

Features

- High Voltage Types (20V Rating)
- Quad NOR R/S Latch- CD4043BMS
- Quad NAND R/S Latch - CD4044BMS
- 3 State Outputs with Common Output ENABLE
- Separate SET and RESET Inputs for Each Latch
- NOR and NAND Configuration
- 5V, 10V and 15V Parametric Ratings
- Standardized Symmetrical Output Characteristics
- 100% Tested for Quiescent Current at 20V
- Maximum Input Current of 1 μ A at 18V Over Full Package-Temperature Range;
 - 100nA at 18V and 25 $^{\circ}$ C
- Noise Margin (Over Full Package Temperature Range):
 - 1V at VDD = 5V
 - 2V at VDD = 10V
 - 2.5V at VDD = 15V
- Meets All Requirements of JEDEC Tentative Standard No. 13B, "Standard Specifications for Description of 'B' Series CMOS Devices"

Applications

- Holding Register in Multi-Register System
- Four Bits of Independent Storage with Output ENABLE
- Strobed Register
- General Digital Logic
- CD4043BMS for Positive Logic Systems
- CD4044BMS for Negative Logic Systems

Description

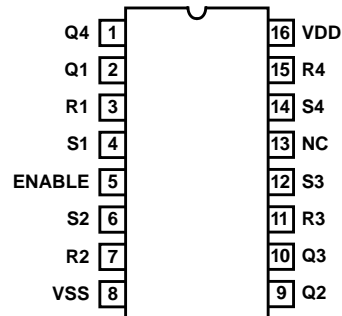
CD4043BMS types are quad cross-coupled 3-state CMOS NOR latches and the CD4044BMS types are quad cross-coupled 3-state CMOS NAND latches. Each latch has a separate Q output and individual SET and RESET inputs. The Q outputs are controlled by a common ENABLE input. A logic "1" or high on the ENABLE input connects the latch states to the Q outputs. A logic "0" or low on the ENABLE input disconnects the latch states from the Q outputs, results in an open circuit feature allows common bussing of the outputs.

The CD4043BMS and CD4044BMS are supplied in these 16-lead outline packages:

| | | |
|------------------|---------------|------|
| Braze Seal DIP | *H4T | †H4T |
| Frit Seal DIP | *H1C | †H1E |
| Ceramic Flatpack | *H3X | †H6W |
| *CD4043B Only | †CD4044B Only | |

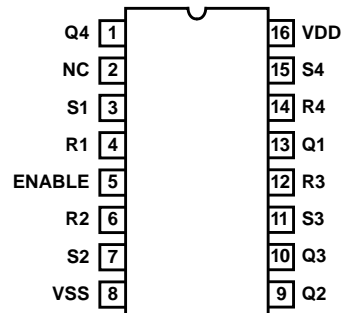
Pinout

CD4043BMS
TOP VIEW



NC = NO CONNECTION

CD4044BMS
TOP VIEW



NC = NO CONNECTION

Specifications CD4043BMS, CD4044BMS

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 θ_{ja} θ_{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 TA = -55°C to +100°C (Package Type D, F, K) 500mW
 For TA = +100°C to +125°C (Package Type D, F, K) Derate
 Linearity at 12mW/°C to 200mW
 Device Dissipation per Output Transistor 100mW
 For TA = 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 | | UNITS |
|-----------------------------|--------|------------------------------------|-----------|----------------------|----------------------|----------------|----------------|-------|
| | | | | | | MIN | MAX | |
| 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 |
| | | | VDD = 18V | 2 | +125°C | -1000 | - | nA |
| | | | | 3 | -55°C | -100 | - | nA |
| Input Leakage Current | IIH | VIN = VDD or GND | VDD = 20 | 1 | +25°C | - | 100 | nA |
| | | | VDD = 18V | 2 | +125°C | - | 1000 | nA |
| | | | | 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 = 5V, VOH > 4.5V, VOL < 0.5V | | 1, 2, 3 | +25°C, +125°C, -55°C | - | 1.5 | V |
| Input Voltage High (Note 2) | VIH | VDD = 5V, VOH > 4.5V, VOL < 0.5V | | 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 | | 1, 2, 3 | +25°C, +125°C, -55°C | - | 4 | V |
| Input Voltage High (Note 2) | VIH | VDD = 15V, VOH > 13.5V, VOL < 1.5V | | 1, 2, 3 | +25°C, +125°C, -55°C | 11 | - | V |
| Tri-State Output Leakage | IOZL | VIN = VDD or GND VOUT = 0V | VDD = 20V | 1 | +25°C | -0.4 | - | μA |
| | | | VDD = 18V | 2 | +125°C | -12 | - | μA |
| | | | | 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 |
| | | | VDD = 18V | 2 | +125°C | - | 12 | μA |
| | | | | 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.

