

**BRITISH STANDARDS INSTITUTION**

2 PARK STREET, LONDON, W1A 2BS

Specification available from:- AS SHOWN IN PD 9002  
AND CECC 00 200 ANDMOTOROLA LTD,  
KELVIN ESTATE,  
EAST KILBRIDE.  
G75 OTG

BS CECC 90 104 - 216

ISSUE 1

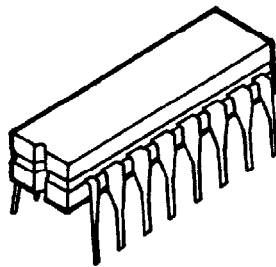
AUGUST 1985



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ELECTRONIC COMPONENTS OF ASSESSED QUALITY  
DETAIL SPECIFICATION IN ACCORDANCE WITH:BS CECC 90 000 : 1982  
BS CECC 90 100 : 1983

MANUFACTURERS TYPE NUMBER

**4522B**SEE PD 9002 AND CECC 00 200  
For ordering information  
see page 18Outline not to scale: Isometric projection  
Marking information see page 18PROGRAMMABLE BCD DIVIDE-BY-N  
4-BIT COUNTERSILICON COMPLEMENTARY MOS.  
WITH (B) BUFFERED OUTPUTS AND  
CAVITY PACKAGING.

For detail dimensions see IEC 191-2 (A50C)

Assessment levels  
R, T and V  
and optional screening  
categories A, B, C and D**CAUTION: THESE ARE STATIC SENSITIVE DEVICES - See clause 1.11**1. Limiting conditions of use (not for inspection purposes)All voltages referenced to  $V_{SS}$ 

|     |                                  |          |                  |
|-----|----------------------------------|----------|------------------|
| 1.1 | Maximum supply voltage, positive | $V_{DD}$ | +18,0 V          |
| 1.2 | Maximum supply voltage, negative | $V_{DD}$ | -0,5 V           |
| 1.3 | Maximum positive input voltage   | $V_{IN}$ | $V_{DD} + 0,5 V$ |
| 1.4 | Maximum negative input voltage   | $V_{IN}$ | -0,5 V           |

Refer to Qualified Products List PD 9002 and/or CECC 00 200  
for details of manufacturers approved to this specification

1. Limiting conditions of use (contd)

|      |                                                      |           |                                   |
|------|------------------------------------------------------|-----------|-----------------------------------|
| 1.5  | Maximum power dissipation, per package<br>per output | $P_{D1}$  | 1,3 W                             |
|      |                                                      | $P_{D2}$  | 315 mW                            |
| 1.6  | Maximum continuous current into any input.           | $ I_I $   | 10,0 mA                           |
| 1.7  | Maximum continuous current into any output.          | $ I_O $   | 10,0 mA                           |
| 1.8  | Operating temperature range                          | $T_{amb}$ |                                   |
|      |                                                      | Full      | -55 to +125 °C                    |
|      |                                                      | Limited   | -40 to + 85 °C                    |
| 1.9  | Storage temperature range                            | $T_{stg}$ | -65 to +150 °C                    |
| 1.10 | Transient energy rating                              |           | 400 V at 100 pF<br>through 1,5 kΩ |

1.11 Recommended handling precautions

- 1.11.1 Store devices in either conductive foam or conductive rails, or connect all leads together using a similar electrical shorting method.
- 1.11.2 Use grounded tip soldering irons.
- 1.11.3 Ground all test equipment.
- 1.11.4 Connect all unused device inputs to  $V_{DD}$  or  $V_{SS}$ .
- 1.11.5 PC boards used to mount MOS devices should have all metal leads grounded during device mounting or flow soldering operations.
- 1.11.6 Soldering equipment, solder pots or flow soldering equipment should be grounded whenever in contact with PC boards and/or MOS devices.
- 1.11.7 Do not use ungrounded automatic insertion equipment or other handling equipment that precludes the use of suitable device lead grounding techniques during inspection or handling.
- 1.11.8 When PC boards containing mounted MOS devices are removed from equipment for test, shipping or storage, 'Dummy connectors' should be used to electrically short all PC board terminals together.
- 1.11.9 Switch off power supply before inserting or removing devices from circuits.
- 1.11.10 Disconnect all low impedance equipment and input signals from the device before d.c. power supplies are switched off.

