

## BRITISH STANDARDS INSTITUTION

2 PARK STREET, LONDON. W1A 2BS

Specification available from:- AS SHOWN IN PD 9002  
AND CECC 00 200 AND

BS CECC 90 104 - 194

ISSUE 1

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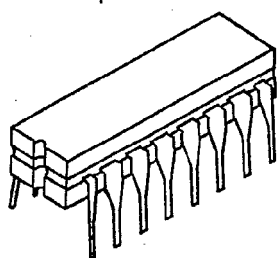
ELECTRONIC COMPONENTS OF ASSESSED QUALITY  
DETAIL SPECIFICATION IN ACCORDANCE WITH:

BS CECC 90 000 : 1976

BS CECC 90 100 : 1977

MANUFACTURERS TYPE NUMBER

4194B

SEE PD 9002 AND CECC 00 200  
For ordering information  
see page 9Outline not to scale: Isometric projection  
Marking information see page 84 BIT BIDIRECTIONAL  
UNIVERSAL SHIFT REGISTERSILICON COMPLEMENTARY MOS.  
WITH (B) BUFFERED OUTPUTS AND  
CAVITY PACKAGING.

For detail dimensions see IEC 191-2 (A50C)

Assessment levels  
R, S, 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
- 1.2 Maximum supply voltage, negative
- 1.3 Maximum positive input voltage
- 1.4 Maximum negative input voltage

|          |                |
|----------|----------------|
| $V_{DD}$ | +18,0V         |
| $V_{DD}$ | -0,5V          |
| $V_I$    | $V_{DD}$ +0,5V |
| $V_I$    | -0,5V          |

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                                                                                                                                                           | $P_{D1}$  | 200,0mW                        |
|         | per output                                                                                                                                                                                       | $P_{D2}$  | 50,0mW                         |
| 1.6     | Maximum continuous current into any input.                                                                                                                                                       | $ I_I $   | 10,0mA                         |
| 1.7     | Maximum continuous current into any output.                                                                                                                                                      | $ I_O $   | 10,0mA                         |
| 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                                                                                                                                                                          |           | 400V at 100pF<br>through 1,5kΩ |
| 1.11    | <u>Recommended handling precautions</u>                                                                                                                                                          |           |                                |
| 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                                                      | $V_{IL} = 0V$<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 $ I_O  < 1,0\mu A$                                | $V_{IL} = 0V$<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 $ I_O  < 1,0\mu A$                               | $V_{IL} = 0V$<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 $ I_O  < 1,0\mu A$  | $V_{IL} = 1,5V$<br>$V_{IL} = 3,0V$<br>$V_{IL} = 4,0V$  | $V_{OLA}$ | 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 $ I_O  < 1,0\mu A$ | $V_{IH} = 3,5V$<br>$V_{IH} = 7,0V$<br>$V_{IH} = 11,0V$ | $V_{OHB}$ | 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                                                        | $V_O = 0,4V$                                           | $I_{OLB}$ | 5,0         | 0,64             | 0,51                | 0,36              | mA      |
|                                                                               | $V_O = 0,5V$                                           | $I_{OLB}$ | 10,0        | 1,60             | 1,30                | 0,90              | mA      |
|                                                                               | $V_O = 1,5V$                                           | $I_{OLB}$ | 15,0        | 4,20             | 3,40                | 2,40              | mA      |
| Limited temperature range                                                     | $V_O = 0,4V$                                           | $I_{OLB}$ | 5,0         | 0,52             | 0,44                | 0,36              | mA      |
|                                                                               | $V_O = 0,5V$                                           | $I_{OLB}$ | 10,0        | 1,30             | 1,10                | 0,90              | mA      |
|                                                                               | $V_O = 1,5V$                                           | $I_{OLB}$ | 15,0        | 3,60             | 3,00                | 2,40              | mA      |

