

**PRELIMINARY DATA SHEET**

# SKY65715-81: Low-Noise Amplifier Front-End Module with GPS/GNSS/BDS Pre-Filter

## Applications

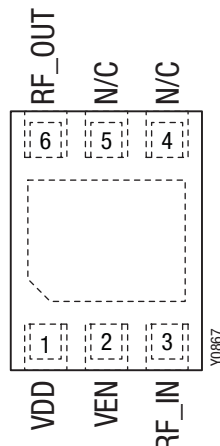
- GPS/GNSS/BDS radio receivers
- Global Navigation Satellite Systems (GLONASS)

## Features

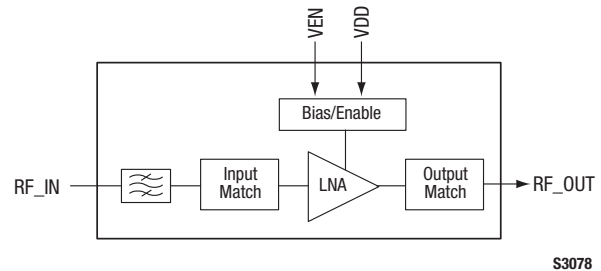
- Wideband pre-filter
- Small signal gain: 16.5 dB typical
- High, out-of-band IP2 and IP3
- Low Noise Figure: 1.9 dB typical
- Low current consumption
- Input/output impedance internally matched to 50  $\Omega$
- Single DC supply: 1.8 V to 3.6 V
- Minimal number of external components required
- Small, MCM (6-pin, 1.7 x 2.3 mm) package (MSL3, 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.



**Figure 2. SKY65715-81 Pinout – 6-Pin MCM (Top View)**



**Figure 1. SKY65715-81 Block Diagram**

## Description

The SKY65715-81 is a Front-End Module (FEM) with an integrated Low Noise Amplifier (LNA) and pre-filter designed for Global Positioning System/Global Navigation Satellite System/Beidou Navigation Satellite System (GPS/GNSS/BDS) receiver applications. The device provides high linearity, excellent gain, a high 1 dB Input Compression Point (IP1dB), and a superior Noise Figure (NF).

The pre-filter provides the low in-band insertion loss and integrated notch filtering for excellent rejections of the cellular, PCS, and WLAN frequency bands. The SKY65715-81 uses surface mount technology (SMT) in the form of a 1.7 x 2.3 mm Multi-Chip Module (MCM) package, which allows for a highly manufacturable and low-cost solution.

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. SKY65715-81 Signal Descriptions**

Pin	Name	Description	Pin	Name	Description
1	VDD	Source voltage	4	N/C	Not connected
2	VEN	LNA enable	5	N/C	Not connected
3	RF_IN	RF input	6	RF_OUT	RF output

## Technical Description

### LNA Enable

The VEN signal (pin 2) enables or disables the LNA. A logic high signal powers on the LNA and a logic low signal powers off the device. An external series resistor can be used on this pin to adjust the LNA bias current.

## Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY65715-81 are provided in Table 2. The recommended operating conditions are specified in Table 3 and electrical specifications are provided in Tables 4 and 5.

**Table 2. SKY65715-81 Absolute Maximum Ratings (Note 1)**

Parameter	Symbol	Minimum	Maximum	Units
RF input power	P <sub>IN</sub>		+10	dBm
Supply voltage	V <sub>DD</sub>	0	3.6	V
Storage temperature	T <sub>STG</sub>	−55	+125	°C
Junction temperature	T <sub>J</sub>		+150	°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.