2. Recommended conditions of use and associated characteristics (not for inspection purposes)

These apply over the operating temperature range unless otherwise stated. All voltages referenced to  $V_{SS}$ .

| Characteristics                                                                   | Conditions                                                | Symbol    | $V_{DD}(V)$ | $T_{amb}$<br>LOW | $T_{amb}$<br>= 25 °C | $T_{amb}$<br>HIGH | Unit    |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------|-----------|-------------|------------------|----------------------|-------------------|---------|
| Quiescent device current                                                          | $V_{IL} = 0 V$<br>$V_{IH} = V_{DD}$                       |           |             |                  |                      |                   |         |
| Full temperature range                                                            | Outputs open circuit                                      | $I_{DDA}$ | 5,0         | 5,0              | 5,0                  | 150,0             | $\mu A$ |
|                                                                                   |                                                           | $I_{DDA}$ | 10,0        | 10,0             | 10,0                 | 300,0             | $\mu A$ |
|                                                                                   |                                                           | $I_{DDA}$ | 15,0        | 20,0             | 20,0                 | 600,0             | $\mu A$ |
| Limited temperature range                                                         |                                                           | $I_{DDA}$ | 5,0         | 20,0             | 20,0                 | 150,0             | $\mu A$ |
|                                                                                   |                                                           | $I_{DDA}$ | 10,0        | 40,0             | 40,0                 | 300,0             | $\mu A$ |
|                                                                                   |                                                           | $I_{DDA}$ | 15,0        | 80,0             | 80,0                 | 600,0             | $\mu A$ |
| LOW level output voltage at<br>$ I_O  < 1,0 \mu A$                                | $V_{IL} = 0 V$<br>$V_{IH} = V_{DD}$                       | $V_{OLA}$ | 5,0         | 0,05             | 0,05                 | 0,05              | V       |
|                                                                                   |                                                           | $V_{OLA}$ | 10,0        | 0,05             | 0,05                 | 0,05              | V       |
|                                                                                   |                                                           | $V_{OLA}$ | 15,0        | 0,05             | 0,05                 | 0,05              | V       |
| HIGH level output voltage at<br>$ I_O  < 1,0 \mu A$                               | $V_{IL} = 0 V$<br>$V_{IH} = V_{DD}$                       | $V_{OHB}$ | 5,0         | 4,95             | 4,95                 | 4,95              | V       |
|                                                                                   |                                                           | $V_{OHB}$ | 10,0        | 9,95             | 9,95                 | 9,95              | V       |
|                                                                                   |                                                           | $V_{OHB}$ | 15,0        | 14,95            | 14,95                | 14,95             | V       |
| LOW level output voltage (for worst case combinations) at<br>$ I_O  < 1,0 \mu A$  | $V_{IL} = 1,5 V$<br>$V_{IL} = 3,0 V$<br>$V_{IL} = 4,0 V$  | $V_{OLA}$ | 5,0         | 0,5              | 0,5                  | 0,5               | V       |
|                                                                                   |                                                           | $V_{OLA}$ | 10,0        | 1,0              | 1,0                  | 1,0               | V       |
|                                                                                   |                                                           | $V_{OLA}$ | 15,0        | 1,5              | 1,5                  | 1,5               | V       |
| HIGH level output voltage (for worst case combinations) at<br>$ I_O  < 1,0 \mu A$ | $V_{IH} = 3,5 V$<br>$V_{IH} = 7,0 V$<br>$V_{IH} = 11,0 V$ | $V_{OHB}$ | 5,0         | 4,5              | 4,5                  | 4,5               | V       |
|                                                                                   |                                                           | $V_{OHB}$ | 10,0        | 9,0              | 9,0                  | 9,0               | V       |
|                                                                                   |                                                           | $V_{OHB}$ | 15,0        | 13,5             | 13,5                 | 13,5              | V       |
| Output LOW (sink) current                                                         |                                                           |           |             |                  |                      |                   |         |
| Full temperature range                                                            | $V_O = 0,4 V$                                             | $I_{OLB}$ | 5,0         | 0,64             | 0,51                 | 0,36              | mA      |
|                                                                                   | $V_O = 0,5 V$                                             | $I_{OLB}$ | 10,0        | 1,60             | 1,30                 | 0,90              | mA      |
|                                                                                   | $V_O = 1,5 V$                                             | $I_{OLB}$ | 15,0        | 4,20             | 3,40                 | 2,40              | mA      |

