

RELIABILITY REPORT
FOR
MAX9697ATI+
PLASTIC ENCAPSULATED DEVICES

May 12, 2009

MAXIM INTEGRATED PRODUCTS

120 SAN GABRIEL DR.
SUNNYVALE, CA 94086

Approved by
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Conclusion

The MAX9697ATI+ 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 MAX9697 12-channel programmable gamma reference system provides 12 programmable reference voltages with 10-bit resolution. These voltages can be used for gamma correction in TFT-LCD displays, as a VCOM reference, or as sources for level shifter inputs. Each reference voltage features a 10-bit digital-to-analog converter (DAC) and buffer with high peak current to reduce the recovery time of the output voltages when critical levels and patterns are displayed. An adjustable, low-dropout linear regulator (LDO) further improves the stability and accuracy of the DAC outputs by creating the DAC reference. The MAX9697's integrated gate-driver output controls an external p-channel FET to slowly turn on the linear regulator so that the reference voltages ramp up in a controlled manner. The MAX9697 has a serial peripheral interface (SPI(tm)) bus for programming the reference voltages. The device also has a current-sense comparator to detect an abnormally high supply current in other areas of the application circuit. The MAX9697 is available in a 28-pin TQFN package and is specified for operation over the -40°C to +125°C temperature range.

II. Manufacturing Information

A. Description/Function:	12-Channel Programmable Gamma Reference System
B. Process:	S4
C. Number of Device Transistors:	22084
D. Fabrication Location:	Texas
E. Assembly Location:	UTL Thailand
F. Date of Initial Production:	January 24, 2009

III. Packaging Information

A. Package Type:	28-pin TQFN 5x5
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Die Attach:	Conductive Epoxy
E. Bondwire:	Au (1.3 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#
H. Flammability Rating:	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C	Level 1
J. Single Layer Theta Ja:	47°C/W
K. Single Layer Theta Jc:	2.1°C/W
L. Multi Layer Theta Ja:	29°C/W
M. Multi Layer Theta Jc:	2.1°C/W

IV. Die Information

A. Dimensions:	89 X 85 mils
B. Passivation:	Si ₃ N ₄ /SiO ₂ (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Aluminum/Si (Si = 1%)
D. Backside Metallization:	None
E. Minimum Metal Width:	Metal1 = 0.5 / Metal2 = 0.6 / Metal3 = 0.6 microns (as drawn)
F. Minimum Metal Spacing:	Metal1 = 0.45 / Metal2 = 0.5 / Metal3 = 0.6 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:	Ken Wendel (Director, Reliability Engineering) Bryan Preeshl (Managing Director of QA)
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 pending. Using these results, the Failure Rate (λ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 4340 \times 47 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

(where 4340 = Temperature Acceleration factor assuming an activation energy of 0.8eV)

$$\lambda = 22.8 \times 10^{-9}$$

$$\lambda = 22.8 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

The following failure rate represents data collected from Maxim's reliability monitor program. Maxim performs quarterly 1000 hour life test monitors on its processes. This data is published in the Product Reliability Report found at <http://www.maxim-ic.com/>. Current monitor data for the S4 Process results in a FIT Rate of 4.6 @ 25C and 79.2 @ 55C (0.8 eV, 60% UCL)

B. Moisture Resistance Tests

The industry standard 85°C/85%RH or HAST testing is monitored per device process once a quarter.

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

The PF35 die type has been found to have all pins able to withstand a transient pulse of:

ESD HBM: +/-2500 V per JESD22 A114
ESD MM: +/-200V per JESD22 A115.

Latch-Up testing has shown that this device withstands a current of +/-100 mA, 1.5x VCCMax Overvoltage per JESD78.

Table 1
Reliability Evaluation Test Results

MAX9697ATI+

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	47	0
Moisture Testing (Note 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 & functionality	77	0

Note 1: Life Test Data may represent plastic DIP qualification lots.

Note 2: Generic Package/Process data