

PROGRAMMABLE QUAD BIPOLEAR OPERATIONAL AMPLIFIER

- PROGRAMMABLE ELECTRICAL CHARACTERISTICS
- LOW SUPPLY CURRENT (250µA/amplifier)
- GAIN-BANDWIDTH PRODUCT : 1MHz
- LARGE DC VOLTAGE GAIN : 120dB
- LOW NOISE VOLTAGE : 28nV/√Hz
- WIDE POWER SUPPLY RANGE / ±1.5V to ±22V
- CLASSE AB OUTPUT STAGE. NO CROSS-OVER DISTORTION
- OVERLOAD PROTECTION FOR INPUTS AND OUTPUTS

DESCRIPTION

The LM346 consists of four independent, high gain, internally compensated, low power programmable amplifiers. Two external resistors (R_{set}) allow the user to program the gain-bandwidth product, slew rate, supply current, input bias current, input offset current and input noise. For example the user can trade-off supply current for bandwidth or optimize noise figure for a given source resistance. In a similar way other amplifier characteristics can be tailored to the application.

Except for the two programming pins at the end of the package the LM346 pin out is the same as the LM324 and LM348.

PROGRAMMING EQUATIONS :

Total supply current = 1mA ($I_{set} = 10\mu A$)
 Gain bandwidth product = 1MHz ($I_{set} = 10\mu A$)
 Slew rate = 0.5V/µs ($I_{set} = 10\mu A$)
 Input bias current ≈ 30nA ($I_{set} = 10\mu A$)
 I_{set} = current into pin 8 and pin 9 (see schematic diagram)

$$I_{set} = \frac{V_{cc+} - V_{cc-} - 0.6V}{R_{set}}$$

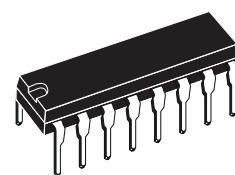
ORDER CODE

| Part Number | Temperature Range | Package |
|-------------|-------------------|---------|
| | | N |
| LM146 | -55°C, +125°C | • |
| LM246 | -40°C, +105°C | • |
| LM346 | 0°C, +70°C | • |

Example : LM246N

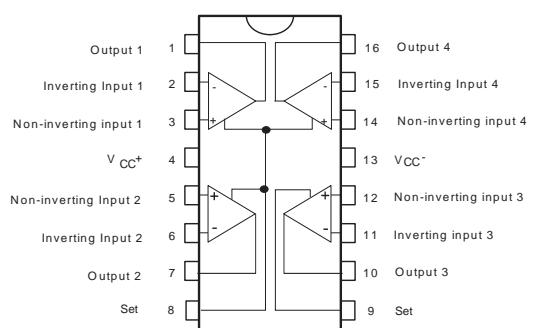
N = Dual in Line Package (DIP))

April 2003

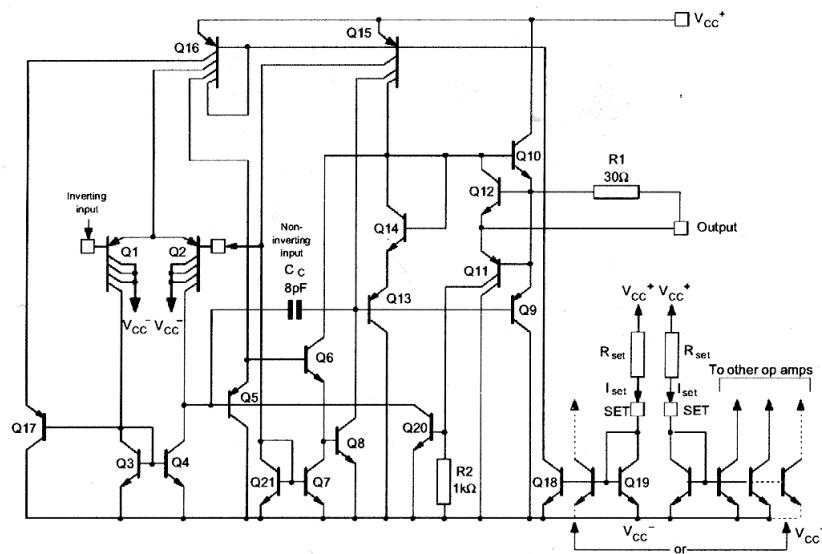


N
DIP16
(Plastic Package)

