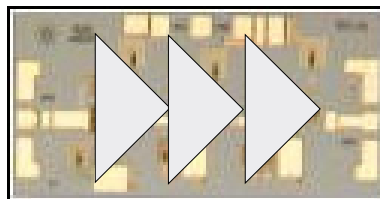


# AMMC - 6220

## 6 - 20 GHz Low Noise Amplifier



### Data Sheet



Chip Size: 1700 x 800  $\mu\text{m}$  (67 x 31.5 mils)  
Chip Size Tolerance:  $\pm 10 \mu\text{m}$  ( $\pm 0.4$  mils)  
Chip Thickness: 100  $\pm 10 \mu\text{m}$  (4  $\pm 0.4$  mils)  
Pad Dimensions: 100 x 100  $\mu\text{m}$  (4  $\pm 0.4$  mils)

#### Description

Avago Technologies' AMMC-6220 is a high gain, low-noise amplifier that operates from 6 GHz to 20 GHz. This LNA provides a wide-band solution for system design since it covers several bands, thus, reduces part inventory. The device has input / output match to 50 Ohm, is unconditionally stable and can be used as either primary or sub-sequential low noise gain stage. By eliminating the complex tuning and assembly processes typically required by hybrid (discrete-FET) amplifiers, the AMMC-6220 is a cost-effective alternative in the 6 - 20 GHz communications receivers. The backside of the chip is both RF and DC ground. This helps simplify the assembly process and reduces assembly related performance variations and costs. It is fabricated in a PHEMT process to provide exceptional noise and gain performance. For improved reliability and moisture protection, the die is passivated at the active areas.

#### Features

- Wide frequency range: 6 - 20 GHz
- High gain: 23 dB
- Low 50  $\Omega$  Noise Figure: 2.0 dB
- 50  $\Omega$  Input and Output Match
- Single 3V Supply Bias

#### Applications

- Microwave Radio systems
- Satellite VSAT, DBS Up/Down Link
- LMDS & Pt-Pt mmW Long Haul
- Broadband Wireless Access (including 802.16 and 802.20 WiMax)
- WLL and MMDS loops
- Commercial grade military

#### AMMC-6220 Absolute Maximum Ratings<sup>[1]</sup>

| Symbol           | Parameters/Conditions              | Units | Min. | Max. |
|------------------|------------------------------------|-------|------|------|
| V <sub>d</sub>   | Positive Drain Voltage             | V     |      | 7    |
| V <sub>g</sub>   | Gate Supply Voltage                | V     |      | NA   |
| I <sub>d</sub>   | Drain Current                      | mA    |      | 100  |
| P <sub>in</sub>  | CW Input Power                     | dBm   |      | 15   |
| T <sub>ch</sub>  | Operating Channel Temp.            | °C    |      | +150 |
| T <sub>stg</sub> | Storage Case Temp.                 | °C    | -65  | +150 |
| T <sub>max</sub> | Maximum Assembly Temp (60 sec max) | °C    |      | +300 |

Note:

1. Operation in excess of any one of these conditions may result in permanent damage to this device



*Note: These devices are ESD sensitive. The following precautions are strongly recommended. Ensure that an ESD approved carrier is used when dice are transported from one destination to another. Personal grounding is to be worn at all times when handling these devices*

## AMMC-6220 DC Specifications/Physical Properties [1]

| Symbol     | Parameters and Test Conditions                                                         | Units              | Min. | Typ. | Max. |
|------------|----------------------------------------------------------------------------------------|--------------------|------|------|------|
| $I_d$      | Drain Supply Current<br>(under any RF power drive and temperature)<br>( $V_d=3.0$ V)   | mA                 |      | 55   | 70   |
| $V_g$      | Gate Supply Operating Voltage<br>( $I_{d(Q)} = 800$ (mA))                              | V                  |      | NA   |      |
| $q_{ch-b}$ | Thermal Resistance <sup>[2]</sup><br>(Backside temperature, $T_b = 25^\circ\text{C}$ ) | $^\circ\text{C/W}$ |      | 25   |      |

Notes:

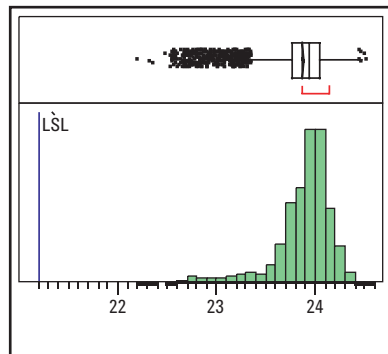
1. Ambient operational temperature  $T_A=25^\circ\text{C}$  unless otherwise noted.
2. Channel-to-backside Thermal Resistance ( $q_{ch-b}$ ) =  $26^\circ\text{C/W}$  at  $T_{channel}$  ( $T_c$ ) =  $34^\circ\text{C}$  as measured using infrared microscopy. Thermal Resistance at backside temperature ( $T_b$ ) =  $25^\circ\text{C}$  calculated from measured data.

## AMMC-6220 RF Specifications [3, 4, 5] ( $T_A = 25^\circ\text{C}$ , $V_d=3.0$ V, $I_{d(Q)}=55$ mA, $Z_o=50\ \Omega$ )

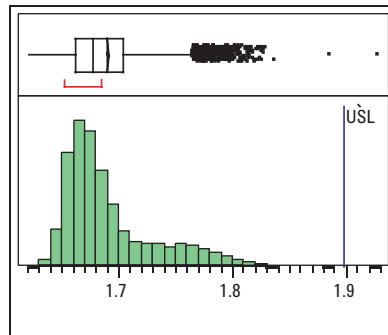
| Symbol     | Parameters and Test Conditions                                              | Units | Minimum | Typical                                              | Maximum                                     | Sigma |
|------------|-----------------------------------------------------------------------------|-------|---------|------------------------------------------------------|---------------------------------------------|-------|
| Gain       | Small-signal Gain <sup>[6]</sup>                                            | dB    | 21      | 23                                                   |                                             | 0.30  |
| NF         | Noise Figure into 50 W                                                      | dB    |         | 7-10 GHz = 2.1<br>10-16 GHz = 1.8<br>16-20 GHz = 2.0 | 8 GHz = 2.4<br>12 GHz = 2.2<br>18 GHz = 2.4 | 0.10  |
| $P_{-1dB}$ | Output Power at 1dB Gain Compression                                        | dBm   |         | +9                                                   |                                             | 0.87  |
| OIP3       | Third Order Intercept Point;<br>$Df=100\text{MHz}$ ; $P_{in}=-35\text{dBm}$ | dBm   |         | +19                                                  |                                             | 1.20  |
| RLin       | Input Return Loss <sup>[6]</sup>                                            | dB    |         | -12                                                  | -10                                         | 0.31  |
| RLout      | Output Return Loss <sup>[6]</sup>                                           | dB    |         | -16                                                  | -10                                         | 0.68  |
| Isol       | Reverse Isolation <sup>[6]</sup>                                            | dB    |         | -45                                                  |                                             | 0.50  |

Notes:

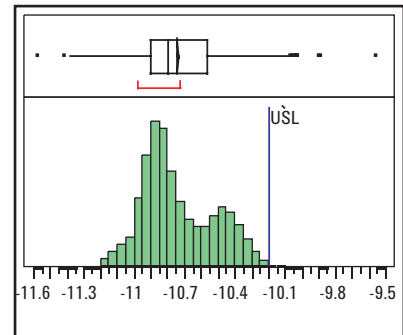
3. Small/Large -signal data measured in wafer form  $T_A = 25^\circ\text{C}$ .
4. 100% on-wafer RF test is done at frequency = 8, 12, and 18 GHz.
5. Specifications are derived from measurements in a 50  $\Omega$  test environment. Aspects of the amplifier performance may be improved over a more narrow bandwidth by application of additional conjugate, linearity, or low noise ( $\Gamma_{opt}$ ) matching.
6. As derived from measured s-parameters



Gain at 12 GHz



Noise Figure at 12 GHz



Return Loss at 12 GHz

Typical distribution of Small Signal Gain, Noise Figure, and Return Loss. Based on 1500 part sampled over several production lots.

# AMMC-6220 Typical Performances ( $T_A = 25^\circ\text{C}$ , $V_d = 3.0\text{ V}$ , $I_D = 55\text{ mA}$ , $Z_{in} = Z_{out} = 50\ \Omega$ unless otherwise stated)

NOTE: These measurements are in a  $50\ \Omega$  test environment. Aspects of the amplifier performance may be improved over a more narrow bandwidth by application of additional conjugate, linearity, or low noise ( $\Gamma_{opt}$ ) matching. Figure 1. Typical Gain

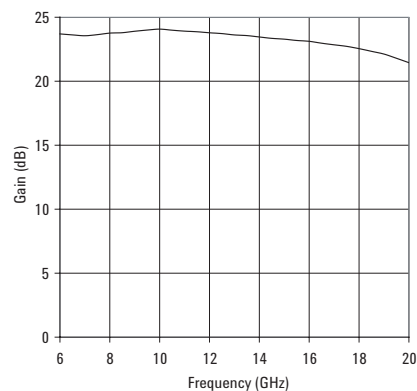


Figure 1. Typical Gain

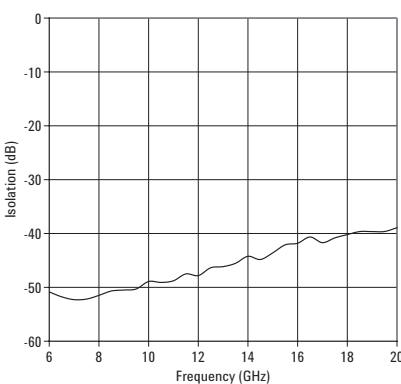


Figure 2. Typical Isolation

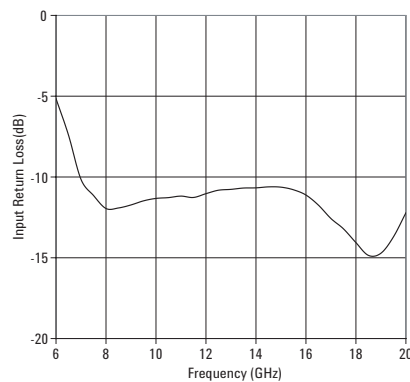


Figure 3. Typical Input Return Loss

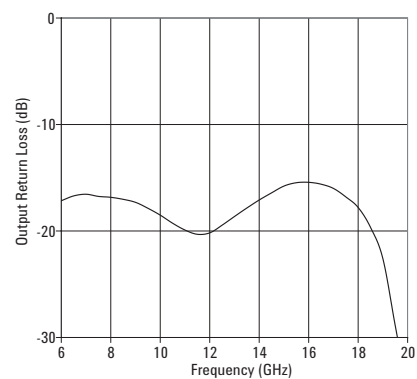


Figure 4. Typical Output Return Loss

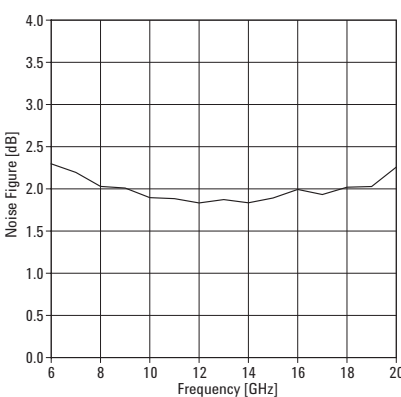


Figure 5. Typical Noise Figure into a 50 W load.

