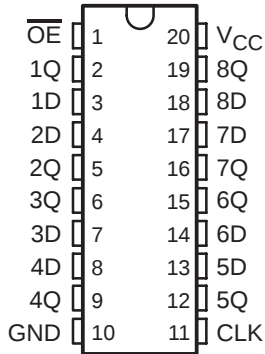


SN54LV374A, SN74LV374A OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH 3-STATE OUTPUTS

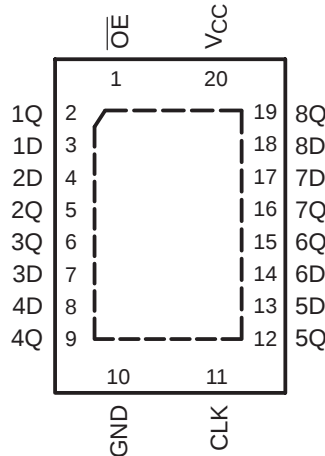
SCLS408G – APRIL 1998 – REVISED DECEMBER 2004

- 2-V to 5.5-V V_{CC} Operation
- Max t_{pd} of 9.5 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
- I_{off} Supports Partial-Power-Down Mode Operation
- 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)

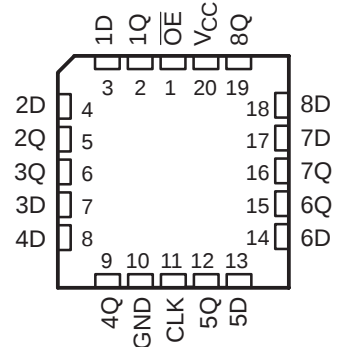
SN54LV374A . . . J OR W PACKAGE
SN74LV374A . . . DB, DGV, DW, NS,
OR PW PACKAGE
(TOP VIEW)



SN74LV374A . . . RGY PACKAGE
(TOP VIEW)



SN54LV374A . . . FK PACKAGE
(TOP VIEW)



description/ordering information

The 'LV374A devices are octal edge-triggered D-type flip-flops 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	SN74LV374ARGYR	LV374A
	SOIC – DW	Tube of 25	SN74LV374ADW	LV374A
		Reel of 2000	SN74LV374ADWR	
	SOP – NS	Reel of 2000	SN74LV374ANSR	74LV374A
	SSOP – DB	Reel of 2000	SN74LV374ADBR	LV374A
	TSSOP – PW	Tube of 70	SN74LV374APW	LV374A
		Reel of 2000	SN74LV374APWR	LV374A
		Reel of 250	SN74LV374APWT	LV374A
-55°C to 125°C	TVSOP – DGV	Reel of 2000	SN74LV374ADGVR	LV374A
	VFBGA – GQN	Reel of 1000	SN74LV374AGQNR	LV374A
	CDIP – J	Tube of 20	SNJ54LV374AJ	SNJ54LV374AJ
	CFP – W	Tube of 85	SNJ54LV374AW	SNJ54LV374AW
	LCCC – FK	Tube of 55	SNJ54LV374AFK	SNJ54LV374AFK

[†] 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.

UNLESS OTHERWISE NOTED this document contains PRODUCTION DATA information current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS
INSTRUMENTS**

POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 2004, Texas Instruments Incorporated

SN54LV374A, SN74LV374A
OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS
WITH 3-STATE OUTPUTS

SCLS408G – APRIL 1998 – REVISED DECEMBER 2004

description/ordering information (continued)

These devices feature 3-state outputs designed specifically for driving highly capacitive or relatively low-impedance loads. They are particularly suitable for implementing buffer registers, I/O ports, bidirectional bus drivers, and working registers.

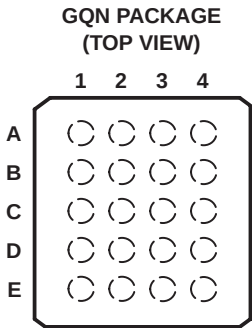
On the positive transition of the clock (CLK) input, the Q outputs are set to the logic levels set up at the data (D) inputs.

A buffered output-enable ($\overline{OE}$) input can be used to place the eight outputs in either a normal logic state (high or low logic levels) or high-impedance state. In the high-impedance state, the outputs neither load nor drive the bus lines significantly. The high-impedance state and the increased drive provide the capability to drive bus lines without need for interface or pullup components.

$\overline{OE}$ does not affect internal operations of the latch. Old data can be retained or new data can be entered while the outputs are in the high-impedance state.

To ensure the high-impedance state during power up or power down, $\overline{OE}$ should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

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.



terminal assignments

	1	2	3	4
A	1Q	$\overline{OE}$	V_{CC}	8Q
B	2D	7D	1D	8D
C	3Q	2Q	6Q	7Q
D	4D	5D	3D	6D
E	GND	4Q	CLK	5Q

FUNCTION TABLE
(each flip-flop)

INPUTS			OUTPUT Q
$\overline{OE}$	CLK	D	
L	↑	H	H
L	↑	L	L
L	L	X	Q_0
H	X	X	Z

SCLS408G – APRIL 1998 – REVISED DECEMBER 2004

Logic diagram of a 1D latch. Inputs: OE (1), CLK (11), 1D (3). Output: 1Q (2). The diagram shows a 1D latch block with inputs C1 and 1D. The 1D input is connected to the 1D input of the latch. The C1 input is connected to the output of a 2-input AND gate. The inputs to this AND gate are the output of a NOT gate (input OE) and the output of another NOT gate (input CLK). The output of the 1D latch is connected to the output of a third NOT gate, which produces the 1Q signal. A bracket indicates that the output 1Q is connected to seven other channels.

3

SN54LV374A, SN74LV374A

OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS

WITH 3-STATE OUTPUTS

SCLS408G – APRIL 1998 – REVISED DECEMBER 2004

recommended operating conditions (see Note 5)

			SN54LV374A		SN74LV374A		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	High or low state	0	V _{CC}	0	V _{CC}	V
		3-state	0	5.5	0	5.5	
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	−8		−8		
		V _{CC} = 4.5 V to 5.5 V	−16		−16		
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	8		8		
		V _{CC} = 4.5 V to 5.5 V	16		16		
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}	SN54LV374A			SN74LV374A			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} = -8 mA	3 V	2.48			2.48			
	I _{OH} = -16 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} = 8 mA	3 V	0.44			0.44			
	I _{OL} = 16 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 _{OZ}	V _O = V _{CC} or GND	5.5 V	±5			±5			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	2.9			2.9			pF

PRODUCT PREVIEW information concerns products in the formative or design phase of development. Characteristic data and other specifications are design goals. Texas Instruments reserves the right to change or discontinue these products without notice.



SN54LV374A, SN74LV374A OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH 3-STATE OUTPUTS

SCLS408G – APRIL 1998 – 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)

		$T_A = 25^\circ\text{C}$		SN54LV374A		SN74LV374A		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
t_W	Pulse duration, CLK high or low	6		7		7		ns
t_{SU}	Setup time, data before CLK $\uparrow$	5		5.5		5.5		ns
t_H	Hold time, data after CLK $\uparrow$	2.5		2.5		2.5		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)

		$T_A = 25^\circ\text{C}$		SN54LV374A		SN74LV374A		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
t_W	Pulse duration, CLK high or low	5		5.5		5.5		ns
t_{SU}	Setup time, data before CLK $\uparrow$	4.5		4.5		4.5		ns
t_H	Hold time, data after CLK $\uparrow$	2		2		2		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)

