

December 1992

### Features

- High Voltage Type (20V Rating)
- Medium Speed  $f_{CL} = 12\text{MHz}$  (typ.) at  $V_{DD} = 10\text{V}$
- Fully Static Operation
- Synchronous Parallel or Serial Operation
- Three State Outputs (CD40104BMS)
- Asynchronous Master Reset (CD40194BMS)
- 5V, 10V and 15V Parametric Ratings
- Standardized Symmetrical Output Characteristics
- Meets All Requirements of JEDEC Tentative Standard No. 13B, "Standard Specifications for Description of 'B' Series CMOS Devices"

### Applications

- Arithmetic Unit Bus Registers
- Serial/Parallel Conversions
- General Purpose Register for Bus Organized Systems
- General Purpose Registers

### Description

The CD40104BMS is a universal shift register featuring parallel inputs, parallel outputs, SHIFT RIGHT and SHIFT LEFT serial inputs, and a high impedance third output state allowing the device to be used in bus organized systems.

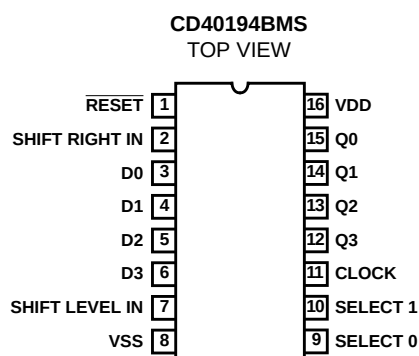
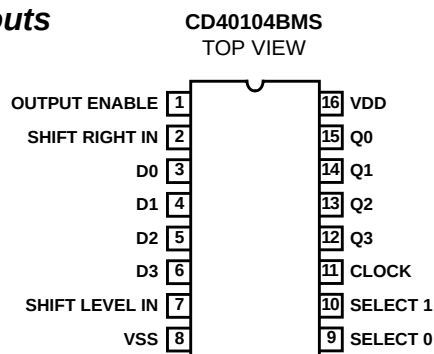
In the parallel load mode ( $S_0$  and  $S_1$  are high), data is loaded into the associated flip-flop and appears at the output after the positive transition of the CLOCK input. During loading, serial data flow is inhibited. Shift right and shift left are accomplished synchronously on the positive clock edge with serial data entered at the SHIFT RIGHT and SHIFT LEFT serial inputs, respectively. Clearing the register is accomplished by setting both mode controls low and clocking the register. When the output enable input is low, all outputs assume the high impedance state.

The CD40194BMS is a universal shift register featuring parallel inputs, parallel outputs SHIFT RIGHT and SHIFT LEFT serial inputs, and a direct overriding clear input. In the parallel load mode ( $S_0$  and  $S_1$  are high), data is loaded into the associated flip-flop and appears at the output after the positive transition of the CLOCK input. During loading, serial data flow is inhibited. Shift right and shift left are accomplished synchronously on the positive clock edge with data entered at the SHIFT RIGHT and SHIFT LEFT serial inputs, respectively. Clocking of the register is inhibited when both mode control inputs are low. When low, the RESET input resets all stages and forces all outputs low. The CD40194BMS is similar to industry types 340194 and MC40194.

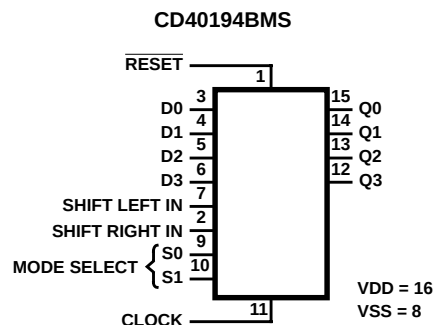
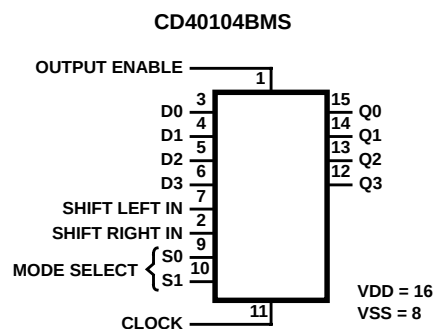
The CD40104BMS and CD40194BMS series types are supplied in these 16 lead outline packages

|                                     |       |      |
|-------------------------------------|-------|------|
| Braze Seal DIP                      | *HNX, | †H4W |
| Frit Seal DIP                       | *H1L, | †HIF |
| Ceramic Flatpack                    | H6W   |      |
| * CD40104B Only      †CD40194B Only |       |      |

### Pinouts



### Functional Diagrams



# Specifications CD40104BMS, CD40194BMS

## 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 .....  $\pm 10\mu\text{A}$   
 Operating Temperature Range .....  $-55^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$   
 Package Types D, F, K, H  
 Storage Temperature Range (TSTG) .....  $-65^{\circ}\text{C}$  to  $+150^{\circ}\text{C}$   
 Lead Temperature (During Soldering) .....  $+265^{\circ}\text{C}$   
 At Distance  $1/16 \pm 1/32$  Inch ( $1.59\text{mm} \pm 0.79\text{mm}$ ) from case for  
 10s Maximum

