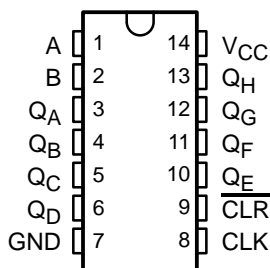


SN54LV164A, SN74LV164A 8-BIT PARALLEL-OUT SERIAL SHIFT REGISTERS

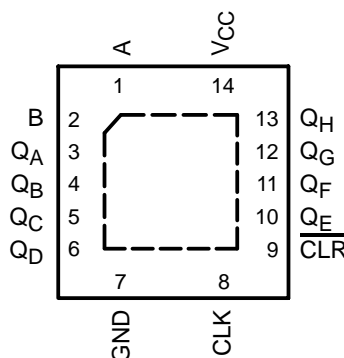
SCLS403F – APRIL 1998 – REVISED JULY 2003

- 2-V to 5.5-V V_{CC} Operation
- Max t_{pd} of 10.5 ns at 5 V
- Typical V_{OLP} (Output Ground Bounce) <0.8 V at $V_{CC} = 3.3$ V, $T_A = 25^\circ\text{C}$
- Typical V_{OHV} (Output V_{OH} Undershoot) >2.3 V at $V_{CC} = 3.3$ V, $T_A = 25^\circ\text{C}$
- Support Mixed-Mode Voltage Operation on All Ports
- Latch-Up Performance Exceeds 250 mA Per JESD 17
- ESD Protection Exceeds JESD 22
 - 2000-V Human-Body Model (A114-A)
 - 200-V Machine Model (A115-A)
 - 1000-V Charged-Device Model (C101)

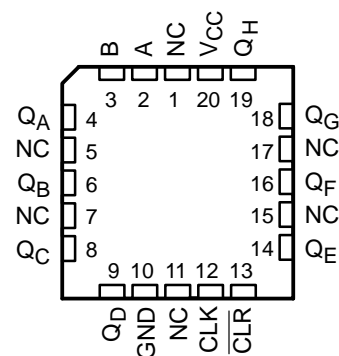
SN54LV164A ... J OR W PACKAGE
SN74LV164A ... D, DB, DGV, NS,
OR PW PACKAGE
(TOP VIEW)



SN74LV164A ... RGY PACKAGE
(TOP VIEW)



SN54LV164A ... FK PACKAGE
(TOP VIEW)



NC – No internal connection

description/ordering information

The 'LV164A devices are 8-bit parallel-out serial shift registers designed for 2-V to 5.5-V V_{CC} operation.

ORDERING INFORMATION

T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	QFN – RGY	Reel of 1000	SN74LV164ARGYR	LV164A
	SOIC – D	Tube of 50	SN74LV164AD	LV164A
		Reel of 2500	SN74LV164ADR	
	SOP – NS	Reel of 2000	SN74LV164ANSR	74LV164A
	SSOP – DB	Reel of 2000	SN74LV164ADBR	LV164A
	TSSOP – PW	Tube of 90	SN74LV164APW	LV164A
		Reel of 2000	SN74LV164APWR	
Reel of 250		SN74LV164APWT		
TVSOP – DGV	Reel of 2000	SN74LV164ADGVR	LV164A	
–55°C to 125°C	CDIP – J	Tube of 25	SNJ54LV164AJ	SNJ54LV164AJ
	CFP – W	Tube of 150	SNJ54LV164AW	SNJ54LV164AW
	LCCC – FK	Tube of 55	SNJ54LV164AFK	SNJ54LV164AFK

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.



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 **TEXAS
INSTRUMENTS**

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SN54LV164A, SN74LV164A 8-BIT PARALLEL-OUT SERIAL SHIFT REGISTERS

SCLS403F – APRIL 1998 – REVISED JULY 2003

description/ordering information (continued)

These devices feature AND-gated serial (A and B) inputs and an asynchronous clear ($\overline{\text{CLR}}$) input. The gated serial inputs permit complete control over incoming data, as a low at either input inhibits entry of the new data and resets the first flip-flop to the low level at the next clock pulse. A high-level input enables the other input, which then determines the state of the first flip-flop. Data at the serial inputs can be changed while the clock is high or low, provided the minimum setup time requirements are met. Clocking occurs on the low-to-high-level transition of the clock (CLK) input.

