

# CD4521 CMOS 24-Stage Frequency Divider

## 1. General Description

### 1.1 Description

CD4521 consists of an oscillator section and 24 ripple-carry binary counter stages. The oscillator configuration (using IN1) allows design of either RC or crystal oscillator circuits. IN1 should be tied either HIGH or LOW when not in use. A HIGH on the RESET causes the counter to go to the all-0's state and disables the oscillator. The count is advanced on the negative transition of IN1 (and IN2).

### 1.2 Features

- Reset disables the RC oscillator for low-power standby condition
- VDD' and VSS' pins are brought out from the crystal oscillator to allow use of external

resistors for low-power operation

- Common reset
- Standardized, symmetrical output characteristics
- 100% tested for quiescent current at 18 V
- Maximum input current of 1μA at 18V and 25°C
- 5V, 10V, and 15V parametric ratings

### 1.3 Device Information

| PART NUMBER | PACKAGE |
|-------------|---------|
| CD4521      | DIP     |
|             | SOP     |
|             | TSSOP   |

## 2. Pin Description and Functional Diagram

Figure 2.1 Top View

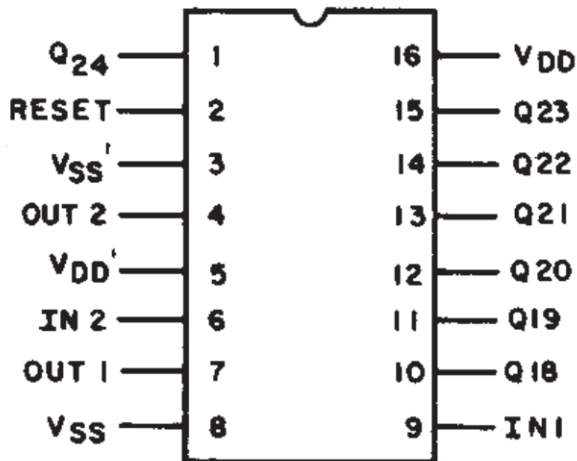
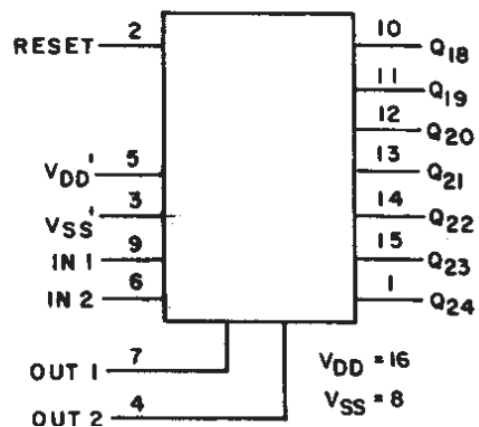


Figure 2.2 Functional Diagram



| PIN No. | NAME | I/O | FUNCTION |
|---------|------|-----|----------|
|---------|------|-----|----------|



|    |       |   |                                |
|----|-------|---|--------------------------------|
| 1  | Q24   | I | Data Output                    |
| 2  | RESET | I | RESET Input                    |
| 3  | VSS'  |   | Ground'                        |
| 4  | OUT2  | O | External oscillator connection |
| 5  | VDD'  |   | Supply Voltage'                |
| 6  | IN2   | I | External oscillator connection |
| 7  | OUT1  | O | External oscillator connection |
| 8  | VSS   |   | Ground                         |
| 9  | IN1   | I | External oscillator connection |
| 10 | Q18   | O | Data Output                    |
| 11 | Q19   | O | Data Output                    |
| 12 | Q20   | O | Data Output                    |
| 13 | Q21   | O | Data Output                    |
| 14 | Q22   | O | Data Output                    |
| 15 | Q23   | O | Data Output                    |
| 16 | VDD   |   | Supply Voltage                 |

| OUTPUT | COUNT CAPACITY        |
|--------|-----------------------|
| Q18    | $2^{18} = 262,144$    |
| Q19    | $2^{19} = 524,288$    |
| Q20    | $2^{20} = 1,048,576$  |
| Q21    | $2^{21} = 2,097,152$  |
| Q22    | $2^{22} = 4,194,304$  |
| Q23    | $2^{23} = 8,388,608$  |
| Q24    | $2^{24} = 16,777,216$ |

