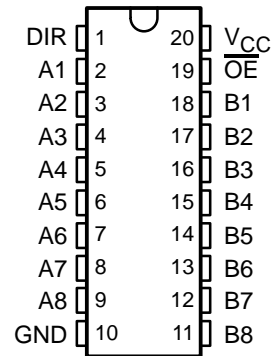


# SN74AHC245Q OCTAL BUS TRANSCEIVER WITH 3-STATE OUTPUTS

SGDS018 – FEBRUARY 2002

- Q Devices Meet Automotive Performance Requirements
- Customer-Specific Configuration Control Can Be Supported Along With Major-Change Approval
- Operating Range 2-V to 5.5-V  $V_{CC}$
- Latch-Up Performance Exceeds 250 mA Per JESD 17

DW OR PW PACKAGE  
(TOP VIEW)



## description

The SN74AHC245Q octal bus transceiver is designed for asynchronous two-way communication between data buses. The control-function implementation minimizes external timing requirements.

This device allows data transmission from the A bus to the B bus or from the B bus to the A bus, depending on the logic level at the direction-control (DIR) input. The output-enable ( $\overline{OE}$ ) input can be used to disable the device so that the buses are effectively isolated.

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

## ORDERING INFORMATION

T <sub>A</sub>	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
	SOIC – DW	Tape and reel		
–40°C to 125°C	TSSOP – PW	Tape and reel	SN74AHC245QDWR	AHC245Q
			SN74AHC245QPWR	HA245Q

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).

FUNCTION TABLE  
(each transceiver)

INPUTS		OPERATION
$\overline{OE}$	DIR	
L	L	B data to A bus
L	H	A data to B bus
H	X	Isolation



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

 **TEXAS  
INSTRUMENTS**

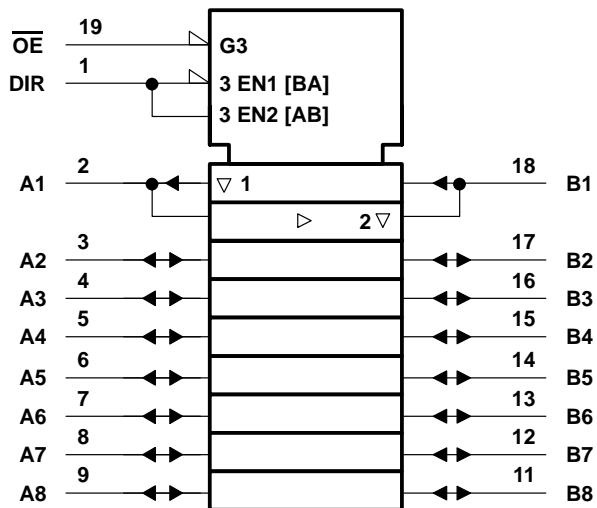
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# SN74AHC245Q OCTAL BUS TRANSCEIVER WITH 3-STATE OUTPUTS

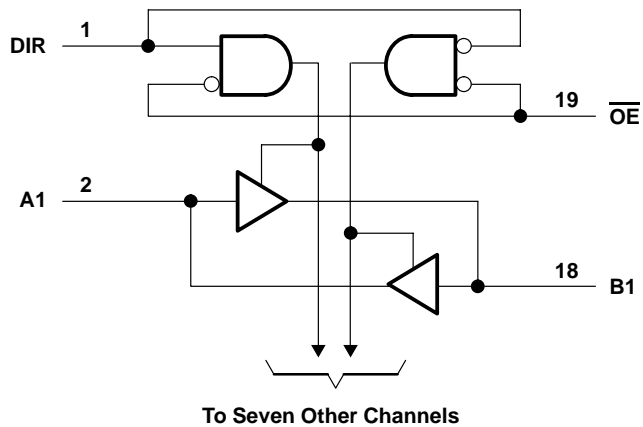
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## logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

