

SN74LV8153-Q1 SERIAL-TO-PARALLEL INTERFACE

SCLS591A - SEPTEMBER 2004 - REVISED APRIL 2008

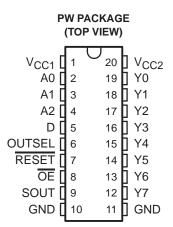
DESCRIPTION

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	
VCC1	3 V to 5.5 V
V _{CC2}	3 V to 13.2 V
lOL	40 mA @ V _{CC2} = 4.5 V (open-collector mode)
ЮН	-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)

	INPUT	S		OUTPUT	OUTPUT
OUTSEL	RESET	OE	Dn	Yn	STRUCTURE
L	Н	L	Н	L	
L	Н	L	L	Н	0
L	Χ	Н	X	Н	Open collector
L	L	Χ	Χ	Н	
Н	Н	L	Н	Н	
Н	Н	L	L	L	Duch null
Н	X	Н	X	Z	Push-pull
Н	L	L	Χ	L	

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

ORDERING INFORMATION†

TA			PACKAGE [‡]		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 125	°C	TSSOP - PW		Tape and reel	SN74LV8153QPWRQ1	LV8153Q

[†] 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.

PIN DESCRIPTION

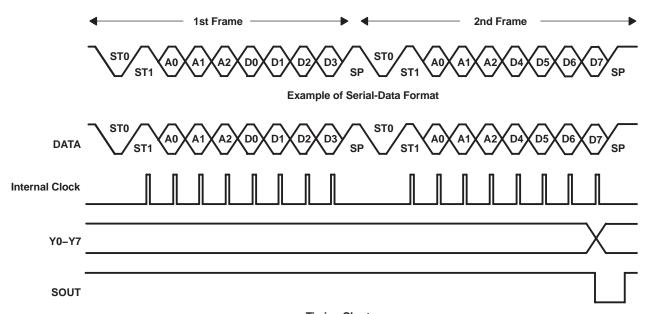
PIN#	PIN NAME	I/O	PIN FUNCTION
1	V _{CC1}		Power-supply pin (all inputs and outputs except for Y0-Y7)
2-4	A0, A1, A2	In	The address pins are used to program the address of the device and allow up to eight devices to share the same bus.
5	D	In	Serial data input
6	OUTSEL	In	Choose between open-collector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

 $^{\ ^{\}ddagger} \ \mathsf{Package} \ \mathsf{drawings}, \ \mathsf{thermal} \ \mathsf{data}, \ \mathsf{and} \ \mathsf{symbolization} \ \mathsf{are} \ \mathsf{available} \ \mathsf{at} \ \mathsf{http://www.ti.com/packaging}.$

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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.



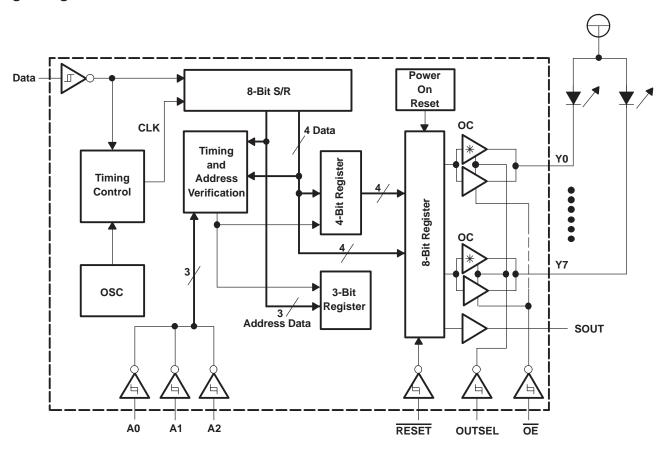
Timing Chart

⁽¹⁾Internal clock cannot be observed.

