

PRELIMINARY DATA SHEET


# SKY73049-11: 200-5000 MHz Single Downconversion Mixer

## Applications

- 2G, 2.5G, 3G, and 4G base station transceivers: GSM, EDGE, CDMA, WCDMA, LTE, WiMAX
- General purpose RF systems

## Features

- RF frequency operation range: 200 to 5000 MHz
- High-side or low-side injection
- Integrated LO driver
- Wideband integrated 50 Ω matched LO and RF ports
- +3.3 V or +5 V operation
- Small, QFN (16-pin, 3 x 3 mm) package (MSL3, 260 °C per JEDEC J-STD-020)

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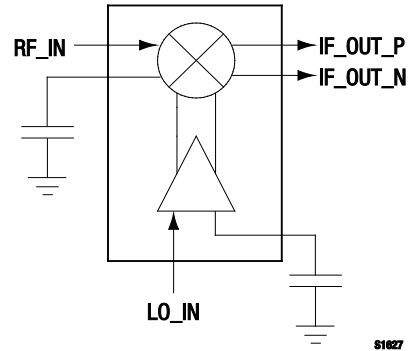


Figure 1. SKY73049-11 Block Diagram

## Description

The SKY73049-11 is a fully integrated, wideband single mixer that includes Local Oscillator (LO) drivers, an RF input stage, and a high linearity mixer core. The SKY73049-11 features a power gain of 7 dB, a 3<sup>rd</sup> Order Input Intercept Point (IIP3) of +26 dBm, and a Noise Figure (NF) of 15 dB over a wide frequency range, which makes the device an ideal solution for multi-band 2G, 2.5G, 3G, and 4G base station transceivers.

The SKY73049-11 is manufactured using a robust SiGe BiCMOS process, and has been designed for optimum long-term reliability. The device is provided in a compact, 3 x 3 mm, 16-pin Quad Flat No-Lead (QFN) package. 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.

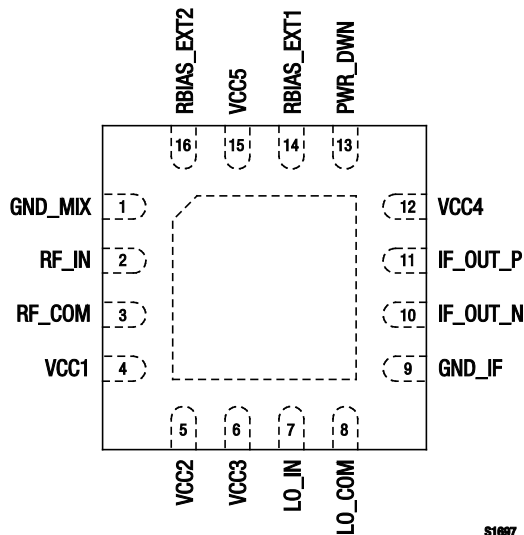


Figure 2. SKY73049-11 Pinout – 16-Pin QFN (Top View)

**Table 1. SKY73049-11 Signal Descriptions**

Pin #	Name	Description	Pin #	Name	Description
1	GND_MIX	Ground for mixer	9	GND_IF	Ground for IF
2	RF_IN	RF input for mixer	10	IF_OUT_N	Negative IF output
3	RF_COM	RF common (AC ground) for mixer input	11	IF_OUT_P	Positive IF output
4	VCC1	Supply for mixer	12	VCC4	Supply for mixer
5	VCC2	Supply for mixer	13	PWR_DWN	Power down control
6	VCC3	Supply for mixer	14	RBIAS_EXT1	External bias resistor for mixer
7	LO_IN	LO input	15	VCC5	Supply for mixer
8	LO_COM	LO common (AC ground) for LO input	16	RBIAS_EXT2	External bias resistor for LO chain

**Note:** Exposed pad must be grounded.

### Technical Description

The SKY73049-11 is a high dynamic range single mixer, optimized for base station receiver applications. The device consists of an RF input stage, a high linearity active mixer core, and an LO amplifier.

#### RF Active Mixer

The high linearity SKY73049-11 is an active, double balanced mixer that provides good noise performance and an excellent IIP3. Additionally, the balanced nature of the mixer provides for high port-to-port isolation. A wideband match to 50 Ω is provided internally, which eliminates the need for any external matching components except for a coupling capacitor.

