THE DATASHEET OF

SN74LV245APWR

SNx4LV245A Octal Bus Transceivers With 3-State Outputs

1 Features

- 2-V to 5.5-V V_{CC} Operation
- Max t_{pd} of 6.5 ns at 5 V
- Typical V_{OLP} (Output Ground Bounce) <0.8 V at V_{CC} = 3.3 V, T_A = 25°C
- Typical V_{OHV} (Output V_{OH} Undershoot) >2.3 V at V_{CC} = 3.3 V, T_A = 25°C
- Support Mixed-Mode Voltage Operation on All Ports
- I_{off} Supports Partial-Power-Down Mode Operation
- Latch-Up Performance Exceeds 250 mA Per JESD 17
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)
  - 1000-V Charged-Device Model (C101)

2 Applications

- Servers
- LED Displays
- Network Switches
- Telecom Infrastructure
- Motor Drivers
- I/O Expanders

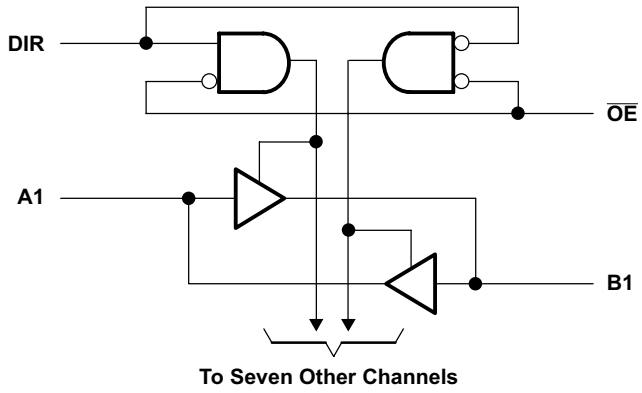
3 Description

These octal bus transceivers are designed for 2-V to 5.5-V V_{CC} operation.

Device Information

PART NUMBER	PACKAGE	BODY SIZE (NOM)
SNx4LV245A	SSOP (20)	7.20 mm × 5.30 mm
	TVSOP (20)	5.00 mm × 4.40 mm
	TSSOP (20)	6.50 mm × 4.40 mm
	VQFN (20)	4.50 mm × 3.50 mm
	SOIC (20)	12.80 mm × 7.50 mm

4 Simplified Schematic



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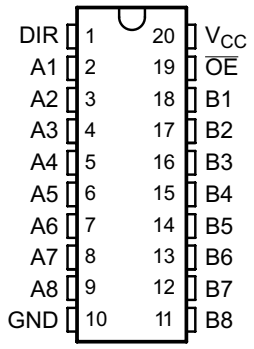
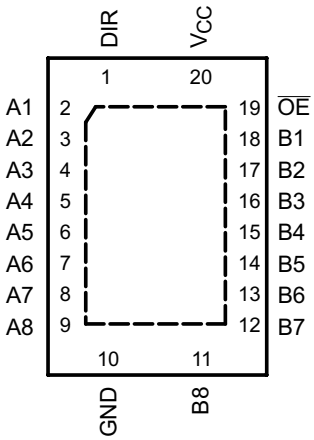
6 Pin Configuration and Functions

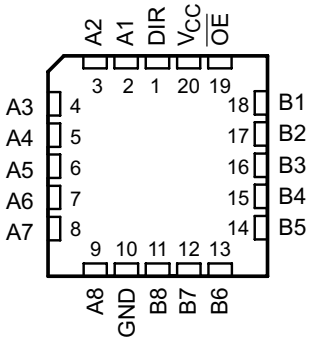
SN54LV245A . . . J OR W PACKAGE
SN74LV245A . . . DB, DGV, DW, NS, OR PW PACKAGE
(TOP VIEW)



SN74LV245A . . . RGY PACKAGE
(TOP VIEW)



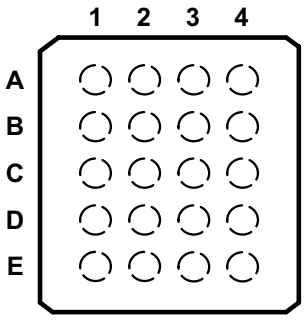
SN54LV245A . . . FK PACKAGE
(TOP VIEW)



Pin Functions

PIN		I/O	DESCRIPTION
NO.	NAME		
1	DIR	I	Direction Pin
2	A1	I/O	A1 I/O
3	A2	I/O	A2 I/O
4	A3	I/O	A3 I/O
5	A4	I/O	A4 I/O
6	A5	I/O	A5 I/O
7	A6	I/O	A6 I/O
8	A7	I/O	A7 I/O
9	A8	I/O	A8 I/O
10	GND	—	Ground Pin
11	B8	I/O	B8 I/O
12	B7	I/O	B7 I/O
13	B6	I/O	B6 I/O
14	B5	I/O	B5 I/O
15	B4	I/O	B4 I/O
16	B3	I/O	B3 I/O
17	B2	I/O	B2 I/O
18	B1	I/O	B1 I/O
19	$\overline{OE}$	I	Output Enable
20	V_{CC}	—	Power Pin

GQN PACKAGE
(TOP VIEW)



Pin Assignments

	1	2	3	4
A	A1	DIR	V_{CC}	$\overline{OE}$
B	A3	B2	A2	B1
C	A5	A4	B4	B3
D	A7	B6	A6	B5
E	GND	A8	B8	B7

7 Specifications

7.1 Absolute Maximum Ratings

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

			MIN	MAX	UNIT
V_{CC}	Supply voltage range		–0.5	7	V
V_I	Input voltage range	Except I/O ports(2)	–0.5	7	V
		I/O ports(2)(3)	–0.5	7	
V_O	Voltage range applied to any output in the high-impedance or power-off state(2)		–0.5	7	V
V_O	Output voltage range applied in the high or low state(2)(3)		–0.5	V_{CC} + 0.5	V
I_{IK}	Input clamp current	V_I < 0		–20	mA
I_{OK}	Output clamp current	V_O < 0		–50	mA
I_O	Continuous output current	V_O = 0 to V_{CC}		±35	mA
	Continuous current through V_{CC} or GND			±70	mA

(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 current ratings are observed.
(3) This value is limited to 5.5-V maximum.

7.2 Handling Ratings

			MIN	MAX	UNIT
T_{stg}	Storage temperature range		–65	150	°C
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins(1)	0	2000	V
		Charged device model (CDM), per JEDEC specification JESD22-C101, all pins(2)	0	1000	

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

7.3 Recommended Operating Conditions

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

			SN54LV245A(2)		SN74LV245A		UNIT
			MIN	MAX	MIN	MAX	
V_{CC}	Supply voltage		2	5.5	2	5.5	V
V_{IH}	High-level input voltage	V_{CC} = 2 V	1.5		1.5		V
		V_{CC} = 2.3 V to 2.7 V	V_{CC} × 0.7		V_{CC} × 0.7		
		V_{CC} = 3 V to 3.6 V	V_{CC} × 0.7		V_{CC} × 0.7		
		V_{CC} = 4.5 V to 5.5 V	V_{CC} × 0.7		V_{CC} × 0.7		
V_{IL}	Low-level input voltage	V_{CC} = 2 V		0.5		0.5	V
		V_{CC} = 2.3 V to 2.7 V		V_{CC} × 0.3		V_{CC} × 0.3	
		V_{CC} = 3 V to 3.6 V		V_{CC} × 0.3		V_{CC} × 0.3	
		V_{CC} = 4.5 V to 5.5 V		V_{CC} × 0.3		V_{CC} × 0.3	
V_I	Input voltage		0	5.5	0	5.5	V
V_O	Output voltage	High or low state	0	V_{CC}	0	V_{CC}	V
		3-state	0	5.5	0	5.5	
I_{OH}	High-level output current	V_{CC} = 2 V		–50		–50	µA
		V_{CC} = 2.3 V to 2.7 V		–2		–2	mA
		V_{CC} = 3 V to 3.6 V		–8		–8	
		V_{CC} = 4.5 V to 5.5 V		–16		–16	
I_{OL}	Low-level output current	V_{CC} = 2 V		50		50	µA
		V_{CC} = 2.3 V to 2.7 V		2		2	mA
		V_{CC} = 3 V to 3.6 V		8		8	
		V_{CC} = 4.5 V to 5.5 V		16		16	
Δt/Δv	Input transition rise or fall rate	V_{CC} = 2.3 V to 2.7 V		200		200	ns/V
		V_{CC} = 3 V to 3.6 V		100		100	
		V_{CC} = 4.5 V to 5.5 V		20		20	
T_A	Operating free-air temperature		–55	125	–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* (SCBA004).
(2) Product Preview

7.4 Thermal Information

THERMAL METRIC(1)		SN74LV245A						UNIT
		DB	DGV	DW	NS	PW	RGY	
		20 PINS						
$R_{\theta JA}$	Junction-to-ambient thermal resistance	94.6	114.8	77.5	76.6	101.5	34.1	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	56.3	30.1	43.7	43.0	35.6	38.4	
$R_{\theta JB}$	Junction-to-board thermal resistance	49.8	56.3	45.1	44.1	52.5	12.0	
ψ_{JT}	Junction-to-top characterization parameter	18.3	0.9	16.9	16.7	2.2	0.8	
ψ_{JB}	Junction-to-board characterization parameter	49.4	55.6	44.7	43.7	52.0	12.0	
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	—	—	—	—	—	7.1	

(1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report (SPRA953).

