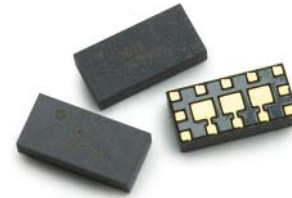


# ALM-1812

## GPS Filter-LNA-Filter Front-End Module



### Data Sheet



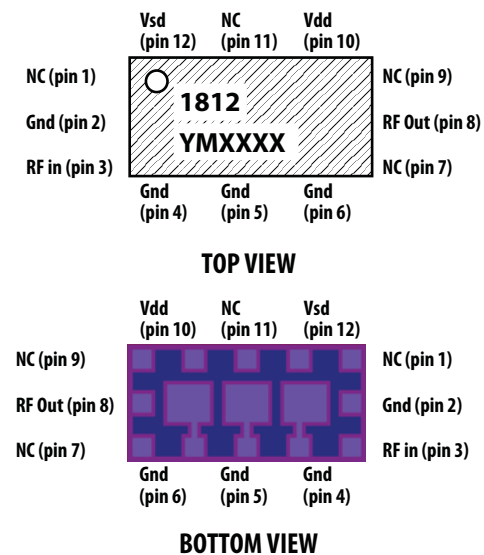
#### Description

Avago Technologies' ALM-1812 is a GPS front-end module that combines a high-gain low-noise amplifier (LNA) with GPS FBAR filters. The LNA uses Avago Technologies' proprietary GaAs Enhancement-mode pHEMT process to achieve high gain with very low noise figure and high linearity. Noise figure distribution is very tightly controlled. A CMOS-compatible shutdown pin is included either for turning the LNA on/off, or for current adjustment. The integrated filter utilizes an Avago Technologies' leading-edge FBAR filter for exceptional rejection at Cell/PCS-Band frequencies.

The low noise figure and high gain, coupled with low current consumption make it suitable for use in critical low-power GPS applications or during low-battery situations.

#### Component Image

Surface Mount 4.5 x 2.2 x 0.95 mm<sup>3</sup> 12-lead MCOB



Note:  
 Package marking provides orientation and identification  
 "1812" = Product Code  
 "Y" = Year of manufacture  
 "M" = Month of manufacture  
 "XXXX" = Last 4 digit of lot number

#### Features

- Very Low Noise Figure
- Exceptional Cell/PCS-Band rejection
- Low external component count
- Fully-matched at RF input and RF output
- Shutdown current: < 1 uA
- CMOS compatible shutdown pin (SD)
- ESD: > 3kV at RFin pin
- 4.5 x 2.2 x 0.95 mm<sup>3</sup> size
- Adjustable bias current via single external resistor/voltage
- Lead-free, Halogen free and meets MSL3

#### Specifications (Typical performance @ 25°C)

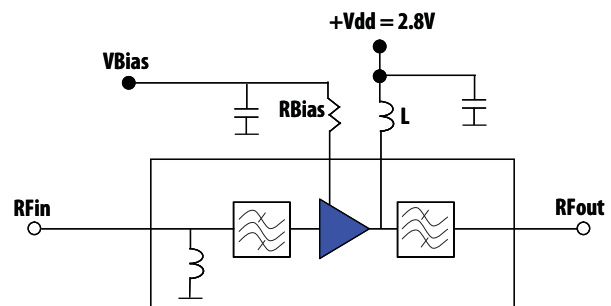
At 1.575GHz, Vdd = 2.8V, Idd = 6.8mA

- Gain = 19.1 dB
- NF = 1.66 dB
- IIP3 = +2 dBm, IP1dB = -8 dBm
- S11 = -10 dB, S22 = -15 dB
- Cell-Band Rejection: > 90dBc
- PCS-Band Rejection: > 85dBc

#### Application

- GPS Front-end Module

#### Application Circuit



## Absolute Maximum Rating <sup>[1]</sup> T<sub>A</sub> = 25°C

| Symbol              | Parameter                                                            | Units | Absolute Max. |
|---------------------|----------------------------------------------------------------------|-------|---------------|
| V <sub>dd</sub>     | Device Drain to Source Voltage <sup>[2]</sup>                        | V     | 3.6           |
| I <sub>dd</sub>     | Drain Current <sup>[2]</sup>                                         | mA    | 15            |
| P <sub>in,max</sub> | CW RF Input Power<br>(V <sub>dd</sub> = 2.8V, I <sub>dd</sub> = 6mA) | dBm   | 13            |
| P <sub>diss</sub>   | Total Power Dissipation <sup>[4]</sup>                               | mW    | 54            |
| T <sub>L</sub>      | Operating Temperature                                                | °C    | -40 to 85     |
| T <sub>j</sub>      | Junction Temperature                                                 | °C    | 150           |
| T <sub>STG</sub>    | Storage Temperature                                                  | °C    | -65 to 150    |

## Thermal Resistance <sup>[3]</sup>

(V<sub>dd</sub> = 2.8 V, I<sub>dd</sub> = 6mA) θ<sub>JC</sub> = 82.1°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 T<sub>B</sub> is 25°C. Derate 4.2 mW/°C for T<sub>B</sub> > 145.6°C.

## Electrical Specifications

T<sub>A</sub> = 25°C, Freq = 1.575GHz, measured on demo board<sup>[1]</sup> unless otherwise specified – Typical Performance<sup>[1]</sup>

**Table 1. Performance at V<sub>dd</sub> = V<sub>sd</sub> = 2.8V, I<sub>dd</sub> = 6.8mA (R<sub>2</sub> = 3.9k Ohm, see Fig 1) nominal operating conditions**

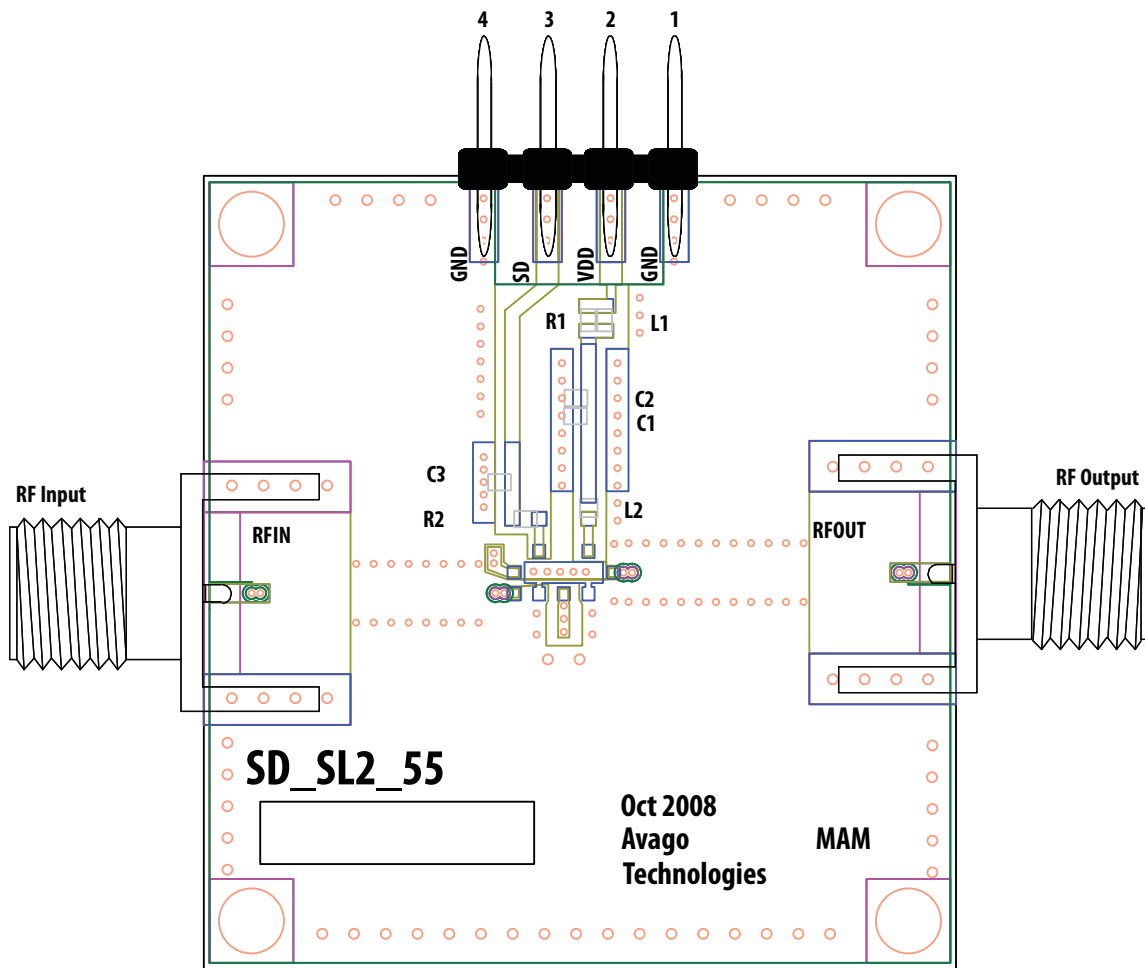
| Symbol                   | Parameter and Test Condition                                                     | Units | Min. | Typ  | Max. |
|--------------------------|----------------------------------------------------------------------------------|-------|------|------|------|
| G                        | Gain                                                                             | dB    | 16.5 | 19.1 | –    |
| NF                       | Noise Figure                                                                     | dB    | –    | 1.66 | 2.3  |
| IP1dB                    | Input 1dB Compressed Power                                                       | dBm   | –    | -8   | –    |
| IIP3 <sup>[2]</sup>      | Input 3 <sup>rd</sup> Order Intercept Point (2-tone @ F <sub>c</sub> +/- 2.5MHz) | dBm   | –    | +2   | –    |
| S11                      | Input Return Loss                                                                | dB    | –    | -10  | –    |
| S22                      | Output Return Loss                                                               | dB    | –    | -15  | –    |
| S12                      | Reverse Isolation                                                                | dB    | –    | -30  | –    |
| Cell Band Rejection      | Relative to 1.575GHz @ 827.5MHz                                                  | dBc   | 78   | 96.6 | –    |
| PCS Band Rejection       | Relative to 1.575GHz @ 1885MHz                                                   | dBc   | 78   | 91.7 | –    |
| IP1dB <sub>890MHz</sub>  | Input 1dB gain compression interferer signal level at 890MHz                     | dBm   |      | 29   |      |
| IP1dB <sub>1885MHz</sub> | Input 1dB gain compression interferer signal level at 1885MHz                    | dBm   |      | 26   |      |
| I <sub>dd</sub>          | Supply DC current at Shutdown (SD) voltage V <sub>sd</sub> = 2.8V                | mA    | –    | 6.8  | 11.5 |
| I <sub>sh</sub>          | Shutdown Current @ V <sub>SD</sub> = 0V                                          | uA    | –    | 0.5  | –    |

