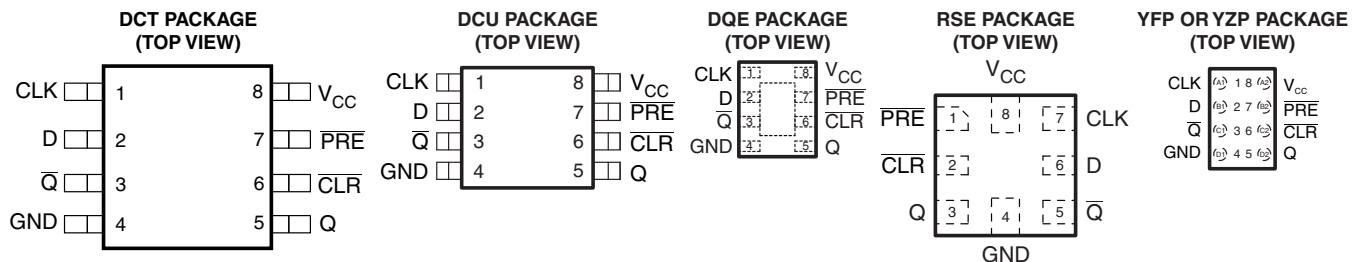


## LOW-POWER SINGLE POSITIVE-EDGE-TRIGGERED D-TYPE FLIP-FLOP WITH CLEAR AND PRESET

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.

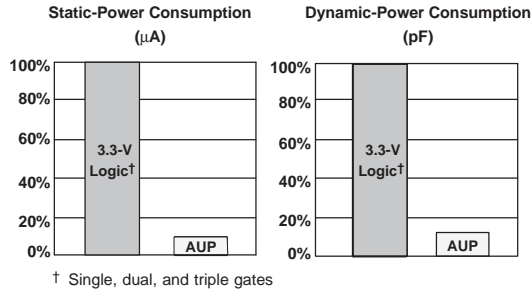


Figure 1. AUP – The Lowest-Power Family

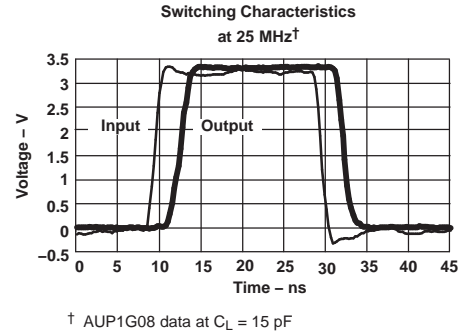


Figure 2. Excellent Signal Integrity

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 ( $\overline{PRE}$ ) or clear ( $\overline{CLR}$ ) input sets or resets the outputs, regardless of the levels of the other inputs. When  $\overline{PRE}$  and  $\overline{CLR}$  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  $\overline{CLR}$  input overrides the  $\overline{PRE}$  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.

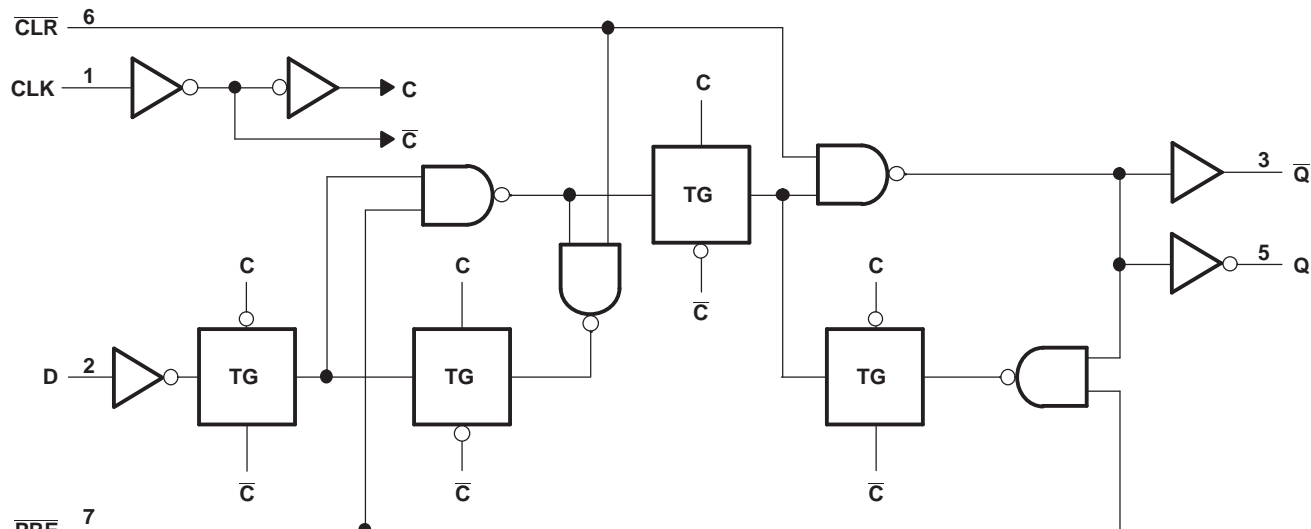
ORDERING INFORMATION<sup>(1)</sup>

$T_A$	PACKAGE <sup>(2)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING <sup>(3)</sup>
-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](http://www.ti.com).
- (2) Package drawings, thermal data, and symbolization are available at [www.ti.com/packaging](http://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	
$\overline{PRE}$	$\overline{CLR}$	CLK	D	Q	$\overline{Q}$
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<sup>(1)</sup>**

