

### Features

- High Voltage Types (20V Rating)
- CD4518BMS Dual BCD Up Counter
- CD4520BMS Dual Binary Up Counter
- Medium Speed Operation
  - 6MHz Typical Clock Frequency at 10V
- Positive or Negative Edge Triggering
- Synchronous Internal Carry Propagation
- 100% Tested for Quiescent Current at 20V
- 5V, 10V and 15V Parametric Ratings
- Maximum Input Current of 1 $\mu$ A at 18V Over Full Package Temperature Range; 100nA at 18V and +25°C
- Noise Margin (Over Full Package/Temperature Range)
  - 1V at VDD = 5V
  - 2V at VDD = 10V
  - 2.5V at VDD = 15V
- Standardized Symmetrical Output Characteristics
- Meets All Requirements of JEDEC Tentative Standard No. 13B, "Standard Specifications for Description of 'B' Series CMOS Devices"

### Applications

- Multistage Synchronous Counting
- Multistage Ripple Counting
- Frequency Dividers

### Description

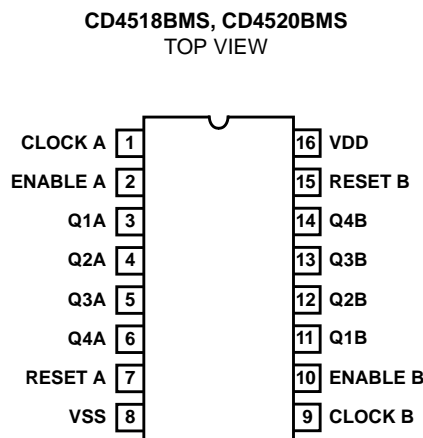
CD4518BMS Dual BCD Up Counter and CD4520BMS Dual Binary Up Counter each consist of two identical, internally synchronous 4-stage counters. The counter stages are D-type flip-flops having interchangeable CLOCK and ENABLE lines for incrementing on either the positive-going or negative-going transition. For single unit operation the ENABLE input is maintained high and the counter advances on each positive-going transition of the CLOCK. The counters are cleared by high levels on their RESET lines.

The counter can be cascaded in the ripple mode by connecting Q4 to the enable input of the subsequent counter while the CLOCK input of the latter is held low.

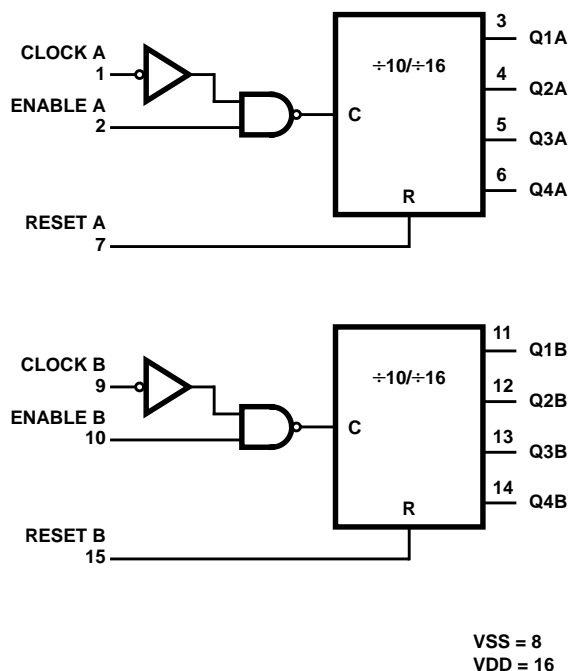
The CD4518BMS and CD4520BMS are supplied in these 16-lead outline packages:

|                  |               |
|------------------|---------------|
| Braze Seal DIP   | H4S           |
| Frit Seal DIP    | H1F           |
| Ceramic Flatpack | *H6P †H6W     |
| *CD4518B Only    | †CD4520B Only |

### Pinout



### Functional Diagram



# Specifications CD4518BMS, CD4520BMS

## 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 .....  $\pm 10\text{mA}$   
 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) .....  $500\text{mW}$   
 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 .....  $100\text{mW}$   
 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 = 20  | 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 = 20  | 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                    | $+25^{\circ}\text{C}$                                            | $\text{VOH} > \text{VDD}/2$ | $\text{VOL} < \text{VDD}/2$ | 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 (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 (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 (Note 2)  | VIL    | VDD = 15V, VOH > 13.5V, VOL < 1.5V |           | 1, 2, 3              | $+25^{\circ}\text{C}, +125^{\circ}\text{C}, -55^{\circ}\text{C}$ | -                           | 4                           | V             |
| Input Voltage High (Note 2) | VIH    | VDD = 15V, VOH > 13.5V, VOL < 1.5V |           | 1, 2, 3              | $+25^{\circ}\text{C}, +125^{\circ}\text{C}, -55^{\circ}\text{C}$ | 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 CD4518BMS, CD4520BMS

