

# CD4514B, CD4515B Types

## CMOS 4-Bit Latch/4-to-16 Line Decoders

High-Voltage Types (20-Volt Rating)  
CD4514B Output "High" on Select  
CD4515B Output "Low" on Select

■ CD4514B and -CD4515B consist of a 4-bit strobed latch and a 4-to-16-line decoder. The latches hold the last input data presented prior to the strobe transition from 1 to 0. Inhibit control allows all outputs to be placed at 0 (CD4514B) or 1 (CD4515B) regardless of the state of the data or strobe inputs.

The decode truth table indicates all combinations of data inputs and appropriate selected outputs.

These devices are similar to industry types MC14514 and MC14515.

The CD4514B and CD4515B types are supplied in 16-lead hermetic dual-in-line ceramic packages (F3A suffix), 16-lead dual-in-line plastic packages (E suffix), and 16-lead small-outline packages (M and M96 suffixes).

### Features:

- Strobed input latch
- Inhibit control
- 100% tested for quiescent current at 20 V
- Maximum input current of 1  $\mu$ A at 18 V over full package-temperature range; 100 nA at 18 V and 25°C
- Noise margin (over full package temperature range):
  - 1 V at  $V_{DD} = 5$  V
  - 2 V at  $V_{DD} = 10$  V
  - 2.5 V at  $V_{DD} = 15$  V
- 5-V, 10-V, and 15-V parametric ratings
- Standardized, symmetrical output characteristics.
- Meets all requirements of JEDEC Tentative Standard No. 13B; "Standard Specifications for Description of 'B' Series CMOS Devices"

### Applications:

- Digital multiplexing
- Address decoding
- Hexadecimal/BCD decoding
- Program-counter decoding
- Control decoder

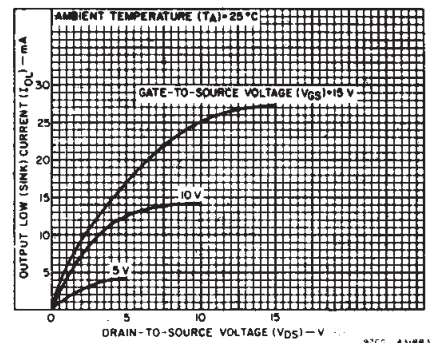
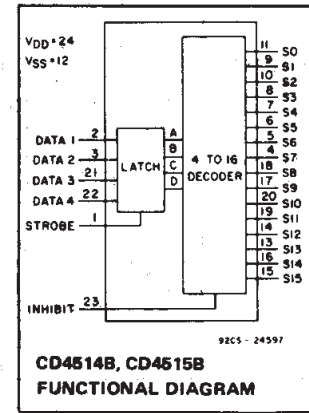


Fig. 1 – Typical output low (sink) current characteristics.

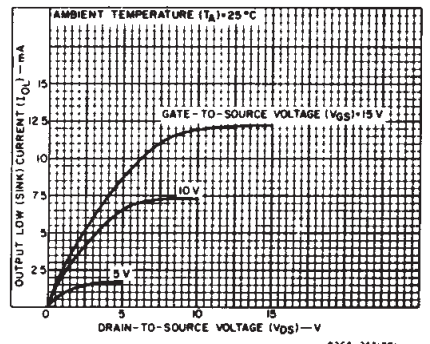


Fig. 2 – Minimum output low (sink) current characteristics.

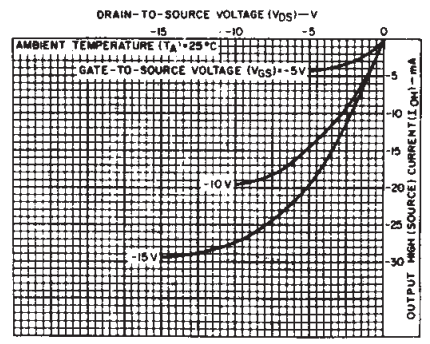


Fig. 3 – Typical output high (source) current characteristics.

### MAXIMUM RATINGS, Absolute-Maximum Values:

|  |  |
|--|--|
| DC SUPPLY-VOLTAGE RANGE, ( $V_{DD}$ )                                      |  |
| Voltages referenced to $V_{SS}$ Terminal                                   | -0.5V to +20V                                      |
| INPUT VOLTAGE RANGE, ALL INPUTS  | -0.5V to $V_{DD} + 0.5V$                           |
| DC INPUT CURRENT, ANY ONE INPUT  | $\pm 10$ mA  |
| POWER DISSIPATION PER PACKAGE ( $P_D$ ):                                   |  |
| For $T_A = -55^\circ\text{C}$ to $+100^\circ\text{C}$                      | 500mW  |
| For $T_A = +100^\circ\text{C}$ to $+125^\circ\text{C}$                     | Derate Linearly at 12mW/ $^\circ\text{C}$ to 200mW |
| DEVICE DISSIPATION PER OUTPUT TRANSISTOR                                   |  |
| FOR $T_A =$ FULL PACKAGE-TEMPERATURE RANGE (All Package Types)             | 100mW  |
| OPERATING-TEMPERATURE RANGE ( $T_A$ )                                      | $-55^\circ\text{C}$ to $+125^\circ\text{C}$        |
| STORAGE TEMPERATURE RANGE ( $T_{stg}$ )                                    | $-65^\circ\text{C}$ to $+150^\circ\text{C}$        |
| LEAD TEMPERATURE (DURING SOLDERING):                                       |  |
| At distance 1/16 $\pm$ 1/32 inch (1.59 $\pm$ 0.79mm) from case for 10s max | $+265^\circ\text{C}$                               |

