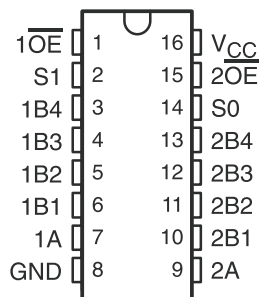


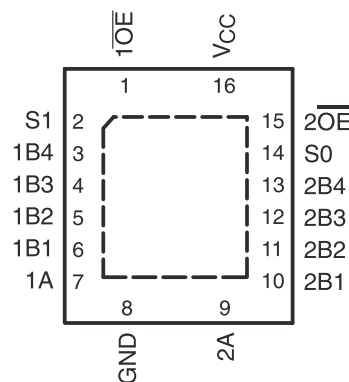
FEATURES

- SN74CBT3253C Functionally Identical to Industry-Standard '3253 Function
- Undershoot Protection for Off-Isolation on A and B Ports up to -2 V
- Bidirectional Data Flow, With Near-Zero Propagation Delay
- Low ON-State Resistance (r_{on}) Characteristics ($r_{on} = 3 \Omega$ Typical)
- Low Input/Output Capacitance Minimizes Loading and Signal Distortion ($C_{io(OFF)} = 5.5$ pF Typical)
- Data and Control Inputs Provide Undershoot Clamp Diodes
- Low Power Consumption ($I_{CC} = 3 \mu A$ Max)
- V_{CC} Operating Range From 4 V to 5.5 V
- Data I/Os Support 0 to 5-V Signaling Levels (0.8 V, 1.2 V, 1.5 V, 1.8 V, 2.5 V, 3.3 V, 5 V)
- Control Inputs Can Be Driven by TTL or 5-V/3.3-V CMOS Outputs
- I_{off} Supports Partial-Power-Down Mode Operation
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- ESD Performance Tested Per JESD 22
 - 2000-V Human-Body Model (A114-B, Class II)
 - 1000-V Charged-Device Model (C101)
- Supports I²C Bus Expansion
- Supports Both Digital and Analog
Applications: USB Interface, Bus Isolation, Low-Distortion Signal Gating

D, DB, DBQ, OR PW PACKAGE
(TOP VIEW)



RGY PACKAGE
(TOP VIEW)



DESCRIPTION/ORDERING INFORMATION

The SN74CBT3253C is a high-speed TTL-compatible FET multiplexer/demultiplexer with low ON-state resistance (r_{on}), allowing for minimal propagation delay. Active Undershoot-Protection Circuitry on the A and B ports of the SN74CBT3253C provides protection for undershoot up to -2 V by sensing an undershoot event and ensuring that the switch remains in the proper OFF state.

The SN74CBT3253C is organized as two 1-of-4 multiplexer/demultiplexers with separate output-enable ($\overline{1OE}$, $\overline{2OE}$) inputs. The select (S0, S1) inputs control the data path of each multiplexer/demultiplexer. When \overline{OE} is low, the associated multiplexer/demultiplexer is enabled, and the A port is connected to the B port, allowing bidirectional data flow between ports. When \overline{OE} is high, the associated multiplexer/demultiplexer is disabled, and a high-impedance state exists between the A and B ports.



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.

SN74CBT3253C
DUAL 1-OF-4 FET MULTIPLEXER/DEMULTIPLEXER
5-V BUS SWITCH WITH -2-V UNDERSHOOT PROTECTION

SCDS123B–JULY 2003–REVISED JANUARY 2007

DESCRIPTION/ORDERING INFORMATION (CONTINUED)

This device is fully specified for partial-power-down applications using I_{off} . The I_{off} feature ensures that damaging current will not backflow through the device when it is powered down. The device has isolation during power off.

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.

