

CD4071BMS, CD4072BMS, CD4075BMS

CMOS OR Gate

FN3323
 Rev 0.00
 December 1992

Features

- High-Voltage Types (20V Rating)
- CD4071BMS Quad 2-Input OR Gate
- CD4072BMS Dual 4-Input OR Gate
- CD4075BMS Triple 3-Input OR Gate
- Medium Speed Operation:
 - t_{PHL} , t_{PLH} = 60ns (typ) at 10V
- 100% Tested for Quiescent Current at 20V
- Maximum Input Current of $1\mu A$ at 18V Over Full Package Temperature Range; 100nA at 18V and $+25^{\circ}C$
- Standardized Symmetrical Output Characteristics
- Noise Margin (Over Full Package Temperature Range):
 - 1V at VDD = 5V
 - 2V at VDD = 10V
 - 2.5V at VDD = 15V
- 5V, 10V and 15V Parametric Ratings
- Meets All Requirements of JEDEC Tentative Standard No. 13B, "Standard Specifications for Description of 'B' Series CMOS Devices"

Description

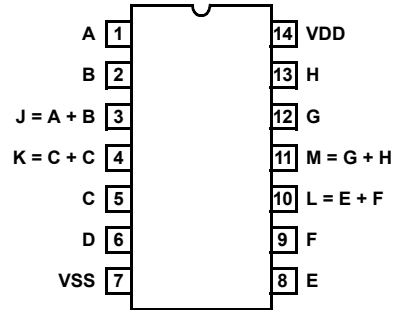
CD4071BMS, CD4072BMS and CD4075BMS OR gates provide the system designer with direct implementation of the positive-logic OR function and supplement the existing family of CMOS gates.

The CD4071BMS, CD4072BMS and CD4075BMS are supplied in these 14 lead outline packages:

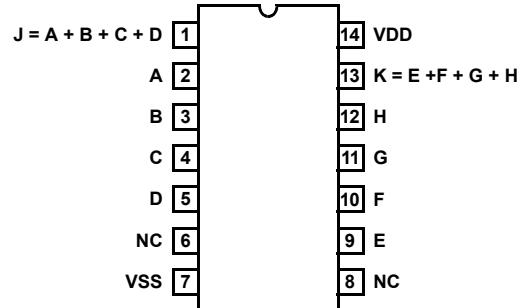
| | | |
|------------------|--------------|------|
| Braze Seal DIP | *H4H | †H4Q |
| Frit Seal DIP | H1B | |
| Ceramic Flatpack | H3W | |
| *CD4071, CD4072 | †CD4075 Only | |

