RELIABILITY REPORT

FOR

MAX3232Exxx

PLASTIC ENCAPSULATED DEVICES

January 23, 2002

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by

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Conclusion

The MAX3232E 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 MAX3232E is a 3V-powered EIA/TIA-232 and V.28/V.24 communications interface with low power requirements, high data-rate capabilities, and enhanced electrostatic discharge (ESD) protection. All transmitter outputs and receiver inputs are protected to ±15kV using IEC 1000-4-2 Air-Gap Discharge, ±8kV using IEC 1000-4-2 Contact Discharge, and ±15kV using the Human Body Model.

This transceiver has a proprietary low-dropout transmitter output stage, delivering true RS-232 performance from a +3.0V to +5.5V supply with a dual charge pump. The charge pump requires only four small 0.1µF capacitor for operation from a +3.3V supply. This device is guaranteed to run at data rates of 250kbps while maintaining RS-232 output levels.

The MAX3232E has two receivers and two drivers. It is pin, package, and functionally compatible with the industry-standard MAX232.

B. Absolute Maximum Ratings

Item	Rating
V_{CC} to GND	-0.3V to +6V
V+ to GND (Note 1)	-0.3V to +7V
V- to GND (Note 1)	+0.3V to -7V
V+ + |V-| (Note 1)	+13V
Input Voltages	
T_IN, /EN, /SHDN, MBAUD to GND	-0.3V to +6V
R_IN to GND	±25V
Output Voltages	
T_OUT to GND	±13.2V
Short-Circuit Duration, T_OUT to GND	Continuous
Storage Temp.	-65°C to +160°C
Lead Temp. (10 sec.)	+300°C
Power Dissipation	
16-Pin PDIP	889mW
16-Pin SO	762mW
16-Pin SSOP	571mW
20-Pin TSSOP	559mW
Derates above +70°C	
16-Pin PDIP	11.11mW/°C
16-Pin SO	9.52mW/°C
16-Pin SSOP	7.14mW/°C
20-Pin TSSOP	7.00mW/°C

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

II. Manufacturing Information

A. Description/Function: ±15kV ESD-Protected, 3.0V to 5.5V, Low-Power, up to 250kbps, True RS-232 Transceiver

B. Process: S3 [(SG3) - Standard 3 micron silicon gate CMOS]

C. Number of Device Transistors: 1129

D. Fabrication Location: California or Oregon, USA

E. Assembly Location: Philippines or Malaysia

F. Date of Initial Production: January, 1998

III. Packaging Information

A. Package Type:	**16-Pin PDIP**	**16-Pin WSO**	**16-Pin SSOP**	**20-Pin TSSOP**
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 with silica filler
G. Assembly Diagram:	# 05-1901-0178	# 05-1901-0181	# 05-1901-0179	# 05-1901-0208
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: 91 X 163 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 of QA)
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:

$$\lambda = \frac{1}{MTTF} = \frac{1.83}{192 \times 4389 \times 400 \times 2}$$

(Chi square value for MTTF upper limit)

↳ Thermal acceleration factor assuming a 0.8eV activation energy

$\lambda = 2.71 \times 10^{-9}$ λ= 2.71 F.I.T. (60% confidence level @ 25°C)

This low failure rate represents data collected from Maxim's reliability qualification and monitor programs. Maxim also performs weekly Burn-In on samples from production to assure the reliability of its processes. The reliability required for lots which receive a burn-in qualification 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 lots exceeding this level. The following Burn-In Schematic (Spec. # 06-5054) shows the static circuit used for this test. Maxim also performs 1000 hour life test monitors quarterly for each process. This data is published in the Product Reliability Report (**RR-1M**).

B. Moisture Resistance Tests

Maxim evaluates pressure pot stress from every assembly process during qualification of each new design. Pressure Pot testing must pass a 20% LTPD for acceptance. Additionally, industry standard 85°C/85%RH or HAST tests are performed quarterly per device/package family.