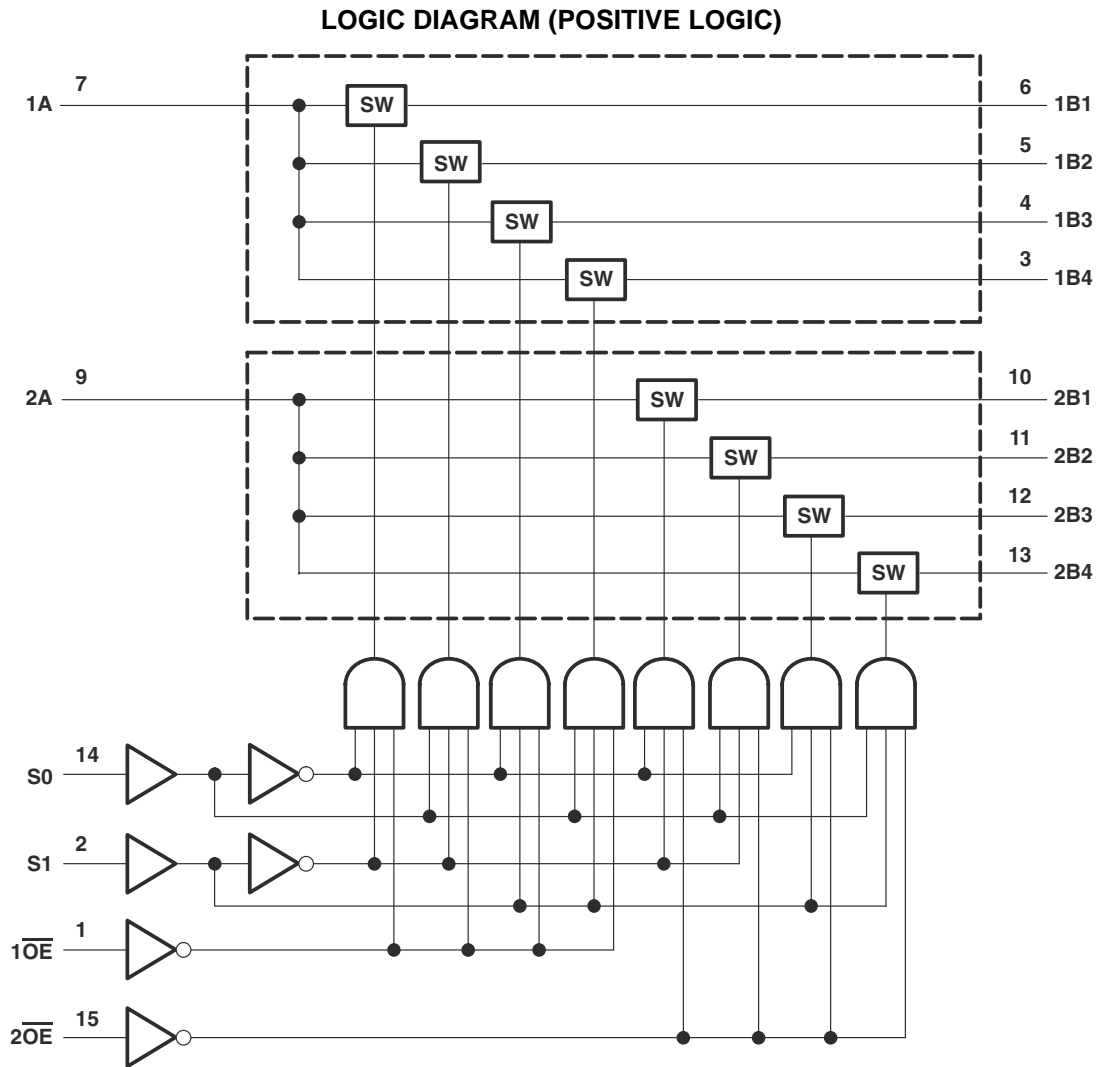
ORDERING INFORMATION

T_A	PACKAGE ⁽¹⁾		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 85°C	QFN – RGY	Reel of 1000	SN74CBT3253CRGYR	CU253C
	SOIC – D	Tube of 40	SN74CBT3253CD	CBT3253C
		Reel of 2500	SN74CBT3253CDR	
	SSOP – DB	Tube of 80	SN74CBT3253CDB	CU253C
		Reel of 2000	SN74CBT3253CDBR	
	SSOP (QSOP) – DBQ	Reel of 2500	SN74CBT3253CDBQR	CU253C
	TSSOP – PW	Tube of 90	SN74CBT3253CPW	CU253C
		Reel of 2000	SN74CBT3253CPWR	

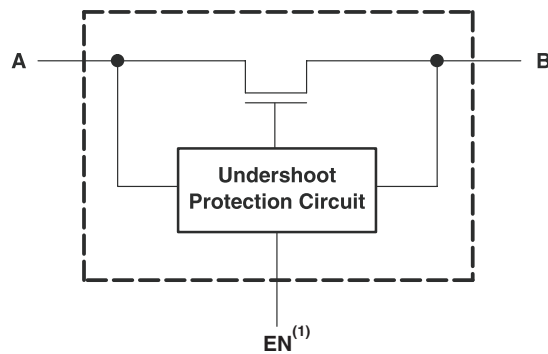
(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

FUNCTION TABLE
(each multiplexer/demultiplexer)

INPUTS			INPUT/OUTPUT A	FUNCTION
\overline{OE}	S1	S0		
L	L	L	B1	A port = B1 port
L	L	H	B2	A port = B2 port
L	H	L	B3	A port = B3 port
L	H	H	B4	A port = B4 port
H	X	X	X	Disconnect



SIMPLIFIED SCHEMATIC, EACH FET SWITCH (SW)



(1) EN is the internal enable signal applied to the switch.

SN74CBT3253C

DUAL 1-OF-4 FET MULTIPLEXER/DEMULTIPLEXER

5-V BUS SWITCH WITH -2-V UNDERSHOOT PROTECTION

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Absolute Maximum Ratings⁽¹⁾

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

		MIN	MAX	UNIT
V _{CC}	Supply voltage	-0.5	7	V
V _{IN}	Control input voltage range ⁽²⁾⁽³⁾	-0.5	7	V
V _{I/O}	Switch I/O voltage range ⁽²⁾⁽³⁾⁽⁴⁾	-0.5	7	V
I _{IK}	Control input clamp current		-50	mA
		V _{IN} < 0		
I _{I/O} K	I/O port clamp current		-50	mA
		V _{I/O} < 0		
I _{I/O}	ON-state switch current ⁽⁵⁾		±128	mA
	Continuous current through V _{CC} or GND terminals		±100	mA
θ _{JA}	Package thermal impedance	D package ⁽⁶⁾		°C/W
		DB package ⁽⁶⁾		
		DBQ package ⁽⁶⁾		
		PW package ⁽⁶⁾		
		RGY package ⁽⁷⁾		
T _{stg}	Storage temperature range	-65	150	°C

