SNx4HC244 Octal Buffers and Line Drivers With 3-State Outputs

1 Features

- Wide Operating Voltage Range of 2 V to 6 V
- High-Current Outputs Drive Up to 15 LSTTL Loads
- 3-State Outputs Drive Bus Lines or Buffer Memory Address Registers
- Low Power Consumption: I_{CC}, 80-µA (Maximum)
- Typical t_{pd} = 11 ns
- ±6-mA Output Drive at 5 V
- Low Input Current of 1 µA (Maximum)
- On Products Compliant to MIL-PRF-38535, All Parameters Are Tested Unless Otherwise Noted. On All Other Products, Production Processing Does Not Necessarily Include Testing of All Parameters.

2 Applications

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

3 Description

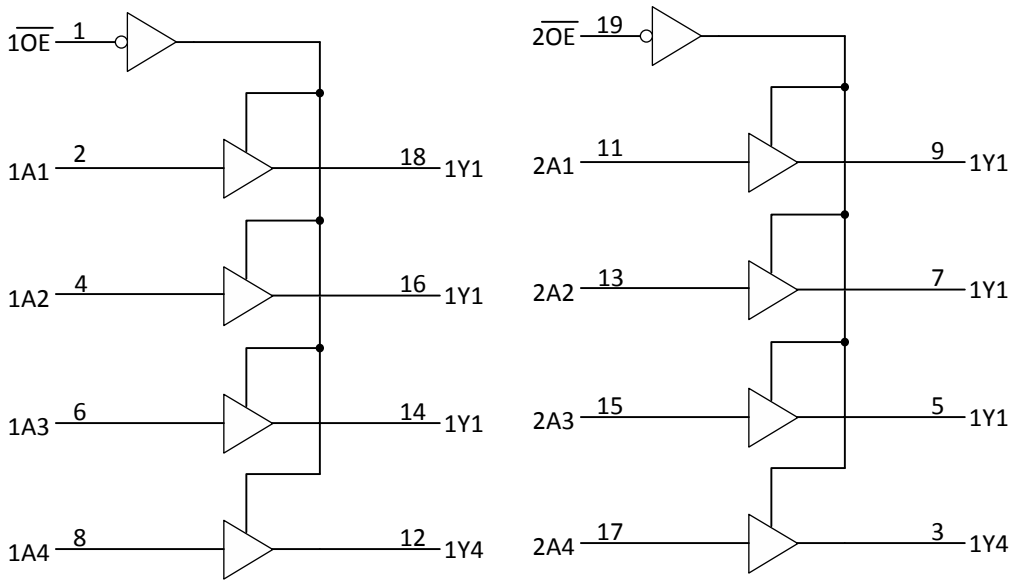
The SNx4HC244 octal buffers and line drivers are designed specifically to improve both the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters. The SNx4HC244 devices are organized as two 4-bit buffers and drivers with separate output-enable ($\overline{OE}$) inputs. When $\overline{OE}$ is low, the device passes noninverted data from the A inputs to the Y outputs. When $\overline{OE}$ is high, the outputs are in the high-impedance state.

Device Information(1)

PART NUMBER	PACKAGE (PINS)	BODY SIZE (NOM)
SN54HC244	CDIP (20)	6.92 mm × 24.38 mm
	CFP (20)	6.92 mm × 13.72 mm
	LCCC (20)	8.89 mm × 8.89 mm
SN74HC244DB	SSOP (20)	5.30 mm × 7.25 mm
SN74HC244DW	SOIC (20)	7.50 mm × 12.80 mm
SN74HC244N	PDIP (20)	6.30 mm × 25.40 mm
SN74HC244NS	SOP (20)	5.30 mm × 12.60 mm
SN74HC244PW	TSSOP (20)	4.40 mm × 6.50 mm

(1) For all available packages, see the orderable addendum at the end of the data sheet.

Logic Diagram (Positive Logic)



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4 Revision History

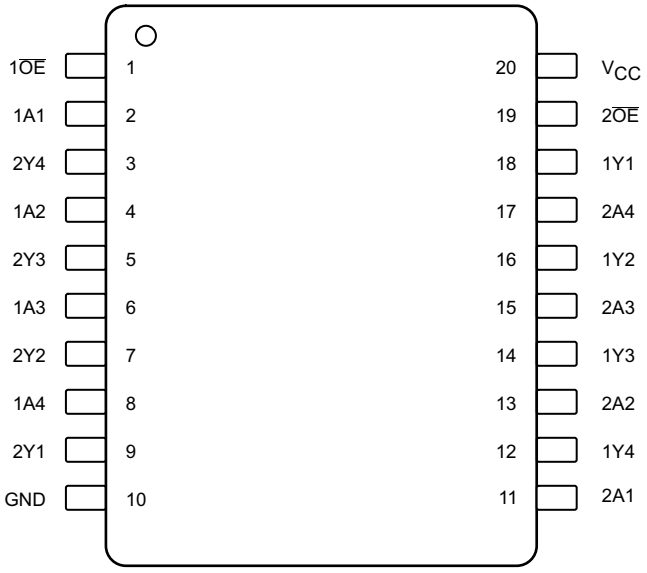
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision D (August 2003) to Revision E **Page**

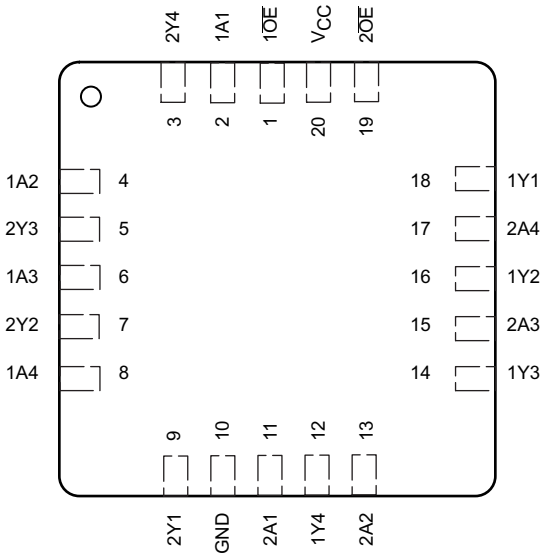
- Added *ESD Ratings* table, *Feature Description* section, *Device Functional Modes*, *Application and Implementation* section, *Power Supply Recommendations* section, *Layout* section, *Device and Documentation Support* section, and *Mechanical, Packaging, and Orderable Information* section ... 1
- Added Military Disclaimer to *Features* section ... 1
- Added *Applications* section ... 1
- Removed Ordering Information table ... 1
- Added *Device Information* table ... 1

5 Pin Configuration and Functions

DB, DW, J, N, NS, PW, W Package
20-Pin SSOP, SOIC, CDIP, PDIP, SOP, TSSOP, or CFP
Top View



FK Package
20-Pin LCCC
Top View



Pin Functions

PIN		I/O	DESCRIPTION
NO.	NAME		
1	1$\overline{OE}$	I	Output Enable
2	1A1	I	Input
3	2Y4	O	Output
4	1A2	I	Input
5	2Y3	O	Output
6	1A3	I	Input
7	2Y2	O	Output
8	1A4	I	Input
9	2Y1	O	Output
10	GND	—	Ground
11	2A1	I	Input
12	1Y4	O	Output
13	2A2	I	Input
14	1Y3	O	Output
15	2A3	I	Input
16	1Y2	O	Output
17	2A4	I	Input
18	1Y1	O	Output
19	2$\overline{OE}$	I	Output Enable
20	V_{CC}	—	Power Pin

6 Specifications

6.1 Absolute Maximum Ratings

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

		MIN	MAX	UNIT
Supply voltage range, V_{CC}		–0.5	7	V
Input clamp current, I_{IK}	$V_I < 0$ or $V_I > V_{CC}$(2)		±20	mA
Output clamp current, I_{OK}	$V_O < 0$ or $V_O > V_{CC}$(2)		±20	mA
Continuous output current, I_O	$V_O = 0$ or V_{CC}		±35	mA
Continuous current through V_{CC} or GND			±70	mA
Junction Temperature, T_J			150	°C
Storage temperature, T_{stg}		–65	150	°C

(1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. 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.

6.2 ESD Ratings

SN74HC244			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001(1)	±2000	V
		Charged-device model (CDM), per JEDEC specification JESD22-C101(2)	±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.

6.3 Recommended Operating Conditions

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

			MIN	NOM	MAX	UNIT
V_{CC}	Supply voltage		2	5	6	V
V_{IH}	High-level input voltage	V_{CC} = 2 V	1.5			V
		V_{CC} = 4.5 V	3.15			
		V_{CC} = 6 V	4.2			
V_{IL}	Low-level input voltage	V_{CC} = 2 V			0.5	V
		V_{CC} = 4.5 V			1.35	
		V_{CC} = 6 V			1.8	
V_I	Input voltage		0		V_{CC}	V
V_O	Output voltage		0		V_{CC}	V
Δt/Δv	Input transition rise and fall time	V_{CC} = 2 V			1000	ns/V
		V_{CC} = 4.5 V			500	
		V_{CC} = 6 V			400	
C_{pd}	Power dissipation capacitance per buffer or driver (no load)			35		pF
T_A	Operating free-air temperature	SN54HC244	–55		125	°C
		SN74HC244	–40		85	

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

6.4 Thermal Information

THERMAL METRIC[1]		SN54HC244, SN74HC244					UNIT
		DB (SSOP)	DW (SOIC)	N (PDIP)	NS (SOP)	PW (TSSOP)	
		20 PINS	20 PINS	20 PINS	20 PINS	20 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	89.5	76.8	44.9	71.9	97.5	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	50.9	42.2	30.9	38.2	32.6	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	44.6	44.6	25.8	39.3	48.4	°C/W
ψ_{JT}	Junction-to-top characterization parameter	17	15.6	16.4	14.9	1.7	°C/W
ψ_{JB}	Junction-to-board characterization parameter	44.2	44.1	25.7	39	47.9	°C/W

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

6.5 Electrical Characteristics

T_A = 25°C (unless otherwise noted)

PARAMETER	TEST CONDITIONS			MIN	TYP	MAX	UNIT
V_{OH}	V_I = V_{IH} or V_{IL}	I_{OH} = –20 µA	V_{CC} = 2 V	1.9	1.998		V
			V_{CC} = 4.5 V	4.4	4.499		
			V_{CC} = 6 V	5.9	5.999		
		I_{OH} = –6 mA, V_{CC} = 4.5 V		3.98	4.3		
		I_{OH} = –7.8 mA, V_{CC} = 6 V		5.48	5.8		
V_{OL}	V_I = V_{IH} or V_{IL}	I_{OL} = 20 µA	V_{CC} = 2 V		0.002	0.1	V
			V_{CC} = 4.5 V		0.001	0.1	
			V_{CC} = 6 V		0.001	0.1	
		I_{OL} = 6 mA, V_{CC} = 4.5 V			0.17	0.26	
		I_{OL} = 7.8 mA, V_{CC} = 6 V			0.15	0.26	
I_I	V_I = V_{CC} or 0, V_{CC} = 6 V				±0.1	±100	nA
I_{OZ}	V_O = V_{CC} or 0, V_I = V_{IH} or V_{IL}, V_{CC} = 6 V				±0.01	±0.5	µA
I_{CC}	V_I = V_{CC} or 0, I_O = 0, V_{CC} = 6 V					8	µA
C_i	V_{CC} = 2 V to 6 V				3	10	pF

6.6 Electrical Characteristics – SN54HC244

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

PARAMETER	TEST CONDITIONS			MIN	TYP	MAX	UNIT
V_{OH}	V_I = V_{IH} or V_{IL}	I_{OH} = –20 µA	V_{CC} = 2 V	1.9			V
			V_{CC} = 4.5 V	4.4			
			V_{CC} = 6 V	5.9			
		I_{OH} = –6 mA, V_{CC} = 4.5 V		3.7			
		I_{OH} = –7.8 mA, V_{CC} = 6 V		5.2			
V_{OL}	V_I = V_{IH} or V_{IL}	I_{OL} = 20 µA	V_{CC} = 2 V			0.1	V
			V_{CC} = 4.5 V			0.1	
			V_{CC} = 6 V			0.1	
		I_{OL} = 6 mA, V_{CC} = 4.5 V				0.4	
		I_{OL} = 7.8 mA, V_{CC} = 6 V				0.4	
I_I	V_I = V_{CC} or 0, V_{CC} = 6 V					±1000	nA
I_{OZ}	V_O = V_{CC} or 0, V_I = V_{IH} or V_{IL}, V_{CC} = 6 V					±10	µA
I_{CC}	V_I = V_{CC} or 0, I_O = 0, V_{CC} = 6 V					160	µA
C_i	V_{CC} = 2 V to 6 V					10	pF

6.7 Electrical Characteristics – SN74HC244

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

PARAMETER	TEST CONDITIONS			MIN	TYP	MAX	UNIT
V_{OH}	$V_I = V_{IH}$ or V_{IL}	$I_{OH} = -20$ µA	$V_{CC} = 2$ V	1.9			V
			$V_{CC} = 4.5$ V	4.4			
			$V_{CC} = 6$ V	5.9			
		$I_{OH} = -6$ mA, $V_{CC} = 4.5$ V		3.84			
		$I_{OH} = -7.8$ mA, $V_{CC} = 6$ V		5.34			
V_{OL}	$V_I = V_{IH}$ or V_{IL}	$I_{OL} = 20$ µA	$V_{CC} = 2$ V			0.1	V
			$V_{CC} = 4.5$ V			0.1	
			$V_{CC} = 6$ V			0.1	
		$I_{OL} = 6$ mA, $V_{CC} = 4.5$ V				0.33	
		$I_{OL} = 7.8$ mA, $V_{CC} = 6$ V				0.33	
I_I	$V_I = V_{CC}$ or 0, $V_{CC} = 6$ V					±1000	nA
I_{OZ}	$V_O = V_{CC}$ or 0, $V_I = V_{IH}$ or V_{IL}, $V_{CC} = 6$ V					±5	µA
I_{CC}	$V_I = V_{CC}$ or 0, $I_O = 0$, $V_{CC} = 6$ V					80	µA
C_i	$V_{CC} = 2$ V to 6 V					10	pF

6.8 Switching Characteristics

$T_A = 25°C$ (unless otherwise noted; see Figure 2)

PARAMETER	TEST CONDITIONS			MIN	TYP	MAX	UNIT
t_{pd}	From A (input) to Y (output)	$V_{CC} = 2$ V	$C_L = 50$ pF		40	115	ns
			$C_L = 150$ pF		56	165	
		$V_{CC} = 4.5$ V	$C_L = 50$ pF		13	23	
			$C_L = 150$ pF		18	33	
		$V_{CC} = 6$ V	$C_L = 50$ pF		11	20	
			$C_L = 150$ pF		15	28	
t_{en}	From $\overline{OE}$ (input) to Y (output)	$V_{CC} = 2$ V	$C_L = 50$ pF		75	150	ns
			$C_L = 150$ pF		100	200	
		$V_{CC} = 4.5$ V	$C_L = 50$ pF		15	30	
			$C_L = 150$ pF		20	40	
		$V_{CC} = 6$ V	$C_L = 50$ pF		13	26	
			$C_L = 150$ pF		17	34	
t_{dis}	From $\overline{OE}$ (input) to Y (output)	$V_{CC} = 2$ V	$C_L = 50$ pF		75	150	ns
		$V_{CC} = 4.5$ V	$C_L = 50$ pF		15	30	
		$V_{CC} = 6$ V	$C_L = 50$ pF		13	26	
t_t	To Y (output)	$V_{CC} = 2$ V	$C_L = 50$ pF		28	60	ns
			$C_L = 150$ pF		45	210	
		$V_{CC} = 4.5$ V	$C_L = 50$ pF		8	12	
			$C_L = 150$ pF		17	42	
		$V_{CC} = 6$ V	$C_L = 50$ pF		6	10	
			$C_L = 150$ pF		13	36	

6.9 Switching Characteristics – C_L = 50 pF

over recommended operating free-air temperature range (unless otherwise noted; see Figure 2)

PARAMETER	TEST CONDITIONS			MIN	TYP	MAX	UNIT
t_{pd}	From A (input) to Y (output)	V_{CC} = 2 V	SN54HC244			170	ns
			SN74HC244			145	
		V_{CC} = 4.5 V	SN54HC244			34	
			SN74HC244			29	
		V_{CC} = 6 V	SN54HC244			29	
			SN74HC244			25	
t_{en}	From $\overline{OE}$ (input) to Y (output)	V_{CC} = 2 V	SN54HC244			225	ns
			SN74HC244			190	
		V_{CC} = 4.5 V	SN54HC244			45	
			SN74HC244			38	
		V_{CC} = 6 V	SN54HC244			38	
			SN74HC244			32	
t_{dis}	From $\overline{OE}$ (input) to Y (output)	V_{CC} = 2 V	SN54HC244			225	ns
			SN74HC244			190	
		V_{CC} = 4.5 V	SN54HC244			45	
			SN74HC244			38	
		V_{CC} = 6 V	SN54HC244			38	
			SN74HC244			32	
t_t	To Y (output)	V_{CC} = 2 V	SN54HC244			90	ns
			SN74HC244			75	
		V_{CC} = 4.5 V	SN54HC244			18	
			SN74HC244			15	
		V_{CC} = 6 V	SN54HC244			15	
			SN74HC244			13	

6.10 Switching Characteristics – C_L = 150 pF

over recommended operating free-air temperature range (unless otherwise noted; see Figure 2)

PARAMETER	TEST CONDITIONS			MIN	TYP	MAX	UNIT
t_{pd}	From A (input) to Y (output)	V_{CC} = 2 V	SN54HC244			245	ns
			SN74HC244			210	
		V_{CC} = 4.5 V	SN54HC244			49	
			SN74HC244			42	
		V_{CC} = 6 V	SN54HC244			42	
			SN74HC244			35	
t_{en}	From $\overline{OE}$ (input) to Y (output)	V_{CC} = 2 V	SN54HC244			300	ns
			SN74HC244			250	
		V_{CC} = 4.5 V	SN54HC244			60	
			SN74HC244			50	
		V_{CC} = 6 V	SN54HC244			51	
			SN74HC244			43	
t_t	To Y (output)	V_{CC} = 2 V	SN54HC244			315	ns
			SN74HC244			265	
		V_{CC} = 4.5 V	SN54HC244			63	
			SN74HC244			53	
		V_{CC} = 6 V	SN54HC244			53	
			SN74HC244			45	

