# CD40109BMS

December 1992

## CMOS Quad Low-to-High Voltage Level Shifter

### Features

- **High Voltage Type (20V Rating)**
- **Independence of Power Supply Sequence Considerations**
  - **VCC can Exceed VDD**
  - **Input Signals can Exceed Both VCC and VDD**
- **Up and Down Level Shifting Capability**
- **Three-State Outputs with Separate Enable Controls**
- **100% Tested for Quiescent Current at 20V**
- **5V, 10V and 15V Parametric Ratings**
- **Maximum Input Current of 1μA at 18V Over Full Package Temperature Range; 100nA at 18V and +25°C**
- **Noise Margin (Over Full Package/Temperature Range)**
  - **1V at VCC = 5V, VDD = 10V**
  - **2V at VCC = 10V, VDD = 15V**
- **Standardized Symmetrical Output Characteristics**
- **Meets All Requirements of JEDEC Tentative Standard No. 13B, "Standard Specifications for Description of 'B' Series CMOS Devices"**

### Applications

- **High or Low Level Shifting with Three-State Outputs for Unidirectional or Bidirectional Bussing**
- **Isolation of Logic Subsystems Using Separate Power Supplies from Supply Sequencing, Supply Loss and Supply Regulation Considerations**

### Description

CD40109BMS contains four low-to-high voltage level shifting circuits. Each circuit will shift a low voltage digital logic input signal (A, B, C, D) with logical 1 = VCC and logical 0 = VSS to a higher voltage output signal (E, F, G, H) with logical 1 = VDD and logical 0 = VSS.

The CD40109BMS, unlike other low-to-high level shifting circuits, does not require the presence of the high voltage supply (VDD) before the application of either the low voltage supply (VCC) or the input signals. There are no restrictions on the sequence of application of VDD, VCC, or the input signals. In addition, with one exception there are no restrictions on the relative magnitudes of the supply voltages or input signals within the device maximum ratings, provided that the input signal swings between VSS and at least 0.7VCC; VCC may exceed VDD, and input signals may exceed VCC and VDD. When operated in the mode VCC > VDD, the CD40109BMS will operate as a high-to-low level shifter.

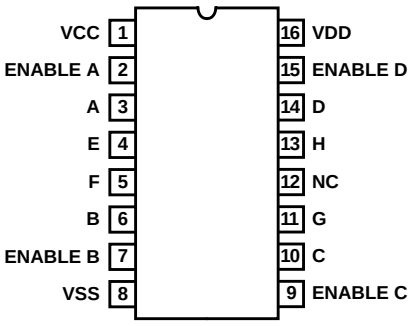
The CD40109BMS also features individual three-state output capability. A low level on any of the separately enabled three-state output controls produces a high impedance state in the corresponding output.

The CD40109BMS is supplied in these 16-lead outline packages:

| | |
|---|---|
| Braze Seal DIP | H4T |
| Frit Seal DIP | H1E |
| Ceramic Flatpack | H6W |

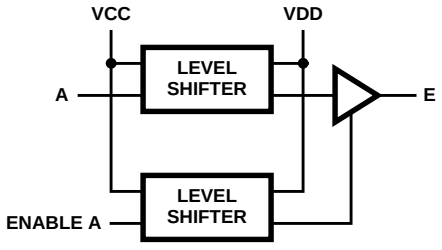
### Pinout

**CD40109BMS**
TOP VIEW




### Functional Diagram

**1 OF 4 UNITS**



## Absolute Maximum Ratings

DC Supply Voltage Range, (VDD) . . . . . -0.5V to +20V
(Voltage Referenced to VSS Terminals)
Input Voltage Range, All Inputs . . . . . -0.5V to VDD +0.5V
DC Input Current, Any One Input . . . . . ±10mA
Operating Temperature Range . . . . . -55°C to +125°C
Package Types D, F, K, H
Storage Temperature Range (TSTG) . . . . . -65°C to +150°C
Lead Temperature (During Soldering) . . . . . +265°C
At Distance 1/16 ± 1/32 Inch (1.59mm ± 0.79mm) from case for 10s Maximum

## Reliability Information

| Thermal Resistance | $\theta_{ja}$ | $\theta_{jc}$ |
|---|---|---|
| Ceramic DIP and FRIT Package | 80°C/W | 20°C/W |
| Flatpack Package | 70°C/W | 20°C/W |

Maximum Package Power Dissipation (PD) at +125°C
For $T_A$ = -55°C to +100°C (Package Type D, F, K) . . . . . 500mW
For $T_A$ = +100°C to +125°C (Package Type D, F, K) . . . . . Derate Linearity at 12mW/°C to 200mW
Device Dissipation per Output Transistor . . . . . 100mW
For $T_A$ = Full Package Temperature Range (All Package Types)
Junction Temperature . . . . . +175°C