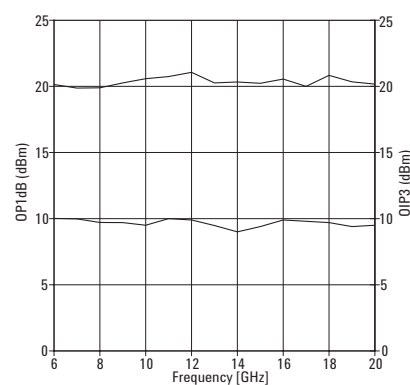


Figure 6. Typical Output P<sub>1dB</sub> and 3<sup>rd</sup> Order Intercept Pt.

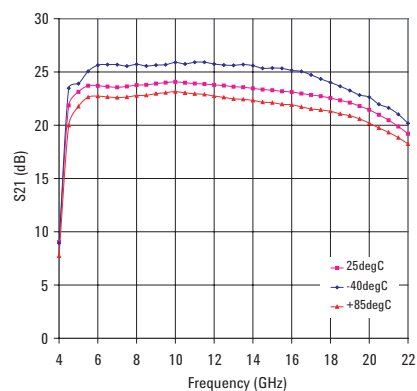


Figure 7. Typical Gain ( $s_{21}$ ) over temperature

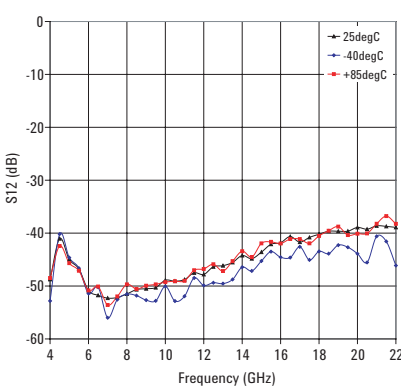


Figure 8. Typical Isolation ( $s_{12}$ ) over temperature

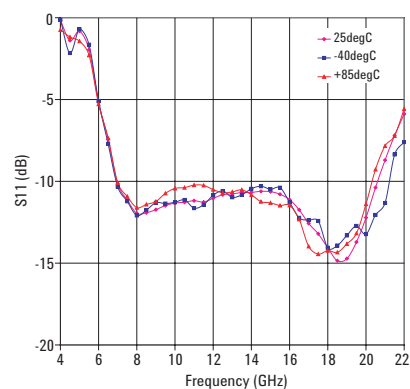
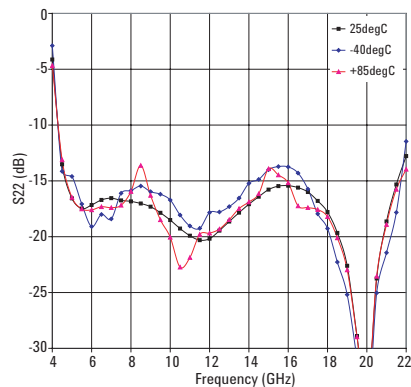


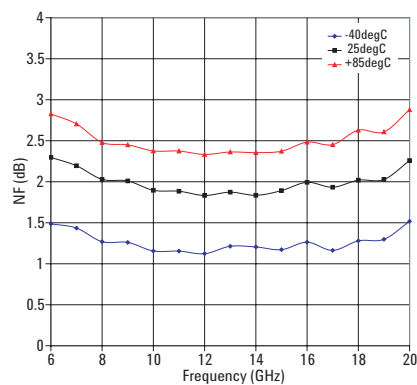
Figure 9. Typical Input Return Loss ( $s_{11}$ ) over temperature

# **AMMC-6220 Typical Performances ( $T_A = 25^\circ\text{C}$ , $V_d = 3.0\text{ V}$ , $I_D = 55\text{ mA}$ , $Z_{in} = Z_{out} = 50\Omega$ unless otherwise stated)**

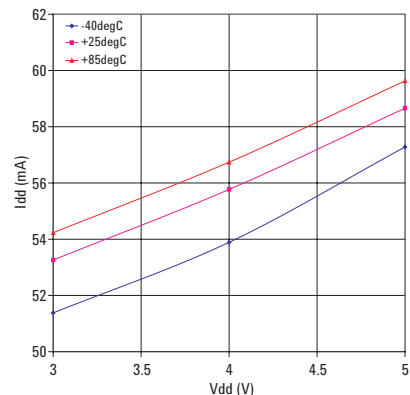
NOTE: These measurements are in a  $50\Omega$  test environment. Aspects of the amplifier performance may be improved over a more narrow bandwidth by application of additional conjugate, linearity, or low noise ( $\Gamma_{opt}$ ) matching.



