RELIABILITY REPORT

FOR

MAX3160xAP

PLASTIC ENCAPSULATED DEVICES

January 8, 2001

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by

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Conclusion

The MAX3160 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

A. General

The MAX3160 is a programmable RS-232/RS-485/422 multiprotocol transceiver. The MAX3160 ia pin programmable as a 2TX/2RX RS-232 interface or a single RS-485/422 transceiver.

The device incorporate a proprietary low-dropout transmitter output stage and an on-board dual charge pump to allow RS-232 and RS-485/422 compliant performance from a +3V to +5.5V supply. The receiver feature true fail-safe circuitry that guarantees a logic-high receiver output when the receiver inputs are open or shorted. This devices also feature pin-selectable transmitter slew rates for both RS-232 and RS-485/422 modes. Slew-rate limiting minimizes EMI and reduces reflections caused by improperly terminated cables, allowing error-free data transmission up to 250kbps. Disabling slew-rate limiting allows these devices to transmit at data rates up to 10Mbps in RS-485/422 mode and up to 1Mbps in RS-232 mode. The MAX3160 features a 1µA shutdown mode, and short-circuit limiting and thermal shutdown circuitry to protect against excessive power dissipation.

The MAX3160 offers a flow-through pinout that facilitates board layout. The MAX3160 is available in tiny SSOP packages and operates over the commercial and extended temperature ranges.

B. Absolute Maximum Ratings

Item	Rating
V_{CC} to GND	-0.3V to +6V
V+ to GND	-0.3V to +7V
V- to GND	+0.3V to -7V
V+ + |V-| (Note 1)	+13V
Input Voltages (T1IN, T2IN, DI, DE485, /RE485, TE232, /RE232, /SHDN, FAST, HDPLX, RS485/RS232 to GND)	-0.3V to +6V
Input Voltages (A,B,R1IN, R2IN to GND)	±25V
Output Voltages (T1OUT, T2OUT, Y, Z to GND)	±13.2V
Output Voltage (R2OUT, R1OUT, RO to GND)	-0.3V to (V_{CC} + 0.3V)
Short-Circuit Duration (T1OUT, T2OUT, Y, Z)	Continuous
Storage Temp.	-65°C to +150°C
Lead Temp. (10 sec.)	+300°C
Power Dissipation	
20-Pin SSOP	728mW
Derates above +70°C	
20-Pin SSOP	9.1mW/°C

II. Manufacturing Information

A. Description/Function:	+3.0 to +5.5V, 1uA RS-232/RS-485/422 Multiprotocol Transceiver
B. Process:	S3 (Standard 3 micron silicon gate CMOS)
C. Number of Device Transistors:	1580
D. Fabrication Location:	California or Oregon, USA
E. Assembly Location:	Philippines or Malaysia
F. Date of Initial Production:	September, 2000

III. Packaging Information

A. Package Type:	**20-Lead SSOP**
B. Lead Frame:	Copper
C. Lead Finish:	Solder Plate
D. Die Attach:	Silver-filled Epoxy
E. Bondwire:	Gold (1.0 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	# 05-1901-0212
H. Flammability Rating:	Class UL94-V0

I. Classification of Moisture Sensitivity per JEDEC standard JESD22-A112: Level 1

IV. Die Information

A. Dimensions:	135 x 159 mils
B. Passivation:	Si_3N_4/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:

$$\lambda = \frac{1}{MTTF} = \frac{1.83}{192 \times 4389 \times 160 \times 2}$$

(Chi square value for MTTF upper limit)

Temperature Acceleration factor assuming an activation energy of 0.8eV

$\lambda = 6.79 \times 10^{-9}$

$\lambda = 6.79$ 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. # 06-5455) 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 RS45 die type has been found to have all pins able to withstand a transient pulse of ± 2500V, per Mil-Std-883 Method 3015 (reference attached ESD Test Circuit). Latch-Up testing has shown that this device withstands a current of ±250mA and/or ±20V.

Table 1
Reliability Evaluation Test Results

MAX3160xAP

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		160	0
Moisture Testing (Note 2)					
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 96hrs.	DC Parameters & functionality	SSOP	340	1
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		77	0

Note 1: Life Test Data may represent plastic D.I.P. 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

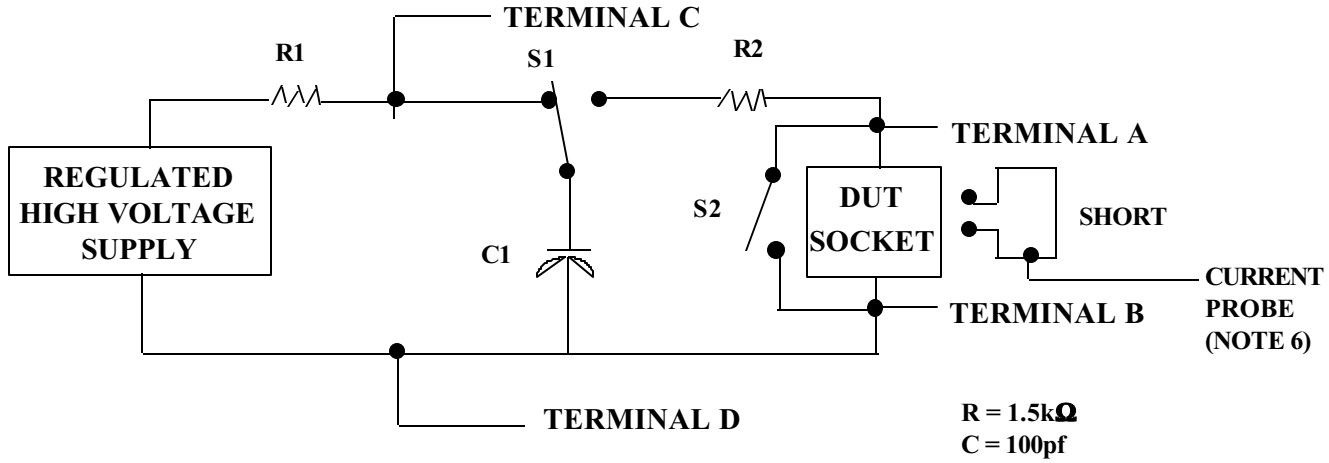
1/ Table II is restated in narrative form in 3.4 below.
2/ No connects are not to be tested.
3/ Repeat pin combination I for each named Power supply and for ground (e.g., where V_{PS1} is V_{DD}, V_{CC}, V_{SS}, V_{BB}, GND, $+V_S$, $-V_S$, V_{REF}, etc).

