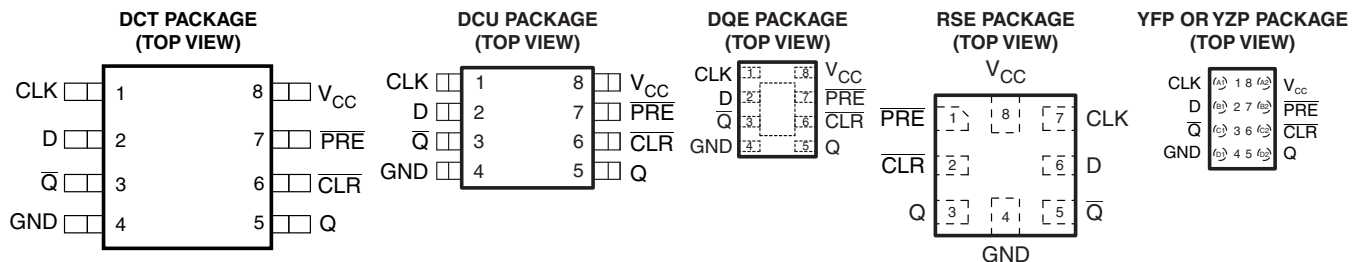


LOW-POWER SINGLE POSITIVE-EDGE-TRIGGERED D-TYPE FLIP-FLOP WITH CLEAR AND PRESET

Check for Samples: [SN74AUP1G74](#)

FEATURES

- Available in the Texas Instruments NanoStar™ Package
- Low Static-Power Consumption:
 $I_{CC} = 0.9 \mu\text{A Max}$
- Low Dynamic-Power Consumption:
 $C_{pd} = 5.5 \text{ pF Typ at } 3.3 \text{ V}$
- Low Input Capacitance: $C_i = 1.5 \text{ pF Typ}$
- Low Noise – Overshoot and Undershoot
<10% of V_{CC}
- I_{off} Supports Partial-Power-Down Mode Operation
- Schmitt-Trigger Action Allows Slow Input Transition and Better Switching Noise Immunity at the Input
($V_{hys} = 250 \text{ mV Typ at } 3.3 \text{ V}$)
- Wide Operating V_{CC} Range of 0.8 V to 3.6 V
- Optimized for 3.3-V Operation
- 3.6-V I/O Tolerant to Support Mixed-Mode Signal Operation
- $t_{pd} = 5 \text{ ns Max at } 3.3 \text{ V}$
- Suitable for Point-to-Point Applications
- 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)



See mechanical drawings for dimensions.

DESCRIPTION/ORDERING INFORMATION

The AUP family is TI's premier solution to the industry's low-power needs in battery-powered portable applications. This family ensures a very low static- and dynamic-power consumption across the entire V_{CC} range of 0.8 V to 3.6 V, resulting in increased battery life (see [Figure 1](#)). This product also maintains excellent signal integrity (see the very low undershoot and overshoot characteristics shown in [Figure 2](#)).



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.

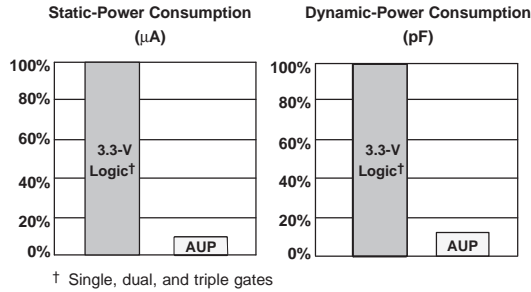


Figure 1. AUP – The Lowest-Power Family

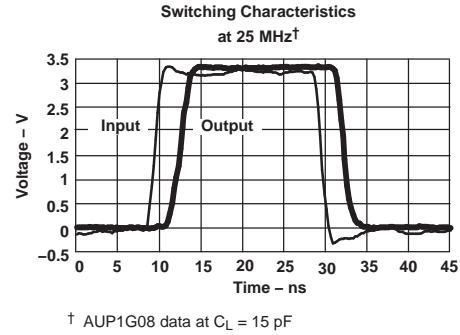


Figure 2. Excellent Signal Integrity

This single positive-edge-triggered D-type flip-flop is designed for 0.8-V to 3.6-V V_{CC} operation.

A low level at the preset ($\overline{\text{PRE}}$) or clear ($\overline{\text{CLR}}$) input sets or resets the outputs, regardless of the levels of the other inputs. When $\overline{\text{PRE}}$ and $\overline{\text{CLR}}$ are inactive (high), data at the data (D) input meeting the setup time requirements is transferred to the outputs on the positive-going edge of the clock pulse. Clock triggering occurs at a voltage level and is not related directly to the rise time of the clock pulse. Following the hold-time interval, data at the D input can be changed without affecting the levels at the outputs. To better optimize the flip-flop for higher frequencies, the $\overline{\text{CLR}}$ input overrides the $\overline{\text{PRE}}$ input when they are both low.

NanoStar™ package technology is a major breakthrough in IC packaging concepts, using the die as the package.

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.

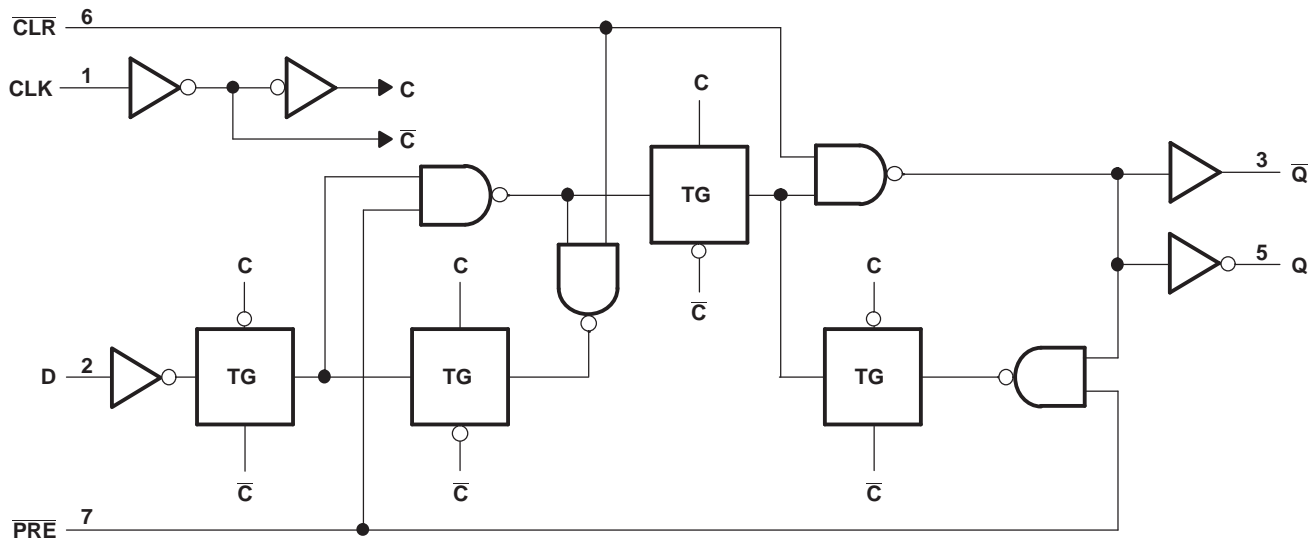
ORDERING INFORMATION⁽¹⁾

T_A	PACKAGE ⁽²⁾		ORDERABLE PART NUMBER	TOP-SIDE MARKING ⁽³⁾
-40°C to 85°C	NanoStar™ – WCSP (DSBGA) 0.23-mm Large Bump – YFP	Reel of 3000	SN74AUP1G74YFPR	__HS_
	NanoStar™ – WCSP (DSBGA) 0.23-mm Large Bump – YZP (Pb-free)	Reel of 3000	SN74AUP1G74YZPR	__HS_
	SSOP – DCT	Reel of 3000	SN74AUP1G74DCTR	H74__
	VSSOP – DCU	Reel of 3000	SN74AUP1G74DCUR	H74_
	uQFN – DQE	Reel of 5000	SN74AUP1G74DQER	HS
	QFN – RSE	Reel of 5000	SN74AUP1G74RSER	HS

- (1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at www.ti.com.
- (2) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.
- (3) DCT: The actual top-side marking has three additional characters that designate the year, month, and wafer fab/assembly site.
DCU: The actual top-side marking has one additional character that designates the wafer fab/assembly site.
YFP/YZP: The actual top-side marking has three preceding characters to denote year, month, and sequence code, and one following character to designate the wafer fab/assembly site. Pin 1 identifier indicates solder-bump composition (1 = SnPb, • = Pb-free).