### RECOMMENDED OPERATING CONDITIONS at $T_A = 25^\circ\text{C}$ , Except as Noted.

For maximum reliability, nominal operating conditions should be selected so that operation is always within the following ranges:

| CHARACTERISTIC  | $V_{DD}$ (V)  | LIMITS           |             | UNITS |
|---|---------------|------------------|-------------|-------|
|   |               | Min.             | Max.        |       |
| Supply-Voltage Range (For $T_A =$ Full Package-Temperature Range) |               | 3                | 18          | V     |
| Data Setup Time, $t_S$  | 5<br>10<br>15 | 150<br>70<br>40  | —<br>—<br>— | ns    |
| Strobe Pulse Width, $t_W$   | 5<br>10<br>15 | 250<br>100<br>75 | —<br>—<br>— | ns    |

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## STATIC ELECTRICAL CHARACTERISTICS

| CHARACTERISTIC                                     | CONDITIONS            |                        |                        | LIMITS AT INDICATED TEMPERATURES (°C) |       |       |       |       |                   |      | UNITS |
|--|-----------------------|------------------------|------------------------|---------------------------------------|-------|-------|-------|-------|-------------------|------|-------|
|  | V <sub>O</sub><br>(V) | V <sub>IN</sub><br>(V) | V <sub>DD</sub><br>(V) | -55                                   | -40   | +85   | +125  | +25   |                   |      |       |
|  |                       |                        |                        |                                       |       |       |       | Min.  | Typ.              | Max. |       |
| Quiescent Device Current, I <sub>DD</sub> Max.     | -                     | 0.5                    | 5                      | 5                                     | 5     | 150   | 150   | -     | 0.04              | 5    | μA    |
|  | -                     | 0.10                   | 10                     | 10                                    | 10    | 300   | 300   | -     | 0.04              | 10   |       |
|  | -                     | 0.15                   | 15                     | 20                                    | 20    | 600   | 600   | -     | 0.04              | 20   |       |
|  | -                     | 0.20                   | 20                     | 100                                   | 100   | 3000  | 3000  | -     | 0.08              | 100  |       |
| Output Low (Sink) Current I <sub>OL</sub> Min.     | 0.4                   | 0.5                    | 5                      | 0.64                                  | 0.61  | 0.42  | 0.36  | 0.51  | 1                 | -    | mA    |
|  | 0.5                   | 0.10                   | 10                     | 1.6                                   | 1.5   | 1.1   | 0.9   | 1.3   | 2.6               | -    |       |
|  | 1.5                   | 0.15                   | 15                     | 4.2                                   | 4     | 2.8   | 2.4   | 3.4   | 6.8               | -    |       |
| Output High (Source) Current, I <sub>OH</sub> Min. | 4.6                   | 0.5                    | 5                      | -0.64                                 | -0.61 | -0.42 | -0.36 | -0.51 | -1                | -    | mA    |
|  | 2.5                   | 0.5                    | 5                      | -2                                    | -1.8  | -1.3  | -1.15 | -1.6  | -3.2              | -    |       |
|  | 9.5                   | 0.10                   | 10                     | -1.6                                  | -1.5  | -1.1  | -0.9  | -1.3  | -2.6              | -    |       |
|  | 13.5                  | 0.15                   | 15                     | -4.2                                  | -4    | -2.8  | -2.4  | -3.4  | -6.8              | -    |       |
| Output Voltage: Low-Level, V <sub>OL</sub> Max.    | -                     | 0.5                    | 5                      | 0.05                                  |       |       |       | -     | 0                 | 0.05 | V     |
|  | -                     | 0.10                   | 10                     | 0.05                                  |       |       |       | -     | 0                 | 0.05 |       |
|  | -                     | 0.15                   | 15                     | 0.05                                  |       |       |       | -     | 0                 | 0.05 |       |
| Output Voltage: High-Level, V <sub>OH</sub> Min.   | -                     | 0.5                    | 5                      | 4.95                                  |       |       |       | 4.95  | 5                 | -    | V     |
|  | -                     | 0.10                   | 10                     | 9.95                                  |       |       |       | 9.95  | 10                | -    |       |
|  | -                     | 0.15                   | 15                     | 14.95                                 |       |       |       | 14.95 | 15                | -    |       |
| Input Low Voltage, V <sub>IL</sub> Max.            | 0.5, 4.5              | -                      | 5                      | 1.5                                   |       |       |       | -     | -                 | 1.5  | V     |
|  | 1, 9                  | -                      | 10                     | 3                                     |       |       |       | -     | -                 | 3    |       |
|  | 1.5, 13.5             | -                      | 15                     | 4                                     |       |       |       | -     | -                 | 4    |       |
| Input High Voltage, V <sub>IH</sub> Min.           | 0.5, 4.5              | -                      | 5                      | 3.5                                   |       |       |       | 3.5   | -                 | -    | V     |
|  | 1, 9                  | -                      | 10                     | 7                                     |       |       |       | 7     | -                 | -    |       |
|  | 1.5, 13.5             | -                      | 15                     | 11                                    |       |       |       | 11    | -                 | -    |       |
| Input Current I <sub>IN</sub> Max.                 | -                     | 0.18                   | 18                     | ±0.1                                  | ±0.1  | ±1    | ±1    | -     | ±10 <sup>-5</sup> | ±0.1 | μA    |

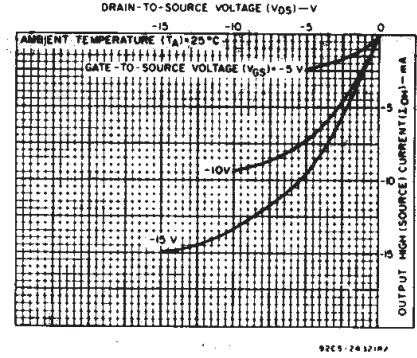


Fig. 4 - Minimum output high (source) current characteristics.

