

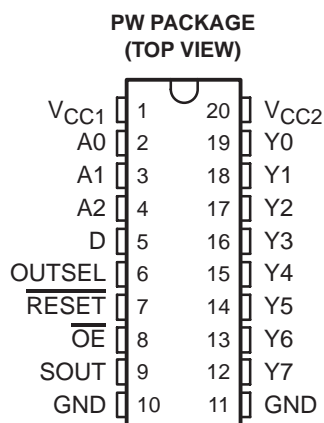
## DESCRIPTION

The SN74LV8153 is a serial-to-parallel data converter. It accepts serial input data and outputs 8-bit parallel data.

The automatic data-rate detection feature of the SN74LV8153 eliminates the need for an external oscillator and helps with cost and board real-estate savings.

The OUTSEL pin is used to choose between open collector and push-pull outputs. The open-collector option is suitable when this device is used in applications such as LED interface, where high drive current is required. SOUT is the output that acknowledges reception of the serial data.

To ensure the high-impedance state during power up or power down,  $\overline{OE}$  should be tied to  $V_{CC1}$  through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.



## FEATURES

- **Qualified for Automotive Applications**
- **Single-Wire Serial Data Input**
- **Compatible With UART Serial-Data Format**
- **Up to Eight Devices (64-Bit Parallel) Can Share the Same Bus by Using Different Combinations of A0, A1, A2**
- **Up to 40 mA Current Drive in Open-Collector Mode for Driving LEDs**
- **Outputs Can be Configured as Open-Collector or Push-Pull**
- **Internal Oscillator and Counter for Automatic Data-Rate Detection**
- **Output Levels Are Referenced to  $V_{CC2}$  and Can Be Configured From 3 V to 12 V**
- **Latch-Up Performance Exceeds 250 mA Per JESD 17**
- **ESD Protection Exceeds JESD 22**
  - 2000-V Human-Body Model (A114-A)
  - 1000-V Charged-Device Model (C101)

## SUMMARY OF RECOMMENDED OPERATING CONDITIONS

PARAMETER	
$V_{CC1}$	3 V to 5.5 V
$V_{CC2}$	3 V to 13.2 V
$I_{OL}$	40 mA @ $V_{CC2} = 4.5$ V (open-collector mode)
$I_{OH}$	–24 mA @ $V_{CC2} = 12$ V (push-pull mode)
Maximum Data Rate	24 Kbps



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.

**FUNCTION TABLE**  
(each buffer)

INPUTS				OUTPUT Yn	OUTPUT STRUCTURE
OUTSEL	RESET	OE	Dn		
L	H	L	H	L	Open collector
L	H	L	L	H	
L	X	H	X	H	
L	L	X	X	H	
H	H	L	H	H	Push-pull
H	H	L	L	L	
H	X	H	X	Z	
H	L	L	X	L	

In the open-collector mode (OUTSEL = L), the outputs are inverted, e.g., Y1 = I, when D1 = H

### ORDERING INFORMATION<sup>†</sup>

T <sub>A</sub>	PACKAGE <sup>‡</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 125°C	TSSOP – PW	Tape and reel	SN74LV8153QPWRQ1	LV8153Q

<sup>†</sup> 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 <http://www.ti.com>.

<sup>‡</sup> Package drawings, thermal data, and symbolization are available at <http://www.ti.com/packaging>.