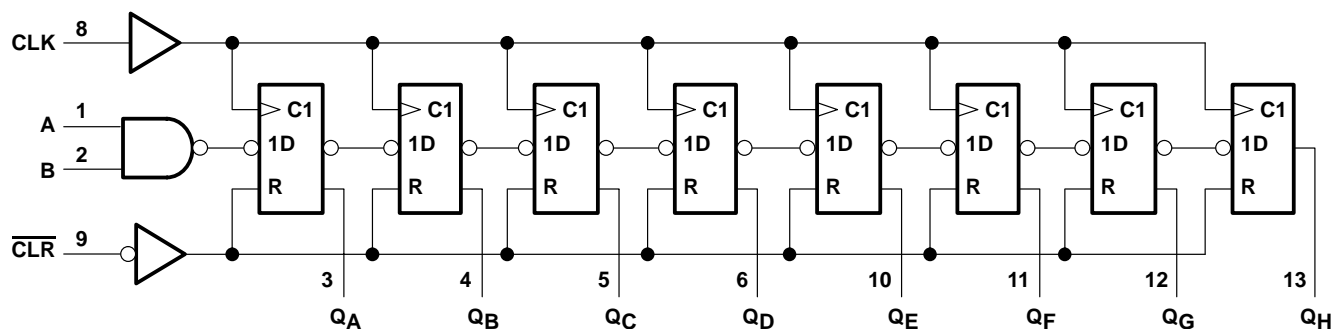
FUNCTION TABLE

INPUTS				OUTPUTS		
$\overline{\text{CLR}}$	CLK	A	B	Q_A	$Q_B \dots Q_H$	
L	X	X	X	L	L	L
H	L	X	X	Q_{A0}	Q_{B0}	Q_{H0}
H	\uparrow	H	H	H	Q_{An}	Q_{Gn}
H	\uparrow	L	X	L	Q_{An}	Q_{Gn}
H	\uparrow	X	L	L	Q_{An}	Q_{Gn}

Q_{A0}, Q_{B0}, Q_{H0} = the level of $Q_A, Q_B,$ or $Q_H,$ respectively, before the indicated steady-state input conditions were established.

Q_{An}, Q_{Gn} = the level of Q_A or Q_G before the most recent \uparrow transition of the clock: indicates a 1-bit shift.

logic diagram (positive logic)

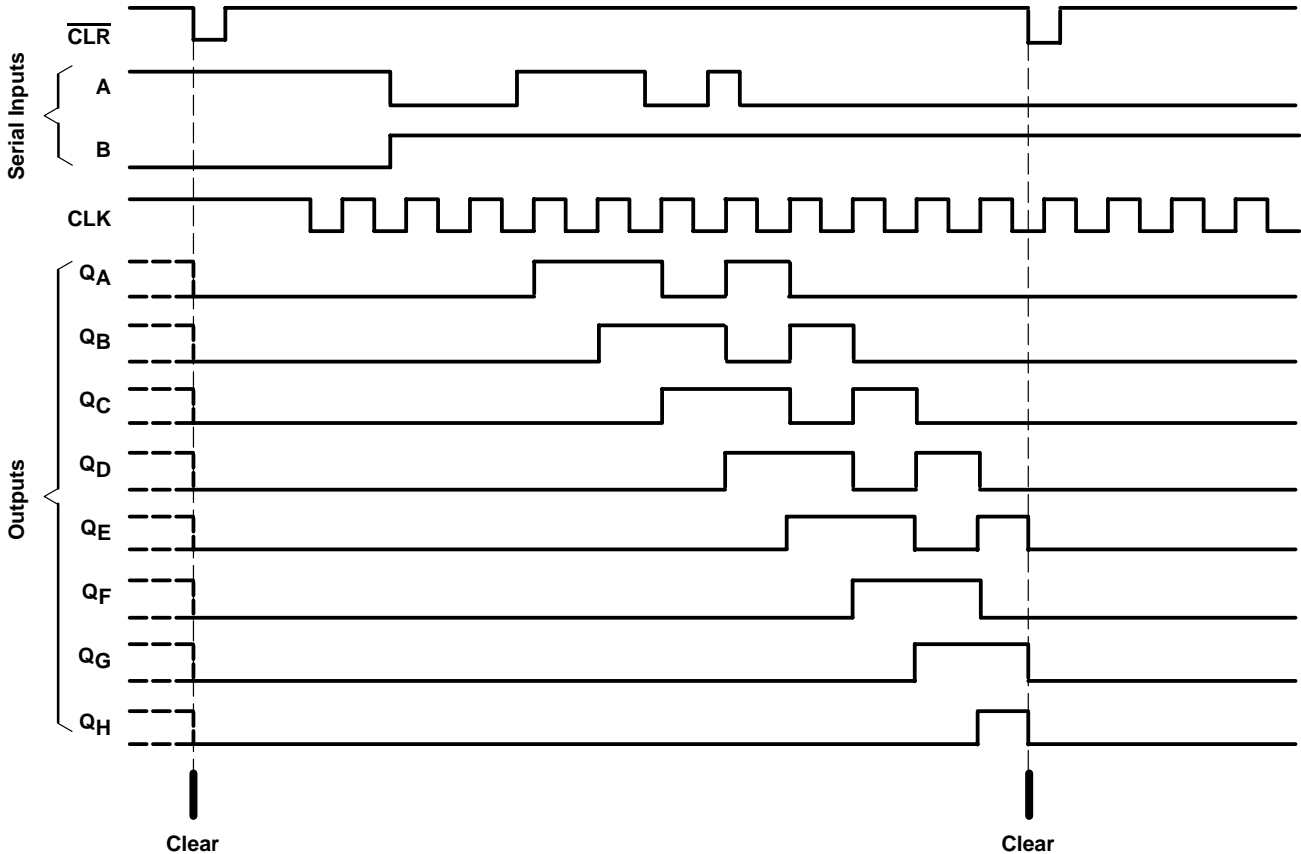


Pin numbers shown are for the D, DB, DGV, J, NS, PW, RGY, and W packages.

SN54LV164A, SN74LV164A 8-BIT PARALLEL-OUT SERIAL SHIFT REGISTERS

SCLS403F – APRIL 1998 – REVISED JULY 2003

typical clear, shift, and clear sequences



SN54LV164A, SN74LV164A 8-BIT PARALLEL-OUT SERIAL SHIFT REGISTERS

SCLS403F – APRIL 1998 – REVISED JULY 2003

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
Voltage range applied to any output in the high-impedance or power-off state, V_O (see Note 1)	-0.5 V to 7 V
Output voltage range, V_O (see Notes 1 and 2)	-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 $V_O > V_{CC}$)	± 50 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 3): D package	86°C/W
(see Note 3): DB package	96°C/W
(see Note 3): DGV package	127°C/W
(see Note 3): NS package	76°C/W
(see Note 3): PW package	113°C/W
(see Note 4): RGY package	47°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. This value is limited to 5.5 V maximum.
 3. The package thermal impedance is calculated in accordance with JESD 51-7.
 4. The package thermal impedance is calculated in accordance with JESD 51-5.



POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

SN54LV164A, SN74LV164A 8-BIT PARALLEL-OUT SERIAL SHIFT REGISTERS

SCLS403F – APRIL 1998 – REVISED JULY 2003

recommended operating conditions (see Note 5)

