

DATA SHEET

SKY13568-11: RX Diversity FEM with Gain (B4, B7, and B17)

Applications

- Antenna cable loss compensation circuit for LTE data antenna
- 3G/4G multimode cellular tablets and handsets (LTE, UMTS, CDMA2000, EDGE, and GSM)
- Embedded data cards

Features

- RX Diversity FEM with three selectable filters and LNA paths and optional bypass mode
- Low insertion loss thru path
- Integrated SAW filter and discrete LNA gain stage
- SAW filters:
 - B17 (734 to 746 MHz)
 - B4 (2110 to 2155 MHz)
 - B7 (2620 to 2690 MHz)
- Integrated GPIO interface
- Small (4 x 3 x 0.8 mm) 17-lead MCM package (MSL3, 260 °C per JEDEC J-STD-020)



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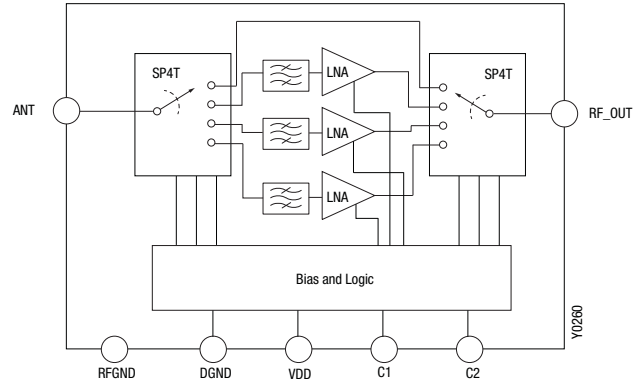


Figure 1. SKY13568-11 Block Diagram

Description

The SKY13568-11 is an RX front-end module (FEM) combining two SP4T switches (input and output switch) with three paths that include B4, B7, and B17 SAW filters in series with high gain LNAs. The four separate paths are GPIO selectable with two control lines.

Using advanced switching technology, the SKY13568-11 maintains low insertion loss in the thru path and high isolation between paths when RX filtering and gain stages are selected. Integrated LNAs provide cable loss compensation to overcome path loss from the antenna to the transceiver.

The SKY13568-11 is packaged in a small, 4 x 3 x 0.8 mm, 17-lead surface-mount package. No external DC blocking capacitors are required on the RF paths as long as no DC voltage is applied. The switch can operate over the temperature range of -35 °C to +90 °C.

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.

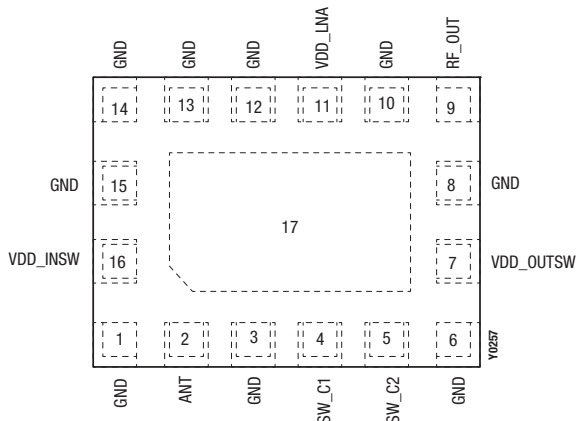


Figure 2. SKY13568-11 Pinout – 17-Lead MCM (Top View)

Table 1. SKY13568-11 Signal Descriptions (Note 1)

Pin	Name	Description	Pin	Name	Description
1	GND	Ground	10	GND	Ground
2	ANT	Antenna	11	VDD_LNA	LNA supply voltage
3	GND	Ground	12	GND	Ground
4	SW_C1	Switch control 1	13	GND	Ground
5	SW_C2	Switch control 2	14	GND	Ground
6	GND	Ground	15	GND	Ground
7	VDD_OUTSW	Switch 2 supply voltage	16	VDD_INSW	Switch 1 supply voltage
8	GND	Ground	17	GND	Ground
9	RF_OUT	Output			

Note 1: Exposed pads must be connected to ground.

Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY13568-11 are provided in Table 2. Electrical specifications are provided in Tables 3 and 4.

Table 2. SKY13568-11 Absolute Maximum Ratings (Note 1)
(TOP = +25 °C, Characteristic Impedance [Zo] = 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Minimum	Maximum	Units
Supply voltage	VDD		3.5	V
Digital control voltage	VCTL	-0.5	+3.0	V
RF input power (Peak power at ANT port) at bypass mode	PIN		+30	dBm
Storage temperature	TSTG	-55	+150	°C
Operating temperature	TOP	-35	+90	°C
Electrostatic discharge:	ESD			
Charged-Device Model (CDM), Class 4			1000	V
Human Body Model (HBM), Class 1C			1000	V
Machine Model (MM), Class A			100	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.

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. SKY13568-11 General Electrical Specifications (Note 1)**(V_{DD} = 2.85 V, V_{IO} = 1.8 V, T_{OP} = +25 °C, Characteristic Impedance [Z₀] = 50 Ω, Unless Otherwise Noted)**

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Supply voltage	V _{DD}		2.70	2.85	3.00	V
Digital control signal: High Low	V _{CTL}		1.35 -0.5	1.8 0	3 0.45	V V
Supply current, V _{DD_OUTSW} and V _{DD_INSW}	I _{CTL}		-57	2.2	3.1	μA
Supply current: LNA on LNA off	I _{DD}			5 30	10 40	mA μA
DC supply turn-on time		Measured from 50% of final V _{DD} supply voltage to final RF power ±1 dB		2	5	μs
DC supply turn-off time		Measured from 50% of final V _{DD} supply voltage to final RF power ±1 dB		2	5	μs
RF path switching time	t _{sw}	Measured from beginning of V _{CTL} transition to final RF power ±1 dB		1	3	μs

Note 1: Performance is guaranteed only under the conditions listed in this table.**Table 4. SKY13568-11 RF Electrical Specifications (1 of 2) (Notes 1 and 2)****(V_{DD} = 2.85 V, V_{IO} = 1.8 V, T_{OP} = +25 °C, Characteristic Impedance [Z₀] = 50 Ω, Unless Otherwise Noted)**

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Bypass mode insertion loss: B17 @ 740 MHz B4 @ 2132 MHz B7 @ 2655 MHz	Thru	Thru state	-1.9 -2.0 -2.2	-1.5 -1.7 -1.9		dB dB dB
In Band gain: 734 MHz 740 MHz 746 MHz 2110 MHz 2132 MHz 2155 MHz 2620 MHz 2655 MHz 2690 MHz	G		14 14 14 12 12 11.8 14.5 14.5 14.5	15.4 16 15.9 13.5 14.1 13.2 15.7 16.4 15.9	17 17.5 17.5 16 16 16 18 18 18	dB dB dB dB dB dB dB dB dB
In Band Noise Figure: LNA on B17 @ 740 MHz LNA on B4 @ 2132 MHz LNA on B7 @ 2655 MHz	NF	Cascaded Noise Figure		3.9 2.9 4.4	4.6 5 5	dB dB dB
In Band input return loss: Thru state @ 2132 MHz LNA on B17 @ 740 MHz LNA on B4 @ 2132 MHz LNA on B7 @ 2655 MHz	S11			-18.4 -19.4 -16.6 -13.9	-14 -12 -10 -8	dB dB dB dB
In Band output return loss: Thru state @ 2132 MHz LNA on B17 @ 740 MHz LNA on B4 @ 2132 MHz LNA on B7 @ 2655 MHz	S22			-16.2 -20.8 -13.8 -22.7	-12 -12 -10 -12	dB dB dB dB

