# SN74BCT2414
## MEMORY DECODER
## WITH ON-CHIP SUPPLY VOLTAGE MONITOR

- **BiCMOS Design Substantially Reduces Standby Current**
- **Two Independent 2-Line to 4-Line Decoders or One 3-Line to 8-Line Decoder**
- **Separate Enable Inputs for Easy Cascading**
- **Two Supply Voltage Terminals ($V_{CC}$ and $V_{bat}$)**
- **Built-In Supply-Voltage Monitor for $V_{CC}$**
- **Automatic Cut Off of Outputs During $V_{CC}$ Fail**
- **Package Options Include Plastic Small-Outline (DW) Packages and Standard Plastic 300-mil DIPs (N)**

**DW OR N PACKAGE**
**(TOP VIEW)**

| | | | |
|---|---|---|---|
| VS | 1 | 20 | $V_{CC}$ |
| $\overline{SD}$ | 2 | 19 | $V_{bat}$ |
| 1A | 3 | 18 | 1Y0 |
| 2A | 4 | 17 | 1Y1 |
| 1B | 5 | 16 | 1Y2 |
| 2B | 6 | 15 | 1Y3 |
| 1$\overline{G}$ | 7 | 14 | 2Y0 |
| 2G | 8 | 13 | 2Y1 |
| $\overline{G}$ | 9 | 12 | 2Y2 |
| GND | 10 | 11 | 2Y3 |
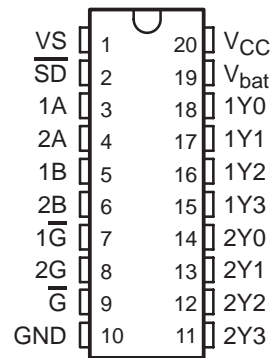
## description

The SN74BCT2414 is a decoder specially designed to be used in memory systems with battery backup during power failure. The two independent 2-line to 4-line decoders with separate and common control inputs may be externally cascaded to implement a 3-line to 8-line decoder.

The circuit has two supply voltage inputs: the voltage monitor (bandgap) is powered via the $V_{CC}$ terminal; the internal logic of the circuit is powered via the $V_{bat}$ terminal. In case $V_{CC}$ drops below 3.65 V (nominal), the voltage monitor forces the voltage-control (VS) and decoder outputs (Y) to the high level. VS may be used to disconnect the supply voltage of the memories ($V_{bat}$) from the system supply. This output is switched off when the on-chip supply voltage monitor detects a power failure.

The SN74BCT2414 is characterized for operation from 0°C to 70°C.

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**TEXAS INSTRUMENTS**

# SN74BCT2414
# MEMORY DECODER
# WITH ON-CHIP SUPPLY VOLTAGE MONITOR
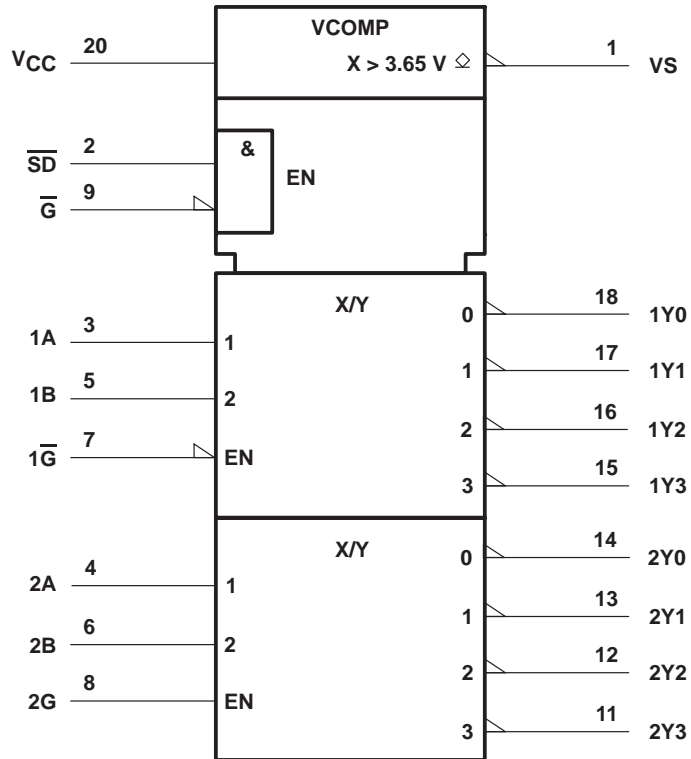
## logic symbol†



