HEX BIPOLAR SENSE AMPLIFIERS FOR MOS CIRCUITS

3208A HEX SENSE AMPLIFIER
3408A HEX SENSE AMPLIFIER WITH LATCHES

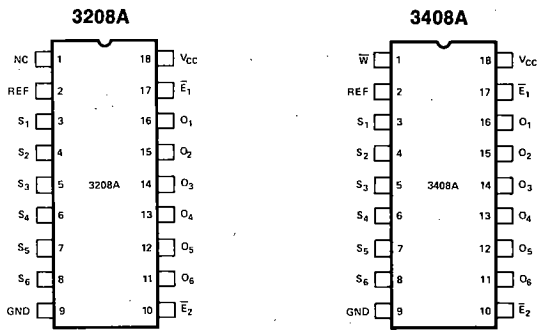
- High Speed—20 nsec. max.
- Wire-OR Capability—
  Open Collector Output..3208A
  Three-State Output 3408A
- Single 5 V Power Supply
- Input Level Compatible with 1103 Output
- Two Enable Inputs
- Minimum Line Reflection .... Low Voltage Diode Input Clamp
- Plastic 18 Pin Dual In-Line Package
- Schottky TTL

The Intel 3208A is a high speed hex sense amplifier designed to sense the output signals of the 1103 memory. The device features two separate enable inputs each controlling the output state of three sense amplifiers, and a common voltage reference input. OR-tie capability is available with the 3208A open collector TTL compatible output.

The 3408A is a hex sense amplifier with a latch circuit connected to each amplifier. The sensed data may be stored in the latches through application of a write pulse. The 3408A has three-state TTL outputs, hence in the non-enabled state the outputs float allowing wire-OR memory expansion. The latches may be bypassed by grounding the write input pin. Under this condition, the 3408A functions as a hex sense amplifier.

The 3208A and 3408A operate from a single +5 volt power supply. Device performance is specified over the complete ambient temperature range of 0°C to 70°C and over a V_{CC} supply voltage range of 5 volts ±5%. The 3208A and 3408A are packaged in an 18 pin plastic dual in-line package.

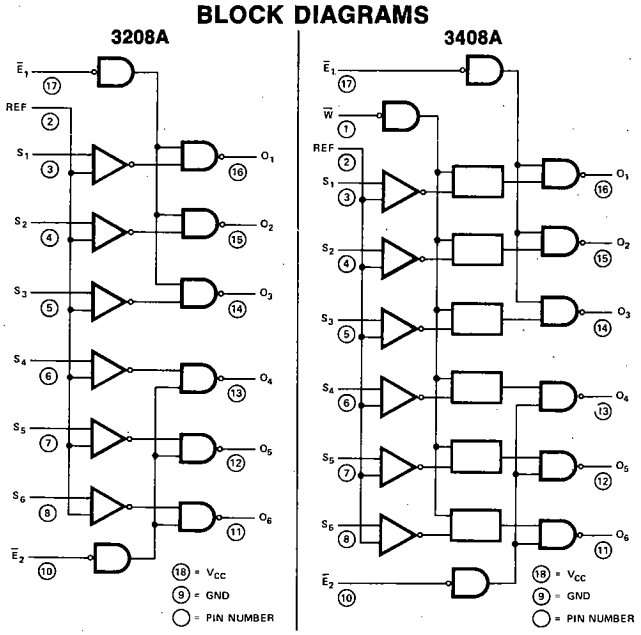
PIN CONFIGURATIONS



PIN NAMES

$S_1, S_2, S_3, S_4, S_5, S_6$	SENSE AMP INPUTS
$\bar{E}_1, \bar{E}_2$	ENABLE INPUTS
REF	REFERENCE INPUT
$O_1, O_2, O_3, O_4, O_5, O_6$	OUTPUTS (Non-inverting)
$\bar{W}$	WRITE INPUT (3408A only)

BLOCK DIAGRAMS



Absolute Maximum Ratings*

Temperature Under Bias	−55°C to +125°C
Storage Temperature	−65°C to +160°C
All Outputs or Supply Voltage	−0.5 to +7 Volts
All TTL Input Voltages	−1 to +5.5 Volts
All Sense Input Voltages	−1 to +1 Volt
Output Currents Total	300mA
Input Current	125mA

*COMMENT:

Stresses above those listed under "Absolute Maximum Rating" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at this or at any other condition above those indicated in the operational sections of this specification is not implied.