The IF outputs are designed for 200 Ω differential impedance and require off-chip matching.

#### LO Buffers

The LO buffers allow the input power of the SKY73049-11 to be in the range of -10 to 0 dBm. The LO input frequency range is optimized for 200 to 5000 MHz, and could drive the mixer with both low-side and high-side LO injection. The single-ended LO port is internally matched to 50 Ω without the need for any external components.

#### IF Output

The SKY74039 has differential, high impedance open collector outputs (IF\_OUT\_N and IF\_OUT\_P) that need to be pulled up to supply voltage through RF chokes or through the center tap of a balun. The IF load for the mixer is provided externally. This flexible configuration enables the user to apply any external load, making IF\_OUT\_N and IF\_OUT\_P “broadband” outputs. The nominal value of this load is 200 Ω differential.

### Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY73049-11 are provided in Table 2. The recommended operating conditions are specified in Table 3 and electrical specifications are provided in Tables 4 (+5 V operation) and 5 (+3.3 V operation).

### Evaluation Board Description

The SKY73049-11 Evaluation Board is used to test the performance of the SKY73049-11 downconversion mixer. An Evaluation Board schematic diagram is provided in Figure 3. An assembly drawing for the Evaluation Board is shown in Figure 4 and the layer detail is provided in Figure 5.

### Package Dimensions

The PCB layout footprint for the SKY73049-11 is provided in Figure 6. Package dimensions for the 16-pin QFN are shown in Figure 7, and tape and reel dimensions are provided in Figure 8.

### Package and Handling Information

Since the device package is sensitive to moisture absorption, it is baked and vacuum packed before shipping. 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 SKY73049-11 is rated to Moisture Sensitivity Level 1 (MSL3) at 260 °C. It can be used for lead or lead-free soldering.

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.

**Table 2. SKY73049-11 Absolute Maximum Ratings**

Parameter	Symbol	Minimum	Typical	Maximum	Units
Supply voltage	V <sub>CC</sub>	3.0	5.0	5.5	V
Supply current	I <sub>CC</sub>			200	mA
RF input power	P <sub>IN</sub>			+10	dBm
LO input power	P <sub>LO</sub>			+10	dBm
Operating temperature	T <sub>OP</sub>	-40		+85	°C
Junction temperature				+150	°C
Storage temperature	T <sub>STG</sub>	-40		+125	°C

**Notes:** 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.

Nominal thermal resistance (junction to case) is 5.1 °C/W.

**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 SKY73049-11 ESD threshold level is 2500 VDC using Human Body Model (HBM) testing. This level applies to RF signal lines >100 MHz, analog and RF line <100 MHz, digital lines, power supply lines, and ground pins.

**Table 3. SKY73049-11 Recommended Operating Conditions**

Parameter	Symbol	Minimum	Typical	Maximum	Units
RF frequency range	f <sub>RF</sub>	200		5000	MHz
LO frequency range	f <sub>LO</sub>		RF ± IF		MHz
IF frequency range	f <sub>IF</sub>	50		500	MHz
Supply voltage	V <sub>CC</sub>	3.00	5.00	5.25	V
Supply current	I <sub>CC</sub>		133	170	mA
LO input power	P <sub>LO</sub>	-10	0		dBm
Operating temperature	T <sub>OP</sub>	-40		+85	°C

**Table 4. SKY73049-11 Electrical Specifications (Note 1)**  
**(V<sub>CC</sub> = +5 V, T<sub>OP</sub> = +25 °C, L<sub>O</sub> = 0 dBm, High Side Injection, IF = 100 MHz, Unless Otherwise Noted)**