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

## logic diagram (positive logic)
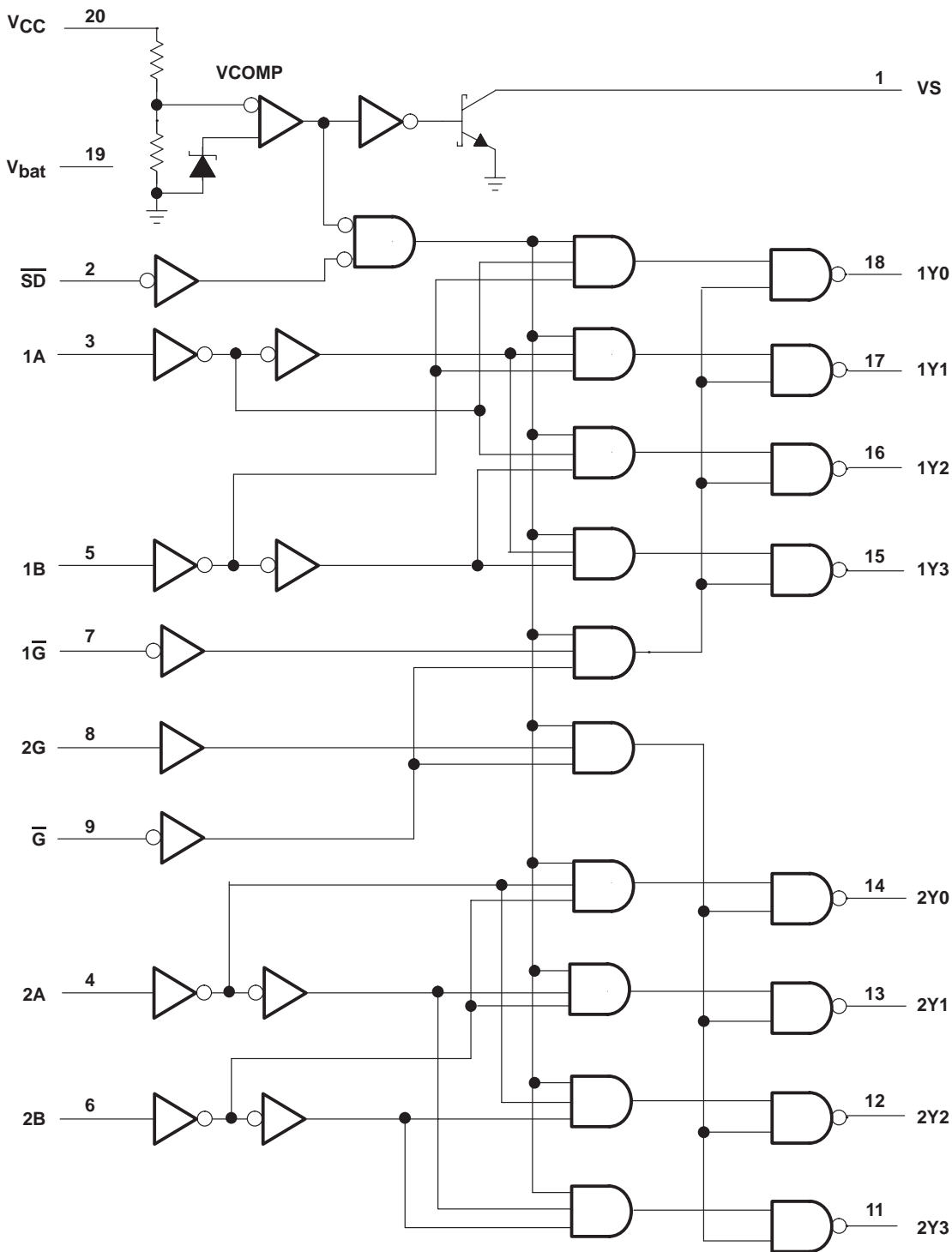
**FUNCTION TABLES**

| INPUTS | | | | | OUTPUTS | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| CONTROL | | | SELECT | | | | | |
| $\overline{G}$ | $1\overline{G}$ | $\overline{SD}$ | 1B | 1A | 1Y0 | 1Y1 | 1Y2 | 1Y3 |
| H | X | X | X | X | H | H | H | H |
| X | H | X | X | X | H | H | H | H |
| X | X | L | X | X | H | H | H | H |
| L | L | H | L | L | L | H | H | H |
| L | L | H | L | H | H | L | H | H |
| L | L | H | H | L | H | H | L | H |
| L | L | H | H | H | H | H | H | L |

| INPUTS | | | | | OUTPUTS | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| CONTROL | | | SELECT | | | | | |
| $\overline{G}$ | 2G | $\overline{SD}$ | 2B | 2A | 2Y0 | 2Y1 | 2Y2 | 2Y3 |
| H | X | X | X | X | H | H | H | H |
| X | H | X | X | X | H | H | H | H |
| X | X | L | X | X | H | H | H | H |
| L | H | H | L | L | L | H | H | H |
| L | H | H | L | H | H | L | H | H |
| L | H | H | H | L | H | H | L | H |
| L | H | H | H | H | H | H | H | L |

NOTE: For a 3-line to 8-line decoder, the following pins must be shorted: $1\overline{G}$ to 2G, 1A to 2A and 1B to 2B.

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

Supply voltage range, $V_{bat}$ ................................................... −0.5 V to 7 V
Supply voltage range, $V_{CC}$ ................................................... −0.5 V to 7 V
Supply voltage $V_{CC}$ with respect to $V_{bat}$ ................................................ −1.5 V
Input voltage range, $V_I$ ................................................ −0.5 V to $V_{CC}$ + 0.5 V
Off-state output voltage range at VS ................................................ −0.5 V to 7 V
Voltage range applied to any Y output in the power-off state ........................... −0.5 V to 7 V
Voltage applied to any Y output in the power-off state with respect to $V_{bat}$ ........................ 0.5 V
Operating free-air temperature range ................................................ 0°C to 70°C
Storage temperature range ................................................ −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

## recommended operating conditions

|  |  |  | MIN | NOM | MAX | UNIT |
|---|---|---|---|---|---|---|
| $V_{CC}$ | Supply voltage | | 4.5 | 5 | 5.5 | V |
| $V_{bat}$ | Supply voltage | | 4.5 | 5 | 5.5 | V |
| $V_{IH}$ | High-level input voltage | | 2 | | | V |
| $V_{IL}$ | Low-level input voltage | | | | 0.8 | V |
| $I_{IK}$ | Input clamp current | | | | −18 | mA |
| $I_{OH}$ | High-level output current | | | | −400 | µA |
| $I_{OL}$ | Low-level output current | Y outputs | | | 8 | mA |
| | | VS outputs | | | 20 | |
| $t_t$ | Input transition time | | 0 | | 10 | ns/V |
| $T_A$ | Operating free-air temperature | | 0 | | 70 | °C |