## Reliability Information

Thermal Resistance .....  $\theta_{ja}$   $\theta_{jc}$   
 Ceramic DIP and FRIT Package .....  $80^{\circ}\text{C/W}$   $20^{\circ}\text{C/W}$   
 Flatpack Package .....  $70^{\circ}\text{C/W}$   $20^{\circ}\text{C/W}$   
 Maximum Package Power Dissipation (PD) at  $+125^{\circ}\text{C}$   
 For  $T_A = -55^{\circ}\text{C}$  to  $+100^{\circ}\text{C}$  (Package Type D, F, K) ..... 500mW  
 For  $T_A = +100^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$  (Package Type D, F, K) ..... Derate  
 Linearity at  $12\text{mW}/^{\circ}\text{C}$  to  $200\text{mW}$   
 Device Dissipation per Output Transistor ..... 100mW  
 For  $T_A = \text{Full Package Temperature Range (All Package Types)}$   
 Junction Temperature .....  $+175^{\circ}\text{C}$

**TABLE 1. DC ELECTRICAL PERFORMANCE CHARACTERISTICS**

| PARAMETER                      | SYMBOL | CONDITIONS (NOTE 1)                   |           | GROUP A<br>SUBGROUPS | TEMPERATURE                                                            | LIMITS         |                | UNITS         |
|--------------------------------|--------|---------------------------------------|-----------|----------------------|------------------------------------------------------------------------|----------------|----------------|---------------|
|                                |        |                                       |           |                      |                                                                        | MIN            | MAX            |               |
| Supply Current                 | IDD    | VDD = 20V, VIN = VDD or GND           |           | 1                    | $+25^{\circ}\text{C}$                                                  | -              | 10             | $\mu\text{A}$ |
|                                |        |                                       |           | 2                    | $+125^{\circ}\text{C}$                                                 | -              | 1000           | $\mu\text{A}$ |
|                                |        | VDD = 18V, VIN = VDD or GND           |           | 3                    | $-55^{\circ}\text{C}$                                                  | -              | 10             | $\mu\text{A}$ |
| Input Leakage Current          | IIL    | VIN = VDD or GND                      | VDD = 20V | 1                    | $+25^{\circ}\text{C}$                                                  | -100           | -              | nA            |
|                                |        |                                       |           | 2                    | $+125^{\circ}\text{C}$                                                 | -1000          | -              | nA            |
|                                |        |                                       | VDD = 18V | 3                    | $-55^{\circ}\text{C}$                                                  | -100           | -              | nA            |
| Input Leakage Current          | IIH    | VIN = VDD or GND                      | VDD = 20V | 1                    | $+25^{\circ}\text{C}$                                                  | -              | 100            | nA            |
|                                |        |                                       |           | 2                    | $+125^{\circ}\text{C}$                                                 | -              | 1000           | nA            |
|                                |        |                                       | VDD = 18V | 3                    | $-55^{\circ}\text{C}$                                                  | -              | 100            | nA            |
| Output Voltage                 | VOL15  | VDD = 15V, No Load                    |           | 1, 2, 3              | $+25^{\circ}\text{C}$ , $+125^{\circ}\text{C}$ , $-55^{\circ}\text{C}$ | -              | 50             | mV            |
| Output Voltage                 | VOH15  | VDD = 15V, No Load (Note 3)           |           | 1, 2, 3              | $+25^{\circ}\text{C}$ , $+125^{\circ}\text{C}$ , $-55^{\circ}\text{C}$ | 14.95          | -              | V             |
| Output Current (Sink)          | IOL5   | VDD = 5V, VOUT = 0.4V                 |           | 1                    | $+25^{\circ}\text{C}$                                                  | 0.53           | -              | mA            |
| Output Current (Sink)          | IOL10  | VDD = 10V, VOUT = 0.5V                |           | 1                    | $+25^{\circ}\text{C}$                                                  | 1.4            | -              | mA            |
| Output Current (Sink)          | IOL15  | VDD = 15V, VOUT = 1.5V                |           | 1                    | $+25^{\circ}\text{C}$                                                  | 3.5            | -              | mA            |
| Output Current (Source)        | IOH5A  | VDD = 5V, VOUT = 4.6V                 |           | 1                    | $+25^{\circ}\text{C}$                                                  | -              | -0.53          | mA            |
| Output Current (Source)        | IOH5B  | VDD = 5V, VOUT = 2.5V                 |           | 1                    | $+25^{\circ}\text{C}$                                                  | -              | -1.8           | mA            |
| Output Current (Source)        | IOH10  | VDD = 10V, VOUT = 9.5V                |           | 1                    | $+25^{\circ}\text{C}$                                                  | -              | -1.4           | mA            |
| Output Current (Source)        | IOH15  | VDD = 15V, VOUT = 13.5V               |           | 1                    | $+25^{\circ}\text{C}$                                                  | -              | -3.5           | mA            |
| N Threshold Voltage            | VNTH   | VDD = 10V, ISS = $-10\mu\text{A}$     |           | 1                    | $+25^{\circ}\text{C}$                                                  | -2.8           | -0.7           | V             |
| P Threshold Voltage            | VPTH   | VSS = 0V, IDD = $10\mu\text{A}$       |           | 1                    | $+25^{\circ}\text{C}$                                                  | 0.7            | 2.8            | V             |
| Functional                     | F      | VDD = 2.8V, VIN = VDD or GND          |           | 7                    | $+25^{\circ}\text{C}$                                                  | VOH ><br>VDD/2 | VOL <<br>VDD/2 | V             |
|                                |        | VDD = 20V, VIN = VDD or GND           |           | 7                    | $+25^{\circ}\text{C}$                                                  |                |                |               |
|                                |        | VDD = 18V, VIN = VDD or GND           |           | 8A                   | $+125^{\circ}\text{C}$                                                 |                |                |               |
|                                |        | VDD = 3V, VIN = VDD or GND            |           | 8B                   | $-55^{\circ}\text{C}$                                                  |                |                |               |
| Input Voltage Low<br>(Note 2)  | VIL    | VDD = 5V, VOH > 4.5V, VOL < 0.5V      |           | 1, 2, 3              | $+25^{\circ}\text{C}$ , $+125^{\circ}\text{C}$ , $-55^{\circ}\text{C}$ | -              | 1.5            | V             |
| Input Voltage High<br>(Note 2) | VIH    | VDD = 5V, VOH > 4.5V, VOL < 0.5V      |           | 1, 2, 3              | $+25^{\circ}\text{C}$ , $+125^{\circ}\text{C}$ , $-55^{\circ}\text{C}$ | 3.5            | -              | V             |
| Input Voltage Low<br>(Note 2)  | VIL    | VDD = 15V, VOH > 13.5V,<br>VOL < 1.5V |           | 1, 2, 3              | $+25^{\circ}\text{C}$ , $+125^{\circ}\text{C}$ , $-55^{\circ}\text{C}$ | -              | 4              | V             |
| Input Voltage High<br>(Note 2) | VIH    | VDD = 15V, VOH > 13.5V,<br>VOL < 1.5V |           | 1, 2, 3              | $+25^{\circ}\text{C}$ , $+125^{\circ}\text{C}$ , $-55^{\circ}\text{C}$ | 11             | -              | V             |
| Tri-State Output<br>Leakage    | IOZL   | VIN = VDD or GND<br>VOUT = 0V         | VDD = 20V | 1                    | $+25^{\circ}\text{C}$                                                  | -0.4           | -              | $\mu\text{A}$ |
|                                |        |                                       |           | 2                    | $+125^{\circ}\text{C}$                                                 | -12            | -              | $\mu\text{A}$ |
|                                |        |                                       | VDD = 18V | 3                    | $-55^{\circ}\text{C}$                                                  | -0.4           | -              | $\mu\text{A}$ |
| Tri-State Output<br>Leakage    | IOZH   | VIN = VDD or GND<br>VOUT = VDD        | VDD = 20V | 1                    | $+25^{\circ}\text{C}$                                                  | -              | 0.4            | $\mu\text{A}$ |
|                                |        |                                       |           | 2                    | $+125^{\circ}\text{C}$                                                 | -              | 12             | $\mu\text{A}$ |
|                                |        |                                       | VDD = 18V | 3                    | $-55^{\circ}\text{C}$                                                  | -              | 0.4            | $\mu\text{A}$ |

