

STA400EP

Enhanced Plastic Dual 2:1 Analog Mux with IEEE 1149.4

General Description

This Dual 2 to 1 Analog Mux with IEEE 1149.4 incorporates many features of the IEEE 1149.4 Test Standard. The device provides access to up to 9 Analog test points and can be used to sample Analog signals as well as assist in the measurement of passive components. The device can be configured as a dual 2 to 1 multiplexor, or in a single 4 to 1 format. The device is compliant with both IEEE 1149.1 and IEEE 1149.4 Boundary Scan Test Standards.

ENHANCED PLASTIC

- Extended Temperature Performance of -55°C to +125°C
- Baseline Control - Single Fab & Assembly Site
- Process Change Notification (PCN)
- Qualification & Reliability Data
- Solder (PbSn) Lead Finish is standard
- Enhanced Diminishing Manufacturing Sources (DMS) Support

Features

- Compliant to IEEE 1149.1 and IEEE 1149.4
- Analog mux/demux either dual 2 to 1 or single 4 to 1
- Samples up to 9 Analog test points
- Includes CLAMP and HIGHZ instructions
- TRST Input
- Input range from -0.5V to +6.5

Applications

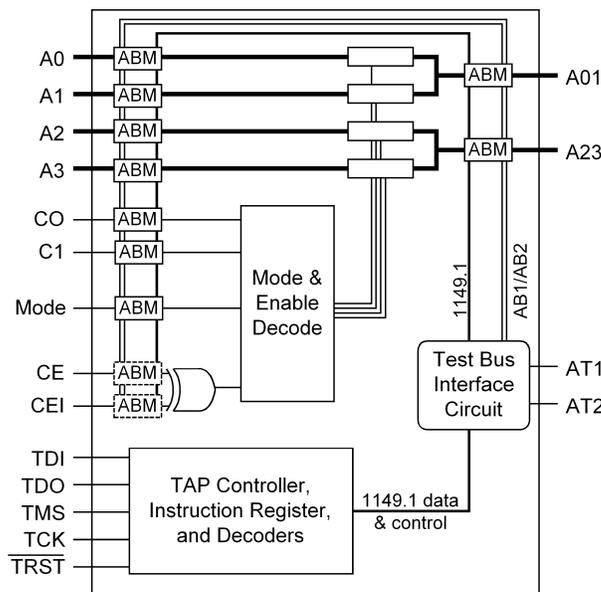
- Industrial Applications
- Automotive Applications
- Selected Military Applications
- Selected Avionics Applications

Ordering Information

| PART NUMBER | VID PART NUMBER | NS PACKAGE NUMBER (Note 1) |
|-------------|-----------------|----------------------------|
| STA400MTEP | V62/04727-01 | MTC20 |

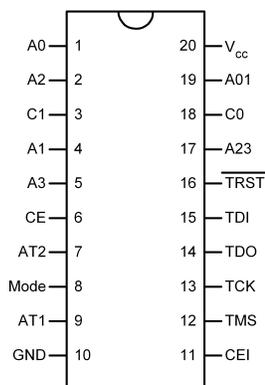
Note 1: Refer to package details under Physical Dimensions

Block Diagram



20100306

Connection Diagram



20100301

Pinout Description

| Pin Name | Pin # | Input/ Output | Descriptions |
|--------------------------|------------|---------------|---|
| A0, A2, A1, A3 | 1, 2, 4, 5 | I/O | Analog Multiplexor Input/IEEE 1149.4 Analog Access Pin |
| A23, A01 | 17, 19 | I/O | Analog Multiplexor Output/IEEE 1149.4 Analog Access Pin |
| C0, C1 | 18, 3 | I/O | Analog Multiplexor Select/IEEE 1149.4 Analog Access Pin |
| Mode | 8 | I/O | Analog Multiplexor Mode/IEEE 1149.4 Analog Access Pin |
| CE, CEI | 6, 11 | I | Analog Multiplexor Mode/Test Mode Select |
| GND | 10 | Ground | Ground |
| V _{CC} | 20 | Power | Power |
| AT1 | 9 | O | Analog Current Source for IEEE 1149.4 |
| AT2 | 7 | I | Analog Voltage Monitor for IEEE 1149.4 |
| $\overline{\text{TRST}}$ | 16 | I | Test Reset Input for IEEE 1149.1 |
| TMS | 12 | I | Test Mode Select for IEEE 1149.1 |
| TCK | 13 | I | Test Clock for IEEE 1149.1 |
| TDI | 15 | I | Test Data Input for IEEE 1149.1 |
| TDO | 14 | O | Test Data Output for IEEE 1149.1 |

Truth Table

| CE | Mode | C1 | C0 | A01 | A23 |
|-----------------------|------|----|----|---------------|---------------|
| not equal to CEI | 0 | 0 | 0 | A0 | A2 |
| | 0 | 0 | 1 | A1 | A2 |
| | 0 | 1 | 0 | A0 | A3 |
| | 0 | 1 | 1 | A1 | A3 |
| | 1 | 0 | 0 | A0 | not connected |
| | 1 | 0 | 1 | A1 | not connected |
| | 1 | 1 | 0 | not connected | A2 |
| | 1 | 1 | 1 | not connected | A3 |
| equal to CEI (Note 2) | X | X | X | not connected | not connected |

Note 2: When CEI = CE, the analog pins can be used as analog probes in IEEE 1149.4.

Absolute Maximum Ratings (Note 3)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

| | |
|-----------------------------|----------------------------|
| Supply Voltage (V_{CC}) | 6.5V |
| DC Input/Out Voltage | -0.5V to V_{CC} +0.5V |
| Storage Temperature | -65C to +150C |

Recommended Operating Conditions

| | |
|---------------------------------|-----------------|
| Supply Voltage (V_{CC}) | 3.0V to 5.5V |
| Operating Temperature (T_A) | -55°C to +125°C |

Note 3: Absolute maximum ratings are those values beyond which damage to the device may occur. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. National does not recommend operation of SCAN circuits outside databook specifications.

DC Electrical Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|------------|----------------------------|---------------------------------|---|-----|-----|---------|
| V_{IL} | Maximum Input Low Voltage | | | | 0.8 | V |
| V_{IH} | Minimum Input High Voltage | | 2.0 | | | V |
| I_{IN} | Input Leakage Current | All Inputs | -200 | | 5 | μ A |
| I_{OZ} | Tristate Output Current | (TDO only) | -5 | | 5 | μ A |
| V_{OL} | Output Low Voltage | $I_{OL} = 100\mu$ A (TDO only) | | | 0.2 | V |
| | Output Low Voltage | $I_{OL} = 12$ mA (TDO only) | | | 0.5 | V |
| V_{OH} | Output High Voltage | $I_{OH} = -100\mu$ A (TDO only) | $V_{CC} - 0.2$ v | | | V |
| | Output High Voltage | $I_{OH} = -12$ mA (TDO only) | 2.4 | | | V |
| I_{CCL} | Power Supply Current | $V_{CC} = 3.0$ V | | | 400 | μ A |
| I_{CCH} | | | | | 40 | μ A |
| I_{CCT} | | | | | 500 | μ A |
| I_{CCL} | Power Supply Current | $V_{CC} = 5.5$ V | | | 1 | mA |
| I_{CCH} | | | | | 80 | μ A |
| I_{CCT} | | | | | 500 | μ A |
| I_{CCT2} | | | TCK, TMS, TDI, \overline{TRST} active | | | 2.0 |
| C_{IN} | Input Capacitance (Note 4) | C0, C1, Mode | | 8 | | pF |
| | | A0, A1, A2, A3 | | 12 | | pF |
| | | A01, A23 | | 16 | | pF |

MUX Electrical Characteristics Over recommended operating supply and temperature ranges unless otherwise specified.

| | | | | | | |
|----------|-----------------------------------|----------------------------------|---|--|----|----------|
| R_{ON} | Mux Switch On Resistance (Note 4) | A01 to A0 or A1, A23 to A2 or A3 | 5 | | 50 | Ω |
|----------|-----------------------------------|----------------------------------|---|--|----|----------|

ABM Electrical Characteristics (Muxes disconnected) Over recommended operating supply and temperature ranges unless otherwise specified.

| | | | | | | |
|----------|----------------------------|---|-----|------|------|----------|
| R_{ON} | Test Bus Path Resistance | AT1 or AT2 to any input with ABM (A01, A23, A0, A1, A2, A3, C0, C1) | 400 | | 2000 | Ω |
| V_{TH} | Threshold Voltage (Note 4) | $V_{CC} = 5.5$ V | | 2.56 | | V |
| | | $V_{CC} = 3.0$ V | | 1.31 | | V |

Note 4: Not production tested.

AC Electrical Characteristics

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|-----------|-------------------|------------|-----|-----|-----|-------|
| t_{PLH} | Propagation Delay | TDO Output | 0.5 | | 9.5 | ns |
| t_{PHL} | Propagation Delay | TDO Output | 0.5 | | 9.5 | ns |

Applications Examples

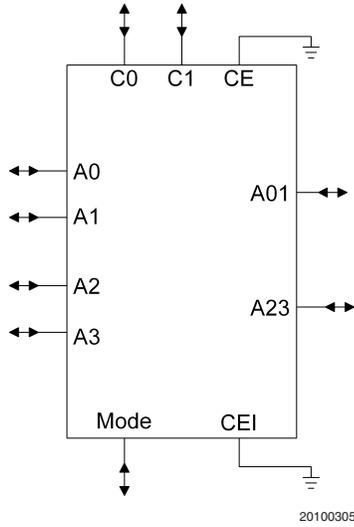


FIGURE 1. Nine (9) IEEE 1149.4 probes

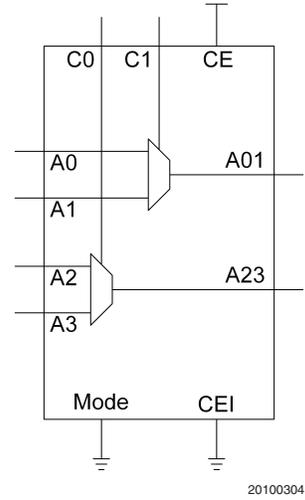


FIGURE 3. Dual 2 to 1 Multiplexer

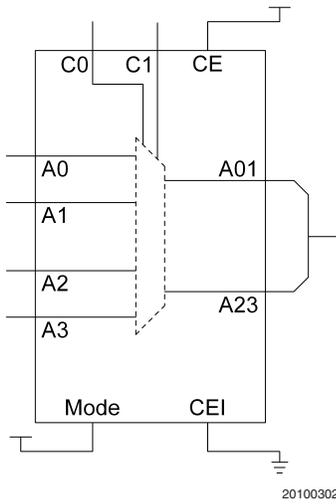


FIGURE 2. Single 4 to 1 Multiplexer

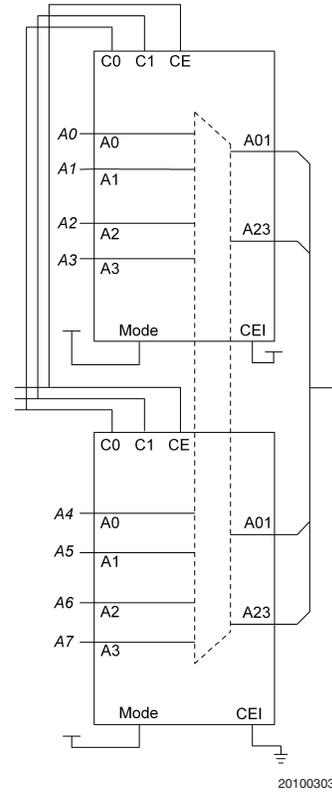
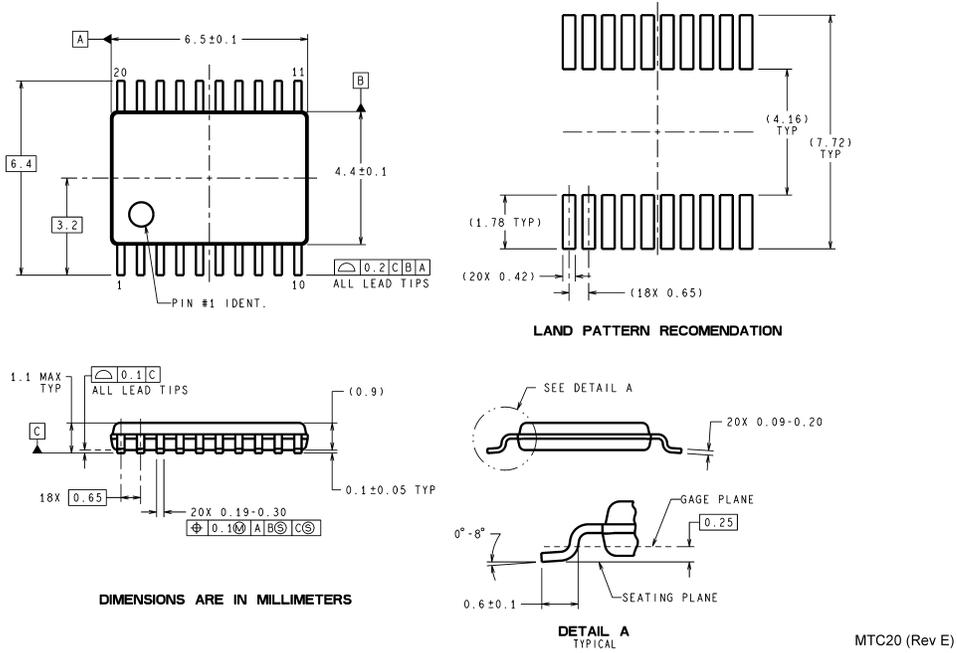


FIGURE 4. Single 8 to 1 Multiplexer

Physical Dimensions inches (millimeters) unless otherwise noted



**20-Lead Molded TSSOP Package
NS Package Number MTC20**

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