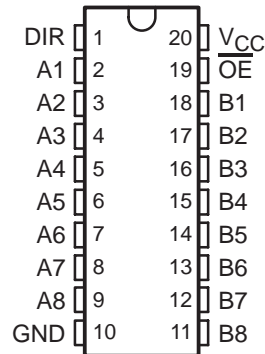
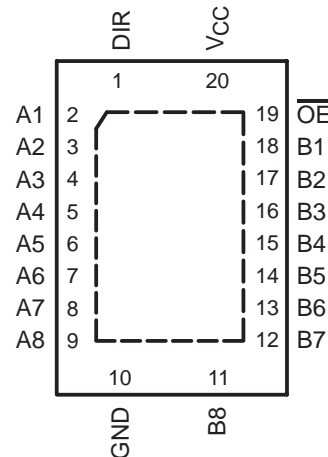


- Inputs Are TTL-Voltage Compatible
- 4.5-V to 5.5-V V_{CC} Operation
- Typical t_{pd} of 3.5 ns at 5 V
- Typical V_{OLP} (Output Ground Bounce)
 <0.8 V at $V_{CC} = 5$ V, $T_A = 25^\circ\text{C}$
- Typical V_{OHV} (Output V_{OH} Undershoot)
 >2.3 V at $V_{CC} = 5$ V, $T_A = 25^\circ\text{C}$
- Supports 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)
 - 1000-V Charged-Device Model (C101)

DB, DGV, DW, NS, OR PW PACKAGE
(TOP VIEW)



RGY PACKAGE
(TOP VIEW)



description/ordering information

This octal bus transceiver is designed for asynchronous two-way communication between data buses. The control-function implementation minimizes external timing requirements.

The SN74LV245AT allows data transmission from the A bus to the B bus or from the B bus to the A bus, depending on the logic level at the direction-control (DIR) input. The output-enable (\overline{OE}) input can be used to disable the device so that the buses are effectively isolated.

ORDERING INFORMATION

T_A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	QFN – RGY	Tape and reel	SN74LV245ATRGYR	LV245A
	SOIC – DW	Tube	SN74LV245ATDW	LV245A
		Tape and reel	SN74LV245ATDWR	
	SOP – NS	Tape and reel	SN74LV245ATNSR	74LV245A
	SSOP – DB	Tape and reel	SN74LV245ATDBR	LV245A
	TSSOP – PW	Tape and reel	SN74LV245ATPWR	LV245AT
	TVSOP – DGV	Tape and reel	SN74LV245ATDGV	LV245A

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



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PRODUCTION DATA information is 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

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SN74LV245AT
OCTAL BUS TRANSCEIVER
WITH 3-STATE OUTPUTS

SCLS605A – DECEMBER 2004 – MARCH 2005

description/ordering information (continued)

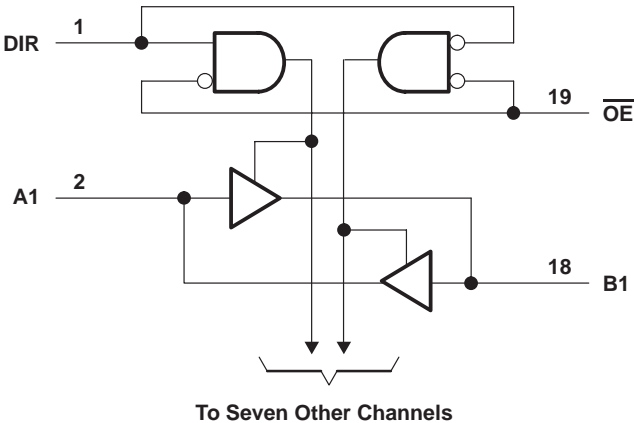
To ensure the high-impedance state during power up or power down, \overline{OE} should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

This device is fully specified for partial-power-down applications using I_{off} . The I_{off} circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

FUNCTION TABLE
(each transceiver)

INPUTS		OPERATION
\overline{OE}	DIR	
L	L	B data to A bus
L	H	A data to B bus
H	X	Isolation

logic diagram (positive logic)



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 applied in the high or low state, 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})	±35 mA
Continuous current through V_{CC} or GND	±70 mA
Package thermal impedance, θ_{JA} (see Note 3): DB package	70°C/W
(see Note 3): DGV package	92°C/W
(see Note 3): DW package	58°C/W
(see Note 3): NS package	60°C/W
(see Note 3): PW package	83°C/W
(see Note 4): RGY package	37°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.

recommended operating conditions (see Note 5)

		MIN	MAX	UNIT
V_{CC}	Supply voltage	4.5	5.5	V
V_{IH}	High-level input voltage	$V_{CC} = 4.5$ V to 5.5 V		V
V_{IL}	Low-level input voltage	$V_{CC} = 4.5$ V to 5.5 V		V
V_I	Input voltage	0	5.5	V
V_O	Output voltage	High or low state	0 V_{CC}	V
		3-state	0 5.5	
I_{OH}	High-level output current	$V_{CC} = 4.5$ V to 5.5 V		–16 mA
I_{OL}	Low-level output current	$V_{CC} = 4.5$ V to 5.5 V		16 mA
$\Delta t/\Delta v$	Input transition rise or fall rate	$V_{CC} = 4.5$ V to 5.5 V		20 ns/V
T_A	Operating free-air temperature	–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.

SN74LV245AT

OCTAL BUS TRANSCEIVER

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

PARAMETER	TEST CONDITIONS	V _{CC}	T _A = 25°C			T _A = -40°C TO 85°C		UNIT
			MIN	TYP	MAX	MIN	MAX	
V _{OH}	I _{OH} = -50 µA	4.5 V	4.4	4.5		4.4		V
	I _{OH} = -16 mA	4.5 V	3.8			3.8		
V _{OL}	I _{OL} = 50 µA	4.5 V		0	0.1		0.1	V
	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			±0.1		±1	µA
I _{OZ}	V _O = V _{CC} or GND	5.5 V			±0.25		±2.5	µA
I _{CC}	V _I = V _{CC} or GND, I _O = 0	5.5 V			2		20	µA
ΔI _{CC} [†]	One input at 3.4 V, Other inputs at V _{CC} or GND	5.5 V			1.35		1.5	mA
I _{off}	V _I or V _O = 0 to 5.5 V	0			0.5		5	µA
C _i	Control inputs	V _I = V _{CC} or GND			3			pF
C _{io}	A or B port	V _O = V _{CC} or GND			7			pF

[†] This is the increase in supply current for each input at one of the specified TTL voltage levels rather than 0 V or V_{CC}.

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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T _A = 25°C			MIN	MAX	UNIT
				MIN	TYP	MAX			
t _{PLH}	A or B	B or A	C _L = 15 pF	3.1	4.9	7.7	1	8.5	ns
t _{PHL}				2.3	4.9	7.7	1	8.5	
t _{PZH}	$\overline{\text{OE}}$	A or B	C _L = 15 pF	3.5	9.4	13.8	1	15	ns
t _{PZL}				3.7	9.4	13.8	1	15	
t _{PHZ}	$\overline{\text{OE}}$	A or B	C _L = 15 pF	3.5	3.9	7.5	1	8	ns
t _{PLZ}				2.6	3.9	7.5	1	8	
t _{PLH}	A or B	B or A	C _L = 50 pF	4.6	5.4	8.7	1	9.5	ns
t _{PHL}				4.7	5.4	8.7	1	9.5	
t _{PZH}	$\overline{\text{OE}}$	A or B	C _L = 50 pF	4.9	9.9	14.8	1	16	ns
t _{PZL}				5.3	9.9	14.8	1	16	
t _{PHZ}	$\overline{\text{OE}}$	A or B	C _L = 50 pF	4.5	10.1	15.4	1	16.5	ns
t _{PLZ}				4.1	10.1	15.4	1	16.5	
t _{sk(o)}			C _L = 50 pF			1		1	ns

noise characteristics, V_{CC} = 5 V, C_L = 50 pF (see Note 6)

