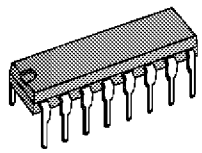
SGS-THOMSON MICROELECTRONICS

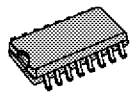
LM146
LM246 - LM346

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 CROSSOVER DISTORTION
- OVERLOAD PROTECTION FOR INPUTS AND OUTPUTS



N
DIP16
(Plastic Package)



D
SO16
(Plastic Micropackage)

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			

146-01.TBL

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-bandwith 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.

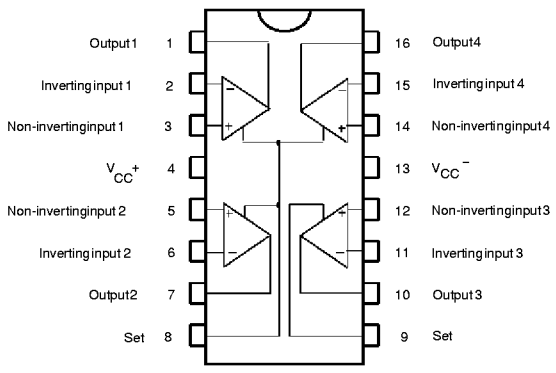
Except for the two programming pins at the end of the package the LM346 pin out is the same as the LM324 and LM348.

PROGRAMMING EQUATIONS :

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

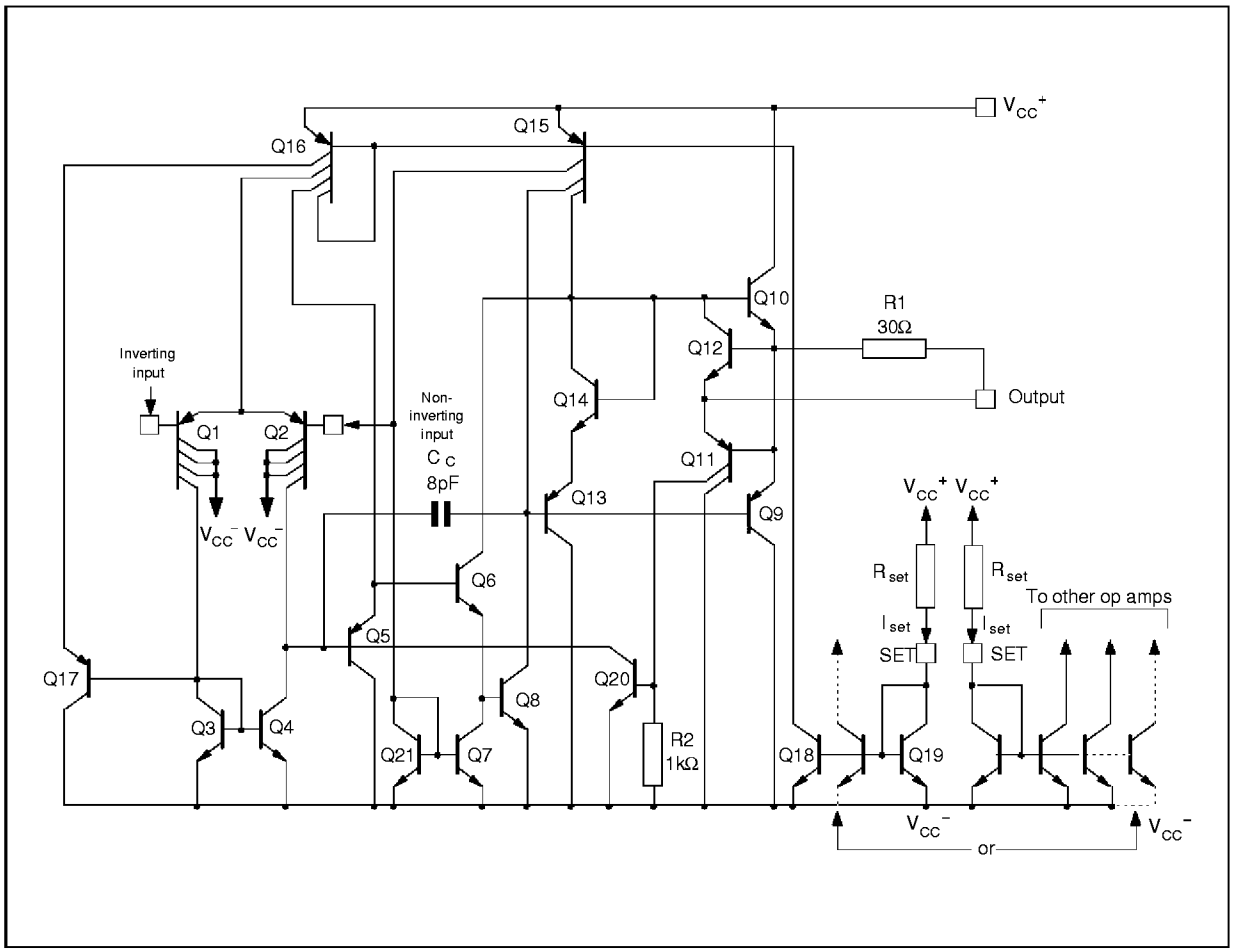
$$I_{set} = \frac{V_{CC}^{+} \pm V_{CC}^{\pm} \pm 0.6V}{R_{set}}$$

PIN CONNECTIONS (top view)



146-01.EPS

SCHEMATIC DIAGRAM (1/4 LM146)



146-02.EPS

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

146-02.TBL

Notes : 1. For supply voltages 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 indefinitly ; however more than one should not be simultaneously shorted as the maximum junction temperature will be exceeded.

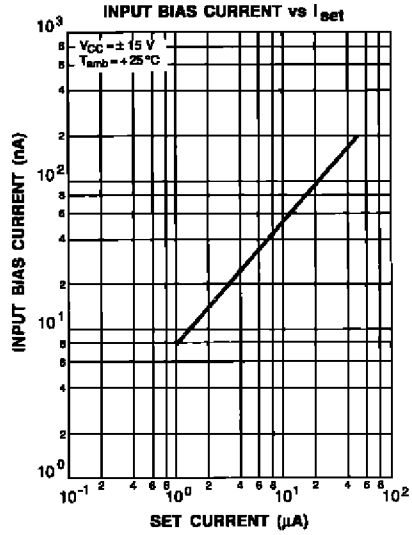
ELECTRICAL CHARACTERISTICS

V_{CC} = ±15V, I_{set} = 10µA, T_{amb} = +25°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°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°C $T_{min.} \leq T_{amb} \leq T_{max.}$		2	20 25		2	100 100	nA
I_{ib}	Input Bias Current T_{amb} = 25°C $T_{min.} \leq T_{amb} \leq T_{max.}$		30	100 100		30	250 250	nA
A_{vd}	Large Signal Voltage Gain (V_o = ±10V, R_L = 10kΩ) T_{amb} = 25°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°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°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°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°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°C $T_{min.} \leq T_{amb} \leq T_{max.}$	 10 4	 20	 30 35	 10 4	 20	 30 35	mA
± V_{opp}	Output Voltage Swing (R_L = 10kΩ) T_{amb} = 25°C $T_{min.} \leq T_{amb} \leq T_{max.}$	 12 12	 14		 12 12	 14		V
SR	Slew Rate (V_I = ±10V, R_L = 10kΩ, C_L = 100pF, T_{amb} = 25°C, unity Gain)	 0.3	 0.5		 0.3	 0.5		V/µs
R_I	Input Resistance		1			1		MΩ
C_I	Input Capacitance		2			2		pF
V_{o1}/V_{o2}	Channel Separation (R_L = 10kΩ, V_o = 12V_{pp})		120			120		dB
GBP	Gain Bandwidth Product (V_I = 10 mV, R_L = 10kΩ, C_L = 100pF f = 100kHz, T_{amb} = 25°C)	 0.8	 1		 0.5	 1		MHz
THD	Total Harmonic Distortion (f = 1kHz, A_v = 20dB, R_L = 10kΩ C_L = 100pF, T_{amb} = 25°C, v_o = 2V_{pp})		 0.015			 0.015		%
e_n	Equivalent Input Noise Voltage (f = 1kHz, R_S = 100Ω)		28			28		$\frac{nV}{\sqrt{Hz}}$

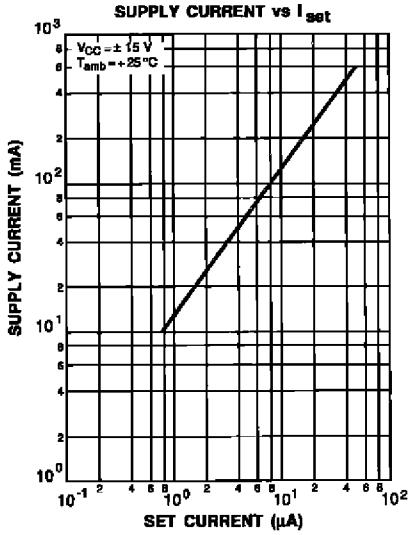
146-03.TBL

INPUT BIAS CURRENT vs I_{set}



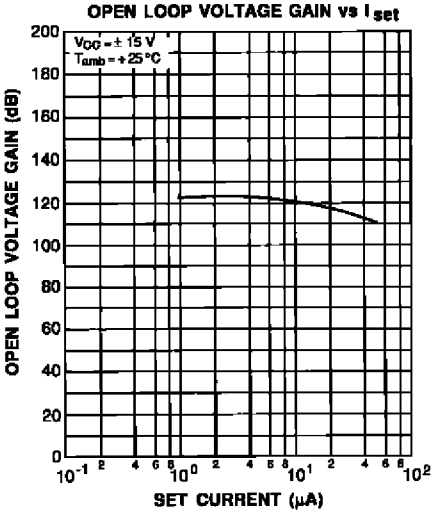
146-03.EPS

SUPPLY CURRENT vs I_{set}



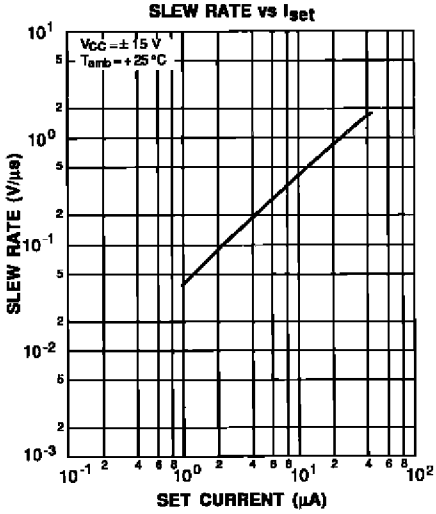
146-04.EPS

OPEN LOOP VOLTAGE GAIN vs I_{set}



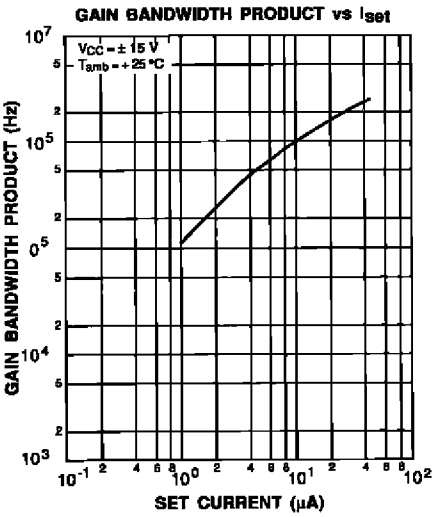
146-05.EPS

SLEW RATE vs I_{set}



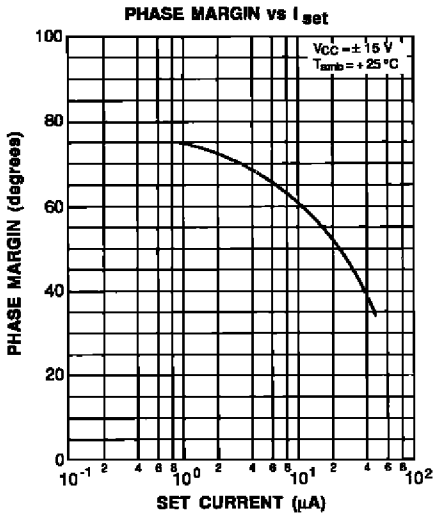
146-06.EPS

GAIN BANDWIDTH PRODUCT vs I_{set}



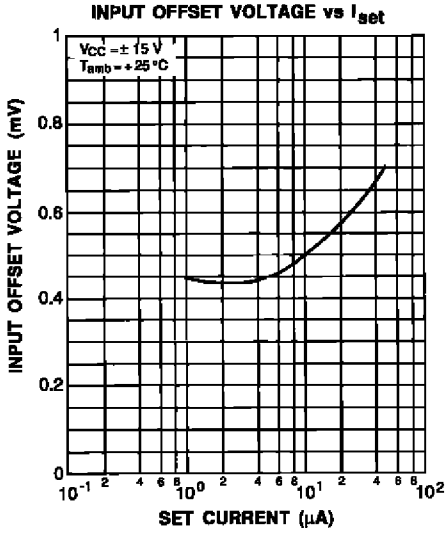
146-07.EPS

PHASE MARGIN vs I_{set}



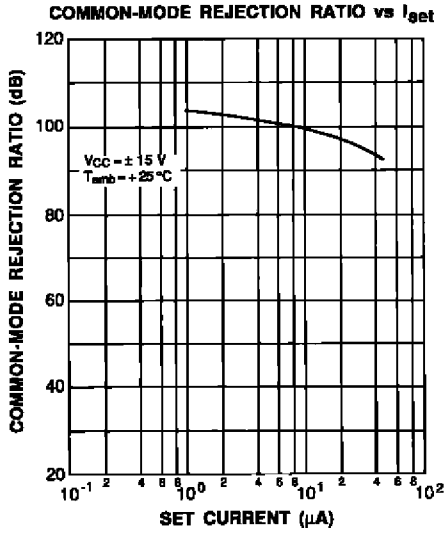
146-08.EPS

INPUT OFFSET VOLTAGE vs I_{set}



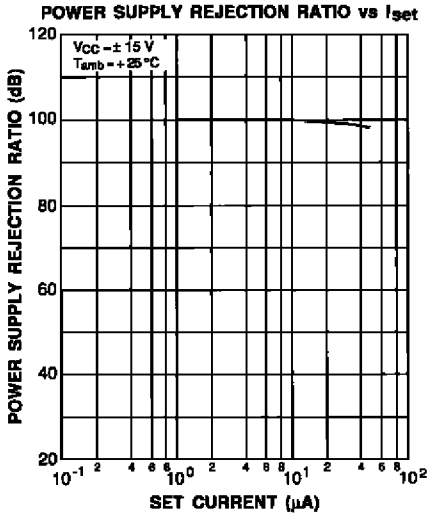
146-09.EPS

COMMON-MODE REJECTION RATIO vs I_{set}



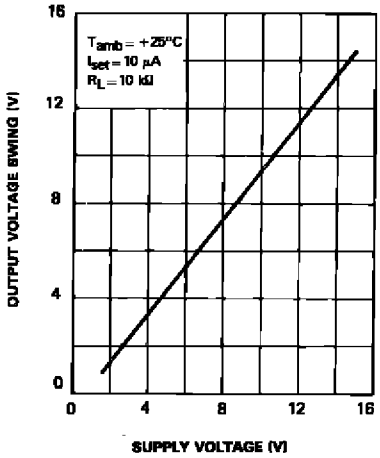
146-10.EPS

POWER SUPPLY REJECTION RATIO vs I_{set}



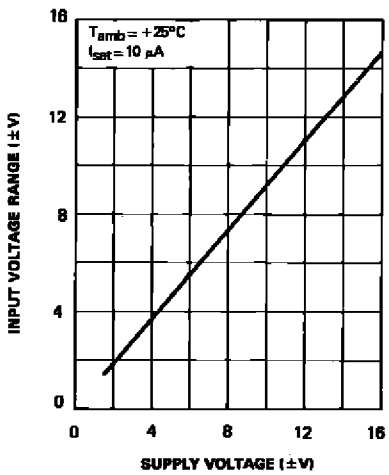
146-11.EPS

OUTPUT VOLTAGE SWING



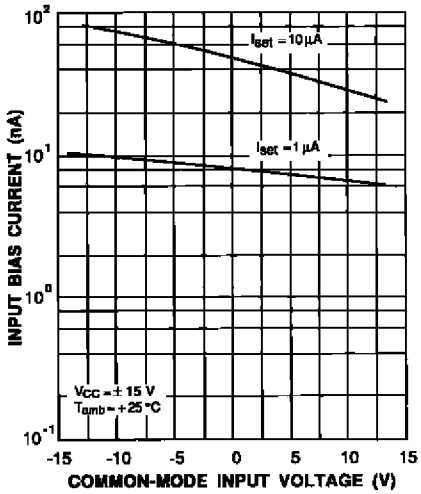
146-12.EPS

INPUT VOLTAGE RANGE



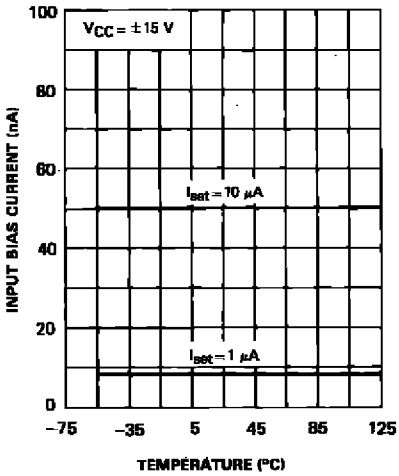
146-13.EPS

INPUT BIAS CURRENT



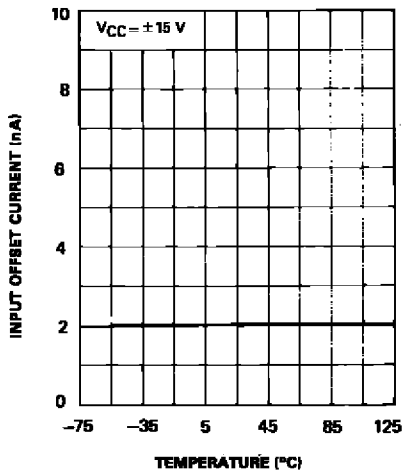
146-14.EPS

INPUT BIAS CURRENT vs TEMPERATURE



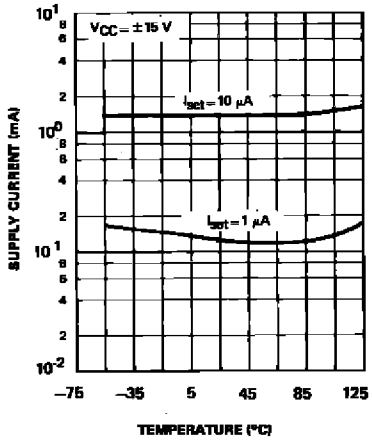
146-15.EPS

INPUT OFFSET CURRENT vs TEMPERATURE



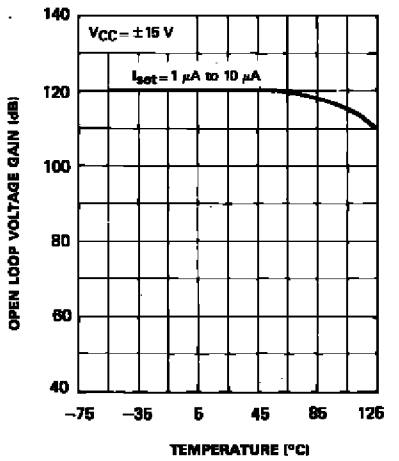
146-16.EPS

SUPPLY CURRENT vs TEMPERATURE



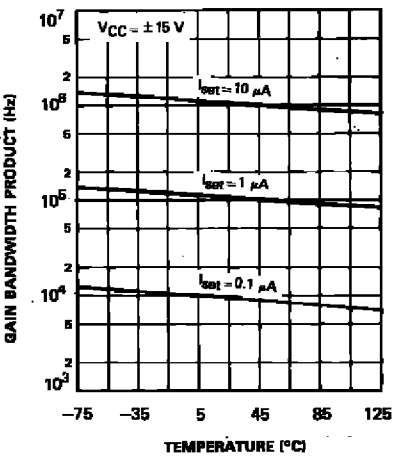
146-17.EPS

OPEN LOOP VOLTAGE GAIN vs TEMPERATURE



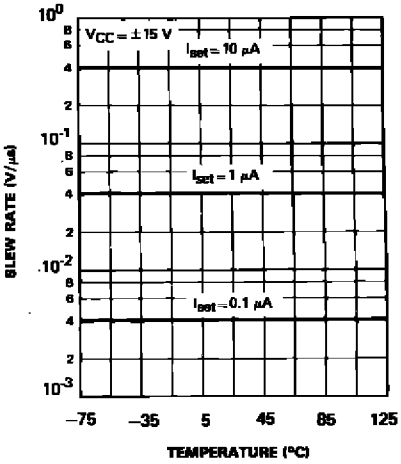
146-18.EPS

GAIN BANDWIDTH PRODUCT vs TEMPERATURE



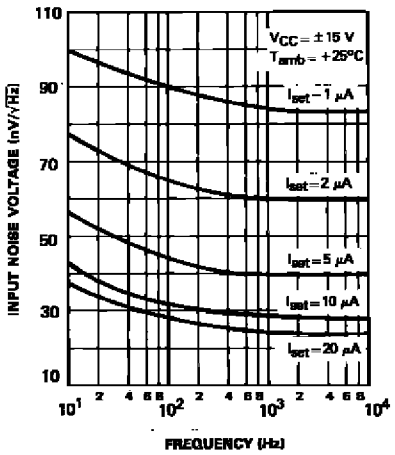
146-19.EPS

SLEW RATE vs TEMPERATURE



