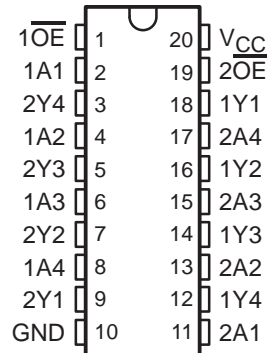


SN74HC244-EP OCTAL BUFFER AND LINE DRIVER WITH 3-STATE OUTPUTS

SCLS463A – JULY 2002 – REVISED JANUARY 2004

- **Controlled Baseline**
 - One Assembly/Test Site, One Fabrication Site
- **Extended Temperature Performance of Up To -55°C to 125°C**
- **Enhanced Diminishing Manufacturing Sources (DMS) Support**
- **Enhanced Product-Change Notification**
- **Qualification Pedigree†**
- **3-State Outputs Drive Bus Lines or Buffer Memory Address Registers**
- **High-Current Outputs Drive Up To 15 LSTTL Loads**

DW OR PW PACKAGE
(TOP VIEW)



† Component qualification in accordance with JEDEC and industry standards to ensure reliable operation over an extended temperature range. This includes, but is not limited to, Highly Accelerated Stress Test (HAST) or biased 85/85, temperature cycle, autoclave or unbiased HAST, electromigration, bond intermetallic life, and mold compound life.

description/ordering information

This octal buffer and line driver is designed specifically to improve both the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters. The SN74HC244 is organized as two 4-bit buffers/drivers with separate output-enable ($\overline{\text{OE}}$) inputs. When $\overline{\text{OE}}$ is low, the device passes noninverted data from the A inputs to the Y outputs. When $\overline{\text{OE}}$ is high, the outputs are in the high-impedance state.

ORDERING INFORMATION

| TA | PACKAGE‡ | | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|------------|---------------|-----------------------|------------------|
| –40°C to 125°C | SOP – DW | Tape and reel | SN74HC244QDWREP | SHC244EP |
| | TSSOP – PW | Tape and reel | SN74HC244QPWREP | SHC244EP |
| –55°C to 125°C | SOP – DW | Tape and reel | SN74HC244MDWREP | HC244MEP |

‡ Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

FUNCTION TABLE
(each buffer/driver)

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



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

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**

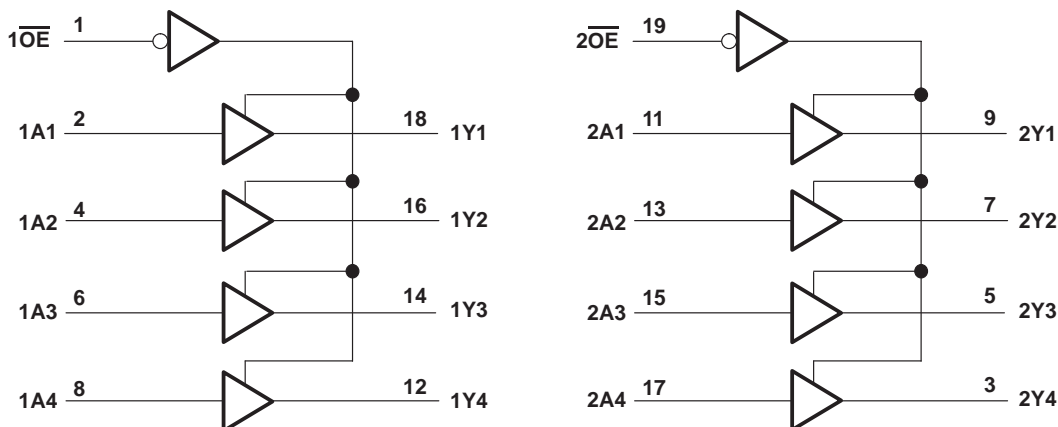
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SN74HC244-EP OCTAL BUFFER AND LINE DRIVER WITH 3-STATE OUTPUTS