**Table 2. Performance at V<sub>dd</sub> = V<sub>sd</sub> = 1.8V, I<sub>dd</sub> = 4mA (R<sub>2</sub> = 3.9k Ohm, see Fig 1) nominal operating conditions**

| Symbol                   | Parameter and Test Condition                                                     | Units | Typ  |
|--------------------------|----------------------------------------------------------------------------------|-------|------|
| G                        | Gain                                                                             | dB    | 16.5 |
| NF                       | Noise Figure                                                                     | dB    | 1.9  |
| IP1dB                    | Input 1dB Compressed Power                                                       | dBm   | -11  |
| IIP3 <sup>[2]</sup>      | Input 3 <sup>rd</sup> Order Intercept Point (2-tone @ F <sub>c</sub> +/- 2.5MHz) | dBm   | -1   |
| S11                      | Input Return Loss                                                                | dB    | -9   |
| S22                      | Output Return Loss                                                               | dB    | -13  |
| S12                      | Reverse Isolation                                                                | dB    | -29  |
| Cell Band Rejection      | Relative to 1.575GHz @ 827.5MHz                                                  | dBc   | >90  |
| PCS Band Rejection       | Relative to 1.575GHz @ 1885MHz                                                   | dBc   | >85  |
| IP1dB <sub>890MHz</sub>  | Input 1dB gain compression interferer signal level at 890MHz                     | dBm   | 29   |
| IP1dB <sub>1885MHz</sub> | Input 1dB gain compression interferer signal level at 1885MHz                    | dBm   | 26   |
| I <sub>dd</sub>          | Supply DC current at Shutdown (SD) voltage V <sub>sd</sub> = 1.8V                | mA    | 4    |
| I <sub>sh</sub>          | Shutdown Current @ V <sub>SD</sub> = 0V                                          | uA    | 0.5  |

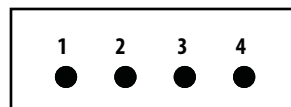
Notes:

1. Measurements at 1.575GHz obtained using schematic described in Figure 1 below.
2. 1.575GHz IIP3 test condition: F<sub>RF1</sub> = 1572.5 MHz, F<sub>RF2</sub> = 1577.5 MHz with input power of -20dBm per tone measured at the worst case side band.



#### DC Pin Configuration of 4-pin connector

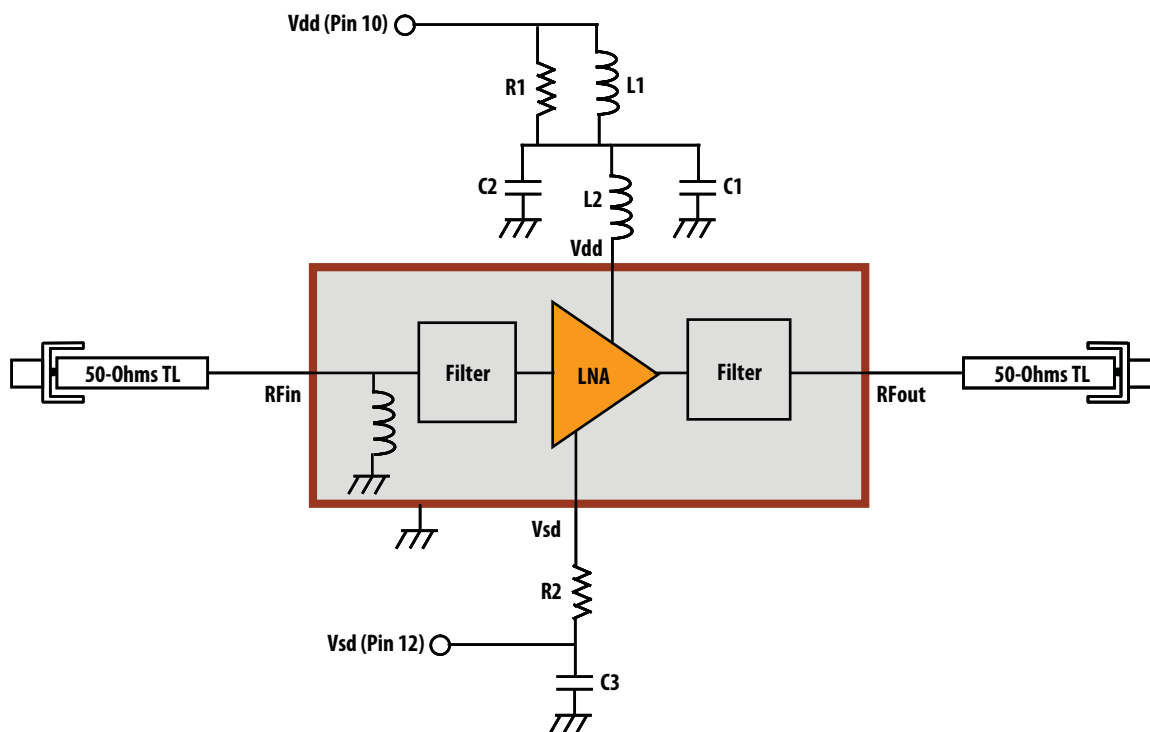
Pins pointing  
out of the page



Pins 1, 4 = GND  
Pin 2 = Vdd Supply  
Pin 3 = Shutdown (SD)

| Circuit Symbol | Size | Description                                |
|----------------|------|--------------------------------------------|
| L1             | 0402 | 22 nH Inductor (Taiyo Yuden HK100522NJ-T)  |
| L2             | 0402 | 1.5 nH Inductor (Taiyo Yuden HK10051N5S-T) |
| C1             | 0402 | 0.1 uF Capacitor (Kyocera CM05X5R104K10AH) |
| C2             | 0402 | 47 pF Capacitor (Kyocera CM05CH470J50AHF)  |
| C3             | 0402 | 330 pF Capacitor (Kyocera CM05CH331J16AHF) |
| R1             | 0402 | 10 Ohms Resistor (KOA RK73B1ETTB100J )     |
| R2             | 0402 | 3.9 kOhm Resistor (KOA RK73B1ETTB392J)     |

Figure 1. Demoboard and application circuit components table



**Figure 2. Demoboard and application schematic diagram**

#### Notes

1. The module is fully matched at the input and output RF pins. The RFin pin is directly connected to a shunt inductor that is grounded. The RF output filter blocks DC. Best noise performance is obtained using high-Q wirewound inductors. This circuit demonstrates that low noise figures are obtainable with standard 0402 chip inductors.
2. C2 and L2 form a matching network that affects the frequency response and linearity of the LNA, these can be tuned to optimize gain and return loss.
3. L1 and R1 isolates the demoboard from external disturbances during measurement. It is not needed in actual application. Likewise, C1 and C3 mitigate the effect of external noise pickup on the Vdd and Vsd lines respectively. These components are not required in actual operation.
4. Bias control is achieved by either varying the Vsd voltage with/ without R2, or fixing the Vsd voltage to Vdd and adjusting R2 for the desired current.