6.11 Typical Characteristic

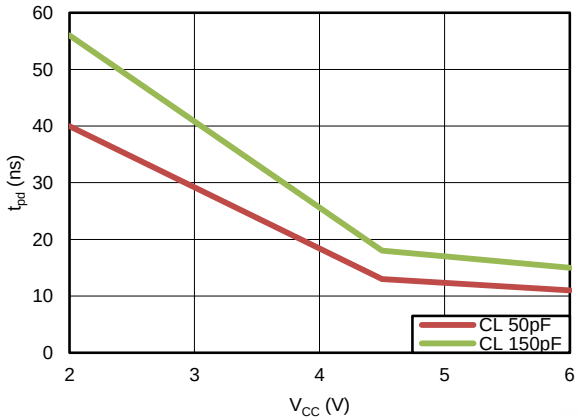


Figure 1. Propagation Delay

7 Parameter Measurement Information

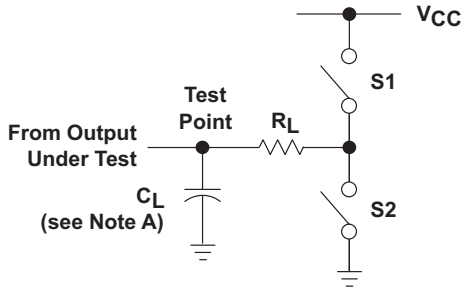


Figure 2. Load Circuit

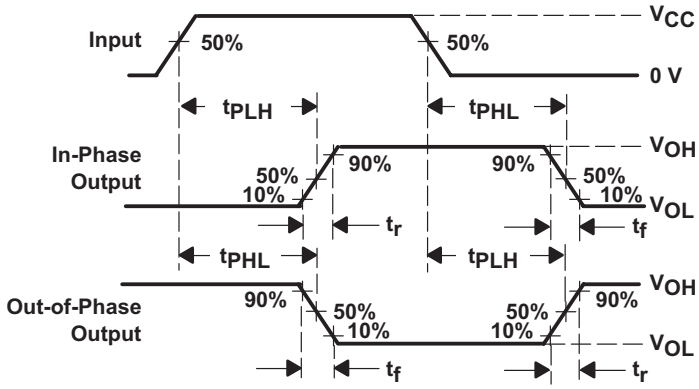


Figure 3. Propagation Delay and Output Transition Times

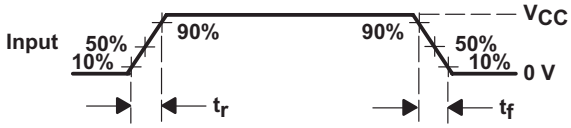


Figure 4. Input Rise and Fall Times

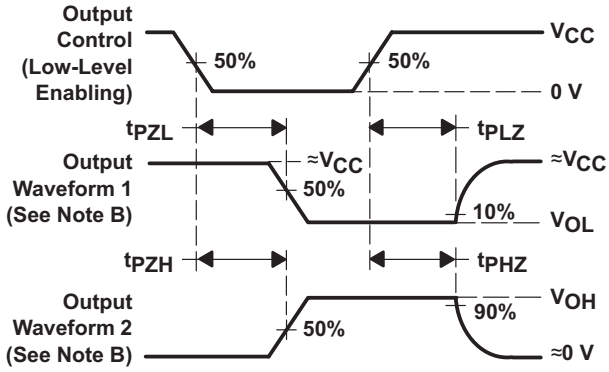


Figure 5. Enable and Disable Times for 3-State Outputs

NOTE:

A. C_L includes probe and test-fixture capacitance.

Parameter Measurement Information (continued)

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. Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, Z_O = 50 Ω, t_r = 6 ns, t_f = 6 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_{PLH} and t_{PHL} are the same as t_{pd}.

Table 1. Switching Information Table

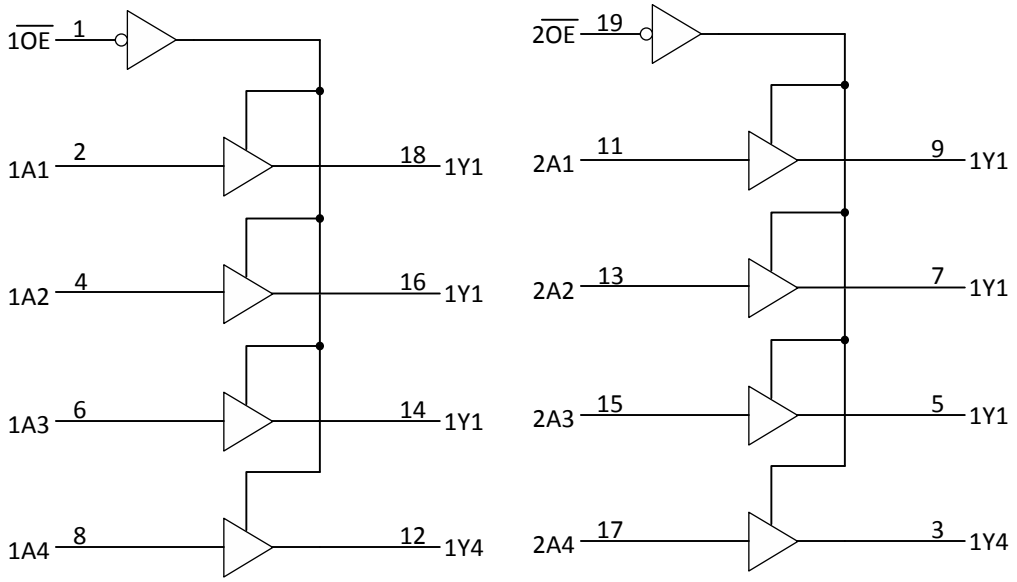
PARAMETER		RL	CL	S1	S2
t_{en}	t_{PZH}	1 kΩ	50 pF or 150 pF	Open	Closed
	t_{PZL}	1 kΩ	50 pF or 150 pF	Closed	Open
t_{dis}	t_{PHZ}	1 kΩ	50 pF	Open	Closed
	t_{PLZ}	1 kΩ	50 pF	Closed	Open
t_{pd} or t_t		—	50 pF or 150 pF	Open	Open

8 Detailed Description

8.1 Overview

The SNx4HC244 device is organized as two 4-bit buffers and line drivers with separate output-enable ($\overline{OE}$) inputs. When $\overline{OE}$ is low, the device passes data from the A inputs to the Y outputs. When $\overline{OE}$ is high, the outputs are in the high-impedance state. 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.

8.2 Functional Block Diagram



8.3 Feature Description

The SNx4HC244 has a wide operating voltage of 2 V to 6 V. Inputs accept voltage levels up to V_{CC}. This device has a low power consumption of I_{CC} 80 µA (maximum). The SNx4HC244 device can drive ±6 mA at V_{CC} of 5 V.

8.4 Device Functional Modes

Table 2 lists the functions of the SNx4HC244.

Table 2. Function Table (Each Buffer or Driver)

INPUTS		OUTPUT
$\overline{OE}$	A	Y
L	H	H
L	L	L
H	X	Z

9 Application and Implementation

NOTE

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes. Customers should validate and test their design implementation to confirm system functionality.

9.1 Application Information

SN74HC244 is a high-drive CMOS device that can be used for a multitude of bus interface type applications where output drive or PCB trace length is a concern.

9.2 Typical Application

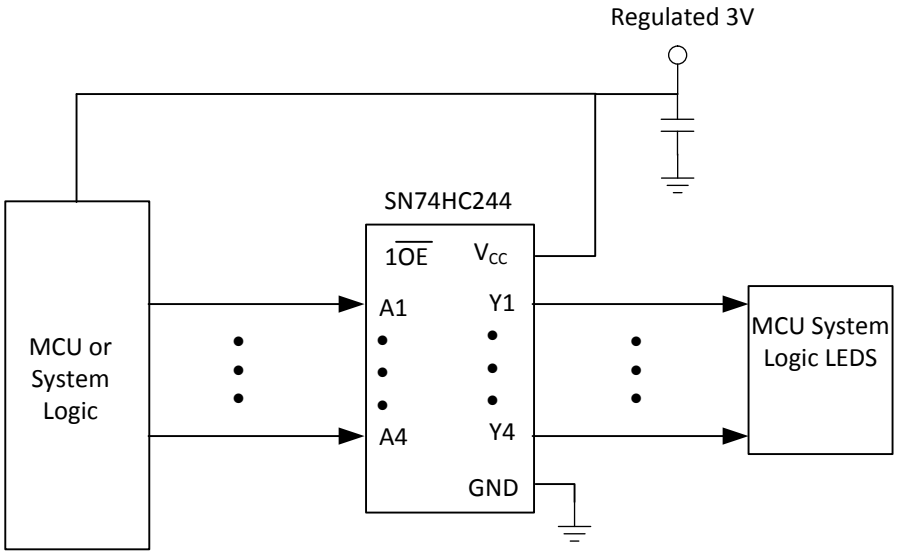


Figure 6. SN74HC244 Application Schematic

9.2.1 Design Requirements

This device uses CMOS technology and has balanced output drive. Take care to avoid bus contention because it can drive currents that would exceed maximum limits. The high drive also creates fast edges into light loads so routing and load conditions should be considered to prevent ringing.

9.2.2 Detailed Design Procedure

1. Recommended input conditions:
   - For rise time and fall time specifications, see Δt/ΔV in *Recommended Operating Conditions*.
   - For specified high and low levels, see V_{IH} and V_{IL} in *Recommended Operating Conditions*.
2. Recommend output conditions:
   - Load currents should not exceed I_O max per output and should not exceed the continuous current through V_{CC} or GND total current for the part. These limits are located in *Absolute Maximum Ratings*.
   - Outputs should not be pulled above V_{CC}.

Typical Application (continued)

9.2.3 Application Curve

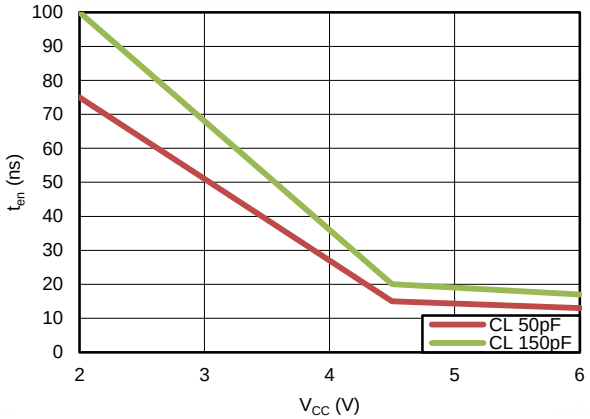


Figure 7. Enable Time

10 Power Supply Recommendations

The power supply can be any voltage between the MIN and MAX supply voltage rating located in the *Recommended Operating Conditions*.