Table 4. SKY13568-11 RF Electrical Specifications (2 of 2) (Notes 1 and 2)
(V_{DD} = 2.85 V, V_{IO} = 1.8 V, T_{OP} = +25 °C, Characteristic Impedance [Z₀] = 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Cascaded input IP3:	IIP3					
Thru state			+50.3	+52.7		dBm
LNA on B17 @ 740 MHz			-6	-2.4		dBm
LNA on B4 @ 2132 MHz			-5	-1		dBm
LNA on B7 @ 2655 MHz	-3	+1.9		dBm		
Cascaded Input 1 dB Compression:	IP1dB					
Thru state			+32.2	+33.4		dBm
LNA on B17 @ 740 MHz			-20	-15.2		dBm
LNA on B4 @ 2132 MHz			-19	-13.7		dBm
LNA on B7 @ 2655 MHz	-15	-10.2		dBm		

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

Note 2: Performance is verified with 15 nH (0201) shunt at antenna port (pin 2).

Table 5. Logic Truth Table

Path	C1	C2
Bypass	High	High
B17	Low	High
B4	Low	Low
B7	High	Low

Evaluation Board Description

The SKY13568-11 Evaluation Board is used to test the performance of the SKY13568-11 RX Diversity FEM. An Evaluation Board schematic diagram is provided in Figure 3. An assembly drawing for the Evaluation Board is shown in Figure 4.

Package Dimensions

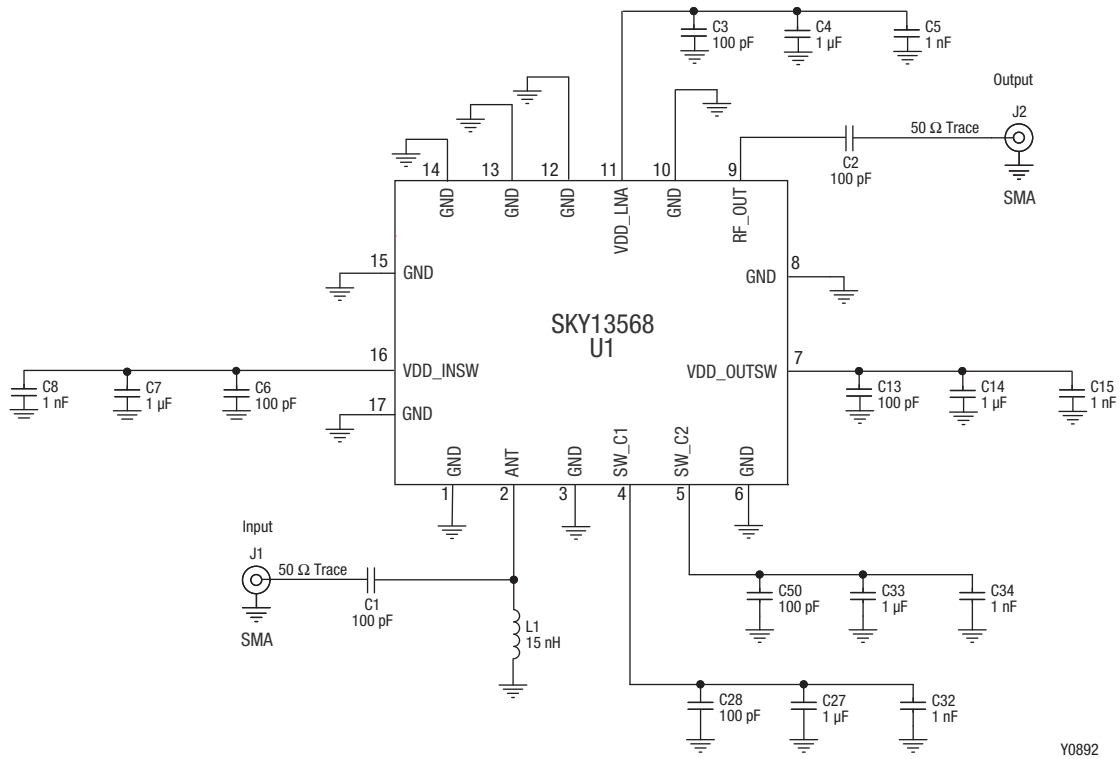
The PCB layout footprint for the SKY13568-11 is shown in Figure 5. Typical case markings are shown in Figure 6. Package dimensions for the 17-lead MCM are shown in Figure 7, and tape and reel dimensions are provided in Figure 8.

