

RELIABILITY REPORT
FOR
MAX3222xxx
PLASTIC ENCAPSULATED DEVICES

August 21, 2001

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by



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Conclusion

The MAX3222 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 InformationAttachments

I. Device Description

A. General

The MAX3222 transceiver has 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 device requires only four small 0.1 μ F external charge-pump capacitors. The MAX3222 is guaranteed to run at data rates of 120kbps while maintaining RS-232 output levels.

The MAX3222 has 2 receivers and 2 drivers. The MAX3222 features a 1 μ A shutdown mode that reduces power consumption and extends battery life in portable systems. Its receivers remain active in shutdown mode, allowing external devices such as modems to be monitored using only 1 μ A supply current.

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} , /SHDN, /EN	-0.3V to +6V
MBAUD	-0.3V to (V _{CC} + 0.3V)
R _{IN}	\pm 25V
Output Voltages	
T _{OUT}	\pm 13.2V
R _{OUT}	-0.3V to (V _{CC} + 0.3V)
Short-Circuit Duration	
T _{OUT}	Continuous
Storage Temp.	-65°C to +150°C
Lead Temp. (10 sec.)	+300°C
Power Dissipation	
20 Lead SSOP	640mW
20 Lead TSSOP	559mW
18 Lead SO	762mW
18 Lead PDIP	889mW
Derates above +70°C	
20 Lead SSOP	8.00mW/°C
20 Lead TSSOP	7.0mW/°C
18 Lead SO	9.52mW/°C
18 Lead PDIP	11.11mW/°C

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

II. Manufacturing Information

- A. Description/Function: 3.0V to 5.5V, Low-Power, up to 1Mbps, True RS-232 Transceiver Using Four 0.1 μ F External Capacitors
- B. Process: S3 (Standard 3 micron silicon gate CMOS)
- C. Number of Device Transistors: 339
- D. Fabrication Location: California or Oregon, USA
- E. Assembly Location: Philippines, Malaysia, or Korea
- F. Date of Initial Production: January, 1998

III. Packaging Information

- | | | | | |
|---|--------------------------|--------------------------|--------------------------|------------------------|
| A. Package Type: | 20 Lead SSOP | 20 Lead TSSOP | 18 Lead SO | 18 Lead PDIP |
| B. Lead Frame: | Copper | Copper | Copper | Copper |
| C. Lead Finish: | Solder Plate | Solder Plate | Solder Plate | Solder Plate |
| D. Die Attach: | Silver-filled Epoxy | Silver-filled Epoxy | Silver-filled Epoxy | Silver-filled Epoxy |
| E. Bondwire: | Gold (1.3 mil dia.) | Gold (1.3 mil dia.) | Gold (1.3 mil dia.) | Gold (1.3 mil dia.) |
| F. Mold Material: | Epoxy with silica filler | Epoxy with silica filler | Epoxy with silica filler | Epoxy w/ silica filler |
| G. Assembly Diagram: | 05-1901-0243 | # 05-1901-0251 | # 05-1901-0256 | # 05-1901-0247 |
| H. Flammability Rating: | Class UL94-V0 | Class UL94-V0 | Class UL94-V0 | Class UL94-V0 |
| I. Classification of Moisture Sensitivity per JEDEC standard JESD22-A112: | Level 1 | | | |

IV. Die Information

- A. Dimensions: 87x127 mils
- B. Passivation: Si₃N₄/SiO₂ (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: SiO₂
- 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: < 100 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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4389 \times 558 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

 Temperature Acceleration factor assuming an activation energy of 0.8eV

$$\lambda = 1.94 \times 10^{-9}$$

$$\lambda = 1.94 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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. # 06-5055) 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-1L**).

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 RS21 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 $\pm 100\text{mA}$ and/or $\pm 20\text{V}$.