| Characteristics                                                                                                                         | Conditions                          | Symbol                              | $V_{DD}(V)$         | $T_{amb}$<br>LOW  | $T_{amb}$<br>= 25 °C | $T_{amb}$<br>HIGH | Unit        |
|-----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-------------------------------------|---------------------|-------------------|----------------------|-------------------|-------------|
| Output LOW (sink)<br>current<br>(contd)                                                                                                 |                                     |                                     |                     |                   |                      |                   |             |
| Limited temperature<br>range                                                                                                            | $V_O = 0,4 V$                       | $I_{OLB}$                           | 5,0                 | 0,52              | 0,44                 | 0,36              | mA          |
|                                                                                                                                         | $V_O = 0,5 V$                       | $I_{OLB}$                           | 10,0                | 1,30              | 1,10                 | 0,90              | mA          |
|                                                                                                                                         | $V_O = 1,5 V$                       | $I_{OLB}$                           | 15,0                | 3,60              | 3,00                 | 2,40              | mA          |
| Output HIGH (source)<br>current                                                                                                         |                                     |                                     |                     |                   |                      |                   |             |
| Full temperature<br>range                                                                                                               | $V_O = 4,6 V$                       | $-I_{OHB}$                          | 5,0                 | 0,64              | 0,51                 | 0,36              | mA          |
|                                                                                                                                         | $V_O = 9,5 V$                       | $-I_{OHB}$                          | 10,0                | 1,60              | 1,30                 | 0,90              | mA          |
|                                                                                                                                         | $V_O = 13,5 V$                      | $-I_{OHB}$                          | 15,0                | 4,20              | 3,40                 | 2,40              | mA          |
| Limited temperature<br>range                                                                                                            | $V_O = 4,6 V$                       | $-I_{OHB}$                          | 5,0                 | 0,52              | 0,44                 | 0,36              | mA          |
|                                                                                                                                         | $V_O = 9,5 V$                       | $-I_{OHB}$                          | 10,0                | 1,30              | 1,10                 | 0,90              | mA          |
|                                                                                                                                         | $V_O = 13,5 V$                      | $-I_{OHB}$                          | 15,0                | 3,60              | 3,00                 | 2,40              | mA          |
| Input leakage<br>current                                                                                                                | $V_{IL} = 0 V$<br>$V_{IH} = V_{DD}$ |                                     |                     |                   |                      |                   |             |
| Full temperature<br>range                                                                                                               |                                     | $ I_{IA} $                          | 15,0                | 0,10              | 0,10                 | 1,00              | $\mu A$     |
| Limited temperature<br>range                                                                                                            |                                     | $ I_{IA} $                          | 15,0                | 0,30              | 0,30                 | 1,00              | $\mu A$     |
| Input capacitance<br>per unit load<br>(Any input)                                                                                       | $V_I = 0 V$<br>$f = 1 MHz$          | $C_{IA}$                            | -                   | -                 | 7,5                  | -                 | pF          |
| Noise margin at<br>LOW level output<br>(equal to the<br>difference between<br>$V_{IL}$ and $V_{OL}$ for<br>worst case<br>combinations)  |                                     | $V_{NLB}$<br>$V_{NLB}$<br>$V_{NLB}$ | 5,0<br>10,0<br>15,0 | 1,0<br>2,0<br>2,5 | 1,0<br>2,0<br>2,5    | 1,0<br>2,0<br>2,5 | V<br>V<br>V |
| Noise margin at<br>HIGH level output<br>(equal to the<br>difference between<br>$V_{IH}$ and $V_{OH}$ for<br>worst case<br>combinations) |                                     | $V_{NHB}$<br>$V_{NHB}$<br>$V_{NHB}$ | 5,0<br>10,0<br>15,0 | 1,0<br>2,0<br>2,5 | 1,0<br>2,0<br>2,5    | 1,0<br>2,0<br>2,5 | V<br>V<br>V |

