

SDLS028

**SN5403, SN54LS03, SN54S03,  
SN7403, SN74LS03, SN74S03**

**QUADRUPLE 2-INPUT POSITIVE-NAND GATES WITH OPEN-COLLECTOR OUTPUTS**

DECEMBER 1983—REVISED MARCH 1988

- Package Options Include Plastic "Small Outline" Packages, Ceramic Chip Carriers and Flat Packages, and Plastic and Ceramic DIPs
- Dependable Texas Instruments Quality and Reliability

**description**

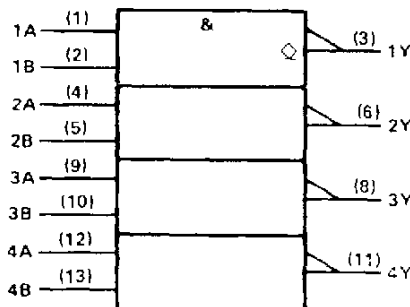
These devices contain four independent 2-input-NAND gates. The open-collector outputs require pull-up resistors to perform correctly. They may be connected to other open-collector outputs to implement active-low wired-OR or active-high wired-AND functions. Open-collector devices are often used to generate higher  $V_{OH}$  levels.

The SN5403, SN54LS03 and SN54S03 are characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ . The SN7403, SN74LS03 and SN74S03 are characterized for operation from  $0^{\circ}\text{C}$  to  $70^{\circ}\text{C}$ .

**FUNCTION TABLE (each gate)**

| INPUTS |   | OUTPUT |
|--------|---|--------|
| A      | B | Y      |
| H      | H | L      |
| L      | X | H      |
| X      | L | H      |

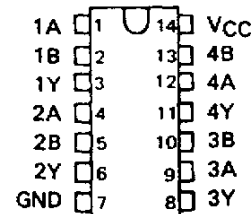
**logic symbol †**



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12. Pin numbers shown are for D, J, N, and W packages.

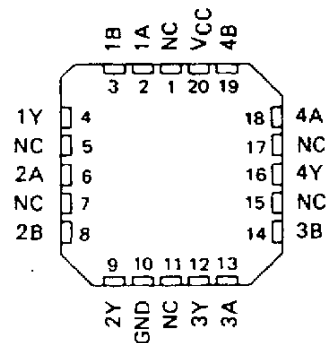
SN5403 . . . J OR W PACKAGE  
SN54LS03, SN54S03 . . . J OR W PACKAGE  
SN7403 . . . N PACKAGE  
SN74LS03, SN74S03 . . . D OR N PACKAGE

(TOP VIEW)



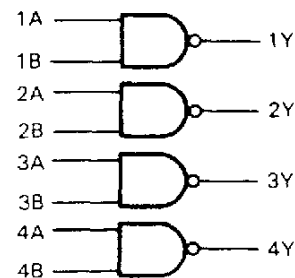
SN54LS03, SN54S03 . . . FK PACKAGE

(TOP VIEW)



