

RELIABILITY REPORT
FOR
MAX3735ExG
PLASTIC ENCAPSULATED DEVICES

January 14, 2003

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.

SUNNYVALE, CA 94086

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Conclusion

The MAX3735 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 MAX3735 is a +3.3V laser driver for SFP/SFF applications from 155Mbps up to 2.7Gbps. The device accepts differential input data and provides bias and modulation currents for driving a laser. DC-coupling to the laser allows for multirate applications and reduces the number of external components. The MAX3735 is fully compliant with the SFP MSA timing and the SFF-8472 transmit diagnostic requirements.

An automatic power-control (APC) feedback loop is incorporated to maintain a constant average optical power over temperature and lifetime. The wide modulation current range of 10mA to 60mA (up to 85mA AC-coupled) and bias current of 1mA to 100mA make this product ideal for driving FP/DFB laser diodes in fiber-optic modules. The resistor range for the laser current settings is optimized to interface with the DS1858 SFP controller IC.

The MAX3735 also provides transmit-disable control, a single-point latched transmit-failure monitor output, photocurrent monitoring, and bias-current monitoring to indicate when the APC loop is unable to maintain the average optical power.

The MAX3735 comes in a 4mm x 4mm 24-pin thin QFN package, a 4mm x 4mm 24-pin QFN package, and in die form, and operates over the extended temperature range of -40°C to +85°C.

B. Absolute Maximum Ratings

<u>Item</u>	<u>Rating</u>
Supply Voltage, VCC	-0.5V to +6.0V
Current into BIAS, OUT+, OUT-	-20mA to +150mA
Current into MD	-5mA to +5mA
Voltage at IN+, IN-, TX_DISABLE, TX_FAULT, SHUTDOWN	-0.5V to (VCC + 0.5V)
Voltage at BIAS, PC_MON, BC_MON, MODSET, APCSET	-0.5V to (VCC + 0.5V)
Voltage at OUT+, OUT-	+0.5V to (VCC + 1.5V)
Voltage at APCFILT1, APCFILT2	-0.5V to +3V
Operating Ambient Temperature Range (TA)	-40°C to +85°C
Storage Ambient Temperature Range	-55°C to +150°C
Lead Temperature (soldering, 10s)	+300°
Continuous Power Dissipation (TA = +70°C)	
24-Lead Thin QFN	1354mW
24-Lead QFN	1354mW
Derates above +70°C	
24-Lead Thin QFN	20.8mW/°C
24-Lead QFN	20.8mW/°C

II. Manufacturing Information

A. Description/Function:	2.7Gbps, Low-Power SFP Laser Driver
B. Process:	GST4-F60
C. Number of Device Transistors:	327
D. Fabrication Location:	Oregon, USA
E. Assembly Location:	Korea or Thailand
F. Date of Initial Production:	September, 2002

III. Packaging Information

A. Package Type:	24-Pin Thin QFN (4x4)	24-Pin QFN (4x4)
B. Lead Frame:	Copper	Copper
C. Lead Finish:	Solder Plate	Solder Plate
D. Die Attach:	Conductive Epoxy	Silver-filled epoxy
E. Bondwire:	Gold (1.3 mil dia.)	Gold (1.2 mil dia.)
F. Mold Material:	Epoxy with silica filler	Epoxy with silica filler
G. Assembly Diagram:	Buildsheet # 05-9000-0014	Buildsheet # 05-9000-0378
H. Flammability Rating:	Class UL94-V0	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard JESD22-A112:	Level 1	Level 1

IV. Die Information

A. Dimensions:	60 x 79 mils
B. Passivation:	Si ₃ N ₄ /SiO ₂ (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Au
D. Backside Metallization:	None
E. Minimum Metal Width:	Metal1: 1.2; Metal2: 1.2; Metal3: 1.2; Metal4: 5.6 microns (as drawn)
F. Minimum Metal Spacing:	Metal1: 1.6; Metal2: 1.6; Metal3: 1.6; Metal4: 4.2 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:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 9823 \times 45 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

└ Temperature Acceleration factor assuming an activation energy of 0.8eV

$$\lambda = 10.78 \times 10^{-8} \quad \lambda = 10.78 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

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 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 rejects from lots exceeding this level. Maxim also performs 1000 hour life test monitors quarterly for each process. This data is published in the Product Reliability Reports (**RR-1M & RR-B3A**).

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 HD37die type has been found to have all pins able to withstand a transient pulse of +/-800V, 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

MAX3735ExG

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES
Static Life Test (Note 1)				
	Ta = 150°C Biased Time = 192 hrs.	DC Parameters & functionality	45	0
Moisture Testing (Note 2)				
Pressure Pot	Ta = 121°C P = 15 psi. RH= 100% Time = 168hrs.	DC Parameters & functionality	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 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.