FUNCTION TABLE

INPUTS				OUTPUTS	
$\overline{\text{PRE}}$	$\overline{\text{CLR}}$	CLK	D	Q	$\overline{\text{Q}}$
L	H	X	X	H	L
X	L	X	X	L	H
H	H	↑	H	H	L
H	H	↑	L	L	H
H	H	L	X	Q_0	\overline{Q}_0

LOGIC DIAGRAM (POSITIVE LOGIC)


Pin numbers shown are for the DCT, DCU, and DQE packages

ABSOLUTE MAXIMUM RATINGS⁽¹⁾

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

		MIN	MAX	UNIT	
V_{CC}	Supply voltage range	-0.5	4.6	V	
V_I	Input voltage range ⁽²⁾	-0.5	4.6	V	
V_O	Voltage range applied to any output in the high-impedance or power-off state ⁽²⁾	-0.5	4.6	V	
V_O	Output voltage range in the high or low state ⁽²⁾	-0.5	$V_{CC} + 0.5$	V	
I_{IK}	Input clamp current	$V_I < 0$		-50	mA
I_{OK}	Output clamp current	$V_O < 0$		-50	mA
I_O	Continuous output current			± 20	mA
	Continuous current through V_{CC} or GND			± 50	mA
θ_{JA}	Package thermal impedance ⁽³⁾	DCT package		220	°C/W
		DCU package		227	
		DQE package		261	
		RSE package		253	
		YFP/YZP package		102	
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) The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.

(3) The package thermal impedance is calculated in accordance with JESD 51-7.

RECOMMENDED OPERATING CONDITIONS⁽¹⁾

		MIN	MAX	UNIT	
V _{CC}	Supply voltage	0.8	3.6	V	
V _{IH}	High-level input voltage	V _{CC} = 0.8 V	V _{CC}	V	
		V _{CC} = 1.1 V to 1.95 V	0.65 × V _{CC}		
		V _{CC} = 2.3 V to 2.7 V	1.6		
		V _{CC} = 3 V to 3.6 V	2		
V _{IL}	Low-level input voltage	V _{CC} = 0.8 V	0	V	
		V _{CC} = 1.1 V to 1.95 V	0.35 × V _{CC}		
		V _{CC} = 2.3 V to 2.7 V	0.7		
		V _{CC} = 3 V to 3.6 V	0.9		
V _I	Input voltage	0	3.6	V	
V _O	Output voltage	0	V _{CC}	V	
I _{OH}	High-level output current	V _{CC} = 0.8 V	-20	mA	
		V _{CC} = 1.1 V	-1.1		
		V _{CC} = 1.4 V	-1.7		
		V _{CC} = 1.65	-1.9		
		V _{CC} = 2.3 V	-3.1		
		V _{CC} = 3 V	-4		
I _{OL}	Low-level output current	V _{CC} = 0.8 V	20	mA	
		V _{CC} = 1.1 V	1.1		
		V _{CC} = 1.4 V	1.7		
		V _{CC} = 1.65 V	1.9		
		V _{CC} = 2.3 V	3.1		
		V _{CC} = 3 V	4		
Δt/Δv	Input transition rise or fall rate	V _{CC} = 0.8 V to 3.6 V		200	ns/V
T _A	Operating free-air temperature	-40	85	°C	

(1) All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. See 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}	T _A = 25°C			T _A = -40°C to 85°C		UNIT
			MIN	TYP	MAX	MIN	MAX	
V _{OH}	I _{OH} = -20 μA	0.8 V to 3.6 V	V _{CC} - 0.1			V _{CC} - 0.1		V
	I _{OH} = -1.1 mA	1.1 V	0.75 × V _{CC}			0.7 × V _{CC}		
	I _{OH} = -1.7 mA	1.4 V	1.11			1.03		
	I _{OH} = -1.9 mA	1.65 V	1.32			1.3		
	I _{OH} = -2.3 mA	2.3 V	2.05			1.97		
	I _{OH} = -3.1 mA		1.9			1.85		
	I _{OH} = -2.7 mA	3 V	2.72			2.67		
	I _{OH} = -4 mA		2.6			2.55		
V _{OL}	I _{OL} = 20 μA	0.8 V to 3.6 V	0.1			0.1		V
	I _{OL} = 1.1 mA	1.1 V	0.3 × V _{CC}			0.3 × V _{CC}		
	I _{OL} = 1.7 mA	1.4 V	0.31			0.37		
	I _{OL} = 1.9 mA	1.65 V	0.31			0.35		
	I _{OL} = 2.3 mA	2.3 V	0.31			0.33		
	I _{OL} = 3.1 mA		0.44			0.45		
	I _{OL} = 2.7 mA	3 V	0.31			0.33		
	I _{OL} = 4 mA		0.44			0.45		
I _i	A or B input	V _i = GND to 3.6 V	0 V to 3.6 V			0.1	0.5	μA
I _{off}		V _i or V _O = 0 V to 3.6 V	0 V			0.2	0.6	μA
ΔI _{off}		V _i or V _O = 0 V to 3.6 V	0 V to 0.2 V			0.2	0.6	μA
I _{CC}		V _i = GND or (V _{CC} to 3.6 V), I _O = 0	0.8 V to 3.6 V			0.5	0.9	μA
ΔI _{CC}		V _i = V _{CC} - 0.6 V ⁽¹⁾ , I _O = 0	3.3 V			40	50	μA
C _i	V _i = V _{CC} or GND	0 V	1.5					pF
		3.6 V	1.5					
C _o	V _O = GND	0 V	3					pF

 (1) One input at V_{CC} - 0.6 V, other input at V_{CC} or GND

TIMING REQUIREMENTS

over recommended operating free-air temperature range (unless otherwise noted) (see [Figure 3](#))

PARAMETER		V _{CC}	T _A = 25°C	T _A = –40°C to 85°C		UNIT
			TYP	MIN	MAX	
f _{clock}	Clock frequency	0.8 V	21			MHz
		1.2 V ± 0.1 V			40	
		1.5 V ± 0.1 V			50	
		1.8 V ± 0.15 V			60	
		2.5 V ± 0.2 V			90	
		3.3 V ± 0.3 V			90	
t _w	CLK high or low	0.8 V	3.5			ns
		1.2 V ± 0.1 V		2		
		1.5 V ± 0.1 V		2		
		1.8 V ± 0.15 V		2		
		2.5 V ± 0.2 V		2		
		3.3 V ± 0.3 V		2		
	PRE or CLR low	0.8 V	4.5			
		1.2 V ± 0.1 V		2		
		1.5 V ± 0.1 V		2		
		1.8 V ± 0.15 V		2		
		2.5 V ± 0.2 V		2		
		3.3 V ± 0.3 V		2		
t _{su}	Data high	0.8 V	3			ns
		1.2 V ± 0.1 V		1.3		
		1.5 V ± 0.1 V		1		
		1.8 V ± 0.15 V		1		
		2.5 V ± 0.2 V		0.5		
		3.3 V ± 0.3 V		0.5		
	Data low	0.8 V	1			
		1.2 V ± 0.1 V		1.2		
		1.5 V ± 0.1 V		1		
		1.8 V ± 0.15 V		1		
		2.5 V ± 0.2 V		1		
		3.3 V ± 0.3 V		1		
	PRE or CLR inactive	0.8 V	1			
		1.2 V ± 0.1 V		0.5		
		1.5 V ± 0.1 V		0.5		
		1.8 V ± 0.15 V		0.5		
		2.5 V ± 0.2 V		0.5		
		3.3 V ± 0.3 V		0.5		
t _h	Hold time, data after CLK↑	0.8 V	0			ns
		1.2 V ± 0.1 V		0		
		1.5 V ± 0.1 V		0		
		1.8 V ± 0.15 V		0		
		2.5 V ± 0.2 V		0		
		3.3 V ± 0.3 V		0		

SWITCHING CHARACTERISTICS

 over recommended operating free-air temperature range, $C_L = 5$ pF (unless otherwise noted) (see [Figure 3](#) and [Figure 4](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC}	$T_A = 25^\circ\text{C}$			$T_A = -40^\circ\text{C to } 85^\circ\text{C}$		UNIT	
				MIN	TYP	MAX	MIN	MAX		
f_{max}			0.8 V	60					MHz	
			$1.2\text{ V} \pm 0.1\text{ V}$	80			60			
			$1.5\text{ V} \pm 0.1\text{ V}$	125			90			
			$1.8\text{ V} \pm 0.15\text{ V}$	150			120			
			$2.5\text{ V} \pm 0.2\text{ V}$	180			160			
			$3.3\text{ V} \pm 0.3\text{ V}$	190			180			
t_{pd}	CLK	Q	0.8 V	31					ns	
			$1.2\text{ V} \pm 0.1\text{ V}$	2	10	20	2.7	20.4		
			$1.5\text{ V} \pm 0.1\text{ V}$	2	6	12	1.9	12.4		
			$1.8\text{ V} \pm 0.15\text{ V}$	2	5	9	1.4	9.5		
			$2.5\text{ V} \pm 0.2\text{ V}$	2	3	6	1.1	6.2		
		$3.3\text{ V} \pm 0.3\text{ V}$	2	3	4	1	4.7			
		\bar{Q}	0.8 V	28						
			$1.2\text{ V} \pm 0.1\text{ V}$	2	9	19	2.4	19		
			$1.5\text{ V} \pm 0.1\text{ V}$	2	6	11	1.6	11.8		
			$1.8\text{ V} \pm 0.15\text{ V}$	2	5	9	1.3	9		
	$2.5\text{ V} \pm 0.2\text{ V}$		2	3	6	1.1	6			
	\bar{Q}	$3.3\text{ V} \pm 0.3\text{ V}$	2	3	4	1	4.6			
		$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$	Q or \bar{Q}	0.8 V	26					
				$1.2\text{ V} \pm 0.1\text{ V}$	2	9	20	2		20
				$1.5\text{ V} \pm 0.1\text{ V}$	2	6	12	1.5		13
				$1.8\text{ V} \pm 0.15\text{ V}$	2	5	9	1.3		10
	$2.5\text{ V} \pm 0.2\text{ V}$			2	3	6	1	7		
	$3.3\text{ V} \pm 0.3\text{ V}$	2	3	5	1	5				

SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range, $C_L = 10$ pF (unless otherwise noted) (see [Figure 3](#) and [Figure 4](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC}	$T_A = 25^\circ\text{C}$			$T_A = -40^\circ\text{C to } 85^\circ\text{C}$		UNIT
				MIN	TYP	MAX	MIN	MAX	
f_{max}			0.8 V	46					MHz
			$1.2\text{ V} \pm 0.1\text{ V}$	65			50		
			$1.5\text{ V} \pm 0.1\text{ V}$	95			55		
			$1.8\text{ V} \pm 0.15\text{ V}$	110			60		
			$2.5\text{ V} \pm 0.2\text{ V}$	170			130		
			$3.3\text{ V} \pm 0.3\text{ V}$	180			160		
t_{pd}	CLK	Q	0.8 V	33					ns
			$1.2\text{ V} \pm 0.1\text{ V}$	2	10	22	3.4	21.8	
			$1.5\text{ V} \pm 0.1\text{ V}$	2	7	13	2.4	13.5	
			$1.8\text{ V} \pm 0.15\text{ V}$	2	6	10	1.9	10.4	
			$2.5\text{ V} \pm 0.2\text{ V}$	2	4	6	1.5	7	
			$3.3\text{ V} \pm 0.3\text{ V}$	2	3	5	1.2	5.3	
		\bar{Q}	0.8 V	30					
			$1.2\text{ V} \pm 0.1\text{ V}$	2	10	20	3	20.3	
			$1.5\text{ V} \pm 0.1\text{ V}$	2	7	12	2.2	12.8	
			$1.8\text{ V} \pm 0.15\text{ V}$	2	5	9	1.8	9.9	
			$2.5\text{ V} \pm 0.2\text{ V}$	2	4	6	1.3	6.7	
			$3.3\text{ V} \pm 0.3\text{ V}$	2	3	5	1.1	5.2	
	$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$	Q or \bar{Q}	0.8 V	29					
			$1.2\text{ V} \pm 0.1\text{ V}$	2	10	21	2	21.4	
			$1.5\text{ V} \pm 0.1\text{ V}$	2	7	13	2	13.8	
			$1.8\text{ V} \pm 0.15\text{ V}$	2	5	10	2	10.8	
			$2.5\text{ V} \pm 0.2\text{ V}$	2	4	7	1.5	7.4	
			$3.3\text{ V} \pm 0.3\text{ V}$	2	3	5	1.5	5.8	

SWITCHING CHARACTERISTICS

 over recommended operating free-air temperature range, $C_L = 15$ pF (unless otherwise noted) (see [Figure 3](#) and [Figure 4](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC}	$T_A = 25^\circ\text{C}$			$T_A = -40^\circ\text{C to } 85^\circ\text{C}$		UNIT
				MIN	TYP	MAX	MIN	MAX	
f_{max}			0.8 V	41					MHz
			$1.2\text{ V} \pm 0.1\text{ V}$	75			50		
			$1.5\text{ V} \pm 0.1\text{ V}$	95			55		
			$1.8\text{ V} \pm 0.15\text{ V}$	100			60		
			$2.5\text{ V} \pm 0.2\text{ V}$	150			130		
			$3.3\text{ V} \pm 0.3\text{ V}$	200			160		
t_{pd}	CLK	Q	0.8 V	35					ns
			$1.2\text{ V} \pm 0.1\text{ V}$	2	12	23.1	4.1	23.2	
			$1.5\text{ V} \pm 0.1\text{ V}$	2	8	14.1	2.9	14.6	
			$1.8\text{ V} \pm 0.15\text{ V}$	2	6	10.7	2.4	11.3	
			$2.5\text{ V} \pm 0.2\text{ V}$	2	4	7	1.9	7.6	
			$3.3\text{ V} \pm 0.3\text{ V}$	2	4	5.4	1.6	5.9	
		\bar{Q}	0.8 V	32					
			$1.2\text{ V} \pm 0.1\text{ V}$	2	11	21.8	3.7	21.8	
			$1.5\text{ V} \pm 0.1\text{ V}$	2	7	13.5	2.6	14	
			$1.8\text{ V} \pm 0.15\text{ V}$	2	6	10.4	2.2	10.9	
			$2.5\text{ V} \pm 0.2\text{ V}$	2	4	7.1	1.7	7.5	
			$3.3\text{ V} \pm 0.3\text{ V}$	2	3	5.4	1.4	5.8	
	$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$	Q or \bar{Q}	0.8 V	31					
			$1.2\text{ V} \pm 0.1\text{ V}$	2	11	23	2	22.9	
			$1.5\text{ V} \pm 0.1\text{ V}$	2	7	14	2	14.9	
			$1.8\text{ V} \pm 0.15\text{ V}$	2	6	11	2	11.7	
			$2.5\text{ V} \pm 0.2\text{ V}$	2	4	7	2	8.1	
			$3.3\text{ V} \pm 0.3\text{ V}$	2	4	6	1.5	6.4	

SWITCHING CHARACTERISTICS

over recommended operating free-air temperature range, $C_L = 30$ pF (unless otherwise noted) (see [Figure 3](#) and [Figure 4](#))

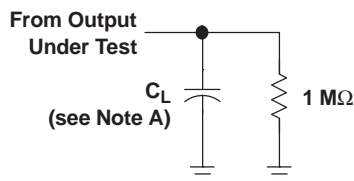
PARAMETER	FROM (INPUT)	TO (OUTPUT)	V_{CC}	$T_A = 25^\circ\text{C}$			$T_A = -40^\circ\text{C to } 85^\circ\text{C}$		UNIT
				MIN	TYP	MAX	MIN	MAX	
f_{\max}			0.8 V	21					MHz
			$1.2\text{ V} \pm 0.1\text{ V}$	50			40		
			$1.5\text{ V} \pm 0.1\text{ V}$	60			50		
			$1.8\text{ V} \pm 0.15\text{ V}$	75			70		
			$2.5\text{ V} \pm 0.2\text{ V}$	100			90		
			$3.3\text{ V} \pm 0.3\text{ V}$	100			90		
t_{pd}	CLK	Q	0.8 V	32					ns
			$1.2\text{ V} \pm 0.1\text{ V}$	3	14	27	5.9	27	
			$1.5\text{ V} \pm 0.1\text{ V}$	3	10	17	4.4	17.2	
			$1.8\text{ V} \pm 0.15\text{ V}$	3	8	13	3.6	13.4	
			$2.5\text{ V} \pm 0.2\text{ V}$	3	6	9	3	9.2	
			$3.3\text{ V} \pm 0.3\text{ V}$	3	5	7	2.6	7.2	
		\bar{Q}	0.8 V	40					
			$1.2\text{ V} \pm 0.1\text{ V}$	3	13	26	5.5	25.9	
			$1.5\text{ V} \pm 0.1\text{ V}$	3	9	16	4.1	16.8	
			$1.8\text{ V} \pm 0.15\text{ V}$	3	7	13	3.5	13.2	
			$2.5\text{ V} \pm 0.2\text{ V}$	3	5	9	2.7	9.2	
			$3.3\text{ V} \pm 0.3\text{ V}$	3	5	7	2.4	7.2	
	$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$	Q or \bar{Q}	0.8 V	38					
			$1.2\text{ V} \pm 0.1\text{ V}$	3	13	26	3	27	
			$1.5\text{ V} \pm 0.1\text{ V}$	3	9	17	3	17.4	
			$1.8\text{ V} \pm 0.15\text{ V}$	3	8	13	3	14	
			$2.5\text{ V} \pm 0.2\text{ V}$	3	6	9	3	10	
			$3.3\text{ V} \pm 0.3\text{ V}$	3	5	7	2.5	8	

OPERATING CHARACTERISTICS

$T_A = 25^\circ\text{C}$

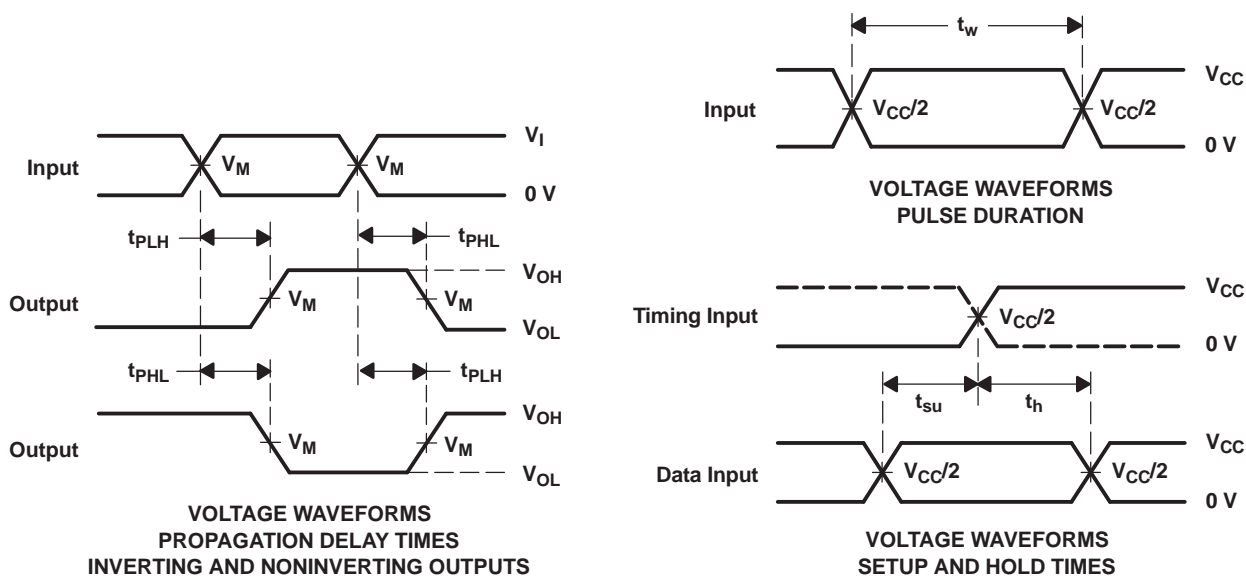
PARAMETER		TEST CONDITIONS	V_{CC}	TYP	UNIT
C_{pd}	Power dissipation capacitance	$f = 10\text{ MHz}$	0.8 V	5.5	pF
			$1.2\text{ V} \pm 0.1\text{ V}$	5.5	
			$1.5\text{ V} \pm 0.1\text{ V}$	5.5	
			$1.8\text{ V} \pm 0.15\text{ V}$	5.5	
			$2.5\text{ V} \pm 0.2\text{ V}$	5.5	
			$3.3\text{ V} \pm 0.3\text{ V}$	5.5	

PARAMETER MEASUREMENT INFORMATION
(Propagation Delays, Setup and Hold Times, and Pulse Width)



LOAD CIRCUIT

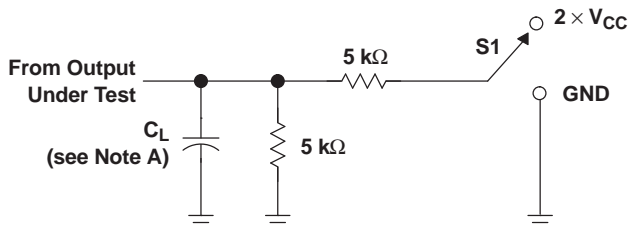
	$V_{CC} = 0.8\text{ V}$	$V_{CC} = 1.2\text{ V}$ $\pm 0.1\text{ V}$	$V_{CC} = 1.5\text{ V}$ $\pm 0.1\text{ V}$	$V_{CC} = 1.8\text{ V}$ $\pm 0.15\text{ V}$	$V_{CC} = 2.5\text{ V}$ $\pm 0.2\text{ V}$	$V_{CC} = 3.3\text{ V}$ $\pm 0.3\text{ V}$
C_L	5, 10, 15, 30 pF	5, 10, 15, 30 pF	5, 10, 15, 30 pF	5, 10, 15, 30 pF	5, 10, 15, 30 pF	5, 10, 15, 30 pF
V_M	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$
V_I	V_{CC}	V_{CC}	V_{CC}	V_{CC}	V_{CC}	V_{CC}



- NOTES: A. C_L includes probe and jig capacitance.
 B. All input pulses are supplied by generators having the following characteristics: PRR \leq 10 MHz, $Z_O = 50\ \Omega$, $t_r/t_f = 3\text{ ns}$.
 C. The outputs are measured one at a time, with one transition per measurement.
 D. t_{PLH} and t_{PHL} are the same as t_{pd} .
 E. All parameters and waveforms are not applicable to all devices.

Figure 3. Load Circuit and Voltage Waveforms

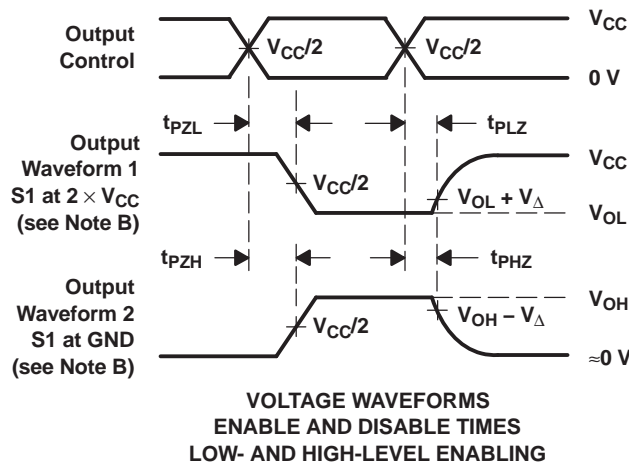
**PARAMETER MEASUREMENT INFORMATION
(Enable and Disable Times)**



TEST	S1
t_{PLZ}/t_{PZL}	$2 \times V_{CC}$
t_{PHZ}/t_{PZH}	GND

LOAD CIRCUIT

	$V_{CC} = 0.8\text{ V}$	$V_{CC} = 1.2\text{ V}$ $\pm 0.1\text{ V}$	$V_{CC} = 1.5\text{ V}$ $\pm 0.1\text{ V}$	$V_{CC} = 1.8\text{ V}$ $\pm 0.15\text{ V}$	$V_{CC} = 2.5\text{ V}$ $\pm 0.2\text{ V}$	$V_{CC} = 3.3\text{ V}$ $\pm 0.3\text{ V}$
C_L	5, 10, 15, 30 pF	5, 10, 15, 30 pF	5, 10, 15, 30 pF	5, 10, 15, 30 pF	5, 10, 15, 30 pF	5, 10, 15, 30 pF
V_M	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$
V_I	V_{CC}	V_{CC}	V_{CC}	V_{CC}	V_{CC}	V_{CC}
V_{Δ}	0.1 V	0.1 V	0.1 V	0.15 V	0.15 V	0.3 V



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

- 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: $PRR \leq 10\text{ MHz}$, $Z_O = 50\ \Omega$, $t_r/t_f = 3\text{ ns}$.
 - 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. All parameters and waveforms are not applicable to all devices.

Figure 4. 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⁾
SN74AUP1G74DCUR	ACTIVE	US8	DCU	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AUP1G74DCURG4	ACTIVE	US8	DCU	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AUP1G74DQER	ACTIVE	X2SON	DQE	8	5000	Green (RoHS & no Sb/Br)	NIPDAU	Level-1-260C-UNLIM
SN74AUP1G74RSER	ACTIVE	UQFN	RSE	8	5000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74AUP1G74YFPR	ACTIVE	DSBGA	YFP	8	3000	TBD	Call TI	Call TI
SN74AUP1G74YZPR	ACTIVE	DSBGA	YZP	8	3000	Green (RoHS & no Sb/Br)	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 - 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.