**TABLE 1. DC ELECTRICAL PERFORMANCE CHARACTERISTICS**

| PARAMETER | SYMBOL | CONDITIONS (NOTE 1) | | GROUP A SUBGROUPS | TEMPERATURE | LIMITS MIN | LIMITS MAX | UNITS |
|---|---|---|---|---|---|---|---|---|
| Supply Current | IDD | VDD = 20V, VIN = VDD or GND | | 1 | +25°C | - | 2 | µA |
| | | | | 2 | +125°C | - | 200 | µA |
| | | VDD = 18V, VIN = VDD or GND | | 3 | -55°C | - | 2 | µA |
| Input Leakage Current | IIL | VIN = VDD or GND | VDD = 20 | 1 | +25°C | -100 | - | nA |
| | | | | 2 | +125°C | -1000 | - | nA |
| | | | VDD = 18V | 3 | -55°C | -100 | - | nA |
| Input Leakage Current | IIH | VIN = VDD or GND | VDD = 20 | 1 | +25°C | - | 100 | nA |
| | | | | 2 | +125°C | - | 1000 | nA |
| | | | VDD = 18V | 3 | -55°C | - | 100 | nA |
| Output Voltage | VOL15 | VDD = 15V, No Load | | 1, 2, 3 | +25°C, +125°C, -55°C | - | 50 | mV |
| Output Voltage | VOH15 | VDD = 15V, No Load (Note 3) | | 1, 2, 3 | +25°C, +125°C, -55°C | 14.95 | - | V |
| Output Current (Sink) | IOL5 | VDD = 5V, VOUT = 0.4V | | 1 | +25°C | 0.53 | - | mA |
| Output Current (Sink) | IOL10 | VDD = 10V, VOUT = 0.5V | | 1 | +25°C | 1.4 | - | mA |
| Output Current (Sink) | IOL15 | VDD = 15V, VOUT = 1.5V | | 1 | +25°C | 3.5 | - | mA |
| Output Current (Source) | IOH5A | VDD = 5V, VOUT = 4.6V | | 1 | +25°C | - | -0.53 | mA |
| Output Current (Source) | IOH5B | VDD = 5V, VOUT = 2.5V | | 1 | +25°C | - | -1.8 | mA |
| Output Current (Source) | IOH10 | VDD = 10V, VOUT = 9.5V | | 1 | +25°C | - | -1.4 | mA |
| Output Current (Source) | IOH15 | VDD = 15V, VOUT = 13.5V | | 1 | +25°C | - | -3.5 | mA |
| N Threshold Voltage | VNTH | VDD = 10V, ISS = -10µA | | 1 | +25°C | -2.8 | -0.7 | V |
| P Threshold Voltage | VPTH | VSS = 0V, IDD = 10µA | | 1 | +25°C | 0.7 | 2.8 | V |
| Functional | F | VDD = 2.8V, VIN = VDD or GND | | 7 | +25°C | VOH > VDD/2 | VOL < VDD/2 | V |
| | | VDD = 20V, VIN = VDD or GND | | 7 | +25°C | | | |
| | | VDD = 18V, VIN = VDD or GND | | 8A | +125°C | | | |
| | | VDD = 3V, VIN = VDD or GND | | 8B | -55°C | | | |
| Input Voltage Low (Note 2) | VIL | VDD = 10V, VOH > 9V, VOL < 1V VCC = 5V | | 1, 2, 3 | +25°C, +125°C, -55°C | - | 1.5 | V |
| Input Voltage High (Note 2) | VIH | VDD = 10V, VOH > 9V, VOL < 1V VCC = 5V | | 1, 2, 3 | +25°C, +125°C, -55°C | 3.5 | - | V |
| Input Voltage Low (Note 2) | VIL | VDD = 15V, VOH > 13.5V, VOL < 1.5V, VCC = 10V | | 1, 2, 3 | +25°C, +125°C, -55°C | - | 3 | V |
| Input Voltage High (Note 2) | VIH | VDD = 15V, VOH > 13.5V, VOL < 1.5V, VCC = 10V | | 1, 2, 3 | +25°C, +125°C, -55°C | 7 | - | V |
| Tri-State Output Leakage | IOZL | VIN = VDD or GND VOUT = 0V | VDD = 20V | 1 | +25°C | -0.4 | - | µA |
| | | | | 2 | +125°C | -12 | - | µA |
| | | | VDD = 18V | 3 | -55°C | -0.4 | - | µA |
| Tri-State Output Leakage | IOZH | VIN = VDD or GND VOUT = VDD | VDD = 20V | 1 | +25°C | - | 0.4 | µA |
| | | | | 2 | +125°C | - | 12 | µA |
| | | | VDD = 18V | 3 | -55°C | - | 0.4 | µA |

NOTES: 1. All voltages referenced to device GND, 100% testing being implemented.
2. Go/No Go test with limits applied to inputs.
3. For accuracy, voltage is measured differentially to VDD. Limit is 0.050V max.

**TABLE 2. AC ELECTRICAL PERFORMANCE CHARACTERISTICS**

| PARAMETER | SYMBOL | CONDITIONS | GROUP A SUBGROUPS | TEMPERATURE | LIMITS MIN | LIMITS MAX | UNITS |
|---|---|---|---|---|---|---|---|
| Propagation Delay Data In to Out Shift Mode L-H | TPHL1 | VDD = 10V, VIN = VCC or GND VCC = 5V (Notes 1, 2) | 9 | +25°C | - | 600 | ns |
| | | | 10, 11 | +125°C, -55°C | - | 810 | ns |
| Propagation Delay Data In to Out Shift Mode L-H | TPLH1 | VDD = 10V, VIN = VCC or GND VCC = 5V (Notes 1, 2) | 9 | +25°C | - | 260 | ns |
| | | | 10, 11 | +125°C, -55°C | - | 351 | ns |
| Propagation Delay Data In to Out Shift Mode H-L | TPHL2 | VDD = 5V, VIN = VCC or GND VCC = 10V (Notes 1, 2) | 9 | +25°C | - | 500 | ns |
| | | | 10, 11 | +125°C, -55°C | - | 675 | ns |
| Propagation Delay Data In to Out Shift Mode H-L | TPLH2 | VDD = 5V, VIN = VCC or GND VCC = 10V (Notes 1, 2) | 9 | +25°C | - | 460 | ns |
| | | | 10, 11 | +125°C, -55°C | - | 621 | ns |
| Transition Time Shift Mode L-H | TTHL1 TTLH1 | VDD = 10V, VIN = VDD or GND VCC = 5V (Notes 1, 2) | 9 | +25°C | - | 100 | ns |
| | | | 10, 11 | +125°C, -55°C | - | 135 | ns |
| Transition Time Shift Mode H-L | TTHL2 TTLH2 | VDD = 5V, VIN = VDD or GND VCC = 10V (Notes 1, 2) | 9 | +25°C | - | 200 | ns |
| | | | 10, 11 | +125°C, -55°C | - | 270 | ns |
| Propagation Delay 3-State Shift Mode L-H | TPHZ1 | VDD = 10V, VIN = VCC or GND VCC = 5V (Notes 2, 3) | 9 | +25°C | - | 120 | ns |
| | | | 10, 11 | +125°C, -55°C | - | 162 | ns |
| Propagation Delay 3-State Shift Mode H-L | TPHZ2 | VDD = 5V, VIN = VCC or GND VCC = 10V (Notes 2, 3) | 9 | +25°C | - | 400 | ns |
| | | | 10, 11 | +125°C, -55°C | - | 540 | ns |
| Propagation Delay 3-State Shift Mode L-H | TPLZ1 | VDD = 10V, VIN = VCC or GND VCC = 5V (Notes 2, 3) | 9 | +25°C | - | 740 | ns |
| | | | 10, 11 | +125°C, -55°C | - | 999 | ns |
| Propagation Delay 3-State Shift Mode H-L | TPLZ2 | VDD = 5V, VIN = VCC or GND VCC = 10V (Notes 2, 3) | 9 | +25°C | - | 500 | ns |
| | | | 10, 11 | +125°C, -55°C | - | 675 | ns |
| Propagation Delay 3-State Shift Mode L-H | TPZH1 | VDD = 10V, VIN = VCC or GND VCC = 5V (Notes 2, 3) | 9 | +25°C | - | 640 | ns |
| | | | 10, 11 | +125°C, -55°C | - | 864 | ns |
| Propagation Delay 3-State Shift Mode H-L | TPZH2 | VDD = 5V, VIN = VCC or GND VCC = 10V (Notes 2, 3) | 9 | +25°C | - | 600 | ns |
| | | | 10, 11 | +125°C, -55°C | - | 810 | ns |
| Propagation Delay 3-State Shift Mode L-H | TPZL1 | VDD = 10V, VIN = VCC or GND VCC = 5V (Notes 2, 3) | 9 | +25°C | - | 200 | ns |
| | | | 10, 11 | +125°C, -55°C | - | 270 | ns |
| Propagation Delay 3-State Shift Mode H-L | TPZL2 | VDD = 5V, VIN = VCC or GND VCC = 10V (Notes 2, 3) | 9 | +25°C | - | 400 | ns |
| | | | 10, 11 | +125°C, -55°C | - | 540 | ns |

NOTES:

1. CL = 50pF, RL = 200K, Input TR, TF < 20ns.
2. -55°C and +125°C limits guaranteed, 100% testing being implemented.
3. CL = 50pF, RL = 1K, Input TR, TF < 20ns.

**TABLE 3. ELECTRICAL PERFORMANCE CHARACTERISTICS**

| PARAMETER | SYMBOL | CONDITIONS | NOTES | TEMPERATURE | LIMITS MIN | LIMITS MAX | UNITS |
|---|---|---|---|---|---|---|---|
| Supply Current | IDD | VDD = 5V, VIN = VDD or GND | 1, 2 | -55°C, +25°C | - | 1 | µA |
| | | | | +125°C | - | 30 | µA |
| | | VDD = 10V, VIN = VDD or GND | 1, 2 | -55°C, +25°C | - | 2 | µA |
| | | | | +125°C | - | 60 | µA |
| | | VDD = 15V, VIN = VDD or GND | 1, 2 | -55°C, +25°C | - | 2 | µA |
| | | | | +125°C | - | 120 | µA |
| Output Voltage | VOL | VDD = 5V, No Load | 1, 2 | +25°C, +125°C, -55°C | - | 50 | mV |

