

SSI 32R2041RW

4, 6-Channel, Two-Terminal

Read/Write Device

CIRCUIT OPERATION

The SSI 32R2041RW addresses up to 6 two-terminal thin film heads providing write drive or read amplification. Head selection and mode control is accomplished with pins \overline{HSn} , \overline{CS} and R/\overline{W} , as shown in Tables 1 & 2. Internal resistor pullups, provided on pins \overline{CS} and R/\overline{W} will force the device into a non-writing condition if either control line is opened accidentally.

WRITE MODE

The write mode configures the SSI 32R2041RW as a current switch and activates the Write Unsafe (WUS) detection circuitry. Write current is toggled between the X and Y direction of the selected head on each low to high transition on the WD, Write Data input. (See Figure 1.)

A preceding read operation initializes the Write Data Flip Flop (WDFF) to pass write current in the X-direction of the head, i.e., into the X-port of the head. HnX will be biased higher than HnY .

The magnitude of the write current (0-pk) is given by:

$$I_w = \frac{V_{wc}}{R_{wc}}$$

where V_{wc} (WC pin voltage) = $1.65V \pm 5\%$, is programmed by an external resistor R_{wc} , connected from pin WC to ground. In multiple device applications, a single R_{wc} resistor may be made common to all devices. The actual head current $I_{x,y}$ is given by:

$$I_{x,y} = \frac{I_w}{1 + R_h/R_d}$$

where:

R_h = head resistance + external wire resistance, and
 R_d = damping resistance.

Power supply fault protection improves data security by disabling the write current generator during a voltage fault or power supply sequencing. Additionally, the write unsafe detection circuitry will flag any of the conditions listed below as a high level on the open collector output pin, WUS. Up to two positive transitions on the WD, Write Data input line, after the fault is corrected, are required to clear the WUS flag.

- WD frequency too low
- Device in read mode
- Device not selected
- No write current
- Open head

READ MODE

The read mode configures the SSI 32R2041RW as a low noise differential amplifier and deactivates the write current generator and write unsafe detection circuitry. The RDX and RDY outputs are emitter followers and are in phase with the "X" and "Y" head ports. These outputs should be AC coupled to the load. The RDX, RDY common mode voltage is maintained at the write mode value, minimizing the transient between write mode and read mode, substantially reducing the write to read recovery time in the subsequent Pulse Detection circuitry.

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

0 = Low level

1 = High level

*Unused heads should be left open

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PIN DESCRIPTION

NAME	TYPE	DESCRIPTION
HS0 - HS2	I	Head Select
\overline{CS}	I	Chip Select: a low level enables the device
R/W	I	Read/Write: a high level selects read mode
WUS	O*	Write Unsafe: Open collector output, a high level indicates an unsafe writing condition
WD, \overline{WD}	I	Differential Write Data inputs: a positive transition on WD toggles the direction of the head current
H0X - H5X H0Y - 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
VCC	-	+5V Logic Circuit Supply
VDD	-	+12V
GND	-	Ground

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

ELECTRICAL SPECIFICATIONS

ABSOLUTE MAXIMUM RATINGS

Operation outside these rating limits may permanently damage the device.

PARAMETER	SYMBOL	RATING
DC Supply Voltage	VDD	-0.3 to +13.5 VDC
	VCC	-0.3 to +6 VDC
Write Current	I _w	100 mA
Digital Input Voltage	V _{in}	-0.3 to VCC +0.3 VDC
Head Port Voltage	V _H	-0.3 to +8 VDC
Differential Port Voltage H _n X - H _n Y	ΔV_H	6 VDC
WUS Pin Voltage Range	V _{wus}	-0.3 to VCC VDC
Output Current RDX, RDY	I _o	-10 mA
	I _{wus}	+12 mA
Storage Temperature	T _{stg}	-65 to +150°C

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ELECTRICAL SPECIFICATIONS (continued)

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	RATING
DC Supply Voltage	VDD	12 ± 10% VDC
	VCC	5 ± 10% VDC
Operating Temperature	Tj	+25 to +135°C

DC CHARACTERISTICS

Unless otherwise specified, recommended operating conditions apply.

PARAMETER	CONDITIONS	MIN	NOM	MAX	UNITS
VDD Supply Current	Read Mode	-	36	44	mA
	Write Mode	-	25 + Iw	29 + Iw	mA
	Idle Mode	-	3.5	4	mA
VCC Supply Current	Read Mode	-	22	29	mA
	Write Mode	-	14	18	mA
	Idle Mode	-	9	11.5	mA
Power Dissipation (Tj = +135°C)	Read Mode	-	540	740	mW
	Write Mode	-	370+10.35•Iw	490 +11.6•Iw	mW
	Idle Mode	-	87	115	mW
WD, $\overline{\text{WD}}$ Input Low Current (IIL1)	VIL1 = VCC -1.625V			80	mA
WD, $\overline{\text{WD}}$ Input High Current (IIH1)	VIH1 = VCC -0.72V			100	mA
WD, $\overline{\text{WD}}$ Input Low Voltage (VIL1)		VCC -1.870		VCC -1.625	VDC
WD, $\overline{\text{WD}}$ Input High Voltage (VIH1)		VCC -1.00		VCC -0.720	VDC
R/W, $\overline{\text{CS}}$, HS0-HS2 Input Low Current (IIL2)	VIL2 = 0.8V	-0.4			mA
R/W, $\overline{\text{CS}}$, HS0-HS2 Input High Current (IIH2)	VIH2 = 2.0V			100	mA
R/W, $\overline{\text{CS}}$, HS0-HS2 Input Low Voltage (VIL2)				0.8	VDC
R/W, $\overline{\text{CS}}$, HS0-HS2 Input High Voltage (VIH2)		2.0			VDC
WUS Output Low Voltage (VOL)	IOL = 4 mA	-	-	0.5	VDC
VDD Fault Voltage		9.0	-	10.3	VDC
VCC Fault Voltage		3.5	-	4.2	VDC

