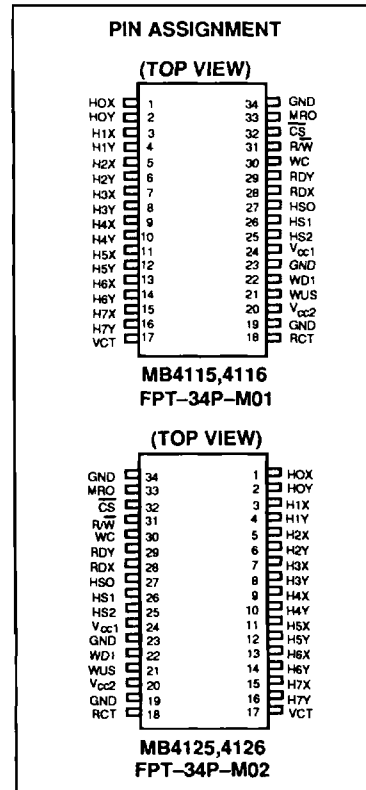
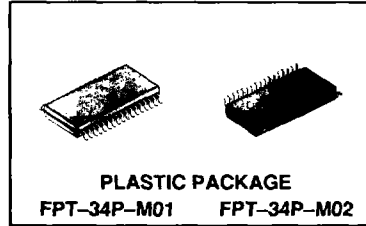


MB4115/4116/4125/4126 8-CH MAGNETIC DISC R/W AMP. FOR HDD

8-CHANNEL MAGNETIC DISK READ/WRITE AMPLIFIER FOR HDD

The Fujitsu MB4115/4116/4125/4126 are 8-channel magnetic disk read/write amplifier designed for hard disc drive equipments.

- Dual Power Supplies : +5V
+12V
- Drive capability of 8 ferrite heads with centre tap
- Write data input, control input level : TTL level
- On-chip write current source
Current value is controlled by an external resistor
- On-chip write unsafe detector in order to detect abnormal condition on head
- On-chip two systems of power supply monitors with hysteresis to prohibit mis-writing at abnormal voltage
- Read amplifier is low noise and differential voltage gain is 100
- On-chip head damping resistor 750Ω : MB4116, 4126
- A chip is mounted in a small 34-pin SOP package (lead pitch is 1.0mm)
- Pin assignment enables easy mounting
MB4125, MB4126 pin assignment is reflected reversal image of MB4115, MB4116. This is suitable for mounting several devices on the PCB.
Head pins are placed at the same side of centre tap voltage output pin (VCT pin)



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ABSOLUTE MAXIMUM RATINGS (see NOTE) (T_A = 25°C)

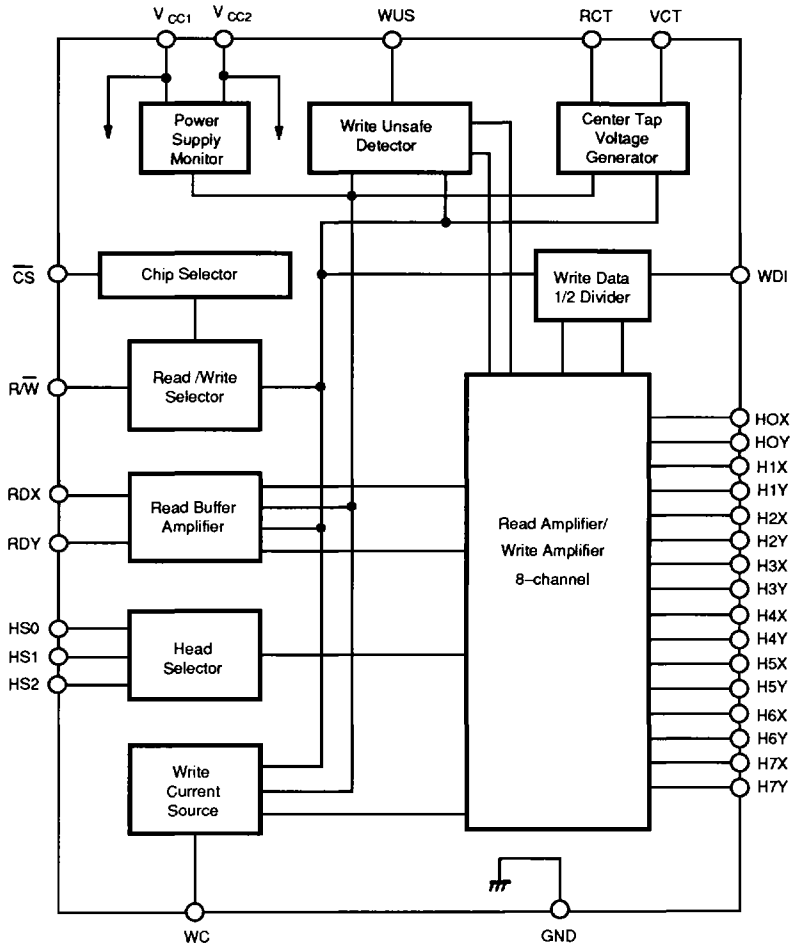
Rating	Symbol	Value	Unit
Power Supply Voltage	V _{CC1}	-0.3 to 7.0	V
	V _{CC2}	-0.3 to 15.0	V
	V _{RCT}	-0.3 to 15.0	V
Digital Input Voltage	V _{IN}	-0.3 to V _{CC1} + 0.3	V
Head Input/Output Voltage	V _{HEAD}	-0.3 to V _{CC2} + 0.3	V
WUS pin, Output Voltage	V _{WUS}	-0.3 to 15.0	V
Write Current	I _W	40	mA
Read Output Current	I _{RDO}	-10	mA
Centre Tap Output Current	I _{VCTO}	-40	mA
WUS pin, Output Current	I _{WUO}	+12	mA
Storage Temperature	T _{STG}	-55 to 125	°C
Power Dissipation	P _D	1100 (T _A ≤ 25°C)	mW

NOTE: Permanent device damage may occur if the above **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.

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.

MB4115
 MB4116
 MB4125
 MB4126

Fig. 1 — BLOCK DIAGRAM



6

PIN DESCRIPTIONS

Pin No.	Pin Name	Descriptions
1 to 16	HOX to H7X HOY to H7Y	These pins are provided to connect the head from 0-channel to 7-channel
17	VCT	Output pin for head centre tap. Write current flows to head centre tap.
18	RCT	Power supply pin for centre tap. VCT pin gets the current depending on write current. When this pin is connected with V_{CC2} pin through a resistor 120 Ω (1/2W), power dissipation will be reduced.
19	GND	Sub-ground pin Ground pin for analog circuitry which operates at 12V. This pin is connected with main-ground internally through a writing resistor about 1.5 Ω . The bypass condenser is easily connected between this pin and V_{CC2} pin (20 pin).
20	V_{CC2}	Power supply voltage, 12V
21	WUS	Output pin for write abnormal detector This pin outputs high level to prevent a disc from mis-writing for each of the following conditions. <ul style="list-style-type: none"> • Input frequency of write data is zero or very low • VCT pin is open • WC pin is open • Head pins are open • Each head pin is shorted • Head pin and centre tap pin are shorted • Device is in read mode • Operation mode is not selected
22	WDI	Write data input pin Input data is divided by two which drives write circuitry.
23	GND	Sub-ground pin Ground pin for digital circuitry which operates at 5V. This pin is connected with main-ground internally through a writing resistor about 1.5 Ω . The bypass condenser is easily connected between this pin and V_{CC2} pin (24 pin).
24	V_{CC1}	Power supply voltage, 5V
25 26 27	HS2 HS1 HS0	Head selection signal input One of 8-channel becomes active condition by combination of these inputs.

MB4115
 MB4116
 MB4125
 MB4126

PIN DESCRIPTIONS (Continued)

Pin No.	Pin Name	Descriptions
28 29	RDX RDY	Differential output pin of read amplifier Emitter follower output
30	WC	Write current setting input Write current is controlled by an external resistor R_{WC} connected between this pin and GND pin. Write current is formulated; $I_w (A) = K/R_{WC}(\Omega)$
31	R/\bar{W}	Read/Write mode select pin. When this pin is at high level, read mode is selected. When this pin is at low level, write mode is selected.
32	\bar{CS}	Chip select input Control signal input pin which selects operating mode or idle mode. When this pin is at high level, device enters idle mode When this pin is at low level, device enters operation mode The device can be applicable for usage with several IC's for this pin.
33	MRO	No connection This pin should be open.
34	GND	Main-ground This pin should be grounded as main-ground. Recommended to connect this pin with sub-ground.

6

FUNCTION

Table – 1. Mode selection

Mode	\overline{CS} pin, Voltage	R/\overline{W} pin, Voltage
Idle (I)	H	—
Read (R)	L	H
Write (W)	L	L

Table – 2. Head Selection

\overline{CS} pin, Voltage	HS0 pin, Voltage	HS1 pin, Voltage	HS2 pin, Voltage	Selected Head
H	—	—	—	—
L	L	L	L	0
	H	L	L	1
	L	H	L	2
	H	H	L	3
	L	L	H	4
	H	L	H	5
	L	H	H	6
	H	H	H	7

6

Table – 3. Output table of write abnormal detector

\overline{CS} pin, Voltage	R/\overline{W} pin, Voltage	Mode	Conditions	WUS pin, Output Voltage
H	—	I	Idle mode	H
L	H	R	Read mode	
L	L	W	Write mode	L
L	L	W	Output of the following conditions is occurred <ul style="list-style-type: none"> • WDI pin, input frequency $f_{WDI} = 0\text{MHz}$ • VCT pin is open • WC pin is open • Head input pins are open • Both ends of head input pins are shorted • Head input pin and VCT pin are shorted 	H

Note : H : High level
 L : Low level

MB4115
 MB4116
 MB4125
 MB4126

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Value	Unit
Power Supply Voltage	V _{CC1}	4.5 to 5.5	V
	V _{CC2}	10.8 to 13.2	V
Write Current	I _W	8 to 30	mA
Operating Temperature	T _A	0 to 70	°C

ELECTRICAL CHARACTERISTICS

(V_{CC1} = 5V ± 10%, V_{CC2} = 12V ± 10%, T_A = 25°C, unless otherwise noted.)

Parameter	Symbol	Condition	Value				Unit
			Mode	Min	Typ	Max	

Power Section

V _{CC1} Power Supply Current	I _{CC1I}	Symbol	I		16	24	mA
	I _{CC1R}		R		14	23	mA
	I _{CC1W}		W		20	30	mA
V _{CC2} Power Supply Current	I _{CC2I}		I		12	22	mA
	I _{CC2R}		R		28	38	mA
	I _{CC2W}		W		12+ I _W	12+ I _W	mA
Power Dissipation	P _{DI}		I		220	400	mW
	P _{DR}		R		410	600	mW
	P _{DWO}	I _W = 30mA	W		600	830	mW
	P _{DWI}	I _W = 30mA, Resistor 120Ω (1/2W) is placed between V _{CC2} pin and RCT pin	W		500	700	mW

*Note I : Idle
 R : Read
 W : Write

6

ELECTRICAL CHARACTERISTICS (Continued)

($V_{CC1} = 5V \pm 10\%$, $V_{CC2} = 12V \pm 10\%$, $T_A = 25^\circ C$, unless otherwise noted.)

Parameter	Symbol	Condition	Value			Unit
			Mode	Min	Typ	

Power Supply Monitor Section

V_{CC1} Detection Voltage	V_{TH1}	When V_{CC1} is falling	R/W	3.45	3.90	4.30	V
		When V_{CC1} is rising	R/W	3.55	4.10	4.46	V
V_{CC1} Detection Voltage Hysteresis Width	ΔV_{TH1}		R/W		0.2		V
V_{CC2} Detection Voltage	V_{TH2}	When V_{CC2} is falling	R/W	7.50	8.80	10.10	V
		When V_{CC2} is rising	R/W	7.90	9.30	10.50	V
V_{CC2} Detection Voltage Hysteresis Width	ΔV_{TH2}		R/W		0.5		V
Head Input Current	I_{WOF1}	$0 < V_{CC1} \leq 5.5V$ $0 < V_{CC2} \leq 13.2V$	I/R	-100		100	μA
	I_{WOF2}	$0 < V_{CC1} < 3.45V$ $0 < V_{CC2} < 7.50V$	W	-100		100	μA

