5V, Low Power R/W Preamplifier for 3 Terminal Recording Heads, 2 or 4 channels

Advanced Information

GENERAL DESCRIPTION

The XR-9010/9010R are monolithic disk drive integrated circuits providing read mode pre-amplification, write current control, and head selection. They require a single +5V power supply and consume far less power than similar devices.

The XR-9010R option offers internal 750 Ohm damping resistors.

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-9010/9010R are 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 Write Current

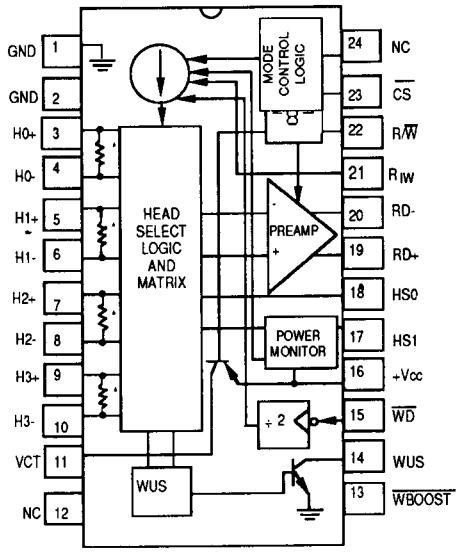
APPLICATIONS

Battery powered Winchester 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

PIN ASSIGNMENT



(Evaluation SOIC)

ORDERING INFORMATION

Part Number	Package	Operating Temperature
XR-9010(R)-4CD	20 Pin SOP	0°C To 70°C
XR-9010(R)-2CD	16 Pin SOP	0°C To 70°C
XR-9010(R)-4CU	24 Pin SSOP	0°C To 70°C

(other versions and packages available upon request)

SYSTEM DESCRIPTION

The XR-9010/9010R is a low power, up to 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-9010/9010R provides equivalent or superior performance at lower power consumption and requires only a single +5V power supply.

The read preamplifier section consists of a 60MHz bandwidth 0.65nV/ $\sqrt{Hz}$ noise level(both typical) differential amplifier. 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.

ELECTRICAL CHARACTERISTICS

Test Conditions: T_A = 25°C, V_{CC} = 4.5V to 5.5V (5.0V nominal), I_W = 25 mA, R_D = 750Ω, C_L (R_{D+}, R_{D-}) ≤ 20 pF, Lh = 10 µH, Data Rate = 5 MHz, unless specified otherwise.

SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT	CONDITIONS
I_{CC}	Supply Current			35	mA	V_{CC} = 5.5V, Read
				30	mA	V_{CC} = 5.5V, Write Mode I_W = 0
P_D	Power Dissipation			2	mW	Idle Mode. V_{CC} = 5.5V
			125	190	mW	Read Mode. V_{CC} = 5.5V,
			100	165	mW	Write Mode: I_W = 0mA. V_{CC} = 5.5V
V_{CT}	Center Tap Voltage		4.2		V	Write Mode. V_{CC} = 5V
V_{PM}	Power Monitor Protection	3.9	4.1	4.4	V	V_{CC} to Disable Write
DIGITAL CHARACTERISTICS						
WUS	Write Unsafe Output					
V_{OL}	Saturation Voltage		0.2	0.5	V	I_{OL} = 8mA
I_{OH}	Leakage Current			100	µA	V_{OH} = 5V
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} = 0.8V
I_{IH}	Input High Current			100	µA	V_{IH} = 2.0V
WRITE CHARACTERISTICS						
	Write Current Accuracy	-7	±2	7	%	Error from I_W = 50V/R_W See Fig.2
	Recommended Write Current Range	10		50	mA	
$\overline{WBOOST}$	Write Current Boost Factor	1.20	1.25	1.30	I/I	$\overline{WBOOST}$ = Low
	Differential Head Voltage Swing	6.0			V	Peak (Inductive Load), L_h =10µH Iw = 40mA
	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			10	pF	
	Differential Output Resistance	10			KΩ	XR-9010
		600	750	960	Ω	XR-9010R
WUS	WD Rate/Transition Freq.	125			KHz	WUS = Unsafe
K_I	Current Source Factor		20			K_I = I_W/(Current through R_W)
K	Write Current Constant		50		V	I_w = K / R_w
	Write Protection Shut-off Leakage Current	-200		+200	µA	Per Side, V_{CC} ≤ 3.7V

SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT	CONDITIONS
V_{CM}	Preamplifier Output Common Mode Voltage		2.3		V	Write Mode
	Preamplifier Output Leakage Current	-200		+200	µA	Write or Idle Mode, $R_D+ = R_D- = V_{CC}$
READ MODE						
A_V	Differential Voltage Gain	170	200	230	V/V	V_{IN} = 1mVp-p at 300 KHz, $R_L+ = R_L- = 1K\Omega$
	Dynamic Range	-3		+3	mV	DC input voltage where gain drops 10% $V_{in} = V_i + 0.5$ mVp-p at 300 KHz.
R_{IN}	Differential Input Resistance	2	8		KΩ	XR-9010
		500	650	850	Ω	XR-9010R
C_{IN}	Differential Input Capacitance			15	pF	
e_{ni}	Input Noise Voltage		.65	.85	nV/√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	50			dB	$V_{CM} = V_{CT}$ + 100 mVp-p at 5MHz
PSRR	Power Supply Rejection Ration	45			dB	100mVp-p at 5 MHz Superimposed on V_{CC}
	Channel Separation	45				Unselected Channel: V_{IN} = 100 mVp-p at 5 MHz. Selected Channel V_{IN} = 0
V_{OS}	Output Offset Voltage	-200		+200	mV	
ΔV_{OS}	Output Offset Voltage Change	-100		+100	mV	Switching Between Any Two Heads
V_{CM}	Common Mode Output Voltage		2.3		V	
	Head Current Leakage	-200		+200	µA	Per Side
R_O	Single Ended Output Resistance			30	Ω	f = 5 MHz
I_O	Output Current	1.5			mA	AC Coupled, Source or Sink

4

SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT	CONDITIONS
SWITCHING CHARACTERISTICS						
R/$\overline{W}$	Read to Write		0.1	1	µs	Note 1
	Write to Read		0.1	1	µs	Notes 2,3
$\overline{CS}$	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 mA, See Figure 1, TD1
	Unsafe to Safe		0.2	1	µs	I_W = 25 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 = 0µH, R_h =0Ω