- (1) 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.
- (2) All voltages are with respect to ground unless otherwise specified.
- (3) The input and output voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
- (4) V_I and V_O are used to denote specific conditions for V_{I/O}.
- (5) I_I and I_O are used to denote specific conditions for I_{I/O}.
- (6) The package thermal impedance is calculated in accordance with JESD 51-7.
- (7) The package thermal impedance is calculated in accordance with JESD 51-5.

Recommended Operating Conditions⁽¹⁾

		MIN	MAX	UNIT
V _{CC}	Supply voltage	4	5.5	V
V _{IH}	High-level control input voltage	2	5.5	V
V _{IL}	Low-level control input voltage	0	0.8	V
V _{I/O}	Data input/output voltage	0	5.5	V
T _A	Operating free-air temperature	-40	85	°C

- (1) All unused control 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⁽¹⁾

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

PARAMETER		TEST CONDITIONS			MIN	TYP ⁽²⁾	MAX	UNIT	
V_{IK}	Control inputs	$V_{CC} = 4.5\text{ V}$,	$I_{IN} = -18\text{ mA}$				-1.8	V	
V_{IKU}	Data inputs	$V_{CC} = 5\text{ V}$,	$0\text{ mA} > I_I \geq -50\text{ mA}$, $V_{IN} = V_{CC}$ or GND, Switch OFF				-2	V	
I_{IN}	Control inputs	$V_{CC} = 5.5\text{ V}$,	$V_{IN} = V_{CC}$ or GND				± 1	μA	
$I_{OZ}^{(3)}$		$V_{CC} = 5.5\text{ V}$,	$V_O = 0$ to 5.5 V , $V_I = 0$, Switch OFF, $V_{IN} = V_{CC}$ or GND				± 10	μA	
I_{off}		$V_{CC} = 0$,	$V_O = 0$ to 5.5 V , $V_I = 0$				10	μA	
I_{CC}		$V_{CC} = 5.5\text{ V}$,	$I_{I/O} = 0$, $V_{IN} = V_{CC}$ or GND, Switch ON or OFF				3	μA	
$\Delta I_{CC}^{(4)}$	Control inputs	$V_{CC} = 5.5\text{ V}$,	One input at 3.4 V , Other inputs at V_{CC} or GND				2.5	mA	
C_{in}	Control inputs	$V_{IN} = 3\text{ V}$ or 0					3.5	pF	
$C_{iO(OFF)}$	A port	$V_{I/O} = 3\text{ V}$ or 0 ,	Switch OFF,	$V_{IN} = V_{CC}$ or GND			14	pF	
	B port						5.5		
$C_{iO(ON)}$		$V_{I/O} = 3\text{ V}$ or 0 ,	Switch ON, $V_{IN} = V_{CC}$ or GND				22	pF	
$r_{on}^{(5)}$		$V_{CC} = 4\text{ V}$, TYP at $V_{CC} = 4\text{ V}$	$V_I = 2.4\text{ V}$,	$I_O = -15\text{ mA}$			8	12	Ω
			$V_I = 0$	$I_O = 64\text{ mA}$			3	6	
		$V_{CC} = 4.5\text{ V}$	$V_I = 0$	$I_O = 30\text{ mA}$			3	6	
			$V_I = 2.4\text{ V}$,	$I_O = -15\text{ mA}$			5	10	

(1) V_{IN} and I_{IN} refer to control inputs. V_I , V_O , I_I , and I_O refer to data pins.

(2) All typical values are at $V_{CC} = 5\text{ V}$ (unless otherwise noted), $T_A = 25^\circ\text{C}$.

(3) For I/O ports, the parameter I_{OZ} includes the input leakage current.

(4) This is the increase in supply current for each input that is at the specified voltage level, rather than V_{CC} or GND

(5) Measured by the voltage drop between the A and B terminals at the indicated current through the switch. ON-state resistance is determined by the lower of the voltages of the two (A or B) terminals.

Switching Characteristics

over recommended operating free-air temperature range, $C_L = 50\text{ pF}$ (unless otherwise noted) (see [Figure 3](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC} = 4\text{ V}$		$V_{CC} = 5\text{ V} \pm 0.5\text{ V}$		UNIT
			MIN	MAX	MIN	MAX	
$t_{pd}^{(1)}$	A or B	B or A	0.24		0.15		ns
$t_{pd(s)}$	S	A	5.9		1.5	5.4	ns
t_{en}	S	B	6.2		1.5	5.8	ns
	\overline{OE}	A or B	5.7		1.5	5.3	
t_{dis}	S	B	6.2		1.5	5.8	ns
	\overline{OE}	A or B	5.7		1.5	5.3	

(1) The propagation delay is the calculated RC time constant of the typical ON-state resistance of the switch and the specified load capacitance, when driven by an ideal voltage source (zero output impedance).