7.5 Electrical Characteristics

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

PARAMETER		TEST CONDITIONS	V_{CC}	SN54LV245A(1)			–40°C to 85°C SN74LV245A			–40°C to 125°C SN74LV245A			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
V_{OH}		I_{OH} = –50 µA	2 V to 5.5 V	V_{CC} – 0.1			V_{CC} – 0.1			V_{CC} – 0.1			V
		I_{OH} = –2 mA	2.3 V	2			2			2			
		I_{OH} = –8 mA	3 V	2.48			2.48			2.48			
		I_{OH} = –16 mA	4.5 V	3.8			3.8			3.8			
V_{OL}		I_{OL} = 50 µA	2 V to 5.5 V			0.1			0.1			0.1	V
		I_{OL} = 2 mA	2.3 V			0.4			0.4			0.4	
		I_{OL} = 8 mA	3 V			0.44			0.44			0.44	
		I_{OL} = 16 mA	4.5 V			0.55			0.55			0.55	
I_I	Control inputs	V_I = 5.5 V or GND	0 to 5.5 V			±1			±1			±1	µA
I_{OZ}	A or B port	$V_O = V_{CC}$ or GND	5.5 V			±5			±5			±5	µA
I_{CC}		$V_I = V_{CC}$ or GND, I_O = 0	5.5 V			20			20			20	µA
I_{off}		V_I or V_O = 0 to 5.5 V	0			5			5			5	µA
C_i	Control inputs	$V_I = V_{CC}$ or GND	3.3 V		3			3					pF
			5 V		3			3					
C_{io}	A or B port	$V_O = V_{CC}$ or GND	3.3 V		5.5			5.5					pF
			5 V		5.5			5.5					

(1) Product Preview

7.6 Switching Characteristics, V_{CC} = 2.5 V ± 0.2 V

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T_A = 25°C			SN54LV245A(1)		SN74LV245A		–40°C to 125°C SN74LV245A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{pd}	A or B	B or A	C_L = 15 pF		8.3(2)	13(2)	1(2)	15(2)	1	15	1	17	ns
t_{en}	$\overline{OE}$	A or B			11.8(2)	19.9(2)	1(2)	22(2)	1	22	1	24	
t_{dis}	$\overline{OE}$	A or B			11.8(2)	18.1(2)	1(2)	20(2)	1	20	1	22	
t_{pd}	A or B	B or A	C_L = 50 pF		11.2	15.9	1	18	1	18	1	21	ns
t_{en}	$\overline{OE}$	A or B			14.1	22.7	1	26	1	26	1	28	
t_{dis}	$\overline{OE}$	A or B			17.6	23.1	1	25	1	25	1	27	
$t_{sk(o)}$						2				2			

(1) Product Preview
(2) On products compliant to MIL-PRF-38535, this parameter is not production tested.

7.7 Switching Characteristics, V_{CC} = 3.3 V ± 0.3 V

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T_A = 25°C			SN54LV245A(1)		SN74LV245A		–40°C to 125°C SN74LV245A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{pd}	A or B	B or A	C_L = 15 pF		5.9(2)	8.4(2)	1(2)	10(2)	1	10	1	11	ns
t_{en}	$\overline{OE}$	A or B			8.2(2)	13.2(2)	1(2)	15.5(2)	1	15.5	1	16.5	
t_{dis}	$\overline{OE}$	A or B			9.6(2)	16.5(2)	1(2)	19.5(2)	1	19.5	1	20.5	
t_{pd}	A or B	B or A	C_L = 50 pF		7.9	11.9	1	13.5	1	13.5	1	14.5	ns
t_{en}	$\overline{OE}$	A or B			9.9	16.7	1	19	1	19	1	20	
t_{dis}	$\overline{OE}$	A or B			13.9	19.8	1	22	1	22	1	23	
$t_{sk(o)}$						1.5				1.5			

(1) Product Preview
(2) On products compliant to MIL-PRF-38535, this parameter is not production tested.

7.8 Switching Characteristics, V_{CC} = 5 V ± 0.5 V

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 3)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	LOAD CAPACITANCE	T_A = 25°C			SN54LV245A(1)		SN74LV245A		–40°C to 125°C SN74LV245A		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{pd}	A or B	B or A	C_L = 15 pF		4.3(2)	5.5(2)	1(2)	6.5(2)	1	6.5	1	7	ns
t_{en}	$\overline{OE}$	A or B			5.7(2)	8.5(2)	1(2)	10.6(2)	1	10	1	10.5	
t_{dis}	$\overline{OE}$	A or B			7.8(2)	12.8(2)	1(2)	14.7(2)	1	14.2	1	14.7	
t_{pd}	A or B	B or A	C_L = 50 pF		5.6	7.5	1	8.5	1	8.5	1	9	ns
t_{en}	$\overline{OE}$	A or B			7	10.6	1	12	1	12	1	12.5	
t_{dis}	$\overline{OE}$	A or B			10.9	14.7	1	16	1	16	1	16.5	
$t_{sk(o)}$						1				1			

(1) Product Preview
(2) On products compliant to MIL-PRF-38535, this parameter is not production tested.

7.9 Noise Characteristics(1)

V_{CC} = 3.3 V, C_L = 50 pF, T_A = 25°C

PARAMETER		SN74LV245A			UNIT
		MIN	TYP	MAX	
$V_{OL(P)}$	Quiet output, maximum dynamic V_{OL}		0.5	0.8	V
$V_{OL(V)}$	Quiet output, minimum dynamic V_{OL}		–0.4	–0.8	V
$V_{OH(V)}$	Quiet output, minimum dynamic V_{OH}		2.9		V
$V_{IH(D)}$	High-level dynamic input voltage	2.31			V
$V_{IL(D)}$	Low-level dynamic input voltage			0.99	V

(1) Characteristics are for surface-mount packages only.

7.10 Operating Characteristics

T_A = 25°C

PARAMETER			TEST CONDITIONS		V_{CC}	TYP	UNIT
C_{pd}	Power dissipation capacitance	Outputs enabled	C_L = 50 pF,	f = 10 MHz	3.3 V	20	pF
					5 V	25	

7.11 Typical Characteristics

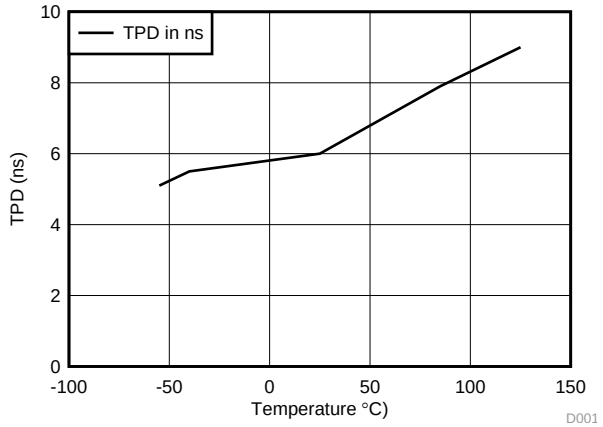


Figure 1. TPD vs Temperature at 3.3V

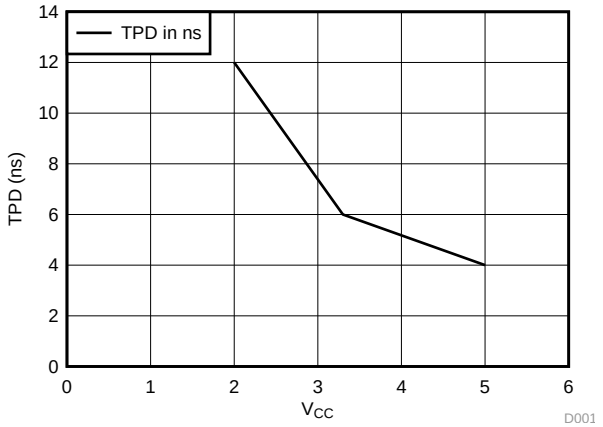
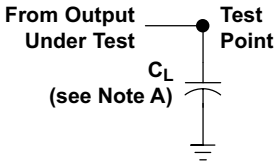
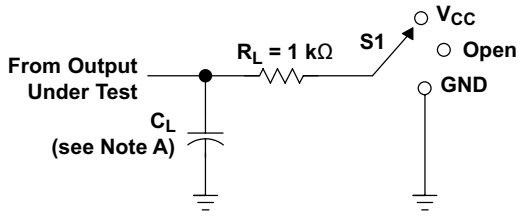


Figure 2. TPD vs V_{CC}

8 Parameter Measurement Information

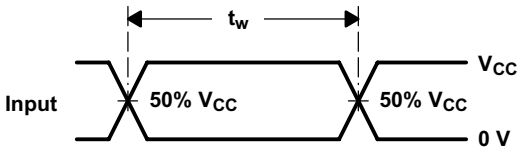


LOAD CIRCUIT FOR
TOTEM-POLE OUTPUTS

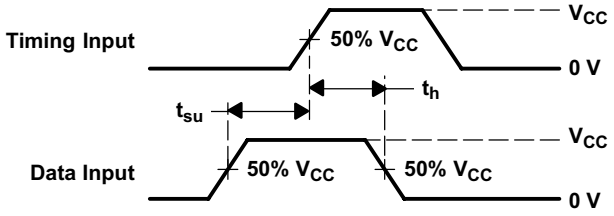


LOAD CIRCUIT FOR
3-STATE AND OPEN-DRAIN OUTPUTS

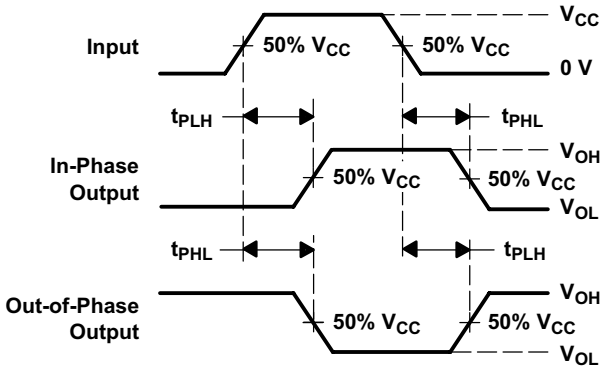
TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	V_{CC}
t_{PHZ}/t_{PZH}	GND
Open Drain	V_{CC}



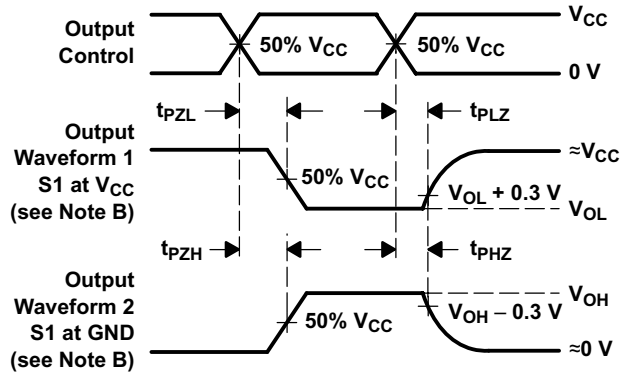
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

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 ≤ 1 MHz, Z_O = 50 Ω, t_r ≤ 3 ns, t_f ≤ 3 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 3. Load Circuit and Voltage Waveforms

9 Detailed Description

9.1 Overview

The SNx4LV245A devices are designed for asynchronous communication between data buses. The device transmits data 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 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.

These devices are fully specified for partial-power-down applications using I_{off}. The I_{off} circuitry disables the outputs, preventing damaging current backflow through the devices when they are powered down.

