

Floppy Disk Write Amplifier

GENERAL DESCRIPTION

The XR-2247/2247A is a write amplifier designed to provide the complete interface between write data signals and tunnel-erase magnetic heads. Although primarily intended for floppy disk drive systems, the XR-2247/2247A can also be used in other magnetic media systems such as tape drives. To minimize external part count for dual head systems, complete head switching is done internally with emitter-coupled PNP transistors in the XR-2247 and diodes (which offer improved broadband noise characteristics) in the XR-2247A. Write and erase currents are each externally programmable with a single resistor. Also included is circuitry for inner track write current compensation. To prevent false write current outputs during power-on, an inhibit input has been provided. Erase turn-on and turn-off times are each externally programmable.

The XR-2247/2247A, available in a 22-Pin DIP, operates from a single power supply and provides TTL compatible inputs.

FEATURES

- Fully Programmable Write and Erase Currents
- Fully Programmable Erase Turn-on/Turn-off Times
- Internal Head Switching for Dual Head Drives
- Single Supply Operation
- Inner Track Write Current Compensation
- Inhibit Input
- TTL Compatible Inputs
- Low External Parts Count

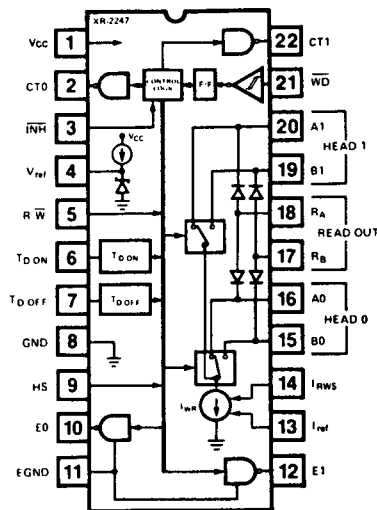
APPLICATIONS

- Floppy Disk Drives
- Single/Dual Head Systems
- Magnetic Tape Write Amplifier

ABSOLUTE MAXIMUM RATINGS

Power Supply Voltage (Pin 1)	16 V dc
Input Voltage (all digital inputs)	-0.2V to +16 V dc
Reference Current (Pin 4)	10 mA dc
Output Current (Pins 2, 10, 12, 22)	100 mA dc
Storage Temperature	-55°C to +150°C
Operating Junction Temperature	150°C
Power Dissipation	750 mW
Derate Above 25°C	6.5 mW/°C

FUNCTIONAL BLOCK DIAGRAM



ORDERING INFORMATION

Part Number	Package	Operating Temperature
XR-2247CN	Ceramic	0°C to +70°C
XR-2247CP	Plastic	0°C to +70°C
XR-2247ACN	Ceramic	0°C to +70°C
XR-2247ACP	Plastic	0°C to +70°C

SYSTEM DESCRIPTION

The XR-2247/2247A accepts a serial binary data stream input. With the write mode selected, negative transitions of this input signal will alternately provide write current to each half of the head. The XR-2247/2247A provides two sets of current outputs for dual head drives, with the head select (HS) control determining which is active. The write current is externally programmed with a resistor between the internal voltage reference and the current setting input. Two high-current open-collector outputs provide the erase coil drive. Turn-on and turn-off delay circuitry is provided for these outputs, with the delay externally programmed.

An inhibit input ($\overline{\text{INH}}$) is provided to disable the outputs to prevent false writing during power-on. With the read mode selected, internal head switching channels the proper head to the read outputs.

XR-2247/2247A

ELECTRICAL CHARACTERISTICS

Test Conditions: $T_A = 25^\circ\text{C}$, $V_{CC} = 12\text{V}$, $R_{ref} = 10\text{ k}\Omega$, unless otherwise specified.