Each V_{CC} terminal should have a good bypass capacitor to prevent power disturbance. For devices with a single supply, TI recomments a 0.1-µF capacitor. If there are multiple V_{CC} terminals, then TI recommends 0.01-µF or 0.022-µF capacitors for each power terminal. It is ok to parallel multiple bypass capacitors to reject different frequencies of noise. Multiple bypass capacitors may be paralleled to reject different frequencies of noise. The bypass capacitor should be installed as close to the power terminal as possible for the best results.

11 Layout

11.1 Layout Guidelines

When using multiple bit logic devices, inputs should not float. In many cases, functions or parts of functions of digital logic devices are unused. Some examples are when only two inputs of a triple-input and gate are used, or when 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 8 are 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.

11.2 Layout Example

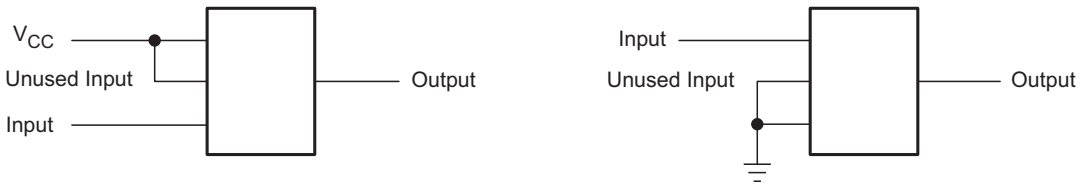


Figure 8. Layout Diagram

12 Device and Documentation Support

12.1 Related Links

Table 3 lists quick access links. Categories include technical documents, support and community resources, tools and software, and quick access to sample or buy.

Table 3. Related Links

PARTS	PRODUCT FOLDER	SAMPLE & BUY	TECHNICAL DOCUMENTS	TOOLS & SOFTWARE	SUPPORT & COMMUNITY
SN54HC244	Click here	Click here	Click here	Click here	Click here
SN74HC244	Click here	Click here	Click here	Click here	Click here

12.2 Community Resources

The following links connect to TI community resources. Linked contents are provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

TI E2E™ Online Community ***TI's Engineer-to-Engineer (E2E) Community.*** Created to foster collaboration among engineers. At e2e.ti.com, you can ask questions, share knowledge, explore ideas and help solve problems with fellow engineers.

Design Support ***TI's Design Support*** Quickly find helpful E2E forums along with design support tools and contact information for technical support.

12.3 Trademarks

E2E is a trademark of Texas Instruments.
All other trademarks are the property of their respective owners.

12.4 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.

12.5 Glossary

SLYZ022 — *TI Glossary*.

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

13 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
5962-8409601VRA	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-8409601VR A SNV54HC244J	Samples
5962-8409601VSA	ACTIVE	CFP	W	20	25	TBD	A42	N / A for Pkg Type	-55 to 125	5962-8409601VS A SNV54HC244W	Samples
84096012A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	84096012A SNJ54HC 244FK	Samples
8409601RA	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type	-55 to 125	8409601RA SNJ54HC244J	Samples
8409601SA	ACTIVE	CFP	W	20	1	TBD	A42	N / A for Pkg Type	-55 to 125	8409601SA SNJ54HC244W	Samples
JM38510/65705B2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	JM38510/ 65705B2A	Samples
JM38510/65705BRA	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type	-55 to 125	JM38510/ 65705BRA	Samples
JM38510/65705BSA	ACTIVE	CFP	W	20	1	TBD	A42	N / A for Pkg Type	-55 to 125	JM38510/ 65705BSA	Samples
M38510/65705B2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	JM38510/ 65705B2A	Samples
M38510/65705BRA	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type	-55 to 125	JM38510/ 65705BRA	Samples
M38510/65705BSA	ACTIVE	CFP	W	20	1	TBD	A42	N / A for Pkg Type	-55 to 125	JM38510/ 65705BSA	Samples
SN54HC244J	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type	-55 to 125	SN54HC244J	Samples
SN74HC244DBR	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	HC244	Samples
SN74HC244DBRG4	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	HC244	Samples
SN74HC244DW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	HC244	Samples
SN74HC244DWE4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	HC244	Samples

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
SN74HC244DWG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	HC244	Samples
SN74HC244DWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU | CU SN	Level-1-260C-UNLIM	-40 to 85	HC244	Samples
SN74HC244DWRE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	HC244	Samples
SN74HC244DWRG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	HC244	Samples
SN74HC244N	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-40 to 85	SN74HC244N	Samples
SN74HC244NE4	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-40 to 85	SN74HC244N	Samples
SN74HC244NSR	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	HC244	Samples
SN74HC244NSRG4	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	HC244	Samples
SN74HC244PW	ACTIVE	TSSOP	PW	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	HC244	Samples
SN74HC244PWE4	ACTIVE	TSSOP	PW	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	HC244	Samples
SN74HC244PWG4	ACTIVE	TSSOP	PW	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	HC244	Samples
SN74HC244PWR	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	HC244	Samples
SN74HC244PWRE4	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	HC244	Samples
SN74HC244PWRG4	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	HC244	Samples
SN74HC244PWT	ACTIVE	TSSOP	PW	20	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	HC244	Samples
SN74HC244QDWRG4Q1	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM		HC244Q	Samples
SNJ54HC244FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	84096012A SNJ54HC 244FK	Samples
SNJ54HC244J	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type	-55 to 125	8409601RA	Samples

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
										SNJ54HC244J	
SNJ54HC244W	ACTIVE	CFP	W	20	1	TBD	A42	N / A for Pkg Type	-55 to 125	8409601SA SNJ54HC244W	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) 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.

OTHER QUALIFIED VERSIONS OF SN54HC244, SN54HC244-SP, SN74HC244 :

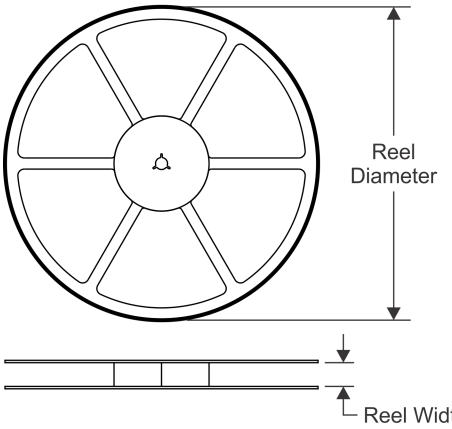
- Catalog: SN74HC244, SN54HC244
- Automotive: SN74HC244-Q1, SN74HC244-Q1
- Enhanced Product: SN74HC244-EP, SN74HC244-EP
- Military: SN54HC244
- Space: SN54HC244-SP

NOTE: Qualified Version Definitions:

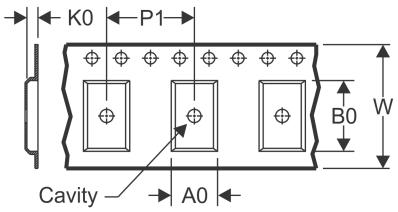
- Catalog - TI's standard catalog product
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Enhanced Product - Supports Defense, Aerospace and Medical Applications
- Military - QML certified for Military and Defense Applications
- Space - Radiation tolerant, ceramic packaging and qualified for use in Space-based application

TAPE AND REEL INFORMATION

REEL DIMENSIONS

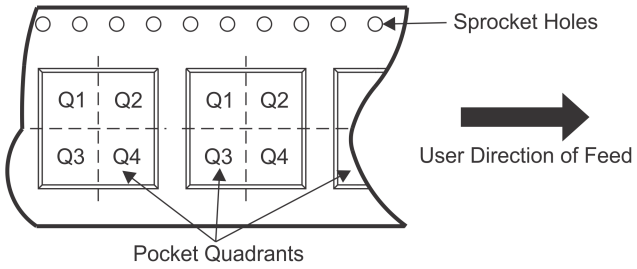


TAPE DIMENSIONS



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

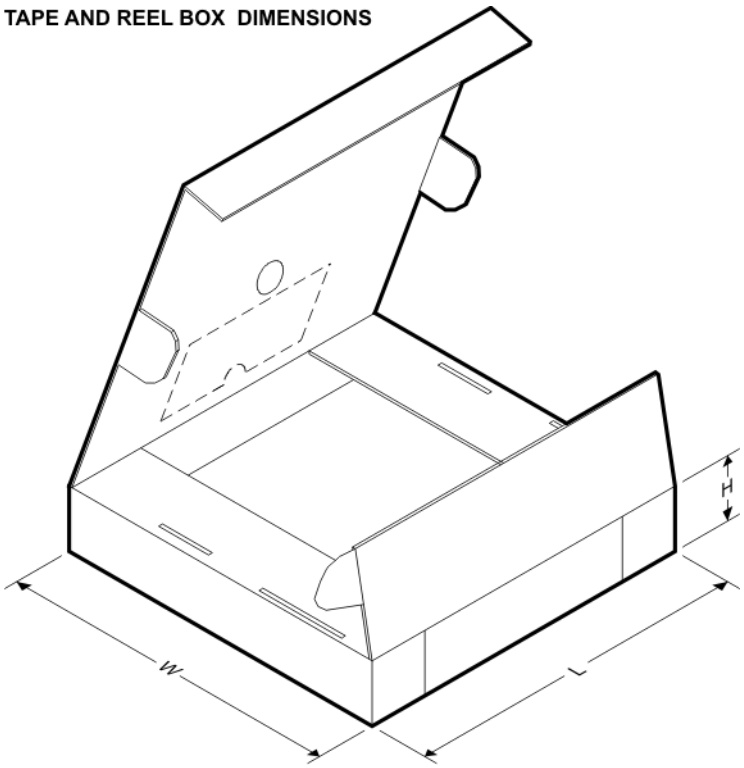
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
SN74HC244DBR	SSOP	DB	20	2000	330.0	16.4	8.2	7.5	2.5	12.0	16.0	Q1
SN74HC244DWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1
SN74HC244DWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1
SN74HC244DWRG4	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1
SN74HC244DWRG4	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1
SN74HC244NSR	SO	NS	20	2000	330.0	24.4	8.4	13.0	2.5	12.0	24.0	Q1
SN74HC244PWR	TSSOP	PW	20	2000	330.0	16.4	6.95	7.1	1.6	8.0	16.0	Q1
SN74HC244PWT	TSSOP	PW	20	250	330.0	16.4	6.95	7.1	1.6	8.0	16.0	Q1
SN74HC244QDWRG4Q1	SOIC	DW	20	2000	330.0	24.4	10.8	13.3	2.7	12.0	24.0	Q1

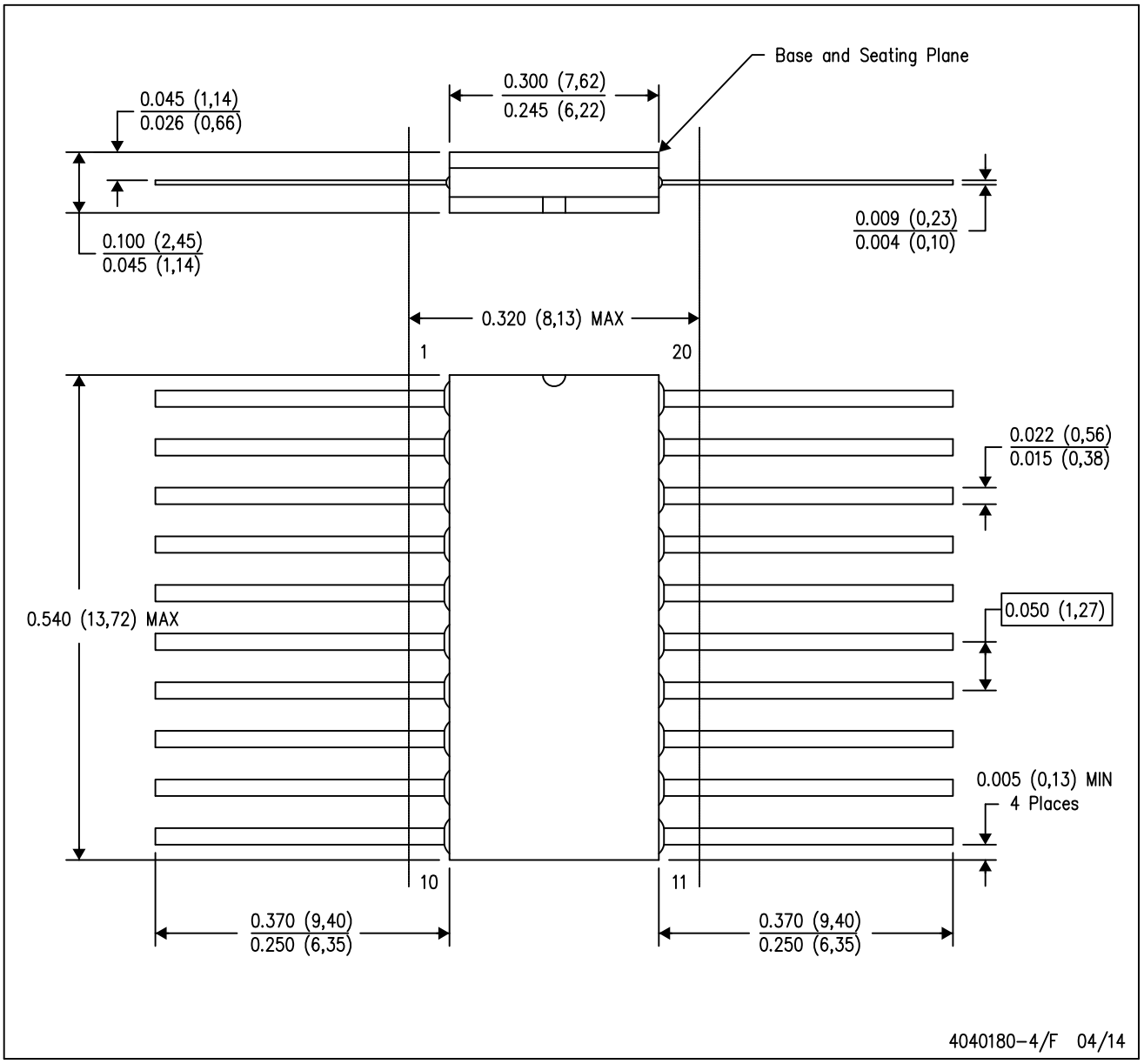
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74HC244DBR	SSOP	DB	20	2000	367.0	367.0	38.0
SN74HC244DWR	SOIC	DW	20	2000	367.0	367.0	45.0
SN74HC244DWR	SOIC	DW	20	2000	600.0	144.0	84.0
SN74HC244DWRG4	SOIC	DW	20	2000	367.0	367.0	45.0
SN74HC244DWRG4	SOIC	DW	20	2000	367.0	367.0	45.0
SN74HC244NSR	SO	NS	20	2000	367.0	367.0	45.0
SN74HC244PWR	TSSOP	PW	20	2000	367.0	367.0	38.0
SN74HC244PWT	TSSOP	PW	20	250	367.0	367.0	38.0
SN74HC244QDWRG4Q1	SOIC	DW	20	2000	367.0	367.0	45.0

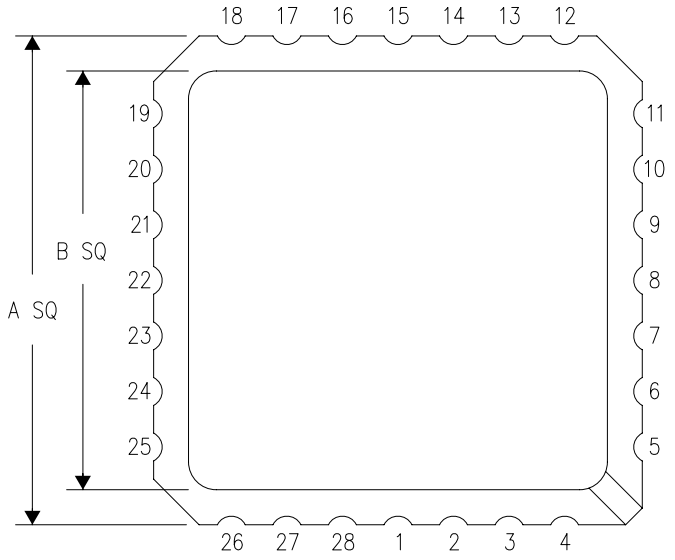
W (R–GDFP–F20) CERAMIC DUAL FLATPACK



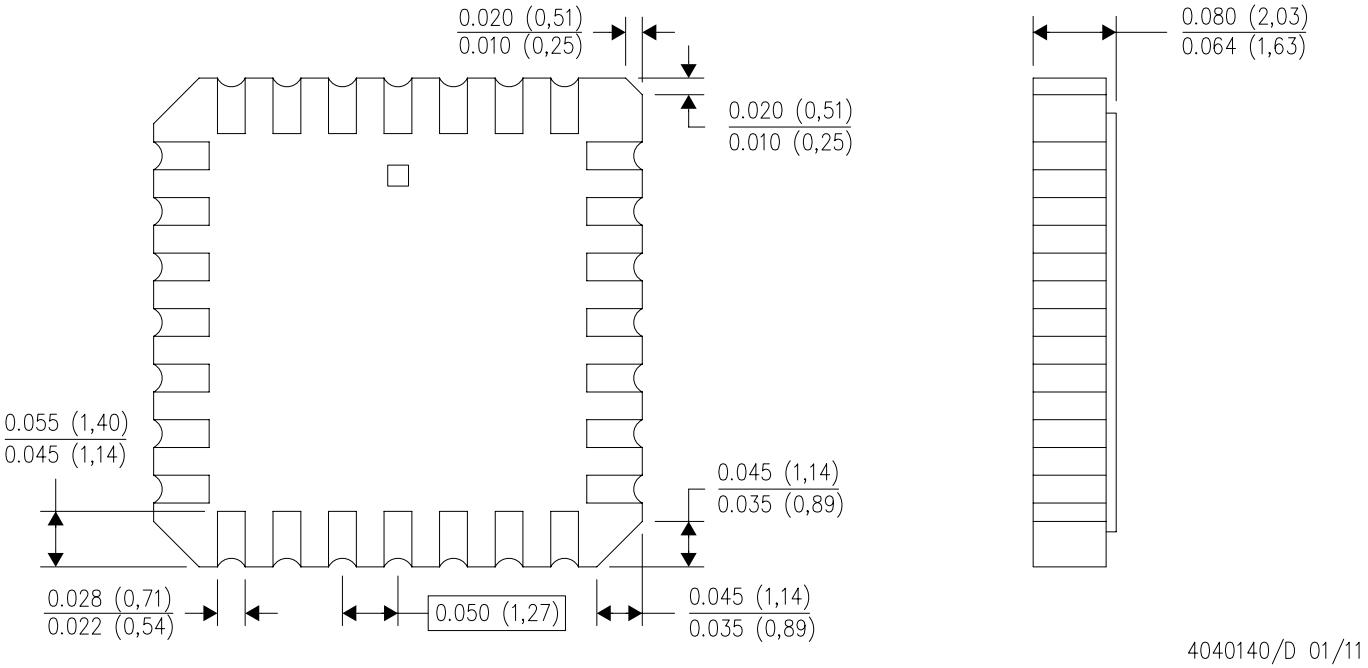
NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only.
E. Falls within Mil–Std 1835 GDFP2–F20