| Characteristics                                                                                 | Conditions                                                    | Symbol                    | $V_{DD}(V)$ | $T_{amb}$<br>LOW | $T_{amb}$<br>= 25 °C | $T_{amb}$<br>HIGH | Unit    |
|-------------------------------------------------------------------------------------------------|---------------------------------------------------------------|---------------------------|-------------|------------------|----------------------|-------------------|---------|
| Propagation and Transition Times                                                                | $C_L = 50 \text{ pF}$<br>(Test conditions as in Sub-group A5) |                           |             |                  |                      |                   |         |
| Propagation Delay Time<br>LOW to HIGH and<br>HIGH to LOW level<br>'Q' Outputs from any<br>Input |                                                               | $t_{PLHA}/$<br>$t_{PHLA}$ | 5,0         | -                | 1100,0               | -                 | ns      |
|                                                                                                 |                                                               | $t_{PLHA}/$<br>$t_{PHLA}$ | 10,0        | -                | 450,0                | -                 | ns      |
|                                                                                                 |                                                               | $t_{PLHA}/$<br>$t_{PHLA}$ | 15,0        | -                | 320,0                | -                 | ns      |
|                                                                                                 |                                                               | $t_{PLHA}/$<br>$t_{PHLA}$ | 5,0         | -                | 480,0                | -                 | ns      |
|                                                                                                 |                                                               | $t_{PLHA}/$<br>$t_{PHLA}$ | 10,0        | -                | 260,0                | -                 | ns      |
|                                                                                                 |                                                               | $t_{PLHA}/$<br>$t_{PHLA}$ | 15,0        | -                | 200,0                | -                 | ns      |
| Propagation Delay Time<br>LOW to HIGH and<br>HIGH to LOW level<br>'O' Output from any<br>Input  |                                                               | $t_{TLHA}/$<br>$t_{THLA}$ | 5,0         | -                | 200,0                | -                 | ns      |
|                                                                                                 |                                                               | $t_{TLHA}/$<br>$t_{THLA}$ | 10,0        | -                | 100,0                | -                 | ns      |
|                                                                                                 |                                                               | $t_{TLHA}/$<br>$t_{THLA}$ | 15,0        | -                | 80,0                 | -                 | ns      |
|                                                                                                 |                                                               | $t_{TLHA}/$<br>$t_{THLA}$ | 5,0         | -                | 15,0                 | -                 | $\mu s$ |
|                                                                                                 |                                                               | $t_{TLHA}/$<br>$t_{THLA}$ | 10,0        | -                | 5,0                  | -                 | $\mu s$ |
|                                                                                                 |                                                               | $t_{TLHA}/$<br>$t_{THLA}$ | 15,0        | -                | 4,0                  | -                 | $\mu s$ |
| Transition Time<br>LOW to HIGH and<br>HIGH to LOW level                                         |                                                               | $t_{TLHA}/$<br>$t_{THLA}$ | 5,0         | -                | 200,0                | -                 | ns      |
|                                                                                                 |                                                               | $t_{TLHA}/$<br>$t_{THLA}$ | 10,0        | -                | 100,0                | -                 | ns      |
|                                                                                                 |                                                               | $t_{TLHA}/$<br>$t_{THLA}$ | 15,0        | -                | 80,0                 | -                 | ns      |
| Maximum Clock or<br>Inhibit Rise and<br>Fall Time                                               |                                                               | $t_{TLHA}/$<br>$t_{THLA}$ | 5,0         | -                | 15,0                 | -                 | $\mu s$ |
|                                                                                                 |                                                               | $t_{TLHA}/$<br>$t_{THLA}$ | 10,0        | -                | 5,0                  | -                 | $\mu s$ |
|                                                                                                 |                                                               | $t_{TLHA}/$<br>$t_{THLA}$ | 15,0        | -                | 4,0                  | -                 | $\mu s$ |

| Characteristics                               | Conditions | Symbol              | V <sub>DD</sub> (V) | T <sub>amb</sub><br>LOW | T <sub>amb</sub><br>= 25 °C | T <sub>amb</sub><br>HIGH | Unit |
|-----------------------------------------------|------------|---------------------|---------------------|-------------------------|-----------------------------|--------------------------|------|
| Minimum Clock Pulse Width                     |            | t <sub>WH(c1)</sub> | 5,0                 | -                       | 250,0                       | -                        | ns   |
|                                               |            | t <sub>WH(c1)</sub> | 10,0                | -                       | 100,0                       | -                        | ns   |
|                                               |            | t <sub>WH(c1)</sub> | 15,0                | -                       | 80,0                        | -                        | ns   |
| Maximum Clock Pulse Frequency (with PE = low) |            | f <sub>c1</sub>     | 5,0                 | -                       | 1,5                         | -                        | MHz  |
|                                               |            | f <sub>c1</sub>     | 10,0                | -                       | 3,0                         | -                        | MHz  |
|                                               |            | f <sub>c1</sub>     | 15,0                | -                       | 4,0                         | -                        | MHz  |
| Hold Time                                     |            | t <sub>h</sub>      | 5,0                 | -                       | 150,0                       | -                        | ns   |
|                                               |            | t <sub>h</sub>      | 10,0                | -                       | 50,0                        | -                        | ns   |
|                                               |            | t <sub>h</sub>      | 15,0                | -                       | 40,0                        | -                        | ns   |
| Minimum Preset Enable Pulse Width             |            | t <sub>WH(PE)</sub> | 5,0                 | -                       | 250,0                       | -                        | ns   |
|                                               |            | t <sub>WH(PE)</sub> | 10,0                | -                       | 100,0                       | -                        | ns   |
|                                               |            | t <sub>WH(PE)</sub> | 15,0                | -                       | 80,0                        | -                        | ns   |
| Minimum Master Reset Pulse Width              |            | t <sub>WH(R)</sub>  | 5,0                 | -                       | 350,0                       | -                        | ns   |
|                                               |            | t <sub>WH(R)</sub>  | 10,0                | -                       | 250,0                       | -                        | ns   |
|                                               |            | t <sub>WH(R)</sub>  | 15,0                | -                       | 200,0                       | -                        | ns   |

