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

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 0.1µF 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 1µA 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 1µA supply current.

B. Absolute Maximum Ratings

Item	Rating
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	±25V
Output Voltages	
T_OUT	±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 0.1µF 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: 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: < 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:

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

(192 × 4389: Temperature Acceleration factor assuming an activation energy of 0.8eV)

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

$\lambda = 1.94$ 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 ± 2500V, per Mil-Std-883 Method 3015 (reference attached ESD Test Circuit). Latch-Up testing has shown that this device withstands a current of ±100mA and/or ±20V.

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 TSSOP SO DIP	340 97 77 77	1 0 0 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

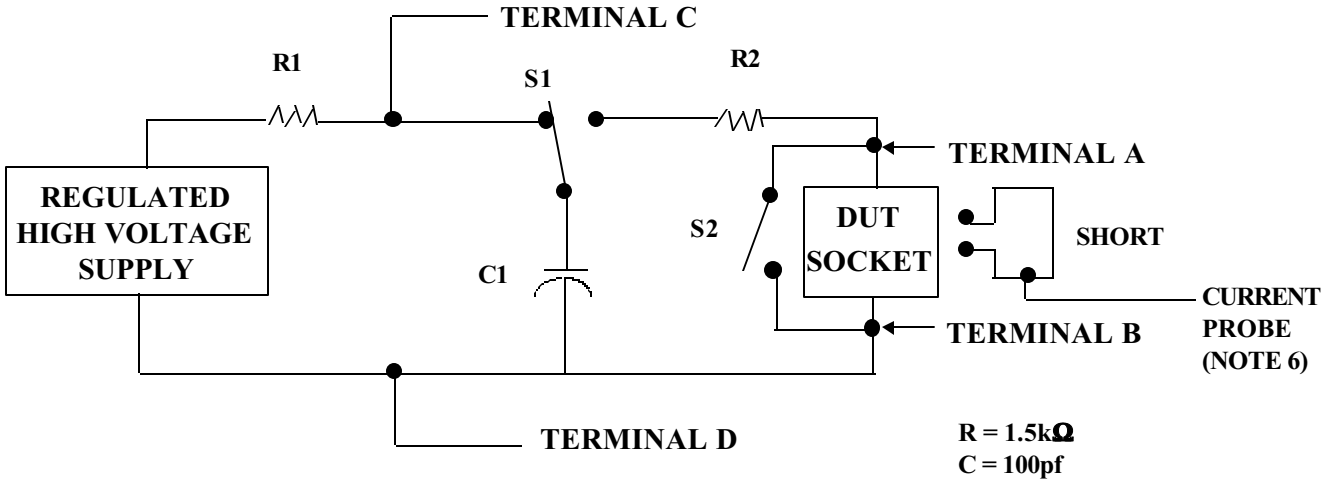
1/ Table II is restated in narrative form in 3.4 below.
2/ No connects are not to be tested.
3/ Repeat pin combination I for each named Power supply and for ground (e.g., where V_{PS1} is V_{DD}, V_{CC}, V_{SS}, V_{BB}, GND, $+V_S$, $-V_S$, V_{REF}, etc).

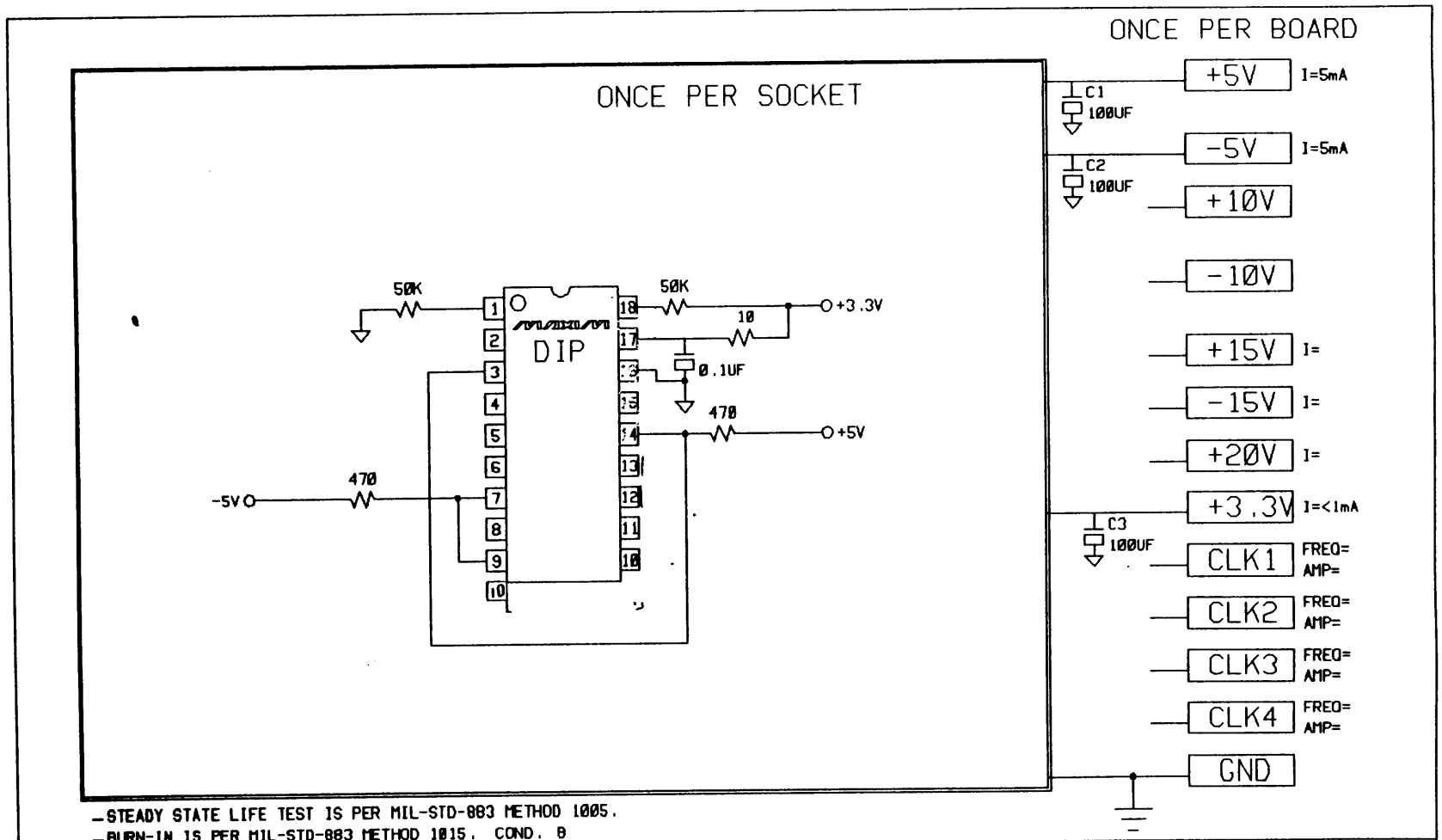
3.4 Pin combinations to be tested.

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.





-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: 160 HOURS MIN. OR EQUIVALENT
3. ALL COMPONENTS AND MATERIAL MUST STAND 150C CONTINUOUS
4. APPROVED FOR (X) COMMERCIAL
   (X) MR/883