D. C. Characteristics for 3208A T_A = 0°C to 70°C, V_{CC} = 5V ±5%

SYMBOL	PARAMETER	LIMITS			UNIT	TEST CONDITIONS
		MIN.	TYP.	MAX.		
I_{FE}	INPUT LOAD CURRENT ON ENABLE INPUT			−0.25	mA	V_{CC} = 5.25V V_F = 0.45V
I_{RE}	INPUT LEAKAGE CURRENT ON ENABLE INPUT			20	μA	V_{CC} = 4.75V V_R = 5.25V
V_{IH}	INPUT "HIGH" VOLTAGE ON ENABLE INPUT	2.0			V	V_{CC} = 5.0V
V_{IL}	INPUT "LOW" VOLTAGE ON ENABLE INPUT			0.85	V	V_{CC} = 5.0V
V_{OL}	OUTPUT "LOW" VOLTAGE			0.45	V	V_{CC} = 4.75V I_{OL} = 10mA
I_{CEX}	OUTPUT LEAKAGE CURRENT			100	μA	V_{CC} = 5.25V V_{CEX} = 5.25V
I_{REF}	INPUT CURRENT ON REFERENCE INPUT			−150	μA	V_{CC} = 5.25V V_{REF} = 100mV
I_S	INPUT CURRENT ON SENSE AMP INPUT			−25	μA	V_{CC} = 5.25V V_S = 100mV
V_{SH}	INPUT "HIGH" VOLTAGE FOR SENSE AMP INPUT	V_{REF}			mV	V_{CC} = 4.75 to 5.25V V_{REF} = 100 to 200mV
V_{SL}	INPUT "LOW" VOLTAGE FOR SENSE AMP INPUT			V_{REF} −50	mV	V_{CC} = 4.75 to 5.25V V_{REF} = 100 to 200mV
V_{REF}	OPERATING RANGE OF REFERENCE VOLTAGE	100		200	mV	V_{CC} = 4.75 to 5.25V
I_{CC}	POWER SUPPLY CURRENT			120	mA	V_{CC} = 5.25V
V_C	INPUT CLAMP VOLTAGE ON ALL INPUTS			−1.0	V	V_{CC} = 4.75V I_C = −5.0mA
V_{SD}	SENSE INPUT CLAMP DIODE VOLTAGE			1.0	V	V_{CC} = 5.0V I_D = 5.0mA

