

# HA17324/A Series

## Quad Operational Amplifier

# HITACHI

ADE-204-031A (Z)

Rev.1

Mar. 2001

### Description

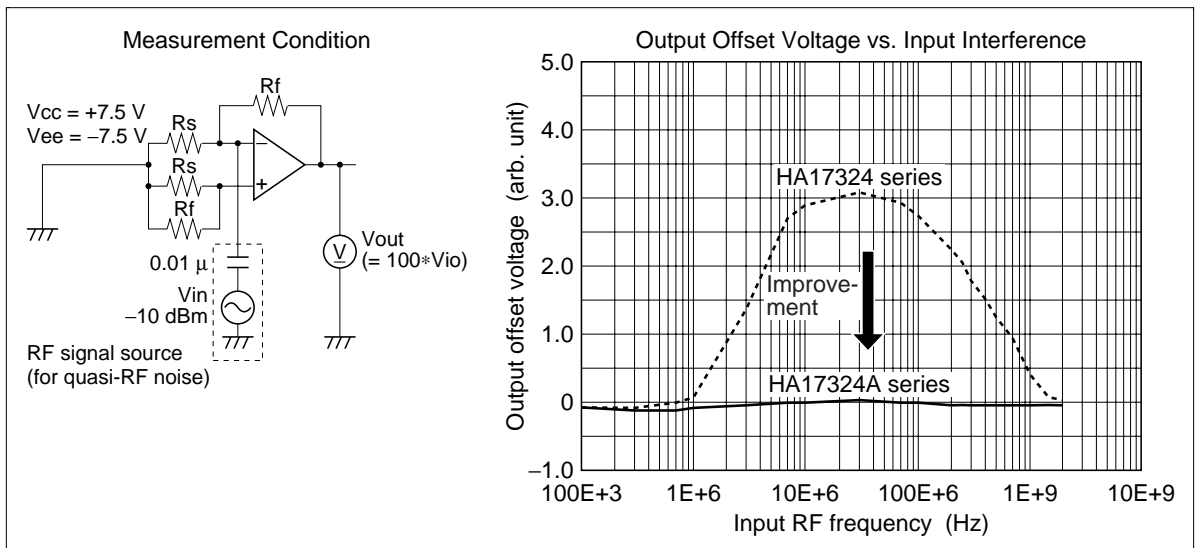
HA17324 series and HA17324A series are quad operational amplifier that provide high gain and internal phase compensation, with single power supply. They can be widely used to control equipments.

### Features

- Wide range of supply voltage, and single power supply used
- Internal phase compensation
- Wide range of common mode voltage, and possible to operate with an input about 0 V

### Features only for "A" series

- Low electro-magnetic susceptibility level

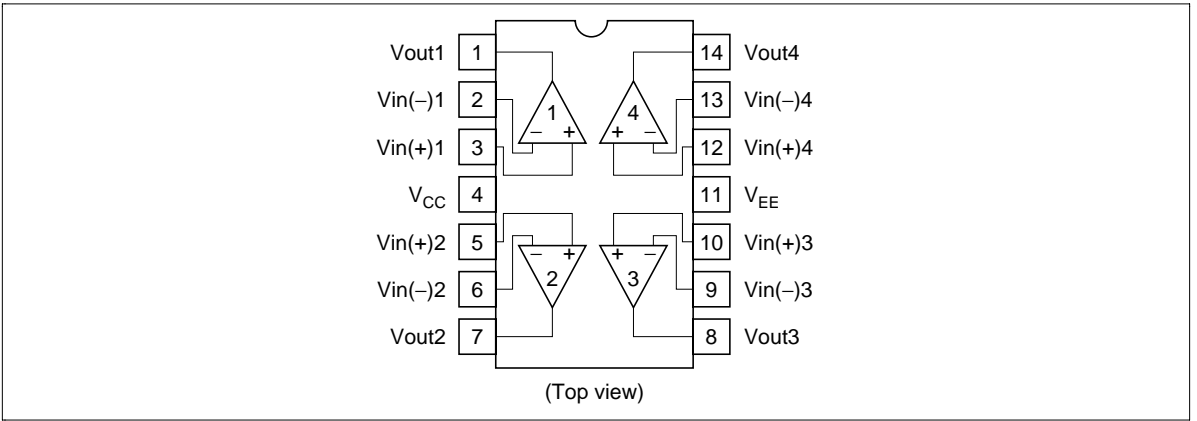


# HA17324/A Series

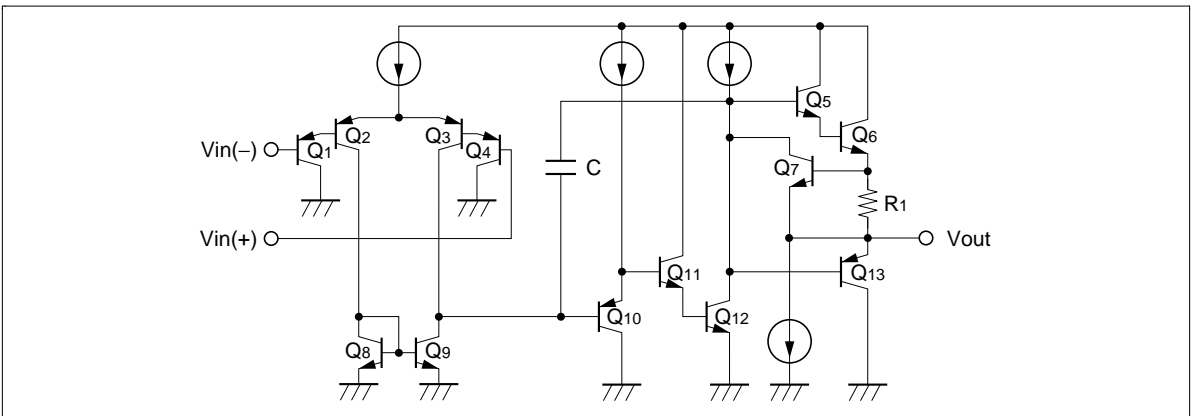
## Ordering Information

Type No.	Application	Package
HA17324	Commercial use	DP-14
HA17324F		FP-14DA
HA17324P	Industrial use	DP-14
HA17324FP		FP-14DA
HA17324AP	Industrial use	DP-14
HA17324ARP	Commercial use	FP-14DN
HA17324AFP		FP-14DA

## Pin Arrangement



## Circuit Schematic (1/4)



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## Absolute Maximum Ratings (Ta = 25°C)

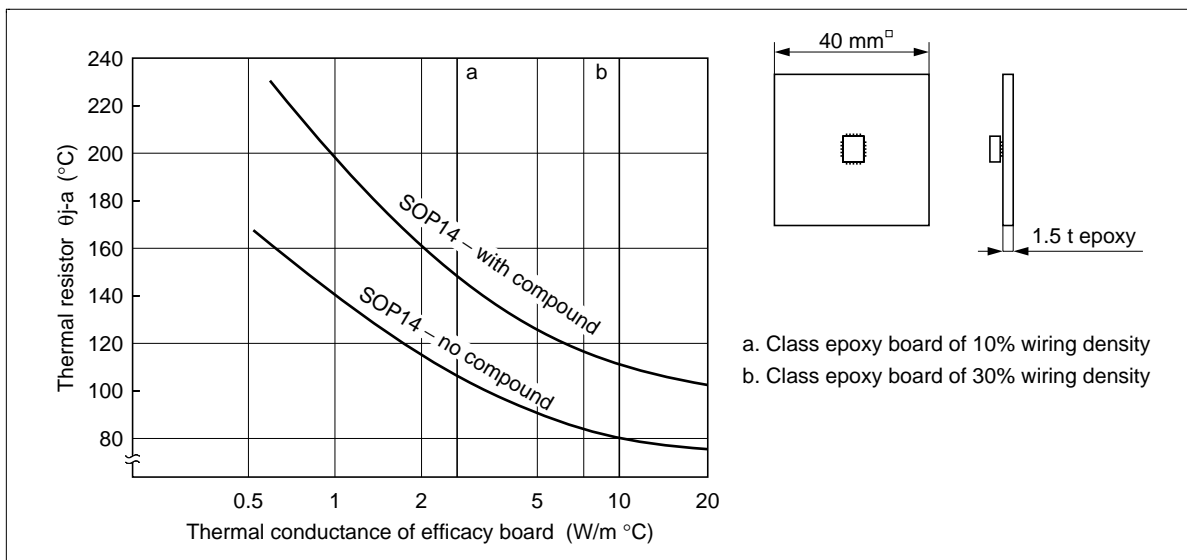
Item	Symbol	Ratings		Unit
		HA17324/P/F/FP	HA17324AP/ARP/AFP	
Supply voltage	V <sub>CC</sub>	32	32	V
Sink current	I <sub>sink</sub>	50	50	mA
Power dissipation	P <sub>T</sub>	625 *1	625 *2	mW
Common mode input voltage	V <sub>CM</sub>	-0.3 to V <sub>CC</sub>	-0.3 to V <sub>CC</sub>	V
Differential input voltage	V <sub>in (diff)</sub>	±V <sub>CC</sub>	±V <sub>CC</sub>	V
Operating temperature	T <sub>opr</sub>	-20 to +75	-40 to +85	°C
Storage temperature	T <sub>stg</sub>	-55 to +125	-55 to +125	°C

