DATA SHEET

SKY18108-11: 0.4-2.7 GHz SP9T Antenna Switch Module

Applications

- Dual-mode handsets (GSM/EDGE, Quad/TD-SCDMA or WCDMA dual mode)
- Low-cost, small footprint FEMs

Features

- Supports quad-band GSM and TD-SCDMA or GSM and WCDMA dual-mode for 2G and 3G systems
- Three TD/WCDMA ports are designed for 3G high power transmit/receive operation
- Low insertion loss:
  - 1.00 dB @ 1 and 2 GHz GSM transmit
  - 0.80 dB @ 1 GHz GSM receive
  - 1.05 dB @ 2 GHz GSM receive
  - 0.69 dB @ 2 GHz TD/WCDMA transmit/receive
- Good 2nd/3rd harmonic performance:
  - –64/–56 dBm @ P_{IN} = +32 dBm (2G high-band transmit)
  - –50/–58 dBm @ P_{IN} = +35 dBm (2G low-band transmit)
- Supply voltage: 2.65 to 3.30 V
- State-of-the-art SOI process with GPIO logic
- Small MCM (20-pin, 3.2 x 2.5 mm) package (MSL3, 260 °C per JEDEC J-STD-020)

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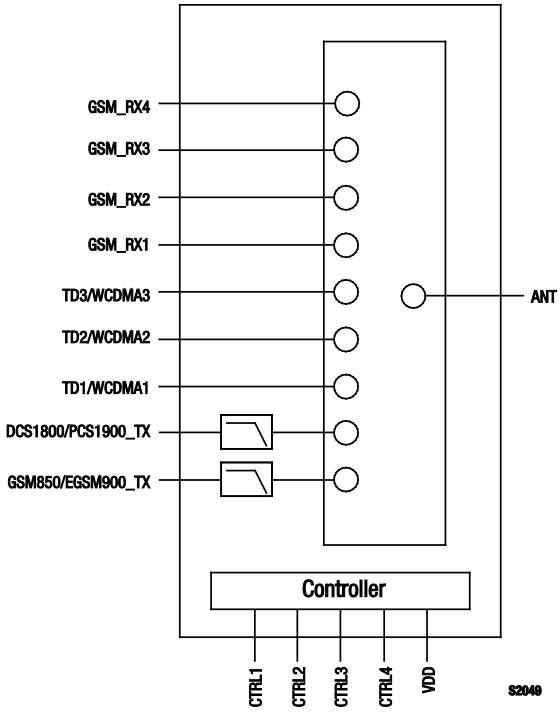


Figure 1. SKY18108-11 Block Diagram

Description

The SKY18108-11 is a Single Pole, Nine-Throw (SP9T) antenna switch Front-End Module (FEM) designed for dual-mode, high power band switching applications that require low harmonics and low insertion loss. The device is optimized for both GSM/EDGE and TD/WCDMA systems.

The SKY18108-11 consists of an SP9T switch, GSM transmit signal low-pass harmonic filters, and a GPIO controller. The low current consumption makes this device very suitable for battery operated applications.

The SKY18108-11 is manufactured in a compact, 3.2 x 2.5 mm, 20-pin Multi-Chip Module (MCM) 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.

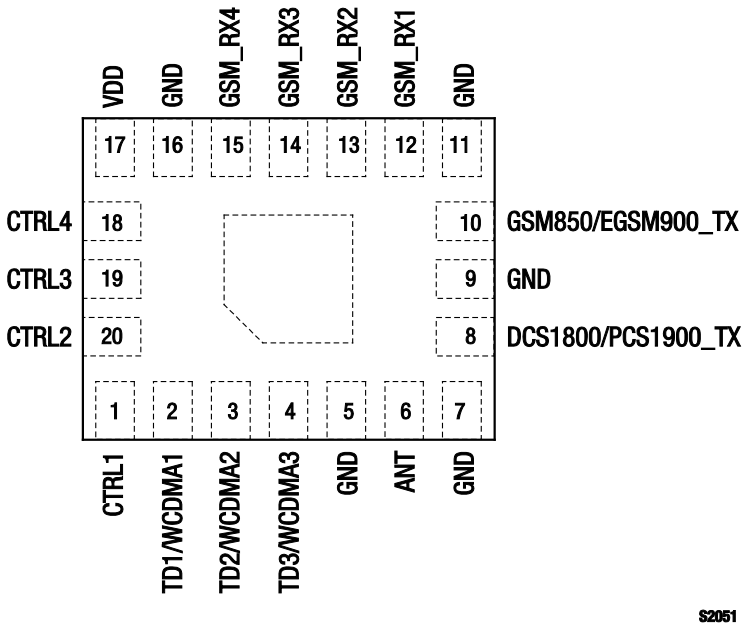


Figure 2. SKY18108-11 Pinout – 20-Pin MCM (Top View)

Table 1. SKY18108-11 Signal Descriptions

Pin #	Name	Description	Pin #	Name	Description
1	CTRL1	Antenna switch control logic pin	11	GND	Ground
2	TD1/WCDMA1	RF input for TD1/WCDMA1 transmit/receive	12	GSM_RX1	RF output for GSM receive
3	TD2/WCDMA2	RF input for TD2/WCDMA2 transmit/receive	13	GSM_RX2	RF output for GSM receive
4	TD3/WCDMA3	RF input for TD3/WCDMA3 transmit/receive	14	GSM_RX3	RF output for GSM receive
5	GND	Ground	15	GSM_RX4	RF output for GSM receive
6	ANT	Antenna	16	GND	Ground
7	GND	Ground	17	VDD	Supply voltage
8	DCS1800/PCS1900_TX	RF input for DCS1800/PCS1900 transmit	18	CTRL4	Antenna switch control logic pin
9	GND	Ground	19	CTRL3	Antenna switch control logic pin
10	GSM850/EGSM900_TX	RF input for GSM850/EGSM900 transmit	20	CTRL2	Antenna switch control logic pin

Note: Bottom ground paddle must be connected to ground.

Table 2. SKY18108-11 Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Minimum	Typical	Maximum	Units
Supply voltage	V_{DD}	2.65	2.80	3.30	V
Control voltage	V_{CTRL}	1.5	1.8	3.3	V
RF input power: GSM850/EGSM900 transmit DCS1800/PCS1900 transmit TD/WCDMA transmit All receive ports	P_{IN}			 +36 (Note 2) +34 (Note 2) +30 +13	 dBm dBm dBm dBm
Storage temperature	T_{STG}	–60		+150	°C
Operating temperature	T_{OP}	–35		+85	°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.

Note 2: 12.5% to 50% duty cycle.

***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.*

Functional Description

The SKY18108-11 SP9T Antenna Switch Module can operation in one of nine states when the VDD signal is high. These states are controlled by the CTRL1 to CTRL4 pin signals.

Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY18108-11 are provided in Table 2. Electrical specifications are provided in Tables 3 and 4.

A plot of harmonic attenuation versus frequency is shown in Figure 3 (GSM850/EGSM900) and in Figure 4 (DCS1800/PCS1900).

The state of the SKY18108-11 is determined by the logic shown in Table 5.

Table 3. SKY18108-11 General Electrical Specifications (Note 1) (1 of 2)
(V_{DD} = 2.8 V, T_{OP} = +25 °C, Characteristic Impedance [Z_0] = 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition (Note 2)	Min	Typical	Max	Units
Insertion Loss						
GSM850/EGSM900_TX pin to ANT pin	IL	P_{IN} = +36 dBm:				
		824 to 915 MHz (NTC)		0.95	1.20	dB
		824 to 915 MHz (ETC)		1.03	1.30	dB
DCS1800/PCS1900_TX pin to ANT pin	IL	P_{IN} = +34 dBm:				
		1710 to 1910 MHz (NTC)		1.0	1.2	dB
		1710 to 1910 (ETC)		1.1	1.3	dB
ANT pin to GSM_RX1-4 pins	IL	P_{IN} = +13 dBm:				
		869 to 960 MHz (NTC)		0.80	1.10	dB
		869 to 960 MHz (ETC)		0.91	1.30	dB
		P_{IN} = +13 dBm:				
		1805 to 1990 MHz (NTC)		1.05	1.30	dB
		1805 to 1990 MHz (ETC)		1.17	1.50	dB
TD1/WCDMA1 pin to ANT pin	IL	700 to 960 MHz (NTC)		0.51	0.60	dB
		700 to 960 MHz (ETC)		0.61	0.70	dB
		1710 to 1920 MHz (NTC)		0.67	0.90	dB
		1710 to 1920 MHz (ETC)		0.77	1.10	dB
		2010 to 2025 MHz (NTC)		0.69	0.90	dB
		2010 to 2025 MHz (ETC)		0.79	1.10	dB
		2110 to 2700 MHz (NTC)		0.78	1.00	dB
		2110 to 2700 MHz (ETC)		0.88	1.20	dB
TD2/WCDMA2 and TD3/WCDMA3 pins to ANT pin	IL	700 to 960 MHz (NTC)		0.51	0.60	dB
		700 to 960 MHz (ETC)		0.61	0.70	dB
		1710 to 1920 MHz (NTC)		0.65	0.90	dB
		1710 to 1920 MHz (ETC)		0.75	1.10	dB
		2010 to 2025 MHz (NTC)		0.66	0.90	dB
		2010 to 2025 MHz (ETC)		0.76	1.10	dB
		2110 to 2700 MHz (NTC)		0.80	1.00	dB
		2110 to 2700 MHz (ETC)		0.90	1.20	dB
Harmonic Attenuation						
GSM850/EGSM900_TX pin to ANT pin second and third harmonics	2fo, 3fo	1648 to 1698 MHz	25	30		dB
		1760 to 1830 MHz	25	30		dB
		2472 to 2547 MHz	25	28		dB
		2640 to 2745 MHz	25	32		dB
DCS1800/PCS1900_TX pin to ANT pin second and third harmonics	2fo, 3fo	3420 to 3820 MHz	25	28		dB
		5130 to 5730 MHz	25	28		dB
Isolation						
GSM850/EGSM900_TX pin to GSM_RX1 pin	Iso	824 to 915 MHz	30	46		dB
GSM850/EGSM900_TX pin to GSM_RX2 pin			30	52		dB
GSM850/EGSM900_TX pin to GSM_RX3 pin			30	54		dB
GSM850/EGSM900_TX pin to GSM_RX4 pin			30	63		dB
GSM850/EGSM900_TX pin to ANT pin (GSM receive mode)	Iso	824 to 915 MHz	20	30		dB
DCS1800/PCS1900_TX pin to GSM_RX1 pin	Iso	1710 to 1910 MHz	30	41		dB
DCS1800/PCS1900_TX pin to GSM_RX2 pin			30	49		dB
DCS1800/PCS1900_TX pin to GSM_RX3 pin			35	46		dB
DCS1800/PCS1900_TX pin to GSM_RX4 pin			35	46		dB
DCS1800/PCS1900_TX pin to ANT pin (GSM receive mode)			20	26		dB

Table 3. SKY18108-11 General Electrical Specifications (Note 1) (2 of 2)
(V_{DD} = 2.8 V, T_{OP} = +25 °C, Characteristic Impedance [Z_0] = 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition (Note 2)	Min	Typical	Max	Units
Isolation (continued)						
TD1/WCDMA1 pin to TD2/WCDMA2 pin	Iso	700 to 960 MHz 1880 to 3000 MHz	25 18	29 22		dB dB
TD1/WCDMA1 pin to TD3/WCDMA3 pin	Iso	ANT pin to TD1/WCDMA1 pin on: 700 to 960 MHz 1880 to 3000 MHz	 35 20	 40 31		 dB dB
TD1/WCDMA1 pin to ANT pin	Iso	ANT pin to TD2/WCDMA2 pin on: 700 to 960 MHz 1880 to 2025 MHz	 35 25	 40 36		 dB dB
TD1/WCDMA1 pin to ANT pin	Iso	ANT pin to TD3/WCDMA3 pin on: 700 to 960 MHz 1880 to 2025 MHz	 35 25	 45 38		 dB dB
Voltage Standing Wave Ratio (VSWR)						
GSM850/EGSM900_TX pin to ANT pin	VSWR	824 to 915 MHz, GSM850/EGSM900_TX pin to ANT pin on		1.4:1	1.6:1	–
GSM850/EGSM900_TX pin to ANT pin	VSWR	1710 to 1910 MHz, DCS1800/PCS1900_TX pin to ANT pin on		1.4:1	1.6:1	–
GSM_RX1-4 pins	VSWR	869 to 960 MHz 1805 to 1990 MHz		1.2:1 1.4:1	1.6:1 1.6:1	– –
TD1/WCDMA1 pin	VSWR	1880 to 1920 MHz 2010 to 2025 MHz		1.2:1 1.3:1	1.6:1 1.6:1	– –
TD2/WCDMA2 pin	VSWR	1880 to 1920 MHz 2010 to 2025 MHz		1.2:1 1.3:1	1.6:1 1.6:1	–
TD3/WCDMA3 pin	VSWR	1880 to 1920 MHz 2010 to 2025 MHz		1.2:1 1.3:1	1.6:1 1.6:1	–
Operating Modes and Current Consumption						
GSM850/EGSM900 transmit	I_{CC}			25	50	µA
DCS1800/PCS1900 transmit	I_{CC}			25	50	µA
TD/WCDMA transmit	I_{CC}			25	50	µA
GSM receive	I_{CC}			25	50	µA
TD/WCDMA receive	I_{CC}			25	50	µA
Control current	I_{CTRL}			1.5	20	µA
Switching Time						
Rise/fall		50% control to 90% RF		2.5	5.0	µs

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

Note 2: NTC = Normal test conditions (T_A = 25 °C, V_{DD} = 2.8 V).
ETC = Extreme test conditions (T_A = –35 °C to +85 °C, V_{DD} = 2.65 to 3.30 V).