Table 1
Reliability Evaluation Test Results
MAX3222xxx

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	
Static Life Test (Note 1)					
	Ta = 135°C Biased Time = 192 hrs.	DC Parameters & functionality	558	0	
Moisture Testing					
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 96hrs.	DC Parameters & functionality	SSOP	340	1
			TSSOP	97	0
			SO	77	0
			DIP	77	0
85/85	Ta = 85°C RH = 85% Biased Time = 1000hrs.	DC Parameters & functionality	77	0	
Mechanical Stress					
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 for the Small Outline package.

Note 2: Generic process/package 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

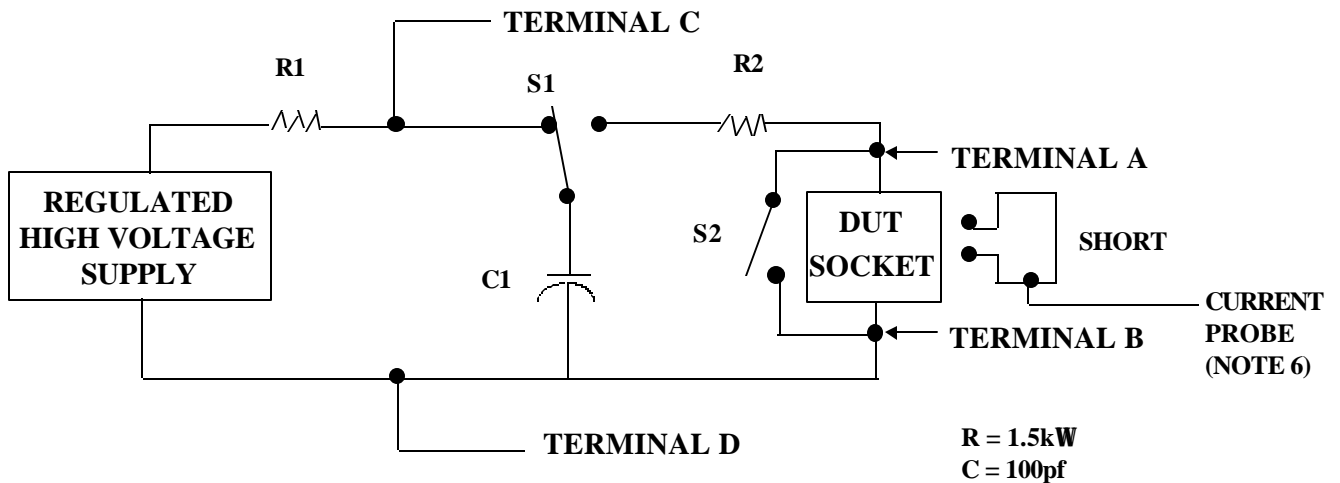
1/ Table II is restated in narrative form in 3.4 below.

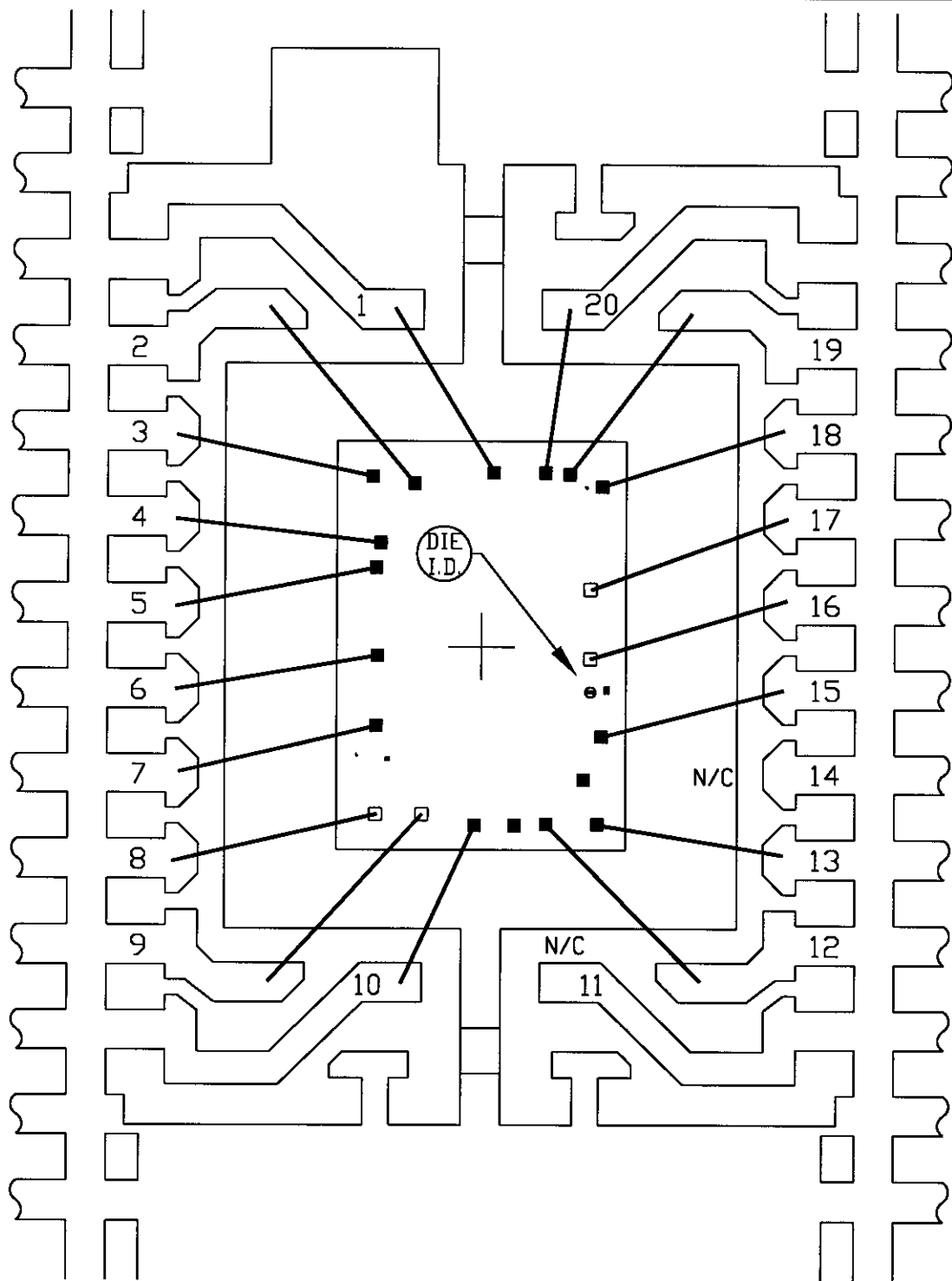
2/ No connects are not to be tested.

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	
CAV./PAD SIZE: 154X169	PKG. DESIGN

