



# SN54AS856, SN74AS856

## 8-BIT UNIVERSAL TRANCEIVER PORT CONTROLLERS

SDAS032A – DECEMBER 1983 – REVISED MARCH 1985

FUNCTION TABLE

MODE	MODE	CLOCK	SERIN	A1	Q1	B1	A2	Q2	B2	A3	Q3	B3	A4	Q4	B4	A5	Q5	B5	A6	Q6	B6	A7	Q7	B7	A8	Q8	B8	FUNCTION
L	L	H or L	X	Q1	Q1	H	Q2	Q2	Q2	Q3	Q3	Q3	Q4	Q4	Q4	Q5	Q5	Q5	Q6	Q6	Q6	Q7	Q7	Q7	Q8	Q8	Q8	Feedback
L	L	↑	X	Q1	Q1	H	Q2	Q2	Q2	Q3	Q3	Q3	Q4	Q4	Q4	Q5	Q5	Q5	Q6	Q6	Q6	Q7	Q7	Q7	Q8	Q8	Q8	
L	L	H or L	X	B1	Q1	H	B2	Q2	Z	B3	Q3	Z	B4	Q4	Z	B5	Q5	Z	B6	Q6	Z	B7	Q7	Z	B8	Q8	Z	B to A
L	L	↑	X	B1	B1	L	B2	B2	Z	B3	B3	Z	B4	B4	Z	B5	B5	Z	B6	B6	Z	B7	B7	Z	B8	B8	Z	A to Q
L	H	H or L	X	Z	Q1	L	Z	Q2	Q2	Z	Q3	Q3	Z	Q4	Q4	Z	Q5	Q5	Z	Q6	Q6	Z	Q7	Q7	Z	Q8	Q8	A to Q
L	H	↑	X	Z	A1	L	Z	A2	A2	Z	A3	A3	Z	A4	A4	Z	A5	A5	Z	A6	A6	Z	A7	A7	Z	A8	A8	Q to B
L	H	H or L	X	Z	Q1	L	Z	Q2	Z	Z	Q3	Z	Z	Q4	Z	Z	Q5	Z	Z	Q6	Z	Z	Q7	Z	Z	Q8	Z	A to Q
L	H	↑	X	Z	A1	L	Z	A2	Z	Z	A3	Z	Z	A4	Z	Z	A5	Z	Z	A6	Z	Z	A7	Z	Z	A8	Z	A to Q
H	L	H or L	X	Q <sub>n</sub>	Q <sub>n</sub>	L	Q2	Q <sub>n</sub>	Q2	Q3	Q <sub>n</sub>	Q3	Q4	Q <sub>n</sub>	Q4	Q5	Q <sub>n</sub>	Q5	Q6	Q <sub>n</sub>	Q6	Q7	Q <sub>n</sub>	Q7	Q8	Q <sub>n</sub>	Q8	Shift
H	L	↑	H	H	L	L	Q1	Q1	Q1	Q2	Q2	Q2	Q3	Q3	Q3	Q4	Q4	Q4	Q5	Q5	Q5	Q6	Q6	Q6	Q7	Q7	Q7	To
H	L	↑	L	L	L	L	Q1	Q1	Q1	Q2	Q2	Q2	Q3	Q3	Q3	Q4	Q4	Q4	Q5	Q5	Q5	Q6	Q6	Q6	Q7	Q7	Q7	A and B
H	H	H or L	X	Q <sub>n</sub>	Q <sub>n</sub>	L	Q2	Q <sub>n</sub>	Z	Q3	Q <sub>n</sub>	Z	Q4	Q <sub>n</sub>	Z	Q5	Q <sub>n</sub>	Z	Q6	Q <sub>n</sub>	Z	Q7	Q <sub>n</sub>	Z	Q8	Q <sub>n</sub>	Z	Shift
H	H	↑	H	H	L	L	Q1	Q1	Z	Q2	Q2	Z	Q3	Q3	Z	Q4	Q4	Z	Q5	Q5	Z	Q6	Q6	Z	Q7	Q7	Z	To
H	H	↑	L	L	L	L	Q1	Q1	Q1	Q2	Q2	Z	Q3	Q3	Z	Q4	Q4	Z	Q5	Q5	Z	Q6	Q6	Z	Q7	Q7	Z	A
H	H	H or L	X	Z	Q <sub>n</sub>	L	Z	Q <sub>n</sub>	Q2	Z	Q <sub>n</sub>	Q3	Z	Q <sub>n</sub>	Q4	Z	Q <sub>n</sub>	Q5	Z	Q <sub>n</sub>	Q6	Z	Q <sub>n</sub>	Q7	Z	Q <sub>n</sub>	Q8	Shift
H	H	↑	H	Z	H	L	Z	Q1	Q1	Z	Q2	Q2	Z	Q3	Q3	Z	Q4	Q4	Z	Q5	Q5	Z	Q6	Q6	Z	Q7	Q7	To
H	H	↑	L	Z	L	L	Z	Q1	Q1	Z	Q2	Q2	Z	Q3	Q3	Z	Q4	Q4	Z	Q5	Q5	Z	Q6	Q6	Z	Q7	Q7	B
H	H	H or L	X	Z	Q <sub>n</sub>	L	Z	Q <sub>n</sub>	Z	Z	Q <sub>n</sub>	Z	Z	Q <sub>n</sub>	Z	Z	Q <sub>n</sub>	Z	Z	Q <sub>n</sub>	Z	Z	Q <sub>n</sub>	Z	Z	Q <sub>n</sub>	Z	Shift
H	H	↑	H	Z	H	L	Z	Q1	Z	Z	Q2	Z	Z	Q3	Z	Z	Q4	Z	Z	Q5	Z	Z	Q6	Z	Z	Q7	Z	To
H	H	↑	L	Z	L	L	Z	Q1	Z	Z	Q2	Z	Z	Q3	Z	Z	Q4	Z	Z	Q5	Z	Z	Q6	Z	Z	Q7	Z	B