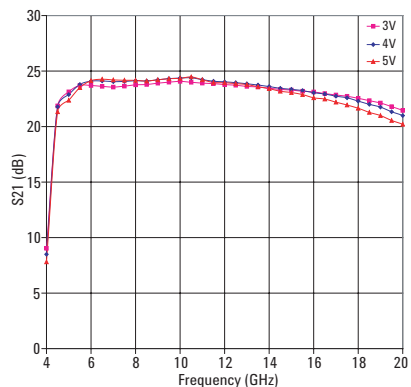
**Figure 10. Typical Output Return Loss over Temperature**



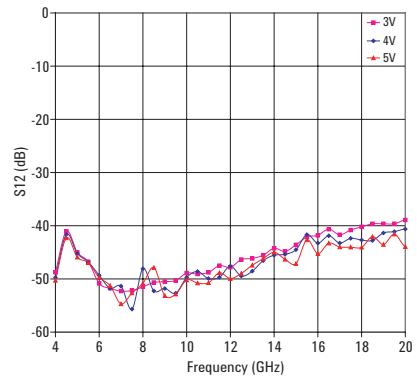
**Figure 11. Typical Noise Figure over Temperature**



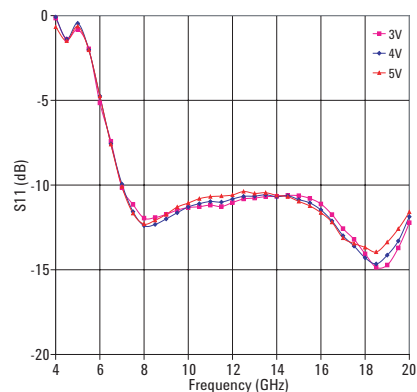
**Figure 12. Typical Total Idd over Temperature**



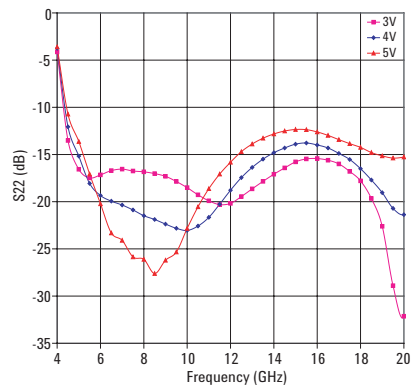
**Figure 13. Typical Gain over Vdd (supply voltage.)**



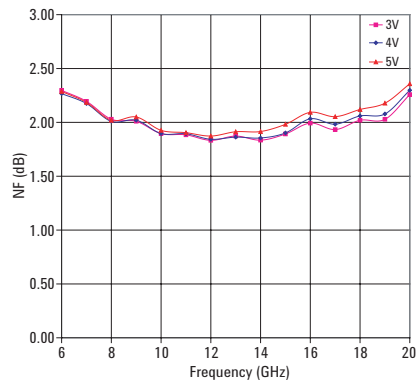
**Figure 14. Typical Isolation over Vdd (supply voltage)**



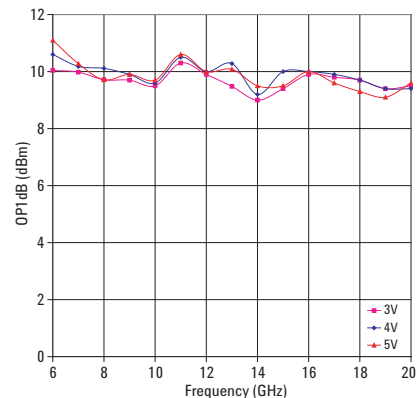
**Figure 15. Typical Input Return Loss over Vdd (supply voltage)**



**Figure 16. Typical Output Return Loss over Vdd (supply voltage)**



**Figure 17. Typical Noise Figure over Vdd (supply voltage.)**



**Figure 18. Typical OP<sub>1dB</sub> over Vdd (supply voltage.)**

**AMMC-6220 Typical Scattering Parameters<sup>[1]</sup> (Tc=25°C, V<sub>D1</sub>=V<sub>D2</sub>= 3 V, Z<sub>in</sub> = Z<sub>out</sub> = 50 Ω)**

| Freq<br>GHz | S11     |       |          | S21    |        |          | S12     |       |          | S22     |       |          |
|-------------|---------|-------|----------|--------|--------|----------|---------|-------|----------|---------|-------|----------|
|             | dB      | Mag   | Phase    | dB     | Mag    | Phase    | dB      | Mag   | Phase    | dB      | Mag   | Phase    |
| 4.000       | -0.146  | 0.983 | 103.687  | 9.033  | 2.829  | -128.237 | -48.748 | 0.004 | -115.810 | -4.132  | 0.621 | 171.001  |
| 4.500       | -1.392  | 0.852 | 74.728   | 21.862 | 12.391 | 118.600  | -41.044 | 0.009 | 103.896  | -13.516 | 0.211 | 141.837  |
| 5.000       | -0.823  | 0.910 | 37.284   | 23.130 | 14.338 | 39.967   | -44.986 | 0.006 | 29.720   | -16.564 | 0.149 | 168.028  |
| 5.500       | -1.961  | 0.798 | -3.456   | 23.710 | 15.328 | -15.875  | -46.775 | 0.005 | -28.575  | -17.481 | 0.134 | -175.481 |
| 6.000       | -5.151  | 0.553 | -33.435  | 23.699 | 15.310 | -59.866  | -50.848 | 0.003 | -45.938  | -17.158 | 0.139 | -166.821 |
| 6.500       | -7.415  | 0.426 | -53.353  | 23.622 | 15.174 | -95.795  | -51.753 | 0.003 | -76.787  | -16.707 | 0.146 | -164.516 |
| 7.000       | -10.150 | 0.311 | -65.197  | 23.557 | 15.060 | -126.279 | -52.284 | 0.002 | -109.752 | -16.549 | 0.149 | -165.262 |
| 7.500       | -11.146 | 0.277 | -71.056  | 23.641 | 15.207 | -153.658 | -52.173 | 0.002 | -108.492 | -16.750 | 0.145 | -165.145 |
| 8.000       | -11.953 | 0.253 | -76.086  | 23.761 | 15.419 | -179.298 | -51.490 | 0.003 | -134.195 | -16.835 | 0.144 | -165.958 |
| 8.500       | -11.917 | 0.254 | -79.875  | 23.793 | 15.475 | 156.812  | -50.677 | 0.003 | -149.675 | -17.025 | 0.141 | -166.708 |
| 9.000       | -11.731 | 0.259 | -85.876  | 23.908 | 15.681 | 133.712  | -50.500 | 0.003 | -159.105 | -17.310 | 0.136 | -167.942 |
| 9.500       | -11.478 | 0.267 | -93.111  | 24.000 | 15.849 | 111.612  | -50.296 | 0.003 | -171.408 | -17.862 | 0.128 | -168.952 |
| 10.000      | -11.328 | 0.271 | -100.430 | 24.071 | 15.979 | 90.667   | -48.911 | 0.004 | -176.724 | -18.509 | 0.119 | -168.793 |
| 10.500      | -11.278 | 0.273 | -107.107 | 23.989 | 15.829 | 70.398   | -49.083 | 0.004 | 174.601  | -19.271 | 0.109 | -166.105 |
| 11.000      | -11.184 | 0.276 | -114.292 | 23.915 | 15.695 | 50.874   | -48.773 | 0.004 | 155.804  | -19.908 | 0.101 | -161.607 |
| 11.500      | -11.267 | 0.273 | -119.551 | 23.867 | 15.607 | 31.947   | -47.506 | 0.004 | 155.799  | -20.309 | 0.097 | -153.779 |
| 12.000      | -11.033 | 0.281 | -125.024 | 23.786 | 15.464 | 14.018   | -47.811 | 0.004 | 150.219  | -20.177 | 0.098 | -146.759 |
| 12.500      | -10.820 | 0.288 | -130.580 | 23.724 | 15.354 | -3.874   | -46.361 | 0.005 | 124.708  | -19.456 | 0.106 | -141.031 |
| 13.000      | -10.768 | 0.289 | -136.143 | 23.620 | 15.170 | -20.953  | -46.149 | 0.005 | 119.468  | -18.642 | 0.117 | -137.531 |
| 13.500      | -10.685 | 0.292 | -140.774 | 23.568 | 15.081 | -37.794  | -45.536 | 0.005 | 120.694  | -17.844 | 0.128 | -136.674 |
| 14.000      | -10.672 | 0.293 | -147.067 | 23.459 | 14.891 | -54.252  | -44.238 | 0.006 | 108.871  | -17.088 | 0.140 | -136.397 |
| 14.500      | -10.611 | 0.295 | -151.974 | 23.351 | 14.707 | -70.766  | -44.824 | 0.006 | 98.487   | -16.419 | 0.151 | -137.700 |
| 15.000      | -10.629 | 0.294 | -157.342 | 23.287 | 14.600 | -86.927  | -43.591 | 0.007 | 85.314   | -15.782 | 0.163 | -140.788 |
| 15.500      | -10.792 | 0.289 | -164.023 | 23.184 | 14.428 | -102.737 | -42.101 | 0.008 | 81.787   | -15.469 | 0.168 | -145.110 |
| 16.000      | -11.118 | 0.278 | -169.248 | 23.119 | 14.320 | -119.061 | -41.806 | 0.008 | 64.948   | -15.429 | 0.169 | -150.386 |
| 16.500      | -11.744 | 0.259 | -173.681 | 22.973 | 14.082 | -135.063 | -40.650 | 0.009 | 63.398   | -15.606 | 0.166 | -156.073 |
| 17.000      | -12.571 | 0.235 | -176.840 | 22.847 | 13.879 | -151.033 | -41.699 | 0.008 | 48.516   | -16.000 | 0.158 | -160.598 |
| 17.500      | -13.207 | 0.219 | -179.413 | 22.728 | 13.689 | -166.718 | -40.813 | 0.009 | 43.851   | -16.795 | 0.145 | -166.616 |
| 18.000      | -14.063 | 0.198 | -176.351 | 22.548 | 13.409 | 176.850  | -40.203 | 0.010 | 34.195   | -17.791 | 0.129 | -173.574 |
| 18.500      | -14.853 | 0.181 | -172.040 | 22.336 | 13.086 | 160.709  | -39.642 | 0.010 | 21.429   | -19.662 | 0.104 | 178.090  |
| 19.000      | -14.720 | 0.184 | -161.713 | 22.122 | 12.767 | 144.491  | -39.641 | 0.010 | 20.910   | -22.604 | 0.074 | 169.680  |
| 19.500      | -13.710 | 0.206 | -153.813 | 21.797 | 12.298 | 128.151  | -39.632 | 0.010 | 8.070    | -28.897 | 0.036 | 148.784  |
| 20.000      | -12.221 | 0.245 | -148.391 | 21.451 | 11.819 | 111.521  | -38.926 | 0.011 | -7.980   | -35.137 | 0.018 | 31.294   |
| 20.500      | -10.382 | 0.303 | -147.276 | 20.983 | 11.198 | 95.148   | -39.251 | 0.011 | -13.094  | -23.741 | 0.065 | -15.174  |
| 21.000      | -8.701  | 0.367 | -150.640 | 20.472 | 10.558 | 78.624   | -38.616 | 0.012 | -25.399  | -18.636 | 0.117 | -26.892  |
| 21.500      | -7.194  | 0.437 | -156.785 | 19.879 | 9.862  | 62.593   | -38.726 | 0.012 | -35.505  | -15.322 | 0.171 | -36.809  |
| 22.000      | -5.883  | 0.508 | -163.716 | 19.198 | 9.118  | 47.073   | -38.915 | 0.011 | -38.784  | -12.780 | 0.230 | -45.747  |

Note: Data obtained from on-wafer measurements

**AMMC-6220: Typical Scattering Parameters<sup>[1]</sup> (Tc=25°C, V<sub>D1</sub>=V<sub>D2</sub>= 5 V, Z<sub>in</sub> = Z<sub>out</sub> = 50 Ω)**

| S11  |         |       |          | S21    |        |          | S12     |       |          | S22     |       |          |
|------|---------|-------|----------|--------|--------|----------|---------|-------|----------|---------|-------|----------|
| Freq | dB      | mag   | phase    | dB     | mag    | phase    | dB      | mag   | phase    | dB      | mag   | phase    |
| 4.0  | -0.673  | 0.925 | 103.544  | 8.514  | 2.665  | -130.371 | -50.551 | 0.003 | -109.410 | -3.600  | 0.661 | 170.277  |
| 4.5  | -1.492  | 0.842 | 74.318   | 21.395 | 11.742 | 117.926  | -43.657 | 0.007 | 103.138  | -10.722 | 0.291 | 137.294  |
| 5.0  | -0.635  | 0.929 | 37.411   | 22.845 | 13.875 | 43.305   | -45.849 | 0.005 | 43.526   | -13.626 | 0.208 | 140.892  |
| 5.5  | -2.032  | 0.791 | -3.432   | 23.951 | 15.759 | -11.567  | -48.892 | 0.004 | -22.501  | -17.072 | 0.140 | 136.619  |
| 6.0  | -4.747  | 0.579 | -34.664  | 24.262 | 16.335 | -56.971  | -49.740 | 0.003 | -50.634  | -20.223 | 0.097 | 138.857  |
| 6.5  | -7.598  | 0.417 | -55.144  | 24.334 | 16.471 | -94.487  | -51.629 | 0.003 | -90.737  | -23.311 | 0.068 | 145.708  |
| 7.0  | -10.093 | 0.313 | -66.567  | 24.292 | 16.392 | -126.702 | -54.247 | 0.002 | -108.004 | -26.096 | 0.050 | 152.950  |
| 7.5  | -11.669 | 0.261 | -72.043  | 24.333 | 16.468 | -155.390 | -52.202 | 0.002 | -121.340 | -29.853 | 0.032 | 167.732  |
| 8.0  | -12.300 | 0.243 | -74.699  | 24.406 | 16.606 | 178.048  | -51.151 | 0.003 | -137.135 | -33.106 | 0.022 | -157.216 |
| 8.5  | -12.080 | 0.249 | -78.056  | 24.422 | 16.639 | 153.532  | -52.505 | 0.002 | -155.276 | -31.608 | 0.026 | -119.404 |
| 9.0  | -11.733 | 0.259 | -84.004  | 24.477 | 16.744 | 129.984  | -51.516 | 0.003 | -155.878 | -28.205 | 0.039 | -97.950  |
| 9.5  | -11.303 | 0.272 | -91.544  | 24.511 | 16.810 | 107.486  | -52.868 | 0.002 | -177.492 | -25.326 | 0.054 | -87.835  |
| 10.0 | -11.062 | 0.280 | -99.362  | 24.549 | 16.883 | 86.003   | -51.015 | 0.003 | 175.740  | -22.836 | 0.072 | -83.845  |
| 10.5 | -10.806 | 0.288 | -106.223 | 24.467 | 16.724 | 65.381   | -50.416 | 0.003 | 169.269  | -20.540 | 0.094 | -82.739  |
| 11.0 | -10.685 | 0.292 | -113.824 | 24.397 | 16.590 | 45.507   | -50.539 | 0.003 | 161.489  | -18.620 | 0.117 | -83.562  |
| 11.5 | -10.652 | 0.293 | -120.486 | 24.282 | 16.372 | 26.125   | -49.084 | 0.004 | 140.732  | -17.073 | 0.140 | -86.634  |
| 12.0 | -10.584 | 0.296 | -126.927 | 24.165 | 16.152 | 7.602    | -49.630 | 0.003 | 129.430  | -15.819 | 0.162 | -91.173  |
| 12.5 | -10.383 | 0.303 | -133.049 | 24.037 | 15.916 | -10.789  | -49.737 | 0.003 | 117.272  | -14.698 | 0.184 | -95.581  |
| 13.0 | -10.495 | 0.299 | -139.396 | 23.885 | 15.641 | -28.235  | -47.563 | 0.004 | 112.685  | -13.888 | 0.202 | -100.779 |
| 13.5 | -10.452 | 0.300 | -144.569 | 23.757 | 15.412 | -45.463  | -47.315 | 0.004 | 114.739  | -13.275 | 0.217 | -106.161 |
| 14.0 | -10.610 | 0.295 | -150.864 | 23.582 | 15.104 | -62.199  | -48.035 | 0.004 | 101.112  | -12.824 | 0.228 | -111.602 |
| 14.5 | -10.688 | 0.292 | -155.580 | 23.400 | 14.792 | -79.220  | -47.535 | 0.004 | 89.549   | -12.509 | 0.237 | -116.032 |
| 15.0 | -10.967 | 0.283 | -161.115 | 23.239 | 14.519 | -95.555  | -46.791 | 0.005 | 88.406   | -12.349 | 0.241 | -121.314 |
| 15.5 | -11.235 | 0.274 | -166.831 | 23.018 | 14.154 | -111.710 | -45.741 | 0.005 | 82.235   | -12.368 | 0.241 | -126.026 |
| 16.0 | -11.633 | 0.262 | -170.420 | 22.817 | 13.831 | -128.090 | -45.071 | 0.006 | 65.758   | -12.610 | 0.234 | -130.007 |
| 16.5 | -12.194 | 0.246 | -173.577 | 22.522 | 13.369 | -144.087 | -46.403 | 0.005 | 65.253   | -12.974 | 0.225 | -132.934 |
| 17.0 | -13.128 | 0.221 | -174.413 | 22.241 | 12.944 | -159.749 | -44.636 | 0.006 | 52.243   | -13.422 | 0.213 | -134.003 |
| 17.5 | -13.449 | 0.213 | -173.665 | 21.974 | 12.552 | -175.168 | -44.918 | 0.006 | 40.428   | -13.851 | 0.203 | -134.954 |
| 18.0 | -13.681 | 0.207 | -169.464 | 21.613 | 12.041 | 169.124  | -44.953 | 0.006 | 41.677   | -14.243 | 0.194 | -134.370 |
| 18.5 | -13.952 | 0.201 | -166.852 | 21.241 | 11.536 | 154.065  | -44.297 | 0.006 | 28.636   | -14.790 | 0.182 | -132.741 |
| 19.0 | -13.377 | 0.214 | -162.360 | 20.881 | 11.067 | 139.077  | -44.325 | 0.006 | 18.417   | -15.145 | 0.175 | -128.824 |
| 19.5 | -12.587 | 0.235 | -158.579 | 20.458 | 10.541 | 124.370  | -44.648 | 0.006 | 17.829   | -15.378 | 0.170 | -124.591 |
| 20.0 | -11.593 | 0.263 | -155.670 | 20.070 | 10.080 | 109.618  | -44.290 | 0.006 | 7.552    | -15.265 | 0.172 | -118.577 |
| 20.5 | -10.402 | 0.302 | -156.118 | 19.610 | 9.561  | 95.315   | -43.949 | 0.006 | 4.072    | -14.896 | 0.180 | -112.117 |
| 21.0 | -9.292  | 0.343 | -158.544 | 19.157 | 9.075  | 81.210   | -44.129 | 0.006 | 2.016    | -14.201 | 0.195 | -108.617 |
| 21.5 | -8.122  | 0.393 | -161.368 | 18.767 | 8.677  | 66.820   | -43.714 | 0.007 | -6.903   | -13.518 | 0.211 | -105.366 |
| 22.0 | -7.019  | 0.446 | -165.866 | 18.255 | 8.180  | 53.298   | -43.878 | 0.006 | -4.490   | -12.580 | 0.235 | -102.937 |

