



Pages 1 to 28

**INTEGRATED CIRCUITS, SILICON MONOLITHIC, CMOS
QUAD LOW TO HIGH VOLTAGE LEVEL SHIFTER WITH
3-STATE OUTPUTS**

BASED ON TYPE 40109B

ESCC Detail Specification No. 9407/003

| | |
|---------|----------------|
| Issue 3 | September 2009 |
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| DCR No. | CHANGE DESCRIPTION |
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| 255, 447, 485 | Specification up issued to incorporate editorial and technical changes per DCRs. |

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1. GENERAL

1.1 SCOPE

This specification details the ratings, physical and electrical characteristics and test and inspection data for the component type variants and/or the range of components specified below. It supplements the requirements of, and shall be read in conjunction with, the ESCC Generic Specification listed under Applicable Documents.

1.2 APPLICABLE DOCUMENTS

The following documents form part of this specification and shall be read in conjunction with it:

- (a) ESCC Generic Specification No. 9000
- (b) MIL-STD-883, Test Methods and Procedures for Microelectronics

1.3 TERMS, DEFINITIONS, ABBREVIATIONS, SYMBOLS AND UNITS

For the purpose of this specification, the terms, definitions, abbreviations, symbols and units specified in ESCC Basic Specification No. 21300 shall apply.

1.4 THE ESCC COMPONENT NUMBER AND COMPONENT TYPE VARIANTS

1.4.1 The ESCC Component Number

The ESCC Component Number shall be constituted as follows:

Example: 940700301

- Detail Specification Reference: 9407003
- Component Type Variant Number: 01 (as required)

1.4.2 Component Type Variants

The component type variants applicable to this specification are as follows:

| Variant Number | Based on Type | Case | Terminal Material and /or Finish | Weight max g |
|----------------|---------------|------|----------------------------------|--------------|
| 01 | 40109B | FP | G2 | 0.7 |
| 02 | 40109B | FP | G4 | 0.7 |
| 07 | 40109B | CCP | 2 | 0.6 |
| 08 | 40109B | DIP | G2 | 2.2 |
| 09 | 40109B | DIP | G4 | 2.2 |
| 10 | 40109B | SO | G2 | 0.7 |
| 11 | 40109B | SO | G4 | 0.7 |

The terminal material and/or finish shall be in accordance with the requirements of ESCC Basic Specification No. 23500.

1.5 MAXIMUM RATINGS

The maximum ratings shall not be exceeded at any time during use or storage.

Maximum ratings shall only be exceeded during testing to the extent specified in this specification and when stipulated in Test Methods and Procedures of the ESCC Generic Specification.

| Characteristics | Symbols | Maximum Ratings | Units | Remarks |
|--|------------------|-----------------|-------------|--------------------|
| Supply Voltage | V_{CC}, V_{DD} | -0.5 to 18 | V | Note 1 |
| Input Voltage | V_{IN} | -0.5 to 18.5 | V | Note 1 Power on |
| Input Current | I_{IN} | ± 10 | mA | Note 2 |
| Device Power Dissipation (Continuous) | P_D | 200 | mW | - |
| Power Dissipation per Output | P_{DSO} | 100 | mW | - |
| Operating Temperature Range | T_{op} | -55 to +125 | $^{\circ}C$ | T_{amb} |
| Storage Temperature Range | T_{stg} | -65 to +150 | $^{\circ}C$ | - |
| Soldering Temperature For FP, DIP and SO For CCP | T_{sol} | +265 +245 | $^{\circ}C$ | Note 3 Note 4 |

NOTES:

1. Device is functional for $3V \leq V_{CC} \leq 15V$ and $3V \leq V_{DD} \leq 15V$. V_{IN} may exceed V_{CC} and V_{DD} . V_{CC} may exceed V_{DD} .
2. For any single input.
3. Duration 10 seconds maximum at a distance of not less than 1.5mm from the device body and the same terminal shall not be resoldered until 3 minutes have elapsed.
4. Duration 5 seconds maximum and the same terminal shall not be resoldered until 3 minutes have elapsed.

1.6 HANDLING PRECAUTIONS

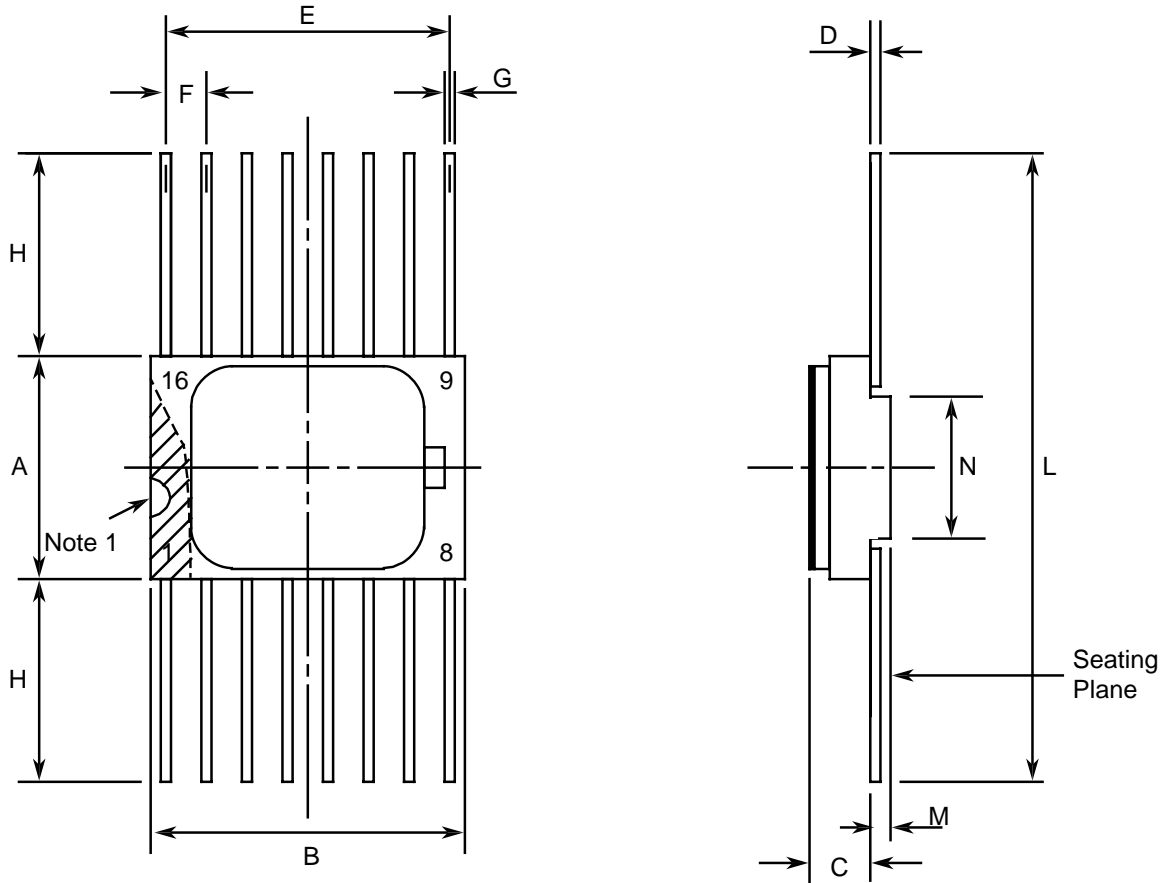
These devices are susceptible to damage by electrostatic discharge. Therefore, suitable precautions shall be employed for protection during all phases of manufacture, testing, packaging, shipment and any handling.

