

Features

- High Voltage Types (20V Rating)
- Decoded 7 Segment Display Outputs and Ripple Blanking
- Counter and 7 Segment Decoding in One Package
- Easily Interfaced with 7 Segment Display Types
- Fully Static Counter Operation DC to 6MHz (typ.) at VDD = 10V
- Ideal for Low-Power Displays
- "Ripple Blanking" and Lamp Test
- 100% Tested for Quiescent Current at 20V
- Standardized Symmetrical Output Characteristics
- 5V, 10V and 15V Parametric Ratings
- Schmitt-Triggered Clock Inputs
- Meets All Requirements of JEDEC Tentative Standards No. 13B, "Standard Specifications for Description of "B" Series CMOS Device's

Applications

- Decade Counting 7 Segment Decimal Display
- Frequency Division 7 Segment Decimal Displays
- Clocks, Watches, Timers (e.g. ÷ 60, ÷ 60, ÷12 Counter/Display)
- Counter/Display Driver For Meter Applications

Description

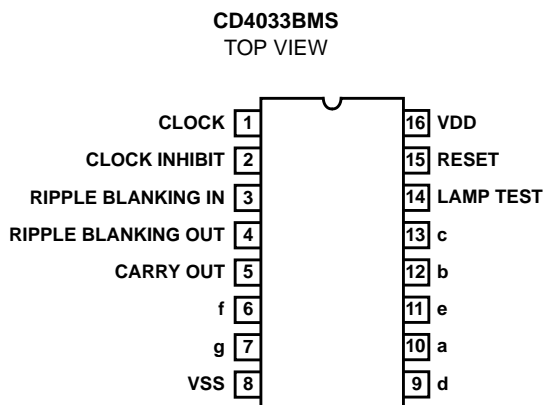
CD4033BMS consists of a 5 stage Johnson decade counter and an output decoder which converts the Johnson code to a 7 segment decoded output for driving one stage in a numerical display.

This device is particularly advantageous in display applications where low power dissipation and/or low package count is important.

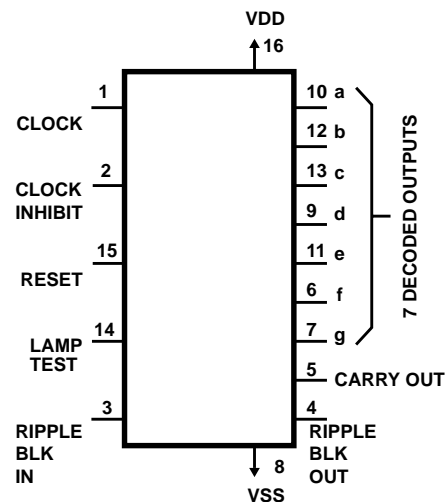
A high RESET signal clears the decade counter to its zero count. The counter is advanced one count at the positive clock signal transition if the CLOCK INHIBIT signal is low. Counter advancement via the clock line is inhibited when the CLOCK INHIBIT signal is high. The CLOCK INHIBIT signal can be used as a negative-edge clock if the clock line is held high. Antilock gating is provided on the JOHNSON counter, thus assuring proper counting sequence. The CARRY-OUT (Cout) signal completes one cycle every ten CLOCK INPUT cycles and is used to clock the succeeding decade directly in a multi-decade counting chain.

The seven decoded outputs (a, b, c, d, e, f, g) illuminate the proper segments in a seven segment display device used for representing the decimal numbers 0 to 9. The 7 segment outputs go high on selection.

Pinout



Functional Diagram



CD4033BMS

The CD4033BMS has provisions for automatic blanking of the non-significant zeros in a multi-digit decimal number which results in an easily readable display consistent with normal writing practice. For example, the number 0050.0700 in an eight digit display would be displayed as 50.07. Zero suppression on the integer side is obtained by connecting the RBI terminal of the CD4033BMS associated with the most significant digit in the display to a low-level voltage and connecting the RBO terminal of that stage to the RBI terminal of the CD4033BMS in the next-lower significant position in the display. This procedure is continued for each succeeding CD4033BMS on the interger side of the display.

On the fraction side of the display the RBI of the CD4033BMS associated with the least significant bit is connected to a low-level voltage and the RBO of that CD4033BMS is connected to the RBI terminal of the CD4033BMS in the next more-significant-bit position. Again, this procedure is continued for all CD4033BMS's on the fraction side of the display.

In a purely fractional number the zero immediately preceding the decimal point can be displayed by connecting the RBI of that stage to a high level voltage (instead of to the RBO of the next more-significant-stage). For example: optional zero → 0.7346. Likewise, the zero in a number such as 763.0 can be displayed by connecting the RBI of the CD4033BMS associated with it to a high-level voltage.

