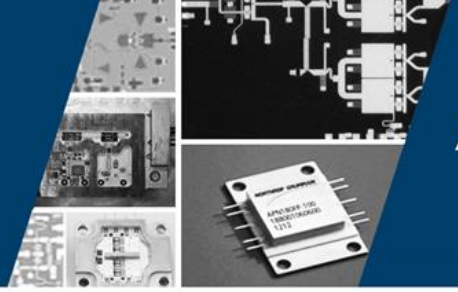
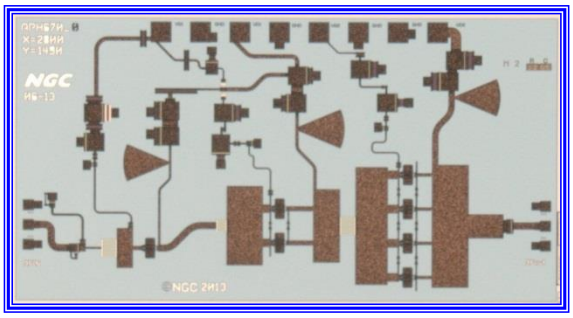
# APH670
## 71-76 GHz
## Medium Power Amplifier



NORTHROP GRUMMAN

Preliminary Datasheet

Revision: February 2015



X=2800 µm Y=1490 µm

### Product Features

- RF Frequency: 71 to 76 GHz
- Linear Gain: 21 dB typ.
- Psat: 25 dBm typ..
- Die Size: 4.17 sq. mm.
- 2 mil substrate
- DC Power: 4 VDC @ 305 mA

## Applications

- FCC E-band Communication Systems @ 71-76 GHz Frequency Band
- Short Haul / High Capacity Links
- Enterprise Wireless LAN
- Wireless Fiber Replacement

## Product Description

The APH670 is a Gallium Arsenide-based broadband, three-stage power amplifier device, designed for use in commercial digital radios and wireless LANs. To ensure rugged and reliable operation, GaAs pHEMT devices are fully passivated. Both bond pad and backside metallization are Ti/Au, which is compatible with conventional die attach, thermocompression, and thermosonic wire bonding assembly techniques.

Performance Characteristics (Ta = 25°C)

| Specification | Min | Typ | Max | Unit |
|---|---|---|---|---|
| Frequency | 71 | | 76 | GHz |
| Linear Gain | 18 | 21 | | dB |
| Input Return Loss | 6 | 10 | | dB |
| Output Return Loss | 8 | 11 | | dB |
| P1dB | | 20 | | dBm |
| Psat | 24 | 25 | | dBm |
| PAE @ Psat | | 23 | | % |
| Vd1, Vd2 | | 4 | | V |
| Vg1 | | 0.02 | | V |
| Vg2 | | 0.03 | | V |
| Id1 | | 135 | | mA |
| Id2 | | 180 | | mA |

Absolute Maximum Ratings (Ta = 25°C)

| Parameter | Min | Max | Unit |
|---|---|---|---|
| Vd1, Vd2 | | 4 | V |
| Vg1 | -0.8 | 0.3 | V |
| Vg2 | -0.8 | 0.3 | V |
| Id1 | | 150 | mA |
| Id2 | | 200 | mA |
| Input drive level | | 16 | dBm |
| Assy. Temperature (60 seconds) | | 300 | deg. C |



**Web: http://www.as.northropgrumman.com/mps**

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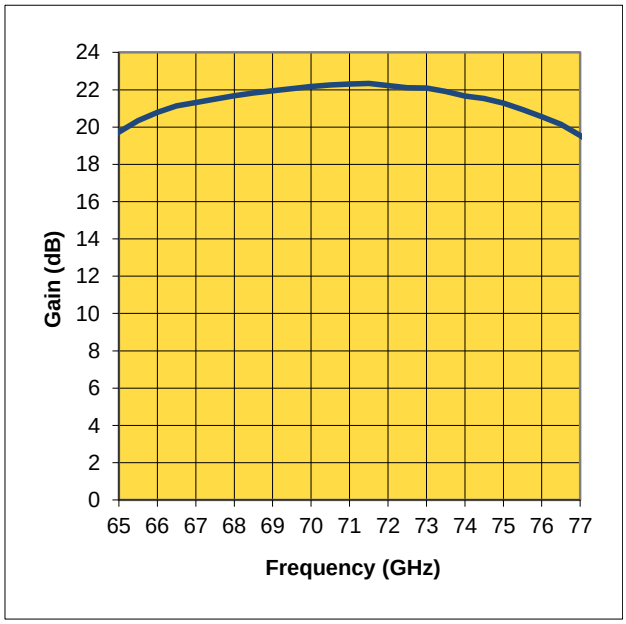
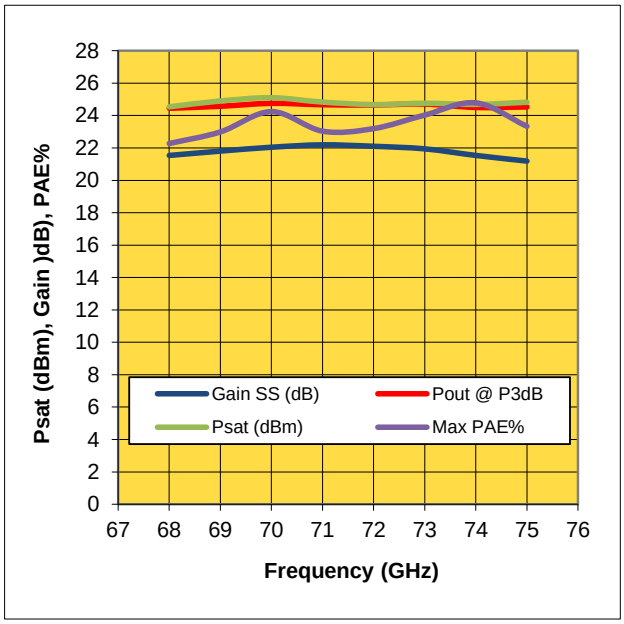
## Measured (On-Wafer) Performance Characteristics (Typical Performance at 25°C)
## Vd = 4V, Id1 = 135 mA, Id2 = 180 mA

