

RELIABILITY REPORT  
FOR  
**MAX9121ExE**  
PLASTIC ENCAPSULATED DEVICES

March 5, 2003

**MAXIM INTEGRATED PRODUCTS**

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by



Jim Pedicord  
Quality Assurance  
Reliability Lab Manager

Reviewed by



Bryan J. Preeshl  
Quality Assurance  
Executive Director

## Conclusion

The MAX9121 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	V. ....Quality Assurance Information
II. ....Manufacturing Information	VI. ....Reliability Evaluation
III. ....Packaging Information	IV. ....Die Information
	.....Attachments

### I. Device Description

#### A. General

The MAX9121 quad low-voltage differential signaling (LVDS) differential line receiver is ideal for applications requiring high data rates, low power, and low noise. The MAX9121 is guaranteed to receive data at speeds up to 500Mbps (250MHz) over controlled-impedance media of approximately 100Ω. The transmission media may be printed circuit (PC) board traces or cables.

The MAX9121 accepts four LVDS differential inputs and translate them to LVCMOS outputs. The MAX9121 inputs are high impedance and require an external termination resistor when used in a point-to-point connection.

The device supports a wide common-mode input range of 0.05V to 2.35V, allowing for ground potential differences and common-mode noise between the driver and the receiver. A fail-safe feature sets the output high when the inputs are open, or when the inputs are undriven and shorted or parallel terminated. The EN and EN-bar inputs control the high-impedance output. The enables are common to all four receivers. Inputs conform to the ANSI TIA/EIA-644 LVDS standard. Flow-through pinout simplifies PC board layout and reduces crosstalk by separating the LVDS inputs and LVCMOS outputs. The MAX9121 operates from a single +3.3V supply, and is specified for operation from -40°C to +85°C. The device is available in a 16-pin TSSOP and SO packages

#### B. Absolute Maximum Ratings

<u>Item</u>	<u>Rating</u>
VCC to GND	-0.3V to +4.0V
IN_+, IN_- to GND	-0.3V to +4.0V
EN, EN to GND	-0.3V to (VCC + 0.3V)
OUT_ to GND	-0.3V to (VCC + 0.3V)
Storage Temperature Range	-65°C to +150°C
Maximum Junction Temperature	+150°C
Operating Temperature Range	-40°C to +85°C
Lead Temperature (soldering, 10s)	+300°C
ESD Protection (Human Body Model, IN_+, IN_-)	±8kV
Continuous Power Dissipation (TA = +70°C)	
16-Pin TSSOP	755mW
16-Pin SO	696mW
Derates above +70°C	
16-Pin TSSOP	9.4mW/°C
16-Pin SO	8.7mW/°C

## II. Manufacturing Information

A. Description/Function:	Quad LVDS Line Receivers with Integrated Termination and Flow-Through Pinout
B. Process:	TC35
C. Number of Device Transistors:	1354
D. Fabrication Location:	Taiwan
E. Assembly Location:	Philippines, Malaysia or Thailand
F. Date of Initial Production:	January, 2001

## III. Packaging Information

A. Package Type:	<b>16-Pin TSSOP</b>	<b>16-Pin SO</b>
B. Lead Frame:	Copper	Copper
C. Lead Finish:	Solder Plate	Solder Plate
D. Die Attach:	Silver-filled Epoxy	Silver-filled Epoxy
E. Bondwire:	Gold (1 mil dia.)	Gold (1 mil dia.)
F. Mold Material:	Epoxy with silica filler	Epoxy with silica filler
G. Assembly Diagram:	# 05-2801-0011	# 05-2801-0012
H. Flammability Rating:	Class UL94-V0	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard JESD22-112:	Level 1	Level 1