## Terminal identification

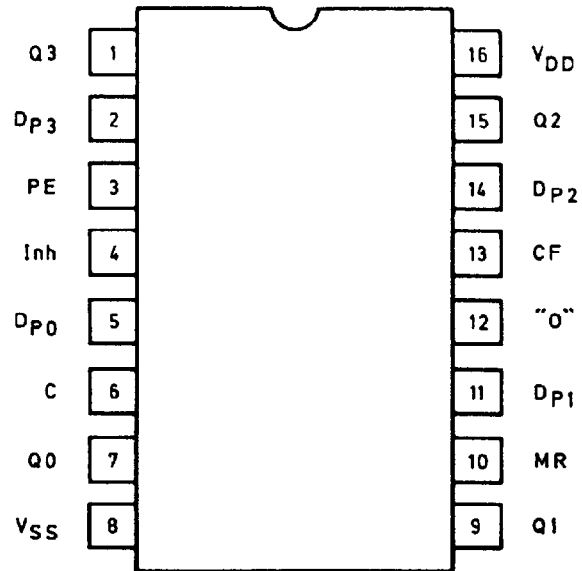


Figure 1

## Function Tables

Table 1

| Clock      | Inhibit    | Preset Enable | Master Reset | Action   |
|------------|------------|---------------|--------------|----------|
| L          | L          | L             | L            | No Count |
| $\nearrow$ | L          | L             | L            | Count 1  |
| X          | H          | L             | L            | No Count |
| H          | $\searrow$ | L             | L            | Count 1  |
| X          | X          | H             | L            | Preset   |
| X          | X          | X             | H            | Reset    |

H = High level  
 L = Low level  
 X = Level irrelevant  
 $\nearrow$  = Transition from low to high  
 $\searrow$  = Transition from high to low

Table 2

| Count | Output |    |    |    |
|-------|--------|----|----|----|
|       | Q3     | Q2 | Q1 | Q0 |
| 9     | H      | L  | L  | H  |
| 8     | H      | L  | L  | L  |
| 7     | L      | H  | H  | H  |
| 6     | L      | H  | H  | L  |
| 5     | L      | H  | L  | H  |
| 4     | L      | H  | L  | L  |
| 3     | L      | L  | H  | H  |
| 2     | L      | L  | H  | L  |
| 1     | L      | L  | L  | H  |
| 0     | L      | L  | L  | L  |

