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MAX14934–MAX14936

Four-Channel, 5kV_{RMS} Digital Isolators

General Description

The MAX14934–MAX14936 are a family of four-channel, 5kV_{RMS} digital isolators utilizing Maxim's proprietary process technology. For applications requiring 2.75kV_{RMS} of isolation, see the MAX14930–MAX14932. The MAX14934–MAX14936 family transfers digital signals between circuits with different power domains at ambient temperatures up to +125°C.

The MAX14934–MAX14936 family offers all three possible unidirectional channel configurations to accommodate any four-channel design, including SPI, RS-232, RS-485, and large digital IO modules. For applications requiring bidirectional channels, such as I²C, refer to the MAX14937.

Devices are available with data rates from DC up to 1Mbps, 25Mbps, or 150Mbps. Each device is also available in either a default high or default low configuration. The default is the state an output goes to when its input is unpowered. See the [Product Selector Guide](#) and [Ordering Information](#) for the suffixes associated with each option.

Independent 1.71V to 5.5V supplies on each side of the isolator also make the devices suitable for use as level translators.

The MAX14934–MAX14936 are available in a 16-pin wide body (10.3mm x 7.5mm) SOIC package. All devices are rated for operation at ambient temperatures of -40°C to +125°C.

[Product Selector Guide](#) and [Ordering Information](#) appear at end of data sheet.

Benefits and Features

- Robust Galvanic Isolation of Digital Signals
 - Withstands 5kV_{RMS} for 60s (V_{ISO})
 - Continuously Withstands 848V_{RMS} (V_{IOWM})
 - 1200V_P Repetitive Peak Voltage (V_{IORM})
 - Withstands ±10kV Surge per IEC 61000-4-5
- Interfaces Directly with Most Micros and FPGAs
 - Accepts 1.71V to 5.5V Supplies
- Many Options Support Broad Applications
 - 3 Data Rates (1Mbps, 25Mbps, 150Mbps)
 - 3 Channel Direction Configuration
 - 2 Output Default States (High or Low)
- Low Power Consumption at High Data Rates
 - At 1.8V:
 - 2.5mA per Channel Typical at 1Mbps
 - 5.25mA per Channel Typical at 100Mbps
 - At 3.3V:
 - 2.6mA per Channel Typical at 1Mbps
 - 7.1mA per Channel Typical at 100Mbps

Safety Regulatory Approvals

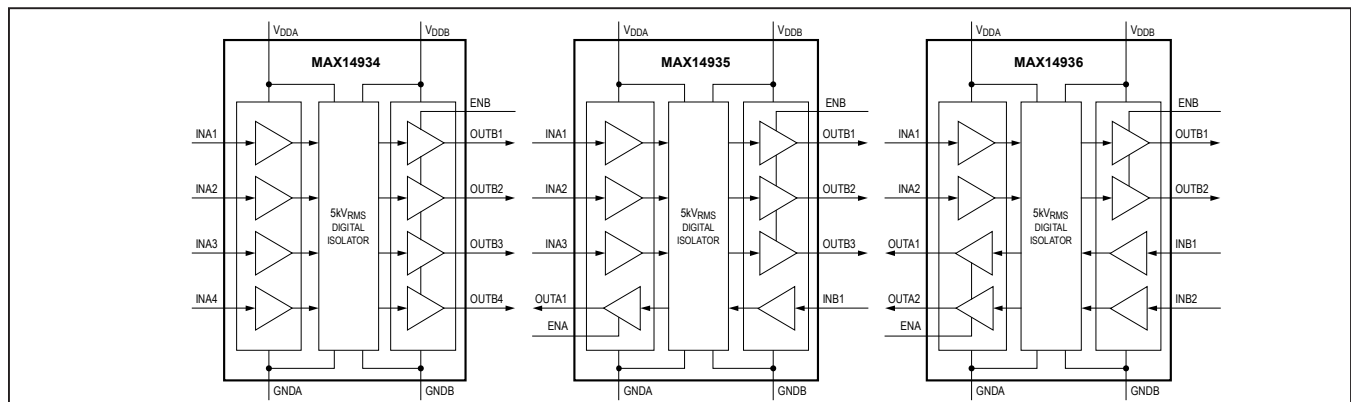
(see [Safety Regulatory Approvals](#))

- UL According to UL1577
- cUL According to CSA Bulletin 5A
- VDE 0884-11 Basic Insulation

Applications

- Fieldbus Communications for Industrial Automation
- Isolated SPI, RS-232, RS-485/RS-422
- General Multichannel Isolation Applications
- Battery Management
- Medical Systems

Functional Diagram



Absolute Maximum Ratings

| | | |
|--|------------------------------------|---|
| V _{DDA} to GNDA, V _{DDB} to GNDB | -0.3V to +6V | Continuous Power Dissipation (T _A = +70°C) |
| INA ₋ , ENA to GNDA | -0.3V to +6V | Wide SOIC (derate 14.1mW/°C above +70°C) |
| INB ₋ , ENB to GNDB | -0.3V to +6V | Operating Temperature Range |
| OUTA ₋ to GNDA | -0.3V to (V _{DDA} + 0.3V) | Maximum Junction Temperature |
| OUTB ₋ to GNDB | -0.3V to (V _{DDB} + 0.3V) | Storage Temperature Range |
| Short-Circuit Duration | | Lead Temperature (soldering, 10s) |
| (OUTA ₋ to GNDA, OUTB ₋ to GNDB) | Continuous | Soldering Temperature (reflow) |

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Package Information

| | |
|---|-------------------------|
| PACKAGE TYPE: 16 Wide SOIC | |
| Package Code | W16M+8 |
| Outline Number | 21-0042 |
| Land Pattern Number | 90-0107 |
| THERMAL RESISTANCE, FOUR-LAYER BOARD | |
| Junction to Ambient (θ _{JA}) | 71°C/W |
| Junction to Case (θ _{JC}) | 23°C/W |

Package thermal resistances were obtained using the method described in JEDEC specification JESD51-7, using a four-layer board. For detailed information on package thermal considerations, refer to www.maximintegrated.com/thermal-tutorial.

For the latest package outline information and land patterns (footprints), go to www.maximintegrated.com/packages. Note that a "+", "#", or "-" in the package code indicates RoHS status only. Package drawings may show a different suffix character, but the drawing pertains to the package regardless of RoHS status.

DC Electrical Characteristics

(V_{DDA} - V_{GNDA} = +1.71V to +5.5V, V_{DDB} - V_{GNDB} = +1.71V to +5.5V, C_L = 15pF, T_A = -40°C to +125°C, unless otherwise noted. Typical values are at V_{DDA} - V_{GNDA} = +3.3V, V_{DDB} - V_{GNDB} = +3.3V, V_{GNDA} = V_{GNDB}, T_A = +25°C, unless otherwise noted.) (Note 1)

| PARAMETER | SYMBOL | CONDITIONS | | MIN | TYP | MAX | UNITS |
|---|----------------------------|------------------------------|-------------------------|------|------|------|-------|
| POWER SUPPLY | | | | | | | |
| Operating Supply Voltage | V _{DDA} | Relative to GNDA | | 1.71 | | 5.5 | V |
| | V _{DDB} | Relative to GNDB | | 1.71 | | 5.5 | V |
| Undervoltage Lockout Threshold | V _{UVLO_} | V _{DD_} rising | | 1.45 | 1.58 | 1.71 | V |
| Undervoltage Lockout Threshold Hysteresis | V _{UVLO_} HYST | | | | 50 | | mV |
| Supply Current (MAX14934_) | I _{DDA} | 500kHz square wave | V _{DDA} = 5V | | 1.2 | 1.9 | mA |
| | | | V _{DDA} = 3.3V | | 1.2 | 1.9 | |
| | | | V _{DDA} = 2.5V | | 1.2 | 1.9 | |
| | | | V _{DDA} = 1.8V | | 1.1 | 1.9 | |
| | | 12.5MHz square wave (Note 2) | V _{DDA} = 5V | | 2.1 | 2.7 | |
| | | | V _{DDA} = 3.3V | | 2 | 2.7 | |
| | | | V _{DDA} = 2.5V | | 2 | 2.7 | |
| | | | V _{DDA} = 1.8V | | 2 | 2.6 | |
| | | 50MHz square wave (Note 2) | V _{DDA} = 5V | | 5 | 6.6 | |
| | | | V _{DDA} = 3.3V | | 4.6 | 6.1 | |
| | | | V _{DDA} = 2.5V | | 4.5 | 6.0 | |
| | | | V _{DDA} = 1.8V | | 4.5 | 6.0 | |
| | I _{DDB} | 500kHz square wave | V _{DDB} = 5V | | 8.1 | 11.2 | |
| | | | V _{DDB} = 3.3V | | 7.9 | 11.1 | |
| | | | V _{DDB} = 2.5V | | 7.9 | 11.0 | |
| | | | V _{DDB} = 1.8V | | 7.7 | 10.8 | |
| | | 12.5MHz square wave (Note 2) | V _{DDB} = 5V | | 12.8 | 15.9 | |
| | | | V _{DDB} = 3.3V | | 11.1 | 14.2 | |
| | | | V _{DDB} = 2.5V | | 10.2 | 13.4 | |
| | | | V _{DDB} = 1.8V | | 9.4 | 12.4 | |
| | | 50MHz square wave (Note 2) | V _{DDB} = 5V | | 27.2 | 35.4 | |
| | | | V _{DDB} = 3.3V | | 21.7 | 27.8 | |
| | | | V _{DDB} = 2.5V | | 17.6 | 23.0 | |
| | | | V _{DDB} = 1.8V | | 14.4 | 18.9 | |

DC Electrical Characteristics (continued)

(V_{DDA} - V_{GNDA} = +1.71V to +5.5V, V_{DDB} - V_{GNDB} = +1.71V to +5.5V, C_L = 15pF, T_A = -40°C to +125°C, unless otherwise noted. Typical values are at V_{DDA} - V_{GNDA} = +3.3V, V_{DDB} - V_{GNDB} = +3.3V, V_{GNDA} = V_{GNDB}, T_A = +25°C, unless otherwise noted.) (Note 1)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|----------------------------|------------------|------------------------------|-------------------------|------|------|-------|
| Supply Current (MAX14935_) | I _{DDA} | 500kHz square wave | V _{DDA} = 5V | 3.4 | 5.3 | mA |
| | | | V _{DDA} = 3.3V | 3.3 | 5.3 | |
| | | | V _{DDA} = 2.5V | 3.3 | 5.3 | |
| | | | V _{DDA} = 1.8V | 3.2 | 5.1 | |
| | | 12.5MHz square wave (Note 2) | V _{DDA} = 5V | 5.6 | 7.1 | |
| | | | V _{DDA} = 3.3V | 5 | 6.6 | |
| | | | V _{DDA} = 2.5V | 4.7 | 6.4 | |
| | | | V _{DDA} = 1.8V | 4.5 | 6.1 | |
| | | 50MHz square wave (Note 2) | V _{DDA} = 5V | 12.4 | 16.0 | |
| | | | V _{DDA} = 3.3V | 10.1 | 13.0 | |
| | | | V _{DDA} = 2.5V | 9.1 | 11.6 | |
| | | | V _{DDA} = 1.8V | 8.2 | 10.4 | |
| | I _{DDB} | 500kHz square wave | V _{DDB} = 5V | 6.5 | 9.2 | |
| | | | V _{DDB} = 3.3V | 6.4 | 9.1 | |
| | | | V _{DDB} = 2.5V | 6.3 | 9.1 | |
| | | | V _{DDB} = 1.8V | 6.2 | 8.9 | |
| | | 12.5MHz square wave (Note 2) | V _{DDB} = 5V | 10.3 | 12.8 | |
| | | | V _{DDB} = 3.3V | 8.9 | 11.6 | |
| | | | V _{DDB} = 2.5V | 8.2 | 11.0 | |
| | | | V _{DDB} = 1.8V | 7.6 | 10.3 | |
| | | 50MHz square wave (Note 2) | V _{DDB} = 5V | 22.7 | 29.1 | |
| | | | V _{DDB} = 3.3V | 17.7 | 23.0 | |
| | | | V _{DDB} = 2.5V | 14.7 | 19.4 | |
| | | | V _{DDB} = 1.8V | 11.9 | 15.9 | |

DC Electrical Characteristics (continued)

(V_{DDA} - V_{GNDA} = +1.71V to +5.5V, V_{DDB} - V_{GNDB} = +1.71V to +5.5V, C_L = 15pF, T_A = -40°C to +125°C, unless otherwise noted. Typical values are at V_{DDA} - V_{GNDA} = +3.3V, V_{DDB} - V_{GNDB} = +3.3V, V_{GNDA} = V_{GNDB}, T_A = +25°C, unless otherwise noted.) (Note 1)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|----------------------------|------------------|------------------------------|-------------------------|------|------|-------|
| Supply Current (MAX14936_) | I _{DDA} | 500kHz square wave | V _{DDA} = 5V | 5.2 | 7.2 | mA |
| | | | V _{DDA} = 3.3V | 5.2 | 7.2 | |
| | | | V _{DDA} = 2.5V | 5.2 | 7.2 | |
| | | | V _{DDA} = 1.8V | 5 | 7.0 | |
| | | 12.5MHz square wave (Note 2) | V _{DDA} = 5V | 8.2 | 10.0 | |
| | | | V _{DDA} = 3.3V | 7.2 | 9.1 | |
| | | | V _{DDA} = 2.5V | 6.7 | 8.7 | |
| | | | V _{DDA} = 1.8V | 6.3 | 8.2 | |
| | | 50MHz square wave (Note 2) | V _{DDA} = 5V | 18 | 23.3 | |
| | | | V _{DDA} = 3.3V | 14.2 | 18.4 | |
| | | | V _{DDA} = 2.5V | 12.3 | 16.1 | |
| | | | V _{DDA} = 1.8V | 10.5 | 13.6 | |
| | I _{DDB} | 500kHz square wave | V _{DDB} = 5V | 5.2 | 7.2 | |
| | | | V _{DDB} = 3.3V | 5.2 | 7.2 | |
| | | | V _{DDB} = 2.5V | 5.2 | 7.2 | |
| | | | V _{DDB} = 1.8V | 5 | 7.0 | |
| | | 12.5MHz square wave (Note 2) | V _{DDB} = 5V | 8.2 | 10.0 | |
| | | | V _{DDB} = 3.3V | 7.2 | 9.1 | |
| | | | V _{DDB} = 2.5V | 6.7 | 8.7 | |
| | | | V _{DDB} = 1.8V | 6.3 | 8.2 | |
| | | 50MHz square wave (Note 2) | V _{DDB} = 5V | 18 | 23.3 | |
| | | | V _{DDB} = 3.3V | 14.2 | 18.4 | |
| | | | V _{DDB} = 2.5V | 12.3 | 16.1 | |
| | | | V _{DDB} = 1.8V | 10.5 | 13.6 | |

DC Electrical Characteristics (continued)

($V_{DDA} - V_{GNDA} = +1.71V$ to $+5.5V$, $V_{DDB} - V_{GNDB} = +1.71V$ to $+5.5V$, $C_L = 15pF$, $T_A = -40^{\circ}C$ to $+125^{\circ}C$, unless otherwise noted. Typical values are at $V_{DDA} - V_{GNDA} = +3.3V$, $V_{DDB} - V_{GNDB} = +3.3V$, $V_{GNDA} = V_{GNDB}$, $T_A = +25^{\circ}C$, unless otherwise noted.) (Note 1)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|---------------------------------|-----------|--|---------------------------------|------|-----|---------|
| LOGIC INPUTS AND OUTPUTS | | | | | | |
| Input High Voltage | V_{IH} | ENA, INA_ relative to GNDA | 0.7 x V_{DDA} | | | V |
| | | ENB, INB_ relative to GNDB | 0.7 x V_{DDB} | | | |
| Input Low Voltage | V_{IL} | ENA, INA_ relative to GNDA | $1.71V \leq V_{DDA} \leq 1.89V$ | 0.6 | | V |
| | | | $2.25V \leq V_{DDA} \leq 5.5V$ | 0.8 | | |
| | | ENB, INB_ relative to GNDB | $1.71V \leq V_{DDB} \leq 1.89V$ | 0.6 | | |
| | | | $2.25V \leq V_{DDB} \leq 5.5V$ | 0.8 | | |
| Input Hysteresis | V_{HYS} | $V_{INA_}$ relative to GNDA or $V_{INB_}$ relative to GNDB | MAX1493_A/D | 410 | | mV |
| | | | MAX1493_B/E | 410 | | |
| | | | MAX1493_C/F | 80 | | |
| Input Leakage Current | I_L | $V_{INA_} = 0$ or V_{DDA} , $V_{INB_} = 0$ or V_{DDB} | -1 | | +1 | μA |
| Input Capacitance | C_{IN} | INA_, INB_, $f = 1MHz$ | | 2 | | pF |
| EN_ Pullup Current | I_{PU} | | -4 | -2.3 | -1 | μA |
| Output Voltage High | V_{OH} | $V_{OUTA_}$ relative to GNDA, $I_{OUTA_} = -4mA$ (Note 3) | $V_{DDA} - 0.4$ | | | V |
| | | $V_{OUTB_}$ relative to GNDB, $I_{OUTB_} = -4mA$ (Note 3) | $V_{DDB} - 0.4$ | | | |
| Output Voltage Low | V_{OL} | $V_{OUTA_}$ relative to GNDA, $I_{OUTA_} = 4mA$ (Note 3) | 0.4 | | | V |
| | | $V_{OUTB_}$ relative to GNDB, $I_{OUTB_} = 4mA$ (Note 3) | 0.4 | | | |

Dynamic Electrical Characteristics (MAX1493_A/D)

(V_{DDA} - V_{GNDA} = +1.71V to +5.5V, V_{DDB} - V_{GNDB} = +1.71V to +5.5V, C_L = 15pF, T_A = -40°C to +125°C, unless otherwise noted. Typical values are at V_{DDA} - V_{GNDA} = +3.3V, V_{DDB} - V_{GNDB} = +3.3V, V_{GNDA} = V_{GNDB}, T_A = +25°C, unless otherwise noted.) (Notes 1, 2)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|--|--------------------|---|---|------|------|-------|
| INPUT AND OUTPUT CHANNELS | | | | | | |
| Common-Mode Transient Immunity | CMTI | IN__ = GND_ or VDD_ (Note 4) | | 25 | | kV/μs |
| Maximum Data Rate | DR _{MAX} | | 1 | | | Mbps |
| Minimum Pulse Width | PW _{MIN} | INA_ to OUTB_, INB_ to OUTA_ | | | 1 | μs |
| Glitch Rejection | | INA_ to OUTB_, INB_ to OUTA_ | | 32 | | ns |
| Propagation Delay (Figure 1) | t _{PLH} | INA_ to OUTB_, INB_ to OUTA_, C _L = 15pF | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | 38.2 | 54.1 | ns |
| | | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | 38.7 | 54.6 | |
| | | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | 39.7 | 55.6 | |
| | | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | 42.9 | 58.4 | |
| | t _{PHL} | INA_ to OUTB_, INB_ to OUTA_, C _L = 15pF | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | 38.6 | 55.3 | |
| | | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | 38.9 | 55.6 | |
| | | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | 39.8 | 56.1 | |
| | | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | 42.3 | 60.2 | |
| Pulse-Width Distortion | PWD | t _{PLH} - t _{PHL} | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | 0.4 | 4.5 | ns |
| | | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | 0.2 | 4.3 | |
| | | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | 0.1 | 3.9 | |
| | | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | 0.6 | 4.7 | |
| Propagation Delay Skew Part-to-Part (Same Channel) | t _{SPLH} | | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | | 26.6 | ns |
| | | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | | 26.6 | |
| | | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | | 26.6 | |
| | | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | | 26.9 | |
| | t _{SPHL} | | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | | 27.9 | |
| | | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | | 27.7 | |
| | | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | | 27.6 | |
| | | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | | 29.7 | |
| Propagation Delay Skew Channel-to-Channel (Same Direction) | t _{SCSLH} | | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | | 6.7 | ns |
| | | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | | 6.7 | |
| | | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | | 6.7 | |
| | | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | | 6.7 | |
| | t _{SCSHL} | | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | | 6.7 | |
| | | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | | 6.7 | |
| | | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | | 6.7 | |
| | | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | | 6.7 | |

Dynamic Electrical Characteristics (MAX1493_A/D) (Continued)

(V_{DDA} - V_{GNDA} = +1.71V to +5.5V, V_{DDB} - V_{GNDB} = +1.71V to +5.5V, C_L = 15pF, T_A = -40°C to +125°C, unless otherwise noted. Typical values are at V_{DDA} - V_{GNDA} = +3.3V, V_{DDB} - V_{GNDB} = +3.3V, V_{GNDA} = V_{GNDB}, T_A = +25°C, unless otherwise noted.) (Notes 1, 2)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|--|--------------------|---|-----|-----|------|-------|
| Propagation Delay Skew Channel-to-Channel (Opposing Direction) | t _{SCOLH} | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | | | 26.6 | ns |
| | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | | | 26.6 | |
| | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | | | 26.6 | |
| | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | | | 26.9 | |
| | t _{SCOHL} | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | | | 27.9 | |
| | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | | | 27.7 | |
| | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | | | 27.6 | |
| | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | | | 29.7 | |
| Rise Time (Figure 1) | t _R | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | | 2 | ns | |
| | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | | 2 | | |
| | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | | 2 | | |
| | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | | 2 | | |
| Fall Time (Figure 1) | t _F | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | | 2 | ns | |
| | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | | 2 | | |
| | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | | 2 | | |
| | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | | 2 | | |
| Enable to Data Valid | t _{EN} | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | | | 5.1 | ns |
| | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | | | 5.5 | |
| | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | | | 6.7 | |
| | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | | | 16.3 | |
| Enable to Three-State | t _{TRI} | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | | | 2.7 | ns |
| | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | | | 4.4 | |
| | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | | | 7.0 | |
| | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | | | 11.7 | |

Dynamic Electrical Characteristics (MAX1493_B/E)

(V_{DDA} - V_{GNDA} = +1.71V to +5.5V, V_{DDB} - V_{GNDB} = +1.71V to +5.5V, C_L = 15pF, T_A = -40°C to +125°C, unless otherwise noted. Typical values are at V_{DDA} - V_{GNDA} = +3.3V, V_{DDB} - V_{GNDB} = +3.3V, V_{GNDA} = V_{GNDB}, T_A = +25°C, unless otherwise noted.) (Notes 1, 2)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|--|--------------------|---|---|------|------|-------|
| INPUT AND OUTPUT CHANNELS | | | | | | |
| Common-Mode Transient Immunity | CMTI | IN__ = GND_ or VDD_ (Note 4) | | 25 | | kV/μs |
| Maximum Data Rate | DR _{MAX} | | 25 | | | Mbps |
| Minimum Pulse Width | PW _{MIN} | INA_ to OUTB_, INB_ to OUTA_ | | | 40 | ns |
| Glitch Rejection | | INA_ to OUTB_, INB_ to OUTA_ | | 15 | | ns |
| Propagation Delay (Figure 1) | t _{PLH} | INA_ to OUTB_, INB_ to OUTA_, C _L = 15pF | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | 20.9 | 27.5 | ns |
| | | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | 21.4 | 28.7 | |
| | | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | 22.4 | 31.2 | |
| | | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | 25.7 | 36.9 | |
| | t _{PHL} | INA_ to OUTB_, INB_ to OUTA_, C _L = 15pF | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | 21.1 | 28.8 | |
| | | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | 21.5 | 29.8 | |
| | | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | 22.3 | 31.9 | |
| | | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | 24.9 | 37.4 | |
| Pulse-Width Distortion | PWD | t _{PLH} - t _{PHL} | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | 0.2 | 2.6 | ns |
| | | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | 0.1 | 2.6 | |
| | | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | 0.1 | 2.4 | |
| | | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | 0.7 | 3.2 | |
| Propagation Delay Skew Part-to-Part (Same Channel) | t _{SPLH} | | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | | 11.7 | ns |
| | | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | | 11.5 | |
| | | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | | 11.3 | |
| | | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | | 13.6 | |
| | t _{SPHL} | | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | | 9.8 | |
| | | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | | 9.8 | |
| | | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | | 11.1 | |
| | | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | | 14.4 | |
| Propagation Delay Skew Channel-to-Channel (Same Direction) | t _{SCSLH} | | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | | 3 | ns |
| | | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | | 3 | |
| | | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | | 3 | |
| | | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | | 3 | |
| | t _{SCSHL} | | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | | 3 | |
| | | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | | 3 | |
| | | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | | 3 | |
| | | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | | 3 | |

Dynamic Electrical Characteristics (MAX1493_B/E) (Continued)

(V_{DDA} - V_{GNDA} = +1.71V to +5.5V, V_{DDB} - V_{GNDB} = +1.71V to +5.5V, C_L = 15pF, T_A = -40°C to +125°C, unless otherwise noted. Typical values are at V_{DDA} - V_{GNDA} = +3.3V, V_{DDB} - V_{GNDB} = +3.3V, V_{GNDA} = V_{GNDB}, T_A = +25°C, unless otherwise noted.) (Notes 1, 2)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|--|--------------------|--|---|------|------|-------|
| Propagation Delay Skew Channel to Channel (Opposing Direction) | t _{SCOLH} | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | | | 11.7 | ns |
| | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | | | 11.5 | |
| | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | | | 11.3 | |
| | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | | | 13.6 | |
| | t _{SCOHL} | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | | | 9.8 | |
| | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | | | 9.8 | |
| | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | | | 11.1 | |
| | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | | | 14.4 | |
| Rise Time (Figure 1) | t _R | OUTA ₋ / OUTB ₋ , 10% to 90%, C _L = 15pF | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | 2 | | ns |
| | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | 2 | | | |
| | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | 2 | | | |
| | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | 2 | | | |
| Fall Time (Figure 1) | t _F | OUTA ₋ / OUTB ₋ , 90% to 10%, C _L = 15pF | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | 2 | | ns |
| | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | 2 | | | |
| | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | 2 | | | |
| | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | 2 | | | |
| Enable to Data Valid | t _{EN} | ENA to OUTA ₋ , ENB to OUTB ₋ , C _L = 15pF | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | | 5.1 | ns |
| | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | | 5.5 | | |
| | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | | 6.7 | | |
| | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | | 16.3 | | |
| Enable to Three-State | t _{TRI} | ENA to OUTA ₋ , ENB to OUTB ₋ , C _L = 15pF | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | | 2.7 | ns |
| | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | | 4.4 | | |
| | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | | 7.0 | | |
| | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | | 11.7 | | |

Dynamic Electrical Characteristics (MAX1493_C/F)

(V_{DDA} - V_{GND A} = +1.71V to +5.5V, V_{DDB} - V_{GND B} = +1.71V to +5.5V, C_L = 15pF, T_A = -40°C to +125°C, unless otherwise noted. Typical values are at V_{DDA} - V_{GND A} = +3.3V, V_{DDB} - V_{GND B} = +3.3V, V_{GND A} = V_{GND B}, T_A = +25°C, unless otherwise noted.) (Notes 1, 2)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|--|--------------------|---|---|-----|------|-------|
| INPUT AND OUTPUT CHANNELS | | | | | | |
| Common-Mode Transient Immunity | CMTI | IN _{__} = GND _{__} or V _{DD} _{__} (Note 4) | | 25 | | kV/μs |
| Maximum Data Rate | DR _{MAX} | | 150 | | | Mbps |
| Minimum Pulse Width | PW _{MIN} | INA _{__} to OUTB _{__} , INB _{__} to OUTB _{__} | | | 6.67 | ns |
| Propagation Delay (Figure 1) | t _{PLH} | INA _{__} to OUTB _{__} , INB _{__} to OUTA _{__} , C _L = 15pF | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | 5.1 | 7.5 | ns |
| | | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | 5.2 | 8.1 | |
| | | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | 5.8 | 9.7 | |
| | | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | 8.1 | 14 | |
| | t _{PHL} | INA _{__} to OUTB _{__} , INB _{__} to OUTA _{__} , C _L = 15pF | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | 4.9 | 7.4 | |
| | | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | 5.3 | 8.3 | |
| | | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | 5.9 | 10.2 | |
| | | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | 8.2 | 14.9 | |
| Pulse-Width Distortion | PWD | t _{PLH} - t _{PHL} | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | 0.2 | 1 | ns |
| | | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | 0.1 | 1 | |
| | | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | 0.1 | 1 | |
| | | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | 0.1 | 1 | |
| Propagation Delay Skew Part-to-Part (Same Channel) | t _{SPLH} | | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | | 3.0 | ns |
| | | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | | 3.3 | |
| | | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | | 4.3 | |
| | | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | | 7.1 | |
| | t _{SPHL} | | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | | 2.8 | |
| | | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | | 3.4 | |
| | | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | | 4.6 | |
| | | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | | 7.9 | |
| Propagation Delay Skew Channel-to-Channel (Same Direction) | t _{SCSLH} | | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | | 0.9 | ns |
| | | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | | 1.2 | |
| | | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | | 1.4 | |
| | | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | | 1.6 | |
| | t _{SCSHL} | | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | | 0.9 | |
| | | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | | 1.2 | |
| | | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | | 1.4 | |
| | | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | | 1.6 | |

Dynamic Electrical Characteristics (MAX1493_C/F) (continued)

(V_{DDA} - V_{GNDA} = +1.71V to +5.5V, V_{DDB} - V_{GNDB} = +1.71V to +5.5V, C_L = 15pF, T_A = -40°C to +125°C, unless otherwise noted. Typical values are at V_{DDA} - V_{GNDA} = +3.3V, V_{DDB} - V_{GNDB} = +3.3V, V_{GNDA} = V_{GNDB}, T_A = +25°C, unless otherwise noted.) (Notes 1, 2)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|--|----------------------|---|-----|-----|------|-------|
| Propagation Delay Skew Channel-to-Channel (Opposing Direction) | t _{SCOLH} | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | | | 3 | ns |
| | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | | | 3.3 | |
| | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | | | 4.3 | |
| | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | | | 7.1 | |
| | t _{SCOHL} | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | | | 2.8 | |
| | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | | | 3.4 | |
| | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | | | 4.6 | |
| | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | | | 7.9 | |
| Rise Time (Figure 1) | t _R | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | | 2 | ns | |
| | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | | 2 | | |
| | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | | 2 | | |
| | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | | 2 | | |
| Fall Time (Figure 1) | t _F | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | | 2 | ns | |
| | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | | 2 | | |
| | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | | 2 | | |
| | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | | 2 | | |
| Enable to Data Valid | t _{EN} | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | | | 5.1 | ns |
| | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | | | 5.5 | |
| | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | | | 6.7 | |
| | | 1.71V ≤ V _{DDA} , V _{DDB} ≤ 1.89V | | | 16.3 | |
| Enable to Three-State | t _{TRI} | 4.5V ≤ V _{DDA} , V _{DDB} ≤ 5.5V | | | 2.7 | ns |
| | | 3.0V ≤ V _{DDA} , V _{DDB} ≤ 3.6V | | | 4.4 | |
| | | 2.25V ≤ V _{DDA} , V _{DDB} ≤ 2.75V | | | 7.0 | |
| | | V _{DDA} , V _{DDB} ≤ 1.89V | | | 11.7 | |
| Peak Eye Diagram Jitter | T _{JIT(PK)} | V _{DDA} , V _{DDB} = 5.0V | | | 140 | ps |
| | | V _{DDA} , V _{DDB} = 3.3V | | | 130 | |
| | | V _{DDA} , V _{DDB} = 2.5V | | | 140 | |
| | | V _{DDA} , V _{DDB} = 1.8V | | | 160 | |

ESD Protection

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|-----------|--------|----------------------------|-----|-----|-----|-------|
| ESD | | Human Body Model, All Pins | | ±4 | | kV |

- Note 1:** All devices are 100% production tested at T_A = +125°C. Specifications over temperature are guaranteed by design.
- Note 2:** Not production tested. Guaranteed by design.
- Note 3:** All currents into the device are positive. All currents out of the device are negative.
- Note 4:** CMTI is the maximum sustainable common-mode voltage slew rate while maintaining the correct output. CMTI applies to both rising and falling common-mode voltage edges. Tested with the transient generator connected between GNDA and GNDB (V_{CM} = 1000V).

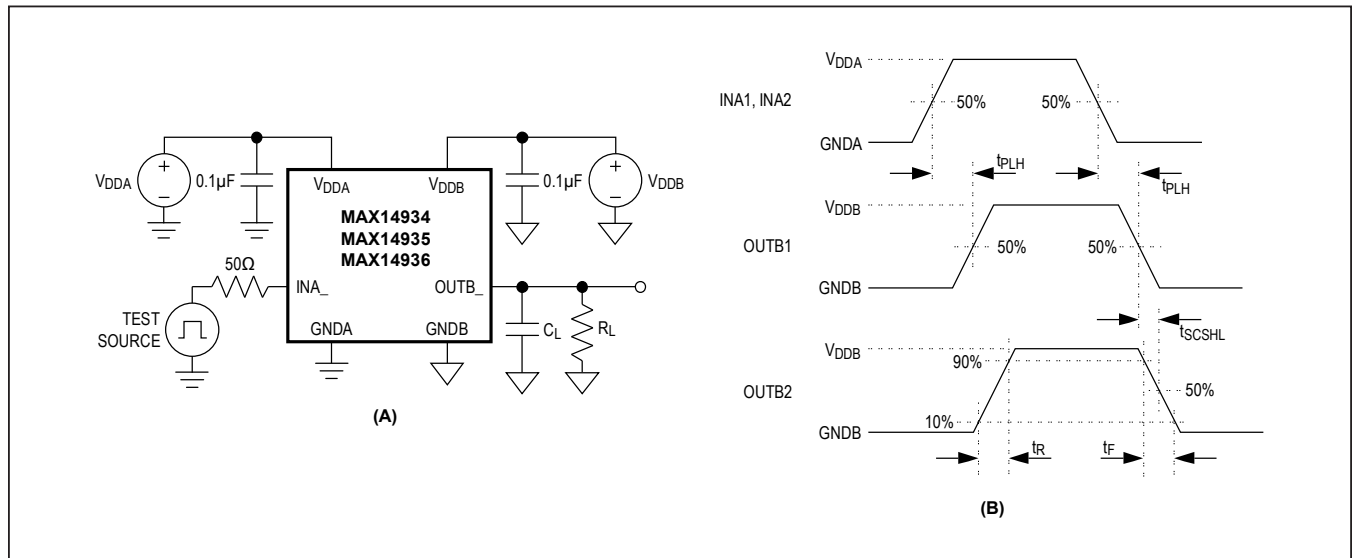


Figure 1. Test Circuit (A) and Timing Diagram (B)

Safety Regulatory Approvals

| |
|--|
| UL |
| The MAX14934–MAX14936 are certified under UL1577. For more details, refer to File E351759. |
| Rated up to 5000V _{RMS} isolation voltage for single protection. |
| cUL (Equivalent to CSA notice 5A) |
| The MAX14934-MAX14936 are certified up to 5000V _{RMS} for single protection. For more details, refer to File E351759. |
| VDE |
| The MAX14934-MAX14936 are certified to DIN VDE V 0884-11: 2017-01. For details, see file ref. 5015017-4880-0001/272147/TL7/ SCT. Basic Insulation, Maximum Transient Isolation Voltage 8400V _{PK} , Maximum Repetitive Peak Isolation Voltage 1200V _{PK} |

This coupler is suitable for “safe electrical insulation” only within the safety ratings. Compliance with the safety ratings shall be ensured by means of suitable protective circuits.

IEC Insulation Testing

| TUV |
|---|
| The MAX14934-MAX14936 are tested under TUV. |
| IEC 60950-1: Up to 1200V _{PK} (848V _{RMS}) working voltage for basic insulation. |
| IEC 61010-1 (ed. 3): Up to 848V _{RMS} working voltage for basic insulation. For details, see Technical Report number 095-72100581-100. |
| IEC 60601-1 (ed. 3): For details see Technical Report number 095-72100581-200. |
| Basic insulation 1 MOOP, 1200V _{PK} (848V _{RMS}) |
| Withstand isolation voltage (V _{ISO}) for 60s, 5000V _{RMS} |

MAX14934–MAX14936 Insulation Characteristics

| PARAMETER | SYMBOL | CONDITIONS | VALUE | UNITS |
|---|-------------------|--|--------------------|------------------|
| Partial Discharge Test Voltage | V _{PR} | Method B1 = V _{IORM} × 1.875 (t = 1s, partial discharge < 5pC) | 2250 | V _P |
| Maximum Repetitive Peak Isolation Voltage | V _{IORM} | (Note 5) | 1200 | V _P |
| Maximum Working Isolation Voltage | V _{IOWM} | Continuous RMS voltage (Note 5) | 848 | V _{RMS} |
| Maximum Transient Isolation Voltage | V _{IOTM} | t = 1s (Note 5) | 8400 | V _P |
| Maximum Withstand Isolation Voltage | V _{ISO} | f _{SW} = 60Hz, duration = 60s (Note 5, 6) | 5000 | V _{RMS} |
| Maximum Surge Isolation Voltage | V _{IOSM} | Basic insulation, 1.2/50μs pulse per IEC 61000-4-5 (Note 5, 7) | 10 | kV |
| Insulation Resistance | R _{IO} | V _{IO} = 500V, T _A = 25°C | > 10 ¹² | Ω |
| | | V _{IO} = 500V, 100°C ≤ T _A ≤ 125°C | > 10 ¹¹ | |
| | | V _{IO} = 500V at T _S = 150°C | > 10 ⁹ | |
| Barrier Capacitance Side A to Side B | C _{IO} | f _{SW} = 1MHz (Note 8) | 2 | pF |
| Minimum Creepage Distance | CPG | Wide SOIC | 8 | mm |
| Minimum Clearance Distance | CLR | Wide SOIC | 8 | mm |
| Internal Clearance | | Distance through insulation | 0.015 | mm |
| Comparative Tracking Index | CTI | Material Group II (IEC 60112) | 575 | |
| Climatic Category | | | 40/125/21 | |
| Pollution Degree (DIN VDE 0110, Table 1) | | | 2 | |

Note 5: V_{ISO}, V_{IOTM}, V_{IOSM}, V_{IOWM}, and V_{IORM} are defined by the IEC 60747-5-5 standard.

Note 6: Products are qualified at V_{ISO} for 60s and 100% production tested at 120% of V_{ISO} for 1s.

Note 7: Devices are immersed in oil during surge characterization.

Note 8: Capacitance is measured with all pins on field-side and logic-side tied together.

Safety Limits

Damage to the IC can result in a low-resistance path to ground or to the supply and, without current limiting, the MAX14934–MAX14936 could dissipate excessive amounts of power. Excessive power dissipation can damage the die and result in damage to the isolation barrier, potentially causing downstream issues. [Table 1](#) shows the safety limits for the MAX14934–MAX14936.

The maximum safety temperature (T_S) for the device is the 150°C maximum junction temperature specified in the [Absolute Maximum Ratings](#). The power dissipation (P_D) and junction-to-ambient thermal impedance (θ_{JA})

determine the junction temperature. Thermal impedance values (θ_{JA} and θ_{JC}) are available in the [Package Information](#) section of the datasheet. Calculate the junction temperature (T_J) as:

$$T_J = T_A + (P_D \times \theta_{JA})$$

[Figure 2](#) to [Figure 3](#) show the thermal derating curves for the safety power limiting and safety current limiting of the devices. Ensure that the junction temperature does not exceed 150°C.

Table 1. Safety Limiting Values for the MAX14934–MAX14936

| PARAMETER | SYMBOL | TEST CONDITIONS | MAX | UNITS |
|---|----------------|---|------|-------|
| Safety Current on Any Pin (No Damage to Isolation Barrier) | I _S | T _J = 150°C, T _A = 25°C | 300 | mA |
| Total Safety Power Dissipation | P _S | T _J = 150°C, T _A = 25°C | 1760 | mW |
| Maximum Safety Temperature | T _S | | 150 | °C |

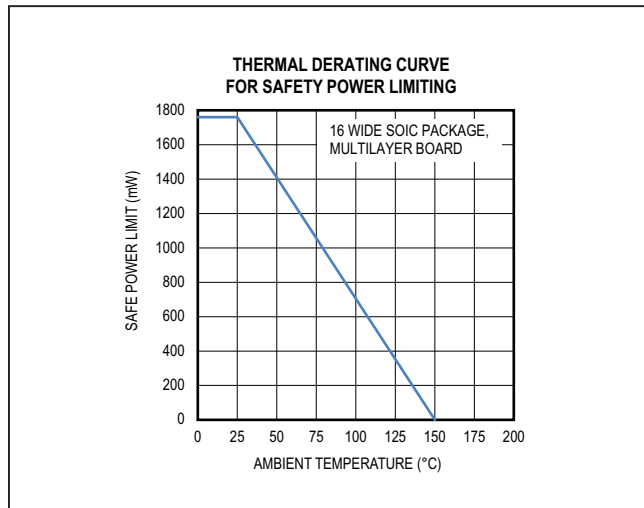


Figure 2. Thermal Derating Curve for Safety Power Limiting

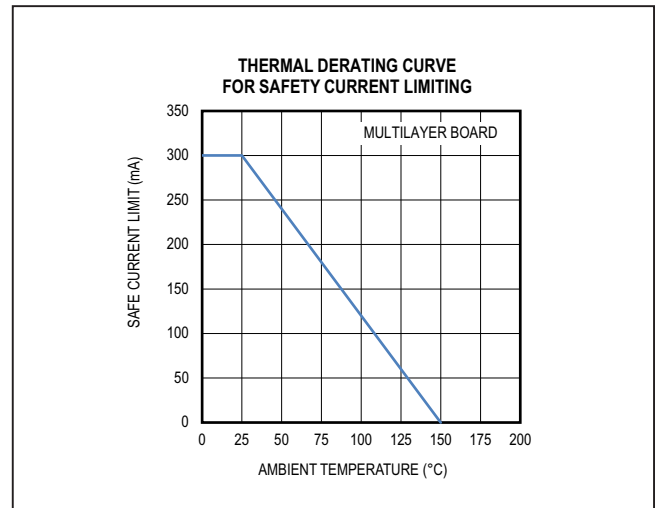
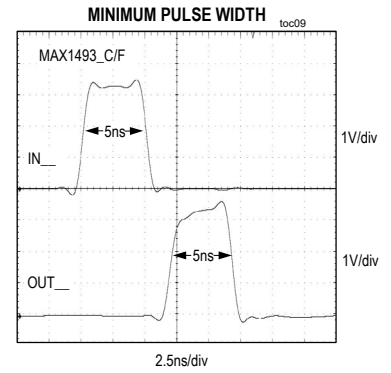
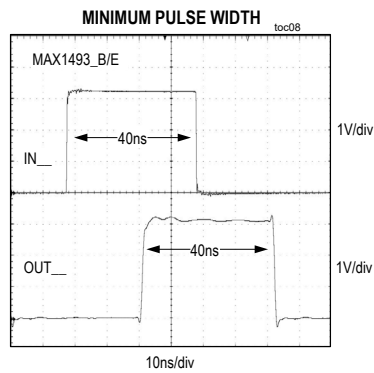
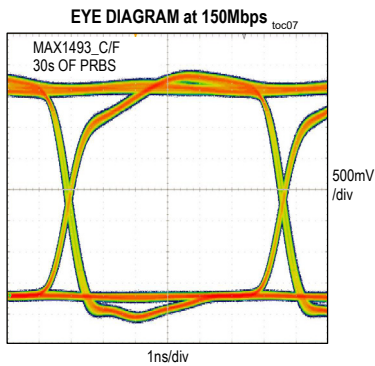
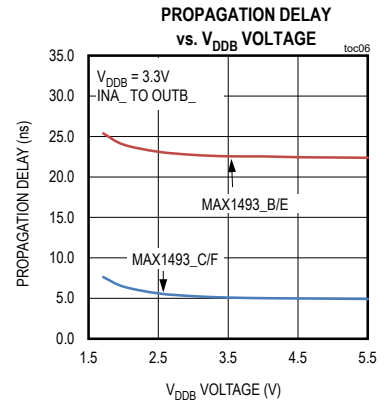
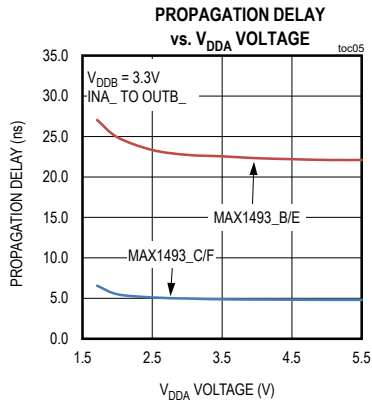
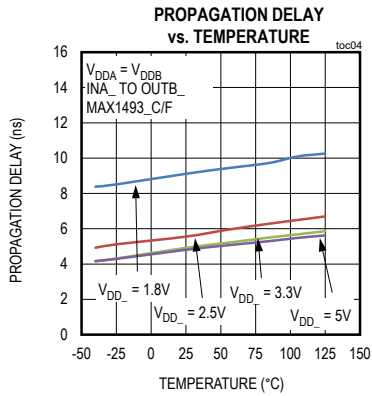
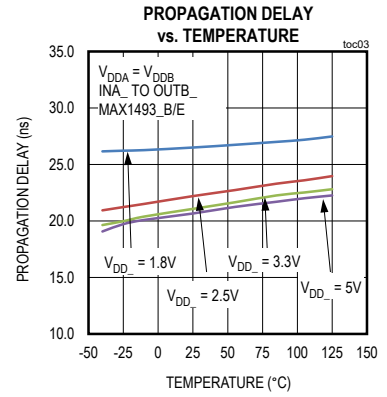
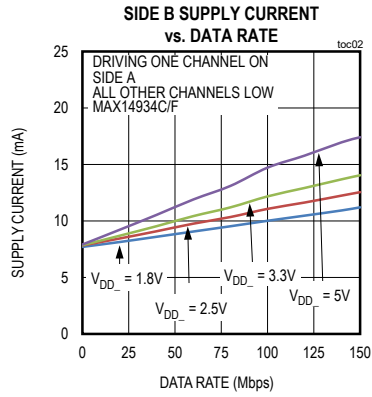
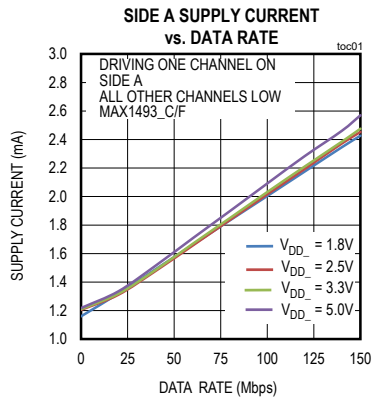


