



## Section Contents

BI-FET™/BI-FET II™ Op Amp Selection Guide.....	3-v
Military Op Amp Selection Guide.....	3-vii
Industrial Op Amp Selection Guide.....	3-ix
Commercial Op Amp Selection Guide.....	3-x
Special Function Operational Amplifier and Special Function Buffer Amplifier Guides.....	3-xii
Definition of Terms.....	3-xiii
<b>High Input Impedance (<math>I_B &lt; 25</math> nA)</b>	
LF155/LF255/LF355 Monolithic JFET Input Operational Amplifier.....	3-1
LF155A/LF355A Monolithic JFET Input Operational Amplifier.....	3-1
LF156/LF256/LF356 Monolithic JFET Input Operational Amplifier.....	3-1
LF156A/LF356A Monolithic JFET Input Operational Amplifier.....	3-1
LF157/LF257/LF357 Monolithic JFET Input Operational Amplifier.....	3-1
LF157A/LF357A Monolithic JFET Input Operational Amplifier.....	3-1
LF347 Wide Bandwidth Quad JFET Input Operational Amplifier.....	3-14
LF351 Wide Bandwidth JFET Input Operational Amplifier.....	3-22
LF353 Wide Bandwidth Dual JFET Input Operational Amplifier.....	3-29
LF13741 Monolithic JFET Input Operational Amplifier.....	3-38
LM108/LM208/LM308 Operational Amplifiers.....	3-83
LM108A/LM208A/LM308A, LM308A-1, LM308A-2 Operational Amplifiers.....	3-88
LM110/LM210/LM310 Voltage Follower.....	3-95
LM112/LM212/LM312 Operational Amplifiers.....	3-102
LM121/LM221/LM321, LM121A/LM221A/LM321A Precision Preamplifiers.....	4-11
LM216/LM316, LM216A/LM316A Operational Amplifiers.....	3-187
<b>Low Drift (<math>\Delta V_{OS}/Temp &lt; 10 \mu V/^{\circ}C</math>)</b>	
LF155/LF255/LM355 Monolithic JFET Input Operational Amplifier.....	3-1
LF155A/LF355A Monolithic JFET Input Operational Amplifier.....	3-1
LF156/LF256/LF356 Monolithic JFET Input Operational Amplifier.....	3-1
LF156A/LF356A Monolithic JFET Input Operational Amplifier.....	3-1
LF157/LF257/LF357 Monolithic JFET Input Operational Amplifier.....	3-1
LF157A/LF357A Monolithic JFET Input Operational Amplifier.....	3-1
LM108A/LM208A/LM308A, LM308A-1, LM308A-2 Operational Amplifiers.....	3-88
LM725/LM725A/LM725C (Instrumentation) Operational Amplifier.....	3-194
<b>High Slew Rate (<math>S_R &gt; 10V/\mu s</math>)</b>	
LF156/LF256/LF356 Monolithic JFET Input Operational Amplifier.....	3-1
LF156A/LF356A Monolithic JFET Input Operational Amplifier.....	3-1
LF157/LF257/LF357 Monolithic JFET Input Operational Amplifier.....	3-1
LF347 Wide Bandwidth Quad JFET Input Operational Amplifier.....	3-14
LF351 Wide Bandwidth JFET Input Operational Amplifier.....	3-22
LF353 Wide Bandwidth Dual JFET Input Operational Amplifier.....	3-29
LM102/LM202/LM302 Voltage Followers.....	3-74
LM110/LM210/LM310 Voltage Follower.....	3-95
LM118/LM218/LM318 Operational Amplifiers.....	3-106

## Section Contents (Continued)

### Low Power Consumption

LM10/LM10B(L)/LM10C(L) Op Amp and Voltage Reference.....	3-49
LM108A/LM208A/LM308A, LM308A-1, LM308A-2 Operational Amplifier.....	3-88
LM112/LM212/LM312 Operational Amplifiers.....	3-102
LM124/LM224/LM324, LM124A/LM224A/LM324A, LM2902	
Low Power Quad Operational Amplifiers.....	3-113
LM146/LM246/LM346 Programmable Quad Operational Amplifiers.....	3-135
LM4250/LM4250C Programmable Operational Amplifier.....	3-224

### Single Supply

LM10/LM10B(L)/LM10C(L) Op Amp and Voltage Reference.....	3-49
LM124/LM224/LM324, LM124A/LM224A/LM324A, LM2902	
Low Power Quad Operational Amplifiers.....	3-113
LM158/LM258/LM358, LM158A/LM258A/LM358A, LM2904	
Low Power Dual Operational Amplifiers.....	3-157
LM2900/LM3900, LM3301, LM3401 Quad Amplifiers.....	3-215

### High Voltage ( $V_{CC} > \pm 25V$ )

LM143/LM343 High Voltage Operational Amplifier.....	3-122
LM144/LM344 High Voltage, High Slew Rate Operational Amplifier.....	3-129

### Buffer

LM102/LM202/LM302 Voltage Followers.....	3-74
LM110/LM210/LM310 Voltage Follower.....	3-95
LM733/LM733C Differential Video Amp.....	3-198

### Programmable

LM146/LM246/LM346 Programmable Quad Operational Amplifiers.....	3-135
LM4250/LM4250C Programmable Operational Amplifier.....	3-224
LM13080 Programmable Power Op Amp.....	3-231

### High Output Current ( $I_O \geq 200 \text{ mA}$ )

LM13080 Programmable Power Op Amp.....	3-231
--	-------

### General Purpose, Compensated

LF155/LF255/LM355 Monolithic JFET Input Operational Amplifier.....	3-1
LF155A/LF355A Monolithic JFET Input Operational Amplifier.....	3-1
LF156/LF256/LF356 Monolithic JFET Input Operational Amplifier.....	3-1
LF156A/LF356A Monolithic JFET Input Operational Amplifier.....	3-1
LF157/LF257/LF357 Monolithic JFET Input Operational Amplifier.....	3-1
LF157A/LF357A Monolithic JFET Input Operational Amplifier.....	3-1
LF347 Wide Bandwidth Quad JFET Input Operational Amplifier.....	3-14
LF351 Wide Bandwidth JFET Input Operational Amplifier.....	3-22
LF353 Wide Bandwidth Dual JFET Input Operational Amplifier.....	3-29
LF13741 Monolithic JFET Input Operational Amplifier.....	3-38
LM10/LM10B(L)/LM10C(L) Op Amp and Voltage Reference.....	3-49
LM107/LM207/LM307 Operational Amplifiers.....	3-79
LM124/LM224/LM324, LM124A/LM224A/LM324A, LM2902	
Low Power Quad Operational Amplifiers.....	3-113
LM148, LM149 Series Quad 741 Op Amps.....	3-147
LM158/LM258/LM358, LM158A/LM258A/LM358A, LM2904	
Low Power Dual Operational Amplifiers.....	3-157
LM159/LM359 Dual, High Speed, Programmable, Current Mode (Norton) Amplifiers.....	3-167
LM741/LM741A/LM741C/LM741E Operational Amplifier.....	3-202
LM747/LM747A/LM747C/LM747E Dual Operational Amplifiers.....	3-205

## Section Contents (Continued)

### General Purpose, Compensated (Continued)

LM1558/LM1458 Dual Operational Amplifier.....	3-213
LM2900/LM3900, LM3301, LM3401 Quad Amplifier.....	3-215
LM13080 Programmable Power Op Amp.....	3-231

### General Purpose, Uncompensated

LF157/LF257/LF357 Monolithic JFET Input Operational Amplifier.....	3-1
LF157A/LF357A Monolithic JFET Input Operational Amplifier.....	3-1
LM101A/LM201A/LM301A Operational Amplifiers.....	3-65
LM709/LM709A/LM709C Operational Amplifier.....	3-190
LM748/LM748C Operational Amplifier.....	3-210

### Op Amp—Comparator

LM192/LM292/LM392, LM2924 Low Power Operational Amplifier/Voltage Comparator....	3-183
--	-------

Note. For additional information on operational amplifiers, see National Semiconductor's Special Functions Databook.

DC ELECTRICAL CHARACTERISTICS					AC ELECTRICAL CHARACTERISTICS	
PART NUMBER	V <sub>OS</sub> – MAX OFFSET VOLTAGE (mV) (T <sub>A</sub> = 25°C)	ΔV <sub>OS</sub> /ΔT – T.C. OF V <sub>OS</sub> (μV/°C) TYP	I <sub>B</sub> – MAX BIAS CURRENT (pA) (T <sub>J</sub> = 25°C)	AVOL LARGE SIGNAL VOLTAGE GAIN (V/mV) MIN (T <sub>A</sub> = 25°C)	SR – SLEW RATE (V/μs)	e <sub>n</sub> – EQUIV. INPUT NOISE VOLTAGE (nV/√Hz) (Note 2)
<b>MILITARY BI-FET OP AMP (Note 1)</b>						
LF155	5	5	100	50	5	20
LF155A	2	5 (max)	50	50	5	20
LF156	5	5	100	50	12	12
LF156A	2	5 (max)	50	50	12	12
LF157	5	5	100	50	50	12
LF157A	2	5 (max)	50	50	50	12
<b>INDUSTRIAL BI-FET OP AMP (Note 1)</b>						
LF255	5	5	100	50	5	20
LF256	5	5	100	50	12	12
LF257	5	5	100	50	50	12
<b>COMMERCIAL BI-FET AND BI-FET II OP AMP (Note 3)</b>						
LF351	10	10	200	25	13	16
LF351A	2	10	100	25	13	16
LF351B	5	10	200	25	13	16
LF355	10	5	200	25	5	25
LF355A	2	5 (max)	50	25	5	25
LF356	10	5	200	25	12	15
LF356A	2	5 (max)	50	25	12	15
LF357	10	5	200	25	50	15
LF357A	2	5 (max)	50	25	50	15
LF13741	15	10	200	25	0.5	37
<b>BI-FET II DUAL OP AMPS (Characteristics for Each Amplifier) (Note 3)</b>						
LF353	10	10	200	25	13	16
LF353A	2	10	100	25	13	16
LF353B	5	10	200	25	13	16
<b>BI-FET II QUAD OP AMPS (Characteristics for Each Amplifier) (Note 3)</b>						
LF347	10	10	200	25	13	16
LF347A	2	10	100	25	13	16
LF347B	5	10	200	25	13	16

# BI-FET™/BI-FET II™ Op Amp Selection Guide

3-4

SELECTION BY DESIGN PARAMETER					ADDITIONAL NS PRODUCTS USING BI-FET TECHNOLOGY
Max Input Offset Voltage ( $T_A = 25^\circ\text{C}$ )	<u>2 mV</u> LF155A/LF355A LF156A/LF356A LF357A LF351A LF353A LF347A	<u>5 mV</u> LF351B LF347B LF353B LF155/LF156/LF157 LF255/LF256/LF257	<u>10 mV</u> LF355/LF356/LF357 LF351 LF353 LF347	<u>15 mV</u> LF13741	<ul style="list-style-type: none"> <li>• LF111 Comparator</li> <li>• LF198 Sample and Hold</li> <li>• LF11201 Series of Analog Switches</li> <li>• LF11331 Series of Analog Switches</li> <li>• LF11508 Series of Analog Multiplexers</li> <li>• LF152 Instrumentation Amplifier</li> <li>• LF13300 Integrating A/D Building Block</li> </ul>
Max Input Bias Current ( $T_J = 25^\circ\text{C}$ )	<u>50 pA</u> LF155A/LF156A/LF157A LF355A/LF356A/LF357A	<u>100 pA</u> LF155/LF156/LF157 LF255/LF256/LF257 LF351A LF353A LF347A	<u>200 pA</u> LF355/LF356/LF357 LF351/LF351B LF347/LF347B LF353/LF353B LF13741		
Typ Equivalent Input Noise Voltage per $\sqrt{\text{Hz}}$ , $f = 1000 \text{ Hz}$ , $R_S = 100\Omega$	<u>12 nV or Less</u> LF156/LF156A LF157/LF157A LF256/LF257	<u>15 nV To 20 nV</u> LF356 LF351 LF155 LF356A LF351A LF155A LF357 LF351B LFT155 LF357A LF347 LF255 LF347A LF347B LF353 LF353A LF353B		<u>25 nV To 37 nV</u> LF355 LF13741 LF355A	
Typ Slew Rate	<u>0.5 V/<math>\mu\text{s}</math></u> LF13741	<u>5 V/<math>\mu\text{s}</math></u> LF155/LF155A LF255 LF355/LF355A	<u>12 V/<math>\mu\text{s}</math></u> LF156 LF156A LF256 LF356 LF356A	<u>13 V/<math>\mu\text{s}</math></u> LF351 LF351A LF351B LF353 LF353A LF353B LF347 LF347A LF347B	<u>50 V/<math>\mu\text{s}</math></u> LF157 LF157A LF357 LF357A

MILITARY TEMPERATURE RANGE:  $-55^{\circ}\text{C} \leq T_A \leq +125^{\circ}\text{C}$

Device	Input Offset Voltage Max (mV)	Input Offset Voltage Drift Max ( $\mu\text{V}/^{\circ}\text{C}$ )	Input Offset Current Max (nA)	Input Bias Current Max (nA)	Voltage Gain Min (Volts/V)	Bandwidth $A_V = 1$ Typ (MHz)	Slew Rate $A_V = 1$ Typ (V/ $\mu\text{s}$ )	Output Current Min @ $R_L = 2\text{k}(\text{mA})$	Supply Min (V)	Voltage Max (V)	Common Mode Range (V)	Differential Input Voltage (V)	Supply Current $T_A = 25^{\circ}\text{C}$ Max (mA)	Compensation Components Per Amplifier	Package Types
<b>SINGLE OP AMPS</b>															
LH101	6	6 typ	500	1500	25k	1	0.5	5	$\pm 3$	$\pm 22$	$\pm 12$	$\pm 30$	3	0	TO-5 F.P.
LM101A	3	15	20	100	25k	1	0.5	5	$\pm 3$	$\pm 22$	$\pm 12$	$\pm 30$	3	1	TO-5 DIP F.P.
LM101	6	6 typ	500	1500	25k	1	0.5	5	$\pm 3$	$\pm 22$	$\pm 12$	$\pm 30$	3	1	TO-5 F.P.
LM102	7.5	6 typ	*	100	0.999	10	10	1 ( $R_L = 8\text{k}\Omega$ )	$\pm 12$	$\pm 18$	$\pm 10$	*	5.5	0	TO-5
LM107	3	15	20	100	25k	1	0.5	7.5	$\pm 3$	$\pm 22$	$\pm 12$	$\pm 30$	3	0	TO-5 DIP F.P.
LM108A	1	5	0.4	3	40k	1	0.3	1	$\pm 2$	$\pm 20$	$\pm 14$	(Note 1)	0.6	1	TO-5 DIP F.P.
LM108	3	15	0.4	3	25k	1	0.3	1	$\pm 2$	$\pm 20$	$\pm 14$	(Note 1)	0.6	1	TO-5 DIP F.P.
LM110	6	12	*	10	0.999	20	30	1 ( $R_L = 8\text{k}\Omega$ )	$\pm 5$	$\pm 18$	$\pm 10$	*	5.5	0	TO-5 DIP
LM112	3	15	0.4	3	25k	1	0.2	1.3 ( $R_L = 10\text{k}\Omega$ )	$\pm 2$	$\pm 20$	$\pm 14$	(Note 1)	0.6	0	TO-5 DIP F.P.
LM118	4	*	50	250	20k	15	50 min	6	$\pm 5$	$\pm 18$	$\pm 11.5$	(Note 1)	8	0	TO-5 DIP F.P.
LM121A ( $R_{SET}=70\text{k}$ )	0.65	0.2	1	30	16k	0.5	*	*	$\pm 5$	$\pm 20$	$\pm 15$	$\pm 15$	1.5	1	TO-5 DIP F.P.
LM121 ( $R_{SET}=70\text{k}$ )	1	1	3	30	16k	0.5	*	*	$\pm 5$	$\pm 20$	$\pm 15$	$\pm 15$	1.5	1	TO-5 DIP F.P.
LM143	6	*	7	35	50k	1	2.5	4.4 ( $R_L \geq 5\text{k}$ )	$\pm 4$	$\pm 40$	$\pm 38$	$\pm 40$	4	0	TO-5 DIP F.P.
LM144	6	*	7	35	50k	2	30 ( $A_V > 10$ )	4.4 ( $R_L \geq 5\text{k}$ )	$\pm 4$	$\pm 40$	$\pm 38$	$\pm 40$	4	1	TO-5 DIP F.P.
LF155A	2.5	10	25	0.05	25k	2.5	5	5	$\pm 5$	$\pm 22$	$\pm 20$	$\pm 40$	4	0	TO-5
LF155	7	20	50	0.1	25k	2.5	5	5	$\pm 5$	$\pm 22$	$\pm 20$	$\pm 40$	4	0	TO-5
LF156A	2.5	10	25	0.05	25k	5	15	5	$\pm 5$	$\pm 22$	$\pm 20$	$\pm 40$	7	0	TO-5
LF156	7	20	50	0.1	25k	5	15	5	$\pm 5$	$\pm 22$	$\pm 20$	$\pm 40$	7	0	TO-5
LF157A ( $A_V \geq 5$ )	2.5	10	25	0.05	25k	25	75	5	$\pm 5$	$\pm 22$	$\pm 20$	$\pm 40$	7	0	TO-5
LF157 ( $A_V \geq 5$ )	7	20	50	0.1	25k	25	75	5	$\pm 5$	$\pm 22$	$\pm 20$	$\pm 40$	7	0	TO-5
LM709A	3	15	250	600	25k	1	0.3	5	$\pm 5$	$\pm 22$	$\pm 20$	$\pm 40$	3.6	3	TO-5
LM709	6	6 typ	500	1500	25k	1	0.3	5	$\pm 9$	$\pm 18$	$\pm 8$	$\pm 5$	5.5	3	TO-5 DIP
LM725A	0.7	2	18	180	1000	0.5	0.005	5	$\pm 3$	$\pm 22$	$\pm 13.5$	$\pm 5$	3.5	4	TO-5 DIP
LM725	1.5	5	40	200	1000	0.5	0.005	5	$\pm 3$	$\pm 22$	$\pm 13.5$	$\pm 5$	3.5	4	TO-5 F.P.
LM741A	4	15	70	210	32k	1	0.5	7.5	$\pm 3$	$\pm 22$	$\pm 12$	$\pm 30$	4.0	0	TO-5 DIP F.P.
LM741	6	15 typ	500	1500	25k	1	0.5	5	$\pm 3$	$\pm 22$	$\pm 12$	$\pm 30$	2.8	0	TO-5 DIP F.P.
LM748	6	*	500	1500	25k	1	0.5	5	$\pm 3$	$\pm 22$	$\pm 12$	$\pm 30$	2.8	1	TO-5
LM4250 ( $V_S = \pm 15\text{V}$ )	4	*	3	7.5	50k	0.1	0.03	0.12 ( $R_L \geq 100\text{k}$ )	$\pm 1$	$\pm 18$	$\pm 12$	$\pm 15$	0.011 set	0	TO-5 DIP

Note 1: Inputs have shunt-diode protection; current must be limited.