**TABLE 3. ELECTRICAL PERFORMANCE CHARACTERISTICS (Continued)**

| PARAMETER | SYMBOL | CONDITIONS | NOTES | TEMPERATURE | LIMITS | | UNITS |
|---|---|---|---|---|---|---|---|
| | | | | | MIN | MAX | |
| Output Voltage | VOL | VDD = 10V, No Load | 1, 2 | +25°C, +125°C, -55°C | - | 50 | mV |
| Output Voltage | VOH | VDD = 5V, No Load | 1, 2 | +25°C, +125°C, -55°C | 4.95 | - | V |
| Output Voltage | VOH | VDD = 10V, No Load | 1, 2 | +25°C, +125°C, -55°C | 9.95 | - | V |
| Output Current (Sink) | IOL5 | VDD = 5V, VOUT = 0.4V | 1, 2 | +125°C | 0.36 | - | mA |
| | | | | -55°C | 0.64 | - | mA |
| Output Current (Sink) | IOL10 | VDD = 10V, VOUT = 0.5V | 1, 2 | +125°C | 0.9 | - | mA |
| | | | | -55°C | 1.6 | - | mA |
| Output Current (Sink) | IOL15 | VDD = 15V, VOUT = 1.5V | 1, 2 | +125°C | 2.4 | - | mA |
| | | | | -55°C | 4.2 | - | mA |
| Output Current (Source) | IOH5A | VDD = 5V, VOUT = 4.6V | 1, 2 | +125°C | - | -0.36 | mA |
| | | | | -55°C | - | -0.64 | mA |
| Output Current (Source) | IOH5B | VDD = 5V, VOUT = 2.5V | 1, 2 | +125°C | - | -1.15 | mA |
| | | | | -55°C | - | -2.0 | mA |
| Output Current (Source) | IOH10 | VDD = 10V, VOUT = 9.5V | 1, 2 | +125°C | - | -0.9 | mA |
| | | | | -55°C | - | -1.6 | mA |
| Output Current (Source) | IOH15 | VDD =15V, VOUT = 13.5V | 1, 2 | +125°C | - | -2.4 | mA |
| | | | | -55°C | - | -4.2 | mA |
| Input Voltage Low | VIL | VDD = 10V, VOH > 9V, VOL < 1V VCC = 5V | 1, 2 | +25°C, +125°C, -55°C | - | 1.5 | V |
| Input Voltage High | VIH | VDD = 10V, VOH > 9V, VOL < 1V VCC = 5V | 1, 2 | +25°C, +125°C, -55°C | 3.5 | - | V |
| Propagation Delay Data In to Data Out Shift Mode L-H | TPHL1 | VDD = 15V, VCC = 5V | 1, 2, 3 | +25°C | - | 440 | ns |
| | | VDD = 15V, VCC = 10V | 1, 2, 3 | +25°C | - | 360 | ns |
| Propagation Delay Data In to Out Shift Mode L-H | TPLH1 | VDD = 15V, VCC = 5V | 1, 2, 3 | +25°C | - | 240 | ns |
| | | VDD = 15V, VCC = 10V | 1, 2, 3 | +25°C | - | 140 | ns |
| Propagation Delay Data In to Out Shift Mode H-L | TPHL2 | VDD = 5V, VCC = 15V | 1, 2, 3 | +25°C | - | 500 | ns |
| | | VDD = 10V, VCC = 15V | 1, 2, 3 | +25°C | - | 240 | ns |
| Propagation Delay Data In to Out Shift Mode H-L | TPLH2 | VDD = 5V, VCC = 15V | 1, 2, 3 | +25°C | - | 460 | ns |
| | | VDD = 10V, VCC = 15V | 1, 2, 3 | +25°C | - | 160 | ns |
| Transition Time Shift Mode L-H | TTHL1 TTLH1 | VDD = 15V, VCC = 5V | 1, 2, 3 | +25°C | - | 80 | ns |
| | | VDD = 15V, VCC = 10V | 1, 2, 3 | +25°C | - | 80 | ns |
| Transition Time Shift Mode H-L | TTHL2 TTLH2 | VDD = 5V, VCC = 15V | 1, 2, 3 | +25°C | - | 200 | ns |
| | | VDD = 10V, VCC = 15V | 1, 2, 3 | +25°C | - | 100 | ns |
| Propagation Delay 3-State Shift Mode L-H | TPHZ1 | VDD = 15V, VCC = 5V | 1, 2, 4 | +25°C | - | 150 | ns |
| | | VDD = 15V, VCC = 10V | 1, 2, 4 | +25°C | - | 70 | ns |
| Propagation Delay 3-State Shift Mode H-L | TPHZ2 | VDD = 5V, VCC = 5V | 1, 2, 4 | +25°C | - | 400 | ns |
| | | VDD = 10V, VCC = 15V | 1, 2, 4 | +25°C | - | 80 | ns |
| Propagation Delay 3-State Shift Mode L-H | TPLZ1 | VDD = 15V, VCC = 5V | 1, 2, 4 | +25°C | - | 600 | ns |
| | | VDD = 15V, VCC = 10V | 1, 2, 4 | +25°C | - | 500 | ns |

**TABLE 3. ELECTRICAL PERFORMANCE CHARACTERISTICS (Continued)**

| PARAMETER | SYMBOL | CONDITIONS | NOTES | TEMPERATURE | LIMITS | | UNITS |
|---|---|---|---|---|---|---|---|
| | | | | | MIN | MAX | |
| Propagation Delay 3-State Shift Mode H-L | TPLZ2 | VDD = 5V, VCC = 15V | 1, 2, 4 | +25°C | - | 500 | ns |
| | | VDD = 10V, VCC = 15V | 1, 2, 4 | +25°C | - | 260 | ns |
| Propagation Delay 3-State Shift Mode L-H | TPZH1 | VDD = 15V, VCC = 5V | 1, 2, 4 | +25°C | - | 460 | ns |
| | | VDD = 15V, VCC = 10V | 1, 2, 4 | +25°C | - | 360 | ns |
| Propagation Delay 3-State Shift Mode H-L | TPZH2 | VDD = 5V, VCC = 15V | 1, 2, 4 | +25°C | - | 600 | ns |
| | | VDD = 10V, VCC = 15V | 1, 2, 4 | +25°C | - | 260 | ns |
| Propagation Delay 3-State Shift Mode L-H | TPZL1 | VDD = 15V, VCC = 5V | 1, 2, 4 | +25°C | - | 160 | ns |
| | | VDD = 15V, VCC = 10V | 1, 2, 4 | +25°C | - | 80 | ns |
| Propagation Delay 3-State Shift Mode H-L | TPZL2 | VDD = 5V, VCC = 15V | 1, 2, 4 | +25°C | - | 400 | ns |
| | | VDD = 10V, VCC = 15V | 1, 2, 4 | +25°C | - | 80 | ns |

NOTES:

1. All voltages referenced to device GND.
2. The parameters listed on Table 3 are controlled via design or process and are not directly tested. These parameters are characterized on initial design release and upon design changes which would affect these characteristics.
3. CL = 50pF, RL = 200K, Input TR, TF < 20ns.
4. CL = 50pF, RL = 1K, Input TR, TF < 20ns.