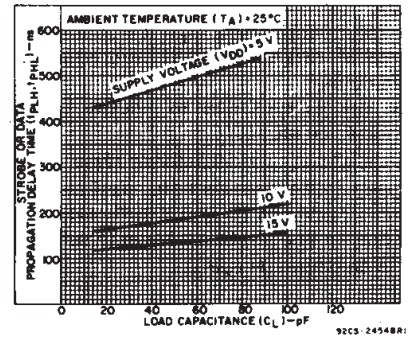


Fig. 5 - Typical strobe or data propagation delay time vs. load capacitance.

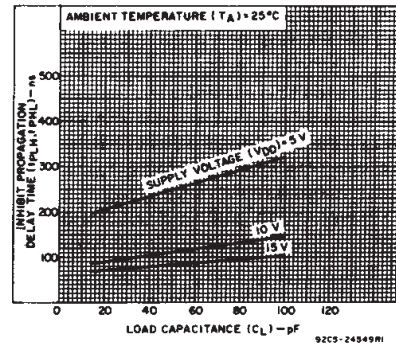


Fig. 6 - Typical inhibit propagation delay time vs. load capacitance.

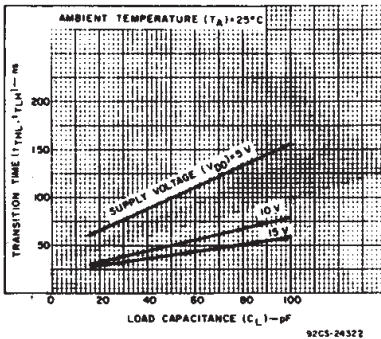


Fig. 7 - Typical low-to-high transition time vs. load capacitance.

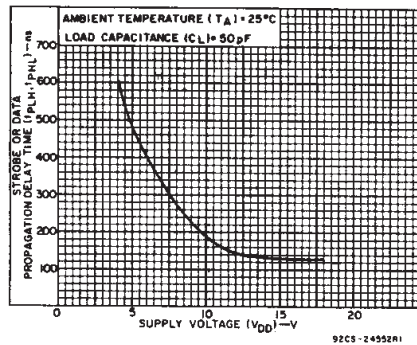


Fig. 8 - Typical strobe or data propagation delay time vs. supply voltage.

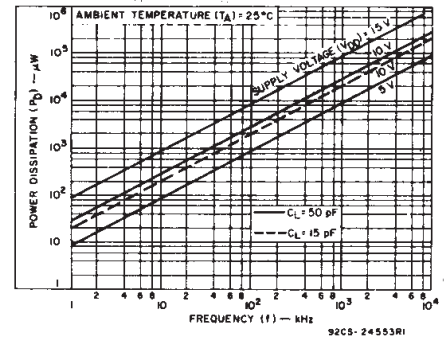


Fig. 9 - Typical power dissipation vs. frequency.

# CD4514B, CD4515B Types

DYNAMIC ELECTRICAL CHARACTERISTICS at  $T_A = 25^\circ\text{C}$ ; Input  $t_r, t_f = 20\text{ ns}$ ,  $C_L = 50\text{ pF}$ ,  $R_L = 200\text{ K}\Omega$

| CHARACTERISTIC  | TEST CONDITIONS | LIMITS   |      |      | UNITS |
|---|-----------------|----------|------|------|-------|
|   |                 | VDD<br>V | Typ. | Max. |       |
| Propagation Delay Time: $t_{PHL}$ , $t_{PLH}$<br>Strobe or Data |                 | 5        | 485  | 970  | ns    |
|   |                 | 10       | 185  | 370  |       |
|   |                 | 15       | 135  | 270  |       |
| Inhibit   |                 | 5        | 250  | 500  | ns    |
|   |                 | 10       | 110  | 220  |       |
|   |                 | 15       | 85   | 170  |       |
| Transition Time, $t_{TLH}$ , $t_{THL}$                          |                 | 5        | 100  | 200  | ns    |
|   |                 | 10       | 50   | 100  |       |
|   |                 | 15       | 40   | 80   |       |
| Minimum Strobe Pulse Width, $t_W$                               |                 | 5        | 125  | 250  | ns    |
|   |                 | 10       | 50   | 100  |       |
|   |                 | 15       | 40   | 75   |       |
| Minimum Data Setup Time, $t_S$                                  |                 | 5        | 75   | 150  | ns    |
|   |                 | 10       | 35   | 70   |       |
|   |                 | 15       | 20   | 40   |       |
| Input Capacitance, $C_{IN}$                                     | Any Input       | —        | 5    | 7.5  | pF    |

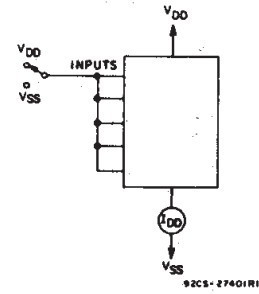


Fig. 10 — Quiescent device current test circuit.

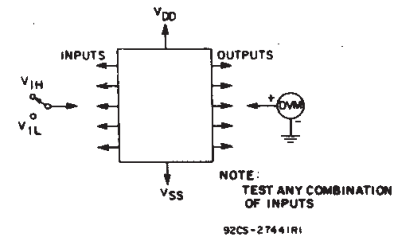


Fig. 11 — Input voltage test circuit.

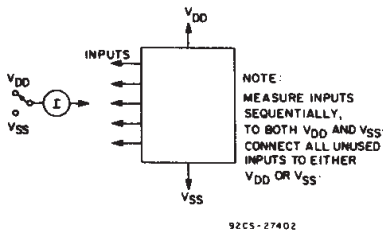


Fig. 12 — Input current test circuit.

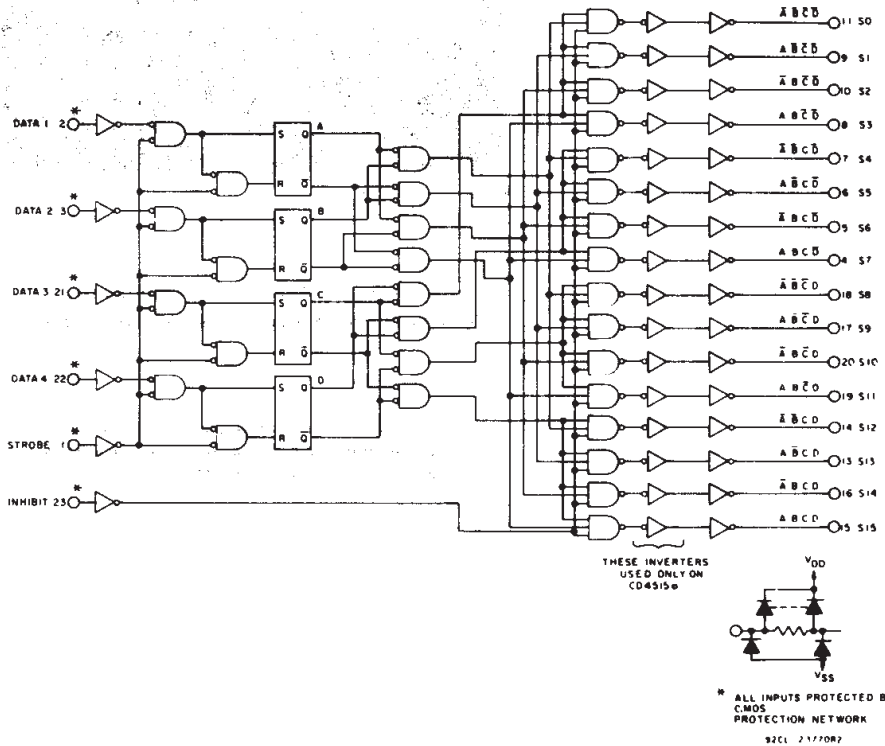


Fig. 13 — Logic diagram for CD4514B and CD4515B.

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# CD4514B, CD4515B Types

DECODE TRUTH TABLE (Strobe = 1)

| INHIBIT | DECODER INPUTS |   |   |   | SELECTED OUTPUT          |                          |
|---------|----------------|---|---|---|--------------------------|--------------------------|
|         | D              | C | B | A | CD4514B = Logic 1 (High) | CD4515B = Logic 0 (Low)  |
| 0       | 0              | 0 | 0 | 0 | S0                       |                          |
| 0       | 0              | 0 | 0 | 1 | S1                       |                          |
| 0       | 0              | 0 | 1 | 0 | S2                       |                          |
| 0       | 0              | 0 | 1 | 1 | S3                       |                          |
| 0       | 0              | 1 | 0 | 0 | S4                       |                          |
| 0       | 0              | 1 | 0 | 1 | S5                       |                          |
| 0       | 0              | 1 | 1 | 0 | S6                       |                          |
| 0       | 0              | 1 | 1 | 1 | S7                       |                          |
| 0       | 1              | 0 | 0 | 0 | S8                       |                          |
| 0       | 1              | 0 | 0 | 1 | S9                       |                          |
| 0       | 1              | 0 | 1 | 0 | S10                      |                          |
| 0       | 1              | 0 | 1 | 1 | S11                      |                          |
| 0       | 1              | 1 | 0 | 0 | S12                      |                          |
| 0       | 1              | 1 | 0 | 1 | S13                      |                          |
| 0       | 1              | 1 | 1 | 0 | S14                      |                          |
| 0       | 1              | 1 | 1 | 1 | S15                      |                          |
| 1       | X              | X | X | X | All Outputs = 0, CD4514B | All Outputs = 1, CD4515B |