Specifications CD4043BMS, CD4044BMS

TABLE 2. AC ELECTRICAL PERFORMANCE CHARACTERISTICS

| PARAMETER | SYMBOL | CONDITIONS | GROUP A SUBGROUPS | TEMPERATURE | LIMITS | | UNITS |
|--|--------------|--|----------------------|---------------|--------|-----|-------|
| | | | | | MIN | MAX | |
| Propagation Delay Set or Reset to Q | TPHL TPLH | VDD = 5V, VIN = VDD or GND (Notes 1, 2) | 9 | +25°C | - | 300 | ns |
| | | | 10, 11 | +125°C, -55°C | - | 405 | ns |
| Propagation Delay 3 - State Enable to Q | TPHZ TPZH | VDD = 5V, VIN = VDD or GND (Notes 2, 3) | 9 | +25°C | - | 230 | ns |
| | | | 10, 11 | +125°C, -55°C | - | 311 | ns |
| Propagation Delay 3 - State Enable to Q | TPLZ TPZL | VDD = 5V, VIN = VDD or GND (Notes 2, 3) | 9 | +25°C | - | 180 | ns |
| | | | 10, 11 | +125°C, -55°C | - | 243 | ns |
| Transition Time | TTHL TTLH | VDD = 5V, VIN = VDD or GND (Notes 1, 2) | 9 | +25°C | - | 200 | ns |
| | | | 10, 11 | +125°C, -55°C | - | 270 | ns |

NOTES:

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

TABLE 3. ELECTRICAL PERFORMANCE CHARACTERISTICS

| PARAMETER | SYMBOL | CONDITIONS | NOTES | TEMPERATURE | LIMITS | | UNITS |
|-------------------------|--------|-----------------------------|-------|-------------------------|--------|-------|-------|
| | | | | | MIN | MAX | |
| 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 |
| 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 |

Specifications CD4043BMS, CD4044BMS

TABLE 3. ELECTRICAL PERFORMANCE CHARACTERISTICS (Continued)

| PARAMETER | SYMBOL | CONDITIONS | NOTES | TEMPERATURE | LIMITS | | UNITS |
|---------------------------------------|--------------|-------------------------------|---------|----------------------|--------|-----|-------|
| | | | | | MIN | MAX | |
| Input Voltage Low | VIL | VDD = 10V, VOH > 9V, VOL < 1V | 1, 2 | +25°C, +125°C, -55°C | - | 3 | V |
| Input Voltage High | VIH | VDD = 10V, VOH > 9V, VOL < 1V | 1, 2 | +25°C, +125°C, -55°C | 7 | - | V |
| Propagation Delay Set or Reset to Q | TPLH TPHL | VDD = 10V | 1, 2, 3 | +25°C | - | 140 | ns |
| | | VDD = 15V | 1, 2, 3 | +25°C | - | 100 | ns |
| Propagation Delay 3 State Enable to Q | TPHZ TPZH | VDD = 10V | 1, 2, 4 | +25°C | - | 110 | ns |
| | | VDD = 15V | 1, 2, 4 | +25°C | - | 80 | ns |
| Propagation Delay 3 State Enable to Q | TPLZ TPZL | VDD = 10V | 1, 2, 4 | +25°C | - | 100 | ns |
| | | VDD = 15V | 1, 2, 4 | +25°C | - | 70 | ns |
| Transition Time | TTHL TTLH | VDD = 10V | 1, 2, 3 | +25°C | - | 100 | ns |
| | | VDD = 15V | 1, 2, 3 | +25°C | - | 80 | ns |
| Minimum Set or Reset Pulse Width | TW | VDD = 5V | 1, 2, 3 | +25°C | - | 160 | ns |
| | | VDD = 10V | 1, 2, 3 | +25°C | - | 80 | ns |
| | | VDD = 15V | 1, 2, 3 | +25°C | - | 40 | ns |
| Input Capacitance | CIN | Any Input | 1, 2 | +25°C | - | 7.5 | pF |

NOTES:

- All voltages referenced to device GND.
- 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.
- CL = 50pF, RL = 200K, Input TR, TF < 20ns.
- 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 |

Specifications CD4043BMS, CD4044BMS

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 |
| 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% Parametric, 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

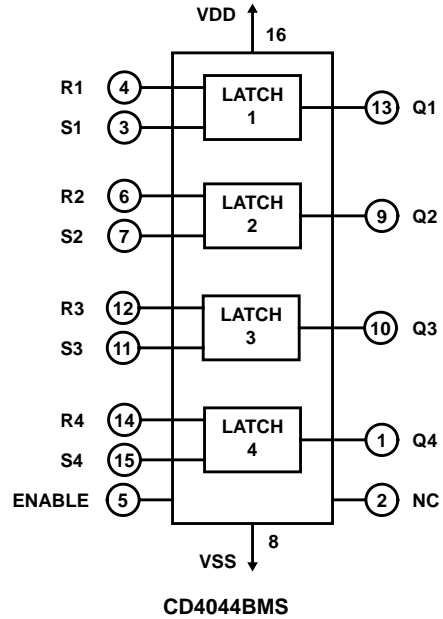
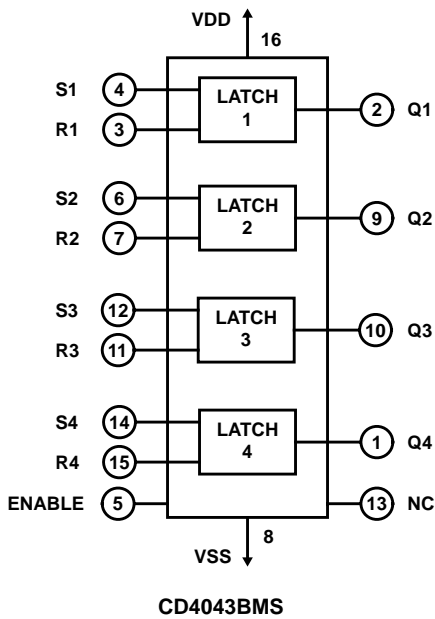
| FUNCTION | OPEN | GROUND | VDD | 9V ± 0.5V | OSCILLATOR | |
|----------------------------|-----------------|--------------------------|---------------------------|--------------|--------------|--------------|
| | | | | | 50kHz | 25kHz |
| PART NUMBER CD4043BMS | | | | | | |
| Static Burn-In 1 Note 1 | 1, 2, 9, 10, 13 | 3 - 8, 11, 12, 14, 15 | 16 | | | |
| Static Burn-In 2 Note 1 | 1, 2, 9, 10, 13 | 8 | 3 - 7, 11, 12, 14 - 16 | | | |
| Dynamic Burn-In Note 1 | 13 | 8 | 5, 16 | 1, 2, 9, 12 | 4, 6, 12, 14 | 3, 7, 11, 15 |
| Irradiation Note 2 | 1, 2, 9, 10, 13 | 8 | 3 - 7, 11, 12, 14 - 16 | | | |
| PART NUMBER CD4044BMS | | | | | | |
| Static Burn-In 1 Note 1 | 1, 2, 9, 10, 13 | 3 - 8, 11, 12, 14, 15 | 16 | | | |
| Static Burn-In 2 Note 1 | 1, 2, 9, 10, 13 | 8 | 3 - 7, 11, 12, 14 - 16 | | | |
| Dynamic Burn-In Note 1 | 2 | 8 | 5, 16 | 1, 9, 10, 13 | 4, 6, 12, 14 | 3, 7, 11, 15 |
| Irradiation Note 2 | 1, 2, 9, 10, 13 | 8 | 3 - 7, 11, 12, 14 - 16 | | | |

NOTE:

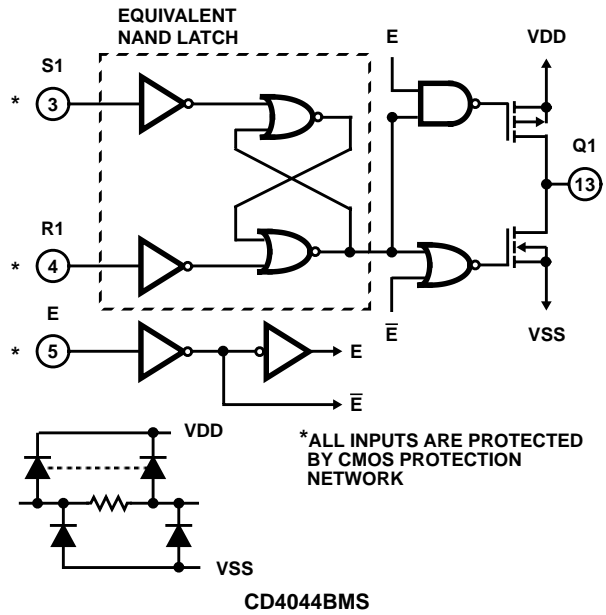
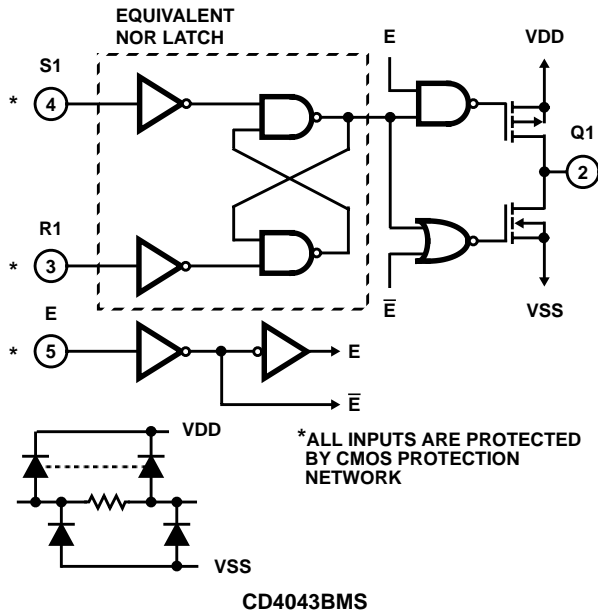
- Each pin except VDD and GND will have a series resistor of 10K ± 5%, VDD = 18V ± 0.5V
- Each pin except VDD and GND will have a series resistor of 47K ± 5%; Group E, Subgroup 2, sample size is 4 dice/wafer, 0 failures, VDD = 10V ± 0.5V

Specifications CD4043BMS, CD4044BMS

Functional Diagram



Logic Diagram



TRUTH TABLE

CD4043BMS

| S | R | E | Q |
|---|---|---|------|
| X | X | O | OC* |
| O | O | 1 | NC** |
| 1 | O | 1 | 1 |
| O | 1 | 1 | O |
| 1 | 1 | 1 | Δ |

* Open Circuit

** No Change

Δ Dominated by S = 1 input

CD4044BMS

| S | R | E | Q |
|---|---|---|------|
| X | X | O | OC* |
| 1 | 1 | 1 | NC** |
| O | 1 | 1 | 1 |
| 1 | O | 1 | O |
| O | O | 1 | ΔΔ |

