



VM3200

2 OR 4-CHANNEL, 3.3 TO 5-VOLT, TWO-TERMINAL, THIN-FILM/MIG HEAD, READ/WRITE PREAMPLIFIER

950801

August, 1995

FEATURES

- High Performance
 - Read Gain = 300, 200 or 150 V/V
 - Input Noise = 0.48nV/√Hz Typical
 - Head Inductance Range = 0.2 – 5 μH
 - Write Current Range 2 - 25 mA
 - Input Capacitance: Standard = 20 pF
Low = 12 pF
- Improved Write Voltage = 5 Vp-p Diff. Typical (3V supply)
- Very Low Power Dissipation = 0.3 mW Typical in Sleep Mode
- Power Up/Down Data Protect Circuitry
- Single Power Supply = 3.3V to 5V ±10%
- Fault Detect Capability
- Designed for Two-Terminal, Thin-Film or MIG Heads
- Standard Schottky - Isolated 400 W Damping Resistor (patent pending)
- Available in 2 or 4 Channels

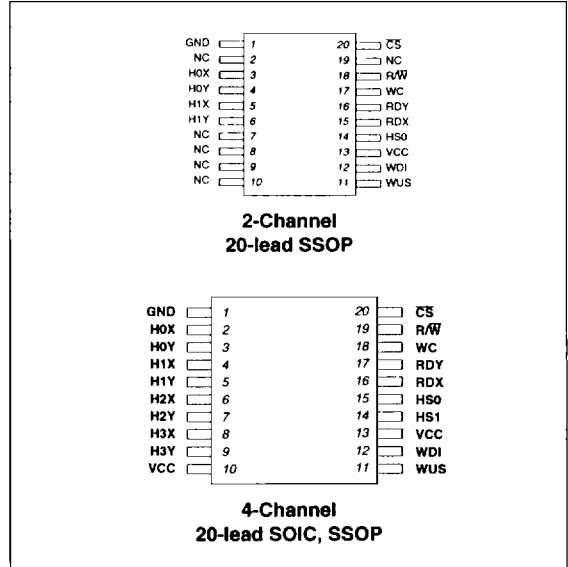
DESCRIPTION

The VM3200 is a high-performance, very low-power read/write preamplifier designed for use with two-terminal, thin-film or MIG recording heads. This device will operate on a single power supply from 3-volts to 5-volts. This makes the VM3200 ideally suited for both battery-powered and 5-volt disk drive applications.

The VM3200 provides write current switching in the write mode and a low noise data path in the read mode for up to four read/write heads. When deactivated, the device enters a sleep mode that reduces power dissipation to 0.7 mW. Data protection circuitry is provided to ensure that the write current source is totally disabled during power up/down conditions. Write-to-read recovery time is minimized by eliminating common mode output voltage swings when switching between modes. Write mode performance is improved by providing 5-volt with 3.3-volt supply differential peak-to-peak head voltage allowing the write current to swing faster.

The VM3200 is available in a variety of package options. Please consult VTC for package availability.

CONNECTION DIAGRAMS



2 - TERMINAL
5V PREAMPS

The write current magnitude is determined by an external resistor (RWC) connected between the WC pin and ground. An internally generated reference voltage is present at the WC pin. The magnitude of the write current is:

$$I_W = K_W/R_{WC} = 25/R_{WC}$$

where,

- I_W = Write Current
- K_W = Write Current Constant
- R_{WC} = Write Current Set Resistor

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, may be required to clear the WUS line. Write unsafe detect conditions:

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

In write mode, the VM3200 provides 5 Vp-p differential head voltage swing with 3.3-volt supply that allows the write current to swing faster. This results in faster rise/fall times and improved writer performance.

Read Mode

In read mode, the VM3200 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 \overline{CS} is high, initially all circuitry is shut down so that power dissipation is reduced to 0.7 mW in the **sleep mode**. Switching the \overline{CS} line low "wakes up" the chip and the device will enter the read or write mode, depending on the status of the R/\overline{W} line.