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

## Specifications CD40104BMS, CD40194BMS

**TABLE 2. AC ELECTRICAL PERFORMANCE CHARACTERISTICS**

| PARAMETER                                  | SYMBOL               | CONDITIONS                                | GROUP A<br>SUBGROUPS | TEMPERATURE   | LIMITS |     | UNITS |
|--------------------------------------------|----------------------|-------------------------------------------|----------------------|---------------|--------|-----|-------|
|                                            |                      |                                           |                      |               | MIN    | MAX |       |
| Propagation Delay<br>Clock to Q            | TPHL<br>TPLH         | VDD = 5V, VIN = VDD or GND<br>(Note 1, 2) | 9                    | +25°C         | -      | 440 | ns    |
|                                            |                      |                                           | 10, 11               | +125°C, -55°C | -      | 594 | ns    |
| Propagation Delay<br>CD40194BMS Reset to Q | TPHL                 | VDD = 5V, VIN = VDD or GND<br>(Note 1, 2) | 9                    | +25°C         | -      | 460 | ns    |
|                                            |                      |                                           | 10, 11               | +125°C, -55°C | -      | 621 | ns    |
| Propagation Delay<br>CD40104BMS 3-State    | TPZH<br>TPZL<br>TPLZ | VDD = 5V, VIN = VDD or GND<br>(Note 2, 3) | 9                    | +25°C         | -      | 160 | ns    |
|                                            |                      |                                           | 10, 11               | +125°C, -55°C | -      | 216 | ns    |
| Propagation Delay<br>CD40104BMS 3-State    | TPHZ                 | VDD = 5V, VIN = VDD or GND<br>(Note 2, 3) | 9                    | +25°C         | -      | 90  | ns    |
|                                            |                      |                                           | 10, 11               | +125°C, -55°C | -      | 122 | ns    |
| Transition Time                            | TTHL<br>TTLH         | VDD = 5V, VIN = VDD or GND<br>(Note 1, 2) | 9                    | +25°C         | -      | 200 | ns    |
|                                            |                      |                                           | 10, 11               | +125°C, -55°C | -      | 270 | ns    |
| Maximum Clock Input<br>Frequency           | FCL                  | VDD = 5V, VIN = VDD or GND<br>(Note 1, 2) | 9                    | +25°C         | 3      | -   | MHz   |
|                                            |                      |                                           | 10, 11               | +125°C, -55°C | 2.22   | -   | MHz   |

