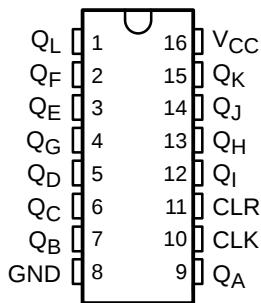


SN54LV4040A, SN74LV4040A 12-BIT ASYNCHRONOUS BINARY COUNTERS

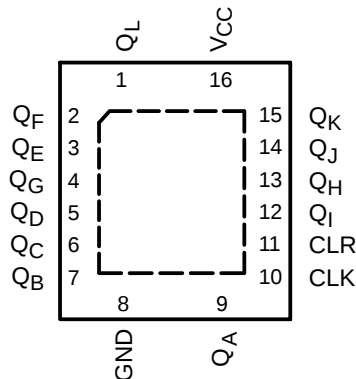
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- 2-V to 5.5-V V_{CC} Operation
- Typical V_{OLP} (Output Ground Bounce) <0.8 V at $V_{CC} = 3.3$ V, $T_A = 25^\circ\text{C}$
- Typical V_{OHV} (Output V_{OH} Undershoot) >2.3 V at $V_{CC} = 3.3$ V, $T_A = 25^\circ\text{C}$
- Support Mixed-Mode Voltage Operation on All Ports
- High On-Off Output-Voltage Ratio
- Low Crosstalk Between Switches
- Individual Switch Controls
- Extremely Low Input Current
- I_{off} Supports Partial-Power-Down Mode Operation
- 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)

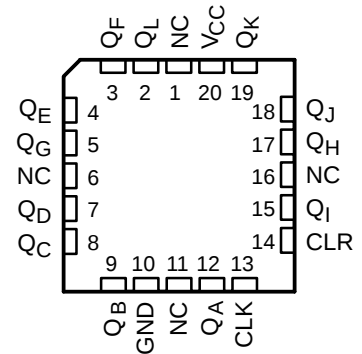
SN54LV4040A . . . J OR W PACKAGE
SN74LV4040A . . . D, DB, DGV, N, NS,
OR PW PACKAGE
(TOP VIEW)



SN74LV4040A . . . RGY PACKAGE
(TOP VIEW)



SN54LV4040A . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

description/ordering information

ORDERING INFORMATION

T_A	PACKAGE [†]		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	PDIP – N	Tube	SN74LV4040AN	SN74LV4040AN
	QFN – RGY	Tape and reel	SN74LV4040ARGYR	LW040A
	SOIC – D	Tube	SN74LV4040AD	LV4040A
		Tape and reel	SN74LV4040ADR	
	SOP – NS	Tape and reel	SN74LV4040ANSR	74LV4040A
	SSOP – DB	Tape and reel	SN74LV4040ADBR	LW040A
	TSSOP – PW	Tape and reel	SN74LV4040APWR	LW040A
–55°C to 125°C	TVSOP – DGV	Tape and reel	SN74LV4040ADGVR	LW040A
	CDIP – J	Tube	SNJ54LV4040AJ	SNJ54LV4040AJ
	CFP – W	Tube	SNJ54LV4040AW	SNJ54LV4040AW
	LCCC – FK	Tube	SNJ54LV4040AFK	SNJ54LV4040AFK

[†] 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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SN54LV4040A, SN74LV4040A

12-BIT ASYNCHRONOUS BINARY COUNTERS

SCES226F – APRIL 1999 – REVISED SEPTEMBER 2002

description/ordering information (continued)