### PIN DESCRIPTION

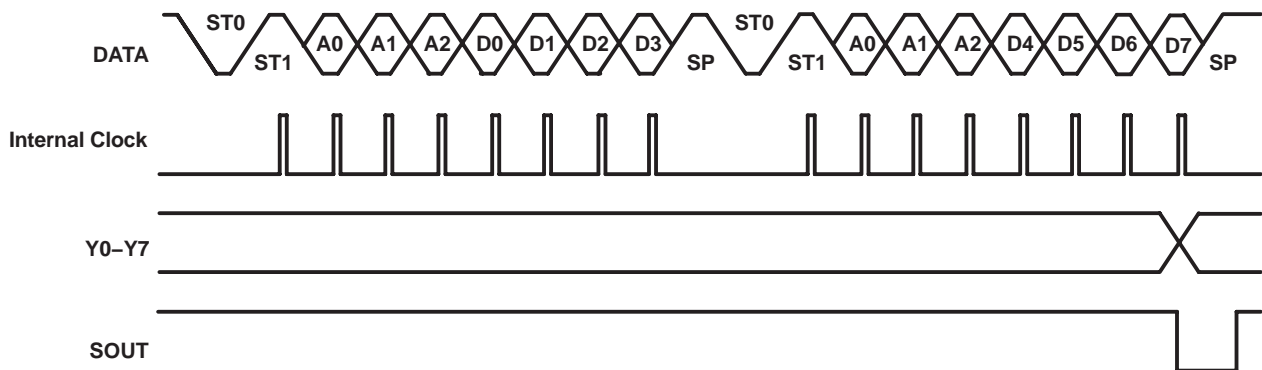
PIN #	PIN NAME	I/O	PIN FUNCTION
1	V <sub>CC1</sub>		Power-supply pin (all inputs and outputs except for Y0-Y7)
2-4	A0, A1, A2	In	The address pins are used to program the address of the device and allow up to eight devices to share the same bus.
5	D	In	Serial data input
6	OUTSEL	In	Choose between open-collector and push-pull type outputs (Y0-Y7).
7	RESET	In	Initialize register status
8	OE	In	Force Y0-Y7 to Hi-Z
9	SOUT	Out	Outputs a pulse when latch data is changed. Supplied by V <sub>CC1</sub> .
12-19	Y0-Y7	Out	Push-pull or open collector parallel data outputs. Supplied by V <sub>CC2</sub> .
20	V <sub>CC2</sub>		Power-supply pin for outputs (Y0-Y7). V <sub>CC2</sub> can range from 3 V to 13.2 V.

## data transmission protocol

- The serial data should be sent as 2START-3ADDRESS-4DATA-1STOP. Two consecutive serial-data frames transmit 8 bits of data. The first frame includes the lower four bits of data (D0-D3), and the second frame includes the upper four bits (D4-D7).
- The three address bits (in the consecutive frame) must be the same as those in the first frame; otherwise, the data will be dropped.
- The order of the two start bits must be 0, then 1 in any frame; otherwise, the data rate will not be detected correctly. The period between the falling edge of the first start bit (ST0) and the rising edge of the second start bit (ST1) is measured to generate an internal-clock synchronized data stream.



Example of Serial-Data Format



Timing Chart

(1) Internal clock cannot be observed.

(1) D0 is LSB and D7 is MSB. The data stream should be LSB first.



Supply voltage range, $V_{CC1}$	.....	-0.5 V to 7 V
Supply voltage range, $V_{CC2}$	.....	-0.5 V to 14.5 V
Input voltage range, $V_I^{(2)}$	.....	-0.5 V to 7 V
Voltage range applied to any output in the high or low state, $V_O$ (SOUT) <sup>(2)(3)</sup>	....	-0.5 V to $V_{CC1} + 0.5$ V
Voltage range applied to any output in the high-impedance or power-off state, $V_O$ (SOUT) <sup>(2)</sup>	.....	-0.5 V to 7 V
Voltage range, applied to any output in the high or low state, $V_O$ (Y0-Y7) <sup>(2)(3)</sup>	....	-0.5 V to $V_{CC2} + 0.5$ V
Voltage range applied to any output in the high-impedance or power-off state, $V_O$ (Y0-Y7) <sup>(2)</sup>	.....	-0.5 V to 14.5 V
Input clamp current, $I_{IK}$ ( $V_I < 0$ )	.....	-20 mA
Output clamp current, $I_{OK}$ ( $V_O < 0$ )	.....	-50 mA
Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ )	.....	25 mA
Continuous current, $I_O$ (OUTSEL = L, Y0-Y7 = L)	.....	60 mA
Package thermal impedance, $\theta_{JA}^{(4)}$	.....	83°C/W
Storage temperature range, $T_{stg}$	.....	-65°C to 150°C

(4) The package thermal impedance is calculated in accordance with JEDEC 51-7.