NOTES:

1. CL = 50pF, RL = 200K, Input TR, TF < 20ns.
2. -55°C and +125°C limits guaranteed, 100% testing being implemented.
3. VDD = 5V, 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            | -      | 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,<br>-55°C | -      | 50    | mV    |
| Output Voltage          | VOL    | VDD = 10V, No Load          | 1, 2  | +25°C, +125°C,<br>-55°C | -      | 50    | mV    |
| Output Voltage          | VOH    | VDD = 5V, No Load           | 1, 2  | +25°C, +125°C,<br>-55°C | 4.95   | -     | V     |
| Output Voltage          | VOH    | VDD = 10V, No Load          | 1, 2  | +25°C, +125°C,<br>-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    |

## Specifications CD40104BMS, CD40194BMS

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

| PARAMETER                                                    | SYMBOL               | CONDITIONS                       | NOTES      | TEMPERATURE             | LIMITS |       | UNITS |
|--------------------------------------------------------------|----------------------|----------------------------------|------------|-------------------------|--------|-------|-------|
|                                                              |                      |                                  |            |                         | MIN    | MAX   |       |
| 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,<br>VOL < 1V | 1, 2       | +25°C, +125°C,<br>-55°C | -      | 3     | V     |
| Input Voltage High                                           | VIH                  | VDD = 10V, VOH > 9V,<br>VOL < 1V | 1, 2       | +25°C, +125°C,<br>-55°C | 7      | -     | V     |
| Propagation Delay<br>Clock to Q                              | TPHL<br>TPLH         | VDD = 10V                        | 1, 2, 3    | +25°C                   | -      | 200   | ns    |
|                                                              |                      | VDD = 15V                        | 1, 2, 3    | +25°C                   | -      | 140   | ns    |
| Propagation Delay<br>CD40194B Reset to Q                     | TPLH<br>TPHL         | VDD = 10V                        | 1, 2, 3    | +25°C                   | -      | 180   | ns    |
|                                                              |                      | VDD = 15V                        | 1, 2, 3    | +25°C                   | -      | 130   | ns    |
| Propagation Delay<br>CD40104BMS 3-State                      | TPZH<br>TPZL<br>TPLZ | VDD = 10V                        | 1, 2, 3, 4 | +25°C                   | -      | 70    | ns    |
|                                                              |                      | VDD = 15V                        | 1, 2, 3, 4 | +25°C                   | -      | 50    | ns    |
| Propagation Delay<br>CD40104BMS 3-State                      | TPHZ                 | VDD = 10V                        | 1, 2, 4    | +25°C                   | -      | 50    | ns    |
|                                                              |                      | VDD = 15V                        | 1, 2, 4    | +25°C                   | -      | 40    | ns    |
| Transition Time                                              | TTHL<br>TTLH         | VDD = 10V                        | 1, 2, 3    | +25°C                   | -      | 100   | ns    |
|                                                              |                      | VDD = 15V                        | 1, 2, 3    | +25°C                   | -      | 80    | ns    |
| Minimum Data Setup<br>Time, D0, D3, SRIN,<br>SLIN to Clock   | TS                   | VDD = 5V                         | 1, 2, 3    | +25°C                   | -      | 100   | ns    |
|                                                              |                      | VDD = 10V                        | 1, 2, 3    | +25°C                   | -      | 70    | ns    |
|                                                              |                      | VDD = 15V                        | 1, 2, 3    | +25°C                   | -      | 50    | ns    |
| Minimum Data Hold Time<br>D0, D3, SRIN, SLIN to<br>Clock     | TH                   | VDD = 5V                         | 1, 2, 3    | +25°C                   | -      | 0     | ns    |
|                                                              |                      | VDD = 10V                        | 1, 2, 3    | +25°C                   | -      | 0     | ns    |
|                                                              |                      | VDD = 15V                        | 1, 2, 3    | +25°C                   | -      | 0     | ns    |
| Minimum Clock Pulse<br>Width                                 | TW                   | VDD = 5V                         | 1, 2, 3    | +25°C                   | -      | 180   | ns    |
|                                                              |                      | VDD = 10V                        | 1, 2, 3    | +25°C                   | -      | 80    | ns    |
|                                                              |                      | VDD = 15V                        | 1, 2, 3    | +25°C                   | -      | 50    | ns    |
| Maximum Clock Rise and<br>Fall Time                          | TRCL<br>TFCL         | VDD = 5V                         | 1, 2, 3, 5 | +25°C                   | 3      | -     | μs    |
|                                                              |                      | VDD = 10V                        | 1, 2, 3, 5 | +25°C                   | 6      | -     | μs    |
|                                                              |                      | VDD = 15V                        | 1, 2, 3, 5 | +25°C                   | 8      | -     | μs    |
| Minimum Data Setup<br>Time<br>Select 1, Select 0 to<br>Clock | TS                   | VDD = 5V                         | 1, 2, 3    | +25°C                   | -      | 400   | ns    |
|                                                              |                      | VDD = 10V                        | 1, 2, 3    | +25°C                   | -      | 220   | ns    |
|                                                              |                      | VDD = 15V                        | 1, 2, 3    | +25°C                   | -      | 130   | ns    |
| Minimum Data Hold Time<br>Select 1, Select 0 to<br>Clock     | TH                   | VDD = 5V                         | 1, 2, 3    | +25°C                   | -      | 0     | ns    |
|                                                              |                      | VDD = 10V                        | 1, 2, 3    | +25°C                   | -      | 0     | ns    |
|                                                              |                      | VDD = 15V                        | 1, 2, 3    | +25°C                   | -      | 0     | ns    |

