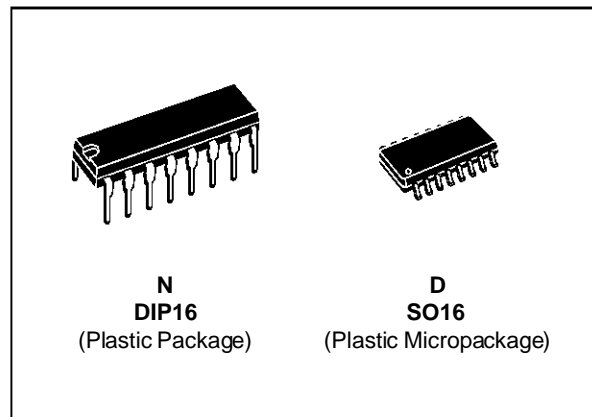


PROGRAMMABLE QUAD BIPOLAR OPERATIONAL AMPLIFIERS

- PROGRAMMABLE ELECTRICAL CHARACTERISTICS
- BATTERY POWERED OPERATION
- 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



ORDER CODES

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

Example : LM246N

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 ($I_{set} = 10\mu A$)

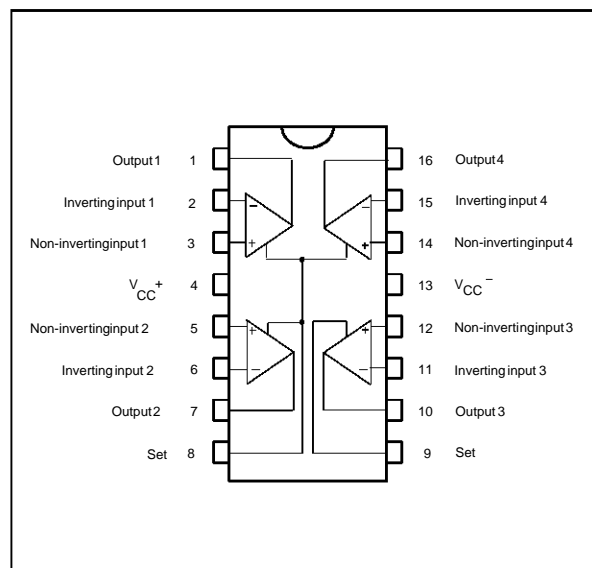
Input bias current ≈ 30 nA ($I_{set} = 10\mu A$)