9.2 Functional Block Diagram

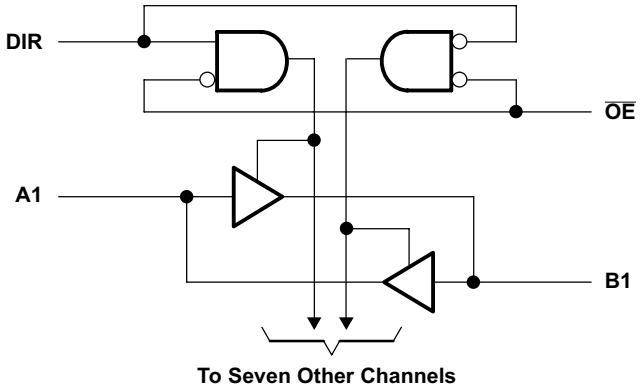


Figure 4. Logic Diagram (Positive Logic)

9.3 Feature Description

- Allows down voltage translation from 5 V to 3.3 V
  - Inputs accept voltage levels up to 5.5 V
- Slow edge rates minimize output ringing

9.4 Device Functional Modes

Table 1. Function Table

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

10 Application and Implementation

10.1 Application Information

The SNx4LV245A is a low-drive CMOS device that can be used for a multitude of bus-interface type applications where output ringing is a concern. The low drive and slow edge rates will minimize overshoot and undershoot on the outputs. The inputs can accept voltages to 5.5 V at any valid V_{CC} making the device ideal for down translation.

10.2 Typical Application

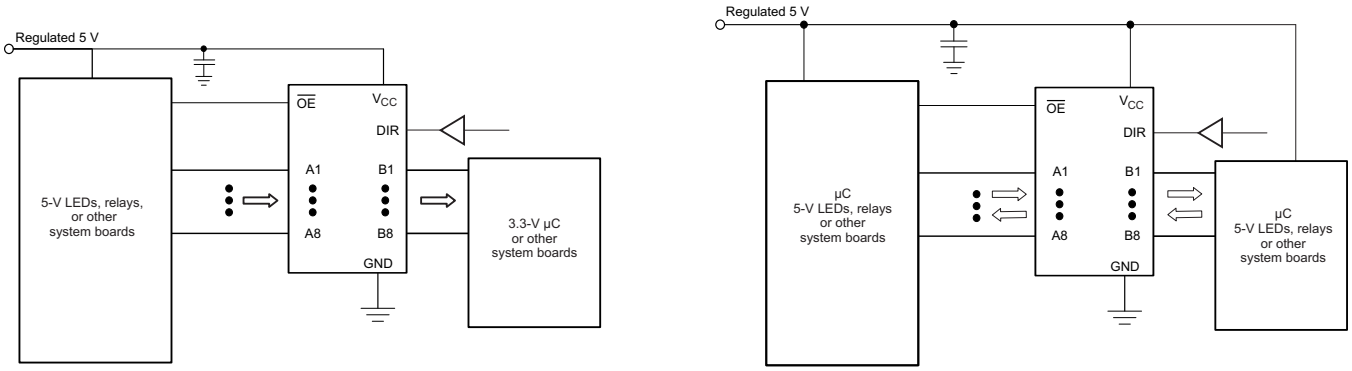


Figure 5. Typical Application Schematic

10.2.1 Design Requirements

This device uses CMOS technology and has balanced output drive. Care should be taken to avoid bus contention, because it can drive currents that would exceed maximum limits. Outputs can be combined to produce higher drive, but the high drive will also create faster edges into light loads; therefore, routing and load conditions should be considered to prevent ringing.

10.2.2 Detailed Design Procedure

1. Recommended Input Conditions:
   - Rise time and fall time specifications, see (Δt/ΔV) in *Recommended Operating Conditions* table.
   - Specified high and low levels, see (V_{IH} and V_{IL}) in *Recommended Operating Conditions* table.
   - Inputs are overvoltage tolerant, allowing them to go as high as 5.5 V at any valid V_{CC}.
2. Recommend Output Conditions:
   - Load currents should not exceed 35 mA per output and 70 mA total for the part.
   - Outputs should not be pulled above V_{CC}.

Typical Application (continued)

10.2.3 Application Curves

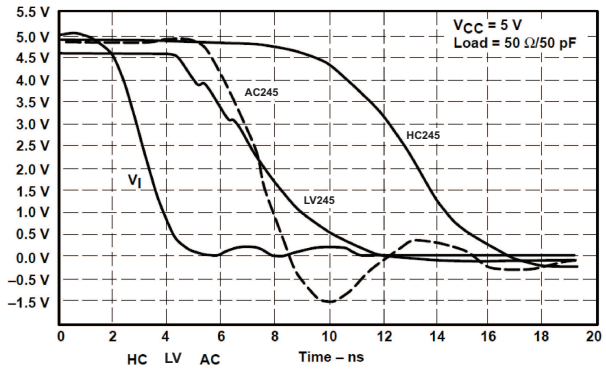


Figure 6. Switching Characteristics Comparison

11 Power Supply Recommendations

The power supply can be any voltage between the Min and Max supply voltage rating located in the *Recommended Operating Conditions* table.

Each V_{CC} terminal should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, 0.1 µF is recommended and if there are multiple V_{CC} terminals then 0.01 µF or 0.022 µF is recommended for each power terminal. It is acceptable to parallel multiple bypass caps to reject different frequencies of noise. A 0.1 µF and 1 µF are commonly used in parallel. The bypass capacitor should be installed as close to the power terminal as possible for best results.

12 Layout

12.1 Layout Guidelines

When using multiple bit logic devices inputs should not ever float.

In many cases, functions or parts of functions of digital logic devices are unused, for example, when only two inputs of a triple-input AND gate are used or only 3 of the 4 buffer gates are used. Such input pins should not be left unconnected because the undefined voltages at the outside connections result in undefined operational states. Specified in Figure 7 are the rules that must be observed under all circumstances. All unused inputs of digital logic devices must be connected to a high or low bias to prevent them from floating. The logic level that should be applied to any particular unused input depends on the function of the device. Generally they will be tied to GND or V_{CC}, whichever makes more sense or is more convenient. It is generally acceptable to float outputs unless the part is a transceiver. If the transceiver has an output enable pin, it will disable the outputs section of the part when asserted. This will not disable the input section of the I/Os so they cannot float when disabled.

12.2 Layout Example

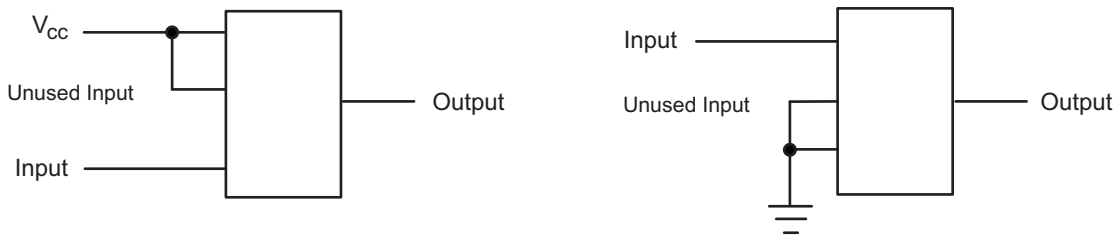


Figure 7. Layout Diagram

13 Device and Documentation Support

13.1 Related Links

The table below lists quick access links. Categories include technical documents, support and community resources, tools and software, and quick access to sample or buy.

Table 2. Related Links

PARTS	PRODUCT FOLDER	SAMPLE & BUY	TECHNICAL DOCUMENTS	TOOLS & SOFTWARE	SUPPORT & COMMUNITY
SN54LV245A	Click here	Click here	Click here	Click here	Click here
SN74LV245A	Click here	Click here	Click here	Click here	Click here

13.2 Trademarks

All trademarks are the property of their respective owners.

13.3 Electrostatic Discharge Caution

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

13.4 Glossary

SLYZ022 — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

14 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74LV245ADBR	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV245A	Samples
SN74LV245ADGVR	ACTIVE	TVSOP	DGV	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV245A	Samples
SN74LV245ADW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV245A	Samples
SN74LV245ADWE4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV245A	Samples
SN74LV245ADWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV245A	Samples
SN74LV245ANSR	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	74LV245A	Samples
SN74LV245ANSRG4	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	74LV245A	Samples
SN74LV245APW	ACTIVE	TSSOP	PW	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV245A	Samples
SN74LV245APWG4	ACTIVE	TSSOP	PW	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV245A	Samples
SN74LV245APWR	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU | CU SN	Level-1-260C-UNLIM	-40 to 125	LV245A	Samples
SN74LV245APWRE4	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV245A	Samples
SN74LV245APWRG3	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU SN	Level-1-260C-UNLIM	-40 to 125	LV245A	Samples
SN74LV245APWRG4	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	LV245A	Samples
SN74LV245ARGYR	ACTIVE	VQFN	RGY	20	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR	-40 to 125	LV245A	Samples
SN74LV245AZQNR	ACTIVE	BGA MICROSTAR JUNIOR	ZQN	20	1000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 85	LV245A	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) 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.

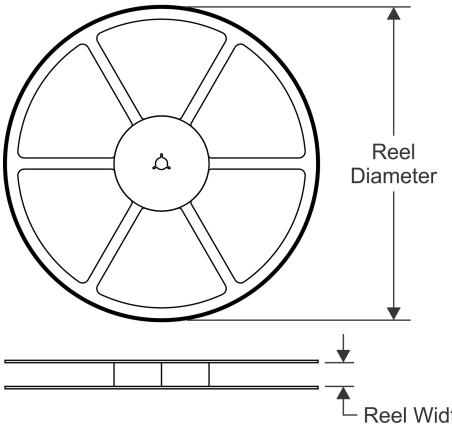
(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(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.