## Specifications CD40104BMS, CD40194BMS

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

| PARAMETER                            | SYMBOL | CONDITIONS | NOTES   | TEMPERATURE | LIMITS |     | UNITS |
|--------------------------------------|--------|------------|---------|-------------|--------|-----|-------|
|                                      |        |            |         |             | MIN    | MAX |       |
| Minimum Reset Pulse Width CD40194BMS | TW     | VDD = 5V   | 1, 2, 3 | +25°C       | -      | 300 | ns    |
|                                      |        | VDD = 10V  | 1, 2, 3 | +25°C       | -      | 200 | ns    |
|                                      |        | VDD = 15V  | 1, 2, 3 | +25°C       | -      | 140 | 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.
4. CL = 50pF, RL = 1K, Input TR, TF < 20ns.
5. If more than one unit is cascaded, TRCL should be made less than or equal to the sum of the transition time and the fixed propagation delay of the output of the driving stage for the estimated capacitive load.

**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  |            |             |             |                    |       |
| Propagation Delay Time    | TPHL<br>TPLH | VDD = 5V                    | 1, 2, 3, 4 | +25°C       | -           | 1.35 x +25°C Limit | ns    |

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

## Specifications CD40104BMS, CD40194BMS

**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 |
| CD40104BMS, CD40194BMS     |       |          |               |            |            |       |
| Static Burn-In 1<br>Note 1 | 12-15 | 1-11     | 16            |            |            |       |
| Static Burn-In 2<br>Note 1 | 12-15 | 8        | 1-7, 9-11, 16 |            |            |       |
| Dynamic Burn-In<br>Note 1  | -     | 7, 8, 10 | 1, 3-6, 9, 16 | 12-15      | 11         | 2     |
| Irradiation<br>Note 2      | 12-15 | 8        | 1-7, 9-11, 16 |            |            |       |

NOTES:

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

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# Logic Diagrams

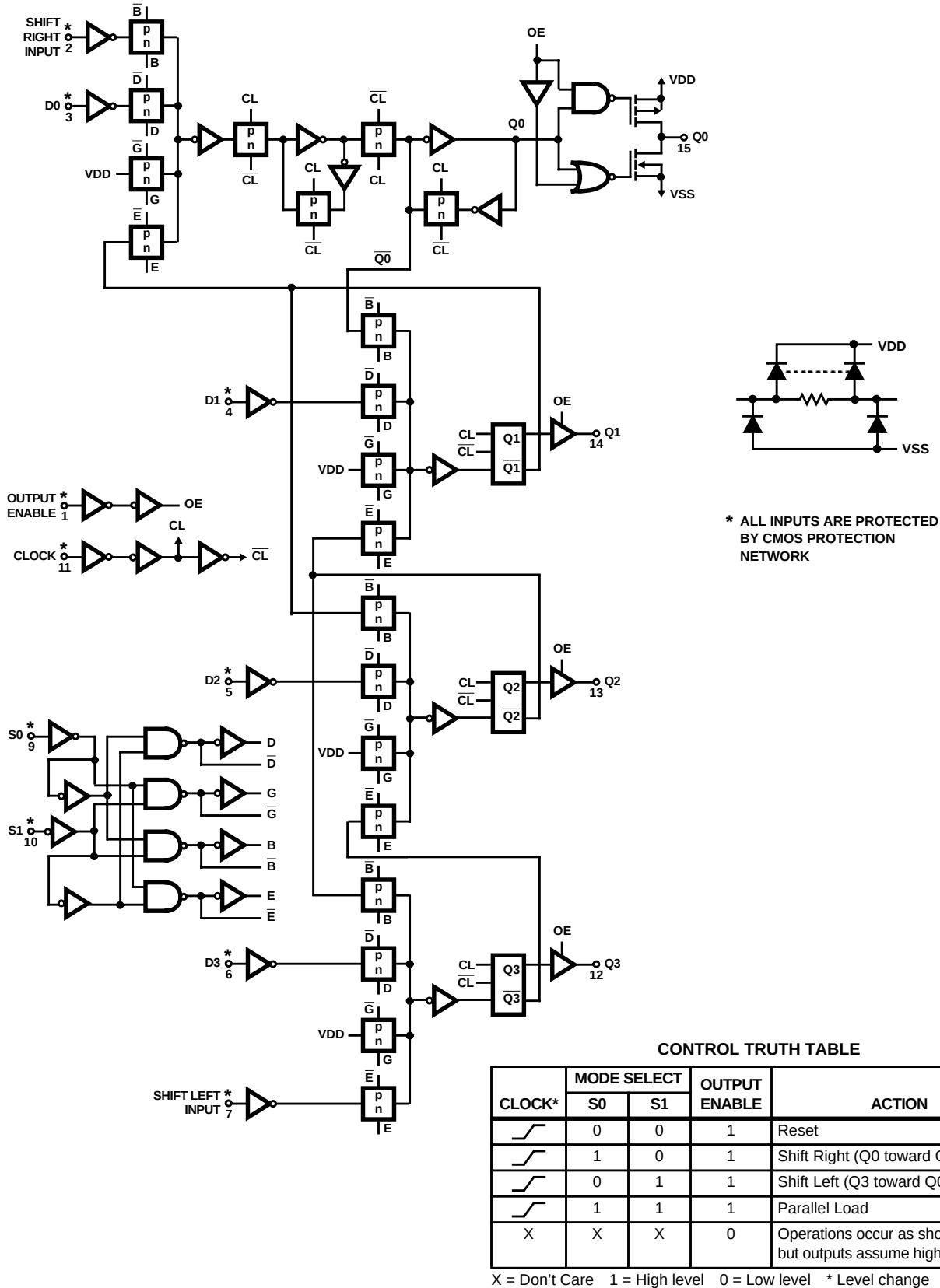
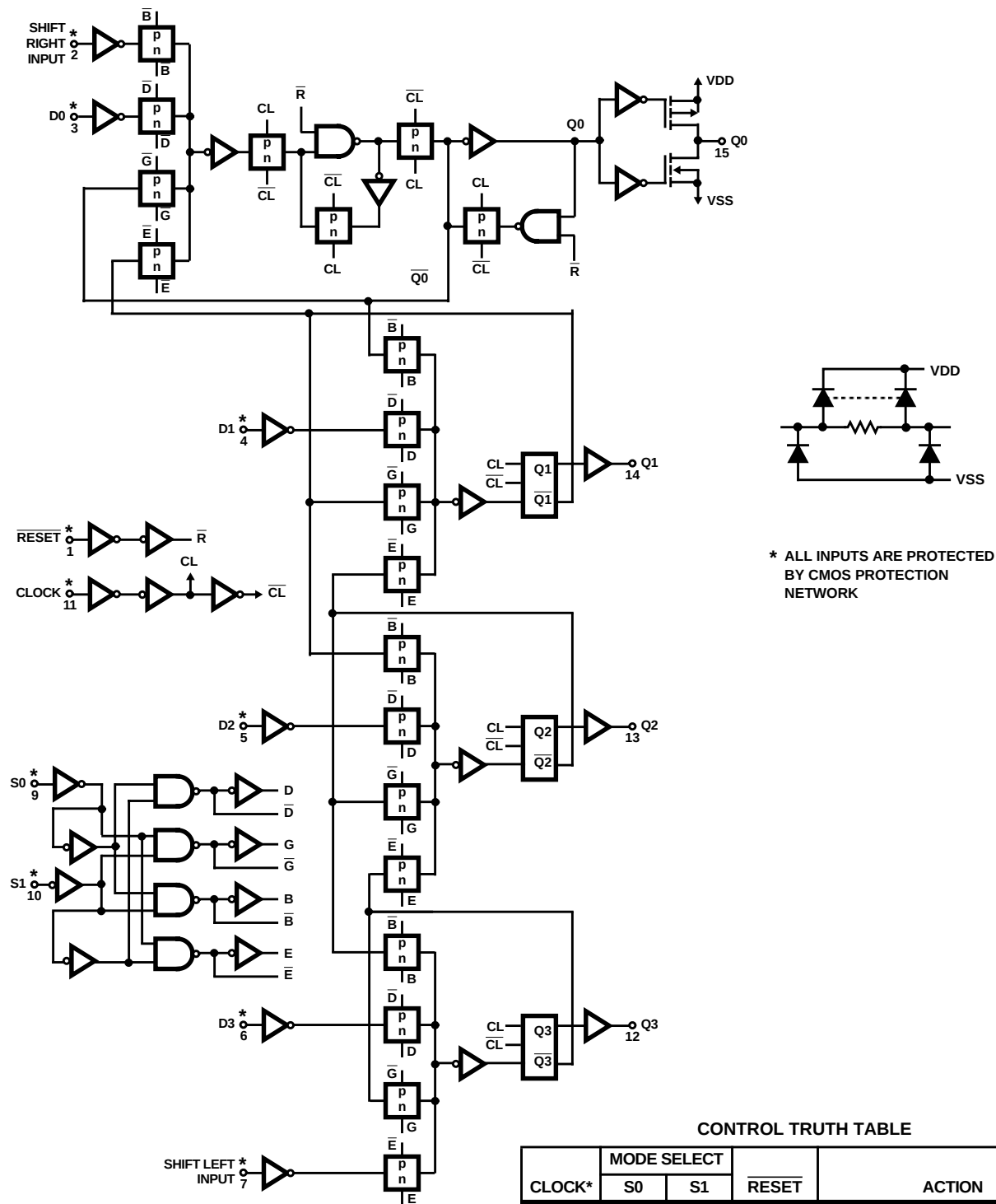


FIGURE 1. CD40104BMS

Logic Diagrams (Continued)



CONTROL TRUTH TABLE

| CLOCK* | MODE SELECT |    | RESET | ACTION                     |
|--------|-------------|----|-------|----------------------------|
|        | S0          | S1 |       |                            |
| X      | 0           | 0  | 1     | No Change                  |
|        | 1           | 0  | 1     | Shift Right (Q0 toward Q3) |
|        | 0           | 1  | 1     | Shift Left (Q3 toward Q0)  |
|        | 1           | 1  | 1     | Parallel Load              |
| X      | X           | X  | 0     | Reset                      |