Notes: 1. This is the allowable values up to Ta = 50°C. Derate by 8.3 mW/°C.

2.  $T_{jmax} = \theta_{j-a} \cdot P_{Cmax} + T_a$  ( $\theta_{j-a}$ ; Thermal resistor between junction and ambient at set board use).

The wiring density and the material of the set board must be chosen for thermal conductance of efficacy board.

And P<sub>Cmax</sub> cannot be over the value of P<sub>T</sub>.

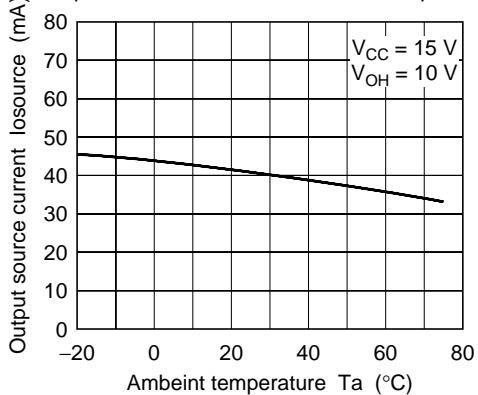


## Electrical Characteristics ( $V_{CC} = +15\text{ V}$ , $T_a = 25^\circ\text{C}$ )

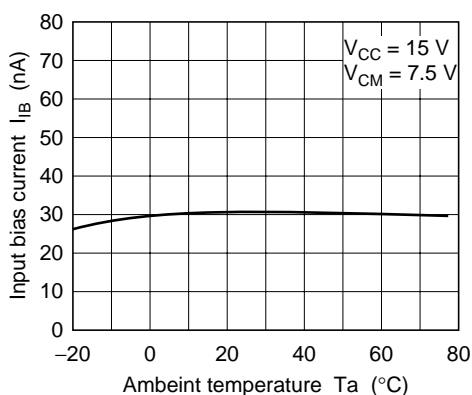
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Input offset voltage	$V_{IO}$	—	2	7	mV	$V_{CM} = 7.5\text{ V}$ , $R_S = 50\ \Omega$ , $R_f = 50\ \text{k}\Omega$
Input offset current	$I_{IO}$	—	5	50	nA	$V_{CM} = 7.5\text{ V}$ , $I_{IO} =  I_{I(-)} - I_{I(+)} $
Input bias current	$I_{IB}$	—	30	500	nA	$V_{CM} = 7.5\text{ V}$
Power source rejection ratio	PSRR	—	93	—	dB	$f = 100\text{ Hz}$ , $R_S = 1\ \text{k}\Omega$ , $R_j = 100\ \text{k}\Omega$
Voltage gain	$A_{VD}$	75	90	—	dB	$R_S = 1\ \text{k}\Omega$ , $R_f = 100\ \text{k}\Omega$ , $R_L = \infty$
Common mode rejection ratio	CMR	—	80	—	dB	$R_S = 50\ \Omega$ , $R_f = 5\ \text{k}\Omega$
Common mode input voltage range	$V_{CM}$	-0.3	—	13.5	V	$R_S = 1\ \text{k}\Omega$ , $R_f = 100\ \text{k}\Omega$ , $f = 100\text{ Hz}$
Maximum output voltage	$V_{op-p}$	—	13.6	—	V	$f = 100\text{ Hz}$ , $R_S = 1\ \text{k}\Omega$ , $R_f = 100\ \text{k}\Omega$ , $R_L = 20\ \text{k}\Omega$
Output source current	$I_{osource}$	20	40	—	mA	$V_{IN}^+ = 1\text{ V}$ , $V_{IN}^- = 0\text{ V}$ , $V_{OH} = 10\text{ V}$
Output sink current	$I_{osink}$	10	20	—	mA	$V_{IN} = 0\text{ V}$ , $V_{IN} = 1\text{ V}$ , $V_{OL} = 2.5\text{ V}$
Supply current	$I_{CC}$	—	0.8	2	mA	$V_{IN} = \text{GND}$ , $R_L = \infty$
Slew rate	SR	—	0.19	—	V/ $\mu\text{s}$	$f = 1.5\text{ kHz}$ , $V_{CM} = 7.5\text{ V}$ , $R_L = \infty$
Channel separation	CS	—	120	—	dB	$f = 1\text{ kHz}$
Output sink current	$I_{osink}$	15	50	—	$\mu\text{A}$	$V_{IN}^+ = 0\text{ V}$ , $V_{IN}^- = 1\text{ V}$ , $V_{OL} = 200\text{ mV}$
	$I_{osink}$	3	9	—	mA	$V_{IN}^+ = 0\text{ V}$ , $V_{IN}^- = 1\text{ V}$ , $V_{OL} = 1\text{ V}$
Output voltage	$V_{OH}$	13.2	13.6	—	V	$I_{OH} = -1\text{ mA}$
	$V_{OH}$	12.0	13.3	—	V	$I_{OH} = -10\text{ mA}$
Output voltage	$V_{OL}$	—	0.8	1.0	V	$I_{OL} = 1\text{ mA}$
	$V_{OL}$	—	1.1	1.8	V	$I_{OL} = 10\text{ mA}$

