



VTC Inc.
Value the Customer™

VM7200H

2, 4, 6 OR 8-CHANNEL, 5-VOLT,
THIN-FILM HEAD, READ/WRITE
PREAMPLIFIER

July, 1993

FEATURES

- High Performance
 - Read Gain = 275 V/V Typical
 - Input Noise = 0.75nV/√Hz max
 - Head Inductance Range = 0.2 - 10 μH
 - Input Capacitance = 23 pF max
- Two Options for Write Current
 - 10 to 40mA (available only in 2 or 4-channel versions)
 - 1 to 40mA (available in all channel versions)
- Very Low Power Dissipation = 7.5 mW Typical in Sleep Mode
- Power Up/Down Data Protect Circuitry
- Reduced Write-to-Read Recovery Time
- Single Power Supply = 5 V ± 10%
- Fault Detect Capability
- Optional Internal Head Damping Resistor
- Designed for Thin-Film heads
- Write Unsafe Detection
- Standard Schottky - Isolated 400 Ω Damping Resistor (patent pending)
- Optional Version Operates at Lower Write Currents
- Available in 2, 4, 6 or 8 Channel Options

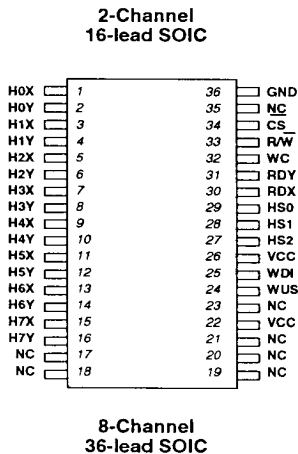
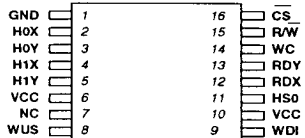
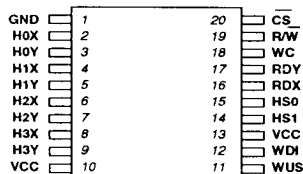
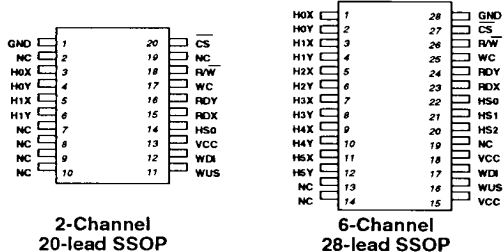
DESCRIPTION

The VM7200H is a high-performance, very low-power read/write preamplifier designed for use with external two-terminal thin-film or MIG recording heads. This circuit will operate on a single 5-volt power supply and is ideally suited for use in battery powered disk drives.

The VM7200H provides write current and data protection circuitry, and low noise read functions for up to eight read/write heads. When deactivated, the device enters a **sleep mode** that reduces power dissipation to 7.5 mW. Data protection circuitry is provided to ensure that the write current source is totally disabled during power supply power up/power down conditions. Write-to-read recovery time is minimized by eliminating common mode output voltage swings when switching between modes.

The VM7200H is available in several different packages. Please consult VTC for package availability.

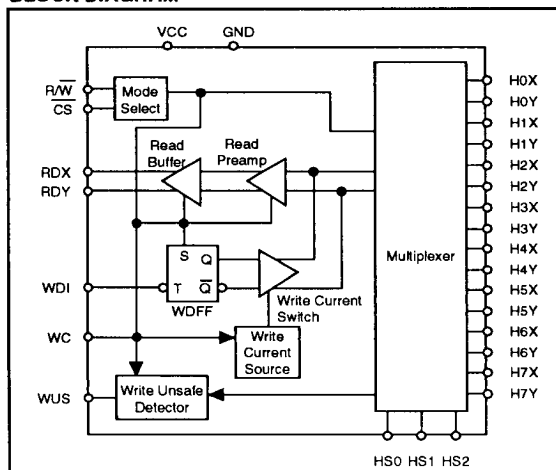
CONNECTION DIAGRAMS



TWO/THREE TERMINAL
8 SERVO PREAMPLIFIERS

VM7200H

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Power Supply:	
V_{CC}	-0.3V to +7V
Write Current I_W	60mA
Input Voltages:	
Digital Input Voltage V_{IN}	-0.3V to $(V_{CC} + 0.3)V$
Head Port Voltage V_H	-0.3V to $(V_{CC} + 0.3)V$
WUS Pin Voltage Range V_{WUS}	-0.3V to +6V
Output Current:	
RDX, RDY: I_O	-10mA
WUS: I_{WUS}	+12mA
Junction Temperature	150°C
Storage Temperature T_{stg}	-65° to 150°C
Thermal Characteristics, Θ_{JA} :	
16-lead SOIC	100°C/W
20-lead SOIC	80°C/W
20-lead SSOP	TBD
20-lead VSOP	TBD
28-lead SOIC	75°C/W
36-lead SOIC	60°C/W

