

RELIABILITY REPORT  
FOR  
MAX3232EEAE+T  
PLASTIC ENCAPSULATED DEVICES

January 27, 2017

**MAXIM INTEGRATED**

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## Conclusion

The MAX3232EEAE+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 MAX3222E/MAX3232E/MAX3237E/MAX3241E/MAX3246E +3.0V-powered EIA/TIA-232 and V.28/V.24 communications interface devices feature low power consumption, high data-rate capabilities, and enhanced electrostatic-discharge (ESD) protection. The enhanced ESD structure protects all transmitter outputs and receiver inputs to  $\pm 15\text{kV}$  using IEC 1000-4-2 Air-Gap Discharge,  $\pm 8\text{kV}$  using IEC 1000-4-2 Contact Discharge ( $\pm 9\text{kV}$  for MAX3246E), and  $\pm 15\text{kV}$  using the Human Body Model. The logic and receiver I/O pins of the MAX3237E are protected to the above standards, while the transmitter output pins are protected to  $\pm 15\text{kV}$  using the Human Body Model. A proprietary low-dropout transmitter output stage delivers true RS-232 performance from a +3.0V to +5.5V power supply, using an internal dual charge pump. The charge pump requires only four small 0.1 $\mu\text{F}$  capacitors for operation from a +3.3V supply. Each device guarantees operation at data rates of 250kbps while maintaining RS-232 output levels. The MAX3237E guarantees operation at 250kbps in the normal operating mode and 1Mbps in the MegaBaud(tm) operating mode, while maintaining RS-232-compliant output levels. The MAX3222E/MAX3232E have two receivers and two transmitters. The MAX3222E features a 1 $\mu\text{A}$  shutdown mode that reduces power consumption in battery-powered portable systems. The MAX3222E receivers remain active in shutdown mode, allowing monitoring of external devices while consuming only 1 $\mu\text{A}$  of supply current. The MAX3222E and MAX3232E are pin, package, and functionally compatible with the industry-standard MAX242 and MAX232, respectively. The MAX3241E/MAX3246E are complete serial ports (three drivers/five receivers) designed for notebook and subnotebook computers. The MAX3237E (five drivers/three receivers) is ideal for peripheral applications that require fast data transfer. These devices feature a shutdown mode in which all receivers remain active, while consuming only 1 $\mu\text{A}$  (MAX3241E/MAX3246E) or 10nA (MAX3237E). The MAX3222E, MAX3232E, and MAX3241E are available in space-saving SO, SSOP, TQFN and TSSOP packages. The MAX3237E is offered in an SSOP package. The MAX3246E is offered in the ultra-small 6 x 6 UCSP(tm) package.

## II. Manufacturing Information

A. Description/Function:	±15kV ESD-Protected, Down to 10nA, 3.0V to 5.5V, Up to 1Mbps, True RS-232 Transceivers
B. Process:	C3
C. Number of Device Transistors:	2445
D. Fabrication Location:	USA
E. Assembly Location:	Philippines
F. Date of Initial Production:	January 24, 1998

## III. Packaging Information

A. Package Type:	16-pin SSOP
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Die Attach:	Conductive
E. Bondwire:	Au (0.8 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#05-9000-5180
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:	140°C/W
K. Single Layer Theta Jc:	34°C/W
L. Multi Layer Theta Ja:	86°C/W
M. Multi Layer Theta Jc:	33°C/W

## IV. Die Information

A. Dimensions:	61.811X109.8425 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/TiW Barrier
D. Backside Metallization:	None
E. Minimum Metal Width:	0.8
F. Minimum Metal Spacing:	1.2
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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{1000 \times 4340 \times 79 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 2.67 \times 10^{-9}$$

$$\lambda = 2.67 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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 C3 Process results in a FIT Rate of 0.72@ 25C and 12.5@ 55C (0.8 eV, 60% UCL)

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

The RU74-2 die type has been found to have all pins able to withstand a transient pulse of:

ESD-HBM: +/- 2500V per JEDEC JESD22-A114  
ESD-CDM: +/- 750V per JEDEC JESD22-C101  
ESD-MM: +/- 250 V 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

**MAX3232EEAE+T**

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
<b>Static Life Test</b> (Note 1)	Ta = 135C Biased Time = 1000 hrs.	DC Parameters & functionality	79	0	

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