These components are categorised as Class 1 per ESCC Basic Specification No. 23800 with a minimum Critical Path Failure Voltage of 400 Volts.

1.7 PHYSICAL DIMENSIONS AND TERMINAL IDENTIFICATION

Consolidated Notes are given following the case drawings and dimensions.

1.7.1 Flat Package (FP) - 16 Pin



| Symbols | Dimensions mm | | Notes |
|---------|---------------|-------|-------|
| | Min | Max | |
| A | 6.75 | 7.06 | |
| B | 9.76 | 10.14 | |
| C | 1.49 | 1.95 | |
| D | 0.1 | 0.15 | 5 |
| E | 8.76 | 9.01 | |
| F | 1.27 BSC | | 3, 6 |
| G | 0.38 | 0.48 | 5 |
| H | 6 | - | 5 |
| L | 18.75 | 22 | |
| M | 0.33 | 0.43 | |
| N | 4.32 TYPICAL | | |

1.7.2 Dual-in-line Package (DIP) - 16 Pin



| Symbols | Dimensions mm | | Notes |
|---------|---------------|-------|-------|
| | Min | Max | |
| A | 2.1 | 2.71 | |
| a1 | 3 | 3.7 | |
| a2 | 0.63 | 1.14 | 2 |
| B | 1.82 | 2.39 | |
| b | 0.4 | 0.5 | 5 |
| b1 | 1.14 | 1.5 | 5 |
| c | 0.2 | 0.3 | 5 |
| D | 20.06 | 20.58 | |
| E | 7.36 | 7.87 | |
| e | 2.54 BSC | | 4, 6 |
| e1 | 17.65 | 17.9 | |
| e2 | 7.62 | 8.12 | |
| F | 7.29 | 7.7 | |
| l | - | 3.83 | |

| Symbols | Dimensions mm | | Notes |
|---------|---------------|------|-------|
| | Min | Max | |
| K | 10.9 | 12.1 | |

1.7.3 Chip Carrier Package (CCP) - 20 Terminal



| Symbols | Dimensions mm | | Notes |
|---------|---------------|------|-------|
| | Min | Max | |
| A | 1.14 | 1.95 | |
| A1 | 1.63 | 2.36 | |
| B | 0.55 | 0.72 | 5 |
| C | 1.06 | 1.47 | 5 |
| C1 | 1.91 | 2.41 | |

| Symbols | Dimensions mm | | Notes |
|---------|---------------|------|-------|
| | Min | Max | |
| D | 8.67 | 9.09 | |
| D1 | 7.21 | 7.52 | |
| d, d1 | 1.27 BSC | | 3 |
| d2 | 7.62 BSC | | |
| E | 8.67 | 9.09 | |
| E1 | 7.21 | 7.52 | |
| e, e1 | 1.27 BSC | | 3 |
| e2 | 7.62 BSC | | |
| f, g | - | 0.76 | |
| h, h1 | 1.01 TYPICAL | | 8 |
| j, j1 | 0.51 TYPICAL | | 7 |

1.7.4 Small Outline Ceramic Package (SO) - 16 Pin



| Symbols | Dimensions mm | | Notes |
|---------|---------------|-------|-------|
| | Min | Max | |
| A | 6.75 | 7.06 | |
| B | 9.76 | 10.14 | |
| C | 1.49 | 1.95 | |
| D | 0.1 | 0.15 | 5 |
| E | 8.76 | 9.01 | |
| F | 1.27 BSC | | 3, 6 |
| G | 0.38 | 0.48 | 5 |
| H | 0.6 | 0.9 | 5 |

| Symbols | Dimensions mm | | Notes |
|---------|---------------|-------|-------|
| | Min | Max | |
| K | 9 TYPICAL | | |
| L | 10 | 10.65 | |
| M | 0.33 | 0.43 | |
| N | 4.31 TYPICAL | | |

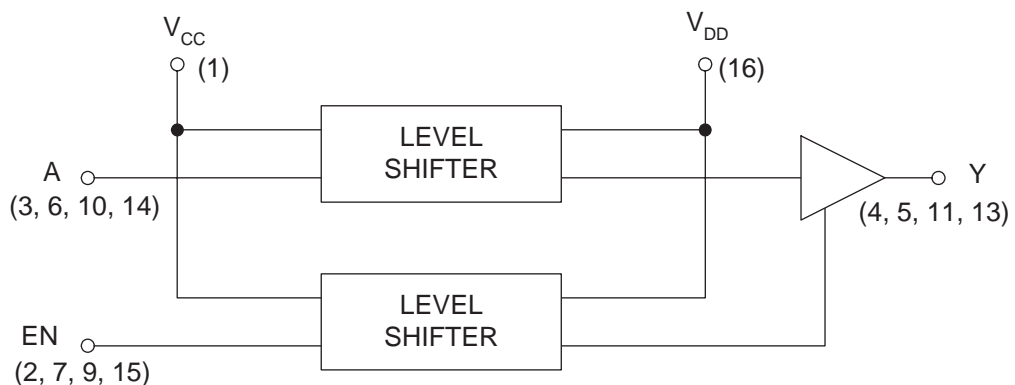
1.7.5 Notes to Physical Dimensions and Terminal Identification

1. Index area; a notch or a dot shall be located adjacent to Pin 1 and shall be within the shaded area shown. For chip carrier packages, the index shall be as shown.
2. The dimension shall be measured from the seating plane to the base plane.
3. The true position pin spacing is 1.27mm between centrelines. Each pin centreline shall be located within $\pm 0.13\text{mm}$ of its true longitudinal position relative to Pin 1 and the highest pin number.
4. The true position pin spacing is 2.54mm between centrelines. Each pin centreline shall be located within $\pm 0.25\text{mm}$ of its true longitudinal position relative to Pin 1 and the highest pin number.
5. All terminals.
6. 14 spaces.
7. Index corner only - 2 dimensions.
8. 3 non-index corners - 6 dimensions.
9. For all pins, either pin shape may be supplied.