6

Digital Section

High-level Input Voltage	V_{IH}	$T_A = 0$ to $70^\circ C$		2.0		$V_{CC1} + 0.3$	V
High-level Input Current	I_{IH}	$V_{IH} = 2.0V$				100	μA
Low-level Input Voltage	V_{IL}	$T_A = 0$ to $70^\circ C$		-0.3		0.8	V
Low-level Input Current	I_{IL}	$V_{IL} = 0.8V$		-400			μA
Read/Write Transition Time	t_{RW}	Read to Write				600	ns
Write/Read Transition Time	t_{WR}	Write to Read				600	ns
Chip Selection Transition Time	t_{IR}	Idle to Read				1000	ns
	t_{IW}	Idle to Write					
Head Selection Delay Time	t_{dH}					1000	ns

Notes : I : Idle
 R : Read
 W : Write

MB4115
 MB4116
 MB4125
 MB4126

ELECTRICAL CHARACTERISTICS (Continued)

($V_{CC1} = 5V \pm 10\%$, $V_{CC2} = 12V \pm 10\%$, $T_A = 25^\circ C$, unless otherwise noted.)

Parameter	Symbol	Condition	Value			Unit
			Min	Typ	Max	

Read Section

Differential Voltage Gain	G_D	$V_{IN} = 1m V_{p-p}$ $f_{IN} = 300kHz$ $R_L = 1k\Omega$	80	100	120	V/V
Frequency Bandwidth	BW	-3dB $V_{IN} = 1m V_{p-p}$ $R_L = 1k\Omega$	30	50		MHz
Input Equivalent Noise	V_N	BW = 1MHz to 10MHz		1.4	2.0	$nV \sqrt{Hz}$
Input Capacitance	C_I	$f_{IN} = 5MHz$ $R_L = 1k\Omega$		16	23	pF
Dynamic Range	D	$f_{IN} = 5MHz$ 3rd Harmonic wave : -30dB	6			mV
Input Bias Current	I_{HR}			12	45	μA
Common mode Output Voltage	V_{RDY} V_{RDY}	Head input pins are shorted with VCT pin	5.0	6.0	7.0	V
Output Offset Voltage	V_{OFF}	Head input pins are shorted with VCT pin	-400		400	mV
Common mode Rejection Ratio	CMRR	$f_{IN} = 5MHz$ $V_{IN} = 100m V_{p-p}$	50	65		dB
Power Supply Rejection Ratio	PSRR	$f_{IN} = 5MHz$ $V_{IN} = 100m V_{p-p}$	45	70		dB
Channel Separation	CSP	$f_{IN} = 5MHz$ $V_{IN} = 100m V_{p-p}$	45	55		dB
Differential Input Resistance	R_I	$f_{IN} = 5MHz$	MB4115	2		$k\Omega$
			MB4116	0.4		$k\Omega$
Single-end Output Resistance	R_O	$f_{IN} = 5MHz$		18	50	Ω

6

ELECTRICAL CHARACTERISTICS (Continued)

($V_{CC1} = 5V \pm 10\%$, $V_{CC2} = 12V \pm 10\%$, $T_A = 25^\circ C$, unless otherwise noted.)

Parameter	Symbol	Condition	Value			Unit
			Min	Typ	Max	

Read Section

Write Current Constant	K	$I_W = 12mA$	112	120	128	V
Write Current Transition Time	t_r t_f	$L = 0\mu H$ $I_W = 30mA$			25	ns
Write Current Delay Time	$tpd1$ $tpd2$	$L = 0\mu H$ $I_W = 30mA$			30	ns
Write Current Differential Delay Time	Δtpd	$L = 0\mu H$ $I_W = 30mA$ $\Delta tpd = tpd1 - tpd2 $			2	ns
Output Voltage Amplitude	ΔV_H		5.7			V
Damping Resistance	R_D	MB4125	525	750	975	Ω
		MB4126				

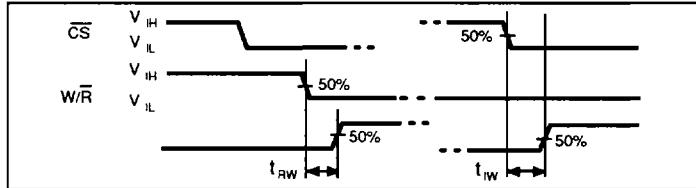
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Write Abnormal Detector Section

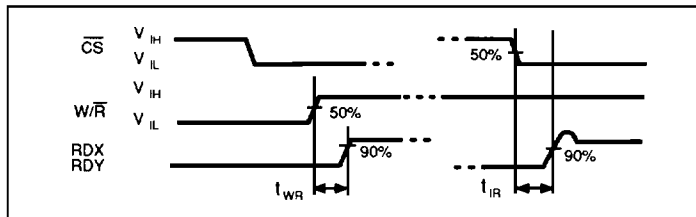
WUS pin, Output Voltage	V_{USL}	$I_W = 10mA$, $R_D = 750\Omega$ $f_{WDI} = 2.5MHz$, $L = 10\mu H$		0.1	0.5	V
WUS pin, Output Voltage	I_{OH}	$L = 10\mu H$, $R_D = 750\Omega$ $I_W = 30mA$, $V_{OH} = 5.0V$		0.1	100	μA
Write Unsafe Delay Time 1	t_{dSF}	Unsafe to Safe $L = 10\mu H$ $I_W = 8mA$, $R_D = 750\Omega$ $F_{WDI} = 0$ to $2.0MHz$		0.06	1.00	μs
Write Unsafe Delay Time 2	t_{dUS}	Safe to Unsafe $L = 10\mu H$ $I_W = 30mA$, $R_D = 750\Omega$ $f_{WDI} = 5$ to $0MHz$		5	8	μs

TIMING CHART

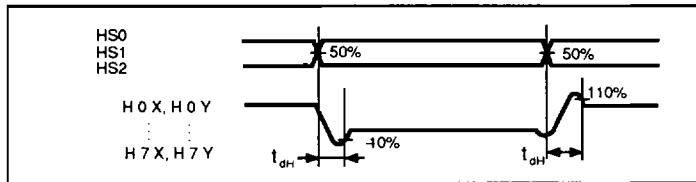
1. Read/Write Transition Time ,Chip Select Transition Time (Idle to Write)



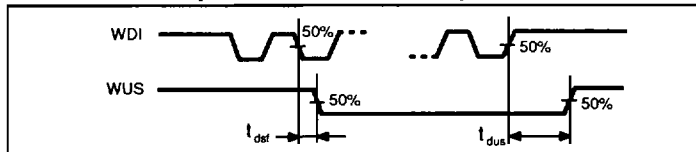
2. Write/Read transition Time, Chip Select Transition Time (Idle Write)