SN74CBT3253C

DUAL 1-OF-4 FET MULTIPLEXER/DEMULTIPLEXER

5-V BUS SWITCH WITH -2-V UNDERSHOOT PROTECTION

SCDS123B–JULY 2003–REVISED JANUARY 2007

Undershoot Characteristics

See [Figure 1](#) and [Figure 2](#)

PARAMETER	TEST CONDITIONS			MIN	TYP ⁽¹⁾	MAX	UNIT
V_{OUTU}	$V_{CC} = 5.5\text{ V}$,	Switch OFF,	$V_{IN} = V_{CC}$ or GND	2	$V_{OH} - 0.3$		V

(1) All typical values are at $V_{CC} = 5\text{ V}$ (unless otherwise noted), $T_A = 25^\circ\text{C}$.

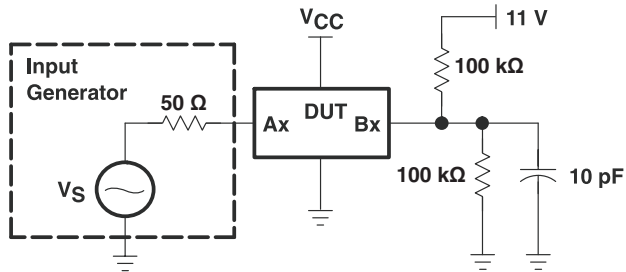


Figure 1. Device Test Setup

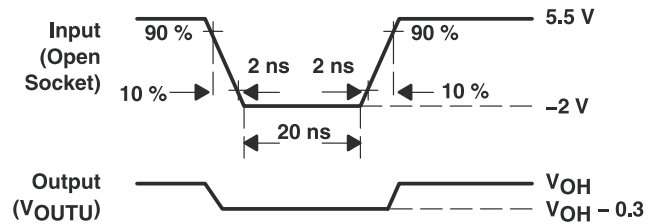
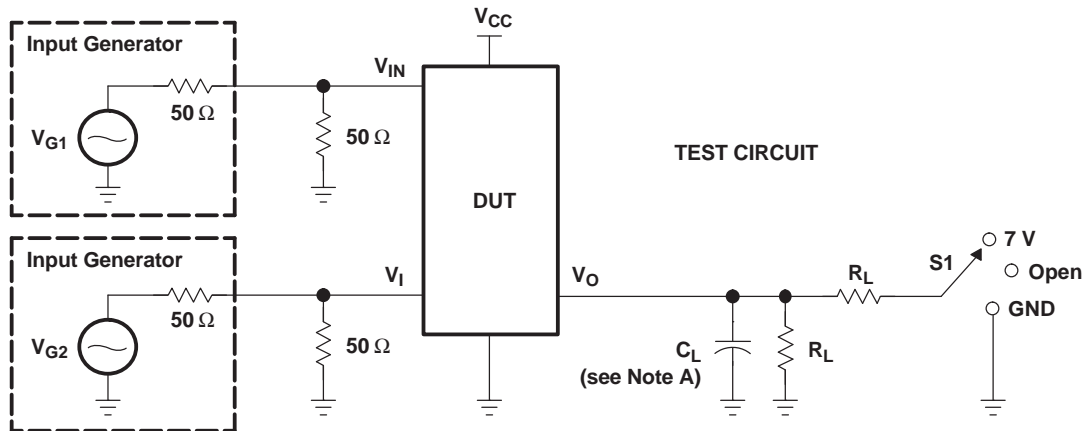
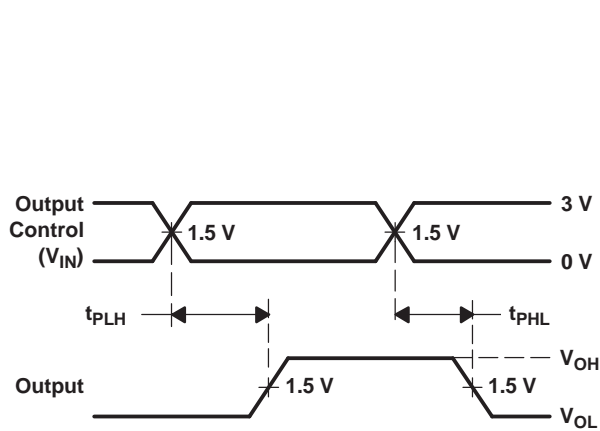


Figure 2. Transient Input Voltage (V_i) and Output Voltage (V_{OUTU}) Waveforms (Switch OFF)

