

Features

- 40-bit Serial-to-Parallel Converter
- 20-bit Multiplexer
- Serial Out Port for Diagnostics and Daisy Chaining
- Compatible with 5.0 V and 3.3 V CMOS Logic
- Built-in Active Pull-down for Logic Inputs
- Fast Switching
- Low Current consumption
- Lead-Free 6 mm 48-lead PQFN Package
- RoHS* Compliant and 260°C Reflow Compatible

Applications

- Aerospace & Defense

Description

The MADR-011007 is a 40-bit serial-to-parallel driver in a low cost 6 mm 48-lead PQFN plastic package. It is designed as a serial control interface. A 20-bit multiplexer is designed on-chip to provide bit destination control capability for bit numbers 21 through 40. High speed digital CMOS technology is utilized to achieve low power dissipation.

The MADR-011007 can be used to drive depletion mode FETs using a -5 V power supply. It can also be used as a general serial-to-parallel converter using a +5 V power supply.

Ordering Information¹

| Part Number | Package |
|--------------------|----------------|
| MADR-011007-TR0500 | 500 piece reel |

1. Reference Application Note M513 for reel size information.

Pin Out

| Pin # | I/O | Function | Pin # | I/O | Function |
|-----------------|-----|-------------------|-------|-----|---------------------|
| 1 | O | C1 or B1 | 25 | O | A10 |
| 2 | O | B1 or C1 | 26 | O | A20 |
| 3 | O | B2 or C2 | 27 | O | A19 |
| 4 | O | B3 or C3 | 28 | O | A18 |
| 5 | O | B4 or C4 | 29 | O | A17 |
| 6 | O | B5 or C5 | 30 | O | A16 |
| 7 | O | B6 or C6 | 31 | O | A15 |
| 8 | O | B7 or C7 | 32 | O | A14 |
| 9 | O | B8 or C8 | 33 | O | A13 |
| 10 | O | B9 or C9 | 34 | O | A12 |
| 11 | O | B10 or C10 | 35 | O | A11 |
| 12 | O | C10 or B10 | 36 | O | A1 |
| 13 | O | C9 or B9 | 37 | O | A2 |
| 14 | O | C8 or B8 | 38 | O | A3 |
| 15 | O | C7 or b7 | 39 | O | A4 |
| 16 | O | C6 or b6 | 40 | O | A5 |
| 17 ³ | | GND or VCC | 41 | I | LOAD |
| 18 ³ | | VEE or GND | 42 | I | CLK |
| 19 | I | CTRL ₁ | 43 | I | SER_IN |
| 20 | I | CTRL ₀ | 44 | O | SER_OUT |
| 21 | O | A6 | 45 | O | C5 or B5 |
| 22 | O | A7 | 46 | O | C4 or B4 |
| 23 | O | A8 | 47 | O | C3 or B3 |
| 24 | O | A9 | 48 | O | C2 or B2 |
| | | | 49 | | Paddle ² |

2. The exposed paddle centered on the package bottom must be either left "open" (no connection) or connected to V_{EE}.
3. When using 0 V/+5 V logic, pin 17 should be connected to positive power supply +5 V (VCC) and pin 18 should be connected to ground. When using -5 V/0 V logic, pin 17 should be connected to ground and pin 18 should be connected to -5 V (VEE).

* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

Guaranteed Operating Ranges^{4,5,6}

| Symbol | Parameter | Min. | Typ. | Max. | Unit |
|------------|----------------------------|------|------|------|------|
| V_{EE}^6 | Negative DC Supply Voltage | -5.5 | -5.0 | -4.5 | V |
| T_{OPER} | Operating Temperature | -40 | 25 | 85 | °C |
| I_{OH} | DC Output Current - High | -1 | — | — | mA |
| I_{OL} | DC Output Current - Low | — | — | 1 | mA |

4. Unused logic inputs must be tied to either GND or V_{EE} .

5. 0.01 μ F decoupling capacitors are required on the power supply line.

6. This driver can also operate at -3.3 V V_{EE} , but at slower speed.

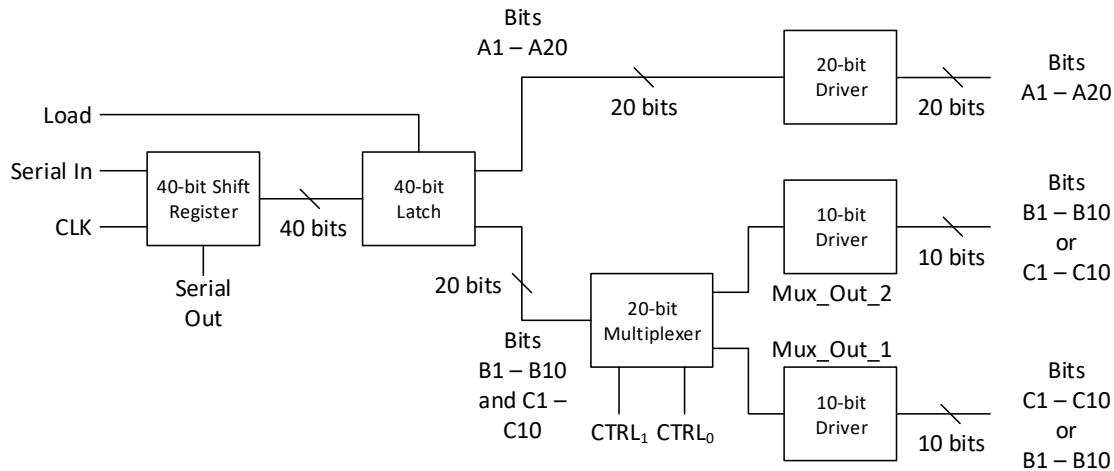
Performance over Guaranteed Operating Range

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|----------|-------------------------------------|---|------|----------------|------|---------|
| V_{IH} | Input High Voltage | Guaranteed High Input Voltage | -1.5 | 0.0 | 0.0 | V |
| V_{IL} | Input Low Voltage | Guaranteed Low Input Voltage | -5.5 | -5.0 | -3.5 | V |
| V_{OH} | Output High Voltage | $I_{OH} = -250 \mu$ A | — | -0.1 | — | V |
| V_{OL} | Output Low Voltage | $I_{OL} = 250 \mu$ A | — | $V_{EE} + 0.1$ | — | V |
| I_{IN} | Input Leakage Current (per Input) | $V_{IN} = \text{GND or } V_{EE}$ | — | 80 | — | μ A |
| I_{OH} | DC Output Current-High (per Output) | $V_{EE} = -5.0$ V | -1 | — | — | mA |
| I_{OL} | DC Output Current-Low (per Output) | $V_{EE} = -5.0$ V | — | — | 1 | mA |
| I_{EE} | Quiescent Supply Current | $V_{IN} = \text{GND or } V_{EE}$, No Output Load | — | — | 400 | μ A |
| T_D | Propagation Delay | 50% LOAD signal to 90% V_O | — | 12 | — | ns |
| C_{IN} | Input Capacitance | — | — | 6 | — | pF |

Absolute Maximum Ratings

| Symbol | Parameter | Min. | Max. | Unit |
|------------|----------------------------|----------------|------|------|
| V_{EE} | Negative DC Supply Voltage | -7.0 | 0.3 | V |
| V_{IN} | DC Input Voltage | $V_{EE} - 0.3$ | 0.3 | V |
| V_O | DC Output Voltage | $V_{EE} - 0.3$ | 0.3 | V |
| T_{OPER} | Operating Temperature | -55 | 125 | °C |
| T_{STG} | Storage Temperature | -65 | 150 | °C |
| ESD | ESD Sensitivity (HBM) | 2.0 | — | kV |

Function Diagram



Serial Bit Stream Definition⁷

| Bit # | Bit Name | Bit # | Bit Name |
|-------|----------|-------|----------|
| 1 | A1 | 21 | B1 |
| 2 | A2 | 22 | C1 |
| 3 | A3 | 23 | B2 |
| 4 | A4 | 24 | C2 |
| 5 | A5 | 25 | B3 |
| 6 | A6 | 26 | C3 |
| 7 | A7 | 27 | B4 |
| 8 | A8 | 28 | C4 |
| 9 | A9 | 29 | B5 |
| 10 | A10 | 30 | C5 |
| 11 | A11 | 31 | B6 |
| 12 | A12 | 32 | C6 |
| 13 | A13 | 33 | B7 |
| 14 | A14 | 34 | C7 |
| 15 | A15 | 35 | B8 |
| 16 | A16 | 36 | C8 |
| 17 | A17 | 37 | B9 |
| 18 | A18 | 38 | C9 |
| 19 | A19 | 39 | B10 |
| 20 | A20 | 40 | C10 |

7. Bit number 1 is the first bit going into the serial interface.

Multiplexer Truth Table^{8, 9}

| CTRL ₁ | CTRL ₀ | Mux_Out_1 | Mux_Out_2 |
|-------------------|-------------------|-----------|-----------|
| L | L | C | B |
| L | H | B | C |
| H | X | C | B |

8. For V_{EE} = -5 V, logic "L" = -5 V, and logic "H" = 0 V. For V_{CC} = 5 V, logic "L" = 0 V, and logic "H" = 5 V.

9. "B" represents odd bits of the uppermost 20-bit stream, and "C" represents even bits of the uppermost 20-bit stream.

Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

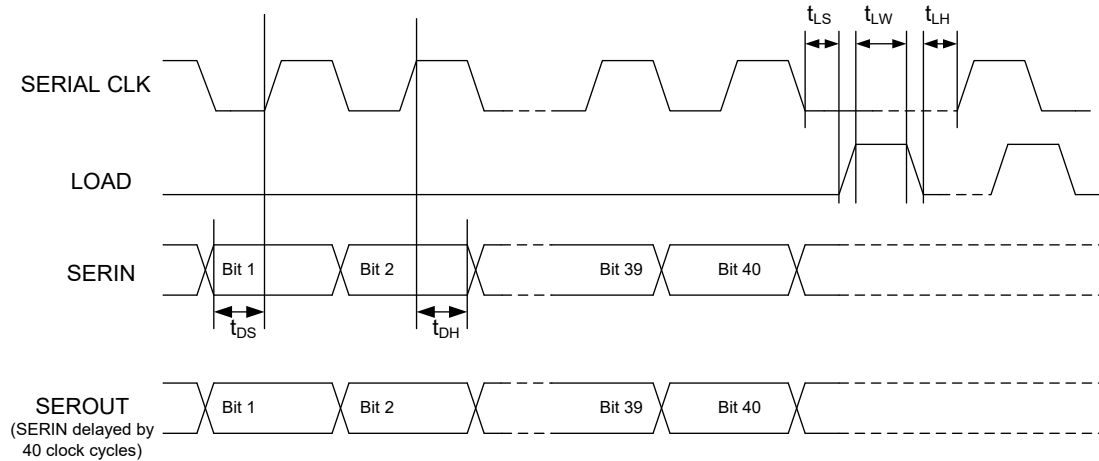
These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

Bit Stream Destinations

| Multiplexer Output | Pin # | Bit # at Output | |
|--------------------|-------|--|-----------|
| | | CTRL ₁ = L CTRL ₀ = H | Otherwise |
| Mux_Out_1 | 2 | 21 | 22 |
| | 3 | 23 | 24 |
| | 4 | 25 | 26 |
| | 5 | 27 | 28 |
| | 6 | 29 | 30 |
| | 7 | 31 | 32 |
| | 8 | 33 | 34 |
| | 9 | 35 | 36 |
| | 10 | 37 | 38 |
| | 11 | 39 | 40 |
| Mux_Out_2 | 1 | 22 | 21 |
| | 48 | 24 | 23 |
| | 47 | 26 | 25 |
| | 46 | 28 | 27 |
| | 45 | 30 | 29 |
| | 16 | 32 | 31 |
| | 15 | 34 | 33 |
| | 14 | 36 | 35 |
| | 13 | 38 | 37 |
| | 12 | 40 | 39 |

| Pin # | Bit # at Output (all states) |
|-------|---------------------------------|
| 36 | 1 |
| 37 | 2 |
| 38 | 3 |
| 39 | 4 |
| 40 | 5 |
| 21 | 6 |
| 22 | 7 |
| 23 | 8 |
| 24 | 9 |
| 25 | 10 |
| 35 | 11 |
| 34 | 12 |
| 33 | 13 |
| 32 | 14 |
| 31 | 15 |
| 30 | 16 |
| 29 | 17 |
| 28 | 18 |
| 27 | 19 |
| 26 | 20 |

Serial Interface Timing Diagram



Serial Interface Timing Characteristics

| Symbol | Parameter | Typical performance | | | Unit |
|-----------|-------------------------------------|---------------------|-------|-------|------|
| | | -40°C | +25°C | +85°C | |
| t_{SCK} | Min. Serial Clock Period | 100 | 100 | 100 | ns |
| t_{DS} | Min. DATA Set-up Time | 20 | 20 | 20 | ns |
| t_{DH} | Min. DATA Hold Time | 20 | 20 | 20 | ns |
| t_{LS} | Min. LOAD Set-up Time | 20 | 20 | 20 | ns |
| t_{LW} | Min. LOAD Pulse Width | 20 | 20 | 20 | ns |
| t_{LH} | Min. Serial CLK Hold Time from LOAD | 20 | 20 | 20 | ns |

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