

**DATA SHEET**

# SKY73049-350LF: 200 to 5000 MHz Single Downconversion Mixer

## Applications

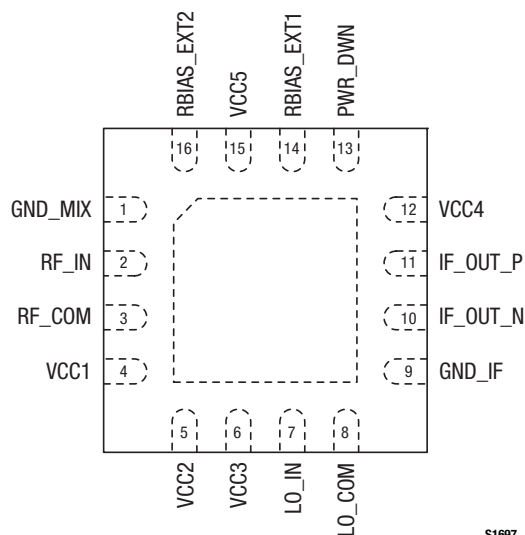
- 2G, 2.5G, 3G, and 4G base station transceivers: GSM, EDGE, CDMA, WCDMA, LTE, WiMAX
- General purpose RF systems
- Wireless infrastructure

## Features

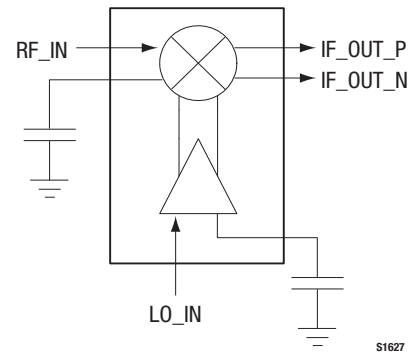
- RF frequency operation range: 200 to 5000 MHz
- High-side or low-side injection
- Integrated LO driver
- Wideband integrated 50  $\Omega$  matched LO and RF ports
- +3.3 V or +5 V operation
- Small, QFN (16-pin, 3 x 3 mm) package (MSL1, 260 °C per JEDEC J-STD-020)



Skyworks Pb-free products are compliant with all applicable legislation. For additional information, refer to *Skyworks Definition of Lead (Pb)-Free*, document number SQ04-0073.



**Figure 2. SKY73049-350LF Pinout – 16-Pin QFN (Top View)**



**Figure 1. SKY73049-350LF Block Diagram**

## Description

The SKY73049-350LF is a fully integrated, wideband single mixer that includes Local Oscillator (LO) drivers, an RF input stage, and a high linearity mixer core. The SKY73049-350LF 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 SKY73049-350LF 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.

**Table 1. SKY73049-350LF 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 SKY73049-350LF 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 SKY73049-350LF 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  $\Omega$  is provided internally, which eliminates the need for any external matching components except for a coupling capacitor.

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

### LO Buffers

The LO buffers allow the input power of the SKY73049-350LF 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  $\Omega$  without the need for any external components.

### IF Output

The SKY73049 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  $\Omega$  differential.

## Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY73049-350LF 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 SKY73049-350LF Evaluation Board is used to test the performance of the SKY73049-350LF 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

Typical part markings are shown 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

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 SKY73049-350LF is rated to Moisture Sensitivity Level 1 (MSL1) 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. SKY73049-350LF 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>CASE</sub>	–40		+85	°C
Junction temperature				+150	°C
Storage temperature	T <sub>STG</sub>	–40		+125	°C
Electrostatic discharge: Human Body Model (HBM), Class 1B (Note 3)	ESD			1000	V

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

**Note 3:** Applies to RF signal lines > 100 MHz, analog and RF lines < 100 MHz, digital lines, power supply lines, and ground pins.