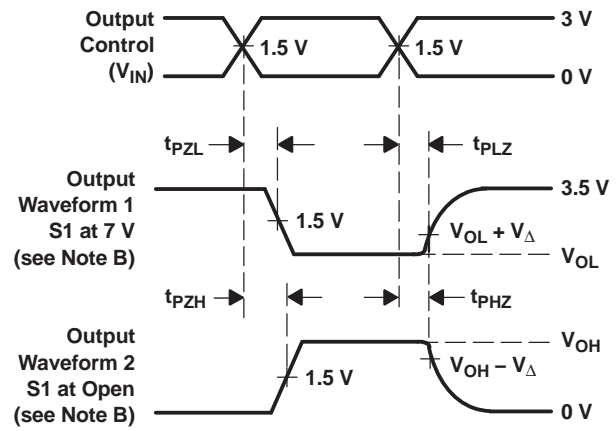
PARAMETER MEASUREMENT INFORMATION



TEST	V _{CC}	S1	R _L	V _I	C _L	V _Δ
t _{pd(s)}	5 V ± 0.5 V	Open	500 Ω	V _{CC} or GND	50 pF	
	4 V	Open	500 Ω	V _{CC} or GND	50 pF	
t _{PLZ} /t _{PZL}	5 V ± 0.5 V	7 V	500 Ω	GND	50 pF	0.3 V
	4 V	7 V	500 Ω	GND	50 pF	0.3 V
t _{PHZ} /t _{PZH}	5 V ± 0.5 V	Open	500 Ω	V _{CC}	50 pF	0.3 V
	4 V	Open	500 Ω	V _{CC}	50 pF	0.3 V



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES (t_{pd(s)})



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES

- 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 ≤ 10 MHz, Z_O = 50 Ω, t_r ≤ 2.5 ns, t_f ≤ 2.5 ns.
 - D. The outputs are measured one at a time, with one 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_{PLH} and t_{PHL} are the same as t_{pd(s)}. The t_{pd} propagation delay is the calculated RC time constant of the typical ON-state resistance of the switch and the specified load capacitance, when driven by an ideal voltage source (zero output impedance).
 - H. All parameters and waveforms are not applicable to all devices.

Figure 3. Test 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⁾
SN74CBT3253CD	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CBT3253CDB	PREVIEW	SSOP	DB	16	80	TBD	Call TI	Call TI
SN74CBT3253CDBQR	ACTIVE	SSOP/ QSOP	DBQ	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR
SN74CBT3253CDBQRE4	ACTIVE	SSOP/ QSOP	DBQ	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR
SN74CBT3253CDBQRG4	ACTIVE	SSOP/ QSOP	DBQ	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR
SN74CBT3253CDBR	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CBT3253CDBRE4	ACTIVE	SSOP	DB	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CBT3253CDE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CBT3253CDR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CBT3253CDRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CBT3253CPW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CBT3253CPWE4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CBT3253CPWR	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CBT3253CPWRE4	ACTIVE	TSSOP	PW	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74CBT3253CRGYR	ACTIVE	QFN	RGY	16	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR
SN74CBT3253CRGYRG4	ACTIVE	QFN	RGY	16	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.

OBSELETE: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), 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.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

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

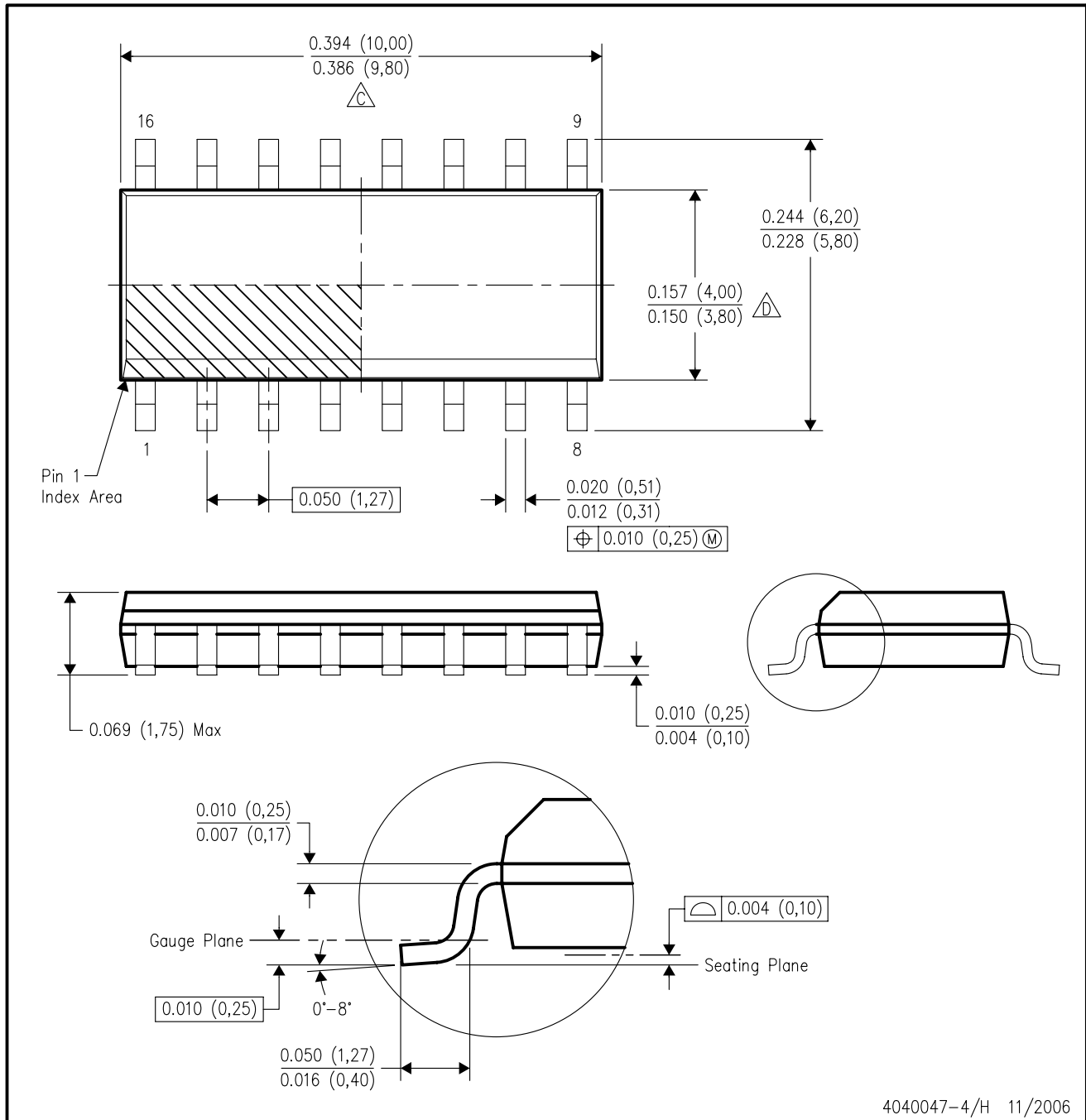
temperature.