RECOMMENDED OPERATING CONDITIONS

Power Supply Voltage:	
V_{CC}	+5V $\pm$ 10%
Write current (I_W)	
L (suffix for only 2 or 4-channel versions)	10 to 40mA
J or M (suffix for 2,4,6, or 8-channel versions)	1 to 40mA
Head Inductance (L_H)	0.2 to 10 μ H
Junction Temperature (T_J)	25°C to 125°C

CIRCUIT OPERATION

The VM7200H addresses up to eight 2-terminal, thin-film/ MiG recording heads, providing switched write current in the write mode, or data amplification in the read mode. Head selection and mode control is determined by the head select lines, HS1, HS2 and mode control lines, CS, R/W as shown in Tables 1 and 2. Internal resistor pullups, provided on the CS and R/W lines, will force the device into a non-write condition if either control line opens up. The part's operation over a wide range of inductive loads makes it suitable for non-thin-film two-terminal heads also.

Write Mode

In write mode, the VM7200H acts as a write current switch with the write unsafe (WUS) detection circuitry activated. Write current is toggled between the X and Y side of the selected head on each high to low transition on the Write Data Flip-Flop (Wdff) so that upon switching to the write mode, the write current flows into the "X" side of the head.

The write current magnitude is determined by an external resistor (R_{WC}) connected between the WC pin and Ground. An internally generated reference voltage is present at the WC pin. The magnitude of the Write Current (0-PK, $\pm$ 8%) is:

$$I_W = K_W/R_{WC} = 50/R_{WC}$$

Power supply fault protection ensures data security on the disk by disabling the write current source during a power supply voltage fault or by supply power up/down conditions. Additionally, the write unsafe (WUS) detection circuitry will flag any of the conditions listed below, as a high level on the WUS line. Two negative transitions on the WDI pin, after the fault is corrected, is required to clear the WUS line.

- No write current
- WDI frequency too low
- Read or sleep mode

Read Mode

In read mode, the VM7200H acts as a low noise differential amplifier for signals coming off the disk. The write current generator and write unsafe circuitry is deactivated. The RDX, RDY pins are emitter follower outputs and are in phase with "X" and "Y" head ports. These outputs should be AC coupled to the load. The RDX, RDY common mode output voltage is constant, minimizing the transient between read and write mode, thereby, substantially reducing the recovery time in the Pulse Detector circuit connected to these outputs.

Sleep Mode

When CS is high, initially all circuitry is shut down so that power dissipation is reduced to 7.5 mW in the **sleep mode**. Switching the CS line low "wakes up" the chip and the device will enter the read or write mode, depending on the status of the R/W line.

Diode Connected Damping Resistor (patent pending)

The VM7200H has damping resistors isolated by Schottky diodes. The diodes effectively remove the resistor from the circuit during the read mode, however during the write mode with the higher level input signal, the resistor provides damping for the write current waveform.

Input Structure:

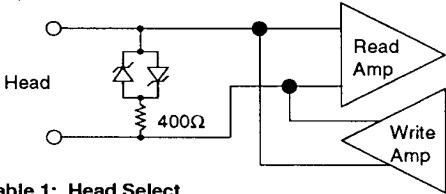


Table 1: Head Select

HS2	HS1	HS0	HEAD
0	0	0	0
0	0	1	1
0	1	0	2
0	1	1	3
1	0	0	4
1	0	1	5
1	1	0	6
1	1	1	7

Table 2: Mode Select

$\overline{CS}$	$R/\overline{W}$	MODE
0	0	Write/Awake
0	1	Read/Awake
1	X	Sleep

PIN DESCRIPTIONS

NAME	I/O	DESCRIPTION
HS0-HS2	I*	Head Select: selects one of up to 8 heads
H0X-H7X H0Y-H7Y	I/O	X, Y Head terminals
WDI	I*	Write Data Input: TTL input signal, negative transition toggles direction of head current
$\overline{CS}$	I	Chip select: high level signal puts chip in sleep mode, low level wakes chip up
$R/\overline{W}$	I*	Read/Write select: High level selects read mode, low-level selects write mode
WUS	O*	Write unsafe: Open collector output: high level indicates writes unsafe condition
WC		Write current adjust: A resistor adjusts level of write current
RDX-RDY	O*	Read data output: differential output data
VCC		+5 volt supply**
GND		Ground

* May be wire-OR'ed for multi-chip usage.

