

DATA SHEET

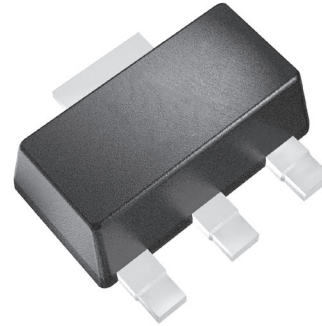
ADA1200: Linear Amplifier

Applications

- Low-noise amplifier for CATV set-top boxes
- CATV drop amplifier

Features

- 12 dB gain
- 50 to 1000 MHz frequency range
- Noise figure: 2.3 dB
- Single +5 V supply
- Small SOT-89 package
- Materials set consistent with RoHS directives
- Characterized for MER performance



Skyworks Green™ products are compliant with all applicable legislation and are halogen-free. For additional information, refer to *Skyworks Definition of Green™*, document number SQ04-0074.

Description

The ADA1200 is a highly linear amplifier developed to meet the stringent requirements of CATV systems. Offered in a low-cost SOT-89 package, this GaAs MESFET design offers low noise and low distortion over a wide frequency range. The device is ideally suited for applications as a low-noise amplifier in CATV set-top boxes, and as a drop amplifier in CATV distribution systems. The ADA1200 requires a single +5 V supply, and typically consumes 400 mW of power.

A block diagram of the ADA1200 is shown in Figure 1. The device package and pinout are shown in Figure 2. Signal pin assignments and functional pin descriptions are described in Table 1.

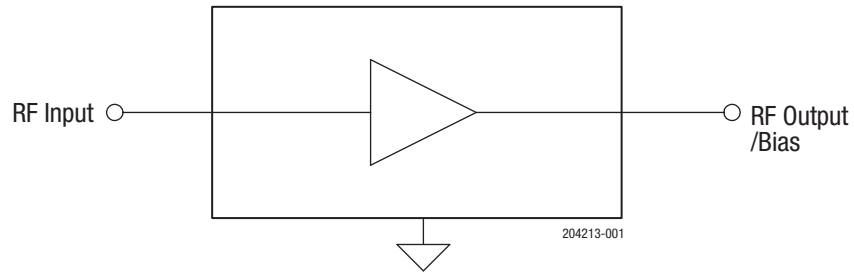


Figure 1. ADA1200 Block Diagram

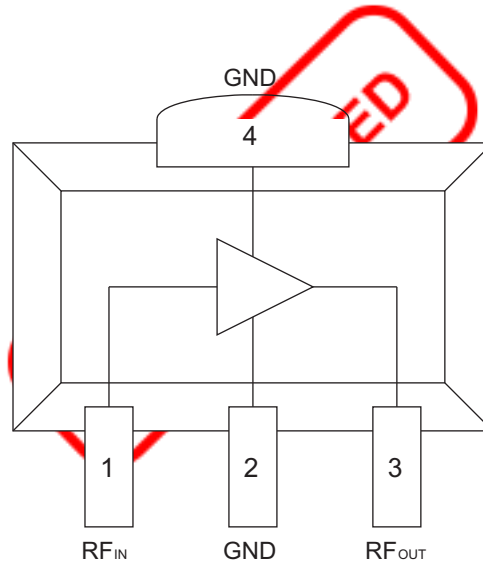


Figure 2. ADA1200 Pinout (Top View)

Table 1. ADA1200 Signal Pin Descriptions

| Pin | Name | Description |
|-----|-------|----------------|
| 1 | RFIN | RF input |
| 2 | GND | Ground |
| 3 | RFOUT | RF output/bias |
| 4 | GND | Ground |

Electrical and Mechanical Specifications

The absolute maximum ratings of the ADA1200 are provided in Table 2. Recommended operating conditions are specified in Table 3.

Electrical specifications are provided in Table 4. Typical performance characteristics are shown in Figures 3 through 16. Evaluation Board S parameters are shown in Table 5.