| Characteristics                                                                                                       | Conditions                                           | Symbol                              | $V_{DD}(V)$         | $T_{amb}$<br>LOW  | $T_{amb}$<br>= 25°C | $T_{amb}$<br>HIGH | Unit        |
|-----------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|-------------------------------------|---------------------|-------------------|---------------------|-------------------|-------------|
| Output HIGH (source) current                                                                                          |                                                      |                                     |                     |                   |                     |                   |             |
| Full temperature range                                                                                                | $V_O = 4,6V$                                         | $-I_{OHB}$                          | 5,0                 | 0,64              | 0,51                | 0,36              | mA          |
|                                                                                                                       | $V_O = 9,5V$                                         | $-I_{OHB}$                          | 10,0                | 1,60              | 1,30                | 0,90              | mA          |
|                                                                                                                       | $V_O = 13,5V$                                        | $-I_{OHB}$                          | 15,0                | 4,20              | 3,40                | 2,40              | mA          |
| Limited temperature range                                                                                             | $V_O = 4,6V$                                         | $-I_{OHB}$                          | 5,0                 | 0,52              | 0,44                | 0,36              | mA          |
|                                                                                                                       | $V_O = 9,5V$                                         | $-I_{OHB}$                          | 10,0                | 1,30              | 1,10                | 0,90              | mA          |
|                                                                                                                       | $V_O = 13,5V$                                        | $-I_{OHB}$                          | 15,0                | 3,60              | 3,00                | 2,40              | mA          |
| Input leakage current                                                                                                 | $V_{IL} = 0V$<br>$V_{IH} = V_{DD}$                   |                                     |                     |                   |                     |                   |             |
| Full temperature range                                                                                                |                                                      | $ I_{IA} $                          | 15,0                | 0,10              | 0,10                | 1,00              | $\mu A$     |
| Limited temperature range                                                                                             |                                                      | $ I_{IA} $                          | 15,0                | 0,30              | 0,30                | 1,00              | $\mu A$     |
| Input capacitance per unit load (Any input)                                                                           | $V_I = 0V$<br>$f = 1MHz$                             | $C_{IA}$                            | -                   | -                 | 7,5                 | -                 | pF          |
| Noise margin at LOW level output (equal to the difference between $V_{IL}$ and $V_{OL}$ for worst case 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 HIGH level output (equal to the difference between $V_{IH}$ and $V_{OH}$ for worst case 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 |
| Propagation and Transition Times                                                                                      | $C_L = 50pF$<br>(Test conditions as in Sub-group A5) |                                     |                     |                   |                     |                   |             |

| 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 |
|---------------------------------------------------------------------------------|------------|---------------------------------|---------------------|-------------------------|----------------------------|--------------------------|------|
| Transition Time<br>HIGH to LOW and LOW<br>to HIGH level                         |            | t <sub>TLHA</sub> /             | 5,0                 | -                       | 200,0                      | -                        | ns   |
|                                                                                 |            | t <sub>THLA</sub>               | 10,0                | -                       | 100,0                      | -                        | ns   |
|                                                                                 |            |                                 | 15,0                | -                       | 80,0                       | -                        | ns   |
| Propagation Delay<br>Time<br>HIGH to LOW and LOW<br>to HIGH level<br>Clock to Q |            | t <sub>PLHA</sub> /             | 5,0                 | -                       | 550,0                      | -                        | ns   |
|                                                                                 |            | t <sub>PHLA</sub>               | 10,0                | -                       | 220,0                      | -                        | ns   |
|                                                                                 |            |                                 | 15,0                | -                       | 170,0                      | -                        | ns   |
| Propagation Delay<br>Time<br>HIGH to LOW and LOW<br>to HIGH level<br>Reset to Q |            | t <sub>PLHA</sub> /             | 5,0                 | -                       | 700,0                      | -                        | ns   |
|                                                                                 |            | t <sub>PHLA</sub>               | 10,0                | -                       | 280,0                      | -                        | ns   |
|                                                                                 |            |                                 | 15,0                | -                       | 220,0                      | -                        | ns   |
| Clock Pulse Width                                                               |            | t <sub>PWCB</sub>               | 5,0                 | -                       | 280,0                      | -                        | ns   |
|                                                                                 |            | t <sub>PWCB</sub>               | 10,0                | -                       | 110,0                      | -                        | ns   |
|                                                                                 |            | t <sub>PWCB</sub>               | 15,0                | -                       | 85,0                       | -                        | ns   |
| Reset Pulse                                                                     |            | t <sub>PWRB</sub>               | 5,0                 | -                       | 180,0                      | -                        | ns   |
|                                                                                 |            | t <sub>PWRB</sub>               | 10,0                | -                       | 70,0                       | -                        | ns   |
|                                                                                 |            | t <sub>PWRB</sub>               | 15,0                | -                       | 50,0                       | -                        | ns   |
| Clock Pulse Frequency<br>(Shift left or right<br>mode)                          |            | f <sub>max.A</sub>              | 5,0                 | -                       | 1,8                        | -                        | MHz  |
|                                                                                 |            | f <sub>max.A</sub>              | 10,0                | -                       | 4,5                        | -                        | MHz  |
|                                                                                 |            | f <sub>max.A</sub>              | 15,0                | -                       | 6,0                        | -                        | MHz  |
| Clock Rise and Fall<br>Times                                                    |            | t <sub>r</sub> , t <sub>f</sub> | 5,0                 | -                       | 15,0                       | -                        | µs   |
|                                                                                 |            | t <sub>r</sub> , t <sub>f</sub> | 10,0                | -                       | 5,0                        | -                        | µs   |
|                                                                                 |            | t <sub>r</sub> , t <sub>f</sub> | 15,0                | -                       | 4,0                        | -                        | µs   |
| Set-up Time Data<br>to Clock                                                    |            | t <sub>PWSTB</sub>              | 5,0                 | -                       | 10,0                       | -                        | ns   |
|                                                                                 |            | t <sub>PWSTB</sub>              | 10,0                | -                       | 20,0                       | -                        | ns   |
|                                                                                 |            | t <sub>PWSTB</sub>              | 15,0                | -                       | 40,0                       | -                        | ns   |
| Set-up Time Mode<br>Control (S) to Clock                                        |            | t <sub>PWSTB</sub>              | 5,0                 | -                       | 200,0                      | -                        | ns   |
|                                                                                 |            | t <sub>PWSTB</sub>              | 10,0                | -                       | 75,0                       | -                        | ns   |
|                                                                                 |            | t <sub>PWSTB</sub>              | 15,0                | -                       | 55,0                       | -                        | ns   |
| Hold Time Data to<br>Clock                                                      |            | t <sub>PWHB</sub>               | 5,0                 | -                       | 180,0                      | -                        | ns   |
|                                                                                 |            | t <sub>PWHB</sub>               | 10,0                | -                       | 50,0                       | -                        | ns   |
|                                                                                 |            | t <sub>PWHB</sub>               | 15,0                | -                       | 35,0                       | -                        | ns   |

