

RELIABILITY REPORT  
FOR  
MAX1484EUB+  
PLASTIC ENCAPSULATED DEVICES

September 23, 2009

**MAXIM INTEGRATED PRODUCTS**

120 SAN GABRIEL DR.  
SUNNYVALE, CA 94086

|                                   |
|-----------------------------------|
| <b>Approved by</b>                |
| Ken Wendel                        |
| Quality Assurance                 |
| Director, Reliability Engineering |

## Conclusion

The MAX1484EUB+ successfully meets the quality and reliability standards required of all Maxim products. In addition, Maxim's continuous reliability monitoring program ensures that all outgoing product will continue to meet Maxim's quality and reliability standards.

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### I. Device Description

#### A. General

The MAX1481/MAX1484/MAX1485/MAX1486 provide software-selectable, half-/full-duplex, low-power, slew-rate-limited, and high-speed (12Mbps) RS-485/RS-422 operation in a 10-pin  $\mu$ MAX<sup>®</sup> package; the smallest 10-pin package available. The software-selectable, half-/full-duplex MAX1485/MAX1486 make obsolete the normally larger and more expensive solutions required for selectable half-/full-duplex RS-485/RS-422 operation: 1) a 14-pin, full-duplex transceiver configured via jumpers between receiver and transmitter lines, or 2) two 8-pin, half-duplex transceivers, which require an additional inverter logic gate for software selectability. The MAX1481/MAX1484 are functionally equivalent to the industry-standard MAX491 and 75180, and are designed for space-constrained, full-duplex RS-422 applications. All parts contain one driver and one receiver and feature a 1/8-unit-load receiver input impedance, allowing up to 256 transceivers on the bus. The MAX1481/MAX1485 feature reduced-slew-rate drivers that minimize EMI and reduce reflections caused by improperly terminated cables, allowing error-free data transmission up to 250kbps. The MAX1484/MAX1486 driver slew rates are not limited, allowing them to transmit up to 12Mbps. The MAX1481/MAX1484/MAX1485/MAX1486 draw only 300 $\mu$ A of supply current. The MAX1481 has a low-power shutdown mode that reduces supply current to only 0.1 $\mu$ A. All devices operate from a single 5V supply. Drivers are output short-circuit current limited and are protected against excessive power dissipation by thermal-shutdown circuitry that places the driver outputs into a high-impedance state. The receiver input has a fail-safe feature that guarantees a logic-high output if the input is open circuit.

**II. Manufacturing Information**

|                                  |  |
|----------------------------------|--|
| A. Description/Function:         | Software-Selectable, Half-/Full-Duplex, Slew-Rate-Limited, 12Mbps, RS-485/RS-422 Transceivers in $\mu$ MAX Package |
| B. Process:                      | S3   |
| C. Number of Device Transistors: |  |
| D. Fabrication Location:         | Oregon   |
| E. Assembly Location:            | Thailand, Malaysia   |
| F. Date of Initial Production:   | 10/25/1997   |

**III. Packaging Information**

|  |                          |
|--|--------------------------|
| A. Package Type:   | 10-pin uMAX              |
| B. Lead Frame:   | Copper                   |
| C. Lead Finish:  | 100% matte Tin           |
| D. Die Attach:   | Conductive Epoxy         |
| E. Bondwire:   | Gold (1 mil dia.)        |
| F. Mold Material:  | Epoxy with silica filler |
| G. Assembly Diagram:   | #05-1901-0171            |
| H. Flammability Rating:  | Class UL94-V0            |
| I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C | Level 1                  |
| J. Single Layer Theta Ja:  | 180°C/W                  |
| K. Single Layer Theta Jc:  | 41.9°C/W                 |
| L. Multi Layer Theta Ja:   | 113.1°C/W                |
| M. Multi Layer Theta Jc:   | 41.9°C/W                 |

**IV. Die Information**

|                            |   |
|----------------------------|---|
| A. Dimensions:             | 87 X 61 mils  |
| B. Passivation:            | $\text{Si}_3\text{N}_4/\text{SiO}_2$ (Silicon nitride/ Silicon dioxide) |
| C. Interconnect:           | Al/0.5%Cu with Ti/TiN Barrier   |
| D. Backside Metallization: | None  |
| E. Minimum Metal Width:    | 3.0 microns (as drawn)  |
| F. Minimum Metal Spacing:  | 3.0 microns (as drawn)  |
| G. Bondpad Dimensions:     | 5 mil. Sq.  |
| H. Isolation Dielectric:   | $\text{SiO}_2$  |
| I. Die Separation Method:  | Wafer Saw   |

## V. Quality Assurance Information

- A. Quality Assurance Contacts: Ken Wendel (Director, Reliability Engineering)  
Bryan Preeshl (Managing Director of QA)
- B. Outgoing Inspection Level: 0.1% for all electrical parameters guaranteed by the Datasheet.  
0.1% For all Visual Defects.
- C. Observed Outgoing Defect Rate: < 50 ppm
- D. Sampling Plan: Mil-Std-105D

## VI. Reliability Evaluation

### A. Accelerated Life Test

The results of the 135°C biased (static) life test are shown in Table 1. Using these results, the Failure Rate ( $\lambda$ ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 160 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

(where 4340 = Temperature Acceleration factor assuming an activation energy of 0.8eV)

$$\lambda = 6.7 \times 10^{-9}$$

$\lambda = 6.7$  F.I.T. (60% confidence level @ 25°C)

The following failure rate represents data collected from Maxim's reliability monitor program. Maxim performs quarterly life test monitors on its processes. This data is published in the Reliability Report found at <http://www.maxim-ic.com/qa/reliability/monitor>. Cumulative monitor data for the S3 Process results in a FIT Rate of 0.04 @ 25C and 0.69 @ 55C (0.8 eV, 60% UCL)

### B. Moisture Resistance Tests

The industry standard 85°C/85%RH or HAST testing is monitored per device process once a quarter.

### C. E.S.D. and Latch-Up Testing

The RS57-1 die type has been found to have all pins able to withstand a HBM transient pulse of +/-2000 V per Mil-Std 883 Method 3015.7. Latch-Up testing has shown that this device withstands a current of +/-150 mA.

**Table 1**  
Reliability Evaluation Test Results

**MAX1484EUB+**

| TEST ITEM                         | TEST CONDITION                                    | FAILURE IDENTIFICATION        | SAMPLE SIZE | NUMBER OF FAILURES |
|-----------------------------------|---|-------------------------------|-------------|--------------------|
| <b>Static Life Test</b> (Note 1)  |   |                               |             |                    |
|                                   | Ta = 135°C<br>Biased<br>Time = 192 hrs.           | DC Parameters & functionality | 160         | 0                  |
| <b>Moisture Testing</b> (Note 2)  |   |                               |             |                    |
| HAST                              | Ta = 130°C<br>RH = 85%<br>Biased<br>Time = 96hrs. | DC Parameters & functionality | 77          | 0                  |
| <b>Mechanical Stress</b> (Note 2) |   |                               |             |                    |
| Temperature<br>Cycle              | -65°C/150°C<br>1000 Cycles<br>Method 1010         | DC Parameters & functionality | 77          | 0                  |

Note 1: Life Test Data may represent plastic DIP qualification lots.

Note 2: Generic Package/Process data