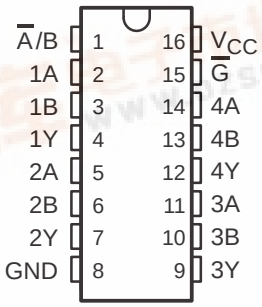
SN54AHC158, SN74AHC158
QUADRUPLE 2-LINE TO 1-LINE DATA SELECTORS/MULTIPLEXERS

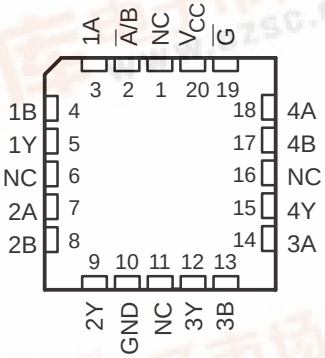
SCLS346E – MAY 1996 – REVISED JANUARY 2000

- *EPIC*™ (Enhanced-Performance Implanted CMOS) Process
- Operating Range 2-V to 5.5-V V_{CC}
- Latch-Up Performance Exceeds 250 mA Per JESD 17
- ESD Protection Exceeds 2000 V Per MIL-STD-833, Method 3015; Exceeds 200 V Using Machine Model (C = 200 pF, R = 0)
- Package Options Include Plastic Small-Outline (D), Shrink Small-Outline (DB), Thin Very Small-Outline (DGV), Thin Shrink Small-Outline (PW), and Ceramic Flat (W) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) DIPs

SN54AHC158 . . . J OR W PACKAGE
SN74AHC158 . . . D, DB, DGV, N, OR PW PACKAGE
(TOP VIEW)



SN54AHC158 . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

description

These quadruple 2-line to 1-line data selectors/multiplexers are designed for 2-V to 5.5-V V_{CC} operation.

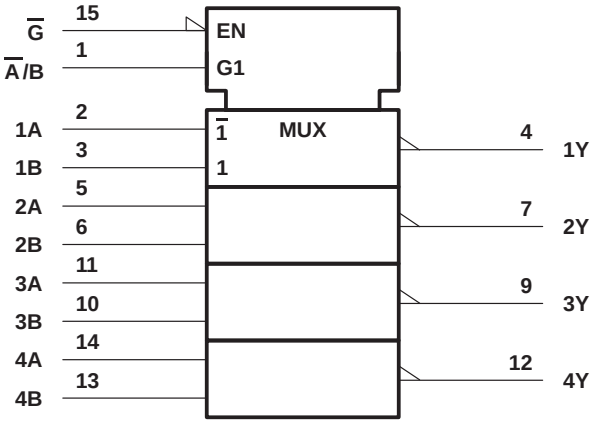
The ’AHC158 devices feature a common strobe ($\overline{G}$) input. When the strobe is high, all outputs are high. When the strobe is low, a 4-bit word is selected from one of two sources and is routed to the four outputs. These devices provide inverted data.

The SN54AHC158 is characterized for operation over the full military temperature range of –55°C to 125°C. The SN74AHC158 is characterized for operation from –40°C to 85°C.

FUNCTION TABLE
(each data selector/multiplexer)