SYMBOL	PARAMETERS	MIN	TYP	MAX	UNIT	CONDITIONS
I_{CC}	Power Supply Current	–	13	20	mA	$V_{CC} = 9V$ to 16V
V_{CC}	Power Supply Range	9	12	16	V	
DIGITAL INPUT VOLTAGE						
V_{IH}	High Level Voltage	2.0	–	–	V	
V_{IL}	Low Level Voltage	–	–	0.8	V	
DIGITAL INPUT CURRENTS						
I_{IH}	High Level Current	–	0.1	4.0	μA	$V_I = 2.4V$
I_{IL}	Low Level Current	–	15	100	μA	
CT0 or CT1 OUTPUTS						
V_{CTH}	Output High Voltage	9.5	10.2	–	V	$I_{out} = 100\text{ mA}$ $I_{out} = 1\text{ mA}$
V_{CTL}	Output Low Voltage	–	0.1	0.2	V	
E0 or E1 OUTPUTS						
I_{OL}	Output High Leakage	–	0.01	20	μA	$V_{CC} = 16V$ $I_{out} = 100\text{ mA}$ $R_{D1} = 4.55\text{ K}\Omega$, $C_{D1} = 0.1\text{ }\mu F$ $R_{D2} = 9.54\text{ K}\Omega$, $C_{D2} = 0.1\text{ }\mu F$
V_{OEL}	Output Low Voltage	–	1.0	1.5	V	
$T_{D\text{ ON}}$	Erase Turn-on Delay	0.45	0.5	0.55	mS	
$T_{D\text{ OFF}}$	Erase Turn-off Delay	0.9	1.0	1.1	mS	
CURRENT SOURCE						
V_{ref}	Reference - Pin 4	8.0	8.5	9.0	V	$I_{ref} = 1\text{ mA}$ $I_{ref} = 10\text{ mA}$ $I_{ref} = 1\text{ mA}$
		7.8	8.2	8.8	V	
		0.65	0.80	0.95	V	
V_{mir}	I_{ref} Input Voltage - Pin 13	–	–	–	V	$I_{RWS} = \text{Low}$ $I_{RWS} = \text{High}$ $I_{RWS} = \text{Low (Note 1)}$
I_{WRL}	Write Current Off Leakage — Pins 15, 16, 19, 20	–	0.03	15	μA	
V_{comp}	Current Sink Compliance — Pins 15, 16, 19, 20	7	–	12	V	
I_{WR}	Write Current w/o I_{RWS} — Pins 15, 16, 19, 20	3.7	4.1	4.5	mA	$I_{RWS} = \text{Low}$ $I_{RWS} = \text{High}$ $I_{RWS} = \text{Low (Note 1)}$
I_{WRS}	Write Current with I_{RWS} — Pins 15, 16, 19, 20	5.1	5.7	6.3	mA	
ΔI_{WR}	Difference in Write Current	–	–	40	μA	
READ OUTPUT						
e_{no}	Differential Noise Voltage at Read Output — 2247 2247A	– –	4 1	– –	μV_{rms} μV_{rms}	$BW = 10\text{ Hz to } 1.0\text{ MHz}$ $I_B = 200\text{ }\mu A$

Note 1: Difference = $|I_{PIN\ 15,16} - I_{PIN\ 19,20}|$

XR-2247/2247A

AC SWITCHING CHARACTERISTICS

Test Conditions: Test Circuit of Figure 4, $V_{CC} = 12V$, $T_A = 25^\circ C$, $I_{RWS} = 0.4V$