		SN54LV164A		SN74LV164A		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} = 2.3 V to 2.7 V	V _{CC} × 0.7	V _{CC} × 0.7		
		V _{CC} = 3 V to 3.6 V	V _{CC} × 0.7	V _{CC} × 0.7		
		V _{CC} = 4.5 V to 5.5 V	V _{CC} × 0.7	V _{CC} × 0.7		
V _{IL}	Low-level input voltage	V _{CC} = 2 V		0.5	0.5	V
		V _{CC} = 2.3 V to 2.7 V		V _{CC} × 0.3	V _{CC} × 0.3	
		V _{CC} = 3 V to 3.6 V		V _{CC} × 0.3	V _{CC} × 0.3	
		V _{CC} = 4.5 V to 5.5 V		V _{CC} × 0.3	V _{CC} × 0.3	
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} = 2.3 V to 2.7 V		-2	-2	mA
		V _{CC} = 3 V to 3.6 V		-6	-6	
		V _{CC} = 4.5 V to 5.5 V		-12	-12	
I _{OL}	Low-level output current	V _{CC} = 2 V		50	50	μA
		V _{CC} = 2.3 V to 2.7 V		2	2	mA
		V _{CC} = 3 V to 3.6 V		6	6	
		V _{CC} = 4.5 V to 5.5 V		12	12	
Δt/Δv	Input transition rise or fall rate	V _{CC} = 2.3 V to 2.7 V		200	200	ns/V
		V _{CC} = 3 V to 3.6 V		100	100	
		V _{CC} = 4.5 V to 5.5 V		20	20	
T _A	Operating free-air temperature	-55	125	-40	85	°C

NOTE 5: 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}	SN54LV164A			SN74LV164A			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V _{OH}	I _{OH} = -50 μA	2 V to 5.5 V	V _{CC} -0.1			V _{CC} -0.1			V
	I _{OH} = -2 mA	2.3 V	2			2			
	I _{OH} = -6 mA	3 V	2.48			2.48			
	I _{OH} = -12 mA	4.5 V	3.8			3.8			
V _{OL}	I _{OL} = 50 μA	2 V to 5.5 V			0.1			0.1	V
	I _{OL} = 2 mA	2.3 V			0.4			0.4	
	I _{OL} = 6 mA	3 V			0.44			0.44	
	I _{OL} = 12 mA	4.5 V			0.55			0.55	
I _I	V _I = 5.5 V or GND	0 to 5.5 V			±1			±1	μA
I _{CC}	V _I = V _{CC} or GND, I _O = 0	5.5 V			20			20	μA
I _{off}	V _I or V _O = 0 to 5.5 V	0			5			5	μA
C _i	V _I = V _{CC} or GND	3.3 V		2.2			2.2		pF

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POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

SN54LV164A, SN74LV164A 8-BIT PARALLEL-OUT SERIAL SHIFT REGISTERS

SCLS403F – APRIL 1998 – REVISED JULY 2003

timing requirements over recommended operating free-air temperature range, $V_{CC} = 2.5 V \pm 0.2 V$ (unless otherwise noted) (see Figure 1)

		$T_A = 25^\circ C$		SN54LV164A		SN74LV164A		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
t_w	Pulse duration	\overline{CLR} low	6	6.5	6.5			ns
		CLK high or low	6.5	7.5	7.5			
t_{su}	Setup time	Data before CLK \uparrow	6.5	8.5	8.5			ns
		\overline{CLR} inactive	3	3	3			
t_h	Hold time	Data after CLK \uparrow	-0.5	0	0			ns

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

		$T_A = 25^\circ C$		SN54LV164A		SN74LV164A		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
t_w	Pulse duration	\overline{CLR} low	5	5	5			ns
		CLK high or low	5	5	5			
t_{su}	Setup time	Data before CLK \uparrow	5	6	6			ns
		\overline{CLR} inactive	2.5	2.5	2.5			
t_h	Hold time	Data after CLK \uparrow	0	0	0			ns

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

		$T_A = 25^\circ C$		SN54LV164A		SN74LV164A		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
t_w	Pulse duration	\overline{CLR} low	5	5	5			ns
		CLK high or low	5	5	5			
t_{su}	Setup time	Data before CLK \uparrow	4.5	4.5	4.5			ns
		\overline{CLR} inactive	2.5	2.5	2.5			
t_h	Hold time	Data after CLK \uparrow	1	1	1			ns

switching characteristics over recommended operating free-air temperature range, $V_{CC} = 2.5 V \pm 0.2 V$ (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	$T_A = 25^\circ C$			SN54LV164A		SN74LV164A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{max}			$C_L = 15 \text{ pF}$	55*	105*		50*		50	MHz	
			$C_L = 50 \text{ pF}$	45	85		40		40		
t_{pd}	CLK	Q	$C_L = 15 \text{ pF}$	9.2*	17.6*		1*	20*	1	20	ns
t_{PHL}	\overline{CLR}	Q		8.6*	16*		1*	18*	1	18	
t_{pd}	CLK	Q	$C_L = 50 \text{ pF}$	11.5	21.1		1	24	1	24	ns
t_{PHL}	\overline{CLR}	Q		10.8	19.5		1	22	1	22	

