DATA SHEET

SKY5A2110: Sky5® Automotive GNSS L1 + L5 Dual-Frequency Low-Noise Amplifier Front-End Module with Pre- and Post-Filter and Diplexed Output

Applications

- Automotive active antennas
- Telematics control units (TCU)
- Automotive OBD-II modules
- Personal navigation devices

Features

- Integrated input and output matching and filtering on GNSS L1 and GNSS L5 paths (with integrated B13 notch on L1 path)
- Dedicated GNSS L1 and GNSS L5 receive paths with single diplexed output
- High gain: 18 dB typical
- Low NF: 1.5 dB typical
- Robust IIP3: –8 dBm typical
- Low current consumption: 9 mA @ 1.8 V
- Single, wide dc supply range: 1.5 to 3.6 V
- AEC-Q104 Grade 2 reliability qualification
- Wide automotive operating temperature: –40 °C to +105 °C
- Robust ESD: 2 kV HBM, 1 kV CDM
- Compact auto friendly MCM package, 26-pin, 2.2 (W) x 2.7 (L) x 0.75 (H nominal) mm
- MSL3, 260 °C per JEDEC J-STD-020
- For RoHS and other product compliance information, see the Skyworks Certificate of Conformance.

Description

The SKY5A2110 front-end module (FEM) features an integrated L1 low-noise amplifier (LNA) and post-filter along with an L5 LNA and post-filter designed for Global Navigation Satellite System (GNSS) receiver applications.

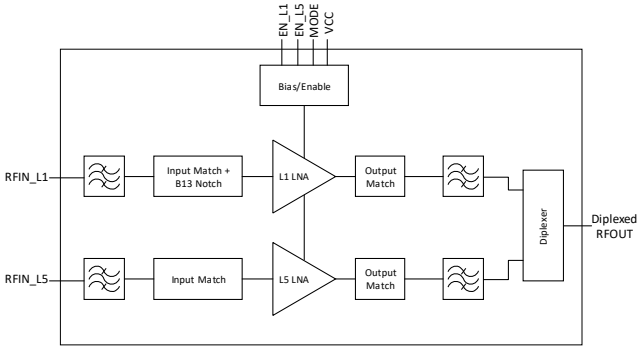


Figure 1. Functional Block Diagram

Part of our Sky5® portfolio, the SKY5A2110 provides high gain, low current consumption, and integrated input and output matching for both GNSS L1 and GNSS L5, all in a compact package.

The L1 path also features an integrated B13 notch filter, providing excellent suppression (–105 dBm) of cellular low-band second harmonic signals impacting GPS L1 reception.

The post-filtering on the L5 path also provides high (less than –70 dB) out-of-band rejection for interference below 1 GHz.

The SKY5A2110 uses surface-mount technology (SMT) in a Multi-Chip Module (MCM), a proven and highly manufacturable solution.

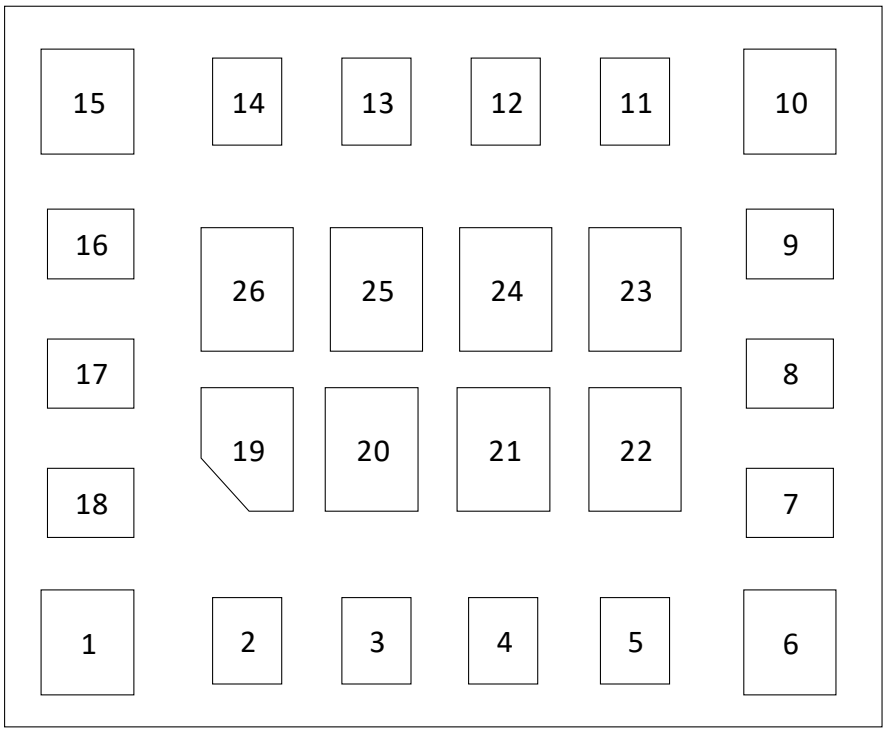


Figure 2. Pinout (Top View)

Table 1. Signal Descriptions

Pin	Name	Description	Pin	Name	Description
1	GND	Ground	14	GND	Ground
2	GND	Ground	15	GND	Ground
3	EN_L5	L5 enable	16	RFIN_L1	L1 RF input
4	MODE	Mode select	17	GND	Ground
5	EN_L1	L1 enable	18	RFIN_L5	L5 RF input
6	GND	Ground	19	GND	Ground
7	GND	Ground	20	GND	Ground
8	RFOUT	RF output	21	GND	Ground
9	GND	Ground	22	GND	Ground
10	GND	Ground	23	GND	Ground
11	GND	Ground	24	GND	Ground
12	VCC	Supply	25	GND	Ground
13	GND	Ground	26	GND	Ground

Technical Description

LNA Control

The EN_L5 (pin 3) and EN_L1 (pin 5) signals enable or disable the L5 and L1 LNAs, respectively. A logic high powers on the LNA and a logic low powers off the device.

The MODE (pin 4) controls the LNA current. Logic low puts the part into low current mode and logic high puts the part into the standard operating mode.

Electrical and Mechanical Specifications

The absolute maximum ratings of the SKY5A2110 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. Absolute Maximum Ratings[1]

Parameter	Symbol	Minimum	Maximum	Units
RF input power	P_{IN}		+10	dBm
Supply voltage	V_{CC}	0	3.9	V
Storage temperature	T_{STG}	–40	+105	°C
Junction temperature	T_J		+105	°C
Electrostatic discharge:				
Charged-Device Model (CDM), Class 3	ESD		1000	V
Human Body Model (HBM), Class 1A			2000	

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: Industry-standard ESD handling precautions must be adhered to at all times to avoid damage to this device.

