



RELIABILITY REPORT  
FOR  
MAX13488EESA+  
PLASTIC ENCAPSULATED DEVICES

February 29, 2012

**MAXIM INTEGRATED PRODUCTS**

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<b>Approved by</b>
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## Conclusion

The MAX13488EESA+ 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 MAX13487E/MAX13488E +5V, half-duplex,  $\pm 15\text{kV}$  ESD-protected RS-485/RS-422-compatible transceivers feature one driver and one receiver. The MAX13487E/MAX13488E include a hot-swap capability to eliminate false transitions on the bus during power-up or live insertion. The MAX13487E/MAX13488E feature Maxim's proprietary AutoDirection control. This architecture makes the devices ideal for applications, such as isolated RS-485 ports, where the driver input is used in conjunction with the driver-enable signal to drive the differential bus. The MAX13487E features reduced slew-rate drivers that minimize EMI and reduce reflections caused by improperly terminated cables, allowing error-free transmission up to 500kbps. The MAX13488E driver slew rate is not limited, allowing transmit speeds up to 16Mbps. The MAX13487E/MAX13488E feature a 1/4-unit load receiver input impedance, allowing up to 128 transceivers on the bus. These devices are intended for half-duplex communications. All driver outputs are protected to  $\pm 15\text{kV}$  ESD using the Human Body Model. The MAX13487E/MAX13488E are available in an 8-pin SO package. The devices operate over the extended  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  temperature range.

## II. Manufacturing Information

A. Description/Function:	Half-Duplex RS-485/RS-422-Compatible Transceiver with AutoDirection Control
B. Process:	B8
C. Number of Device Transistors:	
D. Fabrication Location:	Oregon
E. Assembly Location:	Malaysia
F. Date of Initial Production:	January 20, 2007

## III. Packaging Information

A. Package Type:	150 mil 8L SOIC
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:	#05-9000-2364 / A
H. Flammability Rating:	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C	1
J. Single Layer Theta Ja:	170°C/W
K. Single Layer Theta Jc:	40°C/W
L. Multi Layer Theta Ja:	136°C/W
M. Multi Layer Theta Jc:	38°C/W

## IV. Die Information

A. Dimensions:	65 X 43 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. Bondpad Dimensions:	
H. Isolation Dielectric:	SiO <sub>2</sub>
I. Die Separation Method:	Wafer Saw

## V. Quality Assurance Information

- A. Quality Assurance Contacts: Richard Aburano (Manager, Reliability Engineering)  
Don Lipps (Manager, Reliability Engineering)  
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 biased (static) life test are shown in Table 1. Using these results, the Failure Rate ( $\lambda$ ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 45 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 24.4 \times 10^{-9}$$

$$\lambda = 24.4 \text{ F.I.T. (60\% confidence level @ 25}^\circ\text{C)}$$

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 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 (lot TY30DQ001D D/C 0651)

The RU21 die type has been found to have all pins able to withstand a HBM transient pulse of +/-2500V per JEDEC JESD22-A114. Latch-Up testing has shown that this device withstands a current of +/-250mA.

**Table 1**  
Reliability Evaluation Test Results

**MAX13488EESA+**

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
<b>Static Life Test</b> (Note 1)	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality	45	0	TY32DQ001B, D/C 0651

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