X = Don't Care Logic 1 = high Logic 0 = low

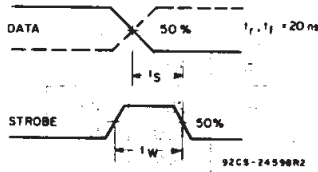
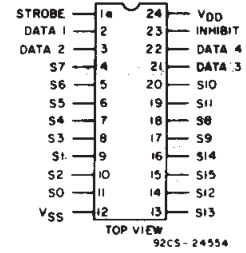
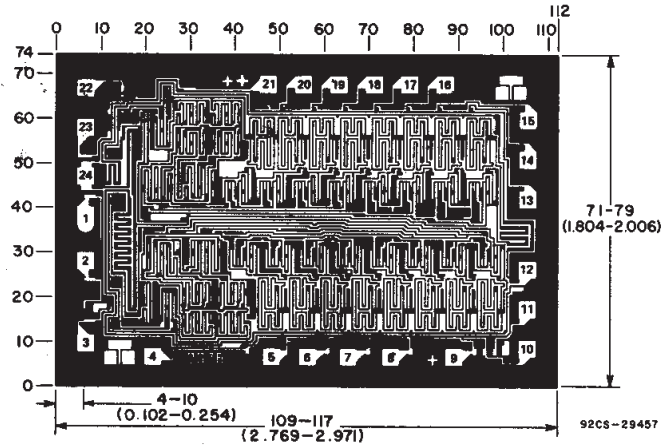


Fig. 14 - Waveforms for setup time and strobe pulse width.



CD4514B  
CD4515B

TERMINAL ASSIGNMENT



Dimensions and Pad Layout for CD4515B Chip  
(Dimensions and pad layout for the CD4514B are identical)

Dimensions in parentheses are in millimeters and are derived from the basic inch dimensions as indicated. Grid graduations are in mils ( $10^{-3}$  inch).

**PACKAGING INFORMATION**

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup>               |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|--|
| 7703201JA        | ACTIVE                | CDIP         | J               | 24   | 1           | None                    | Call TI          | Level-NC-NC-NC                             |
| CD4514BE         | ACTIVE                | PDIP         | N               | 24   | 15          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC                             |
| CD4514BF         | ACTIVE                | CDIP         | J               | 24   | 1           | None                    | Call TI          | Level-NC-NC-NC                             |
| CD4514BF3A       | ACTIVE                | CDIP         | J               | 24   | 1           | None                    | Call TI          | Level-NC-NC-NC                             |
| CD4514BM         | ACTIVE                | SOIC         | DW              | 24   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | Level-2-250C-1 YEAR/<br>Level-1-235C-UNLIM |
| CD4514BM96       | ACTIVE                | SOIC         | DW              | 24   | 2000        | Pb-Free (RoHS)          | CU NIPDAU        | Level-2-250C-1 YEAR/<br>Level-1-235C-UNLIM |
| CD4514BNSR       | OBSOLETE              | SO           | NS              | 24   |             | None                    | Call TI          | Call TI                                    |
| CD4514BPWR       | OBSOLETE              | TSSOP        | PW              | 24   |             | None                    | Call TI          | Call TI                                    |
| CD4515BE         | ACTIVE                | PDIP         | N               | 24   | 15          | Pb-Free (RoHS)          | CU NIPDAU        | Level-NC-NC-NC                             |
| CD4515BF3A       | ACTIVE                | CDIP         | J               | 24   | 1           | None                    | Call TI          | Level-NC-NC-NC                             |
| CD4515BM         | ACTIVE                | SOIC         | DW              | 24   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | Level-2-250C-1 YEAR/<br>Level-1-235C-UNLIM |
| CD4515BM96       | ACTIVE                | SOIC         | DW              | 24   | 2000        | Pb-Free (RoHS)          | CU NIPDAU        | Level-2-250C-1 YEAR/<br>Level-1-235C-UNLIM |

<sup>(1)</sup> 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.

<sup>(2)</sup> Eco Plan - May not be currently available - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**None:** Not yet available Lead (Pb-Free).

**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.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean "Pb-Free" and in addition, uses package materials that do not contain halogens, including bromine (Br) or antimony (Sb) above 0.1% of total product weight.