H = High level

L = Low level

Logic diagram

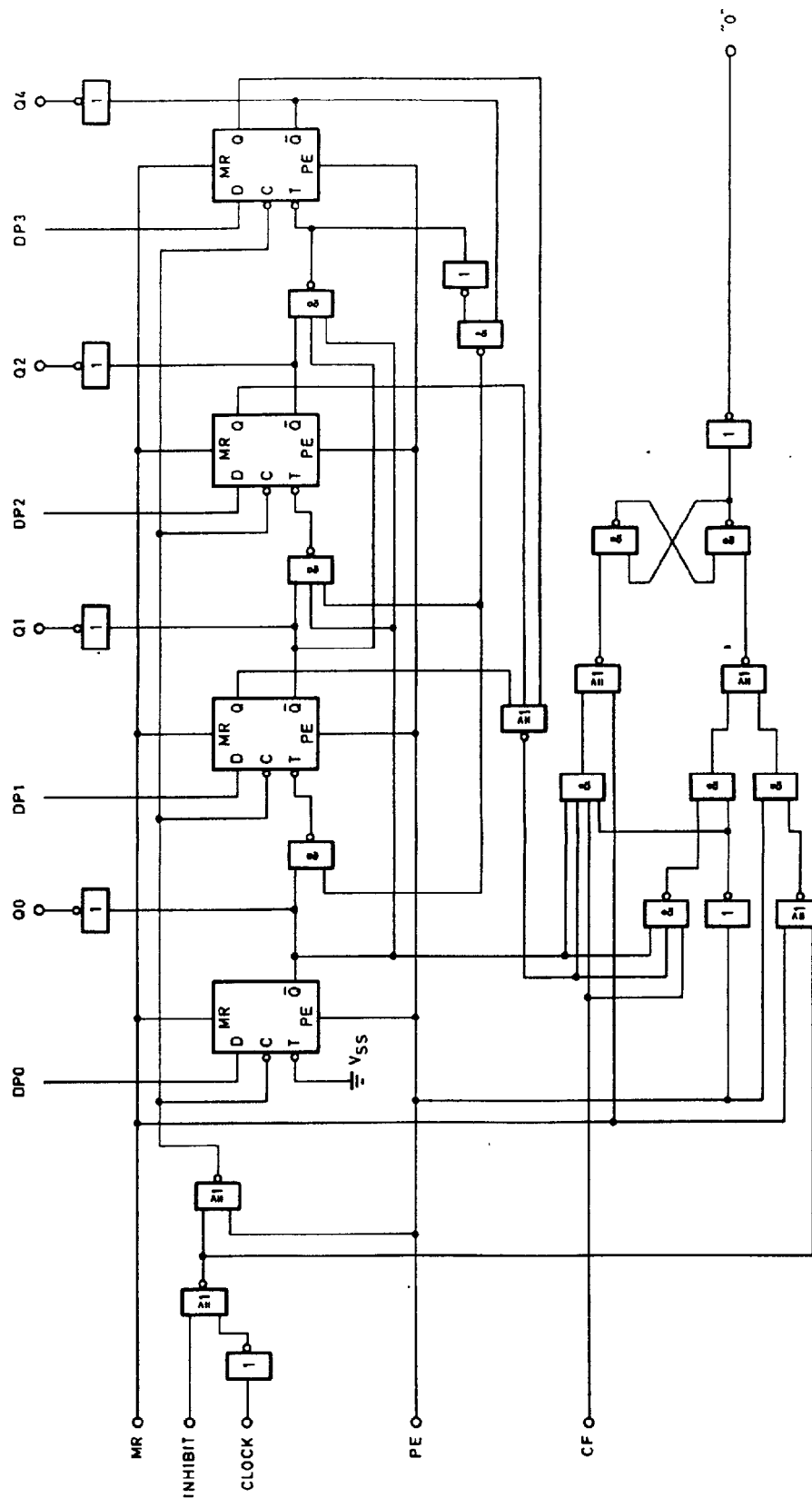


Figure 2

Typical output source  
characteristics test circuit

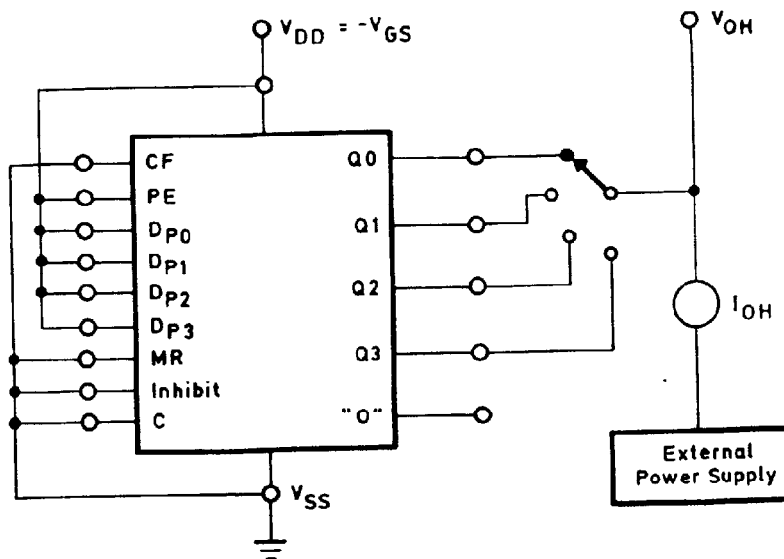


Figure 3

Typical output sink  