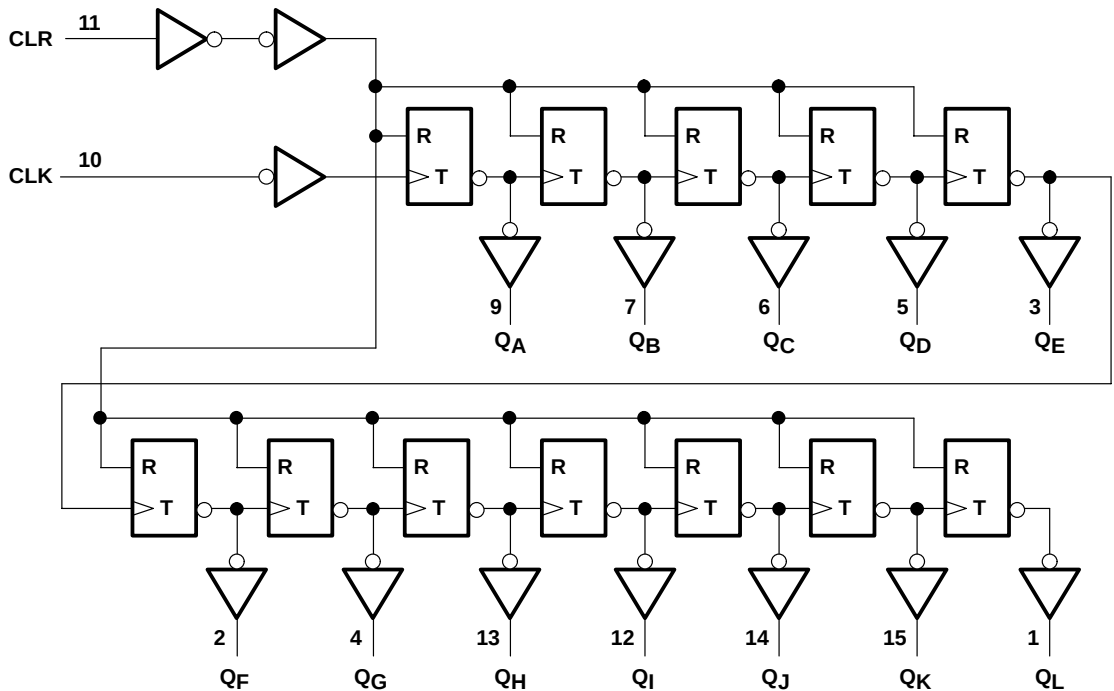
The 'LV4040A devices are 12-bit asynchronous binary counters with the outputs of all stages available externally. A high level at the clear (CLR) input asynchronously clears the counter and resets all outputs low. The count is advanced on a high-to-low transition at the clock (CLK) input. Applications include time-delay circuits, counter controls, and frequency-dividing circuits.

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
(each buffer)

INPUTS		FUNCTION
CLK	CLR	
↑	L	No change
↓	L	Advance to next stage
X	H	All outputs L

logic diagram (positive logic)



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



SN54LV4040A, SN74LV4040A 12-BIT ASYNCHRONOUS BINARY COUNTERS

SCES226F – APRIL 1999 – REVISED SEPTEMBER 2002

absolute maximum ratings over operating free-air temperature[†]

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	73°C/W
(see Note 3): DB package	82°C/W
(see Note 3): DGV package	120°C/W
(see Note 3): N package	67°C/W
(see Note 3): NS package	64°C/W
(see Note 3): PW package	108°C/W
(see Note 4): RGY package	39°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.



SN54LV4040A, SN74LV4040A

12-BIT ASYNCHRONOUS BINARY COUNTERS

SCES226F – APRIL 1999 – REVISED SEPTEMBER 2002

recommended operating conditions (see Note 5)

			SN54LV4040A		SN74LV4040A		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}	SN54LV4040A			SN74LV4040A			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	1.9			1.9			pF

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SN54LV4040A, SN74LV4040A 12-BIT ASYNCHRONOUS BINARY COUNTERS

SCES226F – APRIL 1999 – REVISED SEPTEMBER 2002

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)

			$T_A = 25^\circ\text{C}$		SN54LV4040A		SN74LV4040A		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t_W	Pulse duration	CLK high or low	7		7		7		ns
		CLR high	6.5		6.5		6.5		
t_{su}	Setup time	CLR inactive before CLK↓	6.5		6.5		6.5		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)

			$T_A = 25^\circ\text{C}$		SN54LV4040A		SN74LV4040A		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t_W	Pulse duration	CLK high or low	5		5		5		ns
		CLR high	5		5		5		
t_{su}	Setup time	CLR inactive before CLK↓	5		5		5		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)