* Open Circuit

** No Change

ΔΔ Dominated by R = O input

Typical Performance Characteristics

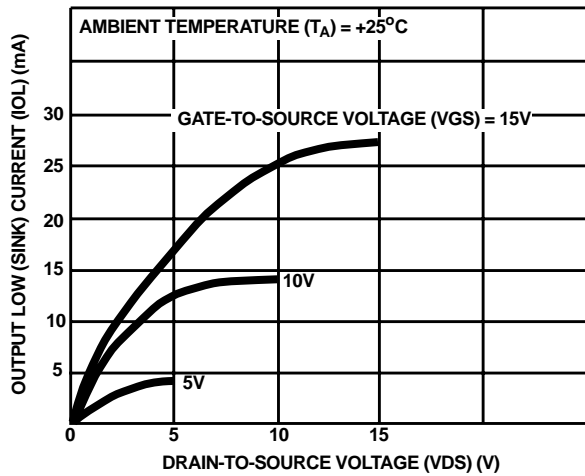


FIGURE 1. TYPICAL OUTPUT LOW (SINK) CURRENT CHARACTERISTICS

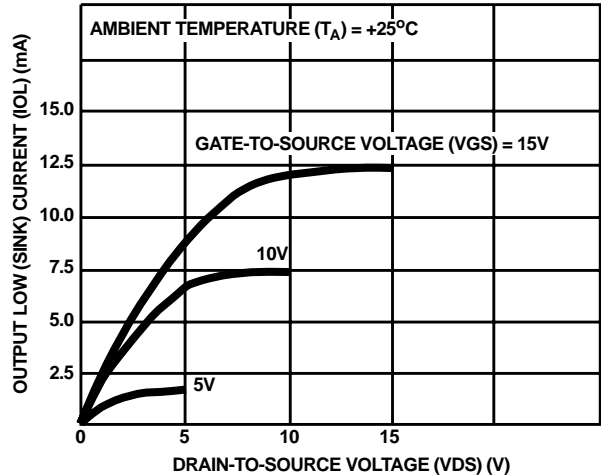


FIGURE 2. MINIMUM OUTPUT LOW (SINK) CURRENT CHARACTERISTICS

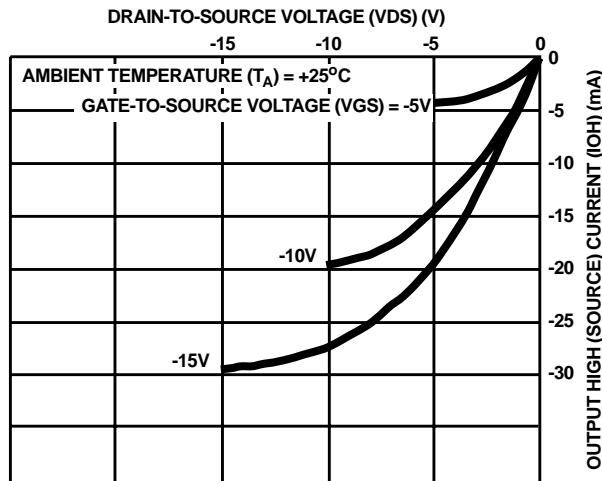


FIGURE 3. TYPICAL OUTPUT HIGH (SOURCE) CURRENT CHARACTERISTICS

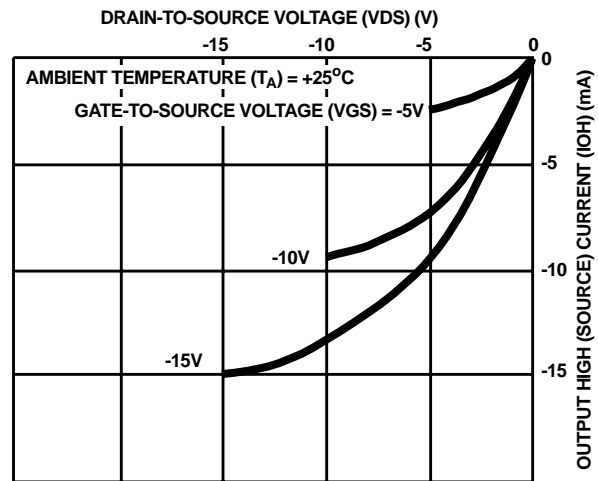


FIGURE 4. MINIMUM OUTPUT HIGH (SOURCE) CURRENT CHARACTERISTICS

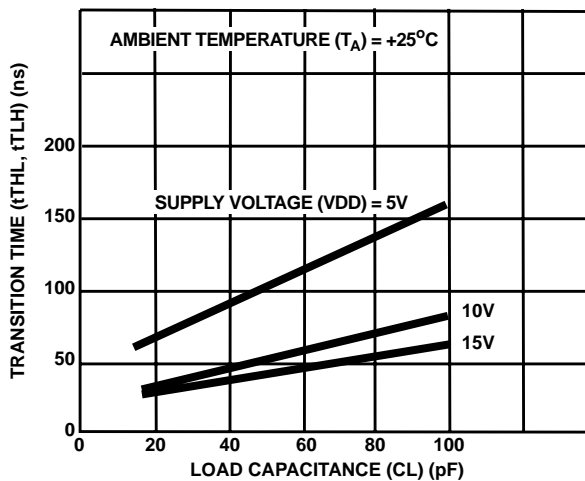


FIGURE 5. TYPICAL TRANSITION TIME AS A FUNCTION OF LOAD CAPACITANCE

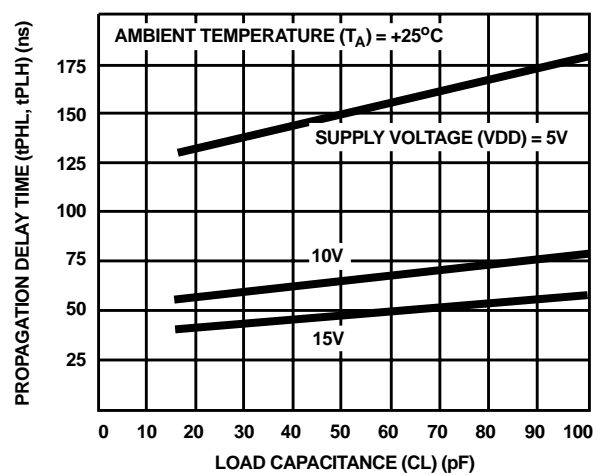


FIGURE 6. TYPICAL PROPAGATION DELAY TIME vs LOAD CAPACITANCE - SET, RESET, to Q, \bar{Q}

CD4043BMS, CD4044BMS

Typical Performance Characteristics (Continued)

