① Operational Amplifiers

Typical Characteristics of Linear IC Operational Amplifiers

Features	Micropower (OTA'S)★ Single			Micropower (OTA'S)★ Triple				Micropower (OTA'S)★ Triple		Single Op. Amp.			High-Current		
RCA Type No.	CA3080, F, S	CA3080A, AF, AS	CA3080A, AF, AS	CA3060BD	CA3060AD, BD, E	CA3060D, H		CA3078F, H, S, T CA6078AH, AS, AT ■		CA3078AF, AS, AT			CA3033 CA3047	CA3033A CA3047A	CA3094AS, AT, BS, BT, S, T
Characteristics / Operating Conditions	$V^+, V^- = \pm 15$ V $I_{ABC} = 500\ \mu A$		$V^+, V^- = \pm 15$ V $I_{ABC} = 5\ \mu A$	$V^+, V^- = \pm 15$ V $I_{ABC} = 1\ \mu A$	$V^+, V^- = \pm 15$ V $I_{ABC} = 100\ \mu A$	$V^+, V^- = \pm 6$ V $I_{ABC} = 1\ \mu A$	$V^+, V^- = \pm 6$ V $I_{ABC} = 100\ \mu A$	$V^+, V^- = \pm 6$ V $I_Q = 100\ \mu A$	$V^+, V^- = \pm 0.75$ V $I_Q = 1\ \mu A$	$V^+, V^- = \pm 6$ V $I_Q = 20\ \mu A$	$V^+, V^- = \pm 0.75$ V $I_Q = 1\ \mu A$	$V^+, V^- = \pm 15$ V $I_Q = 20\ \mu A$	$V^+, V^- = \pm 12$ V	$V^+, V^- = \pm 15$ V	$V^+, V^- = \pm 15$ V Dual Supply $V^+ = 30$ V Single Supply $I_{ABC} = 100\ \mu A$
Static Conditions (at $T_A = 25°C$)															
Input Offset Voltage — mV max (V_{IO})	5	2	2	5	5	5	5	4.5	1.5 typ.	3.5	0.90 typ.	3.5	5	5	5
Input Offset Current — nA max (I_{IO})	600	600	1.2 typ.	14	1000	14	1000	32	0.5 typ.	2.5	0.054 typ.	2.7	35	25	200
Input Bias Current — nA max (I_I)	5000	5000	40 typ.	70	5000	70	5000	170	1.3 typ.	12	0.45 typ.	14	350	180	500
Input Offset Voltage Temperature Coefficient — $\mu V/°C$ typ. ($V_{IO}/\Delta T$)	1.0	1.0	0.5	1.1	1.1	1.1	1.1	6	6	5	5	5	6.6	6.6	4
Peak-to-Peak Output Voltage — V min. (V_{OM})	24	24	28.3 typ.	24	24	10.6	10.2	10	0.30 typ.	10	0.3 typ.	27	18	23	25.95 (Dual Supply Term. 6)
	Load Resistance (R_L) = ∞							R_L = 10 kΩ	R_L = 20 kΩ	--	--	--	R_L = 0.5 kΩ	R_L = 0.3 kΩ	
Peak-to-Peak Output Current — mA min. (I_{OM})	0.700	0.700	0.006	0.0026	0.300	0.0026	0.300	13 Typ.	1.0 typ.	13 Typ.	1	13 Typ.	35	76	—
Device Dissipation — mW max (P_D)	36	36	0.300	0.42	42	0.170	14.5	1.56	0.0015 typ.	0.30	0.0015 typ.	0.75	180	300	—
Maximum Supply Voltage — V^+, V^-	±18	±18	±18	±16	±16	±7	±7	±7	±7	±18	±18	±18	±13	±19	‡
Minimum Output Voltage for Single-Supply Operation (neg. gnd.) — V typ. (V_O)	0.6	0.6	0.5	0.050	0.100	0.050	0.100	0.7	0.7	0.7	0.7	0.7	0.05	0.05	26 @ $V^+ = 30$ (Term. 6)
Common Mode Input Voltage Range V min (V_{ICR})	±12	±12	+14, -14.5 typ.	+12, -12	+12, -12	+4.4, -5.1	+4.3, -5.0	±5	+0.5, -0.2 typ.	-5, +5	-0.2, +0.5 typ.	-14, +14 typ.	+3.5, -7.5	+4.7, -9.7	+12, -14 (Dual Supply)

★ Operational Transductance Amplifiers (OTA'S)

■ Low-noise premium version of the CA3078T that is virtually free of "popcorn" (burst) noise.

‡ Types CA3094T, CA3094AT, and CA3094BT differ only in supply-voltage rating:
CA3094 = ± 12V dual supply, 24 single supply
CA3094AT = ± 18V dual supply, 36 single supply
CA3094BT = ± 22V dual supply, 44 single supply

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Characteristics — Operating Conditions	$V^+, V^- = \pm 15$ V $I_{ABC} = 500\ \mu A$		$V^+, V^- = \pm 15$ V $I_{ABC} = 5\ \mu A$	$V^+, V^- = \pm 15$ V $I_{ABC} = 1\ \mu A$	$V^+, V^- = \pm 15$ V $I_{ABC} = 100\ \mu A$	$V^+, V^- = \pm 6$ V $I_{ABC} = 1\ \mu A$	$V^+, V^- = \pm 6$ V $I_{ABC} = 100\ \mu A$	$V^+, V^- = \pm 6$ V $I_Q = 100\ \mu A$	$V^+, V^- = \pm 0.75$ V $I_Q = 1\ \mu A$	$V^+, V^- = \pm 6$ V $I_Q = 20\ \mu A$	$V^+, V^- = \pm 0.75$ V $I_Q = 1\ \mu A$	$V^+, V^- = \pm 15$ V $I_Q = 20\ \mu A$	$V^+, V^- = \pm 12$ V	$V^+, V^- = \pm 15$ V	$V^+, V^- = \pm 15$ V Dual Supply $V^+ = 30$ V Single Supply $I_{ABC} = 100\ \mu A$
Dynamic Conditions (at $T_A = 25°C$)															
Forward Transconductance — μmho (gm)															To Term. 1
Min.	6700	7700	—	300	30,000	300	30,000	—	—	—	—	—	—	—	1650
Max	13,000	12,000	96 typ.	—	—	—	—								2750
Open-Loop Voltage Gain (A_{OL})	$R_L = \infty$							R_L = 10 kΩ	R_L = 20 kΩ	R_L = 10 kΩ			R_L 500Ω		R_L 2kΩ
volts/volt min.	150,000	150,000	150,000	200,000	200,000	200,000	200,000	25,000	1000 typ.	40,000	1,780 typ.	40,000	15,800	22,400	20,000 (Single Supply)
dB min.	104	104	104	106	106	106	106	88	60 typ.	92	65	92	84	87	86 (Single Supply)
Slew Rate (Non-Inverting Unity Gain) — V/μs typ. (SR)	50 R_L = 1MΩ C_L = 5pF	50 R_L = 1MΩ C_L = 5pF	0.5	0.1	8.0	0.1	8.0	0.4	0.001	0.027	0.001		2.7	3.0	0.7 @ R_L 2 kΩ I_{ABC} 500 μA
Common-Mode Rejection Ratio — dB min. (CMRR)	80	80	110 typ.	80	70	80	70	80	90 typ.	80	90 typ.	80	84	93	70
Gain-Bandwidth Product (Unity Gain Non-Inverting Comp.) MHz typ. (f_T (op-amp))	3.5	3.5	0.01	1.0	1.0	0.01	1.0	0.2	0.003	200 Hz	0.003		0.3	0.5	—
Special Features															
Short Circuit Protection	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	no	no	—
Frequency Compensation	ext.	ext.	ext.	ext.	ext.	ext	ext.	ext.	ext.	ext.	ext.	ext.	ext.	ext.	—
Adaptable to Single-Supply Operation	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Offset Adjustment	no	no	no	no	no	no	no	yes	yes	yes	yes	yes	yes	yes	—