# LMC6482 CMOS Dual Rail-To-Rail Input and Output Operational Amplifier

## General Description

The LMC6482 provides a common-mode range that extends to both supply rails. This rail-to-rail performance combined with excellent accuracy, due to a high CMRR, makes it unique among rail-to-rail input amplifiers.

It is ideal for systems, such as data acquisition, that require a large input signal range. The LMC6482 is also an excellent upgrade for circuits using limited common-mode range amplifiers such as the TLC272 and TLC277.

Maximum dynamic signal range is assured in low voltage and single supply systems by the LMC6482's rail-to-rail output swing. The LMC6482's rail-to-rail output swing is guaranteed for loads down to 600Ω.

Guaranteed low voltage characteristics and low power dissipation make the LMC6482 especially well-suited for battery-operated systems.

See the LMC6484 data sheet for a Quad CMOS operational amplifier with these same features.

## Features (Typical unless otherwise noted)

- Rail-to-Rail Input Common-Mode Voltage Range (Guaranteed Over Temperature)
- Rail-to-Rail Output Swing (within 20 mV of supply rail, 100 kΩ load)
- Guaranteed 3V, 5V and 15V Performance
- Excellent CMRR and PSRR 82 dB
- Ultra Low Input Current 20 fA
- High Voltage Gain ($R_L$ = 500 kΩ) 130 dB
- Specified for 2 kΩ and 600Ω loads

## Applications

- Data Acquisition Systems
- Transducer Amplifiers
- Hand-held Analytic Instruments
- Medical Instrumentation
- Active Filter, Peak Detector, Sample and Hold, pH Meter, Current Source
- Improved Replacement for TLC272, TLC277

## DC Electrical Characteristics

Unless otherwise specified, all limits guaranteed for $T_J$ = 25°C, $V^+$ = 5V, $V^-$ = 0V, $V_{CM}$ = $V_O$ = $V^+/2$ and $R_L$ > 1M. **Boldface** limits apply at the temperature extremes.

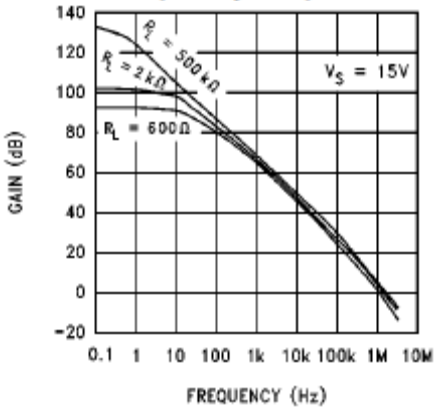
| Symbol | Parameter | Conditions | | Typ (Note 5) | LMC6482AI Limit (Note 6) | LMC6482I Limit (Note 6) | LMC6482M Limit (Note 6) | Units |
|---|---|---|---|---|---|---|---|---|
| $V_{OS}$ | Input Offset Voltage | | | 0.11 | 0.750<br>**1.35** | 3.0<br>**3.7** | 3.0<br>**3.8** | mV max |
| $TCV_{OS}$ | Input Offset Voltage Average Drift | | | 1.0 | | | | μV/°C |
| $I_B$ | Input Current | (Note 13) | | 0.02 | **4.0** | **4.0** | **10.0** | pA max |
| $I_{OS}$ | Input Offset Current | (Note 13) | | 0.01 | **2.0** | **2.0** | **5.0** | pA max |
| $C_{IN}$ | Common-Mode Input Capacitance | | | 3 | | | | pF |
| $R_{IN}$ | Input Resistance | | | >10 | | | | TeraΩ |
| CMRR | Common Mode Rejection Ratio | 0V ≤ $V_{CM}$ ≤ 15.0V<br>$V^+$ = 15V | | 82 | 70<br>**67** | 65<br>**62** | 65<br>**60** | dB min |
| | | 0V ≤ $V_{CM}$ ≤ 5.0V<br>$V^+$ = 5V | | 82 | 70<br>**67** | 65<br>**62** | 65<br>**60** | |
| +PSRR | Positive Power Supply Rejection Ratio | 5V ≤ $V^+$ ≤ 15V, $V^-$ = 0V<br>$V_O$ = 2.5V | | 82 | 70<br>**67** | 65<br>**62** | 65<br>**60** | dB min |
| −PSRR | Negative Power Supply Rejection Ratio | −5V ≤ $V^-$ ≤ −15V, $V^+$ = 0V<br>$V_O$ = −2.5V | | 82 | 70<br>**67** | 65<br>**62** | 65<br>**60** | dB min |
| $V_{CM}$ | Input Common-Mode Voltage Range | $V^+$ = 5V and 15V<br>For CMRR ≥ 50 dB | | $V^-$ − 0.3 | − 0.25<br>**0** | − 0.25<br>**0** | − 0.25<br>**0** | V max |
| | | | | $V^+$ + 0.3V | $V^+$ + 0.25<br>**$V^+$** | $V^+$ + 0.25<br>**$V^+$** | $V^+$ + 0.25<br>**$V^+$** | V min |
| $A_V$ | Large Signal Voltage Gain | $R_L$ = 2 kΩ<br>(Notes 7, 13) | Sourcing | 666 | 140<br>**84** | 120<br>**72** | 120<br>**60** | V/mV min |
| | | | Sinking | 75 | 35<br>**20** | 35<br>**20** | 35<br>**18** | V/mV min |
| | | $R_L$ = 600Ω<br>(Notes 7, 13) | Sourcing | 300 | 80<br>**48** | 50<br>**30** | 50<br>**25** | V/mV min |
| | | | Sinking | 35 | 20<br>**13** | 15<br>**10** | 15<br>**8** | V/mV min |