Table 2. ADA1200 Absolute Maximum Ratings¹

| Parameter | Minimum | Maximum | Units |
|-----------------------------------|---------|---------|-------|
| Device voltage (V_{DD}) | | +9 | VDC |
| RF input power (P_{IN}) | | +10 | dBm |
| Storage temperature (T_{STG}) | -40 | +150 | °C |
| Channel temperature | | +150 | °C |

¹ Exposure to maximum rating conditions for extended periods may reduce device reliability. There is no damage to device with only one parameter set at the limit and all other parameters set at or below their nominal value. Exceeding any of the limits listed here may result in permanent damage to the device.

ESD HANDLING: Although this device is designed to be as robust as possible, electrostatic discharge (ESD) can damage this device. This device must be protected at all times from ESD when handling or transporting. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD handling precautions should be used at all times.

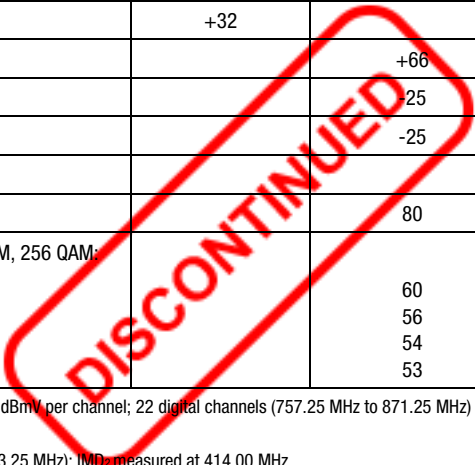
Table 3. ADA1200 Recommended Operating Conditions¹

| Parameter | Min | Typ | Max | Units |
|-----------------------------|-----|-----|------|-------|
| RF input/output frequency | 50 | | 1000 | MHz |
| Supply voltage (V_{DD}) | | +5 | | VDC |
| Case temperature (T_c) | -40 | | +100 | °C |

¹ The device may be operated safely over these conditions; however, parametric performance is guaranteed only over the conditions defined in the electrical specifications.

Table 4. ADA1200 General RF Specifications
 (T_A = +25 °C, V_{DD} = +5 VDC, f = 50 to 860 MHz, 75 Ω System, Refer to Figure 17)

| Parameter | Min | Typ | Max | Units |
|--|------|-----|------|---------|
| Gain | 10.5 | 12 | 13.5 | dB |
| Noise figure | | 2.3 | 3.5 | dB |
| CSO ¹ | | -61 | -55 | dBc |
| CTB ¹ | | -75 | -64 | dBc |
| XMOD ¹ | | -73 | | dBc |
| OIP2 ² | +52 | | | dBm |
| 3-tone OIP3 ³ | +32 | | | dBm |
| P1dB | | +66 | | dBmV |
| Input return loss | | -25 | -16 | dB |
| Output return loss | | -25 | -16 | dB |
| Thermal resistance | | | 50 | °C/W |
| Supply current | | 80 | 100 | mA |
| RF output power per channel, MER = 40 dB, 64 QAM, 256 QAM: | | | | |
| Single channel | | 60 | | dBmV/ch |
| Dual channel | | 56 | | dBmV/ch |
| Triple channel | | 54 | | dBmV/ch |
| Quad channel | | 53 | | dBmV/ch |



¹ 132 total channels, flat input; 110 analog channels @ +15 dBmV per channel; 22 digital channels (757.25 MHz to 871.25 MHz) @ 6 dB below analog channels; Standard NTSC channel plan (55.25 MHz to 871.25 MHz)

² Two tones, -10 dBm per tone at input (439.25 MHz and 853.25 MHz); IMD₂ measured at 414.00 MHz.

³ Three tones, -10 dBm per tone at input (67.25, 439.25 MHz, 853.25 MHz); IMD₃ measured at 481.25 MHz (note that the related 2-tone IP3 is 3 dB higher than the 3-tone IP3).