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D (R-PDSO-G16)

PLASTIC SMALL-OUTLINE PACKAGE

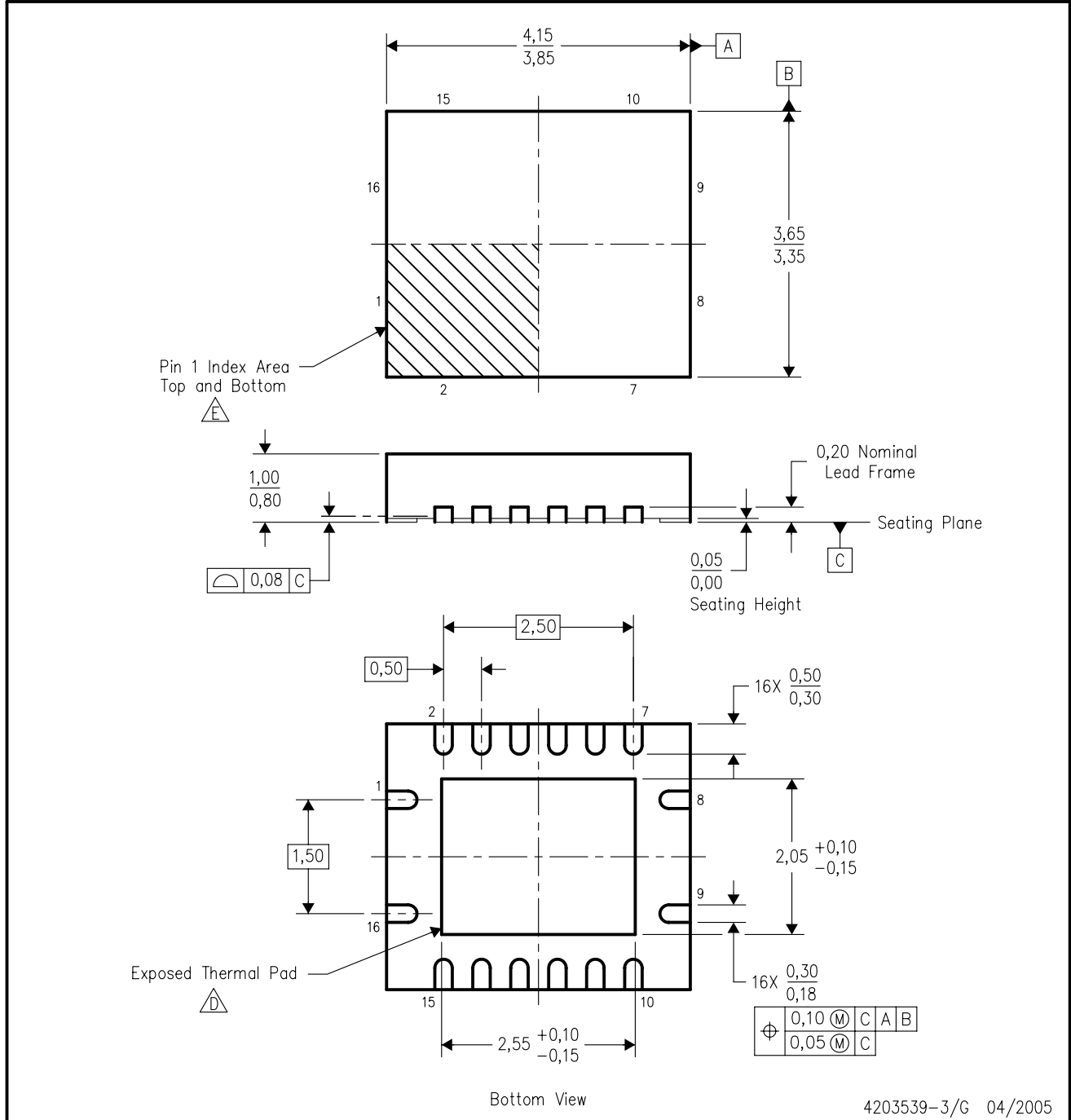


4040047-4/H 11/2006

- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 (0,15) per end.
 - D. Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
 - E. Reference JEDEC MS-012 variation AC.

