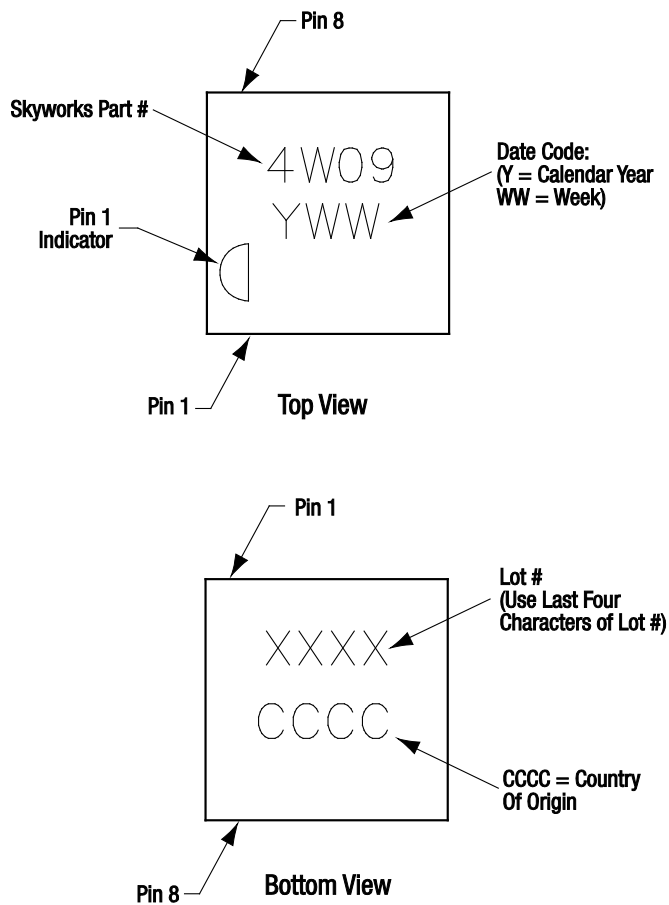
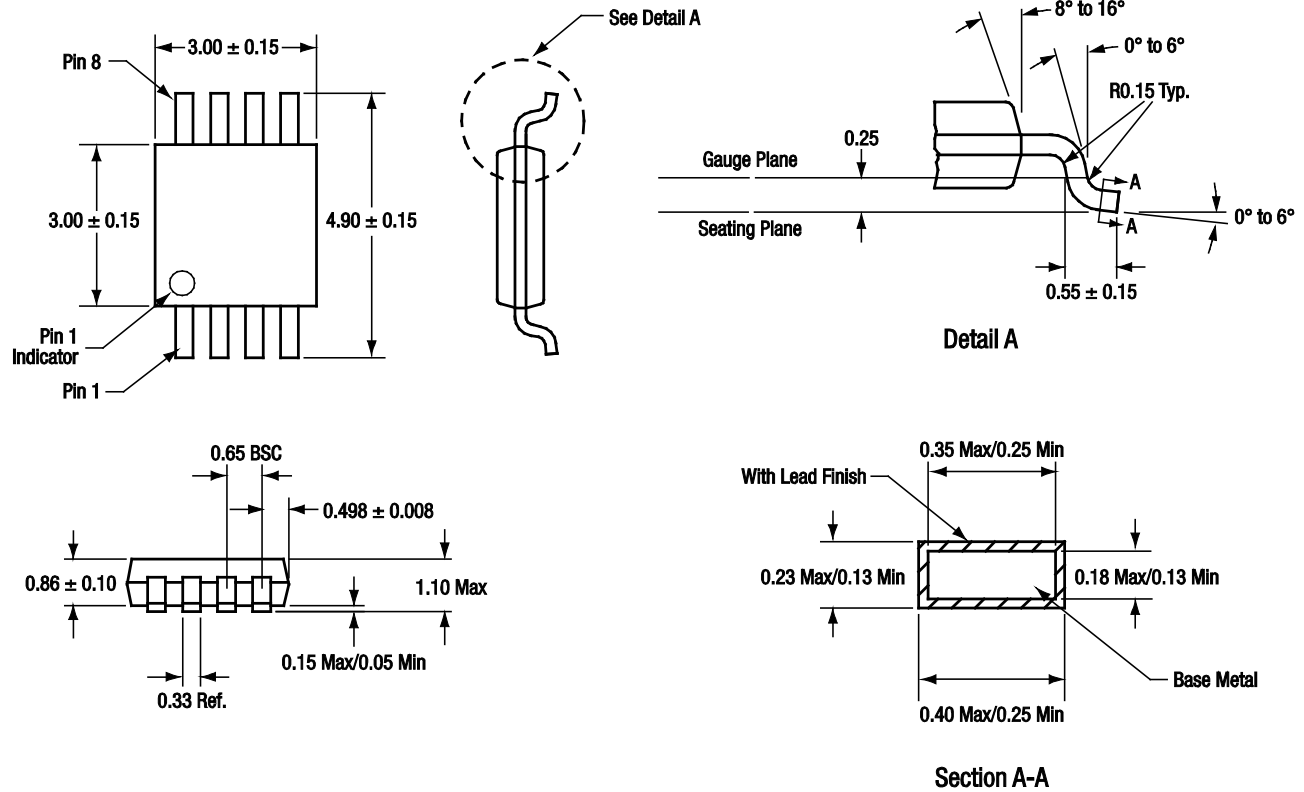


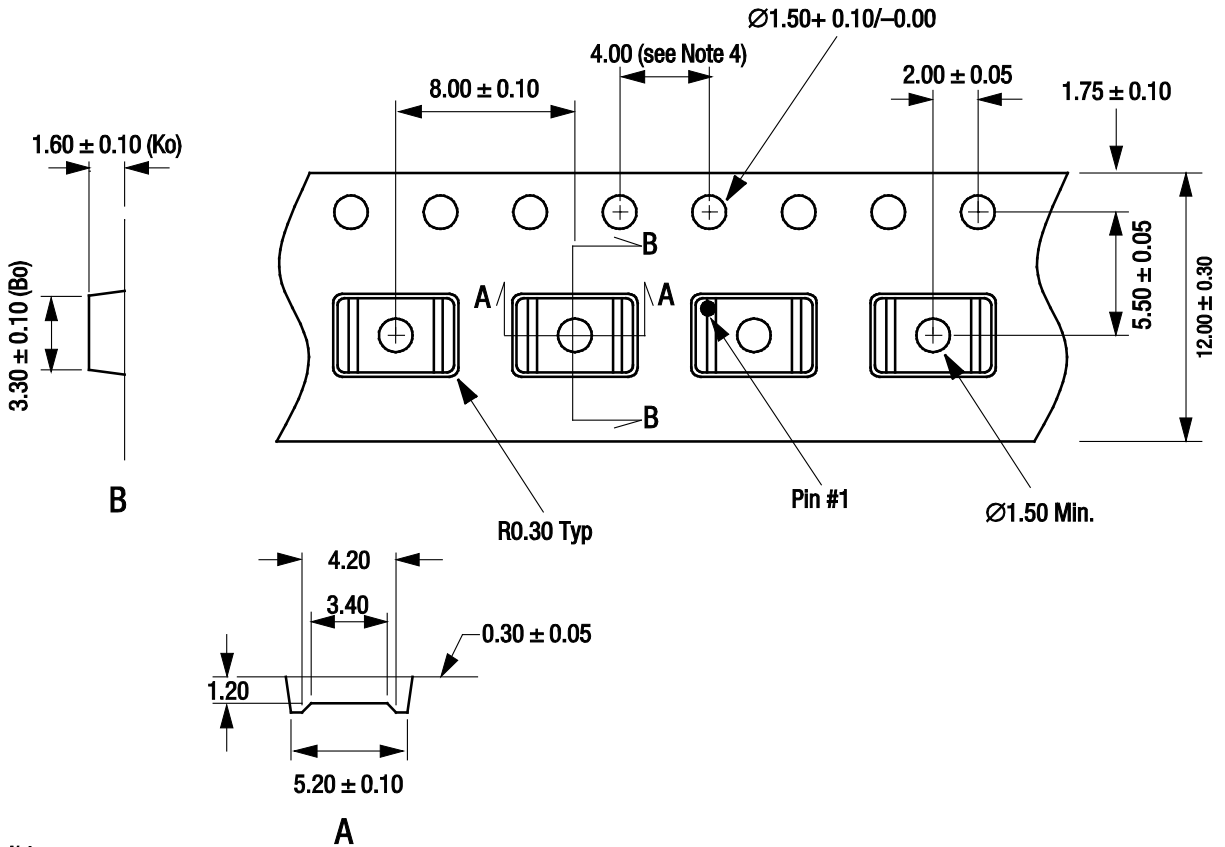
Figure 12. Typical Part Markings



All measurements are in millimeters.  
 Dimensioning and tolerancing according to ASME Y14.5M-1994.  
 Body length dimension does not include mold protrusions and gate burrs do not exceed 0.15 mm per end. Body width dimension does not include interlead mold protrusions. Interlead mold protrusions do not exceed 0.15 mm per side.  
 Lead width dimension does not include dambar protrusion/intrusion. Allowable dambar protrusion is 0.07 mm total in excess of lead width dimension at maximum material condition.  
 Details of pin 1 identifier are optional.  
 JEDEC standard practices and procedures apply (JEDEC Standard No. 95-1, Section 3).  
 Lead coplanarity is 0.10 mm maximum.

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Figure 13. PD4W09-59LF 8-Pin MSOP-8 Package Dimensions



- Notes:
1. Carrier tape: black conductive polystyrene.
  2. Cover tape material: transparent conductive HSA.
  3. Cover tape size: 9.2 mm width.
  4. Ten sprocket hole pitch cumulative tolerance = ±0.20 mm.
  5. All measurements are in millimeters.
  6. Standard reel size is 7 inches. Standard reel quantity is 3000 pcs.

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Figure 14. MSOP-8 Tape and Reel Dimensions



**Ordering Information**

Model Name	Manufacturing Part Number	Evaluation Board Part Number
PD4W09-59LF Power Splitter/Combiner	PD4W09-59LF	PD4W09-59LF-EVB

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