Typical Performance Characteristics

(TA = +25 °C, VDD = +5 V, 75 Ω System)

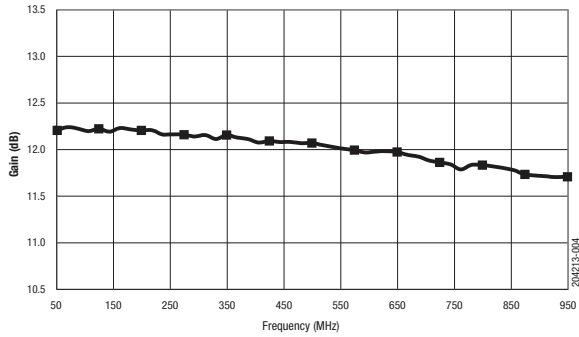


Figure 3. Gain vs Frequency

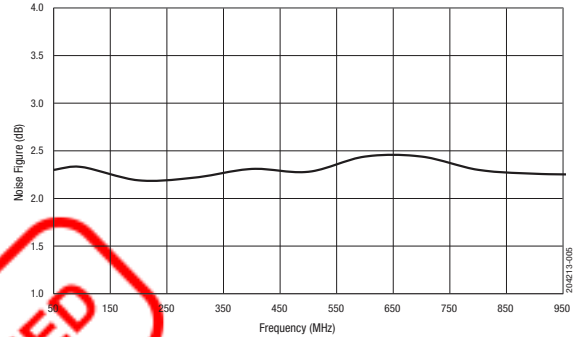


Figure 4. Noise Figure vs Frequency

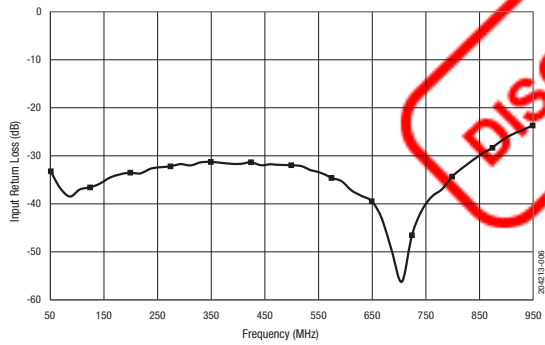


Figure 5. Input Return Loss vs Frequency

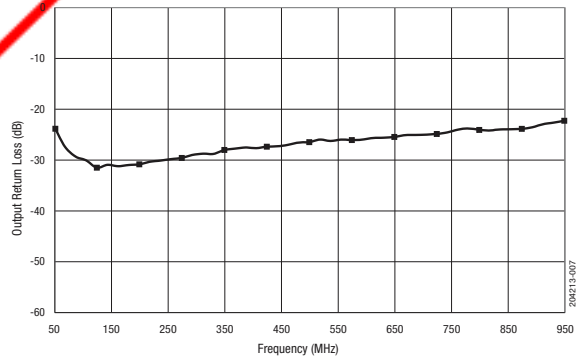


Figure 6. Output Return Loss vs Frequency

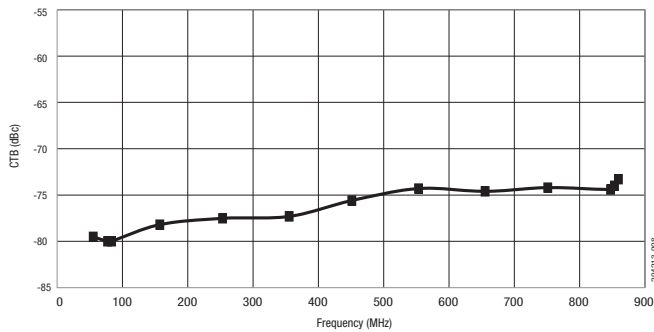


Figure 7. CTB vs Frequency