Ripple blanking of non-significant zeros provides an appreciable savings in display power.

The CD4033BMS has a LAMP TEST input which, when connected to a high-level voltage, overrides normal decoder operation and enables a check to be made on possible display malfunctions by putting the seven outputs in the high state.

The CD4033BMS are supplied in these 16 lead outline packages:

| | |
|------------------|-----|
| Braze Seal DIP | H4W |
| Frit Seal DIP | H2R |
| Ceramic Flatpack | H6W |

Logic Diagram

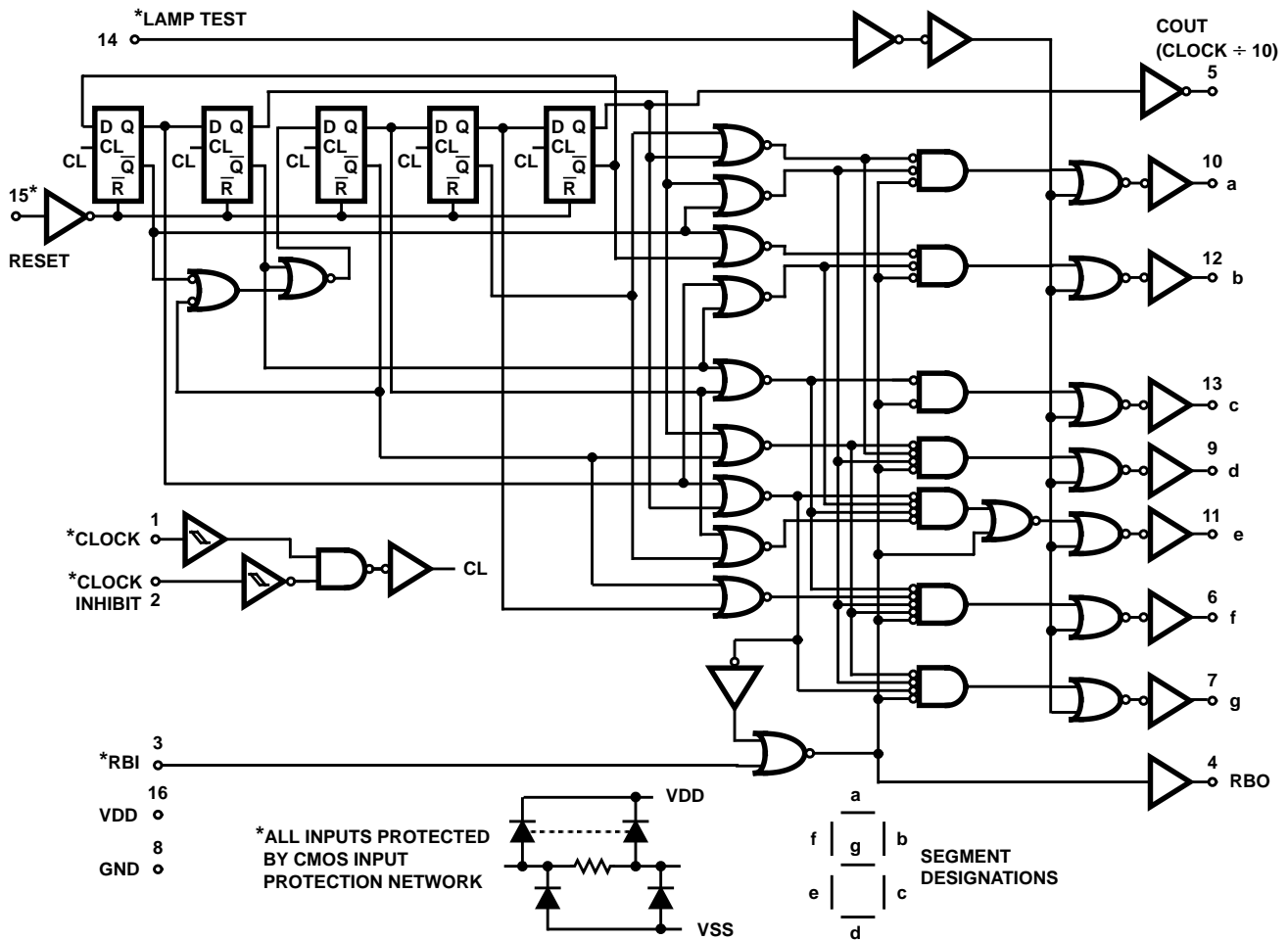


FIGURE 1. CD4033BMS

Specifications CD4033BMS

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 | - | 10 | μA |
| | | | | 2 | +125°C | - | 1000 | μA |
| | | VDD = 18V, VIN = VDD or GND | | 3 | -55°C | - | 10 | 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.

Specifications CD4033BMS

TABLE 2. AC ELECTRICAL PERFORMANCE CHARACTERISTICS

| PARAMETER | SYMBOL | CONDITIONS (NOTE 1, 2) | GROUP A SUBGROUPS | TEMPERATURE | LIMITS | | UNITS |
|--|----------------|----------------------------|----------------------|---------------|--------|-----|-------|
| | | | | | MIN | MAX | |
| Propagation Delay Clock To Carry Out | TPHL1 TPLH1 | VDD = 5V, VIN = VDD or GND | 9 | +25°C | - | 500 | ns |
| | | | 10, 11 | +125°C, -55°C | - | 675 | ns |
| Propagation Delay Clock To Decode Out | TPHL2 TPLH2 | VDD = 5V, VIN = VDD or GND | 9 | +25°C | - | 700 | ns |
| | | | 10, 11 | +125°C, -55°C | - | 945 | ns |
| Propagation Delay Reset To Carry Out | TPLH3 | VDD = 5V, VIN = VDD or GND | 9 | +25°C | - | 550 | ns |
| | | | 10, 11 | +125°C, -55°C | - | 743 | ns |
| Propagation Delay Reset To Decode Out | TPHL4 TPLH4 | VDD = 5V, VIN = VDD or GND | 9 | +25°C | - | 600 | ns |
| | | | 10, 11 | +125°C, -55°C | - | 810 | ns |
| Transition Time | TTHL TTLH | VDD = 5V, VIN = VDD or GND | 9 | +25°C | - | 200 | ns |
| | | | 10, 11 | +125°C, -55°C | - | 270 | ns |
| Maximum Clock Input Frequency | FCL | VDD = 5V, VIN = VDD or GND | 9 | +25°C | 2.5 | - | MHz |
| | | | 10, 11 | +125°C, -55°C | 1.85 | - | MHz |

NOTES:

1. VDD = 5V, CL = 50pF, RL = 200K
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 | - | 5 | μA |
| | | | | +125°C | - | 150 | μA |
| | | VDD = 10V, VIN = VDD or GND | 1, 2 | -55°C, +25°C | - | 10 | μA |
| | | | | +125°C | - | 300 | μA |
| | | VDD = 15V, VIN = VDD or GND | 1, 2 | -55°C, +25°C | - | 10 | μA |
| | | | | +125°C | - | 600 | 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 |

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TABLE 3. ELECTRICAL PERFORMANCE CHARACTERISTICS (Continued)

| PARAMETER | SYMBOL | CONDITIONS | NOTES | TEMPERATURE | LIMITS | | UNITS |
|--|----------------|-------------------------------|---------|----------------------|--------|------|-------|
| | | | | | MIN | MAX | |
| 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 Clock To Carry Out | TPHL1 TPLH1 | VDD = 10V | 1, 2, 3 | +25°C | - | 200 | ns |
| | | VDD = 15V | 1, 2, 3 | +25°C | - | 150 | ns |
| Propagation Delay Clock To Decode Out | TPHL2 TPLH2 | VDD = 10V | 1, 2, 3 | +25°C | - | 250 | ns |
| | | VDD = 15V | 1, 2, 3 | +25°C | - | 180 | ns |
| Propagation Delay Reset To Carry Out | TPLH3 | VDD = 10V | 1, 2, 3 | +25°C | - | 240 | ns |
| | | VDD = 15V | 1, 2, 3 | +25°C | - | 160 | ns |
| Propagation Delay Reset To Decode Out | TPHL4 TPLH4 | VDD = 10V | 1, 2, 3 | +25°C | - | 250 | ns |
| | | VDD = 15V | 1, 2, 3 | +25°C | - | 180 | ns |
| Transition Time | TTHL TTLH | VDD = 10V | 1, 2, 3 | +25°C | - | 100 | ns |
| | | VDD = 15V | 1, 2, 3 | +25°C | - | 50 | ns |
| Maximum Clock Input Frequency | FCL | VDD = 10V | 1, 2, 3 | +25°C | 5.5 | - | MHz |
| | | VDD = 15V | 1, 2, 3 | +25°C | 8 | - | MHz |
| Minimum Reset Pulse Width | TW | VDD = 5V | 1, 2, 3 | +25°C | - | 120 | ns |
| | | VDD = 10V | 1, 2, 3 | +25°C | - | 100 | ns |
| | | VDD = 15V | 1, 2, 3 | +25°C | - | 50 | ns |
| Minimum Reset Removal Time | TREM | VDD = 5V | 1, 2, 3 | +25°C | - | 30 | ns |
| | | VDD = 10V | 1, 2, 3 | +25°C | - | 15 | ns |
| | | VDD = 15V | 1, 2, 3 | +25°C | - | 10 | ns |
| Minimum Clock Pulse Width | TW | VDD = 5V | 1, 2, 3 | +25°C | - | 220 | ns |
| | | VDD = 10V | 1, 2, 3 | +25°C | - | 100 | ns |
| | | VDD = 15V | 1, 2, 3 | +25°C | - | 80 | ns |
| Input Capacitance | CIN | Any Input | 1, 2 | +25°C | - | 7 | 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 | - | 25 | 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 | | | | | |