** Although both VCC connections are recommended, only one connection is required as both are connected internally.

DC CHARACTERISTICS Recommended operating conditions apply unless otherwise specified.

PARAMETER	SYM	CONDITIONS	MIN	TYP (Note 1)	MAX	UNITS
Supply Current	I_{CC}	Read Mode		33	45	mA
		Write Mode		$42 + I_W$	$50 + I_W$	
		Idle Mode		1.5	3	
Power Dissipation	PD	Read Mode		165	230	mW
		Write Mode, $I_W = 20mA$		310	385	
		Idle Mode		7.5	17	
Input High Voltage	V_{IH}		2		$V_{CC} + 0.3$	V
Input Low Voltage	V_{IL}		-0.3		0.8	V
Input High Current	I_{IH}	$V_{IH} = 2.7V$			80	μA
Input Low Current	I_{IL}	$V_{IL} = 0.4V$	-160			μA
WUS Output Low Voltage	V_{OL}	$I_{OL} = 4.0mA$		0.35	0.5	V
WUS Output High Current	I_{OH}	$V_{OH} = 5.0V$		13	100	μA
VCC Value for Write Current Turn Off		$I_{IH} < 0.2mA$	3.7	4.1	4.3	V

Note 1: Typical values are given at $V_{CC} = 5V$ and $T_A = 25^\circ C$.

TWO-THREE TERMINAL
& SERVO PREAMPLIFIERS

VM7200H

READ CHARACTERISTICS Recommended operating conditions apply unless otherwise specified; C_L (RDX, RDY) < 20pF, R_L (RDX, RDY) = 1k Ω .

PARAMETER	SYM	CONDITIONS	MIN	TYP (Note 1)	MAX	UNITS
Differential Voltage Gain	A _V	V _{IN} = 1mVrms, 1MHz	230	268	320	V/V
Bandwidth	BW	-1dB Z _s < 5 Ω , V _{IN} = 1mVp-p	25	40		MHz
		-3dB Z _s < 5 Ω , V _{IN} = 1mVp-p	35	60		
Input Noise Voltage	e _{in}	BW = 17MHz, L _H = 0, R _H = 0		0.56	0.75	nV/ $\sqrt{Hz}$
Differential Input Capacitance	C _{IN}	V _{IN} = 1mVp-p, f = 5MHz		19	23	pF
Differential Input Resistance	R _{IN}	V _{IN} = 1mVp-p, f = 5MHz	380	1000		Ω
Dynamic Range	DR	AC input voltage where the gain falls to 90% of the gain @ 0.2mVrms input, f = 5MHz	3	6		mVrms
Common Mode Rejection Ratio	CMRR	V _{IN} = 100mVp-p @ 5MHz	50	73		dB
Power Supply Rejection Ratio	PSRR	100mVp-p @ 5MHz on V _{CC}	45	70		dB
Channel Separation	CS	Unselected channels driven with 20mVp-p @ 5MHz Selected Channels V _{IN} = 0mVp-p	45	60		dB
Output Offset Voltage	V _{OS}		-400	25	+400	mV
RDX,RDY Common Mode Output Voltage	V _{OCM}	Read Mode		V _{CC} -2.3		V
Read to Write Common Mode Output Voltage Difference	Δ V _{OCM}		-350	120	350	mV
Single-Ended Output Resistance	R _{SEO}			36	50	Ω
Output Current	I _O	AC Coupled Load, RDX to RDY	$\pm$ 1.5			mA

Note 1: Typical values are given at V_{CC} = 5V and T_A = 25°C.

