

Product Features

- DC – 4 GHz
- +18 dBm P1dB at 1 GHz
- +34 dBm OIP3 at 1 GHz
- 19.5 dB Gain at 1 GHz
- 3.3 dB Noise Figure at 2 GHz
- Available in SOT-86 and SOT-89 Package Styles
- Internally matched to 50 Ω

Applications

- Mobile Infrastructure
- CATV / DBS
- W-LAN / ISM
- RFID
- Defense / Homeland Security
- Fixed Wireless

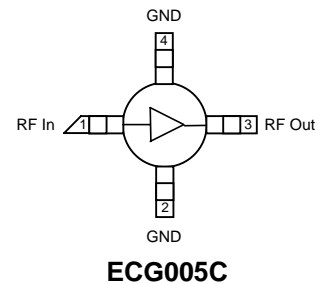
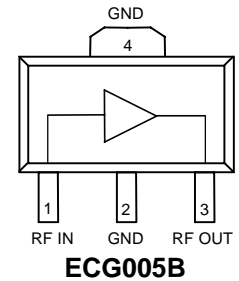
Product Description

The ECG005 is a general-purpose buffer amplifier that offers high dynamic range in a low-cost surface-mount package. At 1000 MHz, the ECG005 typically provides 19.5 dB of gain, +34 dBm Output IP3, and +18 dBm P1dB.

The ECG005 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 low-cost, surface-mountable plastic SOT-86 and SOT-89 packages. 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 ECG005 will work for other various applications within the DC to 4 GHz frequency range such as CATV and fixed wireless.

Functional Diagram



Specifications ⁽¹⁾

| Parameter | Units | Min | Typ | Max |
|---------------------------|-------|-------|-------|------|
| Operational Bandwidth | MHz | DC | | 4000 |
| Test Frequency | MHz | | 1000 | |
| Gain | dB | | 19.7 | |
| Output P1dB | dBm | | +18 | |
| Output IP3 ⁽²⁾ | dBm | | +34 | |
| Test Frequency | MHz | | 2000 | |
| Gain | dB | 17.5 | 18.5 | |
| Input Return Loss | dB | | 16 | |
| Output Return Loss | dB | | 13 | |
| Output P1dB | dBm | +16.5 | +17.5 | |
| Output IP3 ⁽²⁾ | dBm | +30 | +32 | |
| Noise Figure | dB | | 3.3 | |
| Device Voltage | V | 4.2 | 4.8 | 5.3 |
| Device Current | mA | | 65 | |

1. Test conditions unless otherwise noted: 25°C, Supply Voltage = +6 V, R_{bias} = 18 Ω , 50 Ω System.

2. 3OIP measured with two tones at an output power of +4 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 ⁽³⁾

| Parameter | Units | Typical | | | |
|--------------|-------|---------|------|-------|-------|
| Frequency | MHz | 500 | 900 | 1900 | 2140 |
| S21 | dB | 20.5 | 19.7 | 18.7 | 18.5 |
| S11 | dB | -16 | -16 | -16 | -16 |
| S22 | dB | -13 | -13 | -11 | -11 |
| Output P1dB | dBm | +17.8 | +18 | +17.5 | +19.0 |
| Output IP3 | dBm | +33 | +34 | +32 | +30.5 |
| Noise Figure | dB | 5.2 | 3.4 | 3.3 | 3.8 |

3. Test conditions: T = 25°C, Supply Voltage = +6 V, Device Voltage = +5.0V, R_{bias} = 18 Ω , 50 Ω System.

Absolute Maximum Rating

| Parameter | Rating |
|-----------------------------|----------------|
| Operating Case Temperature | -40 to +85 °C |
| Storage Temperature | -55 to +150 °C |
| Device Current | 130 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 |
|-------------|---|
| ECG005B | InGaP HBT Gain Block (SOT-89 Pkg) |
| ECG005C | InGaP HBT Gain Block (SOT-86 Pkg) |
| ECG005B-PCB | 700 –2400 MHz Fully Assembled Eval. Board |
| ECG005C-PCB | 700 –2400 MHz Fully Assembled Eval. Board |

Specifications and information are subject to change without notice

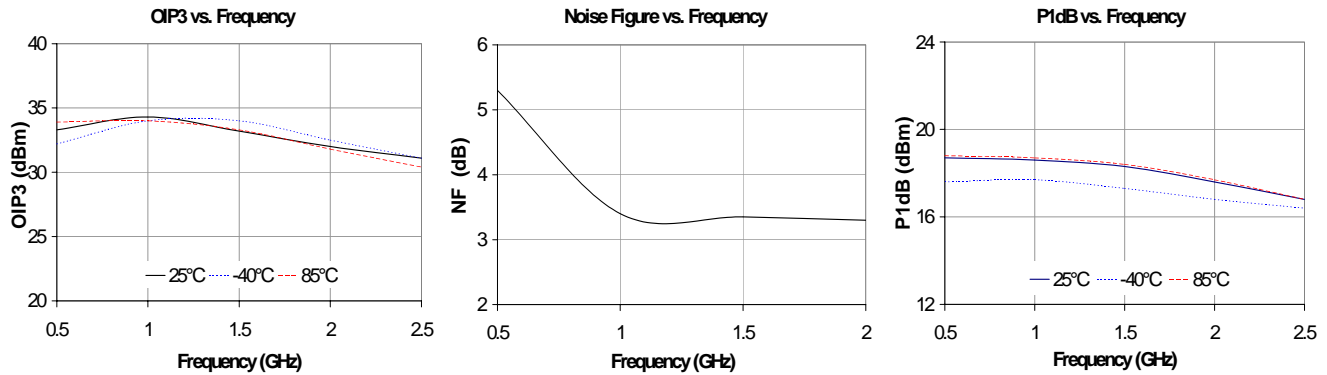
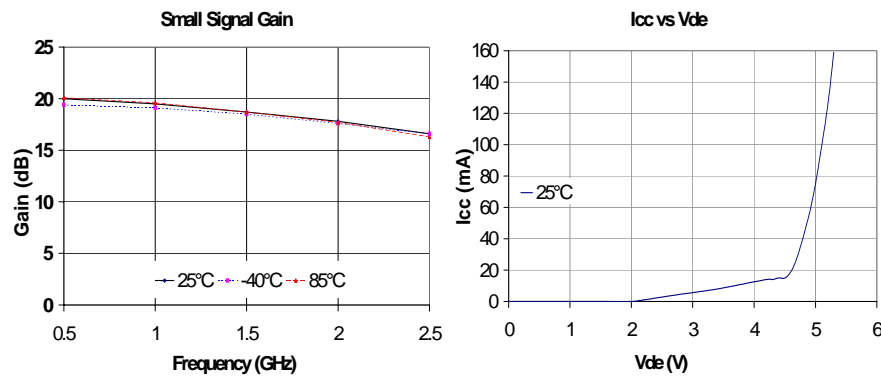


Typical Device RF Performance

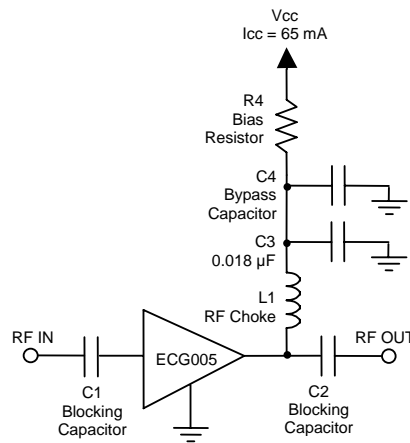
Supply Bias = +6 V, $R_{bias} = 18 \Omega$, $I_{cc} = 65 \text{ mA}$

| Frequency | MHz | 100 | 500 | 900 | 1900 | 2140 | 2400 | 3500 | 5800 |
|--------------|-----|-------|-------|------|-------|-------|-------|------|------|
| S21 | dB | 20.5 | 20.5 | 19.7 | 18.7 | 18.5 | 18.2 | 16.9 | 14.1 |
| S11 | dB | -18.6 | -18.5 | -18 | -21.5 | -24 | -27 | -28 | -22 |
| S22 | dB | -16 | -15.2 | -17 | -16 | -17 | -17 | -15 | -8 |
| Output P1dB | dBm | +17.5 | +17.8 | +18 | +17.6 | +17.3 | +17.1 | +16 | |
| Output IP3 | dBm | +33.6 | +33.5 | +34 | +32 | +31.5 | +31 | | |
| Noise Figure | dB | 5.4 | 5.3 | 3.5 | 3.3 | 3.3 | 3.3 | | |

