

ML4452

MR Head Preamplifier for Tape Drives 2-CH Read and 1-CH Write with Readback

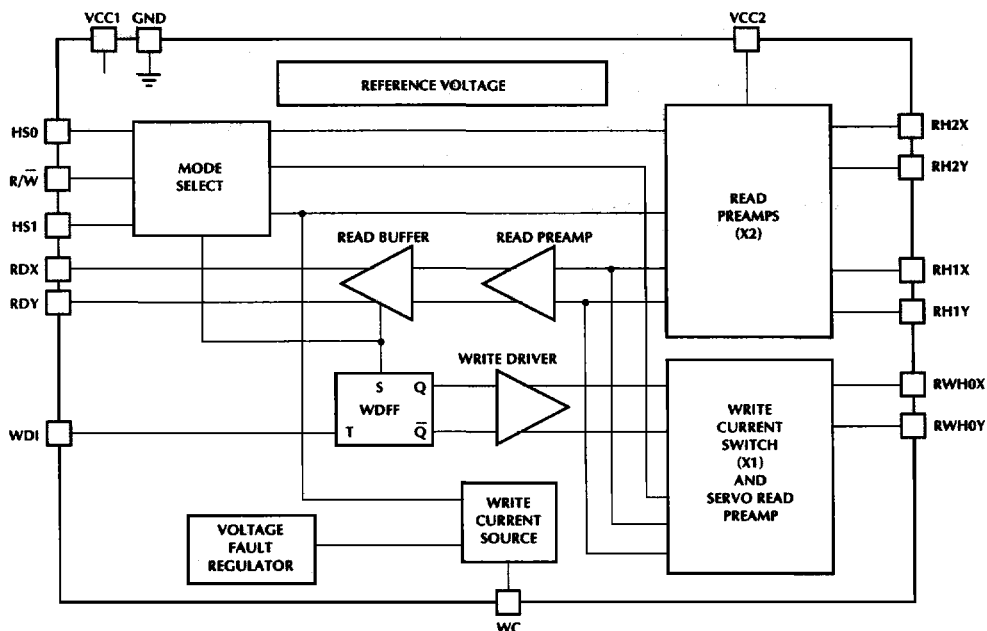
GENERAL DESCRIPTION

The ML4452 is a bipolar monolithic read preamp circuit designed for use with two-terminal thin-film or MR recording heads for tape drives. It provides two dedicated low noise read channels and a separate write channel with read back capability for use with the servo head. The write channel in the ML4452 incorporates an internal 700Ω damping resistor which dampens the write signals to the head. Additionally write current control and data protection circuitry are also provided. Because the read channels are independent there is no voltage drift, which is a problem with normal preamps when switching from the write to read mode. Power supply fault protection is provided by disabling the write current generator during power sequencing.

FEATURES

- Architecturally Compatible to SSI's 32R4610AR
- Single +5 Volt Operation, $P_{MAX} < 200mW$
- Read Mode Gain = 125 V/V
- Dedicated Read Channels for Greater Noise Immunity
- Write Channel also Provides Servo Readback Capability
- 700 Ohm Damping Resistor in the Write Channel
- Input Noise = $0.85nV/\sqrt{Hz}$ max
- Input Capacitance = 45pF max
- Write Current Range = 10–35mA
- Enhanced System Write to Read Recovery Time
- Power Supply Fault Protection
- No Write Current Glitching on Power-up
- 20-pin SSOP Package

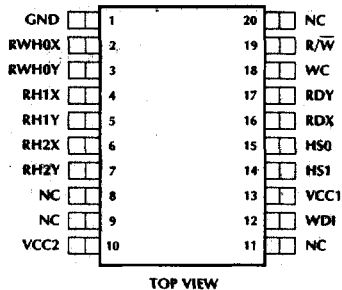
BLOCK DIAGRAM



ML4452

PIN CONNECTION

ML4452
20-Pin SSOP (R20)