3208A TRUTH TABLE

INPUTS		OUTPUT
Sense Amp	Enable	
$<V_{REF}$ −50mV	L	L
$>V_{REF}$	L	H
X	H	H

X = Don't care

D. C. Characteristics for 3408A $T_A = 0°C$ to $+70°C$, $V_{CC} = 5V \pm 5\%$

SYMBOL	PARAMETER	LIMITS			UNIT	TEST CONDITIONS
		MIN.	TYP.	MAX.		
I_{FE}	INPUT LOAD CURRENT ON ENABLE INPUT			−0.25	mA	$V_{CC} = 5.25V$ $V_F = 0.45V$
I_{RE}	INPUT LEAKAGE CURRENT ON ENABLE INPUT			20	μA	$V_{CC} = 4.75V$ $V_R = 5.25V$
I_{FW}	INPUT LOAD CURRENT ON WRITE INPUT			−0.25	mA	$V_{CC} = 5.25V$ $V_F = 0.45V$
I_{RW}	INPUT LEAKAGE CURRENT ON WRITE INPUT			20	μA	$V_{CC} = 4.75V$ $V_R = 5.25V$
V_{IH}	INPUT "HIGH" VOLTAGE ON ENABLE AND WRITE INPUT	2.0			V	$V_{CC} = 5.0V$
V_{IL}	INPUT "LOW" VOLTAGE ON ENABLE AND WRITE INPUT			0.85	V	$V_{CC} = 5.0V$
V_{OL}	OUTPUT "LOW" VOLTAGE			0.45	V	$V_{CC} = 4.75V$ $I_{OL} = 10mA$
V_{OH}	OUTPUT "HIGH" VOLTAGE	2.4			V	$V_{CC} = 4.75V$ $I_{OH} = -1.5mA$
$\lvert I_O \rvert$	OUTPUT LEAKAGE CURRENT FOR HIGH IMPEDANCE STATE			100	μA	$V_{CC} = 5.25V$ $V_O = 0.45V/5.25V$
I_{SC}	OUTPUT SHORT CIRCUIT CURRENT	−40		−100	mA	$V_{CC} = 5.0V$ $V_O = 0V$
I_{REF}	INPUT CURRENT ON REFERENCE INPUT			−150	μA	$V_{CC} = 5.25V$ $V_{REF} = 100mV$
I_S	INPUT CURRENT ON SENSE INPUT			−25	μA	$V_{CC} = 5.25V$ $V_S = 100mV$
V_{SH}	INPUT "HIGH" VOLTAGE FOR SENSE AMP INPUT	V_{REF}			mV	$V_{CC} = 4.75$ to $5.25V$ $V_{REF} = 100$ to $200mV$
V_{SL}	INPUT "LOW" VOLTAGE FOR SENSE AMP INPUT			V_{REF} −60	mV	$V_{CC} = 4.75$ to $5.25V$ $V_{REF} = 100$ to $200mV$
V_{REF}	OPERATING RANGE OF REFERENCE VOLTAGE	100		200	mV	$V_{CC} = 4.75$ to $5.25V$
I_{CC}	POWER SUPPLY CURRENT			125	mA	$V_{CC} = 5.25V$
V_C	INPUT CLAMP VOLTAGE ON ALL INPUTS			−1.0	V	$V_{CC} = 4.75V$ $I_C = -5.0V$
V_{SD}	SENSE INPUT CLAMP DIODE VOLTAGE			1.0	V	$V_{CC} = 5.0V$ $I_D = 5.0mA$

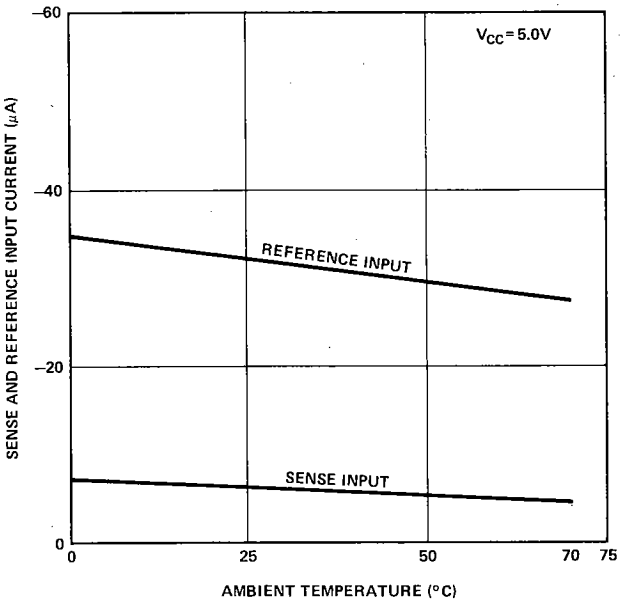
3408A TRUTH TABLE

INPUTS			OUTPUT
Sense Amp	Enable	Write	
$< V_{REF} - 60mV$	L	L	L
$> V_{REF}$	L	L	H
X	L	H	Previous Data Stored
X	H	X	High Z*

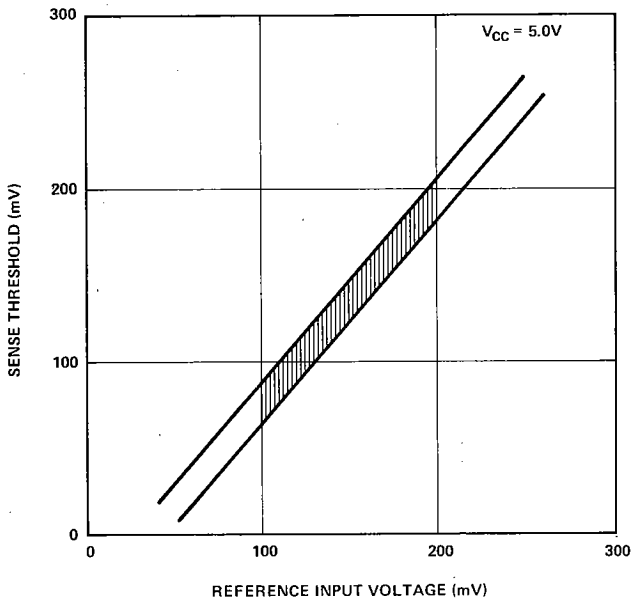
X = Don't care
*The output of the 3408A is three-state, hence when not enabled the output is a high impedance.