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

The RS60-2 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). Additionally, the MAX3232E's I/O pins are ESD-protected to ±15kV using the IEC 1000-4-2, Air-Gap Discharge Method, ±15kV using the Human Body Model, and ±8kV using the IEC 1000-4-2, Contact Discharge Method.

Latch-Up testing has shown that this device withstands a current of ±250mA and/or ±20V.

Table 1
Reliability Evaluation Test Results

MAX3223Exxx

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		400	0
Moisture Testing (Note 2)					
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.	DC Parameters & functionality	PDIP SSOP TSSOP WSO	260 300 77 440	0 0 0 2
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

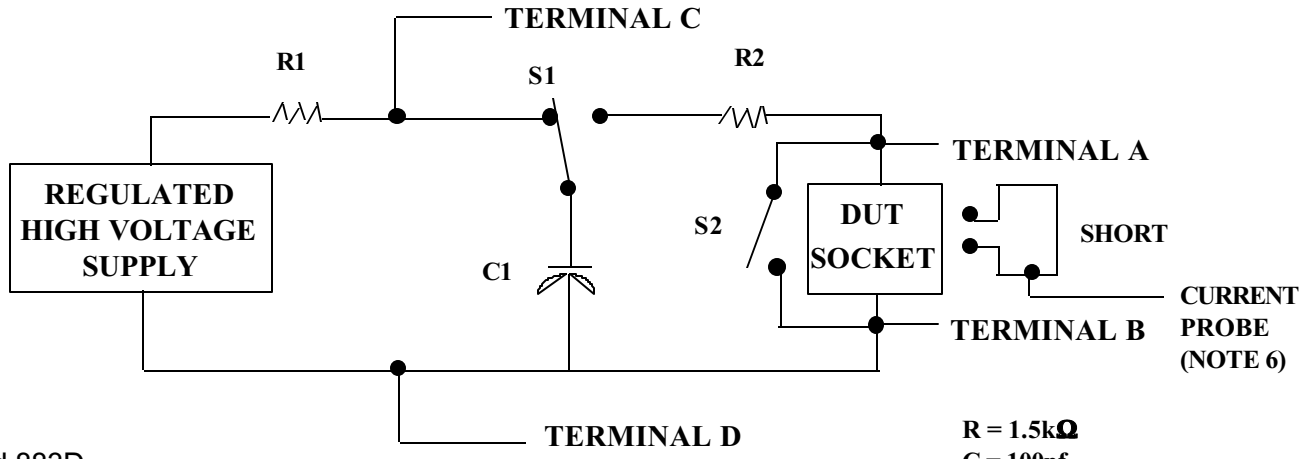
(e.g., where V_{PS1} is V_{DD}, V_{CC}, V_{SS}, V_{BB}, GND, $+V_S$, $-V_S$, V_{REF}, etc).

