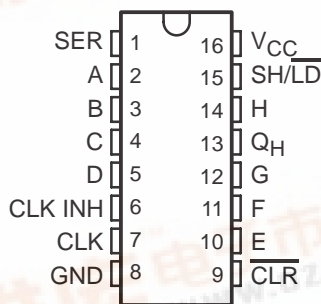
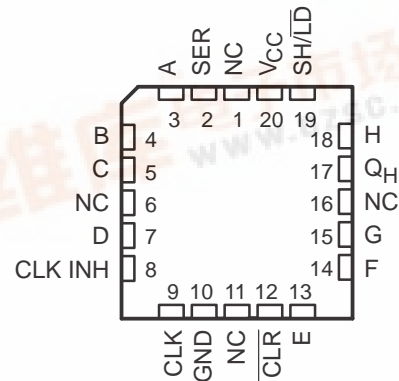


- 2-V to 5.5-V V_{CC} Operation
- Max t_{pd} of 10.5 ns at 5 V
- Typical V_{OLP} (Output Ground Bounce) <0.8 V at $V_{CC} = 3.3$ V, $T_A = 25^\circ\text{C}$
- Typical V_{OHV} (Output V_{OH} Undershoot) >2.3 V at $V_{CC} = 3.3$ V, $T_A = 25^\circ\text{C}$
- I_{off} Supports Partial-Power-Down-Mode Operation
- Synchronous Load
- Direct Overriding Clear
- Parallel-to-Serial Conversion
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- ESD Protection Exceeds JESD 22
 - 2000-V Human-Body Model (A114-A)
 - 200-V Machine Model (A115-A)
 - 1000-V Charged-Device Model (C101)

SN54LV166A . . . J OR W PACKAGE
SN74LV166A . . . D, DB, DGV, NS, OR PW PACKAGE
(TOP VIEW)



SN54LV166A . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

description/ordering information

The 'LV166A devices are 8-bit parallel-load 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	SOIC – D	Tube of 40	SN74LV166AD	LV166A
		Reel of 2500	SN74LV166ADR	
	SOP – NS	Reel of 2000	SN74LV166ANSR	74LV166A
	SSOP – DB	Reel of 2000	SN74LV166ADBR	LV166A
	TSSOP – PW	Tube of 90	SN74LV166APW	LV166A
		Reel of 2000	SN74LV166APWR	
		Reel of 250	SN74LV166APWT	
–55°C to 125°C	TVSOP – DGV	Reel of 2000	SN74LV166ADGVR	LV166A
	CDIP – J	Tube of 25	SNJ54LV166AJ	SNJ54LV166AJ
	CFP – W	Tube of 150	SNJ54LV166AW	SNJ54LV166AW
	LCCC – FK	Tube of 55	SNJ54LV166AFK	SNJ54LV166AFK

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

Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

SN54LV166A, SN74LV166A

8-BIT PARALLEL-LOAD SHIFT REGISTERS

SCLS456B – FEBRUARY 2001 – REVISED DECEMBER 2004

description/ordering information (continued)

The 'LV166A parallel-in or serial-in, serial-out registers feature gated clock (CLK, CLK INH) inputs and an overriding clear ($\overline{\text{CLR}}$) input. The parallel-in or serial-in modes are established by the shift/load ($\text{SH}/\overline{\text{LD}}$) input. When high, $\text{SH}/\overline{\text{LD}}$ enables the serial (SER) data input and couples the eight flip-flops for serial shifting with each clock (CLK) pulse. When low, the parallel (broadside) data inputs are enabled, and synchronous loading occurs on the next clock pulse. During parallel loading, serial data flow is inhibited. Clocking is accomplished on the low-to-high-level edge of CLK through a 2-input positive-NOR gate, permitting one input to be used as a clock-enable or clock-inhibit function. Holding either CLK or CLK INH high inhibits clocking; holding either low enables the other clock input. This allows the system clock to be free running, and the register can be stopped on command with the other clock input. CLK INH should be changed to the high level only when CLK is high. $\overline{\text{CLR}}$ overrides all other inputs, including CLK, and resets all flip-flops to zero.

These devices are fully specified for partial-power-down applications using I_{off} . The I_{off} circuitry disables the outputs, preventing damaging current backflow through the devices when they are powered down.

