

## Product Features

- DC – 3.5 GHz
- +21 dBm P1dB at 1 GHz
- +37 dBm OIP3 at 1 GHz
- 20 dB Gain at 1 GHz
- 4.4 dB Noise Figure at 2 GHz
- Available in Lead-free / green SOT-89 Package Style
- Internally matched to 50 Ω

## Applications

- Mobile Infrastructure
- CATV / FTTH
- W-LAN / ISM
- RFID
- WiMAX / WiBro

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

| Parameter                        | Units | Min  | Typ  | Max  |
|----------------------------------|-------|------|------|------|
| Operational Bandwidth            | MHz   | DC   |      | 3500 |
| Test Frequency                   | MHz   |      | 1000 |      |
| Gain                             | dB    |      | 20   |      |
| Output P1dB                      | dBm   |      | +21  |      |
| Output IP3 <sup>(2)</sup>        | dBm   |      | +37  |      |
| Test Frequency                   | MHz   |      | 2000 |      |
| Gain                             | dB    |      | 17   |      |
| Large-signal Gain <sup>(3)</sup> | dB    | 14.7 | 16   |      |
| Input Return Loss                | dB    |      | 12   |      |
| Output Return Loss               | dB    |      | 8    |      |
| Output P1dB                      | dBm   |      | +20  |      |
| Output IP3 <sup>(2)</sup>        | dBm   |      | +33  |      |
| Noise Figure                     | dB    |      | 4.4  |      |
| Test Frequency                   | MHz   |      | 3000 |      |
| Gain                             | dB    | 13   | 14.5 |      |
| Device Voltage                   | V     | 5.3  | 5.6  | 5.9  |
| Device Current                   | mA    |      | 96   |      |

1. Test conditions unless otherwise noted: 25° C, Supply Voltage = +7 V, Rbias = 14 Ω, 50 Ω System.
2. 3OIP measured with two tones at an output power of +7 dBm/tone separated by 1 MHz. The suppression on the largest IM3 product is used to calculate the 3OIP using a 2:1 rule.
3. Large-signal gain is tested with an input power level of +3 dBm.

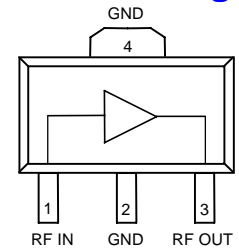
## Product Description

The EC1078B is a general-purpose buffer amplifier that offers high dynamic range in a low-cost surface-mount package. At 1000 MHz, the EC1078B typically provides 20 dB of gain, +37 dBm Output IP3, and +21 dBm P1dB.

The EC1078B consists of Darlington pair amplifiers using the high reliability InGaP/GaAs HBT process technology and only requires DC-blocking capacitors, a bias resistor, and an inductive RF choke for operation. The device is ideal for wireless applications and is available in a low-cost, surface-mountable lead-free/green/RoHS-compliant SOT-89 package. All devices are 100% RF and DC tested.

The broadband MMIC amplifier can be directly applied to various current and next generation wireless technologies such as GPRS, GSM, CDMA, and W-CDMA. In addition, the EC1078B will work for other various applications within the DC to 3.5 GHz frequency range such as CATV and mobile wireless.

## Functional Diagram



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

## Typical Performance <sup>(1)</sup>

| Parameter                 | Units | Typical |     |       |       |
|---------------------------|-------|---------|-----|-------|-------|
| Frequency                 | MHz   | 500     | 900 | 1900  | 2140  |
| S21                       | dB    | 20.7    | 20  | 17.2  | 16.6  |
| S11                       | dB    | -13     | -14 | -14   | -15   |
| S22                       | dB    | -12     | -12 | -12   | -12   |
| Output P1dB               | dBm   | +20.6   | +21 | +20.5 | +20   |
| Output IP3 <sup>(2)</sup> | dBm   | +37.5   | +37 | +33.5 | +32.5 |
| Noise Figure              | dB    | 3.1     | 3.5 | 4.3   | 4.4   |