I_{set} = current into pin 8 and pin 9

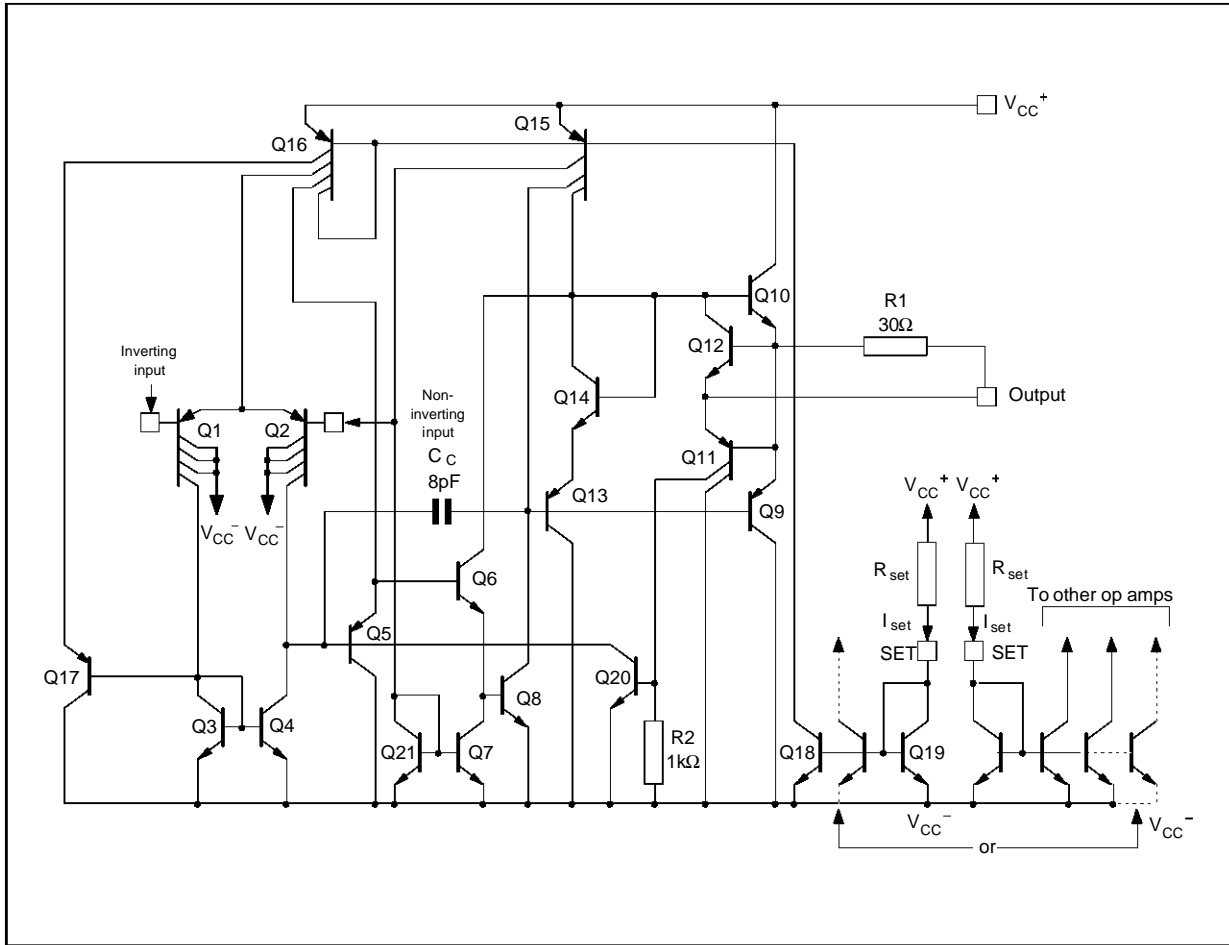
(see schematic diagram)

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

PIN CONNECTIONS (top view)



SCHEMATIC DIAGRAM (1/4 LM146)



ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | LM146 | LM246 | LM346 | Unit |
|------------|--|-------------|-------------|-------------|------|
| V_{CC} | Supply Voltage | ± 22 | ± 22 | ± 22 | V |
| V_i | Input Voltage - (note 1) | ± 15 | ± 15 | ± 15 | V |
| V_{id} | Differential Input Voltage | ± 30 | ± 30 | ± 30 | V |
| | Output Short-circuit Duration - (note 2) | Infinite | | | |
| P_{tot} | Power Dissipation N/D Suffix | 500 | | | mW |
| T_{oper} | Operating Free-air Temperature Range | -55 to +125 | -40 to +105 | 0 to +70 | °C |
| T_{stg} | Storage Temperature Range | -65 to +150 | -65 to +150 | -65 to +150 | °C |