**TABLE 2. AC ELECTRICAL PERFORMANCE CHARACTERISTICS**

| PARAMETER                            | SYMBOL         | CONDITIONS (NOTE 1, 2)     | GROUP A<br>SUBGROUPS | TEMPERATURE   | LIMITS |     | UNITS |
|--------------------------------------|----------------|----------------------------|----------------------|---------------|--------|-----|-------|
|                                      |                |                            |                      |               | MIN    | MAX |       |
| Propagation Delay<br>Clock to Output | TPHL1<br>TPLH1 | VDD = 5V, VIN = VDD or GND | 9                    | +25°C         | -      | 560 | ns    |
|                                      |                |                            | 10, 11               | +125°C, -55°C | -      | 756 | ns    |
| Propagation Delay<br>Reset to Output | TPHL2          | VDD = 5V, VIN = VDD or GND | 9                    | +25°C         | -      | 650 | ns    |
|                                      |                |                            | 10, 11               | +125°C, -55°C | -      | 878 | ns    |
| Transition Time<br>(Note 2)          | TTHL<br>TTLH   | VDD = 5V, VIN = VDD or GND | 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 | 9                    | +25°C         | 1.5    | -   | MHz   |
|                                      |                |                            | 10, 11               | +125°C, -55°C | 1.11   | -   | MHz   |

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            | -      | 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    |
| Output Current (Source) | IOH5B  | VDD = 5V, VOUT = 2.5V         | 1, 2  | +125°C                  | -      | -1.15 | mA    |
|                         |        |                               |       | -55°C                   | -      | -2.0  | mA    |
| Output Current (Source) | IOH10  | VDD = 10V, VOUT = 9.5V        | 1, 2  | +125°C                  | -      | -0.9  | mA    |
|                         |        |                               |       | -55°C                   | -      | -1.6  | mA    |
| Output Current (Source) | IOH15  | VDD = 15V, VOUT = 13.5V       | 1, 2  | +125°C                  | -      | -2.4  | mA    |
|                         |        |                               |       | -55°C                   | -      | -4.2  | mA    |
| Input Voltage Low       | VIL    | VDD = 10V, VOH > 9V, VOL < 1V | 1, 2  | +25°C, +125°C,<br>-55°C | -      | 3     | V     |
| Input Voltage High      | VIH    | VDD = 10V, VOH > 9V, VOL < 1V | 1, 2  | +25°C, +125°C,<br>-55°C | +7     | -     | V     |