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 <sup>(2)</sup>	-0.5	4.6	V	
$V_O$	Voltage range applied to any output in the high-impedance or power-off state <sup>(2)</sup>	-0.5	4.6	V	
$V_O$	Output voltage range in the high or low state <sup>(2)</sup>	-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			$\pm 20$	mA
	Continuous current through $V_{CC}$ or GND			$\pm 50$	mA
$\theta_{JA}$	Package thermal impedance <sup>(3)</sup>	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<sup>(1)</sup>**

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

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

 (1) One input at V<sub>CC</sub> - 0.6 V, other input at V<sub>CC</sub> or GND

## TIMING REQUIREMENTS

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

PARAMETER		V <sub>CC</sub>	T <sub>A</sub> = 25°C	T <sub>A</sub> = –40°C to 85°C		UNIT
			TYP	MIN	MAX	
f <sub>clock</sub>	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 <sub>w</sub>	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		
	$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$ 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 <sub>su</sub>	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		
	$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$ 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 <sub>h</sub>	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		
	$\overline{\text{PRE}}$ or $\overline{\text{CLR}}$	Q or $\bar{Q}$	$3.3\text{ V} \pm 0.3\text{ V}$	2	3	4	1	4.6	
			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](#))

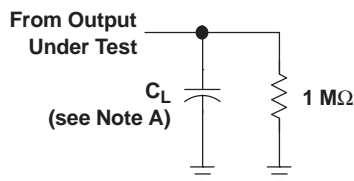
PARAMETER	FROM (INPUT)	TO (OUTPUT)	$V_{CC}$	$T_A = 25^\circ\text{C}$			$T_A = -40^\circ\text{C to } 85^\circ\text{C}$		UNIT
				MIN	TYP	MAX	MIN	MAX	
$f_{\max}$			0.8 V	21					MHz
			$1.2\text{ V} \pm 0.1\text{ V}$	50			40		
			$1.5\text{ V} \pm 0.1\text{ V}$	60			50		
			$1.8\text{ V} \pm 0.15\text{ V}$	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

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

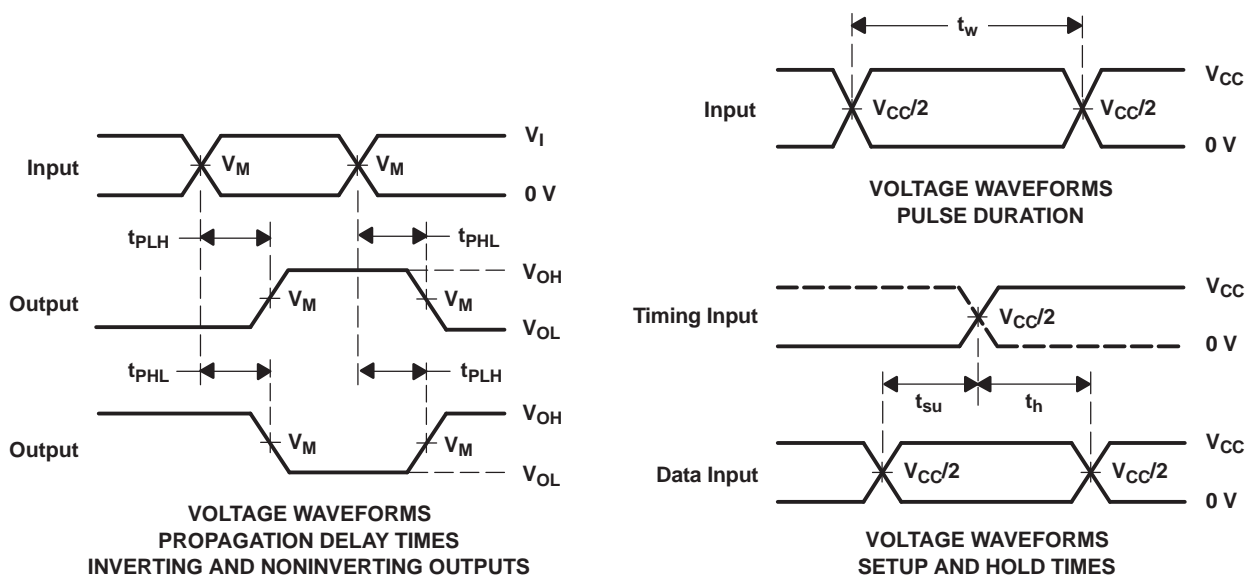
PARAMETER		TEST CONDITIONS	$V_{CC}$	TYP	UNIT
$C_{pd}$	Power dissipation capacitance	$f = 10\text{ MHz}$	0.8 V	5.5	pF
			$1.2\text{ V} \pm 0.1\text{ V}$	5.5	
			$1.5\text{ V} \pm 0.1\text{ V}$	5.5	
			$1.8\text{ V} \pm 0.15\text{ V}$	5.5	
			$2.5\text{ V} \pm 0.2\text{ V}$	5.5	
			$3.3\text{ V} \pm 0.3\text{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

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



LOAD CIRCUIT

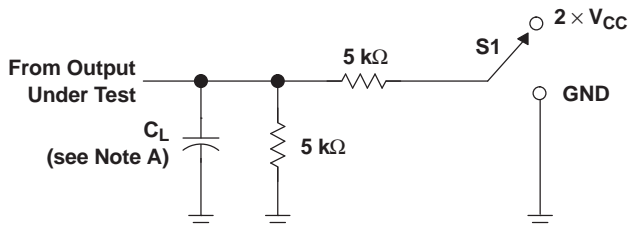
	$V_{CC} = 0.8\text{ V}$	$V_{CC} = 1.2\text{ V}$ $\pm 0.1\text{ V}$	$V_{CC} = 1.5\text{ V}$ $\pm 0.1\text{ V}$	$V_{CC} = 1.8\text{ V}$ $\pm 0.15\text{ V}$	$V_{CC} = 2.5\text{ V}$ $\pm 0.2\text{ V}$	$V_{CC} = 3.3\text{ V}$ $\pm 0.3\text{ V}$
$C_L$	5, 10, 15, 30 pF	5, 10, 15, 30 pF	5, 10, 15, 30 pF	5, 10,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

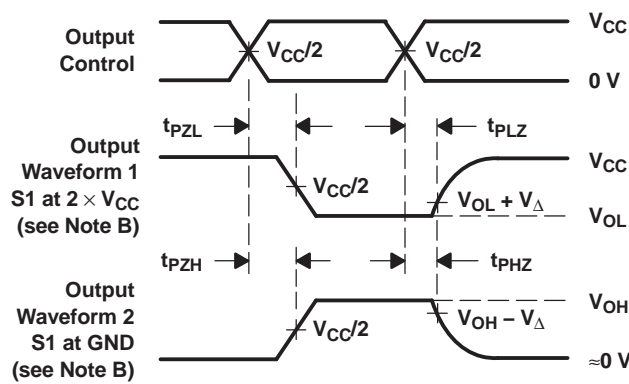
**PARAMETER MEASUREMENT INFORMATION  
(Enable and Disable Times)**



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
$V_M$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$	$V_{CC}/2$
$V_I$	$V_{CC}$	$V_{CC}$	$V_{CC}$	$V_{CC}$	$V_{CC}$	$V_{CC}$
$V_{\Delta}$	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)	Op Temp (°C)	Top-Side Markings (4)	Samples
SN74AUP1G74DCUR	ACTIVE	US8	DCU	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	H74R	<a href="#">Samples</a>
SN74AUP1G74DCURG4	ACTIVE	US8	DCU	8	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	H74R	<a href="#">Samples</a>
SN74AUP1G74DQER	ACTIVE	X2SON	DQE	8	5000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	HS	<a href="#">Samples</a>
SN74AUP1G74RSER	ACTIVE	UQFN	RSE	8	5000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	HS	<a href="#">Samples</a>
SN74AUP1G74YFPR	ACTIVE	DSBGA	YFP	8	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 85	HSN	<a href="#">Samples</a>
SN74AUP1G74YZPR	ACTIVE	DSBGA	YZP	8	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 85	(HS7 ~ HSN)	<a href="#">Samples</a>

(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.

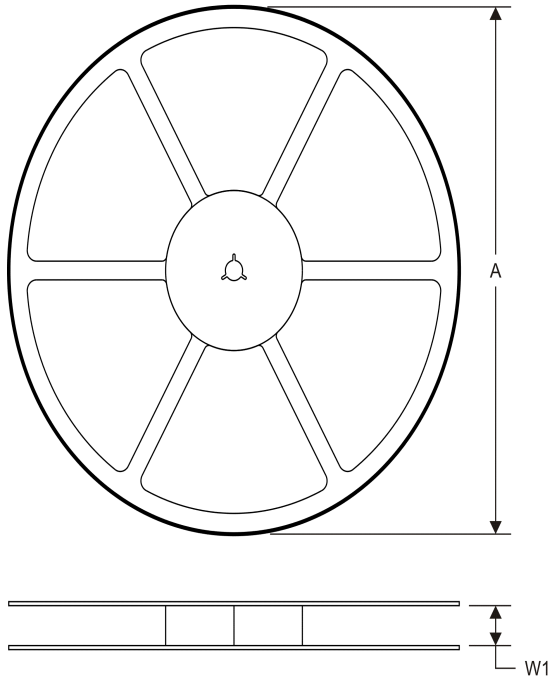
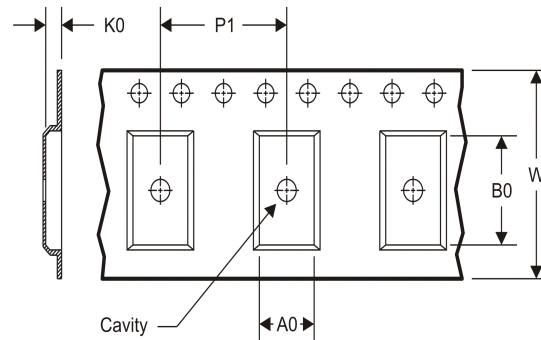
**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

(4) Multiple Top-Side Markings will be inside parentheses. Only one Top-Side Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Top-Side Marking for that device.