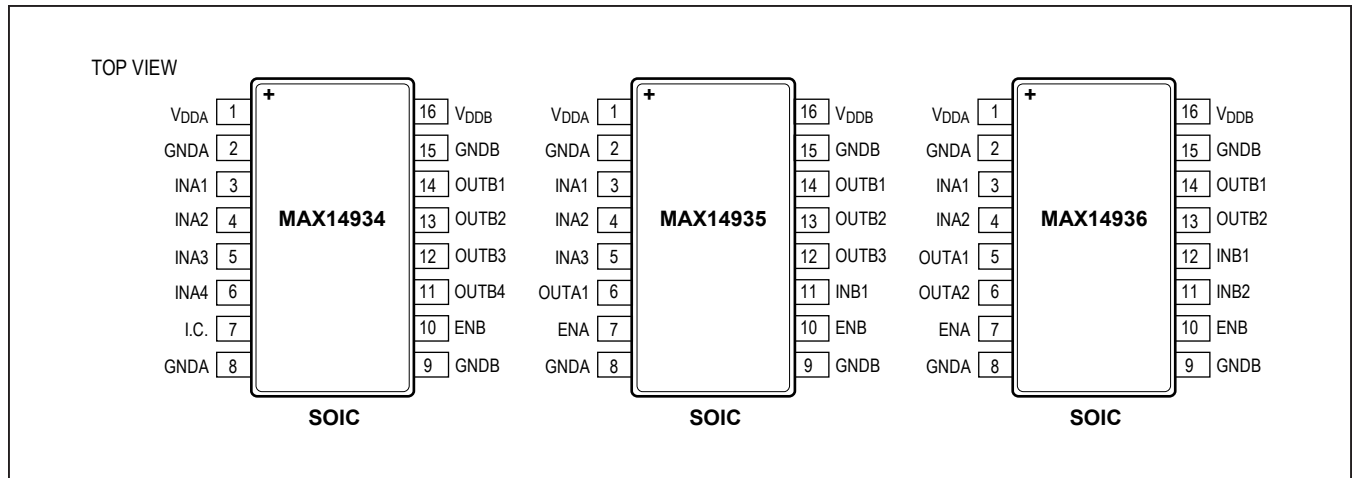
Figure 3. Thermal Derating Curve for Safety Current Limiting

Typical Operating Characteristics

($V_{DDA} - V_{GNDA} = +3.3V$, $V_{DDB} - V_{GNDB} = +3.3V$, $V_{GNDA} = V_{GNDB}$, $T_A = +25^\circ C$, unless otherwise noted.)



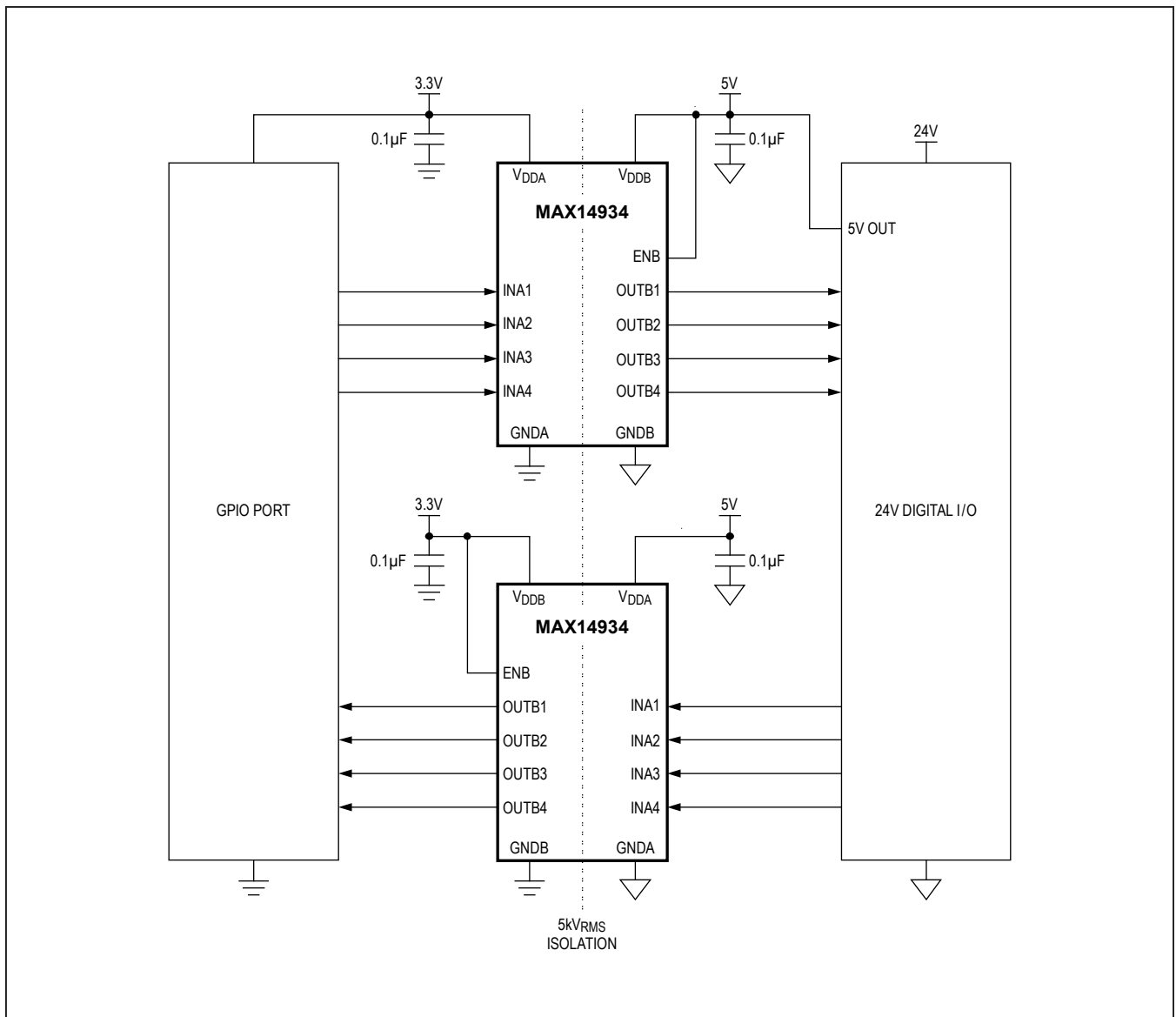
Pin Configurations



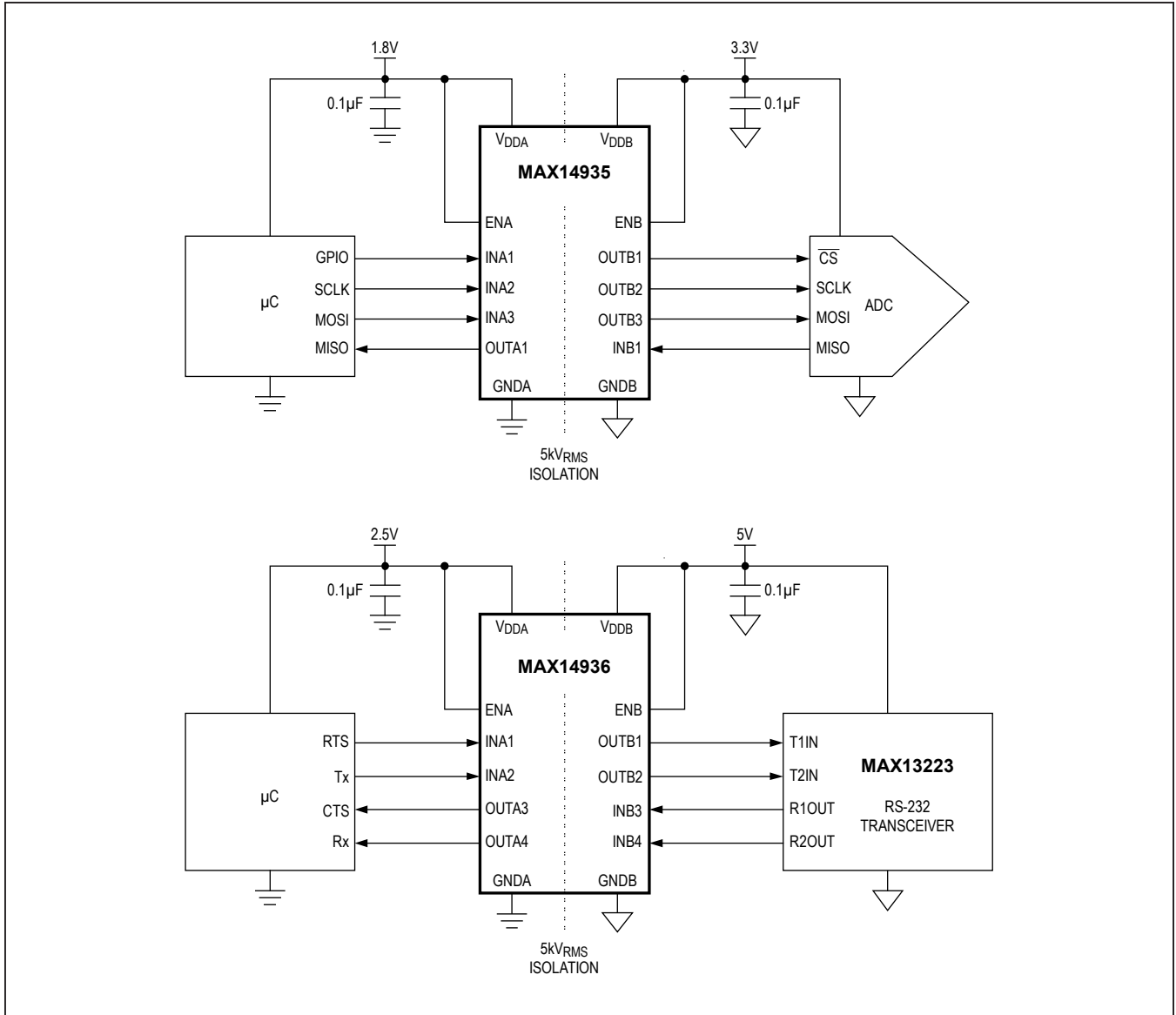
Pin Description

| PIN | | | NAME | FUNCTION | VOLTAGE RELATIVE TO |
|----------|----------|----------|------------------|---|---------------------|
| MAX14934 | MAX14935 | MAX14936 | | | |
| 1 | 1 | 1 | V _{DDA} | Power Supply. Bypass V _{DDA} with a 0.1µF ceramic capacitor as close as possible to the pin. | GNDA |
| 2, 8 | 2, 8 | 2, 8 | GNDA | Ground Reference for Side A | — |
| 3 | 3 | 3 | INA1 | Logic Input 1 on Side A. INA1 corresponds to OUTB1. | GNDA |
| 4 | 4 | 4 | INA2 | Logic Input 2 on Side A. INA2 corresponds to OUTB2. | GNDA |
| 5 | 5 | — | INA3 | Logic Input 3 on Side A. INA3 corresponds to OUTB3. | GNDA |
| 6 | — | — | INA4 | Logic Input 4 on Side A. INA4 corresponds to OUTB4. | GNDA |
| 7 | — | — | I.C. | Internally Connected. Leave unconnected or connect to GNDA or V _{DDA} . | — |
| — | 6 | 5 | OUTA1 | Logic Output 1 on Side A | GNDA |
| — | — | 6 | OUTA2 | Logic Output 2 on Side A | GNDA |
| — | 7 | 7 | ENA | Active-High Enable for Side A. ENA has an internal 2µA pullup to V _{DDA} . | GNDA |
| 9, 15 | 9, 15 | 9, 15 | GNDB | Ground Reference for Side B | — |
| 10 | 10 | 10 | ENB | Active-High Enable for Side B. ENB has an internal 2µA pullup to V _{DDB} . | GNDB |
| 11 | — | — | OUTB4 | Logic Output 4 on Side B | GNDB |
| — | 11 | 12 | INB1 | Logic Input 1 on Side B. INB1 corresponds to OUTA1. | GNDB |
| — | — | 11 | INB2 | Logic Input 2 on Side B. INB2 corresponds to OUTA2. | GNDB |
| 12 | 12 | — | OUTB3 | Logic Output 3 on Side B | GNDB |
| 13 | 13 | 13 | OUTB2 | Logic Output 2 on Side B | GNDB |
| 14 | 14 | 14 | OUTB1 | Logic Output 1 on Side B | GNDB |
| 16 | 16 | 16 | V _{DDB} | Power Supply. Bypass V _{DDB} with a 0.1µF ceramic capacitor as close as possible to the pin. | GNDB |

Typical Application Circuits



Typical Application Circuits (continued)



Detailed Description

The MAX14934–MAX14936 are a family of four-channel digital isolators. The MAX14934–MAX14936 family transfers digital signals between circuits with different power domains. The devices are rated for 5kV_{RMS} isolation voltage for 60 seconds. This family of digital isolators offers low-power operation, high electromagnetic interference (EMI) immunity, and stable temperature performance through Maxim's proprietary process technology. The devices isolate different ground domains and block high-voltage/high-current transients from sensitive or human interface circuitry.

The MAX14934–MAX14936 family offers three unidirectional channel configurations for design convenience. The MAX14934 features four channels transferring digital signals in one direction for applications such as isolated digital I/O. The MAX14935 has three channels transmitting data in one direction and one channel transmitting in the opposite direction, making it ideal for applications such as isolated SPI and RS-485 communication. The MAX14936 provides further design flexibility with two channels in each direction for isolated RS-232 or other applications.

Devices are available with data rates from DC up to 1Mbps (A/D versions), 25Mbps (B/E versions), or 150Mbps (C/F versions). Each device can also be ordered with default-high or default-low outputs. This is the state an output will go to when the input side of the device is unpowered.

The devices have two supply inputs, V_{DDA} and V_{DDB}, that independently set the logic levels on either side of the device. V_{DDA} and V_{DDB} are referenced to GNDA and GNDB, respectively. The MAX14934–MAX14936 family also features a refresh circuit to ensure output accuracy when an input remains in the same state indefinitely.

Digital Isolation

The MAX14934–MAX14936 family provides galvanic isolation for digital signals that are transmitted between two ground domains. Up to 1200V_{PEAK} of continuous isolation is supported, as well as transient differences of up to 5kV_{RMS} for up to 60 seconds.

Level Shifting

The wide supply voltage range of both V_{DDA} and V_{DDB} allows the MAX14934–MAX14936 family to be used for level translation in addition to isolation. V_{DDA} and V_{DDB} can be independently set to any voltage from 1.71V to 5.5V. The supply voltage sets the logic level on the corresponding side of the isolator.

Unidirectional Channels

Each channel of the MAX14934–MAX14936 is unidirectional; it only passes data in one direction, as indicated in the functional diagram. Each device features four unidirectional channels that operate independently with guaranteed data rates from DC up to 1Mbps (A/D versions), 25Mbps (B/E versions), or 150Mbps (C/F versions). The output driver of each channel is push-pull, eliminating the need for pullup resistors. The outputs are able to drive both TTL and CMOS logic inputs.

Startup and Undervoltage Lockout

The V_{DDA} and V_{DDB} supplies are both internally monitored for undervoltage conditions. Undervoltage events can occur during power-up, power-down, or during normal operation due to a sagging supply voltage. When an undervoltage condition is detected on either supply, all outputs go to their default states regardless of the status of the inputs (Table 2). Figure 4 through Figure 7 show the behavior of the outputs during power-up and power-down.

Applications Information

Power-Supply Sequencing

The MAX14934–MAX14936 do not require special power-supply sequencing. The logic levels are set independently on either side by V_{DDA} and V_{DDB}. Each supply can be present over the entire specified range regardless of the level or presence of the other supply.

Power-Supply Decoupling

To reduce ripple and the chance of introducing data errors, bypass V_{DDA} and V_{DDB} with 0.1μF ceramic capacitors to GNDA and GNDB, respectively. Place the bypass capacitors as close to the power-supply input pins as possible.

Layout Considerations

The PCB designer should follow some critical recommendations in order to get the best performance from the design.

- Keep the input/output traces as short as possible. To keep signal paths low-inductance, avoid using vias.
- Have a solid ground plane underneath the high-speed signal layer.
- Keep the area underneath the MAX14934–MAX14936 free from ground and signal planes. Any galvanic or metallic connection between the Side A and Side B defeats the isolation.

Table 2. Output Behavior During Undervoltage Conditions

| V _{IN} | V _{DDA} | V _{DDB} | ENA | ENB | V _{OUTA} | V _{OUTB} |
|-----------------|------------------|------------------|-----|-----|-------------------|-------------------|
| 1 | Powered | Powered | 1 | 1 | 1 | 1 |
| | | | 0 | 0 | Hi-Z | Hi-Z |
| 0 | Powered | Powered | 1 | 1 | 0 | 0 |
| | | | 0 | 0 | Hi-Z | Hi-Z |
| X | Undervoltage | Powered | 1 | 1 | Default | Default |
| | | | 0 | 0 | Hi-Z | Hi-Z |
| X | Powered | Undervoltage | 1 | 1 | Default | Default |
| | | | 0 | 0 | Hi-Z | Hi-Z |

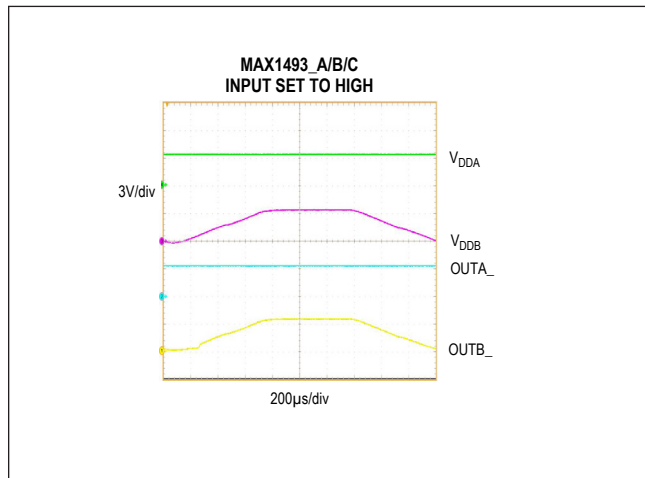


Figure 4. Undervoltage Lockout Behavior (MAX1493_A/B/C High)

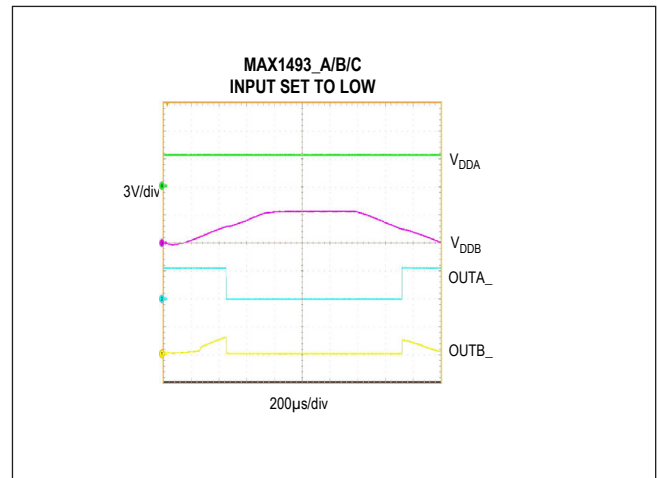


Figure 5. Undervoltage Lockout Behavior (MAX1493_A/B/C Low)

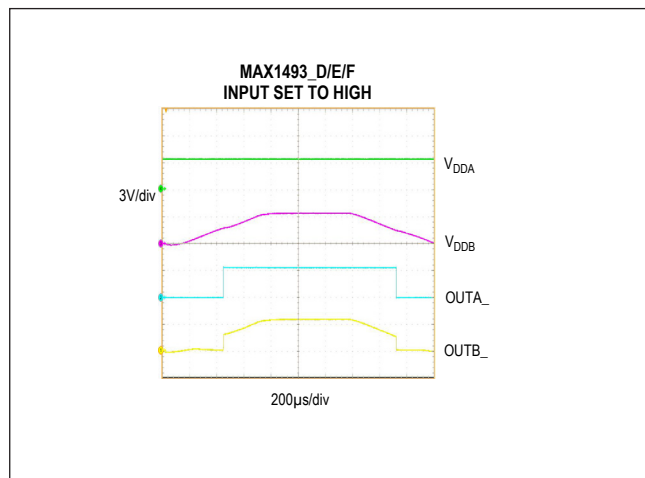


Figure 6. Undervoltage Lockout Behavior (MAX1493_D/E/F High)

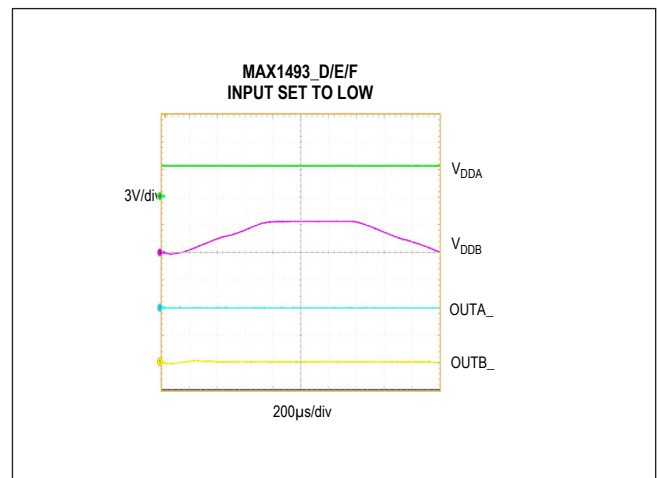


Figure 7. Undervoltage Lockout Behavior (MAX1493_D/E/F Low)

Product Selector Guide

MAX14934 F A W E +

CHANNEL CONFIGURATION
4: 4/0
5: 3/1
6: 2/2

MAXIMUM DATA RATE
DEFAULT OUTPUT (SEE TABLE)

TEMP RANGE: -40°C TO +125°C

PACKAGE: W SOIC

PINS: 16

LEAD-FREE/ROHS COMPLIANT

| DEVICE CONFIGURATION | MAX DATA RATE | | |
|----------------------|---------------|--------|---------|
| | 1Mbps | 25Mbps | 150Mbps |
| DEFAULT-HIGH OUTPUT | A | B | C |
| DEFAULT-LOW OUTPUT | D | E | F |

Ordering Information

| PART | CHANNEL CONFIGURATION | DATA RATE (Mbps) | OUTPUT | TEMP RANGE (°C) | PIN-PACKAGE |
|---------------|-----------------------|------------------|--------------|-----------------|--------------|
| MAX14934AAWE+ | 4/0 | 1 | Default high | -40 to +125 | 16 wide SOIC |
| MAX14934BAWE+ | 4/0 | 25 | Default high | -40 to +125 | 16 wide SOIC |
| MAX14934CAWE+ | 4/0 | 150 | Default high | -40 to +125 | 16 wide SOIC |
| MAX14934DAWE+ | 4/0 | 1 | Default low | -40 to +125 | 16 wide SOIC |
| MAX14934EAW+ | 4/0 | 25 | Default low | -40 to +125 | 16 wide SOIC |
| MAX14934FAWE+ | 4/0 | 150 | Default low | -40 to +125 | 16 wide SOIC |
| MAX14935AAWE+ | 3/1 | 1 | Default high | -40 to +125 | 16 wide SOIC |
| MAX14935BAWE+ | 3/1 | 25 | Default high | -40 to +125 | 16 wide SOIC |
| MAX14935CAWE+ | 3/1 | 150 | Default high | -40 to +125 | 16 wide SOIC |
| MAX14935DAWE+ | 3/1 | 1 | Default low | -40 to +125 | 16 wide SOIC |
| MAX14935EAW+ | 3/1 | 25 | Default low | -40 to +125 | 16 wide SOIC |
| MAX14935FAWE+ | 3/1 | 150 | Default low | -40 to +125 | 16 wide SOIC |
| MAX14936AAWE+ | 2/2 | 1 | Default high | -40 to +125 | 16 wide SOIC |
| MAX14936BAWE+ | 2/2 | 25 | Default high | -40 to +125 | 16 wide SOIC |
| MAX14936CAWE+ | 2/2 | 150 | Default high | -40 to +125 | 16 wide SOIC |
| MAX14936DAWE+ | 2/2 | 1 | Default low | -40 to +125 | 16 wide SOIC |
| MAX14936EAW+ | 2/2 | 25 | Default low | -40 to +125 | 16 wide SOIC |
| MAX14936FAWE+ | 2/2 | 150 | Default low | -40 to +125 | 16 wide SOIC |

+Denotes a lead(Pb)-free/RoHS-compliant package.

Chip Information

PROCESS: BiCMOS