RAYTHEON

Programmable Quad Operational Amplifier

4149

Features

- Programmable A.C. and D.C. characteristics
- Battery powered operation
- Slew rate adjustable to 5V/μSec
- Supply current adjustable to 350μA/Amplifier
- Bandwidth adjustable to 1.5 MHz
- No crossover distortion
- Internally compensated
- High D.C. gain—50V/mV min.
- Temperature compensated input bias current
- Wide supply voltage range
- Supply current can be as low as 40μA
- Adjustable offset (4149-3)

Description

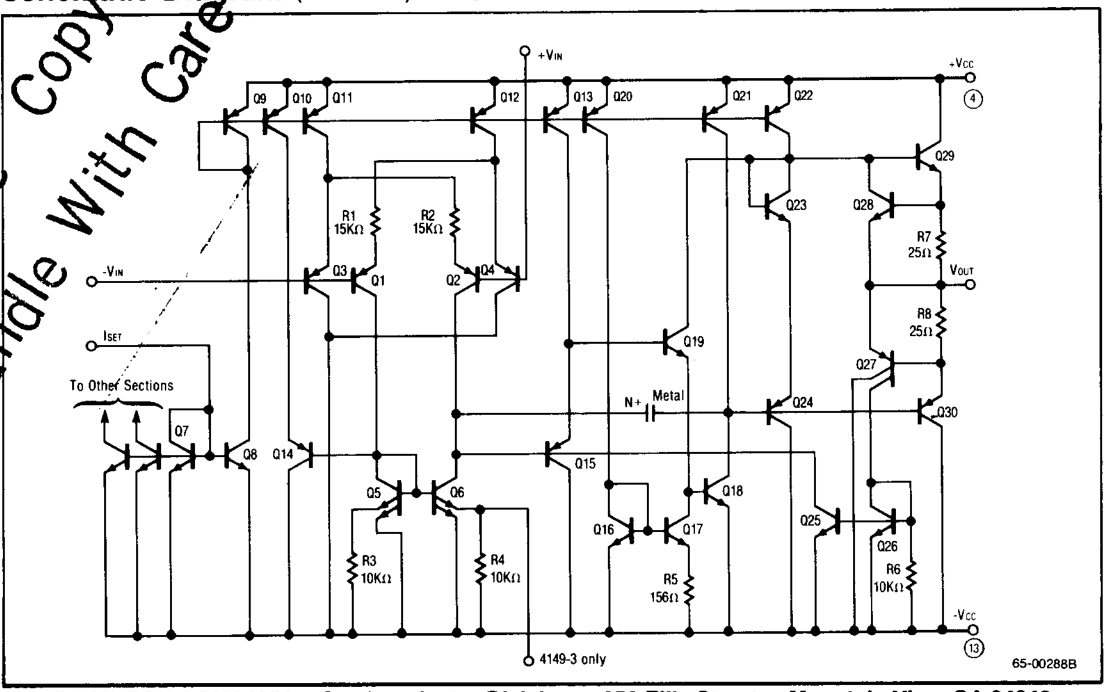
The RM/RC4149 is a monolithic integrated quad op amp consisting of four high gain, compensated, low power amplifiers with programmable A.C. and D.C. characteristics. One external resistor selection allows the user to program the supply current, slew rate, gain-bandwidth product and input noise of 3 amplifiers. In addition, the user can, with another resistor selection, independently adjust the A.C. and D.C. characteristics of the 4th amplifier.

The RC4149-2 allows the user to independently adjust the AC and DC characteristics of the dual amplifiers with just 2 resistor selections. This allows two different AC and DC characteristics in a single package.

If the end application requires identical DC characteristics from all four op amps, then the RC4149-3 will fit these requirements. Just select one external resistor to program the current for all four op amps, pin 8. This leaves pin 9 available to adjust op amp "C" to 0 offset with the addition of a variable resistor.