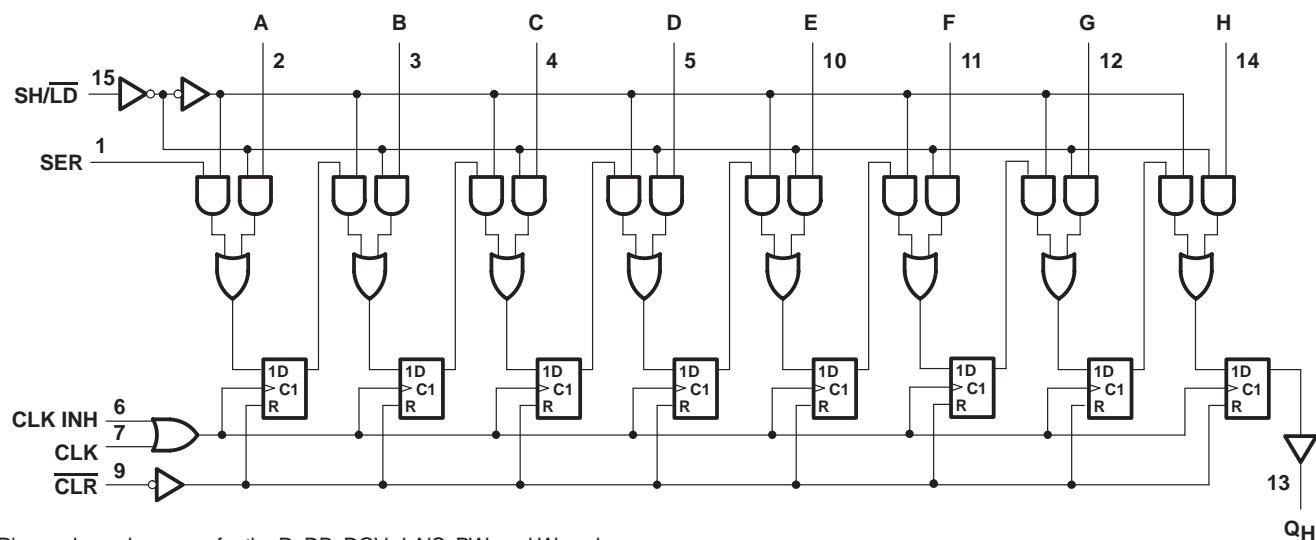
FUNCTION TABLE

INPUTS						OUTPUTS		
						INTERNAL		Q_H
$\overline{\text{CLR}}$	$\text{SH}/\overline{\text{LD}}$	CLK INH	CLK	SER	PARALLEL A . . . H	Q_A	Q_B	
L	X	X	X	X	X	L	L	L
H	X	L	L	X	X	$\text{Q}_{\text{A}0}$	$\text{Q}_{\text{B}0}$	$\text{Q}_{\text{H}0}$
H	L	L	\uparrow	X	a . . . h	a	b	h
H	H	L	\uparrow	H	X	H	$\text{Q}_{\text{A}n}$	$\text{Q}_{\text{G}n}$
H	H	L	\uparrow	L	X	L	$\text{Q}_{\text{A}n}$	$\text{Q}_{\text{G}n}$
H	X	H	\uparrow	X	X	$\text{Q}_{\text{A}0}$	$\text{Q}_{\text{B}0}$	$\text{Q}_{\text{H}0}$

