

RELIABILITY REPORT
FOR
MAX3238xAI
PLASTIC ENCAPSULATED DEVICES

May 8, 2002

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

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Conclusion

The MAX3238 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 MAX3238* true RS-232 transceiver achieves a 1 μ A supply current with Maxim's revolutionary AutoShutdown Plus™ feature. When the device does not sense a valid signal transition on either the receiver or transmitter inputs within 30sec, the on-board power supply and drivers shut down. This occurs if the RS-232 cable is disconnected or if the transmitters of the connected peripheral are inactive. The system turns on again when a valid transition is applied to any RS-232 receiver or transmitter input, saving power without changes to the existing BIOS or operating system.

The MAX3238 5-driver/3-receiver complete serial port is a 3V-powered EIA/TIA-232 and V.28/V.24 communications interface intended for notebook or subnotebook computer applications. A proprietary, high-efficiency, dual charge-pump power supply and a low-dropout transmitter combine to deliver true RS-232 performance from a single +3.0V to +5.5V supply. A guaranteed data rate of 250kbps provides compatibility with popular software for communicating with personal computers. The MAX3238 requires only 0.1 μ F capacitors in 3.3V operation. It is ideal for 3.3V-only systems, mixed 3.3V and 5.0V systems, or 5V-only systems that require true RS-232 performance.

Receiver R1 has an extra, always-active output (in addition to its standard output), which allows external devices, such as a modem, to be monitored without forward biasing the protection diodes in circuitry that may have V_{CC} completely removed.

The MAX3238 is available in a space-saving SSOP package.

B. Absolute Maximum Ratings

<u>Item</u>	<u>Rating</u>
V _{CC}	-0.3V to +6V
V+ (Note 1)	-0.3V to +7V
V- (Note 1)	+0.3V to -7V
V+ + V- (Note 1)	+13V
Input Voltages	
T_IN, /FORCEOFF, FORCEON	-0.3V to +6V
R_IN	±25V
Output Voltages	
T_OUT	±13.2V
R_OUT, /INVALID	0.3V to (V _{CC} + 0.3V)
Short-Circuit Duration	
T_OUT (one at a time)	Continuous
Continuous Power Dissipation (TA = +70°C)	
28-Pin SSOP	762mW
Derate above +70°C	
28-Pin SSOP	9.52mW/°C
Operating Temperature Ranges	
MAX3238CAI	0°C to +70°C
MAX3238EAI	-40°C to +85°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (soldering, 10s)	+300°C

Note 1: V+ and V- can have a maximum magnitude of +7V, but their absolute difference can not exceed +13V.

II. Manufacturing Information

- A. Description/Function: +3.0V to +5.5V, 10nA, 250kbps RS-232 Transceiver with Autoshtutdown Plus
- B. Process: S3 (Standard 3 micron silicon gate CMOS)
- C. Number of Device Transistors: 2110
- D. Fabrication Location: Oregon, USA
- E. Assembly Location: Philippines or Malaysia
- F. Date of Initial Production: September, 1996

III. Packaging Information

- A. Package Type: **28-Pin SSOP**
- B. Lead Frame: Copper
- C. Lead Finish: Solder Plate
- D. Die Attach: Silver-filled Epoxy
- E. Bondwire: Gold (1 mil dia.)
- F. Mold Material: Epoxy with silica filler
- G. Assembly Diagram: # 05-1901-0162
- H. Flammability Rating: Class UL94-V0
- I. Classification of Moisture Sensitivity per JEDEC sandard JESD22-112: Level 1

IV. Die Information

- A. Dimensions: 138 x 150 mils
- B. Passivation: $\text{Si}_3\text{N}_4/\text{SiO}_2$ (Silicon nitride/ Silicon dioxide)
- C. Interconnect: Aluminum/Si (Si = 1%)
- D. Backside Metallization: None
- E. Minimum Metal Width: 3 microns (as drawn)
- F. Minimum Metal Spacing: 3 microns (as drawn)
- G. Bondpad Dimensions: 5 mil. Sq.
- H. Isolation Dielectric: SiO_2
- I. Die Separation Method: Wafer Saw

V. Quality Assurance Information

- A. Quality Assurance Contacts: Jim Pedicord (Reliability Lab Manager)
Bryan Preeshl (Executive Director)
Kenneth Huening (Vice President)
- 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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4389 \times 640 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

▲
Temperature Acceleration factor assuming an activation energy of 0.8eV

$$\lambda = 1.70 \times 10^{-9}$$

$$\lambda = 1.70 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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. # 06-5198) 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-1M**).