Table 3. Recommended Operating Conditions

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Operating frequency	f_L1	GPS	1574.397	1575.42	1576.443	MHz
	f_E1	Galileo	1569.42	1575.42	1581.42	MHz
	f_B1I	BeiDou	1559	1561	1563	MHz
	f_G1	Glonass	1598	1602	1606	MHz
Supply voltage	V_{CC}		1.5	1.8	3.6	V
LNA control	EN_L1_HIGH	EN_HIGH MODE_HIGH	1.5	1.8	VCC	V
	EN_L1_LOW	EN_LOW MODE_LOW	-	0	0.3	V
	EN_L5_HIGH	EN_HIGH MODE_HIGH	1.5	1.8	V_{CC}	V
	EN_L5_LOW	EN_LOW MODE_LOW	-	0	0.3	V
Operating temperature	NTC	Nominal temperature condition	-	25	-	°C
	ETC	Extreme temperature condition	–30	-	85	°C
	A-ETC	Automotive extreme temperature condition	–40	-	105	°C

Table 4. GNSS L1 General Electrical Specifications

Unless Otherwise Specified: V_{CC} = 1.8 V, VEN = 1.8 V, P_{IN} = –40 dBm, T_A = 25 °C, MODE = 1

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Supply current	IDD_NTC	No RF, NTC	-	4.8	10	mA
Supply current extreme	IDD_ETC	No RF, ETC	-	5.3	10	mA
Supply current automotive extreme	IDD_A-ETC	No RF, A-ETC	-	5.3	10	mA
Low current mode	IDD_LCM	No RF, MODE = 0	-	1.23	-	mA
Shutdown current	I_LEAK	No RF, VEN = 0	-	0.12	-	µA
Logic current	I_LOGIC_HIGH	VCC 1.8 V, EN_L1 = 1.8 V	-	0.05	-	µA
	I_LOGIC_LOW	VCC 1.8 V, EN_L1 = 0 V	-	0.04	-	µA
LNA turn on time	T_ON	VCC = 1.8 V, 50% of V_EN to 90% final RF power	-	-	5	µs
LNA turn off time	T_OFF	VCC = 1.8 V, 50% of V_EN to 10% final RF power	-	-	5	µs
Out-of-band rejection	OOB_GAIN_LB	600 to 1000 MHz	-	–61	–53	dB
	OOB_GAIN_MB	1710 to 1980 MHz	-	–66.2	–47	dB
	OOB_GAIN_B40	2300 to 2400 MHz	-	–64.1	–60	dB
	OOB_GAIN_B41	2496 to 2690 MHz	-	–62.8	–60	dB
	OOB_GAIN_B77	3300 to 4200 MHz	-	–63.9	–59	dB
	OOB_GAIN_B79	4400 to 5000 MHz	-	–66	–51	dB
	OOB_GAIN_B13_B14	777 to 798 MHz	-	–58.1	–47	dB
	OOB_GAIN_2.4G_WiFi	2400 to 2500 MHz	-	–63.3	–42	dB
	OOB_GAIN_5G_WIFi	5160 to 5560 MHz	-	–65.2	–42	dB
	OOB_GAIN_WiFi7	5150 to 7125 MHz	-	–63.7	–50	dB
B13 second harmonics	B13_2Fo	NTC	-	–108.5	–97	dBm
	B13_2Fo	NTC, VCC = 3.3 V	-	–111.6	–104	dBm
	B13_2Fo_ETC	ETC	-	–108.6	–93	dBm
	B13_2Fo_ETC	ETC, VCC = 3.3 V	-	–111.5	–101	dBm
	B13_2Fo_A-ETC	A-ETC	-	–111.5	–99	dBm
	B13_2Fo_A-ETC	A-ETC, VCC = 3.3 V	-	–108.6	–91	dBm
LNA stability, k factor	STABILITY_A-ETC	A-ETC, 10 to 15000 MHz	1.5	-	-	k

Table 5. GNSS L5 General Electrical Specifications

Unless Otherwise Specified: V_{CC} = 1.8 V, VEN = 1.8 V, P_{IN} = –40 dBm, T_A = 25 °C, MODE = 1

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Supply current	IDD_NTC	No RF, NTC	-	5	10	mA
Supply current extreme	IDD_ETC	No RF, ETC	-	5.5	10	mA
Supply current automotive extreme	IDD_A-ETC	No RF, A-ETC	-	5.5	10	mA
Low current mode	IDD_LCM	No RF, MODE = 0	-	1.27	-	mA
Shutdown current	I_LEAK	No RF, VEN = 0	-	0.12	-	µA
Logic current	I_LOGIC_HIGH	V_{CC} 1.8 V, EN_L5 = 1.8 V	-	0.05	-	µA
	I_LOGIC_LOW	V_{CC} 1.8 V, EN_L5 = 0 V	-	0.04	-	µA
LNA turn on time	T_ON	V_{CC} = 1.8 V, 50% of V_EN to 90% final RF power	-	-	5	µs
LNA turn off time	T_OFF	V_{CC} = 1.8 V, 50% of V_EN to 10% final RF power	-	-	5	µs
Out-of-band rejection	OOB_GAIN_LB	600 to 1000 MHz	-	–70.5	–65	dB
	OOB_GAIN_MB	1710 to 1980 MHz	-	–79.5	–47	dB
	OOB_GAIN_B40	2300 to 2400 MHz	-	–69.9	–60	dB
	OOB_GAIN_B41	2496 to 2690 MHz	-	–69.9	–61	dB
	OOB_GAIN_B77	3300 to 4200 MHz	-	–65	–60	dB
	OOB_GAIN_B79	4400 to 5000 MHz	-	–65.8	–57	dB
	OOB_GAIN_2.4G_WiFi	2400 to 2500 MHz	-	–68.6	–42	dB
	OOB_GAIN_5G_WiFi	5160 to 5560 MHz	-	–65.8	–42	dB
	OOB_GAIN_WiFi7	5150 to 7125 MHz	-	–64.8	–52	dB
LNA stability, k factor	STABILITY_A-ETC	A-ETC	1.5	-	-	k

Table 6. GPS L1 and Galileo E1 Electrical Specifications

Unless Otherwise Specified: V_{CC} = 1.8 V, VEN = 1.8 V, P_{IN} = –40 dBm, MODE = 1