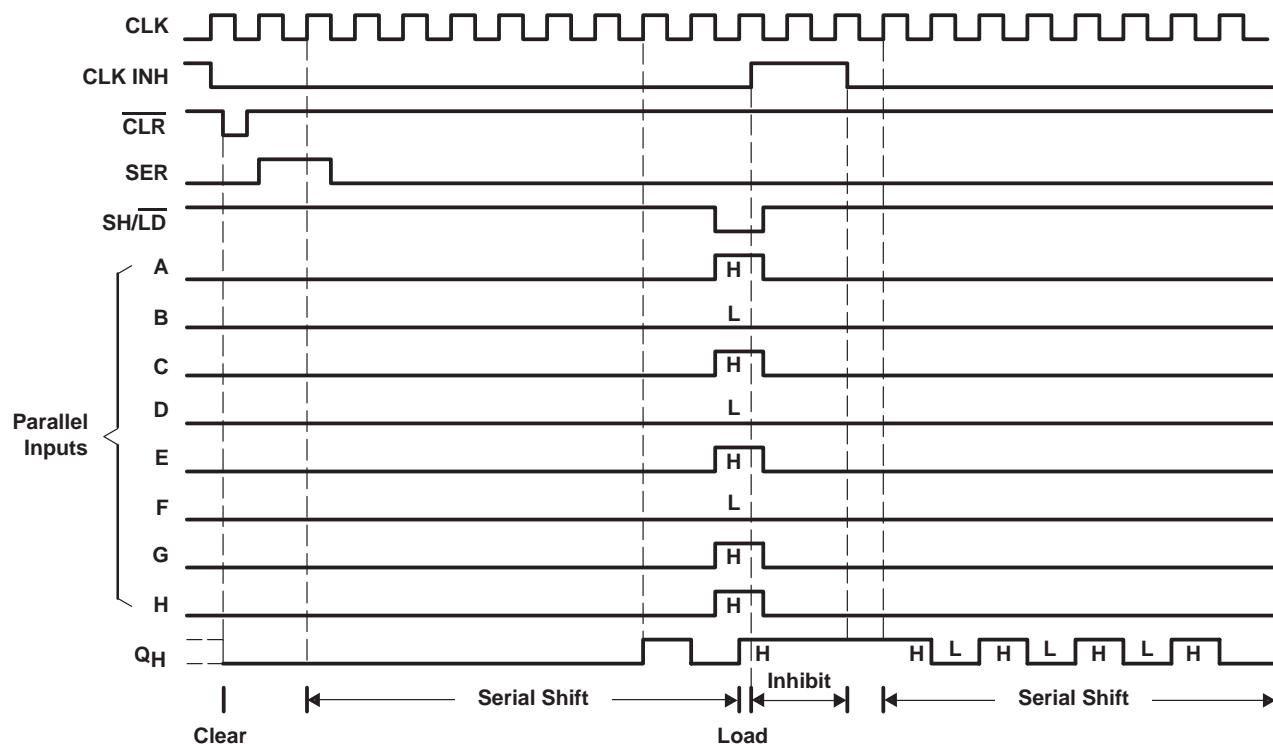
SN54LV166A, SN74LV166A 8-BIT PARALLEL-LOAD SHIFT REGISTERS

SCLS456B – FEBRUARY 2001 – REVISED DECEMBER 2004

logic diagram (positive logic)



typical clear, shift, load, inhibit, and shift sequence



SN54LV166A, SN74LV166A 8-BIT PARALLEL-LOAD SHIFT REGISTERS

SCLS456B – FEBRUARY 2001 – REVISED DECEMBER 2004

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 applied in high or low state, V_O (see Notes 1 and 2)	–0.5 V to $V_{CC} + 0.5$ V
Voltage range applied to any output in the power-off state, V_O (see Note 1)	–0.5 V to 7 V
Input clamp current, I_{IK} ($V_I < 0$)	–20 mA
Output clamp current, I_{OK} ($V_O < 0$)	–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	73°C/W
DB package	82°C/W
DGV package	120°C/W
NS package	64°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. This value is limited to 5.5 V maximum.
 3. The package thermal impedance is calculated in accordance with JESD 51-7.

SN54LV166A, SN74LV166A 8-BIT PARALLEL-LOAD SHIFT REGISTERS

SCLS456B – FEBRUARY 2001 – REVISED DECEMBER 2004

recommended operating conditions (see Note 4)

		SN54LV166A		SN74LV166A		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		
		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		
		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 4: 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}	SN54LV166A			SN74LV166A			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		1.6			1.6		pF

SN54LV166A, SN74LV166A

8-BIT PARALLEL-LOAD SHIFT REGISTERS

SCLS456B – FEBRUARY 2001 – REVISED DECEMBER 2004

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

			T _A = 25°C		SN54LV166A		SN74LV166A		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t _w	Pulse duration	CL $\overline{\text{R}}$ low	8		9		9		ns
		CLK high or low	8.5		9		9		
t _{su}	Setup time	CLK INH before CLK↑	7		7		7		ns
		Data before CLK↑	6.5		8.5		8.5		
		SH/LD before CLK↑	7		8.5		8.5		
		SER before CLK↑	8.5		9.5		9.5		
		CL $\overline{\text{R}}$ ↑ inactive before CLK↑	6		7		7		
t _h	Hold time	Data after CLK↑	−0.5		0		0		ns

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

			T _A = 25°C		SN54LV166A		SN74LV166A		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t _w	Pulse duration	CL $\overline{\text{R}}$ low	6		7		7		ns
		CLK high or low	6		7		7		
t _{su}	Setup time	CLK INH before CLK↑	5		5		5		ns
		Data before CLK↑	5		6		6		
		SH/LD before CLK↑	5		6		6		
		SER before CLK↑	5		6		6		
		CL $\overline{\text{R}}$ ↑ inactive before CLK↑	4		4		4		
t _h	Hold time	Data after CLK↑	0		0		0		ns

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

		T _A = 25°C		SN54LV166A		SN74LV166A		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
t _w	Pulse duration	CL _R low	5	5	5	5	5	ns
		CLK high or low	4	4	4	4	4	
t _{su}	Setup time	CLK INH before CLK↑	3.5	3.5	3.5	3.5	3.5	ns
		Data before CLK↑	4.5	4.5	4.5	4.5	4.5	
		SH/LD before CLK↑	4	4	4	4	4	
		SER before CLK↑	4	4	4	4	4	
		CL _R ↑ inactive before CLK↑	3.5	3.5	3.5	3.5	3.5	
t _h	Hold time	Data after CLK↑	1	1	1	1	ns	

SN54LV166A, SN74LV166A 8-BIT PARALLEL-LOAD SHIFT REGISTERS

SCLS456B – FEBRUARY 2001 – REVISED DECEMBER 2004

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	$T_A = 25^\circ\text{C}$			SN54LV166A		SN74LV166A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{max}			$C_L = 15\text{ pF}$	50*	105*		45*		45		MHz
			$C_L = 50\text{ pF}$	40	80		35		35		
t_{PHL}	$\overline{\text{CLR}}$	Q_H	$C_L = 15\text{ pF}$		8.8*	16*	1*	18*	1	18	ns
t_{pd}	CLK				9.2*	19.8*	1*	22*	1	22	
t_{PHL}	$\overline{\text{CLR}}$	Q_H	$C_L = 50\text{ pF}$		11.3	19.5	1	22	1	22	ns
t_{pd}	CLK				11.8	23.3	1	26	1	26	