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logic diagram (positive logic)



absolute maximum ratings over operating free-air temperature range†

| | |
|---|----------------|
| Supply voltage range, V_{CC} | -0.5 V to 7 V |
| Input clamp current, I_{IK} ($V_I < 0$ or $V_I > V_{CC}$) (see Note 1) | ± 20 mA |
| Output clamp current, I_{OK} ($V_O < 0$ or $V_O > V_{CC}$) (see Note 1) | ± 20 mA |
| Continuous output current, I_O ($V_O = 0$ to V_{CC}) | ± 35 mA |
| Continuous current through V_{CC} or GND | ± 70 mA |
| Package thermal impedance, θ_{JA} (see Note 2): DW package | 58°C/W |
| PW package | 83°C/W |
| Storage temperature range, T_{stg} | -65°C to 150°C |

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

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

recommended operating conditions

| | | 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 | 0.5 | V |
| | | $V_{CC} = 4.5$ V | 0 | 1.35 | |
| | | $V_{CC} = 6$ V | 0 | 1.8 | |
| V_I | Input voltage | 0 | | V_{CC} | V |
| V_O | Output voltage | 0 | | V_{CC} | V |
| t_t | Input transition (rise and fall) time | $V_{CC} = 2$ V | 0 | 1000 | ns |
| | | $V_{CC} = 4.5$ V | 0 | 500 | |
| | | $V_{CC} = 6$ V | 0 | 400 | |
| T_A | Operating free-air temperature | Q-suffix device | -40 | 125 | °C |
| | | M-suffix device | -55 | 125 | |



SN74HC244-EP
OCTAL BUFFER AND LINE DRIVER
WITH 3-STATE OUTPUTS

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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} | V _I = V _{IH} or V _{IL} | I _{OH} = -20 μA | 2 V | 1.9 | 1.998 | | 1.9 | V | |
| | | | 4.5 V | 4.4 | 4.499 | | 4.4 | | |
| | | | 6 V | 5.9 | 5.999 | | 5.9 | | |
| | | I _{OH} = -6 mA | 4.5 V | 3.98 | 4.3 | | 3.7 | | |
| | | I _{OH} = -7.8 mA | 6 V | 5.48 | 5.8 | | 5.2 | | |
| V _{OL} | V _I = V _{IH} or V _{IL} | I _{OL} = 20 μA | 2 V | | 0.002 | 0.1 | | 0.1 | |
| | | | 4.5 V | | 0.001 | 0.1 | | 0.1 | |
| | | | 6 V | | 0.001 | 0.1 | | 0.1 | |
| | | I _{OL} = 6 mA | 4.5 V | | 0.17 | 0.26 | | 0.4 | |
| | | I _{OL} = 7.8 mA | 6 V | | 0.15 | 0.26 | | 0.4 | |
| I _I | V _I = V _{CC} or 0 | | 6 V | | ±0.1 | ±100 | | ±1000 | nA |
| I _{OZ} | V _O = V _{CC} or 0, | V _I = V _{IH} or V _{IL} | 6 V | | ±0.01 | ±0.5 | | ±10 | μA |
| I _{CC} | V _I = V _{CC} or 0, | I _O = 0 | 6 V | | | 8 | | 160 | μA |
| C _i | | | 2 V to 6 V | | 3 | 10 | | 10 | pF |

switching characteristics over recommended operating free-air temperature range, C_L = 50 pF (unless otherwise noted) (see Figure 1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | V _{CC} | T _A = 25°C | | | MIN | MAX | UNIT |
|------------------|-----------------|-------------|-----------------|-----------------------|-----|-----|-----|-----|------|
| | | | | MIN | TYP | MAX | | | |
| t _{pd} | A | Y | 2 V | | 40 | 115 | | 170 | ns |
| | | | 4.5 V | | 13 | 23 | | 34 | |
| | | | 6 V | | 11 | 20 | | 29 | |
| t _{en} | \overline{OE} | Y | 2 V | | 75 | 150 | | 225 | ns |
| | | | 4.5 V | | 15 | 30 | | 45 | |
| | | | 6 V | | 13 | 26 | | 38 | |
| t _{dis} | \overline{OE} | Y | 2 V | | 75 | 150 | | 225 | ns |
| | | | 4.5 V | | 15 | 30 | | 45 | |
| | | | 6 V | | 13 | 26 | | 38 | |
| t _t | | Y | 2 V | | 28 | 60 | | 90 | ns |
| | | | 4.5 V | | 8 | 12 | | 18 | |
| | | | 6 V | | 6 | 10 | | 15 | |