## 3. System Diagram

### 3.1 Logic Diagram

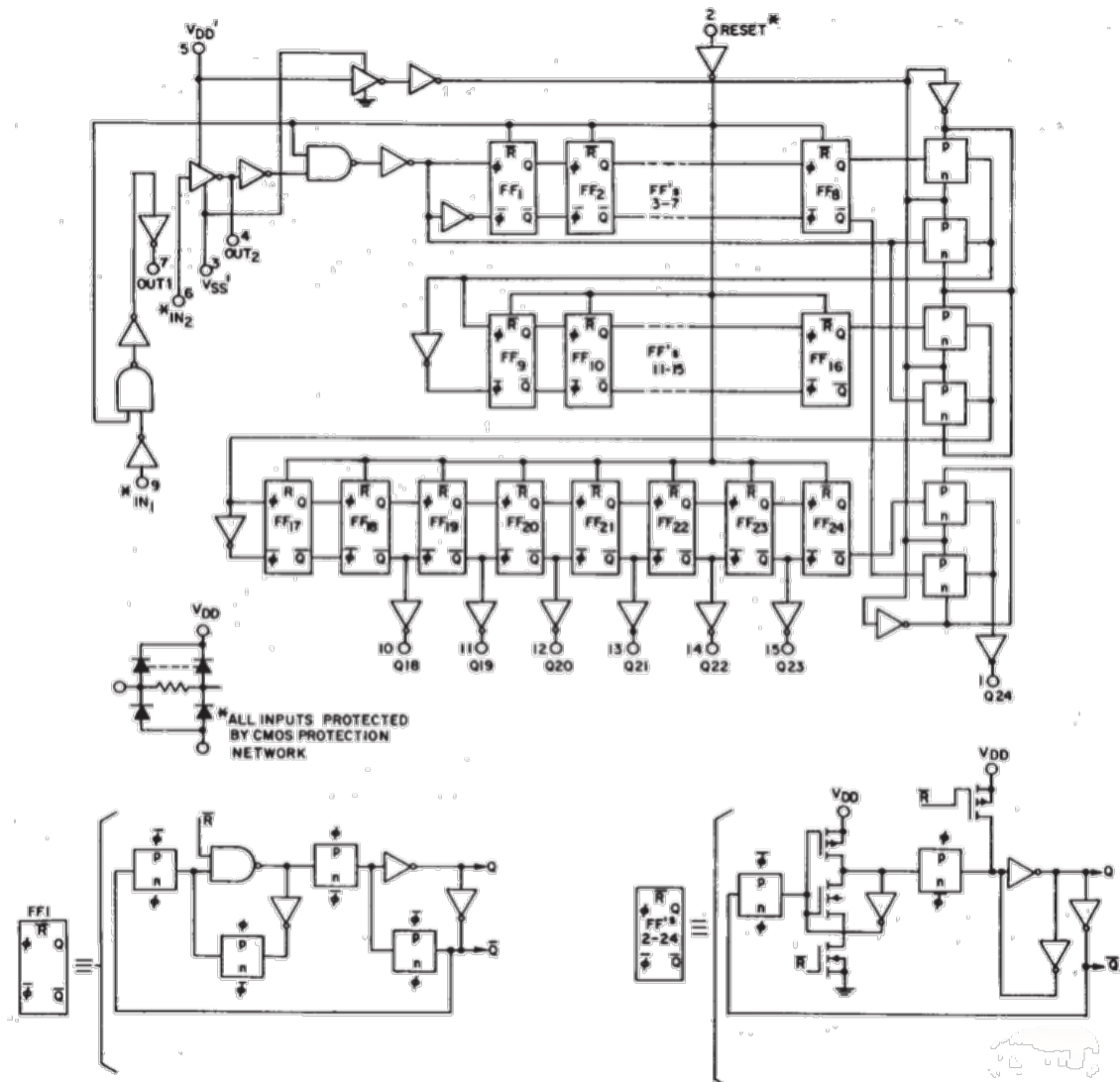


Figure 3.1: CD4521 Logic Diagram

## 4. Specifications

### 4.1 Absolute Maximum Ratings

| Symbol   | Parameter                                                        | MIN  | MAX          | Unit |
|----------|------------------------------------------------------------------|------|--------------|------|
| $V_{DD}$ | DC Supply Voltage Range<br>(Voltage Referenced to VSS Terminals) | -0.5 | 20           | V    |
| $V_I$    | Input Voltage Range, All Inputs                                  | 0.5  | $V_{DD}+0.5$ | V    |
| $P_D$    | Power Dissipation                                                |      | 500          | mW   |
| $T_J$    | Junction Temperature                                             |      | 125          | °C   |
| $T_{OP}$ | Operating Temperature                                            | 0    | 70           | °C   |

Absolute maximum ratings are those values beyond which the device could be permanently damaged, These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions.

## 4.2 Electrical Characteristics

### 4.2.1 DC Specifications

(T<sub>a</sub>=25°C, voltages are referenced to VSS (ground=0V), unless otherwise specified)

| Symbol          | Parameter                                          | Test Condition |      |     | MIN   | TYP  | MAX  | Unit |
|-----------------|----------------------------------------------------|----------------|------|-----|-------|------|------|------|
|                 |                                                    | VO             | VIN  | VDD |       |      |      |      |
| I <sub>DD</sub> | Supply Current                                     | --             | 0,5  | 5   | --    | 0    | 1    | uA   |
|                 |                                                    | --             | 0,10 | 10  | --    | 0    | 1    | uA   |
|                 |                                                    | --             | 0,18 | 18  | --    | 0    | 1    | uA   |
| I <sub>OL</sub> | Low Level Output Current (Pin4,7)                  | 0.4            | 0,5  | 5   | 1     | 2    | --   | mA   |
|                 |                                                    | 0.5            | 0,10 | 10  | 2.5   | 5    | --   | mA   |
|                 |                                                    | 1.5            | 0,15 | 15  | 10    | 20   | --   | mA   |
|                 | Low Level Output Current (Pin1,10,11,12,13,14,15)  | 0.4            | 0,5  | 5   | 1.5   | 3    | --   | mA   |
|                 |                                                    | 0.5            | 0,10 | 10  | 3     | 7    | --   | mA   |
|                 |                                                    | 1.5            | 0,15 | 15  | 12    | 25   | --   | mA   |
| I <sub>OH</sub> | Low Level Output Current (Pin4,7)                  | 4.6            | 0,5  | 5   | -0.2  | -0.5 | --   | mA   |
|                 |                                                    | 2.5            | 0,5  | 5   | -1    | -2   | --   | mA   |