SYMBOL	PARAMETER	MIN	TYP	MAX	UNIT	CONDITIONS
t_{d1}	Delay from $\overline{R/W}$ going low through 0.8V to CT0 or CT1 going high through 9.0V.	–	0.11	–	μs	$\overline{R/W}$ signal at Pin 5: $f = 50$ KHz, 50% duty cycle, amplitude = 0.4V to 2.4V See Figure 1
t_{d2}	Delay from $\overline{R/W}$ going low through 0.8V to A0, A1, B0, or B1 settling to final value.	–	0.40	–	μs	
t_{d3}	Delay from $\overline{R/W}$ going high through 2.0V to A0, A1, B0, or B1 settling to final value.	–	0.20	–	μs	
t_{d4}	Delay from $\overline{R/W}$ going low through 0.8V to V_{ref} going high through 8.0V.	–	0.13	–	μs	
t_{d5}	Delay from $\overline{R/W}$ going high through 2.0V to V_{ref} going low through 1.0V.	–	3.50	–	μs	
t_{d6}	Delay from HS going high through 2.0V to CT0 going high through 9.0V.	–	0.12	–	μs	HS signal at Pin 9: $f = 50$ KHz, 50% duty cycle, amplitude = 0.4V to 2.4V See Figure 1
t_{d7}	Delay from HS going high through 2.0V to CT1 going low through 1.0V.	–	0.11	–	μs	
t_{d8}	Delay from HS going low through 0.8V to CT0 going low through 1.0V.	–	0.10	–	μs	
t_{d9}	Delay from HS going low through 0.8V to CT1 going high through 9.0V.	–	0.20	–	μs	
t_{10}	$\overline{WD}$ low hold time.	150	–	–	ns	See Figure 1
t_{11}	$\overline{WD}$ high hold time.	500	–	–	ns	
t_{d12}	Delay from $\overline{WD}$ going low through 1.4V to A0 or A1 turning on through 50%.	–	75	–	ns	See Figure 3
t_{d13}	Delay from $\overline{WD}$ going low through 1.4V to B0 or B1 turning off through 50%.	–	75	–	ns	
t_{d14}	Delay from $\overline{WD}$ going low through 1.4V to A0 or A1 turning off through 50%.	–	75	–	ns	
t_{d15}	Delay from $\overline{WD}$ going low through 1.4V to B0 or B1 turning on through 50%.	–	75	–	ns	
t_{16}	Turn-on time, 10% to 90%, of A0 or A1	–	50	–	ns	
t_{17}	Turn-on time, 10% to 90%, of B0 or B1	–	50	–	ns	
t_{18}	Turn-off time, 90% to 10%, of A0 or A1	–	50	–	ns	
t_{19}	Turn-off time, 90% to 10%, of B0 or B1	–	50	–	ns	

XR-2247/2247A

PRINCIPLES OF OPERATION

The functions of the input and output pins are as follows:

Head Select — HS (Pin 9): The head select input makes a selection between head 0 and head 1. It channels the proper drive signals to the CT and E pins.

Read/Write — R/W (Pin 5): This input selects read data when high, and write data when low.

Write Data — WD (Pin 21): Digital data to be written to the head is fed into this pin. Data is alternately written to A0, B0 or A1, B1 on negative transitions of WD.

I_{RWS} Select — I_{RWS} (Pin 14): This pin is used to provide a digital control for the amount of current written to the head. It is used to provide inner track compensation. When low, the head current is that dictated, by R_{ref}. When driven high, the head current is increased by 40%.

V_{ref} (Pin 4), I_{ref} (Pin 13): A resistor, R_{ref}, connected between these pins control the write current. With I_{RWS} low, the write current is approximately five times the R_{ref} current, and seven times with I_{RWS} high.

Center Tap 0 — CT0 (Pin 2), Center Tap 1 — CT1 (Pin 22): These pins are high-current outputs used to apply V_{CC} to the center taps of the head. With R/W low, both CT outputs are in the high state.

Erase 0 — E0 (Pin 10), Erase 1 — E1 (Pin 12): These pins provide high-current open-collector outputs for supplying erase current to the head. With R/W low, the erase output selected by HS will be low with the other open. With R/W high, both E0 and E1 will be open or high impedance outputs.

A0 (Pin 16), B0 (Pin 15): These pins provide the write current to the head. A0 is connected to one side of the head, with B0 connected to the other. They provide out-of-phase drive to each end of the head write coil. These outputs are selected when HS is low.

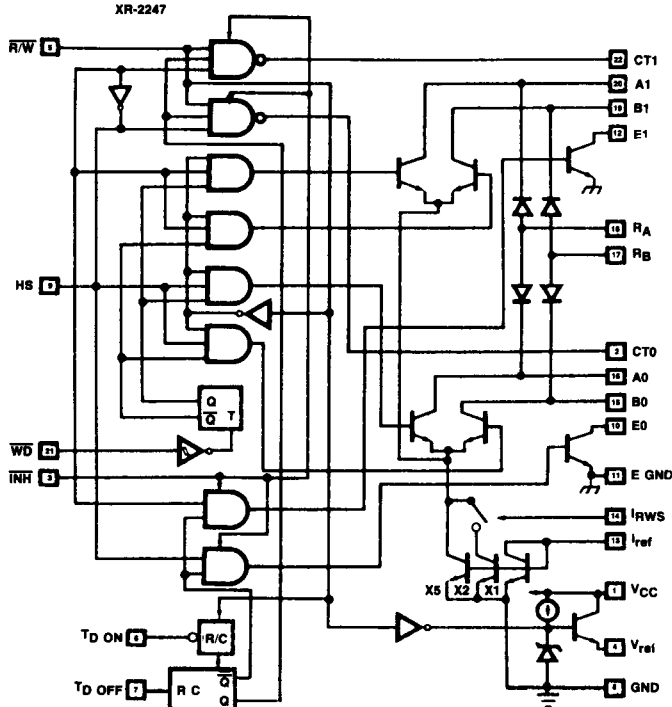
A1 (Pin 20), B1 (Pin 19): These outputs provide the same current-sink drive as A0/B0, except to the other head when HS is high.