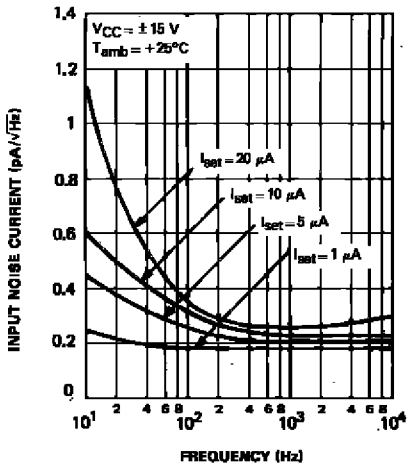
146-20.EPS

INPUT NOISE VOLTAGE vs FREQUENCY



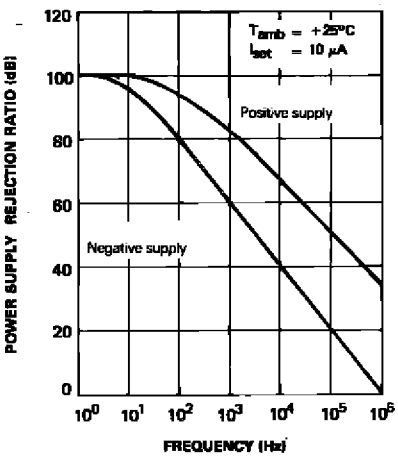
146-21.EPS

INPUT NOISE CURRENT vs FREQUENCY



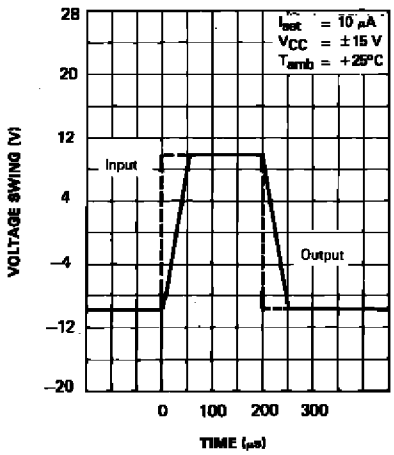
146-22.EPS

POWER SUPPLY REJECTION RATIO

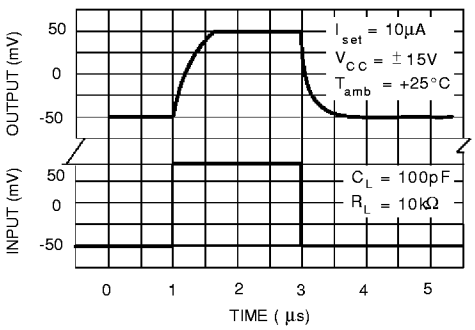


146-23.EPS

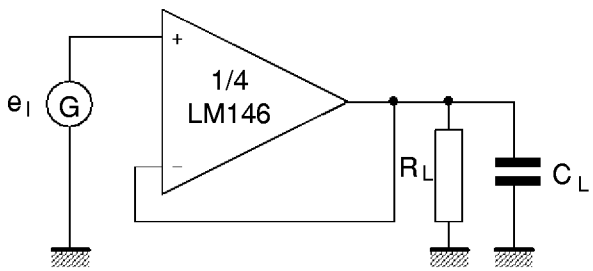
VOLTAGE FOLLOWER PULSE RESPONSE



146-24.EPS



