

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

SCLS346 – MAY 1996

- Operating Range 2-V to 5.5-V V_{CC}
- **EPIC™** (Enhanced-Performance Implanted CMOS) Process
- Package Options Include Plastic Small-Outline (D), Shrink Small-Outline (DB), Thin Shrink Small-Outline (PW), and Ceramic Flat (W) Packages, Ceramic Chip Carriers (FK), and Standard Plastic (N) and Ceramic (J) 300-mil DIPs

description

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

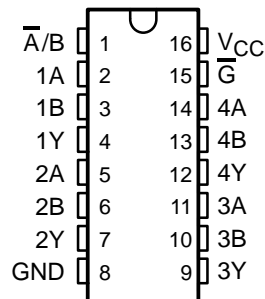
The 'AHC158 feature a common strobe (\bar{G}) input. When the strobe is high, all outputs are high. When the strobe is low, a 4-bit word is selected from one of two sources and is routed to the four outputs. These devices provide inverted data.

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 .

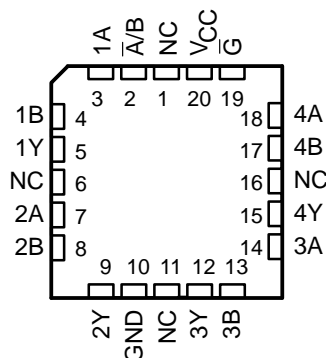
FUNCTION TABLE

\bar{G}	INPUTS			OUTPUT Y
	\bar{A}/\bar{B}	A	B	
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

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



SN54AHC158 ... FK PACKAGE
(TOP VIEW)



NC – No internal connection



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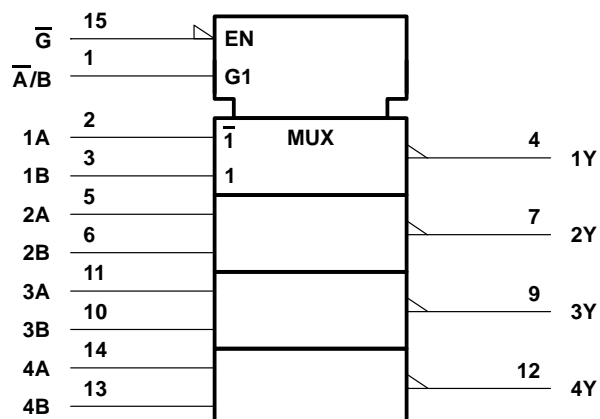
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SN54AHC158, SN74AHC158 QUADRUPLE 2-LINE TO 1-LINE DATA SELECTORS/MULTIPLEXERS

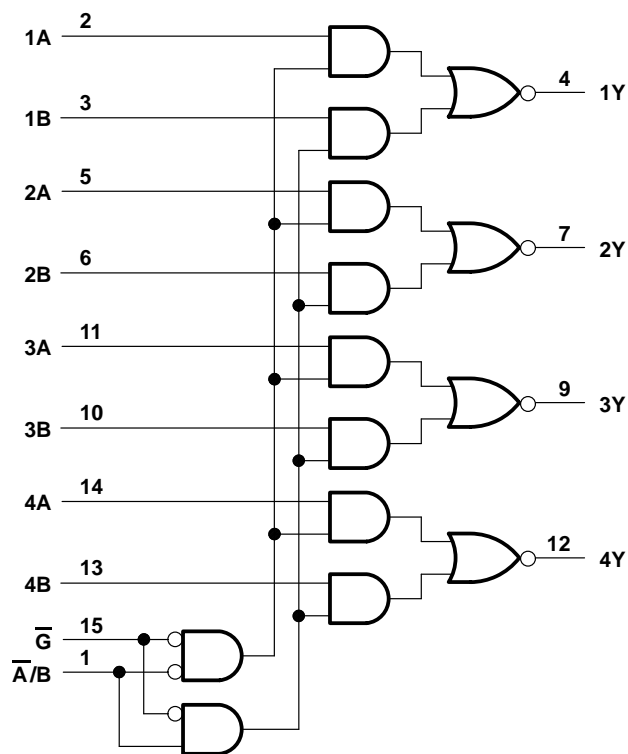
SCLS346 – MAY 1996

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, J, N, PW, and W packages.

logic diagram (positive logic)



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

PRODUCT PREVIEW

SN54AHC158, SN74AHC158

QUADRUPLE 2-LINE TO 1-LINE DATA SELECTORS/MULTIPLEXERS

SCLS346 – MAY 1996

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
Maximum power dissipation at $T_A = 55^\circ\text{C}$ (in still air) (see Note 2):	
D package	1.3 W
DB package	0.55 W
N package	1.1 W
PW package	0.5 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 maximum package power dissipation is calculated using a junction temperature of 150°C and a board trace length of 750 mils, except for the N package, which has a trace length of zero.

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		
Δt/Δv	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: Unused inputs must be held high or low to prevent them from floating.

PRODUCT PREVIEW



SN54AHC158, SN74AHC158

QUADRUPLE 2-LINE TO 1-LINE DATA SELECTORS/MULTIPLEXERS

SCLS346 – MAY 1996

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	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		4	10				10	pF

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	SN54AHC158				UNIT	
				T _A = 25°C			MIN		MAX
				MIN	TYP	MAX			
t _{PLH} *	A or B	Y	C _L = 15 pF	6.2	9.7	1	11.5	ns	
t _{PHL} *				6.2	9.7	1	11.5		
t _{PLH} *	\overline{A}/B	Y	C _L = 15 pF	8.4	13.2	1	15.5	ns	
t _{PHL} *				8.4	13.2	1	15.5		
t _{PLH} *	\overline{G}	Y	C _L = 15 pF	8.7	13.6	1	16	ns	
t _{PHL} *				8.7	13.6	1	16		
t _{PLH}	A or B	Y	C _L = 50 pF	8.7	13.2	1	15	ns	
t _{PHL}				8.7	13.2	1	15		
t _{PLH}	\overline{A}/B	Y	C _L = 50 pF	10.9	16.7	1	19	ns	
t _{PHL}				10.9	16.7	1	19		
t _{PLH}	\overline{G}	Y	C _L = 50 pF	11.2	17.1	1	19.5	ns	
t _{PHL}				11.2	17.1	1	19.5		

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

PRODUCT PREVIEW



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

SCLS346 – MAY 1996

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

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

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

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

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

PRODUCT PREVIEW



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

SCLS346 – MAY 1996

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

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

noise characteristics $V_{CC} = 5\text{ V}$, $C_L = 50\text{ pF}$, $T_A = 25^\circ\text{C}$ (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}				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 determined during product characterization and ensured by design for surface-mount packages only.

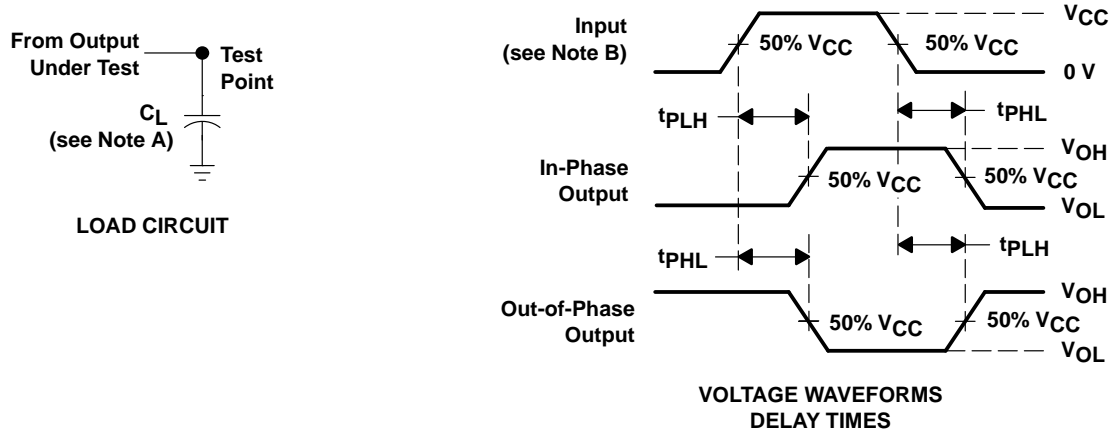
operating characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS	TYP	UNIT
C_{pd}	Power dissipation capacitance per gate	No load, $f = 1\text{ MHz}$	20	pF

PRODUCT PREVIEW



PARAMETER MEASUREMENT INFORMATION



- NOTES: A. C_L includes probe and jig capacitance.
 B. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r = 3 \text{ ns}$, $t_f = 3 \text{ ns}$.
 C. 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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