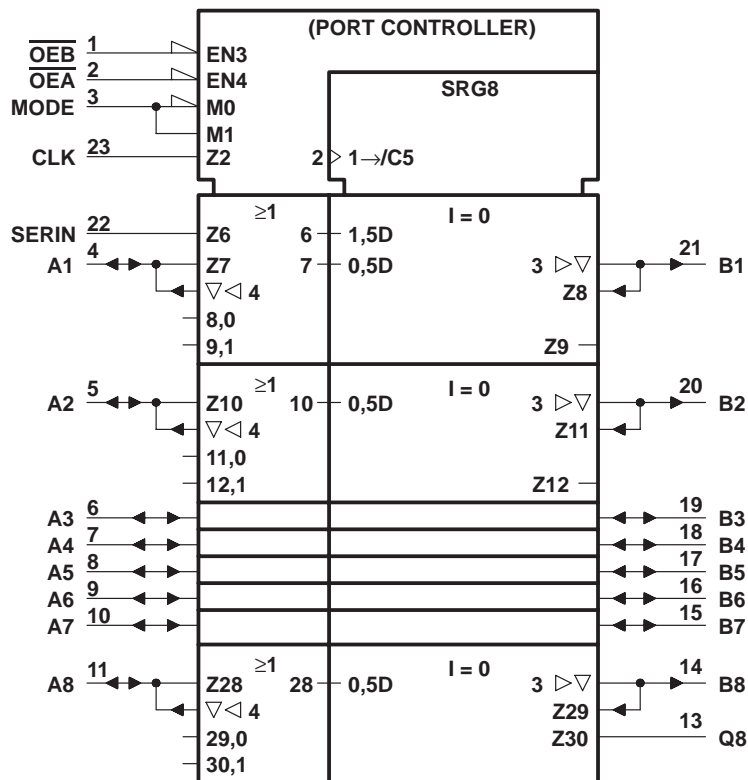
n = level of Q<sub>n</sub> (n = 1, 2, . . . 8) established on most recent ↑ transition of CLK. Q1 through Q8 are the shift register outputs; only Q8 is available externally. The double inversions that take place as the data travels from port are ignored in this table.