FK (S–CQCC–N**) LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



NO. OF TERMINALS **	A		B	
	MIN	MAX	MIN	MAX
20	0.342 (8,69)	0.358 (9,09)	0.307 (7,80)	0.358 (9,09)
28	0.442 (11,23)	0.458 (11,63)	0.406 (10,31)	0.458 (11,63)
44	0.640 (16,26)	0.660 (16,76)	0.495 (12,58)	0.560 (14,22)
52	0.740 (18,78)	0.761 (19,32)	0.495 (12,58)	0.560 (14,22)
68	0.938 (23,83)	0.962 (24,43)	0.850 (21,6)	0.858 (21,8)
84	1.141 (28,99)	1.165 (29,59)	1.047 (26,6)	1.063 (27,0)



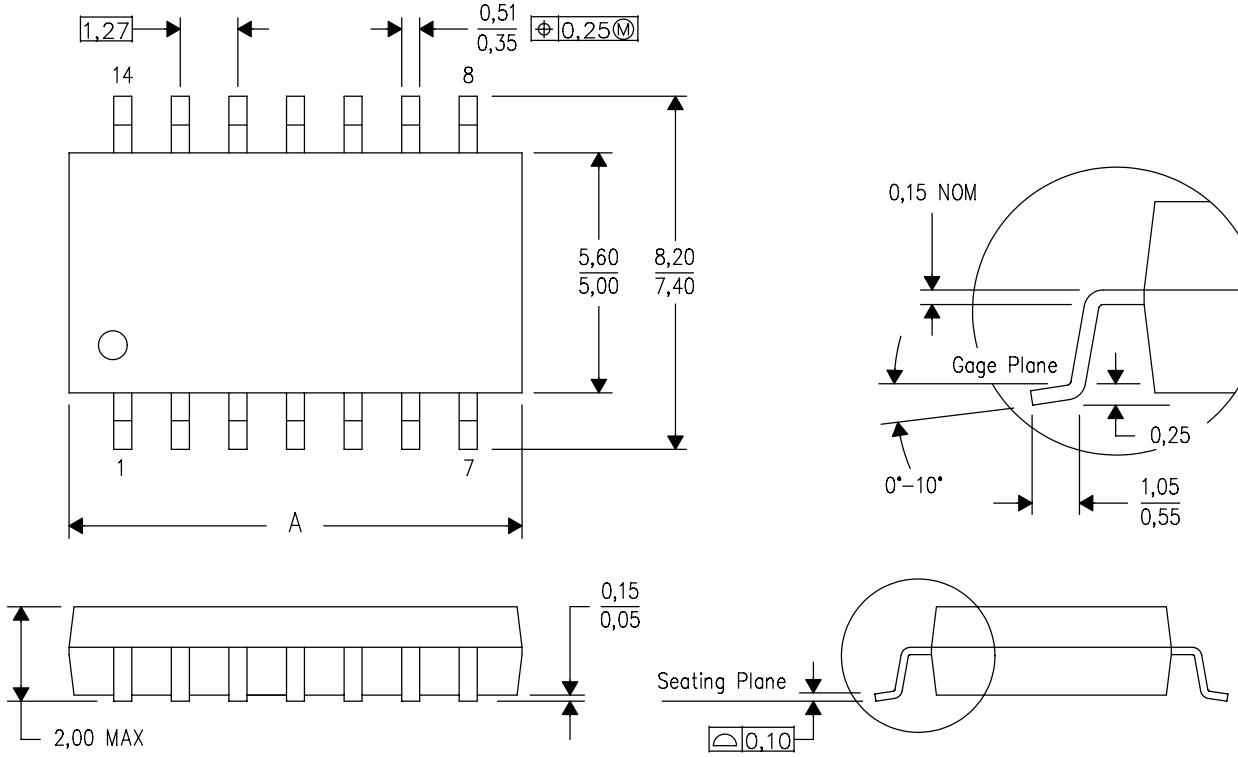
4040140/D 01/11

NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. Falls within JEDEC MS–004

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

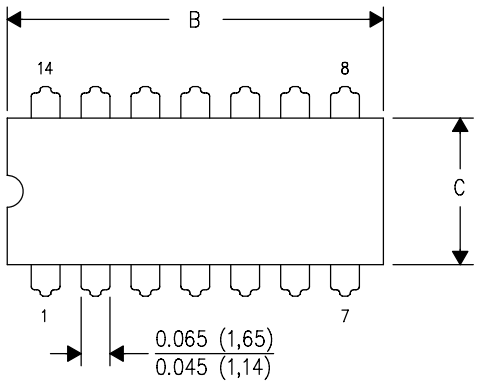
4040062/C 03/03

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.

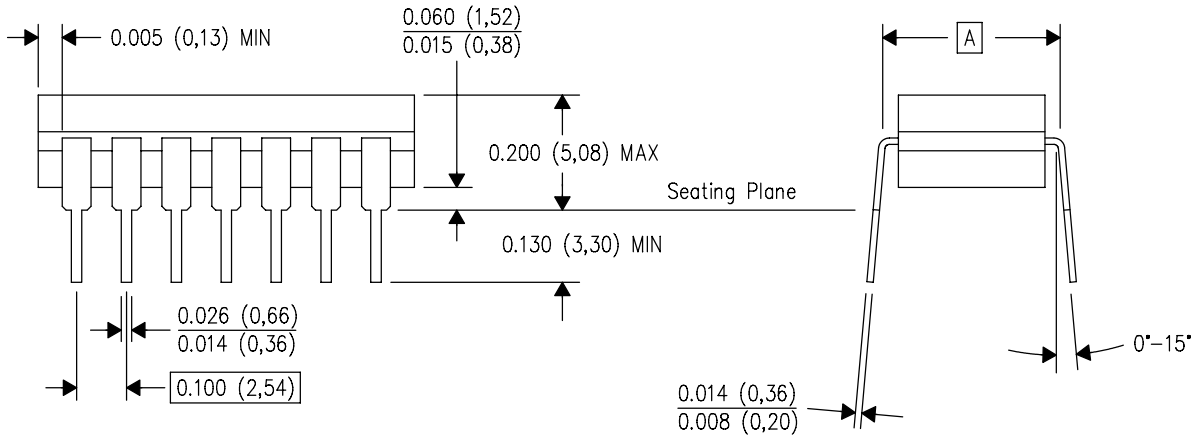
J (R–GDIP–T**)

14 LEADS SHOWN

CERAMIC DUAL IN–LINE PACKAGE



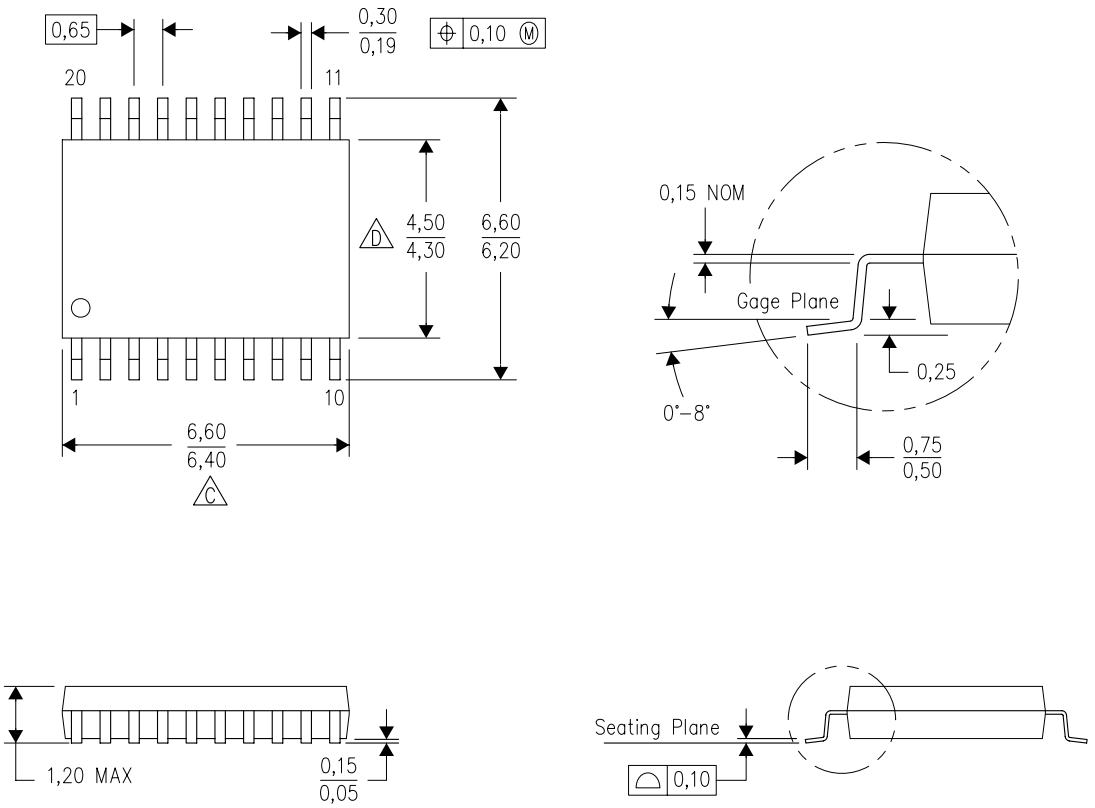
DIM \ PINS **	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)



4040083/F 03/03

NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package is hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
E. Falls within MIL STD 1835 GDIP1–T14, GDIP1–T16, GDIP1–T18 and GDIP1–T20.