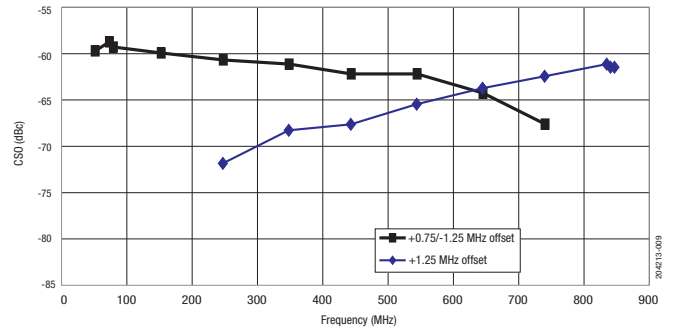


Figure 8. CSO vs Frequency

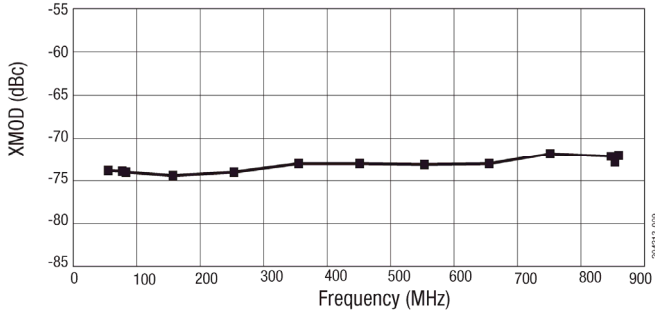


Figure 9. XMOD vs Frequency

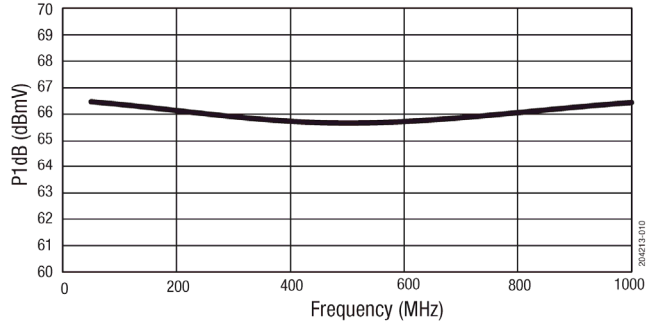


Figure 10. P1dB vs Frequency

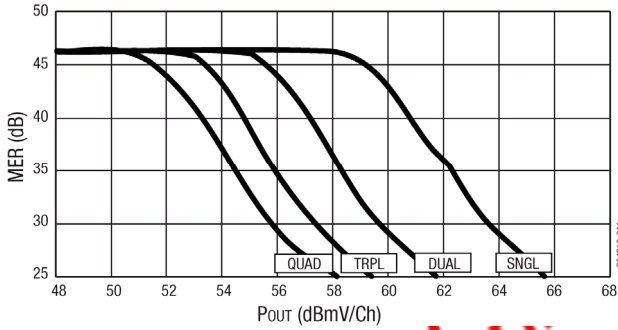


Figure 11. 64 QAM MER vs P_{out}
Test Channel = 86 MHz, TX Channels= 75, 86, 93, 99 MHz

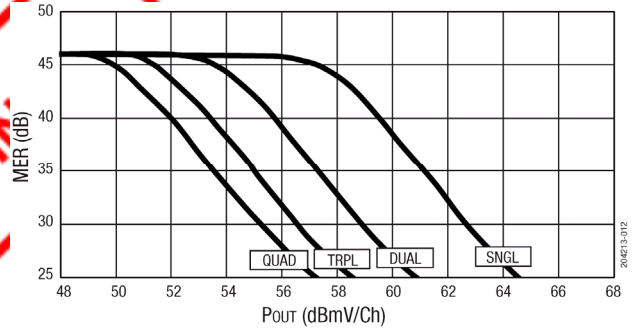


Figure 12. 64 QAM MER vs P_{out}
Test Channel = 543 MHz, TX Channels= 537, 543, 549, 555 MHz