\*Not specified

# Military Op Amp Selection Guide

MILITARY TEMPERATURE RANGE:  $-55^{\circ}\text{C} \leq T_A \leq +125^{\circ}\text{C}$

Device	Input Offset Voltage Max (mV)	Input Offset Voltage Drift Max ( $\mu\text{V}/^{\circ}\text{C}$ )	Input Offset Current Max (nA)	Input Bias Current Max (nA)	Voltage Gain Min (Volts/V)	Bandwidth $A_V = 1$ Typ (MHz)	Slew Rate $A_V = 1$ Typ ( $\text{V}/\mu\text{s}$ )	Output Current Min @ $R_L = 2\text{k}(\Omega)$ (mA)	Supply Voltage Min (V)	Supply Voltage Max (V)	Common Mode Range (V)	Differential Input Voltage (V)	Supply Current $T_A = 25^{\circ}\text{C}$ Max (mA) (Note 2)	Compensation Components Per Amplifier	Package Types
<b>DUAL OP AMPS</b>															
LM158	5	*	30	150	25k	1	*	0.8	$\pm 1.5$	$\pm 16$	$V^{+}-1.5$	$V^{+}$	1.2	0	TO-5 DIP
LM1558	6	*	500	1500	25k	1	0.5	5	$\pm 3$	$\pm 22$	$\pm 12$	$\pm 30$	5.0	0	TO-5
LM747A	4	15	70	210	32k	1	0.5	7.5	$\pm 3$	$\pm 22$	$\pm 12$	$\pm 30$	5.6	0	DIP
LM747	6	*	500	1500	25k	1	0.5	5	$\pm 3$	$\pm 22$	$\pm 12$	$\pm 30$	5.6	0	DIP
<b>QUAD OP AMPS</b>															
LM124	7	7 typ	$\pm 30$	150	50	1.0	*	10	-16	+16	0 to $V^{+}-1.5\text{V}$	$V_{\text{DC}}^{+}$	3	0	D, F, J
LM146 ( $I_{\text{SET}} = 10\mu\text{A}$ )	5	5 typ	20	100	100k	1.2	0.4	1.2	$\pm 2$	$\pm 22$	$\pm 0.7$	$\pm 30$	2	0	DIP
LM148	6	15 typ	75	325	25k	1	0.6	5	$\pm 3$	$\pm 22$	$\pm 12$	$\pm 30$	3.6	0	DIP F.P.
LM149 ( $A_V \geq 5$ )	6	15 typ	75	325	25k	4	3	5	$\pm 3$	$\pm 22$	$\pm 12$	$\pm 30$	3.6	0	DIP F.P.
LM1900	*	*	*	150	0.8k	2.5	*	10 source 1 sink	$\pm 4$	$\pm 36$	*	*	12	0	DIP

**Note 2:** Supply current for all channels of amplifier in the package.

INDUSTRIAL TEMPERATURE RANGE:  $-25^{\circ}\text{C} \leq T_A \leq +85^{\circ}\text{C}$

Device	Input Offset Voltage Max (mV)	Input Offset Voltage Drift Max ( $\mu\text{V}/^{\circ}\text{C}$ )	Input Offset Current Max (nA)	Input Bias Current Max (nA)	Voltage Gain Min (Volts/V)	Bandwidth $A_V = 1$ Typ (MHz)	Slew Rate $A_V = 1$ Typ (V/ $\mu\text{s}$ )	Output Current Min @ $R_L = 2\text{ k}\Omega$ (mA)	Supply Min (V)	Voltage Max (V)	Common Mode Range (V)	Differential Input Voltage (V)	Supply Current $T_A = 25^{\circ}\text{C}$ Max (mA) (Note 2)	Compensation Components Per Amplifier	Package Types
<b>SINGLE OP AMPS</b>															
LM201A	3	15	20	100	25k	1	0.5	5	$\pm 3$	$\pm 22$	$\pm 12$	$\pm 30$	3	1	TO-5 DIP F.P.
LM202	10	15 typ	*	15	0.999	10	10	1	$\pm 12$	$\pm 18$	$\pm 10$	*	5.5	0	TO-5
LM207	2	20	20	100	25k	1	0.5	5	$\pm 3$	$\pm 22$	$\pm 12$	$\pm 30$	3	0	TO-5 DIP F.P.
LM208A	1.0	5	0.4	3	40k	1	0.3	1	$\pm 2$	$\pm 20$	$\pm 14$	(Note 1)	0.6	1	TO-5 DIP F.P.
LM208	3	15	0.4	3	25k	1	0.3	1	$\pm 2$	$\pm 20$	$\pm 14$	(Note 1)	0.6	1	TO-5 DIP F.P.
LM210	4	*	*	3	0.999	20	30	1	$\pm 5$	$\pm 18$	$\pm 10$	*	5.5	0	TO-5 DIP F.P.
LM212	2	15	0.2	2	25k	1	0.3	1	$\pm 2$	$\pm 20$	$\pm 14$	(Note 1)	0.6	0	TO-5 DIP F.P.
LM216A	3	*	0.015	0.05	20k	1	0.3	1	$\pm 5$	$\pm 20$	$\pm 13$	(Note 1)	0.6	0	TO-5 DIP F.P.
LM216	10	*	0.05	0.15	10k	1	0.3	1	$\pm 5$	$\pm 20$	$\pm 13$	(Note 1)	0.8	0	TO-5 DIP F.P.
LM218	4	*	50	500	25k	15	50 min	5	$\pm 5$	$\pm 18$	$\pm 11.5$	(Note 1)	8	0	TO-5 DIP F.P.
LM221A ( $R_{SET} = 70\text{k}$ )	0.65	0.2	1	30	16k	0.5	*	*	$\pm 5$	$\pm 20$	$\pm 15$	$\pm 15$	1.5	1	TO-5 DIP F.P.
LM221 ( $R_{SET} = 70\text{k}$ )	1	1	3	30	16k	0.5	*	*	$\pm 5$	$\pm 20$	$\pm 15$	$\pm 15$	1.5	1	TO-5 DIP F.P.
LF255	6.5	5 typ	20	50	25k	2.5	5	5	$\pm 5$	$\pm 22$	$\pm 20$	$\pm 40$	4	0	TO-5
LF256	6.5	5 typ	20	50	25k	5	15	5	$\pm 5$	$\pm 22$	$\pm 20$	$\pm 40$	7	0	TO-5
LF257 ( $A_V \geq 5$ )	6.5	5 typ	20	50	25k	25	75	5	$\pm 5$	$\pm 22$	$\pm 20$	$\pm 40$	7	0	TO-5
<b>DUAL OP AMPS</b>															
LM258	7.5	7 typ	150	500	15k	1	0.5	10—source 5—sink	3 ( $\pm 1.5$ )	32 ( $\pm 16$ )	$V^+$ -1.5	32	1.2	0	TO-5 DIP
<b>QUAD OP AMPS</b>															
LM224	9	7 typ	150	500	15k	1	*	10	3	32	$V^+ - 1.5$	32	2	0	DIP F.P.
LM246	6	7 typ	100	250	50k	0.5	0.4	1.2	$\pm 2$	$\pm 18$	$\pm 1.5$	$\pm 30$	2.5	0	DIP
LM248	7.5	15 typ	125	500	15k	1	0.5	5	$\pm 5$	$\pm 18$	$\pm 18$	$\pm 36$	4.5	0	DIP
LM249	7.5	15 typ	125	500	15k	4	2	5	$\pm 5$	$\pm 18$	$\pm 18$	$\pm 36$	4.5	0	DIP
LM2900	*	*	*	200	1.2k	2.5	*	3—source 0.5—sink	+4	+36	*	*	10	0	DIP
LM2902	10 ( $T_A = 25^{\circ}$ )	*	$\pm 50$ ( $T_A = 25^{\circ}\text{C}$ )	500 ( $T_A = 25^{\circ}\text{C}$ )	100k typ	1	*	20—source 8—sink	3.0 single $\pm 1.5$ dual	26 single $\pm 13$ dual	$-0.3V_{DC}$ to $+26V_{DC}$	26 $V_{DC}$	2	0	DIP

Note 1: Inputs have shunt-diode protection; current must be limited.

Note 2: Supply current for all channels of amplifier in the package.

\*Not specified



# Commercial Op Amp Selection Guide

COMMERCIAL TEMPERATURE RANGE:  $0^{\circ}\text{C} \leq T_A \leq +70^{\circ}\text{C}$

Device	Input Offset Voltage Max (mV)	Input Offset Voltage Drift Max ( $\mu\text{V}/^{\circ}\text{C}$ )	Input Offset Current Max (nA)	Input Bias Current Max (nA)	Voltage Gain Min (Volts/V)	Bandwidth $A_V = 1$ Typ (MHz)	Slew Rate $A_V = 1$ Typ (V/ $\mu\text{s}$ )	Output Voltage Swing $R_L = 10\text{ k}\Omega$ (V)	Supply Voltage Min (V)	Supply Voltage Max (V)	Common Mode Rejection Ratio (dB) Min	Differential Input Voltage (V)	Supply Current $T_A = 25^{\circ}\text{C}$ Max (mA) (Note 2)	Compensation Components	Package Types
<b>SINGLE OP AMPS</b>															
LM201	10	10 typ	750	200	15k	1	0.5	5	$\pm 3$	$\pm 22$	$\pm 12$	$\pm 30$	3	1	TO-5 F. P.
LM301A	10	30	70	300	15k	1	0.5	5	$\pm 3$	$\pm 18$	$\pm 12$	$\pm 30$	3	1	TO-5 DIP
LM302	20	20 typ	*	30	0.9985	10	10	1	$\pm 12$	$\pm 18$	$\pm 10$	*	5.5	0	TO-5
LM307	10	30	50	250	15k	1	0.5	5	$\pm 3$	$\pm 18$	$\pm 12$	$\pm 30$	3	0	TO-5 DIP F.P.
LM308A	0.73	5	1.5	10	60k	1	0.3	1	$\pm 2$	$\pm 20$	$\pm 14$	(Note 1)	0.8	1	TO-5 DIP F.P.
LM308	10	30	1.5	10	15k	1	0.3	1	$\pm 2$	$\pm 18$	$\pm 14$	(Note 1)	0.8	1	TO-5 DIP F.P.
LM310	10	10 typ	*	10	0.999	20	30	1	$\pm 5$	$\pm 18$	$\pm 10$	*	5.5	0	TO-5 DIP F.P.
LM312	10	30	1.5	10	15k	1	0.3	1	$\pm 2$	$\pm 18$	$\pm 14$	(Note 1)	0.8	0	TO-5 DIP F.P.
LM316A	6	*	0.03	0.1	30k	1	0.3	1	$\pm 5$	$\pm 20$	$\pm 13$	(Note 1)	0.6	0	TO-5 DIP F.P.
LM316	15	*	0.1	0.25	15k	1	0.3	1	$\pm 5$	$\pm 20$	$\pm 13$	(Note 1)	0.8	0	TO-5 DIP F.P.
LM318	15	*	300	750	20k	15	50	5	$\pm 5$	$\pm 18$	$\pm 11.5$	(Note 1)	10	0	TO-5 DIP
LM321A	0.65	0.2	1	25	12k	0.5	*	*	$\pm 5$	$\pm 20$	$\pm 15$	$\pm 15$	2.2	1	TO-5 DIP F.P.
( $R_{SET} = 70\text{k}$ )															
LM321	2.5	1	4	28	12k	0.5	*	*	$\pm 5$	$\pm 20$	$\pm 15$	$\pm 15$	2.2	1	TO-5 DIP F.P.
( $R_{SET} = 70\text{k}$ )															
LM343	10	*	14	55	50k	1	2.5	4	$\pm 4$	$\pm 34$	$\pm 34$	$\pm 34$	5.0	0	TO-5 DIP F.P.
								( $R_L \geq 5\text{k}$ )							
LM344	10	*	14	55	50k	2	30	4	$\pm 4$	$\pm 34$	$\pm 34$	$\pm 34$	5.0	1	TO-5 DIP F.P.
								( $R_L \geq 5\text{k}$ )							
LF351	10	10 typ	0.1	0.2	25k	4	13	$\pm 12$	-18	18	70	$\pm 30$	3.4	0	H, N
LF351A	2	10 typ	0.05	0.2	50k	4	13	$\pm 12$	-18	18	80	$\pm 30$	2.8	0	H, N
LF351B	5	10 typ	0.1	0.1	50k	4	13	$\pm 12$	-18	18	80	$\pm 30$	2.8	0	H, N
LF355A	2.3	5	1	5	25k	2.5	5	5	$\pm 5$	$\pm 22$	$\pm 20$	$\pm 40$	4	0	TO-5, Mini-DIP
LF355	13	5 typ	2	8	15k	2.5	5	5	$\pm 5$	$\pm 18$	$\pm 16$	$\pm 30$	4	0	TO-5, Mini-DIP
LF356A	2.3	5	1	5	25k	5	15	5	$\pm 5$	$\pm 22$	$\pm 20$	$\pm 40$	10	0	TO-5, Mini-DIP
LF356	13	5 typ	2	8	15k	5	15	5	$\pm 5$	$\pm 18$	$\pm 16$	$\pm 30$	10	0	TO-5, Mini-DIP
LF357A	2.3	5	1	5	25k	25	75	5	$\pm 5$	$\pm 22$	$\pm 20$	$\pm 40$	10	0	TO-5, Mini-DIP
( $A_V \geq 5$ )															
LF357	13	5 typ	2	8	15k	25	75	5	$\pm 5$	$\pm 18$	$\pm 16$	$\pm 30$	10	0	TO-5, Mini-DIP
( $A_V \geq 5$ )															
LF13741	20	10 typ	2	8	15k	1	0.5	5	$\pm 4$	$\pm 18$	$\pm 16$	$\pm 30$	4	0	TO-5, Mini-DIP

Note 1: Inputs have shunt-diode protection; current must be limited.