			$T_A = 25^\circ\text{C}$		SN54LV4040A		SN74LV4040A		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t_W	Pulse duration	CLK high or low	5		5		5		ns
		CLR high	5		5		5		
t_{su}	Setup time	CLR inactive before CLK↓	5		5		5		ns

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	$T_A = 25^\circ\text{C}$			SN54LV4040A		SN74LV4040A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{max}			$C_L = 15\text{ pF}$	50*	115*		40*		40		MHz
			$C_L = 50\text{ pF}$	40	95		35		35		
t_{PLH}	CLK	Q_A	$C_L = 15\text{ pF}$	8.7*	19.4*		1*	23*	1	23	ns
t_{PHL}				8.7*	19.4*		1*	23*	1	23	
t_{PHL}	CLR	Any Q	$C_L = 15\text{ pF}$	9.3*	19.9*		1*	24*	1	24	ns
t_{PLH}	$\overline{\text{CLK}}$	Q_A	$C_L = 50\text{ pF}$	10.5	24.1		1	28	1	28	ns
t_{PHL}				10.5	24.1		1	28	1	28	
t_{PHL}	CLR	Any Q	$C_L = 50\text{ pF}$	11.7	24.5		1	28	1	28	ns
Δt_{pd}	Q_n	Q_{n+1}	$C_L = 50\text{ pF}$	1.7	5.9		7		7		ns

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

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SN54LV4040A, SN74LV4040A

12-BIT ASYNCHRONOUS BINARY COUNTERS

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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	$T_A = 25^\circ\text{C}$			SN54LV4040A		SN74LV4040A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{max}			$C_L = 15\text{ pF}$	75*	160*		75*		75		MHz
			$C_L = 50\text{ pF}$	55	130		50		50		
t_{PLH}	CLK	Q_A	$C_L = 15\text{ pF}$		6.1*	11.9*	1*	14*	1	14	ns
t_{PHL}					6.1*	11.9*	1*	14*	1	14	
t_{PHL}	CLR	Any Q	$C_L = 15\text{ pF}$		7.1*	12.8*	1*	15*	1	15	ns
t_{PLH}	$\overline{\text{CLK}}$	Q_A	$C_L = 50\text{ pF}$		7.5	15.4	1	17.5	1	17.5	ns
t_{PHL}					7.5	15.4	1	17.5	1	17.5	
t_{PHL}	CLR	Any Q	$C_L = 50\text{ pF}$		9	16.3	1	18.5	1	18.5	ns
Δt_{pd}	Q_n	Q_{n+1}	$C_L = 50\text{ pF}$		1.2	4.4		5		5	ns

* 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	$T_A = 25^\circ\text{C}$			SN54LV4040A		SN74LV4040A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{max}			$C_L = 15\text{ pF}$	150*	235*		125*		125		MHz
			$C_L = 50\text{ pF}$	95	185		80		80		
t_{PLH}	CLK	Q_A	$C_L = 15\text{ pF}$		4.2*	7.3*	1*	8.5*	1	8.5	ns
t_{PHL}					4.2*	7.3*	1*	8.5*	1	8.5	
t_{PHL}	CLR	Any Q	$C_L = 15\text{ pF}$		5.3*	8.6*	1*	10*	1	10	ns
t_{PLH}	$\overline{\text{CLK}}$	Q_A	$C_L = 50\text{ pF}$		5.3	9.3	1	10.5	1	10.5	ns
t_{PHL}					5.3	9.3	1	10.5	1	10.5	
t_{PHL}	CLR	Any Q	$C_L = 50\text{ pF}$		6.8	10.6	1	12	1	12	ns
Δt_{pd}	Q_n	Q_{n+1}	$C_L = 50\text{ pF}$		0.8	3.1		3.5		3.5	ns

* 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		SN74LV4040A			UNIT
		MIN	TYP	MAX	
$V_{OL(P)}$	Quiet output, maximum dynamic V_{OL}		0.5	0.8	V
$V_{OL(V)}$	Quiet output, minimum dynamic V_{OL}		–0.5	–0.8	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.