R_A (Pin 18), R_B (Pin 17): These are read signal outputs to be connected to the read amplifier inputs. With R/W high, the head selected by HS will be connected to these pins.

Inhibit — INH (Pin 3): When active (low), this input will turn off both erase and center taps to avoid erroneous outputs during power-on.

TD ON (Pin 6), TD OFF (Pin 7): The resistor, R_D, and capacitor, C_D, combination of these pins will set the turn-on and turn-off times of the erase outputs. Figure 5 shows the connection of these components, with section 3 of the applications information describing the time as a function of R_D and C_D.

EQUIVALENT SCHEMATIC DIAGRAM



XR-2247/2247A

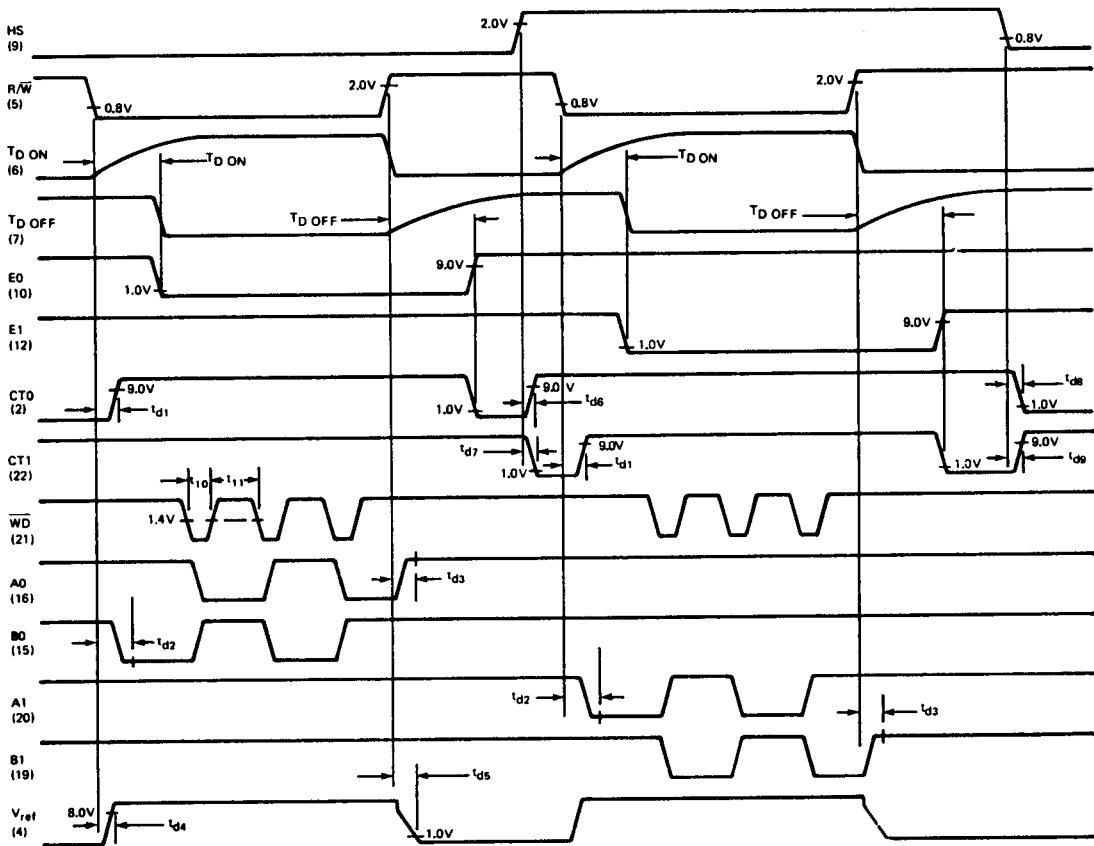


Figure 1. Timing Diagram

INPUT			OUTPUT				
INH	R/W	HS	CT0	CT1	E0	E1	V _{ref}
1	0	0	H	H	Low	Open	H
1	0	1	H	H	Open	Low	H
1	1	0	L	H	Open	Open	L
1	1	1	H	L	Open	Open	L
0	—	—	L*	L*	Open	Open	H