Characteristic Curves

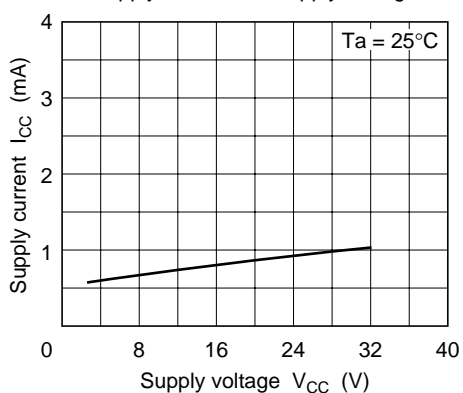
Output Source Current vs. Ambient Temperature



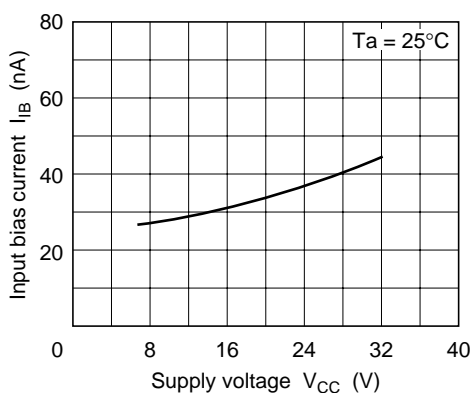
Input Bias Current vs. Ambient Temperature



