

SKY73063-11: 1700 – 2100 MHz High Linearity, Single Up/Downconversion Mixer

Applications

- 2G/3G base station transceivers:
 - GSM/EDGE, CDMA, UMTS/WCDMA
- Wi-Fi (802.11)
- WiMAX (802.16)
- 3GPP Long-Term Evolution
- Wireless Local Loop
- High performance radio links
- Land mobile radio
- Private mobile radio

Features

- Operating frequency range: 1700 to 2100 MHz
- IF frequency range: 100 to 200 MHz
- Insertion loss: 6.5 dB
- Input IP3: +28 dBm
- Noise Figure: 8.6 dB
- Integrated LO driver
- Integrated low loss RF balun
- On-chip SPDT LO switch
- Small, MCM (20-pin, 5 x 5 mm) package (MSL3, 260 °C per JEDEC J-STD-020)



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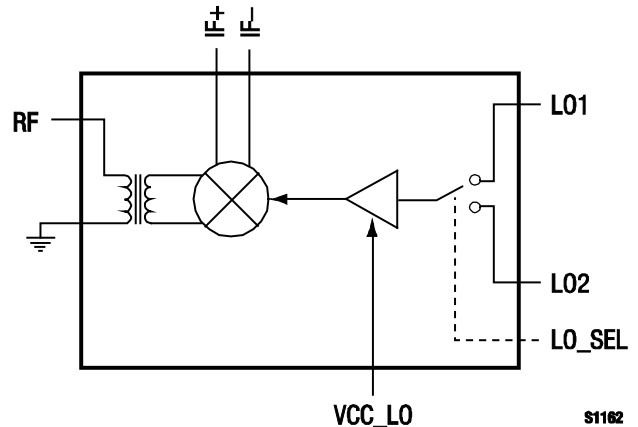


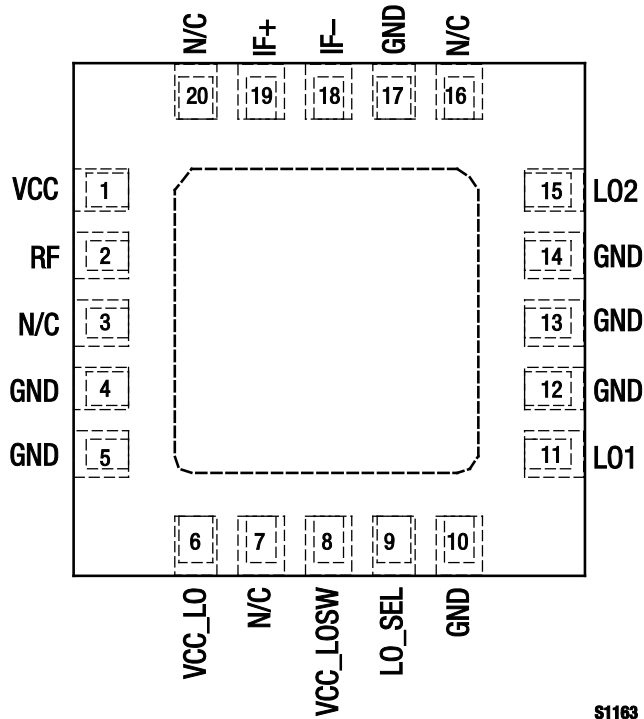
Figure 1. SKY73063-11 Block Diagram

Description

The SKY73063-11 is a fully integrated up/downconversion mixer that includes a Local Oscillator (LO) driver, an LO switch, and a high linearity mixer. A low loss RF balun has also been included to reduce design complications and lower system cost.

The SKY73063-11 features an input IP3 of +28 dBm and an insertion loss of 6.5 dB, making the device an ideal solution for high dynamic range systems such as 2G/3G base station receivers. The LO switch provides good isolation between LO inputs and supports the switching time required for GSM/EDGE base stations.

The SKY73063-11 is manufactured using a robust silicon BiCMOS process and has been designed for optimum long-term reliability. The SKY73063-11 single up/downconversion mixer is provided in a compact, 20-pin 5 x 5 mm Multi-Chip Module (MCM). 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. SKY73063-11 Pinout – 20-Pin MCM (Top View)

Table 1. SKY73063-11 Signal Descriptions

Pin #	Name	Description	Pin #	Name	Description
1	VCC	DC supply, +5V	11	LO1	LO1 input
2	RF	RF input	12	GND	Ground
3	N/C	No connection	13	GND	Ground
4	GND	Ground	14	GND	Ground
5	GND	Ground	15	LO2	LO2 input
6	VCC_LO	LO DC supply, +5V	16	N/C	No connection
7	N/C	No connection	17	GND	Ground
8	VCC_LOSW	LO switch DC supply, +5V	18	IF-	Negative IF output
9	LO_SEL	LO select switch control	19	IF+	Positive IF output
10	GND	Ground	20	N/C	No connection

Functional Description

The SKY73063-11 is a high linearity, single up/downconversion mixer, optimized for base station receiver applications. The device consists of a low loss RF balun and high linearity passive mixer.