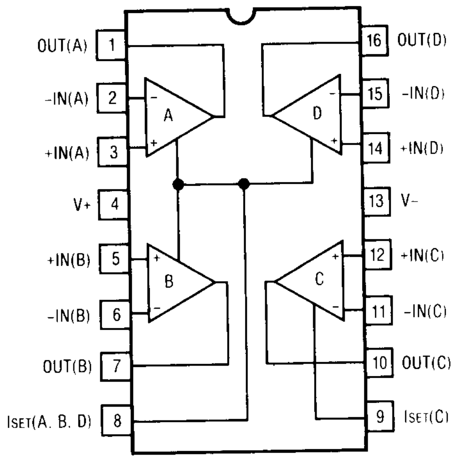
Except for the two programming pins (8 and 9), the RM/RC4149 has the same pin-out as most popular quads (i.e.: 148, 4741, 124, etc.) The RM/RC4149 is a plug-in replacement for the LM146 series, giving substantially higher slew rates in most applications.

Schematic Diagram (¼ shown)



Pin Out Diagrams

RM/RC4149



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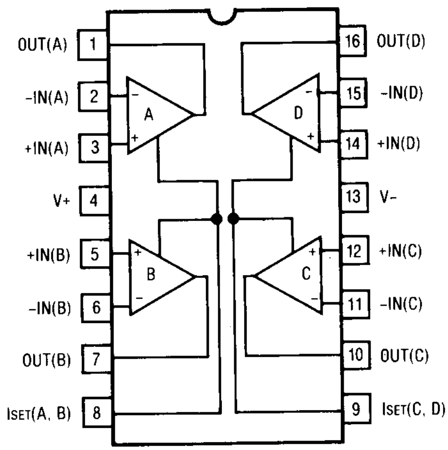
RM/RC4149-2



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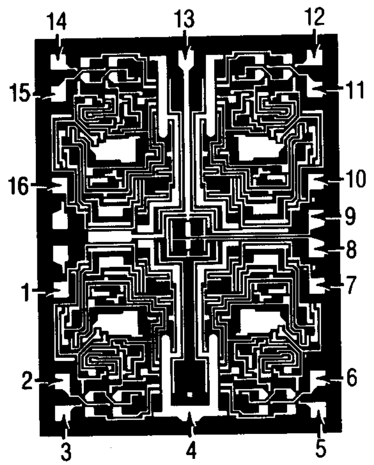
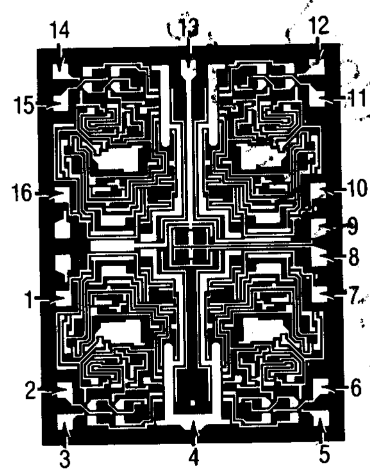
Masks Patterns