## IV. Die Information

A. Dimensions:	45 x 61 mils
B. Passivation:	Si <sub>3</sub> N <sub>4</sub> /SiO <sub>2</sub> (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Aluminum/Si (Si = 1%)
D. Backside Metallization:	None
E. Minimum Metal Width:	Metal1 = 0.5 / Metal2 = 0.6 / Metal3 = 0.6 microns (as drawn)
F. Minimum Metal Spacing:	Metal1 = 0.45 / Metal2 = 0.5 / Metal3 = 0.6 microns (as drawn)
G. Bondpad Dimensions:	5 mil. Sq.
H. Isolation Dielectric:	SiO <sub>2</sub>
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 ( $\lambda$ ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4389 \times 80 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

▲  
Temperature Acceleration factor assuming an activation energy of 0.8eV

$$\lambda = 13.57 \times 10^{-9}$$

$$\lambda = 13.57 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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. # 06-5705) 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 HS08 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

**MAX9121ExE**

<b>TEST ITEM</b>	<b>TEST CONDITION</b>	<b>FAILURE IDENTIFICATION</b>	<b>PACKAGE</b>	<b>SAMPLE SIZE</b>	<b>NUMBER OF FAILURES</b>
<b>Static Life Test</b> (Note 1)					
	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality		80	0
<b>Moisture Testing</b> (Note 2)					
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.	DC Parameters & functionality	TSSOP SO	77 77	0 0
85/85	Ta = 85°C RH = 85% Biased Time = 1000hrs.	DC Parameters & functionality		77	0
<b>Mechanical Stress</b> (Note 2)					
Temperature Cycle	-65°C/150°C 1000 Cycles Method 1010	DC Parameters		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.

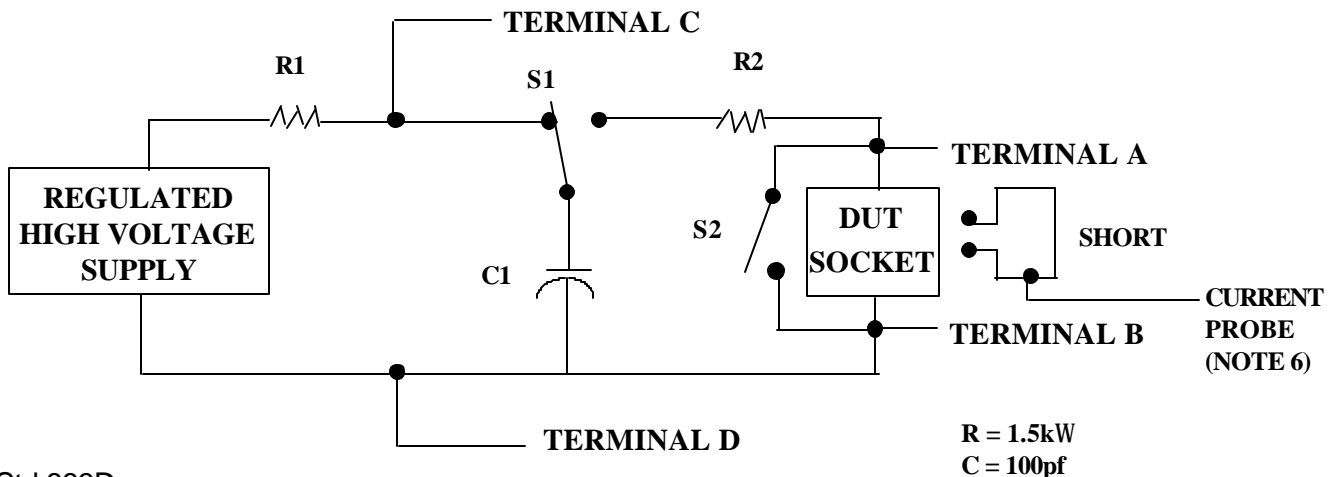
2/ No connects are not to be tested.