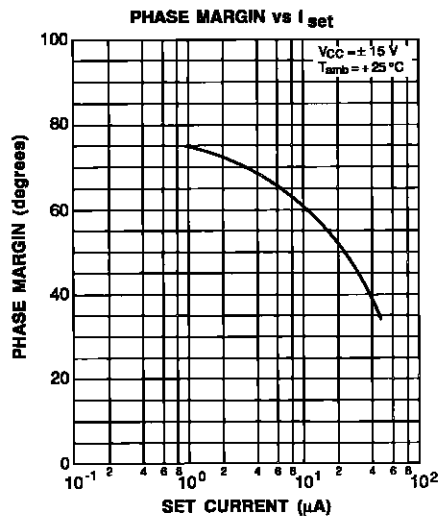
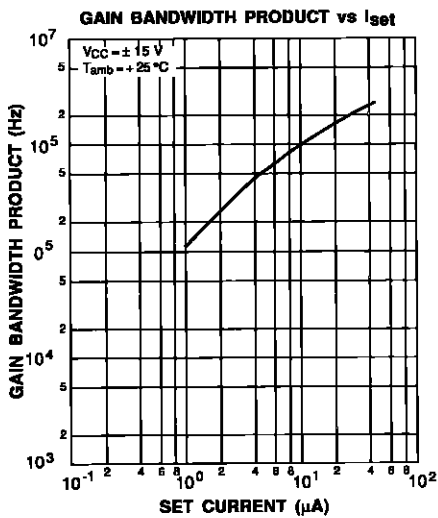
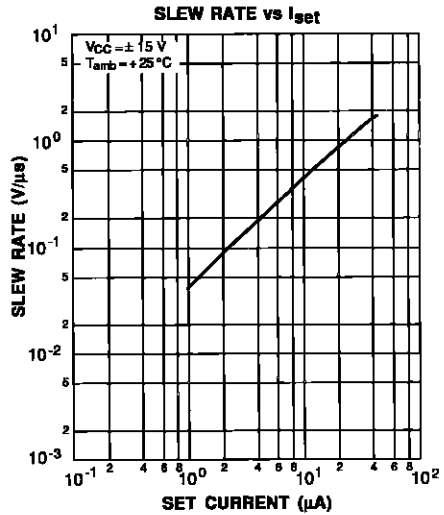
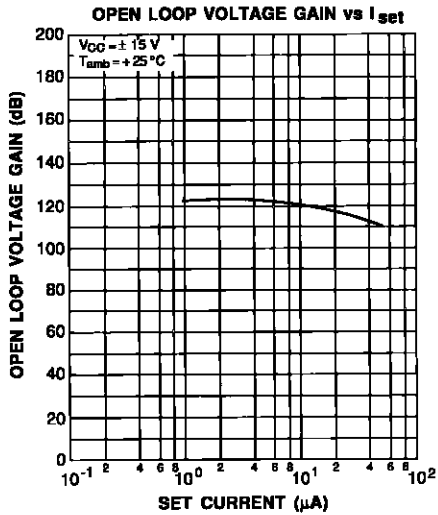
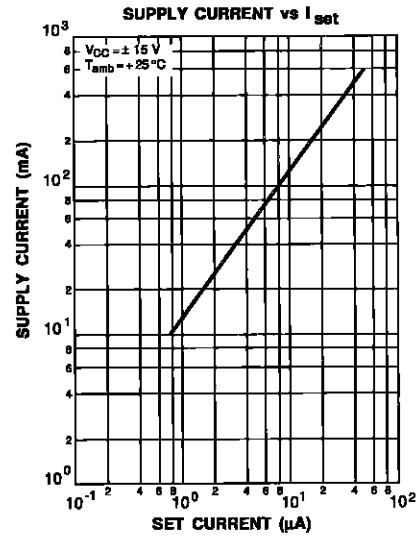
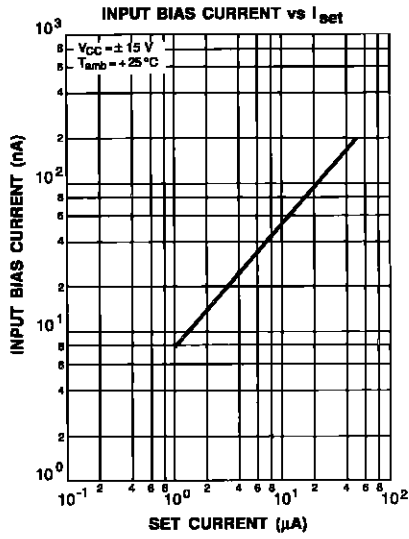
Notes : 1. For supply voltages less than $\pm 15V$, the absolute maximum input voltage is equal to the supply voltage.
 2. Any of the amplifier outputs can be shorted to ground indefinitely ; however more than one should not be simultaneously shorted as the maximum junction temperature will be exceeded.