Note: Data obtained from on-wafer measurements

## Biasing and Operation

The AMMC-6220 is normally biased with a single positive drain supply connected to both  $V_{D1}$  and  $V_{D2}$  bond pads through the 2 bypass capacitors as shown in Figure 20. The recommended supply voltage is 3V. It is important to have 2 separate 100pF bypass capacitors, and these two capacitors should be placed as close to the die as possible.

The AMMC-6220 does not require a negative gate voltage to bias any of the three stages. No ground wires are needed because all ground connections are made with plated through-holes to the backside of the device.

Refer the Absolute Maximum Ratings table for allowed DC and thermal conditions

## Assembly Techniques

The backside of the MMIC chip is RF ground. For microstrip applications the chip should be attached directly to the ground plane (e.g. circuit carrier or heatsink) using electrically conductive epoxy<sup>[1]</sup>

For best performance, the topside of the MMIC should be brought up to the same height as the circuit surrounding it. This can be accomplished by mounting a gold plate metal shim (same length and width as the MMIC) under the chip which is of correct thickness to make the chip and adjacent circuit the same height. The amount of epoxy used for the chip and/or shim attachment should be just enough to provide a thin fillet around the bottom perimeter of the chip or shim. The ground plan should be free of any residue that may jeopardize electrical or mechanical attachment.

The location of the RF bond pads is shown in Figure 12. Note that all the RF input and output ports are in a Ground-Signal-Ground configuration.

RF connections should be kept as short as reasonable to minimize performance degradation due to undesirable series inductance. A single bond wire is normally sufficient for signal connections, however double bonding with 0.7 mil gold wire or use of gold mesh<sup>[2]</sup> is recommended for best performance, especially near the high end of the frequency band.

Thermosonic wedge bonding is preferred method for wire attachment to the bond pads. Gold mesh can be attached using a 2 mil round tracking tool and a tool force of approximately 22 grams and a ultrasonic power of roughly 55 dB for a duration of  $76 \pm 8$  mS. The guided wedge at an ultrasonic power level of 64 dB can be used for 0.7 mil wire. The recommended wire bond stage temperature is  $150 \pm 2$  °C.