**recommended operating conditions<sup>(1)</sup>**

				V <sub>CC1</sub>	V <sub>CC2</sub>	MIN	MAX	UNIT	
V <sub>CC1</sub>	Supply voltage					3	5.5	V	
V <sub>CC2</sub>	Supply voltage					3	13.2	V	
V <sub>IH</sub>	High-level input voltage			3 V	3 V	V <sub>CC</sub> × 0.7		V	
				4.5 V	4.5 V	V <sub>CC</sub> × 0.7			
V <sub>IL</sub>	Low-level input voltage			3 V	3 V	V <sub>CC</sub> × 0.3		V	
				4.5 V	4.5 V	V <sub>CC</sub> × 0.3			
V <sub>I</sub>	Input voltage					0	5.5	V	
V <sub>O</sub>	Output voltage			4.5 V	4.5 V	0	5.5	V	
					12 V	0	13.2		
I <sub>OH</sub>	High-level output current	Y <sub>n</sub>	OUTSEL = H	3 V	3 V	−2		mA	
				4.5 V	4.5 V	−8			
				4.5 V	12 V	−24			
		SOUT			3 V	3 V	−4		mA
					4.5 V	4.5 V	−8		
I <sub>OL</sub>	Low-level output current	Y <sub>n</sub>	OUTSEL = H	3 V	3 V	2		mA	
				4.5 V	4.5 V	8			
			OUTSEL = L	3 V	3 V	20			
				4.5 V	4.5 V	40			
		SOUT		3 V	3 V	4			
				4.5 V	4.5 V	8			
		T <sub>A</sub>	Operating free-air temperature						−40

(1) All unused inputs of the device must be held at V<sub>CC</sub> 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 over recommended operating free-air temperature range (unless otherwise noted)**

PARAMETER		TEST CONDITIONS	V <sub>CC1</sub>	V <sub>CC2</sub>	MIN	TYP	MAX	UNIT
$V_{T+}$ Positive-going input threshold voltage	All inputs		3.3 V	3.3 V			2.31	V
			5 V	5 V			3.5	
$V_{T-}$ Negative-going input threshold voltage	All inputs		3.3 V	3.3 V	0.99			V
			5 V	5 V	1.5			
$\Delta V_T$ Hysteresis ( $V_{T+} - V_{T-}$ )	All inputs		3.3 V	3.3 V	0.33		1.32	V
			5 V	5 V	0.5		2	
$V_{OH}$	Yn	$I_{OH} = -2 \text{ mA}$	3 V	3 V	2.38			V
		$I_{OH} = -8 \text{ mA}$	4.5 V	4.5 V	3.8			
		$I_{OH} = -24 \text{ mA}$	4.5 V	12 V	11			
	SOUT	$I_{OH} = -4 \text{ mA}$	3 V	3 V	2.38			
		$I_{OH} = -8 \text{ mA}$	4.5 V	4.5 V	3.8			
$V_{OL}$	Yn	$I_{OL} = 2 \text{ mA}$ (OUTSEL = H)	3 V	3 V			0.44	V
		$I_{OL} = 8 \text{ mA}$ (OUTSEL = H)	4.5 V	4.5 V			0.44	
		$I_{OL} = 40 \text{ mA}$ (OUTSEL = L)	4.5 V	4.5 V			0.5	
	SOUT	$I_{OL} = 4 \text{ mA}$	3 V	3 V			0.44	
		$I_{OL} = 8 \text{ mA}$	4.5 V	4.5 V			0.44	
$I_I$		$V_I = 5.5 \text{ V}$ or GND	0 to 5.5 V				$\pm 1$	$\mu\text{A}$
$I_{OZ}$		$V_O = V_{CC}$ or GND (OUTSEL = H)	5.5 V	5.5 V			$\pm 5$	$\mu\text{A}$
$I_{OH}$		$V_O = 12 \text{ V}$ (OUTSEL = L)	5.5 V	5.5 V			5	$\mu\text{A}$
$I_{CC}$		$V_I = V_{CC}$ or GND, $I_O = 0$	5.5 V	5.5 V			5	mA
							20	
$I_{off}$ (except SOUT)		$V_I$ or $V_O = 0$ to 5.5 V, $V_{CC} = 0$	0	0			$\pm 50$	$\mu\text{A}$
$C_i$		$V_I = V_{CC}$ or GND	5 V	5 V			5	pF

**switching characteristics over recommended operating free-air temperature range,  $V_{CC1} = V_{CC2} = 3.3 \text{ V} \pm 0.3 \text{ V}$  (unless otherwise noted) (see Figures 1 and 2)**

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	$T_A = 25^\circ\text{C}$			MIN	MAX	UNIT
				MIN	TYP	MAX			
$t_{pd}$	D7	Y	$C_L = 50 \text{ pF}$		$P_w/2$	(1)			ns
	D7	SOUT			$P_w/2$	(1)			
	RESET	Y						220	
	$\overline{OE}(2)$	Y						220	
$t_{en}$	$\overline{OE}(3)$	Y						220	ns
$t_{dis}$	$\overline{OE}(3)$	Y						220	ns
$t_w$		SOUT			$P_w$	(4)			ns
Data rate							2	24	Kbps

(1) The  $t_{pd}$  is dependent on the data pulse width ( $P_w$ ), and Y outputs are changed after one-half of  $P_w$ , because the internal clock is synchronized at the middle of the data pulse. Not tested, but specified by design.