Specifications CD4033BMS

TABLE 4. POST IRRADIATION ELECTRICAL PERFORMANCE CHARACTERISTICS

| PARAMETER | SYMBOL | CONDITIONS | NOTES | TEMPERATURE | LIMITS | | UNITS |
|------------------------|--------------|------------|------------|-------------|--------|--------------------------|-------|
| | | | | | MIN | MAX | |
| 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-2 | IDD | ± 1.0µA |
| 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 | |
| Group B | Subgroup B-5 | 1, 2, 3, 7, 8A, 8B, 9, 10, 11, Deltas | Subgroups 1, 2, 3, 9, 10, 11 |
| | Subgroup B-6 | 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 | | | | | | |
| Static Burn-In 1 (Note 1) | 4 - 7, 9 - 14 | 1 - 3, 8, 15 | 16 | | | |
| Static Burn-In 2 (Note 1) | 1, 2, 14, 15 | 3 - 6, 8, 10 - 13 | 7, 9, 16 | | | |
| Dynamic Burn-In (Note 1) | - | 2, 8, 15 | 3, 16 | 4 - 7, 9 - 13 | 1 | |
| Irradiation (Note 2) | 4 - 7, 9 - 14 | 8 | 1 - 3, 15, 16 | | | |
| PART NUMBER CD4033BMS | | | | | | |

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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 - 7, 9 - 13 | 1 - 3, 8, 14, 15 | 16 | | | |
| Static Burn-In 2 Note 1 | 4 - 7, 9 - 13 | 8 | 1 - 3, 14 - 16 | | | |
| Dynamic Burn-In Note 1 | - | 2, 3, 8, 14, 15 | 16 | 4 - 7, 9 - 13 | 1 | |
| Irradiation Note 2 | 4 - 7, 9 - 13 | 8 | 1 - 3, 14 - 16 | | | |