B. Moisture Resistance Tests

Maxim pulls pressure pot samples from every assembly process three times per week. Each lot sample must meet an LTPD = 20 or less before shipment as standard product. Additionally, the industry standard 85°C/85%RH testing is done per generic device/package family once a quarter.

C. E.S.D. and Latch-Up Testing

The RS38-1 die type has been found to have all pins able to withstand a transient pulse of $\pm 2500\text{V}$, per Mil-Std-883 Method 3015 (reference attached ESD Test Circuit). Latch-Up testing has shown that this device withstands a current of $\pm 250\text{mA}$.

Table 1
Reliability Evaluation Test Results

MAX3238xAI

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	PACKAGE	SAMPLE SIZE	NUMBER OF FAILURES
Static Life Test (Note 1)					
	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality		80	0
Moisture Testing (Note 2)					
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.	DC Parameters & functionality	SSOP	77	0
85/85	Ta = 85°C RH = 85% Biased Time = 1000hrs.	DC Parameters & functionality		77	0
Mechanical Stress (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

Attachment #1

TABLE II. Pin combination to be tested. 1/ 2/

	Terminal A (Each pin individually connected to terminal A with the other floating)	Terminal B (The common combination of all like-named pins connected to terminal B)
1.	All pins except V_{PS1} 3/	All V_{PS1} pins
2.	All input and output pins	All other input-output pins

1/ Table II is restated in narrative form in 3.4 below.

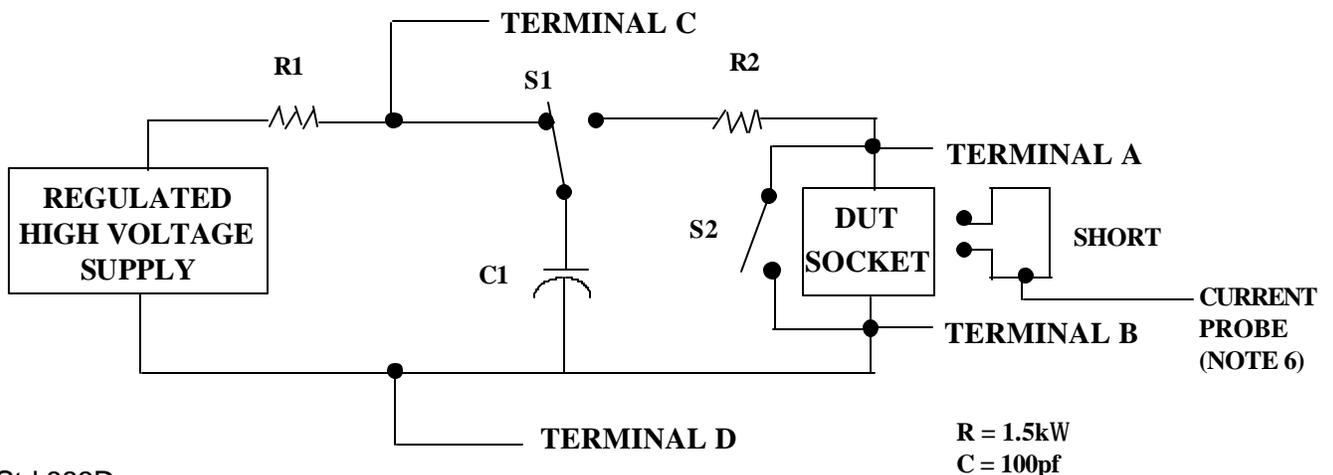
2/ No connects are not to be tested.