Pinout

CD4071BMS
TOP VIEW

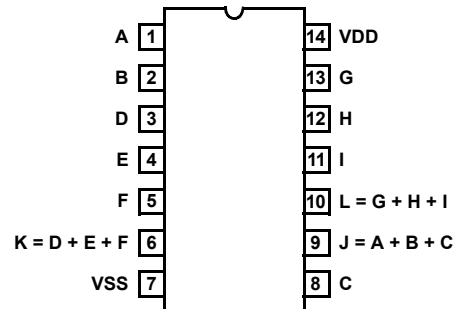


CD4072BMS
TOP VIEW

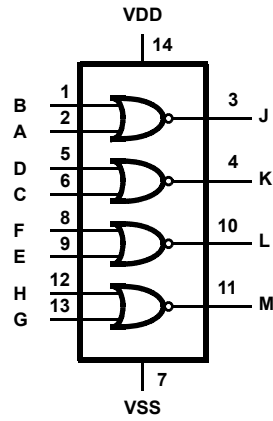


NC = NO CONNECTION

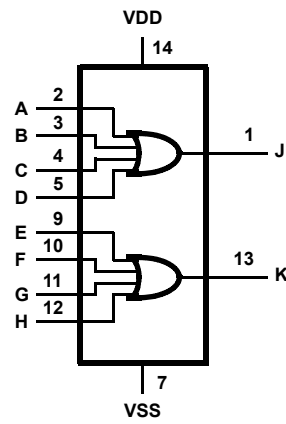
CD4075BMS
TOP VIEW



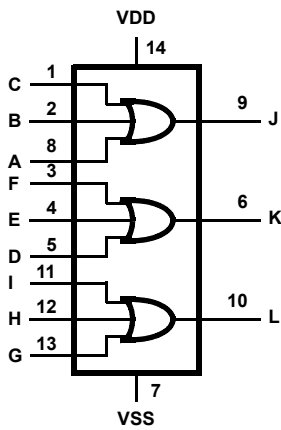
Functional Diagram



CD4071BMS



CD4072BMS



CD4075BMS

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 | - | 0.5 | µA |
| | | | | 2 | +125°C | - | 50 | µA |
| | | VDD = 18V, VIN = VDD or GND | | 3 | -55°C | - | 0.5 | 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 |

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 (NOTES 1, 2) | GROUP A SUBGROUPS | TEMPERATURE | LIMITS | | UNITS |
|-------------------|--------------|----------------------------|-------------------|---------------|--------|-----|-------|
| | | | | | MIN | MAX | |
| Propagation Delay | TPHL TPLH | VDD = 5V, VIN = VDD or GND | 9 | +25°C | - | 250 | ns |
| | | | 10, 11 | +125°C, -55°C | - | 338 | ns |
| Transition Time | TTHL TTLH | VDD = 5V, VIN = VDD or GND | 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.

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 | - | 0.25 | μA |
| | | | | +125°C | - | 7.5 | μA |
| | | VDD = 10V, VIN = VDD or GND | 1, 2 | -55°C, +25°C | - | 0.5 | μA |
| | | | | +125°C | - | 15 | μA |
| | | VDD = 15V, VIN = VDD or GND | 1, 2 | -55°C, +25°C | - | 0.5 | μA |
| | | | | +125°C | - | 30 | 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 | - | -2.6 | 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 | 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 | TPHL TPLH | VDD = 10V | 1, 2, 3 | +25°C | - | 120 | ns |
| | | VDD = 15V | 1, 2, 3 | +25°C | - | 90 | ns |

TABLE 3. ELECTRICAL PERFORMANCE CHARACTERISTICS (Continued)

| PARAMETER | SYMBOL | CONDITIONS | NOTES | TEMPERATURE | LIMITS | | UNITS |
|-------------------|--------|------------|---------|-------------|--------|-----|-------|
| | | | | | MIN | MAX | |
| Transition Time | TTHL | VDD = 10V | 1, 2, 3 | +25°C | - | 100 | ns |
| | TTLH | VDD = 15V | 1, 2, 3 | +25°C | - | 80 | ns |
| Input Capacitance | CIN | Any Input | 1, 2 | +25°C | - | 7.5 | pF |

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.

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 | - | 2.5 | 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 - SSI | IDD | ±0.1μA |
| 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 |
| 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 | |

TABLE 6. APPLICABLE SUBGROUPS (Continued)