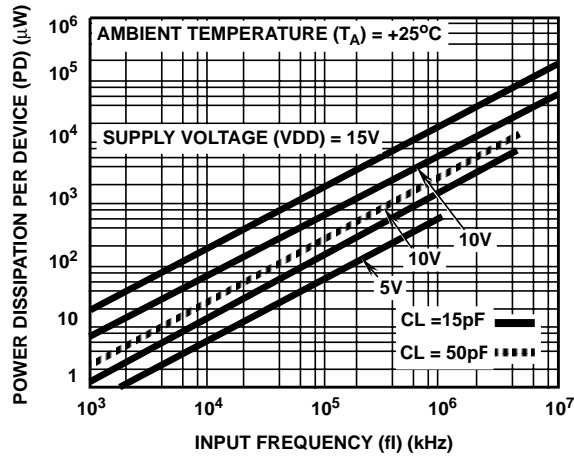


FIGURE 7. TYPICAL POWER DISSIPATION vs FREQUENCY

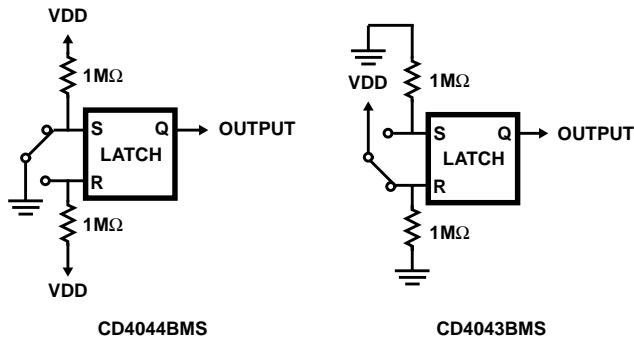


FIGURE 8. SWITCH BOUNCE ELIMINATOR

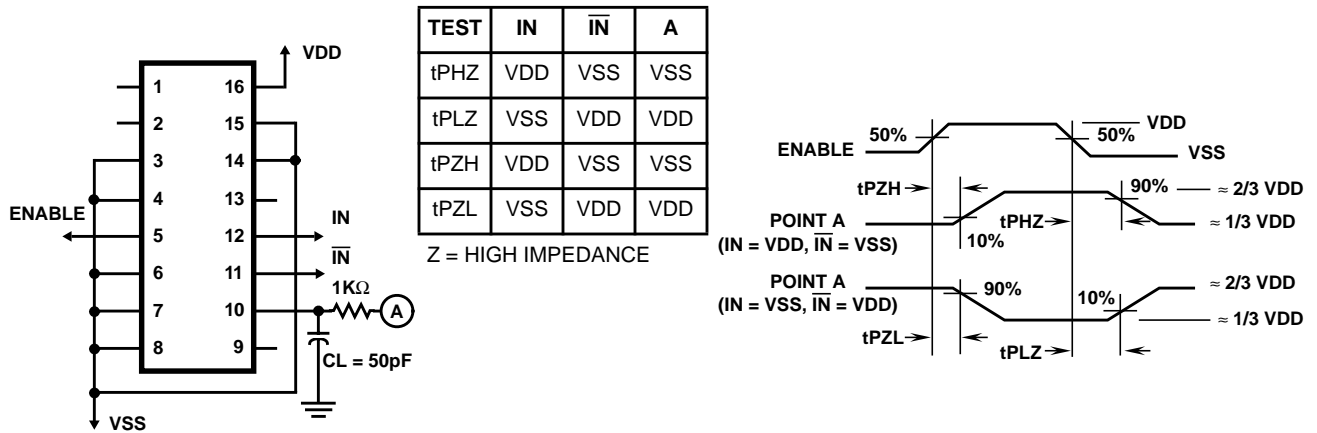


FIGURE 9. ENABLE PROPAGATION DELAY TIME TEST CIRCUIT AND WAVEFORM

CD4043BMS

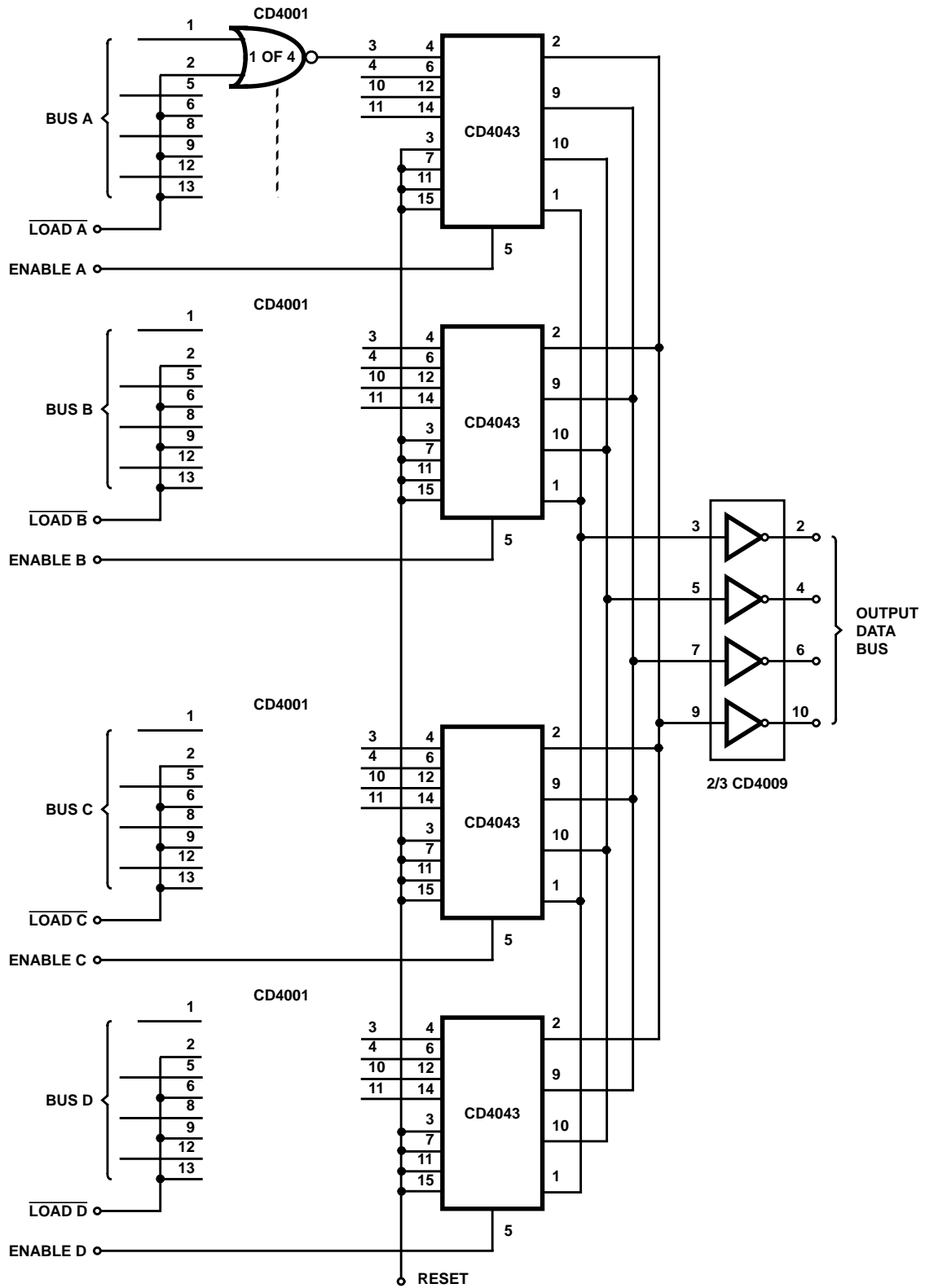
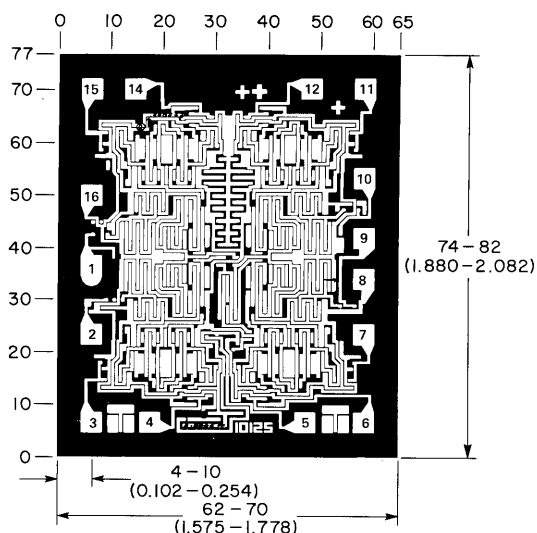