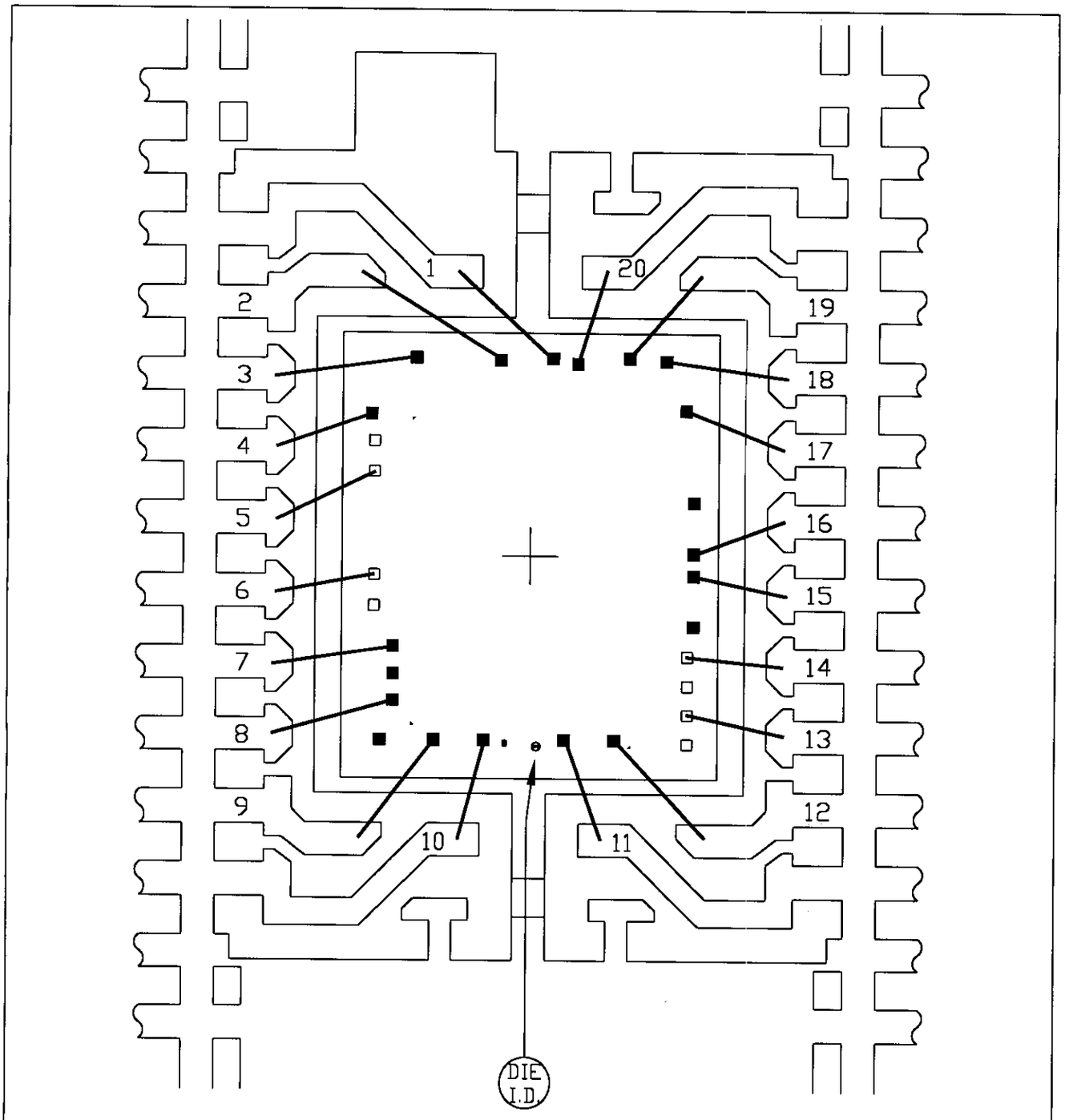
3.4 Pin combinations to be tested.

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.

