

## CMOS Expandable 4-Wide 2-Input AND-OR-INVERT Gate

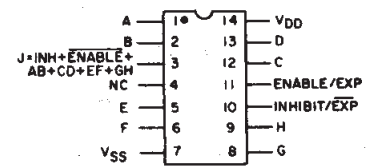
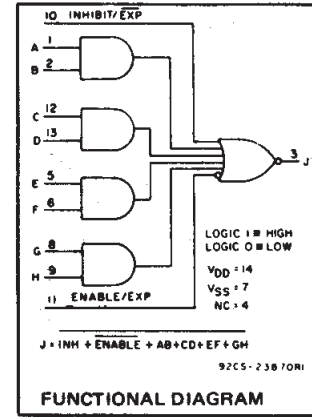
High-Voltage Types (20-Volt Rating)

■ CD4086B contains one 4-wide 2-input AND-OR-INVERT gate with an INHIBIT/EXP input and an ENABLE/EXP input. For a 4-wide A-O-I function INHIBIT/EXP is tied to V<sub>SS</sub> and ENABLE/EXP to V<sub>DD</sub>. See Fig.10 and its associated explanation for applications where a capability greater than 4-wide is required.

The CD4086B is supplied in 14-lead dual-in-line ceramic packages (D and F suffixes), 14-lead dual-in-line plastic packages (E suffix), and in chip form (H suffix).

### Features:

- Medium-speed operation – t<sub>PHL</sub> = 90 ns; t<sub>PLH</sub> = 140 ns (typ.) at 10 V
- INHIBIT and ENABLE inputs
- Buffered outputs
- 100% tested for quiescent current at 20 V
- Maximum input leakage current of 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<sub>DD</sub> = 5 V
  - 2 V at V<sub>DD</sub> = 10 V
  - 2.5 V at V<sub>DD</sub> = 15 V
- Standardized, symmetrical output characteristics
- 5-V, 10-V, and 15-V parametric ratings
- Meets all requirements of JEDEC Tentative Standard No. 13B, "Standard Specifications for Description of 'B' Series CMOS Devices"



92CS-23869R1  
Top View  
TERMINAL ASSIGNMENT

### MAXIMUM RATINGS, Absolute-Maximum Values:

|   |  |                                     |
|---|--|-------------------------------------|
| DC SUPPLY-VOLTAGE RANGE, (V <sub>DD</sub> )                             |  | -0.5V to +20V                       |
| Voltages referenced to V <sub>SS</sub> Terminal)                        |  |                                     |
| INPUT VOLTAGE RANGE, ALL INPUTS   |  | -0.5V to V <sub>DD</sub> + 0.5V     |
| DC INPUT CURRENT, ANY ONE INPUT   |  | ±10mA                               |
| POWER DISSIPATION PER PACKAGE (P <sub>D</sub> ):                        |  |                                     |
| For T <sub>A</sub> = -55°C to +100°C                                    |  | 500mW                               |
| For T <sub>A</sub> = +100°C to +125°C                                   |  | Derate Linearly at 12mW/°C to 200mW |
| DEVICE DISSIPATION PER OUTPUT TRANSISTOR                                |  |                                     |
| FOR T <sub>A</sub> = FULL PACKAGE-TEMPERATURE RANGE (All Package Types) |  | 100mW                               |
| OPERATING-TEMPERATURE RANGE (T <sub>A</sub> )                           |  | -55°C to +125°C                     |
| STORAGE TEMPERATURE RANGE (T <sub>stg</sub> )                           |  | -65°C to +150°C                     |
| LEAD TEMPERATURE (DURING SOLDERING):                                    |  |                                     |
| At distance 1/16 ± 1/32 Inch (1.59 ± 0.79mm) from case for 10s max      |  | +265°C                              |

### RECOMMENDED OPERATING CONDITIONS

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

| CHARACTERISTIC   | LIMITS |      | UNITS |
|--|--------|------|-------|
|  | MIN.   | MAX. |       |
| Supply-Voltage Range (For T <sub>A</sub> = Full Package-Temperature Range) | 3      | 18   | V     |

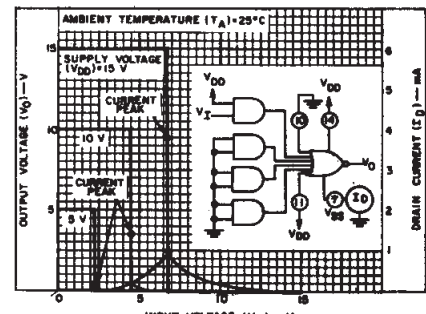


Fig. 1 – Typical voltage and current transfer characteristics.

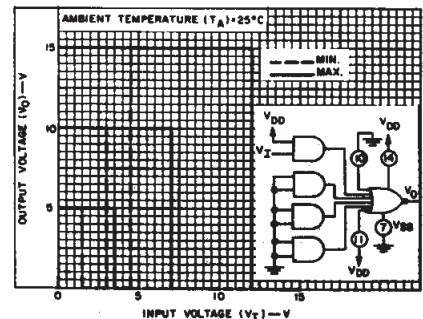


Fig. 2 – Minimum and maximum voltage transfer characteristics.

3  
COMMERCIAL CMOS  
HIGH VOLTAGE ICs

# CD4086B Types

## 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                      | 1                                     | 1     | 30    | 30    | —     | 0.02              | 1    | μA    |   |
|  | —                     | 0.10                   | 10                     | 2                                     | 2     | 60    | 60    | —     | 0.02              | 2    |       |   |
|  | —                     | 0.15                   | 15                     | 4                                     | 4     | 120   | 120   | —     | 0.02              | 4    |       |   |
| 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              | —    |       |   |
| 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    |   |

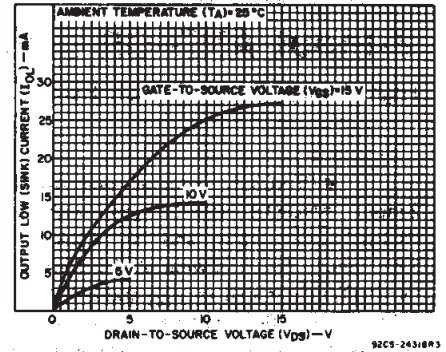


Fig. 3 — Typical output low (sink) current characteristics.

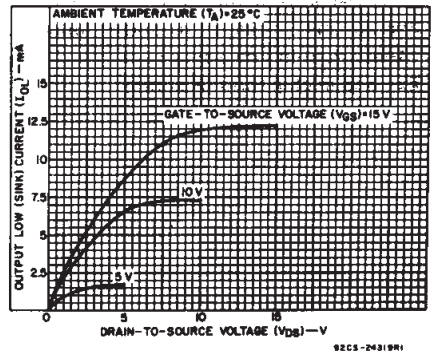


Fig. 4 — Minimum output low (sink) current characteristics.

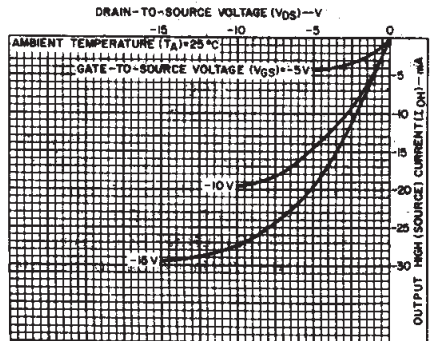


Fig. 5 — Typical output high (source) current characteristics.

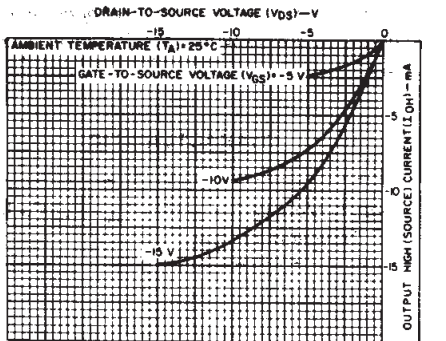


Fig. 8 — Minimum output high (source) current characteristics.

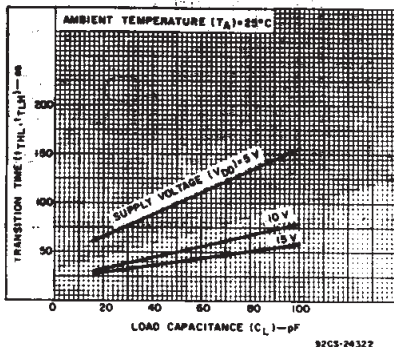


Fig. 6 — Typical transition time vs. load capacitance.

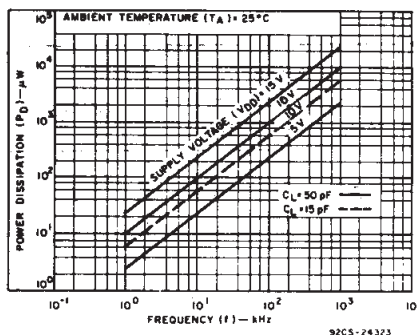


Fig. 7 — Typical power dissipation vs. frequency.

# CD4086B Types

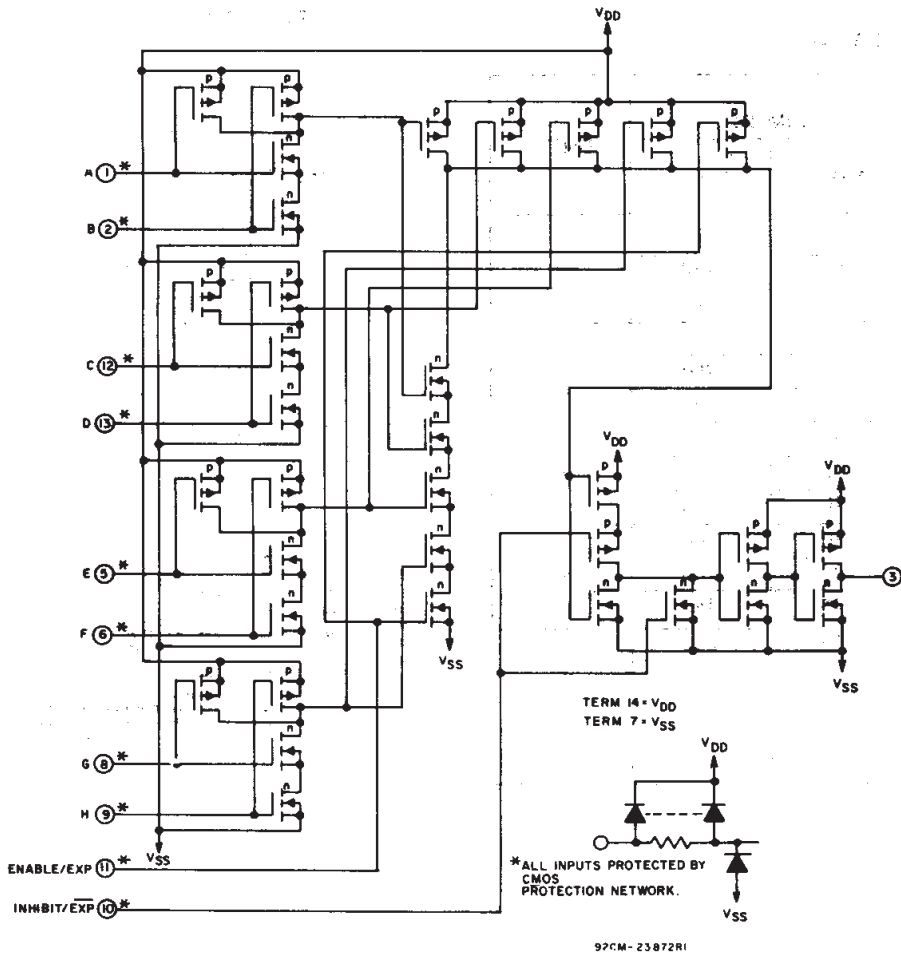


Fig. 9 - CD4086B schematic diagram.

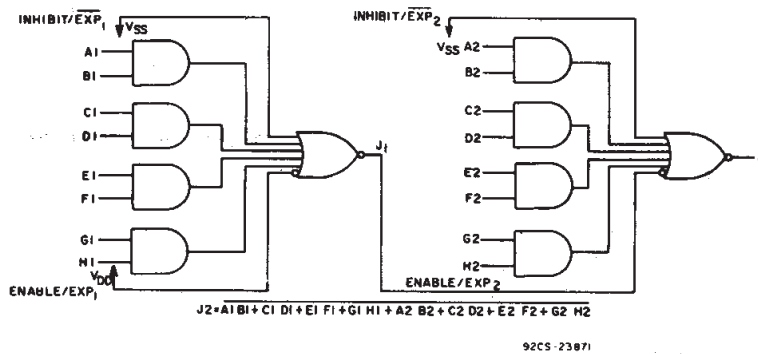


Fig. 10 - Two CD4086's connected as an 8-wide 2-input A-O-I gate.

Fig. 10 above shows two CD4086's utilized to obtain an 8-wide 2-input A-O-I function. The output (J1) of one CD4086 is fed directly to the ENABLE/EXP2 line of the second CD4086. In a similar fashion, any

NAND gate output can be fed directly into the ENABLE/EXP input to obtain a 5-wide A-O-I function. In addition, any AND gate output can be fed directly into the INHIBIT/EXP input with the same result.

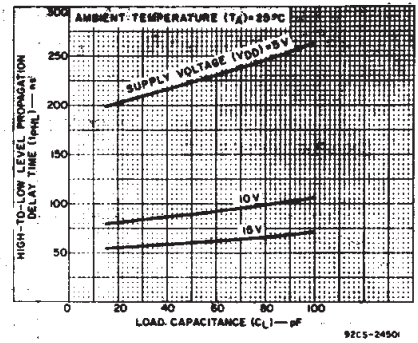


Fig. 11 - Typical DATA or ENABLE high-to-low level propagation delay time vs. load capacitance.

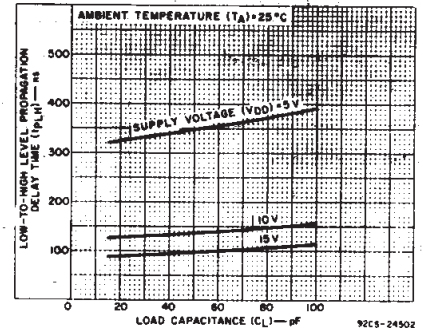


Fig. 12 - Typical DATA or ENABLE low-to-high level propagation delay time vs. load capacitance.

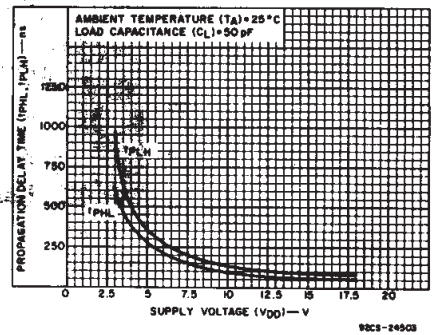


Fig. 13 - Typical DATA or ENABLE propagation delay time vs. supply voltage.

3  
COMMERCIAL CMOS  
HIGH VOLTAGE ICs

# CD4086B 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  | CONDITIONS | LIMITS       |      | UNITS |      |
|---|------------|--------------|------|-------|------|
|   |            | $V_{DD}$ (V) | TYP. |       | MAX. |
| Propagation Delay Time (Data):<br>High-to-Low Level, $t_{pHL}$      |            | 5            | 225  | 450   | ns   |
|   |            | 10           | 90   | 180   |      |
|   |            | 15           | 60   | 120   |      |
| Low-to-High Level, $t_{pLH}$  |            | 5            | 310  | 620   | ns   |
|   |            | 10           | 125  | 250   |      |
|   |            | 15           | 90   | 180   |      |
| Propagation Delay Time (Inhibit): High-to-Low Level, $t_{pHL(INH)}$ |            | 5            | 150  | 300   | ns   |
|   |            | 10           | 60   | 120   |      |
|   |            | 15           | 40   | 80    |      |
| Low-to-High Level, $t_{pLH(INH)}$                                   |            | 5            | 250  | 500   | ns   |
|   |            | 10           | 100  | 200   |      |
|   |            | 15           | 70   | 140   |      |
| Transition Time, $t_{THL}, t_{TLH}$                                 |            | 5            | 100  | 200   | ns   |
|   |            | 10           | 50   | 100   |      |
|   |            | 15           | 40   | 80    |      |
| Input Capacitance $C_{iN}$  | Any Input  |              | 5    | 7.5   | pF   |

## TEST CIRCUITS

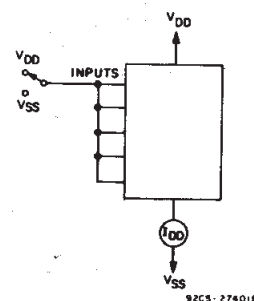


Fig. 14 - Quiescent device current.

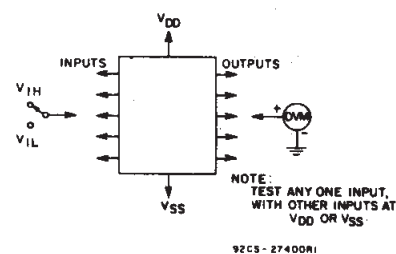
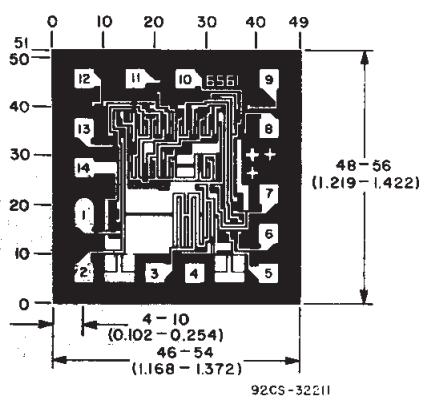


Fig. 15 - Input voltage.



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

## Dimensions and Pad Layout for the CD4086BH

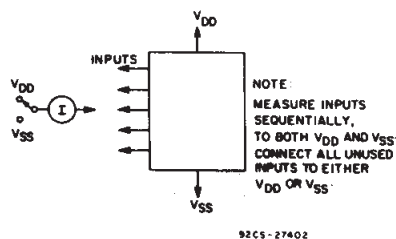


Fig. 16 - Input leakage current.

## IMPORTANT NOTICE

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgement, including those pertaining to warranty, patent infringement, and limitation of liability.

TI warrants performance of its semiconductor products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

CERTAIN APPLICATIONS USING SEMICONDUCTOR PRODUCTS MAY INVOLVE POTENTIAL RISKS OF DEATH, PERSONAL INJURY, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE ("CRITICAL APPLICATIONS"). TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS. INCLUSION OF TI PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE FULLY AT THE CUSTOMER'S RISK.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.

This datasheet has been downloaded from:

[www.DatasheetCatalog.com](http://www.DatasheetCatalog.com)

Datasheets for electronic components.