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.

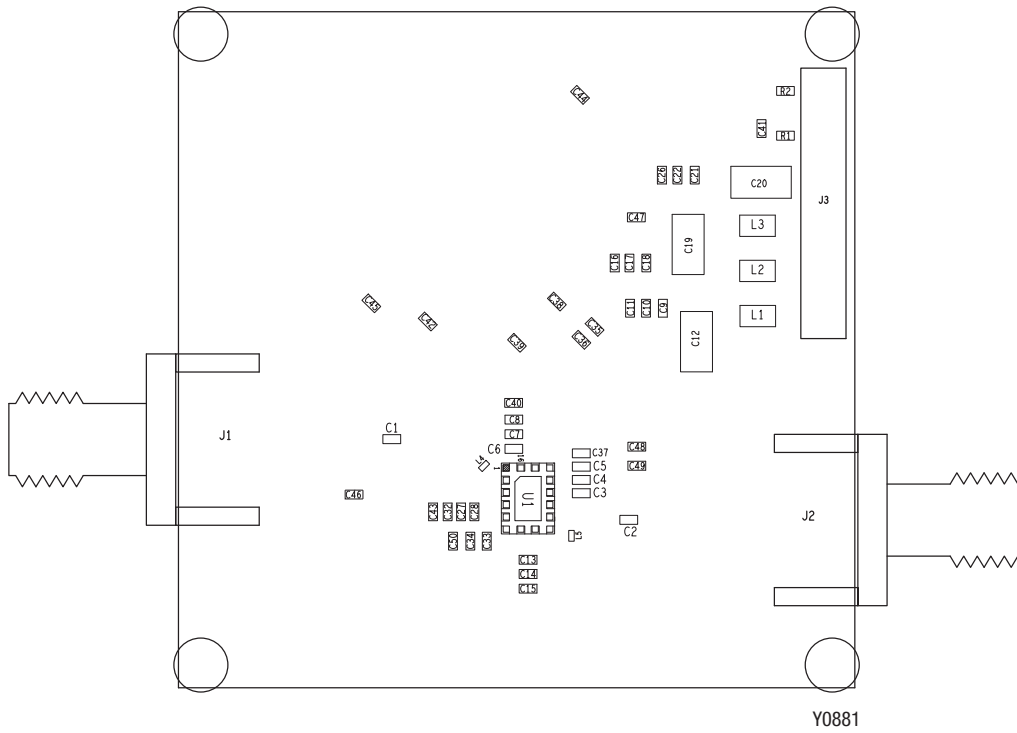
The SKY13568-11 is rated to Moisture Sensitivity Level 3 (MSL3) at 260 °C. It can be used for lead or lead-free soldering. For additional information, refer to the Skyworks Application Note, *PCB Design & SMT Assembly/Rework Guidelines for MCM-L Packages*, document number 101752.