## ALM-1812 Typical Performance Curves at 25°

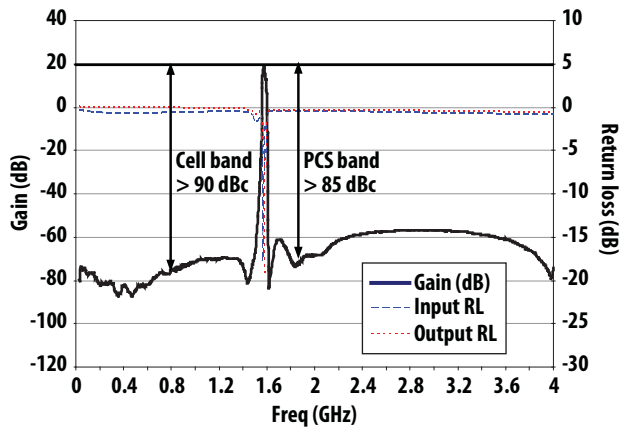


Figure 3a. Typical S-Parameter Plot @ Vdd = 2.8V, Idd = 6.8mA

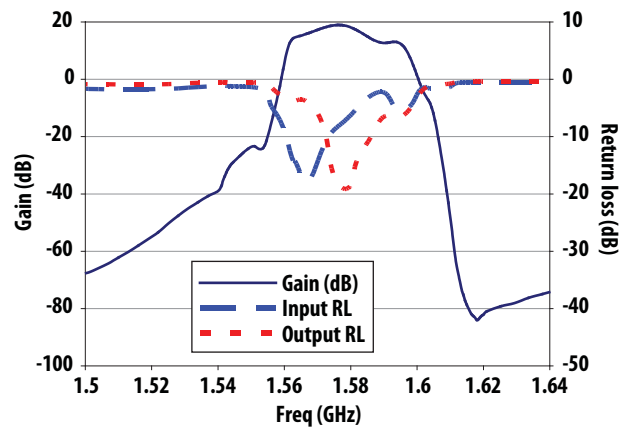


Figure 3b. Passband response of typical S-Parameter Plot @ Vdd = 2.8V, Idd = 6.8mA