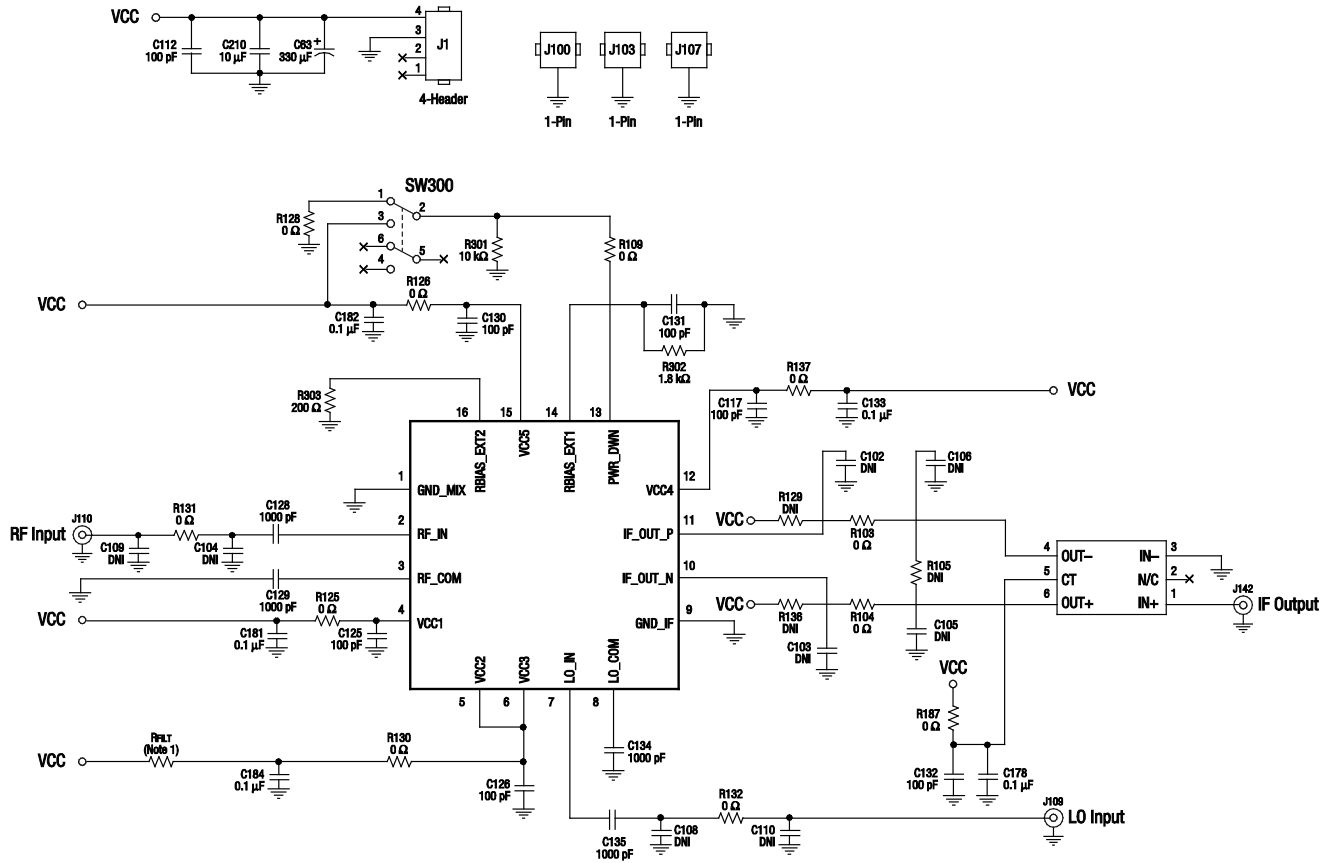
Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Conversion gain	G	@ 0.7 to 0.9 GHz		7.5		dB
		@ 1.9 to 2.2 GHz		6.5		dB
		@ 2.6 to 2.8 GHz		6.2		dB
		@ 3.6 GHz		5.6		dB
Noise Figure	NF	@ 0.7 to 0.9 GHz		14.0		dB
		@ 1.9 to 2.2 GHz		15.5		dB
		@ 2.6 to 2.8 GHz		16.0		dB
		@ 3.6 GHz		17.0		dB
3 <sup>rd</sup> Order Input Intercept Point	IIP3	Tone space = 1 MHz, P <sub>M</sub> = -15 dBm per tone				
		@ 0.7 to 0.9 GHz		+26		dBm
		@ 1.9 to 2.2 GHz		+27		dBm
		@ 2.6 to 2.8 GHz		+27		dBm
2 <sup>nd</sup> Order Input Intercept Point	IIP2	Tone space = 50 MHz				
		@ 0.7 to 0.9 GHz		+53		dBm
		@ 1.9 to 2.2 GHz		+52		dBm
		@ 2.6 to 2.8 GHz		+49		dBm
1 dB Input Compression Point	IP1dB	@ 0.7 to 0.9 GHz		+5		dBm
		@ 1.9 to 2.2 GHz		+6		dBm
		@ 2.6 to 2.8 GHz		+6		dBm
		@ 3.6 GHz		+7		dBm
RF to IF isolation		No filtering at IF output				
		@ 0.7 to 0.9 GHz		-30		dBc
		@ 1.9 to 2.2 GHz		-31		dBc
		@ 2.6 to 2.8 GHz		-35		dBc
LO leakage @ IF port		@ 0.7 to 0.9 GHz		-33		dBc
		@ 1.9 to 2.2 GHz		-35		dBc
		@ 2.6 to 2.8 GHz		-38		dBc
		@ 3.6 GHz		-33		dBc
LO leakage @ RF port		@ 0.7 to 0.9 GHz		-60		dBc
		@ 1.9 to 2.2 GHz		-60		dBc
		@ 2.6 to 2.8 GHz		-45		dBc
		@ 3.6 GHz		-45		dBc
2RF to 2LO	2x2	P <sub>M</sub> = -12 dBm				
		@ 0.7 to 0.9 GHz		-80		dBc
		@ 1.9 to 2.2 GHz		-70		dBc
		@ 2.6 to 2.8 GHz		-65		dBc
3RF to 3LO	3x3	P <sub>M</sub> = -12 dBm				
		@ 0.7 to 0.9 GHz		-80		dBc
		@ 1.9 to 2.2 GHz		-80		dBc
		@ 2.6 to 2.8 GHz		-80		dBc
RF port input return loss	Z <sub>IN_RF</sub>	No matching	-12	-13		dB
			LO port input return loss	Z <sub>IN_LO</sub>	No matching	-12
Total supply current	I <sub>VCC</sub>			133		mA

