



RELIABILITY REPORT  
FOR  
MAX3140EEI+  
PLASTIC ENCAPSULATED DEVICES

January 6, 2009

**MAXIM INTEGRATED PRODUCTS**

120 SAN GABRIEL DR.  
SUNNYVALE, CA 94086

<b>Approved by</b>
Ken Wendel
Quality Assurance
Director, Reliability Engineering

## Conclusion

The MAX3140EEI+ 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

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

## I. Device Description

### A. General

The MAX3140 is a complete universal asynchronous receiver-transmitter (UART) and a true fail-safe RS-485/RS-422 transceiver combined in a single 28-pin QSOP package for space-, cost-, and power-constrained applications. The MAX3140 saves additional board space as well as microcontroller ( $\mu$ C) I/O pins by featuring an SPI(tm)/QSPI(tm)/MICROWIRE(tm)-compatible serial interface. It is pin-programmable for configuration in all RS-485/RS-422 networks. The MAX3140 includes a single RS-485/RS-422 driver and receiver featuring true fail-safe circuitry, which guarantees a logic-high receiver output when the receiver inputs are open or shorted. This feature provides immunity to faults without requiring complex termination. The MAX3140 provides software-selectable control of half- or full-duplex operation, data rate, slew rate, and transmitter and receiver phase. The RS-485 driver slew rate is programmable to minimize EMI and results in maximum data rates of 115kbps, 500kbps, and 10Mbps. Independent transmitter/receiver phase control enables software correction of twisted-pair polarity reversal. A 1/8-unit-load receiver input impedance allows up to 256 transceivers on the bus. The MAX3140's UART includes an oscillator circuit derived from an external crystal, and a baud-rate generator with software-programmable divider ratios for all common baud rates from 300 baud to 230k baud. The UART features an 8-word-deep receive FIFO that minimizes processor overhead and provides a flexible interrupt with four maskable sources, including address recognition on 9-bit networks. Two control lines are included for hardware handshaking-one input and one output. The MAX3140 operates from a single +5V supply and typically consumes only 645 $\mu$ A with the receiver active. Hardware-invoked shutdown reduces supply current to only 20 $\mu$ A. The UART and RS-485/RS-422 functions can be used together or independently since the two functions share only supply and ground connections (the MAX3140 is hardware- and software-compatible with the MAX3100 and MAX3089).

**II. Manufacturing Information**

A. Description/Function:	SPI/MICROWIRE-Compatible UART with Integrated True Fail Safe RS-485/RS-422 Transceivers
B. Process:	Hybrid
C. Number of Device Transistors:	
D. Fabrication Location:	
E. Assembly Location:	ATP Philippines
F. Date of Initial Production:	April 24, 1999

**III. Packaging Information**

A. Package Type:	28-pin QSOP
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Die Attach:	Conductive Epoxy
E. Bondwire:	Gold (1 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#31-4754
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:	93°C/W
K. Single Layer Theta Jc:	27°C/W
L. Multi Layer Theta Ja:	79.3°C/W
M. Multi Layer Theta Jc:	27°C/W

**IV. Die Information**

A. Dimensions:	mils
B. Passivation:	
C. Interconnect:	
D. Backside Metallization:	
E. Minimum Metal Width:	
F. Minimum Metal Spacing:	
G. Bondpad Dimensions:	5 mil. Sq.
H. Isolation Dielectric:	
I. Die Separation Method:	

## 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 biased (static) life test are pending. Using these results, the Failure Rate ( $\lambda$ ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 80 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

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

$$\lambda = 13.4 \times 10^{-9}$$

$$\lambda = 13.4 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

This low failure rate represents data collected from Maxim's reliability monitor program. In addition to routine production Burn-In, Maxim pulls a sample from every fabrication process three times per week and subjects it to an extended Burn-In prior to shipment to ensure its reliability. The reliability control level for each lot to be shipped as standard product is 59 F.I.T. at a 60% confidence level, which equates to 3 failures in an 80 piece sample. Maxim performs failure analysis on any lot that exceeds this reliability control level. Attached Burn-In Schematic (Spec. # 06-5448) shows the static Burn-In circuit. Maxim also performs quarterly 1000 hour life test monitors. This data is published in the Product Reliability Report (RR-1N). Current monitor data for the S4 Process results in a FIT Rate of @ 25C and @ 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 RS81 die type has been found to have all pins able to withstand a HBM transient pulse of +/-800 V per Mil-Std 883 Method 3015.7. Latch-Up testing has shown that this device withstands a current of +/-250 mA.

**Table 1**  
Reliability Evaluation Test Results

**MAX3140EEI+**

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES
<b>Static Life Test</b> (Note 1)				
	Ta = Biased Time = 192 hrs.	DC Parameters & functionality	80	0
<b>Moisture Testing</b> (Note 2)				
85/85	Ta = 85°C RH = 85% Biased Time = 1000hrs.	DC Parameters & functionality		
<b>Mechanical Stress</b> (Note 2)				
Temperature	-65°C/150°C	DC Parameters & functionality		
Cycle	1000 Cycles Method 1010			

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

Note 2: Generic Package/Process data