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

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	$T_A = 25^\circ\text{C}$			SN54LV166A		SN74LV166A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{max}			$C_L = 15\text{ pF}$	65*	150*		55*		55		MHz
			$C_L = 50\text{ pF}$	60	120		50		50		
t_{PHL}	$\overline{\text{CLR}}$	Q_H	$C_L = 15\text{ pF}$		6.3*	12.5*	1*	15*	1	15	ns
t_{pd}	CLK				6.6*	15.4*	1*	18*	1	18	
t_{PHL}	$\overline{\text{CLR}}$	Q_H	$C_L = 50\text{ pF}$		7.9	16.3	1	18.5	1	18.5	ns
t_{pd}	CLK				8.3	18.9	1	21.5	1	21.5	

* 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	$T_A = 25^\circ\text{C}$			SN54LV166A		SN74LV166A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{max}			$C_L = 15\text{ pF}$	110*	205*		90*		90		MHz
			$C_L = 50\text{ pF}$	95	160		85		85		
t_{PHL}	$\overline{\text{CLR}}$	Q_H	$C_L = 15\text{ pF}$		4.6*	8.6*	1*	10*	1	10	ns
t_{pd}	CLK				4.8*	9.9*	1*	11.5*	1	11.5	
t_{PHL}	$\overline{\text{CLR}}$	Q_H	$C_L = 50\text{ pF}$		5.7	10.6	1	12	1	12	ns
t_{pd}	CLK				6.1	11.9	1	13.5	1	13.5	

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

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

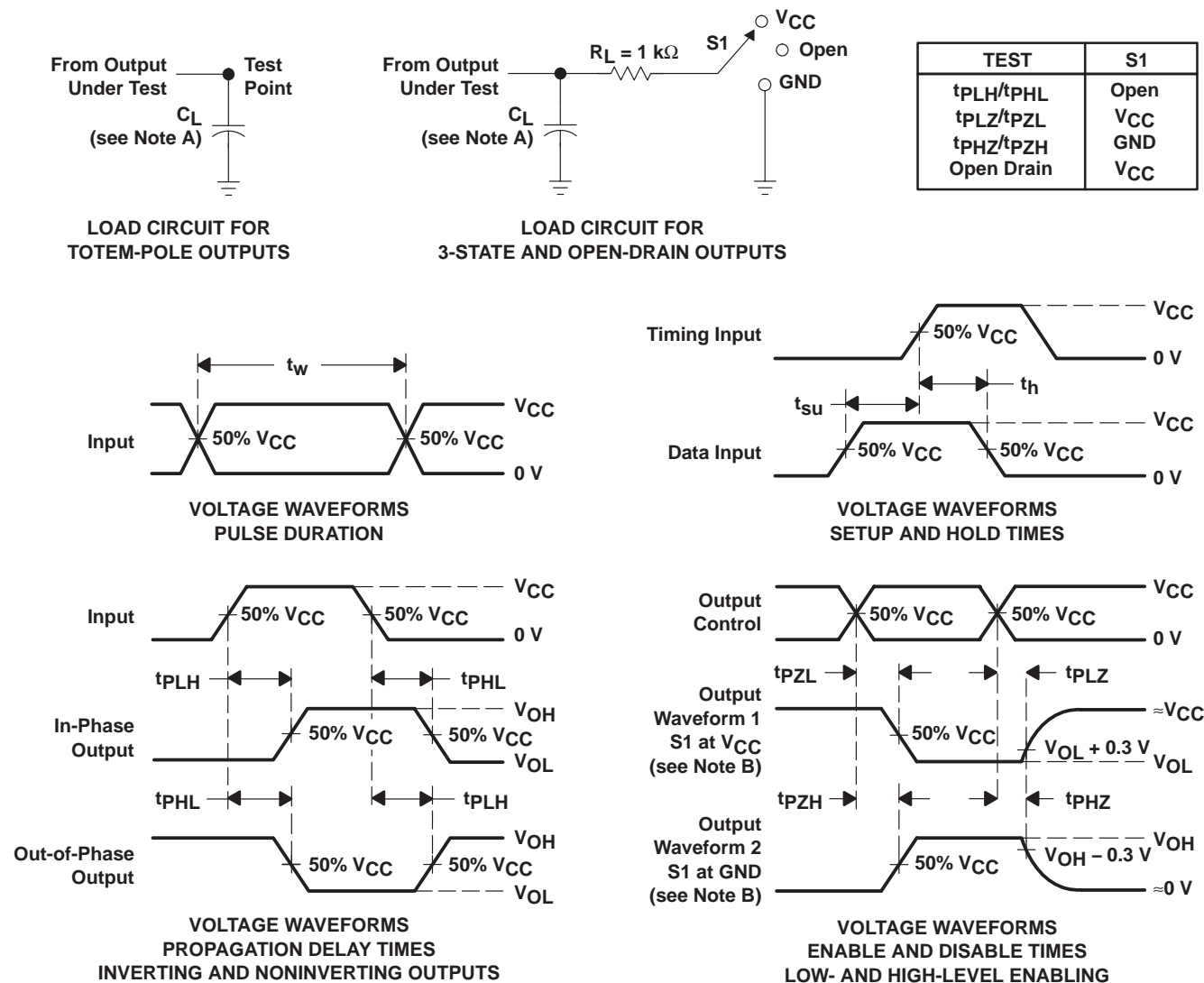
PARAMETER		TEST CONDITIONS		V_{CC}	TYP	UNIT
C_{pd}	Power dissipation capacitance	$C_L = 50\text{ pF}$	$f = 10\text{ MHz}$	3.3 V	39.1	
				5 V	44.5	pF

SN54LV166A, SN74LV166A

8-BIT PARALLEL-LOAD SHIFT REGISTERS

SCLS456B – FEBRUARY 2001 – REVISED DECEMBER 2004

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

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
SN74LV166AD	ACTIVE	SOIC	D	16	40	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74LV166ADB	PREVIEW	SSOP	DB	16	80	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74LV166ADBR	ACTIVE	SSOP	DB	16	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74LV166ADGVR	ACTIVE	TVSOP	DGV	16	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
SN74LV166ADR	ACTIVE	SOIC	D	16	2500	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74LV166ANSR	ACTIVE	SO	NS	16	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74LV166APW	ACTIVE	TSSOP	PW	16	90	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
SN74LV166APWR	ACTIVE	TSSOP	PW	16	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
SN74LV166APWT	ACTIVE	TSSOP	PW	16	250	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM

⁽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) 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.

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.

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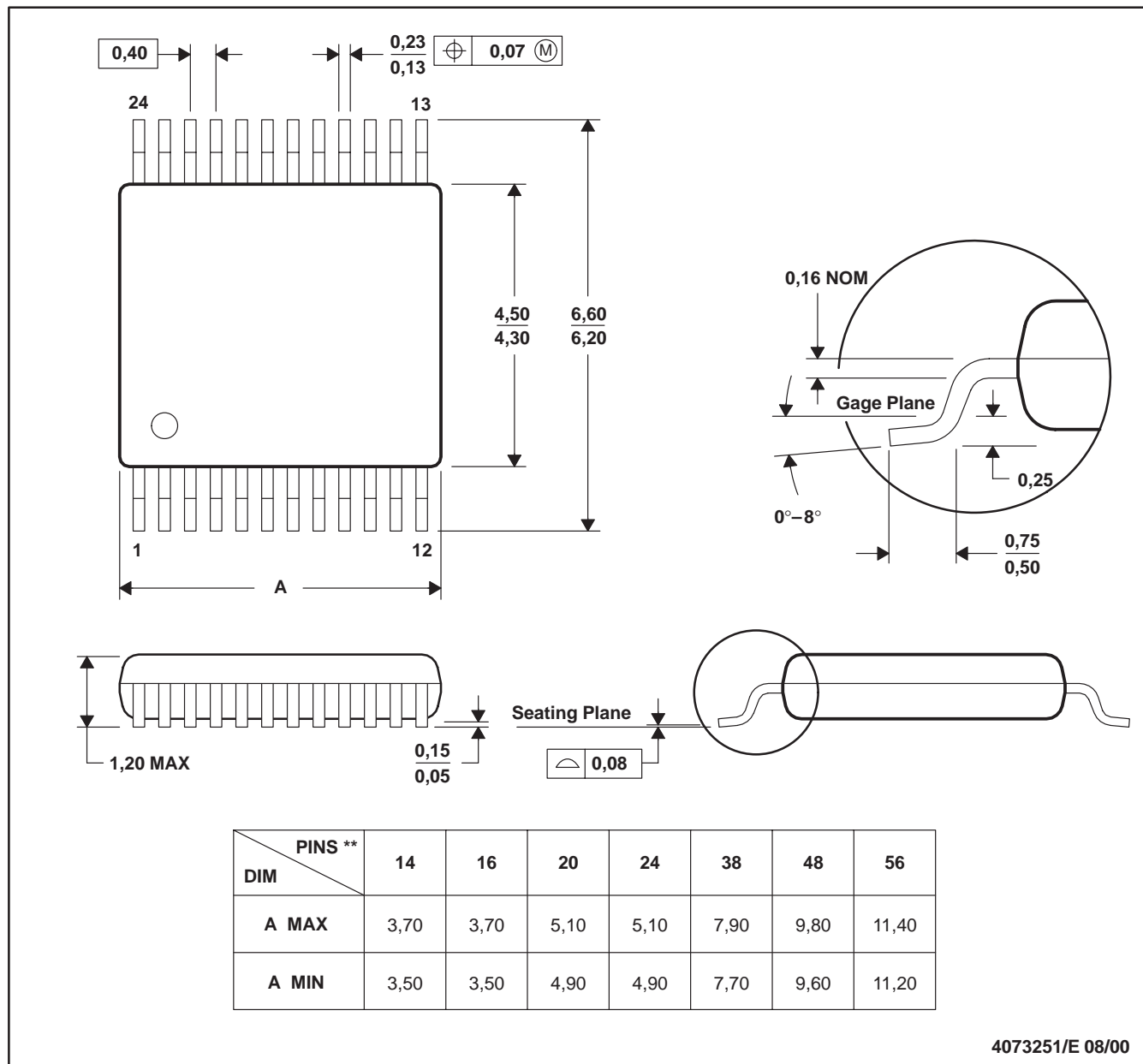
MECHANICAL DATA