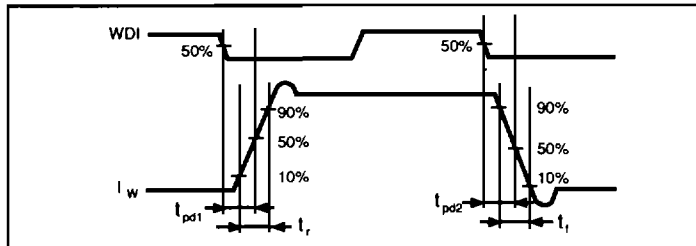
3. Head Select Transition Time



4. Write Unsafe Delay Time 1, Write Unsafe Delay Time 2



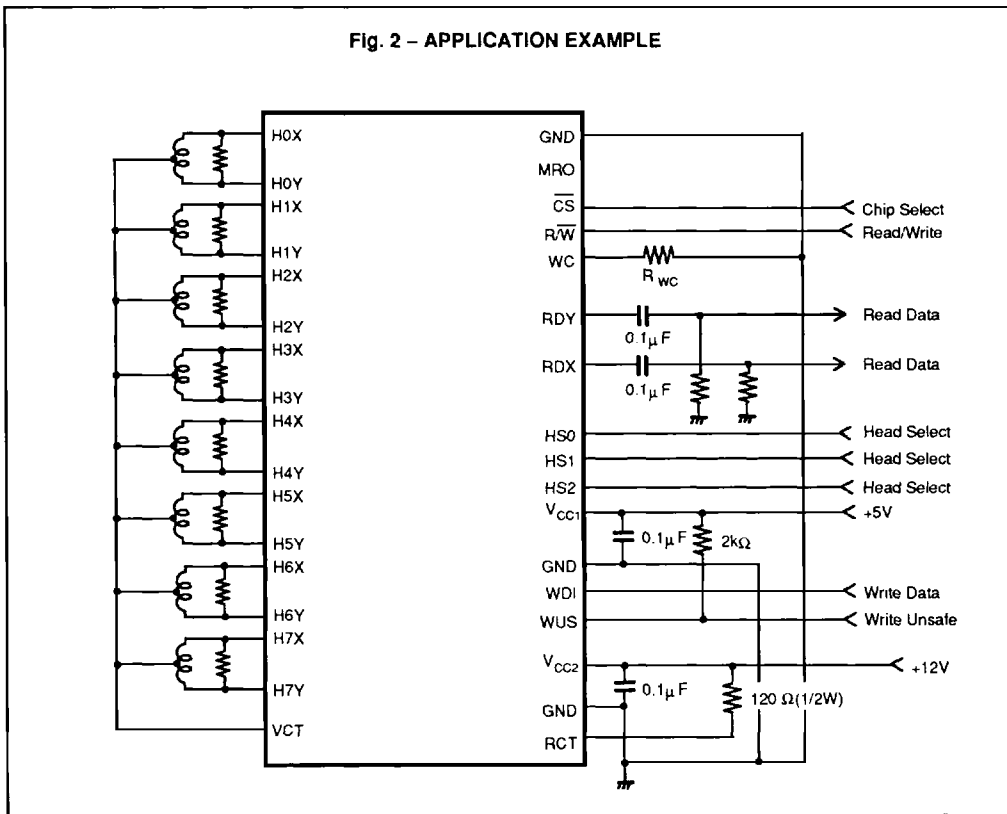
5. Write Current Transition Time, Write Current Delay Time



APPLICATION

- (1) Treatment of GND pin
 It's recommended to ground three ground pins with common ground. If it is impossible, please connect main-ground with ground at least.
- (2) Reduce power dissipation
 When an external resistor 120Ω (1/2W) is placed between RCT pin and V_{CC2} pin, power dissipation is reduced shown below.
 Reduced power $P = I_w^2 \times 120$ (w)
- (3) Setting write current
 Write current I_w is set by an external resistor R_{WC} . Write current is formulated:
 $I_w = K / R_{WC}$ (A) (Adjustable current range is 8 to 30mA)
 External resistor should be located near IC.
- (4) Damping resistor
 The device is intended to be used a head which has inductance of 5 to 15 μH .
 Thus, please use the damping resistor between 500 to 2k Ω .
 Also, write current and impedance should be meet the following formula.
 I_w (mA) $\times L$ (μH) ≥ 200