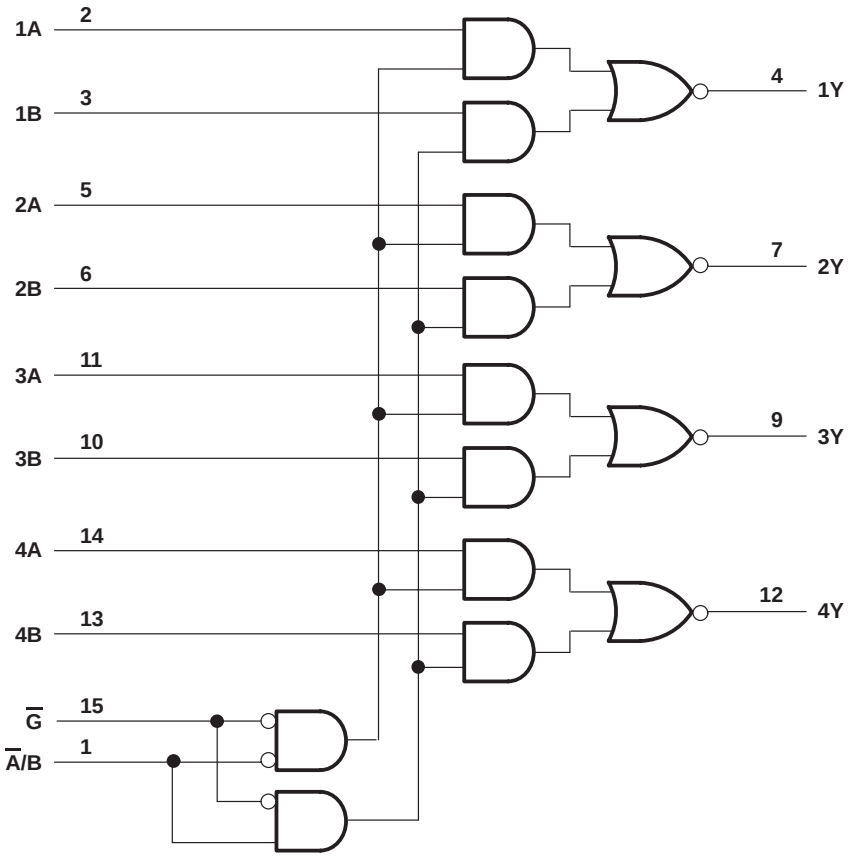
INPUTS				OUTPUT
$\overline{G}$	$\overline{A}$/B	A	B	Y
H	X	X	X	H
L	L	L	X	H
L	L	H	X	L
L	H	X	L	H
L	H	X	H	L

logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.
Pin numbers shown are for the D, DB, DGV, J, N, PW, and W packages.

logic diagram (positive logic)



Pin numbers shown are for the D, DB, DGV, J, N, PW, and W packages.

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage range, V_{CC} . . . . . –0.5 V to 7 V
Input voltage range, V_I (see Note 1) . . . . . –0.5 V to 7 V
Output voltage range, V_O (see Note 1) . . . . . –0.5 V to V_{CC} + 0.5 V
Input clamp current, I_{IK} (V_I < 0) . . . . . –20 mA
Output clamp current, I_{OK} (V_O < 0 or V_O > V_{CC}) . . . . . ±20 mA
Continuous output current, I_O (V_O = 0 to V_{CC}) . . . . . ±25 mA
Continuous current through V_{CC} or GND . . . . . ±50 mA
Package thermal impedance, θ_{JA} (see Note 2): D package . . . . . 73°C/W
DB package . . . . . 82°C/W
DGV package . . . . . 120°C/W
N package . . . . . 67°C/W
PW package . . . . . 108°C/W
Storage temperature range, T_{stg} . . . . . –65°C to 150°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.
2. The package thermal impedance is calculated in accordance with JESD 51.

recommended operating conditions (see Note 3)

			SN54AHC158		SN74AHC158		UNIT
			MIN	MAX	MIN	MAX	
V_{CC}	Supply voltage		2	5.5	2	5.5	V
V_{IH}	High-level input voltage	V_{CC} = 2 V	1.5		1.5		V
		V_{CC} = 3 V	2.1		2.1		
		V_{CC} = 5.5 V	3.85		3.85		
V_{IL}	Low-level input voltage	V_{CC} = 2 V		0.5		0.5	V
		V_{CC} = 3 V		0.9		0.9	
		V_{CC} = 5.5 V		1.65		1.65	
V_I	Input voltage		0	5.5	0	5.5	V
V_O	Output voltage		0	V_{CC}	0	V_{CC}	V
I_{OH}	High-level output current	V_{CC} = 2 V		–50		–50	μA
		V_{CC} = 3.3 V ± 0.3 V		–4		–4	mA
		V_{CC} = 5 V ± 0.5 V		–8		–8	
I_{OL}	Low-level output current	V_{CC} = 2 V		50		50	μA
		V_{CC} = 3.3 V ± 0.3 V		4		4	mA
		V_{CC} = 5 V ± 0.5 V		8		8	
$\Delta t/\Delta v$	Input transition rise or fall rate	V_{CC} = 3.3 V ± 0.3 V		100		100	ns/V
		V_{CC} = 5 V ± 0.5 V		20		20	
T_A	Operating free-air temperature		–55	125	–40	85	°C