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

**Table 5. SKY73049-11 Electrical Specifications (Note 1)****(V<sub>CC</sub> = +3.3 V, T<sub>OP</sub> = +25 °C, LO = 0 dBm, High Side Injection, IF = 100 MHz, Unless Otherwise Noted)**

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Conversion gain	G	@ 0.7 to 0.9 GHz		7.4		dB
		@ 1.9 to 2.2 GHz		6.3		dB
		@ 2.6 to 2.8 GHz		6.0		dB
		@ 3.6 GHz		5.7		dB
Noise Figure	NF	@ 0.7 to 0.9 GHz		13.0		dB
		@ 1.9 to 2.2 GHz		14.0		dB
		@ 2.6 to 2.8 GHz		14.5		dB
		@ 3.6 GHz		15.0		dB
3 <sup>rd</sup> Order Input Intercept Point	IIP3	Tone space = 1 MHz, P <sub>M</sub> = -15 dBm per tone				
		@ 0.7 to 0.9 GHz		+24		dBm
		@ 1.9 to 2.2 GHz		+23		dBm
		@ 2.6 to 2.8 GHz		+23		dBm
2 <sup>nd</sup> Order Input Intercept Point	IIP2	Tone space = 50 MHz				
		@ 0.7 to 0.9 GHz		+53		dBm
		@ 1.9 to 2.2 GHz		+53		dBm
		@ 2.6 to 2.8 GHz		+54		dBm
1 dB Input Compression Point	IP1dB	@ 0.7 to 0.9 GHz		+3.0		dBm
		@ 1.9 to 2.2 GHz		+4.5		dBm
		@ 2.6 to 2.8 GHz		+5.0		dBm
		@ 3.6 GHz		+5.0		dBm
RF to IF isolation		No filtering at IF output				
		@ 0.7 to 0.9 GHz		-30		dBc
		@ 1.9 to 2.2 GHz		-31		dBc
		@ 2.6 to 2.8 GHz		-32		dBc
LO leakage @ IF port		@ 0.7 to 0.9 GHz		-33		dBc
		@ 1.9 to 2.2 GHz		-35		dBc
		@ 2.6 to 2.8 GHz		-38		dBc
		@ 3.6 GHz		-31		dBc
LO leakage @ RF port		@ 0.7 to 0.9 GHz		-60		dBc
		@ 1.9 to 2.2 GHz		-60		dBc
		@ 2.6 to 2.8 GHz		-45		dBc
		@ 3.6 GHz		-45		dBc
2RF to 2LO	2x2	P <sub>M</sub> = -12 dBm				
		@ 0.7 to 0.9 GHz		-70		dBc
		@ 1.9 to 2.2 GHz		-70		dBc
		@ 2.6 to 2.8 GHz		-65		dBc
3RF to 3LO	3x3	P <sub>M</sub> = -12 dBm				
		@ 0.7 to 0.9 GHz		-80		dBc
		@ 1.9 to 2.2 GHz		-80		dBc
		@ 2.6 to 2.8 GHz		-77		dBc
RF port input return loss	Z <sub>IN_RF</sub>	No matching	-12	-13		dB
			LO port input return loss	Z <sub>IN_LO</sub>	No matching	-12
Total supply current	I <sub>VCC</sub>			122		mA