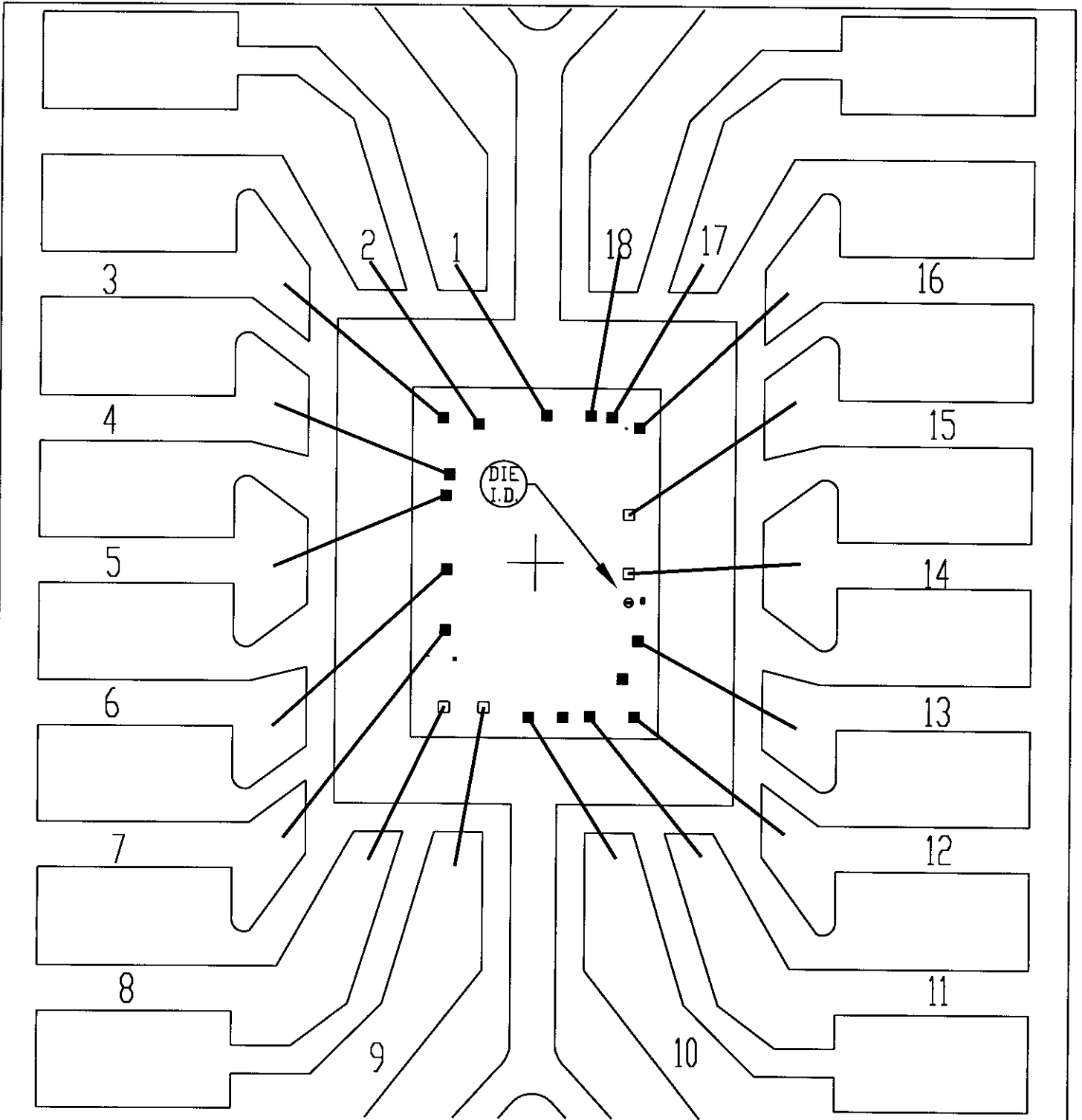
SIGNATURES

DATE

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BOND DIAGRAM #:
05-1901-0243