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

| PARAMETER | | TEST CONDITIONS | | MIN | TYP[†] | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| $V_{IK}$ | | $V_{CC} = 4.5$ V, | $I_I = -18$ mA | | | −1.2 | V |
| $V_{OH}$ | | $V_{bat} = V_{CC} = 4.5$ V | $I_{OH} = -20$ µA | 4.4 | | | V |
| | | | $I_{OH} = -400$ µA | 3.5 | | | |
| | | $V_{bat} = 2$ V, $V_{CC} = 0$, | $I_{OH} = -50$ µA | 1.8 | | | |
| $V_{OL}$ | All except VS | $V_{bat} = V_{CC} = 4.5$ V | $I_{OL} = 4$ mA | | | 0.4 | V |
| | | | $I_{OL} = 8$ mA | | | 0.5 | |
| | VS | $V_{bat} = V_{CC} = 4.5$ V, | $I_{OL} = 20$ mA | | | 1 | |
| $V_T$[‡] | | | | | 3.65 | | V |
| $I_I$ | | $V_{bat} = V_{CC} = 5.5$ V, | $V_I = 5.5$ V | | | 100 | µA |
| $I_{IH}$ | | $V_{bat} = V_{CC} = 5.5$ V, | $V_I = 2.7$ V | | | ±20 | µA |
| $I_{IL}$ | | $V_{bat} = V_{CC} = 5.5$ V, | $V_I = 0.5$ V | | | ±20 | µA |
| $I_{OH}$ | VS | $V_{bat} = 4.5$ V, | $V_{CC} = 0$ | | | 1 | µA |
| $I_O$[§] | | $V_{bat} = V_{CC} = 5.5$ V, | $V_O = 2.25$ V | −30 | | −200 | mA |
| $I_{CC}$ | | $V_{bat} = V_{CC} = 5.5$ V | Outputs high | | | 3 | mA |
| | | | Outputs low | | | 3 | |
| $I_{bat}$ | | $V_{bat} = 2.5$ V, | $V_{CC} = 0$ | | 1 | 10 | µA |
| | | $V_{bat} = V_{CC} = 5.5$ V | Outputs high | | | 20 | |
| | | | Outputs low | | | 3 | mA |
| $C_i$ | | $V_{bat} = V_{CC} = 5$ V, | $V_I = 0$ or 3 V | | | 4 | pF |
| $C_o$ | Any Y | $V_{bat} = V_{CC} = 0$ | | | | 6.5 | pF |
| | VS | | | | | 5 | |

[†] All typical values are at $V_{CC} = 5$ V, $T_A = 25$°C.
[‡] This value represents the $V_{CC}$ monitor threshold voltage. Typical range is from 3.5 V to 3.8 V.
[§] This output condition has been chosen to produce a current that closely approximates one half of the short-circuit output current, $I_{OS}$. Not more than one output should be tested at a time, and the duration of the test should not exceed one second.

TEXAS
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## switching characteristics (see Note 1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | $V_{CC}$ = 5 V, $C_L$ = 50 pF, R1 = 500 $\Omega$, R2 = 500 $\Omega$, $T_A$ = 25°C | | | $V_{CC}$ = 4.5 V to 5.5 V, $C_L$ = 50 pF, R1 = 500 $\Omega$, R2 = 500 $\Omega$, $T_A$ = MIN to MAX[†] | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | MIN | TYP | MAX | MIN | MAX | |
| $t_{PLH}$ | A or B | Any Y | 1 | 5 | 10 | 1 | 12 | ns |
| $t_{PHL}$ | | | 2 | 5.8 | 10 | 2 | 12 | |
| $t_{PLH}$ | Any $\overline{G}$ | Any Y | 1 | 4.5 | 9 | 1 | 10 | ns |
| $t_{PHL}$ | | | 2 | 5.5 | 9 | 2 | 11 | |
| $t_{PLH}$ | $\overline{SD}$ | Any Y | 2 | 6.5 | 11 | 2 | 12 | ns |
| $t_{PHL}$ | | | 2 | 6.5 | 11 | 2 | 12 | |

## switching characteristics (see Note 1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | $V_{CC}$ = 5 V, $C_L$ = 50 pF, R1 = 500 $\Omega$, R2 = 500 $\Omega$, $T_A$ = 25°C | | | $V_{CC}$ = 4.5 V to 5.5 V, $C_L$ = 50 pF, R1 = 500 $\Omega$, R2 = 500 $\Omega$, $T_A$ = MIN to MAX[†] | | UNIT |
|---|---|---|---|---|---|---|---|---|
| | | | MIN | TYP | MAX | MIN | MAX | |
| $t_{PLH}$ | $V_{CC}$ | Any Y | 10 | 25 | 50 | 10 | 250 | ns |
| $t_{PHL}$ | | | 15 | 45 | 100 | 15 | 250 | |
| $t_{PLH}$ | $V_{CC}$ | VS | 10 | 28 | 50 | 10 | 250 | ns |
| $t_{PHL}$ | | | 20 | 50 | 100 | 20 | 250 | |

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
NOTE 1:   Load circuits and voltage waveforms are shown in Section 1.

