RC4277 Dual Precision Operational Amplifiers

Features

- High dc precision
- Very low V_{os} — 30 µV max
- Very low V_{os} drift — 0.3 µV/°C max
- High open-loop gain — 5M min
- High CMRR — 120 dB min
- High PSRR — 110 db min
- Low noise — 0.35 μV_{p-p} (0.1 to 10 Hz)
- Low bias current — 4.0 nA max
- Low power consumption — 120 mW max

Description

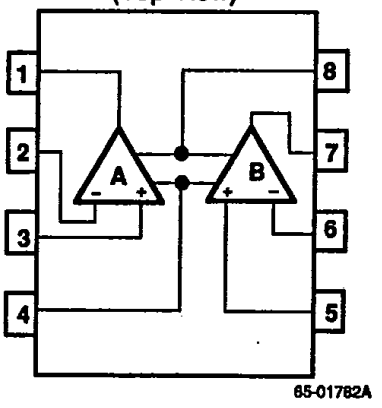
The RC4277 provides the highest precision available in a dual bipolar operational amplifier. A monolithic dual version of the RC4077, the RC4277 is designed to replace OP-207, LT1002, OP-07 and OP-77 type amplifiers in applications requiring high PC board layout density. The RC4277 has a well-balanced, mutually supporting set of input specifications. Low V_{OS}, low I_B, high open-loop gain, and excellent matching characteristics combine to raise the performance level of many instrumentation, low-level signal conditioning, and data conversion applications. PSRR, CMRR, V_{os} drift, and noise levels also support high precision operation.

The high performance of the RC4277 results from two innovative and unconventional manufacturing steps, plus careful circuit layout and design. The key steps are SiCr thin-film resistor deposition and post-package trimming of the input offset voltage characteristic. The low ±30 µV max V_{OS} specification is maintained in high-volume production by way of the post-package trim procedure, where internal resistors are trimmed through the device input leads at the final test operation. Devices retain this low offset through the stability and accuracy of the trimmed thin-film resistors.

The RC4277 is available in 8-lead plastic and ceramic DIPs, and can be ordered with Mil-Std-883 Level B processing.

Connection Information

8-Lead
Dual In-Line Package
(Top View)



Pin	Function
1	Output A
2	-Input A
3	+Input A
4	$-V_s$
5	+Input B
6	-Input B
7	Output B
8	$+V_s$

Ordering Information

Part Number	Package	Operating Temperature Range
RC4277EN	N	0°C to +70°C
RC4277FN	N	0°C to +70°C
RV4277ED	D	-25°C to +85°C
RV4277FD	D	-25°C to +85°C
RM4277AD	D	-55°C to +125°C
RM4277AD/883B	D	-55°C to +125°C

Notes:
/883B suffix denotes Mil-Std-883, Level B processing
N = 8-lead plastic DIP
D = 8 lead ceramic DIP
Contact a Raytheon sales office or representative for ordering information on special package/temperature range combinations.

Absolute Maximum Ratings

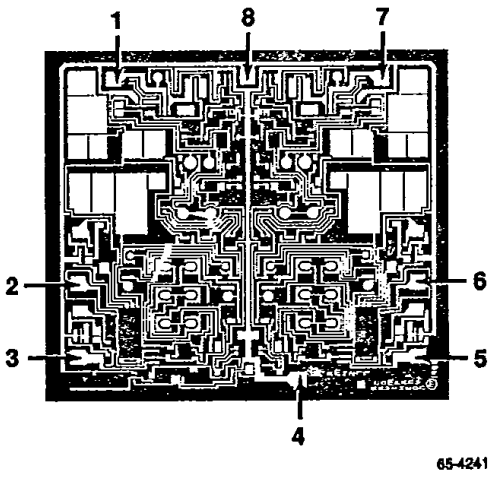
Supply Voltage ..... ±18V
Input Voltage* ..... ±18V
Differential Input Voltage 30V
Internal Power Dissipation** ..... 500 mW
Output Short Circuit Duration ..... Indefinite
Storage Temperature
Range ..... -65°C to +150°C
Operating Temperature Range
RM4277 ..... -55°C to +125°C
RV4277 ..... -25°C to +85°C
RC4277 ..... 0°C to +70°C
Lead Soldering Temperature
(60 sec) ..... +300°C

*For supply voltages less than ±18V, the absolute maximum input voltage is equal to the supply voltage.
**Observe maximum power dissipation vs. ambient temperature in the table of Thermal Characteristics.

Thermal Characteristics

	8-Lead Ceramic DIP	8-Lead Plastic DIP
Max. Junction Temp.	+175°C	+125°C
Max. P_D T_A <50°C	833 mW	468 mW
Therm. Res θ_{JC}	45°C/W	—
Therm. Res. θ_{JA}	150°C/W	160°C/W
For T_A >50°C Derate at	8.33 mW/°C	6.25 mW/°C

Mask Pattern



Die Size: mils
Min Pad Dimensions: 4 x 4 mils

Electrical Characteristics (V_S = ±15V and T_A = +25°C unless otherwise noted)

Parameters	Test Conditions	RC4277A/E			RC4277F			Units
		Min	Typ	Max	Min	Typ	Max	
Input Offset Voltage[3]			12	30		30	75	µV
Long Term V_{os} Stability[1]			0.3			0.3		µV/Mo
Input Offset Current			0.5	3.0		0.5	5.0	nA
Input Bias Current			±0.5	±3.0		±0.5	±5.0	nA
Input Noise Voltage	0.1 Hz to 10 Hz		0.35			0.35		μV_{p-p}
Input Noise Voltage Density	F_O = 10 Hz		10.3			10.3		$nV/\sqrt{Hz}$
	F_O = 100 Hz		10			10		
	F_O = 1000 Hz		9.6			9.6		
Input Noise Current	0.1 Hz to 10 Hz		14			14		pA_{p-p}
Input Noise Current Density	F_O = 10 Hz		0.32			0.32		$nV/\sqrt{Hz}$
	F_O = 100 Hz		0.14			0.14		
	F_O = 1000 Hz		0.12			0.12		
Input Voltage Range[4]		±11	±14		±11	±14		V
Common Mode Rejection Ratio	V_{CM} = ±11V	120	132		110	126		dB
Power Supply Rejection Ratio	V_S = ±4V to ±16.5V	120	132		110	126		dB
Large Signal Voltage Gain	$R_L \geq 2$ kΩ, V_O = ±10V	5000	7000		2500	5000		V/mV
Output Voltage Swing	$R_L \geq 10$ kΩ	±12.5	±13		±12.5	±13		V
	$R_L \geq 2$ kΩ	±12	±12.8		±12	±12.8		
	$R_L \geq 1$ kΩ	±11	±12		±11	±12		
Slewing Rate	$R_L \geq 2$ kΩ	0.1	0.3		0.1	0.3		V/µS
Closed Loop Bandwidth	A_{VCL} = +1.0		1.5			1.5		MHz
Open Loop Output Resistance	V_O = 0, I_O = 0		60			60		Ω
Power Consumption	V_S = 15V, R_L = ∞		140	165		140	165	mW
Crosstalk		126	155		126	155		dB

Notes:
1. Long Term Input Offset Voltage Stability refers to the averaged trend line of V_{os} vs. Time over extended periods after the first 30 days of operation. Excluding the initial hour of operation, changes in V_{os} during the first 30 operating days are typically 2.5 µ.
2. Guaranteed by design.
3. Input Offset Voltage measurements are performed by automated test equipment approximately 0.5 seconds after applica tion of power.
4. The input protection diodes do not allow the device to be removed or inserted into the circuit without first removing power.

Electrical Characteristics ($V_S = \pm 15V$, $-55°C \le T_A \le +125°C$ unless otherwise noted)

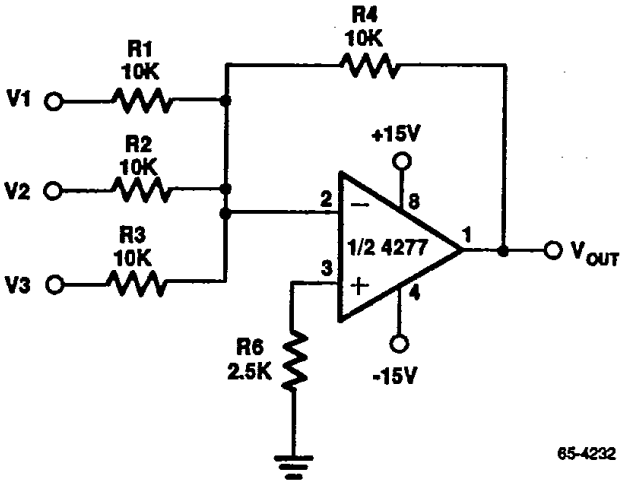
Parameters	Test Conditions	4277A Min	4277A Typ	4277A Max	Units
Input Offset Voltage[1]			25	60	µV
Average Input Offset Voltage Drift[2]			0.1	0.3	µV/°C
Input Offset Current			1.5	5.0	nA
Average Input Offset Current Drift			5.0	20	pA/°C
Input Bias Current			±1.5	±5.0	nA
Average Input Bias Current Drift			5.0	20	pA/°C
Input Voltage range		±10	±13.5		V
Common Mode Rejection Ratio	$V_{CM} = \pm 10V$	120	128		dB
Power Supply Rejection Ratio	$V_S = \pm 4V$ to ± 16.5 V	120	128		dB
Large Signal Voltage Gain	$R_L > 2$ kΩ, $V_O = \pm 10V$	3000	5000		V/mV
Maximum Output Voltage Swing	$R_L > 2$ kΩ	±11	±12.6		V
Power Consumption	$R_L = \infty$		150	200	mW