NC - No internal connection

**logic diagram (positive logic)**



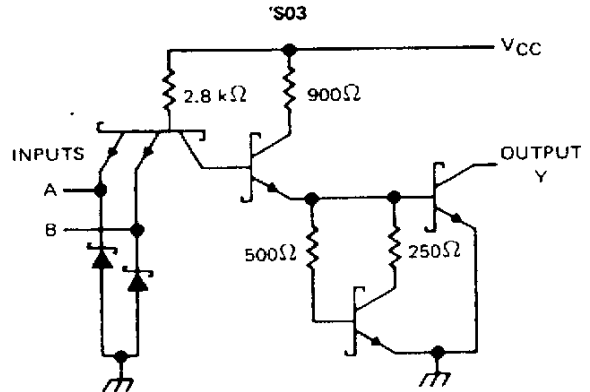
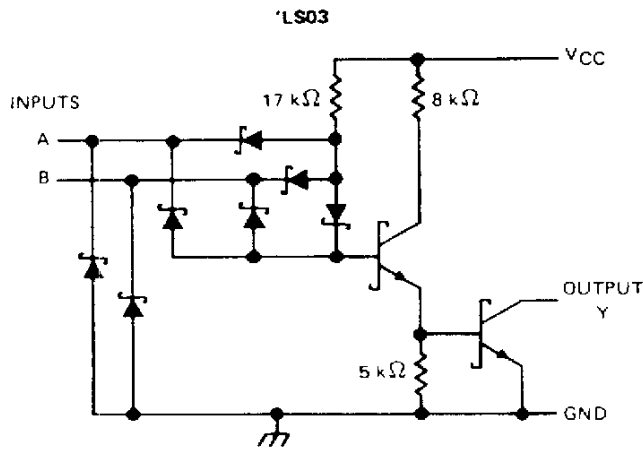
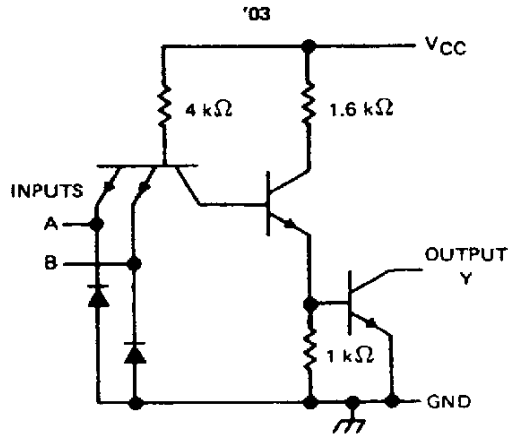
$$Y = \overline{A \cdot B} \text{ or } Y = \overline{A} + \overline{B}$$

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**SN5403, SN54LS03, SN54S03,  
SN7403, SN74LS03, SN74S03  
QUADRUPLE 2-INPUT POSITIVE-NAND GATES WITH OPEN-COLLECTOR OUTPUTS**

schematics (each gate)



Resistor values shown are nominal.

**absolute maximum ratings over operating free-air temperature range (unless otherwise noted)**

|   |                |
|---|----------------|
| Supply voltage, $V_{CC}$ (see Note 1) .....       | 7 V            |
| Input voltage: '03, 'S03 .....                    | 5.5 V          |
| 'LS03 .....                                       | 7 V            |
| Off-state output voltage .....                    | 7 V            |
| Operating free-air temperature range: SN54' ..... | -55°C to 125°C |
| SN74' .....                                       | 0°C to 70°C    |
| Storage temperature range .....                   | -65°C to 150°C |

NOTE 1: Voltage values are with respect to network ground terminal.

## SN5403, SN7403

### QUADRUPLE 2-INPUT POSITIVE-NAND GATES WITH OPEN-COLLECTOR OUTPUTS

#### recommended operating conditions

|                                      | SN5403 |     |     | SN7403 |     |      | UNIT |
|--------------------------------------|--------|-----|-----|--------|-----|------|------|
|                                      | MIN    | NOM | MAX | MIN    | NOM | MAX  |      |
| $V_{CC}$ Supply voltage              | 4.5    | 5   | 5.5 | 4.75   | 5   | 5.25 | V    |
| $V_{IH}$ High-level input voltage    | 2      |     |     | 2      |     |      | V    |
| $V_{IL}$ Low-level input voltage     | 0.8    |     |     | 0.8    |     |      | V    |
| $V_{OH}$ High-level output voltage   | 5.5    |     |     | 5.5    |     |      | V    |
| $I_{OL}$ Low-level output current    | 16     |     |     | 16     |     |      | mA   |
| $T_A$ Operating free-air temperature | - 55   |     |     | 125    |     |      | °C   |

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

| PARAMETER | TEST CONDITIONS <sup>†</sup>  | SN5403 |                  |      | SN7403 |                  |      | UNIT |
|-----------|---|--------|------------------|------|--------|------------------|------|------|
|           |   | MIN    | TYP <sup>‡</sup> | MAX  | MIN    | TYP <sup>‡</sup> | MAX  |      |
| $V_{IK}$  | $V_{CC} = \text{MIN}, I_I = -12 \text{ mA}$                           |        |                  | -1.5 |        |                  | -1.5 | V    |
| $I_{OH}$  | $V_{CC} = \text{MIN}, V_{IL} = 0.8 \text{ V}, V_{OH} = 5.5 \text{ V}$ |        |                  |      |        |                  | 0.25 | mA   |
|           | $V_{CC} = \text{MIN}, V_{IL} = 0.7 \text{ V}, V_{OH} = 5.5 \text{ V}$ |        |                  | 0.25 |        |                  |      |      |
| $V_{OL}$  | $V_{CC} = \text{MIN}, V_{IH} = 2 \text{ V}, I_{OL} = 16 \text{ mA}$   |        | 0.2              | 0.4  |        | 0.2              | 0.4  | V    |
| $I_I$     | $V_{CC} = \text{MAX}, V_I = 5.5 \text{ V}$                            |        |                  | 1    |        |                  | 1    | mA   |
| $I_{IH}$  | $V_{CC} = \text{MAX}, V_I = 2.4 \text{ V}$                            |        |                  | 40   |        |                  | 40   | μA   |
| $I_{IL}$  | $V_{CC} = \text{MAX}, V_I = 0.4 \text{ V}$                            |        |                  | -1.6 |        |                  | -1.6 | mA   |
| $I_{CCH}$ | $V_{CC} = \text{MAX}, V_I = 0$  |        | 4                | 8    |        | 4                | 8    | mA   |
| $I_{CCL}$ | $V_{CC} = \text{MAX}, V_I = 4.5 \text{ V}$                            |        | 12               | 22   |        | 12               | 22   | mA   |

<sup>†</sup>For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

<sup>‡</sup>All typical values are at  $V_{CC} = 5 \text{ V}, T_A = 25^\circ\text{C}$ .

#### switching characteristics, $V_{CC} = 5 \text{ V}, T_A = 25^\circ\text{C}$ (see note 2)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS            |                       | MIN | TYP | MAX | UNIT |
|-----------|--------------|-------------|----------------------------|-----------------------|-----|-----|-----|------|
| $t_{PLH}$ | A or B       | Y           | $R_L = 4 \text{ k}\Omega,$ | $C_L = 15 \text{ pF}$ |     | 35  | 45  | ns   |
| $t_{PHL}$ |              |             | $R_L = 400 \Omega,$        | $C_L = 15 \text{ pF}$ |     | 8   | 15  | ns   |

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.

# SN54LS03, SN74LS03

## QUADRUPLE 2-INPUT POSITIVE-NAND GATES WITH OPEN-COLLECTOR OUTPUTS

### recommended operating conditions

|   | SN54LS03 |     |     | SN74LS03 |     |      | UNIT |
|---|----------|-----|-----|----------|-----|------|------|
|   | MIN      | NOM | MAX | MIN      | NOM | MAX  |      |
| V <sub>CC</sub> Supply voltage                | 4.5      | 5   | 5.5 | 4.75     | 5   | 5.25 | V    |
| V <sub>IH</sub> High-level input voltage      | 2        |     |     | 2        |     |      | V    |
| V <sub>IL</sub> Low-level input voltage       |          |     | 0.7 |          |     | 0.8  | V    |
| V <sub>OH</sub> High-level output voltage     |          |     | 5.5 |          |     | 5.5  | V    |
| I <sub>OL</sub> Low-level output current      |          |     | 4   |          |     | 8    | mA   |
| T <sub>A</sub> Operating free-air temperature | -55      |     | 125 | 0        |     | 70   | °C   |