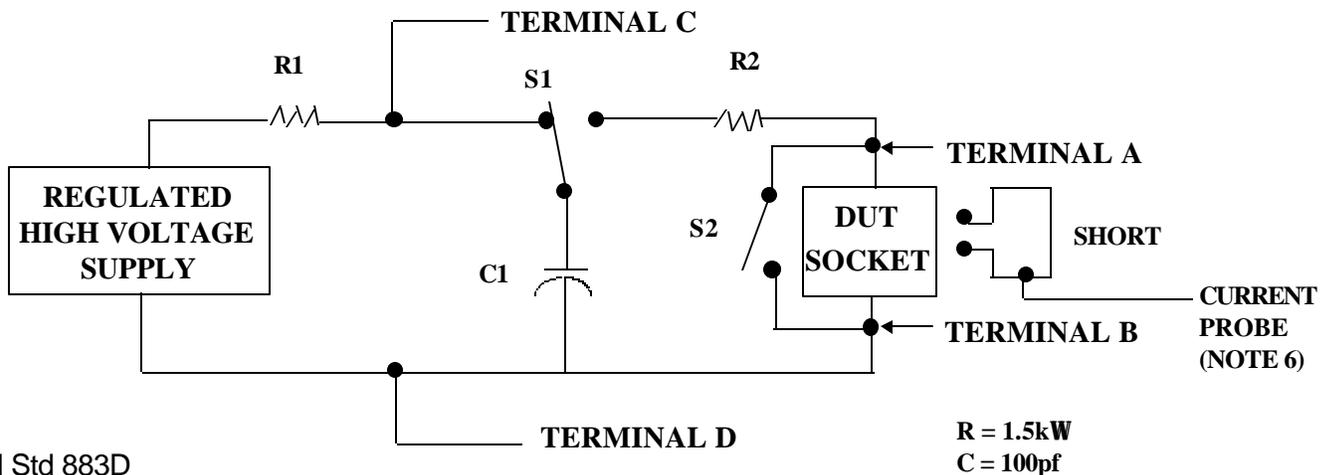
2/ No connects are not to be tested.

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

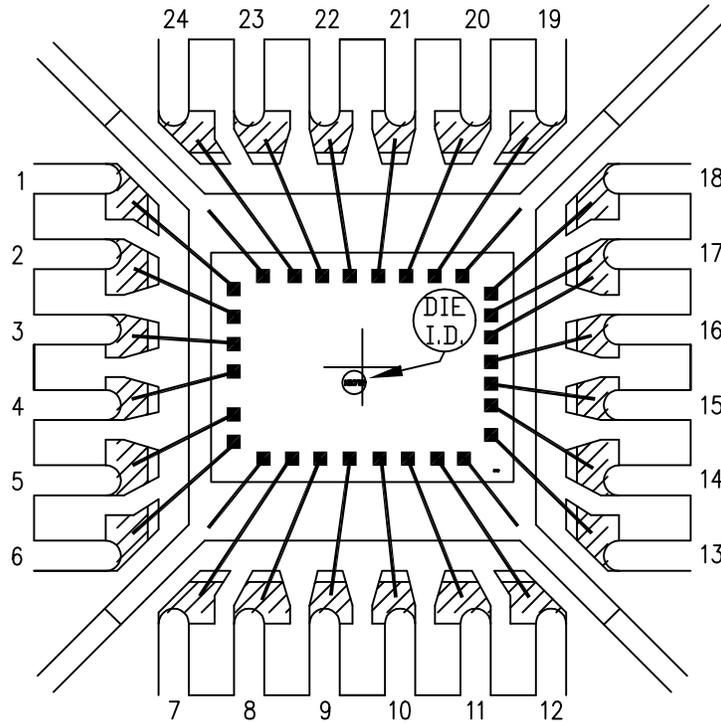
(e.g., where V_{PS1} is V_{DD} , V_{CC} , V_{SS} , V_{BB} , GND, $+V_S$, $-V_S$, V_{REF} , etc).

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.



EXPOSED PAD PKG.



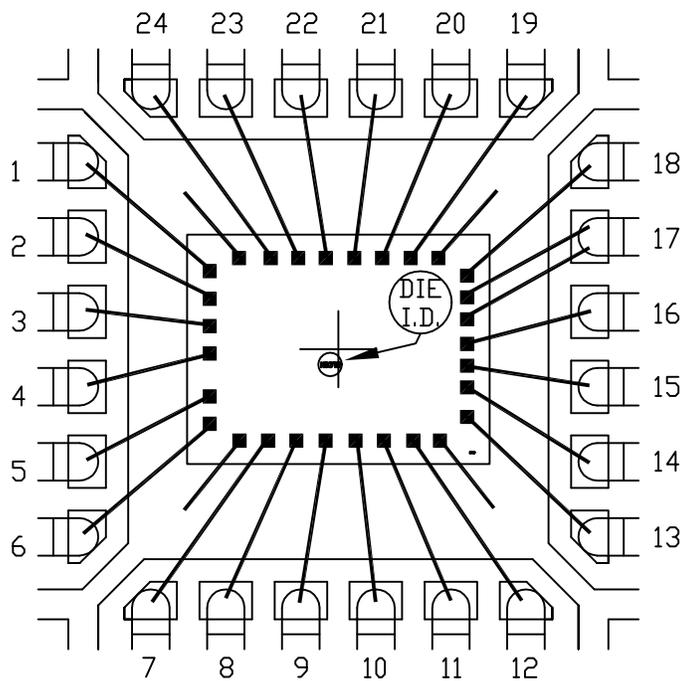
 BONDABLE AREA

PKG. BODY SIZE: 4x4 mm

PKG. CODE: G2444-1		SIGNATURES	DATE	 CONFIDENTIAL & PROPRIETARY	
CAV./PAD SIZE: 91x91	PKG. DESIGN			BOND DIAGRAM #: 05-9000-0014	REV: C

4x4x0.8 MM QFN THIN PKG.

EXPOSED PAD PKG.



PKG. CODE: T2444-1		SIGNATURES	DATE	 CONFIDENTIAL & PROPRIETARY	
CAV./PAD SIZE: 110x110	PKG. DESIGN			BOND DIAGRAM #: 05-9000-0378	REV: A