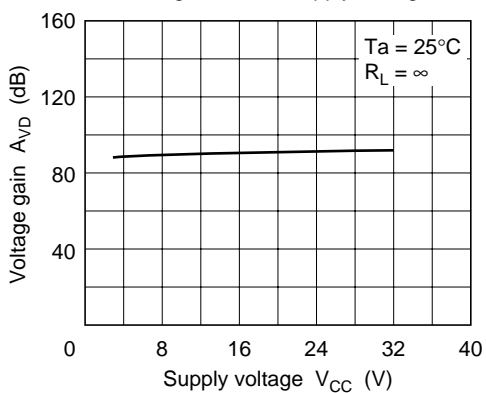
Supply Current vs. Supply Voltage



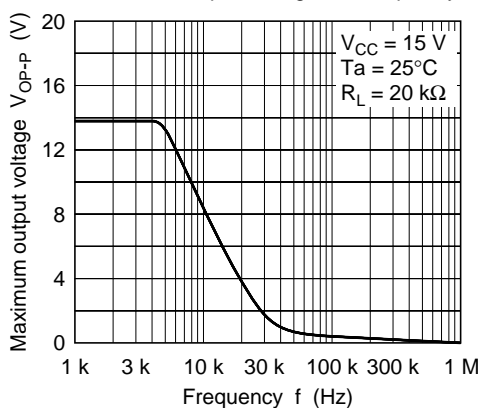
Input Bias Current vs. Supply Voltage

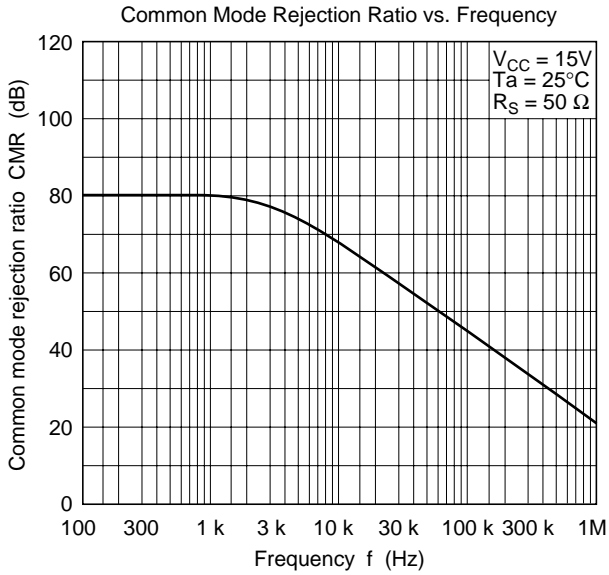
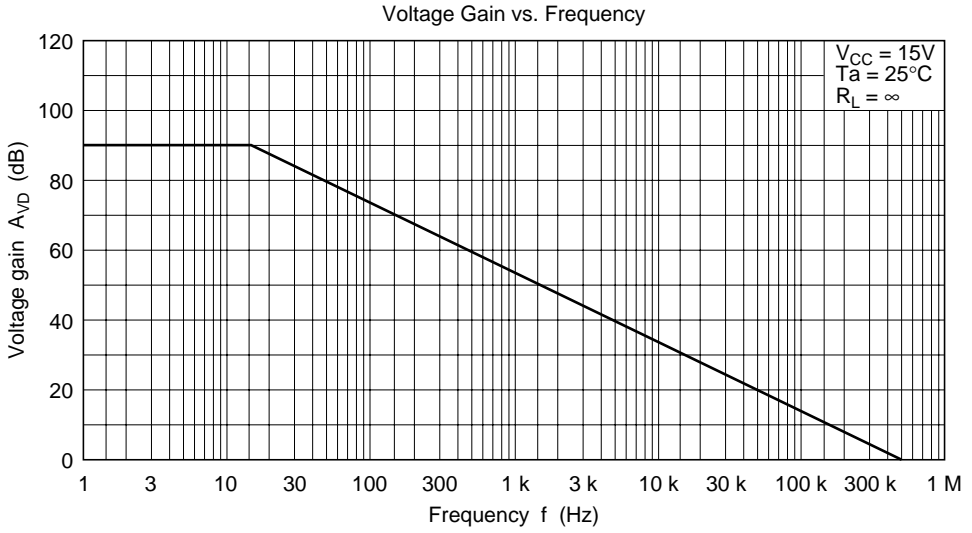