MPDS006C – FEBRUARY 1996 – REVISED AUGUST 2000

DGV (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

24 PINS SHOWN

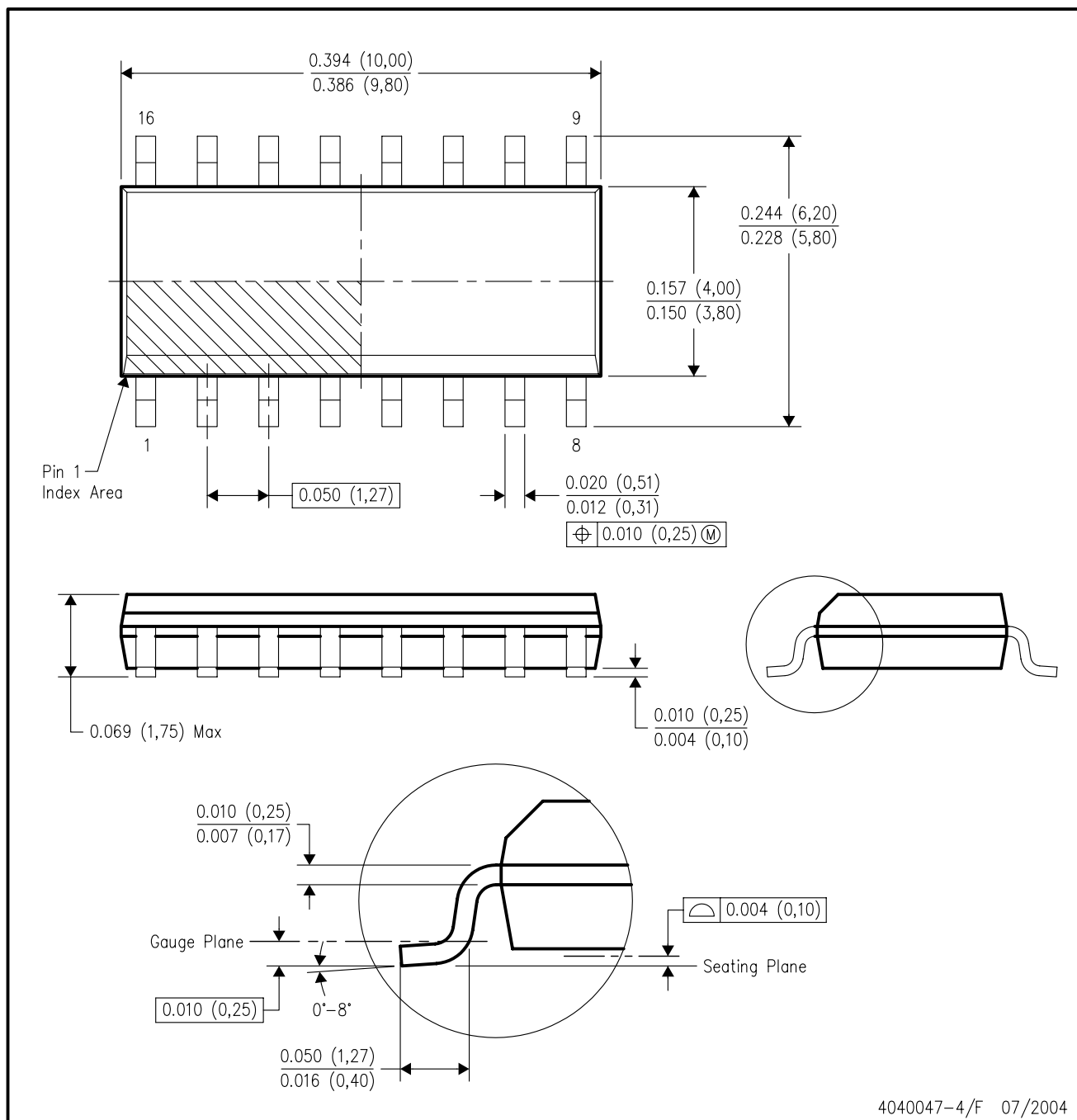


- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15 per side.
 D. Falls within JEDEC: 24/48 Pins – MO-153
 14/16/20/56 Pins – MO-194

MECHANICAL DATA

D (R-PDSO-G16)