*High impedance

Figure 2. Truth Table

XR-2247/2247A

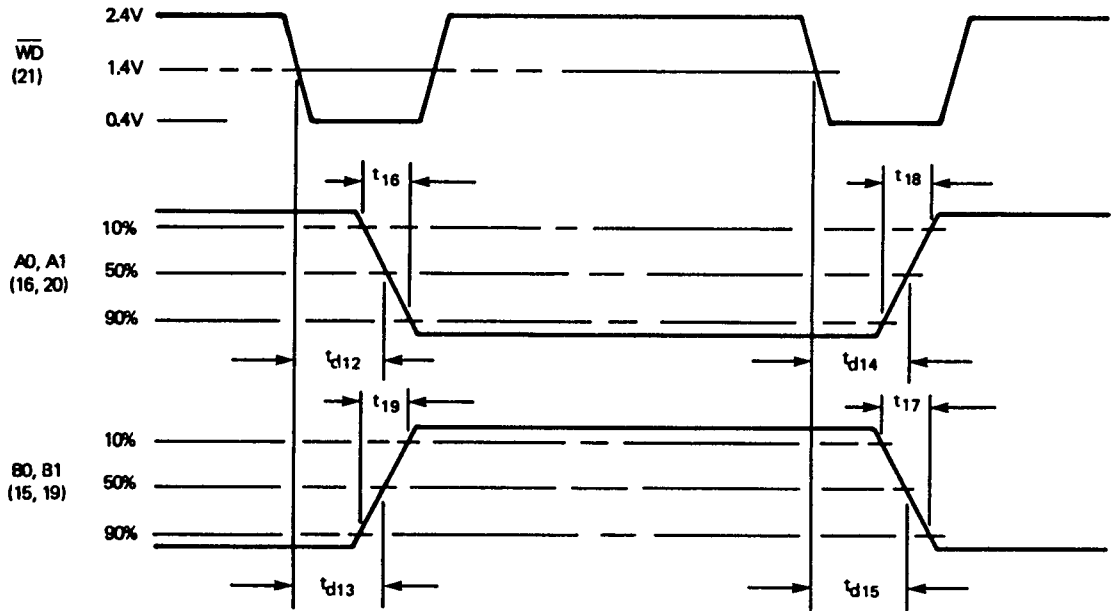


Figure 3. Write Current Output Characteristics

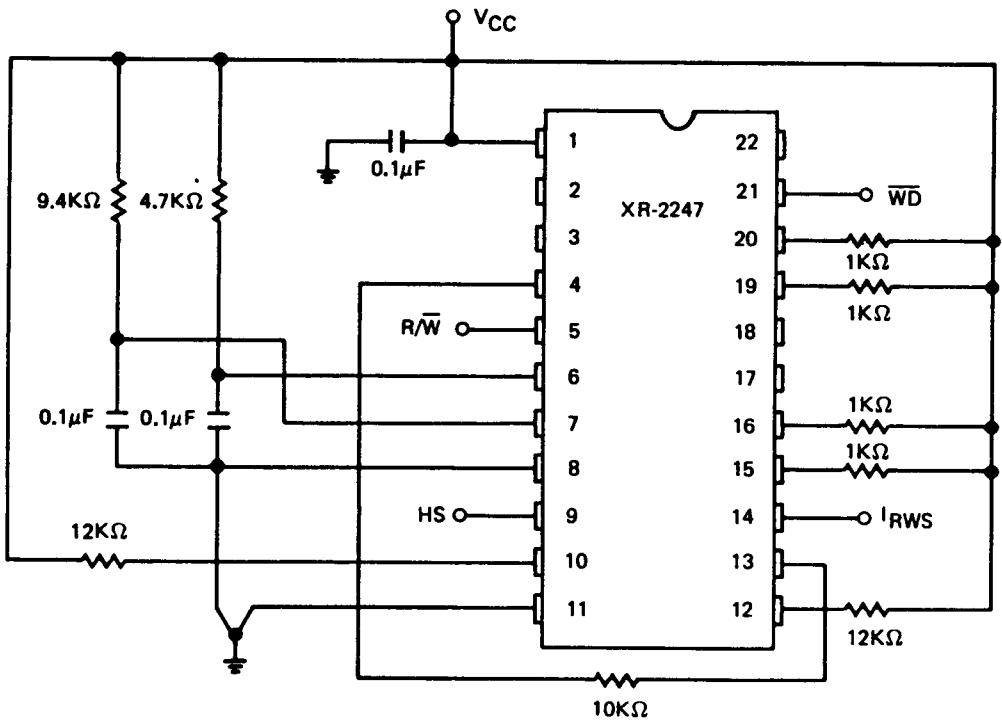


Figure 4. Test Circuit for AC Switching Characteristics

XR-2247/2247A

APPLICATIONS INFORMATION

A typical dual head connection of the XR-2247 in a floppy disk system is shown in Figure 5. Referring to Figure 5 and the electrical characteristics, the external components are calculated as follows:

1) Write Current, I_{WR}

$$I_{WR} = (5.3) \left(\frac{V_{ref} - V_{mir}}{R_{ref}} \right) \quad I_{RWS} = \text{Low}$$

Given $I_{WR} = 4.1 \text{ mA}$, $R_{ref} = 10 \text{ k}\Omega$
 I_{ref} , the current into Pin 13, should not exceed 2.0 mA.

2) Erase Current, I_E

$$I_E = \frac{V_{CTH} - V_{OEL}}{R_E} \approx \frac{V_{CC} - 2V}{R_E}$$

Given $I_E = 50 \text{ mA}$ and $V_{CC} = 12V$, $R_E = 200\Omega \frac{1}{2} W$

3) Erase Delay Time, $T_{D \text{ ON}}$ and $T_{D \text{ OFF}}$

$$T_{D \text{ ON}} \approx 1.1 (R_{D1} \times C_{D1})$$

$$T_{D \text{ OFF}} \approx 1.05 (R_{D2} \times C_{D2})$$

Given $T_{D \text{ ON}} = 0.5 \text{ ms}$ and $T_{D \text{ OFF}} = 1.0 \text{ ms}$,

$$R_{D1} = 4.55 \text{ k}\Omega, R_{D2} = 9.54 \text{ k}\Omega$$

$$C_{D1} = C_{D2} = 0.1 \mu F$$

Control of the erase outputs can also be done from an external source by grounding Pin 6 and driving Pin 7 directly. The selected erase output will be on when Pin 7 is low and off when Pin 7 is high. This input is not TTL compatible, however, with the threshold voltage being approximately $\frac{2}{3} V_{CC}$.

4) Resistors R_{WD} are used to damp any ringing that may occur when the write current transitions are applied to the head. Their value is determined by the head characteristics and the desired damping.

R_{RD} is used to provide additional damping in the read mode if this is desired. Usually, R_{RD} is only used with the XR-2247A where the head switching diodes make the total read damping resistance approximately R_{RD}/R_{WD} . In the XR-2247, the transistors used for head switching act to buffer R_{RD} from the head.

Resistors R_B are used to bias the head switching network in the read mode and their value is selected to provide currents in the $100 \mu A$ to $300 \mu A$ range.

5) When in the read mode, digital signals appearing along the $\overline{WD}$ line (Pin 21) can couple externally through stray capacitances into the read signal coming from the head. It is recommended that $\overline{WD}$ be held low while reading.

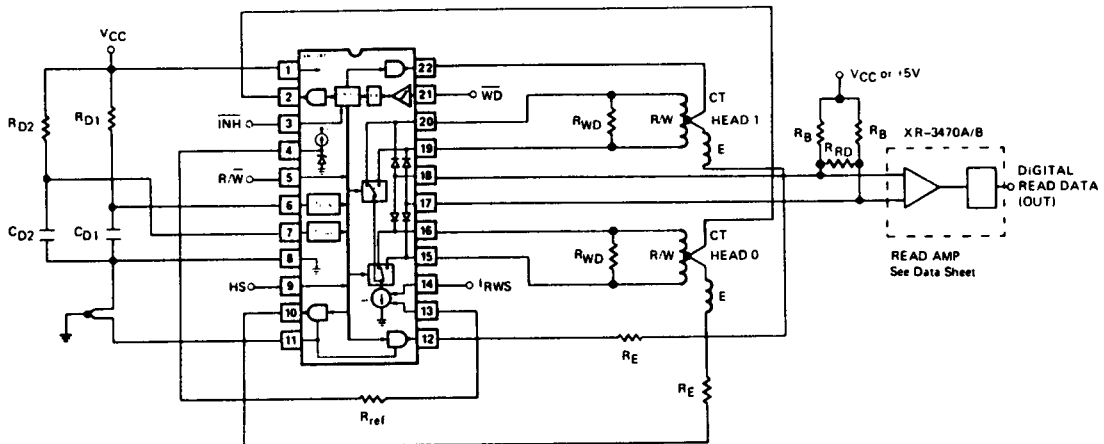


Figure 5. Typical Dual Head Floppy Disk System

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EXAR

91D 04225

D7-75-45-05

XR-1488/1489A

Quad Line Driver/Receiver

GENERAL DESCRIPTION

The XR-1488 is a monolithic quad line driver designed to interface data terminal equipment with data communications equipment in conformance with the specifications of EIA Standard No. RS232C. This extremely versatile integrated circuit can be used to perform a wide range of applications. Features such as output current limiting, independent positive and negative power supply driving elements, and compatibility with all DTL and TTL logic families greatly enhance the versatility of the circuit.

The XR-1489A is a monolithic quad line receiver designed to interface data terminal equipment with data communications equipment. The XR-1489A quad receiver along with its companion circuit, the XR-1488 quad driver, provide a complete interface system between DTL or TTL logic levels and the RS232C defined voltage and impedance levels.

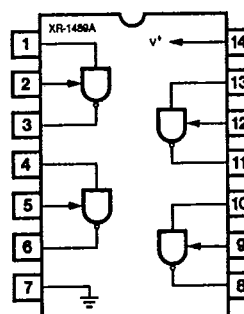
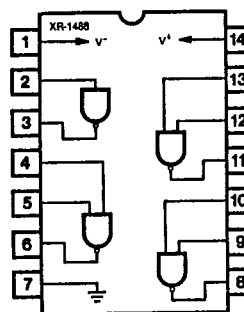
ABSOLUTE MAXIMUM RATINGS

Power Supply	
XR-1488	± 15 Vdc
XR-1489A	+ 10 Vdc
Power Dissipation	
Ceramic Package	1000 mW
Derate above +25°C	6.7 mW/°C
Plastic Package	650 mW/°C
Derate above +25°C	5 mW/°C

ORDERING INFORMATION

Part Number	Package	Operating Temperature
XR-1488N	Ceramic	0°C to +70°C
XR-1488P	Plastic	0°C to +70°C
XR-1489AN	Ceramic	0°C to +70°C
XR-1489AP	Plastic	0°C to +70°C

FUNCTIONAL BLOCK DIAGRAMS



SYSTEM DESCRIPTION

The XR-1488 and XR-1489A are a matched set of quad line drivers and line receivers designed for interfacing between TTL/DTL and RS232C data communication lines.

The XR-1488 contains four independent split supply line drivers, each with a ± 10 mA current limited output. For RS232C applications, the slew rate can be reduced to the 30 V/ μ S limit by shunting the output to ground with a 410 pF capacitor. The XR-1489A contains four independent line receivers, designed for interfacing RS232C to TTL/DTL. Each receiver features independently programmable switching thresholds with hysteresis, and input protection to ± 30 V. The output can typically source 3 mA and sink 20 mA.