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.

TAPE AND REEL INFORMATION

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74AUP1G74DCUR	US8	DCU	8	3000	180.0	9.2	2.25	3.35	1.05	4.0	8.0	Q3
SN74AUP1G74YZPR	DSBGA	YZP	8	3000	180.0	8.4	1.02	2.02	0.63	4.0	8.0	Q1

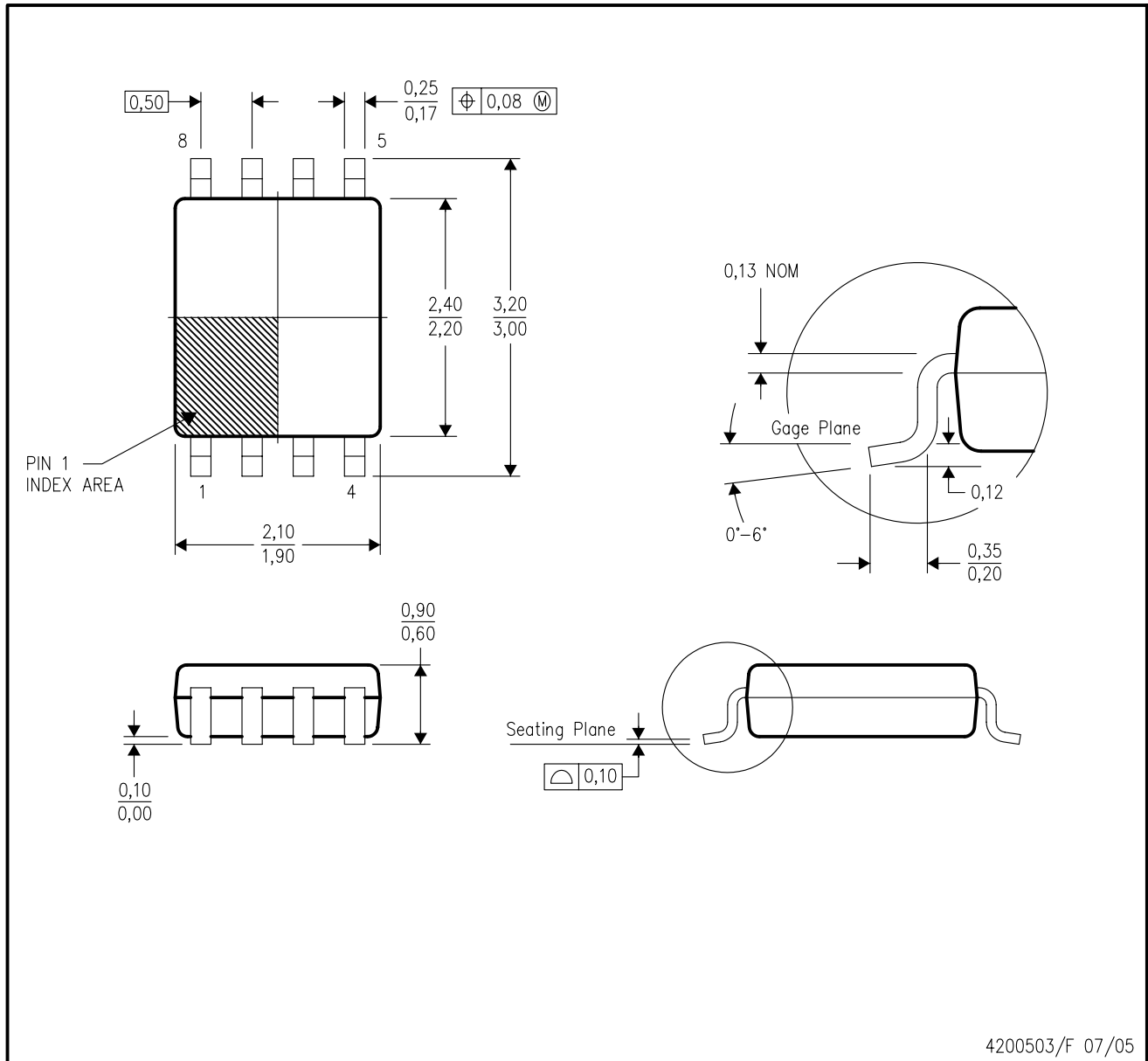
TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74AUP1G74DCUR	US8	DCU	8	3000	202.0	201.0	28.0
SN74AUP1G74YZPR	DSBGA	YZP	8	3000	220.0	220.0	34.0

DCU (R-PDSO-G8)

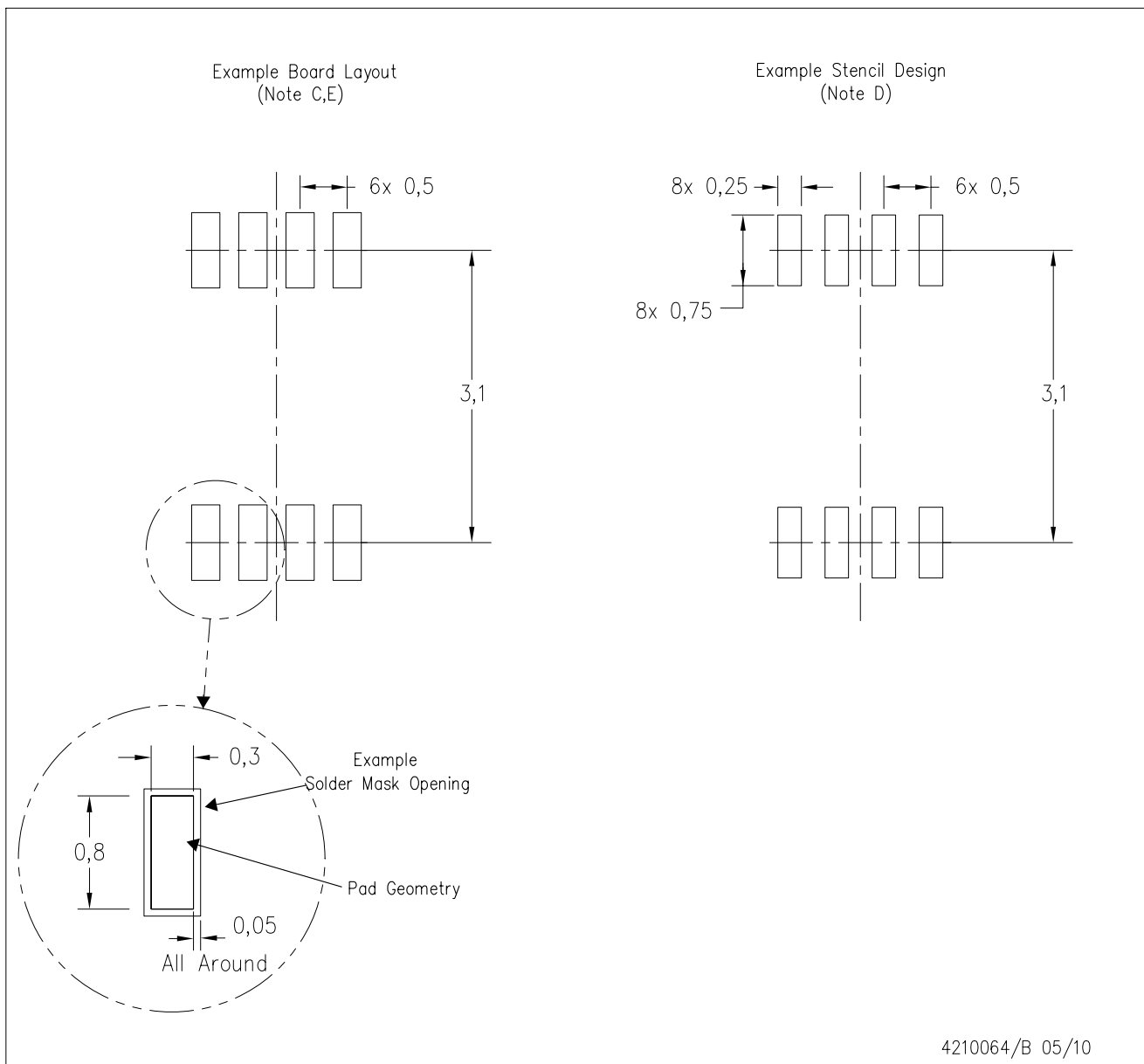
PLASTIC SMALL-OUTLINE PACKAGE (DIE DOWN)



- 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. Mold flash and protrusion shall not exceed 0.15 per side.
 - D. Falls within JEDEC MO-187 variation CA.