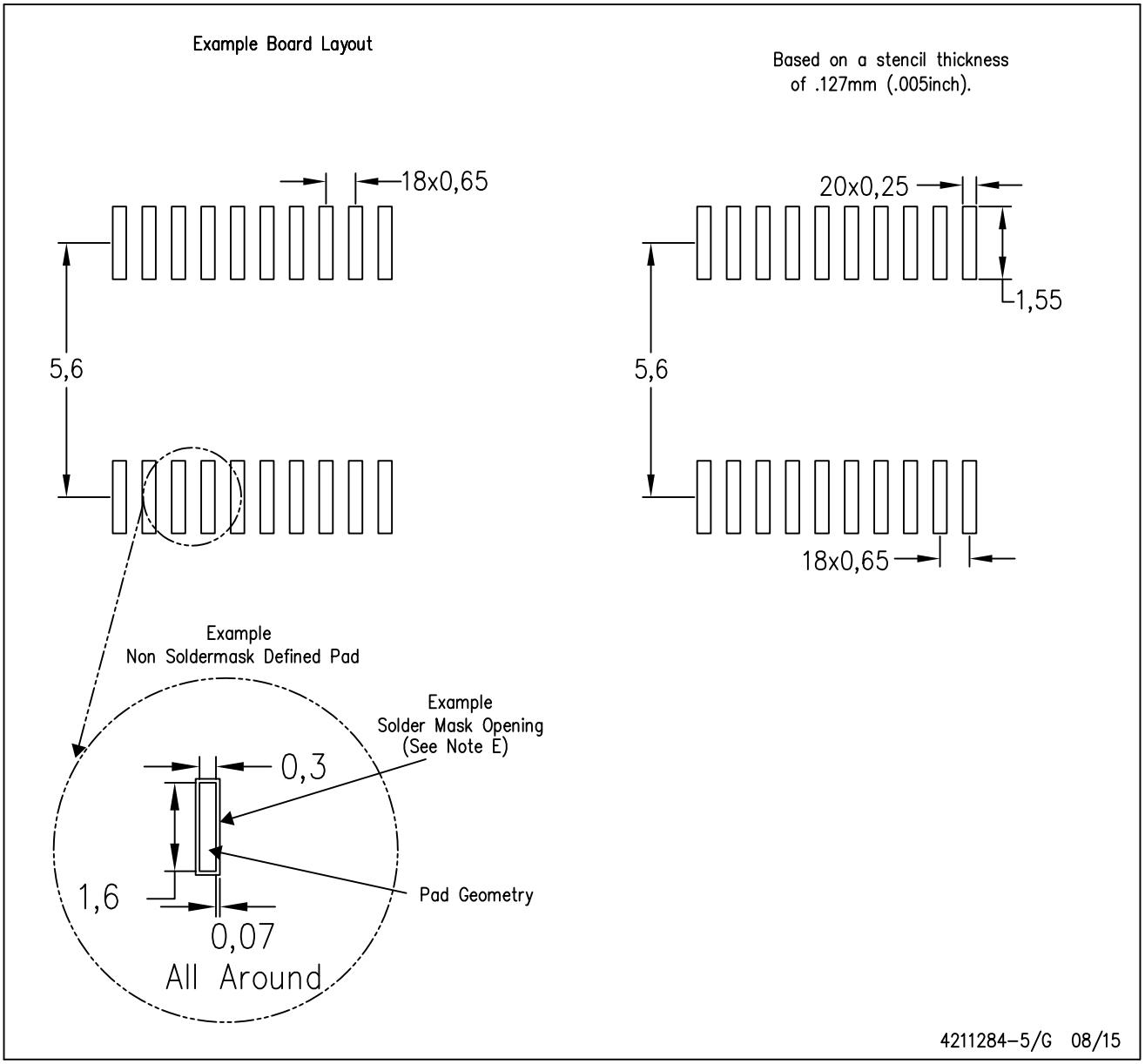
PW (R–PDSO–G20) PLASTIC SMALL OUTLINE



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

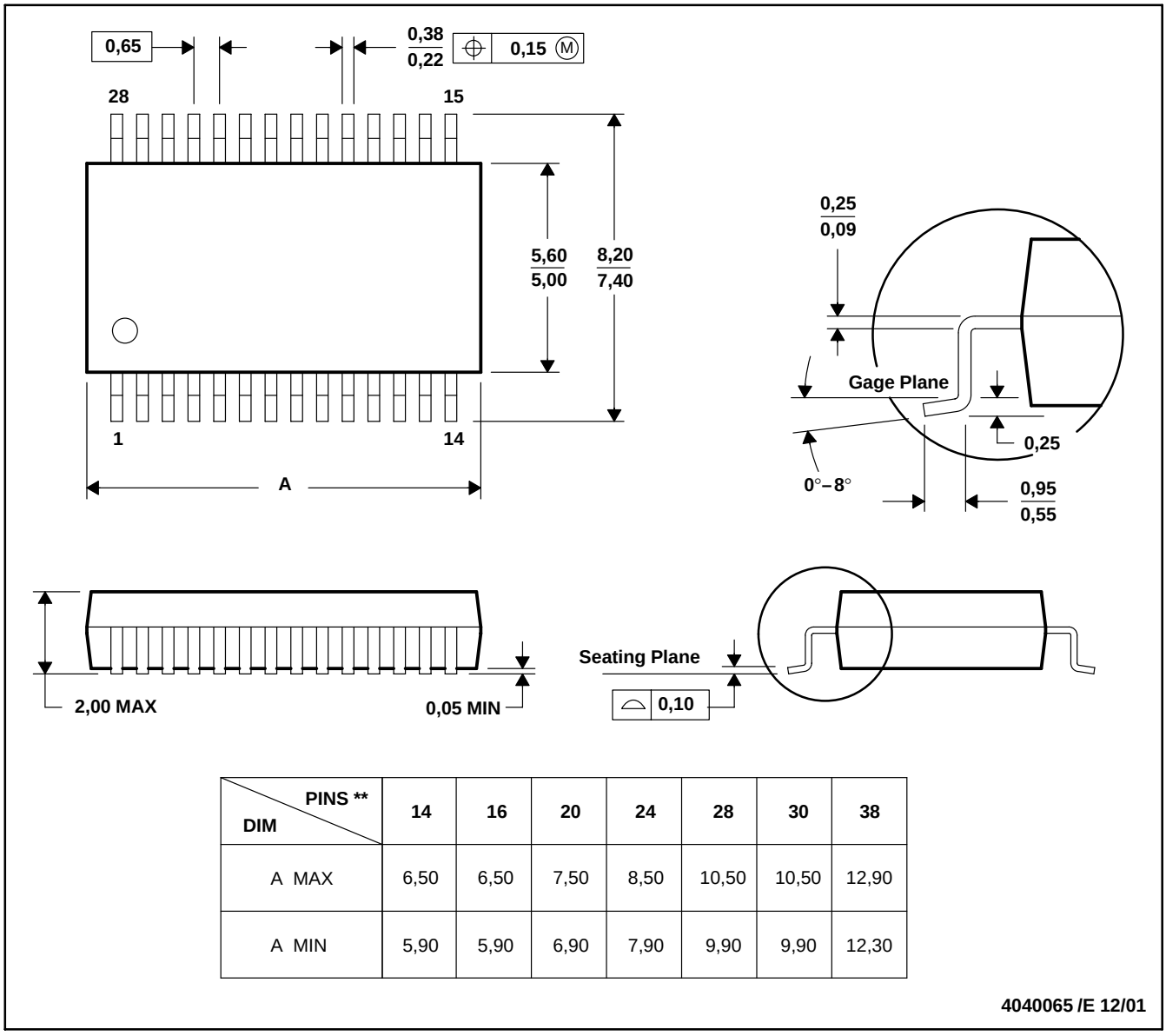


NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Publication IPC–7351 is recommended for alternate design.
D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their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

MSSO002E – JANUARY 1995 – REVISED DECEMBER 2001

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

28 PINS SHOWN



DIM \ PINS **	14	16	20	24	28	30	38
A MAX	6,50	6,50	7,50	8,50	10,50	10,50	12,90
A MIN	5,90	5,90	6,90	7,90	9,90	9,90	12,30

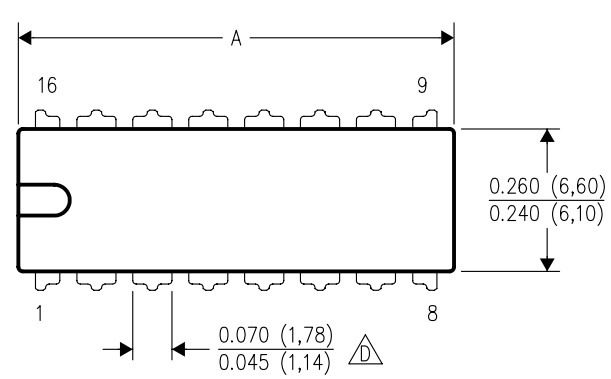
4040065 /E 12/01

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.
D. Falls within JEDEC MO-150

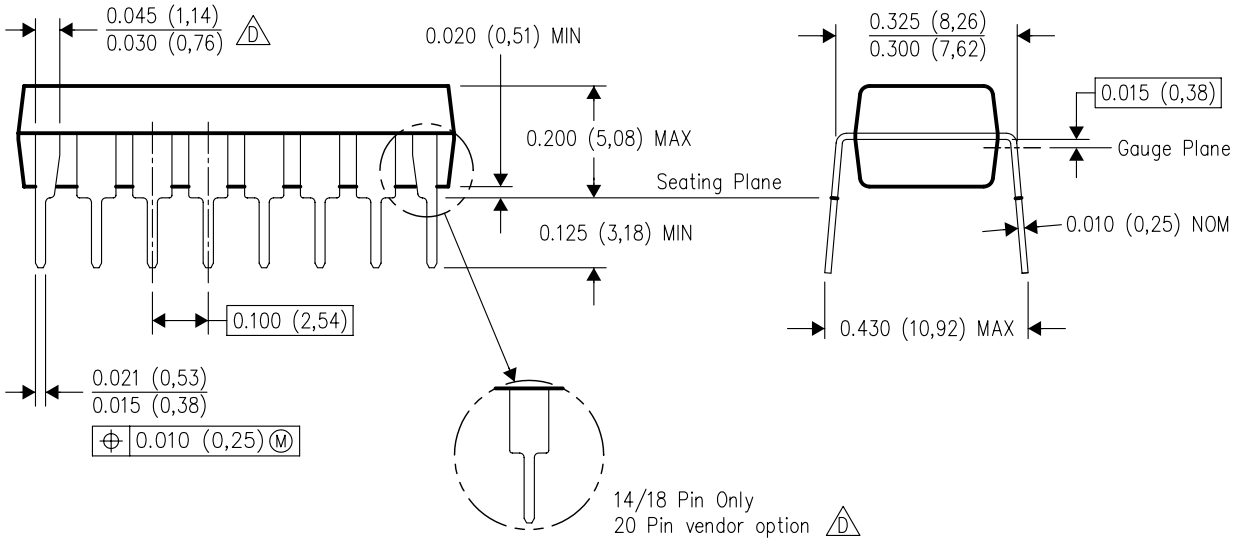
N (R–PDIP–T**)

PLASTIC DUAL–IN–LINE PACKAGE

16 PINS SHOWN

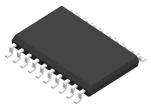


DIM \ PINS **	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS–001 VARIATION (C)	AA	BB	AC	AD



4040049/E 12/2002

NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS–001, except 18 and 20 pin minimum body length (Dim A).
D. The 20 pin end lead shoulder width is a vendor option, either half or full width.