PARAMETER		T _A = 25°C			UNIT
		MIN	TYP	MAX	
V _{OL(P)}	Quiet output, maximum dynamic V _{OL}		1.1	1.5	V
V _{OL(V)}	Quiet output, minimum dynamic V _{OL}		-1.1	-1.5	V
V _{OH(V)}	Quiet output, minimum dynamic V _{OH}		4		V
V _{IH(D)}	High-level dynamic input voltage		2		V
V _{IL(D)}	Low-level dynamic input voltage			0.8	V

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



operating characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS	TYP	UNIT
C_{pd}	Power dissipation capacitance	Outputs enabled $C_L = 50\text{ pF}$, $f = 10\text{ MHz}$	19	pF

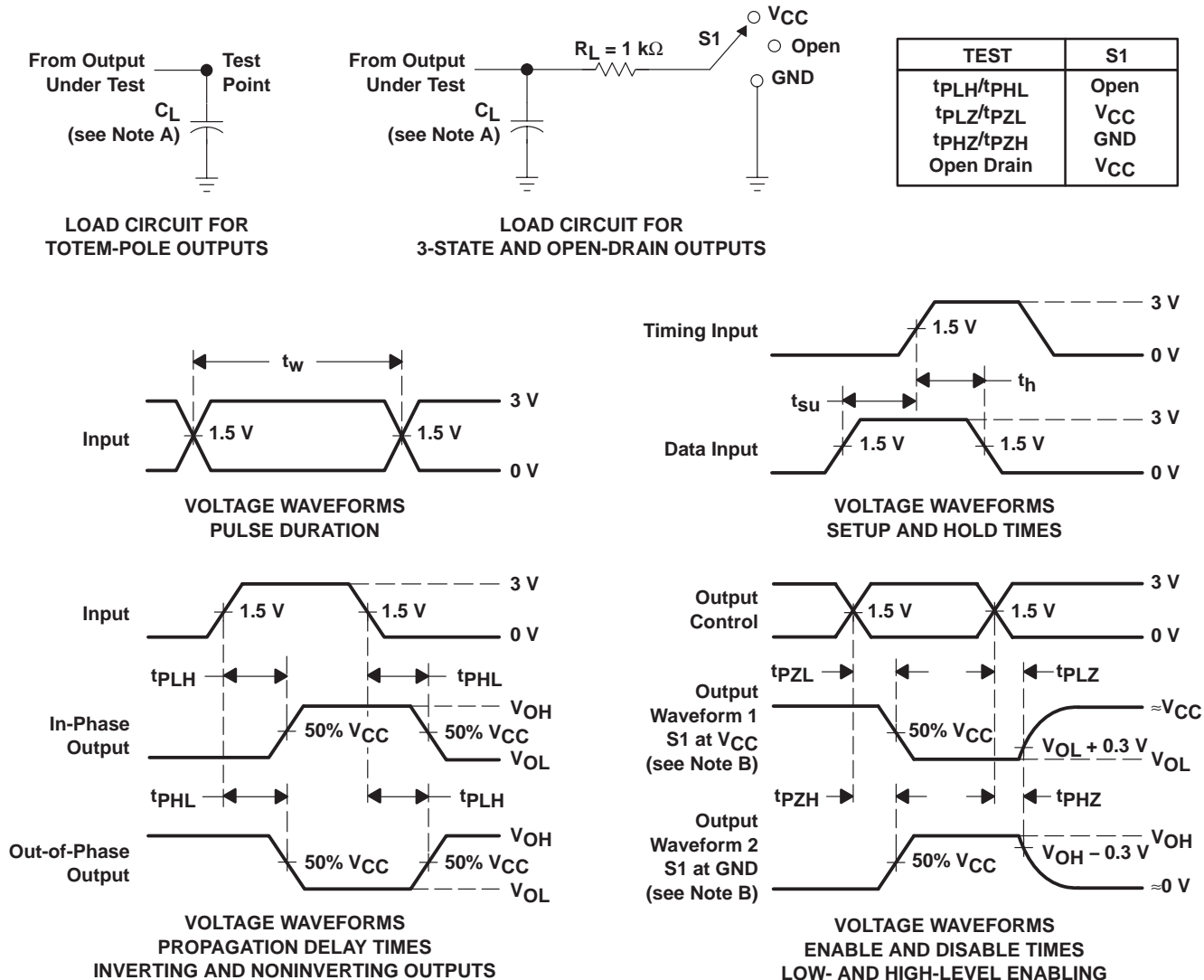
SN74LV245AT

OCTAL BUS TRANSCEIVER

WITH 3-STATE OUTPUTS

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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. 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.

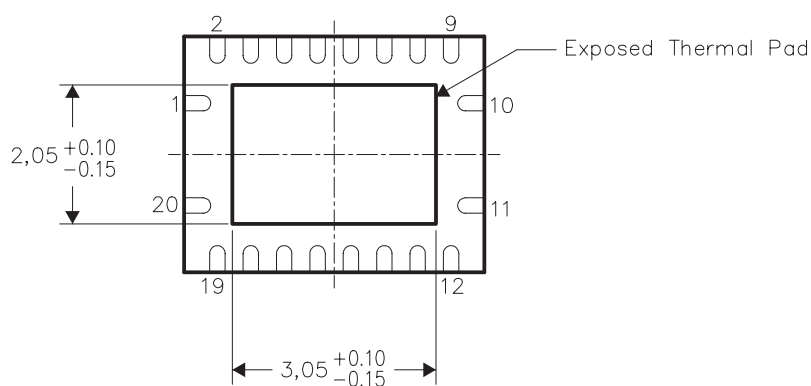
Figure 1. Load Circuit and Voltage Waveforms

THERMAL INFORMATION

This package incorporates an exposed thermal pad that is designed to be attached directly to an external heatsink. The thermal pad must be soldered directly to the printed circuit board (PCB), the PCB can be used as a heatsink. In addition, through the use of thermal vias, the thermal pad can be attached directly to a ground plane or special heatsink structure designed into the PCB. This design optimizes the heat transfer from the integrated circuit (IC).