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



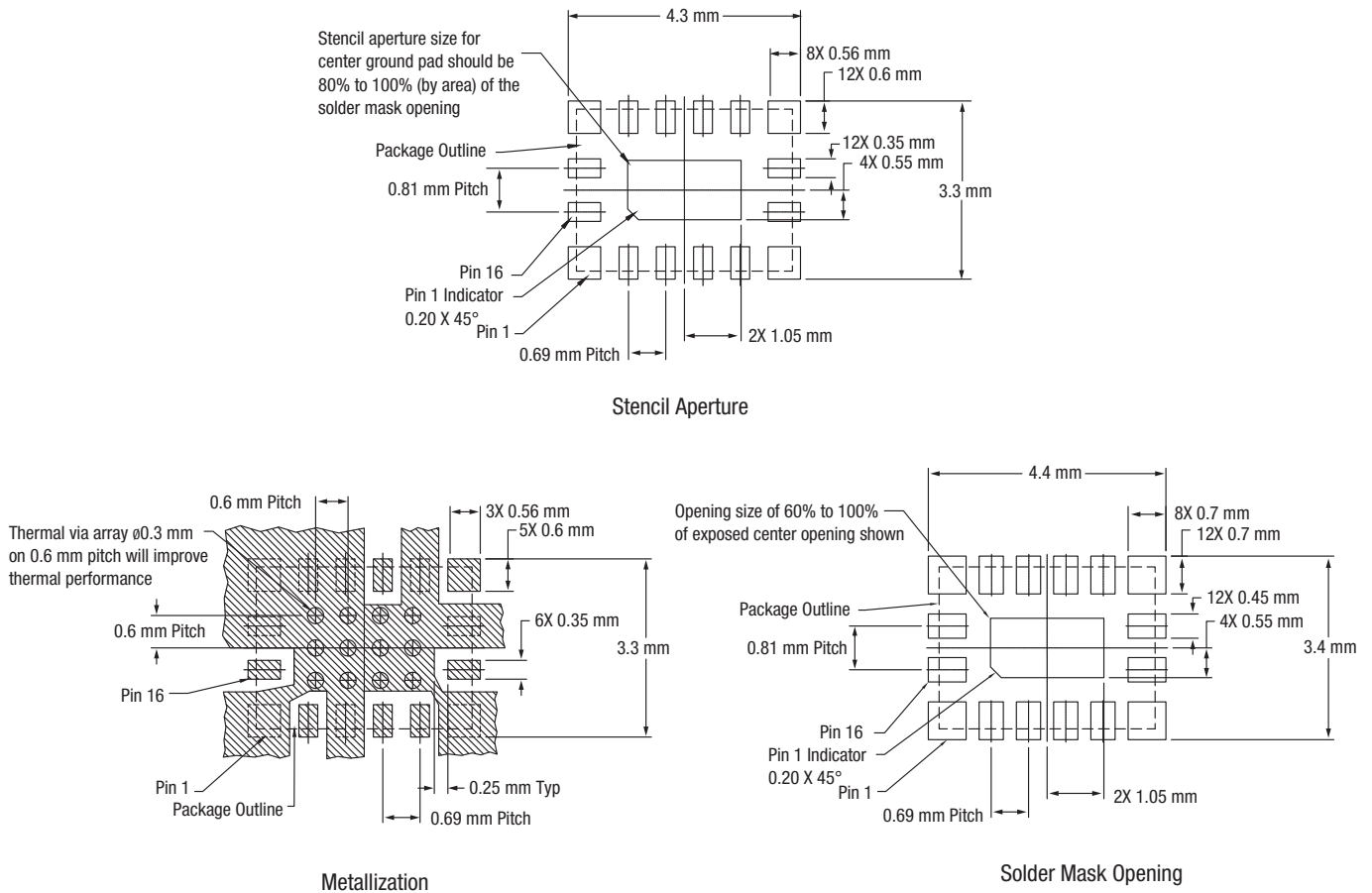
Y0892

Figure 3. SKY13568-11 Evaluation Board Schematic



Y0881

Figure 4. SKY13568-11 Evaluation Board Assembly Diagram



Note:

Thermal vias should be resin filled and capped in accordance with IPC-4761 type VII vias. 30 to 35 μ m Cu thickness is recommended.

Y0923

Figure 5. SKY13568-11 PCB Layout Footprint

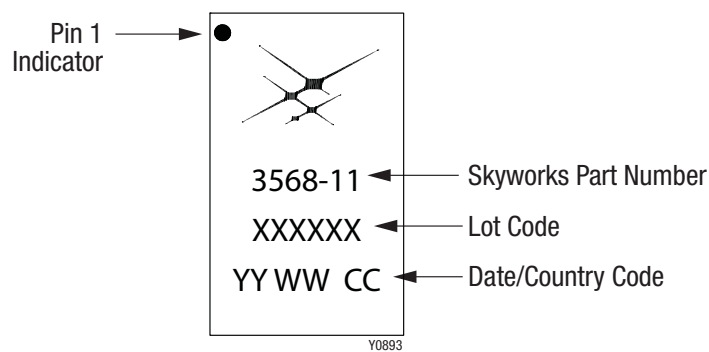
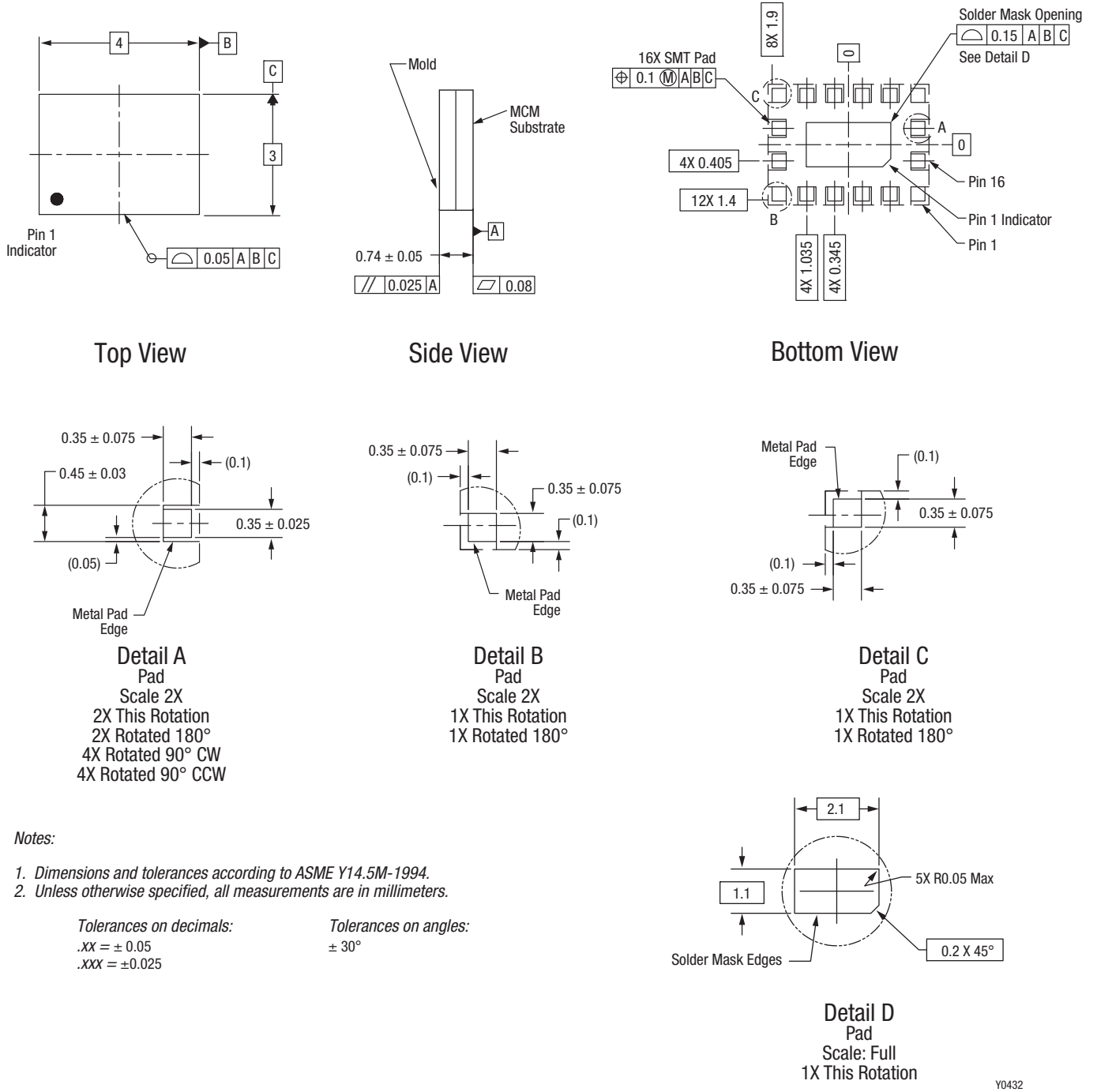


Figure 6. Typical Part Markings (Top View)



Notes:

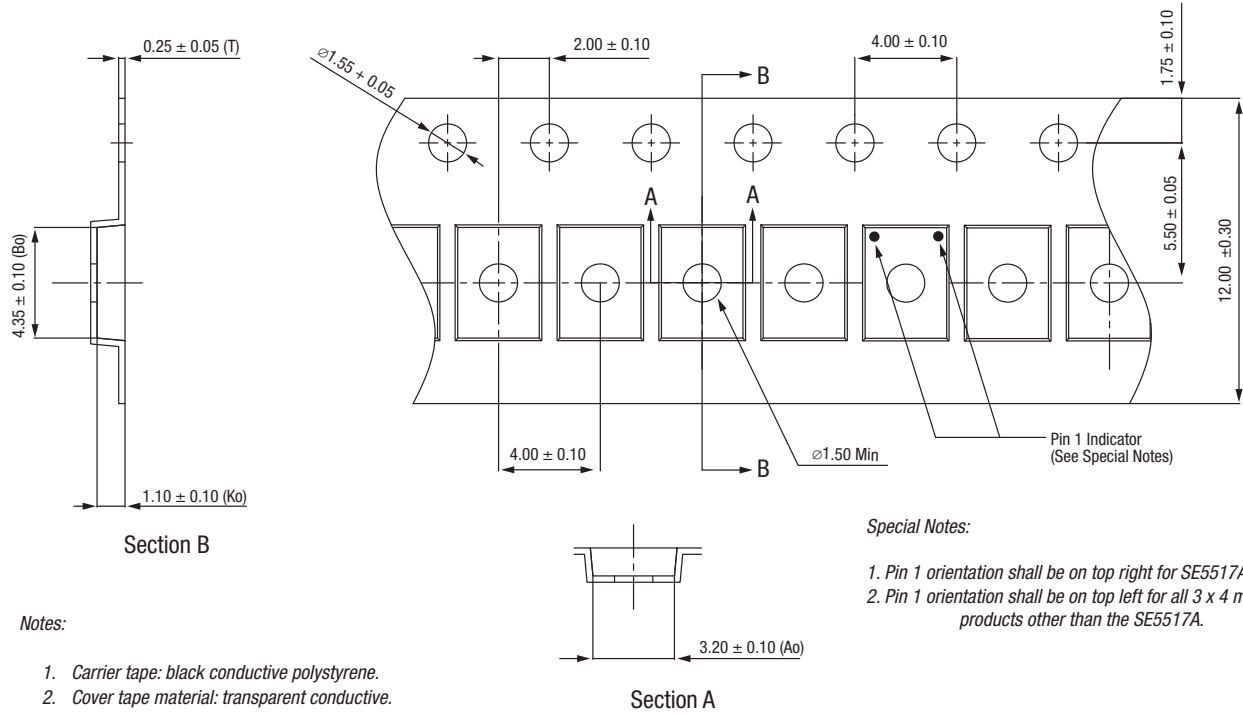
1. Dimensions and tolerances according to ASME Y14.5M-1994.
2. Unless otherwise specified, all measurements are in millimeters.

Tolerances on decimals:
 .XX = ± 0.05
 .XXX = ± 0.025

Tolerances on angles:
 ± 30°

Figure 7. SKY13568-11 17-Lead MCM Package Dimensions

Y0432



Notes:

1. Carrier tape: black conductive polystyrene.
2. Cover tape material: transparent conductive.
3. 10-sprocket hole pitch cumulative tolerance: ±0.20 mm.
4. Ao and Bo measurement point to be 0.30 mm from bottom pocket.
5. All dimensions are in millimeters.

Y0842

Figure 8. SKY13568-11 Tape and Reel Dimensions

Ordering Information

Model Name	Manufacturing Part Number	Evaluation Board Part Number
SKY13568-11: RX Diversity FEM	SKY13568-11	TW21-D800

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