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

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SN54LV164A, SN74LV164A

8-BIT PARALLEL-OUT SERIAL SHIFT REGISTERS

SCLS403F – APRIL 1998 – REVISED JULY 2003

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	$T_A = 25^\circ\text{C}$			SN54LV164A		SN74LV164A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{\max}			$C_L = 15\text{ pF}$	80*	155*		65*		65		MHz
			$C_L = 50\text{ pF}$	50	120		45		45		
t_{pd}	CLK	Q	$C_L = 15\text{ pF}$		6.4*	12.8*	1*	15*	1	15	ns
t_{PHL}	$\overline{\text{CLR}}$				6*	12.8*	1*	15*	1	15	
t_{pd}	CLK	Q	$C_L = 50\text{ pF}$		8.3	16.3	1	18.5	1	18.5	ns
t_{PHL}	$\overline{\text{CLR}}$				7.9	16.3	1	18.5	1	18.5	

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

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	$T_A = 25^\circ\text{C}$			SN54LV164A		SN74LV164A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{\max}			$C_L = 15\text{ pF}$	125*	220*		105*		105		MHz
			$C_L = 50\text{ pF}$	85	165		75		75		
t_{pd}	CLK	Q	$C_L = 15\text{ pF}$		4.5*	9*	1*	10.5*	1	10.5	ns
t_{PHL}	$\overline{\text{CLR}}$				4.2*	8.6*	1*	10*	1	10	
t_{pd}	CLK	Q	$C_L = 50\text{ pF}$		6	11	1	12.5	1	12.5	ns
t_{PHL}	$\overline{\text{CLR}}$				5.8	10.6	1	12.5	1	12.5	

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

noise characteristics, $V_{CC} = 3.3\text{ V}$, $C_L = 50\text{ pF}$, $T_A = 25^\circ\text{C}$ (see Note 6)

PARAMETER		SN74LV164A			UNIT
		MIN	TYP	MAX	
$V_{OL(P)}$	Quiet output, maximum dynamic V_{OL}	0.28	0.8		V
$V_{OL(V)}$	Quiet output, minimum dynamic V_{OL}	-0.22	-0.8		V
$V_{OH(V)}$	Quiet output, minimum dynamic V_{OH}	3.09			V
$V_{IH(D)}$	High-level dynamic input voltage	2.31			V
$V_{IL(D)}$	Low-level dynamic input voltage		0.99		V

NOTE 6: Characteristics are for surface-mount packages only.

operating characteristics, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS	V_{CC}	TYP	UNIT
C_{pd}	Power dissipation capacitance	$C_L = 50\text{ pF}$, $f = 10\text{ MHz}$	3.3 V	48.1	pF
			5 V	47.5	