\*Not specified

COMMERCIAL TEMPERATURE RANGE  $0^{\circ}\text{C} \leq T_A \leq +70^{\circ}\text{C}$

Device	Input Offset Voltage Max (mV)	Input Offset Voltage Max ( $\mu\text{V}/^{\circ}\text{C}$ )	Input Offset Current Max (nA)	Input Bias Current Max (nA)	Voltage Gain Min (Volts/V)	Bandwidth $A_V = 1$ Typ (MHz)	Slew Rate $A_V = 1$ Typ (V/ $\mu\text{s}$ )	Output Voltage Swing $R_L = 10\text{ k}\Omega$ (V)	Supply Voltage Min (V)	Supply Voltage Max (V)	Common Mode Rejection Ratio (dB) Min	Differential Input Voltage (V)	Supply Current $T_A = 25^{\circ}\text{C}$ Max (mA) (Note 2)	Compensation Components	Package Types
<b>SINGLE OP AMPS (Continued)</b>															
LM709C	10	12 typ	500	1500	15k	1	0.3	5	$\pm 9$	$\pm 18$	$\pm 8$	$\pm 5$	6.6	3	TO-5 DIP
LM725C	3.5	2 typ	50	250	125k	0.5	0.005	5	$\pm 3$	$\pm 22$	$\pm 13.5$	$\pm 5$	5	4	TO-5 DIP
LM741C	7.5	15 typ	300	800	15k	1	0.5	5	$\pm 3$	$\pm 18$	$\pm 12$	$\pm 30$	2.8	0	TO-5 DIP F.P.
LM741E	4	15	70	210	32k	1	0.5	7.5	$\pm 3$	$\pm 18$	$\pm 12$	$\pm 30$	3.75	0	TO-5 DIP F.P.
LM748C	6	6	0.5	1.5	25k	1	0.5	5	$\pm 3$	$\pm 18$	$\pm 12$	$\pm 30$	2.8	1	TO-5 DIP
LM4250C	6	*	8	10	50k	0.1	0.03	0.12	$\pm 1$	$\pm 18$	$\pm 12$	$\pm 15$	0.011	0	TO-5 DIP
(A <sub>V</sub> > 10) (R <sub>L</sub> ≥ 100k)															
<b>DUAL OP AMPS</b>															
LF353	10	10 typ	0.1	0.2	25k	4	13	$\pm 12$	-18	18	70	$\pm 30$	3.4	0	N, H
LF353A	2	10 typ	0.05	0.2	50k	4	13	$\pm 12$	-18	18	80	$\pm 30$	2.8	0	N, H
LF353B	5	10 typ	0.1	0.1	50k	4	13	$\pm 12$	-18	18	80	$\pm 30$	2.8	0	N, H
LM358	7.5	7 typ	150	500	15k	1	*	8	$\pm 1.5$	$\pm 15$	V <sup>+</sup> -1.5	V <sup>+</sup>	1.2	0	TO-5 DIP
LM1458	6	*	300	800	15k	1	0.2	5	$\pm 3$	$\pm 18$	$\pm 15$	$\pm 30$	5.6	0	TO-5 DIP
LM747C	6	*	300	800	15k	1	0.5	5	$\pm 3$	$\pm 18$	$\pm 12$	$\pm 30$	5.6	0	DIP
LM747E	4	15	70	210	32k	1	0.5	7.5	$\pm 3$	$\pm 18$	$\pm 12$	$\pm 30$	5.6	0	DIP
<b>QUAD OP AMPS</b>															
LF347	10	10 typ	0.01	0.2	25k	4	13	$\pm 12$	-18	18	70	$\pm 30$	3.4	0	N, J
LF347A	2	10 typ	0.05	0.2	50k	4	13	$\pm 12$	-18	18	80	$\pm 30$	2.8	0	N, J
LF347B	5	10 typ	0.1	0.1	50k	4	13	$\pm 12$	-18	18	80	$\pm 30$	2.8	0	N, J
LM324	9	7 typ	150	500	15k	1	*	10-source 5-sink	3	32	V <sup>+</sup> -1.5	32	2	0	DIP F. P.
									(±1.5)(±16)						
LM346	5	10 typ	100	250	100k	0.8	0.4	$\pm 12$	-18	18	70	$\pm 30$	0.62	0	N, J
LM348	7.5	15 typ	100	400	15k	1	*	5	$\pm 5$	$\pm 18$	$\pm 18$	$\pm 36$	4.5	0	DIP F. P.
LM349	7.5	15 typ	100	400	15k	4	3	5	$\pm 5$	$\pm 18$	$\pm 18$	$\pm 36$	4.5	0	DIP F. P.
(A <sub>V</sub> ≥ 5)															
LM3900	*	*	*	200	2.8k	2.5	20	10	4	36	*	*	10	0	DIP
									(±2) (±18)						

Note 2: Supply current for all channels of amplifier in the package