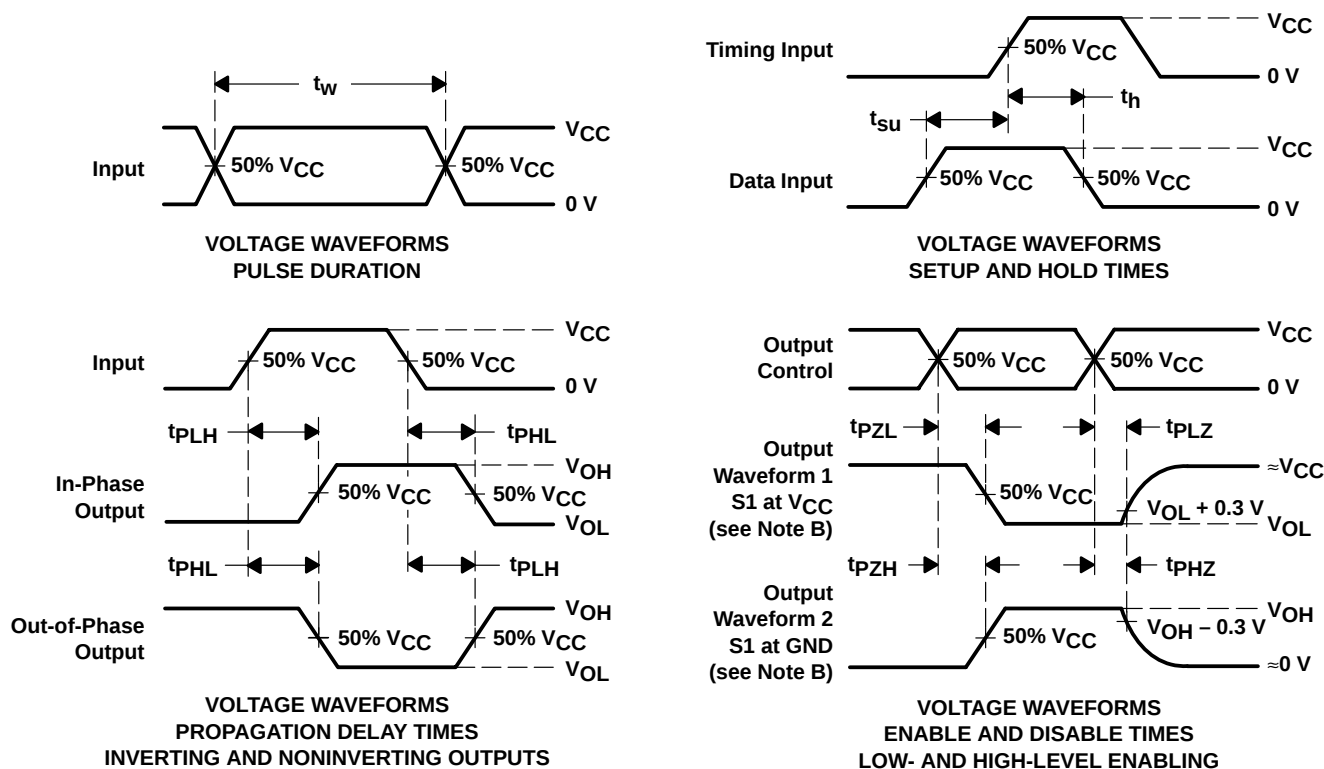
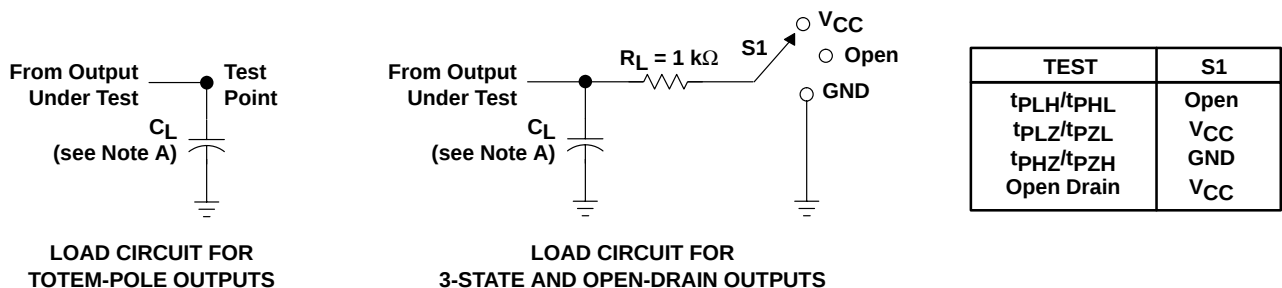
operating characteristics, $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	V_{CC}	TYP	UNIT
C_{pd} Power dissipation capacitance	$C_L = 50\text{ pF}$, $f = 10\text{ MHz}$	3.3 V	11.9	pF
		5 V	13.1	

