

Low Power Quad Operational Amplifier

IR93403/IR93403N

T-79-05-40

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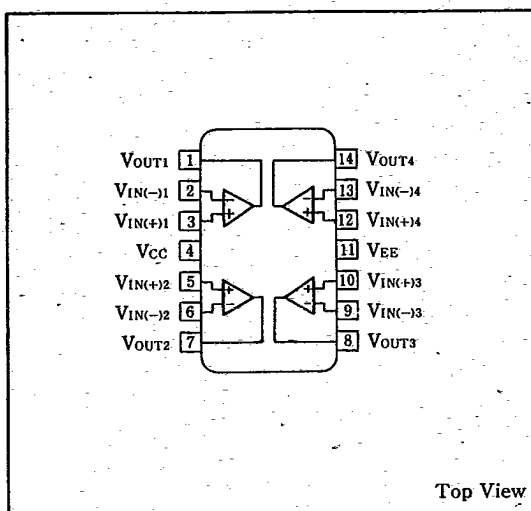
Description

The IR93403/IR93403N is a high performance low power quad operational amplifier, which operates from a single power supply to a wide range of voltage.

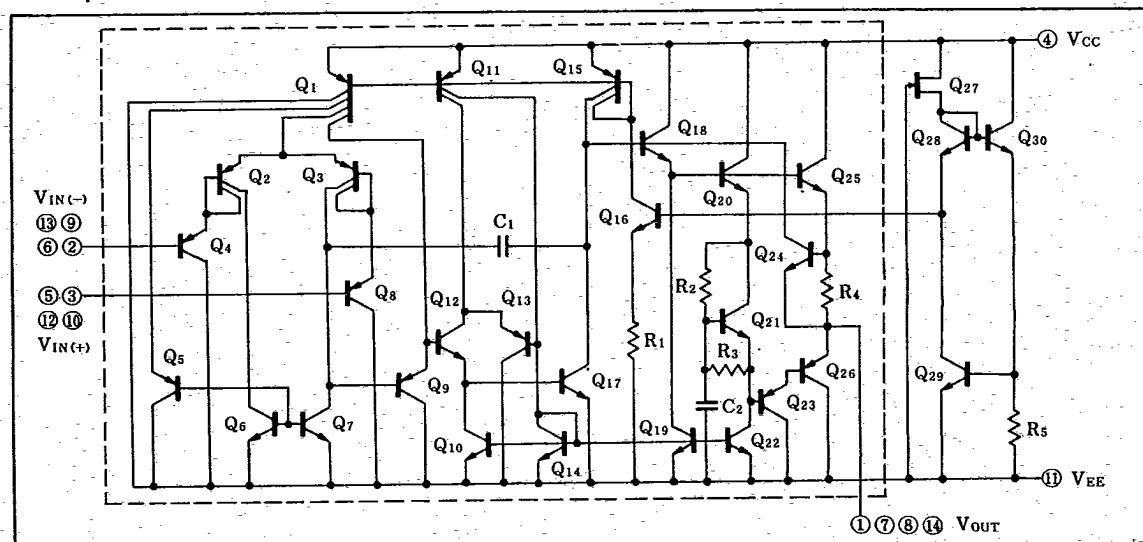
Features

1. Wide power supply range
3~36V :single supply
 $\pm 1.5 \sim \pm 18V$:dual supply
2. Short-circuit protected output
3. Low input bias current 500nA (MAX.)
4. Class AB output stage for minimum crossover distortion
5. 14-pin dual-in-line package (IR93403)
14-pin small-outline package (IR93403N)

Pin Connections



Equivalent Circuit



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■ Absolute Maximum Ratings

(Ta=25°C)

Parameter	Symbol	Condition		Rating	Unit
Supply voltage	$V_{CC}-V_{EE}$			36	V
Differential input voltage	V_{ID}			30	V
In-phase input voltage	V_{ICM}			0~+30	V
Power dissipation	P_D	$T_a\leq 25^{\circ}C$	IR93403	650	mW
			IR93403N	600	
P_D derating ratio	$\Delta P_D/^{\circ}C$	$T_a>25^{\circ}C$	IR93403	6.5	mW/ $^{\circ}C$
			IR93403N	5	
Operating temperature	T_{opr}			0~+70	$^{\circ}C$
Storage temperature	T_{stg}		IR93403	-55~+125	$^{\circ}C$
			IR93403N	-55~+150	

■ Electrical Characteristics 1

(V_{CC}=15V, V_{EE}=-15V, Ta=25°C)