RGY (R-PQFP-N16)

PLASTIC QUAD FLATPACK



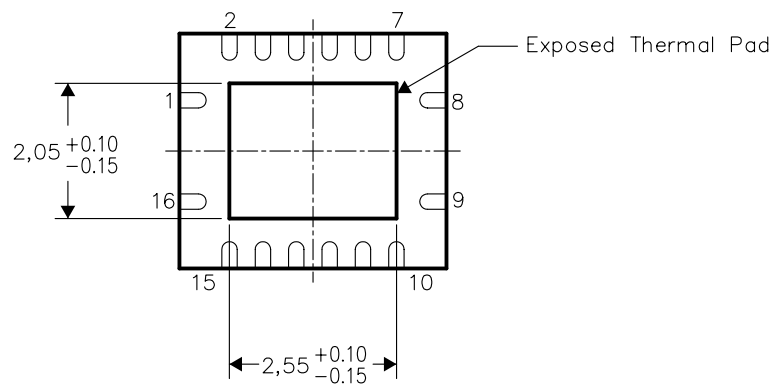
- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
 - B. This drawing is subject to change without notice.
 - C. QFN (Quad Flatpack No-Lead) package configuration.
 - D. The package thermal pad must be soldered to the board for thermal and mechanical performance.
 - E. 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 BB.

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.