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**TAPE AND REEL INFORMATION**
**REEL DIMENSIONS**

**TAPE DIMENSIONS**


A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

**TAPE AND REEL INFORMATION**

\*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	8.4	2.25	3.35	1.05	4.0	8.0	Q3
SN74AUP1G74DQER	X2SON	DQE	8	5000	180.0	8.4	1.2	1.6	0.55	4.0	8.0	Q1
SN74AUP1G74RSER	UQFN	RSE	8	5000	180.0	8.4	1.6	1.6	0.66	4.0	8.0	Q2
SN74AUP1G74YFPR	DSBGA	YFP	8	3000	178.0	9.2	0.9	1.75	0.6	4.0	8.0	Q1
SN74AUP1G74YZPR	DSBGA	YZP	8	3000	178.0	9.2	1.02	2.02	0.63	4.0	8.0	Q1

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

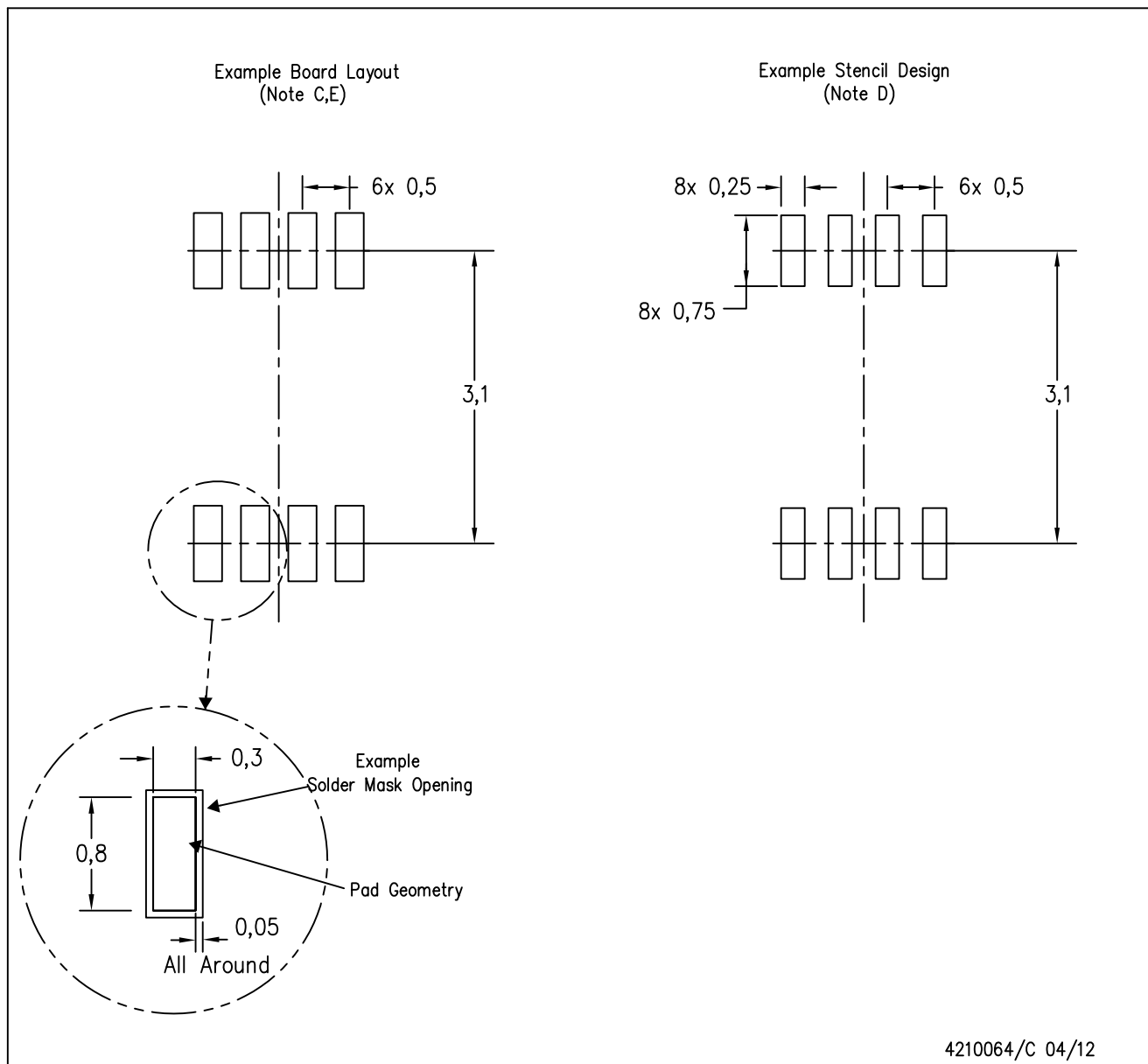
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74AUP1G74DCUR	US8	DCU	8	3000	202.0	201.0	28.0
SN74AUP1G74DQER	X2SON	DQE	8	5000	202.0	201.0	28.0
SN74AUP1G74RSER	UQFN	RSE	8	5000	202.0	201.0	28.0
SN74AUP1G74YFPR	DSBGA	YFP	8	3000	220.0	220.0	35.0
SN74AUP1G74YZPR	DSBGA	YZP	8	3000	220.0	220.0	35.0