**TABLE 4. POST IRRADIATION ELECTRICAL PERFORMANCE CHARACTERISTICS**

| PARAMETER | SYMBOL | CONDITIONS | NOTES | TEMPERATURE | LIMITS | | UNITS |
|---|---|---|---|---|---|---|---|
| | | | | | MIN | MAX | |
| Supply Current | IDD | VDD = 20V, VIN = VDD or GND | 1, 4 | +25°C | - | 7.5 | µA |
| N Threshold Voltage | VNTH | VDD = 10V, ISS = -10µA | 1, 4 | +25°C | -2.8 | -0.2 | V |
| N Threshold Voltage Delta | ΔVTN | VDD = 10V, ISS = -10µA | 1, 4 | +25°C | - | ±1 | V |
| P Threshold Voltage | VTP | VSS = 0V, IDD = 10µA | 1, 4 | +25°C | 0.2 | 2.8 | V |
| P Threshold Voltage Delta | ΔVTP | VSS = 0V, IDD = 10µA | 1, 4 | +25°C | - | ±1 | V |
| Functional | F | VDD = 18V, VIN = VDD or GND | 1 | +25°C | VOH > VDD/2 | VOL < VDD/2 | V |
| | | VDD = 3V, VIN = VDD or GND | | | | | |
| Propagation Delay Time | TPHL TPLH | VDD = 5V | 1, 2, 3, 4 | +25°C | - | 1.35 x +25°C Limit | ns |

NOTES: 1. All voltages referenced to device GND.
2. CL = 50pF, RL = 200K, Input TR, TF < 20ns.
3. See Table 2 for +25°C limit.
4. Read and Record

**TABLE 5. BURN-IN AND LIFE TEST DELTA PARAMETERS +25°C**

| PARAMETER | SYMBOL | DELTA LIMIT |
|---|---|---|
| Supply Current - MSI-1 | IDD | ± 0.2µA |
| Output Current (Sink) | IOL5 | ± 20% x Pre-Test Reading |
| Output Current (Source) | IOH5A | ± 20% x Pre-Test Reading |

**TABLE 6. APPLICABLE SUBGROUPS**

| CONFORMANCE GROUP | MIL-STD-883 METHOD | GROUP A SUBGROUPS | READ AND RECORD |
|---|---|---|---|
| Initial Test (Pre Burn-In) | 100% 5004 | 1, 7, 9 | IDD, IOL5, IOH5A |

**TABLE 6. APPLICABLE SUBGROUPS**

| CONFORMANCE GROUP | | MIL-STD-883 METHOD | GROUP A SUBGROUPS | READ AND RECORD |
|---|---|---|---|---|
| Interim Test 1 (Post Burn-In) | | 100% 5004 | 1, 7, 9 | IDD, IOL5, IOH5A |
| Interim Test 2 (Post Burn-In) | | 100% 5004 | 1, 7, 9 | IDD, IOL5, IOH5A |
| PDA (Note 1) | | 100% 5004 | 1, 7, 9, Deltas | |
| Interim Test 3 (Post Burn-In) | | 100% 5004 | 1, 7, 9 | IDD, IOL5, IOH5A |
| PDA (Note 1) | | 100% 5004 | 1, 7, 9, Deltas | |
| Final Test | | 100% 5004 | 2, 3, 8A, 8B, 10, 11 | |
| Group A | | Sample 5005 | 1, 2, 3, 7, 8A, 8B, 9, 10, 11 | |
| Group B | Subgroup B-5 | Sample 5005 | 1, 2, 3, 7, 8A, 8B, 9, 10, 11, Deltas | Subgroups 1, 2, 3, 9, 10, 11 |
| | Subgroup B-6 | Sample 5005 | 1, 7, 9 | |
| Group D | | Sample 5005 | 1, 2, 3, 8A, 8B, 9 | Subgroups 1, 2 3 |

NOTE: 1. 5% Parameteric, 3% Functional; Cumulative for Static 1 and 2.

**TABLE 7. TOTAL DOSE IRRADIATION**

| CONFORMANCE GROUPS | MIL-STD-883 METHOD | TEST | | READ AND RECORD | |
|---|---|---|---|---|---|
| | | PRE-IRRAD | POST-IRRAD | PRE-IRRAD | POST-IRRAD |
| Group E Subgroup 2 | 5005 | 1, 7, 9 | Table 4 | 1, 9 | Table 4 |

**TABLE 8. BURN-IN AND IRRADIATION TEST CONNECTIONS**

| FUNCTION | OPEN | GROUND | VDD | 9V ± -0.5V | OSCILLATOR | |
|---|---|---|---|---|---|---|
| | | | | | 50kHz | 25kHz |
| Static Burn-In 1 (Note 1) | 4, 5, 11-13 | 2, 3, 6-10, 14, 15 | 1, 16 | | | |
| Static Burn-In 2 (Note 1) | 4, 5, 11-13 | 8 | 16 | 1-3, 4, 7, 9, 10, 14, 15 | | |
| Dynamic Burn-In (Note 4) | 12 | 8 | 16 | 1, 4, 5, 11, 13 | 3, 6, 10, 14 (Note 3) | 2, 7, 9, 15 (Note 3) |
| Irradiation (Note 2) | 4, 5, 11-13 | 8 | 1-3, 6, 7, 9, 10, 14-16 | | | |

NOTES:

1. Each pin except Pin 1, VDD and GND will have a series resistor of 10K ± 5%, VDD = 18V ± 0.5V
2. Each pin except Pin 1, VDD and GND will have a series resistor of 47K ± 5%; Group E, Subgroup 2, sample size is 4 dice/wafer, 0 failures, VDD = 10V ± 0.5V
3. Pin voltage is VDD/2
4. Each pin except Pin 1, VDD and GND will have a series resistor of 4.75K ±5%, VDD = 18V ±0.5V.

## Logic Diagram

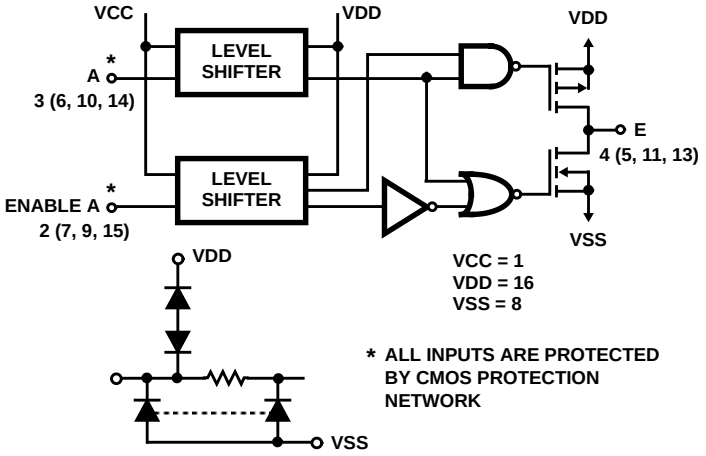



**FIGURE 1. 1 OF 4 UNITS**

**TRUTH TABLE**

| INPUTS | | OUTPUTS |
|---|---|---|
| A, B, C, D | ENABLE A, B, C, D | E, F, G, H |
| 0 | 1 | 0 |
| 1 | 1 | 1 |
| X | 0 | Z |

Logic 0 = Low(VSS)
X = Don't care
Z = High impedance
Logic 1 = VCC at Inputs and VDD at Outputs