SPEC. NO. 06-5055 REV. C

DATE: 11/11/99

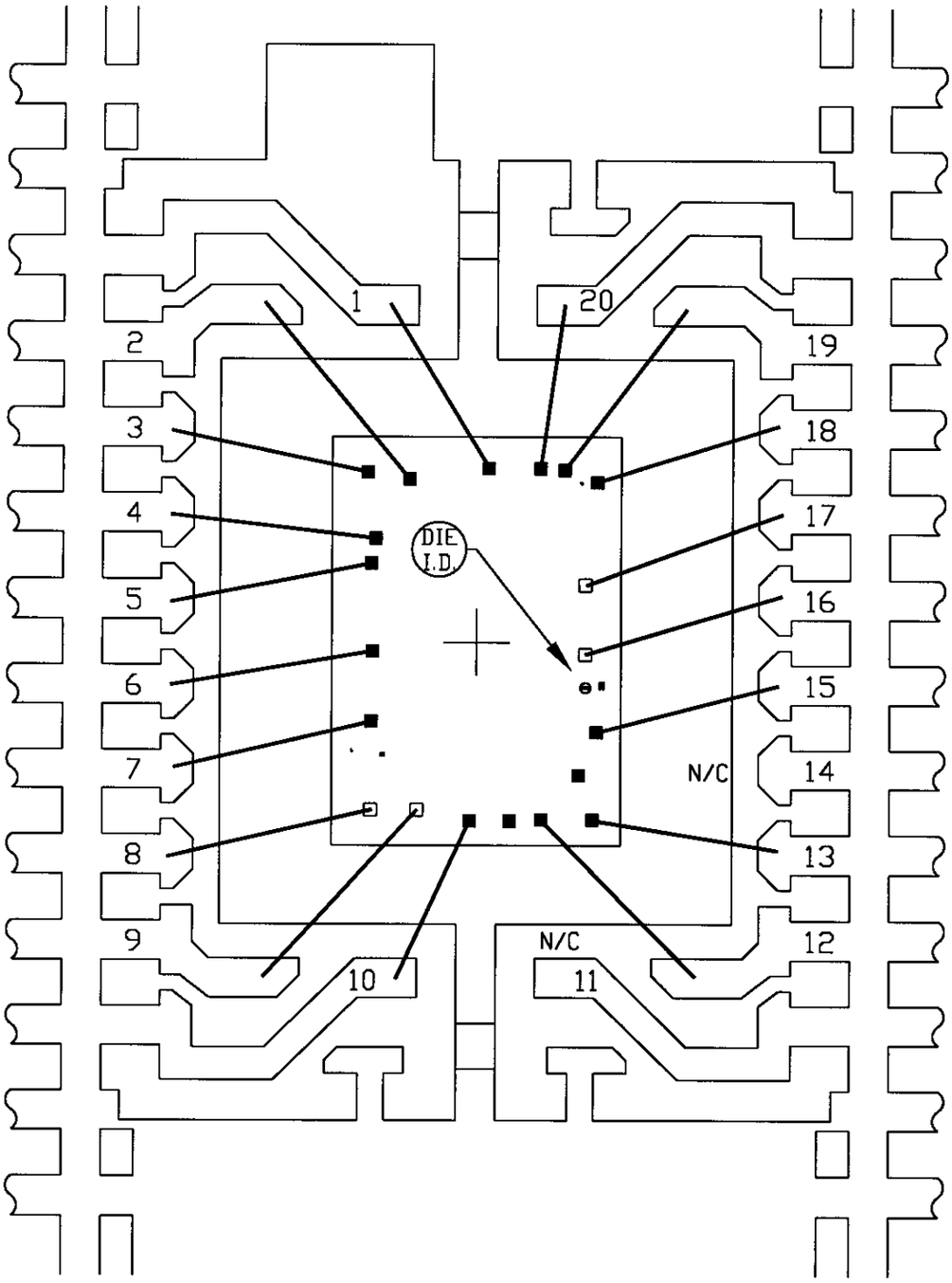