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DC CHARACTERISTICS (continued)

PARAMETER	CONDITIONS	MIN	NOM	MAX	UNITS
Head Current (HnX, HnY)	Write Mode, $0 \leq VCC \leq 3.5V$ $0 \leq VDD \leq 9.0V$	-200	-	+200	μA
	Read/Idle Mode, $0 \leq VCC \leq 5.5V$ $0 \leq VDD \leq 13.2V$	-200	-	+200	μA

WRITE CHARACTERISTICS

Unless otherwise specified, recommended operating conditions apply, $I_w = 20 \text{ mA}$, $L_h = 500 \text{ nH}$, $R_h = 30\Omega$ and $f(WD) = 5 \text{ MHz}$.

WC Pin Voltage (Vwc)		1.57	1.65	1.73	V
Differential Head Voltage Swing		7	-	-	Vpp
Unselected Head Current		-	-	1	mA(pk)
Differential Output Capacitance		-	-	25	pF
Differential Output Resistance		500	700	950	Ω
WDI Transition Frequency	WUS = low	1.7	-	-	MHz
	WUS = high	-	-	500	kHz
Write Current Range		10	-	40	mA

READ CHARACTERISTICS

Unless otherwise specified, recommended operating conditions apply C_L (RDX, RDY) $< 20\text{pF}$ and R_L (RDX,RDY) $= 1 \text{ k}\Omega$.

PARAMETER	CONDITIONS	MIN	NOM	MAX	UNITS
Differential Voltage Gain	$V_{in} = 1 \text{ mVpp @ } 300 \text{ kHz}$	210	250	290	V/V
Bandwidth	-1 dB $ Z_s < 5\Omega$, $V_{in} = 1 \text{ mVpp}$	35	45	-	MHz
	-3 dB $ Z_s < 5\Omega$, $V_{in} = 1 \text{ mVpp}$	50	65	-	MHz
Input Noise Voltage	$BW = 15 \text{ MHz}$, $L_h = 0$, $R_h = 0$	-	0.57	0.80	$\text{nV}/\sqrt{\text{Hz}}$
Differential Input Capacitance	$V_{in} = 1 \text{ mVpp}$, $f = 5 \text{ MHz}$	-	15	22	pF
Differential Input Resistance	$V_{in} = 1 \text{ mVpp}$, $f = 5 \text{ MHz}$	300	565	-	Ω
Dynamic Range	Peak-to-peak AC input voltage where gain falls to 90% of its small signal value, $f = 5 \text{ MHz}$	2.0	-	-	mVpp
Common Mode Rejection Ratio	$V_{cm} = 100 \text{ mVpp AC Coupled @ } 5 \text{ MHz}$	54	-	-	dB
Power Supply Rejection Ratio	100 mVpp @ 5 MHz on VDD 100 mVpp @ 5 MHz on VCC	54	-	-	dB
Channel Separation	Unselected channels driven with 100 mVpp @ 5 MHz, $V_{in} = 0 \text{ mVpp}$	45	-	-	dB

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READ CHARACTERISTICS (continued)

PARAMETER	CONDITIONS	MIN	NOM	MAX	UNITS
Output Offset Voltage		-400	-	+400	mV
RDX, RDY Common Mode Output Voltage	Read Mode	2.3	2.9	3.5	VDC
Single Ended Output Resistance	f = 5 MHz	-	-	50	Ω
Output Current	AC Coupled Load, RDX to RDY	3.2	-	-	mA

SWITCHING CHARACTERISTICS (See Figure 1)

Unless otherwise specified, recommended operating conditions apply, $I_w = 20$ mA, $L_h = 500$ nH, $R_h = 30\Omega$ and $f(WD) = 5$ MHz.