| 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 |
|----------------------------------------|------------|-------------------|---------------------|-------------------------|----------------------------|--------------------------|------|
| Hold Time Mode<br>Control (S) to Clock |            | t <sub>PWHB</sub> | 5,0                 | -                       | 0,0                        | -                        | ns   |
|                                        |            | t <sub>PWHB</sub> | 10,0                | -                       | 0,0                        | -                        | ns   |
|                                        |            | t <sub>PWHB</sub> | 15,0                | -                       | 0,0                        | -                        | ns   |
| Reset Removal Time**                   |            | t <sub>PWRR</sub> | 5,0                 | -                       | 300,0                      | -                        | ns   |
|                                        |            | t <sub>PWRR</sub> | 10,0                | -                       | 110,0                      | -                        | ns   |
|                                        |            | t <sub>PWRR</sub> | 15,0                | -                       | 80,0                       | -                        | ns   |

\*\*The reset signal must be HIGH prior to a positive going transition of the Clock.

# Terminal identification

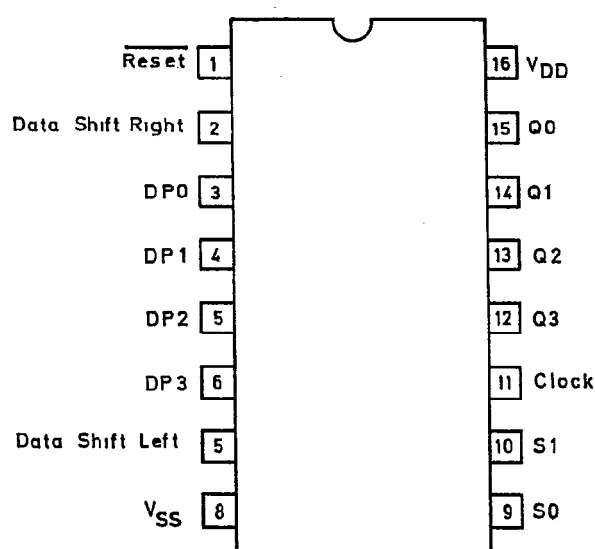


Figure 1

# Function table

Table 1

| OPERATING MODE | INPUTS                               |    |     |     |       | OUTPUTS         |    |    |    |
|----------------|--------------------------------------|----|-----|-----|-------|-----------------|----|----|----|
|                | $\overline{\text{RESET}} = \text{H}$ |    |     |     |       | (at $t_n + 1$ ) |    |    |    |
|                | S1                                   | SO | DSR | DSL | DPO-3 | Q0              | Q1 | Q2 | Q3 |
| Hold           | L                                    | L  | X   | X   | X     | Q0              | Q1 | Q2 | Q3 |
| Shift Left     | H                                    | L  | X   | L   | X     | Q1              | Q2 | Q3 | L  |
|                | H                                    | L  | X   | H   | X     | Q1              | Q2 | Q3 | H  |
| Shift Right    | L                                    | H  | L   | X   | X     | L               | Q0 | Q1 | Q2 |
|                | L                                    | H  | H   | X   | X     | H               | Q0 | Q1 | Q2 |
| Parallel       | H                                    | H  | X   | X   | L     | L               | L  | L  | L  |
|                | H                                    | H  | X   | X   | H     | H               | H  | H  | H  |