DRAWN BY: T. BEJSOVEC

MAXIM BURN-IN SCHEMATIC

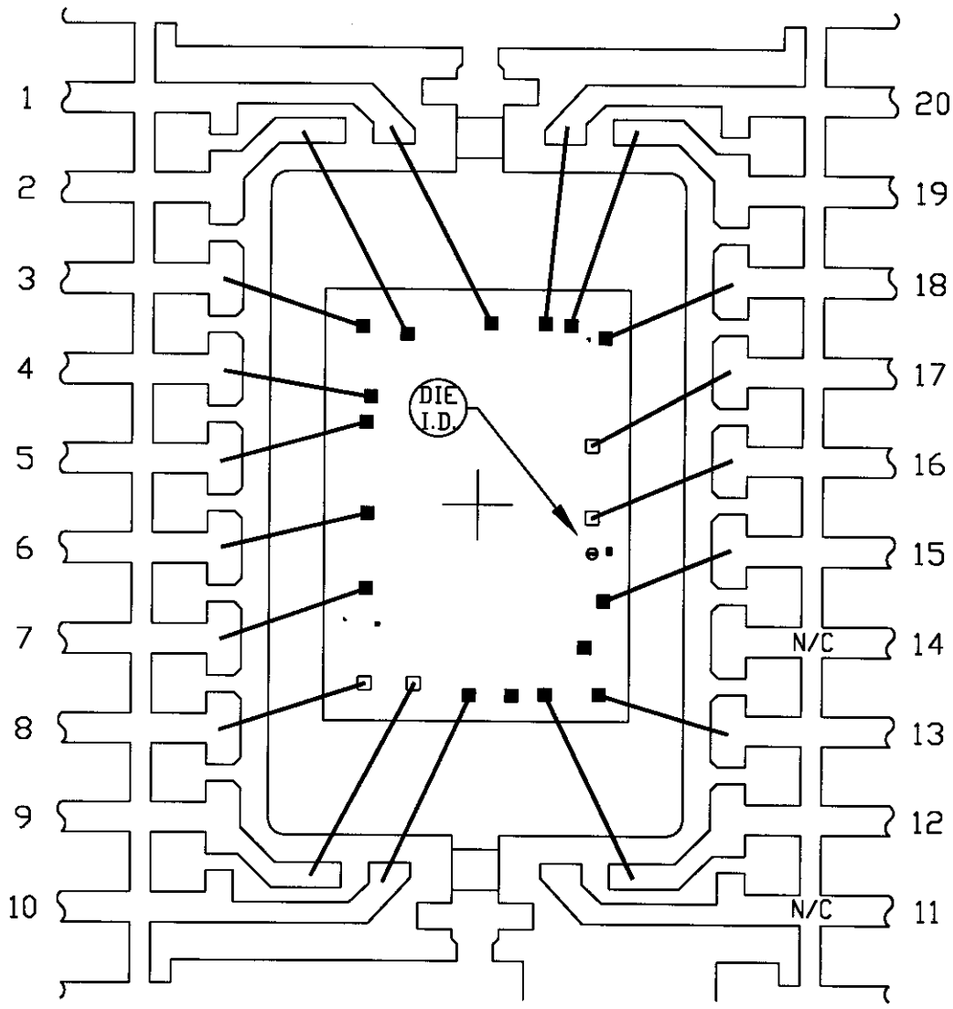
DEVICE TYPE:

MAX3222/E

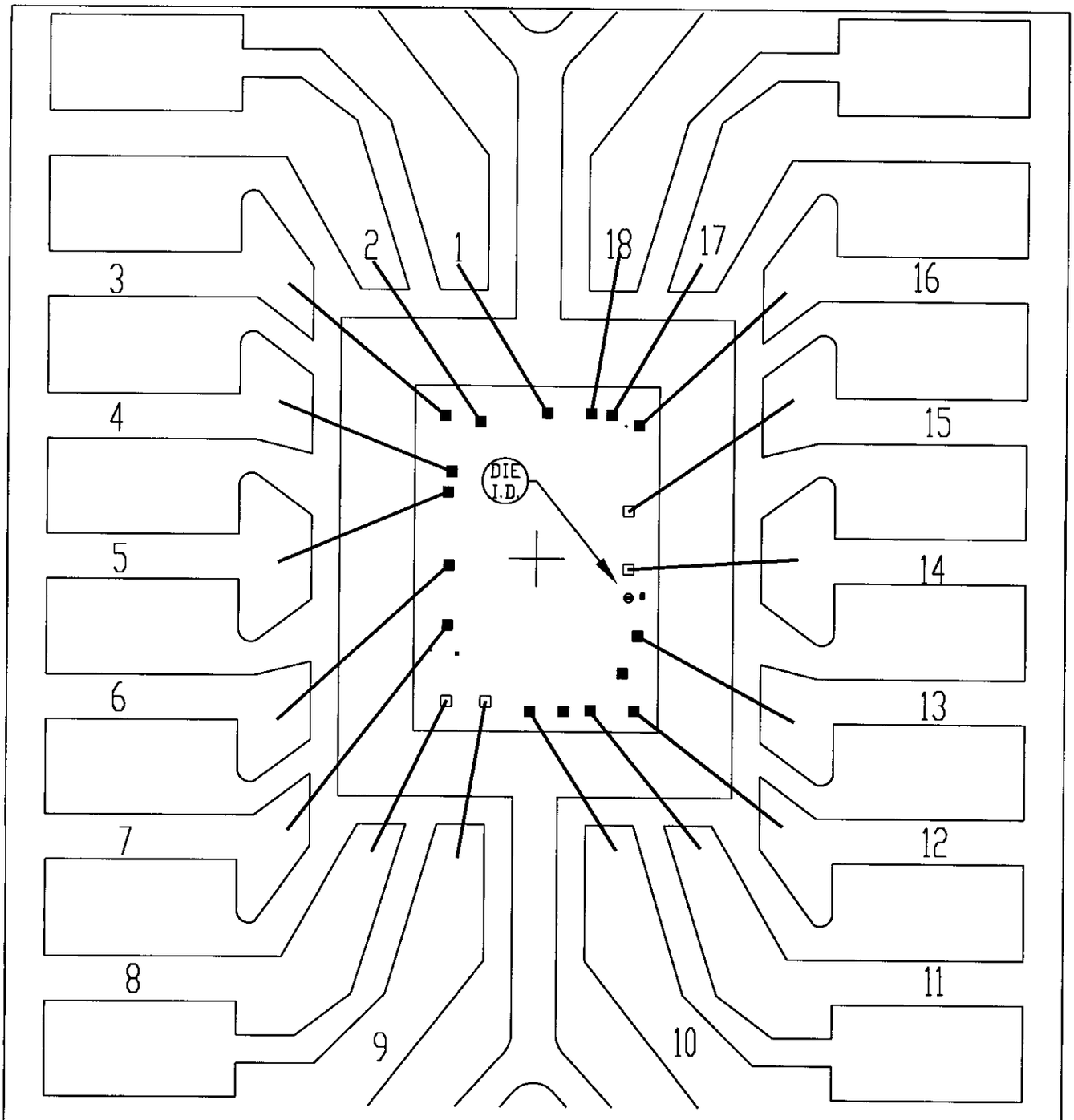
MAX3317E



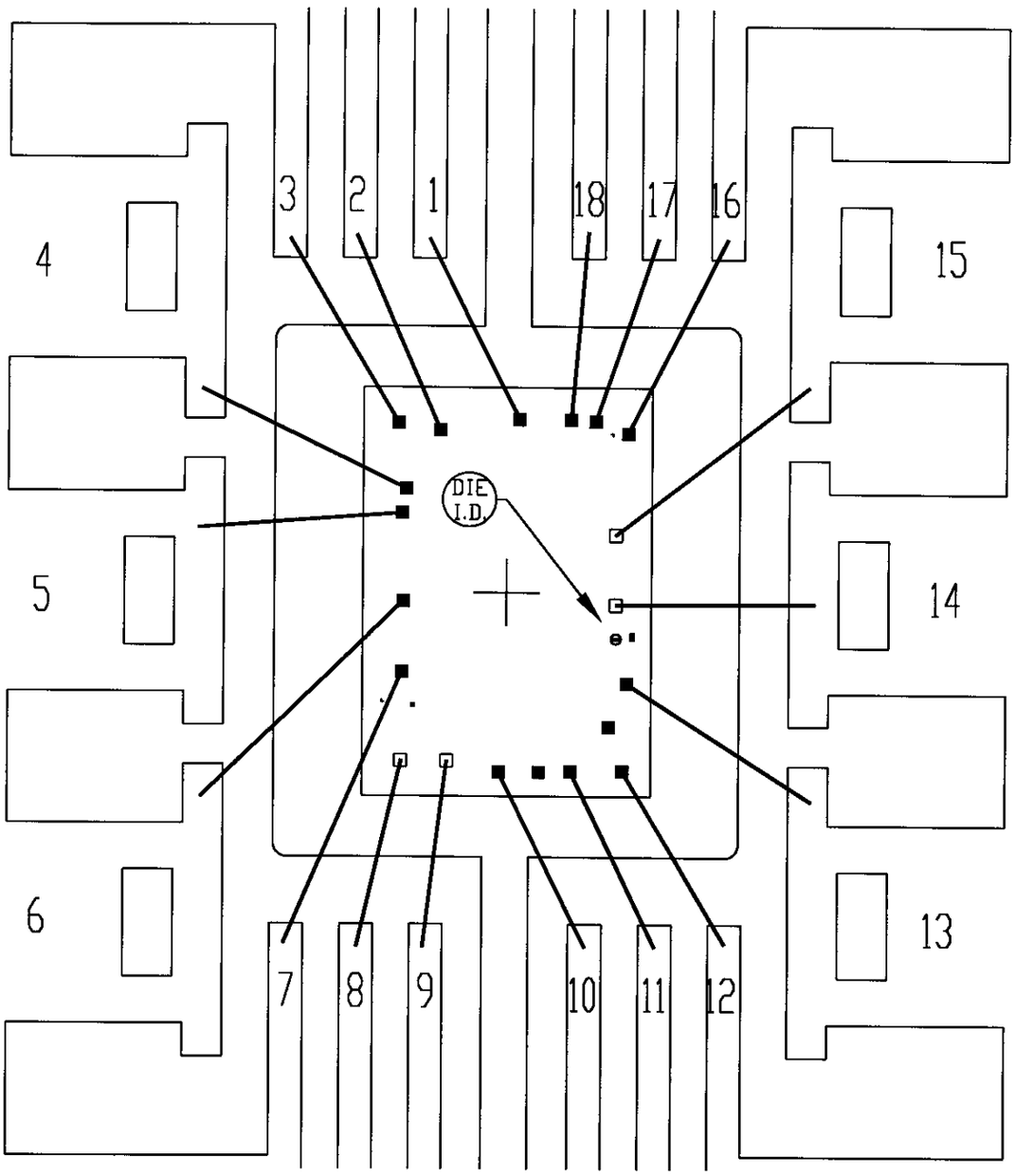
PKG. CODE: A20-1		SIGNATURES	DATE	MAXIM CONFIDENTIAL & PROPRIETARY	
CAV./PAD SIZE: 154X169	PKG.		8/21/10	BOND DIAGRAM #: 05-1901-0243	REV: A
	DESIGN		8-22-10		



PKG. CODE: U20-2		SIGNATURES	DATE	MAXIM CONFIDENTIAL & PROPRIETARY	
CAV./PAD SIZE: 118X189	PKG.		8/21/00	BOND DIAGRAM #: 05-1901-0251	REV: A
	DESIGN		8-22-00		



PKG. CODE: W18-1		SIGNATURES	DATE	MAXIM CONFIDENTIAL & PROPRIETARY	
CAV./PAD SIZE: 140 X 170	PKG.		8/21/00	BOND DIAGRAM #: 05-1901-0256	REV: A
	DESIGN		8-22-00		



PKG. CODE: P18-5		SIGNATURES	DATE	MAXIM CONFIDENTIAL & PROPRIETARY	
CAV./PAD SIZE: 140 X 160	PKG.		8/21/00	BOND DIAGRAM #: 05-1901-0247	REV: A
	DESIGN		8-22-00		