**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. SKY65715-81 Recommended Operating Conditions**

Parameter	Symbol	Minimum	Typical	Maximum	Units
Frequency range	f	1565	1575	1606	MHz
RF input power	P <sub>IN</sub>		−85		dBm
Supply voltage (measured at terminals of Evaluation Board)	V <sub>DD</sub>		1.80	3.3	V
Case operating temperature	T <sub>C</sub>	−40	+25	+85	°C
Shutdown current (V <sub>EN</sub> = 0 V)	I <sub>DD-OFF</sub>		1		μA
Settling time: OFF to ON (within 1 dB of final gain) ON to OFF (within 3 dB of final gain)			5 5		μS μS
LNA enable: Enable (high) Disable (low)	LNA <sub>ENABLE</sub> LNA <sub>DISABLE</sub>	V <sub>DD</sub> − 0.3	V <sub>DD</sub> 0	0.3	V V

**Table 4. SKY65715-81 Electrical Specifications (Note 1)**  
**(V<sub>DD</sub> = 1.8 V, T<sub>C</sub> = +25 °C, Unless Otherwise Noted)**

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Small signal gain	G	f = 1560 MHz		16.4		dB
Noise figure	NF	f = 1560 MHz		1.9		dB
1 dB Input Compression Point	IP1dB	f = 1560.0 MHz		-15.6		dBm
Third Order Input Intercept Point (in band)	IIP3	f1 = 1560 MHz, f2 = 1561 MHz P <sub>IN</sub> = -30 dBm		-7.9		dBm
Reverse isolation	S12			28.0		dB
Input return loss	S11			15.6		dB
Output return loss	S22			9.3		dB
Current consumption	I <sub>DD</sub>			4.4		mA

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

**Table 5. SKY65715-81 Electrical Specifications (Note 1)**  
**(V<sub>DD</sub> = 2.8 V, T<sub>C</sub> = +25 °C, Unless Otherwise Noted)**

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Small signal gain	G	f = 1560 MHz		17.4		dB
Noise figure	NF	f = 1560 MHz		1.9		dB
1 dB Input Compression Point	IP1dB	f = 1560.0 MHz		-14.9		dBm
Third Order Input Intercept Point (in band)	IIP3	f1 = 1560 MHz, f2 = 1561 MHz P <sub>IN</sub> = -30 dBm		-6.7		dBm
Reverse isolation	S12			28.3		dB
Input return loss	S11			16.2		dB
Output return loss	S22			9.5		dB
Current consumption	I <sub>DD</sub>			5.2		mA

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

## Evaluation Board Description

The SKY65715-81 Evaluation Board is used to test the performance of the SKY65715-81 LNA. An assembly drawing for the Evaluation Board is shown in Figure 3. The Evaluation Board schematic diagram is shown in Figure 4. Table 6 provides the Bill of Materials (BOM) list for Evaluation Board components.

## Package Dimensions

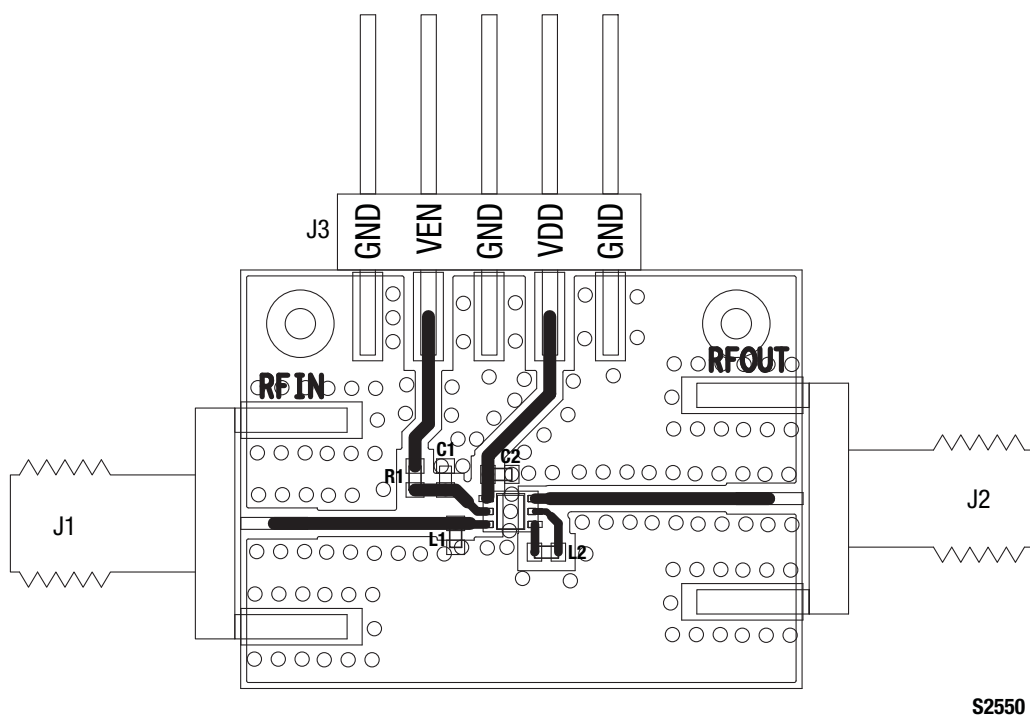
The PCB layout footprint for the SKY65715-81 is provided in Figure 5. Package dimensions for the 6-pin MCM are shown in Figure 6, and tape and reel dimensions are provided in Figure 7.