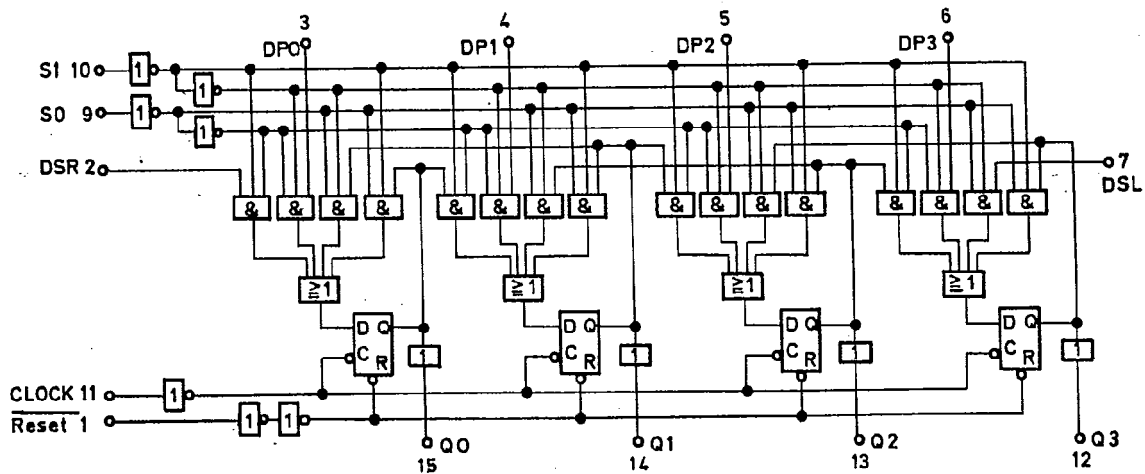
H = HIGH level

L = LOW level

X = Level irrelevant

$t_n + 1$  = Level after the next positive - going transition of the Clock

Typical logic diagram



$V_{DD}$  = Pin 16

$V_{SS}$  = Pin 8

This is a graphic representation, not a circuit diagram

Figure 2

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BS CECC 90 104 - 194  
Issue 1

# Switching time waveforms

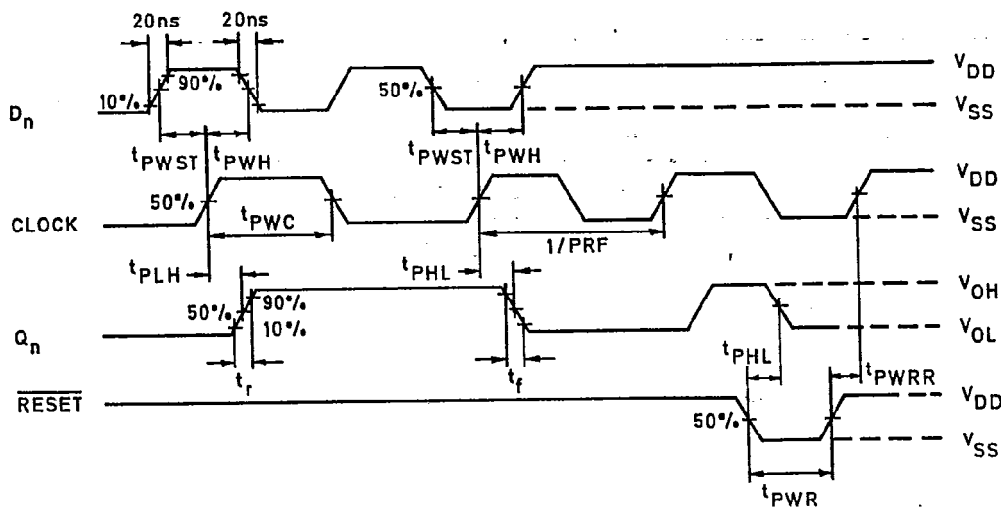


Figure 3

## Marking

The following shall be marked on the device, in the following order of precedence, as space permits. All information, except the terminal marking shall appear on the primary package used as initial protection or wrapping for delivery:

- (1) Terminal identification
- (2) Type number
- (3) Operating temperature range (if not included in 2)
- (4) Quality assessment level applied
- (5) Screening class applied
- (6) Date-code (year-week defined by three or four figures)
- (7) Mark of conformity (CECC logo)
- (8) Manufacturers name or trade mark (may include factory code)
- (9) Factory identification code
- (10) Package materials
- (11) Caution label for devices susceptible to damage by electrostatic discharge
- (12) Optional tests

The marking symbols shall be located following the figures below.