

5V R/W Preamplifier for 3 Terminal Recording Heads, 2 or 4 Channels

GENERAL DESCRIPTION

The XR-505 is a monolithic disk drive integrated circuit providing read mode preamplification, write current control, and head selection. It requires a single +5V power supply and consumes far less power than similar devices.

Up to four read/write heads can be switched with one device; multiple devices are cascadable. A low noise read signal preamplifier provides two user selectable gain levels.

All digital controls are TTL compatible. The XR-505 is available in 16, 20 and 24 pin SO packages. A 24 Pin DIP version is available for evaluation.

FEATURES

- Complete Head Interface Functions, Read and Write
- Low Power, Single +5V Operation
- High Bandwidth and Dynamic Range
- Low Noise Preamplifier
- Error Preventing Power Monitor
- Pinout Designed for Layout Ease
- Digitally Selectable Preamplifier Gain
- Digitally Selectable Write Current

APPLICATIONS

- Battery operated Winchester disk drives
- Low power disk drives
- High density floppy disk drives
- Digital tape drives
- Dedicated servo read/write

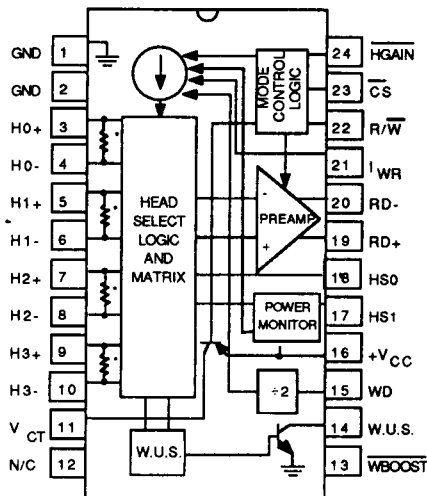
ABSOLUTE MAXIMUM RATINGS

V_{CC}	8 Volts
Digital Inputs	-0.3V to V_{CC} +0.3V
Write Current	70mA
Junction Temperature	150°C
Storage Temperature	-65°C to +150°C

SYSTEM DESCRIPTION

The XR-505 is a low power four channel Winchester Disk Drive Read/Write Amplifier ideally suited for laptop computer system drives and other applications where power consumption is important. Similar in function to other Exar Read/Write amplifiers, the XR-505 provides

PIN ASSIGNMENT



ORDERING INFORMATION

Part Number	Package	Operating Temperature
XR-505-4D	24 JEDEC SO	0°C to 70°C
XR-505R-4D	24 JEDEC SO	0°C to 70°C
XR-505R-4AD	20 JEDEC SO	0°C to 70°C
XR-505R-4BD	20 JEDEC SO	0°C to 70°C
XR-505R-2AD	16 JEDEC SO	0°C to 70°C
XR-505-2BD	16 JEDEC SO	0°C to 70°C
XR-505R-2AD	16 JEDEC SO	0°C to 70°C
XR-505R-2BD	16 JEDEC SO	0°C to 70°C
XR-505R-2AG	16 JEDEC SO	0°C to 70°C
XR-505R-2BG	16 JEDEC SO	0°C to 70°C
XR-505-4CP	24 DIP	0°C to 70°C

(other versions and packages available upon request)

equivalent or superior performance at one-fourth the power consumption and requires only a single +5V power supply.

The read preamplifier section consists of a 55MHz bandwidth 1nV/ Hz noise level differential amplifier. Preamplifier gain of either 100 V/V or 200 V/V is digitally selectable. The write driver controls up to 50mA of write current. A full featured power monitor circuit positively disables write mode operation during low voltage fault conditions to preserve data integrity.

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ELECTRICAL CHARACTERISTICS

Test Conditions: $T_A = 25^\circ\text{C}$, $V_{CC} = 4.5\text{V to } 5.5\text{V}$ (5.0V nominal), $I_W = 25\text{ mA}$, $R_D = 750\Omega$, C_L (R_{D+} , R_{D-}) $\leq 20\text{ pF}$, $L_h = 10\text{ }\mu\text{H}$, Data Rate = 5 MHz, unless specified otherwise.

SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT	CONDITIONS
I_{CC}	Supply Current		25 20	35 30	mA mA	$V_{CC} = 5.5\text{V}$, Read $V_{CC} = 5.5\text{V}$, Write Mode $I_W = 0$
P_D	Power Dissipation		0.5 125 100	1 170 150	mW mW mW	Idle Mode. $V_{CC} = 5.5\text{V}$ Read Mode. $V_{CC} = 5.5\text{V}$, Write Mode: $I_W = 0\text{mA}$.
V_{CT}	Center Tap Voltage		2.1 4.5		V V	$V_{CC} = 5.5\text{V}$ Read Mode. $V_{CC} = 5\text{V}$ Write Mode. $V_{CC} = 5\text{V}$
V_{PM}	Power Monitor Protection	3.7	4.0	4.4	V	V_{CC} to Disable Write
DIGITAL CHARACTERISTICS						
WUS	Write Unsafe Output		0.2	0.5	V	$I_{OL} = 8\text{mA}$
V_{OL}	Saturation Voltage			0.5	V	$V_{OH} = 5\text{V}$
I_{OH}	Leakage Current			100	μA	
V_{IL}	Input Low Voltage			0.8	V	
V_{IH}	Input High Voltage	2.0			V	
I_{IL}	Input Low Current	-0.4			mA	$V_{IL} = 0.8\text{V}$
I_{IH}	Input High Current			100	μA	$V_{IH} = 2.0\text{V}$
WRITE CHARACTERISTICS						
WBOOST	Write Current Accuracy	-7	± 2	7	%	Error from $I_W = 0.47V$ See Fig.2 R_W
	Recommended Write Current Range	10		40	mA	
	Write Current Boost Factor	1.20	1.25	1.30	I/I	WBOOST = Low
	Differential Head Voltage Swing	7.0	8.2		V	Peak (Inductive Load), $L_h = 10\mu\text{H}$ $I_W = 40\text{mA}$
	DC Swing	3.5	4		V	DC Load, One Side
	Unselected Differential Head Current			85	μA	
	Unselected Transient Current			2	mA	Peak
	Differential Output Capacitance			15	pF	
	Differential Output Resistance	10 635	750	865	k Ω Ω	XR-505 XR-505R
	WD Rate/Transition Freq.	125			kHz	
WUS	WD Rate/Transition Freq.					$K_I = I_W / (\text{Current through } R^*W^*)$
K_I	Current Source Factor		1			$K = 1000 I_W \cdot R_W$
K	Write Current Constant	440	470	500	mV	
	Write Protection Shut-off Leakage Current	-200		+200	μA	Per Side, $V_{CC} \leq 3.7\text{V}$
V_{OS}	Preamplifier Output Offset Voltage	-20		+20	mV	Write or Idle Mode

SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT	CONDITIONS
V_{CM}	Preamplifier Output Common Mode Voltage Preamplifier Output Leakage Current		1.5		V μA	Write Mode Write or Idle Mode, $R_{D+} = R_{D-} = 6V$
READ MODE						
A_V	Differential Voltage Gain	85	100	115	V/V	$\overline{HGAIN}$ = High, $V_{IN} = 1mVp-p$ at 300 kHz, $R_{L+} = R_{L-} = 1k\Omega$
	Dynamic Range	170 -3	200	230 +3	V/V mV	$\overline{HGAIN}$ = Low DC input voltage where gain drops 10% $V_{in} = V_i + 0.5$ mVp-p at 300 kHz.
R_{IN}	Differential Input Resistance	2 500	8 650	850	k Ω Ω	XR-505 XR-505R
C_{IN}	Differential Input Capacitance			20	pF	
e_{ni}	Input Noise Voltage		1.0	1.5	nV/ $\sqrt{Hz}$	$L_h = 0, R_h = 0, BW = 15MHz$
BW	Bandwidth	30	60		MHz	-3dB Point, $ Z_s \pm 5\Omega, V_{in} =$ 1mVp-p
I_B	Input Bias Current		10	45	μA	
CMRR	Common Mode Rejection Ratio	60	80		dB	$V_{CM} = V_{CT} + 100 mVp-p$ at 5MHz
PSRR	Power Supply Rejection Ration	60	80		dB	100mVp-p at 5 MHz Super- imposed on V_{CC}
	Channel Separation	45	60			Unselected Channel: $V_{IN} = 100$ mVp-p at 5 MHz. Selected Channel $V_{IN} = 0$
V_{OS}	Output Offset Voltage	-200	150	+200	mV	
ΔV_{OS}	Output Offset Voltage Change	-100	120	+100	mV	Switching Between Any Two Heads
V_{CM}	Common Mode Output Voltage	1.25	1.50	1.75	V	
ΔV_{CM}	V_{CM} Change from Write to Read	-200	+100	+200	mV	Common Mode Output Voltage Change from Write to Read or Read to Write
R_O	Head Current Leakage Single Ended Output Resistance	-200		+200	μA Ω	Per Side $f = 5 MHz$
I_O	Output Current	2.1			mA	AC Coupled, Source or Sink