Notes:
1. Input offset voltage measurements are performed by automated test equipment approximately 0.5 seconds after application of power.
2. This parameter is tested on a sample basis only.

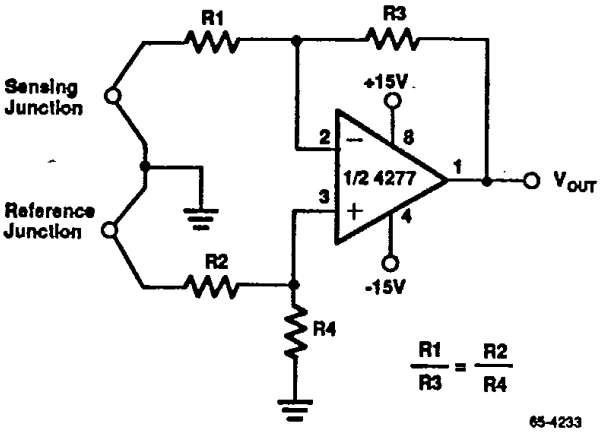
Electrical Characteristics ($V_S = \pm 15V$, -25°C to +85°C for hermetic packages, $0°C \le T_A \le +70°C$ for plastic packages unless otherwise noted)

Parameters	Test Conditions	4277E Min	4277E Typ	4277E Max	4277F Min	4277F Typ	4277F Max	Units
Input Offset Voltage	$0°C \le T_A \le +70°C$ $-25°C \le T_A \le +85°C$		20 20	44 48		50 50	120 135	µV µV
Average Input Offset Voltage Drift[2]			0.1	0.3		0.3	1.0	µV/°C
Input Offset Current			1.5	5.0		1.5	5.0	nA
Input Bias Current			±1.5	±5.0		±1.5	±5.0	nA
Input Voltage Range		±10	±13.5		±10	±13.5		V
Common Mode Rejection Ratio	$V_{CM} = \pm 10V$	120			110	124		dB
Power Supply Rejection Ratio	$V_S = \pm 4V$ to $\pm 16.5V$	120			110	124		dB
Large Signal Voltage Gain	$R_L > 2$ kΩ, $V_O = \pm 10V$	3000	5000		1500	4000		V/mV
Maximum Output Voltage Swing	$R_L > 2$ kΩ	±11	±12.6		±11	±12.6		V
Power Consumption	$R_L = \infty$		150	200		150	200	mW

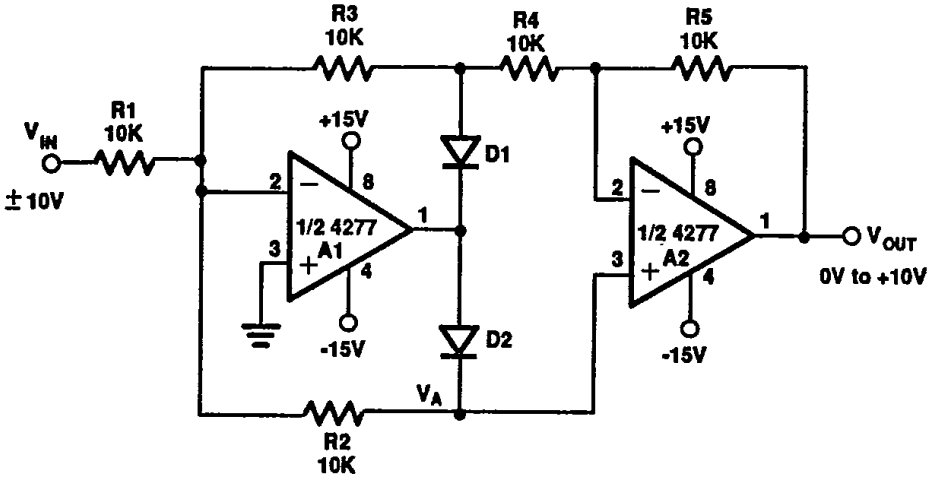
Typical Applications



Adjustment-Free Precision Summary Amplifier



High Stability Thermocouple Amplifier



Precision Absolute Value Circuit

Schematic Diagram