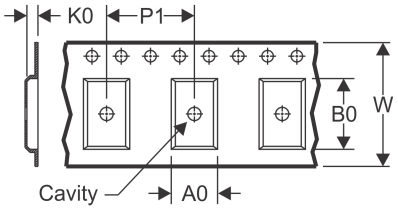
(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

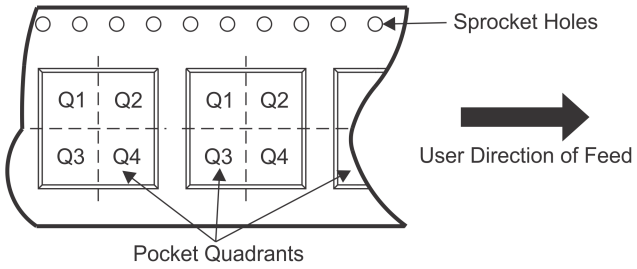


TAPE DIMENSIONS



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

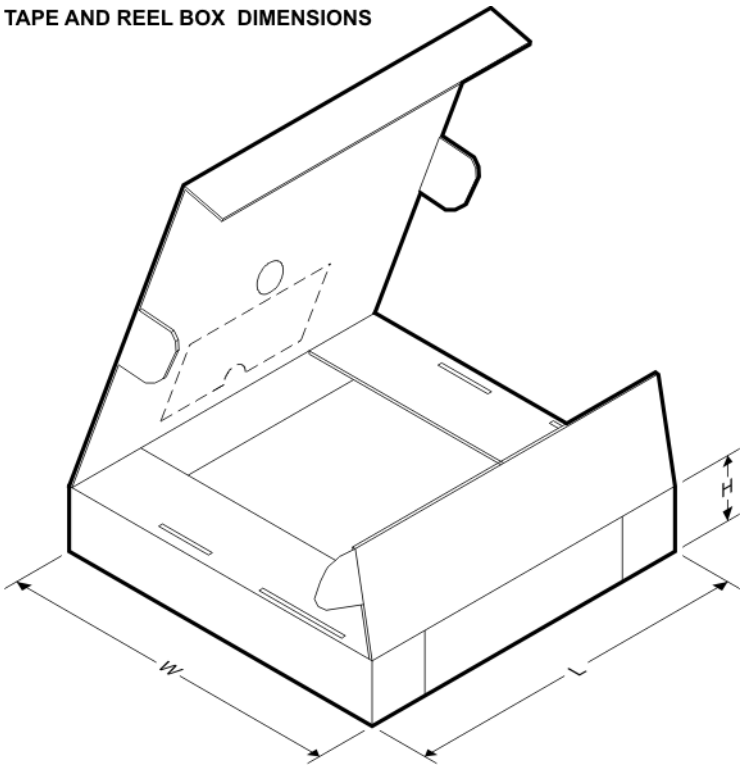
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
SN74LV245ADBR	SSOP	DB	20	2000	330.0	16.4	8.2	7.5	2.5	12.0	16.0	Q1
SN74LV245ADGVR	TVSOP	DGV	20	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
SN74LV245ADWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1
SN74LV245ANSR	SO	NS	20	2000	330.0	24.4	8.4	13.0	2.5	12.0	24.0	Q1
SN74LV245APWR	TSSOP	PW	20	2000	330.0	16.4	6.95	7.1	1.6	8.0	16.0	Q1
SN74LV245APWRG3	TSSOP	PW	20	2000	330.0	16.4	6.95	7.1	1.6	8.0	16.0	Q1
SN74LV245ARGYR	VQFN	RGY	20	3000	330.0	12.4	3.8	4.8	1.6	8.0	12.0	Q1
SN74LV245AZQNR	BGA MICROSTAR JUNIOR	ZQN	20	1000	330.0	12.4	3.3	4.3	1.6	8.0	12.0	Q1

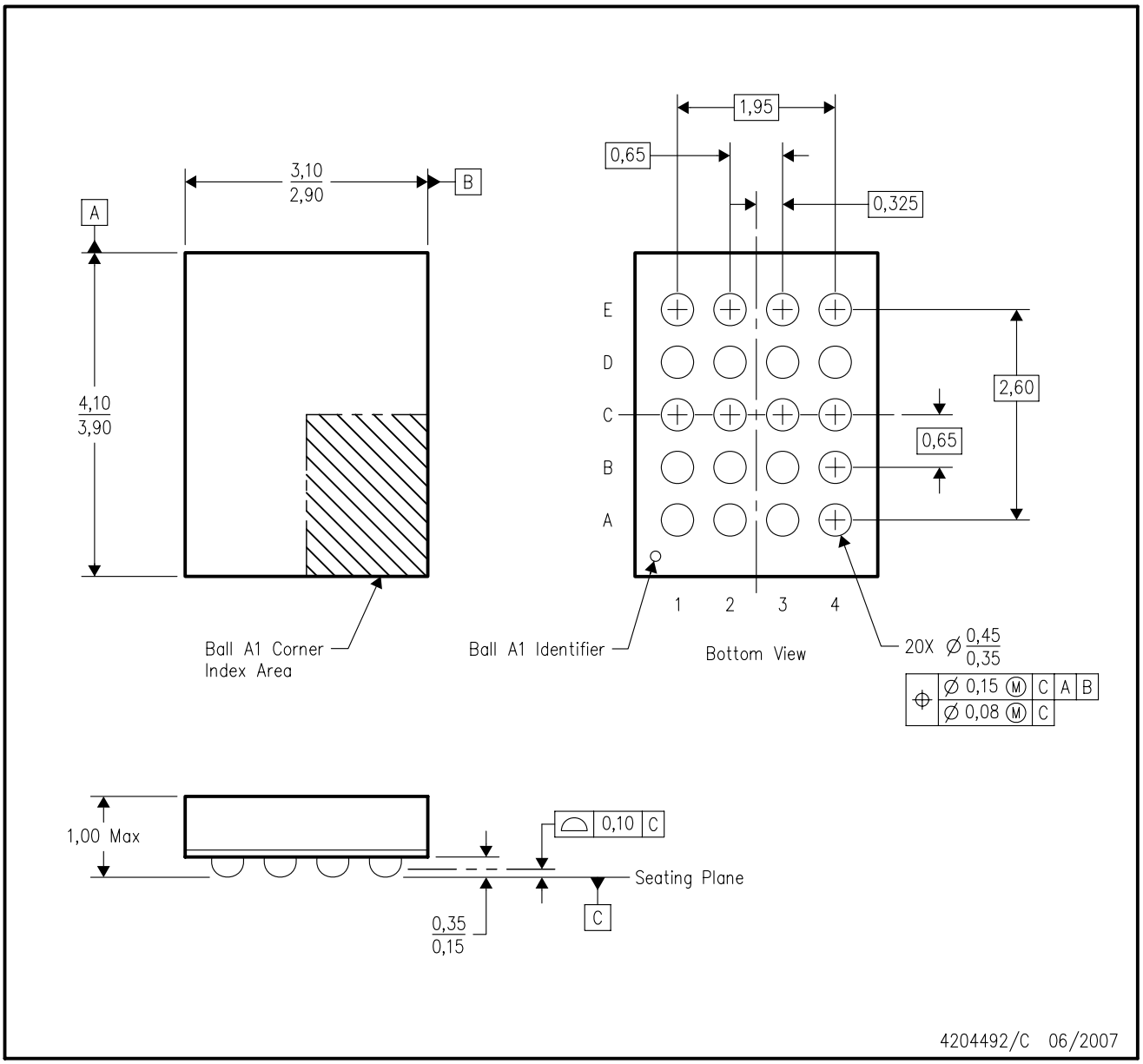
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

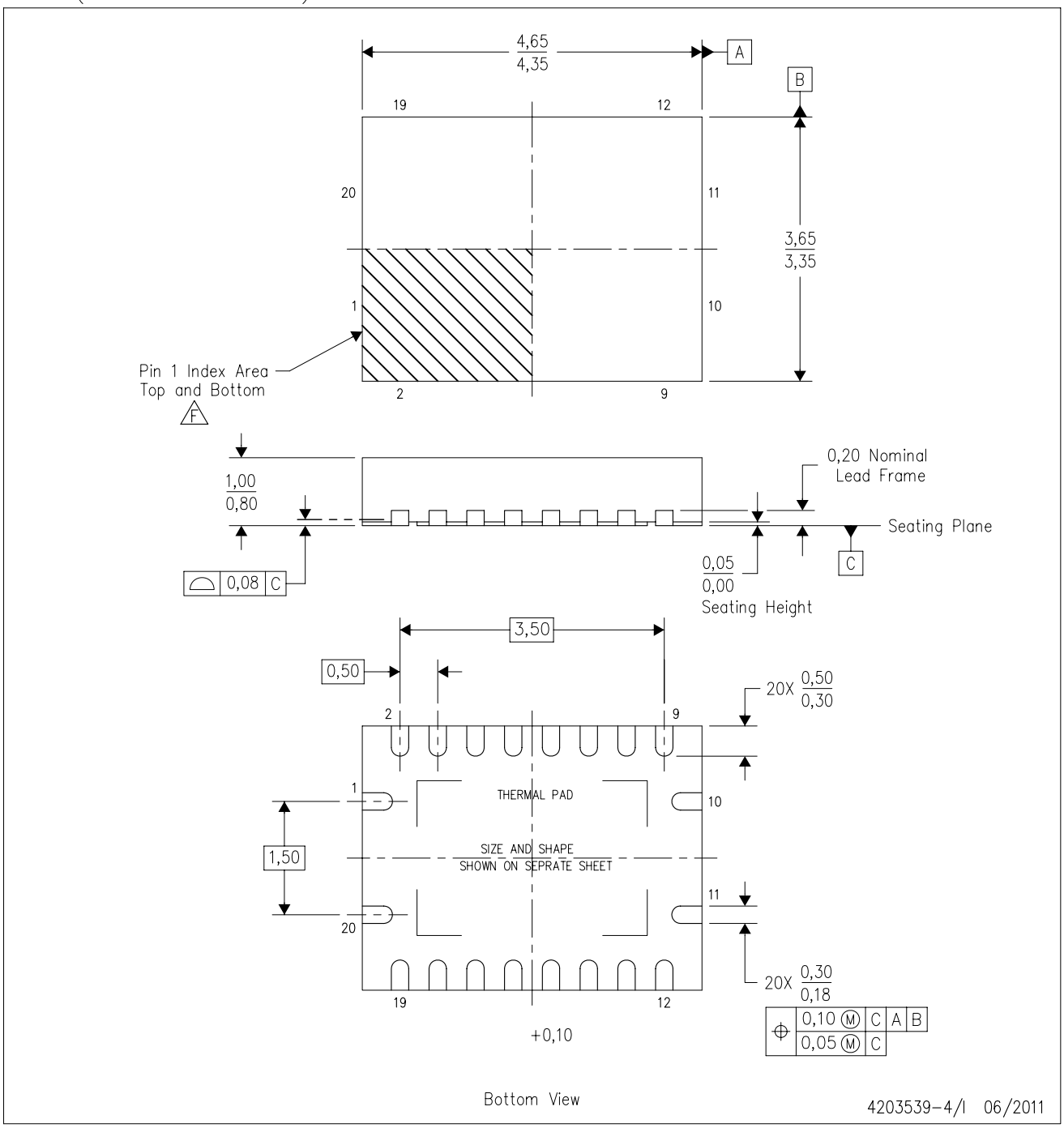
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74LV245ADBR	SSOP	DB	20	2000	367.0	367.0	38.0
SN74LV245ADGVR	TVSOP	DGV	20	2000	367.0	367.0	35.0
SN74LV245ADWR	SOIC	DW	20	2000	367.0	367.0	45.0
SN74LV245ANSR	SO	NS	20	2000	367.0	367.0	45.0
SN74LV245APWR	TSSOP	PW	20	2000	364.0	364.0	27.0
SN74LV245APWRG3	TSSOP	PW	20	2000	364.0	364.0	27.0
SN74LV245ARGYR	VQFN	RGY	20	3000	367.0	367.0	35.0
SN74LV245AZQNR	BGA MICROSTAR JUNIOR	ZQN	20	1000	350.0	350.0	43.0

ZQN (R–PBGA–N20) PLASTIC BALL GRID ARRAY



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. Falls within JEDEC MO–285 variation BC–2.
D. This package is lead–free. Refer to the 20 GQN package (drawing 4200704) for tin–lead (SnPb).

