SSI 32R521/521R
SSI 32R5211
Thin Film-6-Channel Read/Write Devices

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July, 1990

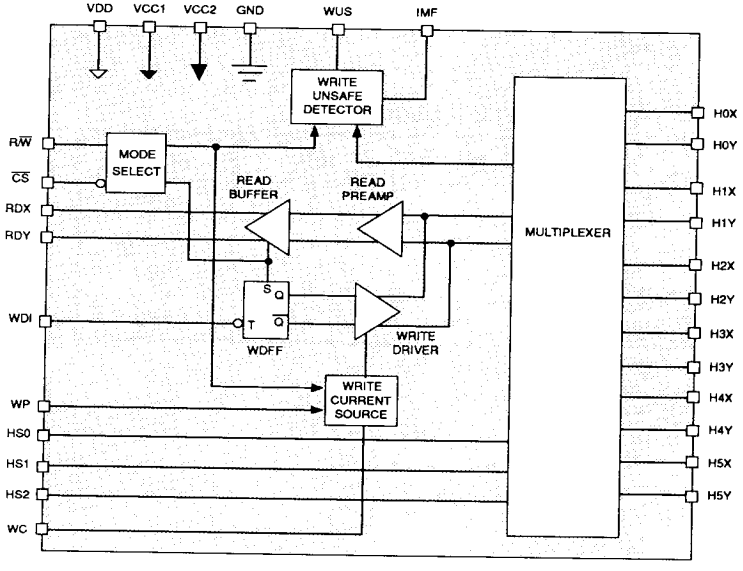
DESCRIPTION

The SSI 32R521 and 32R5211 are bipolar monolithic integrated circuits designed for use with non-center tapped thin film recording heads. They provide a low noise read path, write current control, and data protection circuitry for up to six channels. They require +5V and +12V power supplies and are available in a variety of packages. The SSI 32R521R differs from the SSI 32R521 by having 200Ω internal damping resistors.

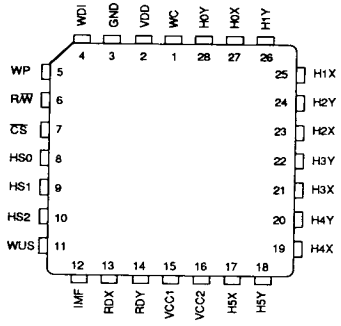
FEATURES

- **High performance**
  - **Read mode gain = 100V/V (32R521)**
  - **= 150V/V (32R5211)**
  - **Input noise = 0.9nV/√Hz maximum**
  - **Input capacitance = 65 pF**
  - **Write current range = 20 mA to 70 mA**
  - **Head voltage swing = 3.4 Vpp**
  - **Write current rise time = 13 nsec**
- **+5V, +12V power supplies**
- **Includes write unsafe detection**

BLOCK DIAGRAM



PIN DIAGRAM



28-LEAD PLCC

CAUTION: Use handling procedures necessary for a static sensitive component.

CIRCUIT OPERATION

The SSI 32R521 functions as a write driver or as a read amplifier for the selected head. Head selection and mode control are described in Tables 1& 2. The inputs R/$\overline{W}$, $\overline{CS}$ and WP have internal pull-up resistors to prevent an accidental write condition.

WRITE MODE

The Write mode configures the SSI 32R521 as a current switch and activates the Write Unsafe Detector. Head current is toggled between the X- and Y-directions of the recording head on the falling edges of WDI, Write Data Input. The magnitude of the write current, given by:

$$Iw = \frac{Vwc}{Rwc}$$

is controlled by an external resistor, Rwc, connected from pin WC to GND.

$$\text{Head Current Ix, y} = \frac{Iw}{1 + Rh/Rd}$$

Any of the following conditions will be indicated as a high level on the Write Unsafe, WUS, open collector output.

- WDI frequency too low
- Device in Read mode
- Chip disabled
- No write current

After fault condition is removed, two negative transitions on WDI are required to clear WUS. The Current monitor output (IMF) sinks one unit of current when the device is selected. This allows a multichip enable fault to be detected.

NOTE: If it is desirable to initialize the Write Data flip-flop to pass current in the Y-direction of the head when entering Write Mode, the WDI input must go low in Read mode for 20 ns minimum.

