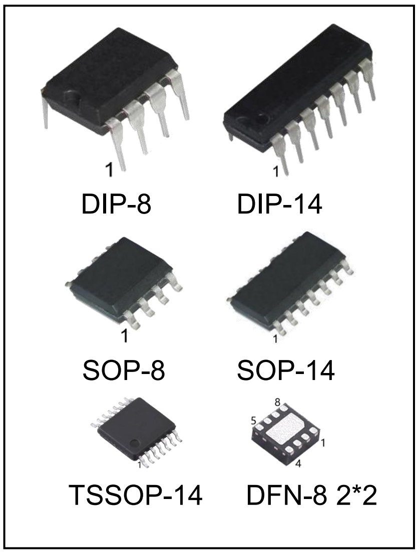
High Precision Operational Amplifiers

Features

- Ultralow Offset Voltage: 10 μV
- Ultralow Drift: ±0.1 μV/°C
- High Open-Loop Gain: 134 dB
- High Common-Mode Rejection: 140 dB
- High Power Supply Rejection: 130 dB
- Low Bias Current: 1-nA maximum
- Wide Supply Range: ±2 V to ±16 V
- Low Quiescent Current: 800 μA/amplifier
- Single, Dual, and Quad Versions



Ordering Information

DEVICE	Package Type	MARKING	Packing	Packing Qty
OPA277UN	DIP-8	A277U	TUBE	2000pcs/box
OPA277UAN	DIP-8	A277UA	TUBE	2000pcs/box
OPA277N	DIP-8	A277,OPA277	TUBE	2000pcs/box
OPA277UM/TR	SOP-8	A277U	REEL	2500pcs/reel
OPA277UAM/TR	SOP-8	A277UA	REEL	2500pcs/reel
OPA277M/TR	SOP-8	A277,OPA277	REEL	2500pcs/reel
OPA277UDQ/TR	DFN-8 2*2	A277U	REEL	3000pcs/reel
OPA277UADQ/TR	DFN-8 2*2	A277UA	REEL	3000pcs/reel
OPA277DQ/TR	DFN-8 2*2	A277,OPA277	REEL	3000pcs/reel
OPA2277UN	DIP-8	A2277U	TUBE	2000pcs/box
OPA2277UAN	DIP-8	A2277UA	TUBE	2000pcs/box
OPA2277N	DIP-8	OPA2277,A2277	TUBE	2000pcs/box
OPA2277UM/TR	SOP-8	A2277U	REEL	2500pcs/reel
OPA2277UAM/TR	SOP-8	A2277UA	REEL	2500pcs/reel
OPA2277M/TR	SOP-8	OPA2277,A2277	REEL	2500pcs/reel
OPA2277UDQ/TR	DFN-8 2*2	A2277U	REEL	3000pcs/reel
OPA2277UADQ/TR	DFN-8 2*2	A2277UA	REEL	3000pcs/reel
OPA2277DQ/TR	DFN-8 2*2	A2277	REEL	3000pcs/reel
OPA4277N	DIP-14	OPA4277	TUBE	1000pcs/box
OPA4277M/TR	SOP-14	OPA4277	REEL	2500pcs/reel
OPA4277MT/TR	TSSOP-14	OPA4277,A4277	REEL	2500pcs/reel

Description

The OPAx277 series precision operational amplifiers replace the industry standard OPA177. They offer improved noise, wider output voltage swing, and are twice as fast with half the quiescent current. Features include ultralow offset voltage and drift, low bias current, high common-mode rejection, and high power supply rejection. Single, dual, and quad versions have identical specifications, for maximum design flexibility.

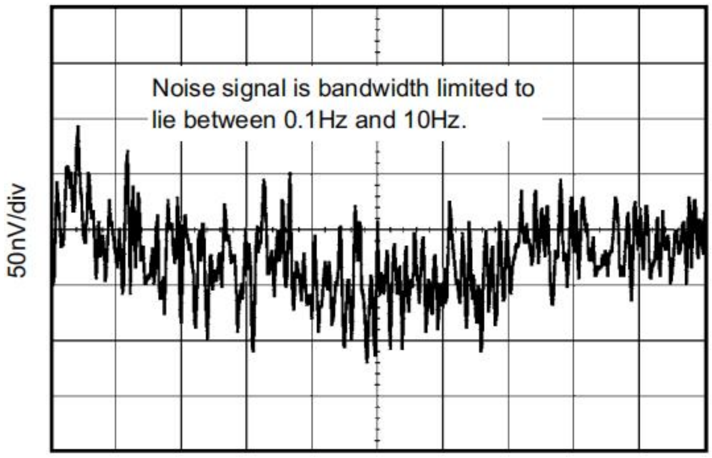
OPAx277 series operational amplifiers operate from ±2V to ±16V supplies with excellent performance. Unlike most operational amplifiers which are specified at only one supply voltage, the OPAx277 series is specified for real-world applications; a single limit applies over the ±5V to ±15V supply range. High performance is maintained as the amplifiers swing to their specified limits. Because the initial offset voltage (±100μV maximum) is so low, user adjustment is usually not required. However, the single version (OPA277) provides external trim pins for special applications.

OPA277 operational amplifiers are easy to use and free from phase inversion and the overload problems found in some other operational amplifiers. They are stable in unity gain and provide excellent dynamic behavior over a wide range of load conditions. Dual and quad versions feature completely independent circuitry for lowest crosstalk and freedom from interaction, even when overdriven or overloaded.

Applications

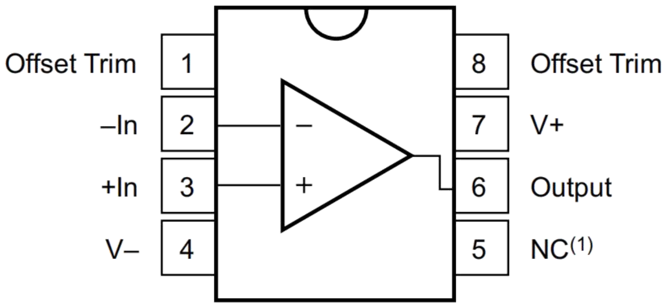
- Transducer Amplifiers
- Bridge Amplifiers
- Temperature Measurements
- Strain Gage Amplifiers
- Precision Integrators
- Battery-Powered Instruments
- Test Equipment

0.1 Hz to 10 Hz Noise

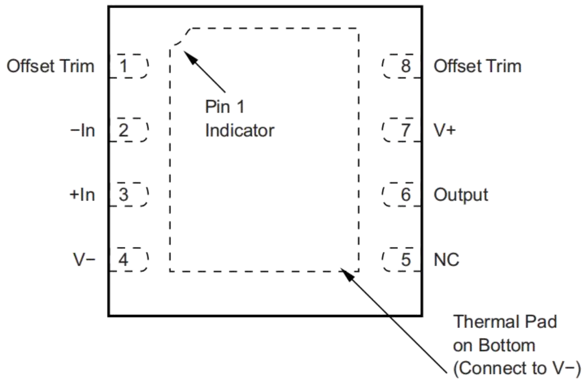


Pin Configuration and Functions

8-Pin DIP and SOP



8-Pin DFN

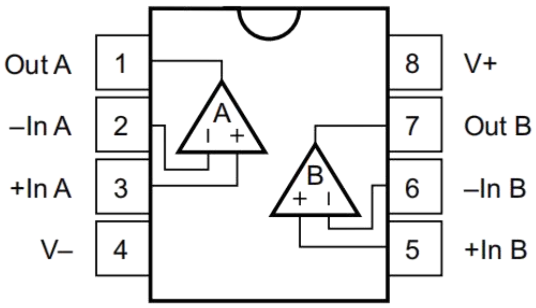


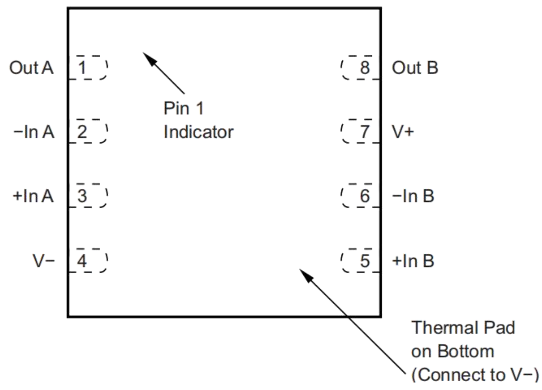
Pin Functions: OPA277

PIN			TYPE	DESCRIPTION
NAME	DIP, SOP NO.	DFN NO.		
Offset Trim	1	1	—	Input offset voltage trim (leave floating if not used)
–In	2	2	Input	Inverting input
+In	3	3	Input	Noninverting input
V–	4	4	—	Negative (lowest) power supply
NC	5	5	—	No intemal connection (can be left floating)
Output	6	6	Output	Output
V+	7	7	—	Positive (highest) power supply
Offset Trim	8	8	—	Input offset voltage trim (leave floating if not used)

8-Pin DIP and SOP

8-Pin DFN

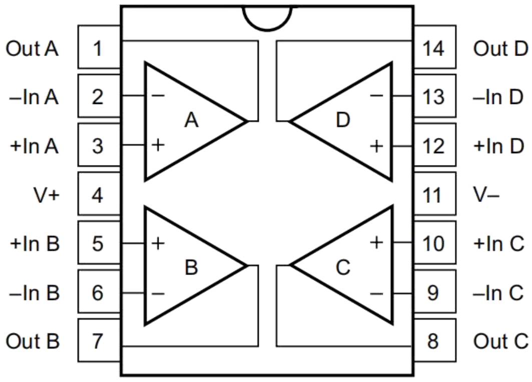




Pin Functions: OPA2277

PIN			I/O	DESCRIPTION
NAME	DIP, SOP NO.	DFN NO.		
Out A	1	1	O	Output channel A
–In A	2	2	I	Inverting input channel A
+In A	3	3	I	Noninverting input channel A
V–	4	4	—	Negative (lowest) power supply
+In B	5	5	I	Noninverting input channel B
–In B	6	6	I	Inverting input channel B
Out B	7	8	O	Output channel B
V+	8	7	—	Positive (highest) power supply

14 Pins DIP, and TSSOP



Pin Functions: OPA4277

PIN		I/O	DESCRIPTION
NO.	NAME		
1	Out A	O	Output channel A
2	–In A	I	Inverting input channel A
3	+In A	I	Noninverting input channel A
4	V+	—	Positive (highest) power supply
5	+In B	I	Noninverting input channel B
6	–In B	I	Inverting input channel B
7	Out B	O	Output channel B
8	Out C	O	Output channel C
9	–In C	I	Inverting input channel C
10	+In C	I	Noninverting input channel C
11	V–	—	Negative (lowest) power supply
12	+In D	I	Noninverting input channel D
13	–In D	I	Inverting input channel D
14	Out D	O	Output channel D

Specifications

Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)

	MIN	MAX	UNIT
Supply voltage, Vs = (V+) – (V–)	-	36	V
Input voltage	(V–) –0.7	(V+) +0.7	V
Output short-circuit(2)	Continuous		
Operating temperature	–20	85	°C
Junction temperature	-	150	°C
Lead temperature,10s	-	245	°C
Storage temperature, T_{stg}	–20	125	°C

1. Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
2. Short-circuit to ground, one amplifier per package.

ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001(1)	±2000	V
		Charged-device model (CDM), per JEDEC specification JESD22-C101(2)	±500	

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

	MIN	NOM	MAX	UNIT
Supply voltage, Vs = (V+) – (V–)	4(±2)	30(±15)	32(±16)	V
Specified temperature	–20		+85	°C

Thermal Information for OPA277

THERMAL METRIC(1)		OPA277			UNIT
		N (DIP)	M (SOP)	DQ(DFN)	
		8 PINS			
RθJA	Junction-to-ambient thermal resistance	49.2	110.1	40.7	°C/W
RθJC(top)	Junction-to-case (top) thermal resistance	39.4	52.2	41.3	°C/W
RθJB	Junction-to-board thermal resistance	26.4	52.3	16.7	°C/W
ΨJT	Junction-to-top characterization parameter	15.4	10.4	0.6	°C/W
ΨJB	Junction-to-board characterization parameter	26.3	51.5	16.9	°C/W
RθJC(bot)	Junction-to-case (bottom) thermal resistance	—	—	3.3	°C/W

1. For more information about traditional and new thermal metrics, see the Semiconductor and IC Package Thermal Metrics application report, SPRA953.

Thermal Information for OPA2277

THERMAL METRIC[1]		OPA2277 N (DIP) 8 PINS	OPA2277 M (SOP) 8 PINS	OPA2277 MT (TSSOP) 8 PINS	UNIT
$R_{\theta JA}$	Junction-to-ambient thermal resistance	47.2	107.4	39.3	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	36.0	45.8	36.9	°C/W

1. For more information about traditional and new thermal metrics, see the Semiconductor and IC Package Thermal Metrics application report, SPRA953.

Thermal Information for OPA2277(continued)

THERMAL METRIC[1]		OPA2277 N (DIP) 8 PINS	OPA2277 M (SOP) 8 PINS	OPA2277 DQ (DFN) 8 PINS	UNIT
$R_{\theta JB}$	Junction-to-board thermal resistance	24.4	47.9	15.4	°C/W
ψ_{JT}	Junction-to-top characterization parameter	13.4	5.7	0.4	°C/W
ψ_{JB}	Junction-to-board characterization parameter	24.3	47.3	15.6	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	—	—	2.2	°C/W

Thermal Information for OPA4277

THERMAL METRIC[1]		OPA4277 N (DIP) 14 PINS	OPA4277 M (SOP) 14 PINS	UNIT
RθJA	Junction-to-ambient thermal resistance	67.0	66.3	°C/W
RθJC(top)	Junction-to-case (top) thermal resistance	24.1	20.5	°C/W
RθJB	Junction-to-board thermal resistance	22.5	26.8	°C/W
ΨJT	Junction-to-top characterization parameter	2.2	2.1	°C/W
ΨJB	Junction-to-board characterization parameter	22.1	26.2	°C/W
RθJC(bot)	Junction-to-case (bottom) thermal resistance	—	—	°C/W

1. For more information about traditional and new thermal metrics, see the Semiconductor and IC Package Thermal Metrics application report, SPRA953.

Electrical Characteristics

At TA = 25°C, and RL = 2 kΩ, unless otherwise noted

PARAMETER		TEST CONDITIONS	OPA277U,UA OPA2277U,UA			OPA277 OPA2277 OPA4277			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
OFFSET VOLTAGE									
V_{OS} Input Offset Voltage				±10	±50		±100	±250	μV
Input Offset Voltage Over Temperature	OPA277U OPA2277U	T_A = –20°C to85°C			±20				μV
	OPA277UA OPA2277UA		±20		±50				
	All Versions							±250	
dV_{0S}/dT Input Offset Voltage Drift	OPA277U (high-grade,single)	T_A = –20°C to85°C		±0.1	±0.15				μV/°C
	OPA2277U (high-grade, dual)			±0.1	±0.25				
	All AIDRM Versions						±0.15	±1	
Input OffsetVoltage: (all models)	vs Time			0.2			See(2)		μV/mo
	vs Power Supply(PSRR)	V_S = ±2 V to ±16V		±0.3	±0.5		See(2)	±1	μV/V
		T_A = –20°C to85°C			±0.5			±1	
Channel Separation (dual, quad)		DC		0.1			See(2)		μV/V

(1) VS = ±15 V

(2) Specifications are the same as OPA277U

Electrical Characteristics (continued)

At T_A = 25°C, and R_L = 2 kΩ, unless otherwise noted

PARAMETER	TEST CONDITIONS	OPA277U,UA OPA2277U,UA MIN	TYP	MAX	OPA277 OPA2277 OPA4277 MIN	TYP	MAX	UNIT
INPUT BIAS CURRENT								
I_B Input Bias Current	T_A = –20°C to85°C		±0.5	±1		See (2)	±2.8	nA
				±2			±4	
I_{OS} Input Offset Current	T_A = –20°C to85°C		±0.5	±1		See (2)	±2.8	nA
				±2			±4	
NOISE								
Input Voltage Noise, f = 0.1 to 10 Hz			0.22			See (2)		μV_{PP}
Input Voltage Noise Density, f = 10 Hz			12			See (2)		nV/√Hz
Input Voltage Noise Density, f = 100 Hz			8			See (2)		nV/√Hz
Input Voltage Noise Density, f = 1 kHz			8			See (2)		nV/√Hz
Input Voltage Noise Density, f = 10 kHz			8			See (2)		nV/√Hz
I_n Current Noise Density, f = 1 kHz			0.2			See (2)		pA/√Hz
INPUT VOLTAGE RANGE								
V_{CM} Common-Mode Voltage Range		(V–)+2		(V+)–2	See (2)		See (2)	V
CMRR Common-Mode Rejection	V_{CM} = (V–) +2 Vto (V+) –2 V	130	140		115	See (2)		dB
	T_A = –20°C to85°C	128			115			dB
INPUT IMPEDANCE								
Differential			100 || 3			See (2)		MΩ || pF
Common-Mode	V_{CM} = (V–) +2 Vto (V+) –2 V		250 || 3			See (2)		GΩ || pF
OPEN-LOOP GAIN								
A_{OL} Open-Loop Voltage Gain	V_O = (V–)+0.5 V to (V+)–1.2 V,R_L = 10 kΩ		140			See (2)		dB
	V_O = (V–)+1.5 Vto (V+)–1.5 V,R_L = 2 kΩ	126	134		See (2)	See (2)		dB
	V_O = (V–)+1.5 V to (V+)–1.5 V,R_L = 2 kΩ, T_A = –20°C to85°C	126				See (2)		dB
FREQUENCY RESPONSE								
GBW Gain-Bandwidth Product			1			See (2)		MHz
SR Slew Rate			0.8			See (2)		V/μs
Settling Time 0.1%	V_S = ±15 V,G = 1, 10-V Step		14			See (2)		μs
Settling Time 0.01%	V_S = ±15 V,G = 1, 10-V Step		16			See (2)		μs
Overload Recovery Time	V_{IN} × G = V_S		3			See (2)		μs
THD+N Total Harmonic Distortion+Noise	1 kHz, G = 1, V_O = 3.5 Vrms		0.002%			See (2)		

Electrical Characteristics (continued)

At TA = 25°C, and RL = 2 kΩ, unless otherwise noted

PARAMETER	TEST CONDITIONS	OPA277U,UA OPA2277U,UA			OPA277 OPA2277 OPA4277			UNIT
		MIN	TYP(1)	MAX	MIN	TYP	MAX	
OUTPUT								
V_O Voltage Output	R_L = 10 kΩ	(V–)+0.5		(V+)–1.2	See(2)		See(2)	V
	T_A = –20°C to +85°C	(V–)+0.5		(V+)–1.2	See(2)		See(2)	
	R_L = 2 kΩ	(V–)+1.5		(V+)–1.5	See(2)		See(2)	
	T_A = –20°C to +85°C	(V–)+1.5		(V+)–1.5	See(2)		See(2)	
I_{SC} Short-Circuit Current		±35			See (2)			mA
C_{LOAD} Capacitive Load Drive		See (3)						
Z_O Open-loop output impedance	f = 1 MHz	40			See (2)			Ω
POWER SUPPLY								
V_S Specified Voltage Range		±5		±15	See(2)		See(2)	V
Operating Voltage Range		±2		±16	See(2)		See(2)	V
I_Q Quiescent Current (per amplifier)	I_O = 0		±790	±825		See(2	See(2)	μA
	T_A = –20°C to 85°C	±900					See(2)	
TEMPERATURE RANGE								
Specified Range		–20		85	See(2)		See(2)	°C
Operating Range		–20		125	See(2)		See(2)	°C

(3) See Typical Characteristics

Typical Characteristics

At TA = 25°C, VS = ±15 V, and RL = 2 kΩ, unless otherwise noted.

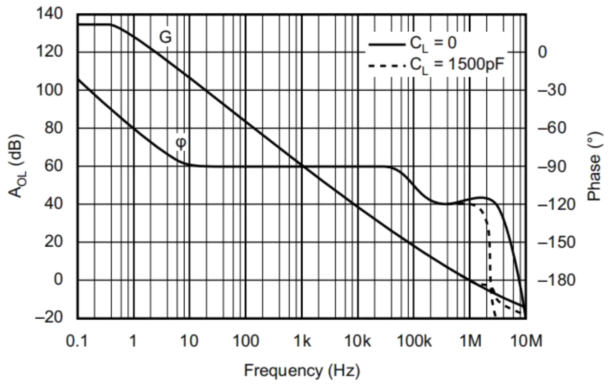


Figure 1. Open-Loop Gain and Phase vs Frequency

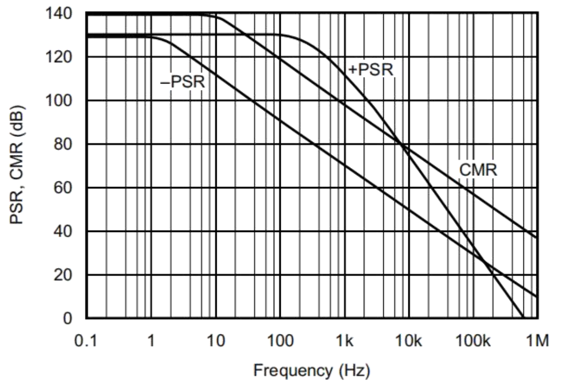


Figure 2. Power Supply and Common-Mod Rejection vs Frequency

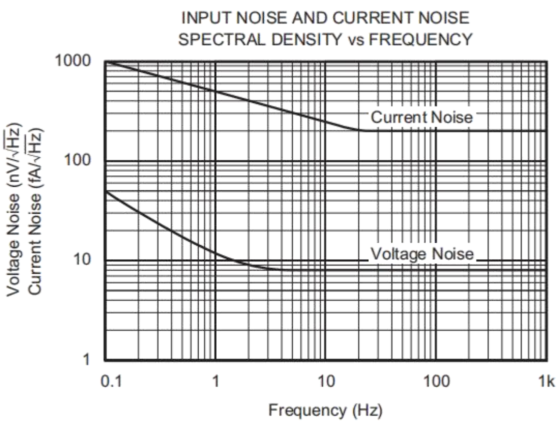


Figure 3. Input Noise and Current Noise Spectral Densityvs Frequency

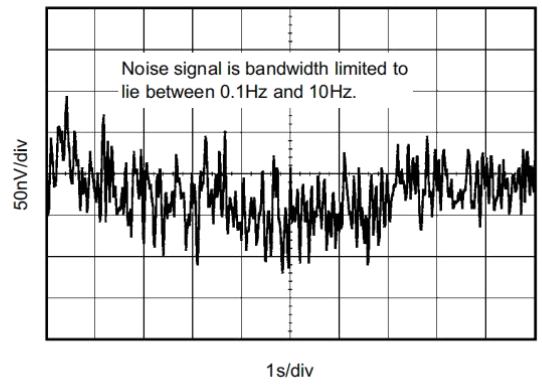


Figure 4. Input Noise Voltage vs Time

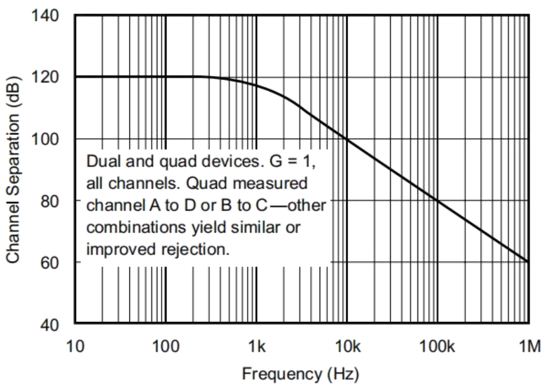


Figure 5. Channel Separation vs Frequency

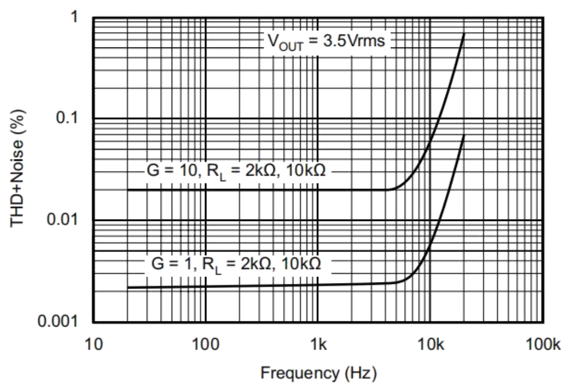


Figure 6. Total Harmonic Distortion + Noise vs Frequency

Typical Characteristics (continued)

At TA = 25°C, VS = ±15 V, and RL = 2 kΩ, unless otherwise noted.

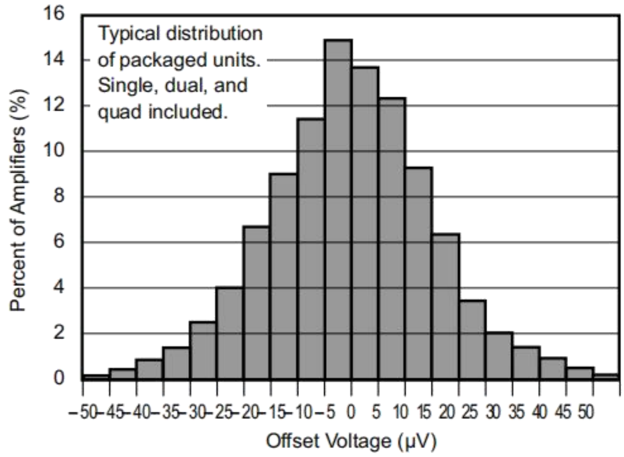


Figure 7. Offset Voltage Production Distribution

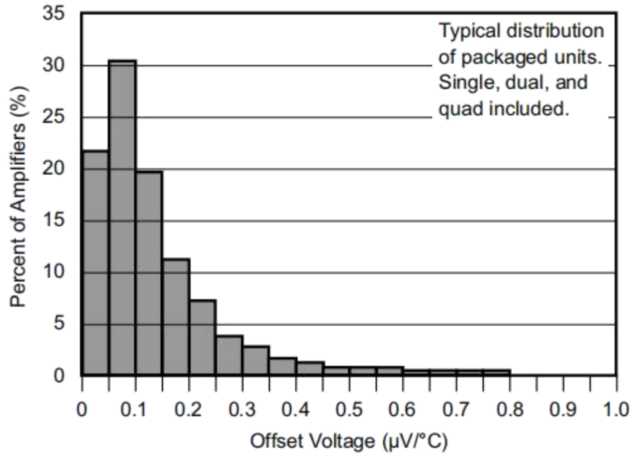


Figure 8. Offset Voltage Drift Production Distribution

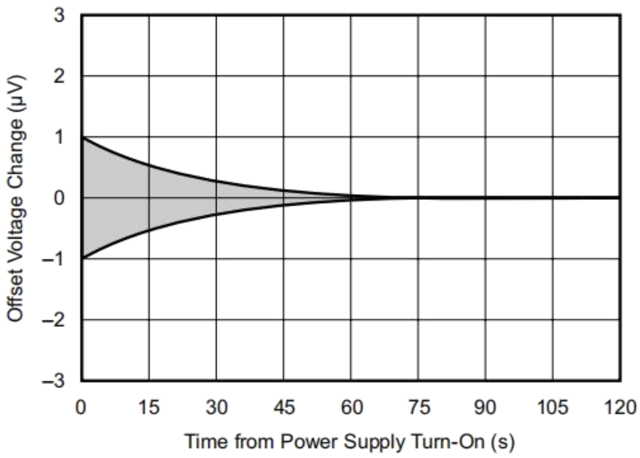


Figure 9. Warm-Up Offset Voltage Drift

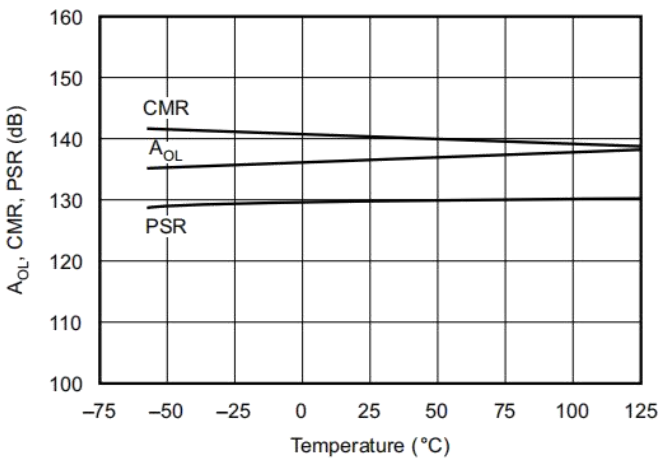


Figure 10. AOL, CMR, PSR vs Temperature

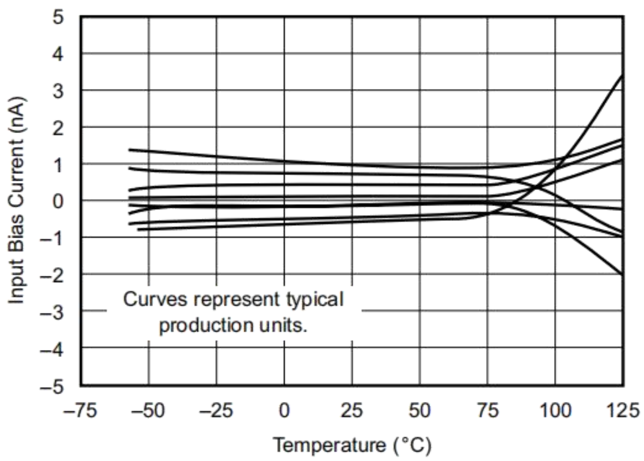


Figure 11. Input Bias Current vs Temperature

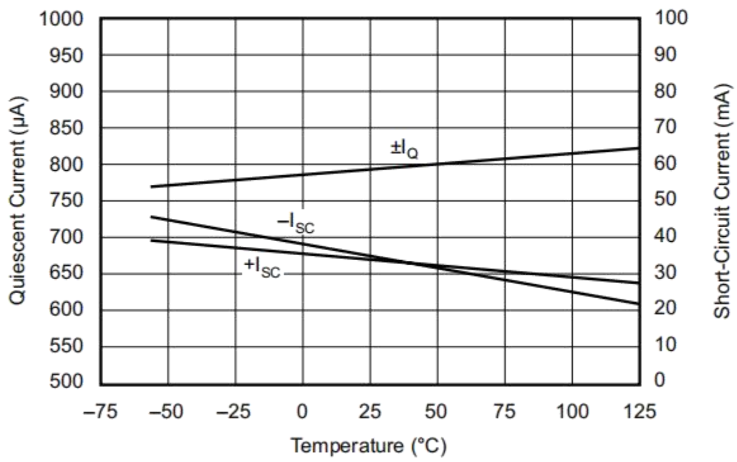


Figure 12. Quiescent Current and Short-Circuit Current vs Temperature

Typical Characteristics (continued)

At TA = 25°C, VS = ±15 V, and RL = 2 kΩ, unless otherwise noted.

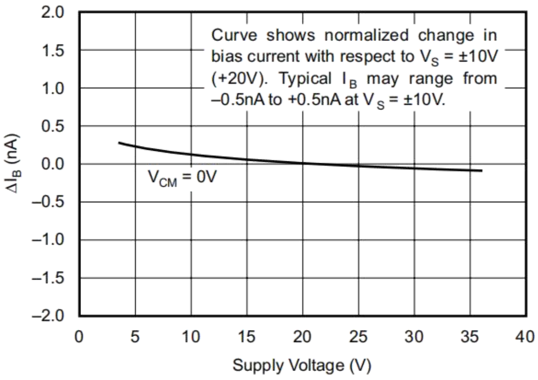


Figure 13. Change in Input Bias Current vs Power Supply Voltage

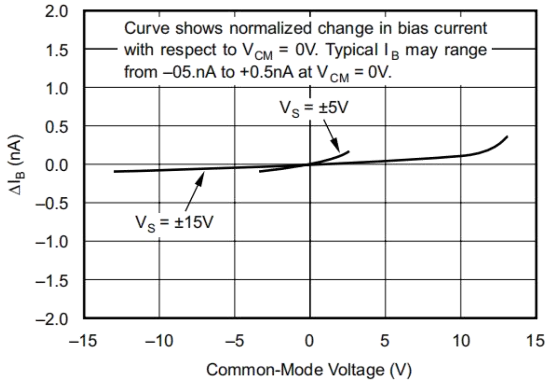


Figure 14. Change in Input Bias Current vs Common-Mode Voltage

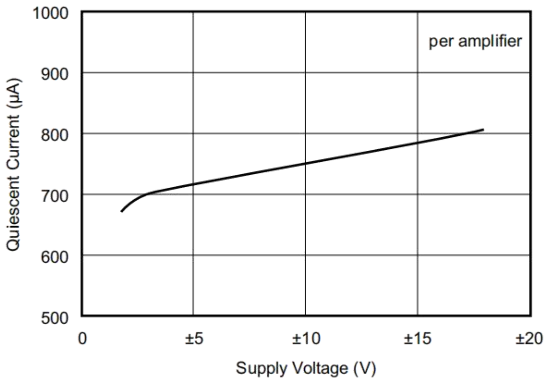


Figure 15. Quiescent Current vs Supply Voltage

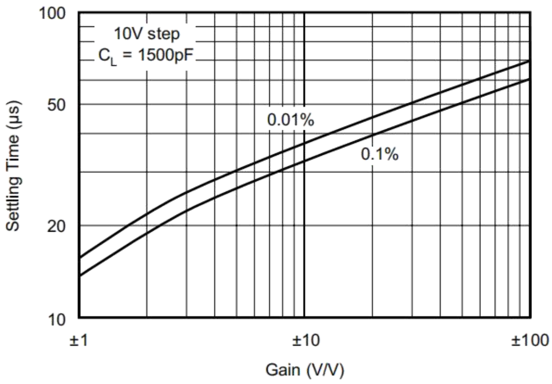


Figure 16. Settling Time vs Closed-Loop Gain

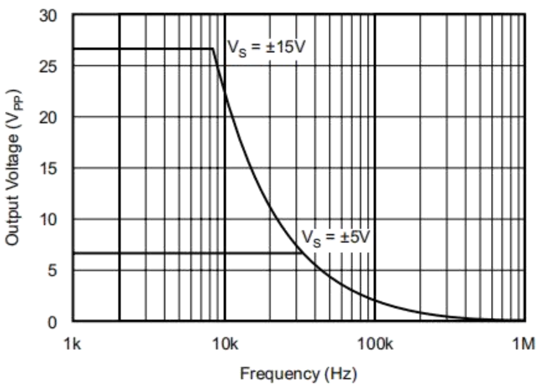


Figure 17. Maximum Output Voltage vs Frequency

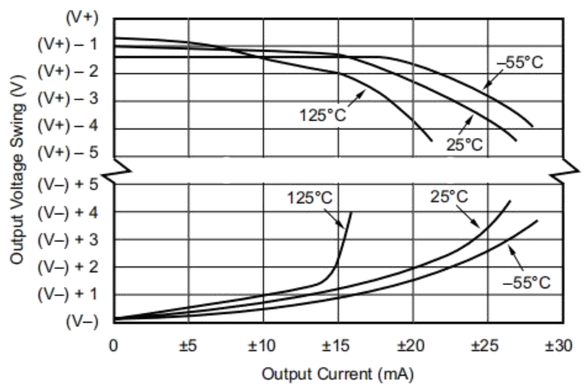


Figure 18. Output Voltage Swing vs Output Current

Typical Characteristics (continued)

At TA = 25°C, VS = ±15 V, and RL = 2 kΩ, unless otherwise noted.

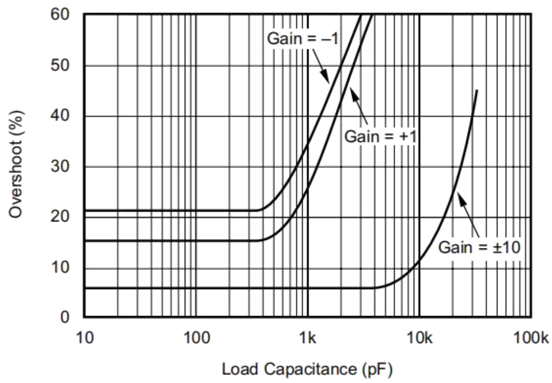


Figure 19. Small-Signal Overshoot vs Load Capacitance

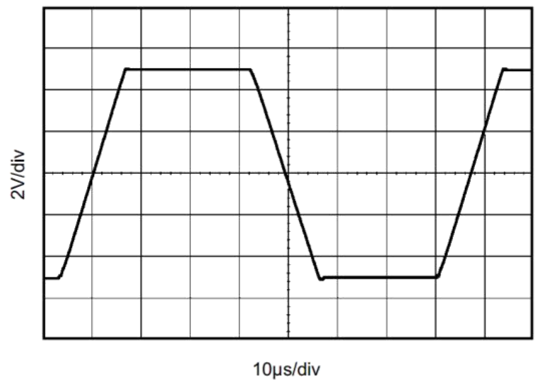


Figure 20. Large-Signal Step Response G = 1, CL = 1500 pF, VS = ±15 V

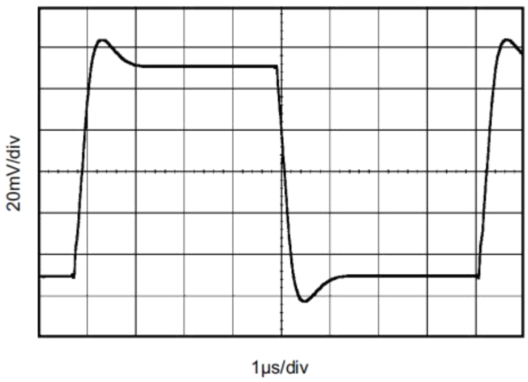


Figure 21. Small-Signal Step Response G= +1, CL = 0, VS = ±15 V

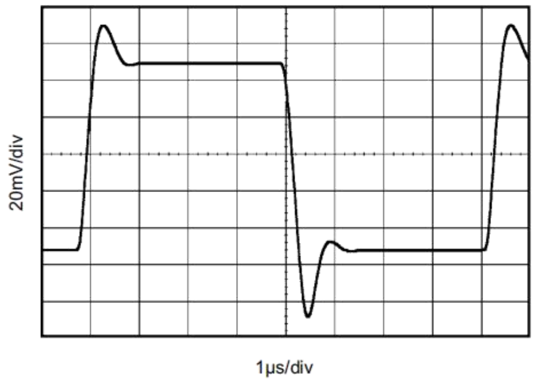


Figure 22. Small-Signal Step Response G= 1, CL = 1500 pF, VS = ±15 V

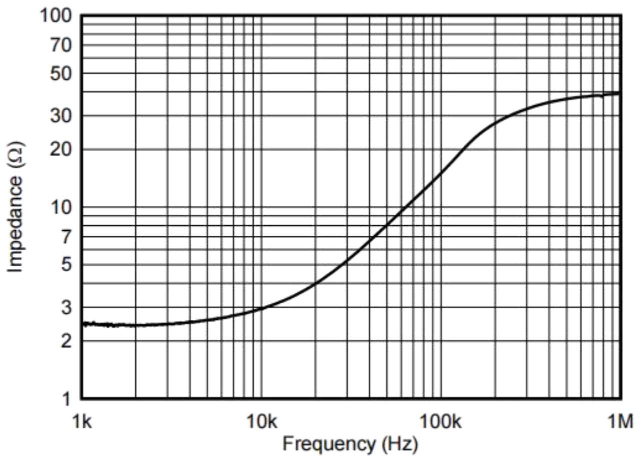


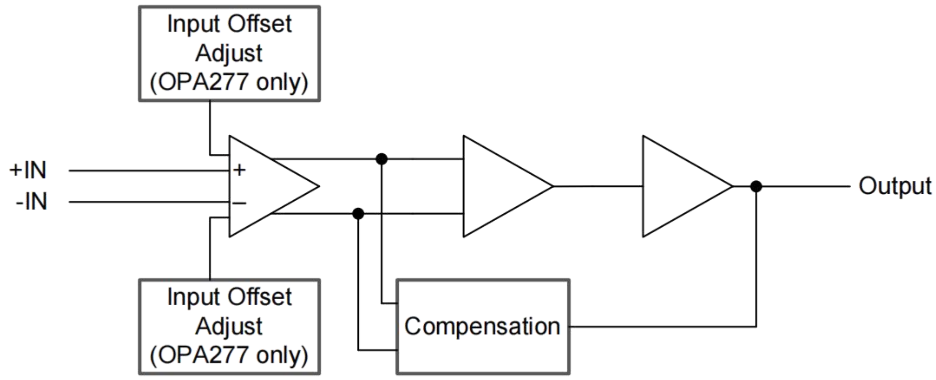
Figure 23. Open-Loop Output Impedance VS = ±15 V

Detailed Description

Overview

The OPAx277 series precision operational amplifiers replace the industry standard OPA177.They offer improved noise, wider output voltage swing, and are twice as fast with half the quiescent current. Features include ultralow offset voltage and drift, low bias current, high common-mode rejection, and high power supply rejection. Single, dual, and quad versions have identical specifications, for maximum design flexibility.

Functional Block Diagram



Feature Description

The OPAx277 series is unity-gain stable and free from unexpected output phase reversal, making it easy to use in a wide range of applications. Applications with noisy or high-impedance power supplies may require decoupling capacitors close to the device pins. In most cases 0.1-μF capacitors are adequate.
The OPAx277series has low offset voltage and drift. To achieve highest performance, the circuit layout and mechanical conditions should be optimized. Offset voltage and drift can be degraded by small thermoelectric potentials at the operational amplifier inputs. Connections of dissimilar metals generate thermal potential, which can degrade the ultimate performance of theOPAx277series. These thermal potentials can be made to cancel by assuring that they are equal in both input terminals.

- Keep the thermal mass of the connections to the two input terminals similar
- Locate heat sources as far as possible from the critical input circuitry
- Shield operational amplifier and input circuitry from air currents, such as cooling fans

Operating Voltage

OPAx277series operational amplifiers operate from ±2V to ±16V supplies with excellent performance. Unlike most operational amplifiers, which are specified at only one supply voltage, the OPA277series is specified for real-world applications; a single limit applies over the ±5V to ±15V supply range. This allows a customer operating at VS = ±10 V to have the same assured performance as a customer using ±15-V supplies. In addition, key parameters are assured over the specified temperature range, –20°C to 85°C. Most behavior remains unchanged through the full operating voltage range (±2V to ±16V). Parameters which vary significantly with operating voltage or temperature are shown in Typical Characteristics.

Offset Voltage Adjustment

The OPAx277series is laser-trimmed for low offset voltage and drift, so most circuits do not require external adjustment. However, offset voltage trim connections are provided on pins 1 and 8. Offset voltage can be adjusted by connecting a potentiometer, as shown in Figure 24. Only use this adjustment to null the offset of the operational amplifier. This adjustment should not be used to compensate for offsets created elsewhere in a system, because this can introduce additional temperature drift.

Feature Description (continued)

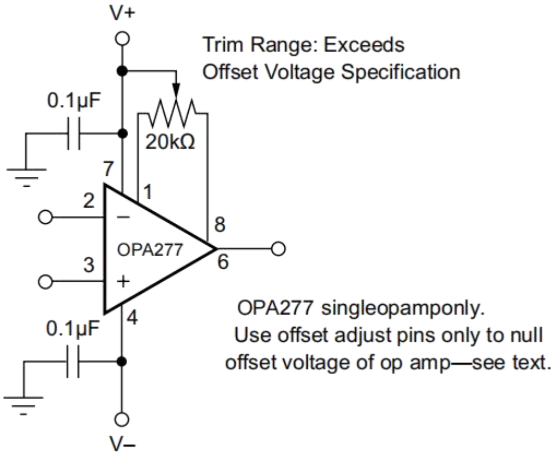


Figure 24. OPA277 Offset Voltage Trim Circuit

Input Protection

The inputs of the OPAx277series are protected with 1-kΩ series input resistors and diode clamps. The inputs can withstand ±30V differential inputs without damage. The protection diodes conduct current when the inputs are over-driven. This may disturb the slewing behavior of unity-gain follower applications, but will not damage the operational amplifier.

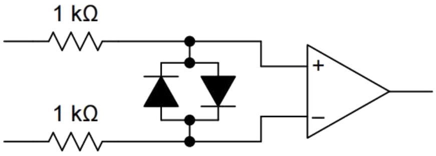


Figure 25. OPAx277Input Protection

Input Bias Current Cancellation

The input stage base current of the OPA x277series is internally compensated with an equal and opposite cancellation circuit. The resulting input bias current is the difference between the input stage base current and the cancellation current. This residual input bias current can be positive or negative.

When the bias current is canceled in this manner, the input bias current and input offset current are approximately the same magnitude. As a result, it is not necessary to use a bias current cancellation resistor, as is often done with other operational amplifiers (see Figure 26). A resistor added to cancel input bias current errors may actually increase offset voltage and noise.

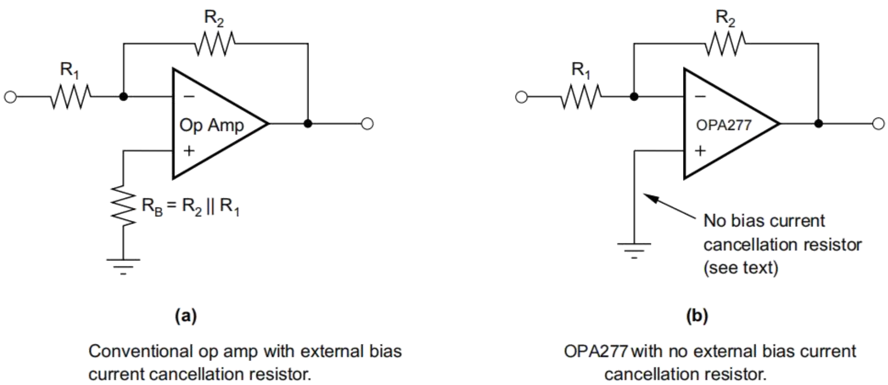


Figure 26. Input Bias Current Cancellation

EMI Rejection Ratio (EMIRR)

The electromagnetic interference (EMI) rejection ratio, or EMIRR, describes the EMI immunity of operational amplifiers. An adverse effect that is common to many operational amplifiers is a change in the offset voltage as a result of RF signal rectification. An operational amplifier that is more efficient at rejecting this change in offset as a result of EMI has a higher EMIRR and is quantified by a decibel value. Measuring EMIRR can be performed in many ways, but this report provides the EMIRR IN+, which specifically describes the EMIRR performance when the RF signal is applied to the noninverting input pin of the operational amplifier. In general, only the noninverting input is tested for EMIRR for the following three reasons:

1. Operational amplifier input pins are known to be the most sensitive to EMI, and typically rectify RF signals better than the supply or output pins.
2. The noninverting and inverting operational amplifier inputs have symmetrical physical layouts and exhibit nearly matching EMIRR performance.
3. EMIRR is easier to measure on noninverting pins than on other pins because the noninverting input terminal can be isolated on a printed circuit board (PCB). This isolation allows the RF signal to be applied directly to the noninverting input terminal with no complex interactions from other components or connecting PCB traces.

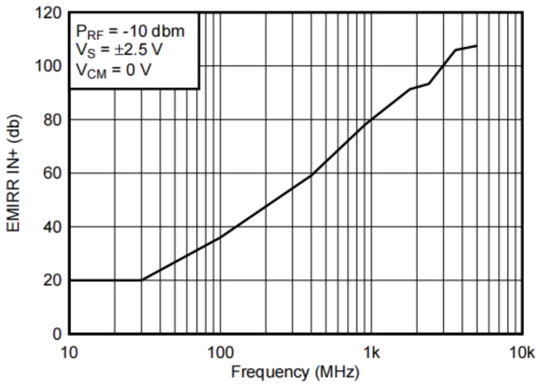


Figure 27. OPA277 EMIRR IN+ vs Frequency

If available, any dual and quad operational amplifier device versions have nearly similar EMIRR IN+ performance. The OPA277unity-gain bandwidth is 1 MHz. EMIRR performance below this frequency denotes interfering signals that fall within the operational amplifier bandwidth.

Feature Description (continued)

Table 1 shows the EMIRR IN+ values for theOPA277at particular frequencies commonly encountered in real world applications. Applications listed in Table 1 may be centered on or operated near the particular frequency shown. This information may be of special interest to designers working with these types of applications, or working in other fields likely to encounter RF interference from broad sources, such as the industrial, scientific, and medical (ISM) radio band.

Table 1. OPA277EMIRR IN+ for Frequencies of Interest

FREQUENCY	APPLICATION/ALLOCATION	EMIRR IN+
400 MHz	Mobile radio, mobile satellite/space operation, weather, radar, UHF	59.1 dB
900 MHz	GSM, radio com/nav./GPS (to 1.6 GHz), ISM, aeronautical mobile,UHF	77.9 dB
1.8 GHz	GSM, mobile personal comm. broadband, satellite, L-band	91.3 dB
2.4 GHz	802.11b/g/n, Bluetooth™, mobile personal comm., ISM, amateurradio/satellite, S-band	93.3 dB
3.6 GHz	Radiolocation, aero comm./nav., satellite, mobile, S-band	105.9 dB
5.0 GHz	802.11a/n, aero comm./nav., mobile comm., space/satelliteoperation, C-band	107.5 dB

EMIRR IN+ Test Configuration

Figure 28 shows the circuit configuration for testing the EMIRR IN+. An RF source is connected to the operational amplifier noninverting input terminal using a transmission line. The operational amplifier is configured in a unity gain buffer topology with the output connected to a low-pass filter (LPF) and a digital multimeter (DMM). Note that a large impedance mismatch at the operational amplifier input causes a voltage reflection; however, this effect is characterized and accounted for when determining the EMIRR IN+. The resulting dc offset voltage is sampled and measured by the multimeter. The LPF isolates the multimeter from residual RF signals that may interfere with multimeter accuracy. Refer to SBOA128 for more details.

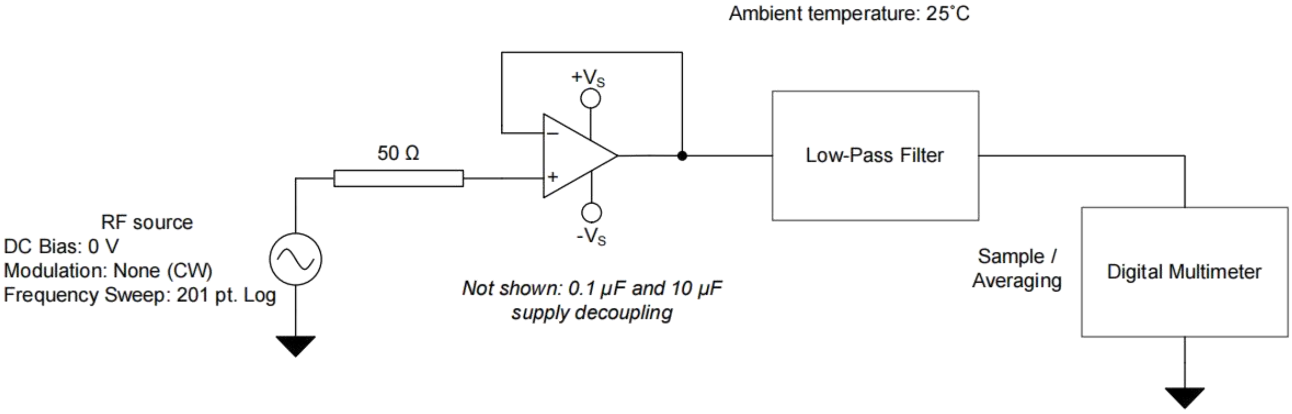


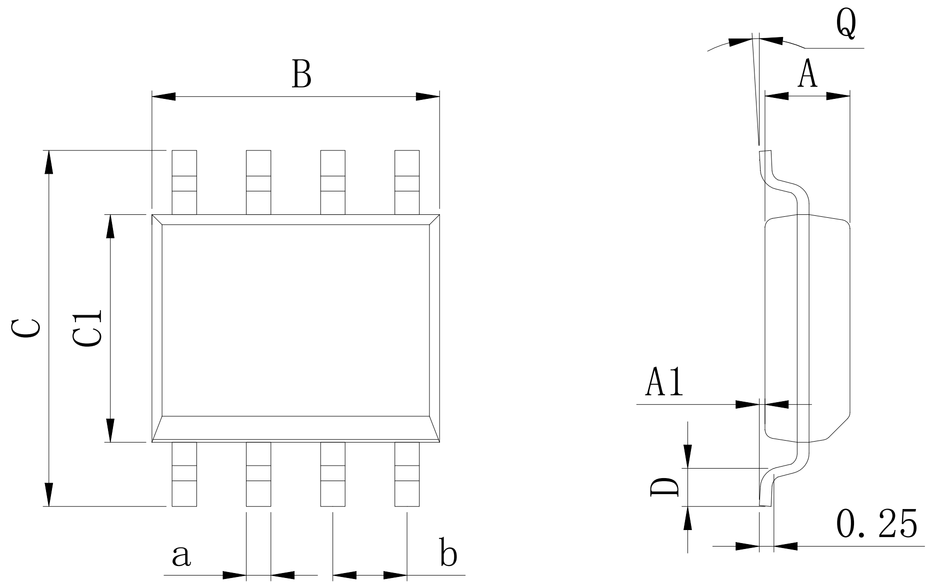
Figure 28. EMIRR IN+ Test Configuration Schematic

Device Functional Modes

TheOPAx277has a single functional mode and is operational when the power-supply voltage is greater than 4V (±2 V). The maximum power supply voltage for the OPAx277is 32 V (±16 V).

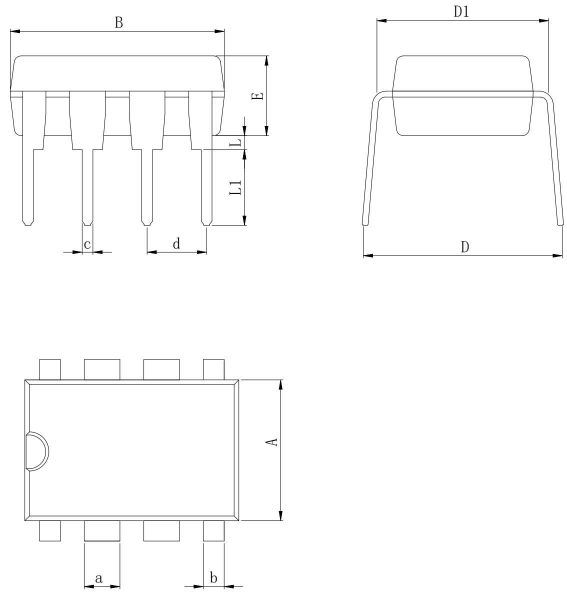
Physical Dimensions

SOP-8



Dimensions In Millimeters(SOP-8)									
Symbol:	A	A1	B	C	C1	D	Q	a	b
Min:	1.35	0.05	4.90	5.80	3.80	0.40	0°	0.35	1.27 BSC
Max:	1.55	0.20	5.10	6.20	4.00	0.80	8°	0.45	

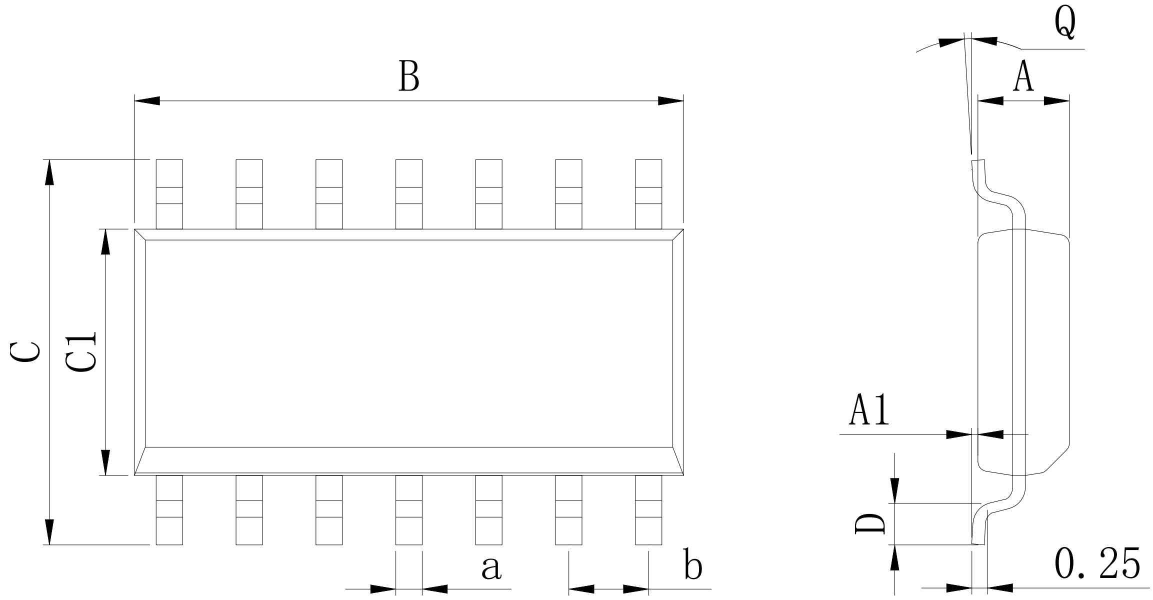
DIP-8



Dimensions In Millimeters(DIP-8)											
Symbol:	A	B	D	D1	E	L	L1	a	b	c	d
Min:	6.10	9.00	8.10	7.42	3.10	0.50	3.00	1.50	0.85	0.40	2.54 BSC
Max:	6.68	9.50	10.9	7.82	3.55	0.70	3.60	1.55	0.90	0.50	

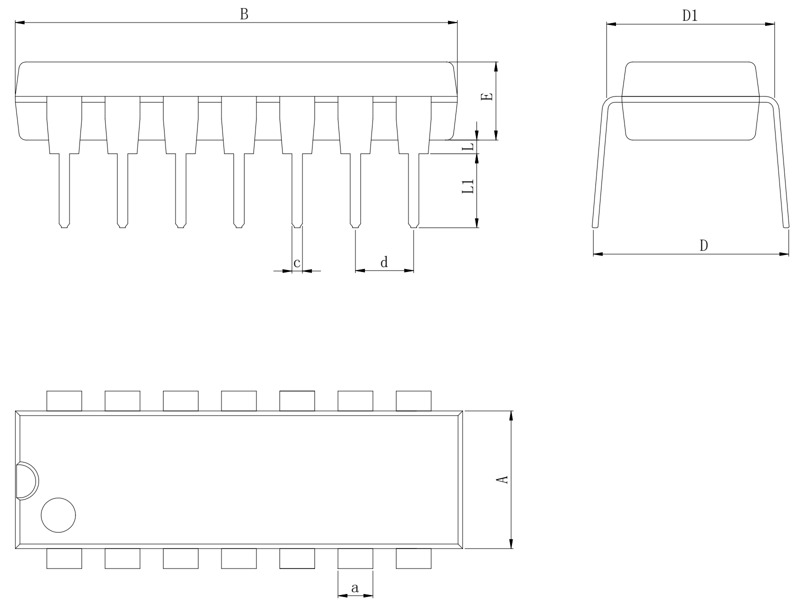
Physical Dimensions

SOP-14



Dimensions In Millimeters(SOP-14)									
Symbol:	A	A1	B	C	C1	D	Q	a	b
Min:	1.35	0.05	8.55	5.80	3.80	0.40	0°	0.35	1.27 BSC
Max:	1.55	0.20	8.75	6.20	4.00	0.80	8°	0.45	

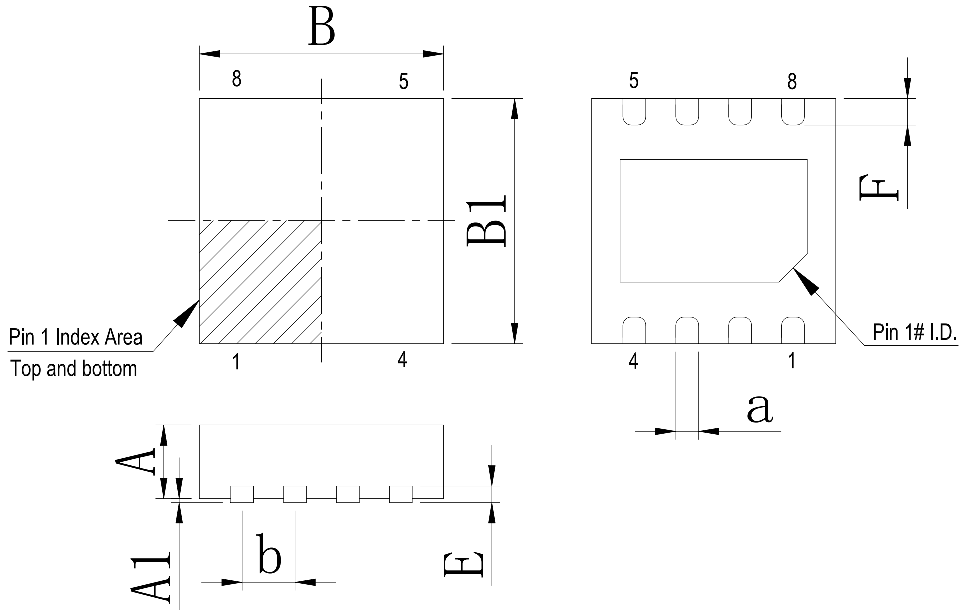
DIP-14



Dimensions In Millimeters(DIP-14)									
Symbol:	A	B	D	D1	E	L	L1	a	c	d
Min:	6.10	18.94	8.10	7.42	3.10	0.50	3.00	1.50	0.40	2.54 BSC
Max:	6.68	19.56	10.9	7.82	3.55	0.70	3.60	1.55	0.50	

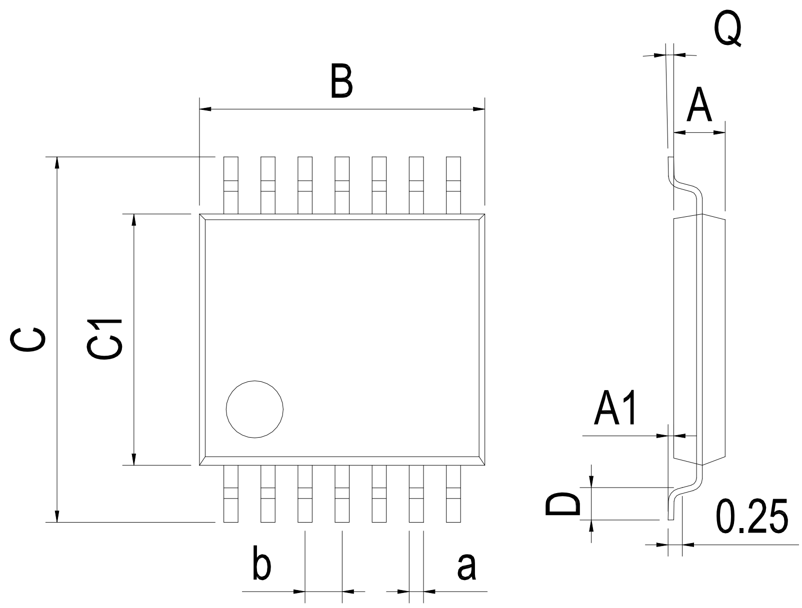
Physical Dimensions

DFN-8 2*2



Dimensions In Millimeters(DFN-8 2*2)								
Symbol:	A	A1	B	B1	E	F	a	b
Min:	0.85	0	1.90	1.90	0.15	0.25	0.18	0.50TYP
Max:	0.95	0.05	2.10	2.10	0.25	0.45	0.30	

TSSOP-14



Dimensions In Millimeters(TSSOP-14)									
Symbol:	A	A1	B	C	C1	D	Q	a	b
Min:	0.85	0.05	4.90	6.20	4.30	0.40	0°	0.20	0.65 BSC
Max:	0.95	0.20	5.10	6.60	4.50	0.80	8°	0.25	

Revision History

DATE	REVISION	PAGE
2017-8-4	New	1-23
2023-8-28	Update encapsulation type、Update Lead Temperature、Updated DIP-8 dimension、Updated DIP-14 dimension	1、6、19、20
2024-9-14	Updated Supply voltage range is ±16V	6

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