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

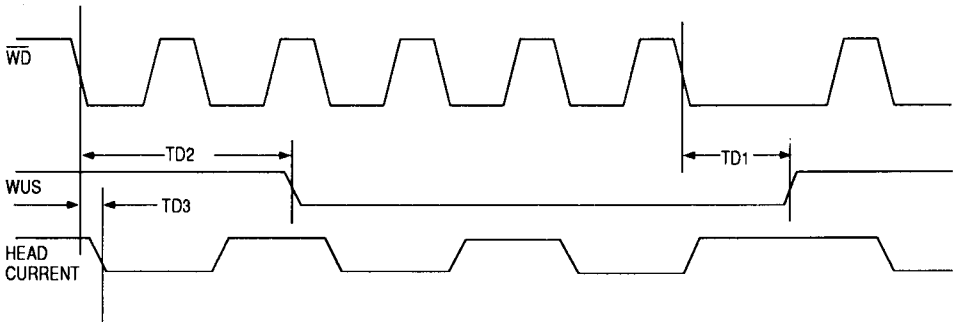


Figure 1. Write Mode Timing Diagram

PIN DESCRIPTION

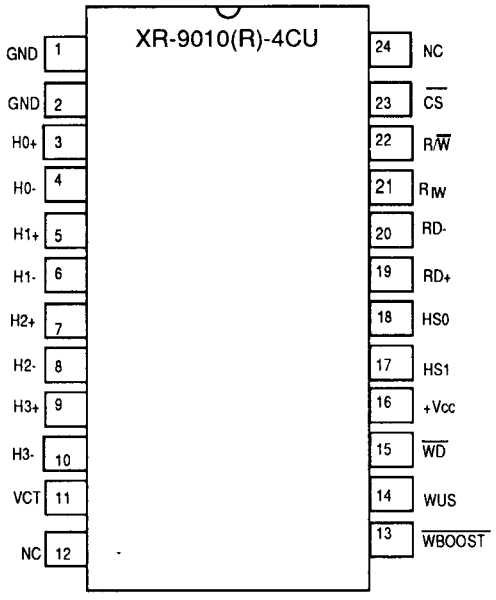
Pin #	Symbol	Description
23	$\overline{CS}$	$\overline{Chip\ Select}$. Low enables device operation.
22	R/$\overline{W}$	Read/$\overline{Write}$ Select. High selects read mode. Low selects write mode.
15	$\overline{WD}$	$\overline{Write\ Data}$ Input.
14	WUS	Write Unsafe Output. Open collector output High indicates write fault condition.
17,18	HS1,HS0,	Head Select. Selects head for Read/Write operation.

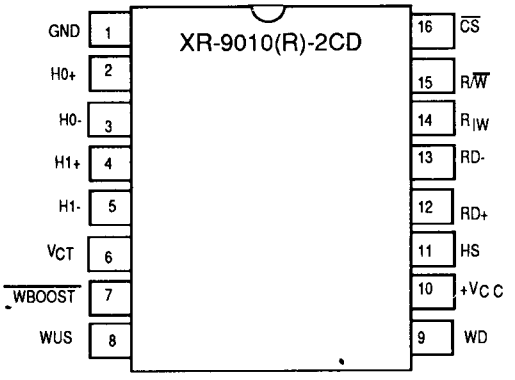
Pin #	Symbol	Description
16	V_{CC}	+5V Supply Input
19,20	R_{D+},R_{D-}	Read Preamplifier. Differential preamplifier output
21	R_{IW}	Write Current. Resistor to ground programs peak write current level
13	$\overline{WBOOST}$	$\overline{Write\ Current\ Boost}$. Low Selects, I_W Boost of $I_W = 1.25\ (K/R_W)$ High Selects Nominal $I_W = K/R_W$

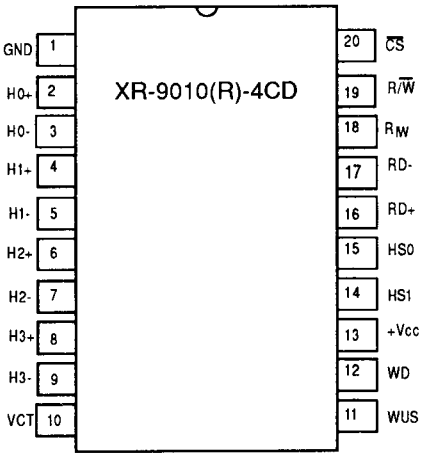
4

DIGITAL CONTROLS

CONTROL PIN					FUNCTION
$\overline{CS}$	R/$\overline{W}$	$\overline{WBOOST}$	HS1	HS0	
1	X	X	X	X	Device Disabled
0	0	0	0	0	Write Mode, Head 0, Iw = Boost
0	0	0	0	1	Write Mode, Head 1, Iw = Boost
0	0	0	1	0	Write Mode, Head 2, Iw = Boost
0	0	0	1	1	Write Mode, Head 3, Iw = Boost
0	0	1	0	0	Write Mode, Head 0, Iw = Normal
0	0	1	0	1	Write Mode, Head 1, Iw = Normal
0	0	1	1	0	Write Mode, Head 2, Iw = Normal
0	0	1	1	1	Write Mode, Head 3, Iw = Normal
0	1	X	0	0	Read Mode, Head 0, Preamp A_V = 200
0	1	X	0	1	Read Mode, Head 1, Preamp A_V = 200
0	1	X	1	0	Read Mode, Head 2, Preamp A_V = 200
0	1	X	1	1	Read Mode, Head 3, Preamp A_V = 200







XR-9010 Packaging Options

Device	WBoost	Package
XR-9010(R)-4CD	1.0	20 SO
XR-9010(R)-2CD	1.0/1.25	16 SO