



# WJA1025

## +5V Active-Bias InGaP HBT Gain Block

### Product Features

- Cascadable gain block
- 50 – 4000 MHz
- 17 dB Gain @ 1.9GHz
- +15.5 dBm P1dB @ 1.9GHz
- +32 dBm OIP3 @ 1.9GHz
- Operates from +5V @ 60mA
- Robust 1000V ESD, Class 1C
- RoHS-compliant SOT-89 package

### Applications

- Wireless Infrastructure
- General Purpose
- Cellular GSM, PCS, UMTS
- W-CDMA, TD-SCDMA, WiMAX

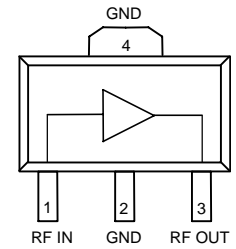
### Product Description

The WJA1025 is a cascadable gain block that offers high linearity in a low-cost surface-mount package. At 1.9 GHz, the WJA1025 typically provides 17 dB gain, +32 dBm OIP3, and +15.5 dBm P1dB. The device is housed in a RoHS-compliant SOT-89 industry-standard SMT package using a NiPdAu plating to eliminate the possibility of tin whiskering.

The WJA1025 consists of Darlington pair amplifiers using a high reliability InGaP/GaAs HBT process technology. The MMIC amplifier is internally matched to 50Ω and only requires DC-blocking capacitors and a bias inductor for operation. An internal active bias is designed to enable stable performance over temperature. A dropping bias resistor is not required allowing the device to be biased directly from a +5V supply voltage.

The broadband amplifier can be directly applied to various current and next generation wireless technologies such as GSM, CDMA, W-CDMA, WiBro, and WiMAX. The WJA1025 is ideal for general purpose applications such as LO buffering, IF amplification and pre-driver stages within the 50 to 4000 MHz frequency range.

### Functional Diagram



| Function    | Pin No. |
|-------------|---------|
| Input       | 1       |
| Output/Bias | 3       |
| Ground      | 2, 4    |

### Specifications <sup>(1)</sup>

| Parameter                 | Units | Min | Typ   | Max  |
|---------------------------|-------|-----|-------|------|
| Operational Bandwidth     | MHz   | 50  |       | 4000 |
| Test Frequency            | MHz   |     | 1900  |      |
| Gain                      | dB    |     | 17    |      |
| Input Return Loss         | dB    |     | 15    |      |
| Output Return Loss        | dB    |     | 10    |      |
| Output P1dB               | dBm   |     | +15.6 |      |
| Output IP3 <sup>(2)</sup> | dBm   |     | +32.4 |      |
| Output IP2                | dBm   |     | +41   |      |
| Noise Figure              | dB    |     | 5.5   |      |
| Device Voltage            | V     |     | 5     |      |
| Device Current            | mA    |     | 60    |      |

1. Test conditions: 25 °C, Supply Voltage = +5 V, 50 Ω System. S-parameters and 3OIP measured at device pins. All other specifications measured on evaluation board.  
 2. 3OIP measured with two tones at an output power of 2 dBm/tone separated by 1 MHz. The suppression on the largest IM3 product is used to calculate the 3OIP using a 2:1 rule.

### Typical Performance <sup>(3)</sup>

| Parameter                 | Units | Typical |       |       |       |       |
|---------------------------|-------|---------|-------|-------|-------|-------|
| Frequency                 | MHz   | 500     | 900   | 1900  | 2140  | 2500  |
| S21                       | dB    | 18.9    | 18.4  | 16.8  | 16.2  | 15.4  |
| S11                       | dB    | -14     | -16   | -37   | -31   | -27   |
| S22                       | dB    | -18     | -14   | -10   | -10   | -13   |
| Output P1dB               | dBm   | +18.2   | +17.3 | +15.6 | +14.8 | +13.5 |
| Output IP3 <sup>(2)</sup> | dBm   | +34.7   | +33   | +31.9 | +31.5 | +30.6 |
| Output IP2                | dBm   | +47.1   | +45.4 | +41   | +39.7 | +36.4 |
| Noise Figure              | dB    | 4.8     | 5.0   | 5.5   | 5.6   | 6.0   |

