ANALOG DEVICES

High Performance Video Op Amp

AD811

FEATURES

High speed
- **140 MHz bandwidth (3 dB, G = +1)**
- **120 MHz bandwidth (3 dB, G = +2)**
- **35 MHz bandwidth (0.1 dB, G = +2)**
- **2500 V/µs slew rate**
- **25 ns settling time to 0.1% (for a 2 V step)**
- **65 ns settling time to 0.01% (for a 10 V step)**

Excellent video performance (R_L =150 Ω)
- **0.01% differential gain, 0.01° differential phase**
- **Voltage noise of 1.9 nV/√Hz**

Low distortion: THD = −74 dB @ 10 MHz

Excellent dc precision: 3 mV max input offset voltage

Flexible operation
- **Specified for ±5 V and ±15 V operation**
- **±2.3 V output swing into a 75 Ω load (V_S = ±5 V)**

APPLICATIONS

Video crosspoint switchers, multimedia broadcast systems

HDTV compatible systems

Video line drivers, distribution amplifiers

ADC/DAC buffers

DC restoration circuits

Medical
- **Ultrasound**
- **PET**
- **Gamma**
- **Counter applications**

GENERAL DESCRIPTION

A wideband current feedback operational amplifier, the AD811 is optimized for broadcast-quality video systems. The −3 dB bandwidth of 120 MHz at a gain of +2 and the differential gain and phase of 0.01% and 0.01° (R_L = 150 Ω) make the AD811 an excellent choice for all video systems. The AD811 is designed to meet a stringent 0.1 dB gain flatness specification to a bandwidth of 35 MHz (G = +2) in addition to low differential gain and phase errors. This performance is achieved whether driving one or two back-terminated 75 Ω cables, with a low power supply current of 16.5 mA. Furthermore, the AD811 is specified over a power supply range of ±4.5 V to ±18 V.

(Continued on page 3)

CONNECTION DIAGRAMS

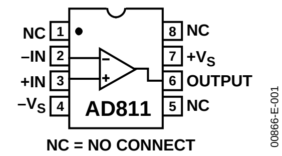


Figure 1. 8-Lead Plastic (N-8), CERDIP (Q-8), SOIC (R-8)

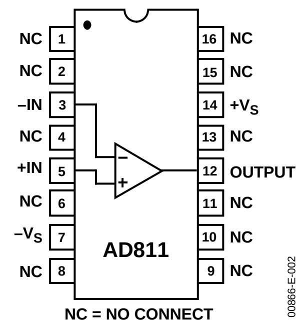


Figure 2. 16-Lead SOIC (R-16)

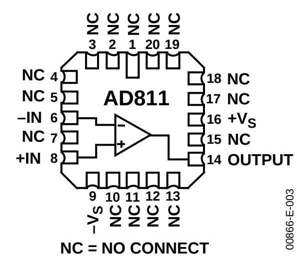


Figure 3. 20-Terminal LCC (E-20A)

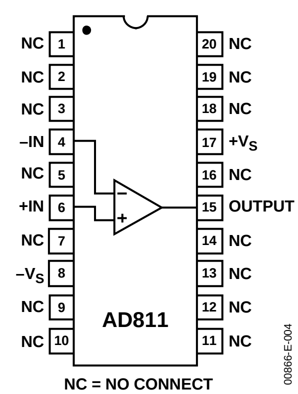


Figure 4. 20-Lead SOIC (R-20)

GENERAL DESCRIPTION (continued)

The AD811 is also excellent for pulsed applications where transient response is critical. It can achieve a maximum slew rate of greater than 2500 V/µs with a settling time of less than 25 ns to 0.1% on a 2 V step and 65 ns to 0.01% on a 10 V step.

The AD811 is ideal as an ADC or DAC buffer in data acquisition systems due to its low distortion up to 10 MHz and its wide unity gain bandwidth. Because the AD811 is a current feedback amplifier, this bandwidth can be maintained over a wide range of gains. The AD811 also offers low voltage and current noise of 1.9 nV/$\sqrt{Hz}$ and 20 pA/$\sqrt{Hz}$, respectively, and excellent dc accuracy for wide dynamic range applications.

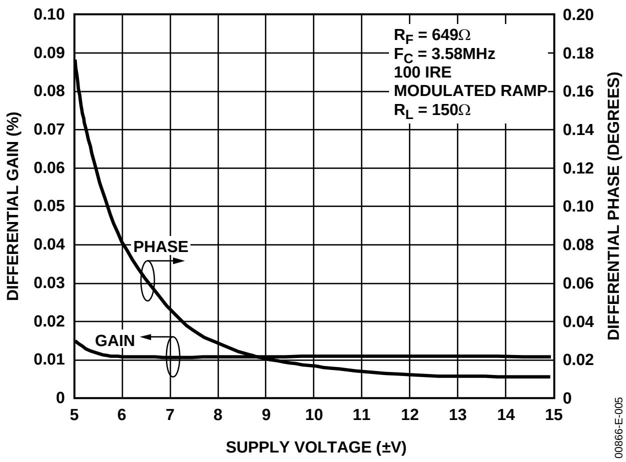


Figure 5. Differential Gain and Phase

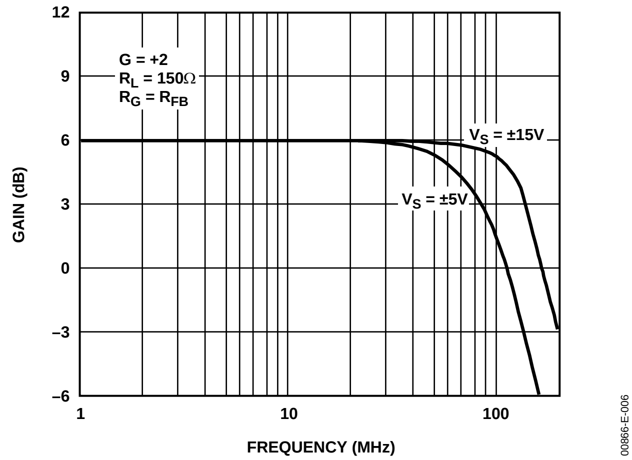


Figure 6. Frequency Response

SPECIFICATIONS

@ T_A = +25°C, V_S = ±15 V dc, R_{LOAD} = 150 Ω, unless otherwise noted.

Table 1.

Parameter	Conditions	V_S	AD811J/A[1]			AD811S[2]			Unit
			Min	Typ	Max	Min	Typ	Max	
DYNAMIC PERFORMANCE									
Small Signal Bandwidth (No Peaking)									
−3 dB									
G = +1	R_{FB} = 562 Ω	±15 V		140			140		MHz
G = +2	R_{FB} = 649 Ω	±15 V		120			120		MHz
G = +2	R_{FB} = 562 Ω	±15 V		80			80		MHz
G = +10	R_{FB} = 511 Ω	±15 V		100			100		MHz
0.1 dB Flat									
G = +2	R_{FB} = 562 Ω	±15		25			25		MHz
	R_{FB} = 649 Ω	±15		35			35		MHz
Full Power Bandwidth[3]	V_{OUT} = 20 V p-p	±15		40			40		MHz
Slew Rate	V_{OUT} = 4 V p-p	±15		400			400		V/μs
	V_{OUT} = 20 V p-p	±15		2500			2500		V/μs
Settling Time to 0.1%	10 V Step, A_V = − 1	±15		50			50		ns
Settling Time to 0.01%	10 V Step, A_V = − 1	±15		65			65		ns
Settling Time to 0.1%	2 V Step, A_V = − 1	±15		25			25		ns
Rise Time, Fall Time	R_{FB} = 649, A_V = +2	±15		3.5			3.5		ns
Differential Gain	f = 3.58 MHz	±15		0.01			0.01		%
Differential Phase	f = 3.58 MHz	±15		0.01			0.01		Degree
THD @ f_C = 10 MHz	V_{OUT} = 2 V p-p, A_V = +2	±15		−74			−74		dBc
Third-Order Intercept[4]	@ f_C = 10 MHz	±15		36			36		dBm
		±15		43			43		dBm
INPUT OFFSET VOLTAGE		±5 V, ±15 V		0.5	3		0.5	3	mV
	T_{MIN} to T_{MAX}				5			5	mV
Offset Voltage Drift				5			5		μV/°C
INPUT BIAS CURRENT									
−Input		±5 V, ±15 V		2	5		2	5	μA
	T_{MIN} to T_{MAX}				15			30	μA
+Input		±5 V, ±1 5 V		2	10		2	10	μA
	T_{MIN} to T_{MAX}				20			25	μA
TRANSRESISTANCE	T_{MIN} to T_{MAX}								
	V_{OUT} = ±10 V								
	R_L = ∞	±15 V	0.75	1.5		0.75	1.5		MΩ
	R_L = 200 Ω	±15 V	0.5	0.75		0.5	0.75		MΩ
	V_{OUT} = ±2.5 V								
	R_L = 150 Ω	±5 V	0.25	0.4		0.125	0.4		MΩ

[1] The AD811JR is specified with ±5 V power supplies only, with operation up to ±12 V.
[2] See the Analog Devices military data sheet for 883B tested specifications.
[3] FPBW = slew rate/(2 π V_{PEAK}).
[4] Output power level, tested at a closed-loop gain of two.

Parameter	Conditions	V_S	AD811J/A[1] Min	AD811J/A[1] Typ	AD811J/A[1] Max	AD811S[2] Min	AD811S[2] Typ	AD811S[2] Max	Unit
COMMON-MODE REJECTION									
V_{OS} (vs. Common Mode)									
T_{MIN} to T_{MAX}	V_{CM} = ±2.5 V	±5 V	56	60		50	60		dB
T_{MIN} to T_{MAX}	V_{CM} = ±10 V	±15 V	60	66		56	66		dB
Input Current (vs. Common Mode)	T_{MIN} to T_{MAX}			1	3		1	3	μA/V
POWER SUPPLY REJECTION	V_S = ±4.5 V to ±18 V								
V_{OS}	T_{MIN} to T_{MAX}		60	70		60	70		dB
+Input Current	T_{MIN} to T_{MAX}			0.3	2		0.3	2	μA/V
−Input Current	T_{MIN} to T_{MAX}			0.4	2		0.4	2	μA/V
INPUT VOLTAGE NOISE	f = 1 kHz			1.9			1.9		nV/√Hz
INPUT CURRENT NOISE	f = 1 kHz			20			20		pA/√Hz
OUTPUT CHARACTERISTICS									
Voltage Swing, Useful Operating Range[3]		±5 V		±2.9			±2.9		V
		±15 V		±12			±12		V
Output Current	T_J = 25°C			100			100		mA
Short-Circuit Current				150			150		mA
Output Resistance	(Open Loop @ 5 MHz)			9			9		Ω
INPUT CHARACTERISTIC									
+Input Resistance				1.5			1.5		MΩ
−Input Resistance				14			14		Ω
Input Capacitance	+Input			7.5			7.5		pF
Common-Mode Voltage Range		±5 V		±3			±3		V
		±15 V		±13			±13		V
POWER SUPPLY									
Operating Range			±4.5		±18	±4.5		±18	V
Quiescent Current		±5 V		14.5	16.0		14.5	16.0	mA
		±15 V		16.5	18.0		16.5	18.0	mA
TRANSISTOR COUNT	Number of Transistors			40			40		

[1] The AD811JR is specified with ±5 V power supplies only, with operation up to ±12 V.
[2] See the Analog Devices military data sheet for 883B tested specifications.
[3] Useful operating range is defined as the output voltage at which linearity begins to degrade.

ABSOLUTE MAXIMUM RATINGS

Table 2.

Parameter	Rating
Supply Voltage	±18 V
AD811JR Grade Only	±12 V
Internal Power Dissipation	Observe Derating Curves
8-Lead PDIP Package	θ_{JA} = 90°C/ W
8-Lead CERDIP Package	θ_{JA} = 110°C/W
8-Lead SOIC Package	θ_{JA} = 155°C/W
16-Lead SOIC Package	θ_{JA} = 85°C/W
20-Lead SOIC Package	θ_{JA} = 80°C/W
20-Lead LCC Package	θ_{JA} = 70°C/W
Output Short-Circuit Duration	Observe Derating Curves
Common-Mode Input Voltage	$\pm V_S$
Differential Input Voltage	±6 V
Storage Temperature Range (Q, E)	−65°C to +150°C
Storage Temperature Range (N, R)	−65°C to +125°C
Operating Temperature Range	
AD811J	0°C to +70°C
AD811A	−40°C to +85°C
AD811S	−55°C to +125°C
Lead Temperature Range (Soldering 60 sec)	300°C

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

MAXIMUM POWER DISSIPATION

The maximum power that can be safely dissipated by the AD811 is limited by the associated rise in junction temperature. For the plastic packages, the maximum safe junction temperature is 145°C. For the CERDIP and LCC packages, the maximum junction temperature is 175°C. If these maximums are exceeded momentarily, proper circuit operation is restored as soon as the die temperature is reduced. Leaving the device in the "overheated" condition for an extended period can result in device burnout. To ensure proper operation, it is important to observe the derating curves in Figure 22 and Figure 25.

While the AD811 is internally short-circuit protected, this may not be sufficient to guarantee that the maximum junction temperature is not exceeded under all conditions. An important example is when the amplifier is driving a reverse-terminated 75 Ω cable and the cable's far end is shorted to a power supply. With power supplies of ±12 V (or less) at an ambient temperature of +25°C or less, and the cable shorted to a supply rail, the amplifier is not destroyed, even if this condition persists for an extended period.

METALIZATION PHOTOGRAPH

Contact the factory for the latest dimensions.

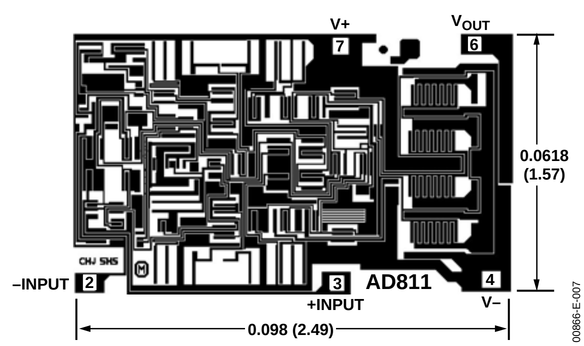
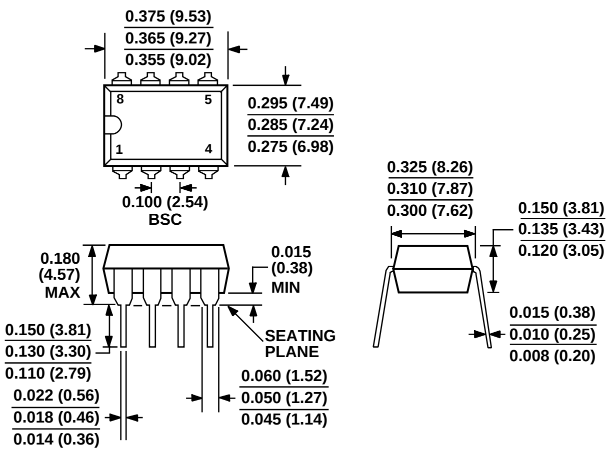


Figure 7. Metalization Photograph
Dimensions Shown in Inches and (Millimeters)

ESD CAUTION

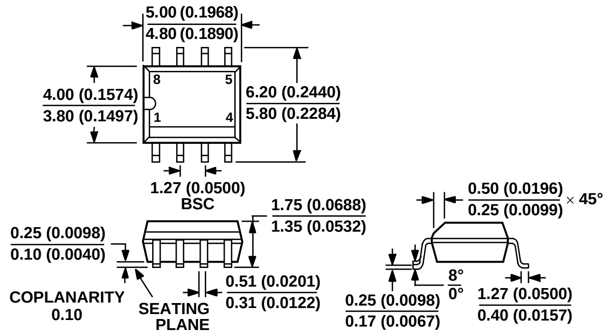
ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although this product features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.

OUTLINE DIMENSIONS



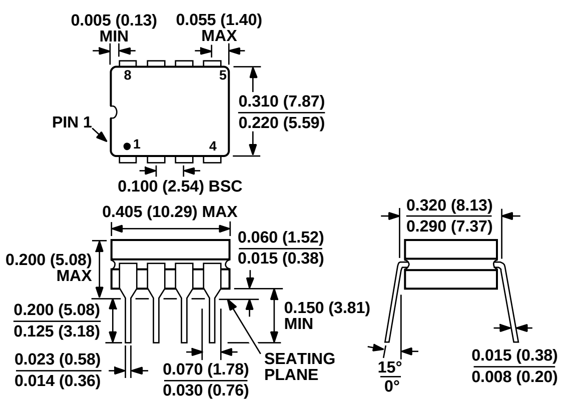
COMPLIANT TO JEDEC STANDARDS MO-095AA
CONTROLLING DIMENSIONS ARE IN INCHES; MILLIMETER DIMENSIONS (IN PARENTHESES) ARE ROUNDED-OFF INCH EQUIVALENTS FOR REFERENCE ONLY AND ARE NOT APPROPRIATE FOR USE IN DESIGN

Figure 50. 8-Lead Plastic Dual In-Line Package [PDIP]
(N-8)
Dimensions shown in inches and (millimeters)



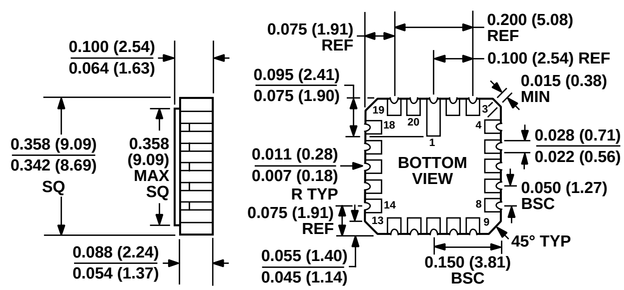
COMPLIANT TO JEDEC STANDARDS MS-012AA
CONTROLLING DIMENSIONS ARE IN MILLIMETERS; INCH DIMENSIONS (IN PARENTHESES) ARE ROUNDED-OFF MILLIMETER EQUIVALENTS FOR REFERENCE ONLY AND ARE NOT APPROPRIATE FOR USE IN DESIGN

Figure 52. 8-Lead Standard Small Outline Package [SOIC]
Narrow Body (R-8)
Dimensions shown in millimeters and (inches)



CONTROLLING DIMENSIONS ARE IN INCHES; MILLIMETER DIMENSIONS (IN PARENTHESES) ARE ROUNDED-OFF INCH EQUIVALENTS FOR REFERENCE ONLY AND ARE NOT APPROPRIATE FOR USE IN DESIGN

Figure 51. 8-Lead Ceramic Dual In-Line Package [CERDIP]
(Q-8)
Dimensions shown in inches and (millimeters)



CONTROLLING DIMENSIONS ARE IN INCHES; MILLIMETER DIMENSIONS (IN PARENTHESES) ARE ROUNDED-OFF INCH EQUIVALENTS FOR REFERENCE ONLY AND ARE NOT APPROPRIATE FOR USE IN DESIGN

Figure 53. 20-Terminal Ceramic Leadless Chip Carrier [LCC]
(E-20A)
Dimensions shown in inches and (millimeters)

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option
AD811AN	−40°C to +85°C	8-Lead Plastic Dual In-Line Package (PDIP)	N-8
AD811ANZ[1]	−40°C to +85°C	8-Lead Plastic Dual In-Line Package (PDIP)	N-8
AD811AR-16	−40°C to +85°C	16-LeadStandard Small Outline Package (SOIC)	R-16
AD811AR-16-REEL	−40°C to +85°C	16-LeadStandard Small Outline Package (SOIC)	R-16
AD811AR-16-REEL7	−40°C to +85°C	16-LeadStandard Small Outline Package (SOIC)	R-16
AD811AR-20	−40°C to +85°C	20-LeadStandard Small Outline Package (SOIC)	R-20
AD811AR-20-REEL	−40°C to +85°C	20-LeadStandard Small Outline Package (SOIC)	R-20
AD811JR	0°C to +70°C	8-LeadStandard Small Outline Package (SOIC)	R-8
AD811JR-REEL	0°C to +70°C	8-LeadStandard Small Outline Package (SOIC)	R-8
AD811JR-REEL7	0°C to +70°C	8-LeadStandard Small Outline Package (SOIC)	R-8
AD811JRZ[1]	0°C to +70°C	8-LeadStandard Small Outline Package (SOIC)	R-8
AD811SQ/883B	−55°C to +125°C	8-Lead Ceramic Dual In-Line Package (CERDIP)	Q-8
5962-9313101MPA	−55°C to +125°C	8-Lead Ceramic Dual In-Line Package (CERDIP)	Q-8
AD811SE/883B	−55°C to +125°C	20-Terminal Ceramic Leadless Chip Carrier (LCC)	E-20A
5962-9313101M2A	−55°C to +125°C	20-Terminal Ceramic Leadless Chip Carrier (LCC)	E-20A
AD811ACHIPS	−40°C to +85°C		DIE
AD811SCHIPS	−55°C to +125°C		DIE

[1] Z = Pb-free part.