**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.

**Table 3. SKY73049-350LF 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
PwrDwn pin level: Mixer On	VPWRDWN	V <sub>CC</sub> –1	0	1	V
Mixer Off	VPWRDWN		V <sub>CC</sub>		V
PwrDwn pin current: Mixer On (current sink)	IPWRDWN		50	70	μA
Mixer Off (current source)	IPWRDWN		50	70	μA
Operating temperature	T <sub>CASE</sub>	–40		+85	°C

**Table 4. SKY73049-350LF Electrical Specifications (Note 1)****(V<sub>CC</sub> = +5 V, T<sub>CASE</sub> = +25 °C, L<sub>O</sub> = 0 dBm, High Side Injection, IF = 100 MHz, Unless Otherwise Noted)**

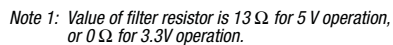
Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Conversion gain	G	@ 0.7 to 0.9 GHz	6.4	7.6		dB
		@ 1.9 to 2.2 GHz	5.8	6.6		dB
		@ 2.6 to 2.8 GHz	5.4	6.2		dB
		@ 3.6 GHz	4.5	5.2		dB
Noise Figure (Note 2)	NF	@ 0.7 to 0.9 GHz		14.1	16.0	dB
		@ 1.9 to 2.2 GHz		15.5	16.9	dB
		@ 2.6 to 2.8 GHz		16.0	17.3	dB
		@ 3.6 GHz		17.0	18.6	dB
3 <sup>rd</sup> Order Input Intercept Point	IIP3	Tone space = 1 MHz, P <sub>IN</sub> = -15 dBm per tone				
		@ 0.7 to 0.9 GHz	+24.0	+26.4		dBm
		@ 1.9 to 2.2 GHz	+24.6	+29.0		dBm
		@ 2.6 to 2.8 GHz	+24.8	+27.8		dBm
2 <sup>nd</sup> Order Input Intercept Point	IIP2	Tone space = 50 MHz				
		@ 0.7 to 0.9 GHz	+41.3	+57.0		dBm
		@ 1.9 to 2.2 GHz	+48.0	+59.8		dBm
		@ 2.6 to 2.8 GHz	+50.4	+56.9		dBm
1 dB Input Compression Point	IP1dB	@ 0.7 to 0.9 GHz	+2.9	+5.4		dBm
		@ 1.9 to 2.2 GHz	+4.4	+6.5		dBm
		@ 2.6 to 2.8 GHz	+4.9	+6.9		dBm
		@ 3.6 GHz	+6.3	+7.9		dBm
RF to IF isolation		No filtering at IF output				
		@ 0.7 GHz		-30.0	-27.0	dBc
		@ 1.9 to 2.2 GHz		-28.2	-25.2	dBc
		@ 2.6 to 2.8 GHz		-33.9	-30.5	dBc
LO leakage @ IF port		@ 0.7 to 0.9 GHz		-55.6	-38.9	dBc
		@ 1.9 to 2.2 GHz		-37.7	-25.3	dBc
		@ 2.6 to 2.8 GHz (Note 3)		-37.1	-23.9	dBc
		@ 3.6 GHz		-34.9	-20.2	dBc
LO leakage @ RF port		@ 0.7 to 0.9 GHz		-59.9	-56.5	dBc
		@ 1.9 to 2.2 GHz		-49.1	-45.7	dBc
		@ 2.6 to 2.8 GHz		-47.9	-43.4	dBc
		@ 3.6 GHz		-49.8	-45.0	dBc
2RF to 2LO	2x2	P <sub>IN</sub> = -10 dBm				
		@ 0.7 to 0.9 GHz		-75.4	-64.2	dBc
		@ 1.9 to 2.2 GHz		-67.1	-59.4	dBc
		@ 2.6 to 2.8 GHz		-61.8	-57.6	dBc
3RF to 3LO	3x3	P <sub>IN</sub> = -10 dBm				
		@ 0.7 to 0.9 GHz		-82.8	-71.9	dBc
		@ 1.9 to 2.2 GHz		-79.0	-68.7	dBc
		@ 2.6 to 2.8 GHz		-78.3	-68.0	dBc
Total supply current	I <sub>VCC</sub>	@ 3.6 GHz		-80.1	-70.0	dBc
RF port input return loss	Z <sub>IN_RF</sub>	No matching		-13	-12	dB
LO port input return loss	Z <sub>IN_LO</sub>	No matching		-14	-12	dB
Total supply current	I <sub>VCC</sub>			133	155	mA

**Note 1:** Performance is guaranteed only under the conditions listed in this Table.**Note 2:** Characterized in an RF screen room.**Note 3:** RF tones at IF output measured with an off-chip balun except at 0.7 to 0.9 GHz for RF to IF isolation.