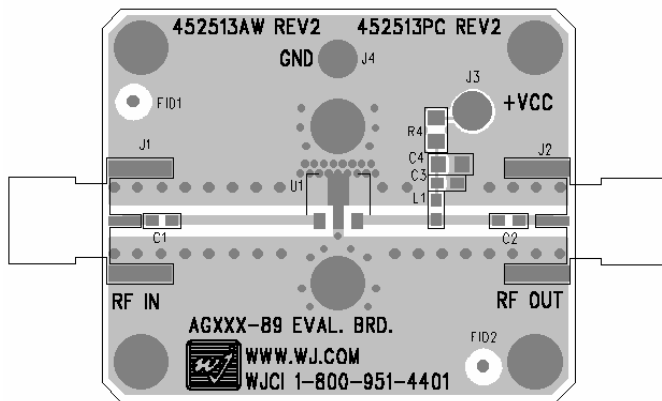
1. Test conditions: $T = 25^\circ \text{C}$, Supply Voltage = +6 V, Device Voltage = 4.8 V, $R_{bias} = 18 \Omega$, $I_{cc} = 65 \text{ mA}$ typical, 50Ω System.
2. 3OIP measured with two tones at an output power of +4.5 dBm/tone separated by 1 MHz. The suppression on the largest IM3 product is used 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.



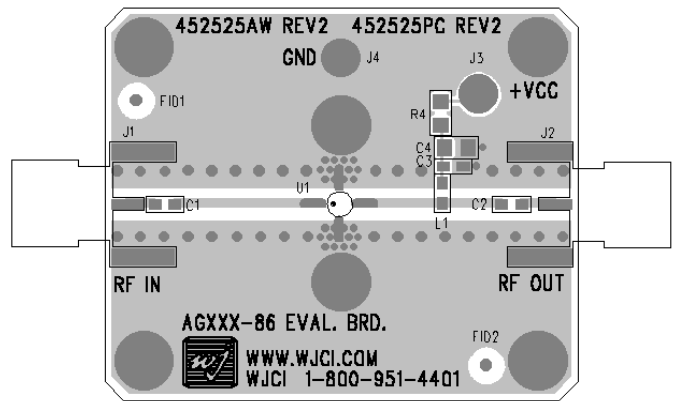
Recommended Application Circuit



ECG005B-PCB



ECG005C-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, C4 | .018 µF | 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 following values are contained on the evaluation board to achieve optimal broadband performance:

| Ref. Desig. | Value / Type | Size |
|-------------|--------------------------|------|
| L1 | 39 nH wirewound inductor | 0603 |
| C1, C2 | 56 pF chip capacitor | 0603 |
| C3 | 0.018 µF chip capacitor | 0603 |
| C4 | Do Not Place | |
| R4 | 18 Ω 1% tolerance | 0805 |

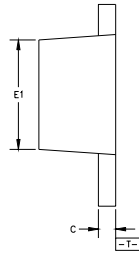
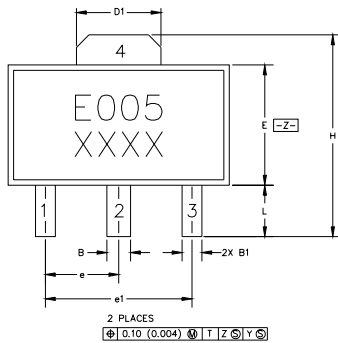
Recommended Bias Resistor Values

| Supply Voltage | R1 value | Size |
|----------------|-----------|------|
| 6 V | 18.5 ohms | 0805 |
| 7 V | 33.8 ohms | 1210 |
| 8 V | 49 ohms | 1210 |
| 9 V | 65 ohms | 2010 |
| 10 V | 80 ohms | 2010 |
| 12 V | 111 ohms | 2512 |

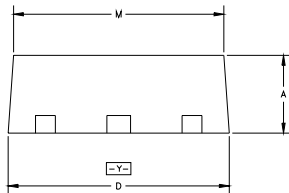
The proper value for R1 is dependent upon the supply voltage and allows for bias stability over temperature. WJ recommends a minimum supply bias of +6 V. A 1% tolerance resistor is recommended.