1.8 FUNCTIONAL DIAGRAM

Pin numbers relate to FP, DIP and SO packages only

EACH GATE



1.9 PIN ASSIGNMENT

| Pin | Function | | Pin | Function | |
|-----|---|---|-----|--|--|
| | FP, DIP and SO | CCP | | FP, DIP and SO | CCP |
| 1 | V _{CC} (Supply Voltage Input Side) | V _{CC} (Supply Voltage Input Side) | 11 | 3Y Output | 3EN Input (Enable) |
| 2 | 1EN Input (Enable) | 1EN Input (Enable) | 12 | - | 3A Input |
| 3 | 1A Input | - | 13 | 4Y Output | - |
| 4 | 1Y Output | 1A Input | 14 | 4A Input | 3Y Output |
| 5 | 2Y Output | 1Y Output | 15 | 4EN Input (Enable) | - |
| 6 | 2A Input | 2Y Output | 16 | V _{DD} (Supply Voltage Output Side) | 4Y Output |
| 7 | 2EN Input (Enable) | 2A Input | 17 | - | 4A Input |
| 8 | V _{SS} | - | 18 | - | - |
| 9 | 3EN Input (Enable) | 2EN Input (Enable) | 19 | - | 4EN Input (Enable) |
| 10 | 3A Input | V _{SS} | 20 | - | V _{DD} (Supply Voltage Output Side) |

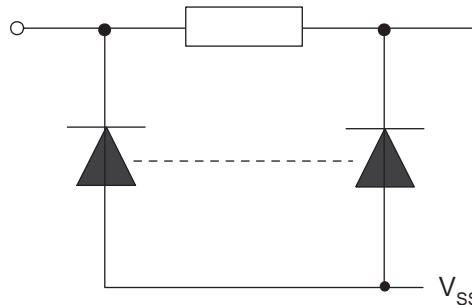
1.10 TRUTH TABLE

- Logic Level Definitions: L = Low Level, H = High Level based on V_{CC} at Inputs and V_{DD} at Outputs, X = Irrelevant, Z = High Impedance.

EACH GATE

| INPUTS | | OUTPUT |
|--------|----|--------|
| A | EN | Y |
| L | H | L |
| H | H | H |
| X | L | Z |

1.11 INPUT PROTECTION NETWORK



2. REQUIREMENTS

2.1 GENERAL

The complete requirements for procurement of the components specified herein are as stated in this specification and the ESCC Generic Specification. Permitted deviations from the Generic Specification, applicable to this specification only, are listed below.

Permitted deviations from the Generic Specification and this Detail Specification, formally agreed with specific Manufacturers on the basis that the alternative requirements are equivalent to the ESCC requirement and do not affect the component's reliability, are listed in the appendices attached to this specification.

2.1.1 Deviations from the Generic Specification

None.

2.2 MARKING

The marking shall be in accordance with the requirements of ESCC Basic Specification No. 21700 and as follows.

The information to be marked on the component shall be:

- (a) Terminal identification.
- (b) The ESCC qualified components symbol (for ESCC qualified components only).
- (c) The ESCC Component Number.
- (d) Traceability information.

2.3 ELECTRICAL MEASUREMENTS AT ROOM, HIGH AND LOW TEMPERATURES

Electrical measurements shall be performed at room, high and low temperatures. Consolidated Notes are given after the tables.

2.3.1 Room Temperature Electrical Measurements

The measurements shall be performed at $T_{amb}=+22 \pm 3^{\circ}\text{C}$.

| Characteristics | Symbols | MIL-STD-883 Test Method | Test Conditions Note 1 | Limits | | Units |
|--|-----------|----------------------------|--|--------|-----|---------|
| | | | | Min | Max | |
| Functional Test 1 | - | 3014 | Verify Truth Table without Load $V_{IL}=0V, V_{IH}=3V$ $V_{CC}=V_{DD}=3V, V_{SS}=0V$ Note 2 | - | - | - |
| Functional Test 2 | - | 3014 | Verify Truth Table without Load $V_{IL}=0V, V_{IH}=15V$ $V_{CC}=V_{DD}=15V,$ $V_{SS}=0V$ Note 2 | - | - | - |
| Quiescent Current | I_{DD} | 3005 | $V_{IL}=0V, V_{IH}=15V$ $V_{CC}=V_{DD}=15V,$ $V_{SS}=0V$ Note 3 | - | 500 | nA |
| Low Level Input Current | I_{IL} | 3009 | V_{IN} (Under Test)=0V $V_{CC}=V_{DD}=15V, V_{SS}=0V$ | - | -50 | nA |
| High Level Input Current | I_{IH} | 3010 | V_{IN} (Under Test)=15V $V_{CC}=V_{DD}=15V, V_{SS}=0V$ | - | 50 | nA |
| Low Level Output Voltage 1 | V_{OL1} | 3007 | $V_{IL}=0V, V_{IH}=15V,$ $I_{OL}=0A$ $V_{CC}=5V, V_{DD}=15V,$ $V_{SS}=0V$ | - | 50 | mV |
| Low Level Output Voltage 2 (Noise Immunity) | V_{OL2} | 3007 | $V_{IL}=1.5V, V_{IH}=3.5V,$ $I_{OL}=0A$ $V_{CC}=V_{DD}=5V, V_{SS}=0V$ | - | 500 | mV |
| Low Level Output Voltage 3 (Noise Immunity) | V_{OL3} | 3007 | $V_{IL}=4V, V_{IH}=11V,$ $I_{OL}=0A$ $V_{CC}=V_{DD}=15V,$ $V_{SS}=0V$ | - | 1.5 | V |
| High Level Output Voltage 1 | V_{OH1} | 3006 | $V_{IL}=0V, V_{IH}=15V,$ $I_{OH}=0A$ $V_{CC}=5V, V_{DD}=15V,$ $V_{SS}=0V$ | 14.95 | - | V |
| High Level Output Voltage 2 (Noise Immunity) | V_{OH2} | 3006 | $V_{IL}=1.5V, V_{IH}=3.5V,$ $I_{OH}=0A$ $V_{CC}=V_{DD}=5V, V_{SS}=0V$ | 4.5 | - | V |
| High Level Output Voltage 3 (Noise Immunity) | V_{OH3} | 3006 | $V_{IL}=4V, V_{IH}=11V,$ $I_{OH}=0A$ $V_{CC}=V_{DD}=15V,$ $V_{SS}=0V$ | 13.5 | - | V |
| Low Level Output Current 1 | I_{OL1} | - | $V_{IL}=0V, V_{IH}=5V,$ $V_{OL}=0.4V$ $V_{CC}=V_{DD}=5V, V_{SS}=0V$ Note 4 | 510 | - | μA |