READ MODE

In the Read mode, the SSI 32R521 is configured as a low noise differential amplifier, the write current source and the write unsafe detector are deactivated, and the write data flip-flop can be set. The RDX and RDY outputs are driven by emitter followers. They should be AC coupled to load. Note that the internal write current source is deactivated for both the Read and chip deselected modes.

IDLE MODE

The idle mode deactivates the internal write current generator, the write unsafe detector and switches the RDX, RDY outputs into a high impedance state. This facilitates multiple device applications by enabling the read outputs to be wire OR'ed and the write current programming resistor to be common to all devices.

TABLE 1: Mode Select

$\overline{CS}$	R/$\overline{W}$	MODE
0	0	Write
0	1	Read
1	0	Idle
1	1	Idle

TABLE 2: Head Select

HS2	HS1	HS0	HEAD
0	0	0	0
0	0	1	1
0	1	0	2
0	1	1	3
1	0	0	4
1	0	1	5
1	1	0	none
1	1	1	none

PIN DESCRIPTIONS

NAME	I/O	DESCRIPTION
HSO - HS2	I	Head Select: selects one of six heads
$\overline{CS}$	I	Chip Select: a high inhibits chip
R/$\overline{W}$	I	Read/Write: a high selects Read mode
WP	I	Write Protect: a low enables the write current source
WUS	O*	Write Unsafe: a high indicates an unsafe writing condition
IMF	O*	Current Monitor Function: allows multichip enable fault detection
WDI	I	Write Data In: changes the direction of the current in the recording head
HOX - H5X HOY - H5Y	I/O	X, Y Head Connections: Current in the X-direction flows into the X-port
RDX, RDY	O*	X, Y Read Data: differential read data output
WC	*	Write Current: used to set the magnitude of the write current
VCC1	-	+5V Logic Circuit Supply
VCC2	-	+5V Write Current Supply
VDD	-	+12V
GND	-	Ground

*When more than one device is used, these signals can be wire OR'ed.

ABSOLUTE MAXIMUM RATINGS

PARAMETER		SYMBOL	VALUE	UNITS
DC Supply Voltage		VDD	-0.3 to +14	VDC
		VCC	-0.3 to +7	VDC
Write Current		IW	100	mA
Digital Input Voltage		Vin	-0.3 to VCC +0.3	VDC
Head Port Voltage		VH	-0.3 to VDD +0.3	VDC
Output Current:	RDX, RDY	Io	-10	mA
	WUS	Iwus	+12	mA
Storage Temperature		Tstg	-65 to +150	°C

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	VALUE	UNITS
DC Supply Voltage	VDD	12 ± 5%	VDC
	VCC1	5 ± 5%	VDC
	VCC2	5 ± 5%	VDC
Operating Temperature	Tj	+25 to +135	°C

DC CHARACTERISTICS
Unless otherwise specified, recommended operating conditions apply.

PARAMETER	CONDITIONS	MIN	MAX	UNITS
VDD Supply Current	Read Mode		34	mA
	Write Mode		38	mA
	Idle Mode		9	mA
VCC Supply Current	Idle Mode		49	mA
	Read Mode		62	mA
	Write Mode		49 + IW	mA
Power Dissipation (Tj = +135°C)	Idle Mode		400	mW
	Read Mode		800	mW
	Write Mode, IW = 70 mA		990	mW

DC CHARACTERISTICS (Continued)

PARAMETER	CONDITIONS	MIN	MAX	UNITS
Digital Inputs				
Input Low Voltage (VIL)		-0.3	0.8	VDC
Input High Voltage (VIH)		2.0	VCC+0.3	VDC
Input Low Current	VIL = 0.8V	-0.4		mA
Input High Current	VIH = 2.0V		100	µA
RDX, RDY Common Mode Output Voltage		3	5	VDC
WUS Output VOL	Iol = 8 mA		0.5	VDC
IMF Output	$\overline{CS}$ = 0	0.73	1.23	mA
	$\overline{CS}$ = 1		0.02	mA

WRITE CHARACTERISTICS
Unless otherwise specified, recommended operating conditions apply, and IW = 40 mA, Lh = 200 nH, Rh = 16Ω, f(Data) = 5 MHz, CL(RDX, RDY) < 20 pF, RL(RDX,RDY) = 1 kΩ.