|                 |                                                    | 9.5            | 0,10 | 10  | -0.5  | -1   | --   | mA   |
|                 |                                                    | 13.5           | 0,15 | 15  | -2    | -4   | --   | mA   |
|                 | Low Level Output Current (Pin7)                    | 4.6            | 0,5  | 5   | -0.5  | -1   | --   | mA   |
|                 |                                                    | 2.5            | 0,5  | 5   | -2    | -5   | --   | mA   |
|                 |                                                    | 9.5            | 0,10 | 10  | -1    | -2   | --   | mA   |
|                 |                                                    | 13.5           | 0,15 | 15  | -4    | -9   | --   | mA   |
|                 | High Level Output Current (Pin1,10,11,12,13,14,15) | 4.6            | 0,5  | 5   | -0.5  | -1.5 | --   | mA   |
|                 |                                                    | 2.5            | 0,5  | 5   | -3    | -7   | --   | mA   |
|                 |                                                    | 9.5            | 0,10 | 10  | -1.5  | -3.5 | --   | mA   |
|                 |                                                    | 13.5           | 0,15 | 15  | -6    | -13  | --   | mA   |
| V <sub>OL</sub> | Low Level Output Voltage                           | --             | 0,5  | 5   | --    | 0    | 0.05 | V    |
|                 |                                                    | --             | 0,10 | 10  | --    | 0    | 0.05 | V    |
|                 |                                                    | --             | 0,15 | 15  | --    | 0    | 0.05 | V    |
| V <sub>OH</sub> | High Level Output Voltage                          | --             | 0,5  | 5   | 4.95  | 5    | --   | V    |
|                 |                                                    | --             | 0,10 | 10  | 9.95  | 10   | --   | V    |
|                 |                                                    | --             | 0,15 | 15  | 14.95 | 15   | --   | V    |
| V <sub>IL</sub> | Low Level Input Voltage                            | 0.5,4.5        | --   | 5   | --    | --   | 1.5  | V    |
|                 |                                                    | 1,9            | --   | 10  | --    | --   | 3    | V    |
|                 |                                                    | 1.5,13.5       | --   | 15  | --    | --   | 4    | V    |
| V <sub>IH</sub> | High Level Input Voltage                           | 0.5,4.5        | --   | 5   | 3.5   | --   | --   | V    |
|                 |                                                    | 1,9            | --   | 10  | 7     | --   | --   | V    |
|                 |                                                    | 1.5,13.5       | --   | 15  | 11    | --   | --   | V    |
| I <sub>IN</sub> | Input Leakage Current                              | --             | 0,18 | 18  | --    | 0    | ±1   | uA   |



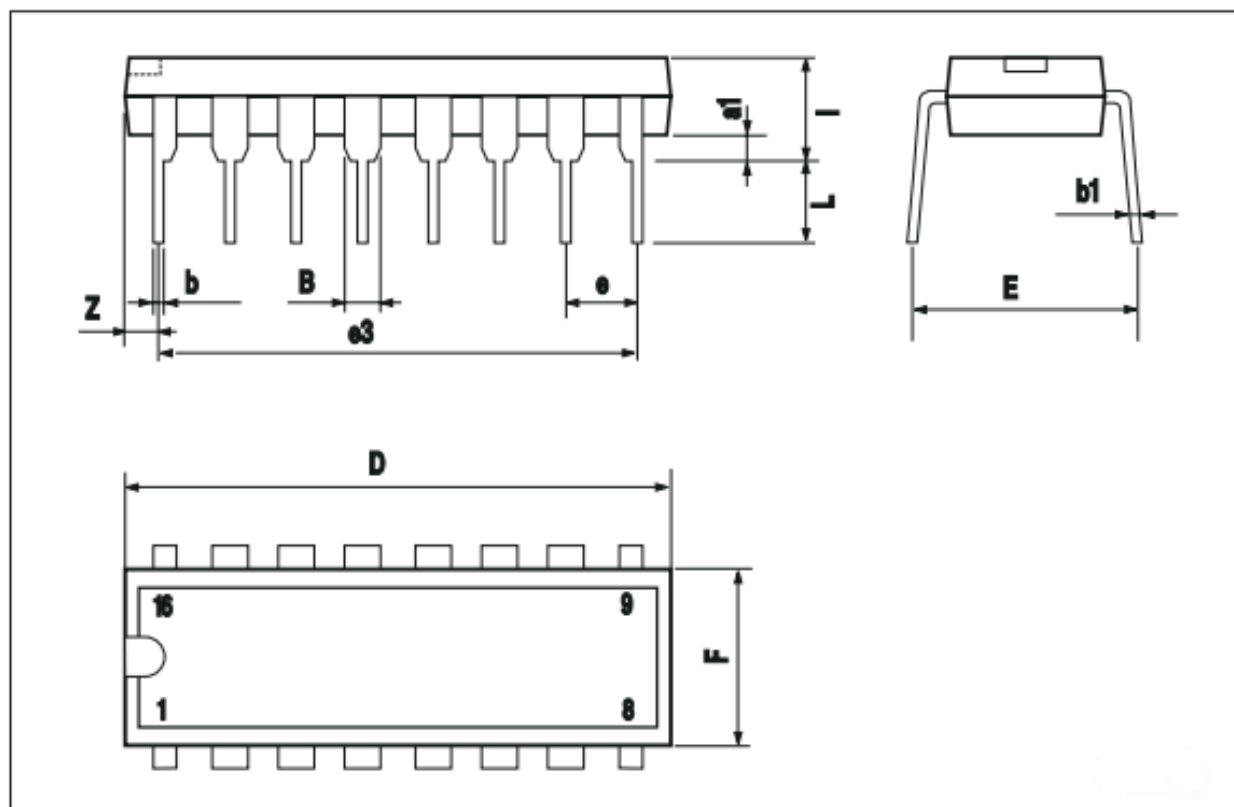
## 5. Ordering Information

| Orderable Device | Package Type | Pins | Packing     | Package Qty |
|------------------|--------------|------|-------------|-------------|
| CD4521ND16ATBE   | DIP          | 16   | Tube        | 25          |
| CD4521NS16ARDQ   | SOP          | 16   | Tape & Reel | 4000        |
| CD4521TS16ARDQ   | TSSOP        | 16   | Tape & Reel | 4000        |