X = Don't Care 1 = High level 0 = Low level \* Level change

FIGURE 2. CD40194BMS



## Typical Performance Characteristics

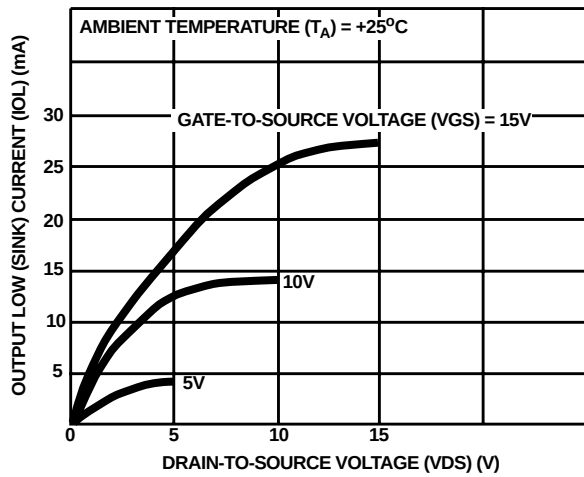


FIGURE 3. TYPICAL N-CHANNEL OUTPUT LOW (SINK) CURRENT CHARACTERISTICS

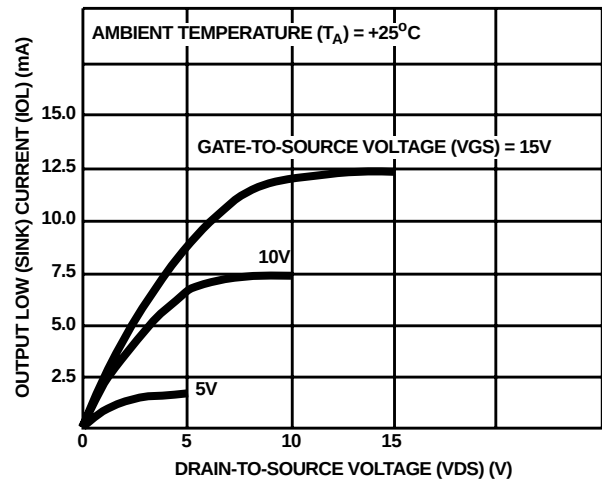


FIGURE 4. MINIMUM N-CHANNEL OUTPUT LOW (SINK) CURRENT CHARACTERISTICS

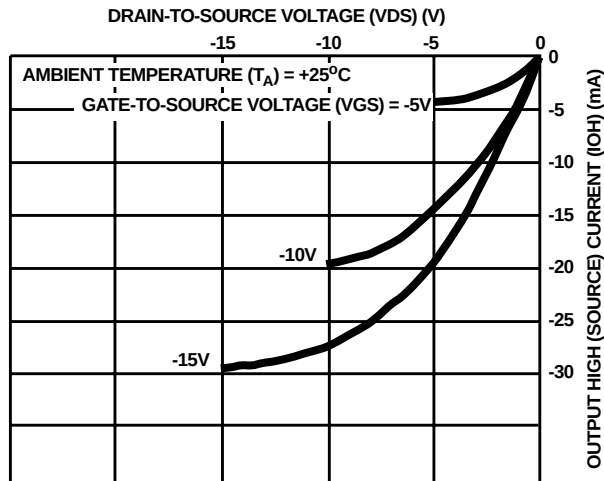


FIGURE 5. TYPICAL P-CHANNEL OUTPUT HIGH (SOURCE) CURRENT CHARACTERISTICS

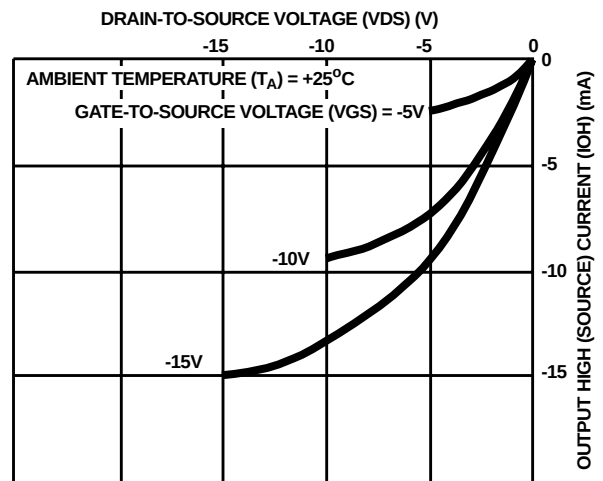


FIGURE 6. MINIMUM P-CHANNEL OUTPUT HIGH (SOURCE) CURRENT CHARACTERISTICS

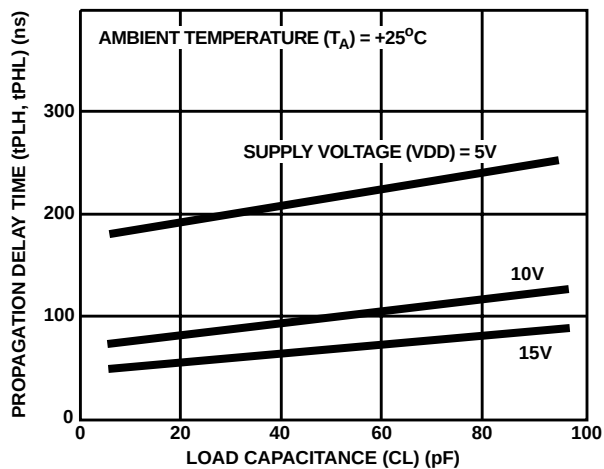


FIGURE 7. TYPICAL PROPAGATION DELAY TIME AS A FUNCTION OF LOAD CAPACITANCE, (CLOCK TO Q)