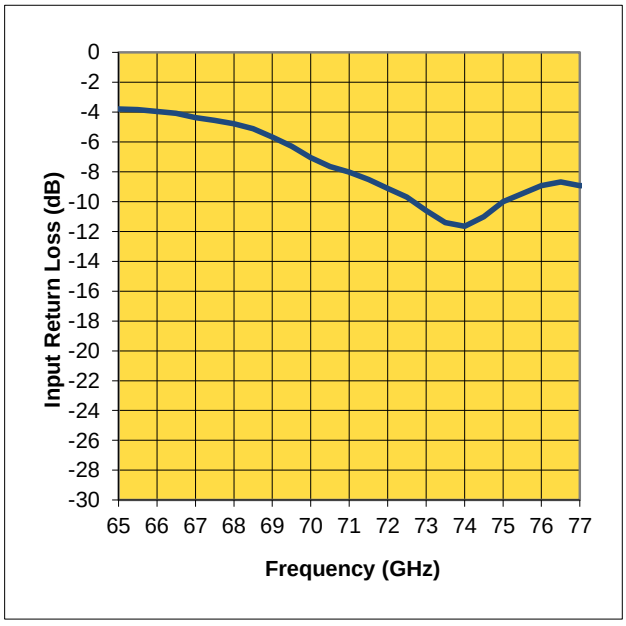
### Linear Gain vs. Frequency



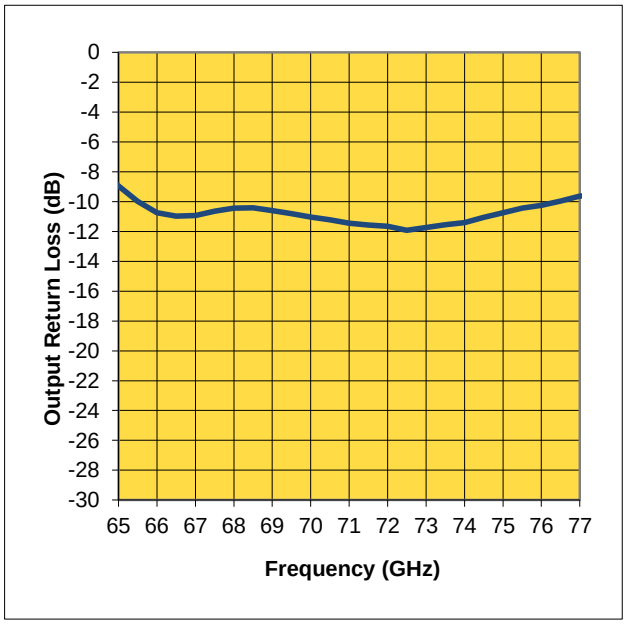

### Output Power, Gain, PAE% vs. Frequency *




### Input Return Loss vs. Frequency




### Output Return Loss vs. Frequency




* Pulsed-Power On-Wafer





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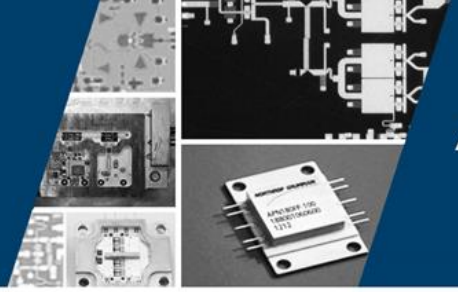
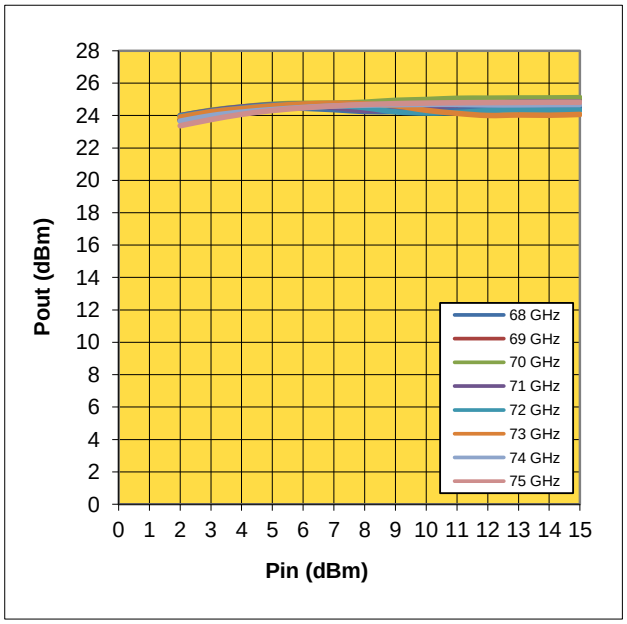


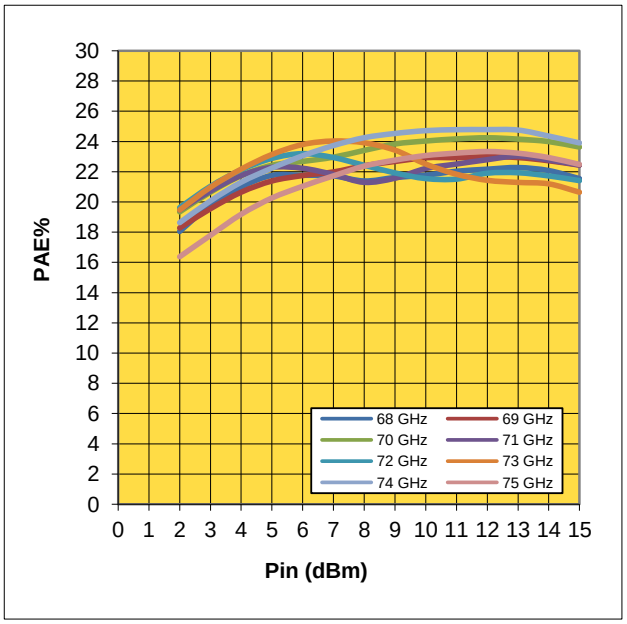


## Measured (On-Wafer) Performance Characteristics (Typical Performance at 25°C)
## Vd = 4V, Id1+Id1a = 270 mA, Id2+Id2a = 360 mA

Pout vs. Pin *




PAE% vs. Pin *




* Pulsed-Power On-Wafer





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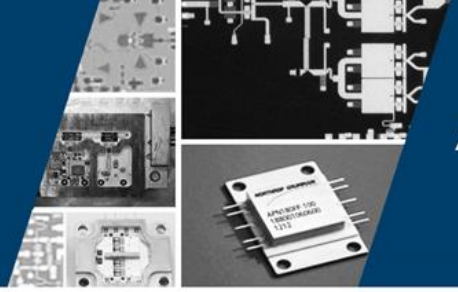