## Specifications CD4518BMS, CD4520BMS

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

| PARAMETER                            | SYMBOL         | CONDITIONS | NOTES      | TEMPERATURE | LIMITS |     | UNITS |
|--------------------------------------|----------------|------------|------------|-------------|--------|-----|-------|
|                                      |                |            |            |             | MIN    | MAX |       |
| Propagation Delay<br>Clock to Output | TPHL1<br>TPLH1 | VDD = 10V  | 1, 2, 3    | +25°C       | -      | 230 | ns    |
|                                      |                | VDD = 15V  | 1, 2, 3    | +25°C       | -      | 160 | ns    |
| Propagation Delay<br>Reset to Output | TPHL2          | VDD = 10V  | 1, 2, 3    | +25°C       | -      | 225 | ns    |
|                                      |                | VDD = 15V  | 1, 2, 3    | +25°C       | -      | 170 | ns    |
| Transition Time                      | TTHL<br>TTLH   | VDD = 10V  | 1, 2, 3    | +25°C       | -      | 100 | ns    |
|                                      |                | VDD = 15V  | 1, 2, 3    | +25°C       | -      | 80  | ns    |
| Maximum Clock Input<br>Frequency     | FCL            | VDD = 10V  | 1, 2, 3    | +25°C       | 3      | -   | MHz   |
|                                      |                | VDD = 15V  | 1, 2, 3    | +25°C       | 4      | -   | MHz   |
| Maximum Clock Rise and<br>Fall Time  | TRCL<br>TFCL   | VDD = 5V   | 1, 2, 3, 4 | +25°C       | -      | 15  | μs    |
|                                      |                | VDD = 10V  | 1, 2, 3, 4 | +25°C       | -      | 5   | μs    |
|                                      |                | VDD = 15V  | 1, 2, 3, 4 | +25°C       | -      | 5   | μs    |
| Minimum Enable Pulse<br>Width        | TW             | VDD = 5V   | 1, 2, 3    | +25°C       | -      | 400 | ns    |
|                                      |                | VDD = 10V  | 1, 2, 3    | +25°C       | -      | 200 | ns    |
|                                      |                | VDD = 15V  | 1, 2, 3    | +25°C       | -      | 140 | ns    |
| Minimum Reset Pulse<br>Width         | TW             | VDD = 5V   | 1, 2, 3    | +25°C       | -      | 250 | ns    |
|                                      |                | VDD = 10V  | 1, 2, 3    | +25°C       | -      | 110 | ns    |
|                                      |                | VDD = 15V  | 1, 2, 3    | +25°C       | -      | 80  | ns    |
| Minimum Clock Pulse<br>Width         | TW             | VDD = 5V   | 1, 2, 3    | +25°C       | -      | 200 | ns    |
|                                      |                | VDD = 10V  | 1, 2, 3    | +25°C       | -      | 100 | ns    |
|                                      |                | VDD = 15V  | 1, 2, 3    | +25°C       | -      | 70  | 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. 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<br>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<br>Delta | ΔVTP         | VSS = 0V, IDD = 10μA        | 1, 4       | +25°C       | -              | ±1                       | V     |
| Functional                   | F            | VDD = 18V, VIN = VDD or GND | 1          | +25°C       | VOH ><br>VDD/2 | VOL <<br>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<br>+25°C<br>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

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

| PARAMETER               | SYMBOL | DELTA LIMIT                   |
|-------------------------|--------|-------------------------------|
| Supply Current - MSI-2  | IDD    | $\pm 1.0\mu\text{A}$          |
| Output Current (Sink)   | IOL5   | $\pm 20\%$ x Pre-Test Reading |
| Output Current (Source) | IOH5A  | $\pm 20\%$ 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 | 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 $\pm$ -0.5V | OSCILLATOR |       |
|----------------------------|------------|----------------|---------------------------|----------------|------------|-------|
|                            |            |                |                           |                | 50kHz      | 25kHz |
| Static Burn-In 1<br>Note 1 | 3-6, 11-14 | 1, 2, 7-10, 15 | 16                        |                |            |       |
| Static Burn-In 2<br>Note 1 | 3-6, 11-14 | 8              | 1, 2, 7, 9, 10,<br>15, 16 |                |            |       |
| Dynamic Burn-In<br>Note 1  | -          | 7, 8, 15       | 2, 10, 16                 | 3-6, 11-14     | 1, 9       |       |
| Irradiation<br>Note 2      | 3-6, 11-14 | 8              | 1, 2, 7, 9, 10,<br>15, 16 |                |            |       |

NOTES:

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

# Logic Diagrams

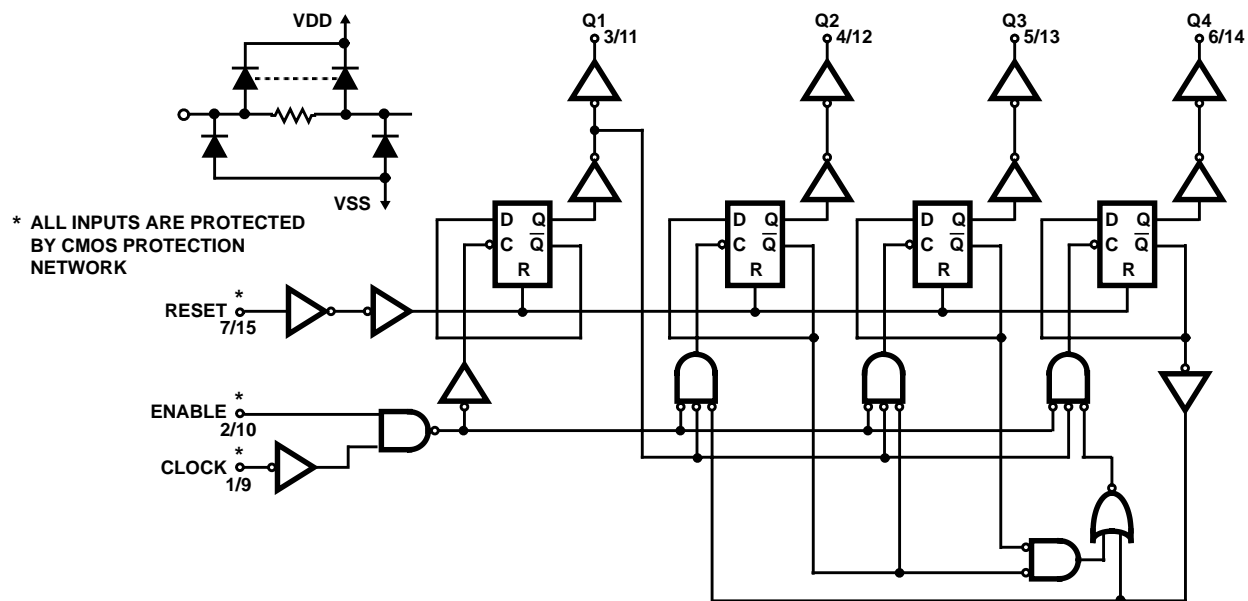


FIGURE 1. DECADE COUNTER (CD4518BMS) LOGIC DIAGRAM FOR ONE OF TWO IDENTICAL COUNTERS

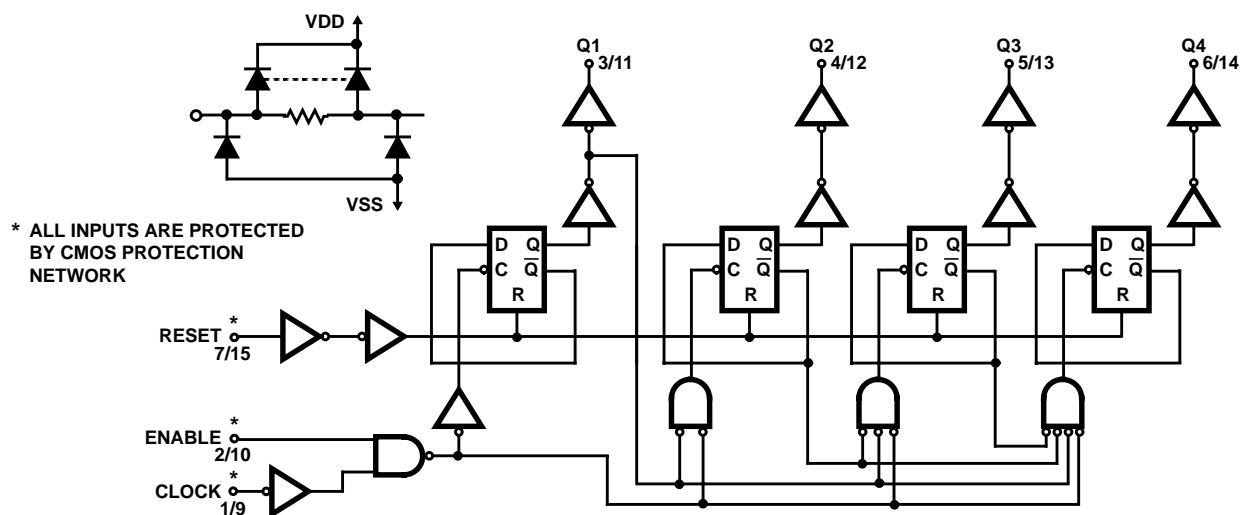


FIGURE 2. BINARY COUNTER (CD4520BMS) LOGIC DIAGRAM FOR ONE OF TWO IDENTICAL COUNTERS

TRUTH TABLE

| CLOCK | ENABLE | RESET | ACTION            |
|-------|--------|-------|-------------------|
|       | 1      | 0     | Increment Counter |
| 0     |        | 0     | Increment Counter |
|       | X      | 0     | No Change         |
| X     |        | 0     | No Change         |
|       | 0      | 0     | No Change         |
| 1     |        | 0     | No Change         |
| X     | X      | 1     | Q1 thru Q4 = 0    |