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

Timing Diagram

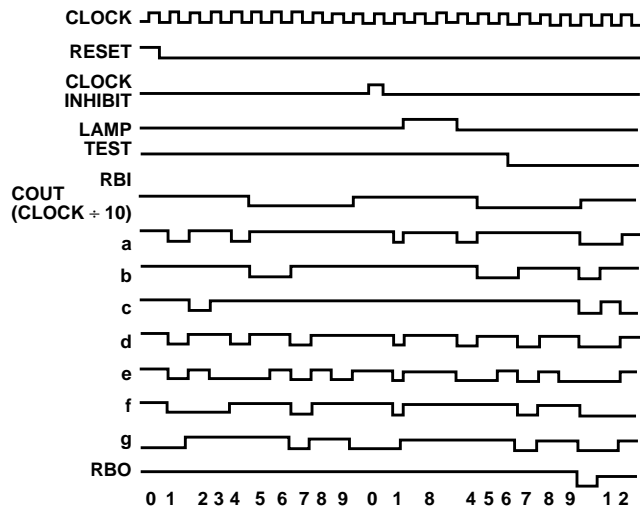


FIGURE 2. CD4033BMS TIMING DIAGRAM

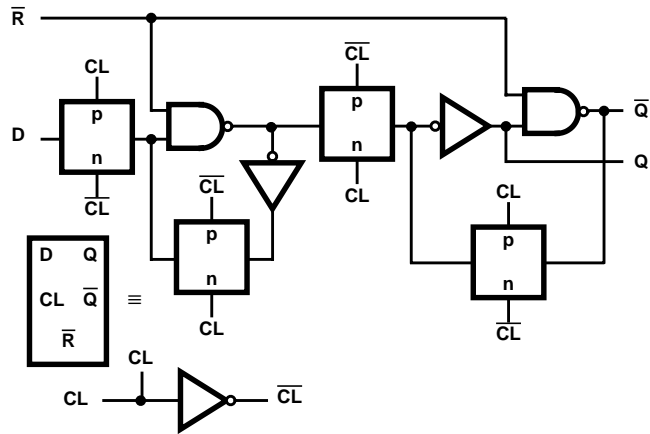


FIGURE 3. DETAIL OF TYPICAL FLIP-FLOP STAGE

Typical Performance Characteristics

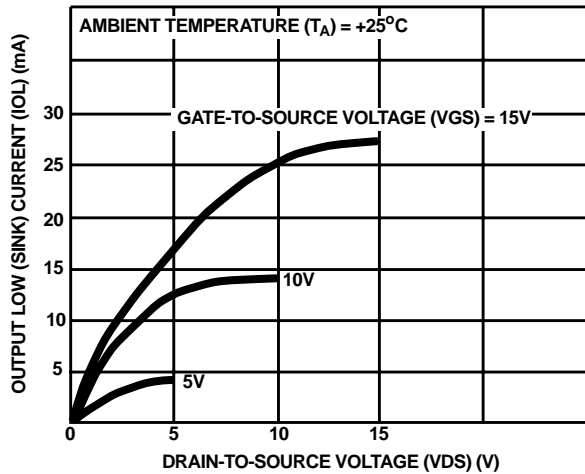


FIGURE 4. TYPICAL N-CHANNEL OUTPUT LOW (SINK) CURRENT CHARACTERISTICS

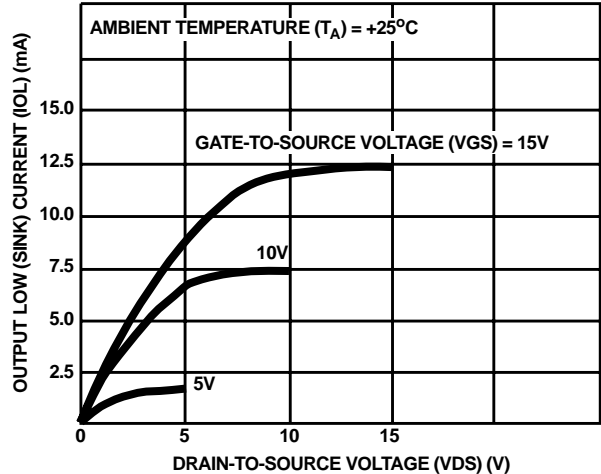


FIGURE 5. MINIMUM N-CHANNEL OUTPUT LOW (SINK) CURRENT CHARACTERISTICS

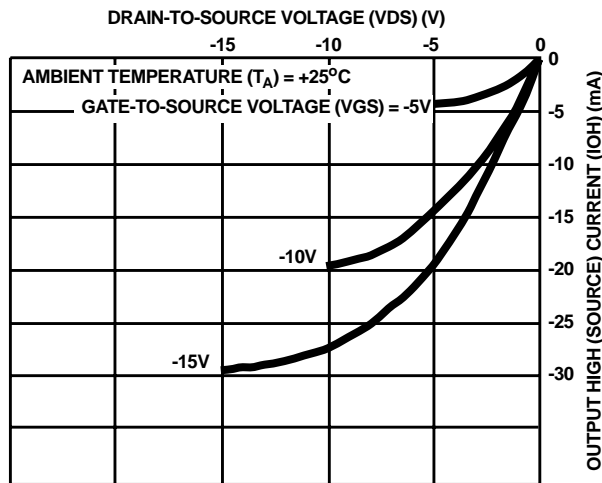


FIGURE 6. TYPICAL P-CHANNEL OUTPUT HIGH (SOURCE) CURRENT CHARACTERISTICS

