

RELIABILITY REPORT
FOR
MAX3227EAAE+
PLASTIC ENCAPSULATED DEVICES

December 2, 2011

MAXIM INTEGRATED PRODUCTS

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| Approved by |
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| Quality Assurance |
| Reliability Engineer |

Conclusion

The MAX3227EAAE+ 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 MAX3224E/MAX3225E/MAX3226E/MAX3227E/MAX3244E/MAX3245E are 3V-powered EIA/TIA-232 and V.28/V.24 communications interfaces with automatic shutdown/wakeup features, high data-rate capabilities, and enhanced electrostatic discharge (ESD) protection. All transmitter outputs and receiver inputs are protected to $\pm 15\text{kV}$ using IEC 1000-4-2 Air-Gap Discharge, $\pm 8\text{kV}$ using IEC 1000-4-2 Contact Discharge, and $\pm 15\text{kV}$ using the Human Body Model. All devices achieve a $1\mu\text{A}$ supply current using Maxim's revolutionary AutoShutdown Plus(tm) feature. These devices automatically enter a low-power shutdown mode when the RS-232 cable is disconnected or the transmitters of the connected peripherals are inactive, and the UART driving the transmitter inputs is inactive for more than 30 seconds. They turn on again when they sense a valid transition at any transmitter or receiver input. AutoShutdown Plus saves power without changes to the existing BIOS or operating system. The MAX3225E/MAX3227E/MAX3245E also feature MegaBaud(tm) operation, guaranteeing 1Mbps for high-speed applications such as communicating with ISDN modems. The MAX3224E/MAX3226E/MAX3244E guarantee 250kbps operation. The transceivers have a proprietary low-dropout transmitter output stage enabling true RS-232 performance from a +3.0V to +5.5V supply with a dual charge pump. The charge pump requires only four small $0.1\mu\text{F}$ capacitors for operation from a 3.3V supply. The MAX3224E-MAX3227E feature a logic-level output (READY) that asserts when the charge pump is regulating and the device is ready to begin transmitting. All devices are available in a space-saving TQFN, SSOP, and TSSOP (MAX3224E/MAX3225E/MAX3244E/MAX3245E) packages.

II. Manufacturing Information

| | |
|---|---|
| A. Description/Function: AutoShutdown Plus | ±15kV ESD-Protected, 1μA, 1Mbps, 3.0V to 5.5V, RS-232 Transceivers with |
| B. Process: | B3 |
| C. Number of Device Transistors: | |
| D. Fabrication Location: | Oregon |
| E. Assembly Location: | Philippines |
| F. Date of Initial Production: | April 17, 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 (1.3 mil dia.) |
| F. Mold Material: | Epoxy with silica filler |
| G. Assembly Diagram: | #05-1901-0184 |
| 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: | 140°C/W |
| K. Single Layer Theta Jc: | 34°C/W |
| L. Multi Layer Theta Ja: | n/a |
| M. Multi Layer Theta Jc: | n/a |

IV. Die Information

| | |
|----------------------------|---|
| A. Dimensions: | 91 X 159 mils |
| B. Passivation: | Si ₃ N ₄ /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: | |
| H. Isolation Dielectric: | SiO ₂ |
| 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 135°C biased (static) life test are shown in Table 1. Using these results, the Failure Rate (λ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 476 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 2.3 \times 10^{-9}$$

$\lambda = 2.3$ 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 B3 Process results in a FIT Rate of 0.51 @ 25C and 8.79 @ 55C (0.8 eV, 60% UCL)

B. E.S.D. and Latch-Up Testing (lot JO3EMA764H D/C 1102)

The RS60-4 die type has been found to have all pins able to withstand a HBM transient pulse of +/-2000V per JEDEC JESD22-A114. Latch-Up testing has shown that this device withstands a current of +/-100mA and over voltage per JEDEC JESD78.

Table 1
Reliability Evaluation Test Results

MAX3227EAAE+

| TEST ITEM | TEST CONDITION | FAILURE IDENTIFICATION | SAMPLE SIZE | NUMBER OF FAILURES | COMMENTS |
|----------------------------------|-----------------|-------------------------------|-------------|--------------------|----------------------|
| Static Life Test (Note 1) | Ta = 135°C | DC Parameters & functionality | 80 | 0 | NO3BIA032B, D/C 0220 |
| | Biased | | 80 | 0 | NO3CH3008Q, D/C 0149 |
| | Time = 192 hrs. | | 80 | 0 | IO3CGA004B, D/C 0127 |
| | | | 80 | 0 | IO3CEA007B, D/C 0001 |
| | | | 80 | 0 | XO3BCA010E, D/C 9831 |
| | | | 76 | 0 | XO3CBN001B, D/C 9805 |

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