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

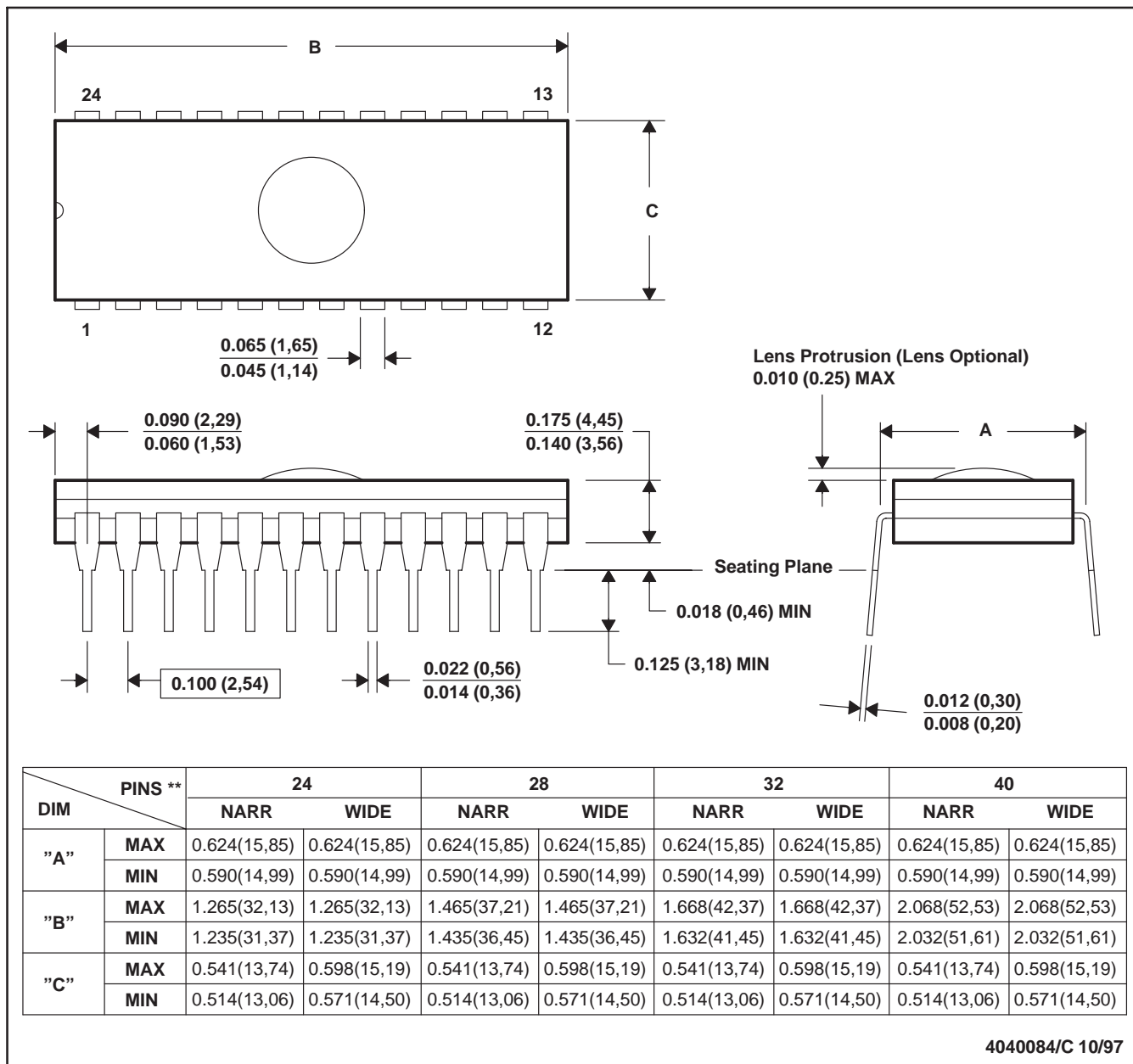
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J (R-GDIP-T\*\*)