## logic diagram (positive logic)



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

Supply voltage range, $V_{CC}$ .....	–0.5 V to 7 V
Input voltage range, $V_I$ (see Note 1): Control inputs .....	–0.5 V to 7 V
I/O, output voltage range, $V_O$ (see Note 1) .....	–0.5 V to $V_{CC} + 0.5$ V
Input clamp current, $I_{IK}$ ( $V_I < 0$ ): Control inputs .....	–20 mA
I/O, output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{CC}$ ) .....	±20 mA
Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ ) .....	±25 mA
Continuous current through $V_{CC}$ or GND .....	±75 mA
Package thermal impedance, $\theta_{JA}$ (see Note 2): DW package .....	58°C/W
PW package .....	83°C/W
Storage temperature range, $T_{stg}$ .....	–65°C to 150°C

† 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.

- NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.  
 2. The package thermal impedance is calculated in accordance with JESD 51-7.

**recommended operating conditions (see Note 3)**

		MIN	MAX	UNIT	
$V_{CC}$	Supply voltage	2	5.5	V	
$V_{IH}$	High-level input voltage	$V_{CC} = 2$ V	1.5	V	
		$V_{CC} = 3$ V	2.1		
		$V_{CC} = 5.5$ V	3.85		
$V_{IL}$	Low-level input voltage	$V_{CC} = 2$ V	0.5	V	
		$V_{CC} = 3$ V	0.9		
		$V_{CC} = 5.5$ V	1.65		
$V_I$	Input voltage	$\overline{OE}$ or DIR	0	5.5	V
$V_O$	Output voltage	A or B	0	$V_{CC}$	V
$I_{OH}$	High-level output current	$V_{CC} = 2$ V	–50	$\mu$ A	
		$V_{CC} = 3.3$ V ± 0.3 V	–4	mA	
		$V_{CC} = 5$ V ± 0.5 V	–8		
$I_{OL}$	Low-level output current	$V_{CC} = 2$ V	50	$\mu$ A	
		$V_{CC} = 3.3$ V ± 0.3 V	4	mA	
		$V_{CC} = 5$ V ± 0.5 V	8		
$\Delta t/\Delta v$	Input transition rise or fall rate	$V_{CC} = 3.3$ V ± 0.3 V	100	ns/V	
		$V_{CC} = 5$ V ± 0.5 V	20		
$T_A$	Operating free-air temperature	–40	125	°C	

NOTE 3: 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.

**SN74AHC245Q**  
**OCTAL BUS TRANSCEIVER**  
**WITH 3-STATE OUTPUTS**

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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			MIN	MAX	UNIT
			MIN	TYP	MAX			
V <sub>OH</sub>	I <sub>OH</sub> = -50 μA	2 V	1.9	2		1.9	V	
		3 V	2.9	3		2.9		
		4.5 V	4.4	4.5		4.4		
	I <sub>OH</sub> = -4 mA	3 V	2.58			2.48		
	I <sub>OH</sub> = -8 mA	4.5 V	3.94			3.8		
V <sub>OL</sub>	I <sub>OL</sub> = 50 μA	2 V			0.1	0.1	V	
		3 V			0.1	0.1		
		4.5 V			0.1	0.1		
	I <sub>OL</sub> = 4 mA	3 V			0.36	0.5		
	I <sub>OL</sub> = 8 mA	4.5 V			0.36	0.5		
I <sub>I</sub>	A or B inputs	V <sub>I</sub> = 5.5 V or GND	5.5 V			±0.1	±1	μA
	$\overline{\text{OE}}$ or DIR		0 V to 5.5 V			±0.1	±1	
I <sub>OZ</sub> <sup>†</sup>		V <sub>O</sub> = V <sub>CC</sub> or GND, V <sub>I</sub> (OE) = V <sub>IL</sub> or V <sub>IH</sub>	5.5 V			±0.25	±2.5	μA
I <sub>CC</sub>		V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0	5.5 V			4	40	μA
C <sub>i</sub>	$\overline{\text{OE}}$ or DIR	V <sub>I</sub> = V <sub>CC</sub> or GND	5 V			2.5	10	pF
C <sub>io</sub>	A or B inputs	V <sub>I</sub> = V <sub>CC</sub> or GND	5 V			4		pF