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logic symbol†



Pin numbers shown are for DW, JT, and NT packages.

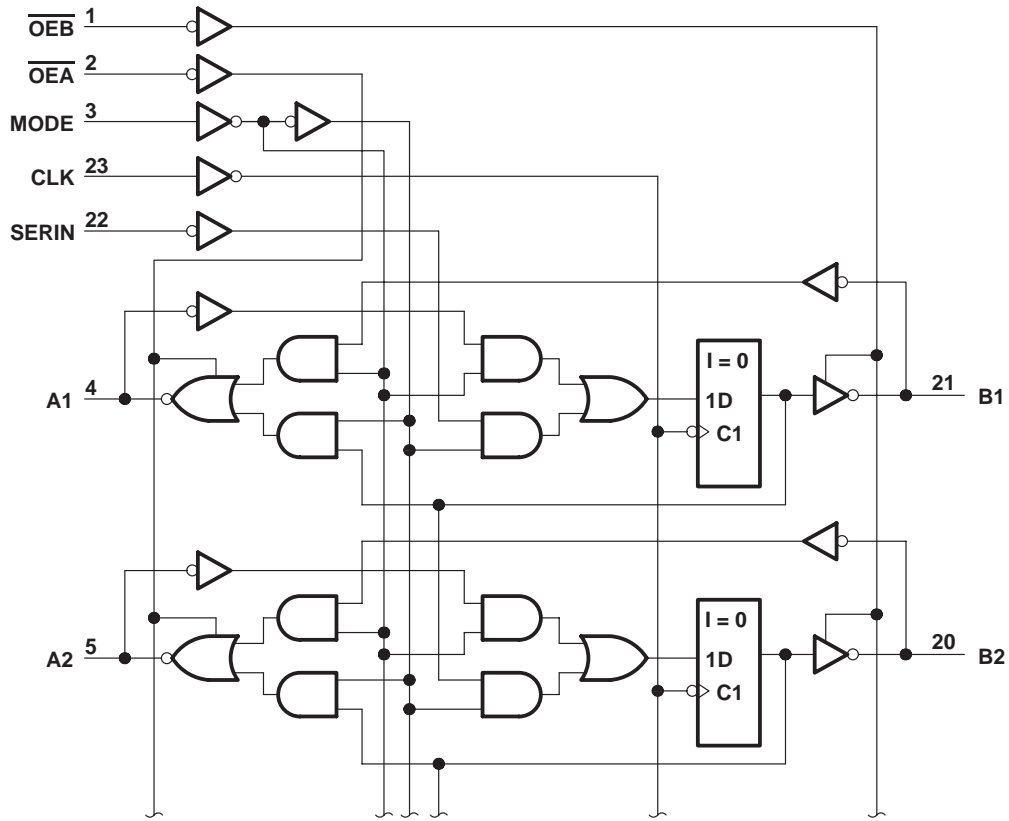
† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

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## 8-BIT UNIVERSAL TRANSCEIVER PORT CONTROLLERS

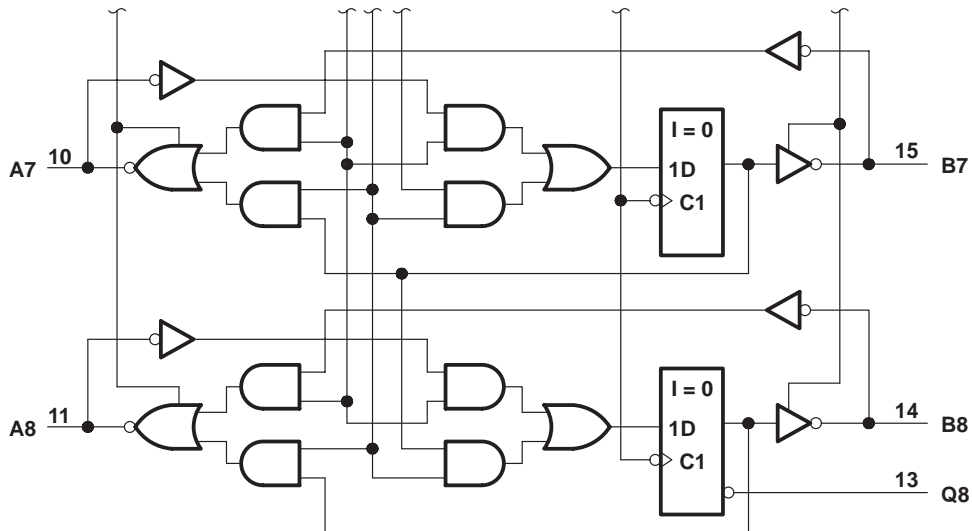
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### logic diagram (positive logic)