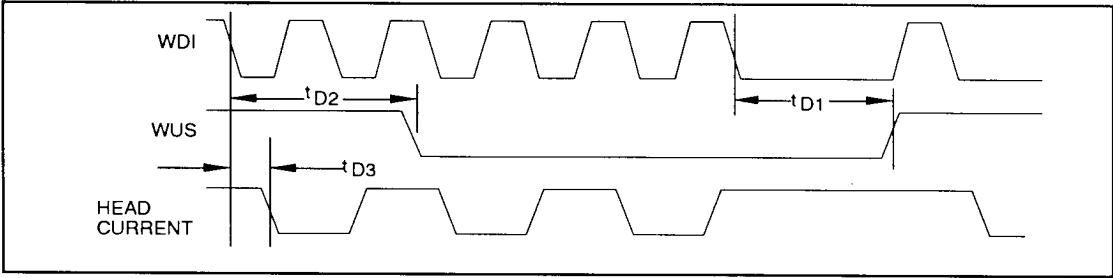


Figure 1: Write Mode Timing Diagram

WRITE CHARACTERISTICS Recommended operating conditions apply unless otherwise specified; $L_H = 1\mu\text{H}$, $R_H = 30\Omega$, $I_W = 20\text{mA}$, $f_{\text{DATA}} = 5\text{MHz}$.

PARAMETER	SYM	CONDITIONS	MIN	TYP (Note 1)	MAX	UNITS
WC Pin Voltage	VWC			2.55		V
I_{WC} to Head Current Gain	A _I			20		mA/mA
Write Current Constant	K _W	$K_W = (V_{\text{WC}})(A_I)$	46	51.5	54	V
Write Current Tolerance	ΔI_W	I_W range 10mA to 40mA	-8	+3	+8	%
Write Current Range	I_W	$1.25\text{K} < R_{\text{WC}} < 5\text{k}\Omega$	Suffix L; 2,4-channel	10	40	mA
			Suffix M; 2,4-channel	1	40	
			Suffix J; 6,8-channel	1	40	
Differential Head Voltage Swing	V _{DH}	Open Head	4	5.2		V _{p-p}
WDI Transition Frequency for Safe Condition	f_{DATA}	WUS = Low	1			MHz
Differential Output Capacitance	C _O	Small signal conditions			25	pF
Differential Output Resistance	R _O	Small signal conditions	3200			Ω
Unselected Head Transient Current	I _{UH}	$I_W = 20\text{mA}$		0.15	1	mA(pk)
RDX, RDY Common Mode Output Voltage	V _{CM}			$V_{\text{CC}} - 2.3$		V

Note 1: Typical values are given at $V_{\text{CC}} = 5\text{V}$ and $T_A = 25^\circ\text{C}$.

SWITCHING CHARACTERISTICS Recommended operating conditions apply unless otherwise specified; $I_W = 20\text{mA}$, $f_{\text{DATA}} = 5\text{MHz}$, $L_H = 1\mu\text{H}$, $R_H = 30\Omega$, C_L (RDX, RDY) $\leq 20\text{pF}$ (see figure 1).

PARAMETER	SYM	CONDITIONS	MIN	TYP (Note 1)	MAX	UNITS
R/W Read to Write Delay	t _{RW}	R/W to 90% I_W		0.1	1.0	μs
R/W Write to Read Delay	t _{WR}	R/W to 90% of 100mV, 10MHz read signal envelope		0.6	1.0	μs
$\overline{\text{CS}}$ Unselect to Select Delay	t _{IR}	$\overline{\text{CS}}$ to 90% I_W or 90% of 100mV, 10MHz read signal envelope		0.27	0.6	μs
$\overline{\text{CS}}$ Select to Unselect Delay	t _{RI}	$\overline{\text{CS}}$ to 10% of I_W		0.08	0.6	μs
HS0, 1, any Head Delay	t _{HS}	HS0, 1 to 90% of 100mV, 10MHz read signal envelope		0.19	0.6	μs
WUS Safe to Unsafe Delay	t _{D1}		0.6	3.1	4.5	μs
WUS Unsafe to Safe Delay	t _{D2}			0.1	1.0	μs
Head Current Propagation Delay (TD3)	t _{D3}	$L_H = 0$, $R_H = 0$, from 50% points		19	30	ns
Head Current Asymmetry	A _{SYM}	50% duty cycle on WDI, 1ns rise/fall time; $L_H = 0$, $R_H = 0$		0.2	1	ns
Head Current Rise/Fall Time	t_r / t_f	10% to 90% points	$L_H = 0$, $R_H = 0$	5	8	ns
			$L_H = 1\mu\text{H}$, $R_H = 30$	16	24	

Note 1: Typical values are given at $V_{\text{CC}} = 5\text{V}$ and $T_A = 25^\circ\text{C}$.