

DATA SHEET

SKY67179-306LF: 1.5 to 3.8 GHz Two-Stage, High-Gain Low-Noise Amplifier

Applications

- LTE, GSM, WCDMA, HSDPA macro-base and micro-base stations
- L and S band ultra-low-noise receivers
- Cellular repeaters, small cell, macro cell, DAS, and RRH/RRUs
- High-temperature applications to +105 °C

Features

- Ultra-low reference design NF: 0.7 dB @ 3.5 GHz
- High gain: 34 dB (typical) @ 2.6 GHz
- Low quiescent current: 120 mA
- Stage 1 and 2 adjustable current
- Small QFN (16-pin, 4 x 4 mm) Pb-free package (MSL1, 260 °C per JEDEC J-STD-020)



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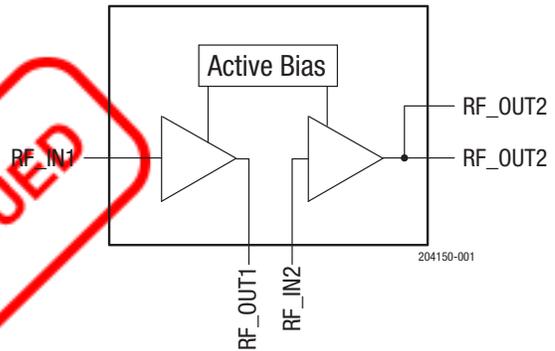
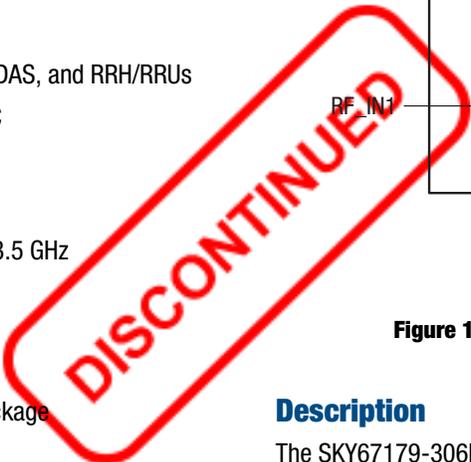


Figure 1. SKY67179-306LF Block Diagram

Description

The SKY67179-306LF is a two-stage, low-noise amplifier (LNA) with active bias and high-linearity performance. The front end of the device provides an ultra-low noise figure (NF) while the output stage provides high gain, linearity, and efficiency.

With excellent thermal performance, the SKY67179-306LF is rated for operation up to +105 °C.

The SKY67179-306LF is provided in a 4 x 4 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.

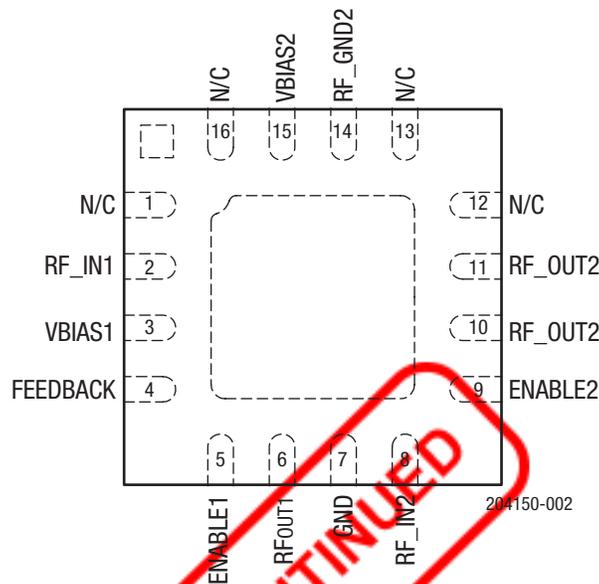


Figure 2. SKY67179-306LF Pinout (Top View)