<sup>†</sup> The parameter I<sub>OZ</sub> includes the input leakage current.

switching characteristics over recommended operating free-air temperature range, V<sub>CC</sub> = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T <sub>A</sub> = 25°C			MIN	MAX	UNIT
				MIN	TYP	MAX			
t <sub>PLH</sub>	A or B	B or A	C <sub>L</sub> = 15 pF		5.8	8.4	1	10	ns
t <sub>PHL</sub>					5.8	8.4	1	10	
t <sub>PZH</sub>	$\overline{\text{OE}}$	A or B	C <sub>L</sub> = 15 pF		8.5	13.2	1	15.5	ns
t <sub>PZL</sub>					8.5	13.2	1	15.5	
t <sub>PHZ</sub>	$\overline{\text{OE}}$	A or B	C <sub>L</sub> = 15 pF		8.9	12.5	1	15.5	ns
t <sub>PLZ</sub>					8.9	12.5	1	15.5	
t <sub>PLH</sub>	A or B	B or A	C <sub>L</sub> = 50 pF		8.3	11.9	1	13.5	ns
t <sub>PHL</sub>					8.3	11.9	1	13.5	
t <sub>PZH</sub>	$\overline{\text{OE}}$	A or B	C <sub>L</sub> = 50 pF		11	16.7	1	19	ns
t <sub>PZL</sub>					11	16.7	1	19	
t <sub>PHZ</sub>	$\overline{\text{OE}}$	A or B	C <sub>L</sub> = 50 pF		11.5	15.8	1	18	ns
t <sub>PLZ</sub>					11.5	15.8	1	18	



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

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	$T_A = 25^\circ\text{C}$			MIN	MAX	UNIT
				MIN	TYP	MAX			
$t_{PLH}$	A or B	B or A	$C_L = 15\text{ pF}$	4	5.5	1	6.5	ns	
$t_{PHL}$				4	5.5	1	6.5		
$t_{PZH}$	$\overline{OE}$	A or B	$C_L = 15\text{ pF}$	5.8	8.5	1	10	ns	
$t_{PZL}$				5.8	8.5	1	10		
$t_{PHZ}$	$\overline{OE}$	A or B	$C_L = 15\text{ pF}$	5.6	7.8	1	9.2	ns	
$t_{PLZ}$				5.6	7.8	1	9.2		
$t_{PLH}$	A or B	B or A	$C_L = 50\text{ pF}$	5.5	7.5	1	8.5	ns	
$t_{PHL}$				5.5	7.5	1	8.5		
$t_{PZH}$	$\overline{OE}$	A or B	$C_L = 50\text{ pF}$	7.3	10.6	1	12	ns	
$t_{PZL}$				7.3	10.6	1	12		
$t_{PHZ}$	$\overline{OE}$	A or B	$C_L = 50\text{ pF}$	7	9.7	1	11	ns	
$t_{PLZ}$				7	9.7	1	11		

noise characteristics,  $V_{CC} = 5\text{ V}$ ,  $C_L = 50\text{ pF}$ ,  $T_A = 25^\circ\text{C}$  (see Note 4)

PARAMETER	MIN	TYP	MAX	UNIT
$V_{OL(P)}$ Quiet output, maximum dynamic $V_{OL}$		0.9		V
$V_{OL(V)}$ Quiet output, minimum dynamic $V_{OL}$		-0.9		V
$V_{OH(V)}$ Quiet output, minimum dynamic $V_{OH}$		4.3		V
$V_{IH(D)}$ High-level dynamic input voltage	3.5			V
$V_{IL(D)}$ Low-level dynamic input voltage			1.5	V

NOTE 4: Characteristics are for surface-mount packages only.

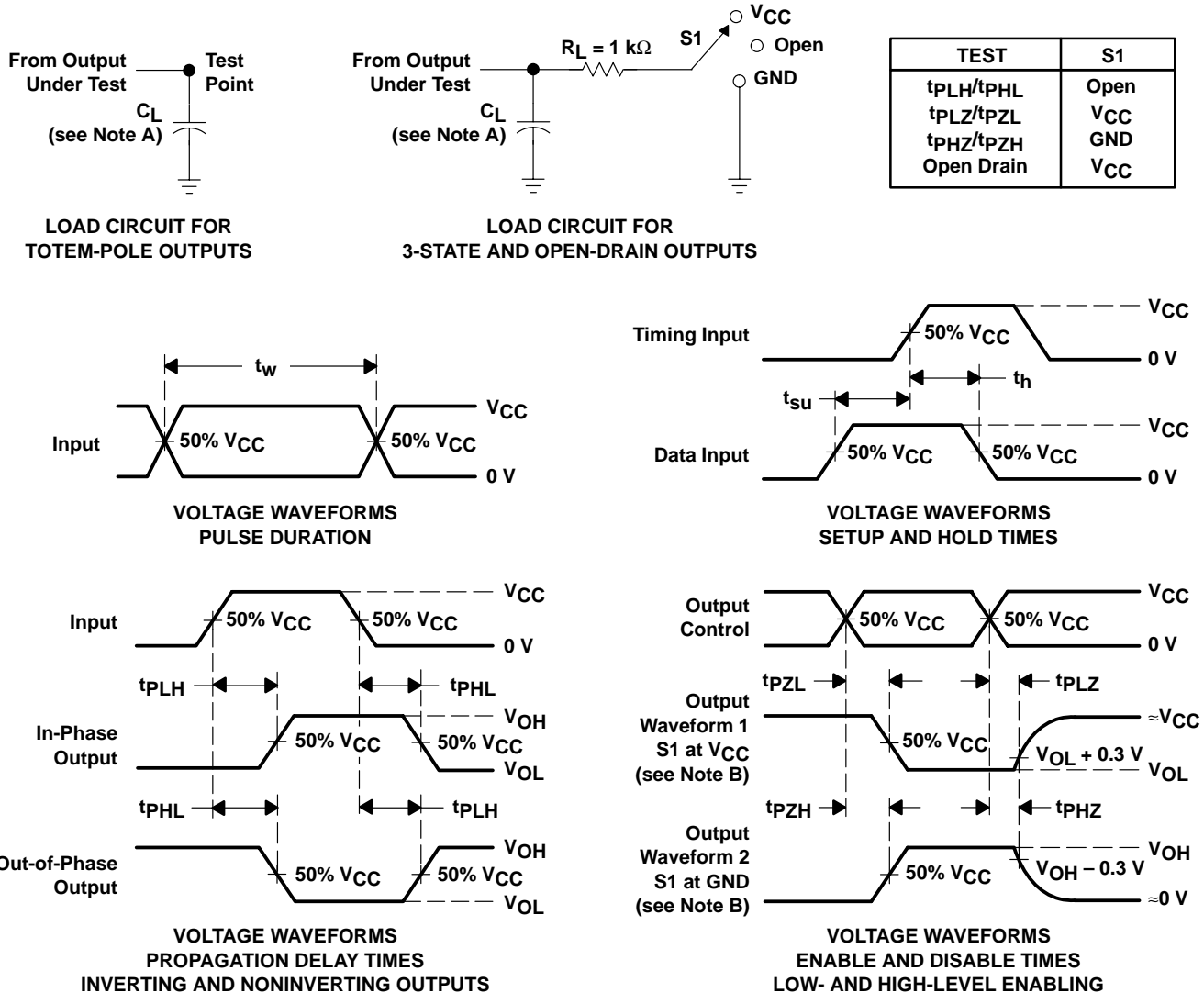
operating characteristics,  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	TYP	UNIT
$C_{pd}$ Power dissipation capacitance	No load, $f = 1\text{ MHz}$	14	pF

# SN74AHC245Q OCTAL BUS TRANSCEIVER WITH 3-STATE OUTPUTS

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## PARAMETER MEASUREMENT INFORMATION



- 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:  $PRR \leq 1\text{ MHz}$ ,  $Z_O = 50\ \Omega$ ,  $t_r \leq 3\text{ ns}$ ,  $t_f \leq 3\text{ ns}$ .
  - D. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74AHC245QDWRG4Q1	ACTIVE	SOIC	DW	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM		AHC245Q1	<a href="#">Samples</a>
SN74AHC245QPWR	ACTIVE	TSSOP	PW	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 125	HA245Q	<a href="#">Samples</a>
SN74AHC245QPWRG4	ACTIVE	TSSOP	PW	20	2000	RoHS & Green	NIPDAU	Level-1-260C-UNLIM		HA245Q	<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.