Table 1: Head Select

HS1	HS0	HEAD
0	0	0
0	1	1
1	0	2
1	1	3

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 - HS1	I*	Head Select: selects one of up to four heads
H0X - H3X H0Y - H3Y	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		+3.3V 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.

2 - TERMINAL
5V PREAMPS



DC CHARACTERISTICS Recommended operating conditions apply unless otherwise specified.

2 - TERMINAL
5V PREAMPS

PARAMETER	SYM	CONDITIONS	MIN	TYP (Note 1)	MAX	UNITS
Power Supply Current	I _{CC}	Read Mode		33	47	mA
		Write Mode		30 + 1.375I _W	35 + 1.375I _W	
		Idle Mode		0.3	TBD	
Power Dissipation	PD	Read Mode		120	170	mW
		Write Mode, I _W = 15mA		165	200	
		Idle Mode		0.7	1.3	
Input High Voltage	V _{IH}		2		5.5	V
Input Low Voltage	V _{IL}		-0.3		0.8	V
Input High Current	I _{IH}	V _{IH} = 2.7V	-400		+1	μA
Input Low Current	I _{IL}	V _{IL} = 0.4V	-1		+20	μA
WUS Output Low Voltage	V _{OL}	I _{OL} = 4.0mA			0.5	V
WUS Output High Current	I _{OH}	V _{OH} = 3.3V			100	μA
VCC Value for Write Current Turn Off		I _H < 0.2mA		2.5		V

Note 1: Typical values are given at T_A = 25°C.

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	$V_{IN} = 1\text{mVrms}, 1\text{MHz}$	260	300	340	V/V
			170	200	330	
			120	150	180	
Bandwidth	BW	-1dB $ Z_S < 5\Omega, V_{IN} = 1\text{mVp-p}$	25	40		MHz
		-3dB $ Z_S < 5\Omega, V_{IN} = 1\text{mVp-p}$	35	60		
Input Noise Voltage	e_{in}	BW = 17MHz, $L_H = 0, R_H = 0$		0.48	TBD	nV/ $\sqrt{\text{Hz}}$
Differential Input Capacitance	C_{IN}	$V_{IN} = 1\text{mVp-p}, f = 5\text{MHz}, \text{standard}$		20	TBD	pF
		$V_{IN} = 1\text{mVp-p}, f = 5\text{MHz}, \text{low}$		12	TBD	
Differential Input Resistance	R_{IN}	$V_{IN} = 1\text{mVp-p}, f = 5\text{MHz}$	380	1000		pF
Dynamic Range	DR	AC input where A_V is 90% of gain at 0.2mVrms input	2	4		mVrms
Common Mode Rejection Ratio	CMRR	$V_{IN} = 100\text{mVp-p @ } 5\text{MHz}$	50	73		dB
Power Supply Rejection Ratio	PSRR	100mVp-p @ 5MHz on V_{CC}	45	70		dB
Channel Separation	CS	Unselected channel driven with 20mVp-p @ 5MHz	45	60		dB
Output Offset Voltage	V_{OS}		-300	25	+300	mV
Single-Ended Output Resistance	R_{SEO}				50	Ω
Output Current	I_O	AC coupled load, RDX to RDY	± 1.5			mA

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

2 - TERMINAL
5V PREAMPS



WRITE CHARACTERISTICS Recommended operating conditions apply unless otherwise specified, $L_H = 1\mu H$, $R_H = 30\Omega$, $I_W = 15mA$, $f_{DATA} = 5MHz$.