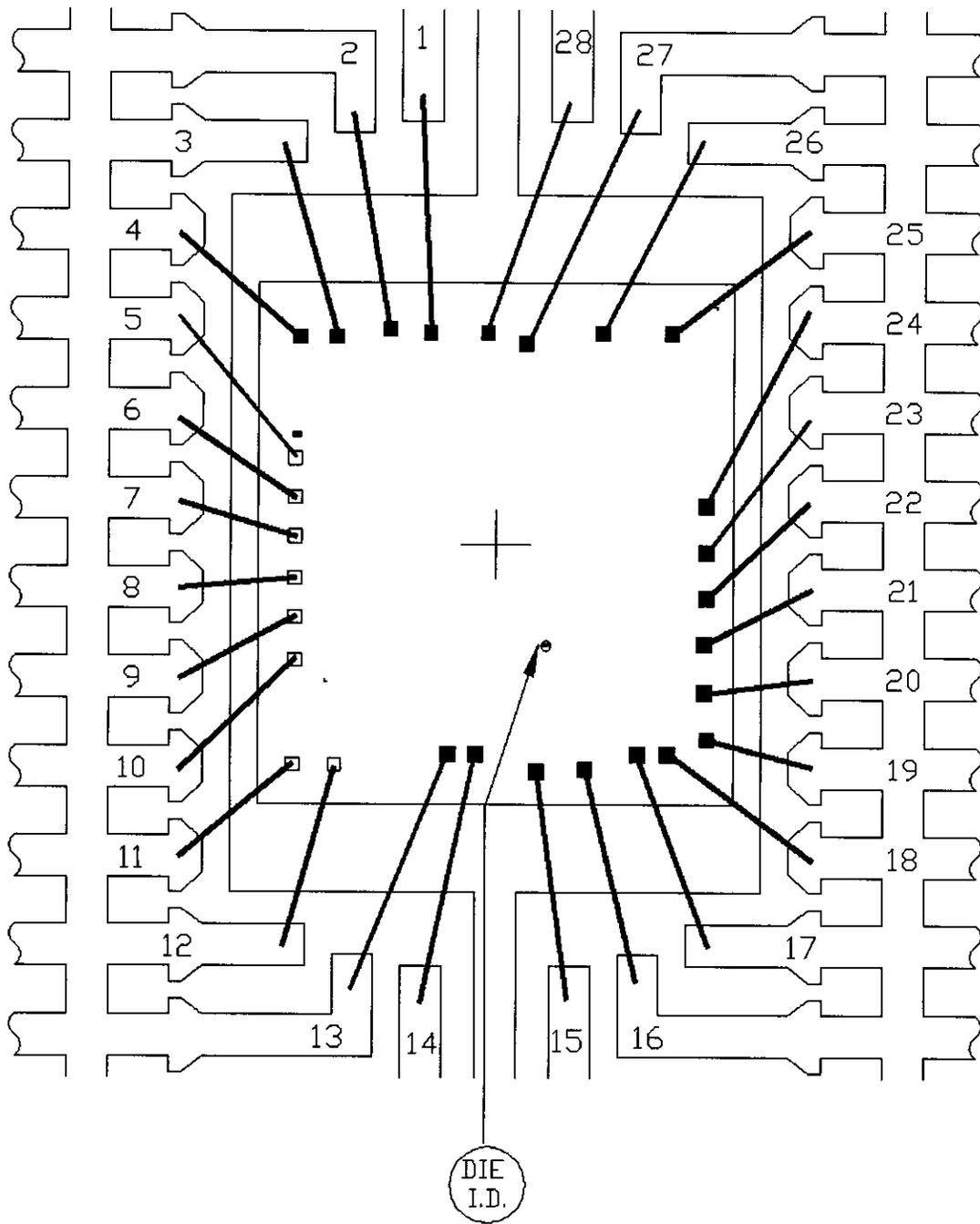
3/ Repeat pin combination I for each named Power supply and for ground

(e.g., where V_{PS1} is V_{DD} , V_{CC} , V_{SS} , V_{BB} , GND, $+V_S$, $-V_S$, V_{REF} , etc).

3.4 Pin combinations to be tested.

- a. Each pin individually connected to terminal A with respect to the device ground pin(s) connected to terminal B. All pins except the one being tested and the ground pin(s) shall be open.
- b. Each pin individually connected to terminal A with respect to each different set of a combination of all named power supply pins (e.g., V_{SS1} , or V_{SS2} or V_{SS3} or V_{CC1} , or V_{CC2}) connected to terminal B. All pins except the one being tested and the power supply pin or set of pins shall be open.
- c. Each input and each output individually connected to terminal A with respect to a combination of all the other input and output pins connected to terminal B. All pins except the input or output pin being tested and the combination of all the other input and output pins shall be open.