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit	Note
Input offset voltage	V_{IO}			2	10	mV	
Input offset current	I_{IO}			30	50	nA	
Input bias current	I_B			-200	-500	nA	
In-phase input voltage	V_{ICM}		13-V _{EE}	13.5-V _{EE}		V	
Input impedance	Z_{IN}	f=20Hz	0.3	1.0		MΩ	
Output impedance	Z_{OUT}	f=20Hz		75		Ω	
Major amplitude voltage gain	A_v	$R_L=2k\Omega$, $V_{OUT}=\pm 10V$	86	106		dB	
Maximum output voltage	V_{OM}	$R_L=10k\Omega$	±12	±13.5		V	
		$R_L=2k\Omega$	±10	±13		V	
Common signal rejection ratio	CMR	$R_S \leq 10k\Omega$	70	90		dB	
Supply voltage rejection ratio	SVR			30	150	μV/V	
Supply current	I_{CC}	$R_L=\infty$, $V_{OUT}=0V$		2.8	7.0	mA	
Output short circuit current	I_{OS}		±10	±20	±45	mA	
Major amplitude bandwidth	B_{WP}	$V_{OUT}=20V_{P-P}$, THD=5%		9.0		kHz	1
Minor amplitude bandwidth	B_N	$R_L=10k\Omega$, $V_{OUT}=50mV$, $A_v=0dB$		1.0		MHz	2
Slew rate	SR			0.6		V/μs	3
Rise time	t_r	$A_v=0dB$, $R_L=10k\Omega$, $V_{OUT}=50mV$		0.35		μs	4
Fall time	t_f			0.35		μs	
Overshoot	OS			20		%	
Phase margin	ϕ_m			60		degrees	
Cross-over strain ratio		$V_{IN}=30mV_{P-P}$, $V_{OUT}=2V_{P-P}$, f=10kHz		1.0		%	5

Note 1: $R_L=2k\Omega$, $V_{OUT}=20V_{P-P}$, THD=5%Note 2: $R_L=10k\Omega$, $V_{OUT}=50mV$, $A_v=1$ Note 3: $V_{IN}=-10\sim+10V$, $A_v=1$ Note 4: $R_L=10k\Omega$, $V_{OUT}=50mV$, $A_v=1$ Note 5: $V_{IN}=30mV_{P-P}$, $V_{OUT}=2V_{P-P}$, f=10kHz

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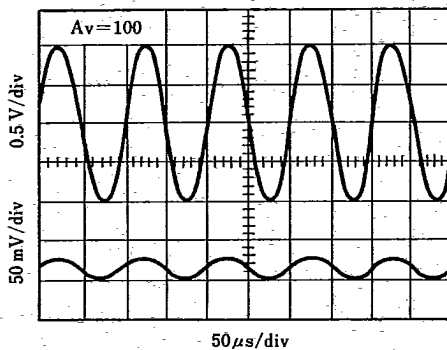
Electrical Characteristics 2

(V_{CC}=5V, V_{EE}=0V, T_a=25°C)

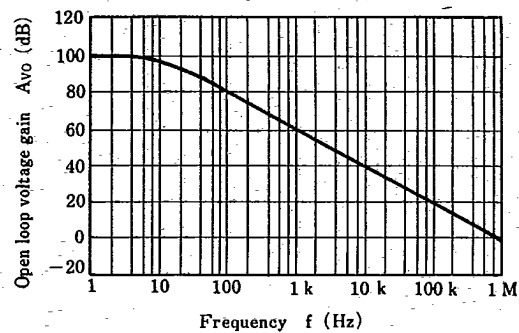
Parameter	Symbol	Condition	MIN.	TYP.	MAX.	Unit
Input offset voltage	V _{IO}			2.0	10	mV
Input offset current	I _{IO}			30	50	nA
Input bias current	I _B			-200	-500	nA
Major amplitude voltage gain	A _V	R _L =2kΩ	86	106		dB
Supply voltage rejection ratio	SVR				150	μV/V
Output voltage	V _{OUT}	R _L =10kΩ, V _{CC} =5V	3.3	3.5		V _{P-P}
		R _L =10kΩ, V _{CC} ≥+5V	V _{CC} -1.7	V _{CC} -1.5		
Supply current	I _{CC}			2.5	7.0	mA
Channel separation	C.S	f=1~20kHz		-120		dB

Electrical Characteristics Curve (Unless otherwise specified, V_{CC}=15V, V_{EE}=-15V, T_a=25°C)

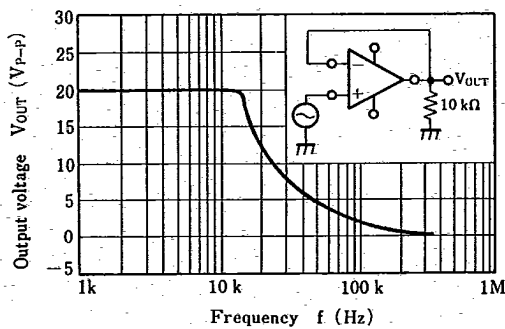
Sinusoidal wave response Characteristics



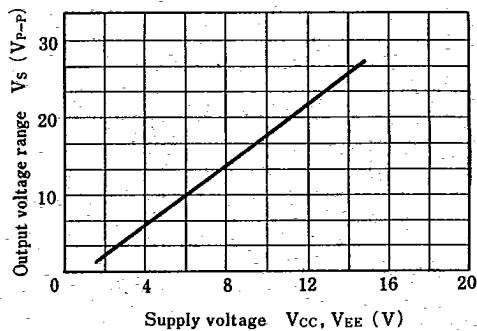
Open loop voltage gain — Frequency Characteristics