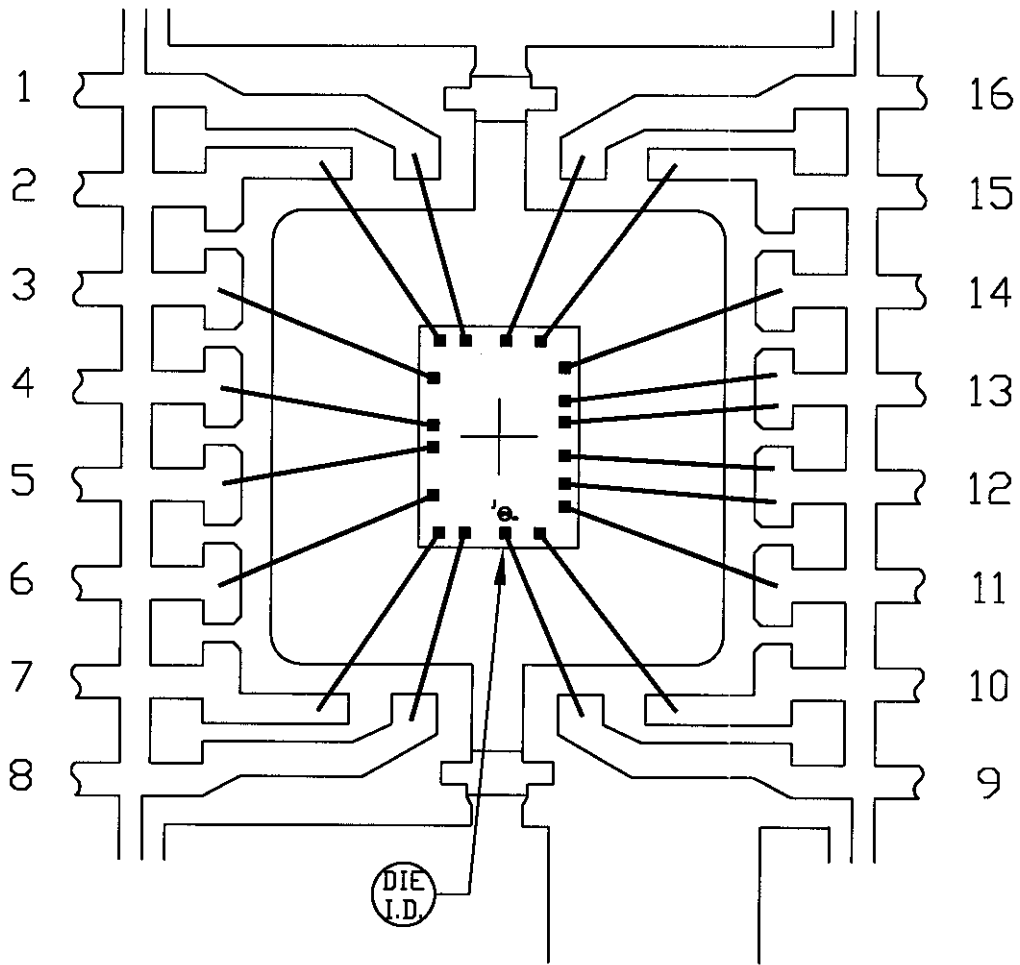
3/ Repeat pin combination 1 for each named Power supply and for ground

(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.





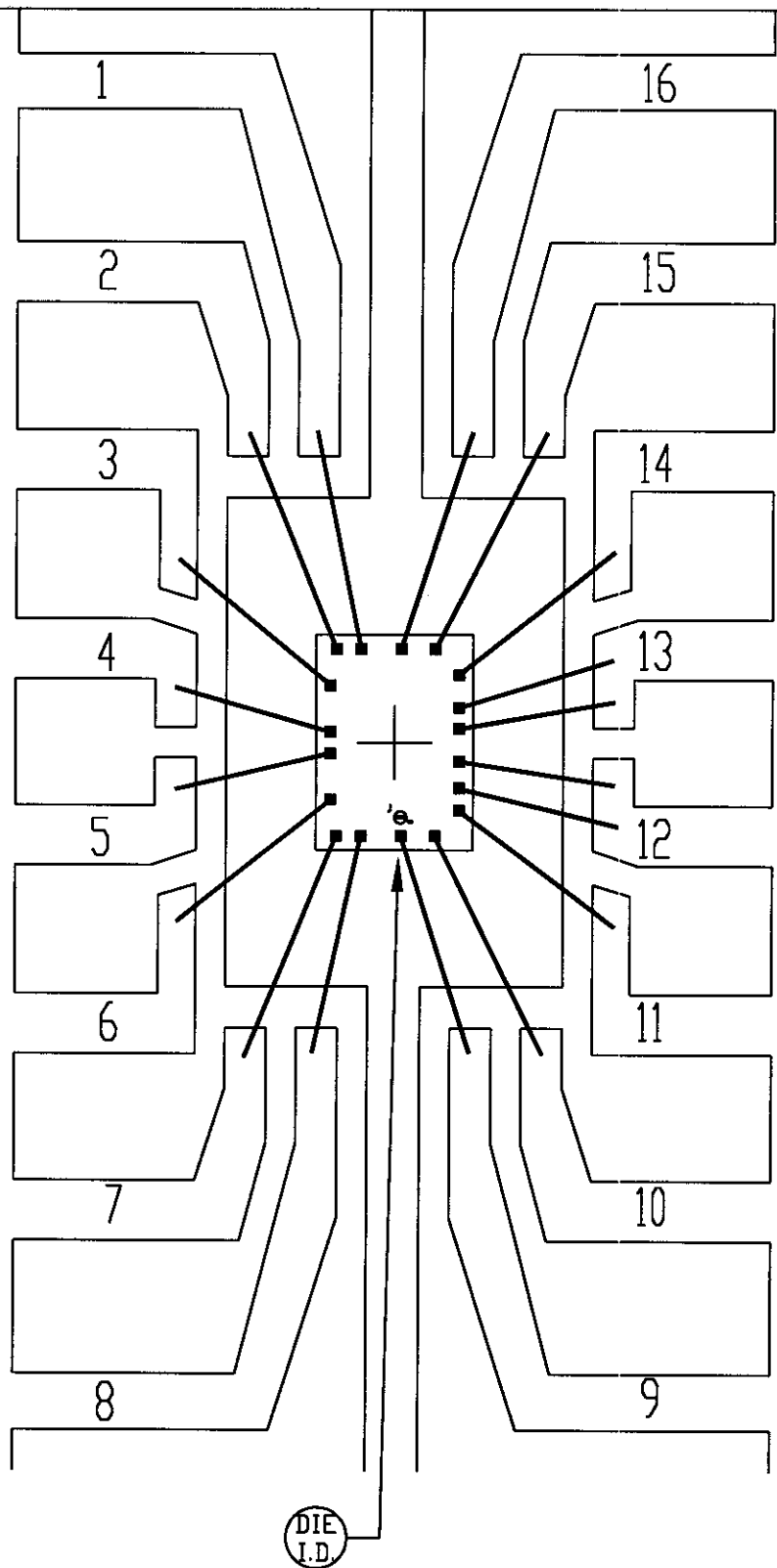
PKG. CODE: U16-2	
CAV./PAD SIZE: 118X118	PKG. DESIGN