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

| PARAMETER        | TEST CONDITIONS†  | SN54LS03 |      | SN74LS03 |     | UNIT |      |     |
|------------------|---|----------|------|----------|-----|------|------|-----|
|                  |   | MIN      | TYP‡ | MAX      | MIN |      | TYP‡ | MAX |
| V <sub>IK</sub>  | V <sub>CC</sub> = MIN, I <sub>I</sub> = -18 mA                        |          |      | -1.5     |     | -1.5 | V    |     |
| I <sub>OH</sub>  | V <sub>CC</sub> = MIN, V <sub>IL</sub> = MAX, V <sub>OH</sub> = 5.5 V |          |      | 0.1      |     | 0.1  | mA   |     |
| V <sub>OL</sub>  | V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, I <sub>OL</sub> = 4 mA  |          | 0.25 | 0.4      |     | 0.25 | 0.4  | V   |
|                  | V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, I <sub>OL</sub> = 8 mA  |          |      |          |     | 0.35 | 0.5  |     |
| I <sub>I</sub>   | V <sub>CC</sub> = MAX, V <sub>I</sub> = 7 V                           |          |      | 0.1      |     | 0.1  | mA   |     |
| I <sub>IH</sub>  | V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7 V                         |          |      | 20       |     | 20   | μA   |     |
| I <sub>IL</sub>  | V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V                         |          |      | -0.4     |     | -0.4 | mA   |     |
| I <sub>CCH</sub> | V <sub>CC</sub> = MAX, V <sub>I</sub> = 0                             |          | 0.8  | 1.6      |     | 0.8  | 1.6  | mA  |
| I <sub>CCL</sub> | V <sub>CC</sub> = MAX, V <sub>I</sub> = 4.5 V                         |          | 2.4  | 4.4      |     | 2.4  | 4.4  | mA  |

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

### switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C (see note 2)

| PARAMETER        | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS                               | MIN | TYP | MAX | UNIT |
|------------------|--------------|-------------|---|-----|-----|-----|------|
| t <sub>PLH</sub> | A or B       | Y           | R <sub>L</sub> = 2 kΩ, C <sub>L</sub> = 15 pF |     | 17  | 32  | ns   |
| t <sub>PHL</sub> |              |             |   |     | 15  | 28  | ns   |

NOTE 2: Load circuits and voltage waveforms are shown in Section 1.

**SN54S03, SN74S03**

**QUADRUPLE 2-INPUT POSITIVE-NAND GATES WITH OPEN-COLLECTOR OUTPUTS**

**recommended operating conditions**

|   | SN54S03 |     |     | SN74S03 |     |      | UNIT |
|---|---------|-----|-----|---------|-----|------|------|
|   | MIN     | NOM | MAX | MIN     | NOM | MAX  |      |
| V <sub>CC</sub> Supply voltage                | 4.5     | 5   | 5.5 | 4.75    | 5   | 5.25 | V    |
| V <sub>IH</sub> High-level input voltage      | 2       |     |     | 2       |     |      | V    |
| V <sub>IL</sub> Low-level input voltage       |         |     | 0.8 |         |     | 0.8  | V    |
| V <sub>OH</sub> High-level output voltage     |         |     | 5.5 |         |     | 5.5  | V    |
| I <sub>OL</sub> Low-level output current      |         |     | 20  |         |     | 20   | mA   |
| T <sub>A</sub> Operating free-air temperature | -55     |     | 125 | 0       |     | 70   | °C   |