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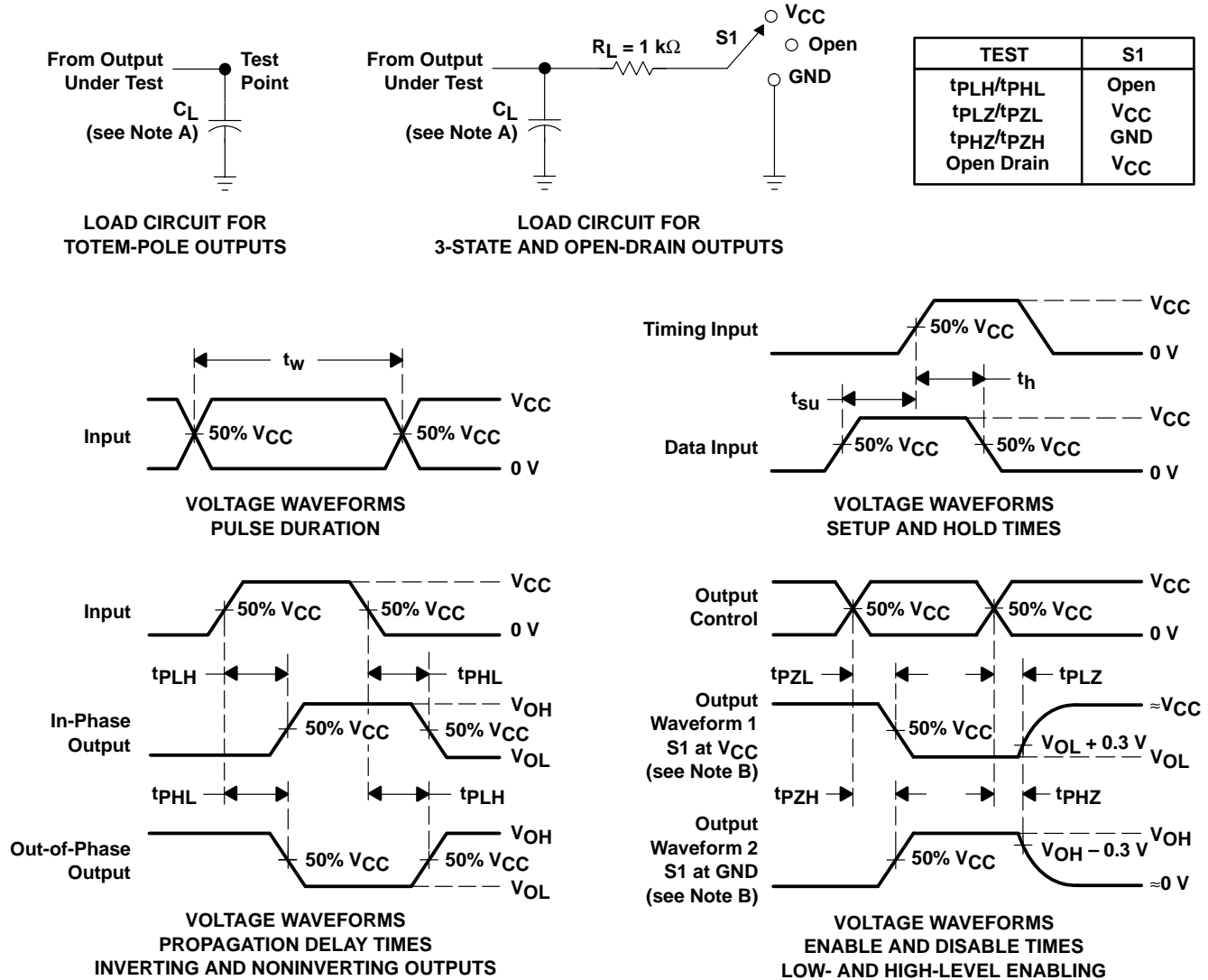


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SN54LV164A, SN74LV164A 8-BIT PARALLEL-OUT SERIAL SHIFT REGISTERS

SCLS403F – APRIL 1998 – REVISED JULY 2003

PARAMETER MEASUREMENT INFORMATION



- 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: $PRR \leq 1\text{ MHz}$, $Z_O = 50\ \Omega$, $t_r \leq 3\text{ ns}$, $t_f \leq 3\text{ ns}$.
 - D. The outputs are measured one at a time with one input transition per measurement.
 - E. t_{PLZ} and t_{PHZ} are the same as t_{dis} .
 - F. t_{PZL} and t_{PZH} are the same as t_{en} .
 - G. t_{PHL} and t_{PLH} are the same as t_{pd} .
 - H. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

DGV (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

24 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15 per side.
 D. Falls within JEDEC: 24/48 Pins – MO-153
 14/16/20/56 Pins – MO-194

D (R-PDSO-G14)