Four Identical Channels Not Shown  
Inputs/Outputs Not Shown:

- |        |         |
|--------|---------|
| (6) A3 | (19) B3 |
| (7) A4 | (18) B4 |
| (8) A5 | (17) B5 |
| (9) A6 | (16) B6 |



Pin numbers shown are for DW, JT, and NT packages.

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## 8-BIT UNIVERSAL TRANSCEIVER PORT CONTROLLERS

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### absolute maximum ratings over free-air temperature range

Supply voltage, $V_{CC}$ .....	7 V
Input voltage: All inputs .....	7 V
I/O ports .....	5.5 V
Voltage applied to a disabled 3-state output .....	5.5 V
Operating free-air temperature range: SN54AS856 .....	–55°C to 125°C
SN74AS856 .....	0°C to 70°C
Storage temperature range .....	–65°C to 150°C

### recommended operating conditions

		SN54AS856			SN74AS856			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
$V_{CC}$	Supply voltage	4.5	5	5.5	4.5	5	5.5	V
$V_{IH}$	High-level input voltage	2			2			V
$V_{IL}$	Low-level input voltage			0.8			0.8	V
$I_{OH}$	High-level output current	A1-A8, B1-B8		–12	–15		mA	
		Q8		–2	–2			
$I_{OL}$	Low-level output current	A1-A8, B1-B8		32	48		mA	
		Q8		20	20			
$f_{clock}$	Clock frequency	0		45	0		50	MHz
$t_w$	Duration of clock pulse	11			10			ns
$t_{su}$	Setup time before CLK↑	A1-A8, B1-B8 SERIN		5.5	5.5		ns	
		OEB, OEA, MODE		5.5	5.5			
$t_h$	Hold-time, data after CLK↑	A1-A8, B1-B8 SERIN		0	0		ns	
		OEB, OEA, MODE		0	0			
$T_A$	Operating free-air temperature	–55		125	0		70	°C



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## 8-BIT UNIVERSAL TRANSCEIVER PORT CONTROLLERS

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

PARAMETER		TEST CONDITIONS		SN54AS856			SN74AS856			UNIT		
				MIN	TYP†	MAX	MIN	TYP†	MAX			
V <sub>IK</sub>		V <sub>CC</sub> = 4.5 V,	I <sub>I</sub> = -18 mA	-1.2			-1.2			V		
V <sub>OH</sub>	A1-A8	V <sub>CC</sub> = 4.5 V,	I <sub>OH</sub> = -12 mA	2	3.2					V		
	B1-B8	V <sub>CC</sub> = 4.5 V,	I <sub>OH</sub> = -15 mA				2	3.3				
	All outputs	V <sub>CC</sub> = 4.5 V to 5.5 V,	I <sub>OH</sub> = -2 mA	V <sub>CC</sub> -2			V <sub>CC</sub> -2					
V <sub>OL</sub>	All outputs except Q8	V <sub>CC</sub> = 4.5 V,	I <sub>OL</sub> = 32 mA	0.25		0.5					V	
		V <sub>CC</sub> = 4.5 V,	I <sub>OL</sub> = 48 mA				0.35	0.5				
	Q8	V <sub>CC</sub> = 4.5 V,	I <sub>OL</sub> = 20 mA				0.5		0.5			
I <sub>I</sub>	OEB, OEA, MODE	V <sub>CC</sub> = 5.5 V,	V <sub>I</sub> = 7 V				0.2		0.2		mA	
	CLK and SERIN						0.1		0.1			
	A1-A8, B1-B8			V <sub>CC</sub> = 5.5 V,	V <sub>I</sub> = 5.5 V				0.2			0.2
I <sub>IH</sub>	OEB, OEA, MODE	V <sub>CC</sub> = 5.5 V,	V <sub>I</sub> = 2.7 V				40		40		μA	
	CLK and SERIN						20		20			
	A1-A8, B1-B8‡						70		70			
I <sub>IL</sub>	OEB, OEA, MODE	V <sub>CC</sub> = 5.5 V,	V <sub>I</sub> = 0.4 V				-1		-1		mA	
	CLK and SERIN						-0.5		-0.5			
	A1-A8, B1-B8‡						-0.5		-0.5			
I <sub>O</sub> §	Except Q8	V <sub>CC</sub> = 5.5 V,	V <sub>O</sub> = 2.25 V	-30		-112		-30		-112		mA
	Q8			-20		-112		-20		-112		
I <sub>CC</sub>		V <sub>CC</sub> = 5.5 V		118		200		118		200		mA

