200-MHz GENERAL-PURPOSE CLOCK BUFFER, PCI-X COMPLIANT

Check for Samples: CDCV304-EP

FEATURES

- **General-Purpose and PCI-X 1:4 Clock Buffer**
- **Operating Frequency**
  - **0 MHz to 200 MHz General-Purpose**
- **Low Output Skew: <100 ps**
- **Distributes One Clock Input to One Bank of Four Outputs**
- **Output Enable Control that Drives Outputs Low when OE is Low**
- **Operates from Single 3.3-V Supply or 2.5-V Supply**
- **PCI-X Compliant**
- **8-Pin TSSOP Package**

SUPPORTS DEFENSE, AEROSPACE, AND MEDICAL APPLICATIONS

- **Controlled Baseline**
- **One Assembly/Test Site**
- **One Fabrication Site**
- **Available in –40°C/105°C Temperature Range**(1)
- **Extended Product Life Cycle**
- **Extended Product-Change Notification**
- **Product Traceability**

TSSOP
PW PACKAGE
(TOP VIEW)

(1) Custom temperature ranges available

DESCRIPTION

The CDCV304 is a high-performance, low-skew, general-purpose PCI-X compliant clock buffer. It distributes one input clock signal (CLKIN) to the output clocks (1Y[0:3]). It is specifically designed for use with PCI-X applications. The CDCV304 operates at 3.3 V and 2.5 V and is therefore compliant to the 3.3-V PCI-X specifications.

The CDCV304 is characterized for operation from –40°C to 105°C.

FUNCTIONAL BLOCK DIAGRAM

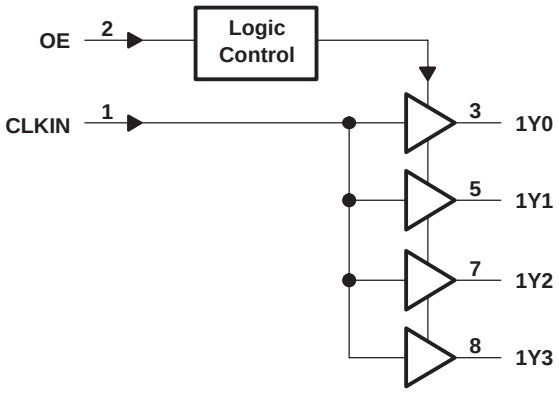


Table 1. FUNCTION TABLE

INPUTS		OUTPUTS
CLKIN	OE	1Y[0:3]
L	L	L
H	L	L
L	H	L
H	H	H

This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

Table 2. ORDERING INFORMATION(1)

T_A	PACKAGE	ORDERABLE PART NUMBER	TOP-SIDE MARKING	VID NUMBER
–40°C to 105°C	TSSOP - PW	CDCV304TPWREP	C304T	V62/12618-01XE

(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.

TERMINAL FUNCTIONS

TERMINAL		I/O	DESCRIPTION
NAME	NO.		
1Y[0:3]	3, 5, 7, 8	O	Buffered output clocks
CLKIN	1	I	Input reference frequency
GND	4	Power	Ground
OE	2	I	Output enable control
V_{DD}	6	Power	Supply

ABSOLUTE MAXIMUM RATINGS

over operating free-air temperature range (unless otherwise noted) (1)

	UNIT
Supply voltage range, V_{DD}	–0.5 V to 4.3 V
Input voltage range, V_I (2) (3)	–0.5 V to V_{DD} + 0.5 V
Output voltage range, V_O (2) (3)	–0.5 V to V_{DD} + 0.5 V
Input clamp current, I_{IK} (V_I < 0 or V_I> V_{DD})	±50 mA
Output clamp current, I_{OK} (V_O < 0 or V_O > V_{DD})	±50 mA
Continuous total output current, I_O (V_O = 0 to V_{DD})	±50 mA
Storage temperature range T_{stg}	–65°C to 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 and output negative voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
(3) This value is limited to 4.6 V maximum.