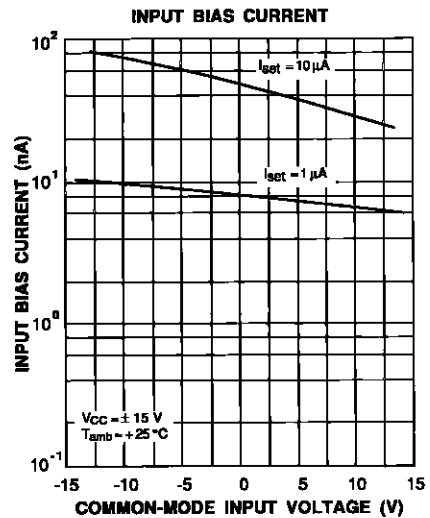
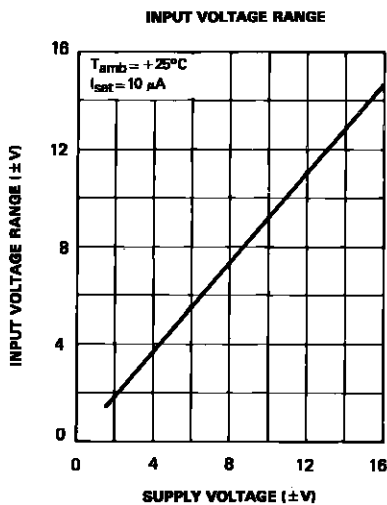
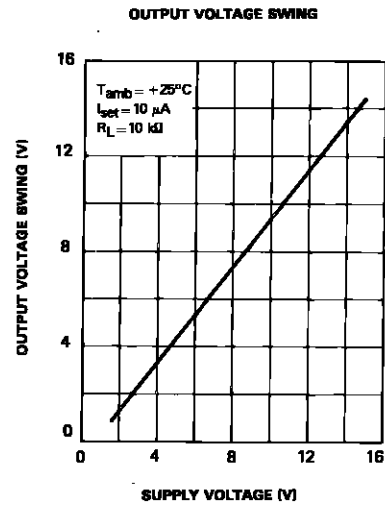
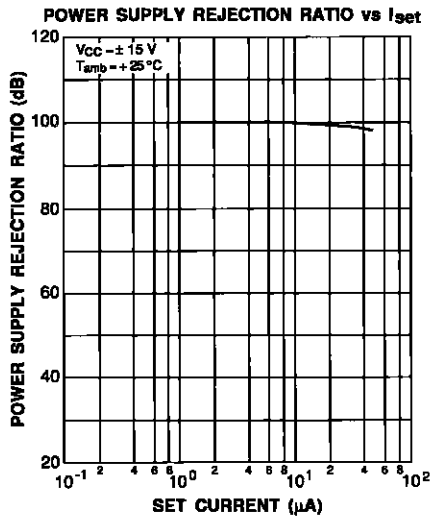
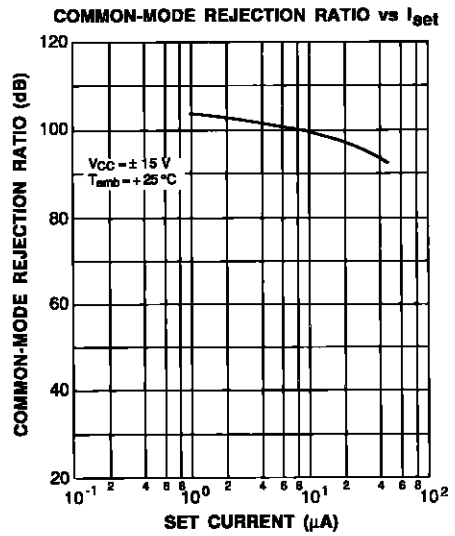
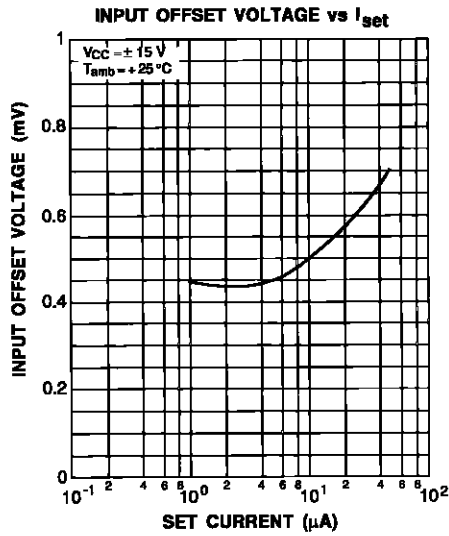
LM146 - LM246 - LM346