Die Size: 98 x 74 mils
Min. Pad Dimensions: 4 x 4 mils

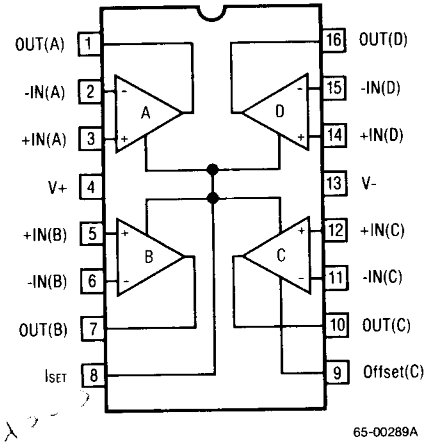


Die Size: 98 x 74 mils
Min. Pad Dimensions: 4 x 4 mils

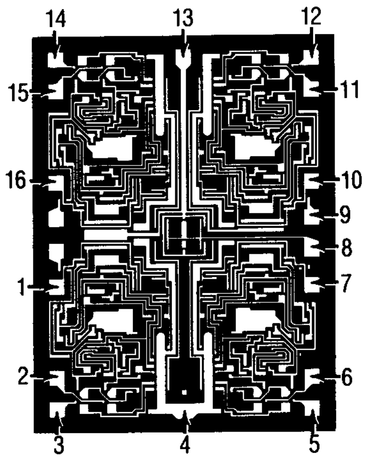
Programmable Quad Operational Amplifier

Pin Out Diagram

RM/RC4149-3



Mask Pattern



Die Size: 98 x 74 mils
Min. Pad Dimensions: 4 x 4 mils

Programming Equations

Total Supply Current = 1.4mA ($I_{SET}/10\mu A$)
Gain Bandwidth Product = 1MHz ($I_{SET}/10\mu A$)
Slew Rate = 1.5V/μSec ($I_{SET}/10\mu A$)
Input Bias Current ≈ 50nA ($I_{SET}/10\mu A$)
I_{SET} = Current into Pin 8 or Pin 9

$$I_{SET} = \frac{V_{S+} - V_{S-} - 0.6V}{R_{SET}}$$

Absolute Maximum Ratings

Supply Voltage
- RC/RV4149 .... ±18V
- RM4149 .... +22V

Differential Input Voltage .... ±30V
Input Voltage Range[1] .... ±15V
Output Short Circuit Duration[2] .... Continuous
Storage Temperature Range .... -65°C to 150°C
Operating Temperature Range
- RC4149 .... 0°C to +70°C
- RM4149 .... -55°C to +125°C
- RV4149 .... -40°C to +85°C

Lead Soldering Temperature (10 Sec) .... 300°C
Maximum Junction Temperature .... 150°C

Notes: 1. For $V_{CC} < \pm 15V$ maximum input voltage range is equal to supply voltage.
2. Short circuit to ground on one amplifier only.

Ordering Information

Part Number	Package	Operating Temperature Range
RC4149DB	Plastic	0°C to +70°C
RC4149-2DB	Plastic	0°C to +70°C
RC4149-3DB	Plastic	0°C to +70°C
RC4149DC	Ceramic	0°C to +70°C
RC4149-2DC	Ceramic	0°C to +70°C
RC4149-3DC	Ceramic	0°C to +70°C
RM4149DC	Ceramic	-55°C to +125°C
RM4149-2DC	Ceramic	-55°C to +125°C
RM4149-3DC	Ceramic	-55°C to +125°C
RV4149DC	Ceramic	-40°C to +85°C
RV4149-2DC	Ceramic	-40°C to +85°C
RV4149-3DC	Ceramic	-40°C to +85°C

Thermal Characteristics

	16-Lead Plastic DIP	16-Lead Ceramic DIP
Max. Junction Temp.	125°C	175°C
Max. P_D T_A < 50°C	555mW	1042mW
Therm. Res. θ_{JC}	—	60°C/W
Therm. Res. θ_{JA}	135°C/W	120°C/W
For T_A > 50°C Derate at	7.41mW per °C	8.33mW per °C

DC Electrical Characteristics (Vs = ±15V, ISET = 10μA, TA = 25°C)