An LO amplifier is also included that allow the SKY73063-11 to connect directly to the output of a Voltage Controlled Oscillator (VCO). This eliminates the extra gain stages needed by most discrete passive mixers. A Single Pole, Double Throw (SPDT) switch has been included to select between two different LO inputs (LO1 and LO2) for frequency hopping applications such as GSM.

RF Balun and Passive Mixer

The RF balun provides a single ended input, which can easily be matched to 50 Ω using a simple external matching circuit. The balun offers very low loss, and excellent amplitude and phase balance.

The high linearity SKY73063-11 is a passive, double-balanced mixer that provides a very low conversion loss, and excellent 3rd Order Input Insertion Point (IIP3).

Additionally, the balanced nature of the mixer provides for high port-to-port isolation.

LO Buffer and SPDT LO Switch

The LO buffer allows the input power of the SKY73063-11 to be in the range of ±6 dBm. The LO section is optimized for high-side LO injection. However, each of the two LOs can be driven over a wide frequency range with some degradation in performance.

A high isolation SPDT switch allows the SKY73063-11 to be used for frequency hopping applications. This switch provides greater than 40 dB of LO1 to LO2 isolation:

LO_SEL Input	LO Path Selected
High	LO1 (pin 11) enabled
Low	LO2 (pin 15) enabled

For applications that do not require frequency hopping, LO_SEL is fixed to one state and the appropriate LO input is used. An internal pull-down resistor enables the LO2 input.

Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY73063-11 are provided in Table 2 and the recommended operating conditions in Table 3. Electrical characteristics for the SKY73063-11 are provided in Table 4.

Typical performance characteristics of the SKY73063-11 are illustrated in Figures 3 through 14.

Table 2. SKY73063-11 Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units
Supply voltage, +5 V	VCC	4.5	5.5	V
Supply current	I _{CC}		100	mA
RF input power	P _{RF}		+20	dBm
IF input power	P _{IF}		+20	dBm
LO input power	P _{LO}		+20	dBm
Operating case temperature	T _C	-40	+85	°C
Junction temperature	T _J		+150	°C
Storage case temperature	T _{STG}	-40	+150	°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.

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. SKY73063-11 Recommended Operating Conditions

Parameter	Symbol	Minimum	Typical	Maximum	Units
Supply voltage, +5 V	VCC	4.75	5.00	5.25	V
Supply current	I _{CC}		83		mA
LO input power	P _{LO}	-6	0	+6	dBm
LO select input: high low	LO_SEL _H LO_SEL _L	2.2		0.8	V V
Operating case temperature	T _C	-40		+85	°C
RF frequency range	F _{RF}	1700		2100	MHz
LO frequency range (Note 1)	F _{LO}	1800		2300	MHz
IF frequency range	F _{IF}	100		200	MHz

Note 1: The SKY73063-11 has been optimized for high-side LO injection. However, the LO can be used outside of the specified frequency range with degraded performance.

Table 4. SKY73063-11 Electrical Specifications (Note 1)

(Voltage Supply = +5 V, T_C = +25 °C, LO = 0 dBm, RF Frequency = 1875 MHz, IF Frequency = 150 MHz, LO Frequency = 2025 MHz, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Downconversion insertion loss	I _{LDOWN}	RF input to IF output, F _{RF} = 1875 MHz, P _{RF} = -7 dBm		6.5	7.5	dB
Upconversion insertion loss	I _{LUP}	IF input to RF output, F _{IF} = 150 MHz, P _{IF} = -7 dBm		5.8	7.0	dB
Noise Figure	NF			8.6	11.5	dB
Downconversion 3 rd Order Input Intercept Point	IIP3 _{DOWN}	RF input, I _{RF} = 1875 MHz and 1875.8 MHz, P _{RF} = 0 dBm	+24	+28		dBm
Input 1 dB compression point	IP1 _{dB}	Downconversion	+15.5	+18.8		dBm
2RF – 2LO	2x2	P _{RF} = 0 dBm Downconversion Upconversion		-54 -87	-48 -79	dBc dBc
3RF – 3LO	3x3	P _{RF} = 0 dBm Downconversion Upconversion		-67 -102	-48 -95	dBc dBc
L01-to-L02 isolation			32	35		dB
LO leakage: @ RF port @ IF port				-24 -36	-15 -28	dBm dBm
RF to IF isolation		Downconversion	41	45		dB
LO_SEL input			-20	+150	+250	μA
LO switching time					0.5	μs
RF port return loss	Z _{RF}	With external matching components	14			dB
LO port return loss	Z _{LO}	With external matching components	14			dB
IF port return loss	Z _{IF}	With external matching components	14			dB