DCU (S-PDSO-G8)

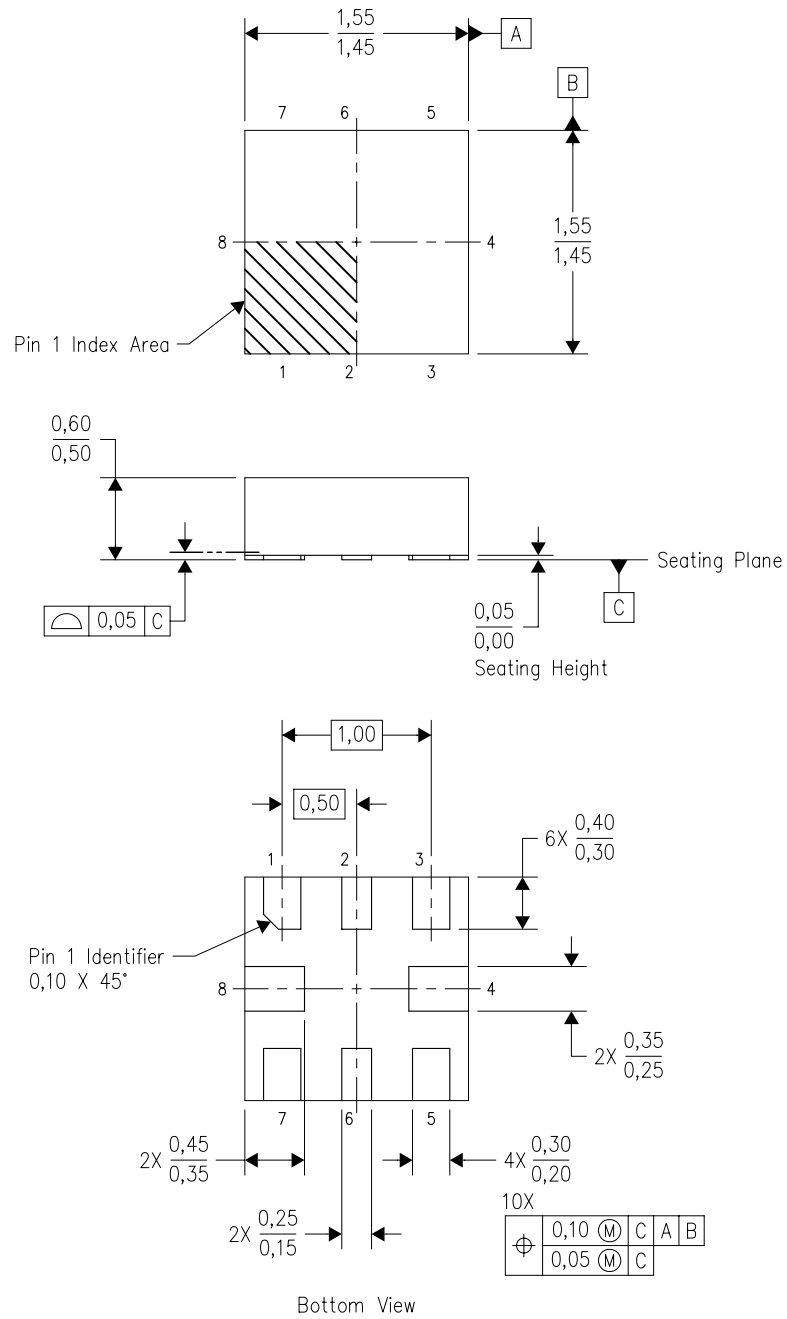
PLASTIC SMALL OUTLINE PACKAGE (DIE DOWN)



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

RSE (S-PUQFN-N8)

