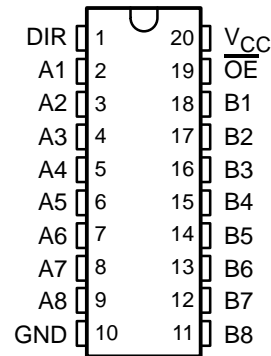


SN74AHC245Q OCTAL BUS TRANSCEIVER WITH 3-STATE OUTPUTS

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 _A	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
-40°C to 125°C	SOIC – DW	Tape and reel	SN74AHC245QDWR	AHC245Q
	TSSOP – PW	Tape and reel	SN74AHC245QPWR	HA245Q

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at 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**

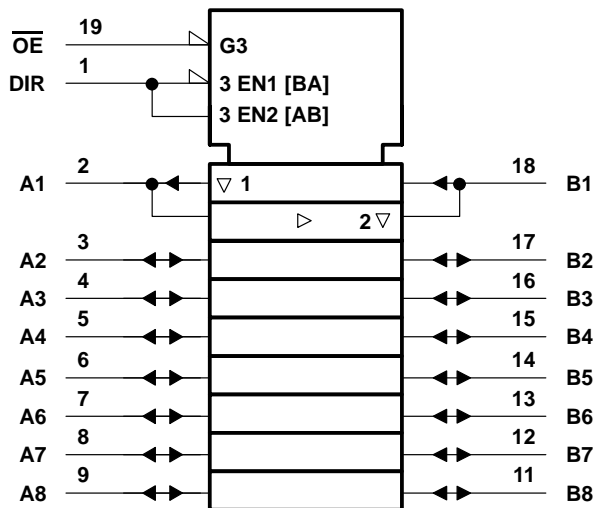
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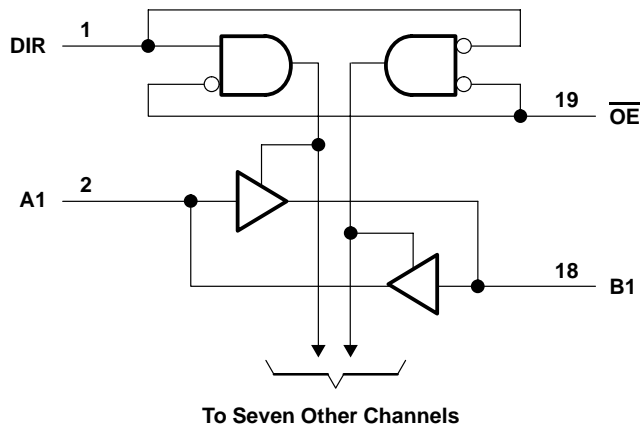
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logic symbol†



† 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, θ_{JA} (see Note 2): DW package	58°C/W
	PW package
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	μ 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	μ 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.

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

PARAMETER	TEST CONDITIONS	V _{CC}	T _A = 25°C			MIN	MAX	UNIT
			MIN	TYP	MAX			
V _{OH}	I _{OH} = -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 _{OH} = -4 mA	3 V	2.58			2.48		
	I _{OH} = -8 mA	4.5 V	3.94			3.8		
V _{OL}	I _{OL} = 50 μA	2 V			0.1	0.1	V	
		3 V			0.1	0.1		
		4.5 V			0.1	0.1		
	I _{OL} = 4 mA	3 V			0.36	0.5		
	I _{OL} = 8 mA	4.5 V			0.36	0.5		
I _I	A or B inputs	V _I = 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 _{OZ} [†]		V _O = V _{CC} or GND, V _I (OE) = V _{IL} or V _{IH}	5.5 V			±0.25	±2.5	μA
I _{CC}		V _I = V _{CC} or GND, I _O = 0	5.5 V			4	40	μA
C _i	$\overline{\text{OE}}$ or DIR	V _I = V _{CC} or GND	5 V			2.5	10	pF
C _{io}	A or B inputs	V _I = V _{CC} or GND	5 V			4		pF

[†] The parameter I_{OZ} includes the input leakage current.

switching characteristics over recommended operating free-air temperature range, V_{CC} = 3.3 V ± 0.3 V (unless otherwise noted) (see Figure 1)

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

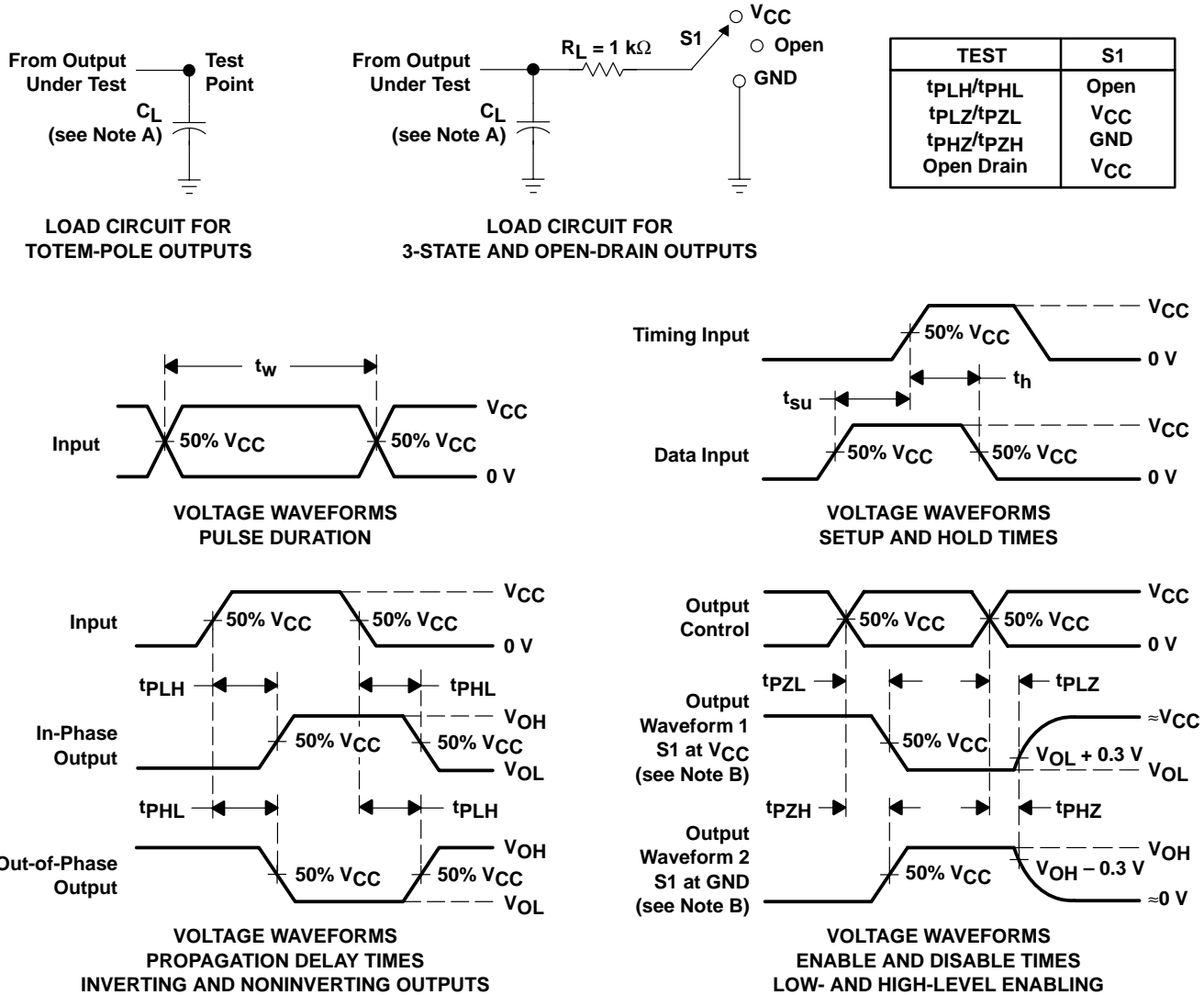
operating characteristics, $V_{CC} = 5\text{ V}$, $T_A = 25^\circ\text{C}$

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

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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 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/Ball Finish	MSL Peak Temp (3)	Samples (Requires Login)
SN74AHC245QDWR	OBSOLETE	SOIC	DW	20		TBD	Call TI	Call TI	
SN74AHC245QDWRG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74AHC245QDWRG4Q1	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74AHC245QPWR	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
SN74AHC245QPWRG4	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	

(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.