For information on the Quad Flatpack No-Lead (QFN) package and its advantages, refer to Application Report, Quad Flatpack No-Lead Logic Packages, Texas Instruments Literature No. SCBA017. This document is available at www.ti.com.

The exposed thermal pad dimensions for this package are shown in the following illustration.



Bottom View

NOTE: All linear dimensions are in millimeters

Exposed Thermal Pad Dimensions

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
SN74LV245ATDBR	ACTIVE	SSOP	DB	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74LV245ATDGVR	ACTIVE	TVSOP	DGV	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
SN74LV245ATDW	ACTIVE	SOIC	DW	20	25	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
SN74LV245ATDWR	ACTIVE	SOIC	DW	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-250C-1 YEAR/ Level-1-235C-UNLIM
SN74LV245ATNS	ACTIVE	SO	NS	20	40	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74LV245ATNSR	ACTIVE	SO	NS	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-2-260C-1 YEAR/ Level-1-235C-UNLIM
SN74LV245ATPW	ACTIVE	TSSOP	PW	20	70	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
SN74LV245ATPWR	ACTIVE	TSSOP	PW	20	2000	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
SN74LV245ATPWT	ACTIVE	TSSOP	PW	20	250	Pb-Free (RoHS)	CU NIPDAU	Level-1-250C-UNLIM
SN74LV245ATRGYR	ACTIVE	QFN	RGY	20	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR

⁽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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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

DW (R-PDSO-G20)