PARAMETER	CONDITIONS	MIN	NOM	MAX	UNITS
Write Current Voltage Vwc			1.65±5%		V
Differential Head Voltage Swing		3.4			V(pp)
Unselected Head Current				2	mA(pk)
Differential Output Capacitance				30	pF
Differential Output Resistance	32R521R	160	200	240	Ω
	32R521, 32R5211	2K			Ω
WDI Transition Frequency	WUS=low	1.7			MHz
Write Current Range		20		70	mA

READ CHARACTERISTICS
Unless otherwise specified, recommended operating conditions apply.

PARAMETER			CONDITIONS	MIN	MAX	UNITS
Differential Voltage Gain		32R521	Vin = 1 mVpp @ 300 kHz RL(RDX), RL(RDY) = 1 kΩ	75	125	V/V
		32R5211	Same as above	120	180	V/V
Voltage Bandwidth	-1dB	32R521	|Zs| < 5Ω, Vin = 1 mVpp @ 300 kHz	25		MHz
		32R5211	Same as above	10		MHz
	-3dB	32R521	Same as above	45		MHz
		32R5211	Same as above	30		MHz

READ CHARACTERISTICS (Continued)

PARAMETER	CONDITIONS	MIN	NOM	MAX	UNITS
Input Noise Voltage	BW = 15 MHz, Lh = 0, Rh = 0			0.9	nV/√Hz
Differential Input Capacitance	f = 5 MHz			65	pF
Differential Input Resistance	521R, f = 5 MHz		200		Ω
	521 and 5211, f = 5 MHz	600			Ω
Input Bias Current				170	mA
Dynamic Range	DC input voltage where gain falls to 90% of its 0 VDC value Vin=VDC+0.5mVpp, f=5MHz	-3		3	mV
Common Mode Rejection Ratio	Vin=0VDC+100mVpp@5MHz	54			dB
Power Supply Rejection Ratio	100 mVpp @ 5 MHz on VDD	54	90		dB
	100 mVpp @ 5 MHz on VCC		49		
Channel Separation	Unselected channels driven with 100 mVpp @ 5 MHz Vin = 0 mVpp	45			dB
Output Offset Voltage		-360		360	mV
Single Ended Output Resistance	f = 5 MHz			30	Ω
Output Current	AC Coupled Load, RDX to RDY	3.2			mA

SWITCHING CHARACTERISTICS
Unless otherwise specified, recommended operating conditions apply, and IW = 40 mA, Lh = 200 nH, Rh = 16Ω, f(Data) = 5 MHz.

PARAMETER		CONDITIONS	MIN	MAX	UNITS
R/$\overline{W}$	R/$\overline{W}$ to Write	To 90% of write current		0.6	µs
	R/$\overline{W}$ to Read	To 90% of 100 mV, 10 MHz Read signal envelope		0.6	µs
$\overline{CS}$	$\overline{CS}$ to Select	To 90% of write current		1	µs
	$\overline{CS}$ to Unselect	To 90% of 100 mV, 10 MHz Read signal envelope		1	µs
HS0, 1, 2 to any Head		To 90% of 100 mV, 10 MHz Read signal envelope		0.4	µs
WUS	Safe to Unsafe TD1		0.6	3.6	µs
	Unsafe to Safe TD2			1	µs
IMF	Transition Time	Delay from 50% point of CS to 90%of IMF current		0.6	µs
Head Current		Lh = 0, Rh = 0			
	WDI to (Ix-Iy) TD3	From 50% points		32	ns
	Asymmetry	WDI has 50% duty cycle and 1ns rise/fall time		1.0	ns
	Rise/Fall Time	10% - 90% points		13	ns

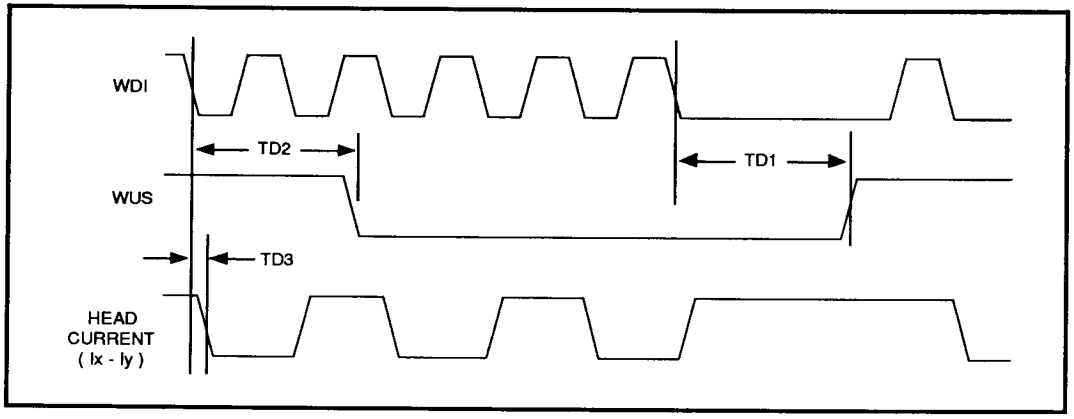


FIGURE 1: Write Mode Timing Diagram

APPLICATIONS INFORMATION

Read mode input port parameter limits, as given in the specifications, are over extremes of temperature, voltage and process. The tabulation below shows parameter correlation as a function of base sheet resistance, a processing parameter. Use of these limits, for worst case analysis, will be more representative of actual performance.

EXAMPLE 1: Base Sheet Resistance = Maximum

PARAMETER		Tj = 25°C	Tj = 135°C	UNITS
Input Noise Voltage (Maximum)		0.69	0.9	nV/√Hz
Differential Input Resistance (Minimum)	521R	146	150	Ω
	521, 5211	1025	1240	Ω
Differential Input Capacitance (Maximum)		43	47	pF

EXAMPLE 2: Base Sheet Resistance = Minimum

PARAMETER		Tj = 25°C	Tj = 135°C	UNITS
Input Noise Voltage (Maximum)		0.58	0.75	nV/√Hz
Differential Input Resistance (Minimum)	521R	133	140	Ω
	521, 5211	600	760	Ω
Differential Input Capacitance (Maximum)		51	56	pF

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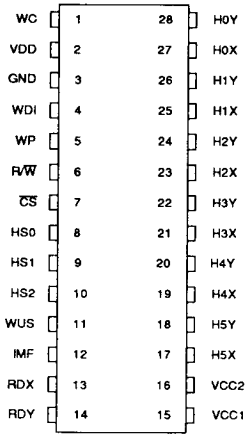
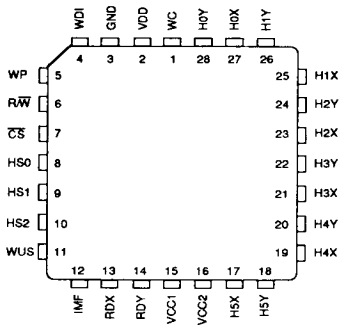
PACKAGE PIN DESIGNATIONS

(Top View)



28-Lead SOL, Flatpack



28-Lead PLCC

THERMAL CHARACTERISTICS: Øja

28-Lead	SOL	75°C/W
	PLCC	65°C/W
	Flatpack	100°C/W

ORDERING INFORMATION

PART DESCRIPTION	ORDER NO.	PKG. MARK
SSI 32R521 - Read/Write IC		
6 - Channel SOL	SSI 32R521-6L	32R521-6L
6 - Channel PLCC	SSI 32R521-6CH	32R521-6CH
6 - Channel Flatpack	SSI 32R521-6F	32R521-6F
SSI 32R521R - with Internal Damping Resistors		
6 - Channel SOL	SSI 32R521R-6L	32R521R-6L
6 - Channel PLCC	SSI 32R521R-6CH	32R521R-6CH
6 - Channel Flatpack	SSI 32R521R-6F	32R521R-6F
SSI 32R5211 - Read/Write IC		
6 - Channel SOL	SSI 32R5211-6L	32R5211-6L
6 - Channel PLCC	SSI 32R5211-6CH	32R5211-6CH

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