PLASTIC QUAD FLATPACK NO-LEAD

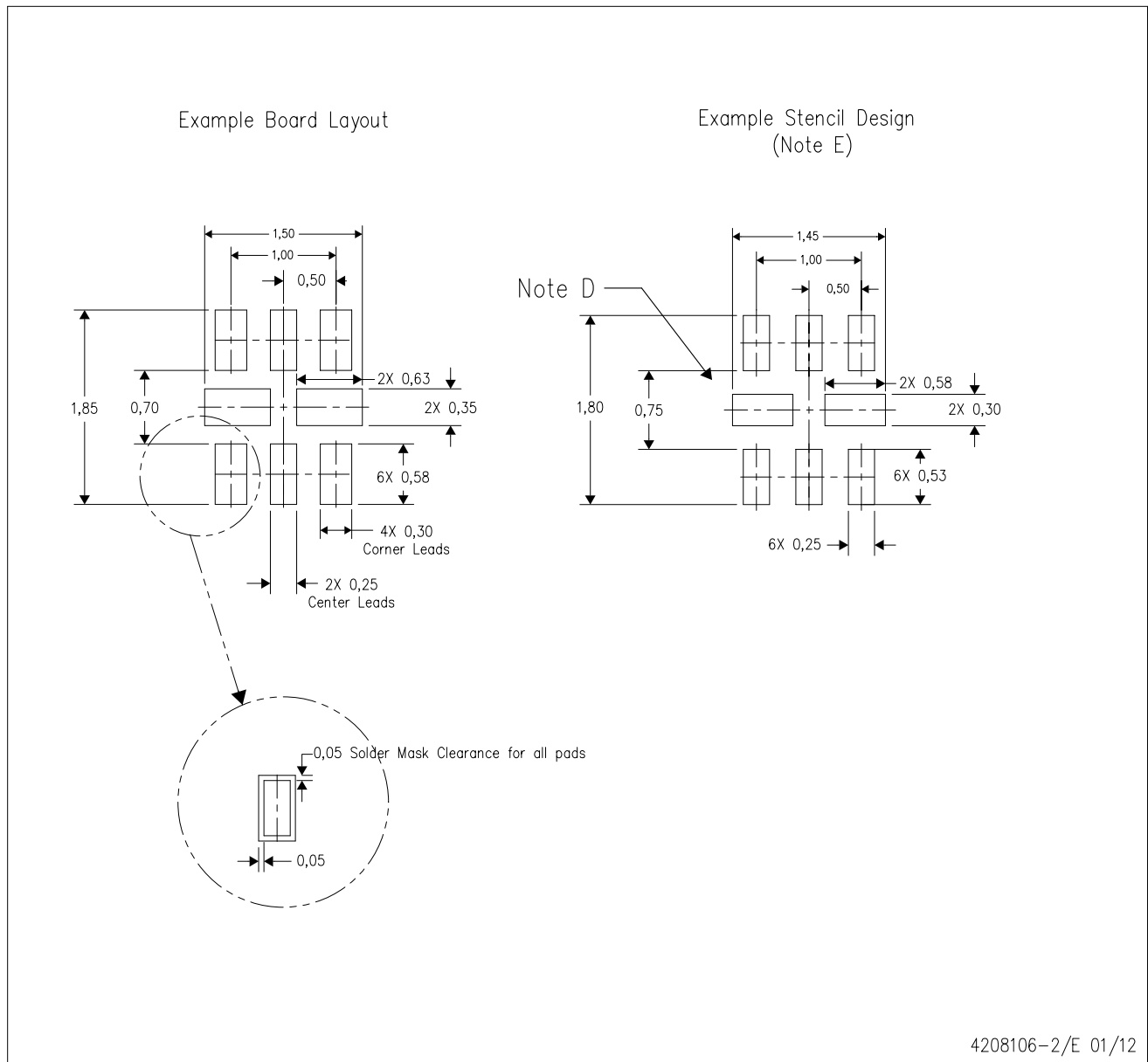


4207268-2/D 01/11

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

RSE (S-PUQFN-N8)