## 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 SKY65715-81 is rated to Moisture Sensitivity Level 3 (MSL3) at 260 °C. It can be used for lead or lead-free soldering. For additional information, refer to the Skyworks Application Note, *PCB Design & SMT Assembly/Rework Guidelines for MCM-L Packages*, document number 101752.

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.



**Figure 3. SKY65715-81 Evaluation Board Assembly Diagram**

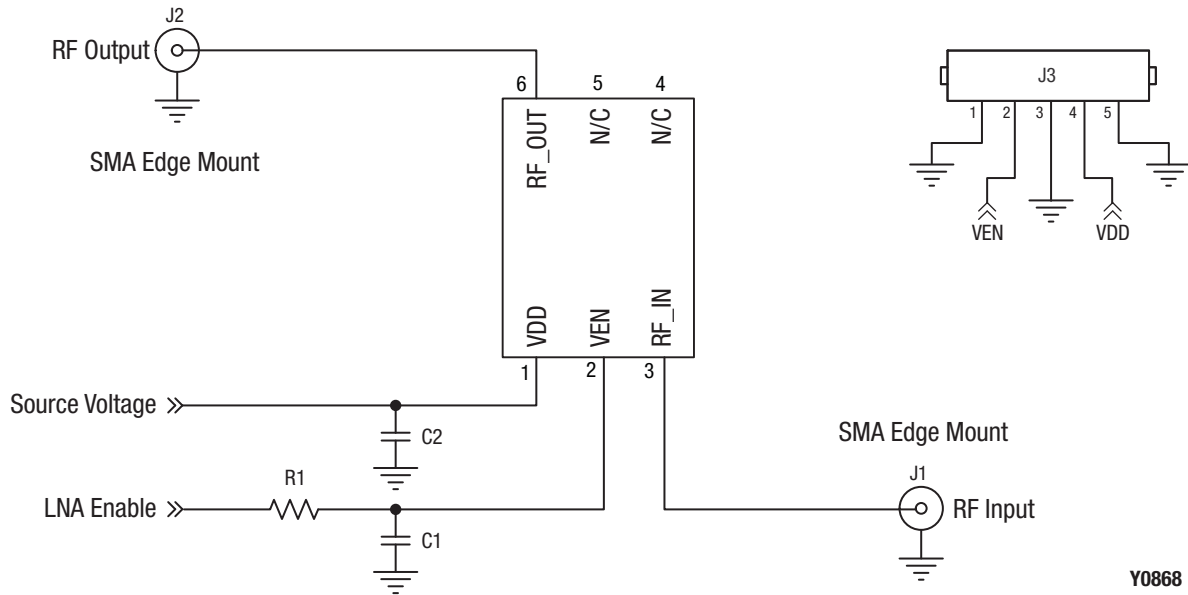
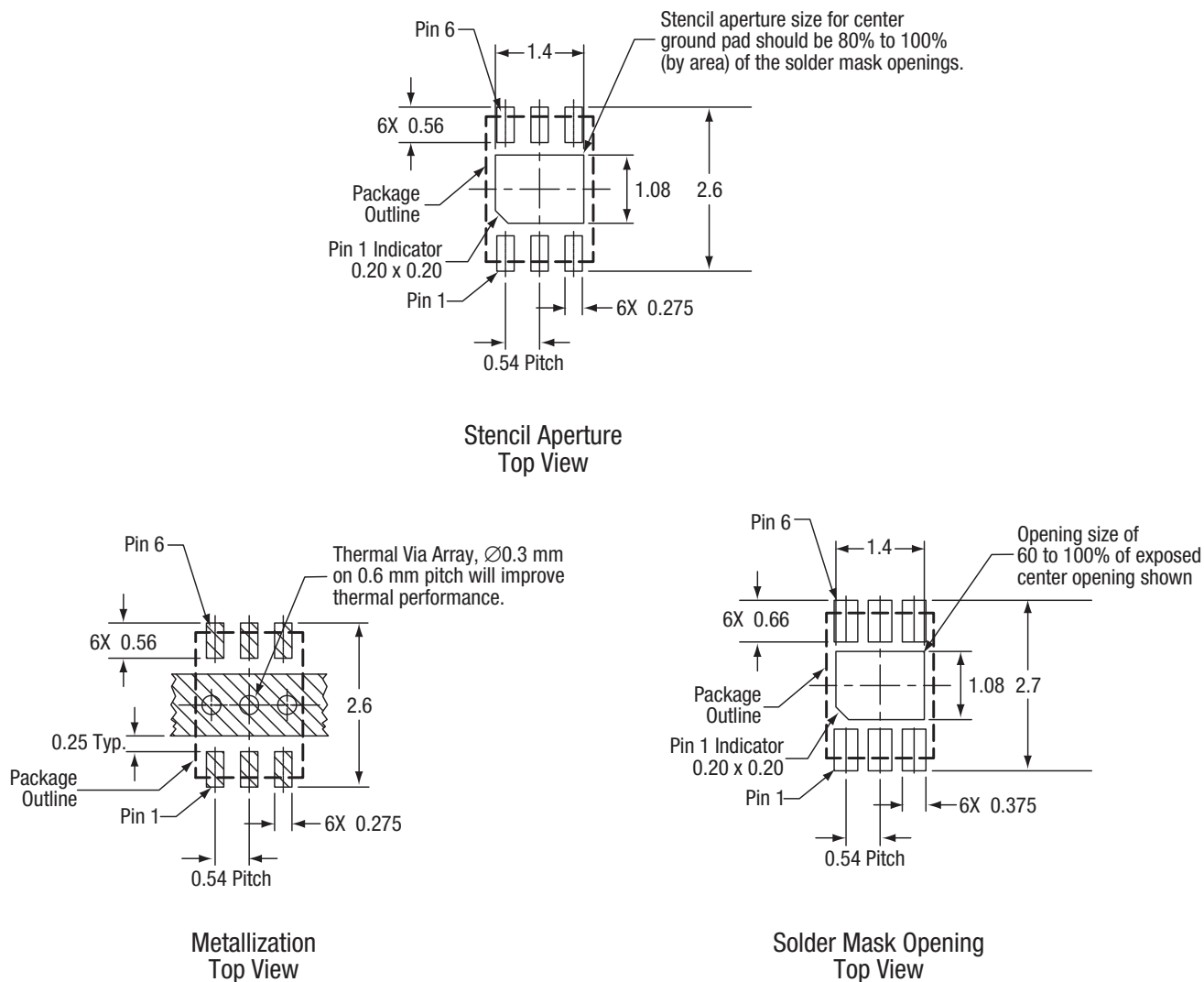


Figure 4. SKY65715-81 Evaluation Board Schematic

Table 6. SKY65715-81 Evaluation Board Bill of Materials

Component	Size	Value
C1, C2	0402	100 pF
R1 (Note 1)	0402	5 kΩ

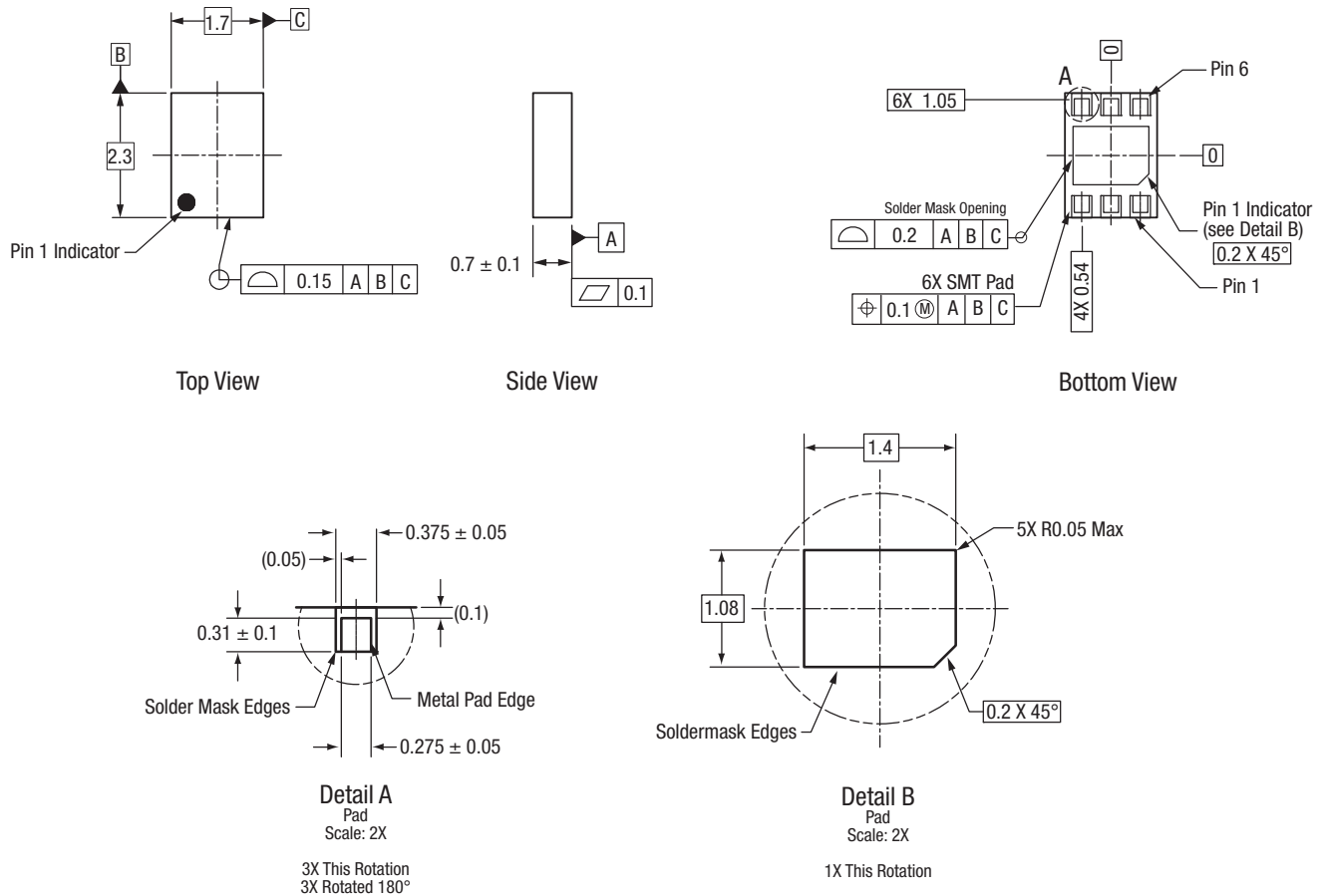
**Note 1:** The value of R1 can vary based on supply voltage and/or supply current requirements.