**OBSELETE:** TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device 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 Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices 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.

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**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**

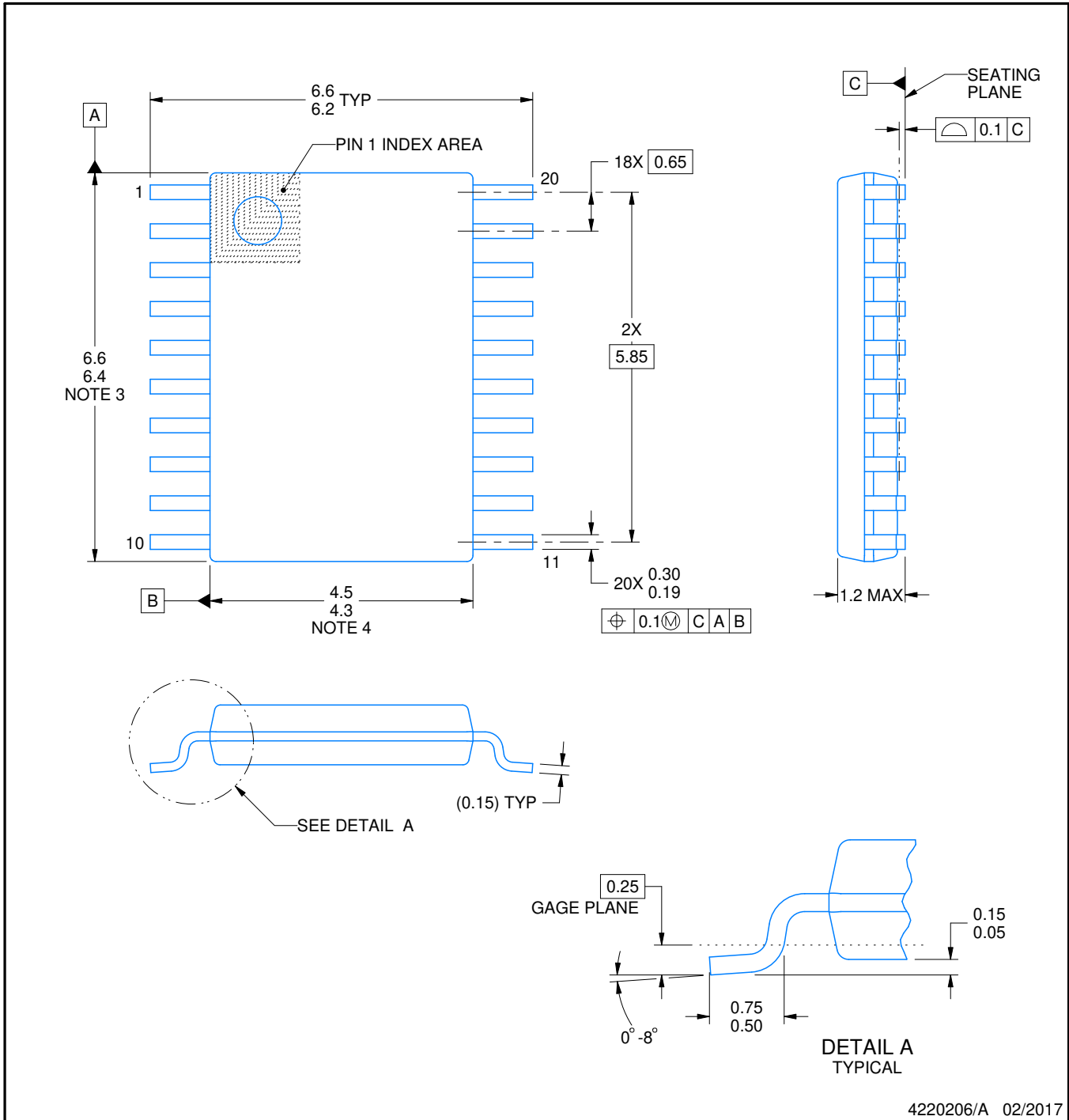

\*All dimensions are nominal

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
SN74AHC245QDWRG4Q1	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1