3.4 Pin combinations to be tested.

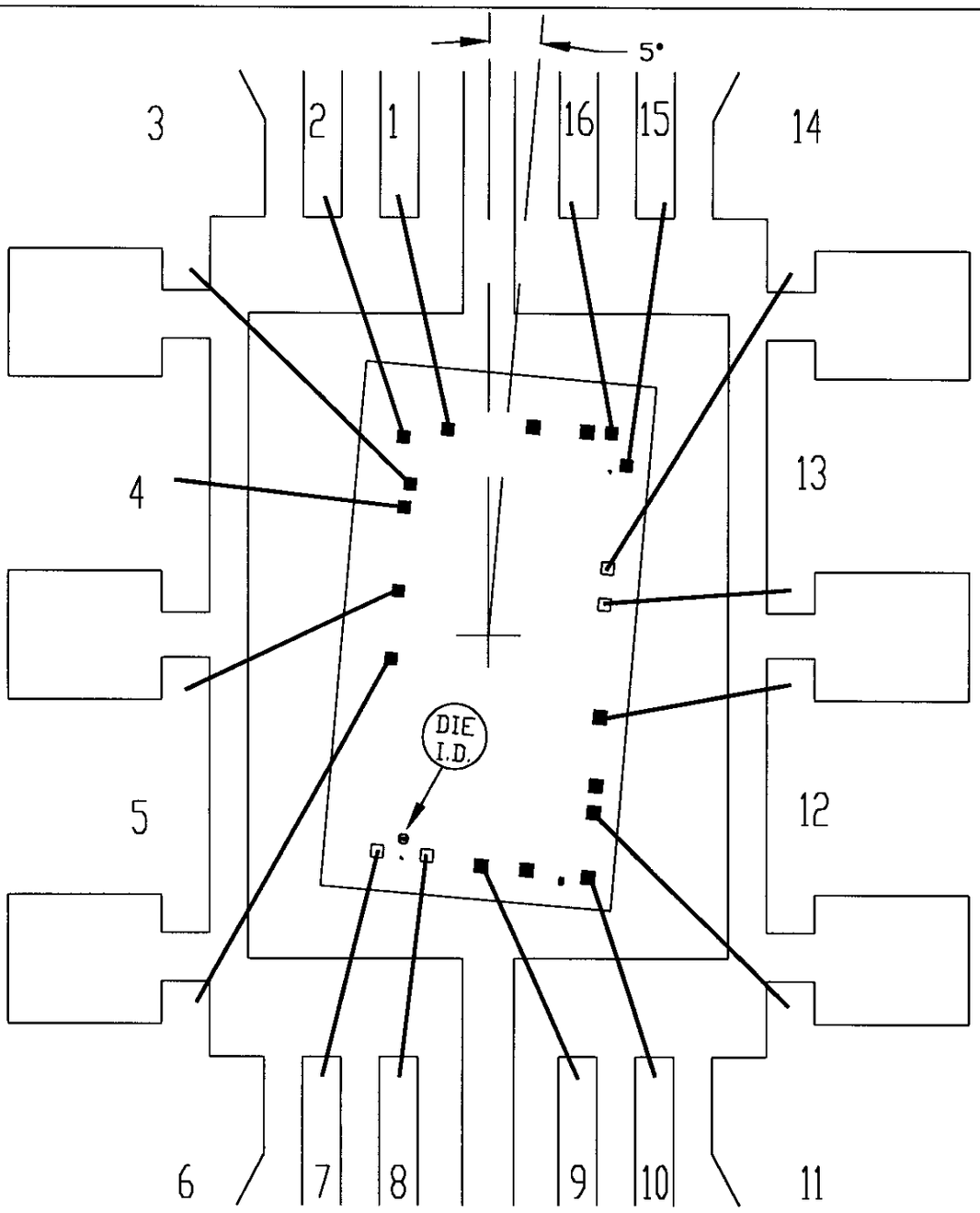
a. Each pin individually connected to terminal A with respect to the device ground pin(s) connected to terminal B. All pins except the one being tested and the ground pin(s) shall be open.

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.

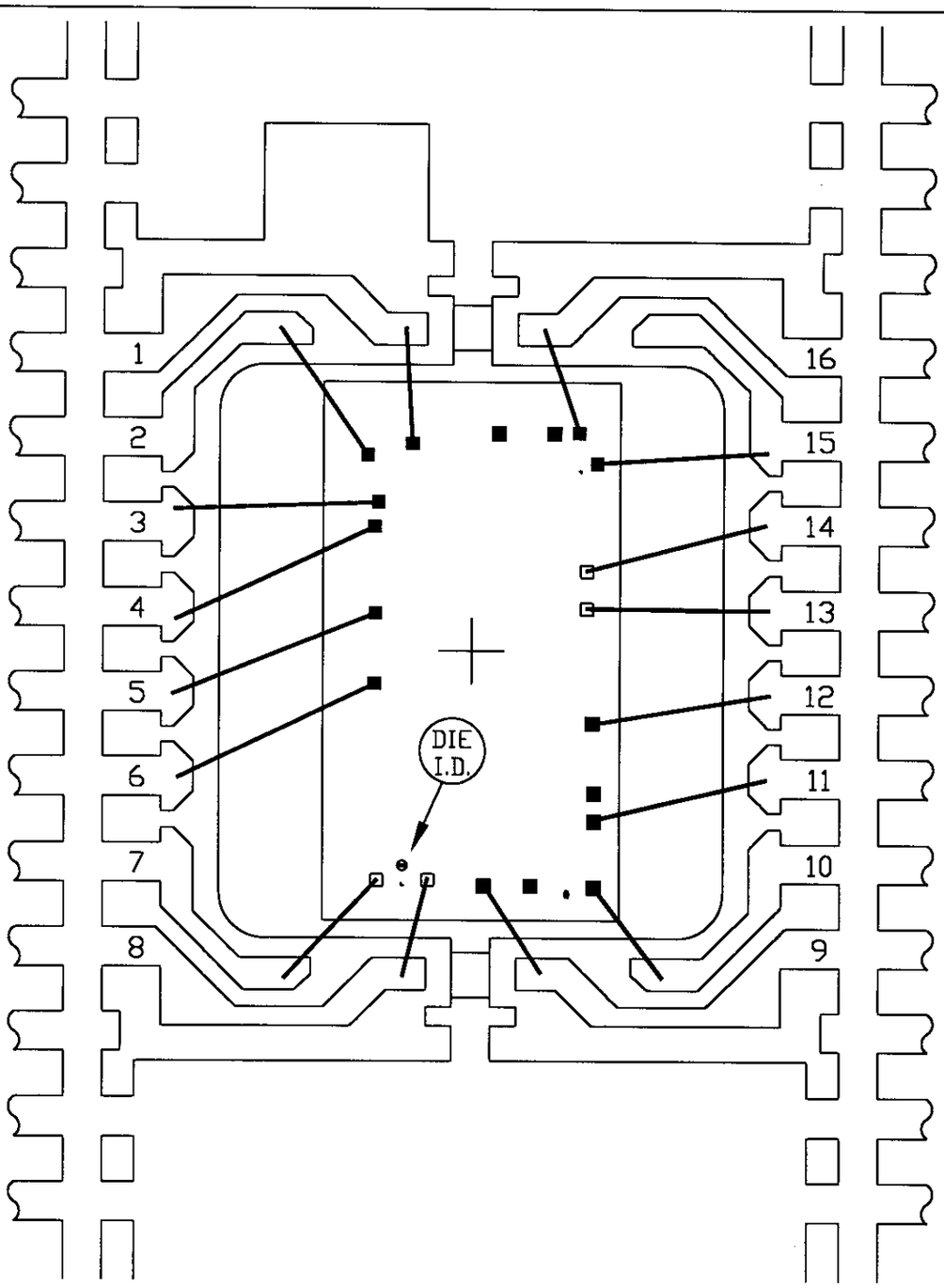
c. Each input and each output individually connected to terminal A with respect to a combination of all the other input and output pins connected to terminal B. All pins except the input or output pin being tested and the combination of all the other input and output pins shall be open.