PLASTIC SMALL-OUTLINE PACKAGE

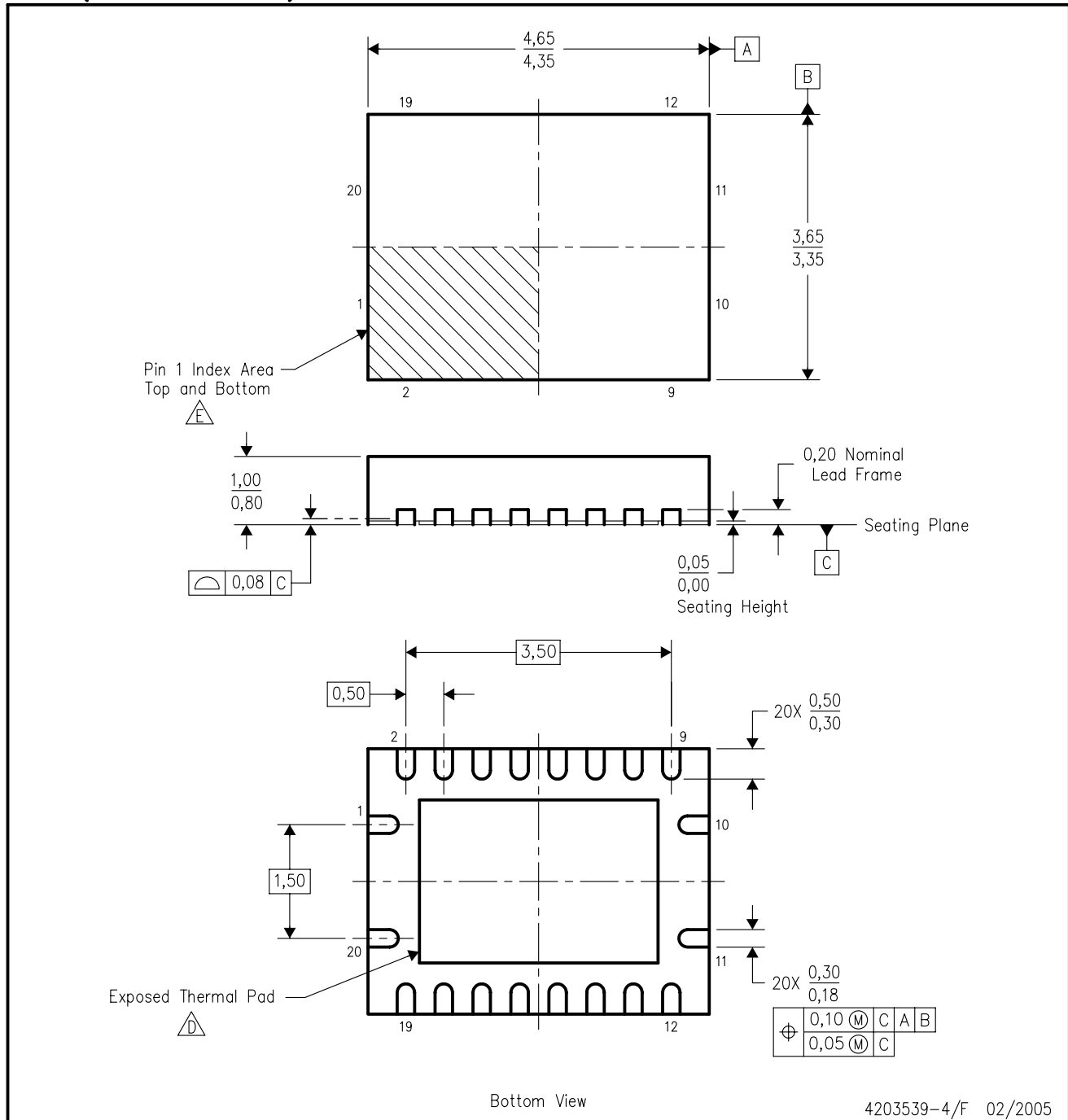


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- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
 - Falls within JEDEC MS-013 variation AC.

RGY (R-PQFP-N20)

PLASTIC QUAD FLATPACK



- NOTES:
- All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
 - This drawing is subject to change without notice.
 - 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.
 - Package complies to JEDEC MO-241 variation BC.

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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