† All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

‡ For I/O ports, the parameters I<sub>I</sub> and I<sub>IL</sub> include the output currents I<sub>OZH</sub> and I<sub>OZL</sub>, respectively.

§ The output conditions have been chosen to produce a current that closely approximates one half of the true short-circuit output current, I<sub>OS</sub>.

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## 8-BIT UNIVERSAL TRANSCEIVER PORT CONTROLLERS

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### switching characteristics (see Note 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 4.5\text{ V to }5.5\text{ V}$ , $C_L = 50\text{ pF}$ , $R_1 = 500\ \Omega$ , $R_2 = 500\ \Omega$ , $T_A = \text{MIN to MAX}$				UNIT
			SN54AS856		SN74AS856		
			MIN	MAX	MIN	MAX	
$f_{\text{max}}$			45		50		MHz
$t_{\text{PLH}}$	Any B port	Any A port	2	8	2	7	ns
$t_{\text{PHL}}$			2	10.5	2	9.5	
$t_{\text{PLH}}$	$\uparrow$ MODE	Any A or B port	2	8.5	2	7.5	ns
$t_{\text{PHL}}$			5	20	5	19	
$t_{\text{PLH}}$	$\downarrow$ MODE †	Any A or B port	2	8.5	2	7.5	ns
$t_{\text{PHL}}$			2	9.5	2	8	
$t_{\text{PLH}}$	CLK	Any A or B port	3	12	3	9	ns
$t_{\text{PHL}}$			3	12	3	11	
$t_{\text{PLH}}$	CLK	Q8	2	9	2	7.5	ns
$t_{\text{PHL}}$			2	10	2	9	
$t_{\text{PHZ}}$	$\overline{\text{OEA}}$ or $\overline{\text{OEB}}$	Any A or B port	2	9	2	7	ns
$t_{\text{PLZ}}$			2	12	2	9.5	
$t_{\text{PZH}}$			2	8	2	7	ns
$t_{\text{PZL}}$			2	11	2	10	

† The positive transition of the MODE control will cause low-level data at the A output bus or stored in Q to be invalid for 12 ns.

NOTE 1: Load circuit and voltage waveforms are shown in Section 1.

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)	Op Temp (°C)	Top-Side Markings (4)	Samples
SN74AS856DW	OBSOLETE	SOIC	DW	24		TBD	Call TI	Call TI	0 to 70		
SN74AS856NT	OBSOLETE	PDIP	NT	24		TBD	Call TI	Call TI	0 to 70		
SN74AS856NT	OBSOLETE	PDIP	NT	24		TBD	Call TI	Call TI	0 to 70		

(1) The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) Multiple Top-Side Markings will be inside parentheses. Only one Top-Side Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Top-Side Marking for that device.

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DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
OMAP Applications Processors	<a href="http://www.ti.com/omap">www.ti.com/omap</a>
Wireless Connectivity	<a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a>

### Applications

Automotive and Transportation	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Energy and Lighting	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
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