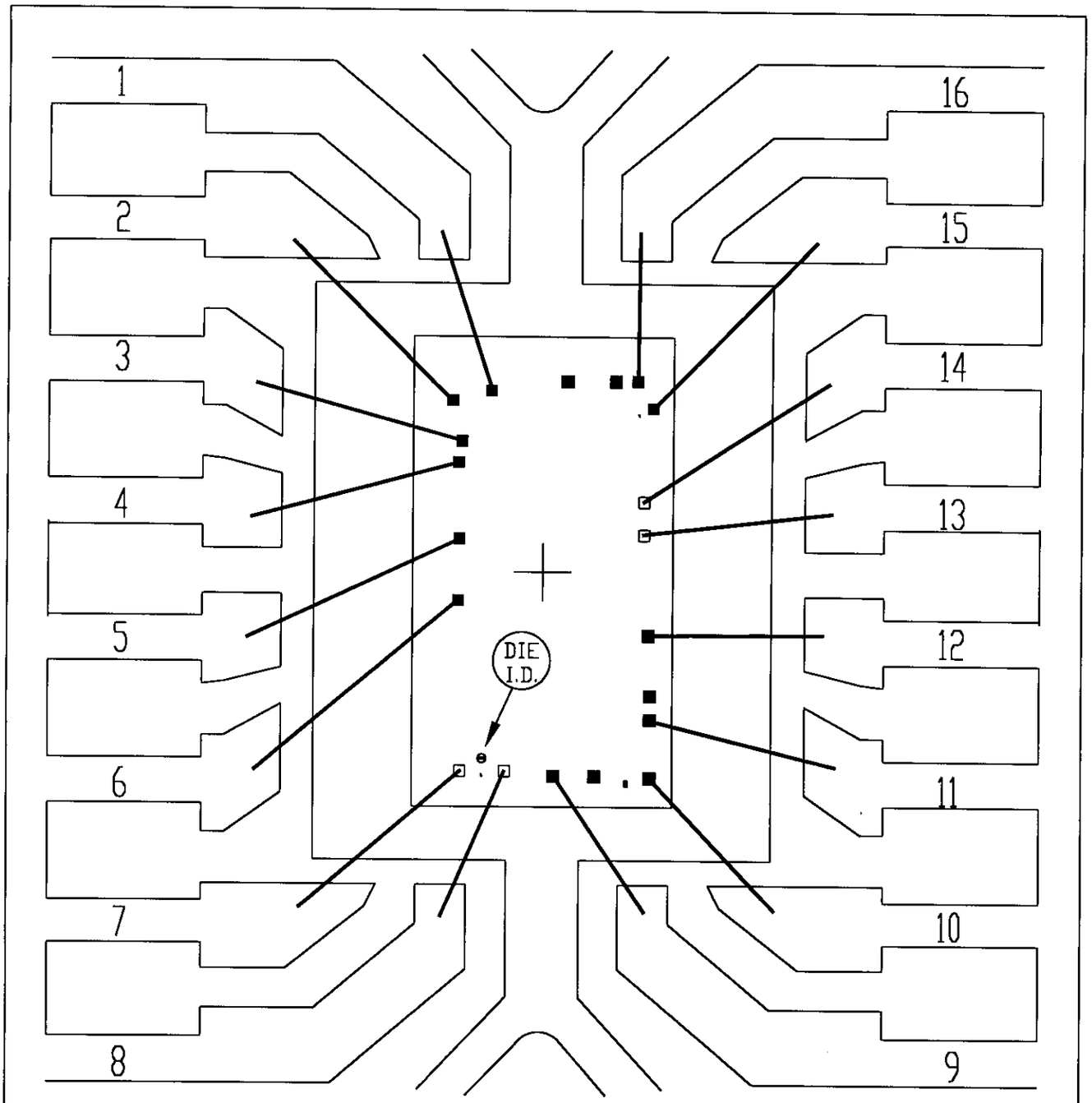
Mil Std 883D
Method 3015.7
Notice 8



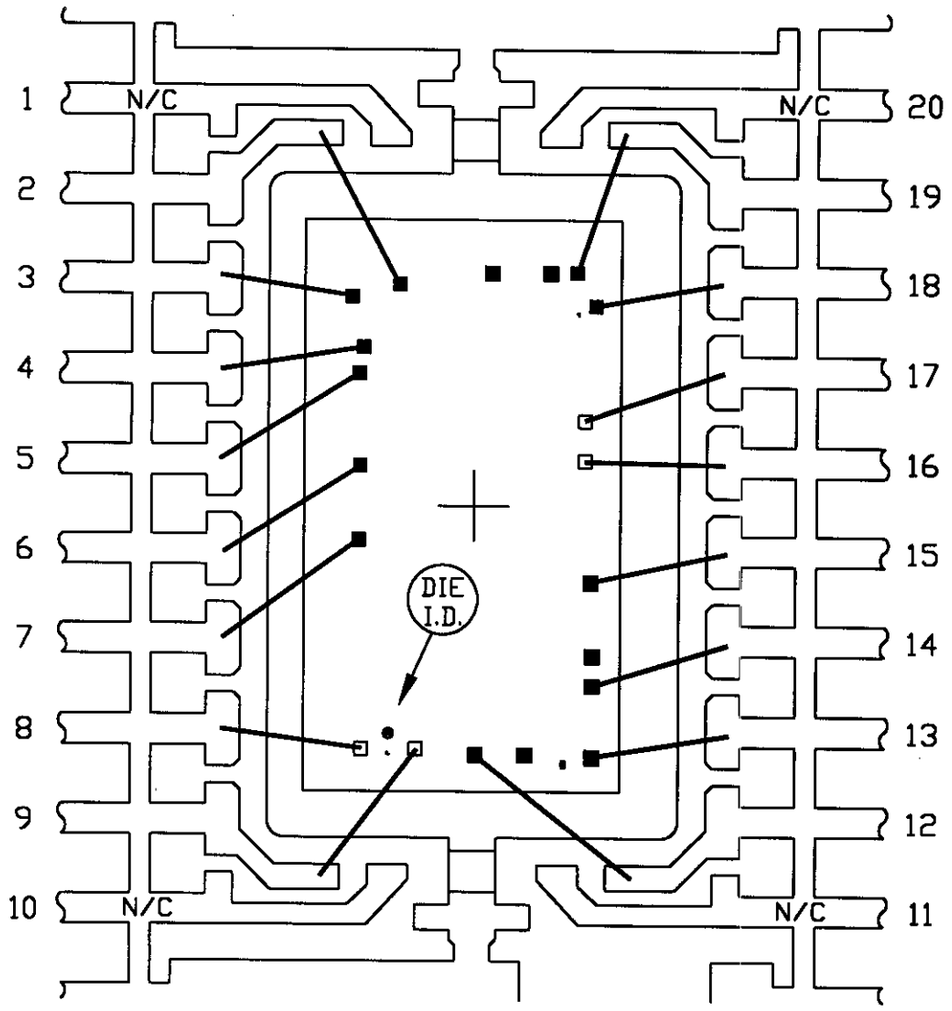
PKG.CODE: P16-3		APPROVALS	DATE	MAXIM	
CAV./PAD SIZE: 150 X 200	PKG.		7/6/99	BUILDSHEET NUMBER: 05-1901-0178	REV.: B
	DESIGN		7/12/99		