NOTE 3: All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS	V_{CC}	T_A = 25°C			SN54AHC158		SN74AHC158		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
V_{OH}		I_{OH} = –50 μA	2 V	1.9	2		1.9		1.9		V
			3 V	2.9	3		2.9		2.9		
			4.5 V	4.4	4.5		4.4		4.4		
		I_{OH} = –4 mA	3 V	2.58			2.48		2.48		
		I_{OH} = –8 mA	4.5 V	3.94			3.8		3.8		
V_{OL}		I_{OL} = 50 μA	2 V			0.1		0.1		0.1	V
			3 V			0.1		0.1		0.1	
			4.5 V			0.1		0.1		0.1	
		I_{OL} = 4 mA	3 V			0.36		0.5		0.44	
		I_{OL} = 8 mA	4.5 V			0.36		0.5		0.44	
I_I	A or B inputs	$V_I = V_{CC}$ or GND	0 V to 5.5 V			±0.1		±1*		±1	μA
I_{CC}		$V_I = V_{CC}$ or GND, I_O = 0	5.5 V			4		40		40	μA
C_i		$V_I = V_{CC}$ or GND	5 V		2	10				10	pF

* On products compliant to MIL-PRF-38535, this parameter is not production tested at V_{CC} = 0 V.

switching characteristics over recommended operating free-air temperature range, V_{CC} = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T_A = 25°C			SN54AHC158		SN74AHC158		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A or B	Y	C_L = 15 pF		6.2**	9.7**	1**	11.5**	1	11.5	ns
t_{PHL}					6.2**	9.7**	1**	11.5**	1	11.5	
t_{PLH}	$\overline{A}$/B	Y	C_L = 15 pF		8.4**	13.2**	1**	15.5**	1	15.5	ns
t_{PHL}					8.4**	13.2**	1**	15.5**	1	15.5	
t_{PLH}	$\overline{G}$	Y	C_L = 15 pF		8.7**	13.6**	1**	16**	1	16	ns
t_{PHL}					8.7**	13.6**	1**	16**	1	16	
t_{PLH}	A or B	Y	C_L = 50 pF		8.7	13.2	1	15	1	15	ns
t_{PHL}					8.7	13.2	1	15	1	15	
t_{PLH}	$\overline{A}$/B	Y	C_L = 50 pF		10.9	16.7	1	19	1	19	ns
t_{PHL}					10.9	16.7	1	19	1	19	
t_{PLH}	$\overline{G}$	Y	C_L = 50 pF		11.2	17.1	1	19.5	1	19.5	ns
t_{PHL}					11.2	17.1	1	19.5	1	19.5	

** On products compliant to MIL-PRF-38535, this parameter is not production tested.

switching characteristics over recommended operating free-air temperature range, V_{CC} = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T_A = 25°C			SN54AHC158		SN74AHC158		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	A or B	Y	C_L = 15 pF		4.1*	6.4*	1*	7.5*	1	7.5	ns
t_{PHL}					4.1*	6.4*	1*	7.5*	1	7.5	
t_{PLH}	$\overline{A}$/B	Y	C_L = 15 pF		5.3*	8.1*	1*	9.5*	1	9.5	ns
t_{PHL}					5.3*	8.1*	1*	9.5*	1	9.5	
t_{PLH}	$\overline{G}$	Y	C_L = 15 pF		5.6*	8.6*	1*	10*	1	10	ns
t_{PHL}					5.6*	8.6*	1*	10*	1	10	
t_{PLH}	A or B	Y	C_L = 50 pF		5.6	8.4	1	9.5	1	9.5	ns
t_{PHL}					5.6	8.4	1	9.5	1	9.5	
t_{PLH}	$\overline{A}$/B	Y	C_L = 50 pF		6.8	10.1	1	11.5	1	11.5	ns
t_{PLH}					6.8	10.1	1	11.5	1	11.5	
t_{PLH}	$\overline{G}$	Y	C_L = 50 pF		7.1	10.6	1	12	1	12	ns
t_{PHL}					7.1	10.6	1	12	1	12	

* On products compliant to MIL-PRF-38535, this parameter is not production tested.

noise characteristics V_{CC} = 5 V, C_L = 50 pF, T_A = 25°C (see Note 4)