Parameter	Conditions	RM4149 Min	RM4149 Typ	RM4149 Max	RV4149/RC4149 Min	RV4149/RC4149 Typ	RV4149/RC4149 Max	Units
Input Offset Voltage	VCM = 0V, Rs ≤ 50Ω		0.5	5		0.5	6	mV
Input Offset Current	VCM = 0V, Rs ≤ 50Ω		2	20		2	100	nA
Input Bias Current	VCM = 0V, Rs ≤ 50Ω		50	100		50	250	nA
Large Signal Voltage Gain	RL ≥ 10k, VOUT = ±10V	100	120		94	120		dB
Input CM Range	RL ≥ 10k, Rs ≤ 50Ω	±13.5	±14		±13.5	±14		V
Common Mode Rejection Ratio	Rs ≤ 10k	80	100		70	100		dB
Power Supply Rejection Ratio	Rs ≤ 10k	80	100		74	100		dB
Output Voltage Swing	RL ≥ 10k	±12	±14		±12	±14		V
Supply Current (4 Op Amps)	RL = ∞		1.4	2.0		1.4	2.5	mA
Short Circuit Current			±16			±16		mA
Input Noise Voltage	20Hz to 20kHz		3.5			3.5		μVRMS
(Vs = ±15V, ISET = 1μA, TA = 25°C)								
Large Signal Voltage Gain	RL = ∞, VOUT = ±10V		120			120		dB
Input Offset Voltage	VCM = 0V, Rs ≤ 50Ω		0.5	5		0.5	7	mV
Input Bias Current	VCM = 0V, Rs ≤ 50Ω		7.5	20		7.5	100	nA
Supply Current (4 Op Amps)	RL = ∞		140	250		140	300	μA
(Vs = ±1.5V, ISET = 10μA, TA = 25°C)								
Input Offset Voltage	VCM = 0V, Rs ≤ 50Ω		0.5	5		0.5	7	mV
Input CM Range	RL ≥ 10k, Rs ≤ 50Ω	±0.7			±0.7			V
Common Mode Rejection Ratio	Rs ≤ 50Ω		80			80		dB
Output Voltage Swing	RL ≥ 10k	±0.6			±0.6			V

DC Electrical Characteristics (Cont'd)

($-55°C \leq T_A \leq +125°C$ for RM; $0°C \leq T_A \leq 70°C$ for RC. $I_{SET} = 10\mu A$, $V_S = \pm 15V$)

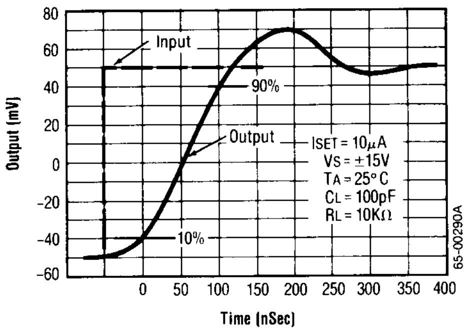
Parameter	Conditions	RM4149			RV4149/RC4149			Units
		Min	Typ	Max	Min	Typ	Max	
Input Offset Voltage	$V_{CM} = 0V$, $R_S \leq 50\Omega$		0.5	6		0.5	7.5	mV
Input Offset Current	$V_{CM} = 0V$, $R_S \leq 50\Omega$		2	25		2	100	nA
Input Bias Current	$V_{CM} = 0V$, $R_S \leq 50\Omega$		50	100		50	250	nA
Supply Current (4 Op Amps)	$R_L = \infty$		1.5	2.0		1.5	2.5	mA
Large Signal Voltage Gain	$R_L \geq 10k$ $V_{OUT} = \pm 10V$	94	120		88	120		dB
Input CM Range	$R_L \geq 10k$, $R_S \leq 50\Omega$	±13.5	±14		±13.5	±14		V
Common Mode Rejection Ratio	$R_S \leq 50\Omega$	70	100		70	100		dB
Power Supply Rejection Ratio	$R_S \leq 50\Omega$	76	100		74	100		dB
Output Voltage Swing	$R_L \geq 10k$	±12	±14		±12	±14		V

Typical Electrical Characteristics ($V_S = \pm 15V$, $T_A = 25°C$)

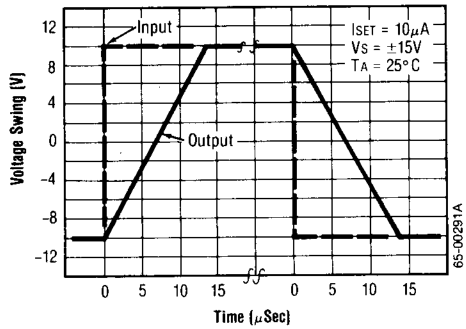
Parameter	Conditions	I_{SET}			Units
		1μA	10μA	50μA	
Gain Bandwidth Product	$R_L = 10k$, $C_L = 100PF$	0.25	1	1.5	MHz
Phase Margin	$R_L = 10k$, $C_L = 100PF$	30	45	55	Degrees
Slew Rate		0.15	1.5	5	V/μS
Channel Separation	F = 1kH	130	120	135	dB
Input Resistance		5	1	0.7	MΩ
Input Capacitance		2.5	2.5	2.5	PF