3. Listed typical performance parameters measured on evaluation board.

### Absolute Maximum Rating

| Parameter                            | Rating         |
|--------------------------------------|----------------|
| Storage Temperature                  | -55 to +150 °C |
| Supply Voltage                       | +6.5 V         |
| Input Power                          | +24 dBm        |
| θ <sub>jc</sub> (junction to paddle) | 83.8 °C / W    |
| Maximum Junction Temperature         | 150 °C         |

Operation of this device above any of these parameters may cause permanent damage.

### Ordering Information

| Part No.    | Description   |
|-------------|---|
| WJA1025     | +5V Active Bias InGaP HBT Gain Block<br>(lead-free/green/RoHS-compliant SOT-89 Package) |
| WJA1025-PCB | 50 – 4000 MHz Fully Assembled Eval. Board   |

Standard tape / reel size = 1000 pieces on a 7" reel

Specifications and information are subject to change without notice

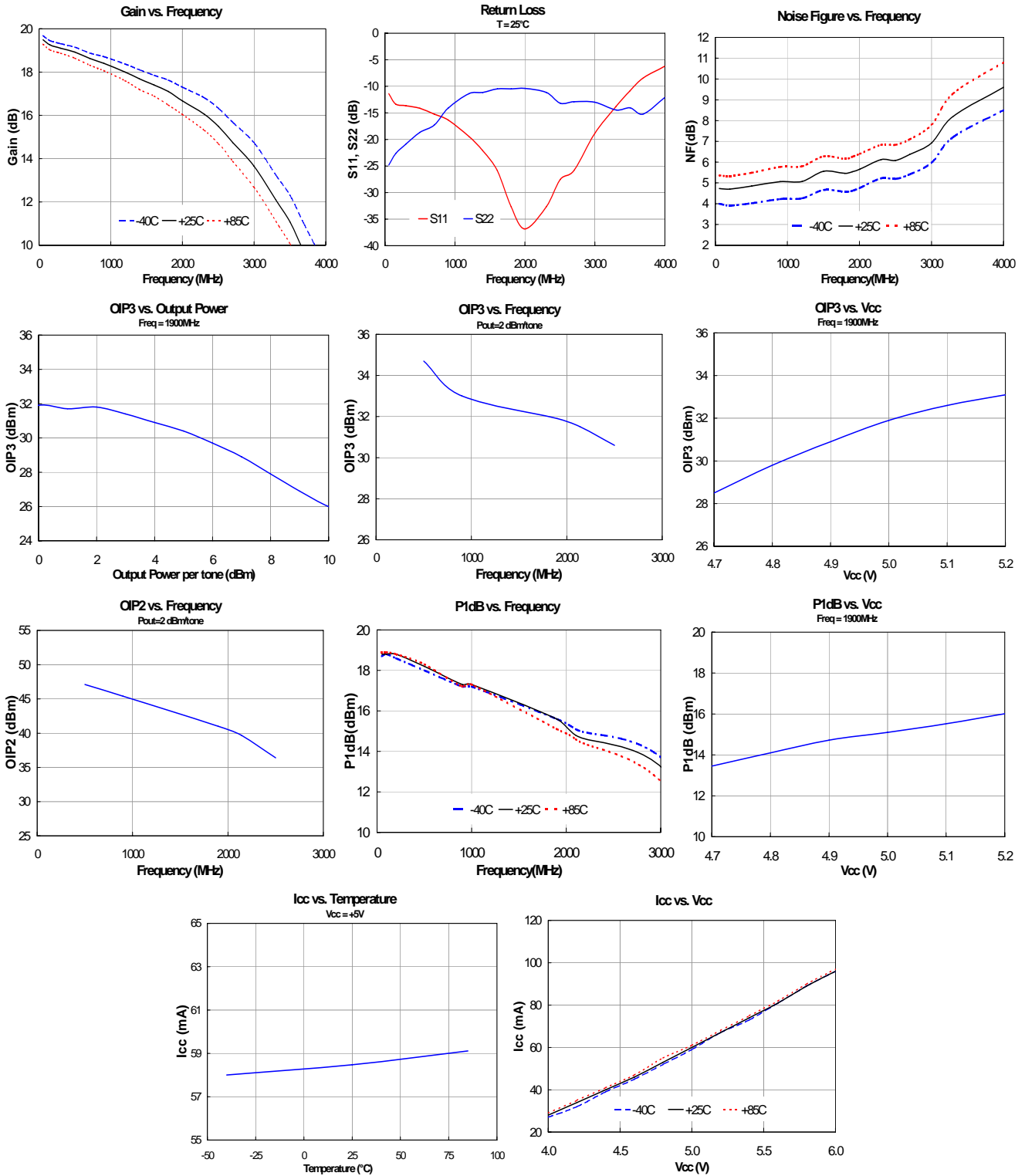


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## Typical Evaluation Board RF Performance

Supply Bias = +5 V,  $I_{CC} = 60$  mA



