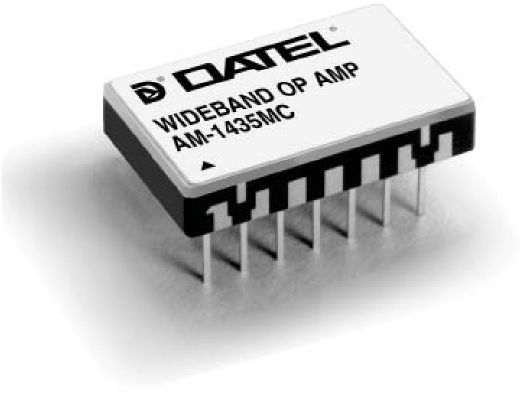
AM-1435

Ultra-Fast, Wideband Operational Amplifiers



FEATURES

- 70 nanosecond settling to ±0.01%
- 1GHz gain bandwidth product
- 100dB open loop gain
- 80dB minimum CMRR
- –55 to +125°C operation
- Industry standard

PRODUCT OVERVIEW

DATEL 's AM-1435 is an ultrafast settling, wideband operational amplifier. Utilizing precision thin-film hybrid construction and differential input operational amplifier design techniques, the AM-1435 achieves a settling time of only 70 nanoseconds for a 10V step to ±0.01% accuracy. High-speed performance is optimized with high open-loop gain, flat frequency response beyond 10kHz, and a roll-off of 6dB/octave to beyond 100MHz. Typically, gain bandwidth product is 1GHz, and slew rate is ±300V/microsecond.

AM-1435's dc characteristics include a dc open loop gain of 100dB, 1MΩ input impedance, and an initial input offset voltage of only ±2mV. Input offset voltage drift is typically ±5μV/°C. Also featured is a minimum common mode rejection ratio of 80dB and full power frequency of 8MHz.

The AM-1435 is designed specifically for applications requiring high accuracy in the amplification of complex wideband waveforms. Such applications include radar and sonar signal processing, video instrumentation, ultrafast A/D and D/A converters and sample-hold amplifiers.

Power supply requirements are ±15V at 30mA maximum quiescent current. Models are specified for operation over the commercial (0 to +70°C), –40 to +100°C and military (–55 to +125°C) temperature ranges. A high-reliability version manufactured and screened to DATEL 's QL screening program is also available. The package is a 14-pin ceramic DIP.

PIN	FUNCTION
1	OPTIONAL BYPASS CAPACITOR
2	OUTPUT
3	COMPENSATION CAPACITOR
4	+15V SUPPLY (+V_S)
5	OFFSET ADJUST
6	OFFSET ADJUST
7	–INPUT
8	+INPUT
9	N.C.
10	N.C.
11	N.C.
12	–15V SUPPLY (–V_S)
13	OUTPUT CURRENT SINK
14	COMMON

FUNCTIONAL BLOCK DIAGRAM

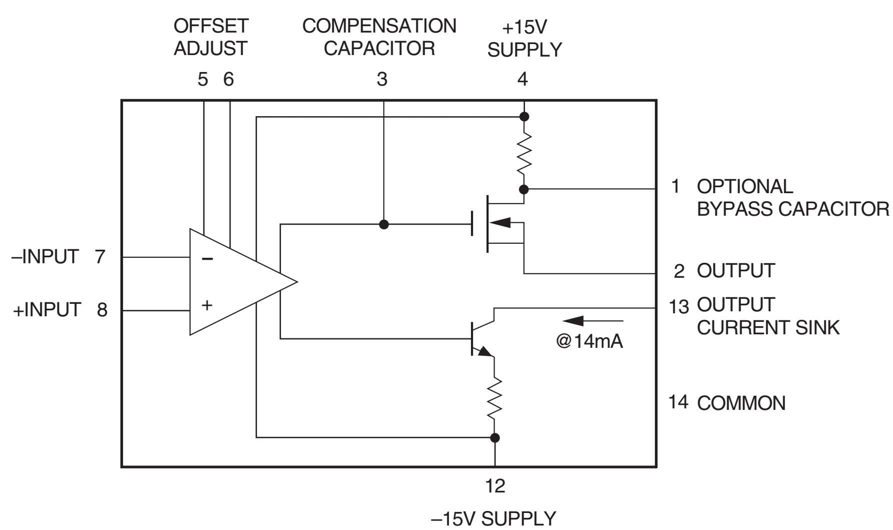


Figure 1. Functional Block Diagram

FUNCTIONAL SPECIFICATIONS

(Typical at +25°C and ±15V supplies, unless otherwise noted.)