THERMAL INFORMATION

THERMAL METRIC[1]		CDCV304 PW 8 PINS	UNITS
θ_{JA}	Junction-to-ambient thermal resistance[2]	175.8	°C/W
θ_{JCtop}	Junction-to-case (top) thermal resistance[3]	61.8	
θ_{JB}	Junction-to-board thermal resistance[4]	104.3	
ψ_{JT}	Junction-to-top characterization parameter[5]	7.7	
ψ_{JB}	Junction-to-board characterization parameter[6]	102.6	

(1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, SPRA953.
(2) The junction-to-ambient thermal resistance under natural convection is obtained in a simulation on a JEDEC-standard, high-K board, as specified in JESD51-7, in an environment described in JESD51-2a.
(3) The junction-to-case (top) thermal resistance is obtained by simulating a cold plate test on the package top. No specific JEDEC-standard test exists, but a close description can be found in the ANSI SEMI standard G30-88.
(4) The junction-to-board thermal resistance is obtained by simulating in an environment with a ring cold plate fixture to control the PCB temperature, as described in JESD51-8.
(5) The junction-to-top characterization parameter, ψ_{JT}, estimates the junction temperature of a device in a real system and is extracted from the simulation data for obtaining θ_{JA}, using a procedure described in JESD51-2a (sections 6 and 7).
(6) The junction-to-board characterization parameter, ψ_{JB}, estimates the junction temperature of a device in a real system and is extracted from the simulation data for obtaining θ_{JA} , using a procedure described in JESD51-2a (sections 6 and 7).

RECOMMENDED OPERATING CONDITIONS

		MIN	NOM	MAX	UNIT
Supply voltage, V_{DD}		2.3		3.6	V
Low-level input voltage, V_{IL}				0.3 x V_{DD}	V
High-level input voltage, V_{IH}		0.7 x V_{DD}			V
Input voltage, V_I		0		V_{DD}	V
High-level output current, I_{OH}	V_{DD} = 2.5 V			–12	mA
	V_{DD} = 3.3 V			–24	
Low-level output current, I_{OL}	V_{DD} = 2.5 V			12	mA
	V_{DD} = 3.3 V			24	
Operating free-air temperature, T_A		–40		105	°C

TIMING REQUIREMENTS

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
f_{clk}	Clock frequency		0		200	MHz

ELECTRICAL CHARACTERISTICS

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

PARAMETER		TEST CONDITIONS		MIN	TYP(1)	MAX	UNIT
V_{IK}	Input voltage	V_{DD} = 3 V,	I_I = –18 mA			–1.2	V
V_{OH}	High-level output voltage	V_{DD} = min to max,	I_{OH} = –1 mA	V_{DD} – 0.3			V
		V_{DD} = 2.3 V,	I_{OH} = –8 mA	1.78			
		V_{DD} = 3 V,	I_{OH} = –24 mA	1.90			
		V_{DD} = 3 V,	I_{OH} = –12 mA	2.30			
V_{OL}	Low-level output voltage	V_{DD} = 2.3 V,	I_{OL} = 8 mA			0.51	V
		V_{DD} = min to max,	I_{OL} = 1 mA			0.20	
		V_{DD} = 3 V,	I_{OL} = 24 mA			0.84	
		V_{DD} = 3 V,	I_{OL} = 12 mA			0.60	
I_{OH}	High-level output current	V_{DD} = 3 V,	V_O = 1 V	–45			mA
		V_{DD} = 3.3 V,	V_O = 1.65 V		–55		
I_{OL}	Low-level output current	V_{DD} = 3 V,	V_O = 2 V	54			mA
		V_{DD} = 3.3 V,	V_O = 1.65 V		70		
I_I	Input current	V_I = V_O or V_{DD}				±5	µA
I_{DD}	Dynamic current, see	f = 67 MHz,	V_{DD} = 2.7 V			28	mA
		f = 67 MHz,	V_{DD} = 3.6 V			37	
C_I	Input capacitance	V_{DD} = 3.3 V,	V_I = 0 V or V_{DD}		3		pF
C_O	Output capacitance	V_{DD} = 3.3 V,	V_I = 0 V or V_{DD}		3.2		pF

(1) All typical values are with respect to nominal V_{DD} and T_A = 25°C.

SWITCHING CHARACTERISTICS

V_{DD} = 2.5 V ± 10%, C_L= 10 pF (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP(1)	MAX	UNIT
t_{PLH}	Low-to-high propagation delay	See Figure 1 and Figure 2	2	2.9	4.5	ns
t_{PHL}	High-to-low propagation delay		2	3	4.5	
$t_{sk(o)}$	Output skew(2)	See Figure 3		50	150	ps
t_r	Output rise slew rate(3)		1	2.2	4	V/ns
t_f	Output fall slew rate(3)		1	2.2	4	V/ns

(1) All typical values are with respect to nominal V_{DD}.
(2) The $t_{sk(o)}$ specification is only valid for equal loading of all outputs and T_A = -40°C to 85°C.
(3) This symbol is according to PCI-X terminology.

SWITCHING CHARACTERISTICS

V_{DD} = 3.3 V ± 10%, C_L= 10 pF (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP(1)	MAX	UNIT
t_{PLH}	Low-to-high propagation delay	See Figure 1 and Figure 2	1.8	2.4	3.8	ns
t_{PHL}	High-to-low propagation delay		1.8	2.5	3.8	
$t_{sk(o)}$	Output skew(2)			50	100	ps
t_{jitter}	Additive phase jitter from input to output 1Y0	12 kHz to 5 MHz, f_{out} = 30.72 MHz		63		fs rms
		12 kHz to 20 MHz, f_{out} = 125 MHz		56		
$t_{sk(p)}$	Pulse skew	$V_{IH} = V_{DD}$, V_{IL} = 0 V		180		ps
$t_{sk(pr)}$	Process skew			0.2		ns
$t_{sk(pp)}$	Part-to-part skew			0.25		ns
t_{high}	Clock high time, see Figure 4	66 MHz	6			ns
		140 MHz	2.2			
t_{low}	Clock low time, see Figure 4	66 MHz	6			ns
		140 MHz	3			
t_r	Output rise slew rate(3)		1	2.7	4	V/ns
t_f	Output fall slew rate(3)		1	2.7	4	V/ns

(1) All typical values are with respect to nominal V_{DD}.
(2) The $t_{sk(o)}$ specification is only valid for equal loading of all outputs and and T_A = -40°C to 85°C.
(3) This symbol is according to PCI-X terminology.