## Measured (On-Wafer) Performance Characteristics (Typical Performance at 25°C)
## Vd = 4V, Id1 = 135 mA, Id2 = 180 mA

| Freq GHz | S11 Mag | S11 Ang | S21 Mag | S21 Ang | S12 Mag | S12 Ang | S22 Mag | S22 Ang |
|---|---|---|---|---|---|---|---|---|
| 68.0 | 0.580 | 81.360 | 12.730 | 73.870 | 0.006 | -7.952 | 0.297 | 38.535 |
| 68.5 | 0.564 | 75.217 | 12.928 | 57.642 | 0.006 | -2.334 | 0.295 | 33.489 |
| 69.0 | 0.533 | 68.987 | 13.024 | 42.338 | 0.008 | -10.017 | 0.295 | 26.747 |
| 69.5 | 0.496 | 62.037 | 13.209 | 27.092 | 0.009 | -28.898 | 0.290 | 18.728 |
| 70.0 | 0.456 | 56.420 | 13.367 | 12.231 | 0.009 | -33.564 | 0.286 | 11.218 |
| 70.5 | 0.428 | 51.573 | 13.515 | -3.200 | 0.008 | -37.175 | 0.282 | 1.718 |
| 71.0 | 0.410 | 47.258 | 13.652 | -18.335 | 0.007 | -39.047 | 0.279 | -8.850 |
| 71.5 | 0.389 | 42.087 | 13.732 | -33.525 | 0.006 | -49.028 | 0.277 | -19.768 |
| 72.0 | 0.362 | 37.369 | 13.634 | -49.204 | 0.007 | -49.074 | 0.276 | -32.427 |
| 72.5 | 0.338 | 31.534 | 13.565 | -63.983 | 0.006 | -50.195 | 0.267 | -43.682 |
| 73.0 | 0.299 | 24.493 | 13.617 | -79.153 | 0.006 | -53.797 | 0.271 | -54.779 |
| 73.5 | 0.269 | 16.183 | 13.543 | -95.080 | 0.007 | -52.124 | 0.279 | -66.347 |
| 74.0 | 0.248 | 7.514 | 13.298 | -110.250 | 0.008 | -72.001 | 0.275 | -79.469 |
| 74.5 | 0.255 | -3.816 | 13.276 | -126.041 | 0.005 | -77.082 | 0.289 | -89.102 |
| 75.0 | 0.272 | -12.373 | 13.126 | -141.704 | 0.006 | -86.269 | 0.298 | -100.267 |
| 75.5 | 0.281 | -23.943 | 12.820 | -158.693 | 0.004 | -81.699 | 0.308 | -111.279 |
| 76.0 | 0.295 | -34.944 | 12.433 | -175.351 | 0.004 | -89.487 | 0.314 | -120.551 |
| 76.5 | 0.295 | -48.428 | 11.948 | 167.357 | 0.003 | -71.660 | 0.330 | -128.928 |
| 77.0 | 0.285 | -66.384 | 11.304 | 149.875 | 0.004 | -70.902 | 0.336 | -137.901 |
| 77.5 | 0.284 | -85.618 | 10.590 | 131.959 | 0.004 | -73.631 | 0.349 | -146.149 |
| 78.0 | 0.296 | -106.325 | 9.611 | 114.015 | 0.004 | -61.032 | 0.352 | -153.625 |
| 78.5 | 0.334 | -124.337 | 8.573 | 96.363 | 0.004 | -66.422 | 0.355 | -160.477 |
| 79.0 | 0.374 | -140.326 | 7.612 | 79.890 | 0.004 | -63.155 | 0.360 | -166.599 |
| 79.5 | 0.406 | -152.260 | 6.655 | 63.852 | 0.003 | -72.417 | 0.361 | -171.367 |
| 80.0 | 0.420 | -161.780 | 5.736 | 49.157 | 0.004 | -71.102 | 0.362 | -176.900 |
| 80.5 | 0.430 | -171.330 | 4.917 | 35.931 | 0.003 | -68.850 | 0.363 | 177.752 |
| 81.0 | 0.436 | 179.154 | 4.246 | 23.432 | 0.002 | -63.704 | 0.363 | 173.644 |
| 81.5 | 0.447 | 170.538 | 3.659 | 10.984 | 0.003 | -53.623 | 0.361 | 169.439 |
| 82.0 | 0.455 | 162.842 | 3.105 | -0.698 | 0.004 | -62.049 | 0.360 | 166.011 |
| 82.5 | 0.466 | 156.366 | 2.668 | -11.427 | 0.003 | -57.580 | 0.361 | 162.526 |
| 83.0 | 0.475 | 150.161 | 2.307 | -22.356 | 0.003 | -62.791 | 0.362 | 159.524 |
| 83.5 | 0.483 | 144.723 | 1.989 | -32.483 | 0.003 | -65.678 | 0.363 | 156.481 |
| 84.0 | 0.489 | 139.695 | 1.725 | -42.733 | 0.003 | -75.331 | 0.363 | 153.375 |
| 84.5 | 0.494 | 134.572 | 1.508 | -51.598 | 0.003 | -54.358 | 0.364 | 149.918 |
| 85.0 | 0.498 | 129.658 | 1.325 | -60.523 | 0.003 | -62.875 | 0.365 | 146.857 |
| 85.5 | 0.502 | 125.079 | 1.163 | -68.977 | 0.002 | -65.609 | 0.367 | 143.985 |
| 86.0 | 0.508 | 120.754 | 1.028 | -77.497 | 0.003 | -81.620 | 0.367 | 141.337 |





