

FEATURES

- 3 dB bandwidth of 2.2 GHz for $A_v = 12$ dB
- Single-resistor programmable gain: $0 \text{ dB} \leq A_v \leq 26 \text{ dB}$
- Differential interface
- Low noise input stage: $2.70 \text{ nV}/\sqrt{\text{Hz}}$ at 70 MHz, $A_v = 10$ dB
- Low harmonic distortion
 - 79 dBc second at 70 MHz
 - 81 dBc third at 70 MHz
- Output third-order intercept (OIP3) of 31 dBm at 70 MHz
- Single-supply operation: 3 V to 5.5 V
- Low power dissipation: 28 mA at 5 V
- Adjustable output common-mode voltage
- Fast settling and overdrive recovery
- Slew rate of $13,000 \text{ V}/\mu\text{s}$
- Power-down capability

ENHANCED PRODUCT FEATURES

- Supports defense and aerospace applications (AQEC standard)
- Extended industrial temperature range: -55°C to $+105^\circ\text{C}$
- Controlled manufacturing baseline
- 1 assembly/test site
- 1 fabrication site
- Product change notification
- Qualification data available upon request

APPLICATIONS

- Differential ADC drivers
- Single-ended-to-differential conversion
- IF sampling receivers
- RF/IF gain blocks
- Surface acoustic wave (SAW) filter interfacing

GENERAL DESCRIPTION

The [AD8351-EP](#) is a low cost differential amplifier useful in RF and IF applications up to 2.2 GHz. The voltage gain can be set from unity to 26 dB using a single external gain resistor. The [AD8351-EP](#) provides a nominal 150Ω differential output impedance. The excellent distortion performance and low noise characteristics of this device allow a wide range of applications.

The [AD8351-EP](#) is designed to satisfy the demanding performance requirements of communications transceiver applications. The device can be used as a general-purpose gain block, an ADC driver, and a high speed data interface driver, among other functions. The [AD8351-EP](#) can also be used as a single-ended-to-differential amplifier with similar distortion

FUNCTIONAL BLOCK DIAGRAM

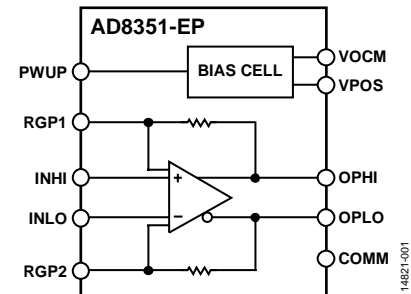


Figure 1.

products as in the differential configuration. The exceptionally good distortion performance makes the [AD8351-EP](#) an ideal solution for 12-bit and 14-bit IF sampling receiver designs.

Fabricated in the Analog Devices, Inc., high speed XFCB process, the [AD8351-EP](#) has a high bandwidth that provides high frequency performance and low distortion. The quiescent current of the [AD8351-EP](#) is 28 mA typically. The [AD8351-EP](#) amplifier comes in a 16-lead LFCSP package, and operates over the temperature range of -55°C to $+105^\circ\text{C}$.

Additional application and technical information can be found in the [AD8351](#) datasheet.

Rev. A

[Document Feedback](#)

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TABLE OF CONTENTS

| | | | |
|---------------------------------|---|--|----|
| Features | 1 | Absolute Maximum Ratings | 5 |
| Enhanced Product Features | 1 | Maximum Power Dissipation | 5 |
| Applications..... | 1 | ESD Caution..... | 5 |
| Functional Block Diagram | 1 | Pin Configuration and Function Descriptions..... | 6 |
| General Description | 1 | Typical Performance Characteristics | 7 |
| Revision History | 2 | Outline Dimensions | 12 |
| Specifications..... | 3 | Ordering Guide | 12 |

REVISION HISTORY

9/2016—Rev. 0 to Rev. A

| | |
|---|----|
| Change to Quiescent Current Parameter, Table 1..... | 3 |
| Changes to Ordering Guide | 12 |

7/2016—Revision 0: Initial Version

SPECIFICATIONS

$V_S = 5\text{ V}$, $R_L = 150\ \Omega$, $R_G = 110\ \Omega$ ($A_V = 10\text{ dB}$), $f = 70\text{ MHz}$, $T = 25^\circ\text{C}$, parameters specified differentially, unless otherwise noted. The gain (A_V) can be set to any value between 0 dB and 26 dB.

Table 1.