## 6. Package Information

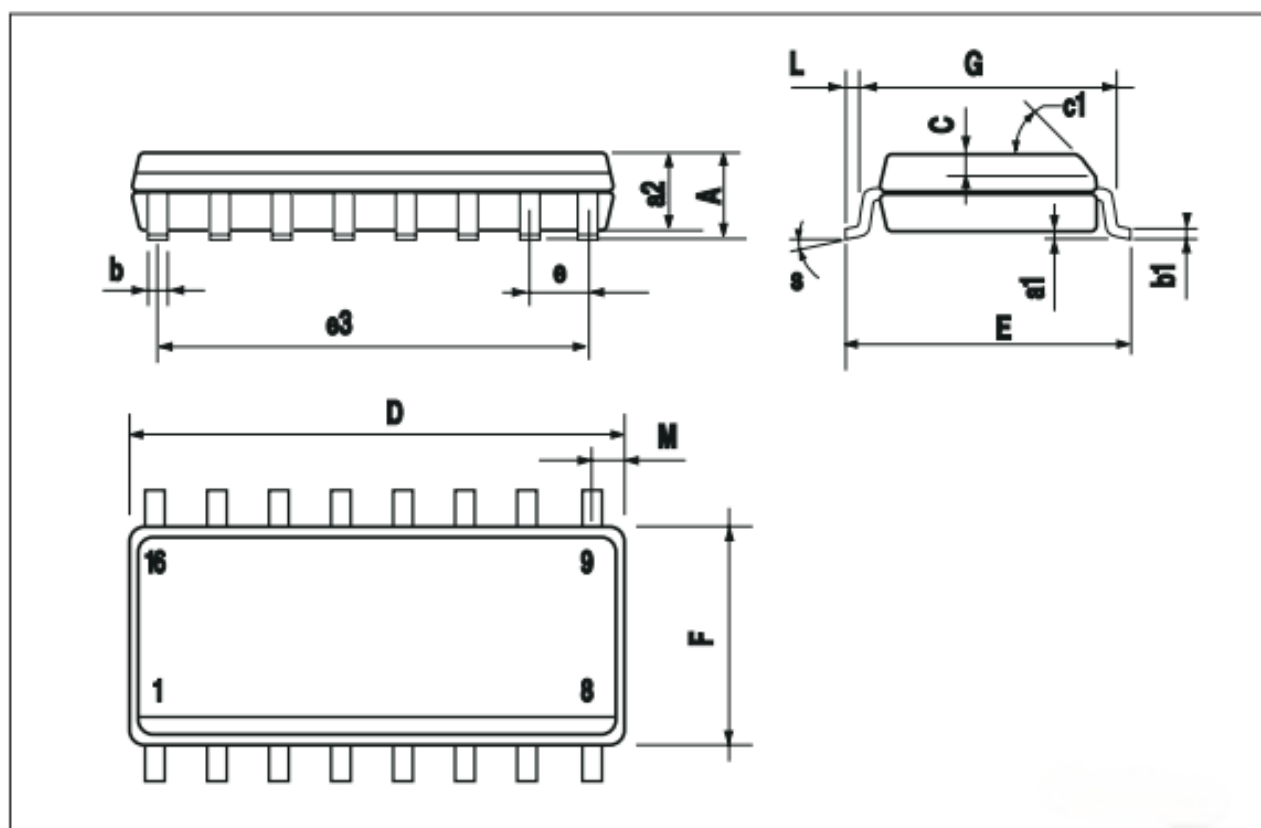
### 6.1 DIP16

| Dim. | mm.  |       |      | inch. |       |       |
|------|------|-------|------|-------|-------|-------|
|      | Min. | Typ.  | Max. | Min.  | Typ.  | Max.  |
| a1   | 0.51 |       |      | 0.020 |       |       |
| B    | 0.77 |       | 1.65 | 0.030 |       | 0.065 |
| b    |      | 0.5   |      |       | 0.020 |       |
| b1   |      | 0.25  |      |       | 0.010 |       |
| D    |      |       | 20   |       |       | 0.787 |
| E    |      | 8.5   |      |       | 0.335 |       |
| e    |      | 2.54  |      |       | 0.100 |       |
| e3   |      | 17.78 |      |       | 0.700 |       |
| F    |      |       | 7.1  |       |       | 0.280 |
| I    |      |       | 5.1  |       |       | 0.201 |
| L    |      | 3.3   |      |       | 0.130 |       |
| Z    |      |       | 1.27 |       |       | 0.050 |



## 6.2 SOP16

| Dim. | mm.        |      |      | inch. |       |       |
|------|------------|------|------|-------|-------|-------|
|      | Min.       | Typ. | Max. | Min.  | Typ.  | Max.  |
| A    |            |      | 1.75 |       |       | 0.068 |
| a1   | 0.1        |      | 0.25 | 0.004 |       | 0.010 |
| a2   |            |      | 1.64 |       |       | 0.063 |
| b    | 0.35       |      | 0.46 | 0.013 |       | 0.018 |
| b1   | 0.19       |      | 0.25 | 0.007 |       | 0.010 |
| C    |            | 0.5  |      |       | 0.019 |       |