CERAMIC DUAL-IN-LINE PACKAGE

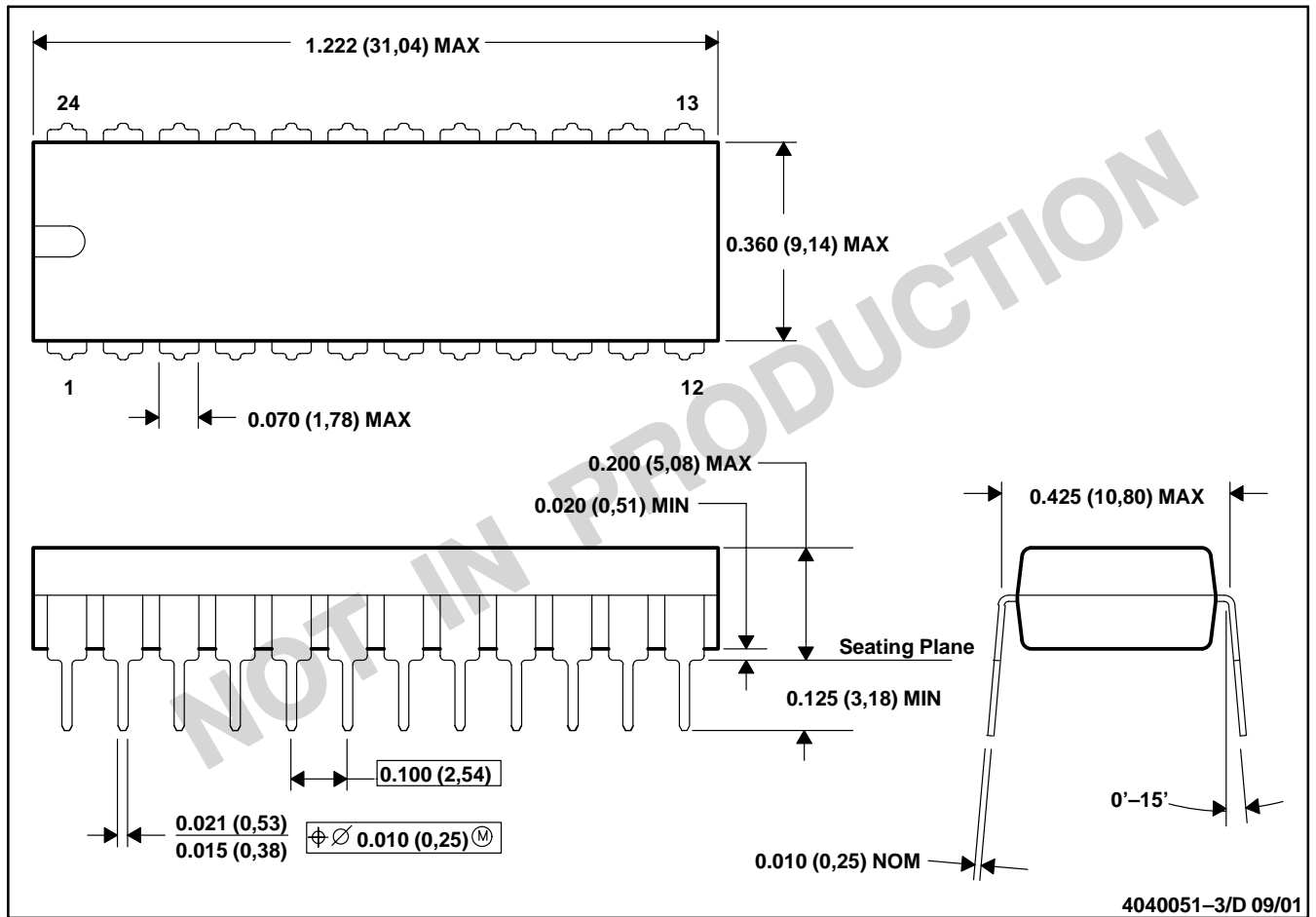
24 PINS SHOWN



- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. Window (lens) added to this group of packages (24-, 28-, 32-, 40-pin).  
 D. This package can be hermetically sealed with a ceramic lid using glass frit.  
 E. Index point is provided on cap for terminal identification.

N (R-PDIP-T24)

PLASTIC DUAL-IN-LINE

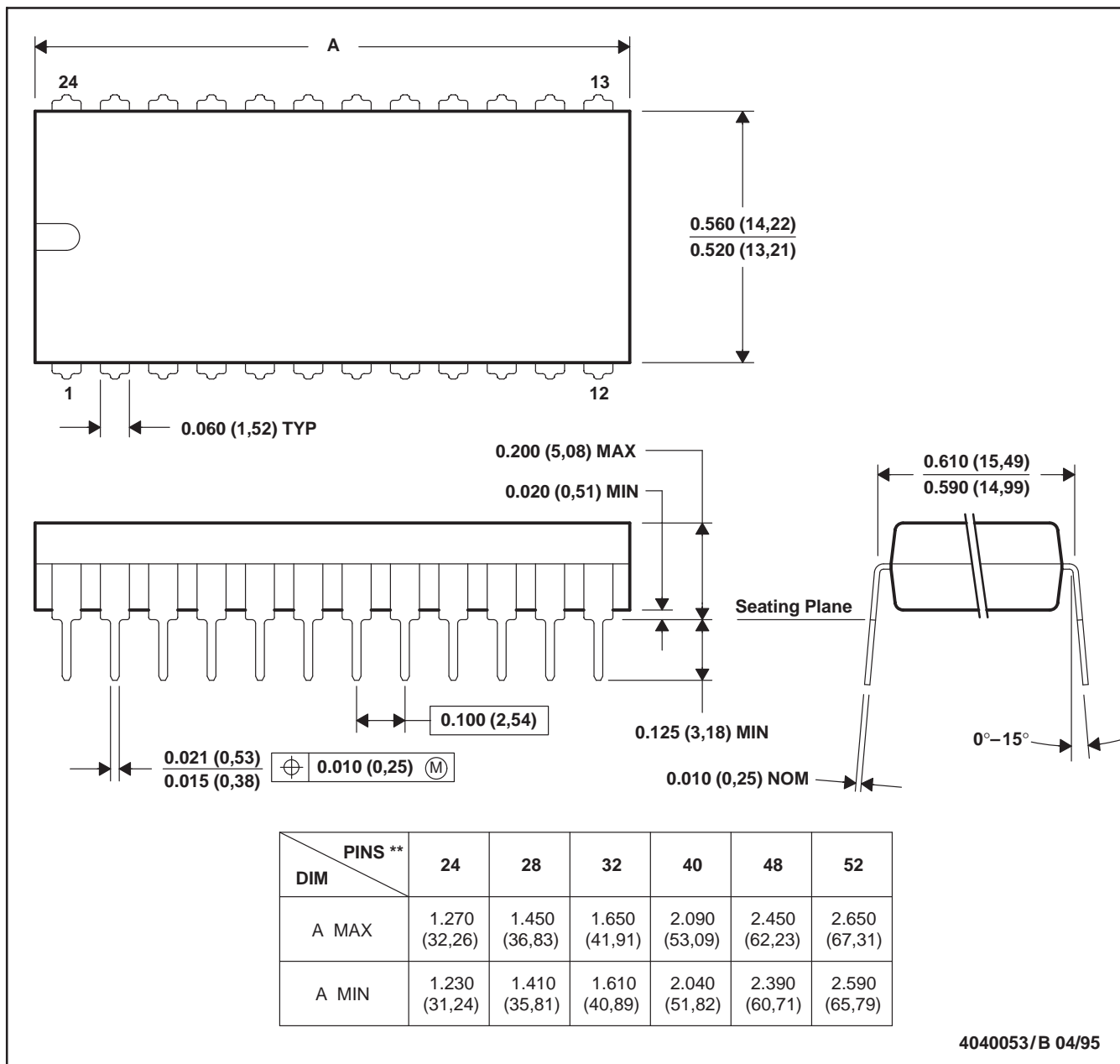


- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. Falls within JEDEC MS-010