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Operating frequency	ƒ_L1	GPS	1574.397	1575.42	1576.443	MHz
	ƒ_E1	Galileo	1569.42	1575.42	1581.42	MHz
Small signal gain	SSG_S21_L1_E1	NTC	17	18.8	21	dB
	SSG_S21_L1_E1	NTC, VCC = 3.3 V	17	19.5	22	dB
Small signal gain extreme	SSG_S21_L1_E1_ETC	ETC	16	18.8	23.25	dB
	SSG_S21_L1_E1_ETC	ETC, VCC = 1.8 V, 3.3 V	17	19.6	24	dB
Small signal gain automotive extreme	SSG_S21_L1_E1_A-ETC	A-ETC	16	18.7	23.75	dB
	SSG_S21_L1_E1_A-ETC	A-ETC, VCC = 1.8 V, 3.3 V	17	19.5	24.5	dB
Gain with LB blocker	SSG_OOB_LB_L1	NTC, blocker input power = 15 dBm, blocker frequency = 600 to 960 MHz	17	19.1	21.0	dB
Gain with MB blocker	SSG_OOB_MB_L1	NTC, blocker input power = 10 dBm, blocker frequency = 1700 to 2000 MHz	15	18.2	21.0	dB
Gain with HB blocker	SSG_OOB_HB_L1	NTC, blocker input power = 10 dBm, blocker frequency = 2000 to 3000 MHz	17	19.2	21.0	dB
Gain with UHB blocker	SSG_OOB_UHB_L1	NTC, blocker input power = 10 dBm, blocker frequency = 3000 to 8000 MHz	17	19.3	21.3	dB
Gain with LB blocker	SSG_OOB_LB_E1	NTC, blocker input power = 15 dBm, blocker frequency = 600 to 960 MHz	17	19.1	21.0	dB
Gain with MB blocker	SSG_OOB_MB_E1	NTC, blocker input power = 10 dBm, blocker frequency = 1700 to 2000 MHz	15	18.2	21.0	dB
Gain with HB blocker	SSG_OOB_HB_E1	NTC, blocker input power = 10 dBm, blocker frequency = 2000 to 3000 MHz	17	19.2	21.0	dB
Gain with UHB blocker	SSG_OOB_UHB_E1	NTC, blocker input power = 10 dBm, blocker frequency = 3000 to 8000 MHz	17	19.3	21.3	dB
Small signal gain low current mode	SSG_S21_L1_E1_LC	NTC, MODE = 0	-	11.6	-	dB
Noise figure	NF_L1_E1	NTC	-	1.2	1.7	dB
	NF_L1_E1	NTC, VCC = 3.3 V	-	1.2	1.7	dB
Noise figure extreme	NF_L1_E1_ETC	ETC	-	1.2	2.2	dB
	NF_L1_E1_ETC	ETC, VCC = 3.3 V	-	1.2	2.3	dB
Noise figure automotive extreme	NF_L1_E1_A-ETC_A-ETC	A-ETC	-	1.3	2.4	dB
	NF_L1_E1_A-ETC_A-ETC	A-ETC, VCC = 3.3 V	-	1.3	2.4	dB
In-band IIP3	IIP3_L1_E1	NTC	–13	–8.6	-	dB
In-band IIP3 extreme	IIP3_L1_E1_ETC	ETC, VCC = 1.5 V to 3.6 V	–16	–8.2	-	dB
In-band IIP3 automotive extreme	IIP3_L1_E1_A-ETC	A-ETC, VCC = 1.5 V to 3.6 V	–16	–8.2	-	dB
In-band P1dB	P1dB_IB_L1_E1	NTC	–23	–18.6	-	dB
In-band P1dB extreme	P1dB_IB_L1_E1_ETC	ETC, VCC = 1.5 V to 3.6 V	–25	–18.1	-	dB
In-band P1dB automotive extreme	P1dB_IB_L1_E1_A-ETC	A-ETC, VCC = 1.5 V to 3.6 V	–25	–18	-	dB

Table 6. GPS L1 and Galileo E1 Electrical Specifications (Continued)

Unless Otherwise Specified: V_{CC} = 1.8 V, VEN = 1.8 V, P_{IN} = –40 dBm, MODE = 1

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Reverse isolation	S12_L1_E1	NTC	34	39.1	-	dB
Reverse isolation extreme	S12_L1_E1_ETC	ETC, VCC = 1.5 V to 3.6 V	33	39	-	dB
Reverse isolation automotive extreme	S12_L1_E1_A-ETC	A-ETC, VCC = 1.5 V to 3.6 V	33	39.1	-	dB
Input return loss	S11_L1_E1	NTC	5.5	-	-	dB
Input return loss extreme	S11_L1_E1_ETC	ETC, VCC = 1.5 V to 3.6 V	-	7.7	-	dB
Input return loss automotive extreme	S11_L1_E1_A-ETC	A-ETC, VCC = 1.5 V to 3.6 V	-	8	-	dB
Output return loss	S22_L1_E1	NTC	7	12.1	-	dB
Output return loss extreme	S22_L1_E1_ETC	ETC, VCC = 1.5 V to 3.6 V	-	13	-	dB
Output return loss automotive extreme	S22_L1_E1_A-ETC	A-ETC, VCC = 1.5 V to 3.6 V	-	13.2	-	dB
Group delay (spot)	GD_L1_E1	NTC	-	32	-	ns
Group delay variation (peak-to-peak)	GDV_E1	NTC	-	5.3	-	ns
Group delay variation (peak-to-peak)	GDV_L1	NTC	-	1.5	-	ns

Table 7. Beidou B1I Electrical Specifications

Unless Otherwise Specified: V_{CC} = 1.8 V, VEN = 1.8 V, P_{IN} = –40 dBm, MODE = 1