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PARAMETER MEASUREMENT INFORMATION



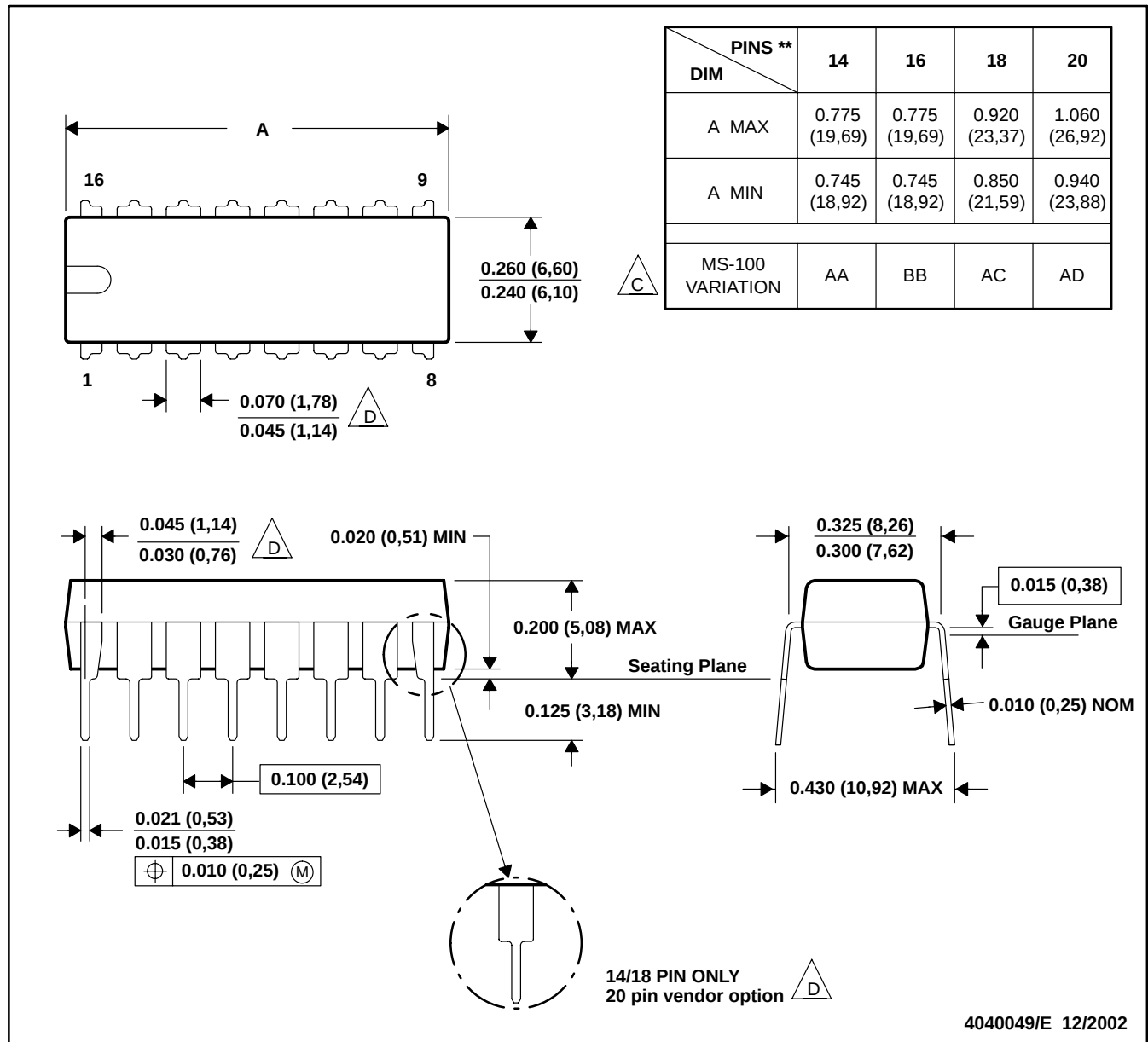
- NOTES: A. C_L includes probe and jig capacitance.
- B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
- 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. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