| CONFORMANCE GROUP | | MIL-STD-883 METHOD | GROUP A SUBGROUPS | READ AND RECORD |
|-------------------|--------------|--------------------|---------------------------------------|------------------------------|
| 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 CD4071BMS | | | | | | |
| Static Burn-In 1 Note 1 | 3, 4, 10, 11 | 1, 2, 5 - 9, 12 - 13 | 14 | | | |
| Static Burn-In 2 Note 1 | 3, 4, 10, 11 | 7 | 1, 2, 5, 6, 8, 9, 12 - 14 | | | |
| Dynamic Burn-In Note 1 | - | 7 | 14 | 3, 4, 10, 11 | 1, 2, 5, 6, 8, 9, 12, 13 | |
| Irradiation Note 2 | 3, 4, 10, 11 | 7 | 1, 2, 5, 6, 8, 9, 12 - 14 | | | |
| PART NUMBER CD4072BMS | | | | | | |
| Static Burn-In 1 Note 1 | 1, 6, 8, 13 | 2 - 5, 7, 9 - 12 | 14 | | | |
| Static Burn-In 2 Note 1 | 1, 6, 8, 13 | 7 | 2 - 5, 9 - 12, 14 | | | |
| Dynamic Burn-In Note 1 | 6, 8 | 7 | 14 | 1, 13 | 2 - 5, 9 - 12 | |
| Irradiation Note 2 | 1, 6, 8, 13 | 7 | 2 - 5, 9 - 12, 14 | | | |
| PART NUMBER CD4075BMS | | | | | | |
| Static Burn-In 1 Note 1 | 6, 9, 10 | 1 - 5, 7, 8, 11 - 13 | 14 | | | |
| Static Burn-In 2 Note 1 | 6, 9, 10 | 7 | 1 - 5, 8, 11 - 14 | | | |
| Dynamic Burn-In Note 1 | - | 7 | 14 | 6, 9, 10 | 1 - 5, 8, 11 - 13 | |
| Irradiation Note 2 | 6, 9, 10 | 7 | 1 - 5, 8, 11 - 14 | | | |

NOTE:

1. Each pin except VDD and GND will have a series resistor of 10K ± 5%, VDD = 18V ± 0.5V
2. 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

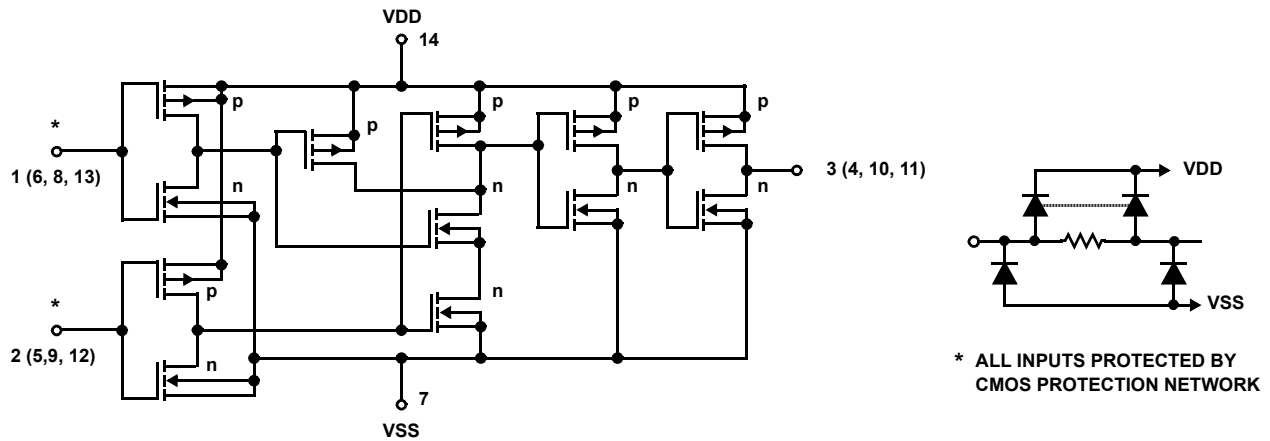


FIGURE 1. SCHEMATIC DIAGRAM FOR CD4071BMS (1 OF 4 IDENTICAL GATES)

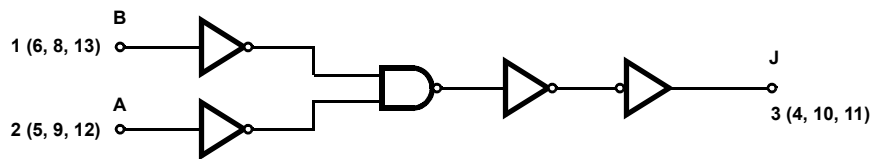


FIGURE 2. LOGIC DIAGRAM FOR CD4071BMS (1 OF 4 IDENTICAL GATES)

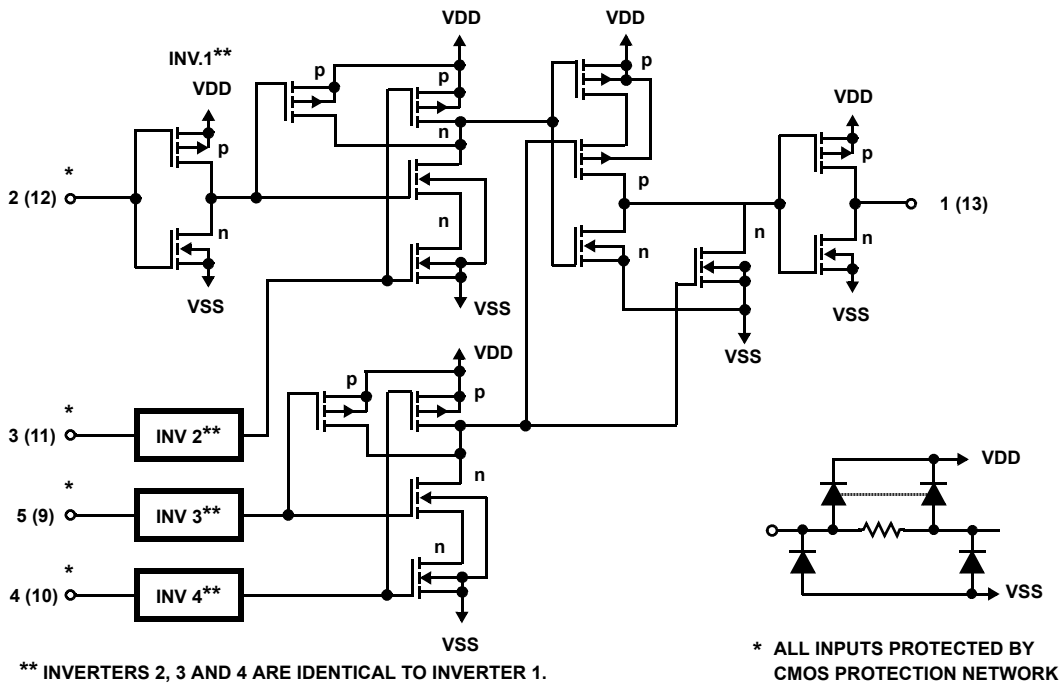


FIGURE 3. SCHEMATIC DIAGRAM FOR CD4072BMS (1 OF 2 IDENTICAL GATES)

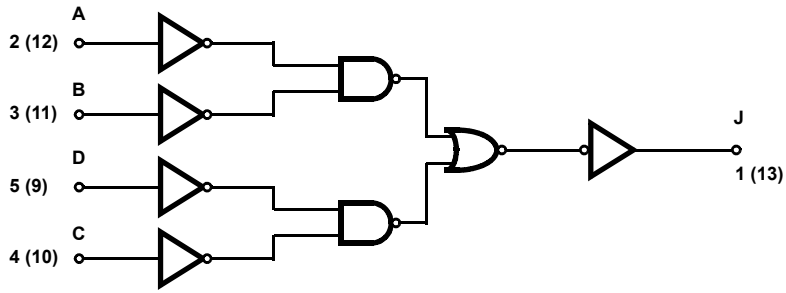


FIGURE 4. LOGIC DIAGRAM FOR CD4072BMS (1 OF 2 IDENTICAL GATES)