PIN DESCRIPTION

NAME	TYPE	DESCRIPTION	NAME	TYPE	FUNCTION
HS0, HS1	I	Head Select: Selects one of three heads	RDX, RDY	O	X, Y Read Data: Differential read data output
R/W	I	Read/Write: A high selects read mode and a low selects write mode	WC		Write Current: Used to set the magnitude of the write current
WDI	I	Write Data In: Changes the direction of the current in the head	VCC1	I	+5 volt supply
RH1X, RH2X RH1Y, RH2Y	I	X, Y Head Connectors for MR Read only	VCC2	I	+5 volt supply for write current drivers
RWH0X RWH0Y	I/O	X, Y Head Connectors for Servo MR read and inductive write	GND	I	Ground

ABSOLUTE MAXIMUM RATINGS

DC Supply Voltage (V _{CC1})	-0.3 to +7VDC
DC Supply Voltage (V _{CC2})	-0.3 to +7VDC
Write Current (I _W)	80mA
Digital Input Voltage (V _{IN})	-0.3 to V _{CC1} + 0.3VDC
Head Port Voltage (V _H)	-0.3 to V _{CC1} + 0.3VDC
Output Current: RDX, RDY (I _O)	-10mA
Storage Temperature T _{STG}	-65 to +150°C

OPERATING CONDITIONS

DC Supply Voltage (V _{CC1})	5 ±5% VDC
DC Supply Voltage (V _{CC2})	5 ±5% VDC
Operating Junction Temperature (T _J)	+25° to +110°C

ELECTRICAL CHARACTERISTICS

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
VCC1 Supply Current	Read Mode Write Mode			33 27	mA
VCC2 Supply Current	Read Mode Write Mode			11 10 + I _W	mA
Power Dissipation	Read Mode Write Mode			230 190 + 4I _W	mW

Digital Inputs

Input Low Voltage (V _{IL})				0.8	VDC
Input High Voltage (V _{IH})		2.0			VDC
Input Low Current	V _{IL} = 0.8V	-0.4			mA
Input High Current	V _{IH} = 2.0V			100	μA
VCC1 Fault Voltage	I _W < 0.2 mA	3.7	4.0	4.2	VDC

Write Characteristics

Write Current Constant "K"			0.99		
Write Current Voltage (V _{WC})		1.15	1.25	1.35	V
Differential Head Voltage Swing		3.4	6		V _{pp}
Unselected Head Current				1	mA (pk)
Head Differential Load Capacitance				25	pF
Head Differential Load Resistance	R _D	500	700	950	ohms
Write Current Range (I _W)		10		45	mA

Read Characteristics C_L (RDX, RDY) < 20pF, R_L (RDX, RDY) = 1KΩ

Differential Voltage Gain	V _{IN} = 1mV _{pp} @ 1MHz	100	125	150	V/V
Voltage BW	-1dB	Z _s < 5 ohm, V _{IN} = 1mV _{pp}	20		MHz
	-3dB		35		MHz
Input Noise Voltage	BW = 15MHz, L _H = 0, R _H = 0		0.6	0.85	nV/√Hz
Differential Input Capacitance	V _{IN} = 1mV _{pp} , f = 5MHz		27	35	pF
Differential Input Resistance	V _{IN} = 1mV _{pp} , f = 5MHz Read/Write head #0 Read heads #1 & #2	360			ohms
		900			ohms
Dynamic Range	AC input voltage where gain falls to 90% of its small signal gain value. @ f = 5MHz	3			mV _{pp}

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ELECTRICAL CHARACTERISTICS (Continued)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Read Characteristics C_L (RDX, RDY) < 20pF, R_L (RDX, RDY) = 1K Ω (Continued)					
Common Mode Rejection Ratio	$V_{IN} = 0VDC + 100mVpp @ 5MHz$	45			dB
Power Supply Rejection Ratio Separation	100mVpp @ 5MHz on V_{CC} Unselected channels driven with $V_{IN} = 0VDC + 100mVpp$	40 45			dBChannel dB
Output Offset Voltage		-200		+200	mV
Single-ended Output Resistance	$f = 5MHz$			40	Ohms
Output Current	AC Coupled Load, RDX to RDY	1.4			mA
RDX, RDY Common Mode Output		2.0	2.8	3.5	VDC
Switching Characteristics $I_W = 20mA$, $R_H = 30 \text{ Ohm}$, $L_H = 1\mu H$, $f_{DATA} = 5MHz$					
R/W Read to Write	R/W to 90% of write current		0.1	1.0	μs
R/W Write to Read	R/W to 90% of 100mV Read signal envelope		0.5	1.0	μs
HS 0, 1 to any head	To 90% of 100 mV 10 MHz Read signal envelope		0.2	1.0	μs
Head Current WDI to I_x - I_y (TD3) Asymmetry Rise/Fall Time	$L_H = 0$, $R_H = 0$ From 50% points WDI has 1 ns rise/fall time 10% to 90% points			32 1.0 12	ns ns ns