Voltage Gain vs. Supply Voltage



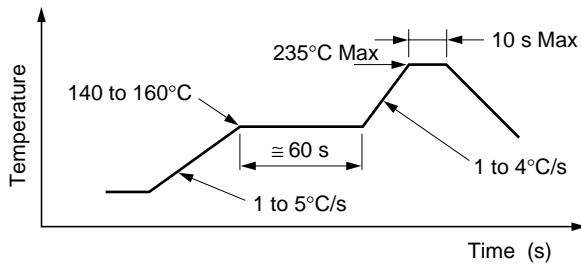
Maximum Output Voltage vs. Frequency





## Solder Mounting Method

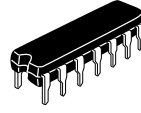
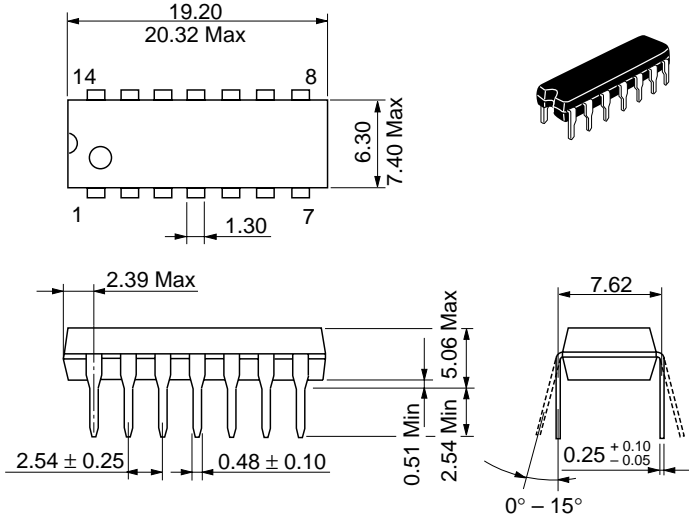
1. Small and light surface-mount packages require special attentions on solder mounting.  
On solder mounting, pre-heating before soldering is needed.  
The following figure show an example of infrared rays reflow.
2. The difference of thermal expansion coefficient between mounted substrates and IC leads may cause a failure like solder peeling or solder wet, and electrical characteristics may change by thermal stress.  
Therefore, mounting should be done after sufficient confirmation for especially in case of ceramic substrates.



**Figure 1 An Example of Infrared Rays Reflow Conditions**

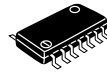
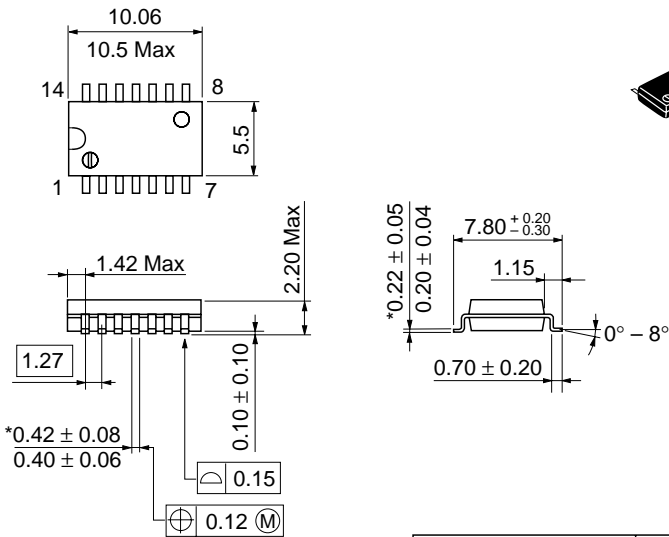
## Package Dimensions

Unit: mm



Hitachi Code	DP-14
JEDEC	Conforms
EIAJ	Conforms
Mass (reference value)	0.97 g

Unit: mm

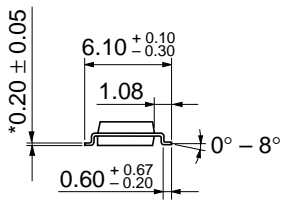
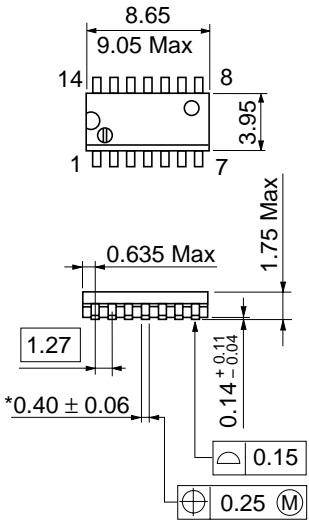


Hitachi Code	FP-14DA
JEDEC	—
EIAJ	Conforms
Mass (reference value)	0.23 g

\*Dimension including the plating thickness  
Base material dimension



Unit: mm



\*Pd plating

Hitachi Code	FP-14DN
JEDEC	Conforms
EIAJ	Conforms
Mass (reference value)	0.13 g

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