Table 4. SKY18108-11 Large Signal Electrical Specifications (Note 1)
(V_{DD} = 2.8 V, T_{OP} = +25 °C, Characteristic Impedance [Z_0] = 50 Ω, Unless Otherwise Noted)

Parameter	Symbol	Test Condition	Min	Typical	Max	Units
Harmonic Power						
GSM850/EGSM900_TX pin to ANT pin		1648 to 1830 MHz, P_{IN} = +35 dBm		–50	–35	dBm
		2472 to 2745 MHz, P_{IN} = +35 dBm		–58	–35	dBm
DCS1800/PCS1900_TX pin to ANT pin		3420 to 3820 MHz, P_{IN} = +32 dBm		–64	–35	dBm
		5130 to 5730 MHz, P_{IN} = +32 dBm		–55	–35	dBm
TD1/WCDMA1 pin to ANT pin		3760 to 4050 MHz, P_{IN} = +26 dBm		–58	–35	dBm
		5640 to 6075 MHz, P_{IN} = +26 dBm		–64	–35	dBm
TD2/WCDMA2 pin to ANT pin		3760 to 4050 MHz, P_{IN} = +26 dBm		–64	–35	dBm
		5640 to 6075 MHz, P_{IN} = +26 dBm		–69	–35	dBm
TD3/WCDMA3 pin to ANT pin		3760 to 4050 MHz, P_{IN} = +26 dBm		–63	–35	dBm
		5640 to 6075 MHz, P_{IN} = +26 dBm		–69	–35	dBm

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

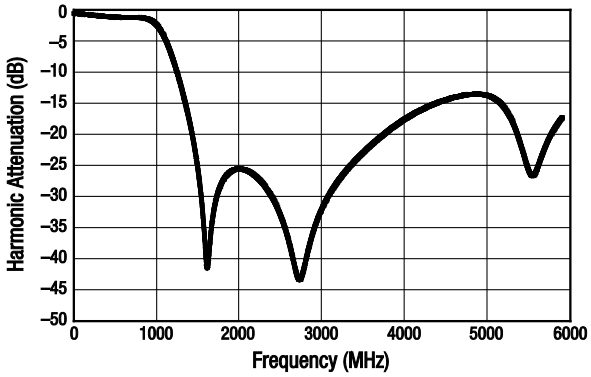


Figure 3. GSM850/EGSM900 Transmit Harmonic Attenuation vs Frequency

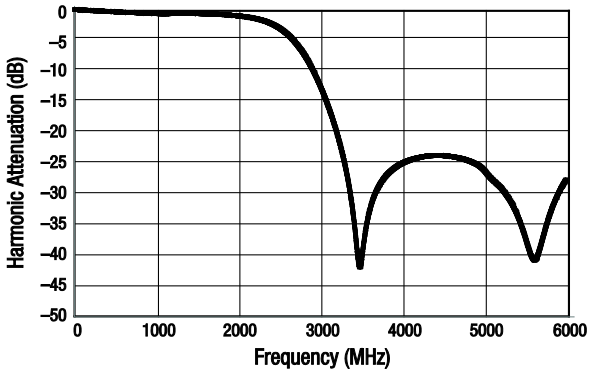


Figure 4. DCS1800/PCS1900 Transmit Harmonic Attenuation vs Frequency

Table 5. SKY18108-11 Control Logic (Note 1)

Pin/Mode	CTRL1 (Pin 1)	CTRL2 (Pin 20)	CTRL3 (Pin 19)	CTRL4 (Pin 18)
GSM850/EGSM900_TX	High	High	Low	Low
DCS1800/PCS1900_TX	High	Low	Low	Low
TD1/WCDMA1	High	Low	High	Low
TD2/WCDMA2	High	High	High	Low
TD3/WCDMA3 (Note 2)	X	X	X	High
GSM_RX1	Low	Low	Low	Low
GSM_RX2	Low	Low	High	Low
GSM_RX3	Low	High	High	Low
GSM_RX4	Low	High	Low	Low

Note 1: "High" = 1.8 V; "Low" = 0 V; "X X X" = Don't Care (all combinations except for "High High High"). Any state other than that described in this Table places the switch into an undefined state. An undefined state will not damage the device.

Note 2: The TD3/WCDMA3 state is enabled by any combination of logic except for "high, high, high, high."

Evaluation Board Description

The SKY18108-11 Evaluation Board is used to test the performance of the SKY18108-11 SP9T Antenna Switch Module. An Evaluation Board schematic diagram is provided in Figure 5. Component values for the SKY18108-11 Evaluation Board are listed in Table 6. An assembly drawing for the Evaluation Board is shown in Figure 6.

Package Dimensions

The PCB layout footprint for the SKY18108-11 is provided in Figure 7. Typical case markings are shown in Figure 8. Package dimensions for the 20-pin MCM are shown in Figure 9, and tape and reel dimensions are provided in Figure 10.

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 SKY18108-11 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.

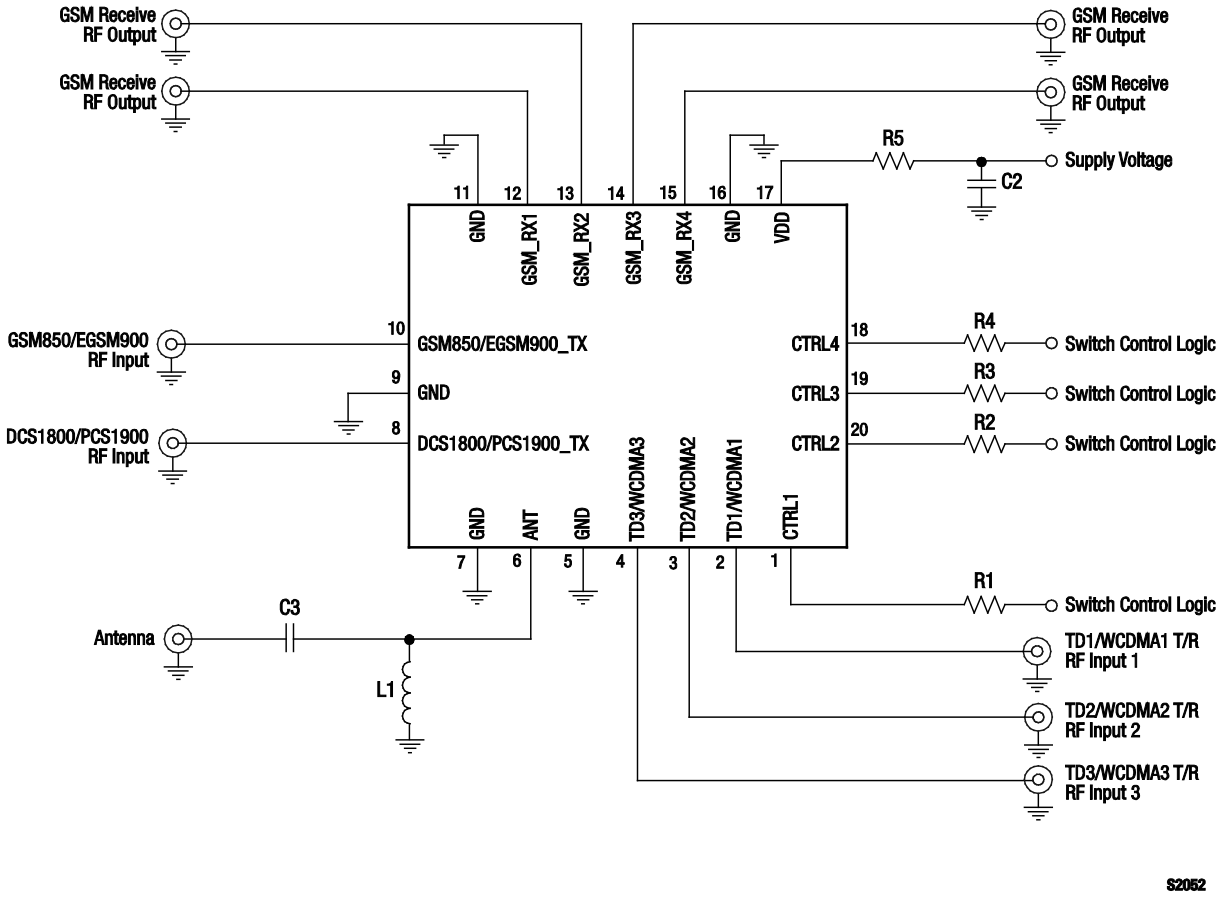


Figure 5. SKY18108-11 Evaluation Board Schematic

Table 6. SKY18108-11 Evaluation Board Bill of Materials

Component	Value	Size
C2	100 nF	0201
C3	10 pF	0201
L1	18 nH	0201
R1	1.3 kΩ	0201
R2	1.3 kΩ	0201
R3	1.3 kΩ	0201
R4	1.3 kΩ	0201
R5	510 Ω	0201

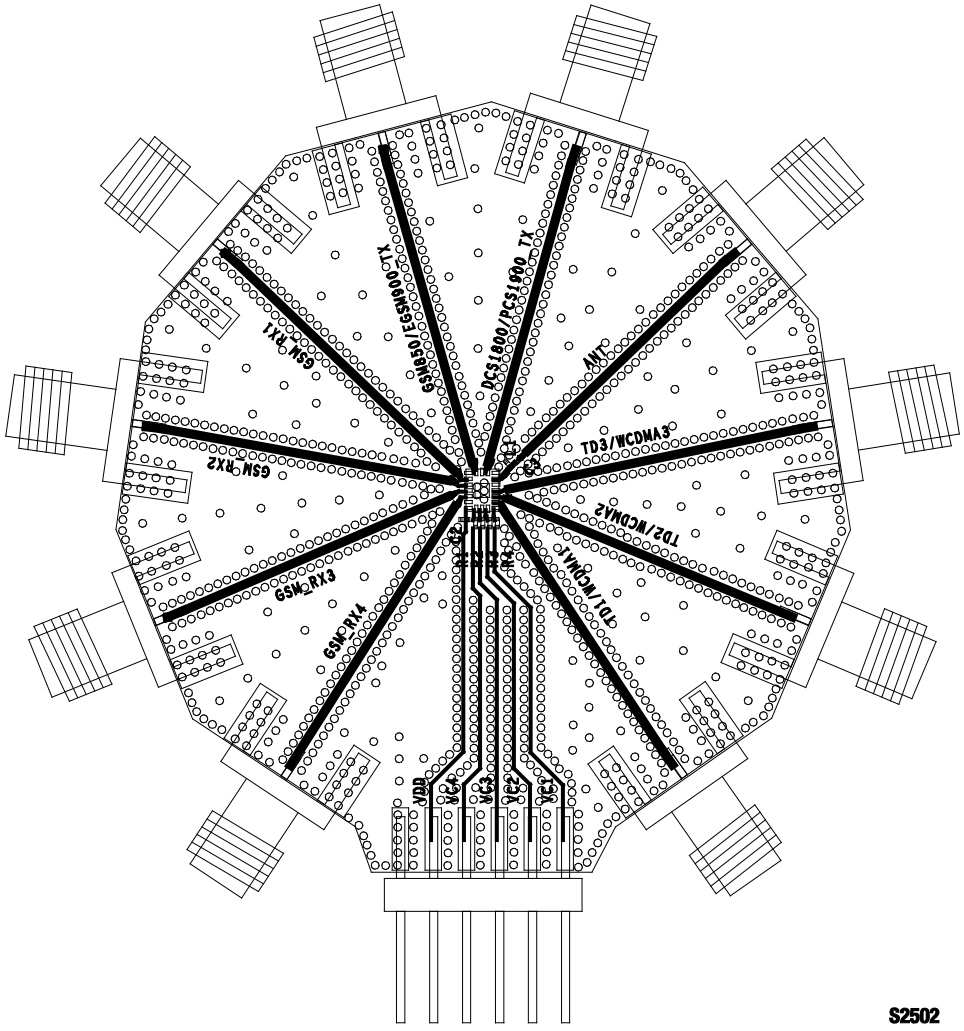


Figure 6. SKY18108-11 Evaluation Board Assembly Diagram

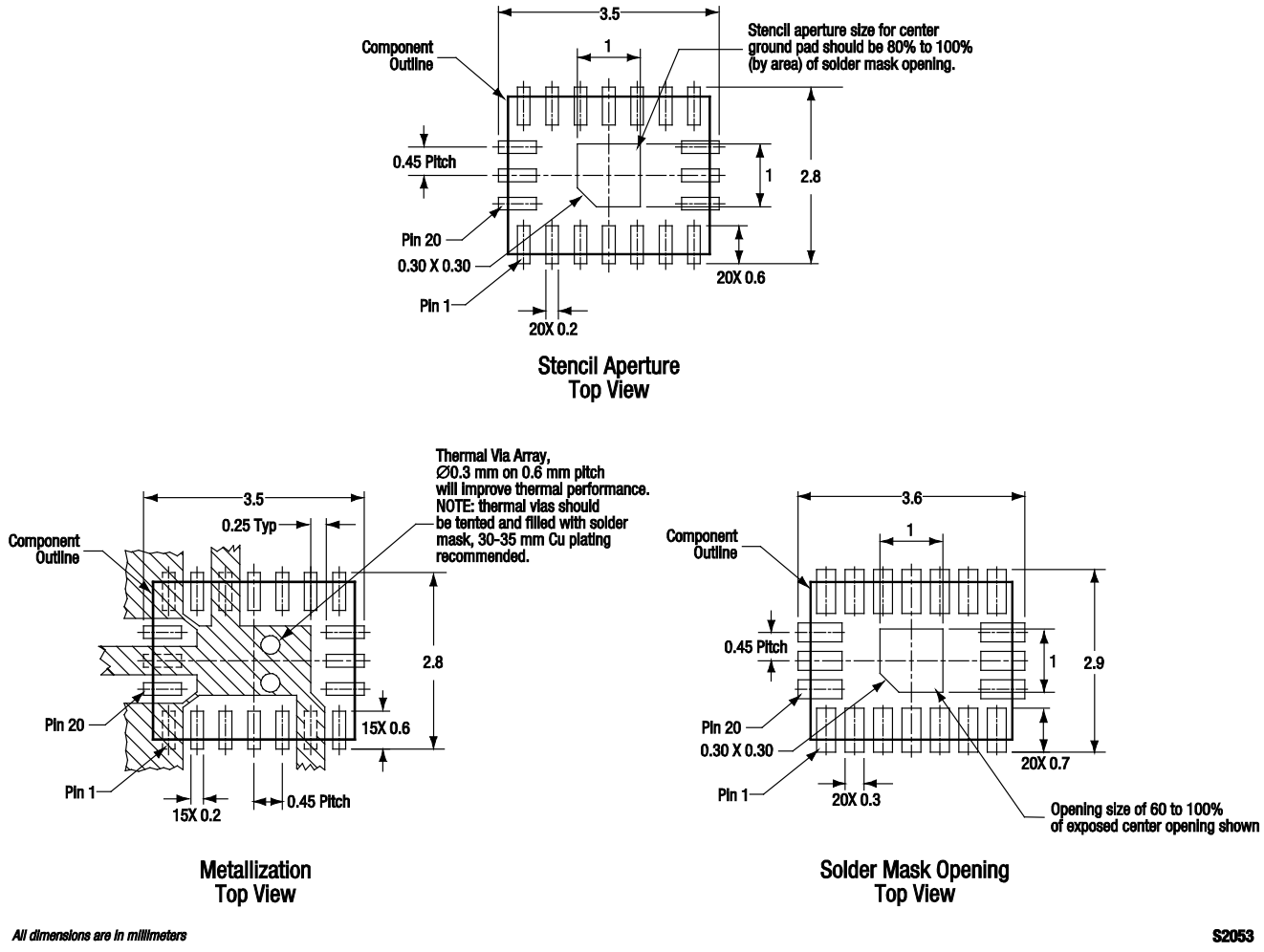


Figure 7. SKY18108-11 PCB Layout Footprint
(Top View)

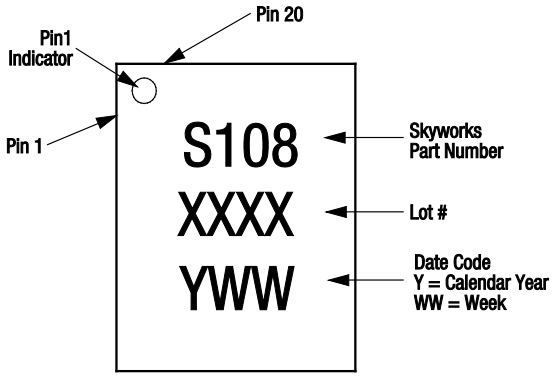


Figure 8. Typical Part Markings
(Top View)

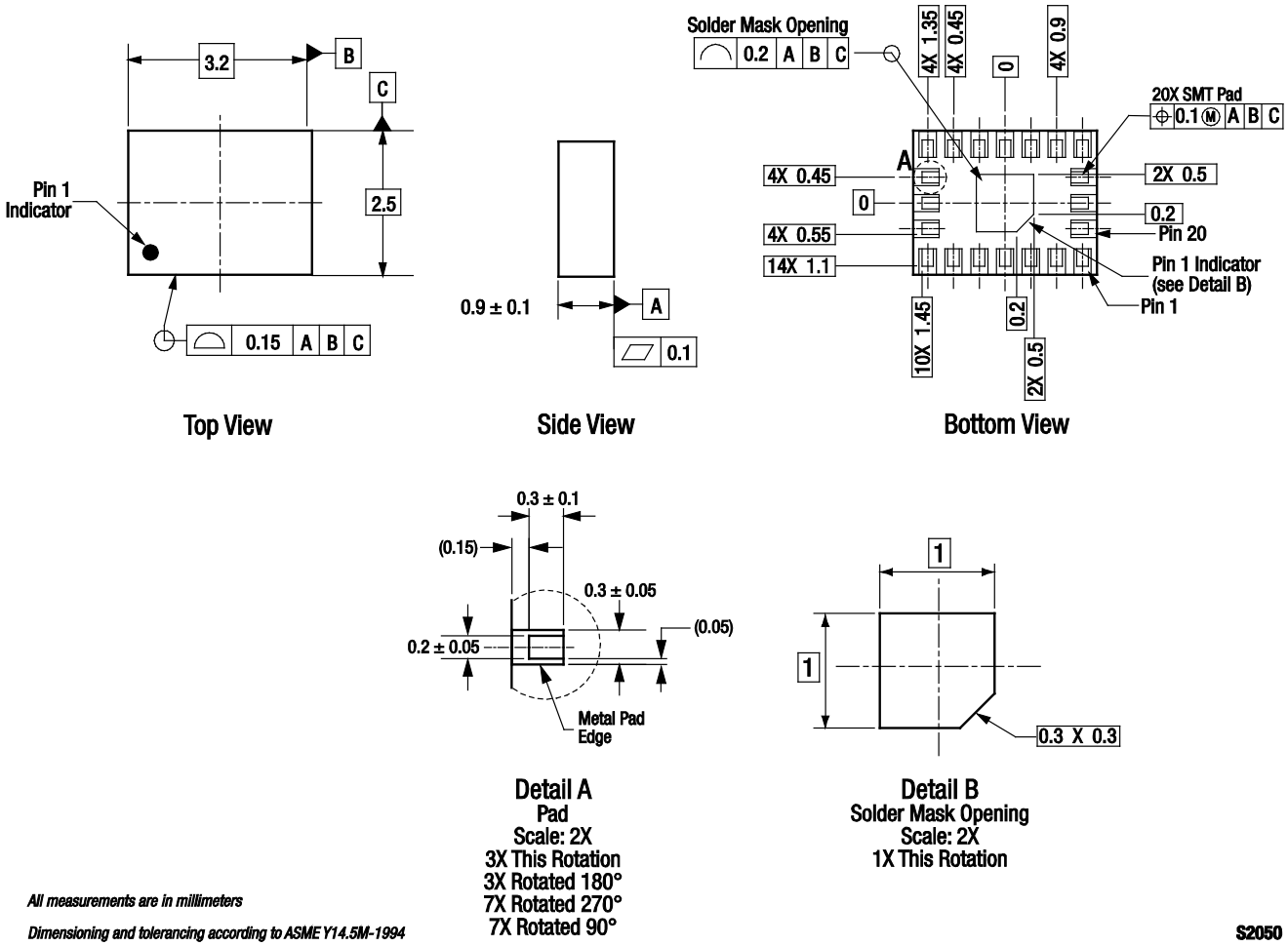
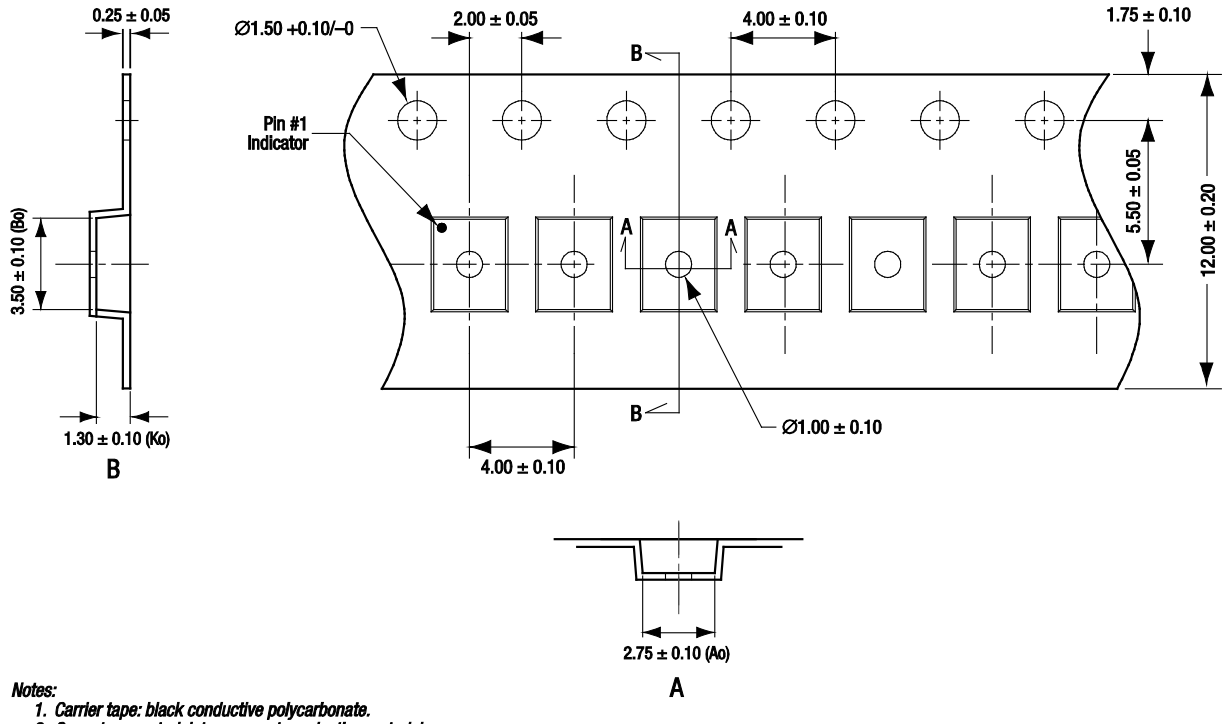


Figure 9. SKY18108-11 20-Pin MCM Package Dimensions



Notes:

1. *Carrier tape: black conductive polycarbonate.*
2. *Cover tape material: transparent conductive material.*
3. *ESD-surface resistivity is ≤1 x 10^{10} Ohms/square per EIA, JEDEC TNR Specification.*
4. *10 sprocket hole pitch cumulative tolerance: ±0.20 mm*
5. *Ao and Bo measusred on plane 0.30 mm above the bottom of the pocket.*
6. *All measurements are in millimeters.*

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Figure 10. SKY18108-11 Tape and Reel Dimensions

Ordering Information

Model Name	Manufacturing Part Number	Evaluation Board Part Number
SKY18108-11 0.4-2.7 GHz SP9T Switch	SKY18108-11	EN32-0375-001

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