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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
SN74AHC245QPWR	TSSOP	PW	20	2000	330.0	16.4	6.95	7.1	1.6	8.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS

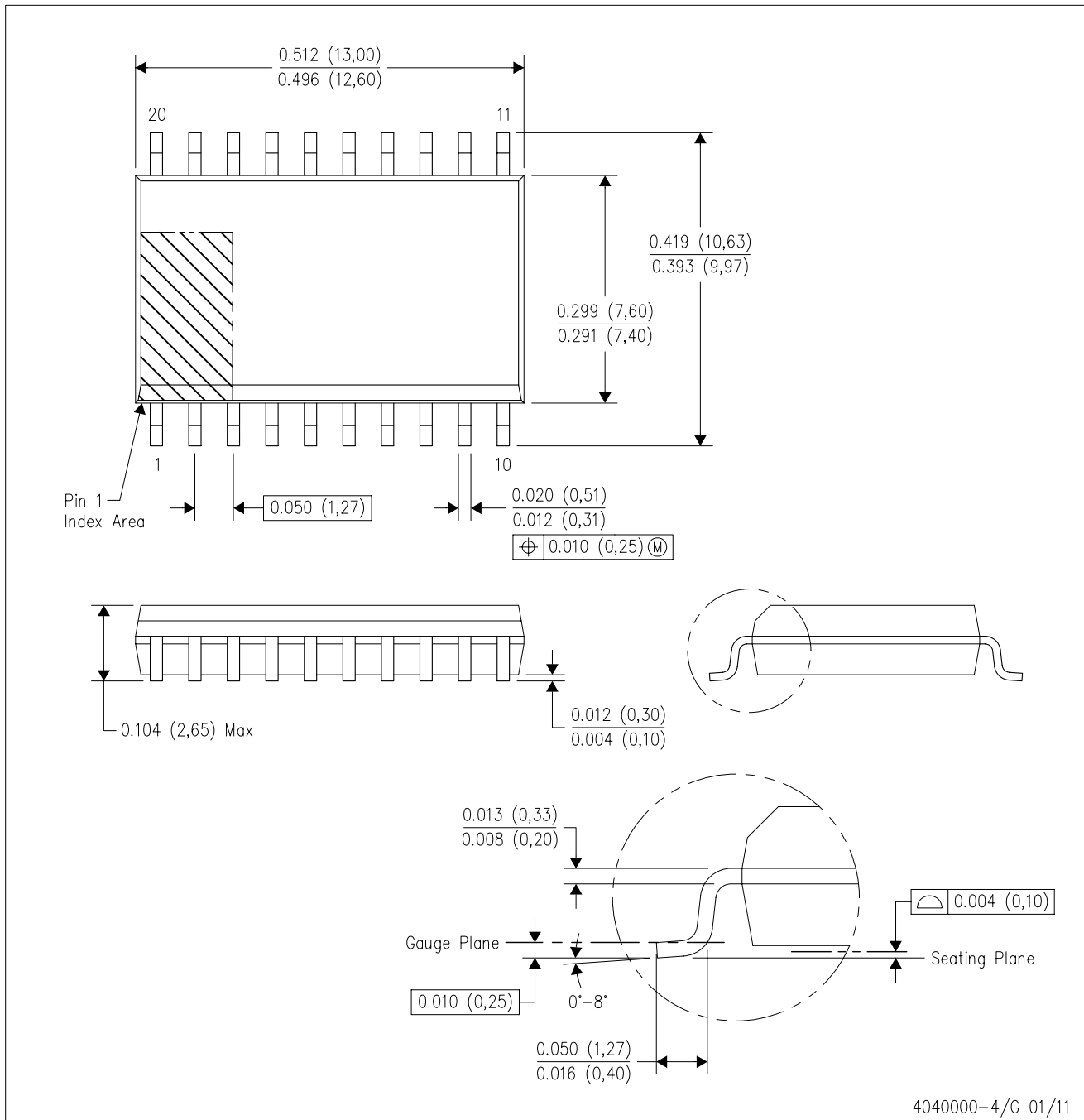


*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74AHC245QPWR	TSSOP	PW	20	2000	367.0	367.0	38.0