X = Don't Care    1 = High State    0 = Low State

## Typical Performance Curves

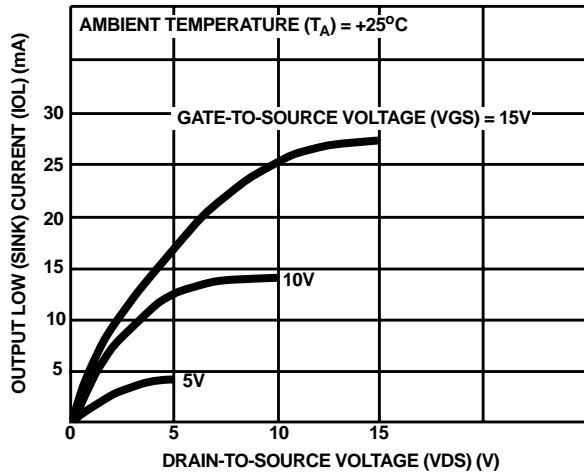


FIGURE 3. TYPICAL OUTPUT LOW (SINK) CURRENT CHARACTERISTICS

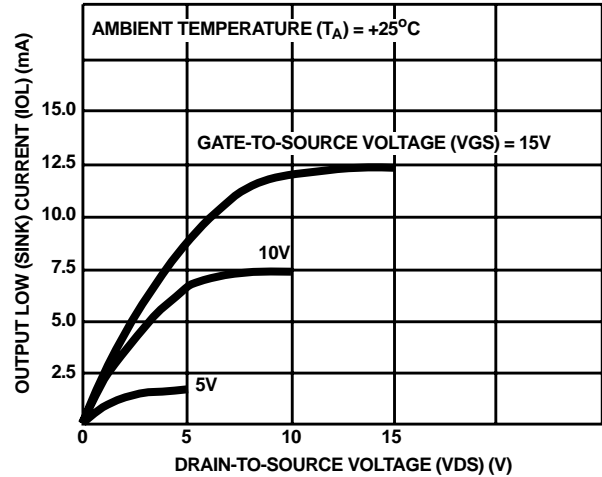


FIGURE 4. MINIMUM OUTPUT LOW (SINK) CURRENT CHARACTERISTICS

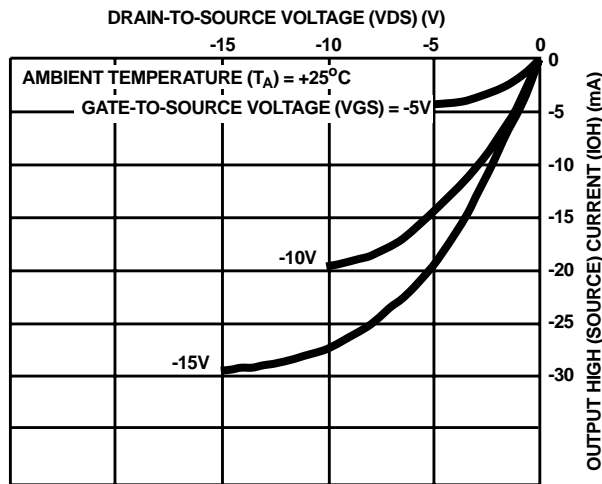


FIGURE 5. TYPICAL OUTPUT HIGH (SOURCE) CURRENT CHARACTERISTICS

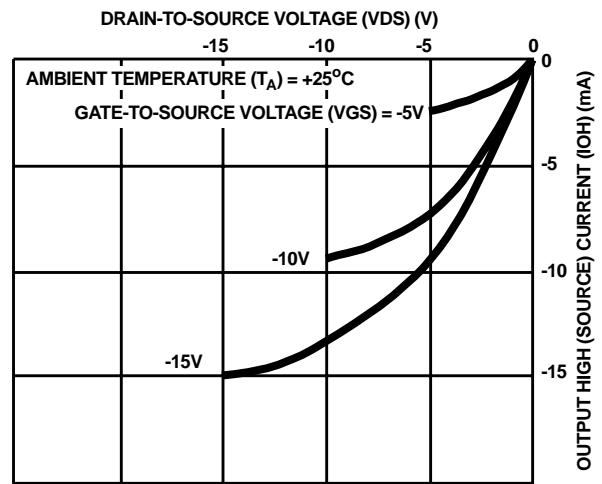


FIGURE 6. MINIMUM OUTPUT HIGH (SOURCE) CURRENT CHARACTERISTICS