## Typical Performance Characteristics

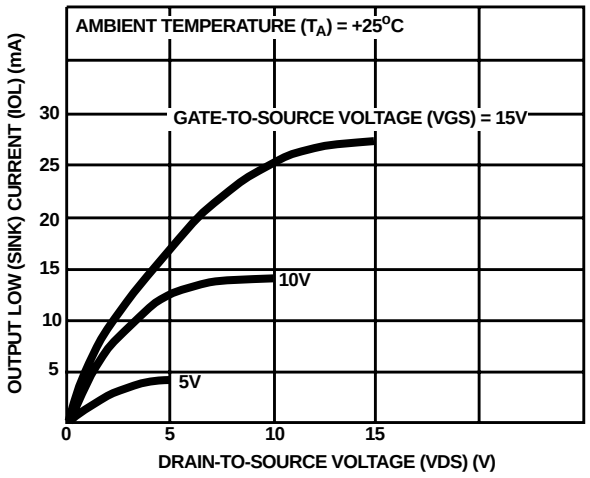



FIGURE 2. TYPICAL OUTPUT LOW (SINK) CURRENT CHARACTERISTICS

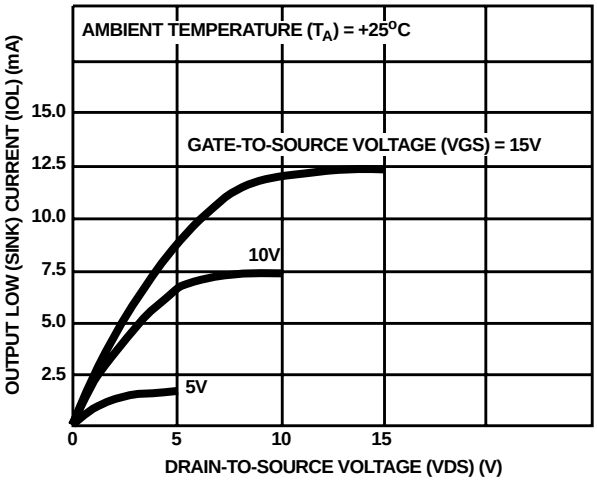



FIGURE 3. MINIMUM OUTPUT LOW (SINK) CURRENT CHARACTERISTICS

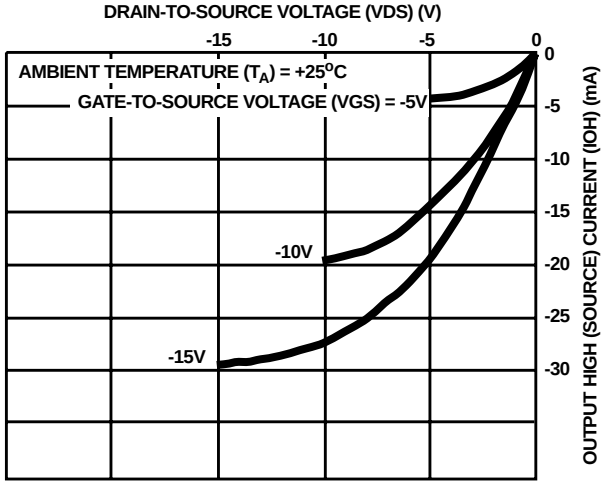



FIGURE 4. TYPICAL OUTPUT HIGH (SOURCE) CURRENT CHARACTERISTICS

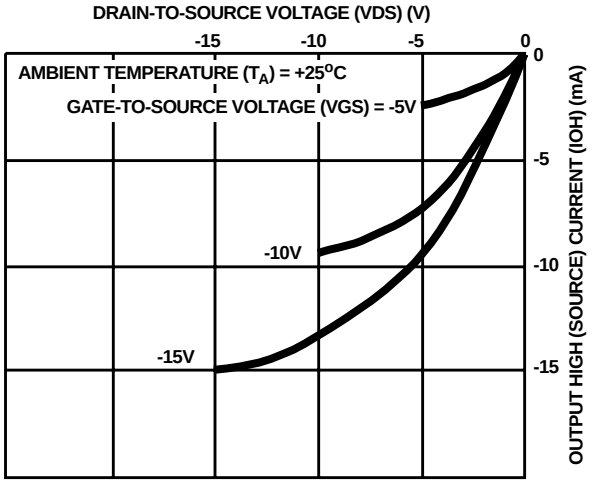



FIGURE 5. MINIMUM OUTPUT HIGH (SOURCE) CURRENT CHARACTERISTICS

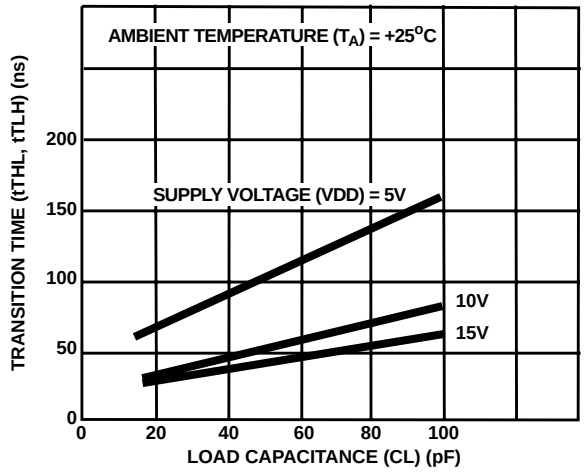



FIGURE 6. TYPICAL TRANSITION TIME AS A FUNCTION OF LOAD CAPACITANCE

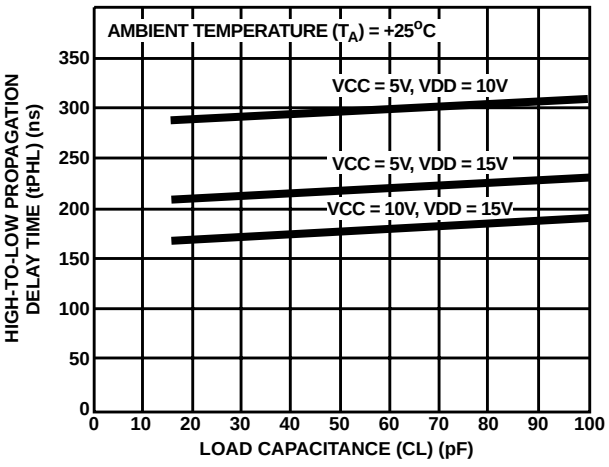



FIGURE 7. TYPICAL HIGH-TO-LOW PROPAGATION DELAY TIME AS A FUNCTION OF LOAD CAPACITANCE

## Typical Performance Characteristics (Continued)

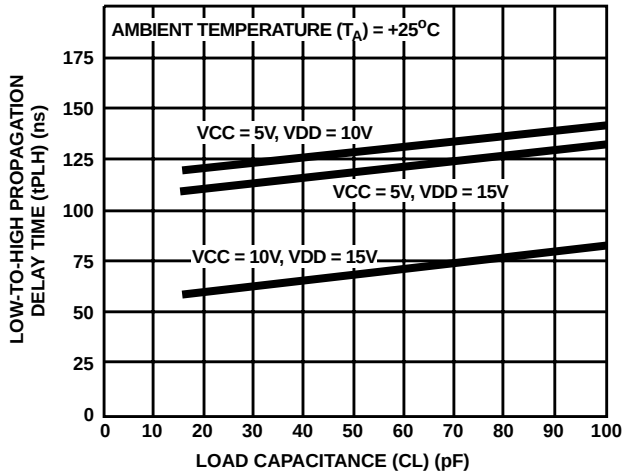



FIGURE 8. TYPICAL LOW-TO-HIGH PROPAGATION DELAY TIME AS A FUNCTION OF LOAD CAPACITANCE

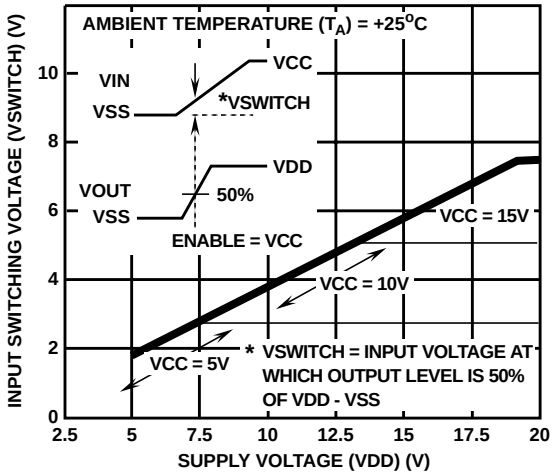



FIGURE 9. TYPICAL INPUT SWITCHING AS A FUNCTION OF HIGH LEVEL SUPPLY VOLTAGE