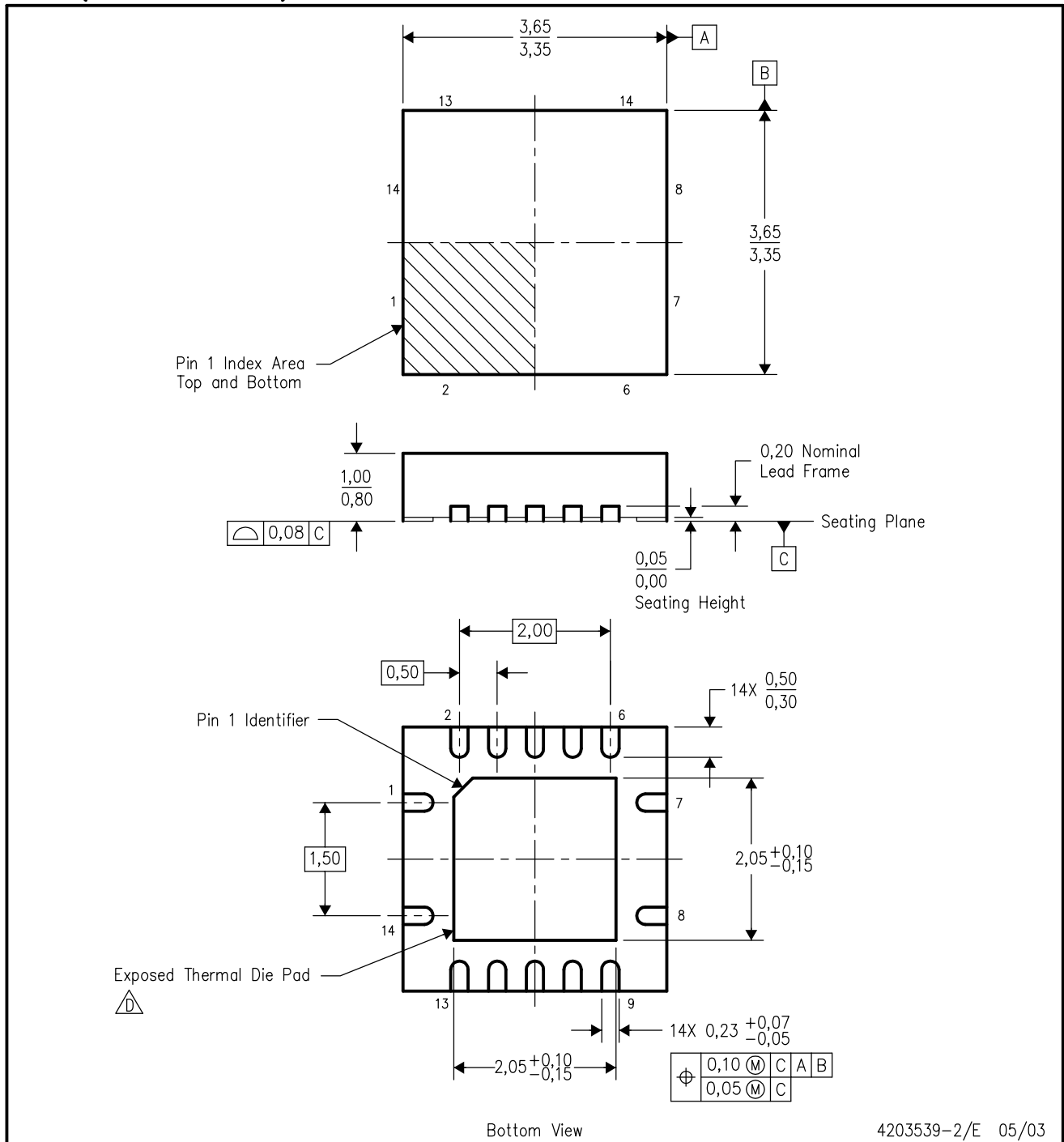
PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
 - D. Falls within JEDEC MS-012 variation AB.

RGY (S-PQFP-N14)

PLASTIC QUAD FLATPACK



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. QFN (Quad Flatpack No-Lead) package configuration.
 - $\triangle D$ The package thermal performance may be enhanced by bonding the thermal die pad to an external thermal plane. This pad is electrically and thermally connected to the backside of the die and possibly selected ground leads.
 - E. Package complies to JEDEC MO-241 variation BA.

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

DB (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

28 PINS SHOWN



- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
 D. Falls within JEDEC MO-150

PW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



4040064/F 01/97

- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
 D. Falls within JEDEC MO-153

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