characteristics test circuit

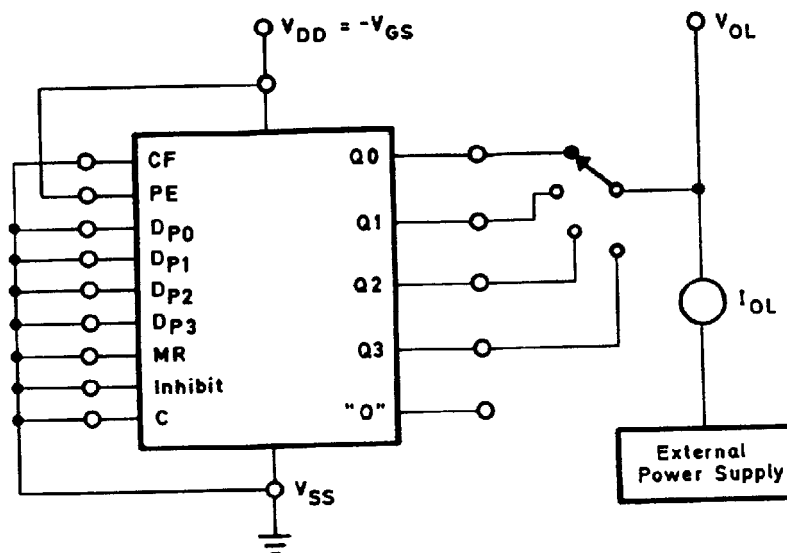


Figure 4

# Power dissipation

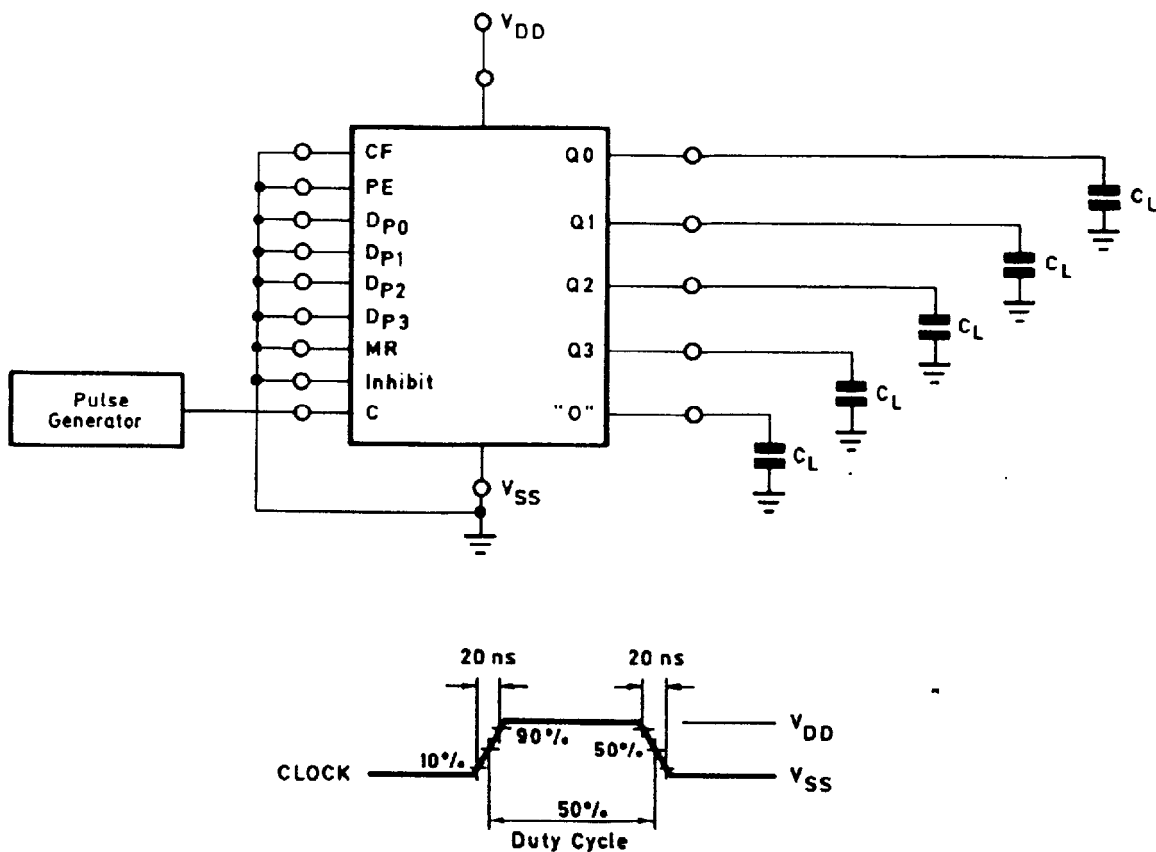


Figure 5

## AC test circuits

### A) Test Nos. 1-6

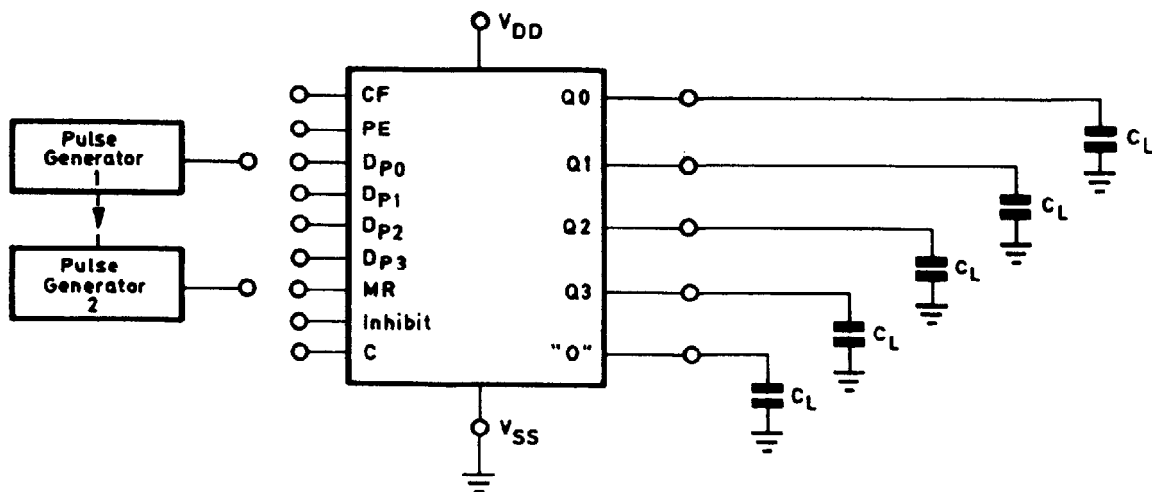