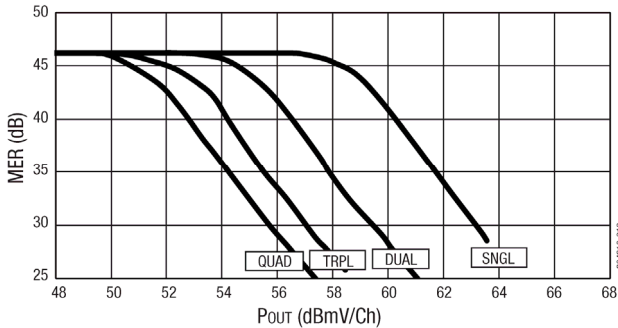


Figure 13. 64 QAM MER vs P_{out}
Test Channel = 987 MHz, TX Channels= 981, 987, 993, 999 MHz

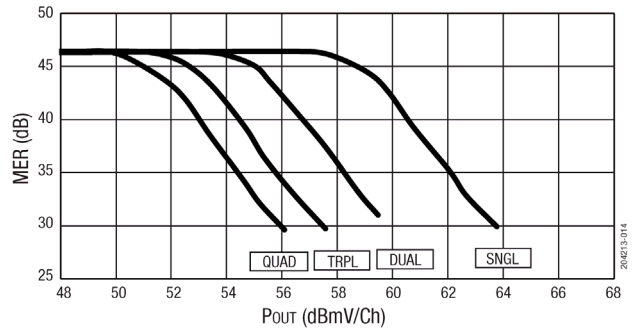


Figure 14. 256 QAM MER vs P_{out}
Test Channel = 86 MHz, TX Channels= 75, 86, 93, 99 MHz

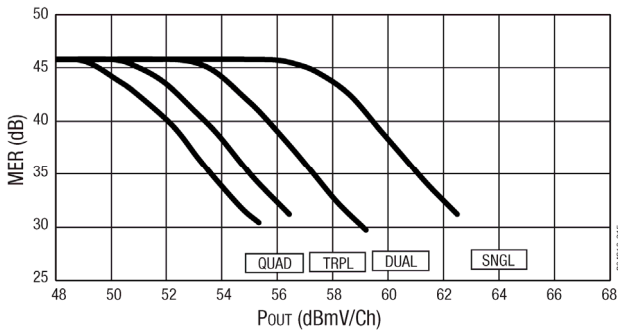


Figure 15. 256 QAM MER vs P_{out}
Test Channel = 543 MHz, TX Channels= 537, 543, 549, 555 MHz

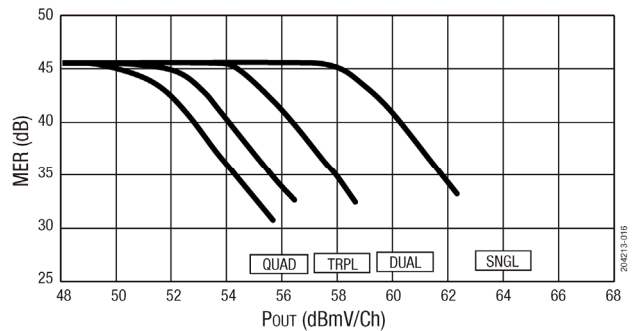


Figure 16. 256 QAM MER vs P_{out}
Test Channel = 987 MHz, TX Channels= 981, 987, 993, 999 MHz

Table 5. Evaluation Board S-Parameters
(TA = +25 °C, VDD = +5.0 VDC, 75 Ω System, Refer to Figure 17)

| Frequency MHz | S11 | | S21 | | S12 | | S22 | | K Factor |
|------------------|-------|--------|------|--------|-------|--------|-------|--------|----------|
| | dB | ANG | dB | ANG | dB | ANG | dB | ANG | |
| 25 | -17.8 | -108.4 | 11.6 | -140.4 | -17.2 | 37.8 | -13.0 | -146.5 | 1.01 |
| 50 | -31.1 | -103.9 | 12.3 | -171.3 | -16.5 | 8.8 | -23.9 | -170.5 | 1.12 |
| 100 | -37.9 | -37.5 | 12.3 | 168.9 | -16.5 | -8.9 | -30.2 | -169.0 | 1.12 |
| 150 | -35.8 | -8.2 | 12.3 | 155.8 | -16.5 | -20.6 | -31.0 | -155.9 | 1.12 |
| 200 | -35.2 | -1.9 | 12.2 | 144.2 | -16.6 | -30.4 | -30.6 | -153.9 | 1.13 |
| 250 | -33.6 | -1.0 | 12.2 | 133.3 | -16.6 | -39.9 | -30.1 | -157.2 | 1.13 |
| 300 | -32.7 | -1.6 | 12.2 | 122.9 | -16.7 | -49.2 | -29.1 | -160.8 | 1.13 |
| 350 | -31.9 | -3.2 | 12.1 | 112.5 | -16.7 | -58.0 | -28.0 | -164.1 | 1.14 |
| 400 | -32.0 | -11.4 | 12.1 | 102.1 | -16.7 | -66.9 | -27.4 | -167.7 | 1.14 |
| 450 | -32.8 | -17.0 | 12.1 | 91.8 | -16.8 | -75.8 | -27.0 | -172.2 | 1.15 |
| 500 | -33.2 | -23.2 | 12.1 | 81.6 | -16.8 | -84.8 | -26.3 | -175.8 | 1.15 |
| 550 | -35.9 | -33.7 | 12.0 | 71.4 | -16.9 | -93.7 | -26.3 | -112.0 | 1.16 |
| 600 | -40.1 | -57.8 | 12.0 | 61.2 | -17.0 | -102.6 | -25.7 | 124.4 | 1.16 |
| 650 | -46.2 | -113.4 | 12.0 | 50.8 | -17.1 | -111.6 | -25.3 | 174.1 | 1.17 |
| 700 | -38.1 | 145.8 | 11.9 | 40.5 | -17.1 | -121.3 | -25.0 | 39.0 | 1.18 |
| 750 | -31.0 | 127.6 | 11.8 | 30.0 | -17.2 | -129.9 | -25.0 | 174.8 | 1.19 |
| 800 | -28.2 | 117.1 | 11.8 | 20.1 | -17.3 | -138.1 | -23.6 | 163.8 | 1.20 |
| 850 | -25.0 | 107.3 | 11.7 | 9.6 | -17.5 | -147.6 | -23.3 | 166.6 | 1.21 |
| 900 | -22.4 | 97.7 | 11.7 | -0.7 | -17.5 | -156.9 | -23.2 | 167.7 | 1.22 |
| 950 | -20.3 | 90.3 | 11.6 | -11.4 | -17.6 | -166.0 | -22.2 | 164.1 | 1.23 |
| 1000 | -18.3 | 82.4 | 11.5 | -22.1 | -17.8 | -175.6 | -20.9 | 160.4 | 1.24 |

Evaluation Board Description

The ADA1200 Evaluation Board is used to test the performance of the ADA1200 device. An Evaluation Board test circuit schematic is provided in Figure 17.

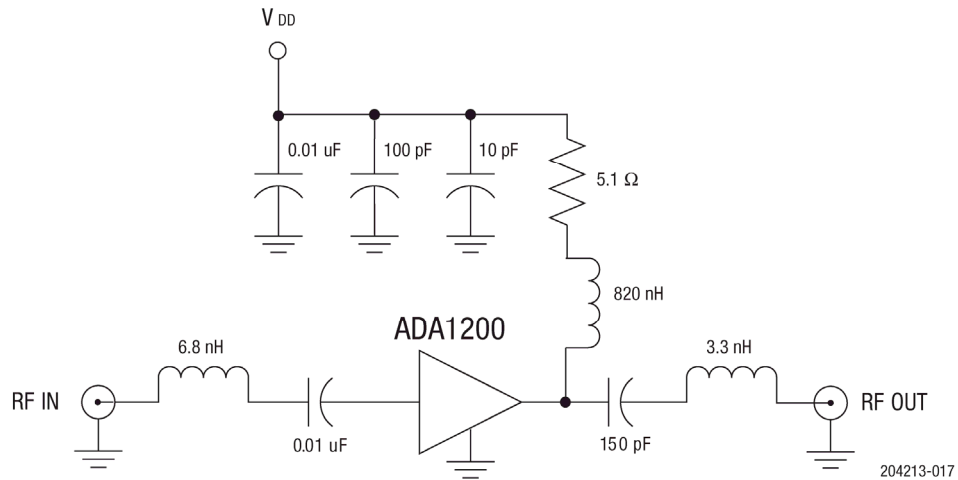


Figure 17. ADA1200 Evaluation Board Schematic

Package Dimensions

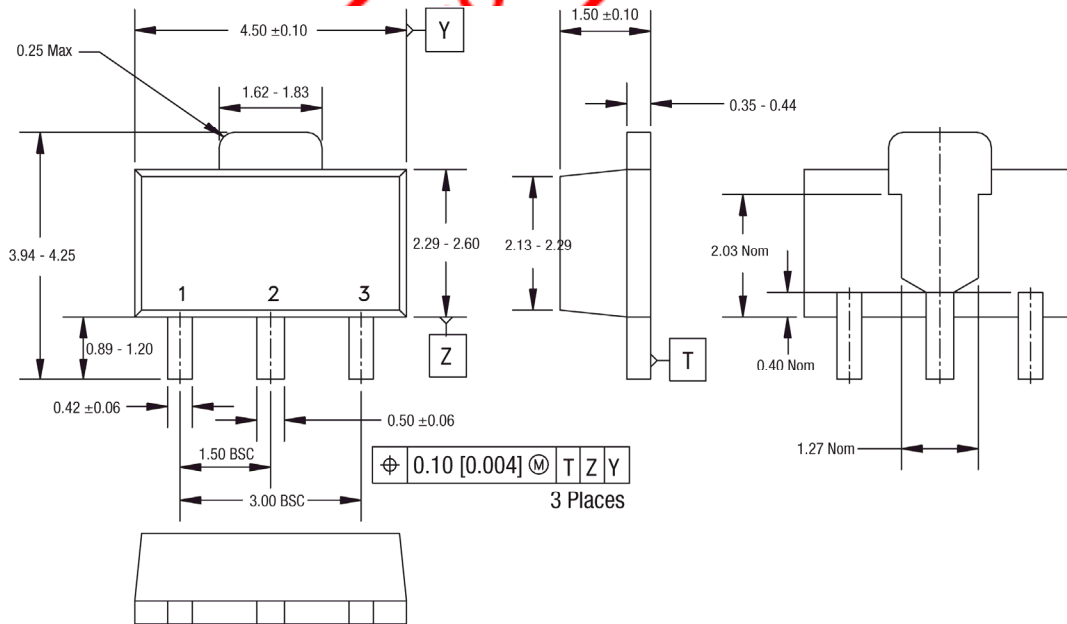
The package dimensions for the ADA1200 are shown in Figure 18.

Package and Handling Information

Since the device package is sensitive to moisture absorption, it is baked and vacuum packed before shipping. Instructions on the shipping container label regarding exposure to moisture after the container seal is broken must be followed. Otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly.

It can be used for lead or lead-free soldering. For additional information, refer to the Skyworks Application Note, *Solder Reflow Information*, document number 200164.

Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. Production quantities of this product are shipped in a standard tape and reel format.



NOTES:

1. CONTROLLING DIMENSIONS: MILLIMETERS.
2. DIMENSIONS DO NOT INCLUDE END FLASH, MOLD FLASH OR MATERIAL PROTRUSIONS.
3. DIMENSION B1, 2 PLACES.
4. DIMENSIONS E1, S, S1 & S2 – REFERENCE ONLY.
5. REFERENCE JEDEC TO-243 (AA).

204213-018

Figure 18. ADA1200 Package Dimensions

Ordering Information

| Part Number | Package Description | Component Packaging |
|---------------|---------------------|------------------------------|
| ADA1200GS24Q1 | SOT-89 package | 1000-piece tape and reel |
| EVB1200 | | Evaluation Board part number |



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