NOTES: A. All linear dimensions are in inches (millimeters).

B. This drawing is subject to change without notice.

C Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).

D The 20 pin end lead shoulder width is a vendor option, either half or full width.

DGV (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

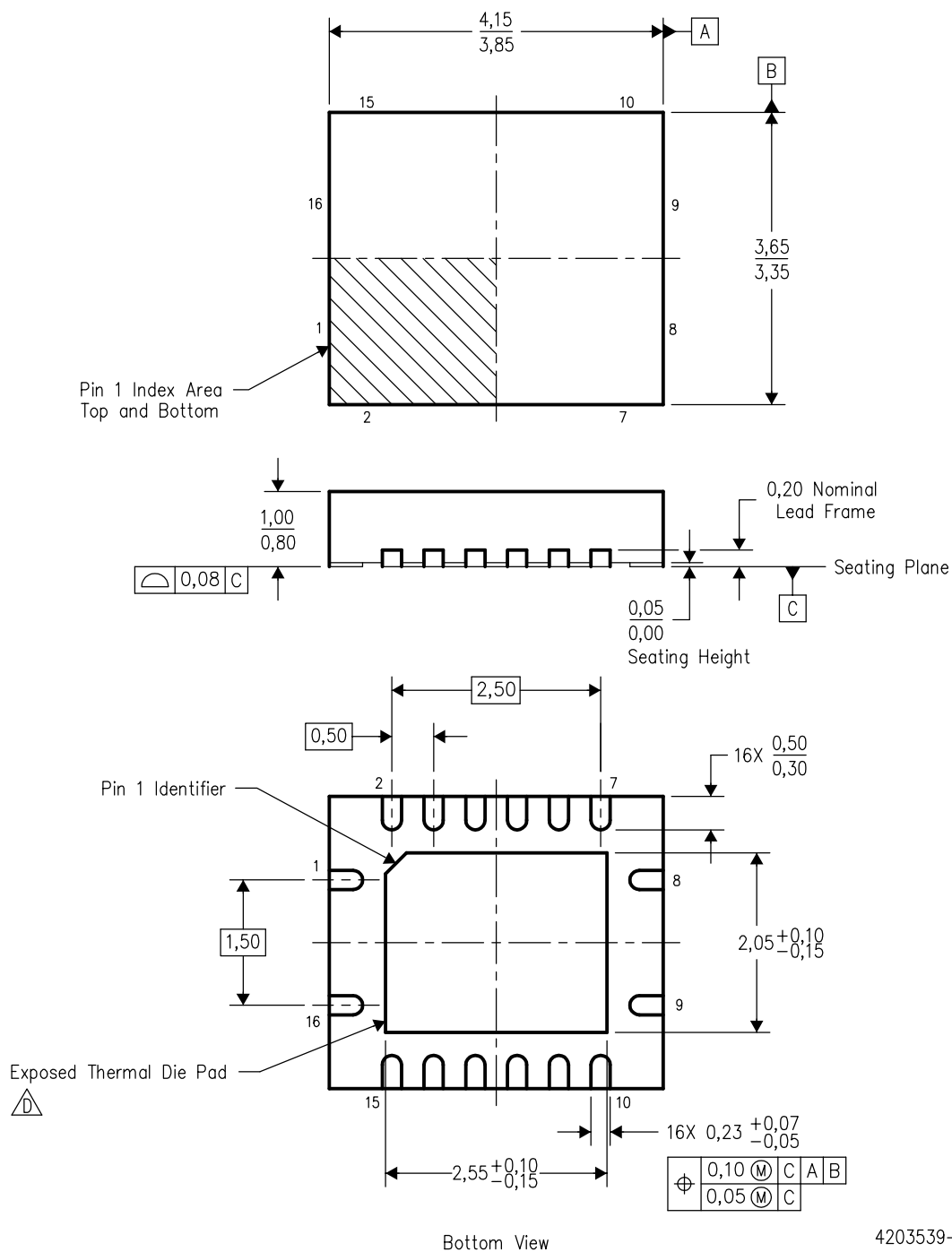
24 PINS SHOWN



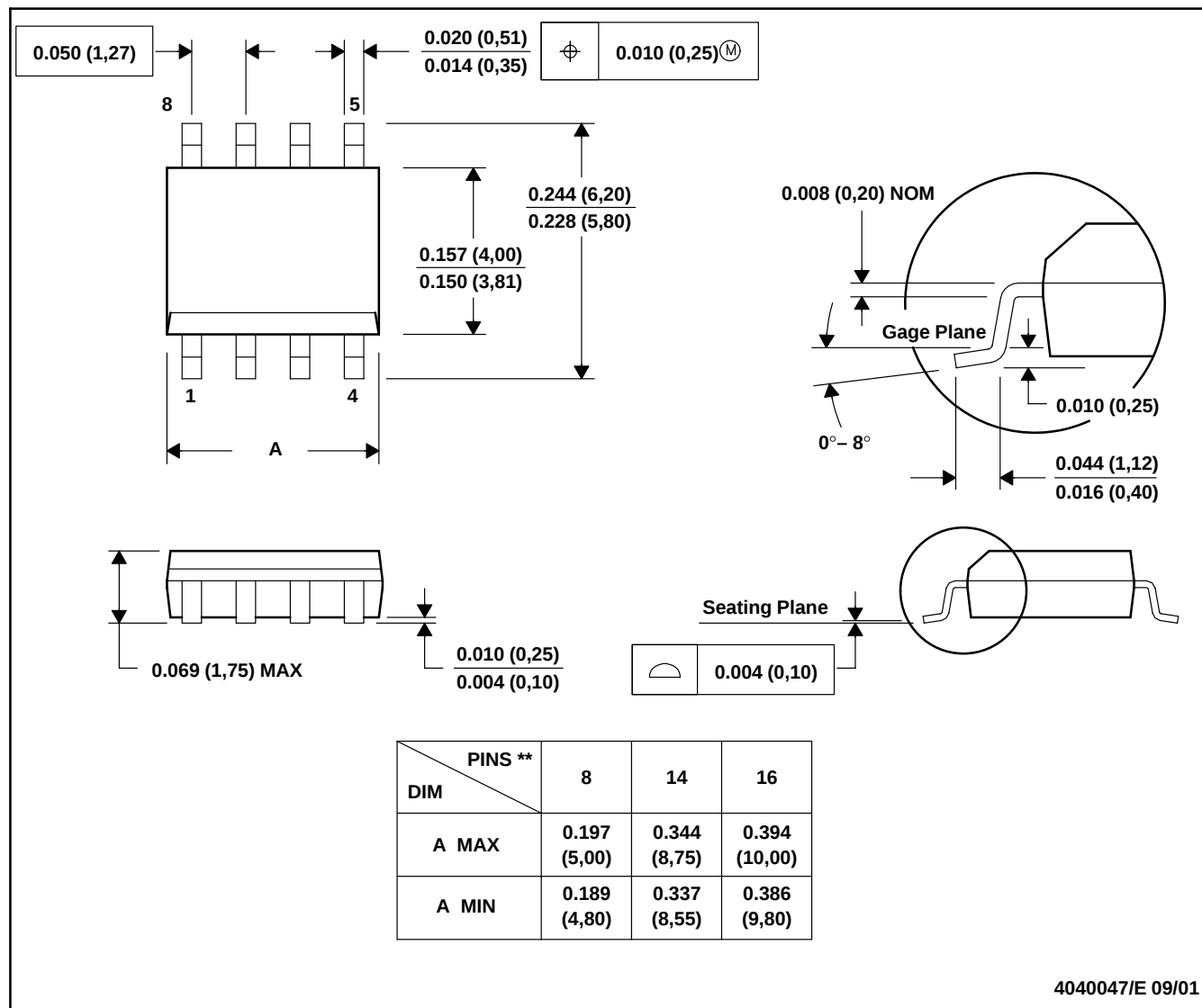
- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15 per side.
 D. Falls within JEDEC: 24/48 Pins – MO-153
 14/16/20/56 Pins – MO-194