PLASTIC SMALL-OUTLINE PACKAGE



4040047-4/F 07/2004

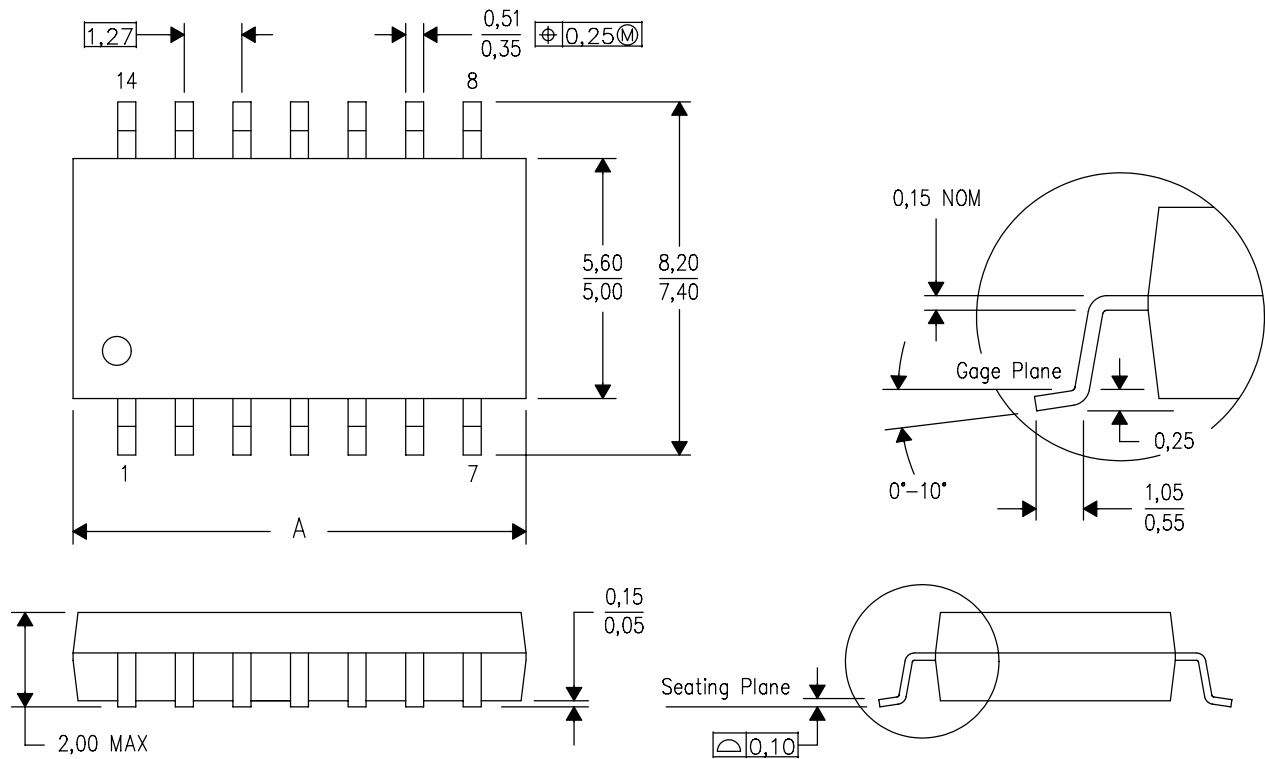
- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
 - Falls within JEDEC MS-012 variation AC.

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



DIM \ PINS **	14	16	20	24
A MAX	10,50	10,50	12,90	15,30
A MIN	9,90	9,90	12,30	14,70

4040062/C 03/03

- 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.