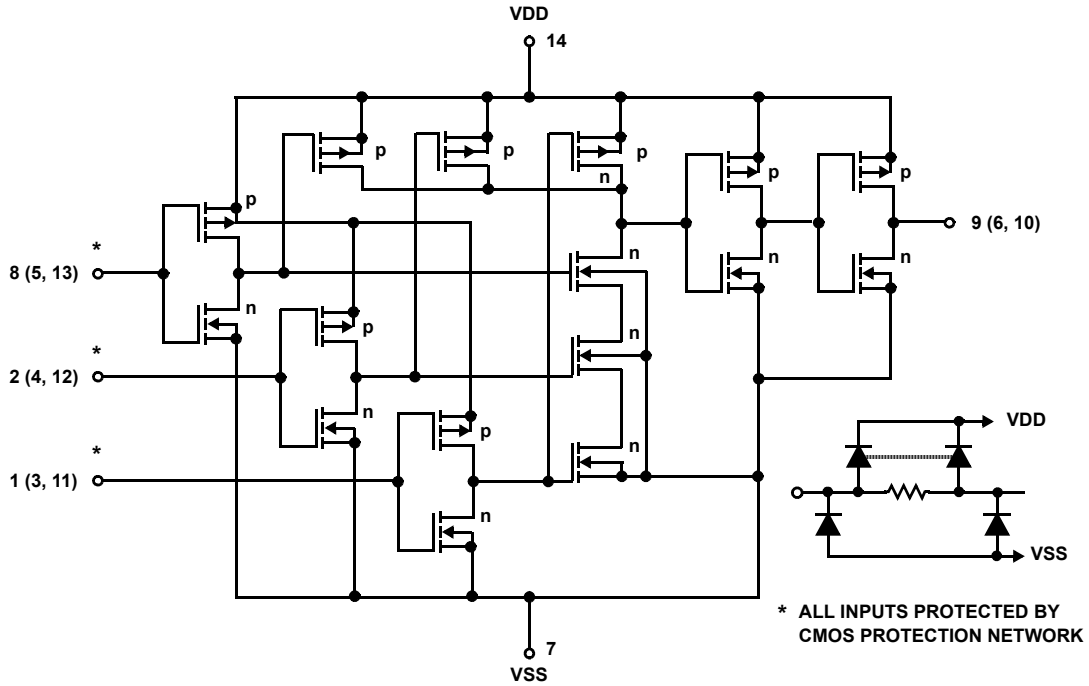


FIGURE 5. SCHEMATIC DIAGRAM FOR CD4075BMS (1 OF 3 IDENTICAL GATES)

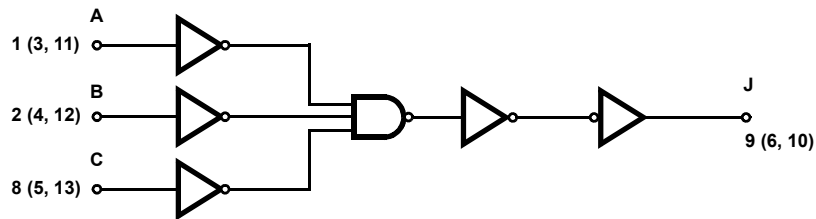


FIGURE 6. LOGIC DIAGRAM FOR CD4075BMS (1 OF 3 IDENTICAL GATES)