ELECTRICAL CHARACTERISTICS

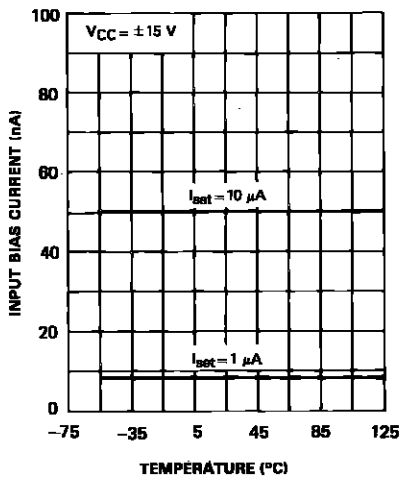
$V_{CC} = \pm 15V$, $I_{set} = 10\mu A$, $T_{amb} = +25^{\circ}C$ (unless otherwise specified)

| 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 | | | V |
| 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 ($R_L = 10k\Omega$) $T_{amb} = 25^{\circ}C$ $T_{min.} \leq T_{amb} \leq T_{max.}$ | 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 | | $\frac{nV}{\sqrt{Hz}}$ |

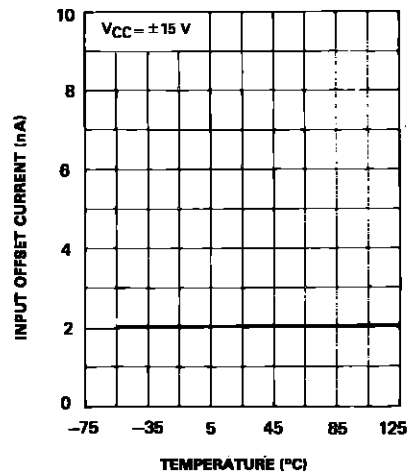




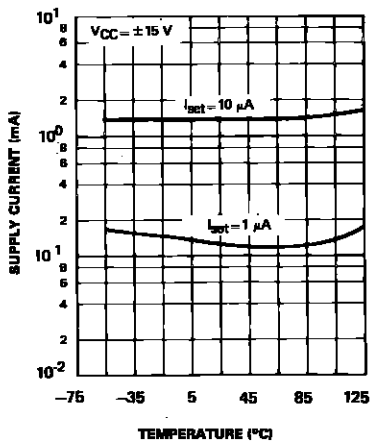
INPUT BIAS CURRENT vs TEMPERATURE



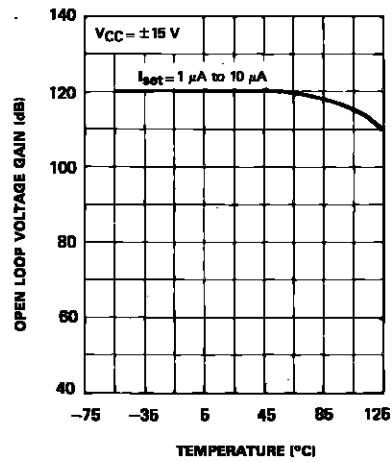
INPUT OFFSET CURRENT vs TEMPERATURE



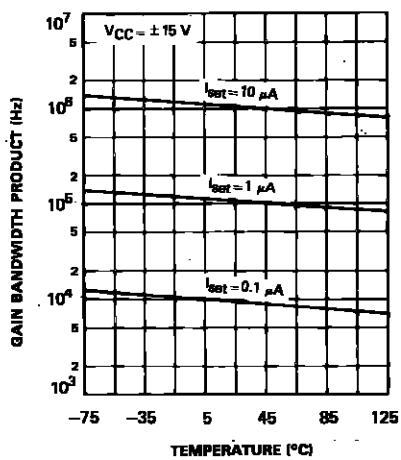
SUPPLY CURRENT vs TEMPERATURE



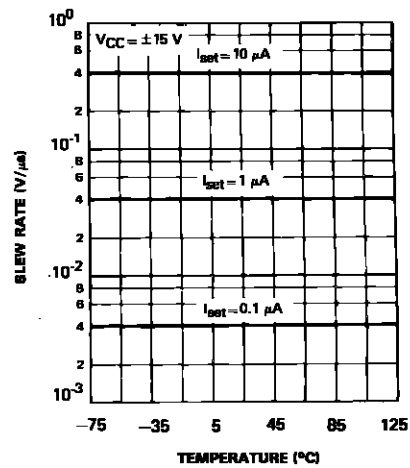
OPEN LOOP VOLTAGE GAIN vs TEMPERATURE

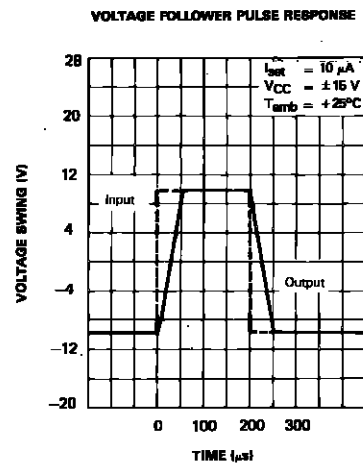
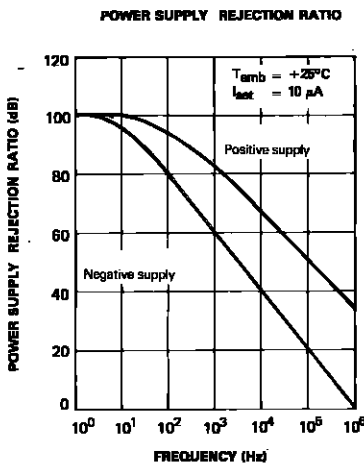
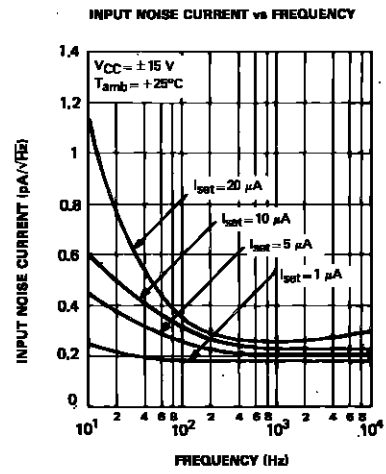
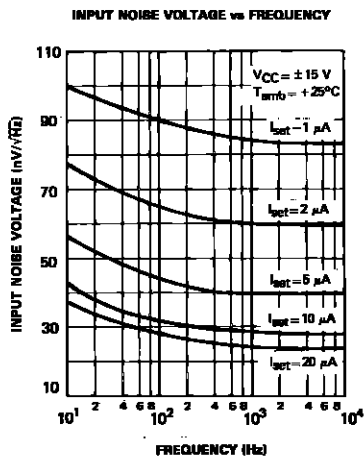


