AGPS-L001

GNSS Low Noise amplifier with Variable bias current and shutdown function

Data Sheet

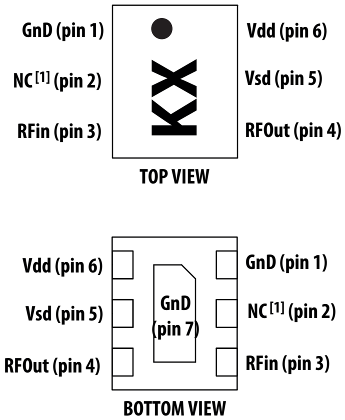
Description

Avago Technologies' AGPS-L001 is an ultra low-noise amplifier designed for GNSS band (GPS, GLONASS, Galileo and Compass) applications. The LNA uses Avago Technologies' proprietary GaAs Enhancement-mode pHEMT process to achieve high gain with very low noise figures and high linearity. Noise figure distribution is very tightly controlled. Gain and supply current are guaranteed parameters. A CMOS compatible shutdown pin is included to turn the LNA off and provide variable bias.

The LNA is usable down to 1.8V operation. It achieves low noise figures and high gain even at 1.8V, making it suitable for use in critical low power GNSS band applications.

Component Image

Surface Mount (0.9 x 1.1 x 0.5) mm^3 6-lead DFN



Note:
1. Pin 2 must be left unconnected.
2. Package marking provides orientation and identification
   "K" = Product code
   "X" = Month and year of manufacture

Attention: Observe precautions for handling electrostatic sensitive devices.
ESD Machine Model = 70 V
ESD Human Body Model = 300 V
Refer to Avago Application Note A004R: Electrostatic Discharge, Damage and Control.

Features

- Advanced GaAs E-pHEMT
- Low Noise Figure: 0.66dB typ.
- High Gain: 17.1dB typ.
- Low external component count
- High IIP3 and IP1dB
- Wide Supply Voltage: 1V to 3.6V
- Shutdown current : < 1uA
- CMOS compatible shutdown pin (Vsd)
- Adjustable bias current via single external resistor/ voltage
- Small Footprint: (0.9 x 1.1) mm^2
- Low Profile: 0.5mm typ.
- Meets MSL1, Lead-free and halogen free

Specifications (Typical performance @ 25°C)

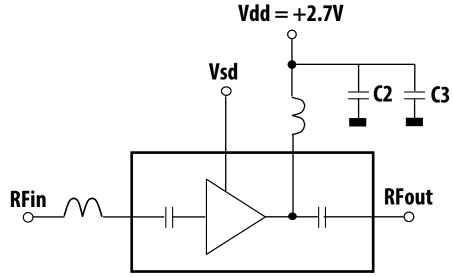
At 1.575GHz, Vdd = 2.7V, Idd = 6mA

- Gain = 17.1dB
- NF = 0.66dB
- IIP3 = 2.5dBm
- IP1dB = -4dBm
- S11 = -7.6dB, S22 =-17dB

Application

LNA for GNSS frequency bands

Application Circuit



Absolute Maximum Rating [1] T_A = 25°C

Symbol	Parameter	Units	Absolute Max.
Vdd	Device Drain to Source Voltage [2]	V	4.0
Idd	Drain Current [2]	mA	15
Pin,max	CW RF Input Power (Vdd = 2.7V, Idd = 6mA)	dBm	15
Pdiss	Total Power Dissipation [4]	mW	60
Tj	Junction Temperature	°C	150
TSTG	Storage Temperature	°C	-65 to 150

Thermal Resistance [3]

(Vdd = 2.7 V, Idd = 6mA), θjc = 107°C/W

Notes:
1. Operation of this device in excess of any of these limits may cause permanent damage.
2. Assuming DC quiescent conditions.
3. Thermal resistance measured using Infra-Red measurement technique.
4. Board (module belly) temperature TB is 25°C. Derate 9.4 mW/°C for T_B > 143°C.

Electrical Specifications

T_A = 25°C, Freq = 1.575GHz, 1.559MHz and 1.610GHz, measured on board as in Figure 1

Table 1. Performance at Vdd = Vsd = 2.7V, Idd = 6mA (R1 = 12kOhm) nominal operating conditions

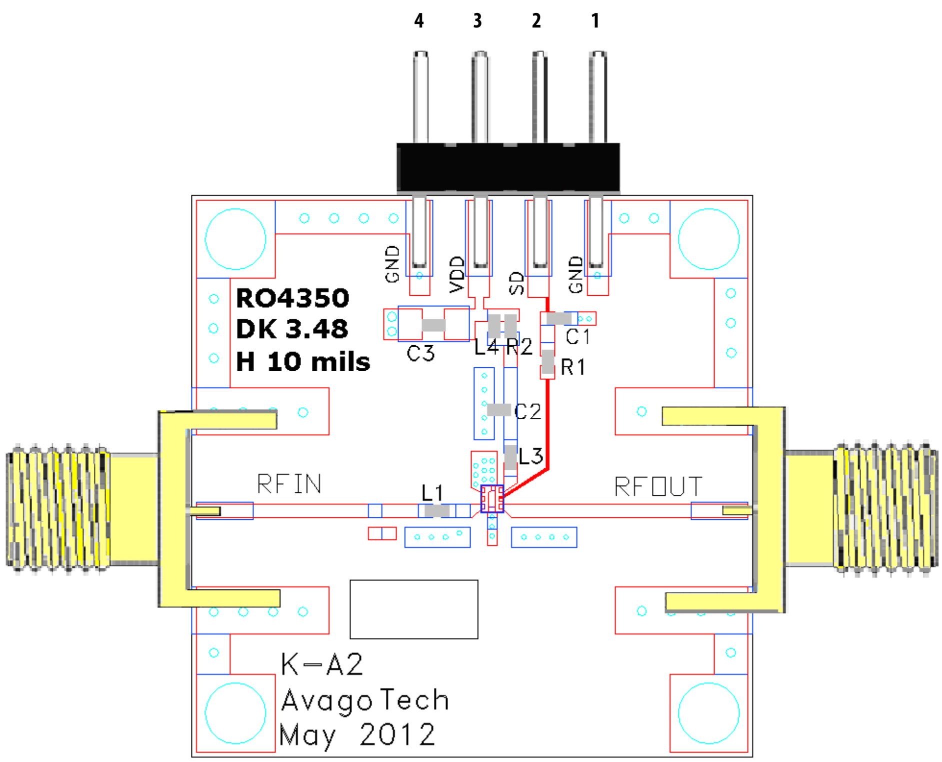
				at 1.575GHz		at 1.559GHz	at 1.610GHz
Symbol	**Parameter and Test Condition**	**Unit**	**Min.**	**Typ.**	**Max.**	**Typ.**	**Typ.**
Passband Performance							
G	Gain	dB	14.5	17.1	19	17.1	16.8
NF [1]	Noise Figure	dB	-	0.66	1.2	0.67	0.68
IP1dB	Input 1dB Compressed Power	dBm	-	-4	-	-	-
IIP3 [2]	Input 3rd Order Intercept Point (2-tone at Fc +/-1MHz)	dBm	-	2.5	-	-	-
S11	Input Return Loss	dB	-	-7.6	-	-7.4	-8
S22	Output Return Loss	dB	-	-17	-	-16	-17
S12	Reverse Isolation	dB	-	-28	-	-29	-28
IIP2 [3]	Input 2nd Order Intercept Point	dBm	-	8	-	-	-
Idd	Supply DC current at Shutdown (SD) voltage Vsd=2.7V	mA	2.8	6	10.5	-	-
Ish	Shutdown Current at Vsd = 0V	uA	-	0.5	-	-	-
Out of Band Performance							
$IP1dB_{890MHz}$	Input 1dB gain compression interferer signal level at 890MHz	dBm	-	3	-	-	-
$IP1dB_{1710MHz}$	Input 1dB gain compression interferer signal level at 1710MHz	dBm	-	-4	-	-	-
$IP1dB_{1850MHz}$	Input 1dB gain compression interferer signal level at 1850MHz	dBm	-	-1	-	-	-
IIP3 [4]	Out of Band Input 3rd Order Intercept Point (2-tone at 1712.7 MHz and 1850MHz)	dBm	-	24	-	-	-

Notes:
1. Losses from demoboard deembeded
2. 1.575GHz IIP3 test condition: FRF1 = 1574 MHz, FRF2 = 1576 MHz with input power of -20dBm per tone measured at the worst case side band
3. OOB Input IP2 test condition: Input jammer tones: 824.6MHz at -17dBm and 2400 MHz at -40dBm. Output IM2 tone at 1.575.4 MHz
4. 1.575GHz IIP3 test condition: FRF1 = 1712.7 MHz, FRF2 = 1850 MHz with input power of 10dBm per tone measured at the worst case side band

Table 2. Performance at Vdd = Vsd = 1.8V, Idd = 6mA (R1 = 0Ohm) nominal operating conditions

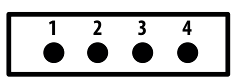
Symbol	Parameter and Test Condition	Units	at 1.575GHz (Typ.)	at 1.559GHz (Typ.)	at 1.610GHz (Typ.)
Passband Performance					
G	Gain	dB	16.0	16.1	15.8
NF [1]	Noise Figure	dB	0.72	0.73	0.73
IP1dB	Input 1dB Compressed Power	dBm	-8	-	-
IIP3 [2]	Input 3rd Order Intercept Point (2-tone at Fc +/- 1MHz)	dBm	1	-	-
S11	Input Return Loss	dB	-6.8	-6.6	-7
S22	Output Return Loss	dB	-19	-17	-23
S12	Reverse Isolation	dB	-27	-27	-27
Idd	Supply DC current at Shutdown voltage Vsd=1.8V	mA	6	-	-
Ish	Shutdown Current at Vsd = 0V	uA	0.5	-	-
Out of Band Performance					
$IP1dB_{890MHz}$	Input 1dB gain compression interferer signal level at 890MHz	dBm	-5	-	-
$IP1dB_{1710MHz}$	Input 1dB gain compression interferer signal level at 1710MHz	dBm	-10	-	-
$IP1dB_{1850MHz}$	Input 1dB gain compression interferer signal level at 1850MHz	dBm	-7	-	-
IIP3 [4]	Out of Band Input 3rd Order Intercept Point (2-tone at 1712.7 MHz and 1850MHz)	dBm	23	-	-

Notes:
1. Losses from demoboard deembeded
2. 1.575GHz IIP3 test condition: FRF1 = 1574 MHz, FRF2 = 1576 MHz with input power of -20dBm per tone measured at the worst case side band
3. OOB Input IP2 test condition: Input jammer tones: 824.6MHz at -17dBm and 2400 MHz at -40dBm. Output IM2 tone at 1.575.4 MHz
4. 1.575GHz IIP3 test condition: FRF1 = 1712.7 MHz, FRF2 = 1850 MHz with input power of 10dBm per tone measured at the worst case side band



DC Pin Configuration of 4-pin connector

Pins pointing out of the page



Pins 1,4 = GND
Pin 2 = Shutdown (Vsd)
Pin 3 = Vdd supply

Circuit Symbol	Size	Description
L1	0402	10nH high Q Inductor (Taiyo Yuden)
L3	0402	4.3nH Inductor (Taiyo Yuden)
L4	0402	22nH Inductor (Taiyo Yuden)
C1	0402	6.8pF Capacitor (Murata)
C2	0402	9.0pF Capacitor (Murata)
C3	0402	0.1uF Capacitor (Murata)
R1	0402	12kOhm Resistor (Rohm)
R2	0402	12Ohm Resistor (Rohm)

Figure 1. Demoboard and application circuit components table

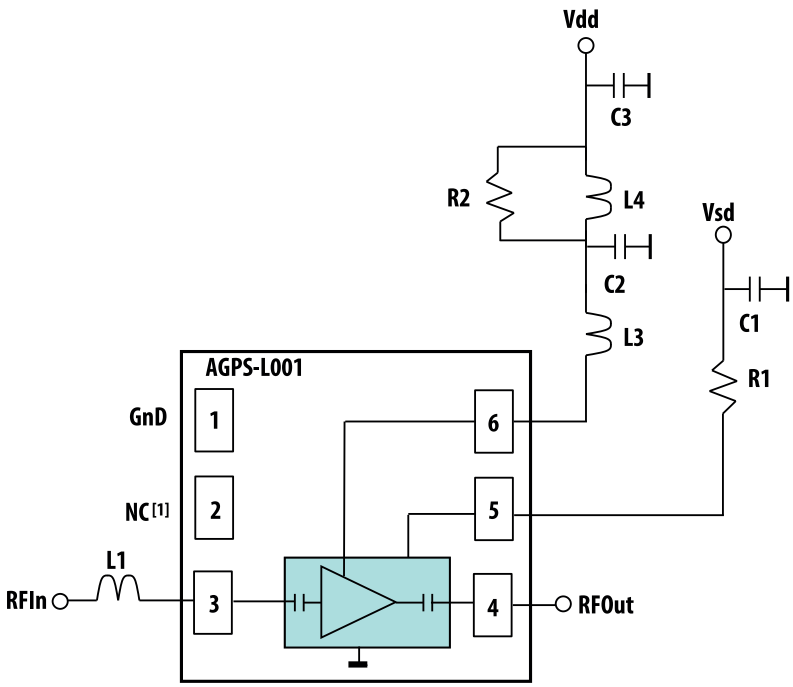


Figure 2. Application Circuit

Notes

1. Pin 2 must be left unconnected.
2. L1 form the input matching network. The LNA module has integrated coupling and DC-block capacitors at the input and output respectively. Best noise performance is obtained using high-Q wirewound inductors. This circuit demonstrates that low noise figures are obtainable with standard 0402 chip inductors.
3. L3 serves as an output matching inductor and supply choke.
4. C1, C2 and C3 are RF bypass capacitors. C1 is optional.
5. R2 and L4 is a network that isolates the measurement demoboard from external disturbances.
6. Bias control is achieved by either varying the VSD voltage without R1 (R1=0 ohm) or fixing the VSD voltage to Vdd and varying R1. Typical value for R1 is 12kOhm for 6mA total current at Vsd=Vdd=+2.7V.
7. Higher gain and IP3 performance can be obtained by increasing the supply current. This can be achieved by reducing the value for R1 to obtain desired current.
8. For low voltage operation such as 1.0V, the R1 may be omitted and Vsd connected directly to the supply pins.

AGPS-L001 Typical Performance Curves at 25*C

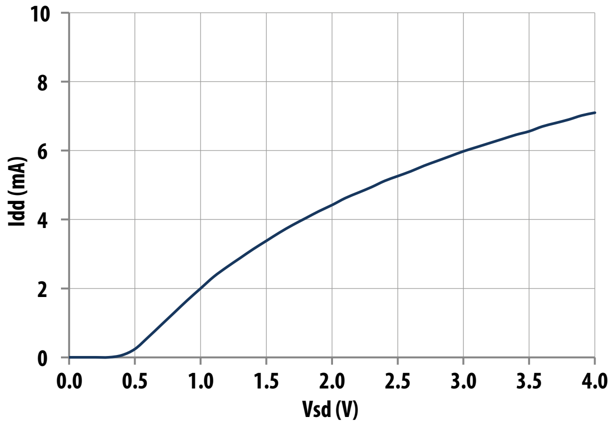


Figure 3. Idd vs Vsd for Vdd = 2.7V, R1 = 12kOhm

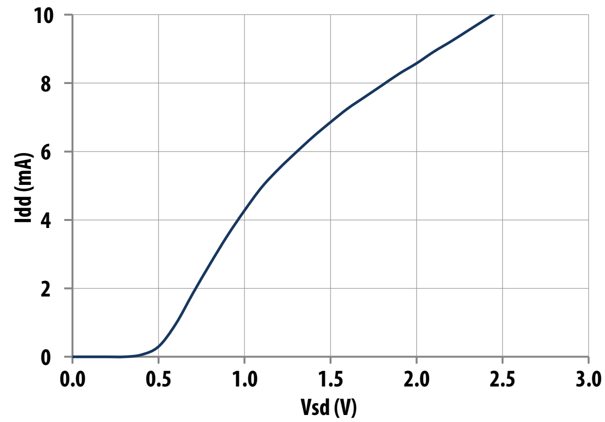


Figure 4. Idd vs Vsd for Vdd = 1.8V, R1 = 0Ohm

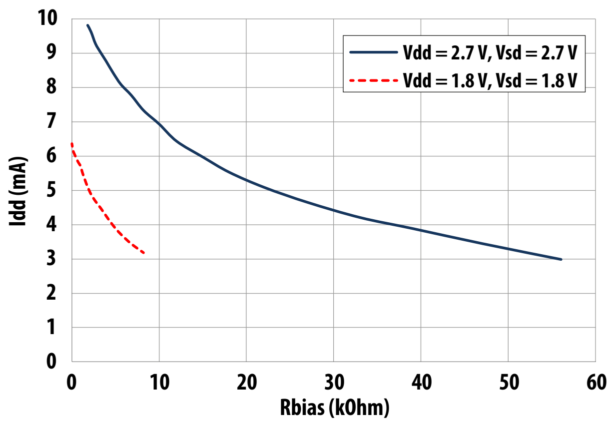


Figure 5. Idd vs R1 for Vdd = Vsd = 2.7V and Vdd = Vsd = 1.8V

Unless otherwise stated, all measurements were made with the demoboard and components on Fig 1 at Vdd = Vsd = 2.7V, Idd = 6mA, R1 = 12kOhm

AGPS-L001 Typical Performance Curves at 25*C

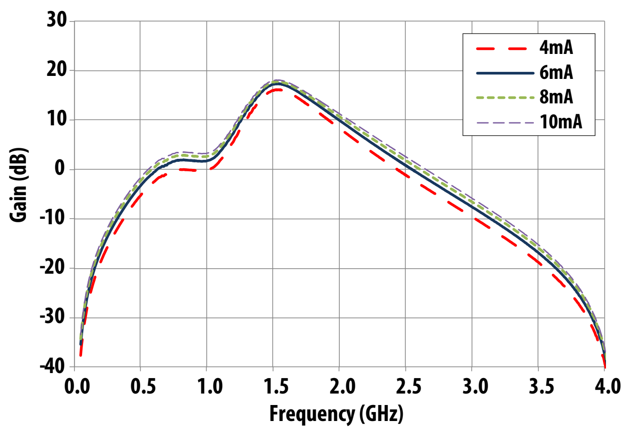


Figure 6. Typical gain plot @ Vdd = 2.7V

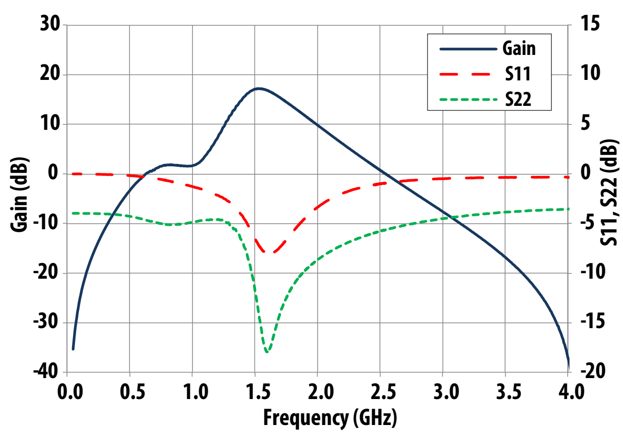


Figure 7a. Typical S-Parameter Plot

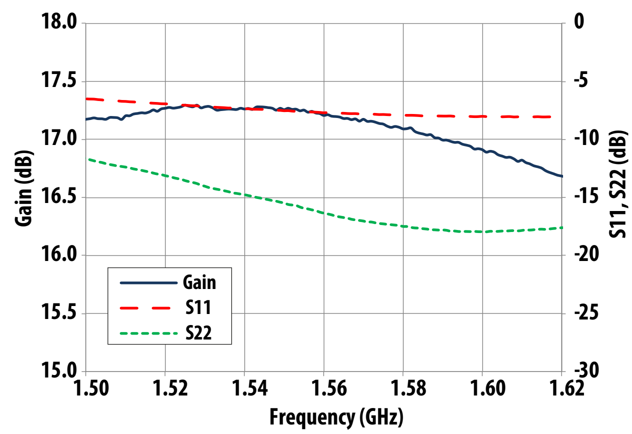


Figure 7b. Passband response of typical S-Parameter Plot

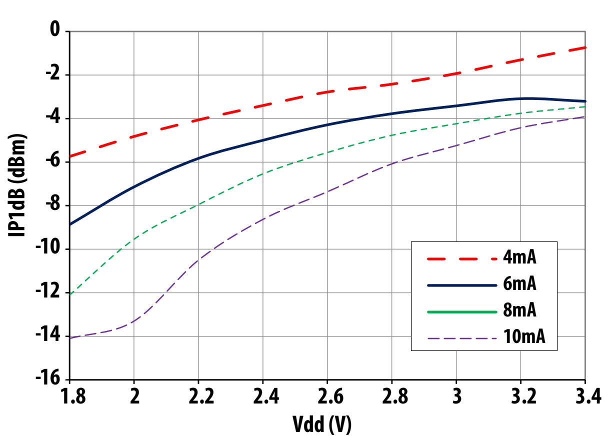


Figure 8. IP1dB vs. Vdd

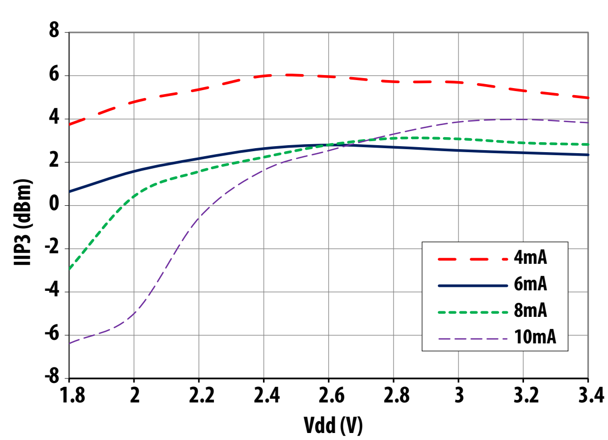


Figure 9. IIP3 vs. Vdd

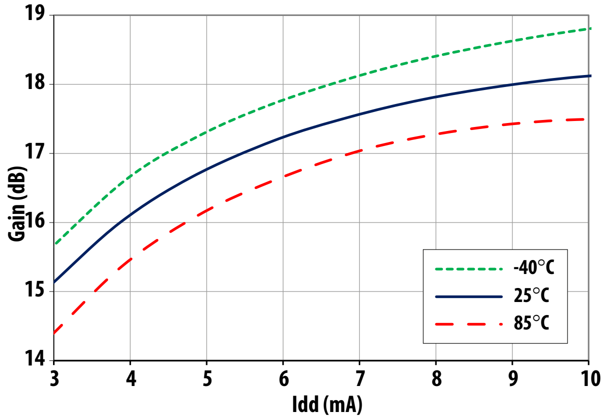


Figure 10. Gain@1.575GHz vs. Idd

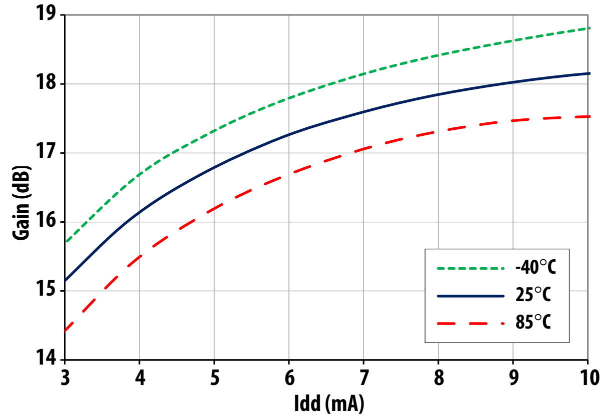


Figure 11. Gain@1.559GHz vs. Idd

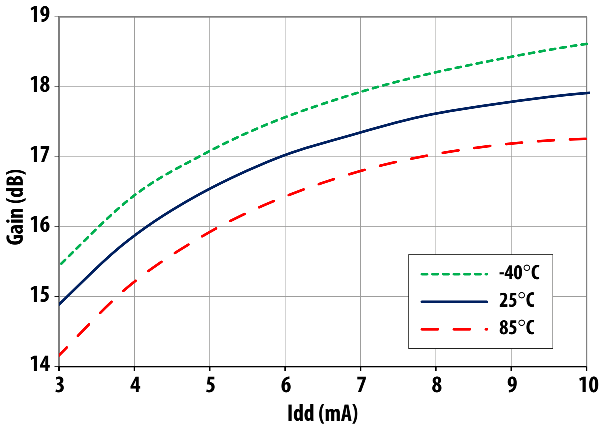


Figure 12. Gain@1.610GHz vs. Idd

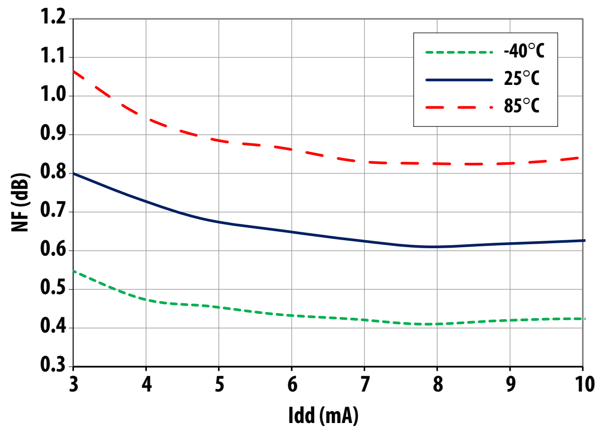


Figure 13. NF@1.575GHz vs. Idd

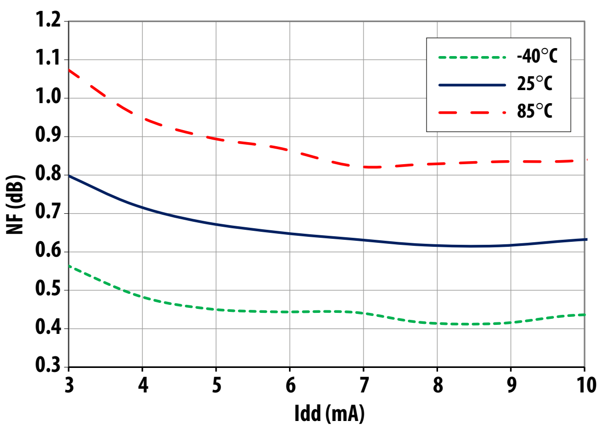


Figure 14. NF@1.559GHz vs. Idd

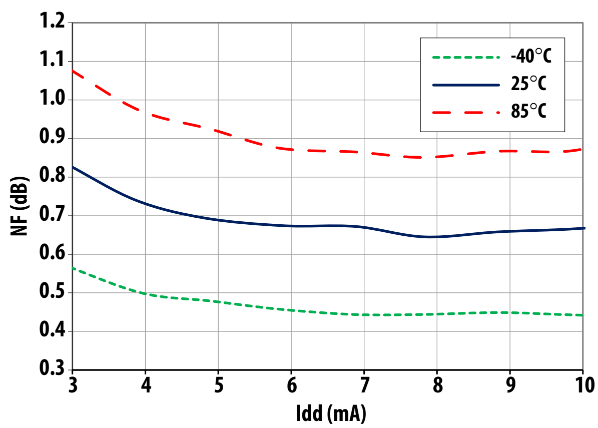


Figure 15. NF@1.610GHz vs. Idd

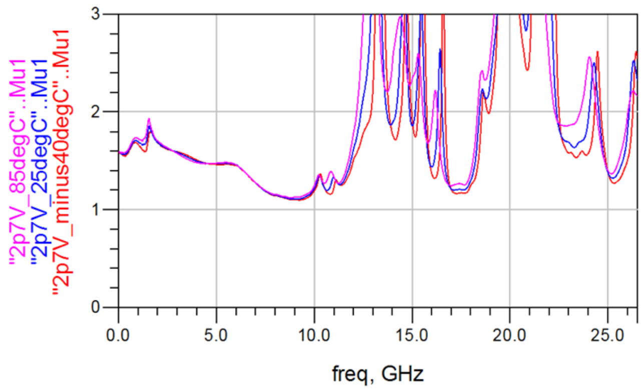


Figure 16. Edwards-Sinsky Output Stability Factor (Mu)

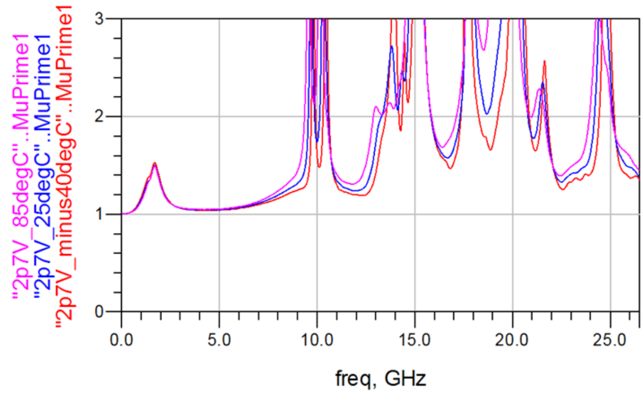


Figure 17. Edwards-Sinsky Input Stability Factor (Mu')

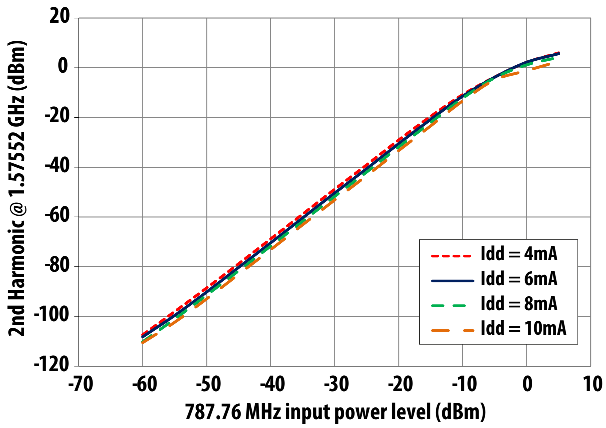


Figure 18. 2nd harmonics (1.57552GHz) vs 787.76MHz input signal power level

Unless otherwise stated, all measurements are made at Vdd=Vsd = 1.8V and Idd=6mA, R1=0Ohm

AGPS-L001 Typical Performance Curves at 25*C

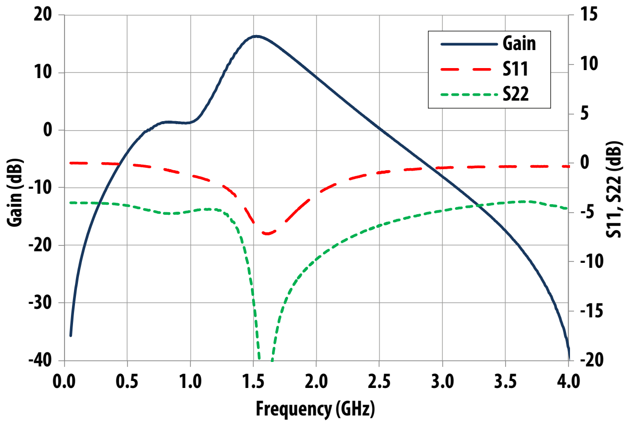


Figure 19a. Typical S-Parameter Plot

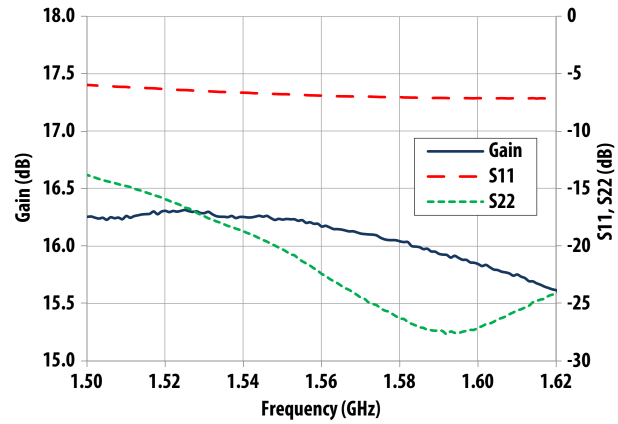


Figure 19b. Passband response of typical S-Parameter Plot

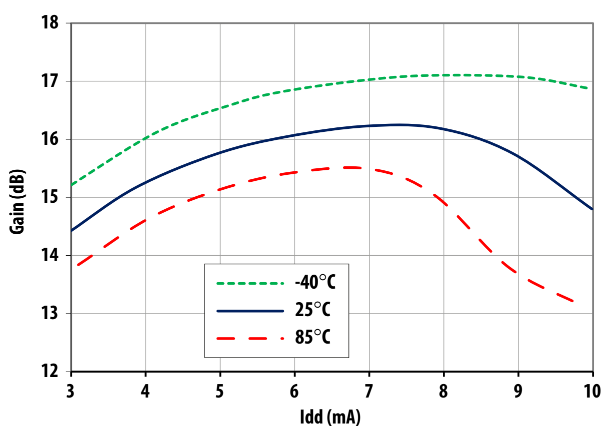


Figure 20. Gain@1.575GHz vs. Idd

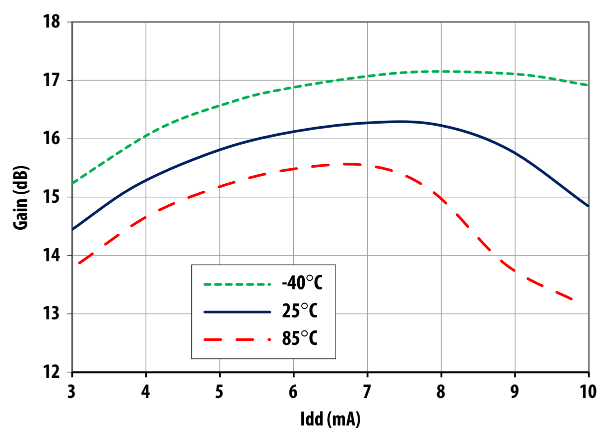


Figure 21. Gain@1.559GHz vs. Idd

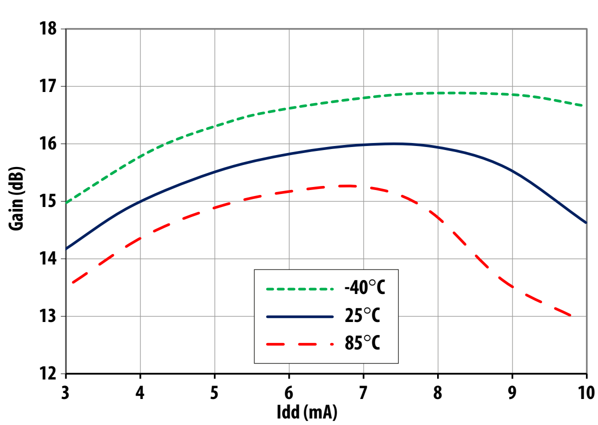


Figure 22. Gain@1.610GHz vs. Idd

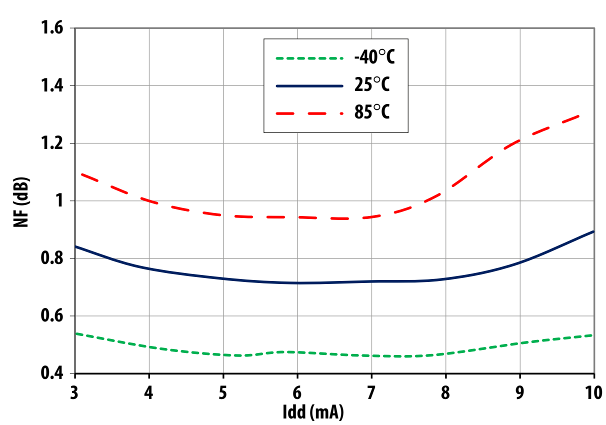


Figure 23. NF@1.575GHz vs. Idd

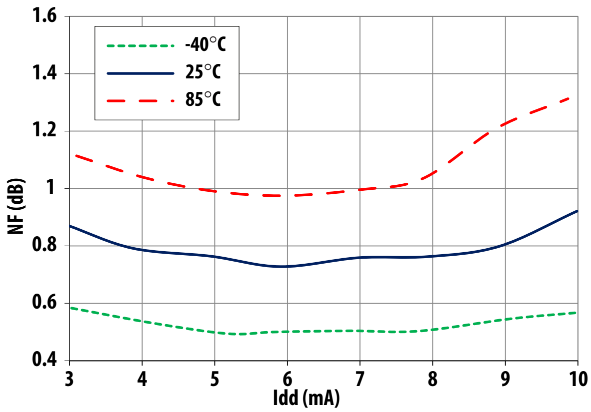


Figure 24. NF@1.559GHz vs. Idd

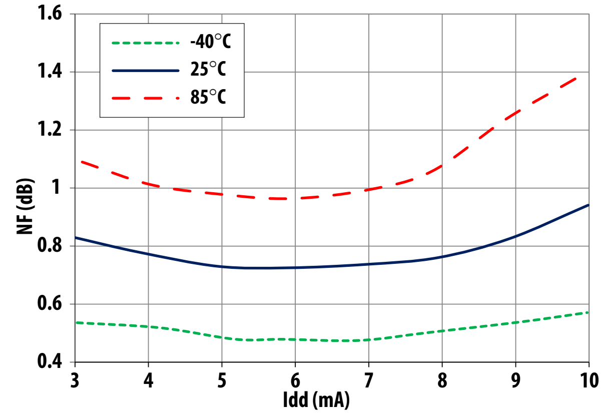


Figure 25. NF@1.610GHz vs. Idd

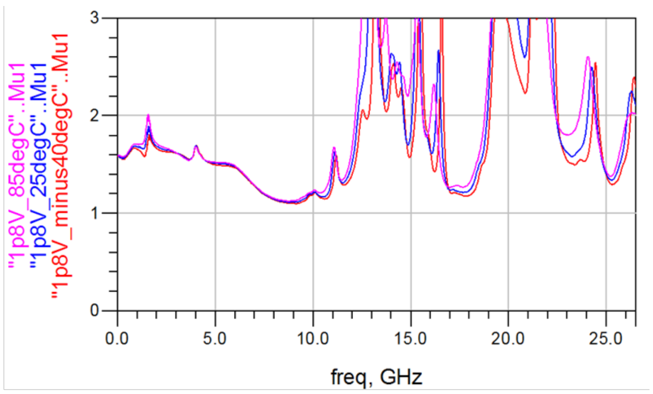


Figure 26. Edwards-Sinsky Output Stability Factor (Mu)

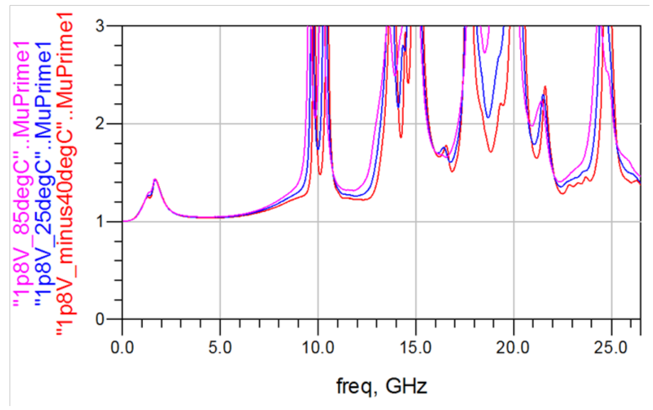


Figure 27. Edwards-Sinsky Input Stability Factor (Mu')

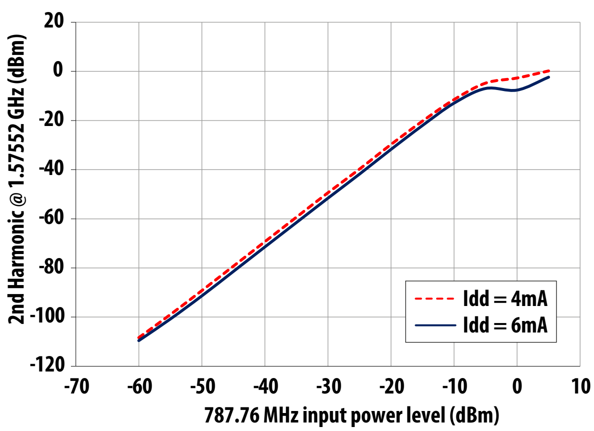


Figure 28. 2nd harmonics (1.57552GHz) vs 787.76MHz input signal power level

AGPS-L001 Scattering Parameter and Measurement Reference Planes

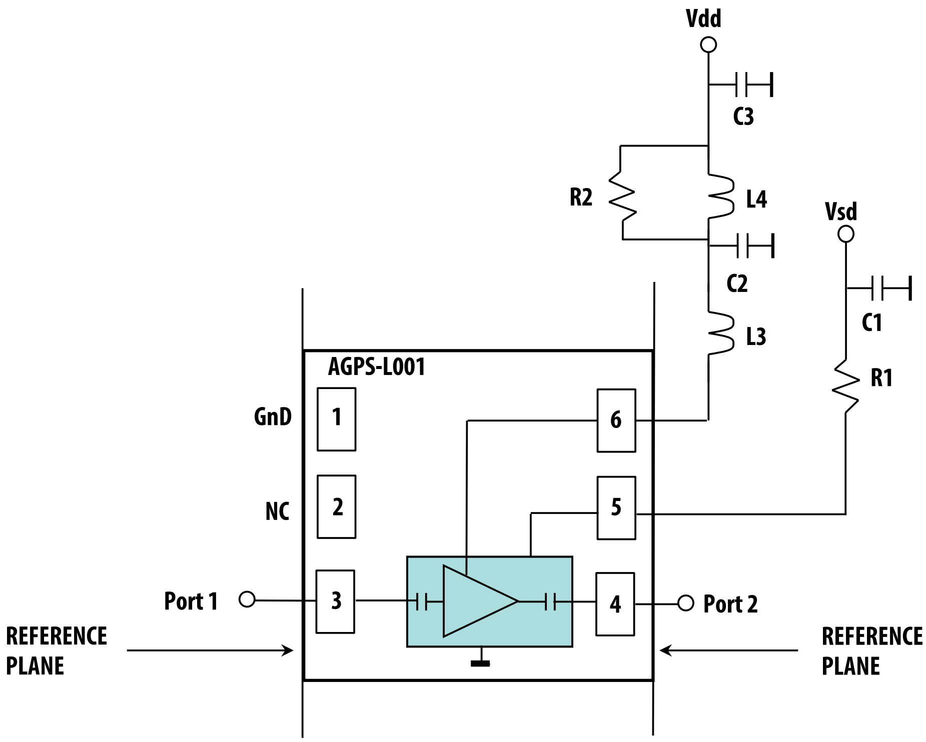


Figure 29. Circuit used for measuring small-signal and noise parameters of packaged part. Data is deembedded to reference planes as shown. Component values are as detailed in Figure 1.

The S- and Noise Parameters are measured using a coplanar waveguide PCB with 10 mils Rogers® RO4350. Figure 29 shows the input and output reference planes. The circuit values are as indicated in Figure 1.

AGPS-L001 Typical Scattering Parameters at 25°C, Vdd = 2.7V, Idd = 6mA

Freq	S11	S11	S21	S21	S12	S12	S22	S22
(GHz)	Mag.(dB)	Ang.	Mag. (dB)	Ang.	Mag (dB).	Ang.	Mag. (dB)	Ang.
0.05	-0.01	-0.88	-35.34	-28.83	-82.86	155.36	-4.00	-2.77
0.1	-0.03	-2.01	-25.48	-42.34	-75.83	83.13	-4.01	-5.72
0.2	-0.05	-4.14	-16.43	-55.15	-69.52	101.86	-4.04	-11.59
0.3	-0.07	-6.33	-10.98	-63.48	-67.25	112.51	-4.10	-17.69
0.4	-0.13	-8.74	-6.75	-73.11	-63.84	131.02	-4.27	-24.03
0.5	-0.19	-11.03	-3.46	-84.41	-60.31	143.16	-4.46	-30.62
0.6	-0.27	-13.41	-1.02	-98.84	-56.06	148.82	-4.79	-36.96
0.7	-0.38	-15.62	0.30	-115.19	-52.98	144.36	-5.18	-42.11
0.8	-0.50	-17.66	0.05	-130.48	-51.34	134.99	-5.34	-45.94
0.825	-0.54	-18.07	-0.43	-133.37	-51.40	134.07	-5.27	-46.78
0.9	-0.53	-19.45	-1.34	-111.68	-52.89	152.84	-4.85	-55.15
1.0	-0.67	-21.74	0.40	-126.54	-49.66	149.14	-5.41	-60.67
1.1	-0.71	-23.16	0.71	-117.94	-48.97	163.68	-5.17	-67.38
1.2	-0.76	-25.49	3.33	-111.43	-45.75	179.48	-5.13	-81.67
1.3	-0.82	-28.38	6.82	-115.18	-41.12	-176.48	-5.39	-102.41
1.4	-0.95	-31.96	10.05	-129.31	-36.81	174.64	-6.31	-133.11
1.5	-1.29	-35.74	12.22	-151.14	-33.68	157.07	-8.31	-178.05
1.559	-1.58	-37.39	12.78	-165.28	-32.60	145.37	-9.69	148.22
1.575	-1.66	-37.76	12.84	-169.02	-32.40	142.20	-9.98	138.49
1.6	-1.80	-38.17	12.86	-174.61	-32.16	137.55	-10.31	123.27
1.610	-1.85	-38.32	12.86	-176.78	-32.08	135.72	-10.40	117.29
1.7	-2.23	-39.14	12.45	165.99	-31.78	121.55	-10.15	69.96
1.8	-2.51	-39.80	11.65	151.50	-31.88	110.32	-9.07	35.49
1.885	-2.68	-40.41	10.92	142.02	-32.02	103.56	-8.26	16.28
1.9	-2.71	-40.54	10.79	140.56	-32.06	102.62	-8.13	13.55
2.0	-2.87	-41.48	10.01	131.94	-32.21	96.97	-7.48	-1.78
2.1	-3.02	-42.66	9.31	124.72	-32.31	92.75	-7.01	-13.37
2.2	-3.16	-43.79	8.68	118.48	-32.36	89.43	-6.63	-22.73
2.3	-3.31	-44.93	8.12	112.96	-32.40	86.78	-6.32	-30.60
2.4	-3.45	-46.06	7.60	107.92	-32.42	84.57	-6.06	-37.51
2.5	-3.60	-47.20	7.13	103.22	-32.37	82.63	-5.83	-43.67
3.0	-4.29	-52.17	5.12	83.47	-32.12	76.28	-4.90	-67.32
3.5	-4.97	-56.19	3.48	67.43	-31.73	72.78	-4.14	-84.29
4.0	-5.63	-60.07	2.02	53.41	-31.37	70.49	-3.53	-97.40
4.5	-6.15	-64.61	0.65	40.96	-31.07	69.64	-3.06	-108.25
5.0	-6.52	-69.56	-0.41	30.84	-30.43	70.39	-2.82	-116.52
6.0	-7.25	-74.20	-2.65	8.36	-29.73	69.07	-2.02	-134.90
7.0	-7.46	-76.13	-4.93	-11.16	-29.01	70.72	-1.52	-152.45
8.0	-8.04	-80.96	-7.62	-30.49	-28.39	72.04	-1.10	-170.67
9.0	-8.18	-94.20	-11.39	-47.87	-28.09	71.29	-0.77	173.06
10.0	-6.57	-106.83	-13.32	-12.83	-34.81	100.24	-1.78	156.53
11.0	-6.36	-117.84	-13.40	-81.88	-23.34	91.39	-0.72	158.88
12.0	-5.89	-124.35	-17.60	-102.79	-22.67	79.78	-1.71	148.96
13.0	-5.35	-133.67	-20.29	-142.44	-19.81	85.95	-0.52	140.41
14.0	-4.40	-150.34	-22.02	164.30	-17.90	77.59	-0.28	131.43
15.0	-3.37	-167.42	-20.76	118.05	-16.74	68.42	-0.21	126.29
16.0	-2.57	-178.14	-19.82	89.21	-16.33	57.40	-0.38	119.92
17.0	-1.76	176.48	-17.57	74.80	-15.21	50.40	-0.68	109.09
18.0	-1.76	163.55	-16.53	45.39	-14.51	29.29	-3.73	95.24
19.0	-1.88	146.79	-16.35	40.63	-14.24	24.49	-0.98	111.88
20.0	-1.33	137.01	-16.69	27.75	-14.89	11.10	-0.76	109.80

AGPS-L001 Typical Scattering Parameters at 25°C, Vdd = 1.8V, Idd = 6mA

Freq	S11	S11	S21	S21	S12	S12	S22	S22
(GHz)	Mag.(dB)	Ang.	Mag. (dB)	Ang.	Mag (dB).	Ang.	Mag. (dB)	Ang.
0.05	0.00	-0.95	-35.71	-29.96	-83.62	66.73	-4.00	-2.78
0.1	-0.02	-2.07	-25.99	-43.37	-74.45	102.73	-4.01	-5.73
0.2	-0.03	-4.26	-17.02	-56.05	-71.59	98.19	-4.04	-11.59
0.3	-0.05	-6.53	-11.60	-64.34	-67.03	123.51	-4.09	-17.67
0.4	-0.11	-9.03	-7.41	-73.98	-63.29	141.62	-4.26	-24.00
0.5	-0.16	-11.40	-4.15	-85.22	-58.59	153.08	-4.45	-30.53
0.6	-0.24	-13.85	-1.75	-99.41	-54.15	154.66	-4.76	-36.82
0.7	-0.35	-16.14	-0.43	-115.38	-50.97	149.19	-5.13	-42.00
0.8	-0.47	-18.20	-0.60	-130.23	-49.36	140.42	-5.29	-46.00
0.8275	-0.50	-18.61	-1.02	-133.10	-49.37	137.79	-5.24	-46.87
0.9	-0.49	-19.85	-2.93	-113.88	-51.34	153.66	-4.72	-54.05
1.0	-0.61	-22.35	-0.15	-126.42	-47.40	153.48	-5.38	-60.69
1.1	-0.64	-23.78	0.12	-118.47	-46.64	166.37	-5.15	-67.10
1.2	-0.67	-26.28	2.71	-112.39	-43.29	-179.89	-5.14	-81.05
1.3	-0.70	-29.34	6.12	-116.40	-38.86	-177.72	-5.49	-101.01
1.4	-0.84	-33.23	9.23	-130.49	-34.76	173.02	-6.61	-129.94
1.5	-1.20	-37.25	11.29	-151.57	-31.80	155.69	-9.07	-171.71
1.559	-1.52	-38.98	11.84	-165.04	-30.76	144.36	-10.93	155.78
1.575	-1.60	-39.37	11.90	-168.61	-30.56	141.26	-11.36	145.92
1.6	-1.75	-39.82	11.95	-173.98	-30.31	136.77	-11.91	130.07
1.610	-1.80	-39.98	11.95	-176.06	-30.23	135.04	-12.07	123.69
1.7	-2.22	-40.81	11.63	167.22	-29.90	121.22	-11.89	71.70
1.8	-2.53	-41.36	10.93	152.86	-29.91	109.92	-10.35	34.70
1.885	-2.72	-41.87	10.27	143.28	-30.06	102.91	-9.24	14.87
1.9	-2.75	-42.01	10.15	141.81	-30.08	101.94	-9.08	12.06
2.0	-2.91	-42.90	9.42	133.04	-30.20	95.85	-8.22	-3.36
2.1	-3.06	-43.97	8.75	125.58	-30.31	91.05	-7.59	-15.16
2.2	-3.20	-45.07	8.13	119.10	-30.40	87.36	-7.12	-24.77
2.3	-3.33	-46.27	7.56	113.36	-30.52	84.38	-6.75	-33.04
2.4	-3.45	-47.48	6.98	108.26	-30.65	82.35	-6.50	-40.61
2.5	-3.57	-48.84	6.42	104.11	-30.75	81.75	-6.43	-47.43
3.0	-4.31	-54.66	4.87	84.25	-29.78	73.19	-5.30	-66.92
3.5	-4.92	-59.27	3.28	67.27	-29.52	67.24	-4.38	-84.12
4.0	-5.46	-63.49	1.87	52.72	-29.26	63.57	-3.70	-97.25
4.5	-5.87	-67.92	0.63	39.64	-29.00	60.83	-3.15	-107.74
5.0	-6.16	-72.45	-0.51	27.52	-28.73	59.01	-2.72	-116.65
6.0	-6.86	-78.68	-2.77	5.46	-28.49	57.80	-2.02	-135.56
7.0	-6.95	-83.29	-5.03	-14.63	-28.28	59.01	-1.53	-153.16
8.0	-7.29	-89.96	-7.57	-34.16	-27.93	61.66	-1.11	-171.44
9.0	-7.29	-104.52	-11.30	-52.79	-27.84	63.09	-0.77	172.33
10.0	-5.80	-119.23	-13.97	-18.27	-33.23	86.36	-1.65	155.35
11.0	-5.30	-129.85	-13.25	-87.61	-23.26	84.90	-0.71	158.86
12.0	-4.96	-136.38	-17.16	-116.98	-20.75	77.69	-0.61	145.64
13.0	-4.69	-149.58	-20.09	-149.17	-19.79	75.06	-0.76	139.81
14.0	-3.63	-167.19	-21.74	159.01	-18.06	68.53	-0.33	130.96
15.0	-2.50	-179.05	-20.68	114.11	-16.85	60.45	-0.22	124.88
16.0	-2.01	171.83	-19.82	84.02	-16.35	48.68	-0.44	118.38
17.0	-1.67	163.10	-17.93	71.80	-15.70	43.57	-0.85	110.58
18.0	-1.50	150.08	-16.82	53.78	-14.91	31.73	-1.82	107.25
19.0	-1.50	135.02	-15.04	32.38	-13.38	15.70	-1.30	100.74
20.0	-1.77	126.74	-16.11	4.65	-14.08	-9.52	-2.12	108.53

AGPS-L001 Typical Noise Parameters at 25°C,

Freq = 1.575 GHz, Vdd = 2.7V, Idd = 6mA

Freq	NFmin	GAMMA OPT		
(GHz)	(dB)	Mag	Ang	Rn/50
1.559	0.63	0.699	41.7	0.2862
1.575	0.62	0.669	42.8	0.2736
1.610	0.65	0.667	43.7	0.2906

AGPS-L001 Typical Noise Parameters at 25°C,

Freq = 1.575 GHz, Vdd = 1.8V, Idd = 6mA

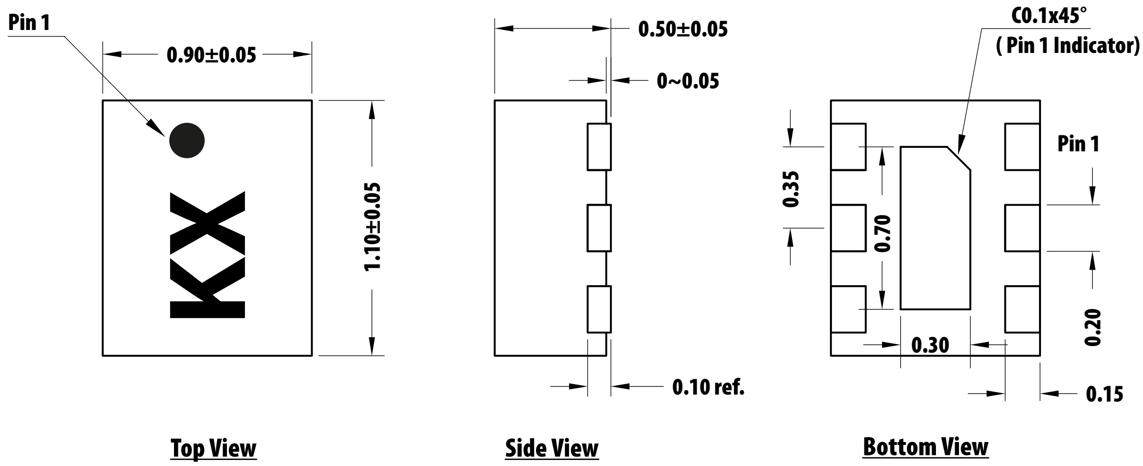
Freq	NFmin	GAMMA OPT		
(GHz)	(dB)	Mag	Ang	Rn/50
1.559	0.69	0.701	44.2	0.3352
1.575	0.68	0.672	45.3	0.3174
1.610	0.70	0.670	45.2	0.3334

Notes:
The exceptional noise figure performance of the AGPS-L001 is due to its highly optimized design. Figure 29 shows the circuit and reference planes for the measurement.

Part Number Ordering Information

Part Number	Qty	Container
AGPS-L001-TR1	3000	7″ Reel
AGPS-L001-BLK	100	Antistatic bag

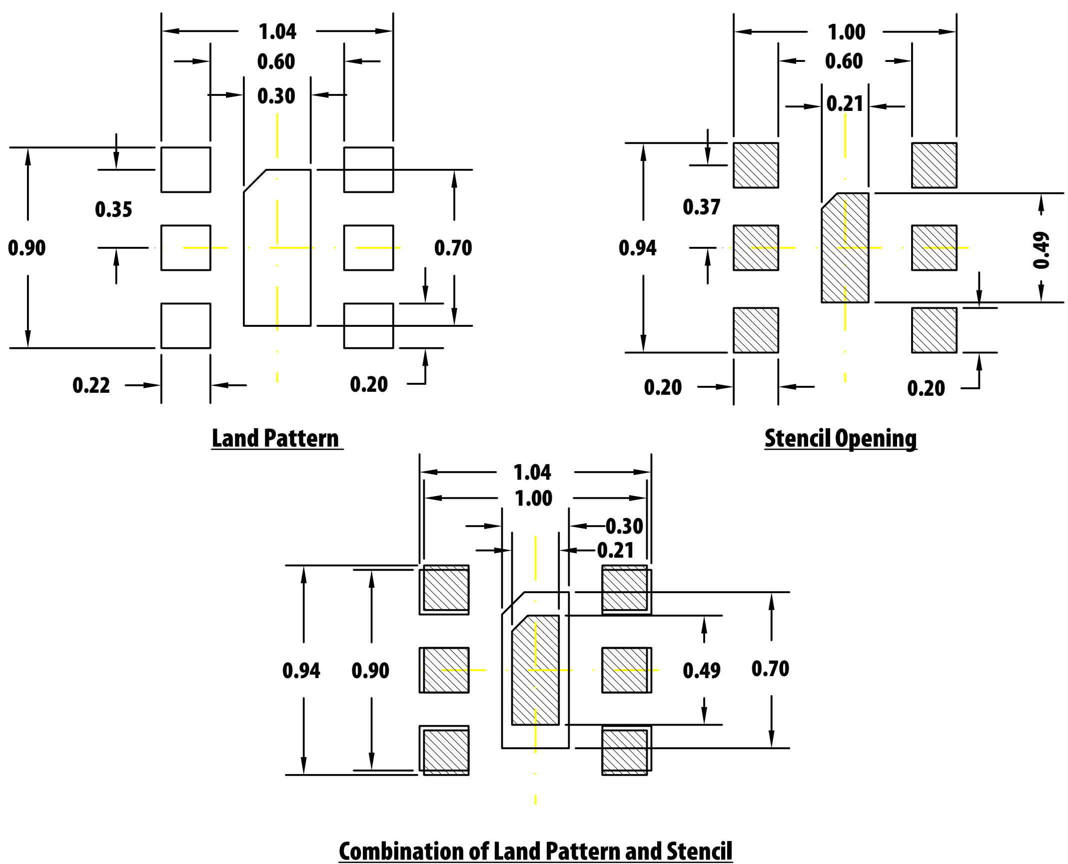
Package Dimensions



Note :

1. Package marking provides orientation and identification.
2. All dimension are in Milimeters
3. Dimension are inclusive of plating
4. Dimension are exclusive of mold flash and metal burr.
5. "K" = Product code
6. "X" = Month & Year of manufacture

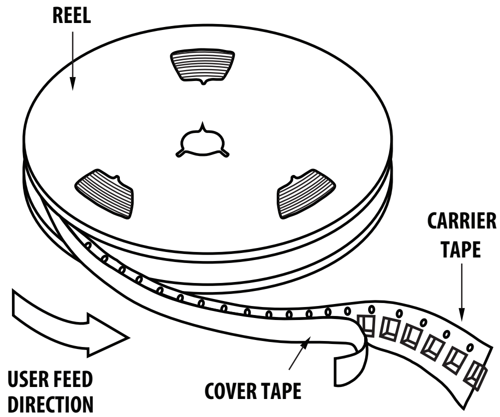
PCB Land Patterns and Stencil Design

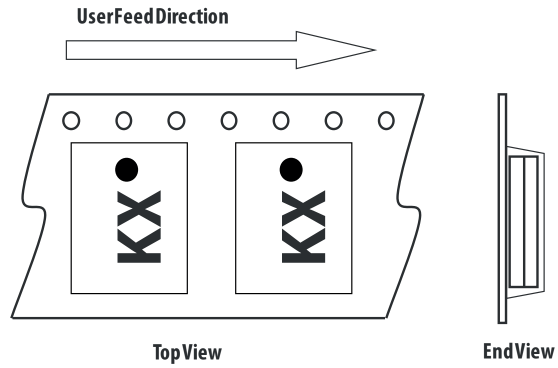


Note :

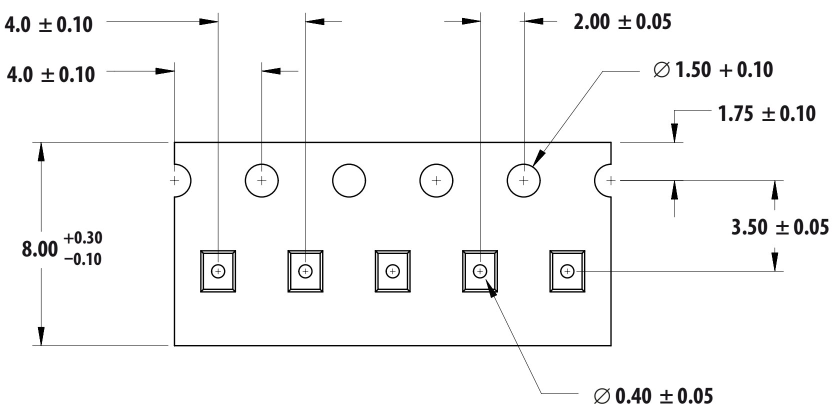
1. All dimension are in MM
2. Recommend to use 3 mils stencil thickness

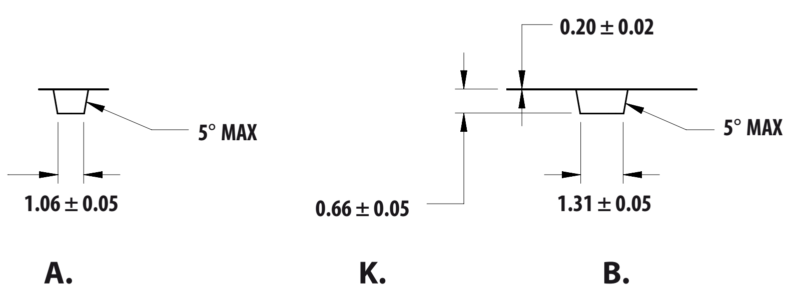
Device Orientation

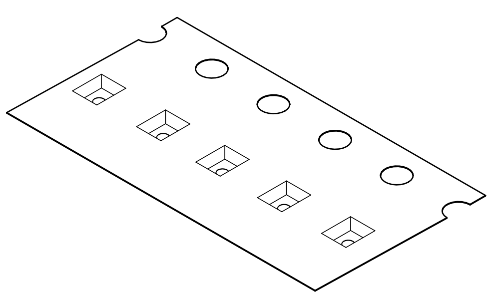




Tape Dimensions

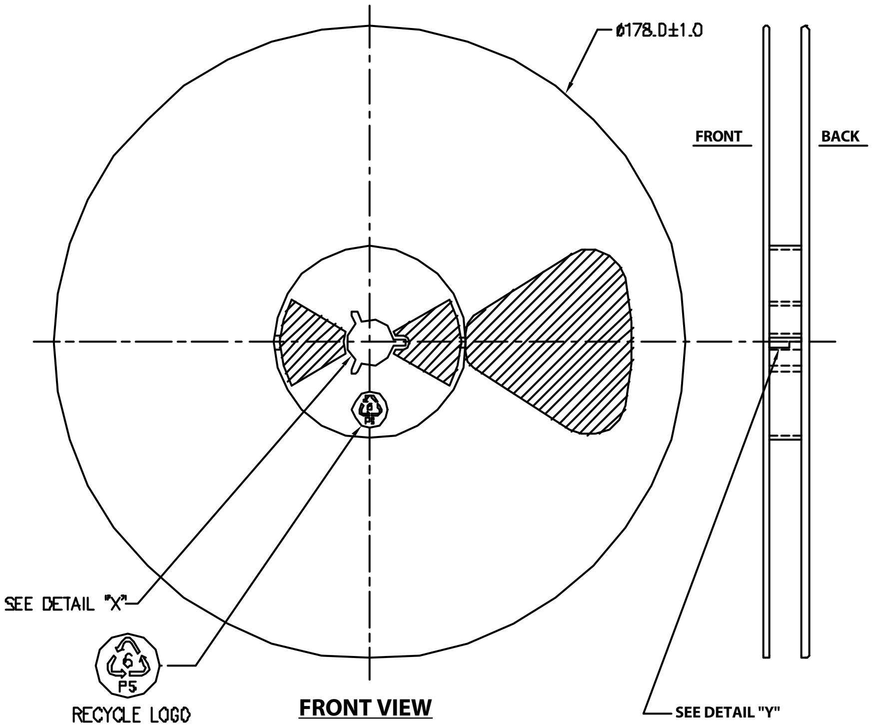






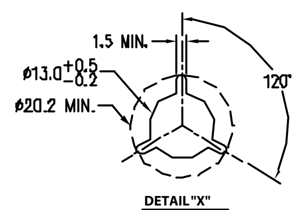
Note: All dimensions are in millimeters

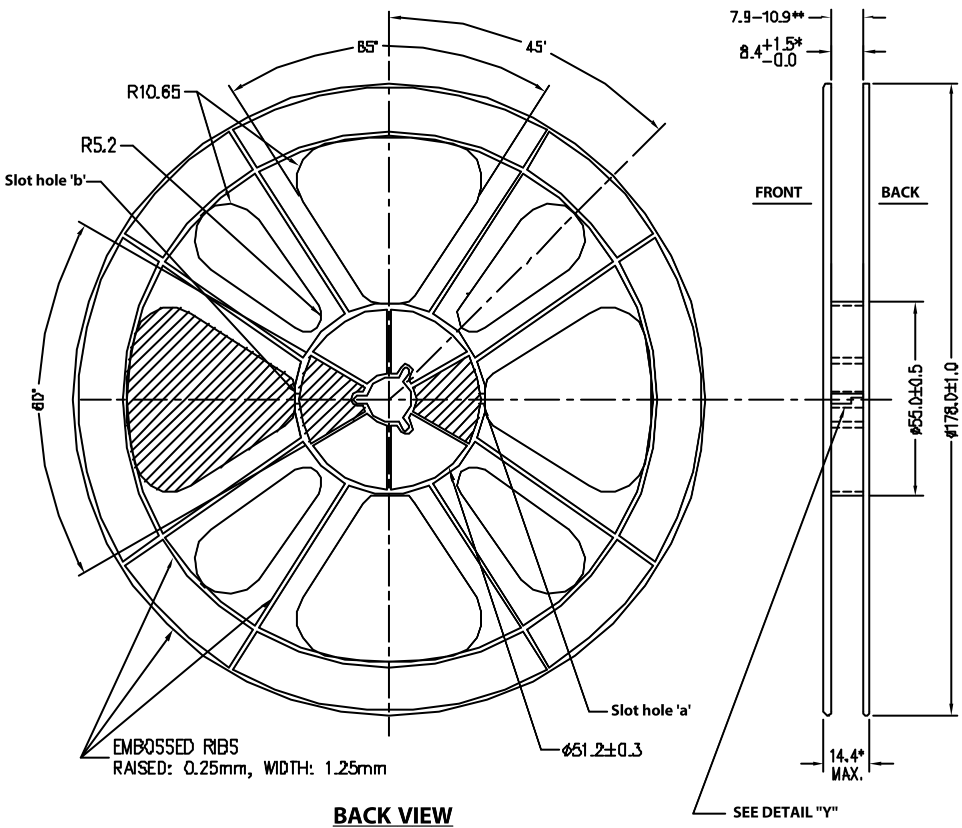
Reel Dimensions (7" reel)

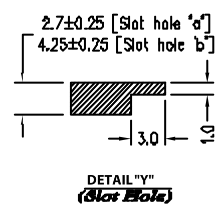


NO.	COLOUR	SURFACE RESISTIVITY
1.	PANTONE 285U DARK BLUE	ANTISTATIC COATED 10^{6}–10^{11} PER OHMS SQUARE
2.	BLACK	CONDUCTIVE $<10^{8}$ PER OHMS SQUARE
3.	WHITE	ANTISTATIC IMPREGNATED 10^{6}–10^{11} PER OHMS SQUARE
4.	PANTONE 3295C DARK GREEN	ANTISTATIC COATED 10^{6}–10^{11} PER OHMS SQUARE
5.	BLACK	ANTISTATIC 10^{6}–10^{11} PER OHMS SQUARE
6.	PANTONE 278C LIGHT BLUE	ANTISTATIC COATED 10^{6}–10^{11} PER OHMS SQUARE
7.	WHITE	ANTISTATIC COATED 10^{6}–10^{11} PER OHMS SQUARE
8.	NATURAL	ANTISTATIC COATED 10^{6}–10^{11} PER OHMS SQUARE
9.	PANTONE 298C-299C DULL LIGHT BLUE	ANTISTATIC COATED 10^{6}–10^{11} PER OHMS SQUARE

Note: X in Part Numbering denotes colour code







Solder Paste recommendation

The soldering and reflow profile recommended is from JEDEC standard JSTD020D-01. Refer to the JEDEC standard for latest updates.

The recommended solder for mounting surface mount package is Sn63 (63% SN 37% Pb) because it is a eutectic compound with a melting point (183°C) not high enough to exceed the standard operating limit of the devices. Furthermore, it is low enough to avoid damaging circuitry during solder reflow operations.

The recommended lead free solder for SMT reflow is Sn-Ag-Cu (95.5% Tin / 3.8% Silver/ 0.7% Copper). This lead free solder paste has a melting point of 217°C (423°F), the ternary eutectic of Sn-Ag-Cu system, giving it the advantage of being the lowest melting lead free alternative. This temperature is still low enough to avoid damaging the internal circuitry during solder reflow operations provided the time of exposure at peak reflow temperature versus time is shown in Figure 30.

The solder paste used in this evaluation is RX 303-92 SK HO(S) by Nihon Handa. Profile in Figure 30 is recommended in automated reflow process to ensure reliable finished joints. However, profile will vary among different solder paste from different manufacturers. Other factors that may affect the profile includes the density and type of components on the board, type of solder and type of board or substrate material being used. The profile shows the actual temperature that should occur on the surface of a test board at or near a central solder joint. During this type of reflow soldering, the circuit board and solder joints tend to heat first. The components on the board are then heated by conduction. The circuit because it has a large surface area, absorbs thermal energy more efficiently, and then distributes this heat to the components.

Reflow temperature profiles designed for tin/ lead alloys will need to be revised accordingly to cater for the melting point of the lead free solder being 34°C (93°F) higher than that of tin / lead eutectic or near eutectic alloys. Outlined below is a typical convection reflow lead free profile. However, this should only be taken as a guideline from which to start from.

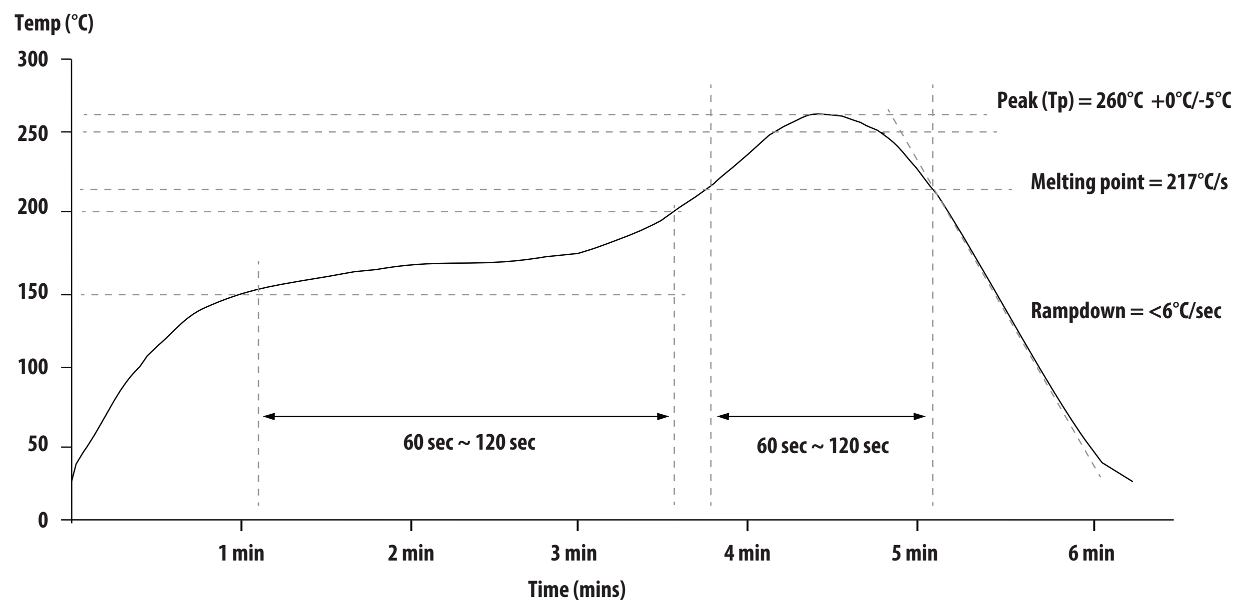


Figure 30. Recommended reflow profile

Remarks

Ramp	Max slope for this zone is limited to 2°C/ sec. Higher than 2°C may result in excessive solder balling and slump.
Preheat	Preheating setting is usually calculated from 100°C to 150°C with typical time setting of between 70-100 seconds. If possible, do not preheat beyond the time setting recommended to prevent excessive oxidation to the solder surface.
Reflow	The peak reflow temperature is calculated by adding ~30°C to the melting point of the solder alloy 92 SK, which melts at 217°C. The peak reflow temperature is 217°C +30°C =247°C (-0°C+5°C). The time at peak is not critical and usually not measured as it is very dependent on the type of oven used.
	Time over 217°C is however critical as it will determine the appearance of the solder joints after reflow. Typical time over 217°C for solder alloy 92 is from 40-60 seconds. Longer reflow time may result in dull and gritty solder joints and charring of flux residues. Time below 30 seconds may result in insufficient wetting and poor inter-metallic formation.
Cooling	Max slope for cooling is limited to 4°C/ sec. Cooling at a faster rate may result in cracked solder joints. Slower cooling may result in dull solder joints.

For product information and a complete list of distributors, please go to our web site: **www.avagotech.com**

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