TIMING DIAGRAM

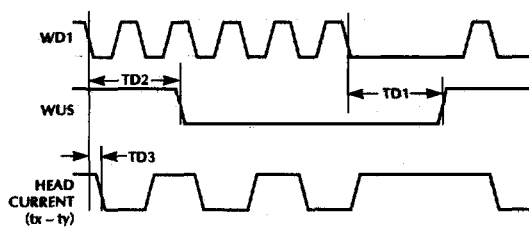


Figure 1. Write Mode.

MODE AND HEAD SELECT

R/W	HS1	HS0	HEAD	MODE
0	0	0	RWH0	Write
1	0	0	RWH0	Read
1	0	1	RH1	Read
1	1	0	RH2	Read
1	1	1	RESERVED	

Note: The TTL input R/W has an internal pull-up resistor to prevent an accidental write condition. The TTL inputs HS0 and HS1 have internal pull-downs.

FUNCTIONAL DESCRIPTION

The ML4452 has the ability to address up to 4 two-terminal thin-film heads and provide write drive or read amplification. Head selection and mode control are described in the tables below. The TTL inputs R/\overline{W} and \overline{CS} have internal pull-up resistors to prevent an accidental write condition. HS0 and HS1 have internal pull-downs. Internal clamp circuitry will protect the ML4610R/4611R from a head short to ground condition in any mode. The damping resistors are switched out during read mode, as identified by the R/\overline{W} pin.

WRITE MODE OPERATION

Taking both \overline{CS} and R/\overline{W} low selects write mode which configures the ML4610R/4611R as a current switch and activates the Write Unsafe (WUS) detector circuitry. Head current is toggled between the X and Y side of the selected head on each high to low transition of the Write Data Input (WDI). A preceding read or idle mode select initializes the Write Data Flip-Flop to pass write current through the "X" side of the head. The current calculations are shown below:

Write current (peak) is given by:

$$I_W = \frac{K \times V_{WC}}{R_{WC}}$$

where

R_{WC} is connected from pin WC to GND

Actual head current is given by:

$$I_{X,Y} = \frac{I_W}{1 + \frac{R_H}{R_D}}$$

where

R_H = head + external wire resistance
 R_D = damping resistance

VOLTAGE FAULT DETECTION

A voltage fault detection circuit improves data security by disabling the write current generator during a voltage fault or power start-up, regardless of mode. The Write Unsafe (WUS) open collector output goes high under the conditions given below. After the fault condition is removed, a negative transition on WDI is required to clear WUS.

- Write Data Input frequency too low
- Device in Read Mode
- Chip is disabled or head is open
- No write current

READ MODE OPERATION

The Read mode configures the ML4452 as a low noise differential amplifier and deactivates the write current generator. The RDX and RDY output are driven by emitter followers. They should be AC coupled to the load. The (X,Y) inputs are non-inverting to the (X,Y) outputs. In the Idle or Write mode, the read amplifier is deactivated and RDX, RDY outputs become high impedance. This facilitates multiple R/\overline{W} applications (wired-OR RDX, RDY) and minimizes voltage drifts when switching from Write to Read mode. The write current source is also deactivated for both the Read and Idle mode. In addition the ML4452 supports the feature by which the internal damping resistors are switched out in the read mode, which allows the full signal to be amplified.

IDLE MODE OPERATION

Taking \overline{CS} high selects the idle mode which switches the RDX and RDY outputs into a high impedance state and deactivates the device. Power consumption in this mode is held to a minimum, less than 50mW.

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ORDERING INFORMATION

PART NUMBER	TEMPERATURE RANGE	PACKAGE
ML4452CR	0°C to +70°C	20-Pin SSOP (R20)