Typical D. C. Characteristics for 3208A/3408A

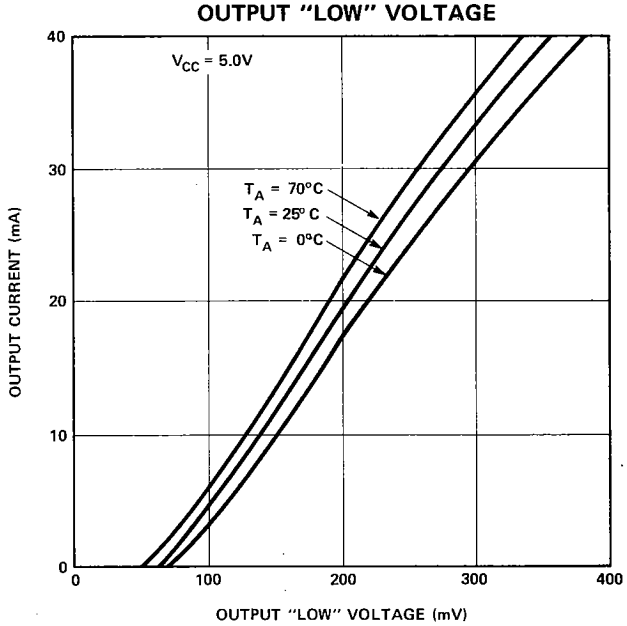
SENSE AND REFERENCE INPUT CURRENT VS. AMBIENT TEMPERATURE



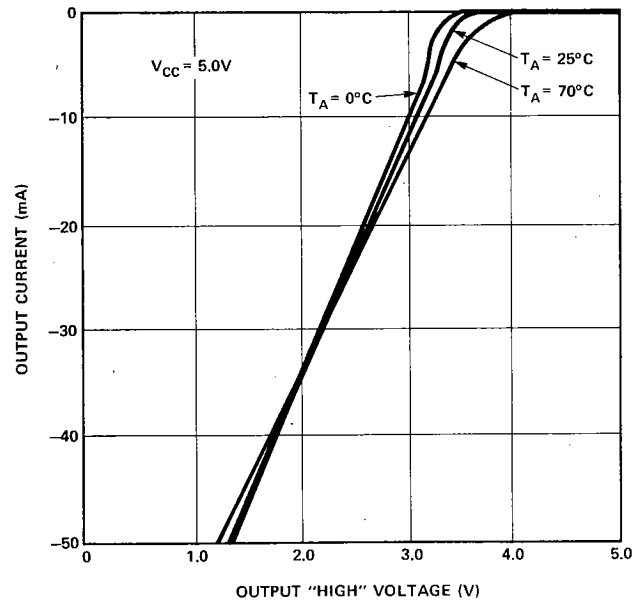
SENSE THRESHOLD VS. REFERENCE INPUT VOLTAGE



OUTPUT CURRENT VS. OUTPUT "LOW" VOLTAGE



OUTPUT CURRENT VS. OUTPUT "HIGH" VOLTAGE



A.C. Characteristics $T_A = 0°C$ to $70°C$, $V_{CC} = 5V \pm 5\%$

3208A

SYMBOL	PARAMETER	LIMITS MIN.	LIMITS TYP.	LIMITS MAX.	UNIT	TEST CONDITIONS
t_{S-}	SENSE AMP INPUT TO OUTPUT DELAY			20	ns	D.C. LOAD = 10mA $C_L = 30pF$
t_{E-}	ENABLE INPUT TO OUTPUT DELAY			20	ns	D.C. LOAD = 10mA $C_L = 30pF$
t_{E+}				25		