SN74HC244-EP
OCTAL BUFFER AND LINE DRIVER
WITH 3-STATE OUTPUTS

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switching characteristics over recommended operating free-air temperature range, $C_L = 150 \text{ pF}$
(unless otherwise noted) (see Figure 1)

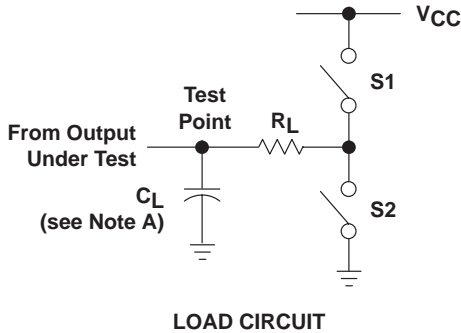
| PARAMETER | FROM (INPUT) | TO (OUTPUT) | V _{CC} | T _A = 25°C | | | MIN | MAX | UNIT |
|-----------------|------------------------|----------------|-----------------|-----------------------|-----|-----|-----|-----|------|
| | | | | MIN | TYP | MAX | | | |
| t _{pd} | A | Y | 2 V | 56 | 165 | | 245 | ns | |
| | | | 4.5 V | 18 | 33 | 49 | | | |
| | | | 6 V | 15 | 28 | 42 | | | |
| t _{en} | $\overline{\text{OE}}$ | Y | 2 V | 100 | 200 | | 300 | ns | |
| | | | 4.5 V | 20 | 40 | 60 | | | |
| | | | 6 V | 17 | 34 | 51 | | | |
| t _t | | Y | 2 V | 45 | 210 | | 315 | ns | |
| | | | 4.5 V | 17 | 42 | 63 | | | |
| | | | 6 V | 13 | 36 | 53 | | | |

operating characteristics, T_A = 25°C

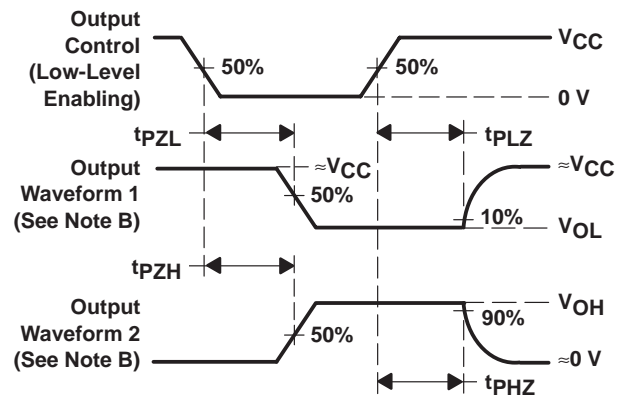
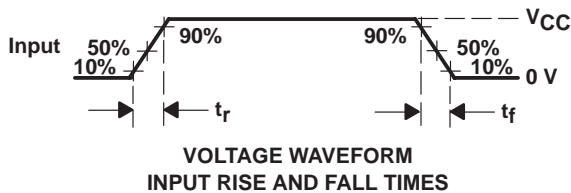
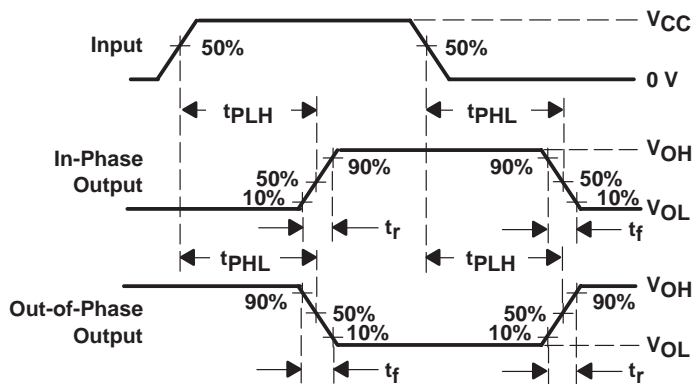
| PARAMETER | | TEST CONDITIONS | TYP | UNIT |
|-----------------|---|-----------------|-----|------|
| C _{pd} | Power dissipation capacitance per buffer/driver | No load | 35 | pF |