		$T_A = 25^\circ\text{C}$		SN54LV374A		SN74LV374A		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
t_W	Pulse duration, CLK high or low	5		5		5		ns
t_{SU}	Setup time, data before CLK $\uparrow$	3		3		3		ns
t_H	Hold time, data after CLK $\uparrow$	2		2		2		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	$T_A = 25^\circ\text{C}$			SN54LV374A		SN74LV374A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{max}			$C_L = 15\text{ pF}$	60*	105*		50*		50		MHz
			$C_L = 50\text{ pF}$	50	85		40		40		
t_{pd}	CLK	Q	$C_L = 15\text{ pF}$	9.7*	16.3*		1*	19*	1	19	ns
t_{en}	$\overline{OE}$	Q		8.9*	15.9*		1*	19*	1	19	
t_{dis}	$\overline{OE}$	Q		6.3*	12.6*		1*	15*	1	15	
t_{pd}	CLK	Q	$C_L = 50\text{ pF}$	11.8	19.3		1	23	1	23	ns
t_{en}	$\overline{OE}$	Q		10.9	18.8		1	22	1	22	
t_{dis}	$\overline{OE}$	Q		8.2	17.3		1	19	1	19	
$t_{sk(o)}$					2					2	

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

PRODUCT PREVIEW information concerns products in the formative or design phase of development. Characteristic data and other specifications are design goals. Texas Instruments reserves the right to change or discontinue these products without notice.



POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

SN54LV374A, SN74LV374A

OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS

WITH 3-STATE OUTPUTS

SCLS408G – APRIL 1998 – REVISED DECEMBER 2004

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	$T_A = 25^\circ\text{C}$			SN54LV374A		SN74LV374A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{max}			$C_L = 15\text{ pF}$	80*	150*		70*		70		MHz
			$C_L = 50\text{ pF}$	55	110		50		50		
t_{pd}	CLK	Q	$C_L = 15\text{ pF}$	6.8*	12.7*		1*	15*	1	15	ns
t_{en}	$\overline{\text{OE}}$	Q		6.3*	11*		1*	13*	1	13	
t_{dis}	$\overline{\text{OE}}$	Q		4.7*	10.5*		1*	12.5*	1	12.5	
t_{pd}	CLK	Q	$C_L = 50\text{ pF}$	8.3	16.2		1	18.5	1	18.5	ns
t_{en}	$\overline{\text{OE}}$	Q		7.7	14.5		1	16.5	1	16.5	
t_{dis}	$\overline{\text{OE}}$	Q		5.9	14		1	16	1	16	
$t_{\text{sk(o)}}$					1.5					1.5	

* 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	$T_A = 25^\circ\text{C}$			SN54LV374A		SN74LV374A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
f_{max}			$C_L = 15\text{ pF}$	130*	205*		110*		110		MHz
			$C_L = 50\text{ pF}$	85	170		75		75		
t_{pd}	CLK	Q	$C_L = 15\text{ pF}$	4.9*	8.1*		1*	9.5*	1	9.5	ns
t_{en}	$\overline{\text{OE}}$	Q		4.6*	7.6*		1*	9*	1	9	
t_{dis}	$\overline{\text{OE}}$	Q		3.4*	6.8*		1*	8*	1	8	
t_{pd}	CLK	Q	$C_L = 50\text{ pF}$	5.9	10.1		1	11.5	1	11.5	ns
t_{en}	$\overline{\text{OE}}$	Q		5.5	9.6		1	11	1	11	
t_{dis}	$\overline{\text{OE}}$	Q		4	8.8		1	10	1	10	
$t_{\text{sk(o)}}$					1					1	

* 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				SN74LV374A			UNIT
				MIN	TYP	MAX	
$V_{OL(P)}$	Quiet output, maximum dynamic V_{OL}				0.6	0.8	V
$V_{OL(V)}$	Quiet output, minimum dynamic V_{OL}				-0.5	-0.8	V
$V_{OH(V)}$	Quiet output, minimum dynamic V_{OH}				2.9		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	Outputs enabled	$C_L = 50\text{ pF}$, $f = 10\text{ MHz}$	3.3 V	21.1	pF
				5 V	22.8	