3408A

t_{WP}	WRITE PULSE WIDTH	30			ns	D.C. LOAD = 10mA $C_L = 30pF$
t_{S-}	SENSE AMP INPUT TO OUTPUT DELAY			25	ns	D.C. LOAD = 10mA $C_L = 30pF$
t_{E-}	ENABLE INPUT TO OUTPUT DELAY, LATCH STORES "LOW"			20	ns	D.C. LOAD = 10mA $C_L = 30pF$
t_{E+}	ENABLE INPUT TO OUTPUT DELAY, LATCH STORES "HIGH"			25	ns	D.C. LOAD = 10mA $C_L = 30\ pF$

Capacitance[1] $T_A = 25°C$, f = 1 MHz

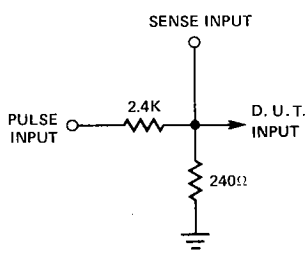
SYMBOL	TEST	LIMITS TYP.	LIMITS MAX.
C_O	$V_{CC} = 0V$, $V_{BIAS} = 2.0V$	8	12
C_{INE}	ENABLE INPUT $V_{CC} = 0V$, $V_{BIAS} = 2.0V$	6	10
C_{INS}	SENSE INPUT $V_{CC} = 0V$, $V_{BIAS} = 0V$	6	10

(1) This parameter is periodically sampled and is not 100% tested.

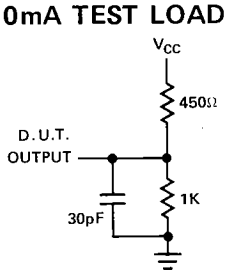
Switching Characteristics

CONDITIONS OF TEST

- Input Pulse amplitude: 2.5V for all TTL compatible inputs and 2.5V through a resistor network as shown below for sense input.
- Input Pulse rise and fall times: 5ns.
- Speed measurements are made at 1.5V for all TTL compatible inputs and outputs, and for sense input, see network and waveforms below. V_{REF} is set at 150mV.