## Absolute Maximum Rating

| Parameter                   | Rating         |
|-----------------------------|----------------|
| Operating Case Temperature  | -40 to +85 °C  |
| Storage Temperature         | -55 to +150 °C |
| Device Current              | 150 mA         |
| RF Input Power (continuous) | +12 dBm        |
| Junction Temperature        | +250 °C        |

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

## Ordering Information

| Part No.    | Description   |
|-------------|---|
| EC1078B-G   | InGaP HBT Gain Block<br>(lead-free/green/RoHS-compliant SOT-89 package) |
| EC1078B-PCB | 700 – 2400 MHz Fully Assembled Eval. Board                              |

Specifications and information are subject to change without notice

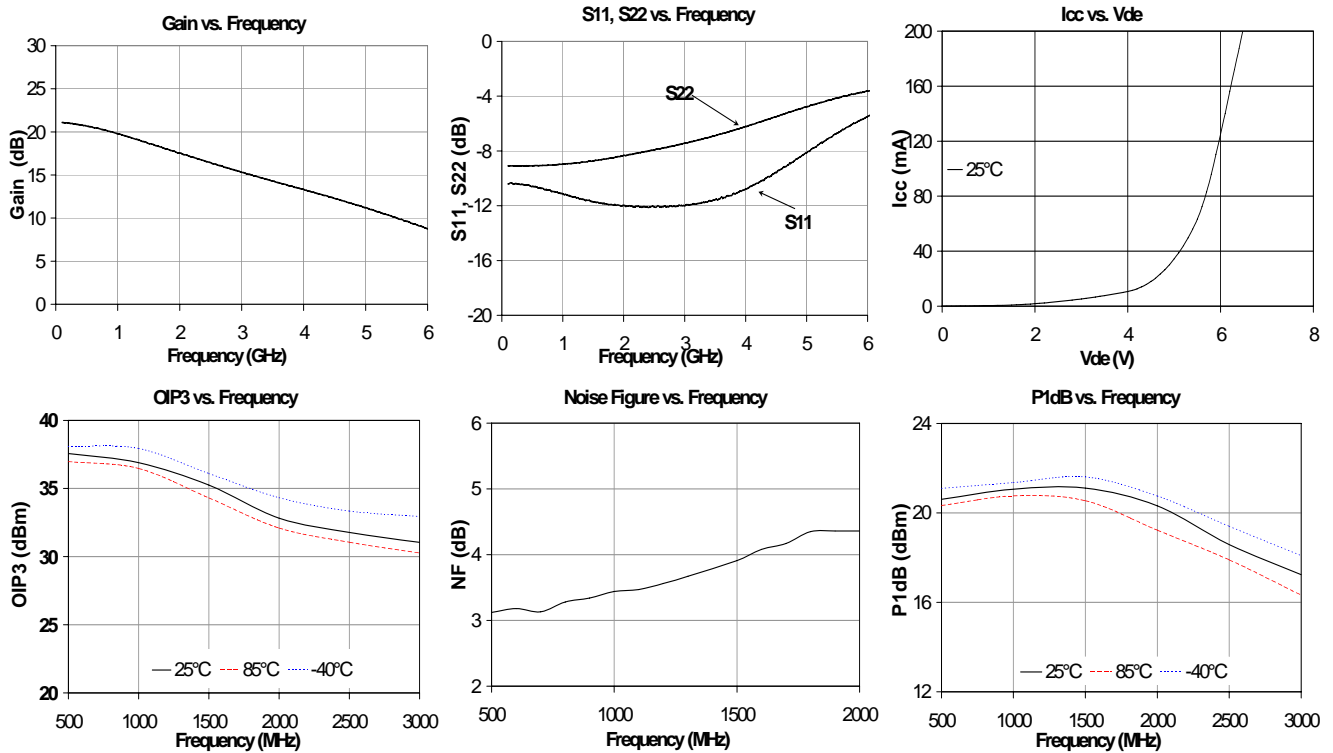


## Typical Device RF Performance

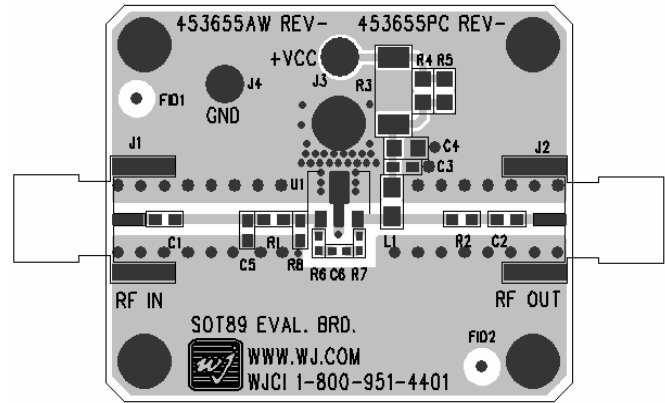
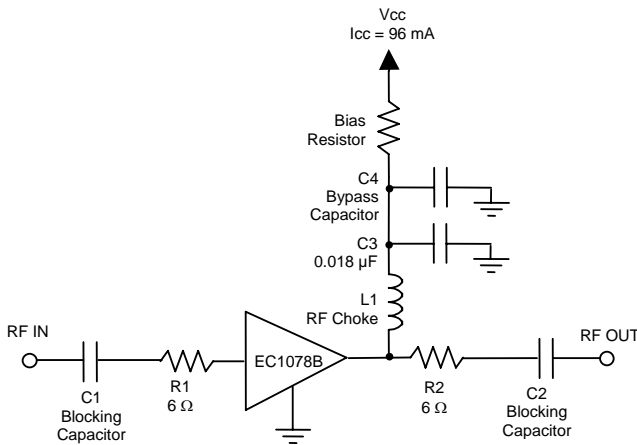
Supply Bias = +7 V,  $R_{bias} = 14 \Omega$ ,  $I_{cc} = 96 \text{ mA}$

| Frequency    | MHz | 100  | 500   | 900 | 1900  | 2140  | 2400 | 3500 |
|--------------|-----|------|-------|-----|-------|-------|------|------|
| S21          | dB  | 21.2 | 20.7  | 20  | 17.2  | 16.6  | 15.9 | 13.5 |
| S11          | dB  | -13  | -13   | -14 | -14   | -15   | -15  | -13  |
| S22          | dB  | -11  | -12   | -12 | -12   | -12   | -11  | -9.2 |
| Output P1dB  | dBm | +20  | +20.6 | +21 | +20.5 | +20   | +19  |      |
| Output IP3   | dBm | +38  | +37.5 | +37 | +33.5 | +32.5 | +32  |      |
| Noise Figure | dB  | 3.4  | 3.5   | 3.5 | 3.8   | 3.8   | 3.9  |      |

1. Test conditions: T = 25°C, Supply Voltage = +7 V, Device Voltage = 5.6 V,  $R_{bias} = 14 \Omega$ ,  $I_{cc} = 96 \text{ mA}$  typical, 50  $\Omega$  System.
2. 3OIP measured with two tones at an output power of +7 dBm/tone separated by 1 MHz. The suppression on the largest IM3 product is used to calculate the 3OIP using a 2:1 rule.
3. Data is shown as device performance only. Actual implementation for the desired frequency band will be determined by external components shown in the application circuit. The performance data does not account for losses attributed to recommended input and output series resistances shown in the application circuit on page 3.



## Recommended Application Circuit (EC1078B-PCB)



Recommended Component Values

| Reference Designator | Frequency (MHz) |         |        |       |       |       |       |
|----------------------|-----------------|---------|--------|-------|-------|-------|-------|
|                      | 50              | 500     | 900    | 1900  | 2200  | 2500  | 3500  |
| L1                   | 820 nH          | 220 nH  | 68 nH  | 27 nH | 22 nH | 18 nH | 15 nH |
| C1, C2, C3           | .018 $\mu$ F    | 1000 pF | 100 pF | 68 pF | 68 pF | 56 pF | 39 pF |

- The proper values for the components are dependent upon the intended frequency of operation.
- The component values in the table below are contained on the evaluation board to achieve optimal broadband performance.
- R1 and R2 are shown in the circuit diagram to avoid potential instabilities. The configuration shown above assures of unconditional stability with the use of the device. It is expected that linearity parameters (OIP3 and P1dB) to degrade about only 0.5 dB, while overall gain will be about 1 dB less than the performance shown in page 1 and 2 of this datasheet. Input and output return loss is expected to improve with the use of the I/O series resistances at 2 GHz.

Recommended Bias Resistor Values

| Supply Voltage | R bias value | Size |
|----------------|--------------|------|
| 7 V            | 14.6 ohms    | 1210 |
| 8 V            | 25 ohms      | 1210 |
| 9 V            | 35 ohms      | 2010 |
| 10 V           | 46 ohms      | 2010 |
| 12 V           | 67 ohms      | 2512 |

The proper value for R bias is dependent upon the supply voltage and allows for bias stability over temperature. WJ recommends a minimum supply bias of +7 V. A 1% tolerance resistor is recommended.

| Ref. Desig. | Value / Type                 | Size |
|-------------|------------------------------|------|
| L1          | 39 nH wirewound inductor     | 0603 |
| C1, C2      | 56 pF chip capacitor         | 0603 |
| C3          | 0.018 $\mu$ F chip capacitor | 0603 |
| C4          | Do Not Place                 |      |
| R1          | 6 $\Omega$ chip resistor     | 0603 |
| R2          | 6 $\Omega$ chip resistor     | 0603 |
| R3          | 14 $\Omega$ 1% tolerance     | 2010 |

## Typical Device S-Parameters

S-Parameters ( $V_{\text{device}} = +5.6 \text{ V}$ ,  $I_{\text{CC}} = 96 \text{ mA}$ ,  $T = 25^\circ\text{C}$ , calibrated to device leads)

| Freq (MHz) | S11 (dB) | S11 (ang) | S21 (dB) | S21 (ang) | S12 (dB) | S12 (ang) | S22 (dB) | S22 (ang) |
|------------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|
| 50         | -13.94   | -3.83     | 21.57    | 176.70    | -24.12   | 0.80      | -11.86   | -4.93     |
| 500        | -13.75   | -39.71    | 20.96    | 148.92    | -23.37   | 6.98      | -11.69   | -48.17    |
| 1000       | -13.18   | -77.85    | 19.93    | 122.53    | -22.08   | 8.80      | -10.82   | -90.17    |
| 1500       | -12.31   | -113.82   | 18.86    | 98.71     | -20.68   | 4.63      | -9.54    | -126.09   |
| 2000       | -11.09   | -148.03   | 17.94    | 76.48     | -19.38   | -1.93     | -8.31    | -158.11   |
| 2500       | -9.97    | -177.99   | 16.84    | 54.17     | -18.50   | -11.42    | -7.34    | 173.96    |
| 3000       | -8.87    | 154.89    | 15.65    | 33.67     | -17.80   | -21.55    | -6.41    | 148.41    |
| 3500       | -7.79    | 129.58    | 14.44    | 13.81     | -17.41   | -32.42    | -5.63    | 125.43    |
| 4000       | -6.76    | 106.00    | 13.18    | -5.36     | -17.25   | -43.17    | -4.78    | 105.05    |
| 4500       | -5.72    | 85.30     | 11.80    | -23.83    | -17.22   | -53.97    | -4.07    | 86.50     |
| 5000       | -4.72    | 66.77     | 10.39    | -41.03    | -17.40   | -64.41    | -3.41    | 70.24     |
| 5500       | -3.91    | 51.00     | 8.85     | -57.10    | -17.84   | -74.10    | -2.93    | 56.07     |
| 6000       | -3.22    | 37.49     | 7.41     | -71.74    | -18.28   | -83.92    | -2.53    | 43.40     |

Device S-parameters are available for download off of the website at: <http://www.wj.com>