| c1   | 45° (typ.) |      |      |       |       |       |
| D    | 9.8        |      | 10   | 0.385 |       | 0.393 |
| E    | 5.8        |      | 6.2  | 0.228 |       | 0.244 |
| e    |            | 1.27 |      |       | 0.050 |       |
| e3   |            | 8.89 |      |       | 0.350 |       |
| F    | 3.8        |      | 4.0  | 0.149 |       | 0.157 |
| G    | 4.6        |      | 5.3  | 0.181 |       | 0.208 |
| L    | 0.5        |      | 1.27 | 0.019 |       | 0.050 |
| M    |            |      | 0.62 |       |       | 0.024 |
| S    | 8° (max.)  |      |      |       |       |       |



## 6.3 TSSOP16

| Dim. | mm.  |          |      | inch. |            |        |
|------|------|----------|------|-------|------------|--------|
|      | Min. | Typ.     | Max. | Min.  | Typ.       | Max.   |
| A    |      |          | 1.2  |       |            | 0.047  |
| A1   | 0.05 |          | 0.15 | 0.002 | 0.004      | 0.006  |
| A2   | 0.8  | 1        | 1.05 | 0.031 | 0.039      | 0.041  |
| b    | 0.19 |          | 0.30 | 0.007 |            | 0.012  |
| c    | 0.09 |          | 0.20 | 0.004 |            | 0.0079 |
| D    | 4.9  | 5        | 5.1  | 0.193 | 0.197      | 0.201  |
| E    | 6.2  | 6.4      | 6.6  | 0.244 | 0.252      | 0.260  |
| E1   | 4.3  | 4.4      | 4.48 | 0.169 | 0.173      | 0.176  |
| e    |      | 0.65 BSC |      |       | 0.0256 BSC |        |
| K    | 0°   |          | 8°   | 0°    |            | 8°     |
| L    | 0.45 | 0.60     | 0.75 | 0.018 | 0.024      | 0.030  |