Figure 6

## AC test circuits (contd)

## B) Test No. 7

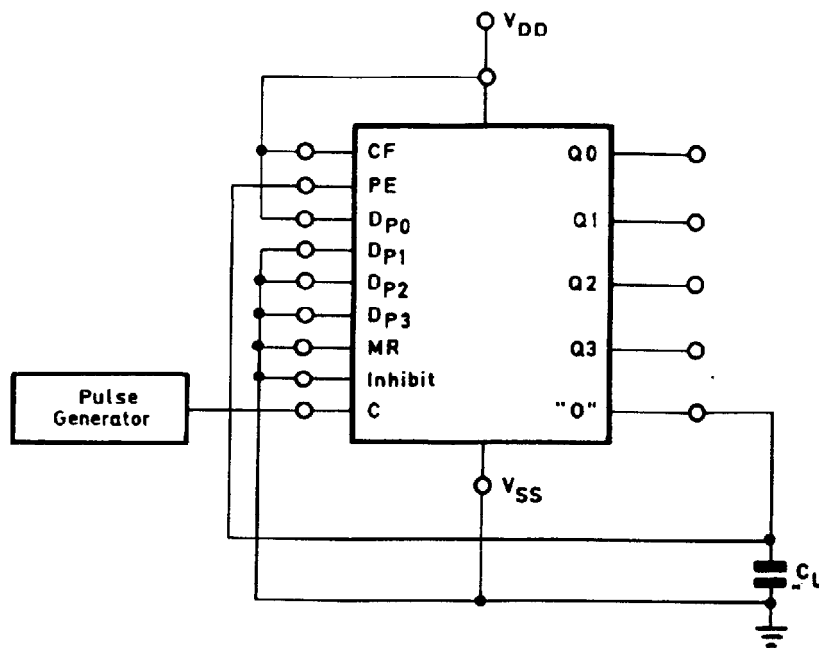


Figure 7

## AC test connections and waveforms

## Test No. 1

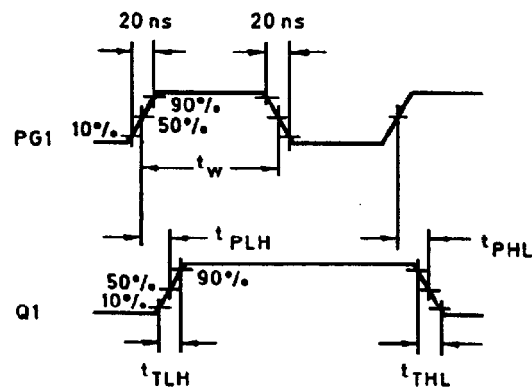


Figure 8