ECG005B (SOT-89 Package) Mechanical Information

Outline Drawing



| SYMBOL | MIN | MAX |
|--------|--------------------|----------------|
| A | 1.40 (.055) | 1.60 (.063) |
| B | .44 (.017) | .56 (.022) |
| B1 | .36 (.014) | .48 (.019) |
| C | .35 (.014) | .44 (.017) |
| D | 4.40 (.173) | 4.60 (.181) |
| D1 | 1.62 (.064) | 1.83 (.072) |
| E | 2.29 (.079) | 2.60 (.102) |
| E1 | 2.15 (.084) | 2.29 (.090) |
| e | 1.50 BSC (.059) | |
| e1 | 3.00 BSC (.118) | |
| H | 3.94 (.155) | 4.25 (.167) |
| L | .89 (.035) | 1.20 (.047) |
| M | 4.04 (.159) | 4.19 (.165) |



- NOTES:
1. DIMENSIONS CONFORM WITH JEDEC TO-243C EXCEPT WHERE INDICATED.
 2. DIMENSIONS ARE EXPRESSED IN MILLIMETERS(INCHES).
 3. DIMENSIONING AND TOLERANCING IAW ANSI Y14.5M

Product Marking

The component will be marked with an "E005" designator with an alphanumeric lot code on the top surface of the package.

Tape and reel specifications for this part are located on the website in the "Application Notes" section.

MSL / ESD Rating



Caution! ESD sensitive device.

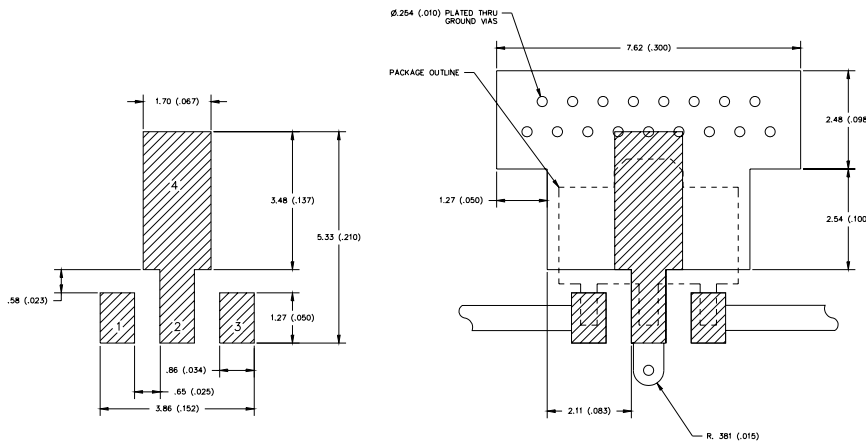
ESD Rating: Class 1A
Value: Passes between 250 and 500V
Test: Human Body Model (HBM)
Standard: JEDEC Standard JESD22-A114

MSL Rating: Level 3 at +235° C convection reflow
Standard: JEDEC Standard J-STD-020

Mounting Config. Notes

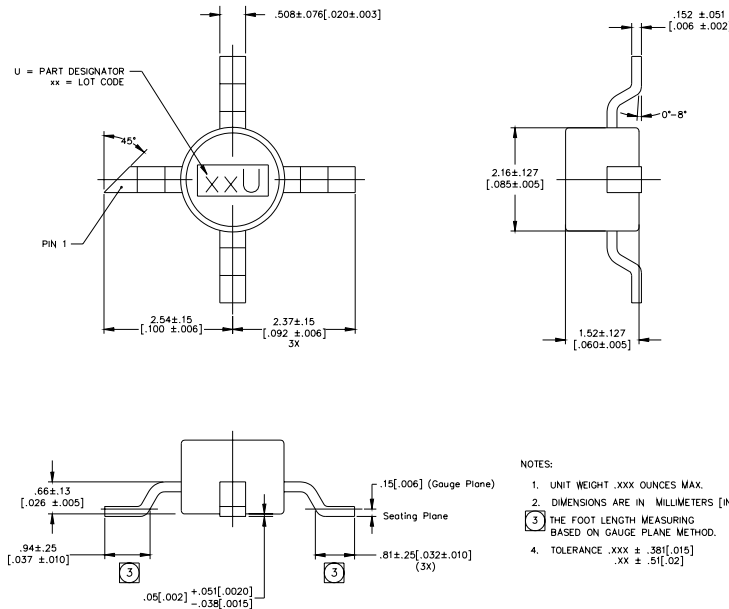
1. GROUND/THERMAL VIAS ARE CRITICAL FOR THE PROPER PERFORMANCE OF THIS DEVICE. VIAS SHOULD USE A .35mm (#80/.0135") DIAMETER DRILL AND HAVE A FINAL PLATED THRU DIAMETER OF .25mm (.010").
2. ADD AS MUCH COPPER AS POSSIBLE TO INNER AND OUTER LAYERS NEAR THE PART TO ENSURE OPTIMAL THERMAL PERFORMANCE.
3. ADD MOUNTING SCREWS NEAR THE PART TO FASTEN THE BOARD TO A HEATSINK. ENSURE THAT THE GROUND/THERMAL VIA REGION CONTACTS THE HEATSINK.
4. DO NOT PUT SOLDER MASK ON THE BACK SIDE OF THE PC BOARD IN THE REGION WHERE THE BOARD CONTACTS THE HEATSINK.
5. RF TRACE WIDTH DEPENDS UPON THE PC BOARD MATERIAL AND CONSTRUCTION.
6. USE 1 OZ. COPPER MINIMUM.
7. ALL DIMENSIONS ARE IN MILLIMETERS (INCHES). ANGLES ARE IN DEGREE

Land Pattern

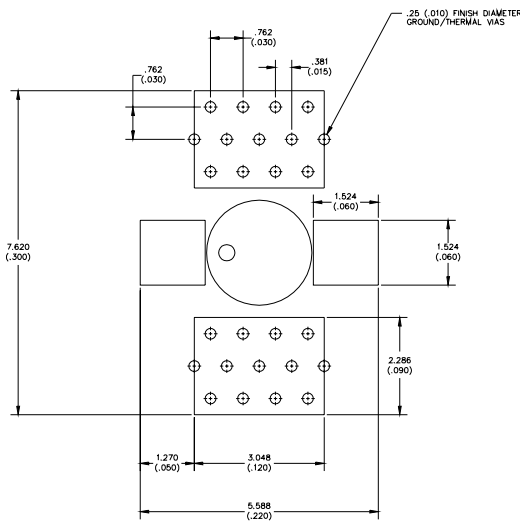


ECG005C (SOT-86 Package) Mechanical Information

Outline Drawing



Land Pattern



Product Marking

The component will be marked with a two-digit numeric lot code followed by a "U" designator on the top surface of the package.

Tape and reel specifications for this part are located on the website in the "Application Notes" section.

MSL / ESD Rating



Caution! ESD sensitive device.

ESD Rating: Class 1A
Value: Passes between 250 and 500V
Test: Human Body Model (HBM)
Standard: JEDEC Standard JESD22-A114

MSL Rating: Level 1 at +235° C convection reflow
Standard: JEDEC Standard J-STD-020

Mounting Config. Notes

1. GROUND/THERMAL VIAS ARE CRITICAL FOR THE PROPER PERFORMANCE OF THIS DEVICE. VIAS SHOULD USE A .35mm (#80/.0135") DIAMETER DRILL AND HAVE A FINAL, PLATED THRU DIAMETER OF .25mm (.010").
2. ADD AS MUCH COPPER AS POSSIBLE TO INNER AND OUTER LAYERS NEAR THE PART TO ENSURE OPTIMAL THERMAL PERFORMANCE.
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4. DO NOT PUT SOLDER MASK ON THE BACK SIDE OF THE PC BOARD IN THE REGION WHERE THE BOARD CONTACTS THE HEATSINK.
5. RF TRACE WIDTH DEPENDS UPON THE PC BOARD MATERIAL AND CONSTRUCTION.
6. USE 1 OZ. COPPER MINIMUM.
7. ALL DIMENSIONS ARE IN MILLIMETERS (INCHES). ANGLES ARE IN DEGREE



Typical Device S-Parameters – ECG005B

S-Parameters ($V_{\text{device}} = +4.8 \text{ V}$, $I_{\text{CC}} = 65 \text{ mA}$, $T = 25^\circ\text{C}$, calibrated to device leads)

| Freq (MHz) | S11 (dB) | S11 (ang) | S21 (dB) | S21 (ang) | S12 (dB) | S12 (ang) | S22 (dB) | S22 (ang) |
|------------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|
| 50 | -16.85 | 0.19 | 20.38 | 177.50 | -22.71 | -0.45 | -14.14 | -3.11 |
| 500 | -16.24 | -9.81 | 20.10 | 157.54 | -22.66 | -4.10 | -13.67 | -37.18 |
| 1000 | -16.15 | -23.76 | 19.70 | 136.72 | -22.59 | -8.40 | -12.86 | -71.27 |
| 1500 | -16.13 | -36.75 | 19.18 | 116.48 | -22.49 | -12.64 | -11.87 | -99.50 |
| 2000 | -16.39 | -53.28 | 18.69 | 97.62 | -22.17 | -15.97 | -10.87 | -125.35 |
| 2500 | -16.93 | -68.72 | 18.08 | 78.80 | -21.86 | -20.64 | -10.22 | -146.72 |
| 3000 | -17.48 | -84.38 | 17.46 | 61.38 | -21.45 | -26.00 | -9.40 | -168.24 |
| 3500 | -19.28 | -104.57 | 16.92 | 44.01 | -20.94 | -32.14 | -8.82 | 171.86 |
| 4000 | -22.47 | -127.54 | 16.40 | 27.02 | -20.58 | -38.33 | -7.90 | 151.59 |
| 4500 | -26.44 | 176.75 | 15.87 | 9.47 | -20.05 | -45.70 | -6.94 | 131.25 |
| 5000 | -20.72 | 103.65 | 15.29 | -7.89 | -19.62 | -54.19 | -5.89 | 111.91 |
| 5500 | -15.55 | 71.92 | 14.59 | -25.94 | -19.45 | -64.15 | -4.89 | 93.31 |
| 6000 | -11.74 | 56.37 | 13.77 | -43.60 | -19.41 | -74.67 | -3.97 | 75.59 |

Typical Device S-Parameters – ECG005C

S-Parameters ($V_{\text{device}} = +4.8 \text{ V}$, $I_{\text{CC}} = 65 \text{ mA}$, $T = 25^\circ\text{C}$, calibrated to device leads)

| Freq (MHz) | S11 (dB) | S11 (ang) | S21 (dB) | S21 (ang) | S12 (dB) | S12 (ang) | S22 (dB) | S22 (ang) |
|------------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|
| 50 | -17.40 | 0.37 | 20.68 | 177.99 | -22.91 | -0.12 | -14.59 | -2.72 |
| 500 | -16.88 | -1.35 | 20.43 | 159.13 | -22.93 | 0.51 | -14.73 | -29.09 |
| 1000 | -16.10 | -5.64 | 19.87 | 139.68 | -22.86 | 1.14 | -14.87 | -56.63 |
| 1500 | -15.40 | -12.39 | 19.09 | 121.78 | -22.84 | 2.39 | -14.84 | -82.79 |
| 2000 | -14.93 | -21.87 | 18.33 | 105.90 | -22.59 | 4.51 | -14.56 | -106.69 |
| 2500 | -14.80 | -30.63 | 17.48 | 90.63 | -22.31 | 4.94 | -14.02 | -127.58 |
| 3000 | -15.00 | -41.19 | 16.61 | 77.28 | -21.91 | 5.67 | -13.32 | -146.19 |
| 3500 | -15.73 | -52.97 | 15.87 | 64.50 | -21.49 | 5.29 | -12.63 | -162.63 |
| 4000 | -16.71 | -64.36 | 15.22 | 52.26 | -20.89 | 5.81 | -11.63 | -177.32 |
| 4500 | -17.78 | -83.08 | 14.60 | 39.83 | -20.28 | 4.59 | -10.76 | 168.36 |
| 5000 | -18.95 | -109.86 | 14.02 | 28.04 | -19.60 | 2.50 | -9.79 | 155.83 |
| 5500 | -19.34 | -143.64 | 13.44 | 15.46 | -18.99 | -0.17 | -8.81 | 143.13 |
| 6000 | -17.30 | -177.52 | 12.82 | 3.40 | -18.32 | -3.34 | -7.70 | 131.06 |