**TEXAS**
**INSTRUMENTS**

POST OFFICE BOX 655303 ● DALLAS, TEXAS 75265
POST OFFICE BOX 1443 ● HOUSTON, TEXAS 77251–1443

## APPLICATION INFORMATION

A typical application circuit for a battery-buffered memory in a microcomputer system is shown in Figure 1 which uses the SN74BCT2414. When power fails, the supply-voltage supervisor (TL7705) resets the microcomputer and disables the memory by switching the shutdown input $\overline{SD}$ of the memory decoder to a logic zero. All memory decoder outputs are forced to a logic one. Abnormal write commands from the microprocessor, which may be issued during further voltage breakdown, no longer affect the contents of the memory. When the system supply voltage becomes lower than approximately 3.65 V, the voltage monitor inside the SN74BCT2414 memory decoder disconnects the input buffers of this circuit from the decoding logic internally and keeps all outputs at a logic one. The VS output is also switched off, disconnecting the system supply voltage from the memory circuits. During this low-voltage condition, the memory decoder and the memory circuits are supplied by the battery.
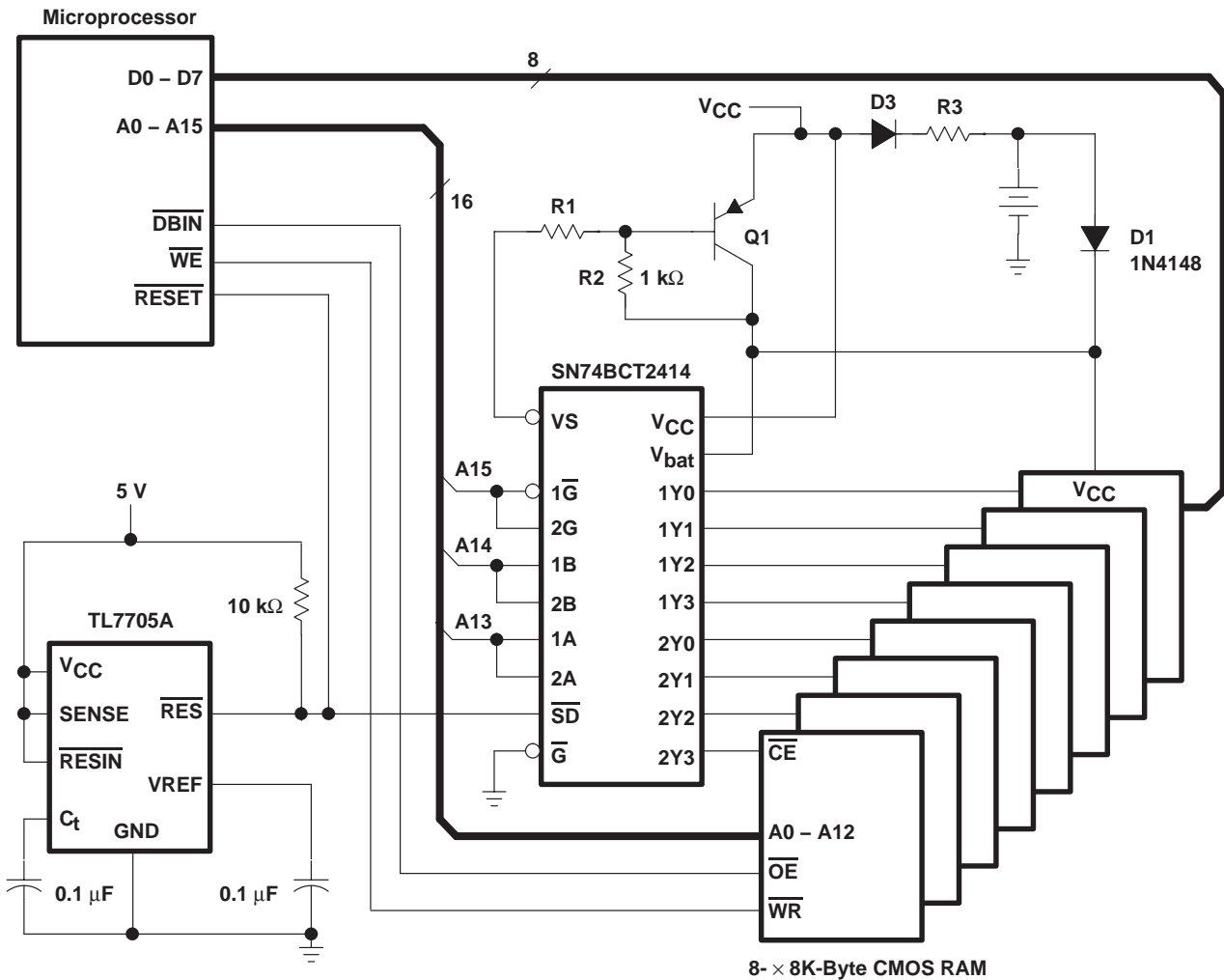