INPUT	MIN.	TYP.	MAX.	UNITS
Differential Between Inputs	—	—	±4	Volts
Common Mode Voltage Range ①	±7	±8.5	—	Volts
Common Mode Rejection Ratio				
1MHz	—	70	—	dB
DC	73	100	—	dB
Input Impedance				
Common Mode	—	1 ‖ 2	—	MΩ ‖ pF
Differential Mode	—	2.5 ‖ 2	—	kΩ ‖ pF
Input Bias Current	—	±20	40	μA
Input Offset Current	—	±0.3	—	μA
Input Offset Voltage ②	—	±2	±5	mV
PERFORMANCE				
DC Open Loop Gain ③	88	100	—	dB
Input Offset Voltage Drift	—	±5	±25	μV/°C
Input Bias Current Drift	—	±50	±100	nA/°C
Input Offset Current Drift	—	±2	—	nA/°C
Input Voltage Noise				
0.01Hz to 10Hz	—	15	—	μVp-p
100Hz to 10kHz	—	1.6	—	μVrms
10Hz to 1MHz	—	5.2	—	μVrms
Input Current Noise ④				
0.01Hz to 10Hz	—	2.5	—	nAp-p
100Hz to 10kHz	—	2.5	—	nArms
10Hz to 1MHz	—	3.5	—	nArms
Power Supply Rejection Ratio	—	±0.15	—	mV/V
DYNAMIC CHARACTERISTICS				
Gain Bandwidth Product	700	1000	—	MHz
Unity Gain Bandwidth	—	150	—	MHz
Full Power Frequency ⑤	8	10	—	MHz
Settling Time				
10V to ±0.025% ⑥	—	60	—	ns
10V to ±0.01% ⑥	—	70	—	ns
5V to ±1.0%	—	25	—	ns
5V to ±0.1%	—	40	60	ns
1V to ±1.0%	—	10	—	ns
1V to ±0.1%	—	20	—	ns
Slew Rate ⑤	±250	±300	—	V/μs
Overshoot	—	1	—	%
Propagation Delay	—	5	—	ns
Rise Time (10V step)	—	40	—	ns
Overload Recovery Time	—	50	—	ns
OUTPUT				
Output Voltage ③	±5	±7	—	Volts
Output Current ③	±10	±14	—	mA
Stable Capacitative Load ⑦	—	1000	—	pF
POWER REQUIREMENTS				
Rated Supply Voltages	±12	±15	±16	Volts
Quiescent Current	—	±22	±30	mA

① Specified for dc linear operation. Common mode voltage range prior to fault condition is ±10V maximum.

② Adjustable to zero.

③ R_L = 500Ω.

④ Referred to input.

⑤ C1 = 0.5pF.

⑥ C1 = 1pF.

⑦ C1 = 3pF, noise gain >2.

⑧ Requires 18°C/W heat sink above +85°C.

PHYSICAL/ENVIRONMENTAL	MIN.	TYP.	MAX.	UNITS
Operating Temp. Range, Case				
AM-1435MC	0	—	+70	°C
AM-1435ME	–40	—	+100	°C
AM-1435MM, MM-QL ⑧	–55	—	+125	°C
Storage Temp. Range	–65	—	+150	°C
Package Type	14-pin, metal-sealed, ceramic DIP			

TECHNICAL NOTES

1. The use of good high-frequency circuit board layout techniques is required for rated performance. The extensive use of a ground plane for all common connections is recommended. Lead lengths should be kept to a minimum with point-to-point connections wired directly to the amplifier pins. 1μF tantalum bypass capacitors should be used at the ±15V supply pins.
2. Operation of the AM-1435MM and MM-QL over the +85 to +125°C temperature range requires additional thermal dissipation to achieve rated performance. Use of an 18°C/W heat sink is recommended.
3. No input protection is provided so as to maximize frequency response. As a result, several precautions must be observed. Do not apply the positive supply voltage before the negative supply. Do not apply signals to either input prior to power-up. If frequency response is not critical, installation of an external input-protection circuit is recommended.
4. A 1μF bypass capacitor (C4) connected from OPTIONAL BYPASS CAPACITOR (pin 1) to COMMON (pin 14) may be required to inhibit output oscillation when driving capacitive loads.
5. To ensure stable operation when the noise gain is less than 10, a 2pF compensation capacitor (C1) must be connected between pins 3 and 7. The value of the compensation capacitor may be application sensitive.
6. The AM-1435 is a prime choice as a current-to-voltage converter due to its excellent E_{OS} and I_{OS} temperature coefficient ratings. Input bias currents are easily compensated by adding a resistor from pin 8 to ground, which is equal to the parallel combination of the feedback resistor and input impedance.

ABSOLUTE MAXIMUM RATINGS, ALL MODELS

Positive Supply, Pin 4	+18V
Negative Supply, Pin 12	–18V
Lead Temperature (soldering, 10s)	300°C

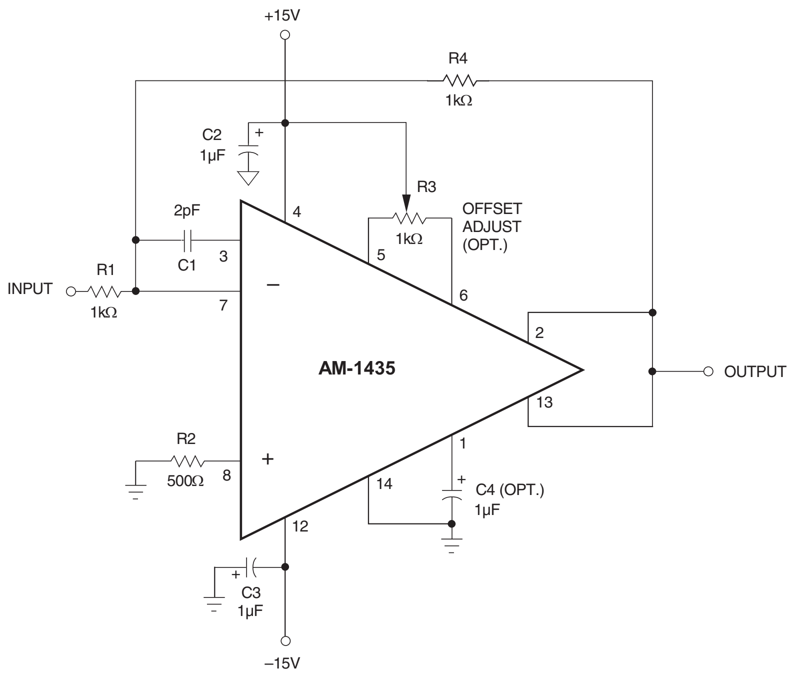


Figure 2. Typical Connection Diagram

TYPICAL CONNECTION AND COMPENSATION

The typical connection diagram (above) shows the AM-1435 in a unity-gain inverting configuration. When used in any conventional operational-amplifier configuration, the AM-1435 (as a non-inverting amplifier) requires a noise gain of at least two (noise gain = 1 + R4/R1).

The 2pF compensation capacitor, C1, at pin 3 is required for stable operation when the noise gain is less than 10. Compensation for bias current is provided by R2 and its value is determined by the formula:

$$R2 = \frac{(R1) \times (R4)}{R1 + R4}$$

The offset adjust potentiometer R3 and the compensation capacitor C4 are optional. Note, however, that C4 should be implemented when driving capacitive loads to prevent oscillation of the output stage.

Operation of the AM-1435 at low impedances requires careful attention to include the feedback resistor as a part of the total output load.

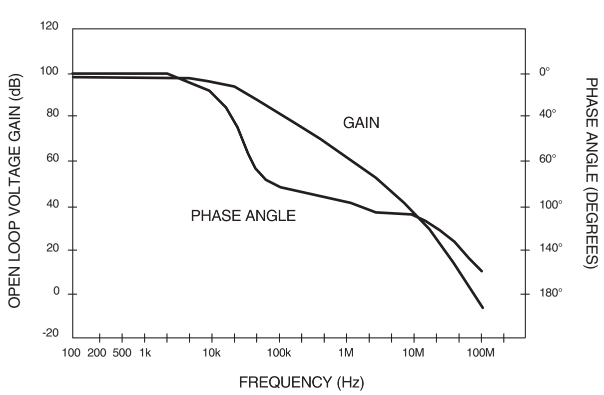


Figure 3. Gain and Phase vs. Frequency (Uncompensated)

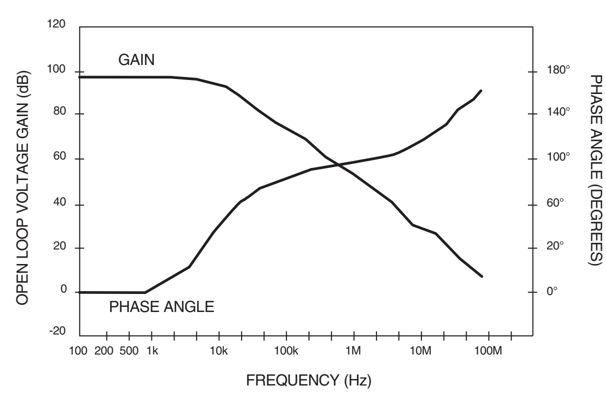


Figure 4. Gain and Phase vs. Frequency (Compensated 2pF)