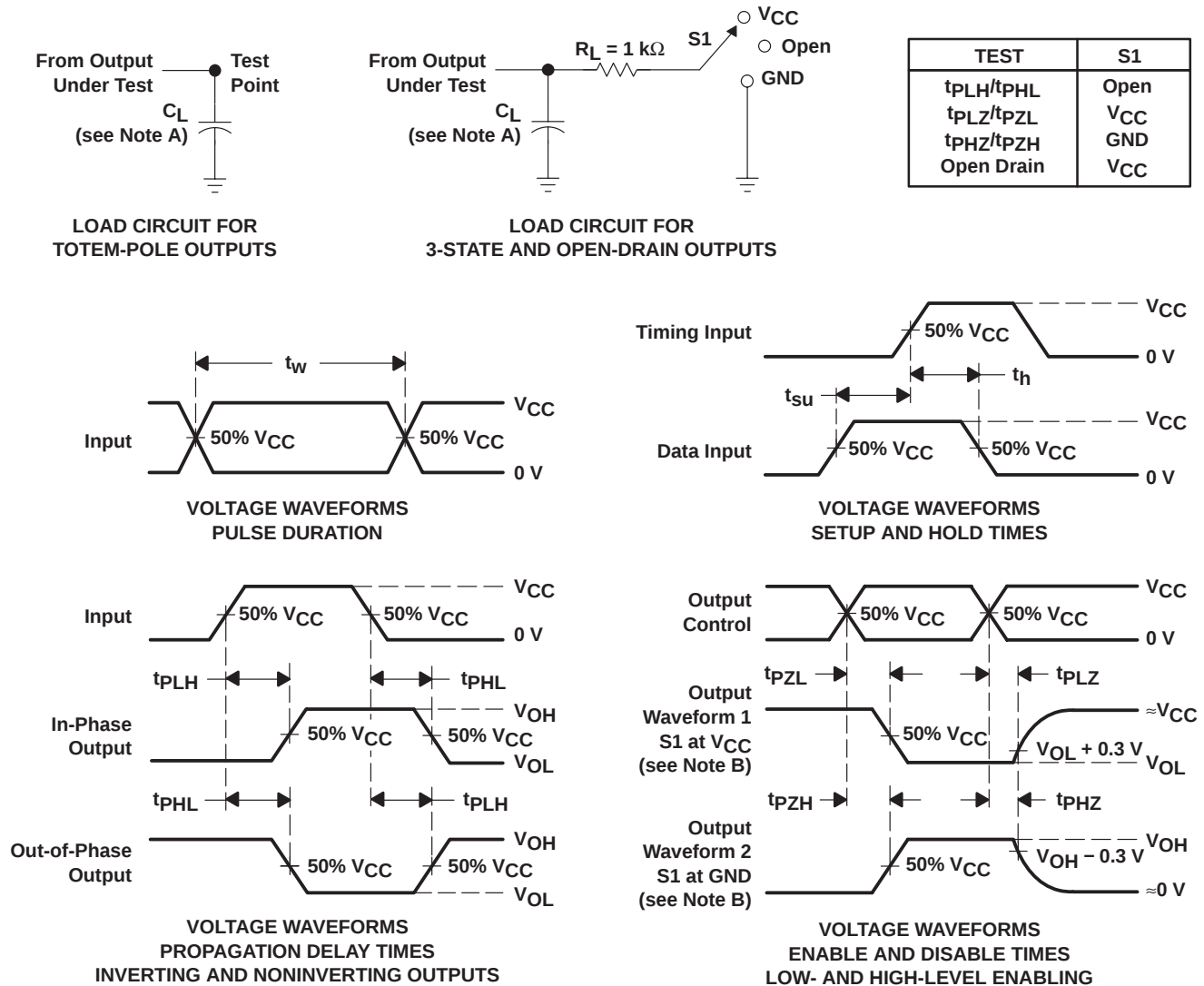
PRODUCT PREVIEW information concerns products in the formative or design phase of development. Characteristic data and other specifications are design goals. Texas Instruments reserves the right to change or discontinue these products without notice.