GAIN BANDWIDTH PRODUCT vs TEMPERATURE

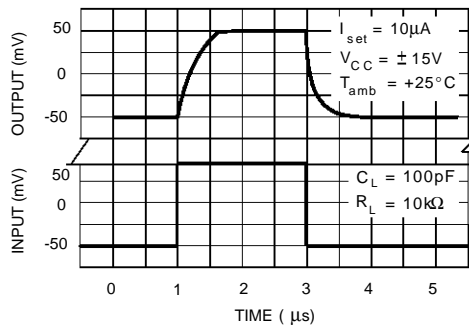


SLEW RATE vs TEMPERATURE

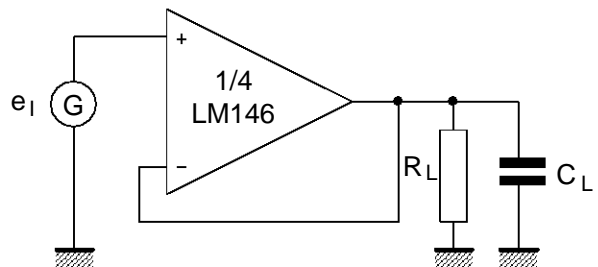




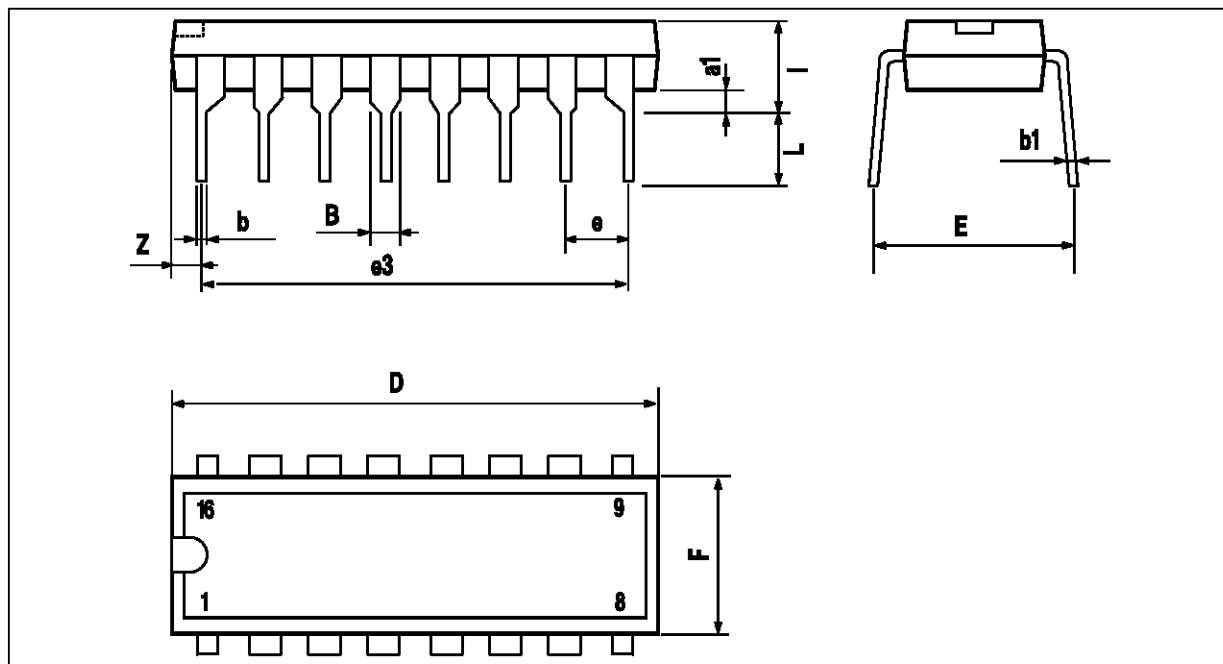
VOLTAGE FOLLOWER TRANSIENT RESPONSE



TRANSIENT RESPONSE TEST CIRCUIT



PACKAGE MECHANICAL DATA
16 PINS - PLASTIC DIP

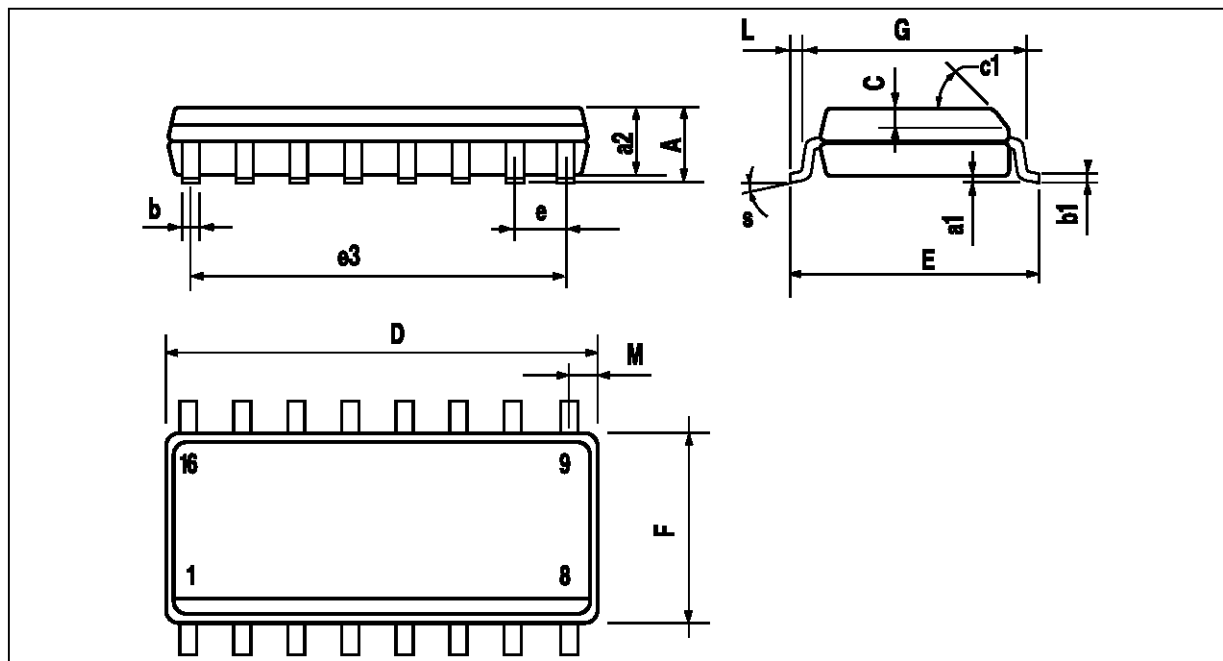


| Dimensions | Millimeters | | | Inches | | |
|------------|-------------|-------|------|--------|-------|-------|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| a1 | 0.51 | | | 0.020 | | |
| B | 0.77 | | 1.65 | 0.030 | | 0.065 |
| b | | 0.5 | | | 0.020 | |
| b1 | | 0.25 | | | 0.010 | |
| D | | | 20 | | | 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 |

PM-DIP16EPS

DIP16.TBL

PACKAGE MECHANICAL DATA
16 PINS - PLASTIC MICROPACKAGE (SO)



PM-SO16EFS

| Dimensions | Millimeters | | | Inches | | |
|------------|-------------|------|------|--------|-------|-------|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | | | 1.75 | | | 0.069 |
| a1 | 0.1 | | 0.2 | 0.004 | | 0.008 |
| a2 | | | 1.6 | | | 0.063 |
| b | 0.35 | | 0.46 | 0.014 | | 0.018 |
| b1 | 0.19 | | 0.25 | 0.007 | | 0.010 |
| C | | 0.5 | | | 0.020 | |
| c1 | 45° (typ.) | | | | | |
| D | 9.8 | | 10 | 0.386 | | 0.394 |
| E | 5.8 | | 6.2 | 0.228 | | 0.244 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 8.89 | | | 0.350 | |
| F | 3.8 | | 4.0 | 0.150 | | 0.157 |
| G | 4.6 | | 5.3 | 0.181 | | 0.209 |

SO16.TBL

Information furnished is believed to be accurate and reliable. However, SGS-THOMSON Microelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of SGS-THOMSON Microelectronics. Specification mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. SGS-THOMSON Microelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of SGS-THOMSON Microelectronics.

© 1997 SGS-THOMSON Microelectronics – Printed in Italy – All Rights Reserved

SGS-THOMSON Microelectronics GROUP OF COMPANIES
Australia - Brazil - Canada - China - France - Germany - Hong Kong - Italy - Japan - Korea - Malaysia - Malta - Morocco
The Netherlands - Singapore - Spain - Sweden - Switzerland - Taiwan - Thailand - United Kingdom - U.S.A.

ORDER CODE :