PARAMETER MEASUREMENT INFORMATION

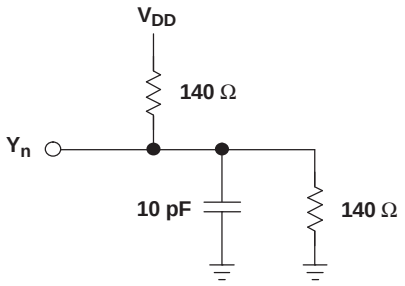


Figure 1. Test Load Circuit

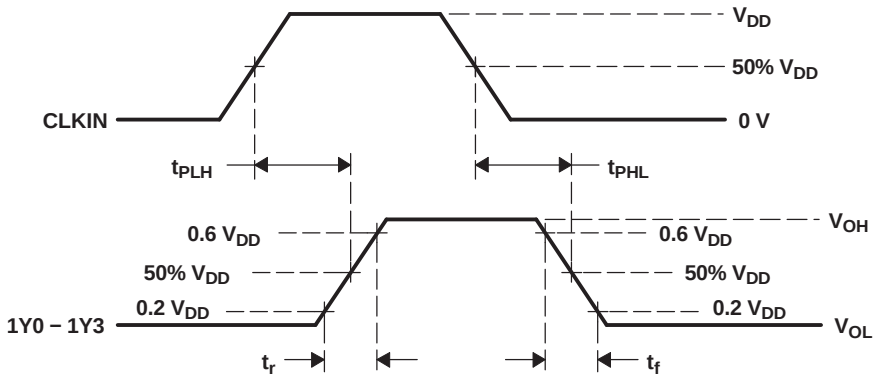


Figure 2. Voltage Waveforms Propagation Delay (t_{pd}) Measurements

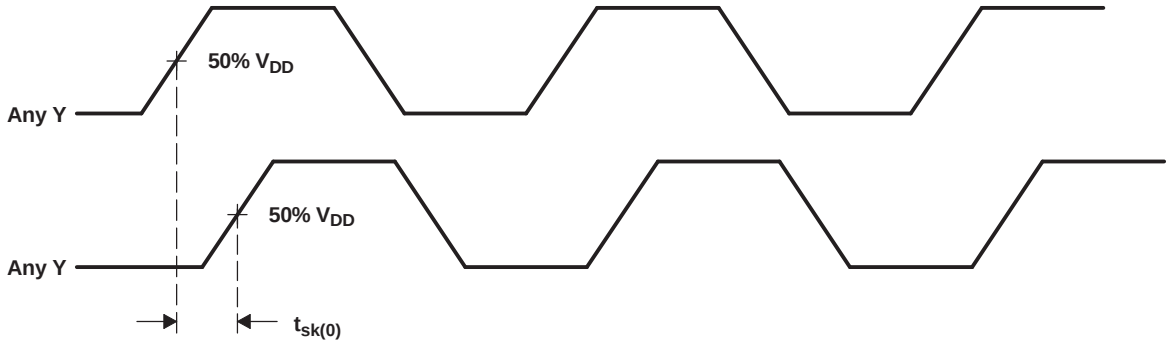
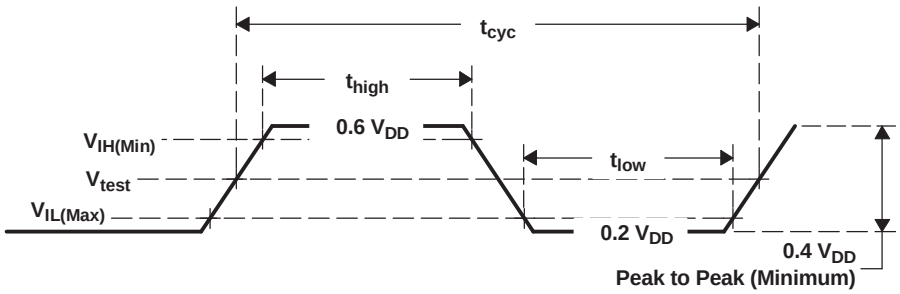