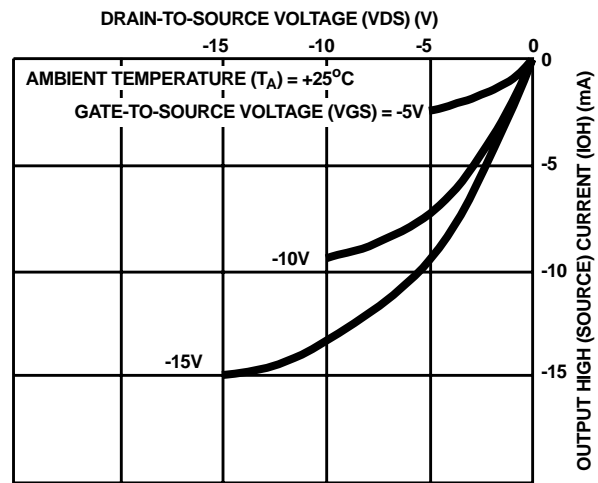


FIGURE 7. MINIMUM P-CHANNEL OUTPUT HIGH (SOURCE) CURRENT CHARACTERISTICS

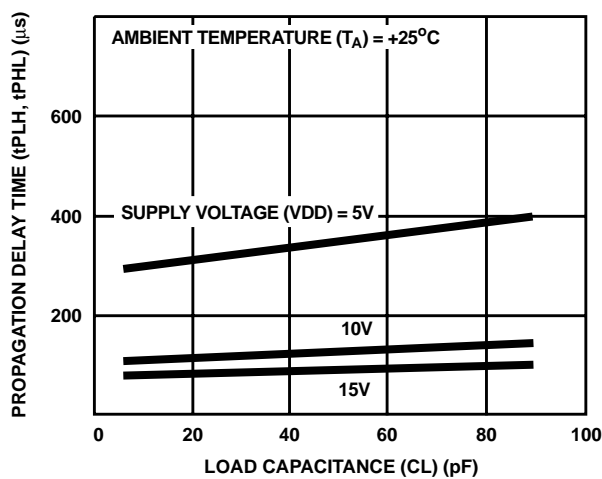


FIGURE 8. TYPICAL PROPAGATION DELAY TIME AS A FUNCTION OF LOAD CAPACITANCE FOR DECODED OUTPUTS

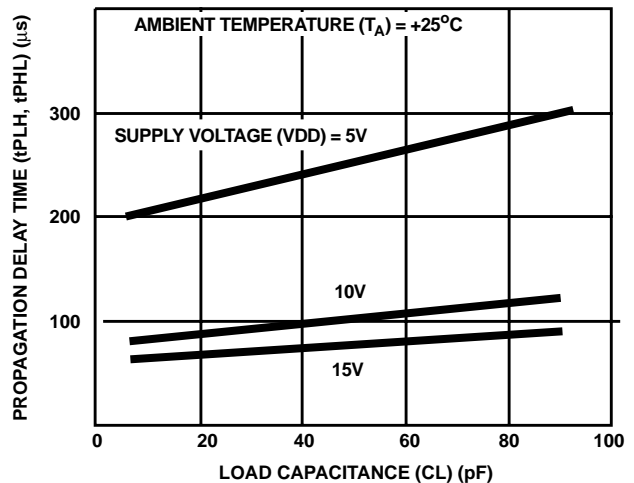


FIGURE 9. TYPICAL PROPAGATION DELAY TIME AS A FUNCTION OF LOAD CAPACITANCE FOR CARRY-OUT OUTPUTS

Typical Performance Characteristics (Continued)

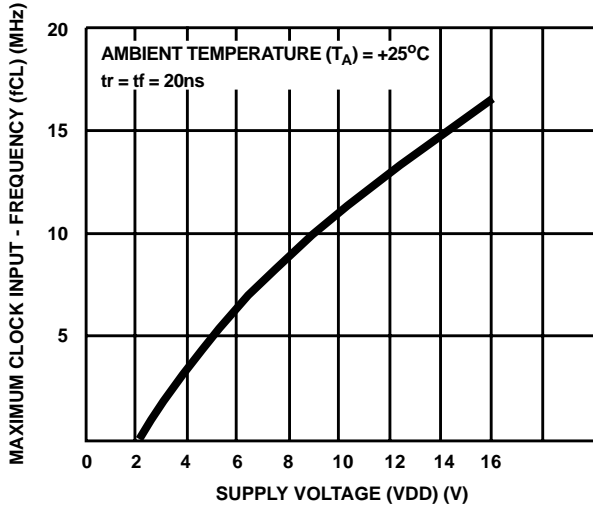


FIGURE 10. TYPICAL MAXIMUM CLOCK INPUT FREQUENCY AS A FUNCTION OF SUPPLY VOLTAGE

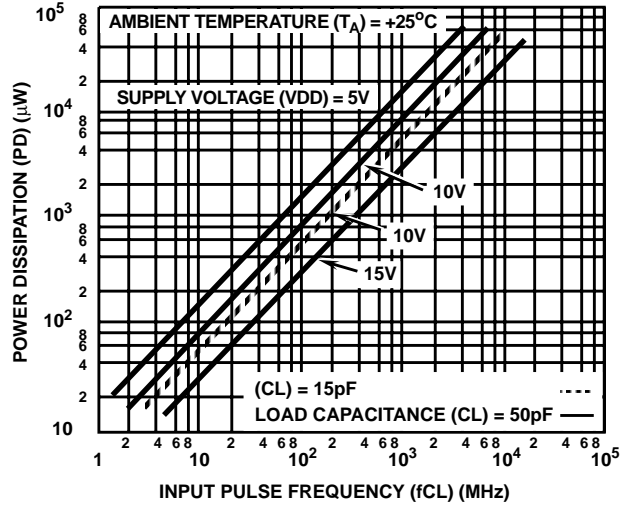
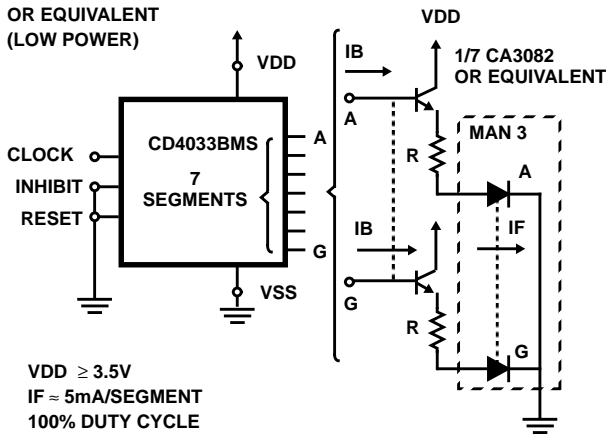


