ADE-207-152 (Z)

HA166162RFP2, HA166163RFP4
Pre Amplifier for Hard Disk Drive

HITACHI

Target Specifications
1st. Edition
Nov. 1994

The HA166162RFP2, HA166163RFP4 are read/write amplifiers designed for use with thin film recording heads. They have the following functions and features.

Functions

- Read amplifier circuit
- Write driver circuit
- Constant write current setup circuit

Features

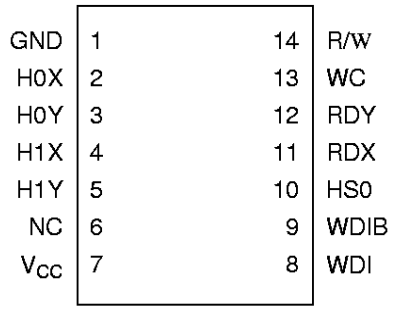
- Single power supply +5 V
- Low power
  Read: 165 mW (Typ)
- Low Noise: 0.5 nV/$\sqrt{\text{Hz}}$ (Typ)
- Read amplifier has high differential voltage gain
  : 300 V/V (Typ)
- ECL compatible interface
- Emitter-follower read amplifier outputs
- Input capacitance: 10 pF (Typ)
- Write current range: 8 to 20 mA
- Diode connected damping
  resistor: 400 ohm

Ordering Information

Type	Channel	Package
HA166162RFP2	2	FP-14DA
HA166163RFP4	4	FP-20DA

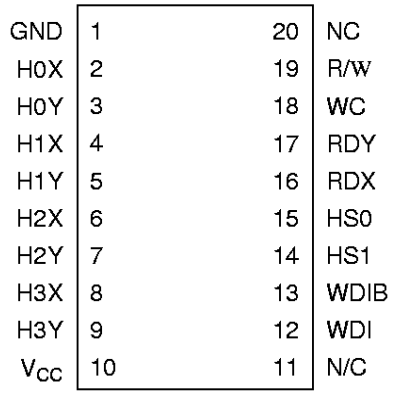
Pin Arrangement

HA166162RFP2



(Top view)

HA166163RFP4



(Top view)

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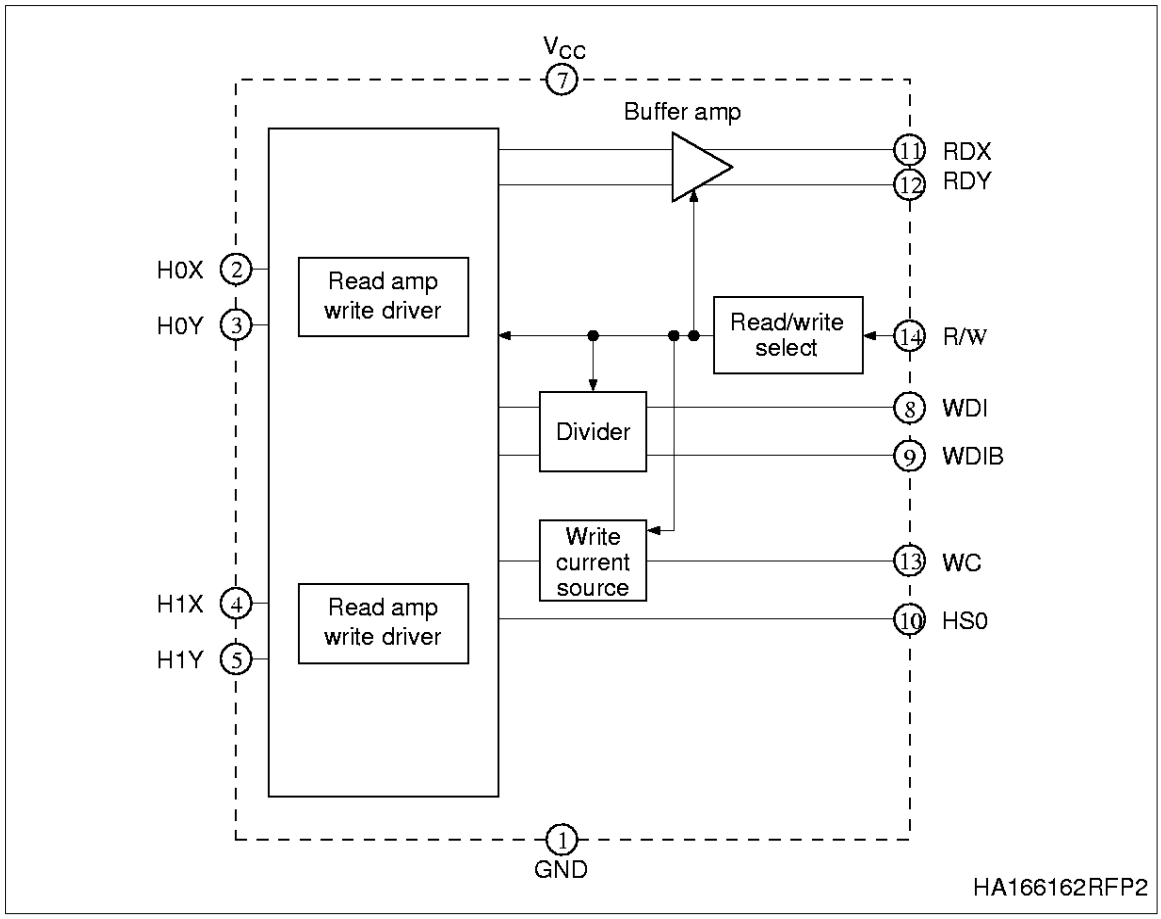
Pin Description

Pin No.					
HA166162	HA166163			Symbol	Pin Name	Description
1	1	GND	Ground	Ground pins	
2, 3	2, 3	H0X, H0Y	Head 0X, 0Y	These pins are connected to the R/W head coil of channel 0.	
4, 5	4, 5	H1X, H1Y	Head 1X, 1Y	These pins are connected to the R/W head coil of channel 1.	
6	11	NC			
7	10	V_{CC}	5 V	5 V power supply	
8, 9	12, 13	WDI, WDIB	Write data input	Write data input pin. The positive edge of WDI toggles head current.	
10	15	HS0	Head select 0	Input pins for head select signals. Refer to the head select table.	
11, 12	16, 17	RDX, RDY	Read amplifier output	Differential output pins for the read amp. The signal read out from the head coil is amplified and provided on these pins.	
13	18	WC	Write current setting	Write current setting pin. The write current is defined by the equation below by connecting the external resistance R_{WC} between this pin and GND. Write current [mA] = K/R_{WC} [kΩ]	
14	19	R/W	R/W switch	Mode select switch for changing over the bias condition of the head coil. A low level selects the write mode, while a high level selects the read mode.	
	6, 7	H2X, H2Y	Head 2X, 2Y	These pins are connected to the R/W head coil of channel 2.	
	8, 9	H3X, H3Y	Head 3X, 3Y	These pins are connected to the R/W head coil of channel 3.	
	14	HS1	Head select 1	Input pins for head select signals. Refer to the head select table.	
	20	NC			

Block Diagram



Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Rating	Unit	Applicable Terminal
Supply voltage	V_{CC}	–0.3 to +6.0	V	V_{CC}
Write current	I_W	35	mA	
Interface input voltage	V_{IN}	–0.3 to V_{CC} +0.3	V	HS0 WDI, WDIB, R/W
Read data output current	I_{RO}	–10	mA	RDX, RDY
Operating temperature	Topr	0 to +70	°C	
Storage temperature	Tstg	–55 to +150	°C	
Head voltage swing	V_{HSW}	4.0	Vpp	
Power dissipation	P_T	550	mW	

Power Supply (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Supply voltage range	V_{CC}	4.5	—	5.5	V	
+5.5 V supply current	I_{CC}	—	33	45	mA	Read mode
		—	35 + I_W	43 + I_W		Write mode
		—	6	10	mA	Off mode I_{WC} < 0.15 mA

Electrical Characteristics (V_{CC} = 5 V, Ta = 25°C unless otherwise specified)

Digital Input

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Low level input voltage1	V_{IL1}	–0.3	—	0.8	V	
Low level input current1	I_{IL1}	–100	—	—	µA	V_{IL} = 0.4 V
High level input voltage1	V_{IH1}	2.0	—	V_{CC} + 0.3	V	
High level input current1	I_{IH1}	—	—	20	µA	V_{IH} = 2.0 V
Low level input voltage2	V_{IL2}	V_{CC} – 2	—	V_{CC} – 1.65	V	(WDI, WDIB)
Low level input current2	I_{IL2}	—	—	0.75	mA	V_{IL} = 3.2 V (WDI, WDIB)
High level input voltage2	V_{IH2}	V_{CC} – 1	—	V_{CC} + 0.3	V	(WDI, WDIB)
High level input current2	I_{IH2}	—	—	0.95	mA	V_{IH} = 4.2 V (WDI, WDIB)
Read/write transition time	t_{RW}	—	—	150	ns	
Write/read transition time	t_{WR}	—	—	500	ns	
Head select switching delay time	t_{HS}	—	—	1000	ns	Read mode

Head Select Table

HS0	HS1	Head Selected
L	L	0
H	L	1
L	H	2
H	H	3

Mode Select Table

R/W	Mode
L	Write
H	Read
H	Read
H	Read

Read Amplifier

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Differential voltage gain	Avd	249	300	351	V/V	f = 300 kHz
Bandwidth	B_W	50	70	—	MHz	–3 dB
Input noise voltage	Vn	—	(0.5)*1	(0.6)*1	nV/√Hz	f ≤ 15 MHz, Inputs shorted
Common mode rejection ratio	CMRR	60	80	—	dB	
Power supply stability	PSRR	45	60	—		V_{CC} ±100 mVp-p, f = 5 MHz
Channel separation	Sep	60	80	—		Vin = 100 mVp-p on unselected channels and Vin = 0 mVp-p on selected channels, f = 5 MHz
Output offset voltage	Vo	–300	—	300	mV	Inputs shorted
Differential input impedance	Rin	—	0.72	—	kΩ	f = 300 kHz
			0.70			f = 5 MHz
Common mode output voltage	Vcom	2.0	2.5	3.0	V	
Output source current	I_{OSO}	—	–10	—	mA	
Output sink current	I_{OSI}	1.5	2.0	—		
Input capacitance	C_{IN}	—	(10)*1	(15)*1	pF	

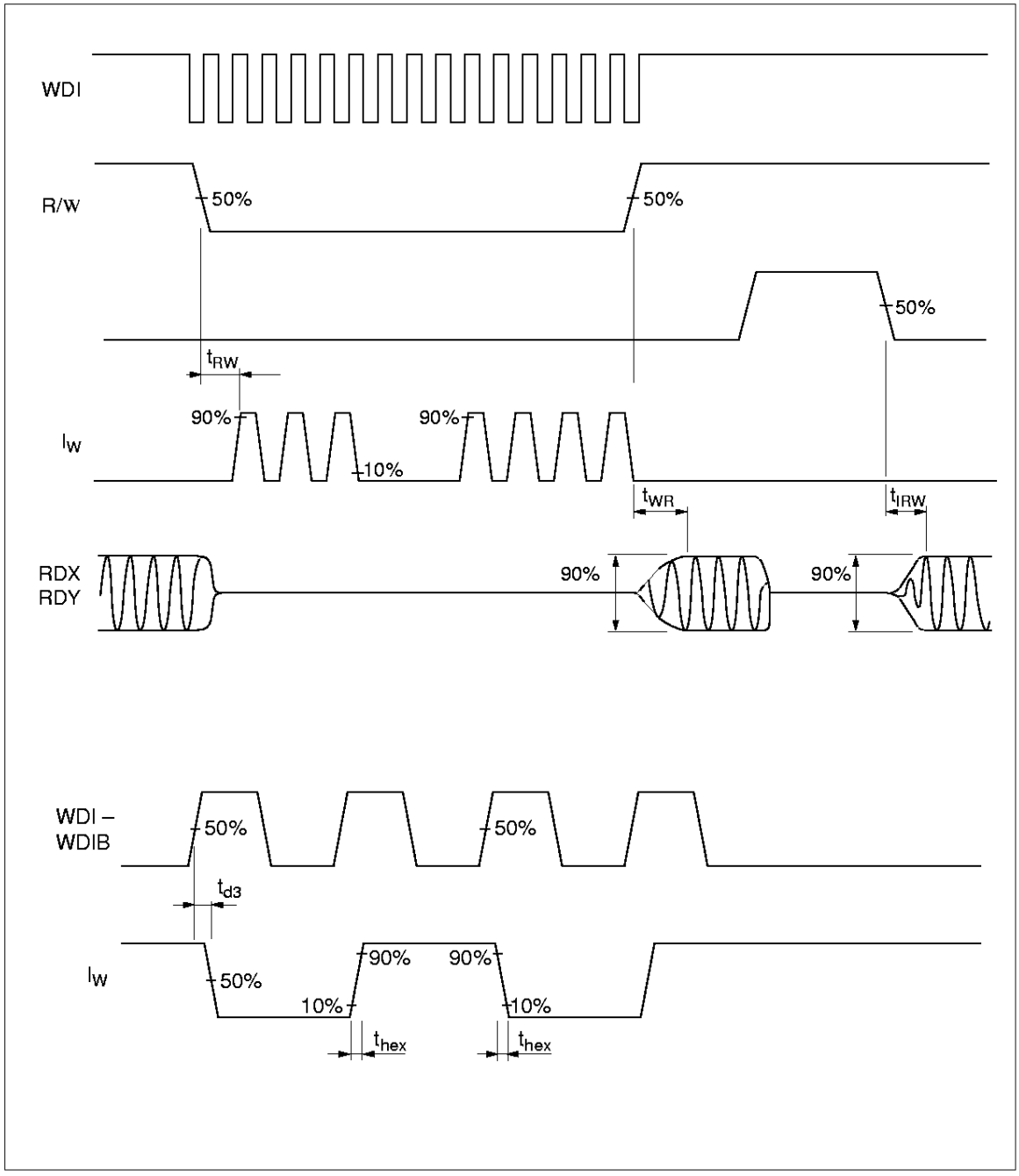
Note: 1. These values are only for design purpose.

Write Driver

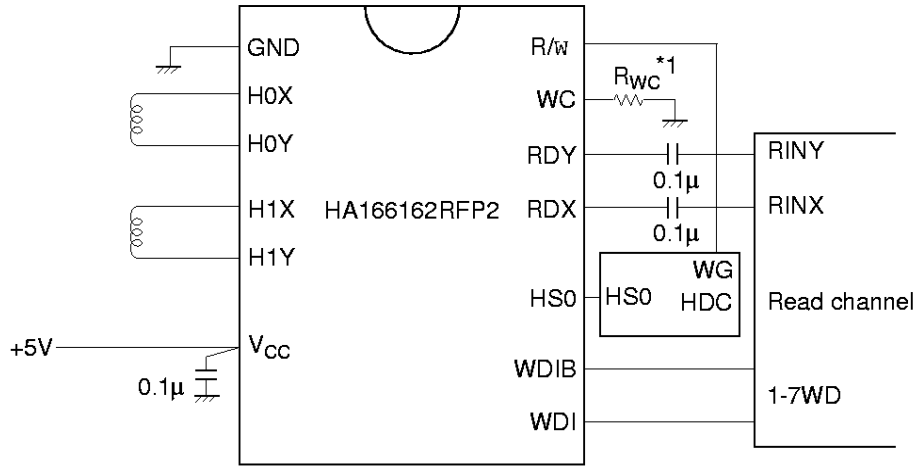
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Write current setting range	I_W	8	—	20	mA	
Head current rise time	t_{hex}	—	4	15	ns	Lh = 0 µH, Rh = 0 Ω, 10% to 90% point
Head current switching delay time	t_{d3}	—	—	30		Rh = 0 Ω, Lh = 0 µH, from 50% point
Head current switching symmetry	t_{d4}	—	—	(1)*1		WDI duty cycle = 50%, rise/fall time = 1 ns
Head current gain	I_H/I_{WC}	—	10.4	—	A/A	Head current/I_{WC}
WC output voltage	V_{WC}	—	3.4	—	V	I_H = 10 mA
Write current accuracy	I_{H1}	8.4	10	11.6	mA	R_{WC} = 3.55 kΩ
V_{CC} monitor operating range (max)	V_{M1}	3.37	3.67	3.97	V	$I_H \leq 0.5$ mA
V_{CC} monitor operating range (min)	V_{M2}	—	—	0	V	$I_h \leq 0.5$ mA

Note: 1. These values are only for design purpose.

Timing Waveforms



Application Circuit Example



Unit R: Ω
C: F

Notes: 1. External resistance value R_{WC} is determined by following equation.

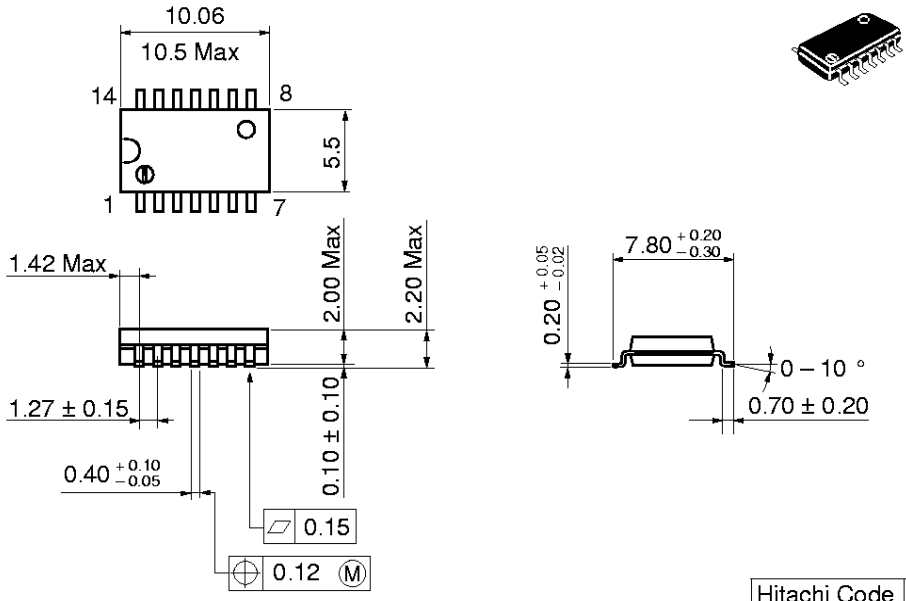
$$R_{WC}\ [k\Omega] = \frac{K}{\text{Write current [mA]}}$$

Also, write current ringing on changeover between read and write can be suppressed by locating the resistor R_{WC} as close as possible to the WC pin.

Package Dimensions

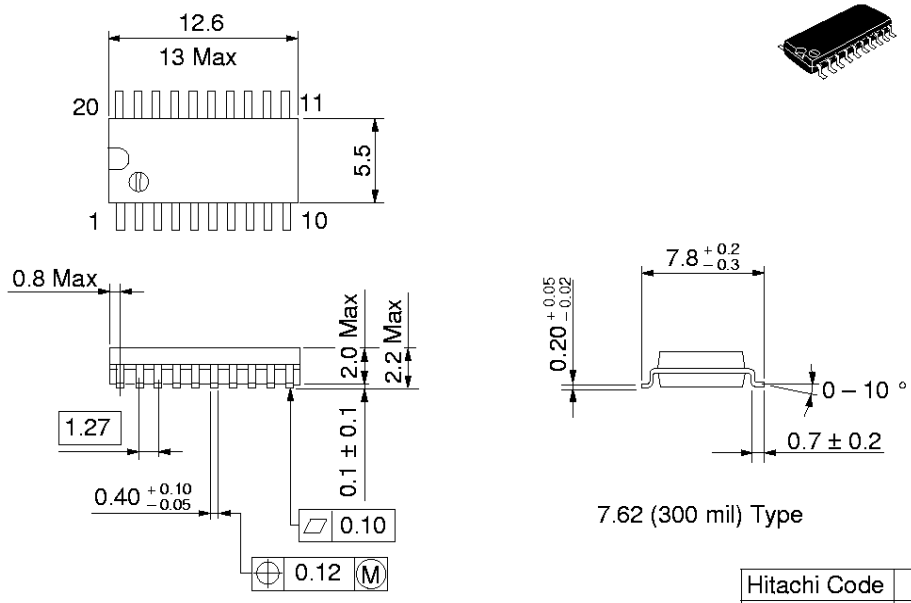
Unit: mm

• HA166162RFP2



Hitachi Code	FP-14DA
EIAJ	SC-529-14B
JEDEC	——

• HA166163RFP4



7.62 (300 mil) Type

Hitachi Code	FP-20DA
EIAJ	SC-531-20
JEDEC	——

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