## AC Electrical Characteristics

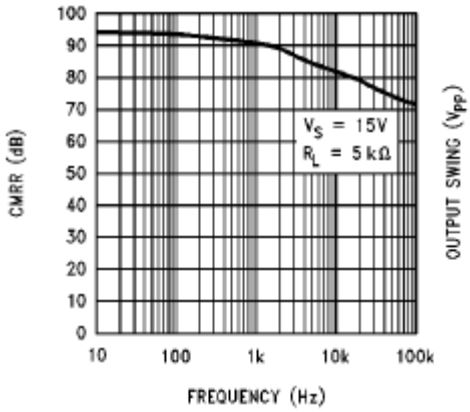
Unless otherwise specified, all limits guaranteed for $T_J$ = 25°C, $V^+$ = 5V, $V^-$ = 0V, $V_{CM}$ = $V_O$ = $V^+/2$, and $R_L$ > 1M. **Boldface** limits apply at the temperature extremes.

| Symbol | Parameter | Conditions | Typ (Note 5) | LMC6482AI Limit (Note 6) | LMC6482I Limit (Note 6) | LMC6482M Limit (Note 6) | Units |
|---|---|---|---|---|---|---|---|
| SR | Slew Rate | (Note 9) | 1.3 | 1.0<br>**0.7** | 0.9<br>**0.63** | 0.9<br>**0.54** | V/µs<br>min |
| GBW | Gain-Bandwidth Product | $V^+$ = 15V | 1.5 | | | | MHz |
| $\phi_m$ | Phase Margin | | 50 | | | | Deg |
| $G_m$ | Gain Margin | | 15 | | | | dB |
| | Amp-to-Amp Isolation | (Note 10) | 150 | | | | dB |
| $e_n$ | Input-Referred Voltage Noise | F = 1 kHz<br>$V_{cm}$ = 1V | 37 | | | | nV/√ Hz |
| $i_n$ | Input-Referred Current Noise | F = 1 kHz | 0.03 | | | | pA/√ Hz |
| T.H.D. | Total Harmonic Distortion | F = 10 kHz, $A_V$ = −2<br>$R_L$ = 10 kΩ, $V_O$ = 4.1 $V_{PP}$ | 0.01 | | | | % |
| | | F = 10 kHz, $A_V$ = −2<br>$R_L$ = 10 kΩ, $V_O$ = 8.5 $V_{PP}$<br>$V^+$ = 10V | 0.01 | | | | % |

**Open Loop Frequency Response**




**CMRR vs Frequency**




**Maximum Output Swing vs Frequency**