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SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT	CONDITIONS
SWITCHING CHARACTERISTICS						
R/W	Read to Write		0.1	1	μS	Note 1
	Write to Read		0.1	1	μS	Notes 2,3
CS	Start-up Delay		0.1	1	μS	Notes 1,2
	Inhibit Delay		0.1	1	μS	Note 3
	Head Switching Delay		0.1	1	μS	Note 2, Switching between any heads.
WUS	Write Unsafe					
	Safe to Unsafe	1.6		8.0	μS	$I_W = 25 \text{ mA}$, See Figure 1, TD1
	Unsafe to Safe		0.2	1	μS	$I_W = 25 \text{ mA}$, See Figure 1, TD2
I_W	Head Current					
	Propagation Delay		2	25	nS	Note 4, See Figure 1, TD3
	Asymmetry		0.1	2	nS	Note 5
	Rise or Fall Time		1	20	nS	10% to 90% or 90% to 10% point

Note 1: Delay to 90% of I_W .

Note 2: Delay to 90% of 100 mVp-p 10 MHz Read Signal Envelope.

Note 3: Delay to 90% Decay of I_W .

Note 4: From 50% Points. $L_h = 0H$, $R_h = 0\Omega$

Note 5: Write Data with 1 nS rise and fall times and 50% duty cycle.