RGY (R–PVQFN–N20) PLASTIC QUAD FLATPACK NO–LEAD



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. QFN (Quad Flatpack No–Lead) package configuration.
D. The package thermal pad must be soldered to the board for thermal and mechanical performance.
E. See the additional figure in the Product Data Sheet for details regarding the exposed thermal pad features and dimensions.
F. Pin 1 identifiers are located on both top and bottom of the package and within the zone indicated. The Pin 1 identifiers are either a molded, marked, or metal feature.
G. Package complies to JEDEC MO–241 variation BA.

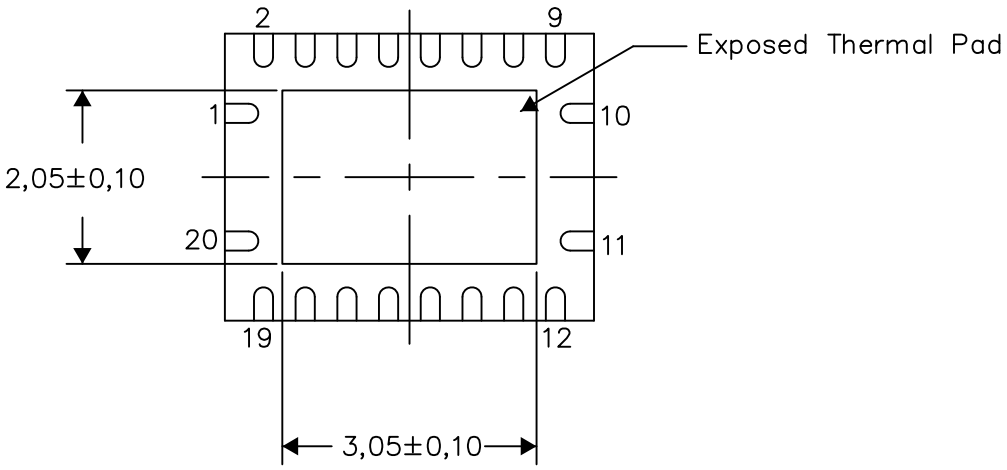
RGY (R–PVQFN–N20) PLASTIC QUAD FLATPACK NO–LEAD

THERMAL INFORMATION

This package incorporates an exposed thermal pad that is designed to be attached directly to an external heatsink. The thermal pad must be soldered directly to the printed circuit board (PCB). After soldering, the PCB can be used as a heatsink. In addition, through the use of thermal vias, the thermal pad can be attached directly to the appropriate copper plane shown in the electrical schematic for the device, or alternatively, can be attached to a special heatsink structure designed into the PCB. This design optimizes the heat transfer from the integrated circuit (IC).

For information on the Quad Flatpack No–Lead (QFN) package and its advantages, refer to Application Report, QFN/SON PCB Attachment, Texas Instruments Literature No. SLUA271. This document is available at www.ti.com.

The exposed thermal pad dimensions for this package are shown in the following illustration.



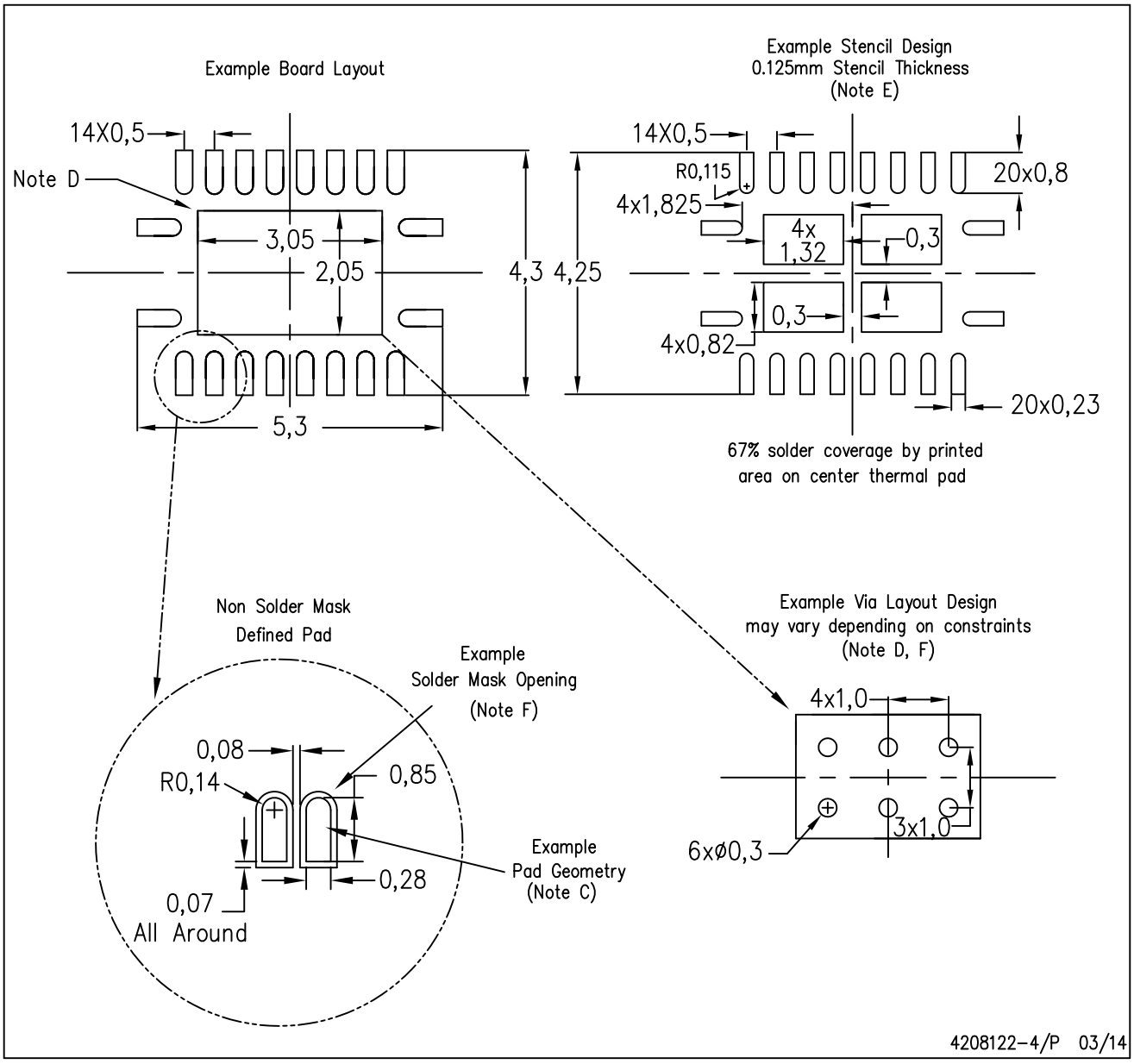
Bottom View

Exposed Thermal Pad Dimensions

4206353–4/P 03/14

NOTE: All linear dimensions are in millimeters

RGY (R–PVQFN–N20) PLASTIC QUAD FLATPACK NO–LEAD

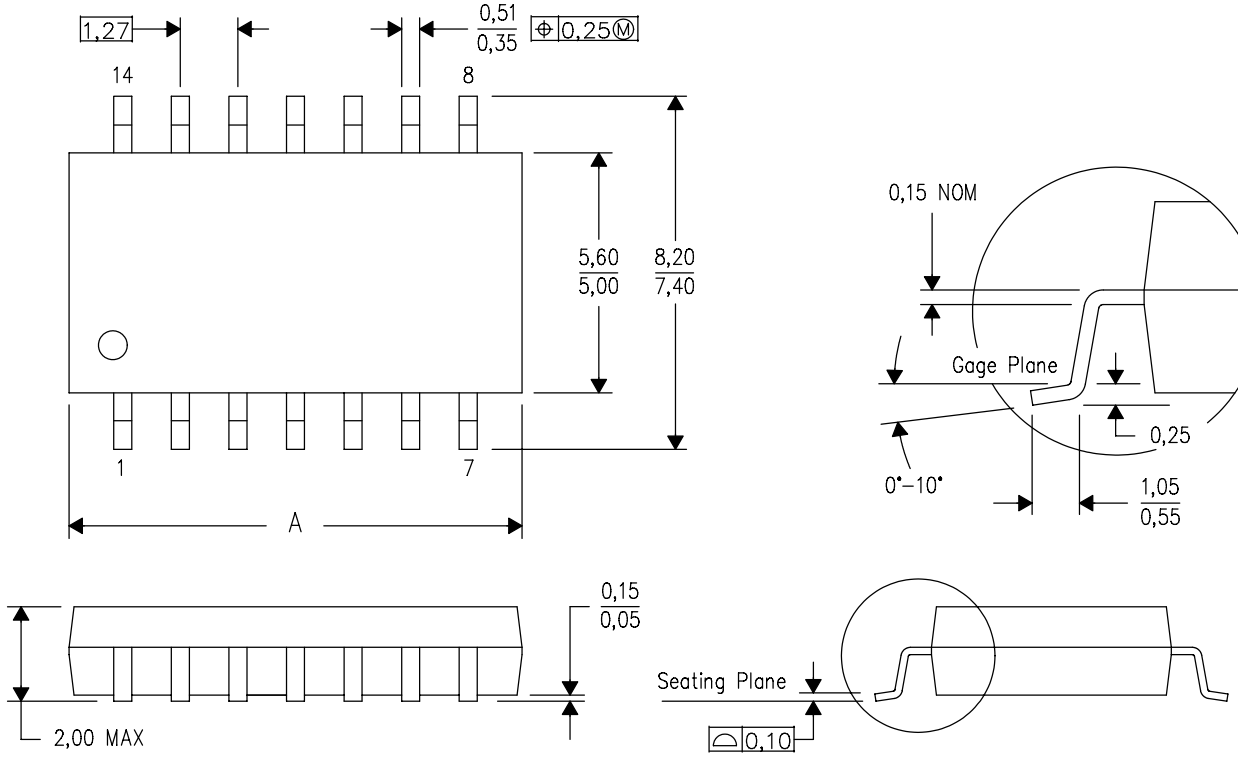


NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Publication IPC–7351 is recommended for alternate designs.
D. This package is designed to be soldered to a thermal pad on the board. Refer to Application Note, Quad Flat–Pack QFN/SON PCB Attachment, Texas Instruments Literature No. SLUA271, and also the Product Data Sheets for specific thermal information, via requirements, and recommended board layout. These documents are available at www.ti.com <http: //www.ti.com>.
E. 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 stencil design considerations.
F. Customers should contact their board fabrication site for minimum solder mask web tolerances between signal pads.