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Operating frequency	ƒ_B1I	BeiDou	1559	1561	1563	MHz
Small signal gain	SSG_S21_B1I	NTC	17	19.5	21	dB
	SSG_S21_B1I	NTC, VCC = 3.3 V	17	20.5	22	dB
Small signal gain extreme	SSG_S21_B1I_ETC	ETC	17	19.3	23	dB
	SSG_S21_B1I_ETC	ETC, VCC = 3.3 V	18	20.4	24	dB
Small signal gain automotive extreme	SSG_S21_B1I_A-ETC	A-ETC	16	19.1	24	dB
	SSG_S21_B1I_A-ETC	A-ETC, VCC = 3.3 V	18	20.3	24	dB
Gain with LB blocker	SSG_OOB_LB_B1I	NTC, blocker input power = 15 dBm, blocker frequency = 600 to 960 MHz	17	19.4	21	dB
Gain with MB blocker	SSG_OOB_MB_B1I	NTC, blocker input power = 10 dBm, blocker frequency = 1700 to 2000 MHz	15	18.3	21	dB
Gain with HB blocker	SSG_OOB_HB_B1I	NTC, blocker input power = 10 dBm, blocker frequency = 2000 to 3000 MHz	17	19.5	21	dB
Gain with UHB blocker	SSG_OOB_UHB_B1I	NTC, blocker input power = 10 dBm, blocker frequency = 3000 to 8000 MHz	17	19.5	21	dB
Small signal gain low current mode	SSG_S21_B1I_LC	NTC, MODE = 0	-	11.04	-	dB
Noise figure	NF_B1I	NTC	-	1.3	1.7	dB
	NF_B1I	NTC, VCC = 3.3 V	-	1.3	2.0	dB
Noise figure extreme	NF_B1I_ETC	ETC	-	1.3	2.2	dB
	NF_B1I_ETC	ETC, VCC = 3.3 V	-	1.3	2	dB

Table 7. Beidou B1I Electrical Specifications (Continued)

Unless Otherwise Specified: V_{CC} = 1.8 V, VEN = 1.8 V, P_{IN} = –40 dBm, MODE = 1

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Noise figure automotive extreme	NF_B1I_A-ETC_A-ETC	A-ETC	-	1.4	2.4	dB
	NF_B1I_A-ETC_A-ETC	A-ETC, VCC = 3.3 V	-	1.4	2	dB
In-band IIP3	IIP3_B1I	NTC	–13	–8.6	-	dB
In-band IIP3 extreme	IIP3_B1I_ETC	ETC, VCC = 1.5 V to 3.6 V	–16	–8.2	-	dB
In-band IIP3 automotive extreme	IIP3_B1I_A-ETC	A-ETC, VCC = 1.5 V to 3.6 V	–16	–8.2	-	dB
In-band P1dB	P1dB_IB_B1I	NTC	–23.0	–18.6	-	dB
In-band P1dB extreme	P1dB_IB_B1I_ETC	ETC, VCC = 1.5 V to 3.6 V	–25.0	–18.1	-	dB
In-band P1dB automotive extreme	P1dB_IB_B1I_A-ETC	A-ETC, VCC = 1.5 V to 3.6 V	–25.0	–18	-	dB
Reverse isolation	S12_B1I	NTC	34	39	-	dB
Reverse isolation extreme	S12_B1I_ETC	ETC, VCC = 1.5 V to 3.6 V	34	39	-	dB
Reverse isolation automotive extreme	S12_B1I_A-ETC	A-ETC, VCC = 1.5 V to 3.6 V	34	39.2	-	dB
Input return loss	S11_B1I	NTC	8	13.5	-	dB
Input return loss extreme	S11_B1I_ETC	ETC, VCC = 1.5 V to 3.6 V	-	12.8	-	dB
Input return loss automotive extreme	S11_B1I_A-ETC	A-ETC, VCC = 1.5 V to 3.6 V	-	13	-	dB
Output return loss	S22_B1I	NTC	7.5	11.2	-	dB
Output return loss extreme	S22_B1I_ETC	ETC, VCC = 1.5 V to 3.6 V	-	10.8	-	dB
Output return loss automotive extreme	S22_B1I_A-ETC	A-ETC, VCC = 1.5 V to 3.6 V	-	10.6	-	dB
Group delay (spot)	GD_B1I	NTC	-	40.9	-	ns
Group delay variation (peak-to-peak)	GDV_B1I	NTC	-	3	-	ns

Table 8. Glonass G1 Electrical Specifications

Unless Otherwise Specified: V_{CC} = 1.8 V, VEN = 1.8 V, P_{IN} = –40 dBm, MODE = 1

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Operating frequency	ƒ_G1	Glonass	1598	1602	1606	MHz
Small signal gain	SSG_S21_G1	NTC	16.75	18.2	20.5	dB
	SSG_S21_G1	NTC, VCC = 3.3 V	17	19.2	21.5	dB
Small signal gain extreme	SSG_S21_G1_ETC	ETC	12.75	17.8	22.75	dB
	SSG_S21_G1_ETC	ETC, VCC = 3.3 V	13.75	18.9	22.75	dB
Small signal gain automotive extreme	SSG_S21_G1_A-ETC	A-ETC	12	17.5	22.75	dB
	SSG_S21_G1_A-ETC	A-ETC, VCC = 3.3 V	13	18.7	23	dB
Gain with LB blocker	SSG_OOB_LB_G1	NTC, blocker input power = 15 dBm, blocker frequency = 600 to 960 MHz	15	17.9	20.75	dB
Gain with MB blocker	SSG_OOB_MB_G1	NTC, blocker input power = 10 dBm, blocker frequency = 1700 to 2000 MHz	12.25	17	20.75	dB
Gain with HB blocker	SSG_OOB_HB_G1	NTC, blocker input power = 10 dBm, blocker frequency = 2000 to 3000 MHz	15	18	21	dB

Table 8. Glonass G1 Electrical Specifications (Continued)

Unless Otherwise Specified: V_{CC} = 1.8 V, VEN = 1.8 V, P_{IN} = –40 dBm, MODE = 1

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Gain with UHB blocker	SSG_OOB_UHB_G1	NTC, blocker input power = 10 dBm, blocker frequency = 3000 to 8000 MHz	14.75	18.1	21	dB
Small signal gain low current mode	SSG_S21_G1_LC	NTC, MODE = 0	-	10	-	dB
Noise figure	NF_G1	NTC	-	1.5	2.5	dB
	NF_G1	NTC, VCC = 3.3 V	-	1.5	2.6	dB
Noise figure extreme	NF_G1_ETC_ETC	ETC	-	1.6	3.0	dB
	NF_G1_ETC_ETC	ETC, VCC = 3.3 V	-	1.6	3.0	dB
Noise figure automotive extreme	NF_G1_A-ETC_A-ETC	A-ETC	-	1.7	3.2	dB
	NF_G1_A-ETC_A-ETC	A-ETC, VCC = 3.3 V	-	1.6	3.2	dB
In-band IIP3	IIP3_G1	NTC	–13	–8.6	-	dB
In-band IIP3 extreme	IIP3_G1_ETC	ETC, VCC = 1.5 V to 3.6 V	–16	–8.2	-	dB
In-band IIP3 automotive extreme	IIP3_G1_A-ETC	A-ETC, VCC = 1.5 V to 3.6 V	–16	–8.2	-	dB
In-band P1dB	P1dB_IB_G1	NTC	–23	–18.6	-	dB
In-band P1dB extreme	P1dB_IB_G1_ETC	ETC, VCC = 1.5 V to 3.6 V	–25	–18.1	-	dB
In-band P1dB automotive extreme	P1dB_IB_G1_A-ETC	A-ETC, VCC = 1.5 V to 3.6 V	–25	–18.0	-	dB
Input return loss	S11_G1	NTC	6	-	-	dB
Input return loss extreme	S11_G1_ETC	ETC, VCC = 1.5 V to 3.6 V	-	13.4	-	dB
Input return loss automotive extreme	S11_G1_A-ETC	A-ETC, VCC = 1.5 V to 3.6 V	-	12.8	-	dB
Output return loss	S22_G1	NTC	-	9.3	-	dB
Output return loss extreme	S22_G1_ETC	ETC, VCC = 1.5 V to 3.6 V	-	10.7	-	dB
Output return loss automotive extreme	S22_G1_A-ETC	A-ETC, VCC = 1.5 V to 3.6 V	-	11.2	-	dB
Group delay (spot)	GD_G1	NTC	-	43.5	-	ns
Group delay variation	GDV_G1	NTC	-	14.9	-	ns

Table 9. GPS L5 and Galileo E5a Electrical Specifications

Unless Otherwise Specified: V_{CC} = 1.8 V, VEN = 1.8 V, P_{IN} = –40 dBm, MODE = 1

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Operating frequency	ƒ_L5	GPS	1164	1176.5	1189	MHz
	ƒ_E5A	Galileo				
Small signal gain	SSG_S21_L5	NTC	16.25	18.1	20.5	dB
	SSG_S21_L5_CTR	NTC, f = 1176 MHz	15.25	17.4	19.5	dB
	SSG_S21_L5	NTC, VCC = 3.3 V	16.25	18.8	21.5	dB
	SSG_S21_L5_CTR	NTC, VCC = 3.3 V, f = 1176 MHz	16	18.1	20.25	dB
Small signal gain extreme	SSG_S21_L5_ETC	ETC	14.5	18	22.5	dB
	SSG_S21_L5_CTR_ETC	ETC, f = 1176 MHz	14.75	17.7	21.5	dB
	SSG_S21_L5_ETC	ETC = 3.3 V	15.5	18.8	23.25	dB
	SSG_S21_L5_CTR_ETC	NTC, VCC = 3.3 V, f = 1176 MHz	15.5	18.5	22.25	dB
Small signal gain automotive extreme	SSG_S21_L5_A-ETC	A-ETC	14.25	17.8	23	dB
	SSG_S21_L5_CTR_A-ETC	A-ETC, f = 1176 MHz	14.5	17.6	21.75	dB
	SSG_S21_L5_A-ETC	A-ETC, VCC = 3.3 V	15.25	18.7	23.5	dB
	SSG_S21_L5_CTR_A-ETC	A-ETC, VCC = 3.3 V, f = 1176 MHz	15.5	18.5	22.5	dB
Gain with LB blocker	SSG_OOB_LB_L5	NTC, blocker input power = 20 dBm, blocker frequency = 600 to 960 MHz	16	18.1	21.25	dB
Gain with NB blocker	SSG_OOB_NB1_L5	NTC, blocker input power = 0 dBm, blocker frequency = 1000 to 1100 MHz	15.5	18.1	21	dB
Gain with NB blocker	SSG_OOB_NB2_L5	NTC, blocker input power = 0 dBm, blocker frequency = 1250 to 1700 MHz	14.5	18.1	20.75	dB
Gain with WB blocker	SSG_OOB_WB_L5	NTC, blocker input power = 10 dBm, blocker frequency = 1710 to 8000 MHz	14.3	18.1	20.75	dB
Small signal gain low current mode	SSG_S21_L5_LC	NTC, MODE = 0	-	10.41	-	dB
Noise figure	NF_L5	NTC	-	1.4	2.6	dB
	NF_L5_CTR	NTC, f = 1176 MHz	-	1.4	2.6	dB
	NF_L5	NTC, VCC = 3.3 V	-	1.4	2.8	dB
	NF_L5_CTR	NTC, VCC = 3.3 V, f = 1176 MHz	-	1.4	2.8	dB
Noise figure extreme	NF_L5_ETC	ETC	-	1.4	2.8	dB
	NF_L5_CTR_ETC	ETC, f = 1176 MHz	-	1.4	2.6	dB
	NF_L5_ETC	ETC, VCC = 3.3 V	-	1.4	2.8	dB
	NF_L5_CTR_ETC	ETC, VCC = 3.3 V, f = 1176 MHz	-	1.4	2.6	dB
Noise figure automotive extreme	NF_L5_A-ETC	A-ETC	-	1.5	3.0	dB
	NF_L5_CTR_A-ETC	A-ETC, f = 1176 MHz	-	1.5	2.6	dB
	NF_L5_A-ETC	A-ETC, VCC = 3.3 V	-	1.5	3.0	dB
	NF_L5_CTR_A-ETC	A-ETC, VCC = 3.3 V, f = 1176 MHz	-	1.4	2.6	dB

Table 9. GPS L5 and Galileo E5a Electrical Specifications (Continued)

Unless Otherwise Specified: V_{CC} = 1.8 V, VEN = 1.8 V, P_{IN} = –40 dBm, MODE = 1

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
In-band IIP3	IIP3_L5	NTC	–13.1	–8.4	-	dB
In-band IIP3 extreme	IIP3_L5_ETC	ETC, VCC = 1.5 V to 3.6 V	–14.3	–7.7	-	dB
In-band IIP3 automotive extreme	IIP3_L5_A-ETC	A-ETC, VCC = 1.5 V to 3.6 V	–14.4	–7.6	-	dB
In-band P1dB	P1dB_IB_L5	NTC	–25	–17.4	-	dB
In-band P1dB extreme	P1dB_IB_L5_ETC	ETC, VCC = 1.5 V to 3.6 V	–25	–15.7	-	dB
In-band P1dB automotive extreme	P1dB_IB_L5_A-ETC	A-ETC, VCC = 1.5 V to 3.6 V	–25	–15.5	-	dB
Input return loss	S11_L5	NTC	4	10.5	-	dB
Input return loss extreme	S11_L5_ETC	ETC, VCC = 1.5 V to 3.6 V	-	10.1	-	dB
Input return loss automotive extreme	S11_L5_A-ETC	A-ETC, VCC = 1.5 V to 3.6 V	-	10.2	-	dB
Output return loss	S22_L5	NTC	10	15.3	-	dB
Output return loss extreme	S22_L5_ETC	ETC, VCC = 1.5 V to 3.6 V	-	15.5	-	dB
Output return loss automotive extreme	S22_L5_A-ETC	A-ETC, VCC = 1.5 V to 3.6 V	-	15.6	-	dB
Group delay (spot)	GD_L5	NTC	-	47.7	-	ns
Group delay variation (peak-to-peak)	GDV_L5	NTC	-	12	-	ns

Evaluation Board

An evaluation board is used to test the performance of the SKY5A2110. The evaluation board schematic is shown in Figure 3. An assembly diagram is shown in Figure 4, followed by the evaluation board bill of materials.

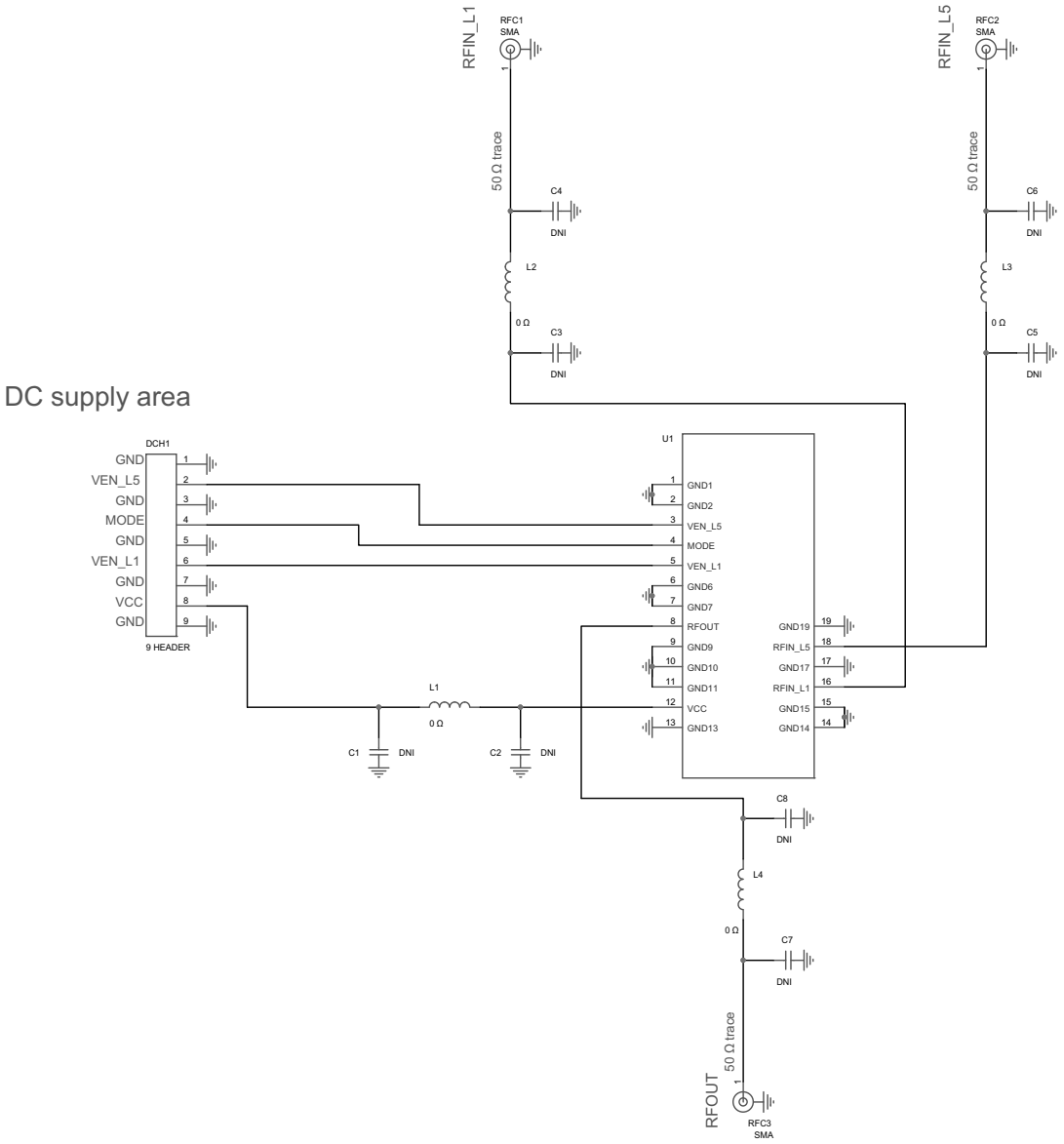


Figure 3. Evaluation Board Schematic

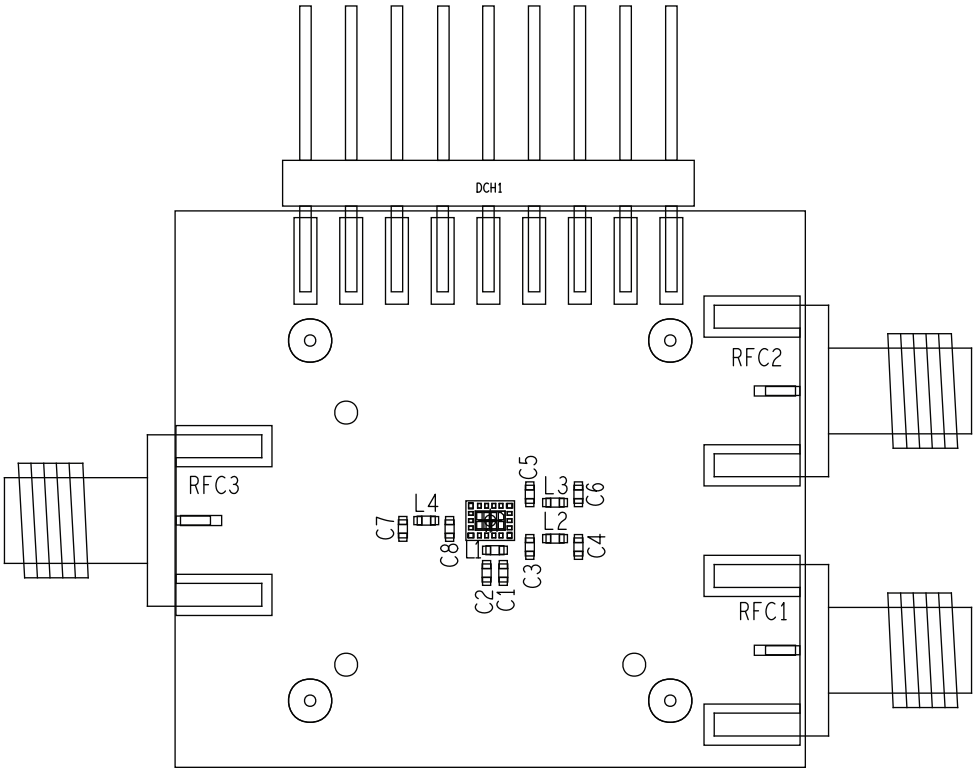


Figure 4. Evaluation Board Assembly Diagram

Table 10. Evaluation Board Bill of Materials

Item	Quantity	Value	Reference Designator	Description
1	1	EN52-D505-001, V1		PCB, SKY5A2110-11 automotive GPS
2	3		RFC1, RFC2, RFC3	SMA connectors
3	1		DCH1	9-pin header
4	1	DNI	U1	
5	4	0 Ω	L1, L2, L3, L4	RES, 0 Ω, jumper, 0.063 W, 0402
6	1	100 pF	C1	CAP, ceramic, 100 pF, 5%, 50 V, 0402
7	1	0.1 µF	C2	CAP, ceramic, 0.1 µF, 10%, X7R, 16 V, 0402
9	6	DNI	C3, C4, C5, C6, C7, C8	

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 SKY5A2110 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.

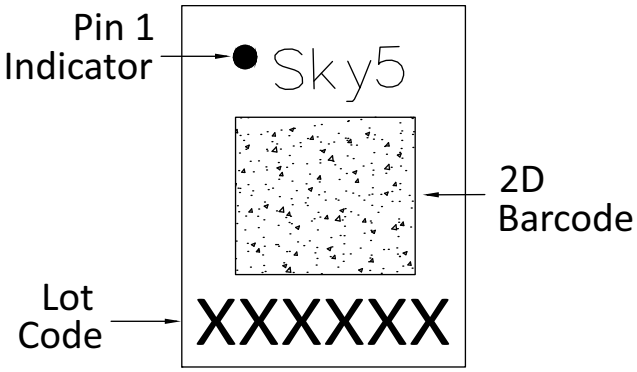
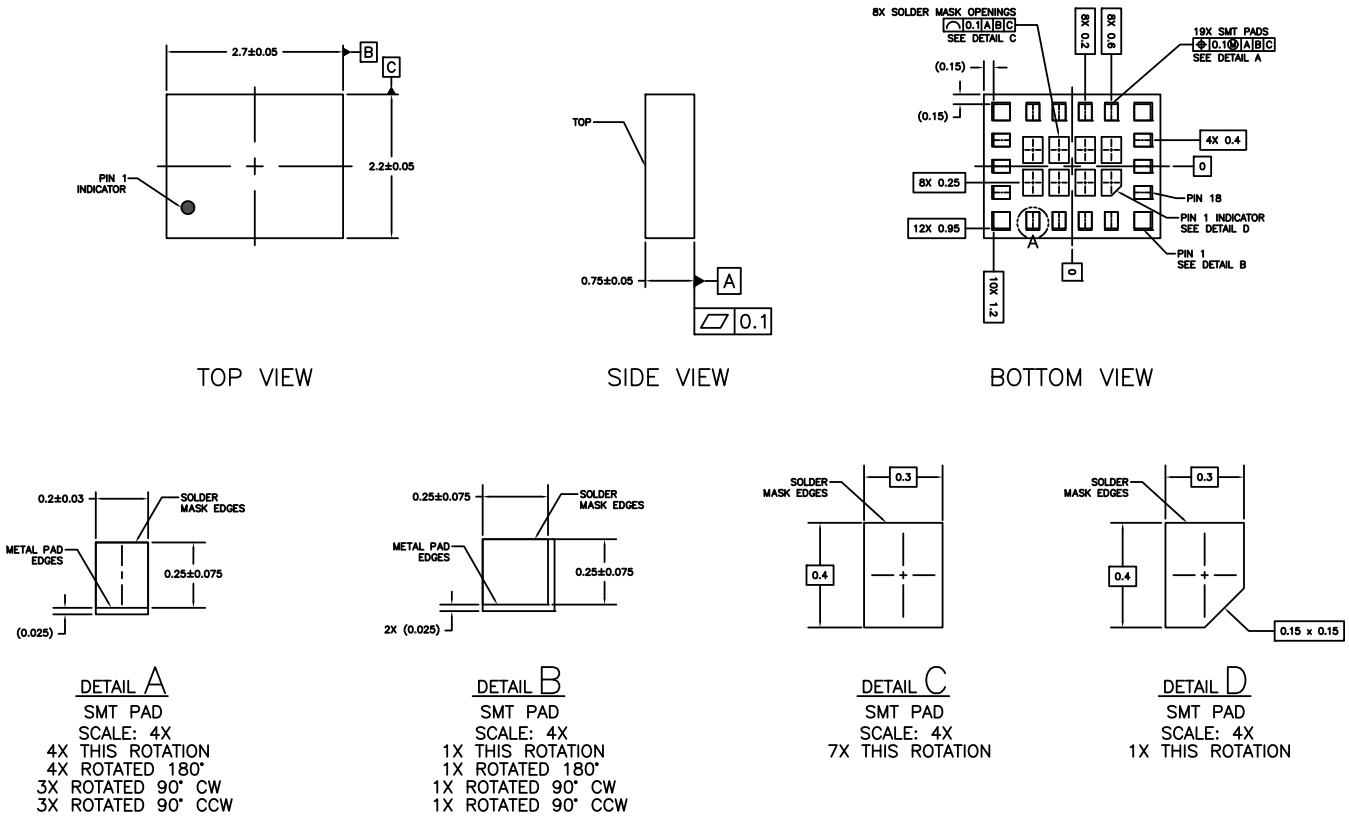


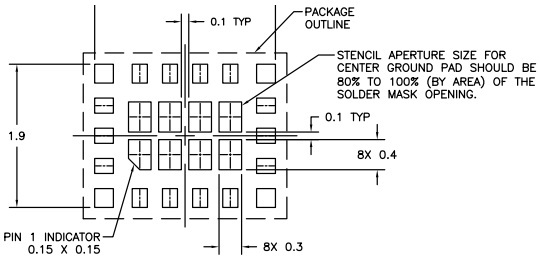
Figure 5. Typical Part Marking



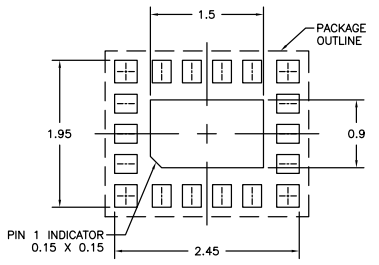
NOTES: UNLESS OTHERWISE SPECIFIED.