| Characteristics | Symbols | MIL-STD-883 Test Method | Test Conditions Note 1 | Limits | | Units |
|--|-----------|----------------------------|--|--------|------|---------|
| | | | | Min | Max | |
| Low Level Output Current 2 | I_{OL2} | - | $V_{IL}=0V, V_{IH}=15V,$ $V_{OL}=1.5V$ $V_{CC}=5V, V_{DD}=15V,$ $V_{SS}=0V$ Note 4 | 3.4 | - | mA |
| High Level Output Current 1 | I_{OH1} | - | $V_{IL}=0V, V_{IH}=5V,$ $V_{OH}=4.6V$ $V_{CC}=V_{DD}=5V, V_{SS}=0V$ Note 4 | -510 | - | μA |
| High Level Output Current 2 | I_{OH2} | - | $V_{IL}=0V, V_{IH}=15V,$ $V_{OH}=13.5V$ $V_{CC}=5V, V_{DD}=15V,$ $V_{SS}=0V$ Note 4 | -3.4 | - | mA |
| Threshold Voltage N-Channel | V_{THN} | - | 1A Input at Ground All Other Inputs: $V_{IN}=5V$ $V_{CC}=5V, V_{DD}=12V,$ $I_{SS}=-10\mu A$ | -0.7 | -3 | V |
| Threshold Voltage P-Channel | V_{THP} | - | 1A Input at Ground All Other Inputs: $V_{IN}=-5V$ $V_{DD}=7V, V_{SS}=-5V,$ $I_{CC}=10\mu A$ | 0.7 | 3 | V |
| Output Leakage Current Third State, Low Level Applied | I_{OZL} | 3020 | $V_{IL}=0V$ $V_{IH}=18V$ $V_{OL}=0V$ $V_{CC}=5V, V_{DD}=18V,$ $V_{SS}=0V$ | - | -400 | nA |
| Output Leakage Current Third State, High Level Applied | I_{OZH} | 3021 | $V_{IL}=0V$ $V_{IH}=18V$ $V_{OH}=15V$ $V_{CC}=5V, V_{DD}=18V,$ $V_{SS}=0V$ | - | 400 | nA |
| Input Clamp Voltage, to V_{SS} | V_{IC} | - | I_{IN} (Under Test)= -100 μA $V_{CC}=0V, V_{DD}=\text{Open},$ $V_{SS}=0V$ All Other Pins Open | - | -2 | V |
| Input Capacitance | C_{IN} | 3012 | V_{IN} (Not Under Test)=0V $V_{CC}=V_{DD}=V_{SS}=0V$ $f = 100 \text{ kHz to } 1 \text{ MHz}$ Note 5 | - | 10 | pF |

| Characteristics | Symbols | MIL-STD-883 Test Method | Test Conditions Note 1 | Limits | | Units |
|---|------------|----------------------------|---|--------|-----|-------|
| | | | | Min | Max | |
| Propagation Delay Low to High 1, 1A to 1Y 2A to 2Y 3A to 3Y 4A to 4Y (Low to High Level Shift) | t_{PLH1} | 3003 | V_{IN} (Under Test)=Pulse Generator V_{IN} (Remaining Inputs)=Truth Table $V_{IL}=0V$, $V_{IH}=5V$, $V_{CC}=5V$, $V_{DD}=10V$, $V_{SS}=0V$ Note 6 | - | 260 | ns |
| Propagation Delay High to Low 1, 1A to 1Y 2A to 2Y 3A to 3Y 4A to 4Y (Low to High Level Shift) | t_{PHL1} | 3003 | V_{IN} (Under Test)=Pulse Generator V_{IN} (Remaining Inputs)=Truth Table $V_{IL}=0V$, $V_{IH}=5V$, $V_{CC}=5V$, $V_{DD}=10V$, $V_{SS}=0V$ Note 6 | - | 600 | ns |
| Propagation Delay Low to High 2, 1A to 1Y 2A to 2Y 3A to 3Y 4A to 4Y (High to Low Level Shift) | t_{PLH2} | 3003 | V_{IN} (Under Test)=Pulse Generator V_{IN} (Remaining Inputs)=Truth Table $V_{IL}=0V$, $V_{IH}=10V$, $V_{CC}=10V$, $V_{DD}=5V$, $V_{SS}=0V$ Note 6 | - | 460 | ns |
| Propagation Delay High to Low 2, 1A to 1Y 2A to 2Y 3A to 3Y 4A to 4Y (High to Low Level Shift) | t_{PHL2} | 3003 | V_{IN} (Under Test)=Pulse Generator V_{IN} (Remaining Inputs)=Truth Table $V_{IL}=0V$, $V_{IH}=10V$, $V_{CC}=10V$, $V_{DD}=5V$, $V_{SS}=0V$ Note 6 | - | 1.6 | ms |
| Output Enable Time High Impedance to Low Output 1, 1EN to 1Y 2EN to 2Y 3EN to 3Y 4EN to 4Y (Low to High Level Shift) | t_{PZL1} | 3003 | V_{IN} (Under Test)=Pulse Generator V_{IN} (Remaining Inputs)=Truth Table $V_{IL}=0V$, $V_{IH}=5V$, $V_{CC}=5V$, $V_{DD}=10V$, $V_{SS}=0V$ Note 6 | - | 200 | ns |

| Characteristics | Symbols | MIL-STD-883 Test Method | Test Conditions Note 1 | Limits | | Units |
|---|------------|----------------------------|---|--------|-----|-------|
| | | | | Min | Max | |
| Output Disable Time Low Output to High Impedance 1, 1EN to 1Y 2EN to 2Y 3EN to 3Y 4EN to 4Y (Low to High Level Shift) | t_{PLZ1} | 3003 | V_{IN} (Under Test)=Pulse Generator V_{IN} (Remaining Inputs)=Truth Table $V_{IL}=0V$, $V_{IH}=5V$, $V_{CC}=5V$, $V_{DD}=10V$, $V_{SS}=0V$ Note 6 | - | 740 | ns |
| Output Enable Time High Impedance to Low Output 2, 1EN to 1Y 2EN to 2Y 3EN to 3Y 4EN to 4Y (High to Low Level Shift) | t_{PZL2} | 3003 | V_{IN} (Under Test)=Pulse Generator V_{IN} (Remaining Inputs)=Truth Table $V_{IL}=0V$, $V_{IH}=10V$, $V_{CC}=10V$, $V_{DD}=5V$, $V_{SS}=0V$ Note 6 | - | 240 | ns |
| Output Disable Time Low Output to High Impedance 2, 1EN to 1Y 2EN to 2Y 3EN to 3Y 4EN to 4Y (High to Low Level Shift) | t_{PLZ2} | 3003 | V_{IN} (Under Test)=Pulse Generator V_{IN} (Remaining Inputs)=Truth Table $V_{IL}=0V$, $V_{IH}=10V$, $V_{CC}=10V$, $V_{DD}=5V$, $V_{SS}=0V$ Note 6 | - | 1.6 | ms |
| Output Enable Time High Impedance to High Output 1, 1EN to 1Y 2EN to 2Y 3EN to 3Y 4EN to 4Y (Low to High Level Shift) | t_{PZH1} | 3003 | V_{IN} (Under Test)=Pulse Generator V_{IN} (Remaining Inputs)=Truth Table $V_{IL}=0V$, $V_{IH}=5V$, $V_{CC}=5V$, $V_{DD}=10V$, $V_{SS}=0V$ Note 6 | - | 640 | ns |
| Output Disable Time High Output to High Impedance 1, 1EN to 1Y 2EN to 2Y 3EN to 3Y 4EN to 4Y (Low to High Level Shift) | t_{PHZ1} | 3003 | V_{IN} (Under Test)=Pulse Generator V_{IN} (Remaining Inputs)=Truth Table $V_{IL}=0V$, $V_{IH}=5V$, $V_{CC}=5V$, $V_{DD}=10V$, $V_{SS}=0V$ Note 6 | - | 120 | ns |