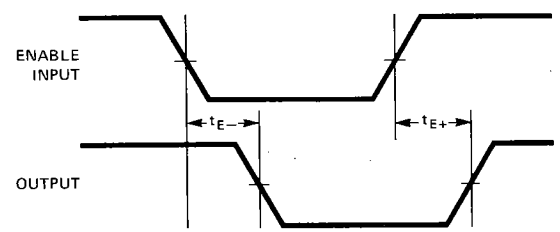


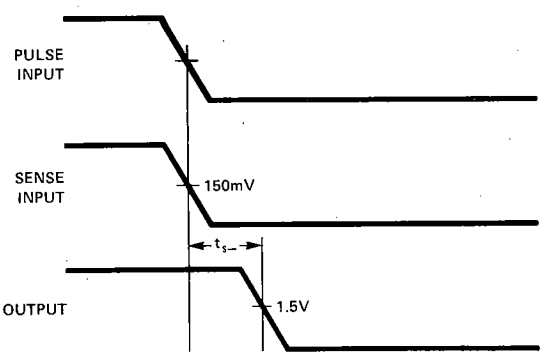
10mA TEST LOAD



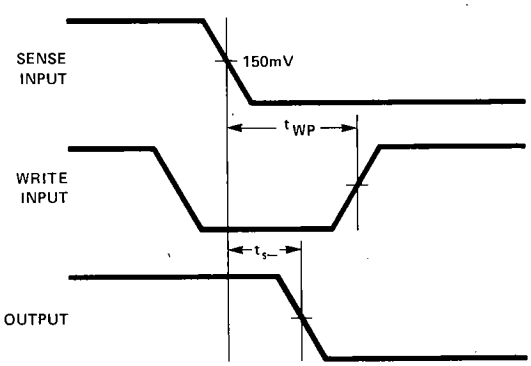
Waveforms

3208A/3408A



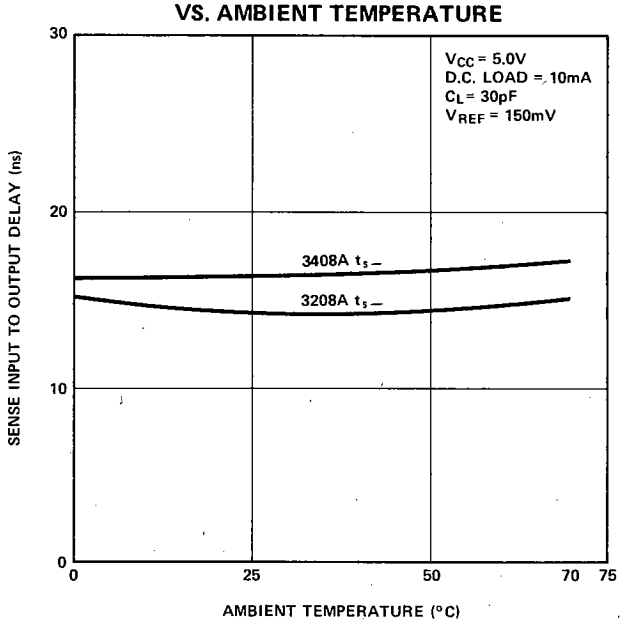


3408A ONLY

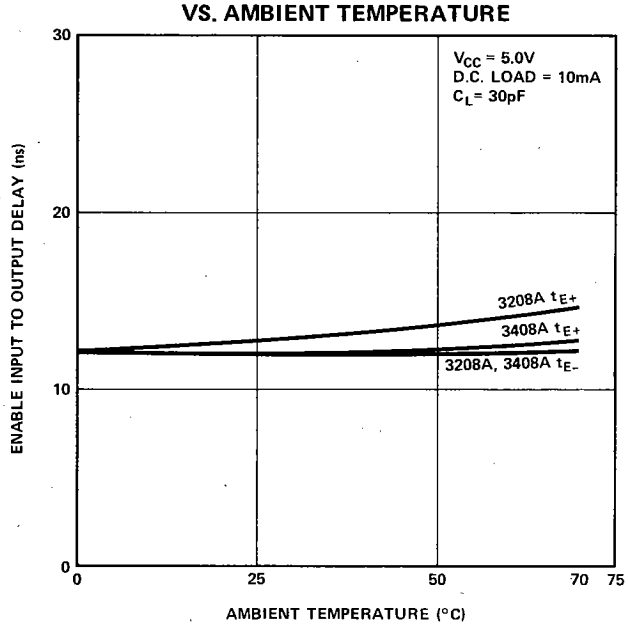


Typical A. C. Characteristics

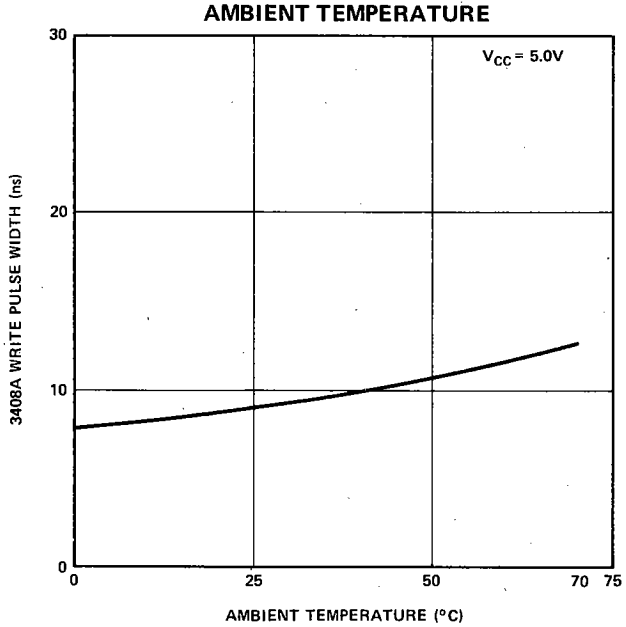
SENSE INPUT TO OUTPUT DELAY VS. AMBIENT TEMPERATURE



ENABLE INPUT TO OUTPUT DELAY VS. AMBIENT TEMPERATURE



3408A WRITE PULSE WIDTH VS. AMBIENT TEMPERATURE



SENSE INPUT TO OUTPUT DELAY VS. REFERENCE INPUT VOLTAGE