FIGURE 11. TYPICAL POWER DISSIPATION AS A FUNCTION OF CLOCK INPUT FREQUENCY

Light Emitting Diode Displays

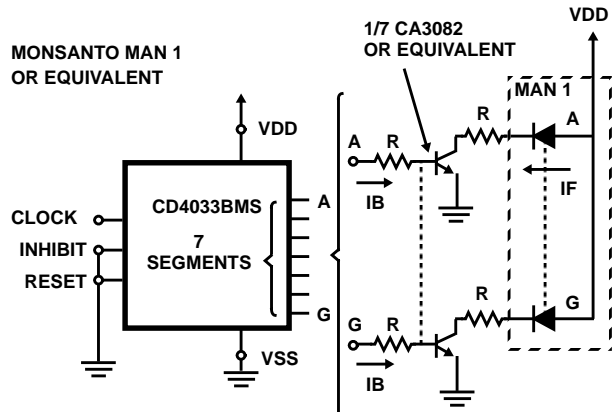
MONSANTO MAN 3
OR EQUIVALENT
(LOW POWER)



VDD ≥ 3.5V
IF ≈ 5mA/SEGMENT
100% DUTY CYCLE
 $R = \frac{VP - VBE - VF(LED)}{ILED}$

WHERE VP = INPUT PULSE
VF = FORWARD DROP
ACROSS DIODE

MONSANTO MAN 1
OR EQUIVALENT



VDD 5V (MIN)
IB 0.4mA
IF 12mA/Seg.(100% DUTY CYCLE)
bdc(MIN) 30
VCE(SAT) £ 0.5V

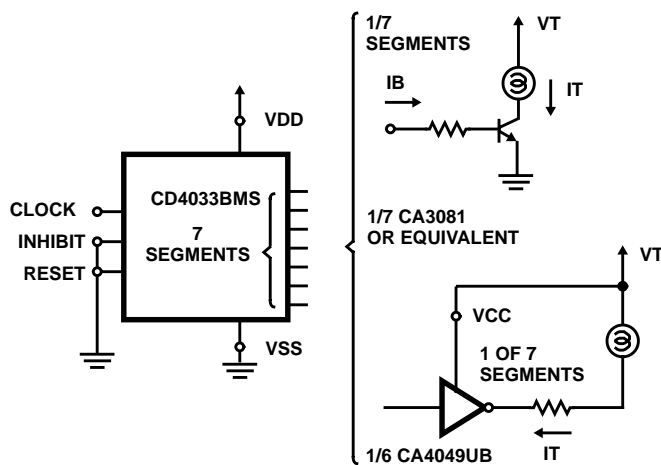
$R = \frac{VDD - VCE(sat) - VF(LED)}{ILED}$

WHERE VF = FORWARD DROP ACROSS DIODE

FIGURE 12. INTERFACING THE CD4033BMS WITH COMMERCIALY AVAILABLE LIGHT EMITTING DIODE DISPLAYS

CD4033BMS

7-Segment Display Devices



INCANDESCENT READOUTS

Numitron DR2000 Series
TUBE REQUIREMENTS
VT = 3.5 - 5V
IT = 24mA Segment

ASSUMED TRANSISTOR CHARACTERISTICS

| | |
|--------------------|-----------------|
| | CD4049UB |
| at VCC = 10V (min) | Vo "0" ≤ 2V |
| | IT = 8mA (min) |
| | VT ≈ 3.5V to 6V |
| βdc (min) ≥ 25 | |
| VCE (sat) ≤ 0.5V | |
| VDD = 8V (min) | |
| IB = 1mA (min) | |
| IT = 24mA (min) | |

CD4049UB

at VCC = 10V (min)

Vo "0" ≤ 0.6V

IT = 8mA (min)

LOW-POWER INCANDESCENT READOUTS PINLITES INC-Series O and R

| TUBE REQUIREMENTS | VT(V) | mA/Segment | βdc (min) ≥ 30 |
|-------------------|-------|------------|-------------------|
| 0-03-15 | 1.5 | 8 | VCE (sat) ≤ 0.5V |
| 0-04-30 | 3 | 8 | |
| 0-06-30 | 3 | 8 | VCC ≥ 3.5V (min) |
| R-R3-20 | 2 | 4.3 | IB ≥ 0.25mA (min) |
| R-R4-30 | 3 | 4.3 | IT ≤ 7.5mA (min) |