Typical Performance Characteristics

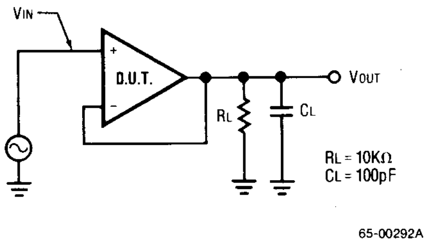
Voltage Follower Transient Response



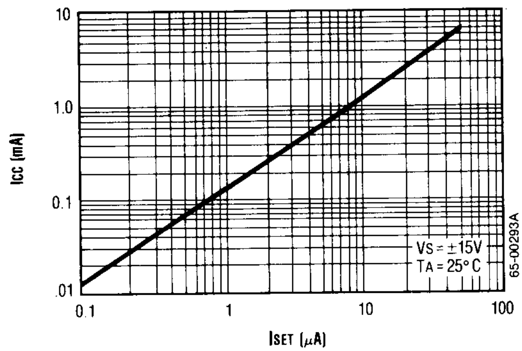
Voltage Follower Pulse Response



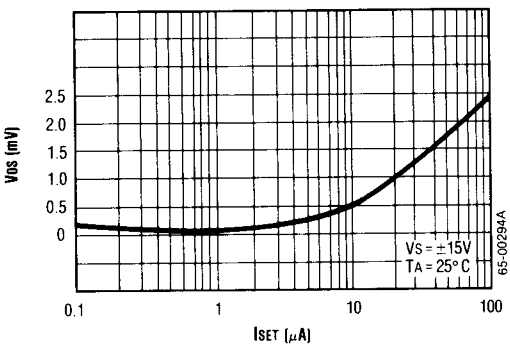
Response Time Test Circuit



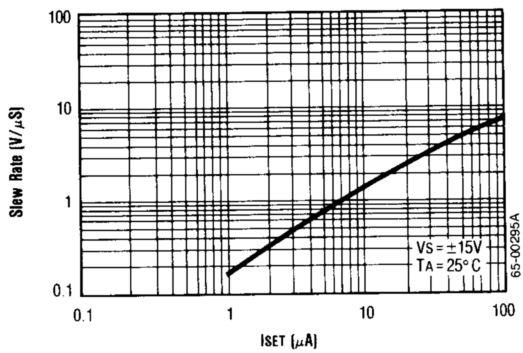
ICC vs. ISET



VOS vs. ISET

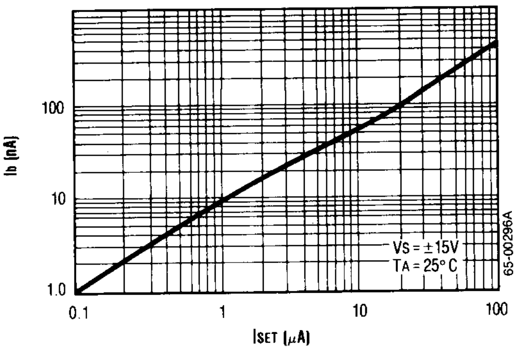


Slew Rate vs. ISET

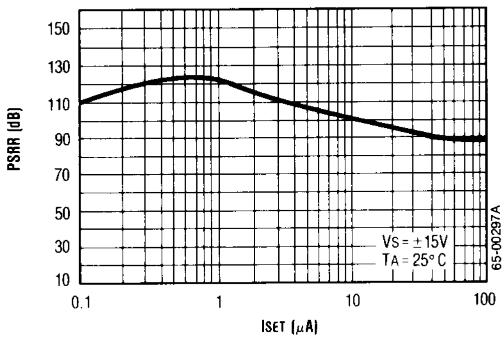


Typical Performance Characteristics (Continued)