1. DIMENSIONING AND TOLERANCING IN ACCORDANCE WITH ASME Y14.5M–1994.
2. DIMENSIONS ARE IN MILLIMETERS
3. PAD DEFINITIONS PER DETAILS ON DRAWING.

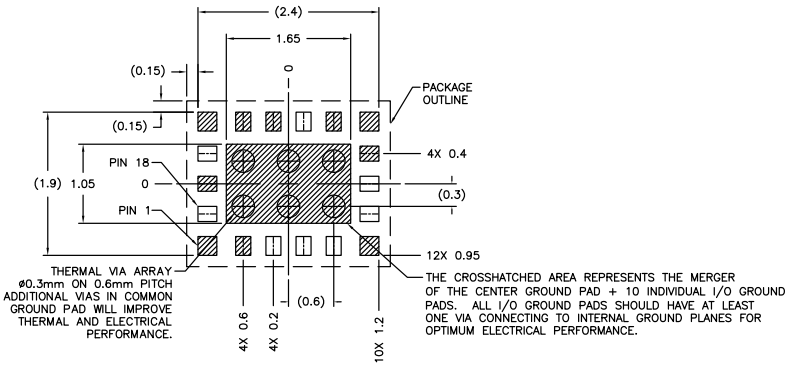
Figure 6. Package Dimensions



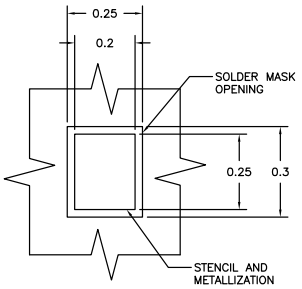
STENCIL APERTURE
TOP VIEW



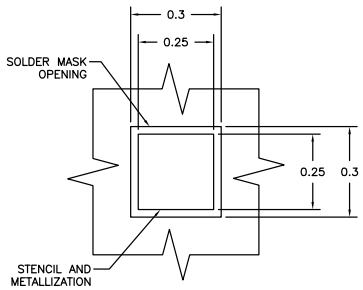
SOLDER MASK OPENING
TOP VIEW



METALLIZATION
TOP VIEW



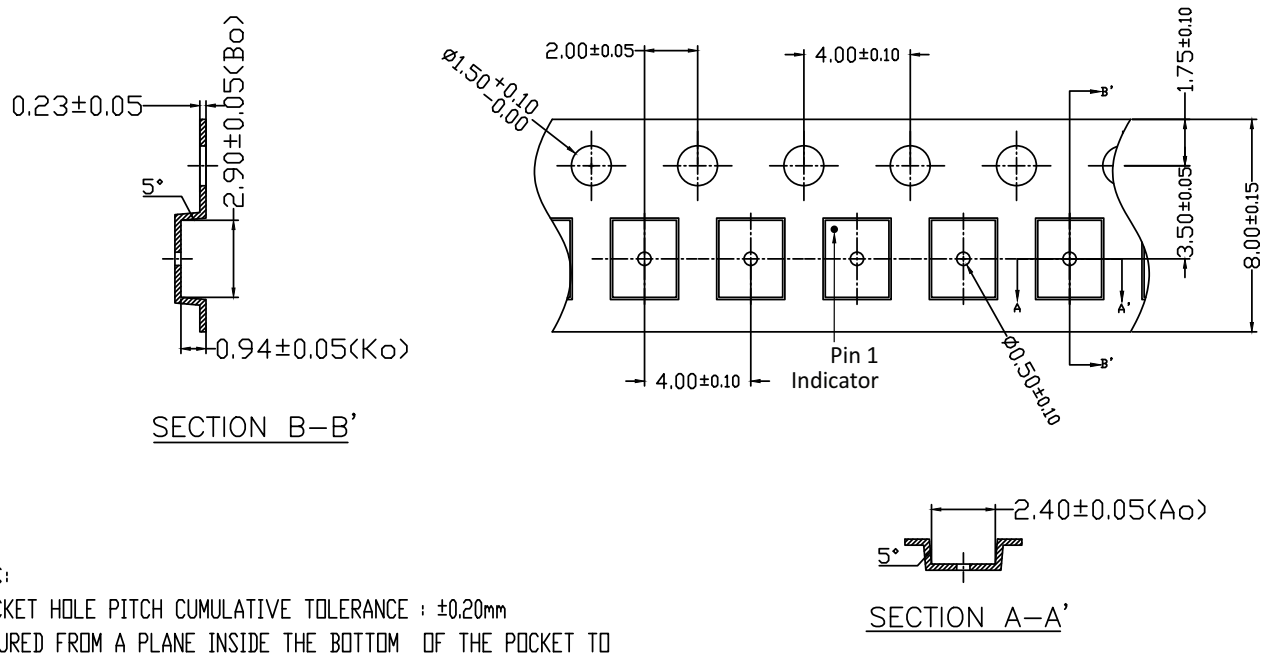
DETAIL
PAD
SCALE: 4X
4X THIS ROTATION
4X ROTATED 180°
3X ROTATED 90° CW
3X ROTATED 90° CCW



DETAIL
PAD
SCALE: 4X
1X THIS ROTATION
1X ROTATED 180°
1X ROTATED 90° CW
1X ROTATED 90° CCW

NOTES:
1. DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE SPECIFIED.
2. THERMAL VIAS SHOULD BE RESIN FILLED AND CAPPED IN ACCORDANCE WITH IPC–4761 TYPE VII VIAS. 30–35UM Cu THICKNESS IS RECOMMENDED.

Figure 7. PCB Layout Footprint



NOTES:

10 SPROCKET HOLE PITCH CUMULATIVE TOLERANCE : ±0.20mm

Ko MEASURED FROM A PLANE INSIDE THE BOTTOM OF THE POCKET TO CARRIER TAPE TOP SURFACE LIMIT.

ALL DIMENSIONS ARE IN MILLIMETERS.

Figure 8. Tape and Reel Information

Ordering Information

Part Number	Description	Evaluation Board Part Number
SKY5A2110	Sky 5® Automotive GNSS L1 + L5 Dual-Frequency Low-Noise Amplifier Front-End Module with Pre- and Post-Filter and Diplexed Output	SKY5A2110EK1