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

Typical Performance Characteristics

(Voltage Supply = +5 V, $T_c = +25\text{ }^\circ\text{C}$, LO = 0 dBm, RF Frequency = 1875 MHz, IF Frequency = 150 MHz, LO Frequency = 2025 MHz, Unless Otherwise Noted)

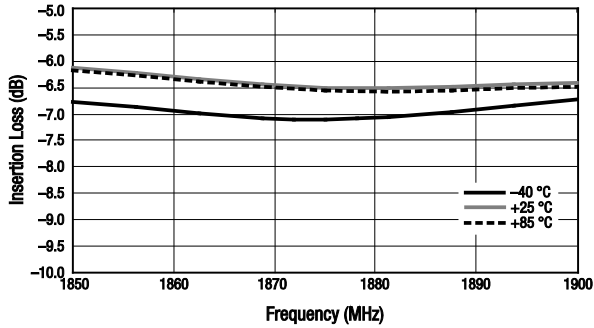


Figure 3. Downconversion Insertion Loss vs Frequency and Temperature

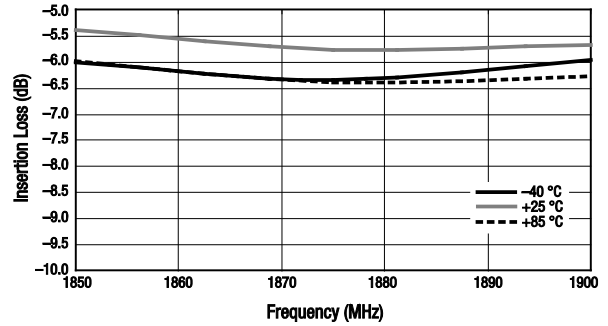


Figure 4. Upconversion Insertion Loss vs Frequency and Temperature

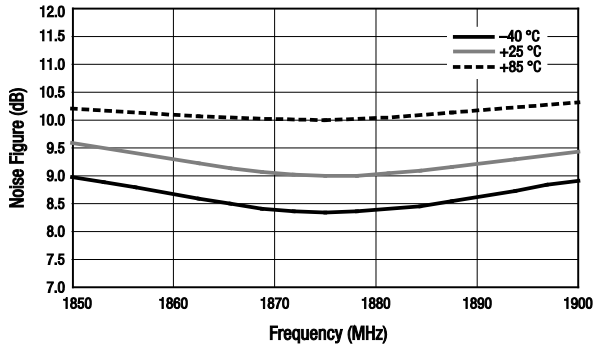


Figure 5. Noise Figure vs Frequency and Temperature

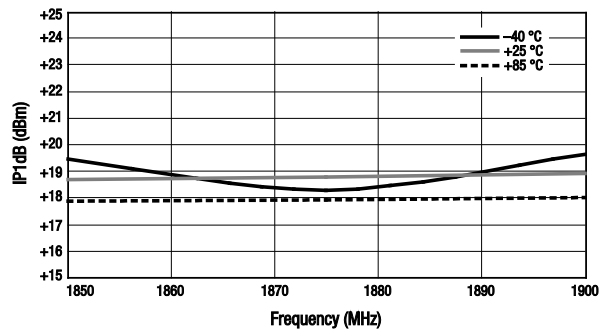