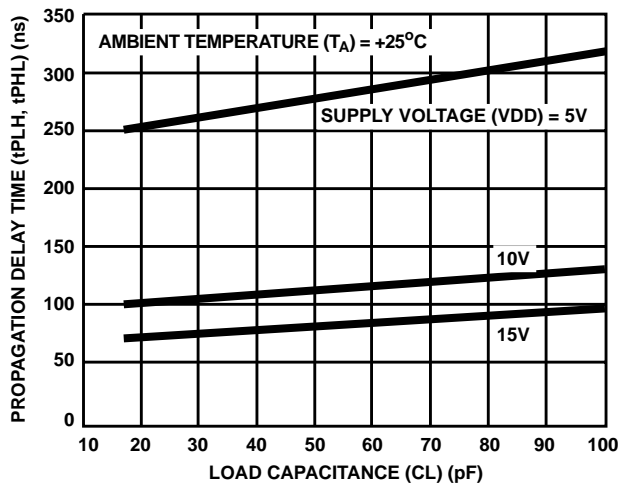


FIGURE 7. TYPICAL PROPAGATION DELAY vs LOAD CAPACITANCE, CLOCK OR ENABLE TO OUTPUT

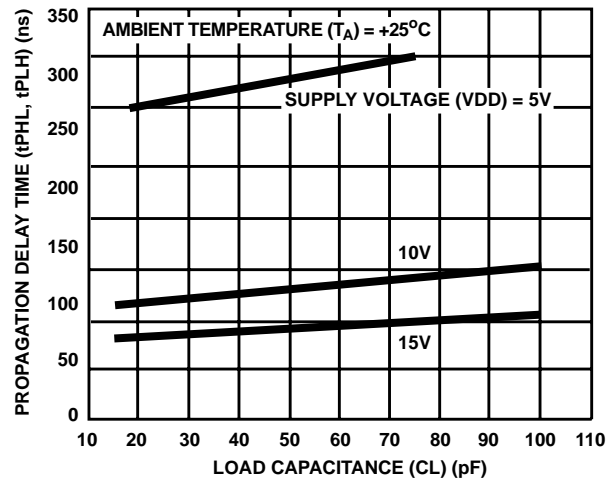


FIGURE 8. TYPICAL PROPAGATION DELAY TIME vs LOAD CAPACITANCE, RESET TO OUTPUT

## Typical Performance Curves

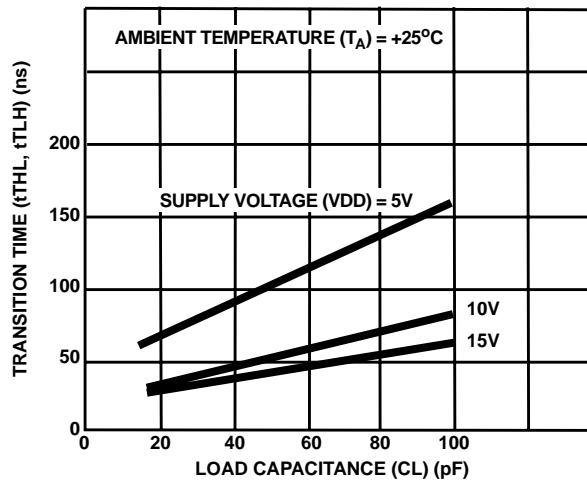


FIGURE 9. TYPICAL TRANSITION TIME vs LOAD CAPACITANCE

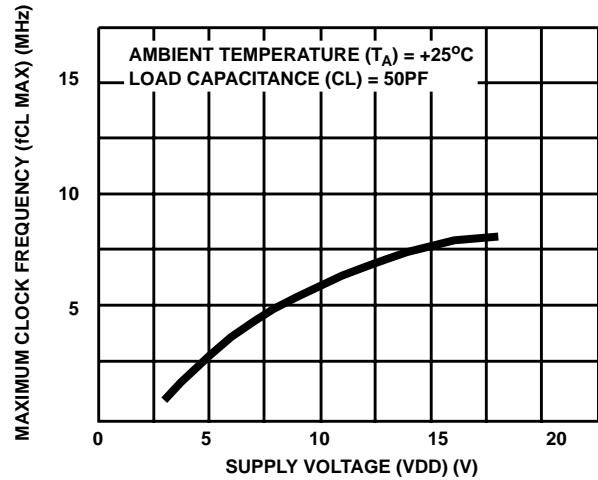


FIGURE 10. TYPICAL MAXIMUM CLOCK FREQUENCY vs SUPPLY VOLTAGE