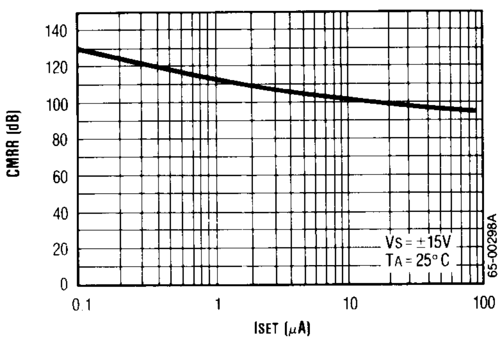
Ib vs. ISET



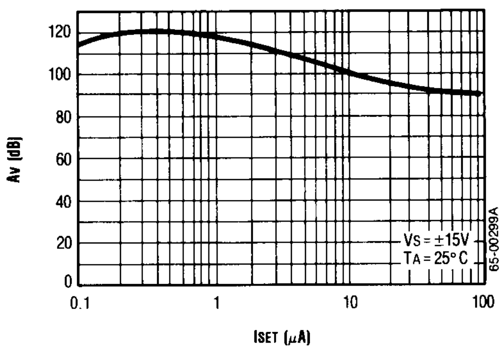
PSRR vs. ISET



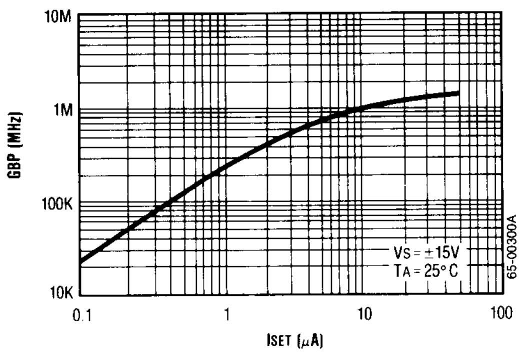
CMRR vs. ISET



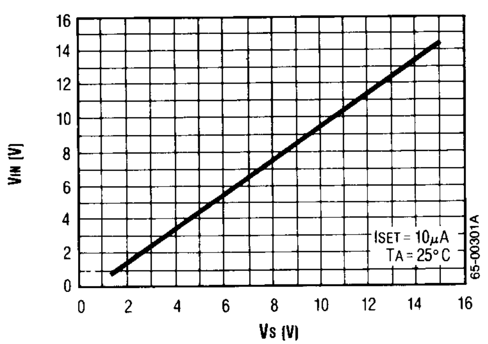
Open Loop Gain vs. ISET



Gain Bandwidth Product vs. ISET

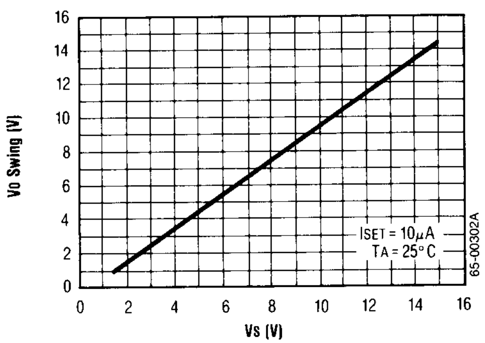


VIN vs. VS

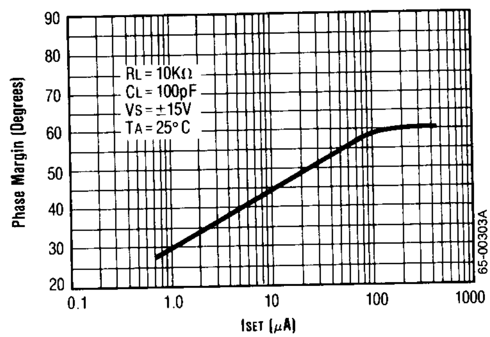


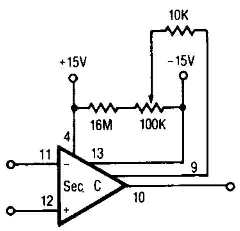
Typical Performance Characteristics (Continued)