Figure 6. Input P1dB vs Frequency and Temperature

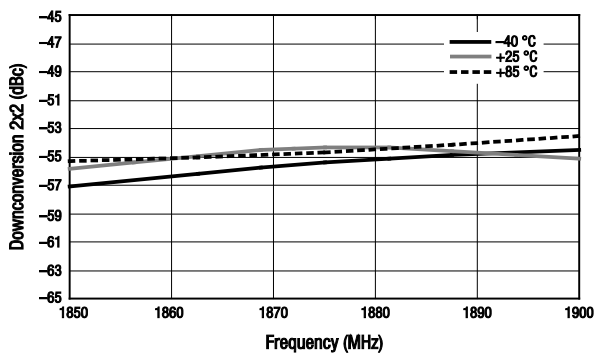


Figure 7. Downconversion 2x2 vs Frequency and Temperature

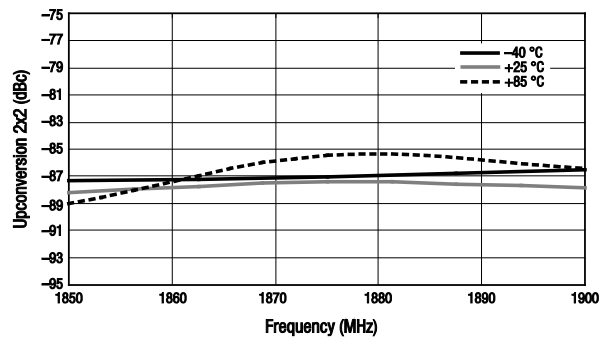


Figure 8. Upconversion 2x2 vs Frequency and Temperature

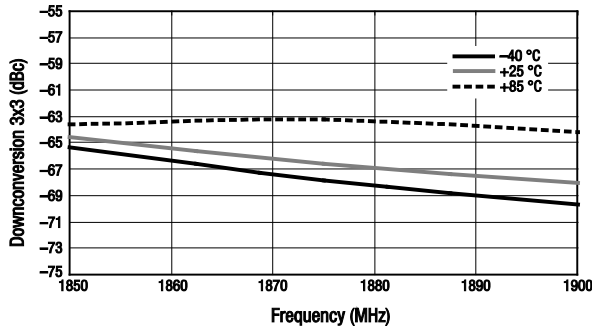


Figure 9. Downconversion 3x3 vs Frequency and Temperature

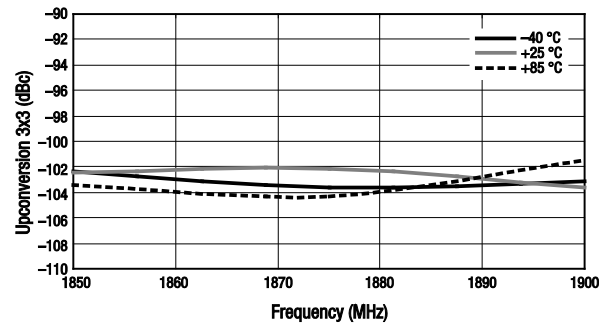


Figure 10. Upconversion 3x3 vs Frequency and Temperature

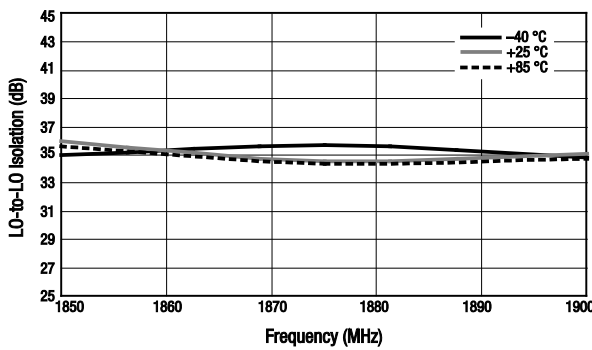


Figure 11. LO-to-LO Isolation vs Frequency and Temperature

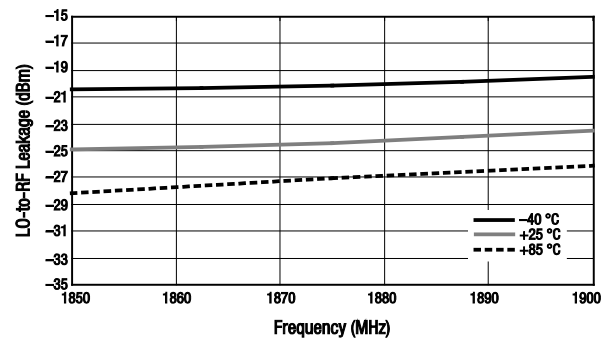


Figure 12. LO-to-RF Leakage vs Frequency and Temperature