Typical Performance Characteristics

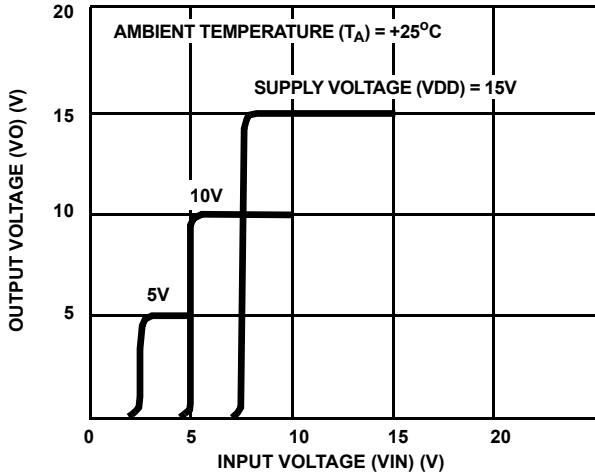


FIGURE 7. TYPICAL VOLTAGE TRANSFER CHARACTERISTICS

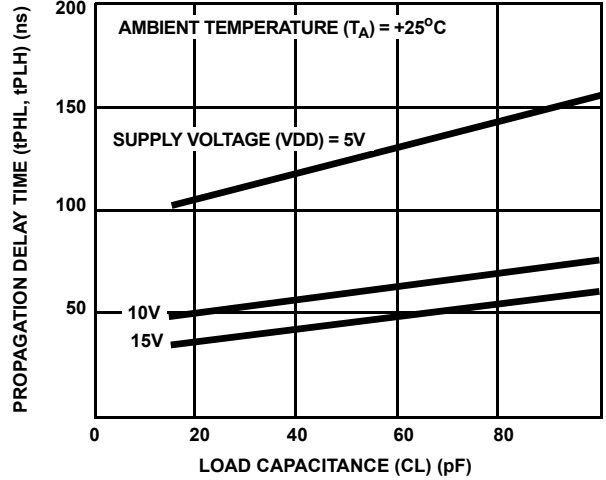


FIGURE 8. TYPICAL PROPAGATION DELAY TIME AS A FUNCTION OF LOAD CAPACITANCE

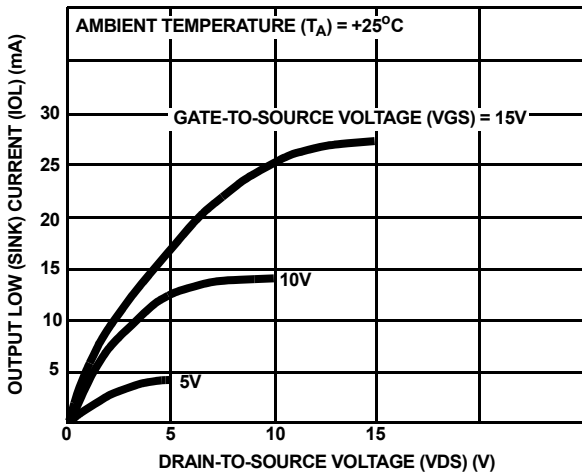


FIGURE 9. TYPICAL OUTPUT LOW (SINK) CURRENT CHARACTERISTICS

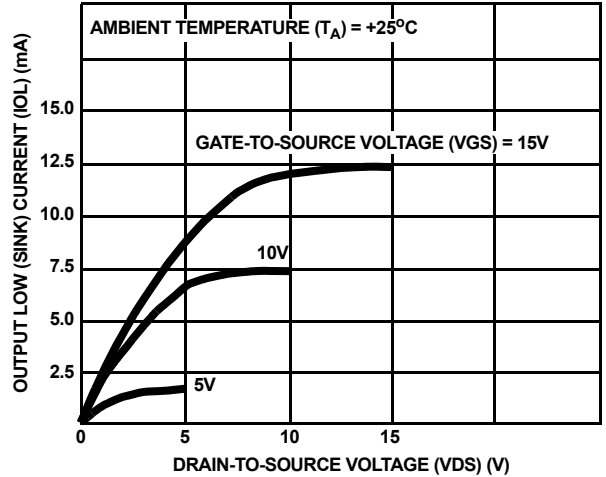


FIGURE 10. MINIMUM OUTPUT LOW (SINK) CURRENT CHARACTERISTICS

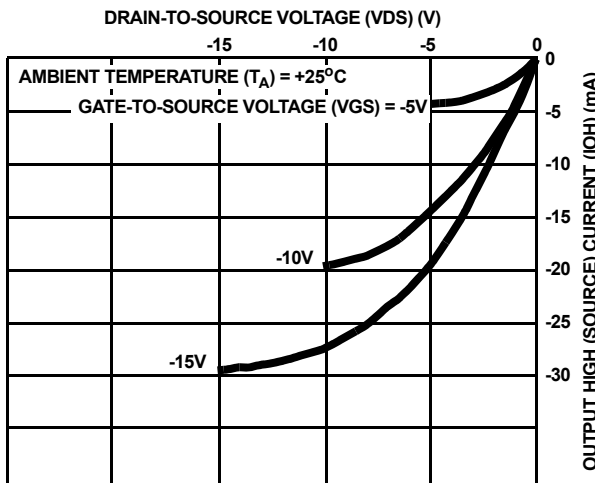


FIGURE 11. TYPICAL OUTPUT HIGH (SOURCE) CURRENT CHARACTERISTICS

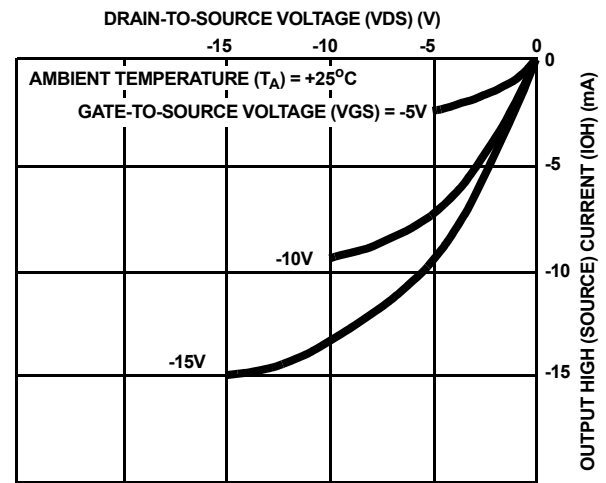


FIGURE 12. MINIMUM OUTPUT HIGH (SOURCE) CURRENT CHARACTERISTICS

Typical Performance Characteristics (Continued)