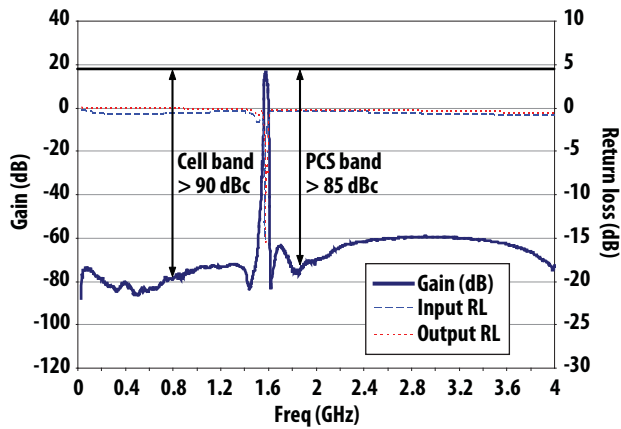


Figure 4a. Typical S-Parameter Plot @ Vdd = 1.8V, Idd = 4mA

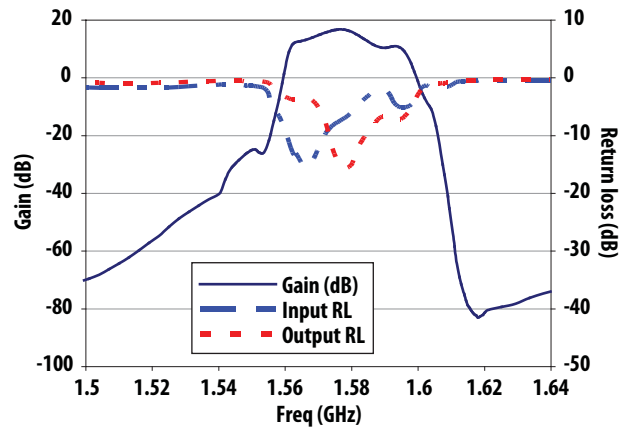


Figure 4b. Passband response of typical S-Parameter Plot @ Vdd = 1.8V, Idd = 4mA

## ALM-1812 Typical Performance Curves at 25°C, R2 = 3.9k0hm

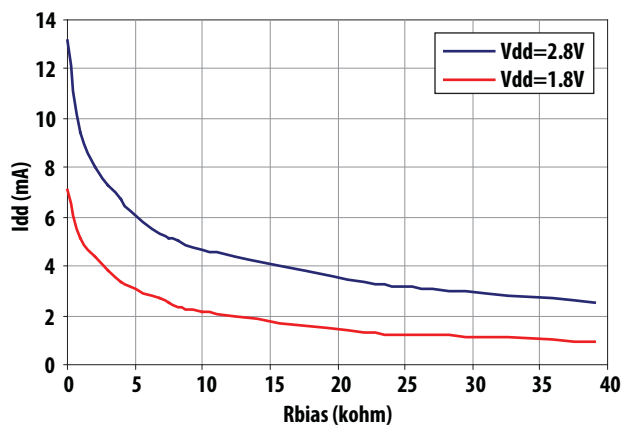


Figure 5. Idd vs Rbias at 25°C

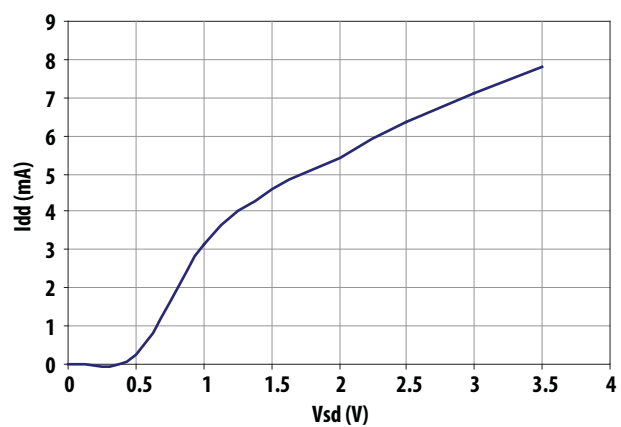


Figure 6. Idd vs Vsd for Vdd = 2.8V, R2 = 3.9k 0hm

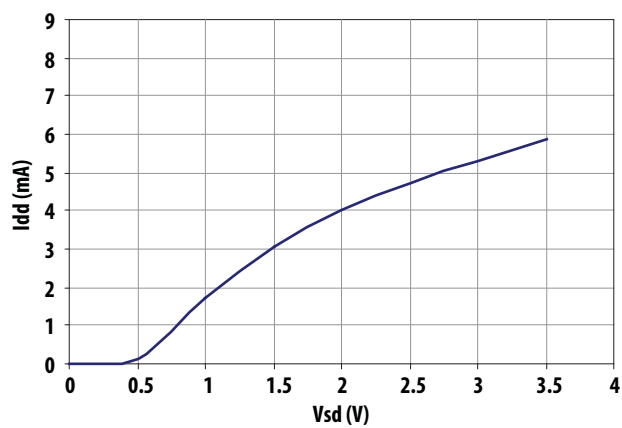


Figure 7. Idd vs Vsd for Vdd = 1.8V, R2 = 3.9k 0hm

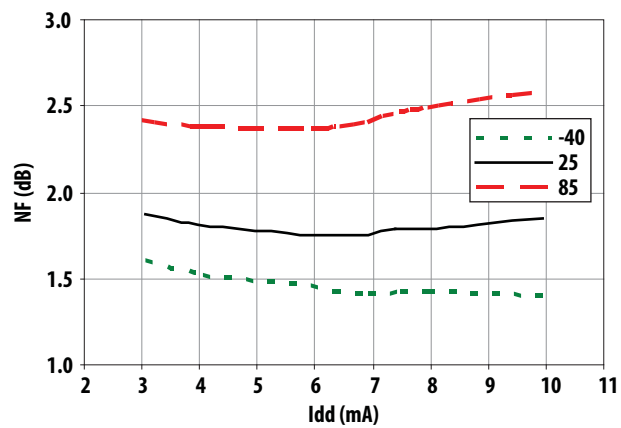


Figure 8. NF vs. Idd at Vdd = 2.8V

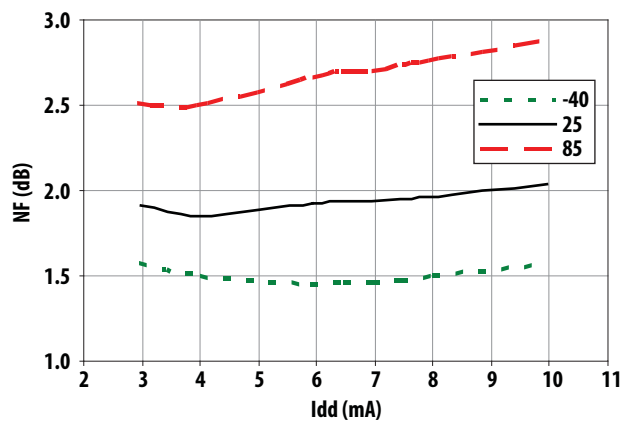


Figure 9. NF vs Idd at Vdd = 1.8V

# ALM-1812 Typical Performance Curves at 25°C, R2 = 3.9k0hm (cont'd)

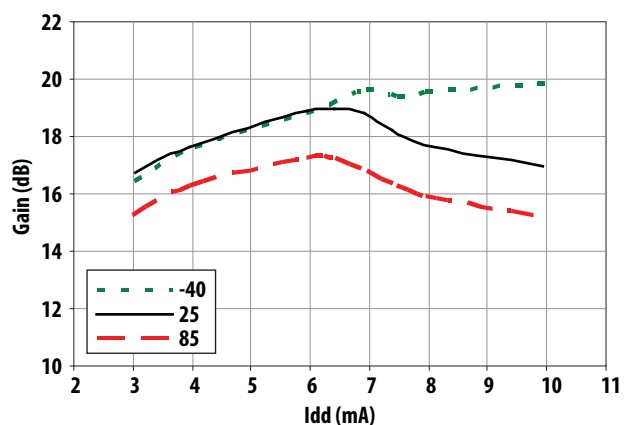


Figure 10. Gain vs. Idd at Vdd = 2.8V

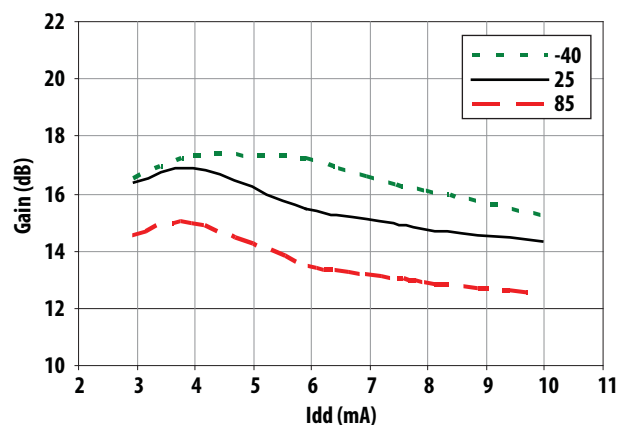


Figure 11. Gain vs. Idd at Vdd = 1.8V

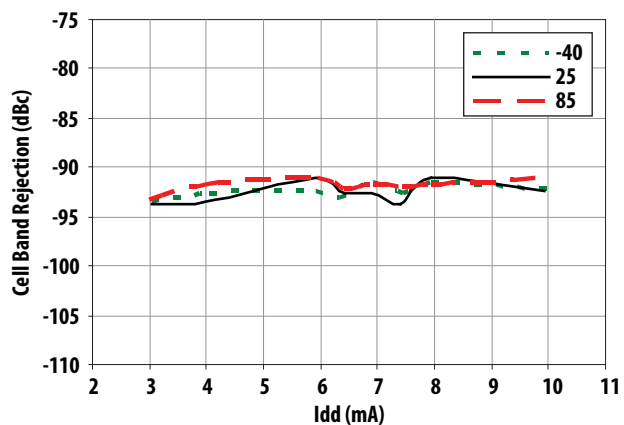


Figure 12. Cell band rejection vs. Idd at Vdd = 2.8V

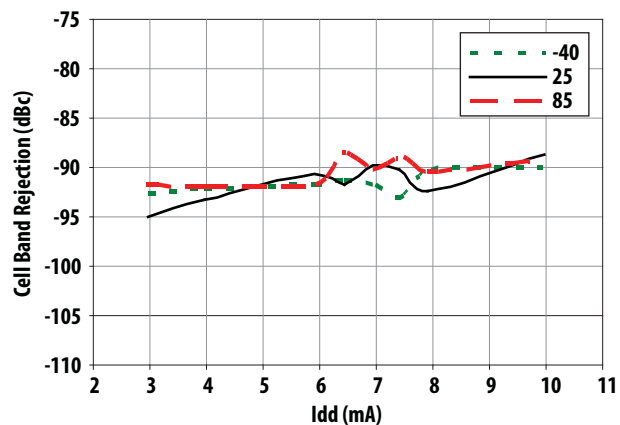


Figure 13. Cell band rejection vs. Idd at Vdd = 1.8V

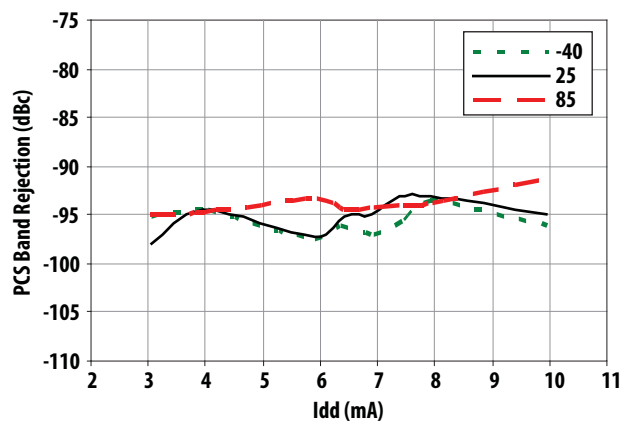


Figure 14. PCS band rejection vs. Idd at Vdd = 2.8V