PERFORMANCE CHARTS

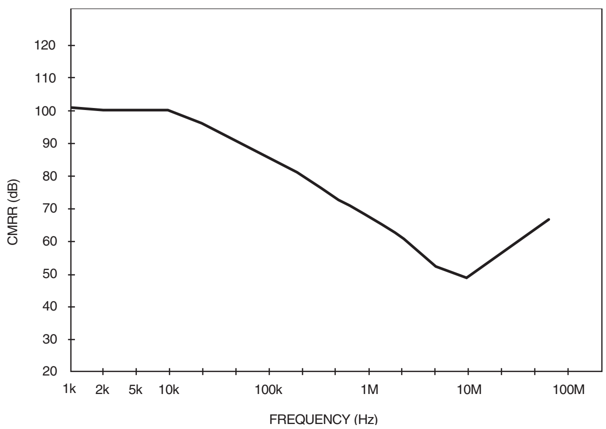


Figure 5. CMRR vs. Frequency

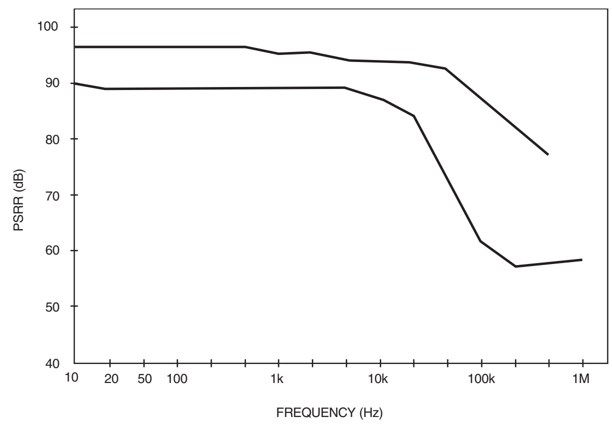
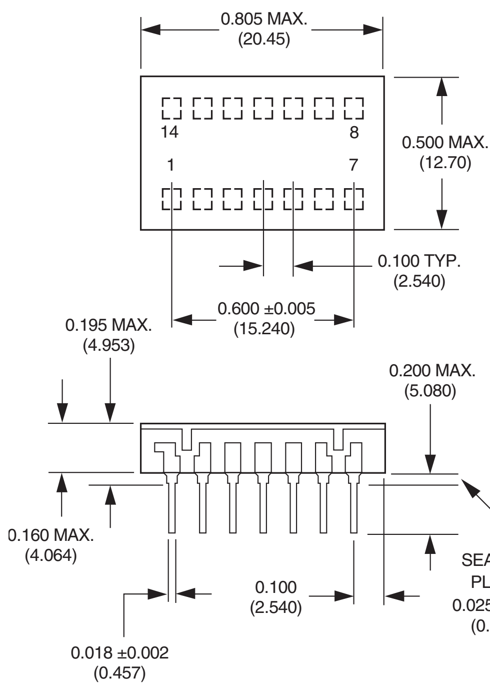


Figure 6. PSRR vs. Frequency

MECHANICAL DIMENSIONS - INCHES (mm)

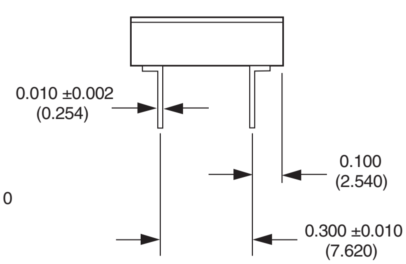


14-PIN DIP

Dimension Tolerances (unless otherwise indicated):
2 place decimal (.XX) ±0.010 (±0.254)
3 place decimal (.XXX) ±0.005 (±0.127)

Lead Material: Kovar alloy

Lead Finish: 50 microinches (minimum) gold plating over 100 microinches (nominal) nickel plating



ORDERING INFORMATION: NON-ROHS MODELS		ORDERING INFORMATION: ROHS MODELS	
MODEL NUMBER	OPERATING TEMP. RANGE	MODEL NUMBER	OPERATING TEMP. RANGE
AM-1435MC	0 to +70°C	AM-1435MC-C	0 to +70°C
AM-1435ME	–40 to +100°C	AM-1435ME-C	–40 to +100°C
AM-1435MM	–55 to +125°C	AM-1435MM-C	–55 to +125°C
AM-1435MM-QL	–55 to +125°C	AM-1435MM-QL-C	–55 to +125°C