**Table 5. SKY73049-350LF Electrical Specifications (Note 1)****(V<sub>CC</sub> = +3.3 V, T<sub>case</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 @ 1.9 to 2.2 GHz @ 2.6 to 2.8 GHz @ 3.6 GHz		7.4 6.3 6.0 5.7		dB dB dB dB
Noise Figure (Note 2)	NF	@ 0.7 to 0.9 GHz @ 1.9 to 2.2 GHz @ 2.6 to 2.8 GHz @ 3.6 GHz		13.0 14.0 14.5 15.0		dB dB dB 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 @ 1.9 to 2.2 GHz @ 2.6 to 2.8 GHz @ 3.6 GHz		+24 +23 +23 +20		dBm dBm dBm dBm
2 <sup>nd</sup> Order Input Intercept Point	IIP2	Tone space = 50 MHz  @ 0.7 to 0.9 GHz @ 1.9 to 2.2 GHz @ 2.6 to 2.8 GHz @ 3.6 GHz		+53 +53 +54 +48		dBm dBm dBm dBm
1 dB Input Compression Point	IP1dB	@ 0.7 to 0.9 GHz @ 1.9 to 2.2 GHz @ 2.6 to 2.8 GHz @ 3.6 GHz		+3.0 +4.5 +5.0 +5.0		dBm dBm dBm dBm
RF to IF isolation		No filtering at IF output  @ 0.7 to 0.9 GHz @ 1.9 to 2.2 GHz @ 2.6 to 2.8 GHz @ 3.6 GHz (Note 3)		-30 -31 -32 -25		dBc dBc dBc dBc
LO leakage @ IF port		@ 0.7 to 0.9 GHz @ 1.9 to 2.2 GHz @ 2.6 to 2.8 GHz (Note 3) @ 3.6 GHz		-33 -35 -38 -31		dBc dBc dBc dBc
LO leakage @ RF port		@ 0.7 to 0.9 GHz @ 1.9 to 2.2 GHz @ 2.6 to 2.8 GHz @ 3.6 GHz		-60 -60 -45 -45		dBc dBc dBc dBc
2RF to 2LO	2x2	P <sub>M</sub> = -12 dBm  @ 0.7 to 0.9 GHz @ 1.9 to 2.2 GHz @ 2.6 to 2.8 GHz @ 3.6 GHz		-70 -70 -65 -69		dBc dBc dBc dBc
3RF to 3LO	3x3	P <sub>M</sub> = -12 dBm  @ 0.7 to 0.9 GHz @ 1.9 to 2.2 GHz @ 2.6 to 2.8 GHz @ 3.6 GHz		-80 -80 -77 -80		dBc dBc dBc dBc
RF port input return loss	Z <sub>IN_RF</sub>	No matching		-13		dB
LO port input return loss	Z <sub>IN_LO</sub>	No matching		-14		dB
Total supply current	I <sub>VCC</sub>			122		mA

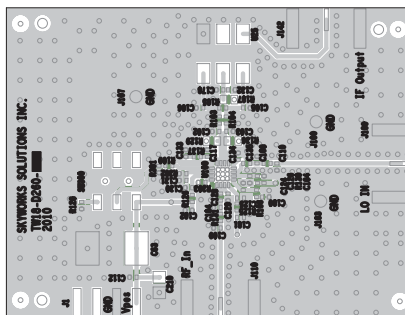
**Note 1:** Performance is verified by characterization.**Note 2:** Characterized in an RF screen room**Note 3:** RF tones at IF output measured with an off-chip balun except at 0.7 to 0.9 GHz for RF to IF isolation.

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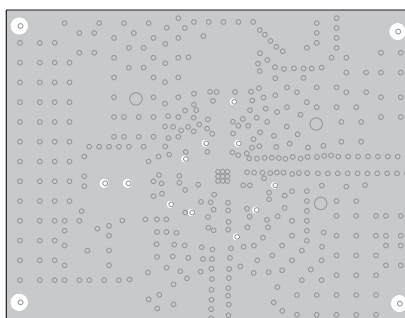
### Figure 3. SKY73049-350LF Evaluation Board Typical Application Schematic



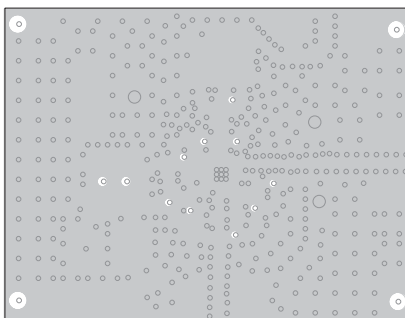
### Figure 4. SKY73049-350LF Evaluation Board Assembly Drawing



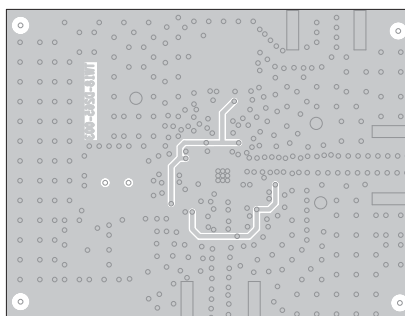
Layer 1: Top – Metal



Layer 2: Ground



Layer 3: Power Plane

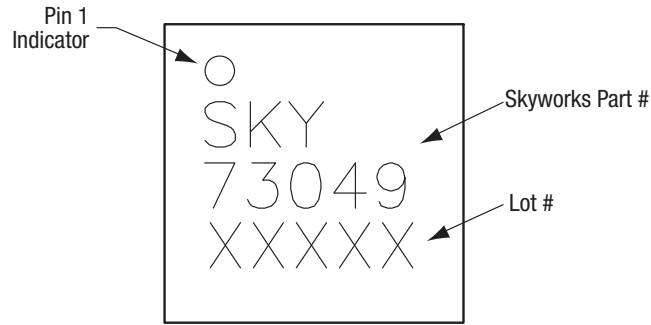


Layer 4: Solid Ground Plane

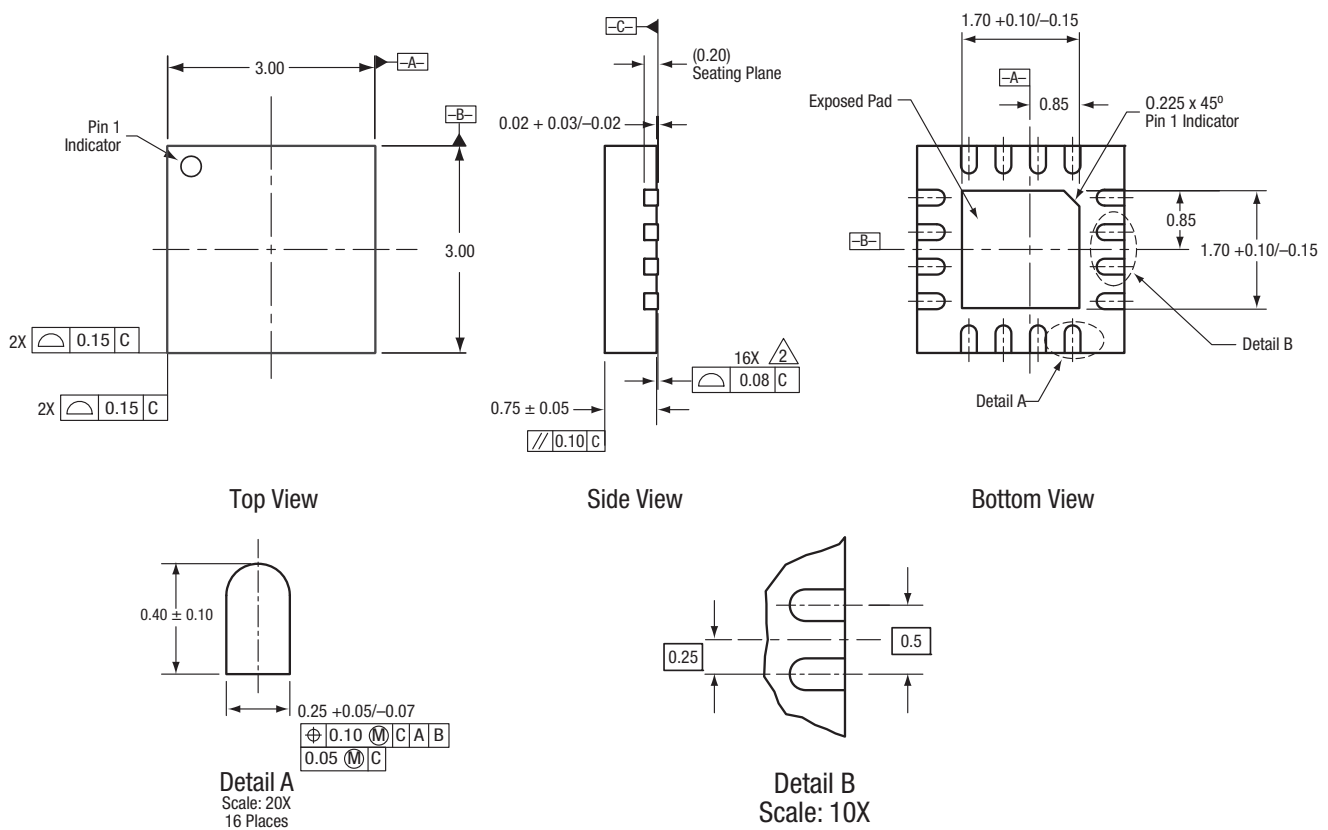
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**Figure 5. SKY73049-350LF Evaluation Board Layer Detail**