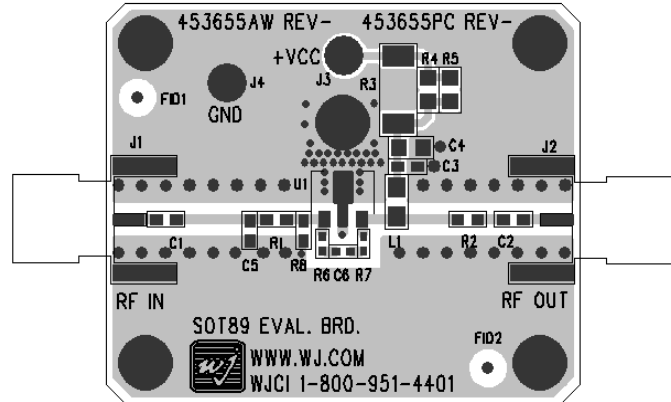
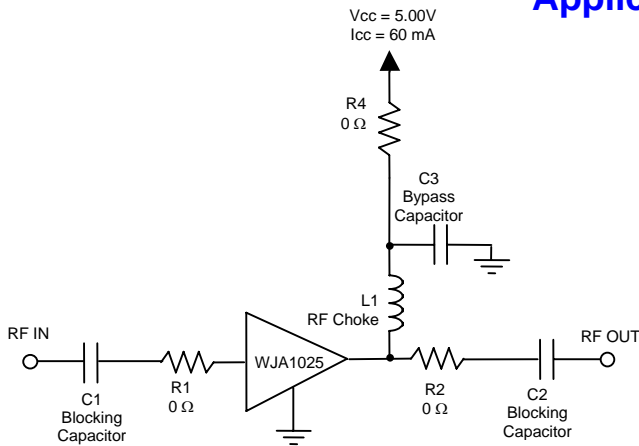
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### Application Circuit



### Recommended Component Values <sup>(1)</sup>

| Ref. Name                            | Value / Type   | Size |
|--------------------------------------|--|------|
| L1                                   | 470 nH ferrite core wire wound inductor <sup>(2)</sup> | 0805 |
| C1, C2                               | 1000 pF NPO chip capacitor                             | 0603 |
| C3                                   | 0.018 μF chip capacitor                                | 0603 |
| R1, R2, R4                           | 0 Ω <sup>(3)</sup>                                     | 0603 |
| C4, C5, C6,<br>R3, R5, R6,<br>R7, R8 | Do Not Place <sup>(3)</sup>                            |      |

1. The listed values are contained on the evaluation board to achieve optimal broadband performance
2. For lower cost and performance (500 – 4000 MHz) option use 18 nH air core wire wound inductor.
3. Place holders for the 0Ω resistors and “Do Not Place” references are not needed for final design.