Fig. 2 – APPLICATION EXAMPLE



INPUT/OUTPUT CIRCUIT CONFIGURATION

FIG. 3 - \overline{CS} pin , $\overline{R/W}$ pin , HS0 to HS2 pins

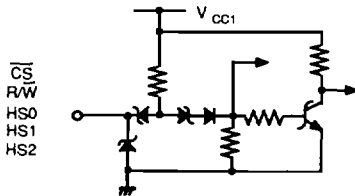


FIG. 4 - RCT pin , VCT pin

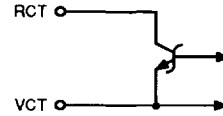


FIG. 5 - WC pin

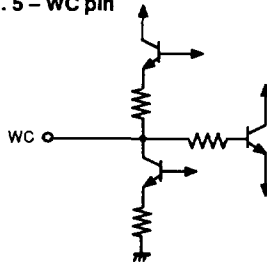


FIG. 6 - WUS pin

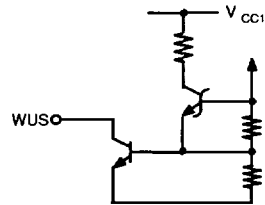


FIG. 7 - WDI pin

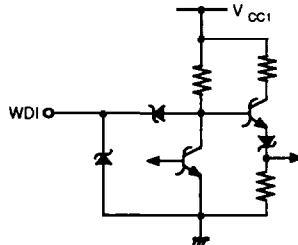


FIG. 8 - RDX pin , RDY pin

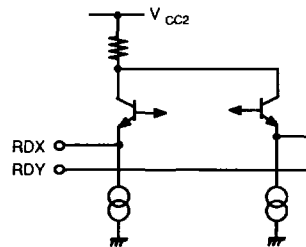
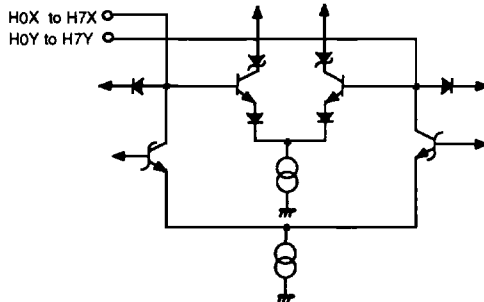


FIG. 9 - H0X to H7X pins, H0Y to H7Y pins



TYPICAL CHARACTERISTICS CURVES

Fig.10 – WRITE CURRENT vs. POWER SUPPLR VOLTAGE

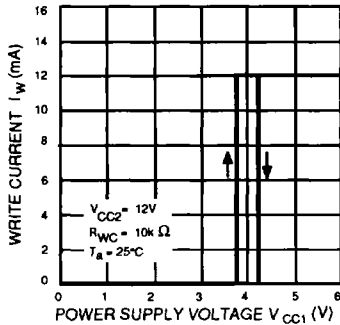


Fig.11 – WRITE CURRENT vs. POWER SUPPLR VOLTAGE

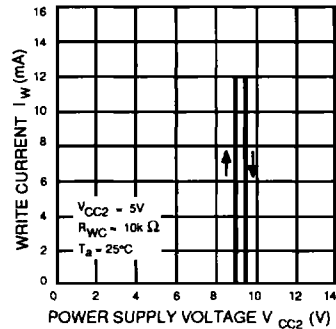


Fig.12 – WRITE CURRENT CONSTANT vs. POWER SUPPLR VOLTAGE

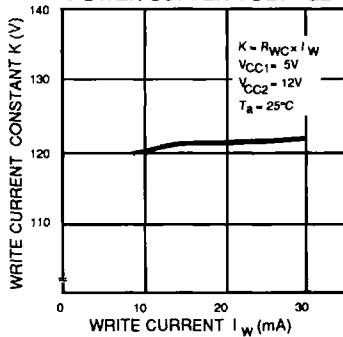


Fig.13 – WRITE CURRENT vs. WRITE CURRENT SETTING RESISOR

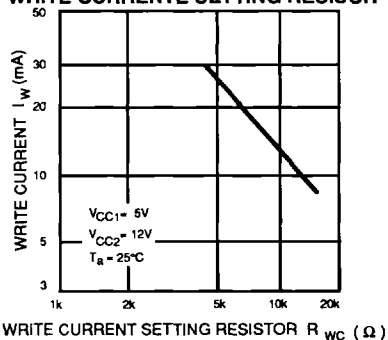


Fig.14 – WRITE CURRENT CONSTANT vs. TEMPERATURE

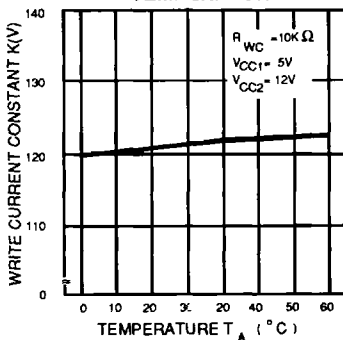
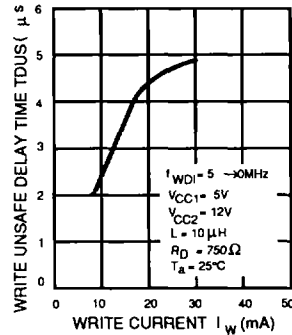