SN74AHC245QPWR	TSSOP	PW	20	2000	330.0	16.4	6.95	7.1	1.6	8.0	16.0	Q1
SN74AHC245QPWRG4	TSSOP	PW	20	2000	330.0	16.4	6.95	7.1	1.6	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)
SN74AHC245QDWRG4Q1	SOIC	DW	20	2000	367.0	367.0	45.0
SN74AHC245QPWR	TSSOP	PW	20	2000	356.0	356.0	35.0
SN74AHC245QPWRG4	TSSOP	PW	20	2000	356.0	356.0	35.0



4220206/A 02/2017

NOTES:

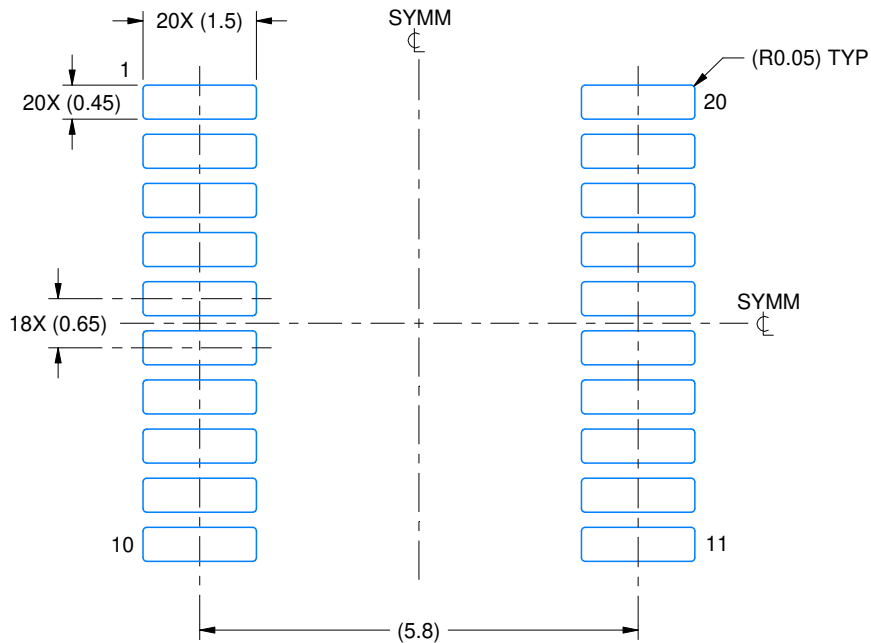
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or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

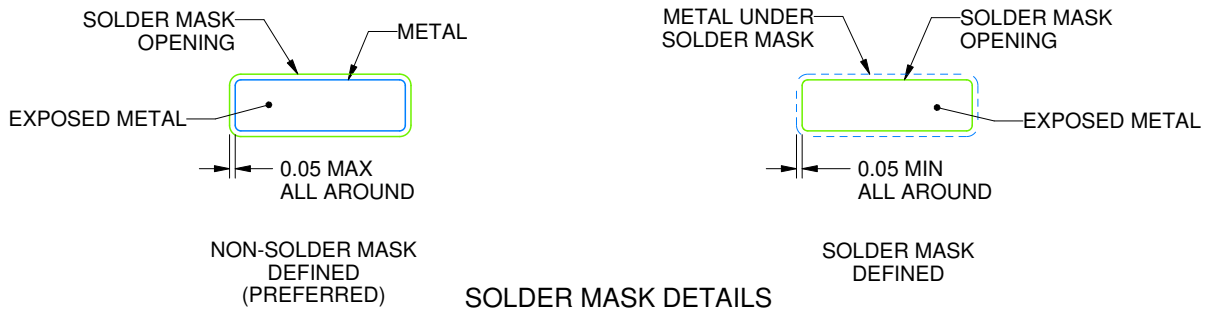
PW0020A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



4220206/A 02/2017

NOTES: (continued)

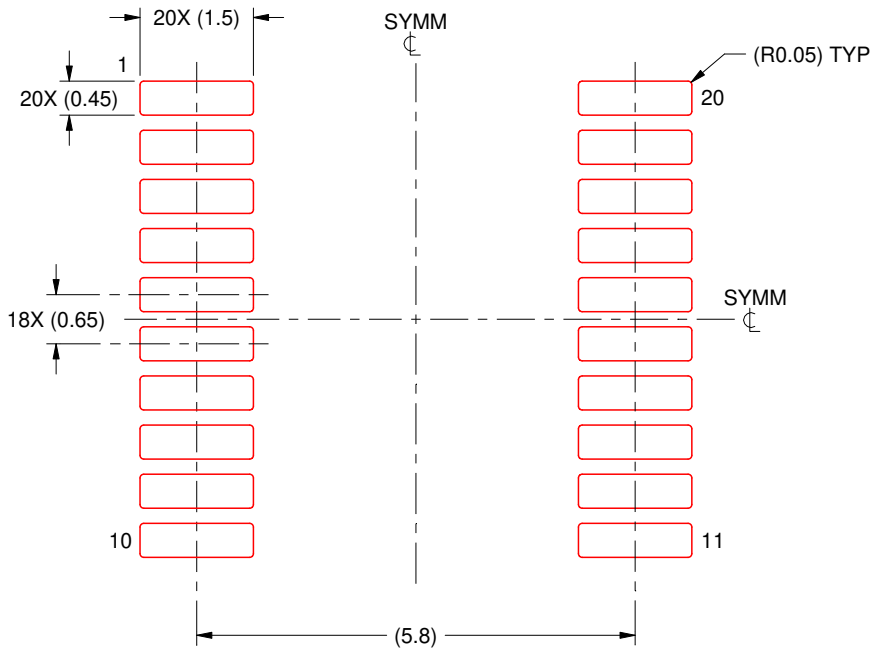
- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# 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