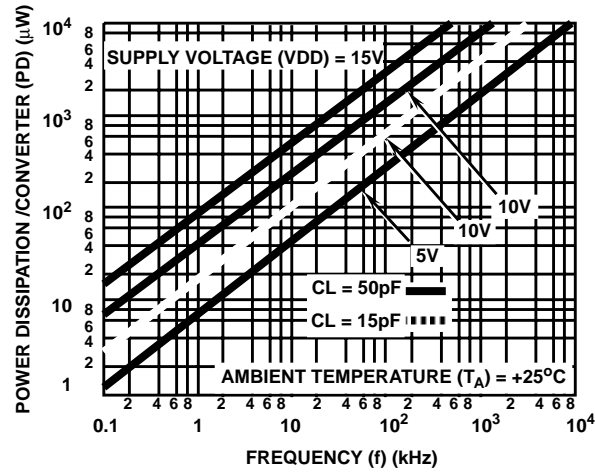


FIGURE 11. TYPICAL POWER DISSIPATION CHARACTERISTICS

## Timing Diagrams

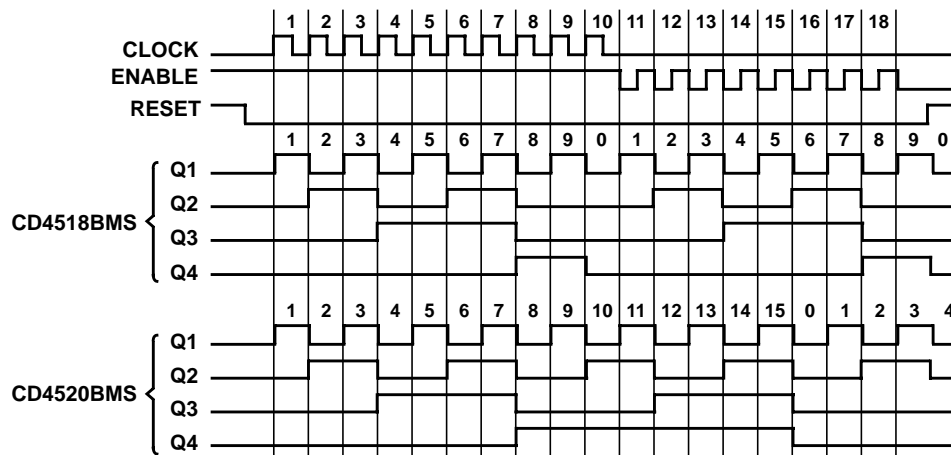


FIGURE 12. TIMING DIAGRAMS FOR CD4518BMS AND CD4520BMS



## CD4518BMS, CD4520BMS

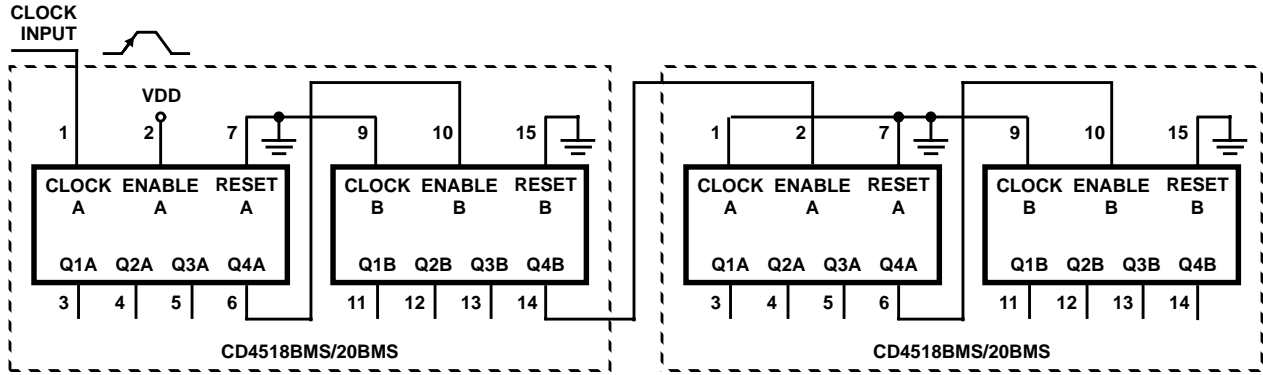
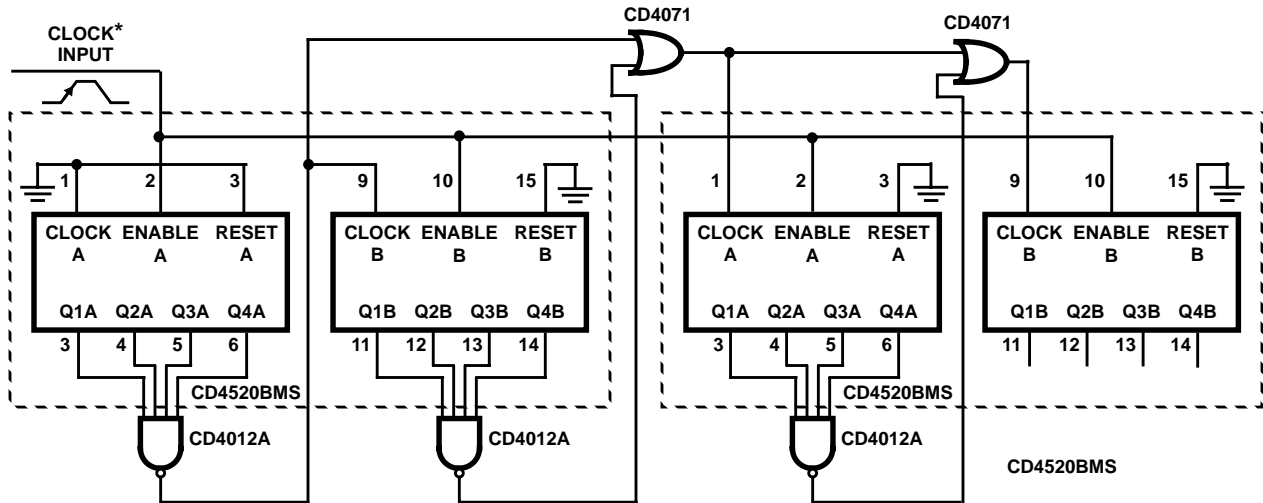


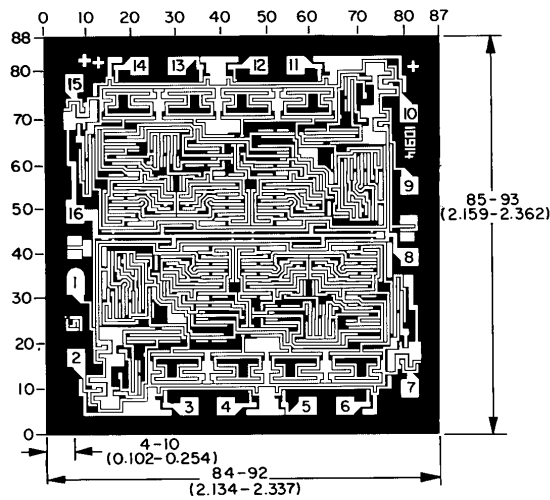
FIGURE 13. RIPPLE CASCADING OF FOUR COUNTERS WITH POSITIVE EDGE TRIGGERING



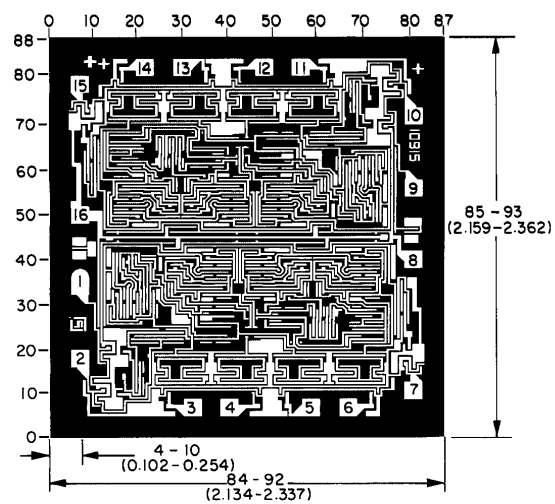
\* For synchronous cascading, the clock transition time should be made less than or equal to the sum of the fixed propagation delay at 15pF and the transition time of the output driver stage for the estimated capacitive load.

FIGURE 14. SYNCHRONOUS CASCADING OF FOUR BINARY COUNTERS WITH NEGATIVE EDGE TRIGGERING

## Chip Dimensions and Pad Layouts



CD4518BMS



CD4520BMS

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

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