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



Note 1: Value of filter resistor is 13 Ω for 5 V operation, or 0 Ω for 3.3V operation.

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Figure 3. SKY73049-11 Evaluation Board Typical Application Schematic

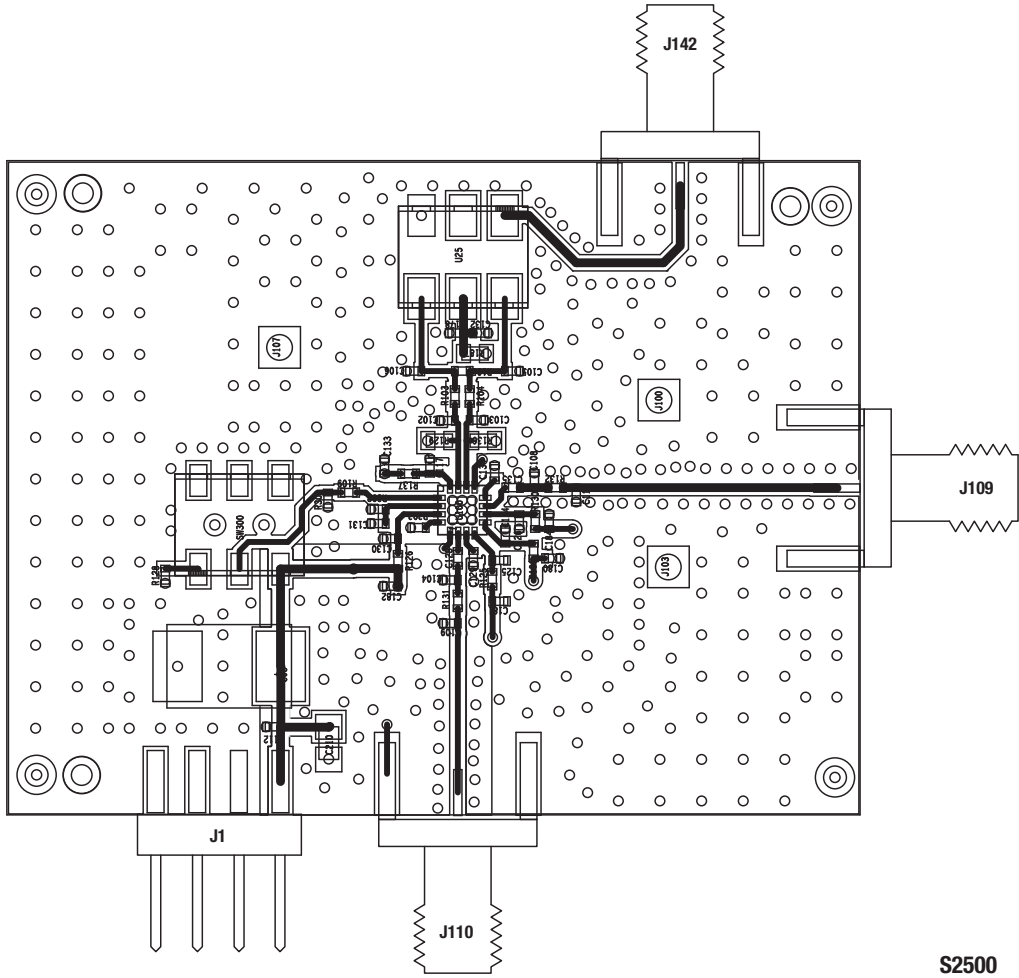
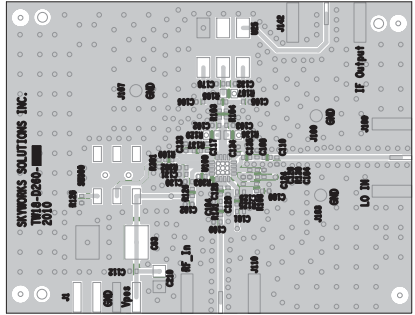
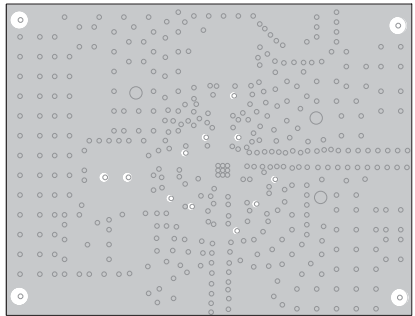


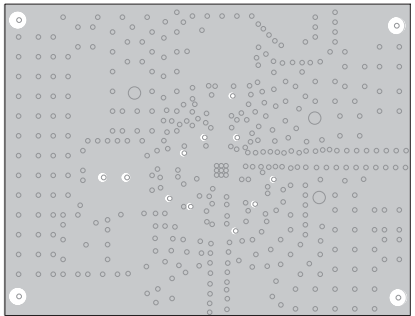
Figure 4. SKY73049-11 Evaluation Board Assembly Drawing



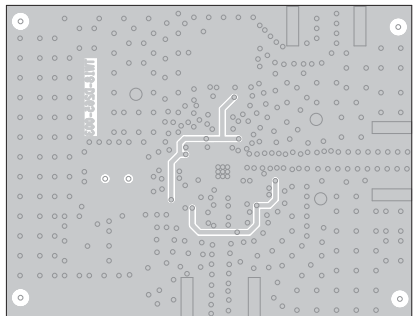
Layer 1: Top – Metal



Layer 2: Ground



Layer 3: Power Plane



Layer 4: Solid Ground Plane

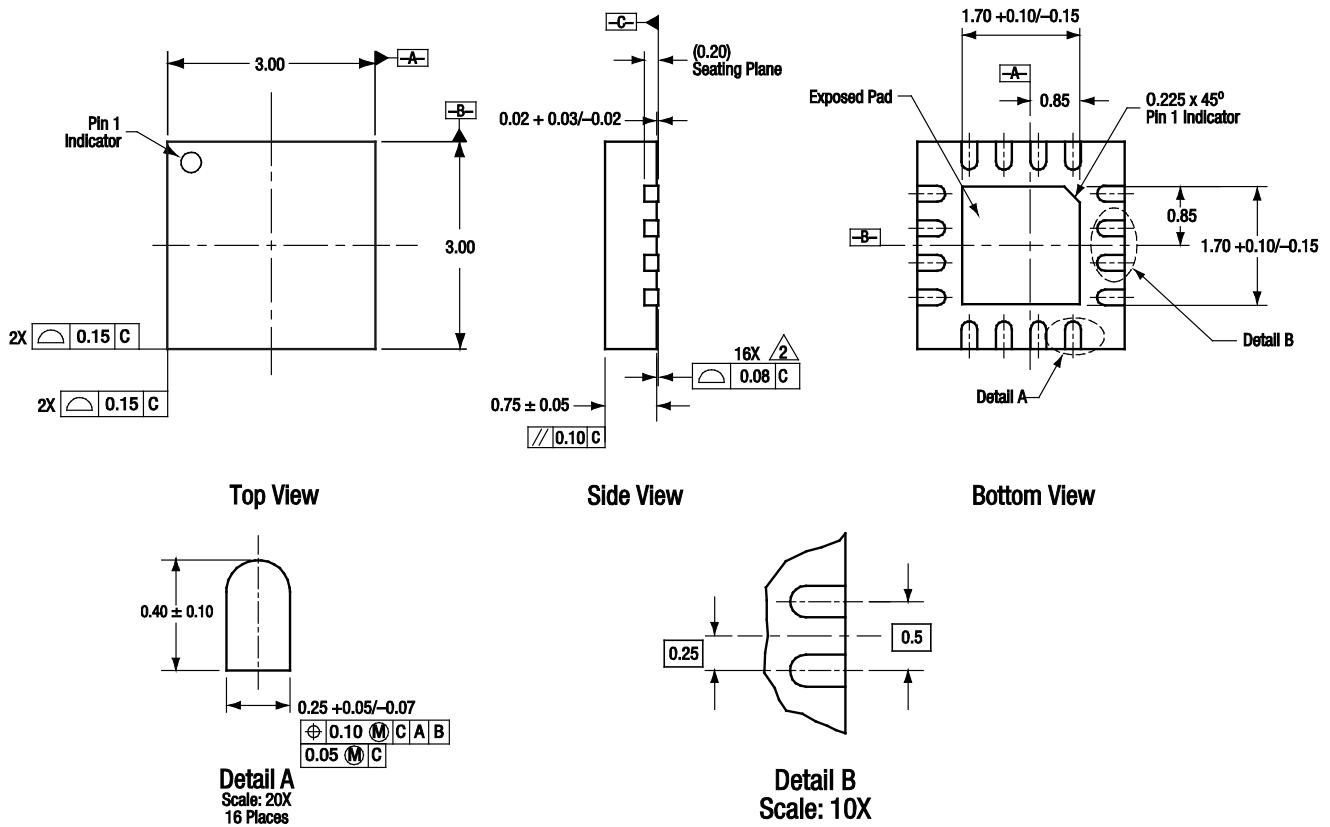
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Figure 5. SKY73049-11 Evaluation Board Layer Detail