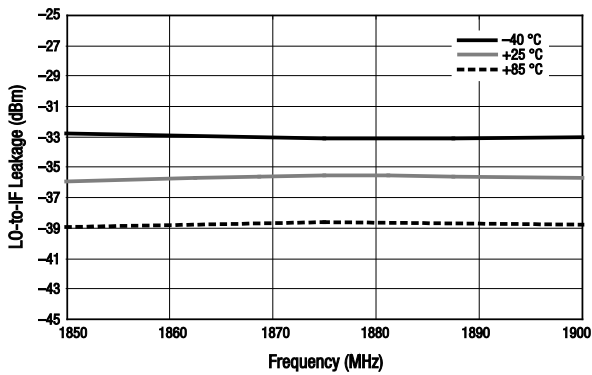


Figure 13. LO-to-IF Leakage vs Frequency and Temperature

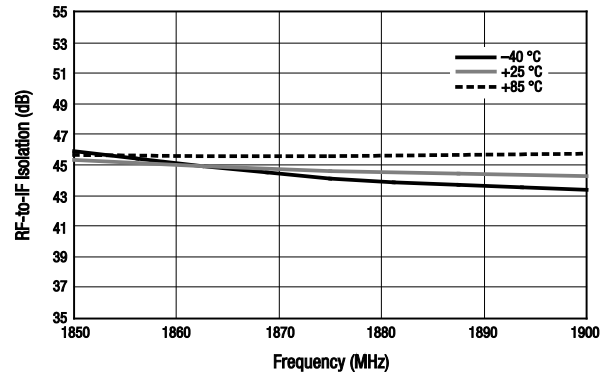


Figure 14. RF-to-IF Isolation vs Frequency and Temperature

Evaluation Board Description

The SKY73063-11 Evaluation Board is used to test the performance of the SKY73063-11 downconversion mixer. An assembly drawing for the Evaluation Board is shown in Figure 15 and the layer detail is provided in Figure 16.

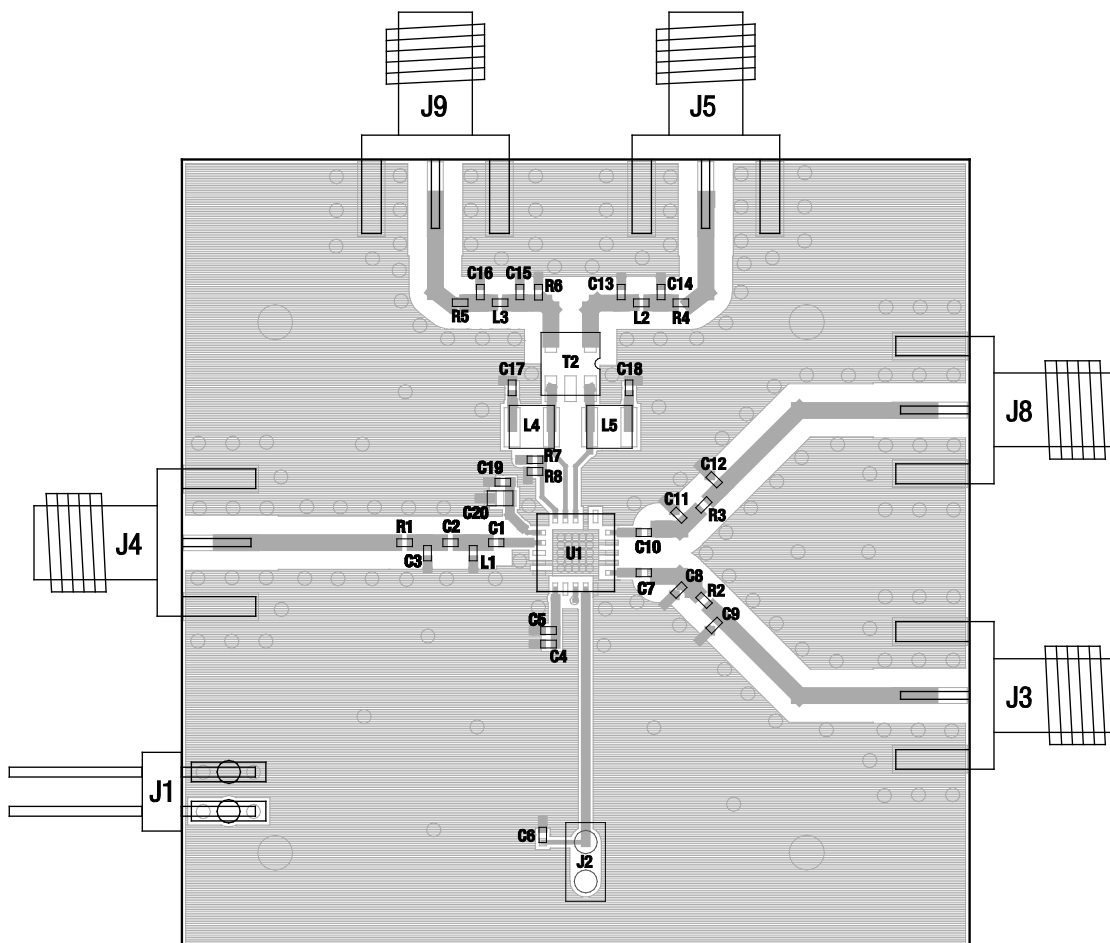
Circuit Design Configurations

The following design considerations are general in nature and must be followed regardless of final use or configuration:

1. Paths to ground should be made as short and as low impedance as possible.

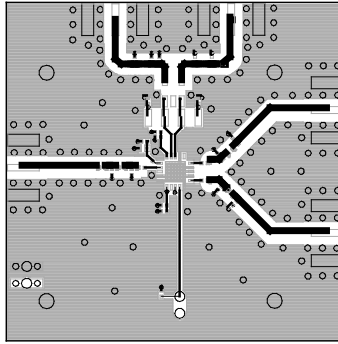
2. The ground pad of the SKY73063-11 provides critical electrical and thermal functionality. The connection to the ground pad should be designed to provide the best ground for the mixer. For more information on soldering the SKY73063-11, refer to the Package and Handling Information section of this Data Sheet.
3. Skyworks recommends including external bypass capacitors on the VCC voltage inputs of the device.

A schematic diagram for the SKY73063-11 Evaluation Board is shown in Figure 17.

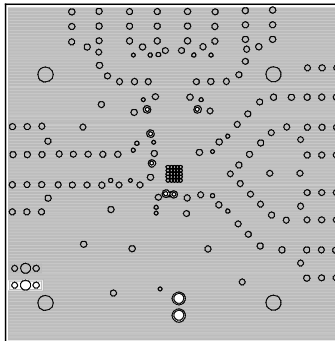


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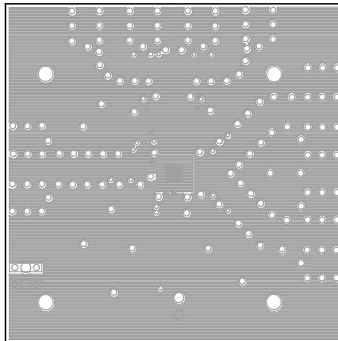
Figure 15. SKY73063-11 Evaluation Board Assembly Diagram