2 - TERMINAL 5V PREAMPS

PARAMETER	SYM	CONDITIONS	MIN	TYP (Note 1)	MAX	UNITS
WC Pin Voltage	V_{WC}			1.114		V
I_{WC} to Head Current Gain	A_I	$V_{CC} = 3V$		22		mA/mA
		$V_{CC} = 5V$		24.7		
Write Current Constant	K_W	$K_W = (V_{WC})(A_I)$, $V_{CC} = 3V$	23	25	27	V
		$K_W = (V_{WC})(A_I)$, $V_{CC} = 5V$		27.5	28	
Write Current Range	I_W	$1 < R_{WC} < 12.5k\Omega$	2		25	mA
Write Current Tolerance	ΔI_W	$I_W = 2 - 25mA$	-8		+8	%
Differential Head Voltage Swing	V_{DH}	Open head, $V_{CC} = 3V$		5		Vp-p
		Open head, $V_{CC} = 5V$		9		
WDI Transition Frequency for Safe Condition	f_{DATA}	WUS = low	1			MHz
Differential Output Capacitance	C_{OUT}				20	pF
Differential Output Resistance	R_{OUT}		3200			Ω
Unselected Head Current	I_{UH}	$I_W = 15mA$		0.15	0.5	mA(pk)
RDX, RDY Common Mode Output Voltage	V_{CM}			1.6		V

Note 1: Typical values are given at $T_A = 25^\circ C$.

SWITCHING CHARACTERISTICS Recommended operating conditions apply unless otherwise specified; $I_W = 15\text{mA}$, $f_{\text{DATA}} = 5\text{MHz}$, $L_H = 1\mu\text{H}$, $R_H = 30\Omega$, $C_L (\text{RDX, RDY}) \leq 20\text{pF}$ (see Figure 1).

PARAMETER	SYM	CONDITIONS	MIN	TYP (Note 1)	MAX	UNITS
R/ \bar{W} Read to Write Delay	t_{RW}	R/ \bar{W} to 90% I_W			1.0	μs
R/ \bar{W} Write to Read Delay	t_{WR}	R/ \bar{W} to 90% of 100mV, 10 MHz read signal envelope			1.0	μs
$\bar{\text{CS}}$ Unselect to Select Delay	t_{IR}	$\bar{\text{CS}}$ to 90% I_W or 90% of 100mV, 10MHz read signal envelope			0.6	μs
$\bar{\text{CS}}$ Select to Unselect Delay	t_{RI}	$\bar{\text{CS}}$ to 10% of I_W			0.6	μs
HS0, HS1 any Head Delay	t_{HS}	HS0, HS1 to 90% of 100mV, 10MHz read signal envelope			0.6	μs
WUS Safe to Unsafe Delay	t_{D1}		1.3		5.6	μs
WUS Unsafe to Safe Delay	t_{D2}				1.0	μs
Head Current Propagation	t_{D3}	$L_H = 0$, $R_H = 0$, from 50% points			30	ns
Head Current Asymmetry	A_{SYM}	50% duty cycle on WDI, 1ns rise/fall time; $L_H = 0$, $R_H = 0$			0.5	ns
Head Current Rise/Fall Time	t_r/t_f	10% to 90% points, $I_W = 15\text{mA}$, $L_H = 0$, $R_H = 0$		3	6	ns
		10% to 90% points, $I_W = 15\text{mA}$, $L_H = 1\mu\text{H}$, $R_H = 30\Omega$		10	14	

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

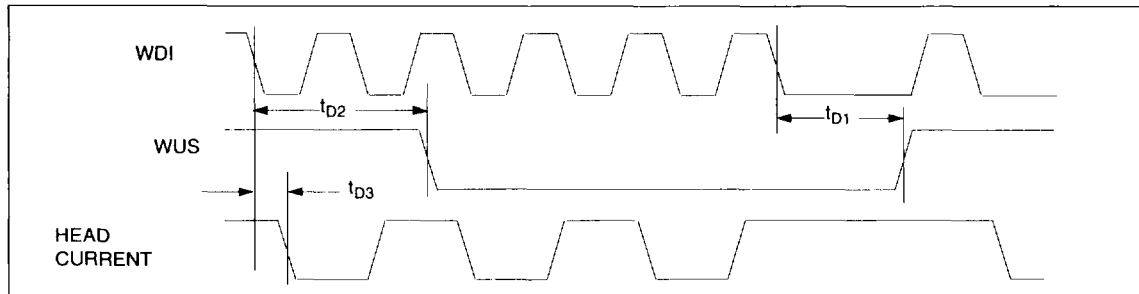


Figure 1: Write Mode Timing Diagram

2 - TERMINAL
5V PREAMPS