| Characteristics | Symbols | MIL-STD-883 Test Method | Test Conditions Note 1 | Limits | | Units |
|---|------------|----------------------------|---|--------|-----|-------|
| | | | | Min | Max | |
| Output Enable Time High Impedance to High Output 2, 1EN to 1Y 2EN to 2Y 3EN to 3Y 4EN to 4Y (High to Low Level Shift) | t_{pZH2} | 3003 | V_{IN} (Under Test)=Pulse Generator V_{IN} (Remaining Inputs)=Truth Table $V_{IL}=0V$, $V_{IH}=10V$, $V_{CC}=10V$, $V_{DD}=5V$, $V_{SS}=0V$ Note 6 | - | 1.5 | ms |
| Output Disable Time High Output to High Impedance 2, 1EN to 1Y 2EN to 2Y 3EN to 3Y 4EN to 4Y (High to Low Level Shift) | t_{pHZ2} | 3003 | V_{IN} (Under Test)=Pulse Generator V_{IN} (Remaining Inputs)=Truth Table $V_{IL}=0V$, $V_{IH}=10V$, $V_{CC}=10V$, $V_{DD}=5V$, $V_{SS}=0V$ Note 6 | - | 240 | ns |
| Transition Time Low to High 1, 1Y, 2Y, 3Y, 4Y (Low to High Level Shift) | t_{TLH1} | 3004 | V_{IN} (Under Test)=Pulse Generator V_{IN} (Remaining Inputs)=Truth Table $V_{IL}=0V$, $V_{IH}=5V$, $V_{CC}=5V$, $V_{DD}=10V$, $V_{SS}=0V$ Note 6 | - | 100 | ns |
| Transition Time High to Low 1, 1Y, 2Y, 3Y, 4Y (Low to High Level Shift) | t_{THL1} | 3004 | V_{IN} (Under Test)=Pulse Generator V_{IN} (Remaining Inputs)=Truth Table $V_{IL}=0V$, $V_{IH}=5V$, $V_{CC}=5V$, $V_{DD}=10V$, $V_{SS}=0V$ Note 6 | - | 100 | ns |
| Transition Time Low to High 2, 1Y, 2Y, 3Y, 4Y (High to Low Level Shift) | t_{TLH2} | 3004 | V_{IN} (Under Test)=Pulse Generator V_{IN} (Remaining Inputs)=Truth Table $V_{IL}=0V$, $V_{IH}=10V$, $V_{CC}=10V$, $V_{DD}=5V$, $V_{SS}=0V$ Note 6 | - | 200 | ns |

| Characteristics | Symbols | MIL-STD-883 Test Method | Test Conditions Note 1 | Limits | | Units |
|---|------------|-------------------------|---|--------|-----|-------|
| | | | | Min | Max | |
| Transition Time High to Low 2, 1Y, 2Y, 3Y, 4Y (High to Low Level Shift) | t_{THL2} | 3004 | V_{IN} (Under Test)=Pulse Generator V_{IN} (Remaining Inputs)=Truth Table $V_{IL}=0V, V_{IH}=10V, V_{CC}=10V, V_{DD}=5V, V_{SS}=0V$ Note 6 | - | 200 | ns |

2.3.2 High and Low Temperatures Electrical Measurements

The measurements shall be performed at $T_{amb}=+125 (+0 -5) ^\circ C$ and $T_{amb}=- 55(+5-0)^\circ C$.

| Characteristics | Symbols | MIL-STD-883 Test Method | Test Conditions Note 1 | Limits | | Units |
|---|-----------|-------------------------|--|--------|-------------|---------|
| | | | | Min | Max | |
| Functional Test 1 | - | 3014 | Verify Truth Table without Load $V_{IL}=0V, V_{IH}=3V$ $V_{CC}=V_{DD}=3V, V_{SS}=0V$ Note 2 | - | - | - |
| Functional Test 2 | - | 3014 | Verify Truth Table without Load $V_{IL}=0V, V_{IH}=15V$ $V_{CC}=V_{DD}=15V, V_{SS}=0V$ Note 2 | - | - | - |
| Quiescent Current | I_{DD} | 3005 | $V_{IL}=0V, V_{IH}=15V$ $V_{CC}=V_{DD}=15V, V_{SS}=0V$ Note 3 $T_{amb}=+125^\circ C$ $T_{amb}=-55^\circ C$ | - | 15 0.5 | μA |
| Low Level Input Current | I_{IL} | 3009 | V_{IN} (Under Test)=0V $V_{CC}=V_{DD}=15V, V_{SS}=0V$ $T_{amb}=+125^\circ C$ $T_{amb}=-55^\circ C$ | - | -100 -50 | nA |
| High Level Input Current | I_{IH} | 3010 | V_{IN} (Under Test)=15V $V_{CC}=V_{DD}=15V, V_{SS}=0V$ $T_{amb}=+125^\circ C$ $T_{amb}=-55^\circ C$ | - | 100 50 | nA |
| Low Level Output Voltage 1 | V_{OL1} | 3007 | $V_{IL}=0V, V_{IH}=15V, I_{OL}=0A$ $V_{CC}=5V, V_{DD}=15V, V_{SS}=0V$ | - | 50 | mV |
| Low Level Output Voltage 2 (Noise Immunity) | V_{OL2} | 3007 | $V_{IL}=1.5V, V_{IH}=3.5V, I_{OL}=0A$ $V_{CC}=V_{DD}=5V, V_{SS}=0V$ | - | 500 | mV |