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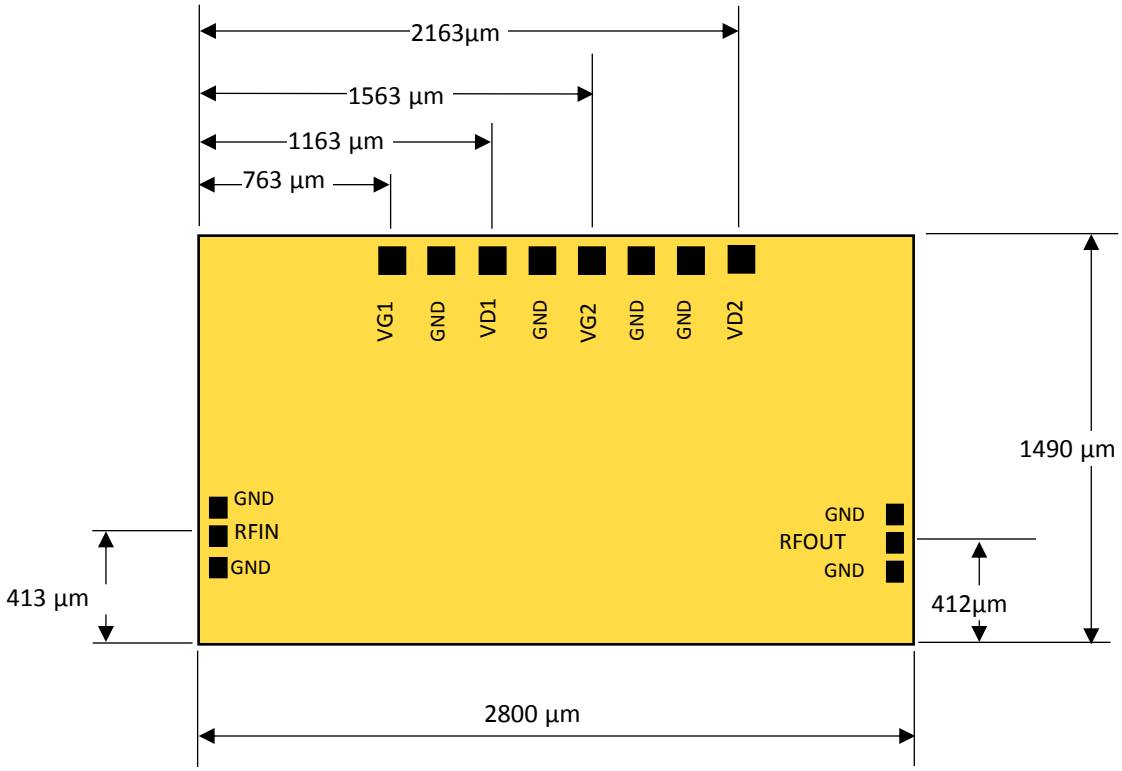
## Die Size and Bond Pad Locations (Not to Scale)