### Typical Device Data

S-Parameters ( $V_{device} = +5 V$ ,  $I_{CC} = 60 mA$ ,  $T = 25 ^\circ C$ , calibrated to device leads)

| Freq (GHz) | S11 (dB) | S11 (ang) | S21 (dB) | S21 (ang) | S12 (dB) | S12 (ang) | S22 (dB) | S22 (ang) |
|------------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|
| 10         | -12.85   | -77.05    | 22.11    | 164.87    | -25.13   | 20.66     | -8.70    | -47.21    |
| 50         | -14.19   | -152.32   | 19.58    | 168.33    | -22.87   | 5.69      | -17.97   | -102.07   |
| 100        | -14.21   | -165.96   | 19.35    | 168.73    | -22.76   | 2.34      | -20.84   | -121.78   |
| 200        | -14.11   | -173.50   | 19.19    | 163.14    | -22.64   | -0.94     | -21.65   | -132.99   |
| 400        | -13.61   | -177.58   | 19.15    | 149.92    | -22.60   | -4.22     | -20.44   | -134.99   |
| 600        | -12.87   | 178.85    | 19.00    | 135.94    | -22.62   | -8.09     | -18.63   | -139.25   |
| 800        | -12.55   | 173.55    | 18.77    | 121.91    | -22.51   | -11.63    | -16.59   | -142.32   |
| 1000       | -12.61   | 164.24    | 18.61    | 108.26    | -22.49   | -14.60    | -14.32   | -147.99   |
| 1200       | -12.86   | 152.84    | 18.29    | 93.65     | -22.48   | -17.94    | -12.60   | -153.76   |
| 1400       | -13.00   | 142.18    | 17.95    | 80.02     | -22.35   | -21.86    | -11.42   | -159.72   |
| 1600       | -13.52   | 132.80    | 17.67    | 65.69     | -22.41   | -25.23    | -10.77   | -166.91   |
| 1800       | -14.61   | 126.51    | 17.30    | 51.45     | -22.28   | -28.01    | -10.30   | -174.79   |
| 2000       | -17.13   | 119.56    | 16.91    | 37.76     | -22.28   | -32.24    | -9.72    | 177.45    |
| 2200       | -22.24   | 110.52    | 16.34    | 23.48     | -22.26   | -35.27    | -9.14    | 169.23    |
| 2400       | -39.41   | 104.25    | 15.69    | 9.57      | -22.24   | -38.29    | -8.51    | 162.75    |
| 2600       | -26.52   | -105.93   | 15.05    | -4.25     | -22.18   | -41.60    | -8.22    | 156.67    |
| 2800       | -18.85   | -119.90   | 14.26    | -17.37    | -22.12   | -45.32    | -8.12    | 150.77    |
| 3000       | -14.60   | -131.55   | 13.41    | -31.11    | -21.94   | -49.10    | -8.05    | 143.93    |
| 3200       | -11.79   | -141.13   | 12.49    | -43.51    | -21.88   | -53.46    | -7.85    | 138.14    |
| 3400       | -9.85    | -148.69   | 11.44    | -56.00    | -21.80   | -56.71    | -7.62    | 131.91    |
| 3600       | -8.43    | -157.87   | 10.43    | -67.63    | -21.70   | -60.90    | -7.20    | 127.90    |
| 3800       | -7.44    | -168.60   | 9.52     | -78.22    | -21.49   | -64.48    | -7.01    | 126.16    |
| 4000       | -6.55    | -179.99   | 8.41     | -89.17    | -21.49   | -68.82    | -7.07    | 122.98    |

Device S-parameters are available for Download from the website at: <http://www.wj.com>

