



LM146
LM246
LM346

PROGRAMMABLE QUAD BIPOLAR 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)

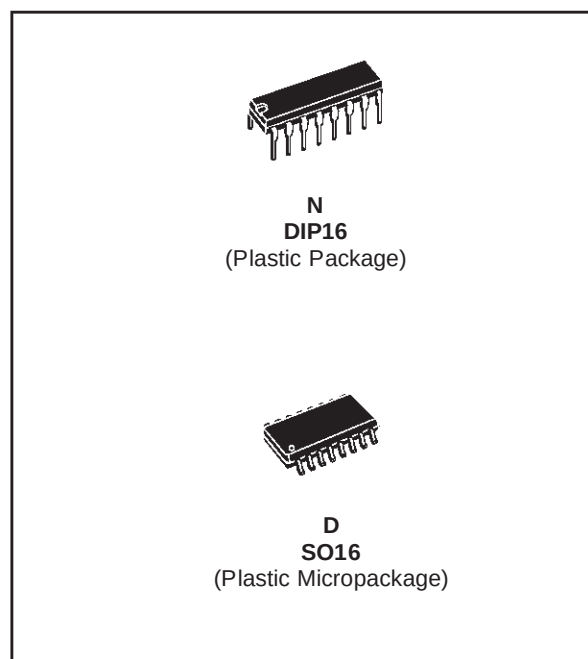
$$I_{set} = \frac{V_{cc+} - V_{cc-} - 0.6V}{R_{set}}$$

ORDER CODE

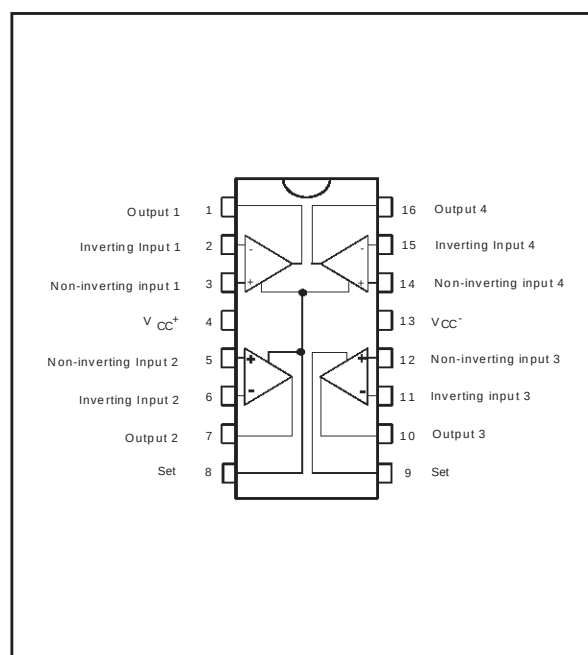
Part Number	Temperature Range	Package	
		N	D
LM146	-55°C, +125°C	•	•
LM246	-40°C, +105°C	•	•
LM346	0°C, +70°C	•	•
Example : LM246N			

N = Dual in Line Package (DIP)
D = Small Outline Package (SO) - also available in Tape & Reel (DT)

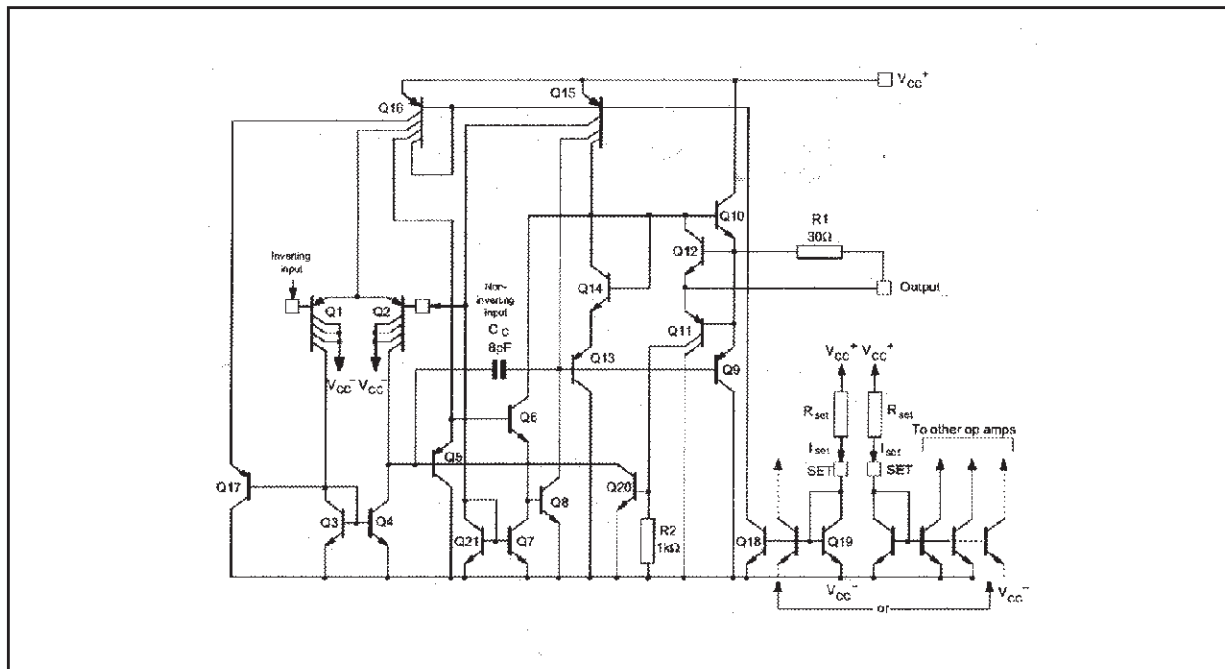
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PIN CONNECTIONS (top view)



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 N/D Suffix	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

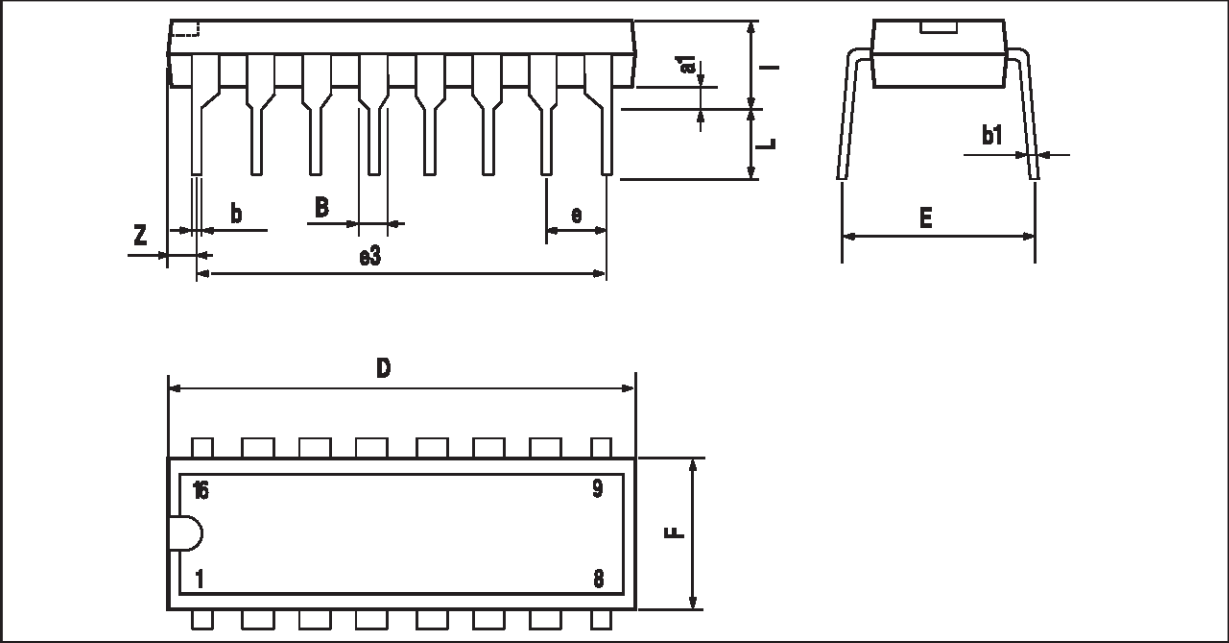
1. For supply voltage less than $\pm 15V$, the absolute maximum input voltage is equal to the supply voltage.