PIN CONNECTIONS (top view)



SCHEMATIC DIAGRAM (1/4 LM146)



ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|-------------------|---|--|------|
| V _{CC} | Supply voltage | ±22 | V |
| V _i | Input Voltage ¹⁾ | ±15 | V |
| V _{id} | Differential Input Voltage | ±30 | V |
| | Output Short-circuit Duration ²⁾ | Infinite | |
| P _{tot} | Power Dissipation | 500 | mW |
| T _{oper} | Operating Free-air Temperature Range LM146 LM246 LM346 | -55 to +125 40 to +105 0 to +70- | °C |
| T _{stg} | Storage Temperature Range | -65 to +150 | °C |

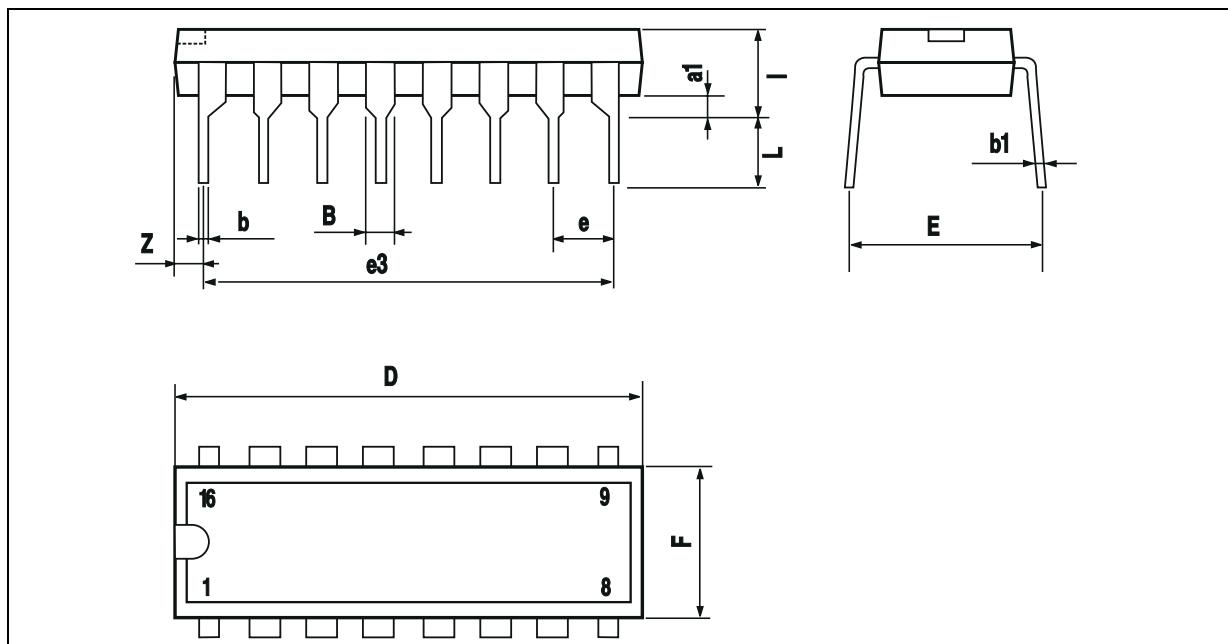
1. For supply voltage less than ±15V, the absolute maximum input voltage is equal to the supply voltage.
2. Any of the amplifier outputs can be shorted to ground indefinitely; however more than one should not be simultaneously shorted as the maximum junction will be exceeded.