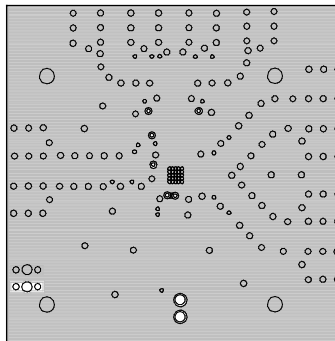
Layer 1: Top – Metal



Layer 2: Ground



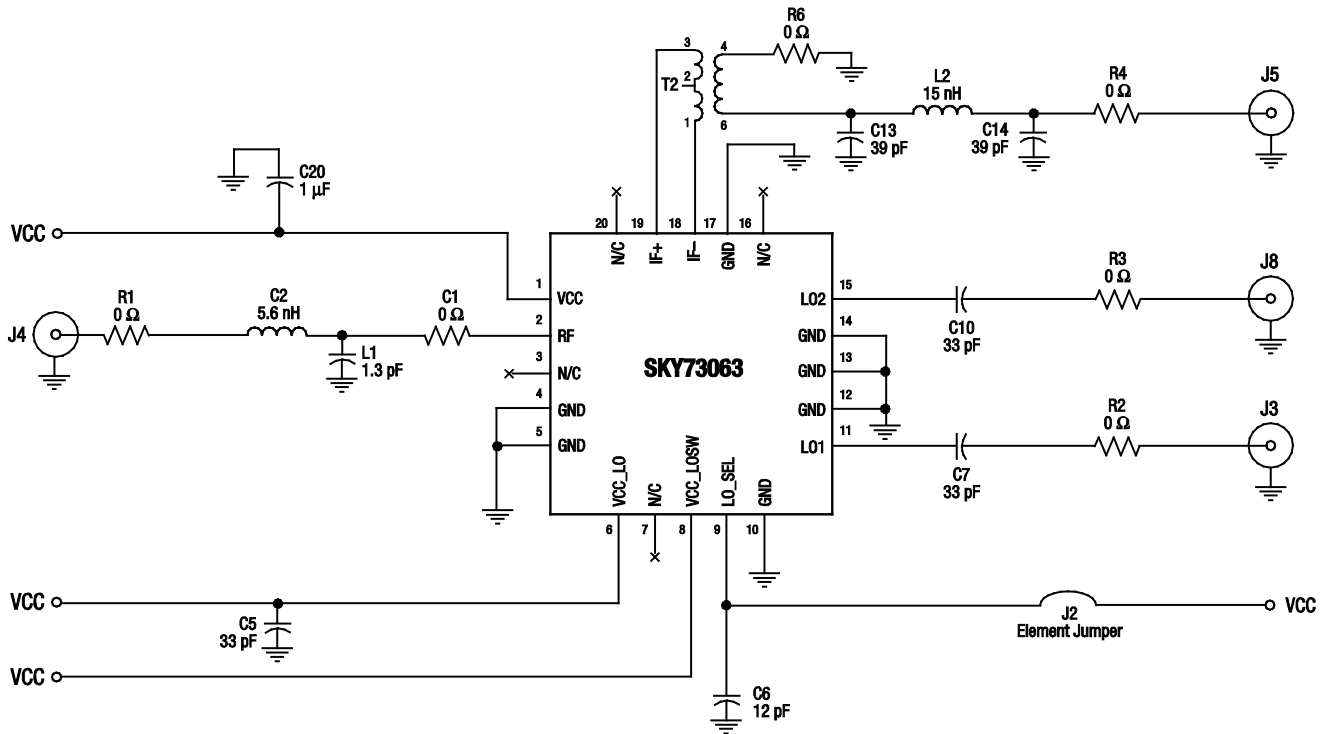
Layer 3: Power Plane



Layer 4: Solid Ground Plane

S1073

Figure 16. SKY73063-11 Evaluation Board Layer Detail



Notes: Values for all components are subject to change for matching purposes.

Some component labels may be different than the corresponding component symbol shown here. Component values, however, are accurate as of the date of this Data Sheet.

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Figure 17. SKY73063-11 Evaluation Board Schematic

Package Dimensions

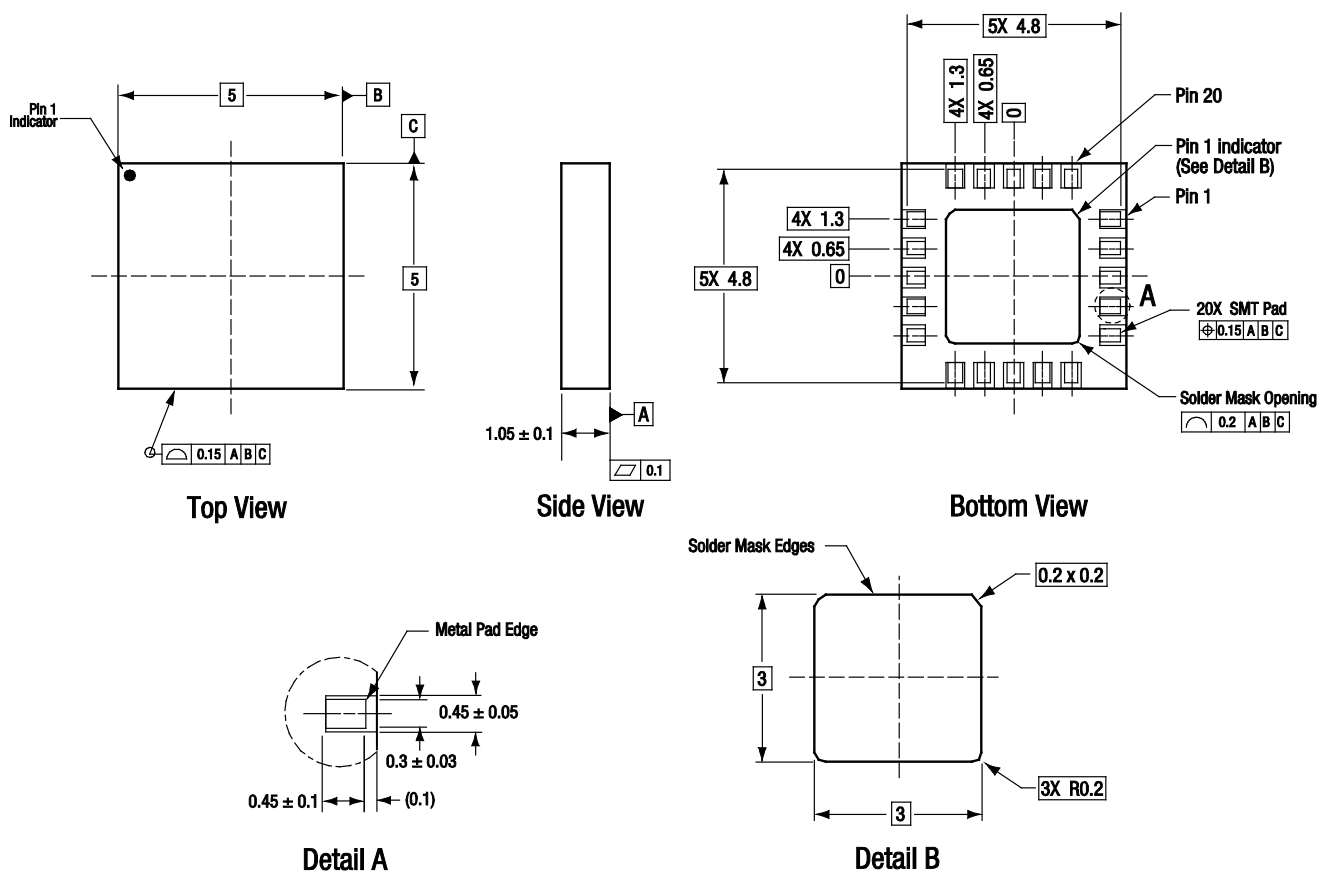
Figure 18 shows the package dimensions for the 20-pin MCM, and Figure 19 provides the tape and reel dimensions.