Figure 3. Output Skew

PARAMETER	VALUE	UNIT
$V_{IH(Min)}$	0.5 V_{DD}	V
$V_{IL(Max)}$	0.35 V_{DD}	V
V_{test}	0.4 V_{DD}	V



A. All parameters in Figure 4 are according to PCI-X 1.0 specifications.

Figure 4. Clock Waveform

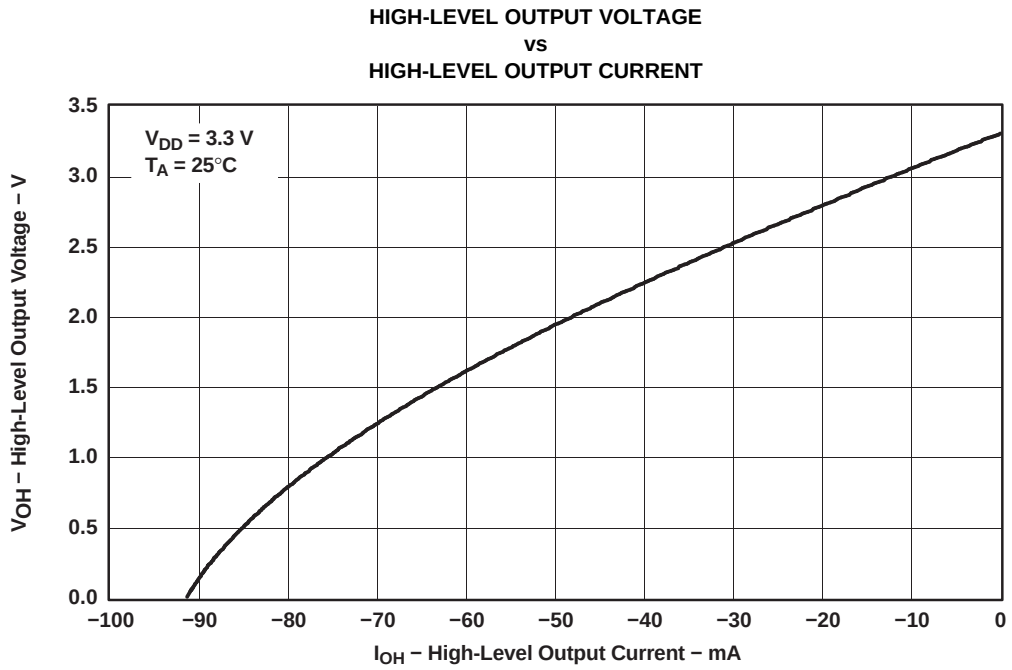


Figure 5.

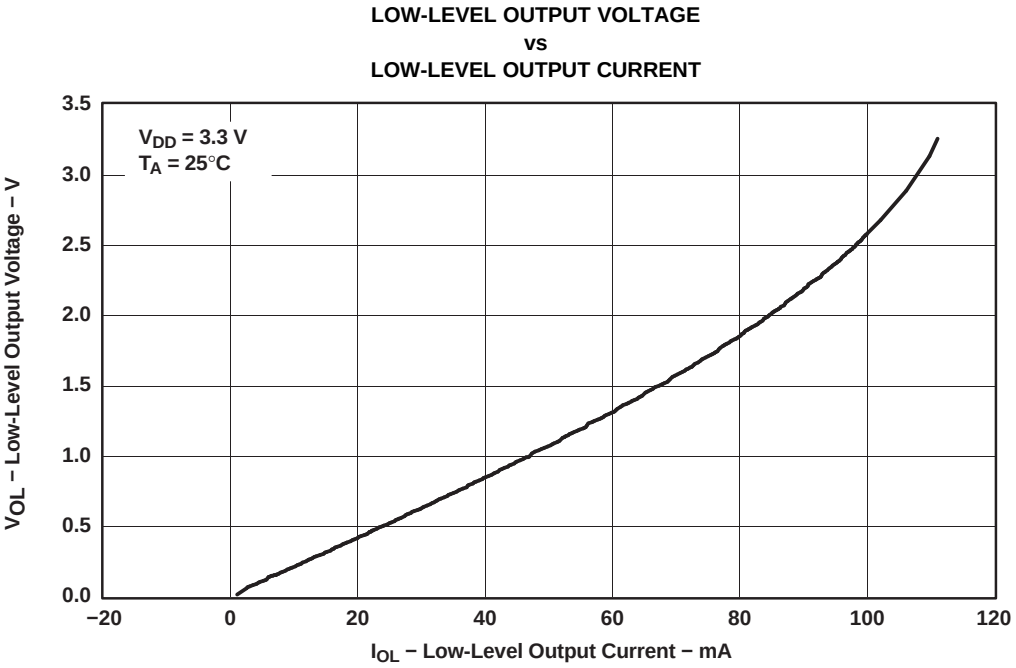


Figure 6.