MECHANICAL DATA

NS (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

14-PINS SHOWN



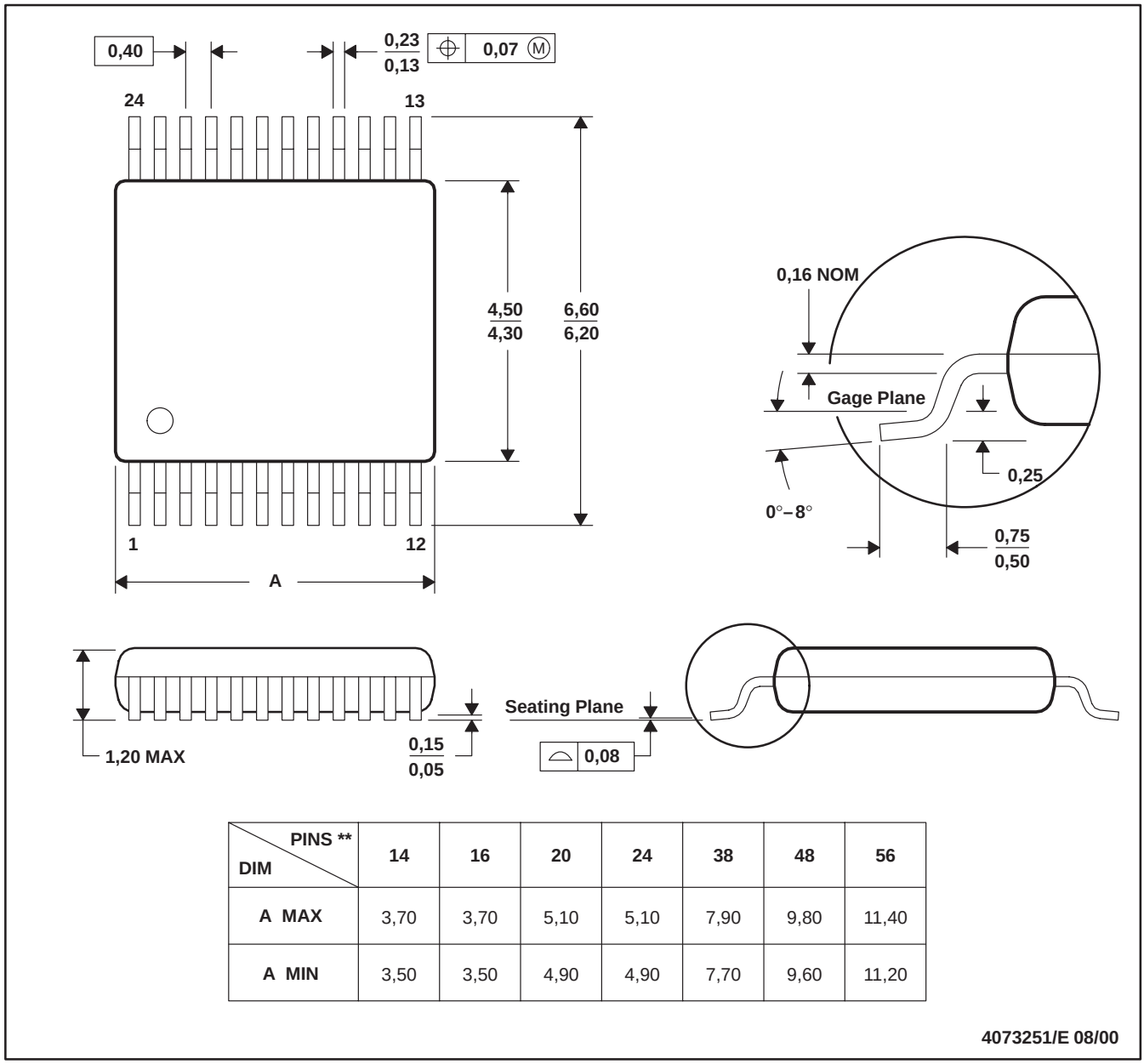
DIM \ PINS **	14	16	20	24
A MAX	10,50	10,50	12,90	15,30
A MIN	9,90	9,90	12,30	14,70

4040062/C 03/03

NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

DGV (R-PDSO-G)** **PLASTIC SMALL-OUTLINE**

24 PINS SHOWN

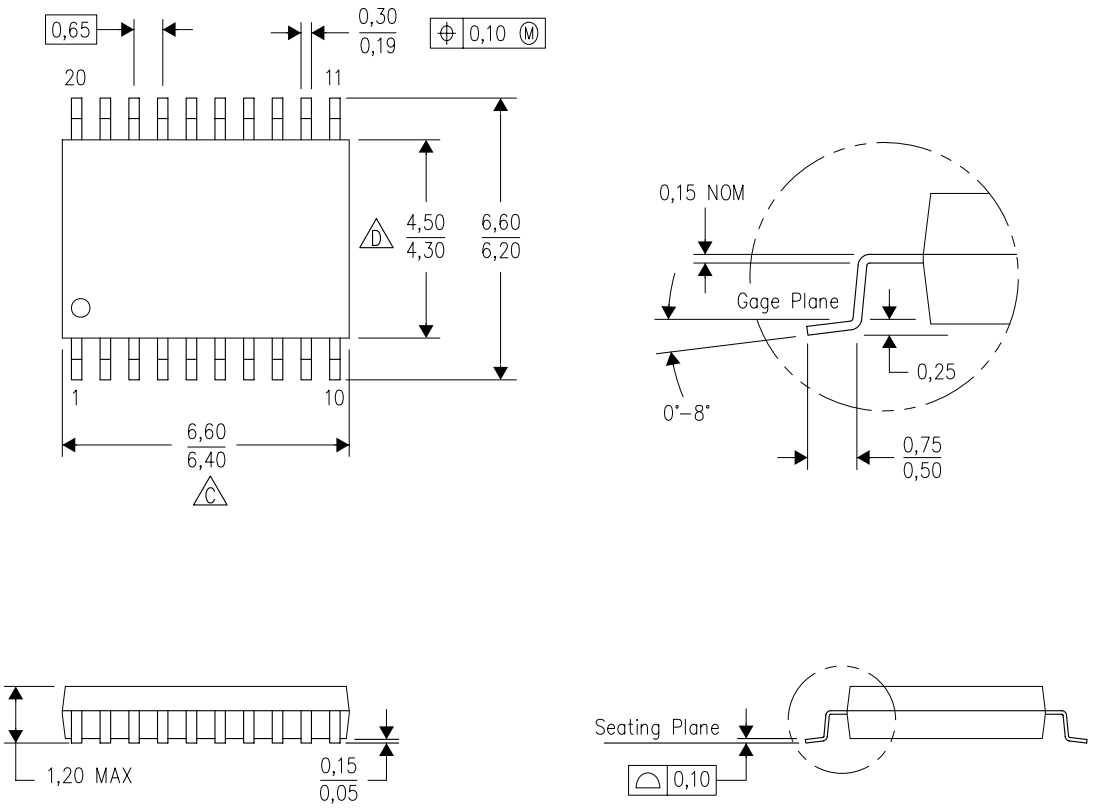


DIM \ PINS **	14	16	20	24	38	48	56
A MAX	3,70	3,70	5,10	5,10	7,90	9,80	11,40
A MIN	3,50	3,50	4,90	4,90	7,70	9,60	11,20

4073251/E 08/00

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15 per side.
D. Falls within JEDEC: 24/48 Pins – MO-153
14/16/20/56 Pins – MO-194