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 SKY73063-11 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.

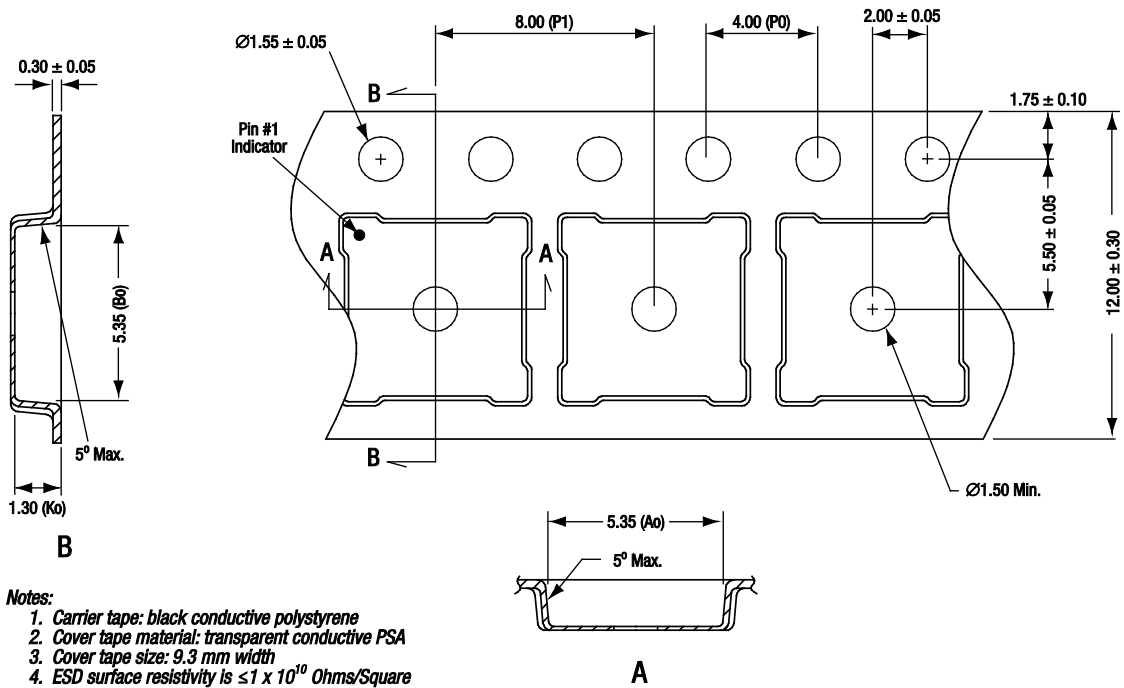
Care must be taken when attaching this product, whether it is done manually or in a production reflow environment. Production quantities of this product are shipped in a standard tape and reel format.



All measurements are in millimeters.
Dimensioning and tolerancing according to ASME Y14.5M-1994.

S944

Figure 18. SKY73063-11 20-Pin MCM Package Dimensions



Notes:

1. Carrier tape: black conductive polystyrene
2. Cover tape material: transparent conductive PSA
3. Cover tape size: 9.3 mm width
4. ESD surface resistivity is $\leq 1 \times 10^{10}$ Ohms/Square according to EIA, JEDIC TNR specification.
5. P_0/P_1 10 pitches cumulative tolerance on tape: ± 0.20 mm
6. A and B measurement points are 0.30 mm from bottom pocket.
7. All dimensions are in millimeters

S461b

Figure 19. SKY73063-11 Tape and Reel Dimensions

Ordering Information

Model Name	Manufacturing Part Number	Evaluation Board Part Number
SKY73063-11 1700-2100 MHz Up/Downconversion Mixer	SKY73063-11	TW18-480

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