ELECTRICAL CHARACTERISTICS $V_{CC}^+ = \pm 15V$, $I_{set} = 10\mu A$, $T_{amb} = +25^\circ C$ (unless otherwise specified)

| Symbol | Parameter | LM146 | | | LM246 - LM346 | | | Unit |
|-----------------|---|--------------------------|-------|------------|--------------------------|-------|------------|------------------------|
| | | Min. | Typ. | Max. | Min. | Typ. | Max. | |
| V_{io} | Input Offset Voltage ($R_s \leq 10k\Omega$) $T_{amb} = 25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$ | | 0.5 | 3 5 | | 0.5 | 5 6 | mV |
| I_{io} | Input Offset Current $T_{amb} = 25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$ | | 2 | 20 25 | | 2 | 100 100 | nA |
| I_{ib} | Input Bias Current $T_{amb} = 25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$ | | 30 | 100 100 | | 30 | 250 250 | nA |
| A_{vd} | Large Signal Voltage Gain ($V_o = \pm 10V$, $R_L = 10k\Omega$) $T_{amb} = 25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$ | 100 50 | 1000 | | 50 25 | 1000 | | V/mV |
| SVR | Supply Voltage Rejection Ratio ($R_s \leq 10k\Omega$) $T_{amb} = 25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$ | 80 80 | 110 | | 80 80 | 110 | | dB |
| I_{cc} | Supply Current, all Amp, no load $T_{amb} = 25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$ | | 1 | 2 2 | | 1 | 2 2 | mA |
| V_{icm} | Input Common Mode Voltage Range $T_{amb} = 25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$ | ± 13.5 ± 13.5 | | | ± 13.5 ± 13.5 | | | |
| CMR | Common Mode Rejection Ratio ($R_s \leq 10k\Omega$) $T_{amb} = 25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$ | 80 70 | 110 | | 80 70 | 110 | | dB |
| I_{os} | Output Short-circuit Current $T_{amb} = 25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$ | 10 4 | 20 | 30 35 | 10 4 | 20 | 30 35 | mA |
| $\pm V_{opp}$ | Output Voltage Swing ($R_L \leq 10k\Omega$) $T_{amb} = 25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$ | 12 12 | 14 | | 12 12 | 14 | | V |
| SR | Slew Rate ($V_I = \pm 10V$, $R_L = 10k\Omega$, $C_L = 100pF$, unity Gain) | 0.3 | 0.5 | | 0.3 | 0.5 | | V/ μs |
| R_I | Input Resistance | | 1 | | | 1 | | M Ω |
| C_I | Input Capacitance | | 2 | | | 2 | | pF |
| V_{o1}/V_{o2} | Channel Separation ($R_L = 10k\Omega$, $V_o = 12V_{pp}$) | | 120 | | | 120 | | dB |
| GBP | Gain Bandwidth Product ($V_I = 10 mV$, $R_L = 10k\Omega$, $C_L = 100pF$ $f = 100kHz$) | 0.8 | 1 | | 0.5 | 1 | | MHz |
| THD | Total Harmonic Distortion ($f = 1kHz$, $A_v = 20dB$, $R_L = 10k\Omega$ $C_L = 100pF$, $V_o = 2V_{pp}$) | | 0.015 | | | 0.015 | | % |
| e_n | Equivalent Input Noise Voltage ($f = 1kHz$, $R_s = 100\Omega$) | | 28 | | | 28 | | $\frac{nV}{\sqrt{Hz}}$ |

PACKAGE MECHANICAL DATA

16 PINS - PLASTIC PACKAGE



| Dim. | Millimeters | | | Inches | | |
|------|-------------|-------|------|--------|-------|-------|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| a1 | 0.51 | | | 0.020 | | |
| B | 0.77 | | 1.65 | 0.030 | | 0.065 |
| b | | 0.5 | | | 0.020 | |
| b1 | | 0.25 | | | 0.010 | |
| D | | | 20 | | | 0.787 |
| E | | 8.5 | | | 0.335 | |
| e | | 2.54 | | | 0.100 | |
| e3 | | 17.78 | | | 0.700 | |
| F | | | 7.1 | | | 0.280 |
| i | | | 5.1 | | | 0.201 |
| L | | 3.3 | | | 0.130 | |
| Z | | | 1.27 | | | 0.050 |

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