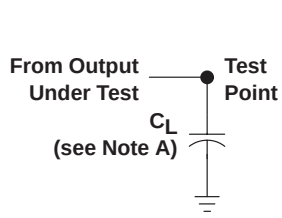
PARAMETER		SN74AHC158			UNIT
		MIN	TYP	MAX	
$V_{OL(P)}$	Quiet output, maximum dynamic V_{OL}			0.8	V
$V_{OL(V)}$	Quiet output, minimum dynamic V_{OL}			–0.8	V
$V_{OH(V)}$	Quiet output, minimum dynamic V_{OH}		4.8		V
$V_{IH(D)}$	High-level dynamic input voltage	3.5			V
$V_{IL(D)}$	Low-level dynamic input voltage			1.5	V

NOTE 4: Characteristics are for surface-mount packages only.

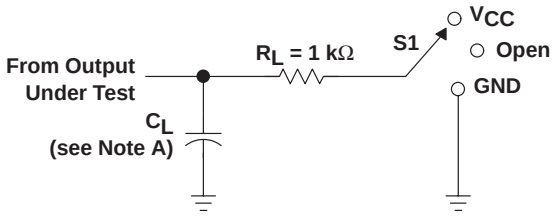
operating characteristics, V_{CC} = 5 V, T_A = 25°C

PARAMETER		TEST CONDITIONS		TYP	UNIT
C_{pd}	Power dissipation capacitance	No load,	f = 1 MHz	11	pF

PARAMETER MEASUREMENT INFORMATION

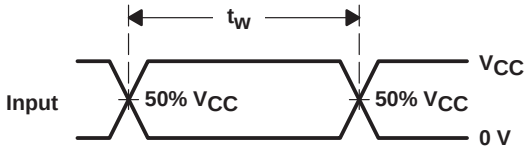


LOAD CIRCUIT FOR
TOTEM-POLE OUTPUTS

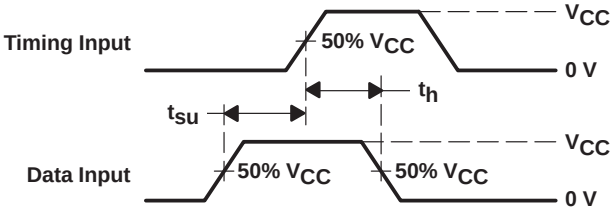


LOAD CIRCUIT FOR
3-STATE AND OPEN-DRAIN OUTPUTS

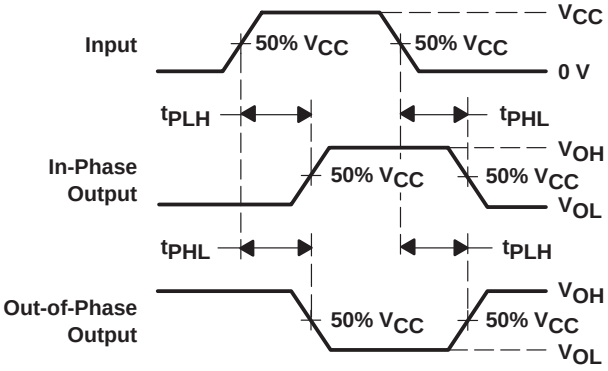
TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	V_{CC}
t_{PHZ}/t_{PZH}	GND
Open Drain	V_{CC}



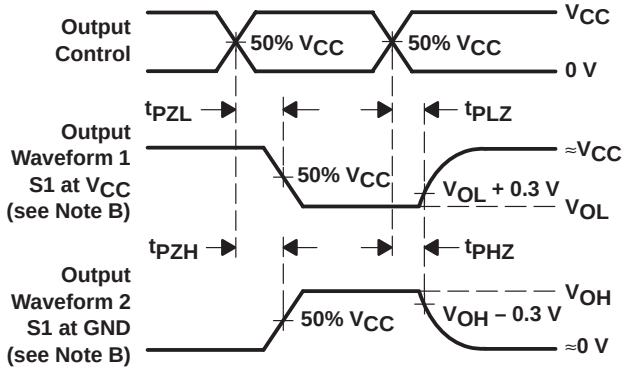
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

NOTES: A. C_L includes probe and jig capacitance.
B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control.
Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
C. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, Z_O = 50 Ω, t_r ≤ 3 ns, t_f ≤ 3 ns.
D. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

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