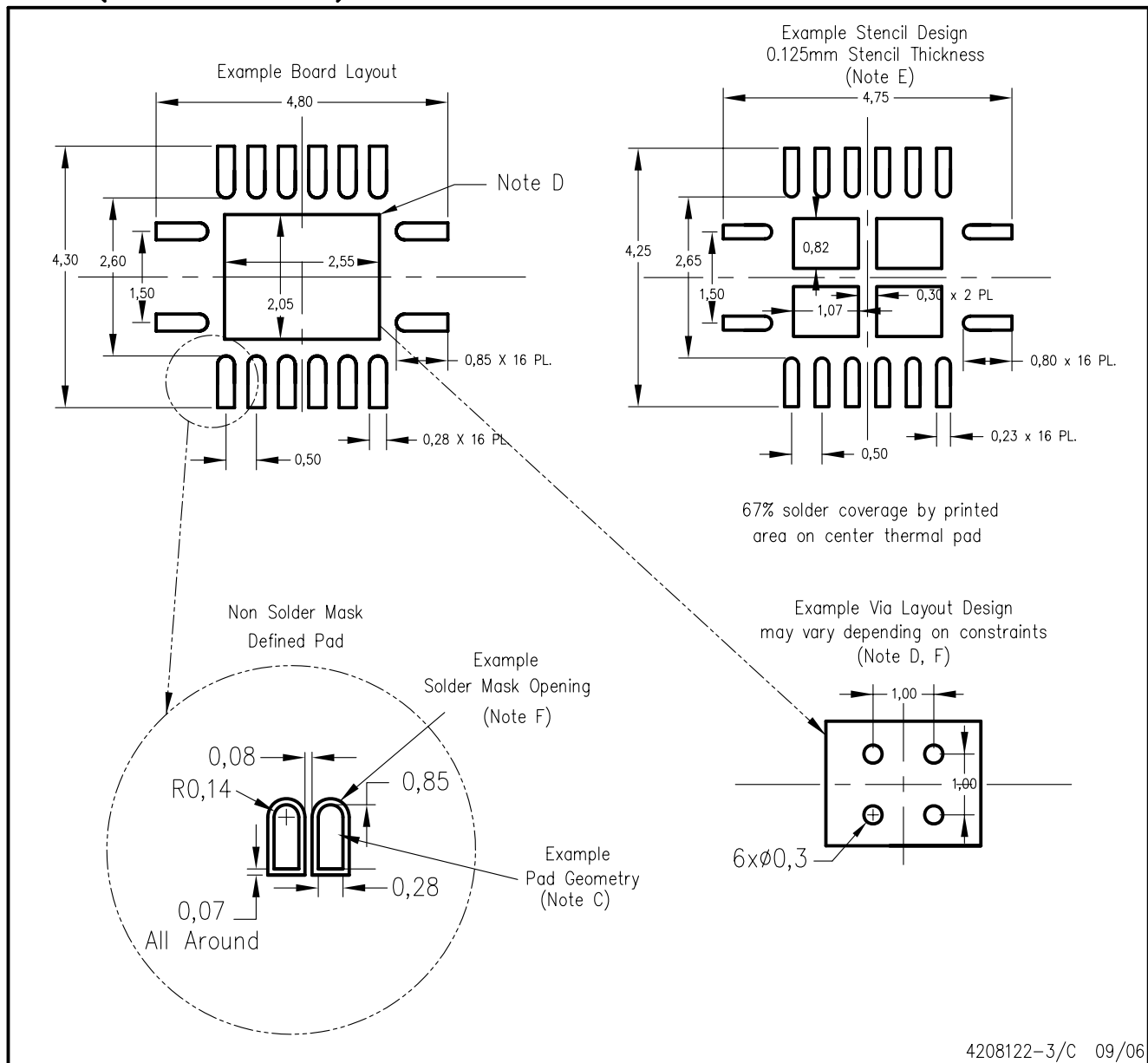


Bottom View

NOTE: All linear dimensions are in millimeters

Exposed Thermal Pad Dimensions

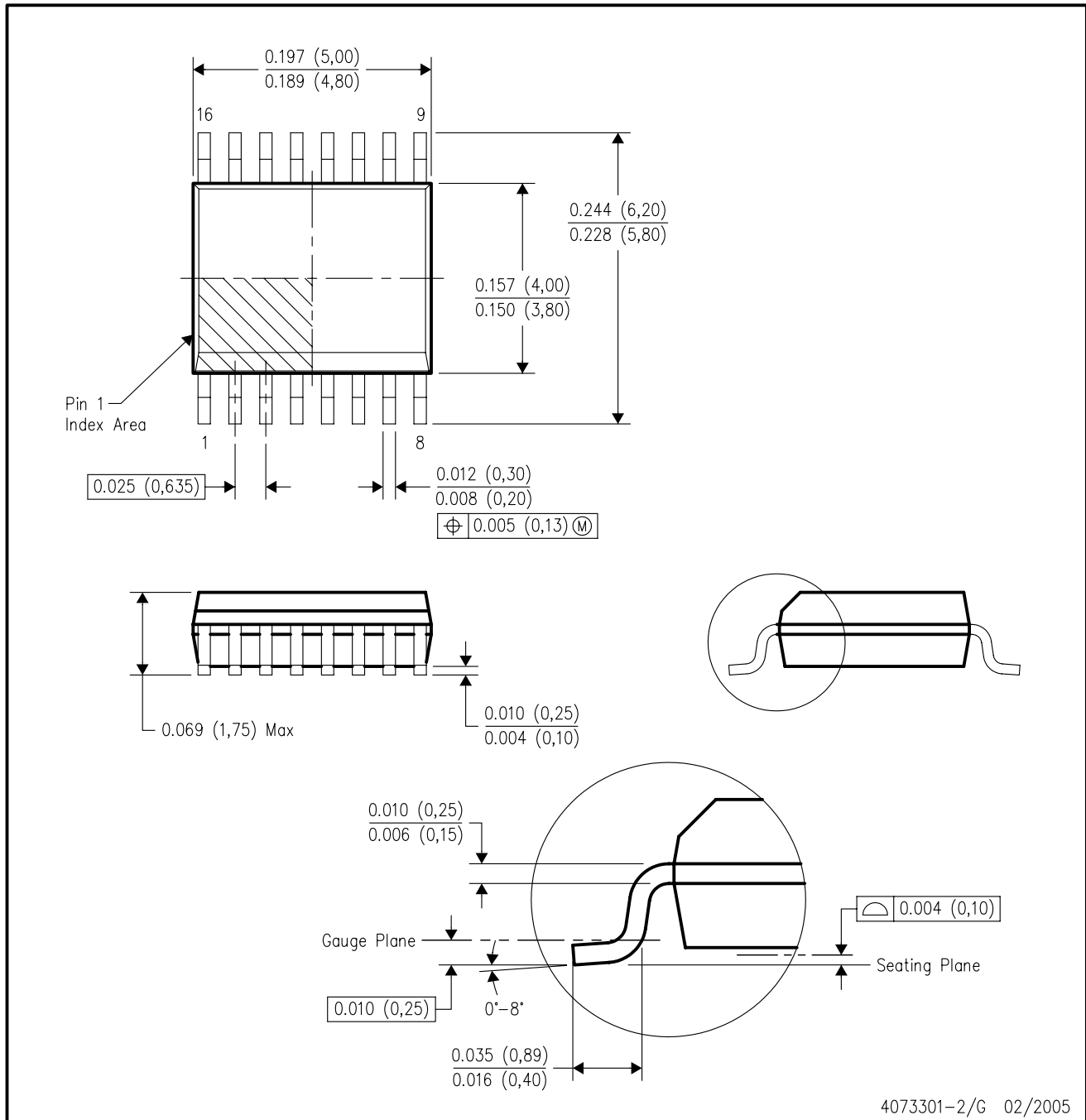
RGY (R-PQFP-N16)



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Publication IPC-7351 is recommended for alternate designs.
 - D. This package is designed to be soldered to a thermal pad on the board. Refer to Application Note, Quad Flat-Pack Packages, Texas Instruments Literature No. SCBA017, SLUA271, and also the Product Data Sheets for specific thermal information, via requirements, and recommended board layout. These documents are available at www.ti.com <<http://www.ti.com>>.
 - E. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC 7525 for stencil design considerations.
 - F. Customers should contact their board fabrication site for minimum solder mask web tolerances between signal pads.

DBQ (R-PDSO-G16)

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) per side.
 - D. Falls within JEDEC MO-137 variation AB.

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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