PKG.CODE: A28-1

APPROVALS

DATE



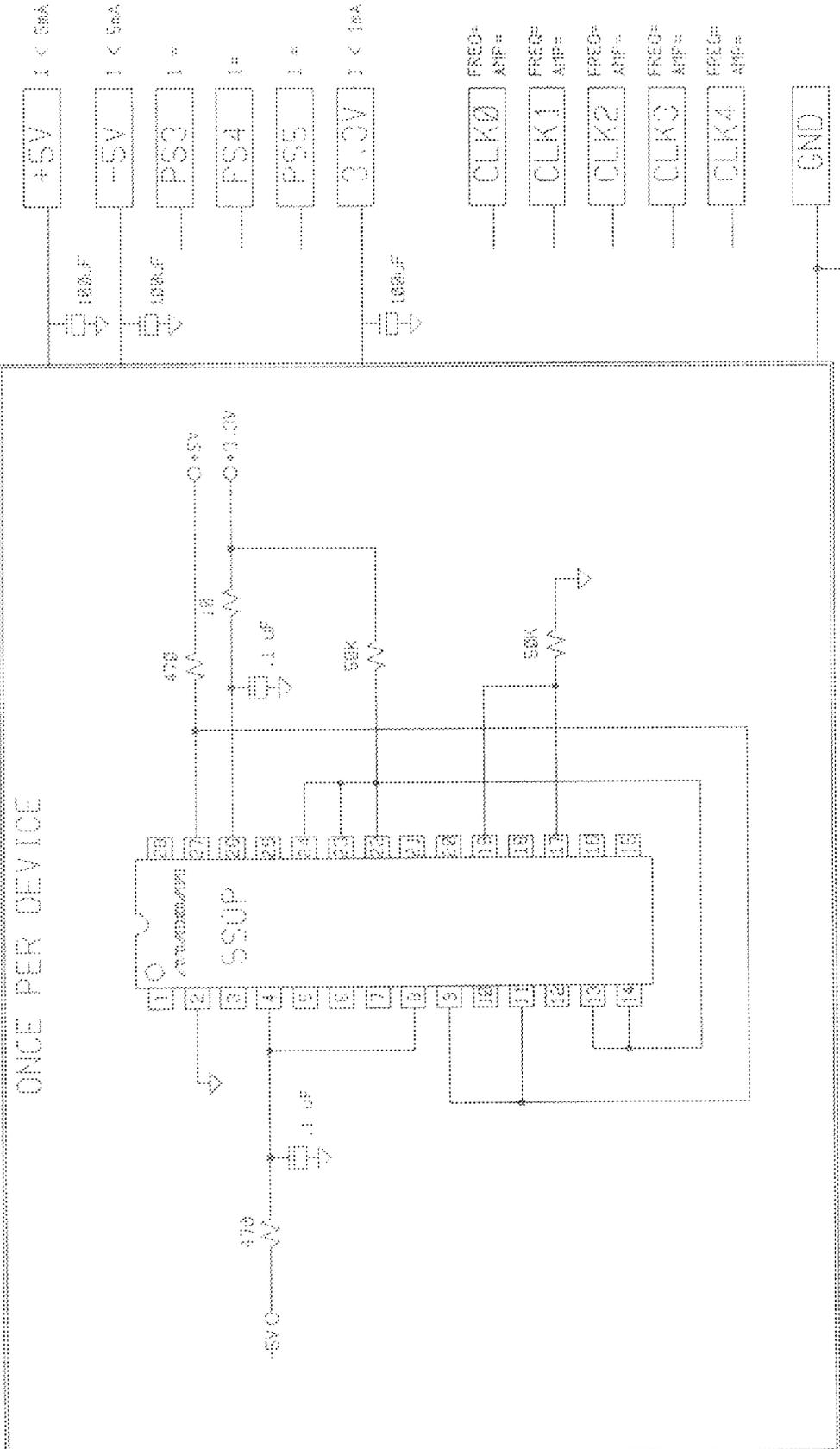
CAV./PAD SIZE:
154X200

PKG.
DESIGN

BUILDSHEET NUMBER: 05-1901-0162	REV.: B
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ONCE PER BOARD

ONCE PER DEVICE



— STEADY STATE LIFE TEST IS PER MIL-STD-883 METHOD 1065.
 — BURN-IN IS PER MIL-STD-883 METHOD 1015, COND. B

MAXIM BURN-IN SCHEMATIC

SPEC. NO. 06-5198 REV. A

NOTES:

1. TEMPERATURE: 125C OF EQUIVALENT
2. TIME: 100 HOURS MIN. OR EQUIVALENT
3. ALL COMPONENTS AND MATERIAL MUST STAND 150C CONTINUOUS
4. APPROVED FOR D33 COMMERCIAL EX 967690

DEVICE TYPE(S):

DATE: 4/29/96

MAX3237 / 3238

DRAWN BY: