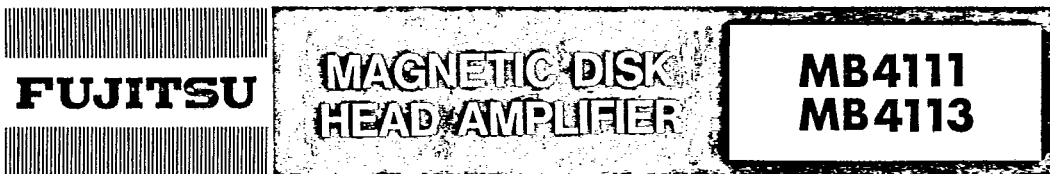


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December 1988
Edition 3.0

MAGNETIC DISK HEAD AMPLIFIER

The Fujitsu MB4111/MB4113 is a monolithic bipolar integrated circuit optimized for high performance application to disk head systems.

The MB4111/MB4113 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 MB4111/MB4113 has three modes, Read, Write and Idle.

The MB4111/MB4113 is suitable for mounting directly on the arm of movable disk head.

ABSOLUTE MAXIMUM RATINGS (*: Referenced to ground) ($T_a = 25^\circ\text{C}$)

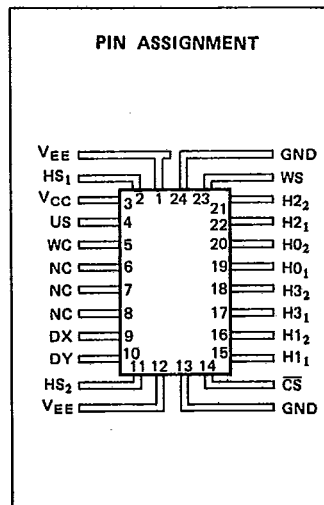
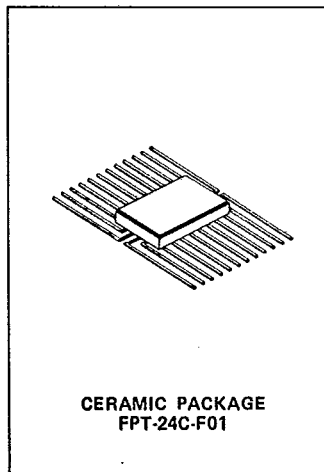
Rating	Symbol	Value	Unit
Supply Voltage	V_{CC}^*	7.0	V
Supply Voltage	V_{EE}^*	-5.5	V
Operating Temperature	T_{OP}	0 to +70	$^\circ\text{C}$
Storage Temperature	T_{STG}	-65 to +150	$^\circ\text{C}$

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		6.3	V
Supply Voltage (Read/Write/Idle)	V_{EE}	-4.2		-3.8	V

Ambient temperature: 0°C to $+70^\circ\text{C}$



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	No.	Symbol	Name	No.	Symbol	Name
1	V _{EE}	Supply Voltage	9	DX	Data X	17	H31	Head 3
2	HS ₁	Head Select 1	10	DY	Data Y	18	H32	
3	V _{CC}	Supply Voltage	11	HS ₂	Head Select 2	19	H01	Head 0
4	US	Unsafe	12	V _{EE}	Supply Voltage	20	H02	
5	WC	Write Current	13	GND	Ground	21	H21	Head 2
6	NC	Non-connection*	14	WS	Write Select	22	H22	
7	NC	Non-connection*	15	H11	Head 1	23	\overline{CS}	Chip Select
8	NC	Non-connection*	16	H12		24	GND	Ground

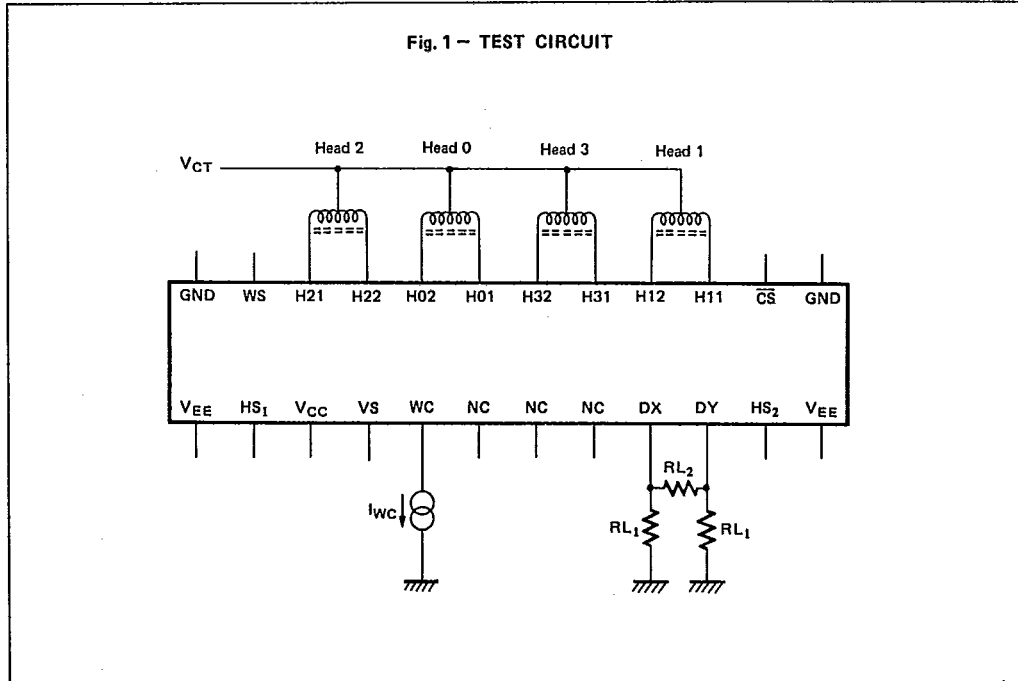
Note: NCs should be left open any time.

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	

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Note: NCs should be left open.

ELECTRICAL CHARACTERISTICS

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

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MODE SELECT

Parameter	Symbol	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	$V_{CT} = 0, 3.5V$

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HEAD SELECT

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



HEAD SELECTION TABLE

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

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READ MODE

Parameter	Symbol	Condition	Value			Unit
			Min	Typ	Max	
Differential Gain	A_V	$V_{IN} = 1\text{mVp-p}, 0\text{V DC}, f = 300\text{KHz}$	22.0	35.0	46.0	V/V
Common Mode Rejection Ratio	CMRR	$V_{IN} = 5\text{mVp-p}, 0\text{V DC}, f \leq 5\text{MHz}$	45			dB
Power Supply Rejection Ratio	SV_{RR}	$V_{IN} = 0\text{V}, f \leq 5\text{MHz}$	45			dB
Band Width	BW	$Z_{IN} = 0\Omega (-3\text{dB})$	35			MHz
Channel Noise	V_n	$V_{IN} = 0\text{V}, Z_{IN} = 0\Omega, 10\text{MHz Power Band Width}$			5.4	$\mu\text{V RMS}$
Input Current	I_{IN}	$V_{IN} = 0\text{V}$			40	μA
Input Capacitance	C_I				18.8	pF
Differential Input Resistance	MB4111	R_D	585	750	915	Ω
	MB4113		380	480	580	
Output Offset Voltage	V_{OFF}		-100		100	mV
Unsafe Current	I_U	$V_{US} = 6.0\text{V}, I_{WC} = 45\text{mA}$	40		45	mA
Dynamic Range	D		6			mVp-p
Channel Separation	S_I	See Note	40			dB
Common Mode Output Voltage	V_O		-0.75	-0.60	-0.45	V

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

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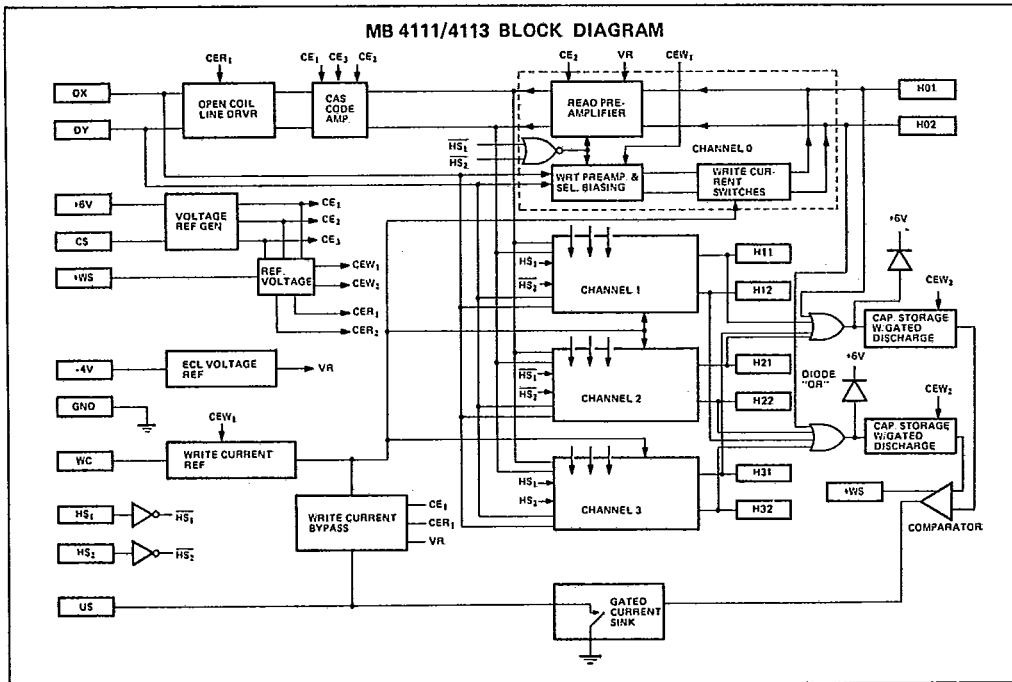
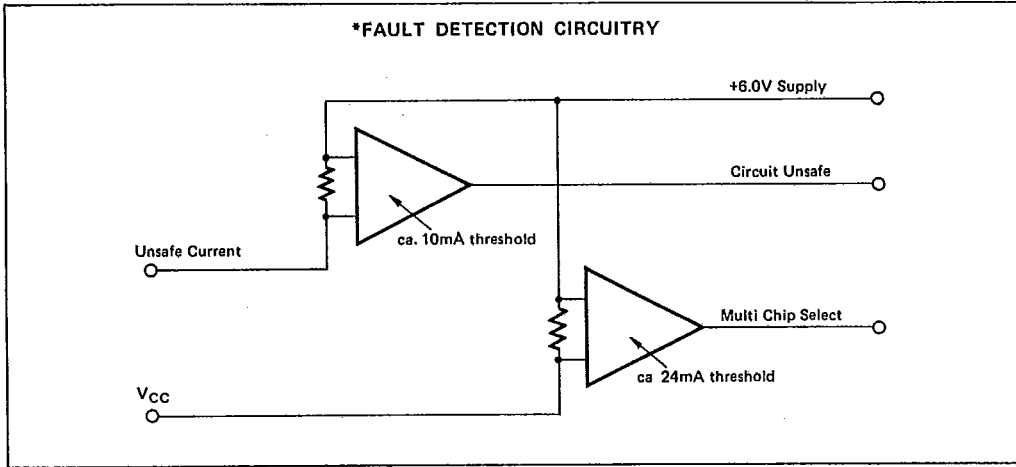
WRITE MODE

Parameter	Symbol	Condition	Value			Unit
			Min	Typ	Max	
Write Current	I_{WC}				50	mA
Current Gain	A_I	$I_{WC} = 50\text{mA}$	0.95			
Write Current Voltage	V_{WC}	$I_{WC} = 50\text{mA}$	$V_{EE} + 0.3$		$V_{EE} + 1$	V
Differential Input Voltage	V_{IN}		0.225			V
DX DY Input Current	I_{IN}		-2.0		2.0	mA
Unsafe Current	I_{US}	$L = 7\mu\text{H}$, $f = 1.2\text{MHz}$			0.1	mA
		$L = 9\mu\text{H}$, $f = 0$	20			
Head Current Transition Time	t_T	$L = 0$, $f = 5\text{MHz}$ $I_{WC} = 50\text{mA}$		5	10	ns
Head Current Hysterisis	t_{HY}	$L = 0$, $f = 5\text{MHz}$ $I_{WC} = 50\text{mA}$			2.0	ns
Unselected Head Current	I_{OP}	$L = 9\mu\text{H}$, $f = 2\text{MHz}$, $I_{WC} = 50\text{mA}$			1.5	mA
Unsafe Switching Delay Time	MB4111	$L = 9\mu\text{H}$, $f = 6.0\text{MHz to DC}$	0.5		4.0	μs
		$L = 7\mu\text{H}$, $f = \text{DC to } 1.2\text{MHz}$			1.0	
Differential Head Voltage	V_{DIF}	$I_{WC} = 45\text{mA}$ $L = 9\mu\text{H}$	6.2		7.2	V

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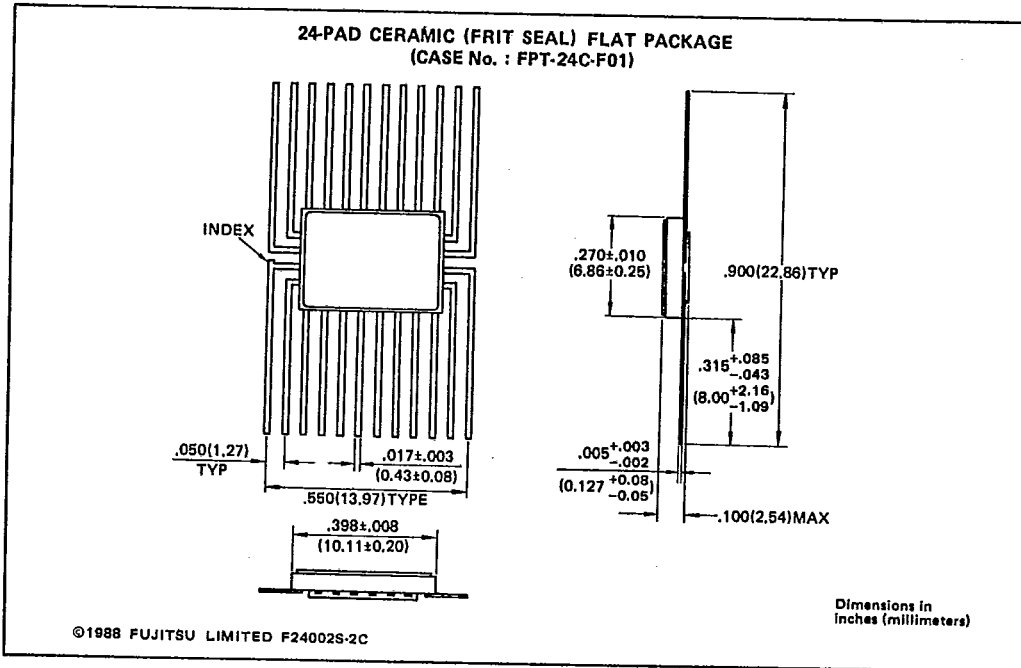
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PACKAGE DIMENSIONS



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