ASSUMED TRANSISTOR CHARACTERISTICS

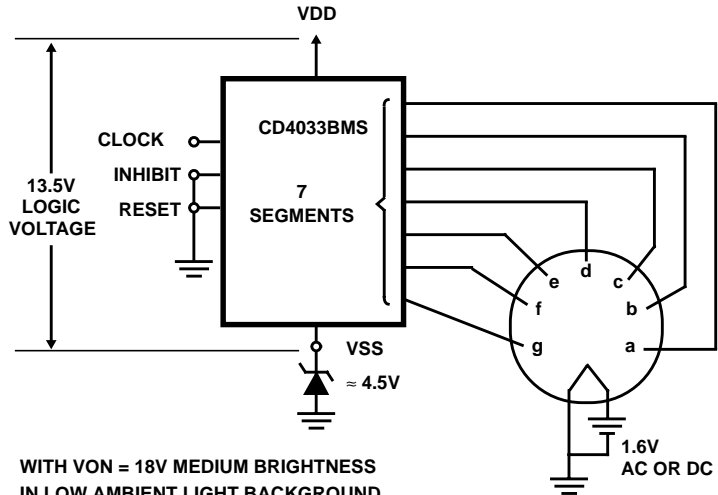
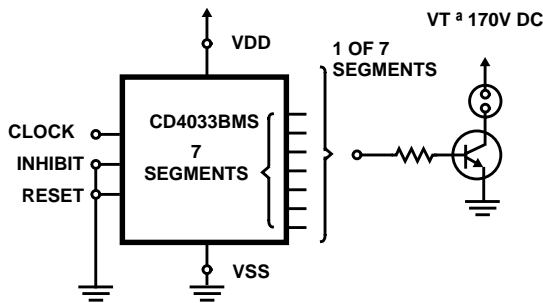
at VCC = 6V (min)

Vo "0" ≤ 1V

IT = 5mA (min)

VT ≈ 1.5V to 3.5V

*The interfacing buffers shown, while a necessity with the CD4033A, are not required when using the "B" devices; the "B" outputs (≈ 10 times the "A" outputs) can drive most display devices directly especially at voltages above 10V.



WITH VON = 18V MEDIUM BRIGHTNESS
IN LOW AMBIENT LIGHT BACKGROUND
WILL RESULT. THE POINT OF NO
NOTICEABLE GLOW IS VOFF ≈ 4.5V

NEON READOUT (NIXIE TUBE**)

- Alco Electronics - MG19
- Burroughs - B5971, B7971, B8971

| TUBE REQUIREMENTS | VT(Vdc) | mA/Segment |
|------------------------|---------|------------|
| Alco MG19 | 180 | 0.5 |
| Burroughs B5971 | 170 | 3 |
| Burroughs B7971, B8971 | 170 | 6 |

** (Trademark) Burroughs Corp.
TRANSISTOR CHARACTERISTICS
Leakage with transistor cutoff - 0.05mA

V(BR)CER > VT
βdc (min) ≥ 30

LOW VOLTAGE VACUUM FLORESCENT READOUTS

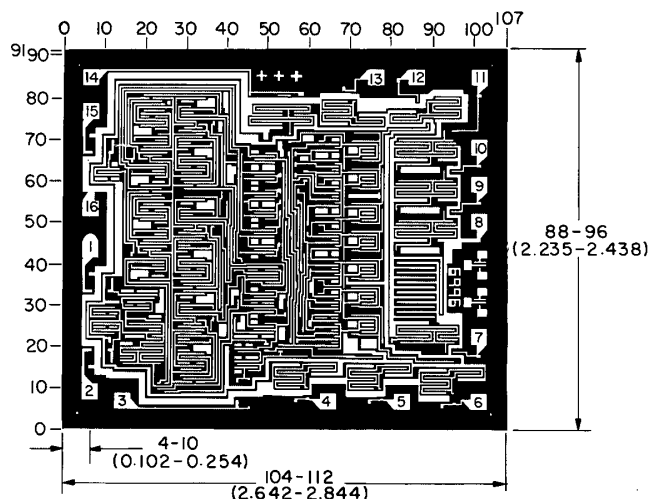
- Tung-Sol DIGIVAC S/G ‡ Type DT1704A or DT1705C
- Nippon Electric (NEC): Type DG12E or LD915
TUBE REQUIREMENTS: 100 to 300 μA/segment at tube voltages of 12V to 25V depending on required brightness Filament requirement 45mA at 1.6V, ac or dc.

‡ (Trademark) Wagner Electric Co.

FIGURE 13. INTERFACING THE CD4033BMS WITH COMMERCIALY AVAILABLE 7-SEGMENT DISPLAY DEVICES*

CD4033BMS

Chip Dimensions and Pad Layouts



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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