R/W					
R/W to Write Mode	Delay to 90% of write current	-	0.2	0.6	μ s
R/W to Read Mode	Delay to 90% of 100 mV 10 MHz Read signal envelope or to 90% decay of write current	-	0.3	0.6	μ s
CS					
CS to Select	Delay to 90% of write current or to 90% of 100 mV 10 MHz Read signal envelope	-	0.3	0.6	μ s
CS to Unselect	Delay to 10% of write current	-	0.2	0.6	μ s
HSn					
HS0, 1, 2 to any Head	Delay to 90% of 100 mV 10 MHz Read signal envelope	-	0.1	0.4	μ s
WUS					
Safe to Unsafe - TD1		-	0.6	2.0	μ s
Unsafe to Safe - TD2		-	-	1	μ s
Head Current					
Prop. Delay - TD3	From 50% points, $L_h = 0$ μ H, $R_h = 0\Omega$	-	-	32	ns
Asymmetry	WD has 50% duty cycle and 1ns rise/fall time, $L_h = 0$ μ H, $R_h = 0\Omega$	-	-	1	ns
Rise/Fall Time	10% - 90% points, $L_h = 0$ μ H, $R_h = 0\Omega$	-	-	5	ns
Rise/Fall Time	10% - 90% points, $L_h = 1$ μ H, $R_h = 35\Omega$	-	9	-	ns

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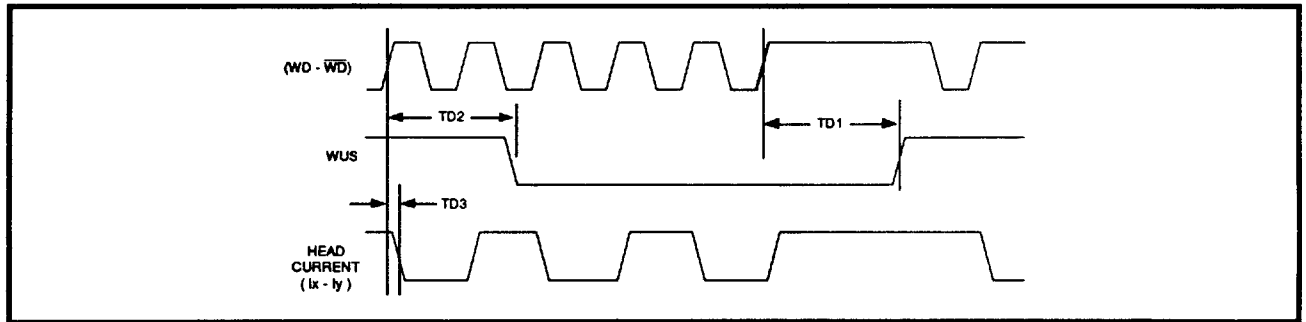


FIGURE 1: Write Mode Timing Diagram

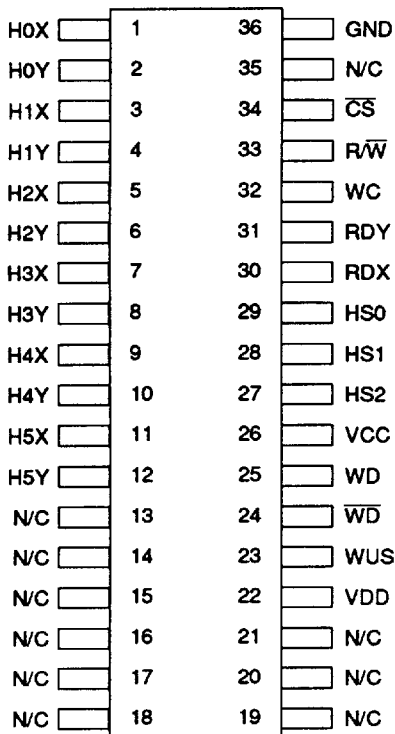
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PACKAGE PIN DESIGNATIONS

(Top View)

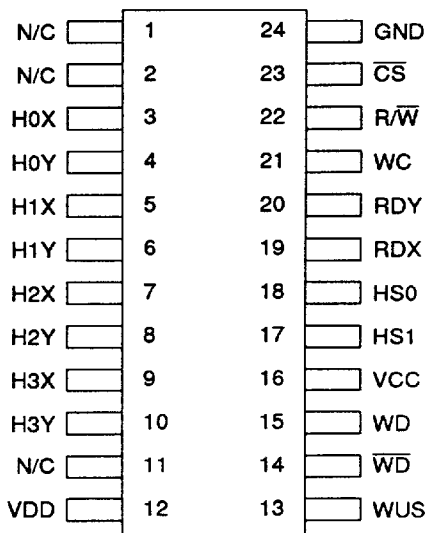


**36-Lead SOM
6-Channel**

THERMAL CHARACTERISTICS*: t_{ja}

24-Lead VSOP	110°C/W
24-Lead SOL	80°C/W
36-Lead SOM	70°C/W

*Care should be taken not to exceed the maximum junction temperature. For example, on the 24-Lead VSOP, at a write current of 25 mA, the maximum ambient temperature should not exceed 50°C.



24-Lead SOL, VSOP

CAUTION Use handling procedures necessary for a static sensitive component

ORDERING INFORMATION

PART DESCRIPTION	ORDER NUMBER	PACKAGE MARK
SSI 32R2041RW 24-Lead SOL	32R2041RW-CL	32R2041RW-CL
24-Lead VSOP	32R2041RW-CV	32R2041RW-CV
36-Lead SOM	32R2041RW-CM	32R2041RW-CM

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