

**SCOPE: Slew-Rate Limited, Low-Power RS-485 Tranceivers**

| <u>Device Type</u> | <u>Generic Number</u> | <u>Device Type</u> | <u>Generic Number</u> |
|--------------------|-----------------------|--------------------|-----------------------|
| 01                 | MAX481M(x)/883B       | 05                 | MAX488M(x)/883B       |
| 02                 | MAX483M(x)/883B       | 06                 | MAX489M(x)/883B       |
| 03                 | MAX485M(x)/883B       | 07                 | MAX490M(x)/883B       |
| 04                 | MAX487M(x)/883B       | 08                 | MAX491M(x)/883B       |

**Case Outline(s).** The case outlines shall be designated in Mil-Std-1835 and as follows:

| <u>Outline Letter</u> | <u>Mil-Std-1835</u>    | <u>Case Outline</u> | <u>Package Code</u> |
|-----------------------|------------------------|---------------------|---------------------|
| MAXIM SMD             |                        |                     |                     |
| JA P                  | GDIP1-T8 or CDIP2-T8   | 8 LEAD Cerdip       | J8                  |
| JD C                  | GDIP1-T14 or CDIP2-T14 | 14 LEAD Cerdip      | J14                 |

**Absolute Maximum Ratings**

|                                                          |                              |
|----------------------------------------------------------|------------------------------|
| Supply Voltage ( $V_{CC}$ ) .....                        | +12V                         |
| Control Input Voltage _____                              |                              |
| (RE, DE) .....                                           | -0.5V to ( $V_{CC} + 0.5V$ ) |
| Driver Input Voltage (DI) .....                          | -0.5V to ( $V_{CC} + 0.5V$ ) |
| Driver Output Voltage (A,B) .....                        | -8V to 12.5V                 |
| Receiver Input Voltage (A,B) .....                       | -8V to 12.5V                 |
| Receiver Output Voltage (RO) .....                       | -0.5V to ( $V_{CC} + 0.5V$ ) |
| Lead Temperature (soldering, 10 seconds) .....           | +300°C                       |
| Storage Temperature .....                                | -65°C to +160°C              |
| Continuous Power Dissipation .....                       | $T_A = +70^\circ\text{C}$    |
| 8 pin Cerdip (derate 8.0mW/°C above +70°C) .....         | 640mW                        |
| 14 pin Cerdip (derate 9.1mW/°C above +70°C) .....        | 727mW                        |
| Junction Temperature $T_J$ .....                         | +150°C                       |
| Thermal Resistance, Junction to Case, $\theta_{JC}$      |                              |
| 8 pin Cerdip .....                                       | 55°C/W                       |
| 14 pin Cerdip .....                                      | 55°C/W                       |
| Thermal Resistance, Junction to Ambient, $\theta_{JA}$ : |                              |
| 8 pin Cerdip .....                                       | 125°C/W                      |
| 14 pin Cerdip .....                                      | 110°C/W                      |

**Recommended Operating Conditions**

|                                              |                 |
|----------------------------------------------|-----------------|
| Ambient Operating Range ( $T_A$ ) .....      | -55°C to +125°C |
| Receiver Input Voltage Operating Range ..... | -7V to +12V     |

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.

**TABLE 1. ELECTRICAL TESTS:**

| TEST                                                                                                   | Symbol           | CONDITIONS<br>-55 °C ≤ T <sub>A</sub> ≤ +125 °C 1/<br>V <sub>CC</sub> =5V±5%<br>Unless otherwise specified | Group A<br>Subgroup | Device<br>type                      | Limits<br>Min | Limits<br>Max                   | Units |
|--------------------------------------------------------------------------------------------------------|------------------|------------------------------------------------------------------------------------------------------------|---------------------|-------------------------------------|---------------|---------------------------------|-------|
| Differential Driver Output<br>(no load)                                                                | V <sub>OD1</sub> |                                                                                                            | 1,2,3               | All                                 |               | 5                               | V     |
| Differential Driver Output<br>(with load)                                                              | V <sub>OD2</sub> | R=50Ω (RS-422), Figure 4                                                                                   | 1,2,3               | All                                 | 2.0           |                                 | V     |
|                                                                                                        |                  | R=27Ω (RS-485), Figure 4                                                                                   |                     |                                     | 1.5           | 5.0                             |       |
| Change in Magnitude of<br>Driver Differential Out-<br>put Voltage for comple-<br>mentary output states | ΔV <sub>OD</sub> | R=27Ω or 50Ω, Figure 4                                                                                     | 1,2,3               | All                                 |               | 0.2                             | V     |
| Driver Common-mode<br>Output Voltage                                                                   | V <sub>OC</sub>  | R=27Ω or 50Ω, Figure 4                                                                                     | 1,2,3               | All                                 |               | 3.0                             | V     |
| Change in Magnitude of<br>Driver Common Mode<br>Output Voltage for comple-<br>mentary output states    | ΔV <sub>OD</sub> | R=27Ω or 50Ω, Figure 4                                                                                     | 1,2,3               | All                                 |               | 0.2                             | V     |
| Input High Voltage                                                                                     | V <sub>IH</sub>  | DE, DI, RE                                                                                                 | 1,2,3               | All                                 | 2.0           |                                 | V     |
| Input Low Voltage                                                                                      | V <sub>IL</sub>  | DE, DI, RE                                                                                                 | 1,2,3               | All                                 |               | 0.8                             | V     |
| Input Current                                                                                          | I <sub>IN1</sub> | DE, DI, RE                                                                                                 | 1,2,3               | All                                 |               | ±2.0                            | μA    |
| Input Current (A, B)                                                                                   | I <sub>IN2</sub> | DE=0V, V <sub>CC</sub> =0V<br>or 5.25V                                                                     | 1,2,3               | 01,02,03,<br>05,06,07,<br>08        |               | 1.0                             | mA    |
|                                                                                                        |                  |                                                                                                            |                     |                                     |               | -0.8                            |       |
| Input Current (A, B)                                                                                   | I <sub>IN2</sub> | DE=0V, V <sub>CC</sub> =0V<br>or 5.25V                                                                     | 1,2,3               | 04                                  |               | 0.25                            | mA    |
|                                                                                                        |                  |                                                                                                            |                     |                                     |               | -0.2                            |       |
| Receiver Differential<br>Threshold Voltage                                                             | V <sub>TH</sub>  | -7V ≤ V <sub>CM</sub> ≤ 12V                                                                                | 1,2,3               | All                                 | -0.2          | 0.2                             | V     |
| Receiver Output High<br>Voltage                                                                        | V <sub>OH</sub>  | IO=-4mA, V <sub>ID</sub> =200mV                                                                            | 1,2,3               | All                                 | 3.5           |                                 | V     |
| Receiver Output Low<br>Voltage                                                                         | V <sub>OL</sub>  | IO=4mA, V <sub>ID</sub> =-200mV                                                                            | 1,2,3               | All                                 |               | 0.4                             | V     |
| Three-State (High<br>Impedance) Output<br>Current at Receiver                                          | I <sub>OZR</sub> | 0.4V ≤ V <sub>O</sub> ≤ 2.4V                                                                               | 1,2,3               | All                                 |               | ±1.0                            | μA    |
| Receiver Input Resistance                                                                              | R <sub>IN</sub>  | -7V ≤ V <sub>CM</sub> ≤ 12V                                                                                | 4,5,6               | 01,02,03,<br>05,06,07,<br>08        | 12            |                                 | kΩ    |
|                                                                                                        |                  |                                                                                                            |                     | 04                                  | 48            |                                 |       |
| Supply Current (See Note<br>2 for No Load)                                                             | I <sub>CC</sub>  | DE=V <sub>CC</sub><br>DE=0V<br>DE=5V<br>DE=5V<br>DE=0V                                                     | 1,2,3               | 01,03<br>01,03<br>02<br>04<br>02,04 |               | 900<br>500<br>650<br>400<br>250 | μA    |
|                                                                                                        |                  | DE, DI, RE=0V or V <sub>CC</sub>                                                                           | 1,2,3               | 05,06<br>07,08                      |               | 250<br>500                      |       |

| TEST                                  | Symbol                                 | CONDITIONS<br>-55 °C ≤ T <sub>A</sub> ≤ +125 °C 1/<br>V <sub>CC</sub> = 5V ± 5%<br>Unless otherwise specified | Group A<br>Subgroup | Device<br>type  | Limits<br>Min | Limits<br>Max | Units |
|---------------------------------------|----------------------------------------|---------------------------------------------------------------------------------------------------------------|---------------------|-----------------|---------------|---------------|-------|
| Supply Current in Shutdown            | I <sub>SHDN</sub>                      | —<br>DE=0V, RE=V <sub>CC</sub>                                                                                | 1,2,3               | 01,02,04        |               | 10            | μA    |
| Driver Short-Circuit Current, VO=High | I <sub>OSD1</sub>                      | -7V ≤ V <sub>O</sub> ≤ 12V, NOTE 3                                                                            | 1,2,3               | All             | 35            | 250           | mA    |
| Driver Short-Circuit Current, VO=Low  | I <sub>OSD2</sub>                      | -7V ≤ V <sub>O</sub> ≤ 12V, NOTE 3                                                                            | 1,2,3               | All             | 35            | 250           | mA    |
| Receiver Short-Circuit Current        | I <sub>OSR</sub>                       | 0V ≤ V <sub>O</sub> ≤ V <sub>CC</sub>                                                                         | 1,2,3               | All             | 7             | 95            | mA    |
| Driver Input to Output                | t <sub>PLH</sub> /<br>t <sub>PHL</sub> | R <sub>DIFF</sub> =54Ω, C <sub>L1</sub> =C <sub>L2</sub> =100pF<br>Figures 6 and 8                            | 9,10,11             | 01,03,07,<br>08 | 10            | 60            | ns    |
|                                       |                                        |                                                                                                               |                     | 02,04,05,<br>06 | 250           | 2000          |       |
| Driver Output Skew to Output          | t <sub>SKEW</sub>                      | R <sub>DIFF</sub> =54Ω, C <sub>L1</sub> =C <sub>L2</sub> =100pF<br>Figures 6 and 8                            | 9,10,11             | 01,03,07,<br>08 |               | 10            | ns    |
|                                       |                                        |                                                                                                               |                     | 02,04,05,<br>06 |               | 800           |       |
| Driver Rise or Fall Time              | t <sub>R</sub> , t <sub>F</sub>        | R <sub>DIFF</sub> =54Ω, C <sub>L1</sub> =C <sub>L2</sub> =100pF<br>Figures 6 and 8                            | 9,10,11             | 01,03,07,<br>08 | 3             | 40            | ns    |
|                                       |                                        |                                                                                                               |                     | 02,04,05,<br>06 | 250           | 2000          |       |
| Driver Enable to Output High          | t <sub>ZH</sub>                        | C <sub>L</sub> =100pF, S2 closed<br>Figures 7 and 9                                                           | 9,10,11             | 01,03,07,<br>08 |               | 70            | ns    |
|                                       |                                        |                                                                                                               |                     | 02,04,05,<br>06 | 250           | 2000          |       |
| Driver Enable to Output Low           | t <sub>ZL</sub>                        | C <sub>L</sub> =100pF, S1 closed<br>Figures 7 and 9                                                           | 9,10,11             | 01,03,07,<br>08 |               | 70            | ns    |
|                                       |                                        |                                                                                                               |                     | 02,04,05,<br>06 | 250           | 2000          |       |
| Driver Disable Time from Low          | t <sub>LZ</sub>                        | C <sub>L</sub> =15pF, S1 closed<br>Figures 7 and 9                                                            | 9,10,11             | 01,03,07,<br>08 |               | 70            | ns    |
|                                       |                                        |                                                                                                               |                     | 02,04,05,<br>06 | 300           | 3000          |       |
| Driver Disable Time from High         | t <sub>HZ</sub>                        | C <sub>L</sub> =15pF, S2 closed<br>Figures 7 and 9                                                            | 9,10,11             | 01,03,07,<br>08 |               | 70            | ns    |
|                                       |                                        |                                                                                                               |                     | 02,04,05,<br>06 | 300           | 3000          |       |
| Receiver Input to Output              | t <sub>PLH</sub> / t <sub>PHL</sub>    | R <sub>DIFF</sub> =54Ω, C <sub>L1</sub> =C <sub>L2</sub> =100pF<br>Figures 6 and 10                           | 9,10,11             | 01,03,07,<br>08 | 20            | 200           | ns    |
|                                       |                                        |                                                                                                               |                     | 02,04,05,<br>06 | 250           | 2000          |       |
| Receiver Enable to Output Low         | t <sub>ZL</sub>                        | C <sub>RL</sub> =15pF, S1 closed<br>Figures 5 and 11                                                          | 9,10,11             | All             |               | 50            | ns    |
| Receiver Enable to Output High        | t <sub>ZH</sub>                        | C <sub>RL</sub> =15pF, S2 closed<br>Figures 5 and 11                                                          | 9,10,11             | All             |               | 50            | ns    |
| Receiver Disable Time from Low        | t <sub>LZ</sub>                        | C <sub>RL</sub> =15pF, S1 closed<br>Figures 5 and 11                                                          | 9,10,11             | All             |               | 50            | ns    |
| Receiver Disable Time from High       | t <sub>HZ</sub>                        | C <sub>RL</sub> =15pF, S2 closed<br>Figures 5 and 11                                                          | 9,10,11             | All             |               | 50            | ns    |

| TEST                                            | Symbol                | CONDITIONS<br>-55 °C ≤ T <sub>A</sub> ≤ +125 °C 1/<br>V <sub>CC</sub> = 5V ± 5%<br>Unless otherwise specified | Group A<br>Subgroup | Device<br>type  | Limits<br>Min | Limits<br>Max | Units |
|-------------------------------------------------|-----------------------|---------------------------------------------------------------------------------------------------------------|---------------------|-----------------|---------------|---------------|-------|
|                                                 |                       |                                                                                                               |                     |                 |               |               |       |
| Maximum Data Rate                               | f <sub>MAX</sub>      | t <sub>PLH</sub> , t <sub>PHL</sub> < 50% of data period                                                      | 9,10,11             | 01,03,07,<br>08 | 2.5           |               | Mbps  |
|                                                 |                       |                                                                                                               |                     | 02,04,05,<br>06 | 250           |               | kbps  |
| Time to Shutdown                                | t <sub>SHDN</sub>     | NOTE 4                                                                                                        | 9,10,11             | 01,02,04        | 50            | 600           | ns    |
| Driver Enable from<br>Shutdown to Output High   | t <sub>ZH(SHDN)</sub> | CL=100pF, S2 closed<br>Figure 7 and 9                                                                         | 9,10,11             | 01<br>02,04     |               | 100<br>2000   | ns    |
| Driver Enable from<br>Shutdown to Output Low    | t <sub>ZL(SHDN)</sub> | CL=100pF, S1 closed<br>Figure 7 and 9                                                                         | 9,10,11             | 01<br>02,04     |               | 100<br>2000   | ns    |
| Receiver Enable from<br>Shutdown to Output High | t <sub>ZH(SHDN)</sub> | CL=15pF, S2 closed<br>Figure 5 and 11                                                                         | 9,10,11             | 01<br>02,04     |               | 1000<br>2500  | ns    |
| Receiver Enable from<br>Shutdown to Output Low  | t <sub>ZL(SHDN)</sub> | CL=15pF, S1 closed<br>Figure 5 and 11                                                                         | 9,10,11             | 01<br>02,04     |               | 1000<br>2500  | ns    |

NOTE 1: All currents into device pins are positive; all currents out of device pins are negative.

All voltages are referenced to device ground unless otherwise specified.

NOTE 2: Supply current specification is valid for loaded transmitters when DE=0V.

NOTE 3: Applies to peak current.

NOTE 4: The device types 01, 02, 04 are put into shutdown by bringing RE high and DE low.

If the inputs are in this state for less than 50ns, the parts are guaranteed not to enter shutdown. If the inputs are in this state for at least 600ns, the parts are guaranteed to have entered shutdown.

FIGURES 4 to 11: See Commercial Datasheet.

FIGURE 4: Driver DC Test Load

FIGURE 5: Receiver Timing Test Load

FIGURE 6: Driver/Receiver Timing Test Circuit

FIGURE 7: Driver Timing Test Load

FIGURE 8: Driver Propagation Delays

FIGURE 9: Driver Enable and Disable Times for 01, 02, 03, 04, 06, 08.

FIGURE 10: Receiver Propagation Delays

FIGURE 11: Receiver Enable and Disable Times for 01, 02, 03, 04, 06, 08.

#### TERMINAL CONNECTIONS FOR 01, 02, 03, 04, 05, 06, 07, 08

|    | 01,02,03,04     | 05, 07    | 06, 08          | DASH | ORDERING       | PKG |
|----|-----------------|-----------|-----------------|------|----------------|-----|
|    | MAX481/83/85/87 | MAX488/90 | MAX489/91       |      | INFORMATION    |     |
| 1  | RO              | VCC       | NC              | 01   | MAX481MJA/883B | J8  |
| 2  | RE              | RO        | RO              | 02   | MAX483MJA/883B | J8  |
| 3  | DE              | DI        | RE              | 03   | MAX485MJA/883B | J8  |
| 4  | DI              | GND       | DE              | 04   | MAX487MJA/883B | J8  |
| 5  | GND             | Y         | DI              | 05   | MAX488MJA/883B | J8  |
| 6  | A               | Z         | GND             | 06   | MAX489MJD/883B | J14 |
| 7  | B               | B         | GND             | 07   | MAX490MJA/883B | J8  |
| 8  | V <sub>CC</sub> | A         | NC              | 08   | MAX491MJD/883B | J14 |
| 9  |                 |           | Y               |      |                |     |
| 10 |                 |           | Z               |      |                |     |
| 11 |                 |           | B               |      |                |     |
| 12 |                 |           | A               |      |                |     |
| 13 |                 |           | NC              |      |                |     |
| 14 |                 |           | V <sub>CC</sub> |      |                |     |

## QUALITY ASSURANCE

Sampling and inspection procedures shall be in accordance with MIL-Prf-38535, Appendix A as specified in Mil-Std-883.

Screening shall be in accordance with Method 5004 of Mil-Std-883. Burn-in test Method 1015:

1. Test Condition, A, B, C, or D.
2. TA = +125°C minimum.
3. Interim and final electrical test requirements shall be specified in Table 2.

Quality conformance inspection shall be in accordance with Method 5005 of Mil-Std-883, including Groups A, B, C, and D inspection.

Group A inspection:

1. Tests as specified in Table 2.
2. Selected subgroups in Table 1, Method 5005 of Mil-Std-883 shall be omitted.

Group C and D inspections:

- a. End-point electrical parameters shall be specified in Table 1.
- b. Steady-state life test, Method 1005 of Mil-Std-883:
  1. Test condition A, B, C, D.
  2. TA = +125°C, minimum.
  3. Test duration, 1000 hours, except as permitted by Method 1005 of Mil-Std-883.

**TABLE 2. ELECTRICAL TEST REQUIREMENTS**

| Mil-Std-883 Test Requirements                                | Subgroups<br>per Method 5005, Table 1 |
|--------------------------------------------------------------|---------------------------------------|
| Interim Electric Parameters<br>Method 5004                   | 1                                     |
| Final Electrical Parameters<br>Method 5005                   | 1*, 2, 3, 9, 10, 11                   |
| Group A Test Requirements<br>Method 5005                     | 1, 2, 3, 9, 10, 11                    |
| Group C and D End-Point Electrical Parameters<br>Method 5005 | 1                                     |

\* PDA applies to Subgroup 1 only.