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

| PARAMETER        | TEST CONDITIONS <sup>†</sup>  | SN54S03 |                  |      | SN74S03 |                  |      | UNIT |
|------------------|---|---------|------------------|------|---------|------------------|------|------|
|                  |   | MIN     | TYP <sup>‡</sup> | MAX  | MIN     | TYP <sup>‡</sup> | MAX  |      |
| V <sub>IK</sub>  | V <sub>CC</sub> = MIN, I <sub>I</sub> = -18 mA                          |         |                  | -1.2 |         |                  | -1.2 | V    |
| I <sub>OH</sub>  | V <sub>CC</sub> = MIN, V <sub>IL</sub> = 0.8 V, V <sub>OH</sub> = 5.5 V |         |                  |      |         |                  | 0.25 | mA   |
|                  | V <sub>CC</sub> = MIN, V <sub>IL</sub> = 0.7 V, V <sub>OH</sub> = 5.5 V |         |                  | 0.25 |         |                  |      |      |
| V <sub>OL</sub>  | V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, I <sub>OL</sub> = 20 mA   |         |                  | 0.5  |         |                  | 0.5  | V    |
| I <sub>I</sub>   | V <sub>CC</sub> = MAX, V <sub>I</sub> = 5.5 V                           |         |                  | 1    |         |                  | 1    | mA   |
| I <sub>IH</sub>  | V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.7 V                           |         |                  | 50   |         |                  | 50   | μA   |
| I <sub>IL</sub>  | V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.5 V                           |         |                  | -2   |         |                  | -2   | mA   |
| I <sub>CCH</sub> | V <sub>CC</sub> = MAX, V <sub>I</sub> = 0                               |         | 6                | 13.2 |         | 6                | 13.2 | mA   |
| I <sub>CCL</sub> | V <sub>CC</sub> = MAX, V <sub>I</sub> = 4.5 V                           |         | 20               | 36   |         | 20               | 36   | mA   |

<sup>†</sup>For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

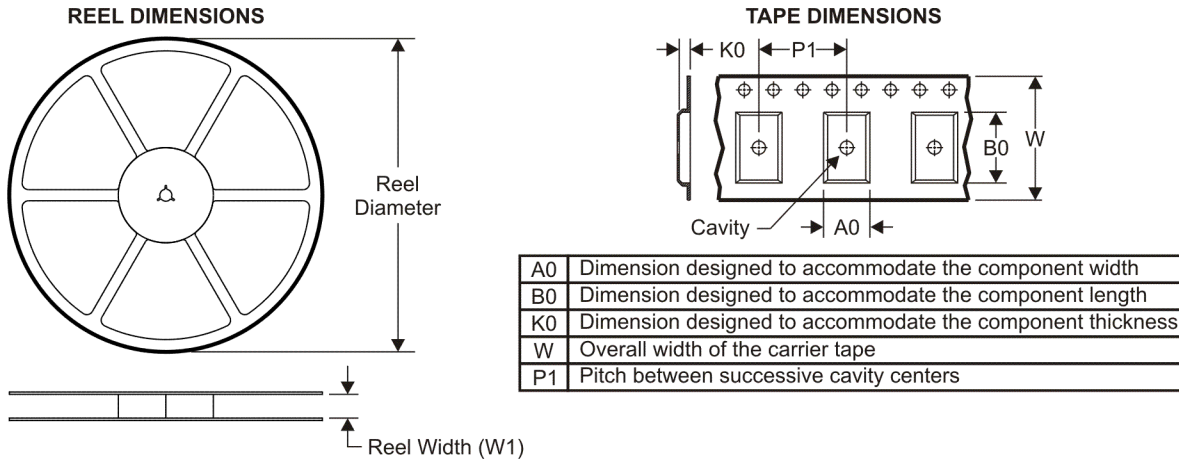
<sup>‡</sup>All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

**switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C (see note 2)**

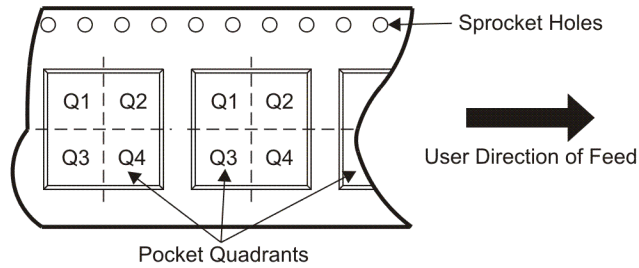
| PARAMETER        | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS                                | MIN | TYP | MAX | UNIT |
|------------------|--------------|-------------|--|-----|-----|-----|------|
| t <sub>PLH</sub> | A or B       | Y           | R <sub>L</sub> = 280 Ω, C <sub>L</sub> = 15 pF | 2   | 5   | 7.5 | ns   |
| t <sub>PHL</sub> |              |             |  | 2   | 4.5 | 7   | ns   |
| t <sub>PLH</sub> |              |             | R <sub>L</sub> = 280 Ω, C <sub>L</sub> = 50 pF | 7.5 |     |     | ns   |
| t <sub>PHL</sub> |              |             |  | 7   |     |     | ns   |

NOTE 2. Load circuits and voltage waveforms are shown in Section 1.

