



RELIABILITY REPORT  
FOR  
MAX2022ETX+T  
PLASTIC ENCAPSULATED DEVICES

September 19, 2012

**MAXIM INTEGRATED PRODUCTS**

120 SAN GABRIEL DR.  
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<b>Approved by</b>
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Quality Assurance
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## Conclusion

The MAX2022ETX+T 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

<b>I. ....Device Description</b>	<b>V. ....Quality Assurance Information</b>
<b>II. ....Manufacturing Information</b>	<b>VI. ....Reliability Evaluation</b>
<b>III. ....Packaging Information</b>	<b>IV. ....Die Information</b>
<b>.....Attachments</b>	

### I. Device Description

#### A. General

The MAX2022 low-noise, high-linearity, direct upconversion quadrature modulator is designed for single and multicarrier 1800MHz to 2200MHz UMTS/WCDMA, cdma2000®, and DCS/PCS base-station applications. Direct upconversion architectures are advantageous since they significantly reduce transmitter cost, part count, and power consumption as compared to traditional IF-based double upconversion systems. In addition to offering excellent linearity and noise performance, the MAX2022 also yields a high level of component integration. This device includes two matched passive mixers for modulating in-phase and quadrature signals, three LO mixer amplifier drivers, and an LO quadrature splitter. On-chip baluns are also integrated to allow for single-ended RF and LO connections. As an added feature, the baseband inputs have been matched to allow for direct interfacing to the transmit DAC, thereby eliminating the need for costly I/Q buffer amplifiers. The MAX2022 operates from a single +5V supply. It is available in a compact 36-pin thin QFN package (6mm x 6mm) with an exposed paddle. Electrical performance is guaranteed over the extended -40°C to +85°C temperature range.

## II. Manufacturing Information

A. Description/Function:	High-Dynamic-Range, Direct Upconversion 1500MHz to 2500MHz Quadrature Modulator
B. Process:	G4
C. Number of Device Transistors:	1414
D. Fabrication Location:	USA
E. Assembly Location:	China, Taiwan and Thailand
F. Date of Initial Production:	January 22, 2005

## III. Packaging Information

A. Package Type:	36-pin TQFN 6x6
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Die Attach:	Conductive
E. Bondwire:	Au (1 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#05-9000-1602
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:	38°C/W
K. Single Layer Theta Jc:	1°C/W
L. Multi Layer Theta Ja:	28°C/W
M. Multi Layer Theta Jc:	1°C/W

## IV. Die Information

A. Dimensions:	126 X 124 mils
B. Passivation:	Si <sub>3</sub> N <sub>4</sub>
C. Interconnect:	Au
D. Backside Metallization:	None
E. Minimum Metal Width:	Metal1-3 = 1.2 / Metal 4 = 5.6 microns (as drawn)
F. Minimum Metal Spacing:	Metal1-3 = 1.6 / Metal 4 = 4.2 microns (as drawn)
G. Bondpad Dimensions:	
H. Isolation Dielectric:	SiO <sub>2</sub>
I. Die Separation Method:	Wafer Saw

**V. Quality Assurance Information**

- A. Quality Assurance Contacts: Richard Aburano (Manager, Reliability Engineering)  
Don Lipps (Manager, Reliability Engineering)  
Bryan Preeshl (Vice President 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 135C biased (static) life test are shown in Table 1. Using these results, the Failure Rate ( $\lambda$ ) is calculated as follows:

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

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

$$\lambda = 23.4 \times 10^{-9}$$

$$\lambda = 23.4 \text{ F.I.T. (60\% confidence level @ 25°C)}$$

The following failure rate represents data collected from Maxim's reliability monitor program. Maxim performs quarterly life test monitors on its processes. This data is published in the Reliability Report found at <http://www.maxim-ic.com/qa/reliability/monitor>. Cumulative monitor data for the G4 Process results in a FIT Rate of 0.02 @ 25C and 0.37 @ 55C (0.8 eV, 60% UCL)

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

The CR29 die type has been found to have all pins able to withstand a HBM transient pulse of +/- 1500V, except the BBIP/BBIN/BBQN/BBQP pins (pins 20, 21, 25, 26) which only pass +/- 700V per JEDEC JESD22-A114 (lot NP0AAQ003G, D/C 1123). Latch-Up testing has shown that this device withstands a current of 250mA (lot NP0AAQ001G, D/C 0453).

**Table 1**  
Reliability Evaluation Test Results

**MAX2022ETX+T**

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
<b>Static Life Test</b> (Note 1)	Ta = 135C Biased Time = 192 hrs.	DC Parameters & functionality	47	0	NP0AAQ001G, D/C 0453

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