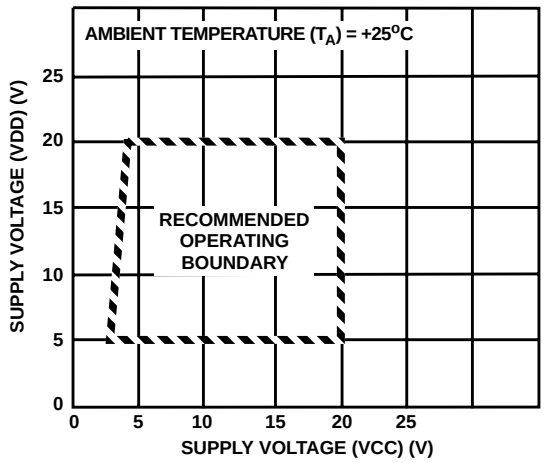



FIGURE 10. HIGH LEVEL SUPPLY VOLTAGE vs LOW LEVEL SUPPLY VOLTAGE

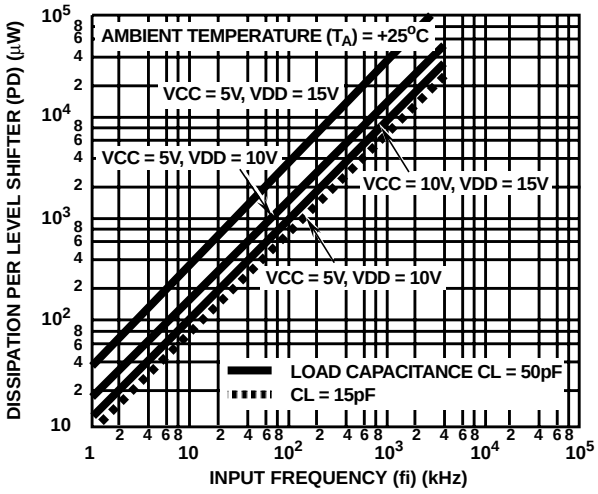
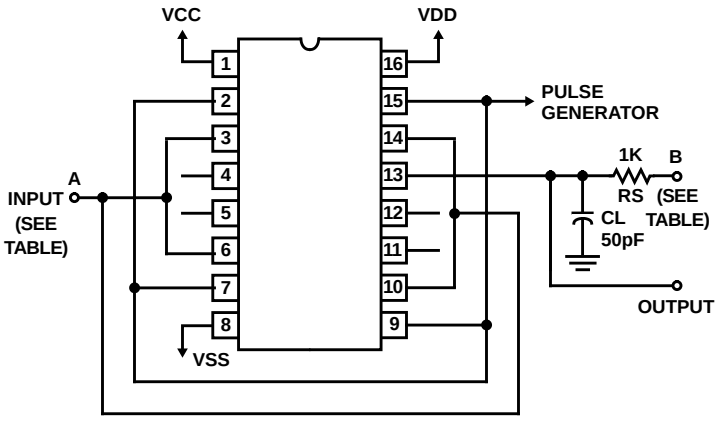



FIGURE 11. TYPICAL DYNAMIC POWER DISSIPATION AS A FUNCTION OF INPUT FREQUENCY

## Test Circuit and Waveform




| CHAR | TEST VOLTAGE AT A | TEST VOLTAGE AT B |
|---|---|---|
| tPHZ | VCC | VSS |
| tPLZ | VSS | VDD |
| tPZL | VSS | VDD |
| tPZH | VCC | VSS |

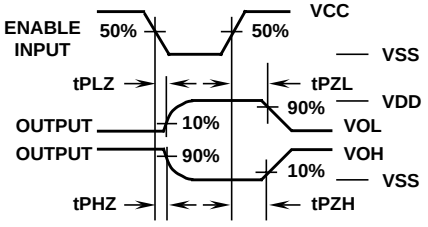
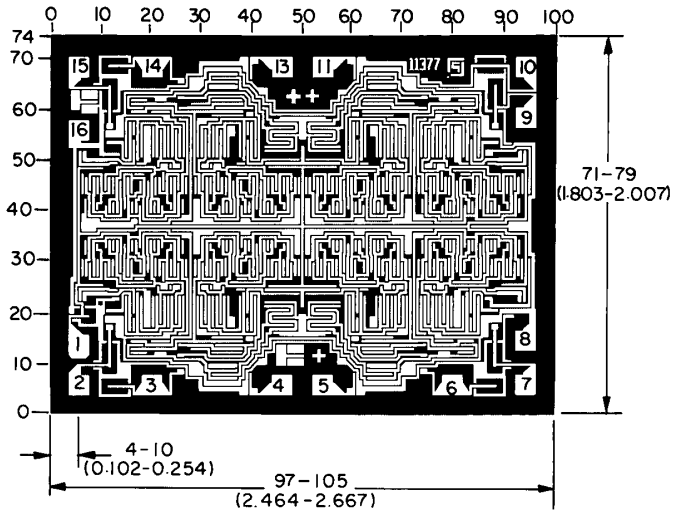



FIGURE 12. OUTPUT ENABLE DELAY TIMES TEST CIRCUIT AND WAVEFORMS

## Chip Dimensions and Pad Layout




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

**METALLIZATION:** Thickness: 11kÅ – 14kÅ, AL.

**PASSIVATION:** 10.4kÅ - 15.6kÅ, Silane

**BOND PADS:** 0.004 inches X 0.004 inches MIN

**DIE THICKNESS:** 0.0198 inches - 0.0218 inches



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