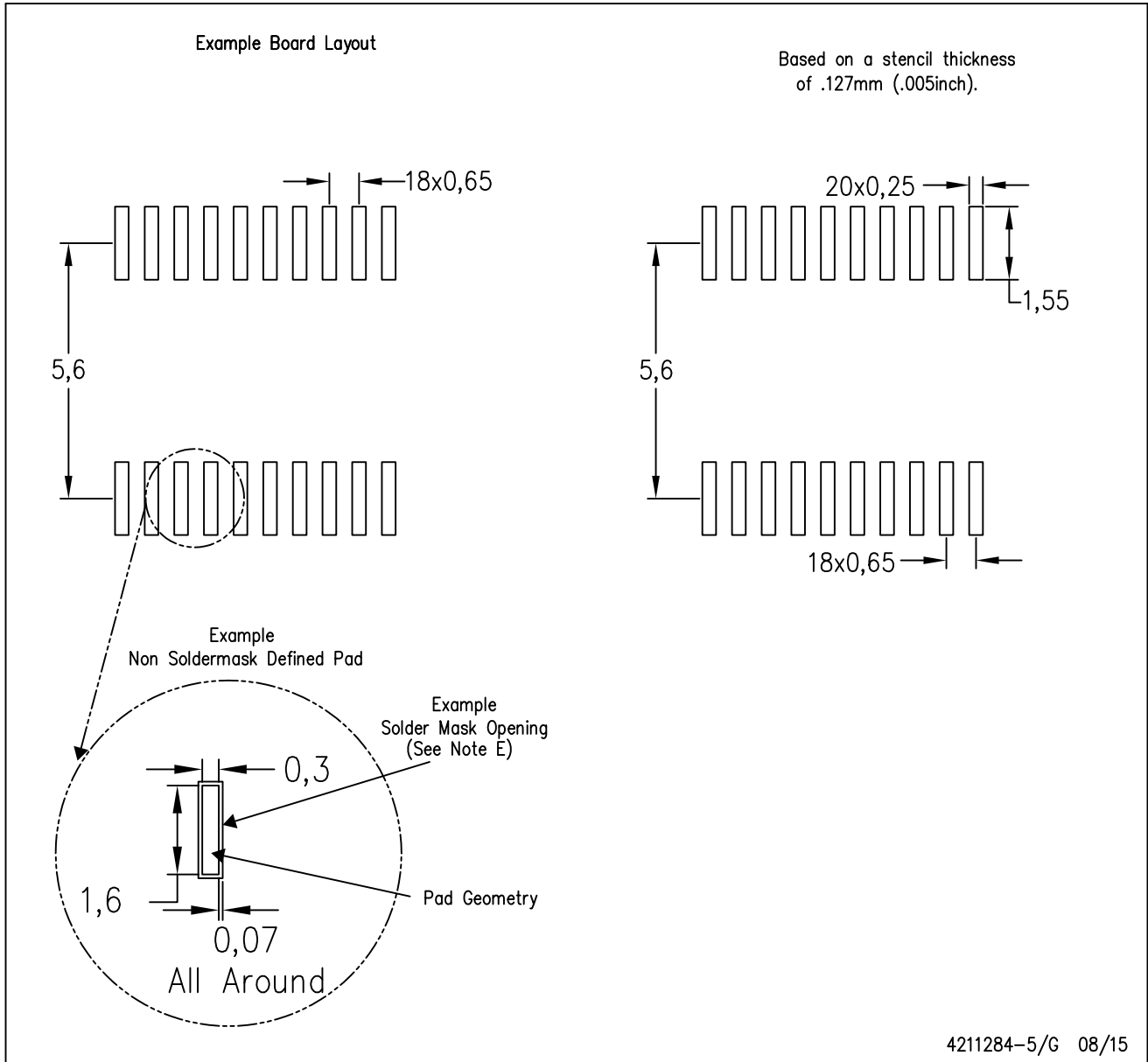
4220206/A 02/2017

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.

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.

# DW0020A



# PACKAGE OUTLINE

## SOIC - 2.65 mm max height

SOIC



4220724/A 05/2016

**NOTES:**

- All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
- This drawing is subject to change without notice.
- 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.
- This dimension does not include interlead flash. Interlead flash shall not exceed 0.43 mm per side.
- Reference JEDEC registration MS-013.

# EXAMPLE BOARD LAYOUT

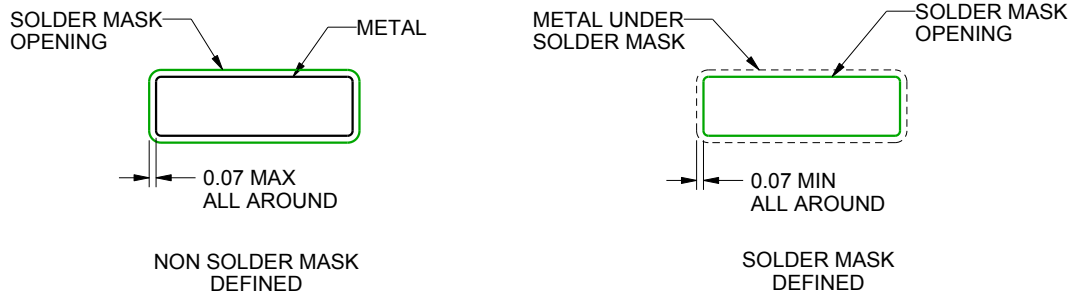
DW0020A

SOIC - 2.65 mm max height

SOIC



LAND PATTERN EXAMPLE  
SCALE:6X



SOLDER MASK DETAILS

4220724/A 05/2016

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

DW0020A

SOIC - 2.65 mm max height

SOIC



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:6X

4220724/A 05/2016

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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