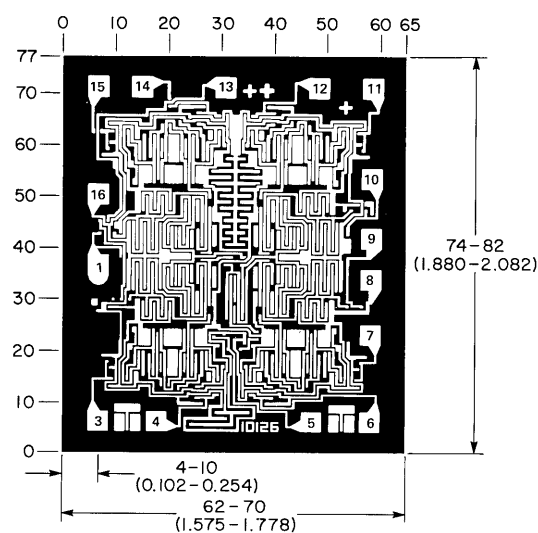
FIGURE 10. MULTIPLE BUS STORAGE

CD4043BMS

Chip Dimensions and Pad Layouts



CD4043BMSH



CD4044BMSH

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

METALLIZATION: Thickness: $11\text{k}\text{\AA} - 14\text{k}\text{\AA}$, AL.

PASSIVATION: $10.4\text{k}\text{\AA} - 15.6\text{k}\text{\AA}$, Silane

BOND PADS: 0.004 inches X 0.004 inches MIN

DIE THICKNESS: 0.0198 inches - 0.0218 inches

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Sales Office Headquarters

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Intersil Corporation
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Melbourne, FL 32902
TEL: (321) 724-7000
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EUROPE

Intersil SA
Mercure Center
100, Rue de la Fusee
1130 Brussels, Belgium
TEL: (32) 2.724.2111
FAX: (32) 2.724.22.05

ASIA

Intersil (Taiwan) Ltd.
Taiwan Limited
7F-6, No. 101 Fu Hsing North Road
Taipei, Taiwan
Republic of China
TEL: (886) 2 2716 9310
FAX: (886) 2 2715 3029

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