DW (R-PDSO-G20)

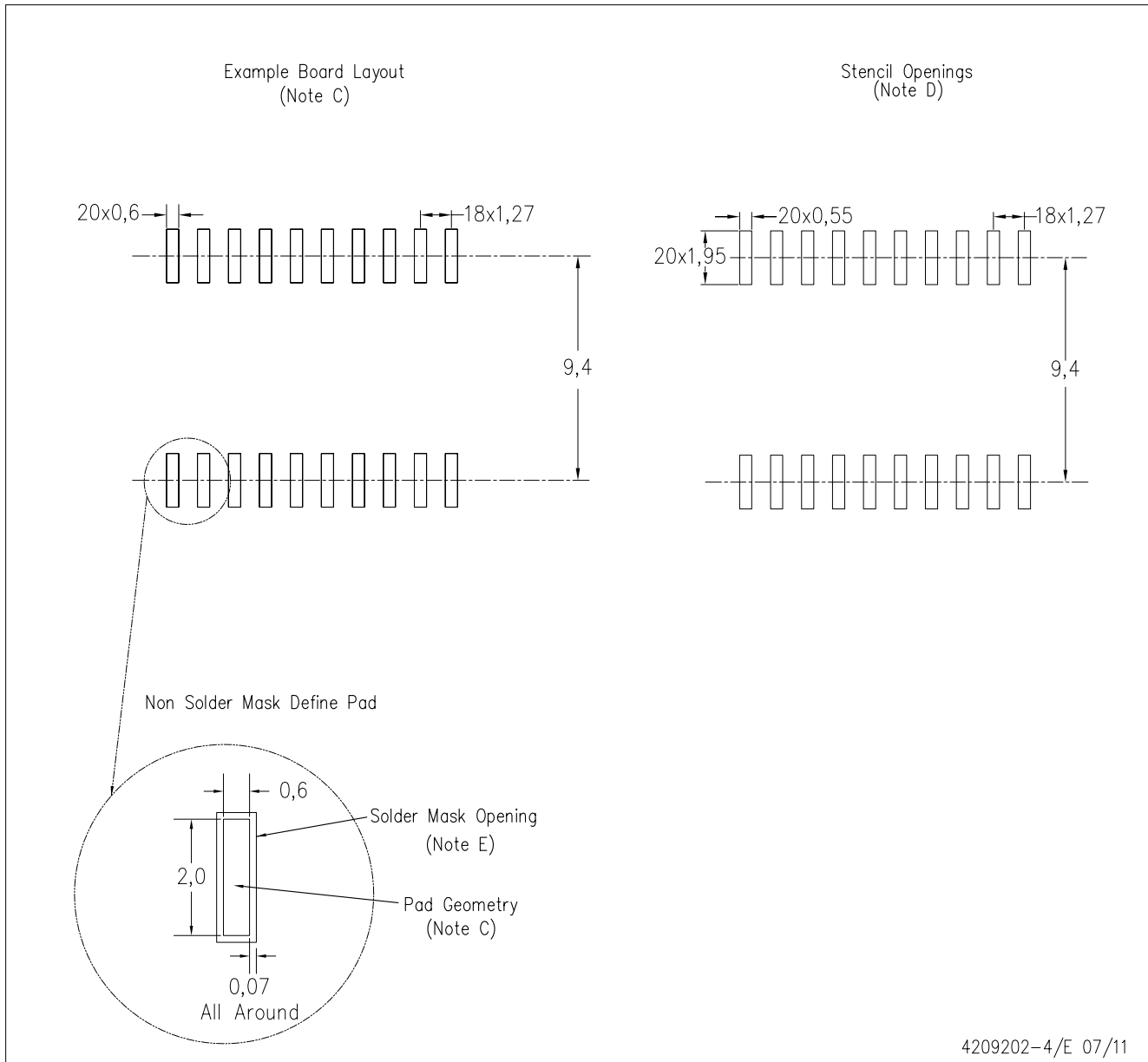
PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.
 - This drawing is subject to change without notice.
 - Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
 - Falls within JEDEC MS-013 variation AC.

DW (R-PDSO-G20)

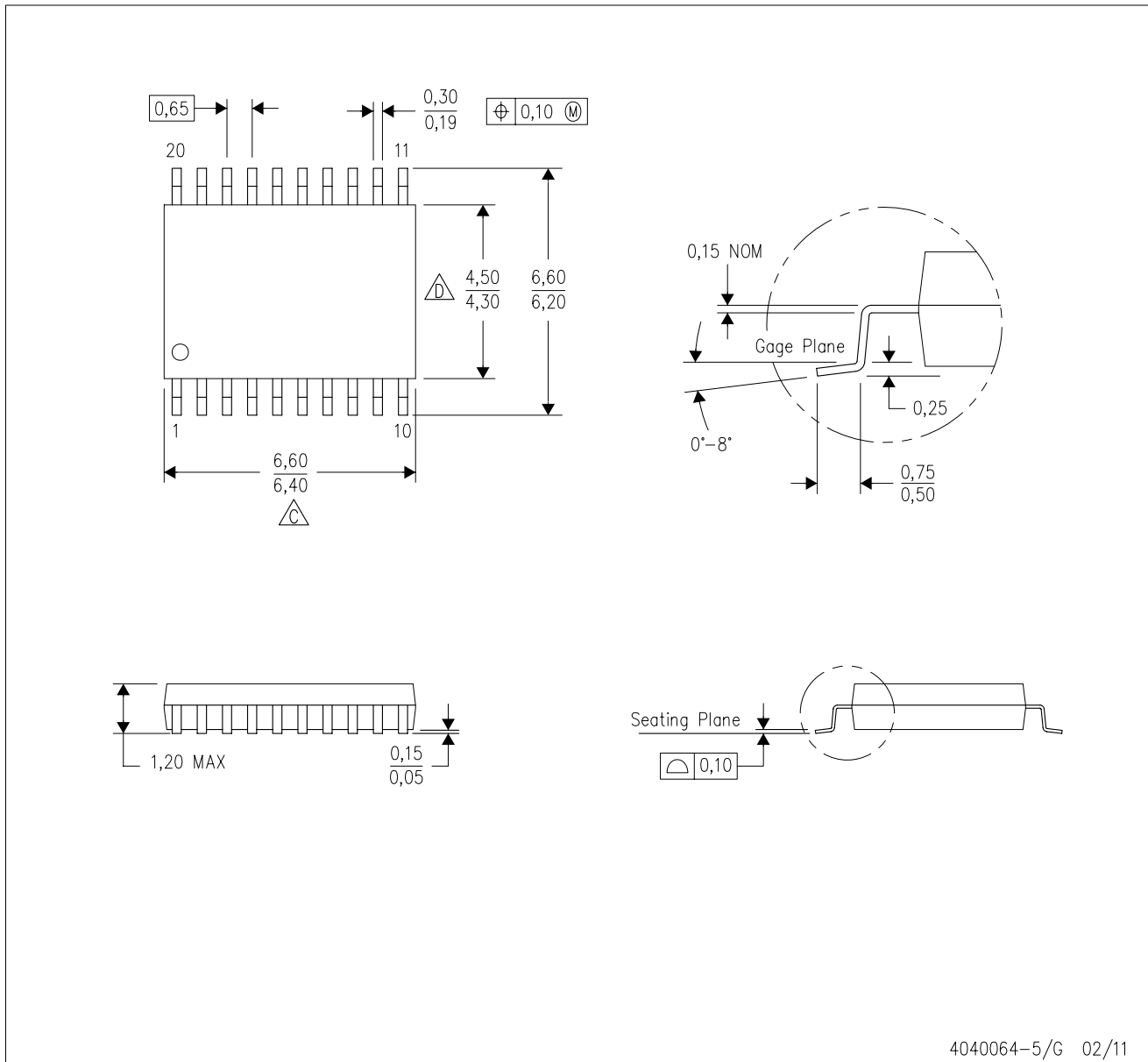
PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Refer to IPC7351 for alternate board 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
 - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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.
 - △ C Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
 - △ D 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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