Fig.15 – WRITE UNSAFE DELAY TIME vs. WRITE CURRENT



TYPICAL CHARACTERISTICS CURVES (Continued)

Fig.16 – READ OUTPUT VOLTAGE vs. READ INPUT VOLTAGE

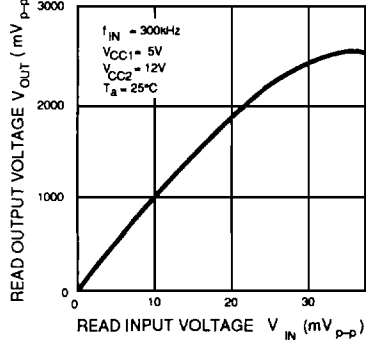


Fig.17 – DIFFERENTIAL VOLTAGE GAIN vs. TEMPERATURE

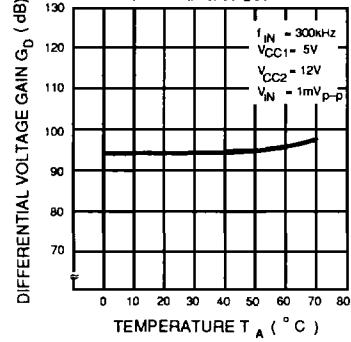


Fig.18 – DIFFERENTIAL VOLTAGE GAIN vs. FREQUENCY

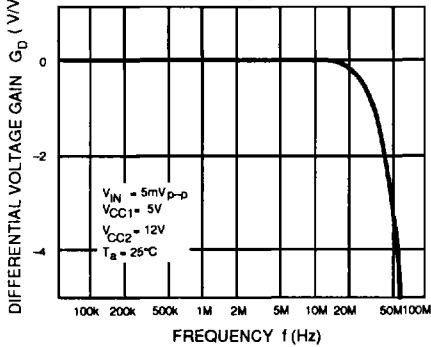
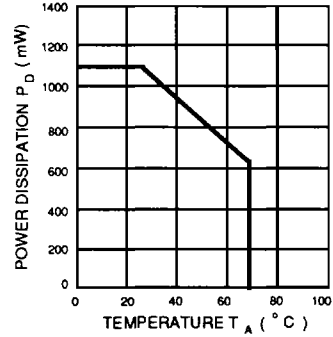
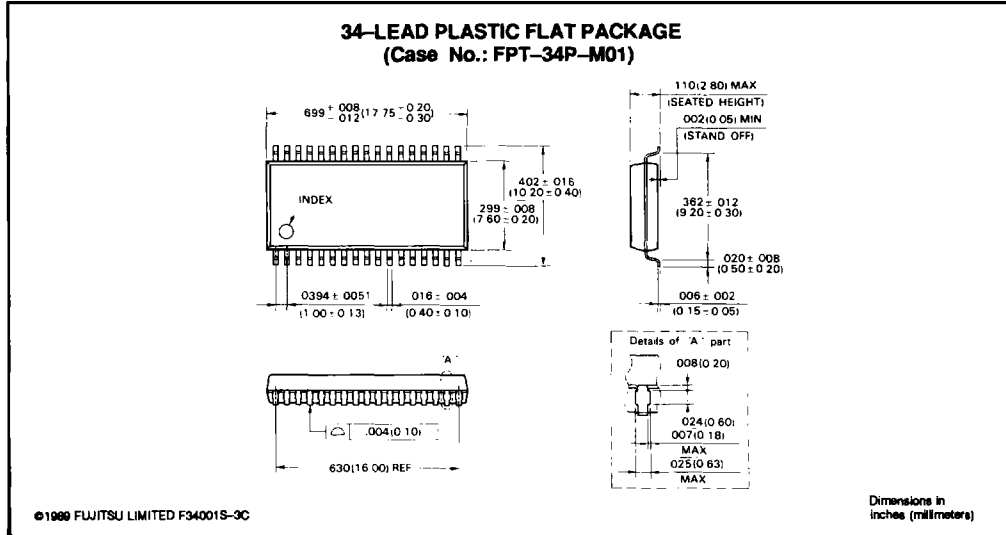


Fig.19 – POWER DERATING CURVE



PACKAGE DIMENSIONS



6