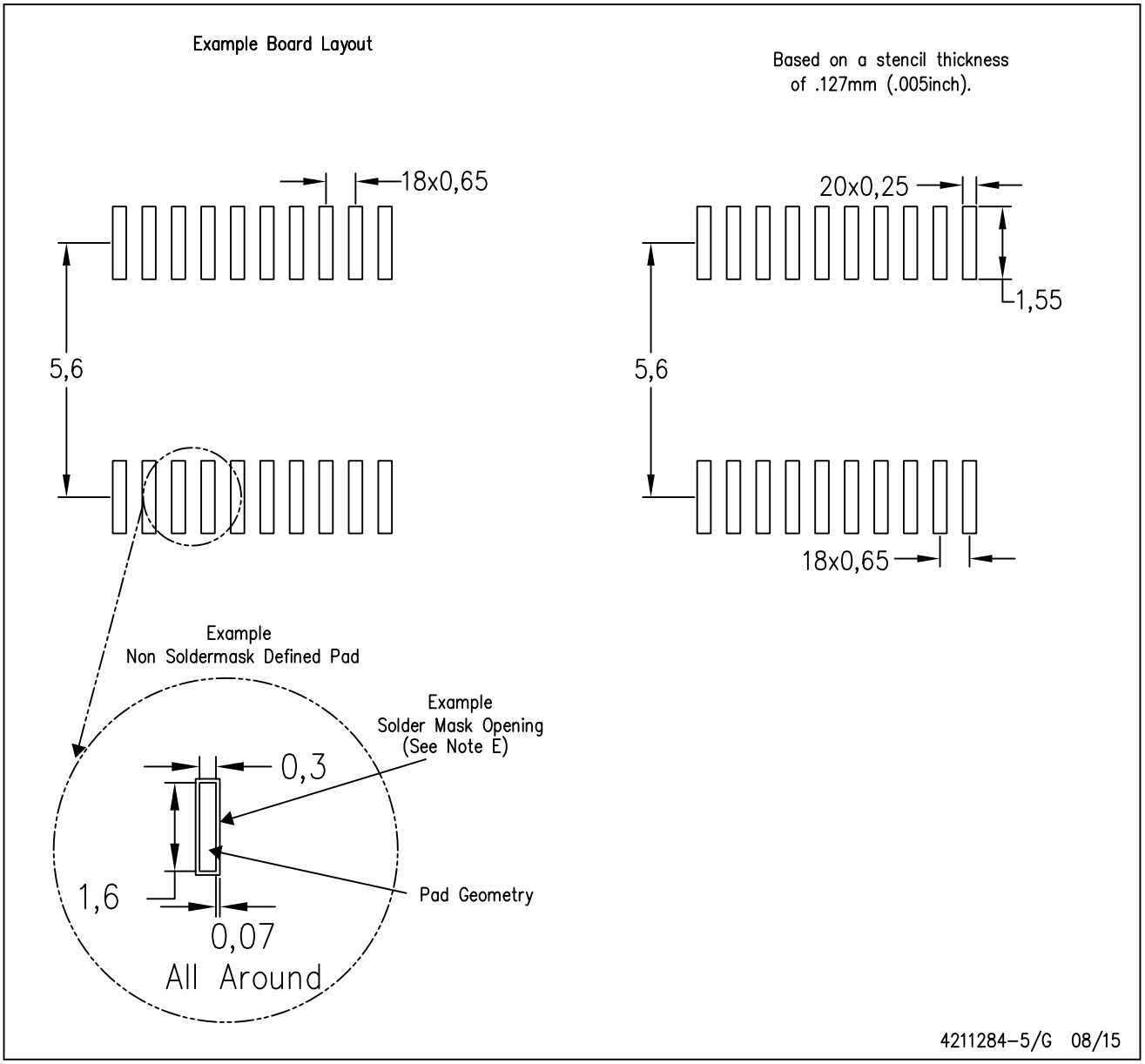
PW (R–PDSO–G20) PLASTIC SMALL OUTLINE



4040064–5/G 02/11

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



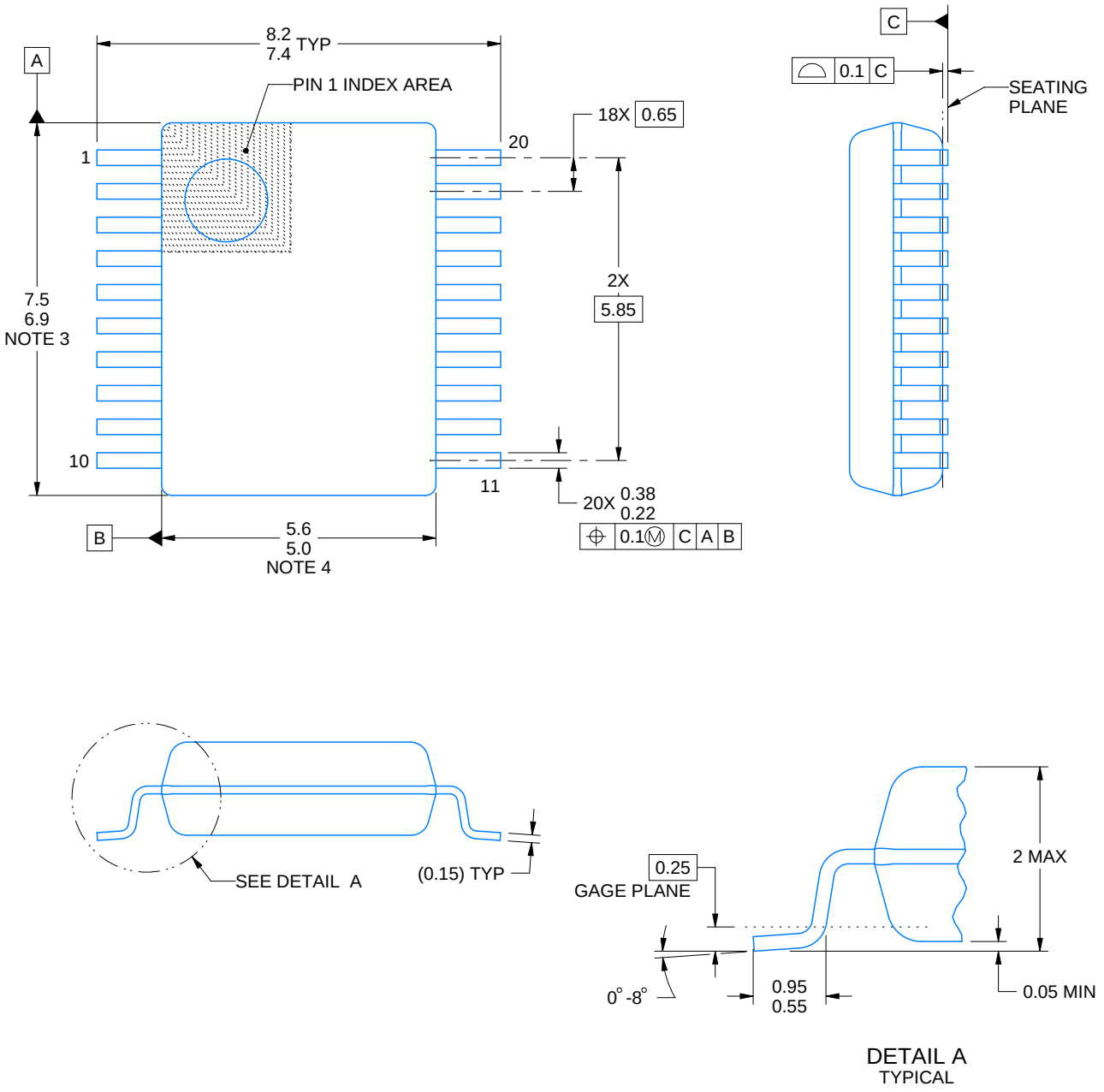
NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Publication IPC–7351 is recommended for alternate design.
D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their 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.

PACKAGE OUTLINE

DB0020A

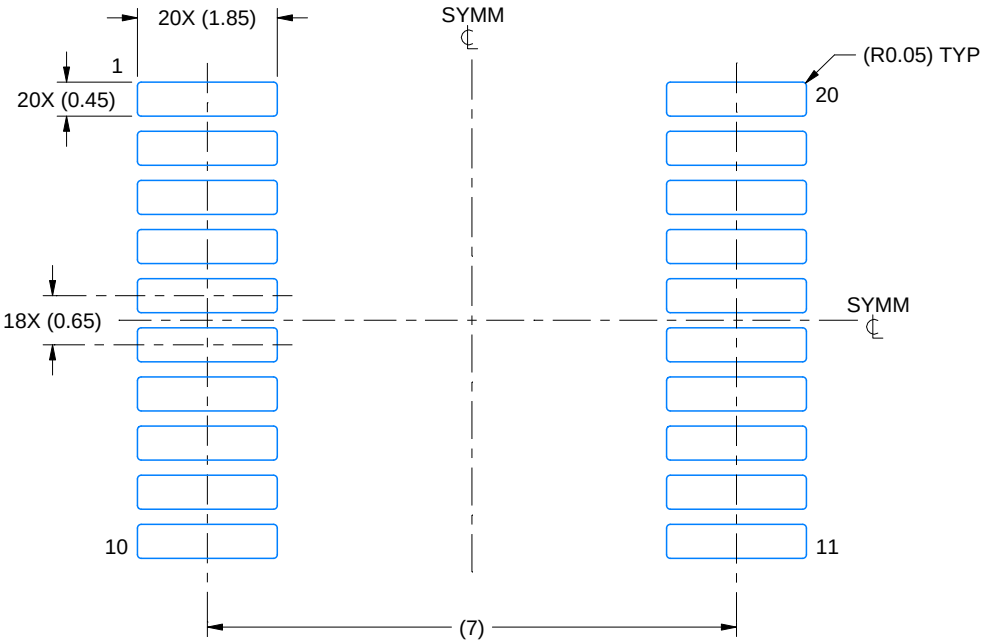
TSSOP - 2 mm max height

SMALL OUTLINE PACKAGE

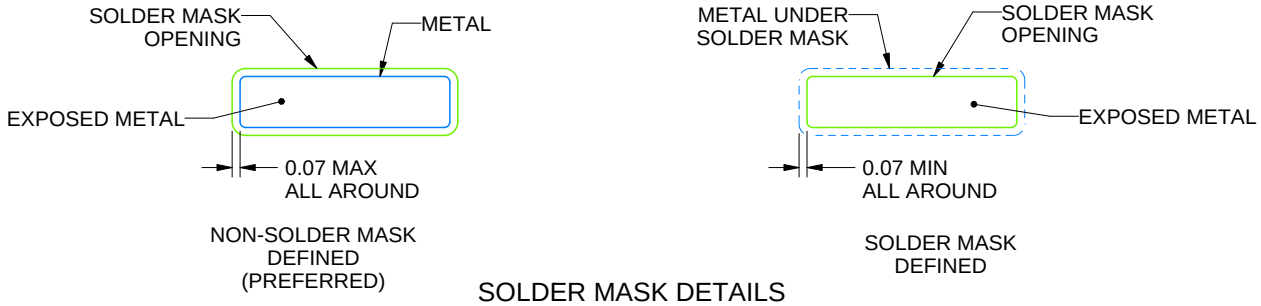


NOTES:

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-150.