Table 1. SKY67179-306LF Signal Descriptions

Pin	Name	Description	Pin	Name	Description
1	N/C	No connection. May be grounded with no change in performance.	9	ENABLE2	Second stage LNA Enable pin.
2	RF_IN1	RF input to first stage LNA	10	RF_OUT2	RF output of second stage amplifier
3	RF_GND/VBIAS1	AC ground for first stage bias circuit and bias voltage input that sets the first stage bias current.	11	RF_OUT2	RF output of second stage amplifier
4	FEEDBACK	Feedback pin. Leave open when not used. This feedback option is typically not used since it reduces gain.	12	N/C	No connection. May be grounded with no change in performance.
5	ENABLE1	First stage LNA Enable pin.	13	N/C	No connection. May be grounded with no change in performance.
6	RFOUT1	RF output of first stage LNA	14	RF_GND2	AC ground for second stage bias circuit
7	GND	Ground	15	VBIAS2	Bias voltage input that sets the second stage bias current
8	RF_IN2	RF input to second stage amplifier	16	N/C	No connection. May be grounded with no change in performance.

Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY67179-306LF are provided in Table 2.

Electrical specifications are provided in Table 3. Typical performance characteristics are shown in Figures 3 through 7.

Table 2. SKY67179-306LF Absolute Maximum Ratings¹

Parameter	Symbol	Minimum	Maximum	Units
Supply voltage	V _{DD}		6.0	V
RF input power	P _{IN}		+20	dBm
Operating temperature	T _{OP}	-40	+105	°C
Storage temperature	T _{STG}	-65	+125	°C
Junction temperature	T _J		+150	°C
Thermal resistance:	Θ _{JC}			
Stage 1			50	°C/W
Stage 2			65	°C/W
Electrostatic discharge:	ESD			
Charged Device Model (CDM), Class 4			1000	V
Human Body Model (HBM), Class 1A			250	V
Machine Model (MM), Class A			25	V

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.

ESD HANDLING: 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 when handling or transporting. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD handling precautions should be used at all times.

Table 3. SKY67179-306LF Electrical Specifications¹

(V_{DD} = +5 V, T_{OP} = +25 °C, P_{IN} = -30 dBm, Optimized for 2.4 to 2.7 GHz Operation, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
RF Specifications						
Noise figure ²	NF	@ 2600 MHz		0.65	0.85	dB
Small signal gain	IS21I	@ 2600 MHz	31	34		dB
Input return loss	IS11I	@ 2600 MHz	12	15		dB
Output return loss	IS22I	@ 2600 MHz	10	15		dB
Reverse isolation	IS12I	@ 2600 MHz	48	54		dB
Third order input intercept point	IIP3	@ 2600 MHz, Δf = 1 MHz, P _{IN} = -30 dBm/tone		+3		dBm
Third order output intercept point	OIP3	@ 2600 MHz, Δf = 1 MHz, P _{IN} = -30 dBm/tone		+35		dBm
1 dB input compression point	IP1dB	@ 2600 MHz		-17		dBm
1 dB output compression point	OP1dB	@ 2600 MHz		+18		dBm
DC Specifications						
Supply voltage	V _{DD}			5		V
Quiescent current	I _{DD}	Set with external resistor		113		mA

¹ Performance is guaranteed only under the conditions listed in this table.

² Noise figure has been de-embedded as 0.1 dB @ 2600 MHz for connector and board loss.

Typical Performance Characteristics

(V_{DD} = +5 V, T_{OP} = +25 °C, P_{IN} = -30 dBm, Optimized for 2.4 to 2.7 GHz Operation, Unless Otherwise Noted)

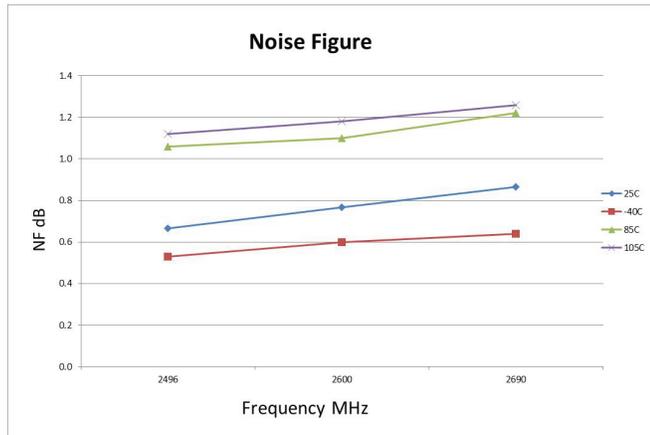


Figure 3. Noise Figure

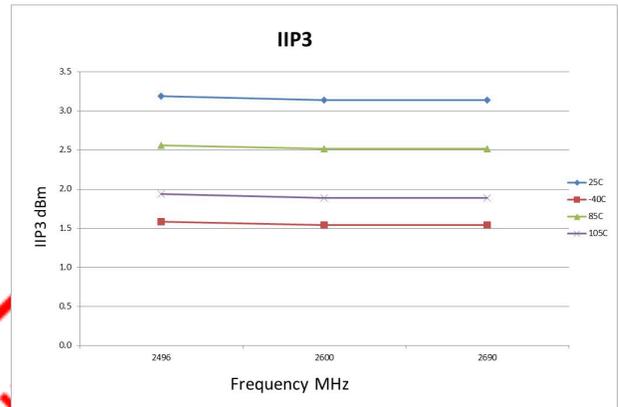


Figure 4. Third Order Intercept Point

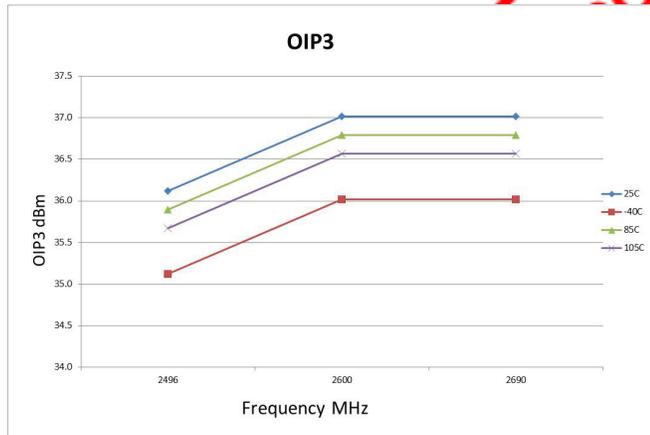


Figure 5. Third Order Output Intercept Point

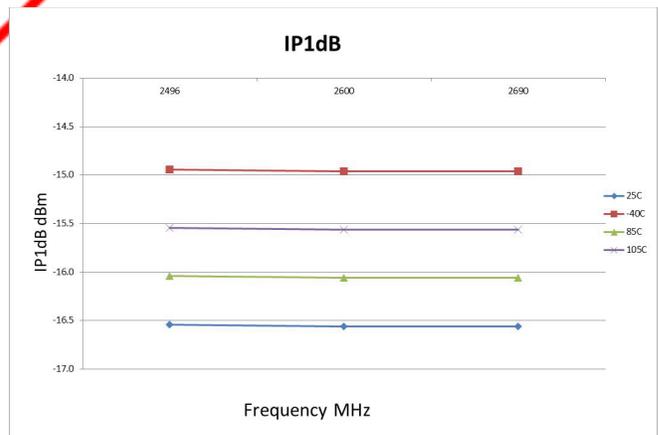


Figure 6. Input 1 dB Compression Point

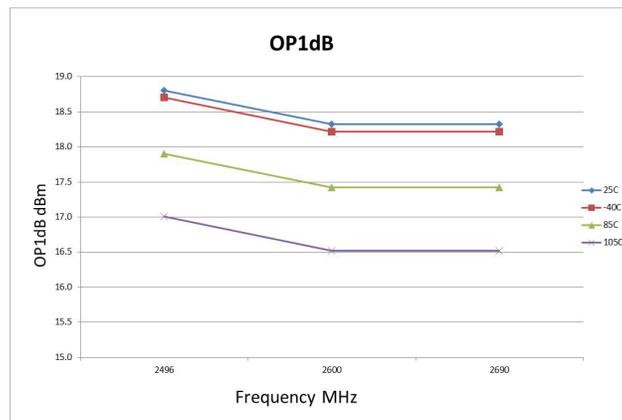


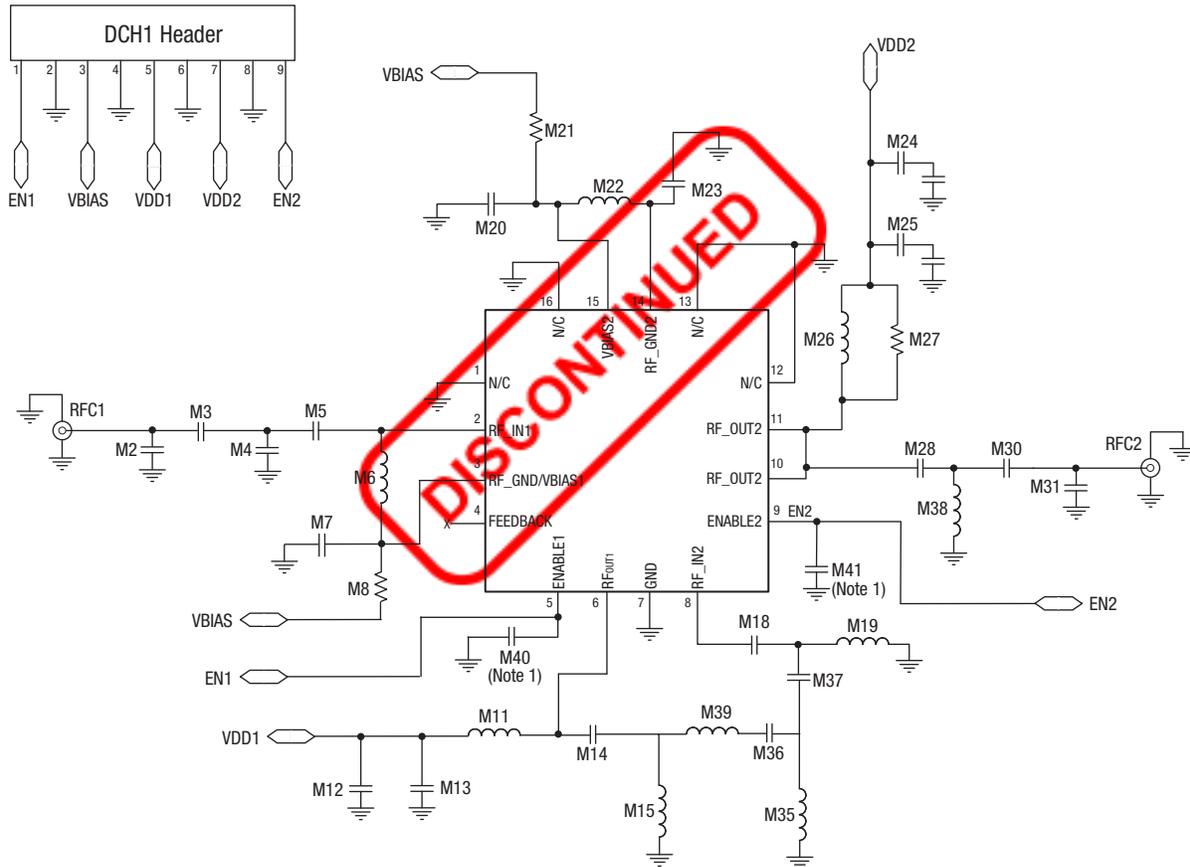
Figure 7. Output 1dB Compression Point

Evaluation Board Description

The SKY67179-306LF Evaluation Board is used to test the performance of the SKY67179-306LF two-stage LNA. An Evaluation Board schematic diagram is provided in Figure 8 and represents device performance in a matched environment.

Actual values used in application may vary particular to layout parasitics. Table 5 provides the Evaluation Board Bill of Materials.

The Evaluation Board assembly drawing is shown in Figure 9.



Note 1:
 M40 and M41 are general noise immunity bypass capacitors and are optional.
 These capacitors are not recommended for applications with series resistance on control lines.

204150-008

Figure 8. SKY67179-306LF Evaluation Board Schematic

Table 5. SKY67179-306LF Evaluation Board Bill of Materials for Band 41

Component	Type	Value	Size	Manufacturer	Manufacturer Part Number
M2	Capacitor	1.2 pF	402	Murata	GJM1555C1H1R2BB01
M3	Inductor	1.0 nH	402	Murata	MLG1005S1N0C
M4	Capacitor	1.0 pF	402	Murata	GJM1555C1H1R0BB01
M5	Capacitor	33 pF	402	Murata	GRM1555C1H3R3DZ01
M6	Inductor	18 nH	402	Murata	LQW15AN18NH
M7	DNP				
M8	Resistor	18 k Ω	402	Panasonic	ERJ-2RKF1802X
M11	Inductor	3.3 nH	402	Murata	LQP15MN3N3B02
M12	Capacitor	1000 pF	402	Murata	GRM155R71H102KA01
M13	Capacitor	10000 pF	402	Murata	GRM155R71H103KA88
M14	Capacitor	33 pF	402	Murata	GRM1555C1H3R3DZ01
M15	DNP				
M18	Capacitor	2 pF	402	Murata	GJM1555C1H2R0BB01
M19	Inductor	1 nH	402	Murata	LQP15MN1N0B02
M20	Capacitor	5.6 pF	402	Murata	GJM1555C1H5R6CB01
M21	Resistor	7.5 k Ω	402	Panasonic	ERJ-2RKF7501X
M22	Inductor	15 nH	402	Murata	LQW15AN15NH
M23	Capacitor	1000 pF	402	Murata	GRM155R71H102KA01
M24	Capacitor	1 μ F	402	Murata	GRM155R61A105KE15
M25	Capacitor	10 pF	402	Murata	GJM1555C1H100GB01
M26	Inductor	9.1 nH	402	Murata	LQG15HN9N1J02D
M27	DNP				
M28	Capacitor	4.7 pF	402	Murata	GJM1555C1H4R7BB01
M30	Resistor	0 Ω	402	Panasonic	ERJ-2GE0R00X
M31	DNP				
M35	DNP				
M36	Resistor	0 Ω	402	Panasonic	ERJ-2GE0R00X
M37	Inductor	1 nH	402	Murata	LQP15MN1N0B02
M38	Inductor	2.2 nH	402	Murata	LQP15MN2N2B02
M39	Capacitor	2 pF	402	Murata	GJM1555C1H2R0BB01
M40	Capacitor	1000 pF	402	Murata	GRM155R71H102KA01
M41	DNP				

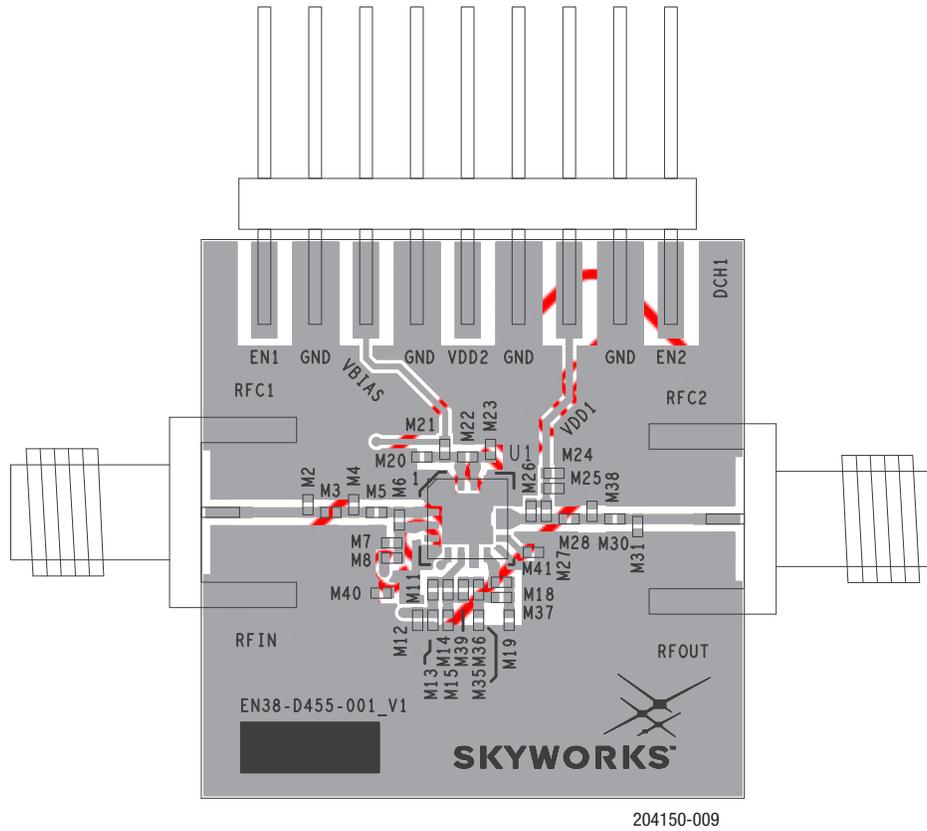


Figure 9. SKY67179-306LF Evaluation Board Assembly Diagram

Package Dimensions

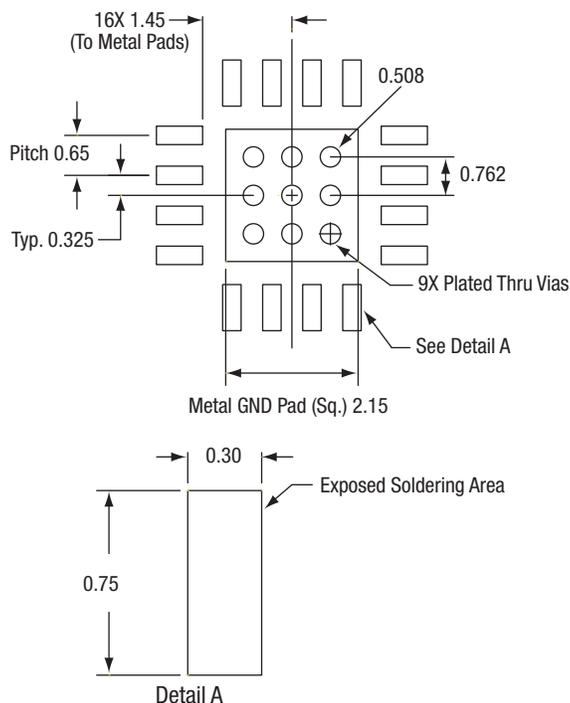
The PCB layout footprint for the SKY67179-306LF is shown in Figure 10. Typical part markings are noted in Figure 11. Package dimensions are shown in Figure 12, and tape and reel dimensions are provided in Figure 13.

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 SKY67179-306LF 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.



All measurements in millimeters 204150-010

Figure 10. SKY67179-306LF PCB Layout Footprint

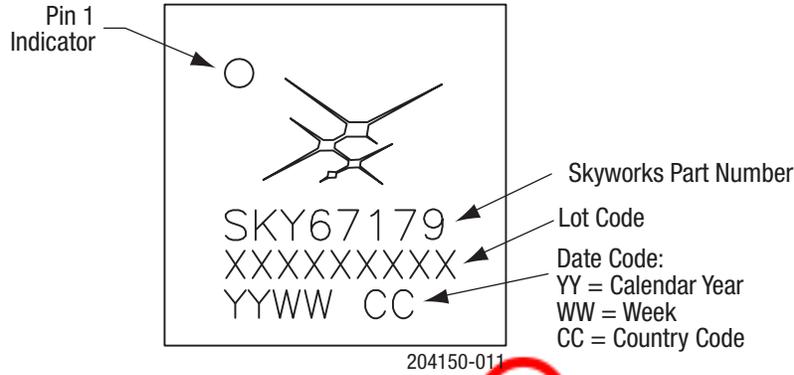
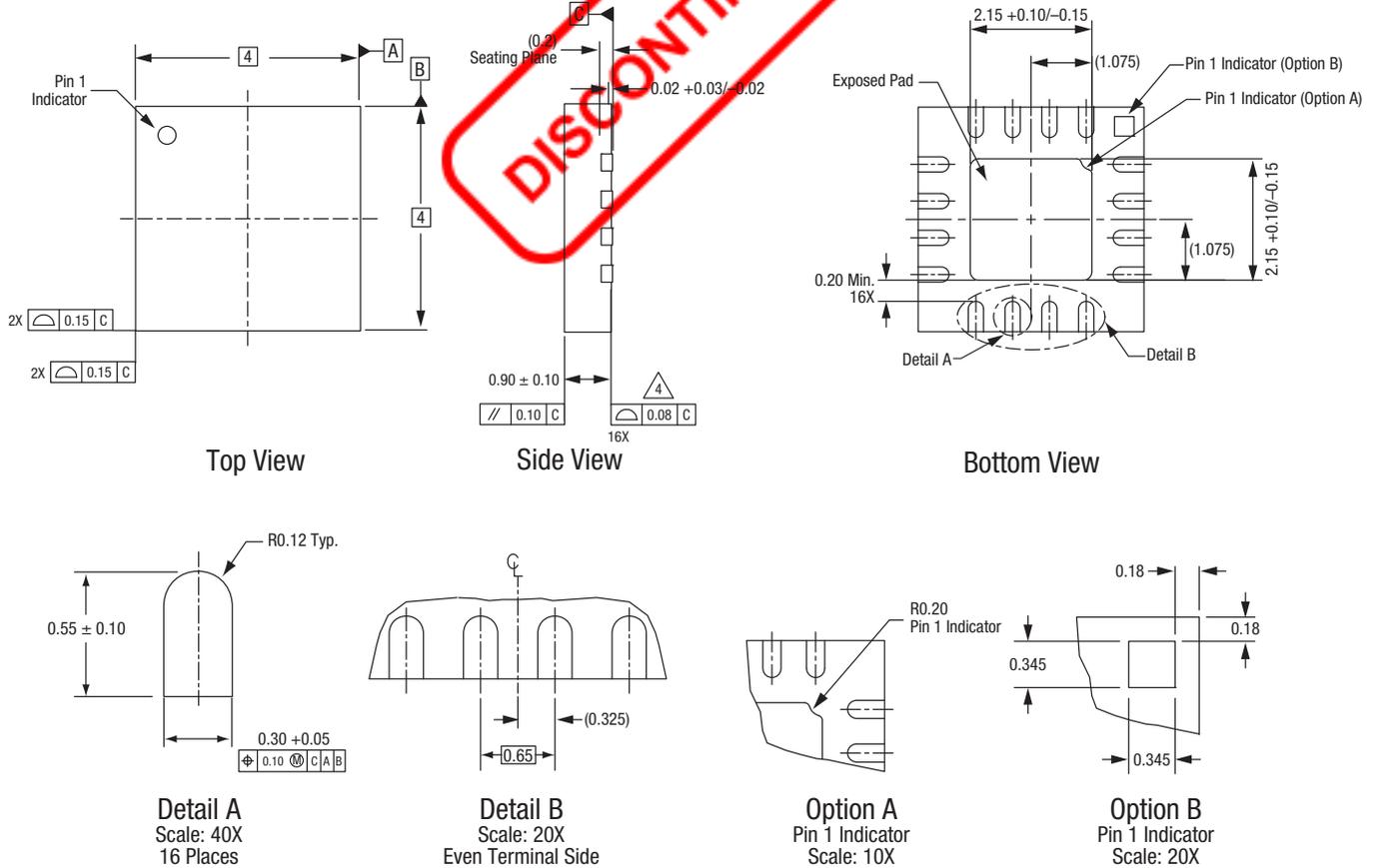
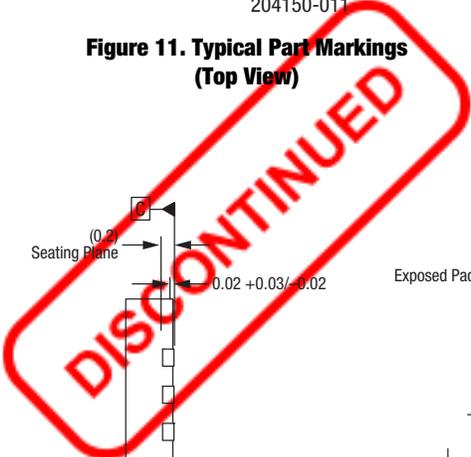


Figure 11. Typical Part Markings (Top View)



Notes:

1. All measurements are in millimeters.
2. Dimensions and tolerances according to ASME Y14.5M-1994.
3. Coplanarity applies to the exposed heat sink slug as well as the terminals.
4. Package may have option A or option B pin 1 indicator.

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Figure 12. SKY67179-306LF Package Dimensions

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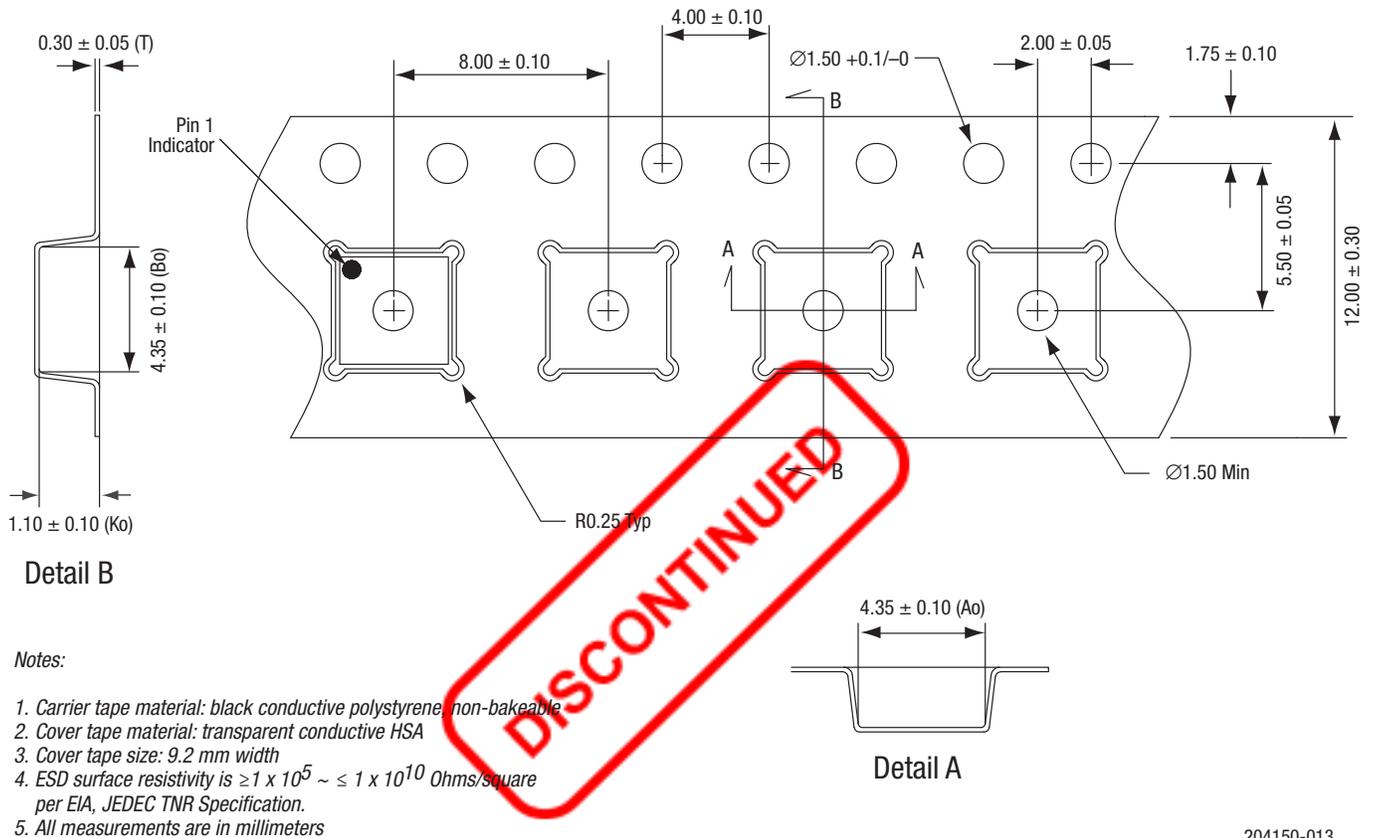


Figure 13. SKY67179-306LF Tape and Reel Dimensions

Ordering Information

Model Name	Manufacturing Part Number	Evaluation Board Part Number
SKY67179-306LF: Two-Stage, High-Gain LNA	SKY67179-306LF	SKY67179-306LF EVK1 (2600 MHz) SKY67179-306LF EVK2 (3500 MHz)



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