All dimensions are in millimeters

S2621

Figure 5. SKY65715-81 PCB Layout Footprint

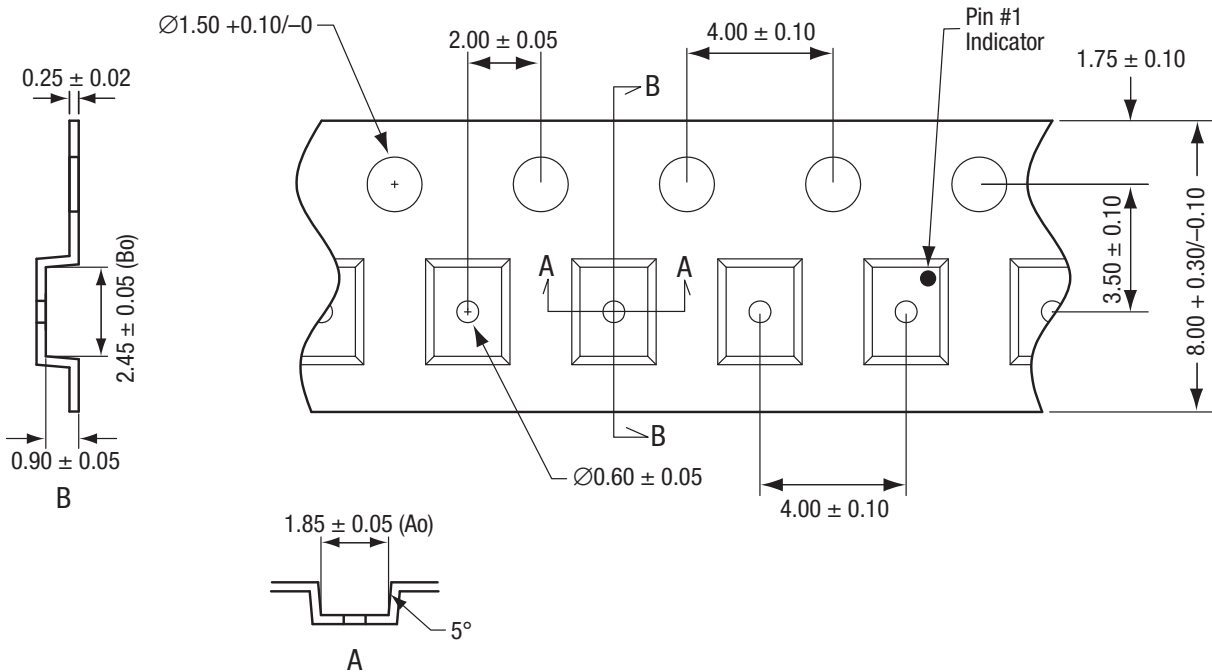


All measurements are in millimeters

Dimensioning and tolerancing according to ASME Y14.5M-1994

S2549

**Figure 6. SKY65715-81 6-Pin MCM Package Dimensions**



Notes:

1. Carrier tape: black conductive polycarbonate.
2. Cover tape material: transparent adhesive material.
3. ESD-surface resistivity is  $\geq 1 \times 10^5 \sim \leq 1 \times 10^8$  Ohms/square per EIA, JEDEC TNR Specification.
4. 10 sprocket hole pitch cumulative tolerance:  $\pm 0.20$  mm.
5.  $Ao$  and  $Bo$  measured on plane 0.30 mm above the bottom of pocket.
6. Camber not to exceed 1 mm in 250 mm.
7. All measurements are in millimeters.

S2657

Figure 7. SKY65715-81 Tape and Reel Dimensions



## Ordering Information

Model Name	Manufacturing Part Number	Evaluation Board Part Number
SKY65715-81: Low-Noise Amplifier FEM with GPS/GNSS/BDS Filter	SKY65715-81	TW19-D510

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