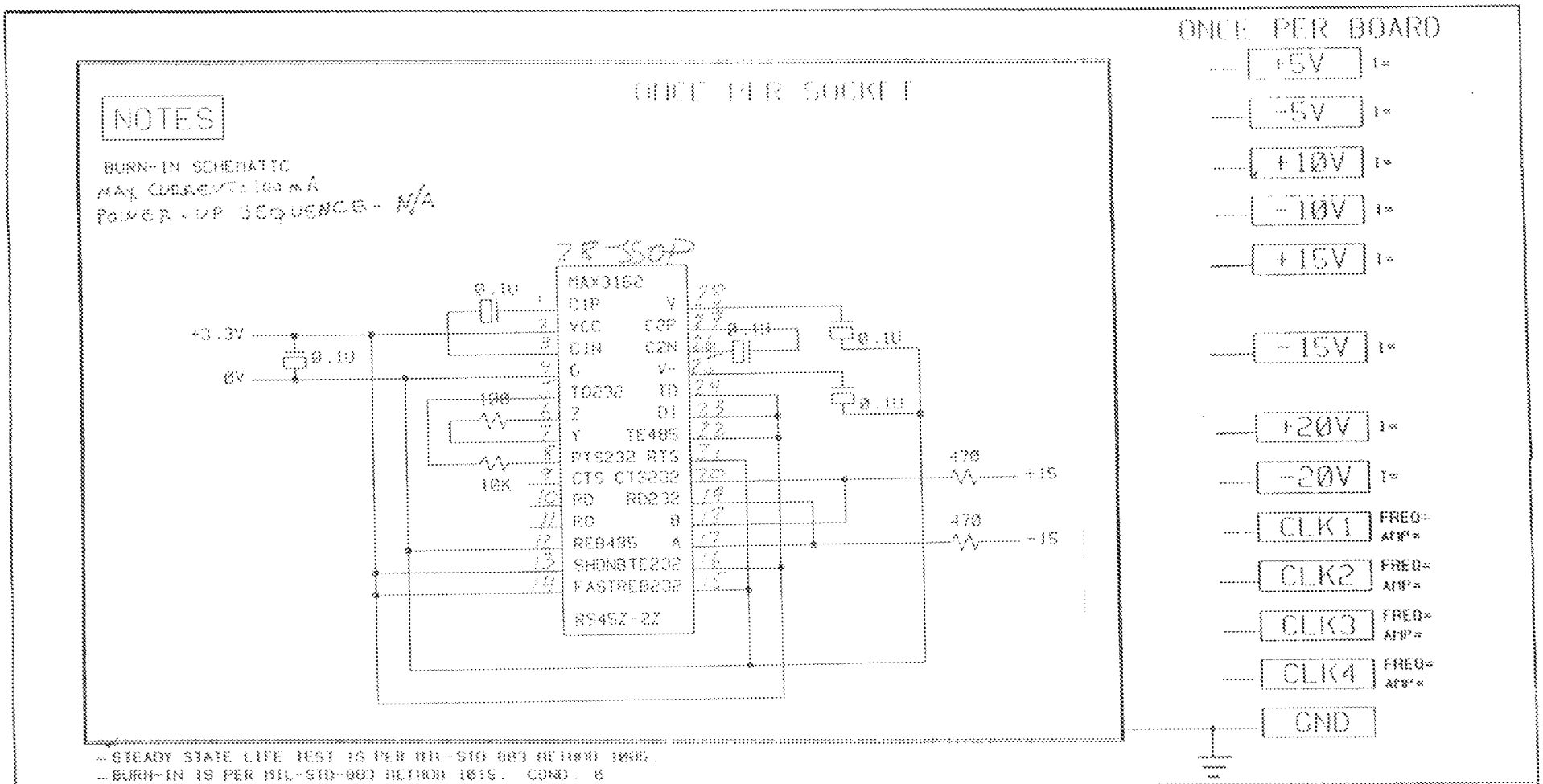
b. Each pin individually connected to terminal A with respect to each different set of a combination of all named power supply pins (e.g., V_{SS1}, or V_{SS2} or V_{SS3} or V_{CC1}, or V_{CC2}) connected to terminal B. All pins except the one being tested and the power supply pin or set of pins shall 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: A20-1		SIGNATURES	DATE	MAXIM CONFIDENTIAL & PROPRIETARY	
CAV./PAD SIZE: 154X169	PKG.		1/19/00	BOND DIAGRAM #: 05-1901-0212	REV: B
	DESIGN	EB	1/20/00		



NOTES:

1. TEMPERATURE: 125C OR EQUIVALENT
2. TIME: 168 HOURS MIN. OR EQUIVALENT
3. ALL COMPONENTS AND MATERIAL MUST STAND 150C CONTINUOUS
4. APPROVED FOR (x) COMMERCIAL
   (x) MR/883

SPEC. 06-5455 REV.

DATE: 5/13/99

DRAWN BY:

MAXIM BURN-IN SCHEMATIC

DEVICE TYPE: MAX3160/61/62 (RS45)