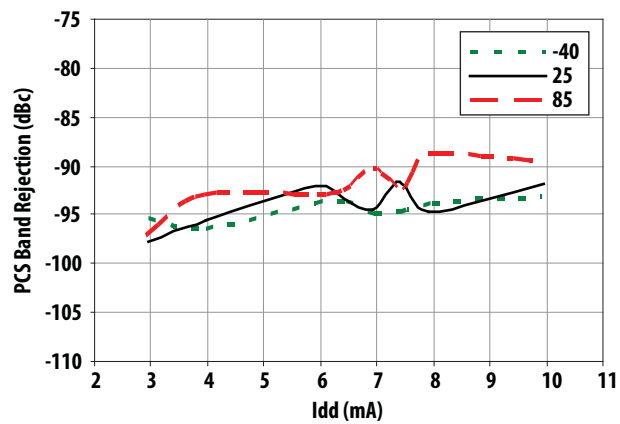


Figure 15. PCS band rejection vs. Idd at Vdd = 1.8V

# ALM-1812 Typical Performance Curves at 25°C, R2 = 3.9k0hm (cont'd)

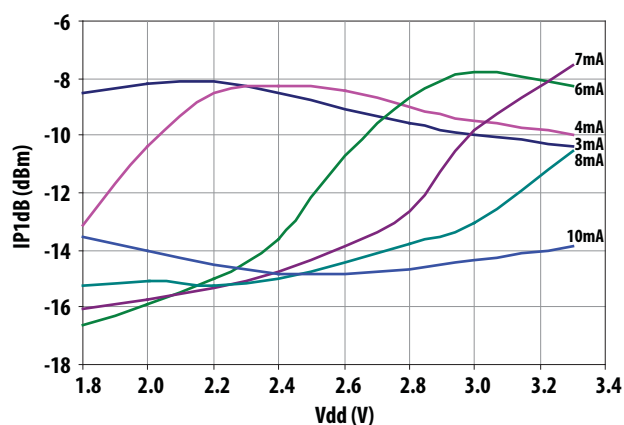


Figure 16. IP1dB vs. Vdd at 25°C

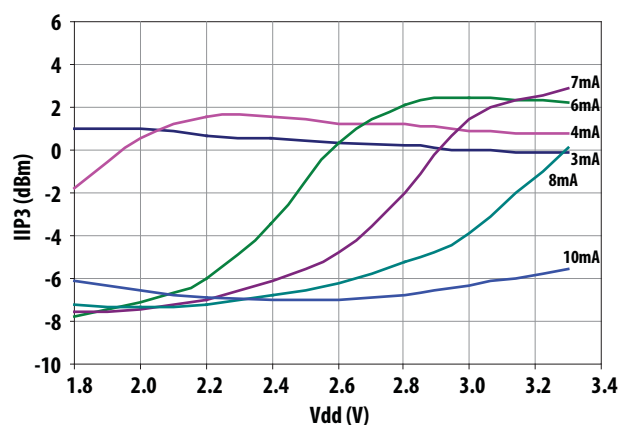


Figure 17. IIP3 vs. Vdd at 25°C

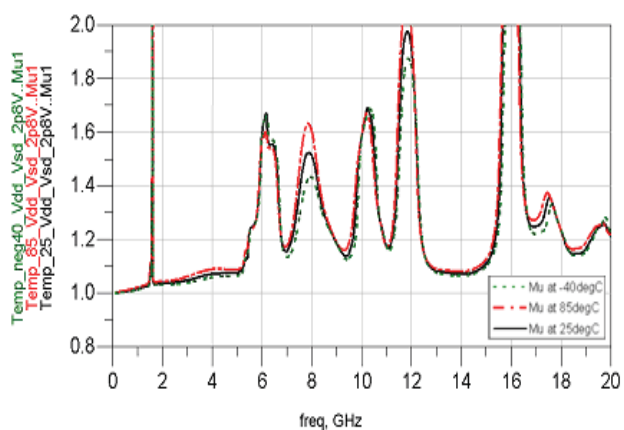


Figure 18. Edwards-Sinsky Output Stability Factor (Mu) at Vdd = 2.8V

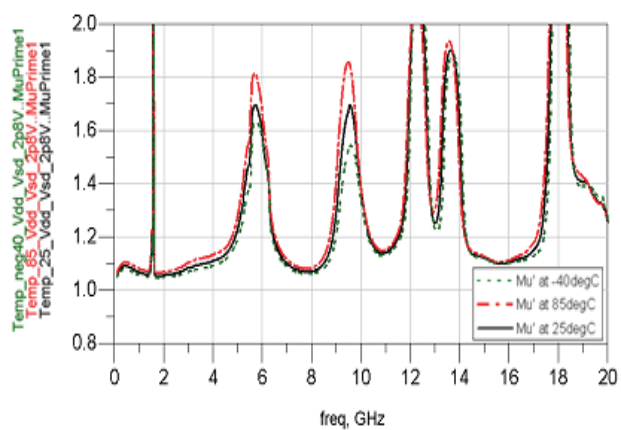


Figure 19. Edwards-Sinsky Input Stability Factor (Mu') at Vdd = 2.8V

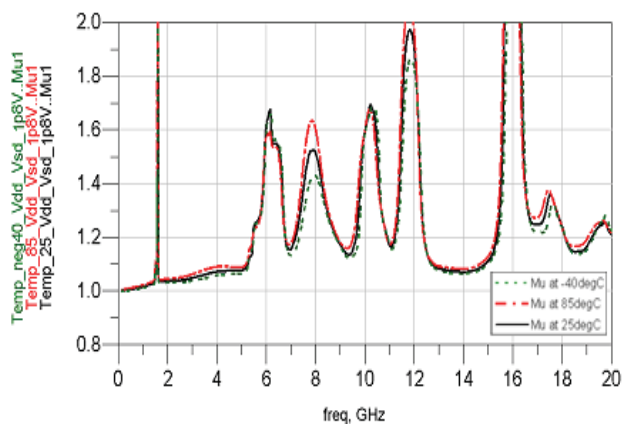


Figure 20. Edwards-Sinsky Output Stability Factor (Mu) at Vdd = 1.8V

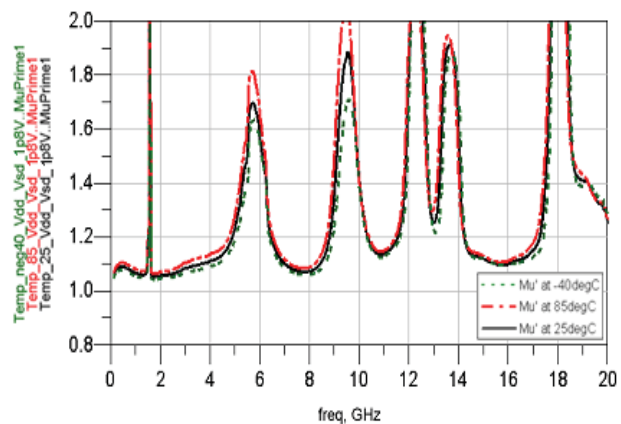


Figure 21. Edwards-Sinsky Input Stability Factor (Mu') at Vdd = 1.8V

## ALM-1812 Scattering Parameter and Measurement Reference Planes

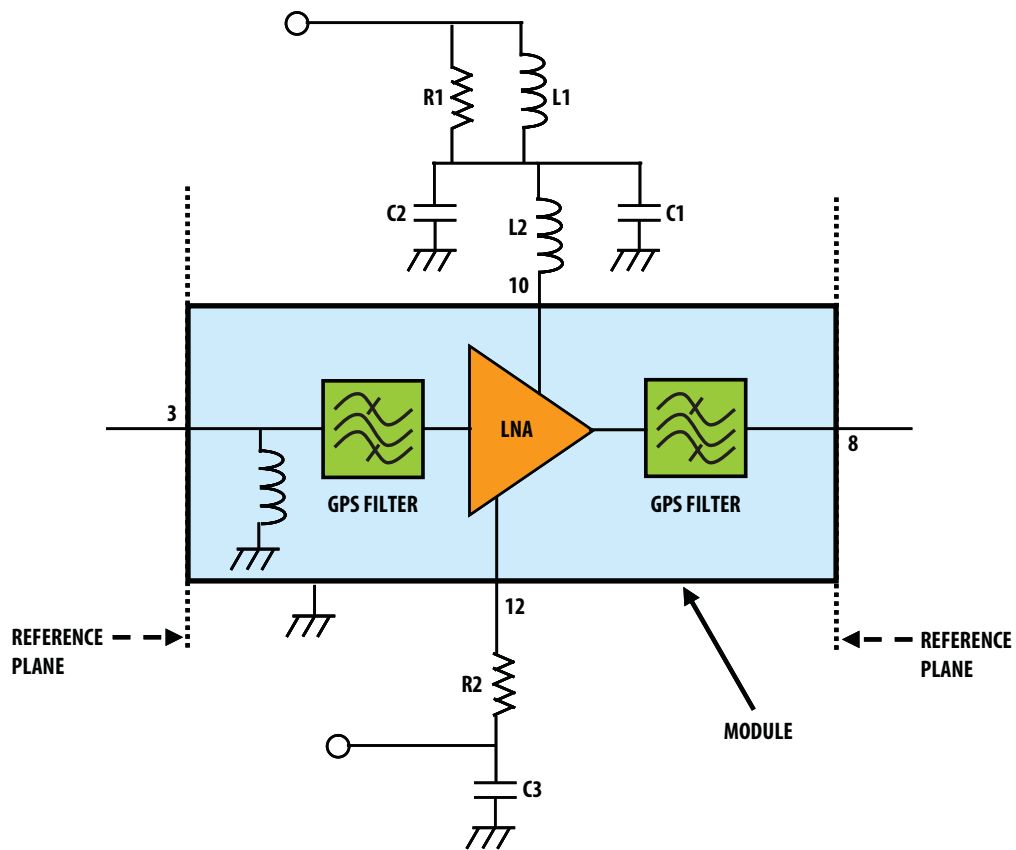


Figure 22. Scattering parameter measurement reference planes

## ALM-1812 Typical Scattering Parameters at 25°C, Vdd = 2.8V, Idd = 6.8mA

The S- and Noise Parameters are measured using a coplanar waveguide PCB with 10 mils Rogers® RO4350. Figure 27 shows the input and output reference planes. The circuit values are as indicated in Figure 6.

| Freq<br>(GHz) | S11<br>Mag. (dB) | S11<br>Ang. | S21<br>Mag. (dB) | S21<br>Ang. | S12<br>Mag. (dB) | S12<br>Ang. | S22<br>Mag. (dB) | S22<br>Ang. |
|---------------|------------------|-------------|------------------|-------------|------------------|-------------|------------------|-------------|
| 0.05          | -0.36            | 167.90      | -70.91           | 179.43      | -72.41           | -33.51      | -0.02            | -1.13       |
| 0.1           | -0.48            | 157.43      | -73.83           | 90.22       | -72.95           | -44.37      | -0.02            | -2.30       |
| 0.2           | -0.61            | 137.05      | -75.70           | -98.13      | -76.85           | 143.01      | -0.03            | -4.72       |
| 0.3           | -0.59            | 118.80      | -79.52           | 144.78      | -78.22           | 18.52       | -0.03            | -7.15       |
| 0.4           | -0.56            | 102.02      | -80.81           | -93.44      | -80.94           | -96.45      | -0.05            | -9.58       |
| 0.5           | -0.54            | 86.73       | -80.23           | 173.99      | -81.68           | 49.58       | -0.07            | -12.00      |
| 0.6           | -0.51            | 72.90       | -84.40           | -139.64     | -83.85           | -22.49      | -0.08            | -14.49      |
| 0.7           | -0.48            | 60.09       | -80.13           | 31.21       | -84.39           | 104.85      | -0.10            | -17.07      |
| 0.8           | -0.47            | 48.25       | -77.24           | 19.91       | -82.49           | 140.19      | -0.13            | -19.77      |
| 0.8275        | -0.46            | 45.13       | -76.66           | -1.05       | -81.84           | -26.77      | -0.13            | -20.53      |
| 0.9           | -0.45            | 37.19       | -74.69           | -9.12       | -80.63           | 159.19      | -0.15            | -22.57      |
| 1.0           | -0.44            | 26.19       | -72.60           | -22.11      | -83.78           | 49.06       | -0.17            | -25.01      |
| 1.1           | -0.44            | 15.97       | -71.50           | -42.85      | -83.42           | 164.49      | -0.20            | -27.52      |
| 1.2           | -0.46            | 6.12        | -71.18           | -53.20      | -84.42           | -64.80      | -0.23            | -31.01      |
| 1.3           | -0.51            | -4.06       | -70.88           | -56.47      | -84.53           | 28.25       | -0.26            | -34.89      |
| 1.4           | -0.60            | -16.54      | -77.69           | -86.33      | -78.22           | -127.64     | -0.30            | -40.11      |
| 1.5           | -2.15            | -39.74      | -52.92           | 178.08      | -71.88           | -163.04     | -1.14            | -49.93      |
| 1.575         | -12.00           | -162.25     | 18.44            | 157.76      | -30.80           | 116.58      | -7.66            | 49.43       |
| 1.6           | -0.95            | 56.36       | -4.42            | -5.83       | -53.21           | -47.84      | -1.14            | 4.99        |
| 1.7           | -0.51            | -13.71      | -77.00           | -145.33     | -80.55           | -115.70     | -0.32            | -35.94      |
| 1.8           | -0.57            | -27.70      | -76.26           | -121.44     | -78.53           | -131.67     | -0.33            | -42.70      |
| 1.885         | -0.60            | -36.23      | -84.37           | 147.81      | -71.90           | -132.40     | -0.34            | -46.60      |
| 1.9           | -0.61            | -37.61      | -77.77           | 96.20       | -72.22           | -128.72     | -0.34            | -47.22      |
| 2.0           | -0.66            | -46.35      | -62.56           | 48.44       | -70.83           | -128.36     | -0.35            | -51.19      |
| 2.1           | -0.70            | -54.49      | -52.67           | 3.05        | -67.29           | -138.82     | -0.35            | -54.92      |
| 2.2           | -0.70            | -62.05      | -49.53           | -43.62      | -64.95           | -149.31     | -0.36            | -58.43      |
| 2.3           | -0.69            | -69.58      | -49.33           | -75.23      | -63.28           | -150.12     | -0.36            | -61.85      |
| 2.4           | -0.69            | -76.98      | -49.47           | -93.88      | -62.60           | -160.56     | -0.36            | -65.19      |
| 2.5           | -0.69            | -84.41      | -49.34           | -107.39     | -61.30           | -165.14     | -0.37            | -68.55      |
| 3.0           | -0.71            | -118.39     | -48.63           | -151.44     | -56.60           | 176.28      | -0.37            | -83.99      |
| 3.5           | -0.69            | -150.17     | -48.84           | 171.67      | -53.14           | 154.09      | -0.36            | -98.92      |
| 4.0           | -0.83            | 176.10      | -54.58           | 125.18      | -50.85           | 127.76      | -0.41            | -115.73     |
| 4.5           | -1.07            | 145.32      | -52.45           | -42.92      | -51.74           | 108.49      | -0.49            | -131.29     |
| 5.0           | -1.37            | 108.52      | -36.63           | -103.59     | -57.19           | 116.36      | -0.71            | -153.16     |
| 6.0           | -3.36            | 39.77       | -24.42           | 135.12      | -42.94           | 124.29      | -7.89            | 89.52       |
| 7.0           | -1.25            | -20.47      | -39.38           | -6.98       | -53.09           | 139.34      | -0.95            | 178.08      |
| 8.0           | -1.50            | -73.87      | -32.30           | 82.78       | -40.36           | 141.29      | -0.96            | 135.38      |
| 9.0           | -1.57            | -129.61     | -30.13           | 163.08      | -27.18           | 86.19       | -1.65            | 118.05      |
| 10.0          | -2.49            | -178.13     | -22.11           | 54.31       | -22.22           | 41.54       | -2.73            | 71.53       |
| 11.0          | -4.03            | 132.11      | -18.89           | -75.98      | -20.13           | -111.40     | -3.60            | 82.03       |
| 12.0          | -4.63            | 63.14       | -29.16           | -95.52      | -35.45           | -70.23      | -2.13            | 53.32       |
| 13.0          | -4.96            | -64.89      | -24.87           | -131.78     | -28.36           | -120.38     | -1.60            | 27.95       |
| 14.0          | -3.23            | -143.72     | -24.81           | 158.49      | -28.55           | 171.46      | -2.11            | -5.53       |
| 15.0          | -3.78            | 131.84      | -28.69           | 146.44      | -29.29           | 160.75      | -2.96            | -34.59      |
| 16.0          | -5.51            | 49.69       | -21.18           | 55.22       | -23.10           | 62.73       | -4.57            | -100.39     |
| 17.0          | -10.35           | 174.02      | -24.73           | -68.32      | -27.84           | -66.54      | -4.47            | 107.18      |
| 18.0          | -4.30            | 89.47       | -26.34           | 99.23       | -26.72           | 92.85       | -2.37            | 28.83       |
| 19.0          | -5.60            | 49.69       | -24.29           | -38.15      | -25.85           | -43.76      | -4.27            | -29.69      |
| 20.0          | -3.34            | 1.63        | -21.00           | 178.45      | -21.72           | -176.08     | -8.70            | 114.20      |

# ALM-1812 Typical Scattering Parameters at 25°C, Vdd = 1.8V, Idd = 4mA

| Freq<br>(GHz) | S11    | S11     | S21    | S21     | S12    | S12     | S22   | S22     |
|---------------|--------|---------|--------|---------|--------|---------|-------|---------|
|               | Mag.   | Ang.    | Mag.   | Ang.    | Mag.   | Ang.    | Mag.  | Ang.    |
| 0.05          | -0.37  | 167.91  | -70.39 | -97.32  | -69.97 | -112.11 | -0.02 | -1.20   |
| 0.1           | -0.49  | 157.48  | -69.16 | -138.73 | -72.30 | 169.58  | -0.02 | -2.34   |
| 0.2           | -0.62  | 137.11  | -76.73 | 63.86   | -73.74 | -156.90 | -0.03 | -4.76   |
| 0.3           | -0.60  | 118.84  | -76.40 | 176.75  | -78.51 | 129.65  | -0.04 | -7.16   |
| 0.4           | -0.57  | 102.07  | -79.44 | 149.69  | -80.33 | -109.07 | -0.05 | -9.57   |
| 0.5           | -0.55  | 86.79   | -82.26 | -11.94  | -78.34 | -150.44 | -0.07 | -12.01  |
| 0.6           | -0.52  | 72.98   | -81.51 | 153.55  | -82.35 | -45.85  | -0.09 | -14.48  |
| 0.7           | -0.49  | 60.16   | -82.42 | 40.14   | -85.39 | 163.19  | -0.11 | -17.06  |
| 0.8           | -0.47  | 48.32   | -81.13 | 4.95    | -80.01 | 130.58  | -0.13 | -19.74  |
| 0.8275        | -0.46  | 45.21   | -80.98 | 20.28   | -81.98 | 114.35  | -0.14 | -20.51  |
| 0.9           | -0.46  | 37.27   | -77.14 | -3.31   | -79.31 | 87.20   | -0.15 | -22.55  |
| 1.0           | -0.44  | 26.28   | -75.53 | -6.38   | -82.00 | 123.22  | -0.18 | -25.00  |
| 1.1           | -0.44  | 16.08   | -74.01 | -31.95  | -81.92 | -13.35  | -0.20 | -27.48  |
| 1.2           | -0.47  | 6.22    | -75.82 | -51.00  | -86.49 | -162.55 | -0.23 | -30.95  |
| 1.3           | -0.51  | -3.92   | -74.62 | -52.43  | -82.08 | -66.69  | -0.26 | -34.83  |
| 1.4           | -0.60  | -16.42  | -78.94 | -94.19  | -78.84 | -121.08 | -0.31 | -40.01  |
| 1.5           | -2.07  | -39.34  | -54.42 | 173.14  | -70.76 | -152.73 | -1.07 | -49.72  |
| 1.575         | -11.07 | -146.67 | 16.10  | 157.09  | -29.37 | 109.49  | -6.41 | 52.69   |
| 1.6           | -1.03  | 57.61   | -6.09  | -3.46   | -51.01 | -52.59  | -1.20 | 4.51    |
| 1.7           | -0.52  | -13.37  | -75.43 | -141.27 | -80.16 | -92.38  | -0.32 | -35.70  |
| 1.8           | -0.57  | -27.52  | -77.68 | -133.47 | -75.83 | -134.34 | -0.33 | -42.55  |
| 1.885         | -0.61  | -36.04  | -79.90 | -164.72 | -75.06 | -137.96 | -0.34 | -46.47  |
| 1.9           | -0.62  | -37.42  | -79.59 | 150.62  | -73.21 | -126.80 | -0.34 | -47.08  |
| 2.0           | -0.67  | -46.25  | -65.59 | 57.67   | -70.33 | -133.91 | -0.35 | -51.03  |
| 2.1           | -0.72  | -54.30  | -54.83 | 2.11    | -67.29 | -132.12 | -0.36 | -54.76  |
| 2.2           | -0.71  | -61.83  | -51.92 | -51.69  | -64.81 | -146.54 | -0.36 | -58.27  |
| 2.3           | -0.70  | -69.36  | -52.25 | -82.45  | -63.37 | -150.82 | -0.37 | -61.70  |
| 2.4           | -0.70  | -76.80  | -52.26 | -99.40  | -62.01 | -157.87 | -0.37 | -65.02  |
| 2.5           | -0.70  | -84.22  | -51.91 | -111.81 | -61.19 | -162.45 | -0.37 | -68.40  |
| 3.0           | -0.72  | -118.09 | -50.59 | -154.73 | -56.43 | 176.99  | -0.38 | -83.94  |
| 3.5           | -0.69  | -149.84 | -49.90 | 169.50  | -53.05 | 153.40  | -0.36 | -98.87  |
| 4.0           | -0.84  | 175.62  | -53.88 | 123.13  | -50.94 | 127.37  | -0.41 | -115.93 |
| 4.5           | -1.08  | 145.43  | -54.39 | -10.94  | -51.69 | 108.35  | -0.49 | -131.23 |
| 5.0           | -1.37  | 108.81  | -39.20 | -100.13 | -56.65 | 120.15  | -0.73 | -153.35 |
| 6.0           | -3.23  | 43.37   | -27.63 | 130.07  | -43.36 | 116.78  | -6.93 | 78.08   |
| 7.0           | -1.29  | -20.01  | -42.97 | -39.94  | -53.04 | 143.68  | -0.94 | 178.58  |
| 8.0           | -1.58  | -73.96  | -37.01 | 61.20   | -39.13 | 149.21  | -1.03 | 135.81  |
| 9.0           | -1.98  | -129.44 | -24.67 | 117.64  | -27.12 | 69.33   | -1.64 | 116.29  |
| 10.0          | -2.39  | -174.95 | -20.63 | 41.58   | -23.81 | 38.85   | -2.93 | 71.46   |
| 11.0          | -3.68  | 133.54  | -19.84 | -86.50  | -23.10 | -107.44 | -3.54 | 83.40   |
| 12.0          | -4.41  | 68.72   | -29.61 | -94.04  | -34.87 | -65.55  | -2.20 | 54.36   |
| 13.0          | -5.02  | -56.19  | -25.13 | -126.95 | -28.33 | -111.80 | -1.57 | 29.96   |
| 14.0          | -3.16  | -142.79 | -24.93 | 161.15  | -28.26 | 178.99  | -2.04 | -4.80   |
| 15.0          | -3.76  | 133.45  | -28.24 | 145.51  | -28.54 | 162.38  | -3.01 | -34.28  |
| 16.0          | -5.59  | 50.35   | -21.00 | 54.18   | -22.58 | 64.69   | -4.55 | -100.24 |
| 17.0          | -10.67 | 179.81  | -24.58 | -71.53  | -27.36 | -63.53  | -4.52 | 108.07  |
| 18.0          | -4.41  | 91.57   | -25.69 | 96.10   | -26.34 | 92.52   | -2.40 | 29.96   |
| 19.0          | -5.90  | 52.36   | -24.25 | -42.63  | -25.64 | -45.43  | -4.30 | -28.21  |
| 20.0          | -3.26  | 4.18    | -21.63 | 177.14  | -22.08 | -177.16 | -8.61 | 114.98  |

**ALM-1812 Typical Noise Parameters at 25°C, Freq = 1.575 GHz,  
Vdd = 2.8V, Idd = 6.8mA**

| Freq<br>(GHz) | Fmin<br>(dB) | GAMMA OPT |     |       |
|---------------|--------------|-----------|-----|-------|
|               |              | Mag       | Ang | Rn/50 |
| 1.575         | 1.50         | 0.24      | -99 | 0.19  |

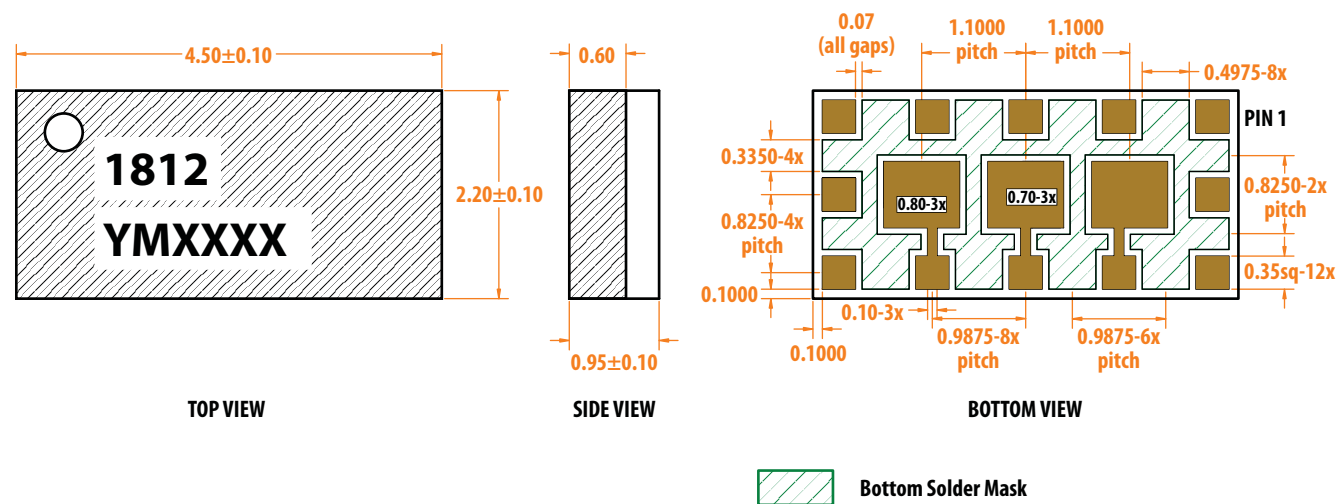
**ALM-1812 Typical Noise Parameters at 25°C, Freq = 1.575 GHz,  
Vdd = 1.8V, Idd = 4mA**

| Freq<br>(GHz) | Fmin<br>(dB) | GAMMA OPT |     |       |
|---------------|--------------|-----------|-----|-------|
|               |              | Mag       | Ang | Rn/50 |
| 1.575         | 1.52         | 0.24      | -99 | 0.19  |

**Notes:**

- The exceptional noise figure performance of the ALM-1812 is due to its highly optimized design. In this regard, the Fmin of the ALM-1812 shown above is locked down by the internal input pre-match. This allows the use of relatively inexpensive chip inductors for external matching.

**Package Dimension**



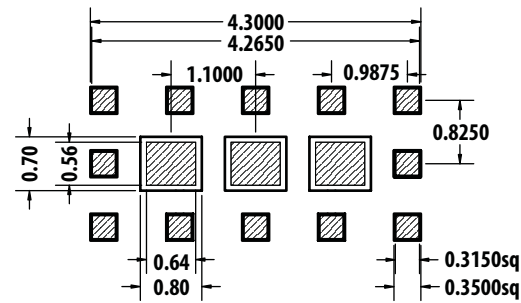
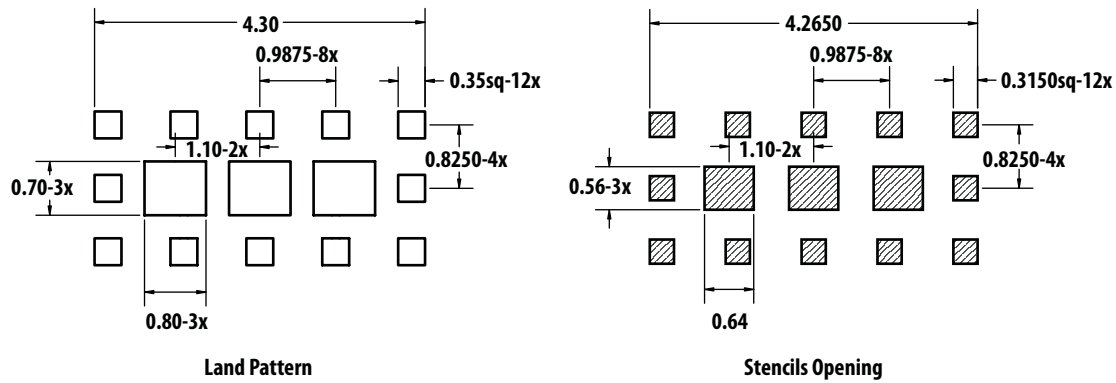
**Note :**

1. All dimensions are in millimeters
2. Dimensions are inclusive of plating
3. Dimensions are exclusive of mold flash and metal burr.
4. Y refer to year, M refer to month & XXXX refer to last 4 digit of lot number

**Part Number Ordering Information**

| Part Number   | Qty  | Container      |
|---------------|------|----------------|
| ALM-1812-BLKG | 100  | Antistatic Bag |
| ALM-1812-TR1G | 3000 | 13" Reel       |