(2) When outputs are open collector (OUTSEL = L)

(3) When outputs are push-pull (OUTSEL = H)

(4) SOUT goes low when the data is received correctly and maintains a low level for one data-pulse period. Not tested, but specified by design.

switching characteristics over recommended operating free-air temperature range,  $V_{CC1} = V_{CC2} = 5\text{ V} \pm 0.5\text{ V}$  (unless otherwise noted) (see Figures 1 and 2)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	$T_A = 25^\circ\text{C}$			MIN	MAX	UNIT
				MIN	TYP	MAX			
$t_{pd}$	D7	Y	$C_L = 50\text{ pF}$		Pw/2	(1)			ns
	D7	SOUT			Pw/2	(1)			
	$\overline{\text{RESET}}$	Y						200	
	$\overline{\text{OE}}(2)$	Y						200	
$t_{en}$	$\overline{\text{OE}}(3)$	Y						200	ns
$t_{dis}$	$\overline{\text{OE}}(3)$	Y						200	ns
$t_w$		SOUT			Pw	(4)			ns
Data rate							2	24	Kbps

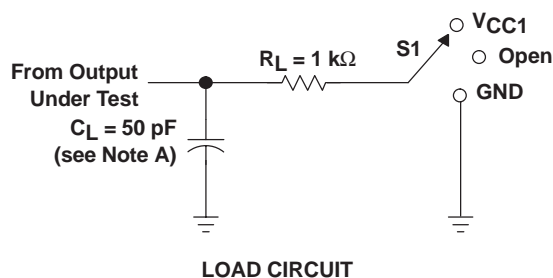
(1) The  $t_{pd}$  is dependent on the data pulse width (Pw), and Y outputs are changed after one-half of Pw, because the internal clock is synchronized at the middle of the data pulse. Not tested, but specified by design.

(2) When outputs are open collector (OUTSEL = L)

(3) When outputs are push-pull (OUTSEL = H)

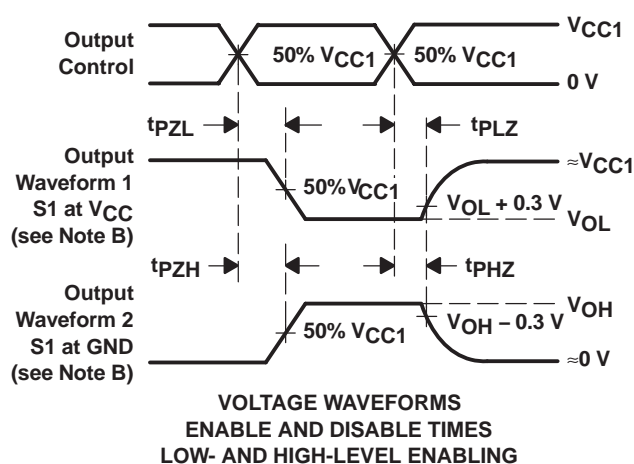
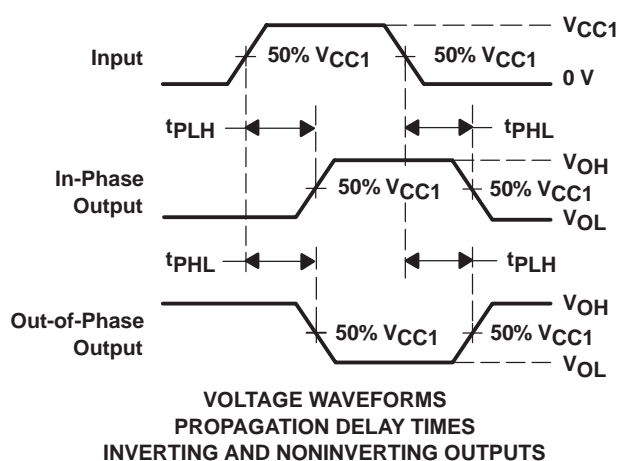
(4) SOUT goes low when the data is received correctly and maintains a low level for one data-pulse period. Not tested, but specified by design.