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 will be exceeded.

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

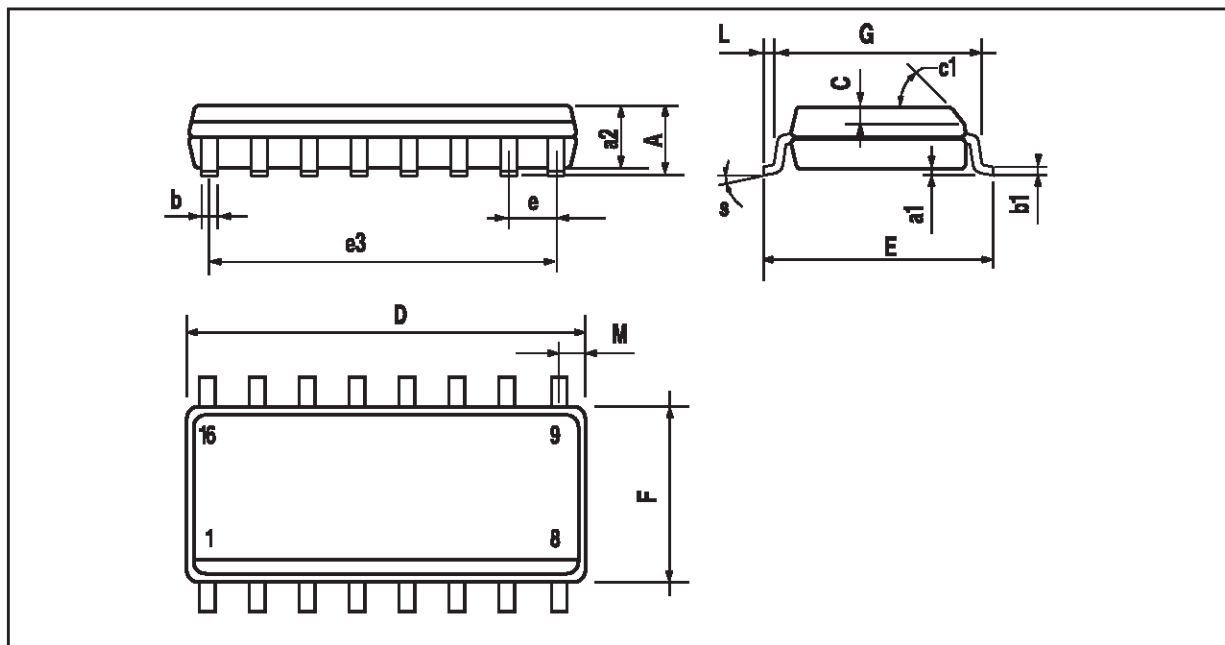
Symbol	Parameter	LM146			LM246 - LM346			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{io}	Input Offset Voltage ($R_s \leq 10k\Omega$) $T_{amb} = 25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$		0.5	3 5		0.5	5 6	mV
I_{io}	Input Offset Current $T_{amb} = 25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$		2	20 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

PACKAGE MECHANICAL DATA
16 PINS - PLASTIC MICROPACKAGE



Dim.	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
L	0.5		1.27	0.020		0.050
M			0.62			0.024
S	8° (max.)					

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