RGY (R-PQFP-N16)

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.
 -  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 BB.

D (R-PDSO-G)****PLASTIC SMALL-OUTLINE PACKAGE****8 PINS SHOWN**

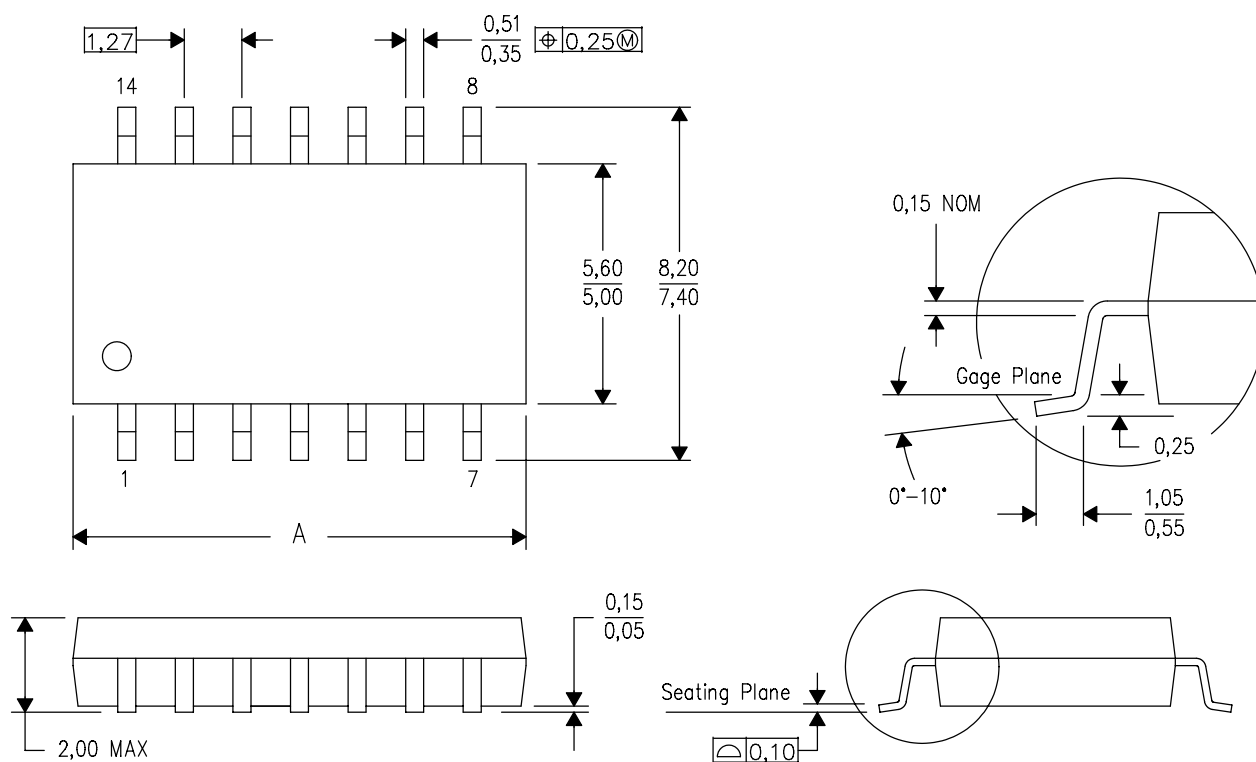
- NOTES: A. All linear dimensions are in inches (millimeters).
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0.006 (0,15).
 D. Falls within JEDEC MS-012

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.

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



- 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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