## PARAMETER MEASUREMENT INFORMATION (PUSH-PULL OUTPUT)



TEST	S1
$t_{PLH}/t_{PHL}$	Open
$t_{PLZ}/t_{PZL}$	VCC1
$t_{PHZ}/t_{PZH}$	GND

50% VCC1

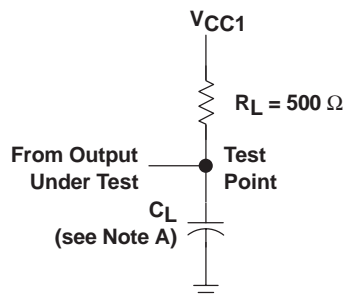


- NOTES:
- A.  $C_L$  includes probe and jig capacitance.
  - B. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
  - C. All input pulses are supplied by generators having the following characteristics:  $Z_O = 50 \Omega$ ,  $t_r \leq 3 \text{ ns}$ ,  $t_f \leq 3 \text{ ns}$ .
  - D. The outputs are measured one at a time, with one input transition per measurement.
  - E.  $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
  - F.  $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .
  - G.  $t_{PHL}$  and  $t_{PLH}$  are the same as  $t_{pd}$ .
  - H. All parameters and waveforms are not applicable to all devices.

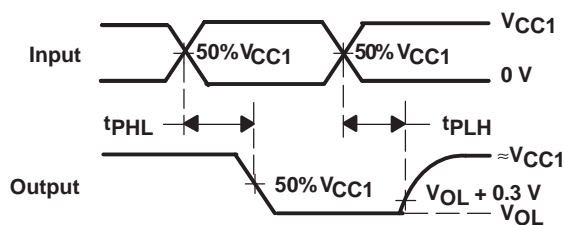
Figure 1. Load Circuit and Voltage Waveforms



## PARAMETER MEASUREMENT INFORMATION (OPEN-COLLECTOR OUTPUT)



LOAD CIRCUIT FOR  
OPEN-COLLECTOR OUTPUTS



VOLTAGE WAVEFORMS  
PROPAGATION DELAY TIMES

- NOTES:
- A.  $C_L$  includes probe and jig capacitance.
  - B. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 1 \text{ MHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r \leq 3 \text{ ns}$ ,  $t_f \leq 3 \text{ ns}$ .
  - C. The outputs are measured one at a time, with one input transition per measurement.
  - D.  $t_{PHL}$  and  $t_{PLH}$  are the same as  $t_{pd}$ .

Figure 2. Load Circuit and Voltage Waveforms

## 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)
<a href="#">SN74LV8153QPWRG4Q1</a>	Active	Production	TSSOP (PW)   20	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV8153Q
SN74LV8153QPWRG4Q1.A	Active	Production	TSSOP (PW)   20	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV8153Q
<a href="#">SN74LV8153QPWRQ1</a>	Active	Production	TSSOP (PW)   20	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV8153Q
SN74LV8153QPWRQ1.A	Active	Production	TSSOP (PW)   20	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV8153Q

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **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.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **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.

<sup>(5)</sup> **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.

<sup>(6)</sup> **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.

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**OTHER QUALIFIED VERSIONS OF SN74LV8153-Q1 :**

- Catalog : [SN74LV8153](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

## TAPE AND REEL INFORMATION



\*All dimensions are nominal

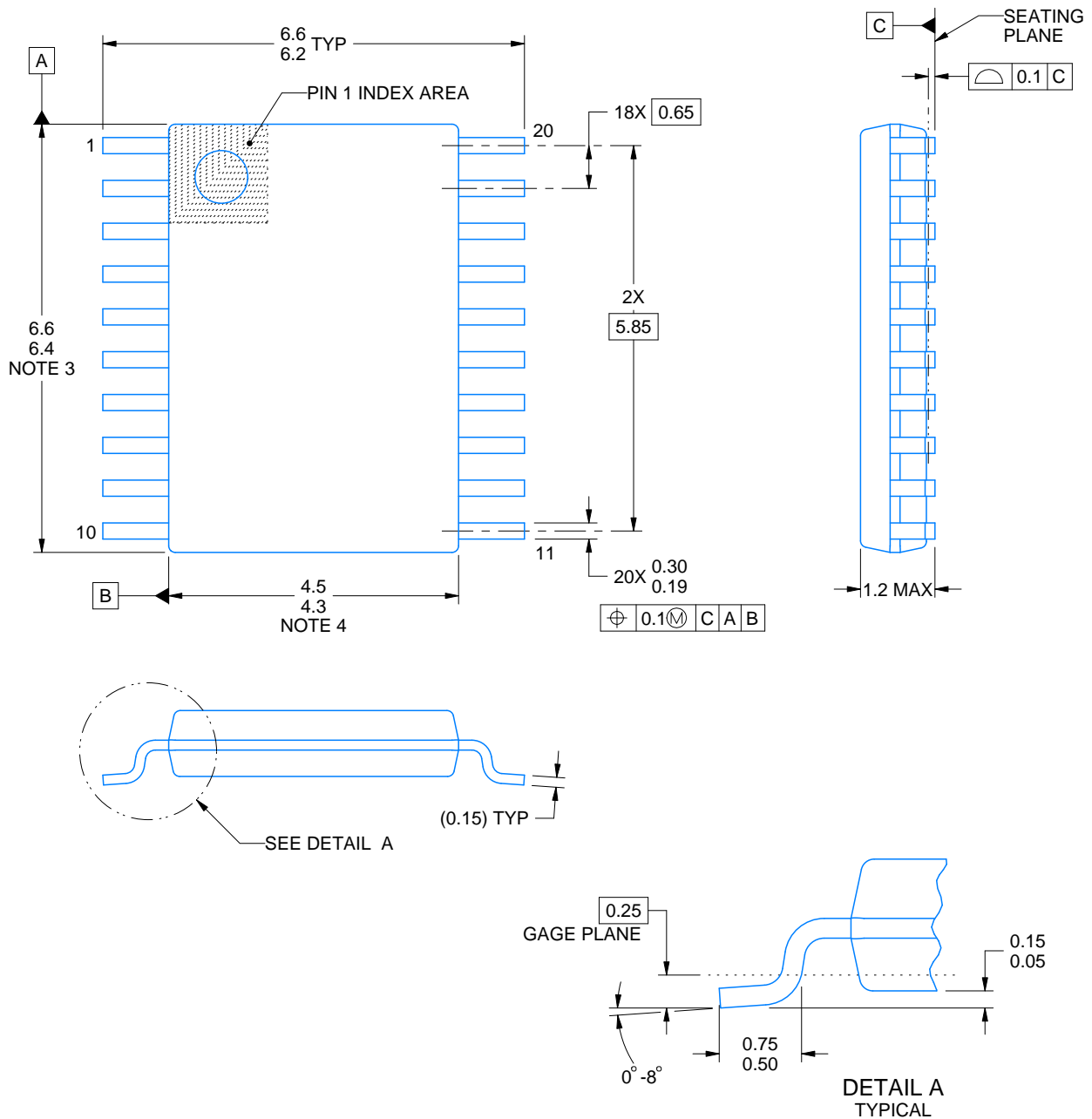
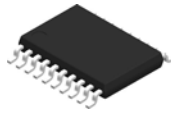
Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74LV8153QPWRG4Q1	TSSOP	PW	20	2000	330.0	16.4	6.95	7.0	1.4	8.0	16.0	Q1
SN74LV8153QPWRQ1	TSSOP	PW	20	2000	330.0	16.4	6.95	7.0	1.4	8.0	16.0	Q1

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LV8153QPWRG4Q1	TSSOP	PW	20	2000	353.0	353.0	32.0
SN74LV8153QPWRQ1	TSSOP	PW	20	2000	353.0	353.0	32.0



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## NOTES:

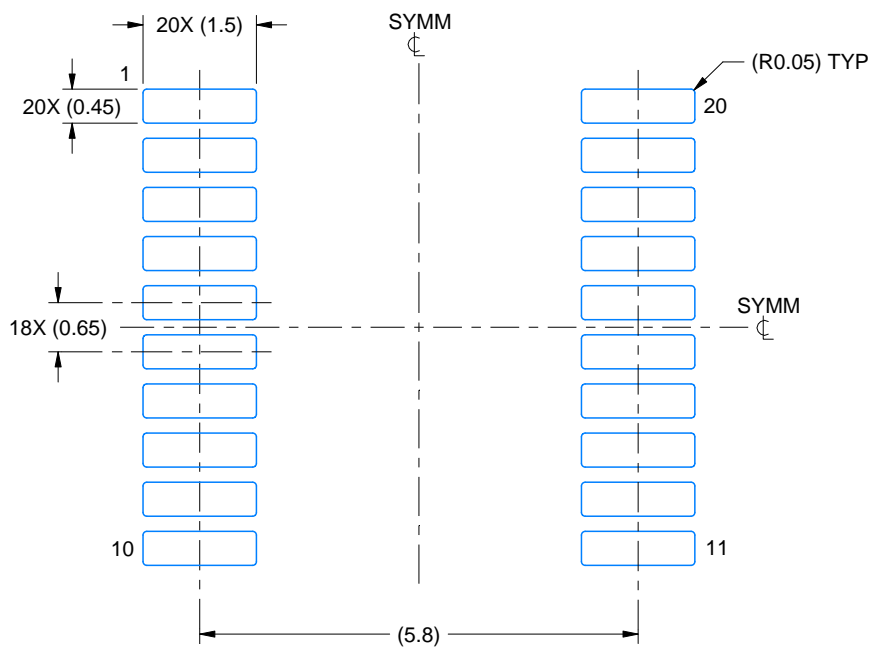
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or 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.

# EXAMPLE BOARD LAYOUT

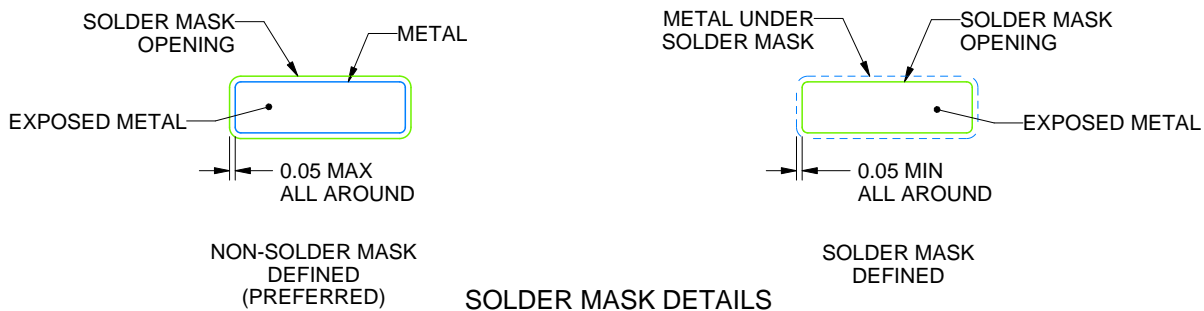
PW0020A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



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NOTES: (continued)

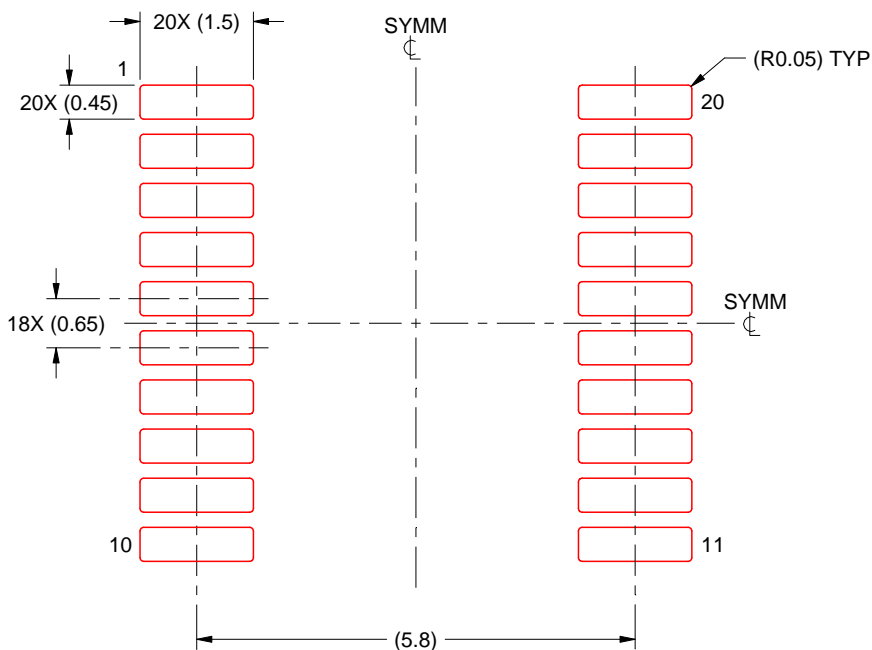
6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

## EXAMPLE STENCIL DESIGN

PW0020A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



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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