SN54LV374A, SN74LV374A OCTAL EDGE-TRIGGERED D-TYPE FLIP-FLOPS WITH 3-STATE OUTPUTS

SCLS408G – APRIL 1998 – REVISED DECEMBER 2004

PARAMETER MEASUREMENT INFORMATION



- NOTES:
- C_L includes probe and jig capacitance.
 - 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.
 - All input pulses are supplied by generators having the following characteristics: $PRR \leq 1\text{ MHz}$, $Z_O = 50\ \Omega$, $t_r \leq 3\text{ ns}$, $t_f \leq 3\text{ ns}$.
 - The outputs are measured one at a time, with one input transition per measurement.
 - t_{PLZ} and t_{PHZ} are the same as t_{dis} .
 - t_{PZL} and t_{PZH} are the same as t_{en} .
 - t_{PHL} and t_{PLH} are the same as t_{pd} .
 - 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⁾
SN74LV374ADBR	ACTIVE	SSOP	DB	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74LV374ADGVR	ACTIVE	TVSOP	DGV	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
SN74LV374ADW	ACTIVE	SOIC	DW	20	25	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
SN74LV374ADWR	ACTIVE	SOIC	DW	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
SN74LV374AGQNR	ACTIVE	VFBGA	GQN	20	1000	None	SNPB	Level-1-240C-UNLIM
SN74LV374ANSR	ACTIVE	SO	NS	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74LV374APW	ACTIVE	TSSOP	PW	20	70	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
SN74LV374APWR	ACTIVE	TSSOP	PW	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
SN74LV374APWT	ACTIVE	TSSOP	PW	20	250	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
SN74LV374ARGYR	ACTIVE	QFN	RGY	20	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR
SN74LV374AZQNR	ACTIVE	VFBGA	ZQN	20	1000	Pb-Free (RoHS)	SNAGCU	Level-1-260C-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 - May not be currently available - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

None: Not yet available Lead (Pb-Free).

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" and in addition, uses package materials that do not contain halogens, including bromine (Br) or antimony (Sb) above 0.1% of total product weight.