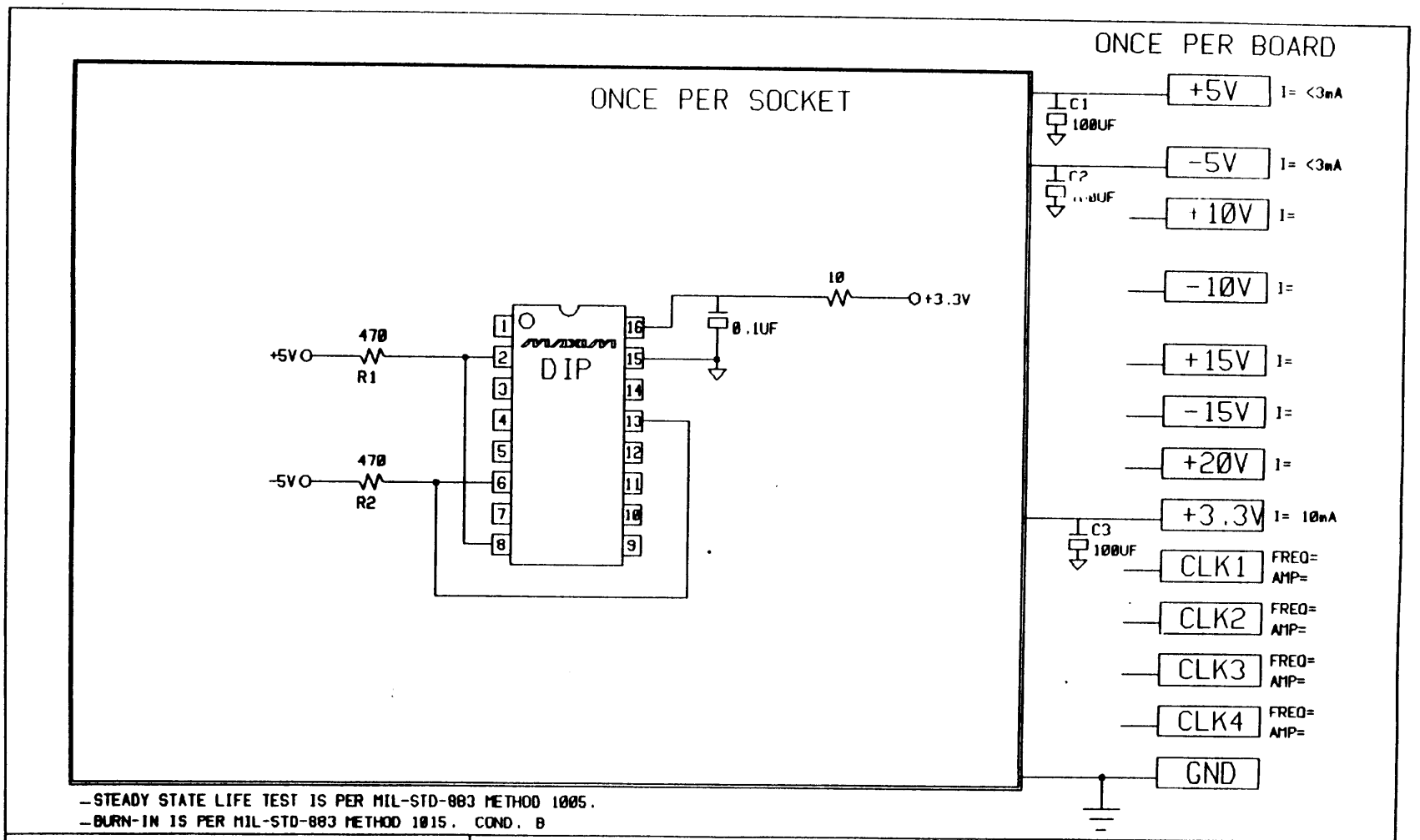
PKG.CODE: A16-2		APPROVALS	DATE	MAXIM	
CAV./PAD SIZE: 154X173	PKG.		7/6/99	BUILDSHEET NUMBER: 05-1901-0179	REV.: B
	DESIGN		7/12/99		



PKG.CODE: W16-3		APPROVALS	DATE	MAXIM
CAV./PAD SIZE: 160 X 200	PKG.		7/6/99	BUILDSHEET NUMBER: 05-1901-0181 REV.: B
	DESIGN		7/14/99	



PKG.CODE: U20-2		APPROVALS	DATE	MAXIM	
CAV./PAD SIZE: 118X189	PKG.		2/22/99	BUILDSHEET NUMBER: 05-1901-0208	REV.: A
	DESIGN		3/2/99		



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] HR/883

SPEC. NO. 06-5054 REV. C

DATE: 11/11/99

DRAWN BY: T. BEJSOVEC

MAXIM BURN-IN SCHEMATIC

DEVICE TYPE: MAX3232/E

MAX3316E