Caution should be taken to not exceed the Absolute Maximum Rating for assembly temperature and time.

The chip is 100um thick and should be handled with care. This MMIC has exposed air bridges on the top surface and should be handled by the edges or with a custom collet (do not pick up the die with a vacuum on die center).

This MMIC is also static sensitive and ESD precautions should be taken.

### Notes:

[1] Ablebond 84-1 LM1 silver epoxy is recommended.

[2] Buckbee-Mears Corporation, St. Paul, MN, 800-262-3824

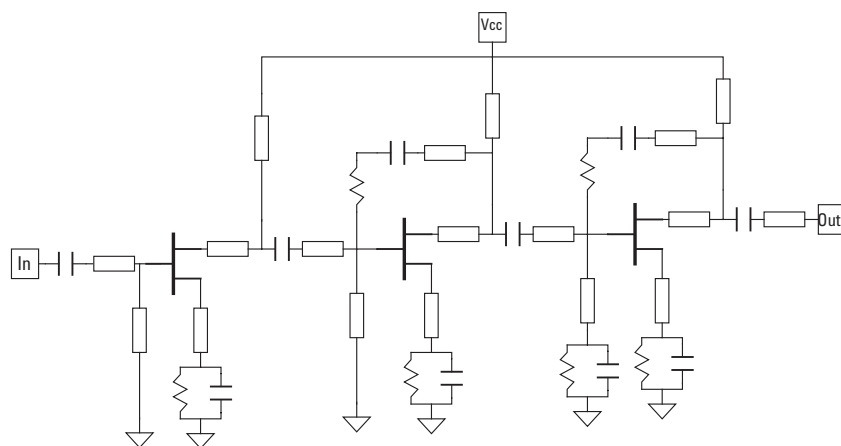
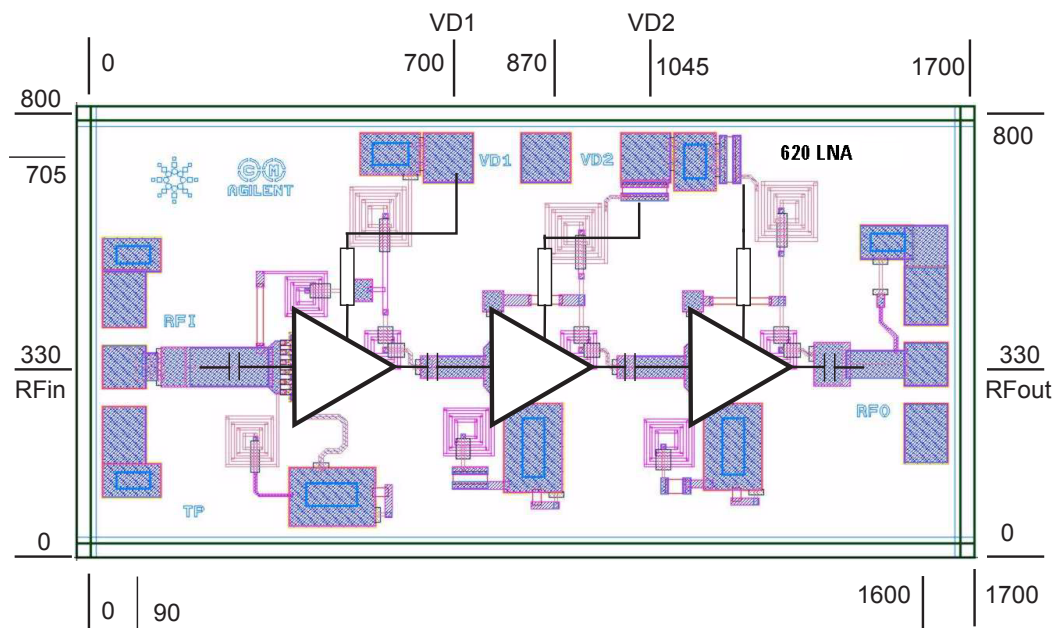
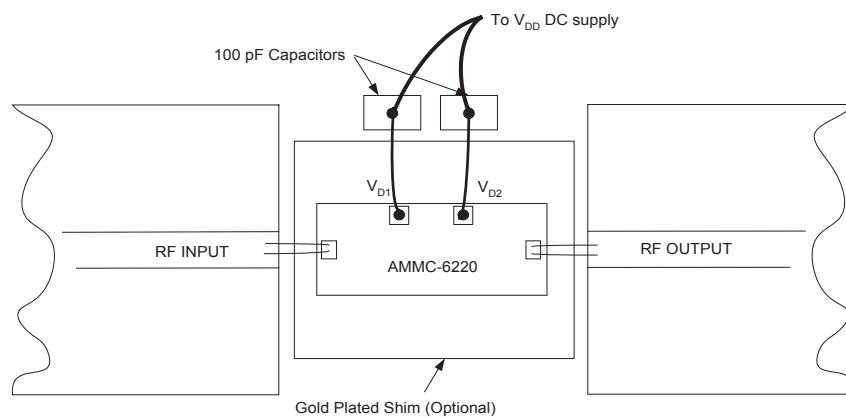


Figure 19. AMMC-6220 Schematic



**Figure 20. AMMC-6220 Bonding pad locations**



**Figure 21. AMMC-6220 Assembly diagram**

### Ordering Information:

AMMC-6220-W10 = 10 devices per tray

AMMC-6220-W50 = 50 devices per tray

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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