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
CDCV304TPWREP	Active	Production	TSSOP (PW) | 8	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 105	C304T
CDCV304TPWREP.A	Active	Production	TSSOP (PW) | 8	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 105	C304T
V62/12618-01XE	Active	Production	TSSOP (PW) | 8	2000 | LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 105	C304T

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

OTHER QUALIFIED VERSIONS OF CDCV304-EP :

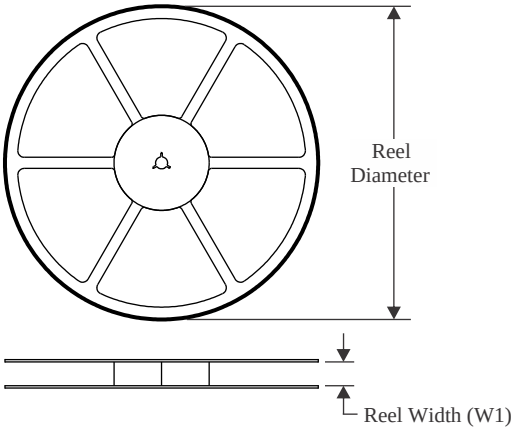
- Catalog : CDCV304

NOTE: Qualified Version Definitions:

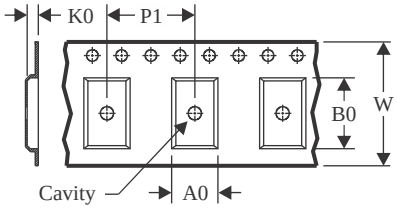
- Catalog - TI's standard catalog product

TAPE AND REEL INFORMATION

REEL DIMENSIONS

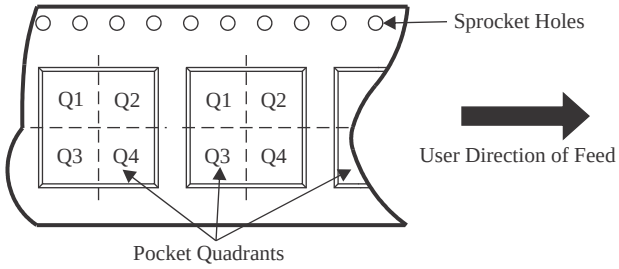


TAPE DIMENSIONS



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

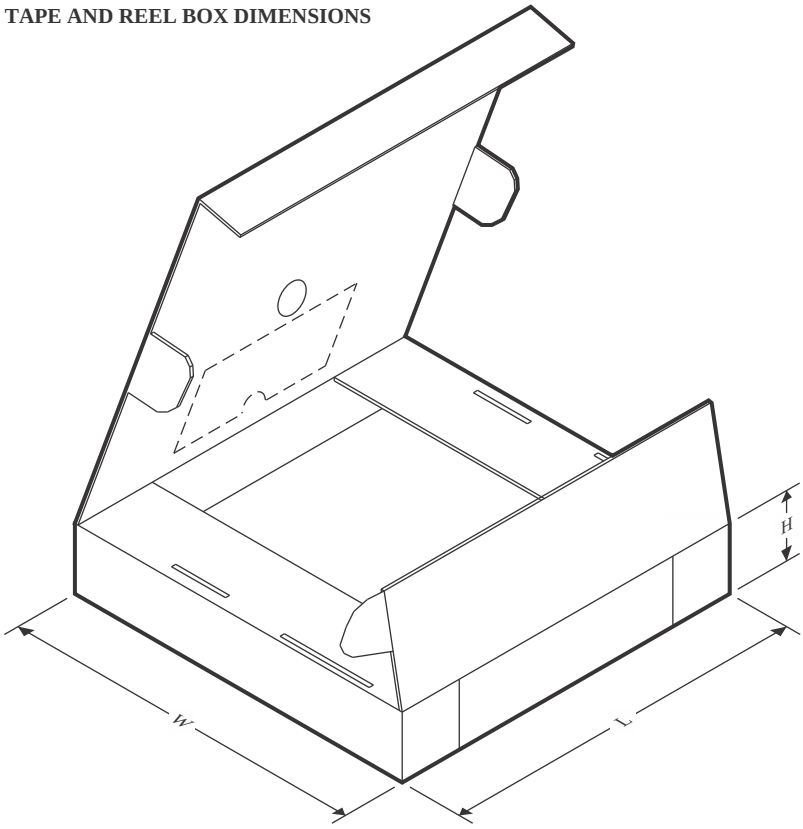
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
CDCV304TPWREP	TSSOP	PW	8	2000	330.0	12.4	7.0	3.6	1.6	8.0	12.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

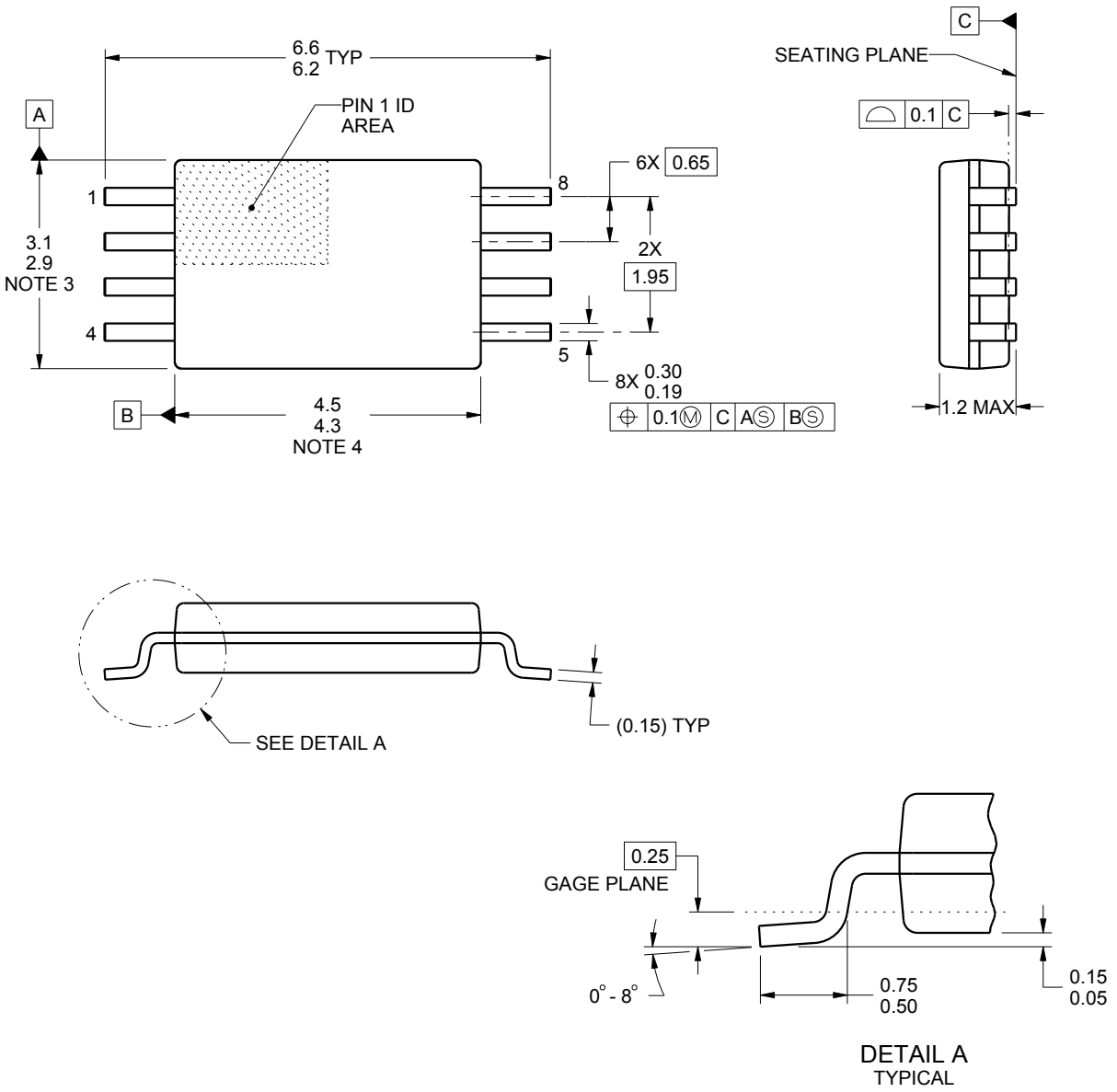
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CDCV304TPWREP	TSSOP	PW	8	2000	353.0	353.0	32.0

PACKAGE OUTLINE

PW0008A

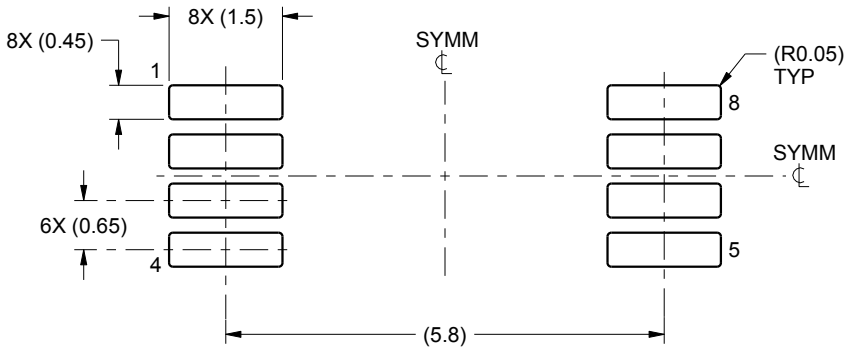
TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE

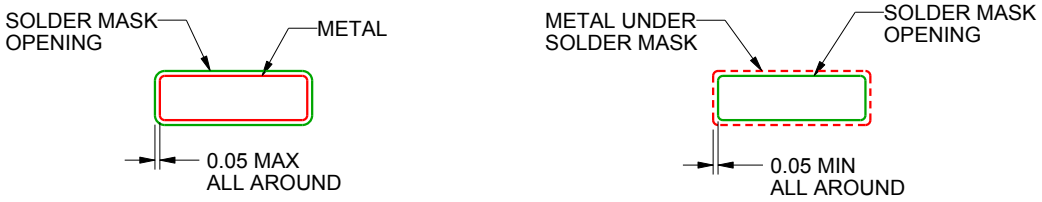


NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153, variation AA.



LAND PATTERN EXAMPLE
SCALE:10X



SOLDER MASK DETAILS
NOT TO SCALE

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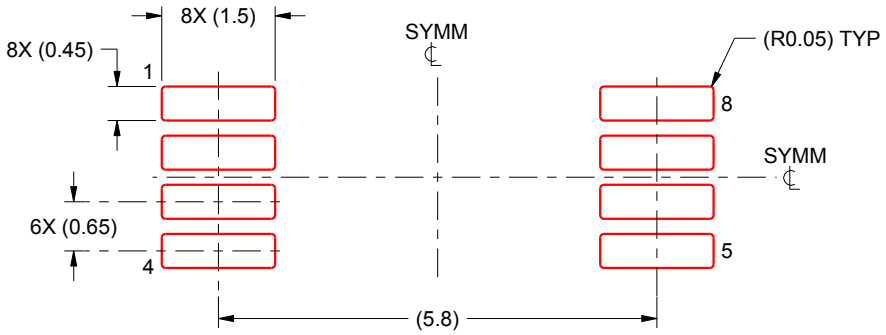
NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE:10X

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NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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