Output voltage — Frequency Characteristics



Output voltage range — Supply voltage Characteristics



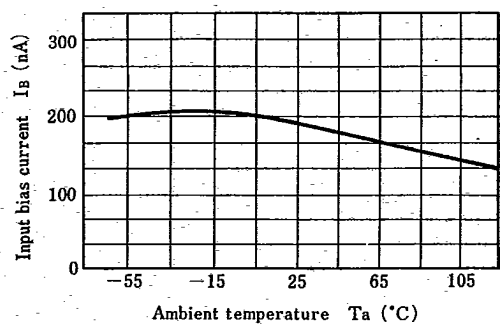
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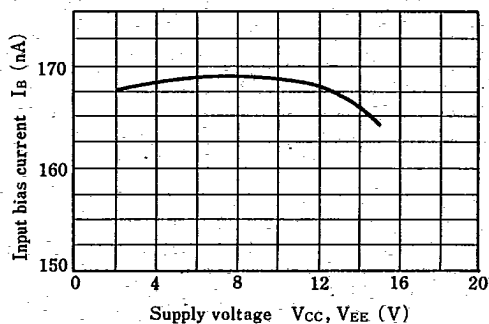
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Input bias current — Ambient temperature Characteristics

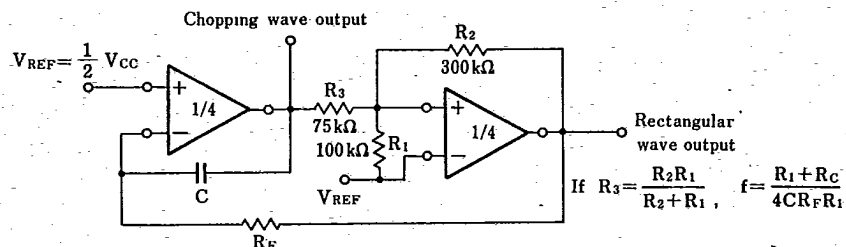


Input bias current — Supply voltage Characteristics

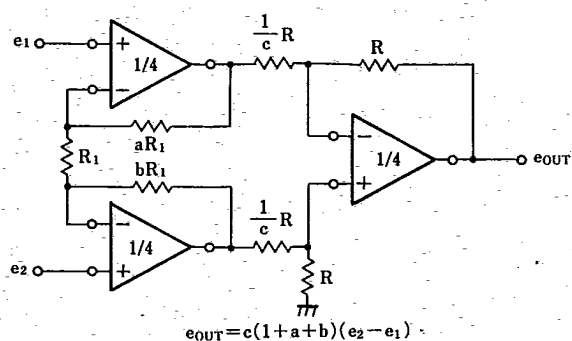


Application Circuit Example

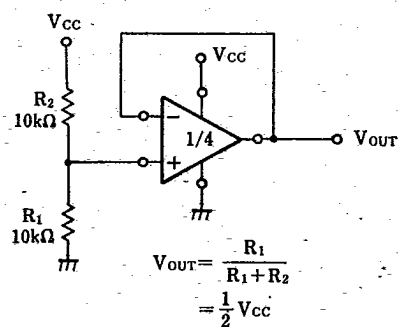
(1) Function generator



(2) High input impedance differential amplifier



(3) Voltage reference



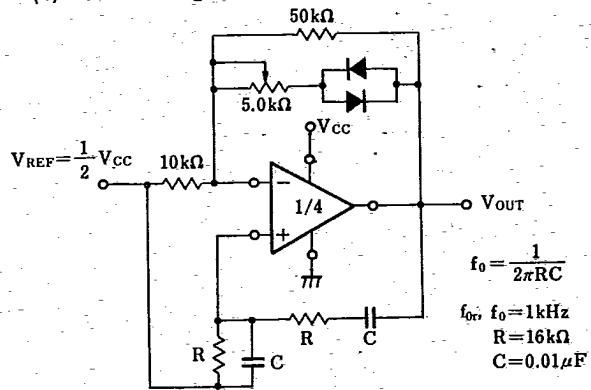
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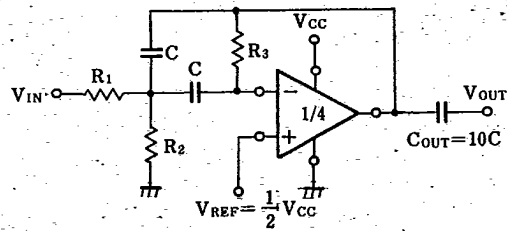
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(4) Wien bridge oscillator



(5) Multiple feedback band-pass filter

 f_0 : central frequency (Hz) $A(f_0)$: gain at the central frequency

$$R_1 = \frac{R_3}{2A(f_0)}$$

$$R_2 = \frac{R_1 R_3}{4Q^2 R_1 - R_3}$$

$$R_3 = \frac{Q}{\pi f_0 C}$$



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