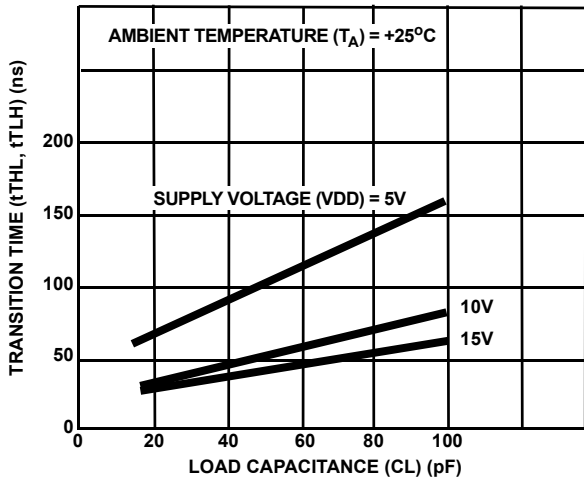


FIGURE 13. TYPICAL TRANSITION TIME AS A FUNCTION OF LOAD CAPACITANCE

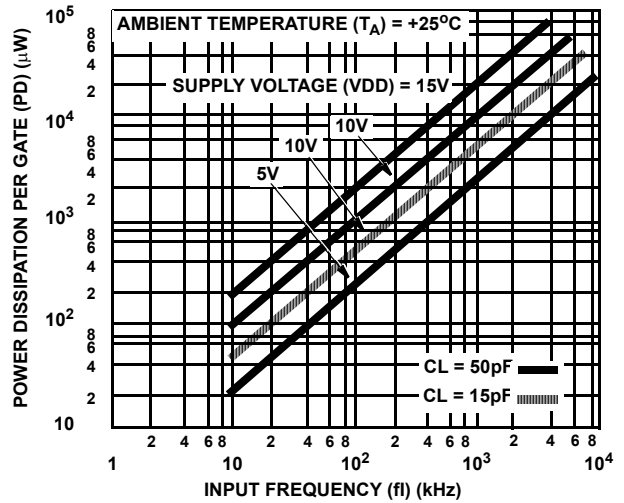
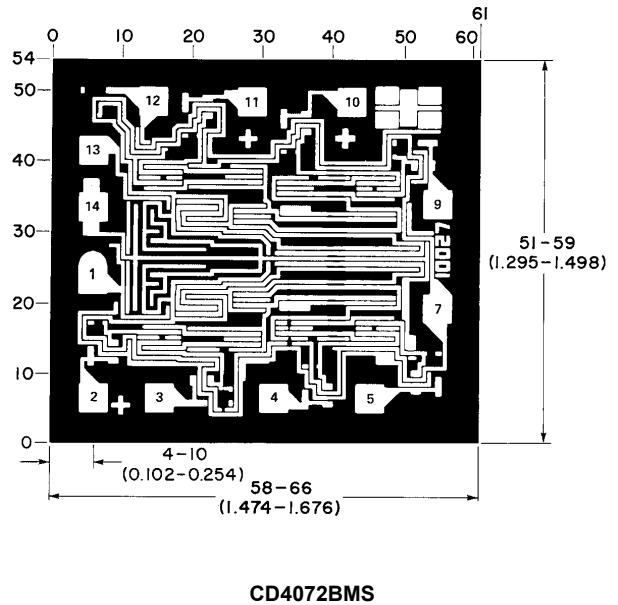
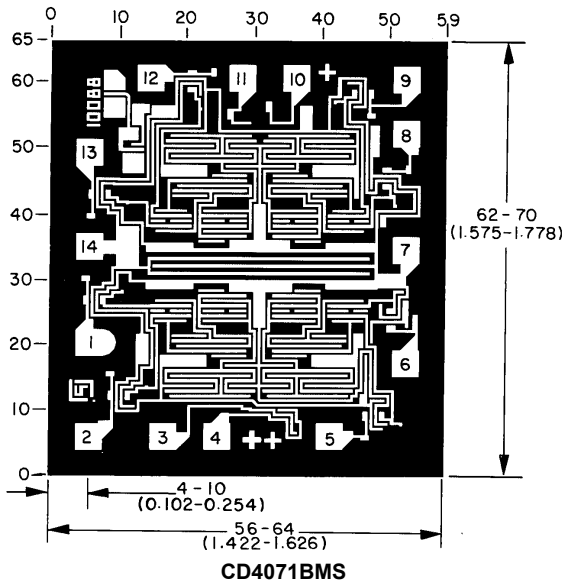
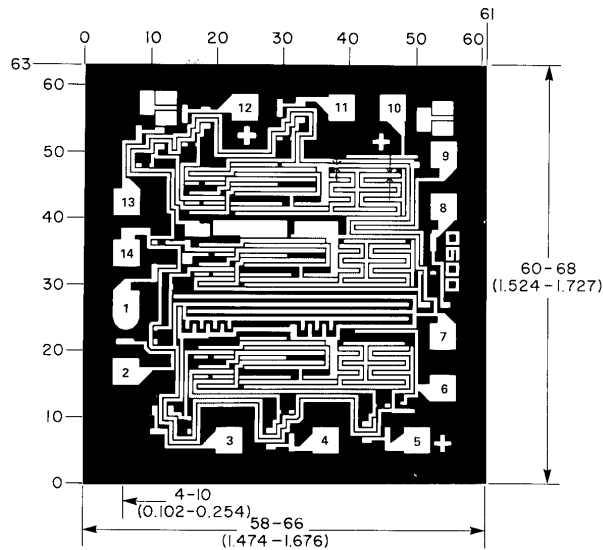


FIGURE 14. TYPICAL DYNAMIC POWER DISSIPATION AS A FUNCTION OF FREQUENCY

Chip Dimensions and Pad Layouts



Chip Dimensions and Pad Layouts



CD4075BMS

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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