LAND PATTERN EXAMPLE
EXPOSED METAL SHOWN
SCALE: 10X

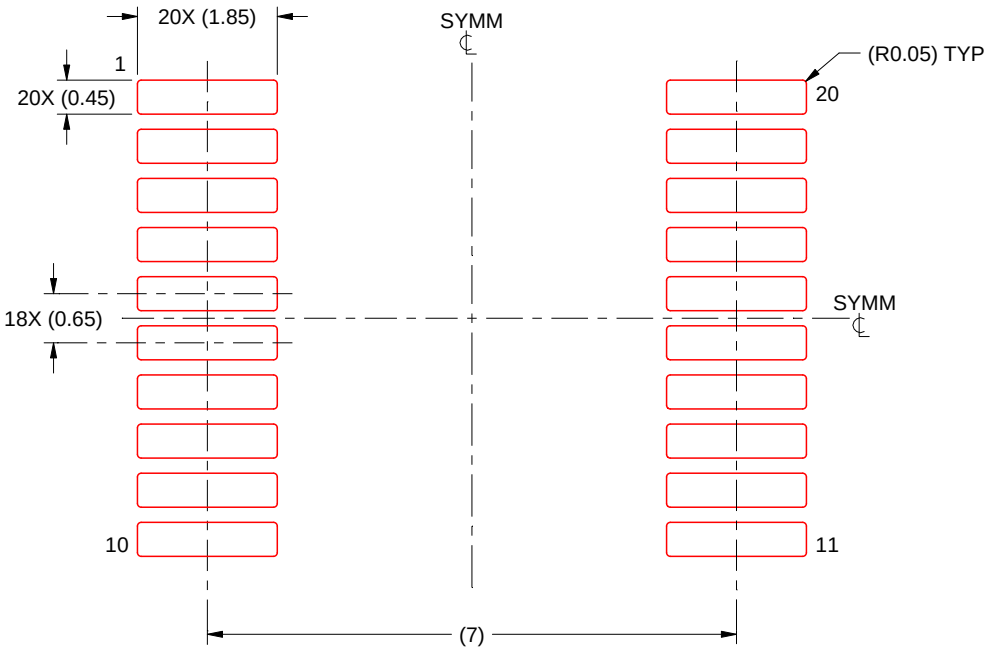


SOLDER MASK DETAILS

4214851/A 12/2017

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.

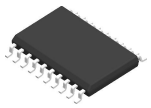


SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL
SCALE: 10X

4214851/A 12/2017

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.

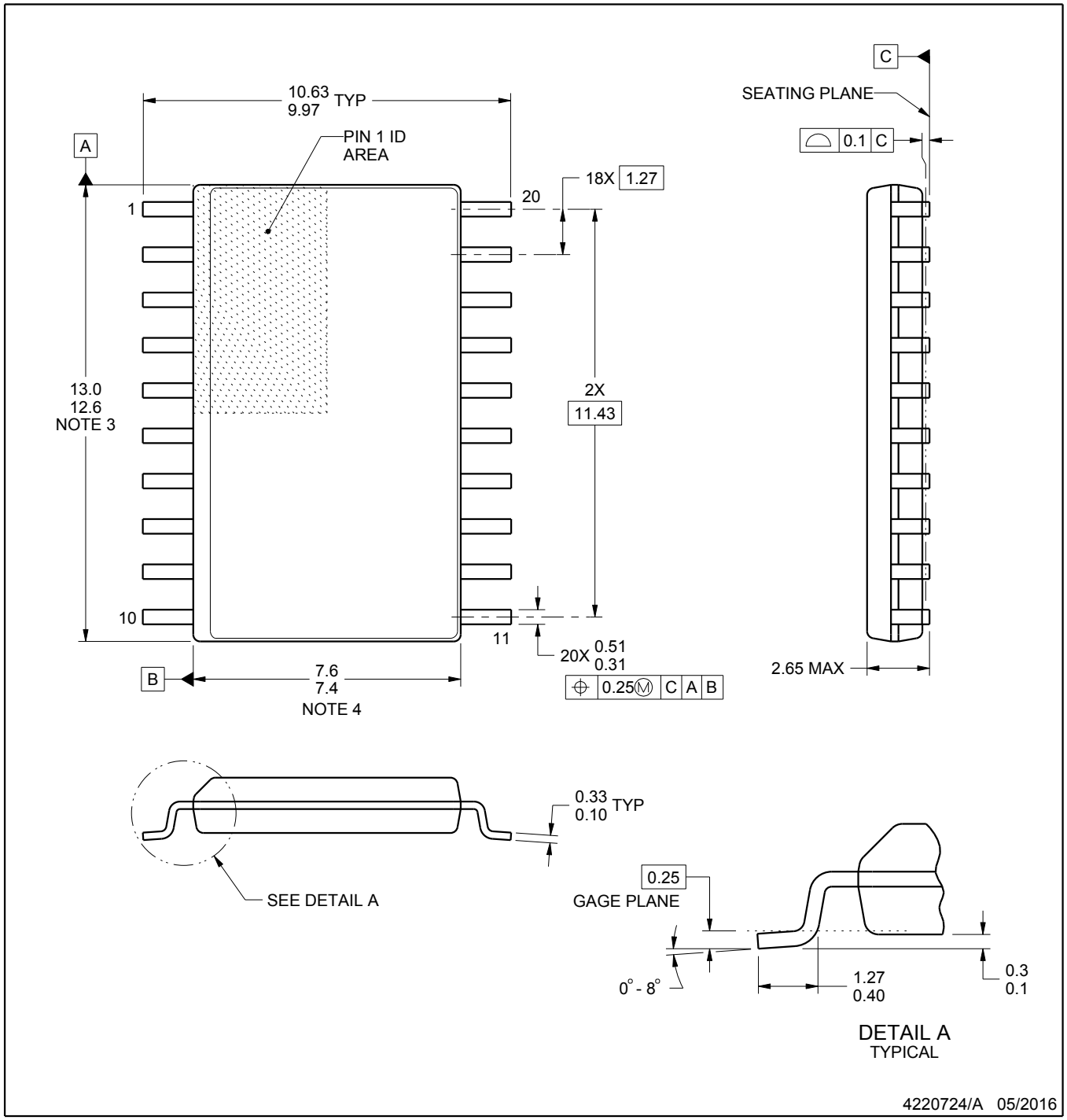


PACKAGE OUTLINE

DW0020A

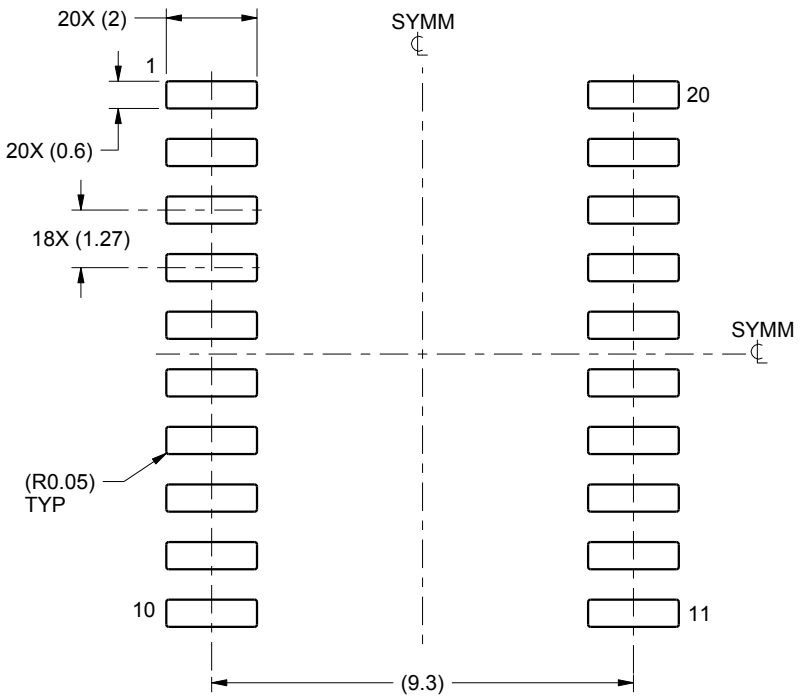
SOIC - 2.65 mm max height

SOIC

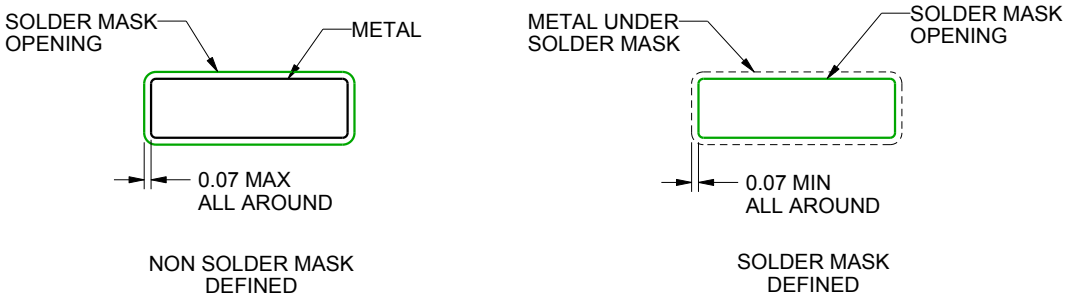


NOTES:

1. All linear dimensions are in millimeters. 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 0.43 mm per side.
5. Reference JEDEC registration MS-013.



LAND PATTERN EXAMPLE
SCALE:6X



SOLDER MASK DETAILS

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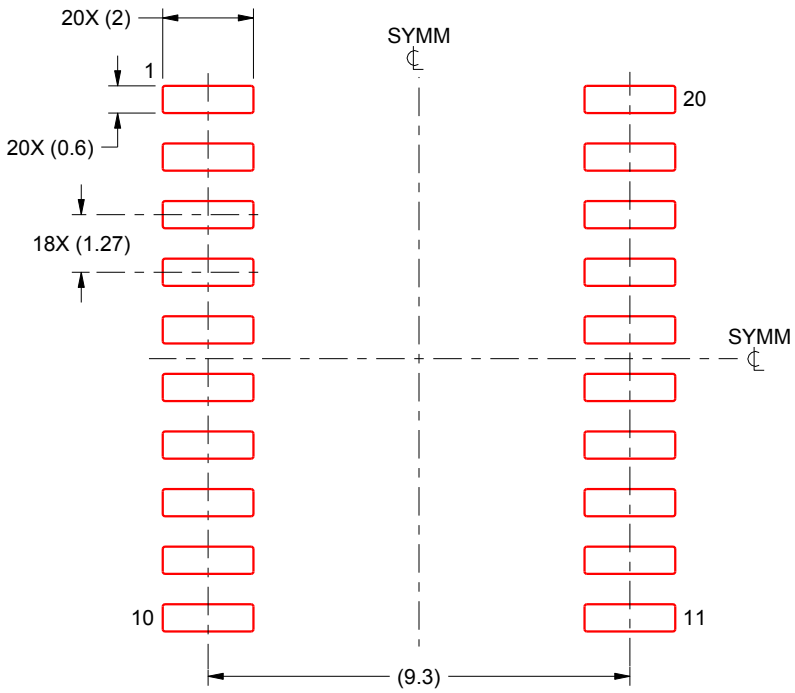
NOTES: (continued)

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:6X

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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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