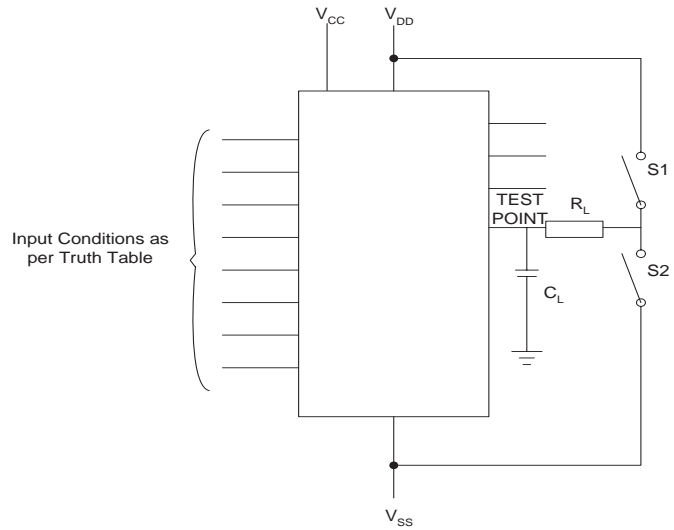
| Characteristics | Symbols | MIL-STD-883 Test Method | Test Conditions Note 1 | Limits | | Units |
|--|-----------|----------------------------|--|--------------|--------------|---------|
| | | | | Min | Max | |
| Low Level Output Voltage 3 (Noise Immunity) | V_{OL3} | 3007 | $V_{IL}=4V, V_{IH}=11V,$ $I_{OL}=0A$ $V_{CC}=V_{DD}=15V, V_{SS}=0V$ | - | 1.5 | V |
| High Level Output Voltage 1 | V_{OH1} | 3006 | $V_{IL}=0V, V_{IH}=15V,$ $I_{OH}=0A$ $V_{CC}=5V, V_{DD}=15V,$ $V_{SS}=0V$ | 14.95 | - | V |
| High Level Output Voltage 2 (Noise Immunity) | V_{OH2} | 3006 | $V_{IL}=1.5V, V_{IH}=3.5V,$ $I_{OH}=0A$ $V_{CC}=V_{DD}=5V, V_{SS}=0V$ | 4.5 | - | V |
| High Level Output Voltage 3 (Noise Immunity) | V_{OH3} | 3006 | $V_{IL}=4V, V_{IH}=11V,$ $I_{OH}=0A$ $V_{CC}=V_{DD}=15V, V_{SS}=0V$ | 13.5 | - | V |
| Low Level Output Current 1 | I_{OL1} | - | $V_{IL}=0V, V_{IH}=5V,$ $V_{OL}=0.4V$ $V_{CC}=V_{DD}=5V, V_{SS}=0V$ Note 4 $T_{amb}=+125^{\circ}C$ $T_{amb}=-55^{\circ}C$ | 360 640 | - - | μA |
| Low Level Output Current 2 | I_{OL2} | - | $V_{IL}=0V, V_{IH}=15V,$ $V_{OL}=1.5V$ $V_{CC}=5V, V_{DD}=15V,$ $V_{SS}=0V$ Note 4 $T_{amb}=+125^{\circ}C$ $T_{amb}=-55^{\circ}C$ | 2.4 4.2 | - - | mA |
| High Level Output Current 1 | I_{OH1} | - | $V_{IL}=0V, V_{IH}=5V,$ $V_{OH}=4.6V$ $V_{CC}=V_{DD}=5V, V_{SS}=0V$ Note 4 $T_{amb}=+125^{\circ}C$ $T_{amb}=-55^{\circ}C$ | -360 -640 | - - | μA |
| High Level Output Current 2 | I_{OH2} | - | $V_{IL}=0V, V_{IH}=15V,$ $V_{OH}=13.5V$ $V_{CC}=5V, V_{DD}=15V,$ $V_{SS}=0V$ Note 4 $T_{amb}=+125^{\circ}C$ $T_{amb}=-55^{\circ}C$ | -2.4 -4.2 | - - | mA |
| Threshold Voltage N-Channel | V_{THN} | - | 1A Input at Ground All Other Inputs: $V_{IN}=5V$ $V_{CC}=5V, V_{DD}=12V,$ $I_{SS}=-10\mu A$ $T_{amb}=+125^{\circ}C$ $T_{amb}=-55^{\circ}C$ | -0.3 -0.7 | -3.5 -3.5 | V |

| Characteristics | Symbols | MIL-STD-883 Test Method | Test Conditions Note 1 | Limits | | Units |
|--|-----------|-------------------------|--|------------|-------------|---------|
| | | | | Min | Max | |
| Threshold Voltage P-Channel | V_{THP} | - | 1A Input at Ground All Other Inputs: $V_{IN}=-5V$ $V_{DD}=7V, V_{SS}=-5V,$ $I_{CC}=10\mu A$ $T_{amb}=+125^{\circ}C$ $T_{amb}=-55^{\circ}C$ | 0.3 0.7 | 3.5 3.5 | V |
| Output Leakage Current Third State, Low Level Applied | I_{OZL} | 3020 | $V_{IL}=0V$ $V_{IH}=18V$ $V_{OL}=0V$ $V_{CC}=5V, V_{DD}=18V,$ $V_{SS}=0V$ $T_{amb}=+125^{\circ}C$ $T_{amb}=-55^{\circ}C$ | - - | -12 -0.4 | μA |
| Output Leakage Current Third State, High Level Applied | I_{OZH} | 3021 | $V_{IL}=0V$ $V_{IH}=18V$ $V_{OH}=15V$ $V_{CC}=5V, V_{DD}=18V,$ $V_{SS}=0V$ $T_{amb}=+125^{\circ}C$ $T_{amb}=-55^{\circ}C$ | - - | 12 0.4 | μA |

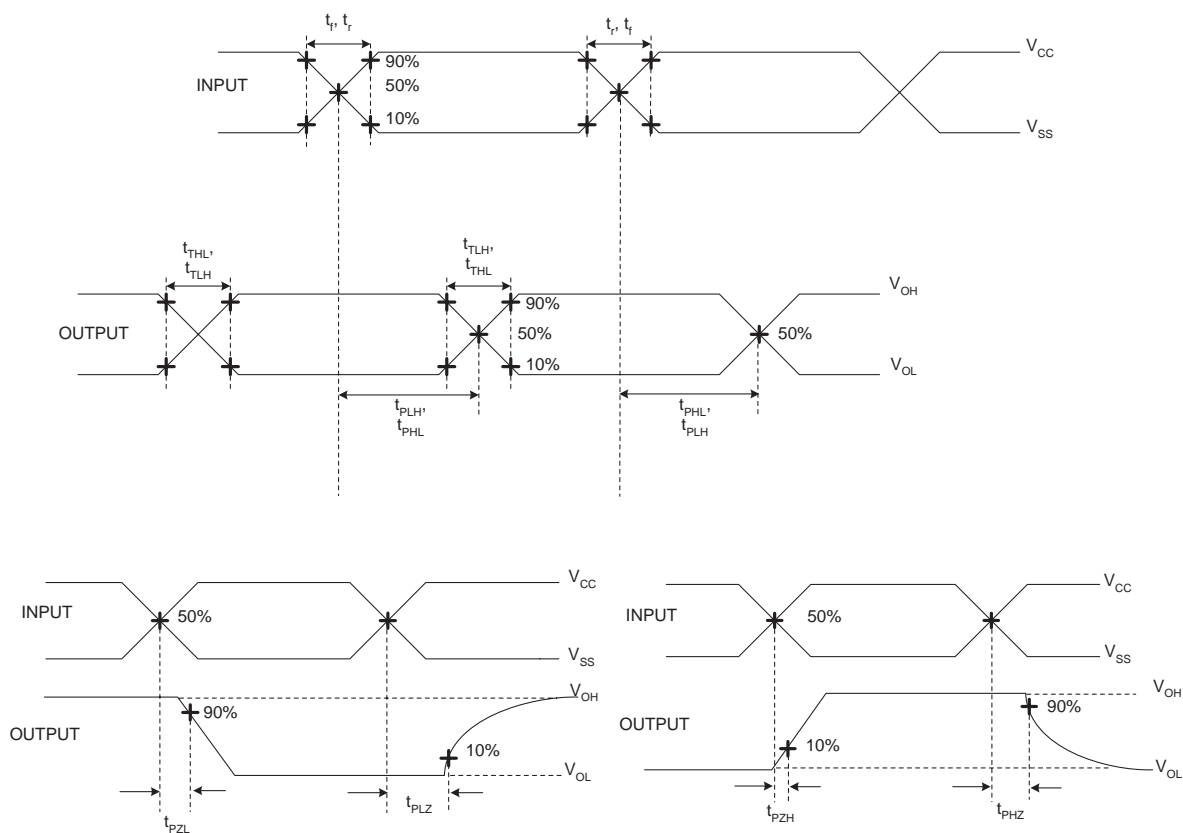
2.3.3

Notes to Electrical Measurement Tables

1. Unless otherwise specified all inputs and outputs shall be tested for each characteristic, inputs not under test shall be $V_{IN} = V_{SS}$ or V_{CC} and outputs not under test shall be open.
2. Functional tests shall be performed to verify Truth Table with $V_{OH} \geq V_{DD} - 0.5V, V_{OL} \leq 0.5V$. The maximum time to output comparator strobe = 300 μs .
3. Quiescent Current shall be tested using the following input conditions:
 - (a) Inputs 1A = 2A = 3A = 4A = V_{IL}
 - (b) Inputs 1A = 2A = 3A = 4A = V_{IH}
4. Interchange of forcing and measuring parameters is permitted.
5. Guaranteed but not tested.
6. Read and record measurements shall be performed on a sample of 32 components with 0 failures permitted.
The pulse generator shall have the following characteristics:
 $V_{GEN} = 0$ to V_{CC} ; $f_{GEN} = 500kHz$; t_r and $t_f \leq 15$ ns (10% to 90%); duty cycle = 50%; $Z_{out} = 50\Omega$. Output load capacitance $C_L = 50pF \pm 5\%$ including scope probe, wiring and stray capacitance without component in the test fixture, and output load resistance $R_L = 1k\Omega \pm 5\%$.
Propagation delay and transition time shall be measured as follows:



| Parameter | R_L | S1 | S2 |
|--------------------------------------|---------------|--------|--------|
| t_{PZH} | 1k Ω | Open | Closed |
| t_{PZL} | | Closed | Open |
| t_{PHZ} | | Open | Closed |
| t_{PLZ} | | Closed | Open |
| $t_{PHL}, t_{PLH}, t_{THL}, t_{TLH}$ | 200k Ω | Open | Closed |



2.4 PARAMETER DRIFT VALUES

Unless otherwise specified, the measurements shall be performed at $T_{amb}=+22 \pm 3^{\circ}\text{C}$.

The test methods and test conditions shall be as per the corresponding test defined in Room Temperature Electrical Measurements.

The drift values (Δ) shall not be exceeded for each characteristic specified. The corresponding absolute limit values for each characteristic shall not be exceeded.

| Characteristics | Symbols | Limits | | | Units |
|---|-----------|----------------------|----------|------|---------------|
| | | Drift Value Δ | Absolute | | |
| | | | Min | Max | |
| Quiescent Current | I_{DD} | ± 75 | - | 500 | nA |
| Low Level Output Current 1 | I_{OL1} | $\pm 15\%$ (2) | 510 | - | μA |
| High Level Output Current 1 | I_{OH1} | $\pm 15\%$ (2) | -510 | - | μA |
| Output Leakage Current Third State, Low Level Applied | I_{OZL} | ± 60 | - | -400 | nA |

| Characteristics | Symbols | Limits | | | Units |
|--|-----------|----------------------|----------|-----|-------|
| | | Drift Value Δ | Absolute | | |
| | | | Min | Max | |
| Output Leakage Current Third State, High Level Applied | I_{OZH} | ± 60 | - | 400 | nA |
| Threshold Voltage N-Channel | V_{THN} | ± 0.3 | -0.7 | -3 | V |
| Threshold Voltage P-Channel | V_{THP} | ± 0.3 | 0.7 | 3 | V |

NOTES:

1. Unless otherwise specified all inputs and outputs shall be tested for each characteristic.
2. Percentage of limit value if voltage is the measuring parameter.

2.5

INTERMEDIATE AND END-POINT ELECTRICAL MEASUREMENTS

Unless otherwise specified, the measurements shall be performed at $T_{amb} = +22 \pm 3^{\circ}C$.

The test methods and test conditions shall be as per the corresponding test defined in Room Temperature Electrical Measurements.

