RELIABILITY REPORT

FOR

MAX3996CGP

PLASTIC ENCAPSULATED DEVICES

August 30, 2002

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

Written by

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Conclusion

The MAX3996 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 MAX3996 is a high-speed laser driver for small-form-factor (SFF) fiber optic LAN transmitters. It contains a bias generator, a laser modulator, and comprehensive safety features. Automatic power control (APC) adjusts the laser bias current to maintain average optical power, regardless of changes in temperature or laser properties. The driver accommodates common anode or differential laser configurations. The output current range of the MAX3996 is appropriate for VCSELs and high-efficiency edge-emitting lasers.

The MAX3996 operates up to 3.2Gbps. It can switch up to 30mA of laser modulation current and sink up to 60mA bias current. Adjustable temperature compensation is provided to keep the optical extinction ratio within specifications over the operating temperature range. The MAX3996 accommodates a variety of laser packages including low-cost TO-46 headers. Low deterministic jitter (9psp-p) combined with fast edge transitions (65ps) provides excellent margins compared to industry-standard transmitter eye masks.

This laser driver provides extensive safety features to guarantee single-point fault tolerance. Safety features include a transmit disable, redundant shutdown, and laser-bias monitoring. The safety circuit detects faults that could cause hazardous light levels and immediately disables the laser output. The MAX3996 safety circuits are compliant with SFF and small-form-factor pluggable (SFP) multisource agreements (MSA).

The MAX3996 is available in a compact 4mm x 4mm, 20-pin QFN package and operates over a temperature range of 0°C to +70°C.

B. Absolute Maximum Ratings

Item	Rating
Supply Voltage at VCC	-0.5V to +7.0V
Voltage at TX_DISABLE, PORDLY, MON1, COMP, IN+, IN-, MD, BIAS, MODSET, TC	-0.5V to (VCC + 0.5V)
Voltage between COMP and MON2	2.3V
Voltage between IN+ and IN-	5V
Voltage at OUT+, OUT-	(VCC - 2V) to (VCC + 2V)
Voltage between MON1 and MON2	1.5V
Voltage between BIAS and MON2	4V
Current into FAULT, SHDNDRV	-1mA to +25mA
Current into OUT+, OUT-	60mA
Current into BIAS	120mA
Operating Ambient Temperature Range	-40°C to +85°C
Operating Junction Temperature Range	-40°C to +150°C
Storage Temperature Range	-55°C to +150°C
Continuous Power Dissipation (TA = +70°C)	
20-Pin QFN	1600mW
Derates above +70°C	
20-Pin QFN	20.0mW/°C

II. Manufacturing Information

A. Description/Function:	3.0V to 5.5V, 2.5Gbps VCSEL and Laser Driver
B. Process:	GST2 (High-Speed Double Poly-Silicon Bipolar Process)
C. Number of Device Transistors:	1061
D. Fabrication Location:	Oregon, USA
E. Assembly Location:	Korea
F. Date of Initial Production:	October, 2001

III. Packaging Information

A. Package Type:	**20-Pin QFN**
B. Lead Frame:	Copper
C. Lead Finish:	Solder Plate
D. Die Attach:	Silver-filled Epoxy
E. Bondwire:	Gold (1.2 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	# 05-7001-0545
H. Flammability Rating:	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard JESD22-A112:	Level 1

IV. Die Information

A. Dimensions:	72 x 53 mils
B. Passivation:	Si_3N_4/SiO_2 (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Poly / Au
D. Backside Metallization:	None
E. Minimum Metal Width:	1.4 microns (as drawn)
F. Minimum Metal Spacing:	1.4 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 150°C biased (static) life test are shown in **Table 1**. Using these results, the Failure Rate (λ) is calculated as follows:

$$\lambda = \frac{1}{MTTF} = \frac{1.83}{192 \times 9823 \times 89 \times 2}$$

(Chi square value for MTTF upper limit)

Thermal acceleration factor assuming a 0.8eV activation energy

$\lambda = 5.45 \times 10^{-9}$ $\lambda = 5.45$ 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 attached Burn-In Schematic (Spec. # 06-5871) 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 or RR-2BA**).

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 HD19 die type has been found to have all pins able to withstand a transient pulse of ±600V, per Mil-Std-883 Method 3015 (reference attached ESD Test Circuit). Latch-Up testing has shown that this device withstands a current of ±250mA.

Table 1
Reliability Evaluation Test Results

MAX3996CGP

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	PACKAGE	SAMPLE SIZE	NUMBER OF FAILURES
Static Life Test (Note 1)					
	Ta = 150°C Biased Time = 192 hrs.	DC Parameters & functionality		89	0
Moisture Testing (Note 2)					
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.	DC Parameters & functionality	QFN	77	0
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 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 I for each named Power supply and for ground

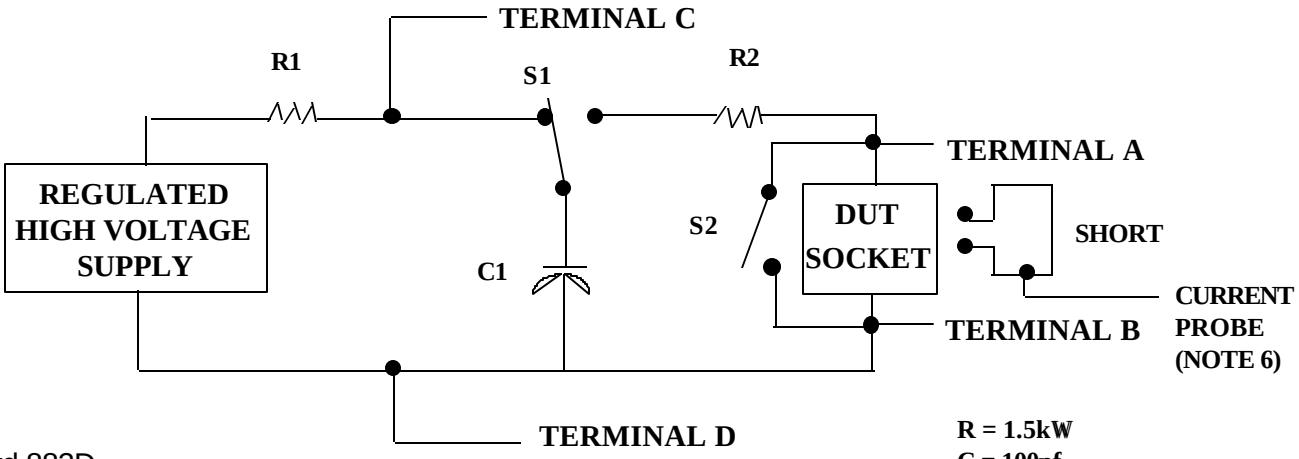
(e.g., where V_{PS1} is V_{DD}, V_{CC}, V_{SS}, V_{BB}, GND, $+V_S$, $-V_S$, V_{REF}, etc).

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.

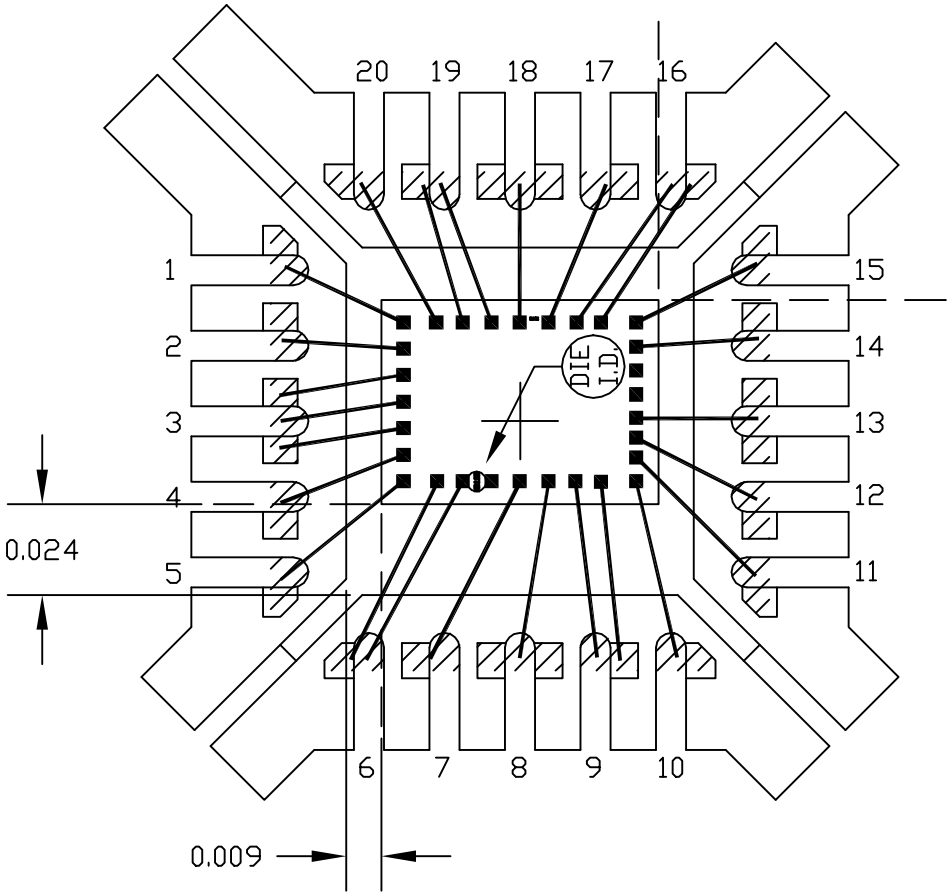
b. Each pin individually connected to terminal A with respect to each different set of a combination of all named power supply pins (e.g., V_{SS1}, or V_{SS2} or V_{SS3} or V_{CC1}, or V_{CC2}) connected to terminal B. All pins except the one being tested and the power supply pin or set of pins shall 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

EXPOSED PAD PKG.



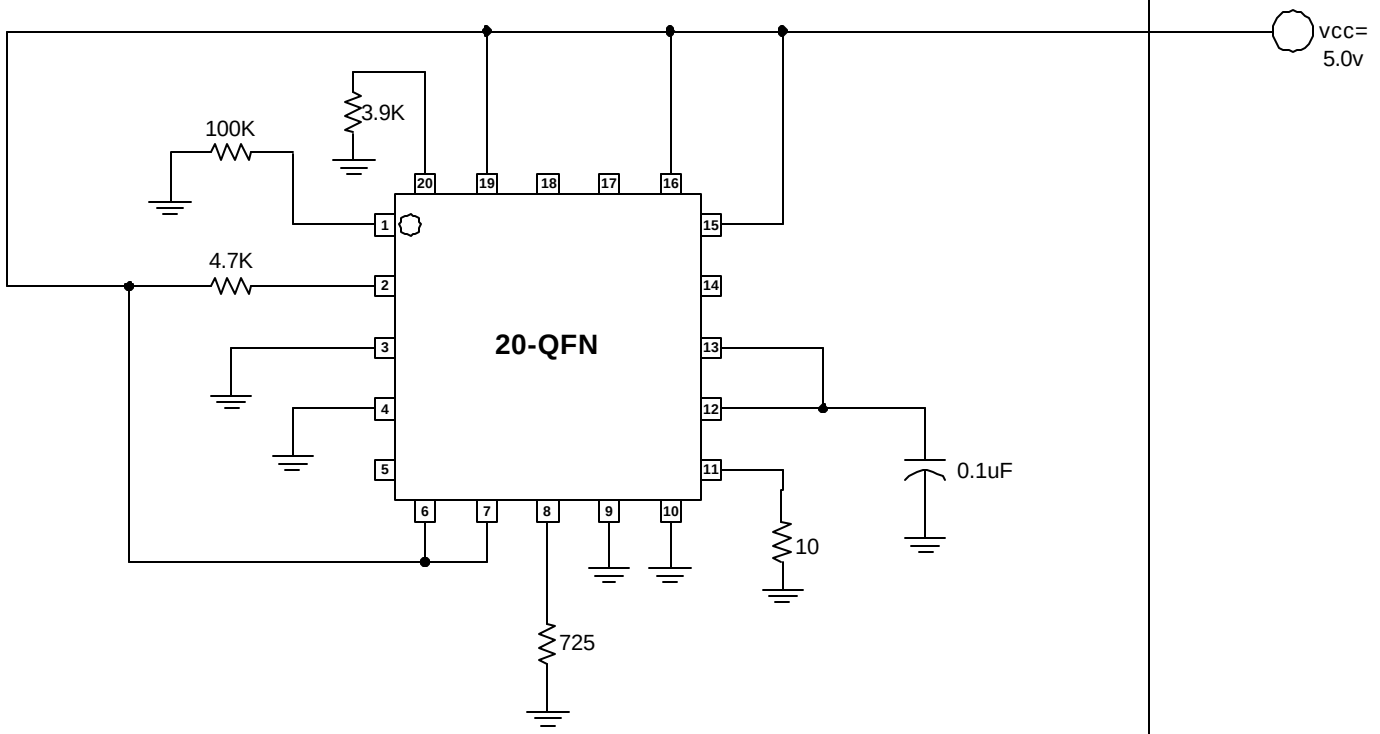
BONDABLE AREA

PKG. BODY SIZE: 4x4 mm

PKG. CODE: G2044-3		SIGNATURES	DATE	MAXIM CONFIDENTIAL & PROPRIETARY	
CAV./PAD SIZE: 91x91	PKG.		4/17/01	BOND DIAGRAM #: 05-7001-0545	REV: A
	DESIGN		4/17/01		

ONCE PER SOCKET

ONCE PER BOARD



DEVICES: MAX3996 / HD19Z

MAX. EXPECTED CURRENT = 60mA

NOTES: