



RELIABILITY REPORT  
FOR  
MAX13235EEUP+  
(MAX13234E-MAX13237E)  
PLASTIC ENCAPSULATED DEVICES

March 16, 2009

**MAXIM INTEGRATED PRODUCTS**

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## Conclusion

The MAX13235EEUP+ 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.

## Table of Contents

I. ....Device Description	V. ....Quality Assurance Information
II. ....Manufacturing Information	VI. ....Reliability Evaluation
III. ....Packaging Information	IV. ....Die Information
.....Attachments	

### I. Device Description

#### A. General

The MAX13234E-MAX13237E are +3V to +5.5V powered EIA/TIA-232 and V.28/V.24 communications interfaces with high data-rate capabilities (up to 3Mbps), a flexible logic voltage interface, and enhanced electrostatic discharge (ESD) protection. All receiver inputs and transmitter outputs are protected to  $\pm 15\text{kV}$  IEC 61000-4-2 Air Gap Discharge,  $\pm 8\text{kV}$  IEC 61000-4-2 Contact Discharge, and  $\pm 15\text{kV}$  Human Body Model. The MAX13234E/MAX13235E have two receivers and two transmitters, while the MAX13236E/MAX13237E have a single receiver and transmitter. The transmitters have a low-dropout transmitter output stage, delivering true RS-232 performance from a +3V to +5.5V supply based on a dual charge pump. The charge pump requires only four small  $0.1\mu\text{F}$  capacitors for operation from a +3.3V supply. All devices achieve a  $1\mu\text{A}$  supply current using Maxim's AutoShutdown Plus(tm) feature. These devices automatically enter a low-power shutdown mode when the RS-232 cable is disconnected or the devices driving the transmitter and receiver inputs are inactive for more than 30s. The MAX13234E-MAX13237E are available in space-saving TQFN and TSSOP packages and operate over the  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  extended temperature range.

## II. Manufacturing Information

A. Description/Function:	3Mbps RS-232 Transceivers with Low-Voltage Interface
B. Process:	B3
C. Number of Device Transistors:	1176
D. Fabrication Location:	Oregon
E. Assembly Location:	UTL Thailand
F. Date of Initial Production:	October 25, 2008

## III. Packaging Information

A. Package Type:	20-pin TSSOP
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Die Attach:	Conductive Epoxy
E. Bondwire:	Au (1.0 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#
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:	91°C/W
K. Single Layer Theta Jc:	20°C/W
L. Multi Layer Theta Ja:	73.8°C/W
M. Multi Layer Theta Jc:	20°C/W

## IV. Die Information

A. Dimensions:	136 X 108 mils
B. Passivation:	Si <sub>3</sub> N <sub>4</sub> /SiO <sub>2</sub> (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Aluminum/Si (Si = 1%)
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:	SiO <sub>2</sub>
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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 48 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 22.4 \times 10^{-9}$$

$$\lambda = 22.4 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

The following failure rate represents data collected from Maxim's reliability monitor program. Maxim performs quarterly 1000 hour life test monitors on its processes. This data is published in the Product Reliability Report found at <http://www.maxim-ic.com/>. Current monitor data for the B3 Process results in a FIT Rate of 1.6 @ 25C and 28.5 @ 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 RU37-1 die type has been found to have all pins able to withstand a HBM transient pulse of +/-1500 V per JEDEC JESD22-A114-D. Latch-Up testing has shown that this device withstands a current of +/-250 mA, 1.5x VCCMax Overvoltage per JESD 78.

**Table 1**  
Reliability Evaluation Test Results

**MAX13235EEUP+**

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES
<b>Static Life Test</b> (Note 1)	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality	48	0
<b>Moisture Testing</b> (Note 2) 85/85	Ta = 85°C RH = 85% Biased Time = 1000hrs.	DC Parameters & functionality	77	0
<b>Mechanical Stress</b> (Note 2) Temperature Cycle	-65°C/150°C 1000 Cycles Method 1010	DC Parameters & functionality	77	0

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

Note 2: Generic Package/Process data