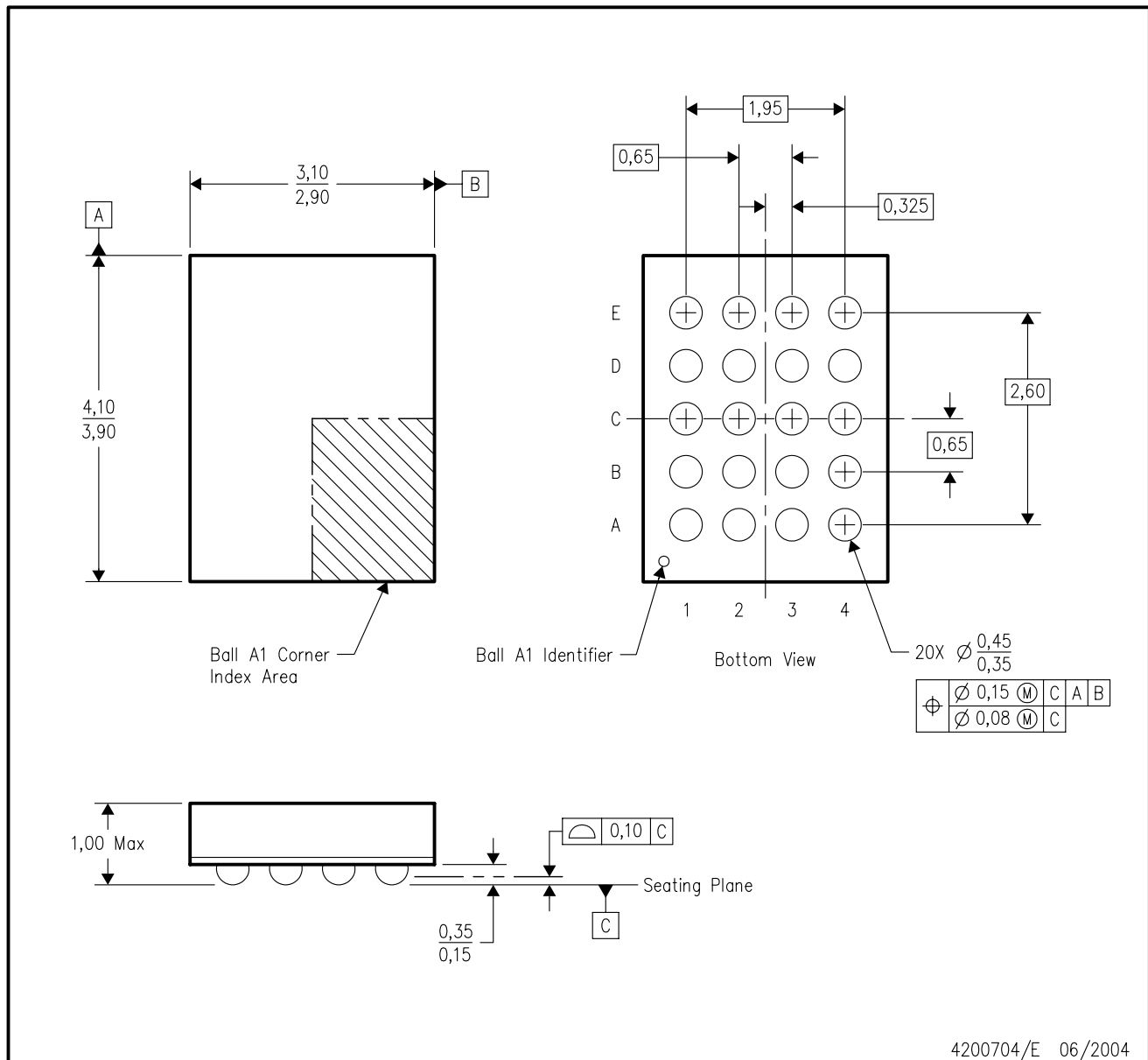
⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

GQN (R-PBGA-N20)

PLASTIC BALL GRID ARRAY

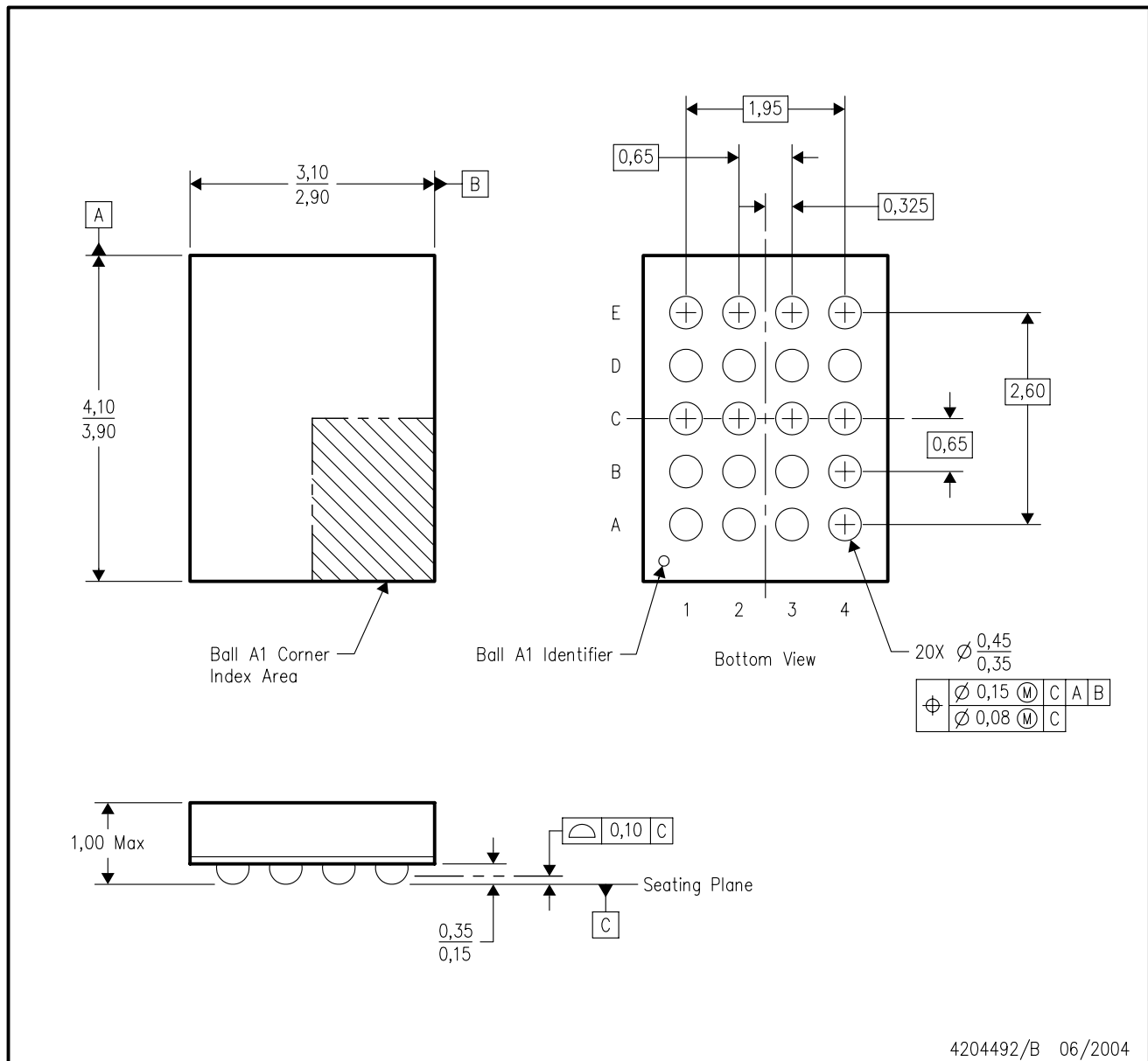


4200704/E 06/2004

- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Falls within JEDEC MO-225 variation BC.
 - This package is tin-lead (SnPb). Refer to the 20 ZQN package (drawing 4204492) for lead-free.

ZQN (R-PBGA-N20)

PLASTIC BALL GRID ARRAY



4204492/B 06/2004

- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Falls within JEDEC MO-225 variation BC.
 - This package is lead-free. Refer to the 20 GQN package (drawing 4200704) for tin-lead (SnPb).

DGV (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

24 PINS SHOWN



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

DW (R-PDSO-G20)

PLASTIC SMALL-OUTLINE PACKAGE

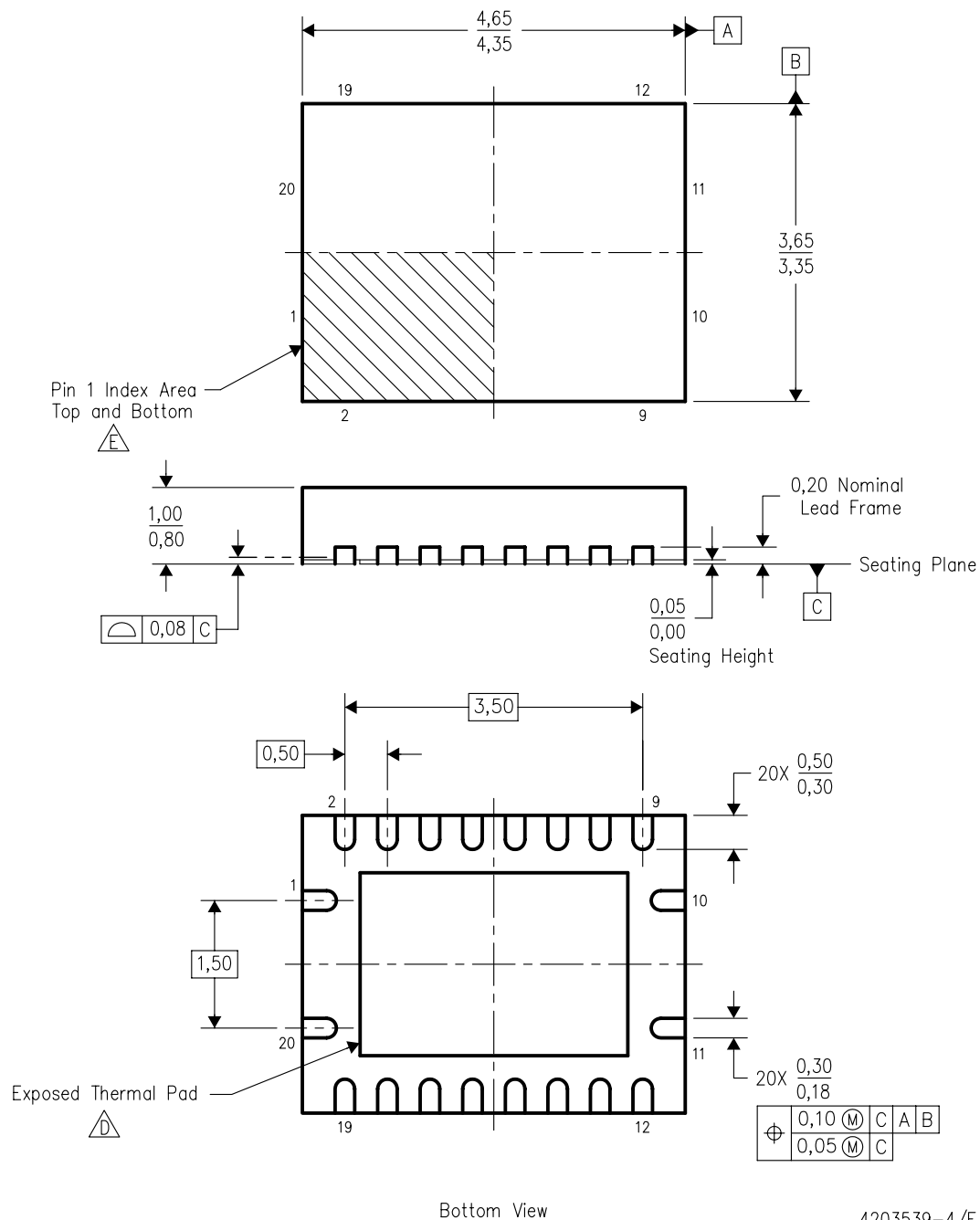


4040000-4/F 06/2004

- 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-013 variation AC.

RGY (R-PQFP-N20)

PLASTIC QUAD FLATPACK



4203539-4/F 02/2005

- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
 - B. This drawing is subject to change without notice.
 - C. QFN (Quad Flatpack No-Lead) package configuration.
 - The package thermal pad must be soldered to the board for thermal and mechanical performance. See the Product Data Sheet for details regarding the exposed thermal pad dimensions.
 - Pin 1 identifiers are located on both top and bottom of the package and within the zone indicated. The Pin 1 identifiers are either a molded, marked, or metal feature.
 - F. Package complies to JEDEC MO-241 variation BC.

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - 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

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		Applications	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DSP	dsp.ti.com	Broadband	www.ti.com/broadband
Interface	interface.ti.com	Digital Control	www.ti.com/digitalcontrol
Logic	logic.ti.com	Military	www.ti.com/military
Power Mgmt	power.ti.com	Optical Networking	www.ti.com/opticalnetwork
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
		Telephony	www.ti.com/telephony
		Video & Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments
Post Office Box 655303 Dallas, Texas 75265

Copyright © 2005, Texas Instruments Incorporated