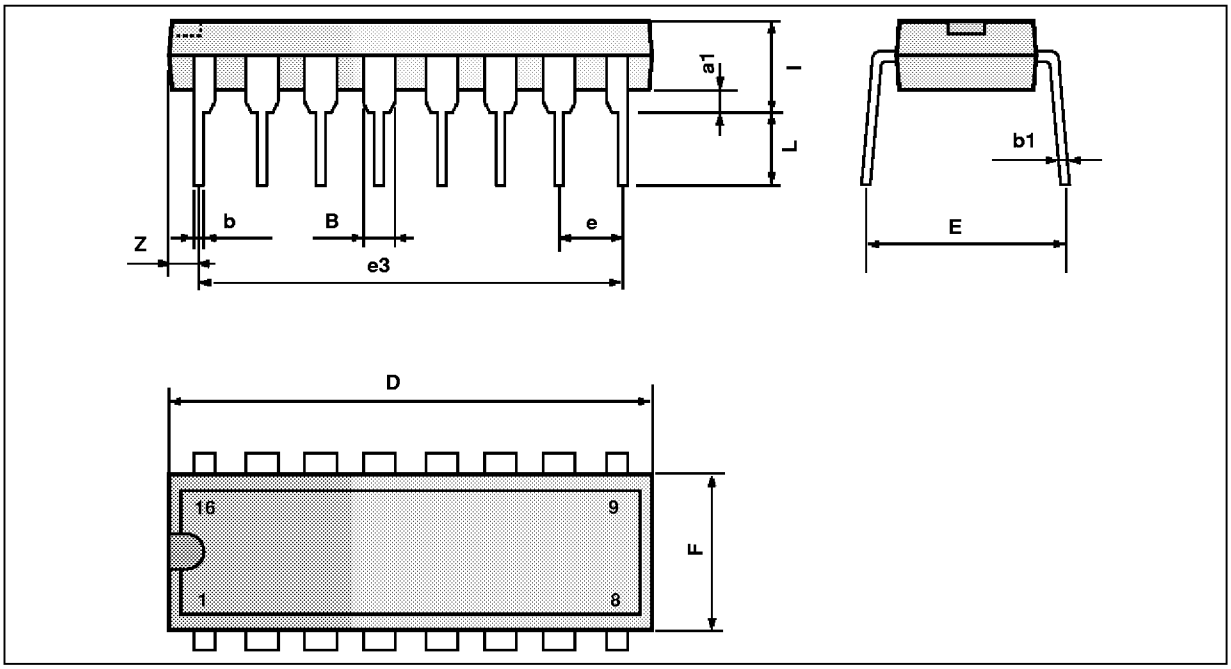
146-25.EPS



146-26.EPS

PACKAGE MECHANICAL DATA

16 PINS - PLASTIC DIP OR CERDIP



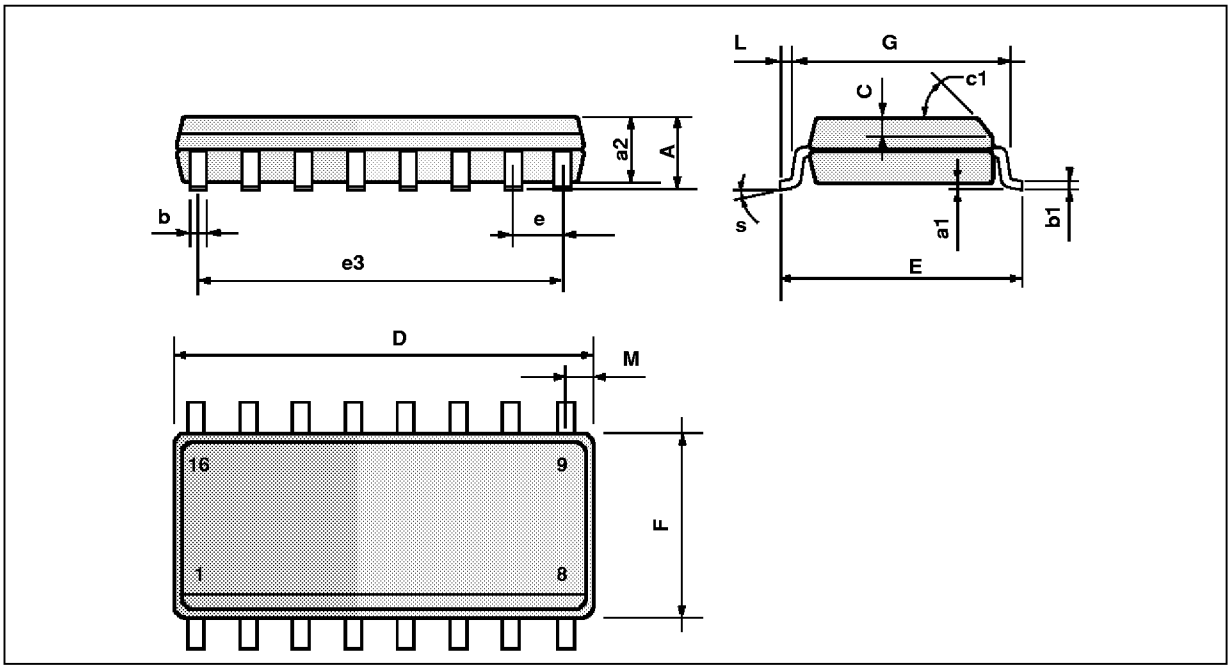
PM-DIP16.EPS

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

DIP16.TBL

PACKAGE MECHANICAL DATA

16 PINS - PLASTIC MICROPACKAGE (SO)



PM-SO16.EPS

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

ORDER CODE :