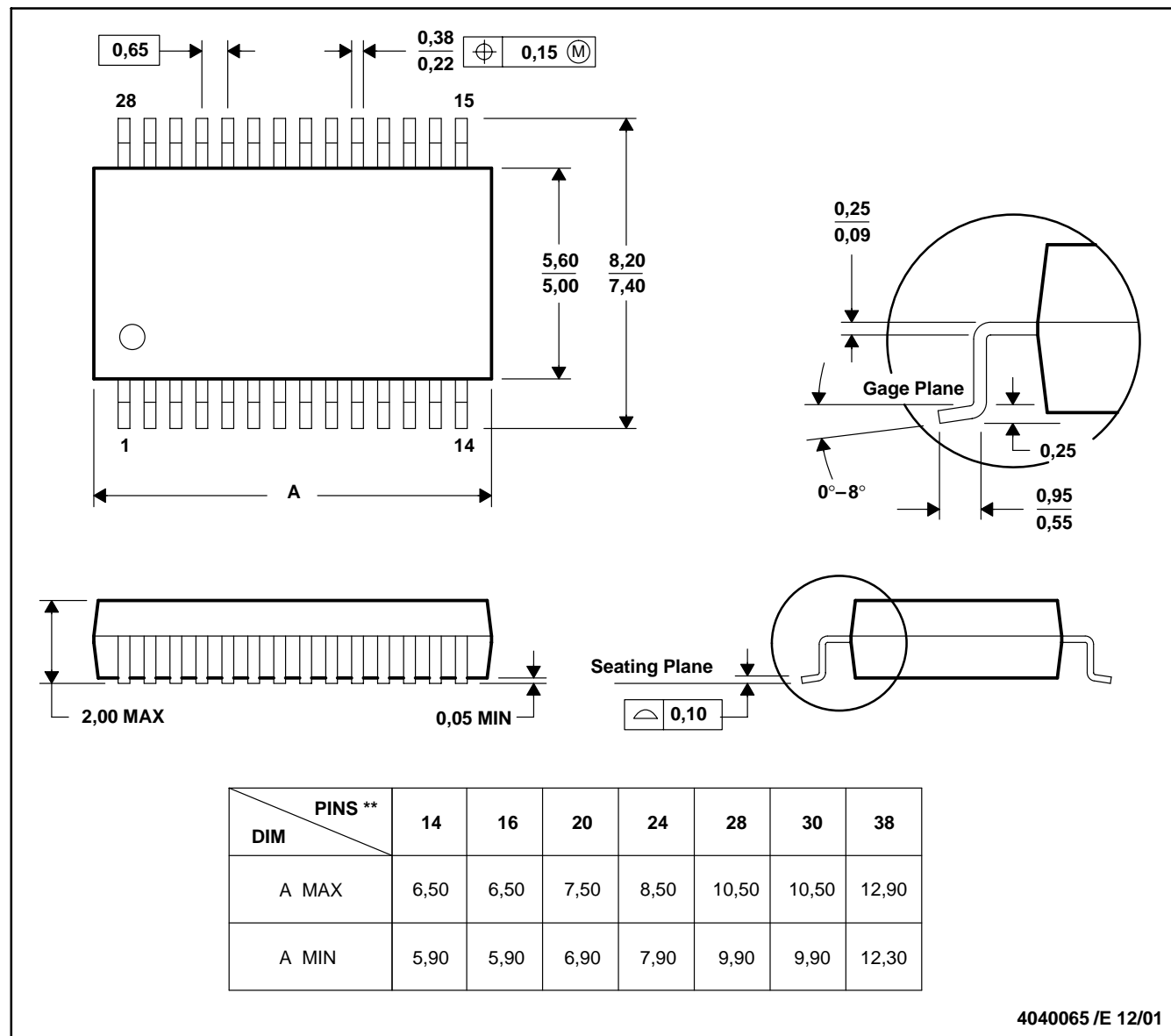
MECHANICAL DATA

MSS0002E – JANUARY 1995 – REVISED DECEMBER 2001

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

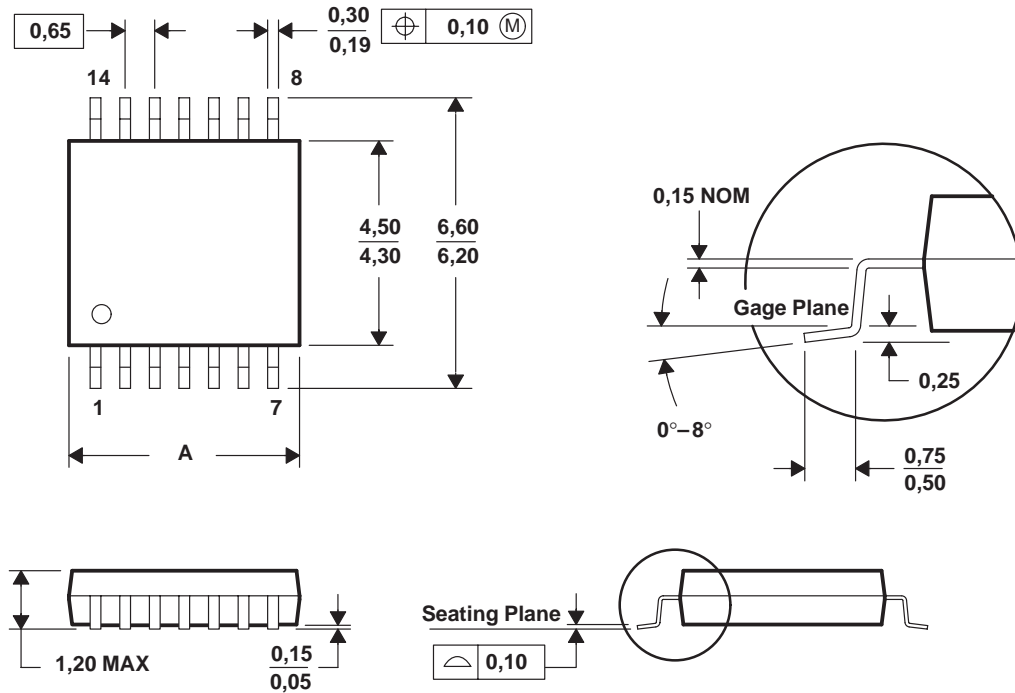
MECHANICAL DATA

MTSS001C – JANUARY 1995 – REVISED FEBRUARY 1999

PW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



PINS ** DIM	8	14	16	20	24	28
A MAX	3,10	5,10	5,10	6,60	7,90	9,80
A MIN	2,90	4,90	4,90	6,40	7,70	9,60

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- 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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