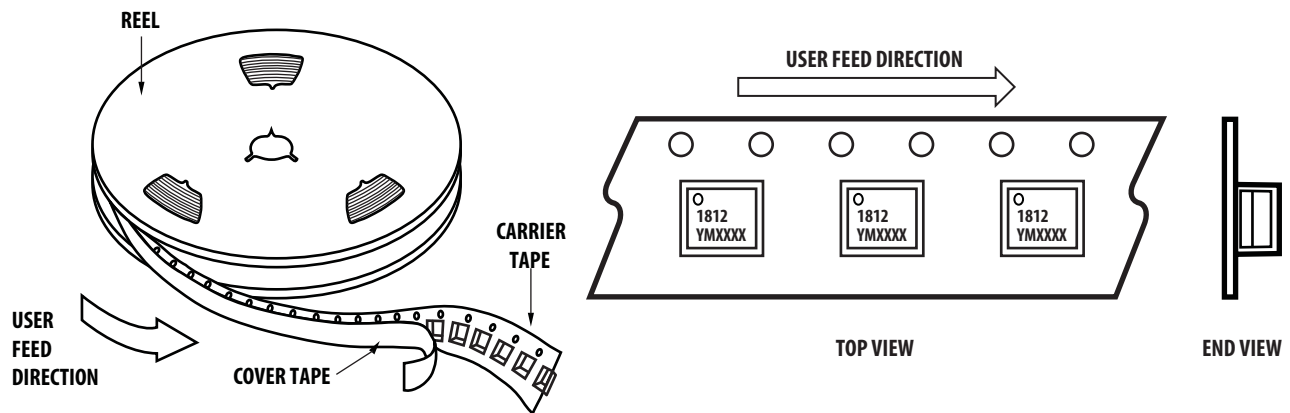
## PCB Land Patterns and Stencil Design



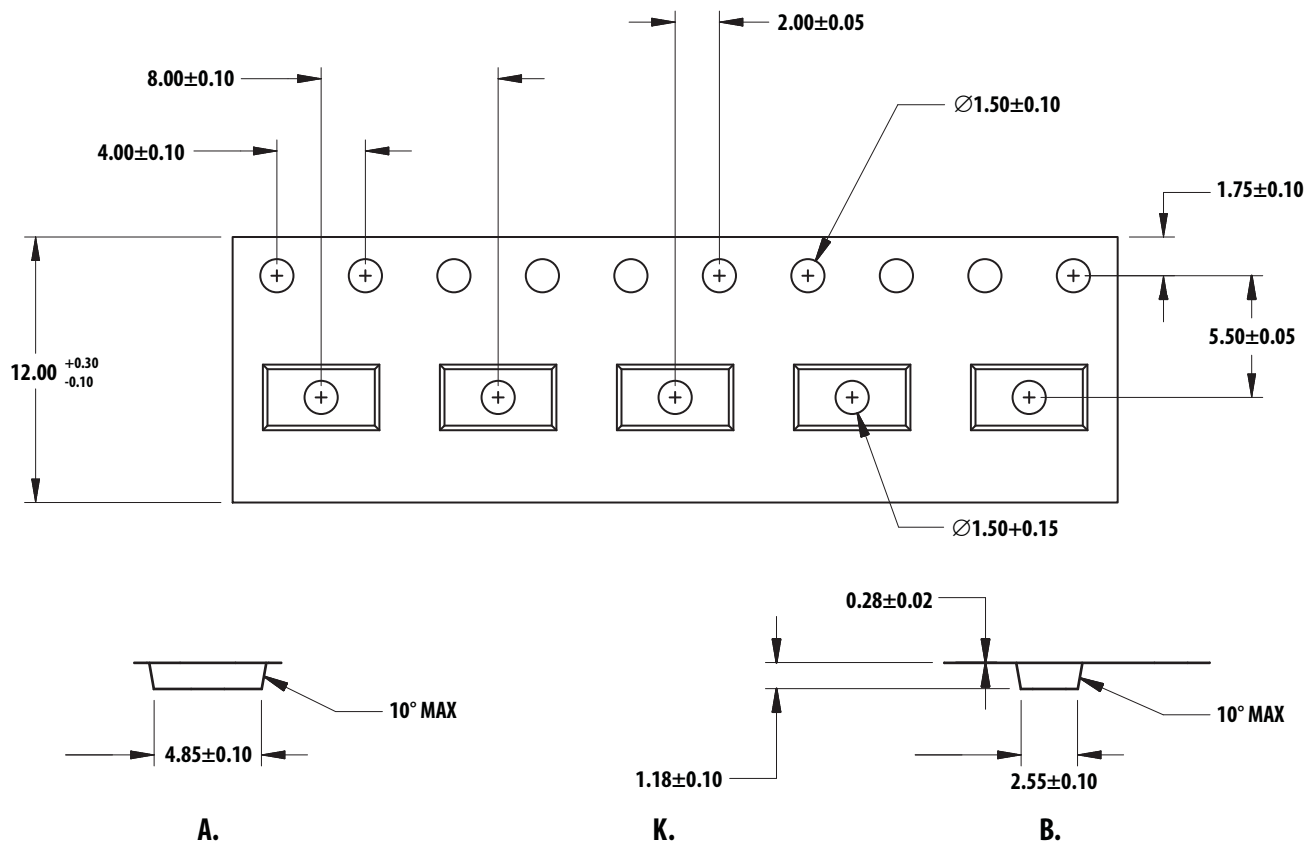
Combined Land Pattern & Stencil Opening

Dimensions are in mm

## Device Orientation

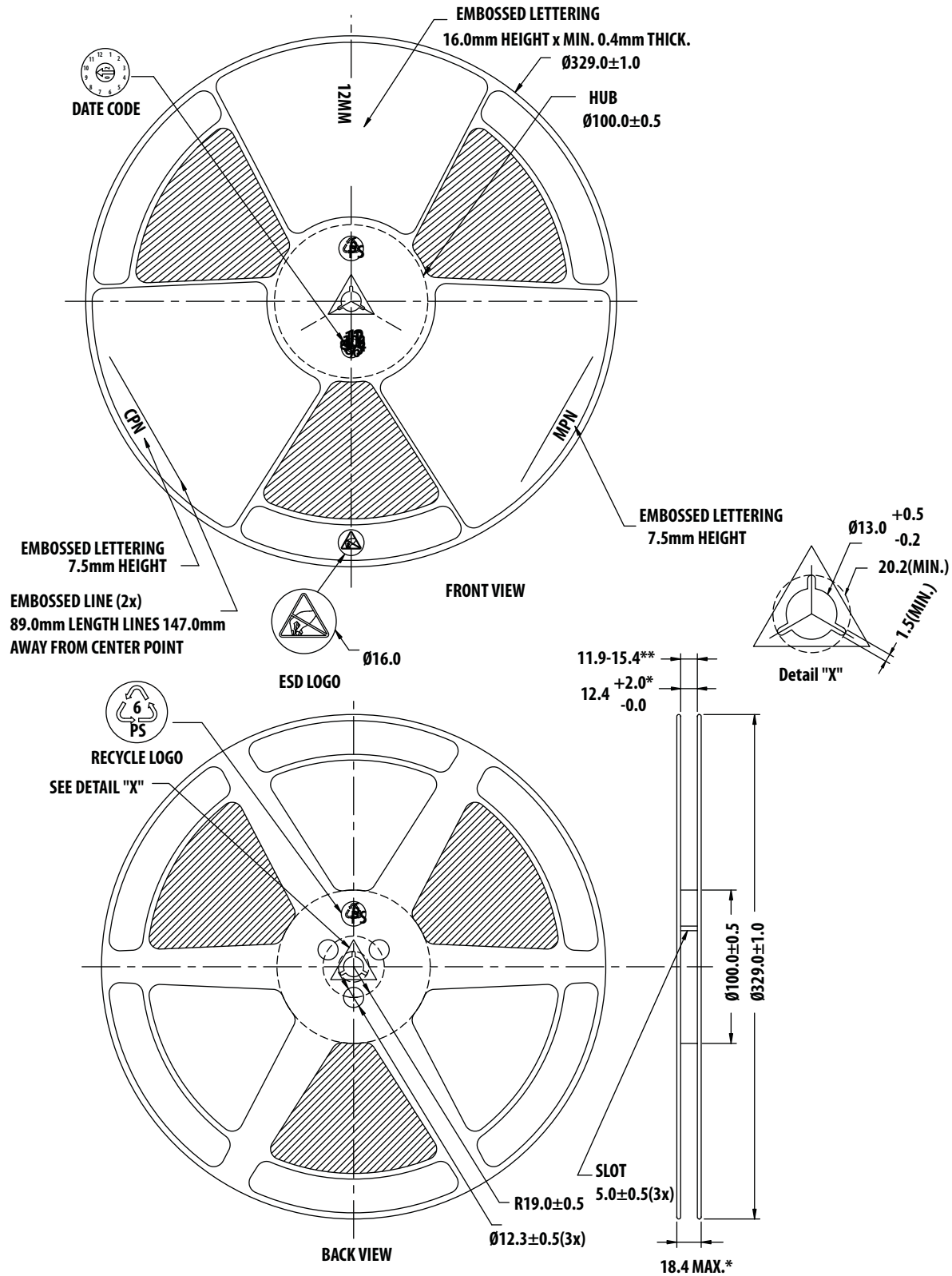


## Tape Dimensions



All dimensions are in millimeters.

## Reel Dimensions (13" reel)



For product information and a complete list of distributors, please go to our web site: [www.avagotech.com](http://www.avagotech.com)

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