**N (R-PDIP-T\*\*)**

**PLASTIC DUAL-IN-LINE PACKAGE**

24 PIN SHOWN

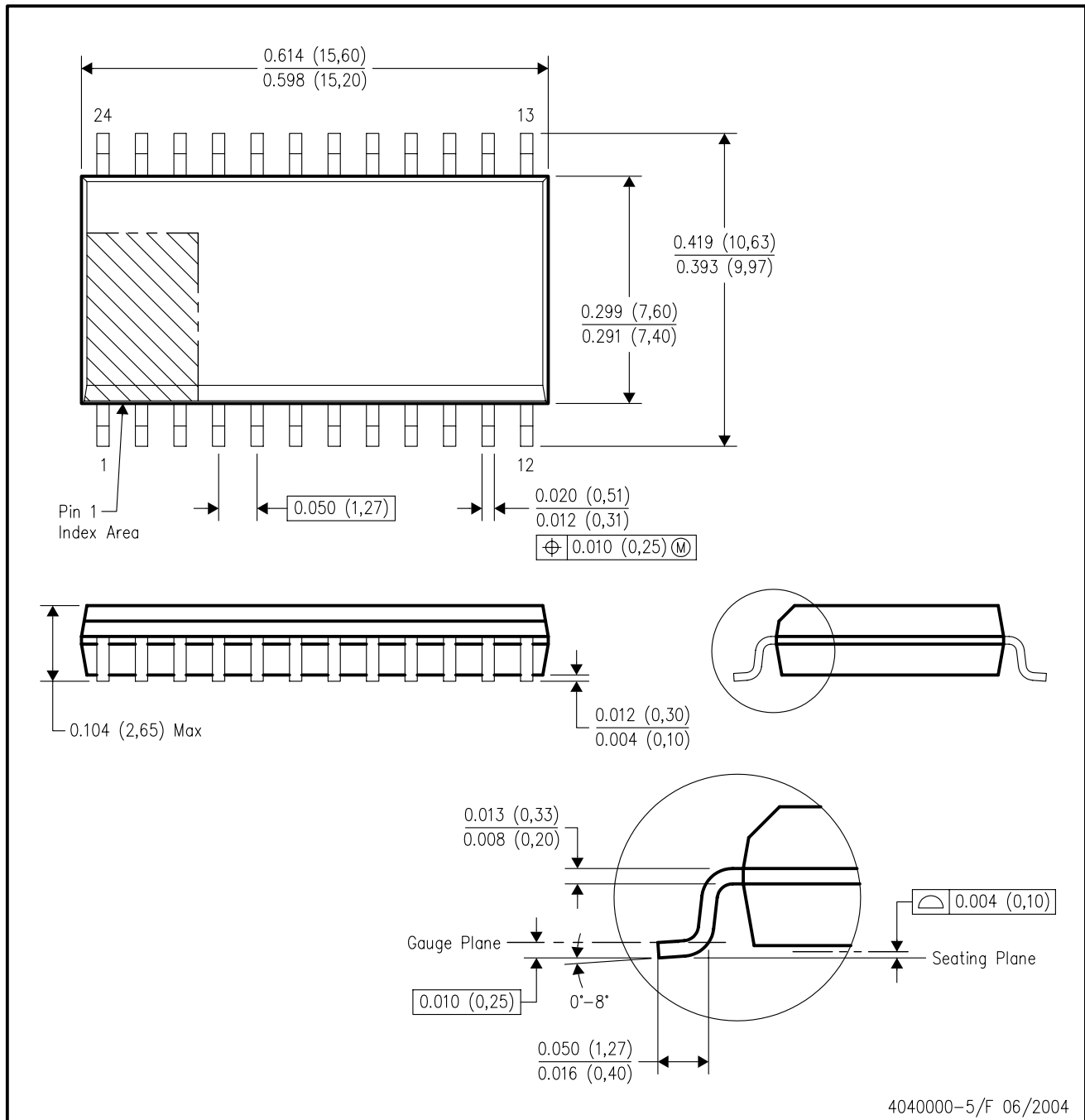


- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. Falls within JEDEC MS-011  
 D. Falls within JEDEC MS-015 (32 pin only)



DW (R-PDSO-G24)

PLASTIC SMALL-OUTLINE PACKAGE



- 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 AD.

# MECHANICAL DATA

NS (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- 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.

PW (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



4040064/F 01/97

- 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-153

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|------------------|--|---------------------|--|
| Amplifiers       | <a href="http://amplifier.ti.com">amplifier.ti.com</a>             | Audio               | <a href="http://www.ti.com/audio">www.ti.com/audio</a>                   |
| Data Converters  | <a href="http://dataconverter.ti.com">dataconverter.ti.com</a>     | Automotive          | <a href="http://www.ti.com/automotive">www.ti.com/automotive</a>         |
| DSP              | <a href="http://dsp.ti.com">dsp.ti.com</a>                         | Broadband           | <a href="http://www.ti.com/broadband">www.ti.com/broadband</a>           |
| Interface        | <a href="http://interface.ti.com">interface.ti.com</a>             | Digital Control     | <a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a> |
| Logic            | <a href="http://logic.ti.com">logic.ti.com</a>                     | Military            | <a href="http://www.ti.com/military">www.ti.com/military</a>             |
| Power Mgmt       | <a href="http://power.ti.com">power.ti.com</a>                     | Optical Networking  | <a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a> |
| Microcontrollers | <a href="http://microcontroller.ti.com">microcontroller.ti.com</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>           |
|                  |  | Video & Imaging     | <a href="http://www.ti.com/video">www.ti.com/video</a>                   |
|                  |  | Wireless            | <a href="http://www.ti.com/wireless">www.ti.com/wireless</a>             |

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