**TAPE AND REEL INFORMATION**



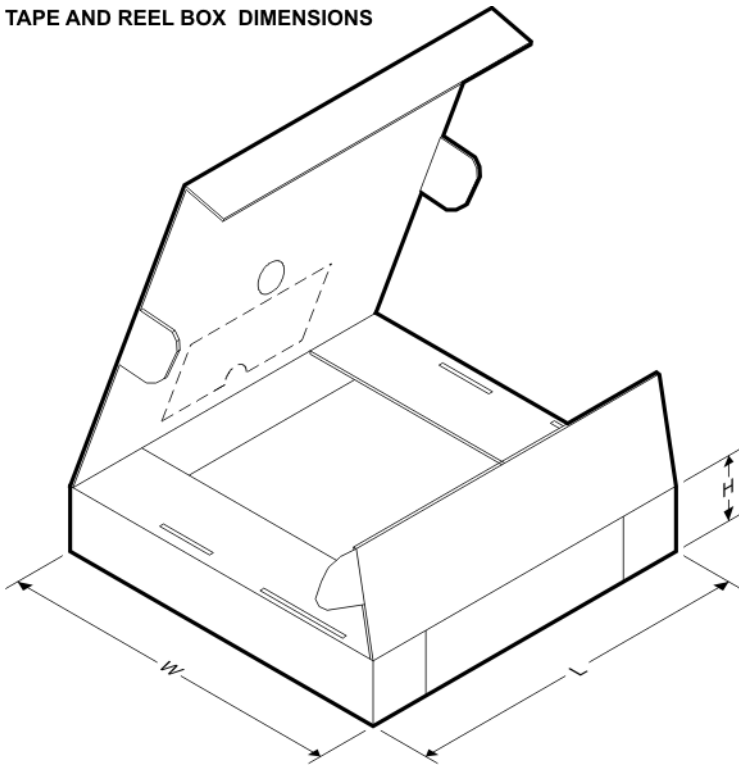
**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**



\*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 |
|-------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74LS03DR  | SOIC         | D               | 14   | 2500 | 330.0              | 16.4               | 6.5     | 9.0     | 2.1     | 8.0     | 16.0   | Q1            |
| SN74LS03NSR | SO           | NS              | 14   | 2000 | 330.0              | 16.4               | 8.2     | 10.5    | 2.5     | 12.0    | 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) |
|-------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74LS03DR  | SOIC         | D               | 14   | 2500 | 346.0       | 346.0      | 33.0        |
| SN74LS03NSR | SO           | NS              | 14   | 2000 | 346.0       | 346.0      | 33.0        |

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| RF/IF and ZigBee® Solutions | <a href="http://www.ti.com/lprf">www.ti.com/lprf</a>               |

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|                    |  |
|--------------------|--|
| Audio              | <a href="http://www.ti.com/audio">www.ti.com/audio</a>                   |
| Automotive         | <a href="http://www.ti.com/automotive">www.ti.com/automotive</a>         |
| Broadband          | <a href="http://www.ti.com/broadband">www.ti.com/broadband</a>           |
| Digital Control    | <a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a> |
| Medical            | <a href="http://www.ti.com/medical">www.ti.com/medical</a>               |
| Military           | <a href="http://www.ti.com/military">www.ti.com/military</a>             |
| Optical Networking | <a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a> |
| Security           | <a href="http://www.ti.com/security">www.ti.com/security</a>             |
| Telephony          | <a href="http://www.ti.com/telephony">www.ti.com/telephony</a>           |
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