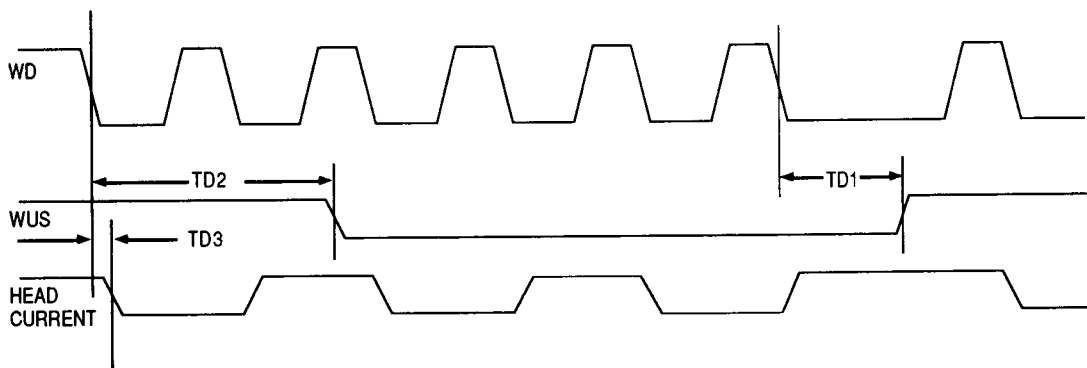


Figure 1. Write Mode Timing Diagram

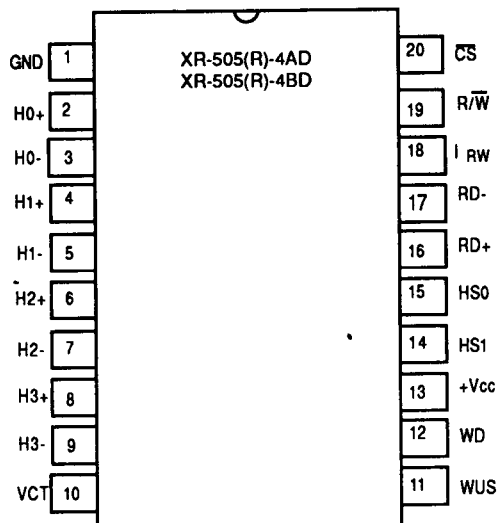
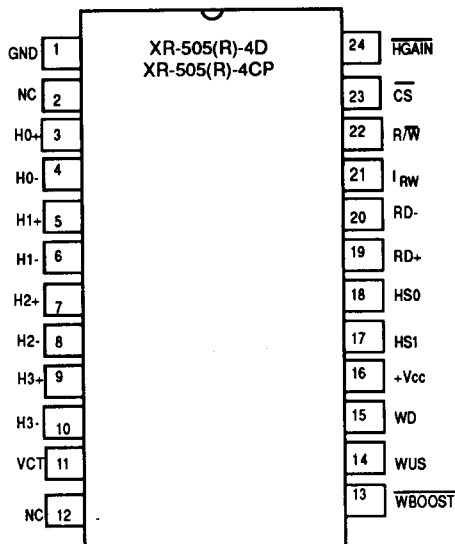
XR-505 PIN DESCRIPTION

PIN	SYMBOL	DESCRIPTION	HS0, HS1	Head Select	Selects head for Read/Write operation
$\overline{\text{CS}}$	Chip Select	Low enables device operation	V_{CC}	+5V Supply Input	
$\overline{\text{R/W}}$	Read/Write Select	High selects read mode Low selects write mode	R_{D+} R^{A-}	Read Preamplifier	Differential preamplifier output
WD	Write Data Input		I_{WR}	Write Current	Resistor to ground programs peak write current level
$\overline{\text{HGAIN}}$	High Gain Select	Low selects preamp gain of 200V/V High selects preamp gain of 100V/V	$\overline{\text{WBOOST}}$	Write Current Boost	Low Selects, I_W Boost of $I_W = 1.25 \cdot \frac{0.47}{R_W}$ High Selects Nominal $I^W = \frac{0.47}{R^W}$
WUS	Write Unsafe Output	Open collector output. High indicates write fault condition			

XR-505 DIGITAL CONTROLS

CONTROL PIN						FUNCTION
$\overline{\text{CS}}$	$\overline{\text{R/W}}$	$\overline{\text{HGAIN}}$	$\overline{\text{WBOOST}}$	HS1	HS0	
1	X	X	X	X	X	Device Disabled
0	0	X	0	0	0	Write Mode, Head 0, I_W = Boost
0	0	X	0	0	1	Write Mode, Head 1, I_W = Boost
0	0	X	0	1	0	Write Mode, Head 2, I_W = Boost
0	0	X	0	1	1	Write Mode, Head 3, I_W = Boost
0	0	X	1	0	0	Write Mode, Head 0, I_W = Normal
0	0	X	1	0	1	Write Mode, Head 1, I_W = Normal
0	0	X	1	1	0	Write Mode, Head 2, I_W = Normal
0	0	X	1	1	1	Write Mode, Head 3, I_W = Normal
0	1	0	X	0	0	Read Mode, Head 0, Preamp A^V = 200
0	1	0	X	0	1	Read Mode, Head 1, Preamp A^V = 200
0	1	0	X	1	0	Read Mode, Head 2, Preamp A^V = 200
0	1	0	X	1	1	Read Mode, Head 3, Preamp A^V = 200
0	1	1	X	0	0	Read Mode, Head 0, Preamp A^V = 100
0	1	1	X	0	1	Read Mode, Head 1, Preamp A^V = 100
0	1	1	X	1	0	Read Mode, Head 2, Preamp A^V = 100
0	1	1	X	1	1	Read Mode, Head 3, Preamp A^V = 100

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XR-505 Packaging Options

Device	HGain	WBoost	Package
XR-505(R)-4D	100/200	1.0/1.25	24 SO
XR-505(R)-4AD	100	1.0	20 SO
XR-505(R)-4BD	200	1.0	20 SO
XR-505(R)-2AD	100	1.0/1.25	16 SO
XR-505(R)-2BD	200	1.0/1.25	16 SO
XR-505(R)-2AG	100	1.0/1.25	16 SO
XR-505(R)-2BG	200	1.0/1.25	16 SO
XR-505(R)-4CP	100/200	1.0/1.25	24 DIP

"G" Package is 150 mil JEDEC SO