For further information on this device, please contact factory.

**Figure 1. Memory System With Battery Backup**

## PACKAGING INFORMATION

| Orderable Device | Status [1] | Package Type | Package Drawing | Pins | Package Qty | Eco Plan [2] | Lead/Ball Finish | MSL Peak Temp [3] |
|---|---|---|---|---|---|---|---|---|
| SN74BCT2414DW | ACTIVE | SOIC | DW | 20 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74BCT2414DWG4 | ACTIVE | SOIC | DW | 20 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74BCT2414DWR | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74BCT2414DWRE4 | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74BCT2414DWRG4 | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74BCT2414N | ACTIVE | PDIP | N | 20 | 20 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| SN74BCT2414NE4 | ACTIVE | PDIP | N | 20 | 20 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |

[1] The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

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

[2] Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

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## TAPE AND REEL INFORMATION

**REEL DIMENSIONS**

Reel Diameter

Reel Width (W1)

**TAPE DIMENSIONS**

Cavity

| 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**

Sprocket Holes

| Q1 | Q2 |
| Q3 | Q4 |

| Q1 | Q2 |
| Q3 | Q4 |

User Direction of Feed

Pocket Quadrants

*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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SN74BCT2414DWR | SOIC | DW | 20 | 2000 | 330.0 | 24.4 | 10.8 | 13.0 | 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) |
|---|---|---|---|---|---|---|---|
| SN74BCT2414DWR | SOIC | DW | 20 | 2000 | 346.0 | 346.0 | 41.0 |

## DW (R−PDSO−G20)  PLASTIC SMALL−OUTLINE PACKAGE



0.512 (13,00)
0.496 (12,60)

20

11

0.419 (10,63)
0.393 (9,97)

0.299 (7,60)
0.291 (7,40)

1

10

Pin 1
Index Area

0.050 (1,27)

0.020 (0,51)
0.012 (0,31)

⊕ 0.010 (0,25) Ⓜ

0.104 (2,65) Max

0.012 (0,30)
0.004 (0,10)

0.013 (0,33)
0.008 (0,20)

0.004 (0,10)

Gauge Plane

Seating Plane

0.010 (0,25)

0°−8°

0.050 (1,27)
0.016 (0,40)

4040000−4/F 06/2004

NOTES:  A.  All linear dimensions are in inches (millimeters).
        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.

## 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 |

0.260 (6,60)
0.240 (6,10)

0.070 (1,78)
0.045 (1,14) △D

0.045 (1,14)
0.030 (0,76) △D

0.020 (0,51) MIN

0.200 (5,08) MAX

Seating Plane

0.125 (3,18) MIN

0.100 (2,54)

0.021 (0,53)
0.015 (0,38)

⊕ 0.010 (0,25) Ⓜ

14/18 Pin Only
20 Pin vendor option △D

0.325 (8,26)
0.300 (7,62)

0.015 (0,38)

Gauge Plane

0.010 (0,25) NOM

0.430 (10,92) MAX

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.