\*\*\* TBD \*\*\*

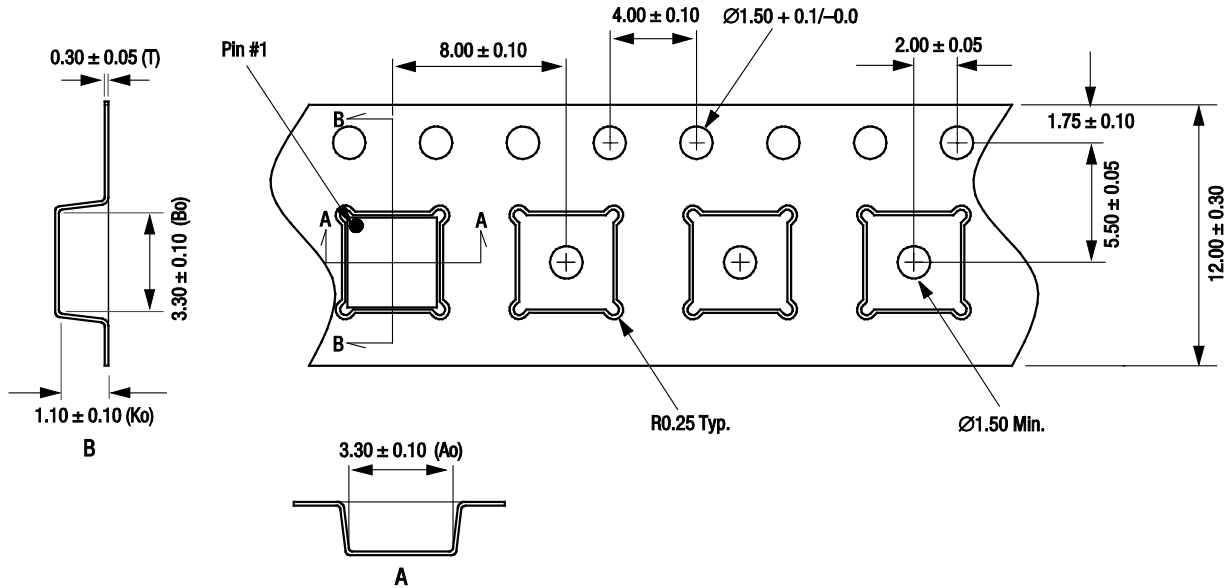
**Figure 6. SKY73049-11 PCB Layout Footprint**



All measurements are in millimeters.  
 Dimensioning and tolerancing according to ASME Y14.5M-1994.  
 Coplanarity applies to the exposed heat sink slug as well as the terminals.  
 Plating requirement per source control drawing (SCD) 2504.

S1692

Figure 7. SKY73049-11 16-Pin QFN Package Dimensions



- Notes:
1. Carrier tape: black conductive polystyrene, non-bakeable material.
  2. Cover tape material: transparent conductive HSA.
  3. Cover tape size: 9.20 mm width.
  4. All measurements are in millimeters.

S1698

Figure 8. SKY73049-11 Tape and Reel Dimensions

**Ordering Information**

Model Name	Manufacturing Part Number	Evaluation Board Part Number
SKY73049-11 200-5000 MHz single downconversion mixer	SKY73049-11	TW18-D260

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