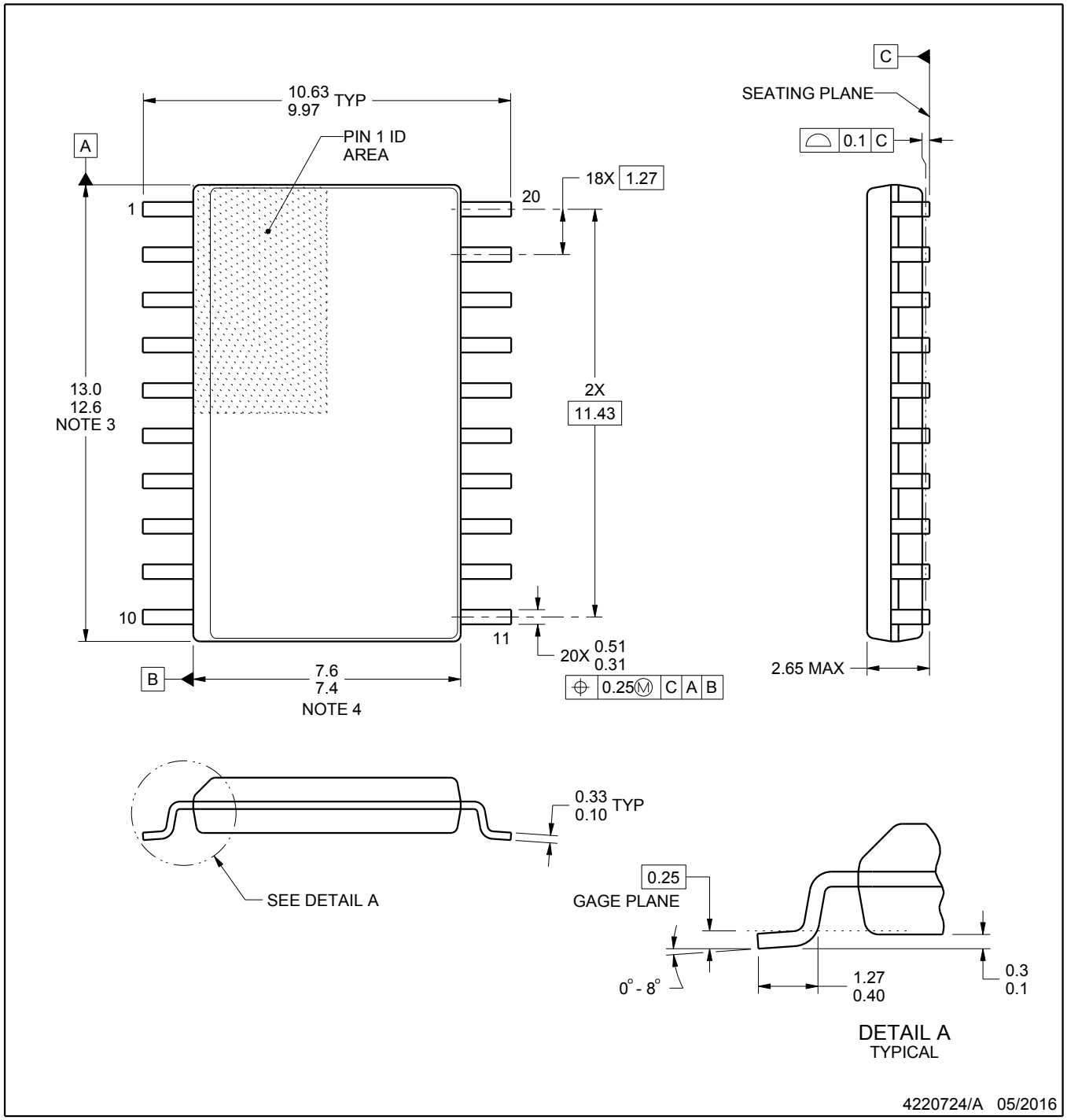


PACKAGE OUTLINE

DW0020A

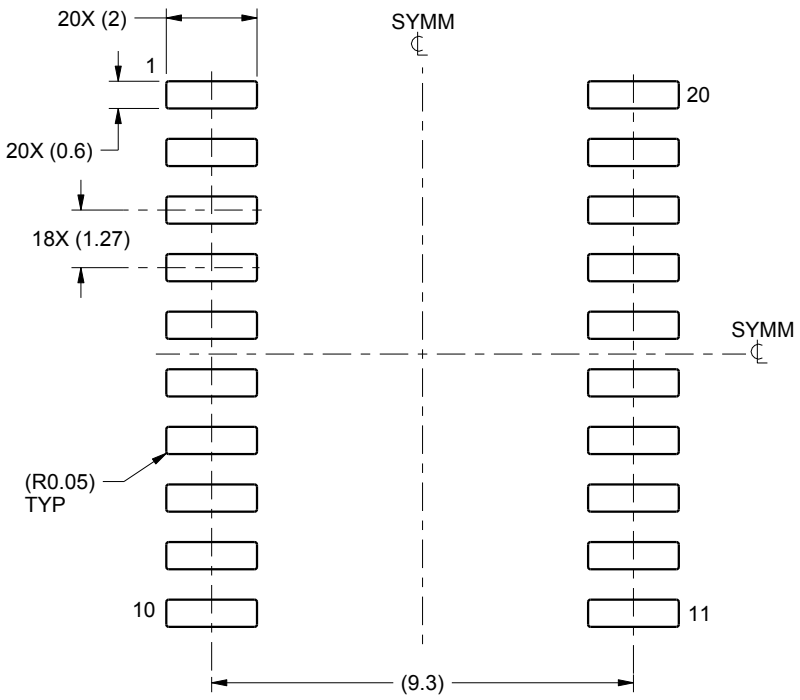
SOIC - 2.65 mm max height

SOIC

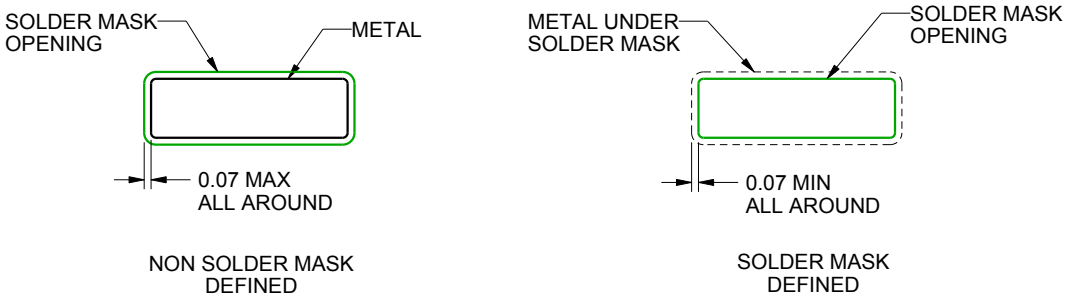


NOTES:

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

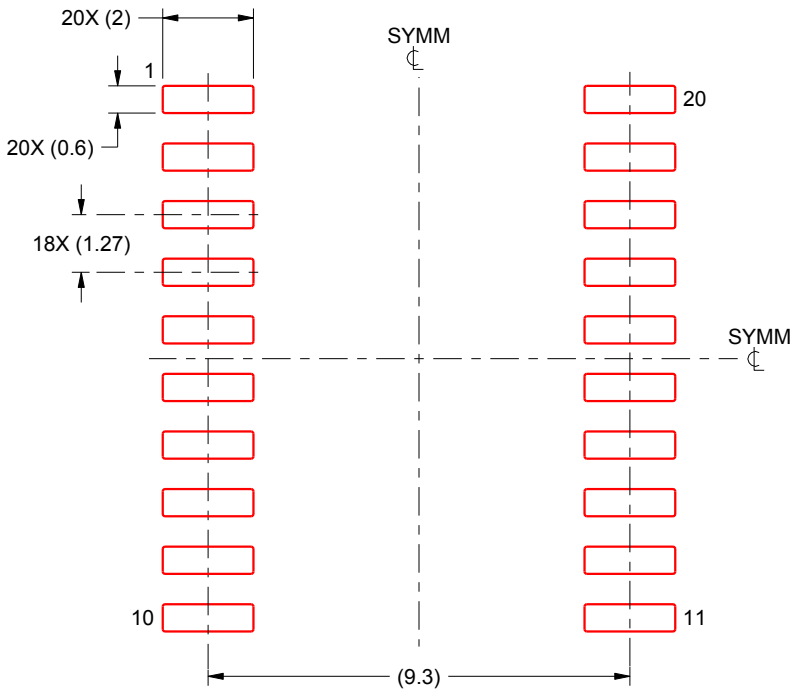


SOLDER MASK DETAILS

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.



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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