REV:
A

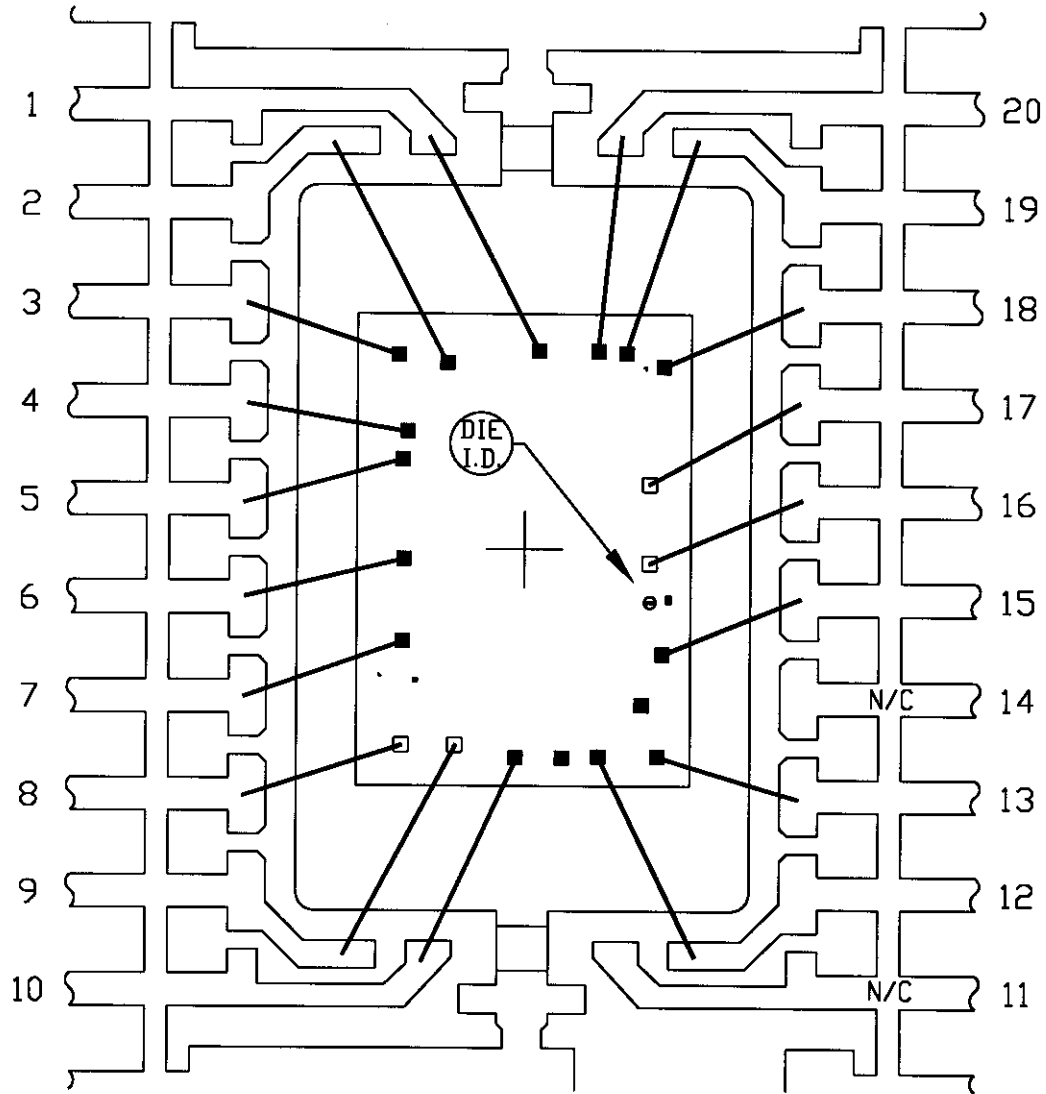


PKG. CODE:	W18-1	
CAV./PAD SIZE:	140 X 170	PKG. DESIGN

SIGNATURES

DATE

 CONFIDENTIAL & PROPRIETARY	
BOND DIAGRAM #:	REV:
05-1901-0256	A



PKG. CODE: U20-2

CAV./PAD SIZE:
118X189

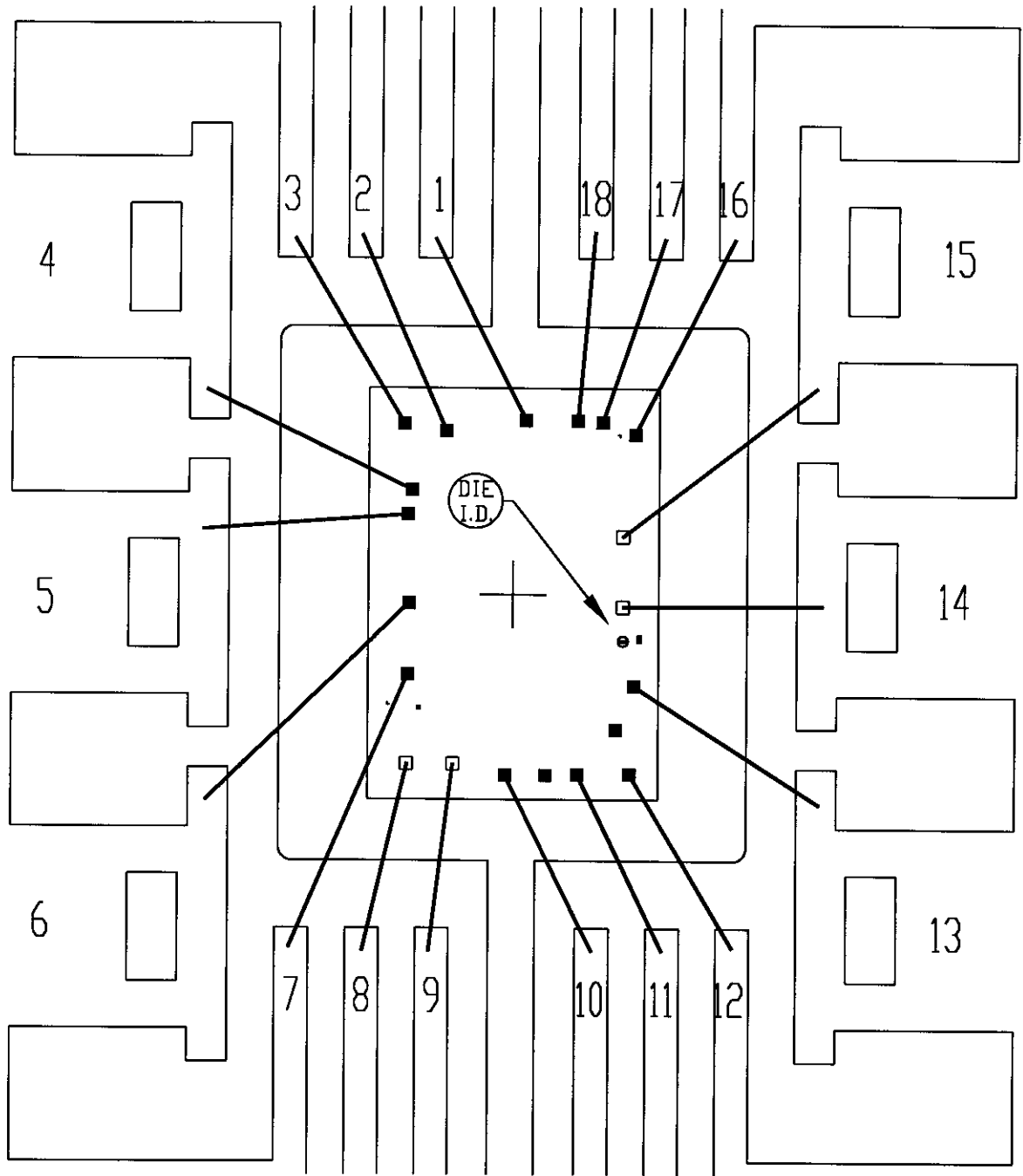
SIGNATURES

DATE

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BOND DIAGRAM #:
05-1901-0251

REV:
A



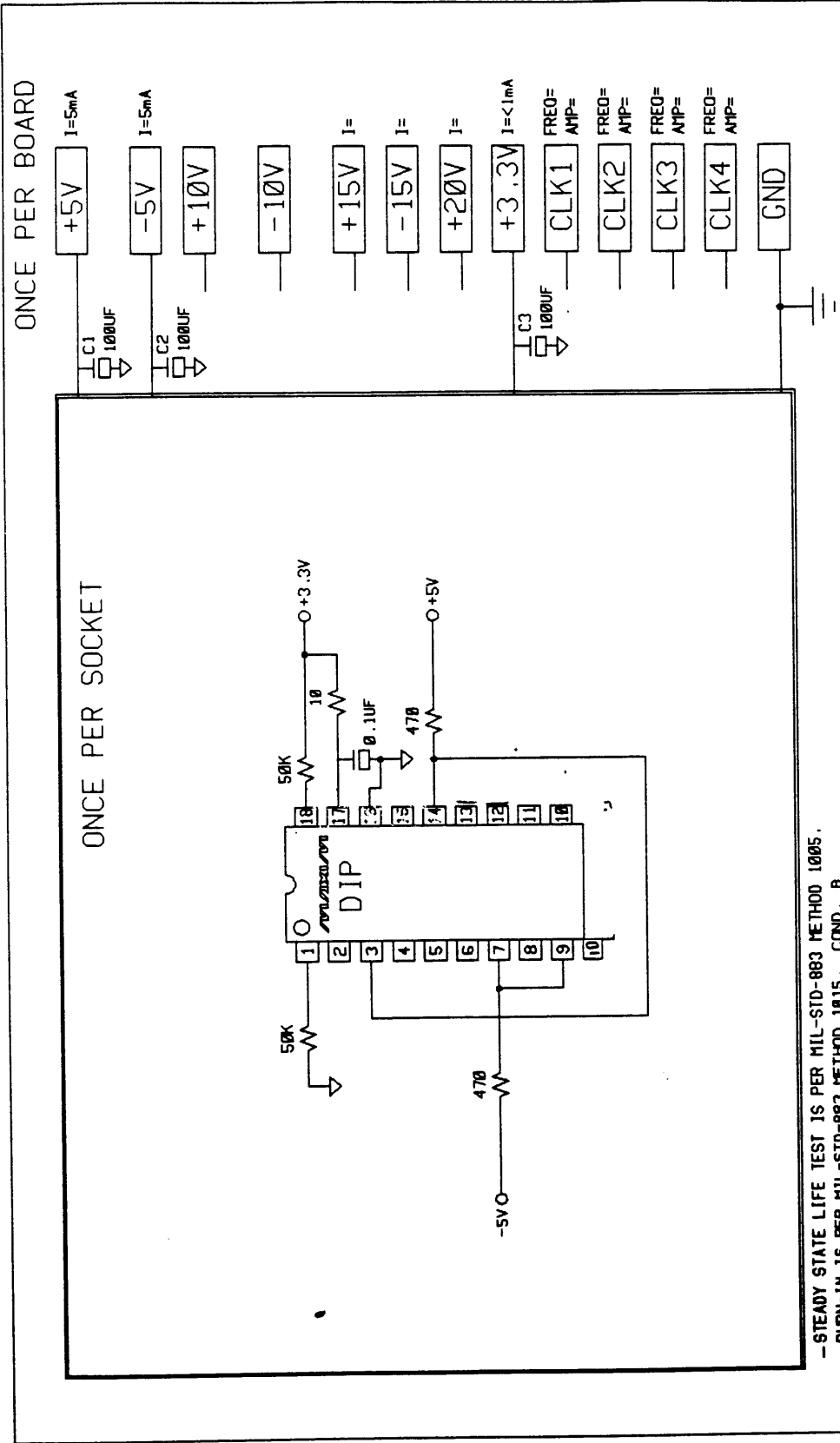
PKG. CODE: P18-5	
CAV./PAD SIZE: 140 X 160	PKG. DESIGN

SIGNATURES

DATE

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BOND DIAGRAM #: 05-1901-0247	REV: A
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—STEADY STATE LIFE TEST IS PER MIL-STD-883 METHOD 1005.
 —BURN-IN IS PER MIL-STD-883 METHOD 1015. COND. B

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/880

SPEC. NO. 06-5055 REV. C

DATE: 11/11/99

DRAWN BY:

MAXIM BURN-IN SCHEMATIC

DEVICE TYPE:

MAX3222/E
 MAX 3317E