DCU (S-PDSO-G8)

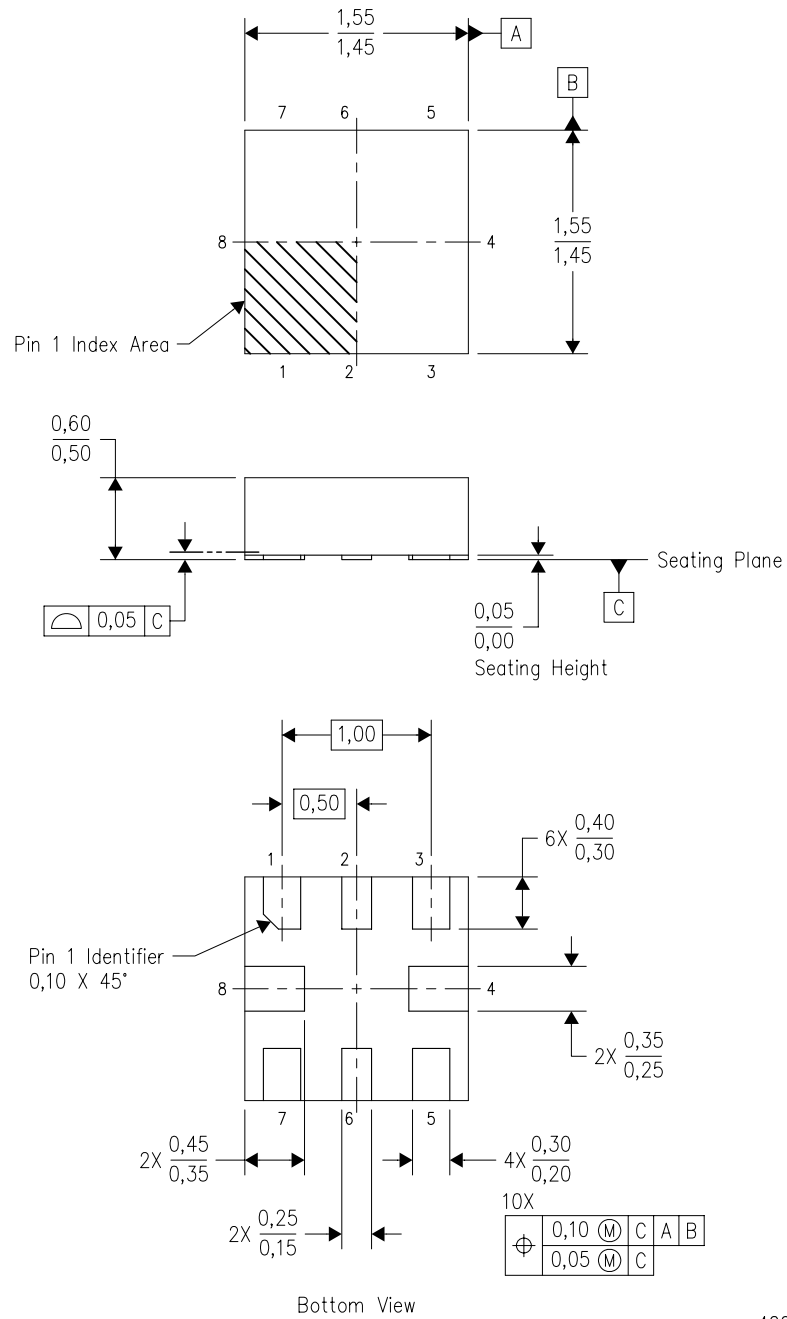
PLASTIC SMALL OUTLINE PACKAGE (DIE DOWN)



- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Publication IPC-7351 is recommended for alternate designs.
 - 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.
 - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

RSE (S-PQFP-N8)

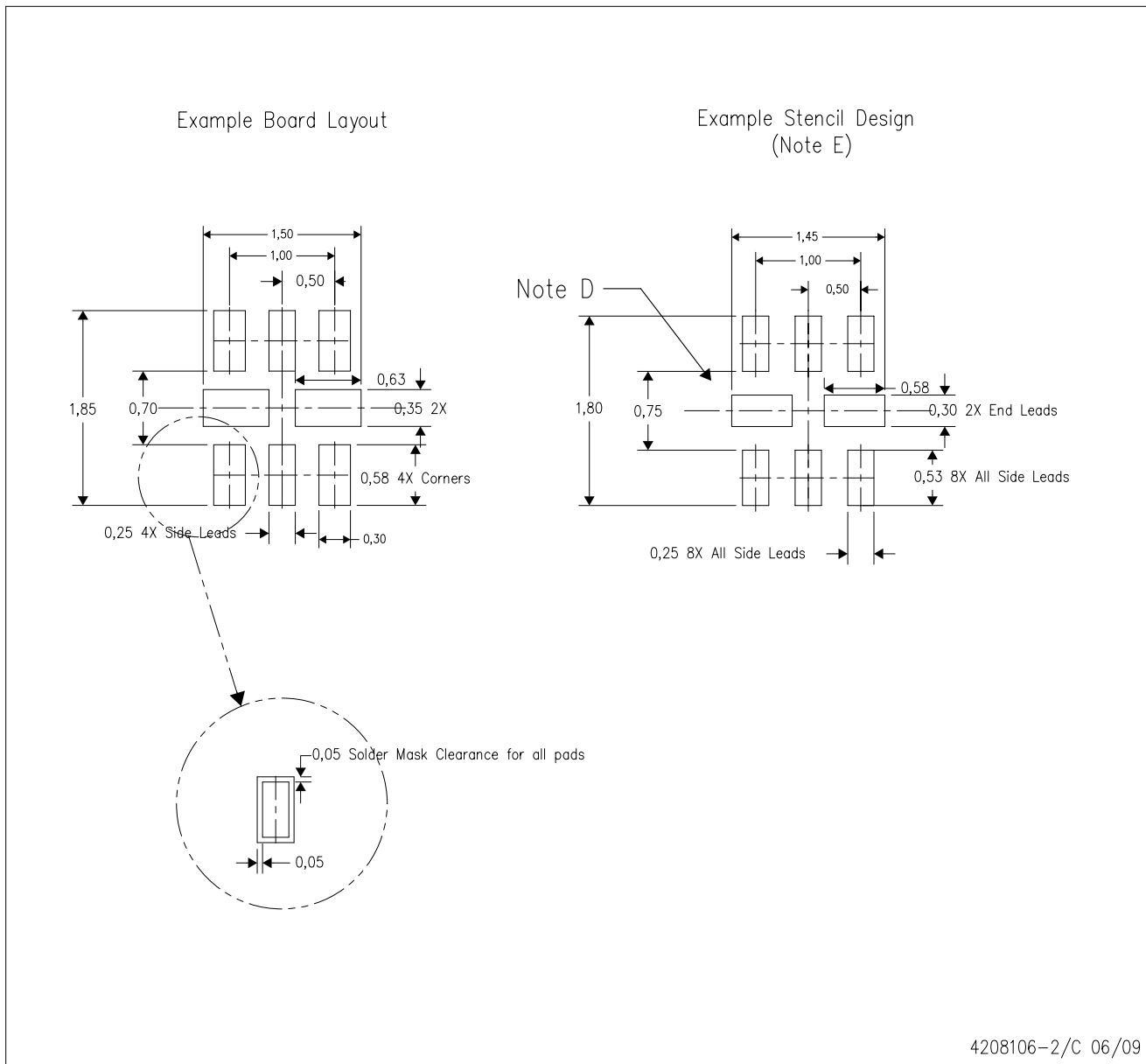
PLASTIC QUAD FLATPACK



4207268-2/C 01/2008

- 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.
 - This package complies to JEDEC MO-288 variation UECD.

RSE (R-PQFP-N8)

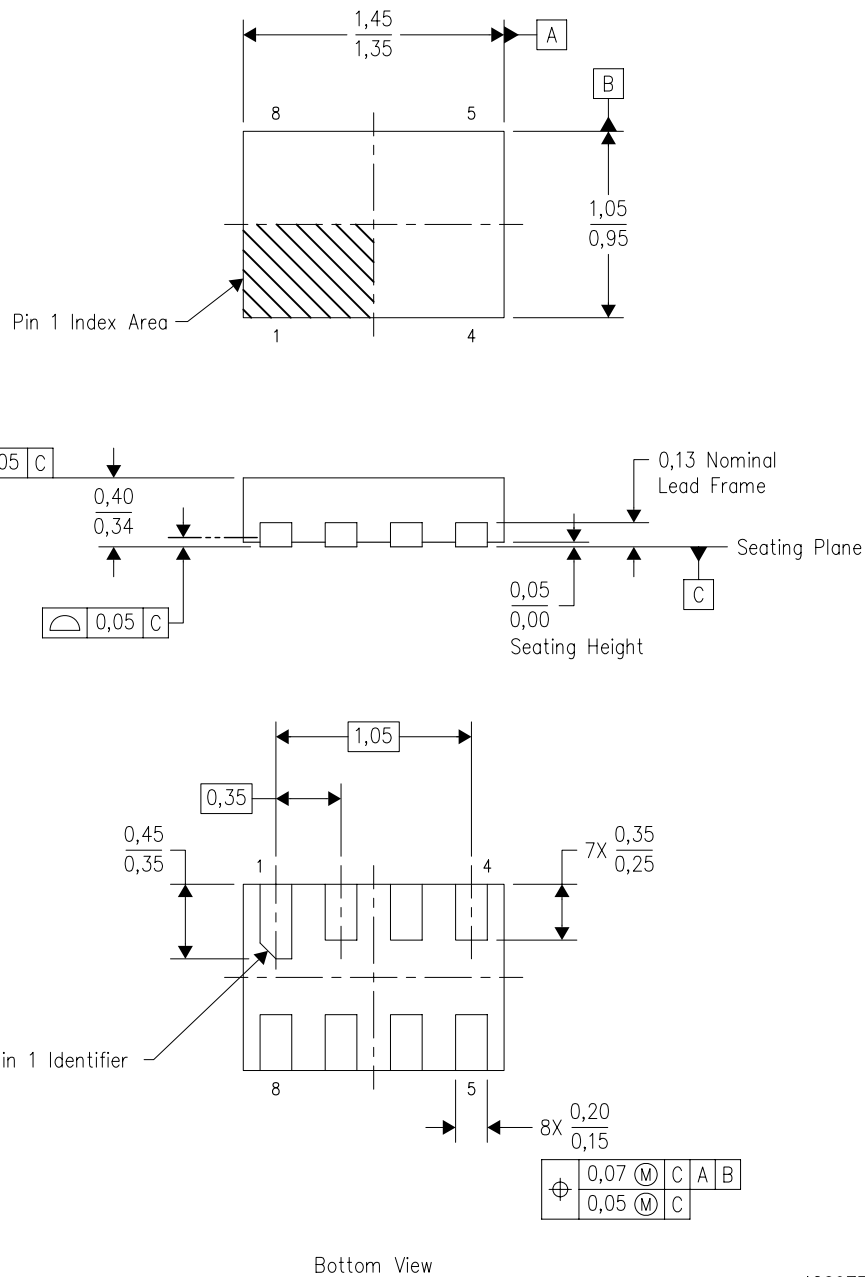


4208106-2/C 06/09

- 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. Customers should contact their board fabrication site for minimum solder mask web tolerances between signal pads.
 - E. Maximum stencil thickness 0,127 mm (5 mils). All linear dimensions are in millimeters.
 - F. 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.
 - G. Side aperture dimensions over-print land for acceptable area ratio > 0.66. Customer may reduce side aperture dimensions if stencil manufacturing process allows for sufficient release at smaller opening.

DQE (R-PX2SON-N8)

PLASTIC SMALL OUTLINE NO-LEAD

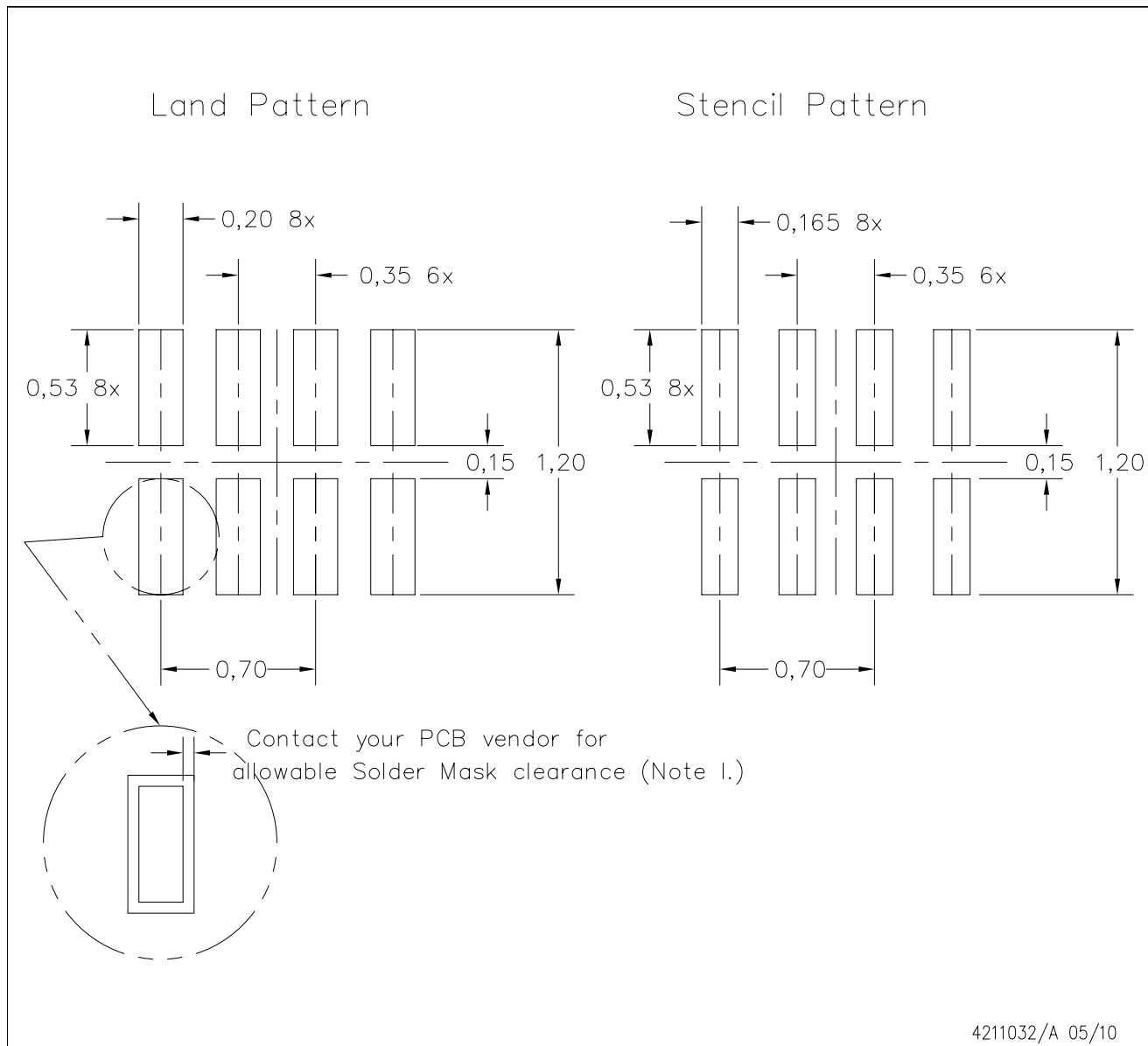


4209779/B 10/2008

- NOTES:
- All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
 - This drawing is subject to change without notice.
 - SON (Small Outline No-Lead) package configuration.
 - This package complies to JEDEC MO-287 variation X2EAF.

DQE (R-PX2SON-N8)

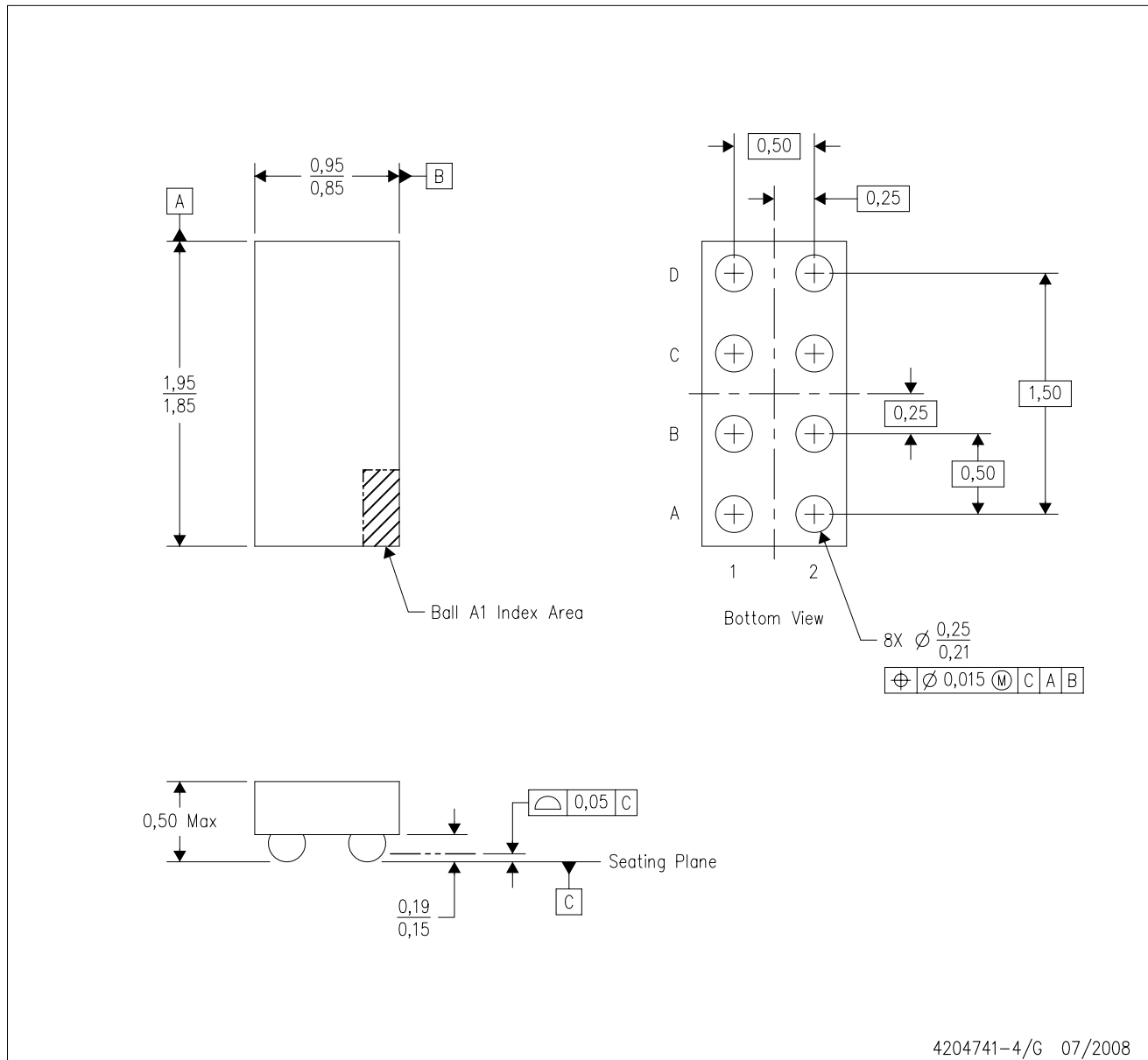
PLASTIC SMALL OUTLINE NO-LEAD



- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Publication IPC-7351 is recommended for alternate designs.
 - Customers should contact their board fabrication site for minimum solder mask web tolerances between signal pads.
If 2 mil solder mask is outside PCB vendor capability, it is advised to omit solder mask.
 - Maximum stencil thickness 0,1016 mm (4 mils). All linear dimensions are in millimeters.
 - 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.
 - Over-printing land for acceptable area ratio is not viable due to land width and bridging potential. Customer may further reduce side aperture dimensions if stencil manufacturing process allows for sufficient release at smaller opening.
 - Suggest stencils cut with lasers such as Fiber Laser that produce the greatest positional accuracy.
 - Component placement force should be minimized to prevent excessive paste block deformation.

YZP (R-XBGA-N8)

DIE-SIZE BALL GRID ARRAY



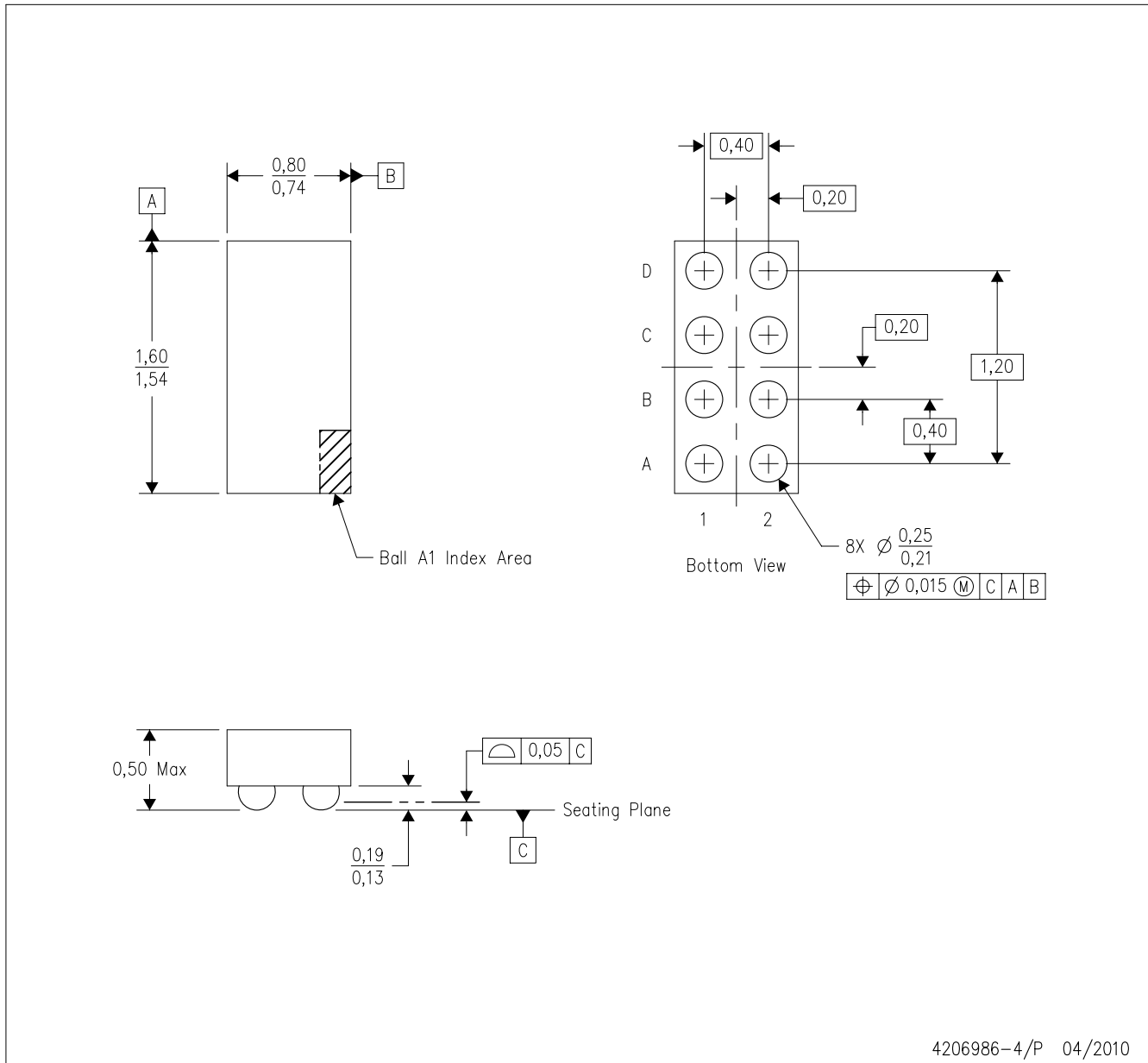
- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
 - B. This drawing is subject to change without notice.
 - C. NanoFree™ package configuration.
 - D. This package is lead-free. Refer to the 8 YEP package (drawing 4204725) for tin-lead (SnPb).

NanoFree is a trademark of Texas Instruments.

MECHANICAL DATA

YFP (R-XBGA-N8)

DIE-SIZE BALL GRID ARRAY



- 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. NanoFree™ package configuration.
 - D. This is a Pb-free solder ball design.

NanoFree is a trademark of Texas Instruments.

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 TI 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. Information of third parties may be subject to additional restrictions.

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.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

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
DLP® Products	www.dlp.com	Communications and Telecom	www.ti.com/communications
DSP	dsp.ti.com	Computers and Peripherals	www.ti.com/computers
Clocks and Timers	www.ti.com/clocks	Consumer Electronics	www.ti.com/consumer-apps
Interface	interface.ti.com	Energy	www.ti.com/energy
Logic	logic.ti.com	Industrial	www.ti.com/industrial
Power Mgmt	power.ti.com	Medical	www.ti.com/medical
Microcontrollers	microcontroller.ti.com	Security	www.ti.com/security
RFID	www.ti-rfid.com	Space, Avionics & Defense	www.ti.com/space-avionics-defense
RF/IF and ZigBee® Solutions	www.ti.com/lprf	Video and Imaging	www.ti.com/video
		Wireless	www.ti.com/wireless-apps

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2010, Texas Instruments Incorporated