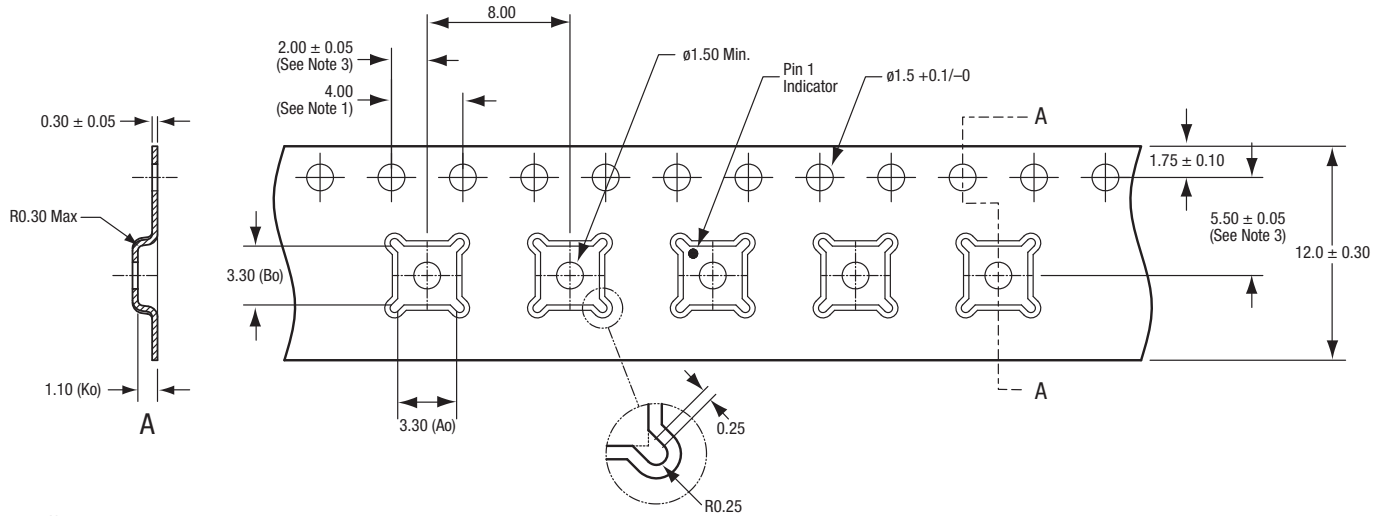
**Figure 6. Typical Part Markings (Top View)**



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. SKY73049-350LF 16-Pin QFN Package Dimensions**



Notes:

1. Sprocket hole pitch cumulative tolerance:  $\pm 0.2$ .
2. Carrier tape: black conductive polystyrene.
3. Pocket position relative to sprocket hole, measure as true position of pocket, not pocket hole.
4. All dimensions are in millimeters.

Y0506

Figure 8. SKY73049-350LF Tape and Reel Dimensions

## Ordering Information

Model Name	Manufacturing Part Number	Evaluation Board Part Number
SKY73049-350LF 200-5000 MHz single downconversion mixer	SKY73049-350LF	TW18-D260

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