Vo Swing vs. Vs

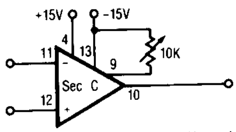


Phase Margin vs. ISET





- Pin 9 is used for input offest voltage adjust.
- For further adjustment of -VOS at low ISET, connect a 10K potentiometer from Pin 9 to -VCC.



- The maximum adjustable -VOS at ISET=1μA is 2.5 mV.

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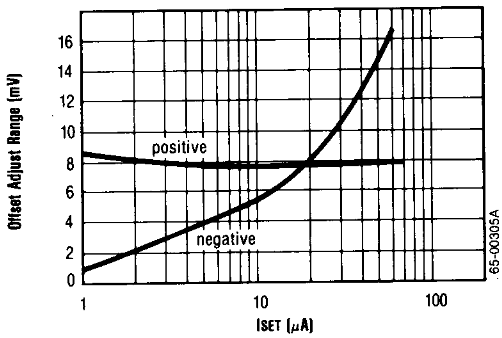
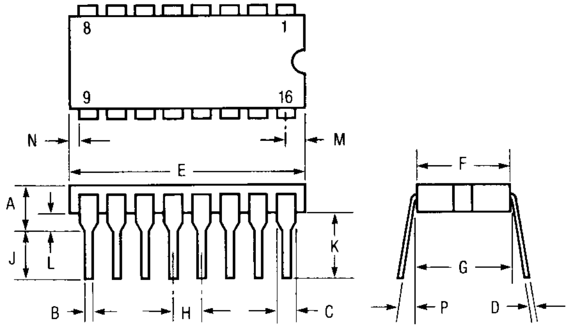
Input Offset Voltage Adjust Range vs. ISET



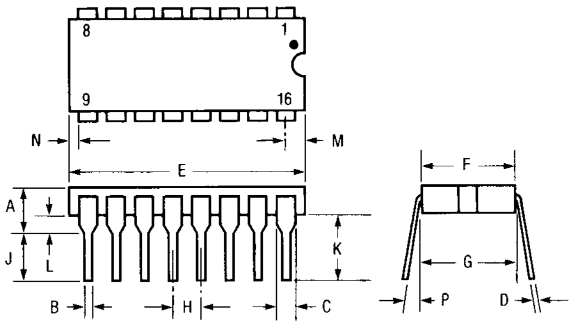
Packaging Information

16-Lead Ceramic Dual-in-Line



Dimension	Inches Min.	Inches Max.	Millimeters Min.	Millimeters Max.
A		.200		5.08
B	.014	.023	.36	.58
C	.030	.070	.76	1.78
D	.008	.015	.20	.38
E		.840		21.34
F	.220	.310	5.59	7.87
G	.290	.320	7.37	8.13
H	.100BSC		2.54BSC	
J	.125	.200	3.18	5.08
K	.150		3.81	
L	.015	.060	.38	1.52
M		.080		2.03
N	.005		.13	
P	0°	15°	0°	15°

16-Lead Plastic Dual-in-Line



Dimension	Inches Min.	Inches Max.	Millimeters Min.	Millimeters Max.
A		.200		5.08
B	.014	.023	0.36	0.58
C	.030	.070	0.76	1.78
D	.008	.015	0.20	0.38
E	.740	.760	18.80	19.30
F	.240	.260	6.10	6.60
G	.290	.320	7.37	8.13
H	.100BSC		2.54BSC	
J	.125	.200	3.18	5.08
K	.135		3.43	
L	.015	.060	0.38	1.52
M	.020		0.51	
N	.005		0.13	
P	0°	15°	0°	15°