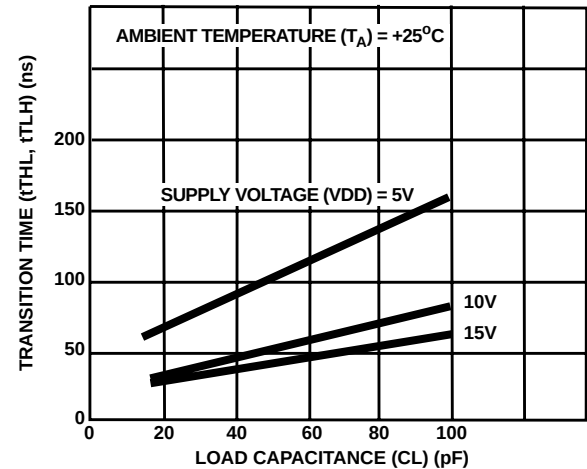


FIGURE 8. TYPICAL TRANSITION TIME AS A FUNCTION OF LOAD CAPACITANCE

Typical Performance Characteristics (Continued)

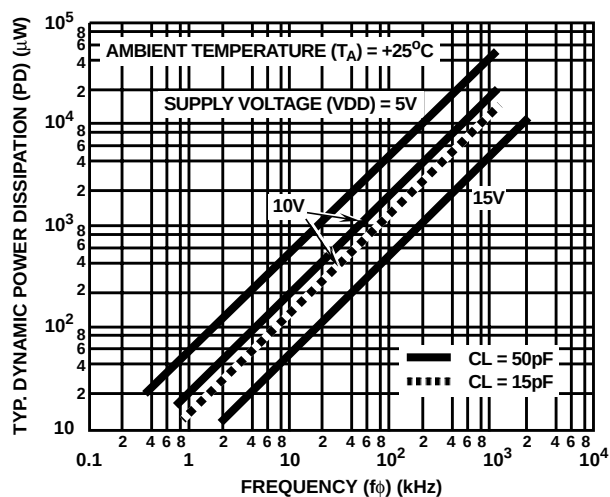
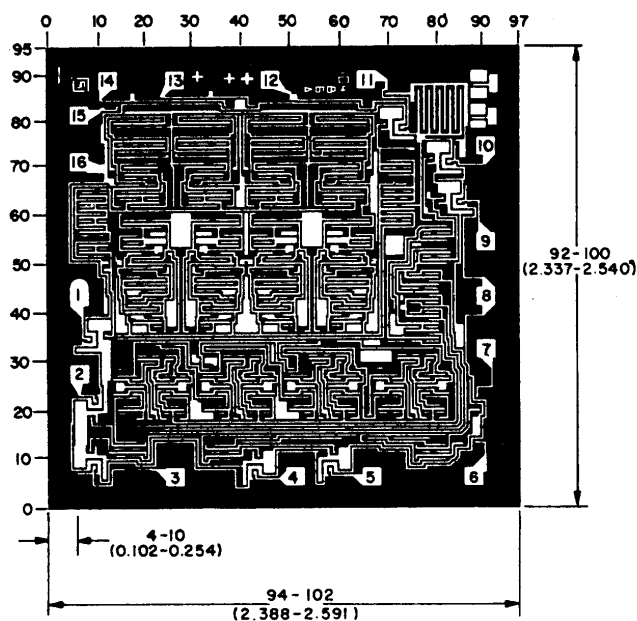
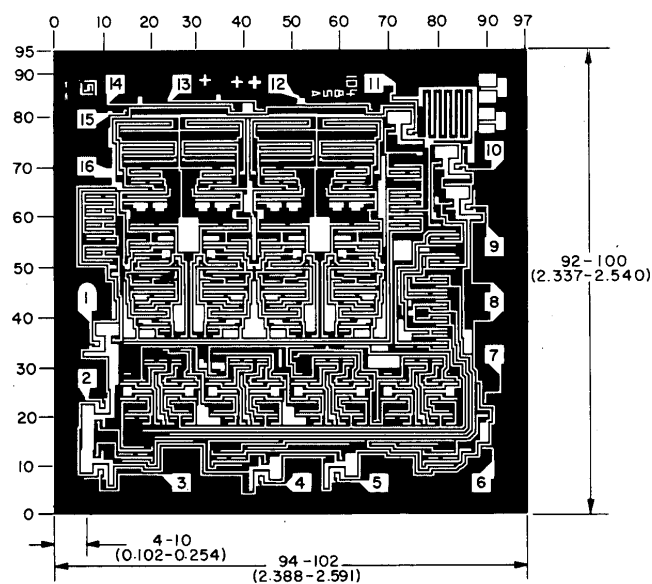


FIGURE 9. TYPICAL POWER DISSIPATION AS A FUNCTION OF FREQUENCY

Chip Dimensions and Pad Layouts



CD40104BMS



CD40194BMS

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:  $11\text{k}\text{\AA}$  -  $14\text{k}\text{\AA}$ , 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