



RELIABILITY REPORT  
FOR  
MAX13081EASA+T  
PLASTIC ENCAPSULATED DEVICES

March 31, 2017

**MAXIM INTEGRATED**

160 RIO ROBLES  
SAN JOSE, CA 95134

|   |   |
|---|---|
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## Conclusion

The MAX13081EASA+T successfully meets the quality and reliability standards required of all Maxim Integrated products. In addition, Maxim Integrated's continuous reliability monitoring program ensures that all outgoing product will continue to meet Maxim Integrated's quality and reliability standards.

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### I. Device Description

#### A. General

The MAX13080E/MAX13089E +5.0V,  $\pm 15$ kV ESD-protected, RS-485/RS-422 transceivers feature one driver and one receiver. These devices include fail-safe circuitry, guaranteeing a logic-high receiver output when receiver inputs are open or shorted. The receiver outputs a logic-high if all transmitters on a terminated bus are disabled (high impedance). The MAX13080E family include a hot-swap capability to eliminate false transitions on the bus during power-up or hot insertion. The MAX13080E/MAX13081E/MAX13082E 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 MAX13083E/MAX13084E also feature slew-rate-limited drivers but allow transmit speeds up to 500kbps. The MAX13086E/MAX13087E/MAX13088E driver slew rates are not limited, making transmit speeds up to 16Mbps possible. The MAX13089E slew rate is pin selectable for 250kbps, 500kbps, and 16Mbps. The MAX13082E/MAX13088E are intended for half-duplex communications, and the MAX13080E/MAX13081E/MAX13083E/MAX13084E/MAX13086E/MAX13087E are intended for full-duplex communications. The MAX13089E is selectable for half-duplex or full-duplex operation. It also features independently programmable receiver and transmitter output phase through separate pins. The MAX13080E family transceivers draw 1.2mA of supply current when unloaded or when fully loaded with the drivers disabled. All devices have a 1/8-unit load receiver input impedance, allowing up to 256 transceivers on the bus. The MAX13080E/MAX13083E/MAX13086E/MAX13089E are available in 14-pin PDIP and 14-pin SO packages. The MAX13081E/MAX13082E/MAX13084E/MAX13087E/MAX13088E are available in 8-pin PDIP and 8-pin SO packages. The devices operate over the commercial, extended, and automotive temperature ranges.

## II. Manufacturing Information

|                                  |   |
|----------------------------------|---|
| A. Description/Function:         | +5.0V, ±15kV ESD-Protected, Fail-Safe, Hot-Swap, RS-485/RS-422 Transceivers |
| B. Process:                      | B8  |
| C. Number of Device Transistors: | 1228  |
| D. Fabrication Location:         | USA   |
| E. Assembly Location:            | Malaysia, Philippines, Thailand   |
| F. Date of Initial Production:   | April 22, 2005  |

## III. Packaging Information

|  |                          |
|--|--------------------------|
| A. Package Type:   | 8-pin SOIC (N)           |
| B. Lead Frame:   | Copper                   |
| C. Lead Finish:  | 100% matte Tin           |
| D. Die Attach:   | Conductive               |
| E. Bondwire:   | Au (1 mil dia.)          |
| F. Mold Material:  | Epoxy with silica filler |
| G. Assembly Diagram:   | #05-9000-0184            |
| 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:  | 170°C/W                  |
| K. Single Layer Theta Jc:  | 40°C/W                   |
| L. Multi Layer Theta Ja:   | 132°C/W                  |
| M. Multi Layer Theta Jc:   | 38°C/W                   |

## IV. Die Information

|                            |   |
|----------------------------|---|
| A. Dimensions:             | 71X107 mils   |
| B. Passivation:            | Si <sub>3</sub> N <sub>4</sub> /SiO <sub>2</sub> (Silicon nitride/ Silicon dioxide) |
| C. Interconnect:           | Al/0.5%Cu with Ti/TiN Barrier   |
| D. Backside Metallization: | None  |
| E. Minimum Metal Width:    | 0.8 microns (as drawn)  |
| F. Minimum Metal Spacing:  | 0.8 microns (as drawn)  |
| G. Isolation Dielectric:   | SiO <sub>2</sub>  |
| H. Die Separation Method:  | Wafer Saw   |

## V. Quality Assurance Information

- A. Quality Assurance Contacts: Eric Wright (Reliability Engineering)  
Brian Standley (Manager, Reliability)  
Bryan Preeshl (Vice President 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 135C biased (static) life test are shown in Table 1. Using these results, the Failure Rate ( $\lambda$ ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{1000 \times 4340 \times 128 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 1.65 \times 10^{-9}$$

$$\lambda = 1.65 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

The following failure rate represents data collected from Maxim Integrated's reliability monitor program. Maxim Integrated performs quarterly life test monitors on its processes. This data is published in the Reliability Report found at <http://www.maximintegrated.com/qa/reliability/monitor>. Cumulative monitor data for the B8 Process results in a FIT Rate of 0.06 @ 25C and 0.99 @ 55C (0.8 eV, 60% UCL)

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

The RT52-1 die type has been found to have all pins able to withstand a transient pulse of:

ESD-HBM: +/- 1000V per JEDEC JESD22-A114  
ESD-MM: +/- 100V per JEDEC JESD22-A115

Latch-Up testing has shown that this device withstands a current of +/-250mA and overvoltage per JEDEC JESD78.

**Table 1**  
Reliability Evaluation Test Results

**MAX13081EASA+T**

| TEST ITEM                        | TEST CONDITION                          | FAILURE IDENTIFICATION           | SAMPLE SIZE | NUMBER OF FAILURES | COMMENTS |
|----------------------------------|---|----------------------------------|-------------|--------------------|----------|
| <b>Static Life Test</b> (Note 1) | Ta = 135C<br>Biased<br>Time = 1000 hrs. | DC Parameters<br>& functionality | 128         | 0                  |          |

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