PARAMETER MEASUREMENT INFORMATION



| PARAMETER | R_L | C_L | S1 | S2 | |
|-------------------|-----------|-----------------|-----------------|--------|--------|
| t_{en} | t_{PZH} | 1 k Ω | 50 pF or 150 pF | Open | Closed |
| | t_{PZL} | | | Closed | Open |
| t_{dis} | t_{PHZ} | 1 k Ω | 50 pF | Open | Closed |
| | t_{PLZ} | | | Closed | Open |
| t_{pd} or t_t | -- | 50 pF or 150 pF | Open | Open | |



- NOTES:
- A. C_L includes probe and test-fixture 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. Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics: PRR \leq 1 MHz, $Z_O = 50 \Omega$, $t_r = 6$ 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} .

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 (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|-------------------|---------------|--------------|-----------------|------|-------------|-------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| SN74HC244MDWREP | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -55 to 125 | HC244MEP | Samples |
| SN74HC244QDWREP | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | SHC244EP | Samples |
| SN74HC244QPWREP | ACTIVE | TSSOP | PW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | SHC244EP | Samples |
| SN74HC244QPWREPG4 | ACTIVE | TSSOP | PW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | SHC244EP | Samples |
| V62/03607-01XE | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -55 to 125 | HC244MEP | Samples |
| V62/03607-02XE | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | SHC244EP | Samples |
| V62/03607-02YE | ACTIVE | TSSOP | PW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -40 to 125 | SHC244EP | 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.

OBSELETE: 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.

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OTHER QUALIFIED VERSIONS OF SN74HC244-EP :

- Catalog: [SN74HC244](#)

- Automotive: [SN74HC244-Q1](#)

- Military: [SN54HC244](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

- Military - QML certified for Military and Defense Applications

TAPE AND REEL INFORMATION



QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|-----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74HC244MDWREP | SOIC | DW | 20 | 2000 | 330.0 | 24.4 | 10.8 | 13.3 | 2.7 | 12.0 | 24.0 | Q1 |
| SN74HC244QDWREP | SOIC | DW | 20 | 2000 | 330.0 | 24.4 | 10.8 | 13.3 | 2.7 | 12.0 | 24.0 | Q1 |
| SN74HC244QPWREP | TSSOP | PW | 20 | 2000 | 330.0 | 16.4 | 6.95 | 7.1 | 1.6 | 8.0 | 16.0 | Q1 |