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



logic diagram



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

Supply voltage range, V _{CC1}	–0.5 V to 7 V
Supply voltage range, V _{CC2}	
Input voltage range, V _I ⁽²⁾	
Voltage range applied to any output in the high or low state, V _O (SOUT) ⁽²⁾⁽³⁾	$-0.5 \text{ V to V}_{CC1} + 0.5 \text{ V}$
Voltage range applied to any output in the high-impedance	
or power-off state, V _O (SOUT) ⁽²⁾	
Voltage range, applied to any output in the high or low state, V _O (Y0-Y7) ⁽²⁾ (3)	$-0.5 \text{ V to V}_{CC2} + 0.5 \text{ V}$
Voltage range applied to any output in the high-impedance	
or power-off state, V _O (Y0-Y7) ⁽²⁾	
Input clamp current, I _{IK} (V _I < 0)	
Output clamp current, I _{OK} (V _O < 0)	–50 mA
Continuous output current, I_O ($V_O = 0$ to V_{CC})	
Continuous current, I _O (OUTSEL = L, Y0-Y7 = L)	
Package thermal impedance, $\theta_{JA}^{(4)}$	
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 voltage ratings may be exceeded if the input and output current ratings are observed.

⁽³⁾ The value of V_{CC} is provided in the recommended operating condition table.

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



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recommended operating conditions (1)

				V _{CC1}	V _{CC2}	MIN	MAX	UNIT
VCC1	Supply voltage					3	5.5	V
V _{CC2}	Supply voltage					3	13.2	V
.,				3 V	3 V	V _{CC} ×0.7		.,
VIH	High-level input voltage		4.5 V	4.5 V	V _{CC} ×0.7		V	
.,	Law law d Sanatas Rawa			3 V	3 V		$V_{CC} \times 0.3$.,
V_{IL}	Low-level input voltage			4.5 V	4.5 V		$V_{CC} \times 0.3$	V
٧ _I	Input voltage					0	5.5	V
.,	0			4.5 V	4.5 V	0	5.5	.,
VO	Output voltage				12 V	0	13.2	V
			OUTSEL = H	3 V	3 V		-2	
		Yn		4.5 V	4.5 V		-8	mA
loh	High-level output current			4.5 V	12 V		-24	
		00117		3 V	3 V		-4	
		SOUT		4.5 V	4.5 V		-8	mA
			OUTOF! !!	3 V	3 V		2	
			OUTSEL = H	4.5 V	4.5 V		8	
	Law law of autout autout	Yn	OLITOFI I	3 V	3 V		20	mA
IOL	Low-level output current		OUTSEL = L	4.5 V	4.5 V		40	
		COLIT		3 V	3 V		4	
		SOUT		4.5 V	4.5 V		8	
TA	Operating free-air temperature					-40	125	°C

⁽¹⁾ All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.



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

PARAMET	ER	TEST CONDITIO	NS	V _{CC1}	V _{CC2}	MIN	TYP	MAX	UNIT
V _{T+}			3.3 V	3.3 V			2.31		
Positive-going input voltage	tthreshold	All inputs		5 V	5 V			3.5	V
V _T _	d dhaaah alal			3.3 V	3.3 V	0.99			.,
Negative-going input voltage	it threshold	All inputs		5 V	5 V	1.5			V
ΔV _T				3.3 V	3.3 V	0.33		1.32	
Hysteresi: (V _{T+} – V _{T-}		All inputs		5 V	5 V	0.5		2	V
		I _{OH} = -2 mA		3 V	3 V	2.38			
	Yn	I _{OH} = -8 mA		4.5 V	4.5 V	3.8			
VOH		I _{OH} = -24 mA	4.5 V	12 V	11			V	
_	2011	I _{OH} = -4 mA	3 V	3 V	2.38				
	SOUT	I _{OH} = -8 mA	4.5 V	4.5 V	3.8				
		I _{OL} = 2 mA (OUTSEL = H)		3 V	3 V			0.44	
	Yn	I _{OL} = 8 mA (OUTSEL = H)	4.5 V	4.5 V			0.44		
VOL		I _{OL} = 40 mA (OUTSEL = L)	4.5 V	4.5 V			0.5	V	
_	2011	I _{OL} = 4 mA	3 V	3 V			0.44		
	SOUT	I _{OL} = 8 mA		4.5 V	4.5 V			0.44	
lį		V _I = 5.5 V or GND		0 to 5.5 V				±1	μА
loz		$V_O = V_{CC}$ or GND (OUTSEL	= H)	5.5 V	5.5 V			±5	μА
ГОН		V _O = 12 V (OUTSEL = L)		5.5 V	5.5 V			5	μΑ
Icc		$V_I = V_{CC}$ or GND, $I_O = 0$ OUTSEL = H OUTSEL = L		5.5 V	5.5 V			5 20	mA
I _{off} (except	SOUT)	V _I or V _O = 0 to 5.5 V, V _{CC} = 0	0	0			±50	μΑ	
Ci	· · · · · · · · · · · · · · · · · · ·	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 V \pm 0.3 V (unless otherwise noted) (see Figures 1 and 2)

DADAMETED	FROM	то	LOAD	T,	4 = 25°C	;	MINI	BAAV	
PARAMETER	(INPUT)	(OUTPUT)	CAPACITANCE	MIN	TYP	MAX	MIN	MAX	UNIT
	D7	Υ			Pw/2	(1)			
for all	D7	SOUT]		Pw/2	(1)			
^t pd	RESET	Υ]					220	ns
	OE(2)	Y	C _L = 50 pF					220	
t _{en}	OE(3)	Υ						220	ns
^t dis	<u>OE</u> (3)	Y]					220	ns
t _W		SOUT]		Pw	(4)			ns
Data rate							2	24	Kbps

⁽¹⁾ The tpd 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.





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

DADAMETER	FROM	то	LOAD	T	չ = 25°C	;	MINI	MAY	LINUT
PARAMETER	(INPUT)	(OUTPUT)	CAPACITANCE	MIN	TYP	MAX	MIN	MAX	UNIT
	D7	Υ			Pw/2	(1)			
to a	D7	SOUT			Pw/2	(1)			20
^t pd	RESET	Υ						200	ns
	OE(2)	Υ	C _L = 50 pF					200	
t _{en}	<u>OE</u> (3)	Υ						200	ns
tdis	<u>OE</u> (3)	Υ						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)

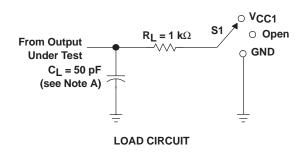
⁽³⁾ When outputs are push-pull (OUTSEL = H)

⁽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.

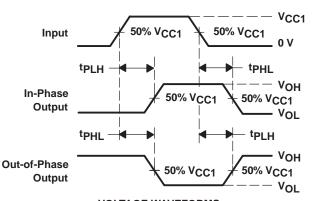


PARAMETER MEASUREMENT INFORMATION (PUSH-PULL OUTPUT)

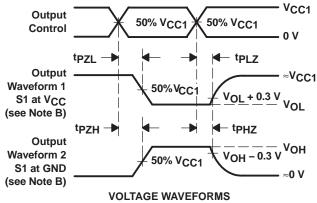
50% V_{CC1}



TEST	S 1
tPLH/tPHL	Open
tPLZ/tPZL	V _{CC1}
tPHZ/tPZH	GND



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

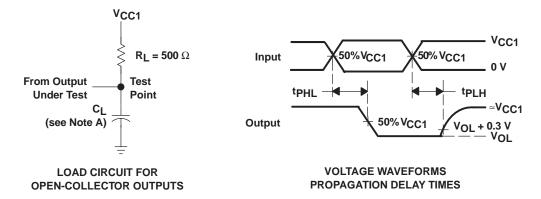
NOTES: A. C_I includes probe and jig capacitance.

- 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: $Z_Q = 50 \ \Omega$, $t_f \le 3 \ ns$, $t_f \le 3 \ ns$.
- D. The outputs are measured one at a time, with one input transition per measurement.
- E. tpLz and tpHz are the same as tdis.
- F. tpzI and tpzH are the same as ten.
- G. tpHL and tpLH are the same as tpd.
- H. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms



PARAMETER MEASUREMENT INFORMATION (OPEN-COLLECTOR OUTPUT)



NOTES: A. C_I includes probe and jig capacitance.

- B. All input pulses are supplied by generators having the following characteristics: PRR \leq 1 MHz, $Z_O = 50 \Omega$, $t_f \leq 3$ 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

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PACKAGING INFORMATION

Orderable Device	Status	Package Type	_	Pins	Package Qty	Eco Plan	Lead/Ball Finish	MSL Peak Temp	Op Temp (°C)	Top-Side Markings	Samples
	(1)		Drawing			(2)		(3)		(4)	
SN74LV8153QPWRG4Q1	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV8153Q	Samples
SN74LV8153QPWRQ1	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV8153Q	Samples

(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⁾ Only one of markings shown within the brackets will appear on the physical device.

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OTHER QUALIFIED VERSIONS OF SN74LV8153-Q1:

Catalog: SN74LV8153





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NOTE: Qualified Version Definitions:

Catalog - TI's standard catalog product

PACKAGE MATERIALS INFORMATION

www.ti.com 14-Mar-2013

TAPE AND REEL INFORMATION





	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		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	7.1	1.6	8.0	16.0	Q1
SN74LV8153QPWRQ1	TSSOP	PW	20	2000	330.0	16.4	6.95	7.1	1.6	8.0	16.0	Q1

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*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LV8153QPWRG4Q1	TSSOP	PW	20	2000	367.0	367.0	38.0
SN74LV8153QPWRQ1	TSSOP	PW	20	2000	367.0	367.0	38.0

PW (R-PDSO-G20)

PLASTIC SMALL OUTLINE



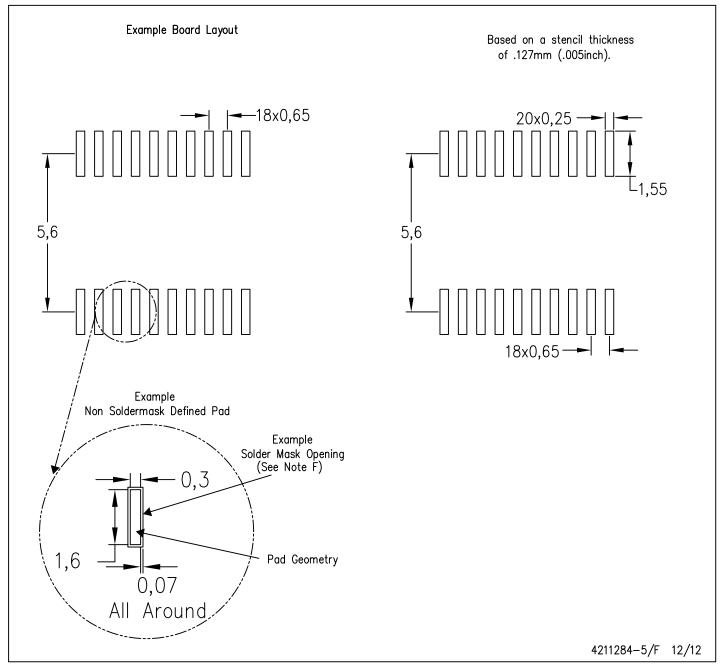
NOTES:

- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M—1994.
- B. This drawing is subject to change without notice.
- Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
- Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
- E. Falls within JEDEC MO-153



PW (R-PDSO-G20)

PLASTIC SMALL OUTLINE



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 design.
- 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.



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Wireless Connectivity <u>www.ti.com/wirelessconnectivity</u>



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Благодаря сотрудничеству с мировыми поставщиками мы осуществляем комплексные и плановые поставки широчайшего спектра электронных компонентов.

Собственная эффективная логистика и склад в обеспечивает надежную поставку продукции в точно указанные сроки по всей России.

Мы осуществляем техническую поддержку нашим клиентам и предпродажную проверку качества продукции. На все поставляемые продукты мы предоставляем гарантию.

Осуществляем поставки продукции под контролем ВП МО РФ на предприятия военно-промышленного комплекса России, а также работаем в рамках 275 ФЗ с открытием отдельных счетов в уполномоченном банке. Система менеджмента качества компании соответствует требованиям ГОСТ ISO 9001.

Минимальные сроки поставки, гибкие цены, неограниченный ассортимент и индивидуальный подход к клиентам являются основой для выстраивания долгосрочного и эффективного сотрудничества с предприятиями радиоэлектронной промышленности, предприятиями ВПК и научноисследовательскими институтами России.

С нами вы становитесь еще успешнее!

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