| Parameter | Test Conditions/Comments | Min | Typ | Max | Unit |
|--|---|-----|------------|-----|------------------------|
| DYNAMIC PERFORMANCE | | | | | |
| -3 dB Bandwidth | $A_V = 6\text{ dB}$, $V_{OUT} \leq 1.0\text{ V p-p}$ | | 3000 | | MHz |
| | $A_V = 12\text{ dB}$, $V_{OUT} \leq 1.0\text{ V p-p}$ | | 2200 | | MHz |
| | $A_V = 18\text{ dB}$, $V_{OUT} \leq 1.0\text{ V p-p}$ | | 600 | | MHz |
| Bandwidth for 0.1 dB Flatness | $0\text{ dB} \leq A_V \leq 20\text{ dB}$, $V_{OUT} \leq 1.0\text{ V p-p}$ | | 200 | | MHz |
| Bandwidth for 0.2 dB Flatness | $0\text{ dB} \leq A_V \leq 20\text{ dB}$, $V_{OUT} \leq 1.0\text{ V p-p}$ | | 400 | | MHz |
| Gain Accuracy | Using 1% resistor for R_G , $0\text{ dB} \leq A_V \leq 20\text{ dB}$ | | ± 1 | | dB |
| Gain Supply Sensitivity | $V_S \pm 5\%$ | | 0.08 | | dB/V |
| Gain Temperature Sensitivity | -55°C to $+105^\circ\text{C}$ | | 3.9 | | mdB/ $^\circ\text{C}$ |
| Slew Rate | $R_L = 1\text{ k}\Omega$, $V_{OUT} = 2\text{ V step}$ | | 13,000 | | V/ μs |
| | $R_L = 150\ \Omega$, $V_S = 2\text{ V step}$ | | 7500 | | V/ μs |
| Settling Time | 1 V step to 1% | | <3 | | ns |
| Overdrive Recovery Time | $V_{IN} = 4\text{ V}$ to 0 V step, $V_{OUT} \leq \pm 10\text{ mV}$ | | <2 | | ns |
| Reverse Isolation (S12) | | | -67 | | dB |
| INPUT/OUTPUT CHARACTERISTICS | | | | | |
| Input Common-Mode Voltage Adjustment Range | | | 1.2 to 3.8 | | V |
| Maximum Output Voltage Swing | 1 dB compressed | | 4.75 | | V p-p |
| Output Common-Mode Offset | | | 40 | | mV |
| Output Common-Mode Drift | -55°C to $+105^\circ\text{C}$ | | 0.24 | | mV/ $^\circ\text{C}$ |
| Output Differential Offset Voltage | | | 20 | | mV |
| Output Differential Offset Drift | -55°C to $+105^\circ\text{C}$ | | 0.13 | | mV/ $^\circ\text{C}$ |
| Input Bias Current | | | ± 15 | | μA |
| Input Resistance ¹ | | | 5 | | k Ω |
| Input Capacitance ¹ | | | 0.8 | | pF |
| Common-Mode Rejection Ratio (CMRR) | | | 43 | | dB |
| Output Resistance ¹ | | | 150 | | Ω |
| Output Capacitance ¹ | | | 0.8 | | pF |
| POWER INTERFACE | | | | | |
| Supply Voltage | | 3 | | 5.5 | V |
| PWUP Threshold | | | 1.3 | | V |
| PWUP Input Bias Current | PWUP at 5 V | | 100 | | μA |
| | PWUP at 0 V | | 25 | | μA |
| Quiescent Current | -55°C to $+105^\circ\text{C}$ | | 28 | 35 | mA |
| NOISE/DISTORTION | | | | | |
| 10 MHz | | | | | |
| Second/Third Harmonic Distortion ² | $R_L = 1\text{ k}\Omega$, $V_{OUT} = 2\text{ V p-p}$ | | -95/-93 | | dBc |
| | $R_L = 150\ \Omega$, $V_{OUT} = 2\text{ V p-p}$ | | -80/-69 | | dBc |
| Third-Order Intermodulation Distortion (IMD) | $R_L = 1\text{ k}\Omega$, $f_1 = 9.5\text{ MHz}$, $f_2 = 10.5\text{ MHz}$, $V_{OUT} = 2\text{ V p-p}$ composite | | -90 | | dBc |
| | $R_L = 150\ \Omega$, $f_1 = 9.5\text{ MHz}$, $f_2 = 10.5\text{ MHz}$, $V_{OUT} = 2\text{ V p-p}$ composite | | -70 | | dBc |
| Output Third-Order Intercept | $f_1 = 9.5\text{ MHz}$, $f_2 = 10.5\text{ MHz}$ | | 33 | | dBm |
| Noise Spectral Density (Referred to Input (RTI)) | | | 2.65 | | nV/ $\sqrt{\text{Hz}}$ |
| 1 dB Compression Point | | | 13.5 | | dBm |

| Parameter | Test Conditions/Comments | Min | Typ | Max | Unit |
|---|---|-----|---------|-----|------------------------|
| 70 MHz | | | | | |
| Second/Third Harmonic Distortion ² | $R_L = 1\text{ k}\Omega, V_{OUT} = 2\text{ V p-p}$ | | -79/-81 | | dBc |
| | $R_L = 150\ \Omega, V_{OUT} = 2\text{ V p-p}$ | | -65/-66 | | dBc |
| Third-Order IMD | $R_L = 1\text{ k}\Omega, f_1 = 69.5\text{ MHz}, f_2 = 70.5\text{ MHz},$ $V_{OUT} = 2\text{ V p-p composite}$ | | -85 | | dBc |
| | $R_L = 150\ \Omega, f_1 = 69.5\text{ MHz}, f_2 = 70.5\text{ MHz},$ $V_{OUT} = 2\text{ V p-p composite}$ | | -69 | | dBc |
| Output Third-Order Intercept | $f_1 = 69.5\text{ MHz}, f_2 = 70.5\text{ MHz}$ | | 31 | | dBm |
| Noise Spectral Density (RTI) | | | 2.70 | | nV/ $\sqrt{\text{Hz}}$ |
| 1 dB Compression Point | | | 13.3 | | dBm |
| 140 MHz | | | | | |
| Second/Third Harmonic Distortion ² | $R_L = 1\text{ k}\Omega, V_{OUT} = 2\text{ V p-p}$ | | -69/-69 | | dBc |
| | $R_L = 150\ \Omega, V_{OUT} = 2\text{ V p-p}$ | | -54/-53 | | dBc |
| Third-Order IMD | $R_L = 1\text{ k}\Omega, f_1 = 139.5\text{ MHz}, f_2 = 140.5\text{ MHz},$ $V_{OUT} = 2\text{ V p-p composite}$ | | -79 | | dBc |
| | $R_L = 150\ \Omega, f_1 = 139.5\text{ MHz}, f_2 = 140.5\text{ MHz},$ $V_{OUT} = 2\text{ V p-p composite}$ | | -67 | | dBc |
| Output Third-Order Intercept | $f_1 = 139.5\text{ MHz}, f_2 = 140.5\text{ MHz}$ | | 29 | | dBm |
| Noise Spectral Density (RTI) | | | 2.75 | | nV/ $\sqrt{\text{Hz}}$ |
| 1 dB Compression Point | | | 13 | | dBm |
| 240 MHz | | | | | |
| Second/Third Harmonic Distortion ² | $R_L = 1\text{ k}\Omega, V_{OUT} = 2\text{ V p-p}$ | | -60/-66 | | dBc |
| | $R_L = 150\ \Omega, V_{OUT} = 2\text{ V p-p}$ | | -46/-50 | | dBc |
| Third-Order IMD | $R_L = 1\text{ k}\Omega, f_1 = 239.5\text{ MHz}, f_2 = 240.5\text{ MHz},$ $V_{OUT} = 2\text{ V p-p composite}$ | | -76 | | dBc |
| | $R_L = 150\ \Omega, f_1 = 239.5\text{ MHz}, f_2 = 240.5\text{ MHz},$ $V_{OUT} = 2\text{ V p-p composite}$ | | -62 | | dBc |
| Output Third-Order Intercept | $f_1 = 239.5\text{ MHz}, f_2 = 240.5\text{ MHz}$ | | 27 | | dBm |
| Noise Spectral Density (RTI) | | | 2.90 | | nV/ $\sqrt{\text{Hz}}$ |
| 1 dB Compression Point | | | 13 | | dBm |

¹ Values are specified differentially.

² See the AD8351 data sheet for information about single-ended to differential operation.

ABSOLUTE MAXIMUM RATINGS

Table 2.

| Parameter | Rating |
|--|-----------------|
| Supply Voltage, VPOS | 6 V |
| PWUP Voltage | VPOS |
| Internal Power Dissipation | 320 mW |
| θ_{JA} | 79.1°C/W |
| Maximum Junction Temperature | 125°C |
| Operating Temperature Range | -55°C to +105°C |
| Storage Temperature Range | -65°C to +150°C |
| Lead Temperature Range (Soldering, 60 sec) | 300°C |

Stresses at or above those listed under Absolute Maximum Ratings may cause permanent damage to the product. This is a stress rating only; functional operation of the product at these or any other conditions above those indicated in the operational section of this specification is not implied. Operation beyond the maximum operating conditions for extended periods may affect product reliability.

MAXIMUM POWER DISSIPATION

The maximum power that can be safely dissipated by this device is limited by the associated rise in junction temperature. Exceeding a junction temperature of 125°C for an extended period can result in device failure.

To ensure proper operation of the [AD8351-EP](#), it is necessary to observe the maximum power derating curve (see Figure 2) to guarantee that the maximum junction temperature (125°C) is not exceeded under all conditions.

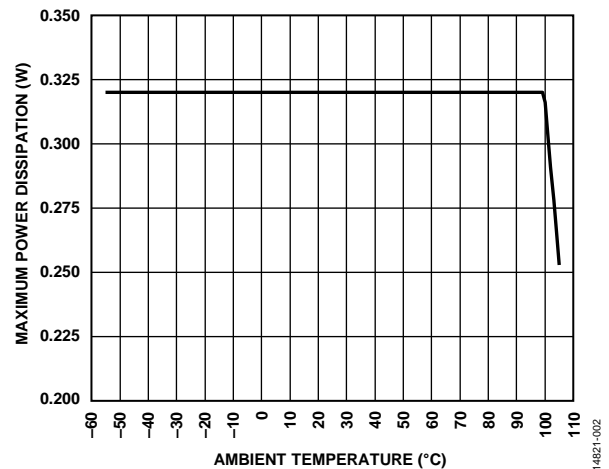


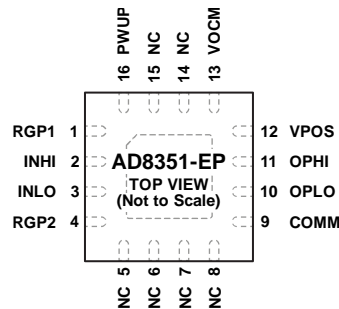
Figure 2. Maximum Power Dissipation vs. Temperature

ESD CAUTION



ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

PIN CONFIGURATION AND FUNCTION DESCRIPTIONS



NOTES
 1. NC = NO CONNECT. DO NOT CONNECT TO THIS PIN.
 2. THE EXPOSED PAD IS INTERNALLY CONNECTED TO GND AND MUST BE SOLDERED TO A LOW IMPEDANCE GROUND PLANE.

14821-003

Figure 3. Pin Configuration

Table 3. Pin Function Descriptions

| Pin No. | Mnemonic | Description |
|--------------------|----------|--|
| 1 | RGP1 | Gain Resistor Input 1. |
| 2 | INHI | Balanced Differential Input, High. Biased to midsupply, typically ac-coupled. |
| 3 | INLO | Balanced Differential Input, Low. Biased to midsupply, typically ac-coupled. |
| 4 | RGP2 | Gain Resistor Input 2. |
| 5, 6, 7, 8, 14, 15 | NC | No Connect. Do not connect to this pin. |
| 9 | COMM | Device Common. Connect this pin to a low impedance ground. |
| 10 | OPLO | Balanced Differential Output, Low. Biased to V _{OCM} , typically ac-coupled. |
| 11 | OPHI | Balanced Differential Output, High. Biased to V _{OCM} , typically ac-coupled. |
| 12 | VPOS | Positive Supply Voltage. 3 V to 5.5 V. |
| 13 | VOCM | Input/Output Common-Mode Voltage. The voltage applied to this pin sets the common-mode voltage at both the input and output. This pin is typically decoupled to ground with a 0.1 μ F capacitor. |
| 16 | PWUP | Apply a positive voltage ($1.3 \text{ V} \leq V_{PWUP} \leq V_{POS}$) to activate the device. |
| | EPAD | Exposed Pad. The exposed pad is internally connected to GND and must be soldered to a low impedance ground plane. |

TYPICAL PERFORMANCE CHARACTERISTICS

$V_S = 5\text{ V}$, $T = 25^\circ\text{C}$, unless otherwise noted.

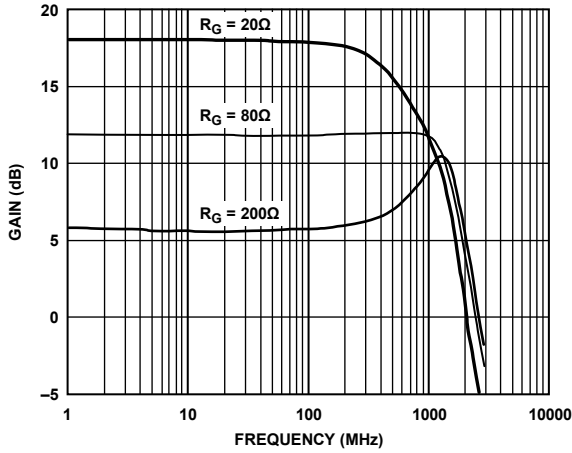


Figure 4. Gain vs. Frequency for a 150 Ω Differential Load ($A_V = 6\text{ dB}$, 12 dB , and 18 dB)

14821-103

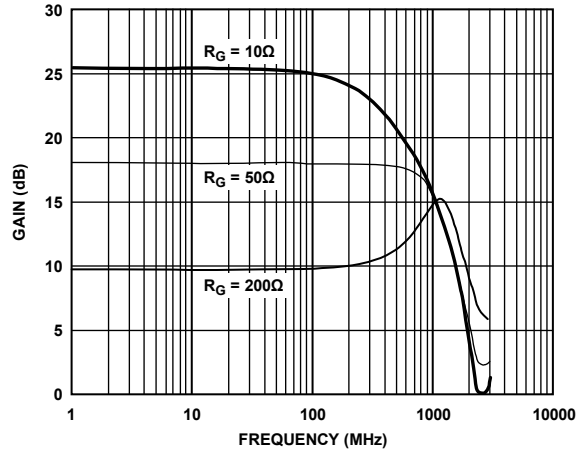


Figure 7. Gain vs. Frequency for a 1 kΩ Differential Load ($A_V = 10\text{ dB}$, 18 dB , and 26 dB)

14821-006



Figure 5. Gain vs. Gain Resistor, R_G ($f = 100\text{ MHz}$, $R_L = 150\ \Omega$, $1\text{ k}\Omega$, and Open)

14821-004



Figure 8. Gain Flatness vs. Frequency ($R_L = 150\ \Omega$ and $1\text{ k}\Omega$, $A_V = 10\text{ dB}$)

14821-007

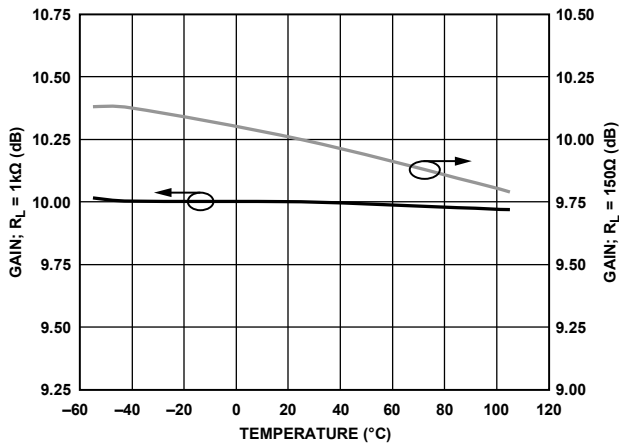


Figure 6. Gain vs. Temperature at 100 MHz ($A_V = 10\text{ dB}$)

14821-005

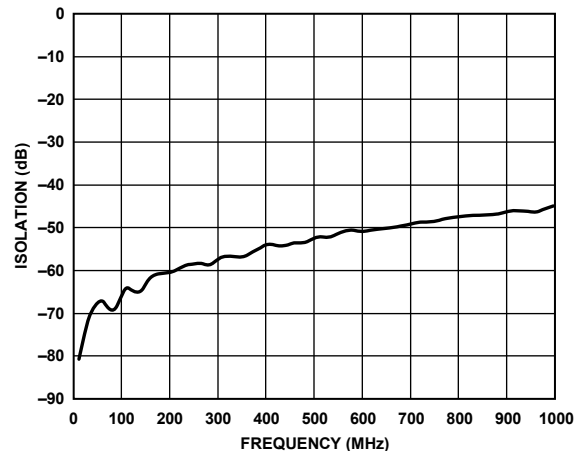


Figure 9. Isolation vs. Frequency ($A_V = 10\text{ dB}$)

14821-008



Figure 10. Harmonic Distortion vs. Frequency for 2 V p-p into $R_L = 1\text{ k}\Omega$ ($A_v = 10\text{ dB}$, at 3 V and 5 V Supplies)

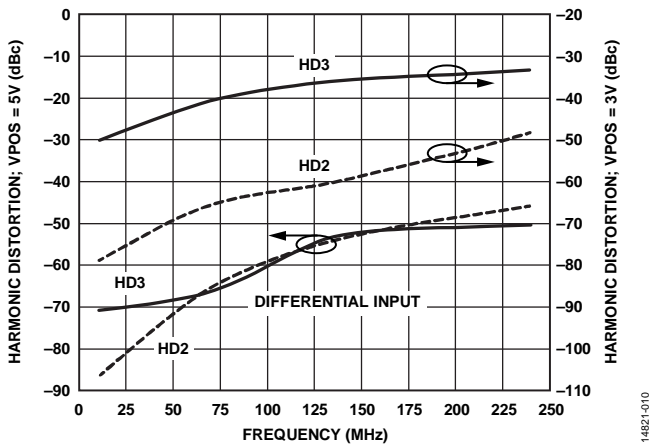


Figure 11. Harmonic Distortion vs. Frequency for 2 V p-p into $R_L = 150\ \Omega$ ($A_v = 10\text{ dB}$)



Figure 12. Noise Spectral Density (RTI) vs. Frequency ($R_L = 150\ \Omega$, 5 V Supply, $A_v = 10\text{ dB}$)



Figure 13. Harmonic Distortion vs. Frequency for 2 V p-p into $R_L = 1\text{ k}\Omega$ Using Single-Ended Input ($A_v = 10\text{ dB}$)



Figure 14. Harmonic Distortion vs. Frequency for 2 V p-p into $R_L = 150\ \Omega$ Using Single-Ended Input ($A_v = 10\text{ dB}$)

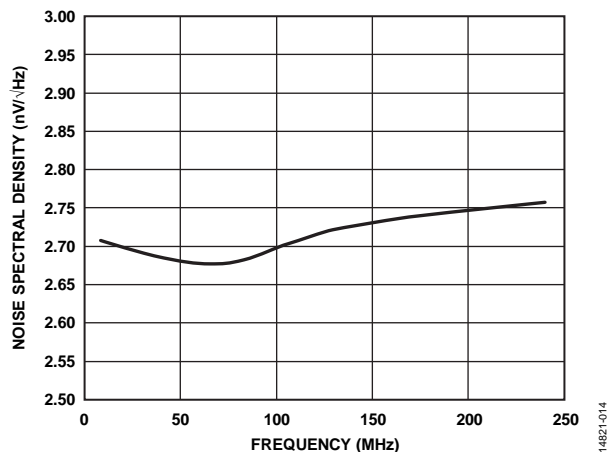


Figure 15. Noise Spectral Density (RTI) vs. Frequency ($R_L = 150\ \Omega$, 3 V Supply, $A_v = 10\text{ dB}$)

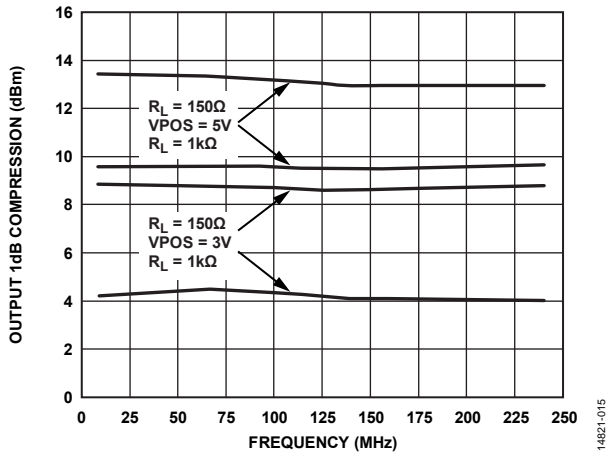


Figure 16. Output 1 dB Compression (P1dB) vs. Frequency ($R_L = 150\Omega$ and $1k\Omega$, $A_V = 10$ dB, at 3 V and 5 V Supplies)



Figure 17. Output 1 dB Compression (P1dB) vs. Gain Resistor (R_G) ($f = 100$, $R_L = 150\Omega$, $A_V = 10$ dB, at 3 V and 5 V Supplies)



Figure 18. Output Compression Point Distribution ($f = 70$ MHz, $R_L = 150\Omega$, $A_V = 10$ dB)

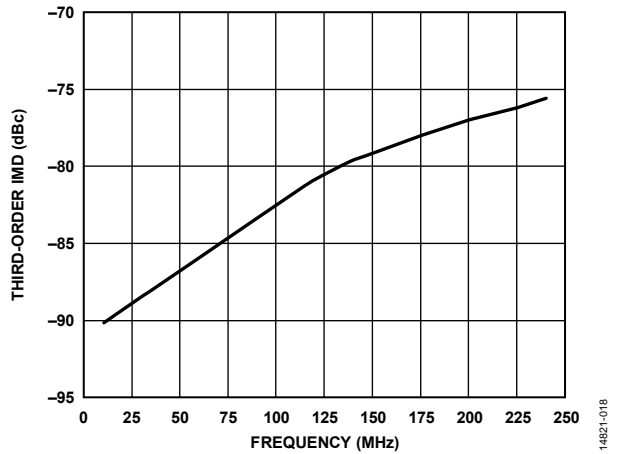


Figure 19. Third-Order Intermodulation Distortion (IMD) vs. Frequency for a 2 V p-p Composite Signal into $R_L = 1k\Omega$ ($A_V = 10$ dB, at 5 V Supplies)

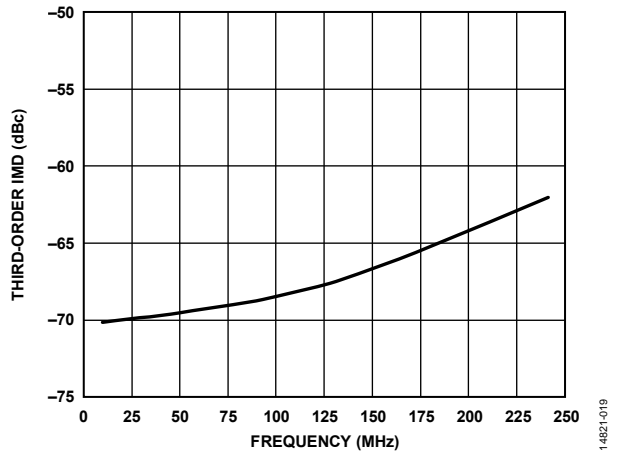


Figure 20. Third-Order Intermodulation Distortion vs. Frequency for a 2 V p-p Composite Signal into $R_L = 150\Omega$ ($A_V = 10$ dB, at 5 V Supplies)

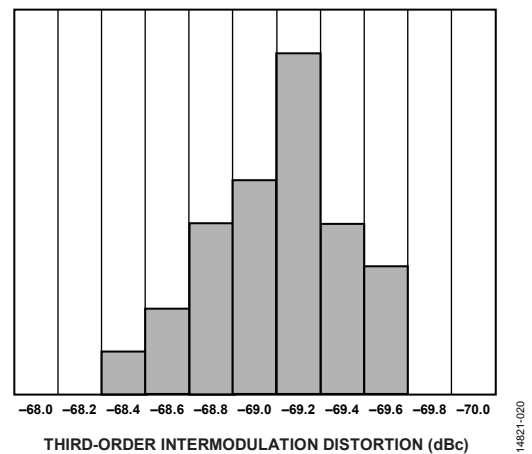


Figure 21. Third-Order Intermodulation Distortion Distribution ($f = 70$ MHz, $R_L = 150\Omega$, $A_V = 10$ dB)



Figure 22. Input Impedance vs. Frequency

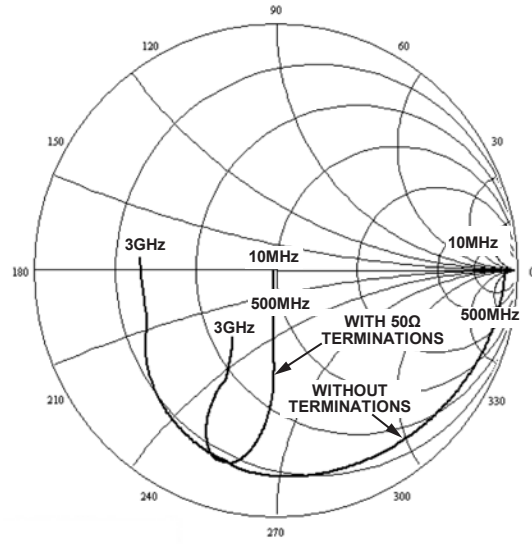


Figure 25. Input Reflection Coefficient vs. Frequency ($R_S = R_L = 100 \Omega$ With and Without 50Ω Terminations)

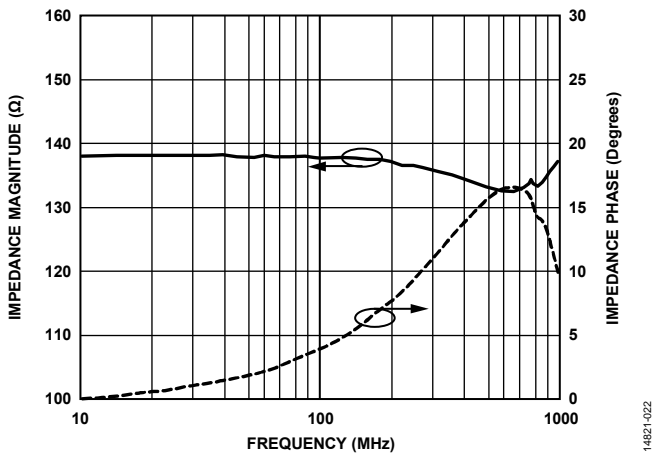


Figure 23. Output Impedance Magnitude and Phase vs. Frequency

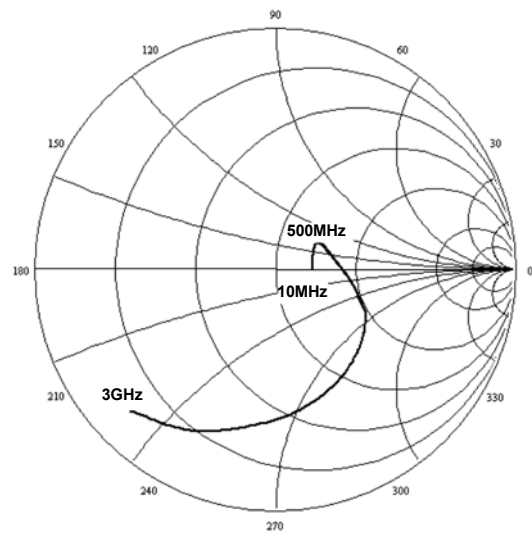


Figure 26. Output Reflection Coefficient vs. Frequency ($R_S = R_L = 100 \Omega$)

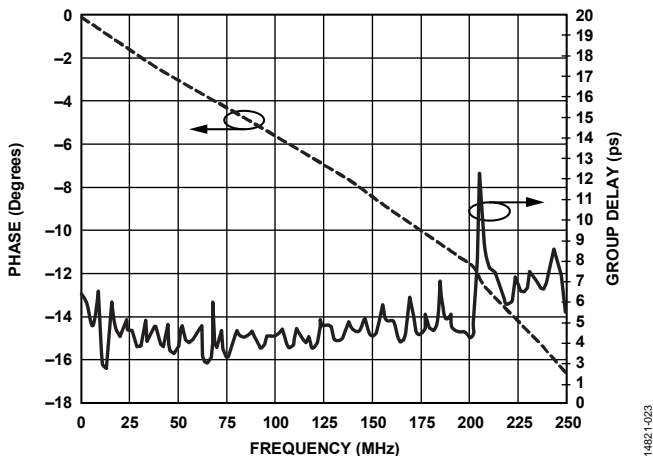


Figure 24. Phase and Group Delay ($A_V = 10 \text{ dB}$, at 5 V Supplies)

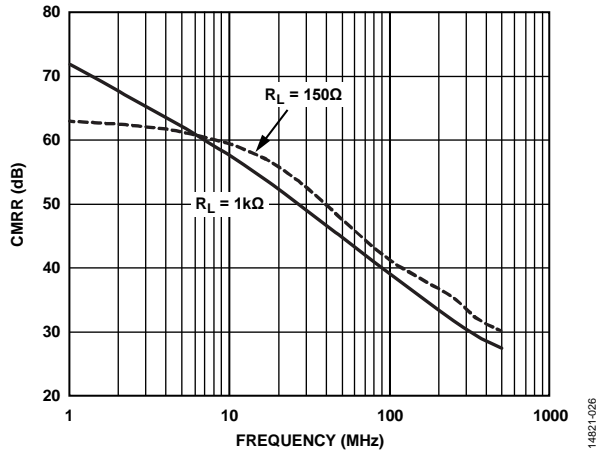


Figure 27. Common-Mode Rejection Ratio, CMRR ($R_S = 100 \Omega$)

14821-026

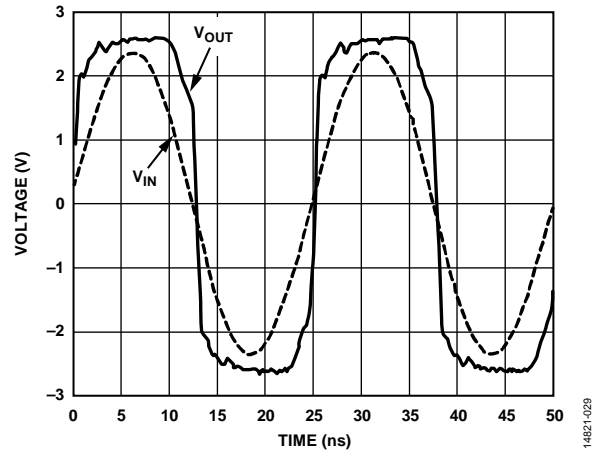


Figure 30. Overdrive Recovery Using Sinusoidal Input Waveform $R_L = 150 \Omega$ ($A_V = 10 \text{ dB}$, at 5V Supplies)

14821-029

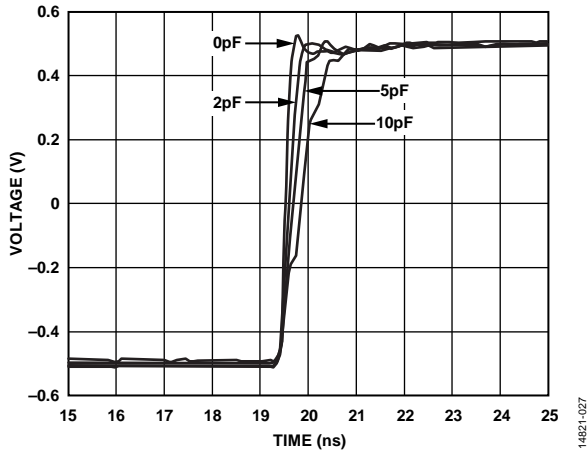


Figure 28. Transient Response Under Capacitive Loading ($R_L = 150 \Omega$, $C_L = 0 \text{ pF}$, 2 pF , 5 pF , 10 pF)

14821-027

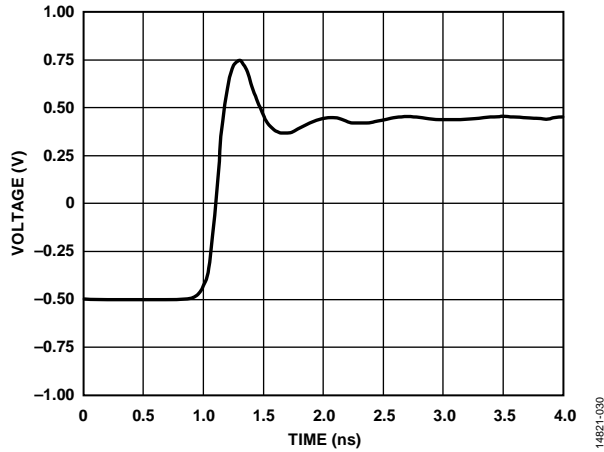


Figure 31. Large Signal Transient Response for a 1 V p-p Output Step ($A_V = 10 \text{ dB}$, $R_{IP} = 25 \Omega$)

14821-030

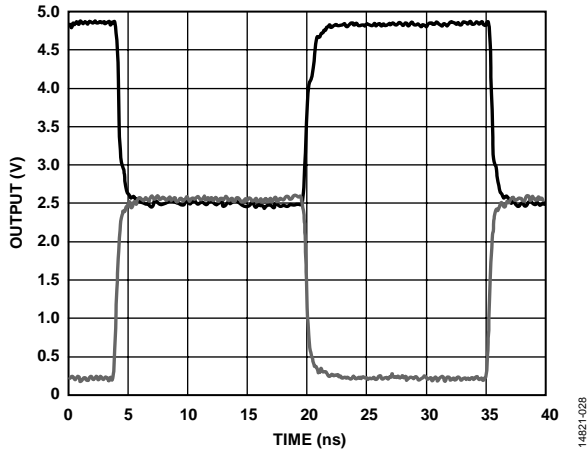


Figure 29. 2x Output Overdrive Recovery ($R_L = 150 \Omega$, $A_V = 10 \text{ dB}$)

14821-028

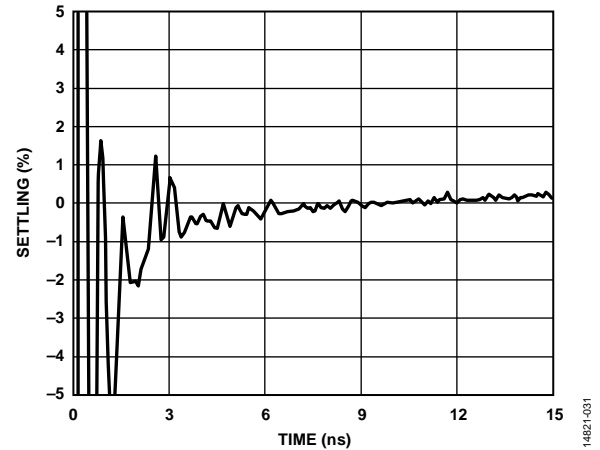
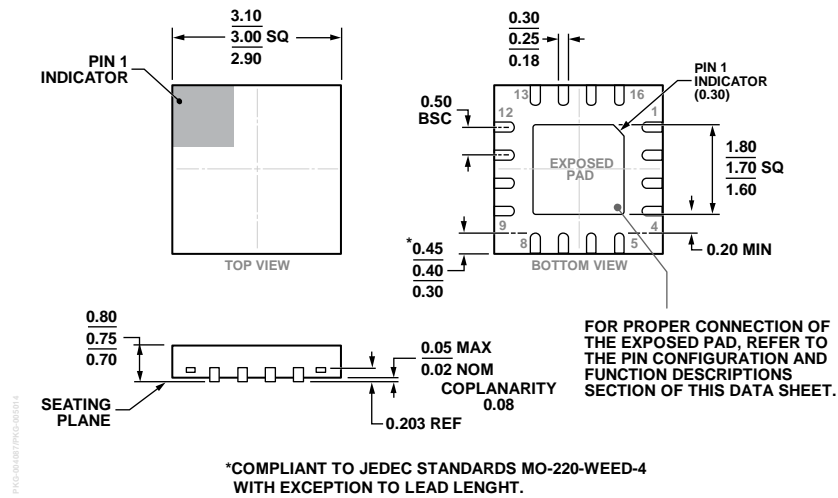


Figure 32. 1% Settling Time for a 2 V p-p Step ($A_V = 10 \text{ dB}$, $R_L = 150 \Omega$)

14821-031

OUTLINE DIMENSIONS



*COMPLIANT TO JEDEC STANDARDS MO-220-WEED-4 WITH EXCEPTION TO LEAD LENGTH.
 Figure 33. 16-Lead Lead Frame Chip Scale Package [LFCSP]
 3 mm x 3 mm Body and 0.75 mm Package Height
 (CP-16-33)
 Dimensions shown in millimeters

ORDERING GUIDE

| Model ¹ | Temperature Range | Package Description | Package Option | Branding |
|--------------------|-------------------|---|----------------|----------|
| AD8351SCPZ-EP-R7 | -55°C to +105°C | 16-Lead Lead Frame Chip Scale Package [LFCSP] | CP-16-33 | Q26 |

¹ Z = RoHS Compliant Part.

Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибьюторов Европы, Америки и Азии.

С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибьюторских договоров

Мы предлагаем:

- Конкуренспособные цены и скидки постоянным клиентам.
- Специальные условия для постоянных клиентов.
- Подбор аналогов.
- Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.
- Приемлемые сроки поставки, возможна ускоренная поставка.
- Доставку товара в любую точку России и стран СНГ.
- Комплексную поставку.
- Работу по проектам и поставку образцов.
- Формирование склада под заказчика.
- Сертификаты соответствия на поставляемую продукцию (по желанию клиента).
- Тестирование поставляемой продукции.
- Поставку компонентов, требующих военную и космическую приемку.
- Входной контроль качества.
- Наличие сертификата ISO.

В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.

Конструкторский отдел помогает осуществить:

- Регистрацию проекта у производителя компонентов.
- Техническую поддержку проекта.
- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



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