PLASTIC QUAD FLATPACK NO-LEAD

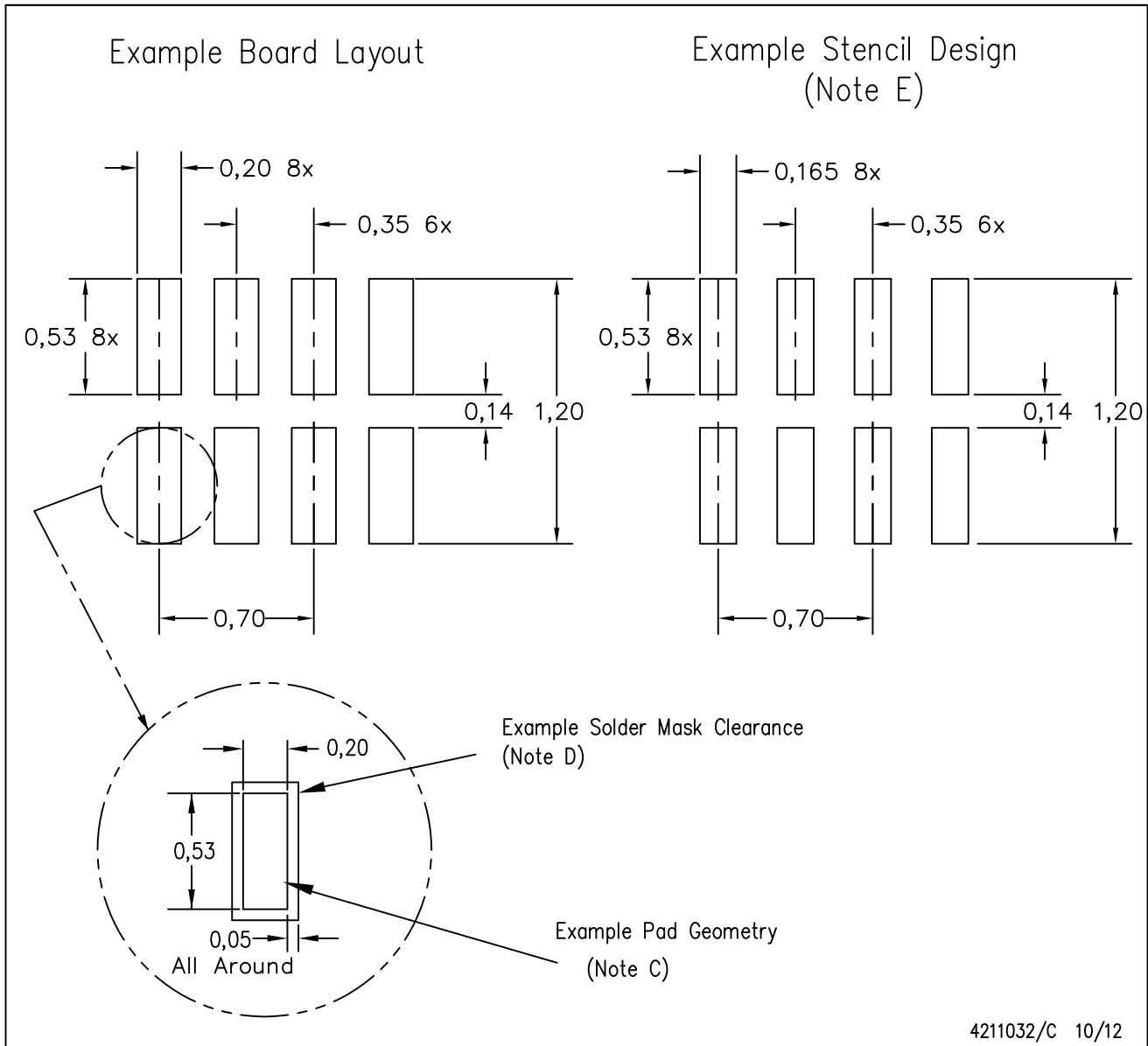


- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate designs.
  - D. Customers should contact their board fabrication site for minimum solder mask web tolerances between signal pads.
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

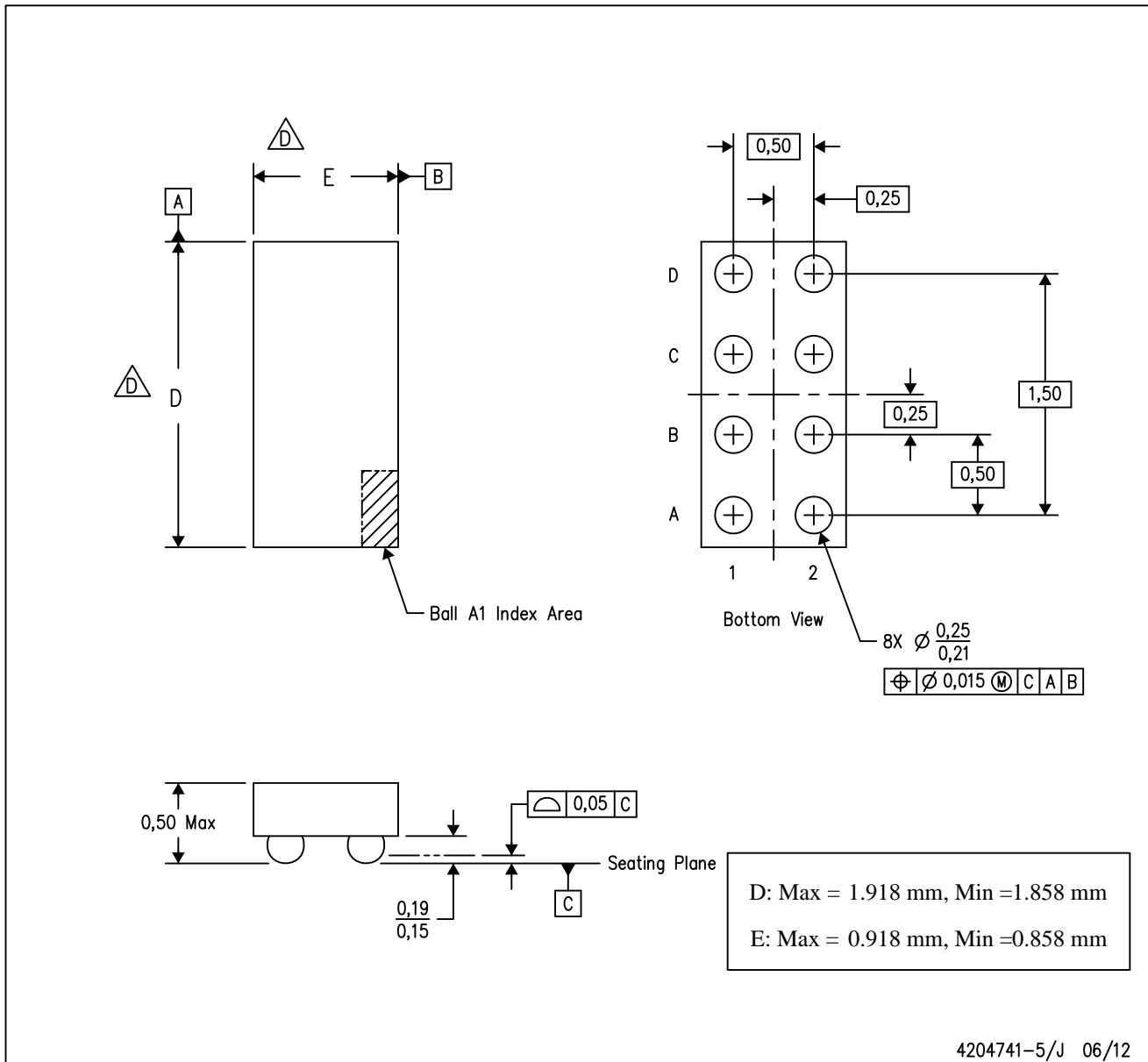
PLASTIC SMALL OUTLINE NO-LEAD



- 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.  
If 2 mil solder mask is outside PCB vendor capability, it is advised to omit solder mask.
  - E. Maximum stencil thickness 0,1016 mm (4 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. 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.
  - H. Suggest stencils cut with lasers such as Fiber Laser that produce the greatest positional accuracy.
  - I. Component placement force should be minimized to prevent excessive paste block deformation.

YZP (R-XBGA-N8)

DIE-SIZE BALL GRID ARRAY

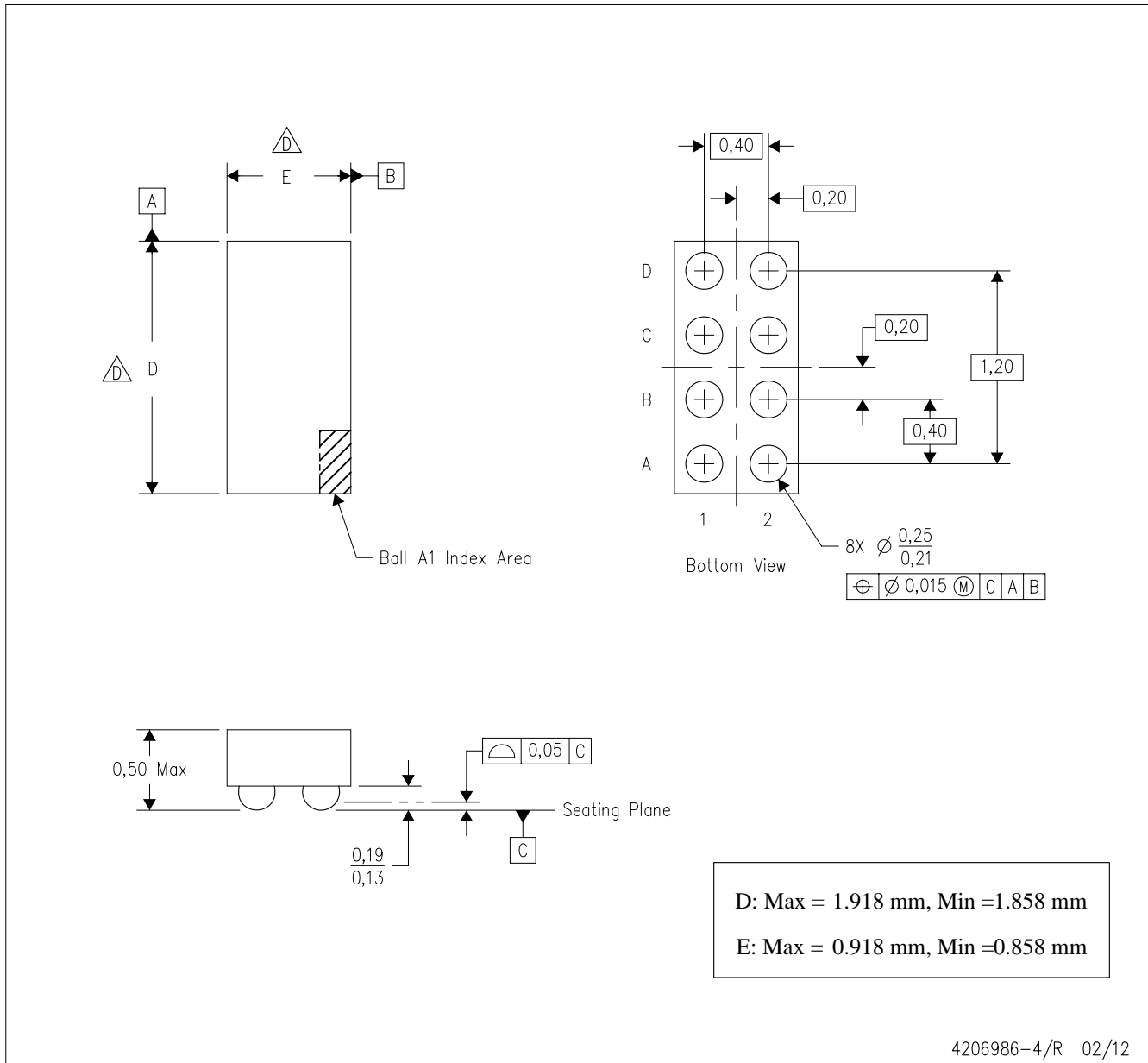


- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - C. NanoFree™ package configuration.
  - $\triangle$  The package size (Dimension D and E) of a particular device is specified in the device Product Data Sheet version of this drawing, in case it cannot be found in the product data sheet please contact a local TI representative.
  - E. This package is a Pb-free solder ball design. Refer to the 8 YEP package (drawing 4204725) for tin-lead (SnPb).

NanoFree is a trademark of Texas Instruments.

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.
  - $\triangle D$  The package size (Dimension D and E) of a particular device is specified in the device Product Data Sheet version of this drawing, in case it cannot be found in the product data sheet please contact a local TI representative.
  - E. Reference Product Data Sheet for array population.  
2 x 4 matrix pattern is shown for illustration only.
  - F. This package contains Pb-free balls.

NanoFree is a trademark of Texas Instruments



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