X = 2800 µm ± 25 µm
Y = 1490 ± 25 µm
DC Bond Pad = 100 x 100 ± 0.5 µm
RF Bond Pad = 50 x 50 ± 0.5 µm
Chip Thickness = 50 ± 5 µm





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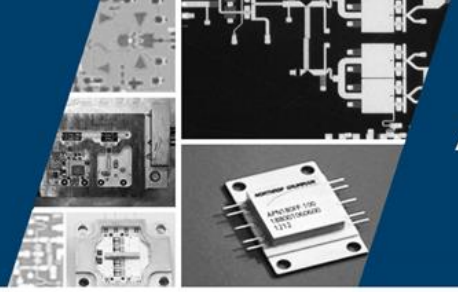
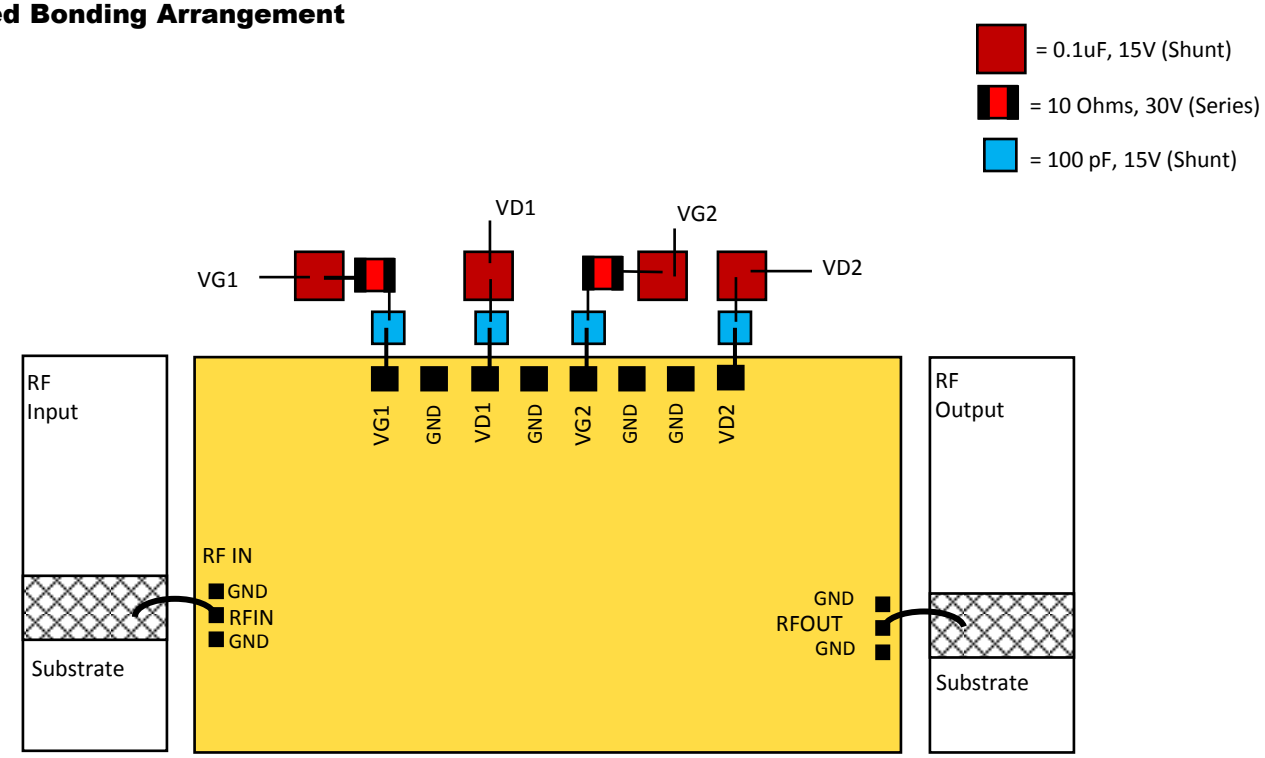




**Suggested Bonding Arrangement**




## Recommended Assembly Notes

1. Bypass caps should be 100 pF ceramic (single-layer) placed no further than 30 mils from the amplifier.
2. Best performance obtained from use of <6 mil (long) by 1.5 by 0.5 mil ribbons on input and output.