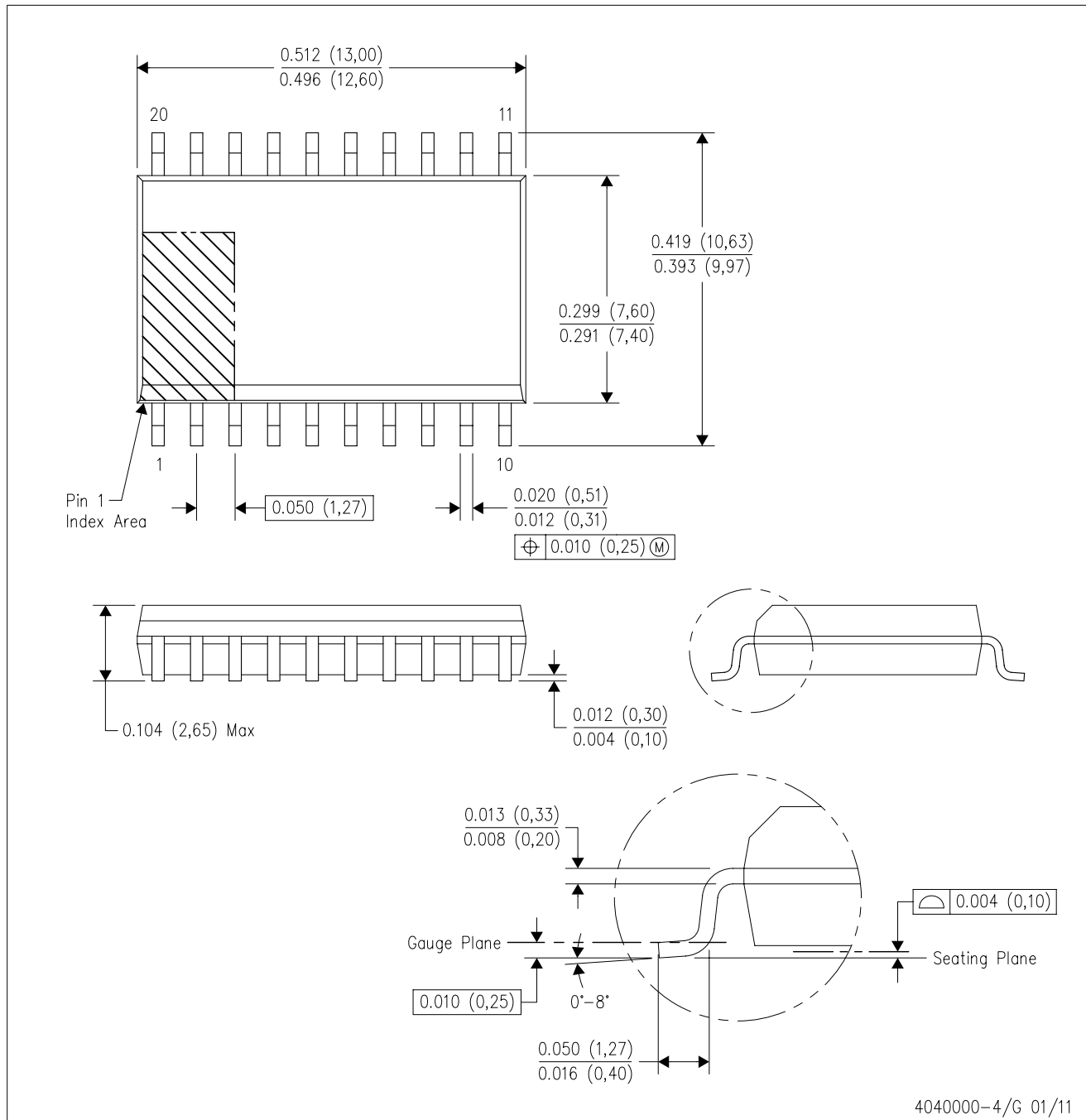
TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|-----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74HC244MDWREP | SOIC | DW | 20 | 2000 | 367.0 | 367.0 | 45.0 |
| SN74HC244QDWREP | SOIC | DW | 20 | 2000 | 367.0 | 367.0 | 45.0 |
| SN74HC244QPWREP | TSSOP | PW | 20 | 2000 | 367.0 | 367.0 | 38.0 |

DW (R-PDSO-G20)