SIGNATURES

DATE

**MAXIM**  
CONFIDENTIAL & PROPRIETARY

BOND DIAGRAM #: 05-2801-0011	REV: A
---------------------------------	-----------



PKG. CODE: S16-2

CAV./PAD SIZE: 90 X 130

SIGNATURES

PKG. DESIGN

DATE

9/29/00  
10/02/00

**MAXIM**  
CONFIDENTIAL & PROPRIETARY

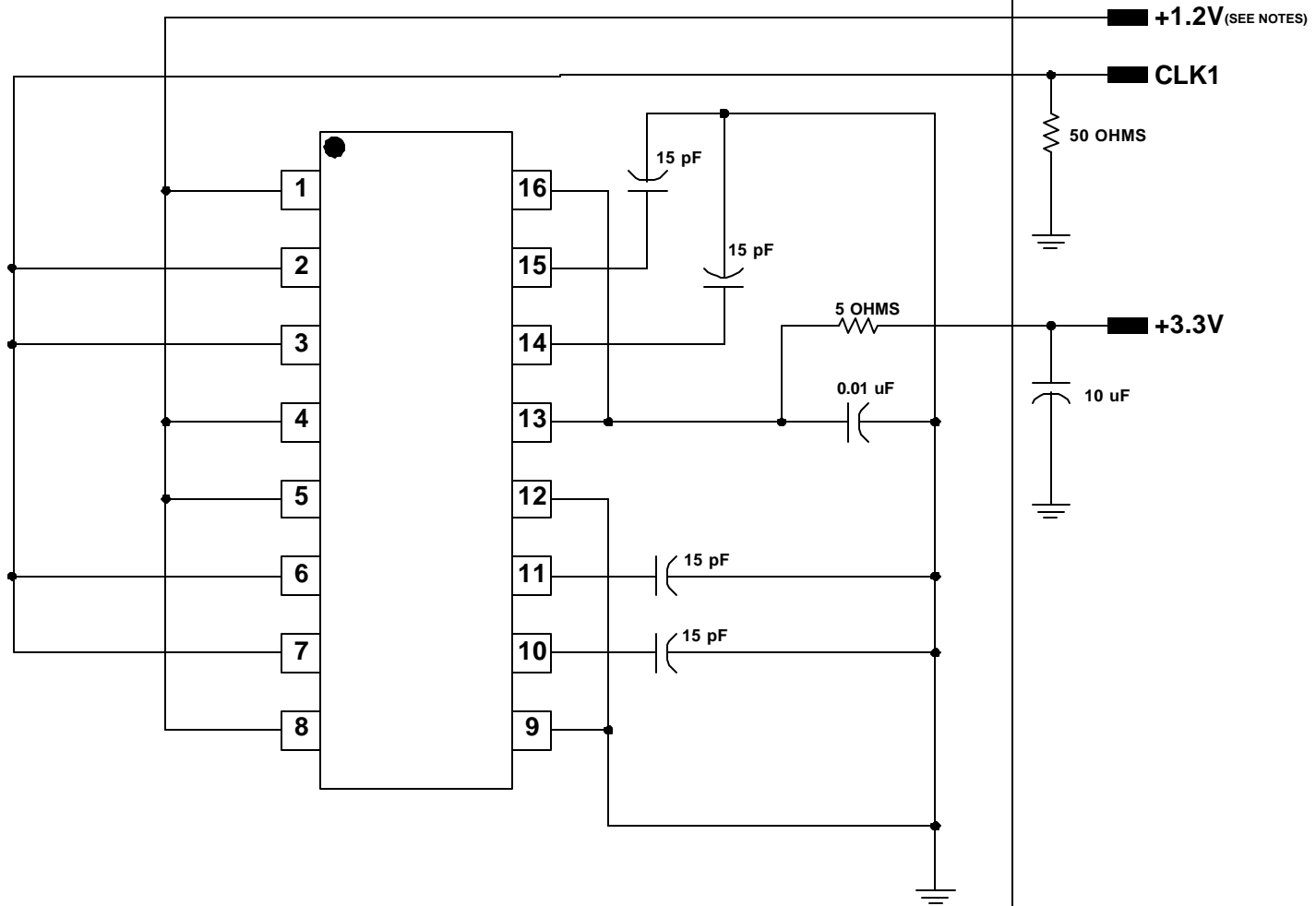
BOND DIAGRAM #: 05-2801-0012

REV: A



ONCE PER SOCKET

ONCE PER BOARD



**DEVICES: MAX 9121/9122/9173/9179**  
**PACKAGE: 16 - NSO**  
**Max current = 15mA (MAX9121/9122), 18mA (MAX9173)**

**DRAWN BY: HAK/TEK TAN**  
**NOTES: No current expected for 1.2V supply, set Bench**  
**Check limited at 1mA. CLK1 = 100 KHz (1.0 To 1.4V).**