FUJITSU

MAGNETIC DISK HEAD AMPLIFIER

MB 4111
MB 4112
MB 4113

March 1984
Edition 2.0

MAGNETIC DISK HEAD AMPLIFIER

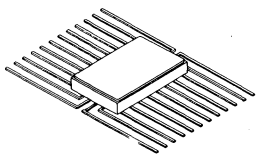
The Fujitsu MB 4111/MB 4112/MB 4113 is a monolithic bipolar integrated circuit optimized for high performance application to disk head systems.

The MB 4111/MB 4112/MB 4113 is featured with the following four major functions to interface with four magnetic heads.

* Write Amplifier Circuit
* Read Amplifier Circuit
* $\overline{RAS}$ (safety) Circuit
* Selection Decode Circuit

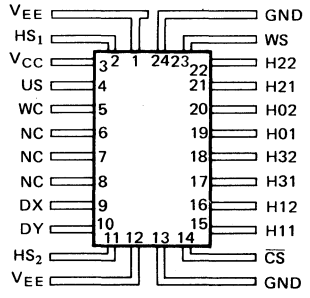
Also, the MB 4111/MB 4112/MB 4113 has three modes, Read, Write and Idle.

The MB 4111/MB 4113 is suitable for mounting directly on the arm of movable disk head.
The MB 4112 is suitable for mounting on the PC board interfacing the fixed disk head.



CERAMIC PACKAGE
FPT-24C-F01

PIN ASSIGNMENT



ABSOLUTE MAXIMUM RATINGS (*: Referenced to ground)

Rating	Symbol	Value	Unit
Supply Voltage	V_{CC}*	7.0	V
Supply Voltage	V_{EE}*	-5.5	V
Operating Temperature	T_{OP}	0 to +70	°C
Storage Temperature	T_{STG}	-65 to +150	°C

Permanent device damage may occur if ABSOLUTE MAXIMUM RATINGS are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Value			Unit
		Min	Typ	Max	
Supply Voltage (Read/Write/Idle)	V_{CC}	5.7	6.0	6.3	V
Supply Voltage (Read/Write/Idle)	V_{EE}	-4.2	-4.0	-3.8	V

Ambient temperature: 0°C to +70°C

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.

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PIN NAMES

No.	Symbol	Name
1	V_{EE}	Supply Voltage
2	$\overline{HS_1}$	Head Select 1
3	V_{CC}	Supply Voltage
4	US	Unsafe
5	WC	Write Current
6	NC	Non-connection*
7	NC	Non-connection*
8	NC	Non-connection*

No.	Symbol	Name
9	DX	Data X
10	DY	Data Y
11	HS_2	Head Select 2
12	V_{EE}	Supply Voltage
13	GND	Ground
14	WS	Write Select
15	H11	Head 1
16	H12	

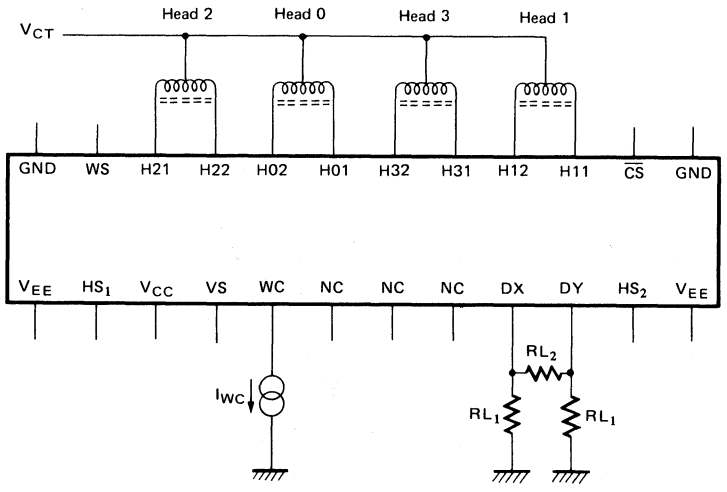
No.	Symbol	Name
17	H31	Head 3
18	H32	
19	H01	Head 0
20	H02	
21	H21	Head 2
22	H22	
23	$\overline{CS}$	Chip Select
24	GND	Ground

Note: NCs should be left open any time.

TEST CONDITIONS

Parameter	Symbol	Mode		Value	Unit
Supply Voltage	V_{CC}	Read/Write/Idle		6.0 ± 1.0%	V
	V_{EE}			-4.0 ± 1.0%	
Head Inductance	L_h	Read/Write	DC	0 (short)	μH
			AC	9.0	
Write Select Voltage	V_{WS}	Write		3.5 ± 1.0%	V
		Read		0.0 ± 0.01	
Chip Select Voltage	V_{CS}	Read/Write		0.0 ± 0.01	V
		Idle		6.0 ± 1.0%	
Unsafe Voltage	V_{US}	Read/Write/Idle		6.0 ± 1.0%	V
Termination Resistor	R_{L1}	Read/Write/Idle		200 ± 1.0%	Ω
	R_{L2}			100 ± 1.0%	
Write Current	I_{WC}	Write		40.0 ± 1.0%	mA
		Read		0.0 ± 0.2	
Ambient Temperature	T_A	Read/Write/Idle		25.0 ± 2.0	°C

Fig. 1 – TEST CIRCUIT



Note: NCs should be left open.

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ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Value			Unit	Note
		Min	Typ	Max		
Supply Current	I_{CC}	12	16	20	mA	Selected
				100	μA	Non Selected
Supply Current	I_{EE}	-70			mA	Selected
		-45				Non Selected

MODE SELECT

Parameter	Sybmol	Mode	Value			Unit	Note
			Min	Typ	Max		
$\overline{CS}$ Input High Voltage	V_{IHC}	Idle	5.7	6.0	6.3	V	$-50\mu A < I_{CS} < 0\mu A$
$\overline{CS}$ Input Low Voltage	V_{ILC}	Read/Write	0.0	0.35	0.7	V	
$\overline{CS}$ Input High Current	I_{IHC}	Idle	-70			μA	
$\overline{CS}$ Input Low Current	I_{ILC}	Read/Write	-1.3	-1.0	-0.6	mA	V_{CS} = 0V
WS Input High Voltage	V_{IHW}	Write/Idle	3.2	3.5	3.8	V	
WS Input Low Voltage	V_{ILW}	Read/Idle	0	0.1	0.2	V	
WS Input High Current	I_{IHW1}	Write/Idle	0.7		2.8	mA	Transition Unsafe OFF
	I_{IHW2}	Write/Idle	0.7		3.5	mA	Transition Unsafe ON
WS Input Low Current	I_{ILW}	Read/Idle			0.1	mA	
Switching Delay	t_{SD}	All Modes			500	ns	

TOTAL HEAD INPUT CURRENT

Parameter	Symbol	Mode	Value			Unit	Note
			Min	Typ	Max		
Input Current	I_{I1}	Write			3.0	mA	V_{CT} = 3.5V
Input Current	I_{I2}	Read			0.16	mA	V_{CT} = 0V
Input Current	I_{I3}	Idle			0.5	mA	V_{CT} High or Low

HEAD SELECT

Parameter	Symbol	Condition	Value			Unit
			Min	Typ	Max	
HS Input High Voltage	V_{IHH}	T_A = 0°C to +70°C	-0.96		-0.81	V
HS Input Low Voltage	V_{ILH}	T_A = 0°C to +70°C	-1.85		-1.65	V
HS Input High Current	I_{IHH}				240	μA
HS Input Low Current	I_{ILH}				30	μA
Switching Delay	t_{SDH}				100	ns

HEAD SELECTION TABLE

Head No.	$\overline{CS}$	HS1	HS2
–	High	–	–
0	Low	High	High
1	Low	Low	High
2	Low	High	Low
3	Low	Low	Low

READ MODE

Parameter		Symbol	Condition	Value			Unit
				Min	Typ	Max	
Differential Gain	MB 4111 MB 4113	A_V	V_{IN} = 1mVp-p, 0V DC, f = 300KHz	22.0	35.0	46.0	V/V
	MB 4112			5.0	9.0	12.5	
Common Mode Rejection Ratio		CMRR	V_{IN} = 5mVp-p, 0V DC, f ≦ 5MHz	45			dB
Power Supply Rejection Ratio		SV_{RR}	V_{IN} = 0V, f ≦ 5MHz	45			dB
Band Width		BW	Z_{IN} = 0Ω (-3dB)	35			MHz
Channel Noise	MB 4111 MB 4113	V_n	V_{IN} = 0V, Z_{IN} = 0Ω, 10MHz Power Band Width			5.4	μV RMS
	MB 4112					20	
Input Current		I_{IN}	V_{IN} = 0V			40	μA
Input Capacitance	MB 4111 MB 4113	C_I				18.8	pF
	MB 4112					16.0	
Differential Input Resistance	MB 4111 MB 4112	R_D		585	750	915	Ω
	MB 4113			380	480	580	
Output Offset Voltage	MB 4111 MB 4113	V_{OFF}		-100		100	mV
	MB 4112			-50		50	
Unsafe Current		I_U	V_{US} = 6.0V, I_{WC} = 45mA	40		45	mA
Dynamic Range	MB 4111 MB 4113	D	DC input voltage where gain is 90% of gain with 0.5 mVp-p input signal	6			mVp-p
	MB 4112			30			
Channel Separation		S_I	See Note	40			dB
Common Mode Output Voltage		V_O		-0.75	-0.60	-0.45	V

Note: V_{IN} = 1mVp-p, f = 300KHz, 3 Channel driven.

WRITE MODE

Parameter		Symbol	Condition	Value			Unit
				Min	Typ	Max	
Write Current		I_{WC}				50	mA
Current Gain		A_I	I_{WC} = 50mA	0.95			
Write Current Voltage		V_{WC}	I_{WC} = 45mA	V_{EE}+0.3		V_{EE}+1	V
Differential Input Voltage		V_{IN}		0.225			V
DX DY Input Current		I_{IN}	$-0.75V \leqq V_{DX} \leqq -0.45V$ $-0.75V \leqq V_{DY} \leqq -0.45V$	-2.0		2.0	mA
Unsafe Current		I_{US}	L = 7μH, f = 1.2MHz, I_{WC} = 20mA			0.1	mA
			L = 9μH, f = 0MHz, I_{WC} = 30mA	20			
Head Current Transition Time		t_T	L = 0μH, f = 5MHz I_{WC} = 50mA		5	10	ns
Head Current Hysterisis		t_{HY}	L = 0μH, f = 5MHz I_{WC} = 50mA			2.0	ns
Unselected Head Current		I_{OP}	L = 9μH, f = 2MHz, I_{WC} = 50mA			1.5	mA
Unsafe Switching Delay Time	MB 4111 MB 4112	t_{USD}	L = 9μH, f = 6.0MHz to 0MHz	0.5		4.0	μs
			L = 7μH, f = 0MHz to 1.2MHz			1.0	
	MB 4113		L = 5μH, I_{WC} = 30mA f = 7.5MHz to 0MHz	0.3		4.0	
			L = 3.5μH, I_{WC} = 15mA f = 0MHz to 3.0MHz			1.0	
Differential Head Voltage	MB 4111 MB 4113	V_{DIF}	I_{WC} = 45mA L = 9μH	6.2		7.2	V
	MB 4112		I_{WC} = 45mA L = 9μH	8.0		9.0	

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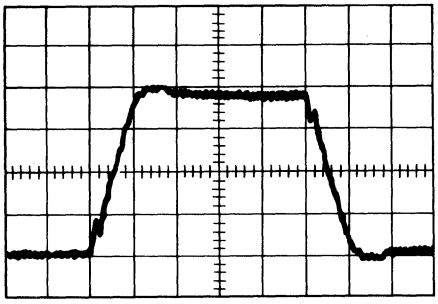
WRITE CURRENT WAVEFORMS

Conditions: L = 9μH, I_{WC} = 40mA

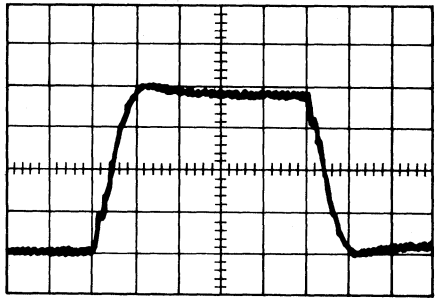
MB 4111



20mA/div

50ns/div

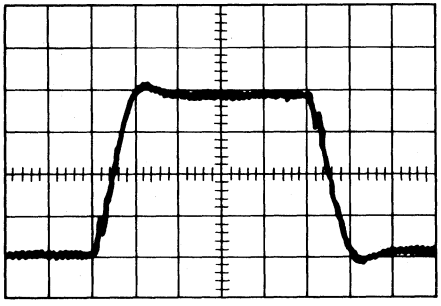
MB 4112



50ns/div

Conditions: L = 7μH, I_{WC} = 40mA

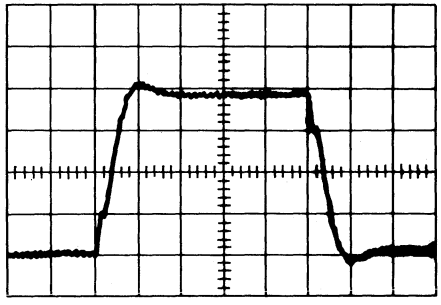
MB 4111



20mA/div

50ns/div

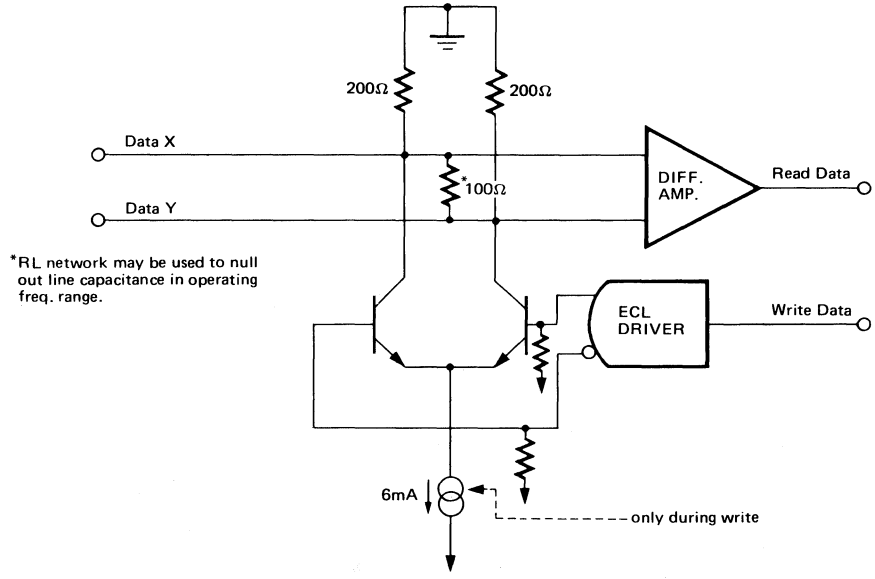
MB 4112



50ns/div

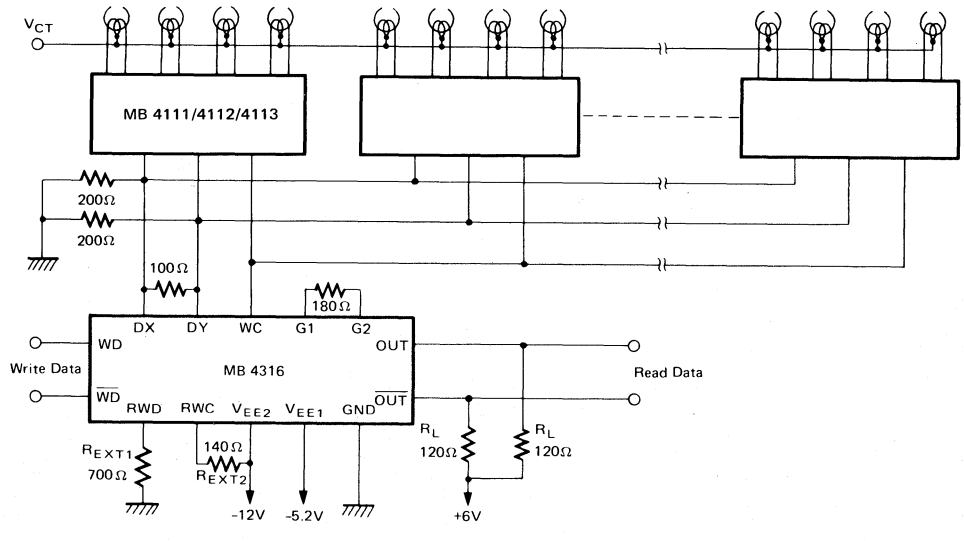
DISK HEAD APPLICATION NOTES

*BIDIRECTIONAL DATA BUS DRIVER



*RL network may be used to null out line capacitance in operating freq. range.

*USAGE IN COMBINATION WITH MB 4316 (BUS SWITCHING CIRCUIT)



Note: NCs should be left open.

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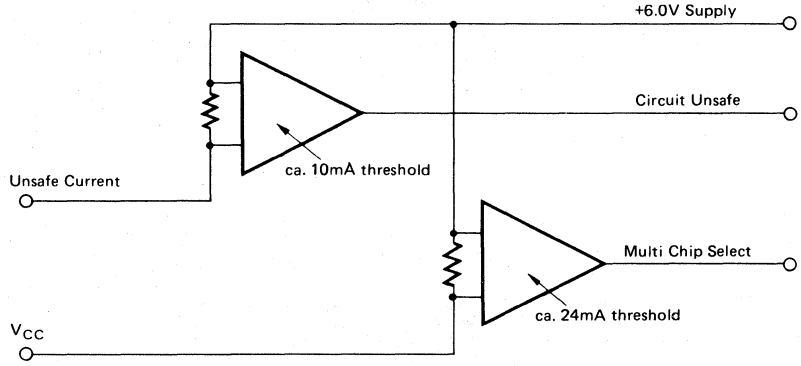
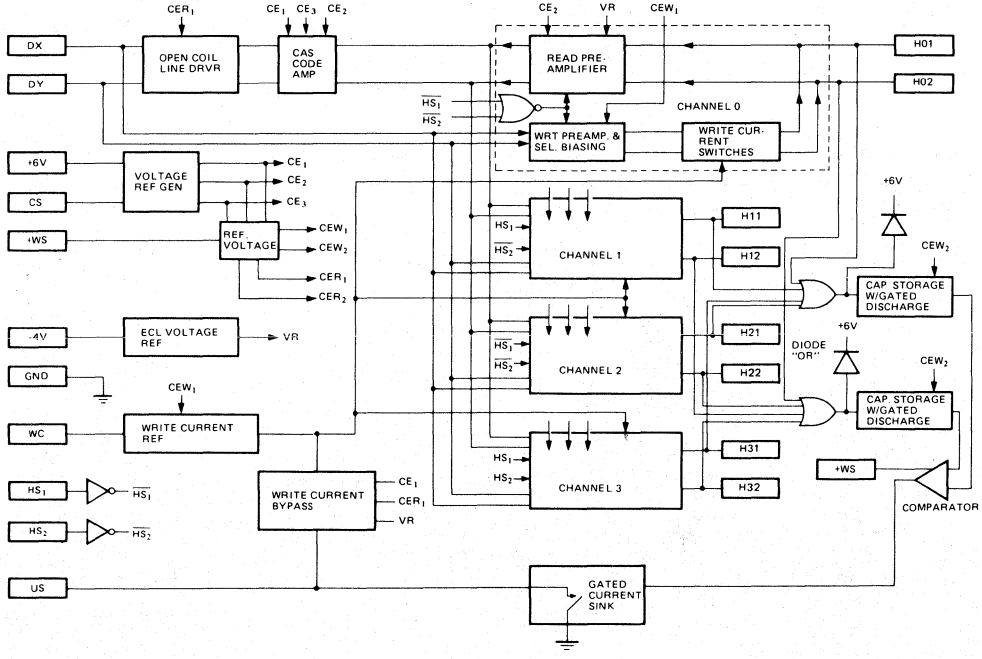
*FAULT DETECTION CIRCUITRY

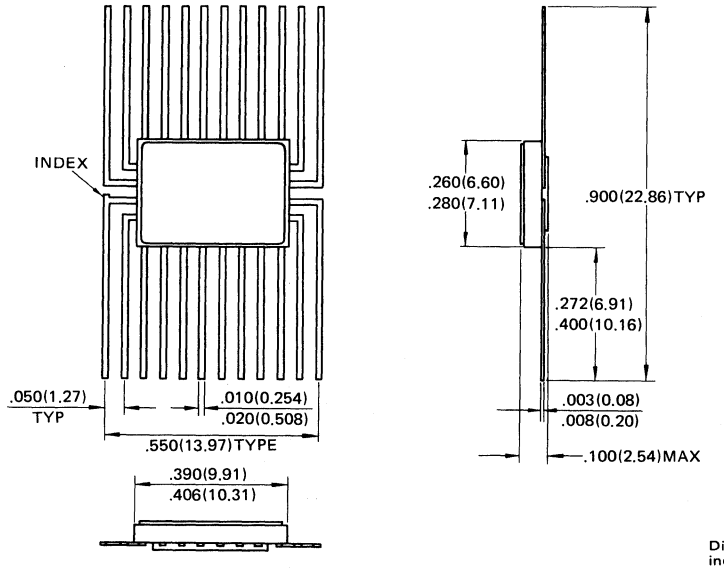


MB 4111/4112/4113 BLOCK DIAGRAM



PACKAGE DIMENSIONS

24-PAD CERAMIC (FRIT SEAL) FLAT PACKAGE
(CASE No. : FPT-24C-F01)



Dimensions in
inches (millimeters)

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