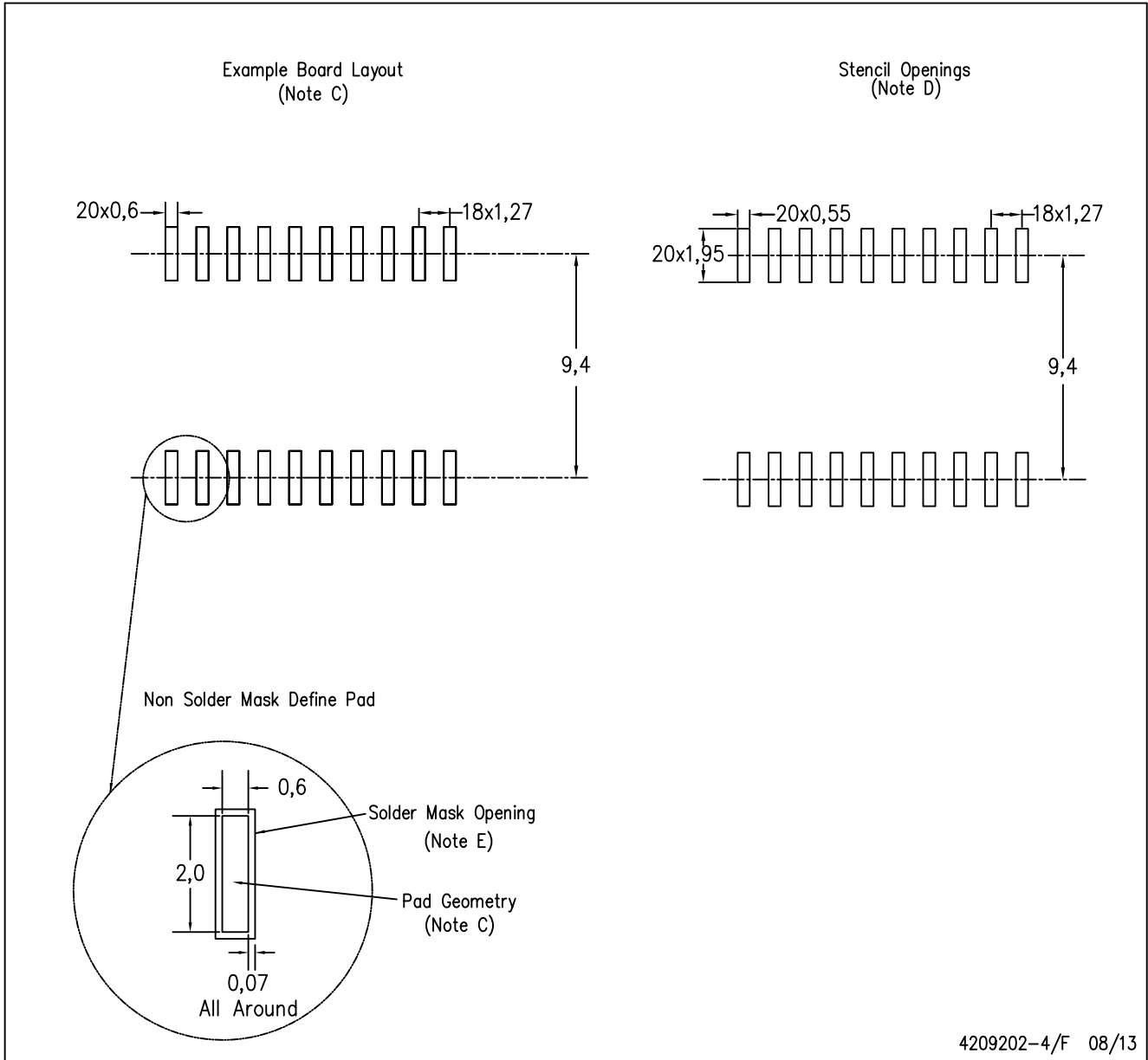
PLASTIC SMALL OUTLINE



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

DW (R-PDSO-G20)