The drift values (Δ) shall not be exceeded for each characteristic where specified. The corresponding absolute limit values for each characteristic shall not be exceeded.

| Characteristics | Symbols | Limits | | | Units |
|--|-----------|----------------------|----------|-----|---------|
| | | Drift Value Δ | Absolute | | |
| | | | Min | Max | |
| Functional Test 1 | - | - | - | - | - |
| Quiescent Current | I_{DD} | ± 75 | - | 500 | nA |
| Low Level Input Current | I_{IL} | - | - | -50 | nA |
| High Level Input Current | I_{IH} | - | - | 50 | nA |
| Low Level Output Voltage 1 | V_{OL1} | - | - | 50 | mV |
| Low Level Output Voltage 2 (Noise Immunity) | V_{OL2} | - | - | 500 | mV |
| High Level Output Voltage 1 | V_{OH1} | - | 14.95 | - | V |
| High Level Output Voltage 2 (Noise Immunity) | V_{OH2} | - | 4.5 | - | V |
| Low Level Output Current 1 | I_{OL1} | $\pm 15\%$ (3) | 510 | - | μA |
| Low Level Output Current 2 | I_{OL2} | $\pm 15\%$ (3) | 3.4 | - | mA |
| High Level Output Current 1 | I_{OH1} | $\pm 15\%$ (3) | -510 | - | μA |
| High Level Output Current 2 | I_{OH2} | $\pm 15\%$ (3) | -3.4 | - | mA |

| Characteristics | Symbols | Limits | | | Units |
|--|-----------|-------------------------|----------|------|-------|
| | | Drift Value Δ | Absolute | | |
| | | | Min | Max | |
| Output Leakage Current Third State, Low Level Applied | I_{OZL} | ± 60 | - | -400 | nA |
| Output Leakage Current Third State, High Level Applied | I_{OZH} | ± 60 | - | 400 | nA |
| Threshold Voltage N-Channel | V_{THN} | ± 0.3 | -0.7 | -3 | V |
| Threshold Voltage P-Channel | V_{THP} | ± 0.3 | 0.7 | 3 | V |

NOTES:

1. Unless otherwise specified all inputs and outputs shall be tested for each characteristic.
2. The drift values (Δ) are applicable to the Operating Life test only.
3. Percentage of limit value if voltage is the measuring parameter.

2.6 HIGH TEMPERATURE REVERSE BIAS BURN-IN CONDITIONS

2.6.1 N-Channel HTRB

| Characteristics | Symbols | Test Conditions | Units |
|---------------------------------------|-----------|-----------------|-------------|
| Ambient Temperature | T_{amb} | +125 (+0 -5) | $^{\circ}C$ |
| Outputs Y (All Gates) | V_{OUT} | Open | V |
| Inputs 1A, 3A, 4A, 1EN | V_{IN} | $V_{DD}/2$ | V |
| Inputs 2A, 2EN, 3EN, 4EN | V_{IN} | V_{SS} | V |
| Positive Supply Voltage (Input Side) | V_{CC} | $V_{DD}/2$ | V |
| Positive Supply Voltage (Output Side) | V_{DD} | 15 (+0 -0.5) | V |
| Negative Supply Voltage | V_{SS} | 0 | V |
| Duration | t | 72 | Hours |

NOTES:

1. Input Protection Resistor = 2k Ω min to 47k Ω max.

2.6.2 P-Channel HTRB

| Characteristics | Symbols | Test Conditions | Units |
|--------------------------------------|-----------|-----------------|-------------|
| Ambient Temperature | T_{amb} | +125 (+0 -5) | $^{\circ}C$ |
| Outputs Y (All Gates) | V_{OUT} | Open | V |
| Inputs 1A, 3A, 4A, 1EN | V_{IN} | V_{SS} | V |
| Inputs 2A, 2EN, 3EN, 4EN | V_{IN} | $V_{DD}/2$ | V |
| Positive Supply Voltage (Input Side) | V_{CC} | $V_{DD}/2$ | V |

| Characteristics | Symbols | Test Conditions | Units |
|---------------------------------------|----------|-----------------|-------|
| Positive Supply Voltage (Output Side) | V_{DD} | 15 (+0 -0.5) | V |
| Negative Supply Voltage | V_{SS} | 0 | V |
| Duration | t | 72 | Hours |

NOTES:

1. Input Protection Resistor = 2kΩ min to 47kΩ max.

2.7 POWER BURN-IN CONDITIONS

| Characteristics | Symbols | Test Conditions | Units |
|---------------------------------------|-----------|--|-------|
| Ambient Temperature | T_{amb} | +125 (+0 -5) | °C |
| Outputs Y (All Gates) | V_{OUT} | $V_{DD}/2$ | V |
| Inputs EN (All Gates) | V_{IN} | V_{DD} | V |
| Inputs A (All Gates) | V_{IN} | V_{GEN} | V |
| Pulse Voltage | V_{GEN} | 0V to V_{DD} | V |
| Pulse Frequency Square Wave | f_{GEN} | $50k \leq f \leq 1M$ 50% Duty Cycle | Hz |
| Positive Supply Voltage (Input Side) | V_{CC} | V_{DD} | V |
| Positive Supply Voltage (Output Side) | V_{DD} | 15 (+0 -0.5) | V |
| Negative Supply Voltage | V_{SS} | 0 | V |

NOTES:

1. Input Protection Resistor = Output Load = 2kΩ min to 47kΩ max.

2.8 OPERATING LIFE CONDITIONS

The conditions shall be as specified for Power Burn-in.

APPENDIX 'A'

AGREED DEVIATIONS FOR STMICROELECTRONICS (F)

| ITEMS AFFECTED | DESCRIPTION OF DEVIATIONS |
|--|--|
| <p>Deviations from Screening Tests - Chart F3</p> | <p>External Visual Inspection: The criteria applicable to chip-outs are those described in MIL-STD-883, Test Method 2009, Paras 3.3.6(b) and 3.3.7(a).</p> <p>High Temperature Reverse Bias Burn-in: The temperature limits of MIL-STD-883, Para. 4.5.8(c) may be used.</p> <p>Power Burn-in test is performed using STMicroelectronics Specification Ref: 0019255.</p> <p>Solderability is not applicable unless specifically stipulated in the Purchase Order.</p> |
| <p>Deviations from Qualification and Periodic Tests - Chart F4</p> | <p>External Visual Inspection: The criteria applicable to chip-outs are those described in MIL-STD-883, Test Method 2009, Paras 3.3.6(b) and 3.3.7(a).</p> <p>Operating Life: The temperature limits of MIL-STD-883, Para. 4.5.8(c) may be used.</p> |
| <p>Deviations from High and Low Temperatures Electrical Measurements</p> | <p>High and Low Temperatures Electrical Measurements may be considered guaranteed but not tested if successful pilot lot testing has been performed on the wafer lot which includes High and Low Temperatures Electrical Measurements per the Detail Specification.</p> <p>A summary of the pilot lot testing shall be provided if required by the Purchase Order.</p> |
| <p>Deviations from Room Temperature Electrical Measurements</p> | <p>All AC characteristics (Capacitance and Timings) may be considered guaranteed but not tested if successful pilot lot testing has been performed on the wafer lot which includes AC characteristic measurements per the Detail Specification.</p> <p>A summary of the pilot lot testing shall be provided if required by the Purchase Order.</p> |