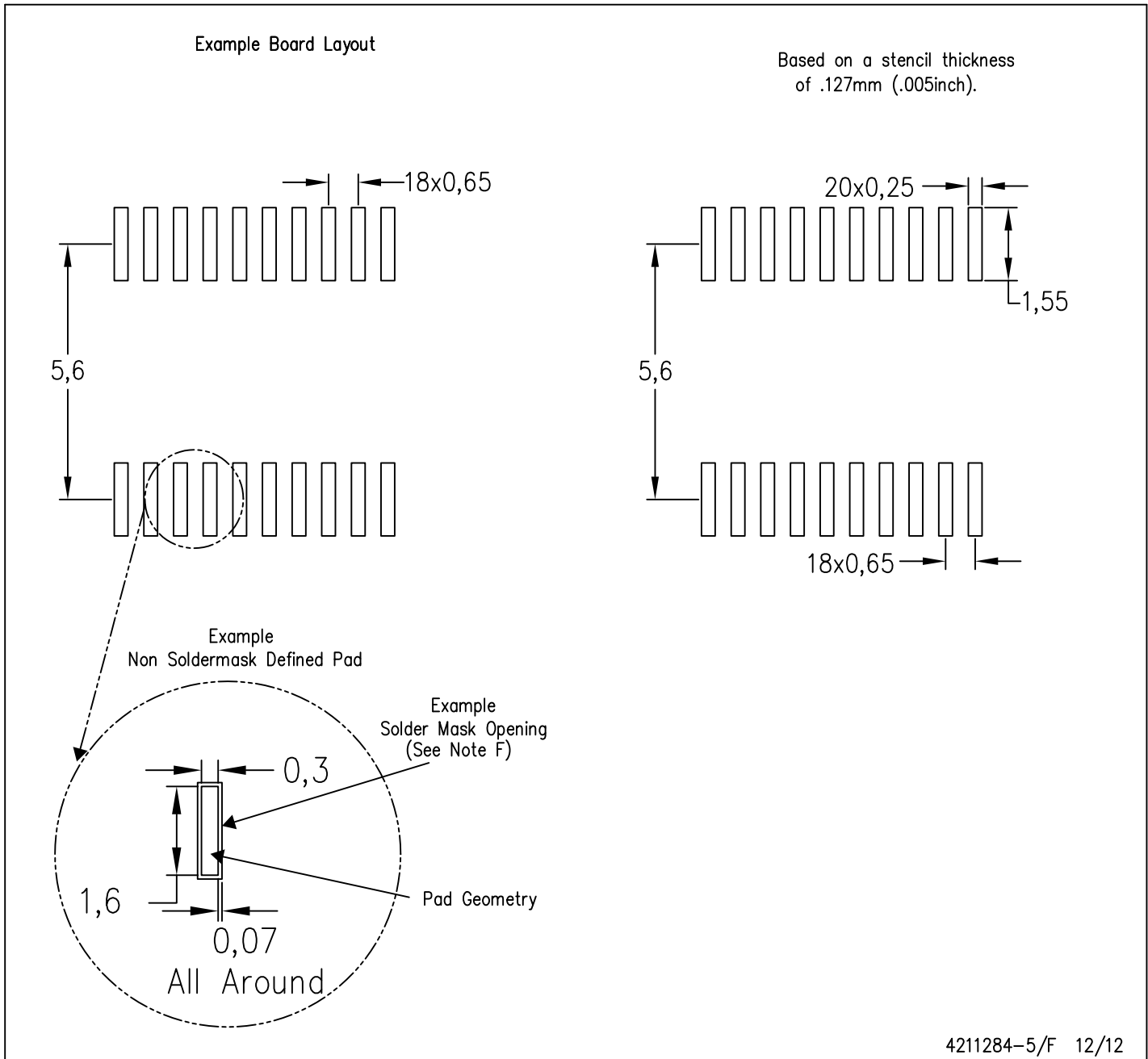
PLASTIC SMALL OUTLINE



- 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.
 - 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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- Сертификаты соответствия на поставляемую продукцию (по желанию клиента).
- Тестирование поставляемой продукции.
- Поставку компонентов, требующих военную и космическую приемку.
- Входной контроль качества.
- Наличие сертификата ISO.

В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.

Конструкторский отдел помогает осуществить:

- Регистрацию проекта у производителя компонентов.
- Техническую поддержку проекта.
- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



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